East Midlands Gateway
Phase 2 (EMG2)

Document DCO 6.14E/MCO 6.14E (Part 2 of 3)
ENVIRONMENTAL STATEMENT

Technical Appendices

Appendix 14E

Preliminary Sources Study Affecting Leicestershire County Council

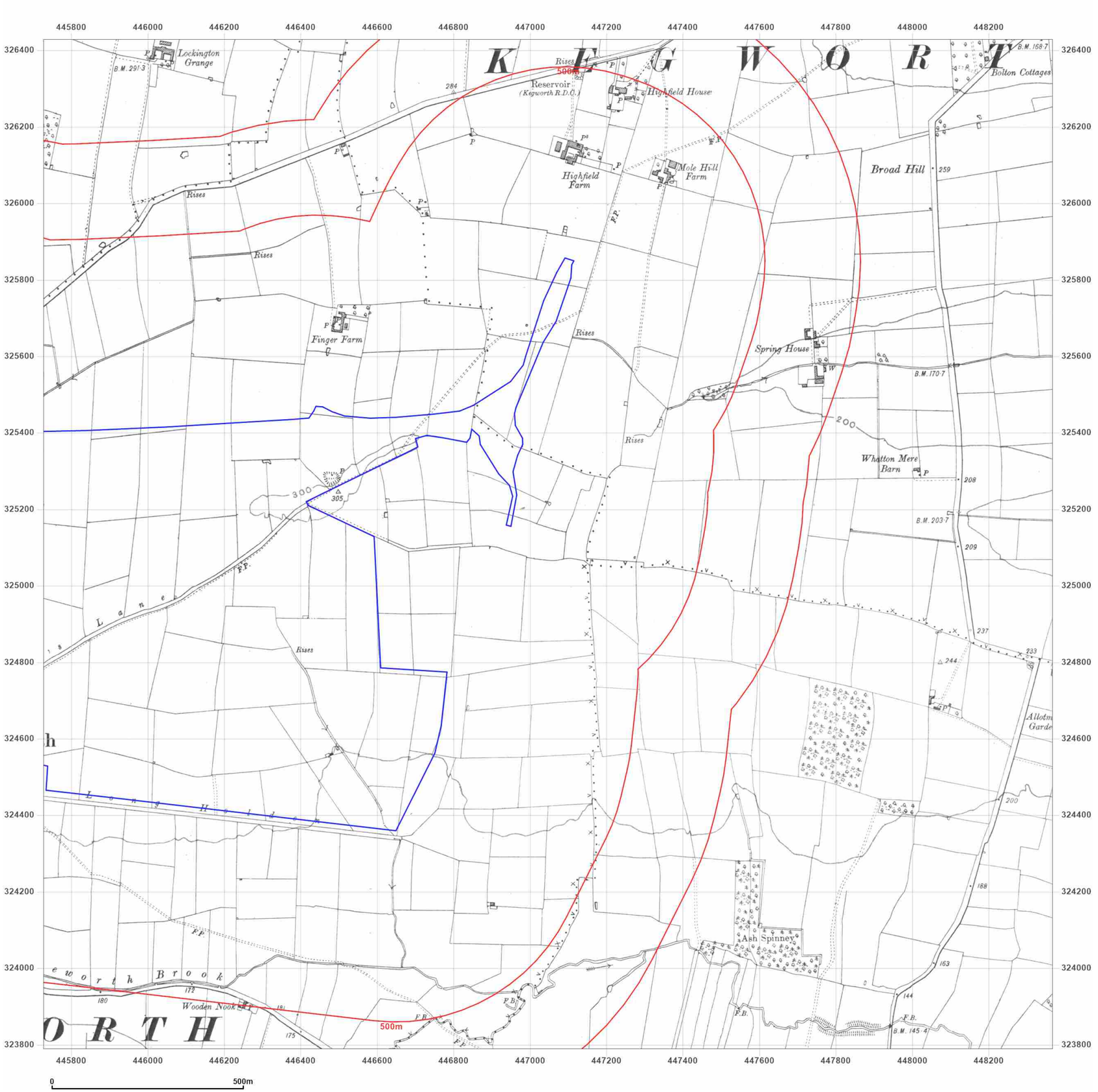
October 2025

14

The East Midlands Gateway Phase 2
and Highway Order 202X and The East Midlands Gateway
Rail Freight and Highway (Amendment) Order 202X

SEGRO.COM/SLPEMG2

SEGRO



Groundsure INSIGHTS

Site Details:

East Midland Gateway, A453
(LCC Land)

Client Ref: 220500 - 10260
Report Ref: GS-AAQ-LPV-BXJ-I3W_SS_2_1
Grid Ref: 447046, 325108

Map Name: County Series

Map date: **1922**

Scale: 1:10,560

Printed at: 1:10,560

N
W E
S

Surveyed 1883
Revised 1922
Edition N/A
Copyright N/A
Levelled N/A

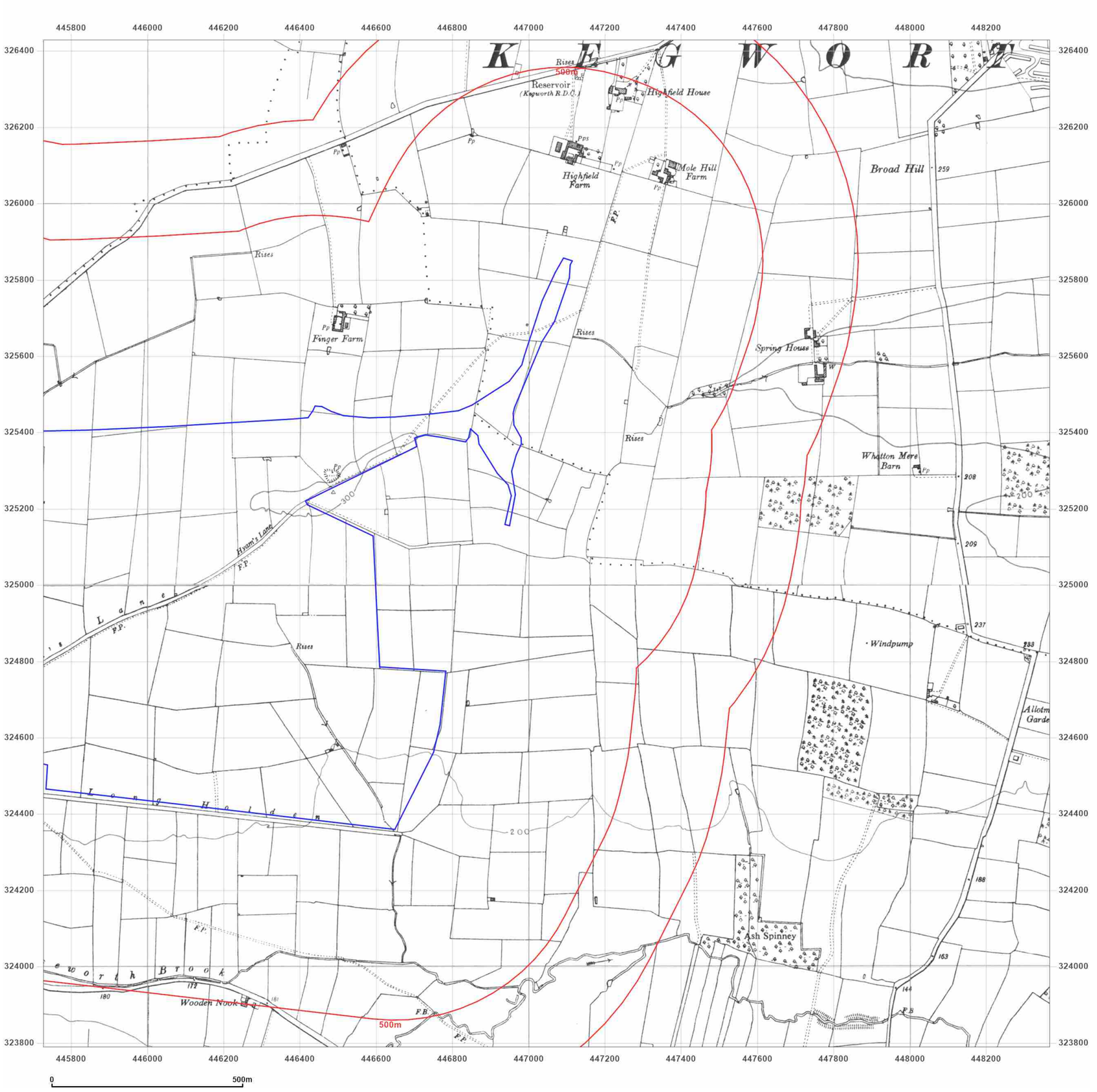
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Production date: 13 December 2024

Map legend available at: [redacted]



Groundsure INSIGHTS

Site Details:

East Midland Gateway, A453
(LCC Land)

Client Ref: 220500 - 10260
Report Ref: GS-AAQ-LPV-BXJ-I3W_SS_2_1
Grid Ref: 447046, 325108

Map Name: Provisional

Map date: **1955**

Scale: 1:10,560

Printed at: 1:10,560

N
W E
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Surveyed N/A
Revised 1954
Edition 1955
Copyright N/A
Levelled N/A

Surveyed N/A
Revised 1954
Edition 1955
Copyright N/A
Levelled N/A

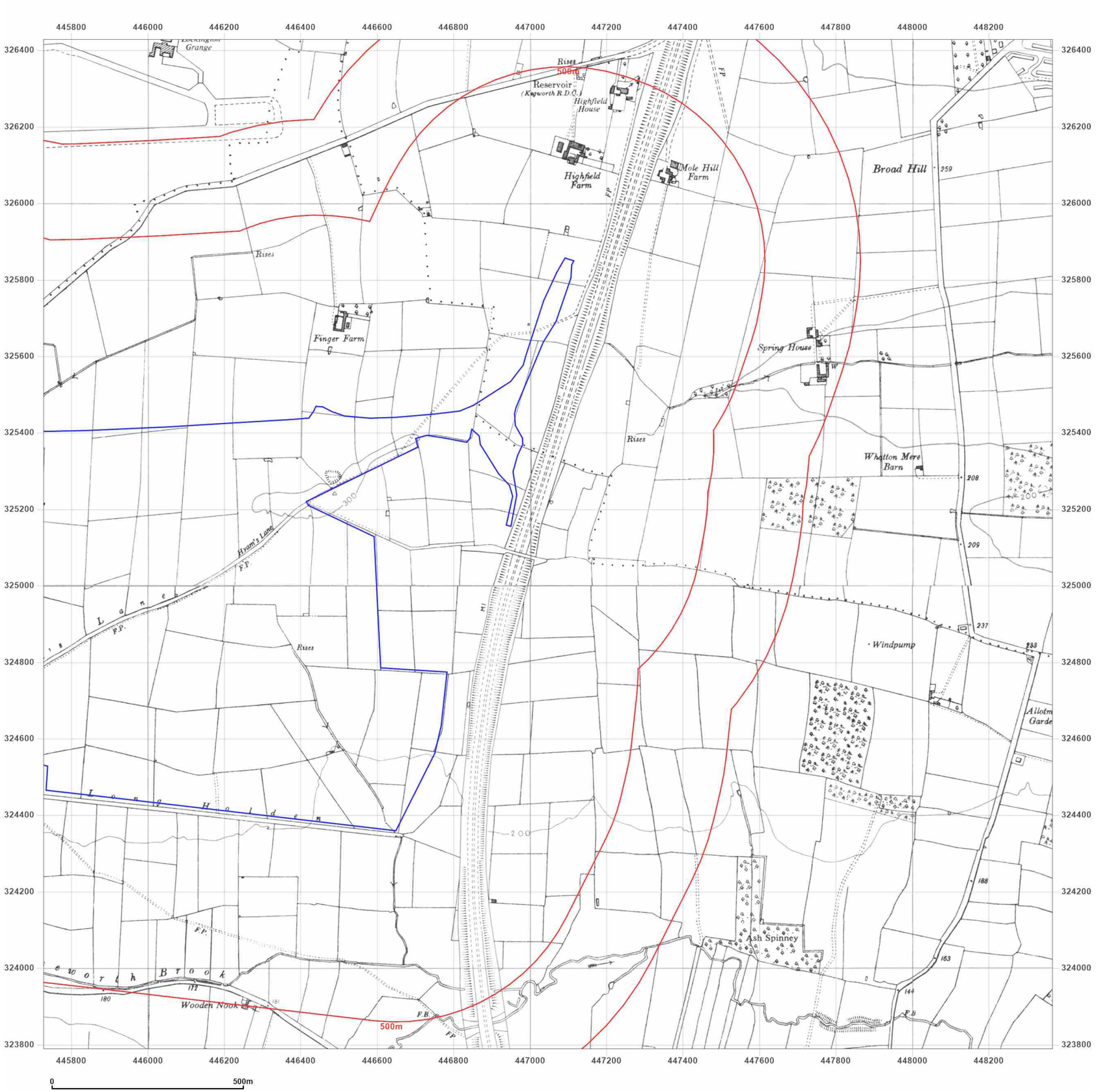
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Groundsure INSIGHTS

Site Details:

East Midland Gateway, A453
(LCC Land)

Client Ref: 220500 - 10260
Report Ref: GS-AAQ-LPV-BXJ-I3W_SS_2_1
Grid Ref: 447046, 325108

Map Name: Provisional

Map date: **1966**

Scale: 1:10,560

Printed at: 1:10,560

N
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Surveyed 1950
Revised 1965
Edition 1955
Copyright 1966
Levelled N/A

Surveyed N/A
Revised 1966
Edition 1955
Copyright N/A
Levelled N/A

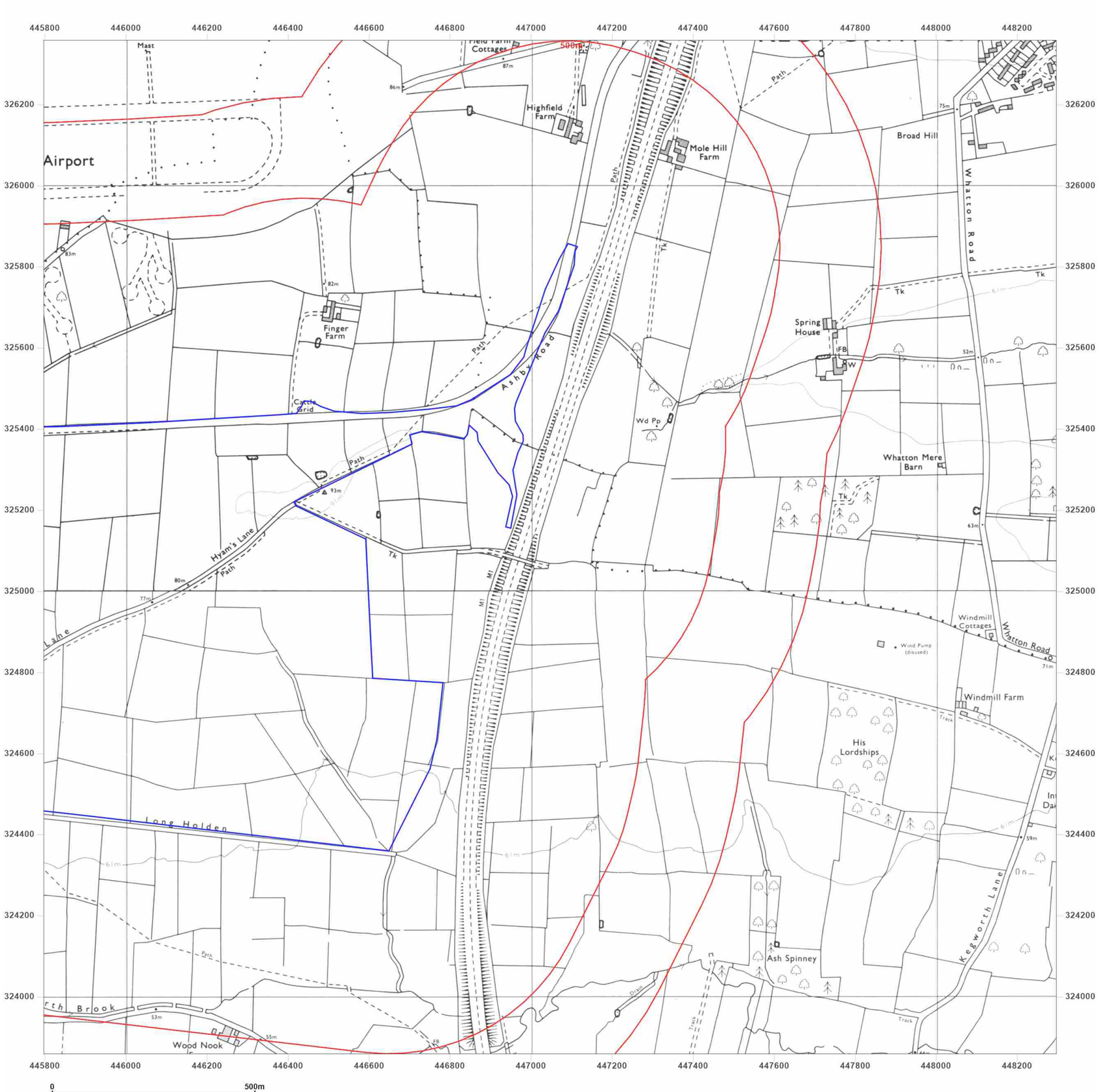
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Groundsure INSIGHTS

Site Details:

East Midland Gateway, A453
(LCC Land)

Client Ref: 220500 - 10260
Report Ref: GS-AAQ-LPV-BXJ-I3W_SS_2_1
Grid Ref: 447046, 325108

Map Name: National Grid

Map date: **1971-1975**

Scale: 1:10,000

Printed at: 1:10,000

N
W E
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Surveyed 1971
Revised 1971
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1969
Revised 1975
Edition N/A
Copyright 1975
Levelled N/A

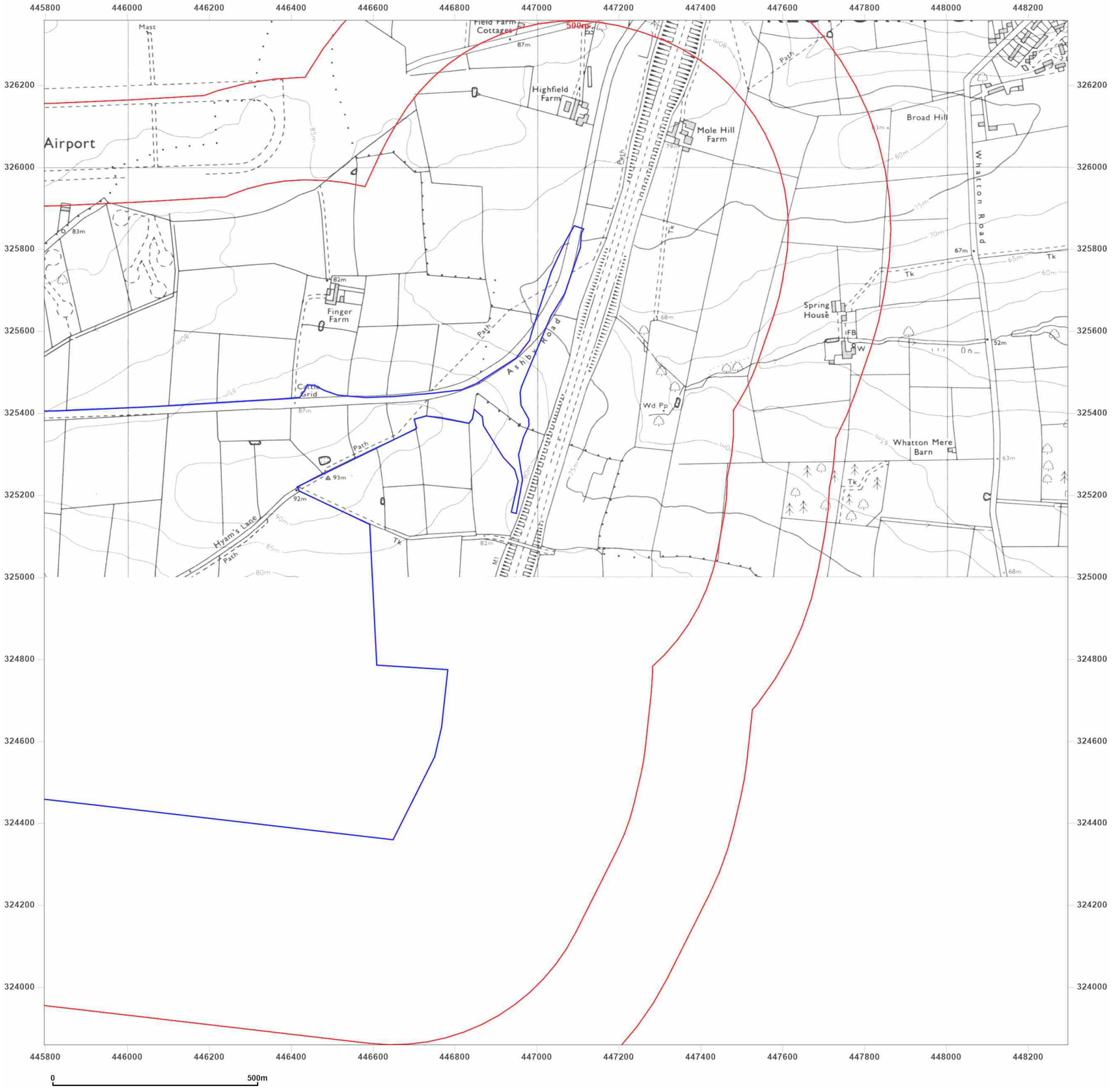
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Groundsure INSIGHTS

Site Details:

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(LCC Land)

Client Ref: 220500 - 10260
Report Ref: GS-AAQ-LPV-BXJ-I3W_SS_2_1
Grid Ref: 447046, 325108

Map Name: National Grid

Map date: **1978**

Scale: 1:10,000

Printed at: 1:10,000

N
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Surveyed 1971
Revised 1978
Edition N/A
Copyright 1972
Levelled 1975

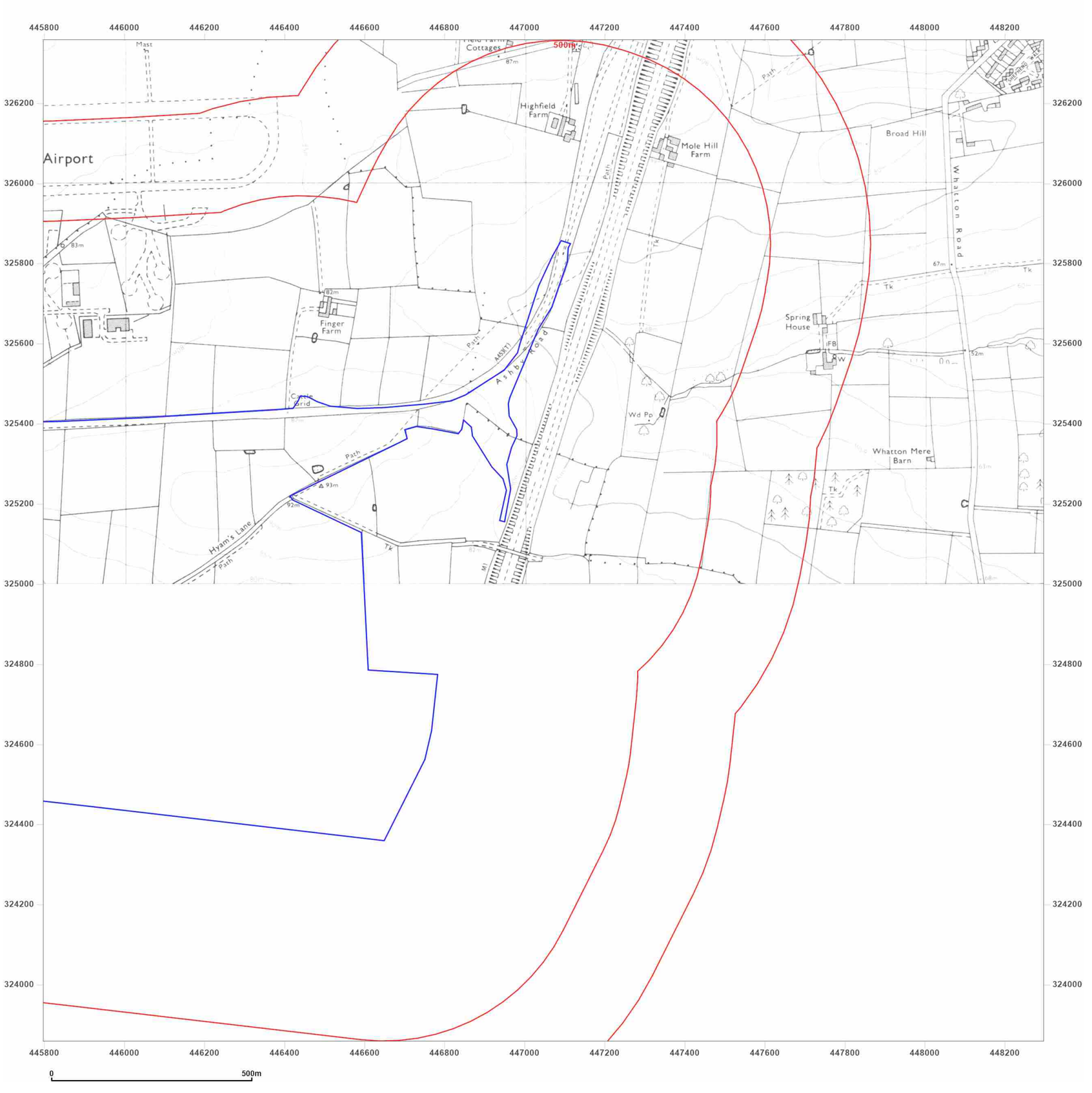
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Map legend available at: [redacted]



Groundsure INSIGHTS

Site Details:

East Midland Gateway, A453
(LCC Land)

Client Ref: 220500 - 10260
Report Ref: GS-AAQ-LPV-BXJ-I3W_SS_2_1
Grid Ref: 447046, 325108

Map Name: National Grid

Map date: **1982**

Scale: 1:10,000

Printed at: 1:10,000

N
W E
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Surveyed 1971
Revised 1982
Edition N/A
Copyright N/A
Levelled N/A

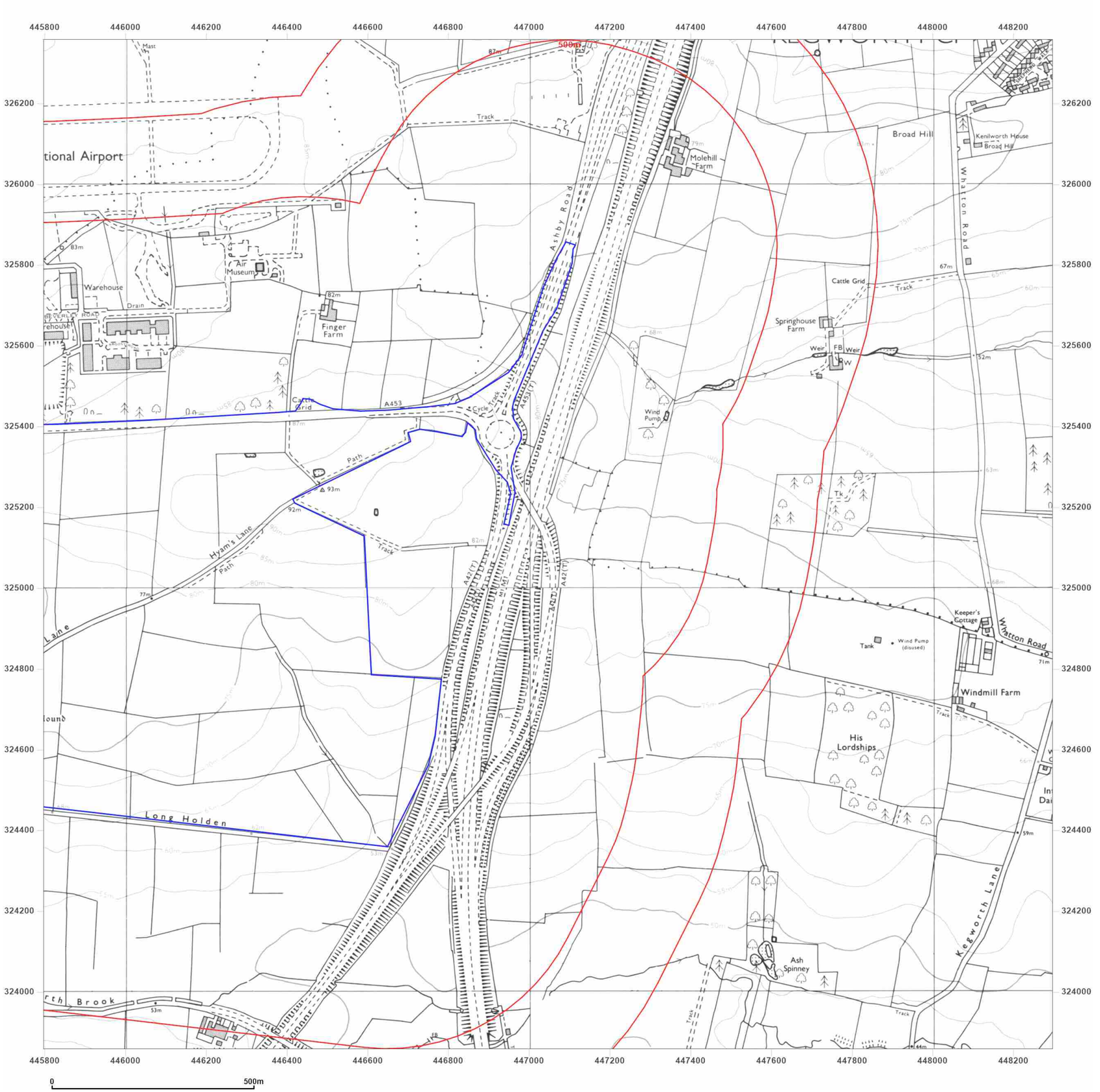
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Production date: 13 December 2024

Map legend available at: [redacted]



Groundsure INSIGHTS

Site Details:

East Midland Gateway, A453
(LCC Land)

Client Ref: 220500 - 10260
Report Ref: GS-AAQ-LPV-BXJ-I3W_SS_2_1
Grid Ref: 447046, 325108

Map Name: National Grid

Map date: **1992-1993**

Scale: 1:10,000

Printed at: 1:10,000

N
W E
S

Surveyed 1991
Revised 1992
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1969
Revised 1993
Edition N/A
Copyright N/A
Levelled N/A

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Map legend available at: [redacted]



Groundsure INSIGHTS

Site Details:

East Midland Gateway, A453
(LCC Land)

Client Ref: 220500 - 10260
Report Ref: GS-AAQ-LPV-BXJ-I3W_SS_2_1
Grid Ref: 447046, 325108

Map Name: National Grid

Map date: **2001**

Scale: 1:10,000

Printed at: 1:10,000

N
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2001

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Map legend available at: [redacted]



Groundsure INSIGHTS

Site Details:

East Midland Gateway, A453
(LCC Land)

Client Ref: 220500 - 10260
Report Ref: GS-AAQ-LPV-BXJ-I3W_SS_2_1
Grid Ref: 447046, 325108

Map Name: National Grid

Map date: **2010**

Scale: 1:10,000

Printed at: 1:10,000

N
W E
S

2010

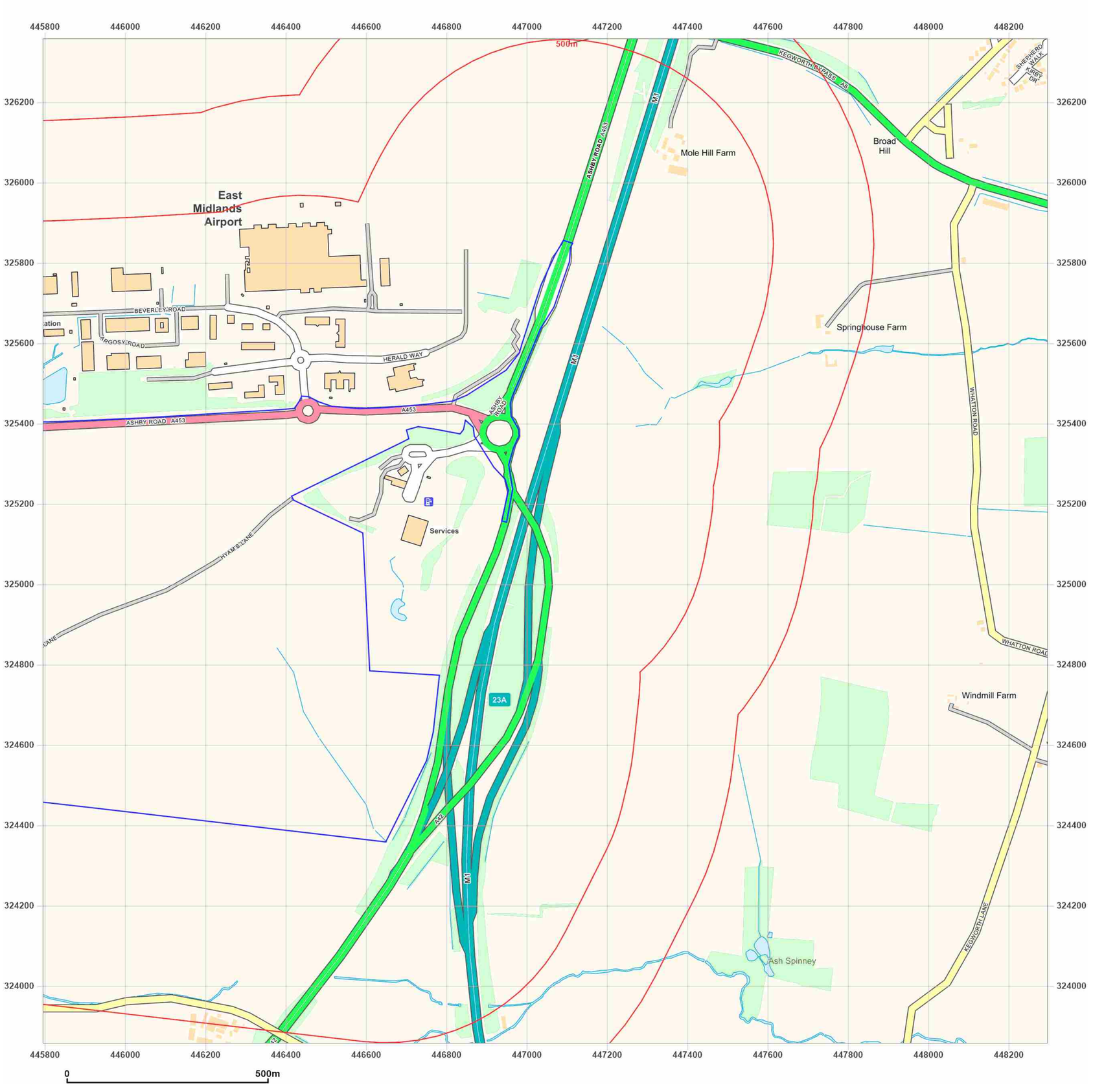
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Production date: 13 December 2024

Map legend available at: [redacted]



Groundsure INSIGHTS

Site Details:

East Midland Gateway, A453
(LCC Land)

Client Ref: 220500 - 10260
Report Ref: GS-AAQ-LPV-BXJ-I3W_SS_2_1
Grid Ref: 447046, 325108

Map Name: National Grid

Map date: **2024**

Scale: 1:10,000

Printed at: 1:10,000

N
W E
S

2024

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Production date: 13 December 2024

Map legend available at: [redacted]

Appendix 3: Historical Boreholes

British Geological Survey

BGS ID: 218232 : BGS Reference: SK42NE92
British National Grid (27700) : 446810,325440

SK 42 NE / 92

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

468 I 2544

BOREHOLE No 276
FIGURE A1
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 17.8.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66846.9 E.
95486.9 N.
Ground Level: 86.63 m O.D.

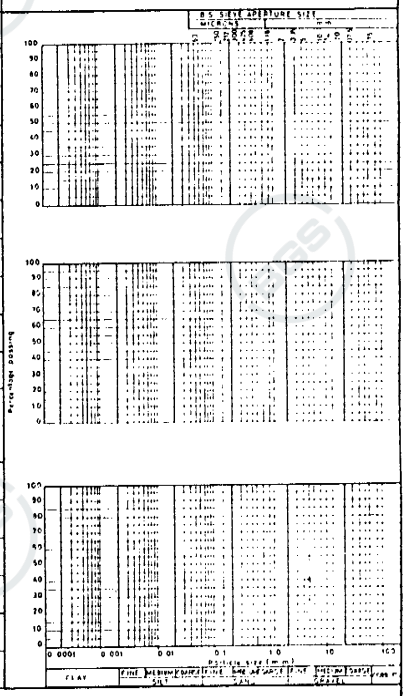
Laboratory Testing by: Dates

Dates	Depth of Casing	Depth to water	Sample/Insitu Test Depth	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata
17.8.84			0.40	J1		0.20	86.43	TOPSOIL
			0.50					Very stiff red brown slightly mottled grey green silty CLAY and slightly sandy silty clay with fine gravel (fragments of sandstone, siltstone, mudstone and flint). Traces of carbonaceous material (GLACIAL TILL)
			0.95	(75)2				
			1.00	J3		1.00	85.63	
			1.45	S(39) J4				Very stiff red brown slightly mottled grey green fissured silty CLAY becoming firm & stiff with occasional lithorelicts in zones. (KEUPER MARL : ZONE III)
			2.00	B5				
			2.45	(70)6				
			2.50	J7				
			2.95	S(35) J8				Band of weak to moderately weak, grey green calcareous siltstone noted at 2.50, 4.00 and 4.40m
			3.00	B9				
			3.50					
		Slight seepage	3.95	(70)10				Many fine to coarse gravel sized lithorelicts of mudstone at 5.00m
		4.00	4.00	*(86 for 225mm)*				
			4.45	J11				
17.8.84	3.00	4.00	5.00	J12		5.00	81.63	End of Shell and Auger Hole.

* Seating blows - J11 = 26

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/litre	pH
	2	17		36	22	100		
	4	13						
	6	14	1890					
	9	20 18**		35	19	100	0.04	8.1
	11	10						

** Microwave Determination



Scale 1:

Disturbed Samples: W – Groundwater
● J – Jar ● S – S.P.T. ● B – Bulk ● M – Maxi

Undisturbed Samples: Soil Sample

Insitu Tests: V (30) – Vane shear strength in KN/m²
Groundwater first struck
Core Cutter Density
Core Cutter Density/C.B.R
Sandbottle Density
C B R
C or S S.P.T. – ne or spoon
(25) – N value

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 218243 : BGS Reference: SK42NE103
British National Grid (27700) : 447000,325580

SK 42 NE/103

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 278

4700 2558 ... URE A1

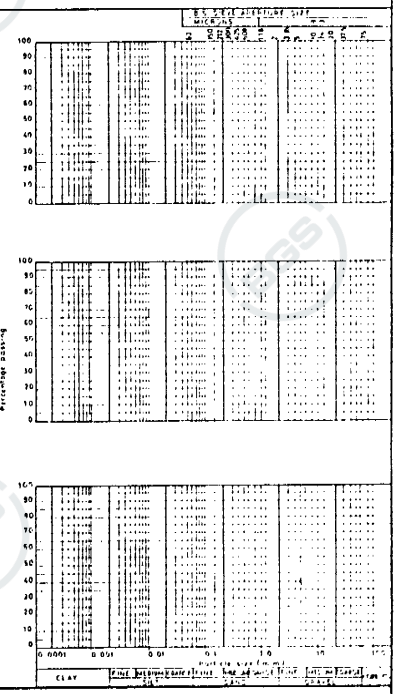
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 20.8.84
Hole Dimensions 150mm
Casing Dimensions 150mm

Coordinates: 67024.0 E.
95618.5 N.
Ground Level: 75.12 m O.D.

Laboratory Testing by: Dates

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/In-situ Test Depth (m)	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
20.8.84						0.20	74.92	TOPSOIL							
			0.50	J1				Stiff red brown mottled grey green fissured silty CLAY with traces of carbonaceous material (KEUPER MARL : ZONE IVa)		1	13				
			0.95	(29)2						2	25	1565	48	26	100
			1.00	J3		1.00	74.12								
			1.45	S(33)				Stiff red brown mottled grey green silty CLAY with some mudstone/siltstone lithorelicts and bands of highly weathered very weak calcareous mudstone/siltstone. (KEUPER MARL : ZONE III)		5	25		45	23	100
			1.50	B5											
			1.70	J6											
			2.00	(120)7											
			2.65												
			2.50	J8				Bands of highly weathered mudstone at 2.50m, 3.50,							
			2.95	S(91) J9											
			3.30	J10											
			3.50	S(120)											
			3.95	J11				Band of highly weathered grey green calcareous siltstone at 4.50m							
			4.20	J12											
			4.50	S(90)											
20.8.84	4.50	Dry	4.95	J13		5.00	70.12	End of Shell and Auger Hole.							



Scale 1:

Disturbed Samples : W – Groundwater ● J – Jar ● S – S.P.T. ● B – Bulk ● M – Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V (30) – Vane shear strength in KN/m²

Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R
▽ Sandbottle Density
▲ C.B.R
Core & S.P.T. hammer or spoon (-/55) – N value

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 218294 : BGS Reference: SK42NE154
British National Grid (27700) : 447044,325719

D3/6 85 © Soil Mechanics Limited, Bracknell, England

Soil Mechanics

TRIAL PIT No. 825 — Sheet 1 of 1

Location No. 7382 — SK42NE154

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

Ground Level 72.57 m AOD

Coordinates 447044.0 mE 325719.0 mN

Date Dug: 23.1.88 Logged: 23.1.88

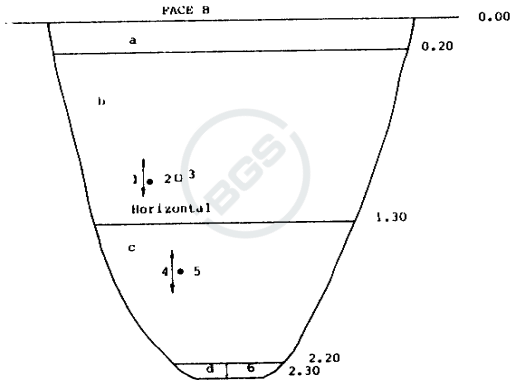
Carried out for
Client: Department of Transport
Engineer: Scott Wilson Kirkpatrick and Partners

Equipment & Methods
Machine dug to 2.30m by JCB 3CX
No support used
Logged on excavated material below 0.00m

Samples

Depth (m)	Type	No
0.00		
1.05	U	3
1.05	B	1
	D	2
1.60	B	4
	D	5
2.30	B	6

Sketch of faces and description of strata



Material Types

a. TOPSOIL

b. Soft to firm red brown mottled orange brown locally slightly fine sandy CLAY with occasional dark grey organic pockets, rootlets and gravel (Possible Glacial Till)

c. Firm to stiff red brown mottled green grey locally slightly fine sandy CLAY in parts mudstone, weak with frequent lithorelics and occasional fibrous rootlets. (Keuper Marl 3)

d. Greenish grey in parts thinly laminated SILTSTONE, moderately weak to moderately strong (Keuper Marl 1/2)

NOTE: Soil Resistivity measurements carried out at ground level and Redox potential tests carried out at 1.40m

Logged by JAS/AAC

Fig. 105

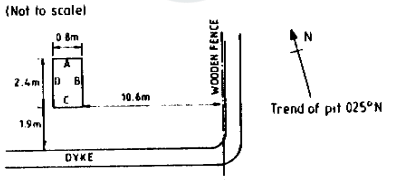
Notes Sample positions shown on faces

Ground water: Not encountered
Ease of excavation: Easy
Variability of faces: All faces similar
Stability of faces: Stable
Weather: Overcast

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample ⌈ B Bulk disturbed sample □ U Undisturbed sample • W Water sample

Plan (Not to scale)



Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 218300 : BGS Reference: SK42NE160
British National Grid (27700) : 446480,325458

SK 46480 25458

SK 42NE/160

Sampling		Properties			Strata			
Depth	Type	Strength kN m²	w %	SPT N	Description	Depth	Level	Legend
0.30	D				Turf over TOPSOIL	G.L	92.26	
0.50–1.00	U(32)	90	14		Soft–firm brown silty very sandy CLAY with frequent fine angular rock fragments and fine–medium rounded gravel	0.30	91.96	
						(0.75)	91.51	
1.40	D		22		Stiff dark red brown silty very sandy CLAY, occasionally mottled grey green, with many roots and associated black mottling.			
2.00–2.50	U(80)		21					
						2.25	90.01	
2.90	D				Stiff becoming hard friable dark red brown mottled grey green silty CLAY with fragments of very weak highly weathered siltstone and mudstone.			
3.50–3.90	U(81)		15					
4.00	D							
4.50–4.80	B							
5.00–5.50	SD		14	200				
5.50	W							
					End of Borehole	5.50	86.76	

Drilling

Type	From	To	Size	Fluid
Shell & Auger	G.L	5.50	0.15	

Ground Water

Struck	Behaviour	Sealed	Date	Hole	Cased	Water
5.50	Rose to 4.10 in 20 minutes	No	19.3.81	G.L	–	–
			19.3.81	5.5	NIL	4.1
			20.3.81	5.5	NIL	2.8

Remarks

Borehole Record

exploration associates

Project Department of Transport
A564 Stoke – Derby Link
Derby Southern By Pass
Isley Walton to M1 Section
Preliminary Site Investigation

Contract S2796

Borehole 13
Sheet 1 of 1

EX1

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 218820 : BGS Reference: SK42NW185
British National Grid (27700) : 444510,325396

SK 4451 2539 SK42NW185

Sampling / Properties / Strata

Depth	Type	Strength kN m²	w %	SPT N	Description	Depth	Level
					Turf over TOPSOIL	G.L	74.78
0.30	D				Light brown silty slightly clayey SAND	0.30	74.48
0.50–0.95	U(30)	100	14		Stiff red brown silty sandy CLAY with occasional gravel, zones of silt and sand.	0.50	
1.25	D				Light brown silty slightly clayey SAND with occasional fine-medium gravel.	1.1	73.68
1.50–1.95	U(45)						
2.10	W				Firm red brown silty CLAY, with fine-coarse flint fragments and gravel.	1.95	72.83
2.25	D		22			2.40	72.38
2.50–2.95	U(60)	90	16		Firm-stiff slightly friable dark red brown very silty CLAY		
3.25	D						
3.50–3.95	U(85)	100	20			3.60	71.18
4.25	D				Stiff red brown and grey green fissured, occasionally friable very silty CLAY with occasional layers of very weak red brown and grey green siltstone. Occasional thin layers of moderately strong siltstone noted.		
4.70–5.15	SD		13	124			
5.30	D						
5.50–5.95	SD		17	108			
6.20	D						
6.50–7.00	SD		13	600+			

Drill Run	Fluid Return	Core Recovery	FI	RQD			
	100%	65%	10	35	Dark reddish brown and grey green fine grained, very thinly bedded highly weathered MUDSTONE. Not competent - very close open horizontal joints infilled with firm red brown silty CLAY **	7.00	67.78
8.50					Dark reddish brown fine grained, very thinly bedded moderately weathered, silty MUDSTONE very weak to moderately weak. Joints closely spaced (all horizontal)		
	100%	1 00%	10	50	Dark reddish brown and grey green fine grained, very thinly bedded moderately weathered silty MUDSTONE, very weak to weak fissured in parts very closely spaced joints (occasionally up to 250mm (close-medium).) Majority horizontal though 2 oblique and 1 vertical and occasional bands siltstone and zones of friable silty CLAY.		
10.00					End of Borehole	10.00	64.78

Legend

Drilling

Type	From	To	Size	Fluid
Shell & Auger	G.L	7.00	0.15	-
Rotary core	7.00	10.00	0.072	Water

Ground Water

Struck	Behaviour	Sealed	Date	Hole	Cased	Water
4.50	very slow ingress, rose to 2.1	6.00	17.3.81	G.L	-	-
6.60	Seepage	No	17.3.81	4.5	3.0	4.2
			18.3.81	10.0	6.0	G.L
			19.3.81	10.0	NIL	1.8

Remarks Hard strata from 4.00–5.30 and from 6.50–7.00 (2.0 hrs)
**May be disturbed by first core run Bedding within 5° of horizontal.

Borehole Record

exploration associates

Project Department of Transport
A564 Stoke – Derby Link
Derby Southern By Pass
Isley Walton to M1 Section
Preliminary Site Investigation

Contract S2796

Borehole B7
Sheet 1 of 1

EX1

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 218821 : BGS Reference: SK42NW186
British National Grid (27700) : 444787,325272

SK 44181 '25212.

SK42NW/186

Sampling		Properties			Strata			
Depth	Type	Strength kN m²	w %	SPT N	Description	Depth	Level	Legend
					Turf over TOPSOIL	G.L	82.49	
0.40	D							
0.50–1.00	U(42)	60	25		Firm becoming stiff brown becoming light brown slightly friable silty sandy CLAY with occasional medium-coarse well rounded gravel and occasional fine gravel and rock fragments towards base.	0.40	82.09	
1.80	D							
2.00–2.50	U(65)							
						2.35	80.14	
2.80	D		23		Dense light brown and light grey brown very clayey (claybound) fine, medium, and coarse angular rounded very sandy GRAVEL. Band of weak friable light grey green mudstone noted 5.30 – 5.50. Orange brown sandstone at 3.0 D			
3.00	D							
3.00–3.50	SD			38				
3.60	D							
4.00–4.50	B							
4.50–5.00	**							
4.50–5.00	B		17					
5.00–5.50	SD		21	73				
						5.3	77.19	
5.50–6.00	B				(Firm) reddish brown silty CLAY matrix with sub-rounded to sub-angular GRAVEL some cobbles containing small pockets of organic silty clay with roots. (TILL)			
						6.0	76.49	
					End of Borehole			

Drilling

Type	From	To	Size	Fluid
Shell & Auger	G.L	6.00	0.15	-

Ground Water

Struck	Behaviour	Sealed	Date	Hole	Cased	Water
NIL			17.3.81	G.L	-	-
			17.3.81	6.00	NIL	NIL
			18.3.81	6.00	NIL	NIL

Remarks ** No penetration

Limestone boulder encountered at 4.50, pushed to 5.0m before breaking up.

Borehole Record

exploration associates

Project Department of Transport
A564 Stoke – Derby Link
Derby Southern By Pass
Isley Walton to M1 Section
Preliminary Site Investigation

Contract S2796

Borehole 8

Sheet 1 of 1

EX1

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 13335412 : BGS Reference: SK42NE510
British National Grid (27700) : 445760,325430

Norwest Holst Soil Engineering Ltd.

Borehole No. **CE-E**

BOREHOLE LOG

Contract No. F4691
Location East Midlands Airport
Client East Midlands Airport Joint Committee
Method of Boring Percussion
Diameter of Borehole 150 mm

Sheet 1 of 1
Chainage
Ground Level 76.68 m.A.O.D.
Date 20/8/80

Description of Strata	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
TOPSOIL	0.22	76.48				20/8
Firm to stiff red brown silty CLAY.	0.45	76.23	150mm to 1.50	0.50		
Firm to stiff becoming hard below 4.00 m red brown to grey green silty CLAY with bands of highly weathered very weak red brown silty mudstone.				1.50		
--- 2.00 m to 2.50 m moderately weathered moderately weak grey green siltstone.				2.50		
				3.50		
				4.50		
				5.50		
	6.00	70.68				

Type of Sample

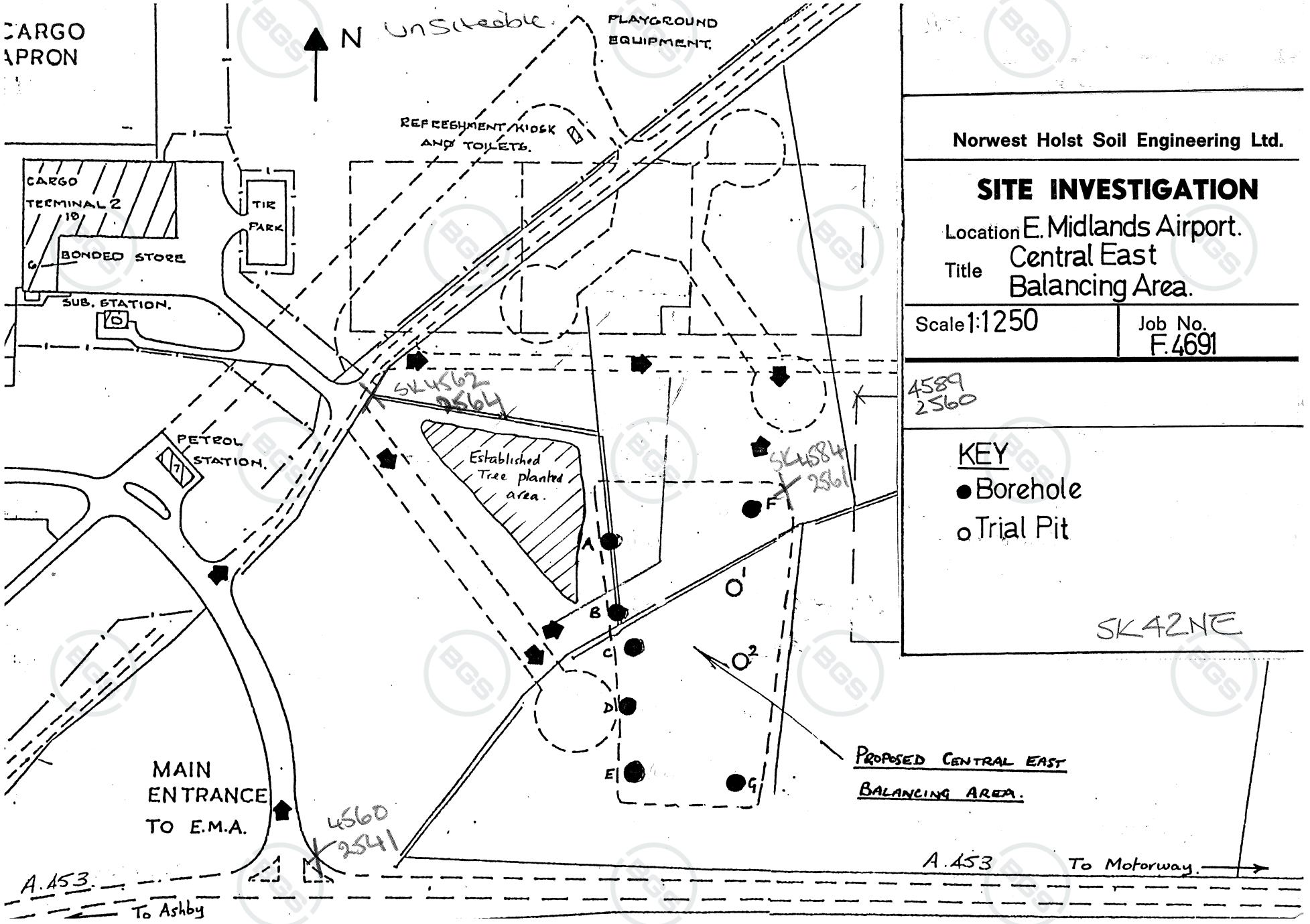
- Is S.P.T.
- Ic. C.P.T.
- O Jar
- ● Bulk
- ■ Undisturbed
- × Vane
- Δ Water
- Piezometer

Remarks (Observations of Ground Water etc.)

20/8/80 Water seepage at 3.90 m. Casing at 1.50 m.
A piezometer was installed with a sand cell from 5.00 m to 6.00 m.

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Contact BGS: ngdc@bgs.ac.uk



Norwest Holst Soil Engineering Ltd.

SITE INVESTIGATION

Location E. Midlands Airport.

Title Central East Balancing Area.

Scale 1:1250

Job No. F.4691

KEY

● Borehole

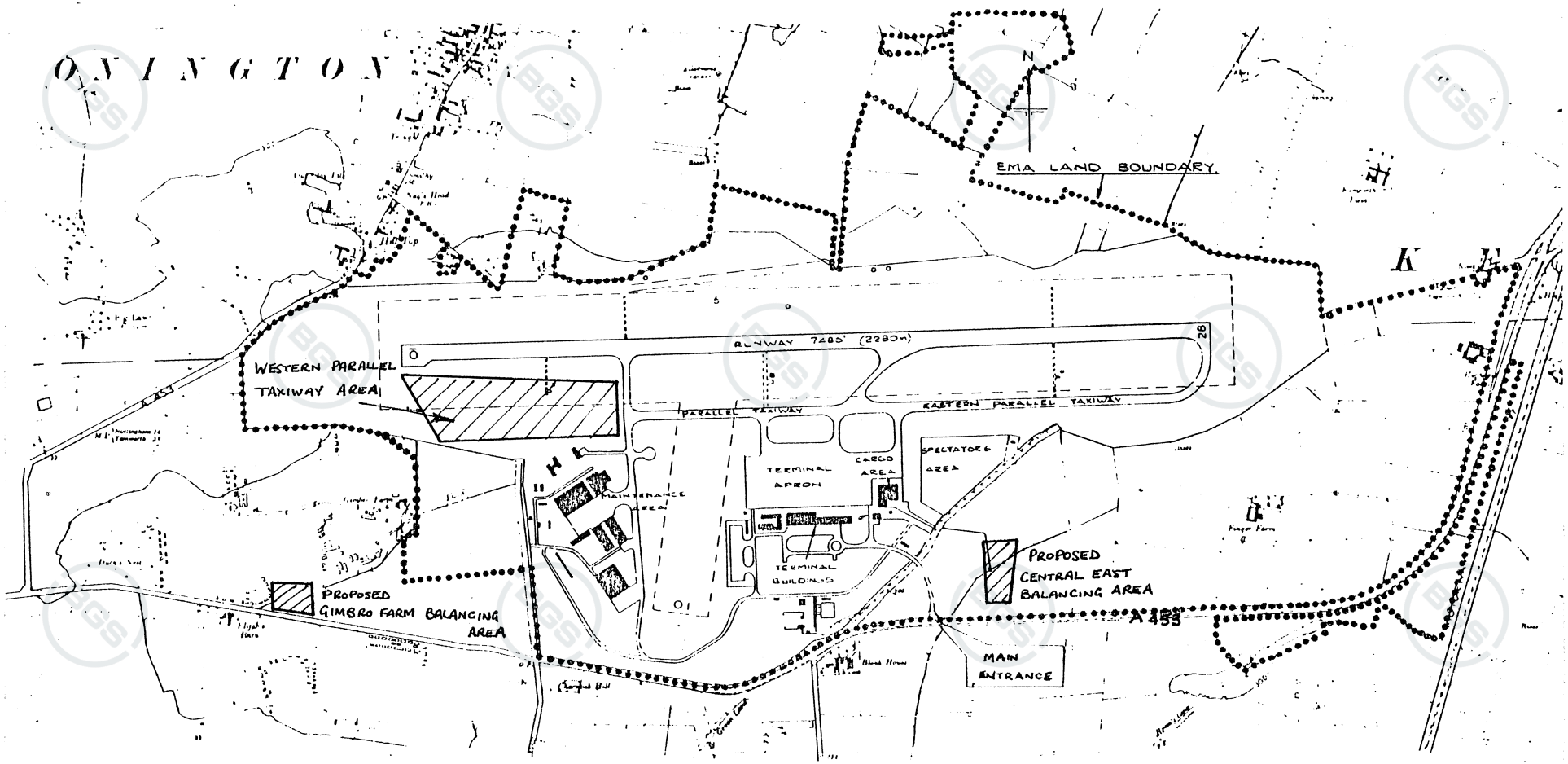
o Trial Pit

SK42NE

British Geological Survey

BGS ID: 13335412 : BGS Reference: SK42NE510
British National Grid (27700) : 445760,325430

Contact BGS: ngdc@bgs.ac.uk



Scale 0 500 1000 2000 3000 FEET
0 100 500 1000 METRES.

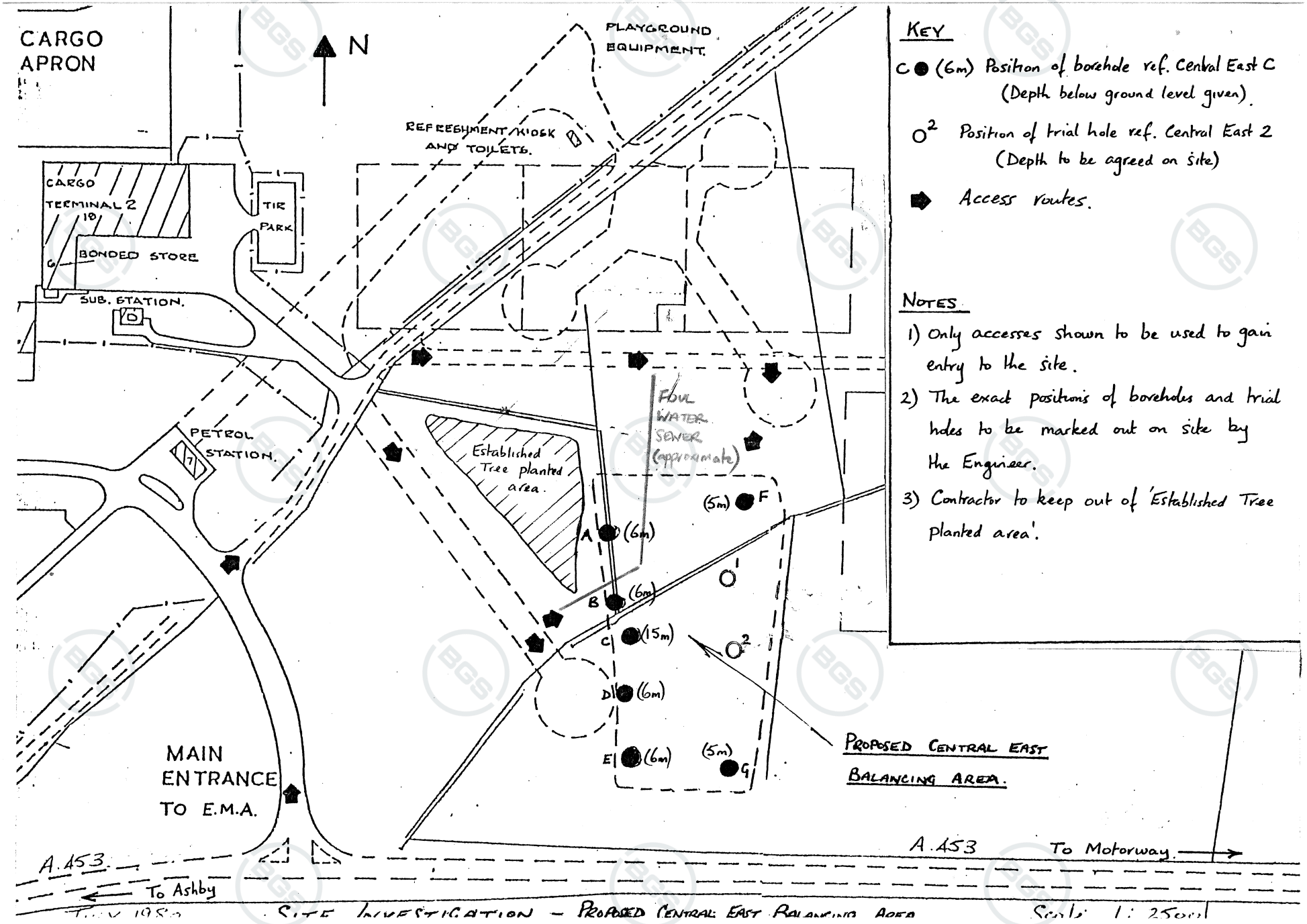
POSITIONS OF SITE INVESTIGATION AREAS SHOWN HATCHED.

AIRPORT LAYOUT

C.V.UNDERWOOD.C.Eng..F.I.Mun.E..F.I.H.E.
Civil Engineer of the Joint Committee.

Contact BGS: ngdc@bgs.ac.uk

BGS ID: 13335412 : BGS Reference: SK42NE510
British National Grid (27700) : 445760,325430



British Geological Survey
BGS ID: 13335412 : BGS Reference: SK42NE510
British National Grid (27700) : 445760,325430
Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 13335414 : BGS Reference: SK42NE512
British National Grid (27700) : 445810,325420

Norwest Holst Soil Engineering Ltd.

Borehole No. **CE-G**

BOREHOLE LOG

Contract No. F4691
Location. East Midlands Airport
Client. East Midlands Airport Joint Committee
Method of Boring. Percussion
Diameter of Borehole. 150mm

Sheet. 1 of. 1
Chainage.
Ground Level. 78.10 m.A.O.D.
Date. 21/8/80

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
TOPSOIL		0.20	77.90				21/8
Stiff to hard slightly fissured red brown locally grey green silty CLAY with some bands of highly weathered very weak red brown silty mudstone		4.60	73.50	150mm to 4.00	0.50 1.50 2.50 3.50 4.50 S	85for 150mm	
Slightly weathered moderately strong grey green SILTSTONE		5.00	73.10				

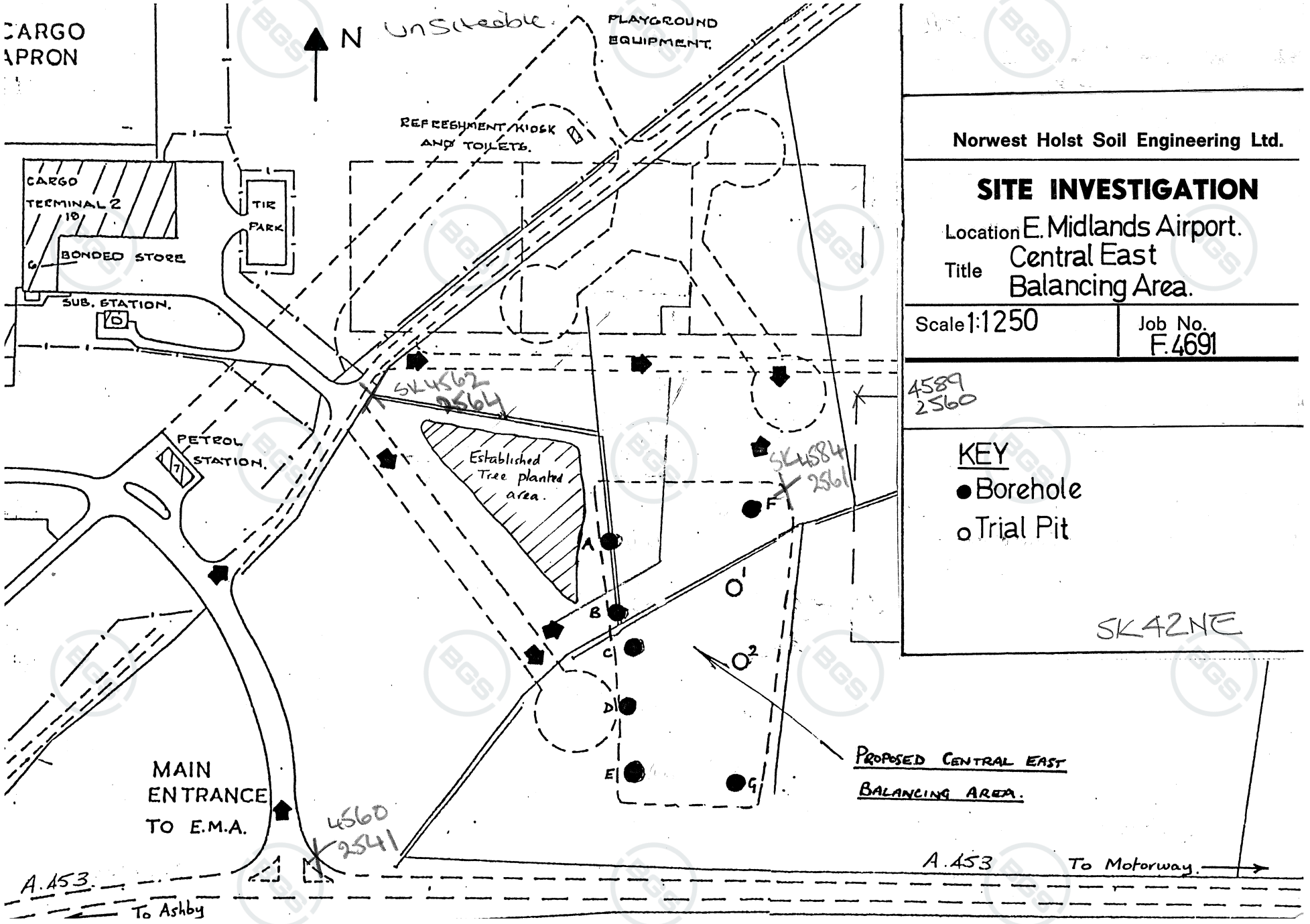
Type of Sample

- Is S.P.T.
- Ic. C.P.T.
- O Jar
- ● Bulk
- ▮ Undisturbed
- × Vane
- Δ Water
- Piezometer

Remarks (Observations of Ground Water etc.)
Borehole dry during drilling

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Contact BGS: ngdc@bgs.ac.uk



Norwest Holst Soil Engineering Ltd.

SITE INVESTIGATION

Location E. Midlands Airport.

Title Central East Balancing Area.

Scale 1:1250

Job No. F.4691

KEY

● Borehole

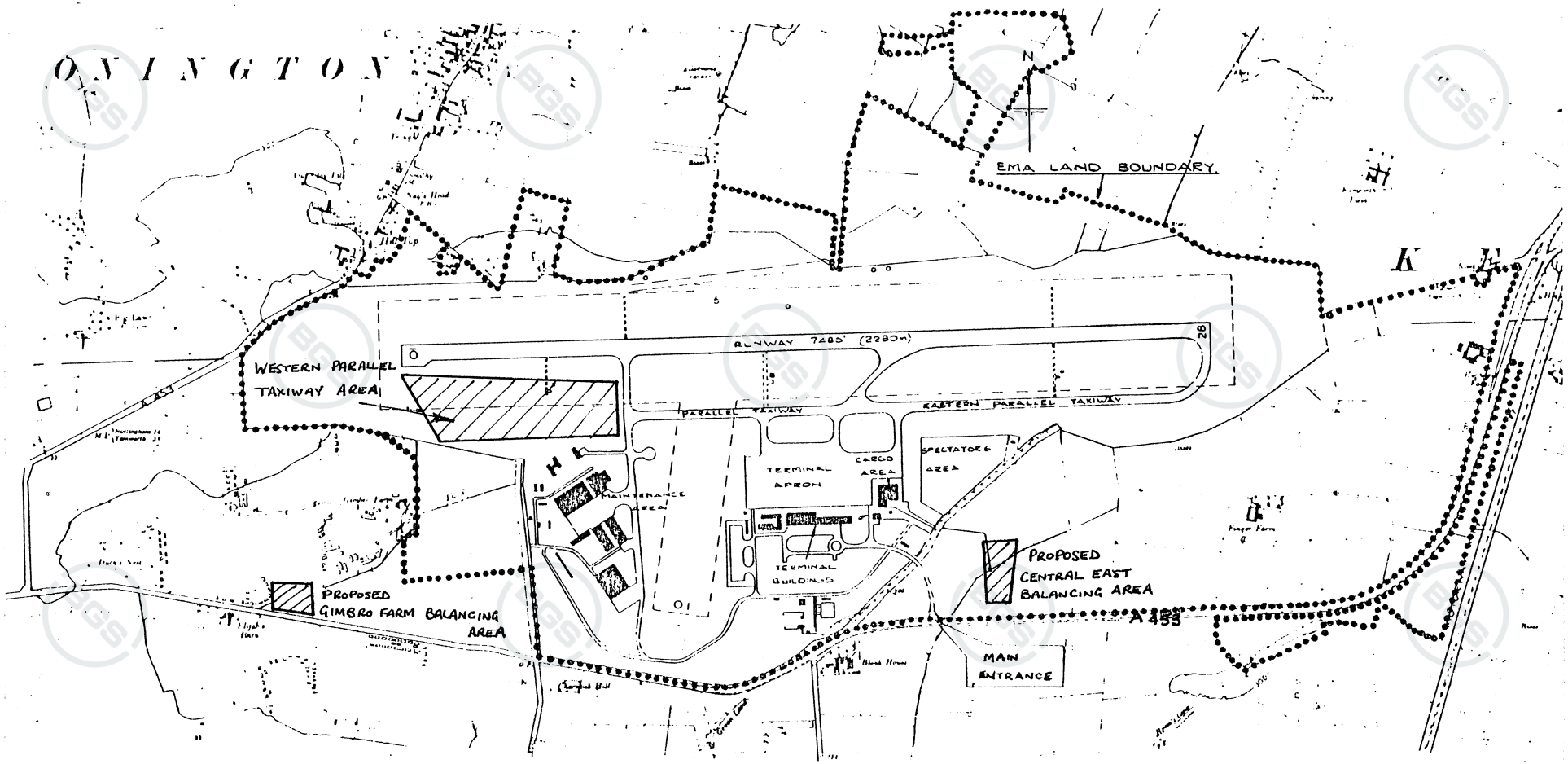
o Trial Pit

SK42NE

British Geological Survey

BGS ID: 13335414 : BGS Reference: SK42NE512
British National Grid (27700) : 445810,325420

Contact BGS: ngdc@bgs.ac.uk



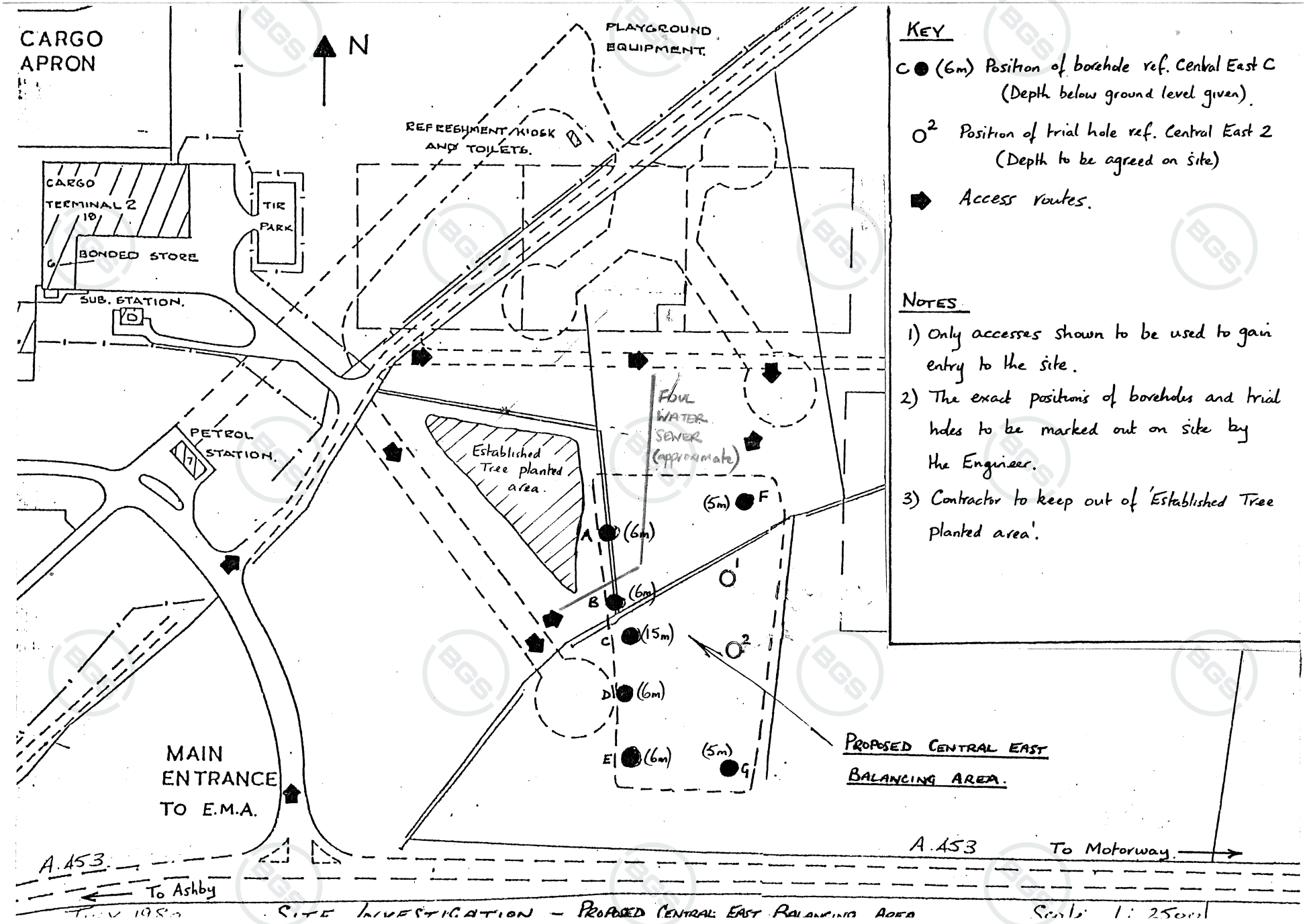
Scale 0 500 1000 2000 3000 FEET
0 100 500 1000 METRES.

Positions of Site Investigation
Areas shown hatched.

AIRPORT LAYOUT

C.V.UNDERWOOD.C.Eng..F.I.Mun.E..F.I.H.E.
Civil Engineer of the Joint Committee.

Contact BGS: ngdc@bgs.ac.uk
BGS ID: 13335414 : BGS Reference: SK42NE512
British National Grid (27700) : 445810,325420



British Geological Survey
BGS ID: 13335414 : BGS Reference: SK42NE512
British National Grid (27700) : 445810,325420
Contact BGS: ngdc@bgs.ac.uk

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Site	Borehole Number
Pegasus Business Park, Phase 2 Plot, East Midlands Airport	BH1

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion		82.30	Office Villages Ltd and Heyford Contracting	P3825
	Location	**Dates**	**Engineer**	**Sheet**
	446214.01 E 325513.54 N	19/12/2005		1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(0.30)	MADE GROUND : Poor weak tarmac overlying firm brown, dark brown slightly gravelly CLAY. Gravel is brick, granite and quartz.		
0.20-0.20	D01				82.00	0.30			
0.30-0.50	B01						Firm to stiff thinly laminated occasional fissured brown slightly sandy CLAY with occasionally green-grey clay lenses and brown sandy silt within fissures. (MERCIA MUDSTONE GROUP)		
0.50-0.95	B02								
0.50-0.95	U01					(1.30)			
1.00-1.45	SPT N=43			4,7/10,12,10,11					
1.20-1.65	D02								
					80.70	1.60			
1.70-2.00	B03						Stiff thinly laminated fissured friable red-brown MUDSTONE with stiff grey clay lenses. (MERCIA MUDSTONE GROUP)		
2.00-2.39	SPT 50/235			5,10/12,14,21,3					
2.00-2.45	D03								
						(1.85)			
2.70-3.00	B04								
3.00-3.41	SPT 50/255			6,9/12,14,16,8					
3.00-3.45	D04								
					78.85	3.45			
				19/12/2005:					
				19/12/2005:			Complete at 3.45m		

Remarks
1. 19mm diameter standpipe installed 3.00m bgl. Plain pipe with bentonite seal from ground level to 1.00m bgl. Slotted pipe with gravel from 1.00m to 3.00m bgl, bentonite 3.00m to 3.45m bgl. Bung gas valve and stopcock cover fitted. 2. Borehole remained dry during drilling.

Scale (approx)	Logged By
1:50	ANT/KT

Figure No.

Appendix 4: GDMS Reports

Report

GROUND INVESTIGATION FOR

A42 CASTLE DONINGTON NORTH

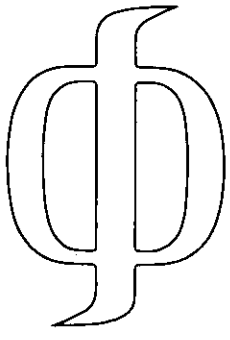
CONTRACT 4

VOLUME 1 : FIELDWORK

Carried out for:

Department of Transport

Date August 1988 No. 7382/1



Soil Mechanics

Soil Mechanics Limited,
Foundation House,
Eastern Road,
Bracknell, Berkshire, RG12 2UZ,
United Kingdom
telephone Bracknell (0344) 424567
telex 847253 SMERCN G

REPORT NO. 7382

GROUND INVESTIGATION FOR

A42 CASTLE DONINGTON NORTH

CONTRACT 4

SCHEDULE OF REPORT VOLUMES

VOLUME 1: FIELDWORK

VOLUME 2: LABORATORY TESTING

VOLUME 3: SITE PLANS AND LONGITUDINAL SECTIONS

REPORT NO 7382/1

GROUND INVESTIGATION FOR

A42 CASTLE DONINGTON NORTH

CONTRACT 4

VOLUME 1: FIELDWORK

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4.	FIELDWORK 4.1 Preamble 4.2 Cable tool boring 4.3 Rotary drilling 4.4 Trial Pits	6
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REPORT NO 7382/1

GROUND INVESTIGATION FOR

A42 CASTLE DONINGTON NORTH

CONTRACT 4

ABSTRACT

Fifty six boreholes put down to a maximum depth of 30.6 m encountered made ground, fill, alluvium, terrace and glacial deposits overlying Coal Measures, Keuper Sandstone and Keuper Marl. The report presents the results of the fieldwork and a programme of laboratory testing. No engineering appraisal of the scheme was required.

REPORT NO 7382/1

GROUND INVESTIGATION FOR
A42 CASTLE DONINGTON NORTH
CONTRACT 4

1. INTRODUCTION

In November 1987 the Department of Transport (DTp) requested Soil Mechanics Limited (SML) to carry out a ground investigation along the proposed line of the Castle Donington North Section of the proposed A42 under the direction of their Consulting Engineers, Scott Wilson Kirkpatrick and Partners (SWKP). The fieldwork, carried out between 12 December 1987 and 19 February 1988, comprised fifty six boreholes and twenty nine trial pits. In addition soil resistivity and redox potential tests were carried out in twenty three of the trial pits.

The report presents the results of the fieldwork (Volume 1) and a programme of laboratory testing (Volume 2). The site plans and longitudinal sections are given in Volume 3.

2. DESCRIPTION OF THE ROUTE

The Castle Donington North section of the proposed A42 extends from approximately 1.5 km north of Ashby-de-la-Zouch (NGR SK 377176), north and east a distance of some 14 km to the proposed intersection with the M1 motorway (NGR SK 470256), see key plan Fig. *. The proposed route crosses predominantly farmland with scattered woodland towards the south eastern end.

3. GEOLOGY OF THE ROUTE

The 1 inch to 1 mile map of the British Geological Survey (Sheet 141: Loughborough) indicates that Coal Measures are present at the southern end of the route faulted against Keuper Sandstone and Keuper Marl which are present across the majority of the route. Two Carboniferous Limestone

inliers are also shown. The results of the investigation confirmed the anticipated bedrock and showed the overlying superficial deposits to consist of made ground, fill, alluvium, terrace deposits and glacial materials.

4. FIELDWORK

4.1 Preamble

A total of fifty six boreholes were put down and twenty nine trial pits were excavated at locations and to depths specified by SWKP. The exploratory hole locations are shown on the site plans (Volume 3 Fig. 1 to 8). All boreholes and trial pits were surveyed on completion by SWKP and the co-ordinates and levels are given on the logs (Fig. 2-83).

4.2 Cable Tool Boring

Forty seven boreholes numbered selectively from 704 to 758 were put down to depths ranging from 1.9 m to 14.2 m using 200 mm and 150 mm diameter cable tools. On the instruction of SKWP inspection pits were hand dug to a maximum depth of 1.5 m at sixteen locations to check for services before boring commenced.

Standard open drive undisturbed tube samples of 102 mm nominal diameter (U100) were recovered from the more cohesive deposits and from weathered bedrock material. Standard penetration tests using both open and solid cone (BS 1377: Test 19) were carried out and the results are presented on the logs in accordance with Fig. 1. Representative disturbed samples were taken of all strata encountered and groundwater samples were taken as appropriate.

All samples obtained were examined on site and then transported to the Doncaster laboratory of SML for laboratory testing and storage as

appropriate. Sample description was in accordance with the Appendix and the descriptions are given on the borehole logs.

Water level observations, made as boring proceeded are included on the borehole logs.

4.3 Rotary drilling

Twenty six boreholes were extended by open hole drilling, adjacent to the backfilled cable tool hole, from ground level to a depth specified by SWKP and then rotary coring to a maximum depth of 25 m. One borehole (727) was extended by rotary core drilling through the base of a cased boring and a further eight boreholes were cored from ground level to a maximum depth of 30.6 m.

During coring continuous core samples of the bedrock of nominal diameter 92 mm were obtained using double tube swivel core barrels with Mylar plastic sleeve as an inner liner. Standard penetration tests were carried out in the weathered bedrock and the results are presented on the logs in accordance with Fig. 1. All core was placed in boxes and described on site in accordance with the Appendix, with the stratum descriptions given on the borehole logs. A photographic record was made of the core samples which has been supplied to SWKP in a separate volume. Point load testing was carried out on core specimens selected by SWKP with the results presented in Volume 2. Representative specimens of core, again selected by SWKP, were taken and preserved by wrapping in aluminium foil and coating with wax. The rock specimens were taken to the Bracknell laboratory of SML for laboratory testing and storage as appropriate. The remaining core was placed in temporary storage near Worthington, Ashby-de-la-Zouch.

Water level observations, made as drilling proceeded, are included on the borehole logs. Seven standpipe piezometers, 19 mm in diameter, were installed at depths varying between 8.2 m and 30 m below ground level. The installation details are presented on the borehole logs and the standing water level observations are given in Table 1.

4.4 Trial pits

Twenty nine trial pits, numbered consecutively from 804 to 832, were taken out by mechanical excavator to a maximum depth of 3.0 m. The excavations were examined and logged by an engineering geologist. Open drive undisturbed tube samples, 38 mm in diameter (U38), were recovered from the more cohesive deposits and from the weathered bedrock. Representative disturbed samples were taken of all strata encountered. All samples obtained were transported to the Doncaster laboratory of SML for testing and storage as appropriate. The trial pit logs are presented as Fig. 84 to Fig. 112.

Soil resistivity measurements and redox potential tests were carried out in twenty three of the trial pits at depths shown on the logs. The results of these tests are given in the Annexe to the report.

for SOIL MECHANICS LIMITED

[redacted]

DHH/AAC/SLR/R4-4/7382/1
Doncaster, June 1988

Appendix

Terminology used in Soil Descriptions

Soils are described in accordance with the principles given in Section 8 of BS 5930 (1981). However, in some instances a modified or extended approach has been adopted as set out below.

Section 8 states that mixtures of coarse and fine soils with more than 35% of the latter should be described as fine soil, (SILT or CLAY) otherwise they should be described as coarse soil (SAND or GRAVEL). This approach has been followed except where strict adherence to it would lead to soil descriptions which did not reflect engineering behaviour and in such instances the percentage limit has been relaxed.

For mixtures with a predominant fine soil content the qualifying terms for sand and gravel percentages given in the code have been extended to include "slightly sandy" and "slightly gravelly" where the coarse soil content is considered significant but less than 35%.

Most purely fine soils are mixtures of silt and clay and according to the code are described as either SILT or CLAY with the option of a qualification in terms of degree of plasticity, as defined by liquid limit. Since such precise classification is often difficult from a visual assessment this approach has been modified. For those fine soils where the influence of the secondary fine constituent on the mass behaviour is considered significant the qualifying terms "very silty" or "very clayey" are used.

For clays the extended strength scale is used as follows:

Term	Undrained shear strength kN/m^2
Very soft	less than 20
Soft	20 to 40
Soft to Firm	40 to 50
Firm	50 to 75
Firm to Stiff	75 to 100
Stiff	100 to 150
Very Stiff	Greater than 150

For coarse soil mixtures the Section 8 scheme with the secondary constituent preceding the main soil types, eg (slightly/ - /very) sandy GRAVEL, can become ambiguous if both constituent sizes require further qualifying adjectives. These difficulties are overcome by placing the secondary constituent after the main soil type using the nomenclature in Section 8 for mixtures which contain very coarse soils, eg GRAVEL (with a little/some/much) sand.

For a more detailed appraisal of soil description in accordance with Section 8 see Norbury et al (1984).

References:

BS 5930 : 1981 : 'Code of practice for site investigations (Formerly CP 2001)' : British Standards Institution.

Norbury D R, G H Child and T W Spink : 1984 : 'A critical review of Section 8 (BS 5930) soil and rock description.' Proc 20th Regional Meeting Engineering Group of the Geological Society : Site Investigation Practice : Assessing BS 5930. Univ of Surrey, Guildford, pp 353-369.

Appendix

Terminology used in Rock Descriptions

The description of rocks generally follows the recommendations given in Section 8 of BS 5930 (1981), with the exception of the description of weathered state. Here the scheme defined in QJEG (1972) has been adopted as being more indicative of the effects of weathering on rock mass properties. This scheme is as follows:

TERM	DEFINITION
Residual Soil	Rock is discoloured and completely changed to a soil in which original rock fabric is completely destroyed.
Completely weathered	Rock is discoloured and changed to a soil but original fabric is mainly preserved. There may be occasional small corestones. The properties of the soil depend in part on the nature of the parent rock.
Highly weathered	Rock is discoloured; discontinuities may be open and have discoloured surfaces, and the original fabric of the rock near to the discontinuities may be altered. Alteration penetrates deeply inwards, but corestones are still present. (The ratio of original rock to weathered rock is estimated where possible).
Moderately weathered	Rock is discoloured; discontinuities may be open and will have discoloured surfaces with alteration starting to penetrate inwards; intact rock is noticeably weaker, as determined in the field, than the fresh rock. (The ratio of original rock to weathered rock is estimated where possible).
Slightly weathered	Rock may be slightly discoloured, particularly adjacent to discontinuities, which may be open and will have slightly discoloured surfaces; the intact rock is not noticeably weaker than the fresh rock.
Fresh	Parent rock showing no discolouration, loss of strength or any other weathering effects.

The main differences are in the highly and moderately weathered ranges as given in Table 10 of the Code and that rock material weathering is not described separately.

The measurement of fracture state has been carried out in accordance with the principles outlines in BS 5930 but the definitions of the various criteria used have been clarified as follows:

Solid Core: Defined as core with at least one full diameter (but not necessarily a full circumference) measured along the core axis between two natural fractures. By this definition core that has a single set of inclined fractures would have a solid core recovery of 100%. Where there are two or more sets of non-parallel fractures, only sections of core in which the fractures actually intersect are excluded from solid core.

Total Core Recovery, TCR%: Defined as the percentage ratio of core recovered (both solid and non-intact) to the total length of core run.

Solid Core Recovery, SCR%: Defined as the percentage ratio of solid core recovered to the total length of core run.

Rock Quality Designation, RQD%: Defined as the total length of solid core pieces each greater than 100 mm between natural fractures expressed as a percentage of total length of core run.

Fracture spacing, I_f mm: Defined as the average length of solid core pieces between natural fractures over core lengths of reasonably uniform characteristics, not core runs. The term non-intact (NI) is used when the core is fragmented. Additional detail can be given by estimating the minimum, average and maximum fracture spacings in mm for any uniform length eg 100/250/300.

The scheme of description outlined in BS 5930 is applicable to most, but not all, rocks. The description of some rocks (eg Chalk, Keuper Marl, young carbonates) requires a different approach to description and, where such an approach is used, it is outlined in a separate appendix.

For a more detailed appraisal of rock description in accordance with Section 8 see Norbury et al (1984).

References:

BS 5930 : 1981 : 'Code of practice for site investigations (Formerly CP 2001)' : British Standards Institution.

QJEG : 1972 :'The preparation of maps and plans in terms of engineering geology' : QJEG Vol 5 No 4.

Norbury D R, G H Child and T W Spink : 1984 : 'A critical review of Section 8 (BS 5930) soil and rock description.' Proc 20th Regional Meeting Engineering Group of the Geological Society : Site Investigation Practice : Assessing BS 5930. Univ of Surrey, Guildford, pp 353-369.

Appendix

Point Load Strength Index

As an index test of rock strength, samples may be subjected to loading between platens to create failure in a tensile mode. Tensile strength of rock has been shown to be related to compressive strength and, as loads required to produce tensile failure are low and samples require no machining or preparation, a test has been developed which may be carried out in the field using a portable hydraulic tester. The results may be used as an index of rock strength and particularly its variability. The test is fully described by Broch E and J A Franklin (1972)*.

The most convenient platen shape has been shown to be a rounded conical 60° point whose tip radius is 5 mm. This size and shape has been taken as standard so that comparison between materials may take place. Total load, P, on the point required to produce failure, together with the sample dimension being tested, D, and recorded so that an index of strength P/D^2 may be calculated. For convenience of comparison between tests it is necessary to correct the index to an equivalent value for the same material having a tested dimension of 50 mm, this corrected value being the Point Load Strength Index, Is_{50}.

Normally tests are carried out on drill core samples although irregular lumps and blocks may also be tested. When testing core samples it is usual to carry out diametral and axial tests so that by comparison of the Is_{50} values an anisotropy index may be obtained such that:

$$Ia = \frac{Is_{50}(axial)}{Is_{50}(diametral)}$$

Testing is carried out in accordance with the Suggested Method published by the International Society of Rock Mechanics (Anon, 1985)*.

For the diametral test is is recommended that the distance between the point of contact of the load and the nearest free end be no less than 0.5D where D is the core diameter and, in the axial test, length/diameter ratios of less then 1.0 are recommended.

Sampling procedure for this index test is generally based on the selection of at least 10 suitable pieces of core from each zone of the drillhole that exhibits an apparent uniformity of strength so that a mean strength index may be determined for each zone.

---

* Broch E and J A Franklin : 1972 : The Point Load Strength Test. Int Jnl Rock Mech Mining Science Vol 9, pp 669-697.

Anon : 1985 : Suggested Method for Determining Point Load Strength. International Society of Rock Mechanics Commission on Testing Methods. Int Jnl Rock Mech Mining Science, Vol 22, pp 51-60.

Tested			Traced		
Checked			Approved		

© Soil Mechanics Limited Foundation House Bracknell Berkshire

Soil Mechanics

Location: A42 CASTLE DONINGTON NORTH
Ground Investigation Contract 4

Loc No. 7382

Table 1

BOREHOLE NO.	INSTALLATION DATE	DEPTH OF RESPONSE ZONE (m. below g.l.)		WATER LEVEL OBSERVATIONS (m. below g.l.)														
		From	To	DATE 1988 19/1	26/1	11/2	12/2	9/2	17/2	18/2	23/2							
703R	17/2/88	30.00	2.00							10.96	11.80							
704R	8/1/88	17.00	2.00	4.35	4.40	11.92		9.34	12.42		13.61							
712R	10/1/88	15.00	1.00	8.43	8.50		8.37	8.10	8.19		8.31							
719R	27/1/88	15.00	1.00				0.61	0.40		0.65	0.77							
728R	3/2/88	20.00	1.00					0.98	1.71		1.76							
733R	28/1/88	8.20	2.00				2.36	2.52	2.50		2.50							
736R	12/2/88	14.00	2.00						8.03		8.33							

STANDPIPE DETAILS AND ASSOCIATED WATER LEVEL OBSERVATIONS

KEY TO BOREHOLE RECORDS

SAMPLES

U	Undisturbed driven tube sample	100mm nominal diameter unless noted otherwise
P	Undisturbed pushed piston sample	
D	Small disturbed sample	
B	Disturbed bulk sample	
WS	Water sample	
CS	Core sample (from rotary core) taken for laboratory testing	

TEST RESULTS

Detailed test results generally presented elsewhere in report.

S	Standard Penetration Test, split spoon sampler
C	Standard Penetration Test, solid cone

The N-value from the Standard Penetration Test is the number of blows required to obtain 300mm penetration below an initial seating drive of 150mm (P = 450mm), using a standard free fall trip hammer. Where this full 300mm penetration has not been achieved (150<P<450mm), the number of blows (not an N-value) is reported for the penetration measured from the base of the 150mm seating drive. Where the total penetration is less than the seating drive (P<150mm) the number of blows is given in brackets for the quoted penetration which is measured from the top of the seating drive.

k	Field permeability test, type of test indicated in Remarks.
V	Field vane test, vane shear strength quoted for natural (N) and remoulded (R) tests in kN/m^2.

Ia	Axial point load strength	Point load strength corrected to 50mm reference diameter and quoted in MN/m^2
Id	Diametral point load strength	

DRILLING RECORDS

W	Water flush returns, estimated percentage returns together with colour where relevant	
TCR	Total Core Recovery, %	Definitions of these indices are given in the Appendix on Terminology Used in Rock Descriptions. See Note 3.
SCR	Solid Core Recovery, %	
RQD	Rock Quality Designation, %	
I_f	Fracture Spacing, mm. The term non-intact (NI) is used where the core is fragmented. Additional detail is often given by quoting minimum, average and maximum fracture spacings	

NOTES

1. Water level observations during boring and drilling are given at the end of the borehole log.
2. Details of borehole installations are given on the installation sheet which is the last sheet of the relevant borehole log.
3. The assessment of solid core recovery, Rock Quality Designation and fracture spacing conventionally excludes all artificial fractures unless noted otherwise.
4. The dip of bedding and joints is given with respect to horizontal, the borehole axis being assumed to be vertical unless noted otherwise.

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Soil Mechanics

BOREHOLE No. 706R

Sheet 3 of 3

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)

Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
14.01	1700	8.00	7.00	DRY	
15.01	0800	8.00	7.00	DRY	
15.01	1700	12.06	7.00	9.56	
19.01	0800	15.06		9.50	no casing
19.01	1730	19.25	7.00	15.00	

Remarks

Logged by AAC

Scale 1:50

Fig. 11

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 21.03.88/11.04 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 707

Sheet 1 of 2

Equipment & Methods

Cable tool boring, 200 mm diameter, from ground level to 6.915m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 110.28 m A.O.D.

Coordinates: 59558.2 mE, 90693.8 mN

Date: 10.12.87 to 11.12.87

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Clayey topsoil	110.28		(0.25)	0.10	D	1		
	110.03		0.25					
Firm becoming stiff red brown very silty CLAY with pockets, partings and lenses of yellow green silt and silty fine sand locally cemented (KEUPER SERIES MARL 4b) — red brown and yellow green banded thinly laminated clay with cemented silt laminae				0.40	D	2		
				0.60 – 1.05	U	3		92 blows
			(1.75)	1.10	D	4		
				1.15 – 1.60	D	5	S N=31	
	108.28		2.00					
				2.10 – 2.55	B	6	C N=139	
				3.10	D	7		
				3.60 – 3.90	B	8	C 89	11,15/39,50 for 75mm
Very stiff (hard) red brown very silty CLAY with occasional lithorelics and pockets of yellow green becoming light green grey silt and silty fine sand locally cemented (KEUPER SERIES MARL 4a)			(4.91 pen)	4.50	D	9		
				5.10 – 5.32	B	10	C 88	13,38/50 for 70mm
				6.00	D	11		
				6.60 – 6.73			C (74)	24,50 for 55mm
				6.80	D	12	C	Chiselling from 6.50 to 6.85m 1.75 hours
				6.80 – 6.91			(85)	35,50 for 40mm
BOREHOLE ENDS AT 6.91 m.	103.36		6.91					

Remarks

Logged by: GAC/AAC

Scale: 1:50

Fig. 12

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 19.04.88/09.32 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 707

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)

Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field Records

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1987					
10.12	–	0.00	0.00		
10.12	1630	4.00	3.00	DRY	End of shift
11.12	0800	4.00	3.00	4.00	Damp
11.12	–	5.00	3.00	5.00	Slight seepage below 5.00m
11.12	1330	6.91	3.00	5.90	End of borehole

Remarks

Logged by GNC/MAC

Scale 1:50

Fig. 12

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics

All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 21.03.88/11.19 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 707R

Sheet 1 of 3

Equipment & Methods

Open hole drilling, air flush, using 6.75in rock bit, from G.L. to 5.90m. Rotary core drilling, air flush, producing 92mm core from 5.90m to 19.216m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 110.28 m A.O.D.

Coordinates: 59558.2 mE, 90693.8 mN

Date: 12.01.88 to 13.01.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
	110.28									
Cable Tool Boring to 6.91m			(5.90)							
Recovered as fragments of yellow brown to green silty SANDSTONE weak (KSS 2) — Assessed zone of core loss	104.38		5.90 (0.21)							at 5.90m S:(89) 39,50 for 35mm
Very stiff (hard) red brown very silty CLAY with green silt and fine sand to 6.25m becoming sandy by 6.87m (weathered MUDSTONE) (KEUPER SERIES MARL 3/4a)	104.17		6.11 (0.87)	5.90 - 7.00		91	65	59		
Assessed zone of core loss	103.30		6.98							at 7.00m S:50 11,43/50 for 23mm
N.I. core										
Light grey and light green to yellow fine to medium grained very thinly to thinly bedded locally silty SANDSTONE moderately weak with up to very thin beds of hard red brown and light green sandy clay, silty clay and silt — N.I. core			(2.65)	7.00 - 9.00		90	73	0	NI 70 100	
(KEUPER SERIES SANDSTONE 1/2) — Assessed zone of core loss										at 9.00m S:(50) 50 for 59mm
	100.65		9.63	9.00 - 12.00		79	70	13		
Hard dark red brown CLAY (As sheet 2)			(1.23)							

Remarks

Logged by: GAC

Scale: 1:50

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.05.88/10.08 (Ver 3.1.10)

Fig. 13

Soil Mechanics

BOREHOLE No. 707R

Sheet 2 of 3

Equipment & Methods: As sheet 1

Location No. 7382

Location: A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4

Carried out for
Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: As sheet 1 | Coordinates: As sheet 1 | Date: As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
Dark red brown very silty CLAY (weathered MUDSTONE) with very thin beds of green grey silt (KSM 2) — red brown to grey sandstone			(1.23)							
	99.42		10.86							
Light grey becoming dark brown then green grey medium grained locally conglomeratic very thinly locally current bedded SANDSTONE strong (KEUPER SERIES SANDSTONE 1)			(0.54)	9.00 – 12.00		79	70	13	25 – 170	
	98.88		11.40							
Hard dark red brown thinly to very thinly bedded CLAY with green grey very clayey silt pockets (weathered MUDSTONE) (KSM 1) — Assessed zone of core loss			(1.06)							
	97.82		12.46							
generally N.I. core. Dark red brown fine to medium grained thinly bedded clayey SANDSTONE very weak (KEUPER SERIES SANDSTONE 2) below 12.93m with green grey to yellow brown silty sandstone beds			(1.23)	12.00 – 15.00		85	64	25	NI 50 90	
	96.59		13.69							
Very stiff (hard) dark red brown fine sandy CLAY with occasional laminations of red brown sand (weathered MUDSTONE) (KEUPER SERIES MARL 3) — vertical rough planar joint. below 14.16m with pockets of light green grey sandy silt around yellow cemented sand			(1.45)							
	95.14		15.14							
N.I. core. 15.14–15.74m with red bands. Very stiff (hard) green laminated very clayey SILT / silty CLAY (weathered SILTSTONE / MUDSTONE) interbedded with thin beds of yellow brown sandstone moderately weak (KEUPER SERIES MARL 2)			(2.16)	15.00 – 17.40		94	80	19		
	92.98		17.30							
CRF. Dark red brown fine to medium grained very clayey SANDSTONE very weak thinly interbedded with yellow to green brown SANDSTONE weak with pockets of green silt around yellow sand (KEUPER SERIES SANDSTONE 2/3) — vertical rough planar joint			(1.92 pen)	17.40 – 19.00		100	81	48		
BOREHOLE ENDS AT 19.22 m.	91.06		19.22							at 19.00m S:50 9,20/50 for 66mm

Remarks

Logged by: GAC

Scale: 1:50

Fig. 13

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 15.04.88/09.32 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 707R

Sheet 3 of 3

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records		Mechanical core log				Field Records and Test Results
				Depth	W	TCR	SCR	RQD	If	

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
12.01	0800	0.00	0.00		
12.01	1800	12.00	6.90	10.05	End of shift
13.01	0800	12.00	6.90	9.60	
13.01	1800	19.00	6.90	10.76	End of borehole

Remarks

Logged by: GAC

Scale: 1:50

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 15.04.88/09.32 (Ver 3.1.0)

Fig. 13

Soil Mechanics

BOREHOLE No. 708

Sheet 1 of 1

Equipment & Methods

Cable tool boring, 200 mm diameter, from ground level to 5.75m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 110.38 m A.O.D.

Coordinates: 59571.2 mE, 90688.0 mN

Date: 11.12.87 to 12.12.87

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Clayey topsoil	110.38		(0.30)	0.10	D	1		
	110.08		0.30					
Firm becoming stiff red brown very silty CLAY locally with occasional up to medium gravel sized lithorelics and pockets and lenses of yellow brown silty and silty fine sand locally cemented (KEUPER SERIES MARL 4a) — red brown to yellow brown clay thinly interlaminated with yellow brown silt and grey fine sand locally cemented				0.45	D	2		
				0.60 – 1.05	U	3		90 blows
				1.10	D	4		
				1.15 – 1.60	D	5	S N=63	
			(2.70)					
				2.20 – 2.57	B	6	C 95	3,10/16,29,50 for 70mm
	107.38		3.00	3.10	D	7		
Very stiff (hard) red brown very silty CLAY locally with frequent medium gravel sized lithorelics and with pockets and lenses of yellow green silt and light grey green silty fine sand locally cemented (KEUPER SERIES MARL 3/4a)				3.70 – 4.00	B	8	C 85	8,17/35,50 for 75mm
			(2.75 pen)	4.60	D	9		
				5.20 – 5.35			C (64)	
				5.20 – 5.50	B	10		14,50 for 75mm Chiselling from 5.20 to 5.60m
				5.60 – 5.70			C (67)	1.00 hour 17,50 for 30mm
BOREHOLE ENDS AT 5.75 m.	104.63		5.75					

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1987					
11.12	–	0.00	0.00	0.00	
11.12	1430	3.50	2.00	DRY	End of shift
12.12	0800	3.50	2.00	3.50	Damp
12.12	1100	5.75	2.00	DRY	End of cable tool boring

Remarks

Logged by: GAC/AAC

Scale: 1:50

Fig. 14

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth colum. 21.03.88/11.34 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 708R

Sheet 1 of 3

Equipment & Methods: Open hole drilling, air flush, using 6.75in rock bit, from G.L. to 4.80m. Rotary core drilling, air flush, producing 92mm diameter core to 17.098m.	Location No. 7382 Location: A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4
Carried out for Client: Department of Transport (E. Midlands Reg. Office) Engineer: Scott Wilson Kirkpatrick & Partners	Ground Level: 110.38 m A.O.D. Coordinates: 59571.2 mE, 90688.0 mN Date: 09.01.88 to 11.09.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
Cable Tool Boring to 5.75m	110.38		(4.80)							
Assessed zone of core loss	105.58		4.80 (0.40)							at 4.80m S:93 6,12,16,27, 50 for 65mm
Light green to yellow brown fine to medium grained very thinly bedded silty SANDSTONE very weak occasional pockets of green and red brown clay (KSS 2) — N.I. core	105.18		5.20 (0.82)	4.80 – 6.02		67	46	0	NI 60 60	
Assessed zone of core loss	104.36		6.02 (0.70)							at 6.02m S:76 6,12,26,50 for 49mm
Dark red brown fine to medium grained thinly bedded sandy MUDSTONE very weak to weak with occasional pockets of green grey silt (KSM 2)	103.66		6.72 (0.81)	6.02 – 8.12		67	57	15	NI 70 180	
Light green grey fine to medium grained very thinly bedded moderately weathered silty SANDSTONE very weak to weak with up to very thin beds of red brown and light green clay, very silty clay and silt and occasional pockets of light brown sand — N.I. core; Assessed zone of core loss; Assessed zone of core loss; N.I. core (KEUPER SERIES SANDSTONE 2)	102.85		7.53 (4.59)	8.12 – 8.92 8.92 – 10.49		17 73	17 56	17 22	NI 50 90 NI 70 130	at 8.12m S:70 8,14,20,50 for 37mm

Remarks

Logged by: GAC/AAC

Scale: 1:50

Fig. 15

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics 21.03.88/11.48 (Ver 3.1.0)

All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

Soil Mechanics

BOREHOLE No. 708R

Sheet 2 of 3

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
Light green grey silty SANDSTONE (As sheet 1)				8.92 - 10.49		73	56	22		
10.39-10.91m light grey to yellow green slightly conglomeratic locally crystalline sandstone. Assessed zone of core loss			(4.59)						NI 70 130	at 10.49 S:83 7,16/33,50 for 40mm
10.91-11.09m hard red brown laminated clay										
11.09-11.66m locally current bedded										
below 11.66m grey brown and micaceous				10.49 - 13.38		87	76	43		
	98.26		12.12							
Very stiff (hard) red brown and light green banded laminated CLAY (weathered MUDSTONE) with occasional brown micaceous sand and sandstone beds and pockets (KEUPER SERIES MARL 2)										
13.71-13.93m light green grey very thinly bedded sandstone moderately strong. Assessed zone of core loss			(3.68)	13.38 - 13.93		89	60	0		
14.47-15.00m subvertical stepped smooth fissures probably closely spaced										
sandy clay with light green grey sandy silt and yellow sand pockets				13.93 - 16.98		90	61	23		
	94.58		15.80							
Red brown, yellow brown and green grey weakly cemented SAND generally recovered non-intact (KSS 2/3)			(0.67)							
	93.91		16.47							
Dark red brown fine to medium grained thinly bedded moderately weathered silty SANDSTONE weak (KEUPER SERIES SANDSTONE 2/3)			(0.63 pen)						80 80 200	
	93.28		17.10							at 16.98m S:(68) 18,50 for 43mm
BOREHOLE ENDS AT 17.10 m.										

Remarks

Logged by: GAC/AAC

Scale: 1:50

Fig. 15

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 21.03.88/11.48 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 708R

Sheet 3 of 3

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records		Mechanical core log				Field Records and Test Results
				Depth	W	TCR	SCR	RQD	If	

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
09.01	–	0.00	0.00		
09.01	1630	4.80	4.80	DRY	End of shift
10.01	0800	4.80	4.80	DRY	
10.01	1700	13.38	4.80	12.03	End of shift
11.01	0800	13.38	4.80	8.92	
11.01	–	17.10	4.80	DRY	End of borehole

Remarks

Logged by GAC/AAC

Scale 1:50

Fig. 15

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 21.03.88/11.48 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 709

Sheet 1 of 1

Equipment & Methods

Cable tool boring, 150 mm diameter, from ground level to 5.41m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 73.84 m A.O.D.

Coordinates: 61037.5 mE, 92338.2 mN

Date: 12.12.87 to 13.12.87

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Clayey topsoil	73.84		(0.50)	0.30	D	1		Water added to assist boring
	73.34		0.50					
Firm red brown very silty CLAY with occasional up to medium gravel sized fragments of yellow green silty sandstone (KEUPER SERIES MARL 4a)			(1.50)	0.50 – 0.95	U	2		44 blows
				1.00	D	3		
				1.00 – 1.45	D	4	S N=12	
	71.84		2.00					
Stiff red brown friable very silty CLAY with pockets and lenses of green grey silt and silty fine sand locally cemented (KEUPER SERIES MARL 4a)				2.00 – 2.45	U	5		100 blows
				2.50	D	6		
				2.50 – 2.95	D	8	S N=31	No sample no.7
below 4.00m with light green reduction spots			(3.41 pen)	3.50 – 3.95	U	9		64 blows
				4.00	D	10		
becoming very stiff by about 4.60m				4.00 – 4.45	D	11	S N=45	
				5.00 – 5.27	D	12	S 86	10,25/36,50 for 45mm
				5.30 – 5.41	D	13	S (71)	Chiselling from 4.60 to 5.30m 1.00 hour 21,50 for 35mm
BOREHOLE ENDS AT 5.41 m.	68.43		5.41					

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1987					
12.12	–	0.00	0.00		
12.12	–	3.00	1.50	DRY	End of shift
13.12	–	3.00	1.50	DRY	
13.12	–	5.41	4.50	DRY	End of cable tool boring

Remarks

Logged by GAC/AAC

Scale 1:50

Fig. 16

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 21.03.88/11.54 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 709R

Sheet 1 of 3

Equipment & Methods

Open hole drilling, air flush, using 4.75in rock bit, from G.L. to 5.50m. Rotary core drilling, air flush, producing 92mm diameter, core from 5.50m to 17.10m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 73.84 m A.O.D.

Coordinates: 61037.5 mE, 92338.2 mN

Date: 07.01.88 to 10.01.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
Cable Tool Boring to 5.41m	73.84		(5.50)							
Stiff to hard red brown very silty CLAY with occasional thin laminae of siltstone and pockets of light brown silt and silty fine sand (KEUPER SERIES MARL 4a/3) — N.I. core; slightly sandy	68.34		5.50	5.50 – 6.30		100	5	0		0.04m CRF
			(1.43)							at 6.30m S:N=35 5,6/8,9,9,9
	66.91		6.93	6.30 – 7.30		100	94	32		
Light brown grey and red brown thinly bedded moderately weathered SILTSTONE with occasional very thin beds of silt and hard friable clay 7.05–7.22m subvertical rough undulating joint (KEUPER SERIES MARL 2) — Assessed zone of core loss; N.I. core			(1.55)						NI 120 280	at 7.30m S:N=124 10,12/21,30 31,42
				7.30 – 9.10		92	43	19		
	65.36		8.48							
Very stiff red brown locally friable very silty CLAY (weathered MUDSTONE) with occasional fine sandy pockets and sandstone lenses (KEUPER SERIES MARL 2/3)			(2.12)							at 9.10m S:50 20,38/50 for 70mm
				9.10 – 10.10		100	78	78		

Remarks

1. CRF = Core recovered by following run

Logged by: GAC/AAC

Scale: 1:50

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 21.03.88/12.06 (Ver 3.1.0)

Fig. 17

Soil Mechanics

BOREHOLE No. 709R

Sheet 2 of 3

Equipment & Methods: As sheet 1

Location No. 7382

Location: A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4

Carried out for
Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: As sheet 1 | Coordinates: As sheet 1 | Date: As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
CLAY (As sheet 1) becoming by 10.10m stiff dark red brown friable very silty CLAY			(2.12)	9.10 – 10.10		100	78	78		at 10.10m S:50 13,25/50 for 72mm
	63.24		10.60	10.10 – 11.00		94	84	84		
Red brown to light red brown and green grey very thinly to thinly bedded clayey SILTSTONE weak interbedded with very stiff (hard) dark red brown very silty CLAY (KEUPER SERIES MARL 2) — Assessed zone of core loss; N.I. core; Assessed zone of core loss; N.I. core; N.I. core			(2.52)	11.00 – 12.50		63	31	9	NI 80 110	at 11.00m S:(69) 19,50 for 40mm
	60.72		13.12	12.50 – 13.50		88	44	13		at 12.50m S:50 20,35/50 for 40mm
Very stiff (hard) dark red brown thickly laminated very silty CLAY (KSM 4b)	60.34		(0.38) 13.50							
Assessed zone of core loss			(0.75)							
	59.59		14.25	13.50 – 15.10		47	14	7		
Dark red brown to grey very thinly to thinly bedded moderately weathered SILTSTONE weak interbedded with hard generally non-intact very silty CLAY (KEUPER SERIES MARL 2/3) — Assessed zone of core loss; N.I. core; Assessed zone of core loss; at 16.32m pocket of soft light green clay			(2.85 pen)	15.10 – 16.10		90	47	0	NI 40 100	at 15.10m S:(74) 24,50 for 60mm
				16.10 – 17.10		59	16	0		
BOREHOLE ENDS AT 17.10 m.	56.74		17.10							at 17.10m S:(50) 50 for 28mm

Remarks

Logged by: GAC/AAC

Scale: 1:50

Fig. 17

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 21.03.88/12.06 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 709R

Sheet 3 of 3

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
07.01	0800	0.00	0.00	0.00	
07.01	1300	5.50	5.50	0.90	Start of coring
07.01	1730	6.30	6.30	DRY	End of shift
08.01	0815	6.30	6.30	4.80	
08.01	1730	11.00	9.00	11.00	Damp, end of shift
09.01	0830	11.00	9.00	1.70	
09.01	1630	15.10	9.00	15.10	Damp, end of shift
10.01	0810	15.10	9.00	1.10	
10.01	-	17.10	9.00	DRY	End of borehole

Remarks

Logged by GAC/AAC

Scale 1:50

Fig. 17

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 21.03.88/12.06 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 710

Sheet 1 of 2

Equipment & Methods

Cable tool boring, 200 mm diameter, from ground level to 12.355m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 74.56 m A.O.D.

Coordinates: 61043.1 mE, 92323.8 mN

Date: 14.12.87 to 15.12.87

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Clayey topsoil	74.56		(0.30)	0.10	D	1		
	74.26		0.30	0.40	D	2		
Firm red brown slightly sandy very silty CLAY with occasional roots			(0.80)	0.60 - 1.05	U	3		90 blows
	73.46		1.10	1.10	D	4		
with occasional black mottling and grey staining				1.10 - 1.55	D	5	S N=21	
				2.10 - 2.55	U	6		70 blows water added to assist boring from 2.00m
				2.60	D	7		
Stiff red brown in parts extremely to very closely fissured locally very silty CLAY with pockets and lenses of light green grey silt and silty fine sand			(3.90)	2.60 - 3.05	D	8	S N=31	
(KEUPER SERIES MARL 4b)				3.60 - 4.05	U	9		150 blows
				4.10	D	10		
with bands of light green grey cemented silty fine sand				4.10 - 4.55	D	11	S N=149	
	69.56		5.00					
				5.10 - 5.45	U	12		150 blows
				5.50	D	13		
Very stiff (hard) red brown to dark red brown extremely to very closely fissured very silty CLAY with pockets and lenses of light green grey silt and silty fine sand locally cemented, occasional light green reduction spots and occasional black staining on fissure surfaces				5.50 - 5.95	D	14	S N=99	
				6.70 - 6.80	U			150 blows no recovery
				6.70	D	15	S	
				6.80 - 6.95	D	16	(72)	12,50 for 75mm
(KEUPER SERIES MARL 4b)			(7.35)	7.60	D	17		
stiff to very stiff becoming by about 8.50m very clayey SILT / very silty CLAY				8.50 - 8.95	D	18	S N=44	
				9.50	D	19		

Remarks

Logged by: GAC/AAC

Scale: 1:50

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 21.03.88/12.19 (Ver 3.1.0)

Fig. 18

Soil Mechanics

BOREHOLE No. 710

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
				10.30 - 10.60	D	20	S 70	9,18/20 50 for 75mm
Very stiff (hard) dark red brown very clayey SILT / very silty CLAY (As sheet 1)			(7.35 pen)	11.20	D	21		
				11.80 - 11.95	D	22	S (77)	27,50 for 75mm Chiselling from 11.90 to 12.25m 1.00 hour
				11.90	WS	23		
				12.25 - 12.35			C (80)	30,50 for 30mm
BOREHOLE ENDS AT 12.35 m.	62.20		12.35					

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1987					
14.12	1545	0.00	0.00		
14.12	1630	1.60	0.50	DRY	
15.12	0800	1.60	0.50	DRY	
15.12	-	6.70	1.50	6.70	Slight seepage below 6.70m
15.12	1515	11.90	1.50	11.90	Water strike
15.12	1520			8.40	5 mins.
15.12	1525			8.30	10 mins.
15.12	1530			8.10	15 mins.
15.12	1535			8.10	20 mins.
15.12	1630	12.35	1.50	7.70	End of cable tool boring

Remarks

Logged by GAC/AAC

Scale 1:50

Fig. 18

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 21.03.88/12.19 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 710R

Sheet 1 of 3

Equipment & Methods Open hole drilling, air flush, using 6.75in rock bit, from G.L. to 12.00m. Rotary core drilling, air flush, producing 92mm core from 12.00m to 19.30m.	Location No. 7382 Location A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4
Carried out for Client: Department of Transport (E. Midlands Reg. Office) Engineer: Scott Wilson Kirkpatrick & Partners	Ground Level: 74.56 m A.O.D. Coordinates: 61043.1 mE, 92323.8 mN Date: 11.01.88 to 13.01.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
	74.56									
Cable Tool Boring to 12.35m			(12.00)							

Remarks

Logged by: GAC/AAC

Scale: 1:50

Fig. 19

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 21.03.88/12.26 (Ver 3.1.10)

Soil Mechanics

BOREHOLE No. 710R

Sheet 2 of 3

Equipment & Methods: As sheet 1

Location No. 7382

Location: A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4

Carried out for
Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: As sheet 1 | Coordinates: As sheet 1 | Date: As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
Cable Tool Boring to 12.35m			(12.00)							
	62.56		12.00							
Assessed zone of core loss			(0.80)	12.00 – 13.00		20	0	0		at 12.00m S:50 13,21/50 for 70mm
	61.76		12.80							
Very stiff red brown to dark red brown very silty CLAY with frequent up to coarse gravel sized lithorelics (weathered MUDSTONE) (KSM 3)			(0.80)	13.00 – 13.60		92	22	0		
	60.96		13.60							
Assessed zone of core loss			(0.60)							at 13.60m S:(78) 28,50 for 70mm
	60.36		14.20	13.60 – 14.80		50	18	0		
Light green grey fine grained very thinly to thinly bedded moderately weathered SILTSTONE moderately weak (KEUPER SERIES MARL 2) — dark red brown, sandy and very weak									NI	
very weak to weak with grey bands and clayey bands, N.I. core									NI 130	
			(2.40)	14.80 – 15.80		100	34	0		
15.50–15.70m dark red brown, slightly sandy — Assessed zone of core loss									30 50 50 120	at 15.80m S:(50) 50 for 60mm
16.38–16.60m red brown sandy very silty mudstone				15.80 – 16.60		62	62	49		
CNF	57.96		16.60							
				16.60 – 16.80		100	60	60		
CRF				16.80 – 17.00		100	55	55		
				17.00 – 17.50		100	100	96		
Light grey brown locally pinkish slightly weathered crystalline porous dolomitic LIMESTONE strong to very strong with occasional up to coarse gravel sized cavities Thinly to mediumly bedded with beds dipping 20 deg. Very closely to widely spaced 50 deg. rough and planar, open and closed joints (CARBONIFEROUS LIMESTONE)			(2.70 pen)						NI 340 370	
				17.50 – 19.30		100	89	84		
BOREHOLE ENDS AT 19.30 m.	55.26		19.30							

Remarks

Logged by: GAC/AAC

Scale: 1:50

Fig. 19

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 21.03.88/12.26 (Ver 3.1.10)

Soil Mechanics

BOREHOLE No. 710R

Sheet 3 of 3

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
11.01	–	0.00	0.00		
11.01	1730	13.60	12.00	13.60	Damp, end of shift
12.01	0810	13.60	12.00	2.80	
12.01	1730	17.00	12.00	17.00	Damp, end of shift
13.01	0800	17.00	12.00	14.80	
13.01	–	19.30	12.00	19.30	Damp, end of borehole

Remarks

Logged by GAC/NAC

Scale 1:50

Fig. 19

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 21.03.88/12.26 (Ver 3.1.10)

Soil Mechanics

BOREHOLE No. 711

Sheet 1 of 2

Equipment & Methods

Cable tool boring, 200 mm diameter, from ground level to 7.815m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 75.31 m A.O.D.

Coordinates: 61059.0 mE, 92273.0 mN

Date: 13.12.87 to 14.12.87

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
	75.31			0.15	D	1		
				0.40	D	2		
Firm dark brown slightly sandy very silty CLAY with occasional fine gravel size fragments of sandstone, siltstone, coal and brick				0.50 - 0.95	U	3		90 blows
becoming brown and red brown by 1.00m			(2.00)	1.00	D	4		
(MADE GROUND)				1.00 - 1.45	D	5	S N=7	
	73.31		2.00					
grey staining on fissure surfaces				2.00 - 2.45	U	6		86 blows
				2.50	D	7		
				2.50 - 2.95	D	8	S N=27	
Firm becoming very stiff red brown extremely to very closely fissured very silty CLAY with dustings and pockets of grey and light green grey silt and silty fine sand				3.50 - 3.85	U	9		150 blows
				3.90	D	10		Water added to assist boring below 3.00m
				3.90 - 4.35	D	11	S N=38	
(KEUPER SERIES MARL 4b)			(5.82 pen)					
				5.00 - 5.45	U	12		150 blows
				5.50	D	13		
				5.50 - 5.95	D	14	S N=29	
				6.30	W	15		
becoming by about 6.80m very stiff (hard) very silty CLAY / very clayey SILT (weathered MUDSTONE / SILTSTONE) (KEUPER SERIES MARL 3)				6.80 - 6.95	D	16	S (58)	8,50 for 75mm
				7.60	D	17	C	Chiselling from 7.40 to 7.70m 1.00 hour
				7.70 - 7.82			(60)	10,50 for 30mm
BOREHOLE ENDS AT 7.82 m.	67.49		7.82					

Remarks

Logged by: GNC/AAC

Scale: 1:50

Fig. 20

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 21.03.88/12.35 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 711

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field Records

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1987					
13.12	-	0.00	0.00		
13.12	1630	6.30	1.50	DRY	End of shift
14.12	0800	6.30	1.50	1.30	
14.12	1430	7.82	1.50	6.60	End of cable tool boring

Remarks

Logged by: GAC/AAC

Scale: 1:50

Fig. 20

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 21.03.88/12.35 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 711R

Sheet 1 of 3

Equipment & Methods: Open hole drilling, air flush using 6.75in rock bit, from G.L. to 7.00m. Rotary core drilling, air flush, producing 92mm core to 17.195m	Location No. 7382 Location: A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4
Carried out for Client: Department of Transport (E. Midlands Reg. Office) Engineer: Scott Wilson Kirkpatrick & Partners	Ground Level: 75.31 m A.O.D. Coordinates: 61059.0 mE, 92273.0 mN Date: 14.01.88 to 15.01.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
Cable Tool Boring to 7.82m	75.31		(7.00)							
Stiff to very stiff (hard) red brown locally very silty CLAY: below 7.40m with pockets of light brown cemented silt (weathered MUDSTONE) (KEUPER SERIES MARL 3)										
Hard red brown very clayey SILT with light green to light brown siltstone lenses: by 7.90m light brown to light green thinly bedded locally sandy SILTSTONE very weak (KEUPER SERIES MARL 2/3)	68.31		7.00 (0.60)							at 7.00m S:79 6,8/29,50 for 60mm
NI										
sub-vertical joint with black speckled staining	67.71		7.60							
Hard dark red brown very silty locally sandy fissured CLAY/clayey SILT (weathered MUDSTONE / SILTSTONE) (KEUPER SERIES MARL 3)	67.27		(0.44) 8.04	7.00 – 8.50		97	66	10	NI 70 80	
			(0.46)							
Assessed zone of core loss	66.81		8.50 (0.95)	8.50 – 10.00		37	30	9		at 8.50m S:50 15,34/50 for 55mm
Hard very silty CLAY (weathered MUDSTONE) (as sheet 2)	65.86		9.45 (2.78)							

Remarks

Logged by: GAC/AAC

Scale: 1:50

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 21.03.88/13.47 (Ver 3.1.0)

Fig. 21

Soil Mechanics

BOREHOLE No. 711R

Sheet 2 of 3

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level — Coordinates — Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
NI/spoil?										
Hard dark red brown very closely fissured very silty CLAY (weathered MUDSTONE) interbedded with up to thin beds of grey silty fine SANDSTONE with pockets of red brown silt very weak				10.00 - 11.00		80	15	15		at 10.00m S:(69) 19,50 for 70mm
NI										
assessed zone of core loss			(2.78)							
Below 10.00m becoming hard dark red brown very silty CLAY in places very clayey silt with occasional lenses of grey fine sandy silt: closely to very closely fissured (KM 2/4b)				11.00 - 12.00		100	72	10		at 11.00m S:(81) 31,50 for 65mm
NI										
assessed zone of core loss	63.08		12.23							at 12.00m S:(50) 50 for 72mm
NI			(1.17)							
Hard dark red brown fissured very silty CLAY (weathered MUDSTONE) with bands and lenses of light brown to grey silt and siltstone (KSM 3)				12.00 - 14.00		82	24	6		
generally NI	61.91		13.40							
assessed zone of core loss			(0.80)							
Firm to very stiff red brown CLAY with up to medium gravel sized lithorelics (weathered MUDSTONE) (KSM 4b)	61.11		14.20							
clay with lithorelics										
NI				14.00 - 15.10		86	45	28		
assessed zone of core loss										
Red brown, grey brown to brown and occasionally light green grey generally very thinly bedded locally fine sandy and locally clayey SILTSTONE weak to moderately strong (KEUPER SERIES MARL 2)			(2.99 pen)	15.10 - 17.00		82	68	28	NI 80 160	
firm red brown clay with lithorelics										
BOREHOLE ENDS AT 17.19 m.	58.11		17.19							at 17.00m S:50 21,28/50 for 45mm

Remarks

Logged by GAC/NAC

Scale 1:50

Fig. 21

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 21.03.88/13.47 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 711R

Sheet 3 of 3

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records		Mechanical core log				Field Records and Test Results
				Depth	W	TCR	SCR	RQD	If	

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
14.01	1800	10.00	7.00	10.00	damp, end of shift
15.01	0800	10.00	7.00	4.10	
15.01	1600	17.00	7.00	17.00	damp, end of shift
18.01	0830	17.00	7.00	3.30	

Remarks

Logged by GAC/AAC

Scale 1:50

Fig. 21

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth colum. 21.03.88/13.47 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 712

Sheet 1 of 1

Equipment & Methods

Cable tool boring, 150 mm diameter, from ground level to 4.675m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 75.42 m A.O.D.

Coordinates: 61803.0 mE, 92586.5 mN

Date: 14.12.87 to 15.12.87

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Clayey topsoil	75.42		(0.25)					
	75.17		0.25	0.25	D	1		
				0.50 - 0.95	U	2		75 blows
				1.00	D	3		
Stiff becoming very stiff red brown very silty CLAY with pockets of light green grey silt and silty fine sand locally cemented and partings of white and light brown silt				1.00 - 1.45	D	4	S N=16	
				2.00 - 2.45	U			130 blows no recovery
				2.00 - 2.45	B	5		
			(4.43 pen)					
				2.50 - 2.95	D	7	S N=57	No sample no.6
becoming by 3.50m very stiff (hard) with light green reduction spots								
				3.50 - 3.70	U			150 blows no recovery
				3.50 - 3.70	B	8		
(KEUPER MARL 4a)				3.70 - 3.89	D	9	S 50	15,31/50 for 38mm Chiselling from 3.70 to 4.50m 1.50 hours
				4.30 - 4.41	D	10	S (70)	20,50 for 27mm
				4.45 - 4.68	D	11	S 50	17,23/50 for 75mm bouncing
BOREHOLE ENDS AT 4.68 m.	70.74		4.68					

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1987					
14.12	1430	0.00	0.00	0.00	
14.12	1630	3.00	1.50	DRY	End of shift
15.12	0800	3.00	1.50	DRY	
15.12	1200	4.68	1.50	DRY	End of cable tool boring

Remarks

Logged by: GAC

Scale: 1:50

Fig. 22

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

(c) Soil Mechanics 24.05.88/11.46 (Ver 3.1.10)

Soil Mechanics

BOREHOLE No. 712R

Sheet 1 of 3

Equipment & Methods

Open hole drilling, air flush, using 6.75in rock bit, from G.L. to 2.60m. Rotary core drilling, air flush, producing 92mm core, from 2.60m to 15.08m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 75.42 m A.O.D.

Coordinates: 61803.0 mE, 92586.5 mN

Date: 08.01.88 to 10.01.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
Cable Tool Boring to 4.68m	75.42		(2.60)							
Assessed zone of core loss N.I. core Very stiff to hard red brown very thinly bedded very silty CLAY with occasional reduction spot closely spaced subvertical fissures smooth and planar with black staining (weathered MUDSTONE) (KEUPER MARL 2) 4.83-4.90m, 4.98-5.27m, 5.52-5.75m, 6.12-6.37m, dark red brown and grey brown very thinly to thinly bedded moderately weathered MUDSTONE weak 5.27-5.52m with pockets and lenses of light green siltstone moderately weak below 6.97m with pockets and lenses of light green grey silt and siltstone N.I. core Assessed zone of core loss N.I. core N.I. core	72.82		2.60	2.60 - 4.05		90	30	9		at 2.60m S:N=46 14/9,8,10, 19
			(4.68)	4.05 - 6.50		96	80	46		at 4.05m S:N=124 45/30,28,31 35
	68.14		7.28							at 6.50m S:(80) 30,50 for 30mm
N.I. core due to subvertical rough undulating joint Light green grey very thinly to thinly bedded moderately weathered SILTSTONE weak with up to very thin beds of very stiff very silty clay (KEUPER MARL 2) N.I. core N.I. core			(1.57)	6.50 - 9.50		97	52	44	NI 80 200	
	66.57		8.85							
Very stiff red brown CLAY (As sheet 2) N.I. core			(4.84)	9.50 - 12.50		100	73	73		at 9.50m S:(50) 50 for 50mm

Remarks

1. Standpipe installed.

Logged by: GAC/AAC

Scale: 1:50

Fig. 23

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 18.04.88/09.59 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 712R

Sheet 2 of 3

Equipment & Methods: As sheet 1

Location No. 7382

Location: A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4

Carried out for
Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: As sheet 1 | Coordinates: As sheet 1 | Date: As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
N.I. core Very stiff (hard) red brown friable very silty CLAY with pockets and lenses of light green grey to red brown silt and siltstone (weathered MUDSTONE / SILTSTONE) (KEUPER MARL 2/3) below 11.42m with very thin beds of dark red brown mudstone very weak N.I. core below 12.20m very closely to closely fissured			(4.84)	9.50 – 12.50		100	73	73		
				12.50 – 13.50		100	69	43		at 12.50m S:(90) 40,50 for 20mm
Dark red brown moderately weathered very thinly to thinly bedded MUDSTONE weak generally recovered as non-intact core due to subvertical very closely spaced rough planar black speckled joints (KEUPER MARL 2)	61.73		13.69	13.50 – 15.00		93	35	7	NI NI 100	
BOREHOLE ENDS AT 15.08 m.	60.34		(1.39 pen) 15.08							at 15.00m S:(50) 50 for 80mm

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
08.01	0800	0.00	0.00		
08.01	1800	3.05	2.60	DRY	End of shift
09.01	0800	3.05	2.60	DRY	
09.01	1700	12.50	2.60	DRY	End of shift
10.01	1100	12.50	2.60	11.00	
10.01	–	15.08	2.60	DRY	End of borehole

Remarks

Logged by: GAC/AAC

Scale: 1:50

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 18.04.88/09.59 (Ver 3.1.0)

Fig. 23

Soil Mechanics

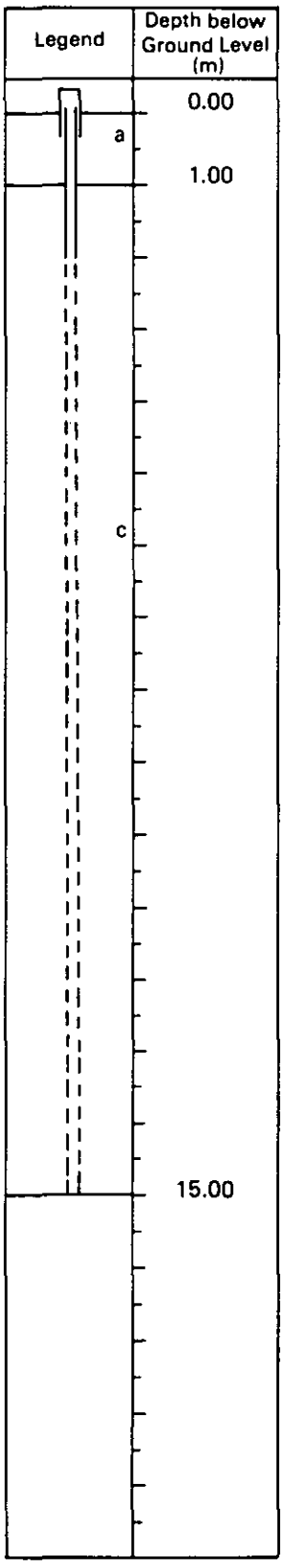
BOREHOLE No. 712R
Sheet 3 of 3

Location No. 7382
Location A42 CASTLE DONINGTON NORTH : GROUND INVESTIGATION CONTRACT 4

Carried out for
Client : Department of Transport (E. Midlands Regional Office)
Engineer : Scott Wilson Kirkpatrick and Partners

Type of installation Standpipe
Internal diameter of tubing 19 mm
Length of filter 16000 mm
Diameter of filter 120 mm

Depth (m) From	Depth (m) To	SUMMARY OF INSTALLATION
		Surface protection: Gas barrel with screw cap
0.00	1.00	Concrete
0.00	15.00	UPVC tubing
1.00	15.00	Gravel filter
2.00	15.00	Perforated section



KEY

a	Concrete
b	Sand
c	Gravel
d	Bentonite seal
e	Bentonite/cement grout
f	Backfill

ACCESS TUBINGS

- Standpipe/Piezometer (x 2 for Hydraulic or Pneumatic piezometers)
- Porous element
- Well with perforated section
- Inclinometer with joint
- Westbay with coupling and port

Remarks

1. Ground level and coordinates as sheet 1.

DETAILS OF INSTRUMENTS

Scale 1:100
Fig. 23

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Soil Mechanics

BOREHOLE No. 713

Sheet 1 of 1

Equipment & Methods

Cable tool boring, 150 mm diameter, from ground level to 3.125m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 75.95 m A.O.D.

Coordinates: 61805.0 mE, 92576.0 mN

Date: 16.12.87

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Clayey topsoil	75.95		(0.30)					
	75.65		0.30	0.25	D	1		
				0.50 - 0.95	U	2		100 blows
				1.00	D	3		
Firm becoming very stiff (hard) red brown extremely to very closely fissured locally very silty CLAY with occasional very thin bands of light green grey cemented silt				1.00 - 1.45	D	4	S N=51	Chiselling from 1.60 to 1.80m 0.50 hours
			(2.83 pen)					
(KEUPER MARL 4a)				2.20 - 2.38	D	5	S 50	10,27/50 for 28mm
				3.00 - 3.13	D	6	S (71)	21,50 for 50mm Chiselling from 2.70 to 3.00m 1.00 hour
BOREHOLE ENDS AT 3.13 m.	72.82		3.13					

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1987					
16.12	1400	0.00	0.00		
16.12	1630	1.80	1.50	DRY	End of shift
17.12	0800	1.80	1.50	DRY	
17.12	0930	3.13	1.50	DRY	End of cable tool boring

Remarks

Logged by: GAC/AAC

Scale: 1:50

Fig. 24

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 23.03.88/15.53 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 713R

Sheet 1 of 3

Equipment & Methods

Open hole drilling, air flush, using 6.75in. rock bit, from G.L. to 2.20m. Rotary core drilling, air flush, producing 92mm diameter core, from 2.20m to 17.075m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 75.95 m A.O.D.

Coordinates: 61805.0 mE, 92576.0 mN

Date: 11.01.88 to 14.01.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
Cable Tool Boring to 3.13m	75.95		(2.20)							
Assessed zone of core loss	73.75		2.20							
Very stiff (hard) red brown to dark red brown fissured very silty CLAY (weathered MUDSTONE) with light brown to light green grey silt and siltstone and bands of dark red brown thinly laminated mudstone weak, black staining on fissures (KEUPER MARL 2/3) 3.24 - 3.40m light green grey to white siltstone weak to moderately weak 2.70 - 2.90m, 3.35 - 3.40m, 4.00 - 4.10m, 4.63 - 4.80m, 5.17 - 5.42m, N.I. core				2.20 - 3.60		43	23	10		at 2.20m S:50 37,26/50 for 75mm
Assessed zone of core loss										
Assessed zone of core loss			(3.22)							
				3.60 - 4.80		67	45	38		at 3.60m S:50 36,25/50 for 50mm
Assessed zone of core loss										at 4.80m S:(100) 50,50 for 80mm
	70.53		5.42							
N.I. core				4.80 - 6.60		83	14	10	NI NI 180	
Dark red brown thinly bedded MUDSTONE weak to moderately weak (KEUPER MARL 2)										
N.I. core										
Assessed zone of core loss										at 6.60m S:50 46,26/50 for 75mm
5.94-6.20m white to light green grey siltstone weak with silt and clay lenses			(3.36)							
below 6.60m interbedded with thin beds of red brown friable clay (N.I)										
below 8.20m with up to thin beds of light green grey siltstone weak				6.60 - 9.65		92	67	37	NI 80 310	
N.I. core										
N.I. core										
	67.17		8.78							
Light grey to light green grey thinly bedded slightly weathered SILTSTONE weak to moderately weak (KEUPER MARL 2) 9.90-10.15m dark red brown mudstone										
N.I. core			(1.37)							
Assessed zone of core loss				9.65 - 10.90		80	46	26		at 9.65m S:(50) 50 for 80mm

Remarks

Logged by: GAC/AAC

Scale: 1:50

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 23.03.88/16.38 (Ver 3.1.0)

Fig. 25

Soil Mechanics

BOREHOLE No. 713R

Sheet 2 of 3

Equipment & Methods: As sheet 1

Location No. 7382

Location: A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4

Carried out for
Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: As sheet 1 | Coordinates | Date

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
	65.80		(1.37) 10.15							
Light green grey and light grey to red brown locally very clayey SILT with weak siltstone beds (weathered SILTSTONE) (KM 2). N.I. core; Generally N.I core			(0.75)	9.65 – 10.90		80	46	26		
	65.05		10.90							
				10.90 – 11.60		14	0	0		
Assessed zone of core loss			(1.70)							
	63.35		12.60							
Stiff to very stiff very silty CLAY / clayey SILT with frequent lithorelics (weathered SILTSTONE). Interbedded with dark red brown thinly bedded MUDSTONE weak (KEUPER MARL 2/3). N.I. core; N.I. core				11.60 – 14.60		67	50	27		
14.42–14.60m with pockets of light green grey fine sandy silt becoming by 14.71m hard red brown fissured very silty CLAY with pockets and lenses of grey silt interbedded with mudstone 16.16–16.50m green grey very clayey silt with bands of weak siltstone. N.I. core; Assessed zone of core loss			(3.90)						NI 55 110	at 14.60m S:(95) 35,60 for 75mm
				14.60 – 15.70		81	45	20		at 15.70m S:(104) 54,50 for 75mm
N.I. core										
				15.70 – 17.00		92	69	37		
	59.45		16.50						NI 140 180	
Red brown thinly bedded MUDSTONE very weak to weak with pockets of light brown siltstone (KEUPER MARL 1/2)			(0.58 pen)							
	58.87		17.08							at 17.00m S:(54) 54 for 75mm
BOREHOLE ENDS AT 17.08 m.										

Remarks

Logged by: GNC/AAC

Scale: 1:50

Fig. 25

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 23.03.88/16.38 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 713R

Sheet 3 of 3

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
11.01	0800	0.00	0.00		
11.01	1700	9.65	3.60	9.65	Water strike
11.01	1800	9.65	3.60		End of shift
12.01	0800	9.65	3.65	9.10	
12.01	1000	11.60	3.65	9.00	End of shift
13.01	1600	11.60	3.65	9.10	
13.01	1800	14.60	3.65	0.00	End of shift
14.01	0800	14.60	3.65	9.10	

Remarks

Logged by GAC/AAC

Scale 1:50

Fig. 25

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 23.03.88/16.38 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 714

Sheet 1 of 1

Equipment & Methods
Cable tool boring, 150 mm diameter, from ground level to 3.05m

Location No. 7382

Location
A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for
Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 77.04 m A.O.D.
Coordinates: 61811.5 mE, 92550.0 mN
Date: 17.12.87

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Clayey topsoil	77.04		(0.20)					
	76.84		0.20	0.25	D	1		
Firm becoming stiff red brown CLAY with partings and lenses of white to light green grey silt				0.50 – 0.95	U	2		55 blows
				1.00	D	3		
(KEUPER MARL 4b) light green grey cemented silt with bands of red brown clay			(1.80)	1.00 – 1.45	D	4	S N=50	No sample no. 5.
	75.04		2.00	2.00 – 2.18	D	6	S 50	10,37/50 for 33mm
Very stiff (hard) red brown extremely to very closely fissured very silty CLAY with occasional light green reduction spots			(1.05 pen)	2.60 – 2.70	D	7	S (74)	24,50 for 29mm Chiselling from 2.60 to 3.00m
(KEUPER MARL 4a)				3.00 – 3.05	D	8	S (50)	1.00 hours 50 for 50mm
BOREHOLE ENDS AT 3.05 m.	73.99		3.05					

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1987					
17.12	-	0.00	0.00		
17.12	-	3.05	1.50	DRY	End of cable tool boring

Remarks

Logged by: GAC

Scale: 1:50

Fig. 26

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.03.88/09.08 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 714R

Sheet 1 of 2

Equipment & Methods

Open hole drilling, air flush, using 6.75in rock bit, from G.L. to 2.00m. Rotary core drilling, air flush to 11.45m, foam flush to base, producing 92mm diameter core to 17.35m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 77.04 m A.O.D.

Coordinates: 61811.5 mE, 92550.0 mN

Date: 15.01.88 to 18.01.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
	77.04									
Cable Tool Boring to 3.05m			(2.00)							
	75.04		2.00							
Assessed zone of core loss			(0.60)							at 2.00m S:111 24,27/54,57 for 75mm
Non intact	74.44		2.60	2.00 – 3.50		60	41	30		
Very stiff red brown locally thinly laminated CLAY (weathered MUDSTONE) Greenish grey moderately weak pockets or lenses of siltstone up to 70mm thick (KEUPER MARL 3) — Non intact disturbed by SPT; friable clay with up to medium gravel sized lithorelics			(1.75)							at 3.50m S:59 61,40/59 for 75mm
	72.69		4.35							
sub-vertical joint; sub-vertical joint; Red brown slightly to moderately weathered SILTSTONE weak; Closely to very closely fractured; Assessed zone of core loss; (KEUPER MARL 2); sub-vertical joint; two intersecting sub-vertical joints; sub-vertical joint, locally stained black			(5.55)	3.50 – 5.90		62	47	9	NI NI 120	at 5.90m S:(118) 68/50 for 75mm
				5.90 – 7.80		61	26	16	NI NI 130	
Below 9.50m with occasional bands and lenses of light green grey coarse grained SILTSTONE moderately strong occasionally strong — assessed zone of core loss; two intersecting sub-vertical joints; assessed zone of core loss				7.80 – 8.90		27	5	0	NI NI 50	at 7.80m S:56 46,33/56
										at 8.90m S:(50) 50 for 75mm
				8.90 – 9.90		80	55	26	NI 80 150	
SILTSTONE (as sheet 2)	67.14		9.90	9.90 – 11.45						

Remarks

Logged by: AAC

Scale: 1:50

Fig. 27

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.03.88/09.28 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 714R

Sheet 2 of 2

Equipment & Methods: As sheet 1

Location No. 7382

Location: A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4

Carried out for
Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: As sheet 1 | Coordinates | Date

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
Light greenish grey slightly weathered, thinly to very thinly bedded SILTSTONE, strong, with occasional completely weathered bands up to 100mm thick (KM 2)			(1.35)	9.90 – 11.45		97	61	39	NI 60 150 NI 90 180	
	65.79		11.25 (0.20)							
Red brown slightly to moderately weathered SILTSTONE strong (KEUPER MARL 2)	65.59		11.45							
Assessed zone of core loss			(1.35)	11.45 – 13.00		13	3	0		
Firm red brown clayey SILT with occasional light green grey silt pockets (weathered SILTSTONE) (KM 4a)	64.24		12.80 (0.20)							
	64.04		13.00 (0.25)							
Assessed zone of core loss	63.79		13.25							at 13.00m S:50 79/50 for 50mm
Dark red brown highly to completely weathered silty MUDSTONE locally altered to a soft silty clay, with occasional light green pockets and lenses of siltstone and silt (KEUPER MARL 3)			(0.60)	13.00 – 13.90		72	6	0		
two intersecting sub-vertical joings	63.19		13.85							
Dark red brown slightly to moderately locally completely weathered SILTSTONE moderately weak with occasional light greenish grey reduction spots			(2.15)	13.90 – 16.00		88	64	50	NI 120 270	
assessed zone of core loss										
Closely spaced sub-horizontal joints (KM 2/3)	61.04		16.00							
completely weathered altered to a soft silty CLAY with occasional lithorelics			(1.35 pen)	16.00 – 17.20		100	67	57	NI 100 230	
Dark red brown slightly to moderately weathered SILTSTONE weak with occasional pockets of light greenish grey coarse siltstone Closely spaced sub-horizontal joints (KM 2)	59.69		17.35							at 17.20m S:(107) 47,60 for 75mm
BOREHOLE ENDS AT 17.35 m.										

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
15.01	1800	11.45	3.50	DRY	
18.01	0800	11.45	3.50	10.25	

Remarks

Logged by: AAC

Scale: 1:50

Fig. 27

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.03.88/09.28 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 715

Sheet 1 of 1

Equipment & Methods

Cable tool boring, 150mm diameter, from ground level to 2.50m

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 77.49 m A.O.D.

Coordinates: 61811.0 mE, 92535.5 mN

Date: 18.12.87

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
'Stiff brown stoney clay' (Foreman's description)	77.49		(0.40)	0.30	D	1		
	77.09		0.40					
				0.50 - 0.95	U	2		72 blows
				1.00	D	3		
'Firm red marl with siltstone' (Foreman's description)			(1.70)	1.00 - 1.45	D	4	S N=39	2,2/5,7,11,17
	75.39		2.10	2.00 - 2.19	D	5	S 50	10,31/50 for 39mm
'Very hard red marl' (Foreman's description)			(0.40p)					Chiselling from 2.00m to 2.40m 1.50 hours
	74.99		2.50	2.40 - 2.50	D	6	S (81)	31,50 for 21mm
BOREHOLE ENDS AT 2.50 m.								

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1987					
18.12	0800	0.00	0.00	DRY	
18.12	-	2.10	1.50	DRY	
18.12	-	2.50	1.50	DRY	

Remarks

Logged by: AAC

Scale: 1:50

Fig. 28

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.05.88/09.52 (Ver 3.1.10)

Soil Mechanics

BOREHOLE No. 715R

Sheet 1 of 2

Equipment & Methods

Open hole drilling, air flush using 6.75in rock bit, from G.L. to 1.50m. Rotary core drilling, air flush, producing 92mm core to 15.225m

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 77.49 m A.O.D.

Coordinates: 61811.0 mE, 92535.5 mN

Date: 19.01.88 to 20.01.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
	77.49									
Cable Tool Boring to 2.50m			(1.50)							
Assessed zone of core loss	75.99		1.50							
Dense light green grey SILT (weathered SILTSTONE) (KM 4/3)			(0.80)							at 1.50m N=62 6,6/12,17, 19,14
Very stiff (hard) red brown CLAY (weathered MUDSTONE) KM 2/3)	75.19		2.30	1.50 - 3.00		47				
			(0.30)							
	74.89		2.60							
			(0.30)							
Light greenish grey locally red brown thinly laminated moderately weathered SILTSTONE weak (KEUPER MARL 2)	74.59		2.90							
Assessed zone of core loss			(0.90)							at 3.00m S:(105) 27,78 for 75mm
Red brown slightly to moderately weathered moderately strong				3.00 - 4.30		46	12	0	NI NI 50	
Assessed zone of core loss	73.69		3.80							
			(0.90)							
Red brown moderately weathered SILTSTONE moderately strong (KEUPER MARL 2/3) From 5.15m to 5.45m friable clayey silt with occasional lithorelics										at 4.30m S:50 24,17/50 for 75mm
Stiff red brown CLAY	72.79		4.70							
Light green grey siltstone very weak				4.30 - 5.70		71	32	14	NI 50 110	
light grey green crystalline siltstone very strong			(1.00)							
sub-vertical joint	71.79		5.70							
2 very closely spaced sub-vertical joints										at 5.70m S:(96) 40,56 for 75mm
non intact										
70 joint				5.70 - 7.30		94	41	0	NI NI 300	
Red brown locally thinly laminated slightly weathered SILTSTONE moderately weak locally moderately strong										
non intact										
Assumed zone of core loss										
Extremely closely spaced open and closed joints										
non intact			(4.40)							
(KEUPER MARL 2)										
sub-vertical joint stained black									NI NI 180	
At 8.60m becoming moderately strong				7.30 - 10.10		82	29	23		
greenish grey silt with frequent siltstone lithorelics									NI 110 170	
light grey green band very weak										

Remarks

Logged by: AAC

Scale: 1:50

Fig. 29

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth colum. 24.03.88/09.39 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 715R

Sheet 2 of 2

Equipment & Methods: As sheet 1

Location No. 7382

Location: A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4

Carried out for
Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: As sheet 1 | Coordinates: As sheet 1 | Date: As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
SILTSTONE (as sheet 1)	67.39		(4.40) 10.10	7.30 – 10.10		82	29	23		
Assessed zone of core loss — non intact			(0.60)							
Red brown locally greenish grey moderately weathered SILTSTONE moderately strong locally weak (KM 2) — Highly weathered band: lithorelics in a soft silty clay matrix	66.79		10.70 (0.60)	10.10 – 12.00		68	18	5	35 to 80	
	66.19		11.30 (0.30)							
Stiff to very stiff red brown silty CLAY (KM 4a) — non intact fine grained SANDSTONE strong	65.89		11.60							
Light greenish grey slightly to moderately weathered SILTSTONE weak to moderately weak with occasional bands of red brown mudstone: closely locally extremely closely fractured (KM 2) — sub-vertical joint stained black	64.69		(1.20) 12.80	12.00 – 13.85		89	70	43	NI 80 120 50 160 220	
Red brown thinly laminated moderately weathered MUDSTONE weak with bands of light greenish grey siltstone interbedded with very stiff (hard) locally soft to firm red brown silty CLAY with pockets of light grey green silt (KEUPER MARL 2)			(2.43 pen)	13.85 – 15.00		87	65	46	NI 90 310	
BOREHOLE ENDS AT 15.23 m.	62.26		15.23							at 15.00 S:57 37,30/57 for 75mm

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988 19.01	1800	12.00	3.50	DRY	

Remarks

Logged by: AAC

Scale: 1:50

Fig. 29

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.03.88/09.39 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 716

Sheet 1 of 2

Equipment & Methods

Cable tool boring, 150 mm diameter, from ground level to 8.685m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 62.02 m A.O.D.

Coordinates: 65226.5 mE, 92945.7 mN

Date: 13.12.87 to 14.12.87

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Clayey topsoil	62.02		(0.30)	0.25	D	1		
	61.72		0.30					
Firm brown and red brown sandy, in parts very sandy CLAY with a little becoming some subangular to rounded flint, sandstone and siltstone gravel (PROBABLE ALLUVIUM)				0.50 - 0.95	U	2		54 blows
				1.00	D	3		
				1.00 - 1.45	D	4	S N=12	
			(1.90)					
	59.82		2.20	2.00 - 2.45	U	5		62 blows
				2.50	D	6		
				2.50 - 2.95	D	7	S N=31	
Stiff red brown very silty CLAY with bands of light green grey silt locally cemented and occasional thickly laminated with dark red brown to green grey siltstone moderately strong				3.50 - 3.95	U	8		140 blows
				4.00	D	9		
(KEUPER MARL 3/4a)				4.00 - 4.45	D	10	S N=20	
				5.00 - 5.45	U	11		72 blows
			(6.49 pen)	5.50	D	12		
				5.50 - 5.95	D	13	S N=27	
				6.50 - 6.95	U	14		80 blows
				7.00	D	15		
				7.00 - 7.45	D	16	S N=44	
becoming by about 8.00m very stiff (hard) dark red brown thinly laminated very silty CLAY with occasional light green reduction spots				8.00 - 8.45	U	17		100 blows
				8.50	D	18		
				8.50 - 8.69	D	19	S 50	15,31/50 for 35mm
BOREHOLE ENDS AT 8.69 m.	53.33		8.69					

Remarks

Logged by: GAC

Scale: 1:50

Fig. 30

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

(c) Soil Mechanics

Soil Mechanics

BOREHOLE No. 716

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1987					
13.12	1400	0.00	0.00		
13.12	1630	3.00	1.50	DRY	End of shift
14.12	0800	3.00	1.50	DRY	
14.12	-	6.00	3.00	6.00	Slight seepage
14.12	1230	8.69	3.00	8.69	Damp End of cable tool boring

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field Records

Remarks

Logged by: GAC

Scale: 1:50

Fig. 30

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.03.88/09.53 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 717

Sheet 1 of 2

Equipment & Methods

Cable tool boring, 150 mm diameter, from ground level to 14.20m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 52.29 m A.O.D.

Coordinates: 66410.2 mE, 93912.7 mN

Date: 08.01.88 to 10.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Clayey topsoil	52.29		(0.25)					
	52.04		0.25	0.25	D	1		
Soft red brown sandy CLAY with some angular to rounded flint, sandstone and siltstone gravel and occasional cobbles (PROBABLE ALLUVIUM)			(0.75)	0.50 - 0.95	B	2	C N=15	
	51.29		1.00	1.05	D	3		
Firm becoming stiff red brown very silty CLAY with occasional thin laminations of dark red brown mudstone and light green grey and red brown siltstone, and with pockets of light green grey silt and very clayey silt (KEUPER MARL 4a)				1.10 - 1.55	U	4		37 blows
				1.60	D	5		
			(1.50)	1.60 - 2.05	D	6	S N=5	
	49.79		2.50					
Stiff becoming very stiff red brown very silty fissured CLAY with frequent sand to fine gravel size lithorelics, occasional light green reduction spots and thin laminae of light green grey siltstone very weak				2.55 - 3.00	U	7		82 blows
				3.05	D	8		
				3.05 - 3.50	D	9	S N=32	
				3.30	WS	14		
				3.65	WS	10		
				4.00 - 4.45	U	11		111 blows
fissures are subhorizontal very closely to closely spaced, generally smooth with black staining				4.45	D	12		
				4.50 - 4.95	D	13	S N=43	
			(5.00)					
(KEUPER MARL 4a)				5.50 - 5.95	U	15		93 blows
				6.00	D	16		
				6.00 - 6.45	D	17	S N=66	
at 7.40m a band of light green thinly laminated siltstone weak				7.00 - 7.45	U	18		115 blows
				7.50	D	19		
	44.79		7.50	7.50 - 7.95	D	20	S N=70	
Very stiff red brown CLAY with occasional light green reduction spots and thin to thick laminae of dark red brown mudstone and light green grey silty sandstone				8.50 - 8.95	U	21		150 blows
			(6.70)	9.00	D	22		
(KEUPER MARL 4a)				9.00 - 9.45	D	23	S N=74	
becoming hard by about 10.00m								

Remarks

Logged by: GAC

Scale: 1:50

Fig. 31

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.03.88/10.05 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 717

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
				10.00 - 10.30	U			150 blows no recovery
				10.00 - 10.30	D	25	S	10,24/50 for 50mm
extremely closely fissured				10.30 - 10.50	D	26	50	
				11.00 - 11.25	D	27	S 82	8,15/32,50 for 25mm
Very stiff (hard) red brown CLAY (As sheet 1)			(6.70 pen)	12.00 - 12.18	D	28	S 50	10,23/50 for 31mm
(KEUPER MARL 4a)				13.00 - 13.23	D	29	S 50	11,27/50 for 75mm
				14.00 - 14.17	D	30	S 50	15,33/50 for 23mm Chiselling from 13.60 to 14.20m 1.50 hours
BOREHOLE ENDS AT 14.20 m.	38.09		14.20					

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
08.01	1300	0.00	0.00		
08.01	-	2.00	1.10	2.00	Water strike
08.01	-			1.60	after 20 mins.
08.01	1700	5.00	5.00	2.90	End of shift
09.01	0800	5.00	5.00	3.30	
09.01	1700	12.50	12.50	10.00	End of shift
10.01	0800	12.50	12.50	10.00	
10.01	-	14.20	14.00	8.00	End of cable tool boring

Remarks

Logged by: GAC

Scale: 1:50

Fig. 31

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1.
All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

(c) Soil Mechanics

Soil Mechanics

BOREHOLE No. 717R

Sheet 1 of 3

Equipment & Methods	Location No. 7382
Open hole drilling, air flush, using 6.75in. rock bit from G.L. to 13.00m. Rotary core drilling, air flush, producing 92mm diameter core from 13.00m to 25.10m	Location: A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4
Carried out for: Client: Department of Transport (E. Midlands Reg. Office) Engineer: Scott Wilson Kirkpatrick & Partners	Ground Level: 52.29 m A.O.D. Coordinates: 66410.2 mE 93912.7 mN Date: 20.01.88 to 24.01.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
	52.29									
Cable Tool Boring to 14.20m			(13.00)							

Remarks

Logged by: JAS/AAC

Scale: 1:50

Fig. 32

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth colum. 15.04.88/09.43 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 717R

Sheet 2 of 3

Equipment & Methods: As sheet 1

Location No. 7382

Location: A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4

Carried out for
Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: As sheet 1 | Coordinates | Date

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
Cable Tool Boring to 14.20m			(13.00)							
	39.29		13.00							
disturbed due to SPT test				13.00 – 14.50		67	30	17		at 13.00m S:N=101 10,15/18,18 25,40
assessed zone of core loss										
Red brown slightly weathered in parts slightly fine sandy very silty MUDSTONE very weak to weak with occasional grey green pockets and lenses of silt (KEUPER MARL 2)			(5.30)	14.50 – 15.90		61	4	0	NI 80 140	at 14.50m S:90 6,14/40,50 for 75mm
				15.90 – 16.80		89	44	12		at 15.90m S:73 10,22/23,50 for 75mm
assessed zone of core loss										at 16.80m S:(50) 50 for 75mm no recovery
				16.80 – 19.00		83	45	20		
	33.99		18.30							
Light grey green slightly weathered slightly fine sandy very clayey SILTSTONE moderately strong (KEUPER MARL 2)			(1.40)						50 100 300	at 19.00m S:(50) 50 for 25mm no recovery
				19.00 – 22.00		53	43	23		
	32.59		19.70							
MUDSTONE (as sheet 3)										

Remarks

Logged by: JAS/AAC

Scale: 1:50

Fig. 32

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 15.04.88/09.43 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 717R

Sheet 3 of 3

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
Red brown slightly weathered in parts slightly fine sandy very silty MUDSTONE very weak to weak with occasional pockets and lenses of grey green silt Locally extremely closely fissured				19.00 – 22.00		53	43	23		
assessed zone of core loss										
(KEUPER MARL 2)			(4.70)							at 22.00m S:108 11,16/23,35 50 for 75mm
From 20.00m to 22.00m with thin to medium beds of grey green clayey SILTSTONE				22.00 – 23.50		67	67	13	NI 70 300	
From 23.50m to 24.40m thinly interbedded with grey green very clayey SILTSTONE										at 23.50m S:(88) 38,50 for 75mm
assessed zone of core loss										
very stiff red brown very silty clay (possibly disturbed)										
	27.89		24.40	23.50 – 25.00		60	37	23		
Assessed zone of core loss			(0.70 pen)							
BOREHOLE ENDS AT 25.10 m.	27.19		25.10							at 25.00m S:(68) 18,50 for 25mm no recovery

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
21.01	0800	9.15	9.15		hole cased off
21.01	1800	15.90	13.65	14.10	
22.01	0800	15.90	13.65	13.90	
22.01	1800	22.00	15.90	15.10	
23.01	0800	22.00	15.90	13.10	

Remarks

Logged by: JAS/AAC

Scale: 1:50

Fig. 32

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 15.04.88/09.43 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 718

Sheet 1 of 1

Equipment & Methods

Cable tool boring, 150 mm diameter, from ground level to 6.75m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 61.45 m A.O.D.

Coordinates: 66822.0 mE, 94571.0 mN

Date: 19.01.88 to 20.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Clayey topsoil	61.45		(0.20) 0.20	0.20	D	1		
Stiff red brown sandy CLAY with occasional up to medium generally siltstone gravel (PROBABLE GLACIAL TILL)	61.25		(0.80)	0.50 – 0.95	U	2		53 blows
	60.45		1.00	1.00	D	3		
				1.00 – 1.45	D	4	S N=20	3,5/4,5,5,6
Stiff red brown very silty CLAY with frequent lithorelics and occasional pockets and lenses of light green grey to light brown silt (KEUPER MARL 3/4a)				2.00	WS	11		
				2.00 – 2.45	U	5		44 blows
				2.50	D	6		
below 2.50m with lenses/laminations of hard dark red brown clay				2.50 – 2.95	D	7	S N=34	5,7/8,7,9,10
by 3.50m becoming very stiff with black stained fissures			(5.00)	3.50 – 3.95	U	8		150 blows
				4.00	D	9		
				4.00 – 4.45	D	10	S N=26	5,5/7,8,6,5
				5.00 – 5.45	D	12	S N=39	6,6/7,8,10,14
	55.45		6.00	6.00 – 6.28	D	13	S 76	4,11/26,50 for 50mm
Very stiff (hard) red brown to dark red brown very silty CLAY with bands of light grey fine sandy silt and siltstone (KM 3/4a)			(0.75 pen)	6.60 – 6.70	D	14	S (65)	15,50 for 30mm
	54.70		6.75					Chiselling from 6.00 to 6.60m 1.50 hours
BOREHOLE ENDS AT 6.75 m.								

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
19.01	–	0.00	0.00		
19.01	1700	4.50	1.50	DRY	End of shift
20.01	0800	4.50	1.50	2.00	
20.01	–	6.75	1.50	6.00	End of cable tool boring

Remarks

Logged by: GAC

Scale: 1:50

Fig. 33

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics 24.05.88/09.50 (Ver 3.1.10)

All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

Soil Mechanics

BOREHOLE No. 718R

Sheet 1 of 2

Equipment & Methods

Open hole drilling, air flush, using 6.75in rock bit from ground level to 6.30m. Rotary core drilling, air flush, producing 92mm diameter core from 6.30m to 15.22m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 61.45 m A.O.D.

Coordinates: 66822.0 mE, 94571.0 mN

Date: 22.01.88 to 24.01.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
	61.45									
Cable Tool Boring to 6.75m			(6.30)							
Assessed zone of core loss										
Firm becoming stiff red brown locally very silty CLAY with occasional fine gravel sized lithorelics and rare pockets and lenses of light grey green silt and fine sand (KM 4a)	55.15		6.30							
			(0.45)							at 6.30m S:N=69 7,14/17,19, 24,29
	54.70		6.75							
Red brown moderately weathered SILTSTONE very weak with very closely spaced fractures with black speckled stain (KM 2/3)			(0.60)	6.30 – 8.00		74	21	13		
	54.10		7.35							
Assessed zone of core loss			(0.65)						NI 50 120	
	53.45		8.00							
Firm to stiff red brown very silty CLAY with frequent fine to medium occasionally coarse gravel sized lithorelics (weathered MUDSTONE) (KM 3/4a)			(1.00)	8.00 – 9.00		0	0	0		at 8.00m S:50 27,39/50 for 55mm
Light grey green slightly to moderately weathered fine sandy SILTSTONE strong (KM 2) core picked up on following run	52.45		9.00							
			(0.60)	9.00 – 9.50		100				
	51.85		9.60	9.50 – 9.60		100				
SILTSTONE (as sheet 1)			(0.30)	9.60 – 10.30		93	57	0	NI 50 120	at 9.60m S:(50) 50 for 45mm
	51.55		9.90							

Remarks

Logged by: AAC

Scale: 1:50

Fig. 34

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

(c) Soil Mechanics 11.04.88/10.59 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 718R

Sheet 2 of 2

Equipment & Methods: As sheet 1

Location No. 7382

Location: A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4

Carried out for
Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: As sheet 1 | Coordinates: As sheet 1 | Date: As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
vertical joint stained black Red brown moderately weathered SILTSTONE weak with extremely to closely spaced fractures stained black (KM 2)			(0.55)	9.60 – 10.30		93	57	0	M 20 40	
	51.00		10.45							
			(0.85)	10.30 – 11.20		17	6	0		
Assessed zone of core loss	50.15		11.30							
Dense light grey green and red brown slightly fine sandy SILT with occasional fine gravel sized lithorelics (Weathered SILTSTONE) (KM 3)	49.85		(0.30) 11.60	11.20 – 11.80		83	18	0		at 11.20m S:(64) 39,25 for 10mm
Light grey green slightly weathered locally very silty fine grained SANDSTONE strong to very strong with closely to very closely spaced sub-horizontal fractures Below 12.20m with occasional bands of very dense clayey silt with up to coarse gravel sized lithorelics (KEUPER SANDSTONE 2)				11.80 – 12.60		100	81	46	NI 170 260	
			(2.30)	12.60 – 13.00		88	63	33		
				13.00 – 14.00		90	70	26		
	47.55		13.90						NI NI 90	
Assessed zone of core loss			(0.40)							
	47.15		14.30							
Stiff red brown very silty CLAY with frequent medium to coarse gravel sized lithorelics (weathered MUDSTONE) (KEUPER MARL 3/4a)				14.00 – 15.00		70				
			(0.92 pen)							
BOREHOLE ENDS AT 15.22 m.	46.23		15.22							at 15.00m S:50 18,24/50 for 65mm

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988 22.01	1730	9.50	6.30		DAMP, end of shift
23.01	0830	9.50	6.30	1.90	
23.01	1730	12.60	9.30	12.60	End of shift
24.01	0830	12.60	9.30	0.60	

Remarks

Logged by: AAC

Scale: 1:50

Fig. 34

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.05.88/10.43 (Ver 3.1.10)

Soil Mechanics

BOREHOLE No. 719

Sheet 1 of 1

Equipment & Methods

Cable tool boring ,150 mm diameter, from ground level to 6.77m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 61.84 m A.O.D.

Coordinates: 66833.0 mE, 94597.0 mN

Date: 19.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Clayey topsoil	61.84		(0.40)	0.25	D	1		
	61.44		0.40					
				0.50 - 0.95	U	2		54 blows.
				1.00	D	3		
Stiff becoming very stiff red brown very silty CLAY with occasional up to coarse gravel sized lithorelics and pockets of light green grey fine sandy silt				1.00 - 1.45	D	4	S N=21	3,3/5,5,5,6
(KEUPER MARL 3/4a)				2.00 - 2.45	U	5		123 blows
				2.50	D	6		
below 2.50m with occasional lense/lamination of light green grey siltstone and light brown sandy siltstone				2.50 - 2.95	D	7	S N=23	5,5/4,6,6,7
			(5.30)					
below about 3.50m with occasional light green reduction spots and indistinct fissures with black staining				3.50 - 3.95	U	8		150 blows
				4.00	D	9		
				4.00 - 4.45	D	10	S N=67	7,10/15,15,17,20
				5.00 - 5.45	D	11	S N=66	4,7/14,10,19,23
				5.30	W	12		
	56.14		5.70					
Very stiff (hard) red brown fissured very silty CLAY with light grey silty fine sand lenses and partings (KEUPER MARL 3/4a)			(1.08 pen)	6.00 - 6.20	D	13	S 50	17,24/50 for 50mm Chiselling from 6.10 to 6.60m 1.00 hour
				6.60 - 6.78	D	14	S 50	19,21/50 for 27mm
BOREHOLE ENDS AT 6.78 m.	55.06		6.78					

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
19.01	0800	0.00	0.00		
19.01	1130	5.30	4.50	5.30	Water strike after 20 mins
19.01	1150			3.60	
19.01	1500	6.78	4.50	5.50	End of cable tool boring

Remarks

Logged by: GAC/AAC

Scale: 1:50

Fig. 35

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

(c) Soil Mechanics

24.03.88/10.16 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 719R

Sheet 1 of 3

Equipment & Methods

Open hole drilling, air flush, using 6.75in. rock bit from ground level to 6.00m. Rotary core drilling, air flush, producing 92mm diameter core from 6.00m to 15.20m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 61.84 m A.O.D.

Coordinates: 66833.0 mE, 94597.0 mN

Date: 25.01.88 to 27.01.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
Cable Tool Boring to 6.80m	61.84		(6.00)							
Assessed zone of core loss										
Firm red brown silty CLAY with fine gravel sized lithorelics (KM 3/4a)	55.84		6.00							
			(0.85)	6.00 – 7.10		23				at 6.00m S:88 7,9/10,28, 50 for 70mm
Red brown becoming light grey green locally thinly laminated slightly to moderately weathered SILTSTONE moderately weak to weak (KM 2)	54.99		6.85							
assessed core loss			(0.40)							
non intact	54.59		7.25	7.10 – 7.60		70	40	0	NI 35 50	
			(0.35)							
Assessed zone of core loss	54.24		7.60							
			(0.70)	7.60 – 8.60		30				at 7.60m S:(72) 22,50 for 75mm
Firm to stiff red brown very silty CLAY with frequent fine to medium occasionally coarse gravel sized lithorelics (weathered MUDSTONE) Occasional pockets and lenses of light grey green silt and siltstone (KM 3/4a)	53.54		8.30							
vertical joint stained black			(0.85)							at 8.60m S:50 18,32/50 for 60mm
non intact	52.69		9.15	8.60 – 9.80		92	17	0	NI 30 45	
2 intersecting vertical joints stained black			(3.95)							
non intact										
SILTSTONE (as sheet 2)				9.80 – 10.60		100	50	0		at 9.80m

Remarks

Logged by: AAC

Scale: 1:50

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 15.04.88/12.36 (Ver 3.1.0)

Fig. 36

Soil Mechanics

BOREHOLE No. 719R

Sheet 2 of 3

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
Red brown moderately to highly weathered locally very clayey SILTSTONE moderately weak with very closely spaced sub-horizontal fractures with speckled black staining (KEUPER MARL 2/3) — locally altered to lithorelics in a clayey silt matrix; light grey green slightly fine sandy siltstone moderately strong to strong; non intact with black speckled staining; assessed zone of core loss		× × ×		9.80 – 10.60		100	50	0	NI NI 70	
									NI NI 100	
			(3.95)	10.60 – 12.00		50	21	7		at 12.00m S:(72) 22,50 for 73mm
Below 10.60m becoming slightly to moderately weathered weak becoming moderately weak: locally with light grey green reduction spots										
				12.00 – 13.20		75	46	30	NI 80 130	
	48.74		13.10							
Light greenish grey slightly weathered fine grained SANDSTONE strong (KSS 2)			(0.40)						110 120 170	
	48.34		13.50							
Light greenish grey slightly to moderately weathered slightly fine sandy SILTSTONE weak (KEUPER MARL 2/3)		× × ×	(0.40)	13.20 – 14.20		70	55	40	NI 30 70	
	47.94		13.90							
Assessed zone of core loss			(0.55)							
	47.39		14.45							
Red brown locally greenish grey moderately to highly weathered SILTSTONE very weak locally altered to a friable silt with frequent lithorelics (KEUPER MARL 3/4a)		× × ×	(0.75 pen)	14.20 – 15.00		69	0	0		at 15.00m S:50 15,23/50 for 50mm
	46.64		15.20							
BOREHOLE ENDS AT 15.20 m.										

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988 25.01	1730	7.60	6.00		DAMP, end of shift
26.01	0830	7.60	6.00	0.45	
26.01	1730	13.20	7.50	0.00	DAMP, end of shift
27.01	1000	13.20	7.50	0.65	

Remarks

Logged by: AAC

Scale: 1:50

Fig. 36

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 15.04.88/12.36 (Ver 3.1.0)

Soil Mechanics

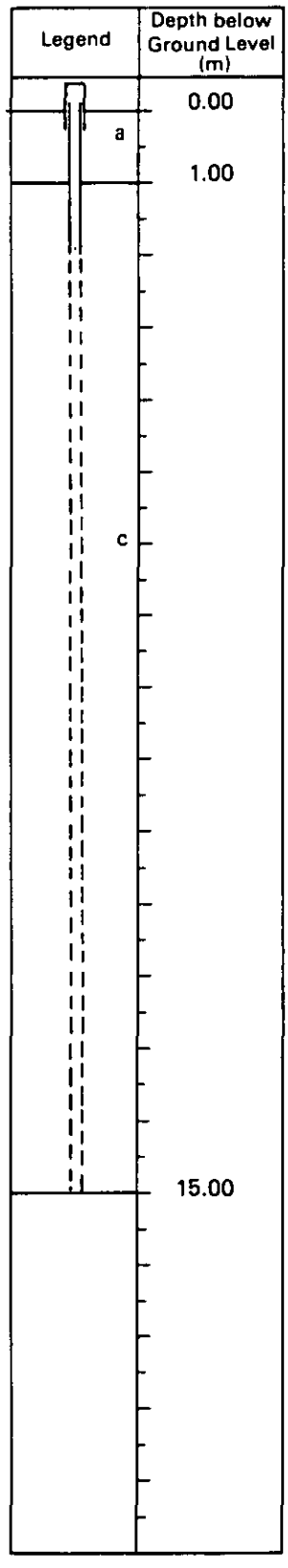
BOREHOLE No. 719R
Sheet 3 of 3

Location No. 7382
Location A42 CASTLE DONINGTON NORTH : GROUND INVESTIGATION CONTRACT 4

Carried out for
Client : Department of Transport (E. Midlands Regional Office)
Engineer : Scott Wilson Kirkpatrick and Partners

Type of installation Standpipe
Internal diameter of tubing 19 mm
Length of filter 14000 mm
Diameter of filter 120 mm

Depth (m) From	Depth (m) To	SUMMARY OF INSTALLATION
		Surface protection: Gas barrel with screw cap
0.00	1.00	Concrete
0.00	15.00	UPVC tubing
1.00	15.00	Gravel filter
2.00	15.00	Perforated section



KEY

a	Concrete
b	Sand
c	Gravel
d	Bentonite seal
e	Bentonite/cement grout
f	Backfill

ACCESS TUBINGS

- Standpipe/Piezometer (x 2 for Hydraulic or Pneumatic piezometers)
- Porous element
- Well with perforated section
- Inclinometer with joint
- Westbay with coupling and port

Remarks

1. Ground level and coordinates as sheet 1.

DETAILS OF INSTRUMENTS

Scale 1:100
Fig. 36

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Soil Mechanics

BOREHOLE No. 720

Sheet 1 of 1

Equipment & Methods

Cable tool boring, 150 mm diameter, from ground level to 6.108m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 63.59 m A.O.D.

Coordinates: 66840.0 mE, 94640.5 mN

Date: 18.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Clayey topsoil	63.59		(0.30)					
	63.29		0.30	0.30	D	1		
slightly sandy with occasional siltstone gravel				0.50 - 0.95	U	2		50 blows
				1.00	D	3		
				1.00 - 1.45	D	4	S N=14	2,2/4,3,3,4
Stiff becoming very stiff red brown locally very silty CLAY with occasional up to medium gravel sized lithorelics, pockets and lenses of light green grey silt and lenses/ laminations of very weak mudstone				2.00 - 2.45	U	5		121 blows
				2.50	D	6		
(KEUPER MARL 3/4a)			(4.70)	2.50 - 2.95	D	7	S N=30	4,4/5,7,9,9
				3.50 - 3.95	U	8		87 blows
				4.00	D	9		
				4.00 - 4.45	D	10	S N=38	6,7/7,9,11,11
	58.59		5.00					
				5.00 - 5.35	U	11		150 blows
				5.40	D	12	S	
Very stiff (hard) red brown extremely closely fissured very silty CLAY with pockets of green grey silt (KEUPER MARL 3/4a)			(1.11 pen)	5.40 - 5.58	D	13	50	14,21/50 for 29mm Chiselling from 5.40 to 6.00m 1.50 hours
				6.00 - 6.11	D	14	S (77)	27,50 for 33mm
BOREHOLE ENDS AT 6.11 m.	57.48		6.11					

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988 18.01	0900	0.00	0.00	DRY	End of cable tool boring
18.01	-	6.11	4.50		

Remarks

Logged by: JAS

Scale: 1:50

Fig.

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.05.88/09.48 (Ver 3.1.10)

Soil Mechanics

BOREHOLE No. 721

Sheet 1 of 1

Equipment & Methods

Cable tool boring, 150 mm diameter, from ground level to 5.299m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 58.45 m A.O.D.

Coordinates: 66824.5 mE, 94422.0 mN

Date: 15.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Clayey topsoil	58.45		(0.30)					
	58.15		0.30	0.40	D	1		
				0.50 - 0.95	U	2		53 blows
				1.00	D	3		
Stiff becoming very stiff red brown locally very silty CLAY with frequent lithorelics and occasional pockets and lenses of light green grey silt				1.00 - 1.45	D	4	S N=15	2,3/4,4,3,4
(KEUPER MARL 3)				2.00 - 2.45	U	5		150 blows
			(4.20)	2.50	D	6		
with light brown silt pockets and lenses				2.50 - 2.95	D	7	S N=36	4,5/8,9,9,10
thinly to thickly laminated with light green reduction spots				3.50 - 3.95	D	8	S N=32	6,5/7,7,8,10
	53.95		4.50	4.50 - 4.68	D	9	S 50	10,19/50 for 33mm Chiselling from 4.50 to 5.20m 1.50 hours 15,50 for 24mm
Very stiff (hard) red brown fissured very silty CLAY (KEUPER MARL 3/4a)			(0.80 pen)					
	53.15		5.30	5.20 - 5.30	D	10	S (65)	
BOREHOLE ENDS AT 5.30 m.								

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
15.01	0900	0.00	0.00	DRY	End of cable tool boring
15.01	1430	5.30	4.50		

Remarks

Logged by: JAS

Scale: 1:50

Fig. 38

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.03.88/10.29 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 721R

Sheet 1 of 3

Equipment & Methods

Open hole drilling, air flush, using 6.75in rock bit, from ground level to 4.00m. Rotary core drilling, air flush, producing 92mm diameter core, from 4.00m to 20.15m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 58.45 m A.O.D.

Coordinates: 66824.5 mE, 94422.0 mN

Date: 15.02.88 to 18.02.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
Cable Tool Boring to 5.30m	58.45		(4.00)							
NO RECOVERY	54.45		4.00	4.00 – 4.50		0	0	0		at 4.00m S:79 8,18/29,50 for 65mm
Soft to firm red brown very silty CLAY with fine gravel sized lithorelics (disturbed) (KM 4)			(1.00)	4.50 – 5.00		0	0	0		
	53.45		5.00							
Red brown slightly to moderately locally highly weathered SILTSTONE weak to moderately weak (KM 2)			(0.35)							
non intact due to vertical joint stained black	53.10		5.35	5.00 – 6.20		100	25	0	NI NI 80	
Assessed zone of core loss	52.25		(0.85) 6.20							at 6.20m S:(87) 37,50 for 70mm
Firm red brown very silty CLAY with up to coarse gravel sized lithorelics (weathered MUDSTONE). Occasional pockets and lenses of light grey green silt (KEUPER MARL 3)	51.35		(0.90) 7.10	6.20 – 7.90		47	1	0		
Red brown slightly to moderately weathered SILTSTONE moderately weak: Closely locally extremely closely fractured with frequent black staining (KM 2)	50.85		(0.50) 7.60							at 7.90m S:(78) 28,50 for 75mm
Dense light grey green SILT with occasional fine to medium gravel sized lithorelics (weathered SILTSTONE). Inclusions of red brown very silty clay. (KEUPER MARL 3/4a)	49.45		(1.40) 9.00	7.90 – 9.00		100	55	0	NI SO 130	
Red brown slightly to moderately weathered SILTSTONE moderately weak: Closely becoming extremely closely fractured (KM 2)	48.85		(0.60) 9.60	9.00 – 9.70		79	11	0		at 9.00m S:(70) 20,50 for 70mm
			(0.50)	9.70 – 10.50		50	0	0		

Remarks

Logged by: AAC

Scale: 1:50

Fig. 39

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 11.04.88/10.44 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 721R

Sheet 2 of 3

Equipment & Methods: As sheet 1

Location No. 7382

Location: A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4

Carried out for
Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: As sheet 1 | Coordinates: As sheet 1 | Date: As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
	48.35		(0.50) 10.10							
Assessed zone of core loss				9.70 – 10.50		50	0	0		
			(0.70)							at 10.50m S:(82) 32,50 for 75mm
Red brown moderately weathered SILTSTONE moderately weak becoming weak: Closely becoming extremely closely spaced generally sub-horizontal fractures (KM 2)	47.65		10.80							
			(0.70)						NI 50 130	
	46.95		11.50	10.50 – 12.20		82	59	29		
Light grey green slightly locally slightly to moderately weathered locally very fine sandy SILTSTONE strong with closely to moderately widely spaced sub-horizontal fractures From 12.10m to 12.40m red brown (KEUPER MARL 1/2)			(1.65)						NI 180 300	
				12.20 – 13.50		73	73	56		
	45.30		13.15							
Assessed zone of core loss			(0.75)							
	44.55		13.90							
Firm red brown very clayey SILT with frequent fine to medium occasionally coarse gravel sized lithorelics and occasional pockets/bands of light grey green silt/siltstone (weathered SILTSTONE) (KM 3/4a)			(0.90)	13.50 – 15.30		78	11	6		
	43.65		14.80							
Red brown moderately weathered very fine sandy SILTSTONE weak: Extremely closely fractured (KM 2/3)			(0.50)						NI NI 100	
	43.15		15.30							
Assessed zone of core loss			(0.60)							
	42.55		15.90							
Recovered as medium to coarse gravel sized fragments of light grey green and red brown SILTSTONE locally in a clayey silt matrix (KM 2/3)			(0.60)	15.30 – 16.90		63	15	9		
	41.95		16.50							
Red brown moderately weathered SILTSTONE weak (KM 2) sub-vertical joint stained black			(0.40)						NI 45 150	
	41.55		16.90							
Assessed zone of core loss			(0.30)							at 16.90m S:79 15,19/29,50 for 65mm
	41.25		17.20							
Stiff to very stiff red brown very silty CLAY with occasional fine gravel sized lithorelics (weathered MUDSTONE) (KM 3)			(0.80)	16.90 – 18.30		79	36	7		
	40.45		18.00							
Light grey green becoming red brown moderately weathered SILTSTONE moderately weak with closely becoming very closely spaced sub-horizontal fractures (bedding?) (KM 2)			(0.85)						NI 15 100	
	39.60		18.85							
Very dense (hard) red brown very clayey SILT with frequent fine to medium gravel sized lithorelics (weathered SILTSTONE) (KEUPER MARL 3/4a)			(0.75)	18.30 – 20.00		76	6	0		
	38.85		19.60							
Assessed zone of core loss			(0.55)							

Remarks

Logged by: AAC

Scale: 1:50

Fig. 39

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 11.04.88/10.44 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 721R

Sheet 3 of 3

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
Assessed zone of core loss	38.30		(0.55 20.00)							at 20.00m S:(78) 28,50 for 70mm
BOREHOLE ENDS AT 20.15 m.										

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
15.02	1800	4.50	4.00		DAMP
16.02	0900	4.50	4.50	1.30	
16.02	1800	10.50	5.50		DAMP
17.02	0830	10.50	5.50	0.40	
17.02	1730	16.90	5.50		DAMP
18.02	0830	16.90	5.50	0.90	

Remarks

Logged by: AAC

Scale: 1:50

Fig. 39

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 11.04.88/10.44 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 722

Sheet 1 of 1

Equipment & Methods

Cable tool boring, 150 mm diameter, from ground level to 5.602m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 58.91 m A.O.D.

Coordinates: 66824.5 mE, 94449.5 mN

Date: 14.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Clayey topsoil	58.91		(0.30)					
	58.61		0.30	0.40	D	1		
Stiff red brown CLAY with frequent lithorelics and pockets and lenses of light green grey silt (KEUPER MARL 3/4a)				0.50 - 0.95	U	2		50 blows
				1.00	D	3		
				1.00 - 1.45	D	4	S N=22	3,4/3,5,7,7,
below 1.00m locally very silty			(2.20)					
				2.00 - 2.45	U	5		150 blows
	56.41		2.50	2.50	D	6		
				2.50 - 2.95	D	7	S N=64	3,7/6,10,17,31
Very stiff (hard) red brown in parts thinly to thickly laminated very silty CLAY locally with occasional mudstone lithorelics: occasional green grey pockets and lenses of silt (KEUPER MARL 3/4a)				3.50 - 3.85	U	8		150 blows
				3.90	D	9		
			(3.10 pen)	3.90 - 4.35	D	10	S N=56	4,11/12,9,15,20
				5.00 - 5.28	D	11	S 85	7,23/35,50 for 50mm Chiselling from 5.00 to 5.50m 1.00 hour 21,50 for 27mm
				5.50 - 5.60	D	12	S (71)	
BOREHOLE ENDS AT 5.60 m.	53.31		5.60					

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988 14.01	1730	5.50	4.50	DRY	End of cable tool boring

Remarks

Logged by: JAS/NAC

Scale: 1:50

Fig. 40

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.03.88/10.44 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 722R

Sheet 1 of 3

Equipment & Methods

Open hole drilling, air flush, using 6.75in rock bit, from ground level to 4.50m. Rotary core drilling, air flush, producing 92mm diameter core, from 4.50m to 20.32m

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 58.91 m A.O.D.

Coordinates: 66824.5 mE, 94449.5 mN

Date: 05.02.88 to 10.02.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
Cable Tool Boring to 5.60m	58.91		(4.50)							
Assessed zone of core loss										
Stiff becoming very stiff (hard) red brown very silty CLAY with frequent medium to coarse gravel sized lithorelics (weathered MUDSTONE) (KM 3)	54.41		4.50 (0.55)							at 4.50m S:Nm117 9,16/21,24, 33,39
Red brown moderately weathered SILTSTONE weak Extremely closely fractured with black staining (KM 2)	53.86		5.05 (0.80)	4.50 - 6.10		66	0	0		
Firm becoming stiff red brown very silty CLAY with frequent fine to medium gravel sized lithorelics (weathered MUDSTONE) (KM 3/4a)	53.06		5.85 (0.25)							
Light grey green slightly weathered SILTSTONE strong (KM 2)	52.81		6.10 (0.65)	6.10 - 7.00		78	11	0		at 6.10m S:55 22,30/55 for 75mm
Assessed zone of core loss	52.16		6.75 (0.25)						NI to wc	
highly disturbed	51.91		7.00 (0.30)							
Red brown moderately locally highly weathered locally very silty MUDSTONE weak to moderately weak: Closely locally extremely closely spaced fractures frequently stained black (KEUPER MARL 2/3)	51.61		7.30 (1.40)	7.00 - 7.60		50	0	0		
NI				7.60 - 8.70		91	55	18	NI 40 100	
Assessed zone of core loss	50.21		8.70 (0.85)							at 8.70m S:(85) 35,50 for 60mm
Red brown slightly to moderately weathered SILTSTONE weak: Extremely closely fractured with black speckled staining (KM 2)	49.36		9.55 (0.45)	8.70 - 10.00		35	3	0	NI NI 40	
	48.91		10.00							

Remarks

Logged by: AAC

Scale: 1:50

Fig. 41

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

(c) Soil Mechanics

14.04.88/14.42 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 722B

Sheet 2 of 3

Equipment & Methods: As sheet 1

Location No. 7382

Location: A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4

Carried out for
Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: As sheet 1 | Coordinates | Date

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
Assessed zone of core loss			(0.30)							at 10.00m S:(91) 41,50 for 60mm
	48.61		10.30							
			(0.30)							
Red brown MUDSTONE and light greenish grey SILTSTONE lithorelics in a soft silty clay matrix (possibly spoil) (KM 2/3)	48.31		10.60	10.00 – 11.20		75	25	13	NI 40 150	
			(0.60)							
	47.71		11.20							
Red brown slightly to moderately weathered SILTSTONE moderately weak: locally extremely closely fractured with black staining (KM 2)			(0.45)							
	47.26		11.65	11.20 – 12.40		92	67	28		
Very stiff (hard) red brown very silty CLAY with fine to medium occasionally coarse gravel sized lithorelics (weathered MUDSTONE) (KEUPER MARL 3)										
Light green grey slightly to moderately weathered locally very fine sandy SILTSTONE strong with closely locally very closely spaced generally 20 deg. fractures (bedding?) (KEUPER MARL 2) Below 12.10m locally red brown			(2.35)	12.40 – 13.60		83	75	32	NI 120 200	
				13.60 – 14.00		100	60	28		
	44.91		14.00							
Very stiff (hard) red brown locally fine sandy very silty CLAY with frequent medium to coarse gravel sized lithorelics and occasional bands of moderately weathered MUDSTONE weak (KEUPER MARL 3)			(1.50)	14.00 – 15.50		90	30	23	NI NI 150	
	43.41		15.50							
Assessed zone of core loss			(0.30)							
	43.11		15.80	15.50 – 16.20		57	0	0		
Red brown moderately to highly weathered locally very silty MUDSTONE very weak (KM 2/3)			(0.40)							
	42.71		16.20							
				16.20 – 17.00		100	25	0	NI NI 70	
Red brown moderately weathered locally very clayey SILTSTONE weak to moderately weak with occasional thin interbeds of light grey green SILTSTONE strong with closely locally extremely closely spaced generally sub-horizontal fractures occasionally with black speckled stain (KEUPER MARL 2) From 17.90m to 18.20m Stiff to very stiff very silty CLAY with fine to medium gravel sized lithorelics (weathered MUDSTONE) From 18.95m to 19.40m mottled light grey green and red brown slightly fine sandy weak			(3.20)	17.00 – 19.40		92	63	36	NI 120 230	
	39.51		19.40							
Very dense (hard) SILT (as sheet 3)			(0.92)	19.40 – 20.20		100	94	31	NI 90 250	

Remarks

Logged by: AAC

Scale: 1:50

Fig. 41

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 14.04.88/14.42 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 722R

Sheet 3 of 3

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
Very dense (hard) red brown very clayey SILT with frequent fine to medium gravel sized lithorelics and occasional bands of moderately weathered siltstone very weak (weathered SILTSTONE) (KM 3)	38.59		(0.92 pmb) 20.32	19.40 – 20.20		100	94	31		at 20.20m S:(84) 34,50 for 45mm
BOREHOLE ENDS AT 20.32 m.										

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
05.02	1730	7.00	6.00		DAMP
06.02	0830	7.00	6.00	0.30	
06.02	1730	10.00	7.00	10.00	'WET'
08.02	1600	10.00	7.00	0.10	
08.02	1800	10.00	7.00	1.40	
09.02	0830	10.00	7.00	0.70	
09.02	1730	16.20	7.00	0.00	DAMP
10.02	0830	16.20	7.00	0.40	

Remarks

Logged by: AAC

Scale: 1:50

Fig. 41

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 14.04.88/14.42 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 723

Sheet 1 of 2

Equipment & Methods

Cable tool boring, 150 mm diameter, from ground level to 7.548m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 60.31 m A.O.D.

Coordinates: 66846.0 mE, 94465.0 mN

Date: 13.01.88 to 14.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Clayey topsoil	60.31		(0.20)					
	60.11		0.20	0.25	D	1		
Firm red brown CLAY with occasional light green grey pockets, dark grey organic pockets and frequent rootlets (PROBABLE FILL)			(1.30)	0.50 – 0.95	U	2		31 blows
				1.00	D	3		
				1.00 – 1.45	D	4	S N=9	1,2/2,3,2,2
	58.81		1.50					
Very stiff red brown very silty CLAY with bands of light brown to red brown very clayey silt and pockets of green grey silt (KEUPER MARL 4b)				2.00	WS	12		
				2.00 – 2.30	U	5		150 blows 300mm penetration
				2.35	D	6		
2.35-2.80m light green grey locallly very clayey silt locally cemented				2.35 – 2.80	D	7	S N=38	4,10/7,9,10,12
			(2.50)					
				3.50 – 3.95	D	8	S N=51	7,12/9,15,15,12
	56.31		4.00					
				4.50 – 4.95	U	9		150 blows
				5.00	D	10		
				5.00 – 5.45	D	11	S N=77	8,11/11,17,23,26
Very stiff (hard) red brown very silty CLAY with pockets and lenses of green grey silt and occasional bands of mudstone up to moderately weak			(3.55 pen)					
(KEUPER MARL 3/4a)				6.00 – 6.45	D	13	S N=110	7,12/17,25,27,41
				7.00 – 7.18	D	14	S 50	12,33/50 for 31mm Chiselling from 7.00 to 7.45m 1.00 hour
				7.45 – 7.55	D	15	S (65)	15,50 for 23mm
BOREHOLE ENDS AT 7.55 m.	52.76		7.55					

Remarks

Logged by: JAS

Scale: 1:50

Fig. 42

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.03.88/11.29 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 723

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field Records

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
13.01	–	0.00	0.00		
13.01	1700	4.00	4.00	DRY	End of shift
14.01	0800	4.00	4.00	2.00	
14.01	–	7.55	6.00	6.00	End of shift

Remarks

Logged by: JAS

Scale: 1:50

Fig. 42

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.03.88/11.29 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 723R

Sheet 1 of 3

Equipment & Methods

Open hole drilling, air flush, using 6.75in. rock bit from ground level to 6.50m. Rotary core drilling, air flush, producing 92mm diameter core, from 6.50m to 20.14m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 60.31 m A.O.D.

Coordinates: 66846.0 mE, 94465.0 mN

Date: 29.01.88 to 03.02.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
Cable Tool Boring to 7.55m	60.31		(6.50)							
Assessed zone of core loss	53.81		6.50 (0.55)							at 6.50m S:50 9,23/50 for 60mm
highly disturbed Stiff locally very stiff (hard) red brown very silty CLAY with occasional becoming frequent fine to medium gravel sized lithorelics (weathered MUDSTONE)	53.26		7.05	6.50 – 8.00		63	7	0		
assessed zone of core loss Occasional bands of red brown moderately weathered SILTSTONE moderately weak to weak (KM 3)			(2.20)	8.00 – 9.00		55	0	0		at 8.00m S:(69) 19,50 for 60mm
light grey green siltstone weak (NI)	51.06		9.25							at 9.00m S:(66) 16,50 for 75mm
SILTSTONE (as sheet 1)			(1.75)	9.00 – 10.30		92	19	0	NI 80	

Remarks

Logged by: AAC

Scale: 1:50

Fig. 43

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 14.04.88/14.53 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 723R

Sheet 2 of 3

Equipment & Methods: As sheet 1

Location No. 7382

Location: A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4

Carried out for
Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: As sheet 1 | Coordinates | Date

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
Red brown slightly to moderately weathered SILTSTONE moderately weak with very closely locally extremely closely spaced fractures frequently stained black (KM 2)		× × ×		9.00 – 10.30		92	19	0	NI	
		× × ×	(1.75)						NI	
		× × ×		10.30 – 11.00		71	17	0	80	
		× × ×								
	49.31	× × ×	11.00							
Assessed zone of core loss			(1.15)							
Red brown slightly to moderately weathered SILTSTONE moderately weak with closely spaced sub-horizontal fractures occasionally stained black (KEUPER MARL 2) — 50 joint stained black; sub-vertical joint stained black				11.00 – 13.00		43	32	22		
	48.16	× × ×	12.15						NI	
		× × ×	(0.85)						90	
		× × ×							160	
	47.31		13.00							at 13.00m S:(50) 50 for 70mm
Assessed zone of core loss			(0.85)							
				13.00 – 14.20		29	17	0		
	46.46		13.85							
Light reddish brown becoming light grey green slightly weathered locally very silty fine grained SANDSTONE strong with closely locally very closely spaced sub-horizontal fractures (KEUPER SANDSTONE 2)			(1.20)						NI	at 14.20m S:(50) 50 for 63mm
				14.20 – 15.40		71	58	14	60	
									170	
	45.26		15.05							
Assessed zone of core loss			(0.60)							
Red brown locally mottled light grey green moderately to highly weathered locally very fine sandy SILTSTONE moderately strong (KM 2/3)	44.66	× × ×	15.65							
		× × ×	(0.85)	15.40 – 16.50		77	41	0	NI	
Assessed zone of core loss		× × ×							30	
	43.81		16.50						70	
Dense red brown locally light grey green slightly fine sandy SILT with rare fine to medium gravel sized lithorelics (weathered SILTSTONE) (KM 3)			(1.05)							
Red brown becoming light grey green moderately becoming highly weathered SILTSTONE weak becoming very weak: Closely becoming very closely spaced fractures often tight (KM 2)	42.76	× × ×	17.55							
		× × ×	(0.50)	16.50 – 19.00		58	16	0		
	42.26	× × ×	18.05							
Assessed zone of core loss		× × ×							NI	
		× × ×	(0.95)						90	
Soft red brown very silty CLAY with frequent fine to medium gravel sized lithorelics (weathered MUDSTONE) (disturbed-possibly spoil) (KM 3?)	41.31	× × ×	19.00							
			(0.30)							at 19.00m S:50 10,33/50 for 55mm
	41.01		19.30							
Red brown moderately weathered SILTSTONE moderately weak to moderately strong Extremely closely fractured (KM 2)			(0.40)	19.00 – 20.00		70	5	0	NI	
	40.61	× × ×	19.70						50	

Remarks

Logged by: AAC

Scale: 1:50

Fig. 43

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 14.04.88/14.53 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 723R

Sheet 3 of 3

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
SILTSTONE (as sheet 2)	40.17	x x x	(0.44p) 20.14							at 20.00m S:(67) 17.50 for 60mm
BOREHOLE ENDS AT 20.14 m.										

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
29.01	1530	8.00	6.50		DAMP
01.02	1700	8.00	6.50		DAMP
02.02	0830	8.00	6.50	3.70	
02.02	1730	14.20	6.50		DAMP
03.02	0830	14.20	6.50	2.70	
03.02	1730	20.00	6.50		DAMP

Remarks

Logged by: AMC

Scale: 1:50

Fig. 43

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 14.04.88/14.53 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 725

Sheet 1 of 1

Equipment & Methods

Hand dug inspection pit from ground level to 1.50m. Cable tool boring, 150mm diameter, from 1.50m to 3.30m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 62.30 m A.O.D.

Coordinates: 66906.5 mE, 94593.0 mN

Date: 26.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
FILL (Foreman's description)	62.30		(0.20)					
TOPSOIL (Foreman's description)	62.10		0.20					
	61.90		(0.20) 0.40					
Very dense (hard) red brown friable very clayey SILT with fine becoming medium gravel sized lithorelics				1.50 – 1.65	U	1		75 blows
				1.70	D	2		
Below about 1.80m becoming very stiff (hard) red brown locally very silty CLAY locally with medium to coarse gravel sized lithorelics and occasional inclusions of light grey green silt and siltstone			(2.90 pen)	1.70 – 2.15	D	3	S N=41	5,7/7,10,10,14
(KEUPER MARL 3/4a)				2.60 – 2.90	D	4	S 79	13,19/26,53 for 75mm
				3.00 – 3.28	D	5	S 81	7,17/31,50 for 50 mm Chiselling from 2.60m to 3.00m 1.00 hour
BOREHOLE ENDS AT 3.30 m.	59.00		3.30					

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
26.01	–	1.60		DRY	
26.01	–	2.70	2.60	DRY	
26.01	–	3.30	2.60	DRY	End of cable tool boring

Remarks

Logged by: AAC

Scale: 1:50

Fig. 44

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 11.04.88/11.13 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 725R

Sheet 1 of 3

Equipment & Methods

Open hole drilling, air flush , using 6.75in rock bit, from G.L. to 2.00m. Rotary core drilling, air flush, to 5.00m, foam flush, to 20.15m producing 92mm diameter core.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 62.30 m A.O.D.

Coordinates: 66906.5 mE, 94593.0 mN

Date: 27.01.88 to 29.01.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
Cable Tool Boring to 3.30m	62.30		(2.00)							
Assessed zone of core loss	60.30		2.00 (0.20)							
disturbed by SPT	60.10		2.20 (0.40)							at 2.00m S:N=87 5,12/15,17, 25,30
Very stiff (hard) red brown silty CLAY with fine gravel sized lithorelics (weathered MUDSTONE) (KM 3/4a)	59.70		2.60	2.00 – 3.50		20	5	0		
Assessed zone of core loss			(3.60)	3.50 – 4.50		0	0	0		at 3.50m S:N=26 3,3/4,5,8,9
				4.50 – 5.00		0	0	0		at 4.50m S:N=54 4/5,10,10, 29
				5.00 – 5.80		0	0	0		
Stiff becoming very stiff (hard) red brown silty CLAY with frequent fine gravel sized lithorelics (weathered MUDSTONE). Interbedded with red brown moderately weathered SILTSTONE weak to very weak locally with extremely closely spaced fractures with black speckled stain (KM 3/4a)	56.10		6.20							at 5.80m S:(86) 30,56 for 75mm
light green grey fine sandy siltstone moderately strong			(1.30)	5.80 – 7.50		76	38	11	NI NI 200	
Assessed zone of core loss	54.80		7.50							
Red brown moderately weathered locally very clayey SILTSTONE weak becoming moderately weak Closely spaced sub-horizontal fractures with speckled black staining (KEUPER MARL 2)			(2.10)	7.50 – 10.30		25	16	0		
50 joint with speckled black stain	52.70		9.60 (0.70)						NI NI 85	

Remarks

Logged by: AAC

Scale: 1:50

Fig. 45

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 11.04.88/11.29 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 725B

Sheet 2 of 3

Equipment & Methods: As sheet 1

Location No. 7382

Location: A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4

Carried out for
Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: As sheet 1 | Coordinates: As sheet 1 | Date: As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
SILTSTONE (as sheet 1) light greenish grey fine sandy calcareous siltstone strong	52.00	× × ×	(0.70) 10.30	7.50 – 10.30		25	16	0		
Assessed zone of core loss			(1.50) 11.80	10.30 – 11.80		0	0	0		
Very stiff (hard) red brown CLAY with frequent fine gravel sized lithorelics (weathered MUDSTONE) (KM 2/3)	50.50		(0.50) 12.30							
Grey green becoming red brown moderately weathered locally fine sandy SILTSTONE moderately weak with extremely closely to closely spaced fractures stained black (KM 2/3)	50.00	× × ×	(1.20) 13.50	11.80 – 13.50		100	38	29	NI NI 130	
Angular to sub-rounded medium to coarse gravel sized fragments of red brown SILTSTONE weak (possibly spoil) (KM 3/2?) assessed zone of core loss	48.80	× × ×	(0.65) 14.15							
Light grey green slightly to moderately weathered slightly fine sandy SILTSTONE strong (KEUPER MARL 2) Very stiff red brown clay with occasional medium gravel sized lithorelics	48.15	× × ×	(1.30) 15.45	13.50 – 15.00		80	53	31	NI 190 210	
Light green grey slightly to moderately weathered fine grained SANDSTONE moderately strong with closely spaced sub-horizontal fractures (KM 1/2) hard red brown clayey silt with occasional lithoreclics	46.85	• • • •	(0.60) 16.05						NI 190 210	
	46.25	× × ×	(0.25) 16.30	15.00 – 17.00		65	52	43		
Light greenish grey fine sandy SILTSTONE weak (KM 2)	46.00		(1.40) 17.70							
Assessed zone of core loss	44.60									
Stiff becoming very stiff (hard) red brown silty CLAY with fine to medium occasionally coarse gravel sized lithorelics (weathered MUDSTONE) Occasional pockets of light grey green silt (KEUPER MARL 3) Below 18.50m thinly interbedded with red brown locally light greenish grey moderately weathered SILTSTONE weak with very closely spaced fractures stained black From 18.50m to 19.30m non intact			(2.45)	17.00 – 20.00		77	37	20	NI NI 250	

Remarks

Logged by: AAC

Scale: 1:50

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 11.04.88/11.29 (Ver 3.1.0)

Fig. 45

Soil Mechanics

BOREHOLE No. 725R

Sheet 3 of 3

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
Very stiff (hard) silty CLAY (as sheet 2)	42.15		(2.45 20.00)							at 20.00m S:(84) 31,53 for 75mm
BOREHOLE ENDS AT 20.15 m.										

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
27.01	1800	5.00	5.00	DRY	End of shift
28.01	0800	5.00	5.00	1.20	
28.01	1800	13.50	6.80		foam flush

Remarks

Logged by: AAC

Scale: 1:50

Fig. 45

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 11.04.88/11.29 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 726

Sheet 1 of 2

Equipment & Methods

Cable Tool Boring, 200mm diameter, from ground level to 9.325m

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 77.03 m A.O.D.

Coordinates: 67051.5 mE, 95155.5 mN

Date: 20.01.88 to 21.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
TOPSOIL	77.03		(0.40)					
SUBSOIL	76.63		0.40 (0.20)					
	76.43		0.60					
Firm to stiff red brown locally silty CLAY with up to coarse gravel sized mudstone lithorelics				0.60 - 1.05	U	1		26 blows
				1.20	D	2		
				1.20 - 1.65	D	3	S N=10	2,2/2,2,3,3
Occasional pockets and lenses of light green grey silt and siltstone			(2.00)					
(KEUPER MARL 3/4)				2.00 - 2.45	U	4		32 blows
				2.60	D	5		
	74.43		2.60	2.60 - 3.05	D	6	S N=14	2,3/3,3,4,4
				3.50 - 3.90	U	7		100 blows
				3.90	D	8		
				3.95 - 4.40	D	9	S N=84	8,15/19,17,22,26
Very stiff (hard) red brown very silty CLAY with frequent medium to coarse occasionally fine gravel sized mudstone lithorelics				5.00 - 5.40	U	10		120 blows
				5.40	D	11	S	
Locally with up to medium gravel sized inclusions of light grey green silt and siltstone				5.40 - 5.68	D	12	82	15,21/32,50 for 50mm
(KEUPER MARL 3)			(6.72 pen)					
				6.50 - 6.71	D	13	S 50	11,25/50 for 60mm
Below 6.90m with bands of dense red brown SILT and frequent siltstone lithorelics: black speckled staining on occasional vertical fissures				6.90 - 7.35	D	14	S N=65	27,17/15,15,16,19
				7.70 - 7.99	D	15	S 79	11,18/29,50 for 60mm
				8.50 - 8.76	D	16	S 75	8,17/25,50 for 40mm
				9.10 - 9.32	D	17	S 56	12,23/56
BOREHOLE ENDS AT 9.32 m.	67.71		9.32					

Remarks

Logged by: AAC

Scale: 1:50

Fig. 46

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

(c) Soil Mechanics

24.03.88/11.27 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 726

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field Records

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
20.01	-	0.70	0.00	DRY	
20.01	-	3.85	0.00	3.85	Water strike
20.01	-			3.80	after 20 mins
20.01	-	7.10	1.84	4.20	
21.01	0800	7.10	1.84	1.70	start of shift
21.01	-	9.32	1.84	1.70	End of cable tool boring

Remarks

Logged by: AAC

Scale: 1:50

Fig. 46

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.03.88/11.27 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 726R

Sheet 1 of 2

Equipment & Methods

Cable tool boring from G.L. to 9.325m. Rotary core drilling, foam flush, producing 92mm diameter core from 9.10m to 14.55m

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 77.03 m A.O.D.

Coordinates: 67051.5 mE, 95155.5 mN

Date: 23.01.88 to 24.01.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
Cable Tool Boring to 9.325m	77.03		(9.10)							
Assessed zone of core loss										
Stiff becoming hard red brown CLAY (KEUPER MARL 3/4a)	67.93		9.10 (0.25)							
	67.68		9.35							
Red brown slightly to moderately weathered SILTSTONE weak (KM 2) 70 joint	67.28		(0.40) 9.75	9.10 – 10.20		77	0	0		

Remarks

Logged by: AAC

Scale: 1:50

Fig. 47

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

(c) Soil Mechanics 15.04.88/09.47 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 726R

Sheet 2 of 2

Equipment & Methods: As sheet 1

Location No. 7382

Location: A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4

Carried out for
Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: As sheet 1 | Coordinates: As sheet 1 | Date: As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
SILTSTONE (as sheet 1)	66.83	× × ×	(0.45) 10.20	9.10 – 10.20		77	0	0		
Assessed zone of core loss	66.43		(0.40) 10.60							at 10.20m S:91 10,14/41,50 for 30mm
Stiff locally very stiff (hard) red brown CLAY very thinly to thinly interbedded with moderately weathered SILTSTONE weak Occasional pockets and lenses of light greenish grey silt and siltstone Closely locally very closely fractured (KM 3) — 60 joint stained black; non intact; non intact; assessed zone ofcore loss; non intact			(2.35)	10.20 – 12.00		78	36	19	NI 200	
Red brown slightly to moderately weathered locally clayey SILTSTONE weak to moderately weak with closely spaced tight joints frequently with black speckled staining (KEUPER MARL 2) — non intact due to sub-vertical joint with speckled black staining; non intact; non intact	64.08	× × ×	12.95 (1.60 pen)	12.00 – 14.50		88	32	18	NI NI 130	
BOREHOLE ENDS AT 14.55 m.	62.48		14.55							at 14.50m S:(50) 50 for 50mm

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
23.01	1500	9.10	9.00	6.00	
24.01	0800	10.20	9.00	7.00	

Remarks

Logged by: AAC

Scale: 1:50

Fig. 47

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 15.04.88/09.47 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 727

Sheet 1 of 2

Equipment & Methods

Cable tool boring, 150 mm diameter, from ground level to 8.00m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 75.78 m A.O.D.

Coordinates: 67064.5 mE, 95201.0 mN

Date: 20.01.88 to 21.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Clayey topsoil	75.78		(0.20)					
	75.58		0.20	0.20	D	1		
Firm yellow brown, red brown and brown sandy CLAY with occasional assorted generally subrounded gravel and black organic pockets (PROBABLE FILL)				0.50 - 0.95	U	2		40 blows
			(1.60)	1.00	D	3		
				1.00 - 1.45	D	4	S N=17	2,4/3,4,5,5
	73.98		1.80	1.80	D	5		
Stiff becoming very stiff red brown CLAY with frequent up to coarse gravel sized lithorelics (KEUPER MARL 3/4a)				1.90 - 2.35	U	6		55 blows
				2.40	D	7		
				2.40 - 2.85	D	8	S N=26	3,5/7,7,6,6
below 2.40m with occasional pockets of light red brown silt								
becoming very silty by 3.40m			(3.40)					
				3.40 - 3.85	U	9		150 blows
below 3.90m with bands of hard very silty clay				3.90	D	10		
				3.90 - 4.35	D	11	S N=25	5,6/6,5,7,7
				4.90 - 5.20	U	12		150 blows
	70.58		5.20	5.25	D	13	S	
				5.25 - 5.70	D	15	N=82	5,9/14,16,22,30
				5.30	WS	14		
Very stiff (hard) red brown to dark red brown extremely to closely fissured very silty CLAY with pockets and lenses of light grey to light red brown silt locally cemented and occasional lens of green grey fine sandy siltstone, black speckled staining on vertical fissures				6.25 - 6.44	D	16	S 50	7,15/50 for 41mm
			(2.80 pen)					
(KEUPER MARL 3/4a)				7.25 - 7.51	D	17	S 89	6,14/39,50 for 40mm
				7.80 - 7.91	D	18	S (63)	13,50 for 31mm
BOREHOLE ENDS AT 8.00 m.	67.78		8.00					Chiselling from 7.20 to 7.80m 1.50 hours

Remarks

Logged by: GAC

Scale: 1:50

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.03.88/11.34 (Ver 3.1.0)

Fig. 48

Soil Mechanics

BOREHOLE No. 727

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field Records

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
20.01	0900	0.00	0.00		
20.01	–	5.25	1.50	5.25	Water strike
20.01	–			3.25	after 20 mins.
20.01	1700	6.50	6.00	4.00	End of shift
21.01	0800	6.50	6.00	3.00	
21.01	1100	8.00	7.50	3.50	End of cable tool boring

Remarks

Logged by: GAC

Scale: 1:50

Fig. 48

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.03.88/11.34 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 727R

Sheet 1 of 2

Equipment & Methods: Cable tool boring from ground level to 8.00m. Rotary core drilling, foam flush, producing 92mm diameter core from 8.00m to 15.15m	Location No. 7382 Location: A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4
Carried out for Client: Department of Transport (E. Midlands Reg. Office) Engineer: Scott Wilson Kirkpatrick & Partners	Ground Level: 75.78 m A.O.D. Coordinates: 67064.5 mE, 95201.0 mN Date: 21.01.88 to 22.01.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
	75.78									
Cable Tool Boring to 8.00m			(8.00)							
Assessed zone of core loss										
	67.78		8.00							
			(0.50)							
Stiff becoming very stiff red brown silty CLAY with fine to medium gravel sized lithorelics thinly interbedded with red brown locally light grey green moderately weathered SILTSTONE moderately weak (KEUPER MARL 2/3)	67.28		8.50	8.00 – 9.00		50	20	10		
disturbed; sub-vertical joint stained black; disturbed by SPT; closely spaced joints stained black			(1.38)	9.00 – 10.50		100	5	0		at 9.00m S:(56) 56 for 75 mm
SILTSTONE (as sheet 2)	65.90		9.88							

Remarks

Logged by: AAC

Scale: 1:50

Fig. 49

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

(c) Soil Mechanics 11.04.88/11.35 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 727R

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
Red brown locally light grey green moderately weathered SILTSTONE weak to moderately weak Very to extremely closely spaced fractures with speckled black staining (KEUPER MARL 2)				9.00 – 10.50		100	5	0	NI NI Je	
very stiff (hard) red brown very silty CLAY										
assessed zone of core loss			(1.47)							at 10.50m S:52 37,39/52 for 75mm
assessed zone of core loss	64.43		11.35						NI 100 130	
Red brown moderately weathered SILTSTONE strong becoming moderately strong with occasional bands of dense clayey silt with frequent fine to medium gravel sized lithorelics (KEUPER MARL 2)				10.50 – 13.20		81	22	20	NI NI 100	
70 joint stained black										
non intact										
vert stiff (hard) red brown CLAY										
non intact										
assessed zone of core loss			(3.80 pen)							
Below 11.80m with extremely closely spaced often tight generally sub-vertical joints with speckled black staining From 13.50m to 13.90m greenish grey slightly to moderately weathered Below 14.90m becoming light greenish grey slightly weathered moderately strong to strong									NI 80 100	
non intact				13.20 – 15.00		83	25	11		
non intact due to 2 intersecting sub-vertical joints stained black									NI NI 100	
non intact										
	60.63		15.15							at 15.00m S:(96) 39,57 for 75mm

BOREHOLE ENDS AT 15.15 m.

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988 22.01	0800	9.00	9.00	5.10	

Remarks

Logged by AAC

Scale 1:50

Fig. 49

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 11.04.88/11.35 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 728

Sheet 1 of 1

Equipment & Methods

Cable tool boring, 150mm diameter, from ground level to 4.45m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 75.49 m A.O.D.

Coordinates: 67031.0 mE, 95296.5 mN

Date: 28.01.88 to 29.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Fill (Foreman's description)	75.49		(0.20)					
	75.29		0.20					
Very stiff (hard) red brown very silty CLAY locally with occasional fine gravel sized lithorelics				1.00 - 1.45	U	1		110 blows
				1.60	D	2		
(KEUPER MARL 3/4a)				1.60 - 2.01	D	3	S 86	5,5/9,11,16,50 for 35mm Chiselling from 2.00m to 2.30m 0.75 hours
Below 3.80m with occasional medium gravel sized lithorelics and occasional bands and lenses of light greenish grey locally slightly fine sandy silt and siltstone			(4.25 pen)	2.30 - 2.75	D	4	S N=63	7,31/12,14,15,22
thinly laminated clay with frequent fine gravel sized lithorelics and occasional fine to medium sub-rounded fine to medium gravel				3.60 - 3.80	D	5		
				3.80	D	6	S	
				3.80 - 4.02	D	7	52	12,26/52 for 75mm Chiselling from 3.80m to 4.30m 1.25 hours
				4.30 - 4.45	D	8	S (70)	16,54 for 75mm
BOREHOLE ENDS AT 4.45 m.	71.04		4.45					

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
28.01	-	1.10		DRY	End of shift
29.01	-	1.70		DRY	
29.01	-	4.45		DRY	End of cable tool boring

Remarks

Logged by: AAC

Scale: 1:50

Fig. 50

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 11.04.88/11.45 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 728R

Sheet 1 of 4

Equipment & Methods

Open hole drilling, air flush, using 6.75in rock bit from ground level to 4.00m. Rotary core drilling, air flush, producing 92mm diameter core, from 4.00m to 20.13m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 75.49 m A.O.D.

Coordinates: 67031.0 mE, 95296.5 mN

Date: 01.02.88 to 03.02.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
Cable Tool Boring to 4.45m	75.49		(4.00)							
Very stiff (hard) red brown very silty CLAY with occasional fine gravel sized lithorelics (KEUPER MARL 3/4a)										
Red brown moderately locally highly weathered locally very silty MUDSTONE weak with occasional bands of light grey green fine sandy siltstone up to 80mm thick Very closely spaced often tight sub-vertical joints with black stain (KM 2/3)	71.49		4.00 (0.45)							at 4.00m S:100 11,12/20,30 50 for 75mm
Assessed zone of core loss	71.04		4.45 (1.05)	4.00 – 5.50		87	50	11	NI NI 110	
Very stiff red brown very silty CLAY with frequent fine to medium gravel sized lithorelics (weathered MUDSTONE) (KM 3/4a)	69.99		5.50 (0.50)							at 5.50m S:84 14,17/34,50 for 70mm
	69.49		6.00 (0.30)	5.50 – 6.70		58	33	13		
Red brown moderately weathered locally very clayey SILTSTONE moderately weak: extremely closely fractured with black staining (KEUPER MARL 2) From 7.00m to 7.40m with occasional bands of light grey green slightly fine sandy siltstone strong From 8.75m to 9.40m moderately to highly weathered weak to very weak locally altered to a hard clayey silt with up to coarse gravel sized lithorelics	69.19		6.30 (3.40)	6.70 – 9.70		93	20	13	NI NI 150	at 6.70m S:50 13,16/50 for 70mm
non intact assessed zone of core loss non intact non intact non intact										
Assessed zone of core loss	65.79		9.70	9.70 – 12.60		83	43	21		at 9.70m S:(78)

Remarks

Logged by: AAC

Scale: 1:50

Fig. 51

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 15.04.88/13.51 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 728R

Sheet 2 of 4

Equipment & Methods: As sheet 1

Location No. 7382

Location: A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4

Carried out for
Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: As sheet 1 | Coordinates: As sheet 1 | Date: As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
Assessed zone of core loss light greenish grey fine sandy siltstone strong	65.29		(0.50) 10.20						10 80 90	
Red brown slightly to moderately weathered SILTSTONE moderately strong becoming strong with very closely spaced sub-horizontal fractures From 11.05m to 11.60m thinly interbedded with hard red brown clayey silt Below 11.60m becoming light green slightly fine sandy with closely to moderately widely spaced sub-horizontal fractures (bedding?) (KEUPER MARL 2) — non intact due to 2 intersecting sub-vertical joints with black staining (a); as (a)				9.70 – 12.60		83	43	21	NI 80 130	
			(3.30)						NI NI 200	
									140 240 280	
occasional bands and lenses of red brown mudstone and very stiff hard red brown clay										
Very stiff (hard) red brown very clayey SILT (weathered SILTSTONE) (KM 3/4a)	61.99		13.50 (0.45)							
Light grey green and red brown mottled moderately becoming highly weathered fine sandy SILTSTONE moderately weak to moderately strong (KEUPER MARL 3/4a) Below 14.50m becoming completely weathered altered to a dense silt with fine to coarse gravel sized lithorelics — non intact; assessed zone of core loss	61.54		13.95 (2.35)	12.60 – 15.55		88	73	37	NI NI 60	
Red brown slightly to moderately weathered locally very clayey SILTSTONE weak becoming moderately weak with extremely closely becoming closely spaced often tight sub-horizontal fractures with black staining Below 18.20m becoming weak with occasional bands of very stiff (hard) red brown silty CLAY (KM 2) — non intact; assessed zone of core loss; light grey green slightly fine sandy siltstone moderately weak; non intact	59.19		16.30 (3.83)	15.55 – 18.00		80	20	16	NI 100 200	
									NI NI 50	
				18.00 – 20.00		90	75	48	NI 90 200	

Remarks

Logged by: AAC

Scale: 1:50

Fig. 51

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 15.04.88/13.51 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 728R

Sheet 3 of 4

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
SILTSTONE (as sheet 2)	55.36	x x x	(3.83 20pe0)							at 20.00m S:(65) 15,50 for 50mm
BOREHOLE ENDS AT 20.13 m.										

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
02.02	0800	4.00		2.90	
02.02	1800	9.70	6.70		DAMP, end of shift
03.02	0830	9.70	6.70	2.80	

Remarks

Logged by: AAC

Scale: 1:50

Fig. 51

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 15.04.88/13.51 (

Soil Mechanics

BOREHOLE No. 728R

Sheet 4 of 4

Location No. 7382

Location A42 CASTLE DONINGTON NORTH : GROUND INVESTIGATION CONTRACT 4

Carried out for

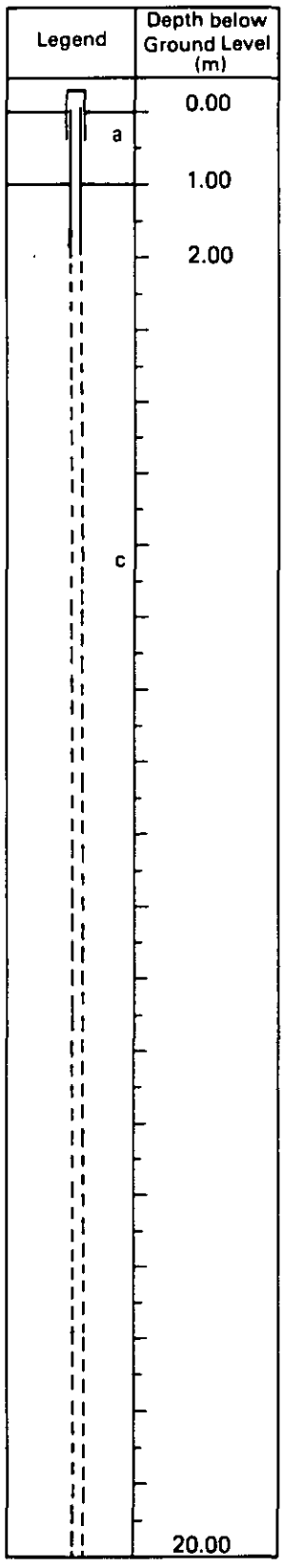
Client : Department of Transport (E. Midlands Regional Office)

Engineer : Scott Wilson Kirkpatrick and Partners

Type of installation Standpipe

Internal diameter of tubing	19	mm
Length of filter	19000	mm
Diameter of filter	121	mm

Depth (m) From	Depth (m) To	SUMMARY OF INSTALLATION
		Surface protection: Gas barrel with screw cap
0.00	1.00	Concrete
0.00	20.00	UPVC tubing
1.00	20.00	Gravel filter
2.00	20.00	Perforated section



KEY

a	Concrete
b	Sand
c	Gravel
d	Bentonite seal
e	Bentonite/cement grout
f	Backfill

ACCESS TUBINGS

- Standpipe/Piezometer (x 2 for Hydraulic or Pneumatic piezometers)
- Porous element
- Well with perforated section
- Inclinometer with joint
- Westbay with coupling and port

Remarks

1. Ground level and coordinates as sheet 1.

DETAILS OF INSTRUMENTS

Scale 1:100

Fig. 51

D4/8/85 © Soil Mechanics Limited, Bracknell, England

Soil Mechanics

BOREHOLE No. 729R

Sheet 1 of 2

Equipment & Methods

Hand dug inspection pit from ground level to 0.40m. Rotary core drilling, air flush, producing 92mm diameter core, from 0.40m to 8.10m

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 74.35 m A.O.D.

Coordinates: 67314.0 mE, 96087.5 mN

Date: 28.01.88 to 29.01.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
Inspection pit dug to 0.40m	74.35		(0.40)							
very stiff red brown CLAY	73.95		0.40							
Red brown slightly to moderately weathered locally very clayey SILTSTONE weak to very weak with frequent pockets and lenses of light grey green silt and siltstone Closely spaced sub-horizontal often tight fractures with occasional black speckled staining				0.40 – 1.50		95	82	64	NI 150 200	
assessed zone of core loss										at 1.50m S:N=30 11,10/8,7,7 8
(KEUPER MARL 2)				1.50 – 3.00		77	60	56	NI NI 60 50 200 340	
assessed zone of core loss										
From 0.55m to 0.65m, 2.00m to 2.20m and from 3.20m to 3.40m completely weathered altered to a dense clayey silt with occasional lithorelics			(6.25)	3.00 – 4.20		83	67	58	NI 130 190	
From 2.70m to 3.00m very thinly interbedded with light grey green slightly fine sandy SILTSTONE strong										
assessed zone of core loss										
stiff becoming very stiff very silty clay										
light green grey siltstone band very weak										
light grey green locally mottled red brown and grey green siltstone weak to very weak				4.20 – 6.65		95	93	80	20 120 250	
Assessed zone of core loss										
light grey green siltstone strong with lenses of red brown mudstone										
	67.70		6.65							
			(0.30)							
	67.40		6.95							
Very stiff (hard) in parts firm to stiff red brown CLAY locally very silty with occasional bands of highly weathered siltstone weak: occasional pockets of light grey green silt (weathered MUDSTONE)				6.65 – 8.00		78	59	54	NI 150 250	
(KEUPER MARL 3)			(1.15 pen)							
non intact										
	66.25		8.10							at 8.00m S:(68) 18,50 for 75mm
BOREHOLE ENDS AT 8.10 m.										

Remarks

Logged by: AAC

Scale: 1:50

Fig. 52

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

(c) Soil Mechanics

18.04.88/10.18 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 729R

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
28.01	1800	3.00		DRY	
29.01	0800	3.00		DRY	

Remarks

Logged by: AAC

Scale: 1:50

Fig. 52

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 15.04.88/09.52 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 730

Sheet 1 of 2

Equipment & Methods

Cable tool boring, 200mm diameter, from ground level to 7.75m

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 79.26 m A.O.D.

Coordinates: 67333.0 mE, 96097.0 mN

Date: 02.02.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
	79.26		(0.40)					
Light brown and dark brown mottled locally very clayey slightly fine sandy SILT with rare sub-rounded fine to medium gravel and occasional plant roots (TOPSOIL)	78.86		0.40	0.30	D	1		
				0.50 - 0.95	U	2		52 blows
band of light green grey fine sandy siltstone moderately weak				1.00	D	3		
Dense light grey green in parts mottled red brown fine sandy SILT locally with occasional fine to medium gravel sized lithorelics (KM 4a)			(1.80)	1.00 - 1.45	D	4	S N=25	
	77.06		2.20	2.00 - 2.45	U	5		100 blows
band of light greenish grey fine sandy siltstone strong				2.50	D	6		
				2.50 - 2.95	D	7	S N=57	
				3.50 - 3.95	U	8		140 blows
light greenish grey and reddish brown mottled fine sandy silt with rare fine gravel sized lithorelics				4.00	D	9		
Very stiff (hard) red brown very silty CLAY with frequent becoming occasional fine to medium gravel sized mudstone lithorelics and occasional pockets and lenses of light greenish grey silt				4.00 - 4.45	D	10	S N=75	
			(5.55 pen)	5.00 - 5.45	D	11	S N=77	
(KEUPER MARL 3/4a)				6.00 - 6.28	D	12	S 85	15,21/35,50 for 50 mm
				7.00 - 7.27	D	13	S 90	21,33/40,50 for 45mm Chiselling from 7.10m to 7.60m 1.00 hour
				7.60 - 7.71	D	14	S (72)	22,50 for 30mm
BOREHOLE ENDS AT 7.75 m.	71.51		7.75					

Remarks

Logged by: MAC

Scale: 1:50

Fig. 53

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth colum. 14.04.88/14.03 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 730

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field Records

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
02.02	-	2.10	1.50	DRY	
02.02	-	3.60	3.00		DAMP
02.02	-	5.10	4.50		DAMP
02.02	-	7.75	4.50		DAMP, end of borehole

Remarks

Logged by: AAC

Scale: 1:50

Fig. 53

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 14.04.88/14.03 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 730B

Sheet 1 of 2

Equipment & Methods: Open hole drilling, air flush, using 6.75in rock bit, from ground level to 7.00m. Rotary core drilling, air flush, producing 92mm diameter core, from 7.00m to 14.14m.	Location No. 7382 Location: A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4
Carried out for Client: Department of Transport (E. Midlands Reg. Office) Engineer: Scott Wilson Kirkpatrick & Partners	Ground Level: 79.26 m A.O.D. Coordinates: 67333.0 mE, 96097.0 mN Date: 04.02.88 to 05.02.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
	79.26									
Cable Tool Boring to 7.75m			(7.00)							
Assessed zone of core loss	72.26		7.00							
Red brown moderately weathered SILTSTONE weak to moderately weak with closely spaced sub-horizontal fractures with black speckled staining thinly interbedded with very stiff red brown silty CLAY with freqent fine to medium gravel sized lithorelics (weathered MUDSTONE) Occasional bands of light grey green fine sandy siltstone and silt (KEUPER MARL 2/3)			(1.10)	7.00 – 8.40		21	6	0		at 7.00m S:122 6,14/30,42, 50 for 75mm
non intact	71.16		8.10						NI 90	
assessed zone of core loss sub-vertical joint with speckled black stain			(2.90)	8.40 – 9.40		70	60	60	NI 190 240	
disturbed by SPT				9.40 – 11.40		85	63	15		at 9.40m S:R+114 15,17/28,32 28,26

Remarks

1. Water added to assist drilling below 7.00m.

Logged by: AAC

Scale: 1:50

Fig. 54

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 11.04.88/12.11 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 730R

Sheet 2 of 2

Equipment & Methods: As sheet 1

Location No. 7382

Location: A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4

Carried out for
Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: As sheet 1 | Coordinates: As sheet 1 | Date: As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
Thinly interbedded SILTSTONE and very stiff CLAY (as sheet 1)										
non intact due to 2 intersecting sub-vertical joints with speckled black stain (a) as (a)			(2.90)	9.40 – 11.40		85	63	15	NI 80 300	
Red brown slightly weathered SILTSTONE moderately weak with closely spaced sub-horizontal fractures (KM 2)	68.26		11.00							
assessed zone of core loss			(0.55)						30 70 90	at 11.40m S:(50) 50 for 60mm
	67.71		11.55							
Dense red brown clayey SILT with occasional fine becoming medium to coarse gravel sized lithorelics and occasional pockets and lenses of light grey green silt and siltstone thinly interbedded with red brown locally reddish green moderately weathered SILTSTONE very weak with extremely closely spaced fractures with black speckled staining (KEUPER MARL 2/3)										
non intact			(2.59 pen)	11.40 – 14.00		98	69	54	NI NI 250 320	
non intact										
light grey green slightly fine sandy siltstone moderately weak									NI NI 170	
	65.12		14.14							at 14.00m S:(82) 32,50 for 60mm

BOREHOLE ENDS AT 14.14 m.

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
04.02	1800	7.00	7.00		cased off
05.02	0800	7.00	7.00		cased off
05.02	1730	14.00	9.40	11.70	

Remarks

Logged by: AAC

Scale: 1:50

Fig. 54

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 11.04.88/12.11 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 731R

Sheet 1 of 2

Equipment & Methods

Hand dug inspection pit from ground level to 0.30m. Rotary core drilling, air flush, producing 92mm diameter core, from 0.30m to 8.30m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 74.00 m A.O.D.

Coordinates: 67322.0 mE, 96116.0 mN

Date: 26.01.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
Hand dug inspection pit to 0.30m	74.00		(0.30)							
assessed zone of core loss	73.70		0.30							
Stiff red brown friable very silty CLAY with fine to medium occasionally coarse gravel sized lithorelics (weathered MUDSTONE). Occasional pockets and bands of light grey green silt and siltstone (KEUPER MARL 3)			(1.00)	0.30 – 1.30		85	10	10		
	72.70		1.30							
Assessed zone of core loss			(0.50)							at 1.30m S:52 9,30/52 for 75mm
highly to completely weathered; medium to coarse lithorelics in a silt matrix	72.20		1.80							
Red brown slightly to moderately weathered SILTSTONE moderately weak to moderately strong Closely locally very closely spaced sub-horizontal fractures with speckled black stain (KM 2)			(1.10)	1.30 – 2.90		69	47	14	NI 65 110	
	71.10		2.90							
occasional bands of moderately weathered SILTSTONE weak to very weak	70.75		(0.35) 3.25						NI 80	at 2.90m S:77 9,11/27,50 for 75mm
Assessed zone of core loss				2.90 – 4.45		77	45	0		
light grey green fine sandy SILT with frequent medium to coarse gravel sized lithorelics										
Very stiff (hard) red brown very silty CLAY with occasional fine gravel sized lithorelics and locally with occasional pockets of light grey green silt (weathered MUDSTONE) (KEUPER MARL 2/3)			(3.35)							aft 4.45m S:75 10,10/25,50 for 75mm
				4.45 – 6.30		89	68	20	NI 110	
with bands of light grey green and red brown siltstone moderately weak									NI 90	
assessed zone of core loss										at 6.30m S:83 11,17/27,56 for 75mm
	67.40		6.60							
Dense becoming hard red brown clayey SILT with occasional fine to medium gravel sized lithorelics (completely weathered SILTSTONE) (KM 4a)			(1.20)	6.30 – 8.00		82	71	65		
70 fissure with speckled black stain										
	66.20		7.80							
Light grey brown moderately weathered very silty fine grained SANDSTONE weak to very weak (KEUPER SANDSTONE 2)	65.70		(0.50 pen) 8.30							at 8.00m S:94 10,16/37,57 for 75mm
BOREHOLE ENDS AT 8.30 m.										

Remarks

Logged by: AAC

Scale: 1:50

Fig. 55

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 11.04.88/12.28 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 731R

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988 26.01	-	6.30	4.45	6.30	water strike

Remarks

Logged by: AAC

Scale: 1:50

Fig. 55

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 11.04.88/12.28 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 732

Sheet 1 of 2

Equipment & Methods

Cable tool boring, 150mm diameter, from ground level to 7.60m

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 79.60 m A.O.D.

Coordinates: 67341.0 mE, 96126.0 mN

Date: 01.02.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
	79.60							
Light grey brown becoming brown slightly fine sandy locally very clayey SILT with occasional medium gravel sized lithorelics (KEUPER MARL 4a)			(0.90)	0.30	D	1		
				0.50 - 0.95	U	2		54 blows
dense light greenish grey slightly fine sandy SILT with occasional medium gravel sized lithorelics	78.70		0.90	1.00	D	3		
				1.00 - 1.45	D	4	S N=24	2,3/3,5,7,9
Stiff to very stiff red brown very silty CLAY with occasional fine to medium gravel sized lithorelics Locally with pockets and lenses of light greenish grey silt and siltstone (KEUPER MARL 3/4a)				2.00 - 2.45	U	5		72 blows
				2.50	D	6		
dense becoming very dense (hard) light green grey locally mottled red brown slightly fine sandy SILT with occasional lithorelics				2.50 - 2.95	D	7	S N=58	7,8/12,14,17,15
				3.10	W	8		
Below 3.70m becoming very stiff (hard) with occasional fine gravel sized lithorelics Locally with very closely spaced fissures with speckled black staining				3.50 - 3.95	U	9		131 blows
				4.00	D	10		
			(6.70 pen)	4.00 - 4.45	D	11	S N=92	9,14/16,19,27,30
				5.00 - 5.45	D	12	S N=129	10,22/28,30,31,40
				6.00 - 6.45	D	13	S N=109	9,18/21,24,29,35
				7.00 - 7.21	D	14	S 50	15,27/50 for 50mm Chiselling from 7.00m to 7.40m 1.00 hour
				7.40 - 7.58	D	15	S 50	21,36/50 for 33mm
BOREHOLE ENDS AT 7.60 m.	72.00		7.60					

Remarks

Logged by: AAC

Scale: 1:50

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 14.04.88/14.05 (Ver 3.1.0)

Fig. 56

Soil Mechanics

BOREHOLE No. 732

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field Records

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
01.02	0800	0.00	0.00		
01.02	-	2.10	1.50	DRY	
01.02	-	3.10	1.50	3.00	Water strike
01.02	-			2.00	after 20 mins
01.02	-	3.60	3.00		DAMP
01.02	-	4.10	3.00	3.50	
01.02	-	5.10	4.50	DRY	water sealed at 4.50m
01.02	-	7.60	4.50	DRY	End of cable tool boring

Remarks

Logged by: AAC

Scale: 1:50

Fig. 56

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 14.04.88/14.05 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 732B

Sheet 1 of 2

Equipment & Methods

Open hole drilling, air flush, using 6.75in rock bit, from ground level to 7.00m. Rotary core drilling, air flush, producing 92mm diameter core from 7.00m to 14.14m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 79.60 m A.O.D.

Coordinates: 67341.0 mE, 96126.0 mN

Date: 08.02.88 to 09.02.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
	79.60									
Cable Tool Boring to 7.60m			(7.00)							
Assessed zone of core loss										
Red brown moderately weathered SILTSTONE moderately weak with occasional bands of very dense red brown silt with up to coarse gravel sized lithorelics Closely locally very closely spaced fractures with black speckled staining (KM 2/3)	72.60		7.00							
			(0.35)							
	72.25		7.35							at 7.00m S:N= 154 5,10/18,36, 30,40
non intact		× × ×		7.00 – 8.50		63	37	27	NI 90 260	
		× × ×	(1.80)							
assessed zone of core loss										
Light grey green moderately weathered slightly fine sandy SILTSTONE very weak (KM 2)										at 8.50m S:81 10,22/31,50 for 75mm at 9.50m S:N=94 10,18/18,18 28,30
altered to a friable silt with frequent lithorelics	70.45	× × ×	9.15	8.50 – 9.50		70	50	29	NI 80 100	
		× × ×	(0.35)							
	70.10	× × ×	9.50							
Assessed zone of core loss			(0.30)							
	69.80		9.80	9.50 – 11.50		85	45	34		
SILTSTONE (as sheet 2)		× × ×								

Remarks

Logged by: AAC

Scale: 1:50

Fig. 57

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

(c) Soil Mechanics

Soil Mechanics

BOREHOLE No. 732R

Sheet 2 of 2

Equipment & Methods: As sheet 1

Location No. 7382

Location: A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4

Carried out for
Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: As sheet 1 | Coordinates: As sheet 1 | Date: As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
non intact										
Red brown moderately locally highly weathered SILTSTONE weak to very weak locally altered to a dense silt with medium to coarse gravel sized lithorelics (KEUPER MARL 2/3)									NI NI 180	
non intact			(1.45)	9.50 - 11.50		85	45	34		
greenish grey and red brown mottled slightly weathered weak to moderately weak									80 120 250	
	68.35		11.25							
assessed zone of core loss										
Very dense red brown clayey SILT (weathered SILTSTONE) (KEUPER MARL 4a/b) Below 12.40m locally with fine to coarse gravel sized lithorelics			(1.85)							at 11.50m S:N=105 14,13/22,26 27,30
band of light grey green silt with frequent lithorelics				11.50 - 14.00		88	80	28		
	66.50		13.10							
Red brown slightly to moderately weathered SILTSTONE weak to very weak with occasional bands of very stiff (hard) clay Closely spaced sub-horizontal fractures (KEUPER MARL 3/4a)			(1.04 pen)						NI 170 290	
sub-vertical joint tight with black stain										
	65.46		14.14							at 14.00m S:(83) 33,50 for 60mm

BOREHOLE ENDS AT 14.14 m.

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
08.02	1800	7.00	7.00		cased off
09.02	0800	7.00	7.00		cased off

Remarks

Logged by: AAC

Scale: 1:50

Fig. 57

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.05.88/09.44 (Ver 3.1.10)

Soil Mechanics

BOREHOLE No. 733R

Sheet 1 of 2

Equipment & Methods

Inspection pit dug to 0.70m, Rotary core, air flush producing 92mm diameter core from 0.70m to 8.35m

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 73.50 m A.O.D.

Coordinates: 67331.0 mE, 96144.5 mN

Date: 28.01.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
Inspection pit dug to 0.70m	73.50		(0.70)							
Assessed zone of core loss	72.80		0.70 (0.45)							
Red brown slightly locally slightly to moderately weathered MUDSTONE weak with occasional lenses of siltstone interbedded with light greenish grey slightly fine sandy SILTSTONE moderately weak to moderately strong beds up to 120mm thick Closely spaced sub-horizontal fractures (KEUPER MARL 2)	72.35		1.15	0.70 – 1.50		44	31	0	NI 60 90	
Assessed zone of core loss				1.50 – 3.00		33	20	15	NI 60 120	at 1.50m S:50 13,28/50 for 75mm
very stiff (hard) friable clay with mudstone lithorelics			(3.05)							
Red brown slightly weathered SILTSTONE strong with occasional light grey green siltstone pockets or lenses (KM 2)	69.30		4.20 (0.30)	3.00 – 4.50		97	90	60	NI 100 200	at 3.00m S:89 3,5/12,27, 50 for 75mm
Assessed zone of core loss	69.00		4.50 (0.70)							
Red brown slightly to moderately weathered locally silty MUDSTONE weak to moderately weak with occasional pockets of light green grey silt (KM 2)	68.30		5.20 (0.60)	4.50 – 7.00		72	34	25	NI 120 190	
Firm to stiff becoming very stiff red brown very silty CLAY with frequent lithorelics (weathered MUDSTONE) (KM 3)	67.70		5.80 (0.45)							
sub-vertical joint; Light greenish grey slightly fine sandy siltstone very weak (non intact); sub-vertical joint	67.25		6.25 (2.10 pen)	7.00 – 8.00		90	75	63	NI 90 120	
very dense silt with frequent lithorelics; sub-vertical joint									NI 130 190	
Red brown moderately weathered SILTSTONE moderately strong with occasional pockets and lenses of mudstone:closely to very closely spaced sub-horizontal fractures (KEUPER MARL 2)	65.15		8.35	8.00 – 8.20		100	0	0		at 8.20m S:(78) 28,50 for 75mm
BOREHOLE ENDS AT 8.35 m.										

Remarks

1. Water level observations during boring: dry to 4.50m, damp 4.50m to base.

Logged by: AAC

Scale: 1:50

Fig. 58

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 18.04.88/10.00 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 733R

Sheet 2 of 2

Location No. 7382

Location A42 CASTLE DONINGTON NORTH : GROUND INVESTIGATION CONTRACT 4

Carried out for

Client : Department of Transport (E. Midlands Regional Office)

Engineer : Scott Wilson Kirkpatrick and Partners

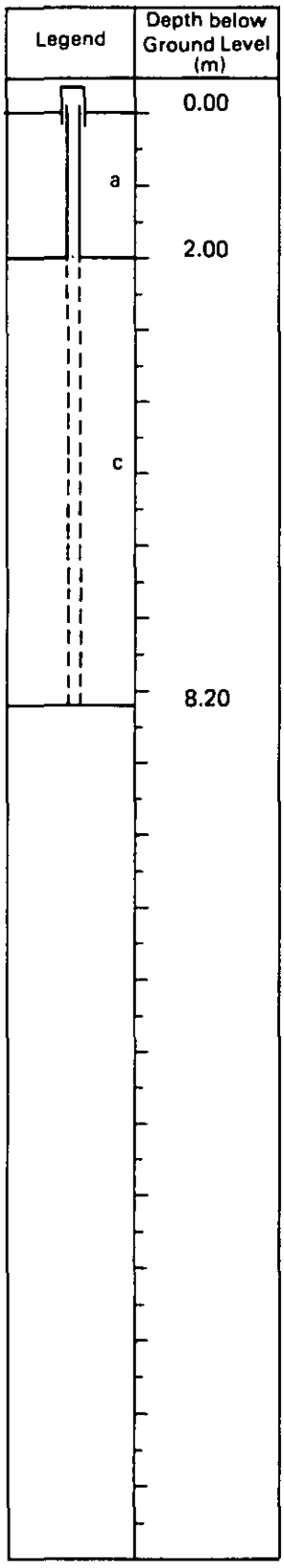
Type of installation Standpipe

Internal diameter of tubing 19 mm

Length of filter 6200 mm

Diameter of filter 121 mm

Depth (m) From	Depth (m) To	SUMMARY OF INSTALLATION
		Surface protection: Gas barrel with screw cap
0.00	2.00	Concrete
0.00	8.20	UPVC tubing
2.00	8.20	Perforated section
2.00	8.20	Gravel filter



KEY

a	Concrete
b	Sand
c	Gravel
d	Bentonite seal
e	Bentonite/cement grout
f	Backfill

ACCESS TUBINGS

Standpipe/Piezometer (x 2 for Hydraulic or Pneumatic piezometers)

Porous element

Well with perforated section

Inclinometer with joint

Westbay with coupling and port

Remarks

1. Ground level and coordinates as sheet 1.

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DETAILS OF INSTRUMENTS

Scale 1:100

Fig. 58

Soil Mechanics

BOREHOLE No. 734

Sheet 1 of 2

Equipment & Methods

Cable tool boring, 150mm diameter, from ground level to 7.10m

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 79.81 m A.O.D.

Coordinates: 67349.0 mE, 96154.0 mN

Date: 29.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
	79.81			0.20	D	1		
Dense mottled red brown and light greenish brown locally red brown slightly fine sandy locally very clayey SILT with occasional fine to medium gravel sized siltstone lithorelics (KEUPER MARL 4a)			(1.80)	0.50 – 0.95	U	2		60 blows
				1.00	D	3		
				1.00 – 1.45	D	4	S N=19	2,2/3,4,6,6
	78.01		1.80	1.80	D	5		
dense mottled red brown and grey green locally very clayey SILT with rare lithorelics				1.90 – 2.35	U	6		55 blows
				2.40	D	7		
				2.40 – 2.95	D	8	S N=15	3,5/4,4,3,4
Stiff becoming very stiff (hard) red brown very silty CLAY with occasional pockets and lenses of light greenish grey silt (KEUPER MARL 3/4a)				3.40 – 3.85	U	9		75 blows
				3.90	D	10		
				3.90 – 4.35	D	11	S N=45	5,7/7,10,12,16
Below 2.40m with fine to medium gravel sized silty mudstone lithorelics Locally with very closely spaced fissures occasionally with speckled black staining			(5.30 pen)					
red brown locally green grey probably moderately weathered SILTSTONE band weak to very weak				4.90 – 5.25	U	12		150 blows
				5.30	D	13		
				5.30 – 5.75	D	14	S N=85	9,12/17,19,23,26
				6.30 – 6.58	D	15	S 86	12,24/36,50 for 50mm Chiselling from 6.40m to 6.90m 1.00 hour
				6.90 – 7.02	D	16	S (71)	21,50 for 40mm
BOREHOLE ENDS AT 7.10 m.	72.71		7.10					

Remarks

Logged by: AAC

Scale: 1:50

Fig. 59

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 12.04.88/15.01 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 734

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field Records

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
29.01	0800	0.00	0.00		
29.01	–	2.00	1.50	DRY	
29.01	–	3.50	3.00	DRY	
29.01	–	5.00	4.50	DRY	
29.01	–	6.40	6.00	DRY	
29.01	–	7.10	6.00	DRY	End of cable tool boring

Remarks

Logged by: AAC

Scale: 1:50

Fig. 59

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 12.04.88/15.01 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 734R

Sheet 1 of 2

Equipment & Methods

Open hole drilling, air flush using 6.75in rock bit from ground level to 6.00m. Rotary core drilling, air flush, producing 92mm diameter core from 6.00m to 14.06m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 79.81 m A.O.D.

Coordinates: 67349.0 mE, 96154.0 mN

Date: 10.02.88 to 11.02.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
	79.81									
Cable Tool Boring to 7.10m			(6.00)							
Assessed zone of core loss										
Very stiff (hard) red brown very silty CLAY with occasional fine gravel sized lithorelics (KEUPER MARL 3/4a)										
Red brown and light greenish grey slightly to moderately weathered SILTSTONE moderately weak (KEUPER MARL 2)	73.81		6.00							
	73.66		(0.15)							
			6.15							at 6.00m S:78
	73.41		(0.25)							10,19/28,50
			6.40						45	for 75mm
Assessed zone of core loss			(0.35)						75	
	73.06		6.75	6.00 - 7.50		60	23	0	90	
Red brown slightly locally moderately weathered very silty MUDSTONE thinly interbedded with very stiff red brown very silty CLAY:moderately widely spaced sub-horizontal fractures (KM 2/3)			(0.60)							
	72.46		7.35							
			(1.90)						NI	
				7.50 - 9.50		100	88	81	270	
Light grey green locally red brown slightly to moderately weathered fine gained SANDSTONE weak to very weak (KM 2)									670	
	70.56		9.25						NI	
Assessed zone of core loss			(0.25)						45	
	70.31		9.50							at 9.50m S:(50)
SANDSTONE (as sheet 2.)			(0.40)	9.50 - 12.30		86	79	5		50 for 50mm no recovery
	69.91		9.90							

Remarks

Logged by: AAC

Scale: 1:50

Fig. 60

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

(c) Soil Mechanics

12.04.88/15.47 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 734R

Sheet 2 of 2

Equipment & Methods: As sheet 1

Location No. 7382

Location: A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4

Carried out for
Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: As sheet 1 | Coordinates: As sheet 1 | Date: As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
Light greenish grey and red brown slightly locally moderately weathered SANDSTONE strong (KM 2) -	69.06		(0.85) 10.75						NI 90 150	
Very dense red brown very clayey SILT with occasional bands of light red brown very weak SILTSTONE (KM 3/4a) Below 11.50m with fine to medium occasionally coarse gravel sized lithorelics			(1.30)	9.50 – 12.30		86	79	5		
non intact; assessed zone of core loss; non intact due to 2 intersecting sub-vertical joints stained black	67.76		12.05							at 12.30m S:(72) 22,50 for 70mm
Red brown slightly to moderately weathered locally very clayey SILTSTONE weak with occasional bands of dense silty clay with fine to medium gravel sized lithorelics and closely spaced sub-horizontal fractures Below 13.50m becoming moderately weak to weak (KEUPER MARL 2/3)			(2.01 pen)	12.30 – 14.00		88	85	48	NI 110 270	
sub-vertical joint stained black	65.75		14.06							at 14.00m S:(50) 50 for 60mm

BOREHOLE ENDS AT 14.06 m.

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
10.02	1730	12.30	6.70	10.80	
11.02	0830	12.30	6.70	9.80	

Remarks

Logged by: AAC

Scale: 1:50

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 12.04.88/15.47 (Ver 3.1.0)

Fig. 60

Soil Mechanics

BOREHOLE No. 735R

Sheet 1 of 2

Equipment & Methods

Hand dug inspection pit from ground level to 0.60m. Rotary core drilling, air flush, producing 92mm diameter core from 0.60m to 8.15m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 72.95 m A.O.D.

Coordinates: 67340.0 mE, 96173.0 mN

Date: 25.01.88 to 26.01.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
TOPSOIL	72.95		(0.20)							
	72.75		0.20							
Red brown moderately weathered SILTSTONE moderately weak to moderately strong with frequent black staining (KM 2)			(0.40)							
	72.35		0.60							
Assessed zone of core loss			(0.60)	0.60 – 1.50		33	9	0	NI 80	
	71.75		1.20							
assessed zone of core loss; disturbed by SPT; light greenish grey slightly fine sandy siltstone strong; Very stiff (hard) red brown very silty CLAY with medium gravel sized mudstone lithorelics (weathered MUDSTONE). Frequent pockets and lenses of light greenish grey silt and siltstone (KEUPER MARL 3) Below 2.50m with medium to coarse gravel sized lithorelics. Locally with sub-vertical fissures with speckled black staining				1.50 – 2.80		77	46	11	NI 50 140	at 1.50m S:N=58 7,8/14,12, 13,19
reddish brown moderately weathered siltstone band			(3.40)							at 2.80m S:87 4,7/37,50 for 75mm
				2.80 – 4.60		83	65	47	NI 200 370	
	68.35		4.60							
Stiff to very stiff red brown very silty CLAY (weathered MUDSTONE) (KM 4b) disturbed by SPT			(0.45)							at 4.60m S:N=59 8,12/12,13, 15,19
	67.90		5.05							
Greenish brown slightly to moderately weathered sandy SILTSTONE weak becoming moderately weak with very closely spaced fractures with black speckled staining (KM 2) At 5.75m becoming red brown with occasional reduction spots			(1.40)	4.60 – 6.45		100	100	75	100 170 460	
assessed zone of core loss	66.50		6.45							
			(0.50)							
	66.00		6.95							
Very stiff red brown very clayey SILT locally with up to coarse gravel sized lithorelics (weathered SILTSTONE) (KM 3/4a)			(0.55)	6.45 – 8.00		87	87	23	50 120 230	
	65.45		7.50							
			(0.00p)							
Red brown slightly to moderately weathered sandy SILTSTONE moderately weak (KM 2)	64.80		8.15							at 8.00m S:(71) 21,50 for 75mm
Very stiff (hard) red brown clayey SILT locally with closely spaced sub-horizontal fissures (weathered SILTSTONE) (KEUPER MARL 3)										
BOREHOLE ENDS AT 8.15 m.										

Remarks

Logged by: AAC

Scale: 1:50

Fig. 61

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 14.04.88/14.02 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 735R

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records		Mechanical core log				Field Records and Test Results
				Depth	W	TCR	SCR	RQD	If	

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988 26.01	0800	1.50		DRY	

Remarks

Logged by: AAC

Scale: 1:50

Fig. 61

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 14.04.88/14.02 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 736

Sheet 1 of 2

Equipment & Methods

Cable tool boring, 150mm diameter, from ground level to 7.50m

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 79.88 m A.O.D.

Coordinates: 67362.0 mE, 96181.0 mN

Date: 22.01.88 to 23.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
TOPSOIL	79.88		(0.30)					
	79.58		0.30	0.30	D	1		
Angular medium to coarse gravel sized fragments of greenish grey slightly weathered silty fine grained SANDSTONE moderately strong to strong with red brown clay smearing (Possibly MADE GROUND)			(0.90)	0.50 – 0.95	D	2	S N=24	3,4/4,6,7,7
	78.68		1.20	1.20	D	3		
Stiff becoming very stiff (hard) red brown silty to very silty CLAY with occasional pockets and lenses of light greenish grey silt and siltstone Locally with very closely spaced fissures with speckled black staining				1.30 – 1.75	U	4		61 blows
				1.80	D	5		
				1.80 – 2.25	D	6	S N=12	2,3/2,2,4,4
(KEUPER MARL 3/4a)				2.80 – 3.25	U	7		94 blows
			(3.90)	3.30	D	8		
Below 1.80m with fine to coarse gravel sized lithorelics From 2.80m to 3.30m: Light grey green fine sandy SILT with medium to coarse gravel sized lithorelics and occasional bands and lenses of very stiff red brown silty clay At 4.60m: Grey green SILTSTONE band moderately weak to moderately strong				3.30 – 3.75	D	9	S N=56	5,6/9,10,14,23
				4.30 – 4.60	U	10		150 blows
				4.65	D	11		
				4.65 – 5.10	D	12	S N=58	5,5/7,11,19,21
	74.78		5.10	5.10	W	13		
Very stiff (hard) red brown silty CLAY with frequent medium to coarse gravel sized silty mudstone lithorelics and occasional pockets and lenses of light greenish grey silt and siltstone (KEUPER MARL 3)				5.60 – 6.05	D	14	S N=77	5,7/14,15,21,27
			(2.40 pen)					
By 6.60m becoming moderately weathered MUDSTONE very weak				6.60 – 6.80	D	15	S 50	14,23/50 for 50mm Chiselling from 6.70m to 7.20m 1.50 hours
				7.20 – 7.31	D	16	S (67)	17,50 for 34mm
BOREHOLE ENDS AT 7.50 m.	72.38		7.50					

Remarks

Logged by: AAC

Scale: 1:50

Fig. 62

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1.

All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

(c) Soil Mechanics

12.04.88/15.13 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 736

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field Records

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
22.01	1330	0.00	0.00		
22.01	-	1.40	1.00	DRY	
22.01	-	3.90	2.50	DRY	
22.01	-	4.40	3.00	DRY	
22.01	1700	5.10	3.00	DRY	End of shift
23.01	0800	5.10	3.00	4.00	Water sample taken
23.01	-	5.70	3.00		DAMP
23.01	-	7.50	3.00		DAMP End of cable tool boring

Remarks

Logged by: AAC

Scale: 1:50

Fig. 62

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 12.04.88/15.13 (Ver 3.1.0)

Soil Mechanics

DRAFT

BOREHOLE No. 736R

Sheet 1 of 3

Equipment & Methods

Open hole drilling, air flush, using 6.75in rock bit, from ground level to 7.00m. Rotary core drilling, air flush, producing 92mm diameter core from 7.00m to 14.13m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 79.88 m A.O.D.

Coordinates: 67362.0 mE, 96181.0 mN

Date: 11.02.88 to 12.02.88

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
	79.88									
Cable Tool Boring to 7.50m			(7.00)							
Assessed zone of core loss										
Very stiff (hard) red brown very silty CLAY with occasional fine gravel sized lithorelics (weathered MUDSTONE) (KEUPER MARL 3/4a)										
	72.88		7.00							
Red brown slightly to moderately weathered SILTSTONE weak to moderately weak (KM 2)			(1.00)							at 7.00m S:N=90 7,14/18,16, 24,30
Assessed zone of core loss				7.00 - 8.50		33	30	13		
	71.88		8.00							
Red brown moderately to highly weathered silty MUDSTONE locally altered to a very stiff silty clay with coarse gravel sized lithorelics (KEUPER MARL 2/3)	71.68		(0.20) 8.20						NI 60 190	
	71.38		(0.30) 8.50							
Light greenish brown locally red brown slightly to moderately weathered very silty fine SANDSTONE (KEUPER SANDSTONE 2)	70.93		(0.45) 8.95							
			(0.50)	8.50 - 9.80		65	28	8	NI NI 80	
From 9.80m to 10.10m stiff red brown silty CLAY with frequent fine to medium gravel sized lithorelics	70.43		9.45							
assessed core loss			(0.89)						NI 60 140	
				9.80 - 11.50		82	68	8		at 9.80m

Remarks

Logged by: MAC

Scale: 1:50

Fig. 63

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth colum. 19.04.88/09.11 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 736R

Sheet 2 of 3

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results
SANDSTONE (as sheet 1)			(0.89)						NI to 140	at 9.80m S:81 6,21,31,50 for 75mm
	69.54		10.34							
Very dense (hard) red brown clayey SILT with occasional fine gravel sized lithorelics (weathered SILTSTONE) (KM 3) From 10.60m to 11.60m with coarse gravel sized lithorelics. Below 11.60m becoming slightly fine sandy			(1.56)	9.80 – 11.50		82	68	8		
assessed zone of core loss										
	67.98		11.90							at 11.50m S:50 15,18/50 for 75mm
			(0.70)						60 170 270	
Light reddish green slightly to moderately weathered very silty fine SANDSTONE weak Closely spaced sub-horizontal fractures (KEUPER SANDSTONE 2/3)	67.28		12.60	11.50 – 14.00		96	86	52		
irregular 70 joint									NI 170 340	
sub-vertical joint										
			(1.53 pen)							
stiff red brown very silty CLAY										
Red brown slightly to moderately weathered SILTSTONE weak to moderately weak with moderately widely becoming widely spaced sub-horizontal fractures (KEUPER MARL 2)	65.75		14.13							at 14.00m S:(88) 38,50 for 50mm

BOREHOLE ENDS AT 14.13 m.

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988 11.02	1730	8.50	7.00		DAMP, end of shift
12.02	0830	8.50	7.00		DAMP

Remarks

Logged by AAC

Scale 1:50

Fig. 63

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 15.04.88/13.52 (Ver 3.1.0)

Soil Mechanics

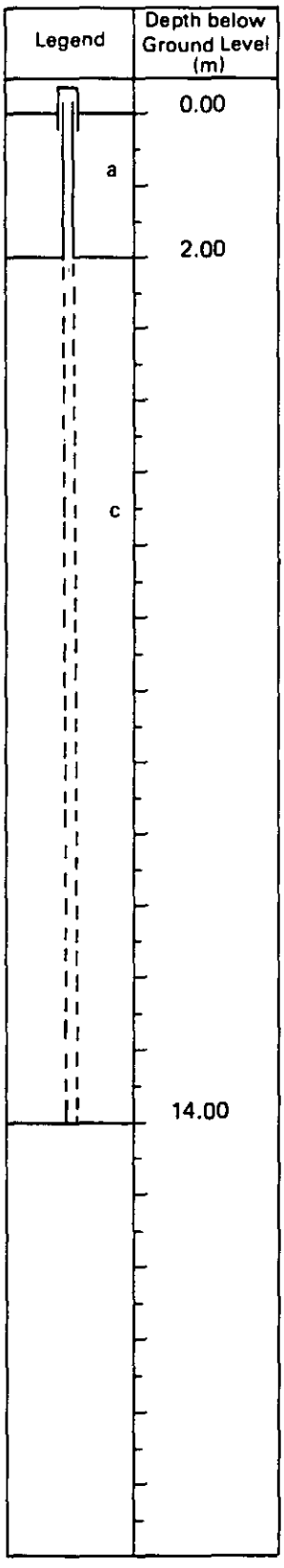
BOREHOLE No. 736R
Sheet 3 of 3

Location No. 7382
Location A42 CASTLE DONINGTON NORTH : GROUND INVESTIGATION CONTRACT 4

Carried out for
Client : Department of Transport (E. Midlands Regional Office)
Engineer : Scott Wilson Kirkpatrick and Partners

Type of installation Standpipe
Internal diameter of tubing 19 mm
Length of filter 12000 mm
Diameter of filter 120 mm

Depth (m) From	Depth (m) To	SUMMARY OF INSTALLATION
		Surface protection: Gas barrel with screw cap
0.00	2.00	Concrete
0.00	14.00	UPVC tubing
2.00	14.00	Slotted section
2.00	14.00	Gravel filter



KEY

a	Concrete
b	Sand
c	Gravel
d	Bentonite seal
e	Bentonite/cement grout
f	Backfill

ACCESS TUBINGS

- Standpipe/Piezometer (x 2 for Hydraulic or Pneumatic piezometers)
- Porous element
- Well with perforated section
- Inclinometer with joint
- Westbay with coupling and port

Remarks

1. Ground level and coordinates as sheet 1.

DETAILS OF INSTRUMENTS

Scale 1:100

Fig. 63

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Soil Mechanics

BOREHOLE No. 737R

Sheet 1 of 1

Equipment & Methods

Hand dug inspection pit from ground level to 0.60m. Rotary core drilling, air flush, producing 92mm diameter core, from 0.60m to 8.375m

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 72.50 m A.O.D.

Coordinates: 67349.0 mE, 96201.5 mN

Date: 27.01.88

Description	Retrieved Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
Inspection pit dug to 0.60m	72.50		(0.60)							
Dense light greenish grey locally friable SILT with occasional lithorelics (KM 4a)	71.90		0.60 (0.43)							
Very stiff (hard) red brown locally very silty CLAY with occasional bands and lenses of light greenish grey and red brown siltstone very weak (KEUPER MARL 3/4a) — assessed zone of core loss; disturbed by SPT	71.47		1.03 (2.57)	0.60 – 2.10		100	93	72	NI 150 320	at 2.10m S:50 9,18/50 for 75mm
				2.10 – 3.60		87	77	59		
Assessed zone of core loss	68.90		3.60 (0.45)							at 3.60m S:50 8,21/50 for 75mm
Very stiff locally stiff red brown very silty CLAY locally with occasional lithorelics (weathered MUDSTONE) (KM 3) From 4.84m to 4.93m band of light greenish grey silt — red brown siltstone; disturbed due to SPT	68.45		4.05 (0.90)	3.60 – 4.70		59	59	0		no recovery
Red brown slightly to moderately weathered SILTSTONE very weak to weak with occasional mudstone bands up to 80mm thick: closely locally very closely spaced often tight fractures occasionally with speckled black staining (KM 2) — stepped sub-vertical joint; silty clay with frequent lithorelics; assessed zone of core loss; disturbed by SPT	67.55		4.95 (2.40)	4.70 – 6.90		100	89	64	NI 130 370	at 4.70m S:108 10,19/23,35 50 for 75mm
Stiff red brown very silty CLAY with occasional lithorelics (weathered MUDSTONE) (KM 4a)	65.15		7.35							
	65.00		(0.15) 7.50	6.90 – 8.00		36				
Assessed zone of core loss			(0.88 pen)							at 8.00m S:115 11,8/24,41, 50 for 75mm
BOREHOLE ENDS AT 8.38 m.	64.12		8.38							

Remarks

Logged by: AAC

Scale: 1:50

Fig. 64

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

(c) Soil Mechanics

12.04.88/16.13 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 738

Sheet 1 of 2

Equipment & Methods

Cable tool boring, 200 mm diameter, from ground level to 7.10m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 83.42 m A.O.D.

Coordinates: 63652.0 mE, 92515.0 mN

Date: 06.01.88 to 08.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
	83.42			0.25	D	1		
Firm light grey and orange brown sandy CLAY with very sandy pockets and a little angular to rounded chert gravel				0.50 – 0.95	U	2		22 blows
				1.00	D	3		
(PROBABLE WEATHERED GLACIAL TILL)			(2.20)	1.00 – 1.45	D	4	S N=24	
below 1.00m mixed with stiff red brown and light grey clay with sandstone fragments and occasional black organic pockets								
	81.22		2.20	2.00 – 2.45	U	5		51 blows
				2.50	D	6		
				2.50 – 2.95	D	7	S N=25	
Stiff becoming very stiff red brown indistinctly fissured CLAY with frequent up to fine gravel sized lithorelics and occasional light green reduction spots and black staining on fissures				3.40	WS	11		
				3.50 – 3.95	U	8		47 blows
				4.00	D	9		
(KEUPER MARL 3)			(3.80)	4.00 – 4.45	D	10	S N=25	
at 5.40m band of light red brown to dark red brown very clayey silt locally cemented, with lenses of light green grey silt and siltstone				5.00 – 5.45	U	12		61 blows
				5.50	D	13		
				5.50 – 5.84	D	14	S 88	10,12/15,23,50 for 44mm
	77.42		6.00					
Very stiff (hard) red brown very silty CLAY (KEUPER MARL 3)			(1.10 pen)	6.50 – 6.60	D	15	S (66)	16,50 for 25mm
				6.70	WS	16		Chiselling from 6.30 to 7.00m 1.75 hours
				7.00 – 7.10	D	17	S (71)	21,50 for 26mm
BOREHOLE ENDS AT 7.10 m.	76.32		7.10					

Remarks

Logged by: GAC

Scale: 1:50

Fig. 65

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.03.88/11.47 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 738

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field Records

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
06.01	-	0.00	0.00		
06.01	1700	1.50	1.50	DRY	End of shift
07.01	0800	1.50	1.50	DRY	
07.01	-	3.50	3.00	3.50	Water strike
07.01	-			1.50	after 20 mins.
07.01	1700	6.50	6.00	3.40	End of shift
08.01	0800	6.50	6.00	0.00	
08.01	0930	7.10	6.00	2.00	End of cable tool boring

Remarks

Logged by: GAC

Scale: 1:50

Fig. 65

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.03.88/11.47 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 740

Sheet 1 of 2

Equipment & Methods

Cable tool boring, 200 mm diameter, from ground level to 4.50m, 150 mm diameter to 7.00m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 81.24 m A.O.D.

Coordinates: 63792.0 mE, 92491.0 mN

Date: 05.01.88 to 06.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
	81.24			0.25	D	1		
Soft becoming firm grey with brown and orange brown staining sandy CLAY with a little generally subrounded chert gravel (PROBABLE WEATHERED GLACIAL TILL)				0.50	WS	13		
				0.50 - 0.95	U	2		24 blows
			(2.00)	1.00	D	3		
below 1.00m mixed with red brown sandy clay with a little gravel sized fragments of cemented silt and fine sand				1.00 - 1.45	D	4	S N=10	1,-/2,2,3,3,
	79.24		2.00					
				2.00 - 2.45	U	5		39 blows
				2.50	D	6		
Stiff red brown indistinctly fissured CLAY with frequent up to fine gravel size lithorelics and pockets and lenses of light green grey silt and yellow brown silty fine sand locally cemented				2.50 - 2.95	D	7	S N=45	2,5/5,10,14,16
				2.80	WS	10		
(KEUPER MARL 3)			(3.00)					
				3.50 - 3.95	U	8		51 blows
				4.00	D	9		
with bands of very stiff (hard) red brown to dark red brown very silty clay				4.00 - 4.45	D	11	S N=51	6,6,9,11,13,18
	76.24		5.00					
				5.00 - 5.45	D	12	S N=120	10,12/17,27,35,41 Chiselling from 4.70 to 5.00m and 5.30 to 5.80m 1.50 hours
Very stiff (hard) red brown extremely closely fissured very silty CLAY with thin to thick laminations of dark red brown mudstone and bands of light green grey very clayey silt with siltstone lenses (KEUPER MARL 3/2)			(2.00 pen)	6.00 - 6.30	U			150 blows no recovery
				6.00 - 6.30	B	14		
				6.40 - 6.51	D	15	S (71)	21,50 for 33mm Chiselling from 6.00 to 7.00m 1.50 hours
	74.24		7.00	7.00			S (50)	50 for no penetration
BOREHOLE ENDS AT 7.00 m.								

Remarks

Logged by: GAC

Scale: 1:50

Fig. 66

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.03.88/11.54 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 740

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field Records

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
05.01	1100	0.00	0.00		
05.01	–	4.00	3.00	4.00	Water strike
05.01	–			2.80	after 20 mins.
05.01	1700	5.80	5.80	3.00	End of shift
06.01	0800	5.80	5.80	0.50	
06.01	1030	7.00	7.00	3.00	End of cable tool boring

Remarks

Logged by: GAC

Scale: 1:50

Fig. 66

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.03.88/11.54 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 741

Sheet 1 of 2

Equipment & Methods

Cable tool boring, 150 mm diameter, from ground level to 7.177m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 53.28 m A.O.D.

Coordinates: 66721.0 mE, 94338.0 mN

Date: 12.01.88 to 13.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Clayey topsoil	53.28		(0.30)					
	52.98		0.30	0.40	D	1		
				0.50 - 0.95	U	2		33 blows
				1.00	D	3	S	
Firm becoming stiff red brown very closely fissured locally very silty CLAY with frequent up to coarse gravel sized lithorelics and occasional light green reduction spots				1.00 - 1.45	D	4	N=19	3,3/3,4,6,6
				1.20	WS	10A		
(KEUPER MARL 3/4a)			(3.20)					
				2.00 - 2.45	U	5		100 blows
				2.50	D	6		
thin to thickly laminated in parts				2.50 - 2.95	D	7	S N=35	5,10/11,9,7,8,
	49.78		3.50					
				3.50 - 3.90	U	8		150 blows for 400mm penetration
				3.95	D	9		
Very stiff (hard) red brown fissured very silty CLAY with bands of dark red brown thinly laminated mudstone, pockets and lenses of light grey silt locally cemented, and occasional light green reduction spots				3.95 - 4.40	D	10	S N=152	7,19/29,35,38,50
				5.00 - 5.45	D	11	S N=80	5,7/11,20,22,27
(KEUPER MARL 3)			(3.68 pen)					
friable				6.00 - 6.45	D	12	S N=100	10,17/15,21,29,35
								Chiselling from 6.70 to 7.00m 1.00 hour
				7.00 - 7.18	D	13	S 50	22,37/50 for 27mm
BOREHOLE ENDS AT 7.18 m.	46.10		7.18					

Remarks

Logged by: GAC

Scale: 1:50

Fig. 67

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.03.88/16.14 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 741

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field Records

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
12.01	–	0.00	0.00		
12.01	1600	3.50	3.00	3.50	Water strike
12.01	1620			2.40	after 20 mins.
12.01	1700	4.50	4.50	1.40	End of shift
13.01	0800	4.50	4.50	1.20	
13.01	–	7.18	7.00	6.50	End of cable tool boring

Remarks

Logged by: GAC

Scale: 1:50

Fig. 67

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.03.88/16.14 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 742

Sheet 1 of 2

Equipment & Methods: Hand dug inspection pit to 1.00m. Cable tool boring, 150mm diameter, from 1.00m to 7.55m.	Location No. 7382 Location: A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4
Carried out for Client: Department of Transport (E. Midlands Reg. Office) Engineer: Scott Wilson Kirkpatrick & Partners	Ground Level: 57.60 m A.O.D. Coordinates: 66903.5 mE 93822.0 mN Date: 28.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Rolled Hardcore (Foreman's description)	57.60		(0.70)					
	56.90		0.70					
				1.00 – 1.45	U	1		26 blows
				1.60	D	2		
				1.60 – 2.05	D	3	S N=10	1,2/2,2,3,3
Firm to stiff becoming locally very stiff red brown very silty CLAY with frequent coarse gravel sized lithorelics:locally with pockets and lenses of light grey green silt								
				2.50 – 2.95	U	4		24 blows
Below 1.60m with generally fine to medium locally coarse gravel sized lithorelics				3.10	D	5		
				3.10 – 3.55	D	6	S N=11	2,3/3,3,2,3
Below 4.60m becoming very stiff								
Below 6.10m becoming very stiff (hard) red brown CLAY with fine to medium gravel sized lithorelics and occasional medium to coarse gravel sized inclusions of dark brown silty clay with decayed rootlets			(6.85 pen)	4.00 – 4.45	U	7		32 blows
				4.60	D	8		
				4.60 – 5.05	D	9	S N=17	2,2/3,4,5,5
(FILL)								
				5.50 – 5.95	U	10		43 blows
				6.10	D	11		
				6.10 – 6.55	D	12	S N=21	3,4/4,5,6,6
				7.10 – 7.55	D	13	S N=26	4,4/5,7,7,7
BOREHOLE ENDS AT 7.55 m.	50.05		7.55					

Remarks

Logged by: AAC

Scale: 1:50

Fig. 68

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

(c) Soil Mechanics

12.04.88/16.15 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 742

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field Records

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
28.01	-	4.00	3.34	DRY	
28.01	-	7.55	3.34	DRY	End of cable tool boring

Remarks

Logged by: AAC

Scale: 1:50

Fig. 68

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 12.04.88/16.15 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 743

Sheet 1 of 2

Equipment & Methods

Cable tool boring, 150mm diameter, from ground level to 7.00m

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 56.31 m A.O.D.

Coordinates: 66847.0 mE, 94265.0 mN

Date: 27.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Tarmac/Hardcore (Foreman's description)	56.31		(0.10)	0.00 - 1.40	B	3		
	56.21		0.10	0.20	D	1		
Brown sandy becoming very sandy CLAY with much becoming some to much generally angular fine to coarse gravel and occasional cobbles: frequent decayed root fragments (MADE GROUND)			(1.40)	0.50 - 0.95			C N=6	1,1/2,1,1,2
	54.81		1.50	1.50	D	4		
				1.50 - 1.95	U	5		70 blows
				2.00	D	6		
				2.00 - 2.45	D	7	S N=29	3,2/4,7,9,9
Stiff becoming very stiff (hard) red brown locally thinly laminated silty locally very silty CLAY with occasional generally fine gravel sized mudstone lithorelics Locally with pockets and lenses of light greenish grey silt and siltstone				3.00 - 3.45	U	8		80 blows
				3.50	D	9		
				3.50 - 3.95	D	10	S N=40	5,6/7,8,10,15
(KEUPER MARL 3/4a)			(5.50 pen)					
At 3.50m with very closely spaced sub-horizontal fissures with speckled black staining				4.50 - 4.95	U	11		95 blows
				5.00	D	12		
Below 3.50m with medium to coarse gravel sized mudstone lithorelics				5.00 - 5.45	D	13	S N=90	7,15/14,21,25,30
				6.00 - 6.45	U	14		150 blows
				6.50	D	15		
				6.50 - 6.88	D	16	S 93	
				6.50 - 6.88				8,12/17,26,50 for 75mm
BOREHOLE ENDS AT 7.00 m.	49.31		7.00					

Remarks

Logged by: AAC

Scale: 1:50

Fig. 69

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.05.88/09.46 (Ver 3.1.10)

Soil Mechanics

BOREHOLE No. 743

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field Records

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
27.01	-	1.50	1.50	DRY	
27.01	-	3.00	3.00	DRY	
27.01	-	4.60	3.00	DRY	
27.01	-	7.00	3.00	DRY	End of cable tool boring

Remarks

Logged by: AAC

Scale: 1:50

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 12.04.88/15.24 (Ver 3.1.0)

Fig. 69

Soil Mechanics

BOREHOLE No. 744

Sheet 1 of 2

Equipment & Methods

Hand dug inspection pit from ground level to 1.00m. Cable tool boring, 150mm diameter, from 1.00m to 7.20m

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 74.65 m A.O.D.

Coordinates: 67006.0 mE, 95214.5 mN

Date: 27.01.88 to 28.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
	74.65			0.00 – 1.00	B	1		
Very stiff (hard) red brown locally friable very silty CLAY with frequent fine to medium gravel sized mudstone lithorelics Locally with closely spaced sub-horizontal fissures				1.00 – 1.20	U	2		150 blows no recovery
				1.25	D	3		
				1.25 – 1.55	D	4	S 72	6,13/22,50 for 75mm
(KEUPER MARL 3/4a) dense friable red brown clayey silt with frequent fine to medium gravel sized lithorelics				2.25 – 2.70	D	5	S N=91	9,11/14,19,27,31
Below 1.25m with occasional pockets and lenses of light greenish grey silt				3.25 – 3.70	D	6	S N=75	10,10/15,17,20,23
			(7.20 pen)					
				4.25 – 4.55	D	7	S 73	15,17/23,50 for 75mm
light red brown locally greenish probably moderately weathered silty fine grained sandstone weak				5.20 – 5.43	D	8	S 50	17,31/50 for 75mm
				5.60	W	9		
Below 6.70m with medium to coarse gravel sized mudstone lithorelics				6.25 – 6.70	D	10	S N=79	7,10/17,18,21,23
				7.00 – 7.15	D	11	S (69)	19,50 for 75mm
BOREHOLE ENDS AT 7.20 m.	67.45		7.20					

Remarks

Logged by: AAC

Scale: 1:50

Fig. 70

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 12.04.88/16.24 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 744

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field Records

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
27.01	-	1.10	1.00	DRY	
27.01	-	2.30	1.50	DRY	
27.01	1700	5.50	1.50	DRY	End of shift
28.01	0800	5.50	3.00	1.00	
28.01	-	6.30	3.00	4.00	
28.01	-	7.20	3.00	6.00	End of cable tool boring

Remarks

Logged by: AAC

Scale: 1:50

Fig. 70

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 12.04.88/16.24 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 746

Sheet 1 of 1

Equipment & Methods

Cable tool boring, 150 mm diameter, from ground level to 6.29m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 77.50 m A.O.D.

Coordinates: 67086.0 mE, 95147.5 mN

Date: 19.01.88 to 20.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Clayey topsoil	77.50		(0.60)					
	76.90		0.60	0.60 – 1.05	U	1		32 blows
Firm becoming stiff red brown locally very silty CLAY with occasional becoming frequent up to fine gravel sized lithorelics (KEUPER MARL 4a)				1.20	D	2		
				1.20 – 1.65	D	3	S N=17	2,3/3,4,5,5
below 2.00m with bands of light green grey thinly laminated fine sandy siltstone with very clayey silt lenses, and occasional band of red brown thinly laminated mudstone			(3.50)	2.00 – 2.45	U	4		65 blows
				2.60	D	5		
				2.60 – 3.05	D	6	S N=30	4,4/5,7,9,9
				3.50	WS			
				3.50 – 3.85	U	7		120 blows
				3.90	D	8		
	73.40		4.10	3.90 – 4.18	D	9	S 71	7,12/21,50 for 60mm Chiselling from 4.10m to 4.60m 1.25 hours
Very stiff (hard) dark red brown very silty CLAY with occasional light green reduction spots (KEUPER MARL 4b)				4.60 – 4.80	D	10	S 50	15,22/50 for 55mm
			(2.19 pen)					
				6.00 – 6.29	D	11	S 76	9,16/26,50 for 70mm Chiselling from 5.60 to 6.00m 1.00 hour
BOREHOLE ENDS AT 6.29 m.	71.21		6.29					

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
19.01	–	0.00	0.00		
19.01	1700	3.50	3.34	DRY	
20.01	0800	3.50	3.34	1.74	
20.01	–	6.29	3.34	6.00	Dump, end of cable tool boring

Remarks

Logged by: GNC

Scale: 1:50

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.03.88/16.30 (Ver 3.1.0)

Fig. 71

Soil Mechanics

BOREHOLE No. 747

Sheet 1 of 2

Equipment & Methods

Hand dug inspection pit from ground level to 0.85m. Cable tool boring, 150mm diameter, from 0.85m to 7.45m

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 77.21 m A.O.D.

Coordinates: 67155.5 mE, 95573.0 mN

Date: 25.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Angular medium to coarse sandstone GRAVEL with some cobbles and a little to some clayey sand (FILL)	77.21		(0.90)	0.30 – 0.60	B	1		
	76.31		0.90	0.85 – 1.30	U	2		29 blows
Very stiff locally stiff red brown silty CLAY with occasional mudstone and siltstone lithorelics and occasional pockets and lenses of light green grey silt and siltstone				1.50 – 1.95	D	3	S N=17	2,3/3,4,5,5
				2.50 – 2.95	U	4		44 blows
Below 3.10m with occasional decayed rootlets and rare wood fragments			(4.20)	3.10	D	5		
Below about 4.20m becoming very stiff (hard) dark brown to brown locally very silty locally with rounded fine to medium gravel and frequent decayed rootlets				3.10 – 3.55	D	6	S N=18	2,4/4,3,5,6
(FILL)				4.00 – 4.45	U	7		48 blows
				4.60	D	8		
				4.60 – 5.05	D	9	S N=29	2,3/5,6,7,11
	72.11		5.10					
Very stiff (hard) red brown slightly silty to silty CLAY with frequent fine to medium gravel sized mudstone lithorelics and occasional pockets and lenses of light greenish grey silt				5.50 – 5.95	U	10		59 blows
				6.10	D	11		
(KEUPER MARL 3/4a)			(2.35 pen)	6.10 – 6.55	D	12	S N=41	4,11/14,8,8,11
Below about 6.10m with very closely spaced sub-horizontal fissures occasionally stained black				7.00 – 7.45	D	13	S N=56	5,9/12,12,15,17
BOREHOLE ENDS AT 7.45 m.	69.76		7.45					

Remarks

Logged by: AAC

Scale: 1:50

Fig. 72

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 12.04.88/15.34 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 747

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field Records

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
25.01	-	0.85	0.00	DRY	
25.01	-	2.60	1.84	DRY	
25.01	-	4.00	1.84	DRY	
25.01	-	7.45	1.84	DRY	End of cable tool boring

Remarks

Logged by: AAC

Scale: 1:50

Fig. 72

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 12.04.88/15.34 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 748

Sheet 1 of 1

Equipment & Methods

Hand dug inspection pit from ground level to 1.00m. Cable tool boring, 150mm diameter from 1.00m to 5.00m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 73.45 m A.O.D.

Coordinates: 67292.0 mE, 96133.5 mN

Date: 01.02.88 to 02.02.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
FILL (Foreman's description)	73.45		(0.30)					
	73.15		0.30					
Angular to sub-angular medium to coarse and cobble sized fragments of light grey green locally red brown slightly fine sandy SILTSTONE moderately strong to strong (FILL)		× × × × × ×	(0.50)	0.50 - 0.70	1	b		
	72.65		0.80					
Very stiff red brown and dark brown mottled CLAY with occasional decayed plant matter and rare angular medium gravel (FILL)			(1.00)	1.00 - 1.45	D	2	S N=34	5,9/7,5,8,14
	71.65		1.80					
Stiff becoming very stiff (hard) red brown locally very silty CLAY with occasional fine gravel sized lithorelics and locally with occasional pockets and lenses of light grey green silt and siltstone				2.00 - 2.45	D	3	S N=71	6,8/8,12,22,29
(KEUPER MARL 4a)				3.00 - 3.45	D	4	S N=47	3,9/12,11,6,18
From 4.00m to 4.60m dense light grey green SILT with occasional fine gravel sized lithorelics			(3.20 pen)					
Below about 4.80m becoming light grey green probably moderately weathered SILTSTONE weak to very weak				4.00 - 4.38	D	5	S 94	7,14/17,25,52 for 75mm Chiselling from 4.40m to 4.70m 1.00 hour
				4.70 - 5.00	D	6	S 54	13,24/54 for 75mm
BOREHOLE ENDS AT 5.00 m.	68.45		5.00					

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
01.02	1800	1.50	1.50	DRY	End of shift
02.02	0800	1.50	1.50	DRY	
02.02	-	2.00	1.84	DRY	
02.02	-	5.00	1.84	DRY	End of cable tool boring

Remarks

Logged by: AAC

Scale: 1:50

Fig. 73

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 12.04.88/16.33 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 749

Sheet 1 of 1

Equipment & Methods

Hand dug inspection pit from ground level to 1.00m. Cable tool boring, 150mm diameter, from 1.00m to 3.61m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 56.75 m A.O.D.

Coordinates: 67491.5 mE, 96858.5 mN

Date: 02.02.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
TOPSOIL	56.75		(0.20)					
	56.55		0.20					
Light grey green moderately weathered silty fine grained porous SANDSTONE weak to very weak with occasional red brown siltstone lenses and occasional black speckled staining			(0.80)	0.20 - 0.80	B	1		
(KEUPER SERIES SANDSTONE 3)	55.75		1.00	1.00 - 1.45	D	2	S N=98	8,9/12,15,24,47
Very stiff (hard) red brown CLAY with occasional fine gravel sized lithorelics thinly to thickly interlaminated with very dense light grey green SILT				1.70 - 2.15	D	3	S N=53	7,15/19,9,8,17
Below 2.30m stiff becoming very stiff red brown locally thinly laminated locally very silty CLAY with occasional fine to medium occasionally coarse gravel sized lithorelics and occasional bands and lenses of light greenish grey slightly fine sandy siltstone			(2.61 pen)	2.50 - 2.95	D	4	S N=98	8,14/17,21,26,34
				3.00 - 3.19	D	5	S 50	12,37/50 for 40mm Chiselling from 3.00m to 3.40m 1.25 hours
(KEUPER SERIES MARL 3/4a)				3.40 - 3.61	D	6	S 50	9,28/50 for 55mm
BOREHOLE ENDS AT 3.61 m.	53.14		3.61					

Remarks

Logged by: AAC

Scale: 1:50

Fig. 74

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 12.04.88/16.37 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 750

Sheet 1 of 2

Equipment & Methods

Cable tool boring from ground level to 7.20m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 57.35 m A.O.D.

Coordinates: 67525.0 mE, 96851.5 mN

Date: 25.01.88 to 26.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Very stiff red brown very silty locally slightly fine sandy CLAY with occasional fine gravel sized lithorelics and a little to some angular medium to coarse mudstone and sandstone gravel (Possible FILL)	57.35		(0.70)	0.20	D	1		
	56.65		0.70	0.50 - 0.95	U	2		150 blows
			(0.70)	1.00	D	3		
				1.00 - 1.45	D	4	S N=64	3,10/15,12,17,20
Light grey green moderately weathered silty fine grained SANDSTONE weak to very weak with black speckled staining Below 1.00m becoming fine silty SAND with frequent medium to coarse gravel sized lithorelics (KEUPER SERIES SANDSTONE 3)	55.95		1.40					
Red brown probably moderately weathered SILTSTONE very weak				2.00 - 2.45	D	5	S N=92	7,12/17,23,25,27
				3.00 - 3.20	D	6	S 50	15,36/50 for 50mm
Very stiff red brown locally thinly laminated CLAY with occasional fine to medium gravel sized lithorelics and occasional pockets and lenses of light grey green silt and siltstone Frequent bands of light reddish green silty fine SAND with occasional fine to medium gravel sized lithorelics			(5.80 pen)	4.00 - 4.19	D	7	S 50	17,31/50 for 42mm
				5.00 - 5.12	D	8	S (70)	20,50 for 40mm
(KEUPER SERIES MARL 3/4a) Below 7.00m becoming probably moderately weathered red brown MUDSTONE very weak				6.00 - 6.23	D	9	S 50	17,36/50 for 75mm Chiselling from 6.70m to 7.00m 1.00 hour
				7.00 - 7.12	D	10	S (72)	22,50 for 50mm
BOREHOLE ENDS AT 7.20 m.	50.15		7.20					

Remarks

Logged by: AAC

Scale: 1:50

Fig. 75

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 12.04.88/16.43 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 750

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field Records

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
25.01	-	2.10	1.50	DRY	
25.01	-	3.20	3.00	DRY	
25.01	-	5.10	5.00	DRY	End of shift
26.01	0800	5.10	5.00	DRY	
26.01	-	6.10	6.00	DRY	
26.01	-	7.20	6.00	DRY	End of cable tool boring

Remarks

Logged by: AAC

Scale: 1:50

Fig. 75

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 12.04.88/16.43 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 751

Sheet 1 of 2

Equipment & Methods

Hand dug inspection pit from ground level to 1.20m. Cable tool boring, 150mm diameter, from 1.20m to 7.00m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: ------

Coordinates: 67530.0 mE, 97315.0 mN

Date: 02.02.88 to 03.02.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
TOPSOIL			(0.20) 0.20					
Stiff red brown very silty CLAY with a little gravel (FILL)			(0.40) 0.60					
Angular sandstone COBBLES (FILL)			(0.30) 0.90					
TARMAC			(0.20) 1.10	1.00 – 1.20	B	1		
Dense red brown very clayey SILT with rare fine to medium occasionally coarse gravel sized lithorelics: locally with a little fine to medium gravel (Probable FILL)			(1.40)	1.20 – 1.65	U	2		81 blows
				1.70	D	3		
				1.70 – 2.15	D	4	S N=23	2,3/5,5,6,7
Light grey brown fine sandy locally very sandy SILT locally very clayey with rare sub-rounded fine to medium gravel (Probable RIVER TERRACE DEPOSITS)			2.50 (0.50) 3.00	2.60	D	5		
				2.60 – 3.05	U	6		50 blows
				3.10	D	7		
				3.10 – 3.55	D	8	S N=31	3,5/7,6,8,10 No sample No. 9
Brown becoming orange brown medium SAND with a little to some sub-angular fine to medium occasionally coarse mainly chert gravel (Probable TERRACE DEPOSITS)			(1.80) 4.80	3.60	W	11		
				4.00 – 4.50	B	10		
				4.05 – 4.50			S N=23	3,3/6,7,6,4
				4.70	W	13		
				4.80	D	12		
Stiff becoming very stiff (hard) red brown very silty CLAY with occasional pockets and lenses of light grey green silt (KEUPER MARL 3/4a) Below about 5.20m with frequent fine to medium gravel sized lithorelics At 5.50m band of moderately weathered siltstone moderately weak			(2.20 pen)	5.00 – 5.45	U	14		87 blows
				5.50	D	15		
				5.50 – 5.95	D	16	S N=41	7,5/8,10,10,13
				6.50 – 6.95	D	17	S N=62	10,11/10,15,17,20
BOREHOLE ENDS AT 7.00 m.			7.00					

Remarks

Logged by: AAC

Scale: 1:50

Fig. 76

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 12.04.88/16.49 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 751

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field Records

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
02.02	-	1.30	1.20	DRY	
02.02	-	2.70	2.60	DRY	
02.02	-	3.60	3.50	3.50	water strike
02.02	-			1.70	after 20 mins
02.02	-	4.10	4.00	3.00	
02.02	1730	4.80	4.80	4.00	End of shift
03.02	0800	4.80	4.80	4.70	
03.02	-	5.10	5.00		DAMP
03.02	-	6.60	6.00		DAMP
03.02	-	7.00	6.00		DAMP, End of cable tool boring

Remarks

Logged by AAC

Scale 1:50

Fig. 76

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 12.04.88/16.49 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 752

Sheet 1 of 2

Equipment & Methods

Hand dug inspection pit from ground level to 1.40m. Cable tool boring, 150mm diameter, from 1.40m to 7.05m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 35.30 m A.O.D.

Coordinates: 67558.0 mE, 98033.0 mN

Date: 03.02.88 to 04.02.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
	35.30		(0.30)					
FILL (Foreman's description)	35.00		0.30					
Light brown to brown clayey fine to medium SAND with a little to some sub-angular to rounded medium to coarse assorted gravel and occasional inclusions of sandy clay (FILL)			(1.50)	0.30 - 1.00	B	1		
				1.40 - 1.85	U	2		
	33.50		1.80					
Soft to firm red brown very silty becoming fine sandy CLAY with a little to some sub-angularto rounded fine to medium occasionally coarse assorted gravel (RIVER TERRACE DEPOSITS)			(0.60)	2.00	D	3		
				2.00 - 2.45	D	4	S N=18	4,4/5,4,4,5
	32.90		2.40					
Soft to firm light reddish brown sandy locally very sandy CLAY/locally very clayey SAND with a little sub-angular to rounded fine to medium assorted gravel (RIVER TERRACE DEPOSITS)			(1.30)	3.00 - 3.45	D	5	S N=16	3,3/4,4,3,5
	31.60		3.70					
Soft to firm red brown CLAY with frequent laminations of light greenish grey slightly fine sandy SILT (KM 4)			(0.60)	3.90 - 4.35	U	7		
	31.00		4.30					
				4.50	D	8		
				4.60 - 5.00	B	10		
Dense light grey green locally mottled red brown locally very clayey silty fine SAND with occasional fine to medium gravel sized lithorelics				4.60 - 5.05	D	9	S N=34	3,4/6,7,10,11
At 4.40m with inclusions of dark brown slightly sandy CLAY with occasional root fragments			(2.75 pen)	5.50 - 5.95	D	11	S N=64	4,4/7,11,19,27
From 4.60m to 5.00m with rare sub-angular to rounded medium gravel and frequent decayed roots								
Below 5.50m becoming fine sandy SILT with a little fine to medium sub-angular to sub-rounded gravel (KM 3/4)				6.60 - 7.05	D	12	S N=73	6,7/11,14,17,31
	28.25		7.05					
BOREHOLE ENDS AT 7.05 m.								

Remarks

Logged by: AAC

Scale: 1:50

Fig. 77

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 12.04.88/16.54 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 752

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
03.02	-	1.50	0.00	DRY	
03.02	-	2.00	0.00	DRY	End of shift
04.02	-	3.80	0.00	3.80	slight seepage
04.02	-			3.80	after 20 mins
04.02	-	4.00	3.34		DAMP
04.02	-	6.00	4.50		slurry
04.02	-	7.05	4.50		slurry, end of cable tool boring

Remarks

Logged by AAC

Scale 1:50

Fig. 77

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 12.04.88/16.54 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 753

Sheet 1 of 2

Equipment & Methods

Cable tool boring, 150 mm diameter, from ground level to 10.00m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 48.25 m A.O.D.

Coordinates: 66665.3 mE, 93784.0 mN

Date: 11.01.88 to 12.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Topsoil	48.25		(0.30)					
	47.95		0.30	0.35	D	1		
Soft red brown slightly sandy CLAY mixed with some brown very silty clay				0.50 - 0.95	U	2		28 blows
				1.00	D	3		
becoming by about 0.80m soft grey brown, greenbrown and red brown sandy CLAY with some locally much assorted angular to rounded gravel (Probable ALLUVIUM)			(1.65)	1.00 - 1.45	B	3A	C N=3	1,0/1,0,1,1,
	46.30		1.95	1.95	D	4		
				2.00 - 2.45	U	5		27 blows
				2.50	D	6		
Soft becoming stiff red brown CLAY with frequent fine gravel sized lithorelics and occasional light grey silt partings				2.50 - 2.95	D	7	S N=18	3,3/4,4,5,5
				3.10	WS	13A		
below 3.00m with thin laminations of hard dark red brown clay				3.50 - 3.95	U	8		43 blows
				4.00	D	9		
becoming very silty by about 4.00m				4.00 - 4.45	D	10	S N=30	3,4/6,6,8,10
(KEUPER MARL 3/4a)			(4.55)					
				5.00 - 5.45	U	11		55 blows
				5.50	D	12		
with light green grey reduction spots and bands of light brown to red brown and light green grey very clayey silt locally cemented				5.50 - 5.95	D	13	S N=49	2,2/7,11,13,18
	41.75		6.50					
				6.50 - 6.95	U	14		150 blows
				7.00	D	15		
				7.00 - 7.45	D	16	S N=30	4,7/7,7,7,9
Very stiff (hard) red brown extremely to very closely fissured very silty CLAY with thin beds of red brown to dark red brown mudstone and light green grey silt and siltstone and black staining on vertical fissure surfaces				8.00 - 8.30	U	17		150 blows
			(3.50 pen)	8.35	D	18		
				8.35 - 8.80	D	19	S N=78	6,18/17,18,21,22
(KEUPER MARL 3/4a)								
				9.50 - 9.95	D	20	S N=92	9,15/15,23,24,30
BOREHOLE ENDS AT 10.00 m.	38.25		10.00					Chiselling from

Remarks

Logged by: GAC/AAC

Scale: 1:50

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 11.04.88/09.53 (Ver 3.1.0)

Fig. 78

Soil Mechanics

BOREHOLE No. 753

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field Records

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
11.01	-	0.00	0.00		
11.01	1700	6.00	6.00	DRY	End of shift
12.01	0800	6.00	6.00	3.10	
12.01	-	9.60	9.50	7.50	
12.01	-	10.00	9.50	7.50	End of cable tool boring

Remarks

Logged by GAC/AAC

Scale 1:50

Fig. 78

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 11.04.88/09.53 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 754

Sheet 1 of 2

Equipment & Methods

Cable tool boring, 150 mm diameter, from ground level to 10.00m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 50.00 m A.O.D.

Coordinates: 66505.7 mE, 93863.6 mN

Date: 10.01.88 to 11.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Clayey topsoil	50.00		(0.25)					
	49.75		0.25	0.30	D	1		
Firm red brown sandy locally very sandy CLAY with occasional to some assorted subangular to rounded gravel (Possible ALLUVIUM)				0.50 - 0.95	U	2		35 blows
				1.00	D	3		
			(1.55)	1.00 - 1.45	D	4	S N=11	2,3/2,2,3,4
Red brown very clayey SAND with occasional assorted fine to medium gravel (Possible ALLUVIUM)	48.20		1.80					
			(0.40)	2.00 - 2.45	U	5		41 blows
	47.80		2.20	2.00	WS	11		
				2.50	D	6		
				2.50 - 2.95	D	7	S N=21	2,3/3,5,7,6
Firm becoming stiff red brown very silty CLAY with frequent up to fine gravel sized lithorelics and pockets of light green grey very clayey silt and occasional bands of dark red brown very stiff (hard) thinly laminated clay				3.50 - 3.95	U	8		39 blows
				4.00	D	9		
(KEUPER MARL 3/4a)				4.00 - 4.45	D	10	S N=35	4,6/6,7,10,12
becoming friable by 4.00m				5.00 - 5.45	U	12		87 blows
				5.50	D	13		
5.50-7.00m with bands of light green grey very clayey silt and siltstone				5.50 - 5.95	D	14	S N=48	3,5/8,9,13,18
			(7.80 pen)					
7.00-8.70m very closely subhorizontally fissured with bands of light brown to red brown silt and laminated siltstone				6.50 - 6.95	U	15		100 blows
				7.00	D	16		
				7.00 - 7.45	D	17	S N=68	3,7/11,14,19,24
8.70-9.10m very stiff (hard)				8.00 - 8.45	U	18		110 blows
				8.50	D	19		
				8.50 - 8.73	D	20	S 50	8,28/50 for 75mm Chiselling from 8.70m to 9.10m 1.00 hour
				9.50 - 9.95	D	21	S N=60	5,9/15,21,24,30
BOREHOLE ENDS AT 10.00 m.	40.00		10.00					

Remarks

Logged by: GAC

Scale: 1:50

Fig. 79

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 11.04.88/10.05 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 754

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field Records

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
10.01	-	0.00	0.00		
10.01	-	2.00	1.50	2.00	Water strike after 20 mins.
10.01	-			1.00	
10.01	1700	4.50	4.50	4.50	Damp, end of shift
11.01	0800	4.50	4.50	2.00	
11.01	-	5.00	4.50	2.50	
11.01	-	6.50	6.00	4.00	
11.01	-	8.00	7.50	4.50	
11.01	-	10.00	9.00	5.40	End of cable tool boring

Remarks

Logged by: GAC

Scale: 1:50

Fig. 79

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 11.04.88/10.05 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 755

Sheet 1 of 1

Equipment & Methods: Hand dug inspection pit from ground level to 1.00m. Cable tool boring, 150mm diameter, from 1.00m to 1.90m.	Location No. 7382 Location: A42 CASTLE DONINGTON NORTH: GROUND INVESTIGATION CONTRACT 4
Carried out for Client: Department of Transport (E. Midlands Reg. Office) Engineer: Scott Wilson Kirkpatrick & Partners	Ground Level: - - - - - Coordinates: 67088.0 mE, 93239.0 mN Date: 27.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
FILL (Foreman's description)			(0.20) 0.20					
Very stiff red brown very silty CLAY with medium to coarse gravel occasionally cobble sized lithorelics and occasional pockets and lenses of light grey green silt (KEUPER MARL 2)			(1.70 pen)	0.30 - 0.70	B	1		
				1.00 - 1.25	U	2		120 blows
				1.30	D	3	S	
Below 1.00m becoming probably moderately weathered MUDSTONE weak to very weak recovered as medium to coarse gravel sized lithorelics in a silty clay matrix				1.30 - 1.53	D	4	54	16,28/54 for 75mm Chiselling form 1.30m to 1.75m 1.25 hours
				1.75 - 1.90	D	5	S (80)	29,51 for 75mm
BOREHOLE ENDS AT 1.90 m.			1.90					

Remarks

Logged by: AAC

Scale: 1:50

Fig. 80

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

(c) Soil Mechanics 14.04.88/14.11 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 756

Sheet 1 of 2

Equipment & Methods

Hand dug inspection pit from ground level to 0.60m. Cable tool boring from 0.60m to 7.55m

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 57.80 m A.O.D.

Coordinates: 66914.0 mE, 93759.0 mN

Date: 27.01.88 to 28.01.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
	57.80							
FILL (Foreman's description)			(0.90)					
light brown clayey fine GRAVEL with some to much angular to sub-rounded fine to medium assorted gravel and frequent root fragments	56.90		0.90	0.60 – 1.05	U	1		44 blows
				1.20	D	2		
				1.20 – 1.65	D	3	S N=9	2,2/2,2,2,3
				2.00 – 2.45	U	4		31 blows
				2.60	D	5		
Very stiff (hard) red brown locally very silty CLAY locally friable with frequent fine to medium gravel sized lithorelics and occasional pockets and lenses of light grey green silt				2.60 – 3.05	D	6	S N=10	2,2/2,3,2,3
(FILL)				3.50 – 3.95	U	7		26 blows
From 1.20m to 2.20m with a little sub-angular medium to coarse occasionally fine assorted gravel				4.10	D	8		
			(6.65 pen)	4.10 – 4.55	D	9	S N=16	3,3/4,3,4,5
Below about 2.20m with frequent medium to coarse occasionally fine gravel sized lithorelics								
Between 3.50m and 5.60m locally firm to stiff				5.00 – 5.45	U	10		29 blows
At 5.60m with occasional inclusions of brown slightly fine sandy CLAY and scattered plant fragments				5.60	D	11		
				5.60 – 6.05	D	12	S N=15	2,3/4,3,4,4
				6.50 – 6.95	U	12		43 blows
				7.10	D	13		
				7.10 – 7.55	D	14	S N=24	3,4/4,6,7,7
BOREHOLE ENDS AT 7.55 m.	50.25		7.55					

Remarks

Logged by: AMC

Scale: 1:50

Fig. 81

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 14.04.88/14.14 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 756

Sheet 2 of 2

Equipment & Methods

As sheet 1

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field Records

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
27.01	-	2.10	1.84	DRY	
27.01	-	4.00	1.84	DRY	
27.01	-	6.05	1.84	DRY	End of shift
28.01	0800	6.05	1.84	DRY	
28.01	-	6.60	6.30	DRY	
28.01	-	7.55	6.30	DRY	End of cable tool boring

Remarks

Logged by: AAC

Scale: 1:50

Fig. 81

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 14.04.88/14.14 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 757

Sheet 1 of 1

Equipment & Methods

Hand dug inspection pit from ground level to 1.00m. Cable tool boring, 150mm diameter from 1.00m to 3.00m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 33.80 m A.O.D.

Coordinates: 67433.0 mE, 98508.0 mN

Date: 03.02.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
TOPSOIL	33.80		(0.20)					
	33.60		0.20					
sub-angular coarse gravel and cobbles of LIMESTONE strong to very strong				0.00 – 1.00	B	1		
Very stiff red brown locally very silty CLAY with occasional fine to medium gravel sized lithorelics and a little sub-rounded to sub-angular fine to medium assorted gravel (FILL)				1.00 – 1.30	U	2		150 blows
angular fine to coarse gravel and cobble sized fragments of light grey green SILTSTONE strong				1.35	D	3		
			(2.50)	1.35 – 1.80	D	4	S N=23	2,2/4,6,6,7
Below 1.35m becoming locally fine sandy with occasional pockets and lenses of light grey green silt				2.20 – 2.65	U	5		150 blows NO RECOVERY
				2.70	D	6		
	31.10		2.70	2.70 – 3.00	D	7	S 71	7,10/21,50 for 75mm
			(0.30p)	3.00				
	30.80		3.00					Chiselling from 3.00m no progress 1.5 hours
Brown fine to medium SAND with a little to some sub-rounded to sub-angular fine to medium occasionally coarse assorted gravel (Probable TERRACE DEPOSITS)								
BOREHOLE ENDS AT 3.00 m.								

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
03.02	–	1.10	1.00	DRY	
03.02	–	2.30	2.00	DRY	
03.02	–	3.00	3.00	2.50	End of cable tool boring

Remarks

1. Water added below 2.80m to assist boring.
2. Borehole terminated at 3.00m on client's instruction.

Logged by: AAC

Scale: 1:50

Fig. 82

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 14.04.88/14.19 (Ver 3.1.0)

Soil Mechanics

BOREHOLE No. 758

Sheet 1 of 1

Equipment & Methods

Hand dug inspection pit from ground level to 1.40m. Cable tool boring, 150mm diameter, from 1.40m to 7.00m.

Location No. 7382

Location

A42 CASTLE DONINGTON NORTH:
GROUND INVESTIGATION CONTRACT 4

Carried out for

Client: Department of Transport (E. Midlands Reg. Office)
Engineer: Scott Wilson Kirkpatrick & Partners

Ground Level: 33.70 m A.O.D.

Coordinates: 67266.0 mE, 99030.0 mN

Date: 03.02.88

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Stiff red brown CLAY with occasional lithorelics and some to much generally sub-angular fine to medium occasionally coarse assorted gravel: frequent decayed roots and occasional black staining (FILL)	33.70		(1.40)	0.40 - 1.00	B	1		
Stiff becoming very stiff light brown to brown sandy locally very sandy CLAY with a little to some sub-angular to rounded fine to medium assorted gravel:locally with a little oraganic matter (FILL)	32.30		1.40	1.40 - 1.85	U	2		38 blows
			(0.80)	2.00	D	3		
Light brown medium to coarse SAND and sub-angular to sub-rounded fine to medium occasionally coarse GRAVEL with a little soft reddish brown clay (Possible FILL)	31.50		2.20	2.10 - 2.55	D	4	S N=38	4,6/7,9,10,12
	30.60		(0.90) 3.10	3.50 - 3.95			C N=16	2,3/3,5,4,4
				3.50 - 4.00	B	5		
Light brown medium to coarse SAND with some to much sub-angular to rounded fine to medium occasionally coarse assorted gravel				4.50 - 4.95			C N=17	2,2/3,3,5,4
(Possible TERRACE DEPOSITS)				4.50 - 5.00	B	6		
From 3.10m to about 5.25m with a little to some clay			(3.90 pen)	5.50 - 5.95			C N=13	2,3/2,3,5,3
				5.50 - 6.00	B	7		
				6.50 - 6.95			C N=16	2,4/4,3,4,5
				6.50 - 7.00	B	8		
BOREHOLE ENDS AT 7.00 m.	26.70		7.00					

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1988					
03.02	-	4.10	4.00	DRY	
03.02	-	4.60	4.50	DRY	
03.02	-	5.40	4.50	5.40	water strike
03.02	-			4.90	after 20 mins

Remarks

1. Water added below 4.00m to assist boring.

Logged by: AAC

Scale: 1:50

Fig. 83

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 14.04.88/14.25 (Ver 3.1.0)

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Soil Mechanics

TRIAL PIT No. 804

Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

Ground Level 61.13 m AOD

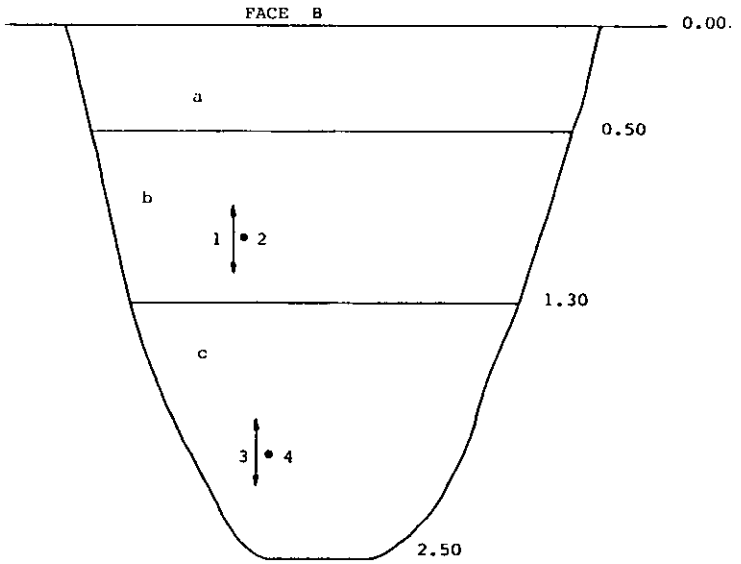
Coordinates 61426.0 me 92520.0 mn

Date Dug: 22.1.88 Logged: 22.1.88

Carried out for Client: Department of Transport Engineer: Scott Wilson Kirkpatrick and Partners

Equipment & Methods Machine Dug to 2.50m by JCB 3cx No support used Logged on excavated material below 0.00m

Sketch of faces and description of strata



Samples			Depth below ground level (m)
Depth (m)	Type	No.	
0.00			0
1.00	B	1	1
	D	2	
2.00	B	3	2
	D	4	

Material Types

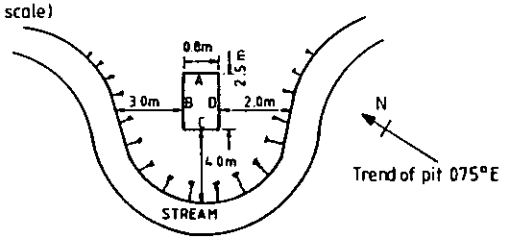
a TOPSOIL

b Firm brown to orange brown very silty locally slightly fine sandy CLAY with frequent rootlets. (Probable Alluvium)

c Firm brown mottled orange brown locally grey sandy very silty CLAY with some dark grey organic pockets and black carbonised timber fragments, occasional chert gravel and a slight organic odour. Becoming by about 2.00m with much chert gravel. (Probable Alluvium)

NOTE: Soil Resistivity measurement carried out at ground level and Redox potential tests carried out at 1.50m

Plan (Not to scale)



Notes Sample positions shown on faces

Ground water: Not encountered

Stability of faces: Stable

Ease of excavation: Easy

Weather: Snow/cold

Variability of faces: All faces similar

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample † B Bulk disturbed sample □ U Undisturbed sample • W Water sample

Logged by JAS

Fig. 84

D3/6/85 © Soil Mechanics Limited, Bracknell, England

Soil Mechanics

TRIAL PIT No. 805 — Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

Ground Level 61.58 m AOD

Coordinates 61412.0 me, 92430.0 mn

Date Dug: 22.1.88, Logged:

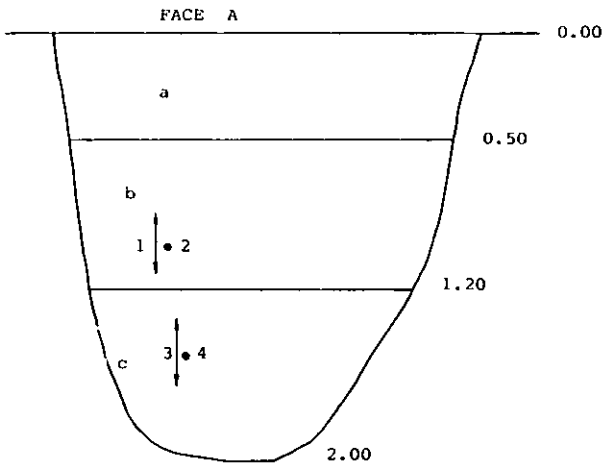
Equipment & Methods
Machine dug to 2.00m by JCB 3CX
No support used
Logged on excavated material below 0.00m

Carried out for
Client: Department of Transport
Engineer: Scott Wilson Kirkpatrick and Partners

Samples

Depth (m)	Type	No.
0.00		
1.00	B	1
	D	2
1.50	B	3
	D	4

Sketch of faces and description of strata



Depth below ground level (m): 0, 1, 2

MATERIAL TYPES

a TOPSOIL

b Firm brown to orange brown very silty locally slightly fine sandy CLAY with frequent rootlets (Probable Alluvium)

c Firm to stiff brown mottled orange brown very silty locally sandy CLAY with occasional dark grey organic pockets and rootlets. (Probable Alluvium)

NOTES: Soil Resistivity measurement carried out at ground level and Redox potential tests carried out at 1.50m

Logged by JAS

Fig. 85

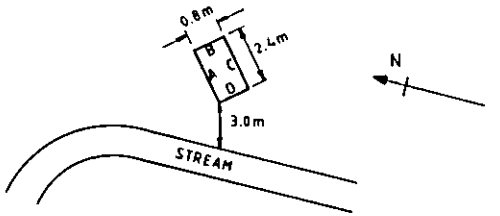
Notes Sample positions shown on faces

Ground water: Not encountered
Stability of faces: Stable
Ease of excavation: Easy
Weather: Snow/cold
Variability of faces: All faces similar

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample | B Bulk disturbed sample □ U Undisturbed sample • W Water sample

Plan (Not to scale)



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Soil Mechanics

TRIAL PIT No. 806

Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH
GROUND INVESTIGATION CONTRACT 4

Ground Level 72.10 m AOD

Coordinates 62124.0 me
92618.0 mn

Date Dug: 24.01.88
Logged: 24.01.88

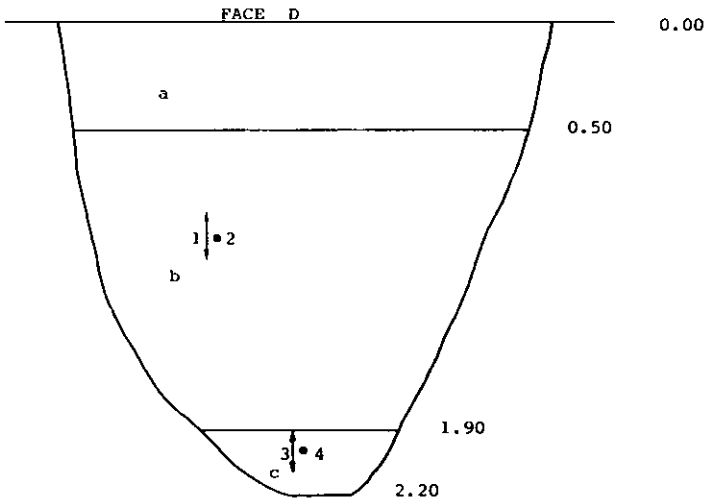
Carried out for
Client: Department of Transport
Engineer: Scott, Wilson Kirkpatrick and Partners

Equipment & Methods
Machine dug to 2.20m by JCB 3CX
No support used.
Logged on excavated material below 0.00m

Samples

Depth (m)	Type	No.
0.00		
1.00	B	1
	D	2
2.00	B	3
	D	4

Sketch of faces and description of strata



Depth below ground level (m)

0
1
2

MATERIAL TYPES

a TOPSOIL
b Firm red brown mottled brown slightly fine sandy CLAY with occasional dark grey organic pockets and fibrous rootlets (Possible Alluvium)
c Firm to stiff red brown is parts green grey locally slightly fine sandy CLAY with frequent Lithorelics and occasional pockets and lenses of light grey green siltstone, moderately weak (Keuper Marl 3/4A)

NOTE: Soil Resistivity measurements carried out at ground level and Redox potential tests carried out at 1.50m

Logged by JAS/AAC

Fig. 86

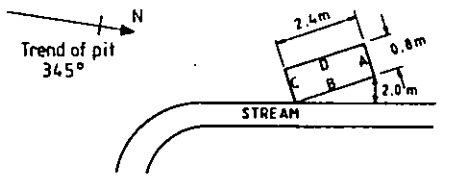
Notes Sample positions shown on faces

Ground water: Not encountered
Stability of faces: Stable
Ease of excavation: Easy
Weather: Fine
Variability of faces: All faces simular

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample ⌈ B Bulk disturbed sample ○ U Undisturbed sample • W Water sample

Plan (Not to scale)



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Soil Mechanics

TRIAL PIT No. 807

Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

Ground Level 73.48 m AOD

Coordinates 62138.0 me 92567.0 mn

Date Dug: 24.1.88 Logged: 24.1.88

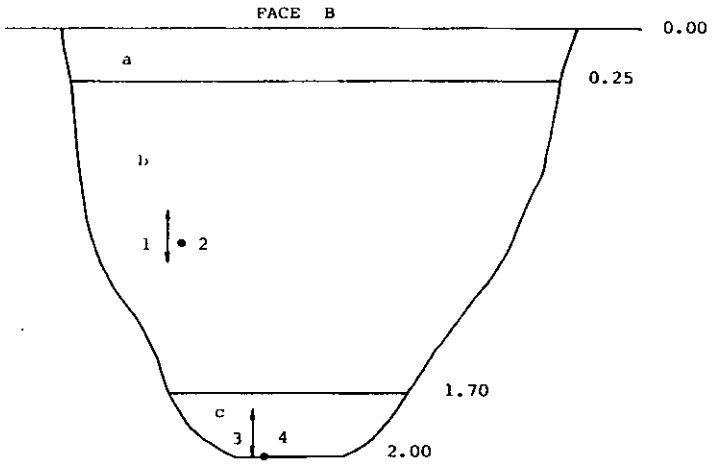
Equipment & Methods
Machine dug to 2.00m by JCB 3CX
No support used
Logged on excavated material below 0.00m

Carried out for
Client: Department of Transport
Engineers: Scott Wilson Kirkpatrick and partners

Samples

Depth (m)	Type	No.
0.00		
1.00	B	1
	D	2
2.00	B	3
	D	4

Sketch of faces and description of strata





Material Types

a TOPSOIL

b Firm to stiff orange brown mottled brown locally slightly fine sandy CLAY with frequent fibrous rootlets. (Possible Alluvium)

c Stiff locally hard red brown mottled green grey sandy CLAY with some green grey pockets of silt/siltstone, moderately weak. (Keuper Marl 3/4a)

NOTE: Soil Resistivity measurements carried out at ground level and Redox potential tests carried out at 1.40m

Notes Sample positions shown on faces

Ground water: Heavy surface run-off

Stability of faces: Collapse of face B and D

Ease of excavation: Easy

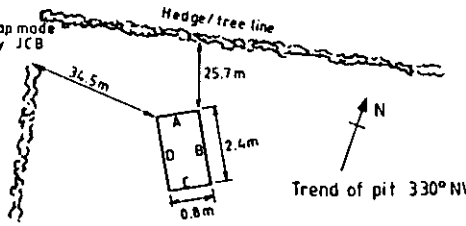
Weather: Fine

Variability of faces: All faces similar

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample ⟊ B Bulk disturbed sample ⊓ U Undisturbed sample • W Water sample

Plan (Not to scale)



Logged by JAS

Fig. 87

D3/6/85 © Soil Mechanics Limited, Bracknell, England

Soil Mechanics

TRIAL PIT No. 808

Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

Ground Level 88.46 mAOD

Coordinates 62699.0 me 92557.0 mn

Date Dug: 21.1.88 Logged: 21.1.88

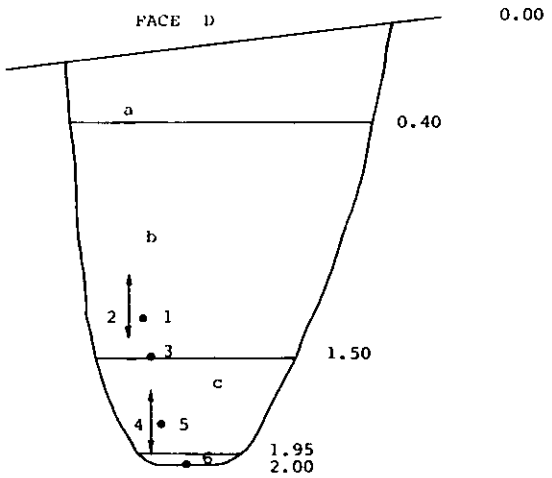
Carried out for
Client: Department of Transport
Engineer: Scott Wilson Kirkpatrick and Partners

Equipment & Methods
Machine dug to 2.00m by JCB 3cIII.
No support used
Logged on excavated material below 0.00m

Samples

Depth (m)	Type	No.
0.00		
1.30	B	1
	D	2
1.50	D	3
1.80	B	4
	D	5
2.00	D	6

Sketch of faces and description of strata



Depth below ground level (m)

0 1 2

Material Types

a TOPSOIL

b Soft to firm orange brown mottled grey and brown becoming mottled grey brown becoming by about 1.30m locally slightly fine sandy CLAY with occastional gravel and cobbles comprising chert and mudstone. Quartzite boulder (300mm ⌀), moderately strong (Glacial Till)

c Firm to stiff orange brown mottled red brown and grey locally sandy CLAY with much fine to medium gravel composed predominantly of chalk and up to cobble sized fragments of chert, quartz, sandstone and grey green mudstone (Glacial Till)

d Very stiff locally hard green grey CLAY/MUDSTONE moderately weak (Keuper Marl 1/2)

NOTE: Soil Resistivity measurements carried out at ground level and Redox potential tests carried out at 1.50m

Logged by

Fig. 88

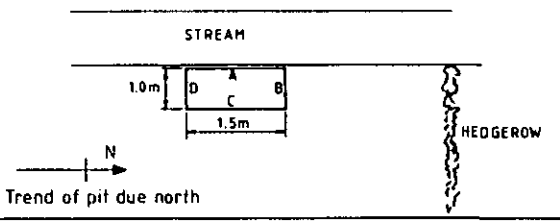
Notes Sample positions shown on faces

Ground water: Not encountered
Stability of faces: Stable
Ease of excavation: Easy
Weather: Fine
Variability of faces: All faces similar

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample ↑ B Bulk disturbed sample ⊓ U Undisturbed sample • W Water sample

Plan (Not to scale)



Trend of pit due north

D3/6/85 © Soil Mechanics Limited, Bracknell, England

Soil Mechanics

TRIAL PIT No. 809

Sheet 1 of 1

Equipment & Methods
Machine dug to 2.20m by JCB 3cIII.
No Support used
Logged on excavated material below 0.00m

Location No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

Carried out for
Client: Department of Transport
Engineer: Scott Wilson Kirkpatrick and partners

Ground Level 88.82 m AOD

Coordinates 62703.0 me 92531.0 mn

Date Dug: 21.1.88 Logged: 21.1.88

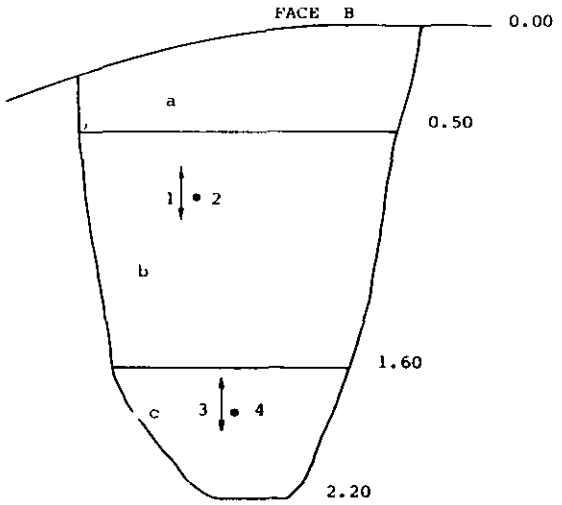
Logged by JAS/AAC

Fig. 89

Samples

Depth (m)	Type	No.
0.00		
0.80	1	B
	2	D
1.80	3	B
	D	4

Sketch of faces and description of strata





NOTE: Land drain (clay 75mm ø) encountered on face D at 0.60m

Material Types

a TOPSOIL

b Firm orange brown mottled grey brown locally slightly fine sandy CLAY with occasional gravel and cobbles of chert and grey green mudstone (Glacial Till)

c Stiff orange brown mottled red brown and grey locally sandy CLAY with much gravel and occasional cobbles comprising chert, chalk, quartz, grey green siltstone and fine to medium grained orange brown sandstone (Glacial Till)

NOTE: Soil Resistivity measurements carried out at ground level and Redox potential tests carried out at 1.50m

Notes Sample positions shown on faces

Ground water: Not encountered

Stability of faces: Stable

Ease of excavation: Easy

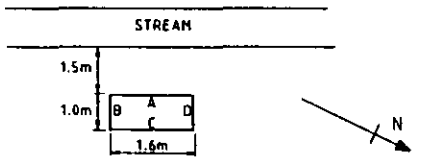
Weather: Fine

Variability of faces: All faces similar

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample | B Bulk disturbed sample □ U Undisturbed sample • W Water sample

Plan (Not to scale)



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Soil Mechanics

TRIAL PIT No. 810

Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

Ground Level 82.83 m AOD

Coordinates 63717.0 me 92544.0 mn

Date Dug: 21.1.88 Logged: 21.1.88

Carried out for Client: Department of Transport Engineer: Scott Wilson Kirkpatrick and Partners

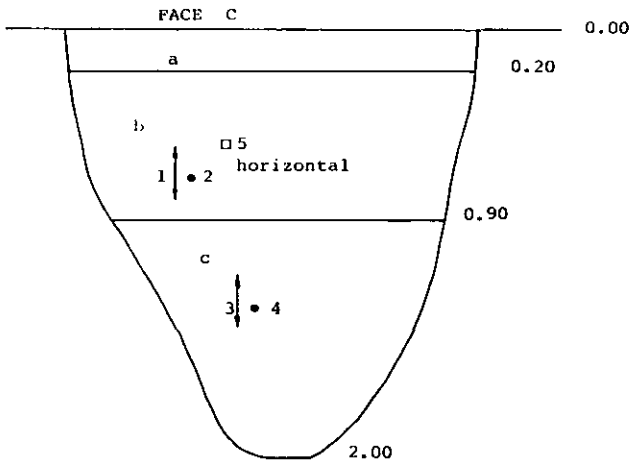
Equipment & Methods Machine dug to 2.00m by JCB 3cIII. No support used

Logged on excavated material below 0.00m

Samples

Depth (m)	Type	No.
0.00		
0.55	U	5
0.70	B	1
	D	2
1.30	B	3
	D	4

Sketch of faces and description of strata



Depth below ground level (m)

0 1 2

Material Types

a TOPSOIL

b Soft to firm orange brown mottled grey brown locally fine sandy CLAY with some chert gravel and occasional dark grey organic carbonaceous pockets (Probable Weathered Glacial Till)

c Firm to stiff red brown locally slightly sandy CLAY with occasional becoming some pockets and lenses of very stiff locally hard greenish grey silt; a little fine to medium gravel and occasional cobbles of predominanly chert, rarely rounded sandstone; occasional dark grey organic/carbonaceous pockets (Glacial Till)

NOTE: Soil resistivity measurements carried out at ground level and Redox potential tests carried out at 1.50m

Logged by JAS/AAC

Fig. 90

Notes Sample positions shown on faces

Ground water: Not encountered

Ease of excavation: Easy

Variability of faces: All faces similar

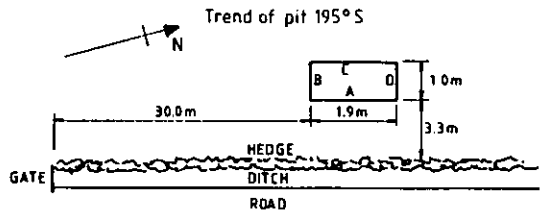
Stability of faces: STable

Weather: Fine/Frost

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample ↑ B Bulk disturbed sample ▯ U Undisturbed sample • W Water sample

Plan (Not to scale)



D3/6/85 © Soil Mechanics Limited, Bracknell, England

Soil Mechanics

TRIAL PIT No. 811

Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

Ground Level 82.39 m AOD

Coordinates 63742.0 mE 92545.0 mN

Date Dug 20.1.88 Logged 20.1.88

Carried out for
Client: Department of Transport
Engineer: Scott Wilson Kirkpatrick and Partners

Equipment & Methods
Machine dug to 2.20m by JCB 3cIII.
No support used
Logged on excavated material below 0.00m

Samples

Depth (m)	Type	No.
0.00		
0.50	B	1
	D	2
1.00	B	3
	D	4
1.20	W	6
1.50	U	5
1.60	B	7
2.20	U	8

Sketch of faces and description of strata

Material Types

a. TOPSOIL

b. Soft to firm orange brown mottled brown and grey locally slightly fine sandy in part very silty CLAY with occasional to some subrounded chert gravel and rootlets (Probable Weathered Glacial Till)

c. Firm to stiff red brown sandy CLAY with some upto cobble size chert gravel, pockets of very stiff to hard greenish grey silt/siltstone, very weak a trace of upto cobble size orange brown fine to medium slightly weathered sandstone gravel and occasional dark grey to black organic/carbonaceous pockets becoming by about 1.80m, with some cobbles of greenish grey in parts thinly laminated claystone , moderately strong and occasional upto cobble size pockets of orange brown fine to medium sand and chert gravel (Glacial Till)

Note: Soil Resistivity measurements carried out at ground level and Redox potential tests carried out at 1.50m

Notes Sample positions shown on faces

Ground water: Slight seepage from face Dat 1.20m

Stability of faces: Stable

Ease of excavation: Easy

Weather: fine

Variability of faces: All faces similar

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample | B Bulk disturbed sample □ U Undisturbed sample • W Water sample

Plan (Not to scale)

Logged by JAS/AAC

Fig. 91

D3/6/85 © Soil Mechanics Limited, Bracknell, England

Soil Mechanics

TRIAL PIT No. 812

Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

Ground Level 83.39 m AOD

Coordinates 63714.0 mE 92477.0 mN

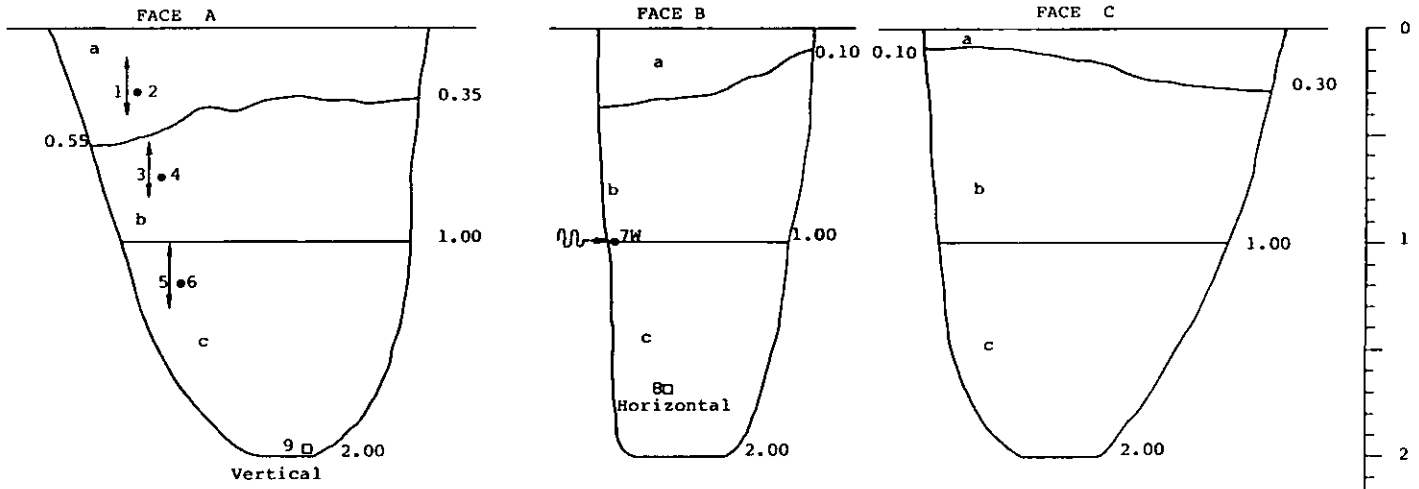
Date Dug: 20.1.88 Logged: 20.1.88

Carried out for Client: Department of Transport Engineer: Scott Wilson Kirkpatrick and Partners

Equipment & Methods Machine dug to 2.00m by JCB 3CIII No support used Logged on excavated material below 0.00m

Samples			
Depth (m)	Type	No.	
0.00			
0.30	B	1	
	D	2	
0.70	B	3	
	D	4	
1.00	W	7	
1.20	B	5	
	D	6	
1.70	U	8	
2.00	U	9	

Sketch of faces and description of strata



Material Types

a. Soft to firm red brown CLAY with some stiff greenish grey silt pockets and lenses and occasional fibrous rootlets (Made Ground)

b. Soft to firm brown locally slightly fine sandy CLAY with occasional subangular to subrounded fine to medium chert gravel and fibrous rootlets (Buried Topsoil)

c. Stiff red brown mottled orange brown locally slightly fine sandy CLAY with occasional gravel and cobbles comprising of chert (mod strong), mudstone (mod weak to mod strong) and a trace of orange brown fine to medium sandstone (mod strong); and with some very stiff locally hard greenish grey in parts thinly laminated pockets and lenses of silt/siltstone, very weak; frequent dark grey organic pockets and carbonaceous fragments (Glacial Till)

NOTE: Soil Resistivity measurements carried out at ground level and Redox potential tests carried out at 1.50m

Logged by JAS/AAC

Fig. 92

Notes Sample positions shown on faces

Ground water: Slow seepage at 1.00m from face B

Stability of faces: Slight collapse of face A at 1.00m

Ease of excavation: Easy.

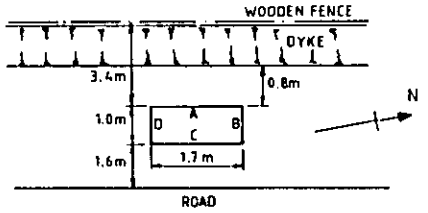
Weather: Fine

Variability of faces: Slight variation

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample ↑ B Bulk disturbed sample ○U Undisturbed sample • W Water sample

Plan (Not to scale)



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Soil Mechanics

TRIAL PIT No. 813

Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

Ground Level 82.79 m AOD

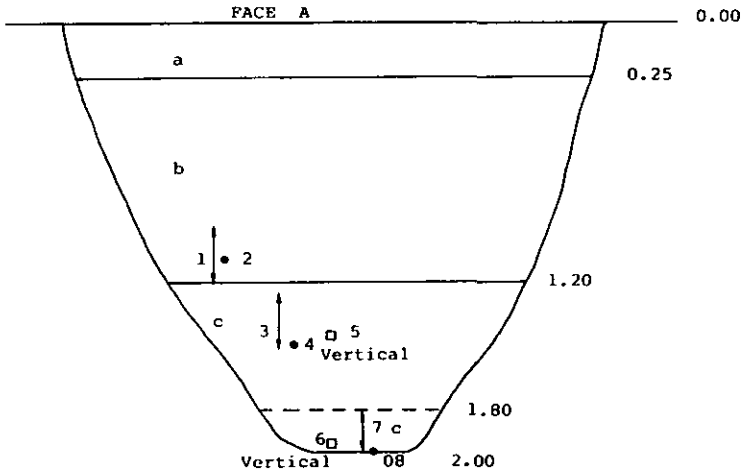
Coordinates 63731.0 mE 92479.0 mN

Date Dug: 20.1.88 Logged: 20.1.88

Carried out for Client: Department of Transport Engineer: Scott Wilson Kirkpatrick and Partners

Equipment & Methods Machine dug to 2.00m by JCB 3CIII No support used. Logged on excavated material below 0.00m

Sketch of faces and description of strata





Material types

a. TOPSOIL

b. Soft to firm orange brown mottled brown and grey locally very sandy CLAY with occasional subangular to subrounded chert gravel and fibrous rootlets (Glacial Till)

c. Firm red brown in parts mottled orange brown sandy locally very sandy CLAY with occasional up to cobble sized chert gravel, pockets of very stiff to hard greenish grey silt/siltstone, and dark grey to black organic/carbonaceous pockets.
Becoming by about 1.80m, with much up to cobble sized fragments of subrounded chert and subangular fine grained orange brown sandstone, moderately weak to moderately strong. (Clacial Till)

NOTE: Soil Resistivity measurements carried out at ground level and Redox potential tests carried out at 1.50m

Samples		
Depth (m)	Type	No.
0.00		
1.10	B	1
	D	2
1.50	B	3
	D	4
	U	5
2.00	U	6
	B	7
	D	8

Notes Sample positions shown on faces

Ground water: Not encountered

Stability of faces: Stable

Ease of excavation: Easy

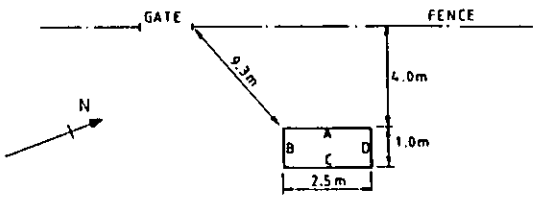
Weather: fine

Varaibility of faces: All faces similar

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample ↕ B Bulk disturbed sample □U Undisturbed sample • W Water sample

Plan (Not to scale)



Logged by JAS/AAC

Fig. 93

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Soil Mechanics

TRIAL PIT No. 814

Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

Ground Level 80.57 m AOD

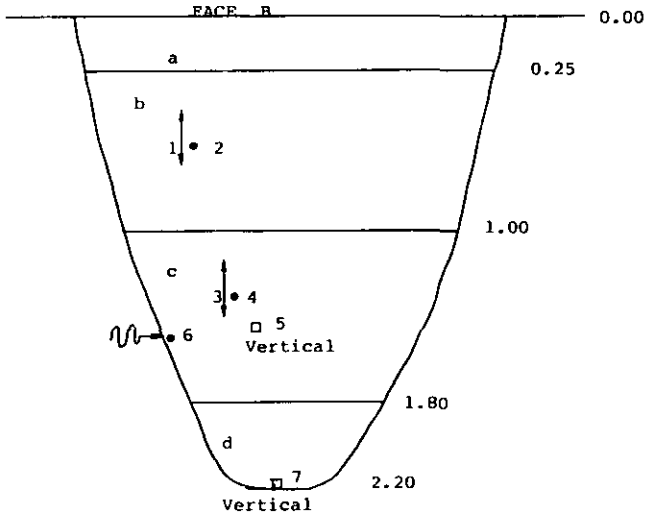
Coordinates 63849.0 mE 92493.0 mN

Date Dug: 20.1.88 Logged: 20.1.88

Carried out for Client: Department of Transport Engineer: Scott Wilson Kirkpatrick and Partners

Equipment & Methods Machine dug to 2.20m by JCB 3CIII Not support used. Logged on excavated material below 0.00m

Sketch of faces and description of strata





Samples			
Depth (m)	Type	No.	
0.00			
0.60	1	B	
	2	D	
1.30	3	B	
	4	D	
1.50	5	U	
	6	W	
2.20	7	U	

Material Types

a. TOPSOIL

b. Soft to firm orange brown mottled brown and red brown locally slightly sandy in parts very silty CLAY with some subrounded chert gravel and occasional orange brown fine sandy pockets and lenses and frequent fibrous rootlets (Probable Weathered Glacial Till)

c. Firm to stiff red brown CLAY with some chert gravel and greenish grey silt pockets and lenses; occasional up to cobble sized mudstone gravel and dark grey to black organic/carbonaceous pockets and a trace of rootlets (Possible Reworked Keuper Marl)

d. Firm to stiff red brown locally sandy CLAY with up to cobble size pockets, lenses and bands of very clayey silt/siltstone, very weak (Keuper Marl 3)

NOTE: Soil Resistivity measurements carried out at ground level and Redox potential tests carried out at 1.50m

Logged by JAS/AAC

Fig. 94

Notes Sample positions shown on faces

Ground water: Slight seepage at 1.50m

Stability of faces: Stable

Base of excavation: Easy

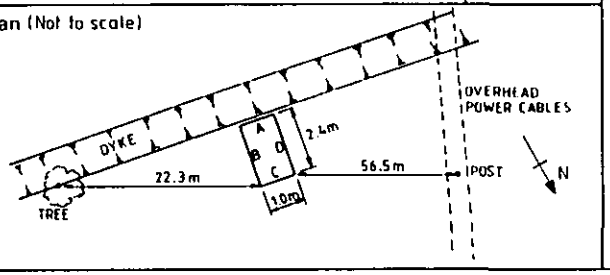
Weather: fine

Variability of faces: All faces similar

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample ⁞ B Bulk disturbed sample ▯ U Undisturbed sample • W Water sample

Plan (Not to scale)



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Soil Mechanics

TRIAL PIT No. 815

Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

Ground Level 80.28 m AOD

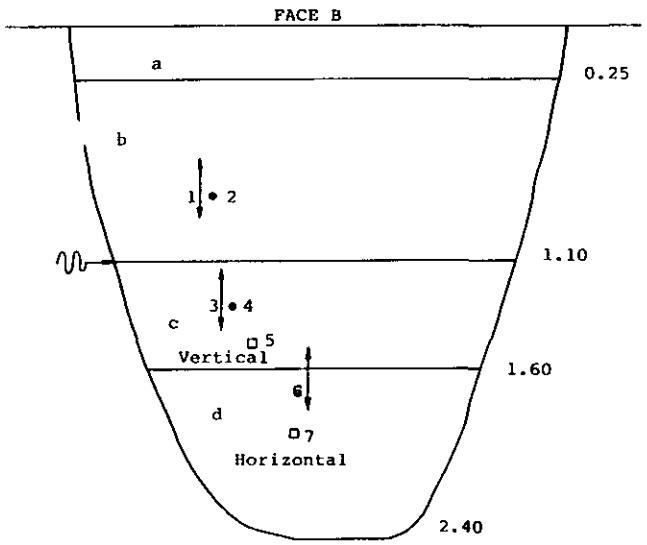
Coordinates 63869.0 mE 92484.0 mN

Date Dug: 20.1.88 Logged 20.1.88

Carried out for Client: Department of Transport Engineer: Scott Wilson Kirkpatrick and Partners

Equipment & Methods Machine dug to 2.40m by JCB 3CIII No support used. Logged on excavated material below 0.00m

Sketch of faces and description of strata





Samples			
Depth (m)	Type	No.
0.00		
0.80	B	1
	D	2
1.30	B	3
	D	4
1.50	U	5
1.60	B	6
1.95	U	7

Material Types

a. TOPSOIL

b. Firm orange brown mottled brown and grey locally sandy in parts very sandy CLAY with some becoming much up to cobble sized chert gravel and a trace of up to cobble sized fine to medium orange brown sandstone, modurately weak. (Glacial Till)

c. Firm to stiff red brown CLAY with some up to cobble sized pockets of very stiff locally hard greenish grey silt/siltstone, weak, occasional chert gravel and a trace of orange brown fine to medium sandstone gravel, moderately strong (Probable Reworked Keuper Marl)

d. Firm to stiff with up to cobble sized pockets of orange brown fine to medium sand with some to much up to cobble sized pockets of very stiff locally hard greenish grey in parts thinly laminated silt/siltstone, weak. (Keuper Marl 3)

NOTE: Soil Resistivity measurements carried out at ground level and Redox potential tests carried out at 1.50m

Logged by JAS/AAc

Fig. 95

Notes Sample positions shown on faces

Ground water: Damp at 1.50m (slight seepage from corner C/D at 1.10m)

Ease of excavation: Easy

Stability of faces: Slight collapse on face D to 1.50m

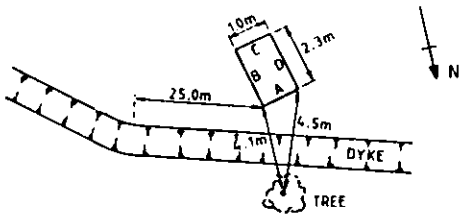
Variability of faces: All faces similar

Weather: fine

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample ⌈ B Bulk disturbed sample □ U Undisturbed sample • W Water sample

Plan (Not to scale)



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Soil Mechanics

TRIAL PIT No. 816

Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

Ground Level 62.93 m AOD

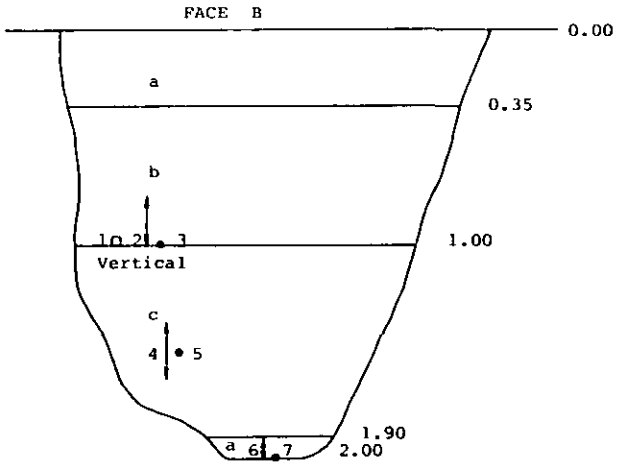
Coordinates 64723.0 mE 92765.0 mN

Date Dug: 22.1.88 Logged: 22.1.88

Equipment & Methods
Machine dug to 2.00m by JCB 3CX
No support used
Logged on excavated material below 0.00m

Carried out for
Client: Department of Transport
Engineer: Scott Wilson Kirkpatrick and Partners

Sketch of faces and description of strata



Depth below ground level (m)

Depth (m)	Type	No.
1.00	U	1
	B	2
	D	3
1.50	B	4
	D	5
2.00	B	6
	D	7

Material Types

a. TOPSOIL

b. Firm red brown mottled orange brown and grey CLAY with frequent roots and plant remains (Probable Alluvium)

c. Soft to firm grey brown slightly fine sandy becoming sandy very silty CLAY with occasional dark grey organic pockets, frequent subvertical brown fibrous rootlets, a trace of up to cobble sized chert gravel; organic odour. (Probable Alluvium)

d. Stiff red brown CLAY with some to much red brown mudstone, weak and occasional chert gravel; brown fibrous rootlets. (Probable Reworked Keuper Marl)

NOTE: Soil Resistivity measurements carried out at ground level and Redox potentional tests carried out at 1.50m

Logged by JAS/AAC

Fig. 96

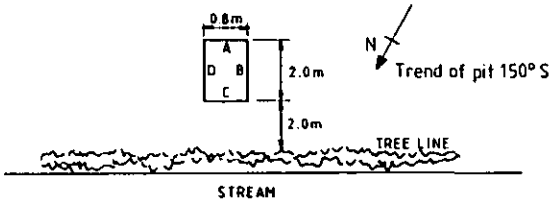
Notes Sample positions shown on faces

Ground water: Not encountered
Stability of faces: Stable
Ease of excavation: Easy
Weather: Snow
Variability of faces: All fased similar

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample [B Bulk disturbed sample □ U Undisturbed sample • W Water sample

Plan (Not to scale)



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Soil Mechanics

TRIAL PIT No. 817 — Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

Ground Level 64.30m AOD

Coordinates 64648.0 mE 92690.0 mN

Date Dug: 22.1.88 Logged: 22.1.88

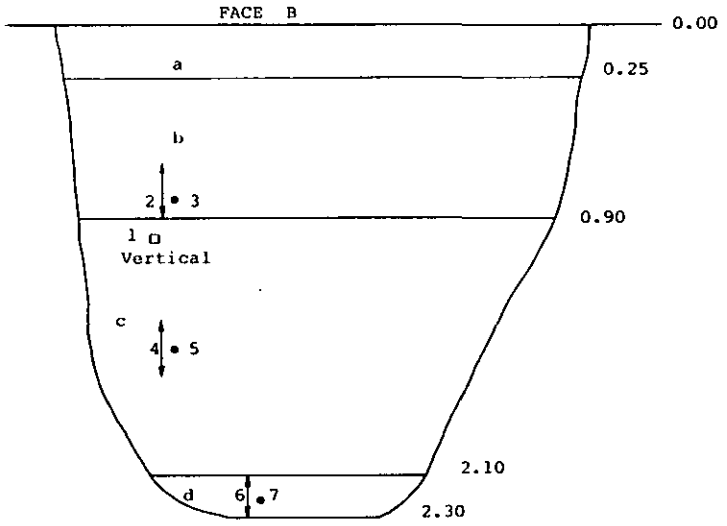
Carried out for
Client: Department of Transport
Engineer: Scott Wilson Kirkpatrick and Partners

Equipment & Methods
Machine dug to 2.30m by JCB JCX
No support used.
Logged on excavated material below 0.00m

Samples

Depth (m)	Type	No.
0.00		
0.80	B	2
	D	3
1.00	U	1
1.50	B	4
	D	5
2.20	B	6
	D	7

Sketch of faces and description of strata





Material Types

a. TOPSOIL

b. Firm red brown mottled orange brown and grey CLAY with frequent rootlets and plant remains (Probable Alluvium)

c. Soft to firm grey brown slightly fine sandy becoming sandy very silty CLAY with occasional greenish grey very clayey silt pockets, dark grey organic pockets, a trace of up to cobble size chert gravel, rootlets and organic odour. (Probable Alluvium)

d. Stiff red brown CLAY with some to much mudstone and occasional chert gravel; brown fibrous rootlets. (Probable Reworked Keuper Marl)

Note: Soil Resistivity measurements carried out at ground level and Redox potential tests carried out at 1.50m

Logged by JAS/AAC

Fig. 97

Notes Sample positions shown on faces

Ground water: Not encountered

Stability of faces: Stable

Ease of excavation: Easy

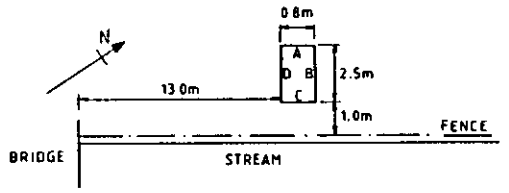
Weather: Snow

Variability of faces: All faces similar

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample ⟨ B Bulk disturbed sample □ U Undisturbed sample • W Water sample

Plan (Not to scale)



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Soil Mechanics

TRIAL PIT No. 818

Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH
Ground Investigation Contract 4

Ground Level 57.95m AOD

Coordinates 65209.0 mE
93049.0 mN

Date Dug: 23.1.88
Logged 23.1.88

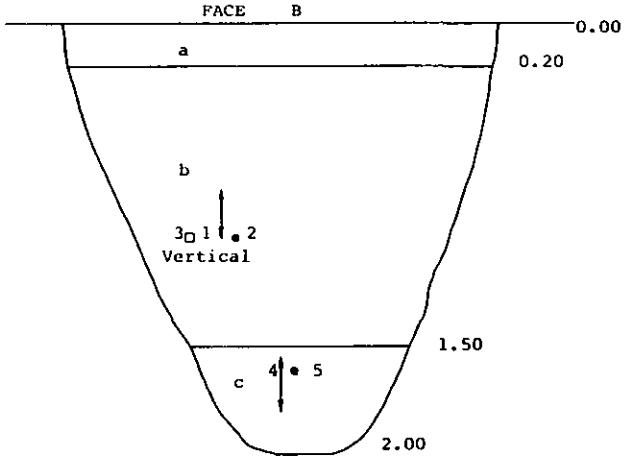
Carried out for
Client: Department of Transport
Engineer: Scott Wilson Kirkpatrick and Partners

Equipment & Methods
Machine dug to 2.00m by JCB 3CX
No support used
Logged on excavated material below 0.00m

Samples

Depth (m)	Type	No.
0.00		
1.00	B	1
	D	2
	U	3
1.60	B	4
	D	5

Sketch of faces and description of strata



Depth below ground level (m)

0
1
2

Material Types

a. TOPSOIL

b. Firm to stiff red brown with occasional grey gleying locally slightly fine sandy CLAY with frequent rootlets and a trace of fine to medium chert gravel (Probable Alluvium)

c. Firm grey to grey brown in parts orange brown becoming sandy CLAY with occasional up to cobble size chert gravel and rootlets (Probable Alluvium)

NOTE: Soil Resistivity measurements carried out at ground level and Redox potential tests carried out at 1.80m

Logged by JAS/AAC

Fig. 98

Notes Sample positions shown on faces

Ground water: Not encountered

Stability of faces: Stable

Ease of excavation: Easy

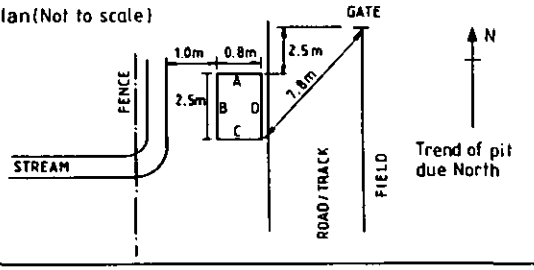
Weather: Fine

Variability of faces: All faces similar

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample ⁞ B Bulk disturbed sample □ U Undisturbed sample • W Water sample

Plan (Not to scale)



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Soil Mechanics

TRIAL PIT No. 819 — Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

Ground Level 56.08 m AOD

Coordinates 65257.0 mE 93072.0 mN

Date Dug: 22.1.88 Logged: 22.1.88

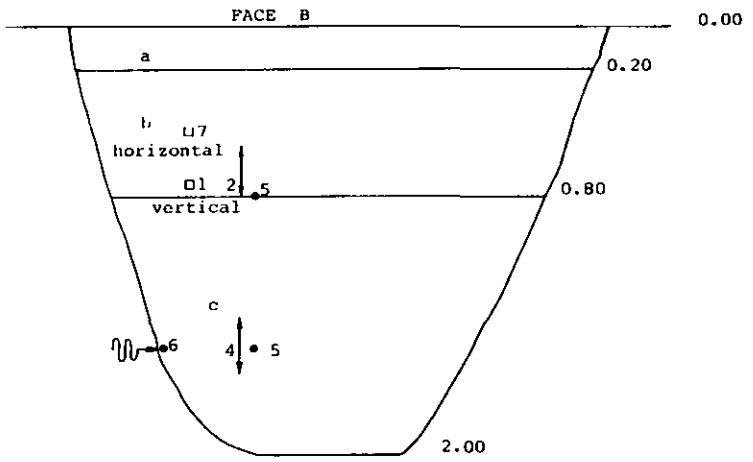
Carried out for Client: Department of Transport Engineer: Scott Wilson Kirkpatrick and Partners

Equipment & Methods: Machine dug to 2.00m by JCB 3CX. No support used. Logged on excavated material below 0.00m

Samples

Depth (m)	Type	No.
0.00		
0.50	U	7
0.75	U	1
0.80	B	2
	D	3
1.30	B	4
	D	5
	W	6

Sketch of faces and description of strata



Depth below ground level (m): 0, 1, 2

Material Types

a. TOPSOIL

b. Firm orange brown mottled brown and grey locally sandy in parts very silty CLAY with some gravel composed of chert and mudstone, and occasional dark grey organic pockets and rootlets (Probable Alluvium)

c. Firm to stiff locally hard red brown CLAY with occasional very stiff to hard grey green pockets of silt/siltstone, weak and dark grey organic pockets and timber fragments. Becoming by about 1.90m, in parts green grey slightly fine sandy with some grey green pockets of silt/siltstone, weak. (Probable Reworked Keuper Marl)

NOTE: Soil Resistivity measurements carried out at ground level and Redox potential tests carried out at 1.50m

Logged by JAS/AAC

Fig. 99

Notes Sample positions shown on faces

Ground water: Slight seepage at 1.50m

Stability of faces: Stable

Ease of excavation: Easy

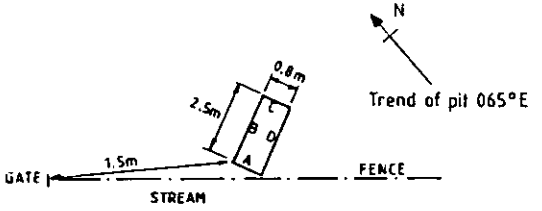
Weather: Snow/cold

Variability of faces: All faces similar

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample | B Bulk disturbed sample □ U Undisturbed sample • W Water sample

Plan (Not to scale)



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Soil Mechanics

TRIAL PIT No. 820

Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

Ground Level 55.76 m AOD

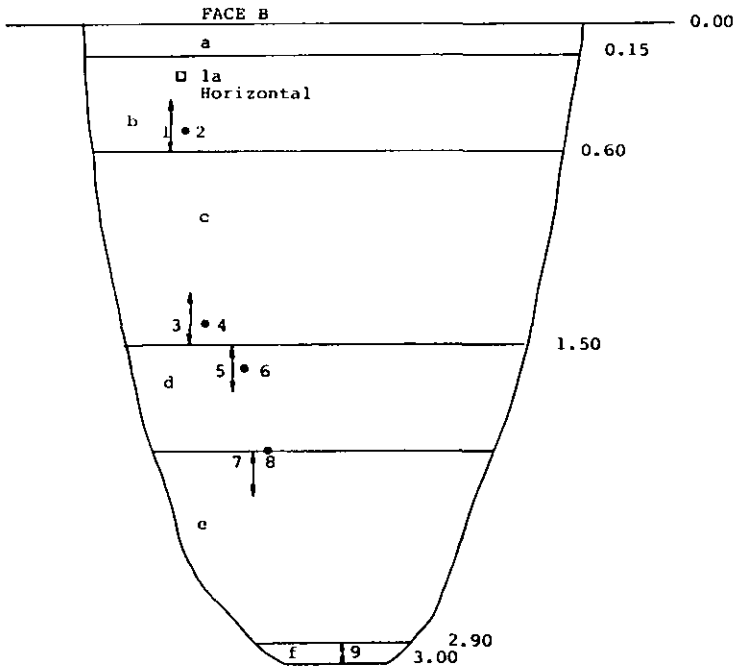
Coordinates 65416.0 mE 93034.0 mN

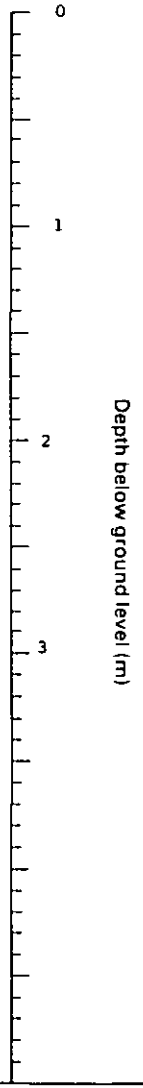
Date Dug: 22.1.88 Logged: 22.1.88

Carried out for Client: Department of Transport Engineer: Scott Wilson Kirkpatrick and Partners

Equipment & Methods Machine dug to 3.00m by JCB 2CX No support used. Logged on excavated material below 0.00m

Sketch of faces and description of strata





Samples			
Depth (m)	Type	No.	
0.00			
0.25	U	1a	
0.50	B	1	
	D	2	
1.40	B	3	
	D	4	
1.60	B	5	
	D	6	
2.00	B	7	
	D	8	
3.00	B	9	

Material Types

a. TOPSOIL

b. Firm brown to red brown CLAY with frequent rootlets and plant remains and occasional dark grey organic pockets (Probable Alluvium)

c. Soft grey and brown to grey brown organic CLAY with occasional fibrous rootlets and organic odour (Probable Alluvium)

d. Subangular to subrounded chert GRAVEL in a brown clayey sand matrix with occasional pockets of red brown and grey brown clay.

e. Subangular to subrounded chert GRAVEL in a orange brown very sandy clay matrix

f. Stiff in parts very stiff red brown mottled green grey locally fine sandy CLAY with some grey green siltstone gravel, moderately weak, and occasional chert gravel. (Probable Reworked Keuper Marl)

NOTE: Soil Resistivity measurements carried out at ground level and Redox potential tests carried out at 1.50m

Logged by JAS/AAC

Fig. 100

Notes Sample positions shown on faces

Ground water: Wet at 1.50m

Stability of faces: Collapse at 1.70m to base on face B

Ease of excavation: Easy

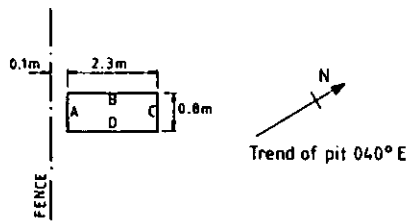
Weather: Fine

Variability of faces: All faces similar

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample | B Bulk disturbed sample ▯ U Undisturbed sample • W Water sample

Plan (Not to scale)



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Soil Mechanics

TRIAL PIT No. 821

Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH GORUND INVESTIGATION CONTRACT 4

Ground Level 48.12 m AOD

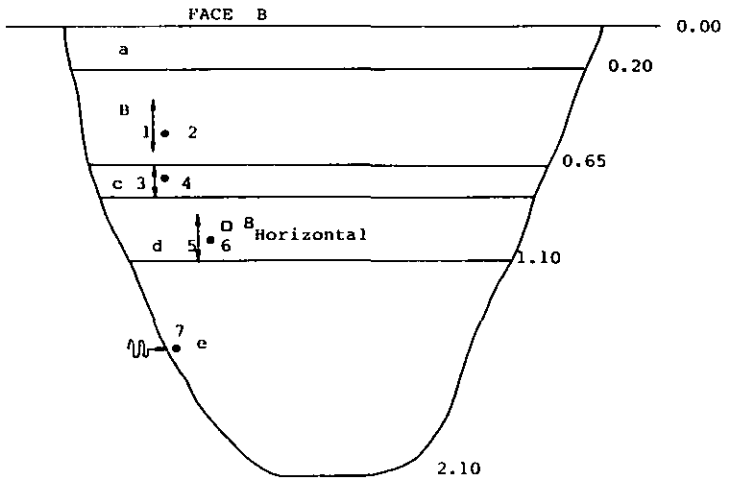
Coordinates 66665.0 mE 93800.0 mN

Date Dug: 23.1.88 Logged: 23.1.88

Carried out for Client: Department of Transport Engineer: Scott Wilson Kirkpatrick and Partners

Equipment & Methods
Machine dug to 2.10m by JCB 3CX
No support used
Logged on excavated material below 0.00m

Sketch of faces and description of strata



Depth below ground level (m)

0
1
2

Samples		
Depth (m)	Type	No.
0.00		
0.50	B	1
	D	2
0.70	B	3
	D	4
0.95	U	8
1.00	B	5
	D	6
1.50	W	7

Material Types

a. TOPSOIL

b. Firm to stiff orange brown in parts red brown slightly fine sandy CLAY with frequent rootlets (Probable Alluvium)

c. Soft grey organic CLAY with some dark grey to black carbonaceous timber fragments and pockets; a trace of mudstone gravel and organic odour. (Probable Alluvium)

d. Firm orange brown to red brown fine to medium very sandy CLAY with much sub-angular to sub-rounded gravel comprising chert, quartz and mudstone (Glacial Till)

e. Firm to stiff red brown CLAY with frequent lithorelics (80% <1cm ⌀) (Keuper Marl 4a)

NOTE: Soil Resistivity measurements carried out at ground level and Redox potential tests carried out at 1.50m

Logged by JAS/AAC

Fig. 101

Notes Sample positions shown on faces

Ground water: Seepage at 1.50m

Stability of faces: Stable

Ease of excavation: Easy

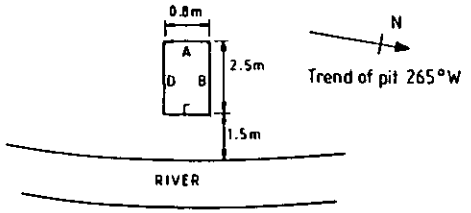
Weather: Overcast/Rain

Variability of faces: All faces similar

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample ⟊ B Bulk disturbed sample ▯ U Undisturbed sample • W Water sample

Plan (Not to scale)



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Soil Mechanics

TRIAL PIT No. 822

Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH
GROUND INVESTIGATION CONTRACT 4

Ground Level 48.22 m AOD

Coordinates 66660.0 mE
93773.0 mN

Date Dug: 23.1.88
Logged: 23.1.88

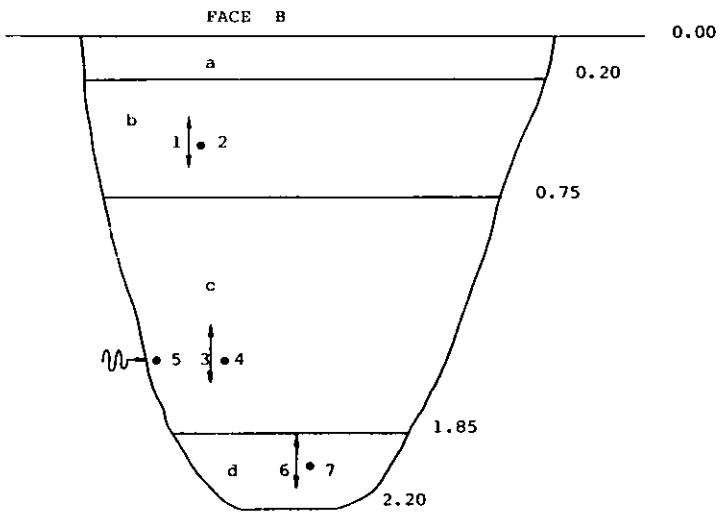
Carried out for
Client: Department of Transport
Engineer: Scott Wilson Kirkpatrick and Partners

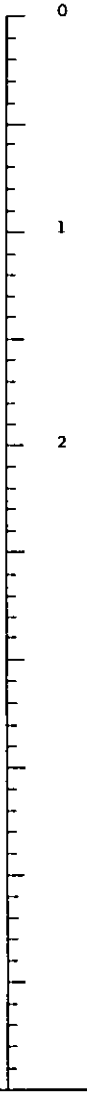
Equipment & Methods
Machine dug to 2.20m by JCB 3CX
No support used
Logged on excavated material below 0.00m

Samples

Depth (m)	Type	No.
0.00		
0.50	B	1
	D	2
1.50	B	3
	D	4
	W	5
2.00	B	6
	D	7

Sketch of faces and description of strata





Material Types

a. TOPSOIL
b. Firm to stiff brown in parts red brown slightly fine sandy CLAY with frequent brown fibrous rootlets (Probable Alluvium)
c. Firm orange brown to red brown fine to medium very sandy CLAY with much sub-angular to sub-rounded gravel comprising chert, quartz and mudstone (Glacial Till)
d. Firm to stiff red brown CLAY wiht frequent lithorelics (80% < 1cmØ) (Keuper Marl 4a)

NOTE: Soil Resistivity measurements carried out at ground level and Redox potential tests carried out at 1.50m

Logged by JAS/AAC

Fig. 102

Notes Sample positions shown on faces

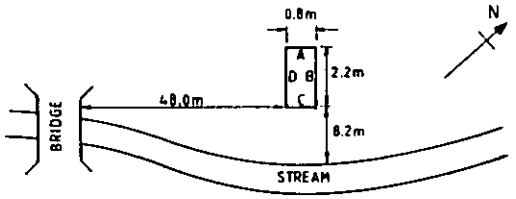
Ground water: Seepage at 1.50m
Ease of excavation: Easy
Variability of faces: All faces similar

Stability of faces: Stable
Weather: Overcast/Rain

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample ⌈ B Bulk disturbed sample ⊔ U Undisturbed sample • W Water sample

Plan (Not to scale)



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Soil Mechanics

TRIAL PIT No. 823

Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

Ground Level 49.70 m AOD

Coordinates 66505.0 mE 94009.0 mN

Date Dug: 22.1.88 Logged: 23.1.88

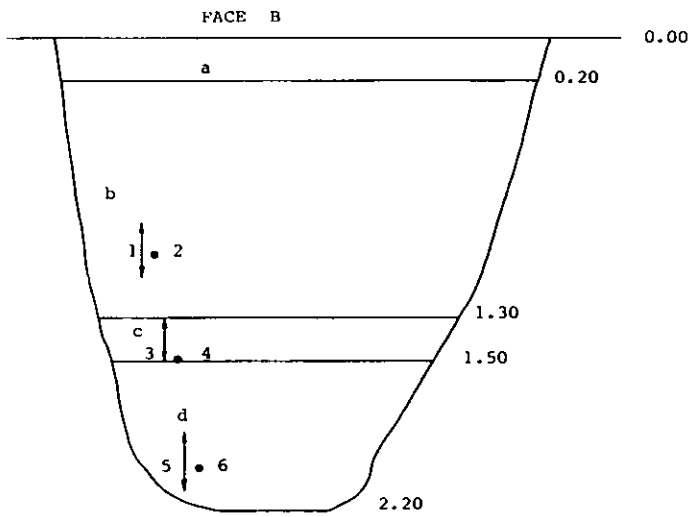
Carried out for
Client: Department of Transport
Engineer: Scott Wilson Kirkpatrick and Partners

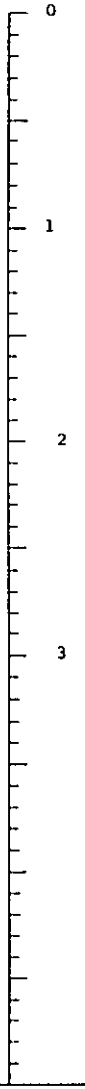
Equipment & Methods
Machine dug to 2.20m by JCB 3CX
No support used
Logged on excavated material below 0.00m

Samples

Depth (m)	Type	No.
0.00		
1.00	B	1
	D	2
1.50	B	3
	D	4
2.00	B	5
	D	6

Sketch of faces and description of strata





Material Types

a. TOPSOIL

b. Firm to stiff brown in parts red brown slightly fine sandy CLAY with frequent rootlets (Probable Alluvium)

c. Soft to firm orange brown to grey brown locally sandy CLAY with occasional dark grey organic pockets, carbonaceous fragments and chert gravel (Probable Alluvium)

d. Firm to stiff orange brown to red brown locally sandy CLAY with some chert gravel, occasional green grey silt pockets and lenses and brown fibrous rootlets (Probable Reworked Keuper Marl)

NOTE: Soil Resistivity measurements carried out at ground level and Redox potential tests carried out 1.50m

Logged by JAS/AAC

Fig. 103

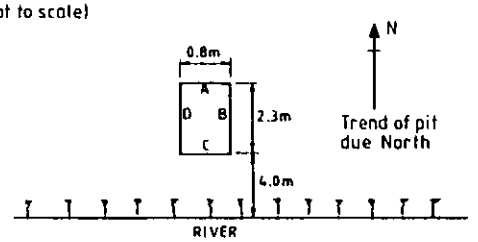
Notes Sample positions shown on faces

Ground water: Not encountered
Stability of faces: Stable
Ease of excavation: Easy
Weather: Overcast/Rain
Variability of faces: All faces similar

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample | B Bulk disturbed sample ⊓ U Undisturbed sample • W Water sample

Plan (Not to scale)



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Soil Mechanics

TRIAL PIT No. 824

Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

Ground Level 49.45 m AOD

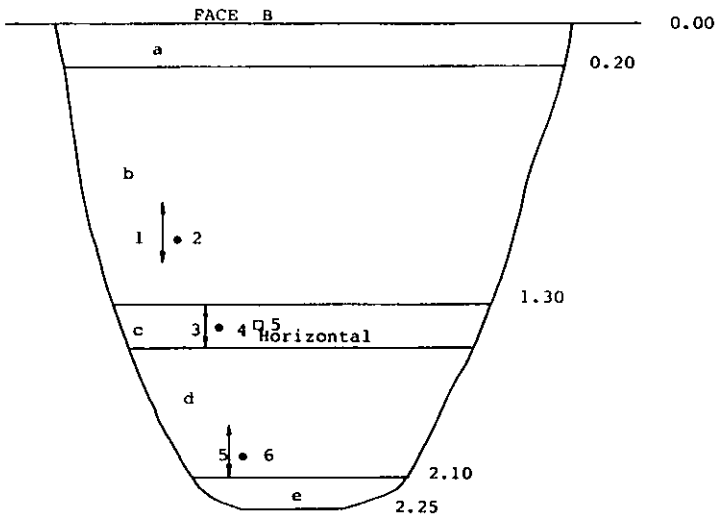
Coordinates 66 556.0 mE 94065.0 mN

Date Dug: 23.1.88 Logged: 23.1.88

Carried out for Client: Department of Transport Engineer: Scott Wilson Kirkpatrick and Partners

Equipment & Methods Machine dug to 2.25m by JCB 3CX No support used Logged on excavated material below 0.00m

Sketch of faces and description of strata





Samples			
Depth (m)	Type	No.	
0.00			
1.00	B	1	
	D	2	
1.40	B	3	
	D	4	
	U	7	
2.00	B	5	
	D	6	

Material Types

a. TOPSOIL

b. Firm brown in parts red brown locally friable and fine sandy CLAY with frequent rootlets and occasional gravel (Probable Alluvium)

c. Soft brown to grey brown locally sandy CLAY wiht occasional dark grey organic pockets, carbonaceous fragments and chert gravel (Probable Alluvium)

d. Firm orange brown to red brown locally very sandy CLAY with much to and GRAVEL comprising chert, sandstone and siltstone. occasional green grey silt pockets and lenses and brown fibrous rootlets (Probable Reworked Keuper Marl)

e. Stiff red brown locally green grey fissured CLAY with much chert gravel (Probable Reworked Keuper Marl)

NOTE: Soil Resistivity measurements carried out at ground level and Redox potential tests carried out at 1.50m

Logged by JAS/AAC

Fig. 104

Notes Sample positions shown on faces

Ground water: Not encountered

Stability of faces: Stable

Ease of excavation: Easy

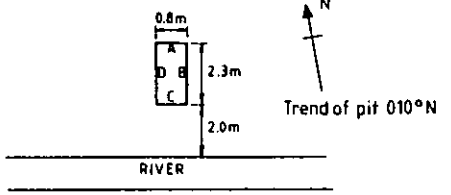
Weather: Overcast/Rain

Variability of faces: All faces similar

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample ‡ B Bulk disturbed sample ▯ U Undisturbed sample • W Water sample

Plan (Not to scale)



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Soil Mechanics

TRIAL PIT No. 825 — Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

Ground Level 72.57 m AOD

Coordinates 67044.0 mE 95719.0 mN

Date Dug: 23.1.88 Logged: 23.1.88

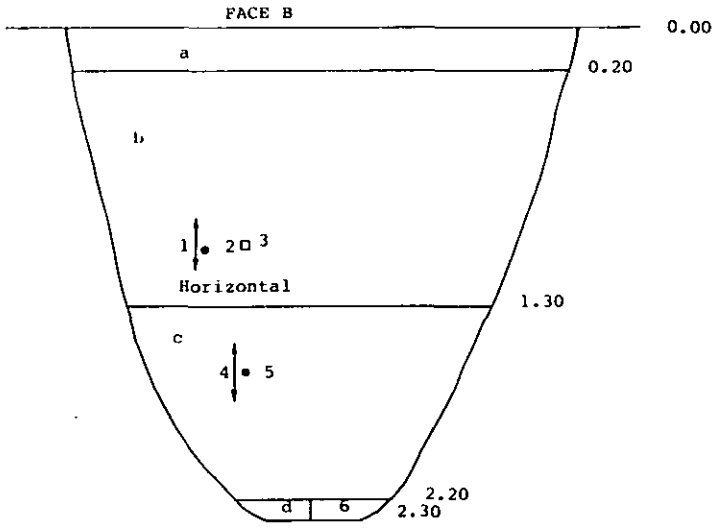
Carried out for
Client: Department of Transport
Engineer: Scott Wilson Kirkpatrick and Partners

Equipment & Methods
Machine dug to 2.30m by JCB 3CX
No support used
Logged on excavated material below 0.00m

Samples

Depth (m)	Type	No.
0.00		
1.05	U	3
1.05	B	1
	D	2
1.60	B	4
	D	5
2.30	B	6

Sketch of faces and description of strata



Depth below ground level (m)

0 1 2 3

Material Types

a. TOPSOIL

b. Soft to firm red brown mottled orange brown locally slightly fine sandy CLAY with occasional dark grey organic pockets, rootlets and gravel (Possible Glacial Till)

c. Firm to stiff red brown mottled green grey locally slightly fine sandy CLAY in parts mudstone, weak with frequent lithorelics and occasional fibrous rootlets. (Keuper Marl 3)

d. Greenish grey in parts thinly laminated SILTSTONE, moderately weak to moderately strong (Keuper Marl 1/2)

NOTE: Soil Resistivity measurements carried out at ground level and Redox potential tests carried out at 1.40m

Logged by JAS/AAC

Fig. 105

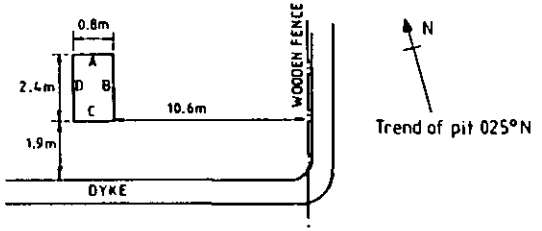
Notes Sample positions shown on faces

Ground water: Not encountered
Stability of faces: Stable
Ease of excavation: Easy
Weather: Overcast
Variability of faces: All faces similar

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample] B Bulk disturbed sample ⊡ U Undisturbed sample • W Water sample

Plan (Not to scale)



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Soil Mechanics

TRIAL PIT No. 826

Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

Ground Level 71.27 m AOD

Coordinates 67094.0 mE 95709.0 mN

Date Dug 23.1.88 Logged: 23.1.88

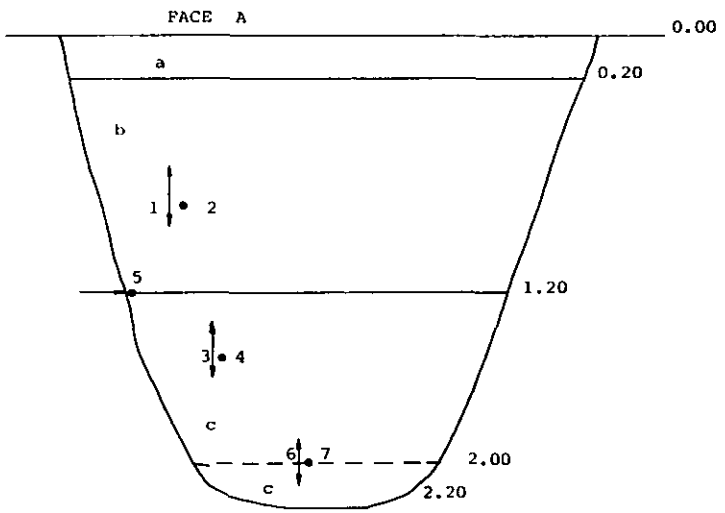
Equipment & Methods
Machine dug to 2.20m by JCB 3CX
No support used
Logged on excavated material below 0.00m

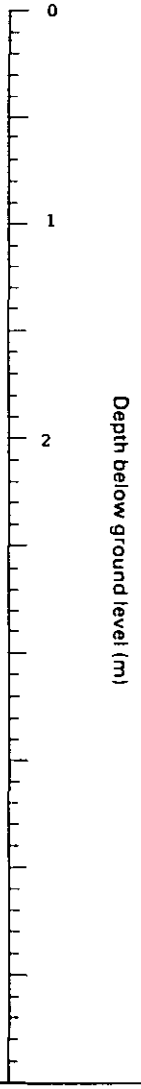
Carried out for
Client: Department of Transport
Engineer: Scott Wilson Kirkpatrick and Partners

Samples

Depth (m)	Type	No.
0.00		
0.80	B	1
	D	2
1.20	W	5
1.50	B	3
	D	4
2.00	B	6
	D	7

Sketch of faces and description of strata





Material Types

a. TOPSOIL

b. Firm red brown mottled orange brown locally slightly fine sandy CLAY with occasional dark grey organic pockets and rootlets (Possible Glacial Till)

c. Firm to stiff red brown locally slightly fine sandy CLAY with occasional fine chert gravel, dark grey organic pockets and fibrous rootlets becoming by about 2.00m, with some pockets of very stiff locally hard green grey silt pockets and lenses, (Possible Reworked Keuper Marl)

NOTE: Soil Resistivity measurements carried out at ground level and Redox potential tests carried out at 1.50m

Logged by JAS/AAC

Fig. 106

Notes Sample positions shown on faces

Ground water: Water entry at 1.20m from face A

Stability of faces: Collapse of face A

Ease of excavation: Easy

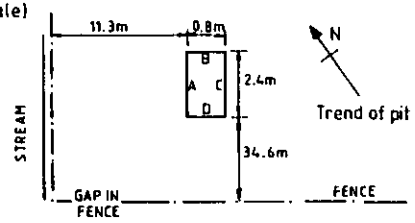
Weather: Fine

Variability of faces: All faces similar

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample | B Bulk disturbed sample ◻ U Undisturbed sample • W Water sample

Plan (Not to scale)



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Soil Mechanics

TRIAL PIT No. 827 — Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

Ground Level 89.66 m AOD

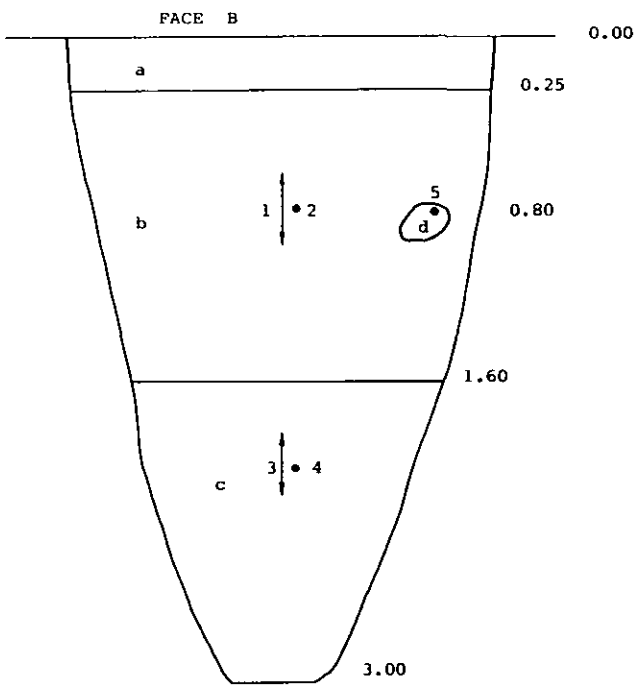
Coordinates 63447.0 mE 92473.0 mN

Date Dug: 18.1.88 Logged: 18.1.88

Equipment & Methods
Machine dug to 3.00m by JCB 3CX
No support used
Logged on excavated material below 0.00m

Carried out for
Client: Department of Transport
Engineer: Scott Wilson Kirkpatrick and Partners

Sketch of faces and description of strata



Depth below ground level (m)

Samples Depth (m)	Type	No.
0.00		
0.80	D	5
0.90	B	1
	D	2
2.00	B	3
	D	4

Material Types

a. TOPSOIL

b. Firm to stiff orange brown locally grey CLAY with up to cobble sized pockets of orange brown clayey sand and occasional fine to medium gravel composed of quartz and chalk, and with rootlets (Glacial Till)

c. Very stiff grey mottled brown CLAY with some subangular to subrounded gravel composed of chert, chalk and sandstone; occasional dark grey organic/carbonaceous pockets and brown amorphous rootlets (Glacial Till)

d. 'Loose' orange brown fine to medium slightly clayey SAND

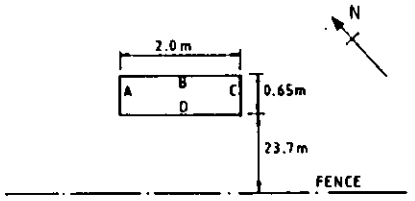
Notes Sample positions shown on faces

Ground water: Not encountered
Stability of faces: Stable
Ease of excavation: Easy
Weather: Overcast
Variability of faces: All faces similar

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample ⌇ B Bulk disturbed sample ▯ U Undisturbed sample • W Water sample

Plan (Not to scale)



Logged by JAS/AAC

Fig. 107

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Soil Mechanics

TRIAL PIT No. 828

Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT

Ground Level 86.99 m AOD

Coordinates 63499.0 mE 92522.0 mN

Date Dug: 18.1.88 Logged: 18.1.88

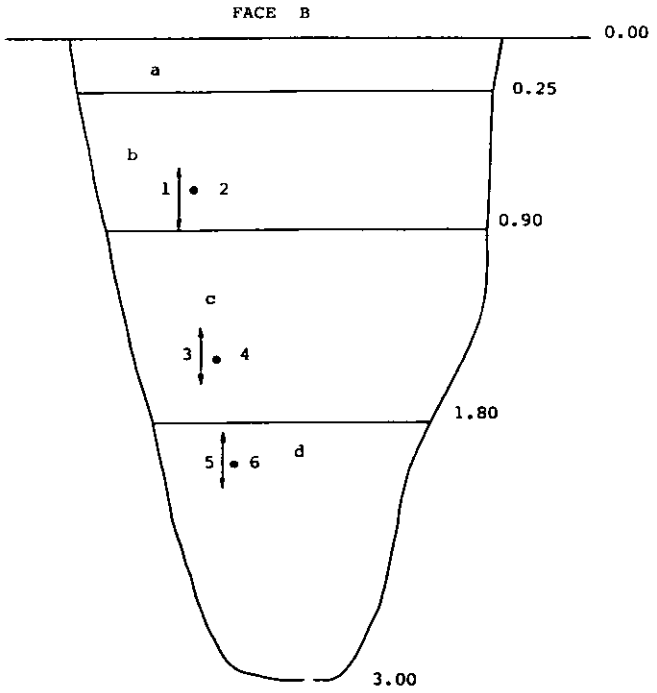
Equipment & Methods
Machine dug to 3.00m by JCB 3CX
No support used
Logged on excavated material below 0.00m

Carried out for
Client: Department of Transport
Engineer: Scott Wilson Kirkpatrick and Partners

Samples

Depth (m)	Type	No.
0.00		
0.80	B	1
	D	2
1.50	B	3
	D	4
2.00	B	5
	D	6

Sketch of faces and description of strata



Depth below ground level (m)

0 1 2 3

Material Types

a. TOPSOIL

b. Firm orange brown mottled grey brown locally fine sandy very silty friable CLAY with occasional dark grey to black organic/carbonaceous pockets, occasional fine chert gravel and up to cobble sized fragments of sandstone (Glacial Till)

c. Stiff orange brown mottled grey locally slightly fine sandy CLAY with a trace to occasional fine chert gravel (Glacial Till)

d. Stiff reddish brown friable CLAY with occasional mudstone and siltstone litlorelics, occasional to some chert gravel and occasional pockets of greenish grey in parts thinly liminated silt and clay : occasional dark grey to black carbonaceous fragments (Possible Reworked Keuper Marl)

Logged by JAS/AAC

Fig. 108

Notes Sample positions shown on faces

Ground water: Not encountered

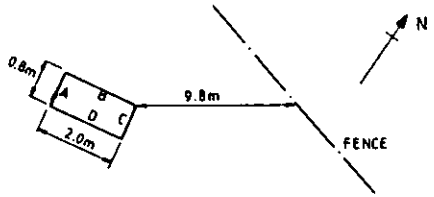
Stability of faces: Stable

Ease of excavation: Easy

Weather: Overcast

Variability of faces: All faces similar

Plan (Not to scale)



Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample | B Bulk disturbed sample ⁞U Undisturbed sample • W Water sample

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Soil Mechanics

TRIAL PIT No. 829

Sheet 1 of 1

Equipment & Methods
Machine dug to 3.00m by JCB 3CX
No support used
Logged on excavated material below 0.00m

Location No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

Ground Level 86.90m AOD

Coordinates 63529.0 mE 92470.0 mN

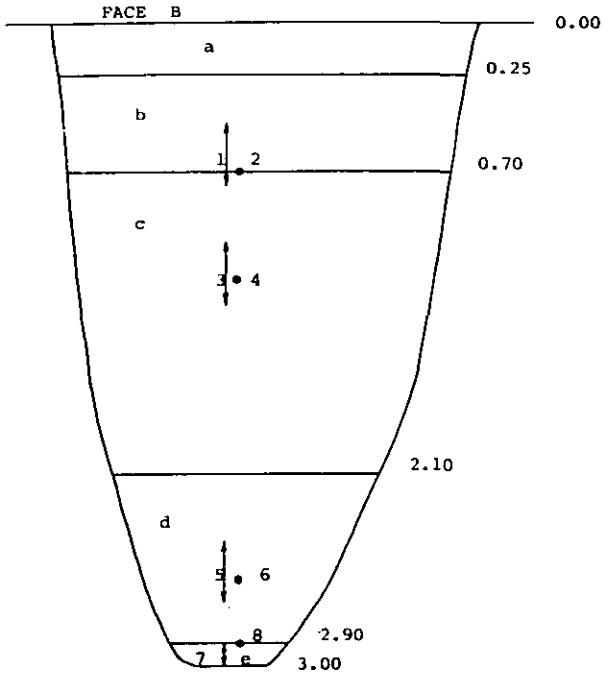
Date Dug 18.1.88 Logged 18.1.88

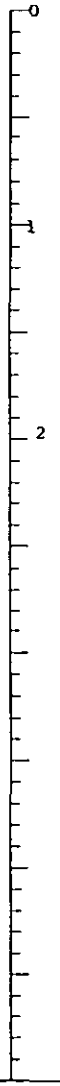
Carried out for
Client: Department of Transport
Engineer: Scott Wilson Kirkpatrick and Partners

Samples

Depth (m)	Type	No.
0.00		
0.70	B	1
	D	2
1.20	B	3
	D	4
2.60	B	5
	D	6
2.90	B	7
	D	8

Sketch of faces and description of strata





Depth below ground level (m)

Material Types

a. TOPSOIL

b. Firm to stiff orange brown mottled grey brown locally fine sandy CLAY with occasional chert gravel, a trace of dark grey organic pockets (<60mm), occasional rootlets and carbonaceous fragments (Glacial Till)

c. Stiff dark brown mottled light grey CLAY with some gravel composed of chert, chalk and a trace of orange brown fine sandstone; with occasional greenish grey very clayey silt pockets partings and lenses and dark grey to black carbonaceous fragments (Glacial Till)

d. Very stiff reddish brown in parts grey CLAY with mudstone/siltstone lithorelics and occasional fine to medium chert and chalk gravel; some inclusions of sand containing carbonaceous fragments (Probable Reworked Keuper Marl)

e. Very stiff (hard) reddish brown fine sandy CLAY with some fine to medium chert gravel (Probable Reworked Keuper Marl)

Logged by JAS/AAC

Fig. 109

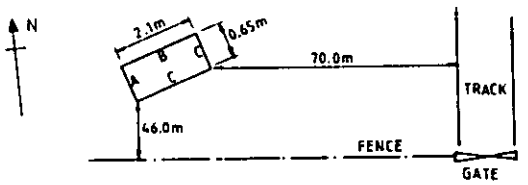
Notes Sample positions shown on faces

Ground water: Not enocountered
Stability of faces: Stable
Ease of excavation: Easy
Weather: Overcast
Variabilityof faces: All faces similar

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample ↑ B Bulk disturbed sample ⊓ U Undisturbed sample • W Water sample

Plan (Not to scale)



D3/6'85 © Soil Mechanics Limited, Bracknell, England

Soil Mechanics

TRIAL PIT No. 830

Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

Ground Level 82.02 m AOD

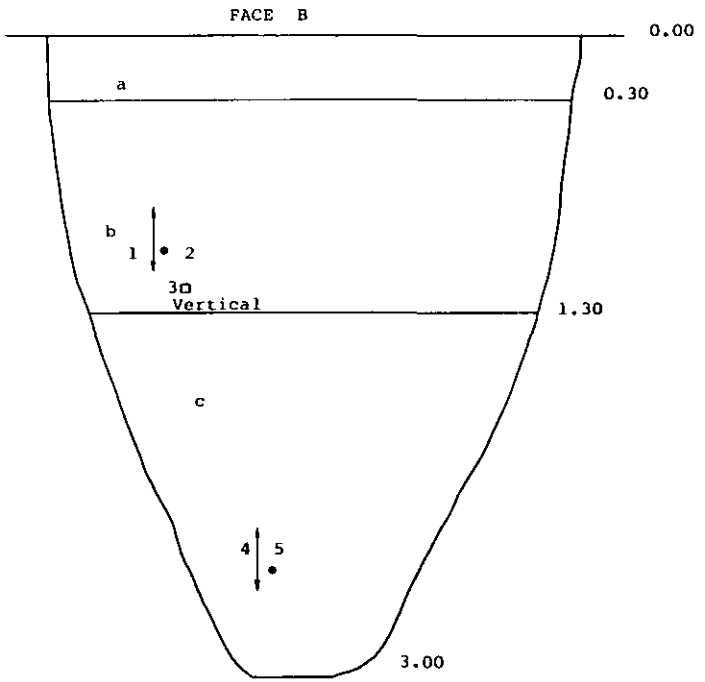
Coordinates 63588.0 mE 92527.0 mN

Date Dug: 24.1.88 Logged: 24.1.88

Carried out for
Client: Department of Transport
Engineer: Scott Wilson Kirkpatrick and Partners

Equipment & Methods
Machine dug to 3.00 m by JCB 3CX
No support used
Logged on excavated material below 0.00m

Sketch of faces and description of strata



Samples			
Depth (m)	Type	No.	
0.00			
1.00	B	1	
	D	2	
1.20	U	3	
2.50	B	4	
	D	5	

Depth below ground level (m)

0 1 2 3

Material Types

a. TOPSOIL

b. Firm to stiff orange brown mottled brown and grey in parts slightly fine sandy becoming sandy CLAY with occasional dark grey organic pockets and fibrous rootlets (Glacial Till)

c. Stiff red brown locally green grey in parts fine sandy CLAY with occasional chert gravel and pockets of very stiff to hard green grey silt/siltstone, moderately weak, and up to coarse gravel size dark grey/black carbonaceous pockets (Possible Reworked Keuper Marl)

Logged by JAS

Fig. 110

Notes Sample positions shown on faces

Ground water: Not encountered

Stability of faces: Stable

Ease of excavation: Easy

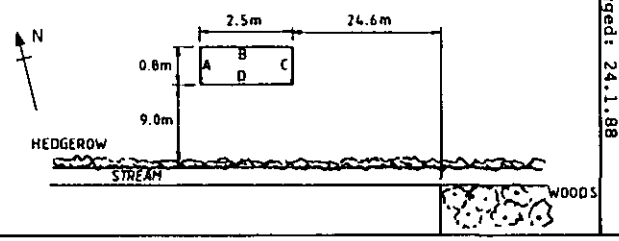
Weather: Fine

Variability of faces: All faces similar

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample | B Bulk disturbed sample ▯ U Undisturbed sample • W Water sample

Plan (Not to scale)



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Soil Mechanics

TRIAL PIT No. 831

Sheet 1 of 1

Location No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

Ground Level 81.57 m AOD

Coordinates 63826.0 mE 92539.0 mN

Date Dug: 24.1.88 Logged: 24.1.88

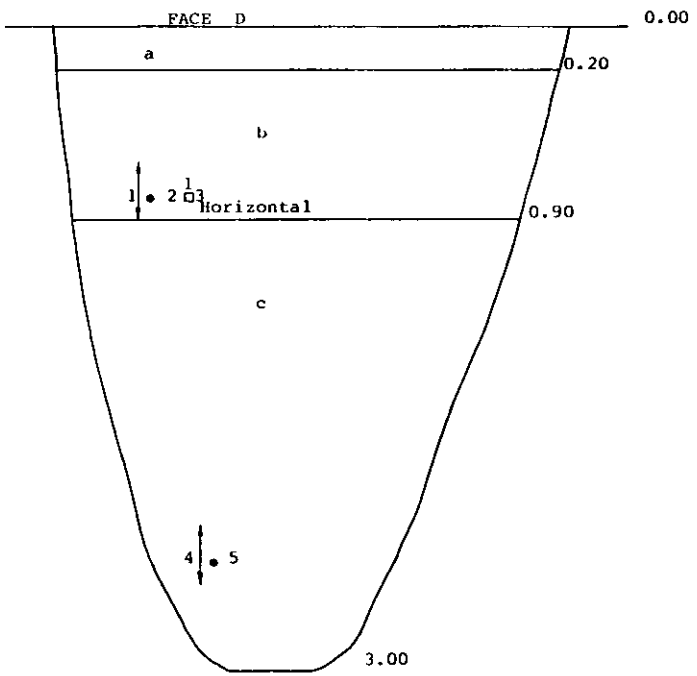
Carried out for
Client: Department of Transport
Engineer: Scott Wilson Kirkpatrick and Partners

Equipment & Methods
Machine dug to 3.00m by JCB 3CX
No support used
Logged on excavated material below 0.00m

Samples

Depth (m)	Type	No.
0.00		
0.80	B	1
	D	2
	U	3
2.50	B	4
	D	5

Sketch of faces and description of strata



Depth below ground level (m)

0 1 2 3

Material Types

a. TOPSOIL

b. Firm to stiff orange brown and grey in parts slightly fine sandy becoming sandy CLAY with occasional dark grey organic pockets and fibrous rootlets. (Glacial Till)

c. Stiff red brown slightly fine sandy locally sandy CLAY with much to and GRAVEL composed of up to cobble size chert, moderately strong, green grey siltstone and orange brown fine to medium sandstone and with occasional dark grey organic/ carbonaceous pockets. (Possible Reworked Keuper Marl)

Notes Sample positions shown on faces

Ground water: Not encountered

Stability of faces: Stable

Ease of excavation: Easy

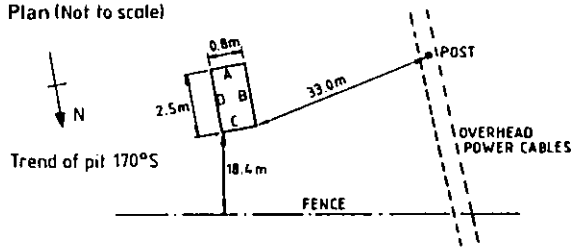
Weather: fine

Variability of faces: All faces similar

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample | B Bulk disturbed sample ⊔ U Undisturbed sample • W Water sample

Plan (Not to scale)



Logged by JAS

Fig. 111

D3/6/85 © Soil Mechanics Limited, Bracknell, England

Soil Mechanics

TRIAL PIT No. 832

Sheet 1 of 1

Carried out for
Client: Department of Transport
Engineer: Scott Wilson and Kirkpatrick and Partners

Equipment & Methods
Machine dug to 3.00m by JCB 3CX
No support used
Logged on excavated material below 0.00m

Location No. 7382

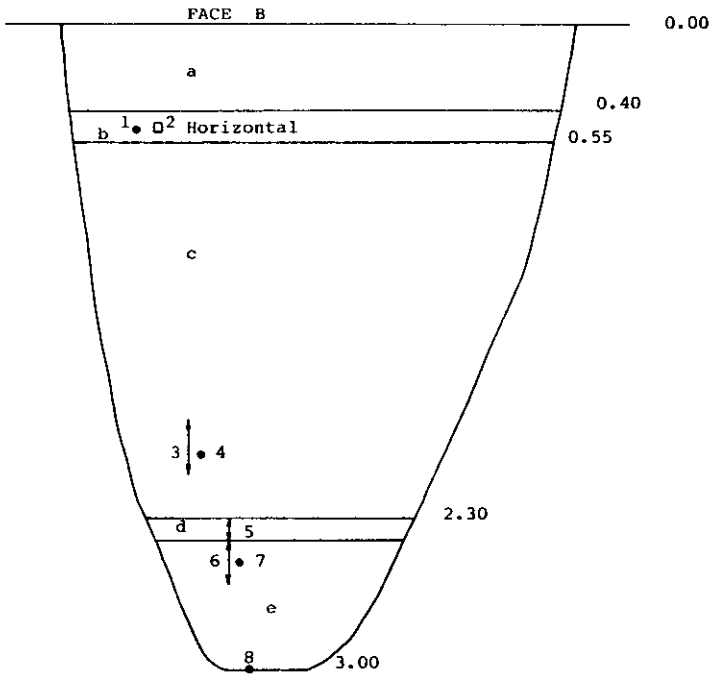
Location
A42 CASTLE DONINGTON NORTH
GROUND INVESTIGATION CONTRACT 4

Ground Level
81.02 m AOD

Coordinates
63905.0 mE
92548.0 mN

Date
Dug: 24.1.88
Logged: 24.1.88

Sketch of faces and description of strata





Depth (m)	Type	No.
0.00		
0.50	D	1
	U	2
2.00	B	3
	D	4
2.30	B	5
2.50	D	6
	B	7
3.00	D	8

Material Types

a. TOPSOIL

b. Firm orange brown mottled brown slightly fine sandy CLAY with some flint gravel and frequent fibrous rootlets (Glacial Till)

c. Stiff red brown locally slightly fine sandy CLAY with some flint gravel and occasional pockets of green grey silt/siltsone, moderately weak to moderately strong, dark grey organic pockets and a trace of orange brown fine to medium sandstone gravel (Possible Reworked Keuper Marl)

d. Green grey in parts thinly laminated SILTSTONE, moderately weak to moderately strong (Keuper Marl 1/2)

e. Stiff red brown mottled green grey locally very silty CLAY with frequent lithorelics and some green/grey siltstone becoming by about 3.00m very stiff in parts hard extremely closely fissured/jointed (Planar, smooth). (Keuper Marl 2/3)

Logged by JAS

Fig. 112

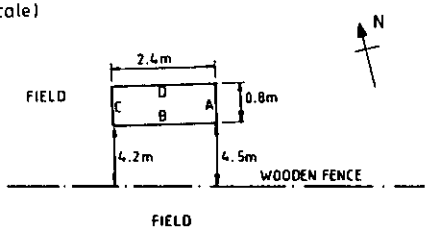
Notes Sample positions shown on faces

Ground water: Not encountered
Stability of faces: Stable
Ease of excavation: Easy
Weather: fine
Variability of faces: All faces similar

Materials are described in accordance with Appendices.

Sample key • D Small disturbed sample ⌈ B Bulk disturbed sample ⌈⌉ U Undisturbed sample • W Water sample

Plan (Not to scale)





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A42 CASTLE DONINGTON NORTH
GROUND INVESTIGATION CONTRACT 4

KEY PLAN

Scale 1:50 000

Soil Mechanics	Loc No 7382	Fig. 113

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ANNEXE

SOIL RESISTIVITY AND REDOX POTENTIAL TESTING

Carried out by:

Roxby Engineering International
Roxby House
Sidcup
Kent
DA15 7EJ

1.0 SOIL RESISTIVITY TESTING

1.1 Introduction

Soil resistivity tests were performed at the sites of trial pits nos. 804-826 incl.

1.2 Test Procedure

The test procedure adopted was similar to that outlined in the Specification Appendix IV, with the exception that stainless steel rather than brass electrodes, were used.

The formula used to calculate the resistivities is:

(1) $\rho = 200 \pi Rd$

where ρ = soil resistivity (ohm cm)
π = 3.142
d = Electrode spacing (m)
R = Resistance from megger (ohms)

Sets of soil resistivity readings were performed parallel to and perpendicular to the alignment of the proposed structures. The readings obtained from the resistance meter are given in Tables 2 and 4, and the calculated values of resistivity are given in Tables 3 and 5.

The resistivity readings were taken at depths of 0.5, 1, 1.5, 2, 2.5 and 3 m.

Readings represent the MEAN soil resistivity down to a particular depth.

1.3 Discussion

The resistivity at all the test locations is remarkably constant and would indicate similar conditions along the route.

At the majority of the locations no marked change in resistivity with depth was observed, and where a change was detected this was probably due to a low water table at depths below 1.5 m.

At 1.5 m the resistivity was in the range 2000 to 4000 ohm cm, which would indicate moderately aggressive corrosive conditions.

The relationship between soil resistivity and anticipated corrosion level is as follows:

Resistivity (ohm cm)	Degree of Corrosion
Less than 1000	Very agressive
1000-3000	Aggressive
3000-10,000	Mildly aggressive
10,000	Not aggressive

1.4 Resistivity Test Journal

(a) Contract Title

A42 Castle Donington North Ground Investigation Contract 4

(b) Contractor's Name

Main Contractor	Soil Mechanics Limited
Resistivity and Redox Sub-Contractor	Roxby Engineering International

(c) Date of Test

Resistivity tests were performed between 18th-19th January 1988

(d) Test Reference No.

Test reference numbers are 804 to 826 inclusive.

(e) Local Grid Co-Ordinates

See trial pit location references.

(f) Resistivity Values

Table 3 gives resistivity readings perpendicular to the proposed line of the structure, whilst Table 5 gives readings parallel to the proposed line of the structure.

2.0 REDOX TESTS

2.1 Introduction

Redox tests are conducted to assess whether or not a particular soil will support anaerobic bacteria. Soils with a high oxygen content will not be conducive to the growth of anaerobic bacteria whilst soils with a low oxygen content can support anaerobic bacterial growth. The corrosion rate of ferrous structures can be accelerated by the presence of anaerobic sulphate reducing bacteria. These bacteria produce acidic conditions local to the steel surface and sulphides from the sulphate reduction process, which results in enhanced rates of corrosion.

By measuring the potential of a platinum electrode in soil, it is possible to determine if a high or low oxygen concentration is present. On a platinum electrode in a soil with pH 5 to 8 two electrochemical processes will occur; oxidation and reduction. The oxidation process is the formation of platinum oxide/hydroxide whilst the corresponding reduction process is oxygen reduction. The potential that the platinum electrode adopts as a result of the two electrochemical reactions occurring on the electrode surface is termed the Redox potential, i.e. REDuction/OXidation potential.

In soils with a low redox potential, as defined in equation 1 below, a low oxygen concentration will be present, and the corrosion rate may well be high because of the increased likelihood of bacteria being present.

$$E = E_p + 250 + 60\ (ph - 7) \qquad 1)$$

Where E = Redox Potential (mV)
Ep = Potential of the platinum probe (mV)
pH = pH of an aqueous solution of the excavated material

NB: 250 mV is the standard potential of a saturated calomel electrode, and that for a $Cu/CuSO_4$ electrode is + 310 mV.

When the Redox potential has been calculated, the corrosive nature of the soil can be assessed by reference to Table 1, (extracted from BS CP 1021).

TABLE 1

Redox Potential of Soils in Relation to Corrosiveness

Redox Potential	Classification of Corrosiveness
100 mV	Severe
100–200 mV	Moderate
200–400 mV	Slight
400 mV	Non-Corrosive

2.2 Test Procedures

The test procedure adopted was generally in accordance with Specification Appendix No. V with the exception that a $Cu/CuSO_4$ reference electrode, rather than a calomel reference electrode, was used. The $Cu/CuSO_4$ electrode was then calibrated against a saturated calomel electrode. The potential of the $Cu/CuSO_4$ electrode was found to be +0.316 V vs. a standard hydrogen electrode (SHE).

A redox probe, which basically consists of two concentric rings of platinised titanium each spaced 25 mm apart in a Delrin (polyacetal body) was inserted into the ground. The redox potential of each of the platinised titanium rings was then recorded approximately 60 to 90 seconds

after the probes were inserted into the soil. The two platinum rings were referred to as lower (one nearest the tip) and upper (one furthest from the tip).

2.3 Redox Measurements

At each trial pit location at least 3 redox tests were conducted and in most cases a wide degree of variation of results was observed, generally the difference was more than 20 mV. There are only a few locations where the sets of results differ by less than 20 mV. For the remaining tests, a consider scatter in results was detected.

The redox potential presented is therefore the mean results for each location, and where the redox potentials from the upper and lower platinum rings does not differ by more than 20 mV, the redox value from this reading is also given.

A typical calculation is presented as follows:

Trial Pit 804	
Mean Redox Potential (E_p)	- 24 mV
Copper/copper sulphate potential	316 mV
Soil pH	7.45

..Redox Potential (E) on hydrogen scale from equation (1) is:

$$E = -24 + 316 + 60\ (7.45 - 7)$$

Redox Potential	319 mV
Corrosivity Classification	Slight

The Redox potential at each test location is given in Table 8.

2.4 Discussion

The Redox potentials quoted in Table 8 are the mean values from a number of readings (see Table 7). It was found to be difficult to take readings that satisfied the Department of Transport specification, i.e. a 20 mV difference between the upper and lower rings of the redox probe. This is not unexpected in Redox testing and it was therefore considered that a sufficient indication as to the redox potential would be obtained from the mean value.

Nearly all the redox tests indicate slight levels of bacterial activity (see Table 8) with severe levels only recorded at four locations. In the trial pits where severe levels of corrosion were detected, i.e. Redox potentials in the range 0-100 mV, groundwater was encountered and as a consequence misleading values for Redox potentials would be recorded.

Only at trial pits 816 and 817 would there be any major cause for concern in terms of Redox testing.

3.0 CONCLUSION

The resistivity values indicate moderately aggressive soil conditions in terms of corrosion activity along the section investigated, whilst the Redox potential only indicates a likelihood of severe bacterial activity at two locations, namely trial pits 816 and 817.

The resistivity values should be taken as a better indication as to the likelihood and extent of corrosion than the Redox values.

TABLE 2 : MEGGER RESISTANCE READING (OHMS)
PERPENDICULAR TO PROPOSED STRUCTURE

Location	Depth (m)					
	0.5	1	1.5	2	2.5	3
804	13.0	9.2	7.9	3.1	2.5	2.0
805	12.0	7.0	6.8	2.5	2.1	1.1
806	9.2	4.7	3.6	2.2	1.8	1.2
807	9.1	4.6	3.6	2.1	1.8	1.1
808	11.1	5.0	3.8	2.6	1.7	1.1
809	12.0	5.4	3.9	2.6	1.5	1.0
810	10.0	5.2	4.2	2.8	1.4	1.0
811	11.1	5.0	4.0	2.0	1.3	1.0
812	12.0	5.9	4.3	2.6	1.8	1.0
813	12.0	5.7	4.3	1.4	1.2	1.2
814	11.0	5.8	4.6	1.8	1.6	1.3
815	10.2	5.6	4.3	1.4	1.4	1.2
816	11.3	5.9	4.5	1.6	1.2	1.1
817	11.1	5.6	4.2	1.5	1.3	1.0
818	10.6	4.9	3.6	1.6	1.4	1.0
819	10.9	4.6	3.5	1.8	1.3	1.2
820	10.9	5.2	3.2	2.9	2.2	1.4
821	11.8	7.1	5.1	3.8	2.2	1.3
822	10.7	5.6	4.2	2.3	1.9	1.2
823	11.1	5.9	4.7	2.2	1.8	1.1
824	8.8	4.6	3.2	2.3	3.1	1.6
825	7.9	4.3	2.4	1.8	1.3	1.1
826	7.8	4.4	2.4	1.6	1.2	1.0

TABLE 3 : SOIL RESISTIVITY READINGS (OHM CM) vs DEPTH
PREPENDICULAR TO PROPOSED STRUCTURE

Location	Depth (m) 0.5	1.0	1.5	2.0	2.5	3.0
804	4060	5750	7450	3900	3930	3770
805	3770	4370	6410	3140	3300	2070
806	2890	2940	3390	2760	2830	2260
807	2830	2870	3390	2640	2830	2070
808	3490	3120	3580	3270	2670	2070
809	3770	3370	3680	3270	2360	1890
810	3140	3250	3960	3520	2200	1890
811	3490	3120	3770	2510	2040	1890
812	3770	3690	4050	3270	2830	1890
813	3770	3560	4050	1760	1890	2260
814	3460	3620	4340	2260	2510	2450
815	3200	3500	4050	1760	2200	2260
816	3550	3690	4240	2010	1890	2070
817	3490	3500	3960	1890	2040	1890
818	3330	3060	3390	2010	2200	1890
819	3420	2870	3300	2260	2040	2260
820	3420	3250	3020	3640	3460	2640
821	3710	4440	4810	4780	3460	2450
822	3360	3500	3960	2890	2980	2260
823	3490	3690	4430	2760	2830	2070
824	2760	2870	3020	2890	4870	3020
825	2480	2690	2260	2260	2040	2070
826	2450	2750	2260	2010	1890	1890

Date of Testing 18 - 19 January 1988

Soil Condition Wet

Approximate Temperature 7 ^{o}C

TABLE 4 : MEGGER RESISTANCE READING (OHMS)
PARALLEL TO PROPOSED STRUCTURE

Location	Depth (m)					
	0.5	1.0	1.5	2.0	2.5	3.0
804	13.0	9.2	7.8	3.2	2.8	2.0
805	12.0	7.1	6.4	2.8	2.1	1.1
806	9.1	4.7	3.6	2.5	2.0	1.3
807	9.0	4.6	3.4	2.2	1.9	1.1
808	10.0	5.2	4.9	2.1	1.8	1.3
809	11.0	5.2	4.7	2.0	1.8	1.2
810	10.0	5.0	4.1	2.2	1.6	1.0
811	10.5	5.1	4.0	2.1	1.5	1.1
812	11.0	5.7	4.2	1.8	1.4	1.1
813	12.0	6.0	5.1	1.7	1.4	1.0
814	11.2	6.0	5.0	1.6	1.3	1.2
815	10.1	5.9	4.8	1.5	1.3	1.0
816	12.0	6.1	5.1	1.6	1.4	1.1
817	11.6	5.8	4.9	1.7	1.6	1.1
818	11.0	4.9	3.8	2.8	1.2	1.0
819	11.1	5.0	3.9	2.6	1.3	1.0
820	10.0	4.8	3.2	2.6	2.2	1.4
821	11.2	5.3	3.4	2.9	2.4	1.5
822	12.2	7.0	5.2	3.7	1.9	1.1
823	10.8	5.8	4.9	3.1	2.4	1.4
824	14.3	7.8	6.7	2.7	3.0	1.7
825	8.9	5.0	3.1	2.2	1.4	1.2
826	8.0	3.5	2.6	1.8	1.4	1.1

TABLE 5 : SOIL RESISTIVITY READINGS (OHM CM) vs DEPTH
PARALLEL TO PROPOSED STRUCTURE

Location	Depth (m)					
	0.5	1.0	1.5	2.0	2.5	3.0
804	4060	5750	7450	3900	4400	3770
805	3770	4370	6410	3140	3300	2070
806	2860	3940	3390	2760	3140	2450
807	2830	2870	3390	2640	2980	2070
808	3140	3120	3580	3270	2830	2450
809	3460	3370	3680	3270	2830	2260
810	3140	3250	3960	3520	2510	1890
811	3300	3120	3770	2510	2360	2070
812	3460	3690	4050	3270	2200	2070
813	3770	3560	4050	1760	2200	1890
814	3640	3620	4340	2260	2040	2260
815	3170	3060	4050	1760	2040	1890
816	3770	3690	4240	2010	2200	2070
817	3640	3500	3960	1890	2510	2070
818	3460	3060	3390	2010	1890	1890
819	3490	2870	3300	2260	2040	1890
820	3140	3250	3020	3640	3460	2640
821	3520	4440	4810	4780	3770	2830
822	3830	3500	3960	2890	2990	2070
823	3390	3690	4430	2760	3770	2640
824	4490	2870	3020	2890	4710	3200
825	2800	2690	2260	2260	2200	2260
826	2510	2750	2260	2010	2200	2070

Date of Testing 18 - 19 January 1988
Soil Condition Wet
Approximate Temperature 7°C

TABLE 6

SOIL pH VALUES AT SELECTED TEST LOCATIONS

Trial Pit No	pH Value
804	7.45
805	7.35
806	7.45
807	7.4
808	7.9
809	7.85
810	7.7
811	7.9
812	7.85
813	7.2
814	8.0
815	7.8
816	6.9
817	7.5
818	7.9
819	8.05
820	7.4
821	7.7
822	7.8
823	8.1
824	8.05
825	7.7
826	8.05

TABLE 7

REDOX POTENTIALS vs A $Cu/CuSO_4$ ELECTRODE AT SELECTED TEST LOCATIONS

Location	Potential (mV) vs a $Cu/CuSO_4$ Electrode		Mean Potential vs a $Cu/CuSO_4$ Electrode (mV)	Calculated Redox Potential (mV)
	Upper Electrode	Lower Electrode		
804	+96	-191	-24	319
	+123	-156		
	+125	-143		
805	+20	-92	-113	224
	-60	-169		
	-133	-243		
806	-210	-230	200	103
	-189	-175		
807	-285	-278	-275	65
	-265	-270		
808	+57	-84	-6	364
	+75	-64		
	+59	-80		
809	+31	-92	-5	362
	+83	-67		
	+93	-80		
810	+19	-204	-56	302
	+59	-158		
	+81	-134		
811	37	-89	-81	289
	19	-10		
	-230	-210	(-220)*	(150)*
812	-50	31	-12	355
	-20	-10	(-15)*	(352)*
813	15	-134	-21	307
	65	-104		
	128	-93		
814	-344	-215	-260	116
	-334	-331	(-333)*	43
	-170	-168	(-169)*	207
815	-23	-124	-88	276
	-69	-160		
	-165	+14		

Location	Potential (mV) vs a $Cu/CuSO_4$ Electrode		Mean Potential vs a $Cu/CuSO_4$ Electrode (mV)	Calculated Redox Potential (mV)
	Upper Electrode	Lower Electrode		
816	-300	-212	-290	20
	-330	-270		
	-340	-290		
817	-250	-220	-264	82
	-282	-233		
	-34	-255		
818	-126	-258	-208	162
	-122	-168		
	-301	-272		
819	-78	-183	-206	173
	-110	-206		
	-342	-319		
820	-126	-244	-239	101
	-138	-236		
	-327	-360		
821	-51	-51	-72	286
	+28	-126		
	-56	-175		
822	+22	-167	-62	302
	+14	-210		
	+69	-102		
823	-28	-175	-104	278
	-92	-96		
	-105	-128		
824	+46	-80	-33	346
	+54	-80		
	-78	-58		
825	-29	-153	-172	186
	-76	-165		
	-199	-203		
	-106	-102		
826	-284	-162	-190	189
	-112	-220		
	-240	-124		

NB! *Redox potentials within 20 mV from upper and lower rings of platinised probes.

TABLE 8

Trial Pit No	Redox Potential (mV)	Corrosive Condition
804	319	Slight
805	224	Slight
806	103*	Severe, soil water saturated
807	65*	Severe, soil water saturated
808	364	Slight
809	362	Slight
810	302	Slight
811	289	Slight
812	355	Slight
813	307	Slight
814	116	Moderate
815	276	Slight
816	20	Severe
817	82	Severe
818	162	Moderate
819	173	Moderate
820	101	Moderate
821	286	Slight
822	302	Slight
823	278	Slight
824	346	Slight
825	186	Moderate
826	189	Moderate

NB! *Trial pits water saturated.

Report

GROUND INVESTIGATION FOR

A42 CASTLE DONINGTON NORTH

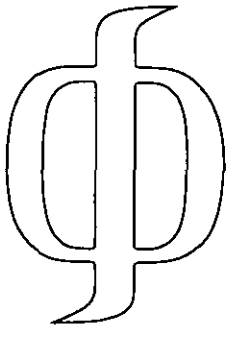
CONTRACT 4

VOLUME 2 : LABORATORY TESTING

Carried out for:

Department of Transport

Date August 1988 **No.** 7382/2



Soil Mechanics

Soil Mechanics Limited,
Foundation House,
Eastern Road,
Bracknell, Berkshire, RG12 2UZ,
United Kingdom
telephone Bracknell (0344) 424567
telex 847253 SMERCN G

REPORT NO. 7382

GROUND INVESTIGATION FOR

A42 CASTLE DONINGTON NORTH

CONTRACT 4

SCHEDULE OF REPORT VOLUMES

VOLUME 1: FIELDWORK

VOLUME 2: LABORATORY TESTING

VOLUME 3: SITE PLANS AND LONGITUDINAL SECTIONS

REPORT NO 7382/2

GROUND INVESTIGATION FOR

A42 CASTLE DONINGTON NORTH

CONTRACT 4

VOLUME 2: LABORATORY TESTING

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2. Point load test results
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REPORT NO 7382/2

GROUND INVESTIGATION FOR A42 CASTLE DONINGTON NORTH CONTRACT 4

ABSTRACT

Fifty six boreholes put down to a maximum depth of 30.6 m encountered made ground, fill, alluvium, terrace and glacial deposits overlying Coal Measures, Keuper Sandstone and Keuper Marl. The report presents the results of the fieldwork and a programme of laboratory testing. No engineering appraisal of the scheme was required.

REPORT NO 7382/2

GROUND INVESTIGATION FOR
A42 CASTLE DONINGTON NORTH
CONTRACT 4

VOLUME 2: LABORATORY TESTING

1. INTRODUCTION

In November 1987 the Department of Transport (DoT) requested Soil Mechanics Limited (SML) to carry out a ground investigation along the proposed line of the Castle Donington North Section of the proposed A42 under the direction of their Consulting Engineers, Scott Wilson Kirkpatrick and Partners (SWKP). The fieldwork, carried out between 12 December 1987 and 19 February 1988, comprised fifty six boreholes and twenty nine trial pits. In addition soil resistivity and redox potential tests were carried out in twenty three of the trial pits.

The report presents the results of the fieldwork (Volume 1) and a programme of laboratory testing (Volume 2). The site plans and longitudinal sections are given in Volume 3.

Laboratory testing was carried out on selected samples generally in accordance with BS1377: 1975. The programme of testing was agreed with SWKP and is described below.

2. INDEX PROPERTY TESTS

Natural moisture content, and liquid and plastic limit determinations were made on selected samples. In addition, moisture content and bulk density determinations were made in association with shear strength and consolidation tests. The results of these determinations are given in Table 1. The percentage of material passing the 425 micron sieve in preparation for the liquid and plastic limit determinations is given in brackets in the liquid limit column. (N) indicates that the determinations were made on material in the natural condition.

3. PARTICLE SIZE DISTRIBUTION TESTS

Particle size distribution analyses were carried out on both granular and cohesive samples, by means of wet sieving and hydrometer analysis. Following sieving, a hydrometer analysis was carried out if more than about 15% material passed the 63 micron mesh. The results of these analyses are presented as grading curves, Fig. 1 to 13. For the glacial till and Keuper Marl the results of all analyses carried out on these materials have been aggregated to show composite grading envelopes which are presented in Fig. 55 and 56.

4. TRIAXIAL COMPRESSION TESTS

All specimens for triaxial compression tests were cut from undisturbed samples. Quick undrained triaxial compression tests were carried out on sets of three 38 mm diameter specimens or on 100 mm nominal diameter specimens, using the multi-stage method where appropriate. The results of these tests are given in Table 1 with the undrained shear strengths calculated assuming the angle of shearing resistance to be zero.

Consolidated undrained triaxial compression tests were carried out on either sets of three 38 mm diameter specimens or where appropriate on 100 mm nominal diameter specimens using the multi-stage method following the procedures given in Head: 1986 and the results of these tests are presented in Fig. 14 to 27.

5. CONSOLIDATION TESTS

One dimensional consolidation tests were carried out in the oedometer on 76 mm diameter by 20 mm thick specimens cut from undisturbed samples and the void ratio/log pressure curves are presented in Fig. 28 to 40. It should be noted that the coefficients of volume compressibility (m_v), and of consolidation (c_v), given refer to laboratory loading curves and as such may require re-assessment to obtain field values for use in the estimation of magnitude and rate of settlement.

Consolidation tests were also carried out in the Rowe Cell on 76 mm nominal diameter specimens cut from undisturbed samples following the procedures given in Head: 1986 and the results are presented in Fig. 41 and 42.

6. CHEMICAL TESTS

Sulphate and pH determinations were made on selected samples of soil, weathered bedrock and groundwater and an organic matter content determination was made on a selected soil sample. The results are given in Table 1.

7. POINT LOAD STRENGTH INDEX TESTS

Point load strength index tests were carried out in accordance with the Appendix on selected portions of drill core samples and the results are presented in Table 2.

8. UNIAXIAL COMPRESSION TESTS

Unconfined compression tests were carried out on selected specimens of intact rock taken from the drill core samples. The results together with moisture content and bulk density determinations are given in Table 3. Where possibile electrical strain gauges were attached to the specimens and the compression tests to failure were preceded by three cycles of loading and unloading for determination of Young's Modulus of Elasticity and Poisson's Ratio. In several instances attachment of strain gauges to the weaker core specimens was inappropriate and the tests were carried out with measurement of vertical strain only by means of a micrometer dial gauge. The stress/strain plots are presented as Fig. 43 to 54.

9. COMPACTION AND SHEAR BOX TESTS

On the instruction of SWKP tests were carried out on material from sandstone horizons in boreholes 704R to 708R (Long Hedge Lane) in order to assess suitability for use as fill material.

Natural moisture content determinations were made on selected portions of core sample and the results are given in Fig. A1.

Selected sections of core sample were combined then crushed to pass through a 20 mm sieve. A particle size distribution analysis was carried out following sieving and the result of this analysis is presented as a grading curve in Fig. A2.

Two compaction tests (BS 1377: Test 14) were carried out on the combined material and the results are given as dry density/moisture content plots in Fig. A5 and A6.

Two consolidated drained shear box tests were carried out on 300 mm square by 100 mm thick specimens prepared by compaction of the combined material and the results of these tests are presented in Fig. A7 and A8. Particle size distribution analyses were carried out on the shear box specimens after test and the grading curves are presented in Fig. A3 and A4.

for SOIL MECHANICS LIMITED

[redacted]

DHH/SLR/R4-5/7382/2

Doncaster, June 1988

REFERENCES

British Standards Institution: 1975: 'Methods of test for soils for civil engineering purposes: BS 1377

Head K.H.: 1986: 'Manual of soil laboratory testing' - Volume 3: Published by Pentech Press

Appendix

Point Load Strength Index

As an index test of rock strength, samples may be subjected to loading between platens to create failure in a tensile mode. Tensile strength of rock has been shown to be related to compressive strength and, as loads required to produce tensile failure are low and samples require no machining or preparation, a test has been developed which may be carried out in the field using a portable hydraulic tester. The results may be used as an index of rock strength and particularly its variability. The test is fully described by Broch E and J A Franklin (1972)*.

The most convenient platen shape has been shown to be a rounded conical 60° point whose tip radius is 5 mm. This size and shape has been taken as standard so that comparison between materials may take place. Total load, P, on the point required to produce failure, together with the sample dimension being tested, D, and recorded so that an index of strength P/D^2 may be calculated. For convenience of comparison between tests it is necessary to correct the index to an equivalent value for the same material having a tested dimension of 50 mm, this corrected value being the Point Load Strength Index, Is_{50}.

Normally tests are carried out on drill core samples although irregular lumps and blocks may also be tested. When testing core samples it is usual to carry out diametral and axial tests so that by comparison of the Is_{50} values an anisotropy index may be obtained such that:

$$Ia = \frac{Is_{50}(axial)}{Is_{50}(diametral)}$$

Testing is carried out in accordance with the Suggested Method published by the International Society of Rock Mechanics (Anon, 1985)*.

For the diametral test is is recommended that the distance between the point of contact of the load and the nearest free end be no less than 0.5D where D is the core diameter and, in the axial test, length/diameter ratios of less then 1.0 are recommended.

Sampling procedure for this index test is generally based on the selection of at least 10 suitable pieces of core from each zone of the drillhole that exhibits an apparent uniformity of strength so that a mean strength index may be determined for each zone.

---

* Broch E and J A Franklin : 1972 : The Point Load Strength Test. Int Jnl Rock Mech Mining Science Vol 9, pp 669-697.

Anon : 1985 : Suggested Method for Determining Point Load Strength. International Society of Rock Mechanics Commission on Testing Methods. Int Jnl Rock Mech Mining Science, Vol 22, pp 51-60.

Soil Mechanics

SUMMARY OF LABORATORY TEST RESULTS ON CABLE TOOL SAMPLES

SAMPLE SOURCE					INDEX PROPERTIES						UNDRAINED TRIAXIAL TESTS[1]					CHEMICAL TESTS				OTHER TESTS (* See figures)								REMARKS
Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t/m^3	Specific Gravity	Cell Pressure $kN\ m^2$	Compressive Stress $kN\ m^2$	Failure Strain %	Cohesion C_u $kN\ m^2$	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
704	4	U	1.50	1.95	40	27	13									8.5	0.35						*					
					(N)																							
	7	B	3.00	3.30	22	13	9	19								8.3	0.15											
					(94%)																							
	10	W	5.00													8.1		0.09										
	12	B	6.00	6.50	22	15	7																					
					(89%)																							
			10.50													8.1	0.07											
																												CORE sample

Notes and Remarks

U – Undisturbed tube sample
D – Disturbed sample
B – Specimen from bulk sample
W – Water sample

TRIAXIAL TESTS

1. Carried out at rate of strain of 2% per minute.
2. Specimens 100mm diameter and 200mm long.
3. Specimens 38mm diameter and 76mm long
4. Multistage test

CHEMICAL TESTS

a. 2:1 Water : Soil extract

Loc. No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

TABLE 1

Soil Mechanics

SUMMARY OF LABORATORY TEST RESULTS ON CABLE TOOL SAMPLES

SAMPLE SOURCE					INDEX PROPERTIES						UNDRAINED TRIAXIAL TESTS[1]					CHEMICAL TESTS				OTHER TESTS (* See figures)								REMARKS
Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t/m³	Specific Gravity	Cell Pressure kN m⁻²	Compressive Stress kN m⁻²	Failure Strain %	Cohesion C_u kN m⁻²	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
705	3	U	0.50	0.95	38	20	18	22	2.03		20	135	1.35															
					(N)			22	1.95		40	109	12	64	(0)													
								21	2.02		80	142	6.5															
	6	U	2.00	2.25	37	22	15	15	1.83																			
					(N)																							
	9	D	3.50	3.80	31	19	12	11																				
					(98%)																							
	15	B	6.50	6.88	26	16	10	15																				
					(N)																							
	16	W	6.90													8.2		0.10										
			8.60													8.2	0.08											CORE sample

Notes and Remarks

U – Undisturbed tube sample
D – Disturbed sample
B – Specimen from bulk sample
W – Water sample

TRIAXIAL TESTS

1. Carried out at rate of strain of 2% per minute.
2. Specimens 100mm diameter and 200mm long.
3. Specimens 38mm diameter and 76mm long
4. Multistage test

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Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t/m^3	Specific Gravity	Cell Pressure $kN\ m^2$	Compressive Stress kN/m^2	Failure Strain %	Cohesion C_u $kN\ m^2$	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
706	3	U	0.50	0.95	46	27	19	23	1.98		20	149	16															
					(N)			26	2.00		40	118	18	67	(0)													
								25	2.00		80	135	13															
	7	D	2.20	2.65	26	20	6	13																				
					(80%)																							
	11	B	5.20	5.43	32	19	13	22								8.7	0.12											
					(N)																							
	14	W	6.65													8.2	0.11											
	15	D	8.20		21	14	7	21																				
					(92%)																							
			8.65													8.3	0.06											
																												CORE sample

Notes and Remarks

U – Undisturbed tube sample
D – Disturbed sample
B – Specimen from bulk sample
W – Water sample

TRIAXIAL TESTS

1. Carried out at rate of strain of 2% per minute.
2. Specimens 100mm diameter and 200mm long.
3. Specimens 38mm diameter and 76mm long
4. Multistage test

CHEMICAL TESTS

a. 2:1 Water : Soil extract

Loc. No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

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SAMPLE SOURCE					INDEX PROPERTIES						UNDRAINED TRIAXIAL TESTS[1]					CHEMICAL TESTS				OTHER TESTS (* See figures)								REMARKS
Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t/m³	Specific Gravity	Cell Pressure kN m⁻²	Compressive Stress kN m⁻²	Failure Strain %	Cohesion C_u kN m⁻²	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
707	3	U	0.60	1.05	37	25	12	21	2.01		20	82	6															
					(N)			21	1.95		40	113	3.5	64	(Ø)													
								20	2.03		80	187	6															
	6	B	2.10	2.55	32	19	13	20																				
					(N)																							
	8	B	3.60	3.90				20								8.5	0.12											
	10	B	5.10		25	15	10	18																				
					(N)																							

Notes and Remarks

U – Undisturbed tube sample
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B – Specimen from bulk sample
W – Water sample

TRIAXIAL TESTS

1. Carried out at rate of strain of 2% per minute.
2. Specimens 100mm diameter and 200mm long.
3. Specimens 38mm diameter and 76mm long
4. Multistage test

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SAMPLE SOURCE					INDEX PROPERTIES						UNDRAINED TRIAXIAL TESTS[1]					CHEMICAL TESTS				OTHER TESTS (* See figures)								REMARKS
Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t/m^3	Specific Gravity	Cell Pressure $kN\ m^2$	Compressive Stress $kN\ m^2$	Failure Strain %	Cohesion C_u $kN\ m^2$	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
708	3	U	0.60	1.05	42	27	15									8.1	0.23											
					(N)																							
	8	B	3.00	4.00	32	18	14	19								8.6	0.13											
					(97%)																							
	10	B	5.20		23	14	9	16																				
					(N)																							

Notes and Remarks

U – Undisturbed tube sample
D – Disturbed sample
B – Specimen from bulk sample
W – Water sample

TRIAXIAL TESTS

1. Carried out at rate of strain of 2% per minute.
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SAMPLE SOURCE					INDEX PROPERTIES						UNDRAINED TRIAXIAL TESTS[1]					CHEMICAL TESTS				OTHER TESTS (* See figures)								REMARKS
Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t/m³	Specific Gravity	Cell Pressure kN m⁻²	Compressive Stress kN m⁻²	Failure Strain %	Cohesion C_u kN m⁻²	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
709	2	U	0.50	0.95	39	21	18	27	2.09							7.5	0.06											
					(N)																							
	5	U	2.00	2.45	35	18	17	19	2.13		30	261	9															
					(N)			17	2.14		60	275	10	151	(0)													
								17	2.14		120	367	13.5															
	9	U	3.50	3.95	31	19	12	21	1.90		40	79	20			8.1	0.12											
					(N)			20	1.98		80	92	18.5	52	(0)													
								19	2.02		160	139	16.5															
	12	D	5.00	5.27	40	17	23	12																				
					(100%)																							

Notes and Remarks

U – Undisturbed tube sample
D – Disturbed sample
B – Specimen from bulk sample
W – Water sample

TRIAXIAL TESTS

1. Carried out at rate of strain of 2% per minute.
2. Specimens 100mm diameter and 200mm long.
3. Specimens 38mm diameter and 76mm long
4. Multistage test

CHEMICAL TESTS

a. 2:1 Water : Soil extract

Loc. No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

TABLE 1

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SUMMARY OF LABORATORY TEST RESULTS ON CABLE TOOL SAMPLES

SAMPLE SOURCE					INDEX PROPERTIES						UNDRAINED TRIAXIAL TESTS[1]					CHEMICAL TESTS				OTHER TESTS (* See figures)								REMARKS
Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t·m^3	Specific Gravity	Cell Pressure kN m^2	Compressive Stress kN m^2	Failure Strain %	Cohesion C_u kN m^2	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
710	6	U	2.10	2.55	39	19	20									8.0	0.33						*					
					(N)																							
	9	U	3.60	4.05	37	18	19	16	1.89		40	97	6							*								
					(N)			17	2.13		80	148	8.5	69	(0)													
								18	2.07		160	169	11															
	12	U	5.10	5.45	30	19	11																*					
					(N)																							
	16	D	6.80	6.95	27	17	10	11																				
					(99%)																							
	18	D	8.50	8.95				17																				
	20	D	10.30	10.60	27	16	11	12																				
					(97%)																							
	22	D	11.80	11.95	23	18	5	15																				
					(99%)																							
	23	W	11.90													8.4		0.07										

Notes and Remarks

U – Undisturbed tube sample
D – Disturbed sample
B – Specimen from bulk sample
W – Water sample

TRIAXIAL TESTS

1. Carried out at rate of strain of 2% per minute.
2. Specimens 100mm diameter and 200mm long.
3. Specimens 38mm diameter and 76mm long
4. Multistage test

CHEMICAL TESTS

a. 2:1 Water : Soil extract

Loc. No. 7382

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TABLE 1

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SUMMARY OF LABORATORY TEST RESULTS ON CABLE TOOL SAMPLES

SAMPLE SOURCE					INDEX PROPERTIES						UNDRAINED TRIAXIAL TESTS[1]					CHEMICAL TESTS				OTHER TESTS (* See figures)								REMARKS
Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t/m^3	Specific Gravity	Cell Pressure $kN\ m^2$	Compressive Stress $kN\ m^2$	Failure Strain %	Cohesion C_u $kN\ m^2$	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
711	3	U	0.50	0.95				19	2.12							7.8	0.28			*								
	6	U	2.00	2.45	33	20	13	20	1.98		25	50	3.5															
					(N)			22	2.00		50	99	20	40	(0)													
								20	1.96		100	88	13															
	9	U	3.50	3.95				14	2.04																			
	12	U	5.00	5.45	34	18	16	16	2.18		50	222	10.5												*			
					(N)			16	2.21		100	371	10	183	(0)													
								15	2.17		200	507	14.5															
	16	D	6.80	6.95	23	17	6	14																				
					(99%)																							

Notes and Remarks

U – Undisturbed tube sample
D – Disturbed sample
B – Specimen from bulk sample
W – Water sample

TRIAXIAL TESTS

1. Carried out at rate of strain of 2% per minute.
2. Specimens 100mm diameter and 200mm long.
3. Specimens 38mm diameter and 76mm long
4. Multistage test

CHEMICAL TESTS

a. 2:1 Water : Soil extract

Loc. No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

TABLE 1

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SAMPLE SOURCE					INDEX PROPERTIES						UNDRAINED TRIAXIAL TESTS[1]					CHEMICAL TESTS				OTHER TESTS (* See figures)								REMARKS
Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density $t \cdot m^3$	Specific Gravity	Cell Pressure kN m^2	Compressive Stress kN m^2	Failure Strain %	Cohesion C_u kN m^2	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
712	2	U	0.50	0.95	42	25	17	22	2.05		20	226	20										*					
					(N)			23	2.04		40	207	18	107	(0)													
								24	2.05		80	207	13.5															
	5	B	2.00	2.45				16								8.2	0.14			*								
	7	D	2.50	2.95	34	21	13	15																				
					(83%)																							
	8	B	3.50	3.70				12								8.7	0.12											
	11	D	4.45	4.68	27	18	9	10																				
					(97%)																							
			8.95													8.2	0.11											CORE sample

Notes and Remarks

U – Undisturbed tube sample
D – Disturbed sample
B – Specimen from bulk sample
W – Water sample

TRIAXIAL TESTS

1. Carried out at rate of strain of 2% per minute.
2. Specimens 100mm diameter and 200mm long.
3. Specimens 38mm diameter and 76mm long
4. Multistage test

CHEMICAL TESTS

a. 2:1 Water : Soil extract

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SUMMARY OF LABORATORY TEST RESULTS ON CABLE TOOL SAMPLES

SAMPLE SOURCE					INDEX PROPERTIES						UNDRAINED TRIAXIAL TESTS[1]					CHEMICAL TESTS				OTHER TESTS (* See figures)								REMARKS
Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t/m^3	Specific Gravity	Cell Pressure $kN\ m^2$	Compressive Stress $kN\ m^2$	Failure Strain %	Cohesion C_u $kN\ m^2$	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
713	2	U	0.50	0.95	38	24	14	22	1.92		20	37	3			8.0	0.25											
					(N)			21	2.05		40	95	12.5	45	(0)													
								23	1.94		80	135	20															
	4	D	1.00	1.45	26	17	9	13																				
					(100%)																							
	5	D	2.20	2.38	35	21	14	13																				
					(98%)																							
			10.40													8.3	0.13											CORE sample

Notes and Remarks

U – Undisturbed tube sample
D – Disturbed sample
B – Specimen from bulk sample
W – Water sample

TRIAXIAL TESTS

1. Carried out at rate of strain of 2% per minute.
2. Specimens 100mm diameter and 200mm long.
3. Specimens 38mm diameter and 76mm long
4. Multistage test

CHEMICAL TESTS

a. 2:1 Water : Soil extract

Loc. No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

TABLE 1

Soil Mechanics

SUMMARY OF LABORATORY TEST RESULTS ON CABLE TOOL SAMPLES

SAMPLE SOURCE					INDEX PROPERTIES						UNDRAINED TRIAXIAL TESTS[1]					CHEMICAL TESTS				OTHER TESTS (* See figures)								REMARKS
Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t/m³	Specific Gravity	Cell Pressure kN m⁻²	Compressive Stress kN m⁻²	Failure Strain %	Cohesion C_u kN m⁻²	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
714	2	U	0.50	0.95	49	28	21	25	1.96		20	125	6.5							*								
					(N)						40	166	9.5	71	(0)													
											80	137	9.0															
	4	D	1.00	1.45	33	21	12	16																				
					(85%)																							
	6	D	2.00	2.18				12								8.5	0.14											
	7	D	2.60	2.70	30	20	10	9.7																				
					(100%)																							
			10.50													8.4	0.14											CORE sample

Notes and Remarks

- U – Undisturbed tube sample
- D – Disturbed sample
- B – Specimen from bulk sample
- W – Water sample

TRIAXIAL TESTS

1. Carried out at rate of strain of 2% per minute.
2. Specimens 100mm diameter and 200mm long.
3. Specimens 38mm diameter and 76mm long
4. Multistage test

CHEMICAL TESTS

a. 2:1 Water : Soil extract

Loc. No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

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SAMPLE SOURCE					INDEX PROPERTIES						UNDRAINED TRIAXIAL TESTS[1]					CHEMICAL TESTS				OTHER TESTS (* See figures)								REMARKS
Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t/m³	Specific Gravity	Cell Pressure kN m⁻²	Compressive Stress kN m⁻²	Failure Strain %	Cohesion C_u kN m⁻²	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
716	2	U	0.50	0.95	39	21	18	15	2.18							7.5	0.16											
					(78%)																							
	8	U	3.50	3.95	34	22	12	16	2.01		40	121	3.5															
					(64%)						80	188	7	102	(0)													
											160	305	14.5															
	11	U	5.00	5.45				21	2.16																			
	14	U	6.50	6.95	37	25	12	20	1.94		70	183	7													*		
					(N)			21	1.81		140	161	7	122	(0)													
								19	1.90		280	385	13.5															
	15	D	7.00					18								8.2	0.17											
	17	U	8.00	8.45				18	2.12																			

Notes and Remarks

U – Undisturbed tube sample
D – Disturbed sample
B – Specimen from bulk sample
W – Water sample

TRIAXIAL TESTS

1. Carried out at rate of strain of 2% per minute.
2. Specimens 100mm diameter and 200mm long.
3. Specimens 38mm diameter and 76mm long
4. Multistage test

CHEMICAL TESTS

a. 2:1 Water : Soil extract

Loc. No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

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SAMPLE SOURCE					INDEX PROPERTIES						UNDRAINED TRIAXIAL TESTS[1]					CHEMICAL TESTS				OTHER TESTS (* See figures)								REMARKS
Borehole No.	Sample No.		Depth m		Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t/m^3	Specific Gravity	Cell Pressure kN/m^2	Compressive Stress kN/m^2	Failure Strain %	Cohesion C_u kN/m^2	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
			From	To																								
717	2	B	0.50	0.95				9.1												*							
	4	U	1.10	1.55	29	16	13	18	2.11																		
					(N)																						
	7	U	2.55	3.00				28	1.96		30	62	3.5														
								24	2.01		60	67	4	30	(0)												
								24	2.00		120	48	4														
	10	W	3.65													8.2		0.14									
	11	U	4.00	4.45	33	19	14	19	2.01		40	109	3.5														
					(N)			19	2.08		80	323	16	127	(0)												
								19	2.09		160	331	16.5														
	15	U	5.50	5.95				20	2.01		60	86	3.5														
								20	2.07		120	175	9	90	(0)												
								20	2.10		240	280	20														
	18	U	7.00	7.45				22	2.00		70	88	7														
								22	2.00		140	121	12	63	(0)												
								21	1.95		280	170	12														

Notes and Remarks

- U – Undisturbed tube sample
- D – Disturbed sample
- B – Specimen from bulk sample
- W – Water sample

TRIAXIAL TESTS

1. Carried out at rate of strain of 2% per minute.
2. Specimens 100mm diameter and 200mm long.
3. Specimens 38mm diameter and 76mm long
4. Multistage test

CHEMICAL TESTS

a. 2:1 Water : Soil extract

Loc. No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

TABLE 1

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SUMMARY OF LABORATORY TEST RESULTS ON CABLE TOOL SAMPLES

SAMPLE SOURCE					INDEX PROPERTIES						UNDRAINED TRIAXIAL TESTS[1]					CHEMICAL TESTS				OTHER TESTS (* See figures)								REMARKS
Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t/m^3	Specific Gravity	Cell Pressure kN/m^2	Compressive Stress kN/m^2	Failure Strain %	Cohesion C_u kN/m^2	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
717	21	U	8.50	8.95	42	25	17	23	1.84		80	140	9.5			7.8	0.30											
					(N)			24	1.90		166	196	9.5	84	(0)													
								23	1.91		320	168	8															
	27	D	11.00	11.25	32	21	11	15																				
					(81%)																							
	29	D	13.00	13.23				15																				

Notes and Remarks

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W – Water sample

TRIAXIAL TESTS

1. Carried out at rate of strain of 2% per minute.
2. Specimens 100mm diameter and 200mm long.
3. Specimens 38mm diameter and 76mm long
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Loc. No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

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SUMMARY OF LABORATORY TEST RESULTS ON CABLE TOOL SAMPLES

SAMPLE SOURCE					INDEX PROPERTIES						UNDRAINED TRIAXIAL TESTS[1]					CHEMICAL TESTS				OTHER TESTS (* See figures)								REMARKS
Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t/m³	Specific Gravity	Cell Pressure kN m⁻²	Compressive Stress kN m⁻²	Failure Strain %	Cohesion C_u kN m⁻²	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
718	2	U	0.50	0.95	31	16	15	17	2.09											*							
					(N)																						
	11	W	2.00													8.1		0.08									
	5	U	2.00	2.45	43	23	20																*		*		
					(N)																						
	8	U	3.50	3.95				16	2.14		40	145	2														
								16	2.02		80	245	5.5	165	(0)												
								14	2.19		160	599	6														
	9	D	4.00					10								8.4	0.21										
	12	D	5.00	5.45	30	19	11	17																			
					(84%)																						
	13	D	6.00	6.28	/			12																			

Notes and Remarks

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TRIAXIAL TESTS

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2. Specimens 100mm diameter and 200mm long.
3. Specimens 38mm diameter and 76mm long
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CHEMICAL TESTS

a. 2:1 Water : Soil extract

Loc. No. 7382

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TABLE 1

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SUMMARY OF LABORATORY TEST RESULTS ON CABLE TOOL SAMPLES

SAMPLE SOURCE					INDEX PROPERTIES						UNDRAINED TRIAXIAL TESTS[1]					CHEMICAL TESTS				OTHER TESTS (* See figures)								REMARKS
Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t/m³	Specific Gravity	Cell Pressure kN m⁻²	Compressive Stress kN m⁻²	Failure Strain %	Cohesion C_u kN m⁻²	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
719	2	U	0.50	0.95	35	20	15	19	2.01																		
					(N)																						
	5	U	2.00	2.45				18	2.19																		
	6	D	2.50					16								8.2	0.34										
	8	U	3.50	3.95	32	20	12	14	2.02		40	212	4												*		
					(N)			16	2.06		80	334	11	172	(0)												
								15	2.03		160	484	11														
	11	D	5.00	5.45	29	22	7	14																			
					(N)																						
	12	W	5.30													8.0	0.09										
	13	D	6.00	6.20				15																			

Notes and Remarks

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SAMPLE SOURCE				INDEX PROPERTIES						UNDRAINED TRIAXIAL TESTS[1]					CHEMICAL TESTS				OTHER TESTS (* See figures)								REMARKS
Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t/m³	Specific Gravity	Cell Pressure kN/m²	Compressive Stress kN/m²	Failure Strain %	Cohesion C_u kN/m²	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
720	2	U	0.50	0.95	44	24	20	25	1.95																		
					(N)																						
	5	U	2.00	2.45	32	15	15									8.3	0.21					*					
					(N)																						
	8	U	3.50	3.95				22	2.00		40	115	2.5														
											80			60	(0)												
								23	1.79		160	126	8.5														
	11	U	5.00	5.35	35	22	13	27	2.08		100	8	3.5	4	(0)												
					(94%)																						
	12	D	5.40					14								8.3	0.14										

Notes and Remarks

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TRIAXIAL TESTS

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2. Specimens 100mm diameter and 200mm long.
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SAMPLE SOURCE				INDEX PROPERTIES						UNDRAINED TRIAXIAL TESTS[1]					CHEMICAL TESTS				OTHER TESTS (* See figures)								REMARKS
Borehole No.	Sample No.		Depth m	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t/m³	Specific Gravity	Cell Pressure kN/m²	Compressive Stress kN/m²	Failure Strain %	Cohesion C_u kN/m²	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
			From / To																								
721	2	U	0.50 / 0.95	39	21	18																*					
				(N)																							
	5	U	2.00 / 2.45	32	21	11	14	2.07		25	227	12													*		
				(N)			14	2.13		50	336	3.5	142	(0)													
							15	2.04		100	291	4															
	6	D	2.50				14								8.2	0.31											
	8	D	3.50 / 3.95	35	19	16	18																				
				(92%)																							
	9	D	4.50 / 4.68				15																				
	10	D	5.20 / 5.30				8.7								8.3	0.39											

Notes and Remarks

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1. Carried out at rate of strain of 2% per minute.
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SAMPLE SOURCE					INDEX PROPERTIES						UNDRAINED TRIAXIAL TESTS[1]					CHEMICAL TESTS				OTHER TESTS (* See figures)								REMARKS
Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t/m^3	Specific Gravity	Cell Pressure $kN\ m^2$	Compressive Stress $kN\ m^2$	Failure Strain %	Cohesion C_u $kN\ m^2$	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
722	2	U	0.50	0.95	42	26	16	26	1.93		20	74	4.5															
					(N)			27	1.92		40	77	8.5	42	(0)													
								27	1.93		80	103	10.5															
	5	U	2.00	2.45				16	2.10							8.2	0.43											
	8	U	3.50	3.85	32	21	11	16	1.99		40	262	3.5															
					(98%)			17	1.81		80	213	5	154	(0)													
								17	1.95		160	446	6.5															
	11	D	5.00	5.28	30	19	11	15																				
					(99%)																							
	12	D	5.50	5.60			14									8.3	0.42											

Notes and Remarks

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TRIAXIAL TESTS

1. Carried out at rate of strain of 2% per minute.
2. Specimens 100mm diameter and 200mm long.
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SAMPLE SOURCE					INDEX PROPERTIES						UNDRAINED TRIAXIAL TESTS[1]					CHEMICAL TESTS				OTHER TESTS (* See figures)								REMARKS
Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t/m³	Specific Gravity	Cell Pressure kN m⁻²	Compressive Stress kN m⁻²	Failure Strain %	Cohesion C_u kN m⁻²	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
723	2	U	0.50	0.95	47	23	24																*					
					(N)																							
	12	W	2.00													8.3		0,11										
	5	U	2.00	2.30	31	18	13	16	1.72		20	58	4															
					(N)			17	1.72		40	84	14.5	68	(0)													
								16	2.03		80	266	6															
	9	U	4.50	4.95	35	25	10	24			Insufficient suitable material														*			
					(95%)																							
	13	D	6.00	6.45				11								8.2	0.23											
	14	D	7.00	7.18	30	22	8	15																				
					(78%)																							

Notes and Remarks

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SAMPLE SOURCE					INDEX PROPERTIES						UNDRAINED TRIAXIAL TESTS[1]					CHEMICAL TESTS				OTHER TESTS (* See figures)								REMARKS
Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t/m³	Specific Gravity	Cell Pressure kN m⁻²	Compressive Stress kN m⁻²	Failure Strain %	Cohesion C_u kN m⁻²	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
725	1	U	1.50	1.65	31	20	11	21	1.84																			
					(N)																							
	2	D	1.70					15								8.3	0.30											
	5	D	3.00	3.28	36	21	15	13																				
					(99%)																							

Notes and Remarks

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SAMPLE SOURCE					INDEX PROPERTIES						UNDRAINED TRIAXIAL TESTS[1]					CHEMICAL TESTS				OTHER TESTS (* See figures)								REMARKS
Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density $t \cdot m^3$	Specific Gravity	Cell Pressure $kN\ m^2$	Compressive Stress $kN\ m^2$	Failure Strain %	Cohesion C_u $kN\ m^2$	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
726	1	U	0.60	1.05	37	22	15	31	1.93							7.3	0.17											
					(63%)																							
	4	U	2.00	2.45																		*						
	7	U	3.50	3.90	37	22	15	18	2.07																			
					(N)																							
	10	U	5.00	5.40				17	2.03		50	87	3.5			8.2	0.14											
								18	2.02		100	291	20	121	(0)													
								16	2.13		200	349	6.5															
	14	D	6.90	7.35	28	18	10	14																				
					(61%)																							
	15	D	7.70	7.99				17								8.3	0.22											
	17	D	9.10	9.32	33	19	14	18																				
					(100%)																							

Notes and Remarks

U – Undisturbed tube sample
D – Disturbed sample
B – Specimen from bulk sample
W – Water sample

TRIAXIAL TESTS

1. Carried out at rate of strain of 2% per minute.
2. Specimens 100mm diameter and 200mm long.
3. Specimens 38mm diameter and 76mm long
4. Multistage test

CHEMICAL TESTS

a. 2:1 Water : Soil extract

Loc. No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

TABLE 1

Soil Mechanics

SUMMARY OF LABORATORY TEST RESULTS ON CABLE TOOL SAMPLES

SAMPLE SOURCE					INDEX PROPERTIES						UNDRAINED TRIAXIAL TESTS[1]					CHEMICAL TESTS				OTHER TESTS (* See figures)								REMARKS
Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t/m³	Specific Gravity	Cell Pressure kN/m²	Compressive Stress kN/m²	Failure Strain %	Cohesion C_u kN/m²	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
727	2	U	0.50	0.95	39	20	19	19	1.93							7.3	0.12											
					(N)																							
	6	U	1.90	2.35	38	20	18	20	2.02		25	162	9.5												*			
					(N)			19	2.08		50	156	10	84	(0)													
								19	1.98		100	188	12															
	9	U	3.40	3.85	31	17	14																*					
					(N)																							
	12	U	4.90	5.20				16	2.03		50	118	6															
								15	2.05		100	188	10	62	(0)													
								16	2.04		200	63	1.5															
	15	D	5.25	5.70	36	20	16	12																				
					(93%)																							
	14	W	5.30													8.2		0.10										
	17	D	7.25	7.51	32	20	12	14																				
					(80%)																							

Notes and Remarks

U – Undisturbed tube sample
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W – Water sample

TRIAXIAL TESTS

1. Carried out at rate of strain of 2% per minute.
2. Specimens 100mm diameter and 200mm long.
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CHEMICAL TESTS

a. 2:1 Water : Soil extract

Loc. No. 7382

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SAMPLE SOURCE					INDEX PROPERTIES						UNDRAINED TRIAXIAL TESTS[1]					CHEMICAL TESTS				OTHER TESTS (* See figures)								REMARKS
Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density $t \cdot m^3$	Specific Gravity	Cell Pressure $kN\ m^2$	Compressive Stress $kN\ m^2$	Failure Strain %	Cohesion C_u $kN\ m^2$	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
728	1	U	1.00	1.45	33	19	14	16	2.10		20	164	3.5			8.2	0.25											
					(N)			15	2.03		40	136	2	78	(0)													
								14	1.98		80	167	10.5															
	4	D	2.30	2.75	32	21	11	14																				
					(93%)																							
	5	D	3.60	3.80				24								8.2	0.19											
	7	D	3.80	4.02	30	20	10	14																				
					(80%)																							

Notes and Remarks

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TRIAXIAL TESTS

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TABLE 1

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SAMPLE SOURCE				INDEX PROPERTIES						UNDRAINED TRIAXIAL TESTS[1]					CHEMICAL TESTS				OTHER TESTS (* See figures)								REMARKS
Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t·m^3	Specific Gravity	Cell Pressure kN m^2	Compressive Stress kN m^2	Failure Strain %	Cohesion C_u kN m^2	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
738	2	U	0.50	0.95	31	18	13	27	1.96		20	75	20													*	
					(85%)			25	1.99		40	61	16.5	37	(0)												
								26	1.96		80	83	15.5														
	5	U	2.00	2.45	39	22	17																		*		
					(N)																						
								24	2.00		25	106	12														
								24	2.01		50	131	8.5	64	(0)												
								25	1.97		100	147	11														
	8	U	3.50	3.95	30	21	9																*		*		
					(N)																						
	12	U	5.00	5.45	34	20	14	28			Insufficient suitable material					8.0	0.18										
					(99%)																						
	15	D	6.50	6.60	33	23	11	15																			
					(83%)																						
	16	W	1.50													7.9		0.09								

Notes and Remarks

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TRIAXIAL TESTS

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3. Specimens 38mm diameter and 76mm long
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CHEMICAL TESTS

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Loc. No. 7382

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Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t·m^3	Specific Gravity	Cell Pressure kN m^2	Compressive Stress kN m^2	Failure Strain %	Cohesion C_u kN m^2	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
740	2	U	0.50	0.95	47	18	29																*				*	
					(N)																							
	3	D	1.00					22								6.8	0.13											
																									*			
	5	U	2.00	2.45	30	18	12	23	2.00		25	69	5															
					(98%)			21	1.98		50	82	10	42	(0)													
								22	2.03		100	102	14.5															
	8	U	3.50	3.95	47	24	23																*					
					(N)																							
	10	W	2.80													8.3		0.06										
	12	D	5.00	5.45	31	20	11	17																				
					(66%)																							
	14	B	6.00	6.30				21								8.1	0.25											
	15	D	6.40	6.51	37	21	16	15																				
					(55%)																							

Notes and Remarks

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TRIAXIAL TESTS

1. Carried out at rate of strain of 2% per minute.
2. Specimens 100mm diameter and 200mm long.
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CHEMICAL TESTS

a. 2:1 Water : Soil extract

Loc. No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

TABLE 1

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SUMMARY OF LABORATORY TEST RESULTS ON CABLE TOOL SAMPLES

SAMPLE SOURCE					INDEX PROPERTIES						UNDRAINED TRIAXIAL TESTS[1]					CHEMICAL TESTS				OTHER TESTS (* See figures)								REMARKS
Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t/m^3	Specific Gravity	Cell Pressure $kN\ m^2$	Compressive Stress $kN\ m^2$	Failure Strain %	Cohesion C_u $kN\ m^2$	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
746	1	U	0.60	1.05	45	21	24	20	2.09		20	232	8.5												*		
					(N)			22	2.03		40	177	9.5	98	(0)												
								24	2.01		80	179	116														
	4	U	2.00	2.45				19	1.90		25	114	9														
								21	1.82		50	57	4	47	(0)												
								21	1.89		100	110	6														
		W	3.50													8.3		0.53									
	7	U	3.50	3.85	34	20	14	19	2.28																		
					(50%)																						
	10	D	4.60	4.80				17																			

Notes and Remarks

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TRIAXIAL TESTS

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Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t/m³	Specific Gravity	Cell Pressure kN m²	Compressive Stress kN m²	Failure Strain %	Cohesion C_u kN m²	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
753	2	U	0.50	0.95	27	14	13	23	1.93		20	13	3.5															
					(59%)						40	17	7	8	(0)													
											80	18	9.5															
	5	U	2.00	2.45	31	19	12	21	2.00		25	46	4													*		
					(N)			21	2.04		50	61	8.5	32	(0)													
								20	2.01		100	87	17.5															
	11	U	5.00	5,45				23	2.15																			

Notes and Remarks

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754	2	U	0.50	0.95	42	19	23	21	2.06		20	107	16.5														
					(N)			21	2.06		40	101	8	54	(0)												
								19	2.05		80	117	12														
	8	U	3.50	3.95	32	30	12	18	2.10		40	192	4												*		
					(N)			18	2.05		80	204	7	111	(0)												
								19	2.07		160	270	4														
	15	U	6.50	6.95				19	2.21																		

Notes and Remarks

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1. Carried out at rate of strain of 2% per minute.
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Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t/m^3	Specific Gravity	Cell Pressure $kN\ m^2$	Compressive Stress $kN\ m^2$	Failure Strain %	Cohesion C_u $kN\ m^2$	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
810	1	B	0.70					29												*							
	5	U	0.55					16	2.07		10	67	9.5	34	(0)												
811	2	D	0.50		34	18	16	22																			
					(83%)																						
	5	U	1.50					14	2.10		30	495	12	248	(0)												
	6	W	1.20													8.0		0.08									
812	4	D	0.70		32	22	10	30																			
					(88%)																						
	8	U	1.70		36	18	18	21	2.06		35	75	9.5	38	(0)												
					(86%)																						
813	1	B	1.10					21												*							
	5	U	1.50					21	2.04		30	110	15.5	55	(0)												

Notes and Remarks

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814	2	D	0.60		35	18	17	25																			
					(87%)																						
	5	D	1.50					25	1.96		30	53	8	27	(0)												
	7	U	2.20					23	1.93		45	317	8.5	159	(0)												
815	1	B	0.80					18												*							
	2	D	0.80		30	15	15	15																			
					(48%)																						
	5	U	1.50					15	2.18		30	154	10	77	(0)												
	7	U	1.95					22	1.98		40	100	12.5	50	(0)												
821	2	D	0.50					31																			
	3	B	0.70					46								7.3	0.05		2.61								
	4	D	0.70					40																			

Notes and Remarks

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821	5	B	1.00					16												*							
	7	W	1.50													8.2		0.05									
822	3	B	1.50					17												*							
	5	W	1.50													8.4		0.09									
827	1	B	0.90					20												*							
	2	D	0.90		42	19	23	19																			
					(90%)																						
828	2	D	0.80		36	17	19	24																			
					(82%)																						
	4	D	1.50		41	23	18	26																			
					(95%)																						

Notes and Remarks

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Borehole No.	Sample No.		Depth m From	Depth m To	Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Density t/m³	Specific Gravity	Cell Pressure kN m⁻²	Compressive Stress kN m⁻²	Failure Strain %	Cohesion C_u kN m⁻²	ϕ_u Degrees	pH	Sulphate Content SOIL %	Sulphate Content WATER g/l	Organic Content %	P.S.D.	Compaction	C.B.R.	C.U. Triaxial	C.D. Triaxial	Shear box	Consolidation	Rowe cell	
829	2	D	0.70		38	18	20	22																			
					(93%)																						
	4	D	1.20		40	17	23	17																			
					(93%)																						
830	1	B	1.00					29												*							
	3	U	1.20		39	20	19	17	2.07		25	780	6.5	390	(0)												
					(98%)																						
831	3	U	0.80		38	17	21	19	2.00		15	287	9.5	144	(0)												
					(10%)																						
832	2	U	0.50		26	16	10	19	2.06		10	81	10	41	(0)												
					(90%)																						

Notes and Remarks

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2. Specimens 100mm diameter and 200mm long.
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CHEMICAL TESTS

a. 2:1 Water : Soil extract

Loc. No. 7382

Location A42 CASTLE DONINGTON NORTH GROUND INVESTIGATION CONTRACT 4

TABLE 1

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Soil Mechanics

POINT LOAD TEST RESULTS

LOCATION NO 7382
LOCATION A42 CASTLE DONINGTON NORTH

DATE
TESTED BY AAC
TESTED IN FIELD/~~LABORATORY~~

Machine Used: ELE Ram Area: 14.42 cm^2

Samples tested as recovered / ~~saturated/dried/as received~~.
Samples tested at natural mc / ~~saturated/dried/as received~~/ core in mylar / ~~core saturated~~

Sample details BH/TP	Depth	Test Type See Note 2	D platen separation mm	W sample width mm	G gauge reading MPa	Description/Remarks	P Failure load kN	De Equivalent diameter mm	De^2 mm^2	I_s MPa	F Size factor	$I_s(50)$ Point load index MPa	Strength classification
							G x ram area	D or $\sqrt{\frac{4DW}{\pi}}$		P/De^2	$\left(\frac{De}{50}\right)^{0.45}$	$I_s \times F$	
704													
	7.86- 7.95	d	89	45	0.02		0.29	89	7921	0.04	1.30	0.05	
	8.49- 8.59	d	89	50	0.01	Spalling failure	0.14						
	8.59- 8.68	d	89	42	0.24		3.46	89	7921	0.44	1.30	0.57	
705													
	6.75- 6.85	d	89	50	0.20		2.88	89	7921	0.36	1.30	0.47	
	8.60- 8.68	d	89	40	0.30		4.33	89	7921	0.55	1.30	0.72	
	9.95-10.06	d	89	55	-	Fractured along tight joint	-						
	10.33-10.45	d	89	60	0.20	Fractured along tight joint	2.88						
	11.25-11.35	d	89	50	-	Fractured along tight fissure	-						
	11.70-11.82	d	89	60	0.18		2.60	89	7921	0.33	1.30	0.43	
	13.85-13.97	d	89	60	0.10	Fractured along tight fissure	1.44						
	16.39-16.54	d	89	75	0.32		4.61	89	7921	0.58	1.30	0.76	
706													
	8.96- 9.04	d	89	40	0.22		2.88	89	7921	0.36	1.30	0.47	
	9.87- 9.97	d	89	50	0.18		2.60	89	7921	0.33	1.30	0.43	
	10.43-10.59	d	89	80	0.18		2.60	89	7921	0.33	1.30	0.43	
	10.99-11.08	d	89	45	0.56		8.08	89	7921	1.02	1.30	1.33	
	11.26-11.35	d	89	55	0.12	Fractured along tight fissure	1.73						

Notes 1. Point Load Testing carried out in accordance with ISRM Suggested Method (1985)
2. Test type: a=axial, d=diametral, b=block, i=irregular lump, ∥=parallel or ⊥=perpendicular to foliation.

Location: A42 CASTLE DONINGTON NORTH
Loc. No. 7382
Table 2

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Location A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Table 2

POINT LOAD TEST RESULTS

LOCATION NO 7382
LOCATION A42 CASTLE DONINGTON NORTH

DATE
TESTED BY AAC
TESTED IN FIELD/[redacted]

Machine Used: ELE Ram Area: 14.42 cm^2

Samples tested as recovered / [redacted].
Samples tested at natural mc / [redacted] core in mylar / [redacted]

Sample details BH/TP	Depth	Test Type See Note 2	D platen separation mm	W sample width mm	G gauge reading MPa	Description/Remarks	P Failure load kN	De Equivalent diameter mm	De^2 mm^2	I_s MPa	F Size factor	$I_s(50)$ Point load index MPa	Strength classification
							G x ram area	D or $\sqrt{\frac{4DW}{\pi}}$		P/De^2	$\left(\frac{De}{50}\right)^{0.45}$	I_s x F	
706													
13.76-13.86		d	89	50	0.21		3.03	89	7921	0.38	1.30	0.50	
707													
6.23- 6.30		d	89	35	0.32		4.61	89	7921	0.58	1.30	0.76	
6.75- 6.87		d	89	60	0.14		2.02	89	7921	0.25	1.30	0.33	
8.50- 8.59		d	89	45	0.20		2.88	89	7921	0.36	1.30	0.47	
8.80- 8.87		d	89	35	0.33		4.76	89	7921	0.60	1.30	0.78	
11.40-11.51		d	89	55	0.25		3.61	89	7921	0.46	1.30	0.59	
11.65-11.73		d	89	40	-	Fractured along tight fissure	-						
11.85-11.94		d	89	45	0.18		2.60	89	7921	0.33	1.30	0.43	
13.71-13.84		d	89	65	0.26		3.75	89	7921	0.47	1.30	0.62	
708													
5.75- 5.81		d	89	30	0.20		2.88	89	7921	0.36	1.30	0.47	
6.92- 7.01		d	89	45	0.40		5.79	89	7921	0.73	1.30	0.95	
7.91- 7.99		d	89	40	0.63		15.05	89	7921	1.90	1.30	2.47	
9.75- 9.91		d	89	80	0.21		3.03	89	7921	0.38	1.30	0.50	
9.98-10.06		d	89	40	0.11		1.59	89	7921	0.20	1.30	0.26	
709													
6.85- 6.96		d	89	55	0.20		2.88	89	7921	0.36	1.30	0.47	
8.10- 8.22		d	89	60	0.24	Spalling failure	3.46						
8.30- 8.40		d	89	50	0.51	Fractured along tight joint	7.35						
8.80- 9.00		d	89	100	9.70		139.87	89	7921	17.66	1.30	22.96	

Notes 1. Point Load Testing carried out in accordance with ISRM Suggested Method (1985)
2. Test type: a=axial, d=diametral, b=block, i=irregular lump, ∥=parallel or ⊥=perpendicular to foliation.

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POINT LOAD TEST RESULTS

LOCATION NO 7382
LOCATION A42 CASTLE DONINGTON NORTH

DATE
TESTED BY AAC
TESTED IN FIELD/LABORATORY

Machine Used: ELE Ram Area: 14.42 cm^2

Samples tested as recovered / ~~oven dried~~.
Samples tested at natural mc / ~~saturated~~ core in mylar / ~~core in polythene~~.

Sample details BH/TP	Depth	Test Type See Note 2	D platen separation mm	W sample width mm	G gauge reading MPa	Description/Remarks	P Failure load kN	De Equivalent diameter mm	De^2 mm^2	I_s MPa	F Size factor	$I_s(50)$ Point load index MPa	Strength classification
							C x ram area	D or $\sqrt{\frac{4DW}{\pi}}$		P/De^2	$\left(\frac{De}{50}\right)^{0.45}$	I_s x F	
709													
	9.38- 9.48	d	89	50	4.00		57.68	89	7921	7.28	1.30	9.47	
	10.65-10.78	d	89	65	0.25		3.61	89	7921	0.46	1.30	0.60	
710													
	14.48-14.54	d	89	32	0.20	Fractured along tight joint	2.88						
	15.50-15.62	d	89	60	0.20		2.88	89	7921	0.36	1.30	0.47	
	16.25-16.43	d	89	90	0.30		4.33	89	7921	0.55	1.30	0.72	
	17.40-17.50	d	89	50	9.05		130.50	89	7921	16.48	1.30	21.42	
711													
	8.40- 8.49	d	89	45	0.20	Fractured along tight joint	2.88						
	9.75- 9.88	d	89	65	0.37		5.34	89	7921	0.67	1.30	0.88	
	10.30-10.42	d	89	60	0.21		3.03	89	7921	0.38	1.30	0.50	
	14.65-14.77	d	89	60	0.34		4.90	89	7921	0.62	1.30	0.80	
712													
	3.57- 3.70	d	89	65	0.16		2.31	89	7921	0.29	1.30	0.38	
	4.33- 4.46	d	89	75	0.16		2.31	89	7921	0.29	1.30	0.38	
	6.20- 6.33	d	89	65	0.16		2.31	89	7921	0.29	1.30	0.38	
713													
	6.02- 6.16	d	89	70	0.20		2.88	89	7921	0.36	1.30	0.47	

Notes 1. Point Load Testing carried out in accordance with ISRM Suggested Method (1985)
2. Test type: a=axial, d=diametral, b=block, i=irregular lump, ∥=parallel or ⊥=perpendicular to foliation.

Location: A42 CASTLE DONINGTON NORTH
Loc. No. 7382
Table 2

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Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Table 2

POINT LOAD TEST RESULTS

LOCATION NO 7382
LOCATION A42 CASTLE DONINGTON NORTH

DATE
TESTED BY AAC
TESTED IN FIELD/LXXXXXXXX

Machine Used: ELE Ram Area: 14.42 cm^2

Samples tested as recovered / core in mylar /

Samples tested at natural mc / core in mylar /

Sample details BH/TP	Depth	Test Type See Note 2	D platen separation mm	W sample width mm	G gauge reading MPa	Description/Remarks	P Failure load kN	De Equivalent diameter mm	De^2 mm^2	I_s MPa	F Size factor	$I_s(50)$ Point load index MPa	Strength classification
							G x ram area	D or $\sqrt{\frac{4DW}{\pi}}$		P/De^2	$\left(\frac{De}{50}\right)^{0.45}$	$I_s \times F$	
713													
10.25-10.35		d	89	50	0.10		1.44	89	7921	0.18	1.30	0.24	
10.50-10.67		d	89	85	0.40		5.79	89	7921	0.73	1.30	0.95	
13.70-13.80		d	89	50	0.21	Fractured along polished surface	3.03						
714													
4.25- 4.37		d	89	60	0.20		2.88	89	7921	0.36	1.30	0.38	
7.30- 7.42		d	89	60	0.12		1.73	89	7921	0.22	1.30	0.28	
9.61- 9.76		d	89	70	0.12		1.73	89	7921	0.22	1.30	0.28	
10.20-10.35		d	89	75	3.80		54.80	89	7921	6.92	1.30	8.99	
10.59-10.76		d	89	85	6.50		93.73	89	7921	11.83	1.30	15.38	
14.00-14.15		d	89	75	0.10		1.44	89	7921	0.18	1.30	0.24	
14.75-14.87		d	89	60	0.25		3.61	89	7921	0.46	1.30	0.59	
715													
2.55- 2.70		d	89	75	0.20	Fractured along tight joint	2.88						
5.06- 5.16		d	89	55	0.36		5.19	89	7921	0.66	1.30	0.85	
8.05- 8.21		d	89	80	0.54		7.79	89	7921	0.98	1.30	1.28	
9.00- 9.06		d	89	30	0.16	Spalling failure	2.31						
11.18-11.28		d	89	50	0.22		3.17	89	7921	0.40	1.30	0.52	
717													
13.66-13.75		d	89	45	0.13		1.87	89	7921	0.24	1.30	0.31	

Notes 1. Point Load Testing carried out in accordance with ISRM Suggested Method (1985)
2. Test type: a=axial, d=diametral, b=block, i=irregular lump, ∥=parallel or ⊥=perpendicular to foliation.

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Location A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Table 2

POINT LOAD TEST RESULTS

LOCATION NO 7382
LOCATION A42 CASTLE DONINGTON NORTH

DATE
TESTED BY AAC
TESTED IN FIELD/[illegible]

Machine Used: ELE Ram Area: 14.42 cm^2

Samples tested as recovered / [illegible].
Samples tested at natural mc / [illegible] core in mylar / [illegible]

Sample details BH/TP	Depth	Test Type See Note 2	D platen separation mm	W sample width mm	G gauge reading MPa	Description/Remarks	P Failure load kN	De Equivalent diameter mm	De^2 mm^2	I_s MPa	F Size factor	$I_s(50)$ Point load index MPa	Strength classification
							C x ram area	D or $\sqrt{\frac{4DW}{\pi}}$		P/De^2	$\left(\frac{De}{50}\right)^{0.45}$	I_s x F	
717													
16.05-16.12		d	89	35	0.50		7.21	89	7921	0.91	1.30	1.18	
16.45-16.56		d	89	65	1.05		15.14	89	7921	1.91	1.30	2.48	
18.55-18.74		d	89	95	2.85		41.10	89	7921	5.19	1.30	6.75	
19.38-19.48		d	89	50	5.30		76.43	89	7921	9.65	1.30	12.54	
718													
11.91-12.02		d	89	55	6.90		99.50	89	7921	12.56	1.30	16.33	
719													
10.60-10.70		d	89	50	0.06		0.87	89	7921	0.11	1.30	0.14	
12.90-13.02		d	89	60	0.08		1.15	89	7921	0.15	1.30	0.19	
13.31-13.49		d	89	90	4.75		68.50	89	7921	8.65	1.30	11.24	
721													
11.85-12.00		d	89	75	5.20		74.98	89	7921	10.40	1.30	13.52	
722													
8.10- 8.20		d	89	50	0.40		5.77	89	7921	0.73	1.30	0.95	
11.65-11.85		d	89	45	1.00	Fractured along a tight joint	14.42						
723													
12.23-12.37		d	89	70	1.60	Spalling failure	23.07						

Notes 1. Point Load Testing carried out in accordance with ISRM Suggested Method (1985)
2. Test type: a=axial, d=diametral, b=block, i=irregular lump, ⇑=parallel or ⊥=perpendicular to foliation.

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POINT LOAD TEST RESULTS

LOCATION NO 7382
LOCATION A42 CASTLE DONINGTON NORTH

DATE
TESTED BY AAC
TESTED IN FIELD/[illegible]

Machine Used: ELE Ram Area: 14.42 cm^2

Samples tested as recovered /[illegible]
Samples tested at natural mc /[illegible] core in mylar /[illegible]

Sample details BH/TP	Depth	Test Type See Note 2	D platen separation mm	W sample width mm	C gauge reading MPa	Description/Remarks	P Failure load kN	De Equivalent diameter mm	De^2 mm^2	I_s MPa	F Size factor	$I_s(50)$ Point load index MPa	Strength classification
							C x ram area	D or $\sqrt{\frac{4DW}{\pi}}$		P/De^2	$\left(\frac{De}{50}\right)^{0.45}$	I_s x F	
726													
13.00-13.11		d	89	55	0.12		1.73	89	7921	0.22	1.30	0.28	
13.30-13.46		d	89	80	0.13		1.87	89	7921	0.24	1.30	0.31	
727													
6.83- 6.91		d	89	40	0.40		5.77	89	7921	0.72	1.30	0.95	
11.13-11.23		d	89	50	0.17	Fractured along tight joint	2.45						
11.48-11.56		d	89	40	0.19		2.74	89	7921	0.35	1.30	0.46	
13.62-13.69		d	89	35	1.15		16.58	89	7921	2.09	1.30	2.72	
728													
5.25- 5.36		d	89	55	0.16		2.31	89	7921	0.29	1.30	0.38	
6.30- 6.50		d	89	100	0.15	Spalling failure	2.16						
10.58-10.64		d	89	30	0.20	Spalling failure	2.88						
12.88-13.06		d	89	40	1.80		25.95	89	7921	3.28	1.30	4.26	
729													
2.69- 2.85		d	89	80	0.19		2.74	89	7921	0.35	1.30	0.45	
3.90- 4.08		d	89	90	0.13	Fractured along tight joint	1.87						
5.29- 5.43		d	89	70	0.18		2.60	89	7921	0.33	1.30	0.43	
5.71- 5.89		d	89	75	0.16		2.31	89	7921	0.29	1.30	0.38	
6.95- 7.13		d	89	90	0.18		2.60	89	7921	0.33	1.30	0.43	
7.62- 7.69		d	89	35	0.14		2.02	89	7921	0.25	1.30	0.33	

Notes 1. Point Load Testing carried out in accordance with ISRM Suggested Method (1985)
2. Test type: a=axial, d=diametral, b=block, i=irregular lump, ∥=parallel or ⊥=perpendicular to foliation.

Location: A42 CASTLE DONINGTON NORTH
Loc. No. 7382
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Location A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Table 2

POINT LOAD TEST RESULTS

LOCATION NO 7382
LOCATION A42 CASTLE DONINGTON NORTH

DATE
TESTED BY AAC
TESTED IN FIELD/LABORATORY

Machine Used: ELE Ram Area: 14.42 cm^2

Samples tested as recovered / ~~XXXXXXXXXXXXXXXX~~.
Samples tested at natural mc / ~~XXXXXXXXXXXXXXX

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Location A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Table 2

POINT LOAD TEST RESULTS

LOCATION NO 7382
LOCATION A42 CASTLE DONINGTON NORTH

DATE
TESTED BY AAC
TESTED IN FIELD/XXXXXXXXX

Machine Used: ELE Ram Area: 14.42 cm^2

Samples tested as recovered / XXXXXXXX

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Location A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Table 2

POINT LOAD TEST RESULTS

LOCATION NO 7382
LOCATION A42 CASTLE DONINGTON NORTH

DATE
TESTED BY AAC
TESTED IN FIELD/LABORATORY

Machine Used: ELE Ram Area: 14.42 cm^2

Samples tested as recovered / ~~xxxxxxxxxxxxxxxxxx~~.
Samples tested at natural mc / ~~xxxxxxxxxxxxxxxxx

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POINT LOAD TEST RESULTS

LOCATION NO 7382
LOCATION A42 CASTLE DONINGTON NORTH

DATE
TESTED BY AAC
TESTED IN FIELD/[illegible]

Machine Used: ELE Ram Area: 14.42 cm^2

Samples tested as recovered / [illegible].
Samples tested at natural mc / [illegible] core in mylar / [illegible]

Sample details BH/TP	Depth	Test Type See Note 2	D platen separation mm	W sample width mm	G gauge reading MPa	Description/Remarks	P Failure load kN G x ram area	De Equivalent diameter mm D or $\sqrt{\frac{4DW}{\pi}}$	De^2 mm^2	I_s MPa P/De^2	F Size factor $(\frac{De}{50})^{0.45}$	$I_s(50)$ Point load index MPa $I_s \times F$	Strength classification
707													
11.65-11.73		a	51	89	0.23		3.32	76	5776	0.57	1.21	0.70	
11.85-11.94		a	39	89	0.26		3.75	66	4356	0.86	1.13	0.97	
13.71-13.84		a	60	89	0.25		7.21	82	6724	1.07	1.25	1.34	
708													
5.57- 5.81		a	31	89	0.26		3.75	59	3481	1.08	1.08	1.16	
6.92- 7.01		a	45	89	0.26		3.75	71	5041	0.74	1.17	0.87	
7.91- 7.99		a	49	89	2.50		36.05	75	5625	6.41	1.20	7.69	
9.75- 9.91		a	50	89	0.13		1.87	75	5625	0.33	1.20	0.40	
9.98-10.06		a	35	89	0.14		2.02	63	3969	0.55	1.11	0.61	
709													
6.85- 6.96		a	75	89	0.14	Spalling failure	2.02						
8.80- 9.00		a	100	89	10.60		152.85	106	11236	13.60	1.40	19.04	
9.38- 9.48		a	70	89	-	Spalling failure	-						
10.65-10.78		a	82	89	0.19	Spalling failure	2.74						
710													
15.50-15.42		a	76	89	0.18	Spalling failure	2.60						
16.25-16-43		a	113	89	0.63	Spalling failure	9.08						

Notes 1. Point Load Testing carried out in accordance with ISRM Suggested Method (1985)
2. Test type: a=axial, d=diametral, b=block, i=irregular lump, ∥=parallel or ⊥=perpendicular to foliation.

Location: A42 CASTLE DONINGTON NORTH
Loc. No. 7382
Table 2

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POINT LOAD TEST RESULTS

LOCATION NO 7382
LOCATION A42 CASTLE DONINGTON NORTH

DATE
TESTED BY AAC
TESTED IN FIELD/[redacted]

Machine Used: ELE Ram Area: 14.42 cm^2

Samples tested as recovered / [redacted].
Samples tested at natural mc / [redacted] core in mylar [redacted].

Sample details BH/TP	Depth	Test Type See Note 2	D platen separation mm	W sample width mm	G gauge reading MPa	Description/Remarks	P Failure load kN	De Equivalent diameter mm	De^2 mm^2	I_s MPa	F Size factor	$I_s(50)$ Point load index MPa	Strength classification
							G x ram area	D or $\sqrt{\frac{4DW}{\pi}}$		P/De^2	$\left(\frac{De}{50}\right)^{0.45}$	$I_s \times F$	
711													
	9.75- 9.88	a	74	89	0.10		1.44	92	8464	0.17	1.32	0.22	
	10.30-10.42	a	67	89	0.30		4.33	87	7569	0.57	1.28	0.73	
	14.65-14.77	a	57	89	0.56		8.08	80	6400	1.26	1.24	1.56	
712													
	3.57- 3.70	a	70	89	0.16		2.31	89	7921	0.29	1.30	0.38	
	4.33- 4.46	a	85	89	0.18		2.60	98	9604	0.27	1.35	0.36	
	6.20- 6.33	a	83	89	0.52		7.50	97	9409	0.80	1.35	1.08	
713													
	6.02- 6.16	a	70	89	0.90		12.98	89	7921	1.64	1.30	2.13	
	10.25-10.35	a	62	89	0.40	Spalling failure							
	10.50-10.67	a	87	89	0.34	Spalling failure							
714													
	4.25- 4.37	a	70	89	0.14		2.02	89	7921	0.26	1.30	0.33	
	7.30- 7.42	a	76	89	-	Spalling failure							
	10.20-10.35	a	99	89	5.50	Spalling failure							
	10.59-10.76	a	94	89	7.50	Spalling failure							
	14.00-14.15	a	57	89	0.30	Spalling failure	4.33						
	14.75-14.87	a	51	82	0.18		2.60	76	5776	0.45	1.21	0.54	
715													
	2.55- 2.70	a	63	89	0.24	Spalling failure	3.46						
	5.05- 5.16	a	74	89	0.95	Spalling failure	13.70						

Notes 1. Point Load Testing carried out in accordance with ISRM Suggested Method (1985)
2. Test type: a=axial, d=diametral, b=block, i=irregular lump, ∥=parallel or ⊥=perpendicular to foliation.

Location: A42 CASTLE DONINGTON NORTH
Loc. No.: 7382
Table 2

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Location A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Table 2

POINT LOAD TEST RESULTS

LOCATION NO 7382
LOCATION A42 CASTLE DONINGTON NORTH

DATE
TESTED BY AAC
TESTED IN FIELD/LXXXXXXXXX

Machine Used: ELE

Ram Area: 14.42 cm^2

Samples tested as recovered / [illegible]
Samples tested at natural mc / [illegible] core in mylar / [illegible]

Sample details BH/TP	Depth	Test Type See Note 2	D platen separation mm	W sample width mm	G gauge reading MPa	Description/Remarks	P Failure load kN	De Equivalent diameter mm	De^2 mm^2	I_s MPa	F Size factor	$I_s(50)$ Point load index MPa	Strength classification
							G x ram area	D or $\sqrt{\frac{4DW}{\pi}}$		P/De^2	$\left(\frac{De}{50}\right)^{0.45}$	I_s x F	
715													
8.05- 8.21		a	110	89	0.66	Spalling failure	9.52						
717													
13.66-13.75		a	44	89	0.25		3.61	71	5041	0.72	1.49	1.07	
16.05-16.12		a	54	89	1.00		14.42	78	6084	2.37	1.22	2.89	
16.45-16.56		a	64	89	1.70		24.51	85	7225	3.39	1.27	4.31	
18.55-18.74		a	75	89	2.90		41.82	92	8464	4.94	1.32	6.52	
19.38-19.48		a	51	89	5.50		79.31	76	5776	13.73	1.21	16.61	
718													
11.91-12.02		a	73	89	10.00	Spalling failure	144.20						
719													
10.60-10.70		a	64	89	0.19	Spalling failure	12.98						
721													
11.85-12.00		a	85	89	6.20		89.40	98	9604	9.31	1.35	12.57	
722													
8.10- 8.20		a	76	89	1.00		14.42	93	8649	1.67	1.32	2.20	
11.65-11.85		a	112	89	1.40	Spalling failure	20.19						
723													
12.23-12.37		a	89	89	1.90	Spalling failure	27.40						

Notes 1. Point Load Testing carried out in accordance with ISRM Suggested Method (1985)
2. Test type: a=axial, d=diametral, b=block, i=irregular lump, ∥=parallel or ⊥=perpendicular to foliation.

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Soil Mechanics

Location A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Table 2

POINT LOAD TEST RESULTS

LOCATION NO 7382
LOCATION A42 CASTLE DONINGTON NORTH

DATE
TESTED BY AAC
TESTED IN FIELD/XXXXXXXXXX

Machine Used: ELE Ram Area: 14.42 cm^2

Samples tested as recovered / cXXXXXXXX

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POINT LOAD TEST RESULTS

LOCATION NO 7382
LOCATION A42 CASTLE DONINGTON NORTH

DATE
TESTED BY AAC
TESTED IN FIELD/LABORATORY

Machine Used: ELE Ram Area: 14.42 cm^2

Samples tested as recovered / [illegible]
Samples tested at natural mc / [illegible] core in mylar [illegible]

Sample details BH/TP	Depth	Test Type See Note 2	D platen separation mm	W sample width mm	G gauge reading MPa	Description/Remarks	P Failure load kN	De Equivalent diameter mm	De^2 mm^2	I_s MPa	F Size factor	$I_s(50)$ Point load index MPa	Strength classification
							G x ram area	D or $\sqrt{\frac{4DW}{\pi}}$		P/De^2	$\left(\frac{De}{50}\right)^{0.45}$	$I_s \times F$	
731													
	5.45- 5.55	a	55	89	0.20		2.88	79	6241	0.14	1.23	0.17	
	8.10- 8.20	a	55	89	0.32		4.61	79	6241	0.74	1.23	0.91	
732													
	8.10- 8.26	a	80	89	0.20		2.88	95	9025	0.32	1.33	0.42	
	7.45- 7.59	a	75	89	0.14		2.02	92	8464	0.24	1.32	0.32	
11.29-	11.41	a	67	89	0.13		1.87	87	7569	0.25	1.28	0.32	
13.55-	13.72	a	77	89	0.12		1.73	93	8649	0.20	1.32	0.26	
733													
	3.44- 3.64	a	73	89	0.80		11.54	91	8281	1.39	1.31	1.82	
	5.20- 5.39	a	102	89	0.20	Spalling failure	2.88						
	6.22- 6.33	a	48	89	0.20	Spalling failure	2.88						
734													
	6.46- 6.55	a	61	89	0.40		5.77	83	6889	0.84	1.26	1.05	
10.35-	10.51	a	74	89	1.40		20.19	92	8464	2.39	1.32	3.15	
10.67-	10.76	a	62	89	4.80	Spalling failure	69.22						
735													
3.37-	3.61	a	102	89	0.39	Spalling failure	5.62						
3.93-	4.10	a	85	89	0.38	Fractured along tight joint	5.48						
5.28-	5.40	a	86	89	0.23		3.32	99	9801	0.34	1.36	0.46	

Notes 1. Point Load Testing carried out in accordance with ISRM Suggested Method (1985)
2. Test type: a=axial, d=diametral, b=block, i=irregular lump, ∥=parallel or ⊥=perpendicular to foliation.

Location: A42 CASTLE DONINGTON NORTH
Loc. No. 7382
Table 2

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Soil Mechanics

Location A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Table 2

POINT LOAD TEST RESULTS

LOCATION NO 7382
LOCATION A42 CASTLE DONINGTON NORTH

DATE
TESTED BY AAC
TESTED IN FIELD/LABORATORY

Machine Used: ELE Ram Area: 14.42 cm^2

Samples tested as recovered / xxxxxxxx / xxx xxx
Samples tested at natural mc / xxxxxxx

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SUMMARY OF LABORATORY TEST RESULTS ON CORE SAMPLES

SAMPLE SOURCE							INDEX PROPERTIES							UNIAXIAL TESTS					
Borehole No.	Sample No.	Depth, m From	Depth, m To	Length mm	Diameter mm	L/D Ratio	Water Content %	Bulk Density Mg/m^3	Relative Density Oven-Dry Mg/m^3	Relative Density Saturated surface-dry Mg/m^3	Apparent Relative Density Mg/m^3	Water Absorption %	Unconfined Compressive Strength MN/m^2	Modulus (1) MN/m^2	Modulus (2) MN/m^2	Modulus (3) MN/m^2	Poissons Ratio	Stress/ Strain Plot	REMARKS
706R		10.76	10.94	152	84.6	1.80	10.9	2.01					11.74			3.19×10^3	0.27		
707R		11.14	11.31	136	79.6	1.71	3.9	1.99					15.27			2.56×10^3	0.20		
709R		6.57	6.85	164	90.0	1.82	13.4	2.21					0.220			3.88×10^1			
713R		13.85	14.10	175	91.6	1.91	14.1	2.30					0.107			0.61×10^1			
721R		11.50	11.73	170	86.8	1.96	12.2	2.31					4.59			1.92×10^3	0.23		
729R		2.35	2.69	158	87.8	1.80	10.0	2.31					1.75			3.51×10^2	0.23		
731R		3.90	4.24	162	92.8	1.75	14.8	2.11					0.175			5.0×10^3			
732R		10.85	11.10	121	88.2	1.37	11.5	2.29					2.04			1.61×10^2			
		13.10	13.30	122	87.6	1.39	12.2	2.39					0.519			3.14×10^1			
733R		5.80	6.22	91	88.0	1.03	20.0	1.93											Unsuitable for testing specimen fragmented
		7.79	8.00	155	87.2	1.78	8.6	2.41					0.7			1.24×10^2	0.10		
735R		7.28	7.52	135	88.0	1.53	13.9	2.18					0.568			5.44×10^1			
737R		1.28	1.54	125	88.4	1.41	8.9	2.36					1.06			6.34×10^1			
		5.63	5.86	133	89.8	1.48	15.1	2.20											Unsuitable for testing specimen fragmented

Notes

Loc. No. 7382

Location

TABLE 3

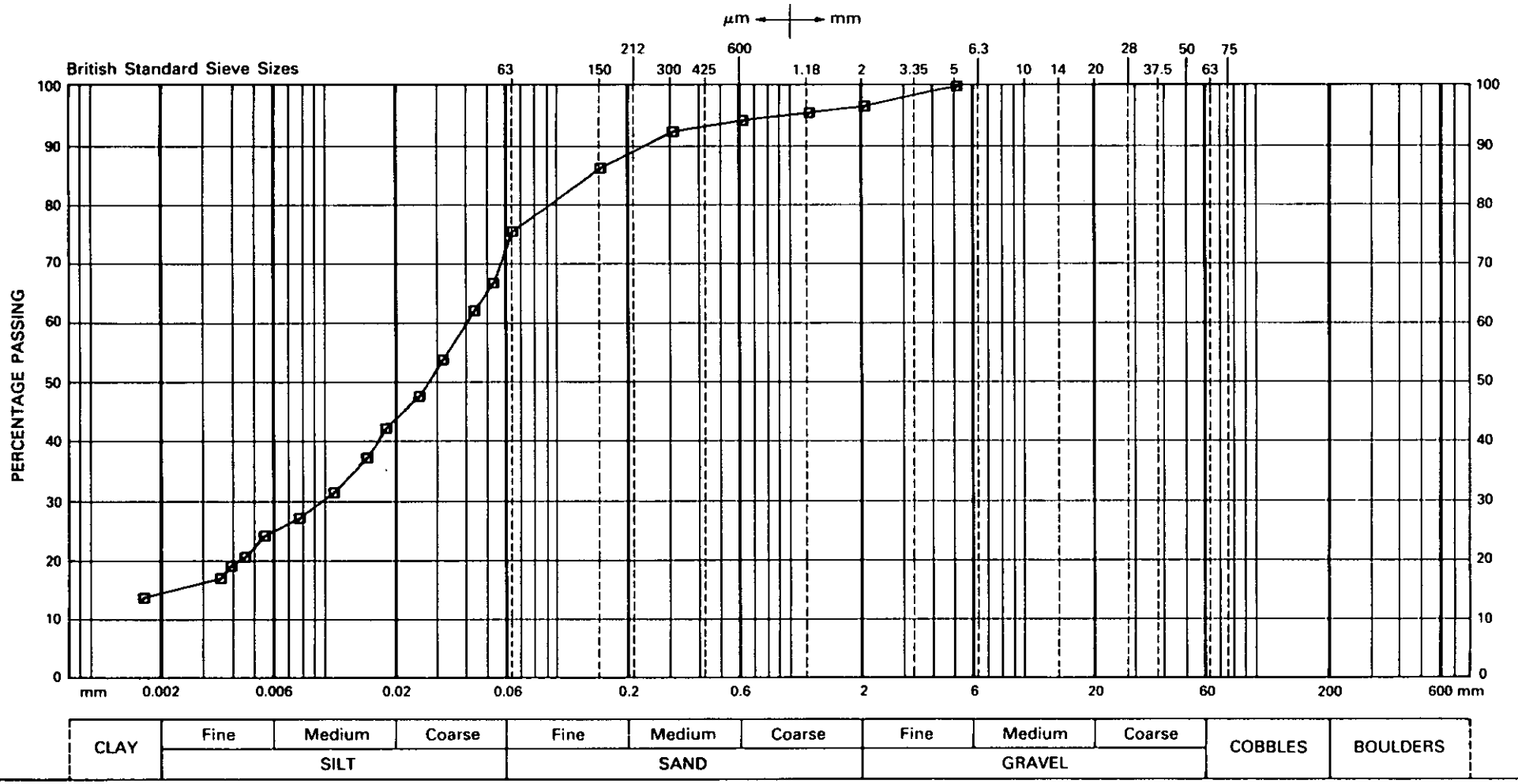
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PARTICLE SIZE DISTRIBUTION

BOREHOLE No: / SAMPLE No: / PLOT SYMBOL	SOIL DESCRIPTION or CLASSIFICATION	SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES				
		Preparation	Mass kg	Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
710 9 ⊡		As BS1377	0.6	As BS1377	50.00	14	60	23	3	0

Notes:



Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Borehole No. 710

Sample No. 9

Depth 3.60 - 4.05m

Fig. 1

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PARTICLE SIZE DISTRIBUTION

Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Fig. 2

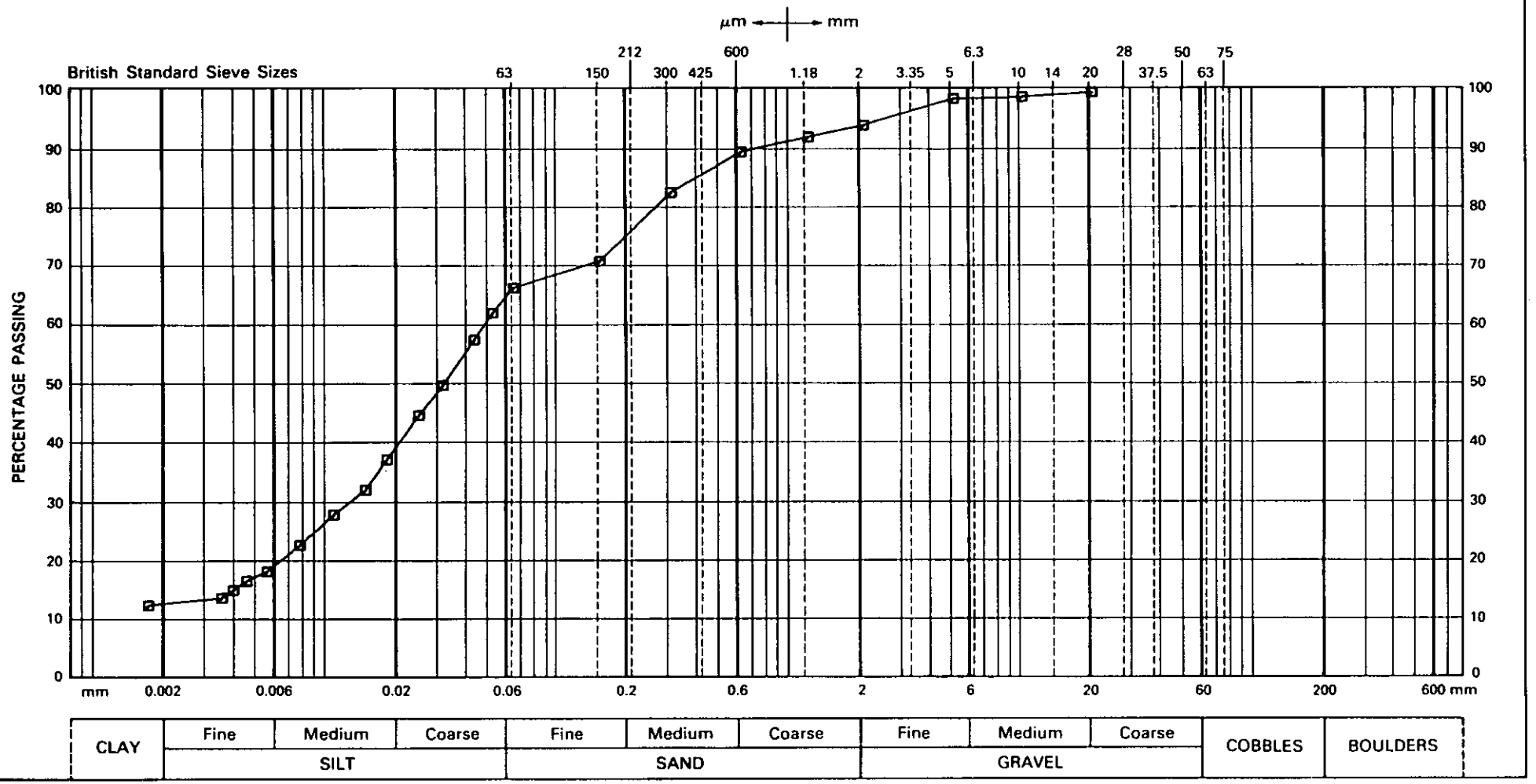
Borehole No. 711

Sample No. 3

Depth 0.50 - 0.95m

BOREHOLE No: / SAMPLE No: / PLOT SYMBOL	SOIL DESCRIPTION or CLASSIFICATION	SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES				
		Preparation	Mass kg	Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
711 3 D		As BS1377	1.4	As BS1377	50.00	13	53	29	5	0

Notes:



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PARTICLE SIZE DISTRIBUTION

Location: A42 CASTLE DONINGTON NORTH

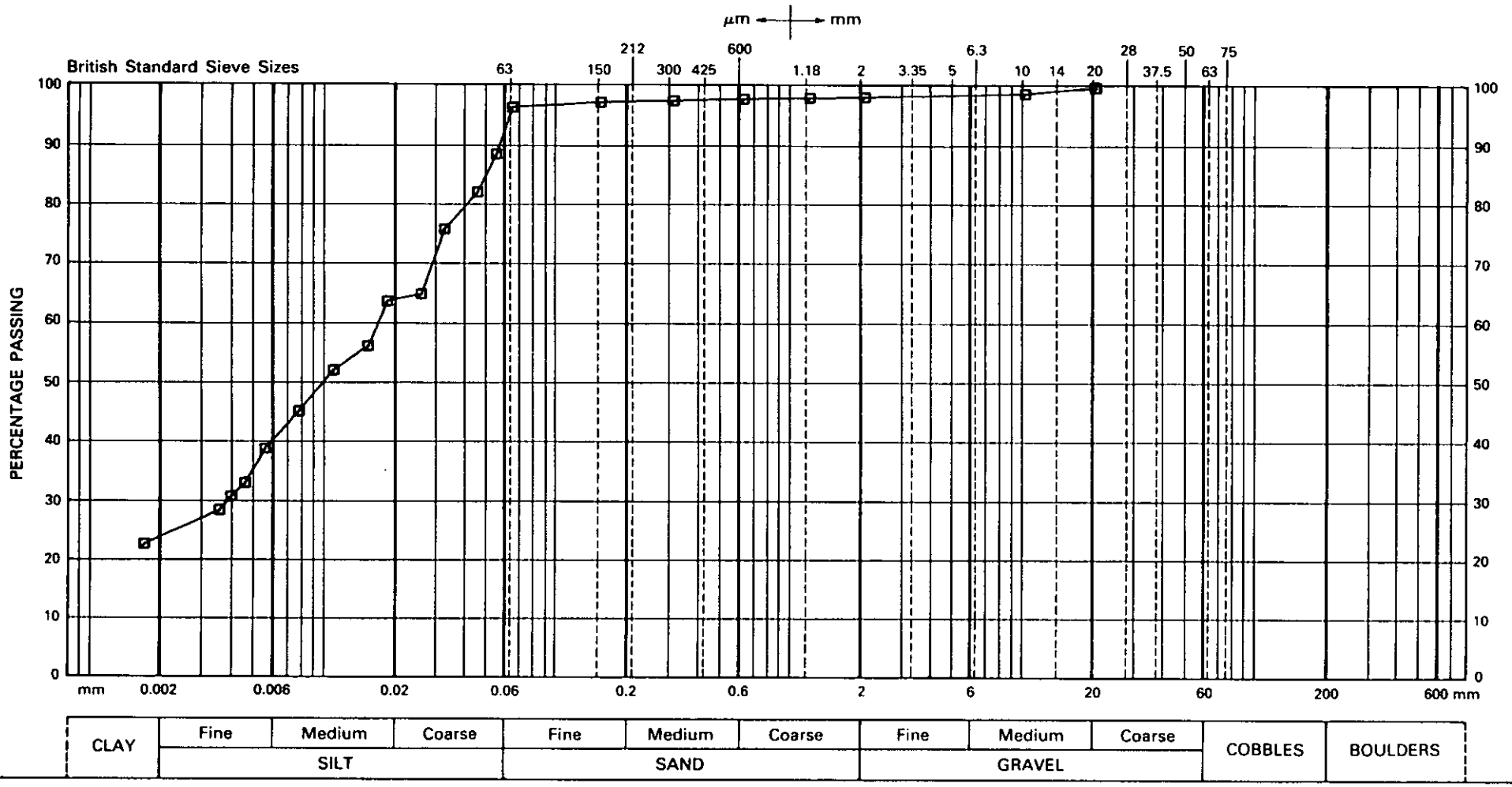
Loc. No. 7382

Fig. 3

Borehole No. 712 Sample No. 5 Depth 2.00-2.45m

BOREHOLE No: SAMPLE No: PLOT SYMBOL	SOIL DESCRIPTION or CLASSIFICATION	SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES				
		Preparation	Mass kg	Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
712 5 ▫		As BS1377	4.0	As BS1377	50.00	24	70	4	2	0

Notes:



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PARTICLE SIZE DISTRIBUTION

Location: A42 CASTLE DONINGTON NORTH

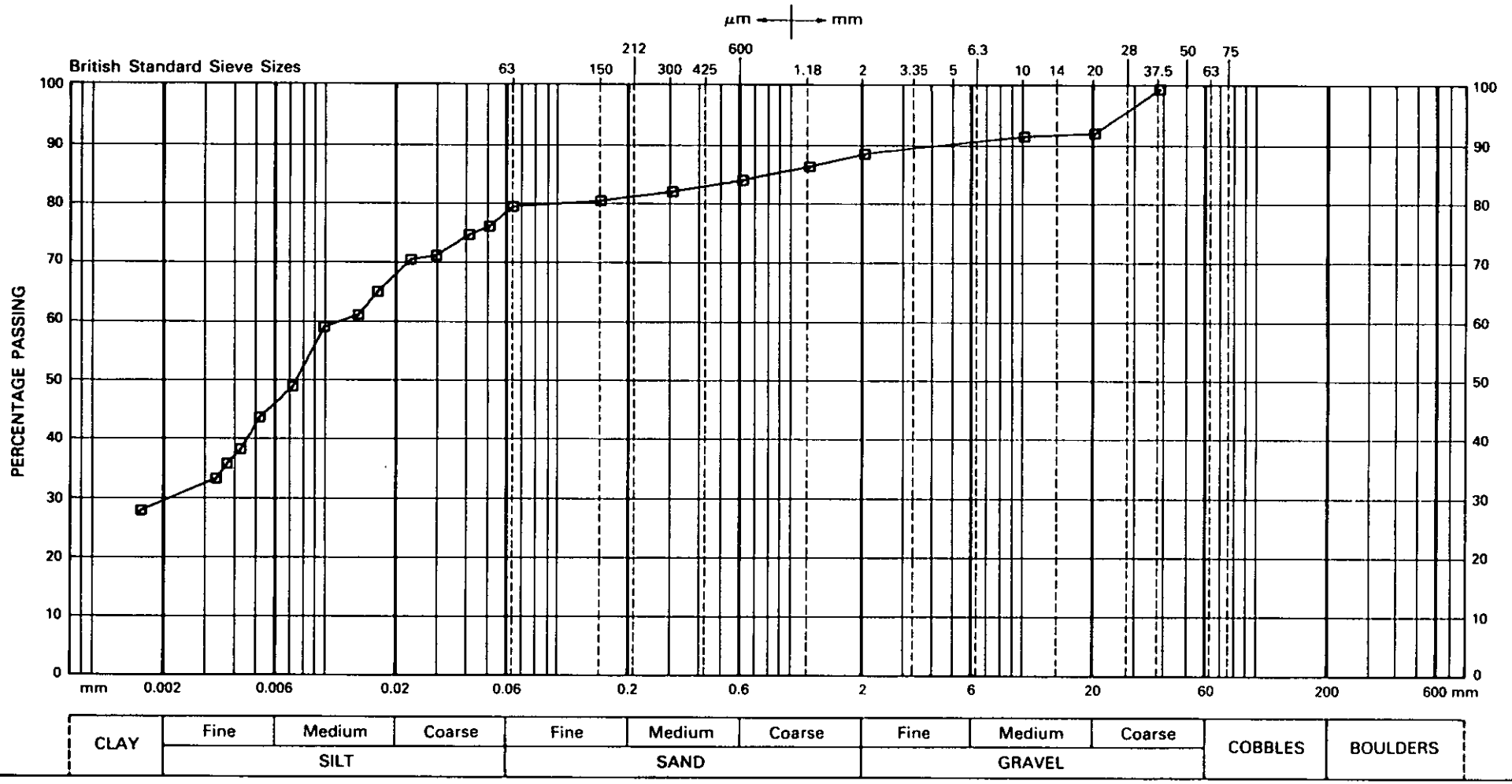
Loc. No. 7382

Fig. 4

Borehole No. 714 Sample No. 2 Depth 0.50-0.95m

BOREHOLE No: SAMPLE No: PLOT SYMBOL	SOIL DESCRIPTION or CLASSIFICATION	SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES				
		Preparation	Mass kg	Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
714 2 ◻		As BS1377	1.6	As BS1377	50.00	29	50	10	11	0

Notes:



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PARTICLE SIZE DISTRIBUTION

Location: A42 CASTLE DONINGTON NORTH

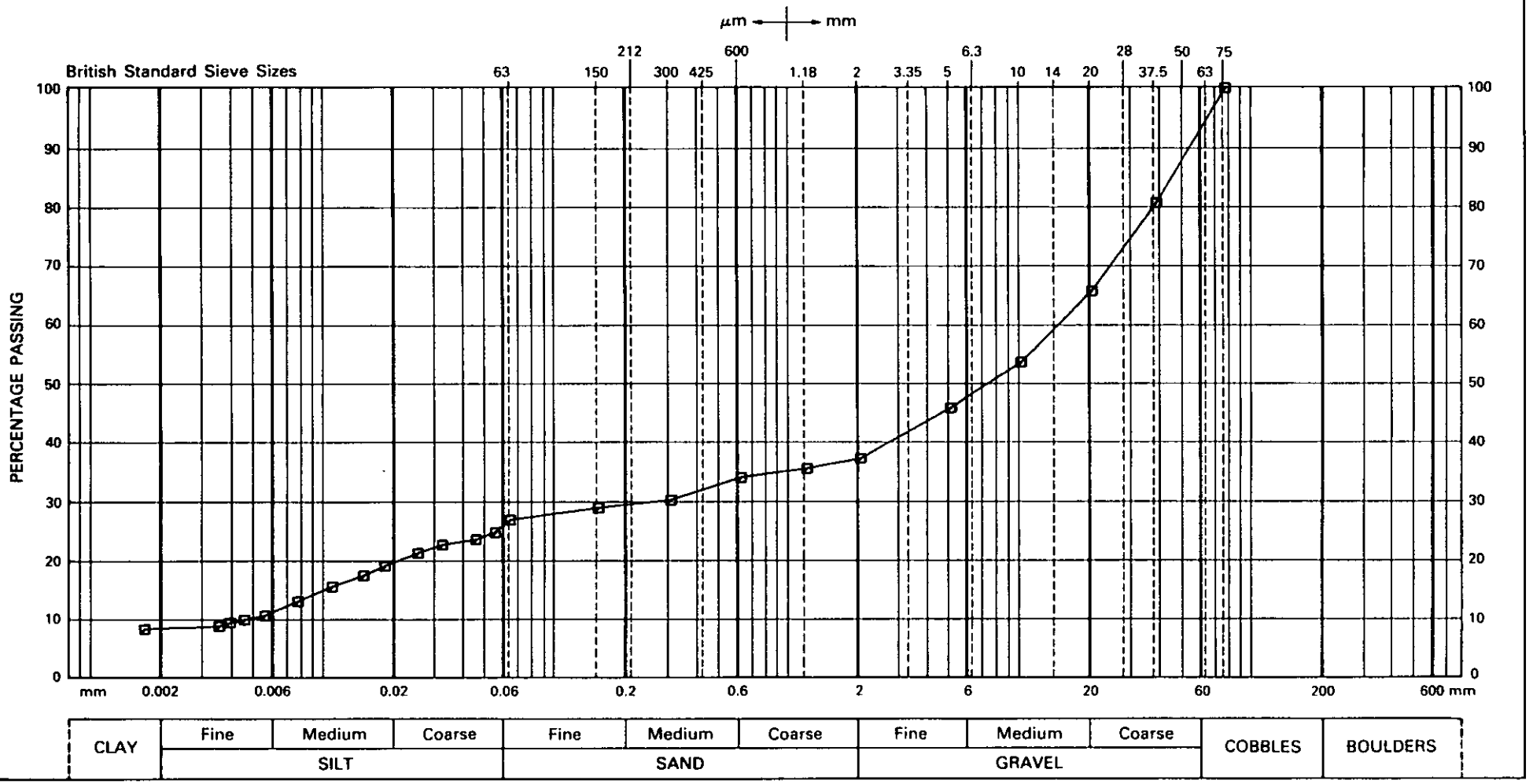
Loc. No. 7382

Fig. 5

Borehole No. 717 Sample No. 2 Depth 0.50 - 0.95m

BOREHOLE No: SAMPLE No: PLOT SYMBOL	SOIL DESCRIPTION or CLASSIFICATION	SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES				
		Preparation	Mass kg	Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
717 2 ⊡		As BS1377	11.3	As BS1377	50.00	9	18	11	56	6

Notes:



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PARTICLE SIZE DISTRIBUTION

Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Fig. 6

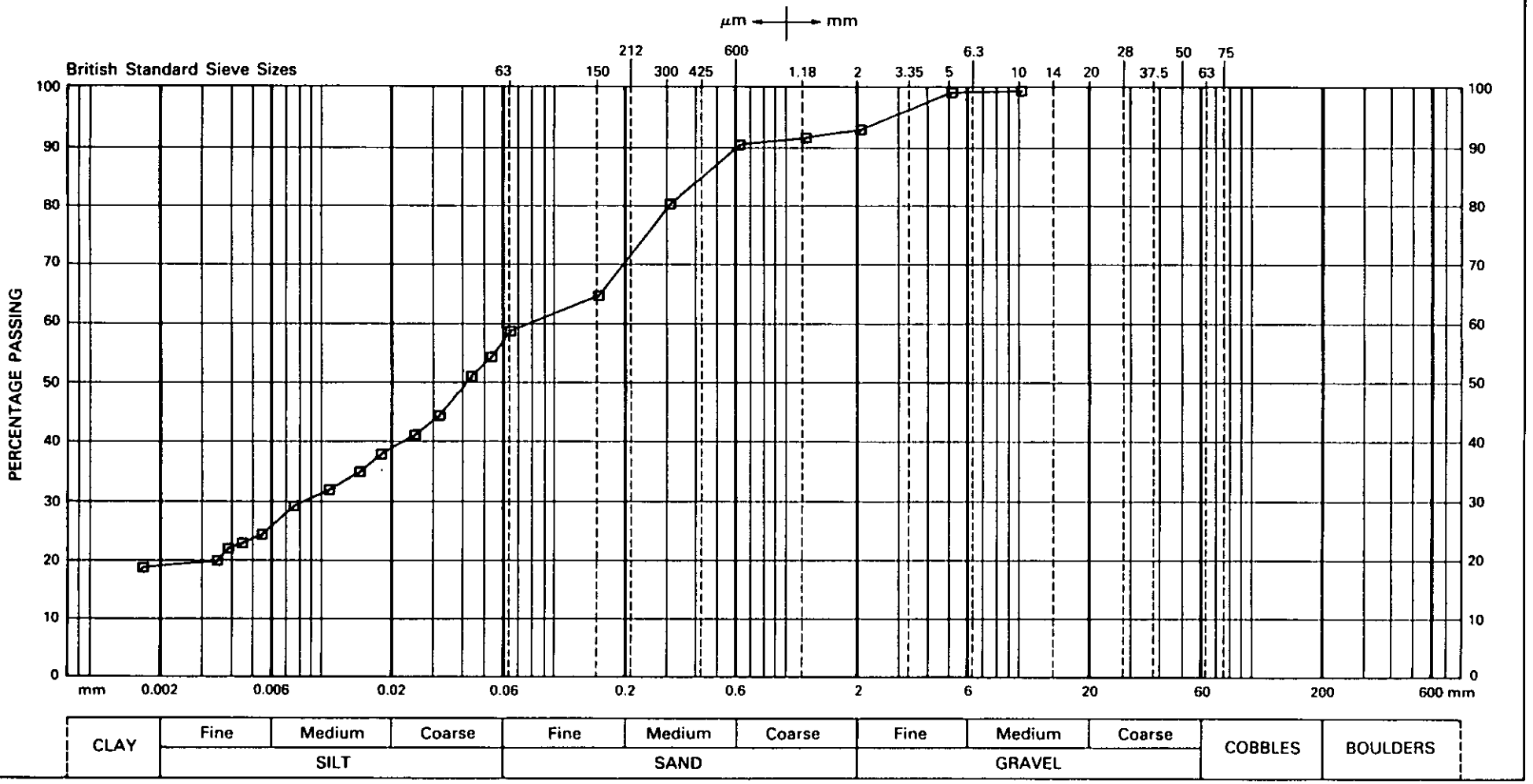
Borehole No. 718

Sample No. 2

Depth 0.50 - 0.95m

BOREHOLE No: SAMPLE No: PLOT SYMBOL	SOIL DESCRIPTION or CLASSIFICATION	SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES				
		Preparation	Mass kg	Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
718 2 ▫		As BS1377	1.1	As BS1377	50.00	19	39	36	6	0

Notes:



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Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

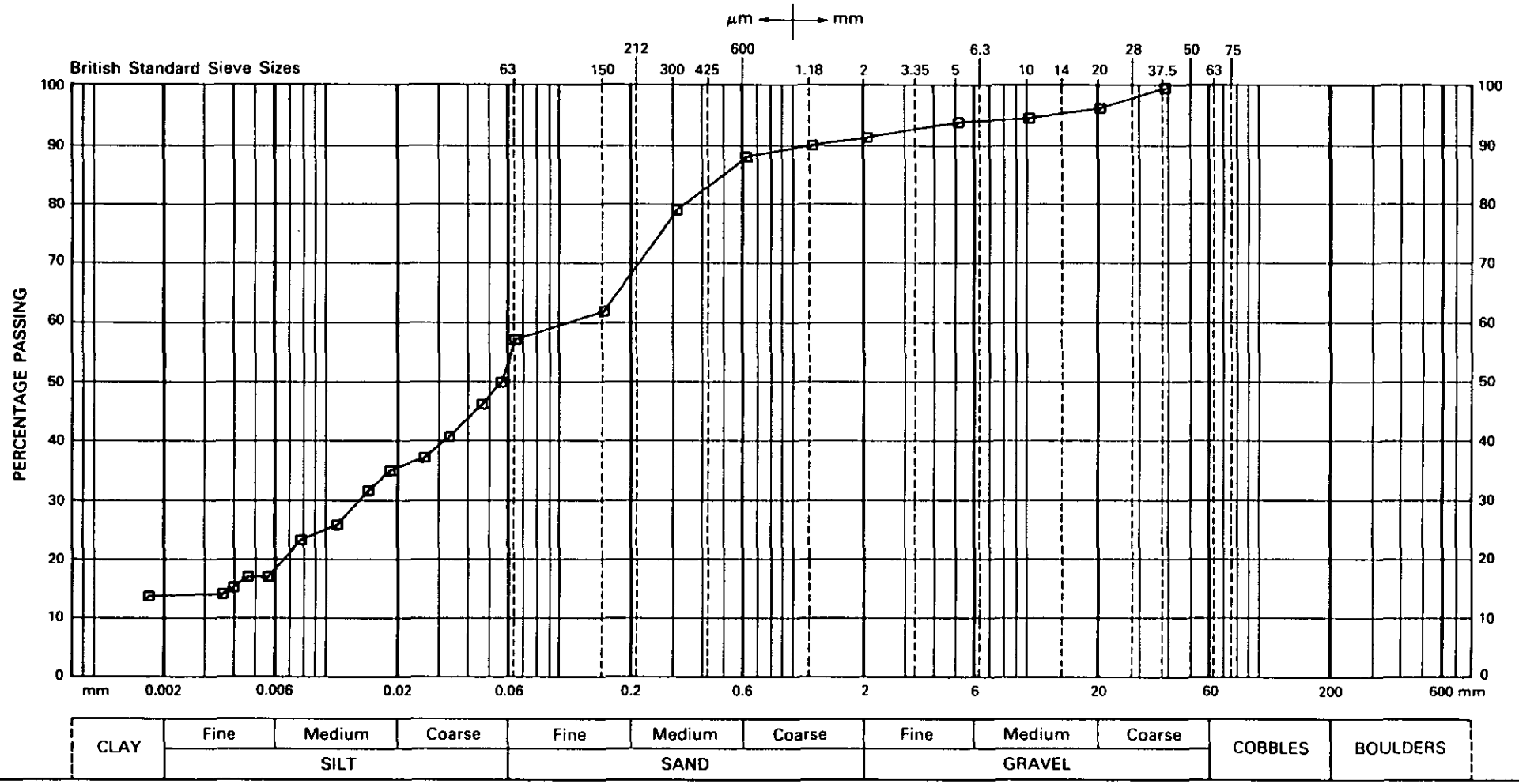
Fig. 7

Trial Pit No. 810 Depth 0.70m

Sample No. 1

BOREHOLE No: SAMPLE No: PLOT SYMBOL	SOIL DESCRIPTION or CLASSIFICATION	SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES				
		Preparation	Mass kg	Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
810 1 ⊡		As BS1377	1.8	As BS1377	50.00	14	41	37	8	0

Notes:



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PARTICLE SIZE DISTRIBUTION

Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

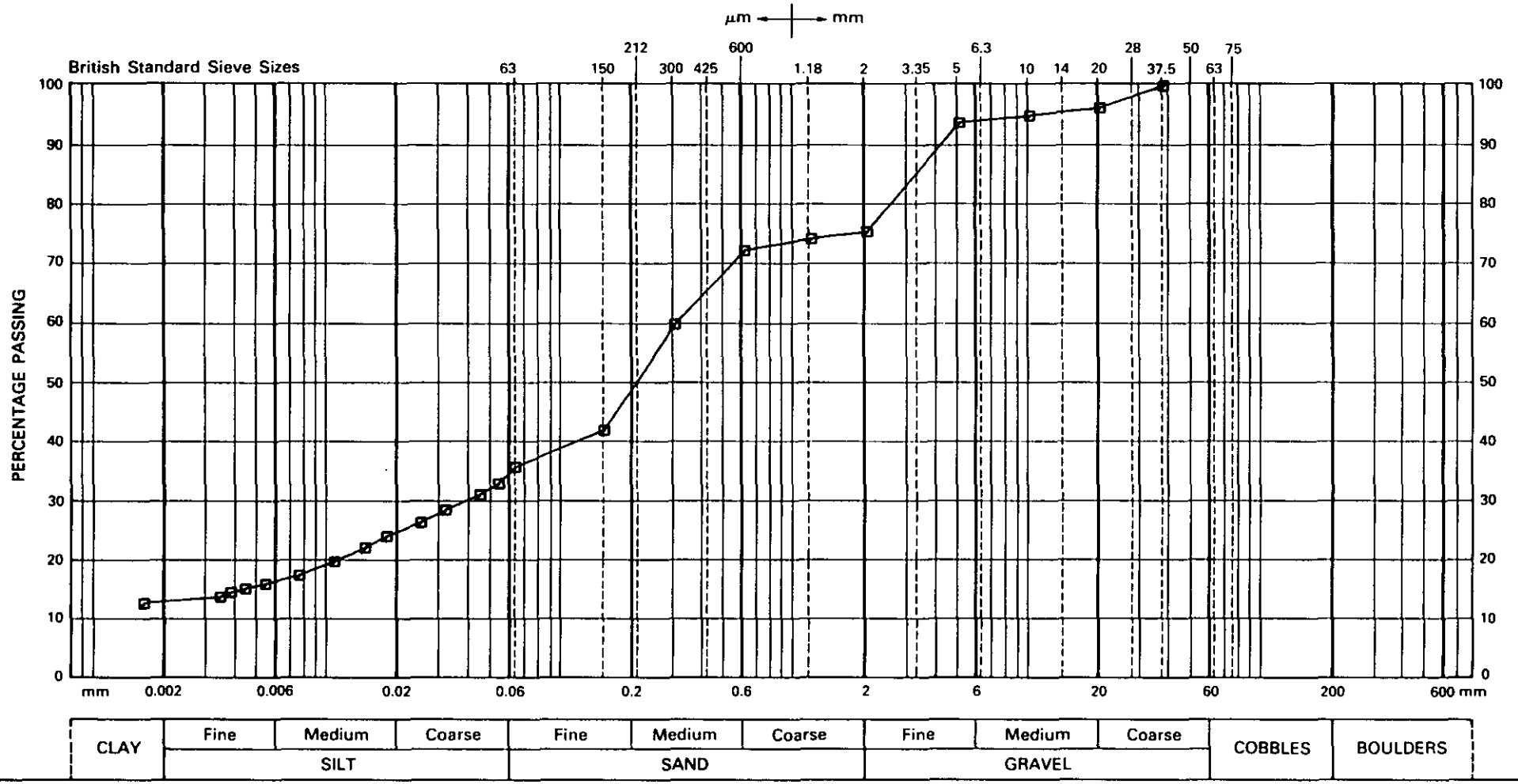
Fig. 8

Trial Pit No. 813 Depth 1.10m

Sample No. 1

BOREHOLE No: SAMPLE No: PLOT SYMBOL	SOIL DESCRIPTION or CLASSIFICATION	SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES				
		Preparation	Mass kg	Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
813 1 ◘		As BS1377	3.3	As BS1377	50.00	13	22	41	24	0

Notes:



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PARTICLE SIZE DISTRIBUTION

Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Fig. 9

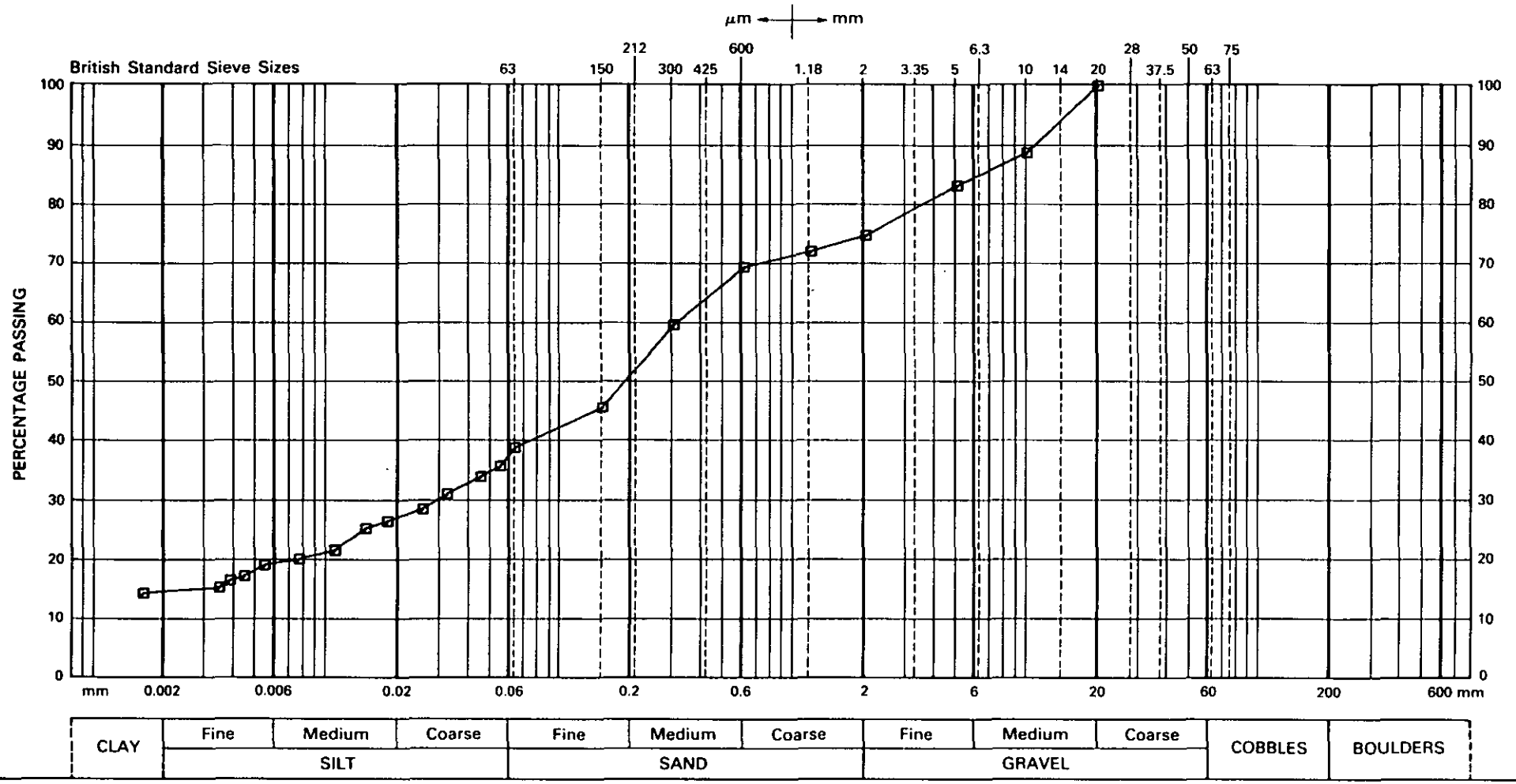
Trial Pit No. 815

Sample No. 1

Depth 0.80m

BOREHOLE No: SAMPLE No: PLOT SYMBOL	SOIL DESCRIPTION or CLASSIFICATION	SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES				
		Preparation	Mass kg	Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
TP815 1 ⊡		As BS1377	2.0	As BS1377	50.00	15	23	37	25	0

Notes:



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PARTICLE SIZE DISTRIBUTION

BOREHOLE No: / SAMPLE No: / PLOT SYMBOL	SOIL DESCRIPTION or CLASSIFICATION	SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES				
		Preparation	Mass kg	Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
TP821 5 ◻		As BS1377	21.6			0	10	37	48	5

Notes:

Location: A42 CASTLE DONINGTON NORTH

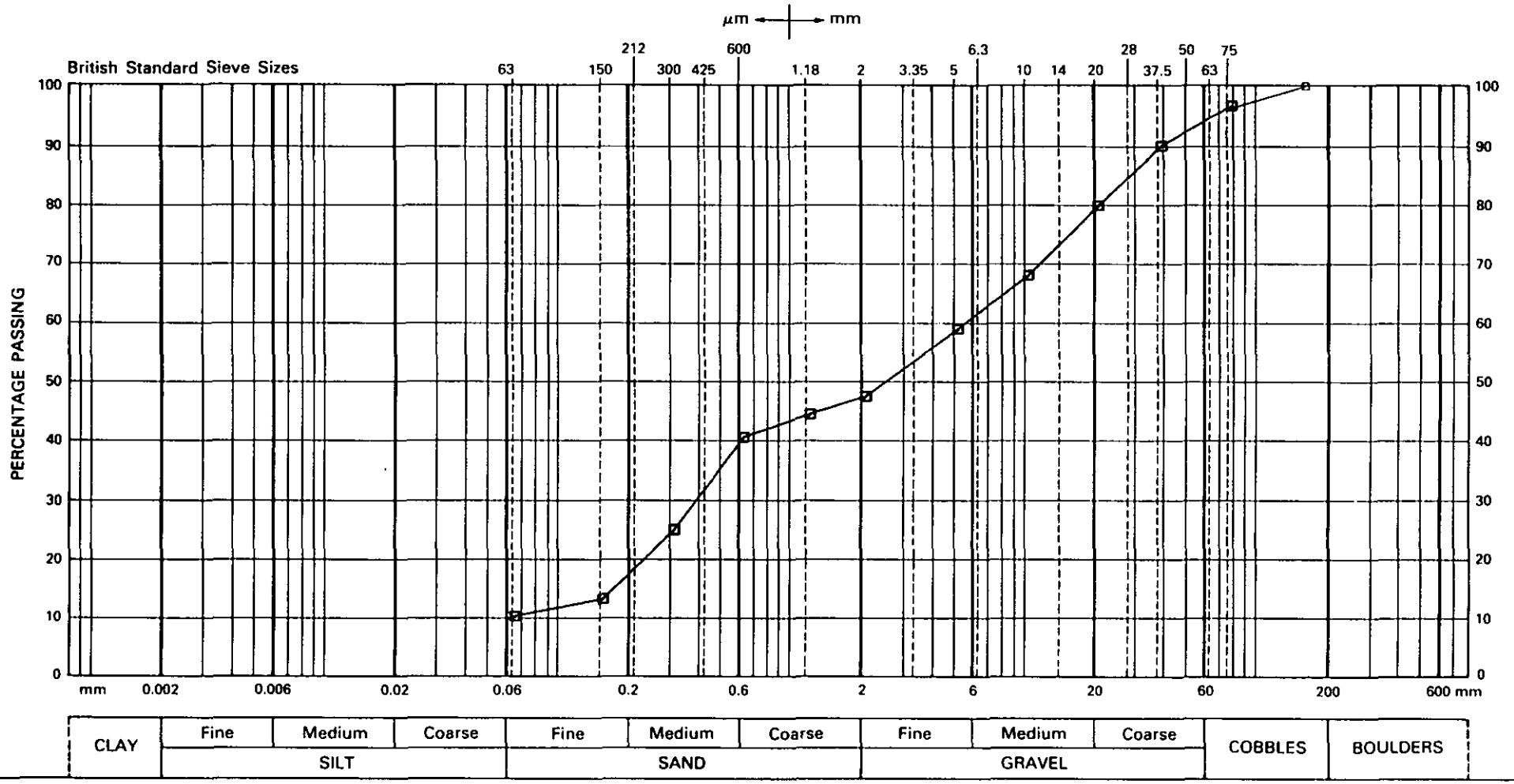
Loc. No. 7382

Trial Pit No. 821

Sample No. 5

Depth 1.00m

Fig. 10



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PARTICLE SIZE DISTRIBUTION

Location: A42 CASTLE DONINGTON NORTH

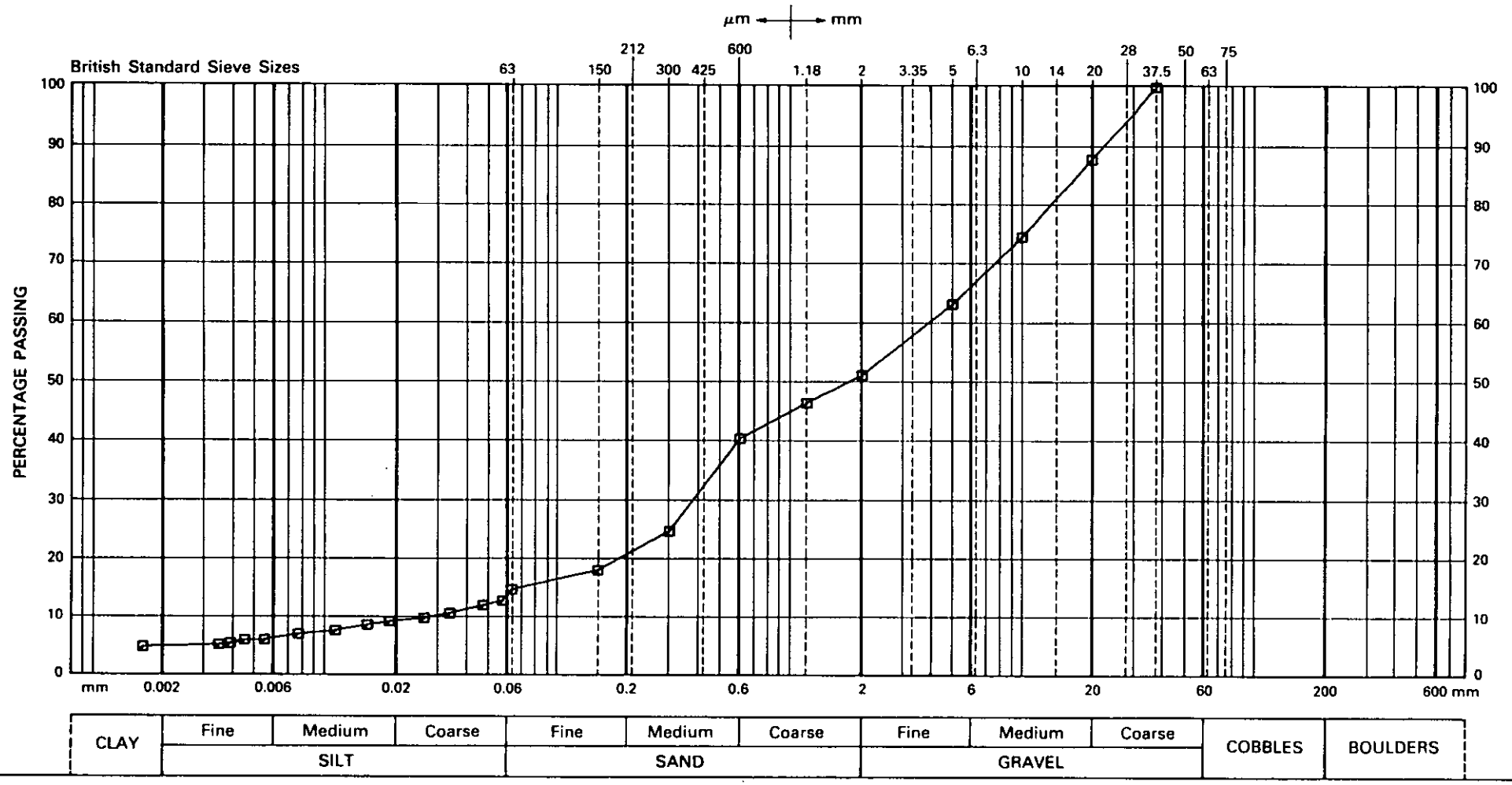
Loc. No. 7382

Trial Pit No. 822 Sample No. 3 Depth 1.50m

Fig. 11

BOREHOLE No: SAMPLE No: PLOT SYMBOL	SOIL DESCRIPTION or CLASSIFICATION	SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES				
		Preparation	Mass kg	Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
822 3 ø		As BS1377	6.9	As BS1377	50.00	5	9	37	49	0

Notes:



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PARTICLE SIZE DISTRIBUTION

Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Fig. 12

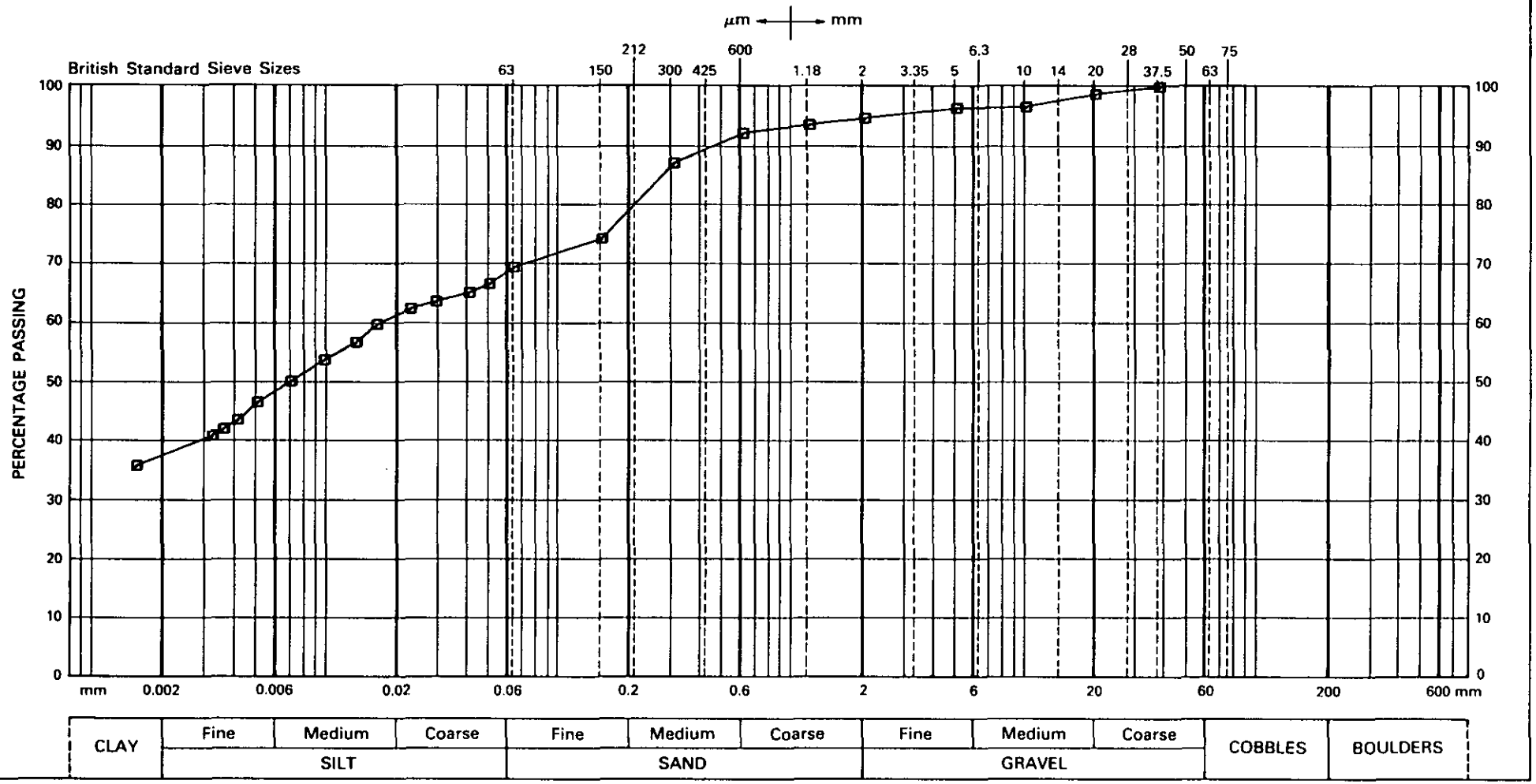
Trial Pit No. 827

Sample No. 1

Depth 0.90m

BOREHOLE No: / SAMPLE No: / PLOT SYMBOL	SOIL DESCRIPTION or CLASSIFICATION	SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES				
		Preparation	Mass kg	Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
827 1 ø		As BS1377	3.1	As BS1377	50.00	37	32	26	5	0

Notes:



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PARTICLE SIZE DISTRIBUTION

Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

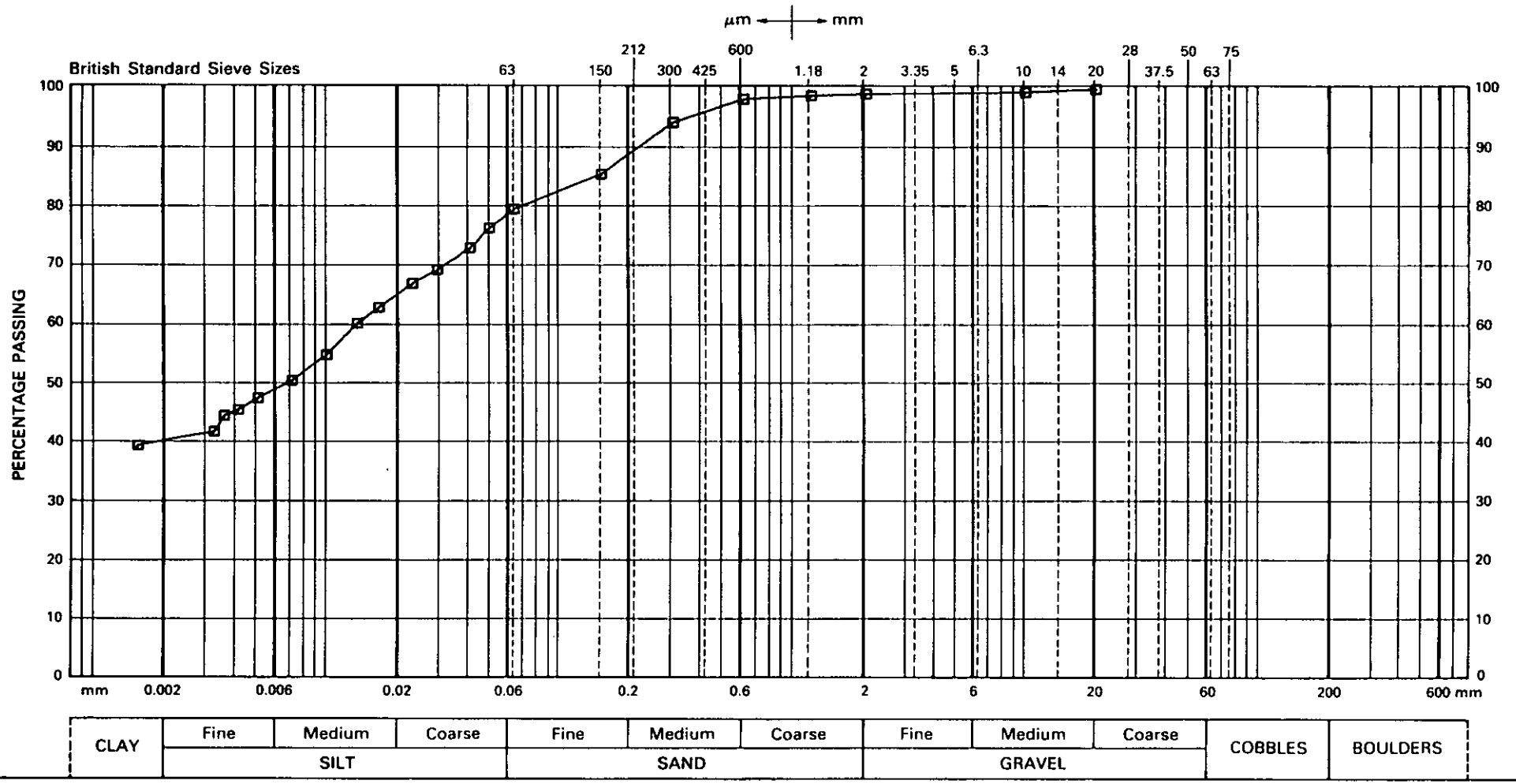
Fig. 13

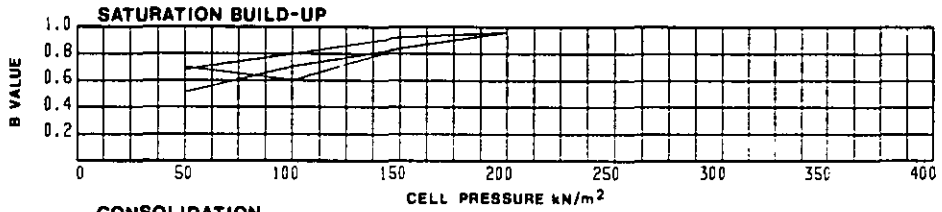
Trial Pit No. 830 Depth 1.00m

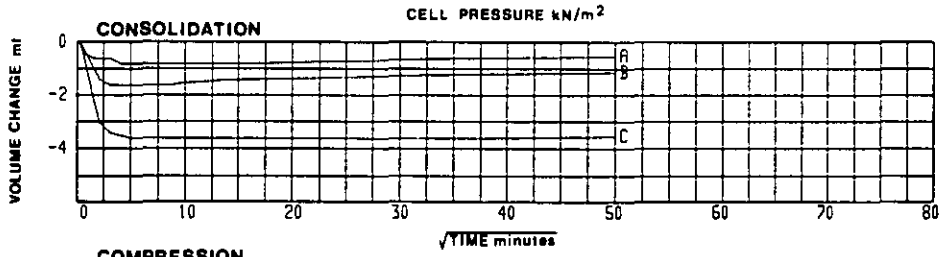
Sample No. 1

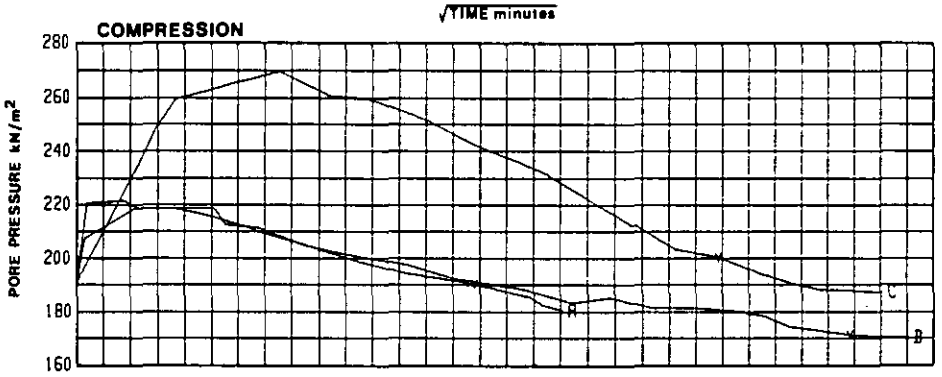
BOREHOLE No: SAMPLE No: PLOT SYMBOL	SOIL DESCRIPTION or CLASSIFICATION	SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES				
		Preparation	Mass kg	Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
TP830 1 ◘		As BS1377	1.4	As BS1377	50.00	40	39	20	1	0

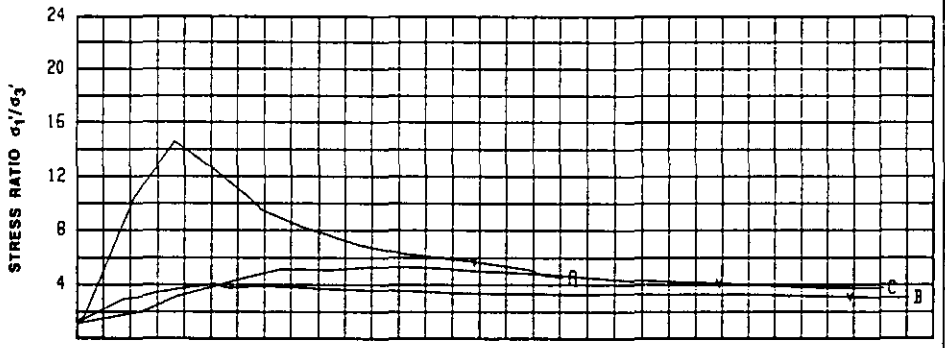
Notes:

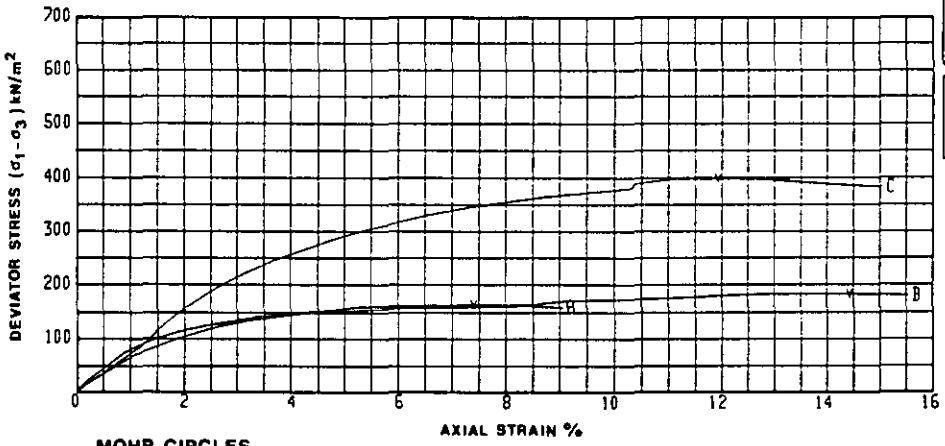


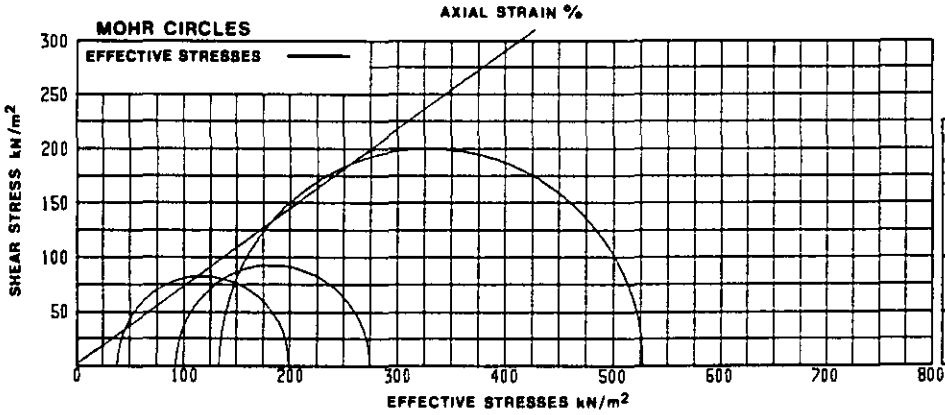


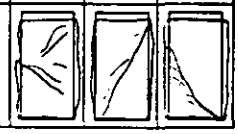










	SPECIMEN		A	B	C
INITIAL	Density Mg/m³		1.99	2.02	2.07
	Moisture %		18	20	20
	Dry Density Mg/m³		1.69	1.68	1.73
AFTER CONSOLIDATION	Density Mg/m³		2.03	1.90	2.16
	Moisture %		21	22	21
	Dry Density Mg/m³		1.68	1.56	1.79
SATURATION STAGE	Initial pwp	kN/m²	-4	-5	-4
	Saturated pwp		140	140	140
	Final cell pressure		200	200	200
	B value		0.96	0.96	0.96
CONSOLIDATION STAGE	Cell pressure	kN/m²	225	260	330
	Back pressure		190	190	190
	Initial pwp		220	251	323
	Final pwp		190	190	190
CONSOLIDATION PARAMETERS	c_{v3} m²/year		4.59	3.66	4.59
	m_{v3} m²/MN		0.27	0.23	0.32
COMPRESSION STAGE	Cell pressure	kN/m²	225	260	330
	Initial pwp		190	190	190
	Initial σ_3'		35	70	140
	Rate of strain	% per hour	1.00	1.00	1.00
FAILURE CONDITIONS AT PEAK DEVIATOR STRESS	Axial Strain %		7.4	14.5	12.0
	$(\sigma_1 - \sigma_3)_f$	kN/m²	161	182	397
	u_f		190	171	200
	$\sigma_3'_f$		35	89	130
	$\sigma_1'_f$		196	271	527
	A_f		0.00	-0.10	0.03
	Time to failure hours		7.4	14.5	12.0
	MODE OF FAILURE				

SHEAR STRENGTH PARAMETERS BY LINEAR REGRESSION	c'	φ'
	2 kN/m²	35½°

NOTES

Saturation by application of cell/back pressure increments of 50 kN/m2 with a differential of 10 kN/m2.

Drainage during consolidation to top with side drains fitted.

Stress/strain curves corrected for area change, membrane and side drains.

SOIL DESCRIPTION

Very stiff red/brown highly fissured silty CLAY with occasional fine sandstone gravel

TYPE OF SPECIMEN UNDISTURBED

SPECIMEN DIMENSIONS (nominal) 38.0 mm dia x 75.0 mm long

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Consolidated Undrained Triaxial Compression Test with measurement of Pore Pressure

Borehole No. 704 **Depth** 1.50 - 1.95M

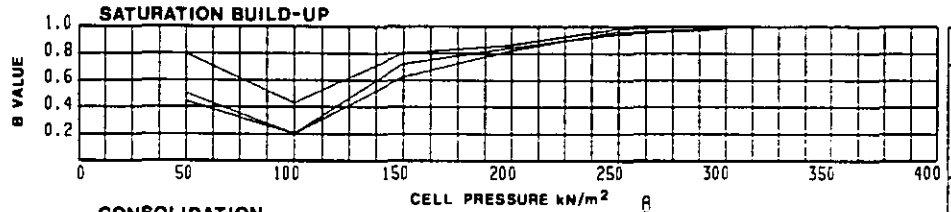
Sample No. 4

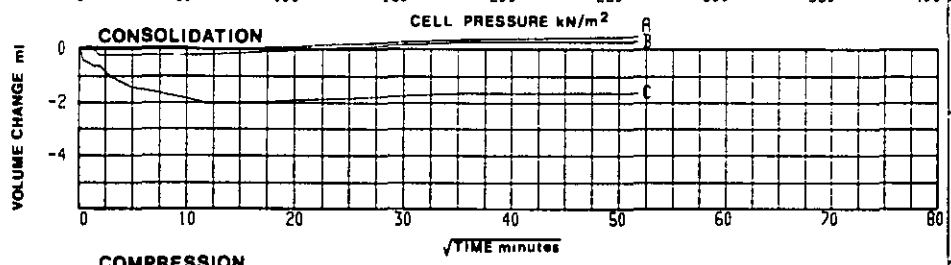
Soil Mechanics

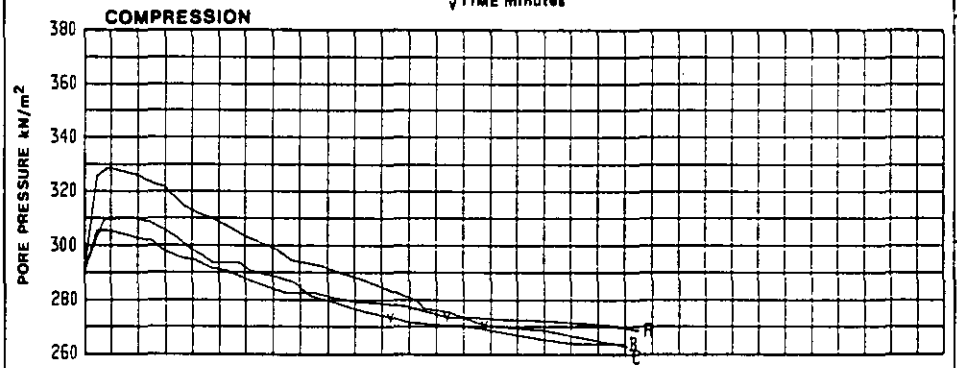
Location A42 CASTLE DONINGTON NORTH

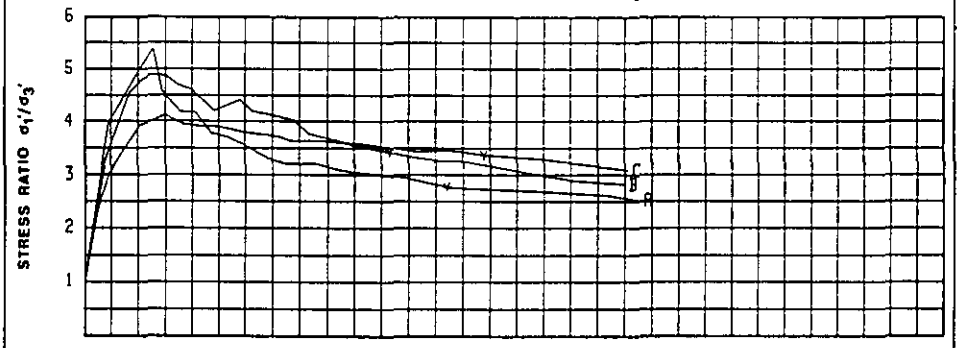
Loc. No. 7382

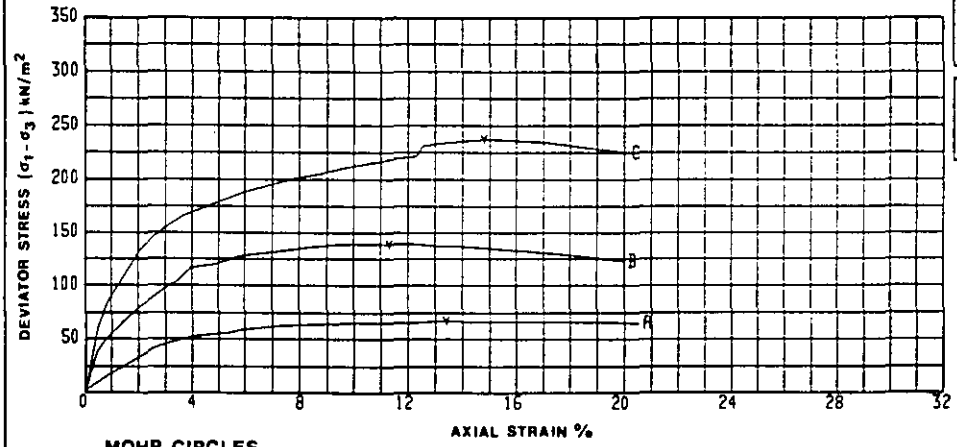
Fig. 14

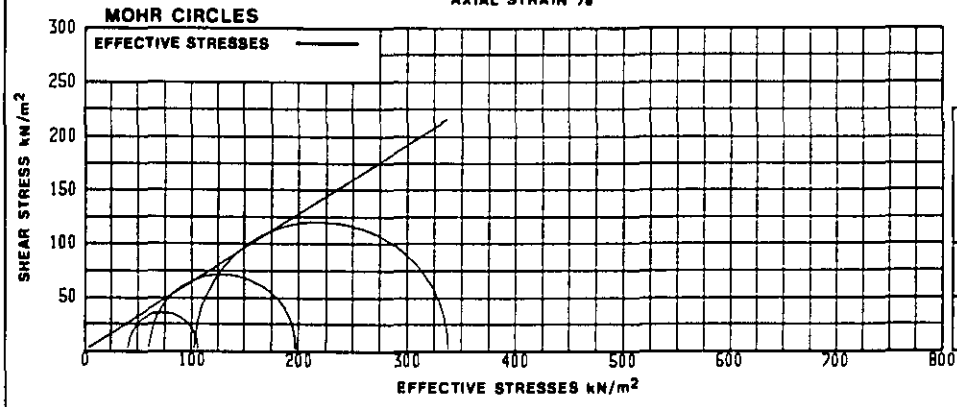












SPECIMEN			A	B	C
INITIAL	Density	Mg/m³	1.98	2.00	2.05
	Moisture	%	25	24	22
	Dry Density	Mg/m³	1.58	1.61	1.67
AFTER CONSOLIDATION	Density	Mg/m³	1.97	2.36	2.38
	Moisture	%	27	25	23
	Dry Density	Mg/m³	1.55	1.88	1.93
SATURATION STAGE	Initial pwp	kN/m²	-5	-6	-5
	Saturated pwp	kN/m²	240	240	240
	Final cell pressure	kN/m²	300	300	300
	B value		1.00	0.98	0.98
CONSOLIDATION STAGE	Cell pressure	kN/m²	310	330	370
	Back pressure	kN/m²	290	290	290
	Initial pwp	kN/m²	305	325	362
	Final pwp	kN/m²	290	290	290
CONSOLIDATION PARAMETERS	c_{v3}	m²/year	28.69	5.93	0.60
	m_{v3}	m²/MN	-0.23	-0.04	0.33
COMPRESSION STAGE	Cell pressure	kN/m²	310	330	370
	Initial pwp	kN/m²	290	290	290
	Initial σ_3'		20	40	80
	Rate of strain	% per hour	2.00	2.00	2.00
FAILURE CONDITIONS AT PEAK DEVIATOR STRESS	Axial Strain	%	13.4	11.3	14.8
	$(\sigma_1-\sigma_3)_f$	kN/m²	65	137	236
	u_f	kN/m²	273	273	270
	$\sigma_3'_f$	kN/m²	37	57	100
	$\sigma_1'_f$	kN/m²	102	194	336
	A_f		-0.26	-0.12	-0.08
	Time to failure	hours	6.7	5.7	7.4
	MODE OF FAILURE				

SHEAR STRENGTH PARAMETERS (COMPUTED)	C'	Ø'
	(-7)	(35°)
ASSESSED VALUES	0 kN/m²	32½°

NOTES

Saturation by application of cell/back pressure increments of 50 kN/m2 with a differential of 10 kN/m2.

Drainage during consolidation to top with side drains fitted.

Stress/strain curves corrected for area change, membrane and side drains.

SOIL DESCRIPTION
Stiff red/brown fissured silty CLAY

TYPE OF SPECIMEN UNDISTURBED

SPECIMEN DIMENSIONS (nominal) 38.0 mm dia x 75.0 mm long

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Consolidated Undrained Triaxial Compression Test with measurement of Pore Pressure

Borehole No. 708 **Depth** 0.60 - 1.05m

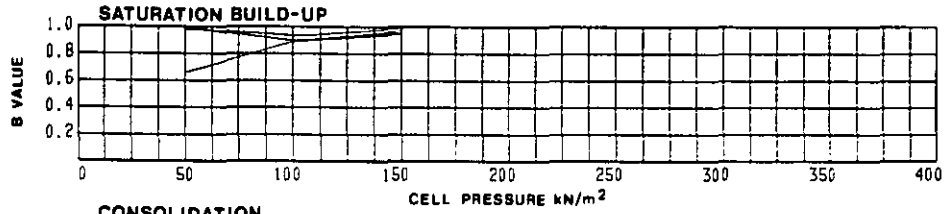
Sample No. 3

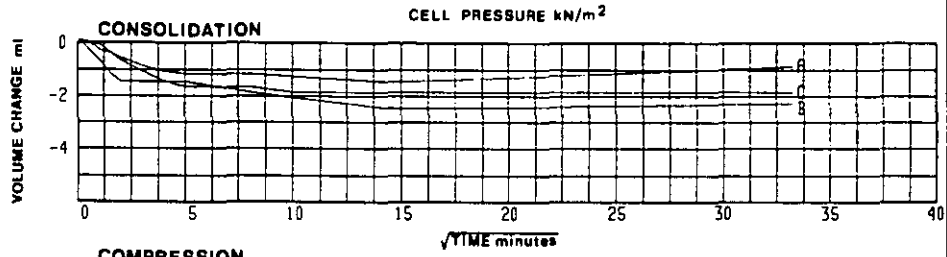
Soil Mechanics

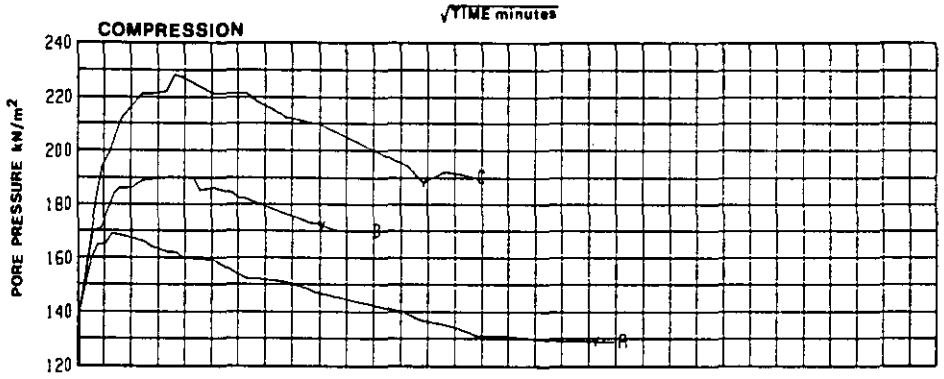
Location A42 CASTLE DONINGTON NORTH

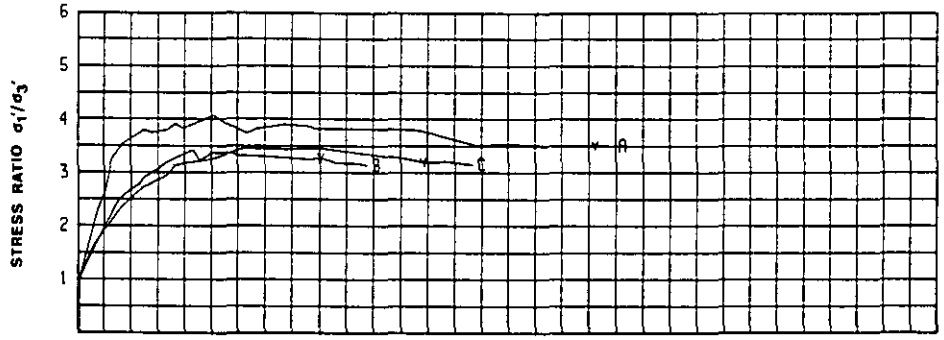
Loc. No. 7382

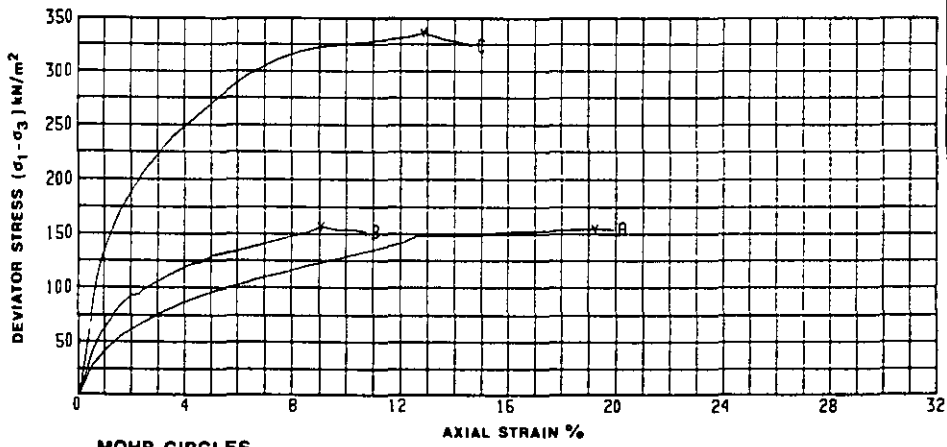
Fig. 15

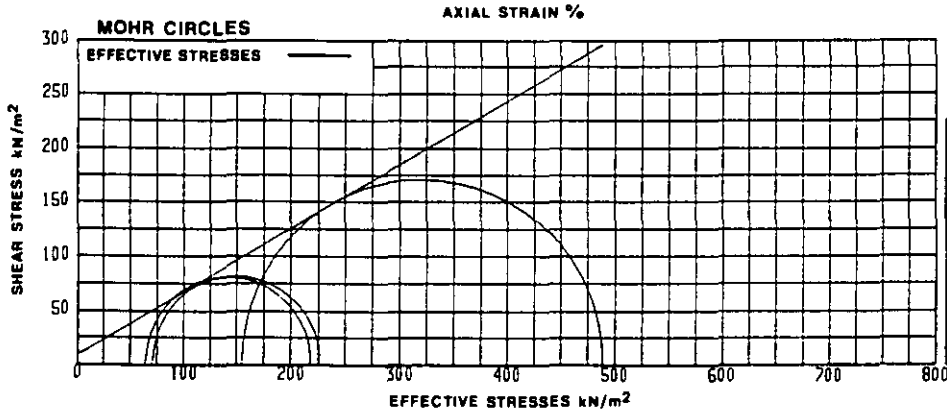




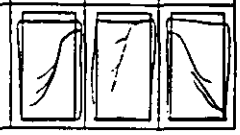








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	SPECIMEN	A	B	C
INITIAL	Density Mg/m³	1.99	1.95	1.98
	Moisture %	24	26	23
	Dry Density Mg/m³	1.61	1.55	1.60
AFTER CONSOLIDATION	Density Mg/m³	1.96	1.95	2.12
	Moisture %	23	24	21
	Dry Density Mg/m³	1.60	1.57	1.75
SATURATION STAGE	Initial pwp (kN/m²)	-5	-4	-2
	Saturated pwp (kN/m²)	90	90	90
	Final cell pressure (kN/m²)	150	150	150
	B value	1.00	0.98	0.96
CONSOLIDATION STAGE	Cell pressure (kN/m²)	190	240	340
	Back pressure (kN/m²)	140	140	140
	Initial pwp (kN/m²)	184	229	330
	Final pwp (kN/m²)	140	140	140
CONSOLIDATION PARAMETERS	c_{v3} m²/year	1.10	0.75	3.66
	m_{v3} m²/MN	0.26	0.31	0.13
COMPRESSION STAGE	Cell pressure (kN/m²)	190	240	340
	Initial pwp (kN/m²)	140	140	140
	Initial σ3' (kN/m²)	50	100	200
	Rate of strain % per hour	1.00	1.00	1.00
FAILURE CONDITIONS	Axial Strain %	19.3	9.0	12.8
AT PEAK DEVIATOR STRESS	$(\sigma_1 - \sigma_3)_f$ (kN/m²)	154	156	336
	u_f (kN/m²)	129	172	188
	$\sigma_3'_f$ (kN/m²)	61	68	152
	$\sigma_1'_f$ (kN/m²)	215	224	488
	A_f	-0.07	0.21	0.14
	Time to failure hours	19.3	9.0	12.8
	MODE OF FAILURE			

SHEAR STRENGTH PARAMETERS BY LINEAR REGRESSION	c'	φ'
	6 kN/m²	30½°

NOTES

Saturation by application of cell/back pressure increments of 50 kN/m2 with a differential of 10 kN/m2.

Drainage during consolidation to top with side drains fitted.

Stress/strain curves corrected for area change, membrane and side drains.

SOIL DESCRIPTION
Firm red/brown silty CLAY

TYPE OF SPECIMEN UNDISTURBED

SPECIMEN DIMENSIONS (nominal) 38.0 mm dia x 75.0 mm long

Consolidated Undrained Triaxial Compression Test with measurement of Pore Pressure

Borehole No. 710 **Depth** 2.10 - 2.55m

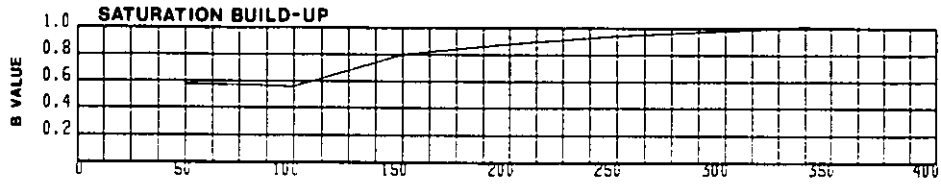
Sample No. 6

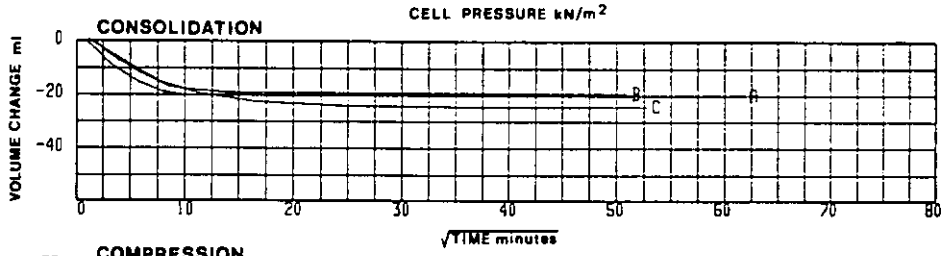
Soil Mechanics

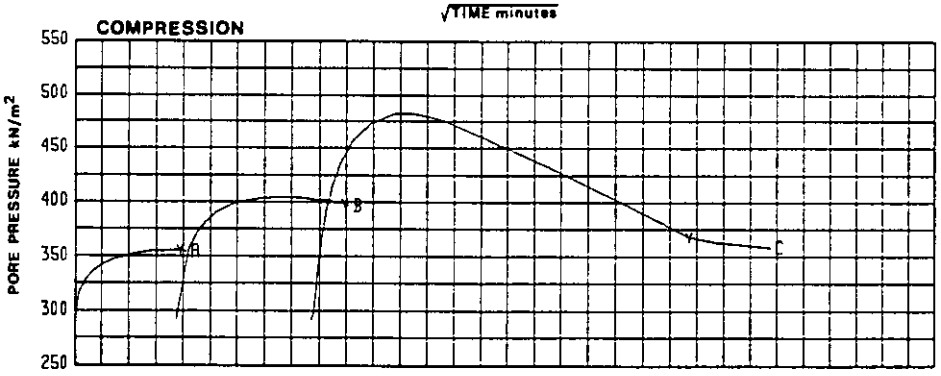
Location A42 CASTLE DONINGTON NORTH

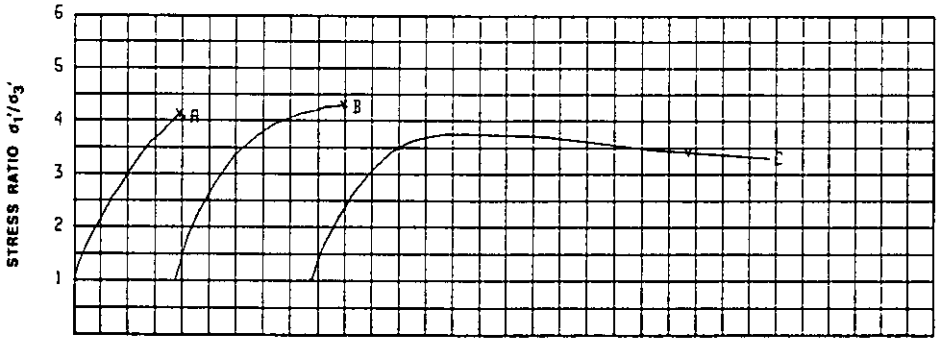
Loc. No. 7382

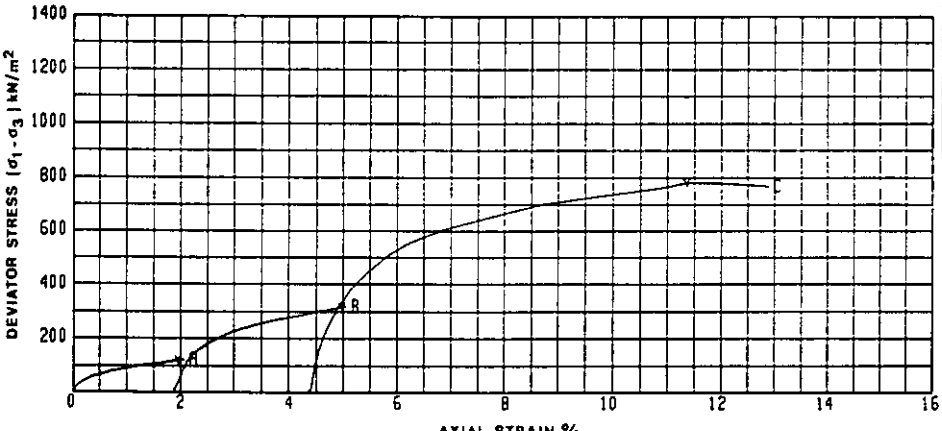
Fig. 16

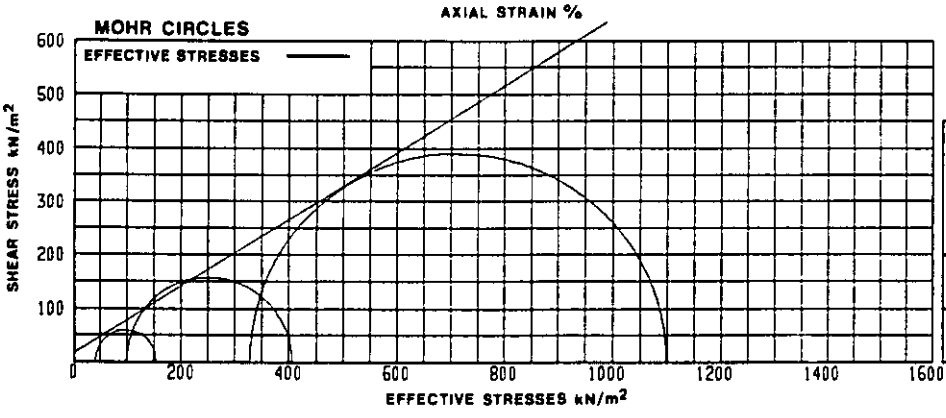












STAGE	SPECIMEN		A	B	C
INITIAL	Density Mg/m³		2.20	2.25	2.27
	Moisture %		15	15	15
	Dry Density Mg/m³		1.92	1.95	1.98
AFTER CONSOLIDATION	Density Mg/m³		2.25	2.27	2.29
	Moisture %		15	15	14
	Dry Density Mg/m³		1.95	1.98	2.01
SATURATION STAGE	Initial pwp	kN/m²	2		
	Saturated pwp	kN/m²	290		
	Final cell pressure	kN/m²	350		
	B value		0.96		
CONSOLIDATION STAGE	Cell pressure	kN/m²	390	490	690
	Back pressure	kN/m²	290	290	290
	Initial pwp	kN/m²	386	444	588
	Final pwp	kN/m²	290	290	290
CONSOLIDATION PARAMETERS	c_{v3}	m²/year	3.90	2.19	1.34
	m_{v3}	m²/MN	0.14	0.09	0.06
COMPRESSION STAGE	Cell pressure	kN/m²	390	490	690
	Initial pwp	kN/m²	290	290	290
	Initial σ3'	kN/m²	100	200	400
	Rate of strain	% per hour	0.50	0.50	0.50
FAILURE CONDITIONS AT PEAK STRESS RATIO	Axial Strain	%	1.9	5.0	11.4
	(σ1 - σ3)f	kN/m²	112	308	776
	uf	kN/m²	354	396	366
	σ3'f	kN/m²	36	94	324
	σ1'f	kN/m²	148	402	1100
	Af		0.57	0.34	0.10
	Time to failure hours		3.9	10.0	22.8
	MODE OF FAILURE at each stage				

SHEAR STRENGTH PARAMETERS BY LINEAR REGRESSION	c'	φ'
	17 kN/m²	32°

NOTES

Saturation by application of cell/back pressure increments of 50 kN/m2 with a differential of 10 kN/m2.

Drainage during consolidation to top with side drains fitted.

Stress/strain curves corrected for area change, membrane and side drains.

SOIL DESCRIPTION

Stiff red/brown fractured silty CLAY becoming less fractured towards the base

TYPE OF SPECIMEN UNDISTURBED

SPECIMEN DIMENSIONS (nominal) 103.0 mm dia x 199.0 mm long

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Consolidated Undrained Triaxial Compression Test with measurement of Pore Pressure - Multistage Test

Borehole No. 710 **Depth** 5.10 - 5.45m

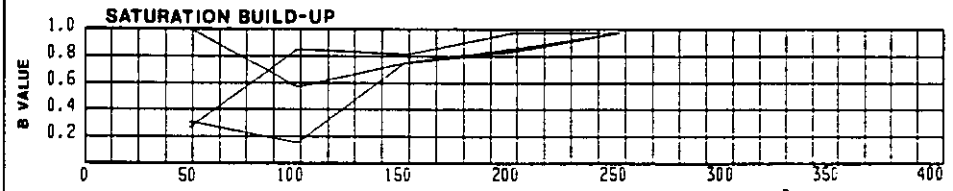
Sample No. 12

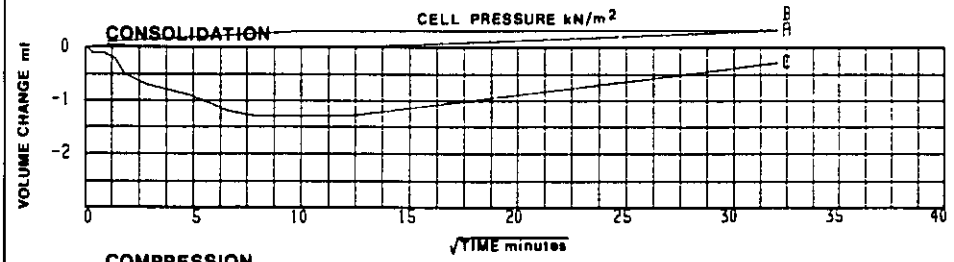
Soil Mechanics

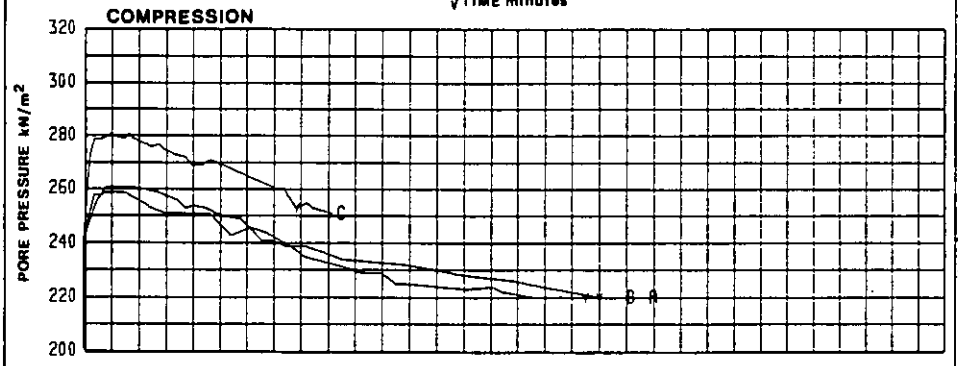
Location A42 CASTLE DONINGTON NORTH

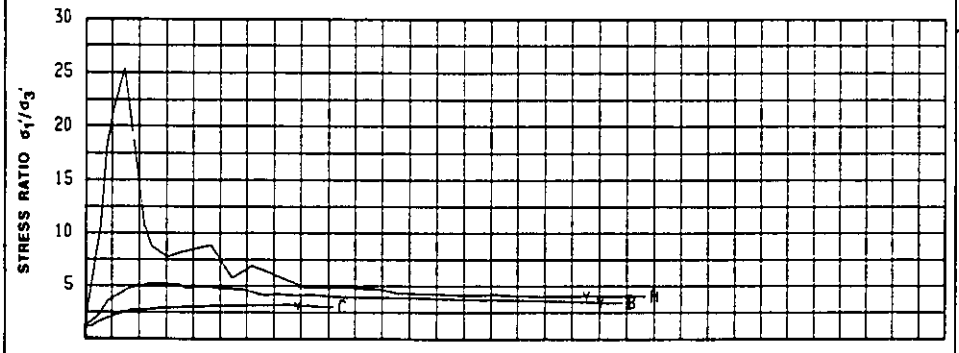
Loc. No. 7382

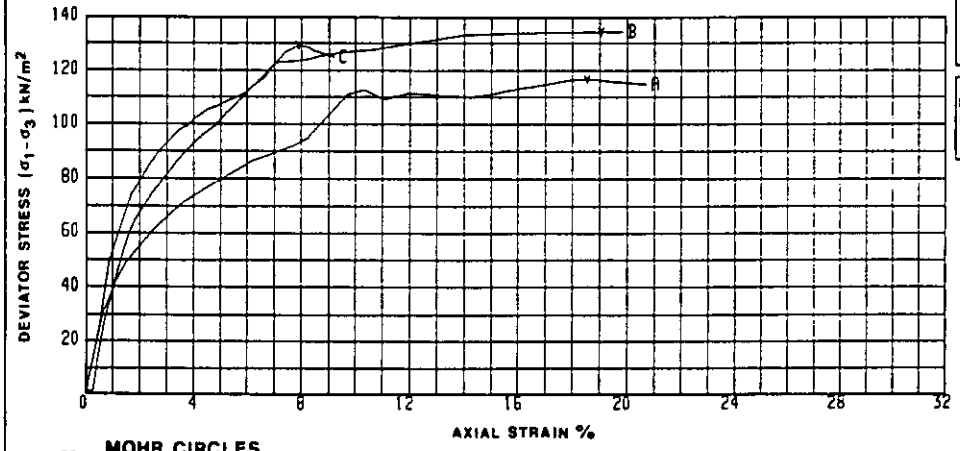
Fig. 17

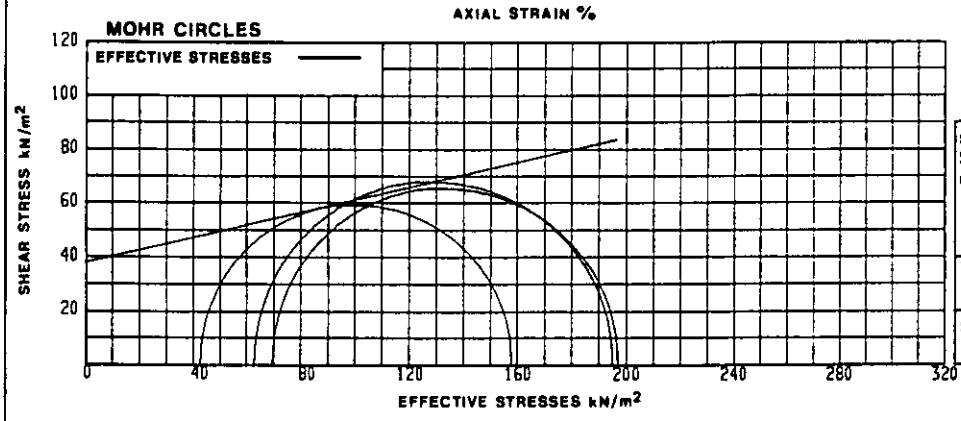


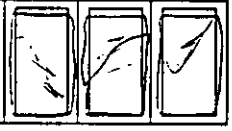










	SPECIMEN		A	B	C
INITIAL	Density Mg/m³		1.97	1.99	1.96
	Moisture %		25	25	25
	Dry Density Mg/m³		1.57	1.60	1.57
AFTER CONSOLIDATION	Density Mg/m³		1.97	2.00	1.95
	Moisture %		27	27	27
	Dry Density Mg/m³		1.54	1.64	1.53
SATURATION STAGE	Initial pwp	kN/m²	-11	-12	-13
	Saturated pwp	kN/m²	190	190	190
	Final cell pressure	kN/m²	250	250	250
	B value		0.96	0.96	0.96
CONSOLIDATION STAGE	Cell pressure	kN/m²	260	280	320
	Back pressure	kN/m²	240	240	240
	Initial pwp	kN/m²	255	275	311
	Final pwp	kN/m²	240	240	240
CONSOLIDATION PARAMETERS	c_{v3} m²/year		2.80	28.69	0.62
	m_{v3} m²/MN		-0.15	-0.07	0.06
COMPRESSION STAGE	Cell pressure	kN/m²	260	280	320
	Initial pwp	kN/m²	240	240	240
	Initial σ_3'	kN/m²	20	40	80
	Rate of strain	% per hour	1.00	1.00	1.00
FAILURE CONDITIONS AT PEAK DEVIATOR STRESS	Axial Strain %		18.6	19.2	7.9
	$(\sigma_1-\sigma_3)_f$	kN/m²	116	133	128
	u_f	kN/m²	219	219	252
	$\sigma_3'_f$	kN/m²	41	61	68
	$\sigma_1'_f$	kN/m²	157	194	196
	A_f		-0.18	-0.16	0.09
	Time to failure hours		18.6	19.2	7.9
	MODE OF FAILURE				

SHEAR STRENGTH PARAMETERS BY LINEAR REGRESSION	c'	ϕ'
	32 kN/m²	13°

NOTES

Saturation by application of cell/back pressure increments of 50 kN/m2 with a differential of 10 kN/m2.

Drainage during consolidation to top with side drains fitted.

Stress/strain curves corrected for area change, membrane and side drains.

SOIL DESCRIPTION

Stiff red/brown fissured silty CLAY (Marl) with occasional grey reduction spots

TYPE OF SPECIMEN UNDISTURBED

SPECIMEN DIMENSIONS (nominal) 38.0 mm dia x 75.0 mm long

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Consolidated Undrained Triaxial Compression Test with measurement of Pore Pressure

Borehole No. 712 **Depth** 0.50 - 0.95m

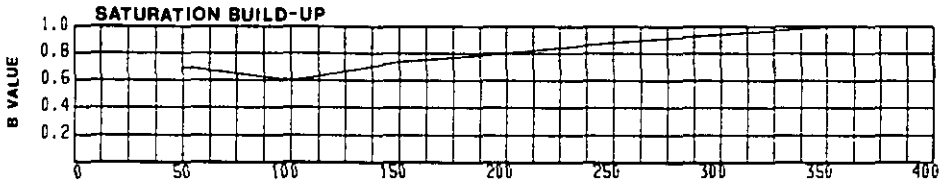
Sample No. 2

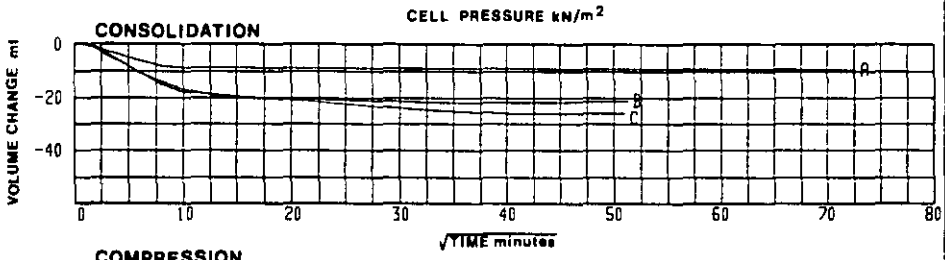
Soil Mechanics

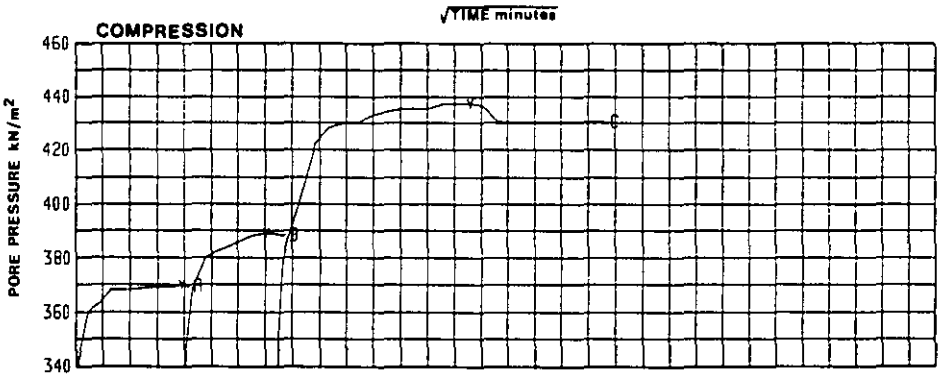
Location A42 CASTLE DONINGTON NORTH

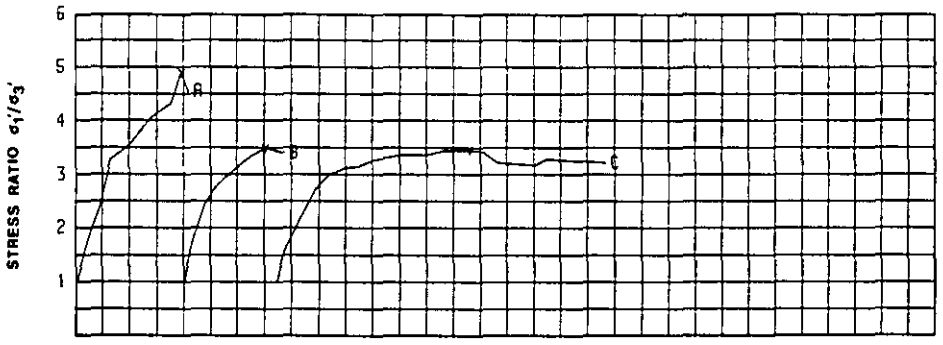
Loc. No. 7382

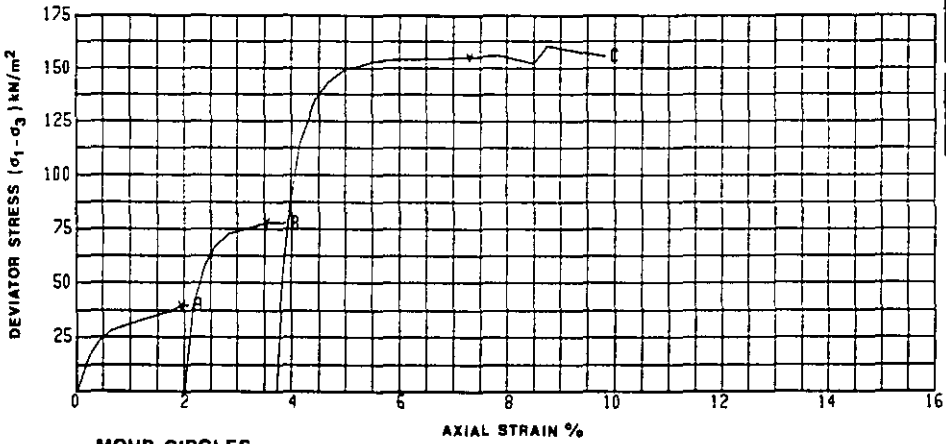
Fig. 18

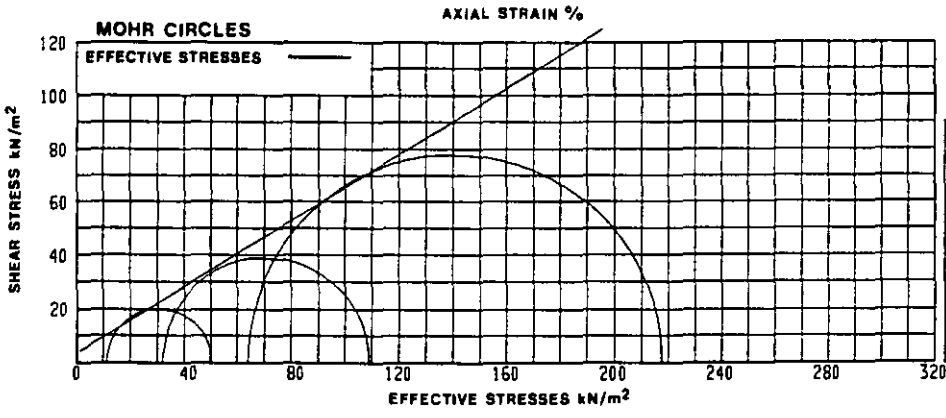












STAGE	SPECIMEN		A	B	C
INITIAL	Density Mg/m³		2.01	2.07	2.08
	Moisture %		21	22	21
	Dry Density Mg/m³		1.67	1.70	1.72
AFTER CONSOLIDATION	Density Mg/m³		2.07	2.08	2.10
	Moisture %		23	21	20
	Dry Density Mg/m³		1.70	1.72	1.75
SATURATION STAGE	Initial pwp	kN/m²	-6		
	Saturated pwp	kN/m²	290		
	Final cell pressure	kN/m²	350		
	B value		0.96		
CONSOLIDATION STAGE	Cell pressure	kN/m²	380	420	500
	Back pressure	kN/m²	340	340	340
	Initial pwp	kN/m²	369	406	464
	Final pwp	kN/m²	340	340	340
CONSOLIDATION PARAMETERS	c_{v3} m²/year		3.24	1.40	1.20
	m_{v3} m²/MN		0.24	0.21	0.14
COMPRESSION STAGE	Cell pressure	kN/m²	380	420	500
	Initial pwp	kN/m²	340	340	340
	Initial σ3'	kN/m²	40	80	160
	Rate of strain	% per hour	0.50	0.50	0.50
FAILURE CONDITIONS AT PEAK STRESS RATIO	Axial Strain %		1.9	3.5	7.3
	(σ1 - σ3)f	kN/m²	39	77	155
	uf	kN/m²	370	389	437
	σ3'f	kN/m²	10	31	63
	σ1'f	kN/m²	49	108	218
	Af		0.77	0.64	0.63
	Time to failure hours		3.8	7.0	14.6
	MODE OF FAILURE at each stage				

SHEAR STRENGTH PARAMETERS BY LINEAR REGRESSION	c'	φ'
	4 kN/m²	31½°

NOTES

Saturation by application of cell/back pressure increments of 50 kN/m2 with a differential of 10 kN/m2.

Drainage during consolidation to top with side drains fitted.

Stress/strain curves corrected for area change, membrane and side drains.

SOIL DESCRIPTION

Firm red/brown silty CLAY with some fine to medium and occasional coarse siltstone gravel

TYPE OF SPECIMEN UNDISTURBED

SPECIMEN DIMENSIONS (nominal) 103.0 mm dia x 199.0 mm long

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Consolidated Undrained Triaxial Compression Test with measurement of Pore Pressure - Multistage Test

Borehole No. 718 **Depth** 2.00 - 2.45m

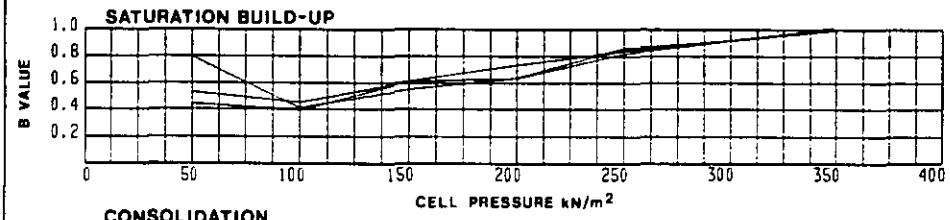
Sample No. 5

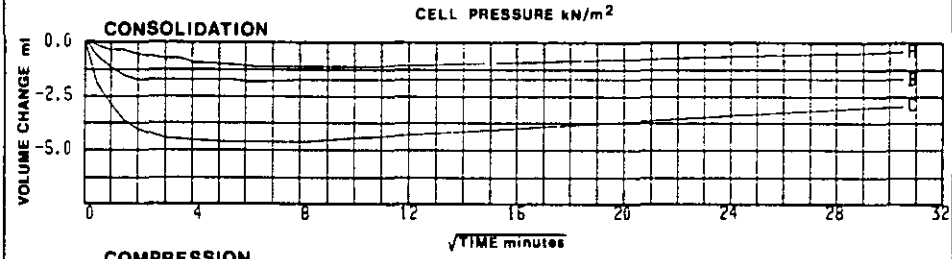
Soil Mechanics

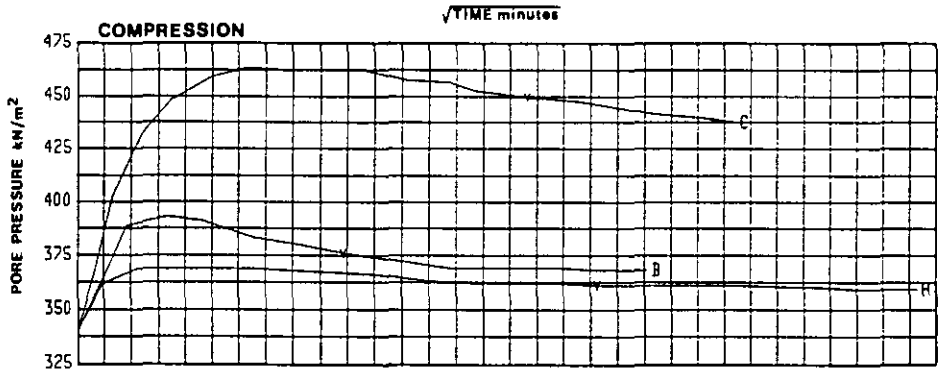
Location A42 CASTLE DONINGTON NORTH

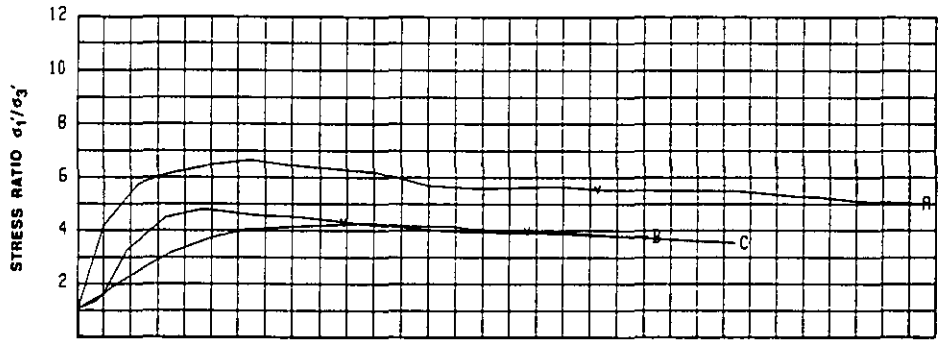
Loc. No. 7382

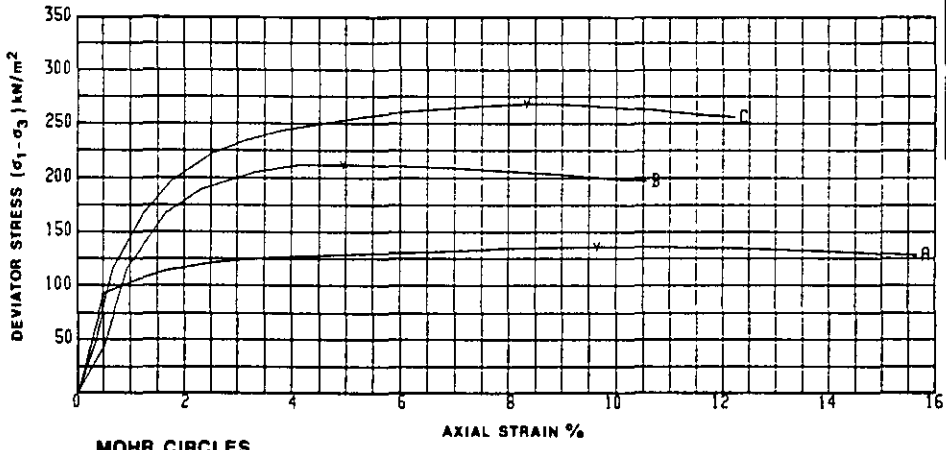
Fig. 19

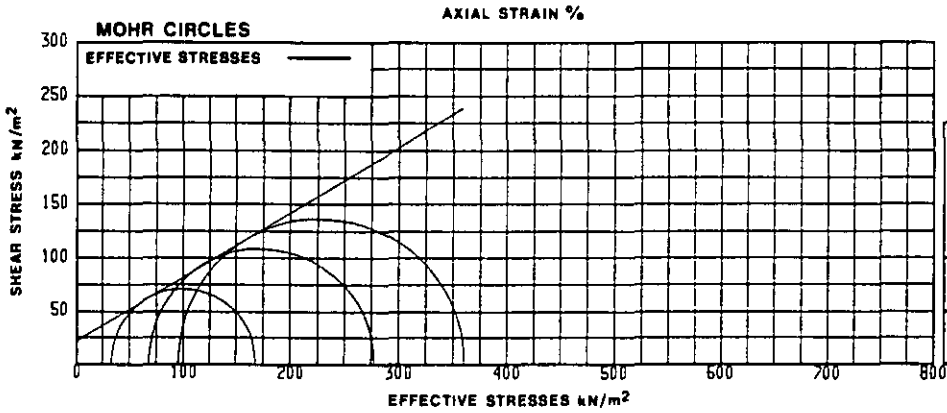












	SPECIMEN		A	B	C
INITIAL	Density Mg/m³		1.93	2.06	1.93
	Moisture %		19	17	17
	Dry Density Mg/m³		1.62	1.76	1.65
AFTER CONSOLIDATION	Density Mg/m³		1.92	2.11	2.00
	Moisture %		23	19	19
	Dry Density Mg/m³		1.56	1.78	1.68
SATURATION STAGE	Initial pwp	kN/m²	-6	-6	-15
	Saturated pwp	kN/m²	290	290	290
	Final cell pressure	kN/m²	350	350	350
	B value		0.98	0.98	1.00
CONSOLIDATION STAGE	Cell pressure	kN/m²	390	440	540
	Back pressure	kN/m²	340	340	340
	Initial pwp	kN/m²	383	432	530
	Final pwp	kN/m²	340	340	340
CONSOLIDATION PARAMETERS	c_{v3} m²/year		1.42	4.24	3.94
	m_{v3} m²/MN		0.18	0.25	0.19
COMPRESSION STAGE	Cell pressure	kN/m²	390	440	540
	Initial pwp	kN/m²	340	340	340
	Initial σ3'	kN/m²	50	100	200
	Rate of strain % per hour		2.00	2.00	2.00
FAILURE CONDITIONS	Axial Strain %		9.7	4.9	8.3
AT PEAK DEVIATOR STRESS	(σ1 - σ3)f	kN/m²	134	210	266
	uf	kN/m²	360	375	448
	σ3'f	kN/m²	30	65	92
	σ1'f	kN/m²	164	275	358
	A_f		0.15	0.17	0.41
	Time to failure hours		4.8	2.5	4.2
	MODE OF FAILURE				

SHEAR STRENGTH PARAMETERS BY LINEAR REGRESSION	c'	φ'
	20 kN/m²	31°

NOTES

Saturation by application of cell/back pressure increments of 50 kN/m2 with a differential of 10 kN/m2.

Drainage during consolidation to top with side drains fitted.

Stress/strain curves corrected for area change, membrane and side drains.

SOIL DESCRIPTION

Firm to stiff red/brown fissured/friable silty CLAY

TYPE OF SPECIMEN: UNDISTURBED

SPECIMEN DIMENSIONS (nominal): 38.0 mm dia x 75.0 mm long

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Consolidated Undrained Triaxial Compression Test with measurement of Pore Pressure

Borehole No. 720 Depth 2.00 - 2.45m

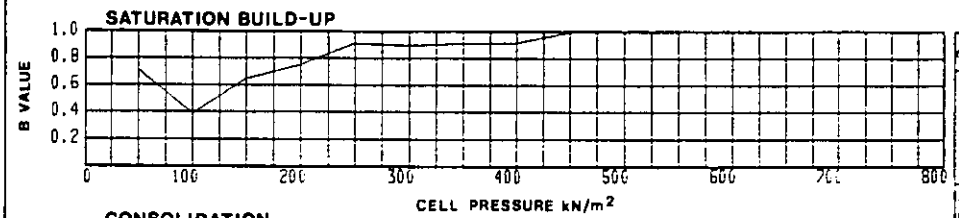
Sample No. 5

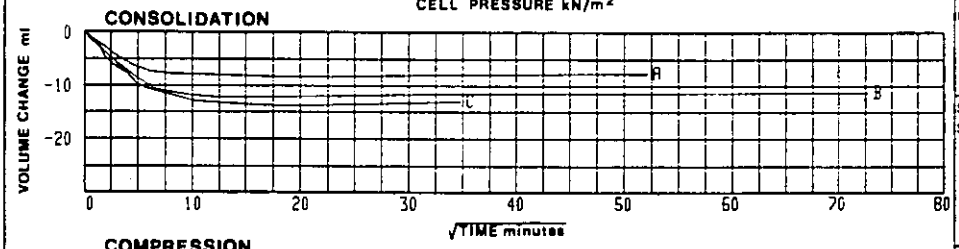
Soil Mechanics

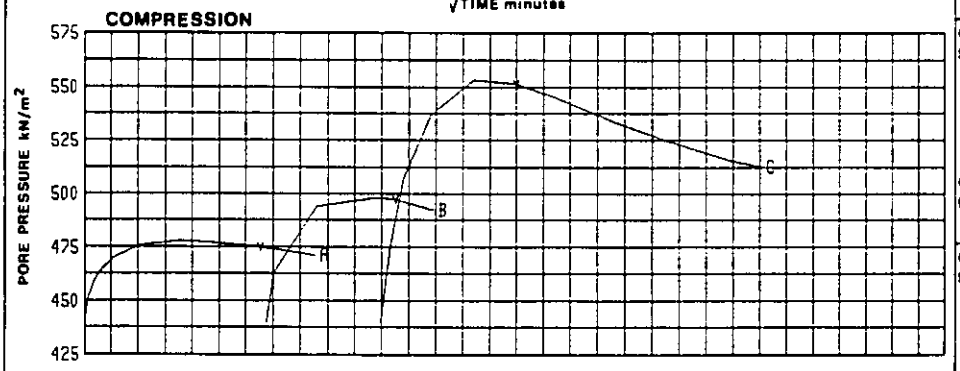
Location: A42 CASTLE DONINGTON NORTH

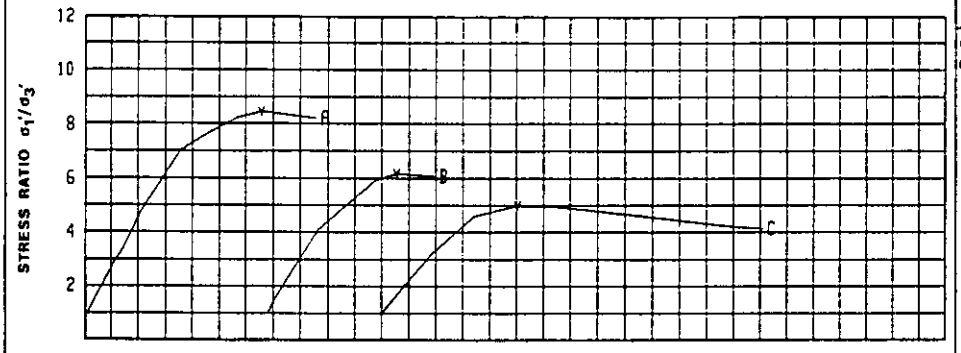
Loc. No. 7382

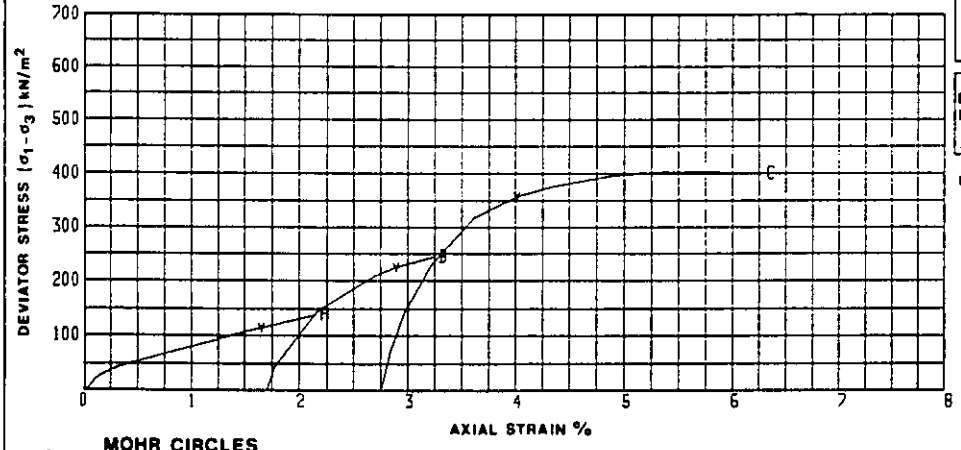
Fig. 20

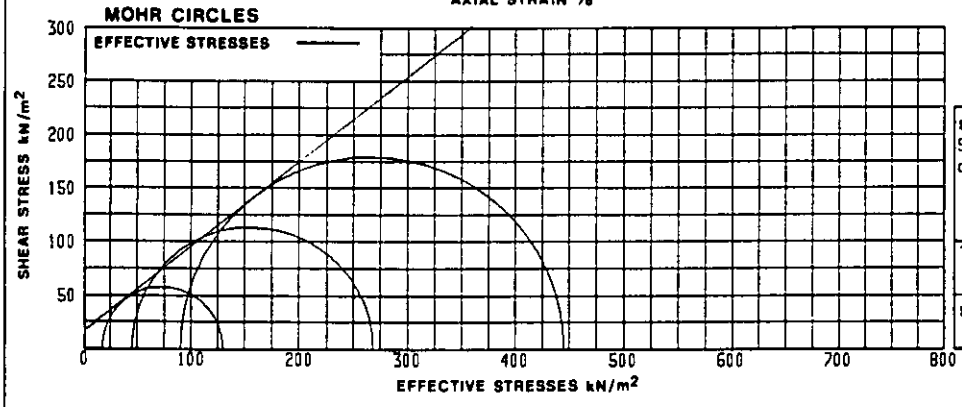












STAGE	SPECIMEN		A	B	C
INITIAL	Density Mg/m³		2.11	2.16	2.16
	Moisture %		15	16	16
	Dry Density Mg/m³		1.84	1.85	1.87
AFTER CONSOLIDATION	Density Mg/m³		2.16	2.16	2.17
	Moisture %		16	16	15
	Dry Density Mg/m³		1.85	1.87	1.88
SATURATION STAGE	Initial pwp	kN/m²	7		
	Saturated pwp	kN/m²	390		
	Final cell pressure	kN/m²	450		
	B value		0.96		
CONSOLIDATION STAGE	Cell pressure	kN/m²	490	540	640
	Back pressure	kN/m²	440	440	440
	Initial pwp	kN/m²	480	516	592
	Final pwp	kN/m²	440	440	440
CONSOLIDATION PARAMETERS	c_{v3} m²/year		4.83	4.83	4.41
	m_{v3} m²/MN		0.13	0.10	0.05
COMPRESSION STAGE	Cell pressure	kN/m²	490	540	640
	Initial pwp	kN/m²	440	440	440
	Initial σ'3	kN/m²	50	100	200
	Rate of strain	% per hour	0.50	0.50	0.50
FAILURE CONDITIONS AT PEAK STRESS RATIO	Axial Strain %		1.6	2.9	4.0
	$(\sigma_1-\sigma_3)_f$	kN/m²	112	224	356
	u_f	kN/m²	475	497	551
	σ'_{3f}	kN/m²	15	43	89
	σ'_{1f}	kN/m²	127	267	445
	A_f		0.31	0.25	0.31
	Time to failure hours		3.3	5.8	8.0
	MODE OF FAILURE at each stage				

SHEAR STRENGTH PARAMETERS BY LINEAR REGRESSION	C'	φ'
	17 kN/m²	38½°

NOTES

Saturation by application of cell/back pressure increments of 50 kN/m2 with a differential of 10 kN/m2.

Drainage during consolidation to top with side drains fitted.

Stress/strain curves corrected for area change, membrane and side drains.

SOIL DESCRIPTION

Stiff red/brown silty CLAY with some fine to coarse marl fragments

TYPE OF SPECIMEN UNDISTURBED

SPECIMEN DIMENSIONS (nominal) 103.0 mm dia x 200.0 mm long

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Consolidated Undrained Triaxial Compression Test with measurement of Pore Pressure - Multistage Test

Borehole No. 722 **Depth** 2.00 - 2.45m

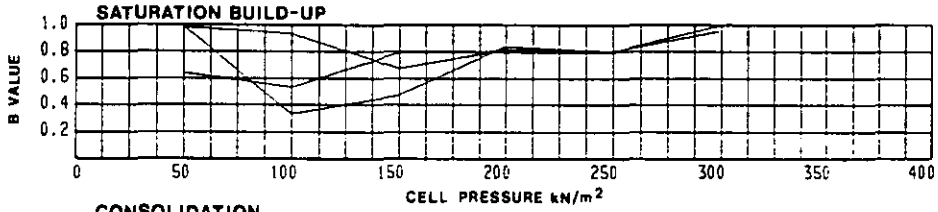
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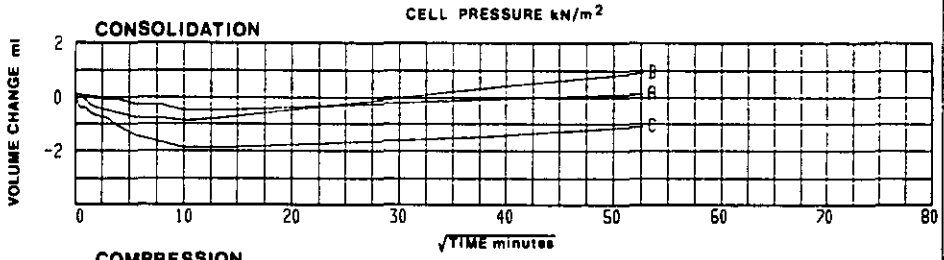
Soil Mechanics

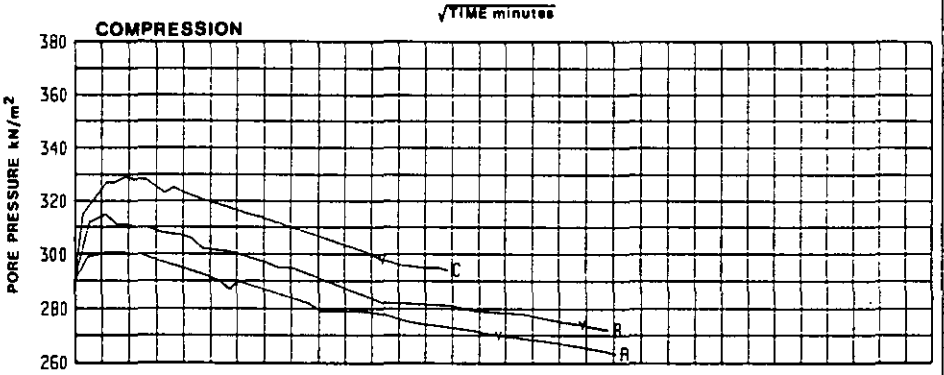
Location A42 CASTLE DONINGTON NORTH

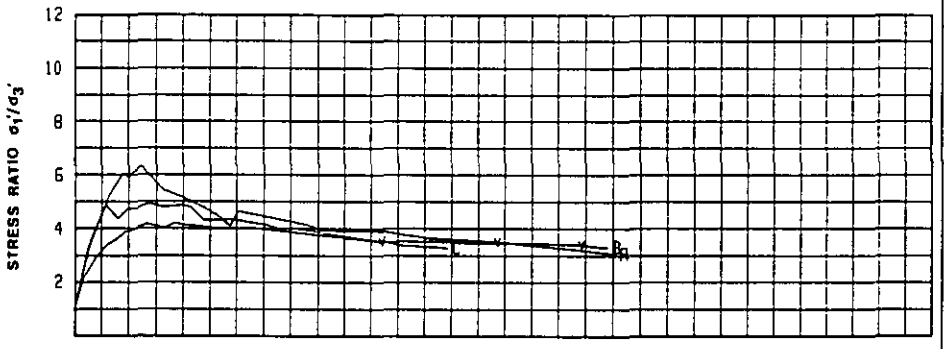
Loc. No. 7382

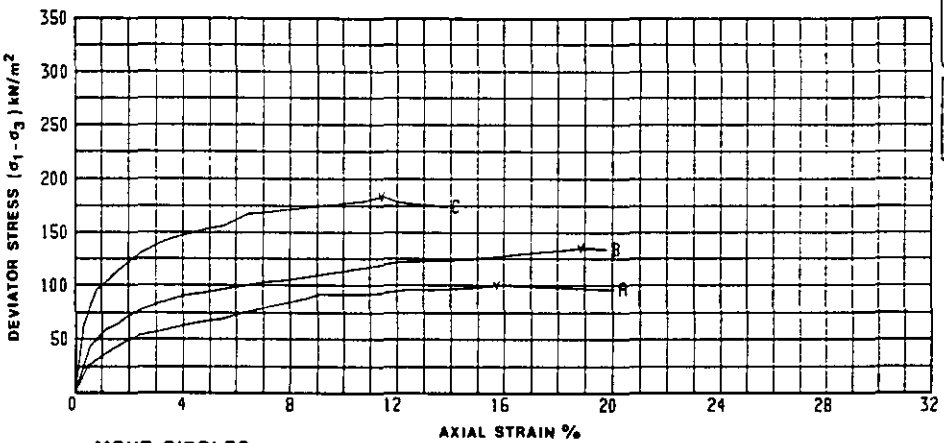
Fig. 21

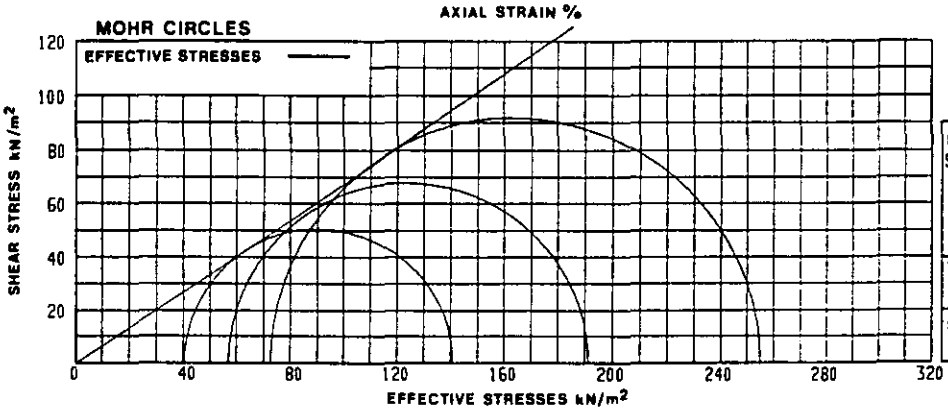












	SPECIMEN		A	B	C
INITIAL	Density	Mg/m³	2.06	2.04	1.97
	Moisture	%	21	22	25
	Dry Density	Mg/m³	1.70	1.67	1.58
AFTER CONSOLIDATION	Density	Mg/m³	2.13	2.00	1.98
	Moisture	%	24	25	25
	Dry Density	Mg/m³	1.72	1.61	1.58
SATURATION STAGE	Initial pwp	kN/m²	-7	-4	-7
	Saturated pwp	kN/m²	240	240	240
	Final cell pressure	kN/m²	300	300	300
	B value		1.00	0.96	0.96
CONSOLIDATION STAGE	Cell pressure	kN/m²	310	330	370
	Back pressure	kN/m²	290	290	290
	Initial pwp	kN/m²	300	320	360
	Final pwp	kN/m²	290	290	290
CONSOLIDATION PARAMETERS	c_{v_3}	m²/year	0.37	1.25	0.45
	m_{v_3}	m²/MN	0.00	-0.30	0.20
COMPRESSION STAGE	Cell pressure	kN/m²	310	330	370
	Initial pwp	kN/m²	290	290	290
	Initial σ_3'	kN/m²	20	40	80
	Rate of strain	% per hour	1.00	1.00	1.00
FAILURE CONDITIONS	Axial Strain	%	15.8	18.9	11.4
AT PEAK DEVIATOR STRESS	$(\sigma_1-\sigma_3)_f$	kN/m²	101	135	184
	u_f	kN/m²	270	274	298
	$\sigma_3'_f$	kN/m²	40	56	72
	$\sigma_1'_f$	kN/m²	141	191	256
	A_f		-0.20	-0.12	0.04
	Time to failure	hours	15.8	18.9	11.4
	MODE OF FAILURE				

	C'	φ'
SHEAR STRENGTH PARAMETERS (COMPUTED)	(-2)	(34½°)
ASSESSED VALUES	0 kN/m²	34°

NOTES

Saturation by application of cell/back pressure increments of 50 kN/m2 with a differential of 10 kN/m2.

Drainage during consolidation to top with side drains fitted.

Stress/strain curves corrected for area change, membrane and side drains.

SOIL DESCRIPTION
Stiff red/brown fissured silty CLAY

TYPE OF SPECIMEN UNDISTURBED

SPECIMEN DIMENSIONS (nominal) 38.0 mm dia x 75.0 mm long

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Consolidated Undrained Triaxial Compression Test with measurement of Pore Pressure

Borehole No. 723 Depth 0.50 - 0.95M

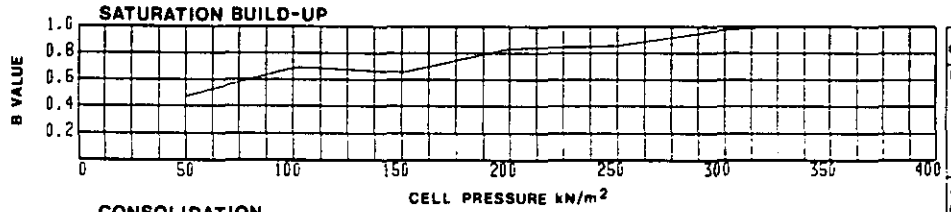
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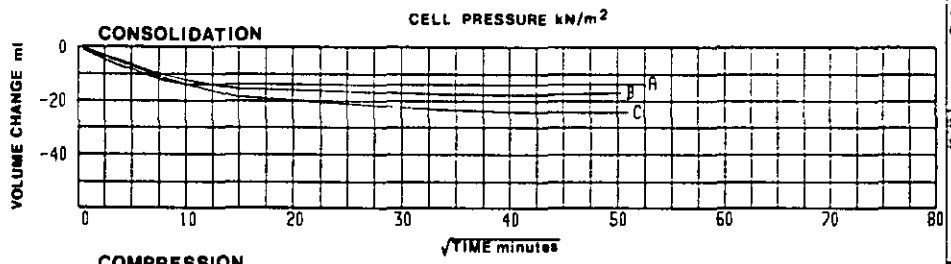
Soil Mechanics

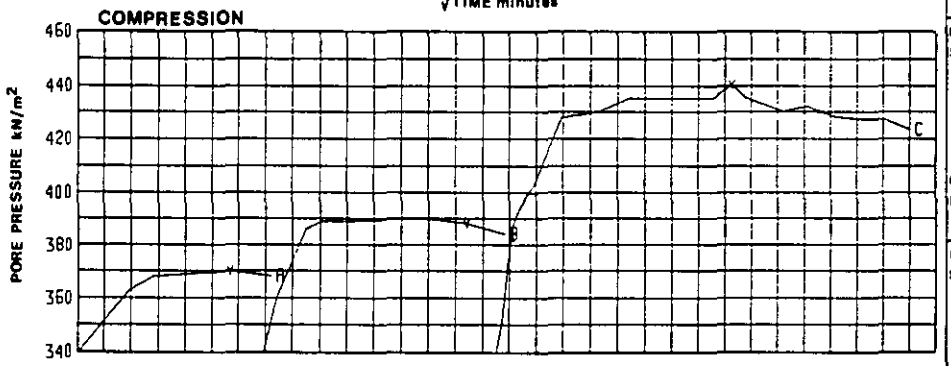
Location: A42 CASTLE DONINGTON NORTH

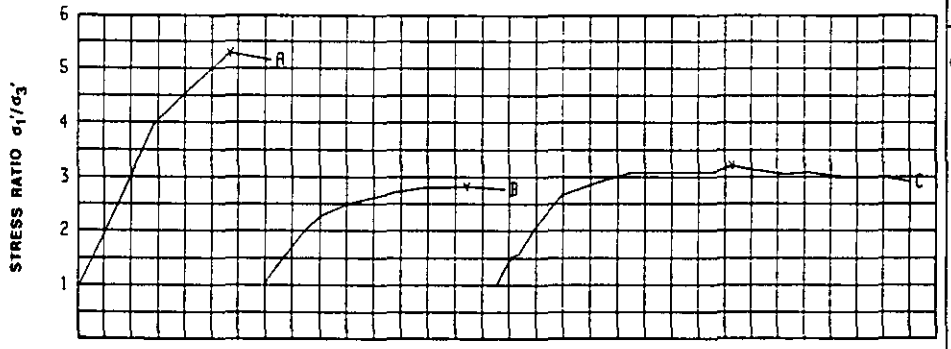
Loc. No. 7382

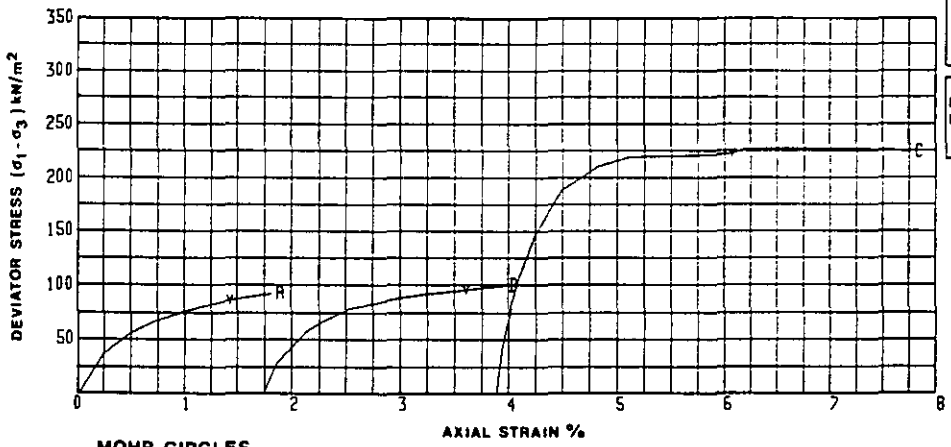
Fig. 22

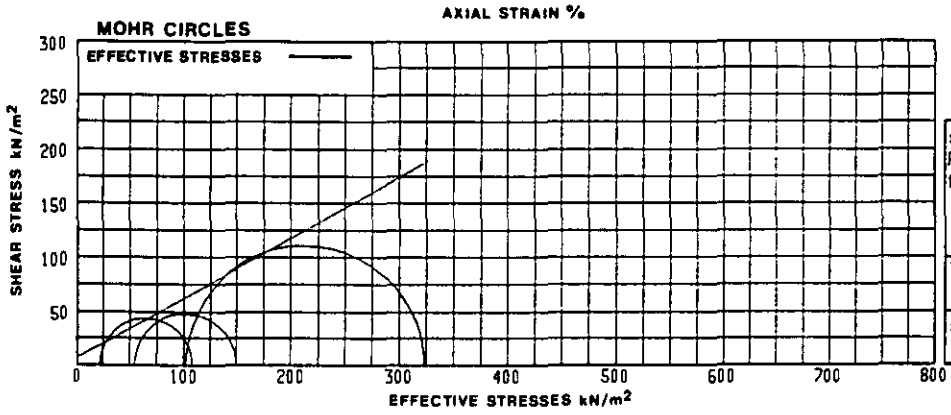












STAGE	SPECIMEN		A	B	C
INITIAL	Density	Mg/m³	2.01	2.08	2.09
	Moisture	%	21	22	21
	Dry Density	Mg/m³	1.66	1.71	1.72
AFTER CONSOLIDATION	Density	Mg/m³	2.08	2.09	2.11
	Moisture	%	22	21	20
	Dry Density	Mg/m³	1.71	1.72	1.75
SATURATION STAGE	Initial pwp	kN/m²	-4		
	Saturated pwp	kN/m²	290		
	Final cell pressure	kN/m²	350		
	B value		1.00		
CONSOLIDATION STAGE	Cell pressure	kN/m²	390	440	540
	Back pressure	kN/m²	340	340	340
	Initial pwp	kN/m²	381	411	482
	Final pwp	kN/m²	340	340	340
CONSOLIDATION PARAMETERS	c_{v3}	m²/year	2.80	1.03	0.68
	m_{v3}	m²/MN	0.22	0.16	0.11
COMPRESSION STAGE	Cell pressure	kN/m²	390	440	540
	Initial pwp	kN/m²	340	340	340
	Initial σ_3'	kN/m²	50	100	200
	Rate of strain	% per hour	0.50	0.50	0.50
FAILURE CONDITIONS AT PEAK STRESS RATIO	Axial Strain	%	1.4	3.6	6.1
	$(\sigma_1-\sigma_3)_f$	kN/m²	86	95	222
	u_f	kN/m²	370	388	440
	$\sigma_3'_f$	kN/m²	20	52	100
	$\sigma_1'_f$	kN/m²	106	147	322
	A_f		0.35	0.50	0.45
	Time to failure	hours	2.8	7.2	12.1
MODE OF FAILURE at each stage					

SHEAR STRENGTH PARAMETERS BY LINEAR REGRESSION	c'	φ'
	8 kN/m²	25°

NOTES

Saturation by application of cell/back pressure increments of 50 kN/m2 with a differential of 10 kN/m2.

Drainage during consolidation to top with side drains fitted.

Stress/strain curves corrected for area change, membrane and side drains.

SOIL DESCRIPTION

Firm to stiff red/brown silty CLAY with some fine to coarse marl fragments

TYPE OF SPECIMEN UNDISTURBED

SPECIMEN DIMENSIONS (nominal) 104.0 mm dia x 199.0 mm long

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Consolidated Undrained Triaxial Compression Test with measurement of Pore Pressure - Multistage Test

Borehole No. 726 **Depth** 2.00 - 2.45m

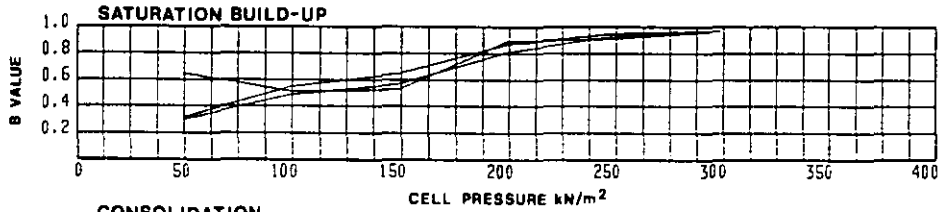
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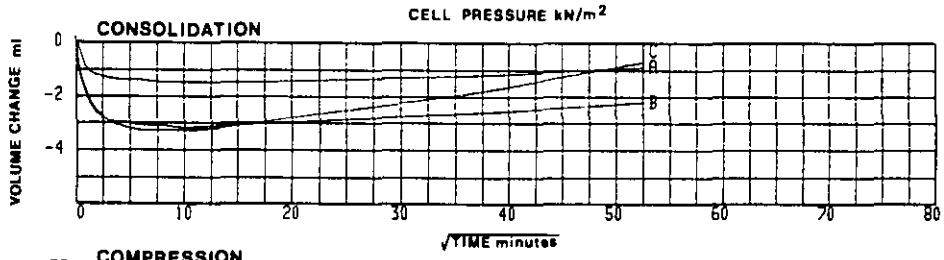
Soil Mechanics

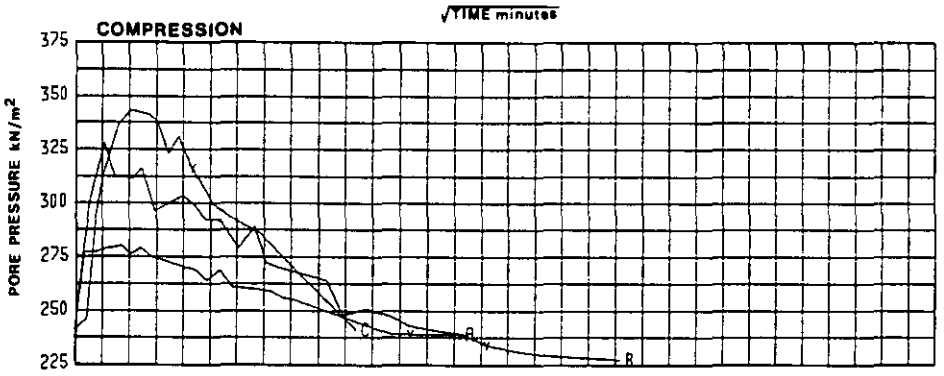
Location A42 CASTLE DONINGTON NORTH

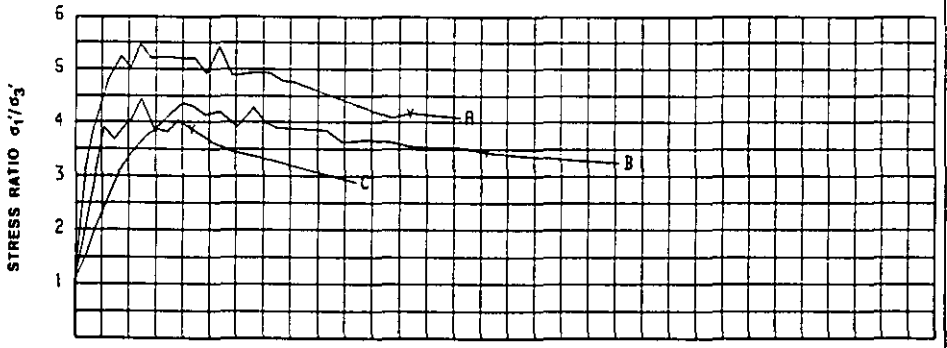
Loc. No. 7382

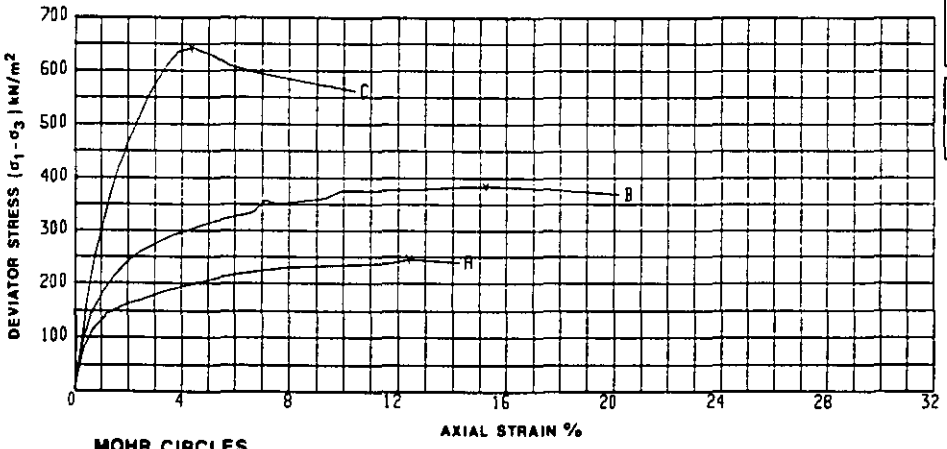
Fig. 23

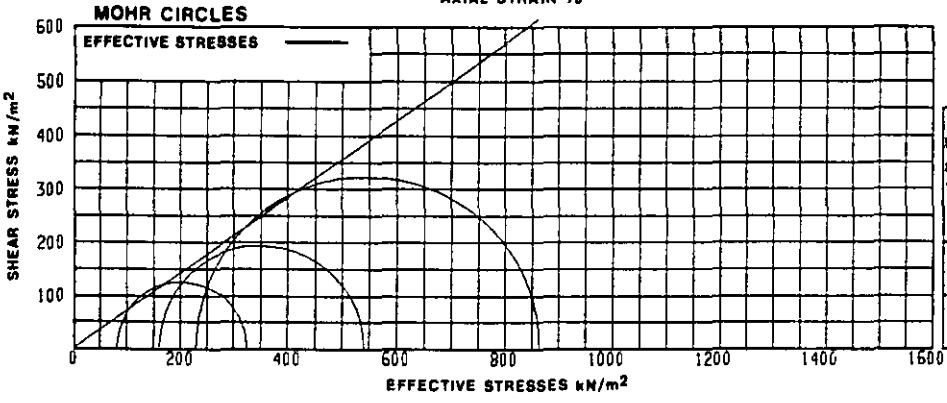












	SPECIMEN		A	B	C
INITIAL	Density Mg/m³		2.05	2.01	2.12
	Moisture %		14	15	15
	Dry Density Mg/m³		1.79	1.75	1.85
AFTER CONSOLIDATION	Density Mg/m³		2.21	2.10	2.21
	Moisture %		17	15	16
	Dry Density Mg/m³		1.88	1.81	1.91
SATURATION STAGE	Initial pwp	kN/m²	-6	-5	-5
	Saturated pwp	kN/m²	240	240	240
	Final cell pressure	kN/m²	300	300	300
	B value		0.96	0.96	0.96
CONSOLIDATION STAGE	Cell pressure	kN/m²	315	390	540
	Back pressure	kN/m²	240	240	240
	Initial pwp	kN/m²	305	381	527
	Final pwp	kN/m²	240	240	240
CONSOLIDATION PARAMETERS	c_{v3} m²/year		3.66	2.99	3.19
	m_{v3} m²/MN		0.21	0.20	0.04
COMPRESSION STAGE	Cell pressure	kN/m²	315	390	540
	Initial pwp	kN/m²	240	240	240
	Initial σ_3'	kN/m²	75	150	300
	Rate of strain	% per hour	1.00	1.00	1.00
FAILURE CONDITIONS	Axial Strain %		12.5	15.3	4.4
AT PEAK DEVIATOR STRESS	$(\sigma_1-\sigma_3)_f$	kN/m²	242	380	639
	u_f	kN/m²	238	233	315
	$\sigma_3'_f$	kN/m²	77	157	225
	$\sigma_1'_f$	kN/m²	319	537	864
	A_f		-0.01	-0.02	0.12
	Time to failure hours		12.5	15.3	4.4
	MODE OF FAILURE				

SHEAR STRENGTH PARAMETERS BY LINEAR REGRESSION	C'	φ'
	1 kN/m²	35°

NOTES

Saturation by application of cell/back pressure increments of 50 kN/m2 with a differential of 10 kN/m2.

Drainage during consolidation to top with side drains fitted.

Stress/strain curves corrected for area change, membrane and side drains.

SOIL DESCRIPTION

Very stiff red/brown occasionally grey mottled silty CLAY becoming more grey towards top

TYPE OF SPECIMEN UNDISTURBED

SPECIMEN DIMENSIONS (nominal) 38.0 mm dia x 75.0 mm long

Consolidated Undrained Triaxial Compression Test with measurement of Pore Pressure

Borehole No. 727 **Depth** 3.40 - 3.85m

Sample No. 9

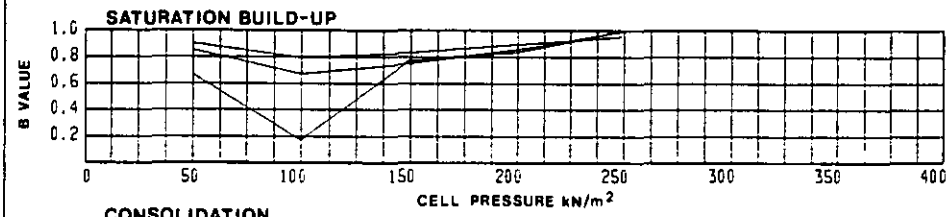
Soil Mechanics

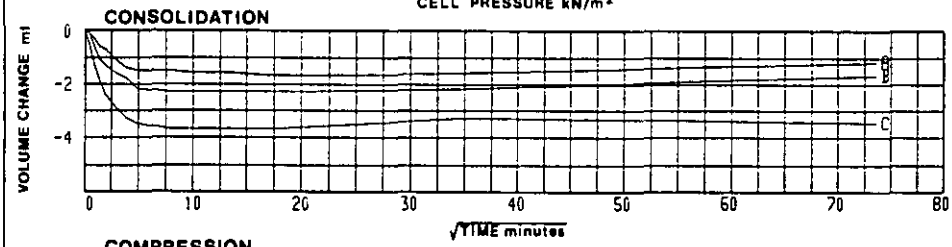
Location A42 CASTLE DONINGTON NORTH

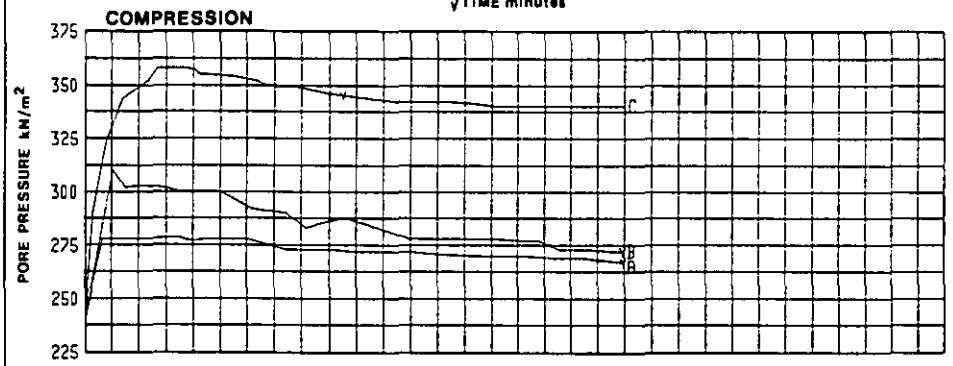
Loc. No. 7382

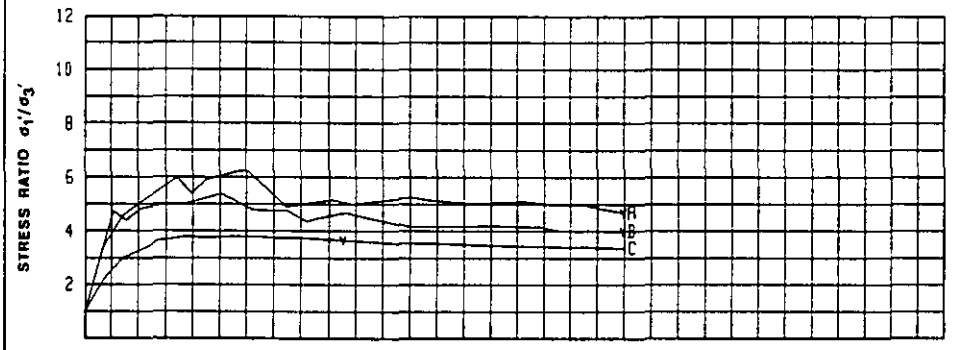
Fig. 24

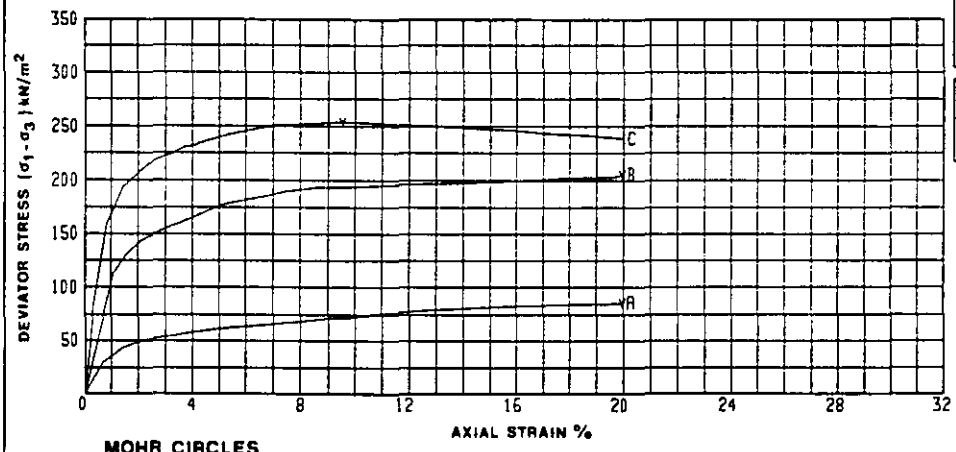
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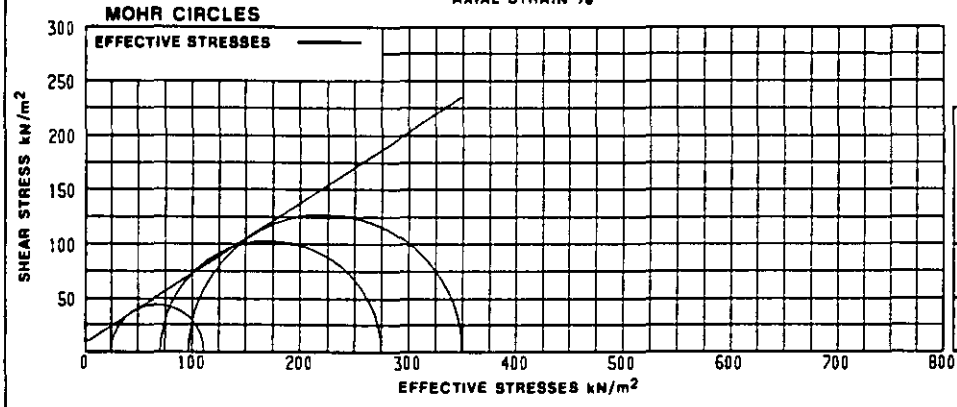


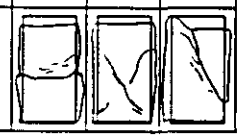










	SPECIMEN		A	B	C
INITIAL	Density Mg/m³		1.96	1.98	1.93
	Moisture %		23	23	22
	Dry Density Mg/m³		1.58	1.61	1.59
AFTER CONSOLIDATION	Density Mg/m³		1.92	2.01	1.93
	Moisture %		22	22	19
	Dry Density Mg/m³		1.57	1.64	1.62
SATURATION STAGE	Initial pwp	kN/m²	-3	-4	-3
	Saturated pwp	kN/m²	190	190	190
	Final cell pressure	kN/m²	250	250	250
	B value		0.96	1.00	1.00
CONSOLIDATION STAGE	Cell pressure	kN/m²	290	340	440
	Back pressure	kN/m²	240	240	240
	Initial pwp	kN/m²	290	335	430
	Final pwp	kN/m²	240	240	240
CONSOLIDATION PARAMETERS	c_{v3} m²/year		1.15	1.99	2.80
	m_{v3} m²/MN		0.30	0.22	0.22
COMPRESSION STAGE	Cell pressure	kN/m²	290	340	440
	Initial pwp	kN/m²	240	240	240
	Initial σ3'	kN/m²	50	100	200
	Rate of strain	% per hour	2.00	2.00	2.00
FAILURE CONDITIONS	Axial Strain %		20.0	20.0	9.5
AT PEAK DEVIATOR STRESS	(σ1-σ3)f	kN/m²	86	205	254
	uf	kN/m²	267	272	345
	σ3'f	kN/m²	23	68	95
	σ1'f	kN/m²	109	273	349
	A_f		0.32	0.16	0.41
	Time to failure hours		10.0	10.0	4.8
	MODE OF FAILURE				

SHEAR STRENGTH PARAMETERS BY LINEAR REGRESSION	C'	φ'
	9 kN/m²	32°

NOTES

Saturation by application of cell/back pressure increments of 50 kN/m2 with a differential of 10 kN/m2.

Drainage during consolidation to top with side drains fitted.

Stress/strain curves corrected for area change, membrane and side drains.

SOIL DESCRIPTION

Soft to firm red/brown silty CLAY with occasional fine to medium marl fragments towards top of specimen

TYPE OF SPECIMEN UNDISTURBED

SPECIMEN DIMENSIONS (nominal) 38.0 mm dia x 75.0 mm long

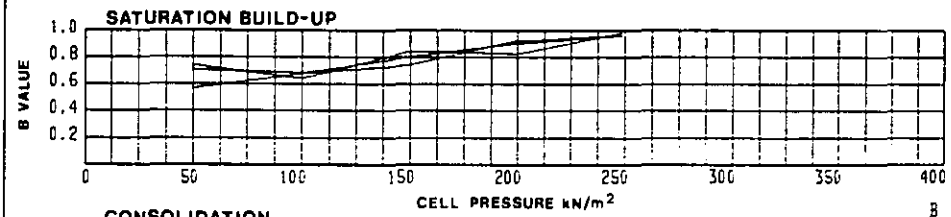
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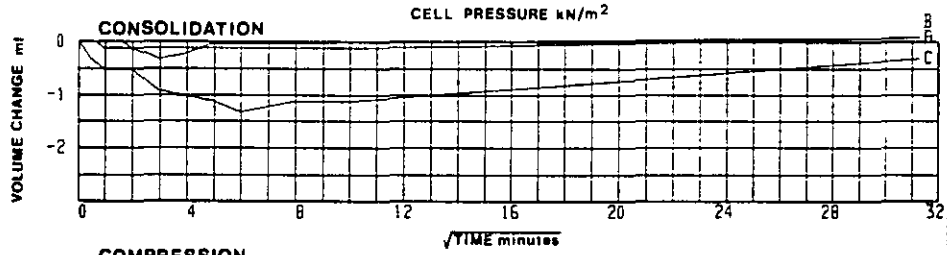
Consolidated Undrained Triaxial Compression Test with measurement of Pore Pressure

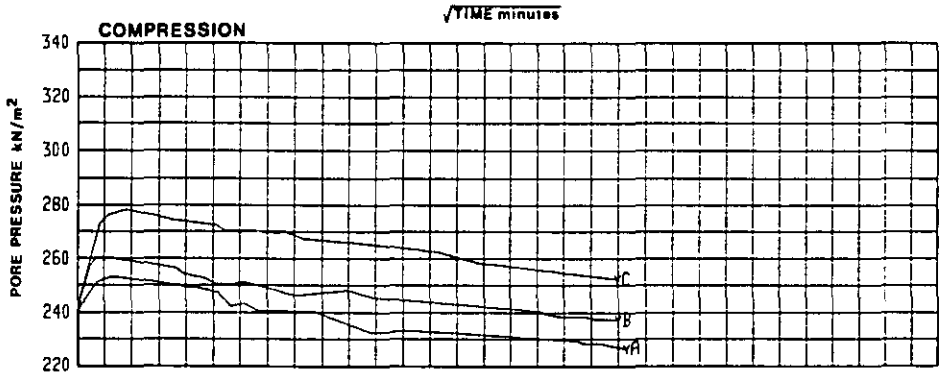
Borehole No. 738 Depth 3.50 - 3.95m

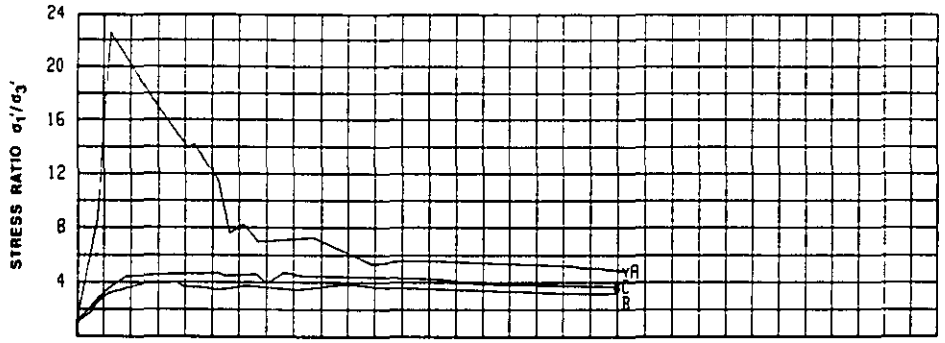
Sample No. B

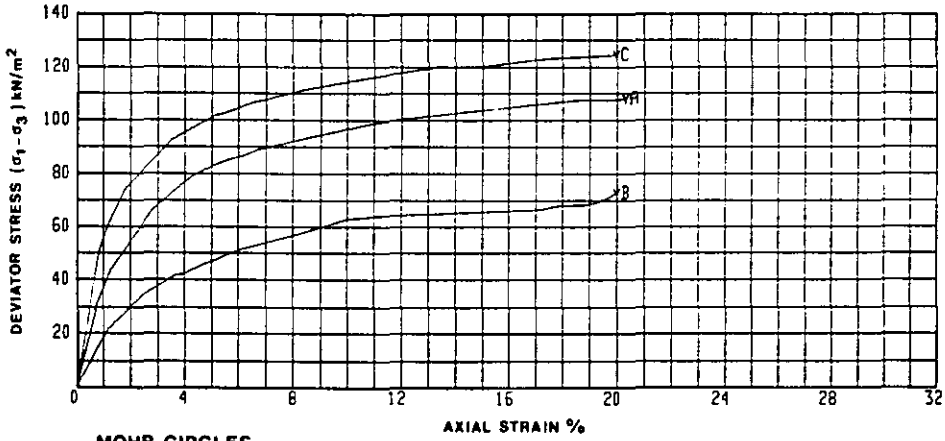
Soil Mechanics	Location	Loc. No.	Fig.
	A42 CASTLE DONINGTON NORTH	7382	25

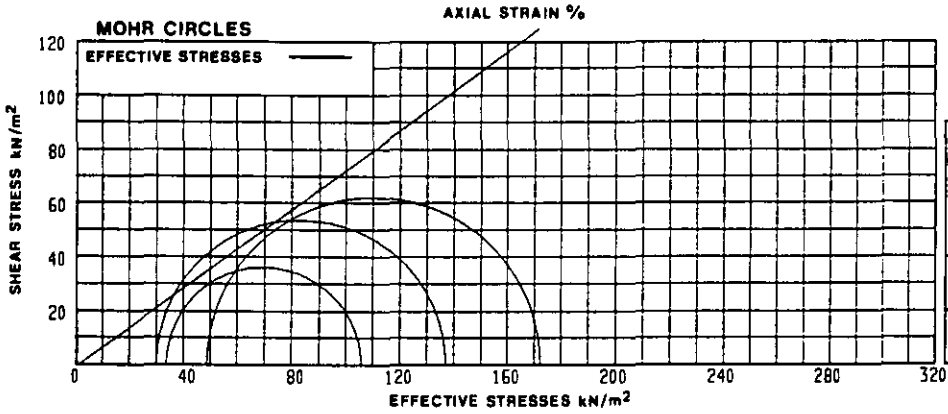


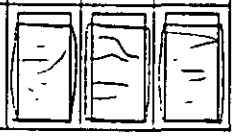










	SPECIMEN		A	B	C
INITIAL	Density Mg/m³		1.95	1.99	1.95
	Moisture %		22	22	24
	Dry Density Mg/m³		1.59	1.63	1.58
AFTER CONSOLIDATION	Density Mg/m³		2.03	2.01	1.96
	Moisture %		23	22	23
	Dry Density Mg/m³		1.65	1.65	1.59
SATURATION STAGE	Initial pwp	kN/m²	-4	-4	-4
	Saturated pwp	kN/m²	190	190	190
	Final cell pressure	kN/m²	250	250	250
	B value		0.96	0.98	0.96
CONSOLIDATION STAGE	Cell pressure	kN/m²	255	270	300
	Back pressure	kN/m²	240	240	240
	Initial pwp	kN/m²	249	262	298
	Final pwp	kN/m²	240	240	240
CONSOLIDATION PARAMETERS	c_{v3}	m²/year	7.17	7.17	0.80
	m_{v3}	m²/MN	0.00	0.00	0.08
COMPRESSION STAGE	Cell pressure	kN/m²	255	270	300
	Initial pwp	kN/m²	240	240	240
	Initial σ3'	kN/m²	15	30	60
	Rate of strain	% per hour	2.00	2.00	2.00
FAILURE CONDITIONS	Axial Strain	%	20.4	20.1	20.1
AT PEAK DEVIATOR STRESS	$(\sigma_1 - \sigma_3)_f$	kN/m²	108	72	124
	u_f	kN/m²	226	237	252
	$\sigma_3'_f$	kN/m²	29	33	48
	$\sigma_1'_f$	kN/m²	137	105	172
	A_f		-0.13	-0.04	0.10
	Time to failure hours		10.2	10.1	10.1
	MODE OF FAILURE				

SHEAR STRENGTH PARAMETERS (COMPUTED)	c'	φ'
	(-1)	(35°)
ASSESSED VALUES	0 kN/m²	35°

NOTES

Saturation by application of cell/back pressure increments of 50 kN/m2 with a differential of 10 kN/m2.

Drainage during consolidation to top with side drains fitted.

Stress/strain curves corrected for area change, membrane and side drains.

SOIL DESCRIPTION

Firm brown and grey mottled slighlty sandy silty CLAY

TYPE OF SPECIMEN: UNDISTURBED

SPECIMEN DIMENSIONS (nominal): 38.0 mm dia x 75.0 mm long

Consolidated Undrained Triaxial Compression Test with measurement of Pore Pressure

Borehole No. 740 Depth 0.50 - 0.95m

Sample No. 2

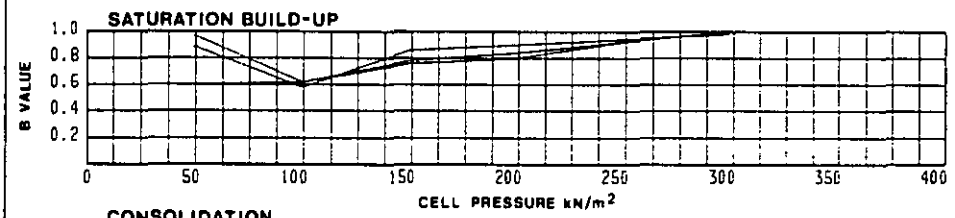
Soil Mechanics

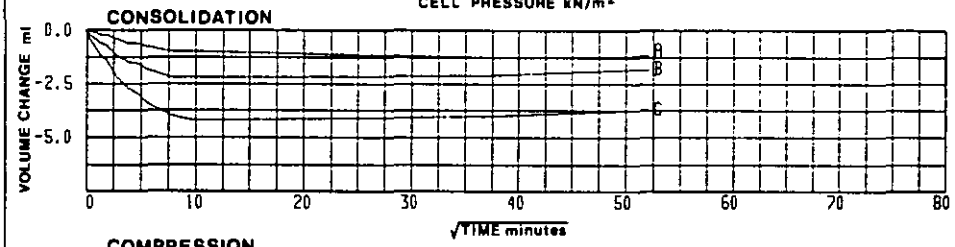
Location: A42 CASTLE DONINGTON NORTH

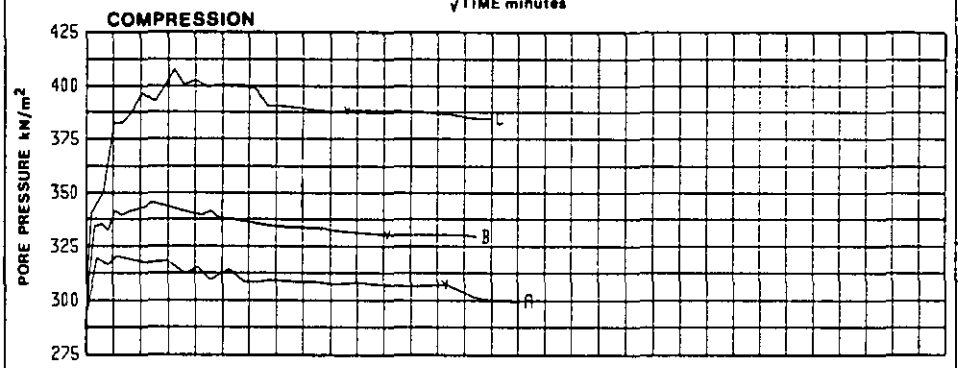
Loc. No. 7382

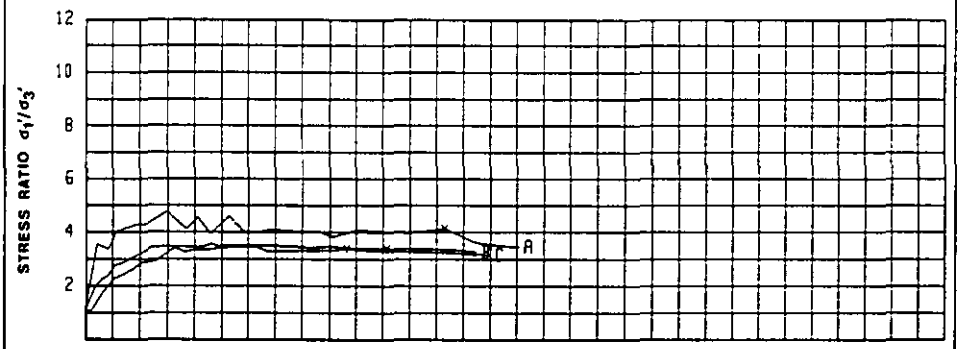
Fig. 26

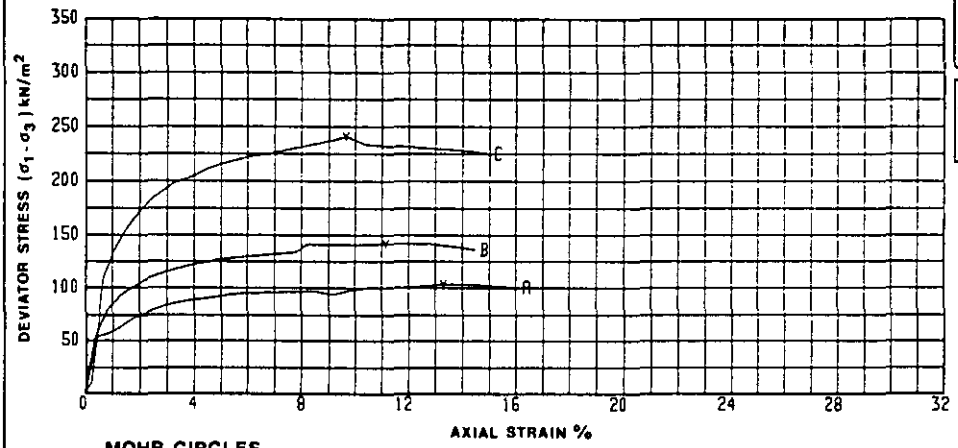
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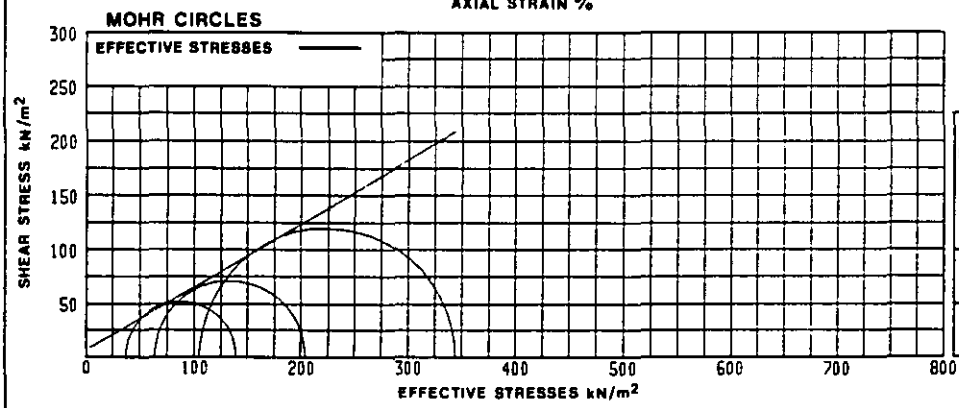












SPECIMEN			A	B	C
INITIAL	Density	Mg/m³	2.00	1.96	1.98
	Moisture	%	26	26	26
	Dry Density	Mg/m³	1.58	1.56	1.56
AFTER CONSOLIDATION	Density	Mg/m³	1.94	1.90	2.00
	Moisture	%	26	25	23
	Dry Density	Mg/m³	1.54	1.52	1.62
SATURATION STAGE	Initial pwp	kN/m²	-5	-6	-7
	Saturated pwp	kN/m²	240	240	240
	Final cell pressure	kN/m²	300	300	300
	B value		1.00	1.00	0.98
CONSOLIDATION STAGE	Cell pressure	kN/m²	340	390	490
	Back pressure	kN/m²	290	290	290
	Initial pwp	kN/m²	331	382	481
	Final pwp	kN/m²	290	290	290
CONSOLIDATION PARAMETERS	c_{v_3}	m²/year	0.35	0.70	0.72
	m_{v_3}	m²/MN	0.38	0.24	0.24
COMPRESSION STAGE	Cell pressure	kN/m²	340	390	490
	Initial pwp	kN/m²	290	290	290
	Initial σ_3'	kN/m²	50	100	200
	Rate of strain	% per hour	1.00	1.00	1.00
FAILURE CONDITIONS AT PEAK DEVIATOR STRESS	Axial Strain	%	13.4	11.2	9.7
	$(\sigma_1-\sigma_3)_f$	kN/m²	102	141	240
	u_f	kN/m²	307	330	388
	$\sigma_3'_f$	kN/m²	33	60	102
	$\sigma_1'_f$	kN/m²	135	201	342
	A_f		0.17	0.28	0.41
	Time to failure	hours	13.4	11.2	9.7
	MODE OF FAILURE				

SHEAR STRENGTH PARAMETERS	C'	φ'
BY LINEAR REGRESSION	8 kN/m²	30½°

NOTES

Saturation by application of cell/back pressure increments of 50 kN/m2 with a differential of 10 kN/m2.

Drainage during consolidation to top with side drains fitted.

Stress/strain curves corrected for area change, membrane and side drains.

SOIL DESCRIPTION

Firm brown occasionally grey silty CLAY with a little fine gravel

TYPE OF SPECIMEN UNDISTURBED

SPECIMEN DIMENSIONS (nominal) 38.0 mm dia x 75.0 mm long

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Consolidated Undrained Triaxial Compression Test with measurement of Pore Pressure

Borehole No. 740 **Depth** 3.50 - 3.95m

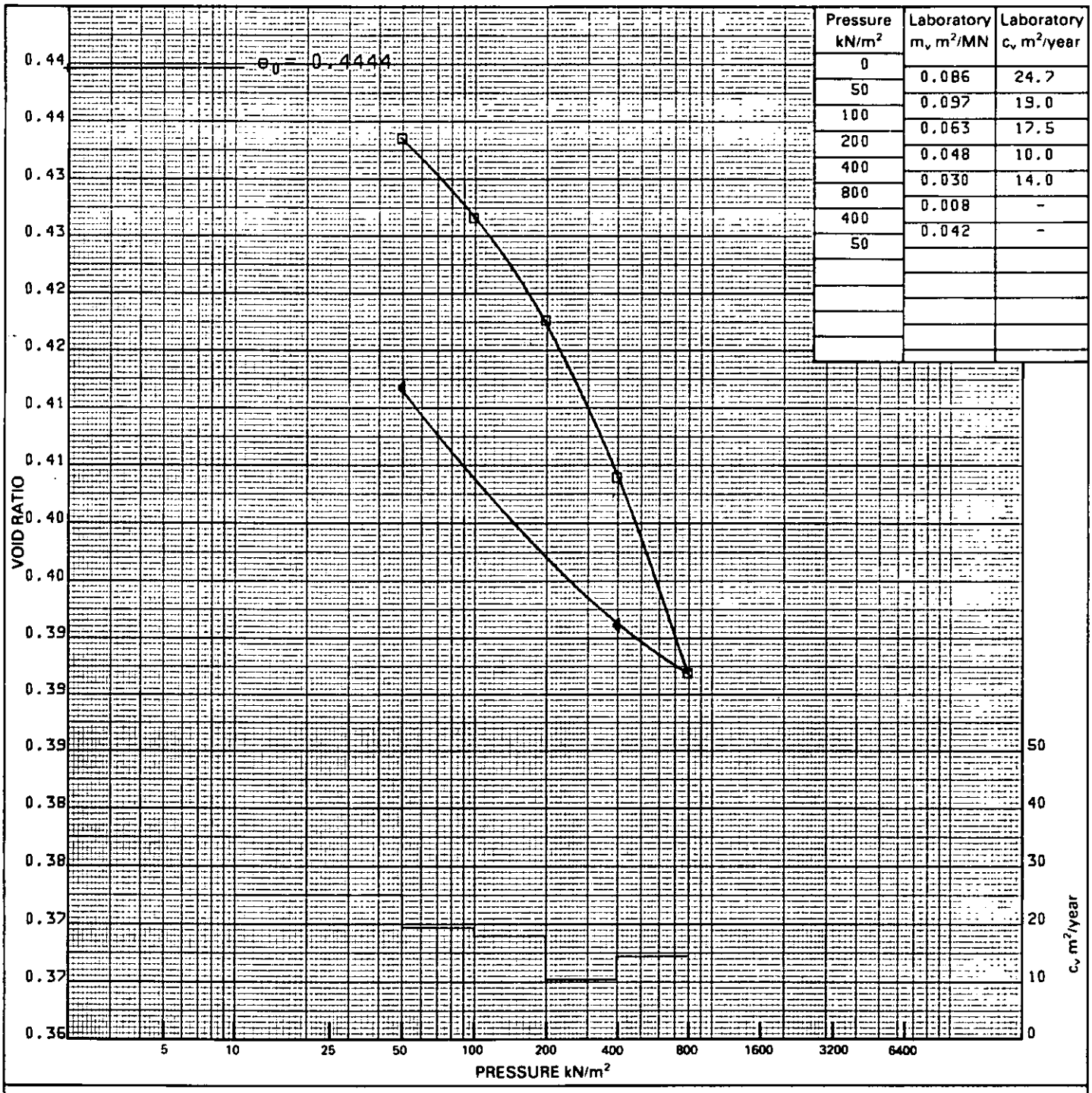
Sample No. 8

Soil Mechanics

Location A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Fig. 27



Pressure kN/m²	Laboratory m_v m²/MN	Laboratory c_v m²/year
0		
50	0.086	24.7
100	0.097	19.0
200	0.063	17.5
400	0.048	10.0
800	0.030	14.0
400	0.008	-
50	0.042	-

Description: Firm to stiff brown/red fissured silty CLAY.

Sample dimensions 76.2 mm dia. x 20.0 mm high. Area = 4560 mm²

Liquid limit Plastic limit Specific gravity 2.65 Assumed

	Moisture content %	Bulk density Mg/m³	Void ratio	Sr %
Initial	16	2.13	0.444	97
Final	16	2.14	0.416	99

Notes:

OEDOMETER TEST

CONSOLIDATION TEST
Log Pressure/Void Ratio Curve

Borehole No. 711 Depth 5.00 - 5.45m
Sample No. 12

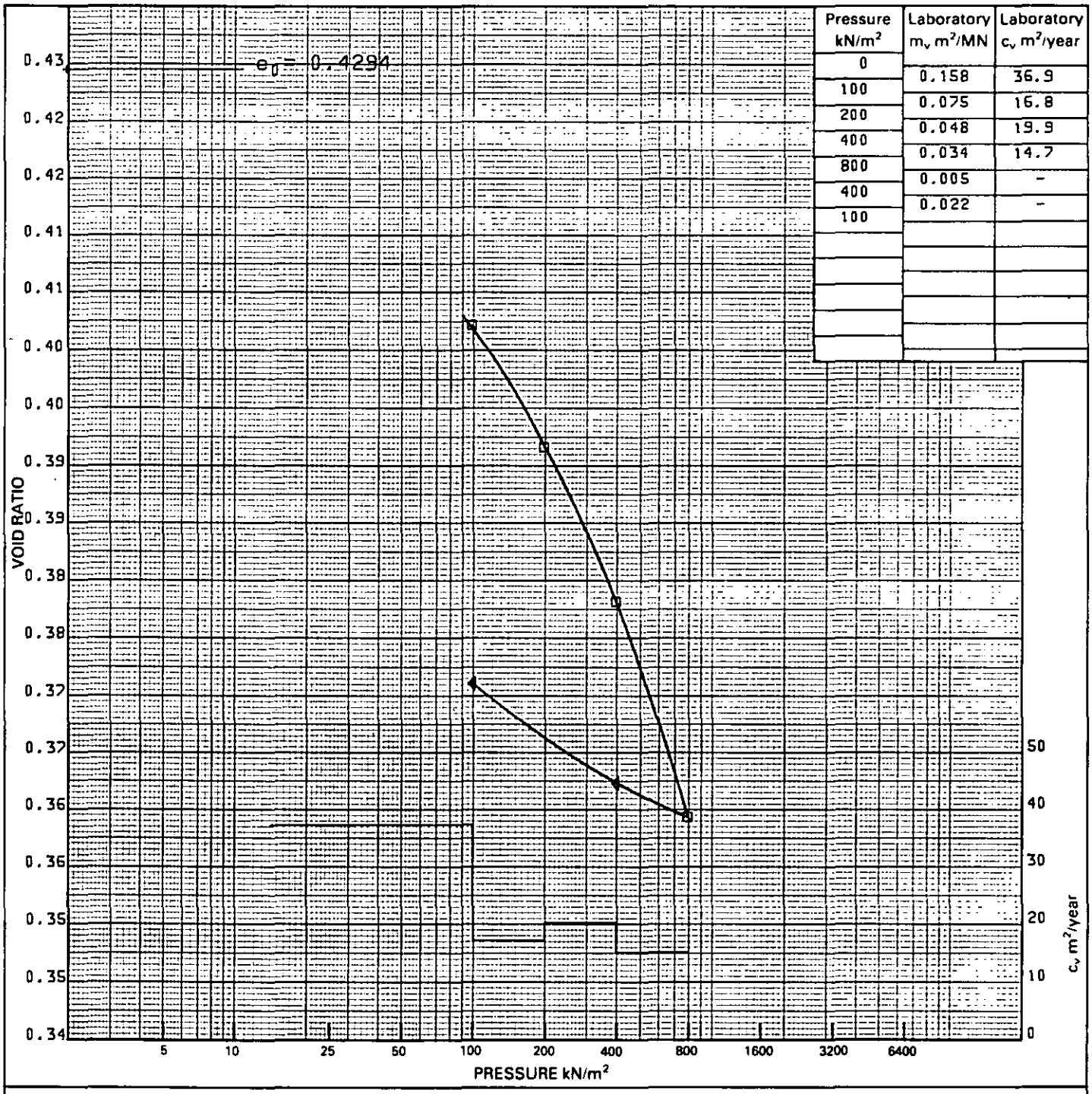
Soil Mechanics

Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Fig. 28

C3/3/84 © Soil Mechanics Limited, Bracknell, England.



Pressure kN/m²	Laboratory m_v m²/MN	Laboratory c_v m²/year
0		
100	0.158	36.9
200	0.075	16.8
400	0.048	19.9
800	0.034	14.7
400	0.005	-
100	0.022	-

Description: Firm to stiff red/brown silty CLAY.

Sample dimensions 75.0 mm dia. x 20.1 mm high. Area = 4418 mm²

Liquid limit Plastic limit Specific gravity 2.65 Assumed

	Moisture content %	Bulk density Mg/m³	Void ratio	Sr %
Initial	15	2.14	0.429	94
Final	14	2.17	0.376	101

Notes:

OEDOMETER TEST

CONSOLIDATION TEST
Log Pressure/Void Ratio Curve

Borehole No. 716 Depth 6.50 - 6.95m
Sample No. 14

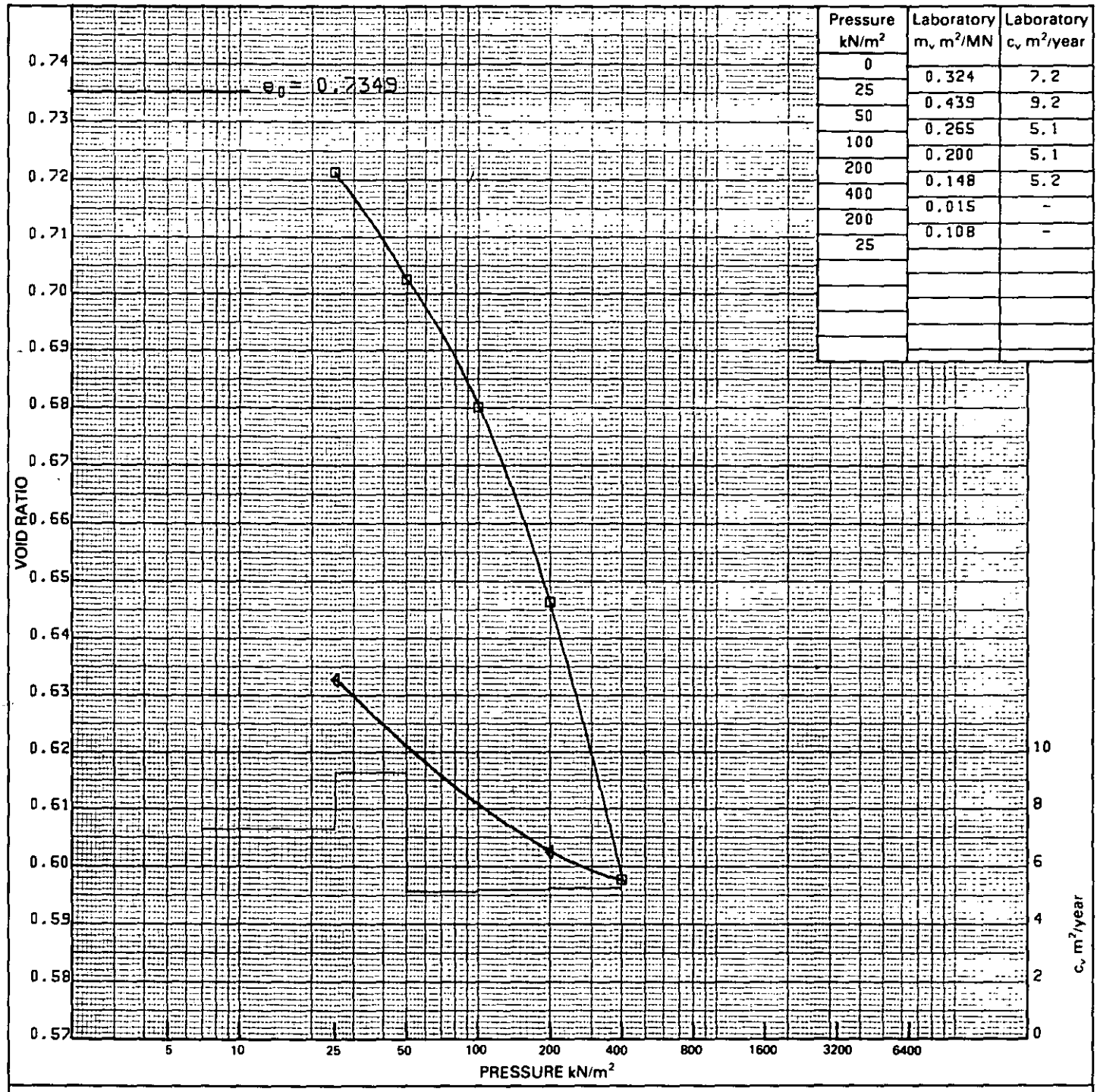
Soil Mechanics

Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Fig. 29

C3/3/84 © Soil Mechanics Limited, Bracknell, England.



Pressure kN/m²	Laboratory m_v m²/MN	Laboratory c_v m²/year
0		
25	0.324	7.2
50	0.439	9.2
100	0.265	5.1
200	0.200	5.1
400	0.148	5.2
200	0.015	-
25	0.108	-

Description: Firm red/brown fissured silty CLAY.

Sample dimensions 76.2 mm dia. x 19.1 mm high. Area = 4560 mm²

Liquid limit Plastic limit Specific gravity 2.65 Assumed

	Moisture content %	Bulk density Mg/m³	Void ratio	Sr %
Initial	27	1.94	0.735	97
Final	25	1.99	0.632	105

Notes:

OEDOMETER TEST

CONSOLIDATION TEST
Log Pressure/Void Ratio Curve

Borehole No. 718 Depth 2.00 - 2.45m
Sample No. 5

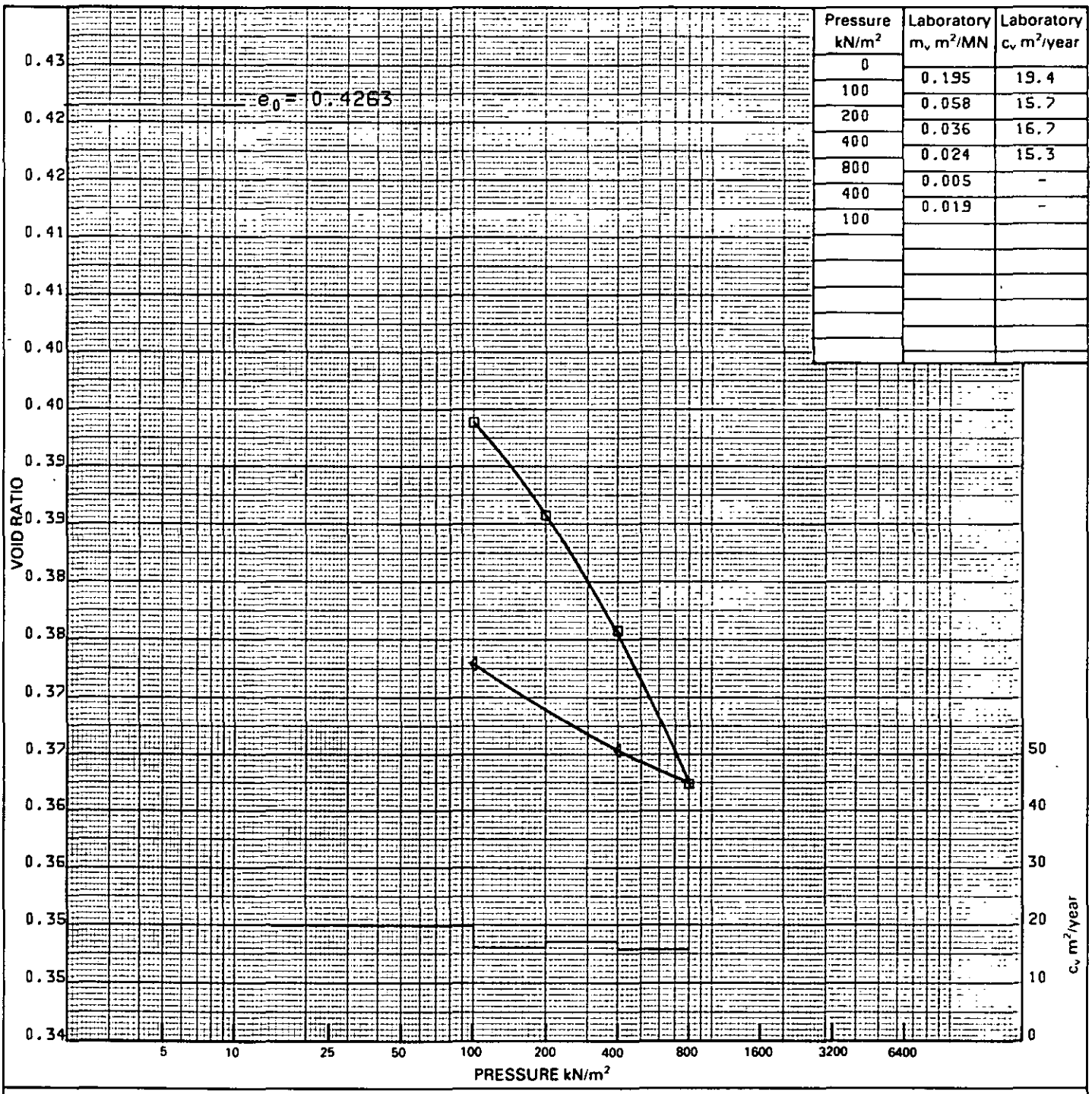
Soil Mechanics

Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Fig. 30

C3/3/84 © Soil Mechanics Limited, Bracknell, England.



Pressure kN/m²	Laboratory m_v m²/MN	Laboratory c_v m²/year
0		
100	0.195	19.4
200	0.058	15.7
400	0.036	16.7
800	0.024	15.3
400	0.005	-
100	0.019	-

Description: Stiff red/brown silty CLAY (MARL).

Sample dimensions 76.2 mm dia. x 19.5 mm high. Area = 4560 mm²

Liquid limit Plastic limit Specific gravity 2.65 Assumed

	Moisture content %	Bulk density Mg/m³	Void ratio	Sr %
Initial	15	2.14	0.426	95
Final	15	2.19	0.377	103

Notes:

OEDOMETER TEST

CONSOLIDATION TEST
Log Pressure/Void Ratio Curve

Borehole No. 719 Depth 3.50 - 3.95m
Sample No. 8

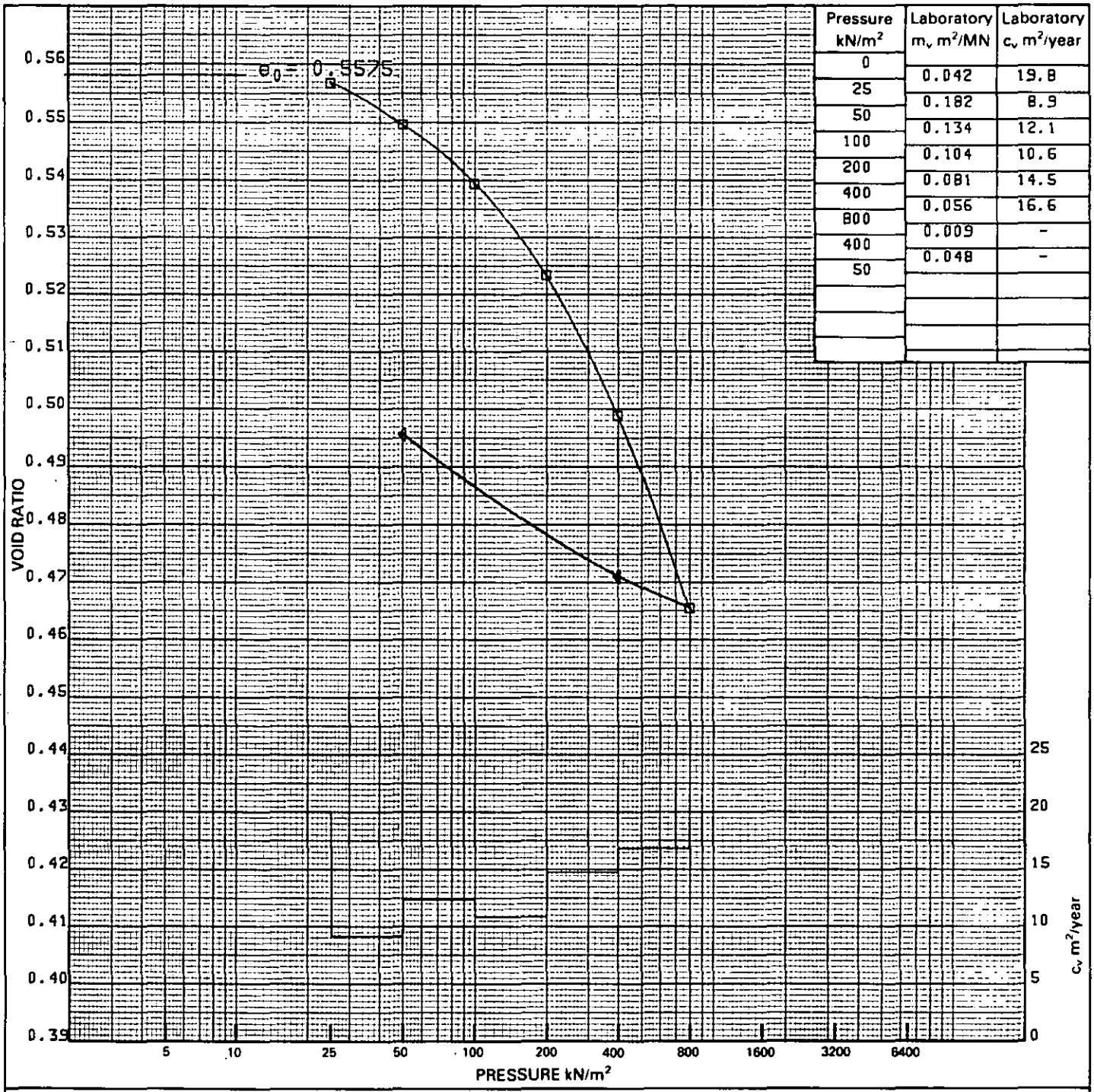
Soil Mechanics

Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Fig. 31

C3/3/84 © Soil Mechanics Limited, Bracknell, England.



Pressure kN/m²	Laboratory m_v m²/MN	Laboratory c_v m²/year
0		
	0.042	19.8
25		
	0.182	8.9
50		
	0.134	12.1
100		
	0.104	10.6
200		
	0.081	14.5
400		
	0.056	16.6
800		
	0.009	-
400		
	0.048	-
50		

Description: Firm to stiff red/brown fissured friable silty CLAY.

Sample dimensions 76.2 mm dia. x 19.5 mm high. Area = 4560 mm²

Liquid limit Plastic limit Specific gravity 2.65 Assumed

	Moisture content %	Bulk density Mg/m³	Void ratio	Sr %
Initial	18	2.01	0.558	87
Final	18	2.04	0.495	98

Notes:

OEDOMETER TEST

CONSOLIDATION TEST
Log Pressure/Void Ratio Curve

Borehole No. 721 Depth 2.00 - 2.45m
Sample No. 5

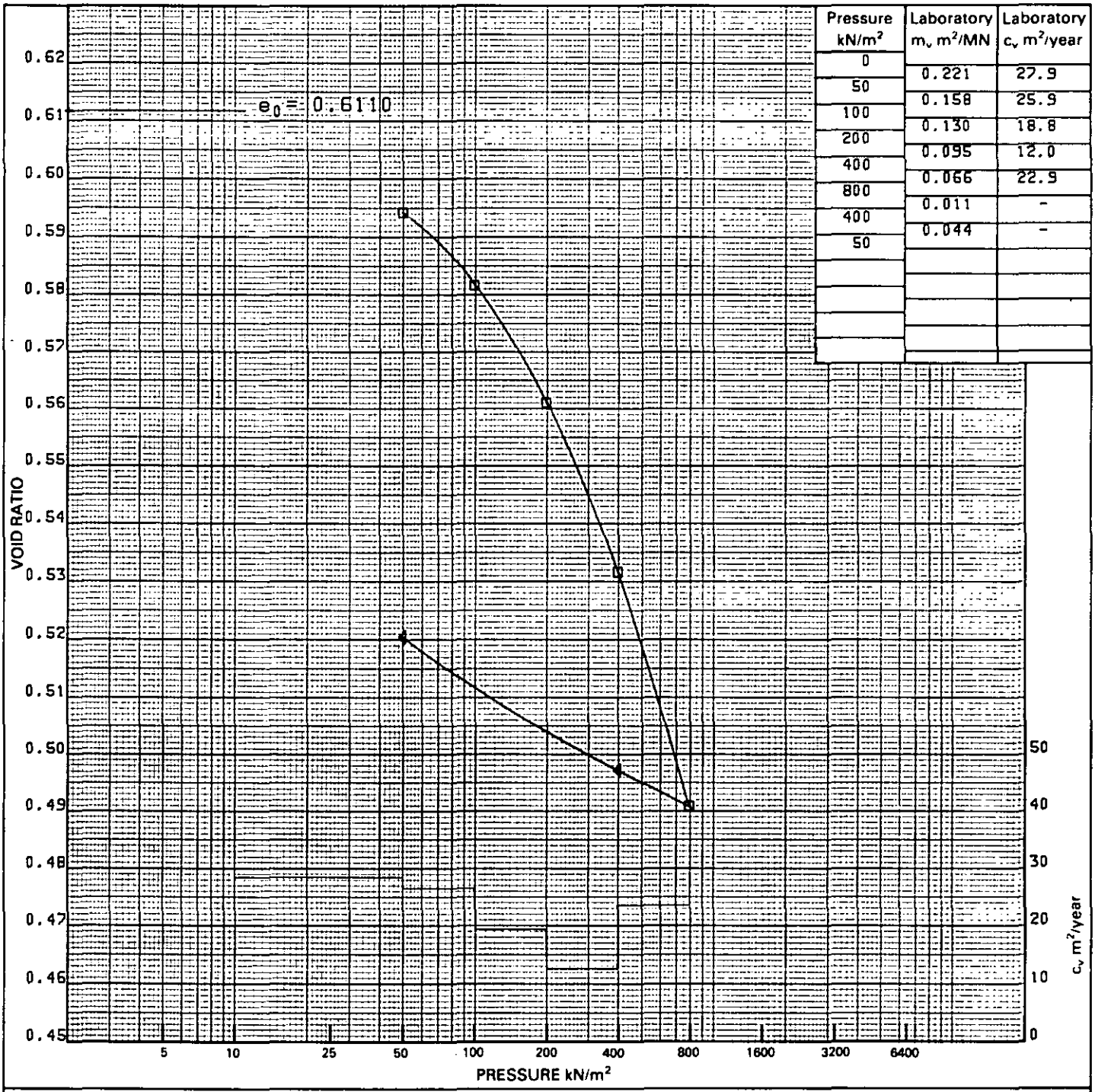
Soil Mechanics

Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Fig. 32

C3/3/84 © Soil Mechanics Limited, Bracknell, England.



Pressure kN/m²	Laboratory m_v m²/MN	Laboratory c_v m²/year
0		
	0.221	27.9
50		
	0.158	25.9
100		
	0.130	18.8
200		
	0.095	12.0
400		
	0.066	22.9
800		
	0.011	-
400		
	0.044	-
50		

Description: Firm brown/grey mottled friable silty CLAY with marl.

Sample dimensions 76.2 mm dia. x 19.5 mm high. Area = 4560 mm²

Liquid limit Plastic limit Specific gravity 2.65 Assumed

	Moisture content %	Bulk density Mg/m³	Void ratio	Sr %
Initial	19	1.97	0.611	85
Final	20	2.05	0.519	102

Notes:

OEDOMETER TEST

CONSOLIDATION TEST
Log Pressure/Void Ratio Curve

Borehole No. 723 Depth 4.50 - 4.95m
Sample No. 9

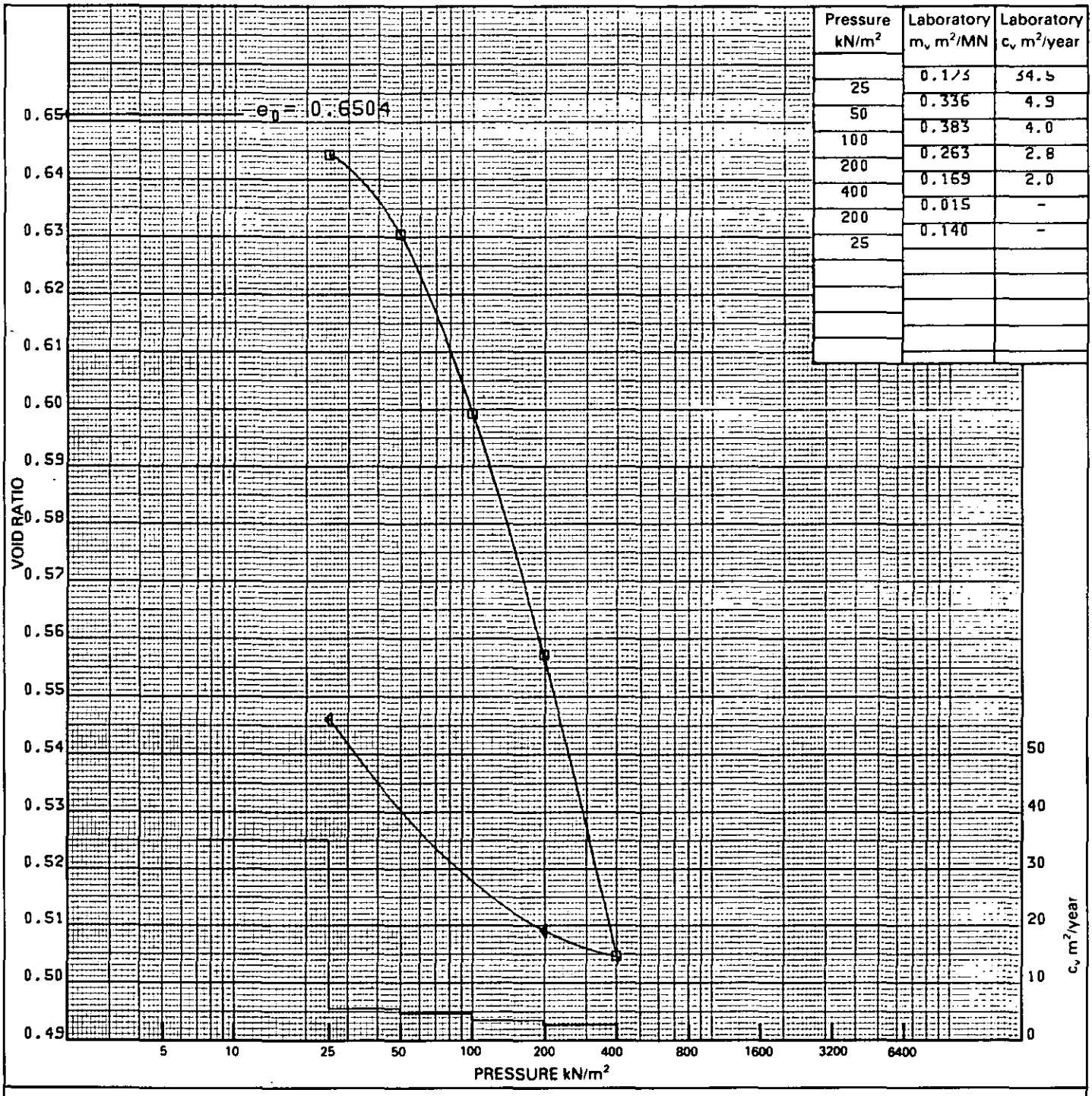
Soil Mechanics

Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Fig. 33

C3/3/84 © Soil Mechanics Limited, Bracknell, England.



Pressure kN/m²	Laboratory m_v m²/MN	Laboratory c_v m²/year
	0.175	54.5
25	0.336	4.9
50	0.383	4.0
100	0.263	2.8
200	0.169	2.0
400	0.015	-
200	0.140	-
25		

Description: Firm red/brown friable silty CLAY with marl.

Sample dimensions 71.4 mm dia. x 20.0 mm high. Area = 4004 mm²

Liquid limit Plastic limit Specific gravity 2.65 Assumed

	Moisture content %	Bulk density Mg/m³	Void ratio	Sr %
Initial	23	1.97	0.650	93
Final	21	2.04	0.545	102

Notes:

OEDOMETER TEST

CONSOLIDATION TEST
Log Pressure/Void Ratio Curve

Borehole No. 727 Depth 1.90 - 2.35m
Sample No. 6

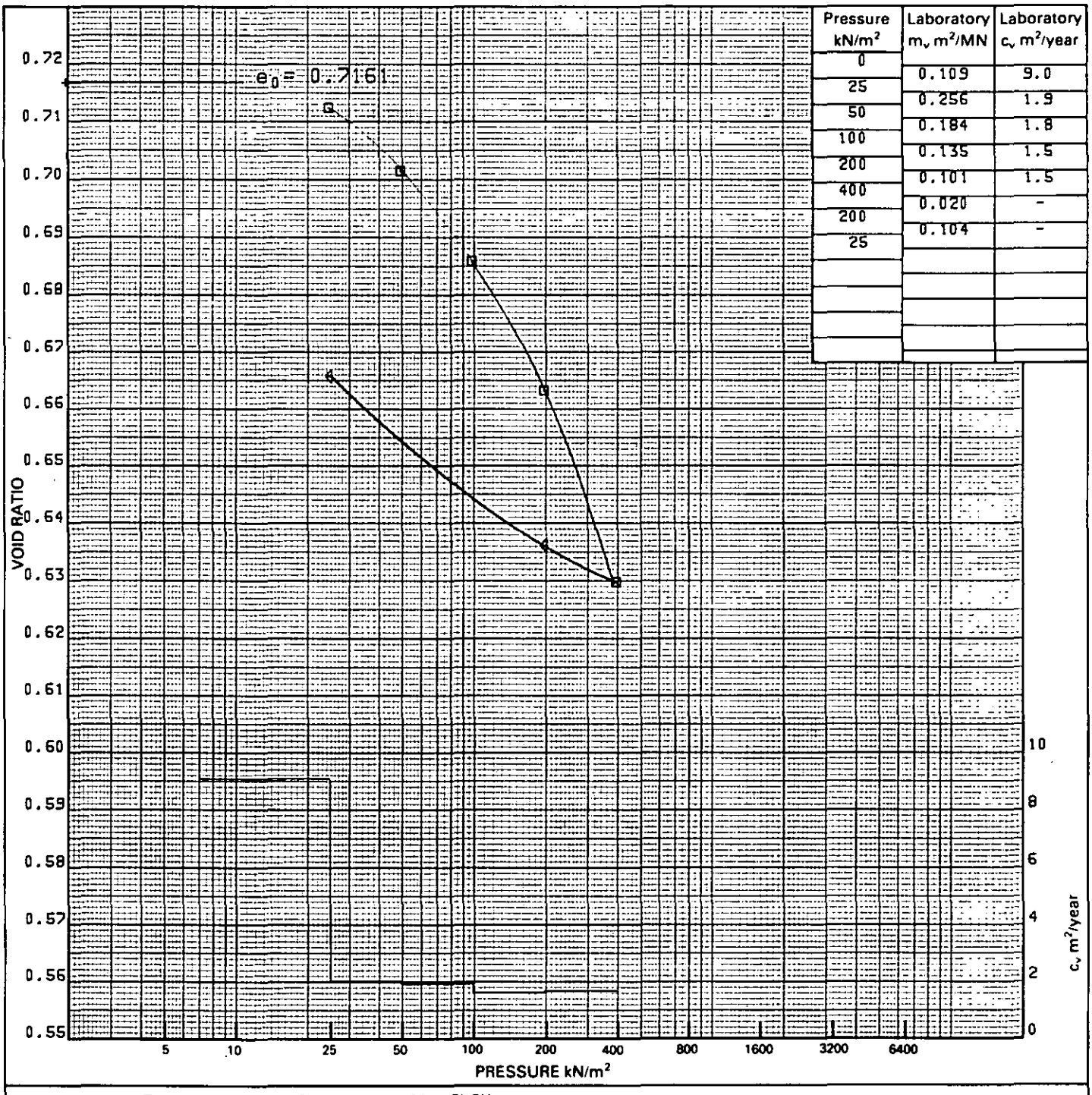
Soil Mechanics

Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Fig. 34

C3/3/84 © Soil Mechanics Limited, Bracknell, England.



Pressure kN/m²	Laboratory m_v m²/MN	Laboratory c_v m²/year
0		
25	0.109	9.0
50	0.256	1.9
100	0.184	1.8
200	0.135	1.5
400	0.101	1.5
200	0.020	-
25	0.104	-

Description: Firm red/brown fissured silty CLAY.

Sample dimensions 76.2 mm dia. x 19.5 mm high. Area = 4560 mm²

Liquid limit Plastic limit Specific gravity 2.65 Assumed

	Moisture content %	Bulk density Mg/m³	Void ratio	Sr %
Initial	25	1.93	0.716	93
Final	24	1.95	0.665	97

Notes:

OEDOMETER TEST

CONSOLIDATION TEST
Log Pressure/Void Ratio Curve

Borehole No. 738 Depth 2.00 - 2.45m
Sample No. 5 (TOP)

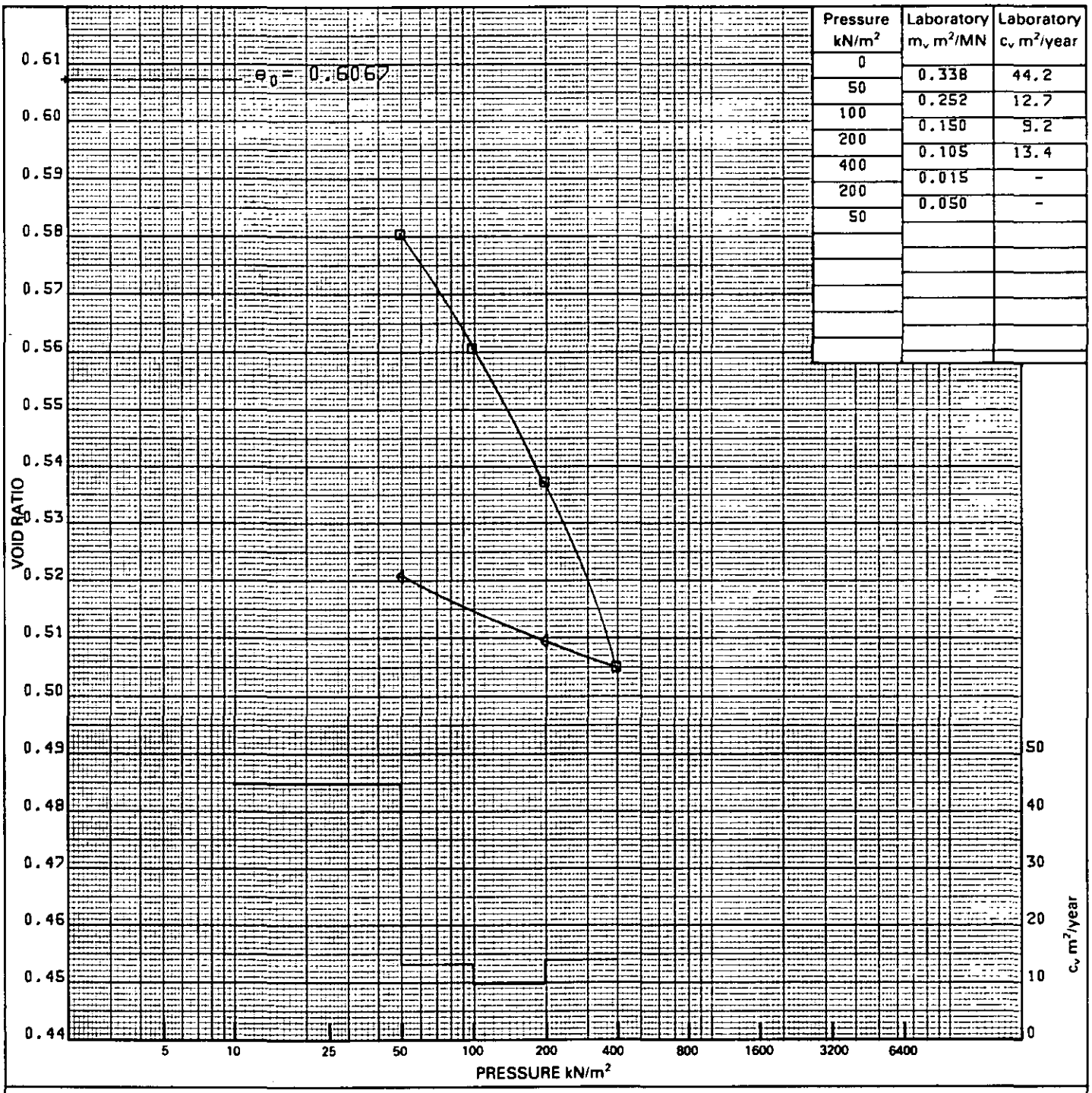
Soil Mechanics

Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Fig. 35

C3/3/84 © Soil Mechanics Limited, Bracknell, England.



Pressure kN/m²	Laboratory m_v m²/MN	Laboratory c_v m²/year
0		
50	0.338	44.2
100	0.252	12.7
200	0.150	9.2
400	0.105	13.4
200	0.015	-
50	0.050	-

Description: Firm red/brown fissured friable silty CLAY.

Sample dimensions 76.2 mm dia. x 19.5 mm high. Area = 4560 mm²

Liquid limit Plastic limit Specific gravity 2.65 Assumed

	Moisture content %	Bulk density Mg/m³	Void ratio	Sr %
Initial	21	2.00	0.607	93
Final	19	2.01	0.520	96

Notes:

OEDOMETER TEST

CONSOLIDATION TEST
Log Pressure/Void Ratio Curve

Borehole No. 738 Depth 3.50 - 3.95m
Sample No. 8

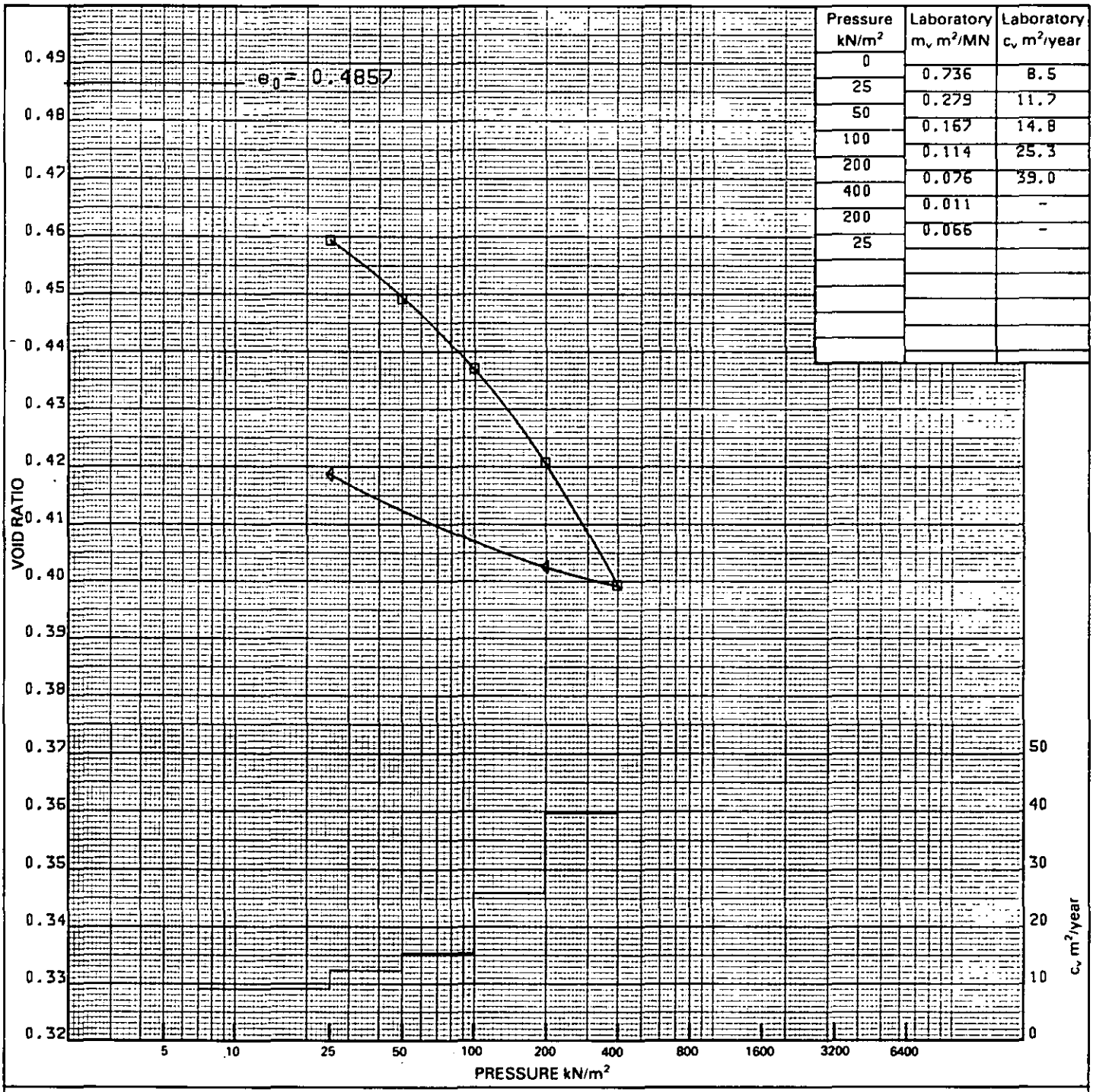
Soil Mechanics

Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Fig. 36

C3/3/84 © Soil Mechanics Limited, Bracknell, England.



Pressure kN/m²	Laboratory m_v m²/MN	Laboratory c_v m²/year
0		
25	0.736	8.5
50	0.279	11.7
100	0.167	14.8
200	0.114	25.3
400	0.076	39.0
200	0.011	-
25	0.066	-

Description: Firm red/brown friable silty CLAY with marl.

Sample dimensions 75.0 mm dia. x 20.0 mm high. Area = 4418 mm²

Liquid limit Plastic limit Specific gravity 2.65 Assumed

	Moisture content %	Bulk density Mg/m³	Void ratio	Sr %
Initial	17	2.09	0.486	94
Final	16	2.12	0.418	104

Notes:

OEDOMETER TEST

CONSOLIDATION TEST
Log Pressure/Void Ratio Curve

Borehole No. 740 Depth 2.00 - 2.45m
Sample No. 5

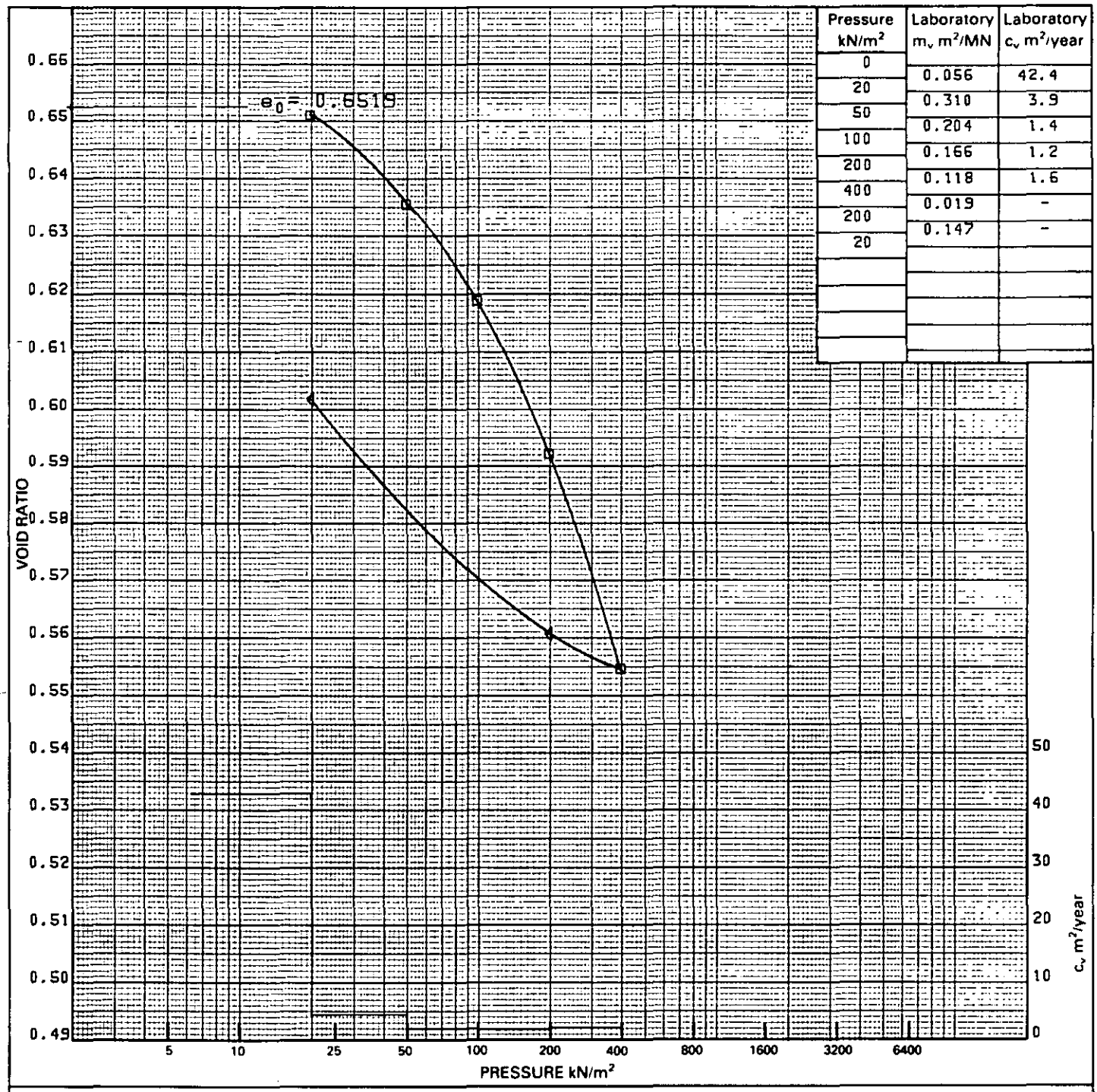
Soil Mechanics

Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Fig. 37

C3/3/84 © Soil Mechanics Limited, Bracknell, England.



Pressure kN/m²	Laboratory m_v m²/MN	Laboratory c_v m²/year
0		
20	0.056	42.4
50	0.310	3.9
100	0.204	1.4
200	0.166	1.2
400	0.118	1.6
200	0.019	-
20	0.147	-

Description: Firm red/brown fissured silty CLAY.

Sample dimensions 76.2 mm dia. x 19.8 mm high. Area = 4560 mm²

Liquid limit Plastic limit Specific gravity 2.65 Assumed

	Moisture content %	Bulk density Mg/m³	Void ratio	Sr %
Initial	24	1.99	0.652	97
Final	23	2.01	0.601	102

Notes:

OEDOMETER TEST

CONSOLIDATION TEST
Log Pressure/Void Ratio Curve

Borehole No. 746 Depth 0.60 - 1.05m
Sample No. 1

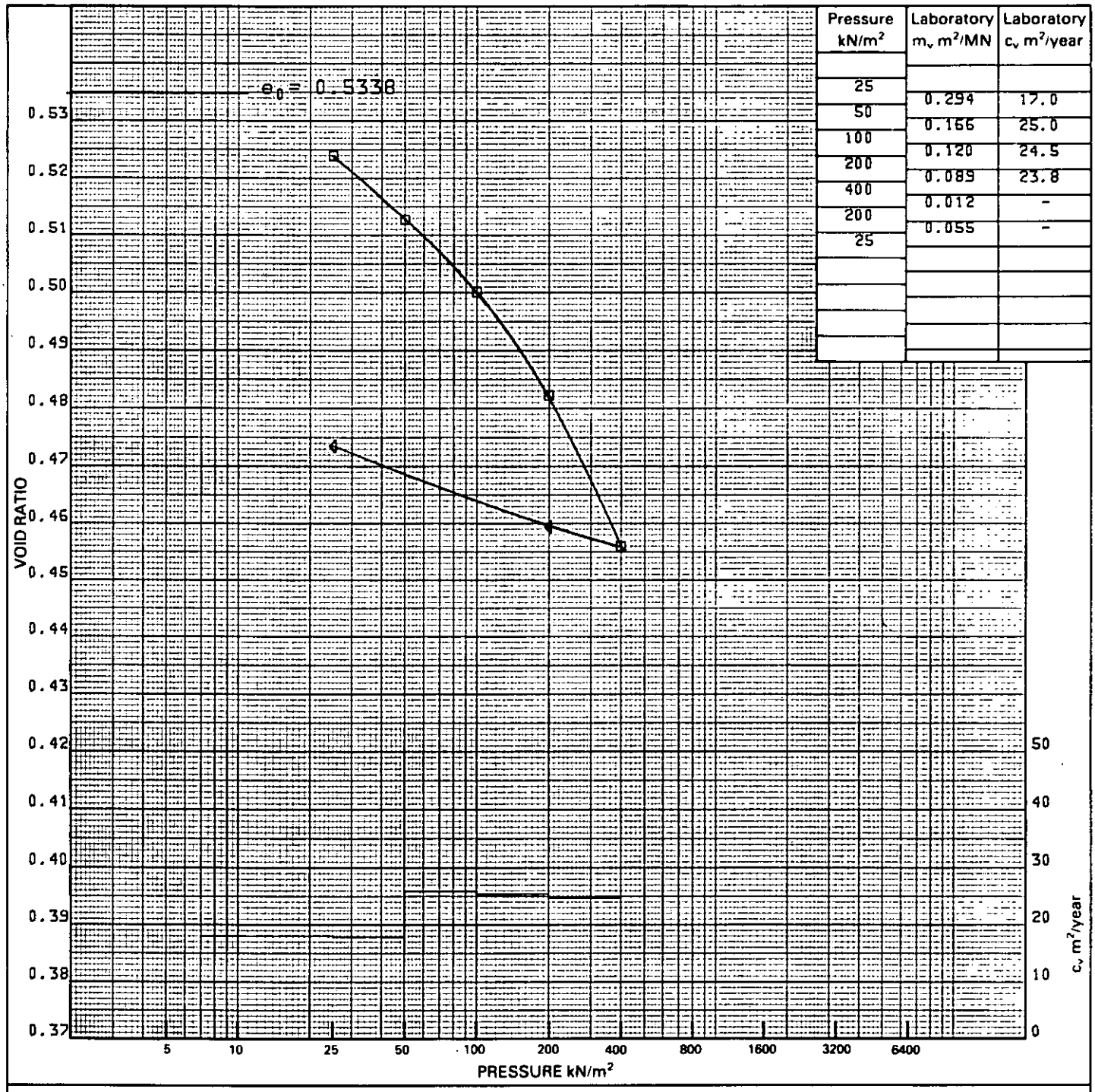
Soil Mechanics

Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Fig. 38

C3/3/84 © Soil Mechanics Limited, Bracknell, England.



Pressure kN/m²	Laboratory m_v m²/MN	Laboratory c_v m²/year
25	0.294	17.0
50	0.166	25.0
100	0.120	24.5
200	0.089	23.8
400	0.012	-
200	0.055	-
25		

Description: Firm red/brown friable silty CLAY with a little marl.

Sample dimensions 76.2 mm dia. x 20.0 mm high. Area = 4560 mm²

Liquid limit Plastic limit Specific gravity 2.65 Assumed

	Moisture content %	Bulk density Mg/m³	Void ratio	Sr %
Initial	20	2.07	0.534	99
Final	18	2.09	0.472	103

Notes:

OEDOMETER TEST

CONSOLIDATION TEST
Log Pressure/Void Ratio Curve

Borehole No. 753 Depth 2.00 - 2.45m
Sample No. 5

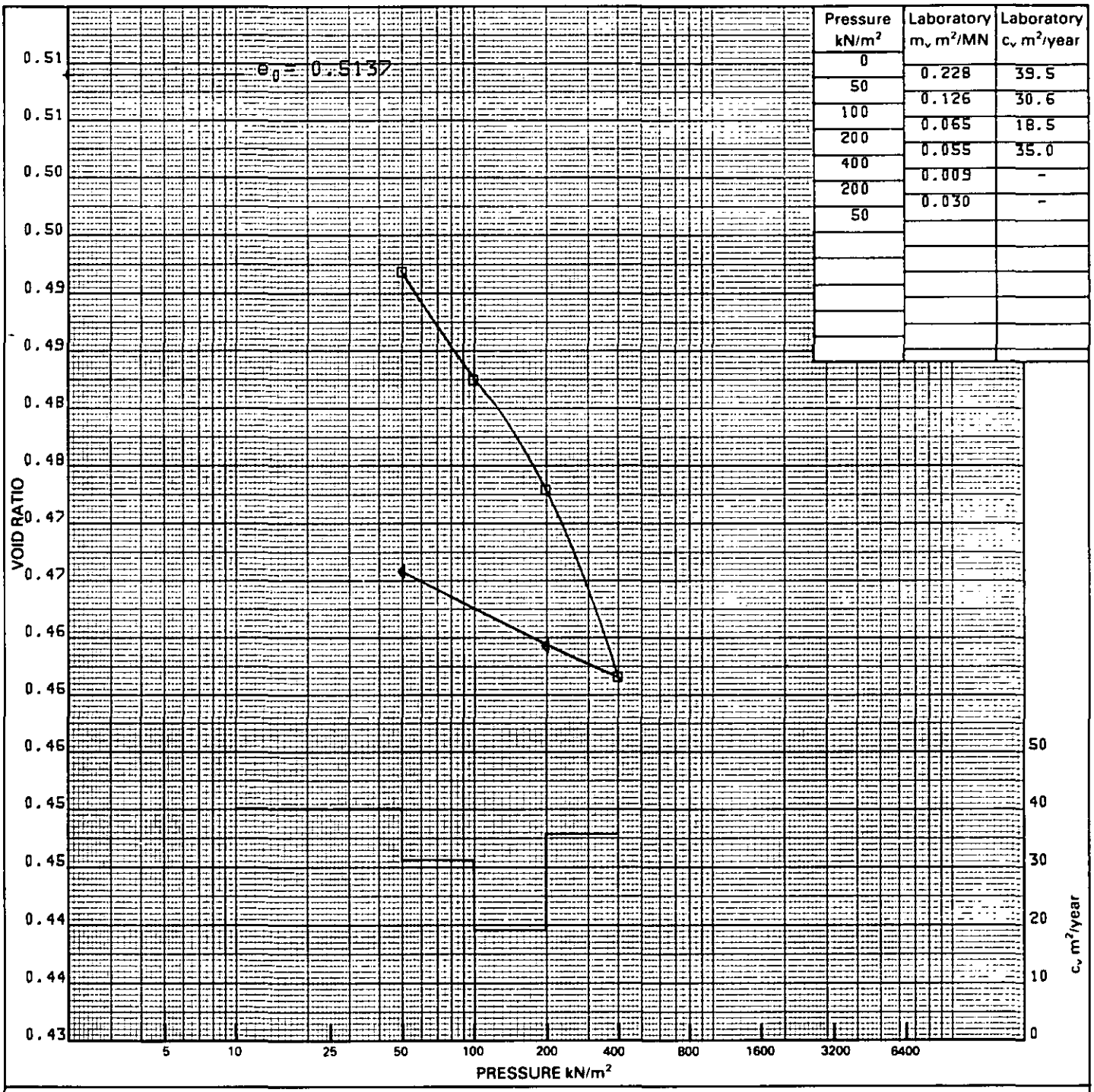
Soil Mechanics

Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Fig. 39

C3/3/84 © Soil Mechanics Limited, Bracknell, England.



Pressure kN/m²	Laboratory m_v m²/MN	Laboratory c_v m²/year
0		
50	0.228	39.5
100	0.126	30.6
200	0.065	18.5
400	0.055	35.0
200	0.009	-
50	0.030	-

Description: Firm red/brown friable silty CLAY.

Sample dimensions 75.0 mm dia. x 20.0 mm high. Area = 4418 mm²

Liquid limit Plastic limit Specific gravity 2.65 Assumed

	Moisture content %	Bulk density Mg/m³	Void ratio	Sr %
Initial	18	2.06	0.514	90
Final	17	2.06	0.470	95

Notes:

OEDOMETER TEST

CONSOLIDATION TEST Borehole No. 754 Depth 3.50 - 3.95m

Log Pressure/Void Ratio Curve Sample No. 8

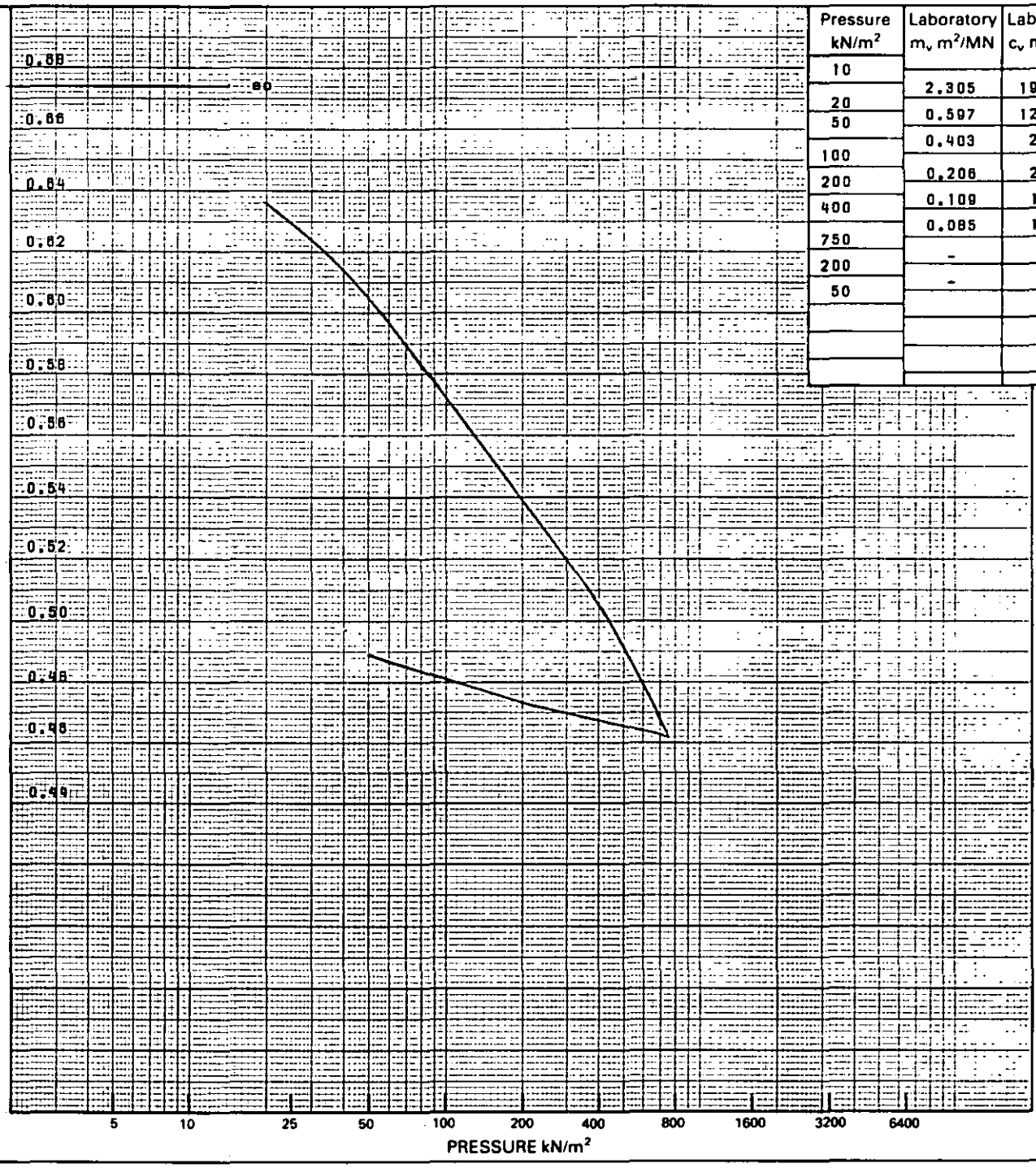
Soil Mechanics

Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Fig. 40

C3/3/84 © Soil Mechanics Limited, Bracknell, England.



Pressure kN/m²	Laboratory m_v m²/MN	Laboratory c_v m²/year
10		
20	2.305	19.28
50	0.597	12.78
100	0.403	2.85
200	0.206	2.55
400	0.109	1.67
750	0.085	1.42
200	-	-
50	-	-

Description: Firm red and brown mottled silty CLAY

Sample dimensions 75.79 mm dia. x 20.83 mm high. Area = 4511.42 mm²

Liquid limit 31 Plastic limit 18 Specific gravity 2.65 assumed

	Moisture content %	Bulk density Mg/m³	Void ratio	Sr
Initial	25	1.9840	0.8745	100
Final	19	2.1687	0.4891	105

Notes: * Specimen swelled under a pressure of 10kn/m²

STRAIN CONDITION - Free
DRAINAGE CONDITIONS - Single vertical drainage pwp at centre base

ROWE CELL TEST

CONSOLIDATION TEST
Log Pressure/Void Ratio Curve

Borehole No. 738 Depth 0.50 - 0.95m
Sample No. 2

Soil Mechanics

Location: A42 CASTLE DONINGTON, NORTH

Loc. No. 7382

Fig. 41

C3/3/84 © Soil Mechanics Limited, Bracknell, England.

ROWE CONSOLIDATION TEST

SUMMARY OF CONSOLIDATION COEFFICIENTS

DRAINAGE CONDITIONS : Vertical to top with pwp at centre base

STRAIN CONDITION : FREE

INITIAL SPECIMEN THICKNESS : 29.83 mm

DIAMETER : 75.79 mm

STAGE No.	EFFECTIVE PRESSURE kN/m2	$\bar{H}^2$ mm2	ROOT TIME v VOL.CHANGE T90 min	ROOT TIME v VOL.CHANGE Cv m2/yr	LOG TIME v PORE PRESSURE T50 min	LOG TIME v PORE PRESSURE Cv m2/yr
0	0	889.83				
1	10	Swell	*	*	*	*
2	20	869.45	16.00	24.24	9.00	19.26
3	50	833.25	132.25	2.81	13.00	12.78
4	100	800.92	156.25	2.29	56.00	2.85
5	200	768.62	84.64	4.05	60.00	2.55
6	400	736.47	53.29	6.16	88.00	1.67
7	750	699.07	108.16	2.88	98.00	1.42
8	200	-	-	-	-	-
9	50	-	-	-	-	-

Cv calculated using :-

Volume change

$$Cv = \frac{0.848 \times \bar{H}^2 \times 0.526}{T90}$$

Pore pressure dissipation

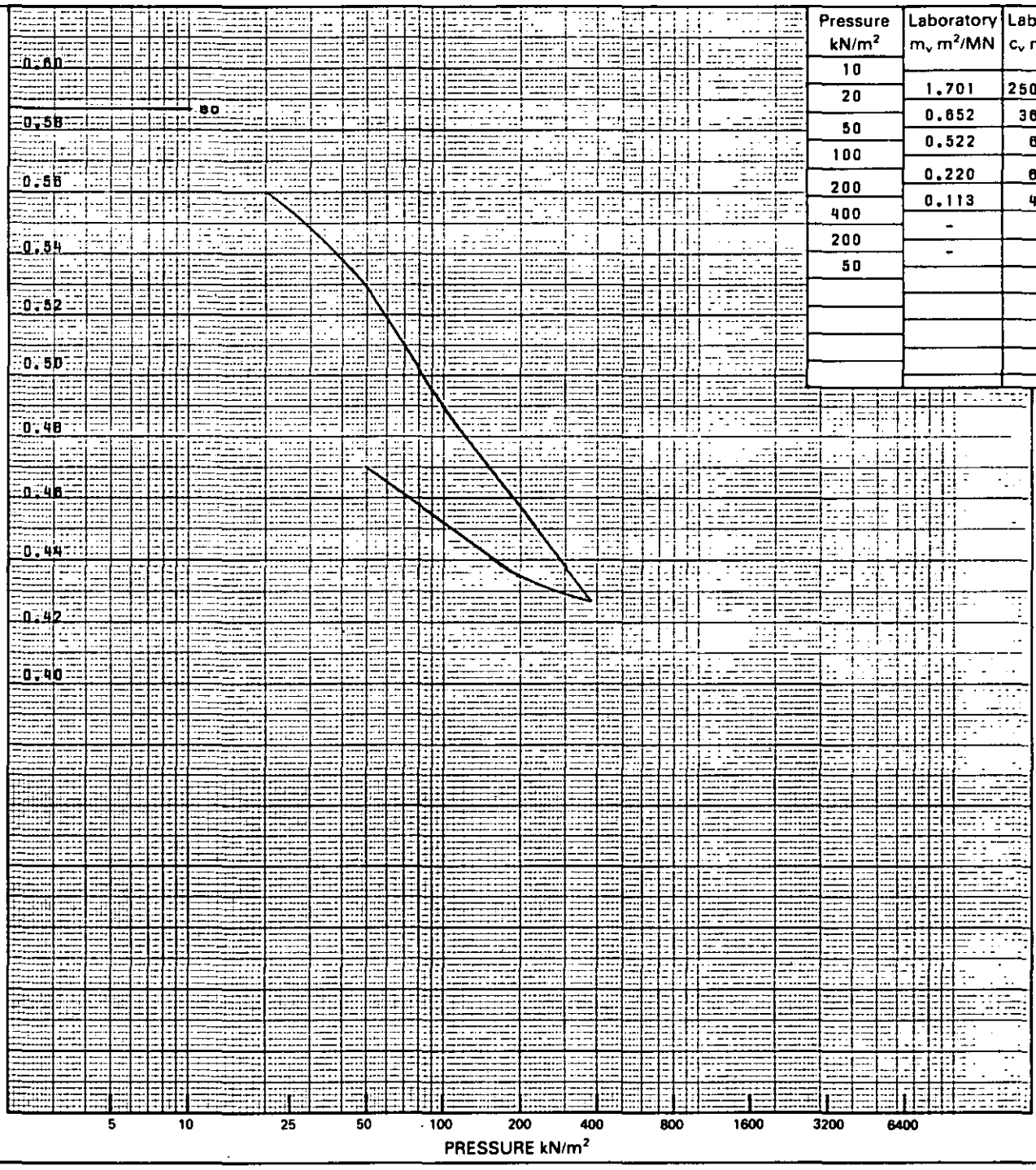
$$Cv = \frac{0.379 \times \bar{H}^2 \times 0.526}{T50}$$

$\bar{H}$ based on dV/Area

Borehole No. 738
Sample No. 2
Depth 0.50m

LOCATION CASTLE DONINGTON

LOC. NO 7382



Pressure kN/m²	Laboratory m_v m²/MN	Laboratory c_v m²/year
10		
20	1.701	250.80
50	0.652	36.78
100	0.522	6.73
200	0.220	6.69
400	0.113	4.33
200	-	-
50	-	-

Description: Firm orange brown slightly sandy silty CLAY with a trace of fine gravel

Sample dimensions 75.86 mm dia. x 20.93 mm high. Area =4519.76 mm²

Liquid limit 47 Plastic limit 18 Specific gravity 2.65 assumed

	Moisture content %	Bulk density Mg/m³	Void ratio	Sr
Initial	22	2.0432	0.5873	101
Final	19	2.1679	0.4700	105

Notes: Specimen swelled under a pressure of 10kn/m²
STRAIN CONDITION - Free
DRAINAGE CONDITION - Single vertical drainage pwp at centre base

ROWE CELL TEST

CONSOLIDATION TEST
Log Pressure/Void Ratio Curve

Borehole No. 740 Depth 0.50 - 0.95m
Sample No. 2

Soil Mechanics

Location: A42 CASTLE DONINGTON, NORTH

Loc. No. 7382

Fig. 42

C3/3/84 © Soil Mechanics Limited, Bracknell, England.

ROWE CONSOLIDATION TEST

SUMMARY OF CONSOLIDATION COEFFICIENTS

DRAINAGE CONDITIONS : Vertical to top with pwp at centre base

STRAIN CONDITION : FREE

INITIAL SPECIMEN THICKNESS : 29.93 mm

DIAMETER : 75.86 mm

STAGE No.	EFFECTIVE PRESSURE kN/m2	$\bar{H}^2$ mm2	ROOT TIME v VOL.CHANGE T90 min	ROOT TIME v VOL.CHANGE Cv m2/yr	LOG TIME v PORE PRESSURE T50 min	LOG TIME v PORE PRESSURE Cv m2/yr
0	0	895.8				
1	10	Swell	*	*	*	*
2	20	880.64	4.00	98.20	0.70	250.80
3	50	848.76	13.69	27.65	4.60	36.78
4	100	810.54	36.00	10.04	24.00	6.73
5	200	771.95	53.29	6.46	23.00	6.69
6	400	737.91	110.25	2.99	34.00	4.33
7	200	-	-	-	-	-
8	50	-	-	-	-	-

Cv calculated using :-

Volume change

$$Cv = \frac{0.848 \times \bar{H}^2 \times 0.526}{T90}$$

Pore pressure dissipation

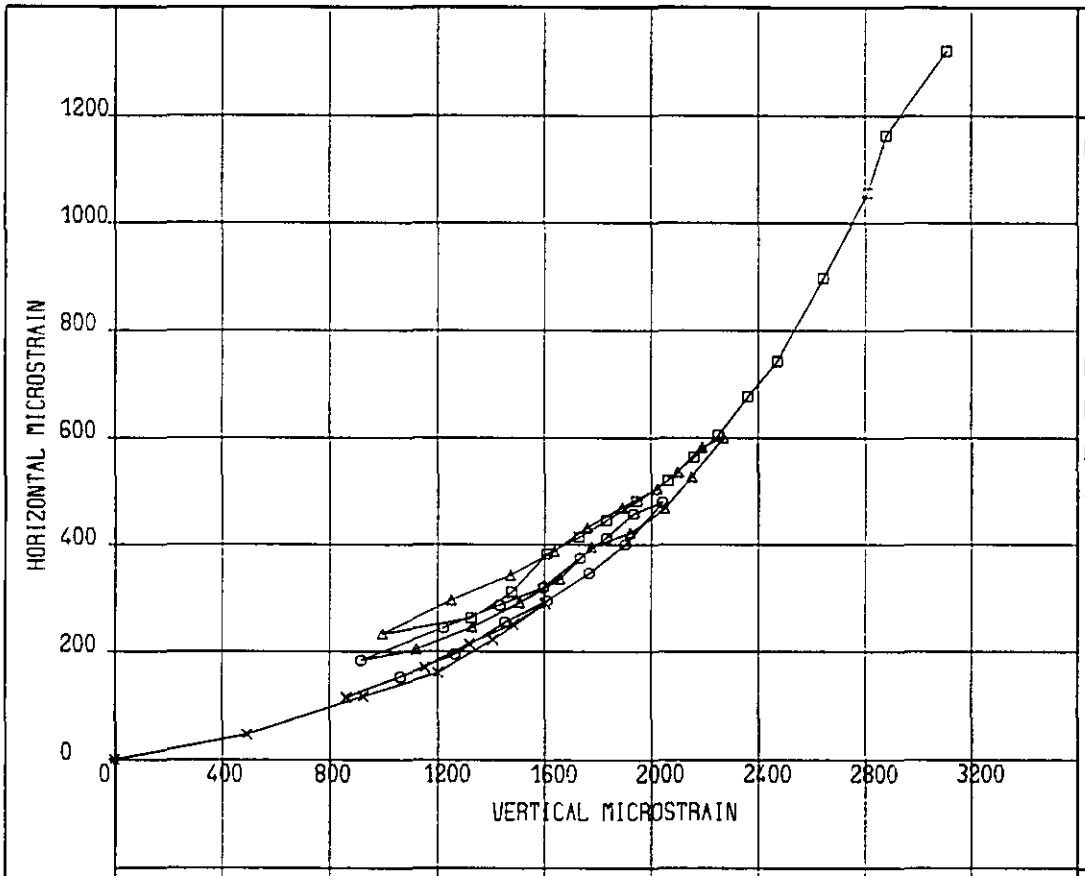
$$Cv = \frac{0.379 \times \bar{H}^2 \times 0.526}{T50}$$

$\bar{H}$ based on dV/Area

Borehole No. 740
Sample No. 2
Depth 0.50m

LOCATION CASTLE DONINGTON

LOC. NO 7382



DETAILS OF ROCK SAMPLE

DESCRIPTION:

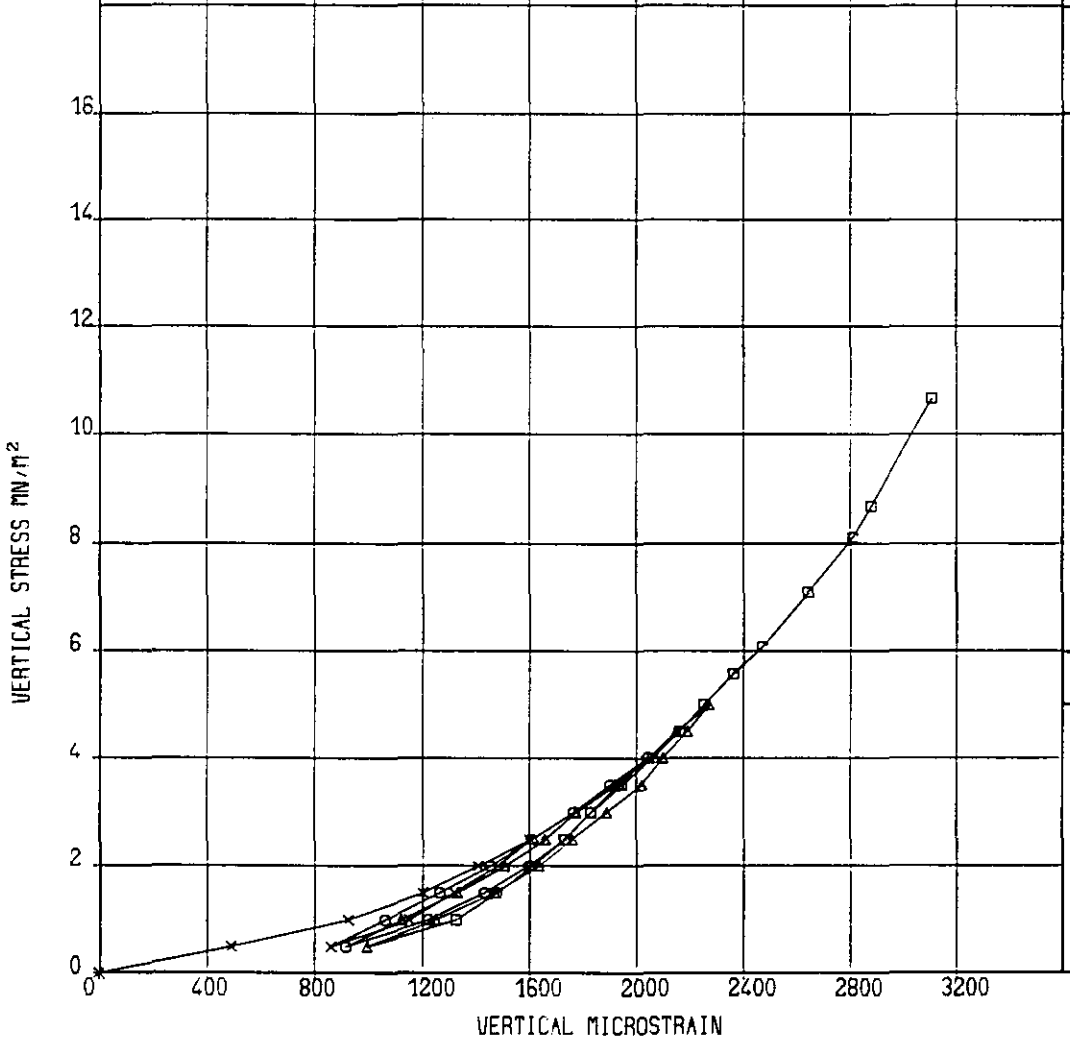
DIAMETER (MM) 84.6

LENGTH (MM) 152

BULK DENSITY (MG/M^3) 2.01

MOISTURE CONTENT (%) 10.9

ADDITIONAL INFORMATION:



UNIAXIAL LOADING

RATE OF TESTING: (MPA/MIN.) 0.001

METHOD OF STRAIN MEASUREMENT: ELECTRICAL STRAIN GAUGES

NOTES

KEY TO CYCLIC LOADINGS

× CYCLE 1
○ CYCLE 2
△ CYCLE 3
□ CYCLE 4

TEST RESULTS

MODULUS: MPA (AS INDICATED)

$E = 3.19 \times 10^3$

$\upsilon = 0.27$

SECANT MODULUS – CALCULATED ON 2nd LOADING CYCLE

LABORATORY DETERMINATION OF YOUNG'S MODULUS AND POISSON'S RATIO

BOREHOLE : 706R

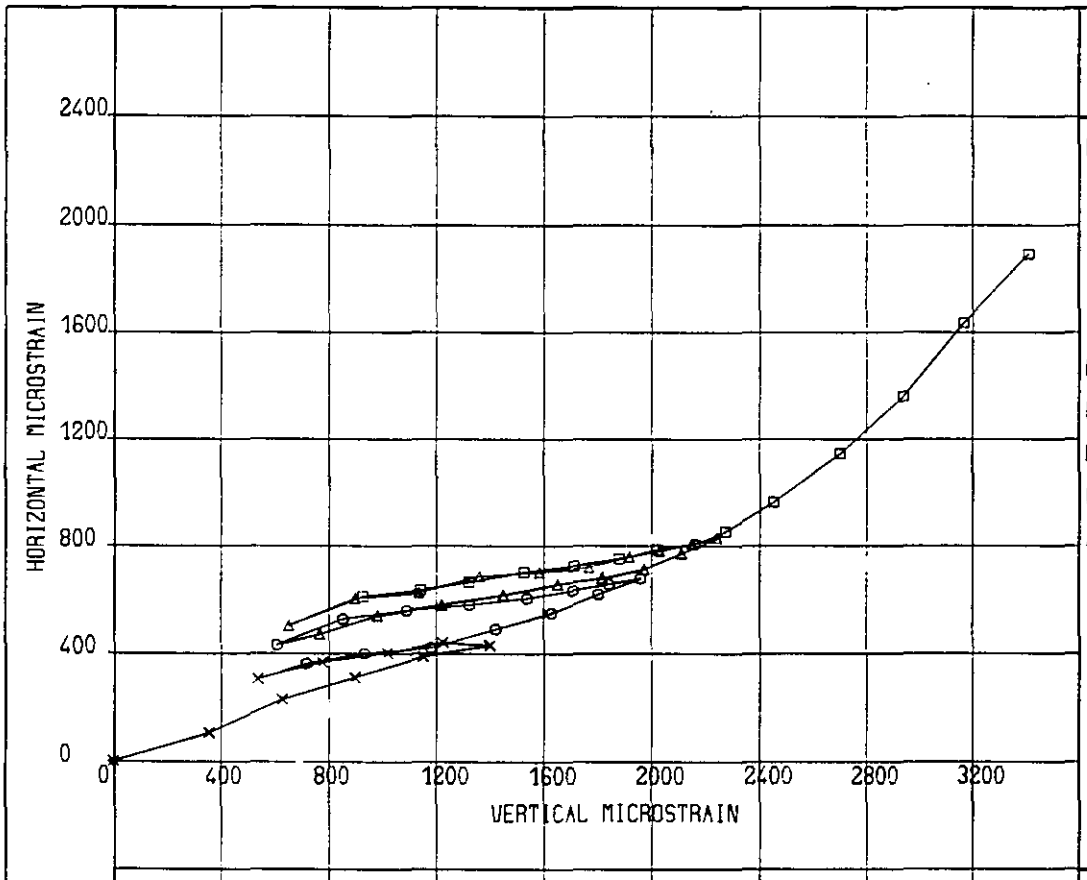
DEPTH : 10.76-10.94

SOIL MECHANICS

LOCATION : A42 CASTLE DONINGTON NORTH

LOC NO. 7382

FIG. 43



DETAILS OF ROCK SAMPLE

DESCRIPTION:

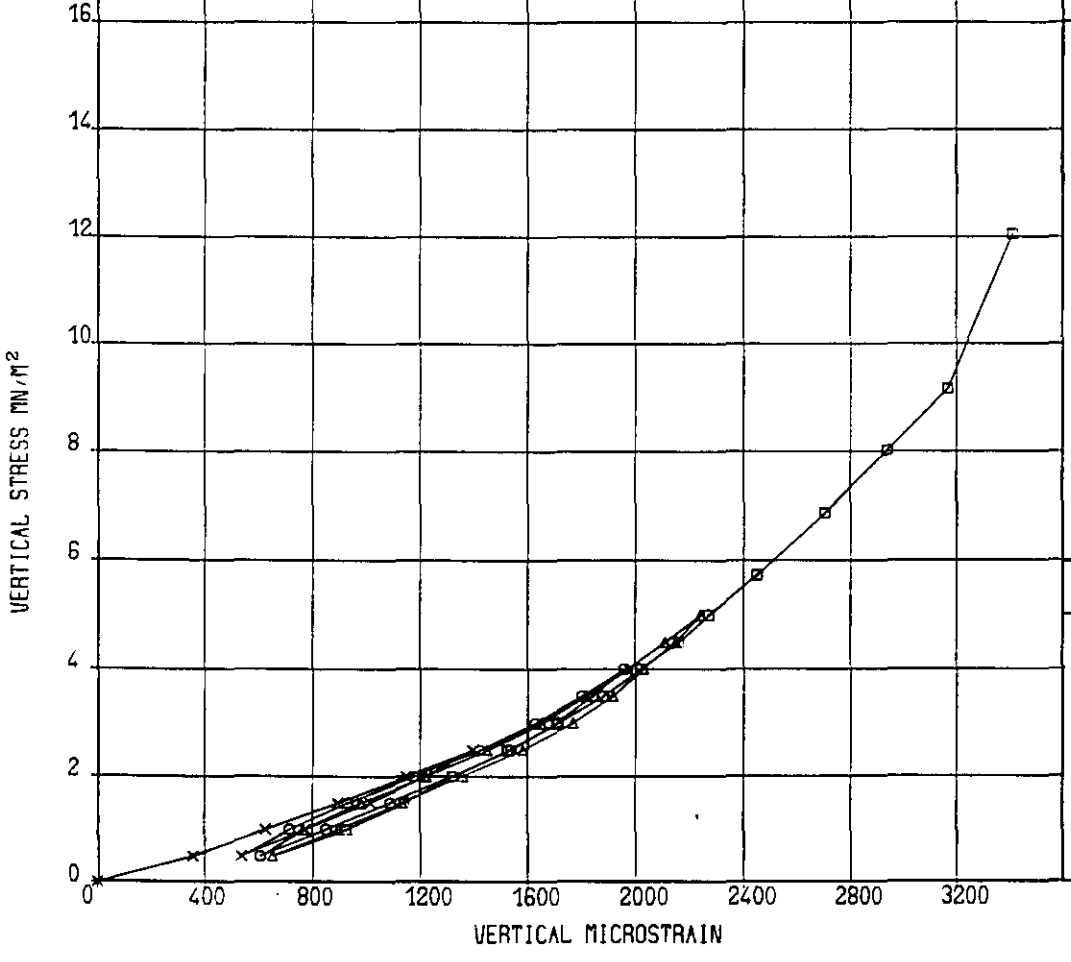
DIAMETER (MM) 79.6

LENGTH (MM) 136

BULK DENSITY (MG/M^3) 1.99

MOISTURE CONTENT (%) 3.9

ADDITIONAL INFORMATION:



UNIAXIAL LOADING

RATE OF TESTING: (MPA/MIN.) 0.001

METHOD OF STRAIN MEASUREMENT:

ELECTRICAL STRAIN GAUGES

NOTES

KEY TO CYCLIC LOADINGS

× CYCLE 1

○ CYCLE 2

△ CYCLE 3

□ CYCLE 4

TEST RESULTS

MODULUS: MPA (AS INDICATED)

$E = 2.56 \times 10^3$

$\upsilon = 0.20$

SECANT MODULUS – CALCULATED ON 2nd LOADING CYCLE

LABORATORY DETERMINATION OF YOUNG'S MODULUS AND POISSON'S RATIO

BOREHOLE : 707R

DEPTH : 11.14-11.31

SOIL MECHANICS

LOCATION : A42 CASTLE DONINGTON NORTH

LOC NO. 7382

FIG. 44

DETAILS OF ROCK SAMPLE

Diameter (mm) 80.0
Length (mm) 184
Bulk density (Mg/m^3) 2.21
Moisture Content (%) 13.4

UNIAXIAL LOADING

Rate of testing:
(MPa/min) 0.001

Method of strain measurement: Micrometer dial gauges.

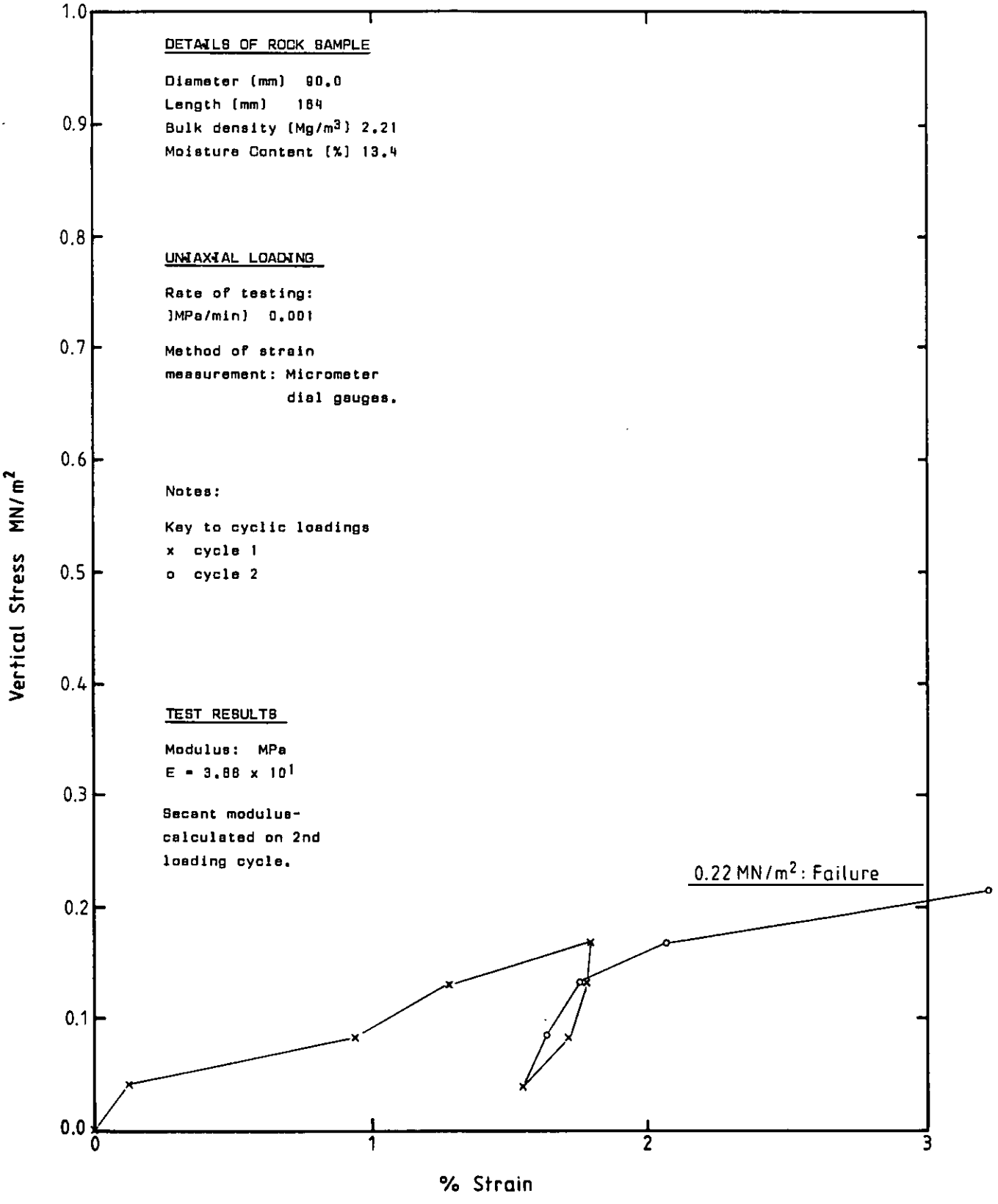
Notes:

Key to cyclic loadings
x cycle 1
o cycle 2

TEST RESULTS

Modulus: MPa
$E = 3.88 \times 10^1$

Secant modulus-calculated on 2nd loading cycle.



LABORATORY DETERMINATION OF YOUNG'S MODULUS

Borehole No. 709R
Depth 6.57-6.85m

Soil Mechanics

Location: A42 CASTLE DONINGTON NORTH

Loc. No 7382

Fig. 45

© Soil Mechanics Limited, Bracknell, England
DS/8/85

DETAILS OF ROCK SAMPLE

Diameter (mm) 91.6
Length (mm) 175
Bulk Density (Mg/m^3) 2.30
Moisture Content (%) 14.1

UNIAXIAL LOADING

Rate of testing:-

(MPa/min) 0.001
Method of strain
measurement: Micrometer
dial gauges

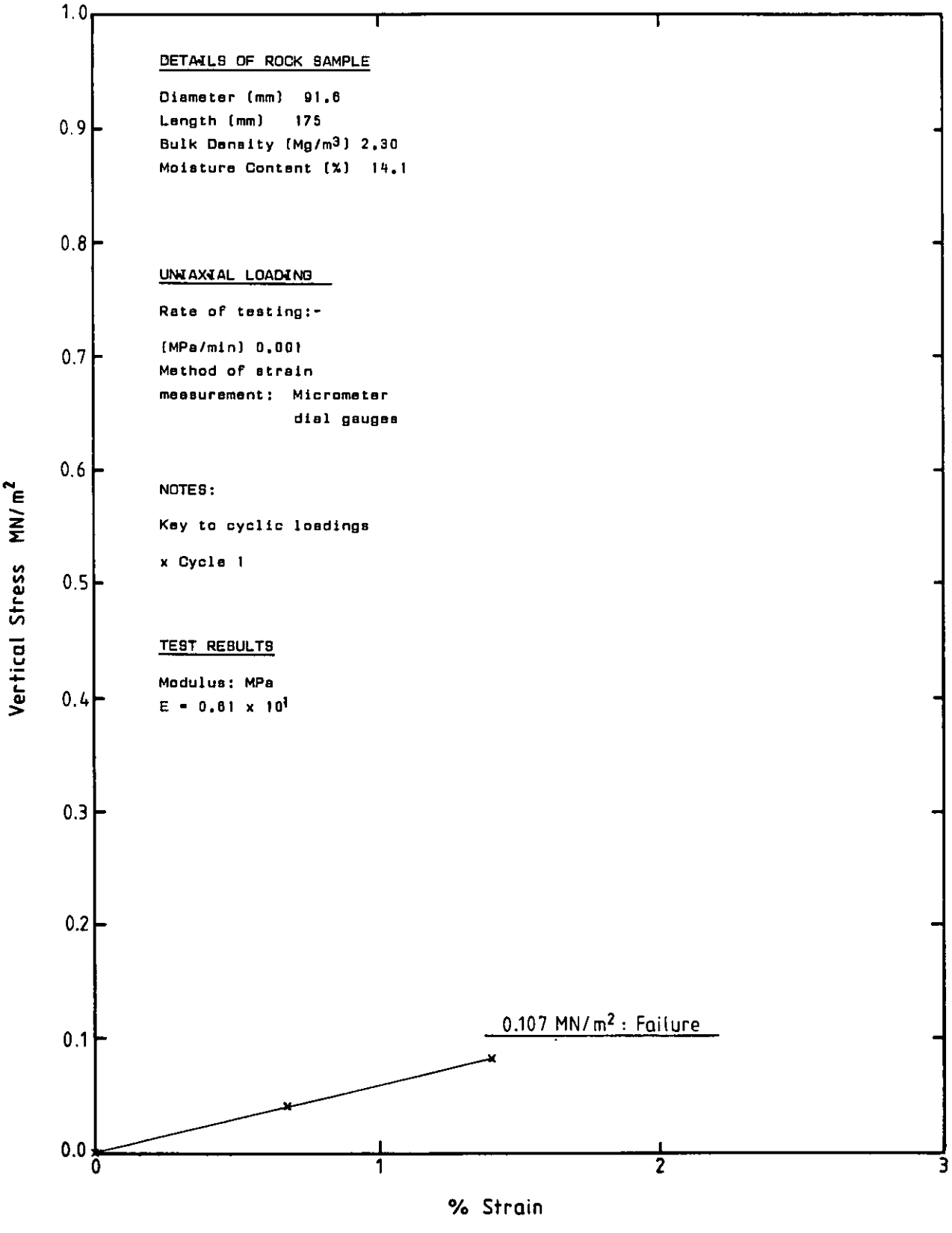
NOTES:

Key to cyclic loadings

x Cycle 1

TEST RESULTS

Modulus: MPa
E = 0.81 x 10^1



LABORATORY DETERMINATION OF YOUNG'S MODULUS

Borehole No. 713R
Depth 13.85-14.10m

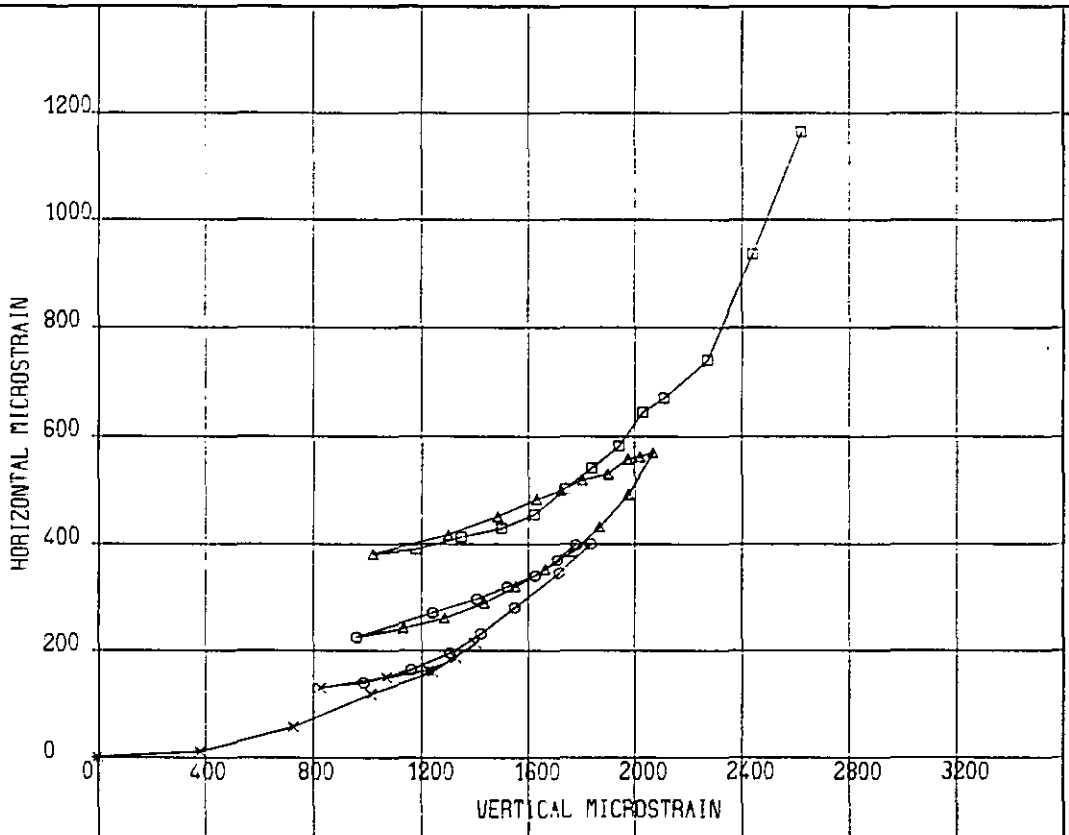
Soil Mechanics

Location: A42 CASTLE DONINGTON NORTH

Loc. No 7382

Fig. 46

DS/8/85 © Soil Mechanics Limited, Bracknell, England



DETAILS OF ROCK SAMPLE

DESCRIPTION:

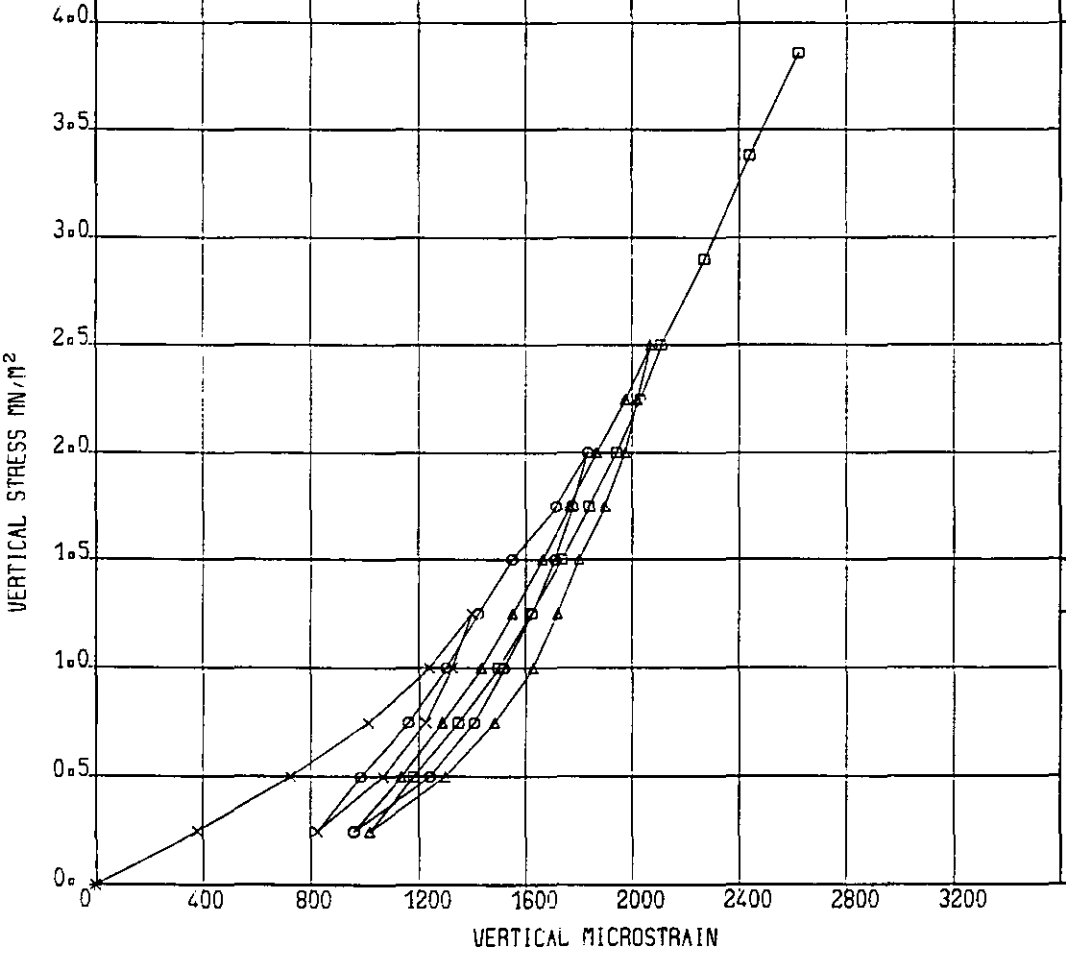
DIAMETER (MM) 86.8

LENGTH (MM) 170

BULK DENSITY (MG/M^3) 2.31

MOISTURE CONTENT (%) 12.2

ADDITIONAL INFORMATION:



UNIAXIAL LOADING

RATE OF TESTING: (MPA/MIN.) 0.001

METHOD OF STRAIN MEASUREMENT:

ELECTRICAL STRAIN GAUGES

NOTES

KEY TO CYCLIC LOADINGS

× CYCLE 1
○ CYCLE 2
△ CYCLE 3
□ CYCLE 4

TEST RESULTS

MODULUS: MPA (AS INDICATED)

$E = 1.92 \times 10^3$

$\upsilon = 0.23$

SECANT MODULUS – CALCULATED ON 2nd LOADING CYCLE

LABORATORY DETERMINATION OF YOUNG'S MODULUS AND POISSON'S RATIO

BOREHOLE : 721R

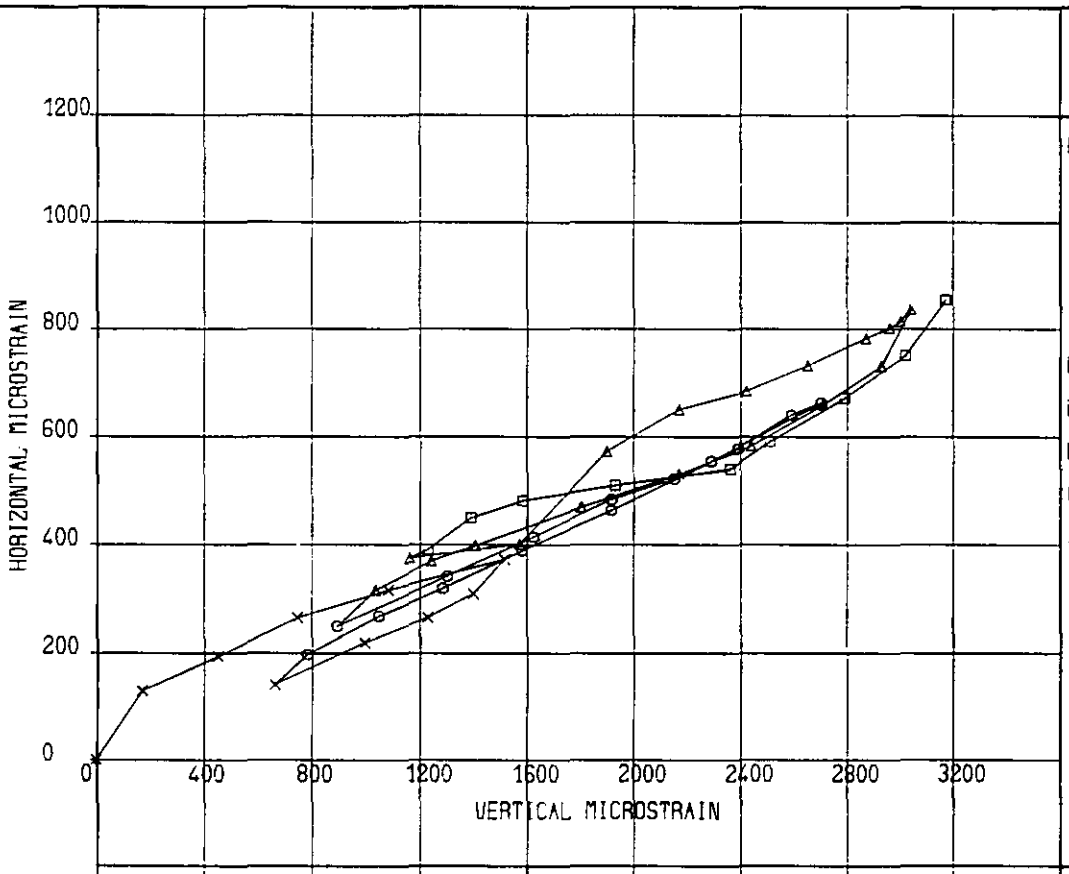
DEPTH : 11.50-11.73

SOIL MECHANICS

LOCATION : A42 CASTLE DONINGTON NORTH

LOC NO. 7382

FIG. 47



DETAILS OF ROCK SAMPLE

DESCRIPTION:

DIAMETER (MM) 87.8

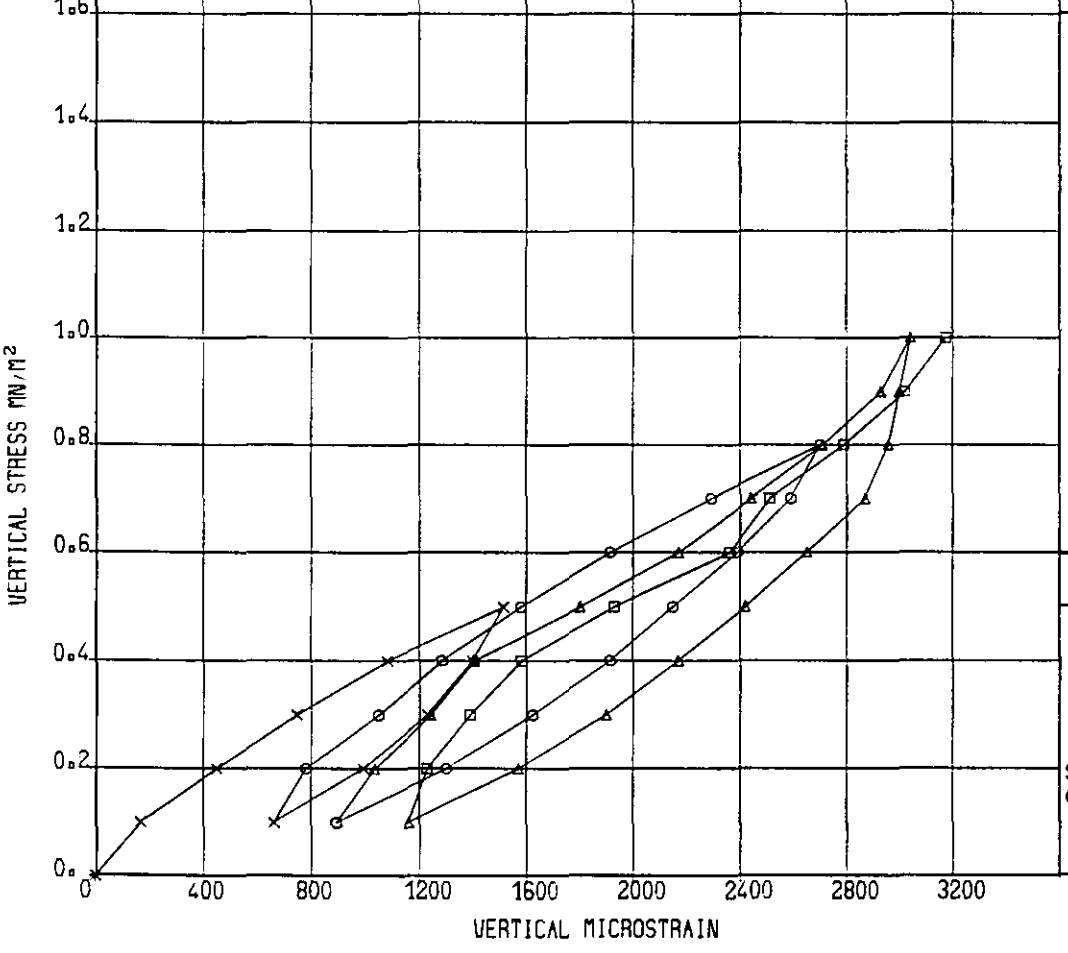
LENGTH (MM) 158

BULK DENSITY (MG/M^3) 2.31

MOISTURE CONTENT (%) 10.0

ADDITIONAL INFORMATION:

UNIAXIAL LOADING



RATE OF TESTING: (MPA/MIN.) 0.001

METHOD OF STRAIN MEASUREMENT:

ELECTRICAL STRAIN GAUGES

NOTES

KEY TO CYCLIC LOADINGS

× CYCLE 1
○ CYCLE 2
△ CYCLE 3
□ CYCLE 4

TEST RESULTS

MODULUS: MPA (AS INDICATED)

$E = 3.51 \times 10^2$

$\upsilon = 0.23$

SECANT MODULUS – CALCULATED ON 2nd LOADING CYCLE

LABORATORY DETERMINATION OF YOUNG'S MODULUS AND POISSON'S RATIO

BOREHOLE : 729R

DEPTH : 2.35-2.69

SOIL MECHANICS

LOCATION : A42 CASTLE DONINGTON NORTH

LOC NO. 7382

FIG. 48

DETAILS OF ROCK SAMPLE

Diameter (mm) 92.8
Length (mm) 182
Bulk Density)Mg/m^3) 2.11
Moisture Content (%) 14.8

UNIAXIAL LOADING

Rate of testing:

(MPa/min) 0.001
Method of strain measurement: Micrometer diel gauges

Notes:

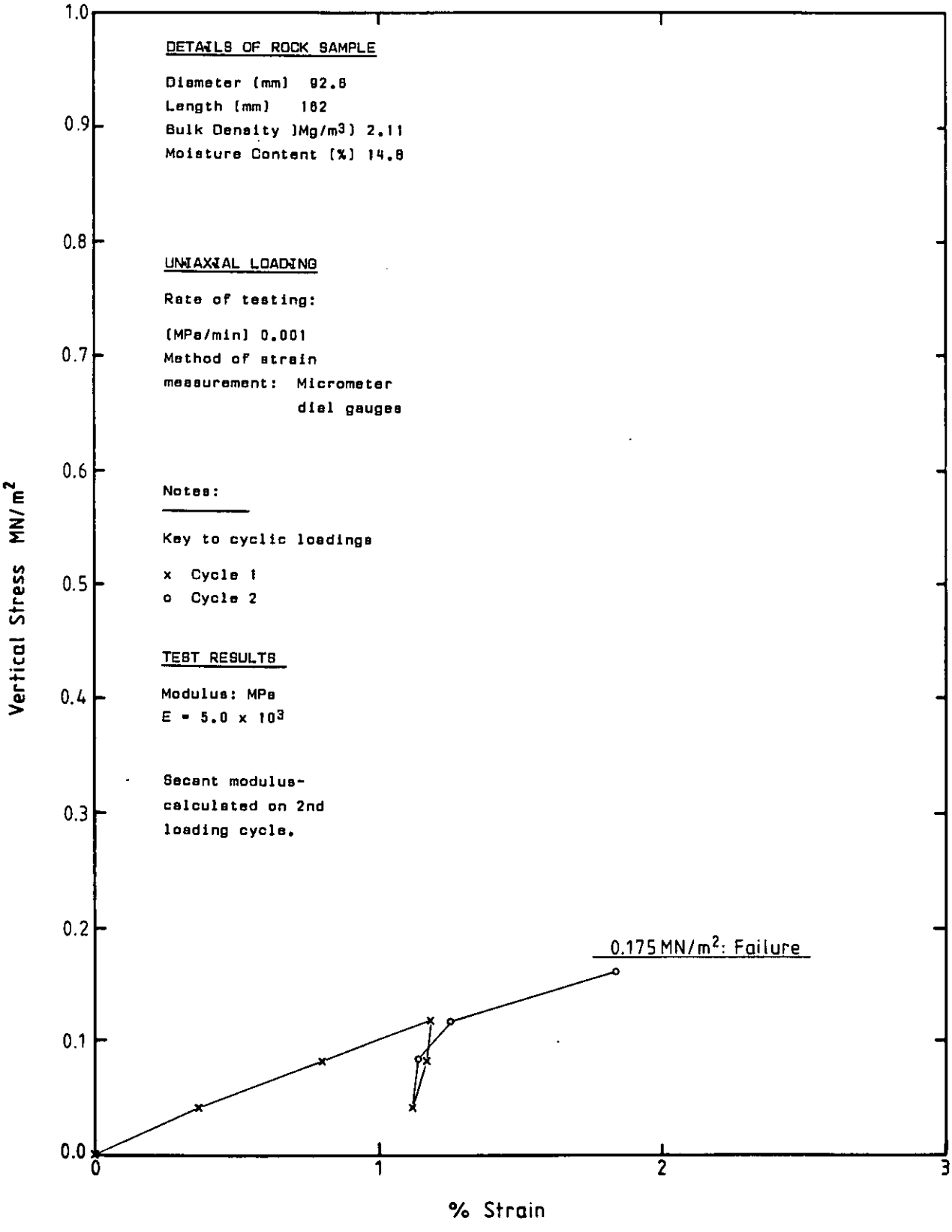
Key to cyclic loadings

x Cycle 1
o Cycle 2

TEST RESULTS

Modulus: MPa
E = 5.0 x 10^3

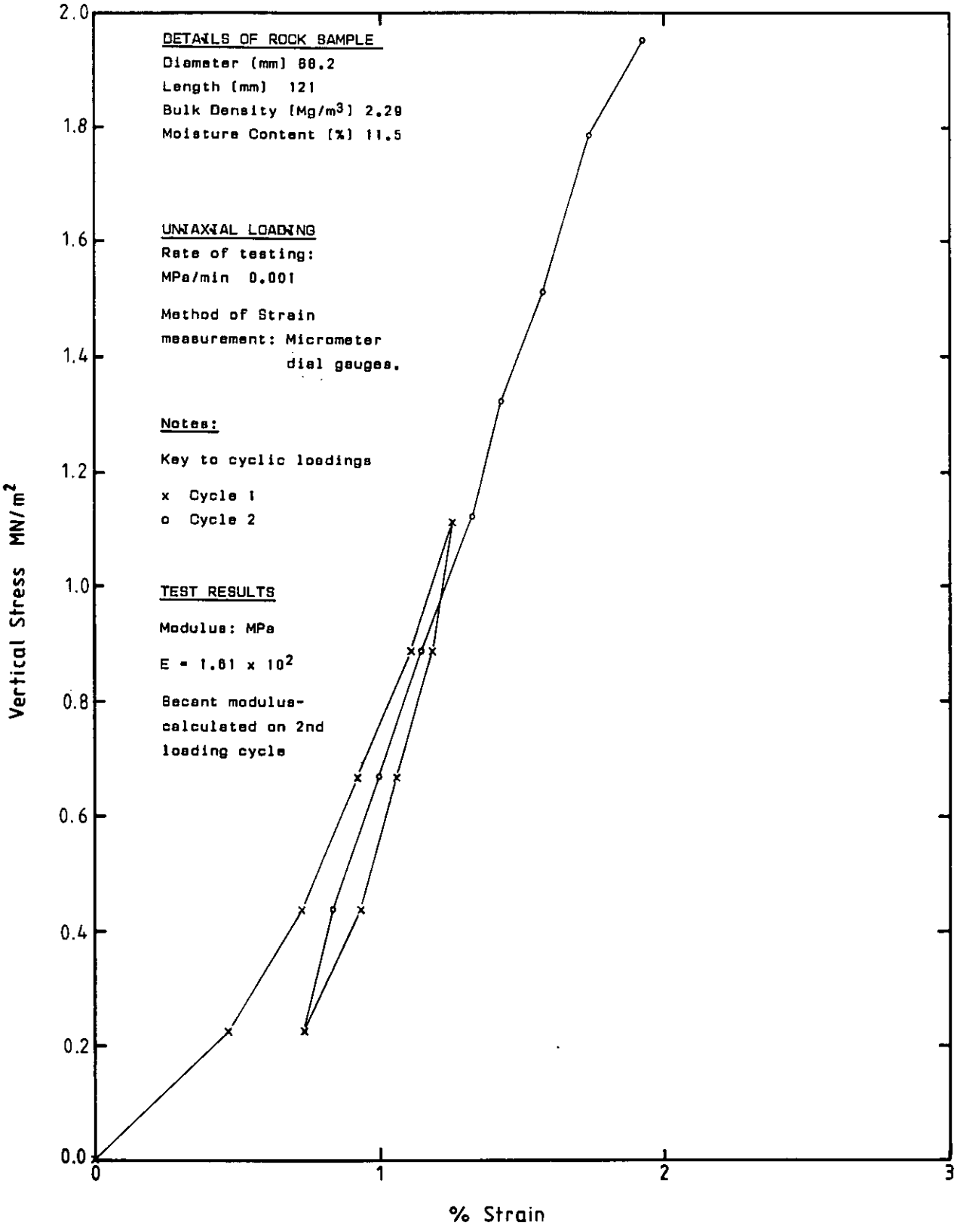
Secant modulus- calculated on 2nd loading cycle.



LABORATORY DETERMINATION OF YOUNG'S MODULUS	Borehole No. 731R Depth 3.90 - 4.24m
Soil Mechanics	Location: A42 CASTLE DONINGTON NORTH Loc. No 7382 Fig. 49

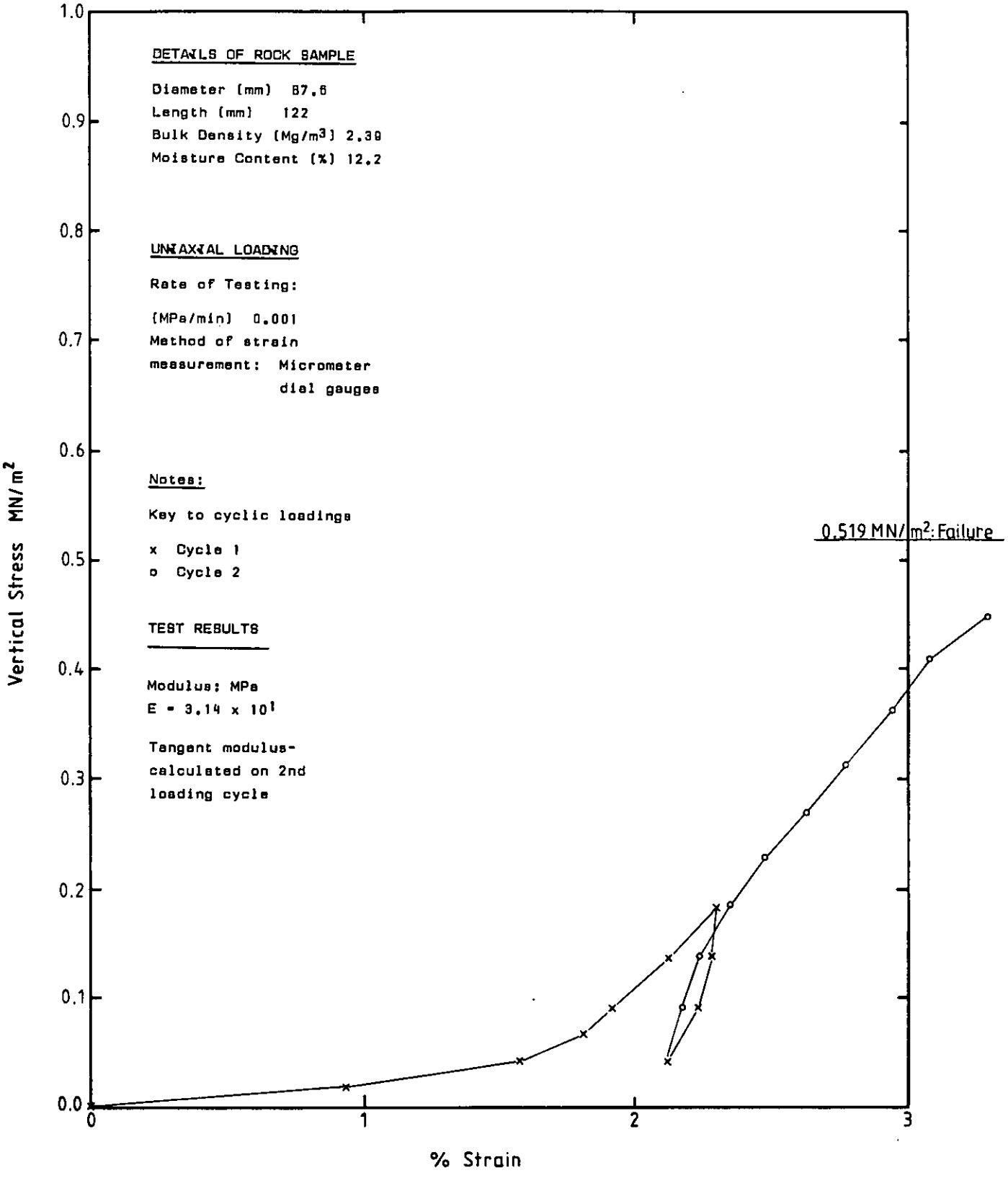
D5/8/85 © Soil Mechanics Limited, Bracknell, England

2.04 MN/m^2: Failure



LABORATORY DETERMINATION OF YOUNG'S MODULUS		Borehole No. 732R Depth 10.85 - 11.10m	
Soil Mechanics	Location A42 CASTLE DONINGTON NORTH	Loc. No 7382	Fig. 50

D5/8/85 © Soil Mechanics Limited, Bracknell, England



LABORATORY DETERMINATION OF YOUNG'S MODULUS

Borehole No. 732
Depth 13.10 - 13.30 m

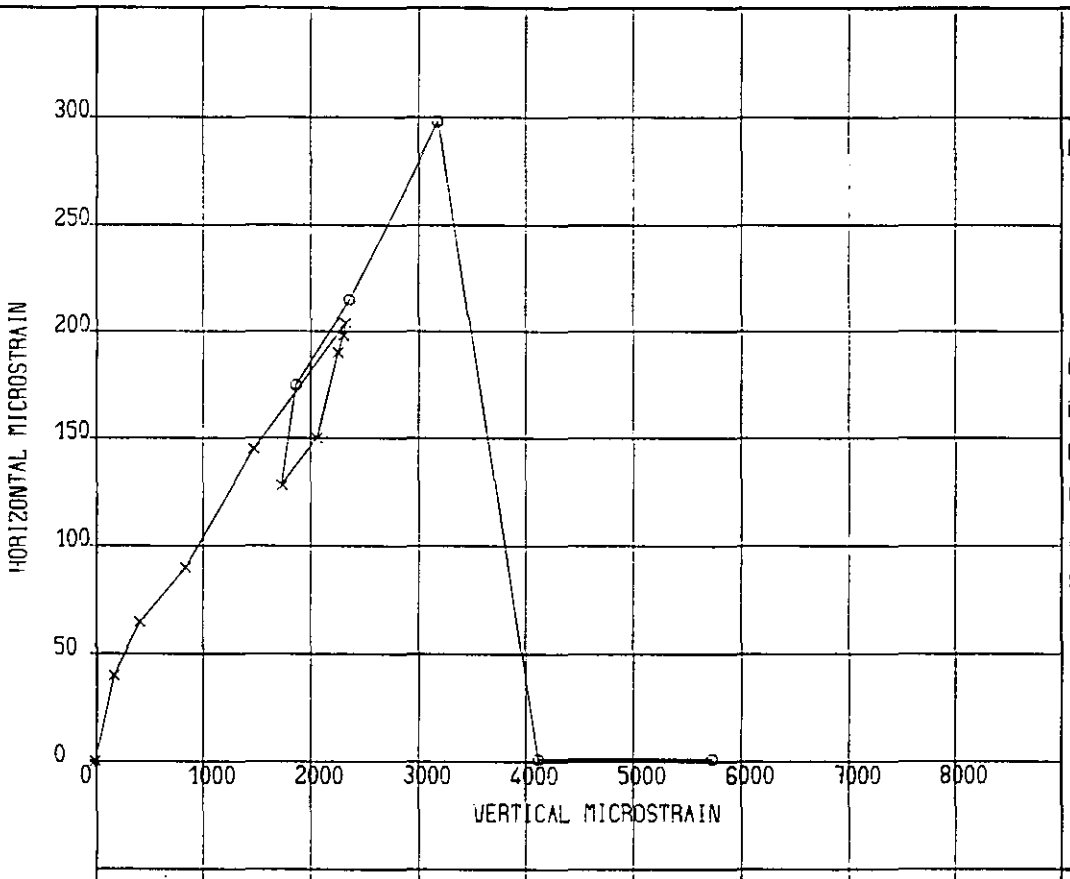
Soil Mechanics

Location: A42 CASTLE DONINGTON NORTH

Loc. No 7382

Fig. 51

© Soil Mechanics Limited, Bracknell, England
D5/8/85
DOME PDS 854068



DETAILS OF ROCK SAMPLE

DESCRIPTION:

DIAMETER (MM) 87.2

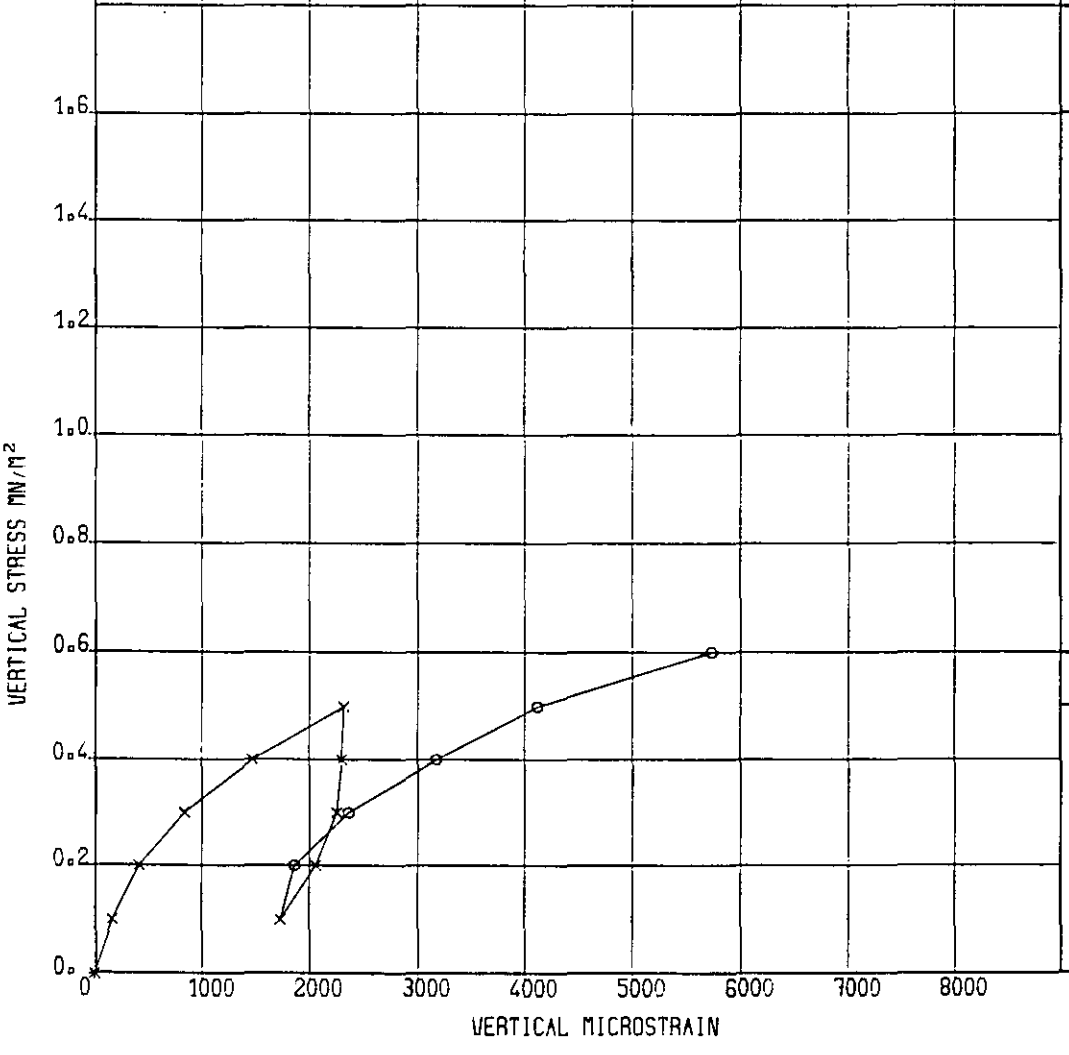
LENGTH (MM) 155

BULK DENSITY (MG/M^3) 2.41

MOISTURE CONTENT (%) 8.6

ADDITIONAL INFORMATION:

SPECIMEN FAILED ON 2nd LOADING CYCLE



UNIAXIAL LOADING

RATE OF TESTING: (MPA/MIN.) 0.001

METHOD OF STRAIN MEASUREMENT:
ELECTRICAL STRAIN GAUGES

NOTES

KEY TO CYCLIC LOADINGS

× CYCLE 1

o CYCLE 2

TEST RESULTS

MODULUS: MPA
(AS INDICATED)

$E = 1.24 \times 10^2$

$\nu = 0.10$

TANGENT MODULUS – CALCULATED ON 2nd LOADING CYCLE

LABORATORY DETERMINATION OF YOUNG'S MODULUS AND POISSON'S RATIO

BOREHOLE : 733R

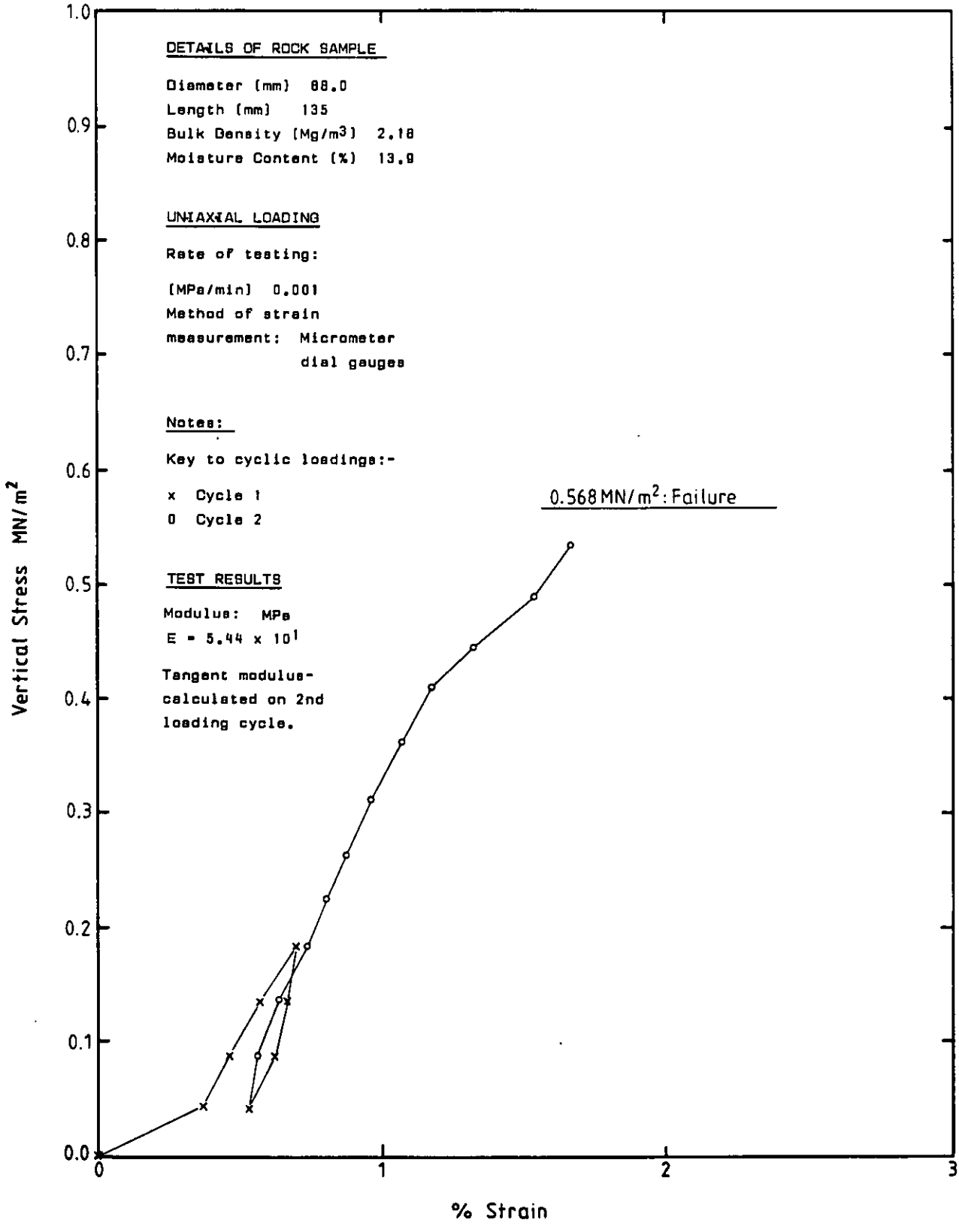
DEPTH : 7.79-8.00

SOIL MECHANICS

LOCATION : A42 CASTLE DONINGTON NORTH

LOC NO. 7382

FIG. 52



LABORATORY DETERMINATION OF YOUNG'S MODULUS

Borehole No. 735 R

Depth 7.28 - 7.52 m

Soil Mechanics

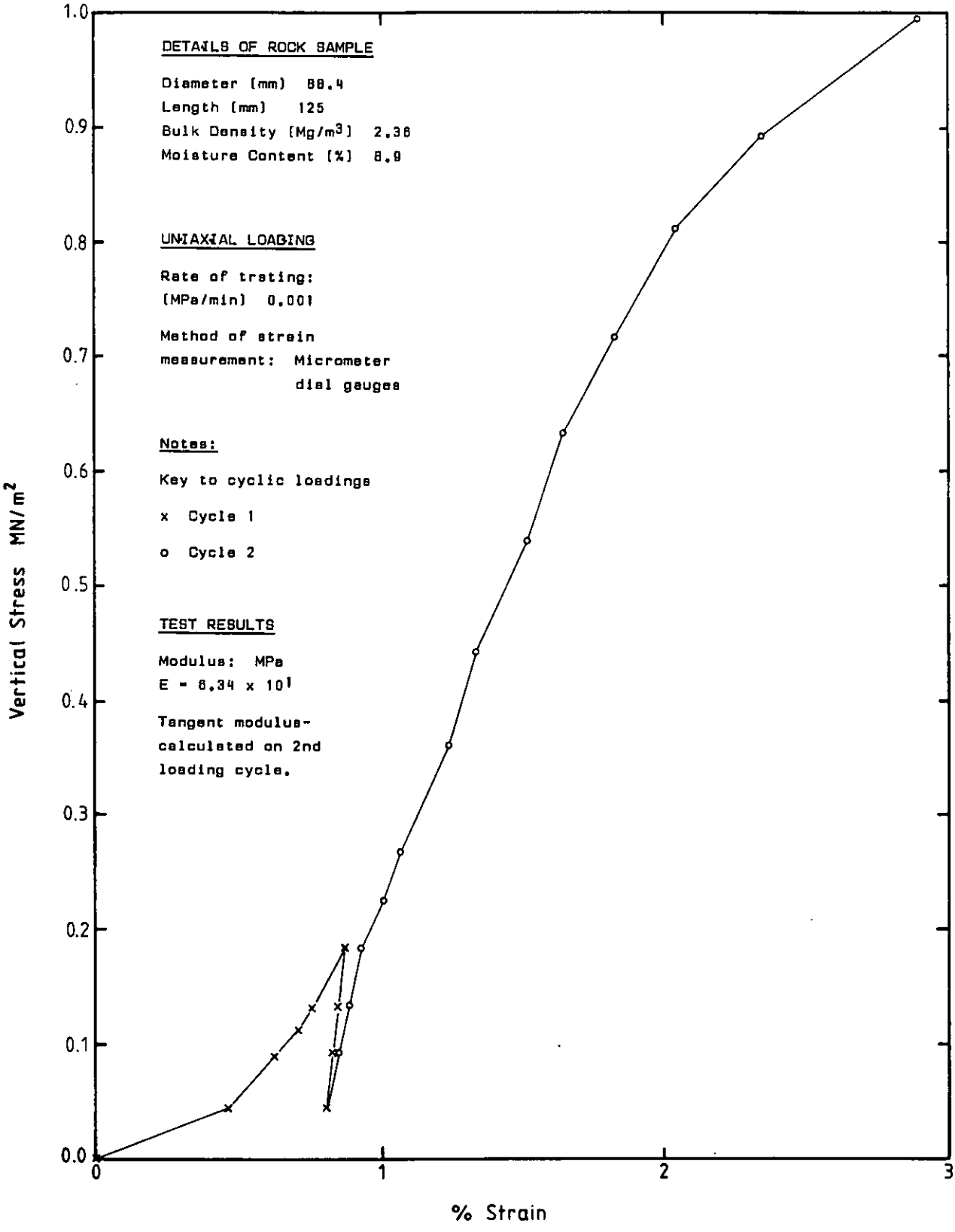
Location: A42 CASTLE DONINGTON NORTH

Loc. No 7382

Fig. 53

© Soil Mechanics Limited, Bracknell, England

1.06 MN/m^2 : Failure



LABORATORY DETERMINATION OF YOUNG'S MODULUS		Borehole No. 737R Depth 1.28 - 1.54 m	
Soil Mechanics	Location A42 CASTLE DONINGTON NORTH	Loc. No 7382	Fig. 54 -

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DOME PHS 854068

C2/1/84 © Soil Mechanics Limited, Bracknell, England

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PARTICLE SIZE DISTRIBUTION

Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Fig. 55

Borehole No.

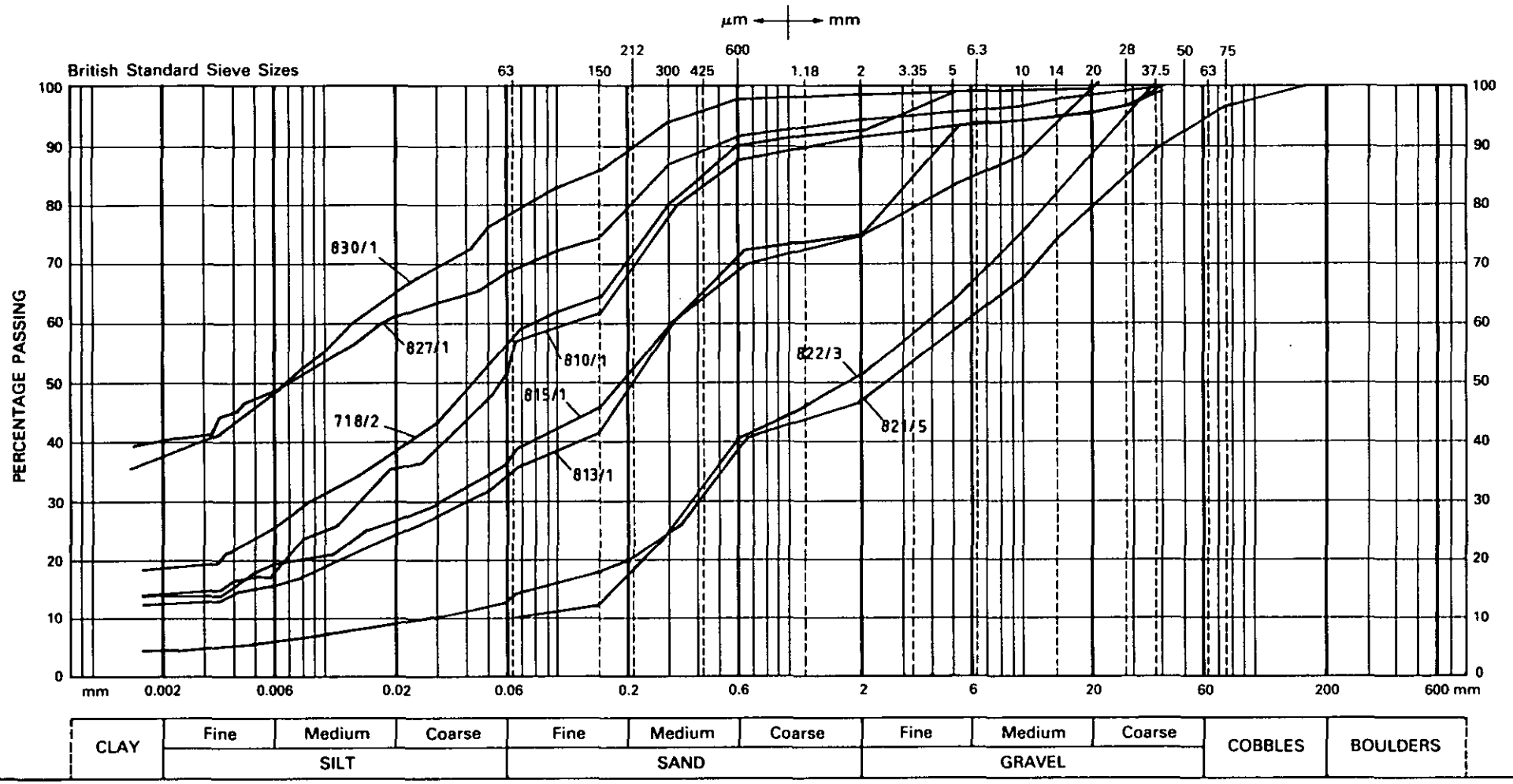
Sample No.

Depth

BOREHOLE No: SAMPLE No: PLOT SYMBOL	SOIL DESCRIPTION or CLASSIFICATION	SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES				
		Preparation	Mass kg	Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
	Composite Grading Envelope- Glacial Till									

Notes:

Borehole/Trial Pit and sample no. indicated for each grading curve thus:- 718/2



C2/1/84 © Soil Mechanics Limited, Bracknell, England

φ Soil Mechanics

PARTICLE SIZE DISTRIBUTION

Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Fig. 56

Borehole No.

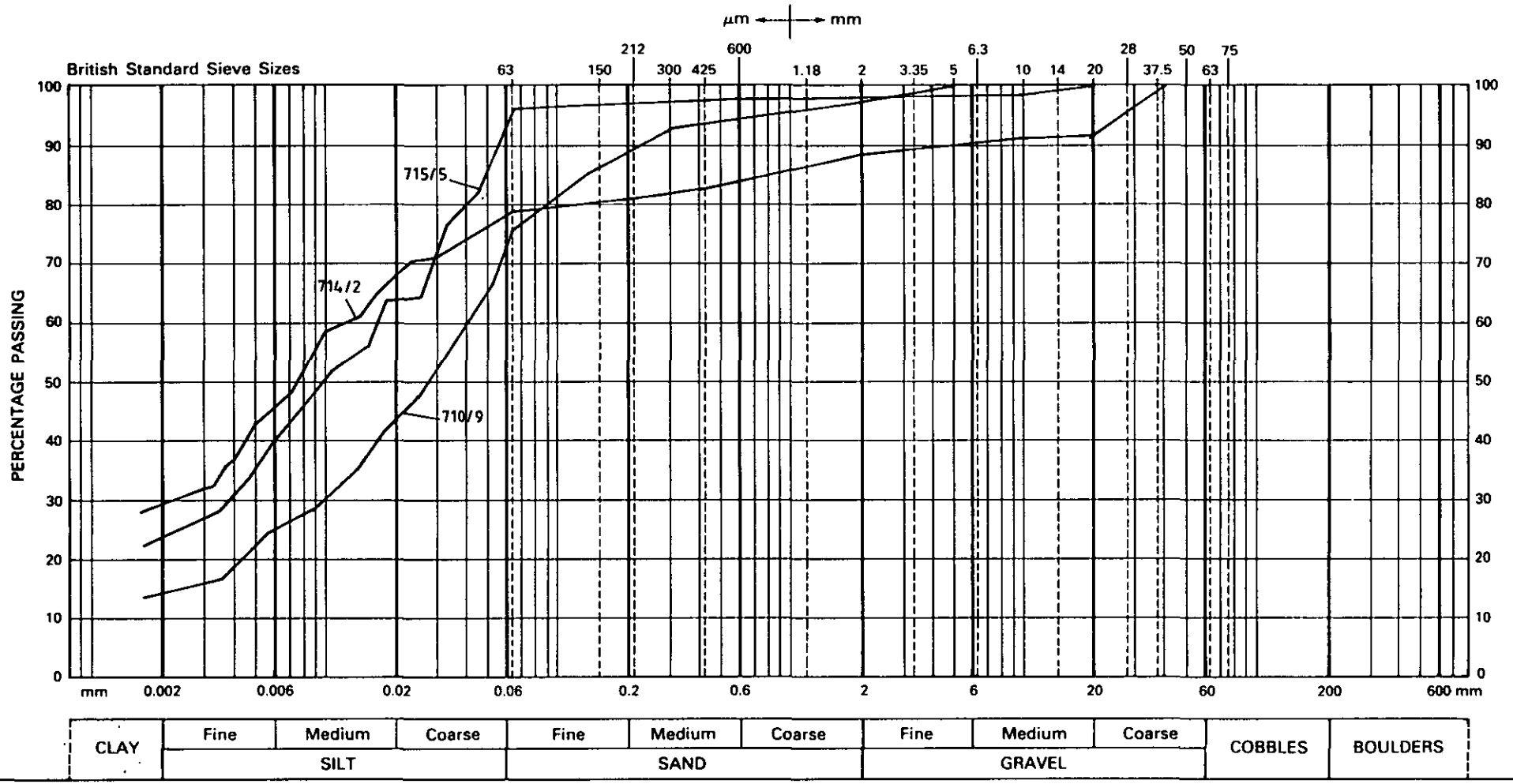
Sample No.

Depth

BOREHOLE No: SAMPLE No: PLOT SYMBOL	SOIL DESCRIPTION or CLASSIFICATION	SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES				
		Preparation	Mass kg	Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
	Composite Grading Envelope- Keuper Marl									

Notes:

Borehole and sample no. indicated for each grading curve thus:- 710/9



ANNEXE

SUMMARY OF MOISTURE CONTENT DETERMINATIONS

ON CORE SAMPLES

Borehole No	Depth (m)	Moisture Content (%)
704R	6.50	0.86
	9.60	0.75
705R	6.50	2.1
	8.40	2.2
706R	7.90	0.42
	9.65	0.80
707R	7.10	0.31
	9.10	0.41
708R	7.60	2.0
	9.70	7.3

D6:8/85 © Soil Mechanics Limited, Bracknell, England

C2/1/84 © Soil Mechanics Limited, Bracknell, England

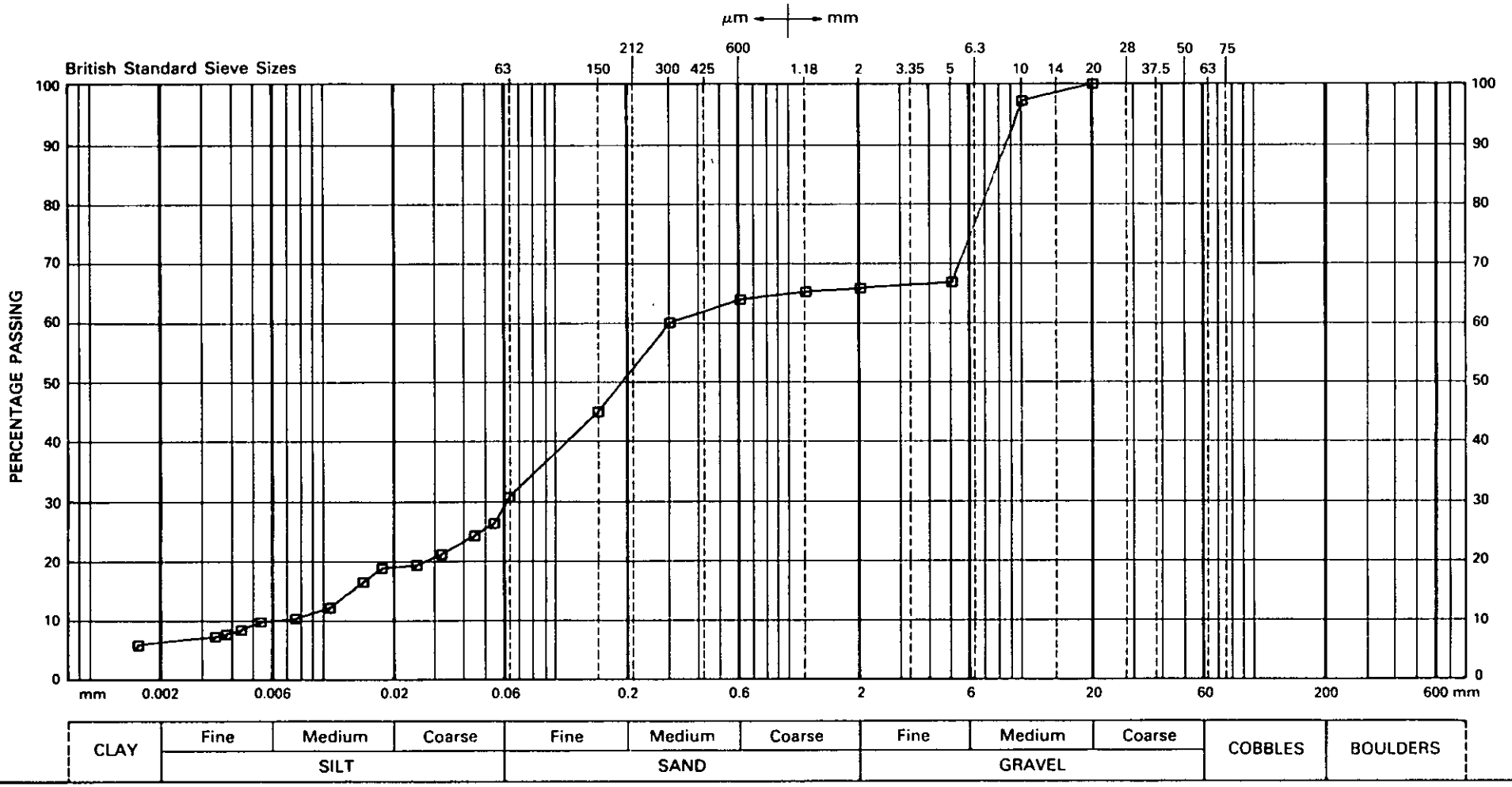
Soil Mechanics

PARTICLE SIZE DISTRIBUTION

BOREHOLE No: SAMPLE No: PLOT SYMBOL	SOIL DESCRIPTION or CLASSIFICATION	SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES				
		Preparation	Mass kg	Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
704R – 708R		As BS1377	7.6	As BS1377	50.00	6	23	37	34	0

Notes:

1. Sieving carried out on material before Compaction Test. Material taken from following depths:
BH 704R 6.50 - 9.60m, BH 705R 6.40 - 8.45m, BH 706R 7.80 - 8.00m and 8.75 - 10.80m,
BH 707R 6.98 - 9.63m and 10.86 - 11.40m, BH 708R 5.20 - 6.02m and 7.53 - 12.12m



Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Fig. A2

Borehole No. 704R - 708R Depth

Sample No.

C2/1/84 © Soil Mechanics Limited, Bracknell, England

Soil Mechanics

PARTICLE SIZE DISTRIBUTION

Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Fig. A3

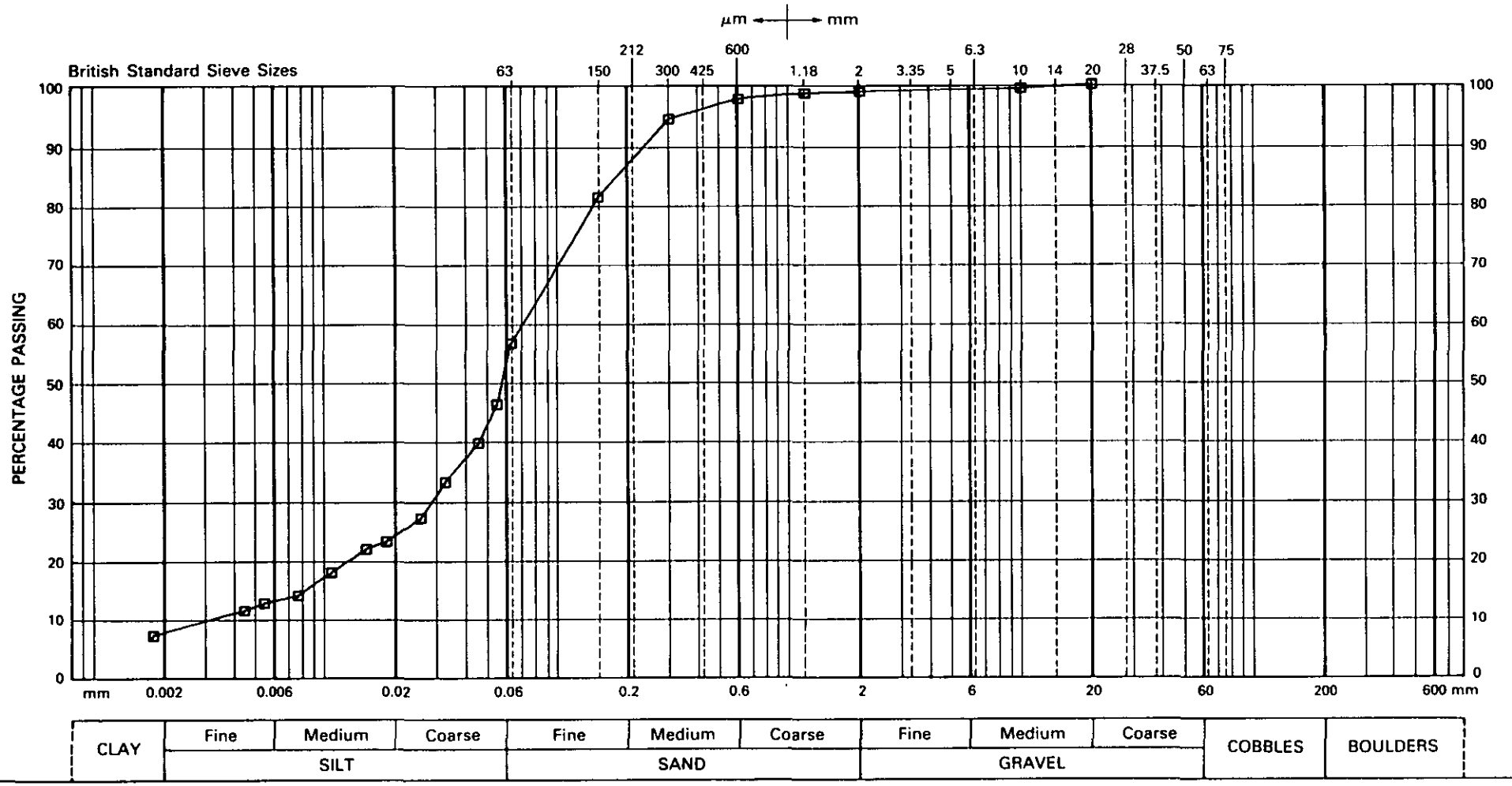
Borehole No. 704R - 708R Depth

Sample No. A

BOREHOLE No: SAMPLE No: PLOT SYMBOL	SOIL DESCRIPTION or CLASSIFICATION	SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES				
		Preparation	Mass kg	Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
704R – 708R A ☒		As BS1377	9.6	As BS1377	50.00	8	46	45	1	0

Notes:

1. Sieving carried out on material after Shear Box Test.



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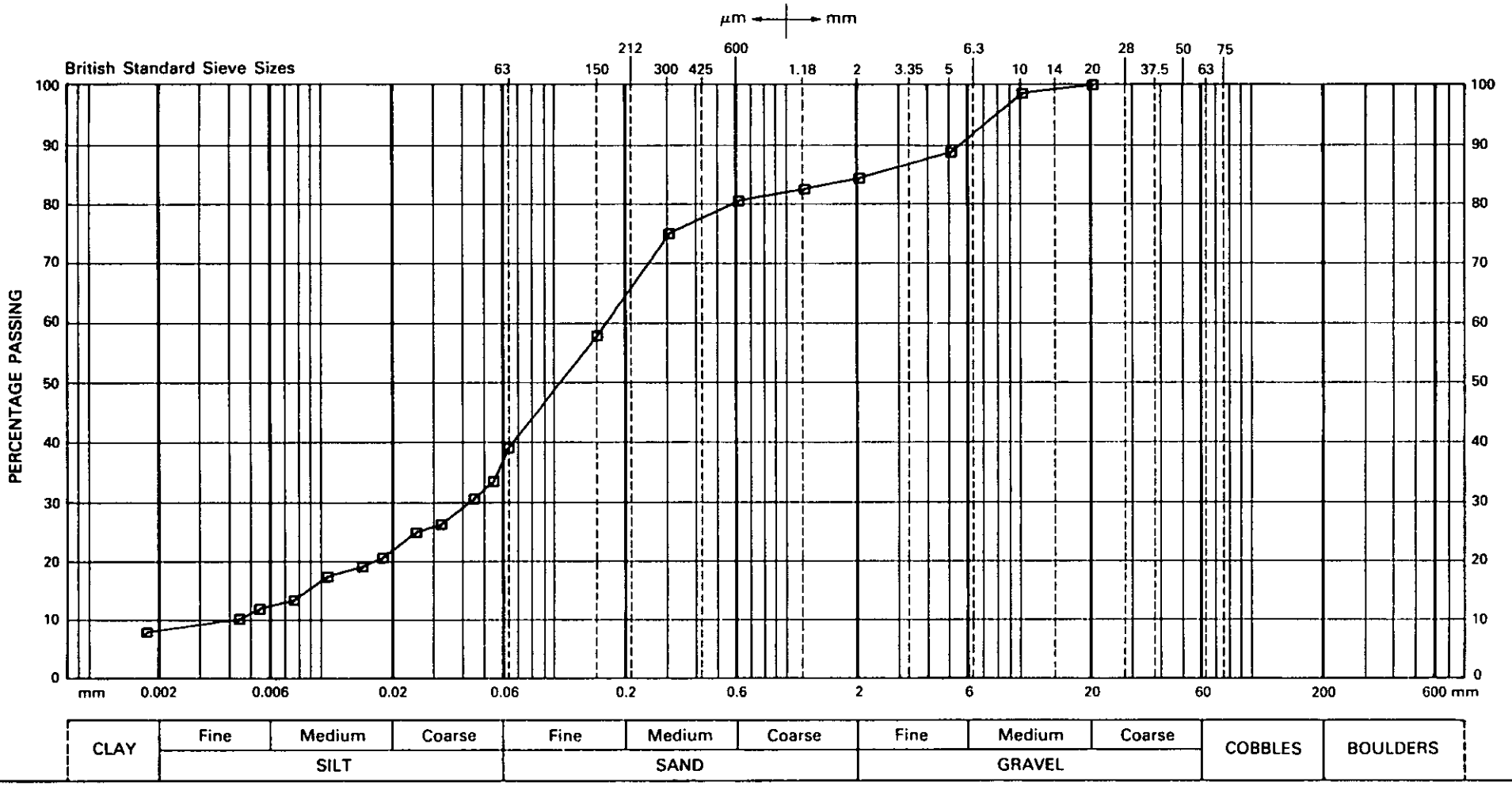
Soil Mechanics

PARTICLE SIZE DISTRIBUTION

BOREHOLE No: SAMPLE No: PLOT SYMBOL	SOIL DESCRIPTION or CLASSIFICATION	SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES				
		Preparation	Mass kg	Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
704R – 708R B ◘		As BS1377	7.3	As BS1377	50.00	8	29	48	15	0

Notes:

1. Sieving carried out on material after Shear Box Test.



Location: A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Fig. A4

Borehole No. 704R - 708R Depth

Sample No. B

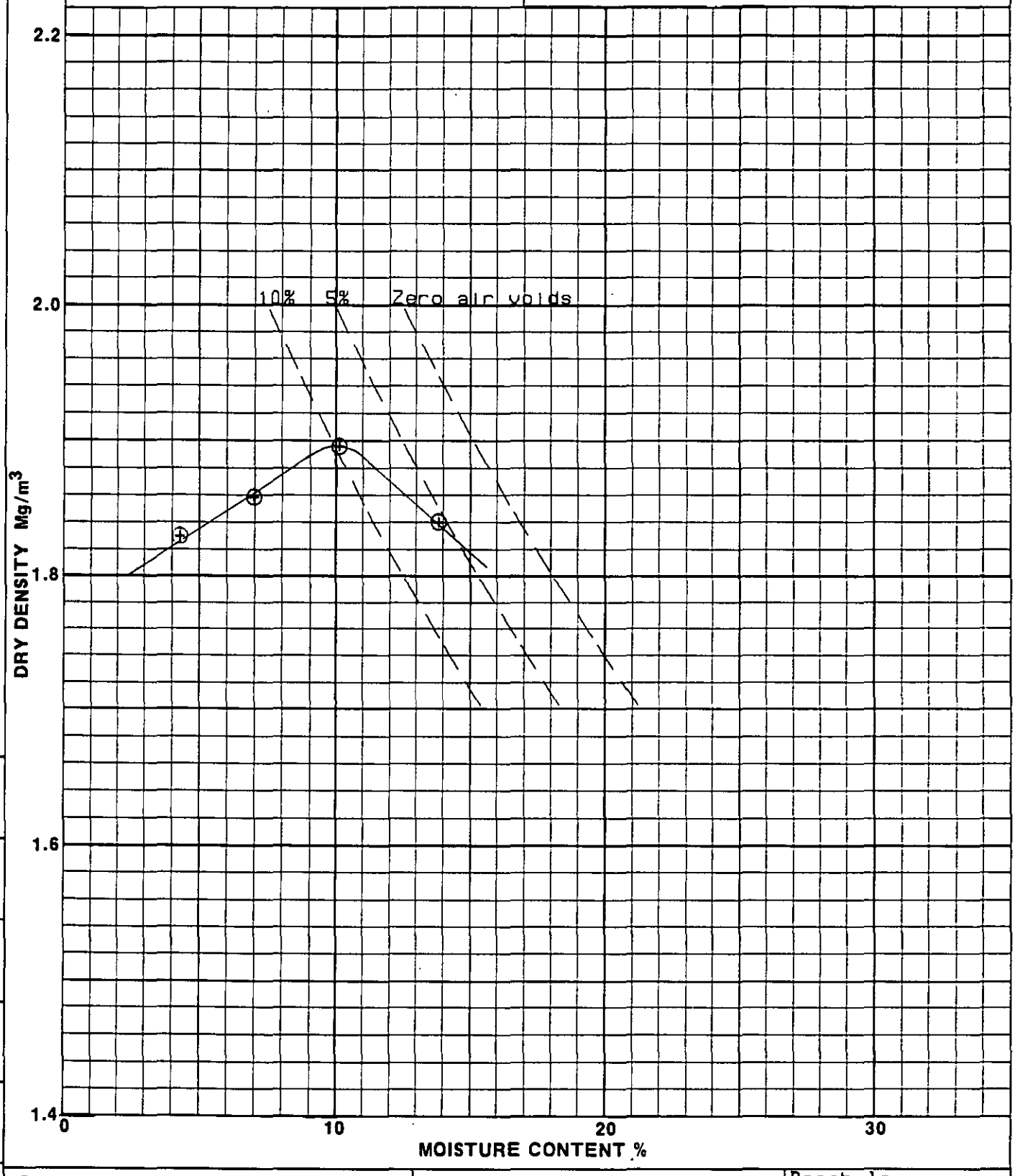
NOTES

1 Maximum particle size as received 20.0 mm

2 Maximum particle size used 20.0 mm

3 Specific gravity of particles assumed 2.65

Test specification	B.S. 1377 : 1975 Test 14
Container	CBR mould
No. of layers	3
Blows per layer	1 Minute per layer Vibrating
Weight of rammer	kg
Height of drop	mm



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Checked | Approved

Compaction Test

DENSITY/MOISTURE CONTENT CURVE

Maximum dry density	1.89 Mg/m3
Optimum moisture content	10 %

Borehole 704R – 708R

L22/77

Soil Mechanics

Location A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Fig. A5

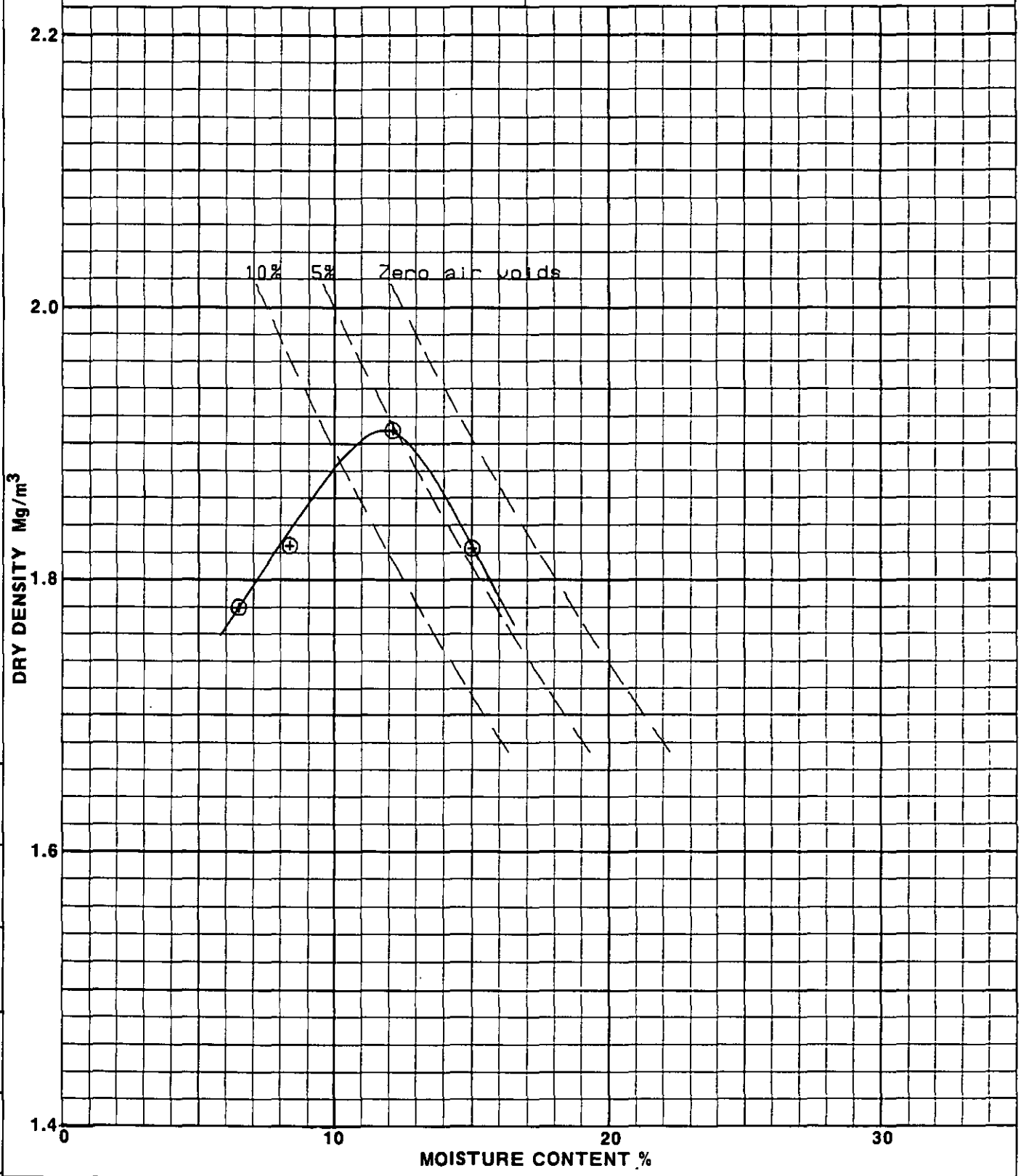
NOTES

1 Maximum particle size as received 20.0 mm

2 Maximum particle size used 20.0 mm

3 Specific gravity of particles ~~measured~~ assumed 2.65

Test specification	B.S. 1377 : 1975 Test 14
Container	CBR mould
No. of layers	3
Blows per layer	1 Minute per layer Vibrating
Weight of rammer	kg
Height of drop	mm



Compaction Test

DENSITY/MOISTURE CONTENT CURVE

Maximum dry density	1.91 Mg/m3
Optimum moisture content	12 %

Borehole 704R – 708R

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Drawn | Checked | Approved

L22/77

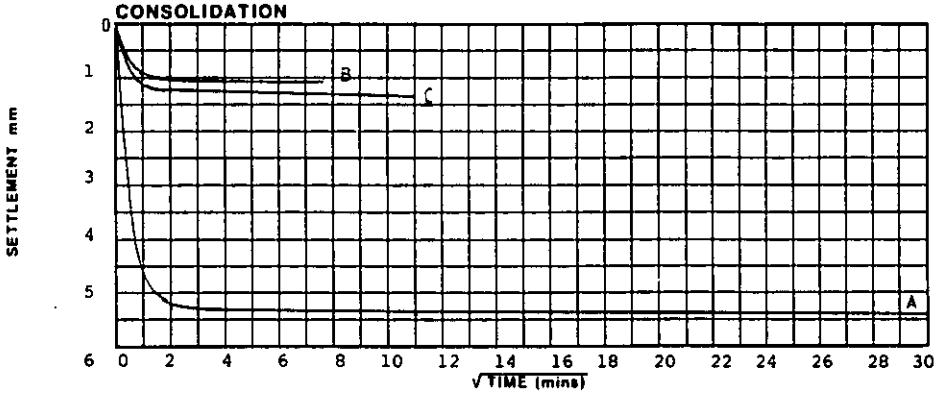
Soil Mechanics

Location A42 CASTLE DONINGTON NORTH

Loc. No. 7382

Fig. A6

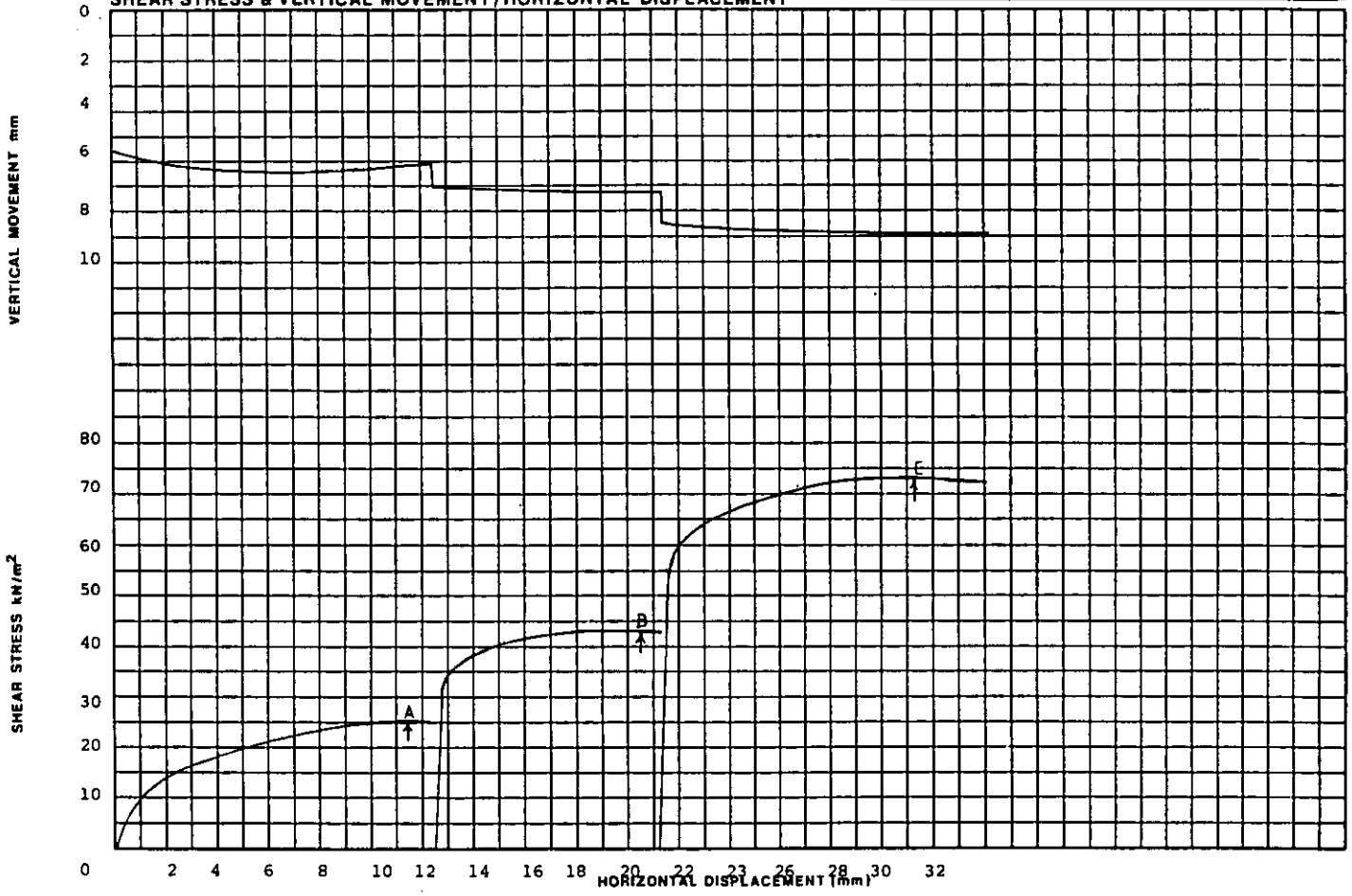
CONSOLIDATION



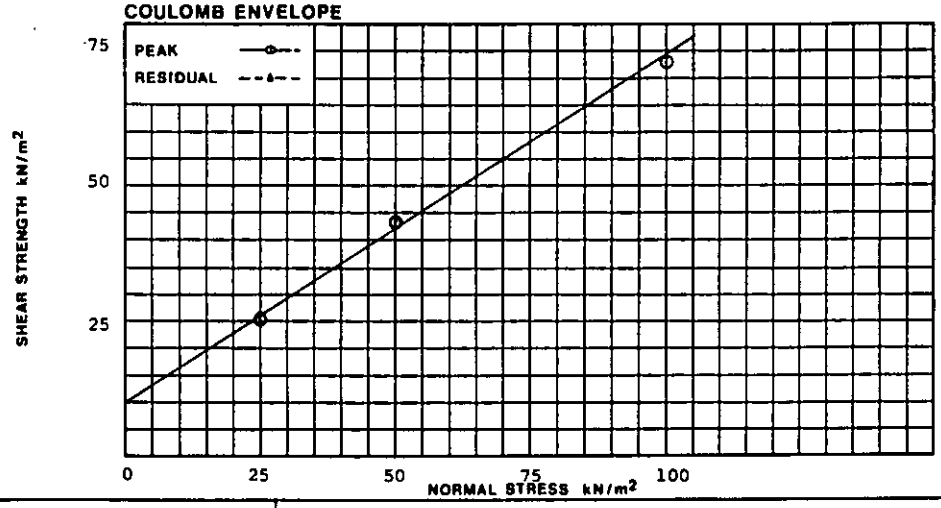
SPECIMEN DETAILS

SOIL DESCRIPTION	Red Brown SANDSTONE				
PREPARATION	Recompacted to 95% maximum dry density at natural moisture content				
SPECIMEN		A	B	C	D
INITIAL	Density Mg/m³	1.99			
	Moisture %	4.1			
	Dry Density Mg/m³	1.91			
AFTER TEST	Density Mg/m³			2.14	
	Moisture %			16.9	
	Dry Density Mg/m³			1.83	
CONSOLIDATION LOAD kN/m²		25	50	100	

SHEAR STRESS & VERTICAL MOVEMENT/HORIZONTAL DISPLACEMENT



COULOMB ENVELOPE



SHEAR STRENGTH DATA

SHEARING STAGE	Normal Stress kN/m²	25	50	100	
	Rate of Displacement mm/min	0.25	0.25	0.25	
PEAK VALUES	Relative Displacement mm	11.40	21.50	31.35	
	Shear Strength kN/m²	25.1	43.4	72.9	
RESIDUAL VALUES	Number of Reversals				
	Relative Displacement mm				
	Shear Strength kN/m²				
SHEAR STRENGTH PARAMETERS	PEAK	C_D	10		kN/m²
		ϕ_D	33		Degrees
	RESIDUAL	C_{Dr}			kN/m²
		ϕ_{Dr}			Degrees

LOCATION No. 7382	LOCATION A42 CASTLE DONINGTON NORTH	BOREHOLE No. 704R - 708R SAMPLE No. A DEPTH (m)

Soil Mechanics

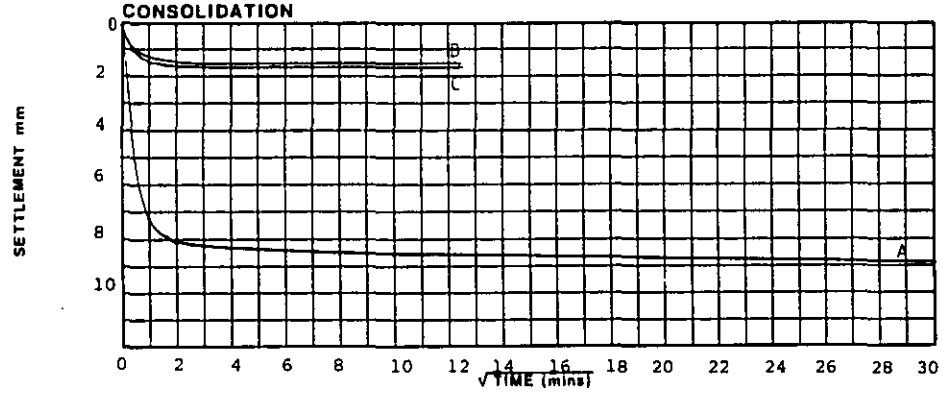
CONSOLIDATED DRAINED DIRECT SHEAR TEST

(300mm x 300mm x 100mm DEEP SPECIMEN) MULTISTAGE TEST

C D
S B

FIG. A7

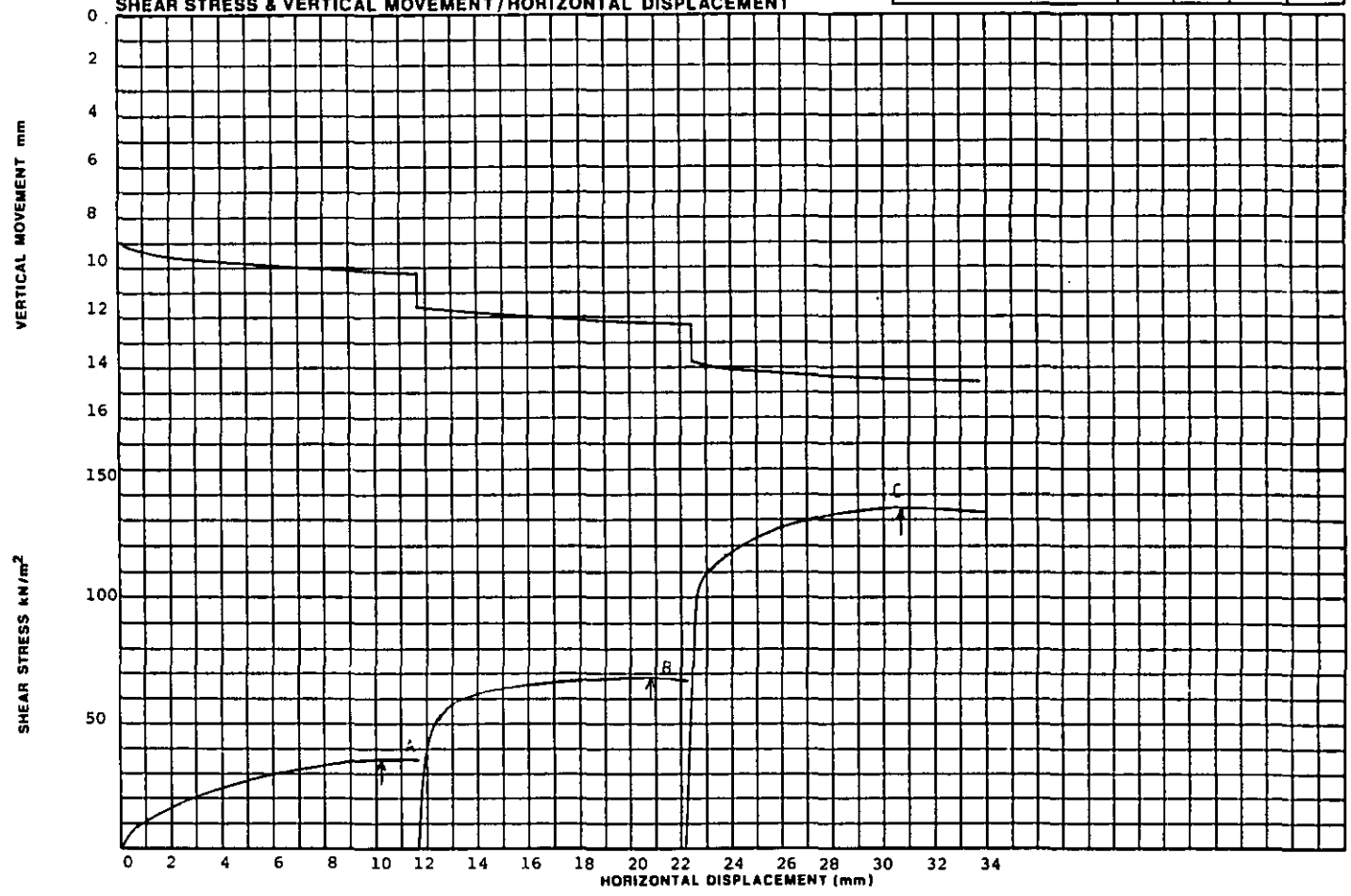
CONSOLIDATION



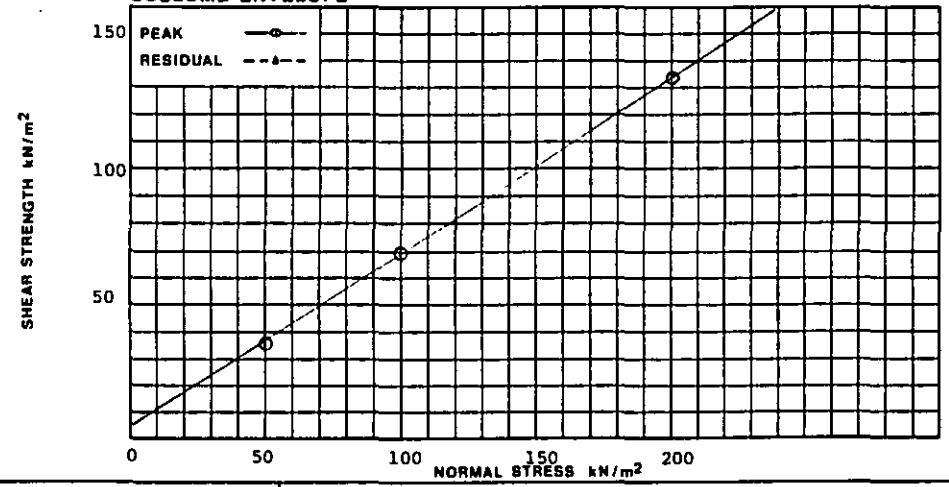
SPECIMEN DETAILS

SOIL DESCRIPTION		Red brown SANDSTONE			
PREPARATION		Recompacted to 95% maximum dry density at natural moisture content			
SPECIMEN		A	B	C	D
INITIAL	Density Mg/m³	1.99			
	Moisture %	4.1			
	Dry Density Mg/m³	1.91			
AFTER TEST	Density Mg/m³			2.17	
	Moisture %			15.5	
	Dry Density Mg/m³			1.88	
CONSOLIDATION LOAD kN/m²		50	100	200	

SHEAR STRESS & VERTICAL MOVEMENT/HORIZONTAL DISPLACEMENT



COULOMB ENVELOPE



SHEAR STRENGTH DATA

SHEARING STAGE	Normal Stress kN/m²	50	100	200	
	Rate of Displacement mm/min	0.25	0.25	0.25	
PEAK VALUES	Relative Displacement mm	10.2	20.95	30.75	
	Shear Strength kN/m²	35.5	69.8	133.5	
RESIDUAL VALUES	Number of Reversals				
	Relative Displacement mm				
	Shear Strength kN/m²				
SHEAR STRENGTH PARAMETERS	PEAK	C_D	5		kN/m²
		ϕ_D	33		Degrees
	RESIDUAL	C_{Dr}			kN/m²
		ϕ_{Dr}			Degrees

LOCATION No.	LOCATION	BOREHOLE No. 704R-708R
7382	A42 CASTLE DONINGTON NORTH	SAMPLE No. B
		DEPTH (m)

Soil Mechanics

CONSOLIDATED DRAINED DIRECT SHEAR TEST

(300mm x 300mm x 100mm DEEP SPECIMEN) MULTISTAGE TEST

C D
S B

FIG. A3

Report

GROUND INVESTIGATION FOR

A42 CASTLE DONINGTON NORTH

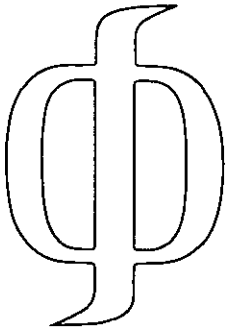
CONTRACT 4

VOLUME 3 : SITE PLANS AND LONGITUDINAL SECTIONS

Carried out for:

Department of Transport

Date August 1988 **No.** 7382/3



Soil Mechanics

Soil Mechanics Limited,
Foundation House,
Eastern Road,
Bracknell, Berkshire, RG12 2UZ,
United Kingdom
telephone Bracknell (0344) 424567
telex 847253 SMERCN G

8/0

Reference 253/3/34/08

M Hubbard
RE Division
Room 4/78
St Christopher House

A42 CASTLE DONINGTON NORTH
SITE INVESTIGATION
CONTRACT IV

I enclose the latest set of site investigation reports from the above scheme for your information.

[redacted]

NSII
EMRO
Room 207
Cranbrook House
Nottingham

17 November 1988

CODE 18-78

REPORT NO. 7382

GROUND INVESTIGATION FOR

A42 CASTLE DONINGTON NORTH

CONTRACT 4

SCHEDULE OF REPORT VOLUMES

VOLUME 1: FIELDWORK

VOLUME 2: LABORATORY TESTING

VOLUME 3: SITE PLANS AND LONGITUDINAL SECTIONS

REPORT NO 7382/3

GROUND INVESTIGATION FOR

A42 CASTLE DONINGTON NORTH

CONTRACT 4

VOLUME 3: SITE PLANS AND LONGITUDINAL SECTIONS

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ABSTRACT

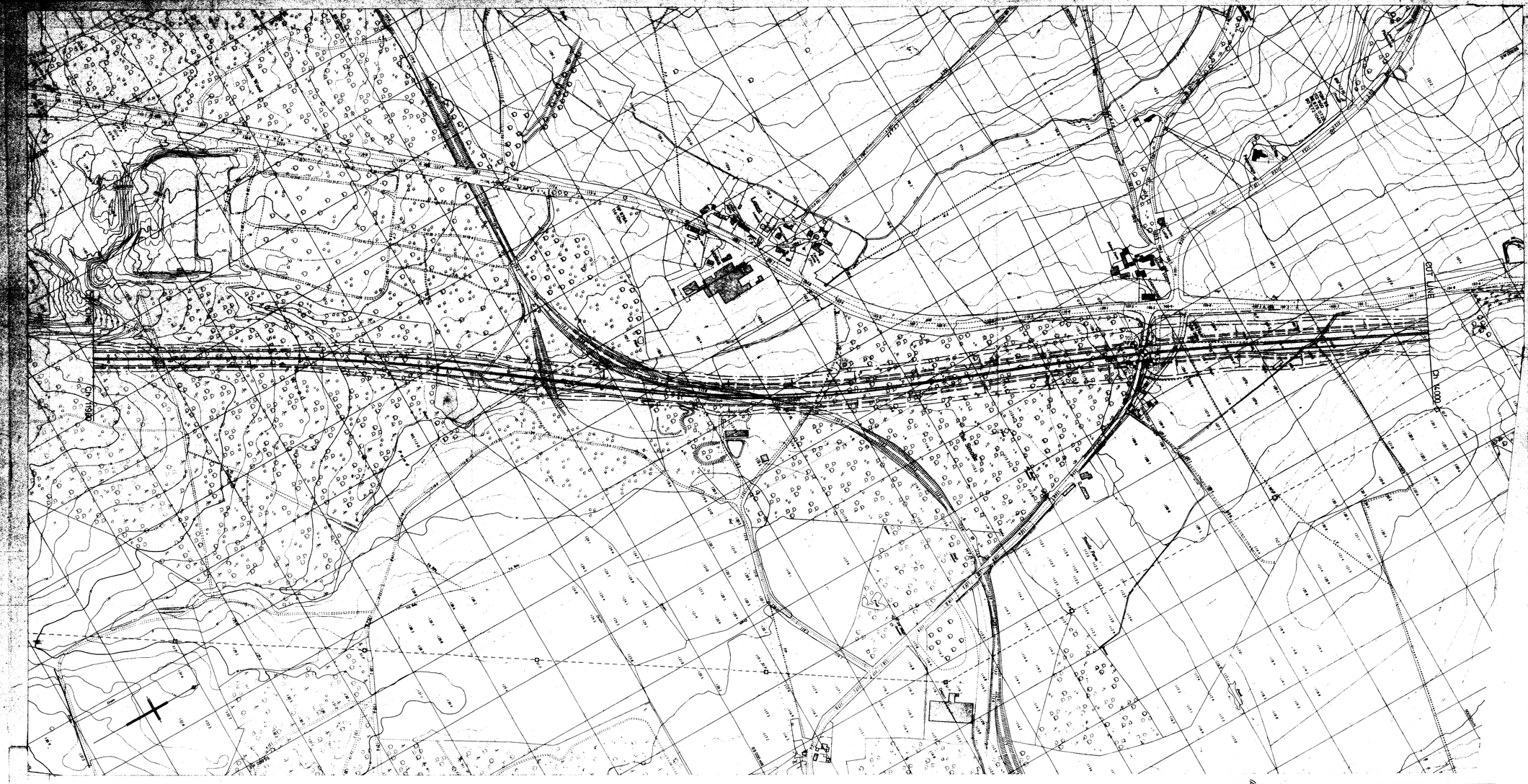
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REPORT NO 7382/3

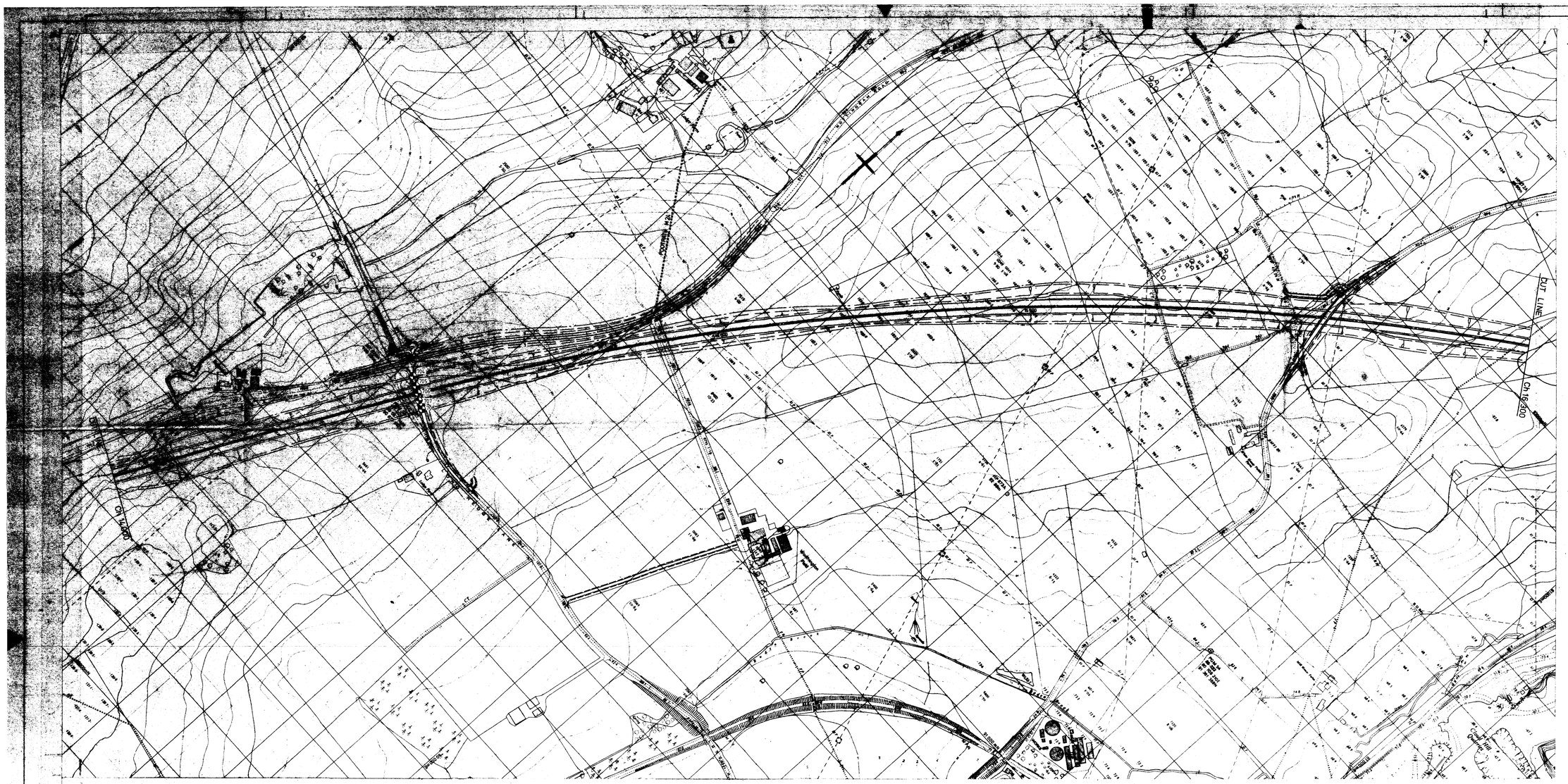
GROUND INVESTIGATION FOR A42 CASTLE DONINGTON NORTH CONTRACT 4

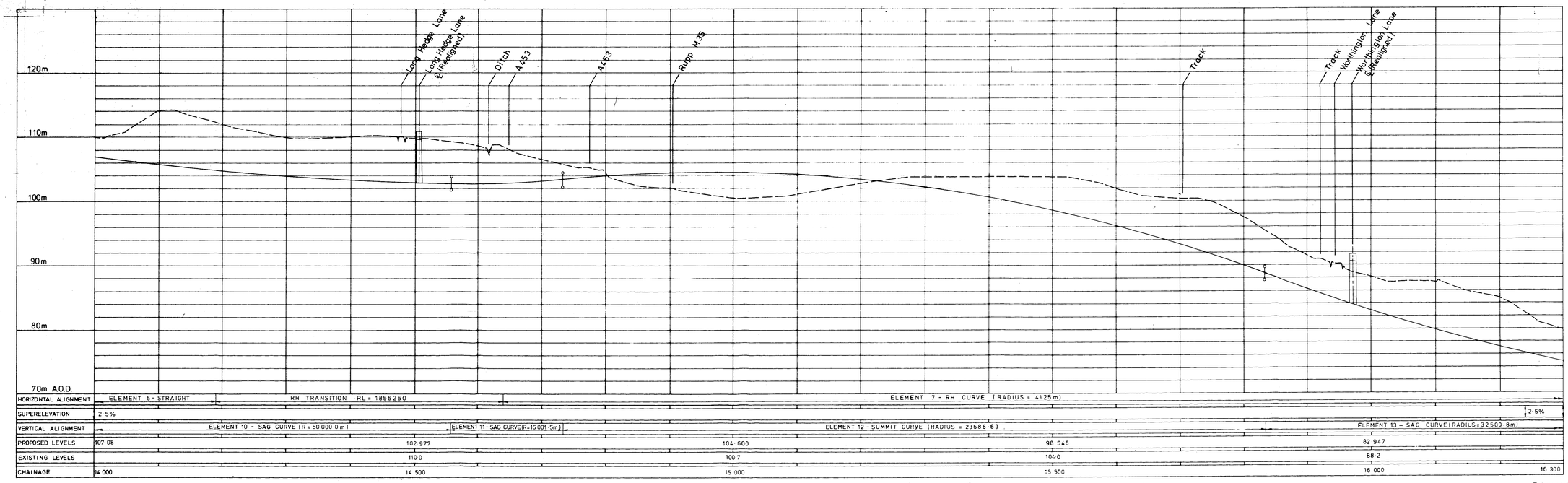
ABSTRACT

Fifty six boreholes put down to a maximum depth of 30.6 m encountered made ground, fill, alluvium, terrace and glacial deposits overlying Coal Measures, Keuper Sandstone and Keuper Marl. The report presents the results of the fieldwork and a programme of laboratory testing. No engineering appraisal of the scheme was required.


Track
Stream
Dismantled Railway
Ditch
B5387 Realigned
B5387
Ditch
Ditch
140m
130m
120m
110m
100m
90m AOD

| | | |





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ORIGINAL DRG SIZE 841 x 1189 (A0)

NOTES

- BOREHOLE LOCATION

Revision Details	By	Date	Suffix
Fencelines for landscaping plots. Access from Nottingham Road altered. Access added at White House Field Farm.	R.S.	Mar'88	A

Revision →

83040/9/133A

Scale HORIZONTAL 1:2500
VERTICAL 1:250

DRAWN	TRACED		DATE
			MAY 1987

DEPARTMENT OF TRANSPORT
EAST MIDLANDS REGIONAL OFFICE

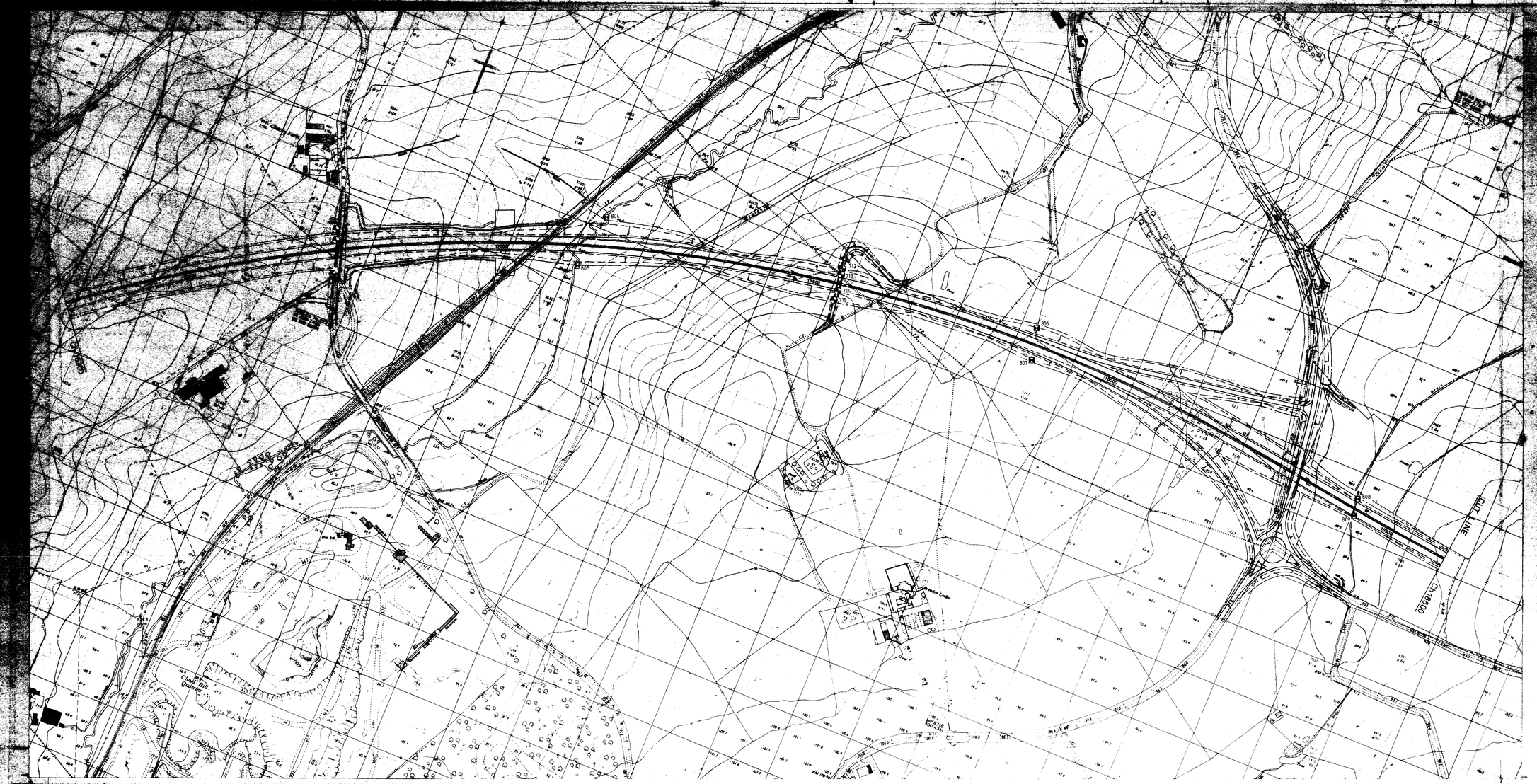
BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON
NORTH SECTION

GROUND INVESTIGATION CONTRACT 4
EXPLORATORY HOLE LOCATIONS

Soil Mechanics — Loc No. 7382 — Fig. 2

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Consulting Engineers and Transportation Planners
Bayheath House · Rose Hill West · Chesterfield
Derbyshire · S40 1JF

A4ROUTE 4664/83



ORIGINAL DRG SIZE 841 x 1189 (A0)

Fencelines for landscaping plots
Breeden lodge Track widened.
Doctors Lane South access, entrance altered.

Revision Details	By	Date
	RS	Mar.88

Revision

83040/9/134A

Scale HORIZONTAL 1:2500
VERTICAL 1:250

DRAWN	TRACED		DATE
D.H.	M.S.		APRIL 88

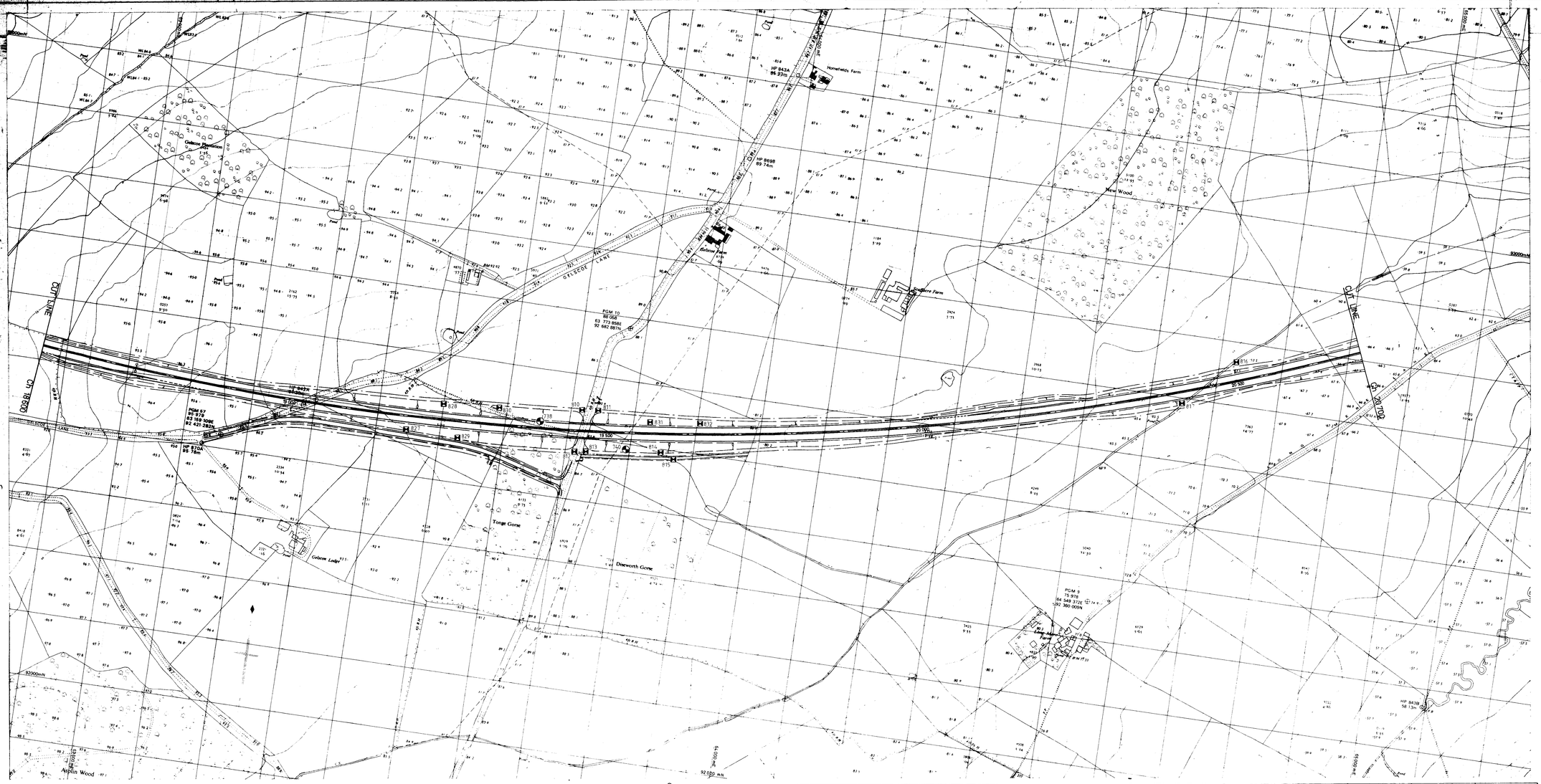
DEPARTMENT OF TRANSPORT
EAST MIDLANDS REGIONAL OFFICE

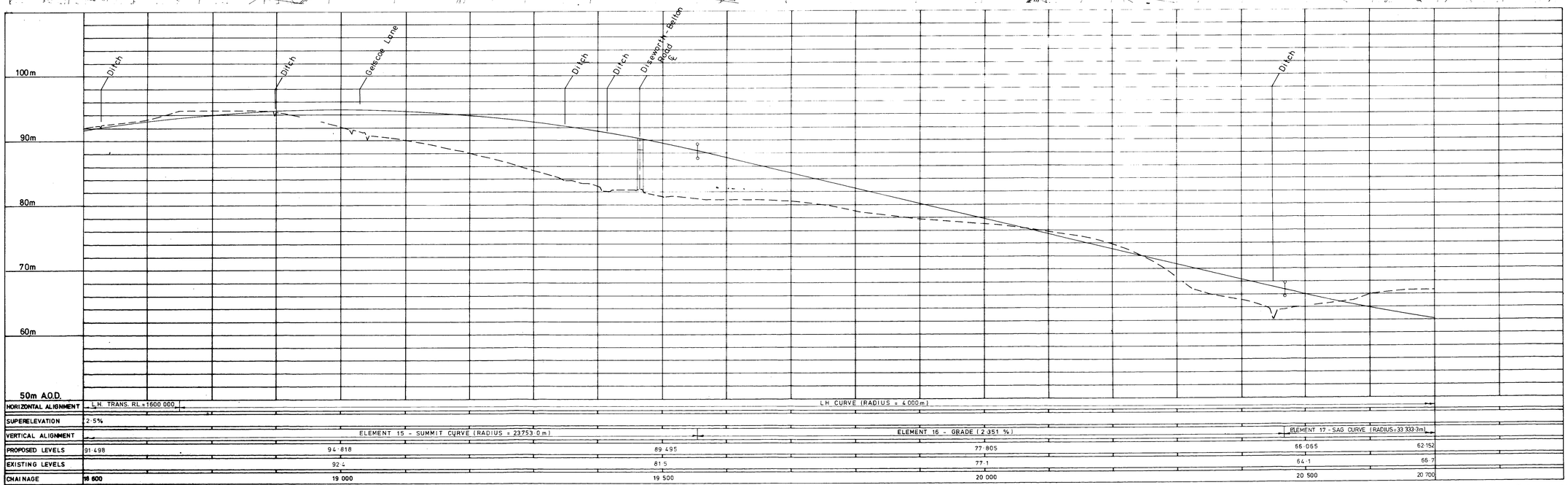
BIRMINGHAM-NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH SECTION

GROUND INVESTIGATION CONTRACT 4
EXPLORATORY HOLE LOCATIONS

Soil Mechanics Loc. No. 7382 Fig. 3

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NOTES

- BOREHOLE LOCATION
- TRIAL PIT LOCATION

Revision Details	By	Date	Suffix
Fencelines for landscaping plots Accesses added on Gelscoe Lane and Diseworth Lane Field entrance altered on Diseworth Lane	R S	Mar. 88	A

Revision

83040/9/135 A

Scale
HORIZONTAL 1 : 2500
VERTICAL 1 : 250

DRAWN	TRACED		DATE
D. H.			MAY 1987

DEPARTMENT OF TRANSPORT
EAST MIDLANDS REGIONAL OFFICE

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON
NORTH SECTION

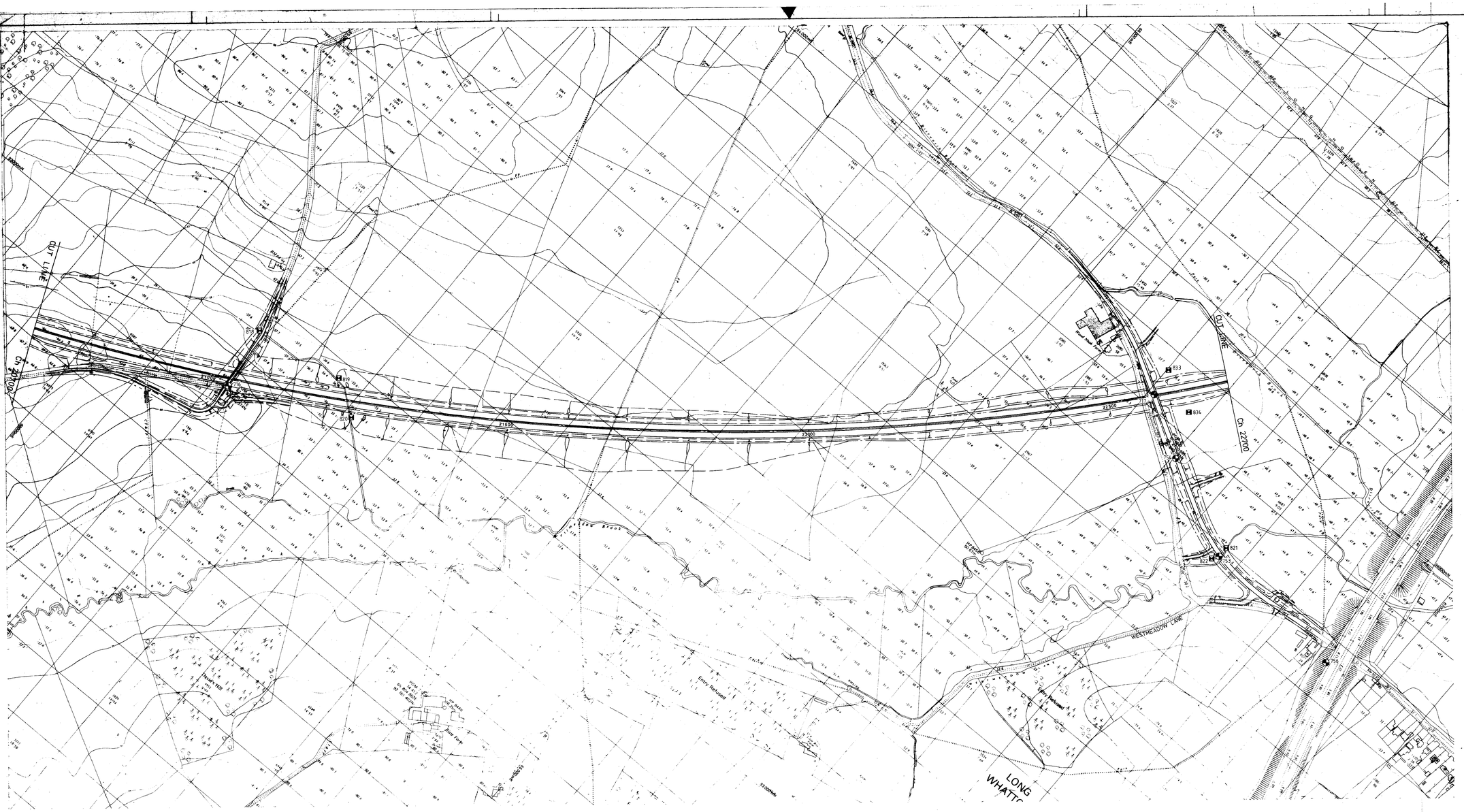
GROUND INVESTIGATION CONTRACT 4
EXPLORATORY HOLE LOCATIONS

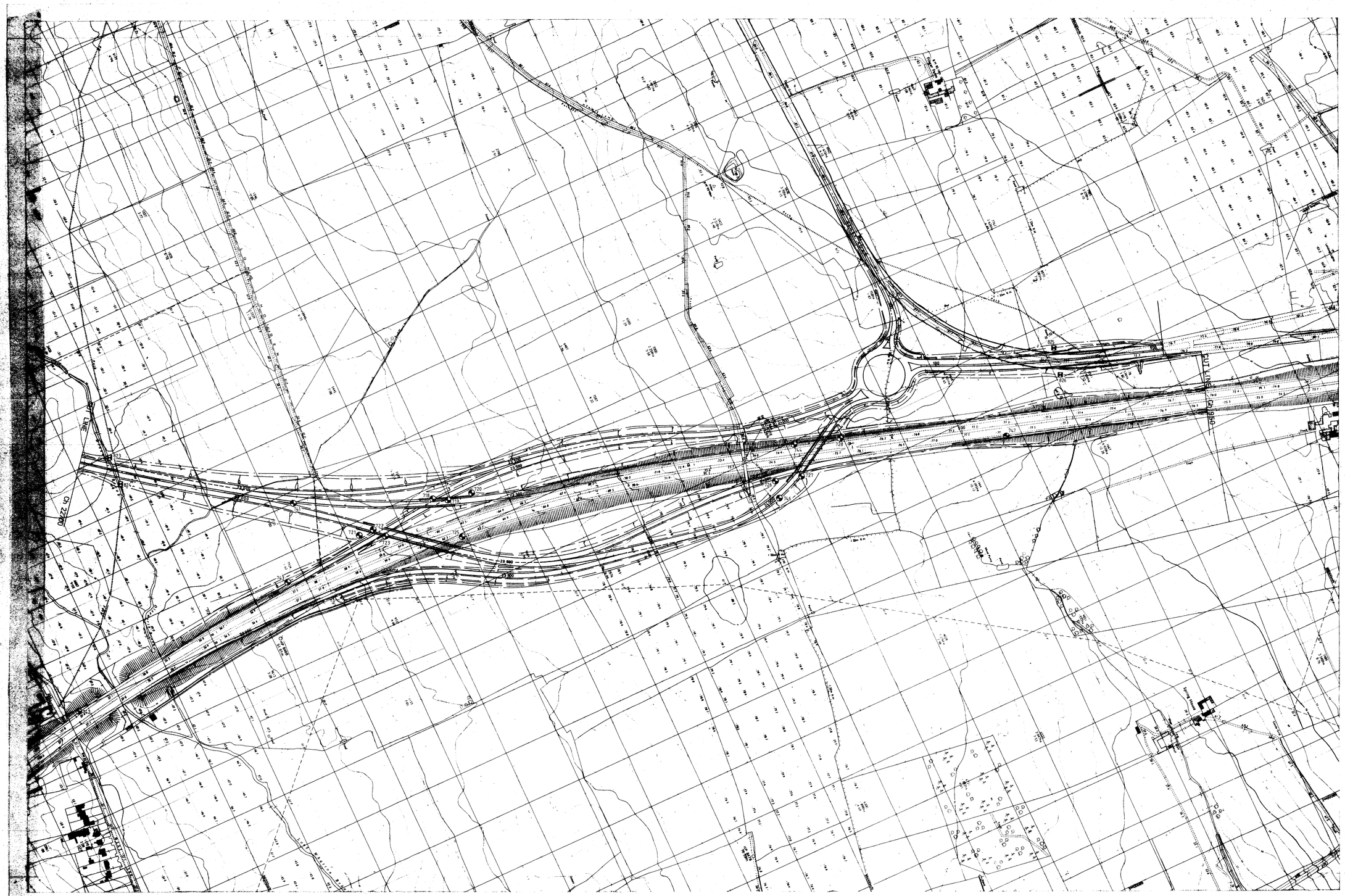
Soil Mechanics

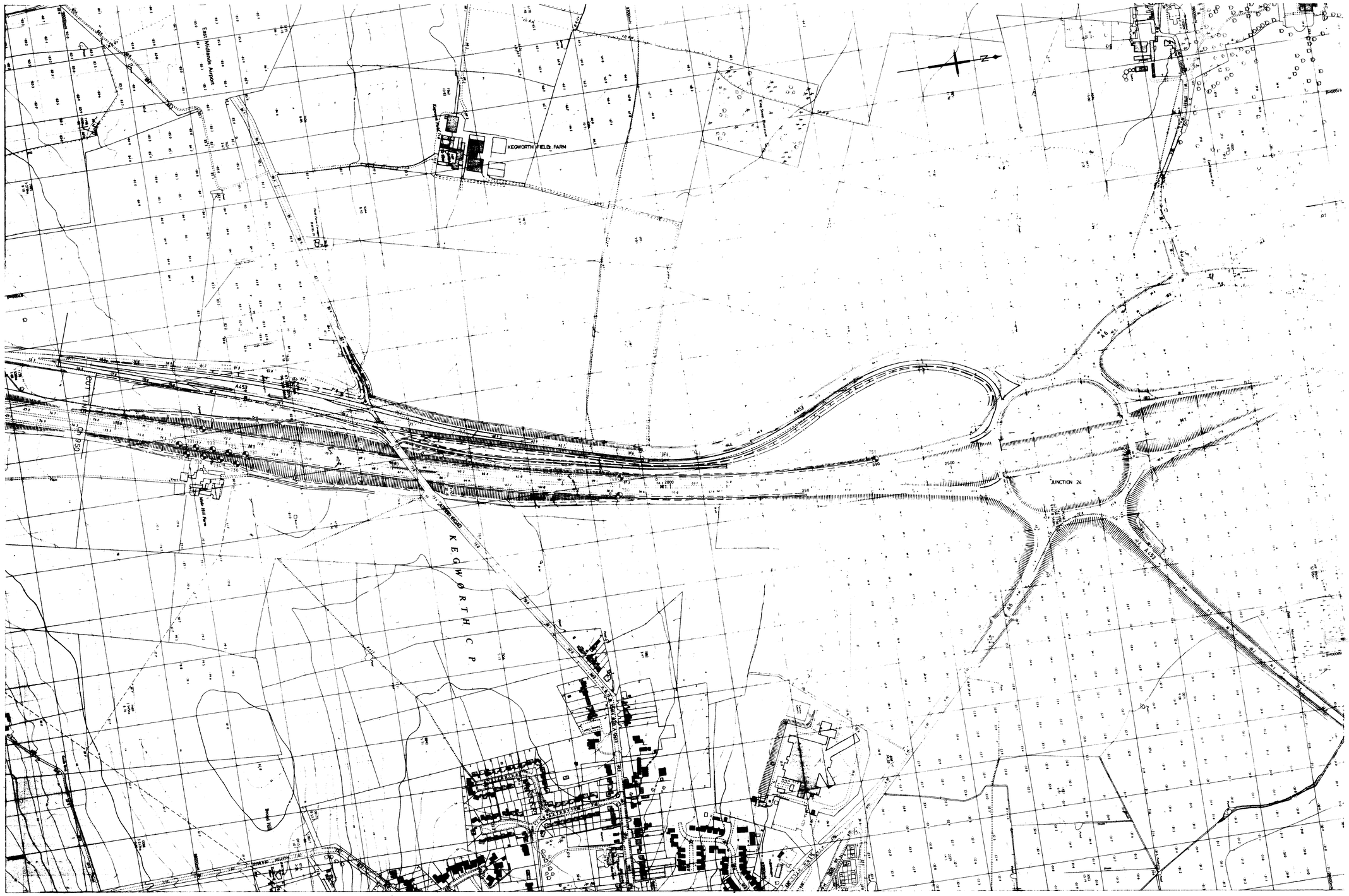
LC 83
1 : 2500
FIG. 4

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Derbyshire · S40 1JF

ORIGINAL DRG SIZE 841 x 1189 (A0)


CUT LINE
Ch 22700
CUT LINE
Ch 22700
WESTMEADOW LANE
Westmeadow Brook
Entry Retained
Entry Retained
Farmhouse
Farmhouse
Poor Farm
Poor Farm
Pond
Pond
Pond


A42
A50
A453
A6
A511
A444
A5
A38
A1
A2
A3
A4
A7
A8
A9
A10
A11
A12
A13
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A32
A33
A34
A35
A36
A37
A38
A39
A40
A41
A42
A43
A44
A45
A46



NOTES

- BOREHOLE LOCATION
- TRIAL PIT LOCATION

Revision Details	By	Date	Suffix
			Revision →

83040/9/138

Scale 1: 2500

DRAWN	TRACED	CHECKED	DATE
PJM	PJM		MAY '86

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EAST MIDLANDS REGIONAL OFFICE

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH

GROUND INVESTIGATION CONTRACT 4
EXPLORATORY HOLE LOCATIONS

Soil Mechanics Loc No. 7282 Fig. 7

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ORIGINAL DRG SIZE 841 x 1189 (A0)



NOTES

BOREHOLE LOCATION

Revision Details	By	Date	Suffix
			Revision →

83040/7/103

Scale
1:2500

DRAWN	TRACED	CHECKED	DATE
PJM	SM		APRIL 1988

DEPARTMENT OF TRANSPORT
EAST MIDLANDS REGIONAL OFFICE

BIRMINGHAM-NOTTINGHAM ROUTE

A42 CASTLE DONINGTON NORTH

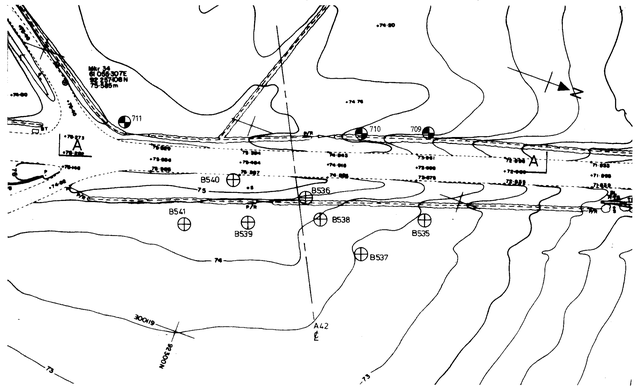
GROUND INVESTIGATION CONTRACT 4
EXPLORATORY HOLE LOCATIONS

Soil Mechanics Lor No. 7392 Fig 8

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Derbyshire · S40 1JF

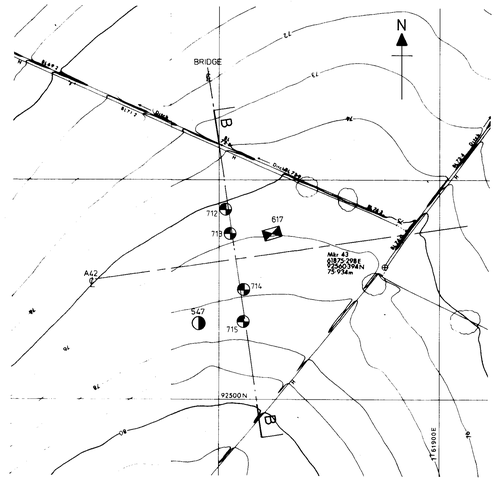
AARQUE 11.27.02

ORIGINAL DRG SIZE 841 x 1189 (AO)



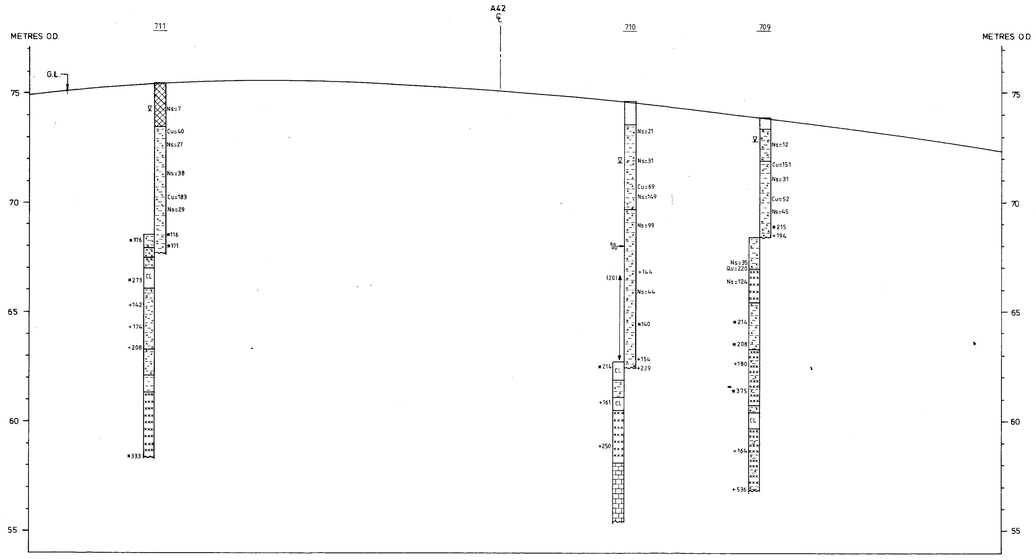
DOCTORS LANE BRIDGE

1:500



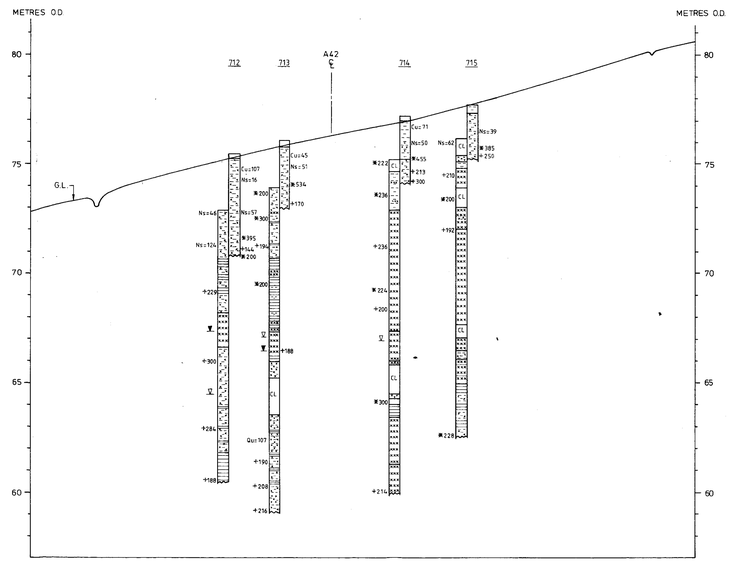
BREEDON LODGE TRACK BRIDGE

1:1000



A-A

HORIZONTAL 1:250 , VERTICAL 1:100



B-B

HORIZONTAL 1:500 , VERTICAL 1:100

NOTES

Ground Investigation Contract 3
B.B. Drilling Ltd. - April 1986

- Shell & Auger Borehole
- Shell & Auger Borehole extended by Rotary Coring
- Trial Pit

Ground Investigation Contract 4
Soil Mechanics Ltd.- 1987/88

- Cable tool borehole extended by rotary coring.

LEGEND

- Topsoil
- IP Inspection pit
- CL Assessed zone of core loss
- Made ground
- Clay
- Silt
- Sand
- Mudstone
- Siltstone
- Sandstone
- Limestone

- Maximum water level in standpipe or piezometer.
- Maximum standing water level during advancement of hole.
- 12Hr Level water rose to in 20 minutes.
- Level water struck.
- Seepage.

- Cu Undrained shear strength (kN/m^2)
- C', ϕ' Effective stress shear strength parameters (kN/m^2, degrees)
- Qu Uniaxial compressive strength of rock (kN/m^2)
- Ns SPT blow count.
- Nc CPT blow count
- * Full penetration not achieved - no. of blows after seating extrapolated to 300mm penetration.
- + Extrapolated to 300mm penetration from seating blows.

Revision Details	By	Date	Suffix
			Revision

83040/8/13

Scale: AS SHOWN

DRAWN	TRACED	CHECKED	DATE
M.G.	S.M.	DSC	MARCH 1988

DEPARTMENT OF TRANSPORT
EAST MIDLANDS REGIONAL OFFICE

BIRMINGHAM-NOTTINGHAM ROUTE
A42 CASTLE DONINGTON
NORTH SECTION

HOLE LOCATIONS AND SUBSOIL PROFILE

DOCTORS LANE BRIDGE AND BREEDON LODGE TRACK BRIDGE

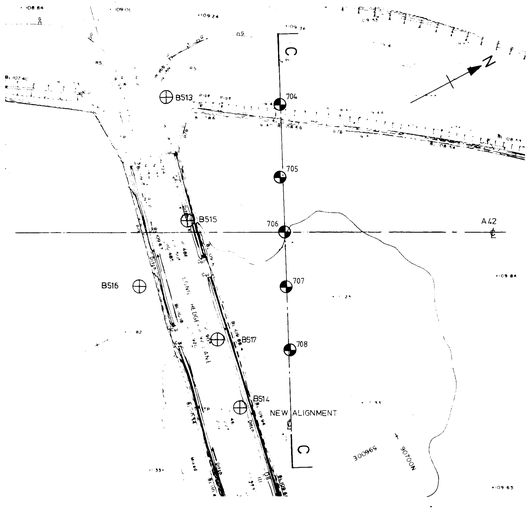
Soil Mechanics Loc. No. 7382 Fig. 9

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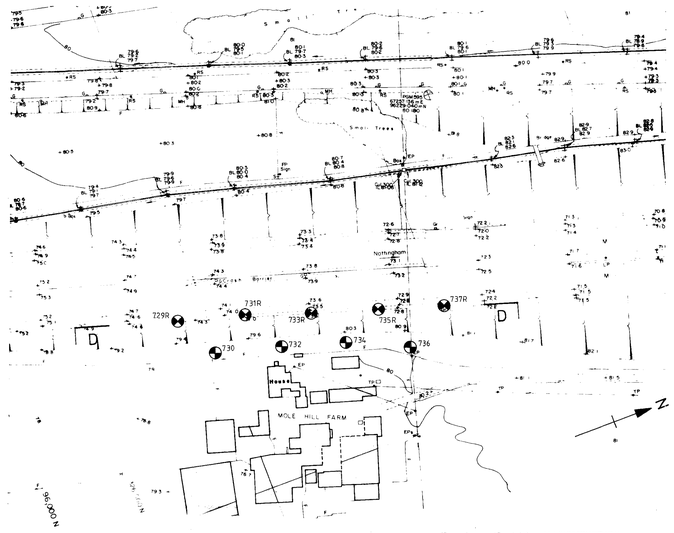
ORIGINAL DRG SIZE 841 x 1189 (A0)

AARQUE 4864/83



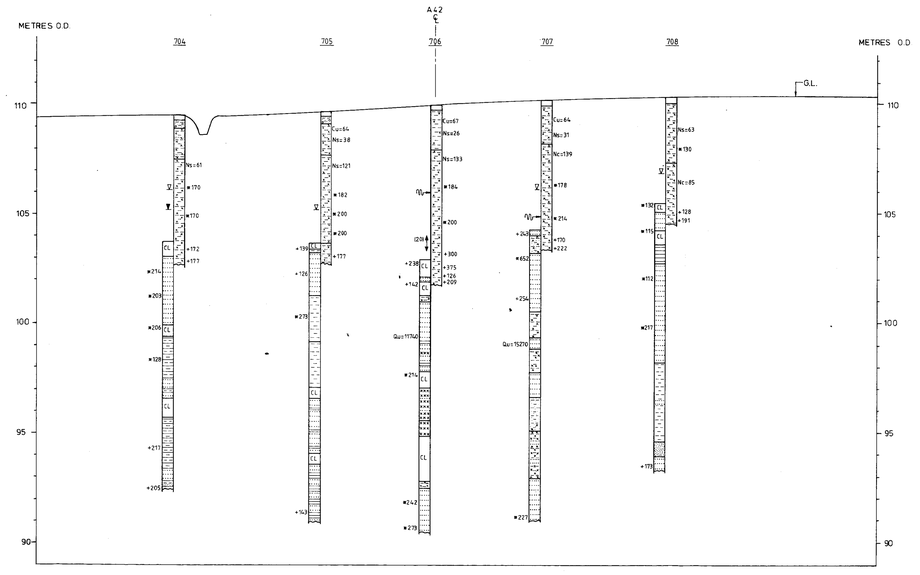
LONG HEDGE LANE BRIDGE

1:500



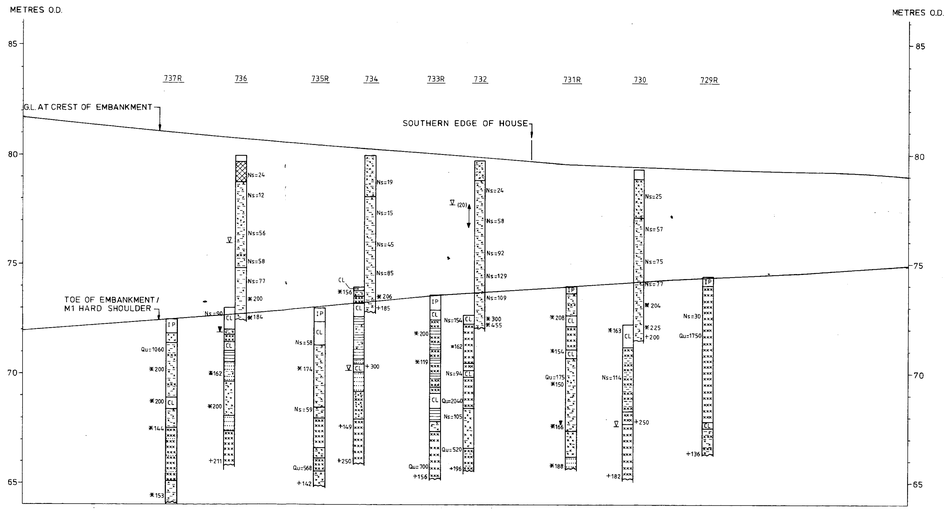
MOLE HILL FARM RETAINING WALL

1:1000



C-C

HORIZONTAL 1:250, VERTICAL : 1:100



D-D

HORIZONTAL 1:500, VERTICAL 1:100

NOTES

Ground Investigation Contract 3
B.B. Drilling Ltd. - April 1986

⊕ Shell & Auger Borehole extended by Rotary Coring

Ground Investigation Contract 4
Soil Mechanics Ltd. - 1987/88

Cable tool borehole extended by rotary coring.

Rotary coring drillhole.

LEGEND

- Topsoil
- IP Inspection pit
- CL Assumed zone of core loss
- Made ground
- Clay
- Silt
- Sand
- Gravel
- Mudstone
- Siltstone
- Sandstone
- ▼ Maximum water level in standpipe or piezometer.
- ⧖ Maximum standing water level during advancement of hole.
- (20)▲ Level water rose to in 20minutes.
- ▼ Level water struck.
- Seepage.
- Cu Undrained shear strength (kN/m^2).
- C',φ' Effective stress shear strength parameters (kN/m^2, degrees)
- Qu Uniaxial compressive strength of rock (kN/m^2).
- Ns SPT blow count
- Nc CPT blow count
- * Full penetration not achieved - no.of blows after seating extrapolated to 300mm penetration.
- + Extrapolated to 300mm penetration from seating blows.

Revision Details	By	Date	Suffix Revision →

83040/8/14

Scale: AS SHOWN

DRAWN	TRACED	CHECKED	DATE
M.G	S.M	DJC	MARCH 1988

DEPARTMENT OF TRANSPORT
EAST MIDLANDS REGIONAL OFFICE

BIRMINGHAM-NOTTINGHAM ROUTE
A42 CASTLE DONINGTON
NORTH SECTION

HOLE LOCATIONS AND SUBSOIL PROFILE

MOLE HILL FARM AND LONG HEDGE LANE BRIDGE

Soil Mechanics — Loc. No. 7382 — Fig. 10

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Consulting Engineers and Transportation Planners

Bayheath House · Rose Hill West · Chesterfield
Derbyshire · S40 1JF

ORIGINAL DRG SIZE 841 x 1189 (A0)

A42 CASTLE DONINGTON NORTH

ROADWORKS GEOTECHNICAL DESIGN REPORT

CONTRACT 2 : M1 WIDENING

October 1988

The Director (Transport)
Department of Transport
East Midlands Regional Office
Cranbrook House
Cranbrook Street
NOTTINGHAM
NG1 1EY

Scott Wilson Kirkpatrick & Partners
Bayheath House
Rose Hill West
CHESTERFIELD
Derbyshire
S40 1JF

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Geotechnical Design Notes

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M1 Widening	Ch 420 - 1450	Cut
M1 Widening	Ch 1450 - 1860	Fill

Longitudinal Soil Profiles		Drawing No
M1 Widening	Ch 0 - 650	83040/7/143
M1 Widening	Ch 650 - 1450	83040/7/144
M1 Widening	Ch 1450 - 2050	83040/7/145

BIRMINGHAM - NOTTINGHAM ROUTE A42 CASTLE DONINGTON NORTH	ROADWORKS GEOTECHNICAL DESIGN NOTE	CONTRACT 2	M1 Widening Ch 0 to CH 420	Issued AUG 88	Rev Date	A

GEOMETRY & TOPOGRAPHY	FILL	MAX HEIGHT 9.0 m	Existing embankment to be widened to accomodate new lanes.	DRAWING: 83040/7/143

GEOLOGY	See long section attached

EXPLORATORY HOLES	Boreholes: 747, 1306 Trial Pits: - Hole locations are shown on the attached drawing

GENERALISED SUBSOIL PROFILE	Base of stratum		Strata	Geological Classification
	Depth m	Level MAOD		
			Up to 8 m of very stiff red brown silty CLAY (embankment fill) overlying :	MG
	5.0		Firm to stiff red brown silty CLAY with frequent lithorelics, and occasional pockets and lenses of silt (Keuper Marl and possibly reworked Keuper Marl).	KM3/4
	> 9.0		Stiff red and grey silty CLAY and SILTSTONE (Keuper Marl).	KM3

GROUNDWATER	Groundwater information from the boreholes is shown on the attached long section. The variation of water levels in the standpipes/piezometers are shown on the attached graph(s) Summary: Water struck in borehole 1306 at approximately 4.5m depth , rising to 2.3m, in August 1961. Borehole 747 dry during boring.

M 1 Widening Ch 0 - Ch 420

MINING	NONE									
EMBANKMENT STABILITY ANALYSIS	Assumed fill materials: KM3/4				Volume of acceptable material in embankment 6200 m3				(2800 m3 of cut excluding topsoil in this section)	
		Assumed parameters							*Minimum factor of safety: In accordance with BS 6031:1981	
		Fill			Foundation soil					
		Cu kPa	c' kPa	phi' deg	Cu kPa	c' kPa	phi' deg	depth m	Factor of Safety	
	Long Term circular slip failure	-	0	28	-	5	30	2.5	*	Assumed water table: ru= 0.25
	Planar failure of new fill layer	-	0	28	Not relevant				*	Water table below new fill.
EMBANKMENT DESIGN RECOMMENDATIONS	Recommendation								Purpose	Area
	Side slopes: 1 (v) : 2.5 (h)								To match existing slope and ensure slope stability	ch 0 to ch 420
	a) Areas of weak founding soil where new fill is to be placed: Excavate unacceptable material to a maximum of 1.0m below existing level and replace with Class 6A2 material drained to toe drains.								a) To ensure stability of new fill.	a) Provisional allowance: 500 m3 ch 0 to ch 420 Actual extent to be directed by Engineer
	b) The existing slope is to be benched (maximum bench height 1m). Adjacent fill layer is to be placed immediately once bench is cut.								b) To ensure stability of of new fill.	
	Flood areas: i) Place Class 6F3 material to a minimum depth of 2m below earthworks outline and to 0.3m above maximum flood level in embankment shoulders.								Ensure slope stability under rapid draw-down	ch to ch N/A
	ii) Exclude Class 2B material below a level of 0.3m above maximum flood level within embankment.								Prevent collapse settlement on saturation	

M 1 Widening Ch 0 - Ch 420

DRAINAGE		Recommendation	Purpose	Area
	Settlement	Anticipated maximum post construction settlement less than 150 mm. (Seek further advice if critical)	Indicate where provision for loss of falls on drains or pavement or change in vertical alignment to be made.	ch to ch N/A
	Chemical attack	See separate design note.		
PAVEMENT DESIGN AND SUBGRADE TREATMENT	CBR	Subgrade: Acceptable fill Assume CBR is : < 2% New construction capping layer thickness : 600 mm		ch 0 to ch 420
	Cut/fill treatment	Provide in accordance with standard detail.	To reduce differential settlements in pavement.	ch N/A

M 1 Widening Ch 420 - Ch 1450

BIRMINGHAM - NOTTINGHAM ROUTE A42 CASTLE DONINGTON NORTH	ROADWORKS GEOTECHNICAL DESIGN NOTE	CONTRACT 2	M 1 Widening Ch 420 to Ch 1450	Issued / Rev AUG 88 / Date	A

GEOMETRY & TOPOGRAPHY	FILL	MAX HEIGHT 12 m	Existing slope to be cut back to allow widening of existing carriageway.	DRAWING: 83040/7/143 & 144

GEOLOGY: See long section attached

EXPLORATORY HOLES: Boreholes: 729 to 737 inclusive, 748, 749, 750, 1307 to 1310 inclusive
Trial Pits: 833 to 845 inclusive
Hole locations are shown on the attached drawing

GENERALISED SUBSOIL PROFILE

	Base of stratum Depth m	Base of stratum Level MAOD	Strata	Geological Classification
(from original ground level) Ch 420 to Ch 1420	0.4		Topsoil.	T
	7.5		Dense grey green sandy SILT with occasional lithorelicts and stiff to very stiff red brown very silty CLAY with occasional to frequent lithorelicts and pockets and lenses of silt and siltstone. (Keuper Marl).	KM3/4
	> 14.0		Red brown slightly to moderately weathered SILSTONE & SANDSTONE, weak to moderately weak, thinly interbedded with very stiff silty CLAY and clayey silt with frequent lithorelicts (Keuper Marl).	KM2/3
Ch 1400 to Ch 1450	1.5		Light grey green moderately weathered silty SANDSTONE, weak to very weak with occasional silt lenses (Keuper Sandstone).	KS3
	7.0		Very stiff red brown CLAY with occasional lithorelicts interlaminated with SILT and frequent bands of silty SAND (Keuper Sandstone).	
	> 7.0		Moderately weathered MUDSTONE, very weak (Keuper Marl).	KS2/3

GROUNDWATER: Groundwater information from the boreholes is shown on the attached long section.
The variation of water levels in the standpipes/piezometers are shown on the attached graph(s)

Summary: Highest G.W.L. encountered during drilling was in borehole 732 at 2.0m b.e.G.L. and probably represents a perched water table. Standpipes in boreholes 733 and 736, highest recorded G.W.L. is 2.3m and 8.1m b.e.G.L. respectively.

M 1 Widening Ch 420 - Ch 1450

MINING	NONE					
CUT SLOPE STABILITY	Stratum	H	c' kPa	phi' deg	Factor of Safety	Assumed water table:
	KM3/4		5	30		5m below existing ground level at slope crest and drawn down to toe of proposed cutting.
	KM2/3		10	31	Complies with BS 6031: 1981	
	Design Recommendations	Side slopes: 1(v): 2.5(h) ch 420 to ch 1450				Slope drainage: See DRAINAGE section of this note.
ACCEPTABILITY	Material from cutting Topsoil 6700 Other 50400	Total approx Volume (m3) (excl topsoil) 50400			Max % Unacceptable Overall 5%	See separate design note for acceptability criteria
DEFINITION OF HARD MATERIAL	A line is shown on the drawings below which the material should be defined in the Contract as hard material for excavation purposes. The line co-incides with the highest levels at which ripping is likely to be required, based on a review of the rotary drill hole information, rock strength tests and the paper. 'Logging the mechanical character of rock' Trans Inst Min Met, 80, (1971) by J A Franklin, E Broch and G Walton. The definition in the DTp Specification can apply to material above the line.					
DRAINAGE		Recommendations			Purpose	Area
	Slope Drains	Not required				
	Carriageway Drains	Special requirement. Drains to incorporate fabric membrane in areas of silty sand.			Fabric is to prevent clo gging of drain by silty sand.	ch 420 to ch 1450
	Chemical attack	See separate design note.				
PAVEMENT DESIGN AND SUBGRADE TREATMENT	CBR	Subgrade: KM/KS 3/2 Assume CBR is : 2 - 5 % New/reconstruction capping layer thickness : 350 mm				ch 420 to ch 1450
	Cut/Fill treatment	Provide in accordance with standard detail			To reduce differential settlements in pavement	ch N/A
	Treatment of soft areas	Excavate unacceptable material to a maximum of 1.0m below finished road level and replace with Class 6F3 material drained to carriageway drains.			To ensure pavement deflections remain within acceptable limits.	No soft material identified on logs. Provisional allowance: 150 m3 ch 1150 to ch 1450 Actual extent to be directed by Engineer

M 1 Widening Ch 420 - Ch 1450

ACCEPTABILITY DATA SHEET

COHESIVE SOILS :
Criteria : W max < 1.3 PL for PL/PI = 0
Varying linearly to
W max < 1.0 PL for PL/PI > 2.1
MCV > 8 Cu (rem) > 40 KN/m2

NON COHESIVE SOILS :
Criterion :
W max < OMC* + 1.5%
* standard compaction

Soil type	Hole	Depth	W	PL	LL	PI	W -- PL	PL -- PI	At natural m.c MCV	At natural m.c Cu rem	At natural m.c CBR	W	Comp Test	W at % m.d.d 95-	W at % m.d.d 98-	W at % m.d.d 100	W at % m.d.d 98 +	W at % m.d.d 95+
KM 3/4a	1307	1.5-2.0		18	35	17		1.06										
KM 3/4a		4.6-5.0	13	21	29	8	0.62	2.63										
KM 3/4a		6.1-6.5	15	18	31	13	0.83	1.38										
KM 3/4a		7.3-7.6	15								18.8T 17.6T							
KM 3/4a		8.8-9.1		17	32	15		1.13										
KM 3/4a	1308	0.8	14															
KM 3/4a	1308	1.5-2.0	26	19	33	14	1.37	1.36										
KM 3/4a	1308	2.3	21															
KM 3/4a	1308	3.1-3.5	17	19	34	15	0.90	1.27										
KM 3/4a	1308	3.4	16															
KM 3/4a	1308	3.8	14															
KM 3/4a	1308	4.6-4.9	15	19	33	14	0.79	1.36								12	14.3	
KM 3/4a	1308	5.3	15															
KM 3/4a	1308	6.1-6.5	15	18	32	14	0.83	1.29										
KM 3/4a	1308	6.9	18															
KM 3/4a	1308	7.6-7.9	17	16	33	17	1.06	0.94							11.6	14.3	16.3	17.2
KM 3/4a	1308	8.4	19															
KM 3/4a	1308	9.1-9.3	16	19	33	14	0.84	1.36										
KM 3/4a	1308	9.9	19															
KM 3/4a	1308	10.7-11.1	17	19	28	9	0.89	2.11			11.7T 13.7T 8.0B 10.2B							
KM 3/4a	1308	12.2	22															
KM 3/4a	1308	12.8-13.3	12	20	30	10	0.80	2.0										
KM 3/4a	1308	13.7	21															
KM 3/4a	1308	14.5	20															

M 1 Widening Ch 420 - Ch 1450

ACCEPTABILITY DATA SHEET

COHESIVE SOILS :
Criteria : W max < 1.3 PL for PL/PI = 0
Varying linearly to
W max < 1.0 PL for PL/PI > 2.1
MCV min > 8 Cu (rem) > 40 KN/m2

NON COHESIVE SOILS :
Criterion :
W max < OMC* + 1.5%
* standard compaction

Soil type	Hole	Depth	W	PL	LL	PI	W / PL	PL / PI	At natural m.c MCV	At natural m.c Cu rem	At natural m.c CBR	W	Comp Test	W at % m.d.d 95-	W at % m.d.d 98-	W at % m.d.d 100	W at % m.d.d 98 +	W at % m.d.d 95+
Topsoil	1309	0.8	8															
Topsoil	1309	1.2	15															
KM3/4a	1309	1.5-2.0	18	20	37	17	0.9	1.18										
KM3/4a	1309	2.3	15															
KM3/4a	1309	3.1-3.4		16	31	15		1.07							10.9	12.9	15.0	
KM3/4a	1309	3.8	16															
KM2/3	1309	4.6-4.9	19	17	30	13	1.12	1.31										
KM2/3	1309	5.3	15															
KM2/3	1309	6.1-6.4	13	19	30	11	0.68	1.73								13	15.3	16.8
KM2/3	1309	6.9	17															
KM2/3	1309	9.9	20															
KM2/3	1309	10.7	22															
KM2/3	1309	11.4	21															
KSM3/4a	1310	0.6	8	17	36	19	0.47	0.89										
KSM3/4a	1310	1.5	15															
KSM3/4a	1310	1.5-2.0	20	19	31	12	1.05	1.58						11.3	13.9	15	16.7	18.2
KSM3/4a	1310	3.0	14															
KSM3/4a	1310	3.4-3.5	12	20	28	8	0.6	2.5										
KSM3/4a	1310	4.6	7															
KSM3/4a	1310	5.2-5.5	9	19	34	15	0.47	1.27										
KSM3/4a	1310	6.1	21															
KSM3/4a	1310	6.7-6.9	18	17	26	9	1.06	1.89										
KSM3/4a	1310	7.6	15															

BIRMINGHAM - NOTTINGHAM ROUTE	ROADWORKS GEOTECHNICAL	CONTRACT 2	M 1 Widening	Issued	Rev	A
A42 CASTLE DONINGTON NORTH	DESIGN NOTE		Ch 1450 to Ch 1860	AUG 88	Date	

GEOMETRY & TOPOGRAPHY	FILL	MAX HEIGHT 4 m	DRAWING : 83040/7/145
GEOLOGY	See long section attached		
EXPLORATORY HOLES	Boreholes: 751, 1311 Trial Pits: - Hole locations are shown on the attached drawing		

GENERALISED SUBSOIL PROFILE	Base of stratum Depth m	Base of stratum Level MAOD	Strata	Geological Classification
	0.2		Topsoil (verge and embankment slopes).	T
	1.1		Stiff red brown very silty CLAY with a little gravel and sandstone cobbles and tarmac (made ground).	MG
	2.5		Dense red brown very clayey SILT with rare lithorelicts, locally with a little gravel (made ground-embankment fill).	MG
	5.0		Brown sandy SILT locally very clayey with rare gravel and SAND with some chert gravel (River terrace deposits).	Recent
	> 7.0		Stiff becoming very stiff red brown very silty CLAY with frequent lithorelicts and occasional pockets and lenses of silt (Keuper Marl). Geoological plan indicates Keuper Sandstone Ch 1450 to Ch 1790.	KM3/4

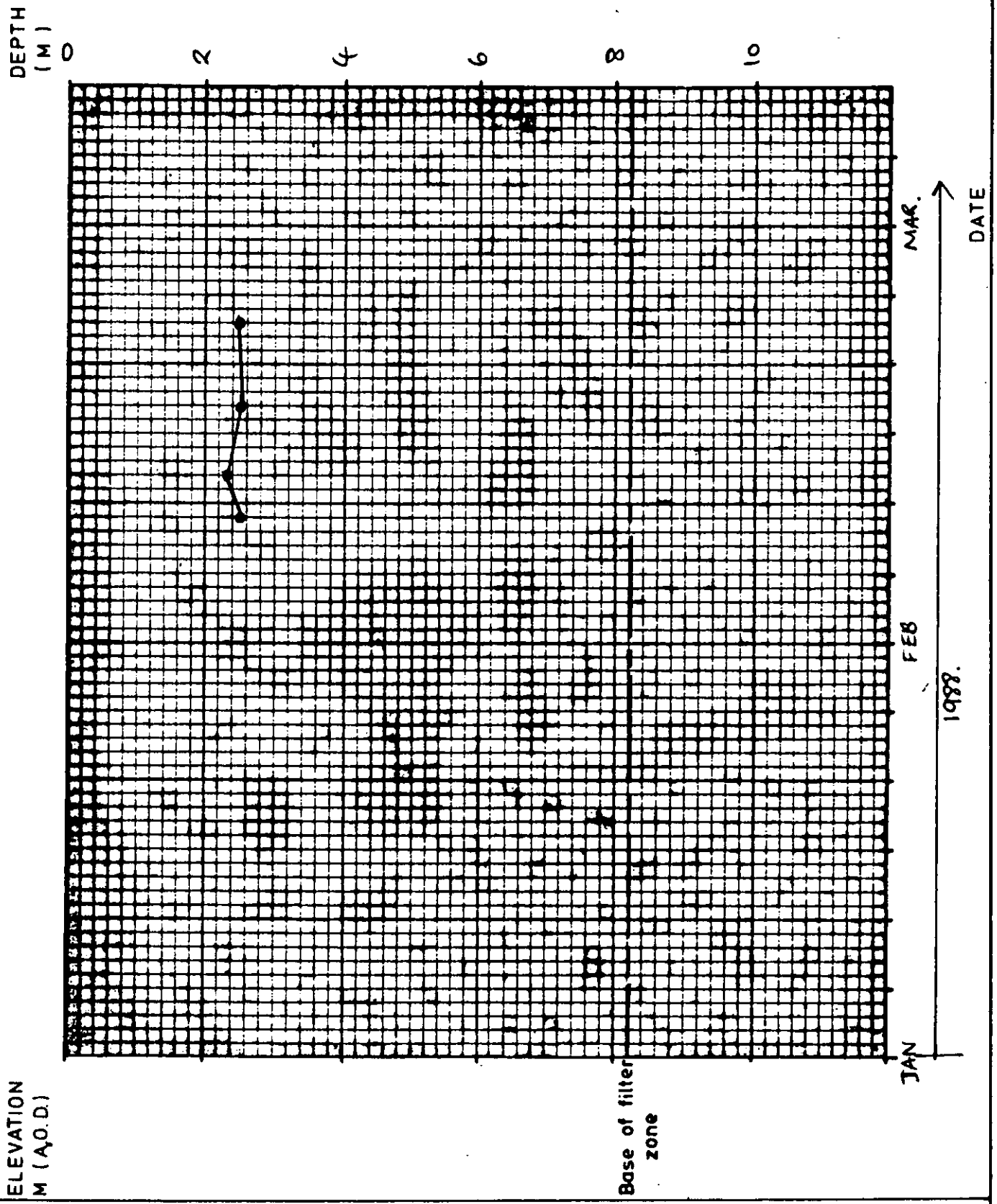
GROUNDWATER	Groundwater information from the boreholes is shown on the attached long section. The variation of water levels in the standpipes/piezometers are shown on the attached graph(s) Summary: Highest G.W.L. recorded during drilling of borehole 751 is 1.70m b.e.G.L. Standing G.W.L. during drilling of borehole 1311 (August 1961) was 1.2m below original G.L. (40.0m AOD).

M 1 Widening Ch 1450 - Ch 1860

MINING	NONE										
EMBANKMENT STABILITY ANALYSIS	Assumed fill materials: KM 3/4				Volume of acceptable material in embankment 1000 m3				(2700 m3 of cut excluding topsoil in this section)		
		Assumed parameters									
		Fill			Soft foundation soil				Factor of Safety	*Minimum factor of safety: In accordance with BS 6031:1981	
		Cu kPa	c' kPa	phi' deg	Cu kPa	c' kPa	phi' deg	depth m			
	Long Term failure	Slope similar to existing							*	Assumed water table: ru =	
	Short Term failure	Not critical							*		
	Planar failure of new fill layer	-	0	28	Not Relevant				*		
EMBANKMENT DESIGN RECOMMENDATIONS	Recommendation									Purpose	Area
	Side slopes: 1 (v) : 2.5 (h) maximum									Ensure slope stability	ch 1450 to ch 1860
	Areas of weak founding soils where new fill is to be placed: Excavate unacceptable material to a maximum of 1.0m below existing level and replace with Class 6A2 material drained to toe drains.									To ensure stability of new fill.	Provisional allowance: 300 m3 Ch 1450 to Ch 1830 Actual extent to be directed by Engineer
	Existing embankment slope to be benched (benches max. 1m high). Adjacent fill layer is to placed immediately once bench is cut.									Ensure stability of new fill.	West slip Ch 1665 to Ch 1863 East slip Ch 1640 to Ch 1750
	Flood areas: i) Place Class 6F3 material to a minimum depth of 2m below earthworks outline and to 0.3m above maximum flood level in embankment shoulders. ii) Exclude Class 2B material below a level of 0.3m above maximum flood level within embankment									Ensure slope stability under rapid draw-down. Prevent collapse settlement on saturation	ch to ch N/A

M 1 Widening Ch 1450 - Ch 1860

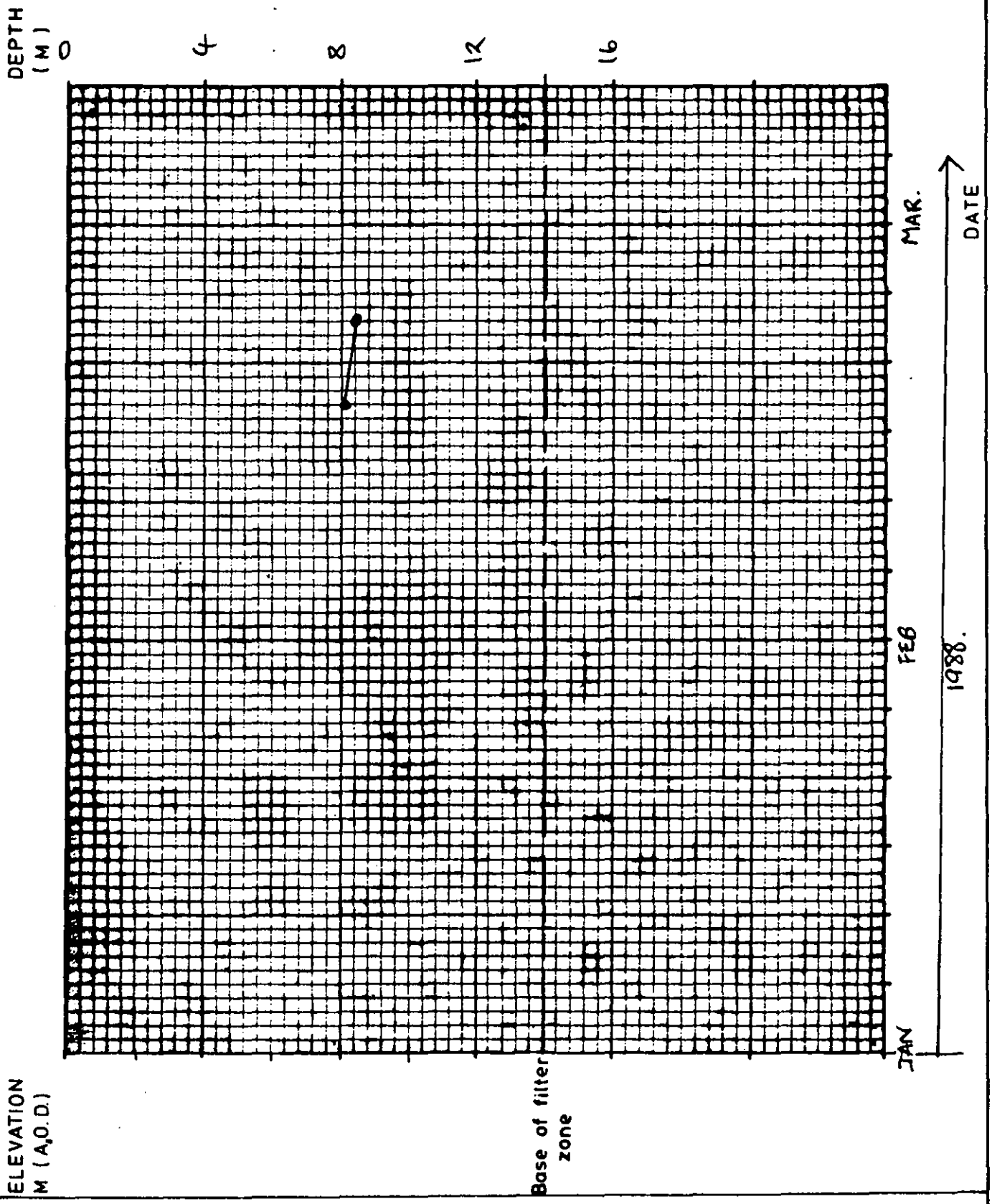
DRAINAGE		Recommendation	Purpose	Area
	Settlement	Anticipated maximum post construction settlement less than 150 mm. (Seek further advice if critical)	Indicate where provision for loss of falls on drains or pavement or change in vertical alignment to be made.	ch N/A to ch
	Embankment Toe Drain	Special requirements : In areas of silt or sand install french drain with fabric membrane or lined open ditch.	To prevent erosion of side of open ditch.	Replace existing with lining.
	Chemical attack	See separate design note.		
PAVEMENT DESIGN AND SUBGRADE TREATMENT	CBR	Subgrade: Acceptable fill Assume CBR is : < 2% New/reconstruction capping layer thickness 600 mm		ch 1450 to ch 1860
	Cut/fill treatment	Provide in accordance with standard detail.	To reduce differential settlements in pavement.	ch N/A



Notes:

STANDPIPE

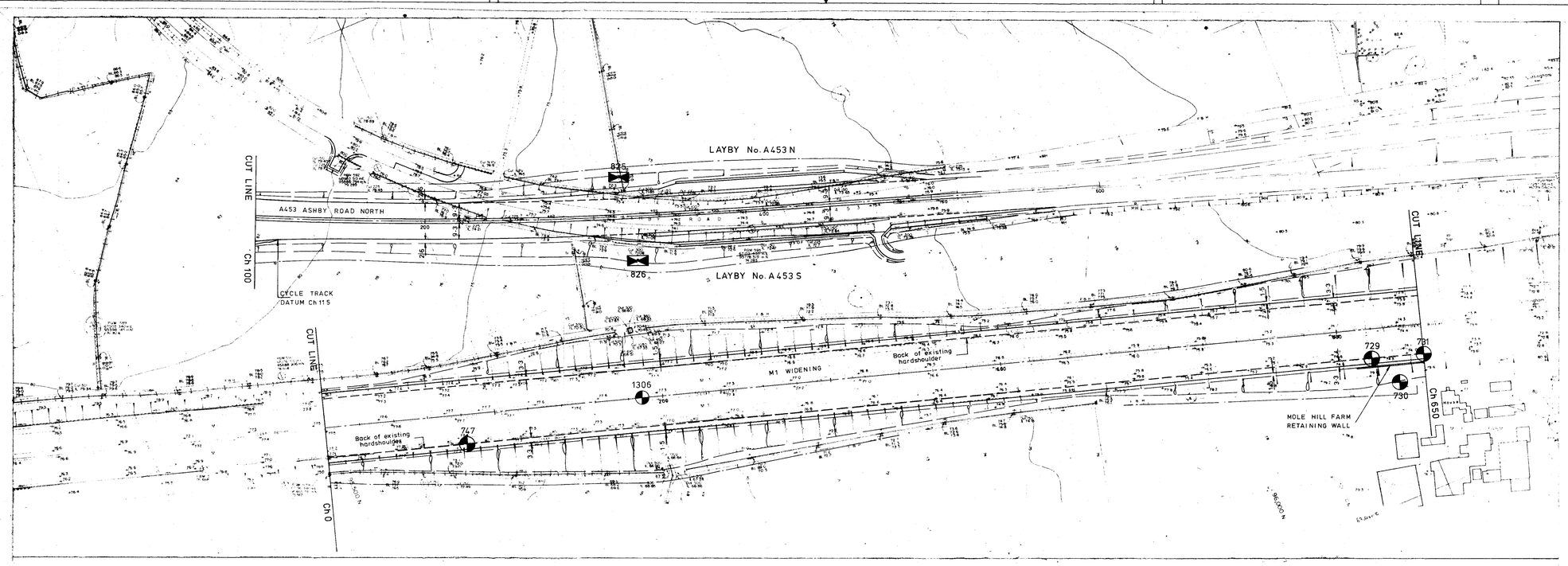
A42 CASTLE DONINGTON SITE INVESTIGATION (NORTH)	PIEZOMETER AND STANDPIPE READINGS	Hole No. 733
		Fig No.



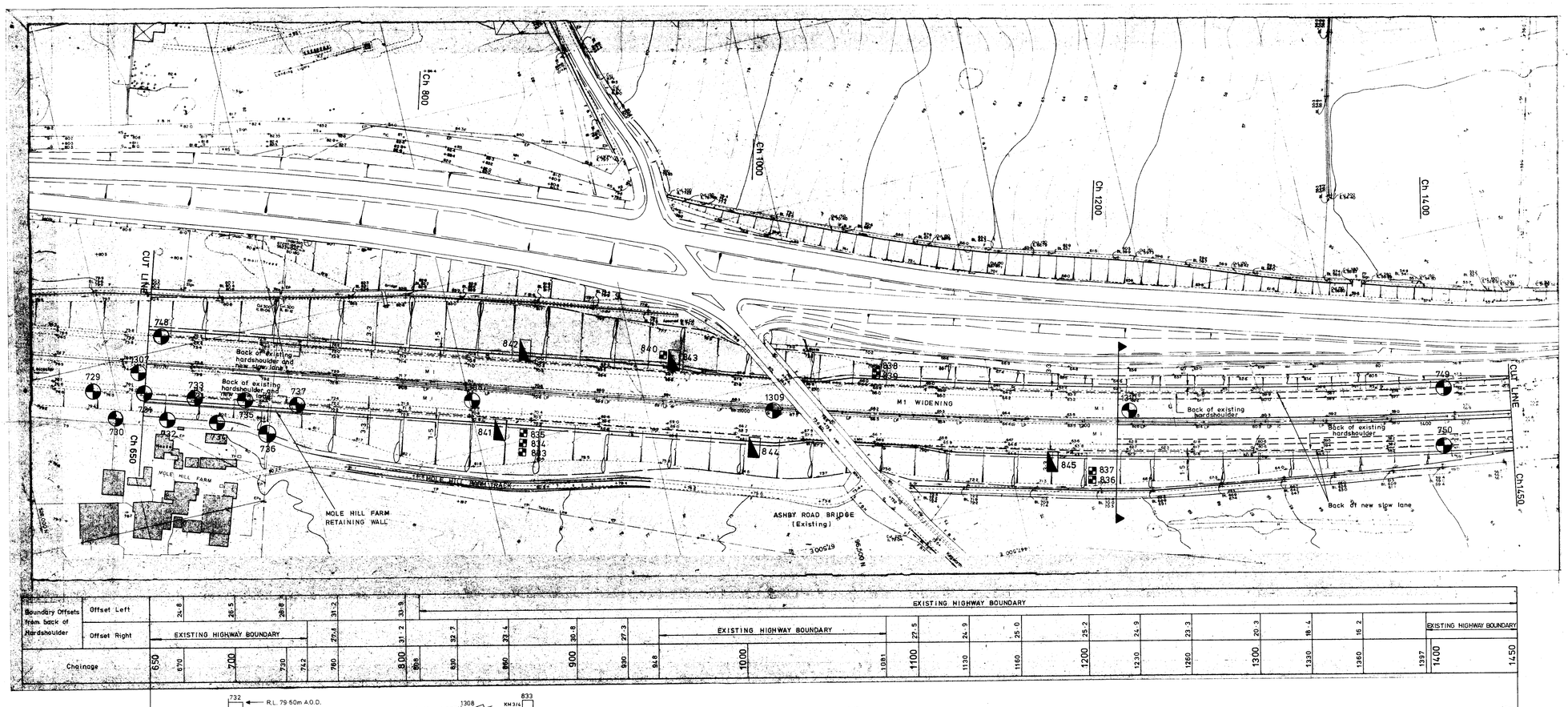
Notes :

STANDPIPE

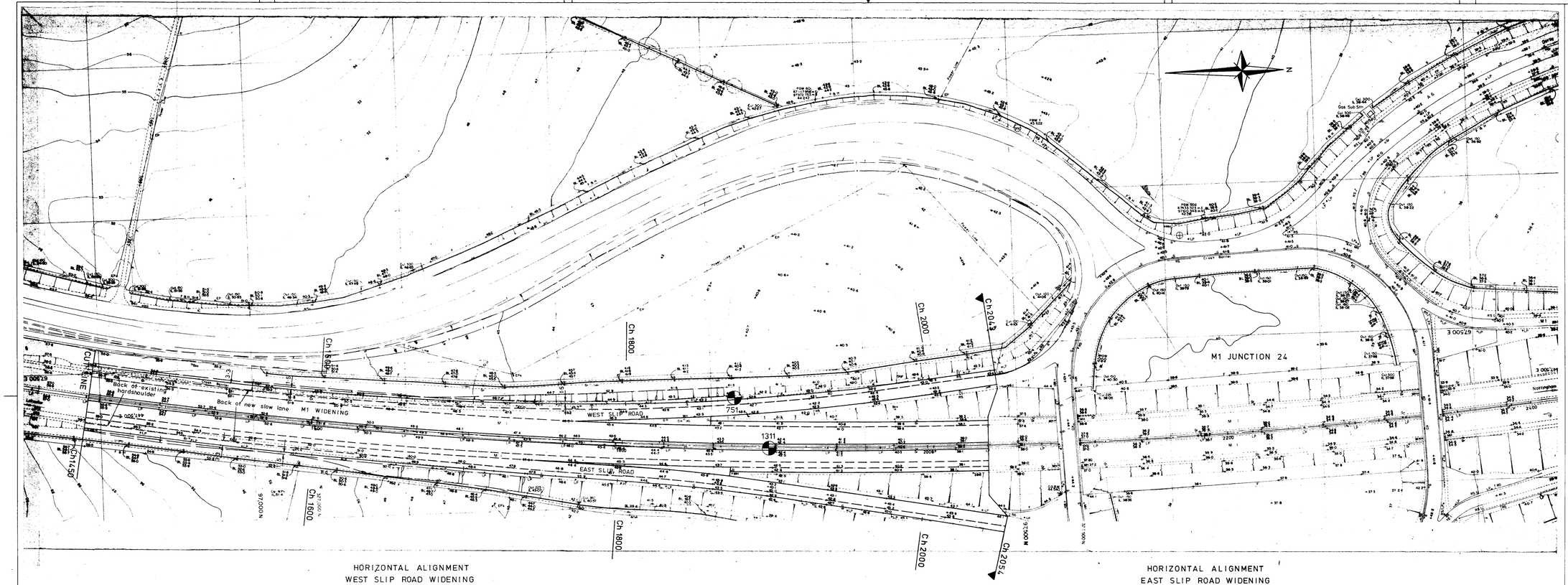
A42 CASTLE DONINGTON SITE INVESTIGATION (NORTH)	PIEZOMETER AND STANDPIPE READINGS	Hole No. 736
		Fig No.



| Boundary Offsets from back of Hardshoulder | | |



| Boundary Offsets from back of Hardshoulder | | |



HORIZONTAL ALIGNMENT
WEST SLIP ROAD WIDENING

HORIZONTAL ALIGNMENT
EAST SLIP ROAD WIDENING

Horizontal Alignment Back of Hardshoulder	Ⓐ	ELEMENT 1 - LH CURVE (RADIUS = 3288·500)	Ⓑ	ELEMENT 2 - LH CURVE (RADIUS = 2100·000)	LH TRANSITION RL = 89725·200	Ⓒ	Ⓓ
Chainage	1473·295	1503·255	1556·285	1573·264	1777·336	1819·547	1833·255	1863·584

EXCAVATE UNACCEPTABLE MATERIAL WHERE NEW FILL IS TO BE PLACED TO A MAXIMUM OF 1·0m BELOW EXISTING LEVEL AND REPLACE WITH CLASS 6A2 MATERIAL DRAINED TO TOE DRAINS PROVISIONAL: 300 m³ CH 1450 CH 1830

PROPOSED HARD MATERIAL LINE

EXISTING EMBANKMENT SLOPES TO BE BENCHED Ch 1665 TO Ch 1863

WEST SLIP ROAD BACK OF EXISTING HARDSHOULDER

KEUPER SANDSTONE

CONJECTURED FAULT

KEUPER MARL

MADE GROUND

RIVER TERRACE DEPOSITS

751

1311

MG

KM 3/4

KM 3/4

Ns = 23 ▲ (20)

Ns = 31 ▼

Ns = 23

Ns = 41

Ns = 52

DATUM 35·0

Chainage	1473·26	1500	1600	1700	1800	1863·58

Horizontal Alignment Back of Hardshoulder	Ⓔ	ELEMENT 2 - LH CURVE (RADIUS = 4000·000)	LH TRANSITION RL = 120000·000	ELEMENT 3 - STRAIGHT	Ⓕ
Chainage	1393·182	1423·182	1641·602	1671·602	1720	1750

EXISTING EMBANKMENT SLOPE TO BE BENCHED Ch 1640 TO Ch 1750

EAST SLIP ROAD BACK OF EXISTING HARDSHOULDER

DATUM 35·0

Chainage	1453	1500	1600	1700	1750

LEGEND

- Trial Pit
- Trial Trench
- Borehole
- (S) Standpipe
- (P) Piezometer
- 30/15/15 Liquid Limit/Plastic Limit/Plasticity Index
- Cu Undrained shear strength (kN/m²)
- C', ϕ' Drained shear strength parameters (kN/m², degrees)
- Qu Uniaxial compressive strength of rock (kN/m²)
- N SPT blow count
- Nc CPT blow count
- * Full penetration not achieved - no. of blows after seating extrapolated to 300mm penetration
- + Extrapolated to 300mm penetration from testing blows
- (WP) SPT blow count when no penetration
- m Moisture content (%)
- W Without Gravel
- M Microwave
- Maximum water level in standpipe or piezometer
- Standing water level during advancement of hole
- ▲ (20) Level water rose to in 20 minutes
- ▼ Level water struck
- Seepage

Revision Details	By	Date	Suffix Revision

83040/7/145

Scale
Horizontal 1:1000 Vertical 1:100

DRAWN	TRACED	CHECKED	DATE
S.J.H.	S.R.G.	R.L.H.	SEPT. 1988

DEPARTMENT OF TRANSPORT
EAST MIDLANDS REGIONAL OFFICE

BIRMINGHAM-NOTTINGHAM ROUTE

A42 CASTLE DONINGTON NORTH SECTION

ROADWORK GEOTECHNICAL DESIGN REPORT

M1 WIDENING
EAST AND WEST SLIP ROADS

PLAN AND LONGITUDINAL SOIL PROFILE

Scott Wilson Kirkpatrick & Partners
Consulting Engineers and Transportation Planners

Bayheath House · Rose Hill West · Chesterfield
Derbyshire · S40 1JF

AARQUE 4664/82

ORIGINAL DRG SIZE 841 x 1189 (A0)

Exploration Associates (Warwick) Limited, Geotechnical House, Hatton, Warwick CV35 7JL. Tel: 0926 41743.

DEPARTMENT OF TRANSPORT

A564 STOKE-DERBY LINK

DERBY SOUTHERN BY-PASS

ISLEY WALTON TO M1 SECTION

FACTUAL REPORT (VOL. 1)

ON PRELIMINARY SITE INVESTIGATION

S2796

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S2796

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Bound Separately

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1. INTRODUCTION

On the instruction of the Midland Road Construction Unit a preliminary investigation into ground conditions was undertaken by Exploration Associates (Warwick) Limited at the site for the proposed A564 Stoke-Derby Link, Isley Walton to M1 section.

2. OBJECT

The object of the investigation was to obtain preliminary information regarding the soil and groundwater conditions likely to be encountered along the proposed line of the Derby Southern By-Pass of the Stoke-Derby Link between Isley Walton and the M1 and hence to assist in the initial design of the road, its associated structures and further site investigation work.

3. PRESENTATION

This report is presented in two volumes as follows:-
Volume 1 - This Volume. Contains the Factual Data Obtained
Volume 2 - Presents the assessment of the significance of this data in relation to the proposed works.

4. PROCEDURE

4.1 General

Ground conditions at the site were determined by drilling boreholes and undertaking laboratory tests on samples recovered. The data so obtained together with published information, drawings supplied by the client and the current design proposals form the basis of this report.

4.2 Drilling

During the period of 9th March 1981 to 27th March 1981, eleven boreholes were drilled to depths of between 5.0 metres and 15.0 metres below existing ground level using Cable Tool (Shell & Auger) boring techniques. In addition, five of these boreholes were continued using Pendant Rotary Coring techniques and water as the flushing medium. Two boreholes were drilled by Hand Auger to a maximum depth of 1.8 metres below existing gound level.

4.2.1 Summary of Drilling Works

B.H. Ref.	Depth of Cable Tool Drilling	Depth of Rotary Drilling
1	G.L. - 6.3m	NIL
B2	G.L. - 9.0m	9.0 - 15.0m
B3	G.L. - 9.5m	9.5 - 15.0m
4	G.L. - 5.0m	NIL
5	G.L. - 5.0m	NIL
6	(Hand Auger to 1.8m)	NIL
B7	G.L. - 7.0m	7.0 - 10.0m
8	G.L. - 6.0m	NIL
B9	G.L. - 6.5m	6.5 - 15.0m
10	G.L. - 7.3m	7.3 - 13.0m
11	(Hand Auger to 1.2m)	NIL
12	G.L. - 6.0m	NIL
13	G.L. - 5.0m	NIL

The locations of all boreholes and hand auger holes are shown on the Borehole Location Plans, Figures, 4.1 - 4.3

The diameter of all the Cable Tool boreholes is 0.15m and the rotary coring was done using H size equipment.

4.3 Sampling

During the course of drilling, small disturbed samples (D) and larger bulk samples (B) of soil were taken at frequent intervals for identification and classification.

In cohesive soils, undisturbed 102mm diameter samples (U), were obtained using standard open drive equipment, in order to allow natural water content, undrained shear strength, consolidation and effective stress characteristics to be measured in the Laboratory.

4.4 Insitu Testing

Standard Penetration Tests (S.P.T's) were performed in the granular strata, where undisturbed samples could not be obtained in order to obtain a measure of their relative density. In addition S.P.T.'s were carried out within the Keuper Marl strata in order that a measure of the intact 'strength' of the marl could be established.

The results of these tests are given on the Borehole Records.

4.5 Instrumentation

A piezometer was installed in Borehole 3 and a standpipe in Borehole 10 to allow the monitoring of groundwater levels for a period following site work. Details of the installed instruments are shown diagramatically on the Borehole Records.

It should be noted that the time for the field work was relatively short and that the period of highest water levels need not necessarily conform to the period of the field work. The readings are shown in Volume 1, Figure 3.71.

4.6 Borehole Records

Descriptions and depths of the strata encountered are presented on the Borehole Records. Sampling depths, details of the groundwater behaviour at the time of the investigation, instrumentation details, S.P.T. results and a summary of laboratory water content and shear strength test results, together with all other pertinent details are also presented.

Soil classification was carried out in accordance with CP2001 1957 and the Draft Revision of CP2001 (July 1976)

4.7 Laboratory Work

Laboratory tests on selected soil and groundwater samples were programmed by Exploration Associates (Warwick) Limited in consultation with the Derbyshire County Council Sub-Unit of the Midland Road Construction Unit.

Testing was performed in accordance with BS 1377 "Methods of Test for Soils for Civil Engineering Purposes", and the Midland Road Construction Unit specification where appropriate.

The effective stress Triaxial Compression testing was undertaken using the procedures outlined in "The Measurement of Soil Properties in the Triaxial Test" by Bishop and Henkel. The results are presented in Volume 1. The procedures used are identified in Appendix 1. Volume 11.

5. THE SITE

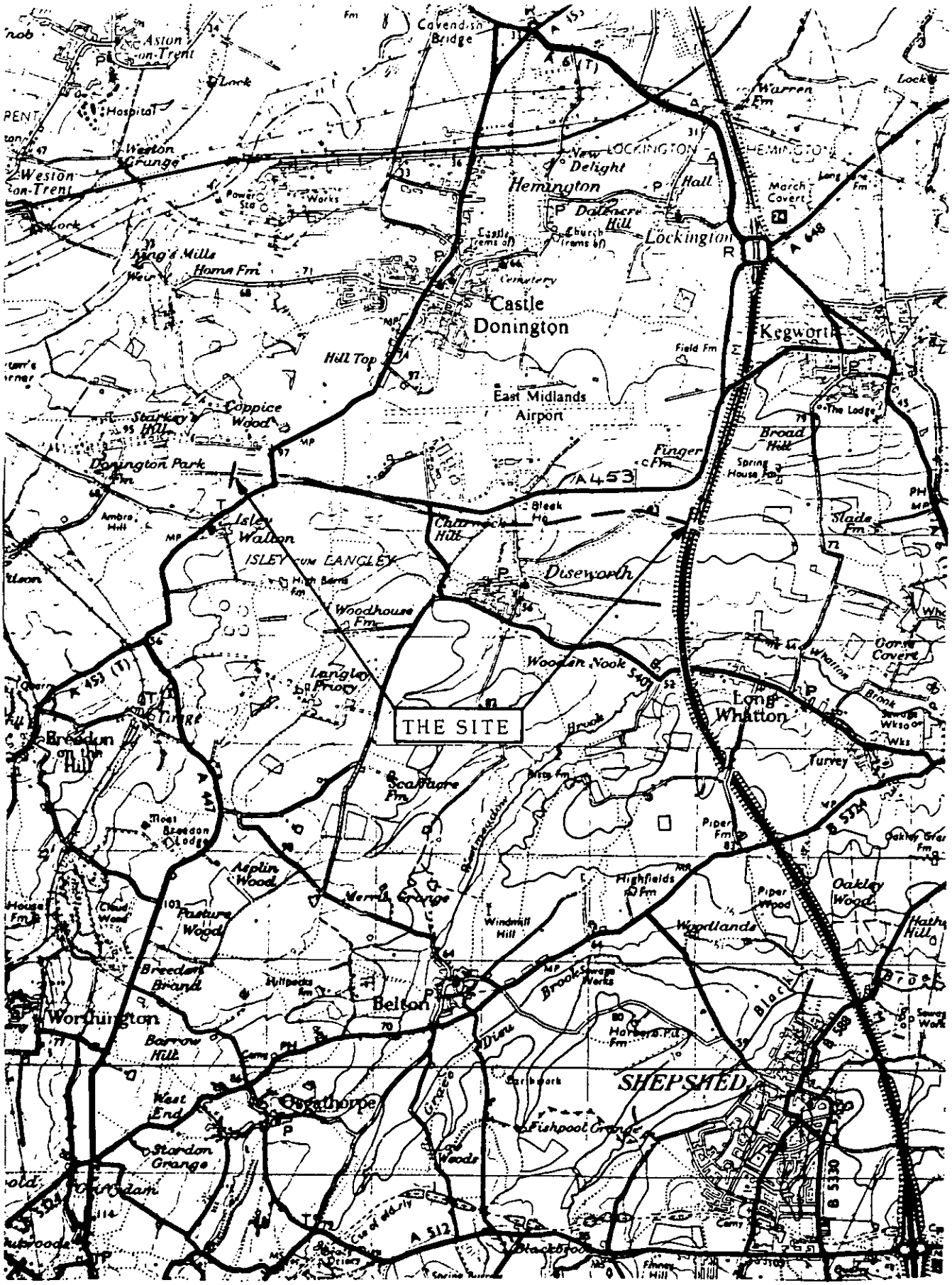
5.1 Location

The proposed route of the Isley Walton to M1 Section is approximately 5 kilometres long. It commences west of Isley Walton and passes North of the village to link into the existing A453. The route then follows the line of the A453 towards the East Midlands Airport, before deviating South of the existing road and airport, to terminate at the M1 motorway.

6. GROUND CONDITIONS

6.1 Geology

The geology along the proposed route is relatively uncomplicated, consisting of a basement of Keuper Marl overlain by deposits of Glacial Till and Glacial Sand and Gravel. Glacial Till is a term which embraces the more commonly used term Boulder Clay but which also covers material which is dominated by either the granular component or the matrix and may not contain either Boulders or Clay. Glacial Sands and Gravels or Glaciofluvial sediments typically result from melt water stream systems which have eroded much of the clays and silts which the Glacial Debris originally contained.



Scale 1:50,000

Site Location Plan	**Project**	Department of Transport A564 Stoke – Derby link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates			**Figure** 1

EX 4

BOREHOLE RECORDS

SYMBOLS

All linear dimensions are in metres

U	Undisturbed 0.100m diameter sample (The figure in brackets is the number of blows required to drive the sampler)
⊬	Undisturbed sample not recovered
B	Bulk Sample - disturbed
D	Jar Sample - disturbed
W	Water Sample
S	Standard Penetration Test
C	Standard Penetration Test with 60° Cone Tip
W%	Natural Water Content
N	Standard Penetration Test Value - blows/0.300m (The suffix "+" denotes extrapolated value)
F.I.	Fracture Index
R.Q.D.	Rock Quality Designation
▽	Depth at which groundwater was encountered
▼	Standing level of groundwater

Borehole Record - Legend	**Project** Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 2

EX3

Borehole Locations as drilled

Exploratory Hole No.	Chainage	Offset (m)
1	60130	12
B2	60440	-16
B3	60540	7
4	61240	-6
5	61455	-13
6	On slip road	
B7	62015	0
8	62345	0
B9	62825	-6
10	62975	-60
11	63160	-30
12	63420	-45
13	64050	-20

Positive offset - Exploratory Hole located to the south of road centreline.

Negative offset - Exploratory Hole located to the north of road centreline.

exploration associates

Project Department of Transport
A564 Stoke - Derby Link
Derby Southern By Pass
Isley Walton to M1 Section
Preliminary Site Investigation

Contract S2796

Figure 2.1

Sampling		Properties			Strata			
Depth	Type	Strength kN m²	w %	SPT N	Description	Depth	Level	Legend
					TOPSOIL	G.L	79.38	
0.40	D					0.40	78.98	
0.60–1.10	U(22)	45	25		Firm friable brown silty very sandy CLAY with roots pockets of sand occasional fine-medium gravel and rock fragments.			
1.20	D							
1.40	D					1.40	77.98	
1.50–2.00	U(35)	110	25		Firm becoming stiff red brown silty CLAY with zones of brown very sandy clay, fine gravel and organic traces			
2.30	D.					2.30	77.08	
2.50–3.00	U(110)	230	18		Very stiff to hard grey green/red brown fissured friable silty clay with abundant mudstone and siltstone fragments.	3.00	76.38	
3.40	D				Very stiff dark red brown fissured friable silty CLAY with fragments of weak siltstone (Marl)			
3.50–4.00	U(115)	220	15					
4.30	D					4.30	75.08	
4.50	W				Very stiff becoming hard dark red brown fissured silty CLAY tending to weak mudstone with thin layers of weak weathered siltstone. (Marl)			
4.50–5.00	U(125)		16					
5.30–5.60	SD			200+				
5.80–6.30	SD		13	200+				
					End of borehole	6.30	73.08	

Drilling

Type	From	To	Size	Fluid
Shell & Auger	G.L	6.30	0.15	

Ground Water

Struck	Behaviour	Sealed	Date	Hole	Cased	Water
4.5	Rose to 2.20 in 20 mins	5.5	20.3.81	GL	–	–
			20.3.81	6.3	5.5	NIL
			20.3.81	6.3	NIL	1.2

Remarks Hard Strata from 4.50 – 6.30

Borehole Record

exploration associates

Project Department of Transport
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Borehole 1

Sheet 1 of 1

EX1

Sampling		Properties			Strata			
Depth	Type	Strength kN.m²	w %	SPT N	Description	Depth	Level	Legend
					Turf over TOPSOIL	.GL	90.56	
0.30	D					0.30	90.26	
0.50–0.95	U(17)		18		Very soft red brown silty sandy CLAY with zones of silt and sand.			
1.00–1.45	SD		19	7		1.0	89.56	
1.50–2.00	B		21		Loose brown silty medium to fine SAND (clayey at top) with roots and coal fragments.			
						(2.20)	88.36	
2.50–2.95	SD		31	8	Soft orange brown becoming red brown slightly sandy silty clay (Marl)			
3.30	W							
3.50	D							
						3.90	86.66	
4.20	D		17		Stiff slightly friable dark red brown silty CLAY, with zones of weak dark red brown mudstone and siltstone fragments.			
4.50–4.80	U(100)	150	16					
5.00–5.45	SD			97				
6.00	D		23					
6.50–6.95	SD		13	192+		(6.50)	84.06	
7.50	D				Red brown, fine grained horizontally very thinly bedded, moderately weathered MUDSTONE, moderately weak to moderately strong with joints extremely closely spaced (20mm) containing zones of stiff friable dark red-brown occasionally grey green silty clay and silstone layers.			
8.00–8.30	SD		15	300+				
9.00	D							
Drill Run	Fluid Return	Core Recovery	F1	RQD				
	100%	100%	>25	NIL				
10.00					Cont. from 10.00	10.00	80.56	

Drilling					Ground Water						
Type	From	To	Size	Fluid	Struck	Behaviour	Sealed	Date	Hole	Cased	Water
Shell & Auger	G.L	9.00	0.15	-		Stood at 3.30 after weekend break		13.3.81	G.L	-	-
Rotary Core	9.00	15.00	0.072	Water				13.3.81	4.00	4.00	NIL
								16.3.81	4.00	4.00	3.30

Remarks Hard boring 6.50 – 9.00

Borehole Record

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Borehole B 2

Sheet 1 of 2

EX1

Sampling		Properties			Strata			
Drill Run	Fluid Return	Core Recovery	FI	RQD	Description	Depth	Level	Legend
10.00					Continued from 10.00	10.00	80.4	
	100%	100%	>25	30	Dark reddish brown, fine grained, very thinly bedded moderately weathered silty MUDSTONE moderately weak to moderately strong with joints, very closely spaced (20 - 60 mm) with frequent more highly weathered friable clayey zones and occasional thin bands (50mm) of siltstone. Joints oblique and horizontal predominantly horizontal - Only 3 vertical joints noted.			
11.00	100%	100%	15	45				
12.00	100%	100%	>25	NIL	(Marl)			
12.80	100%	100%	>25	20				
13.60	100%	100%	10	40				
15.00					End of Borehole	15.00	75.4	

Drilling					Ground Water						
Type	From	To	Size	Fluid	Struck	Behaviour	Sealed	Date	Hole	Cased	Water
								16.3.81	12.00	4.00	GL
								17.3.81	15.00	4.00	GL
								19.3.81	15.00	NIL	GL

Remarks

Borehole Record

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Borehole B2

Sheet 2 of 2

EX1a

Sampling					Properties			Strata			
Depth	Type	Strength kN/m²	w %	SPT N	Description	Depth	Level	Legend			
					Turf over TOPSOIL	G.L	91.06				
						0.30	90.76				
0.50–0.95	U(30)	85	19		Firm becoming stiff dark red brown silty sandy CLAY with light grey green and light brown silty inclusions, occasional fine sub angular gravel and black carbonaceous traces.						
1.50	D										
2.00–2.45	U(35)										
3.00	D					3.00	88.06				
3.50–3.95	U(32)				Soft-firm dark red brown very silty very sandy CLAY, with bands of orange brown slightly silty fine-medium SAND, and bands of dark red brown clayey SILT. (Fissured from 6.5 m) Occasional fine-medium sub angular gravel (including flint gravel) noted, together with occasional weak, weathered siltstone fragments and black carbonaceous traces.							
4.50	D		22								
5.00–5.45	U(30)	9	26								
6.00	D										
6.50–6.95	U(28)	45	26								
7.50–7.95	SD		16	62							
						7.80	83.26				
8.20	D		13		Very stiff–hard dark red brown and brown fissured and slightly friable silty shaly CLAY, rapidly becoming dark red brown and grey green silty MUDSTONE weak with less competent friable more clayey zones (Marl)						
8.50–8.95	SD		14	112							
9.10	D		16								
9.30–9.50	SD		13	400+							
						9.50	81.56				
Drill Run	Fluid Return	Core Recovery	Fl	RQD		10.00	81.06				

Drilling					Ground Water						
Type	From	To	Size	Fluid	Struck	Behaviour	Sealed	Date	Hole	Cased	Water
Shell & Auger	G.L	9.50	0.15	-	8.00	Slight seepage only	8.50	10.3.81	G.L	-	-
Rotary Core	9.50	15.00	0.072	Water				10.3.81	9.50	8.50	NIL

Remarks Hard boring from 8.00 – 9.50m Piezometer installed at 8.0m within filter 7.5 – 8.50

Borehole Record

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Borehole B3

Sheet 1 of 2

EX1

Sampling		Properties			Strata			
Drill Run	Fluid Return	Core Recovery	FI	RQD	Description	Depth	Level	Legend
	100%	85%	>25	NIL	Continued from 10.00 Dark reddish brown occasionally grey green, fine grained very thinly bedded highly weathered silty MUDSTONE weak with extremely closely spaced joints and containing more highly weathered clayey zones.	10.00		
10.70	100%	100%	>25	NIL				
11.30	100%	100%	>25	NIL				
11.60	100%	100%	>25	30	Dark reddish brown, fine grained very thinly bedded moderately weathered silty MUDSTONE, weak to moderately weak with extremely closely spaced joints with moderately strong silstone bands (up to 25mm)	11.6	79.46	
12.70	100%	90%	>25	10				
13.60	100%	100%	>15	40	Dark reddish brown, occasionally mottled grey green fine grained very thinly bedded moderately weathered silty MUDSTONE. Moderately weak to moderately strong very closely spaced joints - horizontal and oblique (equal proportion).	13.60	77.46	
15.00						15.00	76.06	

Drilling				
Type	From	To	Size	Fluid

Ground Water						
Struck	Behaviour	Sealed	Date	Hole	Cased	Water
			11.3.81	11.30	8.50	G.L
			12.3.81	13.60	8.50	G.L.
			13.3.81	15.00	8.50	G.L

Remarks Bedding within 5° of horizontal

Borehole Record

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Borehole B3

Sheet 2 of 2

EX1a

Sampling		Properties			Strata			
Depth	Type	Strength kN/m²	w %	SPT N	Description	Depth	Level	Legend
					Turf over TOPSOIL	G.L	78.62	
0.40	D					0.40	78.22	
0.50-1.00	U(25)	70	23		Firm red brown occasionally fissured very silty CLAY with occasional fine well rounded gravel and coal fragments.			
1.30	D		29					
1.50-2.00	U(28)	45	45			1.70	76.92	
2.20	D		45		Soft becoming firm grey brown silty organic CLAY with decayed roots and occasional gravel			
2.80	B							
3.00-3.50	U(100)	330	26		Weak red brown MUDSTONE with zones of silty CLAy, sand and coal fragments.	3.00	75.62	
3.70	W				Firm to stiff red brown and grey green silty CLAY with siltstone fragments and rounded gravel	3.50	75.12	
3.70-3.90	B							
3.90-4.40	SD			67	Very weak - moderately weak grey green SILTSTONE (Marl)	3.90	74.72	
3.90-4.50	B							
4.50-5.00	U(120)	210	17		Very stiff red brown fissured friable silty CLAY with mudstone fragments and zones of sand.	4.50	74.12	
					End of Borehole	5.00	73.62	

Drilling

Type	From	To	Size	Fluid
Shell & Auger	G.L	5.00	0.15	

Ground Water

Struck	Behaviour	Sealed	Date	Hole	Cased	Water
3.70	Rose to 1.0 in 20 mins		18.3.81	GL	-	-
			18.3.81	5.0	5.0	1.0
			19.3.81	5.0	NIL	0.5

Remarks Hard strata from 3.90 - 4.40 (1 hour)

Borehole Record

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Borehole 4

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EX1

Sampling		Properties			Strata			
Depth	Type	Strength kN.m²	w %	SPT N	Description	Depth	Level	Legend
						G.L	85.53	
0.30	D				FILL: ash, tarmac and hardcore.	0.30	85.23	
0.50–1.00	U(42)	80	16		(Medium dense) reddish brown very clayey (clay bound) angular and rounded SAND and GRAVEL with frequent zones of light brown clayey sand, with fine angular gravel; red brown sandy clay with gravel.			
1.00–1.50	SD			11				
1.70–2.00	B D		13					
2.50–3.00	U(60)		12					
3.00–3.50	SD			23	Mottled light brown Note 1 - 25mm piece tin at 3.0 D 3 pieces (5mm) brick 1.7m B			
3.70–4.10	B		13		White mould and decomposed roots Possibly Fill	3.73	81.80	
4.30	D				(Medium dense) orange brown and dark red brown clayey SAND, with occasional fine gravel and bands of sandy clay.	4.33	81.20	
4.50–5.00	U(120)	220	15		Very stiff dark red brown and orange brown fissured friable silty sandy CLAY with fragments of weak siltstone.			
					End of Borehole	5.03	80.50	

Drilling					Ground Water						
Type	From	To	Size	Fluid	Struck	Behaviour	Sealed	Date	Hole	Cased	Water
Shell & Auger	G.L	5.00	0.15	-	NIL			17.3.81	G.L	-	-
								17.3.81	5.0	NIL	NIL

Remarks

Borehole Record

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Borehole 5

Sheet 1 of 1

EX1

Sampling		Properties			Strata			
Depth	Type	Strength kN/m²	w %	SPT N	Description	Depth	Level	Legend
					Turf over dark brown very sandy TOPSOIL	G.L	76.62	
0.50–0.80	D		19		Soft-Firm dark red brown very silty slightly sandy CLAY with occasional fine rock fragments and gravel	0.50	76.12	
0.80–1.60	D		23	*	'Soft' dark red brown very sandy CLAY with fine rock fragments, gravel and coal fragments.	0.80	75.82	▽
1.60–1.80	D		28		Firm-stiff dark red brown mottled grey green silty CLAY with occasional pockets of sand and coal fragments (weathered MARL)	1.60	75.02	
					End of Auger Hole	1.80	74.82	

Drilling

Type	From	To	Size	Fluid
Hand Auger	G.L	1.8	0.10	-

Ground Water

Struck	Behaviour	Sealed	Date	Hole	Cased	Water
0.80	Remained at that level	No	18.3.81	G.L	-	-
			18.3.81	1.80	-	0.80

Remarks Strata too hard to make further progress from 1.80 with Hand Auger
*Probably softened by water within hand Augered Hole.

Borehole Record

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Hand Auger 6
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EX1

Sampling		Properties			Strata			
Depth	Type	Strength kN/m²	w %	SPT N	Description	Depth	Level	Legend
					Turf over TOPSOIL	G.L	74.78	
0.30	D					0.30	74.48	
0.50–0.95	U(30)	100	14		Light brown silty slightly clayey SAND	0.50		
					Stiff red brown silty sandy CLAY with occasional gravel, zones of silt and sand.			
1.25	D					1.1	73.68	
1.50–1.95	U(45)				Light brown silty slightly clayey SAND with occasional fine-medium gravel.			
2.10	W				Firm red brown silty CLAY, with fine-coarse flint fragments and gravel.	1.95	72.83	
2.25	D		22					
2.50–2.95	U(60)	90	16		Firm-stiff slightly friable dark red brown very silty CLAY	2.40	72.38	
3.25	D							
3.50–3.95	U(85)	100	20			3.60	71.18	
4.25	D				Stiff red brown and grey green fissured, occasionally friable very silty CLAY with occasional layers of very weak red brown and grey green siltstone. Occasional thin layers of moderately strong siltstone noted.			
4.70–5.15	SD		13	124				
5.30	D							
5.50–5.95	SD		17	108				
6.20	D							
6.50–7.00	SD		13	600+				
Drill Run	Fluid Return	Core Recovery	FI	RQD	Dark reddish brown and grey green fine grained, very thinly bedded highly weathered MUDSTONE. Not competent – very close open horizontal joints infilled with firm red brown silty CLAY **	7.00	67.78	
	100%	65%	10	35				
8.50					Dark reddish brown fine grained, very thinly bedded moderately weathered, silty MUDSTONE very weak to moderately weak. Joints closely spaced (all horizontal)			
	100%	100%	10	50	Dark reddish brown and grey green fine grained, very thinly bedded moderately weathered silty MUDSTONE, very weak to weak fissured in parts very closely spaced joints (occasionally up to 250mm (close-medium).) Majority horizontal though 2 oblique and 1 vertical and occasional bands siltstone and zones of friable silty CLAY.			
10.00					End of Borehole	10.00	64.78	

Drilling

Type	From	To	Size	Fluid
Shell & Auger	G.L	7.00	0.15	–
Rotary core	7.00	10.00	0.072	Water

Ground Water

Struck	Behaviour	Sealed	Date	Hole	Cased	Water
4.50	very slow ingress, rose to 2.1	6.00	17.3.81	G.L	–	–
6.60	Seepage	No	17.3.81	4.5	3.0	4.2
			18.3.81	10.0	6.0	G.L
			19.3.81	10.0	NIL	1.8

Remarks Hard strata from 4.00–5.30 and from 6.50–7.00 (2.0 hrs)
**May be disturbed by first core run Bedding within 5° of horizontal.

Borehole Record

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Borehole 87

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EX1

Sampling					Strata			
Depth	Type	Strength kN/m²	w %	SPT N	Description	Depth	Level	Legend
					Turf over TOPSOIL	G.L	82.49	
0.40	D					0.40	82.09	
0.50–1.00	U(42)	60	25		Firm becoming stiff brown becoming light brown slightly friable silty sandy CLAY with occasional medium-coarse well rounded gravel and occasional fine gravel and rock fragments towards base.			
1.80	D							
2.00–2.50	U(65)							
						2.35	80.14	
2.80	D		23		Dense light brown and light grey brown very clayey (claybound) fine, medium, and coarse angular rounded very sandy GRAVEL. Band of weak friable light grey green mudstone noted 5.30 – 5.50. Orange brown sandstone at 3.0 D			
3.00	D							
3.00–3.50	SD			38				
3.60	D							
4.00–4.50	B							
4.50–5.00	D**							
4.50–5.00	B		17					
5.00–5.50	SD		21	73				
						5.3	77.19	
5.50–6.00	B				(Firm) reddish brown silty CLAY matrix with sub-rounded to sub-angular GRAVEL some cobbles containing small pockets of organic silty clay with roots. (TILL)			
						6.0	76.49	
					End of Borehole			

Drilling					Ground Water						
Type	From	To	Size	Fluid	Struck	Behaviour	Sealed	Date	Hole	Cased	Water
Shell & Auger	G.L	6.00	0.15	–	NIL			17.3.81	G.L	–	–
								17.3.81	6.00	NIL	NIL
								18.3.81	6.00	NIL	NIL

Remarks ** No penetration

Limestone boulder encountered at 4.50, pushed to 5.0m before breaking up.

Borehole Record

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Borehole 8

Sheet 1 of 1

EX1

Sampling		Properties			Strata			
Depth	Type	Strength kN/m²	w %	SPT N	Description	Depth	Level	Legend
					Turf over TOPSOIL	G.L	76.47	
0.40	D					0.30	76.17	
0.50-0.95	U(30)	95	21		Firm stiff brown and red brown silty very sandy CLAY with roots and occasional fine medium sub-angular - rounded rock fragments and gravel.			
1.50	D		16			1.20	75.27	
2.00-2.45	U(75)	110	16		Firm-stiff light red brown silty sandy CLAY with frequent fine-medium sub-rounded-rounded rock fragments and gravel. Slightly friable.			
2.45	D					2.30	74.17	
3.00	D		18		Very stiff - hard friable red brown becoming grey brown silty sandy CLAY with abundant fine-medium weathered rock fragments and rounded gravel. Zones of weaker red brown friable very sandy clay noted at 2.45.			
3.50-4.00	U(100)	145	16					
3.95	D		16			3.90	72.57	
4.50	D		15		Very stiff to hard dark grey and dark grey brown fissured silty slightly sandy CLAY with abundant fine-medium rock fragments, rounded gravel, and fine pockets of silt or sand (completely weathered rock fragments).			
5.0-5.40	U(120)							
6.00	D		13					
6.35	S**							
6.40	D					6.50	69.97	
Drill Run	Fluid Return	Core Recovery	FI	RQD	Strong grey and grey green limestone and siltstone BOULDERS (< 0 .3 thick), with layers of very stiff dark red brown sandy CLAY, and fine medium and coarse sandstone, siltstone, flint and quartitu rounded - sub-rounded gravel towards base.			
7.20								
	100%	100%	-	-				
7.80								
	100%	100%	-	-				
8.30								
	100%	100%	-	-				
8.70								
8.80	100%	100%	-	-				
	100%	70%	-	-				
9.50								
	100%	100%	-	-				
9.80								
	100%	100%	-	-	Continued from 10.00	10.00	66.47	

Drilling				
Type	From	To	Size	Fluid
Shell & Auger	G.L	6.50	0.15	-
Rotary Core	6.50	15.00	0.072	water

Ground Water						
Struck	Behaviour	Sealed	Date	Hole	Cased	Water
	Stood at 5.40 overnight		18.3.81	GL	-	-
			18.3.81	4.50	NIL	NIL
			19.3.81	9.50	6.0	GL

Remarks Rock Chisel used to penetrate boulder 4.30-4.40 (0.5 hours) and 4.50-5.0 hard strata from 6.35-6.50
**No penetration possible

Borehole Record

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Borehole B9

Sheet 1 of 2

EX1

Sampling		Properties			Strata			
Drill Run	Fluid Return	Core Recovery	FI	RQD	Description	Depth	Level	Legend
10.00					Continued from 10.00	10.00	66.47	
	100%	*	-	-	as above but with rounded and angular limestone, quartz and sandstone gravel in matrix of firm silty clay			
10.50	100%	100%	-	-				
10.90	100%	100%	-	-				
11.00	100%	100%	15	30		11.10	65.37	
11.50	100%	95%	4	70	Dark reddish brown, fine grained very thinly bedded moderately weathered silty MUDSTONE weak to moderately weak, closely spaced joints with more highly weathered zones of firm silty CLAY and occasional bands of medium strong to strong siltstone (80mm)			
13.00	100%	100%	>25	50	As above but slightly weathered and joints <20mm to 150mm i.e. extremely closely spaced to closely spaced.	13.00	63.47	
14.00	100%	100%	10	35				
15.00					End of Borehole	15.00	61.47	

Drilling				
Type	From	To	Size	Fluid

Ground Water						
Struck	Behaviour	Sealed	Date	Hole	Cased	Water
			23.3.81	10.50	10.00	G.L
			24.3.81	15.00	10.50	G.L

Remarks *Gravel and cobbles recovered after 15 attempts to core
Note: Most joints horizontal. Bedding within 5° of horizontal

Borehole Record

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Borehole B9
Sheet 2 of 2

EX1a

Sampling			Properties		Strata			
Depth	Type	Strength kN/m²	w %	SPT N	Description	Depth	Level	Legend
					Turf over TOPSOIL	G.L	83.77	
0.30	D					0.20	83.57	
0.50–0.90	U(70)	80	19		Soft–firm light brown and brown silty sandy CLAY with fine–medium strong angular rock fragments and fine gravel.			
					BOULDER	0.90	82.87	
1.60	D		9		Firm–Stiff friable light brown silty very sandy CLAY with fine medium and coarse angular rock fragments and gravel.	1.50	82.27	
2.00–2.45	SD			44				
2.80	D					2.80	80.97	
3.00–3.35	U(75)		19		Soft–firm very friable light red brown very silty fine sandy CLAY/clayey sandy SILT and fine SAND. Shear surfaces within the silty CLAY.			
3.80	D		21		Firm friable red brown coarse sandy CLAY with black carbonaceous fragments.	3.70	80.97	
4.50–4.95	U(80)							
						4.80	78.97	
5.50	D				(Very dense) matrix of very stiff brown red brown and grey brown silty sandy CLAY, fine medium and coarse angular rock fragments, GRAVEL and COBBLES.			
6.00	SD		9	**				
7.30	S			**				
8.30	D					8.30	75.47	
8.50–8.65	SD		15	200+	Very weak weathered dark red brown SILTSTONE	8.50	75.27	
Drill Run	Fluid Return	Core Recovery	FI	RQD				
	100%	85%	>25	NIL	As above, though broken in a matrix of firm silty clay and containing several pieces of rounded quartz gravel ***			
				300+		9.5	74.27	
9.70–9.75	SD				See over Continued from 10.00	10.00	73.77	

Drilling

Type	From	To	Size	Fluid
Shell & Auger	G.L	7.30	0.15	–
Rotary Core	7.30	7.50	0.072	water
Shell & Auger	7.50	8.50	0.15	–
Rotary Core	8.50	13.00	0.072	water

Ground Water

Struck	Behaviour	Sealed	Date	Hole	Cased	Water
NIL	Water flush returns lost at 11.00		25.3.81	G.L	–	–
			25.3.81	7.00	7.00	NIL
			26.3.81	8.5	8.3	7.3
			27.3.81	13.0	8.3	NIL

Remarks Rock chisel used from 0.9–1.5, 3.4–3.6, 5.0–5.8 (5.5 hours) 7.0–7.3, 7.5–8.5 (4 hours)
** No penetration. Standpipe installed to 13.0m with bottom 2m perforated and surounded with gravel
***May be disturbed from casing installation

Borehole Record

exploration associates

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Borehole 10

Sheet 1 of 2

EX1

Sampling		Properties			Strata			
Drill Run	Fluid Return	Core Recovery	FI	RQD	Description	Depth	Level	Legend
	100%	75%	15	35	Continued from 10.00 Dark reddish brown fine grained, very thinly bedded mod-highly weathered silty MUDSTONE - very weak, occasional moderately weak, extremely closely bedded (<20) with bands of grey green strong SILTSTONE.	10.00	73.77	
11.00	NIL	100%	10	65				
11.50	NIL	60%	clay	clay	Dark reddish brown silty CLAY with mudstone fragments.	11.60	72.17	
12.00	NIL	90%	15	NIL	Dark reddish brown becoming grey green fine grained highly weathered silty MUDSTONE becoming siltstone very weak with extremely closely spaced predominant horizontal joints. 2 vertical joints noted with bands of grey green strong siltstone and bands of completely weathered siltstone and bands of firm silty CLAY. (up to 200mm).	12.00	71.77	
13.00					End of Borehole	13.00	70.77	

Drilling					Ground Water						
Type	From	To	Size	Fluid	Struck	Behaviour	Sealed	Date	Hole	Cased	Water

Remarks Bedding with 5° of horizontal

Borehole Record

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Borehole 10

Sheet 2 of 2

EX1a

Sampling		Properties			Strata			
Depth	Type	Strength kN/m²	w %	SPT N	Description	Depth	Level	Legend
					Friable dark brown sandy gravelly TOPSOIL	G.L	72.56	
0.4–0.6	D					0.40	72.16	
0.6–1.0	D		23		Soft friable brown silty sandy CLAY with occasional well rounded fine–medium gravel.	0.60	71.96	
1.0–1.2	D		20		Firm friable light brown and light grey brown silty sandy CLAY with fine gravel and pockets of orange brown sand.	1.00	71.56	
					Very stiff slightly friable grey and light grey brown silty very sandy CLAY with abundant fine–medium angular rock fragments and occasional fine gravel.	1.20	71.36	
					End of Auger Hole			

Drilling

Type	From	To	Size	Fluid
Hand Auger	G.L	1.20	0.10	–

Ground Water

Struck	Behaviour	Sealed	Date	Hole	Cased	Water
NIL			19.3.81	G.L	–	–
			19.3.81	1.2	–	NIL
			20.3.81	1.2	–	NIL

Remarks 45 minutes to auger from 1.0–1.2, hole terminated at 1.2

Borehole Record

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Hand Auger 11
Sheet 1 of 1

EX1

Sampling		Properties			Strata			
Depth	Type	Strength kN/m²	w %	SPT N	Description	Depth	Level	Legend
					Turf over TOPSOIL	G.L	87.60	
0.30	D							
0.50–1.00	U(28)	130	22		Firm brown very sandy CLAY with gravel	0.30	87.30	
					Firm becoming stiff red brown silty CLAY with layers of grey green clay and occasional thin layers of grey green siltstone.	0.70	86.90	
1.80	D							
2.00–2.45	U(80)							
						(2.25)	85.35	
2.50	D				Very weak red brown SILTSTONE			
						3.00	84.60	
3.50–4.10	U(20)				Stiff dark red brown mottled grey green friable very silty CLAY with layers and fragments of very weak siltstone.			
3.60–4.10	B		22					
4.10–4.60	SD		14	200+				
5.30	W							
5.50–6.00	SD		14	200+	Becoming hard slightly friable dark red brown silty CLAY at base			
6.00	D					6.00	81.60	
					End of Borehole			

Drilling					Ground Water						
Type	From	To	Size	Fluid	Struck	Behaviour	Sealed	Date	Hole	Cased	Water
Shell & Auger	G.L	5.50	0.15	-	2.60	Slight seepage only	4.50	18.3.81	G.L	-	-
								18.3.81	4.5	4.5	NIL
								19.3.81	6.0	6.0	5.7
								20.3.81	6.0	NIL	0.85

Remarks Hard Strata from 3.50–6.00

Borehole Record

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Borehole 12
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EX1

Sampling		Properties			Strata			
Depth	Type	Strength kN·m²	w %	SPT N	Description	Depth	Level	Legend
						G.L	92.26	
0.30	D				Turf over TOPSOIL	0.30	91.96	
0.50–1.00	U(32)	90	14		Soft–firm brown silty very sandy CLAY with frequent fine angular rock fragments and fine–medium rounded gravel	(0.75)	91.51	
1.40	D		22		Stiff dark red brown silty very sandy CLAY, occasionally mottled grey green, with many roots and associated black mottling.			
2.00–2.50	U(80)		21					
						2.25	90.01	
2.90	D				Stiff becoming hard friable dark red brown mottled grey green silty CLAY with fragments of very weak highly weathered siltstone and mudstone.			
3.50–3.90	U(81)		15					
4.00	D							
4.50–4.80	B							
5.00–5.50	SD		14	200†				
5.50	W							
					End of Borehole	5.50	86.76	

Drilling

Type	From	To	Size	Fluid
Shell & Auger	G.L	5.50	0.15	

Ground Water

Struck	Behaviour	Sealed	Date	Hole	Cased	Water
5.50	Rose to 4.10 in 20 minutes	No	19.3.81	G.L	–	–
			19.3.81	5.5	NIL	4.1
			20.3.81	5.5	NIL	2.8

Remarks

Borehole Record

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Borehole 13
Sheet 1 of 1

EX1

LABORATORY RESULTS - SYMBOLS

U	Undisturbed Sample
B	Bulk Sample - Disturbed
D	Jar Sample - Disturbed
W	Water Sample
pH	Acidity/Alkalinity Index
SO_3	Soluble Sulphate Content
I_p	Plasticity Index
(%)	% of fine material in sample for Index Tests
w_L	Liquid Limit
w_p	Plastic Limit
w	Water Content
γ_b	Bulk Density
U	Undrained Triaxial
CU	Consolidated Undrained Triaxial
CD	Consolidated Drained Triaxial
T	Single Stage Triaxial
M	Multistage Triaxial
100/40	Sample Diameter (mm)
REM	Remoulded Triaxial Test Specimen
LVT	Laboratory Vane Test
DSB	Drained Shear Box
RSB	Residual Shear Box
σ_3	Cell Pressure
$\sigma_1 - \sigma_3$	Deviator Stress
C	Cohesion
C'	Effective Cohesion Intercept
ϕ	Angle of Shearing Resistance - Degrees
ϕ'	Effective Angle of Shearing Resistance
m_v	Coefficient of Volume Decrease
C_v	Coefficient of Consolidation
γ_d	Dry Density
Opt	Optimum
Std	Standard Compaction
CBR	California Bearing Ratio

Laboratory - Legend	**Project** Department of Transport A564 Stoke - Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 3

EX 4

Samples				Chemical		Classification					Strength					
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
1	0.6 1.1	U	Firm friable brown silty sandy CLAY with occasional gravel, zones of sand and decayed vegetation.		Organic 1.28%	88% 10	27	17	25 25 23	1.94 1.94 1.96	UT 38	100 200 400	83 82 117	45	-
	1.5 2.0	U	Firm fissured friable red brown silty CLAY (Marl) with occasional coal fragments and zones of silt.						27 24 25	1.97 2.03 2.00	UT 38	100 200 400	216 240 230	110	-
	2.5 3.0	U	Very stiff fissured friable red brown silty CLAY (Marl) with abundant mudstone fragments.			100% 9	29	20	18	2.16	UM 105	100 200 400	364 449 547	230	-
	3.5 4.0	U	Very stiff fissured friable red brown silty CLAY (Marl) with abundant mudstone fragments.						15	2.20	UM 105	100 200 400	330 432 572	220	-
	4.5	D	Groundwater	7.3	15										
	4.5 5.0	U	Firm occasionally fissured mottled red brown and grey green silty CLAY (Marl) with siltstone fragments.			47% 10	28	18	16						
	5.8 6.3	D	Hard fissured red brown silty CLAY (Marl)						13						
B2	0.5 0.95	U	Very soft red brown silty sandy CLAY with zones of silt and sand.			97% 6	17	11	18						
	1.0 1.45	D	Brown SAND with roots and coal fragments.						19						
	1.5 2.0	B	Brown silty clayey SAND with occasional roots and sandstone fragments.			4			3						

Remarks + Rate of strain 2% /minute

Laboratory Results – Summary

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Figure 3.1

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test+	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B2	2.5 2.95	D	Red brown silty CLAY (Marl) with coal fragments.			100% 15	32	17	31						
	3.3	D	Groundwater	7.7	12										
	4.2	D	Fissured red brown silty CLAY (Marl) with siltstone fragments.						17						
	4.5 4.8	U	Very stiff red brown silty sandy CLAY with siltstone and mudstone fragments			78% 14	34	20	16	2.24	REM UM 105	100 200 400	308 // -	150	-
	6.0	D	Red brown silty CLAY (Marl) with mudstone fragments			75% 13	33	20	23						
	6.5 6.9	D	Fissured red brown silty CLAY (Marl) with siltstone fragments and zones of silt	7.1	0.01 %	92% 15	31	16	13						
	8.0 8.3	D	Stiff red brown fissured friable silty CLAY (Marl) with silstone fragments.	8.5	0.05 %	94% 11	30	19	15						
B3	0.5 0.95	U	Stiff red brown silty sandy CLAY with abundant siltstone fragments, occasional zones of sand and coal fragments.			83% 21	39	18	19	2.05	UM 105	100 200 400	157 170 179	85	-
	2.0 2.45	U	Firm red brown occasionally mottled grey silty sandy CLAY with zones of sand			100% 19	34	15	20	2.14	REM UM 105	100 200 400	76 //- -	40	-
	4.5	D	Soft red brown very silty CLAY with abundant coal fragments and occasional gravel			93% 17	32	15	22						
	5.0 5.45	U	Soft red brown very silty sandy CLAY with zones of sand and occasional siltstone fragments			100% 20 9	35	15	26 26)	2.01 2.07	UM 105	100 200 400	13 16 24	9	-

Remarks // excessive strain.
+ Rate of stress 2% per minute

Laboratory Results – Summary

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Figure 3.2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_P	w %	γ_b Mg/m³	Test+	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B3	6.5	U	Firm fissured red brown			100%			26	1.99		100	69		
	6.95		silty sandy CLAY with zones			14	29	15	26	1.99	UT	200	85	45	-
			of silt and sand.						24	2.01	38	400	128		
	7.5	D	Firm fissured red brown												
	7.95		silty CLAY with zones of	8.7	0.05 %				16						
			silt												
	8.2	D	Hard red brown mudstone			59%									
			with occasional zones of			17	34	17	13						
			silt.												
	8.5	D	Firm fissured friable red						14						
	8.95		brown silty CLAY (Marl)												
			with zones of silt.												
	9.1	D	Stiff grey mottled red			70%									
			brown very silty CLAY (Marl)			10	26	16	16						
			with siltstone fragments.												
	9.3	D	Hard red brown fissured												
	9.5		silty CLAY (Marl) with						13						
			zones of silt.												
4	0.5	U	Firm occasionally fissured						23	2.03		100	177		
	1.0		red brown silty sandy CLAY						23	2.03	UT	200	157	70	-
			(Marl) with abundant coal						22	2.03	38	400	93		
			fragments and occasional												
			zones of sand.												
	1.3	D	Firm fissured red brown						29						
			silty CLAY with coal frag-												
			ments and occasional gravel												
	1.5	U	Firm red brown silty CLAY			100%			46	1.76		100	94		
	2.0		with occasional coal frag-			21	44	23	45	1.76	UT	200	81	45	-
			ments and zones of silt						44	1.78	38	400	110		
	2.2	D	Soft grey very silty CLAY						45						
			with coal fragments and												
			occasional zones of silt.												
	2.8	B													

Remarks + Rate of strain 2% per minute

Laboratory Results – Summary

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Figure 3.3

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_p	w %	γ_b Mg/m³	Test+	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
4	3.0 3.5	U	Red brown MUDSTONE with zones of silty clay and sand and coal fragments.						28	2.18	UM 105	100 200 400	651 ± -	330	-
	3.7	D	Groundwater	7.6	12										
	4.5 5.0	U	Very stiff fissured friable red brown silty CLAY with abundant mudstone fragments and occasional zones of sand.						17	2.18	UM 105	100 200 400	329 404 507	210	-
5	0.5 1.0	U	Stiff brown silty sandy CLAY with abundant gravel siltstone fragments roots and zones of silt.						16	2.08	UM 105	100 200 400	123 161 201	80	-
	1.7 2.0	B	Stiff light brown occasionally mottled yellow brown silty sandy CLAY with gravel siltstone and sandstone fragments.						13						
	2.5 3.0	U	SANDSTONE SILTSTONE and soft white silty fragments in a matrix of soft brown silty sandy clay.			34% 18	36	18	12	2.17					
	3.7 4.1	B	Soft red brown silty slightly sandy CLAY matrix, with abundant zones of sand occasional gravel and coal fragments.						13						
	4.5 5.0	U	Very stiff fissured friable red brown silty CLAY (marl) with abundant mudstone fragments.						15	1.99	UM 105	100 200 400	284 443 587	220	-
6	0.5 0.8	D	Firm brown silty sandy CLAY with occasional gravel, roots and ocal fragments.			90% 9	25	14	19						
						2			2						

Remarks + Rate of strain 2% per minute

Laboratory Results – Summary

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Figure 3.4

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_P	w %	γ_b Mg/m³	Test+	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
6	0.8 1.6	D	Soft brown silty sandy CLAY with occasional gravel, roots and coal fragments.			94% 9	23	14	23						
	1.6 1.8	D	Very soft red brown silty slightly sandy CLAY with occasional coal fragments.			100% 18	33	15	28						
B7	0.5 0.95	U	Stiff red brown silty sandy CLAY with occasional gravel and zones of silt and sand.			93% 10	24	14	14	2.11	UM 105	100 200 400	129 184 286	100	-
	1.5 1.95	U	Firm red brown SAND with gravel turning to silty sandy CLAY.	7.5	0.01 %				22	2.09	UM 105	100 200 400	70 77 82	40	-
	3.5 3.75	U	Stiff red brown fissured friable silty CLAY with abundant mudstone fragments and zones of silt.						20	2.11	UM 105	100 200 400	201 219 **	100	-
	2.1	D	Groundwater	7.8	8.0										
	4.7 5.15	D	Stiff fissured red brown silty CLAY with zones of silt.			100% 16	33	17	13						
	5.5 5.95	D	Firm red brown mottled grey silty CLAY with zones of silt.						17						
	6.5 6.9	D	Stiff red brown mottled grey silty with zones of silt.						13						
8	0.5 1.0	U	Stiff brown occasionally mottled yellow brown silty CLAY with gravel, zones of silt and siltstone and sandstone fragments.			66% 30	54	24	25 25	2.12 2.09	REM UM 105	100 200 400	109 125 140	60	-
	2.0 2.5	U	Stiff red brown silty CLAY with zones of sand and silt.			39	60	21	18 18	2.20 2.21	REM UM 105	100 200 400	198 ø -	100	-

Remarks ** Failed uner 2nd loading
ø Excessive Strain
+ Rater of strain 2% per minute

Laboratory Results – Summary

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Figure 3.5

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test*	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
8	2.8	D	Soft grey brown silty CLAY with siltstone and coal fragments, gravel and zones of silt.						23						
	3.0	D	Orange brown SANDSTONE fragments.						-						
	4.0 4.5	B	Mottled brown and grey clayey silty sandy GRAVEL with sandstone fragments and zones of silt.						17						
	5.0 5.5	D	Firm fissured grey brown silty CLAY with coal fragments and zones of silt.			83% 20	38	18	21						
B9	0.5 0.95	U	Stiff fissured red brown silty CLAY (marl) with abundant siltstone fragments occasional gravel and zones of silt.			75% 18	39	21	21 23 20	2.02 2.01 2.05	UT 38	100 200 400	200 191 169	95	-
	1.5	D	Very stiff fissured brown silty CLAY with gravel and zones of silt.						16						
	2.0 2.45	U	Firm red brown mottled grey silty sandy CLAY with occasional gravel and coal fragments.			83% 17	34	17	16	2.26	REM UM 105	100 200 400	226 * -	110	-
	3.0	D	Very stiff fissured brown silty CLAY with gravel, coal fragments and zones of silt.						18						
	3.5	U	Very stiff brown silty sandy CLAY with gravel, siltstone and sandstone fragments and zones of silt.			91% 40	56	16	15 16	2.11 2.19	REM UM 105	100 200 400	254 284 319	145	-
	3.95	D	Very stiff fissured grey silty CLAY with gravel, siltstone and limestone fragments and zones of silt.						16						

Remarks * Excessive Strain
+ Rate of strain 2% per minute

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Figure 3.6

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_P	w %	γ_b Mg/m³	Test +	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B9	4.5	D	Very stiff fissured grey silty CLAY with gravel, silstone and limestone fragments and zones of silt			79% / 16	33	17	15						
	5.0	U	Very stiff dark brown silty sandy CLAY with gravel, siltstone and sandstone fragments.			91% / 21	36	15	15 / 15	2.20 / 2.19	REM / UM / 105	100 / 200 / 400	441 / 468 / 477	230	-
	5.4														
	6.0	D	Hard fissured grey silty CLAY with gravel, silstone fragments and zones of silt			79% / 18	35	17	13						
	6.4	D	Grey LIMESTONE fragments.						-						
	6.6	CORE							-	2.30				13.2 MN/m2	
	6.9														
	7.8	D	Firm yellow brown mottled red brown silty sandy CLAY with occasional gravel, mudstone fragments and zones of silt.	8.6	0.07 %	57% / 13	27	14	11*						
	7.95	CORE							-	2.45				39.3 MN/m2	
	8.1														
	10.5	D	Very stiff fissured fiable red brown silty CLAY with zones of silt and occasional silstone fragments.	8.6	0.04	100% / 10	28	18	13*						
	12.1	CORE	Unsuitable for strength test.												
	12.25														
	14.5	D	Very stiff fissured red brown silty CLAY (marl) with mudstone fragments and zones pf silt.			100% / 12	28	16	15*						

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Remarks * Note - water flush coring used and D samples not recovered from cores for 4 days. + Rate of strain 2% per minute

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Figure 3.7

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_P	w %	γ_b Mg/m³	Test *	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
10	0.5 0.9	U	Stiff yellow brown mottled grey green silty CLAY with abundant gravel, occasional siltstone fragments and zones of sand.			39% 30	51	21	19	2.02	UM 105	100 200 400	141 184 **	80	-
	1.6	D	Yellow brown mottled grey silty CLAY with gravel and sandstone fragments.			64% 9	27	18	9						
	3.0 3.35	U	Brown clayey sandy SILT with zones of silt clay and fine sand. Shear surfaces within the silty CLAY.			100% 14	27	13	19 18	2.09 2.14	REM UM 105	100 200 400	33 41 49	20	-
	3.8	D	Firm fissured brown silty slightly sandy CLAY with abundant coal fragments.			99% 17	34	17	21						
	4.5 4.95	U	Very stiff red brown silty sandy CLAY with siltstone fragments and zones of silt.			94% 18	33	15	17	2.16					
	6.0 6.25	D	Friable yellow brown very silty CLAY with flint and limestone fragments and zones of silt.						9						
	8.5	D	Firm fissured red brown silty CLAY (marl) with occasional zones of silt.			100% 15	30	15	15						
	9.8	D	Very stiff fissured friable red brown silty CLAY (marl) with occasional mudstone fragments and zones of silt.			100% 10	26	16	13						
	10.55 10.85	CORE							-	2.39				6.9 MN/m2	
	11.2	D	Very stiff fissured friable red brown silty CLAY (marl) with occasional zones of silt.			100% 11	28	17	12*						

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Remarks ** Failed under 2nd-loading + Rate of strain 2% per minute
* Note-water flush coring used and D samples not recovered from cores for 4 days.

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Figure 3.8

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_P	w %	γ_b Mg/m³	Test+	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
10	12.8	D	Firm friable grey green silty CLAY with abundant zones of silt.			100% 15	31	16	18						
11	0.6 1.0	D	Firm friable mottled brown and grey silty sandy CLAY with occasional gravel and zones of silt.			87% 20	43	23	23						
	1.0 1.2	D	Firm friable grey brown silty sandy CLAY with zones of sand and abundant gravel.			78% 14	35	21	20						
12	0.5 1.0	U	Stiff fissured friable red brown silty CLAY with mudstone fragments, occasional roots and zones of silt.			98% 21	43	22	21 22 22	2.08 2.04 2.09	UT 38	100 200 400	336 247 192	130	-
	2.0 2.45	U	Red brown silty CLAY			94% 9	27	18	18						
	3.6 4.1	B	Stiff red brown silty CLAY with siltstone fragments and occasional zones of silt.			100% 19	36	17	32						
	4.1 4.6	D	Stiff fissured friable red brown silty CLAY with occasional zones of silt.			100% 12	32	20	14						
	5.3	D	Groundwater	7.1	14										
	5.5 5.85	D	Stiff fissured red brown silty CLAY with occasional zones of silt.			85% 13	32	19	14						
13	0.5 1.0	U	Stiff red brown silty sandy CLAY with zones of sand occasional gravel and roots.						14	2.02	UM 105	100 200 400	155 173 203	90	-

Remarks + Rate of strain 2% per minute

Laboratory Results – Summary

exploration associates

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Figure 3.9

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_P	w %	γ_b Mg/m³	Test*	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
13	1.4	D	Stiff fissured red brown silty CLAY with abundant coal fragments and zones of silt.			76% / 22	40	18	22						
	2.0 2.5	U	Very stiff friable red brown very silty sandy CLAY with abundant siltstone fragments.			93% / 20	48	28	21						
	3.5 3.9	U	Very stiff fissured red brown silty CLAY with zones of silt and mudstone fragments.						15	2.15					
	5.0 5.4	D	Stiff fissured light grey mottled red brown silty CLAY with occasional zones of silt.			77% / 15	32	17	14						
	5.5	D	Groundwater	8.3	8.2										

3

Remarks + Rate of strain 2% per minute

Laboratory Results – Summary

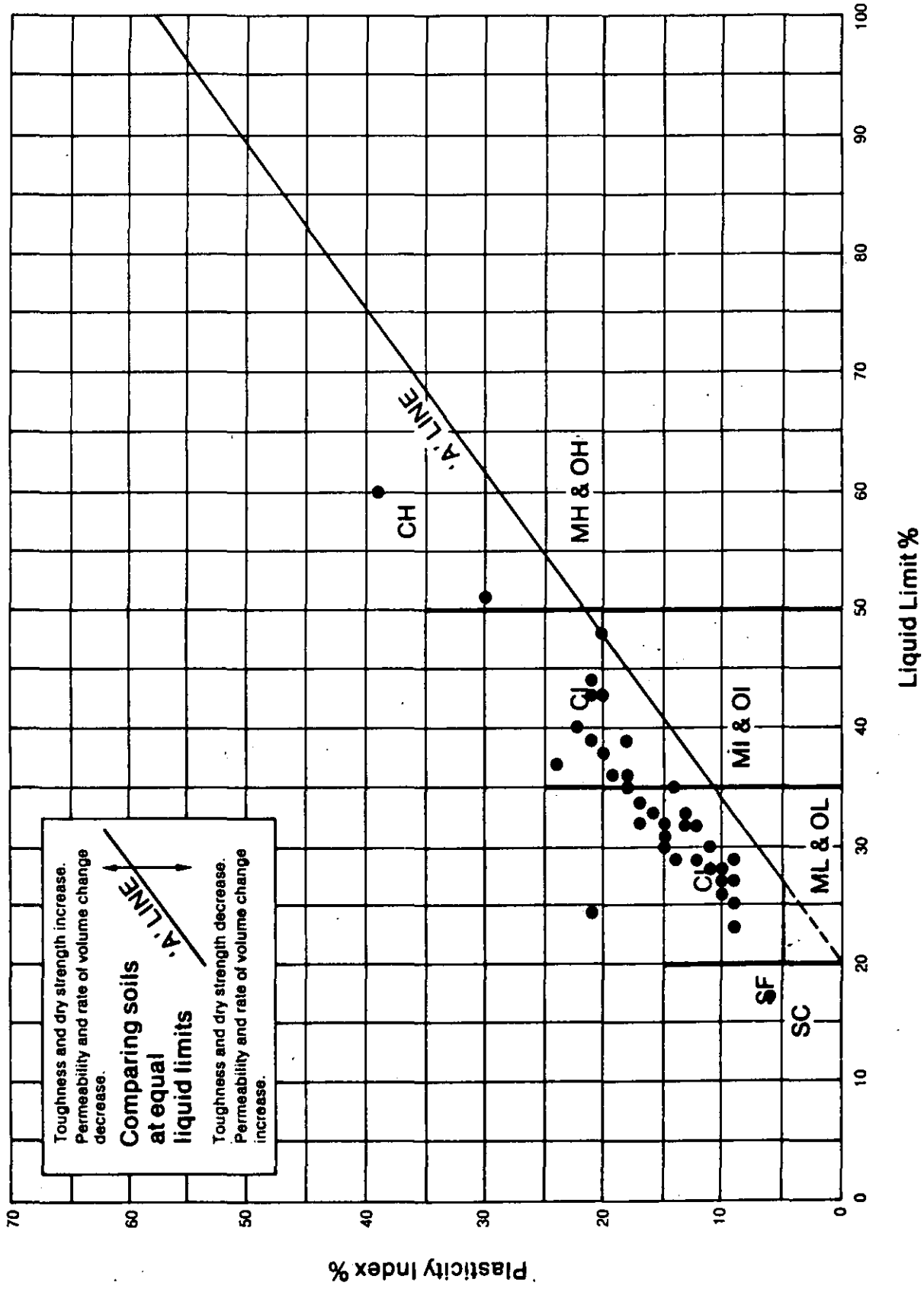
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Figure 3.10

EX2



Remarks

Laboratory—Plasticity chart

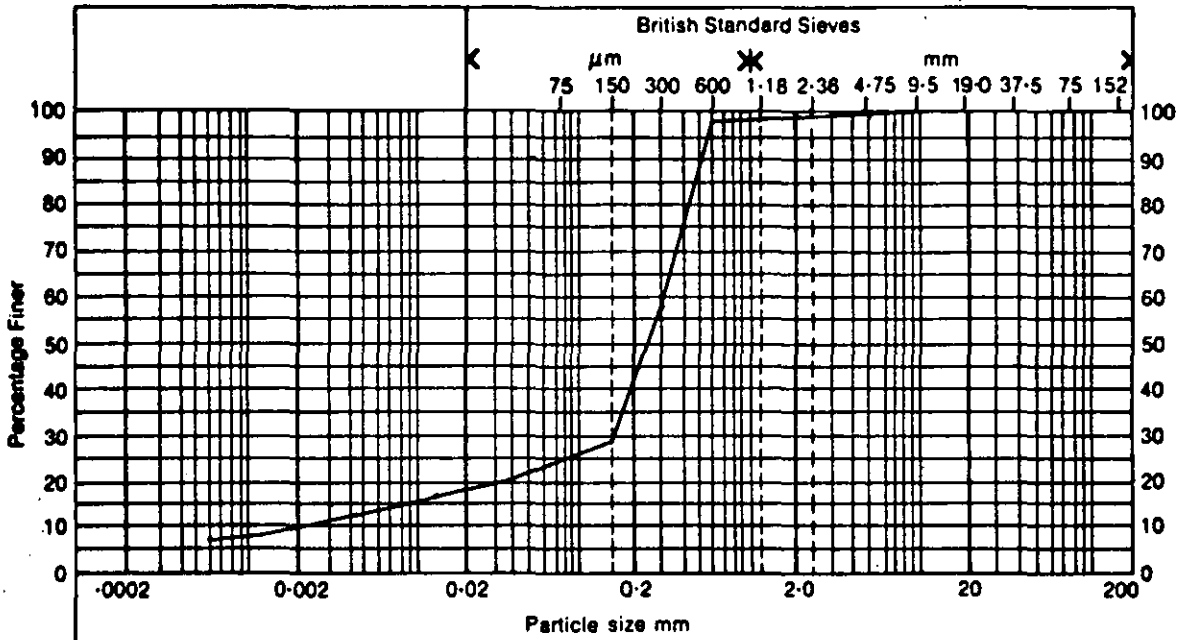
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Figure 3.11

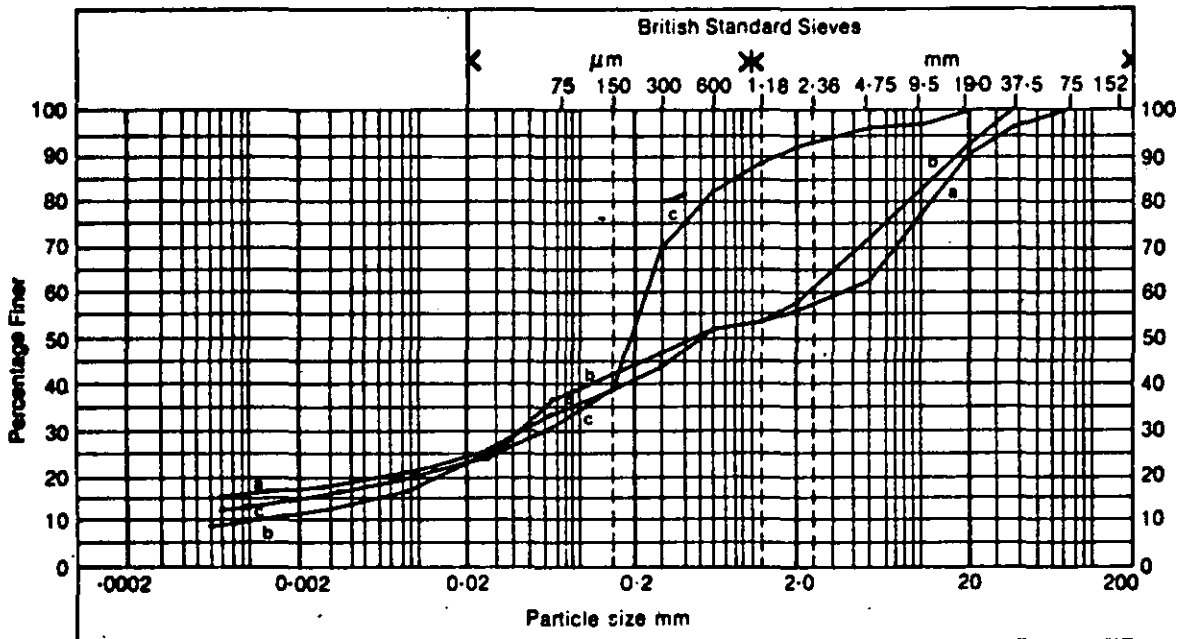
EX 6



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

Depth (a) 1.5 - 2.0
(b)
(c)

Borehole B2



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

Depth (a) 0.5 - 1.0
(b) 1.7 - 2.0
(c) 3.7 - 4.1

Borehole 5

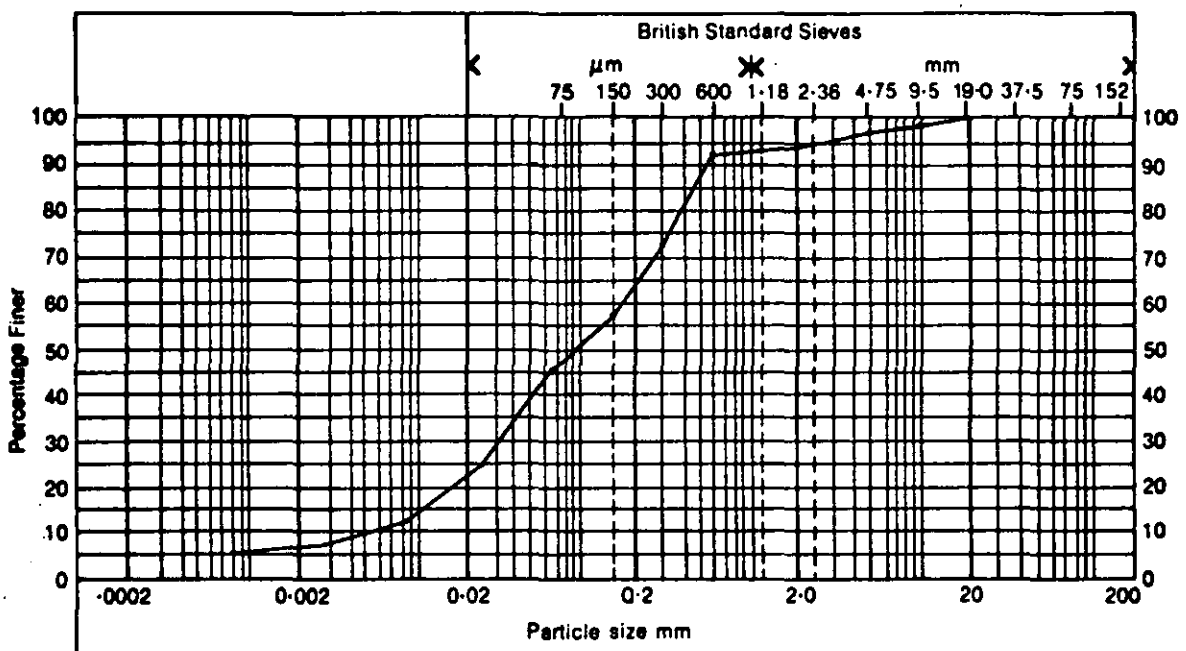
Laboratory—Particle size.

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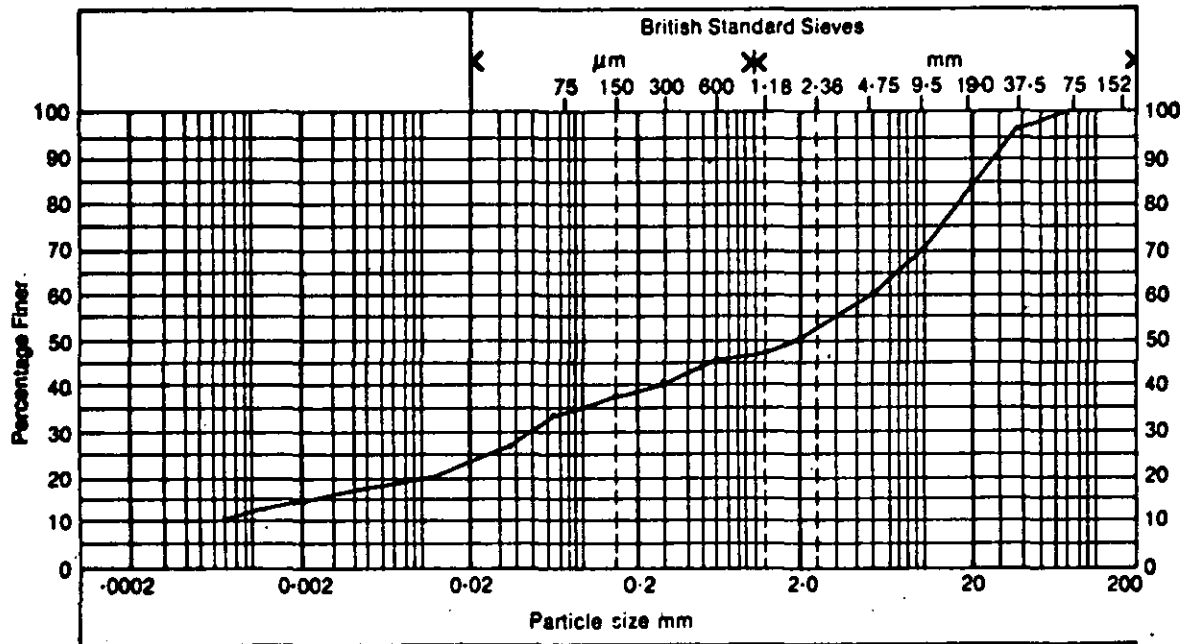
Figure 3.12



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

Depth (a) 0.5 - 0.95
(b)
(c)

Borehole B7



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

Depth (a) 4.0 - 4.5
(b)
(c)

Borehole 8

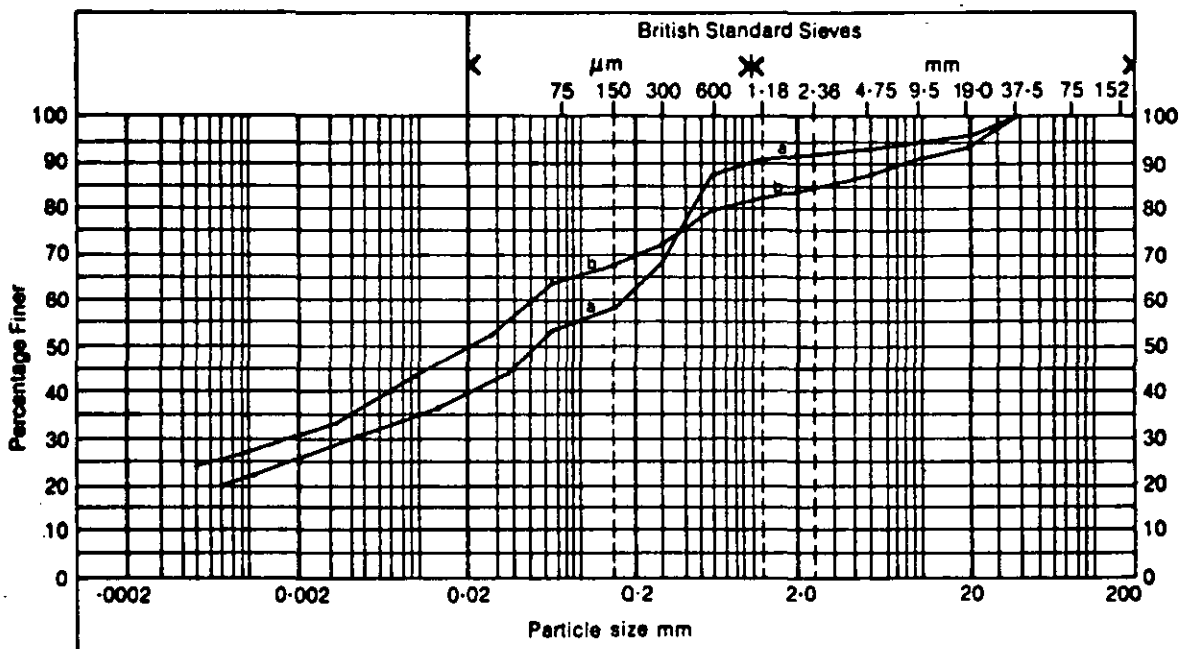
Laboratory—Particle size.

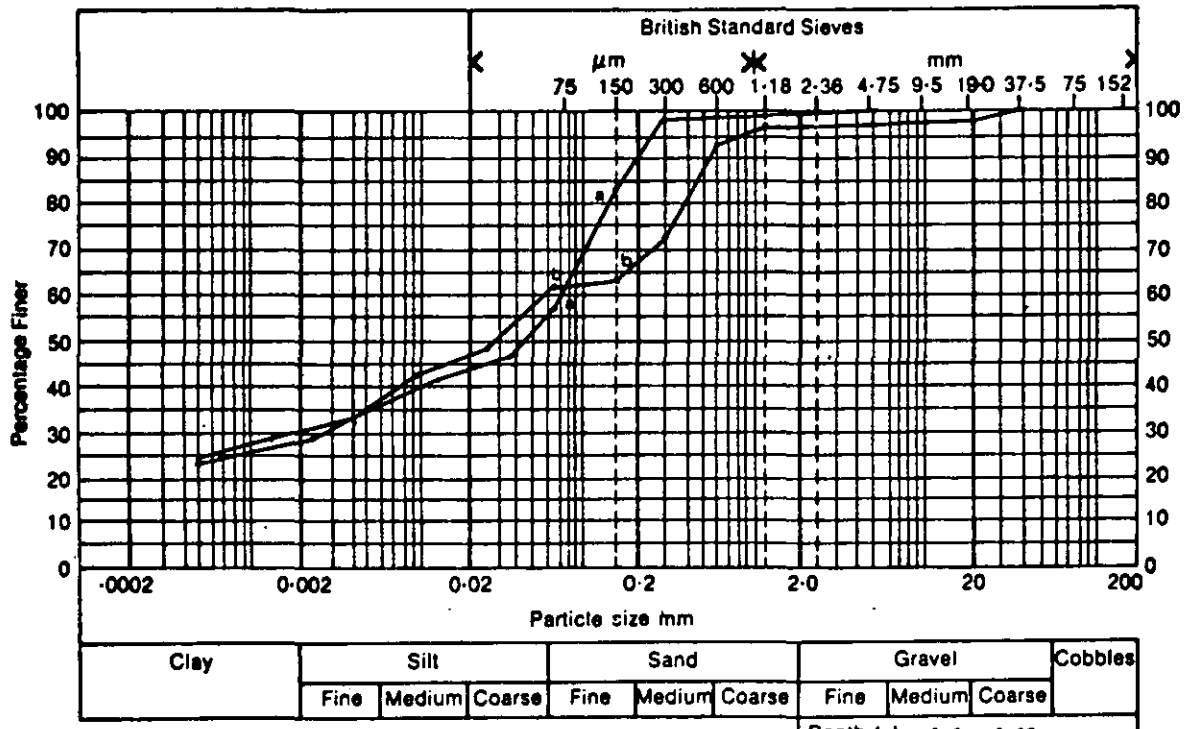
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Figure 3.13





Laboratory—Particle size.

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Figure 3.14

Samples				Class		Compression			Rate						
Hole	Depth	Type	Description	w %	γ_b Mg/m^3	m_v – m^2/kN x 10^{-4}			C_v – m^2/year – For stress ranges (kN/m^2)						
						Po+ 50	Po+ 100	Po+ 300	10 25	25 50	50 110	110 210	210 430	430 850	850 1700
1	0.6 1.1	U	Silty very sandy CLAY with occasional gravel and roots.	21 16 final	2.07	4.31	3.32	2.02	0.72	1.40	0.84	1.56	2.48		
	1.5 2.0	U	Silty CLAY with coal fragments.	27	1.97	2.69	2.48	1.80	-	0.91	2.11	1.91	1.71		
	2.5 3.0	U	Fissured friable silty CLAY (marl).	16 16 final	2.25	0.74	0.74	0.52		-	6.12	9.08	6.87	4.85	
	3.5 4.0	U	Silty CLAY with mudstone fragments.	22	2.13	0.98	0.82	0.65			-	-*	5.89		
B3	6.5 6.95	U	Very clayey SILT with occasional mudstone fragments.	27	2.09	1.31	1.31	1.04	-	5.37	-*	-*	6.47	-*	
4	0.5 1.0	U	Silty CLAY with occasional zones of silt.	26	2.01	3.65	3.09	2.11	-	0.40	0.89	0.72	0.75		
	1.5 2.0	U	Silty slightly sandy organic CLAY with occasional decayed vegatation and zones of silt.	44	1.78	7.67	6.65	4.73	0.31	0.51	0.24	0.28	0.37		
	3.0 3.5	U	Friable very silty CLAY (marl) with zones of mudstone fragments.	15	2.20	1.10	1.02	0.78	-	3.02	7.45	-*	5.73		
B7	0.5 0.95	U	Silty very sandy CLAY with occasional roots.	17	2.07	4.36	2.84	1.68	0.51	1.06	0.47	0.54	2.32		
	1.5 1.95	U	Silty sandy CLAY with gravel, siltstone fragments and zones of sand.	25	2.01	3.68	3.22	2.25	-	0.71	0.69	0.72	0.68		
	2.5 2.95	U	Friable very silty CLAY with occasional siltstone fragments and zones of silt.	19	2.17	1.25	1.25	1.25	-	1.29	2.15	4.96	2.25		

Remarks * Greater than 10m^2/yr.
All specimens cut vertically with nominal dimensions 19mm thick 76mm diamter

Laboratory – Consolidation

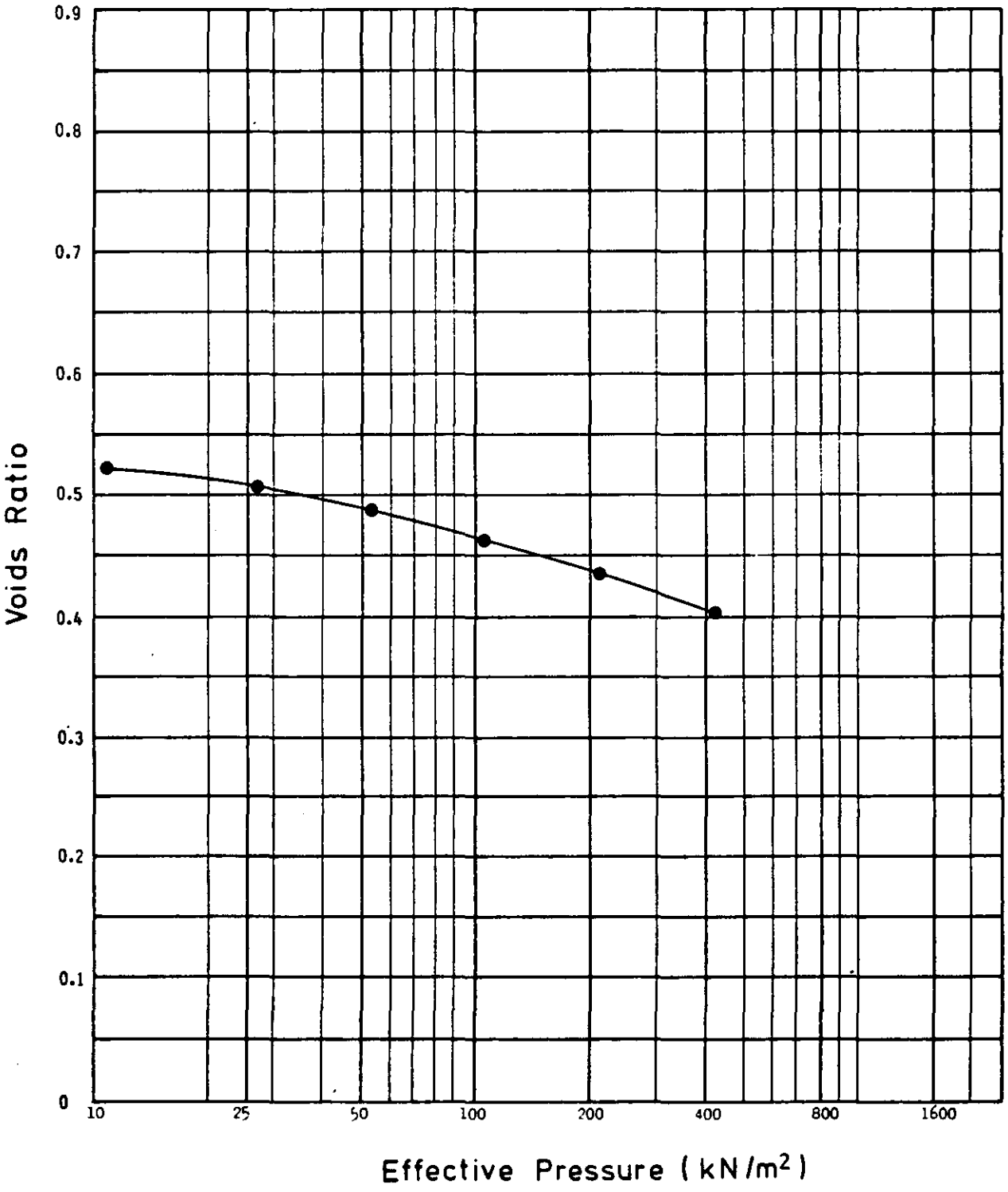
exploration associates

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Isley Walton to M1 Section
Preliminary Site Investigation

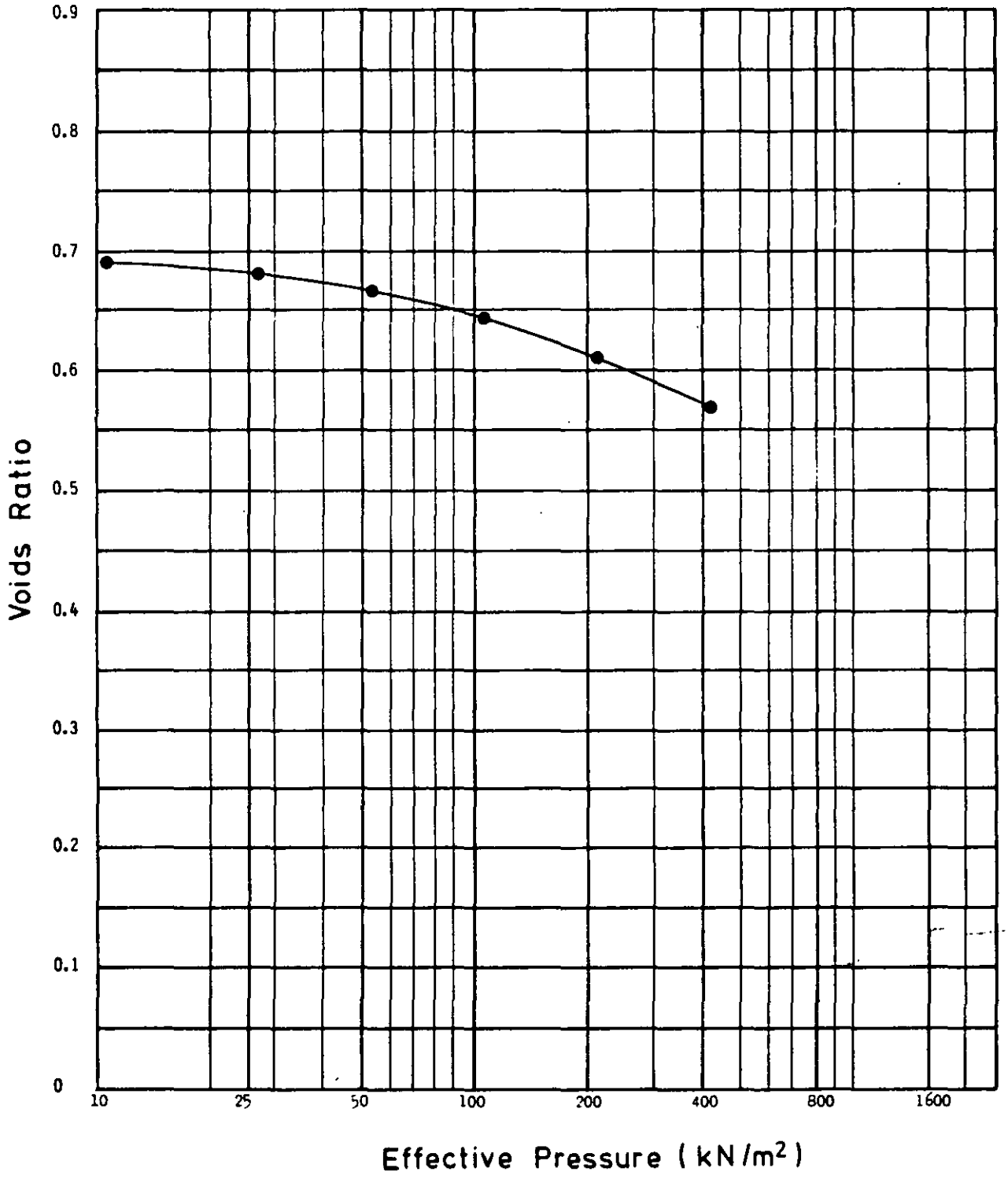
Contract S2796

Figure 3.15

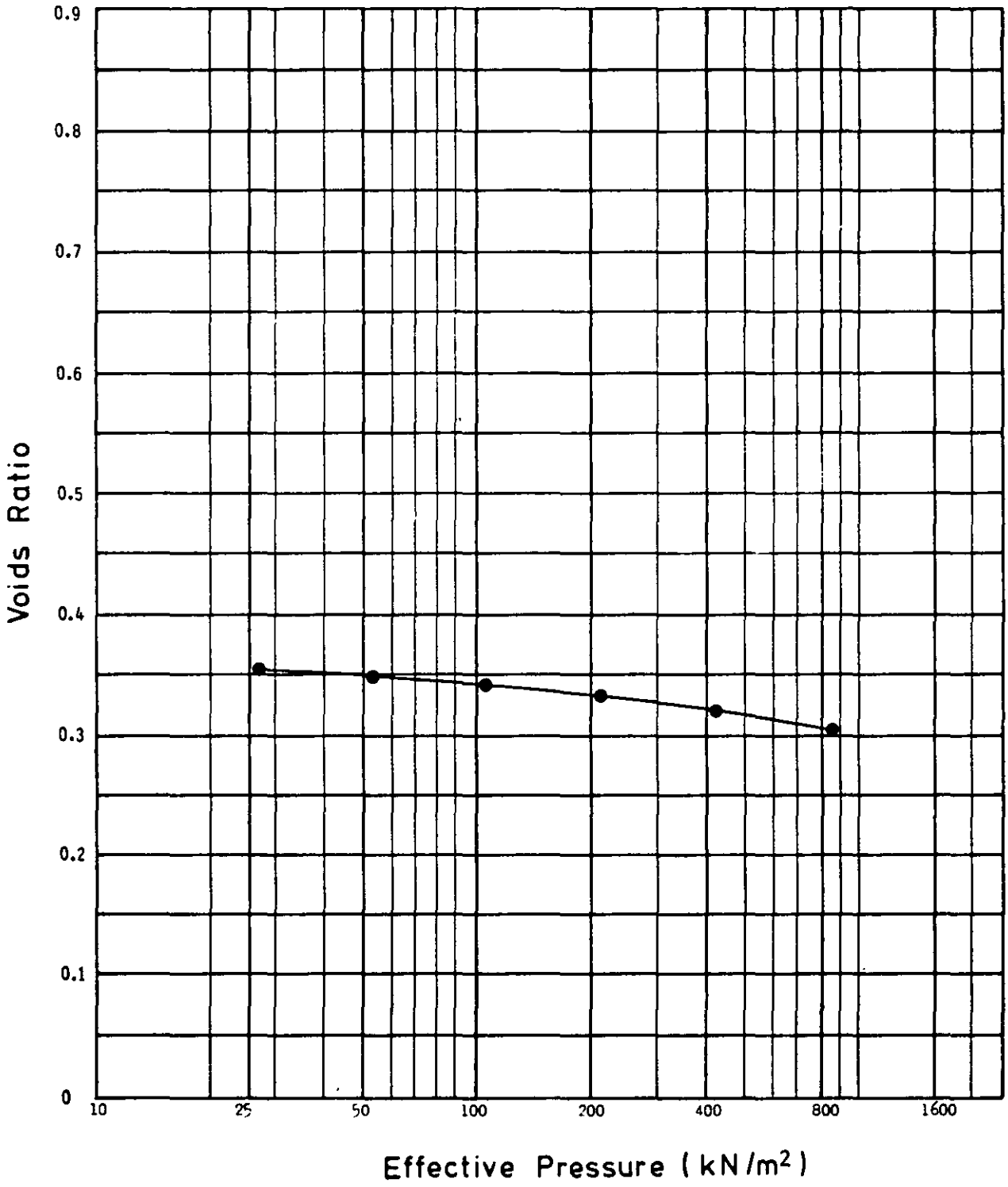
EX 8



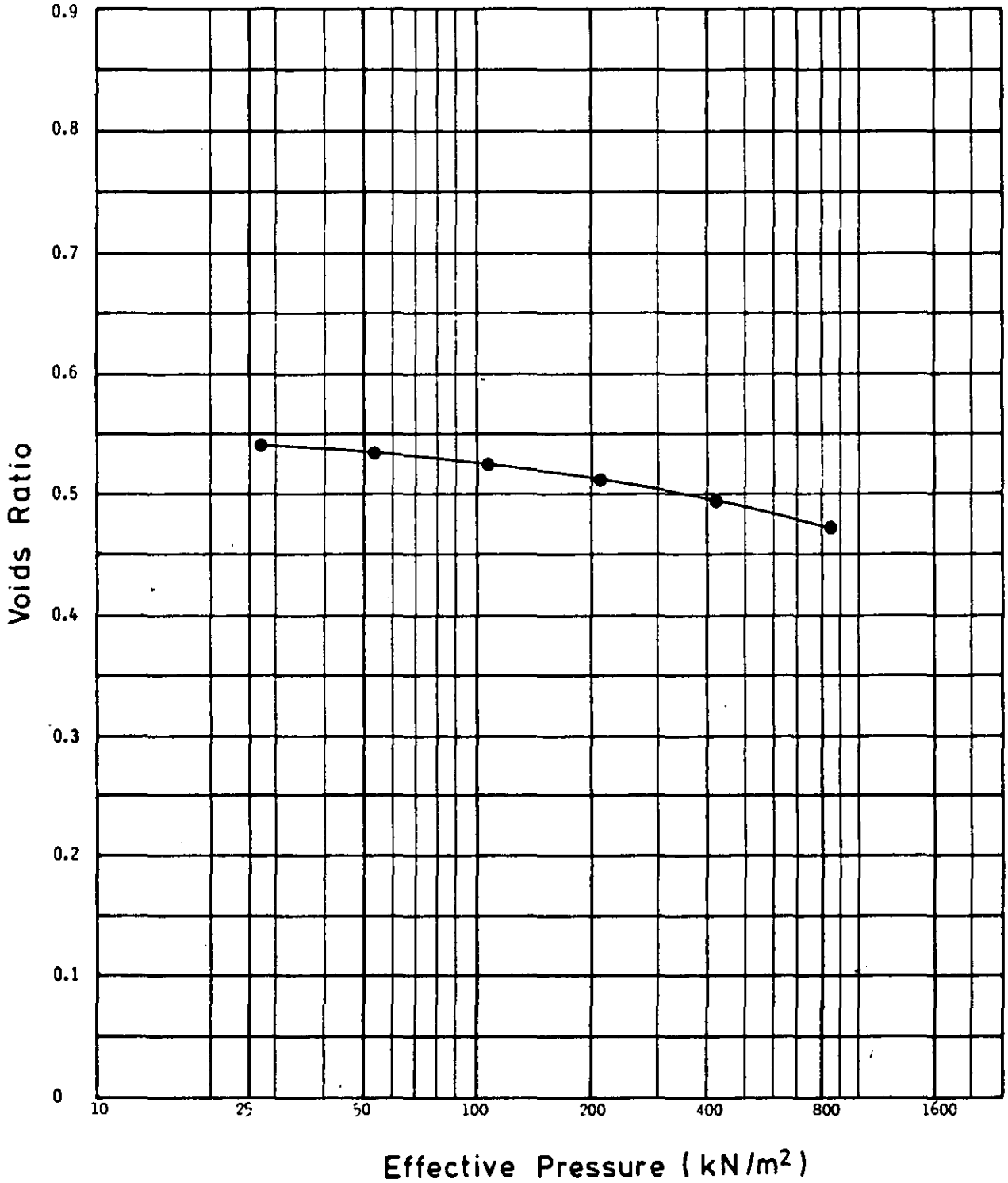
Consolidation Test	Specific Gravity 2.63 (assumed) Initial Voids Ratio 0.544	Depth 0.6 – 1.1 Hole 1
Remarks		
Laboratory – e / log P	**Project** Department of Transport A564 Stoke – Derby Link Derby Southern By. Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 3.16



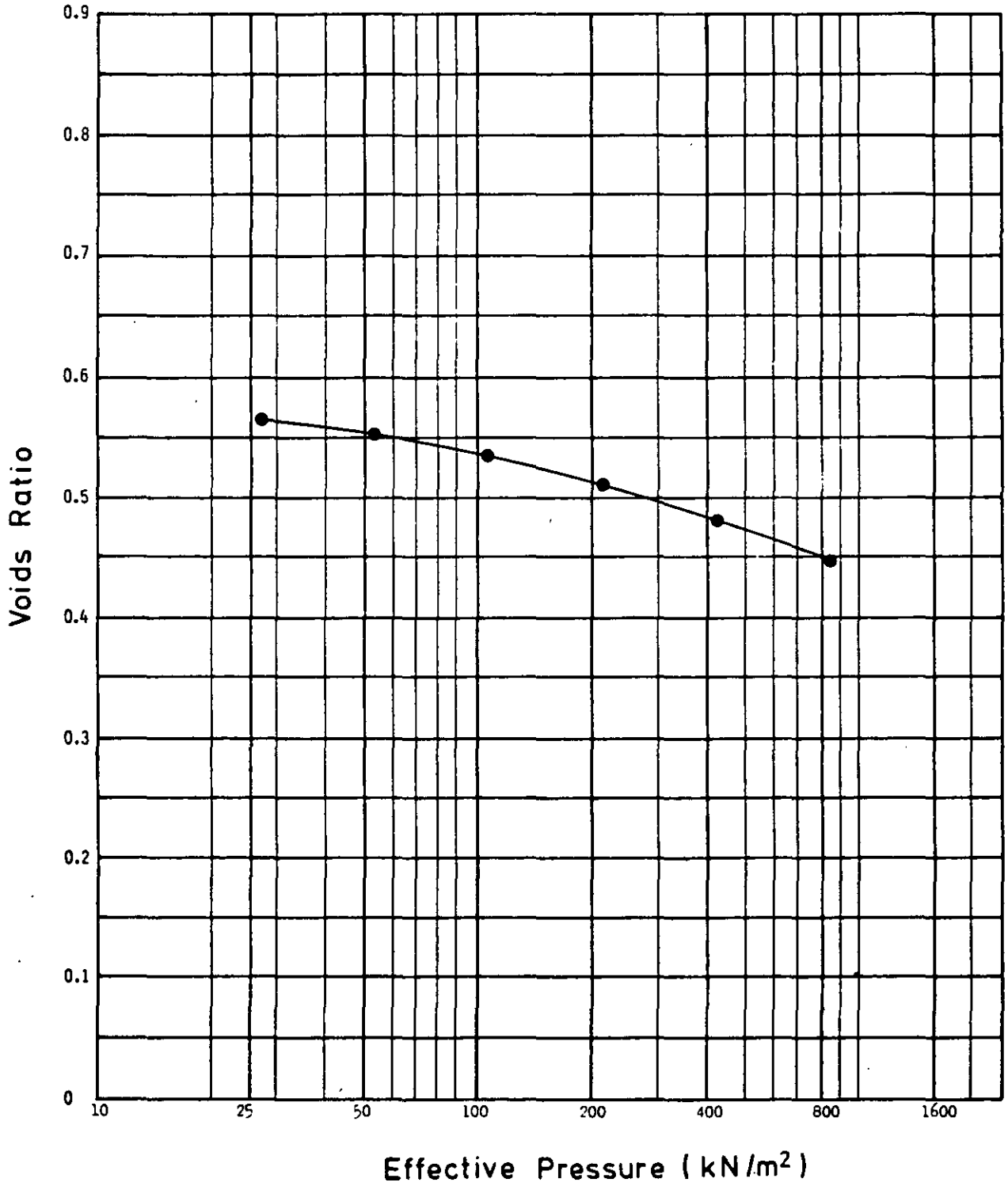
Consolidation Test	Specific Gravity 2.63 (measured) Initial Voids Ratio 0.694	Depth 1.5 - 2.0 Hole 1
Remarks		
Laboratory – e / log P	**Project** Department of Transport A564 Stoke - Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 3.17



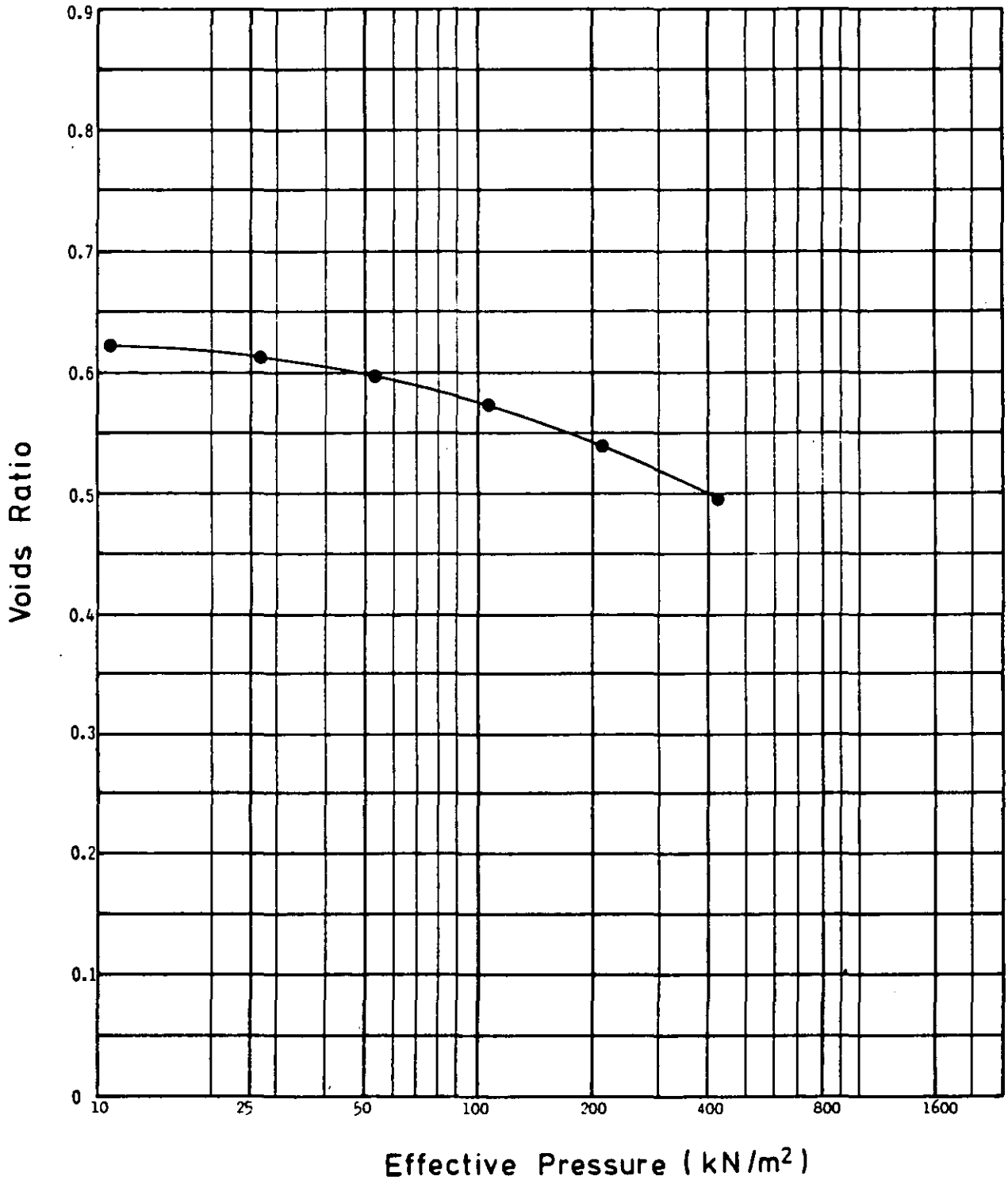
Consolidation Test	Specific Gravity 2.63 (Assumed) Initial Voids Ratio 0.356	Depth 2.5 - 3.0 Hole 1
Remarks		
Laboratory – e / log P	**Project** Department of Transport A564 Stoke – Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 3.18



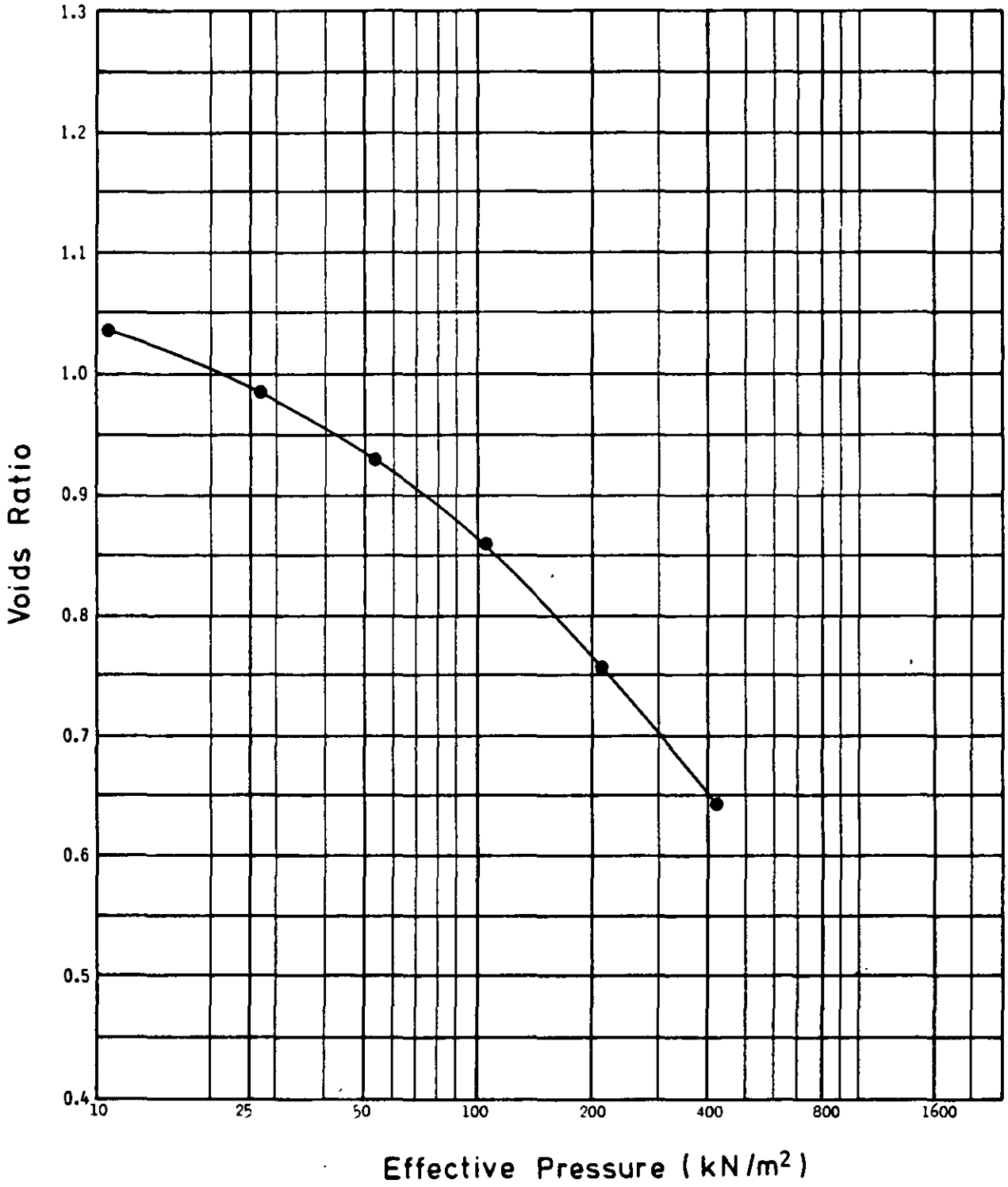
Consolidation Test	Specific Gravity 2.70 (measured) Initial Voids Ratio 0.549	Depth 3.5 - 4.0 Hole 1
Remarks		
Laboratory – e / log P	**Project** Department of Transport A564 Stoke - Derby link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 3.19



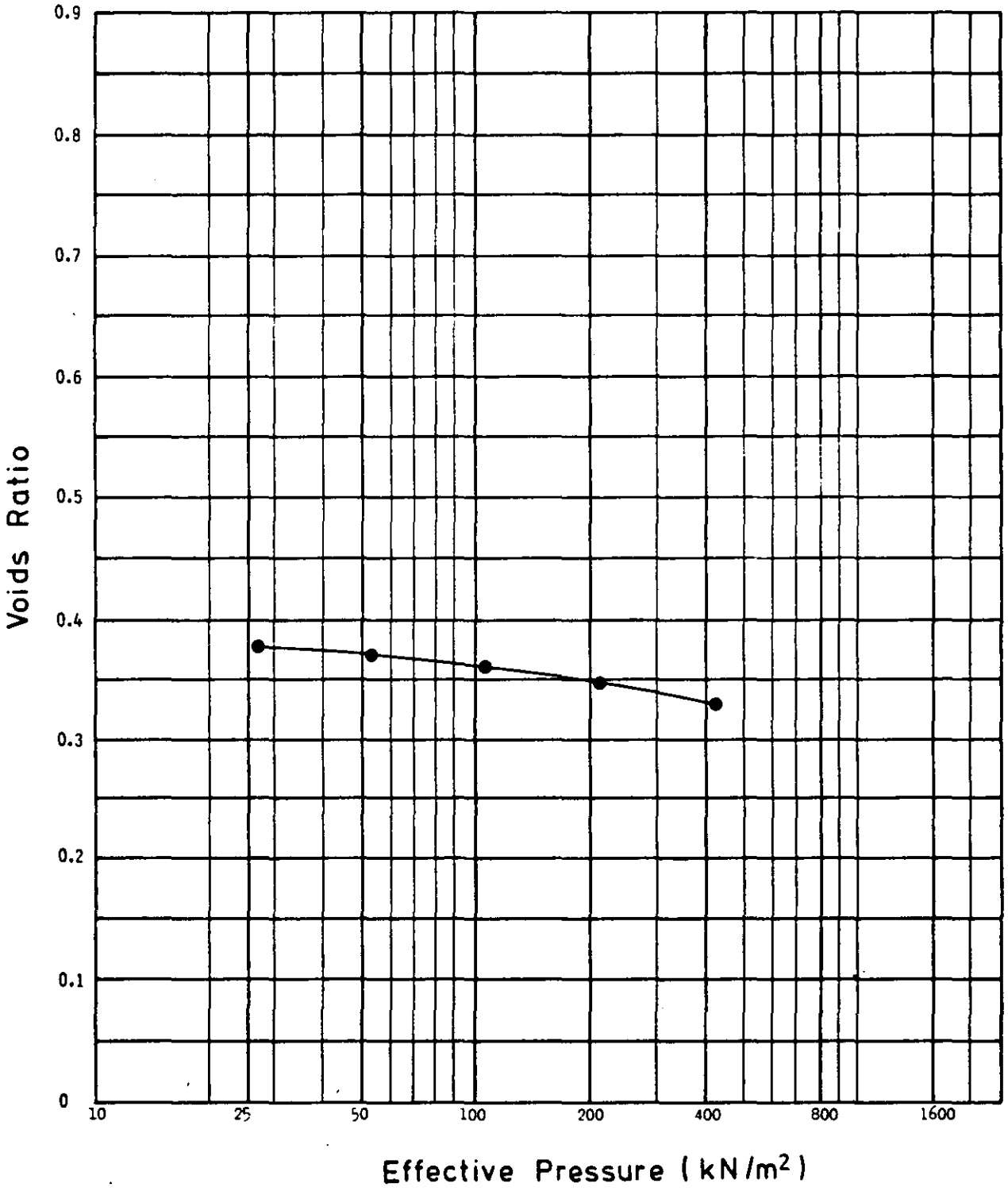
Consolidation Test	Specific Gravity 2.61 (measured) Initial Voids Ratio 0.588	Depth 6.5 – 6.95 Hole B3
Remarks		
Laboratory – e / log P	**Project** Department of Transport A564 Stoke – Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 3.20



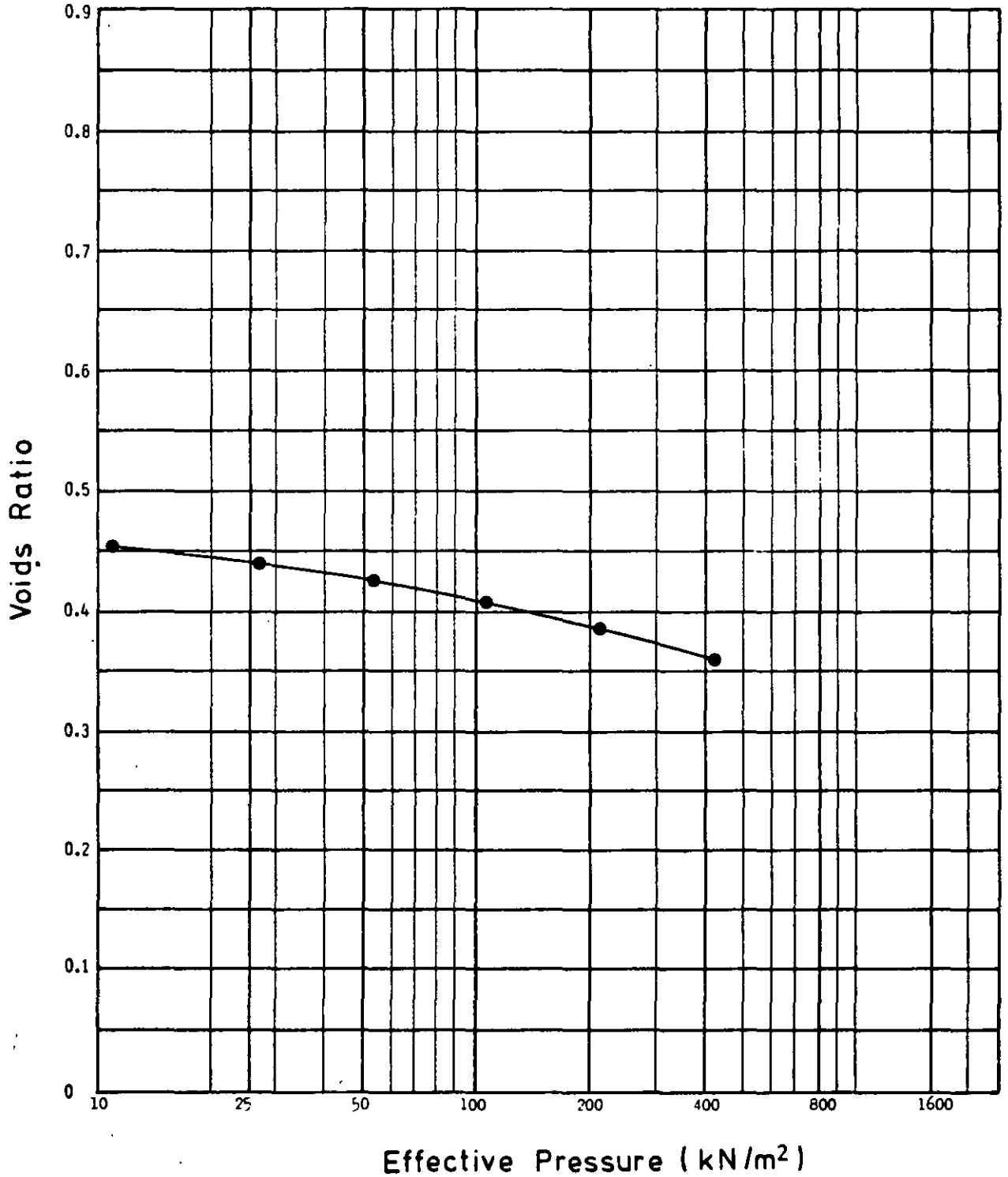
Consolidation Test	Specific Gravity 2.60 (measured) Initial Voids Ratio 0.625	Depth 0.5 - 1.0 Hole 4
Remarks		
Laboratory – e / log P	**Project** Department of Transport A564 Stoke - Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 3.21



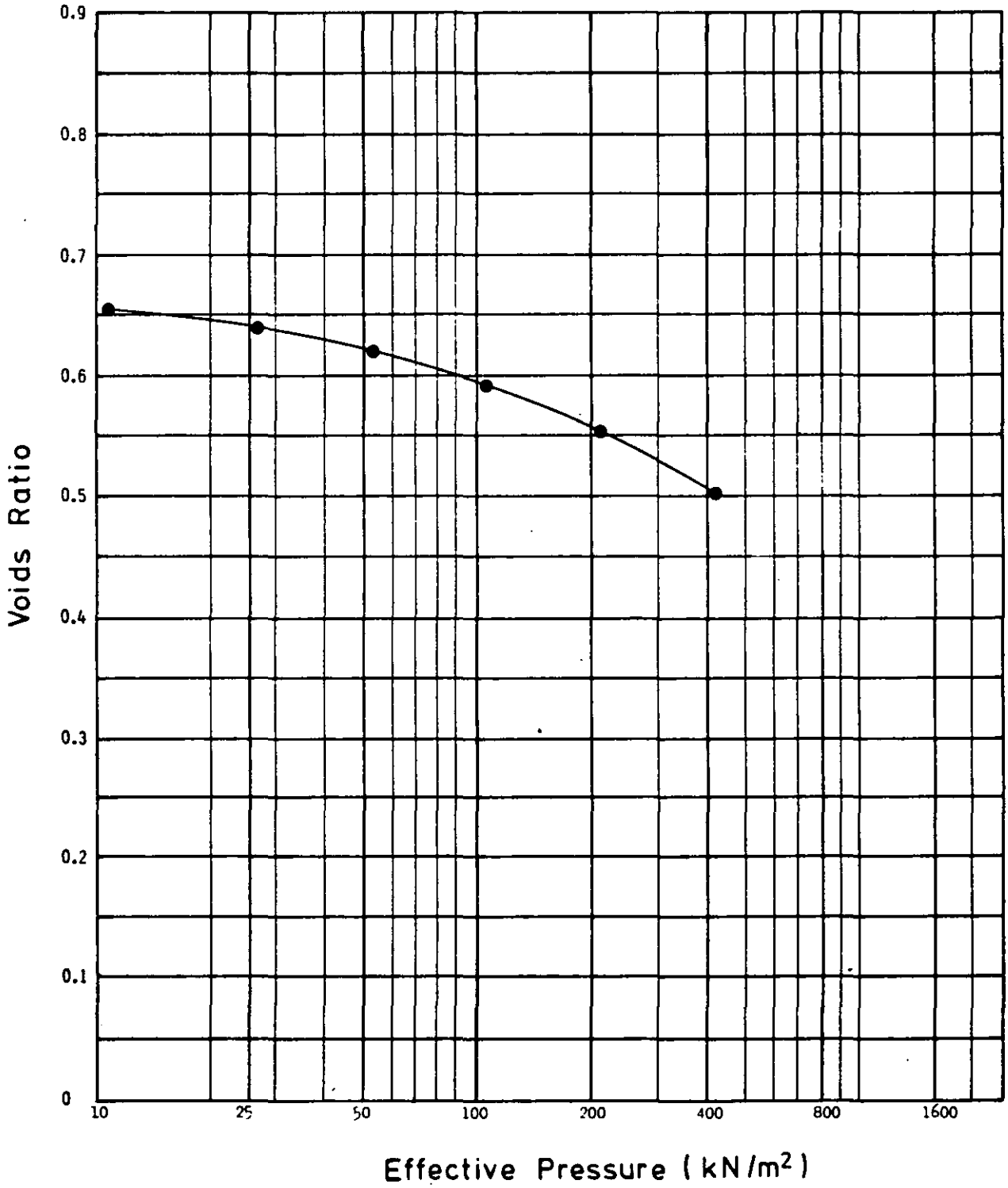
Consolidation Test	Specific Gravity 2.56 (measured) Initial Voids Ratio 1.062	Depth 1.5 - 2.0 Hole 4
Remarks		
Laboratory – e / log P	**Project** Department of Transport A564 Stoke - Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 3.22



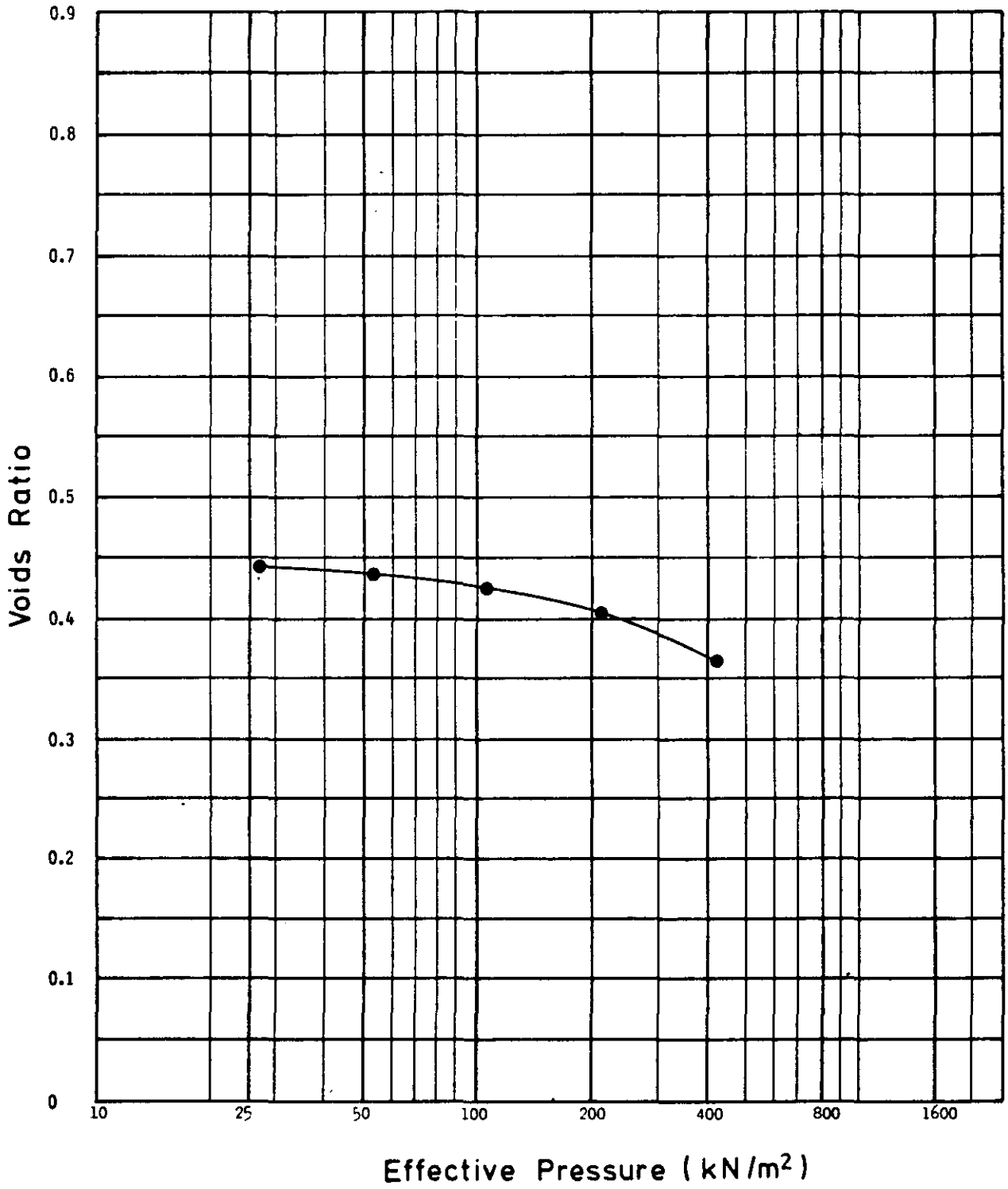
Consolidation Test	Specific Gravity 2.67 (measured) Initial Voids Ratio 0.391	Depth 3.0 - 3.5 Hole 4
Remarks		
Laboratory - e / log P	**Project** Department of Transport A564 Stoke - Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 3.23



Consolidation Test	Specific Gravity 2.61 (measured) Initial Voids Ratio 0.477	Depth 0.5 - 1.0 Hole B7
Remarks		
Laboratory – e / log P	**Project** Department of Transport A564 Stoke – Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 3.24



Consolidation Test	Specific Gravity 2.65 (measured) Initial Voids Ratio 0.657	Depth 1.5 - 2.0 Hole 87
Remarks		
Laboratory – e / log P	**Project** Department of Transport A564 Stoke - Derby link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 3.25



Consolidation Test	Specific Gravity 2.65 (measured) Initial Voids Ratio 0.449	Depth 2.5 - 2.95 Hole B7
Remarks		
Laboratory - e/log P	**Project** Department of Transport A564 Stoke - Derby link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 3.26

Samples				CBR							Compaction				
Hole	Depth	Type	Description	Top	Base	Top w%	Base w%	Surch. kg.	Nat w%	γ_b Mg/m^3	Type	Opt. w%	γ_d Max.	Mg/m^3 At Nat w.	G_s
B2	1.5 2.0	B	Silty clayey SAND with occasional rooots and sandstone fragamnts.	-	-	-	-	-	21	-	Std	11.4	1.88	1.65	2.60
B3	5.0 5.45	U	Very silty sandy CLAY with zones of sand and occasional siltstone fragments.	0.6	0.7	24.5	23.5	13.6	26	1.98 2.01	*— std.	15.9	1.78	1.60	2.70
	6.5 6.95	U	Fisssured silty sandy CLAY (marl) with zones of silt and sand.	0.3	0.3	25.1	25.9	13.6	26	1.99 1.99	* -	-	-	-	-
5	1.7 2.0	B	Silty sandy CLAY with gravel, siltstone and sandstone fragments.	-	-	-	-	-	13	-	Std	14.4	1.84	1.87	2.64
	2.5 3.0	U	SANDSTONE, siltstone and CHALK fragments in a matrix of silty sandy clay.	4.2	4.0	11.8	11.0	13.6	12	2.18 2.17	* -	-	-	-	-
	3.7 4.1	B	Silty slightly sandy CLAY with abundant zones of sand, occasional gravel and coal fragments.	2.1	2.2	12.8	12.7	13.6	13	2.25 -	*— -	-	-	-	-
8	0.5 1.0	U	Silty CLAY with gravel, zones of silt and stilstone and sandstone fragments.	-	-	-	-	-	25	2.12	Std	19.4	1.67	1.64	2.67
	4.0 4.5	B	Silty sandy CLAY with gravel, sandstone fragments and zones of silt.	3.5	2.5	15.5	13.3	13.6	17	2.18 -	*— Std.	11.4	1.91	1.96	2.67
B9	2.0 2.45	U	Silty sandy CLAY with occasional gravel and coal fragments.	-	-	-	-	-	16	2.26	Std	13.0	1.82	1.85	2.64

Remarks *— Remoulded to Proctor effort.
* Remoulded to Natural density

Laboratory — CBR/Compaction

exploration associates

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Derby Southern By Pass
Isley Walton to M1 Section
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Figure 3.27

EX 7

Samples				CBR							Compaction				
Hole	Depth	Type	Description	Top □	Base □	Top w%	Base w%	Surch. kg.	Nat w%	γ_b Mg/m³	Type	Opt. w%	γ_d Max.	Mg/m³ At Nat w.	G_s
10	3.0 3.35	U	Clayey sandy SILT with zones of silty clay and sand.	-	-	-	-	-	19	2.09	Std	13.3	1.90	-	2.71
12	3.6 4.1	B	Silty CLAY with siltstone fragments and occasional zones of silt.	1.8	1.4	21.4	20.7	13.6	22	2.07* -	-	-	-	-	-
13	2.0 2.5	U	Friable silty sandy CLAY with abundant siltstone fragments.	25.6	19.2	18.7	17.1	13.6	21	1.90* -	Std	21.0	1.61	1.55	2.70
	3.5 3.9	U	Fissured silty CLAY with zones of silt and mudstone fragments.	12.4	20.4	16.6	16.2	13.6	15	2.15* 2.15	-	-	-	-	-
										γ_{d_3} Mg/m³					
3	5.0 5.5 and 6.5 6.95		Very silty sandy CLAY with zones of sand and occasional siltstone fragments.	96 82 28 18 8 6	78 76 33 16 8 5	4.1 7.4 10.7 12.2 13.4 15.0	3.9 7.6 10.7 12.6 13.6 15.3	13.6	26*	1.906 1.998 2.013 2.013 1.973 1.893	BSH in CBR mould	11	2.015	-	2.7*
12	3.6 4.1		Silty CLAY with siltstone fragments and occasional zones of silt.	101 97 68 36 17 10	90 91 66 35 19 9	5.0 8.6 11.3 12.4 14.7 15.8	4.9 8.5 10.7 12.7 14.4 16.0	13.6	22*	1.909 1.983 2.015 2.015 1.968 1.899	BSH in CBR Mould	12	2.015	-	2.7**
13	3.5 3.9		Silty CLAY with zones of silt and mudstone fragments.	80 78 63 33 40 10	49 62 70 40 38 8	3.3 4.7 8.5 10.4 12.3 16.1	3.1 4.9 8.2 9.8 12.2 16.7	13.6	15*	1.869 1.875 1.961 1.945 1.948 1.824	BSH in CBR Mould	10	1.96	1.86	2.7**

Remarks *— Remoulded to Proctor effort. * From previous testing programe. **Assumed values

Laboratory — CBR/Compaction

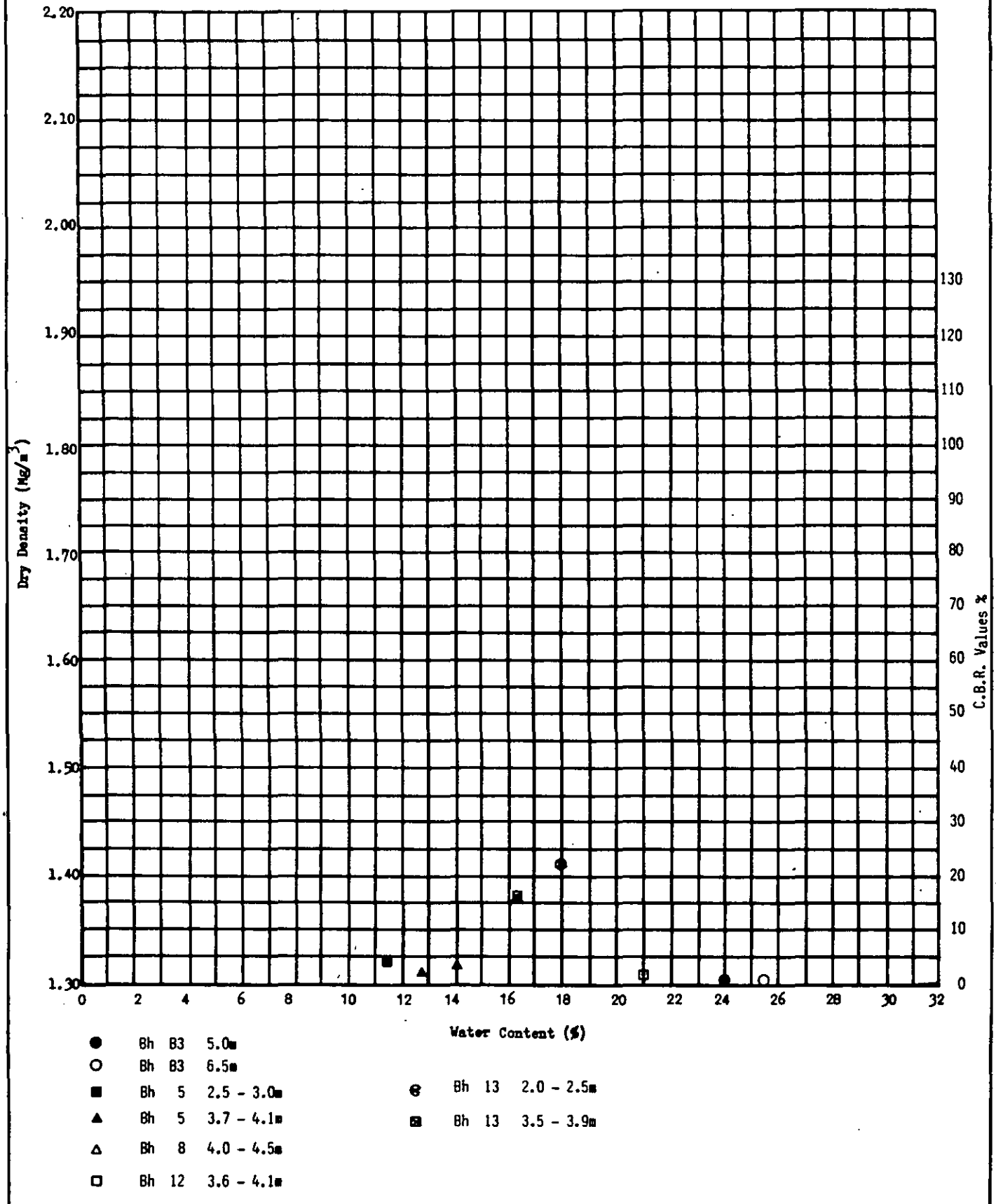
exploration associates

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Figure 3.28

EX 7



Type of Test - Specific Gravity -	Description	Depth Hole

Remarks ○ - Compaction at Natural Water Content.
▼ - Maximum Dry Density/Optimum Water Content.

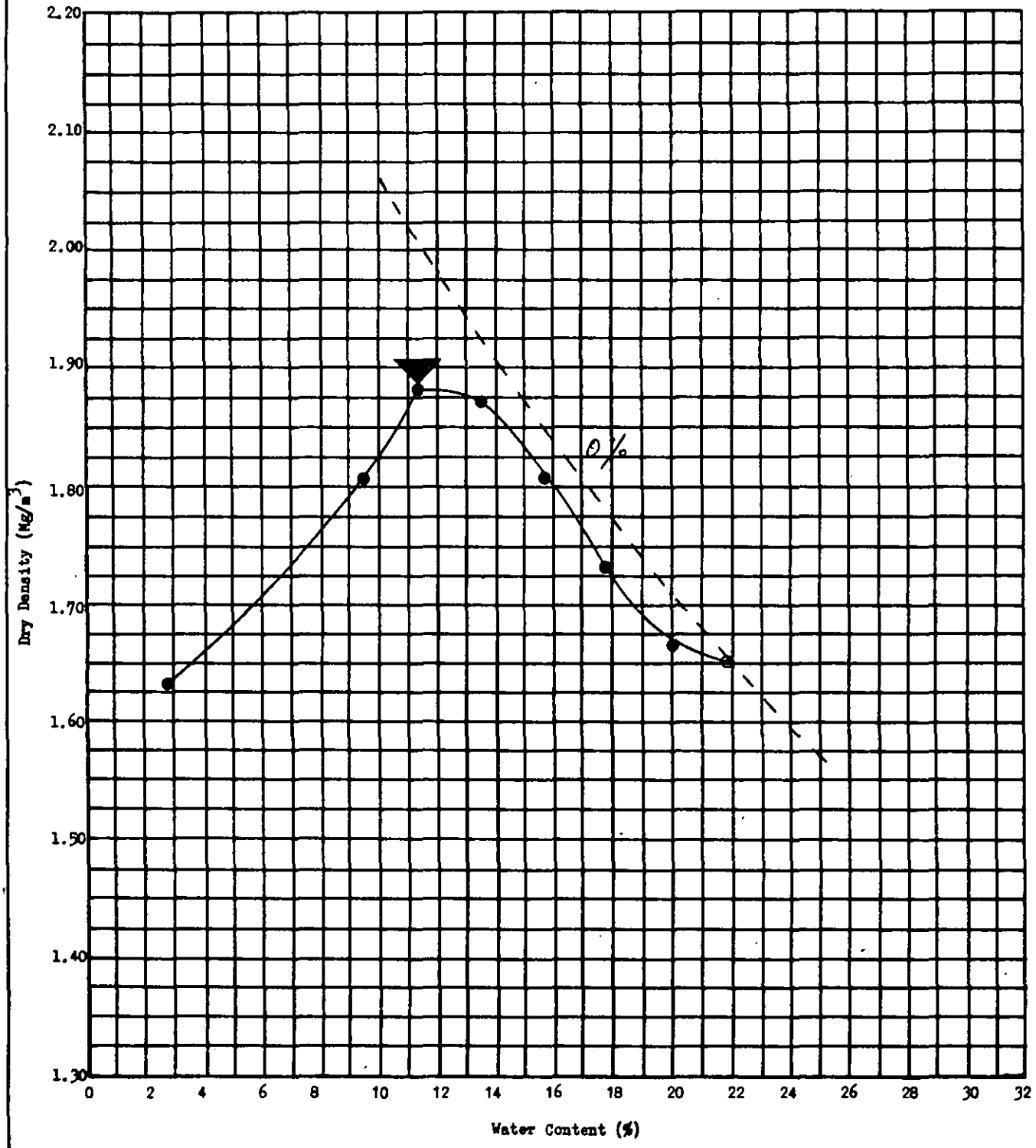
Laboratory — Compaction

exploration associates

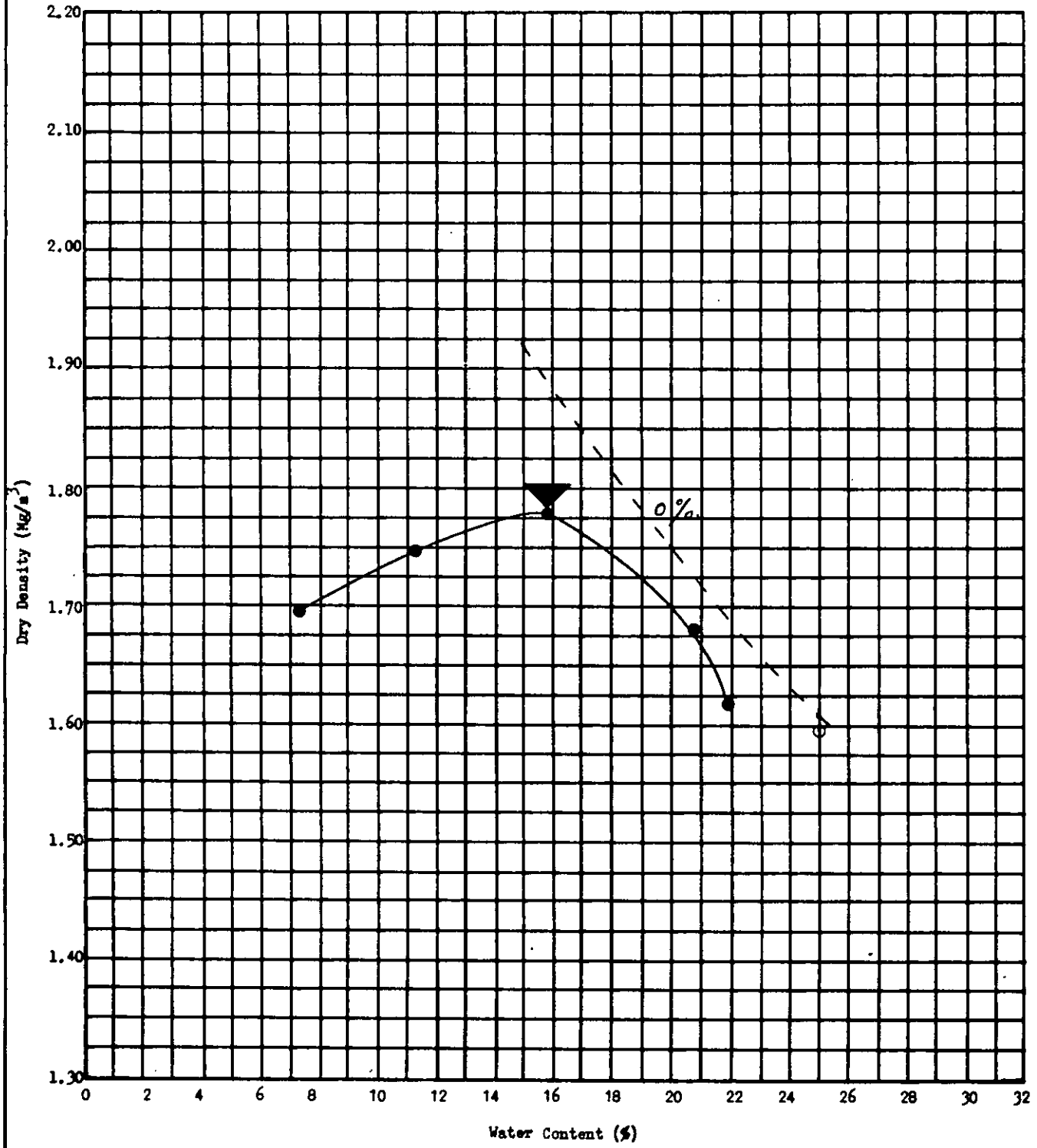
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Figure 3.29



Type of Test - Standard Specific Gravity - 2.60	Description Silty clayey SAND with occasional roots and sandstone fragments.	Depth 1.5 - 2.0 Hole B2
Remarks ○ - Compaction at Natural Water Content. ▼ - Maximum Dry Density/Optimum Water Content.		
Laboratory — Compaction	**Project** Department of Transport A564 Stoke - Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 3.30



Type of Test - Standard Specific Gravity - 2.70	Description Very silty sandy CLAY with zones of sand and occasional siltstone fragments.	Depth 5.0 - 5.45 Hole B3

Remarks O - Compaction at Natural Water Content.
▼ - Maximum Dry Density/Optimum Water Content.

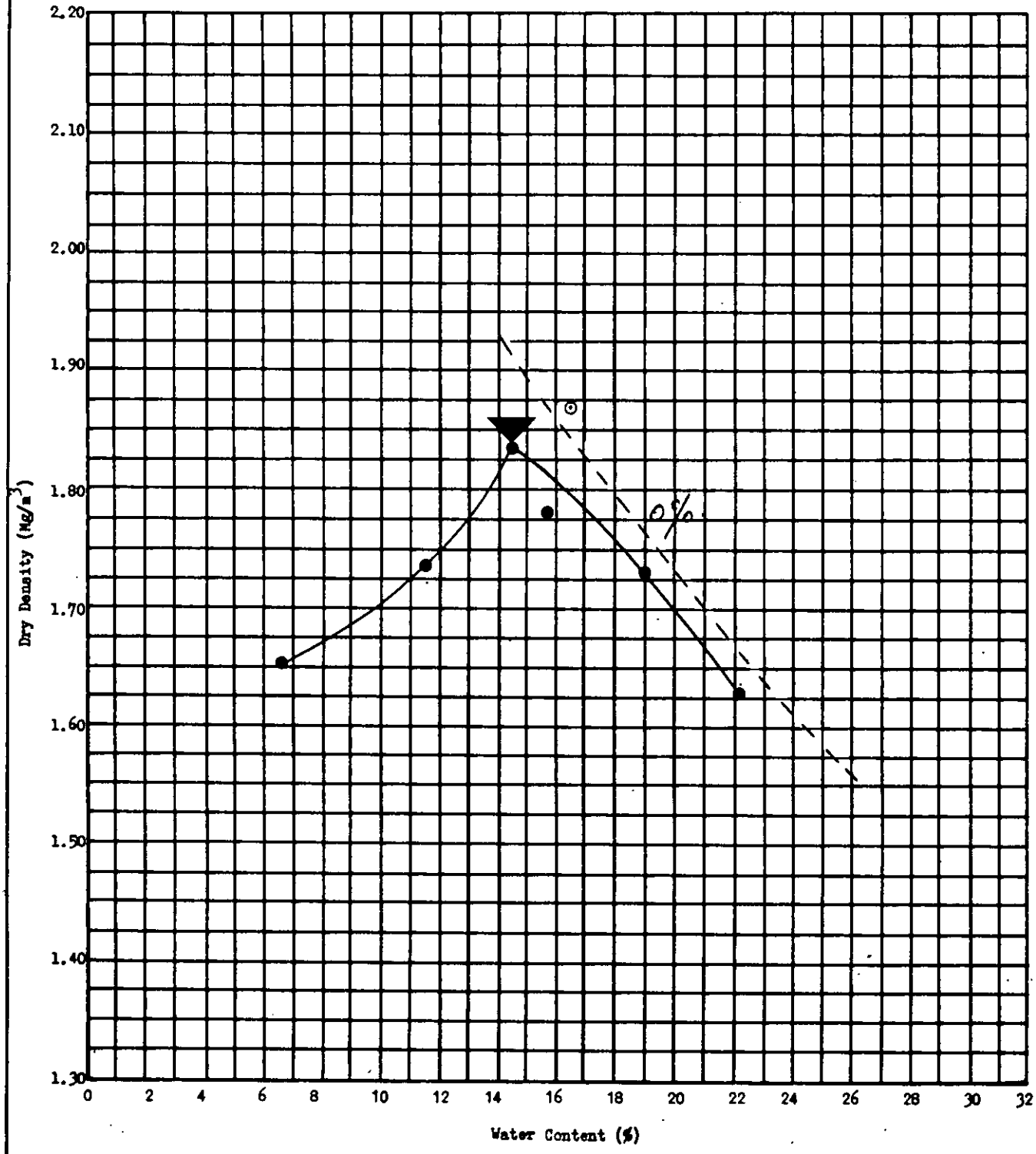
Laboratory — Compaction

exploration associates

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Figure 3.30 A



Type of Test - Standard Specific Gravity - 2.64	Description Silty sandy CLAY with gravel, siltstone and sandstone fragments.	Depth 1.7 - 2.0 Hole 5

Remarks ○ - Compaction at Natural Water Content.
▼ - Maximum Dry Density/Optimum Water Content.

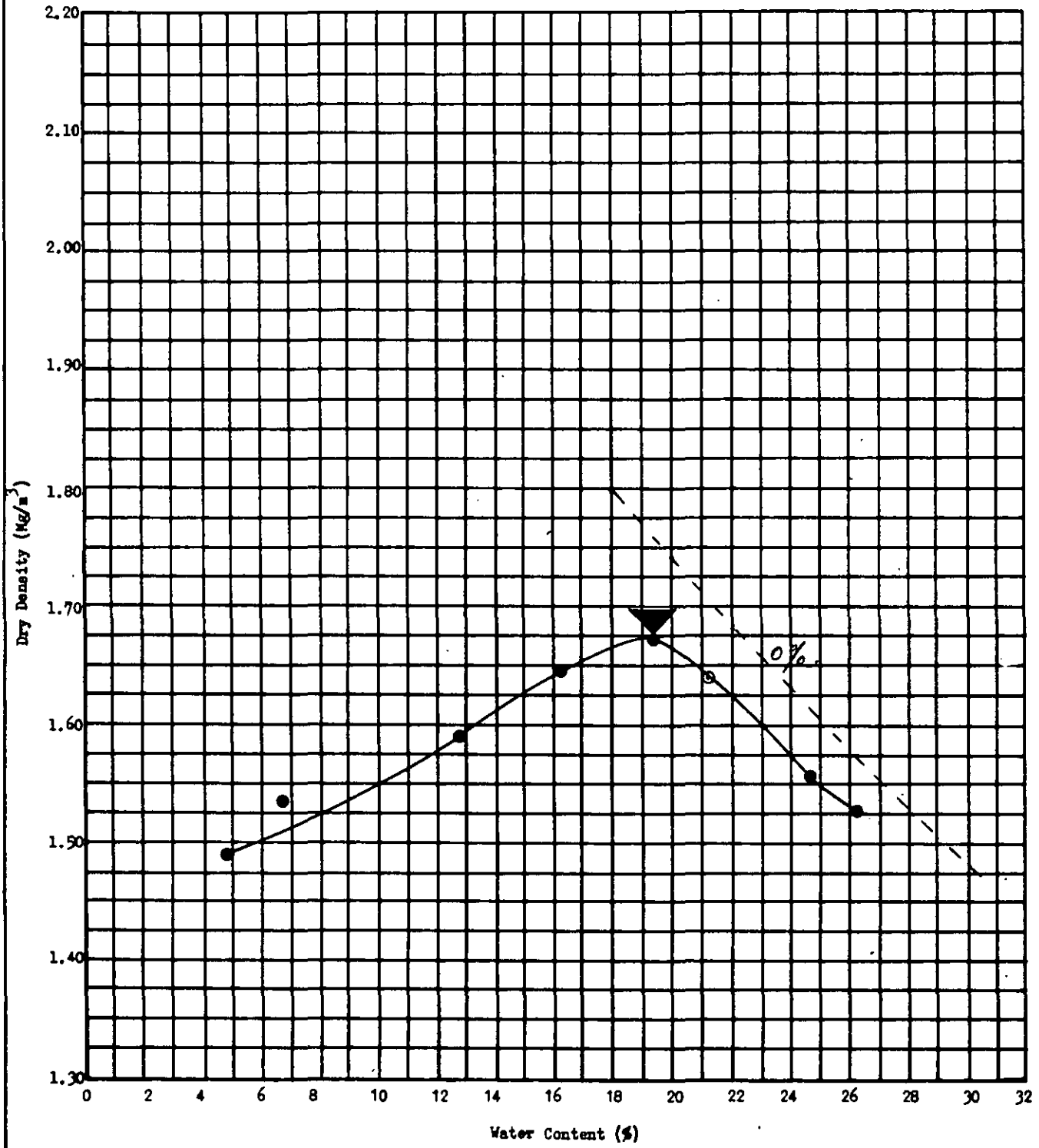
Laboratory — Compaction

exploration associates

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Figure 3.31



Type of Test - Standard Specific Gravity - 2.67	Description Silty CLAY with gravel, zones of silt and siltstone and sandstone fragments.	Depth 0.5 - 1.0 Hole 8

Remarks O - Compaction at Natural Water Content.
▼ - Maximum Dry Density/Optimum Water Content.

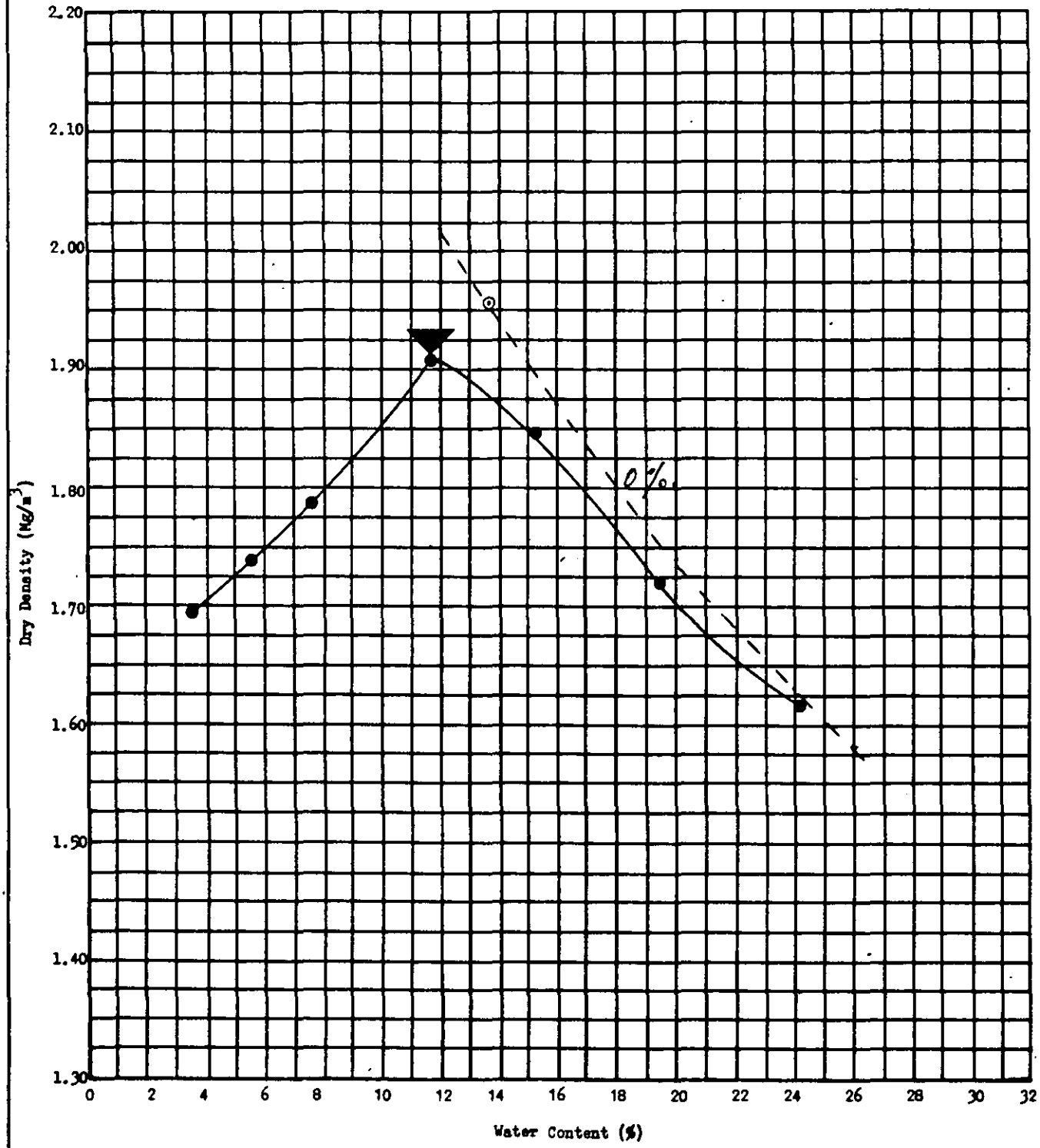
Laboratory — Compaction

exploration associates

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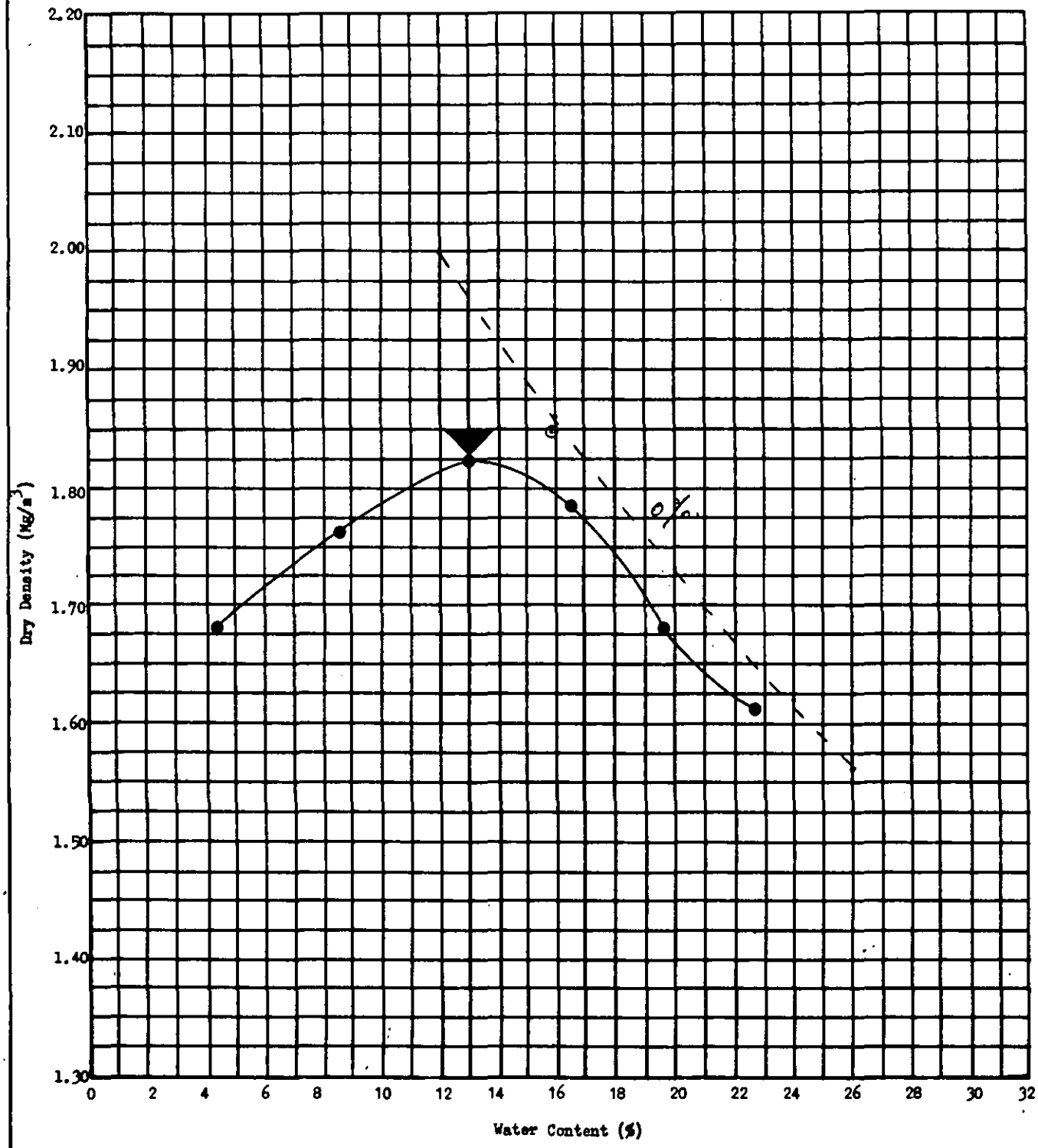
Figure 3.32



Type of Test - Standard Specific Gravity - 2.67	Description Silty sandy CLAY with gravel sandstone fragments and zones of silt.	Depth 4.0 - 4.5 Hole 8

Remarks ○ - Compaction at Natural Water Content.
▼ - Maximum Dry Density/Optimum Water Content.

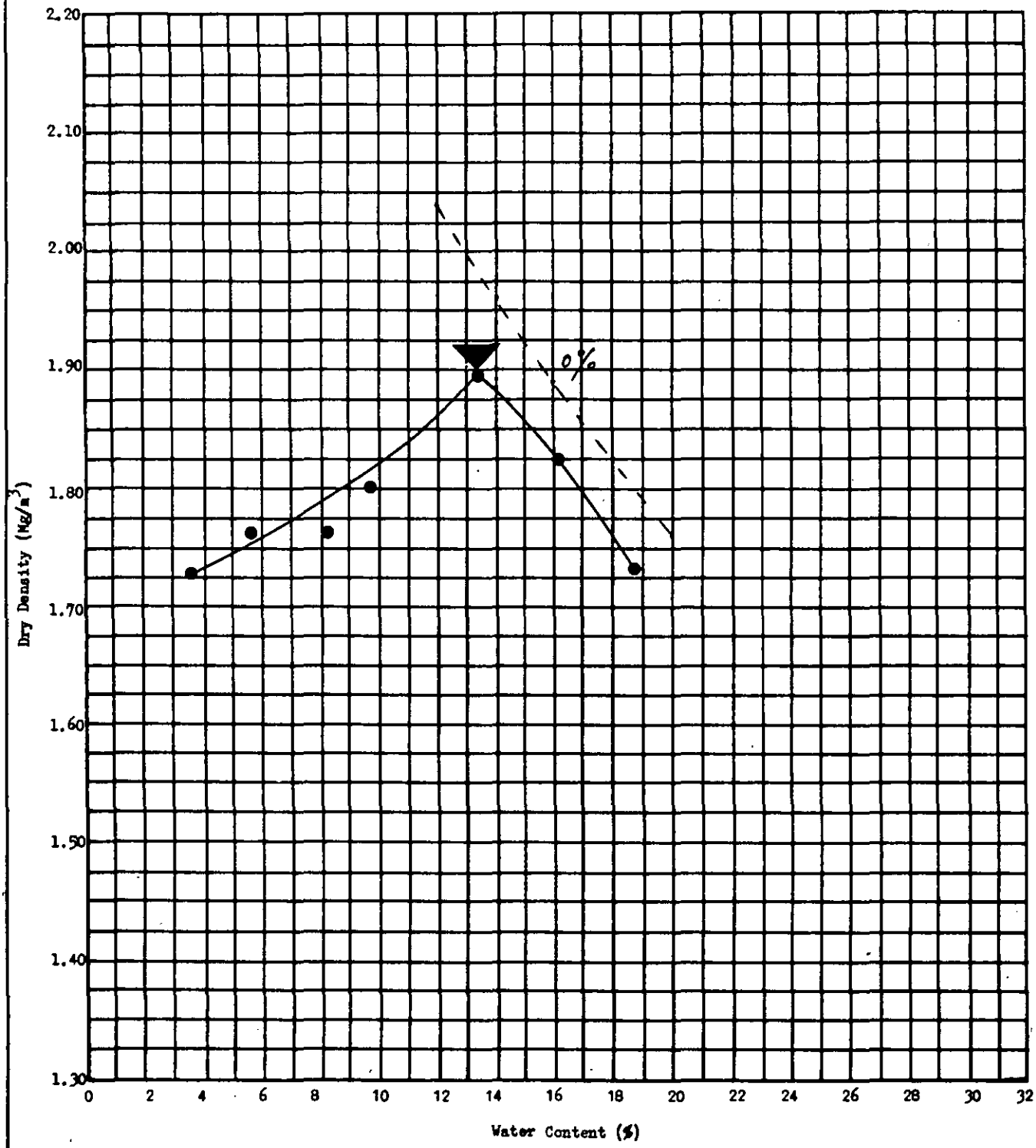
Laboratory — Compaction	**Project** Department of Transport A564 Stoke - Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site investigation	Contract S2796
exploration associates		**Figure** 3.33



Type of Test - Standard Specific Gravity - 2.64	Description Silty sandy CLAY with occasional gravel and coal fragments.	Depth 2.0 - 2.45 Hole B9

Remarks O - Compaction at Natural Water Content.
▼ - Maximum Dry Density/Optimum Water Content.

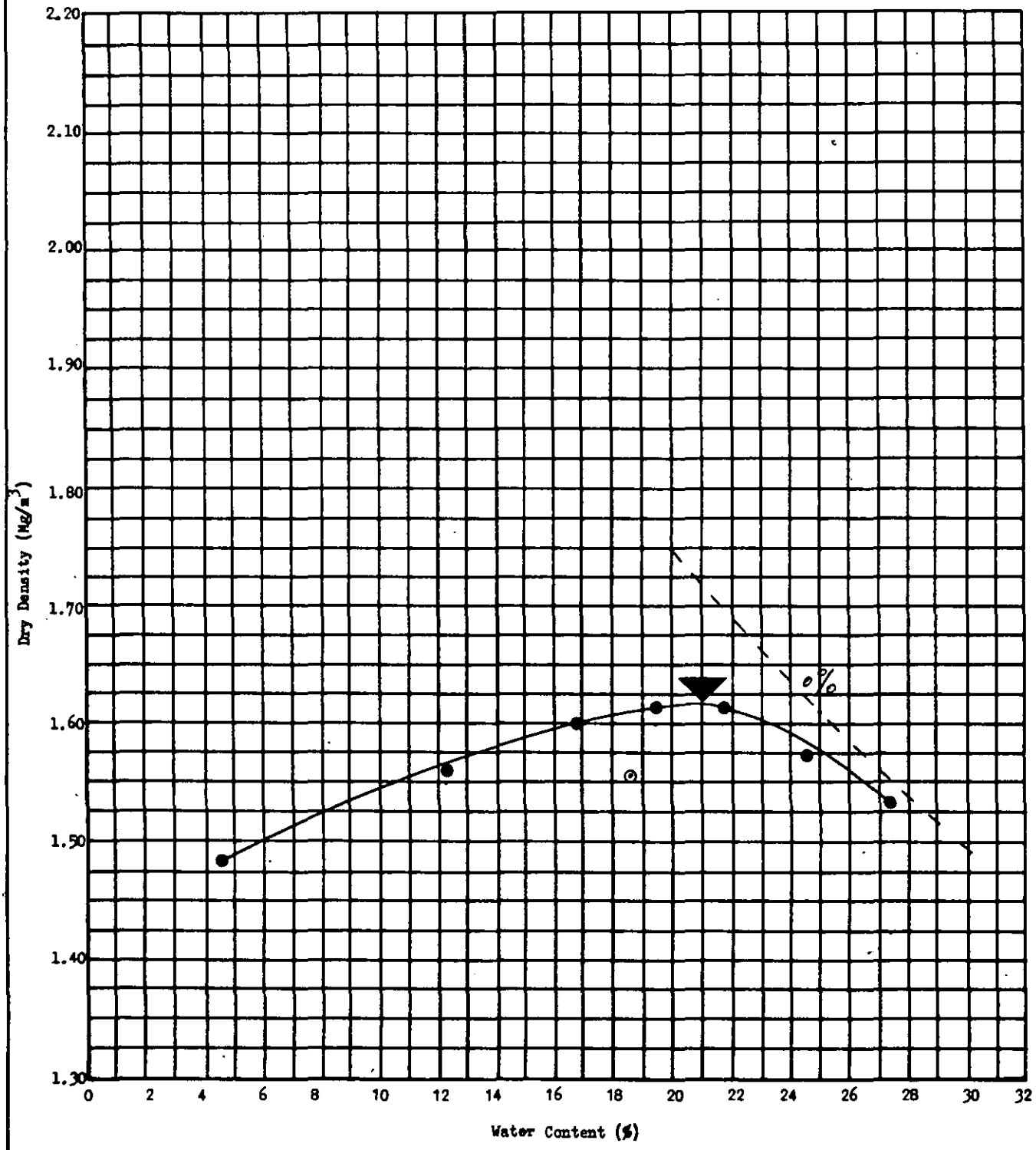
Laboratory — Compaction	**Project** Department of Transport A564 Stoke - Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 3.34



Type of Test - Standard Specific Gravity - 2.71	Description Clayey sandy SILT with zones of silty clay and sand.	Depth 3.0 - 3.35 Hole 10

Remarks ○ - Compaction at Natural Water Content.
▼ - Maximum Dry Density/Optimum Water Content.

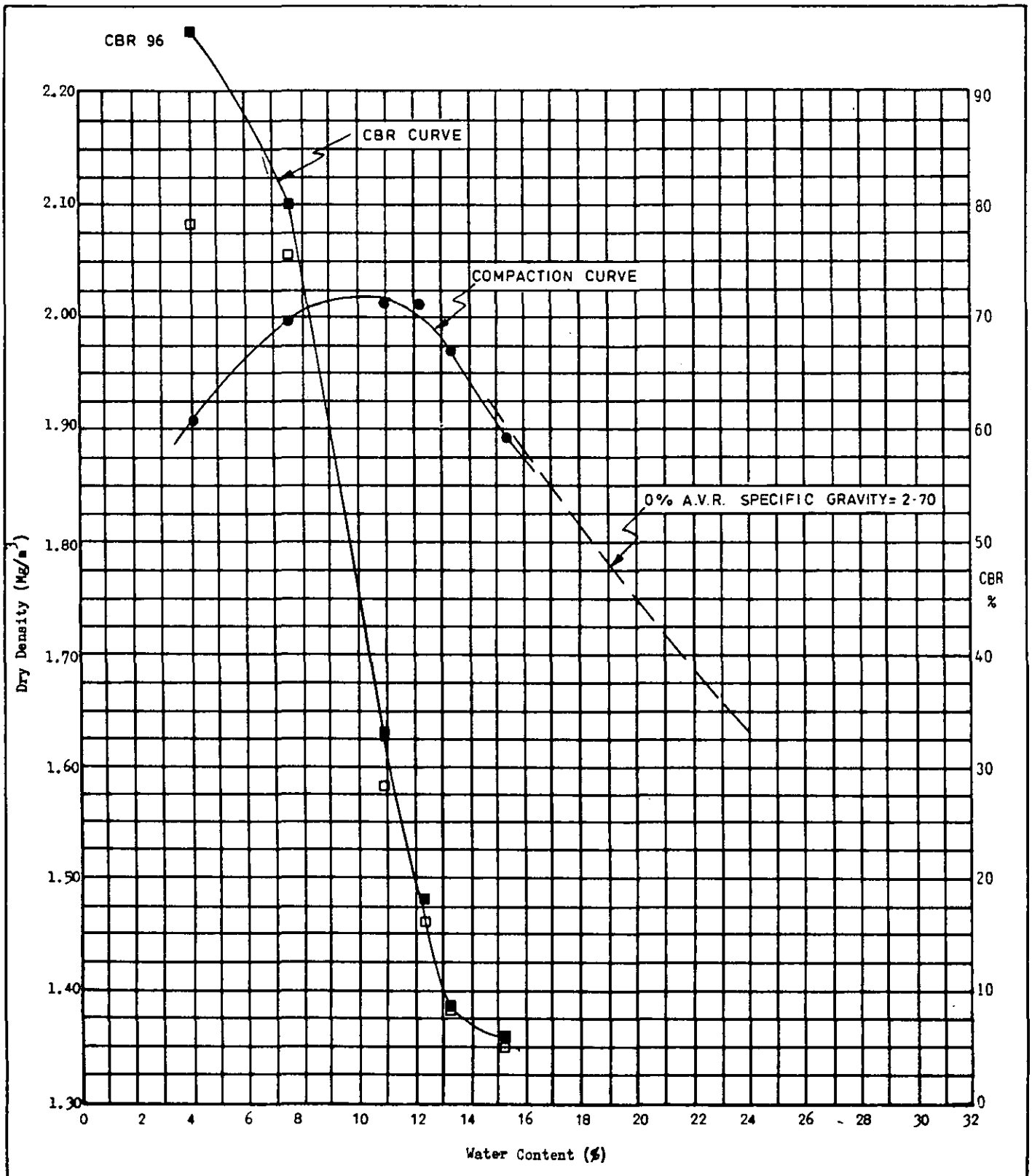
Laboratory — Compaction	**Project** Department of Transport A564 Stoke - Derby Link Derby Southern By Pass Isley walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 3.35



Type of Test - Standard Specific Gravity - 2.70	Description Friable silty sandy CLAY (marl) with abundant siltstone fragments.	Depth 2.0 - 2.5 Hole 13

Remarks ○ - Compaction at Natural Water Content.
▼ - Maximum Dry Density/Optimum Water Content.

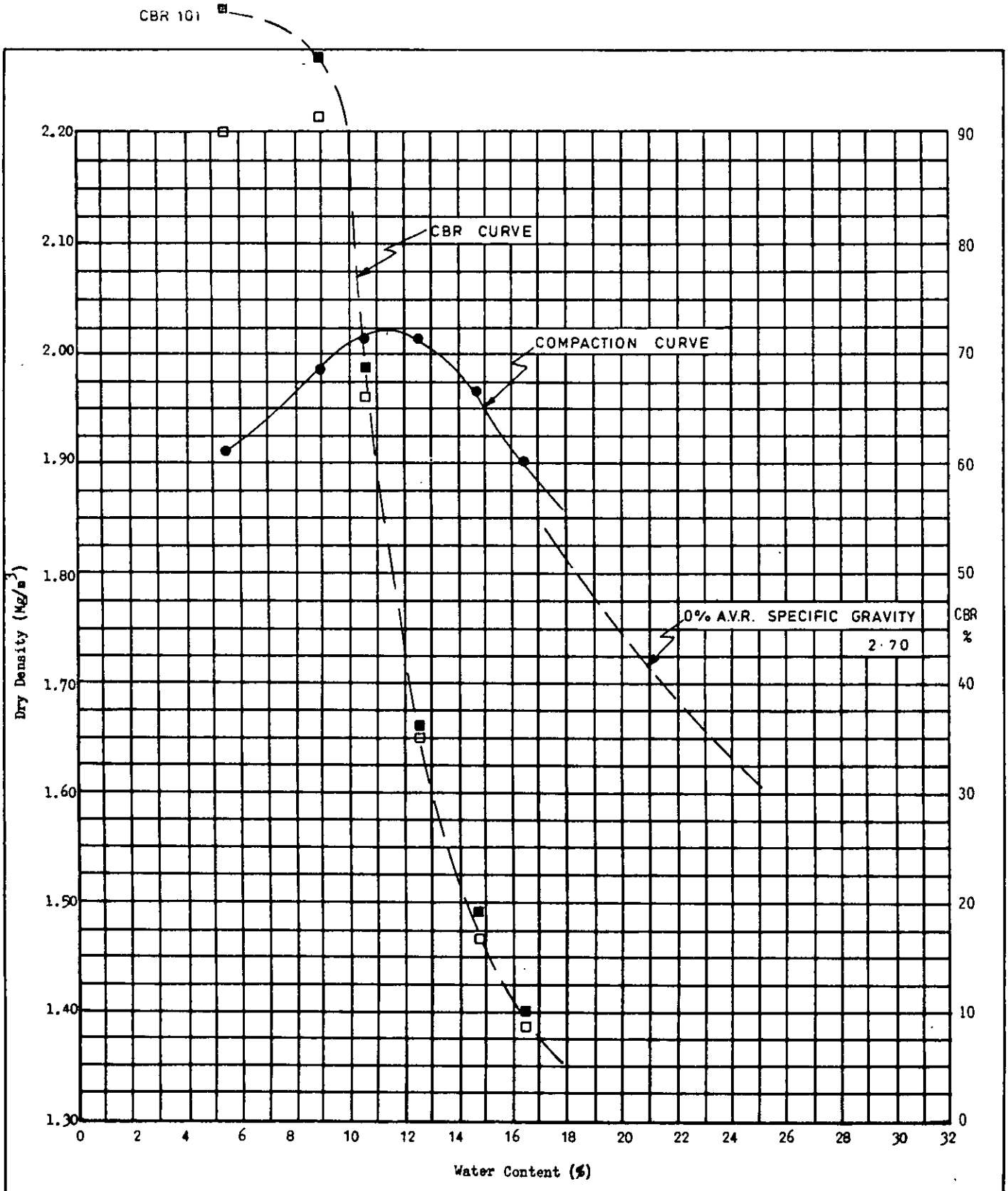
Laboratory — Compaction	**Project** Department of Transport A564 Stoke - Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation.	Contract S2796
exploration associates		**Figure** 3.36



Type of Test - B.S. Heavy -CBR mould Specific Gravity - 2.70 measured	Description Very silty sandy CLAY with zones of sand and occasional siltstone fragments.	Depth 5.5-5.5/6.5-6.95 Hole 3

Remarks ○ - Compaction at Natural Water Content.
▼ - Maximum Dry Density/Optimum Water Content.

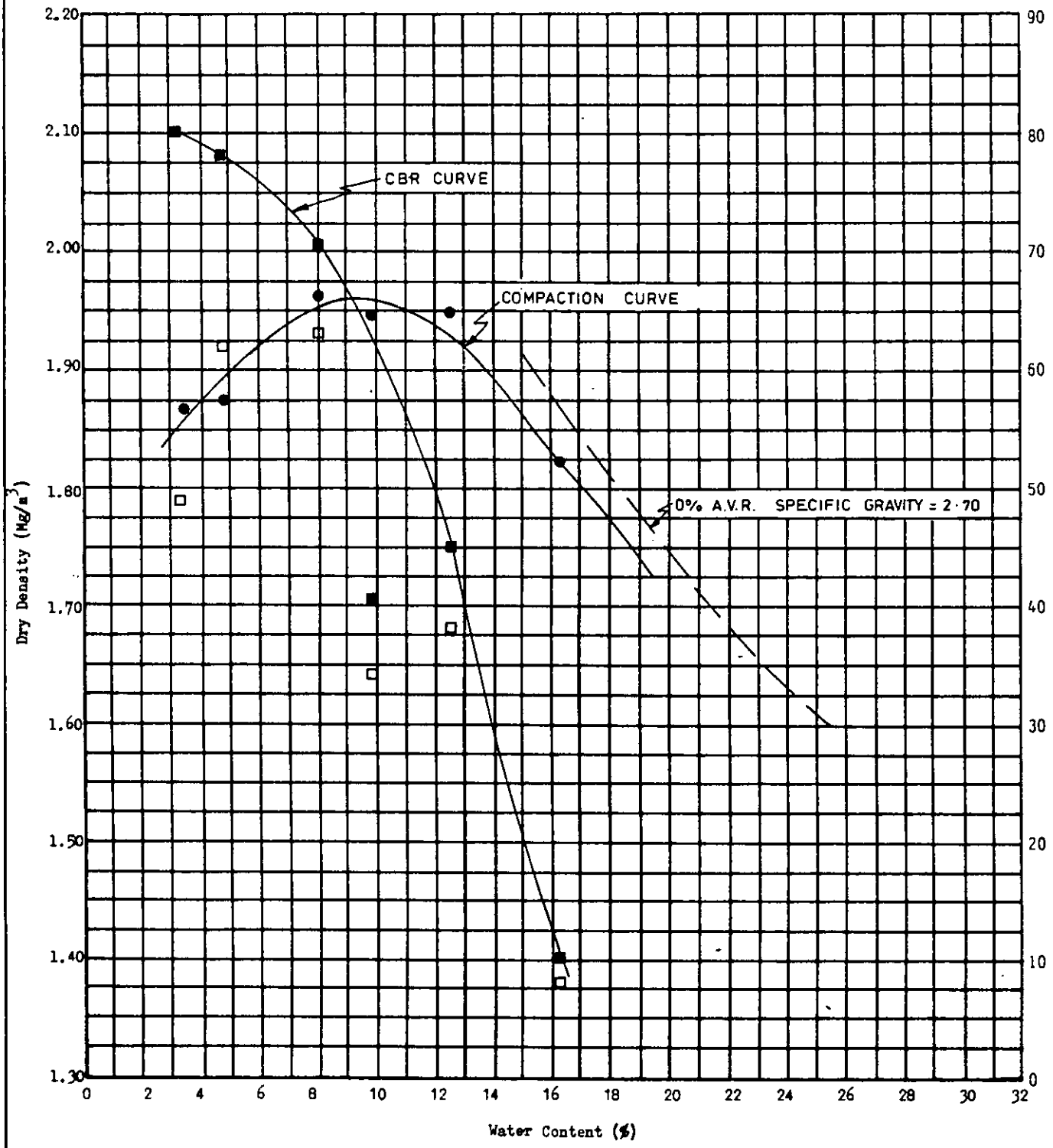
Laboratory — Compaction	**Project** Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 3.36A



Type of Test - B.S. Heavy-CBR mould Specific Gravity - 2.70 (Assumed)	Description Silty CLAY with siltstone fragments and occasional zones of silt.	Depth 3.60-4.10 Hole 12

Remarks ○ - Compaction at Natural Water Content.
▼ - Maximum Dry Density/Optimum Water Content.

Laboratory — Compaction	**Project** Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 3.36B



Type of Test - B.S. Heavy-CBR mould Specific Gravity - 2.70 (Assumed)	Description Silty CLAY with zones of silt and mudstone fragments.	Depth 3.50-3.90 Hole 13

Remarks ○ - Compaction at Natural Water Content.
▼ - Maximum Dry Density/Optimum Water Content.

Laboratory — Compaction	**Project** Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 3.36C

Samples				Water Content		Density			Shear Strength							
Hole	Depth	Type	Description	Initial %	Final %	Initial Mg/m³	Final Mg/m³	Dry Mg/m³	Prep.	Test	P'o kN/m²	u_f kN/m²	$\sigma'_1-\sigma'_3$ kN/m²	c' kN/m²	$\phi'°$
B2	4.5	U	Firm-stiff red brown	17	18	2.14	2.20	1.87			100	+5	183		
	4.8		sandy silty CLAY.	18	18	2.16	2.33	1.84	Nat.	C.D.T.	100	-2	268	12	23
				18	18	2.16	2.31	1.83		38	300	0	406		
B3	2.0	U	Dark red brown clayey	21	21	2.02	2.04	1.67			50	-1	146		
	2.5		fine SAND.	20	20	1.96	1.99	1.63	Nat.	C.D.T.	100	-	286	0	36
				21	20	2.00	2.05	1.65		38	200	+2	553		
	5.0	U	Red brown very clayey	27	24	1.90	1.90	1.50			100	60	123		
	5.5		fine SAND and SILT.	25	23	1.90	1.94	1.52	Nat.	C.U.T.	200	126	198	0	34
				26	23	1.90	1.98			38	300	132	420		
5	2.5	U	Dense yellow brown clayey								50	-	162		
	3.0		SAND and GRAVEL.	11	11	2.04	2.15	1.84	Nat.	C.D.T.	100	-	301	14	34
										106	200	+1	542		
8	2.0	U	Firm fissured brown								50	-1	94		
	2.5		mottled yellow brown slightly silty CLAY with silt pockets and occasional mudstone fragments.	20	20	1.98	2.07	1.65	Nat.	C.D.T.	100	+6	128	16	18.5
										106	200	+3	219		
B9	2.0	U	Firm red brown mottled	2.11	2.21	2.11	2.21	1.80			50	15	139		
	2.5		grey silty sandy CLAY	2.14	2.26	2.14	2.26	1.86	Nat.	C.U.T.	100	30	200	25	28
			with occasional gravel.	2.17	2.29	2.17	2.29	1.90		38	200	87	285		
	5.0	U	Stiff dark brown silty	15	16	2.12	2.14	2.85			100	25	230		
	5.4		sandy CLAY with gravel.	15	15	2.12	2.12	1.85	Nat.	C.U.T.	200	25	367	32	26
				15	14	2.13	2.13	1.86		38	300	62	462		
10	4.5	U	Stiff brown very silty	17	16	1.95	1.99	1.67			100	+1	230		
	5.0		CLAY with silt pockets	16	16	1.96	1.97	1.68	Nat.	C.D.T.	200	+1	393	27	26
			and occasional gravel.	16	16	1.95	2.01	1.68		38	300	+2	556		
12	2.0	U	Soft red brown occasion-								50	-13	344		
	2.5		ally mottled grey green very silty CLAY.	18	18	2.11	2.21	1.79	Nat.	C.D.T.	100	+10	361	0	36
										106	200	+42	448		

Remarks

Laboratory Results – Triaxial Effective Stress

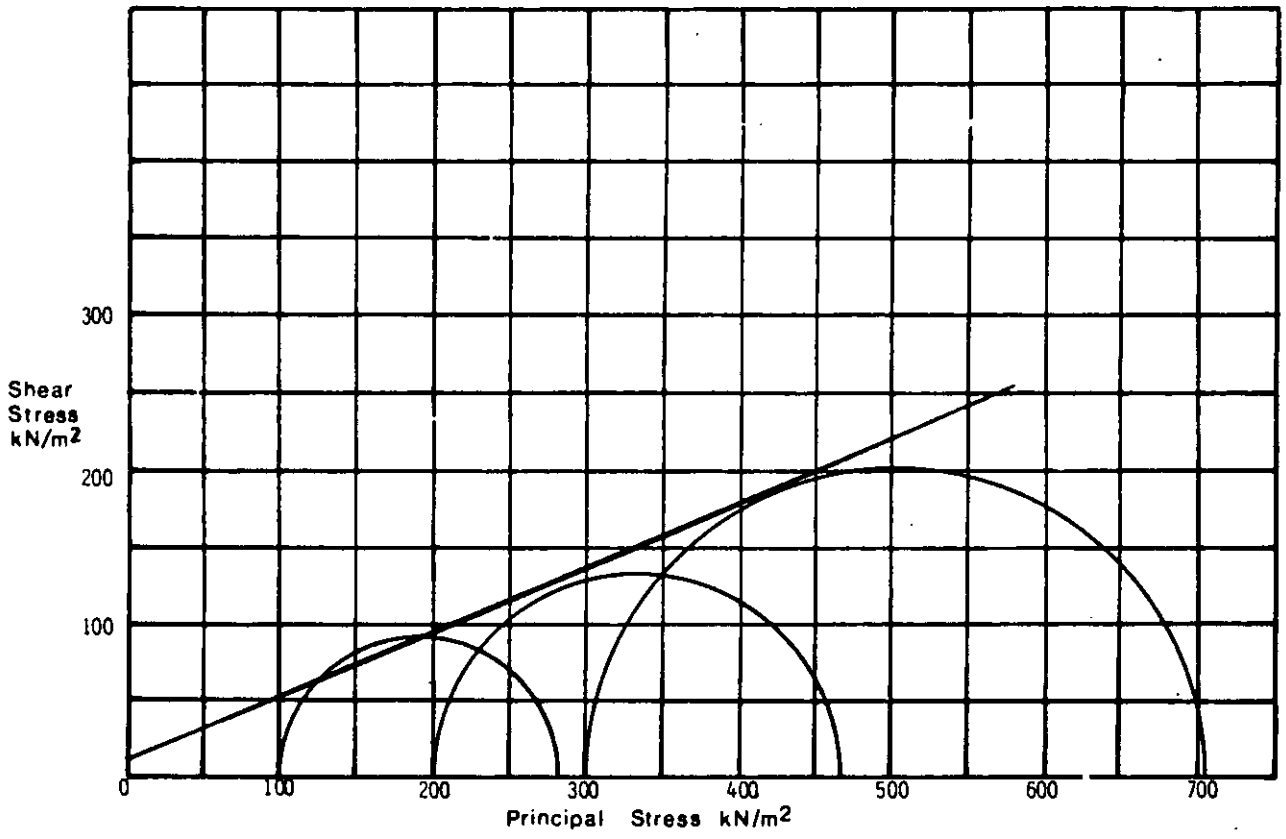
exploration associates

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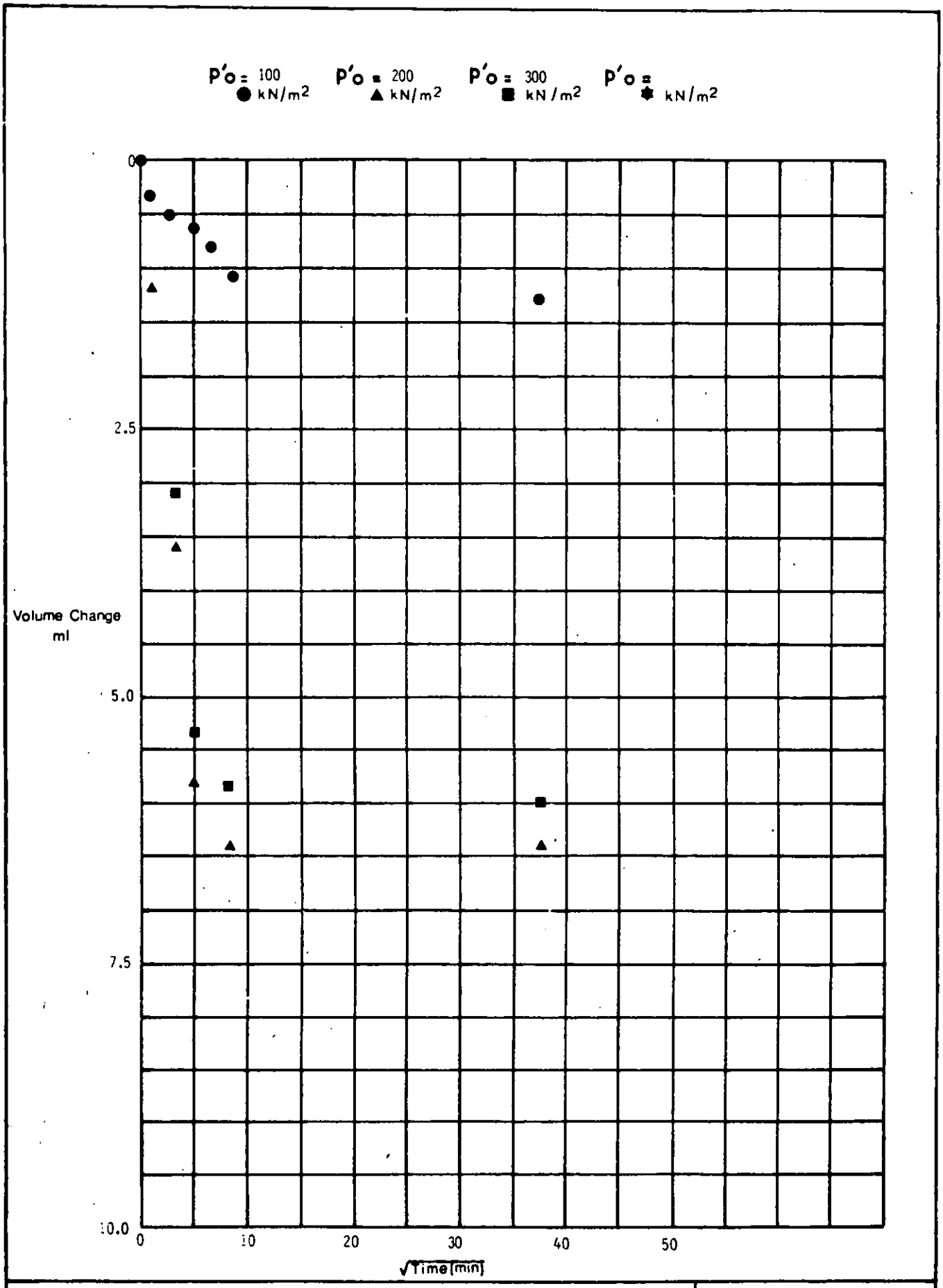
Figure 3.37

EX 4



B	(Initial)		0.87	0.86	0.86	
B_s	(After application of Back Pressure)		1.0	1.0	1.0	
$\dot{\varepsilon}$	(Rate of Strain)	% min	.004	.013	.013	
σ_3	(Cell Pressure during Shear)	kN/m^2	360	510	610	
u_o	(Applied Back Pressure)	kN/m^2	260	310	310	
$p'_o = \sigma_3 - u_o$	Mean effective stress prior to shear = Consolidation Pressure	kN/m^2	100	200	300	
$(\sigma_1 - \sigma_3)$	(Maximum Deviator Stress)	kN/m^2	183	268	406	

Triaxial Compression Test Consolidated Drained	Description Sandy silty CLAY	c' 12 kN/m^2 ϕ 23 Degrees
	Mohr Circles and Summary	Depth 4.5 Borehole B2
Remarks 3 x 38mm diameter samples		
Laboratory-Effective Stress	**Project** Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 3.38



Triaxial Consolidation — Volume Change/ √Time

Depth 4.5
Borehole B2

Remarks

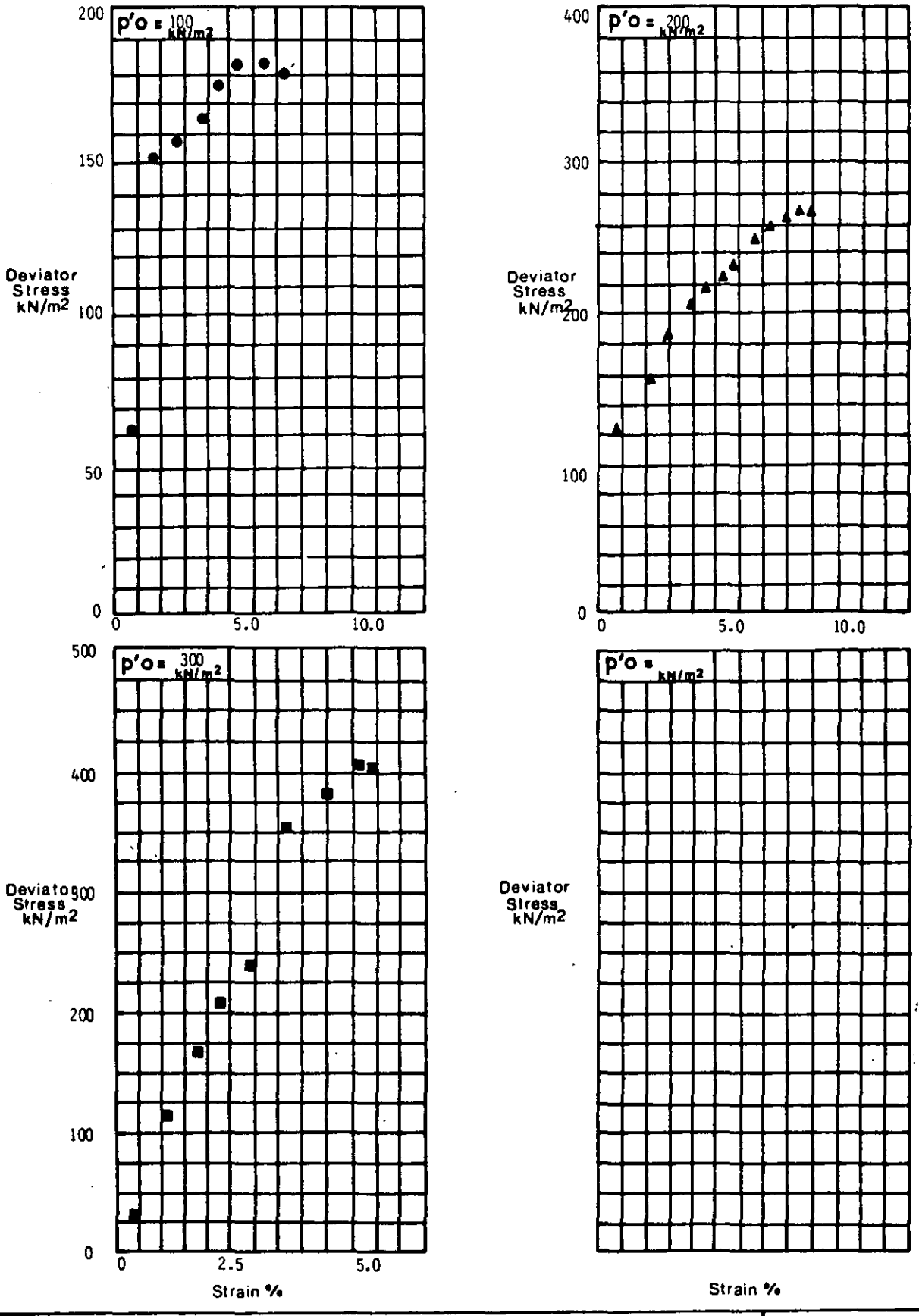
Laboratory — Effective Stress

exploration associates

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Figure 3.39



Deviator Stress / Strain

Depth 4.5
Borehole B2

Remarks

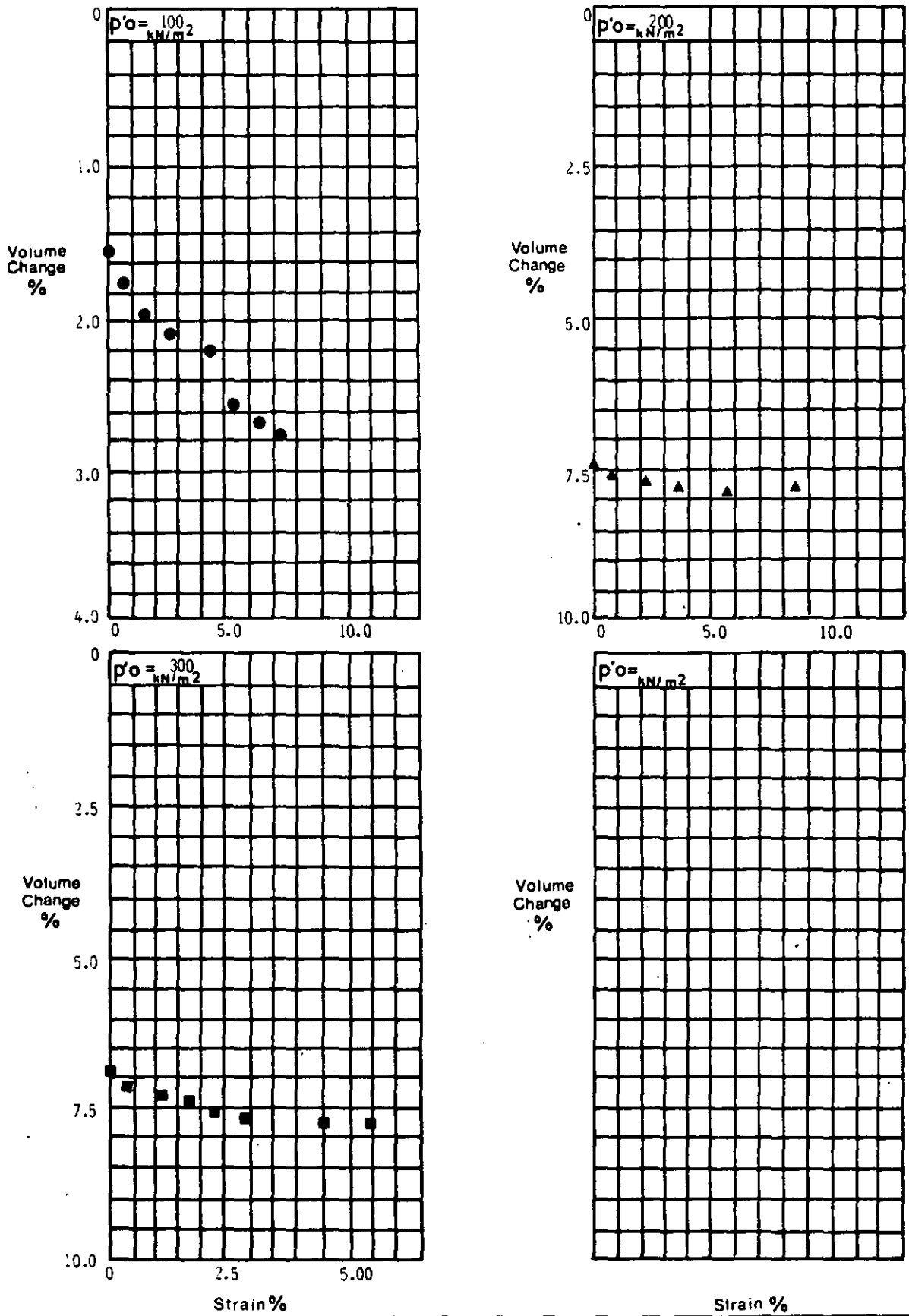
Laboratory - Effective Stress

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Figure 3.40



Volume Change % / Strain %

Depth 4.5
Borehole B2

Remarks

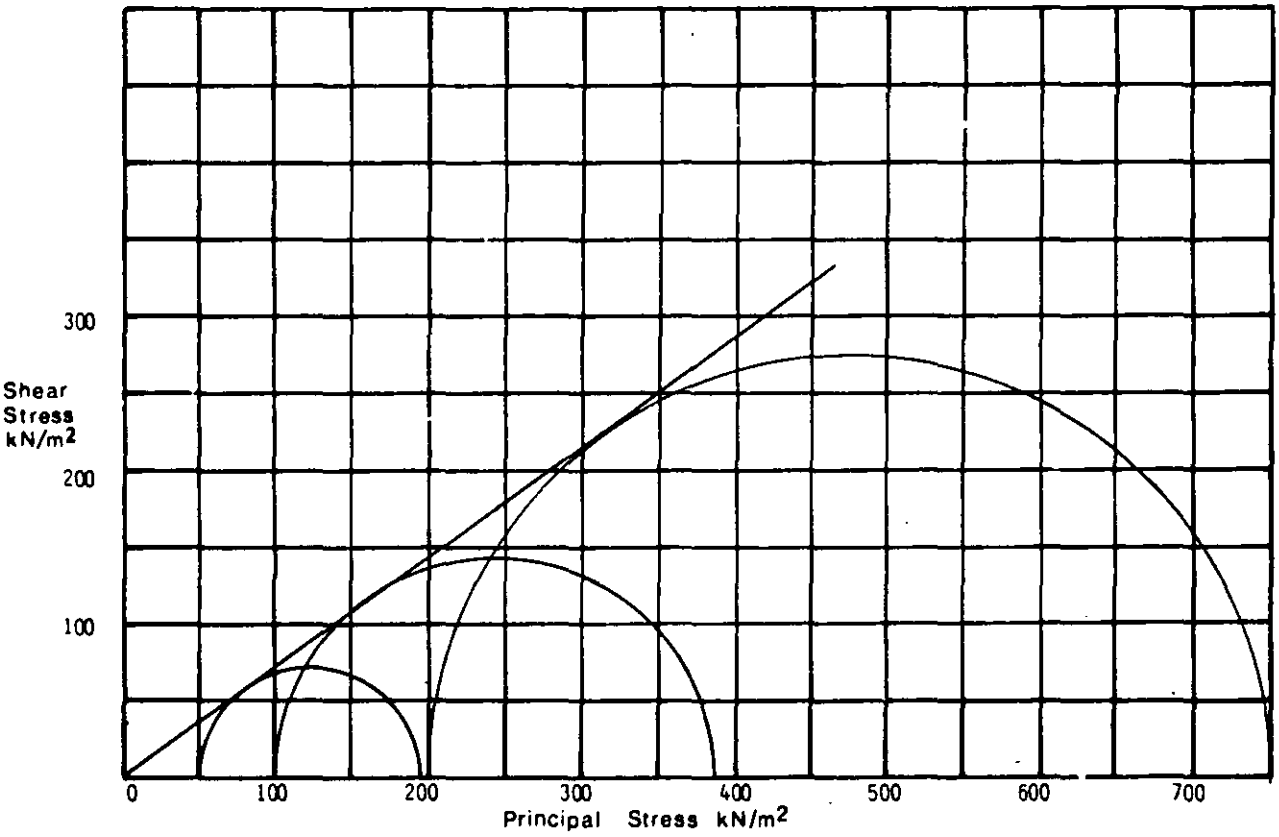
Laboratory – Effective Stress

exploration associates

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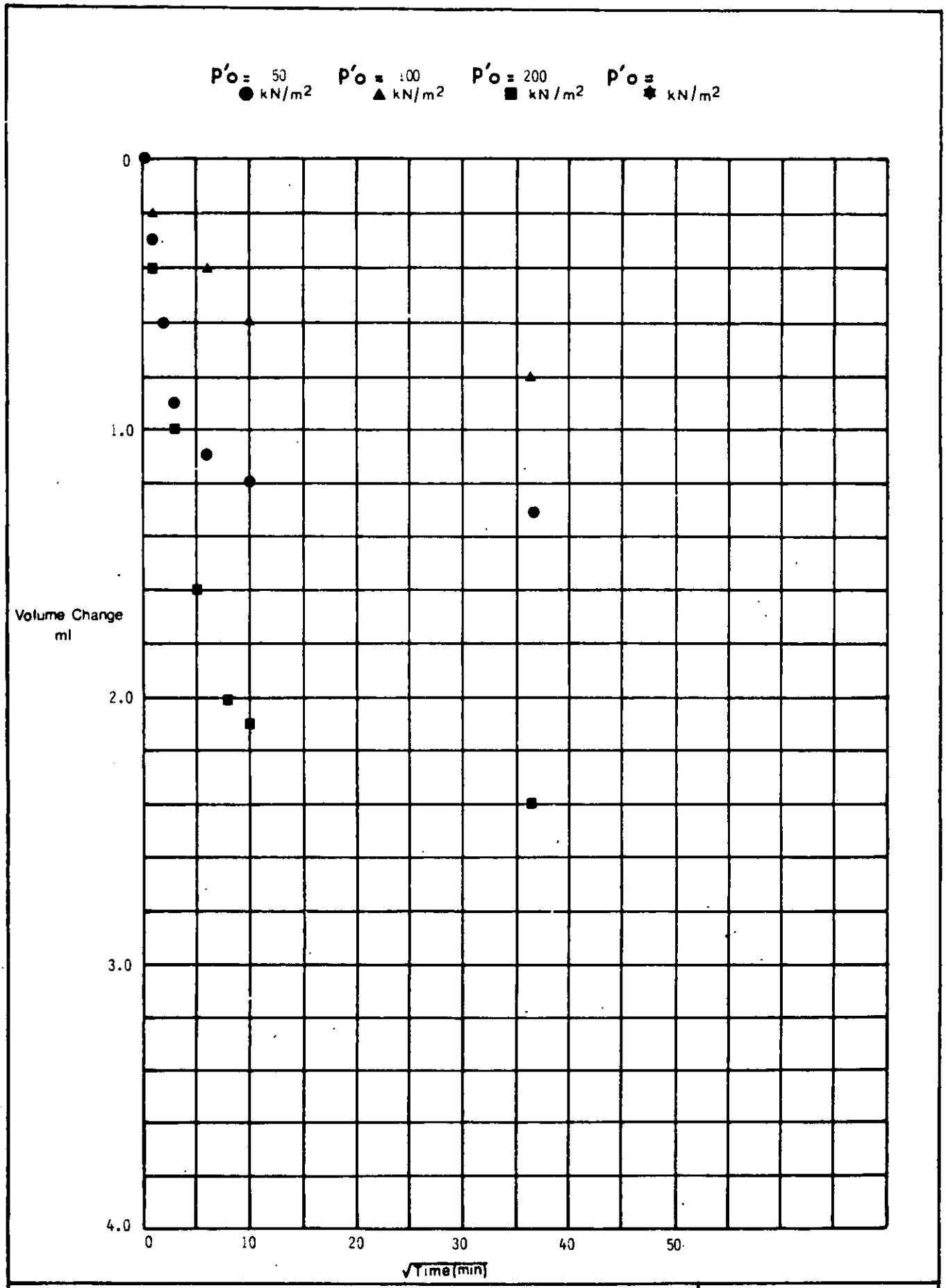
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Figure 3.41



B	(Initial)		.92	.88	.83	
B_e	(After application of Back Pressure)		1.0	1.0	1.0	
$\dot{\varepsilon}$	(Rate of Strain)	% min	.0079	.0079	.0079	
σ_3	(Cell Pressure during Shear)	kN/m^2	360	410	510	
u_o	(Applied Back Pressure)	kN/m^2	310	310	310	
$p'_o = \sigma_3 - u_o$	Mean effective stress prior to shear = Consolidation Pressure	kN/m^2	50	100	200	
$(\sigma_1 - \sigma_3)$	(Maximum Deviator Stress)	kN/m^2	146	286	553	

Triaxial Compression Test Consolidated Drained	Description Clayey fine SAND	c' 0 kN/m² ϕ' 36 Degrees
	Mohr Circles and Summary	Depth 2.0 Borehole 83
Remarks 3 x 38mm diameter samples		
Laboratory-Effective Stress	**Project** Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 3.42



Triaxial Consolidation — Volume Change/ √Time

Depth 2.0
Borehole B3

Remarks

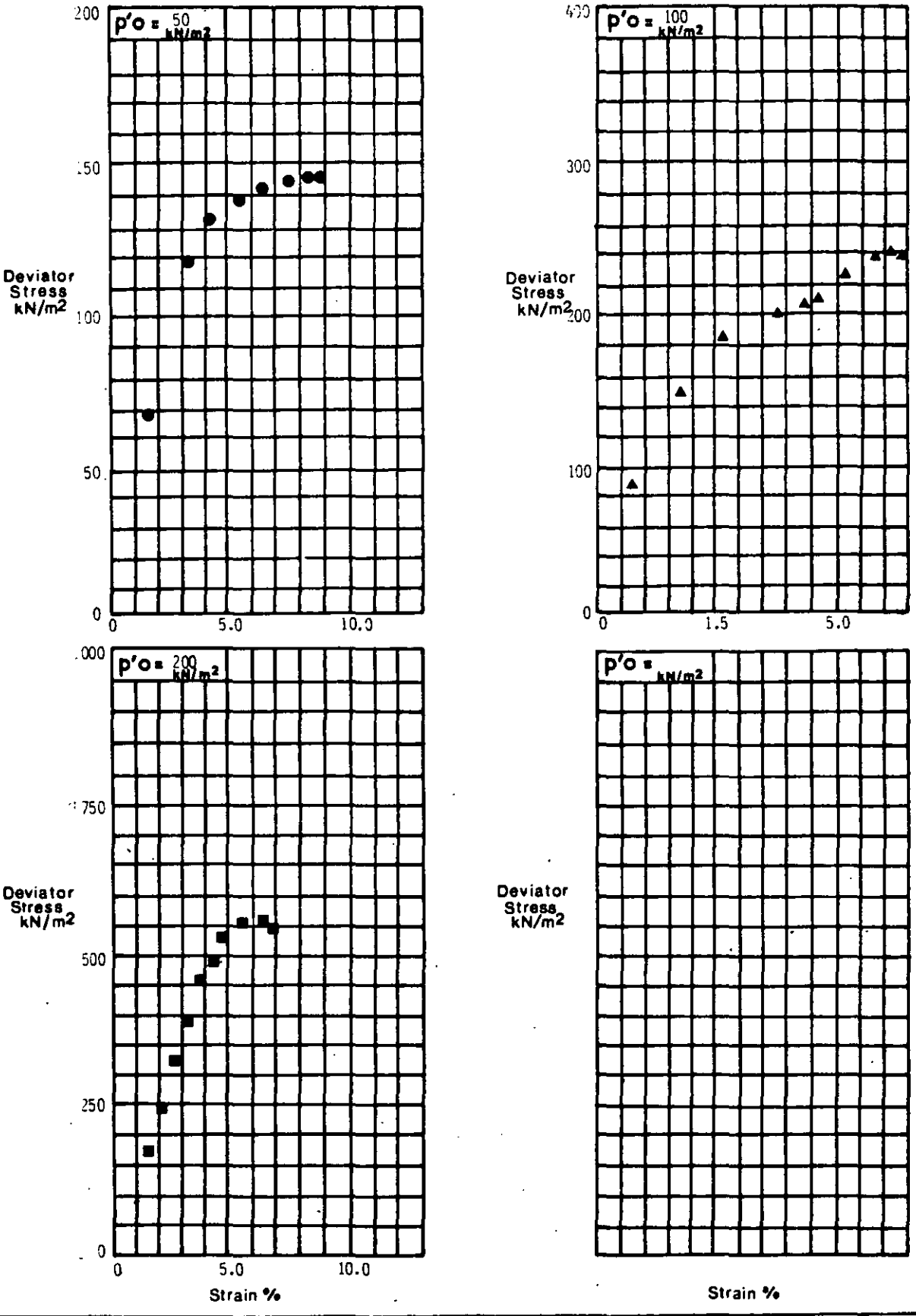
Laboratory — Effective Stress

exploration associates

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Figure 3.43



Deviator Stress / Strain

Depth 2.0
Borehole B3

Remarks

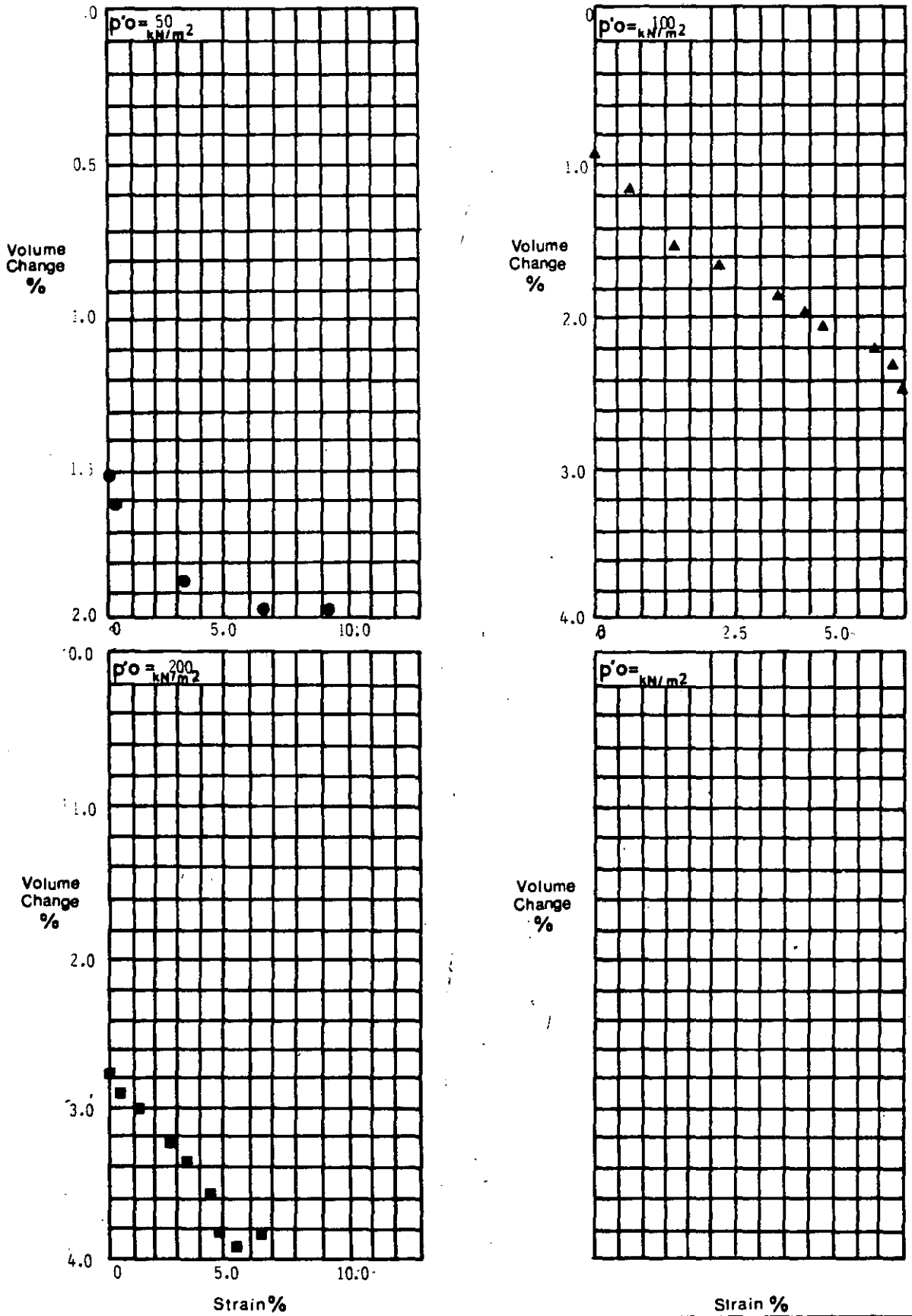
Laboratory - Effective Stress

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Figure 3.44



Volume Change % / Strain %

Depth 2.0
Borehole B3

Remarks

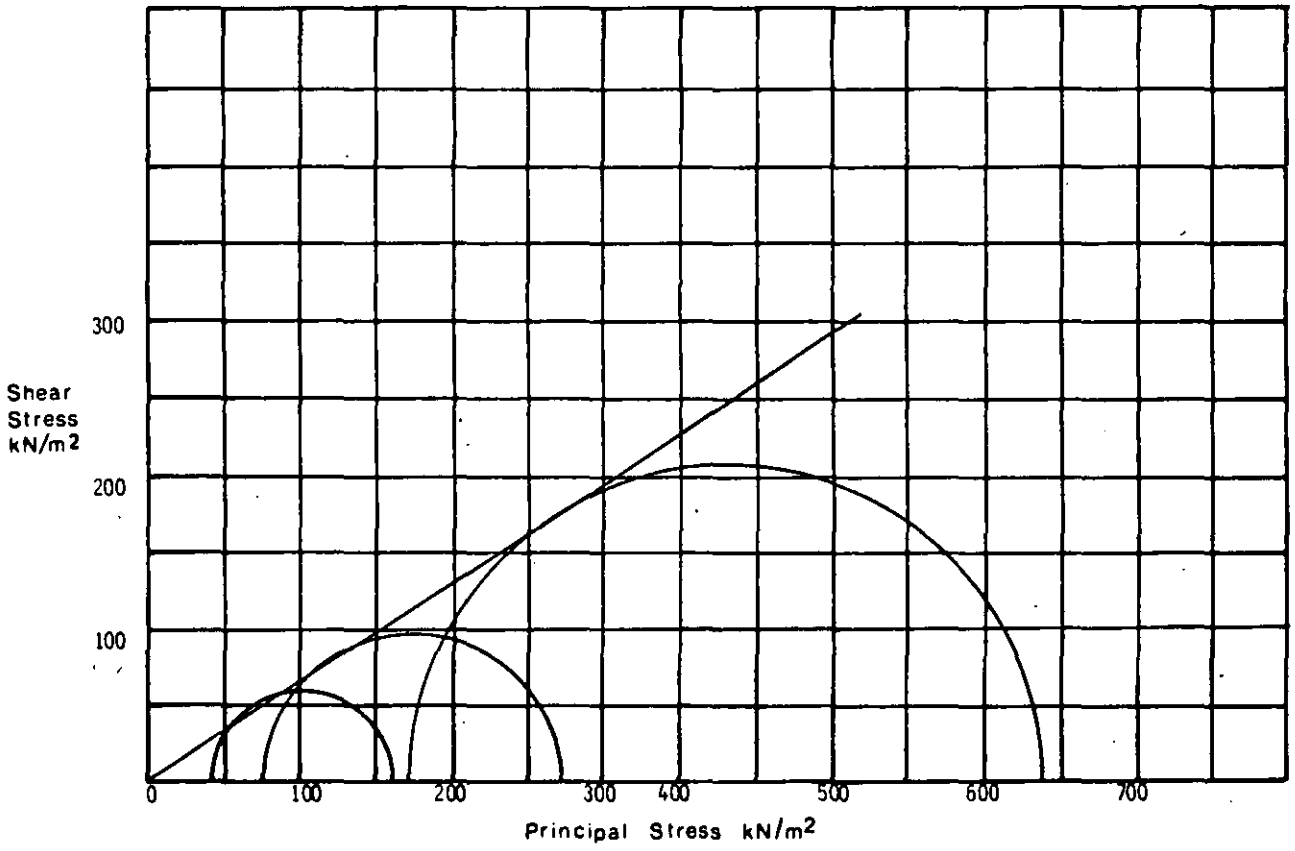
Laboratory – Effective Stress

exploration associates

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Figure
3.45



B	(Initial)		.95	.88	.87	
B_s	(After application of Back Pressure)		1.0	1.0	1.0	
$\dot{\varepsilon}$	(Rate of Strain)	% min	.011	.013	.013	
σ_3	(Cell Pressure during Shear)	kN/m^2	310	410	510	
u_o	(Applied Back Pressure)	kN/m^2	210	210	210	
$p'_o = \sigma_3 - u_o$	Mean effective stress prior to shear = Consolidation Pressure	kN/m^2	100	200	300	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m^2	123	198	420	
$\Delta u_f = u_f - u_o$	(Pore Pressure change to Failure)	kN/m^2	60	126	132	
A_f	(Failure)		.49	.64	.31	

Triaxial Compression Test
Consolidated
Undrained

Description
Very clayey SAND and SILT

Mohr Circles and Summary

C' 0 kN/m^2
ϕ' 34 Degrees

Depth 5.0
Borehole B3

Remarks 3 x 38mm diameter samples

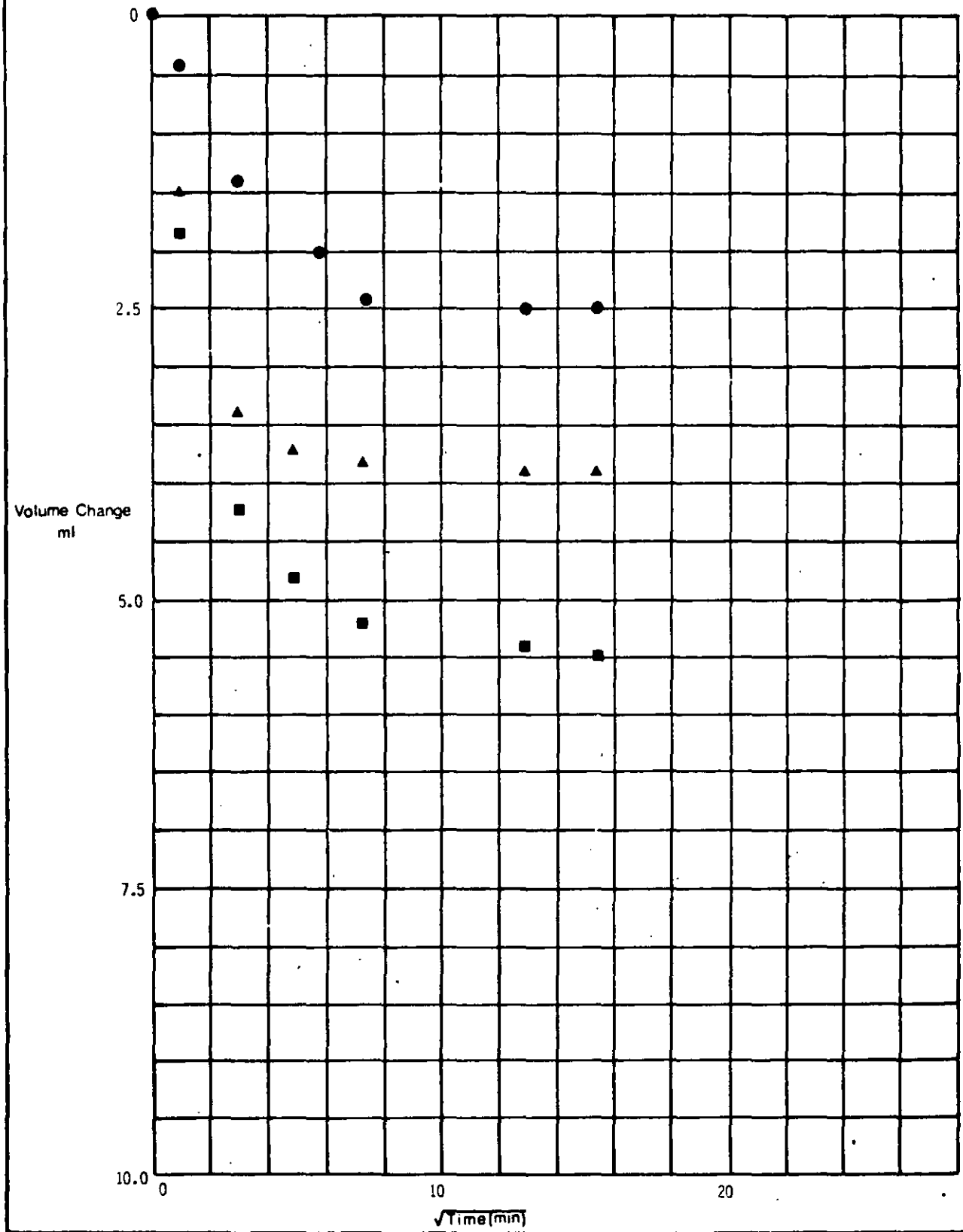
Laboratory-Effective Stress

exploration associates

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Figure 3.46



Triaxial Consolidation — Volume Change/ √Time

Depth 5.0
Borehole B3

Remarks

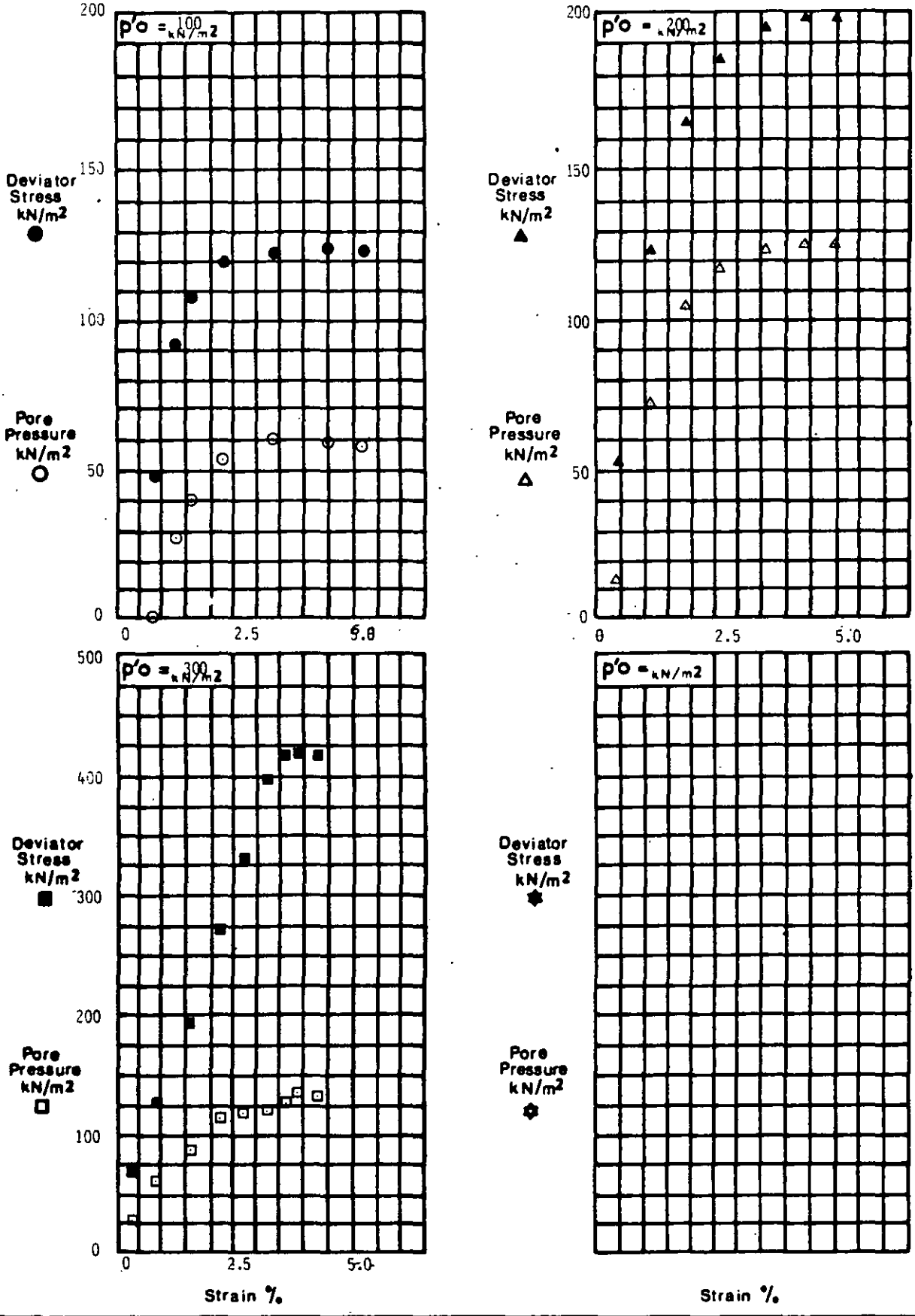
Laboratory – Effective Stress

exploration associates

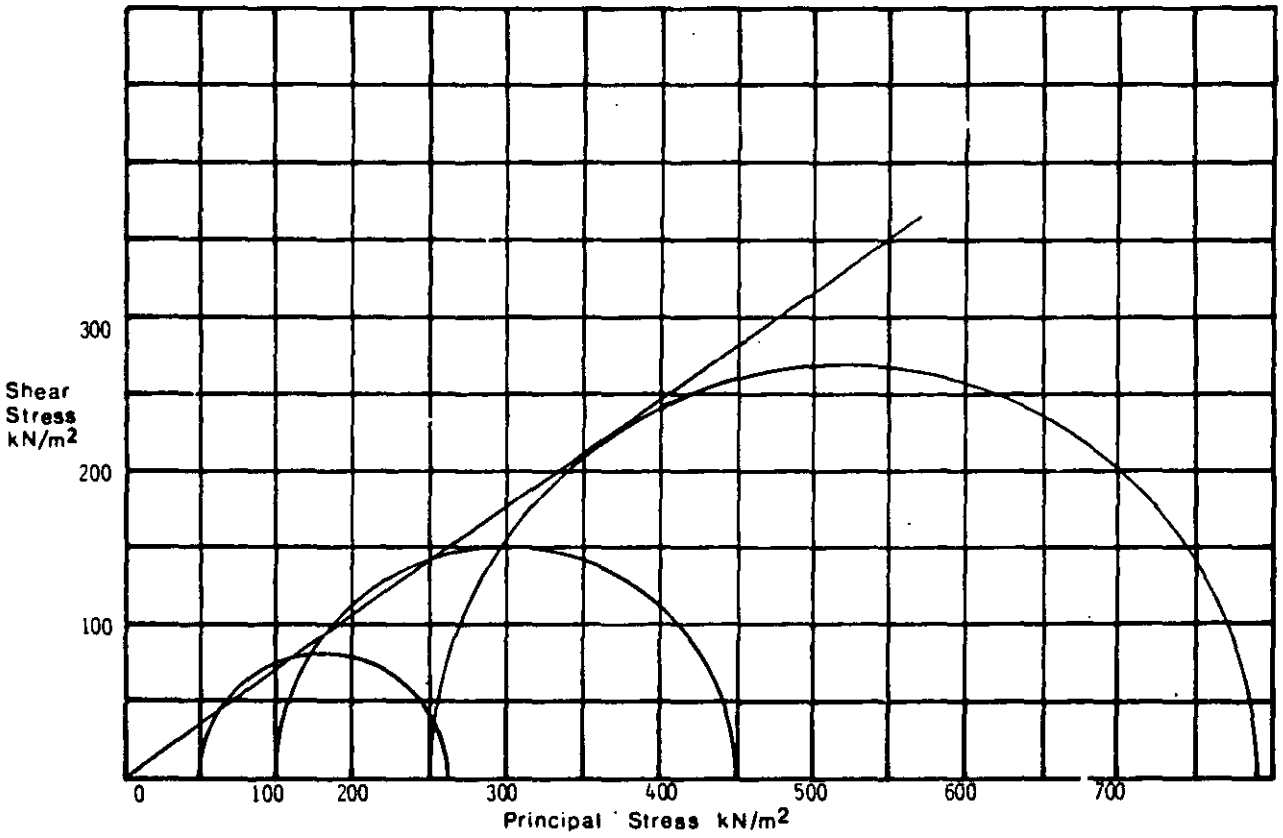
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Figure 3.47

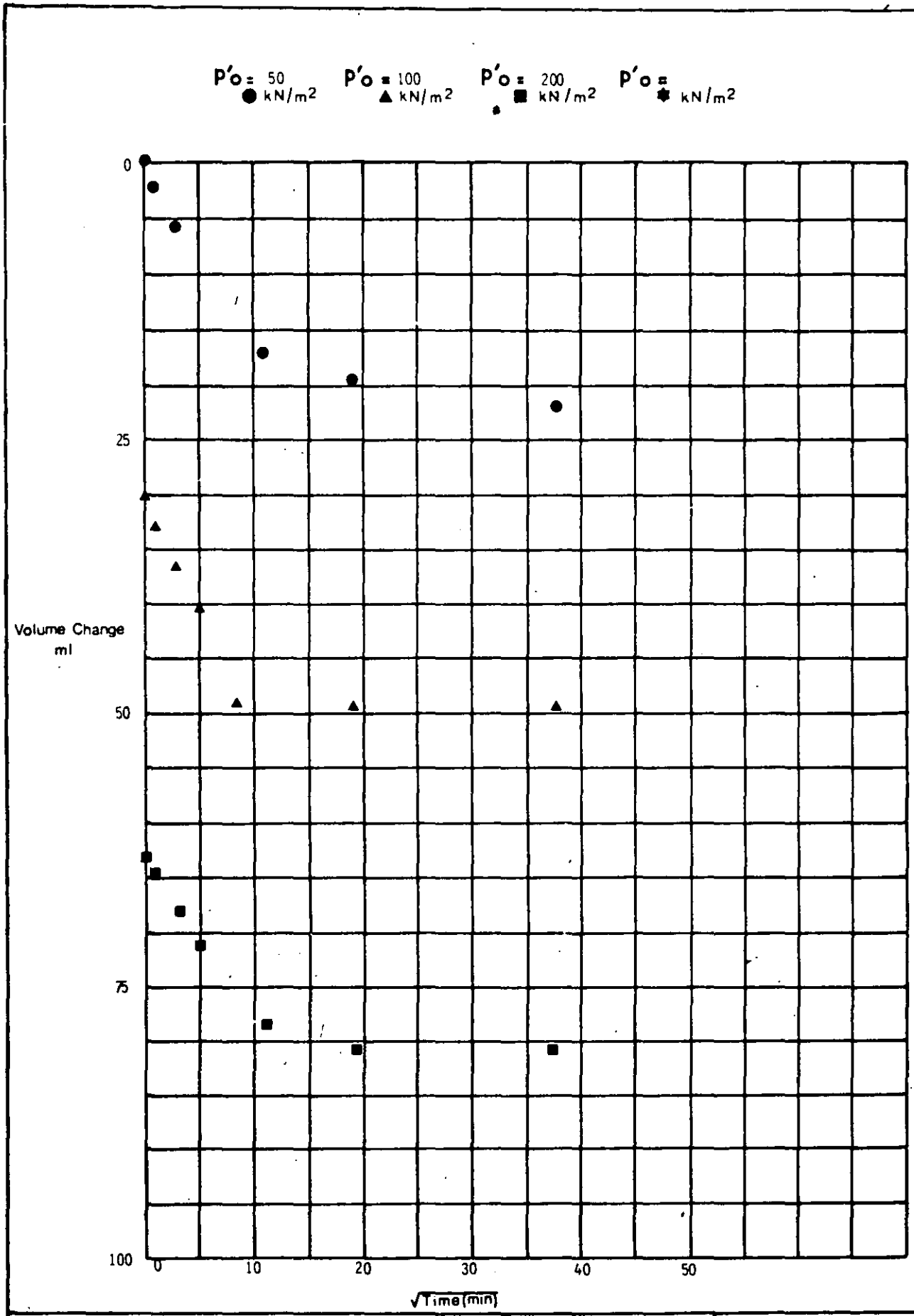


Deviator Stress / Strain Pore Pressure / Strain		Depth 5.0 Borehole B3
Remarks		
Laboratory - Effective Stress	**Project** Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 3.48



B	(Initial)		.92	0.88	.83	
B_s	(After application of Back Pressure)		1.0	1.01	1.0	
$\dot{\varepsilon}$	(Rate of Strain)	% min	.0025	.0025	.0025	
σ_3	(Cell Pressure during Shear)	kN/m^2	310	360	460	
u_o	(Applied Back Pressure)	kN/m^2	260	260	260	
$p'_o = \sigma_3 - u_o$	Mean effective stress prior to shear = Consolidation Pressure	kN/m^2	50	100	200	
$(\sigma_1 - \sigma_3)$	(Maximum Deviator Stress)	kN/m^2	162	301	542	

Triaxial Compression Test Consolidated Drained	Description Clayey SAND and GRAVEL	c' 14 kN/m² ϕ' 34 Degrees
	Mohr Circles and Summary	Depth 2.5 Borehole 5
Remarks 106mm diameter multistage		
Laboratory-Effective Stress	**Project** Department of Transport A564 Stoke-Derby Link. Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 3.49



Triaxial Consolidation — Volume Change/ √Time

Depth 2.5
Borehole 5

Remarks

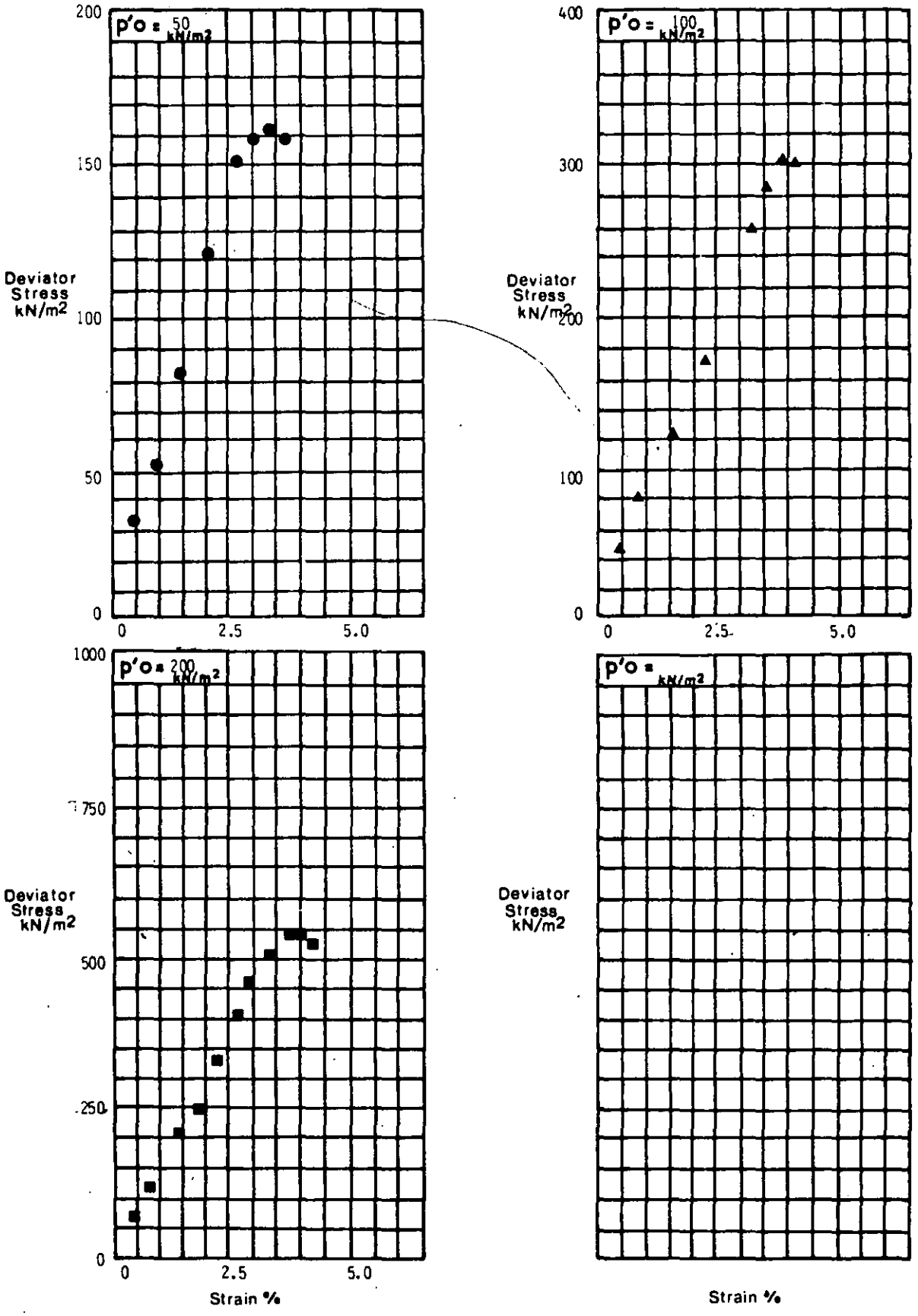
Laboratory – Effective Stress

exploration associates

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Figure 3.50



Deviator Stress / Strain

Depth 2.5
Borehole 5

Remarks

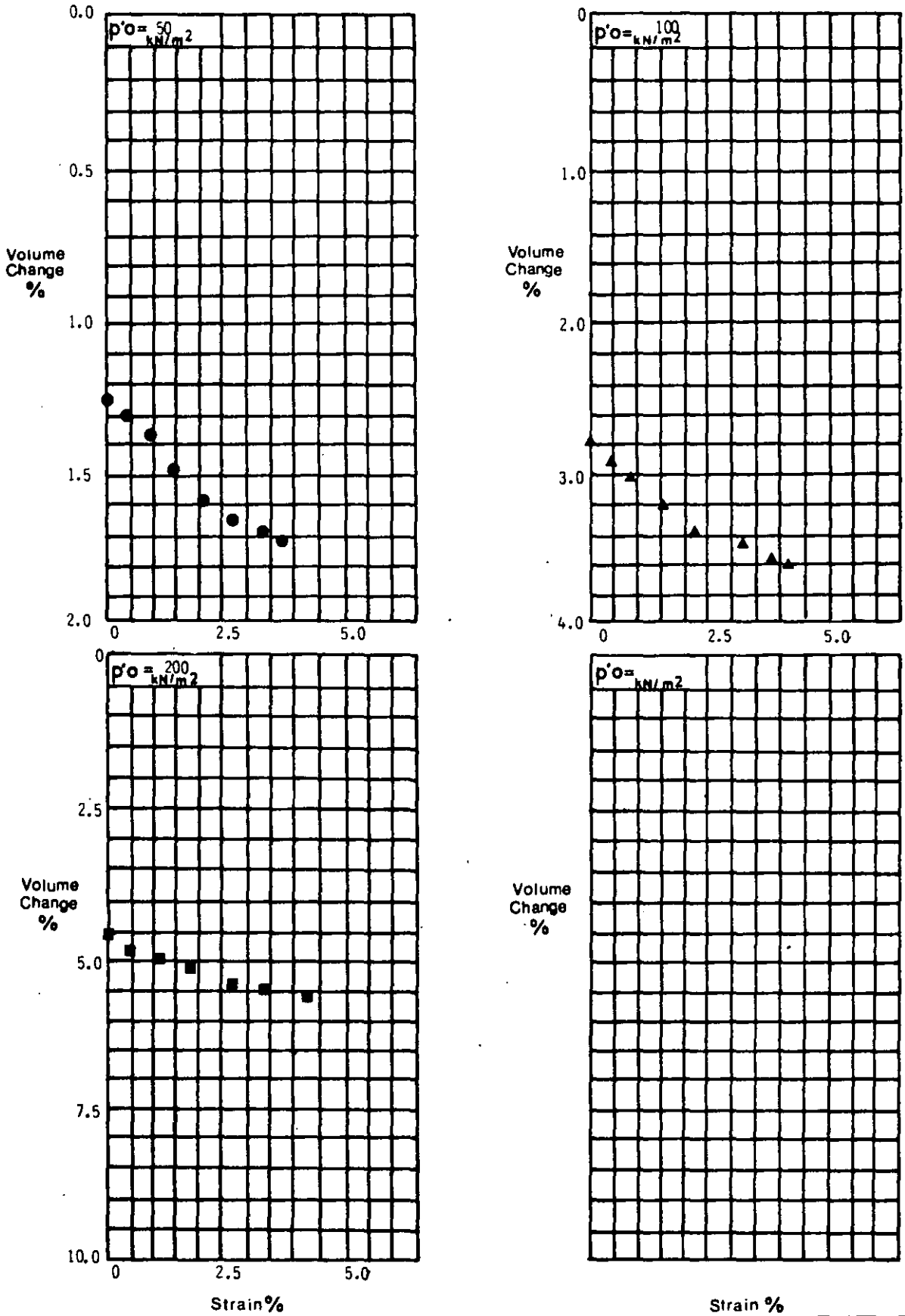
Laboratory - Effective Stress

exploration associates

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A564 Stoke-Derby Link
Derby Southern By Pass
Isley Walton to M1 Section
Preliminary Site Investigation

Contract S2796

Figure 3.51



Volume Change % / Strain %

Depth 2.5
Borehole 5

Remarks

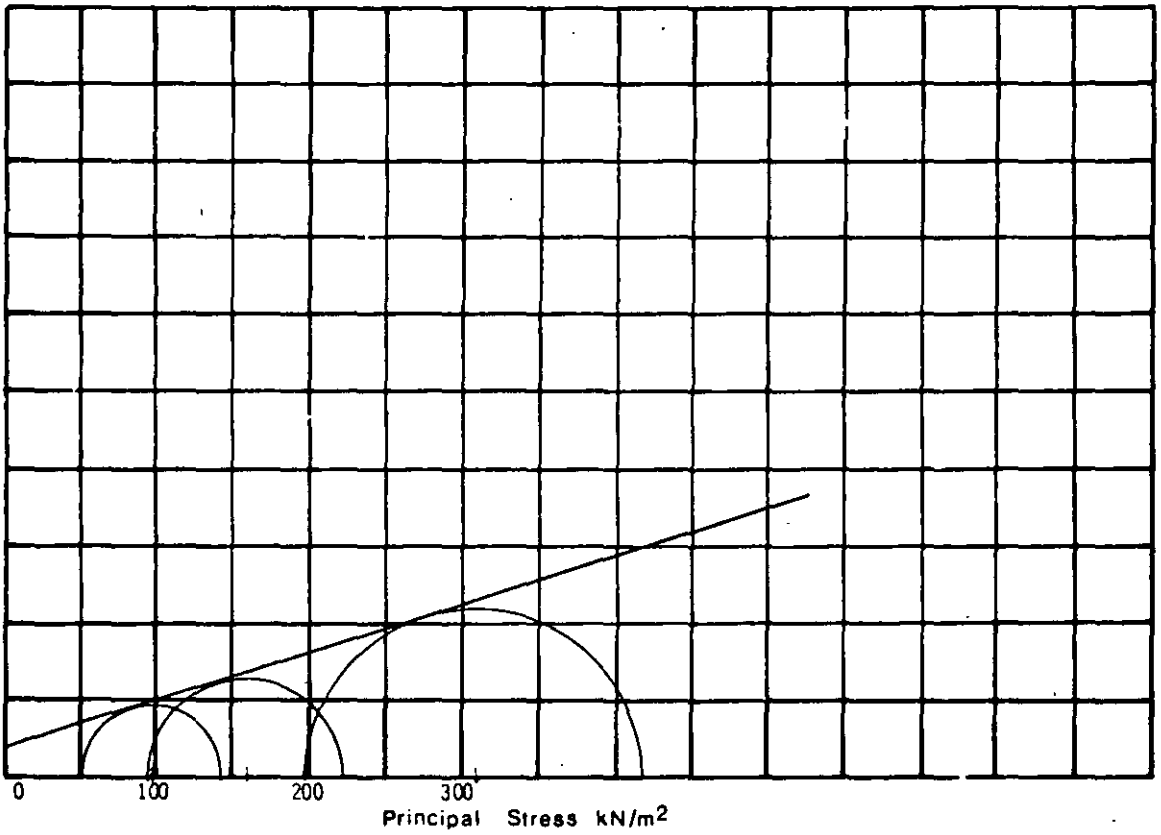
Laboratory - Effective Stress

exploration associates

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A564 Stoke-Derby Link
Derby Southern By Pass
Isley Walton to M1 Section
Preliminary Site Investigation

Contract
S2796

Figure 3.52



B	(Initial)		0.69	0.66	0.84	
B_s	(After application of Back Pressure)		1.0	1.0	1.0	
$\dot{\varepsilon}$	(Rate of Strain)	% min	0.0006	0.0006	0.0006	
σ_3	(Cell Pressure during Shear)	kN/m^2	450	500	600	
u_o	(Applied Back Pressure)	kN/m^2	400	400	400	
$p'_o = \sigma_3 - u_o$	Mean effective stress prior to shear = Consolidation Pressure	kN/m^2	50	200	200	
$(\sigma_1 - \sigma_3)$	(Maximum Deviator Stress)	kN/m^2	94	128	219	

Triaxial Compression Test
Consolidated
Drained

Description Fissured s lightly silty CLAY with silt pockets and occasional mudstone fragments

Mohr Circles and Summary

c'_o 16 kN/m^2
18½° Degrees

Depth 2.0-2.5
Borehole 8

Remarks 106mm diameter multistage

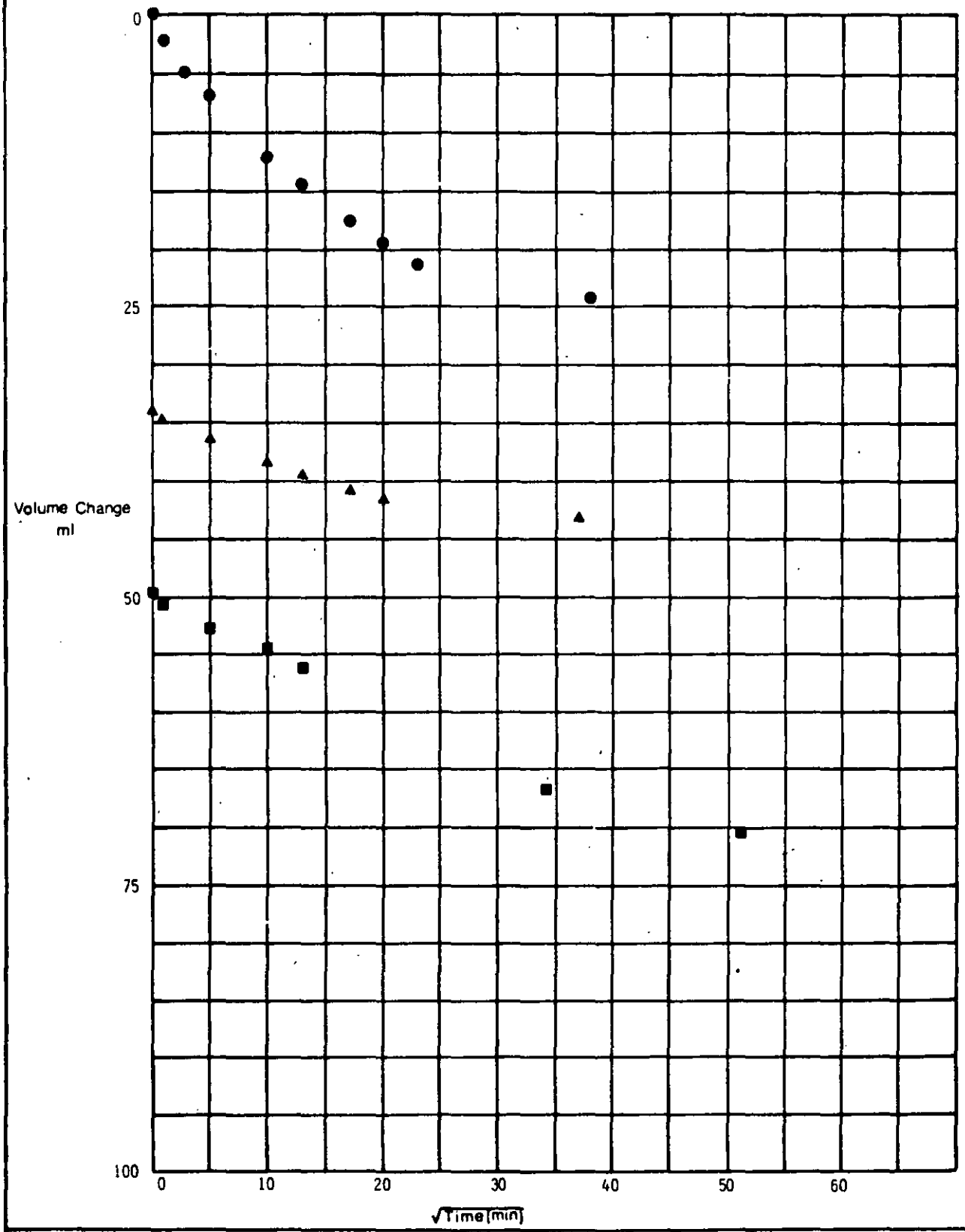
Laboratory-Effective Stress

exploration associates

Project Department of Transport
A564 Stoke-Derby Link
Derby Southern By Pass
Isley Walton to M1 Section
Preliminary Site Investigation

Contract
S2796

Figure 3.53



Triaxial Consolidation — Volume Change/ √Time

Depth 2.0
Borehole 8

Remarks

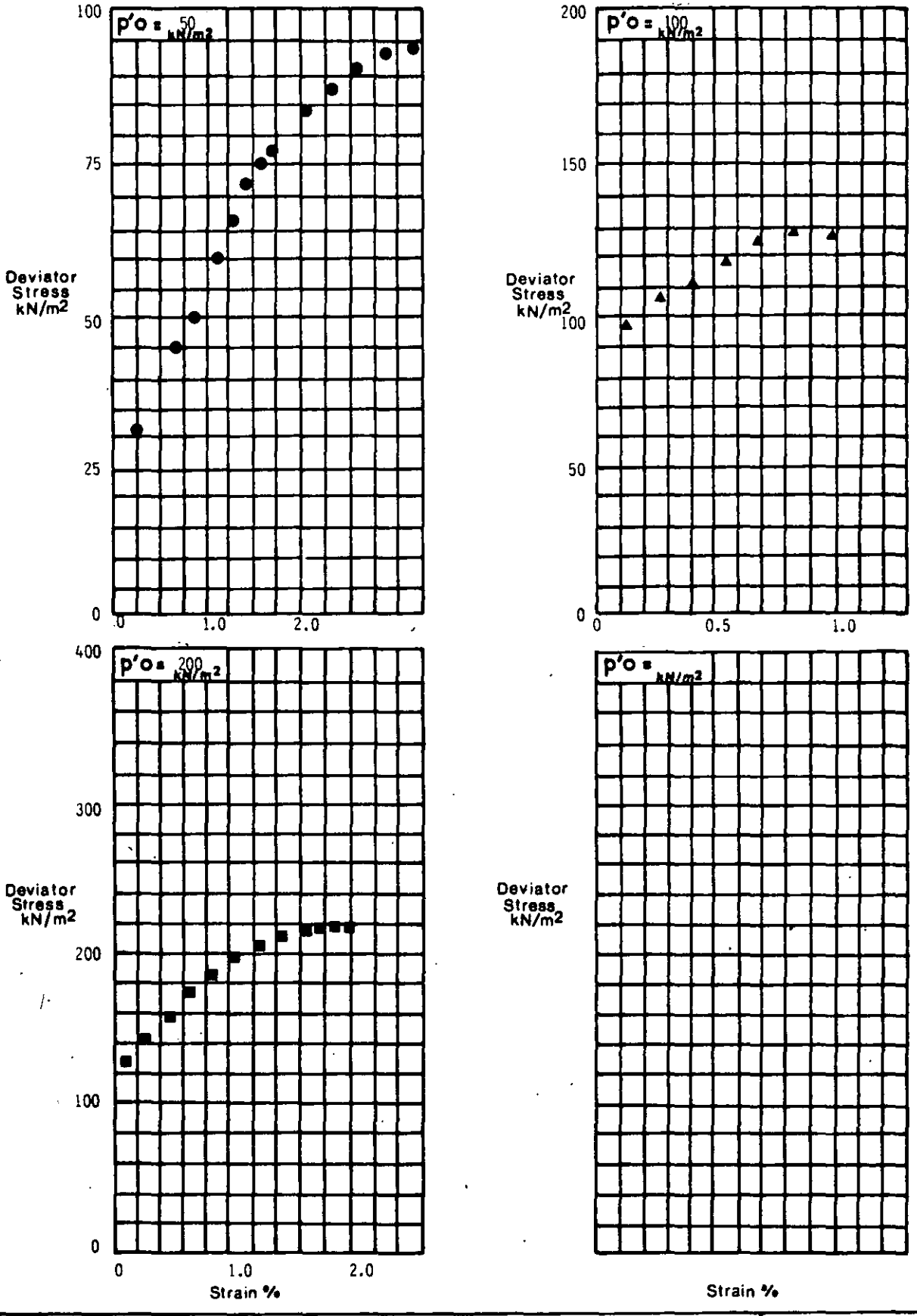
Laboratory — Effective Stress

exploration associates

Project Department of Transport
A564 Stoke-Derby Link
Derby Southern By Pass
Isley Walton to M1 Section
Preliminary Site Investigation

Contract S2796

Figure 3.54



Deviator Stress / Strain

Depth 2.0
Borehole 8

Remarks

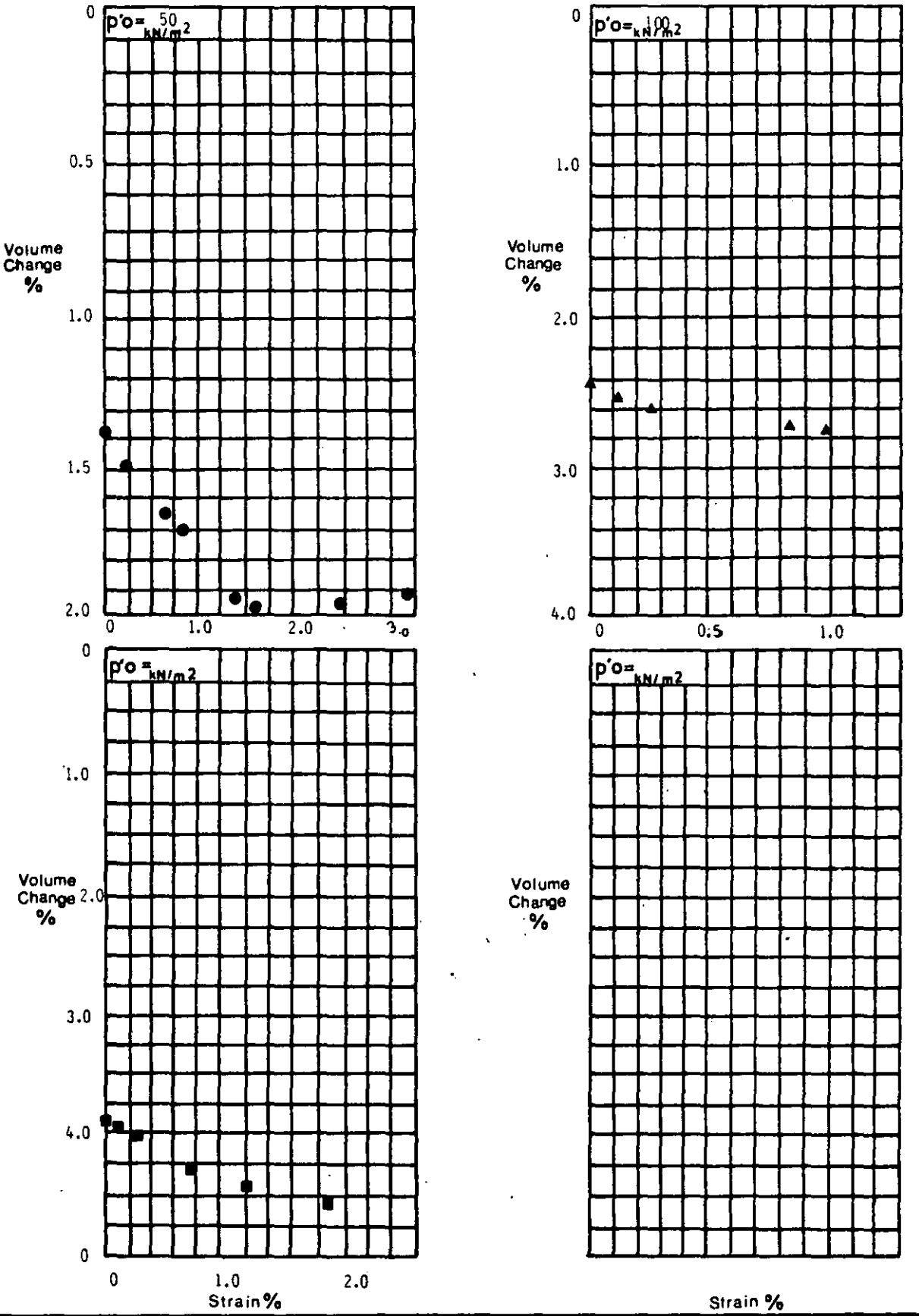
Laboratory - Effective Stress

exploration associates

Project Department of Transport
A564 Stoke-Derby Link
Derby Southern By Pass
Isley Walton to M1 Section
Preliminary Site Investigation

Contract S2796

Figure 3.55



Volume Change % / Strain %

Depth 2.0
Borehole 8

Remarks

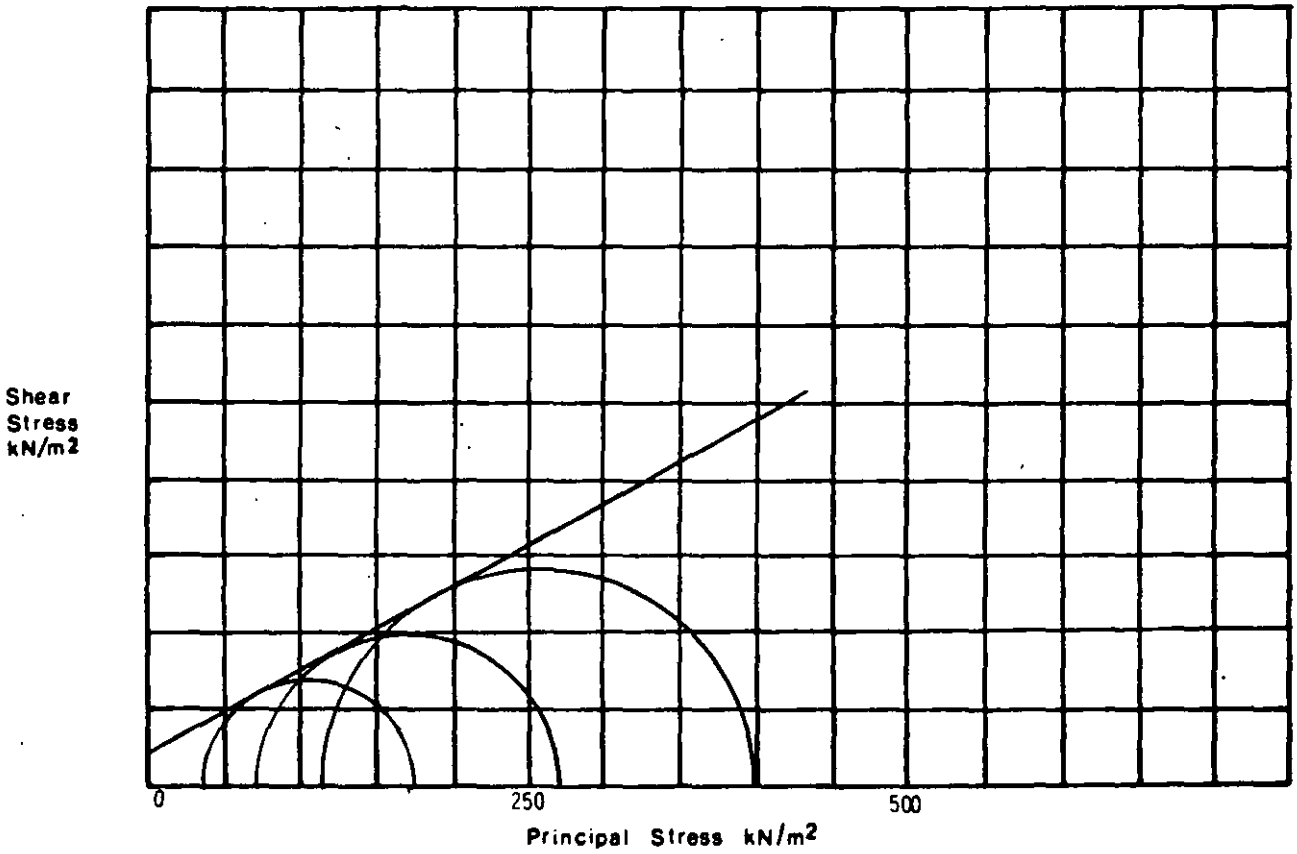
Laboratory – Effective Stress

exploration associates

Project Department of Transport
A564 Stoke-Derby Link
Derby Southern By Pass
Isley Walton to M1 Section
Preliminary Site Investigation

Contract S2796

Figure 3.56



B	(Initial)		0.56	0.37	0.55	
B_s	(After application of Back Pressure)		1.00	0.99	0.99	
$\dot{\varepsilon}$	(Rate of Strain)	% min	0.08	0.08	0.08	
σ_3	(Cell Pressure during Shear)	kN/m^2	350	400	500	
u_o	(Applied Back Pressure)	kN/m^2	300	300	300	
$p'_o = \sigma_3 - u_o$	Mean effective stress prior to shear = Consolidation Pressure	kN/m^2	50	100	200	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m^2	139	200	285	
$\Delta u_f = u_f - u_o$	(Pore Pressure change to Failure)	kN/m^2	15	30	87	
A_f	(Failure)		0.11	0.15	0.31	

Triaxial Compression Test
Consolidated
Undrained

Description Silty sandy CLAY with sand pockets occasional gravel and coal fragments.

C' 25 kN/m²
ϕ' 28 Degrees

Mohr Circles and Summary

Depth 2.0
Borehole 89

Remarks 3 x 38mm diameter samples

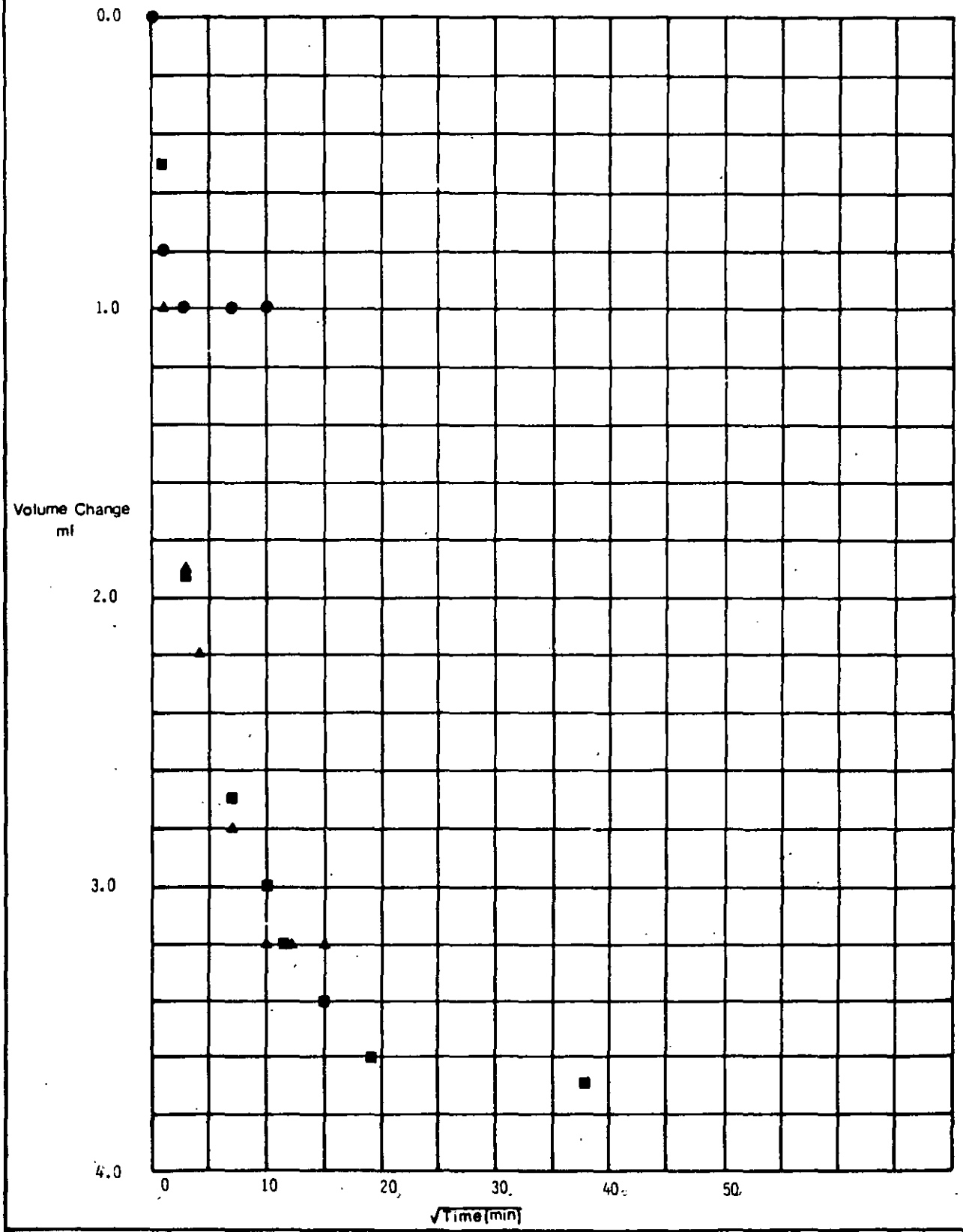
Laboratory-Effective Stress

exploration associates

Project Department of Transport
A564 Stoke-Derby Link
Derby Southern By Pass
Isley Walton to M1 Section
Preliminary Site Investigation

Contract S2796

Figure 3.57



Triaxial Consolidation — Volume Change/ √Time

Depth 2.0
Borehole B9

Remarks

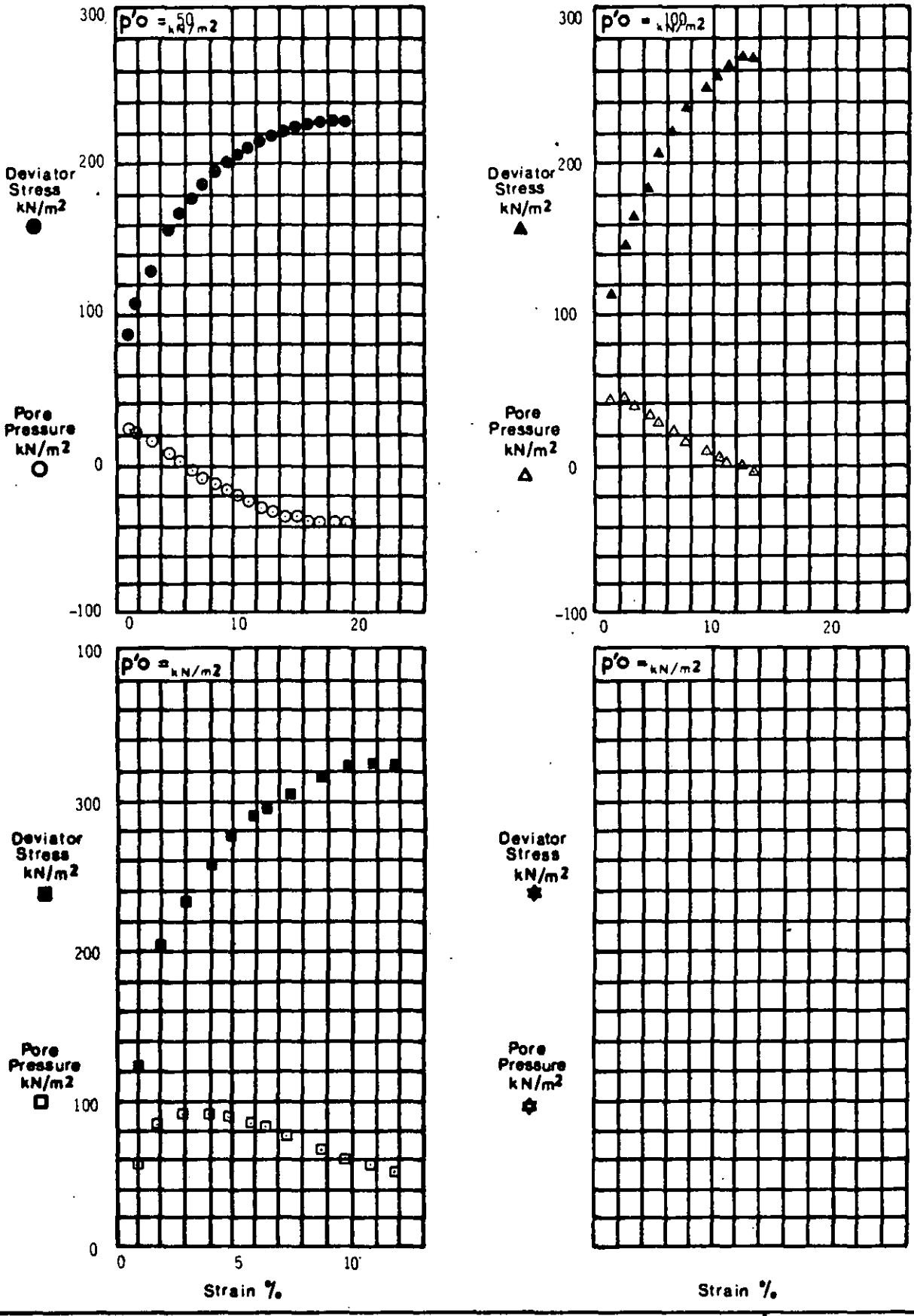
Laboratory — Effective Stress

exploration associates

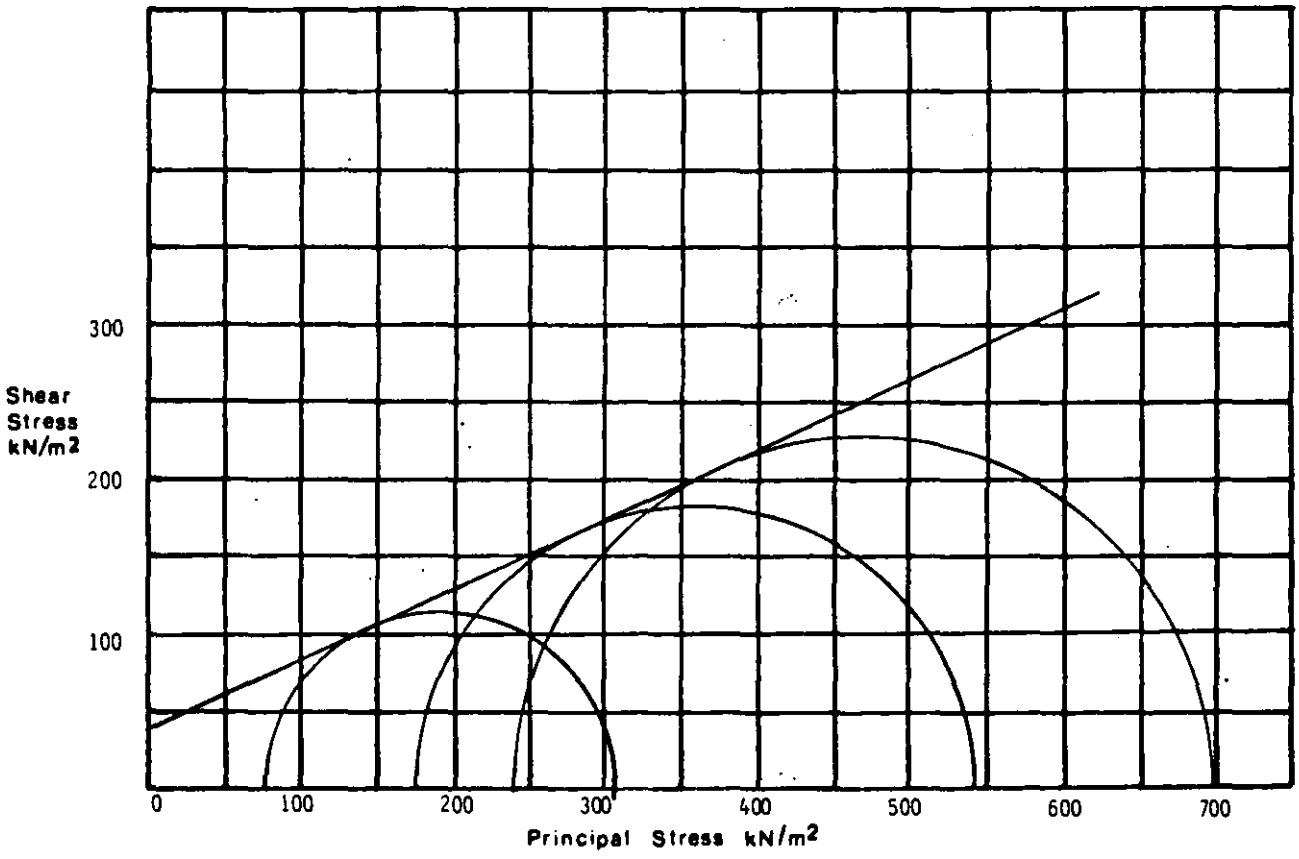
Project Department of Transport
A564 Stoke-Derby Link
Derby Southern By Pass
Isley Walton to M1 Section
Preliminary Site Investigation

Contract
S2796

Figure 3.58



Deviator Stress / Strain Pore Pressure / Strain		Depth 2.0 Borehole B9
Remarks		
Laboratory - Effective Stress	**Project** Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 3.59



B	(Initial)		-72	-66	-86	
B_s	(After application of Back Pressure)		.99	1.0	1.0	
$\dot{\epsilon}$	(Rate of Strain)	% min	.0026	.0026	.0026	
σ_3	(Cell Pressure during Shear)	kN/m^2	410	610	610	
u_o	(Applied Back Pressure)	kN/m^2	310	410	310	
$p'_o = \sigma_3 - u_o$	Mean effective stress prior to shear = Consolidation Pressure	kN/m^2	100	200	300	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m^2	230	367	462	
$\Delta u_f = u_f - u_o$	(Pore Pressure change to Failure)	kN/m^2	25	25	62	
A_f	(Failure)		.11	.07	.13	

Triaxial Compression Test
Consolidated
Undrained

Description
Silty sandy CLAY with gravel.

Mohr Circles and Summary

C' 32 kN/m 2
ϕ' 26 Degrees

Depth 5.0
Borehole B9

Remarks 3 x 38mm diameter samples

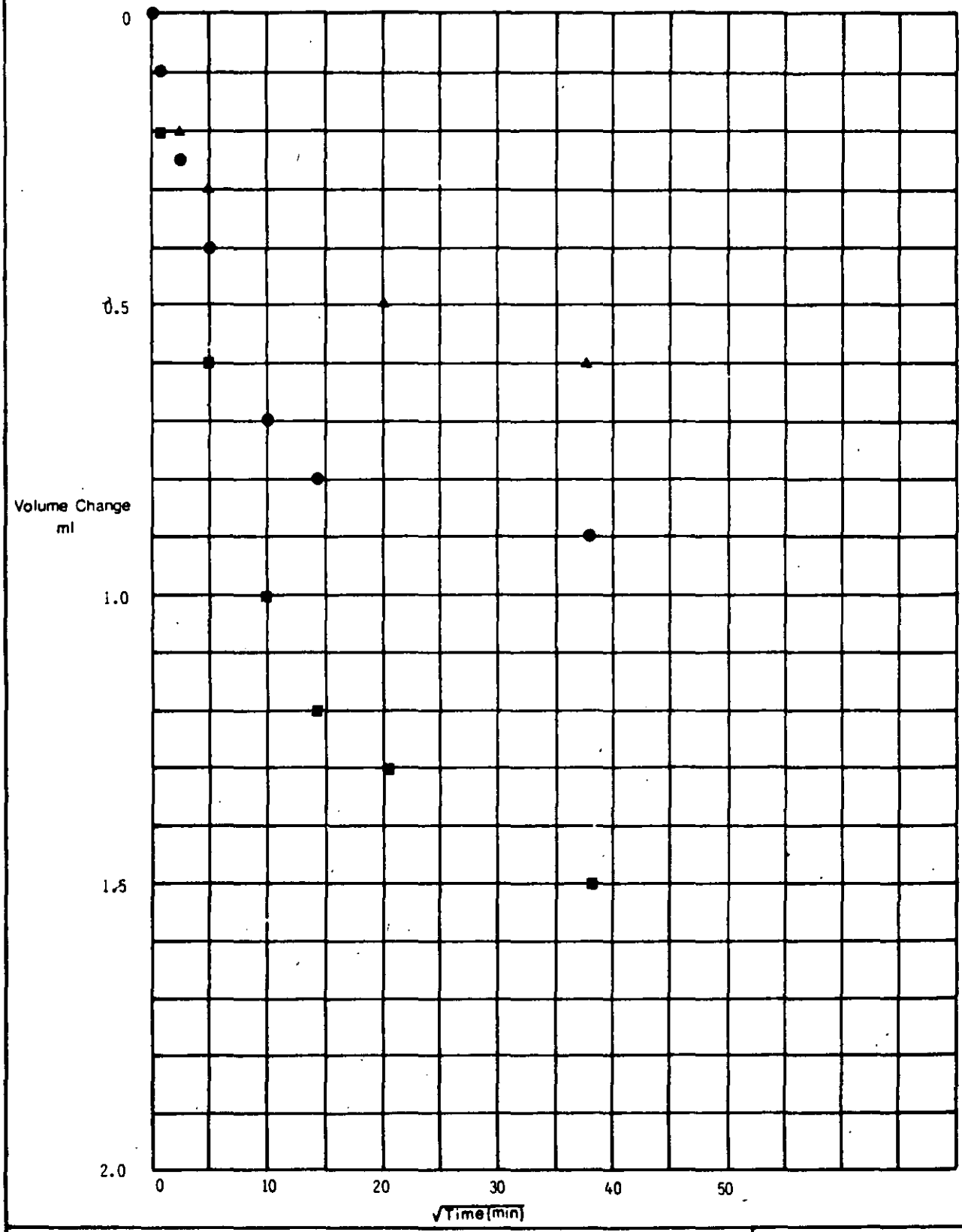
Laboratory-Effective Stress

exploration associates

Project Department of Transport
A564 Stoke-Derby Link
Derby Southern By Pass
Isley Walton to M1 Section
Preliminary Site Investigation

Contract
S2796

Figure 3.60



Triaxial Consolidation — Volume Change/ √Time

Depth 5.0
Borehole B9

Remarks

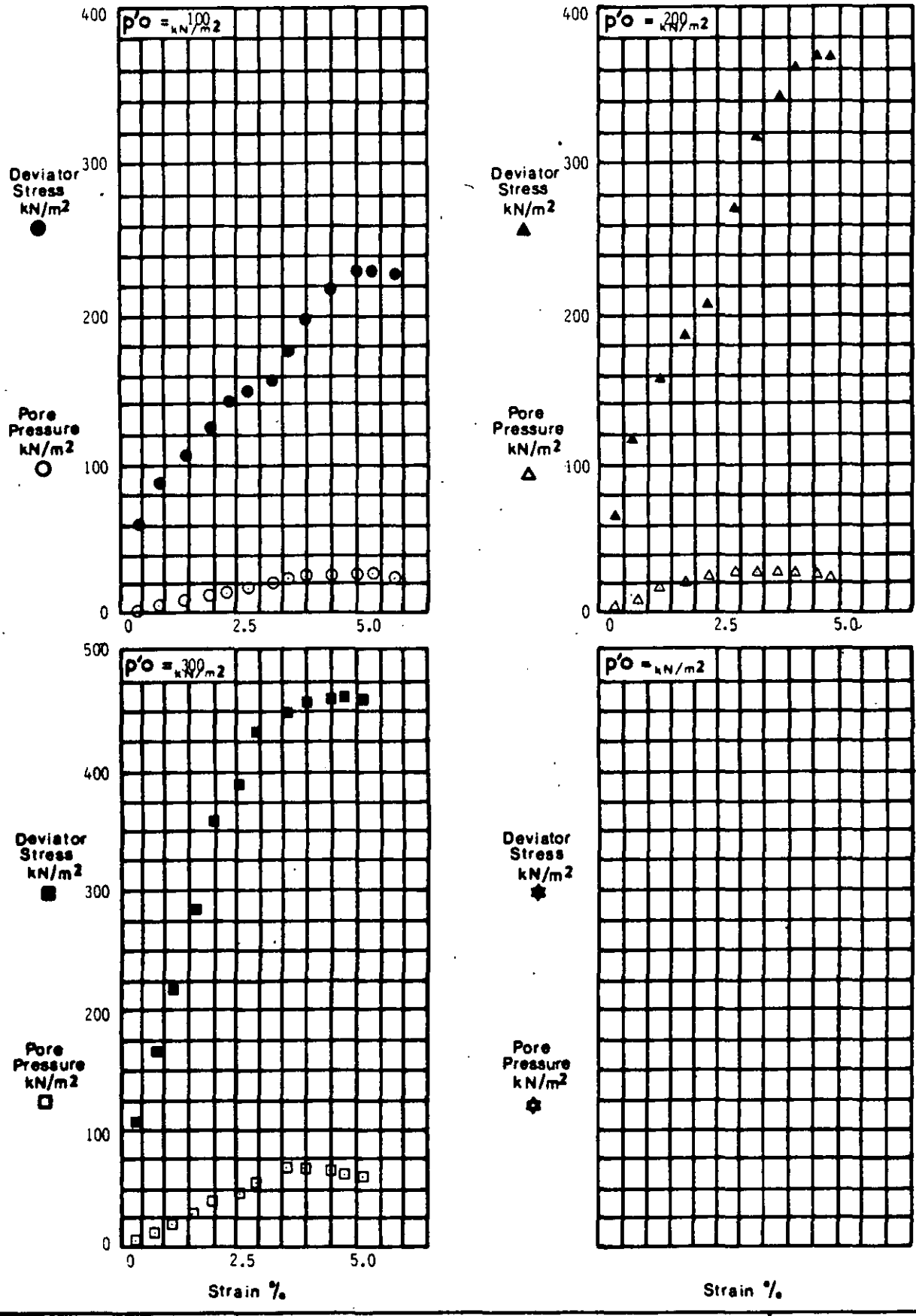
Laboratory — Effective Stress

exploration associates

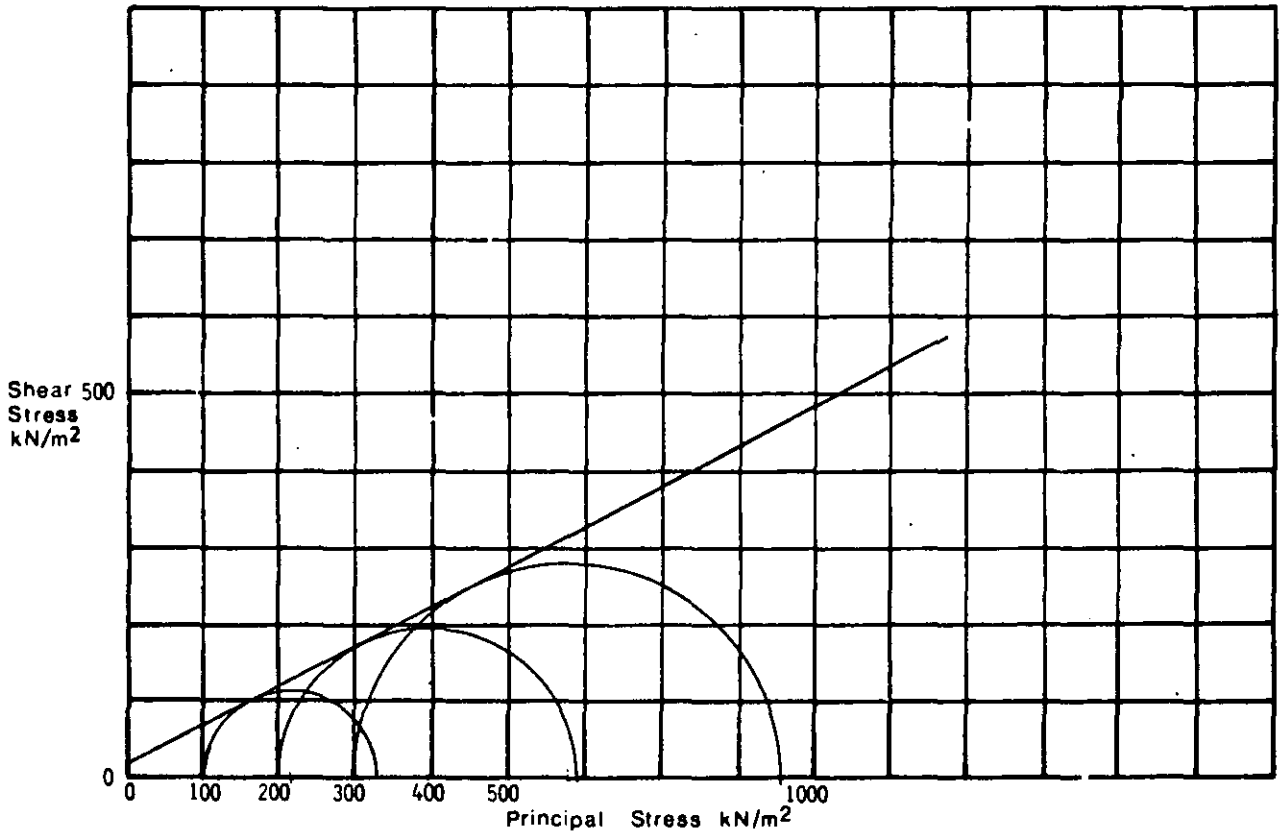
Project Department of Transport
A564 Stoke-Derby Link
Derby Southern By Pass
Isley Walton to M1 Section
Preliminary Site Investigation

Contract S2796

Figure 3.61



Deviator Stress / Strain Pore Pressure / Strain		Depth 5.0 Borehole B9
Remarks		
Laboratory - Effective Stress	**Project** Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 3.62



B	(Initial)		0.89	0.70	0.72	
B_s	(After application of Back Pressure)		1.0	1.0	1.0	
$\dot{\epsilon}$	(Rate of Strain)	% min	0.0035	0.0035	0.0035	
σ_3	(Cell Pressure during Shear)	kN/m^2	410	510	610	
u_o	(Applied Back Pressure)	kN/m^2	310	310	310	
$p'_o = \sigma_3 - u_o$	Mean effective stress prior to shear = Consolidation Pressure	kN/m^2	100	200	300	
$(\sigma_1 - \sigma_3)$	(Maximum Deviator Stress)	kN/m^2	230	393	556	

Triaxial Compression Test
Consolidated
Drained

Description Very silty CLAY with silt pockets and occasional gravel

Mohr Circles and Summary

c' 27 kN/m^2
ϕ' 26 Degrees

Depth 4.5
Borehole 10

Remarks 3 x 38mm dia samples

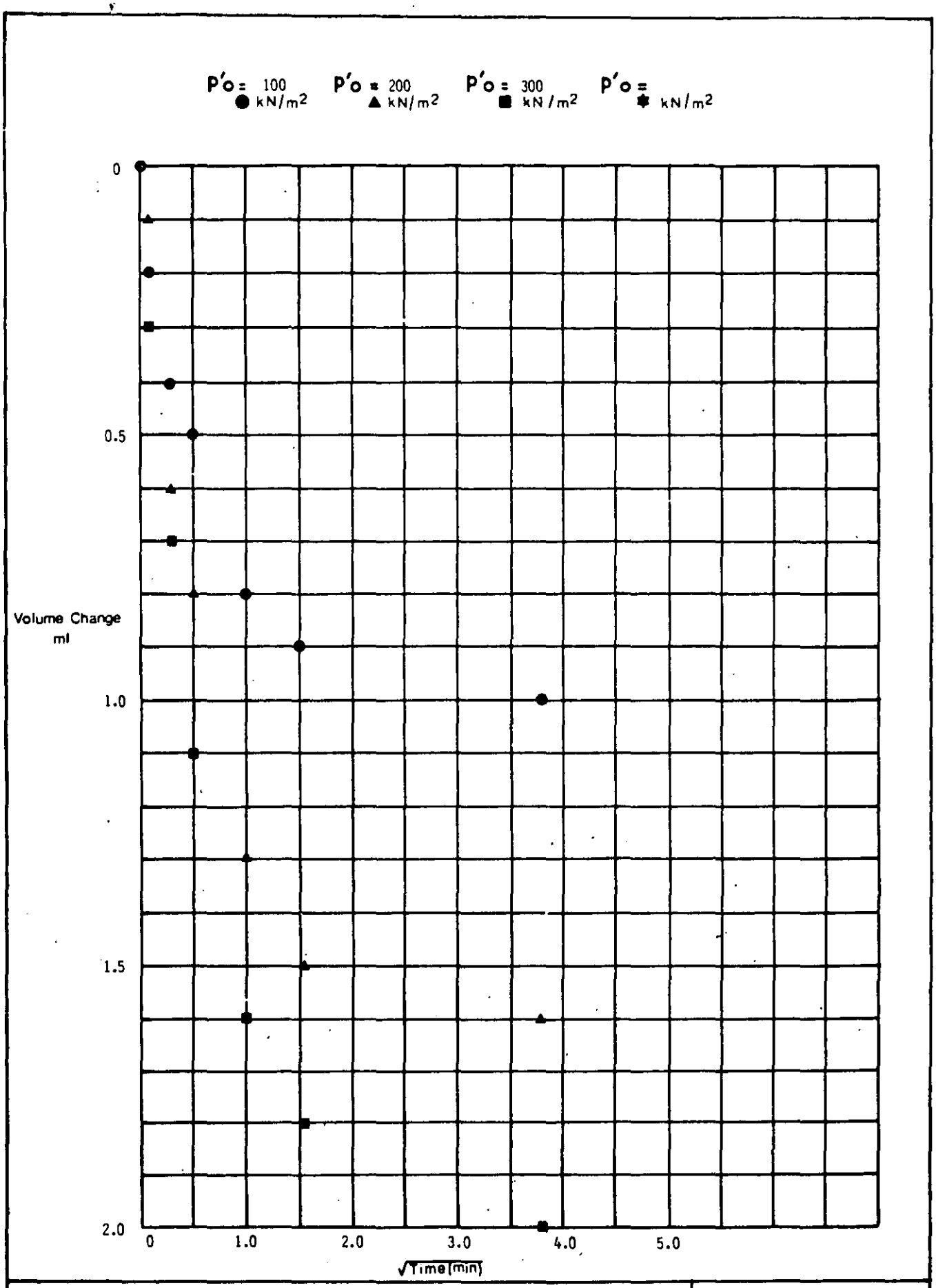
Laboratory–Effective Stress

exploration associates

Project Department of Transport
A564 Stoke-Derby Link
Derby Southern By Pass
Isley Walton to M1 Section
Preliminary Site Investigation

Contract S2796

Figure 3.63



Triaxial Consolidation — Volume Change/ √Time

Depth 4.5
Borehole 10

Remarks

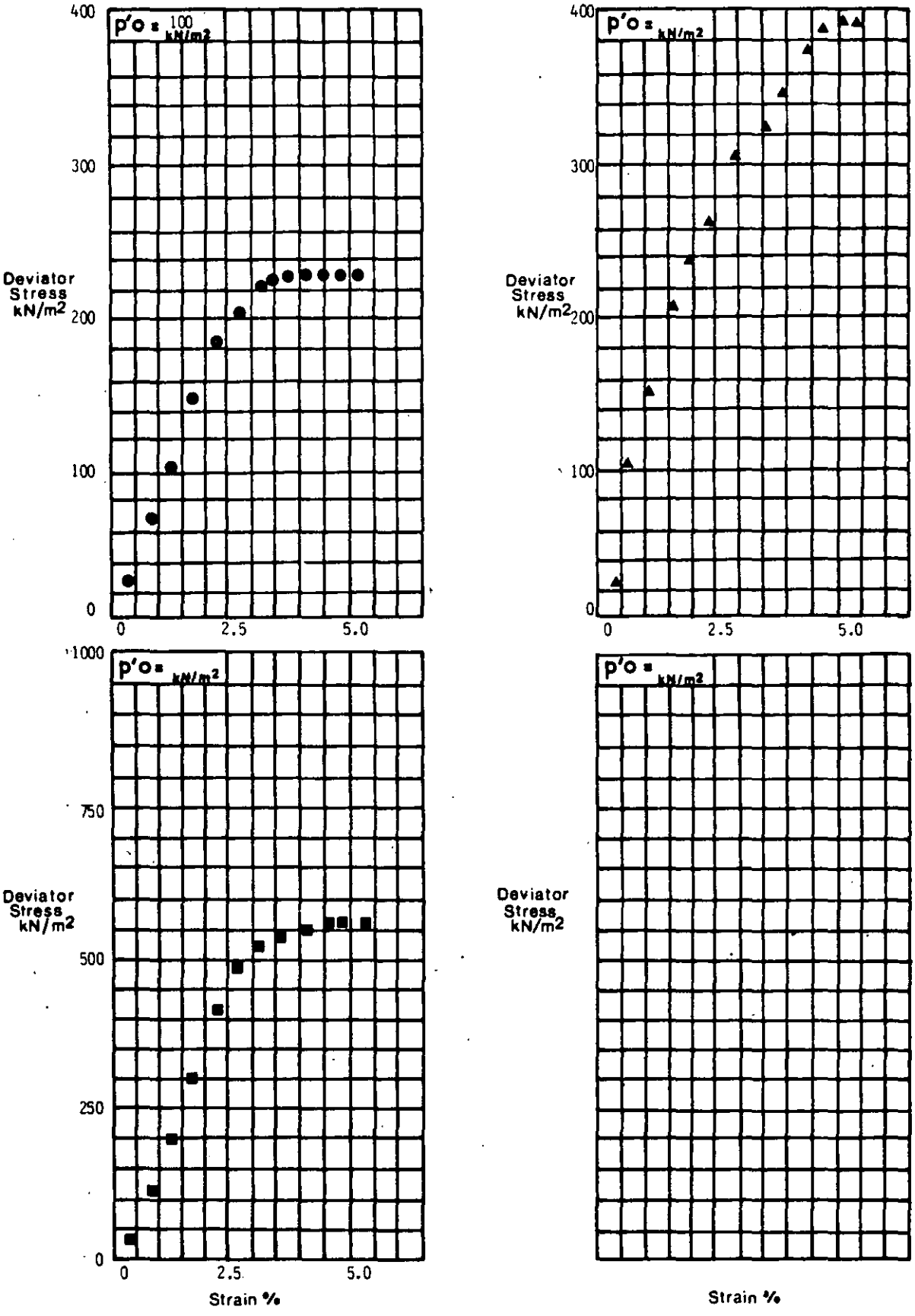
Laboratory — Effective Stress

exploration associates

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A564 Stoke-Derby Link
Derby Southern By Pass
Isley Walton to M1 Section
Preliminary Site Investigation

Contract S2796

Figure 3.64



Deviator Stress / Strain

Depth 4.5
Borehole 10

Remarks

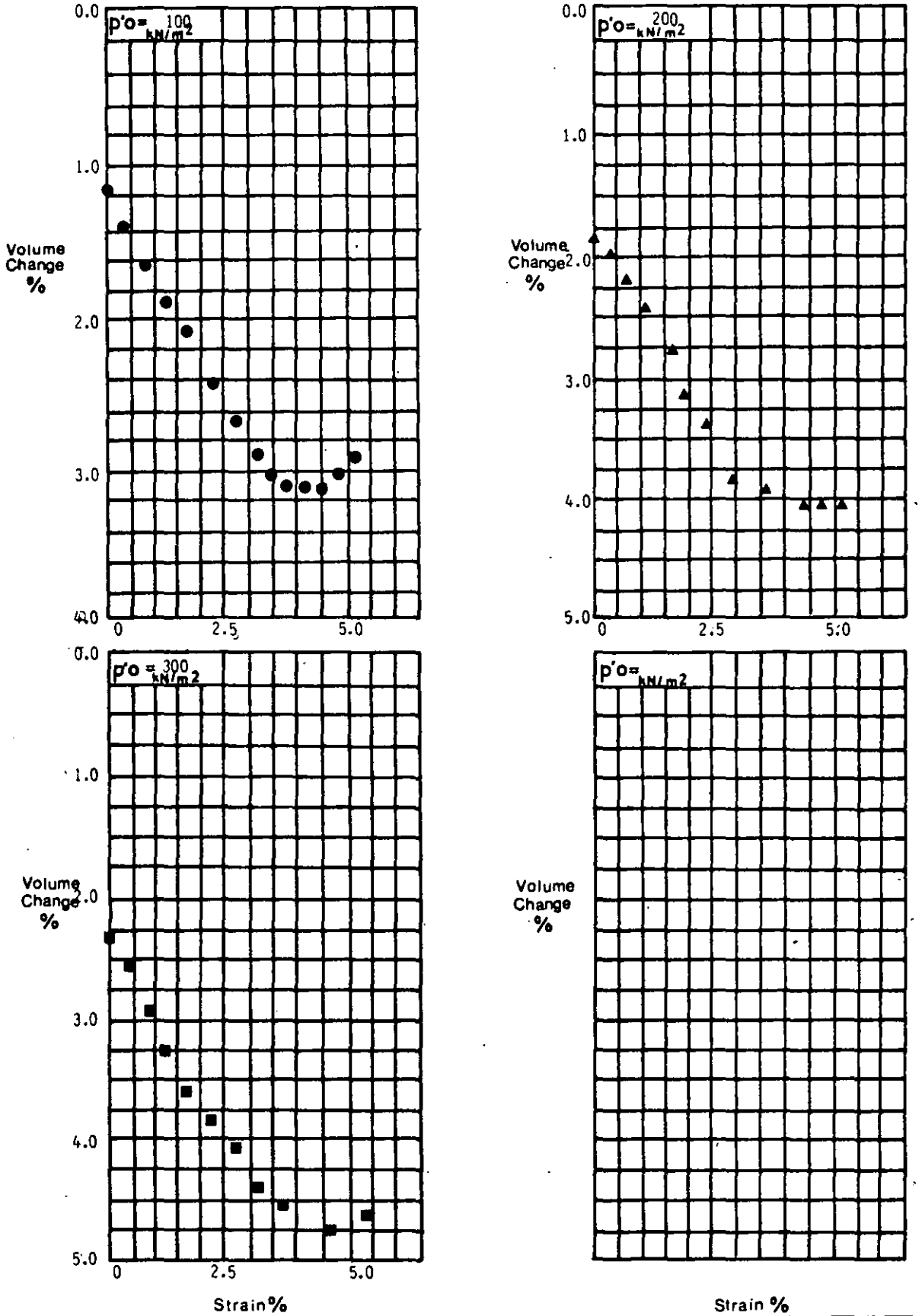
Laboratory - Effective Stress

Project Department of Transport
A564 Stoke-Derby Link
Derby Southern By Pass
Isley Walton to M1 Section
Preliminary Site Investigation

Contract
S2796

exploration associates

Figure 3.65



Volume Change % / Strain %

Depth 4.5
Borehole 10

Remarks

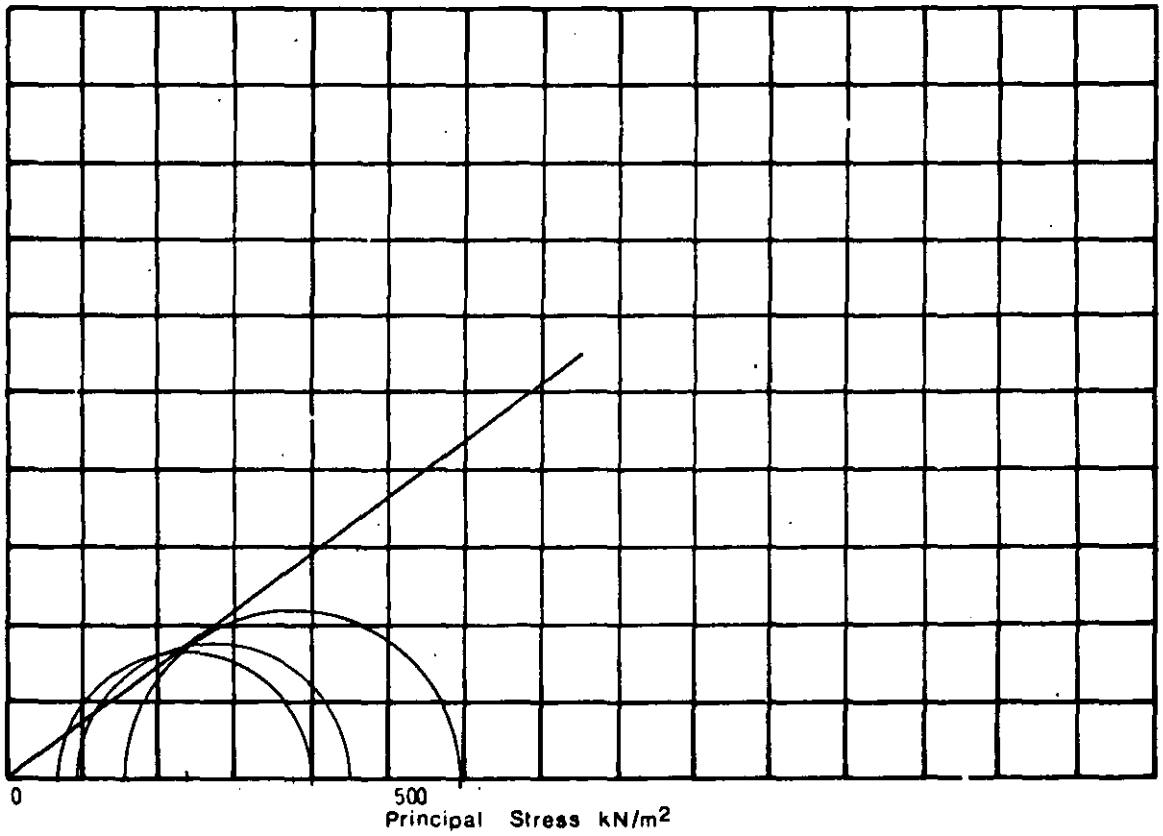
Laboratory – Effective Stress

exploration associates

Project Department of Transport
A564 Stoke-Derby Link
Derby Southern By Pass
Isley Walton to M1 Section
Preliminary Site Investigation

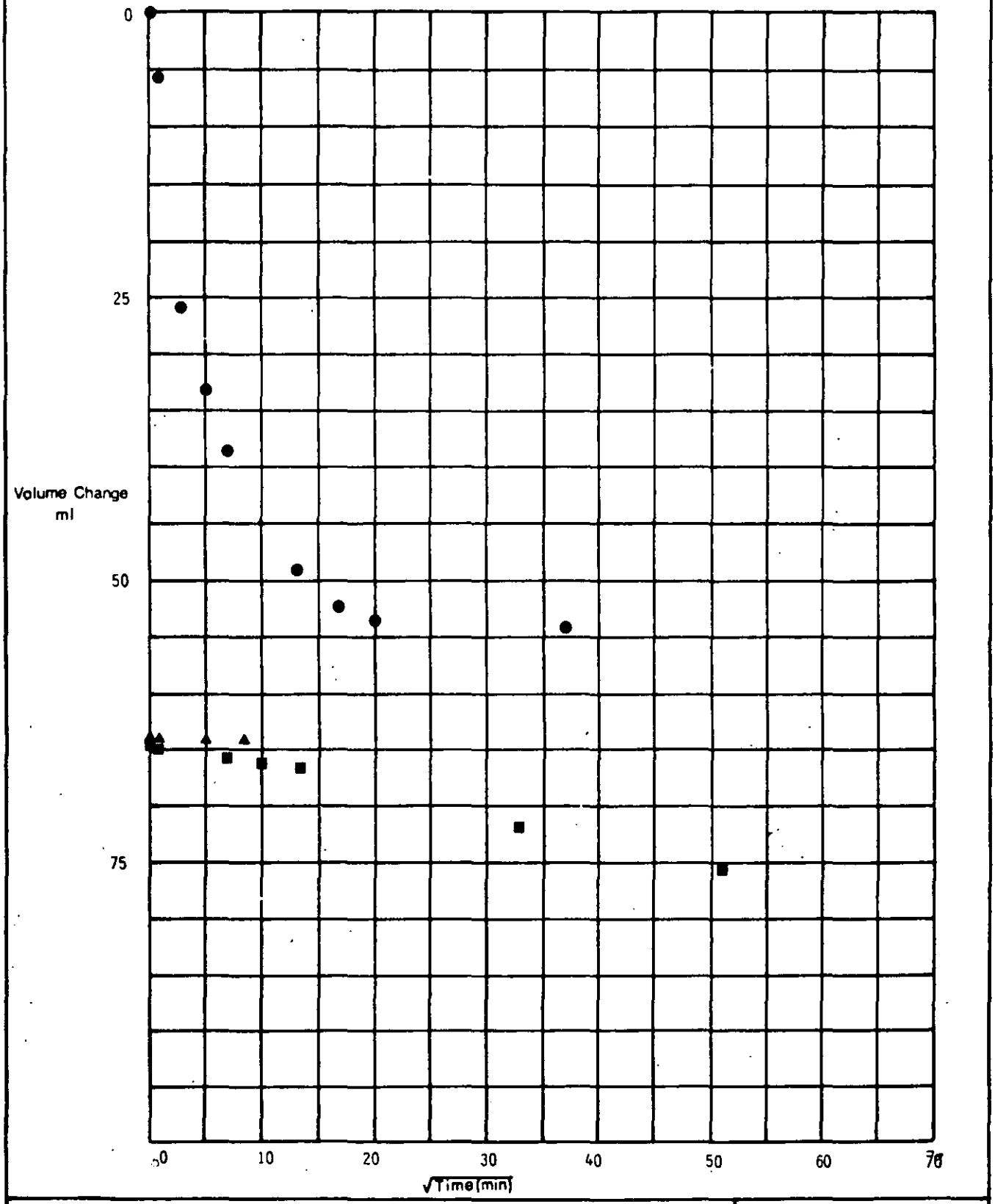
Contract S2796

Figure 3.66



B	(Initial)		0.34	0.46	0.67	
B_s	(After application of Back Pressure)		1.00	1.00	1.00	
$\dot{\varepsilon}$	(Rate of Strain)	% min	0.007	0.007	0.007	
σ_3	(Cell Pressure during Shear)	kN/m^2	450	500	600	
u_o	(Applied Back Pressure)	kN/m^2	400	400	400	
$p'_o = \sigma_3 - u_o$	Mean effective stress prior to shear = Consolidation Pressure	kN/m^2	50	100	200	
$(\sigma_1 - \sigma_3)$	(Maximum Deviator Stress)	kN/m^2	344	361	448	

Triaxial Compression Test Consolidated Drained	Description Very silty Clay	c' 0 kN/m^2 ϕ' 36 Degrees
	Mohr Circles and Summary	Depth 2.0 Borehole 12
Remarks 106mm diameter multistage		
Laboratory-Effective Stress	**Project** Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 3.67



Triaxial Consolidation —— Volume Change/ √Time

Depth 2.0
Borehole 12

Remarks

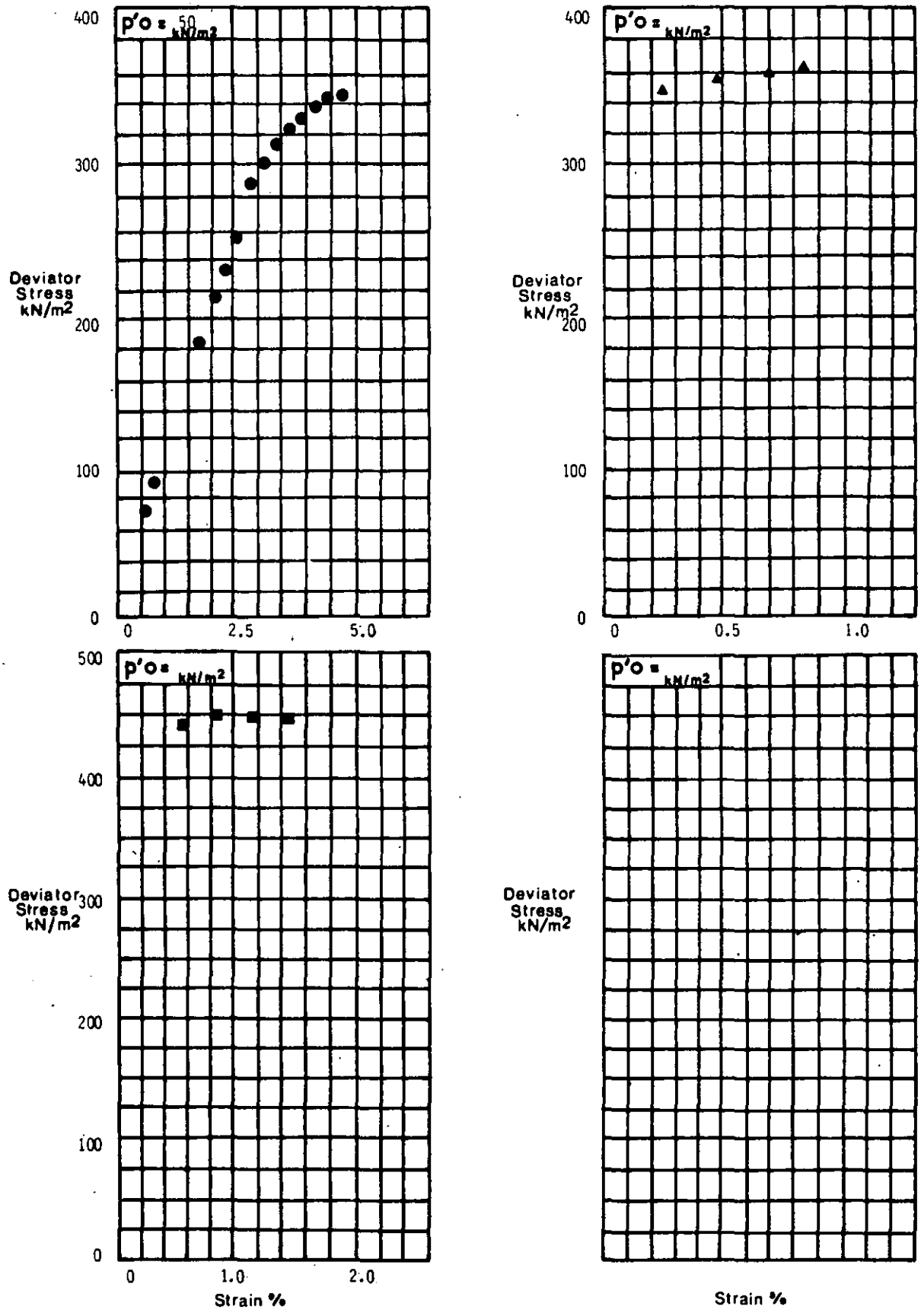
Laboratory — Effective Stress

exploration associates

Project Department of Transport
A564 Stoke-Derby Link
Derby Southern By Pass
Isley Walton to M1 Section
Preliminary Site Investigation

Contract S2796

Figure 3.68



Deviator Stress / Strain

Depth 2.0
Borehole 12

Remarks

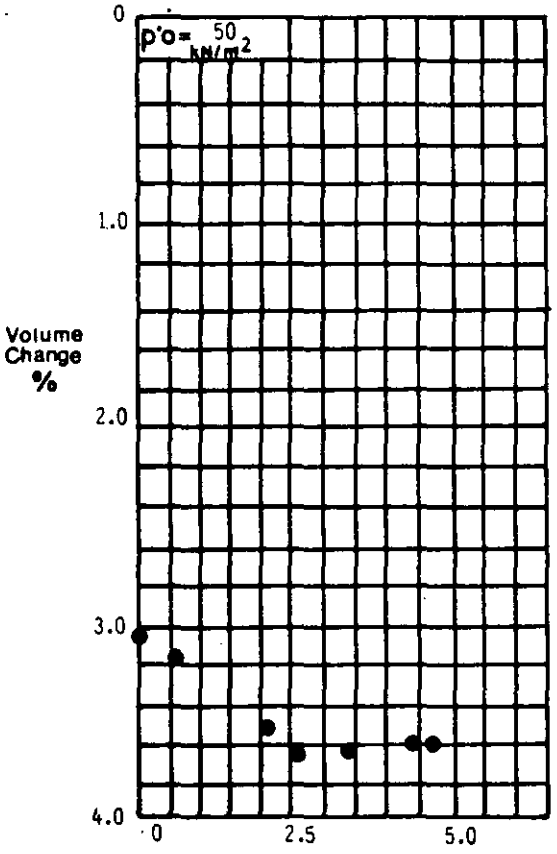
Laboratory - Effective Stress

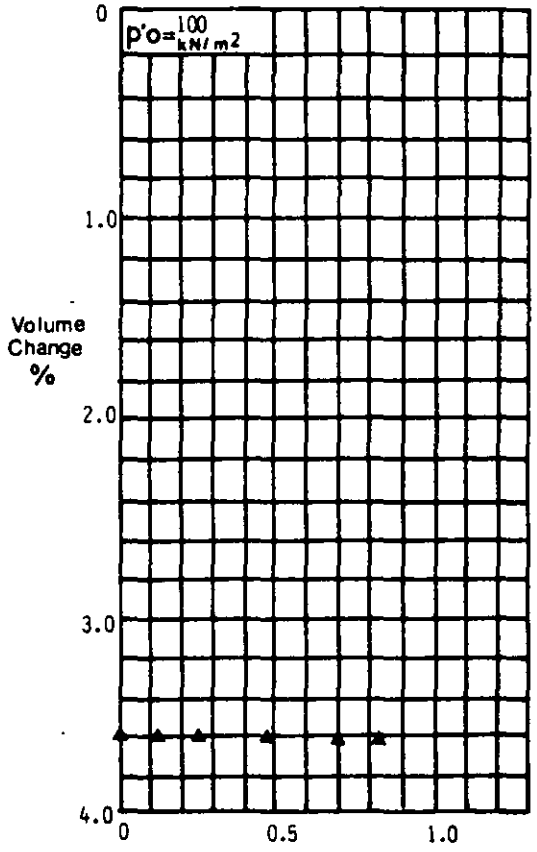
Project Department of Transport
A564 Stoke-Derby Link
Derby Southern By Pass
Isley Walton By Pass
Preliminary Site Investigation

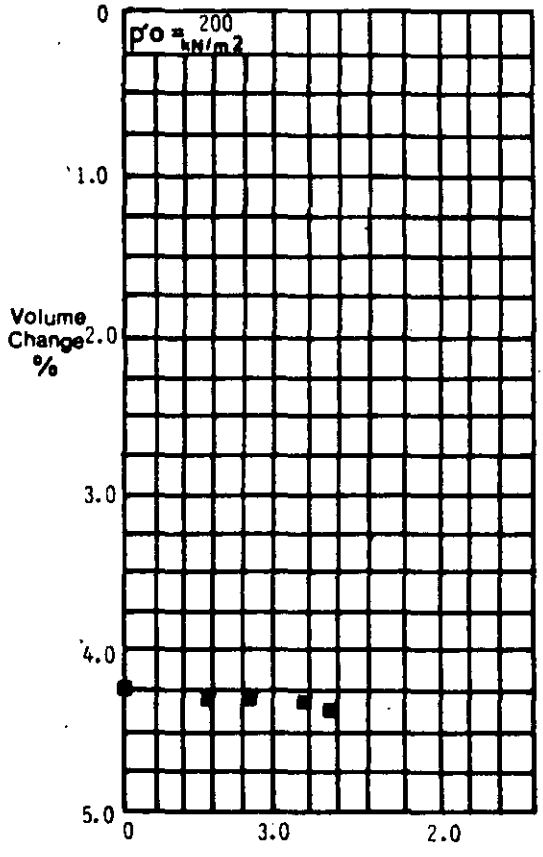
Contract
S2796

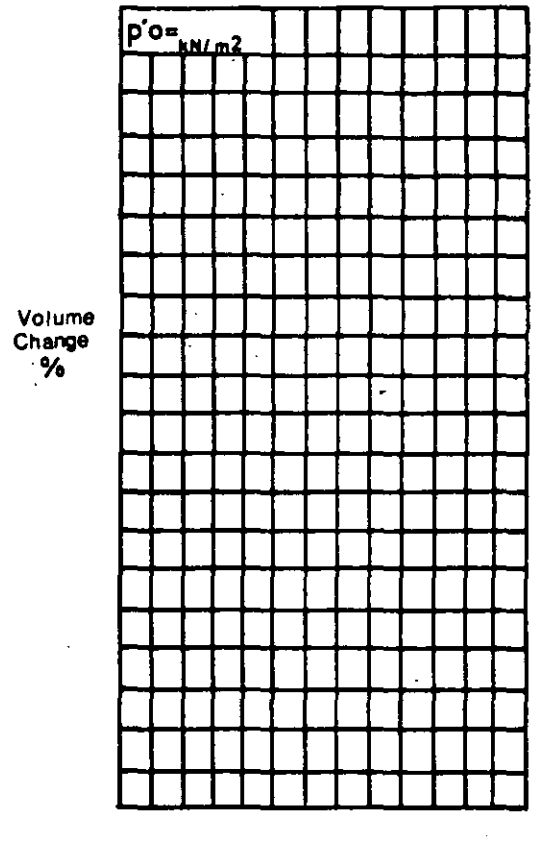
exploration associates

Figure 3.69









Volume Change % / Strain %

Depth 2.0
Borehole 12

Remarks

Laboratory – Effective Stress

exploration associates

Project Department of Transport
A564 Stoke-Derby Link
Derby Southern By Pass
Isley Walton to M1 Section
Preliminary Site Investigation

Contract S2796

Figure 3.70

DATE / BH. N°	16.3.81	25.3.81	30.4.81	15.6.81
3	5.10	5.00	4.67	4.9
10	-	-	6.16	5.75

Piezometer / Standpipe Readings

exploration associates

Project

Department of Transport
A564 Stoke - Derby Link
Derby Southern By Pass
Isley Walton to M1 Section
Preliminary Site Investigation

Contract S2796

Figure 3.71

EX 4

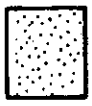
KEY



Topsoil



Silty Clay



Sand



Gravel



Marl



Water Strike

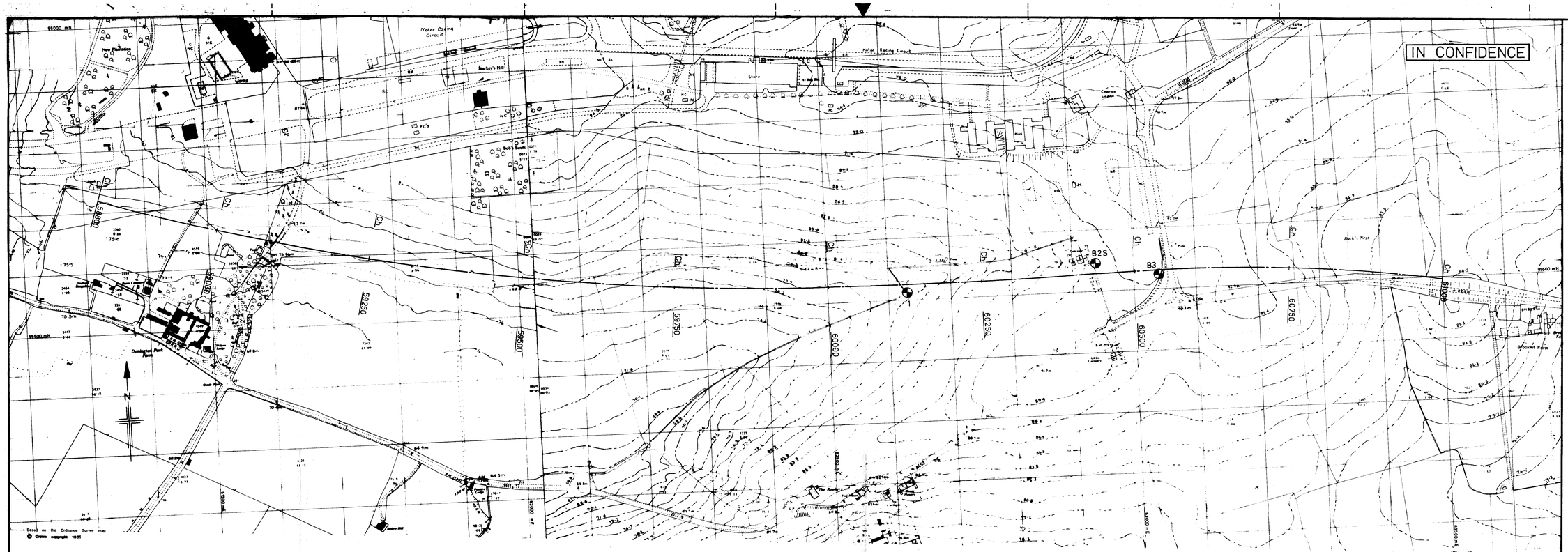


Highest recorded Water Level

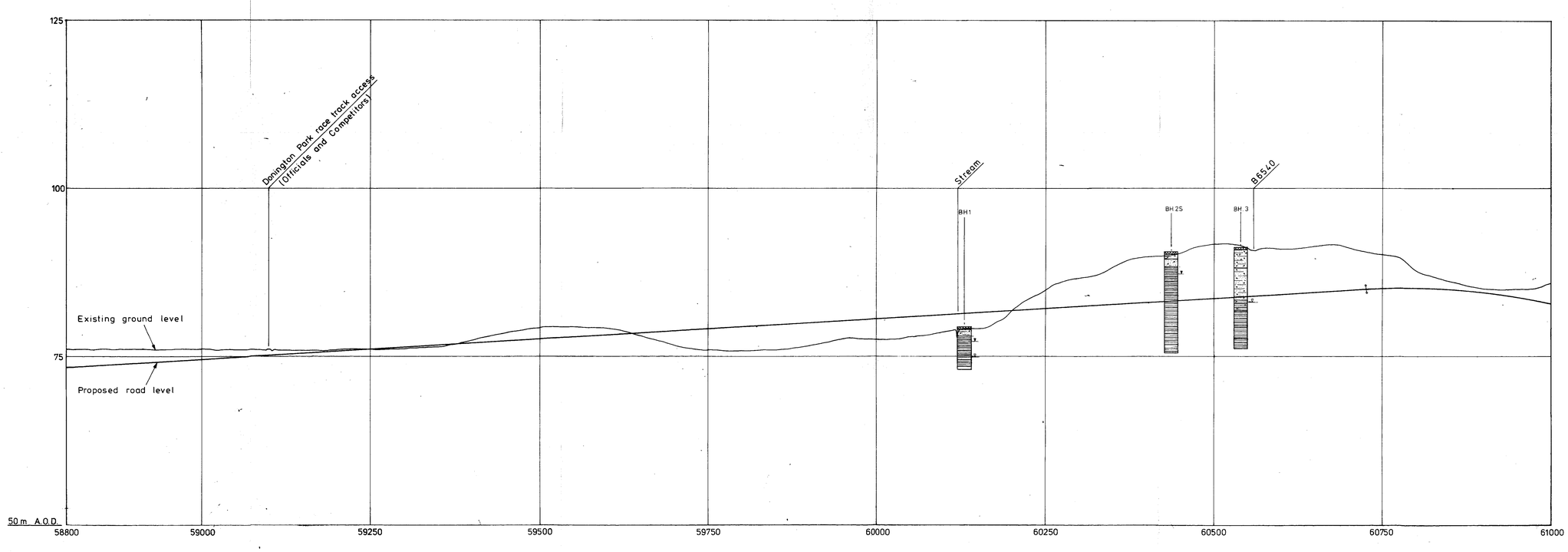
exploration associates	**Project** Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796 **Figure** 4

EX 4

IN CONFIDENCE



PLAN



LONGITUDINAL SECTION

NOTES

Client:– DERBYSHIRE COUNTY COUNCIL SUB-UNIT	exploration associates
Project:– A564 STOKE-DERBY LINK DERBY SOUTHERN BYPASS ISLEY WALTON – M1 SECTION	Scale:– 1/2500 HORIZ 1/250 VERT Drawn by:– Date:– MAY 1981 Based on:– Drg.No. 3M 254/4/7/34
Title:– Borehole Location Plan and Longitudinal Section	Contract:– S 2796 Figure 4.1

IN CONFIDENCE

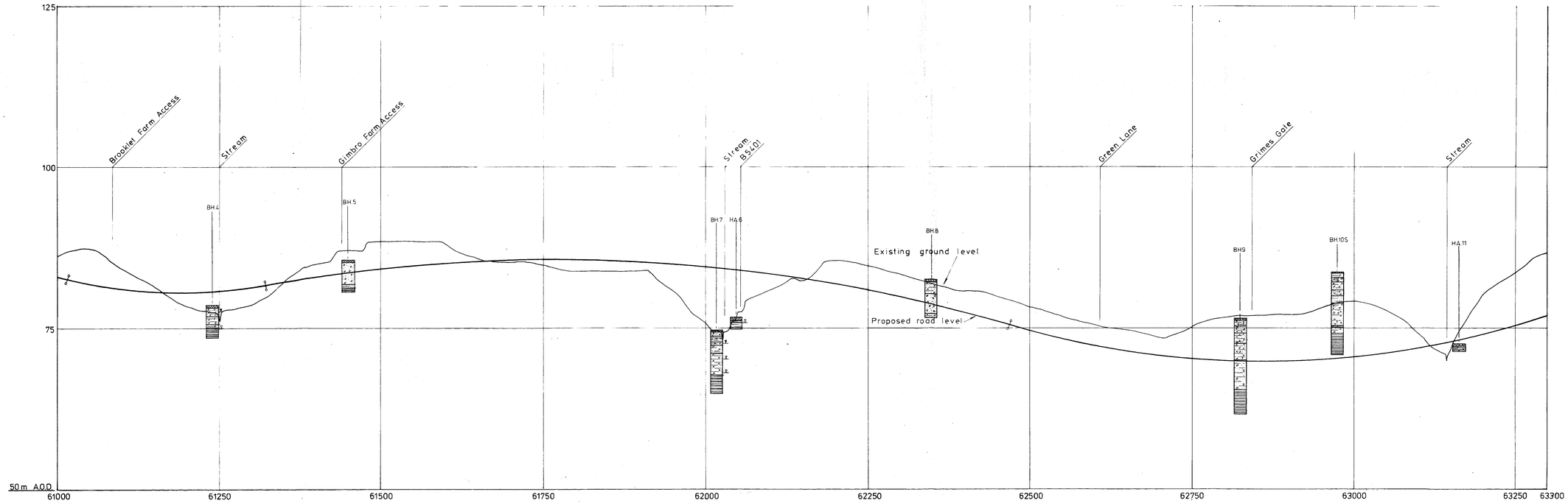
East Midlands Airport

Gimbro Farm

Car Park

A453

PLAN



LONGITUDINAL SECTION

NOTES

Client– DERBYSHIRE COUNTY COUNCIL SUB – UNIT

exploration associates

Project– A564 STOKE – DERBY LINK DERBY SOUTHERN BYPASS ISLEY WALTON — M1 SECTION

Scale– 1/2500 HORIZ 1/250 VERT

Drawn by–

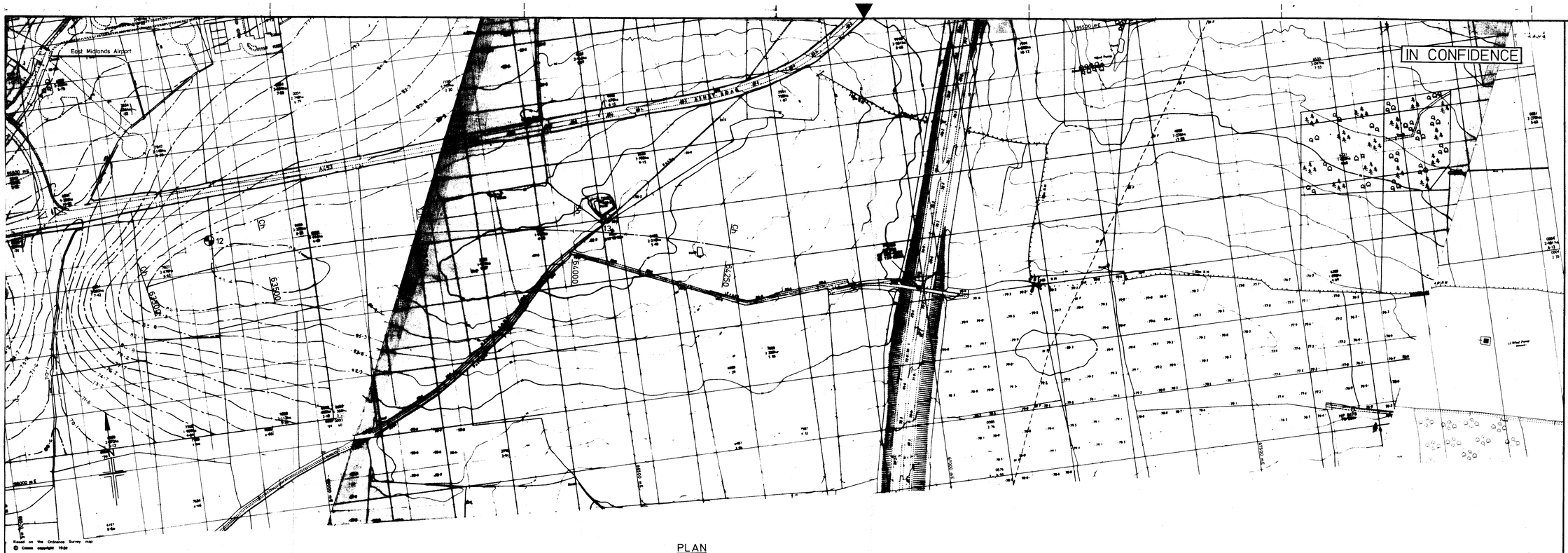
Date– MAY 1981

Based on– Drg No. 3M 254/47/35

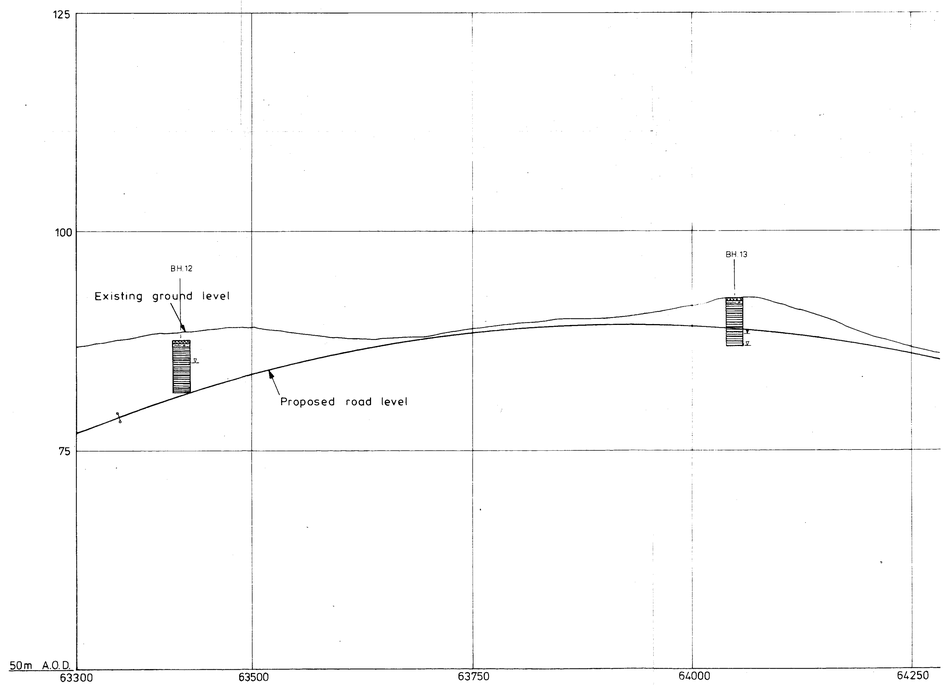
Title– Borehole Location Plan and Longitudinal Section

Contract– S 2796

Figure 4.2



PLAN



LONGITUDINAL SECTION

NOTES

Client – DERBYSHIRE COUNTY COUNCIL SUB – UNIT	exploration associates
Project – A564 STOKE – DERBY LINK DERBY SOUTHERN BYPASS ISLEY WALTON – M1 SECTION	Scale – 1/2500 HORIZ 1/250 VERT
	Drawn by –
	Date – MAY 1981
	Based on – Drg. No. 3M 254/4/7/35
Title – Borehole Location Plan and Longitudinal Section	Contract – S 2796
	Figure 4.3

BH.	DEPTH	SPT / CPT	75mm	75mm	75mm	75mm	75mm	75mm	N
1	5.30–5.60	SPT	10	15	30	50			200++
	5.80–6.18	SPT	7	13	23	34	50		200++
2	1.00–1.45	SPT	1	2	2	1	2	2	7
	2.50–2.95	SPT	1	1	2	2	2	2	8
	5.00–5.45	SPT	6	9	15	23	25	34	97
	6.50–6.88	SPT	8	12	19	35	48		192++
	8.00–8.30	SPT	10	21	33	50*			300++
3	7.50–7.95	SPT	12	5	8	12	12	30	62
	8.50–8.95	SPT	10	14	17	24	31	40	112
	9.30–9.53	SPT	16	31	50**				400++
4	3.90–4.35	SPT	50	35	24	15	14	14	67
5	1.00–1.45	SPT	2	2	2	3	3	3	11
	3.00–3.45	SPT	3	3	5	4	6	8	23
7	4.70–5.15	SPT	8	13	17	25	37	45	124
	5.50–5.95	SPT	7	12	19	23	27	39	108
	6.50–6.88	SPT	9	14	21	40	50***		600++
8	3.00–3.45	SPT	7	7	10	10	10	8	38
	5.00–5.45	SPT	7	7	11	14	23	25	73
9	6.35								
10	2.00–2.45	SPT	9	10	10	10	10	14	44
7.3–□	6.00–6.23	SPT	14	21	(35+) ?				
	8.50–8.65	SPT	16	50					200++
no pen.	9.70–9.78	SPT	50*						300++
12	4.10–4.4	SPT	14	18	35	50			200++
	5.50–5.80	SPT	14	28	39	50			200
13	5.00–5.38	SPT	9	15	27	36	50		200++

* For 50 mm
** For 37·5 mm
*** For 25 mm

+No penetration
++Extrapolated Value

INSITU PENETRATION TEST RESULTS

exploration associates

Project: Department of Transport
A564 Stoke - Derby Link
Derby Southern By-Pass :
Isley Walton to M1 Section
Preliminary Site Investigation

Contract: S2796

Figure: 5

EX 4

Exploration Associates (Warwick) Limited, Geotechnical House, Hatton, Warwick CV35 7JL. Tel: 0926 41743.

DEPARTMENT OF TRANSPORT

A564 STOKE-DERBY LINK

DERBY SOUTHERN BY-PASS

ISLEY WALTON TO M1 SECTION

INTERPRETATIVE REPORT (VOL.11)

ON PRELIMINARY SITE INVESTIGATION

S2796

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S2796

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1. INTRODUCTION

This is Volume 2 of a two volume report which relates to the preliminary investigation of ground conditions along the line of the proposed A564, Stoke-Derby Link, Isley Walton to M1 Section.

2. PRESENTATION

Volume 1 contains a description of the object, nature, and methods of investigation together with the Factual Data which was obtained. The latter comprise Borehole Records, insitu measurements and the results of Laboratory Tests. For completeness the index appropriate to Volume 1 is presented as an Appendix to this report. (Figure 34).

Volume 2, this volume, contains an assessment of the significance of the data obtained in relation to the proposed works. This is presented firstly as general comments in relation to the scheme as a whole and subsequently in more detail in Data Sheet Format in relation to the individual features such as Structure, Embankment or Cutting.

3. STRATA ENCOUNTERED

Longitudinal sections along the line of the road on which the strata at Borehole Locations are shown are presented on Figures 4.1-4.3, Vol 1, Detailed soil descriptions are presented on the Borehole Records and Test Results Sheets.

In general the data obtained tends to confirm that the Keuper Marl is covered by various thicknesses of between 2.3 and 11.1m of deposits which have a Glacial Origin. The proportions of granular and cohesive materials within this drift vary throughout the site but in general there is a significant granular or rock content. On occasion the strata have been classified as clayey sandy gravel. Sub-division into seperate strata is inappropriate at present and the term Glacial Till is felt to best convey the nature of the material.

Local deposits of Alluvium which are derived from these glacial soils are present to thicknesses of between 1m and 3m in the valleys and these sometimes contain organic materials and are soft.

Evidence of local deposits of fill was obtained in Borehole 5 although this will have to be investigated further.

The marl is weathered to various depths and frequently the interface with the overlying soils was difficult to distinguish. Penetration of up to 4m was achieved by percussive techniques at some locations before changing to rotary coring methods. At some locations, however, rotary coring methods were used to penetrate some of the drift deposits where boulders were present.

4. ASSESSMENT

4.1 General

The purpose of a preliminary soil survey is to identify broadly the geology of the site, indicate possible problem areas, obtain preliminary data on soil parameters and hence to indicate any limitation or modification of the route or design which this work shows to be advisable. On this basis the form and location of any further investigation can be assessed.

It is important to realise that the process of design in relation to ground conditions is an iterative one and that behaviour of the ground is dependent, not only on the loads applied but also on their nature, direction, sequence and period, construction technique, the type of structure and the form, depth and programming of drainage works. Many other factors which are governed by constraints other than those imposed by the soils or road works themselves can also affect design and the selection of the most appropriate solution.

In view of the foregoing factors a preliminary report can answer only to a limited extent the questions which a road design can raise and should be read in the same way as a preliminary design Even after a more intensive investigation, final details can only be resolved at the construction stage.

With these points in mind, the data sheets for each structure, cutting or embankment have been drawn up on the assumption that the borehole conditions encountered in the boreholes are representative of the whole of a feature such as a cutting or bridge.

Variations from this are likely to exist. It is felt, however, that a few general points can be made which are sometimes repeated in the sections.

4.2 Structures

4.2.1. Bearing Capacity

Calculations to determine this are based on the principles established by Terzaghi. In general, the most severe condition for foundation load is immediately after completion of a structure when "undrained" conditions are assumed for clays. Thus the undrained shear strength characteristics have been used in bearing capacity calculations. Further consideration will be necessary, however, when data on the proximity of foundations to slopes is known. For the less weathered marl, however, the rate of consolidation is generally taken to be so rapid that the effective stress or long term conditions can be assumed to apply (Chandler and Davis 1973). The latter approach has therefore been used in the design of the piers in the base of cuttings for most of the bridges. A Factor of Safety of 3 has been used for all foundation calculations.

In general, spread foundations should prove suitable although in some instances deeper foundations than those originally anticipated would be required.

4.2.2. Settlement

Settlements of foundations on the slopes would be less than 30mm whilst those in the bases of cuttings less than 15mm. Both are likely to occur largely during the construction period.

The methods of Terzaghi have been used in relation to clays but pseudoelastic analysis has been used for foundations on the marl.

4.2.3. Construction

The bases of all foundation excavations should be blinded with concrete to minimise water softening of the exposed strata. This should be done as soon as possible after excavation.

The sides of all excavations should be fully supported if failure is to be avoided. Requirements in the marl will depend on excavation methods and groundwater conditions.

The removal of groundwater by pumping from sumps should generally prove adequate. The use of water flush rotary drilling methods obscured natural groundwater conditions in the marl or the soils which overlie them, however, and further consideration to this aspect is required.

4.3 Embankment

4.3.1 Stability

The stability of embankment slopes should be considered both in the short term and long term. For each of these conditions failure both within the embankment materials themselves and through the embankment into the existing soils upon which they sit has to be considered. The latter case can also be complicated by the presence of pre-existing shear surfaces.

Each case is considered in each section, amplification of the approach being found in the calculation sheets.

In general the criteria for fill suitability will ensure that the embankments themselves are stable in the short term and the Factors of Safety against failure into the underlying soils are adequate on the basis of the available data, again under short term conditions.

Long term conditions are generally more critical.

Slopes of between 1 in 2 and 1 in 3 have been considered but on the basis of the minimum Factor of Safety of 1.5 which is required, slopes of 1:2½ would appear to be suitable in general.

Further investigation into possible pre-existing shear surfaces is necessary.

4.3.2. Construction

It is normally considered to be good practice to place a granular drainage blanket at the base of embankments to accelerate the consolidation process and to resist the build up of a water table in the embankment. At this

site it not so essential although locally it would provide advantages.

Slopes should be "benched" after removal of topsoil in order to form a "key" between the embankment and slope and facilitate compaction in uniform layers. The dimensions of these benches would depend primarily on construction criteria rather than geotechnical requirements.

The top of these benches should slope downhill slightly to prevent ponding of water on them. Compaction adjacent to abutments should be done so as to minimise loadings imposed on the structure by this process.

4.3.3. Pavement Design

This will depend upon the materials used near to pavement level in the embankment but for guidance, those measured in the adjacent cutting for disturbed material could be adopted. It would be prudent at this stage to consider the materials to be generally frost susceptible.

4.4 Cuttings

4.4.1 Suitability of Cut Soils as Fill

The suitability of cohesive soils for use as fill is frequently based on an upper limit of water content related to the Plastic Limit of the material being used. Such a limit can be related both to shear strength and compaction required and hence to the type of plant most suited to these conditions. The quantity of material available and the amount required also influences selection of a limit.

As the water content of a soil increases, its shear strength decreases. The criteria for efficient operation of earth moving machinery generally imposes more severe shear requirements than those for embankment stability even for the lighter type of plant.

It is also sometimes necessary to impose a Lower Limit of water content so that the compactive energy which the Specification for Road and Bridge Works requires, can achieve adequate compaction. Soils at very low water contents can be hard and difficult to compact satisfactorily.

For very silty soils a small change in water content can change the soil from a "plastic" to a "liquid" state whilst a similar change for more

plastic clays would have much less effect. Hence for very silty soils this Limit is sometimes taken as 1.1 x Plastic Limit whilst for high plasticity clays it can be 1.3 x Plastic Limit or higher. For this reason Consistency Index or Liquidity Index may be considered more suitable criteria. (Highly Plastic clays may be unsuitable for long term stability of embankment slopes of criteria gradients).

The adaption of a strength/compaction related criteria, such as is given by the Moisture Condition Value test, is currently being debated as a possible alternative.

Insufficient data is available at present to determine a suitable upper limit of water content for soils at this site although insitu shear strengths suggest that the cut materials should generally be suitable of the natural water content.

In this region, however, it is understood that upper limits of water contents of between 1.1 and 1.2 x Plastic Limit have been necessary to obtain satisfactory results with the equipment used.

In general the cut soils fall within the general classification "Well Graded Granular or Dry Cohesive Soils", in accordance with the "Specification for a Road Bridge Works" 1976, for the purposes of determining compaction requirements. The marl has a natural water content which is frequently at or below the plastic limit minus 4 criterion for Dry Cohesive material whilst the stone content of the remainder would place this material in the same category (Clause 601, 2 (ii)).

Local soft or organic zones will not be suitable and should be used for non-structural fills.

4.4.2. Slope Stability

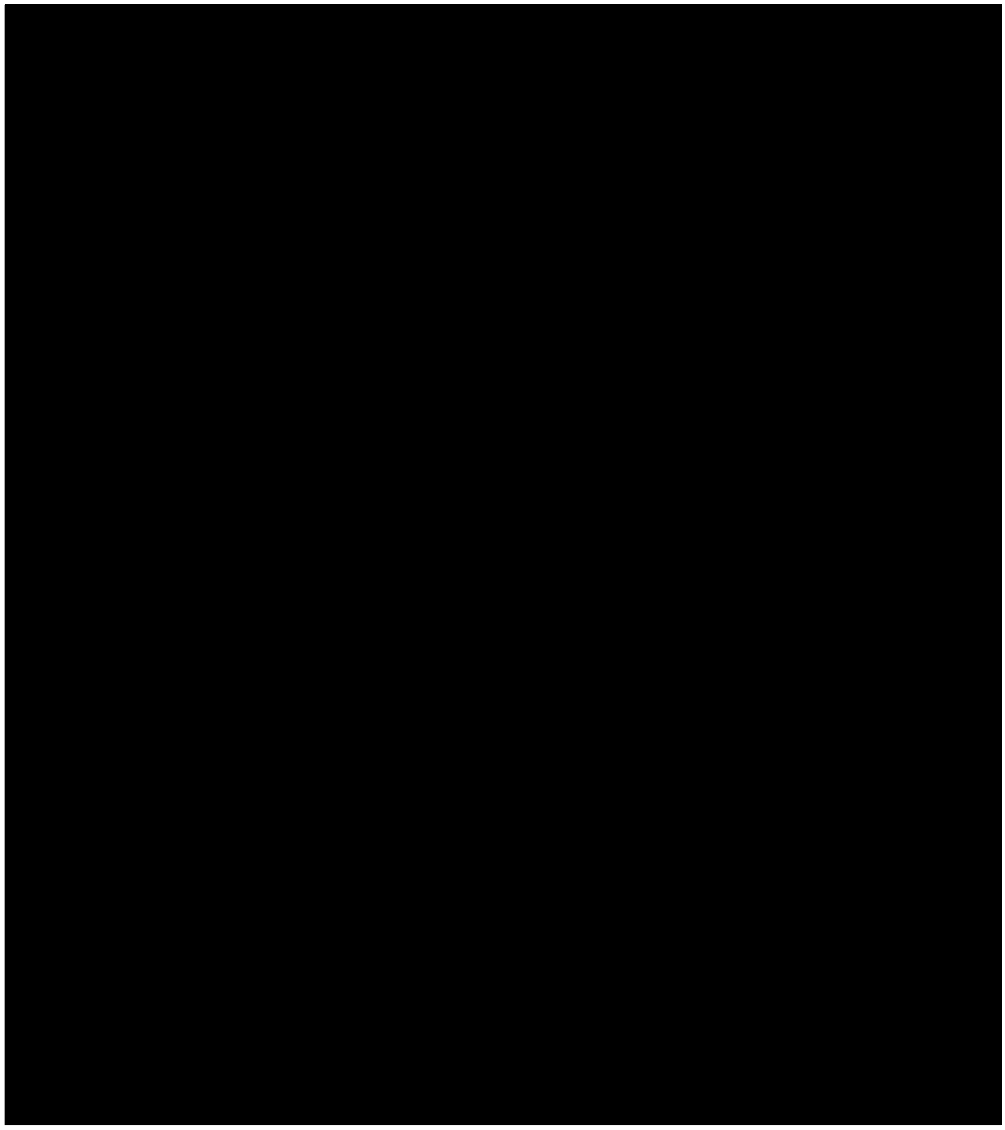
This has been assessed using effective stress parameters obtained from Laboratory Tests together with the charts published by Bishop and Morgenstern. A knowledge of piezometric pressures in the various strata involved is necessary for full analysis, however, and this information is not yet available. Piezometers sealed at selected levels will be necessary to obtain this data, in the absence of which assumptions have been made to give guidance for design.

Other factors such as pre-existing shear surfaces are of particular importance here and these are best investigated using Trial Pits. Some evidence of slip surfaces was obtained in Borehole 10, however, near to Bleak House and in view of the depth of cutting and sensitivity of location, particular investigation is essential here.

Groundwater can be controlled to some extent by slope or counterfort drains but the requirements for this cannot be assessed at the present time.

4.4.3. Pavement Design

No assessment of ground conditions for the purposes of Pavement Design was commissioned by the client. It is understood that this is to be done on the basis of C.B.R. tests on samples compacted under British Standard 2.5 kg effort at a range of water contents.



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GM/MDC/S2796/MAY 1981

DATA SHEETS

The Data Sheets have been presented in the following order.

Structures:

B.H.B2 - A453 Interchange Overbridge
B.H.B3 - A453 Interchange Overbridge
B.H.B7 - Underbridge
B.H.B9 - Overbridge

Embankment:

B.H. 1 - 4m height
B.H. 4 - 0m-4m height
B.H.6
and 7 - 1m-9m height
B.H. 11 - 0m-1m height

Cuttings:

B.H's 2 & 3 - 7m Depth
B.H. 5 - 0-3.5m Depth
B.H's 8,9
and 10 - 3-10m Depth
B.H. 12 - 0-5m Depth
B.H. 13 - 0-2m Depth

Structure Type	A453 Interchange Overbridge	**Location** Borehole B2

Anticipated Performance of Spread Foundations.

Width of Foundation (m)	Depth to Foundation Level (m)	Foundation Stratum	Net Allowable Bearing Pressure (kN/m^2)	Resulting Settlement (mm)	Estimated Rate of Settlement (Months) 50%	90%
4.5	4.0	Stiff red-brown silty CLAY with mudstone fragments	315	30mm*	1	4
4.5	9.0**	Marl	700	15mm***	rapid	rapid

*For continuous loading of 175 kN/m^2
**2 metres below finished road level
***for continuous loading of 225 kN/m^2
The exposed foundation stratum should be blinded with concrete immediately after exposure in order to minimise water softening.

Excavation and Dewatering

The excavation difficulties will depend upon programme.
Foundation excavation for the bank seats should be relatively straight-forward after the cutting has reached some 4 metres depth since it could be done as a "bay" off the side of the cutting. Full support would be necessary to excavation sides if collapse of these relatively sandy materials is to be avoided. Battering the slopes back to 1 in 1½ (vertical to horizontal) should also be satisfactory in the short term.
Groundwater was not struck during drilling but stood at 3.3m after a weekend. Simple pumping from sumps should therefore be adequate drainage measures for the bank seats.
For the piers or the abutments excavation to a suitable founding level, which may be shallower that that indicated could probably be achieved by large back acting plant although some loosening with pneumatic plant could be necessary at depth. Since water was used as a flushing medium for coring in the marl, data on groundwater in this stratum was not obtained. At this stage, however it is felt that the use of pumps and sumps should be adequate. The requirements for support would best be assessed at the time of excavation.

Sulphate Attack on Concrete

Concentrations of Soluble Sulphate fall within Class 1 of B.R.E. Digest 174 for which no special precautions to prevent sulphate attack on foundation concrete are required.

Data Sheet – Structure	**Project** Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 1

Location A453 Interchange - BHB2.

Calculation Bank seat foundations - BH B2. Date May 1981.

For Bank Seat Foundation

Depth = 4m
width = 4.5m

$\frac{D}{B} = \frac{4}{4.5} = 0.9$

From Tomlinson $N_c = 6.3$

Shear strength measured on remoulded sample from below foundation level = 150 KN/m² + BH B2

Allowable increase in load = $\frac{cN_c}{3}$

$= \frac{150 \times 6.3}{3} = 315$ KN/m²

For Foundation on Marl - Piers and Abutments

SPT values at 9m below ground level are 300+ 400+
The strata was too hard to allow a calculation of a bearing capacity in terms of undrained shear strength

Using $c' = 5$ KN/m² and $\phi' = 35°$ (See Graph for Curves BH, B2 & B3)

$q_u = cN_c + \gamma B N_c + \frac{1}{2}\gamma' B N_\gamma$ [Chandra Davis]

$= (5 \times 55) + (20 \times 2 \times 37) + (\frac{1}{2} \times 10 \times 4.5 \times 37)$

$= 275 + 1480 + 832.5$

$= 2588$

∴ Allowable (FOS = 3) = 863 KN/m²

If $c' = 0$ Allowable = 771 KN/m²

The anticipated loading of 300 and 350 KN/m² maximum will be satisfactory.

Calculation Sheet	Project	Contract
exploration associates	Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to MI Section Preliminary Site Investigation	SZ796 3 Figure 2

EX 4

Location A453 Interchange

Calculation Rate of Settlement

Date May 81

For Embankment - Rate of Settlement

Test results not obtained from lower strata.

Assume $C_v = 10$

$$t_{90} = \frac{T_{90} h^2}{C_v}$$

For upper soils thickness = 3.8m $\therefore h = 1.9$m

Assuming 2 way drainage with the relatively permeable mark

$$T_{90} = 0.85$$

Hence $$t_{90} = \frac{0.85 \times 1.9 \times 1.9}{10}$$

$$= 0.31 \text{ years.}$$

ie mainly during the construction period.

Calculation Sheet	Project: Department of Transport, A564 Stoke-Derby Link, Derby Southern By Pass, Isley Walton to M1 Section, Preliminary Site Investigation	Contract S2796
exploration associates		Figure 3

EX 4

Structure Type	A453 Interchange Overbridge	**Location** Borehole B3	

Anticipated Performance of Spread Foundations.

Width of Foundation (m)	Depth to Foundation Level (m)	Foundation Stratum	Net Allowable Bearing Pressure (kN/m^2)	Resulting Settlement (mm)	Estimated Rate of Settlement (Months)	
					50%	90%
4.5	4	Bands of clay and sand	20-90*	-	-	-
4.5	9**	Marl	700	15mm***	rapid	rapid

*Unsuitable as a foundation stratum.
**2 metres below proposed road level.
***Under continuous load of 225 kN/m^2

Excavation and Dewatering

The soft and firm soils revealed by the investigation render Bank Seat foundations at 4 metres unsuitable. Hence, foundations should be extended to deeper more competent strata at and below 7.5 metres by adopting an abutment type structure or merely by excavation into the cutting sides to form a "bay". If necessary compacted well graded granular fill could be used to raise the foundingstratum up to the proposed level. Water was encountered as only a slight seepage at some 8 metres and hence pumping from sumps should be adequate to control groundwater. Full support will be necessary to excavation sides.
For the pier or abutment foundation which extend into marl from the cutting base, the comments made in the previous section are also valid here.

Sulphate Attack on Concrete

No special precautions necessary.

Discussion

The softness of some of the soils encountered to some 7 metres is surprising and the tests may have been affected by the absorbtion by the clay of water contained in the sand layers in this area or due to sample disturbance caused by gravel.
It is clear, however, that further investigation is necessary to determine the extent of this material since it has an important influence on bank seat foundation design. This could be done both by boreholes and Trial Pits and could be linked to the investigations required for the road works.
At present the extension of foundations to the marl or the use of an abutment founded in the base of the cutting appears to be the most appropriate solution.

Data Sheet – Structure	**Project** Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 4

Location A453 Interchange - B.H. B3

Calculation Bearing Capacity

Date May '81

The soils at the upper levels are unsuitable (shear strengths 9 and 45 KN/m²)

Foundations on marl as for A453 Interchange Overbridge

ie 700 KN/m².

∴ Proposed maximum loading of 250 KN/m² Satisfactory.

Settlement

As for A453 Interchange Overbridge

ie foundations on marl.

Structure Type	Underbridge	Location Borehole B7 B5401

Anticipated Performance of Spread Foundations.

Width of Foundation (m)	Depth to Foundation Level (m)	Foundation Stratum	Net Allowable Bearing Pressure (kN/m^2)	Resulting Settlement (mm)	Estimated Rate of Settlement (Months) 50%	90%
4.5	2.4	Firm to stiff red-brown clay.	185	-**	-	-
	4	Marl	700	15mm***		

*Depth to reach top of weathered marl.
**Inadequate for proposed loadings
***Settlement for average permanent load of 225 kN/m^2

Excavation and Dewatering

If foundations are required in the base of the valley the possible depth of 4 metres excavation will require full support although it is likely that it can be achieved with heavy mechanical plant excavation into the marl. Some pneumatic tools may also be necessary.
Water ingress into boreholes was slow but reached ground level overnight. The use of pumps to remove water from sumps should therefore be adequate to control groundwater.

Sulphate Attack on Concrete

No special precautions necessary.

Discussion

The precise foundation requirements will depend upon the details of bridge location. It will therefore be necessary to investigate the strata more closely at actual foundation location. At this stage, however, foundations taken into the less weathered marl would appear to be necessary and this could probably be achieved by deepened bases, possibly using mass concrete to bring foundations up to a more convenient structural level.
Investigation could probably be done using boreholes and Trial Pits. The latter would require plant with the capacity to reach 4 to 5 metres and could be done at the same time as the investigation of possible land slips in the area.

Data Sheet – Structure	Project Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		Figure 6

Location	A 5401.	BH B7
Calculation	Bearing Capacity	Date May 81

Foundation at 2.4 m.

Mean shear strength of soils below 2.4 m is 95 KN/m²

$\frac{D}{B} = \frac{2.4}{5.5} = 0.44$ From Tomlinson $N_c = 5.9$

∴ Ultimate increase in load = 5.9 × 95

= 561 KN/m².

For F.O.S of 3 Allowable = 187 KN/m²

Required loading maximum = 350 KN/m²

∴ Not satisfactory.

Will require to extend foundation into Marl below 3.6 m.

From Calculation as for A453 Interchange

From Allowable increase in load = 700 KN/m²

∴ 350 KN/m² as proposed is satisfactory.

Settlement

Estimated settlements under 225 KN/m² emergency load

= 15mm [As for A453 interchange calculations]

Calculation Sheet	Project	Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates			Figure 7

EX 4

Structure Type	Overbridge	**Location** Borehole 89

Anticipated Performance of Spread Foundations.

Width of Foundation (m)	Depth to Foundation Level (m)	Foundation Stratum	Net Allowable Bearing Pressure (kN/m^2)	Resulting Settlement (mm)	Estimated Rate of Settlement (Months) 50%	90%
4.5	4	Stiff to hard Clay with gravel	300	30*	rapid	rapid
4.5	9	Clay with boulders	300**		rapid	rapid
5.5	9	Clay with boulders	300**			

*Under continuous average loading of 175 kN/m^2

**No testing data is available for this stratum although is should be at least as strong as the overlying stratum; coring was necessary in the Borehole. It is likely that the anticipated maximum load of 350 kN/m^2 can be accommodated on this stratum but further investigation is required.

Excavation and Dewatering

As before excavation for bank seats could be achieved at the same time as the cutting by forming a "bay" in the slope. Alternatively Excavation to this 4 metre depth could be achieved by mechanical excavator and providing full support to the excavation sides.
Excavation into the marl from the base of the cutting could probably be achieved with large excavating plant.
Full support would be necessary to excavation sides if collapse is to be avoided.
Dewatering using simple pumping techniques should be adequate although the use of water-flush coring techniques obscured ground water behaviour.

Sulphate Attack on Concrete

No special precautions are required.

Discussion

In view of the sloping nature of this site across the width of the proposed cutting, conditions are likely to differ at bank seat and pier locations from those encountered in the boreholes and further investigations are required, particularly below pier base level. Slope stability considerations will also influence bank seat foundations and loadings.

Location	BH B9
Calculation	Bankseat Foundations.
Date	May '81

[redacted]

Bank Seat Foundations.

Using shear strength of sample from soil just above foundation level of 140 KN/m²

$$\frac{D}{B} = \frac{4.0}{4.5} = 0.9 \quad \therefore N_c = 6.3$$

∴ Allowable increase in load = $\frac{6.3 \times 145}{3}$

= 304.5 say 300 KN/m²

No data is available on consolidation characteristics in view of the nature of the material but settlements at an average permanent load of 275 KN/m² should be less than 30mm and occur rapidly as before.

Settlements should also largely be complete by the end of the construction period.

For foundations on Marl - See A4530 Overbridge.

As before, Allowable increase in load = 700 KN/m²

and Settlement less than 15mm.

Calculation Sheet	Project: Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		Figure 9

EX 4

Embankment Height	4 metres	**Location** Borehole 1

Construction

The road will lie in an East-West direction across a re-entrant valley which falls West-South-West and has a stream in its base. Borehole 1 shows that soft to firm soils extend to some 1.4m and overlie generally stiff to hard soils. Thus the weaker upper materials suggest that lighter construction traffic would be most suitable for movement over the upper strata. Details of shear strengths on the sloping valley sides are not available, however. Other criteria such as the slopes themselves may influence the choice of plant. Presumably topsoil will be removed prior to embankment construction and the slopes benched to ease the construction process. Soft spots could be removed at this time.

The use of a granular blanket to allow the more rapid completion of the consolidation process is considered good practice. The programme for such placing will no doubt be influenced by that for the culvert construction.

Pavement Design

This will depend on the fill material used.

Slope Stability

For an embankment 4 metres high the Following Factors of Safety have been calculated for Short Term Loading Conditions.

Method	Slope	1:2	1:2½	1:3
Taylor		3.35	3.41	3.52
Raymond		3.1	3.1	3.1
Pilot		2.77	2.95	3.20

For Long Term Conditions, assuming parameters of $C' = 0$, $\emptyset = 34^{\circ}$ for both the re-moulded fill and soil below and no pore water pressure in the slope ($r_u = 0$)

Slope	1:2	1:2½	1:3
	1.35	1.69	2.02

Re-assessment will be necessary when more data is available on the soils and in particular if pre-existing shear surfaces are shown to be present by Trial Pit investigation.
See also the General Discussion on embankment slope stability.

Settlement

In view of the stiff to hard nature of the soils below 2.3 metres significant settlements are not anticipated. Settlement of the upper materials is estimated to be of the order of 50mm most of which will occur over a normal construction period.

Data Sheet – Embankment	**Project** Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 10

Location Borehole 1

Calculation Embankment Stability

Date May 1981.

Embankment Stability in the Short Term.

(a) Taylor's Method

Using this method the shear strength is taken as cohesion (or a Factor of Safety is applied) is determined for each slope and height. The actual Factor of Safety is calculated from the ratio of average shear strength of the soil, both within and beneath the embankment soil, to this value.

For 1:2 slope

Consider a slip through the toe $n=0$, $\gamma = 20 kN/m^3$ $H = 4m$

$\frac{c}{FH} = 0.15$ For $F.o.S = 1$ $\therefore c_{required} = 0.15 \times 20 \times 4 = 12 kN/m^2$

Factor of Safety where $c_u = 45 kN/m^2 = \frac{45}{12} = \underline{3.75}$

For a slip beyond the toe a distance $= H$, $n = 1$

For which $\frac{c}{FH} = 1.68$ $\therefore c_{required} = 13.4 kN/m^2$ $F = \underline{3.35}$

Similarly for 1:2½ slope $\frac{c}{FH} = 0.145$ $F = \underline{3.88}$

For slip beyond toe $\frac{c}{FH} = 0.165$ $F = \underline{3.41}$

For 1:3 slope $\frac{c}{FH} = 0.14$ $F = \underline{4.02}$

For slip beyond toe $\frac{c}{FH} = 0.16$ $F = \underline{3.52}$

(b) Raymond

This considers the stability of soil under the undrained loading imposed by the embankment

Using a shear strength of $45 kN/m^2$

Ultimate load $q = 5.8 \times c_u = 5.8 \times 45 = 248 kN/m^2$

Calculation Sheet	**Project**	Department of Transport A564 Stoke - Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates			**Figure** 11

EX 4

Location: Borehole 1

Calculation: Embankment Stability Date: May '81.

Applied Load = $\gamma H = 20 \times 4 = 80 kN/m^2$

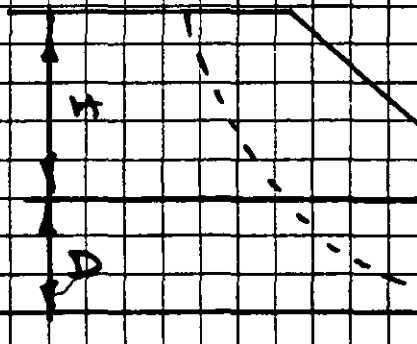
Factor of Safety = $\frac{248}{80} = 3.1$

(c) PLAXIS.

PLAXIS method involves the use of finite elements. Imposed loads can be analysis of the effect of the imposed stress through the soil beneath the embankment. Loads can be applied in stages and the effect of pore pressure dissipation with time can be studied. Where the fill is modelled using a non-linear stress-strain relationship this will also provide a Factor of Safety. Lower bound solutions are available where only shear strength for the fill is used.

Assume we could adopt a cohesion value of $c_u = 45 kN/m^2$ for the existing soil. For the fill material of $c = 0$ & $\phi = 40°$. This is based on laboratory tests carried out on undisturbed samples from the adjacent cutting. Further testing will be required to establish this more definitely.

$D = \frac{c}{\gamma H} = \frac{45}{20 \times 4} = 0.56$ — say 0.5



$\frac{D}{H} = \frac{1.4}{4} = 0.35$

For 1:2 slope, F = 2.77

1:2½ slope, F = 2.95

1:3 slope, F = 3.20

Embankment Stability in the Long Term.

Use Bishop and Morgenstern charts for preliminary assessment.

Calculation Sheet	Project: Department of Transport, A564 Stoke - Derby Link, Derby Southern By Pass, Isley Walton to M1 Section, Preliminary Site Investigation	Contract: S2796	
exploration associates		Figure: 12	

EX 4

Location Borehole 1

Calculation Embankment Stability

Date May 1981

Use $c' = 0, \phi' = 34°$ — as before

$\therefore \frac{c'}{\gamma H} = 0$, Assume no for most known slope

$\therefore m_s = 0$

For 1:3 slope $F = 1.35$
1:2½ slope $F = 1.69$
1:2 slope $F = 2.02$

For a minimum F_s of 1.5, 1:2½ slopes are required.

Settlement

The settlement of the soils beneath the embankment and how they occur will be influenced by the construction method. It will depend, in addition to variations in strata, on the rate of embankment construction and hence the load which is applied, in addition to variations in strata.

For a preliminary assessment however consider a 4m high embankment constructed of material with a unit weight of 20 kN/m³ standing midway on the 4m thick layer of soft silty clay with $m_v = 2.5 \times 10^{-4}$ m²/kN

Settlement $= \gamma H m_v I = 20 \times 4 \times 2.5 \times 10^{-4} \times 2.3$

$= 0.046$ m say 50 mm.

In view of the thickness of the underlying deposits the settlement due to this fill will be small.

The settlement of the fill material will depend upon its method and degree of compaction. However, some settlement does occur and by this movement is likely to be small.

Time for settlement

Assume no vertical drainage and $C_v = 3$.

For 50% consolidation $T_{50} = \frac{0.85 \times 2.3^2}{2} = 2.25$ years, $t_{50} = 0.5$ years.

Calculation Sheet	Project	Department of Transport A564 Stoke - Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates			Figure 12a

EX 4

Embankment Height	0-4 metres	**Location**	Borehole 4

Construction

The laboratory strength tests have shown the soils to range in strength from firm immediately below the topsoil to soft to firm below some 1.7m. The use of the lighter form of earth moving machinery would therefore be advisable for this area although the use of heavier plant is feasible. The use of a granular drainage blanket would assist drainage of the existing soil and embankment during the consolidation process and assist with plant movement. Local records on any tendancy to flooding of this area should be sought and suitable drainage provided. The use of the granular material up to likely flood level is advisable.

Pavement Design

This will depend upon the fill material used in the embankment.

Slope Stability

As for Embankment Borehole 1, the following Factors of Safety have been calculated.

Method	Slope	1:2	1:2½	1:3
Taylor		3.35	3.41	3.52
Raymond		3.1	3.10	3.1
Pilot		2.77	2.95	3.20

For Long Term Conditions, as before

Slope	1:2	1:2½	1:3
	1.35	1.69	2.02

Re-assessment will be necessary in the light of further data.

See also the Discussion on Embankment Slope Stability.

Settlement

Assuming that the strata below 3 metres are virtually incompressible, settlements of the order of 0.1 metres are anticipated in the soils below the embankment. Movements within the fill itself will depend upon the fill material used. Calculations based on Laboratory Tests indicate that 50% consolidation would take some 3.5 years although Field behaviour of the stratum would result in a faster rate.

Location: Borehole A

Calculation: Embankment Stability | Date: May 1981.

Consider Stability in the Short Term.

The analysis of Taylor and Bjerrum would predict the safe height of the embankment in the region of Borehole 1.

Using $\frac{c}{\gamma H}$

$\frac{c}{\gamma H} = \frac{45}{20 \times 4} = 0.56$ say 0.5.

Assume $c' = 0$ $\phi = 34°$ for embankment fill

$\frac{D}{H} = \frac{3}{4} = 0.75$.

For	1:2 Slope	F = 2.68
	1:2½ Slope	F = 2.81
	1:3 Slope	F = 2.95

Consider Long Term Stability

The parameters used and hence the factor of safety would be the same as for the previous calculations.

Settlement.

Assume all the top 3m of existing soil is compressible.

Weight of fill = 4m, unit weight = 20kN/m²

$m_v = 4.5 \times 10^{-4}$ m²/kN.

Settlement = $4.5 \times 10^{-4} \times 1 \times 3 \times 4 \times 20 = 0.11$m say 100mm

Time to consolidate assuming 1 way drainage

$t_{50} = \frac{0.35 \times 3^2}{0.5} = 15.3$ years, $t_{90} = \frac{0.2 \times 3^2}{0.5} = 7.6$ years

Pore consolidation rates are likely to be higher

Calculation Sheet	Project: Department of Transport, A564 Stoke - Derby Link, Derby Southern By Pass, Isley Walton to M1 Section, Preliminary Site Investigation	Contract: S2796
exploration associates		Figure: 14

EX 4

Embankment Height	1-9 m	**Location** Boreholes 6 and B7 B5401 Embankment 420 metres long

Construction

Construction will be across a re-entrant valley which slopes downwards to the South West and carries a stream in its base. The B5401 lies on the sloping side of the valley on its Eastern side. Embankment construction will probably follow bridge and culvert construction. The placing of fill on the eastern slopes to the valley before building up the level in its base is to be avoided on the basis of present evidence, since it is possible that either landslip or re-deposited material from the road exists in this area. This aspect has to be investigated later. It is considered good practice to place a layer of free draining material at the base of embankments in order to allow the soils below and the embankment material itself to consolidate as rapidly as possible.
Care will be required in compacting soils behind bridge abutments to ensure that loads additional to those for which the abutments has been designed are not "built in". The removal of any topsoil or soft organic material from below the embankment is recommended and a series of "benches" cut into the slope, grading downhill slightly are recommended both to ease compaction work and to provide a "Key" into the existing soils. Inspection of the strata insitu by a series of Trial Pits is recommended to make an assessment of the possible presence of shear surfaces caused by geological movements such as landslip, solifluction or shearing due to glaciation.

Pavement Design

Design will depend upon the materials used near to pavement level in the embankment.

Slope Stability

See also construction.
As noted in the general section the stability of the embankment should be considered in three principal modes.

1. The embankment applying load to the existing slopes and instigating a land slip of all or part of the embankment.
2. Failure within the embankment slopes themselves or involving both embankments and the soils below it under short term load conditions.
3. Long term slope stability for both the embankment materials and slopes upon which they sit.

An assessment of mode 1. is best left until further investigation of the upper materials at this site and a search for pre-existing shear surfaces along which any slip would tend to move preferentially.
Analysing of mode 2. is based on undrained shear strengths of the soil. For the 9m high embankment in the region of Borehole 7 a Factor of Safety of 2.68 has been calculated assuming both the Fill and subsoil has an undrained shear strength of 90 kN/m^2. This value would have to be as low as 42 kN/m^2 for the Factor of safety in this mode to reduce to 1.5. This assumes that the topsoil and any soft soils which underlie it are removed.
Mode 3. is usually determined on the basis of the Effective Stress parameters of both the fill and the ground upon which it rests. The latter values will be clarified after the programme of Trial Pitting. Since the fill will probably be obtained from the adjacent cuttings, however, the effective stress parameters determined from the cuttings may be used in the first instance.
Using C' = 5 kN/m^2 and Ø' = 26^0 and Bishop & Morgenstern analysis Factors of Safety for slopes with zero pore water pressure are as follows:-

SLOPE	FACTORS OF SAFETY
1:2	1.40
1:2½	1.65
1:3	1.95

Hence, based on the minimum Factor of Safety requirement of 1.5, slopes no steeper than 1:2½ will be necessary. Even if the C' value were to reduce to zero the Factor of Safety would still be 1.20 for a 1:2½ slope under these conditions. More data on effective stress parameters for the re-moulded material are required however.

SETTLEMENT

Assuming that the soils below 5m are virtually incompressible, estimated settlement will be inthe order of 0.1 to 0.15m. Internal settlement in the fill will depend upon its nature and compaction.

Data Sheet–Embankment	**Project** Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 15

Location B5401 EMBANKMENT

Calculation EMBANKMENT STABILITY

Date MAY 1981.

CONSIDER STABILITY IN THE SHORT TERM

(a) Taylors Method.

For 1:2 slopes $\frac{c}{\gamma H} = 0.15$ for Factor of Safety $= 1$

For $c_u = 90\ kN/m^2$ $H = 9\ m$ $\frac{c}{\gamma H} = 0.5$.

Factor of Safety $= \frac{0.5}{0.15} = \underline{3.33}$

For 1:2½ slopes $\frac{c}{\gamma H} = 0.145$ for Factor of Safety $= 1$

Factor of Safety $= \frac{0.5}{0.145} = \underline{3.45}$

For 1:2¼ slopes $\frac{c}{\gamma H} = 0.14$ for Factor of Safety $= 1$

Factor of Safety $= \frac{0.5}{0.14} = \underline{3.57}$

(b) Bagnold method.

$q = 5.5c = 5.5 \times 90 = 495\ kN/m^2$

Applied Load $= 20 \times 9 = 180\ kN/m^2$

Factor of Safety $= \frac{495}{180} = \underline{2.75}$

(c) Pilot Method.

$\frac{c}{\gamma H} = \frac{90}{20 \times 9} = 0.5$

Assume the use of a standard spoon bar of diameter 44mm and $c = 0$ and $\phi = 26°$ for this material below water table. Assume depth to firm strata is 3.6m.

$D = 3.6\ m$.

$\frac{D}{H} = \frac{3.6}{9} = 0.4$.

Calculation Sheet	**Project** Department of Transport A564 Stoke - Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 16

EX 4

Location B5401 EMBANKMENT

Calculation EMBANKMENT STABILITY Date MAY 1981.

For 1:2 slope F = 2.62
1:2½ slope F = 2.80
1:3 slope F = 3.16.

CONSIDER STABILITY IN THE LONG TERM

For the purposes of this preliminary assessment use the effective shear strength parameters from the adjacent cutting
i.e. Bkhm $\phi' = 26°$

$\frac{A_{cu}}{A_L} = \frac{5}{20 \times 9} = 0.028$ say 0.025

For 1:2 slope F = 1.40
1:2½ slope F = 1.65
1:3 slope F = 1.95

SETTLEMENT

Assume upper strata 0-2.5m with $m_v = 30 \times 10^{-4} m^2/kN$ and $\mu = 0.7$

For strata below to 5m $m_v = 1.25 \times 10^{-4} m^2/kN$, $\mu = 0.4$

Assume strata below this to be "incompressible"

Embankment 9m high, unit weight = 20kN/m³

Settlement = $9 \times 20 \times 3.0 \times 10^{-4} \times 0.7 \times 2.5 + 9 \times 20 \times 1.25 \times 10^{-4} \times 0.4 \times 2.5$

= 0.117m

Say 120mm.

Calculation Sheet	Project	Department of Transport A564 Stoke - Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates			Figure 17

EX 4

Embankment Height	0-1m	**Location** Borehole 11
Construction	This short, low embankment crosses at approximately right angles, a re-entrant valley which slopes downwards to the South. A culvert will be required to take the water which flows down the re-entrant underneath the proposed road. Whilst stability problems are unlikely to occur with embankments constructed over the shallow soft material at this site, the removal of this material at the same time as construction of the culvert will allow better compaction of the materials which are to be laid and provide a transition zone into the cuttings to either side. The use of granular materials would minimise post construction problems resulting from differential behaviour between the compacted soils and the culvert, bearing in mind the proximity of this structure to the road surface.	
Pavement Design	This will depend on the material used in the embankment.	
Slope Stability	As noted under "Construction" the soft upper soils should not create a problem of stability under the embankment loads but then removal would facilitate construction. The slopes in the recommended granular embankment material of 1:2 should be adequately stable.	
Settlement	Settlement of the subsoil should be negligeable in relation to road performance under the loads from a 1m embankment.	

Data Sheet – Embankment	**Project** Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 18

Cutting Depth	7m	**Location** Boreholes B2 and B3

Excavation Technique

Excavation of the soils at the upper levels of the cutting may be achieved with normal excavation plant although local soft pockets such as at the top of Borehole 2 and above 7.8m in Borehole 3 may cause some difficulty. Lighter plant will appear to be most suitable for this material. Below some 4m in Borehole 2, however the soils become stiff to hard or dense and here heavier scrapers with dozer assistance may be necessary. The use of rippers to loosen such material could perhaps be considered but field trials or local experience should be used to clarify the appropriateness of this technique. Face shovels or back acters could be considered as these can produce less disturbed material for re-use as fill.

Suitability of Excavated Material as Fill

The materials should generally prove suitable for re-use as fill although the soft pockets such as at the top of Borehole 2 and to 7.8m in Borehole 3 would be unsuitable at the water contents measured. There would appear to be considerable mixing of the drift soils in this area and such mixed material can be particulary difficult to handle during wet periods. The performance could, more easily be assessed by trial pits.
The classification on the basis of the specification for Road and Bridge works as "Well Graded Granular and Dry Cohesive" would be appropriate in determining necessary compactive effort.
See also the general discussion Paragraph 4.4.1

Pavement Design

Chainage	Strata at Formation Level	Design C.B.R.	Frost Susceptibility of Subgrade	Remarks
60450	Marl	To be assessed by Client	Susceptible	
60550	Glacial Soils			

NOTE: If the subgrade is classified in this table as "frost susceptible" - then a total construction thickness of at least 450mm must be employed.

Side Slope Stability

Using the work of Bishop & Morgenstern and the effective stress parameters C=5KN/m2 $\emptyset' = 34^{\circ}$ the required minimum Factor of Safety of 1.5 is achieved for r_u values equal to or less than:-

Slope		
	1:2	$r_u \leq 0.23$
	1:2½	$r_u \leq 0.39$
	1:3	$r_u \leq 0.49$

In order to estimate the r_u value, long term monitoring of the water levels in piezometers is necessary. At the observed water level over the drilling period of 3.3m below ground level (possibly resulting from surface run-off) an approximate value of r_u of 0.34m would result suggesting that the slope of 1:2½ would be adequate

Data Sheet - Cutting	**Project** Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 19

Location Boreholes 2 & 3

Calculation Cutting Slope Stability

Date May 1981.

The most critical condition for cutting slope stability will be occur under effective stress conditions for long term. For slope in this section of road are summarised in Figure 21.

For the lower Keuper Marls the most appropriate parameters are assessed as $c' = 5 kN/m^2$, $\phi' = 24°$.

Use Bishop's Modified Method of Slices Computer Program for this 2nd stage cutting.

As the presence of water in long term condition will be detrimental to stability required to give the minimum factor of safety of 1.5 which the client requires.

For these studies which indicate factors of safety for various slope angles, height, design factors ($D = \frac{c'}{\gamma H \tan \phi'}$) and average pore water pressure parameters, r_u

Factor of Safety $F = 1.5$

Charts are published for $D = 0$, 0.025 and 0.05 and F is determined by interpolation.

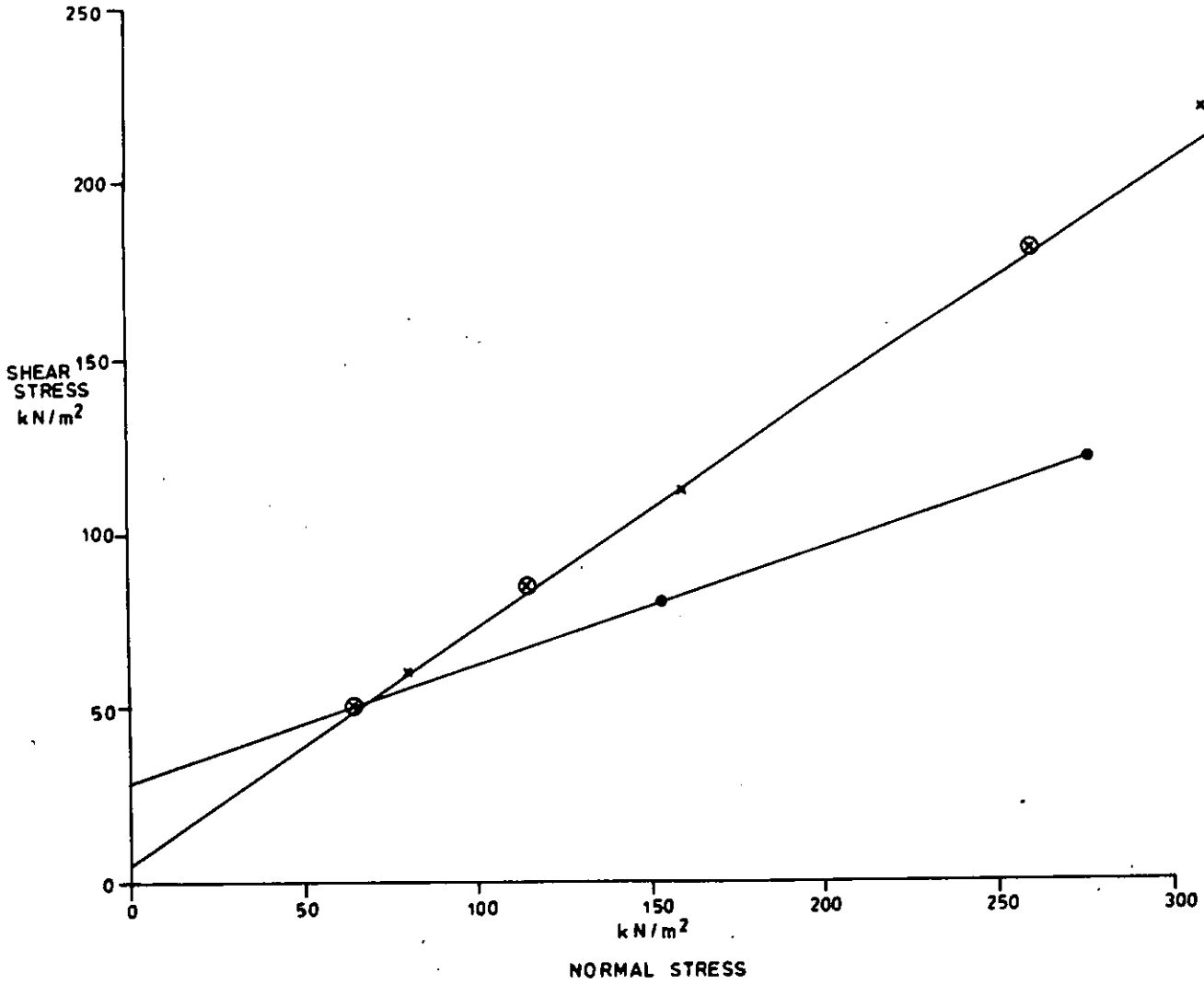
	Slope 1:2		1:2½		1:3	
	H	H	H	H	H	H
D=0.05	21	19	25	22	29	25
D=0.025	18	16.2	22	21	25.5	24
By interpolation D=0.036	19.3	18.4	23.3	21.4	27.0	24.6
For F = 1.5	$c' = 0.23$		0.39		0.49	

Calculation Sheet	Project: Department of Transport, A564 Stoke - Derby Link, Derby Southern By Pass, Isley Walton to M1 Section, Preliminary Site Investigation	Contract S2796
exploration associates		Figure 20

EX 4

CUTTING BOREHOLES B2 &B3

PLOT OF EFFECTIVE STRESS
TEST RESULTS



Effective Stress - Summary	**Project** Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		Figure 21

EX 4

Cutting Depth	0-3.5m	**Location** Borehole 5

Excavation Technique

Conventional excavation plant such as scrapers should be suitable for the excavation of the glacial sands and gravels in a clay matrix.

Suitability of Excavated Material as Fill

The material should be suitable for use as fill on the basis of visual classification and shear strength measurements and should fall within the category of "Well Graded Granular and Dry Cohesive Soil" on the basis of the Specification for Road and Bridge Works classification.

See also general discussion paragraph 4.4.1.

Pavement Design

Chainage	Strata at Formation Level	Design C.B.R.	Frost Susceptibility of Subgrade	Remarks
61525	Glacial Gravel and sands with clay	To be assessed by Client	Susceptible	

NOTE: If the subgrade is classified in this table as "frost susceptible" - then a total construction thickness of at least 450mm must be employed.

Side Slope Stability

Using the design charts of Bishop & Morgenstern and effective stress parameters C'= 5 KN/m2 ϕ'= 34°

Factor of Safety is $\geq$1.5 for r_u values:-

Slope	r_u
1:2	$\leq$0.45
1:2½	$\leq$0.54
1:3	$\leq$0.65

Hence 1:2½ slopes should prove suitable.

Long term measurements of ground water levels in this cutting would aid the selection of the most suitable final design slope.

Data Sheet - Cutting	**Project** Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		Figure 22

Location: Borehole 5

Calculation: Cutting Stability

Date: May 1981.

From the analysis for the section of Borehole 2 only, and taking account of the effective stress data for Clay and the test results from Borehole 5, we have

Critical Slope $\phi' = 34°$

$\frac{H_c'}{H} = \frac{5}{25 \times 3.5} = 0.07$

	Slope 1:2		1:2½		1:3	
	3	4	3	4	3	4
$n = 0.05$	2.15	1.9	2.3	2.2	2.9	2.5
$n = 0.025$	1.85	1.8	2.2	2.1	2.55	2.9
By Interpolation for $n = 0.07$	2.09	1.98	2.24	2.38	3.18	2.68

For $n = 1.5$ $\tau_{max} = 0.45$ $\tau_{max} = 0.54$ $\tau_{max} < 0.63$.

Since it appears that a cutting slope of a slope of 1:2½ should be adequate for this cutting.

Calculation Sheet	Project	Department of Transport A564 Stoke - Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates			Figure 23

EX 4.

Cutting Depth	3 - 10m	**Location** Boreholes 8, 89 and 10 Bleak House Cutting

Excavation Technique

The materials which are to be excavated are derived predominantly from glaciation. The upper soils to a depth of some 2.3m in the West reaching some 4.8m in the deepest part of the cutting to the East are from firm to stiff in nature with local softer zones and with occasional boulders. Conventional lighter weight excavation plant should be suitable for this material. Below this level the materials are a mixture of clay, gravel, and cobbles and in such strata larger scraping plant with dozer assistance would probably be necessary . The use of face shovels or large back acters could well cope with this type of material more efficiently, produce better quality fill and cope with the marl formation which appears to be near to the base of the proposed cutting at its eastern end.

Suitability of Excavated Material as Fill

The excavated material should be suitable for re-use as fill and the major portion will probably fall within the category " Well Graded Granular and Dry Cohesive Soil" classification of the "Specification for Road and Bridge Works".

See also general discussion paragraph 4.4.1.

Pavement Design

Chainage	Strata at Formation Level	Design C.B.R.	Frost Susceptibility of Subgrade	Remarks
B.H. 8	Till/Glacial clayey sand and gravel.	To be assessed by Client	Generally Susceptible	
B.H. 9	Till		Generally Susceptible	
B.H. 10	Till/Marl		Generally Susceptible	

NOTE: If the subgrade is classified in this table as "frost susceptible" - then a total construction thickness of at least 450mm must be employed.

Side Slope Stability

From the laboratory test results mean C'= 30KN/m2 Ø'=26.5°

However, over the lower stress range it is considered prudent to use a lower C' value in design. The parameters C'= 5KN/m2 Ø'=28.5° have been selected as presenting a lower bound case. For a minimum Factor of Safety of 1.5 the following "ru" values (relating pore water pressure to total vertical stress on the potential failure plane) are required.

Slope	r_u
1:2	0.03
1:2½	0.19
1:3	0.32

It should be possible to achieve the value of 0.32 by drainage measures, whatever the groundwater regime and also the conditions for 1:2½ slopes although levels would have to be more favourable. Drainage measures are unlikely to be able to achieve conditions for 1:2 slopes to be acceptable if any water is present. Hence, at this stage 1:2½ slopes would appear to be appropriate.
Possible shear surfaces were observed in Borehole 10 at 3.0 to 3.35m. Further inspection of the

Continued .....

ground using Trial Pits is necessary to study thesefurther and their implications for slope stability in the region which is adjacent to Bleak House. In the event of these shear surfaces being proved, possible alternative solutions could include the provision of additional drainage, a lowering of the slope angle at the top of the slope or structural support. The presence of the loadings from the buildings is unlikely to significantly affect stability. A Factor of Safety of 1.5 would normally be considered adequate in this region.

Typical drainage measures could include deep slope or counterfort drains (depths depending upon data on shear surfaces and water levels) to both intercept and lower the groundwater table in the slope and possibly to intercept pre-existing or potential shear surfaces.

The spacing of such drains similarly depends on requirements but typically these can range between 5 and 10m spacing. Deeper drains can achieve a similar effect to shallower drains at a wider spacing.

Such drains should not be used to carry any other water collected at the top of the slope. This should be kept seperate and discharged into drains at the toe. Clearly, the counterfort drains also require a collector drain so that the water can be discharged away from the slopes. Shallow drains arranged in a "Herring bone" pattern can be used to collect and rapidly discharge water falling onto the slopes themselves.

Whilst surface water may be collected in a shallow lined channel on the up-hill side of the tops of the slope, land drainage parallel and near to the top of the slope can create, in effect, a tension crack into which water is fed and hence stability adversely affected. This type of drainage is not recommended. Any land drains should be intercepted back from the cutting edge and fed away from the slope.

Location	BH89 and 10	[redacted]
Calculation	Cutting	Date May '81

From a combined plot

$c' = 30$ $\phi' = 26.5°$ is appropriate

$c' = 5$ $\phi' = 25.5°$ would be on the safe side for the likely stress levels in the slope.

Using Bishop & Morgenstern

$$\frac{c'}{\gamma H} = \frac{5}{20 \times 9} = 0.028$$

using $\frac{c'}{\gamma H} = 0.025$ bearing in mind the approximations which have been made.

	1:2		1:2½		1:3	
	m	n	m	n	m	n
	1.55	1.5	1.82	1.72	2.12	1.95

For $F_{op} = F_{os} = 1.5$

$r_u =$ 0.03 0.19 0.32

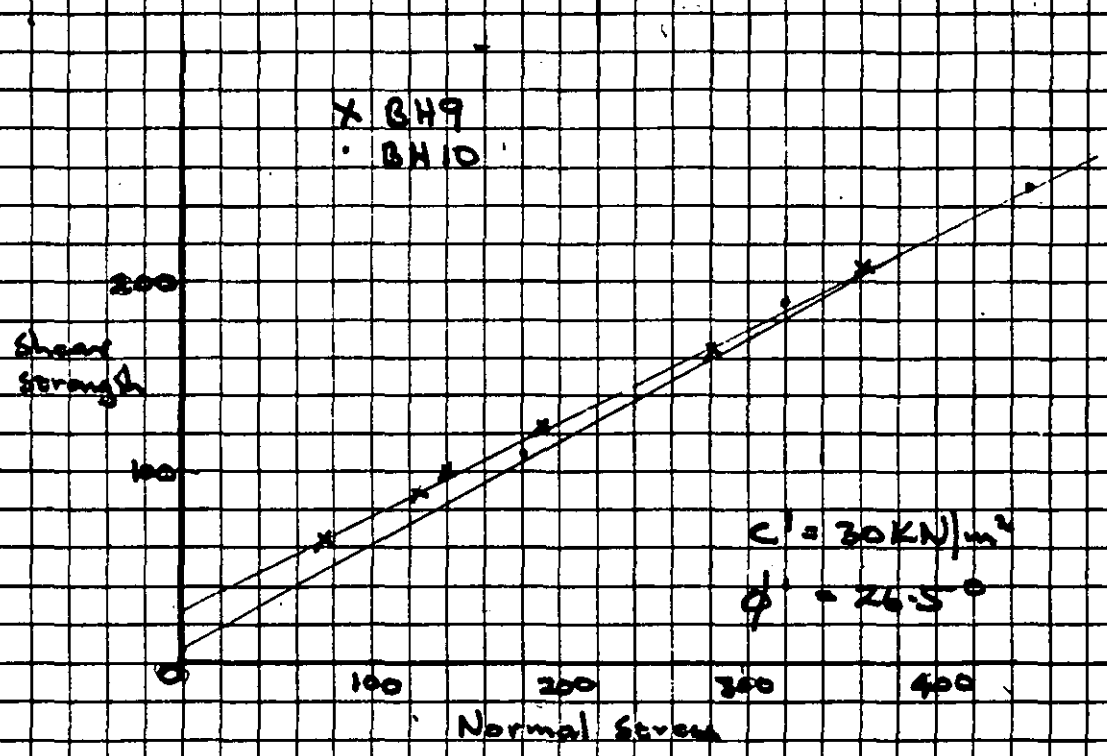
Calculation Sheet	Project	Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates			Figure 26

EX 4

Location: Cutting BH's B9 and 10.

Calculation: Effective Stress Summary.

Date: May '81.



Calculation Sheet	Project: Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		Figure 27

EX 4

Cutting Depth	0 - 5m	**Location**	Borehole 12

Excavation Technique

Beneath the topsoil a relatively thin stratum of very sandy clay overlies marl which rapidly becomes stiff to hard with depth. This latter material may become difficult to excavate with un-aided scrapers and may require the use of dozers to aid twin engined scrapers. The use of rippers to loosen the material prior to scraping may well aid the excavation process but local experience or field trials would aid this assessment. The use of face shovels or large back acters may also be considered since this technique would probably provide better quality fill and allow working under less favourable conditions.

Suitability of Excavated Material as Fill

As noted above the quality of the fill will depend upon the method of excavation.

The shear strength of the material should allow trafficking by relatively heavy plant although the low plasticity of the material demonstrates its sensitivity to small changes in water content. This may lead to restrictions in either working time, size of plant or both. Compactive effort appropriate to a classification as "Well Graded Granular and Dry Cohesive Soil" would probably be most suitable. See general discussion paragraph 4.4.1.

Pavement Design

Chainage	Strata at Formation Level	Design C.B.R.	Frost Susceptibility of Subgrade	Remarks
63467	Marl	To be assessed by Client	Generally Susceptible	

NOTE: If the subgrade is classified in this table as "frost susceptible" - then a total construction thickness of at least 450mm must be employed.

Side Slope Stability

For an interpreted $C' = 0$ $\emptyset' = 36^0$ the following have been calculated for a Factor of Safety ≥ 1.5.

Slope	r_u
1:2	0
1:2½	0.14
1:3	0.29

Since water at mid height of slope would produce a value of $r_u \simeq 0.34$, drainage would be required even for 1:3 slopes. The economics of drainage requirements in comparison with the use of flatter slopes is outside the scope of this report. Additional effective stress testing will be necessary to clarify the most appropriate parameters. Slopes of 1:2½ with drainage are felt to be feasible at this stage, however.

Data Sheet - Cutting	**Project** Department of Transport A564 Stoke-Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		Figure 28

EX 4

Location BH12

Calculation Cutting. **Date** May '81

For Cutting BH12

$c' = 0 \quad \phi' = 36°$

$\frac{c'}{\gamma H} = 0$

Slope	1:2		1:2½		1:3	
	m	n	m	n	m	n
	1.45	1.80	1.80	3.10	2.20	2.60
For F ≥ 1.5	r_u 0.40		0.14		0.29	

For water sub ½ slope height

$r_u \simeq 0.34$ [Richardson Curves]

Cutting Depth	0–2m	**Location** Borehole 13

Excavation Technique

Conventional excavation plant such as scrapers should be suitable for the removal of the upper materials of this site. The soils in the region of foundation level appear to grade rapidly to a very stiff to hard condition where more powerful plant or the assistance of dozers may be required.

Suitability of Excavated Material as Fill

The depth of excavation at this site is relatively limited. After topsoil stripping the upper materials should prove suitable for re-use as fill. At the borehole location, however, these materials contained many roots due to the proximity of trees and bushes. Hence careful selection to exclude such materials will be necessary. In view of this and the relatively small volumes involved it may be considered prudent to classify it as unsuitable for re-use as structural fill at this stage.

See also general discussion paragraph 4.4.1.

Pavement Design

Chainage	Strata at Formation Level	Design C.B.R.	Frost Susceptibility of Subgrade	Remarks
60135	Stiff red brown silty very sandy CLAY grading to very stiff silty CLAY.	To be assessed by Client	Not susceptible on the basis of present tests but see remarks.	Marl is frequently regarded as a frost susceptible material and appropriate precautions here may well be advisable.

NOTE: If the subgrade is classified in this table as "frost susceptible" – then a total construction thickness of at least 450mm must be employed.

Side Slope Stability

Nominal side slopes of 1:2 should prove acceptable in such a shallow cutting.

The pond which is in the vicinity of this cutting will be traversed by a road along the present line and hence it will be necessary to clean out its base and backfill with selected compacted granular material up to formation level. It would also be prudent to provide drainage from the base of the pond away from the site or into a drainage system associated with the road scheme.

In view of the shallowness of the cutting, further investigation would probably be best achieved by the use of Trial Pits.

Data Sheet - Cutting	**Project** Department of Transport A564 Stoke–Derby Link Derby Southern By Pass Isley Walton to M1 Section Preliminary Site Investigation	Contract S2796
exploration associates		**Figure** 30

TECHNICAL REFERENCES

The major references that have been used in the preparation of this report as follows:-

Bishop A.W. and Henkel D.H. (1962)	The measurement of soil properties in the Triaxial Test.
Bishop A.W. and Morgenstern (1960)	"Stability coefficients for earth slopes Geotechnique No. 10.
Chandler R.J. and Davis A.G.	Further work on the engineering properties of Keuper Marl. Ciria Report 47
Peck R.B. Hanson W.E., and Thornburn (1974)	"Foundation Engineering" 2nd Edition Wiley, N. York
Pilot G. et Moreau M. (1973)	"La stabilite des remblais sur sols mous" - Abaques de calcul
Skempton A.W. and Bjerrum L. (1957)	"A contribution to the settlement analysis of foundations on clay" - Geotechnique 7 No. 4.
Simons N.E. and Menzies B.K. (1975)	"A short course in Foundation Engineering" IPC Business Press Limited.
Terzaghi K. (1943)	"Theoretical Soil Mechanics" J. Wiley, New York.
Terzaghi K. and Peck R.B.	"Soil Mechanics in Foundation Practice"
Tomlinson M.J. (1969)	"Foundation Design and Construction" - Pitman
British Standards Institution (1972)	Code of Practice for Foundations - CP 2004
British Standards Institution (1957)	Code of Practice for Site Investigation - CP 2001
British Standards Institution (1975)	Methods of Testing Soils for Civil Engineering Purposes BS 1377
Department of Transport	"Specification for Road and Bridge Works" 1976
Raymond G.P. (1967)	The bearing capacity of large footings and embankments on clays. Geotechnique 17,170

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British Standards Institution (1975)	Methods of Testing Soils for Civil Engineering Purposes BS 1377
Department of Transport	"Specification for Road and Bridge Works" 1976
Raymond G.P. (1967)	The bearing capacity of large footings and embankments on clays. Geotechnique 17,170

GENERAL NOTES

1. The assessment made in this report is based on the ground conditions encountered in the trial holes together with the results of field and laboratory tests. There may be special conditions appertaining to the site, however, which have not been revealed by the boring and which therefore, have not been taken into account in the report.

   Whilst the report may express an opinion on possible configurations of strata between or beyond boreholes, or on the possible presence of features based on either visual, verbal or published evidence, this is for guidance only and no liability can be accepted for its accuracy.

2. The comments on groundwater conditions are based on observations made at the time of the investigation, unless otherwise stated. It should be noted, however, that ground water levels vary due to seasonal or other effects.

APPENDIX

LABORATORY TESTS

SUMMARY OF PROCEDURES USED

Test	BS1377 1975 Reference No.	Remarks
Moisture Content	1A	
Liquid Limit	2A	Cone Method
Plastic Limit	3	
Specific Gravity	6(A)	
Particle Size Distribution		
Coarse	7A	
Fine	7B	
Sulphate Content	9	
Compaction Tests	12	
California Bearing Ratio (C.B.R.)	16	
Consolidation	17	
Triaxial Tests	-	Procedures in accordance with "The Measurement of Soil Properties in the Triaxial Test" by Bishop & Henkel.

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EXPLORATION ASSOCIATES (WARWICK) LIMITED, GEOTECHNICAL HOUSE, HATTON, WARWICK. CV35 7JL
Tel: (0926) 491743

DEPARTMENT OF TRANSPORT

EAST MIDLANDS REGIONAL OFFICE

A42 CASTLE DONINGTON NORTH

MAIN SITE INVESTIGATION : CONTRACT 2 (FEBRUARY 1985)

VOLUME 1 : PART 1 EXPLORATORY HOLE RECORDS AND FORMS B AND C

S4449

Employer for the Works

DEPARTMENT OF THE ENVIRONMENT
AND TRANSPORT
East Midlands Regional Office
52-54 Holly Walk
Leamington Spa
Warwickshire
CV32 4JE

Engineer for the Works

SCOTT WILSON KIRKPATRICK
AND PARTNERS
Bayheath House
Rose Hill West
Chesterfield
Derbyshire
S40 1JF

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Volume 1 : Part 2

Exploratory Hole Record Sheets (Forms A1 and A2) and Laboratory Test Results (Forms B and C)	Boreholes/Drillholes and Trial Pits

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A42 CASTLE DONINGTON NORTH

MAIN SITE INVESTIGATION : CONTRACT 2

INTRODUCTORY TEXT

1. INTRODUCTION

On the instructions of the Secretary of State for Transport a site investigation was undertaken by Exploration Associates (Warwick) Limited for the Northern part of the proposed line of the A42 Castle Donington North. (See Figure 1, Site Location Plan).

The site investigation was directed by Scott Wilson Kirkpatrick and Partners, who are the Engineers for the Works.

The A6 Kegworth By-Pass was investigated from its junction with the A42 and A453 to a point 250 metres East of the M1 Motorway.

2. OBJECTIVE

The objective of the investigation was to obtain detailed information regarding the soil, rock and groundwater conditions likely to be encountered along the Northern part of the proposed line of the A42 Castle Donington North between Wood Nook Farm on the B5401 and Junction 24 on the M1 Motorway.

3. REPORT PRESENTATION

The Site Investigation Factual Report comprises 4 volumes. The composition of the various volumes is shown on the Master Index within this volume.

4. THE SITE

The line of the Northern part of the proposed A42 Castle Donington North is shown on Figure 1. Exploratory Hole Location Plans and Longitudinal Sections are presented in Volume 4.

This section of the proposed A42 scheme is approximately 4 km long and extends from a point adjacent to Wood Nook Farm, immediately to the South-West of the B5401 to junction 24 on the M1 Motorway.

In travelling North-East from Wood Nook Farm, the route crosses the following features:

B5401
Diseworth Brook
Hyam's Lane
M1 Motorway

In addition a minor watercourse is traversed by the proposed scheme.

5. TOPOGRAPHY AND GEOLOGY

From the start of the scheme (i.e. some 50m South-West of the B5401, adjacent to Wood Nook Farm, Chainage 213+00m), the ground level falls gently to the North East to Diseworth Brook (Chainage 215+50m). The topography then rises as the M1 Motorway and junction 24 is approached.

A summary of the geological strata encountered along the route is presented below:-

The following major soil and rock types were recorded on this scheme.

Strata Type	General Description	Main Locations
Made Ground	Limestone Chippings	M1 Motorway Verge
Alluvium	Firm and soft brown and grey silty and sandy clay with gravel and sand.	Isolated deposits flanking Diseworth Brook and adjacent minor stream.

Glacial Till	Firm, stiff and very stiff brown silty and sandy clay with gravel, beds of sand and silt.	Generally thin mantle overlying Keuper Marl Absent in parts, particularly at motorway locations.
Keuper Marl	Stiff red brown and green grey silty CLAY with many lithorelicts becoming very weak and weak mudstone/ siltstone.	Underlies the proposed scheme at shallow depth through out.

6. SITE INVESTIGATION PROCEDURE

6.1 General

The site investigation was designed by Scott Wilson Kirkpatrick and Partners and subsequently undertaken in accordance with the Code of Practice for Site Investigation, BS 5930 (1981) and the specification outlined in the contract document.

Geological and hydrogeological conditions were determined by exploratory boreholes, drill holes, trial pits, and Hand Augers. Laboratory testing was subsequently undertaken on selected samples.

6.2 Exploratory Holes

The site investigation consisted of 73 percussive cable tool Boreholes, 50 rotary drill holes and 14 machine excavated trial pits, to maximum depths of 15.00 metres, 25.0 metres, and 3.50 metres respectively. In addition, six Hand Augers were undertaken to a maximum depth of 2.00 metres below existing ground level.

The fieldwork period extended from 13th August, 1984, to 15th October, 1984.

6.2.1 Methods of Investigation

The method of investigation for each hole is stated at the head of each log record sheet.

6.2.2 Boreholes

The Shell and Auger boring was carried out using Pilcon "Wayfarer 1500" rigs and 150mm diameter casing.

6.2.3 Drill Holes and Core Recovery

Rotary Core drilling was started from the base of Shell and Auger Holes, and from the base of Rotary Open Holes formed alongside Shell and Auger Holes.

The rotary drilling was undertaken using Pilcon "Wayfarer" rigs fitted with a pendant rotary attachment. In addition a lorry mounted Hans England rotary rig was used. Water and air supplemented by water was used as a flushing medium. The cores obtained were 76mm diameter and the recovery obtained was mainly in excess of 80%. Within each Drillhole, Standard Penetration Tests were performed at regular intervals to gain an estimate of the insitu strength of the bedrock.

The cores were extracted directly from the core barrel into plastic guttering, using, whenever possible a hydraulic extruder, and wrapped with polythene before being placed into the core boxes.

The cores were logged on site in accordance with the procedures detailed in the "Quarterly Journal of Engineering Geology", Volume 3, 1970, "Logging of Rock Cores for Engineering Purposes".

6.2.4 Trial Pits

The Trial Pits were excavated by a mechanical back-acter excavator (J.C.B. IIIcx). The pits generally remained stable for the short period of time they were left open, although

occurrences of instability were noted in a small number of pits. The Trial Pits were logged by Exploration Associates (Warwick) Limited, and also by a soils engineer from Scott Wilson Kirkpatrick and Partners.

6.2.5 Hand Augers

Six Hand Augers were performed at selected locations to a maximum depth of 2.0 metres.

6.3 Sampling

During the course of boring small disturbed samples of the strata encountered were obtained for soil identification and classification. Bulk disturbed samples were obtained to supplement the small disturbed samples and to allow a range of tests to be carried out in the laboratory.

In cohesive strata, "undisturbed" 102mm diameter samples were obtained using standard open-drive equipment and sinker bar weight of 80kg. The figure in brackets on form A1 is the number of blows required to drive the sample tube over the depth range shown. These samples were subsequently available for laboratory determination of strength and consolidation characteristics.

Bulk disturbed and small disturbed samples were recovered during the construction of trial pits.

In addition samples of groundwater were obtained from the exploratory holes.

The 76mm diameter rock core samples are being retained at the sample store of Scott Wilson Kirkpatrick and Partners.

6.4 Insitu Testing

Standard Penetration Tests (SPT's) were carried out in accordance with BS 1377 Test 19 in both Boreholes and Drillholes, and in granular and cohesive soils, and in rock. On occasions the split spoon sampler was replaced by a solid 60°

cone. The SPT gives a measure of insitu relative density in granular materials and an indication of shear strength and deformation modulus in cohesive soils and weak rock. Where the Standard Penetration has not been achieved the actual penetration is shown in brackets on the logs after the number of blows.

Where Standard Penetration Tests were curtailed without achieving the standard seating penetration of 150mm, a note has been made on the logs. Otherwise the blow count and penetration recorded on the logs does not include the seating component. On the longitudinal sections, for the tests not achieving the standard total penetration of 450mm the total number of blows (including seating) has been recorded, followed in brackets by the total penetration (including seating penetration).

Falling head insitu Permeability testing was undertaken in five of the Standpipe Piezometers and the results analysed by methods outlined in BS 5930 : 1981. The Shape Factor (F) was calculated from the expression

$$\frac{F}{D} = \frac{2.32\pi \quad (L/D)}{\log_e \left(1.1(L/D) + \sqrt{1 + 1.1(L/D)^2}\right)}$$

Hand Vane and Pocket Penetrometer testing was undertaken by Scott Wilson Kirkpatrick and Partners in several Trial Pits, the results of which are presented on the Trial Pit logs.

6.5 Instrumentation

Casagrande type Standpipe Piezometers were installed at varying depths in five Boreholes, the piezometer tips being sealed into a particular stratum using bentonite seals, (details of filter and seal dimensions are presented on the Borehole and Drillhole records sheets A1 and A2)

Open Standpipes (Observation Wells) were installed in an additional ten boreholes.

All water strikes encountered during drilling were monitored for a period of twenty minutes. Where the times recorded on the Borehole/Drillhole records are less than twenty minutes, the times represent the period to apparent groundwater equalization. However, it should be noted that water strikes may not

necessarily give equilibrium groundwater conditions for the following reasons:-

a) Boring can form a skin, lining the Borehole.
b) Water entry may be reduced by casing.
c) Low permeability clays will make response slow.

Groundwater readings, for each respective instrument are presented in tabular form in Volume 3 of this report.

7. EXPLORATORY HOLE RECORDS

7.1 General

Details and depths of all strata encountered together with samples recovered and insitu test results are given on the Exploratory Hole Records, Figures A1 and A2,

The Exploratory Hole Records also give observations of groundwater conditions encountered during boring, drilling and excavation of trial pits together with details of any instrument installation.

Results of laboratory classification tests, moisture content, and density are also presented on these sheets.

Details of grouting of boreholes and drillholes and where hard strata (as defined in the Specification) was encountered, details of its thickness if penetrated, and the time spent penetrating such strata is given at the end of each log in the description column.

The ground level co-ordinates shown on the Borehole/Drillhole records were supplied by Scott Wilson Kirkpatrick and Partners. The location of exploratory holes are shown on Drawing Nos. 83040/7/26, 27, 28A, 29 and 33 within volume 4. The co-ordinates given are based on the local grid established by J.A. Storey and Partners in their aerial Survey carried out in 1984.

7.2 Soil and Rock Description

All sample description was carried out by Exploration Associates (Warwick) Limited. The description of soils was undertaken in accordance with BS 5930 : 1981. The core samples were logged in accordance with the procedures detailed in the "Quarterly Journal of Engineering Geology", Volume 3, 1970, "Logging of Rock Cores for Engineering Purposes". The presence of bedding in the rock strata, where evident, has been noted on the Exploratory Hole Record Sheets. Where appropriate, descriptions were amended in accordance with the laboratory test results.

8. LABORATORY TESTING

8.1 Presentation

Schedules of laboratory testing were prepared by Scott Wilson Kirkpatrick and Partners. The results of the laboratory testing are presented as follows:-

VOLUME 1

Figure A1 : Natural Moisture Content
Natural Dry Density
Atterberg Limits
Tests for pH, SO3, organic content and
Specific Gravity
Particle Size Distribution

Figure A2 : Natural Moisture Content
Atterberg Limits
Natural Dry Density
Tests for pH, SO3, and Specific Gravity
Point Load Strength
Unconfined Compressive Strength

Figure B : Compaction
Shear Strength (Consolidated Undrained,
Consolidated Drained
Unconsolidated Undrained Triaxial

Laboratory Vane)
Consolidation (oedometer)
Specific Gravity

Figure C : Compaction and CBR Curves.

Volume 2 of the report contains the following laboratory test results which are not incorporated on sheets A1, A2, B or C.

Frost Susceptiblity
M.C.V.
Moisture Content determination using microwave oven
Further details of the shear strength and consolidation tests.
Summaries of laboratory tests in tabular form for each exploratory hole and geological strata.

8.2 Sample Preparation and Testing

Sample preparation and testing were carried out in accordance with BS 1377 : 1975, "Methods of Testing Soils for Civil Engineering Purposes", and "The Measurement of Soil Properties in the Triaxial Test" by Bishop and Henkel, 1962 unless indications to the contrary are presented below.

8.2.1 Natural Moisture Content

The Natural Moisture Content was determined using conventional oven drying techniques. In addition, numerous samples were chosen for Moisture Content determination using a microwave oven. These tests were undertaken by methods outlined in the T.R.R.L. Report LR 280. A power setting of 350 watts was used.

8.2.2 Unconsolidated Undrained Triaxial Compression Test

(Test 21, BS 1377 : 1975 and Bishop and Henkel : 1969)

Triaxial compression tests were carried out on specimens cut from undisturbed samples and the derived shear strength parameters in terms of total stress are presented on figure B in Volume 1 and on the figures summarising all the undrained shear

strength results in Volume 2. Where an undrained angle of friction was exhibited this has been quoted with the cohesion value together with the mean cohesive shear strength from the three tests performed. The former value is shown in brackets. The sets of three 38mm diameter specimens each 76mm high, were tested at three different lateral pressures unless the samples were considered unsuitable for this type of test in which case 102mm diameter by 204mm high specimens were multi-stage tested at three lateral pressures. In the multi-stage test the specimen is subjected to the first confining pressure and a deviator stress is then applied at a constant strain rate until failure is imminent. At this point the cell pressure is increased, and the procedure repeated. A further cell pressure increase and shear stage follows until a drop in deviator stress is recorded, to give a total of three stages and results.

8.2.3 Consolidated Undrained Triaxial Compression Test with Pore Water Pressure Measurement and Consolidated Drained Triaxial Compression Test (Bishop and Henkel : 1969)

Generally, the tests were carried out on sets of three 38mm diameter, 76mm high specimens using different cell pressures. Where it was not possible to prepare satisfactory 38mm diameter specimens, multi-stage tests were carried out on 106mm diameter and 202mm high specimens.

In the tests the specimens were fully saturated using a back pressure which ranged between 100 kN/m^2 to 600 kN/m^2.

The derived effective shear strength parameters are presented on figure B in Volume 1 and in volume 2 together with graphs showing the Mohr's circles and the variation of deviator stress, pore pressures and volume change with strain, volume change with time and the value of B with the consolidation pressure.

8.2.4 Laboratory Vane Test

Laboratory Vane Tests were carried out using a 19mm x 19mm Pilcon Hand Vane.

8.2.5 California Bearing Ratio Test

A surcharge of 13.6kg was used in the CBR Tests.

8.2.6 Frost Susceptiblity Test

The specimens were prepared by compaction to the maximum dry density and the optimum moisture content condition for the BS (2.5kg rammer) compaction test. The tests were generally carried out according to the T.R.R.L. report LR 90, "The Frost Susceptibility of Soils and Road Materials", and the T.R.R.L. Supplementary Report No. 318.

8.2.7 Moisture Condition Test

Tests were carried out as specified in T.R.R.L. Report LR 750. "The rapid measurement of the moisture condition of earthwork material:" and T.R.R.L. Supplementary Report 522. "The moisture condition test and its potential applications in earthworks."

8.2.8 Franklin Point Load Test

The Point Load tests were undertaken as outlined in the publication:- The Point Load Strength Test. E. Broch and J.A. Franklin . International Journal of Rock Mechanics Vol. 9, pp 669 - 697 Pergamon Press 1982.

8.2.9 Compressive Strength Determination in Uniaxial Compression on 76mm Diameter Rock Core Sample.

Tests were carried out as specified in BS 1881 part 4 : 1970.

8.2.10 Compressive Strength Determination in Undrained Triaxial Compression on Rock Core Samples.

Tests were carried as specified in A.S.T.M. D2664 - 67.

Borehole	Ground Level M.O.D.	Easting	Northing
B219	53.02	66386.6	93927.5
B220	52.69	66394.3	93937.3
B221	52.32	66407.2	93929.0
B222	53.02	66418.8	93907.8
B223	53.43	66431.3	93899.8
B224	53.30	66438.4	93911.5
225	48.37	66538.8	93821.8
226	52.47	66482.9	94002.4
227	47.64	66510.3	94072.1
228	49.30	66548.5	94054.6
229	49.06	66572.1	94122.3
230	49.74	66673.8	94223.5
231	50.52	66663.2	94282.0
232	54.84	66742.6	94392.8
233	53.10	66838.6	94232.4
234	55.96	66901.9	94310.1
235	72.54	66841.2	94847.3
236	79.05	66898.4	95010.6
237	80.90	66946.5	95226.9
238	70.72	67083.8	95063.4
239	75.70	67067.4	94880.1
240	78.35	67083.7	94796.2
241	79.73	66912.2	94821.6
B242	58.79	66813.0	94507.1
B243	59.79	66822.7	94508.3
B244	60.89	66835.3	94535.2
B245	60.88	66823.9	94543.5
B246	61.53	66831.3	94566.2
B247	62.17	66847.0	94583.2
B248	59.59	66798.9	94442.2
B249	58.88	66821.5	94457.6
B250	59.00	66822.0	94480.3
B251	59.74	66835.4	94472.8
B252	60.11	66838.1	94493.4
B253	60.23	66844.5	94488.1
B254	61.35	66864.2	94523.7
B255	60.76	66862.2	94497.4
B256	60.25	66859.6	94463.5
B257	61.84	66885.5	94544.9
B258	61.29	66882.6	94517.3
B259	60.39	66878.4	94477.6
B260	61.76	66903.9	94564.8
B261	61.10	66901.0	94537.5
B262	60.20	66896.8	94491.8
B263	66.22	67150.4	95087.2
B264	67.12	67145.8	95061.8
B265	76.34	67052.3	95185.5
B266	75.72	67059.4	95206.5
B267	74.77	67043.0	95211.1
B268	75.00	67049.2	95230.6
B269	75.33	67030.7	95228.6
B270	75.59	67037.1	95246.1
B271	75.09	67018.5	95250.9
B272	75.29	67024.7	95269.3
B273	79.03	67001.2	95262.7
B274	78.85	67006.6	95283.2
275	84.29	66924.1	95366.7
276	86.63	66846.9	95486.9
277	83.05	66960.0	95489.9
278	75.12	67024.0	95618.5
279	62.95	67356.9	96648.9
280	57.18	67404.6	96797.0
B281	79.62	67053.6	95421.1

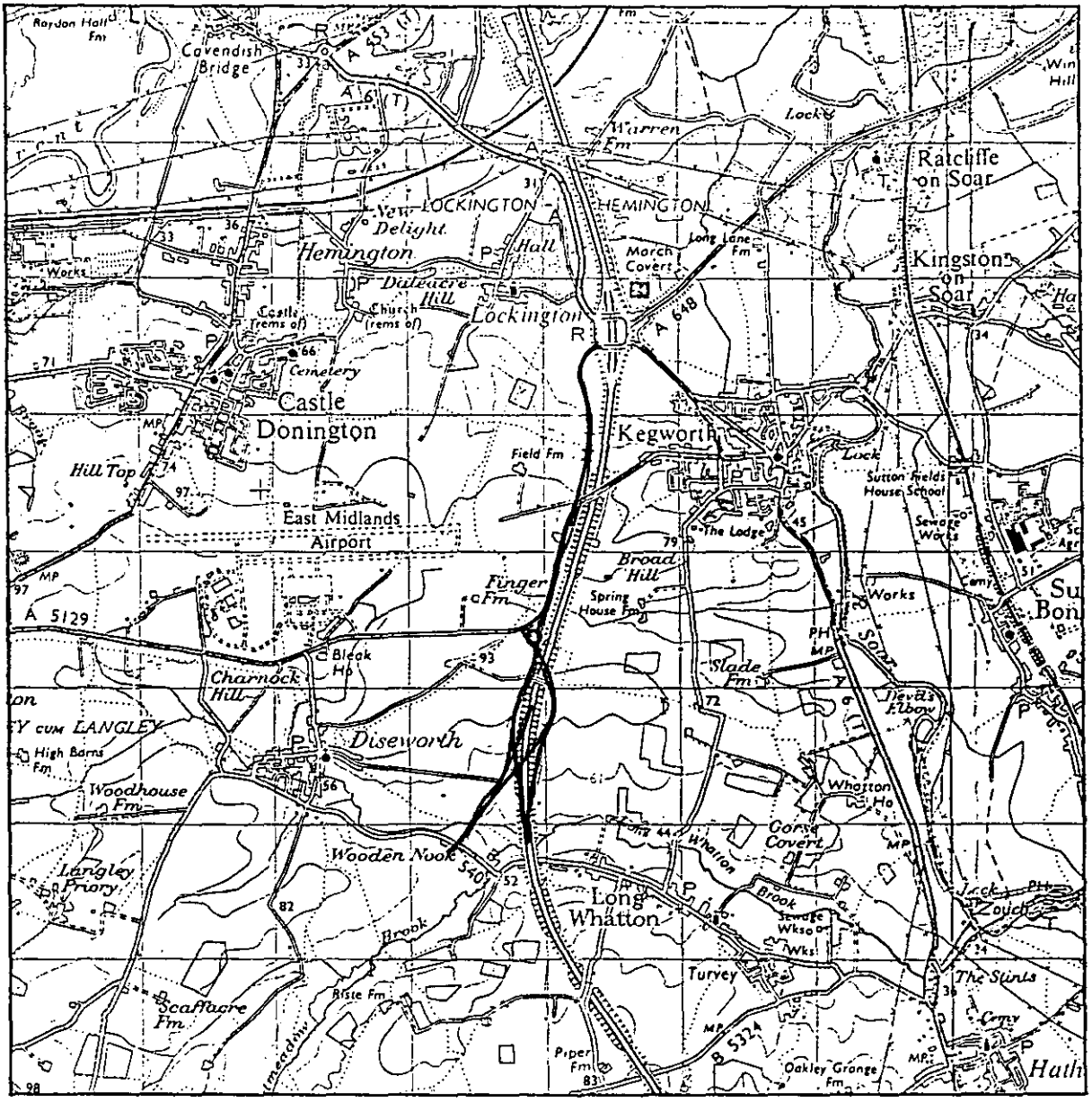
Borehole	Ground Level M.O.D	Easting	Northing
B282	76.57	67073.1	95426.2
B283	76.54	67070.0	95415.9
B284	77.04	67090.5	95420.5
B285	76.94	67086.7	95409.9
B286	76.51	67109.1	95424.2
B287	76.50	67105.4	95411.7
B288	75.60	67120.6	95405.4
B289	75.50	67125.8	95422.3
290	71.43	67209.4	95445.9
291	70.34	67232.6	95400.2

Trial Pits	Ground Level M.O.D	Easting	Northing
438	53.83	66453.0	93963.0
439	65.23	66820.0	94699.0
440	80.60	66934.0	95077.0
441	77.05	67011.0	94887.0
442	77.96	67048.0	94740.0
443	79.94	66958.0	94870.0
444	68.26	67294.0	95400.0
445	68.28	67297.0	95475.0
446	68.20	67290.0	95407.0
447	65.51	67341.0	95447.0
448	64.27	67366.0	95467.0
460	49.20	66555.0	94097.0
461	49.07	66621.0	94180.0
462	51.00	66687.0	94276.0

Hand Auger	Ground Level M.O.D.	Easting	Northing
1	53.8	66300.0	93976.0
2	55.0	66348.0	93953.0
3	51.5	66488.0	93869.0
4	49.5	66524.0	93836.0
5	48.4	66573.0	93796.0
6	52.8	66280.0	93983.0



EXPLORATION ASSOCIATES (WARWICK) LIMITED
PMS/BG/S4449/FEBRUARY 1985



The Route

Scale : 1:50,000

SITE LOCATION PLAN	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investgiation - Contract 2	Contract S4449
exploration associates		**Figure** 1

EX 4

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

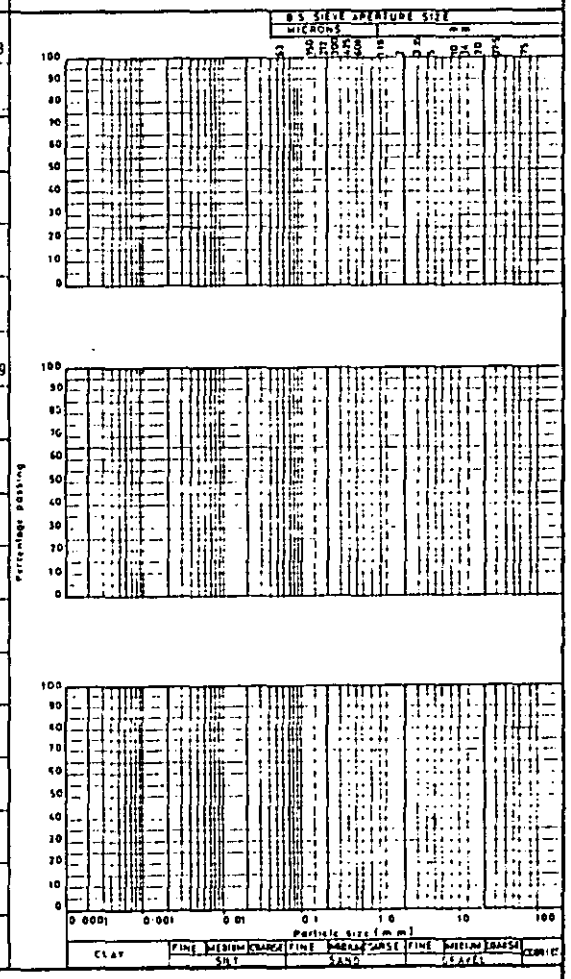
BOREHOLE No B219
FIGURE A1
Sheet 1 of 2

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 13/14/15.8.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66386.6 E.
93927.5 N.
Ground Level: 53.02 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to water (m)	Sample/Insitu Test Depth (m)	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr pH
13.8.84			0.30	J1		0.30	52.72	TOPSOIL		2	17					0.04 7.8
			0.50	(48)2				Red brown mottled yellow grey green clayey silty SAND with much sub-angular fine to medium gravel (fragments of mudstone, siltstone, sandstone and flint) occasional carbonaceous material. (GLACIAL TILL)		6			39	19	100	
			0.95 1.00	J3		1.00	52.02									
			1.00	S(14)				Stiff red brown mottled grey green friable slightly sandy silty CLAY becoming soft to firm very silty clay tending to very clayey sandy silt with occasional gravel, rootlets, (GLACIAL TILL)		8	14					
			1.45	J4												
			1.80	J5						10	21	1730				0.05 7.5
			2.00	(42)6												
			2.45 2.50	J7		2.50	50.52			15	21	1735	31	18	100	
			2.50	S(23)				Stiff red brown mottled grey green friable silty CLAY and bands of grey green silt with occasional lithorelicts of siltstone. (KEUPER MARL : ZONE IV								
			2.95	J8						17	13					
			3.30	J9		3.30	49.72			19	20	1740	35	17	100	0.02 7.9
			3.50	(50)10				Stiff red brown mottled grey green friable slightly sandy silty CLAY tending to clayey silt in zones. (KEUPER MARL : ZONE IVa)								
		3.80	3.95 4.00	J11						23	26	1585	35	19	100	
		4.00	4.00	S(27)				4.00 - 4.50 Very stiff								
			4.45	J12												
13.8.84	Nil	Damp	4.80	J13												
14.8.84	Nil	2.80	5.30	J14		5.30	47.72									
		Sealed at 5.5	5.50	(56)15				Very stiff red brown fissured and friable slightly sandy very silty CLAY tending to clayey silt in zones. (KEUPER MARL : ZONE IVa)								
			5.95 6.00	J16		6.00	47.02									
			6.00	S(57)				Stiff and very stiff red brown fissured silty CLAY. (KEUPER MARL : ZONE IVb)								
			6.45	J17												
			6.80	J18		6.80	46.22									
			7.00	(62)19				Stiff and very stiff red brown mottled grey green silty CLAY with many lithorelicts of siltstone and mudstone. (KEUPER MARL : ZONE III)								
			7.45 7.50	J20		7.50	45.52									
			7.50	S(49)				Stiff and very stiff red brown mottled grey green fissured faintly laminated silty CLAY and very silty clay with lithorelicts of siltstone and mudstone. (KEUPER MARL : ZONE III/IVa) No lithorelicts below 8.30m								
			7.95	J21												
			8.30	J22												
			8.50	(68)23												
			8.95													



Scale 1:

Disturbed Samples: W - Groundwater
J - Jar, S - S.P.T., D - Bulk, M - Mazi

Undisturbed Samples: Soil Sample

Insitu Tests: V [30] - Vane shear strength in KN/m²

Groundwater first struck

Core Cutter Density
Core Cutter Density/C.B.R

Sandbottle Density
C.B.R

C or S - S.P.T. cone or spoon
(25) - N value

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B219

FIGURE A1

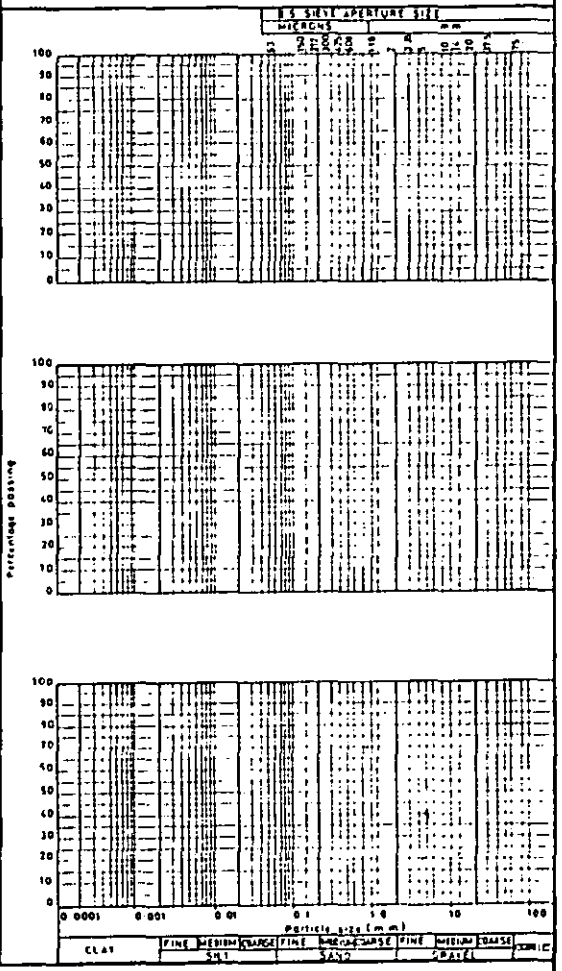
Sheet 2 of 2

Field Work by: _____
Method : _____
Dates : _____
Hole Dimensions: _____
Casing Dimensions: _____

Coordinates: E.
N.
Ground Level: m O.D.

Laboratory Testing by. Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr / pH
			9.00	J24				Firm to very stiff red brown and grey fissured silty CLAY with bands of micaceous mudstone siltstone. (KEUPER MARL : ZONE III/IVa)		33	12					
			9.45	S(47) J25												
			9.80	J26		9.80	43.22			35	-					0.15 / 7.5
			10.00					Firm red brown mottled grey green fissured slightly sandy silty CLAY becoming firm to stiff below 10.50 with many mudstone lithorelicts. (KEUPER MARL : ZONE III)								
			10.45	(80)27						37	15		31	18	100	
			10.50	J28												
			10.95	S(62) J29						39	9.2					
			11.30	J30												
			11.50	(80)31												
			11.95			12.00	41.02									
			12.00	J32 S(50 for J33 50mm)				Very weak red brown grey green fissured moderately weathered thinly laminated MUDSTONE tending to very stiff silty clay in zones. (KEUPER MARL : ZONE III)								
			12.45													
			12.80	J34		12.80	40.22									
14.8.84	13.00	Damp	13.00	W35				Stiff to very stiff brown friable very silty CLAY with lithorelicts of mudstone. (KEUPER MARL : ZONE III)								
15.8.84	13.00	7.50	13.30	J36												
		Sealed at 13.5	13.50	S(50 for 50mm)*												
			13.95	J37		13.80	39.22									
			14.30	J38		14.30	38.72	Stiff to very stiff red brown mottled grey green silty CLAY becoming very silty in zones with many lithorelicts of mudstone and siltstone (KEUPER MARL : ZONE III)								
			14.50	S(78 for 150mm)*		14.50	38.53	Weak to moderately weak grey green SILTSTONE. (KEUPER MARL : ZONE II)								
15.8.84	14.50	Dry	14.95	J39		15.00	38.02	Stiff and very stiff red brown mottled grey green fissured micaceous silty CLAY. (KEUPER MARL : ZONE IVa)								
								End of Shell and Auger Hole.								
								* = Seating Blows - J33 = 45 J37 = 45 J39 = 30								
								Bentonite seal 3.40 - 3.80 Sand filter 3.80 - 4.60 Piezometer tip at 4.50 Bentonite seal 4.60 - 5.00								



Scale 1:

Disturbed Samples : W - Groundwater
● J - Jar ● S - S.P.T. ● B - Bulk ● M - Mazi

Undisturbed Samples : Soil Sample

Insitu Tests : V (30) - Vane shear strength in KN/m²
Groundwater first struck
□ Core Cutter Density
■ Core Cutter Density/C.B.R
▽ Sandbottle Density
▲ C.B.R
C or S SPT refusal or spoon (25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B219

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring Air Flush with Water Injection
Dates : 11/12.10.84
Core Diameter : 76mm
Casing Dimensions : 133.35mm

Coordinates : 66386.6 E
93927.5 N
Ground Level : 53.02 m O.D

Laboratory Testing by :
Dates :

Drilling							Test or Fl (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Dates	Depth of casing/mud	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %		Legend	Depth (m)	Reduced Level	Detail	Main									
11.10.84	-	-									Rotary Open Holed through overburden, alongside Shell and Auger Hole previously drilled to 14.00m. (No Drillers Descriptions.)										

Scale 1 :

Disturbed Samples :
W - Groundwater
• J - Jar
• S - S.P.T.
• B - Bulk
• M - Mazi

50
100

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B219

FIGURE A2

Field Work by : _____
Method : _____
Dates : _____
Core Diameter : _____
Casing Dimensions : _____

Coordinates : _____ E
_____ N
Ground Level : _____ m O.D.

Laboratory Testing by : _____ Dates : _____

Drilling							Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
Date	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or II (mm)	Legend	Depth (m)	Reduced Level	Detail	Main						
											See Sheet 1 of 3								
			14.00						14.00	39.02								
					93%	28%	NI 80 450		15.20	37.82	Completely weathered zones at 14.0 - 14.1, 14.8 - 14.9.	Highly weathered red brown very weak friable calcareous micaceous thinly bedded SILTSTONE with some silty clay along extremely closely spaced sub-horizontal discontinuities (KEUPER MARL : ZONE III)						
			15.60						16.00	37.02		Moderately weathered weak and very weak thinly bedded dark red brown micaceous calcareous SILTSTONE with extremely closely spaced discontinuities. (KEUPER MARL : ZONE II)						
					100%	0%	NI 40 80				Completely weathered zones at 16.0 - 16.2, 16.3, 16.4 17.8 - 17.85.	Moderately weathered dark red brown mottled grey green calcareous micaceous interstratified SILTSTONE /MUDSTONE. (KEUPER MARL : ZONE II/III)		17.15 17.47		26	15	
11.10.84	4.50	10.50	17.00															
12.10.84	4.50		17.36		93%	76%	S NI 230 480			(768, 119 for 21mm)								

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Moist

50
100

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B219

FIGURE A2

Sheet 3 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D

Laboratory Testing by :
Dates :

Drilling							Test or Strength (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Dates	Depth of casing(m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %		Legend	Depth (m)	Reduced Level	Detail	Main									
			18.90									Highly weathered light grey and green mottled red brown thinly bedded and thinly low amplitude ripple bedded micaceous very weak SILTSTONE with very closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE III)									
					90%	21%	N1 80 130														
12.10.84			20.00						20.00	33.02											
			20.04				S (50 for 40mmSB)					End of Rotary Hole.									

Scale 1 :

Disturbed Samples :
W - Groundwater

J - Jar
S - S.P.T.
B - Bulk
M - MCAI

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25). - N value

SCOTT WILSON KIRKPATRICK & PARTNERS
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Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B219
FIGURE B
Sheet 1 of 1

Sample		Compaction			Shear Strength									Consolidation								Notes
					Stress at Failure		Strain at Failure			C	Ø	Type of Shear Test	Initial			Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1-\sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)		0 50	50 200	200 50	50 100	100 200	200 400	400 800	
2.00 2.45	U6				52	71	7.9	28	1520			$\overline{CD}$			m_v							
					148	165	10.7	32	1520						c_v							
					297	291	11.8	30	1540	20	27				k							
															e							
3.50 3.95	U10				100	108	20	21	1680	120	-	UU	21	1730	m_v	0.36	0.14	-	-	0.03	0.07	0.06
					200	110	8	20	1745						c_v	-	25.08	-	-	29.31	15.47	19.83
					300	134	12	20	1755						k	-	34.44	-	-	8.63	10.62	11.67
															e	0.505	0.475	0.479	0.479	0.474	0.452	0.418
5.50 5.95	U15				100	86	10	21	1740	90	-	UU			m_v							
					200	92	7	21	1740						c_v							
					400	97	6	22	1730						k							
															e							
7.00 7.45	U19				150	170	8	18	1785	170	-	UU			m_v							
					300	178	12	21	1725						c_v							
					450	171	10	22	1710						k							
															e							
8.50 8.95	U23				150	61	20	26	1590	60	-	UU			m_v							
					300	66	20	27	1610						c_v							
					600	59	20	26	1555						k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

$m_v = m^2/MN$
$c_v = m^2/yr$
k = m/s $\times 10^{-8}$
e = void ratio at U 100% for each increment

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B220

FIGURE A1

Sheet 1 of 2

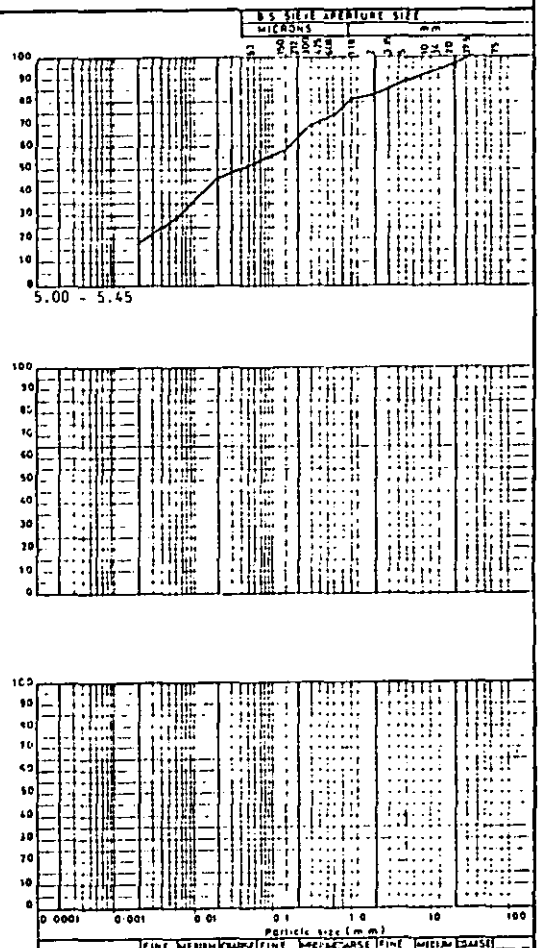
Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 15/16.8.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66394.3 E.
93937.3 N.
Ground Level: 52.69 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata
15.8.84	-	-	0.30	J1		0.30	52.39	TOPSOIL
			0.50	(40)2				Firm red brown slightly mottled yellow brown friable very sandy silty CLAY tending to silty clayey sand in zones with fragments of siltstone and mudstone (GLACIAL TILL)
			0.95					
			1.00	J3		1.00	51.69	
				S(17)				Firm to stiff red brown and light brown mottled grey green fissured slightly sandy silty CLAY with lithorelicts. (KEUPER MARL : ZONE III)
			1.45	J4				
			1.80	J5				
			2.00	(32)6				
			2.45					
			2.50	J7		2.50	50.19	
				S(14)				Firm red brown and grey green fissured slightly sandy very silty CLAY tending to sandy very clayey SILT in zones with lithorelicts of weak and very weak siltstone. (KEUPER MARL : ZONE IVb)
			2.95	J8				
			3.30	J9		3.30	49.39	
			3.50	(30)10				Red brown slightly mottled grey green friable micaceous clayey SILT tending to soft and very soft clay. (KEUPER MARL : ZONE IVa)
			3.95					
			4.00	J11		4.00	48.69	
				S(19)				Stiff to very stiff red brown fissured micaceous silty CLAY becoming firm slightly sandy very silty clay below 4.80m (KEUPER MARL : ZONE III/IVa)
			4.45	J12				
			4.80	J13				
			5.00	(42)14				
			5.45					
			5.50	J15				Bands of grey green clayey SILT with many lithorelicts of siltstone below 5.50m
				S(21)				
			5.95	J16				
			6.30	J17		6.30	46.39	
			6.50	(60)11				Stiff and very stiff red brown fissured silty CLAY with occasional lithorelicts and bands of grey green clayey silt. (KEUPER MARL : ZONE III)
			6.95					
			7.00	J19				
				S(28)				
			7.45	J20				
			7.80	J21				
15.8.84	7.50	Dry	8.00	W22				
16.8.84	7.50	4.50	8.30	J23				
			8.50	(85)24				
			8.95					

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr / pH
	2	19					0.03 / 7.7
	6	22	1685	33	18	100	0.04 / 8.2
	8	13					
	10			33	18	100	
	14	20	1685				0.06 / 8.2
	18	19	1775	30	19	100	
	22	-					0.16 / 7.0



Scale 1:

Disturbed Samples : W - Groundwater
● J - Jar
● S - S.P.T.
● B - Bulk
● M - Mazi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] - Vane shear strength in KN/m²

Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S SPT cone or spoon
(25) - N value

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B220

FIGURE A1

Sheet 2 of 2

Field Work by: _____
Method : _____
Dates : _____
Hole Dimensions _____
Casing Dimensions _____

Coordinates: E. N.

Ground Level: m O.D.

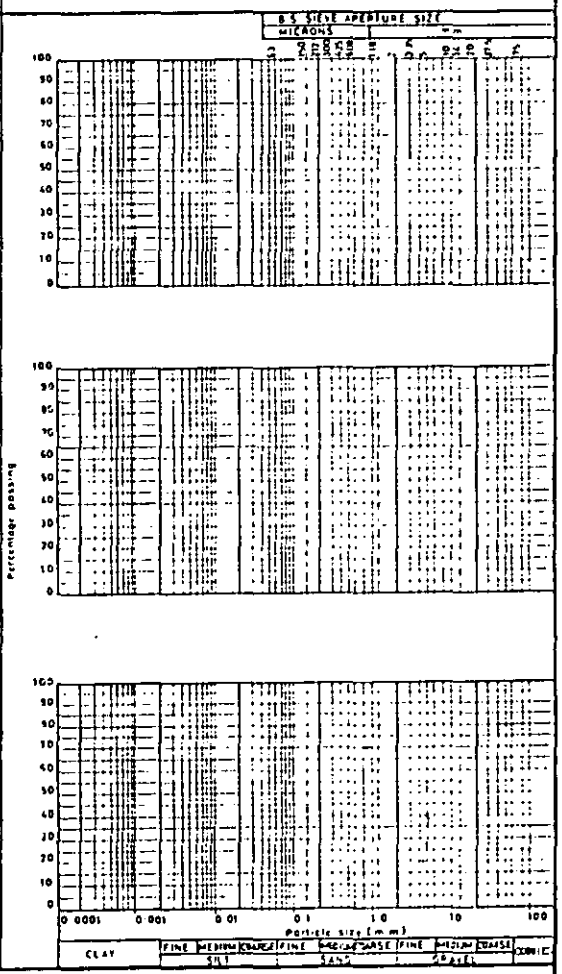
Laboratory Testing by: _____ Dates: _____

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu test Depth (m)	Sample/Insitu test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr / pH
			9.00	J25				Stiff and very stiff red brown mottled grey green fissured silty CLAY and very silty clay tending to clayey silt with many lithorelicts. (KEUPER MARL : ZONE III)								0.03
				S(50)												
			9.45	J26												8.0
			9.80	J27						28	18					
			10.00													
				(70)26						30	10					
			10.45													
			10.50	J29		10.50	42.19			32	22	1680	33	22	100	
				S(46)				Stiff and very stiff red brown mottled grey green fissured silty CLAY and very silty CLAY with many lithorelicts tending to very weak siltstone in zones (KEUPER MARL : ZONE II/III)								
			10.95	J30						36	19		33	23	100	
			11.30	J31		11.30	41.39									
			11.50					Very stiff red brown slightly mottled green grey friable silty CLAY. (KEUPER MARL : ZONE IVa)								
				(50)32												
			11.95			12.00	40.69									
			12.00	J33				Very weak grey green SILTSTONE moderately weathered with bands of stiff silty clay. (KEUPER MARL : ZONE II/III)								
				S(74)												
			12.45	J34												
			12.60	J35		12.80	39.89									
			13.00					Stiff and very stiff red brown mottled grey green fissured very silty CLAY tending to siltstone in zones becoming weak to moderately strong fissured siltstone below 13.50. (KEUPER MARL : ZONE II/III)								
				(96)36												
			13.45													
16.8.84	13.50	9.60	13.50	J37		13.50	39.19									
				S(50 for 65B)				End of Shell and Auger Hole.								

Hard Strata - 12.50 - 12.80 = ¾ hour
13.50 = 1 hour (No progress)

SB = Seating blows only

Bentonite seal 0.50 - 1.50
Gravel Filter 1.50 - 13.50
Standpipe installed at 13.50



Scale 1:

Disturbed Samples : W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] - Vane shear strength in KN/m²

Groundwater first struck

Core Cutter Density
Core Cutter Density/C.B.R

Sandbottle Density
C.B.R

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B220

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring Air Flush with Water Injection
Dates : 10/11.10.84
Core Diameter : 76mm
Casing Dimensions : 114.30mm

Coordinates : 66394.3 E, 93937.3 N
Ground Level : 52.69 m O.D.

Laboratory Testing by :
Dates :

Drilling							Test or II (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
Dates	Depth of casing(m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %		Legend	Depth (m)	Reduced Level	Detail	Main							
10.10.84	-	-									Rotary Open Holed through overburden alongside Shell and Auger Hole previously drilled to 12.50 (No Drillers Description) See Percussion borehole record Fig A1								
		seepage at 6.40																	

Scale 1 :
Disturbed Samples : J - Jar, S - S.P.T., B - Bulk, M - Mazi
W - Groundwater
Core Runs
core recovery %
Groundwater first struck
C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B220

FIGURE A2

Sheet 2 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by : Dates :

Drilling								Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
Dates	Depth of casing(m)	Depth to water (m)	Depth (m)	Run	CR %	R.Q.D %	Test or II (mm)	Legend	Depth (m)	Reduced Level	Detail	Main							
10.10.84	4.50	7.30							12.50	40.19	See Sheet 1 of 3								
11.10.84	4.50	5.10	12.50		99%	0%	NI 70 95		13.27	39.42	Slightly weathered moderately weak band at 13.00 - 13.20	Highly weathered fissured red brown siltstone degraded to stiff silty CLAY with many lithorelicts. (KEUPER MARL : ZONE III)							
			13.50		94%	42%	NI 50 380				Bands of slightly weathered moderately weak to moderately strong siltstone at: 14.20 - 14.40, 15.95 - 16.34, 17.97 - 18.67, 19.34 - 19.90 Highly weathered zone at: 18.67 - 18.79 Sub-vertical discontinuities at: 19.34 - 19.41, 19.91 - 19.97	Slightly weathered fissured red brown occasionally mottled grey green very weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE II)			15.27		28	17	
			14.40		99%	70%	NI 160 460												
			15.95																
			15.99		100%	55%	CPT ↕ NI 155 170			(50 for 44mm SB)									
			17.00		98%	49%	NI 80 300												

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mazi

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B220

FIGURE A2

Sheet 3 of 3

Field Work by : _____
Method : _____
Dates : _____
Core Diameter : _____
Casing Dimensions : _____

Coordinates : _____ E
_____ N
Ground Level : _____ m O.D.

Laboratory Testing by : _____ Dates : _____

Drilling							Test or Fl (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
Dates	Depth of casing(m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %		Legend	Depth (m)	Reduced Level	Detail	Main							
												See sheet 2 of 3			18.26 19.23 18.80 19.23	9.7	31	18	1909
			19.50																
11.10.84			20.00		100%	0%	NI 60 80		20.00	32.69									
			20.25				CPT			(43SB 73 for 110mm)		End of Rotary Hole. NI = Not Intact SB = Seating Blows							

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - SPT
B - Bulk
M - Maxi

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B220

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at Failure		Strain at Failure			C	Ø	Type of Shear Test	Initial		Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)							
2.00 2.45	U6				50	75	20			75	–	UU			m_v							* Excessive Strain
					150	*		22	1685						c_v							
					300										k							
															e							
3.50 3.95	U10				101	210	7.2	21	1680						m_v							
					200	310	7.2	19	1780			$\overline{CD}$			c_v							
					300	406	7.8	19	1810	60	30				k							
															e							
5.00 5.45	U14				100	74	15.5			85	–				m_v							
					200	83	17	20	1685			UU			c_v							
					400	91	18								k							
															e							
6.50 6.95	U18				150	139	12	29	1770	140	–				m_v							
					300	102	8	19	1770			UU			c_v							
					450	180	20	19	1780						k							
															e							
11.50 11.95	U32				200	145	8	22	1670	150	–				m_v							
					400	117	20	22	1675			UU			c_v							
					800	174	20	22	1690						k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p. measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p. measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p. measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s x 10^{-8}
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

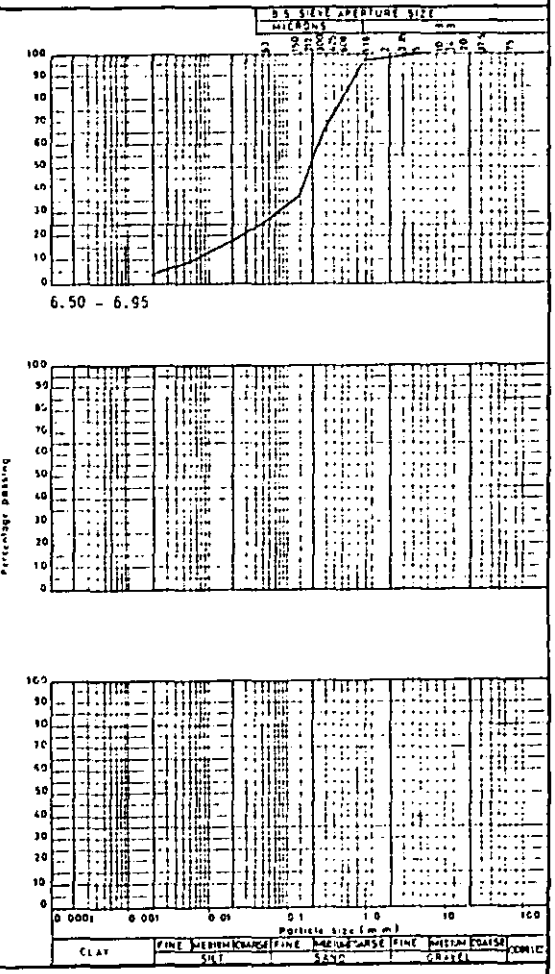
BOREHOLE No B221
FIGURE A1
Sheet 1 of 2

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 17/20.8.84
Hole Dimensions 150mm
Casing Dimensions 150mm

Coordinates: 66407.2 E.
93929.0 N.
Ground Level: 52.32 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr / pH
17.8.84	-	-	0.30	J1				Red brown clayey silty SAND with fine to coarse gravel and much fine to medium gravel (flint sandstone, siltstone and mudstone). (GLACIAL TILL)		3	18					
			0.50	(20)2		0.80	51.52									
			0.95					Firm red brown slightly mottled grey green fissured silty sandy CLAY with occasional lithorelicts of mudstone and siltstone. (KEUPER MARL : ZONE III/IVa)		8	19					
			1.00	J3												
				S(15)						16	19					
			1.45	J4												
			1.80	J5						18			32	16	100	0.03 / 7.5
			2.00					Becoming silty clay below 1.00m								
			2.45	(54)6						20	17					
			2.50	J7		2.50	49.82									
				S(23)				Stiff red brown slightly mottled grey green friable very silty CLAY. (KEUPER MARL : ZONE IVa)		22	22	1665	32	19	100	0.04 / 8.1
			2.95	J8												
			3.30	J9												
			3.50					Tending to clayey silt below 3.80m								
			3.95	(41)10												
			4.00	J11												
				S(27)												
			4.45	J12												
		4.8	4.80	J13		4.80	47.52									
			5.00					Stiff red brown fissured micaceous slightly sandy very silty CLAY. (KEUPER MARL : ZONE IV)								
				(37)14												
		20 ains	5.45													
		5.6	5.50	J15												
				S(26)												
17.8.84	5.50	4.80	5.95	J16												
20.8.84	5.50	2.80	6.30	J17												
			6.50			6.50	45.82									
				(60)18				Stiff-very stiff red brown very silty CLAY tending to clayey silt with bands of weak and very weak siltstone and mudstone.								
			6.95													
			7.00	J19												
				S(23)												
			7.45	J20												
			7.80	J21				Bands of weak to moderately weak siltstone noted at 7.00, 7.80, 8.80m (KEUPER MARL : ZONE II/III)								
			8.00													
				(50)22												
		8.4	8.45													
			8.50	J23												
				S(25)												
			8.95	J24												



6.50 - 6.95

Scale 1:

Disturbed Samples : W - Groundwater
● J - Jar ● S - S.P.T. ● B - Bulk ● M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V C30] - Vane shear strength in KN /m²
Groundwater first struck
□ Core Cutter Density
■ Core Cutter Density/C.B.R
▽ Sandbottle Density
▲ C B R
C or S SPT cone or spoon
(25) - N value

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A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B221

FIGURE A1

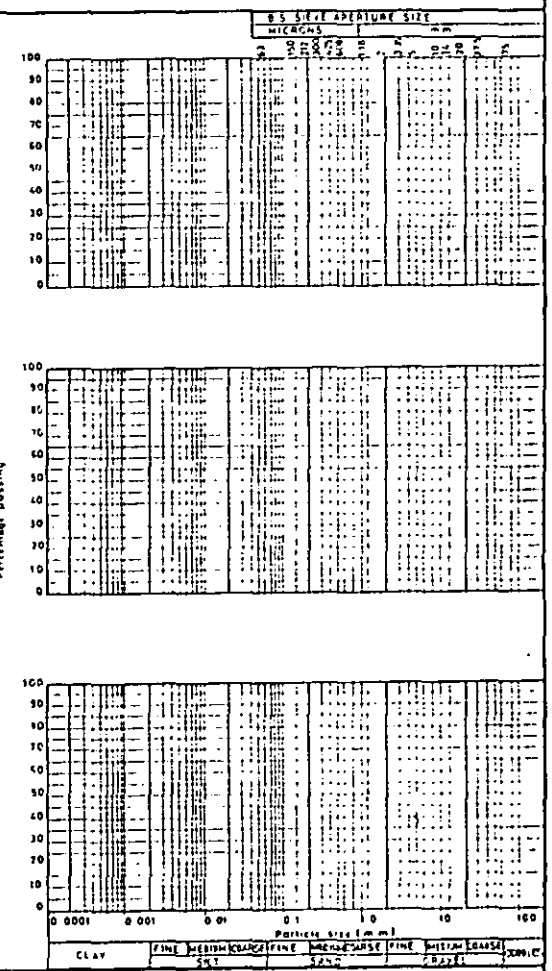
Sheet 2 of 2

Field Work by: _____
Method : _____
Dates : _____
Hole Dimensions _____
Casing Dimensions _____

Coordinates : E.
N.
Ground Level: m O.D.

Laboratory Testing by: _____ Dates: _____

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% Passing 425 microns
			9.30	J25				See Sheet 1 of 2		26	21	1705			
			9.50	(50)26						28	19				
			9.95			10.00	42.32								
			10.00	J27 S(47)				Stiff and very stiff red brown mottled grey green fissured very silty CLAY with some lithorelicts of siltstone and occasional bands of weak and moderately weak siltstone at 11.50 - 12.30 (KEUPER MARL : ZONE II/III)		35	14				
			10.45	J28											
		U 4ins	10.80	J29											
			11.00	(80)30											
			11.45												
		▼11.5	11.50	J31,W32 S(111)											
			11.95	J33											
			12.30	J34											
			12.50	(98)+											
			12.65												
			12.60	J35 S(50 for 50mm)											
20.8.84	13.00	5.80	13.05			13.05	39.27	End of Shell and Auger Hole. SB = Seating Blows only Hard Strata - 12.65 - 13.00 = 1½ hours + Failed U sample							



Scale 1:

Disturbed Samples : W - Groundwater ● J - Jar ● S - S.P.T. ● B - Bulk ● M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V C30 - Vane shear strength in KN /m²

Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C.B.R.

C or S S.P.T. cone or spoon (25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B221

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring Air Flush with Water Injection
Dates : 9/10.10.84
Core Diameter : 76mm
Casing Dimensions : 133.35mm

Coordinates : 66407.2 E
93929.0 N
Ground Level : 52.32 m O.D.

Laboratory Testing by :
Dates :

Drilling							Test or Jt (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Dates	Depth of casing(m)	Depth to water (m)	Depth (m)	Run	CR %	R.Q.D %		Legend	Depth (m)	Reduced Level	Detail	Main									
9.10.84	-	-									Rotary Open Holed through overburden alongside Shell and Auger Hole previously drilled to 12.00 (No Drillers Description) See Percussion Borehole record Fig A1										
		Water seepage at 3.7																			

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mazi

Core Runs
50
100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B221

FIGURE A2

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by : Dates :

Drilling							Test or Fl (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
Dates	Depth of casing/hole (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %		Legend	Depth (m)	Reduced Level	Detail	Main							
											See Sheet 1 of 3								
9.10.84	4.50	6.80	12.00						12.00	40.32									
10.10.84	4.50	3.10			93%	44%	NI 140 310				Slightly weathered grey green moderately weak bands at: 12.43 - 12.46, 13.02 - 13.42, 14.54 - 14.70.	Moderately weathered fissured red brown very weak calcareous SILTSTONE. Very and extremely closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE II)			12.24 12.43		30	18	
			13.30		97%	22%	NI 90 215			(70 for 138mmSB)									
			14.30 14.43				CPT		14.70	37.62									
					100%	56%	NI 150 430				Slightly weathered grey green moderately weak bands at: 16.55 - 16.76 Sub-vertical discontinuities at: 16.84 - 16.89	Slightly weathered fissured red brown very weak calcareous SILTSTONE. Very and extremely closely spaced sub-horizontal smooth discontinuities. (KEUPER MARL : ZONE II)			15.21		27	18	
			17.00		96%	63%	40 90 370			(50 for 71mmSB)									
			17.85 17.92				CPT												

Scale 1 :

Disturbed Samples :
W = Groundwater
J = Jar
S = S.P.T.
B = Bulk
M = Mazi

50 100 Core Runs core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B221

FIGURE A2

Sheet 3 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of Casing (m)	Depth to Water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or It (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details
									18.60	33.72		As Sheet 2 of 3	
					100%	62%	NI 190 590				Highly weathered zones at: 19.39 - 19.42, 19.48 - 19.66, 20.56 - 20.76 degraded to stiff silty clay with many lithorelicts.	Slightly weathered very thinly bedded grey green occasionally red brown moderately weak SILTSTONE. Very and extremely closely spaced rough discontinuities. (KEUPER MARL : ZONE II)	
			19.90										
					95%	38%	NI 190 280		21.05	31.27	Slightly weathered grey green weak bands at: 22.00 - 22.12, 22.69 - 22.78.	Highly weathered fissured red brown very weak calcareous SILTSTONE. Very to extremely closely spaced rough sub-horizontal discontinuities. (KEUPER MARL : ZONE III)	
			22.00										
					98%	26%	NI 110 200		22.83	29.49	Sub-vertical discontinuities at: 23.37 - 23.44, 23.65 - 23.68,	Slightly weathered fissured red brown occasionally grey green weak to moderately weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal smooth discontinuities. (KEUPER MARL : ZONE II)	
			24.00										
10.10.84	4.50				98%	73%	50 140 325		25.00	27.32			
			25.00				CPT			(87)		End of Rotary Hole.	
			25.45									NI = Not Intact SB = Seating Blows	

Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)

Scale 1 :

Disturbed Samples :
W = Groundwater
J = Jar
S = SPT
B = Bulk
M = Moisture

Core Runs
core recovery %

Groundwater first struck

C or S = S.P.T. cone or spoon
(25) = N value

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Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B221

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength								Initial		Consolidation							Notes
					Stress at Failure		Strain at Failure			C	Ø	Type of Shear Test				Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)		0 - 100	100 - 200	200 - 400	400 - 800	800 - 200			
6.50 - 6.95	U18				100	137	9.3	24	1600			$\overline{CD}$			m_v							
					201	218	7.9	26	1620						c_v							
					399	397	9.7	28	1620	20	28				k							
															e							
8.00 - 8.45	U22				150	96	12	23	1665	130	-	UU	22	1675	m_v	0.31	0.13	0.08	0.06	0.01		
					300	101	6	22	1640						c_v	-	18.75	15.84	34.17	-		
					600	179	17	22	1690						k	-	23.91	12.43	20.11	-		
															e	0.532	0.512	0.486	0.449	0.459		
9.50 - 9.95	U26				200	131	5	21	1700	150	-	UU			m_v							
					400	190	6	21	1700						c_v							
					800	135	3	21	1710						k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s x 10^{-8}
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B222
FIGURE A1
Sheet 1 of 2

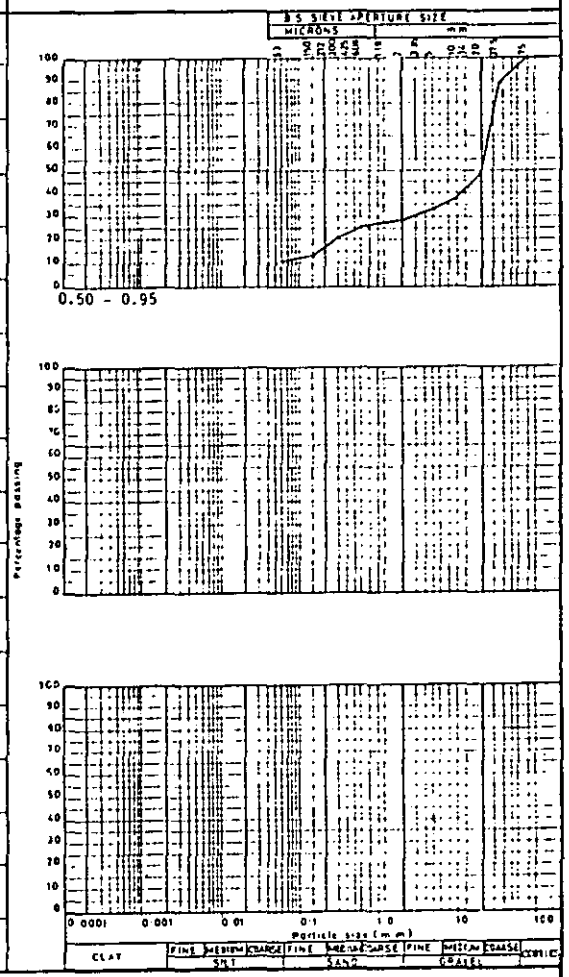
Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 21/23.8.84
Hole Dimensions 150mm
Casing Dimensions: 150mm

Coordinates: 66418.8 E.
93907.8 N.
Ground Level: 53.02 m OD.

Laboratory testing by: Dates:

Date	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata
21.8.84			0.30	J1				Red brown clayey silty SAND with some fine to medium gravel (flint, siltstone, sandstone) (GLACIAL TILL)
			0.50	(30)2				
			0.95					
			1.00	J3				
				S(3)				Lens of fine to coarse gravel with interstitial sandy silty clay at 1.00m
			1.45	J4				Tending to sandy silty clay below 1.10m
						1.60	51.42	
			1.80	J5				Stiff red brown mottled grey green fissured silty CLAY. (KEUPER MARL : ZONE IVa)
			2.00	(26)6				
			2.45					
			2.50	J7		2.50	50.52	
				S(12)				Stiff and firm red brown and grey green fissured very silty CLAY tending to very clayey silt in zones with many mudstone and siltstone lithorelicts (KEUPER MARL : ZONE III)
			2.95	J8				
			3.00					
			3.30	J9				
			3.50	B10, J11				
				(59)12				
			3.95					Becoming firm with occasional lithorelicts below 3.30m
			4.00	J13		4.00	49.02	
				S(19)				Stiff red brown fissured silty CLAY. (KEUPER MARL : ZONE IVa)
			4.45	J14				
			4.50	B15				
			4.80	J16				
			5.00	(30)17				Band of weak to moderately weak mudstone noted at 5.50m
			5.45					
			5.50	J18				
				S(15)				Becoming very silty clay tending to very clayey silt in zones below 6.30m
			5.95	J19				
			6.30	J20				
			6.50	(60)21				
			6.95					
			7.00	J22		7.00	46.02	
				S(37)				Stiff and very stiff red brown fissured silty CLAY with occasional mudstone lithorelicts becoming very silty clay in zones. (KEUPER MARL : ZONE III)
			7.45	J23				
		7.8	7.80	J24				
			8.00	(50)25				
			8.45					
			8.50	J26				Becoming faintly laminated with many mudstone lithorelicts below 8.50m
		9.0		S(27)				
			8.95	J27				

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
	1	11				
	2	12		37	15	47
	5	23				
	10	22		34	19	79
	15	21		33	19	100
	21	17	1815			
	25	20	1740			



Scale 1:

Disturbed Samples : W — Groundwater
● J — Jar
● S — S.P.T.
B — Bulk
● M — Mazi

Undisturbed Samples : Soil Sample

Insitu Tests : V (30) — Vane shear strength in KN/m²

Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S SPT cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B222

FIGURE A1

Sheet 2 of 2

Field Work by: _____
Method : _____
Dates : _____
Hole Dimensions : _____
Casing Dimensions : _____

Coordinates : E. N.

Ground Level: m O.D.

Laboratory Testing by : _____ Dates: _____

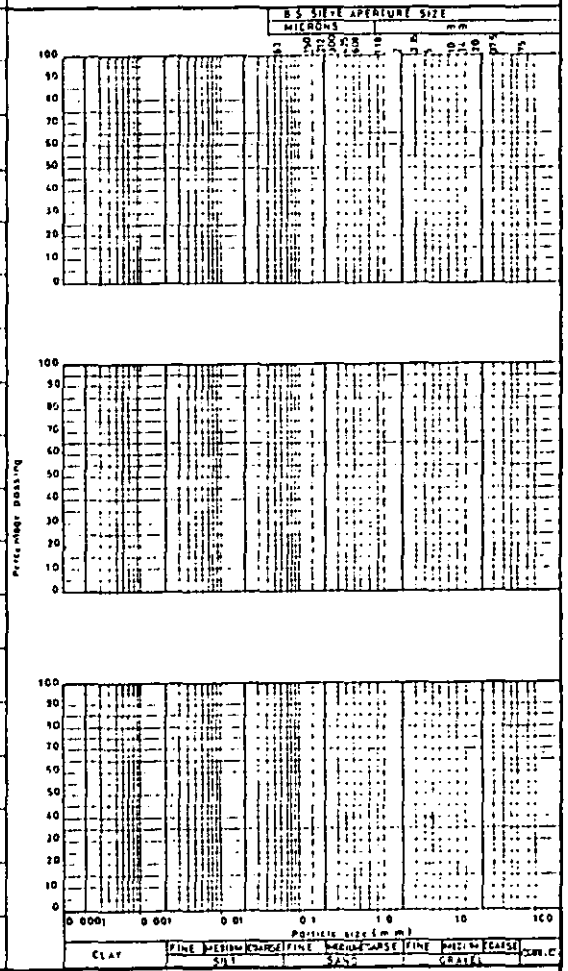
Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu test Depth (m)	Sample/Insitu test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata
			9.00	W28				Bands of moderately weak to weak calcareous siltstone noted at 9.30 - 10.00
			9.30	J29				
			9.50	(65)30				
			9.95					
			10.00	J31		10.00	43.02	
				S(81)				
21.8.84	9.00	9.80	10.45	J32				Very stiff red brown mottled grey green fissured silty CLAY with many lithorelicts of mudstone and siltstone and occasional bands of weak and very weak mudstone and siltstone. (KEUPER MARL : ZONE II/III)
23.8.84	9.00	10.50	10.80	J33				
			11.00	(108)34				
			11.45					
			11.50	J35 *				Band of moderately weak siltstone at 12.00
			11.80	S(76 for 130 150mm				
			12.00					
23.8.84	12.00	5.30	12.05	S(50 for 50mm)		12.05	40.97	
								End of Shell and Auger Hole.

* Seating Blows - J36 = 31
SB = Seating Blows only

Hard Strata - 11.80 - 12.00 = 1 hour

Bentonite seat 0.50 - 1.50
Gravel filter 1.50 - 12.00
Standpipe installed to 12.00

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
	30	29	1580	38.	22	100
	32	16				



Scale 1:

Disturbed Samples : W = Groundwater ● J = Jar ● S = S.P.T. ● B = Bulk ● M = Mazi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] = Vane shear strength in KN /m² ▼ Groundwater first struck

□ Core Cutter Density ■ Core Cutter Density/C.B.R ▽ Sandbottle Density ▲ C B R

C or S - S.P.T. cone or spoon (25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B222

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring Air Flush with Water Injection
Dates : 15.10.84
Core Diameter : 76mm
Casing Dimensions : 133.35mm

Coordinates : 66418.8 E
93907.8 N
Ground Level : 53.02 m O.D.

Laboratory Testing by :
Dates :

Drilling							Test or Tr (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %		Legend	Depth (m)	Reduced Level	Detail	Main									
											Rotary Open Holed through overburden alongside Shell and Auger hole previously drilled to 11.00 (No Drillers Description)										

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mast

Core Runs
50
100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B222

FIGURE A2

Sheet 2 of 3

Field Work by : _____
Method : _____
Dates : _____
Core Diameter : _____
Casing Dimensions : _____

Coordinates : _____ E
_____ N
Ground Level : _____ m O.D.

Laboratory Testing by : _____ Dates : _____
_____ _____

Drilling								Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
Date	Depth of Casing (m)	Depth to water (m)	Depth (m)	Run	CR %	R.Q.D. %	Test or II (mm)	Legend	Depth (m)	Reduced Level	Detail	Main							
									11.00	42.02		As sheet 1 of 3							
15.10.84		Water Inflow ▼ at 11.6	11.00		97%	24	NI 90 140				Highly weathered zones at: 12.00 - 12.18, 12.40 - 12.60. degraded to stiff silty clay with many lithorelicts.	Highly weathered fissured red brown occasionally grey green very weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal rough discontinuities (KEUPER MARL : ZONE III)								
			12.00		100%	20%	NI 70 150				Moderately weathered bands at: 11.42 - 11.59, 11.70 - 11.86, 13.20 - 13.29, 13.85 - 13.90.								
			13.20		92%	12%	NI 70 100		14.00	39.02									
			14.00 14.05				CPT ↕			(50 for 58mmSB)	Highly weathered zones at: 14.28 - 14.31, 14.45 - 14.52, 15.34 - 15.44, 19.00 - 19.50 degraded to stiff silty clay with many lithorelicts.	Slightly weathered fissured red brown occasionally grey green very weak to weak calcareous SILTSTONE Very to extremely closely spaced rough and smooth sub-horizontal discontinuities.								
					100%	28%	NI 115 140				Sub-vertical discontinuities at: 14.00 - 14.07, 16.10 - 16.39, 18.21 - 18.29.	(KEUPER MARL : ZONE II/III)								
			15.30		98%	48%	NI 120 250												
			17.00		98%	11%	NI 70 110												
			18.00																

Scale 1 :

Disturbed Samples : W - Groundwater
J - Jar, S - S.P.T., B - Bulk, M - Mazi

50 / 100 Core Runs
core recovery %

▼ Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B222

FIGURE A2

Sheet 3 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling							Test or II (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %		Legend	Depth (m)	Reduced Level	Detail	Main									
			18.00 18.22				CPT NI 80 225			(54SB, 50 for 73mm)		See sheet 2 of 3									
					100%	47%			19.50	33.52											
			19.50				NI 60 125					Slightly weathered fissured grey green occasionally red brown weak to moderately weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal rough discontinuities (KEUPER MARL : ZONE II)									
					95%	15%															
			21.00				NI 70 150		21.51	31.51											
			21.70		96%	40%	NI 130 250		23.70	29.32	Slightly weathered grey green moderately weak bands at: 22.45 - 22.63 Highly weathered zones at: 23.21 - 23.70	Moderately weathered fissured red brown occasionally grey green very weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal rough discontinuities (KEUPER MARL : ZONE II/III)									
			23.80				CPT NI 70 220			(134)	45° discontinuities at: 24.76 - 24.82	Slightly weathered fissured red brown and grey green very weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal rough discontinuities (KEUPER MARL : ZONE II)									
15.10.84	4.50		24.25		98%	29%															
			25.00						25.00	28.02		End of Rotary Hole. NI = Not Intact SB = Seating Blows.									

Scale 1 :

Disturbed Samples :
W - Groundwater

J - Jar
S - S.P.T.
B - Bulk
M - Maxi

50
100

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B222
FIGURE B
Sheet 1 of 1

Sample Depth (m)	Sample Type & Number	Compaction: Type of Test	Compaction: Optimum Moisture Content (%)	Compaction: Maximum Dry Density (kg/m³)	Shear Strength: Stress at Failure σ_3 (kN/m²)	Shear Strength: Stress at Failure $\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	Shear Strength: Strain at Failure (%)	Shear Strength: Moisture Content (%)	Shear Strength: Dry Density (kg/m³)	Shear Strength: C / C' (kN/m²)	Shear Strength: Ø / Ø' (Degrees)	Shear Strength: Type of Shear Test	Initial: Moisture Content (%)	Initial: Dry Density (kg/m³)	Consolidation	Pressure Range (kN/m²)						Notes
																0 161	161 322	322 161	161 322	322 644		
3.00 3.45	B10				50	22	20	24	1630	24	-	REM UU			m_v							
					100	26	20	24	1650						c_v							
					150	25	20	24	1640						k							
															e							
4.00 4.45	B15				50	52	7.2	21	1690			REM CD			m_v							
					100	107	4.8	22	1680						c_v							
					199	204	8.5	22	1680	0	29				k							
															e							
6.50 6.95	U21				100	133	7	16	1825	140	-	UU			m_v							
					200	152	13	16	1825						c_v							
					400	131	6	20	1785						k							
															e							
8.00 8.45	U25				150	129	11	20	1750	150 (100	- 5)*	UU	23	1700	m_v	0.26	0.10	0.01	0.02	0.07		* alternative interpretation
					300	154	15	20	1740						c_v	-	36.20	-	35.65	28.73		
					600	166	20	21	1720						k	-	35.51	-	6.99	19.73		
															e	0.495	0.471	0.474	0.469	0.437		
9.50 9.95	U30				200	175	12.5			190	-	UU			m_v							
					400	193	14.5	29	1580						c_v							
					800	202	16								k							
															e							
															m_v							
															c_v							
															k							
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															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s $\times 10^{-9}$
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B223

FIGURE A1

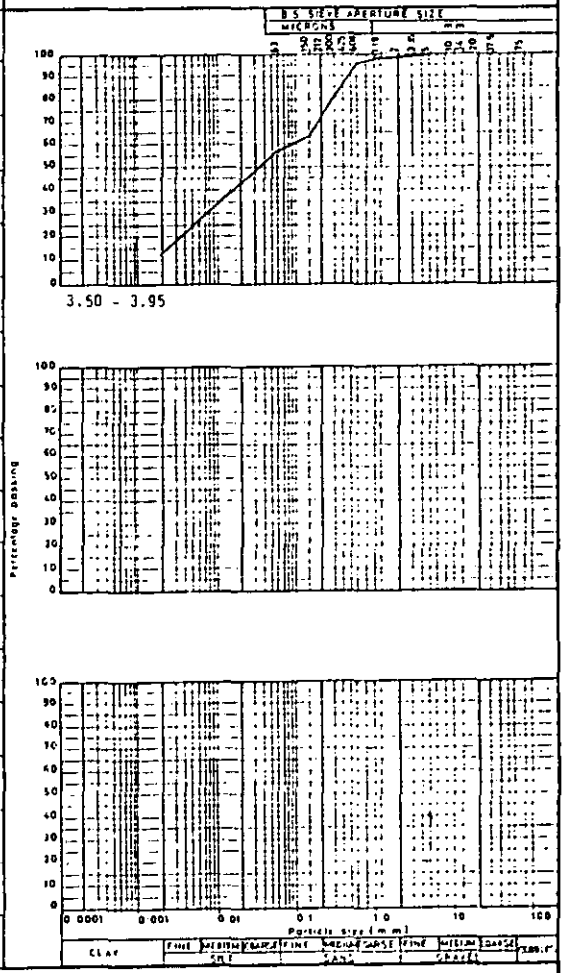
Sheet 1 of 2

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 29/30.8.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66431.3 E.
93899.8 N.
Ground Level: 53.43 m OD.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata	Standpipe/Pipework Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	%passing 425 microns
29.8.84	-	-	0.30	J1		0.30	53.13	TOPSOIL		1.1	9.7				
			0.50	(27)2		0.80	52.63	Red brown clayey silty SAND with some fine to medium gravel, occasional flint. (GLACIAL TILL)		4	19				
			0.95 / 1.00	J3 S(11)				Firm red brown fissured sandy silty CLAY with some fine to medium gravel and flints and traces of carbonaceous material. (GLACIAL TILL)		6	26	1495	47	21	100
			1.45	J4		1.60	51.83	Occasional pockets of silty sand below 1.00m		10			37	19	100
			1.80	J5				Firm red brown slightly mottled grey green silty CLAY with occasional mudstone lithorelicts. (KEUPER MARL : ZONE III)		18	19	1770	32	19	100
			2.00	(28)6											
			2.45 / 2.50	J7 S(7)				Occasional bands of clayey silt with some		23	18	1780			
			2.95	J8				lithorelcits of siltstone below 2.50m							
			3.30	J9		3.30	50.13								
			3.50	(47)10				Firm and soft red brown and grey green silty CLAY and very silty CLAY with many lithorelicts of mudstone and siltstone (KEUPER MARL : ZONE III)							
			3.95 / 4.00	J11 S(10)		4.00	49.43								
			4.45	J12				Red brown fissured clayey silty fine SAND with traces of carbonaceous material and bands of silty clay and sandy clayey silt with some lithorelicts (KEUPER MARL : ZONE III)							
			4.80	J13											
			5.00	(45)14											
			5.45 / 5.50	J15 S(25)											
			5.95	J16		5.80	47.63								
			6.30	J17				Stiff red brown slightly mottled grey green fissured silty CLAY with some lithorelicts of mudstone and siltstone. (KEUPER MARL : ZONE III) Very stiff in parts. Zones of clayey silty sand at 7.00m							
			6.50	(65)18											
		7.0	6.95 / 7.00	J19 S(35)											
			7.45	J20											
			7.80	J21											
29.8.84	6.00	Dry													
30.8.84	6.00	4.30	8.30	J22											
			8.50	(70)23											
			8.95 / 9.00	J24		9.00	44.43								



Scale 1:

Disturbed Samples: W - Groundwater
J - Jar, S - S.P.T., B - Bulk, M - Maxi

Undisturbed Samples: Soil Sample

Insitu Tests: V C30] - Vane shear strength in KN/m²
Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R
▽ Sandbottle Density
▲ C B R.
C or S - S P T cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B223

FIGURE A1

Sheet 2 of 2

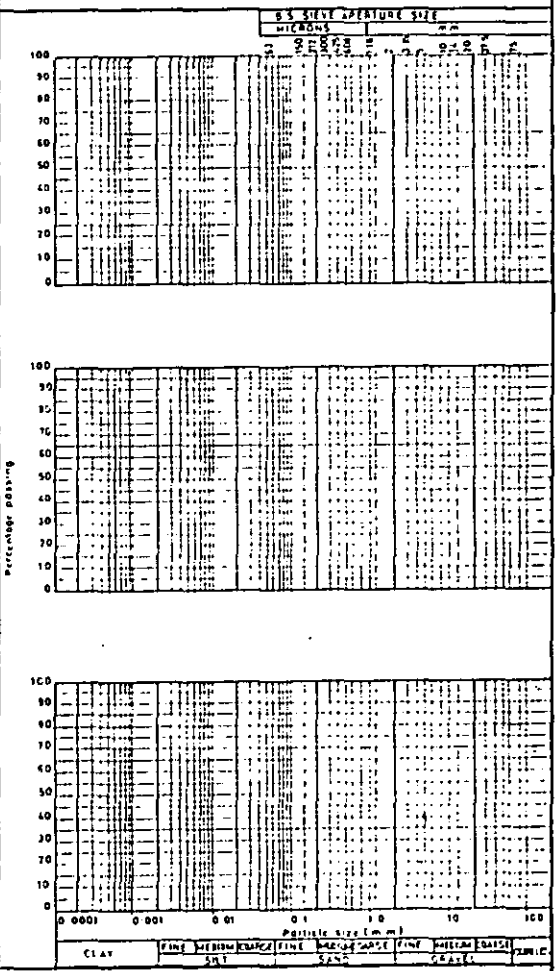
Field Work by: _____
Method : _____
Dates : _____
Hole Dimensions: _____
Casing Dimensions _____

Coordinates: E. N.

Ground Level: m OD

Laboratory Testing by. Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr / pH
			9.00	S(26)				Stiff red brown and grey green very silty CLAY tending to very clayey silt with many mudstone, siltstone lithorelicts and bands of weak and very weak siltstone. (KEUPER MARL : ZONE II/III)		25	23					
		▼ 9.6	9.50	J25												
			9.80	J26,W27						27	—					0.15 / 7.1
			10.00													
			10.45	(70)28						30	14					
			10.50	J29												
				S(37)						40	17		34	18	100	
			10.95	J30												
			11.30	J31												
			11.50													
				(110)32#				Band of weak and very weak siltstone at 13.50. Becoming very stiff below 13.60m								
			11.95													
			12.00	J33												
				S(54)												
			12.45	J34												
			12.80	J35												
			13.00													
				(130)36#												
			13.45													
			13.50	J37												
				S(55)#												
			13.95	J38												
			14.30	J39												
			14.50													
				S(57)												
30.8.84	13.50	7.20	14.95	J40		15.00	38.43									
								End of Shell and Auger Hole. # Samples taken in water.								



Scale 1:

Disturbed Samples : W — Groundwater

● J — Jar
● S — S.P.T.
● B — Bulk
● M — Mazi

Undisturbed Samples : Soil Sample

Insitu Tests : V C30] — Vane shear strength in KN /m²

▼ Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R.

C or S - S P T cone or spoon
(25) — N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B223

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring Air Flush with Water Injection
Dates : 12.10.84
Core Diameter : 76mm
Casing Dimensions :

Coordinates : 66431.3 E
93899.8 N
Ground Level : 53.43 m O.D.

Laboratory Testing by :
Dates :

Drilling							Test or II (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Dates	Depth of casing(m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %		Legend	Depth (m)	Reduced Level	Detail	Main									
12.10.84	-	-									Rotary Open Holed through overburden alongside Shell and Auger Hole previously drilled to 14.00m (No Drillers Description)										

Scale 1:

Disturbed Samples
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B223

FIGURE A2

Sheet 2 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D

Laboratory Testing by : Dates :

Drilling: Dates	Depth of Casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or ø (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
		Seepage 4.5 ▼ 12.00									See Sheet 1 of 3								
			14.00						14.00	39.43		Moderately weathered very weak friable dark red brown mottled grey green calcareous micaceous SILTSTONE with extremely closely spaced discontinuities thinly bedded with some silty clay along sub-horizontal discontinuities. (KEUPER MARL : ZONE II)							
					95%	11%	NI 40 110		14.45	38.98		Slightly weathered moderately weak to weak light grey green SILTSTONE with some low amplitude ripple bedding very weak closely spaced discontinuities. (KEUPER MARL : ZONE I)							
			15.00						14.60	38.83	Occasional thin very weak siltstone bands throughout.								
					95%	54%	NI 40 540		16.00	37.43		Dark red brown mottled grey green SILTSTONE (degraded to very stiff clay) (KEUPER MARL:ZONE III)							
			16.00									Moderately weathered very weak friable dark red brown SILTSTONE thinly bedded with extremely closely spaced discontinuities (KEUPER MARL : ZONE II)							
					95%	23%	NI 40 230												
			17.00				CPI ↕			(90)		Slightly to moderately weathered very weak and weak SILTSTONE thinly bedded with some low amplitude ripple bedding in places with very closely spaced horizontal discontinuities (KEUPER MARL : ZONE I)							
			17.45		92%	30%	NI 60 240		17.45	35.98									

Scale 1 :

Disturbed Samples : • J - Jar, S - S.P.T., B - Bulk, M - Mazi
W - Groundwater

Core Runs: 50, 100 — core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B223

FIGURE A2

Sheet 3 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling							Test or ll (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
Dates	Depth of casing	Depth to water (m)	Depth (m)	Run	CR %	RQD %		Legend	Depth (m)	Reduced Level	Detail	Main							
												See sheet 2 of 3							
									18.10	35.33		Highly weathered siltstone degraded to very stiff friable dark red brown silty CLAY with many lithorelicts tending to a very weak siltstone in places. (KEUPER MARL : ZONE III)			18.24 18.49	13	27	17	1970
			19.00																
					97%	52%	NI 30 520		19.60	33.83									
12.10.84			20.00						20.00	33.43		Moderately weathered weak light grey green mottled red brown SILTSTONE with very closely spaced sub-horizontal discontinuities containing some silty clay. (KEUPER MARL : ZONE II)							
												End of Rotary Hole							
												NI = Not Intact.							

Scale 1 :

Disturbed Samples :
W - Groundwater
• J - Jar
S - S.P.T.
B - Bulk
M - Mast

50
100

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value.

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Laboratory Testing by : Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B223
FIGURE B
Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation										Notes
					Stress at Failure		Strain at Failure			C	Ø	Type of Shear Test	Initial		Pressure Range [kN/m²]								
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)									
2.00 2.45	U6				50	46	9	26	1490	60 (36	– 7)*	UU			m_v								* alternative interpretation
					150	56	6	26	1486						c_v								
					300	79	8	26	1505						k								
															e								
3.50 3.95	U10				50	75	5.1	24	1560			$\overline{CD}$			m_v								
					147	153	7.9	25	1580						c_v								
					298	328	9.5	25	1580	0	31				k								
															e								
6.50 6.95	U18				100	130	13.5			140 (119	– 3)*	UU			m_v								* alternative interpretation
					200	141	16	19	1770						c_v								
					400	151	20								k								
															e								
8.50 8.95	U23				200	140	8	18	1795	150	–	UU			m_v								
					400	128	19	19	1750						c_v								
					800	173	11	17	1790						k								
															e								
															m_v								
															c_v								
															k								
															e								
															m_v								
															c_v								
															k								
															e								
															m_v								
															c_v								
															k								
															e								
															m_v								
															c_v								
															k								
															e								

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

$m_v = m^2/MN$
$c_v = m^2/yr$
k = m/s x 10^{-8}
e = void ratio at U 100% for each increment

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BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B224

FIGURE A1

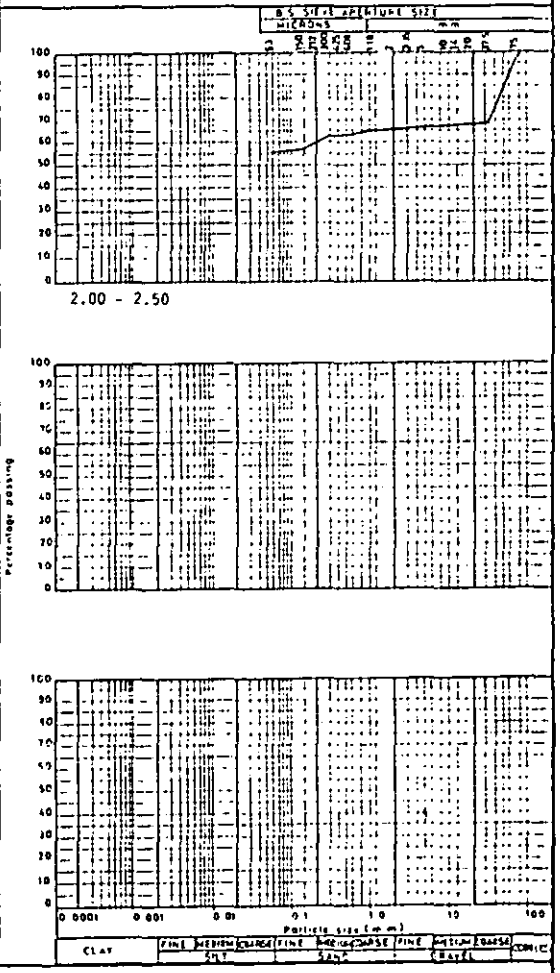
Sheet 1 of 2

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 23/24.8.84
Hole Dimensions 150mm
Casing Dimensions 150mm

Coordinates: 66438.4 E.
93911.5 N.
Ground Level: 53.30 m O.D.

Laboratory testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test: Depth (m)	Sample/Insitu Test: Type & Number	Change of Strata: Legend	Change of Strata: Depth (m)	Change of Strata: Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/litre / pH
23.8.84			0.30	J1		0.10	53.20	Firm dark grey sandy TOPSOIL								
			0.50	(39)2		0.80	52.50	Dark brown clayey SILT with some fine to coarse gravel. (GLACIAL TILL)		1	8.2					
			0.95							4	29					
			1.00	J3				Soft red brown and grey green silty CLAY with very silty clay with some siltstone lithorelicts and pockets of brown silty sand. (KEUPER MARL : ZONE III)		6	33	1400	41	19	89	
			1.45	S(4) J4						8	29					0.01 / 7.9
			1.80	J5						9	18		Untestable			
			2.00	(20)6												
			2.45													
			2.50	J7,B8		2.50	50.80									
				S(4)						15	22	1680	33	19	100	-
			2.95	J9				Soft to firm red brown mottled grey green very silty CLAY tending to clayey silt in zones with occasional bands of weak and very weak siltstone. (KEUPER MARL : ZONE III/IVa)		24	34	1510	33	19	100	
			3.30	J10												
			3.50	(48)11												
			3.95													
			4.00	J12				Occasional lithorelicts of mudstone and siltstone below 4.00m								
				S(11)												
			4.45	J13												
			4.80	J14												
			5.00	(48)15												
			5.45													
			5.50	J16,B17				Band of stiff silty clay 5.00 – 5.50 and 7.00 – 7.50								
				S(13)												
			5.95	J18												
			6.30	J19												
			6.50	(36)20												
			6.95													
			7.00	J21												
				S(40)												
23.8.84	3.00	Dry	7.45	J22												
24.8.84	3.00	4.20	7.80	J23												
			8.00	(28)24												
		8.7	8.45													
			8.50	J25												
				S(17)												
			8.95	J26												



Scale 1:

Disturbed Samples: W – Groundwater; ● J – Jar, S – S.P.T., B – Bulk, M – Maxi

Undisturbed Samples: Soil Sample

Insitu Tests: V [30] – Vane shear strength in KN /m²; ▼ Groundwater first struck; □ Core Cutter Density; ■ Core Cutter Density/C.B.R; ▽ Sandbottle Density; ▲ C B R; Cor S SPT cone or spoon (25) – N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B224

FIGURE A1

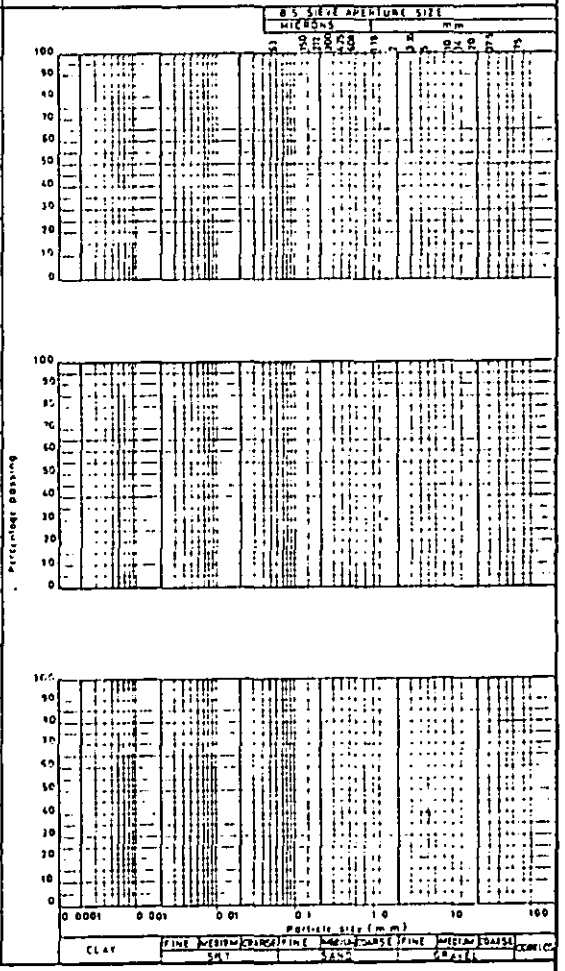
Sheet 2 of 2

Field Work by: _____
Method : _____
Dates : _____
Hole Dimensions: _____
Casing Dimensions: _____

Coordinates: . E.
. N.
Ground Level: m O.D.

Laboratory Testing by: _____ Dates: _____

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr	pH
			9.30	J27				Band of weak to moderately weak siltstone at 10.00		30	19		30	15	100		
			9.50	(50)28						35	-					0.15	7.0
			9.85 10.00	J29		10.00	43.30										
		20 mins		S(25) J30				Stiff red brown slightly mottled grey green very silty CLAY with many siltstone lithorelicts tending to very clayey silt. (KEUPER MARL : ZONE II/III)		39	13						
			10.45 10.80	J31						42	19						
			11.00	(60)32				Bands of very weak to weak fissured mudstone and siltstone noted at 11.50.									
			11.45 11.50	J33 S(43)													
			11.95 12.00	J34 W35													
		12.0	12.30	J36		12.30	41.00										
			12.50	(80)37				Red brown slightly mottled grey green sandy clayey SILT tending to stiff sandy very silty clay with bands of weak to very weak siltstone at 13.20, 13.80, and 14.60m (KEUPER MARL : ZONE II/III)									
			12.95 13.00	J38 * C(102 for J39 175mm)													
			13.45														
			13.80 14.00	J40 (100)41													
			14.45 14.50	J41 * S(50 for J42 50mm)													
24.8.84	14.00	4.00	15.00			15.00	38.30										
								End of Shell and Auger Hole. Hard Strata - 13.50 - 13.90 = 1½ hours. * Seating blows - J39 = 39 J42 = 41									



Scale 1:

Disturbed Samples : W - Groundwater
● J - Jar ● S - S.P.T. ▮ B - Bulk ● M - Maxi

Undisturbed Samples : Soil Sample

Insitu tests : V C30] - Vane shear strength in KN /m²

Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S - S P T cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B224

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring Air Flush with Water Injection
Dates : 9.10.84
Core Diameter : 76mm
Casing Dimensions : 133.35mm

Coordinates : 66438.4 E
93911.5 N
Ground Level : 53.30 m O.D.

Laboratory Testing by :
Dates :

Drilling								Test or Fl (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Dates	Depth of Casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %			Legend	Depth (m)	Reduced Level	Detail	Main									
9.10.84												Rotary Open Holed through overburden alongside Shell and Auger Hole previously drilled to 14.00 (No Drillers Description)										
			Water inflow at 5.6																			

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mgal

50
100

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B224

FIGURE A2

Sheet 2 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing/hole (m)	Depth to water (m)	Depth (m)	Run	CR %	R.Q.D. %	Test or II (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
											See Sheet 1 of 3								
			14.00						14.00	39.30									
					98%	42%	NI 120 140				Highly weathered very weak siltstone bands at: 14.43 - 14.63, 14.90 - 15.50, 15.83 - 16.05, 17.00 - 17.12. Slightly weathered grey green moderately weak bands at: 14.03 - 14.12, 14.26 - 14.35, 14.81 - 14.86, 15.50 - 15.57, 16.30 - 16.54, 17.27 - 17.32	Highly weathered red brown SILTSTONE degraded to stiff silty CLAY with many siltstone lithorelicts. Very and extremely closely spaced sub-horizontal rough discontinuities. (KEUPER MARL : ZONE II/III)								
			15.50		92%	20%	NI 85 160												
			16.30				CPT			(2058, 92 for 145mm)									
			16.59																
					100%	56%	NI 110 320		17.44	35.86									
												See Sheet 3 of 3							

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

Core Runs
50
100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B224

FIGURE A2

Sheet 3 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or II (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details
			19.00						19.31	33.99	Slightly weathered grey green moderately weak bands at: 17.44 - 17.65	Slightly weathered fissured red brown very weak calcareous SILTSTONE. Very and extremely closely spaced sub-horizontal rough discontinuities. (KEUPER MARL : ZONE II)	
					98%	53%	NI 100 190						
9.10.84	4.50		20.00						20.00	33.30		Slightly weathered very thinly bedded grey green moderately weak calcareous SILTSTONE. (KEUPER MARL : ZONE II)	
			20.06				CPT			(50 for 62mmSB)		End of Rotary Hole	

NI = Not Intact
SB = Seating Blows.

Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mast

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25)' = N value

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Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B224

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at Failure					C	ø		Initial			Pressure Range (kN/m²)					
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	Strain at Failure (%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	ø' (Degrees)	Type of Shear Test	Moisture Content (%)	Dry Density (kg/m³)		0 100	100 200	200 400	400 800	800 200		
2.00 2.45	U6				50	38	10			40	-	UU			m_v						
					150	40	12.5	33	1400						c_v						
					300	42	15.5								k						
															e						
5.00 5.45	U15				100	91	6	21	1675	110 (69 | - 8)*	UU	23	1695	m_v	0.33	0.12	0.09	0.06	0.01		
					200	116	18	22	1675						c_v	-	25.66	29.62	53.55	-		
					400	137	14	21	1685						k	-	30.21	26.15	31.52	-		
															e	0.512	0.495	0.467	0.429	0.440		
8.00 8.45	U24				150	35	8			40	-	UU			m_v						
					300	37	10	34	1510						c_v						
					600	44	13.5								k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s $\times 10^{-8}$
e = void ratio at U 100% for each increment

* alternative interpretation

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Consulting Engineers & Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 225

FIGURE A1

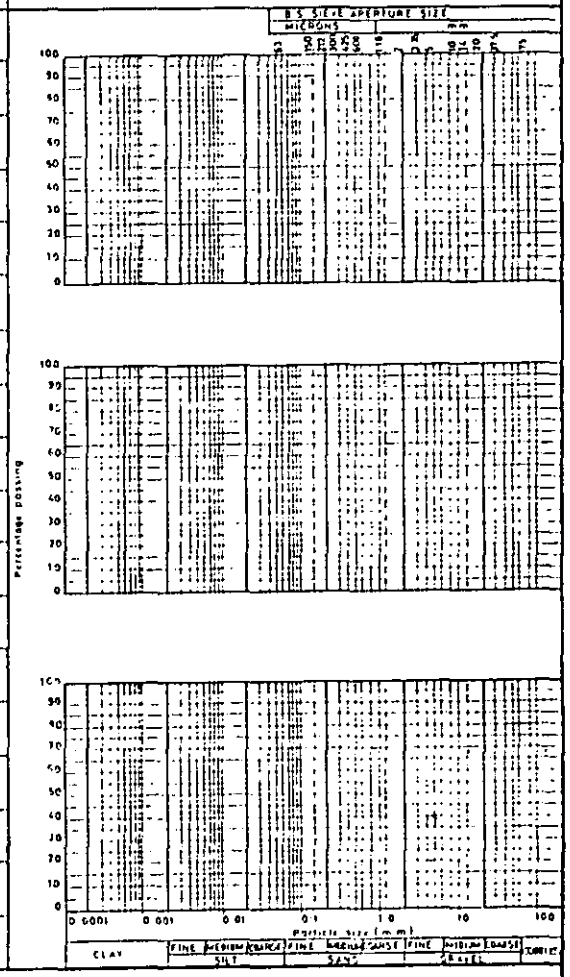
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 31.8.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66538.8 E.
93821.8 N.
Ground Level: 48.37 m OD.

Laboratory Testing by. Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test: Depth (m)	Sample/Insitu Test: Type & Number	Change of Strata: Legend	Change of Strata: Depth (m)	Change of Strata: Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
31.8.84	-	-	0.30	J1		0.30	48.07	TOPSOIL		2	17	1895	20	13	83
			0.50	(20)2				Firm to stiff yellow brown fissured slightly sandy silty CLAY with some fine to medium gravel (Flint, siltstone and sandstone) (GLACIAL TILL)		5	11	1990			
			0.95 / 1.00	J3		1.00	47.37								
			1.30	J4				Red brown clayey silty SAND with much fine to medium sub-angular gravel (mudstone, siltstone and sandstone). (GLACIAL TILL)		7	14				
			1.50	(25)5						9	16				
			1.95 / 2.00	J6		2.00	46.37								
			2.30	J7				Red brown sandy clayey SILT with occasional sub-angular fine to medium gravel (mudstone). (GLACIAL TILL)		11	26	1595	32	18	100
			2.50	(36)8				Becoming clayey silty fine sand below 2.30m							
			2.95 / 3.00	J9		2.80	45.57								
			3.30	J10				Stiff red brown silty CLAY becoming mottled grey green with many mudstone and siltstone lithorelicts below 3.30m (KEUPER MARL : ZONE II/III)							
			3.50	(28)11											
			3.95 / 4.00	J12				Soft to firm zone present between 3.5 and 4.0m							
			4.30	J13				Band of very clayey silt at 4.00m							
			4.50	(49)14				Band of weak and very weak mudstone at 4.30 lending to clayey silt at 5.00							
31.8.84	Nil	Dry	4.95 / 5.00	J15		5.00	43.37								
								End of Shell and Auger Hole.							



Scale 1:

Disturbed Samples: W – Groundwater
● J – Jar
● S – S.P.T.
● B – Bulk
● M – Maxi

Undisturbed Samples: Soil Sample

Insitu Tests: V [30] – Vane shear strength in KN/m²

Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S S.P.T. cone or spoon
(25) – N value

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Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 225

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength								Type of Shear Test	Initial		Consolidation Pressure Range (kN/m²)							Notes
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	Stress at Failure σ_3 (kN/m²)	Stress at Failure $\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	Strain at Failure (%)	Moisture Content (%)	Dry Density (kg/m³)	C / C' (kN/m²)	Ø / Ø' (Degrees)			Moisture Content (%)	Dry Density (kg/m³)								
0.50	U2				50	61	11			60	-		UU			m_v							* Failed under 2nd load
0.95					100	64	12	17	1895							c_v							
					150	*										k							
																e							
3.50	U11				50	24	4	26	1595	40	-		UU			m_v							
3.95					100	55	13	26	1600							c_v							
					200	48	20	26	1595							k							
																e							
																m_v							
																c_v							
																k							
																e							
																m_v							
																c_v							
																k							
																e							
																m_v							
																c_v							
																k							
																e							
																m_v							
																c_v							
																k							
																e							
																m_v							
																c_v							
																k							
																e							
																m_v							
																c_v							
																k							
																e							

For Sample Type see Sheet A

S B.S Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
ŪU = Ditto, with p.w.p measurement
CD = Consolidated Drained
C̄D = Ditto, with p.w.p measurement
CU = Consolidated Undrained
C̄Ū = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s x 10^{-8}
e = void ratio at U 100% for each increment

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 226

FIGURE A1

Sheet 1 of 1

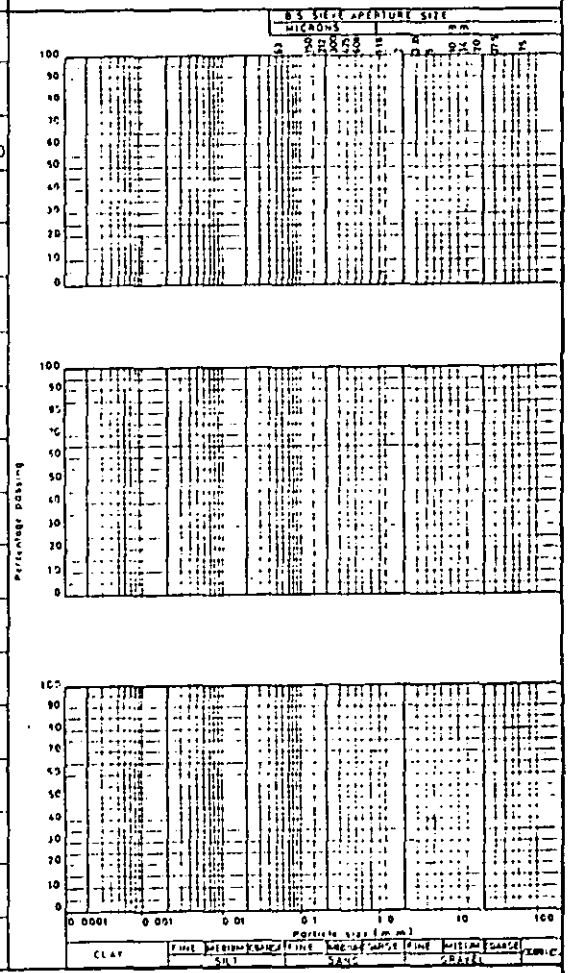
Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 28/29.8.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66482.9 E.
94002.4 N.
Ground Level: 52.47 m OD.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/In-situ Test Depth (m)	Sample/In-situ Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr / pH
28.8.84			0.50			0.50	51.97	TOPSOIL		1	17 17**		40	20	87	
			1.00	B1		1.00	51.47	Very stiff red brown fissured silty CLAY with many mudstone fragments rootlets and occasional fine to medium gravel. (GLACIAL TILL)		3	14					
			1.50	(30)2				Stiff red brown and light brown mottled grey green fissured silty CLAY with some fine gravel sized mudstone lithorelicts. (KEUPER MARL : ZONE III)		5	20 20**		38	21	100	0.05 8.0
			1.95 2.00	J3						6	21	1730				
				S(22)						8	17		38	20	100	
			2.45 2.50	J4		2.50	49.97			12	20					
			3.00	B5				Stiff red brown fissured very silty CLAY tending to very clayey silt below 3.50m (KEUPER MARL : ZONE IVa)								
				(40)6												
			3.45 3.50	J7												
				S(26)												
28.8.84	3.00	Dry	3.95	J8				Very stiff in parts.								
28.8.84	3.00	Dry	4.30	J9												
			4.50													
				(80)10												
			4.95 5.00	J11		5.00	47.47									
				S(59)				Very stiff red brown fissured very silty CLAY with many lithorelicts of mudstone. (KEUPER MARL : ZONE III)								
			5.45	J12												
			5.00													
				(85)13												
			5.95													
29.8.84	3.00	Dry	6.00	J14		6.00	46.47									
								End of Shell and Auger Hole.								

** Microwave Determination



Scale 1:

Disturbed Samples : W – Groundwater
● J – Jar
● S – S.P.T.
● B – Bulk
● M – Mast

Undisturbed Samples : Soil Sample

Insitu Tests : V (30) – Vane shear strength in KN/m²
Groundwater first struck
□ Core Cutter Density
▣ Core Cutter Density/C.B.R
▽ Sandbottle Density
▲ C.B.R
C or S – S.P.T. cone or spoon
N value

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Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 226

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength									Consolidation								Notes
					Stress at Failure		Strain at Failure			C	ø	Type of Shear Test	Initial		Pressure Range (kN/m²)							
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)								
2.50	B5				50	171	19	19	1720	180	-	REM UU										
3.00					100	192	20	19	1770													
					150	173	20	19	1755													
3.00	B6				50	73	9	21	1740	100	-	UU										* alternative interpretation
3.45					100	87	13	21	1710	(72	26)*											
					150	152	20	21	1745													

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 227

FIGURE A1

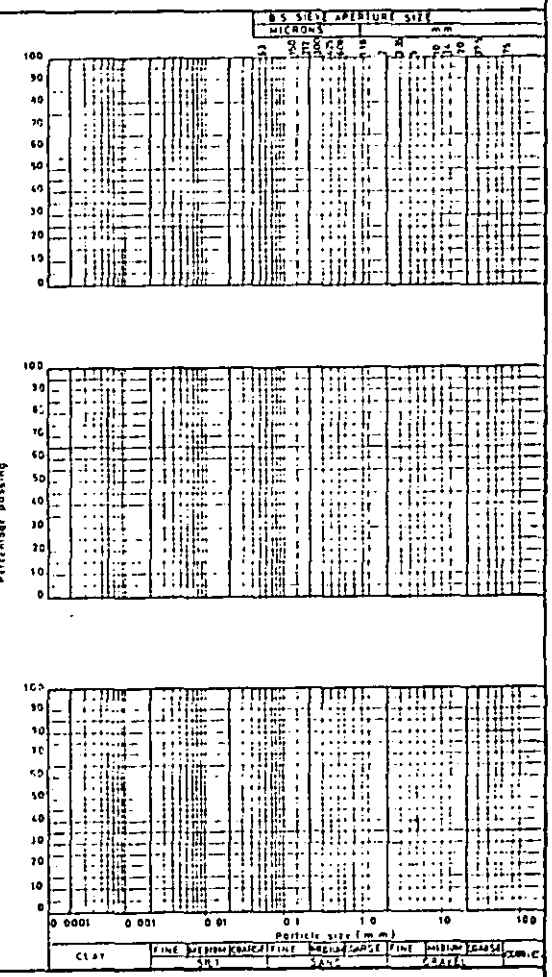
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 31.8.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66510.3 E.
94072.1 N.
Ground Level: 47.64 m OD.

Laboratory Testing by. Dates:

Dates	Depth of Casing (m)	Depth to water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr	pH
31.8.84			0.30	J1		0.30	47.34	TOPSOIL		4	19					0.05	8.0
			0.50	(29)2				Firm to stiff and soft red brown fissured silty and very silty CLAY with traces of carbonaceous material and rootlets tending to clayey silt in zones. (KEUPER MARL : ZONE III/IVa)		5	30	1475	25	16	100		
			0.95 1.00	J3						8	17	1855					
			1.50	B4													
			1.95	(9)5						12	26	1605	32	17	100		
			2.00	J6				Brown green slightly sandy very clayey silt at 2.00m									
			2.30	J7													
			2.50	(40)8													
			2.95			3.00	44.64										
			3.00	J9				Stiff red brown and grey green silty CLAY with some mudstone lithorelicts and decaying rootlets. (KEUPER MARL : ZONE III)								
			3.30	J10		3.30	44.34										
			3.50	B11				Red brown clayey SILT with some lithorelicts of mudstone and siltstone and occasional bands of very weak mudstone. (KEUPER MARL : ZONE II/III)								
			3.95	(40)12													
		4.1	4.00	J13													
			4.30	J14													
			4.50	(50)15													
			4.95			5.00	42.64										
		5.0	5.00	J16,W17				Red brown mottled grey green clayey SILT with occasional siltstone lithorelicts tending to very silty CLAY with occasional bands of very weak siltstone. (KEUPER MARL : ZONE II/III)								
			5.30	J18													
			5.50	(80)19													
			5.95														
31.8.84	4.50	5.20	6.00	J20		6.00	41.64										
								End of Shell and Auger Hole.									



Scale 1:

Disturbed Samples : W — Groundwater
● J — Jar ● S — S.P.T. ● B — Bulk ● M — Maxi

Undisturbed Samples : U100 Soil Sample

Insitu Tests : V (30) — Vane shear strength in KN /m²
▼ Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R
▽ Sandbottle Density
▲ C.B.R
C or S - S.P.T. cone or spoon
(25) - N value

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 227

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength					C	Ø	Type of Shear Test	Initial		Consolidation Pressure Range [kN/m²]							Notes
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	Stress at failure σ_3 (kN/m²)	Stress at failure $\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	Strain at Failure (%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)								
1.50 1.95	U5				50	23	20	30	1470	21	–	UU			m_v							
					100	12	7	30	1470						c_v							
					200	27	17	29	1480						k							
															e							
2.50 2.95	U5				50	75	20			75	–	UU			m_v							* Excessive Strain
					100	*		17	1855						c_v							
					200										k							
															e							
3.50 3.95	U12				100	80	13	26	1600	70	–	UU			m_v							
					200	51	8	26	1595						c_v							
					400	74	12	25	1615						k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s x 10^{-8}
e = void ratio at U 100% for each increment

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

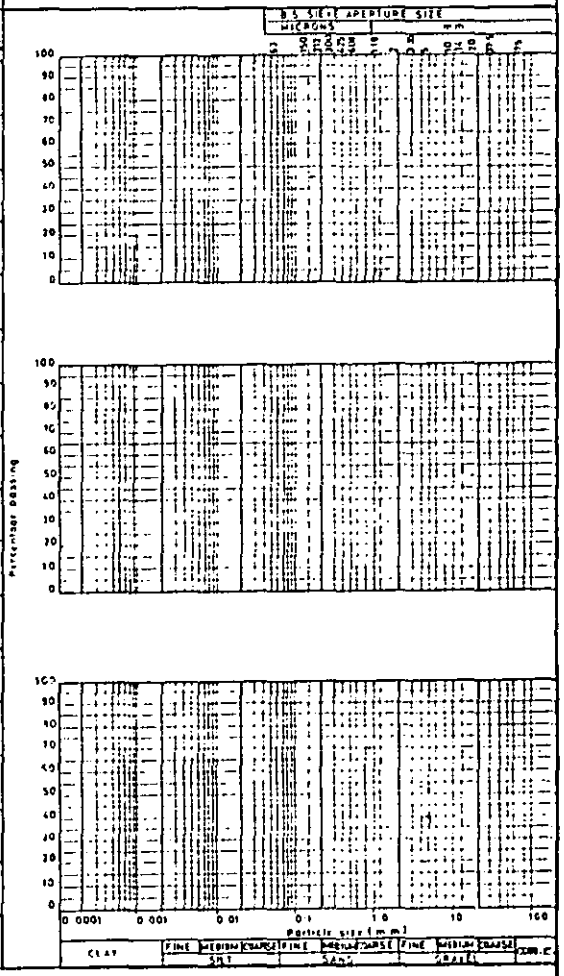
BOREHOLE No 228
FIGURE A1
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 28.8.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66548.5 E.
94054.6 N.
Ground Level: 49.30 m OD.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	%passing 425 microns	Sulphate g/ltr / pH
28.8.84	-	-	0.30	J1		0.20	49.10	TOPSOIL								
			0.50	(20)2				Red brown silty fine SAND with occasional rootlets. (GLACIAL TILL)		2	13	1490				0.04 7.9 org 9.93
			0.95					Becoming clayey silty sand with occasional fine to medium gravel below 1.00		4	10					
			1.00	J3 S(14)						6	13	1850	31	16	100	0.04 7.9
			1.45	J4		1.60	47.70									
			1.80	J5				Firm to stiff red brown sandy silty CLAY with some cobbles. (GLACIAL TILL)		8	13					
			2.00	(45)6												
			2.45			2.30	47.00			10	25	1630	33	19	100	
			2.50	J7 S(13)				Firm red brown slightly mottled grey green sandy silty CLAY and very silty clay with some siltstone and mudstone lithorelicts, pockets of fine sand, and occasional bands of very weak mudstone. (KEUPER MARL : ZONE II/III)								
			2.95	J8												
			3.30	J9												
			3.50	(20)16				Soft in parts.								
			3.95					Tending to clayey silt below 4.00m								
			4.00	J11 S(22)												
			4.45	J12												
			4.80	J13		4.80	44.50									
			5.00	(53)14				Red brown slightly clayey SILT. (KEUPER MARL : ZONE III)								
			5.45													
			5.50	J15 S(28)				Tending to stiff very silty clay with lithorelicts of mudstone.								
28.8.84	3.00	Slight Seepage	5.95	J16		6.00	43.30									
								End of Shell and Auger Hole.								



Scale 1:

Disturbed Samples : W = Groundwater
● J = Jar
● S = S.P.T.
● B = Bulk
● M = Mazi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] = Vane shear strength in KN/m²

Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S - S.P.T. cone or spoon (25) - N value

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT / BOREHOLE No. 228
FIGURE B
Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at Failure		Strain at Failure			C	Ø	Type of Shear Test	Initial			Pressure Range (kN/m²)					
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)		0 54	54 107	107 214	214 428	428 856	856 107	
2.00 2.45	U6				Unsuitable			-													
								13	1850												
					Insufficient Material																
3.50 3.95	U10				100	26	20	25	1635	35	-	UU			m_v	0.83	0.28	0.19	0.12	0.07	0.02	
					200	46	20	25	1610						c_v	-	9.52	16.92	21.98	20.77	-	
					400	34	20	24	1640						k	-	26.15	31.33	25.87	14.26	-	
															e	0.620	0.596	0.564	0.524	0.477	0.495	
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
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															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

$m_v = m^2/MN$
$c_v = m^2/yr$
$k = m/s \times 10^{-8}$
e = void ratio at U 100% for each increment

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 229

FIGURE A1

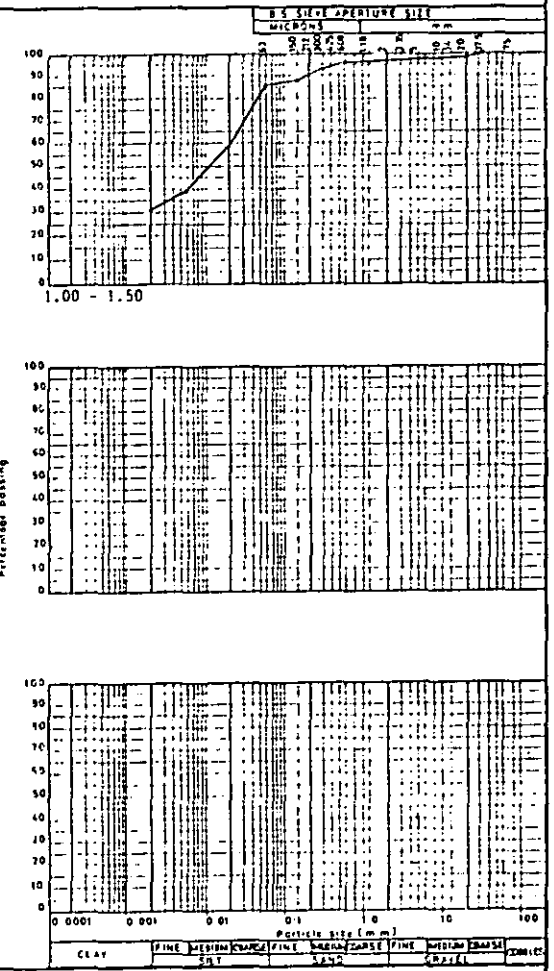
Sheet 1 of 2

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 3/4.9.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66572.1 E.
94122.3 N.
Ground Level: 49.06 m O.D.

Laboratory testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr pH
3.9.84	-	-	0.30	J1		0.30	48.76	TOPSOIL								
			0.50					Stiff brown fissured silty CLAY with traces of carbonaceous material and rootlets. (GLACIAL TILL)		2	21	1605	55	25	100	
			0.95	(23)2						4	34					
			1.00	J3												
				S(2)						5	33					0.208.0 org 1.36%
			1.45	J4												
			1.50	B5												
			1.80	J6		1.70	47.36			7	17	1845				
			2.00					Soft red brown and grey green sandy very clayey SILT with much fine to medium gravel (mudstone, siltstone, sandstone), 2.50m lens of fine to coarse gravel with some fine to medium gravel sized mudstone and siltstone, and residual sandy silty clay. (GLACIAL TILL)								
				(28)7						9	15					
		2.35	2.45													
			2.50	J8												
		20 mins		S(10)						12	22	1675	31	17	100	
			2.95	J9												
		▼ 3.0	3.00	W10												
			3.30	J11						16	24	1660	29	17	100	
			3.50													
				(28)12												
			3.95			3.80	45.26			19	21		34	20	100	
		4.1	4.00	J13				Firm red brown very silty CLAY tending to clayey silt with some siltstone and mudstone lithorelicts (KEUPER MARL : ZONE IV.								
				S(16)												
			4.45	J14												
		30 mins	4.80	J15		4.80	44.26									
			5.00					Firm to stiff red brown clayey SILT (KEUPER MARL : ZONE IVa)								
				(35)16												
		▼ 5.4	5.45													
			5.50	W17,J18		5.60	43.46									
				S(22)												
			6.00	J19				Stiff red brown very silty CLAY. (KEUPER MARL : ZONE III)								
			6.30	J20												
			6.50													
				(100)+												
			6.95													
			7.00	B21				Tending to clayey silt with occasional bands of very weak siltstone below 7.00m								
				S(36)												
			7.45	J22												
			7.80	J23												
			8.00													
				(70)24												
			8.45													
			8.50	J25												
				S(39)												
3.9.84	6.00	6.10	9.00	J26												



Scale 1:

Disturbed Samples : W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mazi

Undisturbed Samples : Soil Sample

Insitu Tests : V C30 - Vane shear strength in KN /m²

Groundwater first struck

Core Cutter Density
Core Cutter Density/C.B.R

Sandbottle Density
C B R

C or S - S.P.T cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 229

FIGURE A1

Sheet 2 of 2

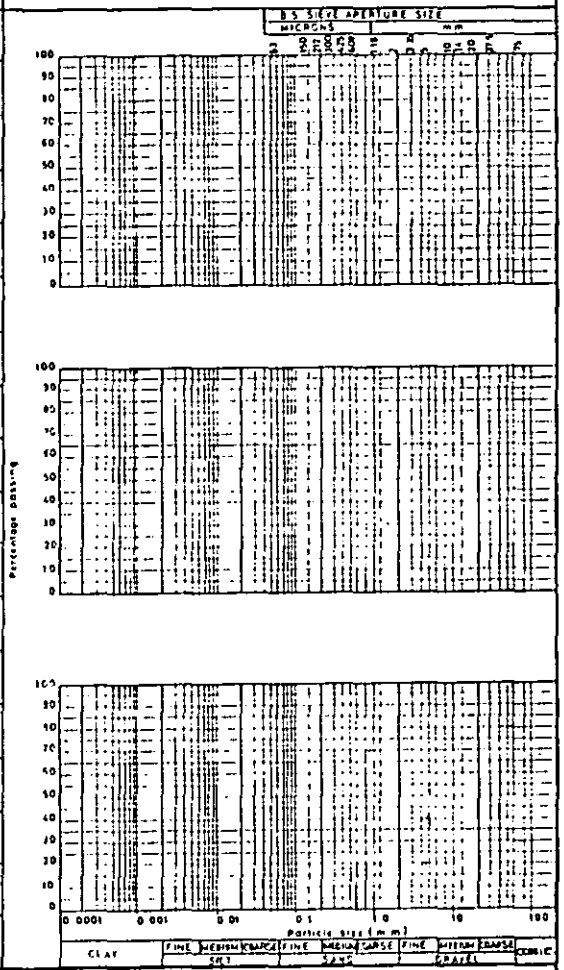
Field Work by: _____
Method : _____
Dates : _____
Hole Dimensions: _____
Casing Dimensions: _____

Coordinates: E. N.
Ground Level: m OD.

Laboratory Testing by: _____ Dates: _____

Dates	Depth of Casing m	Depth to water m	Sample/Insitu Test Depth m	Type & Number	Change of Strata Legend	Depth m	Reduced Level	Description of Strata
4.9.84	6.00	4.20	9.30 ●	J27				As sheet 1 of 2
			9.50 ▲	(84)				Becoming very stiff below 9.00m with many mudstone and siltstone lithorelicts.
4.9.84	9.00	4.80	9.95 ●	J28		10.00	39.06	
								End of Shell and Auger Hole.
								▲ Failed U sample
								Bentonite seal 0.30 - 0.80
								Sand Filter 0.80 - 1.50
								Piezometer tip 1.40
								Bentonite seal 1.50 - 2.30

Standpipe/Piezometer Installation | Sample Number | Natural Moisture Content (%) | Natural Dry Density (kg/m³) | Liquid Limit (%) | Plastic Limit (%) | % passing 425 microns



Scale 1:

Disturbed Samples : W — Groundwater
● J — Jar
● S — S.P.T.
| B — Bulk
● M — Mazi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] — Vane shear strength in KN /m²

Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

| C or S - S.P.T cone or spoon
(25) - N value

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 229
FIGURE B
Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at Failure		Strain at Failure			C	Ø		Initial		Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)	Type of Shear Test	Moisture Content (%)	Dry Density (kg/m³)							
0.50	B2				50	97	9	21	1565	140	-	UU			m_v							* alternative interpretation
0.95					100	109	20	23	1580	(20 | 32)*				c_v							
					150	215	14	19	1660						k							
															e							
2.00	U7				50	19	10			20	-	UU			m_v							
2.45					100	20	10.5	17	1845						c_v							
					150	20	12								k							
															e							
3.50	U12				100	12	7			14	-	UU			m_v							
3.95					200	14	8.5	22	1675						c_v							
					300	17	16.5								k							
															e							
5.00	U16				100	42	14	24	1660	45	-	UU			m_v							
5.45					200	40	16	25	1655						c_v							
					400	49	13	24	1660						k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2 / MN
c_v = m^2 / yr
k = m/s $\times 10^{-8}$
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 230

FIGURE A1

Sheet 1 of 1

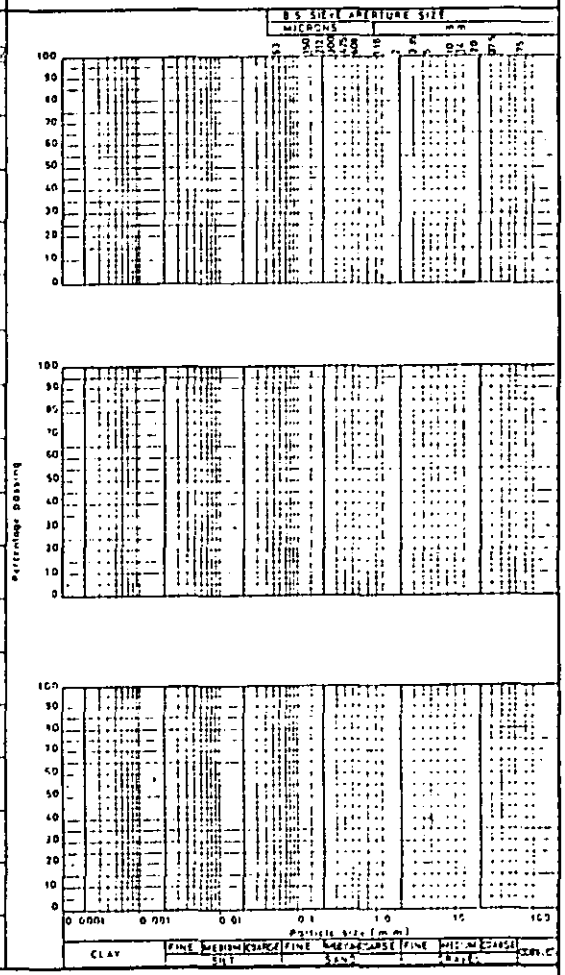
Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 4.9.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66673.8 E.
94223.5 N.
Ground Level: 49.74 m OD

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata
4.9.84	-	-	0.20	J1		0.20	49.54	TOPSOIL
			0.30	(36)2				Stiff brown and red brown silty clay with occasional rootlets. (GLACIAL TILL)
			0.75					
			0.80	J3				Below 1.30 occasional fine gravel (sandstone, siltstone and flint),
			1.30	J4				
		1.4	1.50	(25)5				
			1.95			1.80	47.94	
			2.00	J6				Soft to firm red brown fissured silty CLAY with occasional bands of mudstone (KEUPER MARL : ZONE III/IV)
				S(15)				
4.9.84	Nil	Dry	2.45	J7				Becoming very stiff with depth
5.9.84	Nil	Dry	2.80	J8				Band of weak mudstone at 2.80m
			3.00					
				(50)9				
		20 min	3.45					
			3.50	J10		3.50	46.24	
				S(27)				Stiff red brown fissured very silty CLAY and bands of highly weathered siltstone with many siltstone lithorelicts. (KEUPER MARL : ZONE III)
			3.95	J11				
		▼ 4.0	4.00	W12				
			4.30	J13		4.30	45.44	
			4.50					Moderately weathered fissured weak and very weak occasionally moderately weak MUDSTONE and siltstone (KEUPER MARL : ZONE II)
				(100)14				
			4.95					
			5.00	J15				
				S(76)				
			5.45	J16				
			5.50	J17 *				
				S(97 for				
5.9.84	5.50	1.80	5.95	J18 275m		6.00	43.74	
								End of shell and Auger Hole.
								Hard Strata - 6.00 = 1 hour
								* Seating Blows - J18 = 23
								Bentonite seal 0.50 - 1.50
								Gravel filter 1.50 - 6.00
								Standpipe installed to 6.00

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	%passing 425 microns	Sulphate g/ltr	pH
	2	14	1790	38	18	91	0.03	7.7
	5	30	1450					
	9	14	1930	28	18	92		
	11	12						



Scale 1:

Disturbed Samples: W - Groundwater; ● J - Jar, ● S - S.P.T., ● B - Bulk, ● M - Maxi

Undisturbed Samples: Soil Sample

Insitu Tests: V [30] - Vane shear strength in KN /m²

▼ Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S S.P.T. cone or spoon
(25) - N value

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 230
FIGURE B
Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation							Notes
					Stress at Failure		Strain at Failure			C	ø	Type of Shear Test	Initial			Pressure Range (kN/m²)				
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)		0 27	27 54	54 107	107 214	214 438			
0.30 0.75	U2				50	279	5	13	1795	340 (120	- 34)*	UU			m_v								* alternative interpretation
					100	334	6	15	1780						c_v								
					150	409	10	14	1790						k								
															e								
1.50 1.95	U5				50	23	5	32	1395	40	-	UU	25	1575	m_v	0.85	0.42	0.28	0.19	0.11			
					100	47	14	28	1485						c_v	-	5.21	5.49	4.90	16.15			
					200	54	20	29	1470						k	-	21.47	15.08	9.13	17.42			
															e	0.644	0.625	0.601	0.568	0.530			
																0 54	54 214	214 54	54 107	107 214	214 428		
3.00 3.45	U9				100	192	7	14	1920	240 (120	- 15)*	UU	16	1900	m_v	0.41	0.12	0.03	0.04	0.04	0.05		* alternative interpretation
					200	232	7	13	1945						c_v	-	42.78	-	34.31	34.10	19.88		
					400	282	7	14	1930						k	-	50.36	-	13.46	13.38	9.75		
															e	0.365	0.339	0.346	0.344	0.338	0.324		
															m_v								
															c_v								
															k								
															e								
															m_v								
															c_v								
															k								
															e								
															m_v								
															c_v								
															k								
															e								
															m_v								
															c_v								
															k								
															e								
															m_v								
															c_v								
															k								
															e								

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s x 10^{-8}
e = void ratio at U 100% for each increment

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 231

FIGURE A1

Sheet 1 of 1

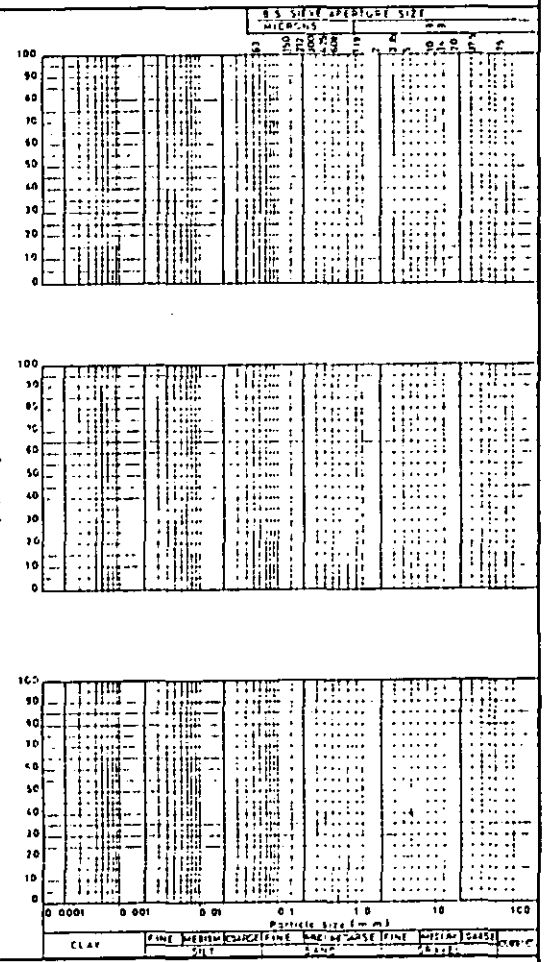
Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 6/7.9.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66663.2 E.
94282.0 N.
Ground Level: 50.52 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata
6.9.84	-	-	0.30 J1			0.20	50.32	TOPSOIL
			0.50	(25)2				Firm brown and orange brown very silty CLAY with occasional fine gravel (flint) tending to clayey silt in zones. (GLACIAL TILL)
			0.95			0.80	49.72	
		20 min 1.0	1.00 J3					Soft and firm red brown mottled grey green silty CLAY with some fine to medium gravel (siltstone and sandstone.) (GLACIAL TILL)
		15 min 1.3	1.30 J4			1.20	49.32	
			1.50	(40)5				Firm and stiff red brown mottled green grey silty to very silty CLAY with some fine to medium gravel sized fragments of siltstone and sandstone. (KEUPER MARL : ZONE III)
		10 min 1.9	1.95					
			2.00 J6					
			2.30 J7					
			2.50	(50)8				Becoming very stiff with occasional bands of very weak mudstone and siltstone below 2.50m.
		5 min 2.6	2.95					
			3.00 J9					
			3.45	S(34)				
		▼ 3.5	3.50 J10					
		Sealed at 3.5	W11					
			3.80 J12					
			4.00	(100)13				
			4.45					
			4.50 J14			4.50	46.02	
				S(68)				Very stiff red brown mottled grey green very silty CLAY with many lithorelicts tending to very weak silty mudstone. (KEUPER MARL : ZONE II/III)
6.9.84	3.50	Dry	4.95 J15					
7.9.84	3.50	1.20						
			5.50 J16					
			5.70	(100)				
			5.80 J17					
			6.00					Bands of weak to moderately weak mudstone and siltstone at 5.50 and 7.00m
				S(97)				
			6.45 J18					
			7.00 J19					
			7.50					
				S(132)				
7.9.84	7.50	2.30	7.95 J20			8.00	42.52	
								End of Shell and Auger Hole.
								Hard Strata - 5.50 - 6.00 = 1 hour
								+ Failed U sample

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr	pH
	1	22						
	2	21	1655	37	17	100	0.03	7.5
	3	23						
	5	27	1565					
	8	16	1880	31	18	100		
	10	12						
	11	-					0.28	6.9
	15	11		33	18	100		



Scale 1:

Disturbed Samples : W - Groundwater
● J - Jar ● S - S.P.T. ● B - Bulk ● M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V (30) - Vane shear strength in KN/m²

▼ Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S S.P.T. cone or spoon
(25) - N value

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

Laboratory Testing by : Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 231
FIGURE 8
Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at failure		Strain at failure			C	Ø	Type of Shear Test	Initial			Pressure Range (kN/m²)					
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)		0 27	27 107	107 27	27 54	54 107	107 214	214 428	
0.50 0.95	U2				50	70	7.5			75	-	UU			m_v							
					100	74	10.5	21	1655						c_v							
					200	78	13								k							
															e							
1.50 1.95	U5												27	1565	m_v	0.72	0.16	0.09	0.07	0.12	0.19	0.13	
															c_v	-	1.77	-	5.31	3.95	2.16	2.06	
															k	-	2.78	-	3.65	4.65	4.03	2.63	
															e	0.660	0.638	0.650	0.647	0.637	0.603	0.559	
2.50 2.95	U8				100	198	19	16	1875	230	-	UU			m_v							
					200	213	12	16	1880						c_v							
					400	281	20	16	1885						k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
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															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

Per Sample Type see Sheet A

S B.S. Standard
N B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s = 10^{-8}
e = void ratio at U 100% for each increment

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 232

FIGURE A1

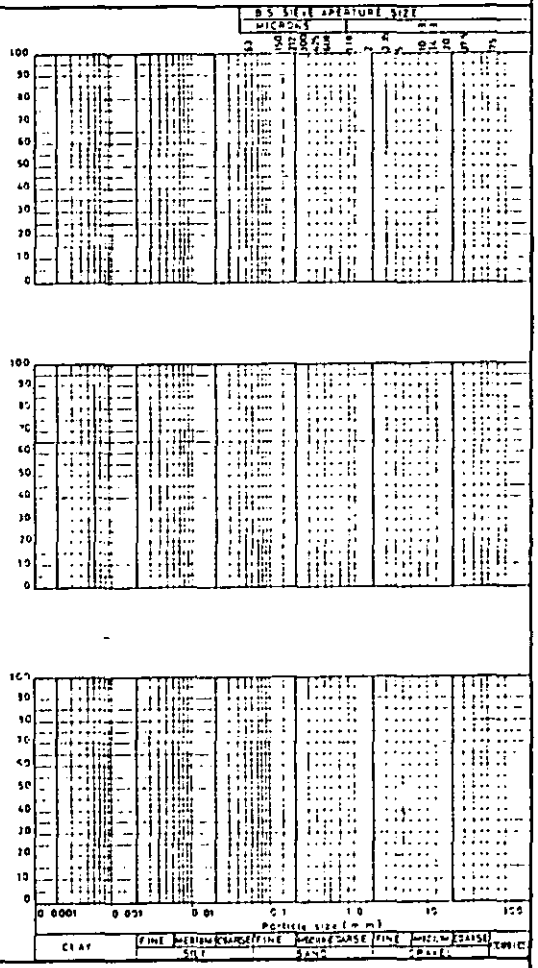
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 24.8.84
Hole Dimensions: 150mm
Casing Dimensions 150mm

Coordinates: 66742.6 E.
94392.8 N.
Ground Level: 54.84 m OD.

Laboratory testing by: Dates:

Dates	Depth of Casing m	Depth to Water m	Sample/Insitu Test Depth m	Type & Number	Change of Strata Legend	Depth m	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
24.8.84	-	-				0.10	54.74	TOPSOIL							
			0.50	J1		0.50	54.34	Stiff brown silty CLAY. (GLACIAL TILL)		2	15	1840	31	19	100
			0.95	(35)2				Stiff red brown mottled light brown silty CLAY with many mudstone lithorelicts. (KEUPER MARL : ZONE III		6	16	1910			
			1.00	J3		1.00	43.84								
			1.00	S(20)				Stiff red brown and grey green fissured silty CLAY and very silty clay with many mudstone and siltstone lithorelicts. (KEUPER MARL : ZONE II/III) Very stiff in parts. Bands of weak and very weak mudstone and siltstone below 2.50m		9	19				
			1.45	J4						11	15 16				
			1.80	J5											
			2.00	(70)6											
			2.45												
			2.50	J7											
			2.50	S(53)											
			2.95	J8											
			3.30	J9		3.30	51.54								
			3.50	(85)10				Stiff red brown mottled grey green highly fissured silty CLAY with many mudstone lithorelicts and occasional bands of weak and very weak siltstone (KEUPER MARL : ZONE II/III)							
			3.95												
			4.00	S(72)											
		Slight seepage at 4.0	4.45	J11											
			4.90	J12											
			5.50	S(107)		5.50	49.34								
			5.95	J13				Weak and very weak red brown slightly mottled grey green fissured MUDSTONE. (KEUPER MARL : ZONE I)							
			6.20	J14											
			6.50	S(89 for 150mm*											
24.8.84	6.00	Dry	6.95	J15		7.00	47.84								
								End of Shell and Auger Hole. * Seating Blows - J15 = 34							



Scale 1:

Disturbed Samples : W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mazi

Undisturbed Samples : Soil Sample

Insitu Tests : V (30) - Vane shear strength in KN /m²

Groundwater first struck

Core Cutter Density
Core Cutter Density/C.B.R

Sandbottle Density
C B R

C or S SPT - cone or spoon
(25) - N value

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 232
FIGURE B
Sheet 1 of 1

Sample		Compaction			Shear Strength									Consolidation								Notes
					Stress at Failure		Strain at Failure			C	ø	Type of Shear Test	Initial		Pressure Range (kN/m²)							
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1-\sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)								
0.50	U2				50	113	2.5			140	-				m_v							* alternative interpretation
0.95					100	139	4	15	1840	(56	22)*	UU			c_v							
					150	174	8								k							
															e							
2.00	U6				50	186	4.5			212	-				m_v							* alternative interpretation
2.45					100	217	6	16	1910	(119	18)*				c_v							
					150	234	8.5								k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
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															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s x 10^{-9}
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 233

FIGURE A1

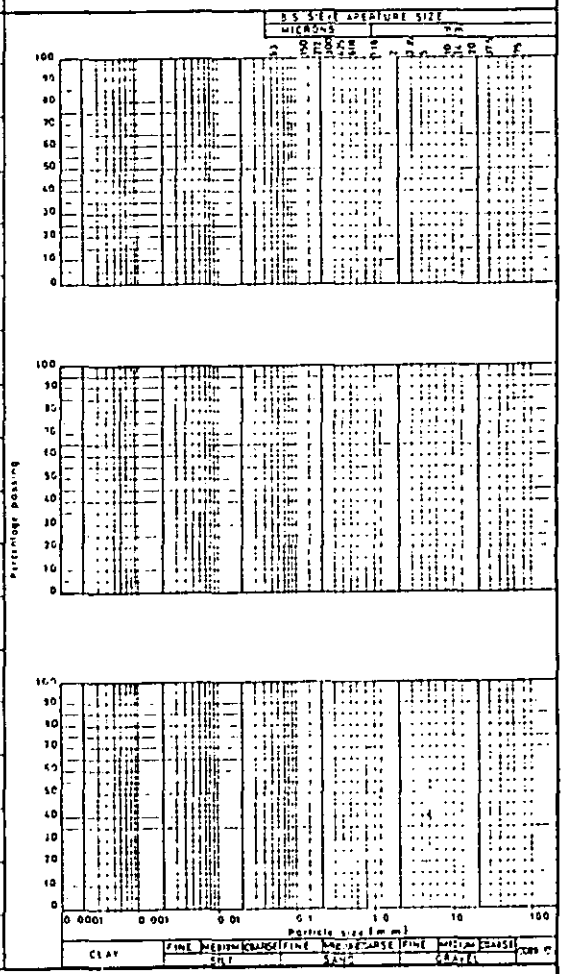
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 5/6.9.84
Hole Dimensions 150mm
Casing Dimensions 150mm

Coordinates: 66838.6 E.
94232.4 N.
Ground Level: 53.10 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
5.9.84	-	-	0.30	J1				Red brown clayey SILT with rootlets and traces of carbonaceous material (TOPSOIL)		1	11				
			0.50	(40)2		0.80	52.30			2	19	1765	35	18	100
			0.95					Stiff and very stiff red brown silty CLAY. (KEUPER MARL : ZONE III/IVa)		6	13	1790			
			1.00	J3											
			1.45	S(21) J4				Slightly mottled grey green with some siltstone and mudstone lithorelicts below 2.50		9	12				
			1.80	J5						12	Dry				
			2.00	(40)6											
			2.45												
			2.50	J7 S(51)											
5.9.84	Nil	Dry	2.95	J8											
6.9.84	Nil	Dry	3.30	J9		3.20	49.90	Moderately weathered fissured weak and very weak red brown calcareous MUDSTONE and SILTSTONE. (KEUPER MARL : ZONE II)							
			3.50	(100)+											
			3.60	S(48 for 10 mm)											
			3.60												
			3.95	S(73 for J11 150)											
6.9.84	3.80	Dry	4.10	S(68 for J12 150)		4.10	49.0								
								End of Shell and Auger Hole.							
								Hard Strata - 3.60 - 3.80 and 3.80 - 3.95 = 2 hour							
								* Seating Blows - J10 = 32							
								SB = Seating Blows only							
								+ Failed U sample.							



Scale 1:

Disturbed Samples : W - Groundwater
● J - Jar
● S - S.P.T.
● B - Bulk
● M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V C30] - Vane shear strength in KN /m²
Groundwater first struck
□ Core Cutter Density
■ Core Cutter Density/C.B.R
▽ Sandbottle Density
▲ C.B.R
C or S SPT cone or spoon (25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 233
FIGURE B
Sheet 1 of 1

Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

Sample		Compaction			Shear Strength									Consolidation								Notes
					Stress at failure		Strain at failure			C	ø	Type of Shear Test	Initial			Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1-\sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)		0 25	25 50	50 100	100 200	200 400			
0.50 0.95	U2				50	114	19	18	1770	120	-	UU	16	1855	m_v	0.11	0.14	0.12	0.09	0.06			
					100	106	17	19	1765						c_v	-	20.26	17.48	15.14	31.36			
					150	129	16	19	1755						k	-	27.83	20.58	13.37	18.46			
															e	0.425	0.420	0.412	0.400	0.382			
2.00 2.45	U6				100	160	11			170	-	UU			m_v								
					200	169	13.5	13	1790						c_v								
					300	174	17.5								k								
															e								
															m_v								
															c_v								
															k								
															e								
															m_v								
															c_v								
															k								
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															c_v								
															k								
															e								

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p. measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p. measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p. measurement
V = Vane Shear
S = Shear Box

m_v = m^2 / MN
c_v = m^2 / yr
k = m/s $\times 10^{-9}$
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 234

FIGURE A1

Sheet 1 of 1

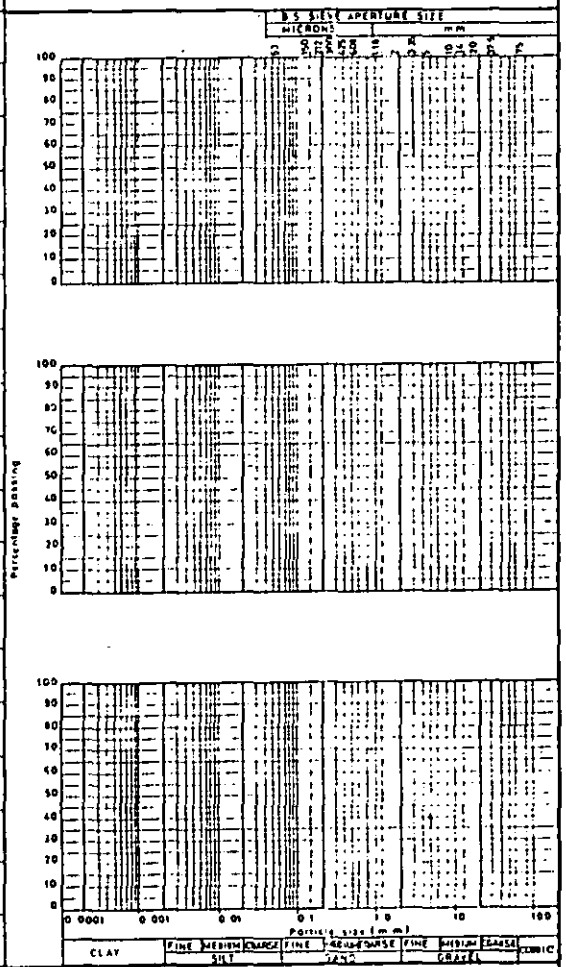
Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 28.9.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66901.9 E.
94310.1 N.
Ground Level: 55.96 m OD.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata
28.9.84	-	-	0.30	J1		0.30	55.66	Turf onto TOPSOIL
			0.50	(30)2				Very stiff red brown intact silty CLAY with occasional siltstone lithorelicts. (KEUPER MARL : ZONE IVa)
			0.95			1.00	54.96	
			1.00	J3				Stiff red brown mottled grey green fissured silty to very silty CLAY with some siltstone lithorelicts and occasional thin bands of highly weathered very weak siltstone. (KEUPER MARL : ZONE II/III)
				S(23)				
			1.45	J4				
			1.50	B5				
			1.70	J6				
			2.00					
				(50)7				
			2.45					
			2.50	J8				Very stiff and stiff below 2.00m
				S(41)				
			2.95	J9				Becoming red brown and grey green below 2.50m
			3.00	B10				
			3.20	J11				
			3.50					
				(60)12				Becoming red brown below 4.00
			3.95					
			4.00	J13,B14				
				S(36)				
			4.45	J15				Becoming red brown and grey green below 5.30
			4.70	J16				Becoming red brown below 5.70
			5.00					
				(60)+				
			5.30	J17				
			5.70					
				S(67)				
28.8.84	Nil	Dry	6.15	J18		6.15	49.81	
								End of Shell and Auger Hole.
								+ Failed U sample.

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	%passing 425 microns
	2	19	1685	43	21	100
	5	25				
	7	13	1950	37	20	100
	10	23				
	12	12	1985			
	14	24				



Scale 1:

Disturbed Samples: W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mazi

Undisturbed Samples: Soil Sample

Insitu Tests: V C30] - Vane shear strength in KN /m²
Groundwater first struck
Core Cutter Density
Core Cutter Density/C.B.R
Sandbottle Density
C B R.
C or S - S P T cone or spoon
(25) - N value

SCOTT WILSON KIRKPATRICK & PARTNERS
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Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 234
FIGURE B
Sheet 1 of 1

Sample Depth (m)	Sample Type & Number	Compaction Type of Test	Compaction Optimum Moisture Content (%)	Compaction Maximum Dry Density (kg/m³)	Shear Strength Stress at Failure σ_3 (kN/m²)	Shear Strength Stress at Failure $\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	Shear Strength Strain at Failure (%)	Shear Strength Moisture Content (%)	Shear Strength Dry Density (kg/m³)	Shear Strength C / C' (kN/m²)	Shear Strength Ø / Ø' (Degrees)	Type of Shear Test	Initial Moisture Content (%)	Initial Dry Density (kg/m³)	Consolidation Pressure Range (kN/m²)	0 / 50	50 / 100	100 / 200	200 / 400	400 / 100	Notes
0.50	U2				50	197	6	18	1730	230	-	UU									
0.95					100	178	9	21	1600												
					200	302	8	17	1730												
2.00	U7				50	173	5	14	1930	240	-	UU	12	2030	m_v	0.26	0.11	0.07	0.04	0.02	
2.45					100	352	8	12	1995						c_v	-	19.82	9.59	13.06	-	
					200	188	10	14	1920						k	-	21.39	6.59	5.12	-	
															e	0.305	0.298	0.288	0.277	0.284	
1.00	B5+10	S	12.0	1830											m_v						
3.00															c_v						
															k						
															e						
3.50	U12				50	356	4	11	2030	340	-	UU			m_v						
3.95					100	266	8	12	1940						c_v						
					200	411	17	12	1990						k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

$m_v = m^2/MN$
$c_v = m^2/yr$
$k = m/s \times 10^{-8}$
e = void ratio at U 100% for each increment

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Laboratory Testing by: Exploration Associates (Warwick) Limited Dates:

BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 234

FIGURE C

Sheet 1 of 1

Sample No.:
Depth: 1.00 - 3.00 m
S.G.: 2.69 estimated / measured *
Max. Dry Density 1830 (kg/m³)
Optimum Moisture Content 12.0 (%)
% Retained on 19mm B.S. Sieve 0

Dry Density (kg/m³)
C.B.R. (%)
Moisture Content (%)
0%
5%
10%

Key to symbols:
Compaction Standard / Heavy *
T (top)
or CBR (averaged if within 10% of mean)
B (base)

Sample No.:
Depth: m
S.G.: estimated / measured *
Max. Dry Density (kg/m³)
Optimum Moisture Content (%)
% Retained on 19mm B.S. Sieve

Dry Density (kg/m³)
C.B.R. (%)
Moisture Content (%)

Key to symbols:
Compaction Standard / Heavy *
T (top)
or CBR (averaged if within 10% of mean)
B (base)

* Delete as necessary

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BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 235

FIGURE A1

Sheet 1 of 1

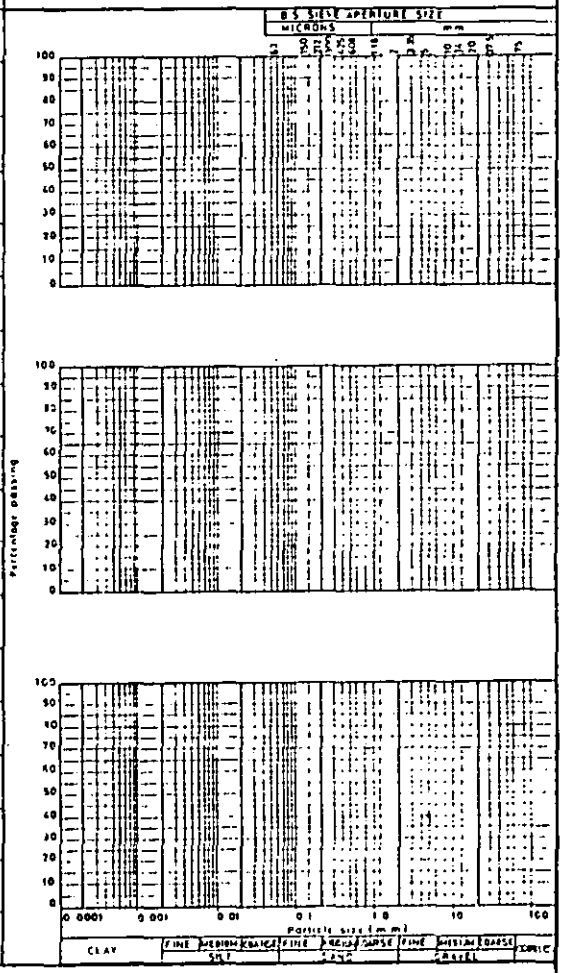
Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 12.9.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66841.2 E.
94847.3 N.
Ground Level: 72.54 m O.D.

Laboratory Testing by. Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata
29.8.84	-	-	0.30	J1		0.30	72.24	TOPSOIL
			0.50	(20)2				Firm to stiff brown silty CLAY with occasional fine angular gravel. Traces of carbonaceous material and rootlets (GLACIAL TILL)
			0.95					
			1.00	J3				
				S(10)				
			1.45	J4,B5				
			1.80	J6				Occasional fine to medium sub-angular gravel and flint below 1.00m
			2.00	(19)7				
			2.45					
			2.50	J8,B9		2.50	70.04	
				S(14)				Firm brown very silty CLAY with pockets of sandy silty clay and occasional fine gravel and traces of carbonaceous material (GLACIAL TILL)
			2.95	J10				
			3.20	J11		3.20	69.34	
			3.50	(30)12				Stiff red brown fissured silty CLAY with blue grey staining on fissure surfaces, many mudstone lithorelicts and some bands of highly weathered calcareous mudstone. (KEUPER MARL : ZONE II/III)
			3.95					
			4.00	J13				
				S(19)				
			4.45	J14,B15				
			4.70	J16				
			5.00	(40)17				
			5.45					
			5.50	J18				Band of moderately weathered fissured weak and very weak micaceous, calcareous mudstone at 6.30 and 6.90m
				S(23)				
			5.95	J19				
			6.30	J20				
			6.50	(80)21				
			6.90	J22				
				S(48)				
			7.35	J23				
			7.50	J24				
			7.60					
				S(53)				
29.8.84	Nil	Dry	8.05	J25		8.05	64.49	
								End of Shell and Auger Hole. Bentonite seal 0.50 – 1.50 Gravel filter 1.50 – 7.80 Standpipe installed to 7.80

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
	1					
	5	22		36	20	100
	7			28	14	100
	9	21		31	15	100
	12	22		39	21	100
	15	24				
	17	20				



Scale 1:

Disturbed Samples : W – Groundwater
● J – Jar
● S – S.P.T.
● B – Bulk
● M – Mazi

Undisturbed Samples : Soil Sample

Insitu Tests : V C30 ☐ – Vane shear strength in KN /m²

Groundwater first struck

☐ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S – S P T cone or spoon
(25) – N value

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 235

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation									Notes
					Stress at Failure		Strain at Failure			C	Ø	Type of Shear Test	Initial		Pressure Range (kN/m²)							
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1-\sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)								
1.45	B	S	14.0	1835											m_v							
															c_v							
															k							
															e							
2.00	U				49	68	4.2	18	1690						m_v							
2.45					98	107	5.1	17	1780			$\overline{CD}$			c_v							
					149	178	13.8	15	1840	0	32				k							
															e							
3.50	U				24	36	3.8	25	1540						m_v							
3.95					57	63	3.6	24	1560			REM $\overline{CU}$			c_v							
					104	102	8.2	25	1550	10	26				k							
															e							
5.00	U				50	56	20	20	1670	60	-				m_v							* alternative interpretation
5.45					100	58	20	21	1675	(48	6)*	REM UU			c_v							
					200	75	20	20	1700						k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p. measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p. measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p. measurement
V = Vane Shear
S = Shear Box

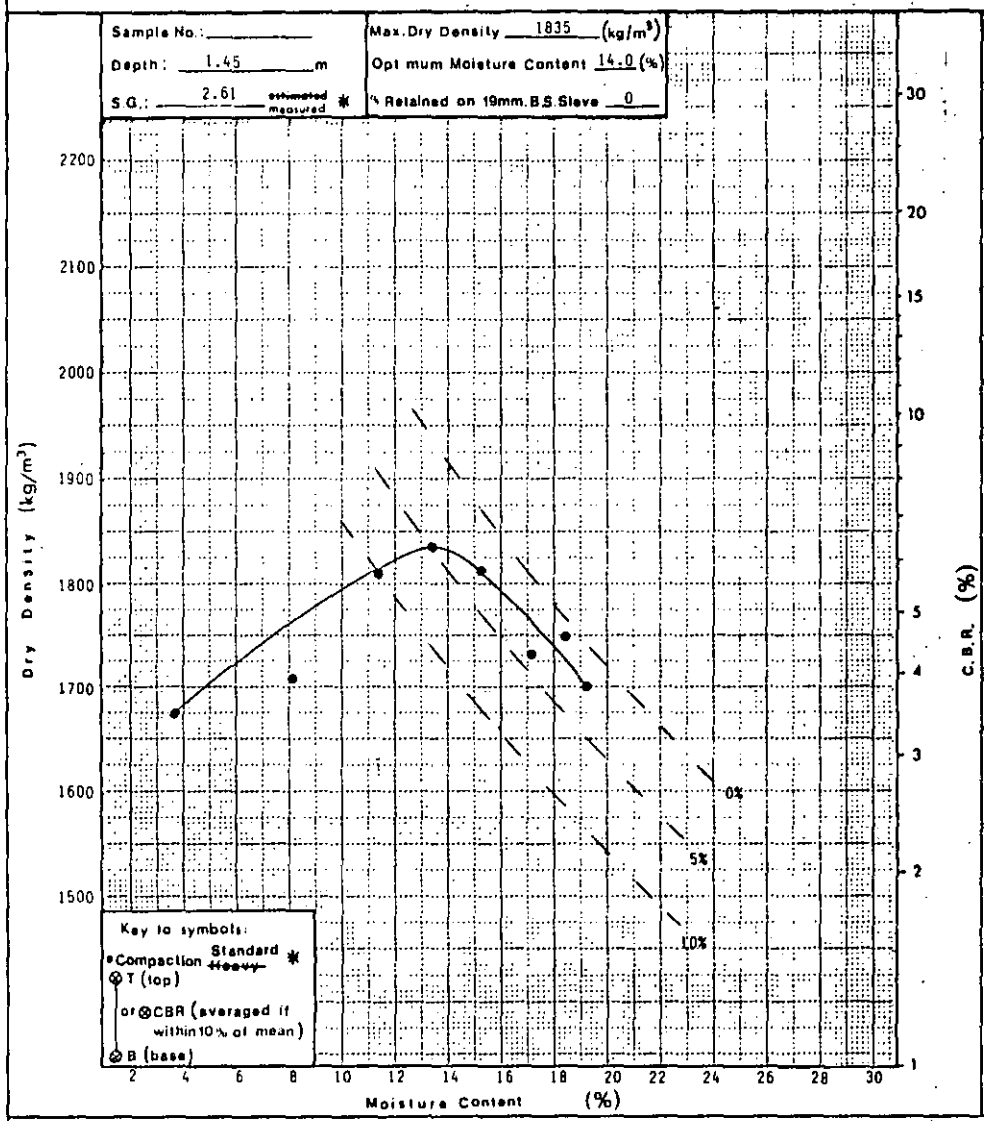
m_v = m^2 / MN
c_v = m^2 / yr
k = m/s = 10^{-8}
e = void ratio at U 100% for each increment

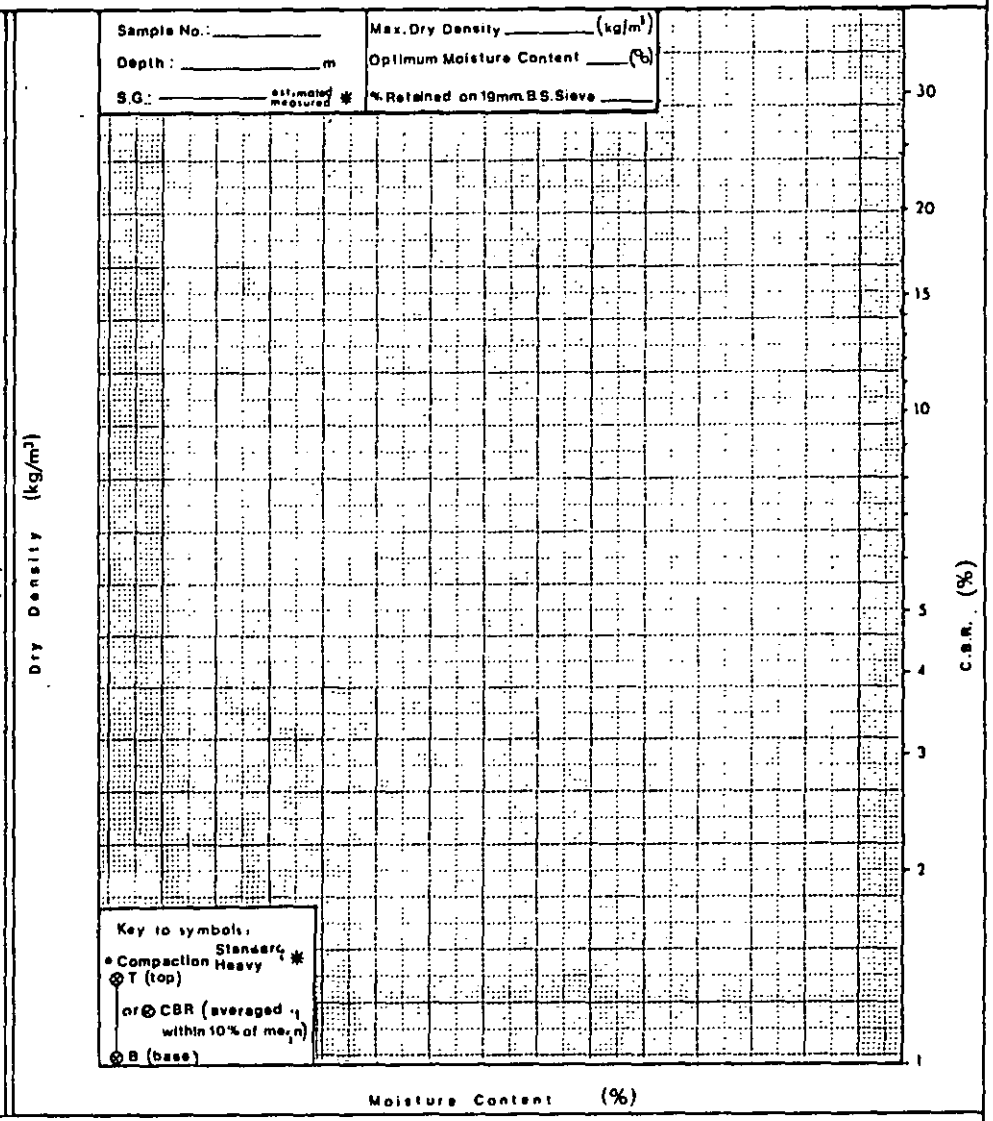
SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 235
FIGURE C
Sheet 1 of 1





* Delete as necessary

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BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 236

FIGURE A1

Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 7.9.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

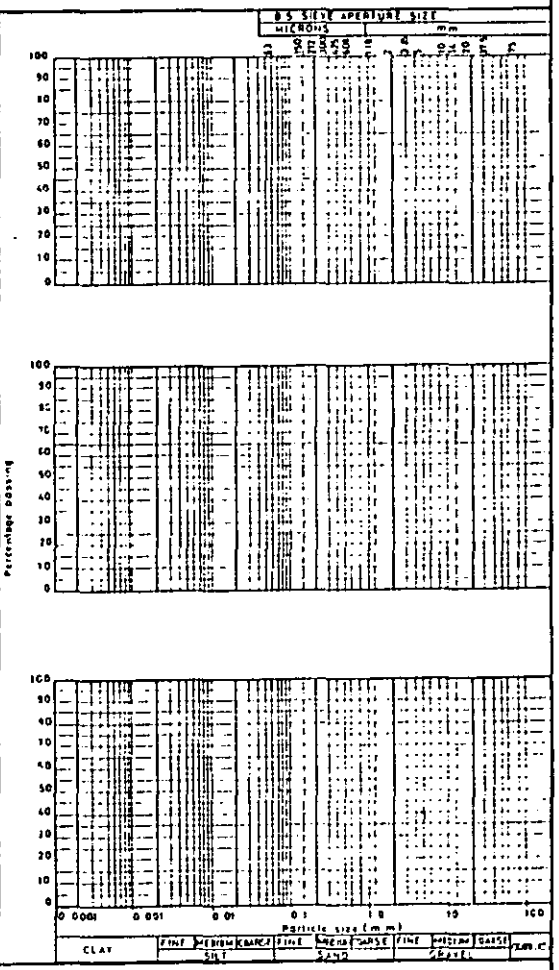
Coordinates: 66898.4 E.
95010.6 N.
Ground Level: 79.05 m OD

Laboratory Testing by: Dates:

Date	Depth of Casing (m)	Depth to water (m)	Sample/In-situ Test Depth (m)	Sample/In-situ Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata
7.9.84	–	–	0.30	J1		0.30	78.75	TOPSOIL
			0.50	(28)2				Stiff orange red brown silty CLAY with occasional fine to medium gravel (siltstone and sandstone) (GLACIAL TILL)
			0.95			1.00	78.05	
			1.00	J3				
				S(21)				Very stiff red brown slightly mottled grey green, fissured silty CLAY with many mudstone lithorelicts and zones of highly weathered mudstone and siltstone (KEUPER MARL : ZONE III)
			1.45	J4				
			1.70	B5				
			1.80	J6				
			2.00					
				(75)7				
			2.45					
			2.50	J8				
				S(31)				
			2.95	J9				
			3.00					
			3.20	J10				
			3.50					
				(60)11				
			3.95					
			4.00	B12		4.00	75.05	
			4.05	J13				Very stiff red brown mottled grey green silty CLAY with many mudstone lithorelicts (highly weathered mudstone) and bands of weak and very weak mudstone and siltstone. (KEUPER MARL : ZONE II/III)
				S(131)				
			4.50	J14				
			4.70	J15				
			5.00					
				(100)16				
			5.40	J17				
				S(49)				
			5.85	J18				Becoming very silty clay below 6.65m
			6.20	J19				
			6.65					
				S(64 for 200mm)*				
7.9.84	Nil	Dry	7.00	J20		7.00	72.05	
								End of Shell and Auger Hole.
								Hard Strata – 4.40 – 4.70 = 1 hour
								* Seating Blows – J20 = 12

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr / pH
	1	15					
	2	16		38	21	100	
	5	24 24**					0.01 7.8
	7	15	1870	34	17	100	
	11	15	1920				
	12	22		42	22	100	0.04 7.5
	14	12					

** Microwave Determination



Scale 1:

Disturbed Samples : W – Groundwater
● J – Jar
● S – S.P.T.
● B – Bulk
● M – Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] – Vane shear strength in KN /m²

Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S – S.P.T. cone or spoon
(25) – N value

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 236
FIGURE B
Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at failure		Strain at failure			C	ø	Type of Shear Test	Initial		Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)							
0.50	U2				21	35	4.4	19	1630			REM / CU			m_v							
0.95					49	54	3.4	17	1660	10	25				c_v							
					65	65	4.8	20	1661						k							
															e							
2.00	U7				50	246	11	15	1850	270	-	UU			m_v							
2.45					100	233	6	15	1870						c_v							
					150	233	11	15	1890						k							
															e							
3.50	U11				50	140	5			160	-	UU			m_v							* alternative interpretation
3.95					100	161	6.5	15	1920	(9 | 17)*				c_v							
					150	181	7								k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2 / MN
c_v = m^2 / yr
k = m/s = 10^{-8}
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 237

FIGURE A1

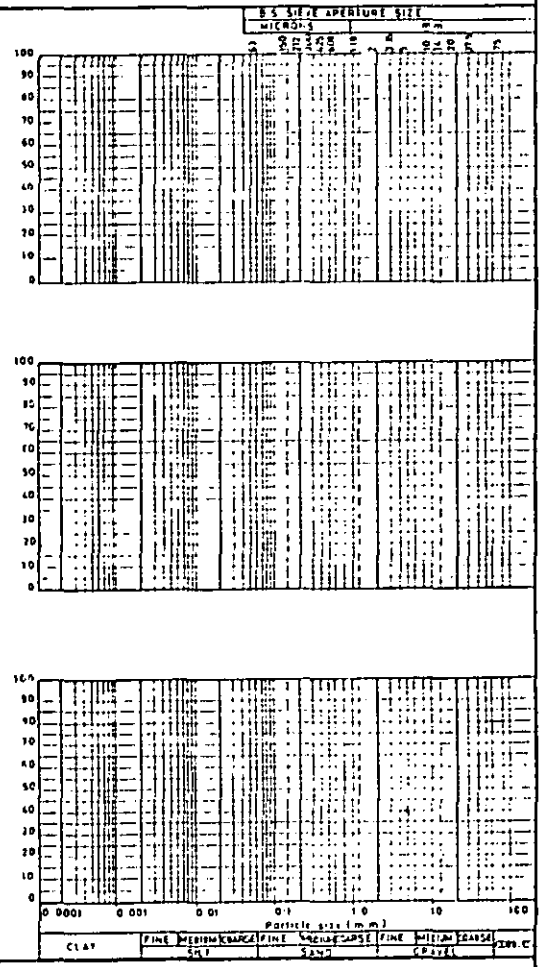
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 14.8.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66946.5 E.
95226.9 N.
Ground Level: 80.90 m O.D.

Laboratory Testing by: Dates:

Date	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr pH
14.8.84	-	-				0.20	80.70	TOPSOIL								
			0.50	J1				Stiff and very stiff red brown mottled light brown fissured friable slightly sandy silty CLAY with many lithorelicts of mudstone and siltstone. (KEUPER MARL : ZONE III)		2	17	1820	38	19	100	
			0.95 / 1.00	(65)2 / J3		1.00	79.90			5	17		40	20	100	0.04 / 8.1
			1.45 / 1.50	S(20) / J4 / B5				Stiff to very stiff red brown slightly mottled grey green fissured silty CLAY. (KEUPER MARL : ZONE IVa)		10	19		34	19	100	
			1.80	J6												
			2.00 / 2.45	(90)7		2.40	78.50	Occasional lithorelicts below 1.80m								
			2.50 / 2.95 / 3.00	J8 / S(36) / J9 / B10		2.50	78.40	Interstratified thickly and thinly laminated red brown silty CLAY very silty clay sand silty clay and very weak grey green siltstone and mudstone. (KEUPER MARL : ZONE IVa)								
			3.30	J11				Stiff red brown silty CLAY and grey green fissured SILT with many lithorelicts of siltstone, 4.00 - moderately weak and moderately strong siltstone. (KEUPER MARL : ZONE II/III)								
			3.50 / 3.95	(98)12												
		Slight seepage at 4.0	4.00	J13		4.00	76.90									
			4.45 / 4.50 / 4.60	S(86) / J14 / B15 / J16		4.60	76.30	Very stiff red brown mottled grey green silty CLAY and very silty clay tending to very weak mudstone and siltstone in zones (KEUPER MARL : ZONE II/III)								
14.8.84	3.00	4.90	5.00	J17		5.00	75.90	Firm red brown fissured very friable silty CLAY with many lithorelicts below 4.90 (KEUPER MARL : ZONE III								
								End of Shell and Auger Hole.								



Scale 1:

Disturbed Samples : W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] - Vane shear strength in KN /m²

Groundwater first struck

Core Cutter Density
Core Cutter Density/C.B.R

Sandbottle Density
C B R

C or S - S.P.T. cone or spoon
(25) - N value

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 237
FIGURE B
Sheet 1 of 1

Laboratory Testing by : Exploration Associates (Warwick) Limited
Dates:

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at Failure		Strain at Failure			C	Ø	Type of Shear Test	Initial		Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)							
0.50	U2				50	229	8	16	1810	240	-	UU								m_v	
0.95					100	202	12	18	1790											c_v	
					150	297	13	16	1850											k	
																				e	
																				m_v	
																				c_v	
																				k	
																				e	
																				m_v	
																				c_v	
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																				m_v	
																				c_v	
																				k	
																				e	
																				m_v	
																				c_v	
																				k	
																				e	

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

$m_v = m^2/MN$
$c_v = m^2/yr$
$k = m/s \times 10^{-8}$
e = void ratio at U 100% for each increment

SCOTT WILSON KIRKPATRICK & PARTNERS
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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 238

FIGURE A1

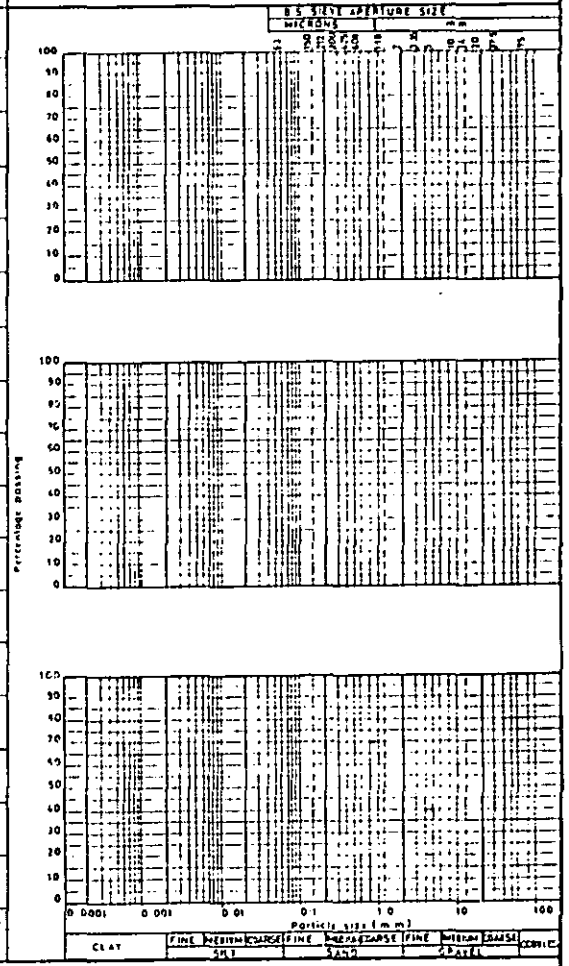
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 13.9.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 67083.8 E.
95063.4 N.
Ground Level: 70.72 m OD

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Samples/Insitu Test Depth (m)	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
13.9.84	-	-	0.30	J1		0.30	70.42	TOPSOIL		1	15				
			0.50					Firm red brown fissured silty to very silty CLAY with occasional siltstone lithorelicts and some thin bands of highly weathered very weak calcareous siltstone. (KEUPER MARL : ZONE II/III)		2	19				
				(36)2											
			0.95												
			1.00	J3						4	17		43	30	100
				S(15)											
			1.45	J4											
			1.80	J5						6	20				
			2.00												
				(50)6											
			2.45							8	18				
			2.50	J7											
				S(15)											
			2.95	J8											
			3.30	J9											
			3.50												
				(55)10											
			3.95												
			4.00	J11											
				S(52)											
			4.45	J12											
			4.50												
				S(60)											
13.9.84	Nil	Dry	4.95	J13		5.00	65.72								
								End of Shell and Auger Hole.							



Scale 1:

Disturbed Samples : W - Groundwater
● J - Jar
● S - S.P.T.
● B - Bulk
● M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] - Vane shear strength in KN/m²

▼ Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S - S.P.T cone or spoon
(25) - N value

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

~~BOREHOLE~~ ~~TRIAL PIT~~ No. 238

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation									Notes
					Stress at Failure		Strain at Failure			C	ø	Type of Shear Test	Initial			Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)								
0.50 2.50	U2 U6	S	14.0	1805											m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
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															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p. measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p. measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p. measurement
V = Vane Shear
S = Shear Box

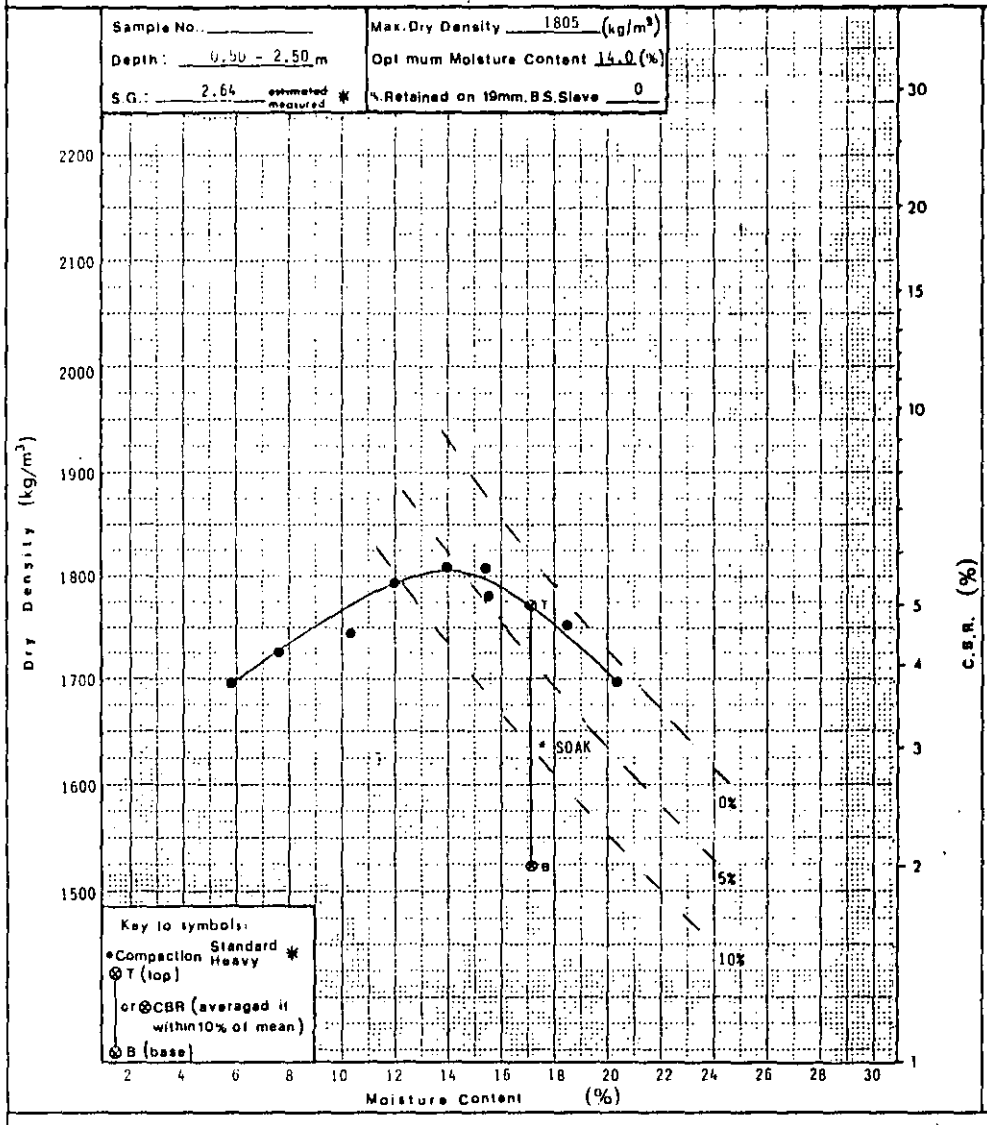
m_v = m^2 /MN
c_v = m^2 / yr
k = m/s x 10^{-9}
e = void ratio at U 100% for each increment

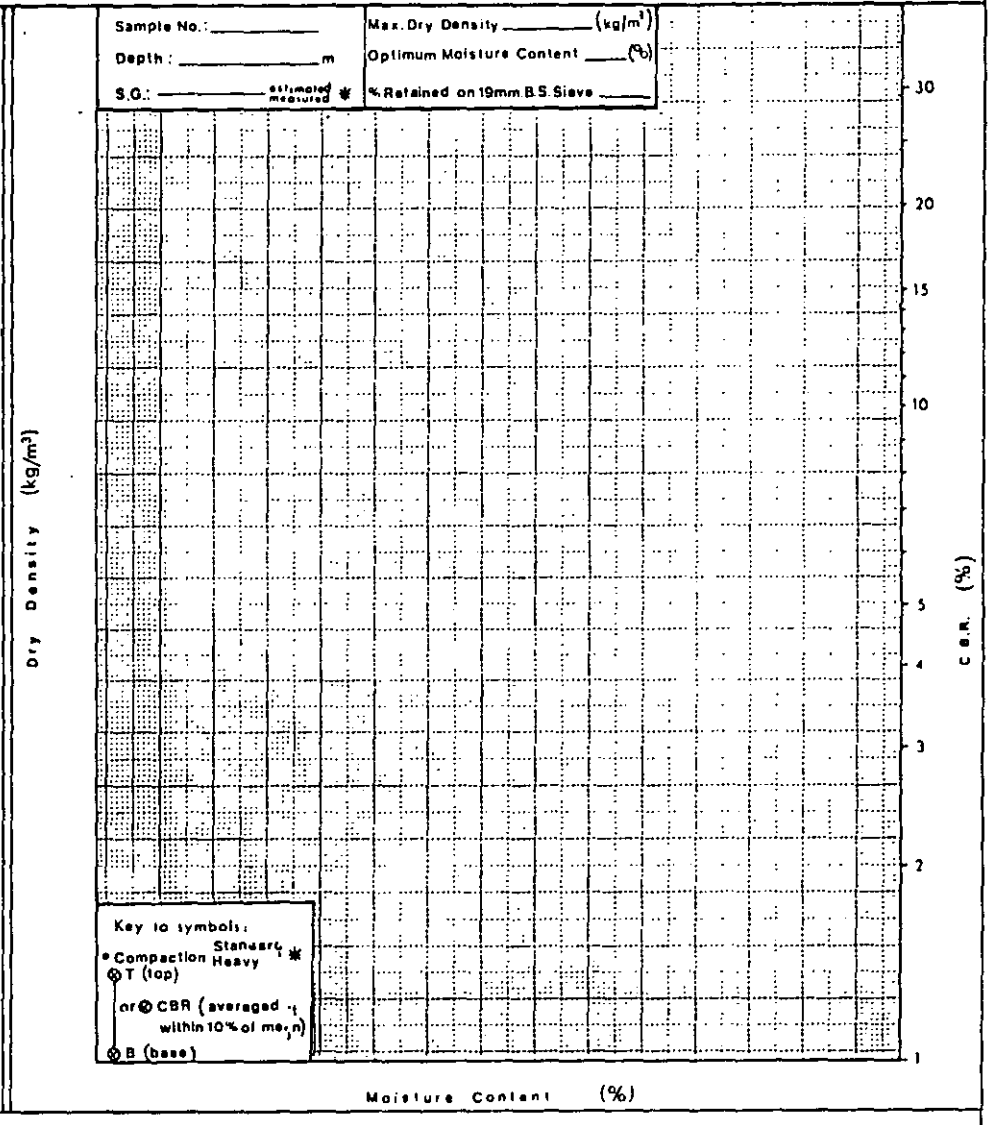
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Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT : 2

BOREHOLE No. 238
FIGURE C
Sheet 1 of 1





* SOAK - Swelling test - sample swelled 0.738mm in 66 hours

* Delete as necessary

SCOTT WILSON KIRKPATRICK & PARTNERS
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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 239

FIGURE A1

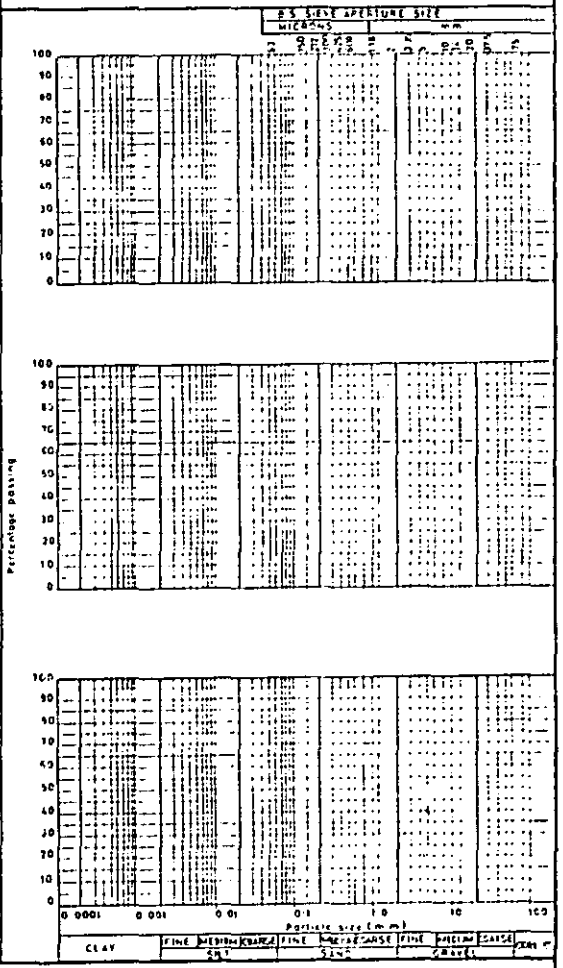
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 13.9.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 67067.4 E.
94880.1 N.
Ground Level: 75.70 m O.D.

Laboratory Testing by. Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr / pH
13.9.84	-	-	0.30	J1		0.20	75.50	TOPSOIL		1	12					
			0.50	(26)2		0.80	74.90	Stiff orange brown sandy silty CLAY with zones of clayey sand and occasional sub-angular fine to medium gravel. (GLACIAL TILL)		2	20		57	25	100	
			0.95													
			1.00	J3				Stiff red brown and grey green silty CLAY with occasional lithorelicts and bands of highly weathered siltstone (KEUPER MARL : ZONE II/III)		6	13					
				S(20)												
			1.45	J4												
			1.80	J5						9	19					
			2.00	(90)6												
			2.45							11			27	16	100	
			2.50	J7												0.03
			2.95	S(22)						12	19					7.8
			3.00	J8 B9												
			3.30	J10		3.30	72.40			13	11	1950				
			3.50	(46)11				Firm and stiff red brown very silty CLAY with occaisonal mudstone lithorelicts and bands of highly weathered fissured mudstone. (KEUPER MARL : ZONE II/III)		15	16					
			3.95													
			4.00													
			5.00	B12												
				(47)13												
			5.45													
			5.50	J14												
				S(32)												
			5.95	J15												
			6.30	J16												
			6.50													
				S(46)												
13.9.84	Nil	Dry	6.95	J17		7.00	68.70									
								End of Shell and Auger Hole.								



Scale 1:

Disturbed Samples : W - Groundwater
● J - Jar ● S - S.P.T. ▮ B - Bulk ● M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V (30) - Vane shear strength in KN/m²
▼ Groundwater first struck
□ Core Cutter Density
■ Core Cutter Density/C.B.R
▽ Sandbottle Density
▲ C.B.R
C or S SPT ... or spoon
(25) - N value

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 239

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength									Initial		Consolidation							Notes
					Stress at Failure		Strain at Failure			C	ø	Type of Shear Test				Pressure Range (kN/m²)							
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1-\sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)									
3.50	U11				49	66	3.2					$\overline{CD}$			m_v								
3.95					100	122	3.7	16	1730						c_v								
					148	144	2.6			0	30				k								
															e								
4.00	B12	H	12.0	1945											m_v								
5.00															c_v								
															k								
															e								
5.00	U13				50	108	4.5			114	-	UU			m_v								* Failed under 2nd load
5.45					100	120	6	11	1950						c_v								
					150	*									k								
															e								
															m_v								
															c_v								
															k								
															e								
															m_v								
															c_v								
															k								
															e								
															m_v								
															c_v								
															k								
															e								
															m_v								
															c_v								
															k								
															e								
															m_v								
															c_v								
															k								
															e								

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2 / MN
c_v = m^2 / yr
k = m/s = 10^{-9}
e = void ratio at U 100% for each increment

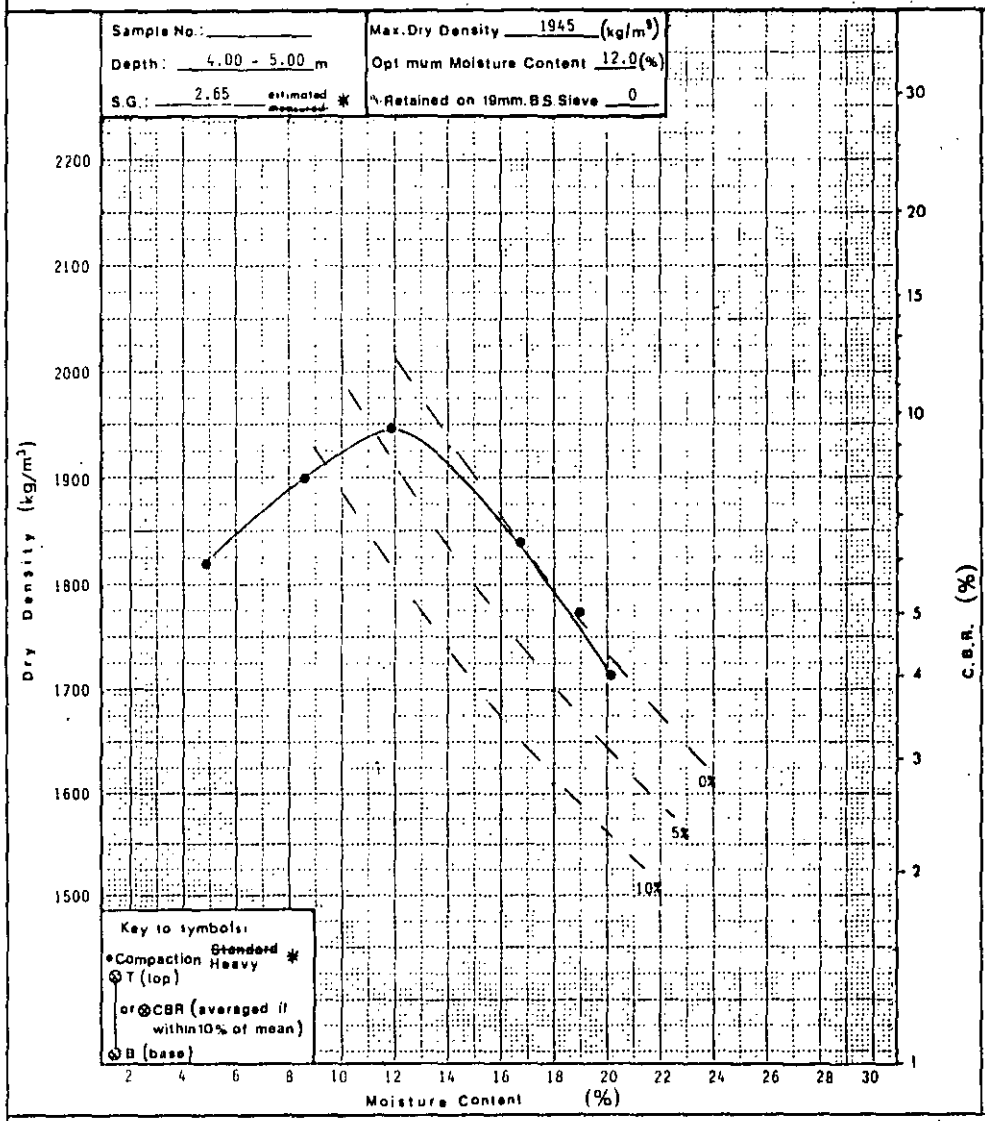
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Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

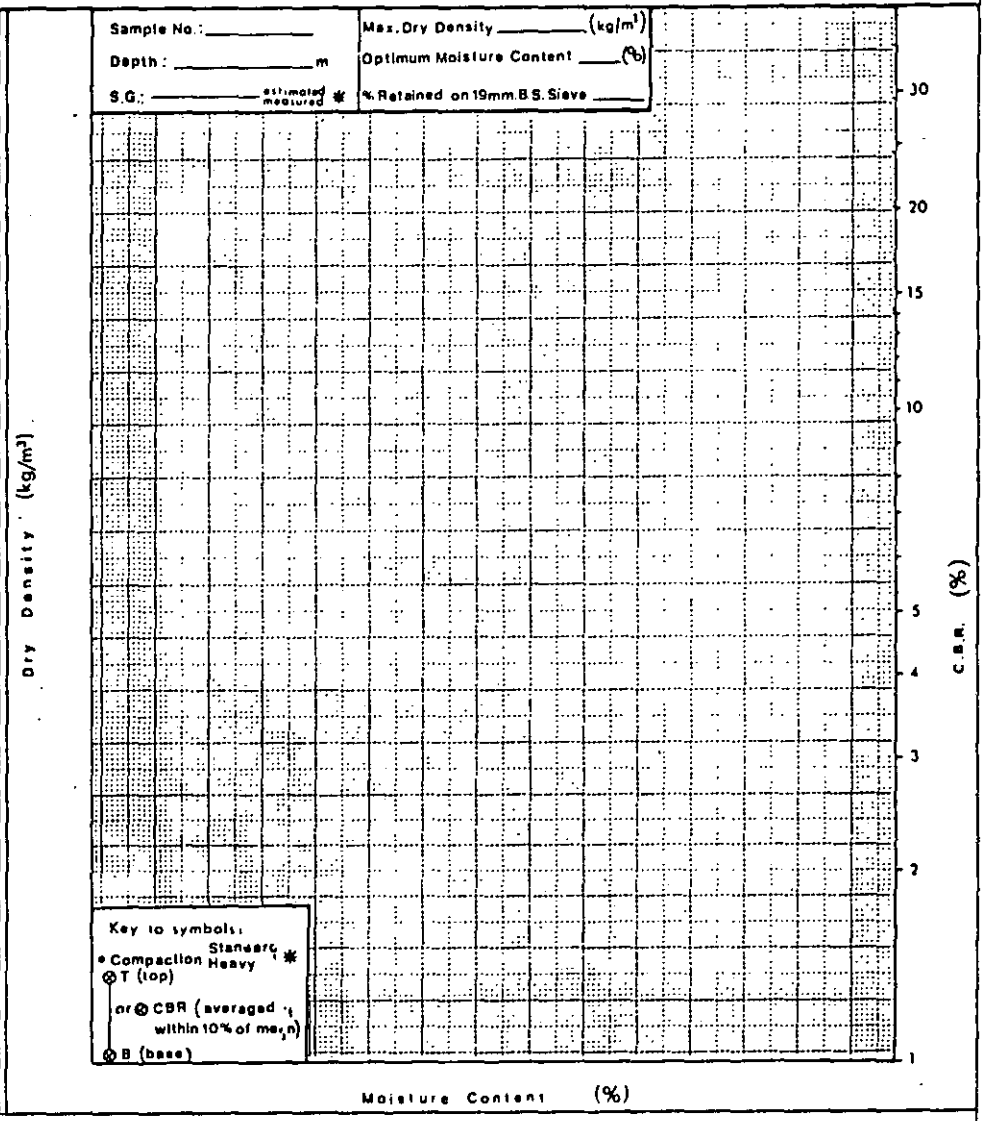
BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 239
FIGURE C
Sheet 1 of 1

Sample No.:
Depth: 4.00 - 5.00 m
S.G.: 2.65 estimated / measured *
Max. Dry Density 1945 (kg/m³)
Optimum Moisture Content 12.0 (%)
% Retained on 19mm B.S. Sieve 0



Sample No.:
Depth: m
S.G.: estimated / measured *
Max. Dry Density (kg/m³)
Optimum Moisture Content (%)
% Retained on 19mm B.S. Sieve



* Delete as necessary

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 240

FIGURE A1

Sheet 1 of 1

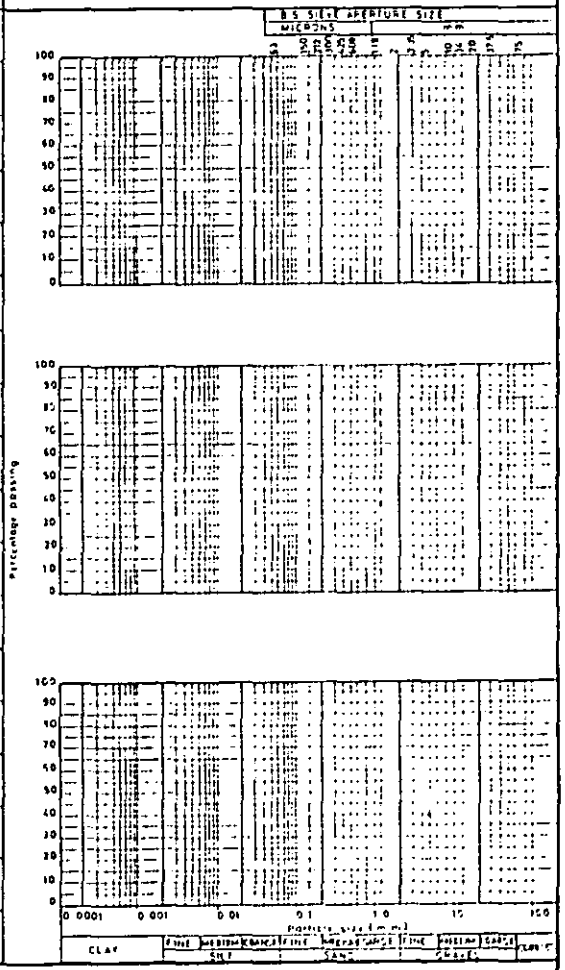
Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 13.9.84
Hole Dimensions 150mm
Casing Dimensions. 150mm

Coordinates: 67083.7 E.
94796.2 N.
Ground Level: 78.35 m O.D.

Laboratory Testing by. Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata
13.9.84	-	-	0.30	J1		0.30	78.05	TOPSOIL
			0.50	(26)2				Stiff orange brown sandy silty CLAY with occasional sub-angular gravel (mudstone/siltstone) and rootlets. Much sub-rounded fine to medium gravel fragments of chalk below 1.00m. Fissuring with grey gleying below 1.70m (GLACIAL TILL)
			0.95					
			1.00	J3				
				S(10)				
			1.45	J4				
			1.70	J5				
			2.00	(30)6				
			2.45					
			2.50	J7		2.50	75.85	
				S(14)				Firm red brown mottled grey green very silty CLAY with many mudstone lithorelicts. (KEUPER MARL : ZONE III)
			2.95	J8				
			3.20	J9				
			3.50			3.50	74.85	
				(40)10				Firm red brown silty CLAY with occasional mudstone lithorelicts. (KEUPER MARL : ZONE II/III)
			3.95					
			4.00	J11,B12				
				S(19)				
			4.45	J13				
			4.70	J14				Band of highly weathered weak and very weak fissured mudstone at 4.70m
			5.00	(50)15				
			5.45					
			5.50	J16		5.50	72.85	
				S(21)				Stiff and very stiff red brown very silty CLAY with many mudstone lithorelicts tending to very weak highly weathered silty mudstone in zones. (KEUPER MARL : ZONE III)
			5.95	J17				
			6.00	B18				
			6.30	J19				
			6.50	(50)20				
			6.95					
			7.00	J21				
				S(62)				
			7.45	J22				
			7.80	S(50)				
13.9.84	Nil	Dry	8.25	J23		8.25	70.10	
								End of Shell and Auger Hole. Bentonite seal 0.50 - 1.50, Gravel filter 1.50 - 7.80, Standpipe installed to 7.80

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr pH
	1	12					
	2	15		46	20	100	
	6			38	18	73	
	8	15		43	20	100	
	10			35	18	100	
	12	21					
	15						
	18	20		36	19	100	0.06 8.1



Scale 1:

Disturbed Samples : W - Groundwater
J - Jar, S - S.P.T., B - Bulk, M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] - Vane shear strength in KN/m²

Groundwater first struck

Core Cutter Density
Core Cutter Density/C.B.R

Sandbottle Density
C B R

C or S S.P.T. cone or spoon
(25) - N value

SCOTT WILSON KIRKPATRICK & PARTNERS
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BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 240
FIGURE B
Sheet 1 of 1

Laboratory Testing by : Exploration Associates (Warwick) Limited
Dates :

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at Failure		Strain at Failure			C	ø	Type of Shear Test	Initial		Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1-\sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)							
0.50	U				48	42	5.3	15	1710			REM									
0.95					100	88	7.5	16	1690												
					150	135	9.8	15	1700	0	27	CD									
2.00	U				50	53	2.3														
2.45					101	91	2.9	24	1710			CD									
					150	136	1.5			0	26										
2.95	B	S	16.0	1755																	
4.00																					
3.50	U				48	35	3.7					REM									
3.95					99	90	3.7	16	1590												
					196	170	2.2			0	27	CD									

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p. measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p. measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p. measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s $\times 10^{-8}$
e = void ratio at U 100% for each increment

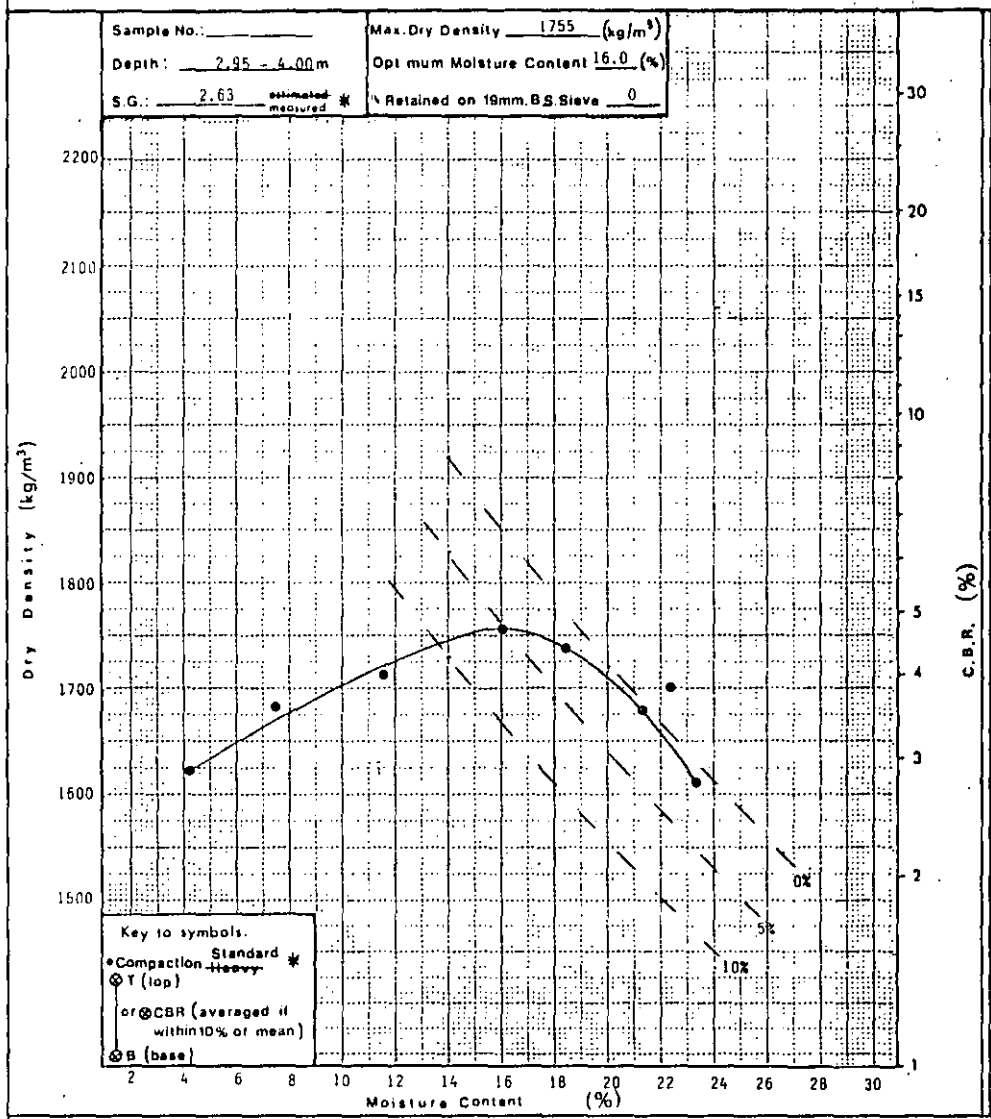
SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

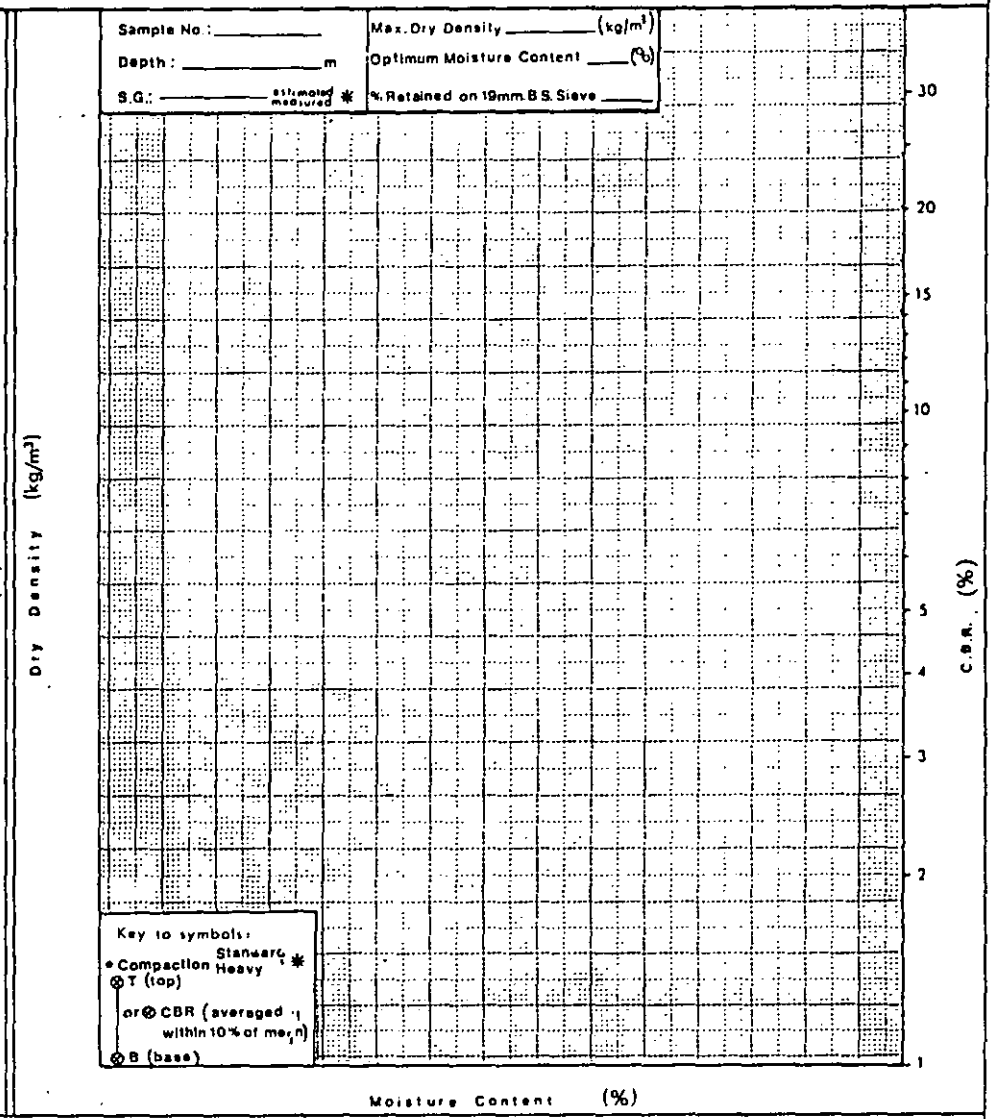
BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 240
FIGURE C
Sheet 1 of 1

Sample No.:
Depth: 2.95 - 4.00 m
S.G.: 2.63 estimated / measured *
Max. Dry Density 1755 (kg/m³)
Optimum Moisture Content 16.0 (%)
% Retained on 19mm B.S. Sieve 0



Sample No.:
Depth: m
S.G.: estimated / measured *
Max. Dry Density (kg/m³)
Optimum Moisture Content (%)
% Retained on 19mm B.S. Sieve



* Delete as necessary

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 241

FIGURE A1

Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 19.9.84
Hole Dimensions 150mm
Casing Dimensions. N/A

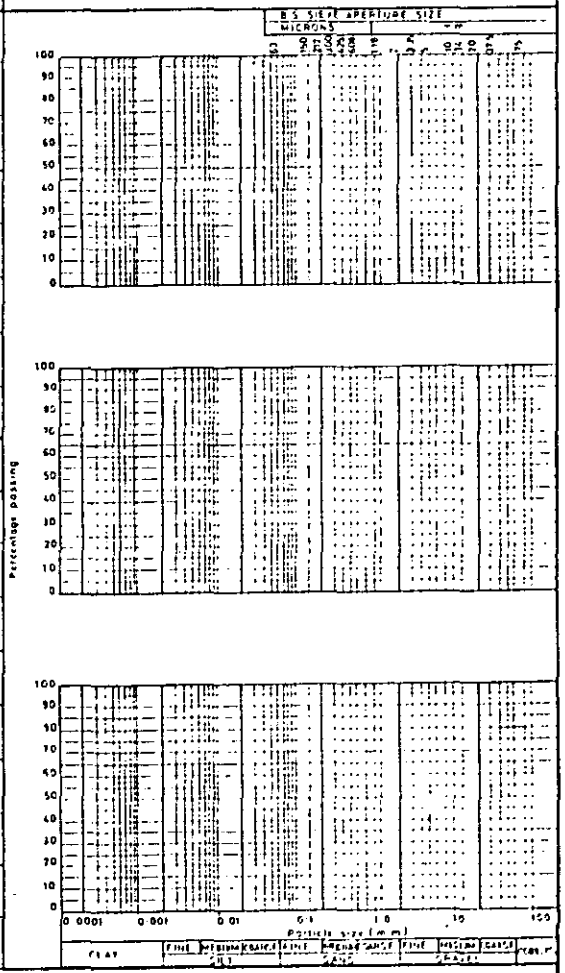
Coordinates: 66912.2 E.
94821.6 N.
Ground Level: 79.73 m OD

Laboratory Testing by. Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata
19.9.84	-	-	0.30	J1		0.30	79.43	TOPSOIL
			0.50	(40)2				Stiff brown silty CLAY with occasional sub-rounded to angular fine to medium gravel and siltstone (GLACIAL TILL)
			0.85	J3		1.00	78.73	
			1.00	S(28)				Firm red brown silty CLAY with some mudstone lithorelicts and thin bands of highly weathered very weak grey green mudstone/siltstone (KEUPER MARL : ZONE II/III)
			1.45	J4				
			1.60	B5				
			1.80	J6				
			2.00	(45)7				
			2.45					
			2.50	J8				
			2.95	S(36) J9				Becoming stiff and firm below 2.50m
			3.20	J10				
			3.50	(40)11				
			3.95					Becoming very stiff below 5.00m
			4.00	J12				
			4.45	S(37) J13				
			4.50	B14				
			4.70	J15				
			5.00	(100)16				
			5.40	J17				
			5.85	S(74) J18				
			6.20	J19				
			6.50	S(87)				
			6.95	J20,B21				
			7.20	J22				
			7.70	S(105)				
19.9.84	Nil	Dry	8.15	J23		8.15	71.58	
								End of Shell and Auger Hole.

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
	1	10				
	2	14		45	20	100
	5	18		41	22	100
	9					
	11			36	20	100
	14	23 24**				
	21	20				

** Microwave Determination



Scale 1:

Disturbed Samples : W – Groundwater
● J – Jar
● S – S.P.T.
■ B – Bulk
◆ M – Mazi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] – Vane shear strength in KN /m²

▼ Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S – S P T cone or spoon
(25) – N value

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Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 241
FIGURE B
Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at Failure		Strain at Failure			C	Ø	Type of Shear Test	Initial		Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1-\sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)							
0.50	U				27	45	6.6	19	1730			REM CU			m_v						
0.95					53	40	4.2	19	1730						c_v						
					117	115	10.2	18	1760	15	25				k						
															e						
1.00	B				50	68	20	20	1650	70	-	REM UU			m_v						
1.60					100	67	20	21	1645						c_v						
					150	70	20	21	1600	-					k						
															e						
3.50	U				50	100	4.8					CD			m_v						
3.95					96	137	2.3	15	1790						c_v						
					147	177	2.1			25	28				k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s x 10^{-8}
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B242

FIGURE A1

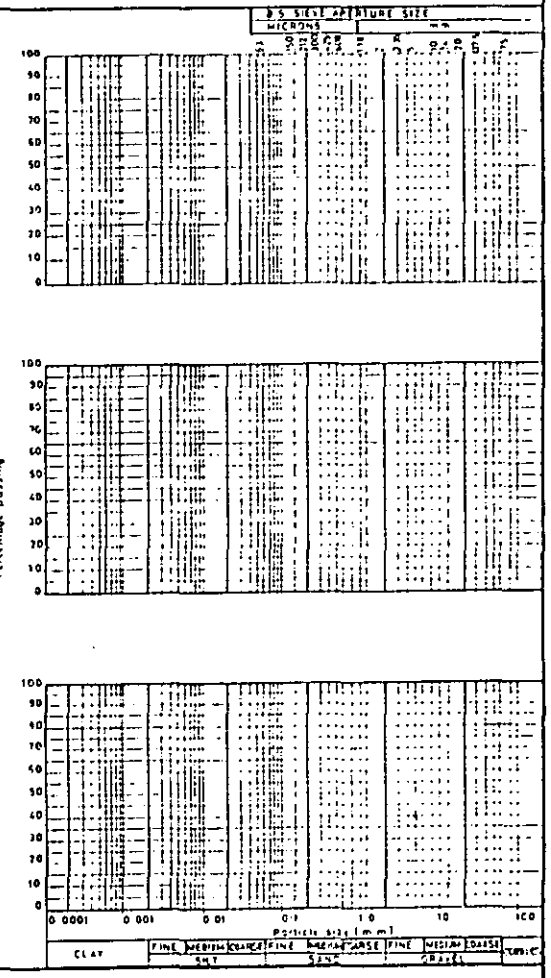
Sheet 1 of 2

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 21.8.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66813.0 E.
94507.1 N.
Ground Level: 58.79 m OD.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
21.8.84	-	-				0.05	58.74	TOPSOIL							
			0.50	J1		0.50	58.29	Firm to stiff brown CLAY (Drillers Description)		2	18	1705	49	22	100
				(40)2				Very stiff red brown mottled greey grey sandy very silty CLAY with occaisonal lithorelicts of mudstone and siltstone. (KEUPER MARL : ZONE III)		4	23				
			0.95			1.00	57.79								
			1.00	J3						6	19	1695	40	20	100
				S(10)				Firm red brown mottled grey green fissured silty CLAY with occasional lithorelicts of mudstone and siltstone. (KEUPER MARL : ZONE III/IVa)							
			1.45	J4											
			1.80	J5						10	8.5	2020	33	18	100
			2.00												
				(75)6						12	16				
			2.45			2.50	56.29								
			2.50	J7				Stiff and very stiff red brown and grey green fissured silty CLAY and very silty clay with many lithorelicts tending to very weak mudstone and siltstone in zone. (KEUPER MARL : ZONE II/III)		16	13				
				S(37)											
			2.95	J8											
			3.30	J9											
			3.50												
				(100)10											
			3.95												
			4.00	J11											
				S(57)											
			4.45	J12											
			4.70	J13											
			5.00												
				S(81)											
			5.45	J14											
			5.90	J15											
			6.50												
				S(94)											
			6.95	J16											
			7.70	J17											
			8.00	S(50 for 75mm)		8.00	50.79								
			8.30	J18				Moderately weak to moderately strong red brown stained grey green fissured MUDSTONE. (KEUPER MARL : ZONE I)							
			9.00	J19											



Scale 1:

Disturbed Samples: W - Groundwater
● J - Jar ● S - S.P.T. ● B - Bulk ● M - Mazi

Undisturbed Samples: Soil Sample

Insitu Tests: V (30) - Vane shear strength in KN/m²

Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S SPT - type of spoon
(25) - N value

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B242

FIGURE A1

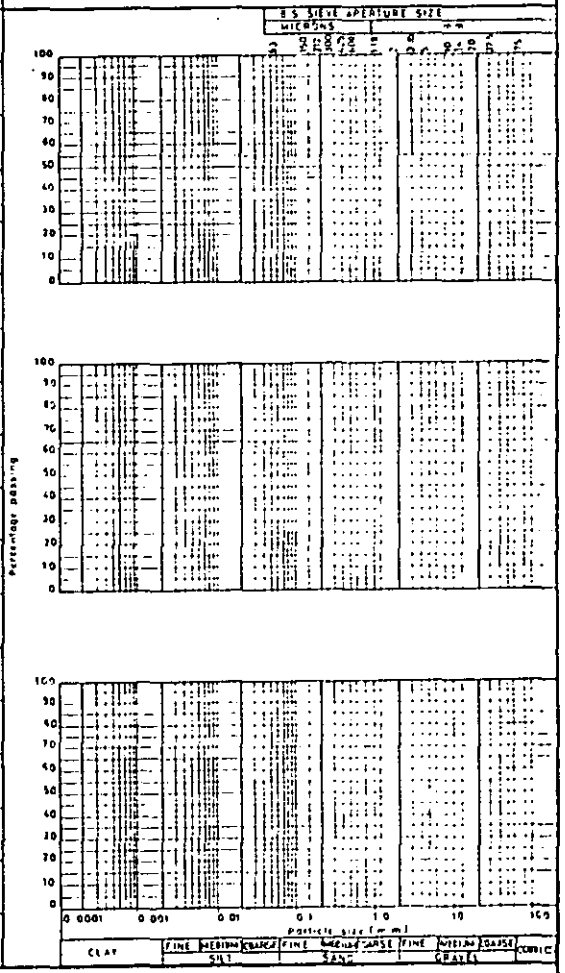
Sheet 2 of 2

Field Work by: _____
Method : _____
Dates : _____
Hole Dimensions _____
Casing Dimensions _____

Coordinates: E. N.
Ground Level: m O.D.

Laboratory Testing by. Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test: Depth (m)	Sample/Insitu Test: Type & Number	Change of Strata: Legend	Change of Strata: Depth (m)	Change of Strata: Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
								As sheet 1 of 2.		20	10				
21.8.84	9.50	Dry	9.60 ▲ 10.00 ▼	S(82 for 150mm)* J20		10.00	48.79								
								End of Shell and Auger Hole.							
								* Seating Blows - J18 = 36 J20 = 40							
								Hole continued by rotary coring - See Fig A2							



Scale 1:

Disturbed Samples : W - Groundwater
● J - Jar
● S - S.P.T.
● B - Bulk
● M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] - Vane shear strength in KN /m²
▼ Groundwater first struck
□ Core Cutter Density
■ Core Cutter Density/C.B.R
▽ Sandbottle Density
▲ C B R
C or S S.P.T. - cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B242

FIGURE A2

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Water Flush
Dates : 11.10.84
Core Diameter : 76mm
Casing Dimensions : 114.30mm

Coordinates : 66813.0 E
94507.1 N
Ground Level : 58.79 m O.D

Laboratory Testing by :
Dates :

Drilling							Test or II (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Dates	Depth of casing(m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %		Legend	Depth (m)	Reduced Level	Detail	Main									
10.10.84	-	-									Rotary Open Hole next to Shell and Auger Hole previously drilled to 9.00m (No Drillers Description) See Fig A1										

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mcaj

50
100

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B242

FIGURE A2

Sheet 2 of 2

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : mO.D.

Laboratory Testing by :
Dates :

Drilling								Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
Dates	Depth of casing(m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or ff (mm)	Legend	Depth (m)	Reduced Level	Detail	Main							
11.10.84	1.0	2.0	9.00		80%	35%	20 50 180		9.00	49.79	Slightly weathered grey green moderately weak bands at: 9.00 - 9.20, 10.69 - 11.30, 12.55 - 13.70	Slightly weathered fissured red brown very weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal smooth discontinuities. (KEUPER MARL : ZONE II)							
			9.80		93%	60%	40 130 200												
			11.30		90%	59%	50 160 160												
			12.60		71%	53%	20 95 225		13.17	45.62									
			13.20				C			(338, 112 for 225mm)		Highly weathered fissured red brown occasionally mottled grey green SILTSTONE degraded to stiff silty CLAY with many lithorelicts. (KEUPER MARL : ZONE III)							
			13.57		74%	56%	20 100 180												
			14.20		52%	40%	NI 100 100												
11.10.84	1.0	4.0	15.00						15.00	43.79		End of Rotary Hole. NI = Not Intact.							

Scale 1 :

Disturbed Samples : W - Groundwater
J - Jar, S - S.P.T., B - Bulk, M - Maxi

Core Runs: 50, 100 — core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B242
FIGURE B
Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at failure		Strain at Failure			C	Ø	Type of Shear Test	Initial		Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)							
0.50	U2				50	175	12	19	1685	170	-	UU			m_v						
0.95					100	156	6	17	1710						c_v						
					200	175	9	17	1720						k						
															e						
2.00	U6				50	69	18			75	-	UU			m_v						
2.45					150	74	19	19	1695						c_v						
					300	75	20								k						
															e						
3.50	U10				100	260	6.4			380 (110	- 27)*	UU			m_v						* alternative interpretation
3.95					200	355	10.5	8.5	2020						c_v						
					400	516	18.1								k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

$m_v = m^2/MN$
$c_v = m^2/yr$
k = m/s $\times 10^{-9}$
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B243

FIGURE A1

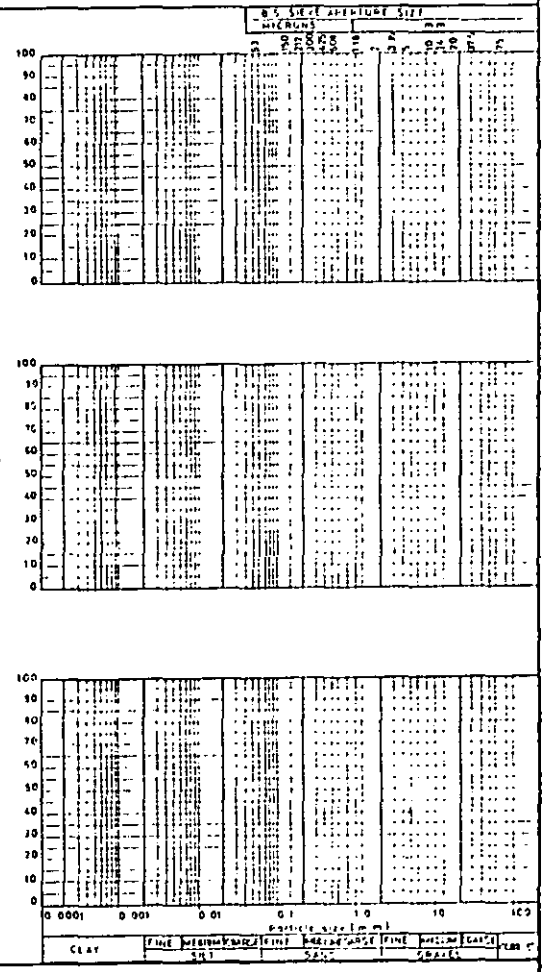
Sheet 1 of 2

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 22.8.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66822.7 E.
94508.3 N.
Ground Level: 59.79 m O.D.

Laboratory testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	%passing 425 microns	Sulphate g/ltr / pH
22.8.84	-	-				0.10	59.69	TOPSOIL								0.07
			0.40	J1		0.40	59.39	Stiff red brown CLAY (Drillers Description)		2	23					7.7
			0.50 / 0.95	(30)2				Firm red brown mottled grey green fissured silty CLAY and bands of very silty clay with occasional lithorelicts of mudstone. (KEUPER MARL : ZONE III)		4	20					
			1.00	S(12)												
			1.45	J3						19	18	1775	38	19	88	
			1.80	J4				Becoming stiff and very stiff with many lithorelicts below 1.80m		13	11		31	19	100	
			2.00 / 2.45	(80)5						15	13		30	13	100	
			2.50	J6				Tending to very weak mudstone and siltstone in zones below 2.50m								
				S(33)												
			2.95	J7												
			3.30	J8				Band of very weak and weak red brown fissured mudstone at 4.00m								
			3.50 / 3.95	(100)9												
			4.00	J10												
				S(126)												
			4.45	J11												
			5.20	J12												
			5.50			5.50	54.29									
				S(86)				Very stiff red brown slightly mottled grey green fissured silty CLAY tending to very weak mudstone. (KEUPER MARL : ZONE II/III)								
			5.95	J13												
			6.80	J14		6.80	52.99									
			7.00	S(90 for 22cm)*				Red brown fissured sandy very clayey SILT with many sub-angular mudstone lithorelicts. (KM:Z III)								
			7.45	J15		7.20	52.59									
		slight seepage at 7.50						Very weak red brown slightly mottled grey green fissured MUDSTONE tending to very stiff silty clay with many lithorelicts of mudstone and siltstone. (KEUPER MARL : ZONE II/III)								
			8.20	J16												
			8.50	S(50 for 6cm)*												
			8.80	J17												



Scale 1:

Disturbed Samples: W = Groundwater
● J = Jar ● S = S.P.T. ● B = Bulk ● M = Maxi

Undisturbed Samples: U = Soil Sample

Insitu Tests: V [30] = Vane shear strength in KN/m²

▼ Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S S.P.T. cone or spoon
[75/5] = N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B243

FIGURE A1

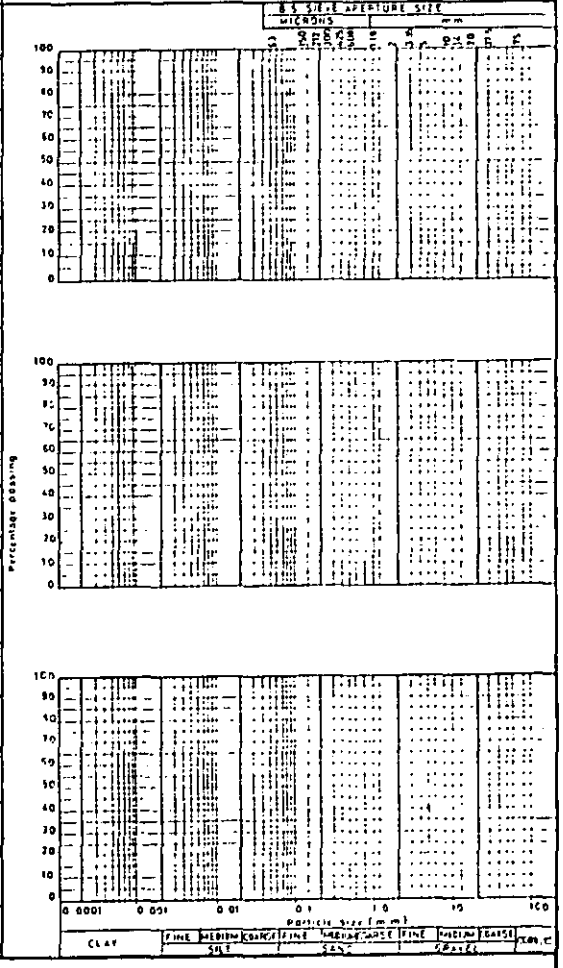
Sheet 2 of 2

Field Work by: _____
Method: _____
Dates: _____
Hole Dimensions: _____
Casing Dimensions: _____

Coordinates: E. N.
Ground Level: m OD.

Laboratory Testing by: _____ Dates: _____

Date	Depth of Casing (m)	Depth to Water (m)	Sample/In-situ Test: Depth (m)	Sample/In-situ Test: Type & Number	Change of Strata: Legend	Change of Strata: Depth (m)	Change of Strata: Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
			9.60	• J18				Tending to moderately weak mudstone below 9.60m		19	8.6				
			9.70	S(73 for J19 150SB											
22.8.84	9.60	Dry	9.90			9.90	42.89								
								End of Shell and Auger Hole.							
								* Seating Blows - J13 = 17 J15 = 30 J17 = 73							
								Hard Strata - 7.50 - 9.70 = 2¼ hours							
								Hole continued by rotary coring - See Fig A2							
								SB = Seating Blows only							



Scale 1:

Disturbed Samples: W - Groundwater
● J - Jar
● S - S.P.T.
B - Bulk
● M - Maxi

Undisturbed Samples: Soil Sample

Insitu Tests: V [30] - Vane shear strength in KN/m²

▼ Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S S.P.T. cone or spoon
(15/35) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B243

FIGURE A2

Sheet 1 of 2

Field Work by : Exploration Associates (Wrawick) Limited
Method : Rotary Coring Air Flush with Water Injection
Dates : 10.10.84
Core Diameter : 76mm
Casing Dimensions : 114.30mm

Coordinates : 66822.7 E, 94508.3 N
Ground Level : 59.79 m O.D.

Laboratory Testing by :
Dates :

Drilling							Test or ll (mm)	Change of Strata		Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
Dates	Depth of casing(m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %		Legend	Depth (m)	Reduced Level	Detail	Main							
10.10.84											Rotary Open Hole next to Shell and Auger Hole previously drilled to 8.50m (No Drillers Description)									
			8.50		85%	28%	NI 80 140		8.50	51.29		Moderately weathered very weak dark red brown with occasional grey green mottling calcareous SILTSTONE with sub-horizontal extremely closely spaced discontinuities (KEUPER MARL : ZONE II)								
									8.85	50.94		Highly weathered SILTSTONE degraded to very stiff dark red brown silty slightly calcareous CLAY with much angular very weak siltstone lithorelicts. (KEUPER MARL : ZONE III)								

Scale 1 :

Disturbed Samples : W - Groundwater
J - Jar, S - S.P.T., B - Bulk, M - Maxi

Core Runs
50
100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B243

FIGURE A2

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling								Test or Sf (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Dates	Depth of Casing(m)	Depth to water (m)	Depth (m)	Run	C.R. %	A.O.D. %			Legend	Depth (m)	Reduced Level	Detail	Main									
													See sheet 1 of 2									
			9.50		65%	0%		NI 30 70		9.10	50.69	Occasional light grey green ripple bedded micaceous SILTSTONE at 10.75 - 10.95 highly and completely weathered zones at: 11.15, 11.60 - 11.70, 10.50 - 10.55 (Zone II/III)	Moderately weathered weak dark red brown mottled light grey green thinly bedded calcareous SILTSTONE with very closely and closely spaced discontinuities. (KEUPER MARL : ZONE II)									
			10.50		100%	90%		NI 200 400								10.87 11.10	9.7			2085		
			11.00							11.10	48.69											
										11.35	48.44		Moderately and highly weathered very weak dark red brown calcareous micaceous friable thinly bedded SILTSTONE. (KEUPER MARL:ZONE II)									
					92%	59%		NI 200 400				Moderately weak and weak light grey green and dark red brown thinly bedded siltstone bands at 11.90 - 11.95 and 12.20.	Highly weathered SILTSTONE degraded to very stiff and stiff dark red brown mottled grey green silty calcareous CLAY with many angular very weak mudstone lithorelicts. (KEUPER MARL:ZONE II/III)									
			12.35							12.35	47.44											
					100%	26%		NI 140 170					Slightly weathered moderately strong light grey green silty fine grained SANDSTONE with some low amplitude ripple bedding and very closely spaced discontinuities and occasional black iron speckling along the discontinuities. (KEUPER MARL:ZONE I)									
			13.50							13.20	46.59											
												Slightly weathered moderately weak light grey green SILTSTONE band (13.50 - 13.60)				13.64 13.86	9.1			2019		
					89%	33%		NI 220 330		14.10	45.69		Moderately to highly weathered weak friable micaceous calcareous SILTSTONE. (KEUPER MARL : ZONE II/III)									
10.10.84	1.00	4.00										Very weak moderately weathered SILTSTONE bands at 14.50 - 14.65									
			15.00							15.00	44.79		Highly weathered SILTSTONE degraded to very stiff dark red brown silty calcareous CLAY with much very weak angular siltstone. lithorelicts. (KEUPER MARL : ZONE III)									
													End of Rotary Hole. NI = Not Intact.									

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

Core Runs
50
100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B243
FIGURE B
Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at Failure		Strain at Failure			C	Ø	Type of Shear Test	Initial			Pressure Range (kN/m²)					
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1-\sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)		0 50	50 00	200 50	50 100	100 200	200 400	400 800	
3.50 3.95	U9				50	149	8.5			160	-	UU	13	1975	m_v	0.11	0.06	0.02	0.02	0.02	0.03	0.02	
					150	159	10.5	18	1775						c_v	-	20.12	-	39.30	48.36	19.82	17.01	
															k	-	11.84	-	7.71	9.49	5.83	3.34	
					300	163	17								e	0.333	0.321	0.326	0.324	0.321	0.313	0.302	
															m_v								
															c_v								
															k								
															e								
															m_v								
															c_v								
															k								
															e								
															m_v								
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															m_v								
															c_v								
															k								
															e								

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s = 10^{-9}
e = void ratio at U 100% for each increment

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Consulting Engineers & Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B244

FIGURE A1

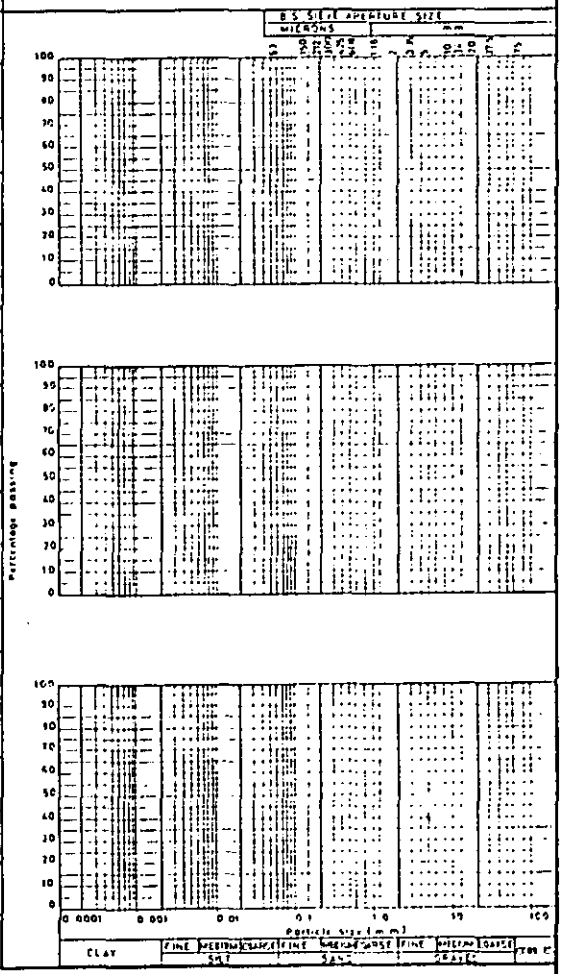
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 23.8.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66835.3 E.
94535.2 N.
Ground Level: 60.89 m OD

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to water (m)	Sample/Insitu Test: Depth (m)	Sample/Insitu Test: Type & Number	Change of Strata: Legend	Change of Strata: Depth (m)	Change of Strata: Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr / pH
23.8.84	-	-				0.04	60.85	TOPSOIL								
			0.40	J1				Very stiff red brown and light brown fissured silty CLAY with some mudstone and siltstone lithorelicts. (KEUPER MARL : ZONE III)		1	13					
			0.50	(45)2						2	19		42	22	88	0.05 / 7.5
			0.95													
			1.00	J3						6	16	1870	33	19	100	
			1.45	S(11) J4				Becoming firm below 1.00m								
			1.80	J5						10	22	1805				
			2.00			2.00	58.89									
			2.45	(60)6						13	13					
			2.50	J7				Very stiff red brown and grey green silty CLAY with some mudstone and siltstone lithorelicts. (KEUPER MARL : ZONE III)								
			2.95	S(28) J8						14	12		32	17	100	
			3.30	J9												
			3.50													
			3.95	(90)10												
			4.00	J11												
			4.45	S(64) J12												
			5.20	J13												
			5.50			5.50	55.39									
				S(132)												
			5.59	J14				Weak and very weak red brown mottled grey green fissured MUDSTONE and SILTSTONE. (KEUPER MARL : ZONE I)								
		6.0														
		After removal of casing														
			6.70	J15												
			7.00	S(80 for 225mm)*												
		slight seepage at 7.0	7.45	J16												
			8.50	S(50 for 75mm)*				End of Shell and Auger Hole.								
23.8.84	8.30	Dry	8.80	J17		8.80	52.09	* Seating Blows - J16 = 22 J17 = 51								



Scale 1:

Disturbed Samples: W - Groundwater
● J - Jar ● S - S.P.T. ● B - Bulk ● M - Maxi

Undisturbed Samples: Soil Sample

Insitu Tests: V C30 □ - Vane shear strength in KN/m²

Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S S.P.T. cone or spoon
(25) - N value

Scott Wilson Kirkpatrick & Partners
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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B244

FIGURE A2

Sheet 1 of 2

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Water Flush
Dates : 8/9.10.84
Core Diameter : 76mm
Casing Dimensions : 114.30mm

Coordinates : 66835.3 E
94535.2 N
Ground Level : 60.89 m O.D.

Laboratory Testing by :
Dates :

Drilling							Test or Fr (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Dates	Depth of Casing(m)	Depth to Water (m)	Depth (m)	Run	CR %	R.Q.D. %		Legend	Depth (m)	Reduced Level	Detail	Main									
8.10.84											Rotary Open Holed alongside Shell and Auger Hole previously drilled to 7.00 (No Drillers Description)										
									7.00	53.89		Highly weathered SILTSTONE degraded to very stiff dark red brown silty slightly fine sandy CLAY with many angular very weak mudstone and siltstone lithorelicts. (KEUPER MARL:: ZONE III)								
7.00											Siltstone bands at 7.50 - 7.60 and 7.40, and 7.20										
					90%	20%	NI 80 100														
7.50									7.90	52.99		Moderately and highly weathered very weak friable dark red brown calcareous micaceous SILTSTONE thinly sub-horizontal bedded with very closely and closely spaced discontinuities. (KEUPER MARL : ZONE III)								
					90%	48%	NI 20 38				Completely weathered zones at: 8.90 to 9.05 and 8.70 and 8.80 with much very silty clay.										
8.50					100%	20%	NI 200 350														

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Moist

50 / 100

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) '- N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B244

FIGURE A2

Sheet 2 of 2

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing/hole (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or ll (mm)
			9.20				
					80%	25%	NI 40 250
8.10.84	1.00	3.00	10.20				
9.10.84	1.00	4.00			100%	70%	NI 200 600
			11.50				
					93%	60%	NI 180 350
			13.00				
					95%	55%	NI 120 380
			14.50				
					71%	17%	NI 80 250
			16.00				
					85%	48%	10 120 200
9.10.84	1.00	4.50	17.00				
			17.10		100%	0%	NI 40 80

Change of Strata: Legend	Depth (m)	Reduced Level
	9.05	51.84
	12.00	48.89
	12.80	48.09
	17.10	43.79

Description of Strata: Detail	Main
	See sheet 1 of 2
Extremely closely spaced discontinuities with some black surface staining dipping at between 40° and 50° between 9.20 and 9.70, becoming very weak and weak between 11.85 - 12.25.	Slightly weathered moderately weak and weak dark red brown thinly sub-horizontal bedded calcareous micaceous SILTSTONE with very closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE I)
	Slightly and faintly weathered moderately weak and moderately strong light grey green mottled red brown SILTSTONE to fine grained SANDSTONE with some ripple bedding places with closely and very closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE I)
	Moderately weathered weak and very weak dark red brown mottled light grey green SILTSTONE extremely closely spaced discontinuities. (KEUPER MARL : ZONE II/III)
	End of Rotary Hole. NI = Not Intact.

Field Records and Standpipe / Piezometer Installation Details

Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)

Scale 1 :

Disturbed Samples : J - Jar, S - S.P.T., B - Bulk, M - Mazi
W - Groundwater

Core Runs
Core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B244
FIGURE B
Sheet 1 of 1

Laboratory Testing by : Exploration Associates (Warwick) Limited
Dates :

Sample		Compaction			Shear Strength								Initial		Consolidation							Notes
					Stress at Failure		Strain at Failure			C	ø	Type of Shear Test			Pressure Range (kN/m²)							
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1-\sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)		0 50	50 200	200 50	50 100	100 200	200 400	400 800	
2.00 2.45	U6				50	207	9	15	1905	200	-	UU			m_v							
					150	151	8	17	1835						c_v							
					300	238	6	16	1875						k							
															e							
3.50 3.95	U10				Untestable										m_v	0.85	0.14	0.05	0.05	0.06	0.07	0.04
								22	1805				19	1785	c_v	-	8.40	-	17.00	19.55	7.34	9.69
					Insufficient Sample										k	-	11.54	-	8.34	11.51	5.04	3.80
															e	0.422	0.393	0.404	0.400	0.391	0.372	0.348
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p. measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p. measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p. measurement
V = Vane Shear
S = Shear Box

$m_v = m^2/MN$
$c_v = m^2/yr$
$k = m/s \times 10^{-8}$
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B245

FIGURE A1

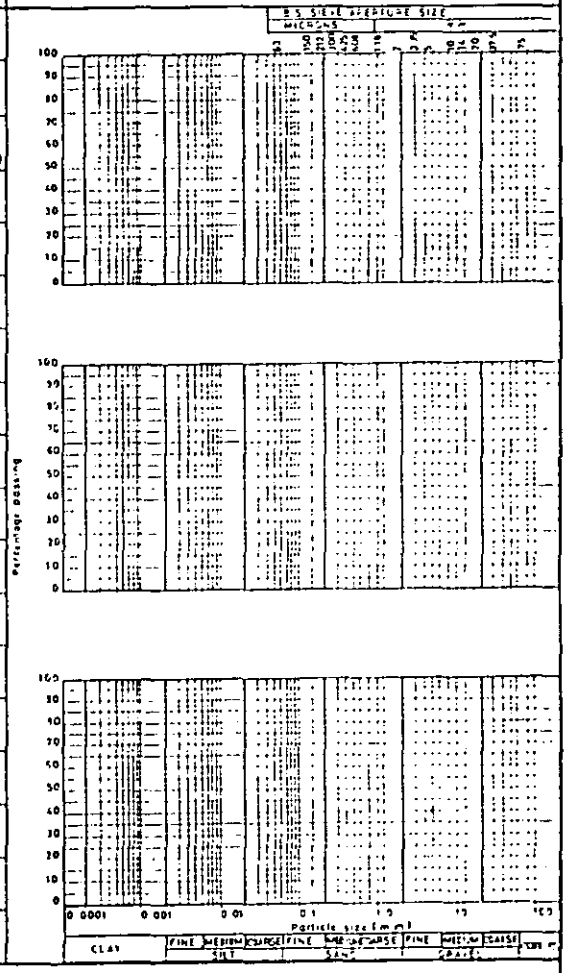
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 28.8.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66823.9 E.
94543.5 N.
Ground Level: 60.88 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr pH
28.8.84	-	-	0.40	J1		0.40	60.48	TOPSOIL		2	21	1650				
			0.50	(45)2				Very stiff red brown slightly mottled grey green silty CLAY with traces of carbonaceous material. (GLACIAL TILL)		4	12					
			0.95													
			1.00	J3		1.00	59.88									
			1.00	S(12)						6	18	1790	35	20	100	0.04 8.0
			1.45	J4				Firm to stiff red brown mottled grey green silty CLAY with some mudstone and siltstone lithorelicts (KEUPER MARL : ZONE III).								
			1.80	J5						10	17	1805	33	19	100	
			2.00	(45)6				Becoming very stiff with depth.								
			2.45							12	12					
			2.50	J7				Occasional bands of weak and very weak siltstone.								
			2.50	S(11)						14	8.4					
			3.00	J8												
			3.30	J9												
			3.50			3.50	57.38									
			3.50	(75)10				Very stiff red brown fissured silty CLAY with many mudstone lithorelicts and bands of very weak mudstone (KEUPER MARL : ZONE II/III)								
			3.95													
			4.00	J11												
			4.00	S(85)												
			4.45	J12												
			4.80	J13												
			5.50	S(94)				Band of moderately weak siltstone at 6.80m								
		5.80	5.95	J14												
		30 mins														
		▼6.80	6.80	J15,W16												
			7.00	S(103)												
			7.45	J17				Band of very weak mudstone below 8.50m								
			8.10	J18												
			8.50	S(111)* for 225												
28.8.84	7.40	Dry	8.90	J19		8.90	51.98	End of Shell and Auger * Seating Blows - J19 = 35								



Scale 1:

Disturbed Samples : W - Groundwater
● J - Jar
● S - S.P.T.
● B - Bulk
● M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] - Vane shear strength in KN/m²

▼ Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S S.P.T. - ... or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B245

FIGURE A2

Sheet 1 of 2

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Water Flush
Dates : 4/5.10.84
Core Diameter : 76mm
Casing Dimensions :

Coordinates : 66823.9 E
94543.5 N
Ground Level : 60.88 m O.D.

Laboratory Testing by :
Dates :

Drilling							Test or Fl (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Dates	Depth of casing(m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %		Legend	Depth (m)	Reduced Level	Detail	Main									
4.10.84											Rotary Open Hole drilled next to Shell and Auger Hole previously drilled to 7.00m (No Drillers Description) See Fig. A1										
									7.00	53.88											
			7.00				NI				Occasional highly weathered very weak friable siltstone bands at 8.00 - 8.10, 7.70 - 7.80, 7.60 - 7.65, 9.30 - 9.35.	Highly weathered SILTSTONE degraded to very stiff dark red brown mottled light grey green silty calcareous CLAY with many angular very weak mudstone lithorelicts. (KEUPER MARL : ZONE III)			7.75 8.00		29	18			
			7.30		100%	12%	80 120														
					100%	90%	50 200 450														
			8.80																		

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

Core Runs
50
100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B245

FIGURE A2

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : mO.D.

Laboratory Testing by :
Dates :

Drilling							Test or	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Dates	Depth of casing(m)	Depth to water (m)	Depth (m)	Run	CR %	R.Q.D. %	II (mm)	Legend	Depth (m)	Reduced Level	Detail	Main									
					100%	80%	10 200 350					See sheet 1 of 2									
			9.80																		
					66%	40%	NI 100 300														
4.10.84	1.00	1.00	10.55						10.55	50.33											
5.10.84	1.00	3.00	10.70				C (9) for 150mm NI		11.15	49.23		Moderately weatherd very weak friable dark red brown mottled grey green micaceous calcareous thinly bedded SILTSTONE with very closely to closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE II)									
					87%	72%	300 800														
			12.00									Moderately and slightly weathered weak and moderately weak light grey green calcareous micaceous thinly bedded and thinly low amplitude ripple bedded SILTSTONE (KEUPER MARL : ZONE I/II)									
					96%	30%	NI 140 200														
			12.65						13.15	47.73											
					73%	56%	10 180 350					Moderately weathered very weak friable dark red brown mottled light grey green micaceous calcareous thinly bedded SILTSTONE with some silty clay along very closely spaced discontinuities. (KEUPER MARL : ZONE II)									
			14.15						14.10	46.78											
					100%	60%	NI 200 400				Occasional thin very weak siltstone bands at 14.20 and 14.70	Highly weathered SILTSTONE degraded to very stiff dark red brown mottled grey green silty calcareous CLAY with much angular very weak mudstone lithorelicts. (KEUPER MARL : ZONE III)									
			15.15						15.35	45.53											
					100%	60%	NI 160 320				Completely weathered zones From 16.30 - 16.50	Slightly and moderately weathered dark red brown mottled light grey green micaceous calcareous thinly bedded SILTSTONE with very closely spaced sub-horizontal discontinuities (KEUPER MARL:ZONE I/II)									
			16.15																		
					36%	12%	NI NI NI														
5.10.84	1.00	3.00	17.00						17.00	43.88											
												End of Rotary Hole. NI = Not Intact.									

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

Core Runs
50
100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B245

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation									Notes
					Stress at Failure		Strain at Failure			c	ø		Initial		Pressure Range [kN/m²]							
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	c' (kN/m²)	ø' (Degrees)	Type of Shear Test	Moisture Content (%)	Dry Density (kg/m³)								
0.50 – 0.95	U2				50	132	15	20	1665	150	–	UU			m_v							
					100	156	17	21	1640						c_v							
					150	151	20	22	1645						k							
															e							
2.00 – 2.45	U6				50	150	18	18	1775	200	–	UU			m_v							
					150	221	20	17	1815						c_v							
					300	225	16	18	1780						k							
															e							
3.50 – 3.95	U10				100	205	7	16	1830	240	–	UU			m_v							
					200	202	12	18	1740						c_v							
					400	317	6	16	1840						k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p. measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p. measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p. measurement
V = Vane Shear
S = Shear Box

m_v = m^2 / MN
c_v = m^2 / yr
k = m/s x 10^{-9}
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B246

FIGURE A1

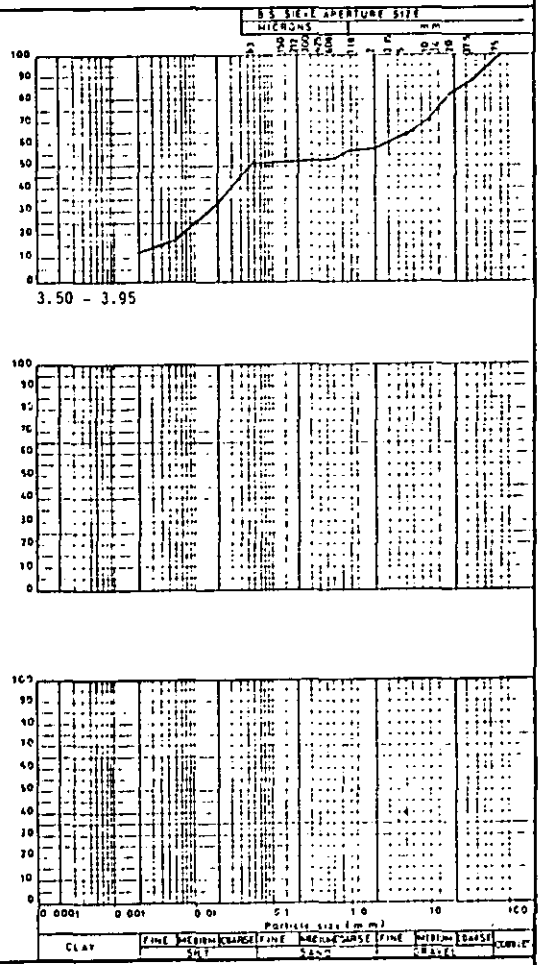
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 29.8.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 86831.3 E.
94566.2 N.
Ground Level: 61.53 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr	pH
29.8.84	-	-				0.05	61.48	TOPSOIL									
			0.50	J1				Very stiff red brown silty CLAY with much sub-angular fine gravel (siltstone), and carbonaceous traces. (GLACIAL TILL)		2	21	1655				
				(26)2						4	16						
			0.95														
			1.00	J3		1.00	60.53										
				S(9)						6	17	1800	30	17	100	0.03	
			1.45	J4				Firm red brown mottled grey green silty CLAY with many mudstone lithorelicts and zones of clayey sand (KEUPER MARL : ZONE III) Becoming very stiff with depth Becoming very silty clay in zones below 2.50m								8.0	
			1.80	J5						10	18	1785	32	20	92		
			2.00														
				(46)6													
			2.45							14	10						
			2.50	J7													
				S(19)						17	8.2						
			2.95	J8				Tending to clayey silt below 3.30m									
			3.30	J9													
			3.50			3.50	58.03										
				(80)10				Very stiff red brown silty CLAY with many mudstone lithorelicts tending to very weak mudstone (highly weathered mudstone). (KEUPER MARL : ZONE III)									
			3.95														
			4.00	J11													
				S(101)													
			4.45	J12													
			5.20	J13				Bands of interlaminated weak and very weak mudstone and siltstone below 6.70m									
			5.50	S(112 for 225mm)													
			5.95	J14													
		6.3															
		20 mins	6.70	J15													
		7.2	7.20	W16													
29.8.84	6.00	6.30	7.50	S(83 for J17 137mm)		7.50	54.03										
								End of Shell and Auger Hole.									
								* Seating Blows - J14 = 24 J17 = 45									



Scale 1:

Disturbed Samples : W - Groundwater
● J - Jar ● S - S.P.T. ● B - Bulk ● M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] - Vane shear strength in KN /m²

▼ Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S S.P.T. - cone or spoon
(25) - N value

Scott Wilson Kirkpatrick & Partners
Consulting Engineers and Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B246

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Water Flush
Dates : 28.9.84 and 1/2.10.84
Core Diameter : 76mm
Casing Dimensions :

Coordinates : 66831.3 E
94566.2 N
Ground Level : 61.53 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	CR %	R.Q.D. %	Test or ø (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m3)
									6.60	54.93	Rotary Open Hole next to Shell and Auger Hole previously drilled to 6.60m See Fig A1 (No Drillers Description)								
28.9.84	1.00	5.00	6.60		62%	0%	NI NI 40				Moderately weathered very weak bands at: 9.20 - 9.60, 11.05 - 11.53, Slightly weathered moderately weak to moderately strong bands at: 8.58 - 8.70, 10.00 - 10.11, 10.30 - 10.40.	Highly weathered red brown SILTSTONE degraded to stiff silty CLAY with many siltstone lithorelicts. (KEUPER MARL : ZONE III)							
			7.30		66%	14%	NI 50 140												
			8.30		57%	0%	NI 10 60												
			8.70		100%	58%	NI, 60 290												

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

50 / 100 Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

Scott Wilson Kirkpatrick & Partners
Consulting Engineers and Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B246

FIGURE A2

Sheet 2 of 3

Field Work by : _____
Method : _____
Dates : _____
Core Diameter : _____
Casing Dimensions : _____

Coordinates : _____ E
_____ N
Ground Level : _____ m O.D.

Laboratory Testing by : _____ Dates : _____

Drilling							Test or Fl (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
Date	Depth of Casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %		Legend	Depth (m)	Reduced Level	Detail	Main							
			9.20				SPT 1			(72 for 150mmSB)									
			9.35		100%	100%	30, 100 210												
26.9.84	1.00	3.00	9.70																
1.10.84	1.00	4.80			70%	23%	NI 90 140												
			10.30																
					100%	87%	NI 210 350					See Sheet 1 of 3							
			11.45																
					81%	45%	NI 110 220		12.10	49.43									
			12.95		53%	0%	40, 50 60					Slightly weathered grey green moderately strong calcareous SILTSTONE. Very to extremely closely spaced round sub-horizontal discontinuities. (KEUPER MARL : ZONE II)								
			13.25						13.52	48.01									
					100%	76%	NI 100 310				Highly weathered zones at: 13.25 - 13.91, 17.00 - 17.21, 17.77 - 18.00, 19.02 - 19.10, 19.17 - 19.29, 19.47 - 19.60, degraded to stiff silty clay with many lithorelicts. Slightly weathered grey green moderately strong bands at: 13.17 - 13.25, 13.91 - 14.00, 19.10 - 19.17.	Moderately to slightly weathered fissured red brown occasionally grey green very weak to weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal rough discontinuities (KEUPER MARL : ZONE II/III)								
1.10.84	1.00	4.80	14.60							(40SB, 130 for 250mm)									
2.10.84	1.00	4.80					SPT												
			15.00		92%	12%	NI NI 110												
			15.90																
					57%	44%	NI 120 240												
			17.35																
					100%	100%	50 110 390												

Scale 1 :

Disturbed Samples : J - Jar, S - S.P.T., B - Bulk, M - Maxi
W - Groundwater

Core Runs 50 100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) '- N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B246

FIGURE A2

Field Work by : _____
Method : _____
Dates : _____
Core Diameter : _____
Casing Dimensions : _____

Coordinates : _____ E
_____ N
Ground Level : _____ m O.D.

Laboratory Testing by : _____ Dates : _____

Drilling							Test or	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	CR %	R.Q.D. %	II (mm)	Legend	Depth (m)	Reduced Level	Details	Main									
			18.15																		
					80%	38%	NI 100 230					See Sheet 2 of 3									
			19.35																		
2.10.84	1.00	5.00			100%	93%	NI 120 290		20.00	41.53											
			20.00									End of Rotary Hole. NI = Not Intact SB = Seating Blows.									

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

Core Runs
50
100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B246
FIGURE B
Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation										Notes
					Stress at Failure		Strain at Failure			C	Ø		Initial		Pressure Range (kN/m²)								
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1-\sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)	Type of Shear Test	Moisture Content (%)	Dry Density (kg/m³)									
0.50	U2				50	250	8	21	1655	250	-	UU			m_v								
0.95					100	258	16	20	1650						c_v								
					150	250	10	21	1660						k								
															e								
2.00	U6				50	125	4	17	1790	170	-	UU			m_v								
2.45					150	130	20	17	1805						c_v								
					300	242	20	17	1810						k								
															e								
3.50	U10				100	254	6	18	1800	250	-	UU			m_v								
3.95					200	247	14	19	1795						c_v								
					400	237	9	19	1760						k								
															e								
															m_v								
															c_v								
															k								
															e								
															m_v								
															c_v								
															k								
															e								
															m_v								
															c_v								
															k								
															e								
															m_v								
															c_v								
															k								
															e								
															m_v								
															c_v								
															k								
															e								

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s x 10^{-8}
e = void ratio at U 100% for each increment

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BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B247

FIGURE A1

Sheet 1 of 2

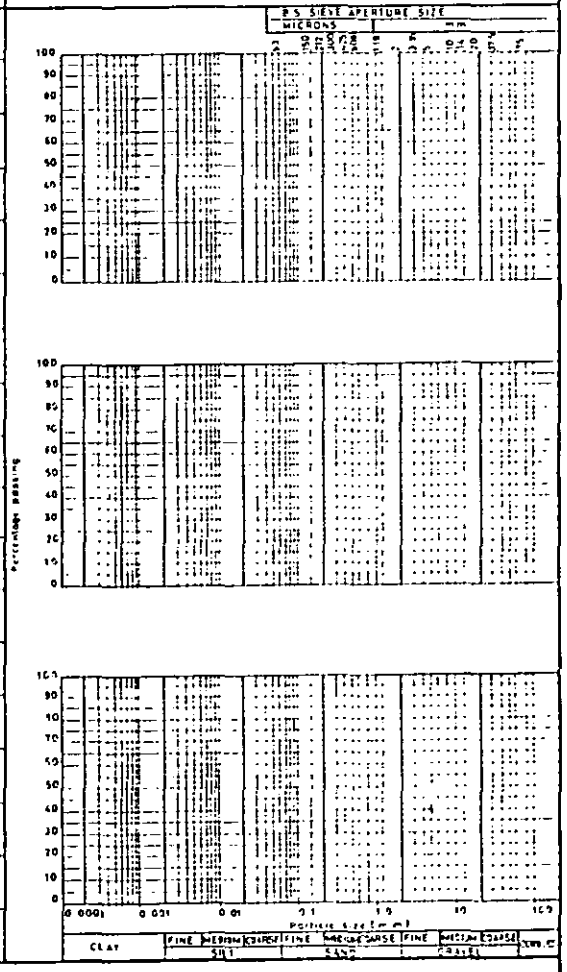
Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 29/30.8.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 86847.0 E.
94583.2 N.
Ground Level: 62.17 m O.D.

Laboratory testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test: Depth (m)	Sample/Insitu Test: Type & Number	Change of Strata: Legend	Change of Strata: Depth (m)	Change of Strata: Reduced Level	Description of Strata
29.8.84	-	-				0.10	62.07	TOPSOIL
			0.50	J1				Very stiff red brown fissured silty CLAY with sub-angular fine to medium gravel sized fragments of sandstone and siltstone and traces of carbonaceous material. (GLACIAL TILL)
			0.95	(65)2		0.60	61.57	
			1.00	J3				
			1.00	S(13)				
			1.45	J4				Firm to stiff red brown slightly mottled grey green fissured silty CLAY with some mudstone lithorelicts (KEUPER MARL : ZONE III)
			1.80	J5				
			2.00					Becoming very stiff towards base.
			2.45	(40)6				
			2.50	J7		2.50	59.67	
				S(18)				
			2.95	J8				Stiff red brown and grey green silty and very silty CLAY with many mudstone and siltstone lithorelicts and occasional bands of very weak siltstone. (KEUPER MARL : ZONE II/III)
			3.30	J9				
			3.50					
		3.8	3.95	(45)10				
			4.00	J11				
		▼4-4.5		S(34 for J12 150mm)				Becoming very stiff tending to very weak mudstone and siltstone below 4.00m
			4.45					
29.8.84	3.00	5.80						
30.8.84	3.00	2.80						
			5.20	J13				
			5.50					
				S(77)				
			5.95	J14				
			6.80	J15				
			7.00					
				S(45)				
			7.45	J16				
			8.20	J17				
			8.50	S(64 for 125SB		8.50	53.67	
			8.70	J18				See sheet 2 of 2

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
	2	15	1870			
	6	16	1795	39	22	100
	8	15				
	10	24	1555	34	20	84
	16	14		33	19	100



Scale 1:

Disturbed Samples: W – Groundwater
● J – Jar
● S – S.P.T.
● B – Bulk
● M – Maxi

Undisturbed Samples: Soil Sample

Insitu Tests: V (30) – Vane shear strength in KN/m²

▼ Groundwater first struck

○ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C.B.R

C or S SPT ... or spoon
(25) – N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B247

FIGURE A1

Sheet 2 of 2

Field Work by : _____
Method : _____
Dates : _____
Hole Dimensions _____
Casing Dimensions _____

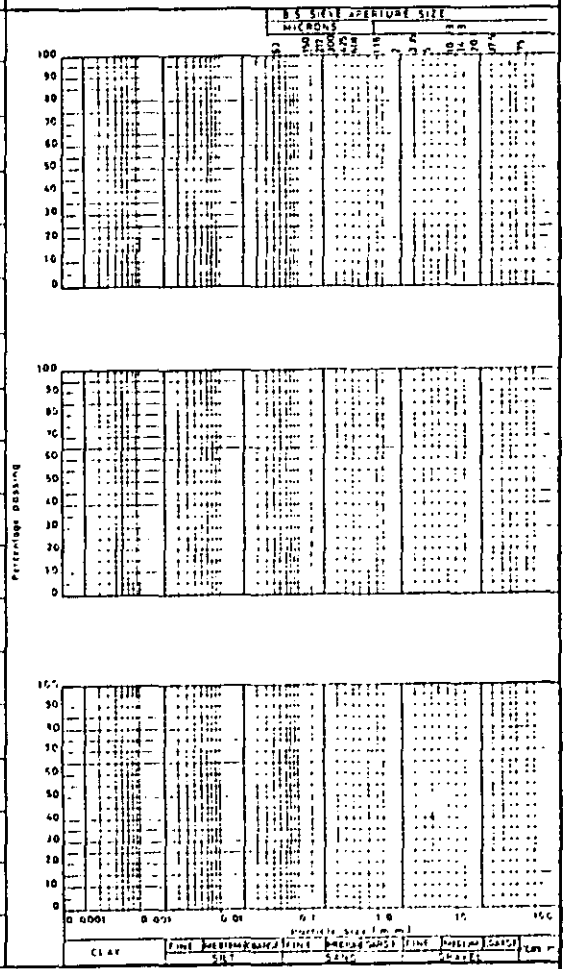
Coordinates : E. N.

Ground Level : m OD

Laboratory testing by . Dates :

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test: Depth (m)	Sample/Insitu Test: Type & Number	Change of Strata: Legend	Change of Strata: Depth (m)	Change of Strata: Reduced Level	Description of Strata
			9.30	J19				Moderately weathered, fissured very weak red brown MUDSTONE. (KEUPER MARL : ZONE II)
			10.00	S(50 for 37mm)*				
30.8.84	8.80	Dry	10.30	J20		10.30	51.87	
								End of Shell and Auger Hole.
								* Seating Blows - J12 = 11 J20 = 47
								SB = Seating Blows only
								Bentonite seal 3.00 - 3.50
								Piezometer tip 4.40
								Sand filter 3.50 - 4.50
								Bentonite seal 4.50 - 5.00

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns



Scale 1 :

Disturbed Samples : W - Groundwater
● J - Jar
● S - S.P.T.
B - Bulk
● M - Mast

Undisturbed Samples : Soil Sample

Insitu Tests : V (30) - Vane shear strength in KN /m²

▼ Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B247

FIGURE A2

Sheet 1 of 2

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Water flush
Dates : 3/4.10.84
Core Diameter : 76mm
Casing Dimensions : 114.30mm

Coordinates : 66847.0 E
94583.2 N
Ground Level : 62.17 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or Fl (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
											Rotary Open Holed to 9.00 alongside Shell and Auger Hole previously drilled. (No Drillers Description)								
			9.00																

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mcai

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B247

FIGURE A2

Sheet 2 of 2

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling							Test or Cf (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	CR %	R.Q.D. %		Legend	Depth (m)	Reduced Level	Detail	Main									
3.10.84	1.00	1.00	9.00				50					Highly weathered SILTSTONE degraded to very stiff red brown mottled grey green silty CLAY with many lithorelicts and thin bands of siltstone. (KEUPER MARL : ZONE III)								
					100%	90%	250														
			10.00				380														
					100%	95%	50 150 350														
			10.40				NI														
					34%	26%	200														
			11.00				430		11.00	51.17											
							NI				50° discontinuity at: 12.40 - 12.50	Very weak friable moderately to highly weathered red brown mottled grey green thinly bedded calcareous SILTSTONE very closely spaced sub-horizontal discontinuities (KEUPER MARL : ZONE III)									
					81%	75%	230														
							600														
			12.20				SPT			(77 for 150mm SB)											
			12.35				NI														
					100%	26%	120		12.80	49.37											
							250				Highly weathered zone at: 13.15 - 13.45	Slightly weathered moderately weak to moderately strong grey green thinly bedded fine SANDSTONE. (KEUPER MARL : ZONE II)									
3.10.84	1.00	3.00																			
4.10.84	1.00	4.20	13.30				80														
					97%	67%	150		13.80	48.37											
							300				Moderately weak grey green bands at: 14.40 - 14.45	Moderately weathered weak to very weak red brown calcareous SILTSTONE. Very closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE II/III)									
			14.30				20														
					95%	70%	180														
4.10.84	1.00	3.50	15.00				250		15.00	47.17											
												End of Rotary Hole. NI = Not Intact SB = Seating Blows									

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mazi

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25)' - N value

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Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B247

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation							Notes
					Stress at Failure		Strain at Failure			C	Ø	Type of Shear Test	Initial			Pressure Range (kN/m²)				
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)		0 50	50 200	200 50	50 100	100 200	200 400	
0.50 0.95	U2				50	259	6	15	1875	305 (142	- 24)*	UU			m_v							* alternative interpretation
					100	327	12	16	1875						c_v							
					159	330	11	15	1855						k							
															e							
2.00 2.45	U6				50	92	7.5			100	-	UU			m_v							
					150	100	10.5	16	1795						c_v							
					300	107	14.5								k							
															e							
3.50 3.95	U10				100	111	7	24	1520	140	-	UU	24	1630	m_v	0.31	0.13	0.06	0.08	0.07	0.13	
					200	113	20	25	1575						c_v	-	11.76	-	26.26	2.34	11.17	
					400	185	12	25	1575						k	-	15.00	-	20.61	1.61	14.25	
															e	0.600	0.569	0.582	0.576	0.565	0.524	
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2 / MN
c_v = m^2 / yr
k = m/s $\times 10^{-8}$
e = void ratio at U 100% for each increment

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Consulting Engineers & Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B248

FIGURE A1

Sheet 1 of 1

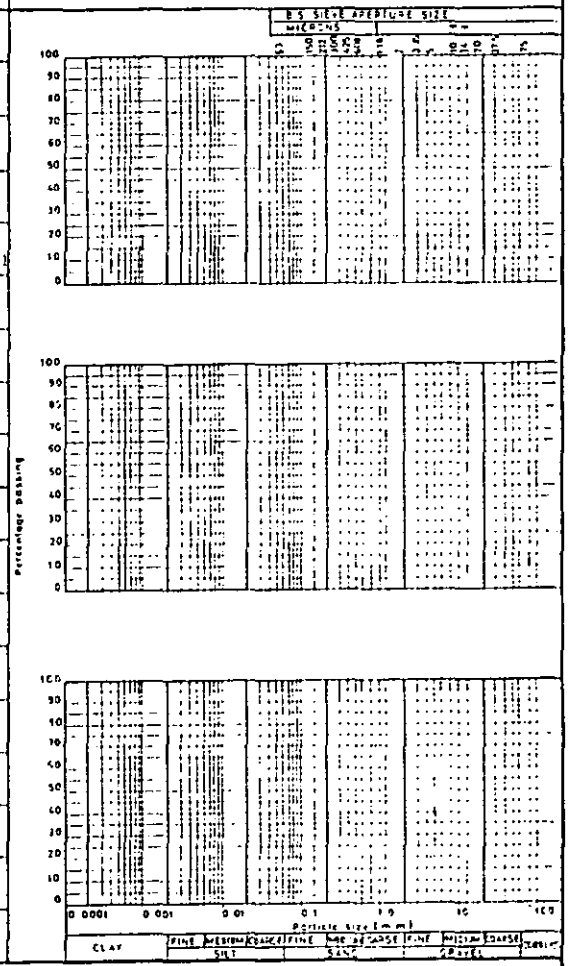
Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 30/31.9.84
Hole Dimensions 150mm
Casing Dimensions 150mm

Coordinates: 66798.9 E.
94442.2 N.
Ground Level: 59.59 m OD.

Laboratory Testing by. Dates:

Date	Depth of Casing m	Depth to water m	Sample/Insitu Test Depth m	Sample/Insitu Test Type & Number	Change of Strata Legend	Depth m	Reduced Level	Description of Strata
30.9.84	-	-				0.10	59.49	TOPSOIL
			0.40	J1				Stiff brown silty CLAY with some sub-angular
			0.50			0.50	59.09	gravel and rootlets. (GLACIAL TILL)
				(35)2				
			0.95					
			1.00	J3				Stiff red brown mottled grey green silty CLAY and
				S(15)				very silty clay with some mudstone/sandstone
30.9.84	1.50	Dry	1.50	J4				lithorelicts and some thin bands of highly weathered
31.9.84	1.50	Dry	1.80	J5				very weak mudstone/siltstone
			2.00					(KEUPER MARL : ZONE II/III)
				(80)6				
			2.45					Becoming very stiff below 2.00m
			2.50	J7				
				S(118)				
			2.95	J8				
			3.30	J9				
			3.50					
				(99)10				
			3.95					
			4.00	J11		4.00	55.59	
				S(72 for 150mm)				Highly weathered fissured weak and very weak
			4.45	J12*				calcareous micaceous MUDSTONE/SILTSTONE.
								(KEUPER MARL : ZONE III)
			4.90	J13				
								Becoming moderately weathered moderately weak below
								4.90m
		▼6.0	6.00	W14				
				S(102 for 213mm)*				
31.9.84	4.50	5.00	6.45	J15		6.50	53.09	
								End of Shell and Auger Hole.
								*Seating Blows - J12 = 29
								J15 = 50

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	sulphate g/ltr / pH
	2	20	1570	45	23	100	
	6	15	1895	31	18	100	0.03 / 8.1
	10	13	1830				
	12	6.1		33	19	100	
	14	-					0.04 / 7.1
	15	8.9					



Scale 1:

Disturbed Samples : W - Groundwater
● J - Jar ● S - S.P.T. ● B - Bulk ● M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V (30) - Vane shear strength in KN/m²
▼ Groundwater first struck
□ Core Cutter Density
■ Core Cutter Density/C.B.R
▽ Sandbottle Density
▲ C B R
C or S S.P.T. - cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B248

FIGURE A2

Sheet 1 of 2

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Water Flush
Dates : 26/27.9.84
Core Diameter : 76mm
Casing Dimensions : 114.30mm

Coordinates : 66798.9 E
94442.2 N
Ground Level : 59.59 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or ff (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
									5.50	54.09	Rotary Open Hole to 5.50 next to Shell and Auger Hole previously drilled. (No Drillers Description) See Fig A1								
26.9.84	-	-	5.50		61%	21%	NI 20 130					Highly weathered red brown SILTSTONE degraded to stiff silty CLAY with many siltstone lithorelicts. (KEUPER MARL : ZONE III)							
			6.10		100%	35%	NI NI 210												
			6.70		100%	53%	NI 140 150		7.60	51.99									
			7.45		76%	59%	NI 40 590					Highly weathered fissured red brown very weak SILTSTONE (KEUPER MARL : ZONE III)			9.00 9.33		29	17	
			8.45																

Scale 1 :

Disturbed Samples : W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mazi

50
100
Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

Scott Wilson Kirkpatrick & Partners
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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B248

FIGURE A2

Sheet 2 of 2

Field Work by : _____
Method : _____
Dates : _____
Core Diameter : _____
Casing Dimensions : _____

Coordinates : _____ E
_____ N
Ground Level : _____ m O.D.

Laboratory Testing by : _____ Dates : _____

Drilling							Test or ff (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %		Legend	Depth (m)	Reduced Level	Detail	Main									
26.9.84	1.00	4.00	9.65		100%	91%	90 300 650		9.65	49.94		See shee 1 of 2			9.00 9.33	13			1775		
27.9.84	1.00	4.00			95%	28%	NI NI 120				Slightly weathered grey green moderately strong bands at: 10.12 - 10.32, 10.45 - 10.65, 10.99 - 11.57	Highly weathered red brown SILTSTONE degraded to stiff silty CLAY with many siltstone lithorelicts. (KEUPER MARL : ZONE III)									
			10.45		85%	34%	NI 80 180														
			11.95		95%	61%	NI 140 220														
			13.45		48%	24%	NI 130 220														
27.9.84	1.00	3.00	14.95						14.95	44.64											
			15.09				SPT ↑			(80 for 143mmSB)		End of Rotary Hole. NI = Not Intact SB = Seating Blows									

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mast

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B248
Drillhole
FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength								Initial		Consolidation							Notes
					Stress at Failure		Strain at Failure			C	ø	Type of Shear Test			Pressure Range (kN/m²)							
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1-\sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	c' (kN/m²)	ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)	0 50	50 200	200 50	50 100	100 200	200 400		
0.50 0.95	U2				50	128	2.5			130	–	UU			m_v							
					100	128	3.5	20	1570						c_v							
					150	129	4.5								k							
															e							
2.00 2.45	U6				50	178	4			240 (110	– 19)*	UU	13	1905	m_v	0.25	0.17	0.04	0.03	0.05	0.07	* alternative interpretation
					150	233	9	15	1895						c_v	–	35.08	–	24.65	34.28	33.66	
					300	300	11.5								k	–	58.50	–	7.25	16.81	23.11	
															e	0.372	0.337	0.344	0.342	0.336	0.318	
3.50 3.95	U10				100	199	14.5			240	–	UU			m_v							* Excessive Strain
					200	276	20	13	1830						c_v							
					400	x									k							
															e							
9.00 9.33	Core									114	–	Unconfined			m_v							
					–	114	2	13	1775						c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2 / MN
c_v = m^2 / yr
k = m/s $\times 10^{-9}$
e = void ratio at U 100% for each increment

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BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B249

FIGURE A1

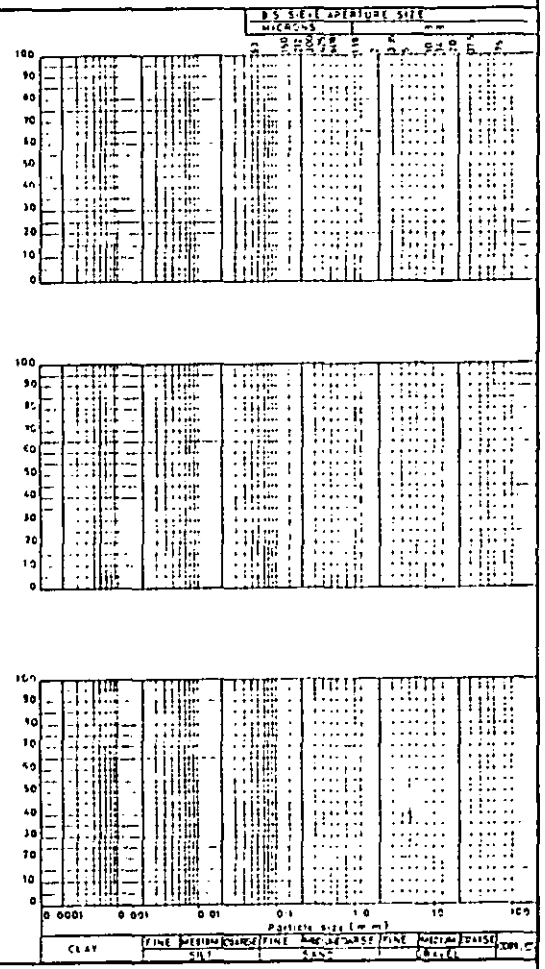
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 12.9.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66821.5 E.
94457.6 N.
Ground Level: 58.88 m OD.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu test Depth (m)	Sample/Insitu test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr / pH
12.9.84	-	-				0.10	58.78	TOPSOIL								
			0.40 0.50	J1		0.40	58.48	Stiff red brown silty CLAY with some sub-angular fine to medium gravel (sandstone, siltstone, mudstone) and carbonaceous material (GLACIAL TILL).		1	13					
			0.95	(47)2						2	14	1815	38	19	100	0.01 7.9
			1.00 1.45	J3 S(17) J6				Very stiff red brown and grey green very silty CLAY with some mudstone/siltstone lithorelicts and bands of highly weathered very weak - weak calcareous mudstone/Siltstone.		6	13	1920	31	19	100	
			1.80 2.00	J5				Many lithorelicts below 2.50m								
			2.45 2.50	(70)6 J7				(KEUPER MARL : ZONE II/III)								
			2.95	S(22) J8												
			3.30	J9												
			3.50 3.80	( )+ J10				Band of moderately weathered very weak fissured red brown mudstone at 3.80m								
			4.20	S(76 for 150mm) J11												
			4.90	J12												
		Slight seepage 5.50	5.50	S(84 for 138mm)+												
12.9.84	4.50	5.70	5.90	J13		5.90	52.98									
								End of Shell and Auger Hole.								
								* Seating Blows – J11 = 24 J13 = 33								
								+ Failed U sample								



Scale 1:

Disturbed Samples : W – Groundwater
● J – Jar
● S – S.P.T.
● B – Bulk
● M – Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] – Vane shear strength in KN /m²

▼ Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C.B.R

C or S SPT – type of spoon
(25) – N value

Scott Wilson Kirkpatrick & Partners
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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B249

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Water Flush
Dates : 25/26.9.84
Core Diameter : 76mm
Casing Dimensions : 114.30mm

Coordinates : 66821.5 E
94457.6 N
Ground Level : 58.88 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or II (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe/Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
25.9.84	-	-									Rotary Open Hole to 4.90 next to Shell and Auger Hole previously drilled. (No Drillers Description)								
									4.90	53.93									
			4.90		97%	8%	NI 60 110				Slightly weathered grey green moderately weak siltstone bands at: 6.23 - 6.26, 6.52 - 6.66. Bands of highly weathered very weak siltstone at: 6.60 - 7.36 becoming highly weathered very weak below 9.50 moderately strong SILTSTONE band between 9.61 - 9.74.	Highly weathered red brown SILTSTONE degraded to a stiff silty CLAY with many angular siltstone lithorelicts. (KEUPER MARL : ZONE ' ' III)							
			6.20		100%	40%	NI 110 190												
			7.30		100%	33%	NI 80 200												
			8.30		100%	0%	NI NI 60												

Scale 1 :

Disturbed Samples : • J - Jar, S - S.P.T., B - Bulk, M - Mast
W - Groundwater

Core Runs: 50 / 100 core recovery %

Groundwater first struck

C or S - S.R.T. cone or spoon
(25)' - N value

Scott Wilson Kirkpatrick & Partners
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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B249

FIGURE A2

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling							Test or	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	If (mm)	Legend	Depth (m)	Reduced Level	Detail	Main							
			9.70									See sheet 1 of 3							
					100%	58%	NI 80 180												
			11.20						11.78	47.10									
					97%	28%	NI 70 130				Zones of highly weathered red brown and grey green siltstone degraded to stiff silty CLAY with many siltstone lithorelicts at 12.10 - 12.34 (KEUPER MARL ZONE III)	Slightly weathered fissured grey green occasionally red brown moderately weak to moderately strong calcareous SILTSTONE (KEUPER MARL : ZONE II)								
			12.50																
					100%	67%	NI 110 350		13.33	45.55									
			14.00								Becoming highly weathered and very weak below 15.42. Bands of slightly weathered grey green moderately weak siltstone at 17.92 - 18.00, 18.19 - 18.40	Highly weathered fissured red brown occasionally grey green SILTSTONE degraded to stiff silty CLAY with many siltstone lithorelicts. (KEUPER MARL : ZONE III)								
					82%	43%	NI NI 80												
			15.50																
					99%	42%	NI 60 170												
26.9.84	1.00	4.00	16.70																
26.9.84	1.00	4.30			100%	54%	NI 120 320												
			18.00																

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mcal

Core Runs
50
100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25)' - N value

Scott Wilson Kirkpatrick & Partners
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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B249

FIGURE A2

Sheet 3 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by : Dates :

Drilling								Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
Dates	Depth of casing(m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or II (mm)	Legend	Depth (m)	Reduced Level	Detail	Main							
			18.00				10												
					89%	59%	100												
							270												
			19.00									See sheet 2 of 3							
							30												
					99%	74%	110												
26.9.84	1.00	4.00					370		20.00	38.88									
			20.00									End of Rotary Hole							
												NI = Not Intact							

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mazi

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B249

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength								Initial		Consolidation							Notes
					Stress at Failure					C	Ø				Pressure Range (kN/m²)							
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	Strain at Failure (%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)	Type of Shear Test	Moisture Content (%)	Dry Density (kg/m³)		0 50	50 200	200 50	50 100	100 200	200 400	400 800	
0.50 0.95	U2				50	231	3.5			250	-	UU			m_v							
					100	250	5	14	1815						c_v							
					150	270	8								k							
															e							
2.00 2.45	U6				50	171	11	14	1905	280 (90 | - 26)*	UU	17	1845	m_v	0.27	0.09	0.02	0.03	0.03	0.06	0.03	* alternative interpretation
					150	285	4	13	1940						c_v	-	36.80	-	45.08	30.05	35.80	34.90	
					300	370	20	13	1915						k	-	32.49	-	13.26	8.84	21.07	10.27	
															e	0.419	0.400	0.405	0.403	0.399	0.381	0.364	
															m_v								
															c_v								
															k								
															e								
															m_v								
															c_v								
															k								
															e								
															m_v								
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															e								
															m_v								
															c_v								
															k								
															e								

For Sample Type see Sheet A

S B.S. Standard
H B.S Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

$m_v = m^2/MN$
$c_v = m^2/yr$
$k = m/s \times 10^{-9}$
e = void ratio at U 100% for each increment

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BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B250

FIGURE A1

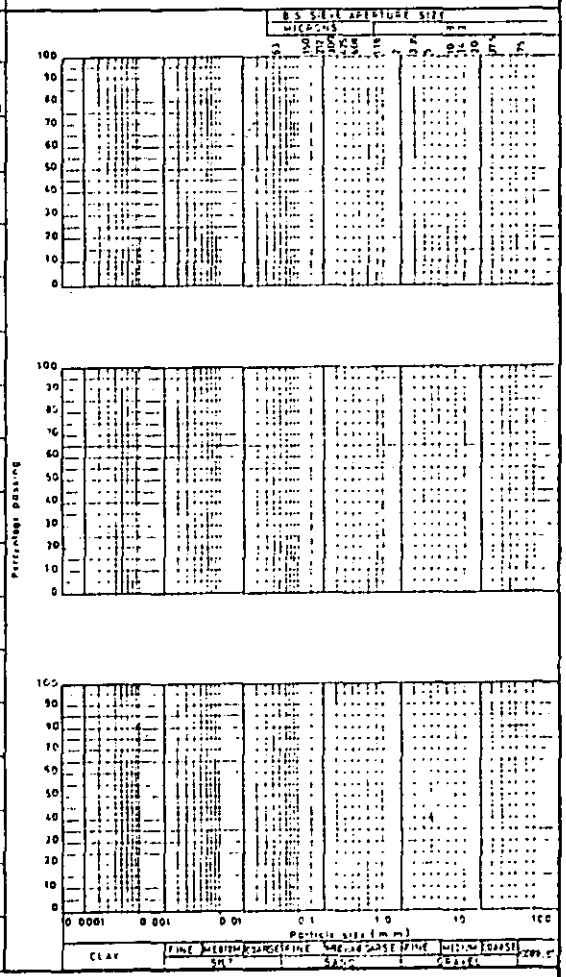
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 4.9.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66822.0 E.
94480.3 N.
Ground Level: 59.00 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	sulphate g/ltr pH
4.9.84	-	-	0.50	J1		0.50	58.50	TOPSOIL		1	25					
			0.95	(45)2				Stiff red brown and grey green very silty CLAY with some mudstone lithorelicts and occasional bands of highly weathered very weak mudstone. (KEUPER MARL : ZONE III) Very stiff towards base.		6	14	1845	35	18	100	0.02 8.0
			1.00	J3						8	16					
			1.45	S(19) J4						13	9.2		33	19	100	
			1.80	J5												
			2.00													
			2.45	(75)6		2.50	56.50									
			2.50	J7				Stiff grey green very silty CLAY with bands of highly weathered very weak siltstone (KEUPER MARL : ZONE II/III)							
			2.95	S(56) J8		3.00	56.00									
			3.30	J9				Very stiff red brown slightly mottled grey green very silty CLAY with some mudstone lithorelicts and bands of highly weathered very weak mudstone. (KEUPER MARL : ZONE III)							
			3.50													
			3.95	(100)10												
			4.00	J11												
			4.45	S(136)												
		Slight seepage 5.00	4.70	J12												
			5.00	S(80 for 150mm)*												
			5.40	J13												
4.9.84	4.70	Dry				5.60	53.40	End of Shell and Auger Hole. * Seating blows – J13 = 39								



Scale 1:

Disturbed Samples : W – Groundwater ● J – Jar ● S – S.P.T. ● B – Bulk ● M – Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] – Vane shear strength in KN/m² ▼ Groundwater first struck

□ Core Cutter Density ■ Core Cutter Density/C.B.R ▽ Sandbottle Density ▲ C.B.R

C or S SPT cone or spoon (25) – N value

Scott Wilson Kirkpatrick & Partners
Consulting Engineers and Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B250

FIGURE A2

Sheet 1 of 2

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Water Flush
Dates : 4/5.9.84
Core Diameter : 76mm
Casing Dimensions : 114.30mm

Coordinates : 66822.0 E
94480.3 N
Ground Level : 59.00 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or ll (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
									5.60	53.40	Drilled by Shell and Auger method to 5.60								
4.9.84	4.70	Dry	5.60		29%	0%	NI NI NI					Slightly weathered laminated and thinly bedded red brown and green grey fine grained weak SILTSTONE with occasional bands (upto 100mm) of highly weathered very weak clayey siltstone and mudstone. (KEUPER MARL : ZONE II) Occasional oblique and sub-vertical joints present.							
			6.40		55%	0%	NI 30 60												
			7.40				SPT		(33SB, 80 for 150mm)										
			7.70		56%	0%	NI NI NI												
			8.20		85%	0%	NI 20 90												

Scale 1 :
Disturbed Samples : • J - Jar, S - S.P.T., B - Bulk, M - Moist
W - Groundwater
Core Runs: 50, 100 — core recovery %
Groundwater first struck
C or S - S.P.T. cone or spoon
(25)* - N value

Scott Wilson Kirkpatrick & Partners
Consulting Engineers and Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B250

FIGURE A2

Sheet 2 of 2

Field Work by : _____
Method : _____
Dates : _____
Core Diameter : _____
Casing Dimensions : _____

Coordinates : _____ E
_____ N
Ground Level : _____ m O.D.

Laboratory Testing by : _____ Dates : _____

Drilling								Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
Dates	Depth of Casing/Lnr	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or ↓ (mm)	Legend	Depth (m)	Reduced Level	Detail	Main							
4.9.84	4.70	0.70																	
5.9.84	4.70	1.60	9.20									Slightly weathered laminated and thinly bedded red brown and green grey fine grained weak SILTSTONE with occasional bands (up to 100mm) of highly weathered very weak clayey siltstone and mudstone. (KEUPER MARL : ZONE I-I)							
					100%	11%	NI 30 110												
			10.15																
					97%	45%	NI 80 200					Occasional oblique and sub-vertical joints present.							
			11.65																
					97%	20%	NI 80 170												
			13.10						13.10	45.90									
					0%	0%	N/A				Completely weathered to stiff silty clay in places.	Moderately to slightly weathered red brown occasional green grey fine grained very weak clayey SILTSTONE. (KEUPER MARL : ZONE II)							
			14.10		200%	0%	NI NI NI												
			14.60				NI												
5.9.84	4.70	2.10			75%	73%	140 220		15.00	44.00									
			15.00				S			(112)		End of Rotary Hole.							
			15.50									NI = Not Intact SB = Seating Blows.							

Scale 1 :

Disturbed Samples : • J = Jar, S = S.P.T., B = Bulk, M = Mold
W = Groundwater

Core Runs
core recovery %

Groundwater first struck

C or S = S.P.T. cone or spoon
(25)' = N value

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B250

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation									Notes
					Stress at Failure		Strain at Failure			C	Ø	Type of Shear Test	Initial		Pressure Range (kN/m²)							
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)								
2.00 2.45	U6				50	125	9	15	1825	230 (67	- 22)*	UU			m_v							* alternative interpretation
					200	265	5	14	1885						c_v							
					350	304	8	14	1820						k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
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															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p. measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p. measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p. measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s $\times 10^{-8}$
e = void ratio at U 100% for each increment

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BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

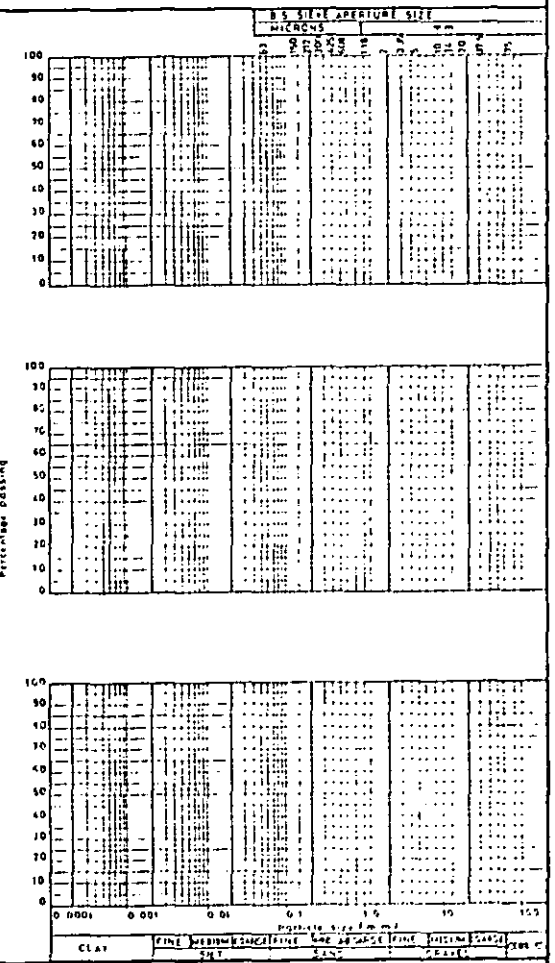
BOREHOLE No B251
FIGURE A1
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 10.9.84
Hole Dimensions 150mm
Casing Dimensions 150mm

Coordinates: 66835.4 E.
94472.8 N.
Ground Level: 59.74 m O.D.

Laboratory Testing by: Dates:

Date	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
10.9.84	-	-				0.40	59.34	TOPSOIL		1	16				
			0.50	J1				Very stiff red brown mottled grey green silty CLAY with some mudstone lithorelicts and rootlets. (KEUPER MARL : ZONE III)		4	13				
			0.95	(75)12											
			1.00	J3						6	14	1920	31	18	100
			1.45	S(36) J4											
			1.80	J5						10	21	1630	36	23	92
			2.00	(75)6											
			2.45 2.50	J7		2.50	57.24								
			2.50	S(57)				Very stiff red brown very silty CLAY with some bands of highly weathered micaceous very weak grey green siltstone. (KEUPER MARL : ZONE III)							
			2.95	J8											
			3.30	J9											
			3.50	(75)10											
			3.95												
			4.00	J11											
			4.45	S(71) J12				Bands of highly weathered mudstone/siltstone at 5.20, 6.80m							
			5.20	J13											
			5.50					Band of Moderately weathered weak mudstone 8.00							
			5.95	S(71) J14											
		6.00													
			6.80	J15											
		7-8.00	7.00	S(102 for 225 mm)*											
10.9.84	6.00	Dry	7.45	J16											
11.9.84	6.00	7.00													
			8.00	J17											
		Sealed at 8.2													
			8.50	S(14) for 0(0mm)*											
11.9.84	8.20	Dry	8.70	J18		8.70	51.04	End of Shell and Auger Hole. * Seating Blows – J16 = 15, J18 = 37							



Scale 1:

Disturbed Samples : W – Groundwater
● J – Jar
● S – S.P.T.
● B – Bulk
● M – Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V C30 – Vane shear strength in KN/m²
Groundwater first struck
□ Core Cutter Density
■ Core Cutter Density/C.B.R
▽ Sandbottle Density
▲ C B R
C or S S.P.T. – cone or spoon
(25) – N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B251

FIGURE A2

Sheet 1 of 2

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Water Flush
Dates : 11/12.9.84
Core Diameter : 76mm
Casing Dimensions : 114.30

Coordinates : 66835.4 E
94472.8 N
Ground Level : 59.74 m O.D.

Laboratory Testing by :
Dates :

Drilling								Test or Tf (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Dates	Depth of casing(m)	Depth to water (m)	Depth (m)	Run	CR %	R.Q.D. %			Legend	Depth (m)	Reduced Level	Details	Main									
												Drilled by Shell and Auger method to 8.70m										
										8.70	51.04											
11.9.84	8.20	Dry	8.70										See Sheet 2 of 2									

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mast

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B251

FIGURE A2

Field Work by : _____
Method : _____
Dates : _____
Core Diameter : _____
Casing Dimensions : _____

Coordinates : _____ E
_____ N
Ground Level : _____ m O.D.

Laboratory Testing by : _____ Dates : _____

Drilling							Test or II (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Dates	Depth of casing(m)	Depth to water (m)	Depth (m)	Run	CR %	RQD %		Legend	Depth (m)	Reduced Level	Detail	Main									
					68%	0%	NI, 40 80				Sub-vertical discontinuities at: 10.93, 11.30, 11.63, 11.94, ... 12.12 45° discontinuities at: 8.90, 9.52, 10.17 Highly weathered zones at: 8.80 - 8.90, 8.97 - 9.26, 9.35 - 9.49, 9.65 - 9.80, 10.73 - 10.93, 11.23 - 11.30, 11.76 - 11.94, 12.02 - 12.12.	Moderately weathered weak/very weak red brown/grey green interstratified calcareous MUDSTONE/SILTSTONE with closely/very closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE II/III)								
			9.35																		
					85%	0%	NI 45 90														
			10.30																		
					100%	49%	NI 130 160								11.46 11.70	9.0	27	15	2120		
			11.70																		
									12.21	47.53											
					98%	20%	NI 80 190				Highly weathered zones at: 12.90 - 12.96, 13.00 - 13.20, 14.35 - 14.50, 14.57 - 14.70 degraded to stiff very silty clay with many lithorelicts. Sub-vertical discontinuity at: 14.10	Moderately weathered weak and moderately weak micaceous calcareous grey green occasionally red brown SILTSTONE with closely/very closely spaced sub-horizontal discontinuities (KEUPER MARL : ZONE II/III)								
			13.20																		
			13.25				SPT ↕			(50 for 50mmSB)											
					85%	41%	NI 100 290														
11.9.84	8.20	1.50	14.70						14.70	45.04											
12.9.84	8.20	3.00									Highly weathered zones degraded to silty marl with some lithorelicts at: 14.70 - 15.00, 15.22 - 15.88. Moderately weathered bands at: 15.00 - 15.04, 15.12 - 15.16, 15.87 - 15.93, 16.82 - 16.94	Highly weathered fissured weak/very weak calcareous mudstone/siltstone very extremely closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE III)								
					100%	50%	NI 140 270														
			16.10																		
					80%	59%	20 160 380														
12.9.84	8.20	2.00	17.00						17.00	42.74											
			17.20				SPT ↕			(77 for 150mmSB)		End of Rotary Hole. NI = Not Intact SB = Seating Blows									

Scale 1 :

Disturbed Samples :
W = Groundwater
• J - Jar
S - S.P.T.
B - Bulk
M - Mast

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25)' - N value

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Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B251
FIGURE 8
Sheet 1 of 1

Sample		Compaction			Shear Strength									Consolidation							Notes
					Stress at failure		Strain at failure				C	ø	Type of Shear Test	Initial			Pressure Range (kN/m²)				
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1-\sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)		0 50	50 100	100 200	200 400	400 800	800 200	
2.00 2.45	U6				50	176	9.5			230 (115	- 18)*	UU			m_v						* alternative interpretation
					150	227	13.5	14	1920						c_v						
					300	294	17								k						
															e						
3.50 3.95	U10				100	119	17	21	1650	130	-	UU	22	1685	m_v	0.25	0.13	0.11	0.08	0.05	0.02	
					200	125	20	22	1590						c_v	-	19.14	18.80	24.90	10.67	-	
					400	137	8	21	1655						k	-	24.41	20.29	19.54	5.23	-	
															e	0.554	0.544	0.527	0.502	0.471	0.485	
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

$m_v = m^2/MN$
$c_v = m^2/yr$
$k = m/s \times 10^{-9}$
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B252

FIGURE A1

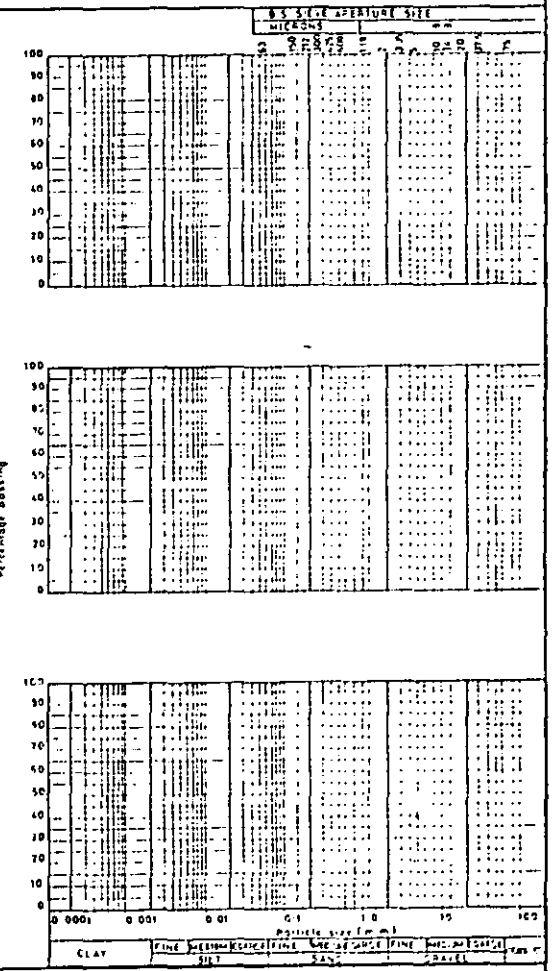
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 6.9.84
Hole Dimensions 150mm
Casing Dimensions 150mm

Coordinates: 66838.1 E.
94493.4 N.
Ground Level: 60.11 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/litre / pH
6.9.84	-	-	0.40	J1		0.40	59.71	TOPSOIL		1	14					
			0.50	(45)2				Very stiff red brown mottled grey green silty CLAY with many mudstone lithorelicts. (KEUPER MARL.: ZONE III)		2	10	1905	36	17	100	0.08 / 8.0
			0.95 / 1.00	J3 S(24)												
			1.45	J4						6	16	1890	33	20	82	
			1.80	J5						10	21	1705	38	22	100	0.04 / 7.7
			2.00	(75)6												
			2.45 / 2.50	J7 S(53)		2.50	57.61									
			2.95	J8				Very stiff red brown silty CLAY with some bands of highly weathered very weak grey green micaceous mudstone/siltstone. (KEUPER MARL : ZONE III)								
			3.40	J9												
			3.50	(66)11												
		Seepage 4.00	3.95 / 4.00	J11 S(74)												
			4.45	J12												
			4.80	J13												
			5.00	(100)14												
			5.45 / 5.50	S(74)												
			5.95	J15												
		6.4	6.70	J16												
		7.0	7.00	W17 S(83 for 225mm)*												
			7.45	J18				Grout seal 3.50 - 4.00 Piezometer tip 4.90 Sand filter 4.00 - 5.00 Grout seal 5.00 - 5.50								
			8.20	J19												
			8.50	S(80 for 150mm)*												
9.9.84	8.00	Dry	8.95	J20		9.00	51.11	End of Shell and Auger Hole. * Seating Blows - J18 = 13, J20 = 23								



Scale 1:

Disturbed Samples: W - Groundwater; J - Jar, S - S.P.T., B - Bulk, M - Maxi

Undisturbed Samples: Soil Sample

Insitu Tests: V [30] - Vane shear strength in KN/m²; Groundwater first struck; Core Cutter Density; Core Cutter Density/C.B.R; Sandbottle Density; C B R; C or S S.P.T. cone or spoon (25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B252

FIGURE A2

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Water Flush
Dates : 7.9.84
Core Diameter : 76mm
Casing Dimensions : 114.30mm

Coordinates : 66838.1 E, 94493.4 N
Ground Level : 60.11 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Drilling: Depth of Casing (m)	Drilling: Depth to water (m)	Drilling: Depth (m)	Drilling: Run	Drilling: C.R. %	Drilling: R.Q.D. %	Test or ∅ (mm)	Change of Strata: Legend	Change of Strata: Depth (m)	Change of Strata: Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
												Drilled by Shell and Auger method to 9.00							
			9.00																

Scale 1 :
Disturbed Samples : J - Jar, S - S.P.T., B - Bulk, M - Moist
W - Groundwater
Core Runs
core recovery %
Groundwater first struck
C or S - S.P.T. cone or spoon
(25) - N value

Scott Wilson Kirkpatrick & Partners
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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B252

FIGURE A2

Sheet 2 of 2

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D

Laboratory Testing by : Dates :

Drilling								Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
Dates	Depth of casing/hole (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or II (mm)	Legend	Depth (m)	Reduced Level	Detail	Main							
7.9.84	8.00	8.00	9.00		91%	0%	NI 30 60		9.30	50.81		Firm to stiff red brown silty CLAY with many siltstone lithorelicts. (KEUPER MARL : ZONE III)							
			9.70		50%	0%	NI 10 20				Highly weathered zones at: 9.60 - 9.70, 45° discontinuity at: 9.70 - 9.75.	Moderately to slightly weathered red brown very weak to weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE II/III)							
			10.30		0%	0%	NI NI NI												
			11.30		100%	46%	NI, 40 210												
			11.75		91%	0%	NI 20 40		12.42	47.69									
			12.75		96%	61%	NI 130 230				Highly weathered very weak zones at: 13.10 - 13.15, 13.30 - 13.35, 13.75 - 13.95,	Slightly weathered moderately weak to moderately strong grey green calcareous SILTSTONE. (KEUPER MARL : ZONE II)							
			13.35				SPT ↕			(50 for 37mm SB)									
			13.39		97%	19%	NI 50 110												
			13.95		80%	41%	NI 70 300		14.35	45.76	Slightly weathered grey green moderately weak band at: 16.00 - 16.20 Highly weathered zones degraded to stiff silty clay with many lithorelicts at: 15.85 - 16.00	Moderately to highly weathered red brown occasionally mottled grey green very weak calcareous SILTSTONE. Very closely spaced sub-horizontal discontinuities (KEUPER MARL : ZONE II/III)							
			15.45		93%	42%	NI 40 280												
7.9.84	8.00	1.50	16.95				SPT ↕		16.95	43.16									
			17.01							(50 for 62mm SB)		End of Rotary Hole. NI = Not Intact SB = Seating Blows							

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mast

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B252

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at Failure		Strain at Failure			C	Ø	Type of Shear Test	Initial		Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1-\sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)							
0.50	U2				50	133	2.5			160	-	UU			m_v							
0.95					100	162	4	10	1905						c_v							
					150	179	5.5								k							
															e							
2.00	U6				50	191	6.5			210	-	UU			m_v							
2.45					150	208	7.5	16	1890						c_v							
					300	224	9								k							
															e							
3.50	U10				100	160	6.5			180	-	UU			m_v							* alternative interpretation
3.95					200	180	8.5	21	1705	(128 | 7)*				c_v							
					400	204	10								k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
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															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A.

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

$m_v = m^2/MN$
$c_v = m^2/yr$
$k = m/s \times 10^{-8}$
e = void ratio at U 100% for each increment

SCOTT WILSON KIRKPATRICK & PARTNERS
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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B253

FIGURE A1

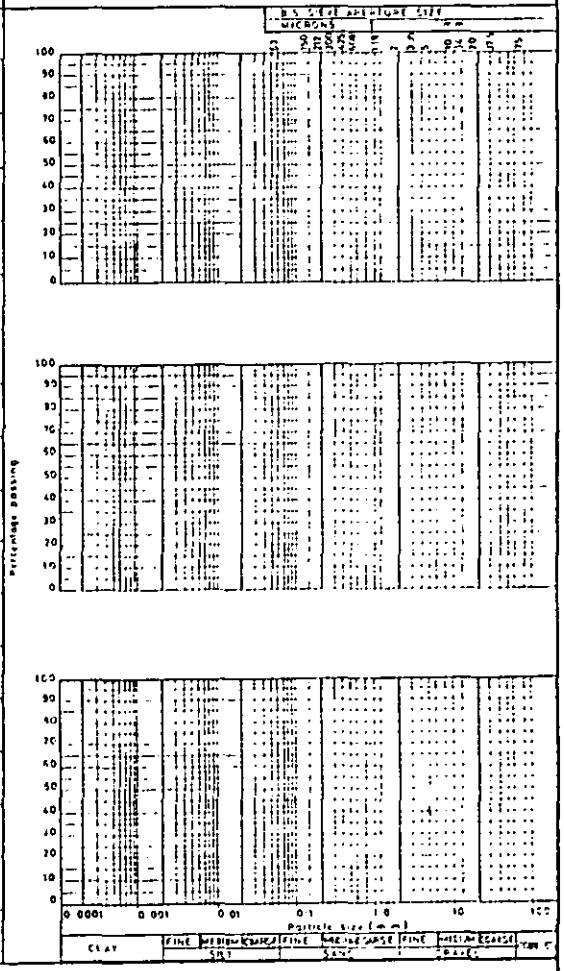
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method : Cable Percussion
Dates : 21.9.84
Hole Dimensions 150mm
Casing Dimensions 150mm

Coordinates: 66844.5 E.
94488.1 N.
Ground Level: 60.23 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
21.9.84	-	-				0.40	59.83	TOPSOIL		2	14		37	18	100
			0.50 0.60	J1				Stiff to very stiff red brown silty CLAY with occasional sub-angular gravel (mudstone, siltstone, quartz, flint, limestone). (GLACIAL TILL)		4	24				
			1.00	B2,J3		1.00	59.23								
			1.45	S(9) J4				Stiff red brown silty CLAY with occasional siltstone lithorelicts. (KEUPER MARL : ZONE IVa)		7	14	1860			
			2.00			2.00	58.23			11	20	1665	38	23	100
			2.50	B5,J6 (50)7				Very stiff red brown mottled grey green fissured silty to very silty CLAY with many mudstone/siltstone lithorelicts. (KEUPER MARL : ZONE III)		13	13				
			2.95 3.00	J8 S(48)											
			3.45	J9				Some bands of highly weathered very weak mudstone/siltstone at 2.50							
			3.70	J10											
			4.00	(70)11				Interstratified firm to stiff silty CLAY and highly weathered very weak to weak siltstone at 4.50m							
			4.45 4.50	J12 S(89)											
			4.95	J13				Occasional bands of highly weathered weak to very weak red brown fissured mudstone/siltstone below 5.80m							
			5.80	J14											
			6.00	S(104 for 225mm)											
21.9.84	5.50	Dry	6.45	J15		6.45	53.78								
								End of Shell and Auger Hole. * Seating Blows - J15 = 26							



Scale 1:

Disturbed Samples : W - Groundwater
● J - Jar ● S - S.P.T. ● B - Bulk ● M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] - Vane shear strength in KN /m²
▼ Groundwater first struck
□ Core Cutter Density
■ Core Cutter Density/C.B.R
▽ Sandbottle Density
▲ C B R
C or S S.P.T. cone or spoon (25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B253

FIGURE A2

Sheet 1 of 2

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Water Flush
Dates : 24.9.84
Core Diameter : 76mm
Casing Dimensions : 114.30mm

Coordinates : 66844.5 E
94488.1 N
Ground Level : 60.23 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	A.O.D. %	Test or ff (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
									6.50	53.73	Drilled by Shell and Auger method to 6.50								
24.9.84	5.50	3.40	6.50								Highly weathered zones at: 7.20 - 7.30, 7.60 - 7.75	Moderately weathered red brown mottled grey green very weak to weak friable calcareous SILTSTONE (KEUPER MARL : ZONE II)			6.76 7.04		26	17	
					100%	0%	NI NI 80												
			7.65		98%	0%	NI 20 60												

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

Core Runs
50
100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B253

FIGURE A2

Sheet 2 of 2

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing/hole	Depth to water (m)	Depth (m)	Run	CA %	R.Q.D. %	Test or ll (mm)
			9.10				NI 20 40
					92%	0%	
			9.80				
							NI 40 80
					76%	0%	
			11.30				SPT ↕
			11.44				
							NI 250 450
					100%	88%	
			12.80				
							NI 50 300
					100%	30%	
			13.80				
							NI 180 350
					91%	37%	
24.9.84	5.50	2.00	15.00				
			15.21				SPT ↕

Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Details	Main
	9.20	51.03		See sheet 1 of 2
				Highly weathered SILTSTONE degraded to very stiff red brown silty CLAY with many siltstone lithorelicts and occasional thin siltstone bands. (KEUPER MARL : ZONE III)
	10.40	49.83		
				Moderately to highly weathered weak to very weak red brown mottled grey green calcareous SILTSTONE. Very closely spaced sub-horizontal discontinuities containing silty clay. (KEUPER MARL : ZONE II/III)
		(80 for 143mm58)		
	12.75	47.48		
			Highly weathered zone at: 13.20 - 13.40	Slightly to moderately weathered grey green occasionally red brown weak to moderately weak calcareous SILTSTONE. ! Very closely spaced sub-horizontal discontinuities
	15.00	45.23		(KEUPER MARL : ZONE II/III)
		(65SB, 50 for 60mm)		End of Rotary Hole.

NI = Not Intact
SB = Seating Blows

Field Records and Standpipe / Piezometer Installation Details

Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B253
FIGURE B
Sheet 1 of 1

Sample Depth (m)	Sample Type & Number	Compaction Type of Test	Compaction Optimum Moisture Content (%)	Compaction Maximum Dry Density (kg/m³)	Shear Strength Stress at Failure σ_3 (kN/m²)	Shear Strength Stress at Failure $\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	Shear Strength Strain at Failure (%)	Shear Strength Moisture Content (%)	Shear Strength Dry Density (kg/m³)	Shear Strength C / C' (kN/m²)	Shear Strength Ø / Ø' (Degrees)	Type of Shear Test	Initial Moisture Content (%)	Initial Dry Density (kg/m³)	Consolidation	Pressure Range (kN/m²)	Notes
2.50 2.95	U7				50	162	10	14	1855	260 (75	- 27)*	UU				0 50	* alternative interpretation
					150	239	12	14	1875							50 200	
					300	373	15	15	1855							200 50	
																50 100	
																100 200	
																200 400	
																400 800	
4.00 4.45	U11				100	135	15	19	1680	170	-	UU	20	1735	m_v	0.06	
					200	183	18	21	1650						c_v	-	
					400	191	16	21	1660						k	-	
															e	0.524	
															m_v	0.10	
															c_v	15.33	
															k	15.04	
															e	0.502	
															m_v	0.05	
															c_v	-	
															k	-	
															e	0.513	
															m_v	0.05	
															c_v	32.34	
															k	15.86	
															e	0.509	
															m_v	0.06	
															c_v	38.80	
															k	22.84	
															e	0.500	
															m_v	0.06	
															c_v	16.94	
															k	9.97	
															e	0.482	
															m_v	0.03	
															c_v	10.29	
															k	3.03	
															e	0.462	
															m_v		
															c_v		
															k		
															e		
															m_v		
															c_v		
															k		
															e		
															m_v		
															c_v		
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															c_v		
															k		
															e		
															m_v		
															c_v		
															k		
															e		

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s x 10^{-8}
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B254

FIGURE A1

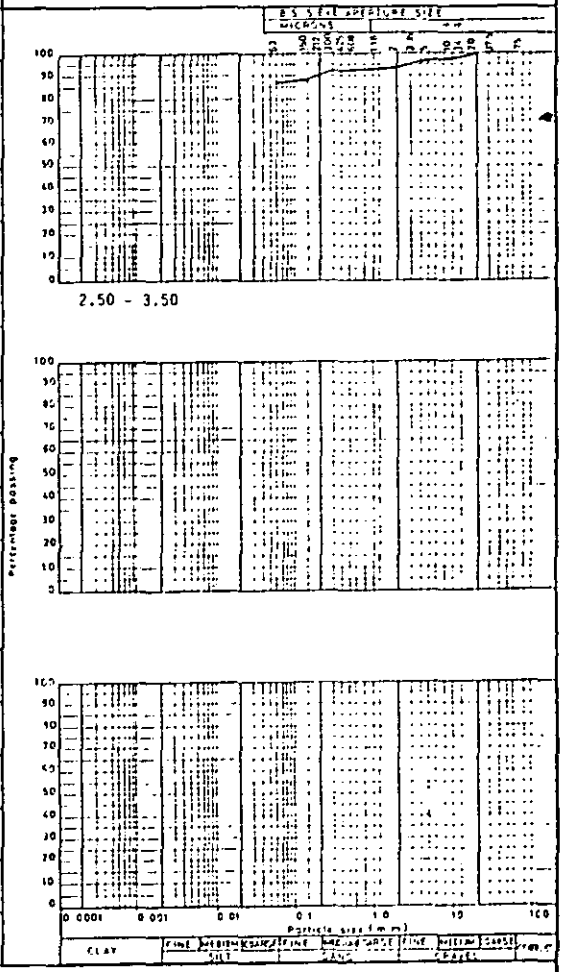
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 12.9.84
Hole Dimensions 150mm
Casing Dimensions: 150mm

Coordinates: 66864.2 E.
94523.7 N.
Ground Level: 61.35 m OD.

Laboratory Testing by: Dates:

Date	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr / pH
12.9.84	-	-				0.40	60.95	Limestone Ballast (MADE GROUND, MOTORWAY VERGE)		1	16					0.07 / 7.8
			0.50					Stiff red brown slightly mottled grey green silty CLAY with many mudstone/siltstone lithorelicts and bands of highly weathered fissured weak and very weak mudstone/siltstone. (KEUPER MARL : ZONE III)		6	14	1875	33	18	100	
			1.00	B1												
			1.30	J2						7	20					
			1.50	(100)3												
			1.95							11	18	1790	38	22	100	
			2.00	J4												
			2.45	S(85) J5						14	11					
			2.50													
			3.00	(66)6				Becoming very stiff below 5.00m tending to highly weathered weak and very weak mudstone/siltstone.								
			3.45													
			3.50	B7, J8												
				S(34)												
			3.95	J9												
			4.30	J10												
			4.50	(85)11												
			4.85													
			5.00	J12 S(50 for 125mm)												
			5.35	J13												
			5.50	S(50 for 50mm)												
12.9.84	Nil	Dry	5.80	J14		5.80	55.55	End of Shell and Auger Hole.								
								* Seating Blows - J13 = 30 J14 = 51								
								Hard Strata - 5.35 - 5.50 = 1 hour								
								Hole started by inspection pit to 1.20m								



Scale 1:

Disturbed Samples : W - Groundwater ● J - Jar ● S - S.P.T. ● B - Bulk ● M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] - Vane shear strength in KN/m²

Groundwater first struck

□ Core Cutter Density ■ Core Cutter Density/C.B.R

▽ Sandbottle Density ▲ C.B.R

Cone S.P.T. hammer or spoon (C.P.T. - N value)

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B254

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Water Flush
Dates : 15/16.9.84
Core Diameter : 76mm
Casing Dimensions : 114.30mm

Coordinates : 66864.2 E, 94523.7 N
Ground Level : 61.35 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D %	Test or II (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
									6.00	55.35	Drilled by Shell and Auger method to 6.00								
15.9.84	3.00	Dry	6.00								Highly weathered zones: 6.00 - 7.50, 7.70 - 8.50 degraded to firm silty clay with many lithorelicts.	Highly weathered highly fissured weak and very weak red brown and grey green calcareous interstratified MUDSTONE and SILTSTONE very and extremely closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE III)							
					33%	0%	NI NI 50												
			7.50							(47SB, 50 for 75mm)									
			7.73				CPT ↕												
					100%	0%	NI NI 80												
			8.50																
					94%	0%	NI NI 60												

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mazi

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) ' - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B254

FIGURE A2

Sheet 2 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	CR %	RQD %	Test or Fl (mm)
			9.55				
					95%	0%	NI NI 60
			10.70				
					86%	0%	NI 40 70
			12.20				
					95%	0%	NI 50 70
			13.55				
15.9.84	3.00	2.00			82%	0%	NI 20 60
16.9.84	3.00	2.50	14.00				
					81%	8%	NI 40 100
			15.20				
					85%	36%	NI 90 180
			16.00				
					94%	68%	20 110 610
			17.70				

Change of Strata: Legend	Depth (m)	Reduced Level
	10.09	51.26
	15.05	46.30
	17.06	44.29

Description of Strata: Detail	Main
	As sheet 1 of 3
Highly weathered zones at: 10.31 - 10.70, 10.87 - 11.00, 11.12 - 12.10, 12.20 - 12.29, 12.34 - 12.38, 12.48 - 12.51, 13.15 - 13.77, 14.15 - 14.35, 14.60 - 14.90. Sub-vertical discontinuities at: 12.10, 12.76 and 13.05. 45° discontinuities at 10.25 and 10.75 Highly weathered zones, degraded to firm very silty clay with many mudstone and siltstone lithorelicts at: 11.84 - 11.90	Moderately weathered weak and very weak red brown occasional grey green calcareous interstratified MUDSTONE and SILTSTONE with closely and very closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE II/III)
Highly weathered zones at: 15.67 - 15.75, 16.10 - 16.15 degraded to stiff silty clay with many lithorelicts. Sub-vertical discontinuities at 15.53	Slightly weathered moderately weak to weak grey green and red brown calcareous micaceous SILTSTONE with medium and closely spaced sub-horizontal discontinuities (KEUPER MARL : ZONE II/III)
	As sheet 3 of 3

Field Records and Standpipe / Piezometer Installation Details

Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
	17.30					0.01
	17.40					0.02
	17.60					0.52

Scale 1 :

Disturbed Samples :
W - Groundwater
• J - Jar
• S - S.P.T.
• B - Bulk
• M - Mcal

Core Runs
50
100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25)' - N value

A - Axial
D - Diametral

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B254

FIGURE A2

Sheet 3 of 3

Field Work by : _____
Method : _____
Dates : _____
Core Diameter : _____
Casing Dimensions : _____

Coordinates : _____ E
_____ N
Ground Level : _____ m O.D.

Laboratory Testing by : _____ Dates : _____

Drilling: Dates	Depth of casing/hole (m)	Depth to water (m)	Depth (m)	Run	CR %	RQD %	Test or If (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe/Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
					84%	15%	NI 50 120				Bands of slightly weathered moderately weak grey green siltstone at: 17.26 - 17.36, 17.69 - 17.80, 18.10 - 18.20, 18.30 - 18.34, 19.12 - 19.60, 19.74 - 19.79 45° discontinuity at 17.69	Highly weathered red brown calcareous SILTSTONE degraded to silty very silty clay with many lithorelicts. (KEUPER MARL : ZONE III)							
			19.20																
					69%	19%	NI 40 150												
16.9.86	3.00	2.30							20.00	41.35									
			20.00									End of Rotary Hole. NI = Not Intact SB = Seating blows.							

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mast

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT / BOREHOLE No. B254
FIGURE 8
Sheet 1 of 1

Sample		Compaction			Shear Strength									Consolidation										Notes
					Stress at Failure		Strain at Failure			C	Ø	Type of Shear Test	Initial			Pressure Range (kN/m²)								
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	c' (kN/m²)	ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)										
3.00 3.45	U6				50	119	9			140 (98	- 7)*	UU			m_v									* alternative interpretation
					150	143	18	14	1875						c_v									
					300	156	20								k									
															e									
4.50 4.95	U11				100	99	11			110	-	UU			m_v									
					200	112	11.5	18	1790						c_v									
					400	119	13								k									
															e									
															m_v									
															c_v									
															k									
															e									
															m_v									
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															k									
															e									
															m_v									
															c_v									
															k									
															e									

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s $\times 10^{-9}$
e = void ratio at U 100% for each increment

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BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B255

FIGURE A1

Sheet 1 of 1

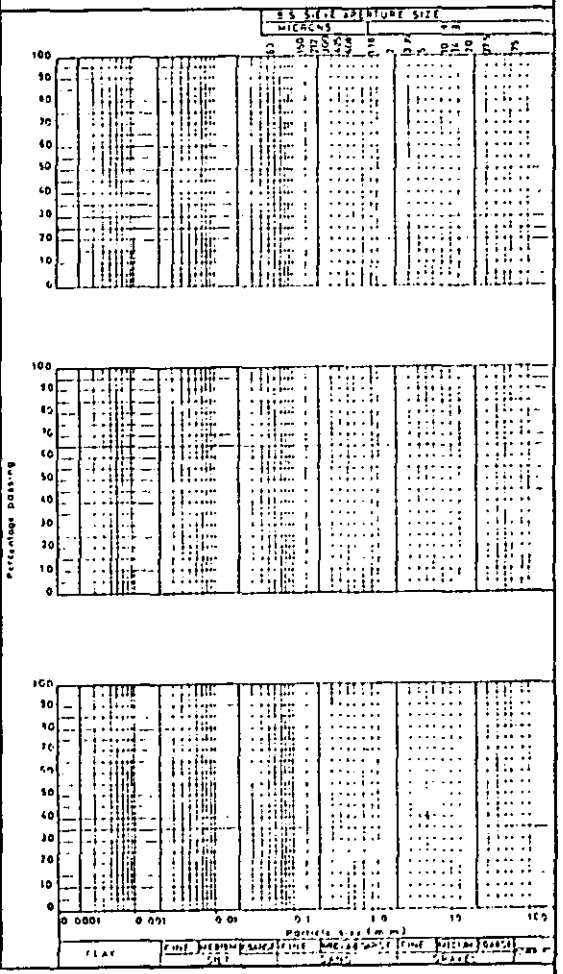
Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 11/12.9.84
Hole Dimensions 150mm
Casing Dimensions 150mm

Coordinates: 66862.2 E.
94497.4 N.
Ground Level: 60.76 m O.D.

Laboratory Testing by. Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Type & Number	Legend	Change of Strata Depth (m)	Reduced Level	Description of Strata
11.9.84	-	-						Limestone Ballast (MADE GROUND, MOTORWAY VERGE)
			0.50	J1		0.50	60.26	
			1.00	J2				Stiff red brown mottled grey green silty CLAY with some mudstone/siltstone lithorelicts and occasional bands of highly weathered fissured, very weak mudstone.
11.9.84	Nil	Dry	1.50	B3				
12.9.84	Nil	Dry		(80)4				Becoming very stiff with depth.
			1.90	J5				1.90 highly weathered mudstone becoming very silty clay below 1.90
				S(92)				
			2.35	J6				
			2.70	B7, J8				Zone of sandy silty clay 2.70 – 3.50
			3.00					
				(60)9				(KEUPER MARL : ZONE III)
			3.45					
			3.50	J10				
				S(83)				
			3.95	J11				
			4.20	J12				
			4.50					
				(70)13				
		slight seepage	4.95					
			5.00	J14				
				S(74)				
			5.45	J15				
			5.70	J16		5.70	55.06	
		slight seepage	6.00	S(45 for 75mm)				Highly weathered fissured very weak red brown MUDSTONE with residual silty clay.
		slight seepage	6.25	J17				(KEUPER MARL : ZONE III)
			6.30	S(50 for* 50mm)				
12.9.84	Nil	Dry	6.50	J18		6.50	54.26	
								End of Shell and Auger Hole.
								* Seating Blows – J12 = 37
								J18 = 49
								Hard Strata – 2.30 – 2.50 & 6.00 – 6.30 = 1½ hours
								Hole started by inspection pit to 1.20m

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr	pH
	3	19						
	7	19					0.09	8.2
	9	18	1785	32	19	100		
	13	14	1850	30	19	82		
	17	12						



Scale 1:

Disturbed Samples : W – Groundwater
● J – Jar
● S – S.P.T.
● B – Bulk
● M – Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] – Vane shear strength in KN/m²

▼ Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

[ ] – S.P.T. no. of blows per spoon penetration
( ) – N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B255

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Air Flush with Water Injection.
Dates : 14/15.9.84
Core Diameter : 76mm
Casing Dimensions : 133.35mm

Coordinates : 66862.2 E
94497.4 N
Ground Level : 60.76 m O.D.

Laboratory Testing by :
Dates :

Drilling								Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	CR %	R.Q.D. %	Test or II (mm)	Legend	Depth (m)	Reduced Level	Details	Main							
									6.50	54.26	Drilled by Shell and Auger method to 6.50								
14.9.84	6.50	1.70	6.50		98%	40%	NI 60 400			(495, 89 for 132mm)	Moderately and highly weathered weak zones at: 7.20 - 7.21, 7.31 - 7.38, 8.50 - 8.69, 8.75 - 8.82, 9.20 - 9.50, 9.56 - 9.62, 9.71 - 9.90, 10.65 - 10.70, 11.19 - 11.24, 11.45 - 11.50.	Highly weathered red brown calcareous MUDSTONE degraded to stiff very silty CLAY with many lithorelicts very and extremely closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE III)			6.76 7.04	14	Unworkable		
			7.50 7.78		100%	15%	CPT NI NI 110												
			8.50																

Scale 1 :
Disturbed Samples : J - Jar, S - S.P.T., B - Bulk, M - Maxi
W - Groundwater
Core Runs
core recovery %
Groundwater first struck
C or S - S.P.T. cone or spoon
(25) ' - N value

Scott Wilson Kirkpatrick & Partners
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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B255

FIGURE A2

Sheet 2 of 3

Field Work by : _____
Method : _____
Dates : _____
Core Diameter : _____
Casing Dimensions : _____

Coordinates : _____ E
_____ N
Ground Level : _____ m O.D.

Laboratory Testing by : _____ Dates : _____

Drilling								Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Date	Depth of Casing(m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or If (mm)	Legend	Depth (m)	Reduced Level	Detail	Main									
					97%	21%	NI 50 210				Highly and moderately weathered zones at: 11.65 - 12.07, 12.48 - 12.60, 13.65 - 13.96.	As sheet 1 of 3									
			10.00																		
					94%	21%	NI NI 360														
			11.70																		
					100%	40%	NI 50 300														
			13.00																		
			13.21				CPT			(58SB, 50 for 62mm)											
					98%	0%			13.96	46.80											
14.9.84	6.50	4.60																			
15.9.84	6.50	3.40	14.00								Bedding 16° Highly weathered zones at: 14.25 - 14.32, 14.41 - 14.48, 15.86 - 16.04, degraded to stiff silty clay with many lithorelicts. 45° discontinuities at: 15.25 and 15.68	Moderately weathered moderately weak to weak calcareous micaceous red brown and grey green SILTSTONE with closely and very closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE II/III)									
					90%	33%	NI 65 260														
									16.09	44.67											
											Bands of moderately weathered weak siltstone at: 16.25 - 16.28, 16.86 - 17.11, 17.95 - 18.01.	Highly weathered calcareous red brown and grey green siltstone degraded to stiff silty CLAY. (KEUPER MARL : ZONE III)									
			17.00																		
			17.04				CPT			(50 for 37mmSB)											
					91%	27%	NI 60 200														

Scale 1 :

Disturbed Samples : • J - Jar • S - S.P.T. • B - Bulk • M - Mazi

W - Groundwater

50 / 100 Core Runs core recovery %

▼ Groundwater first struck

C or S - S.P.T. cone or spoon

(25) - N value

Scott Wilson Kirkpatrick & Partners
Consulting Engineers and Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B255

FIGURE A2

Sheet 3 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : ____ E ____ N
Ground Level : ____ m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or ∥ (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details
			18.50						18.50	42.26		As sheet 2 of 3	
					98%	35%	NI 80 250				Highly weathered zones at: 19.31 - 19.64, 20.26 - 20.56, 20.75 - 20.90, 20.93 - 21.12, 21.44 - 21.82, 22.32 - 22.42, 22.50 - 22.61, 22.86 - 22.94, 23.11 - 23.18, 23.13 - 23.69, 24.03 - 24.10, 24.24 - 24.28, 24.40 - 25.00 degraded to stiff silty clay with many lithorelicts.	Moderately weathered weak and very weak calcareous red brown and grey green SILTSTONE with very and extremely closely spaced sub-horizontal discontinuities (KEUPER MARL : ZONE II/III)	
			20.50										
					89%	19%	NI 60 190						
			22.00										
			22.13				CPT			(79 for 133mmSB)			
					98%	48%	NI 110 500						
15.9.84			25.00						25.00	35.76			
												End of Rotary Hole. NI = Not Intact SB = Seating Blows.	

Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)

Scale 1 :

Disturbed Samples :
W - Groundwater

J - Jar
S - S.P.T.
B - Bulk
M - Mazi

50
100

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B255

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength								Initial		Consolidation							Notes
					Stress at Failure		Strain at Failure			C	ø	Type of Shear Test				Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1-\sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)		0 54	54 214	214 54	54 107	107 214	214 428	428 856	
3.00 3.45	U9				50	127	9.5			180 (88 | - 14)**	UU	16	1825	m_v	0.29	0.12	0.03	0.04	0.04	0.06	0.04	** alternative interpretation
					200	187	15	18	1785						c_v	-	30.61	-	36.63	30.08	35.80	17.73	
					350	227	17								k	-	36.03	-	14.38	11.80	21.07	6.96	
															e	0.428	0.399	0.407	0.404	0.398	0.381	0.367	
4.50 4.95	U13				100	190	12			260 (80 | - 24)**	UU			m_v								* Excessive Strain ** alternative interpretation
					300	324	20	14	1850						c_v								
					500	*									k								
															e								
															m_v								
															c_v								
															k								
															e								
															m_v								
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															c_v								
															k								
															e								

For Sample Type see Sheet A.

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
ŪŪ = Ditto, with p.w.p. measurement
CD = Consolidated Drained
C̄D̄ = Ditto, with p.w.p. measurement
CU = Consolidated Undrained
C̄Ū = Ditto, with p.w.p. measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s × 10^{-8}
e = void ratio at U 100% for each increment

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BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B256

FIGURE A1

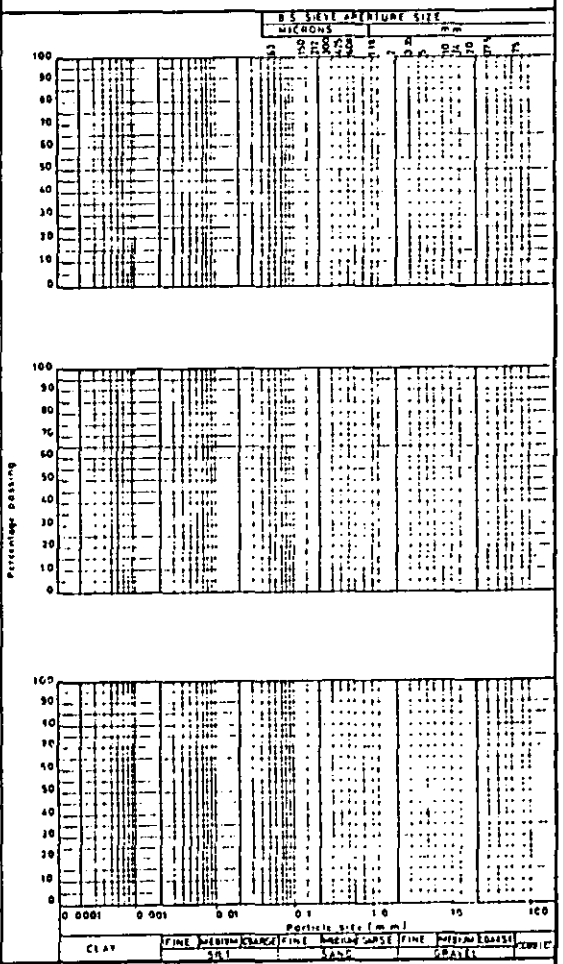
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 11.9.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66859.6 E.
94463.5 N.
Ground Level: 60.25 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr / pH
11.9.84	-	-						LIMESTONE BALLAST (MADE GROUND MOTORWAY VERGE)		1	11					
			0.60	J1		0.60	59.65	Firm red brown mottled grey green silty CLAY with bands of highly weathered calcareous mudstone (KEUPER MARL : ZONE III)		3	15		34	19	100	
			1.00	J2		1.00	59.25			7	20					
			1.50	B3				Very stiff red brown slightly mottled grey green silty CLAY with many mudstone lithorelicts and some bands of highly weathered very weak calcareous mudstone/siltstone. (KEUPER MARL : ZONE III)		9	16	1875	35	20	100	
			1.95	(60)4						12	19					0.03
			2.00	J5												8.1
			2.45	S(50) J6				Band of highly weathered mudstone/siltstone at 2.00 and 4.55m		14	12	1830	40	23	100	
			2.70	B7						16	14					
			2.80	J8												
			3.00	(60)9												
			3.45													
			3.50	J10												
				S(84)												
			3.95	J11												
			4.00	B12												
			4.20	J13												
			4.30	(100)14												
			4.55	J15												
			4.80	S(73 for 125mm)												
11.9.84	1.50	Dry	5.10	J16		5.10	55.15	End of Shell and Auger Hole.								
								* Seating Blows – J16 = 35								
								Hard Strata 4.50 – 4.80 = ¾ hour								
								Hole started by inspection pit to 1.20m								



Scale 1:

Disturbed Samples : W – Groundwater
● J – Jar ● S – S.P.T. ● B – Bulk ● M – Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V C30 – Vane shear strength in KN/m²

▼ Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S S.P.T. – cone or spoon
(25) – N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B256

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Water Flush
Dates : 13/14.9.84
Core Diameter : 76mm
Casing Dimensions : N/A

Coordinates : 66859.6 E, 94463.5 N
Ground Level : 60.25 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of Casing (m)	Depth to Water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or H (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details
									5.10	55.15	Drilled by Shell and Auger method to 5.10m		
13.9.84	Nil	2.00	5.10		71%	0%	NI 40 90				Weak to moderately weak grey green slightly weathered bands of siltstone at: 8.25 - 8.29, 8.38 - 8.50, 9.40 - 9.47. Highly weathered zones at: 7.76 - 7.96, 7.17 - 7.23, degraded to stiff silty clay with many lithorelicts.	Highly weathered fissured very weak red brown calcareous MUDSTONE with blue grey staining on fissure surfaces. (KEUPER MARL : ZONE III)	
			6.30		78%	0%	NI 50 60						
			7.30		97%	25%	NI 40 300						
			8.50		91%	0%	NI NI 60		8.90	51.35			

As sheet 2 of 3

Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)

Scale 1 :

Disturbed Samples : W - Groundwater
J - Jar, S - S.P.T., B - Bulk, M - Mazi

Core Runs: core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25), - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 : CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B256

FIGURE A2

Sheet 2 of 3

Field Work by : _____
Method : _____
Dates : _____
Core Diameter : _____
Casing Dimensions : _____

Coordinates : _____E
_____N
Ground Level : _____m O.D.

Laboratory Testing by : _____ Dates : _____

Drilling								Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
Dates	Depth of casing(m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or ff (mm)	Legend	Depth (m)	Reduced Level	Detail	Main								
			9.80								Sub-vertical discontinuities at: 8.95, 9.14, 9.60, 9.97, 10.41. 45° discontinuity 11.20 - 11.25. Highly weathered zones at: 11.00 - 11.46, 12.57 - 12.76.	Moderately weathered fissured weak to very weak calcareous red brown occasionally grey green SILTSTONE with closely and very closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE II/III)								
			9.93				SPT 5 NI			(77 for 13mmSD)										
					91%	0%	NI 40													
			10.76																	
					85%	35%	NI 100 200													
13.9.84	3.00	2.00	12.25																	
14.9.84	3.00	1.50			82%	24%	NI 90 140		12.76	47.49										
			13.25								Highly weathered zones: 13.68 - 13.75, 13.85 - 13.92,	Moderately weathered weak and moderately weak calcareous grey green SILTSTONE with closely and very closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE II/III)			13.00					0.90D
					88%	40%	30 100 200								13.10					0.36A
			13.75												13.10					
					93%	47%	NI 110 340		14.65	45.60					13.23					
			15.25								Highly weathered zones at: 15.25 - 15.50, 16.00 - 16.75, 16.97 - 17.17, degraded to stiff silty clay with many lithorelicts.	Highly weathered fissured very weak red brown and grey green calcareous SILTSTONE occasional bands of moderately weathered weak calcareous siltstone. (KEUPER MARL : ZONE II/III)			15.30					0.02A
					73%	15%	NI NI 220								15.43					0.02D
			16.75																	
					68%	25%	NI 50 370		17.77	42.48										
												As sheet 3 of 3								

Scale 1 :

Disturbed Samples :
W = Groundwater
J = Jar
S = S.P.T.
B = Bulk
M = Mazi

Core Runs
50
100
core recovery %

Groundwater first struck

C or S = S.P.T. cone or spoon
(25) = N value

A = Axial
D = Diametral

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Consulting Engineers and Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B256

FIGURE A2

Sheet 3 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling								Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
Dates	Depth of casing(m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or II (mm)	Legend	Depth (m)	Reduced Level	Detail	Main								
			18.25								Highly weathered zone: 18.97 - 19.20	Moderately weathered very weak to weak red brown mottled grey green silty calcareous MUDSTONE with closely and medium spaced sub-horizontal discontinuities (KEUPER MARL : ZONE II/III)			18.00					0.03A
					94%	44%	NI 100 190								18.10					0.03A
			19.25												18.25					0.03A
					92%	32%	NI 40 140								18.35					0.06D
14.9.84	3.00	1.30	20.00						20.00	40.25					19.90					0.25A
			20.23				SPT			(49SB, 50 for 75mm)		End of Rotary Hole. IN = Not Intact. SB = Seating Blows.			19.90					0.11D

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

A = Axial
D = Diametral

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Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B256
FIGURE B
Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation									Notes
					Stress at Failure		Strain at Failure			C	ø	Type of Shear Test	Initial		Pressure Range (kN/m²)							
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)								
3.00	U9				100	195	12.5			280	-				m_v							* alternative interpretation
3.45					300	309	18	16	1875	(128	14)*	UU			c_v							
					500	336	20								k							
															e							
4.30	U14				100	160	9.9			200	-				m_v							* alternative interpretation
4.55					300	213	14.6	12	1830	(120	9)*	UU			c_v							
					500	240	16.9								k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
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															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s = 10^{-8}
e = void ratio at U 100% for each increment

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B257

FIGURE A1

Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 25.9.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66885.5 E.
94544.9 N.
Ground Level: 61.84 m O.D.

Laboratory Testing by: Dates:

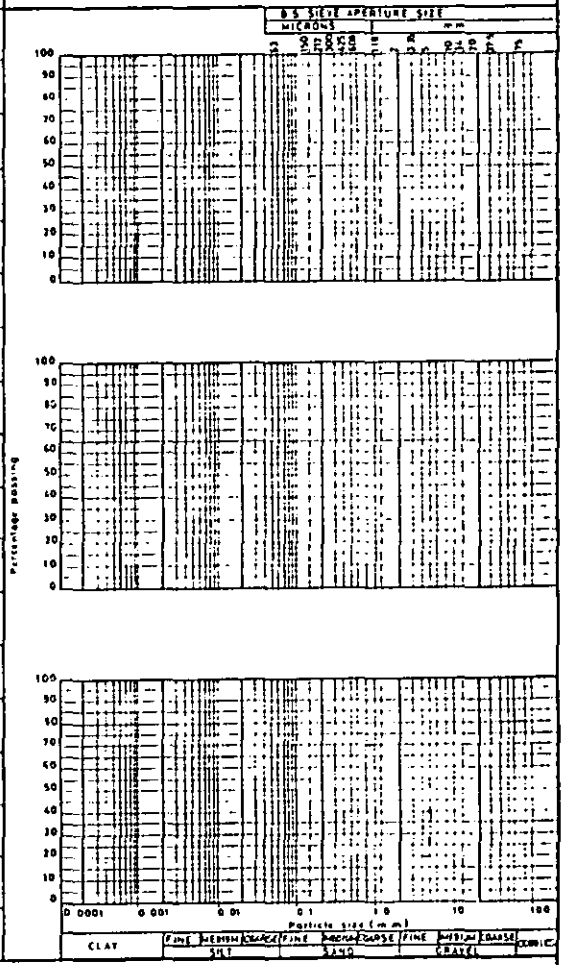
Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata
25.9.84	-	-						LIMESTONE CHIPPINGS (Motorway central reserve)
			0.80	J1		0.80	61.04	
			1.10	J2		1.10	60.74	Firm red brown occasionally mottled grey green fissured silty CLAY with some mudstone/siltstone lithorelicts. (KEUPER MARL : ZONE III)
			1.50	(20)3				Highly weathered fissured red brown very weak SILTSTONE (KEUPER MARL : ZONE III)
			1.90	J4				
			2.20	S(63 for 150mm)*				
			2.40	B6				
			2.70	J7		2.70	59.14	
			3.00	S(71)				Stiff to very stiff red brown fissured silty to very silty CLAY with many mudstone/siltstone lithorelicts and many thin bands of highly weathered inter-stratified fissured very weak siltstone and mudstone. (KEUPER MARL : ZONE II/III)
			3.45	J8				
			3.50	B9				
			3.70	S(72 for 150mm)*				
			4.00	J10				
			4.20	S(73 for 150mm)*		4.20	57.64	
25.9.84	Nil	Dry	4.50	J12		4.50	57.34	Highly weathered fissured red brown mottled grey green weak SILTSTONE. (KEUPER MARL : ZONE III)
								End of Shell and Auger Hole.

* Seating Blows - J5 = 27
J10 = 28
J12 = 31

Hard Strata - 2.10 - 2.50 and 3.90 - 4.20 = 1½ hours.

Hole started by inspection pit to 1.20m

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr / pH
	2	12					
	3	12	2160				
	6	21					0.01 / 7.7
	9	19		34	18	100	



Scale 1:

Disturbed Samples : W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V (30) - Vane shear strength in KN /m²
Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R
▽ Sandbottle Density
▲ C B R.
C or S - S.P.T cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B257

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Air Flush with Water Injection
Dates : 26.9.84
Core Diameter : 76mm
Casing Dimensions : 133.35mm

Coordinates : 66885.5 E, 94544.9 N
Ground Level : 61.84 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing/hole	Depth to water (m)	Depth (m)	Run	CR %	RQD %	Test or fracture (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
									4.50	57.34	Drilled by Shell and Auger method to 4.50									
26.9.84	-	4.20	4.50								Slightly weathered grey green moderately weak bands at: 3.90 - 6.04, 6.20 - 6.30, 7.05 - 7.10, 8.28 - 8.44, 11.66 - 11.87. Highly weathered zones at: 8.58 - 8.90, 11.05 - 11.27. Sub-vertical discontinuities at: 10.58 - 10.67 45° discontinuities at: 12.52 - 12.57.	Moderately to slightly weathered fissured to very fissured red brown occasionally grey green very weak to weak calcareous SILTSTONE Very to extremely closely spaced sub-horizontal rough discontinuities. (KEUPER MARL : ZONE II)									
					96%	22%	NI NI 400													
			6.30																	
			6.50		100%	0%	NI NI 30								6.80					9.04A
															6.90					
															6.90					0.03D
					100%	21%	NI 30 300								7.00					
			7.90																	
			8.18				CPT			(28SB, 66 for 125mm)										
					100%	12%	NI NI 130								8.24					9.29A
															8.34					

Scale 1 :

Disturbed Samples : W - Groundwater
J - Jar, S - S.P.T., B - Bulk, M - Maxi

Core Runs: core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon (25) - N value

A - Axial
D - Diametral

Scott Wilson Kirkpatrick & Partners
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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE Nº B257

FIGURE A2

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling								Tester II (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
Dates	Depth of Casing (m)	Depth to Water (m)	Depth (m)	Run	C.R. %	R.Q.D. %			Legend	Depth (m)	Reduced Level	Detail	Main								
		Water Inflow at 9.2	9.20										See sheet 1 of 3			9.20					0.38A
																9.30					
																9.30					0.28D
																9.40					
					97%	35%		NI 120 320													
			12.20																		
			12.34					CPT			(77 for 136mmSB)										
																12.20					0.07A
																12.30					
																12.30					0.11D
																12.40					
					100%	55%		NI 150 340		13.64	48.20										
												Moderately weathered very weak zone at: 14.31 - 14.60.	Slightly weathered intact grey green moderately weak to moderately strong calcareous SILTSTONE. (KEUPER MARL : ZONE II)								
			15.10																		
					95%	48%		NI 120 180		15.10	46.74		Slightly weathered fissured red brown occasionally grey green very weak calcareous SILTSTONE. (KEUPER MARL : ZONE II/III)								
			16.10									Highly weathered zones at: 16.00 - 16.10 degraded to stiff silty clay with many lithorelicts.								
			16.38					CPT		16.50	(19SB, 74 for 129mm) 45.34										
					100%	17%		NI 80 130				Slightly weathered weak bands at: 16.73 - 16.85, 17.55 - 17.60 17.80 - 17.84.	Highly weathered red brown and grey green SILTSTONE degraded to stiff silty clay with many siltstone lithorelicts. (KEUPER MARL : ZONE III)								
			17.80																		

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mazi

Core Runs
50
100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

A - Axial
D - Diametral

Scott Wilson Kirkpatrick & Partners
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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B257
FIGURE A2
Sheet 3 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of Casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or Fracture Index (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
									18.10	43.74		As sheet 2 of 3.			18.10					0.024
												Slightly weathered fissured red brown very weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal rough discontinuities. (KEUPER MARL : ZONE II)			18.22					
					97%	71%	NI								19.25					0.034
							280								19.37					
							860								19.37					0.020
24.9.84	4.50														19.50					
			20.00						20.00	41.84		End of Rotary Hole								

NI = Not Intact ;
SB = Seating Blows.

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Moist

Core Runs
Core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

A - Axial
D - Diametral

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Consulting Engineers & Transportation Planners

Laboratory Testing by : Exploration Associates (Warwick) Limited

Dates :

BIRMINGHAM - NOTTINGHAM ROUTE
A42 · CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B257

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength									Consolidation								Notes
					Stress at failure		Strain at Failure			C	Ø	Type of Shear Test	Initial		Pressure Range (kN/m²)							
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)								
1.50	U3				Untestable										m_v							
1.90								12	2160						c_v							
					Insufficient material										k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
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															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s x 10^{-8}
e = void ratio at U 100% for each increment

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BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH MAIN, SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B258

FIGURE A1

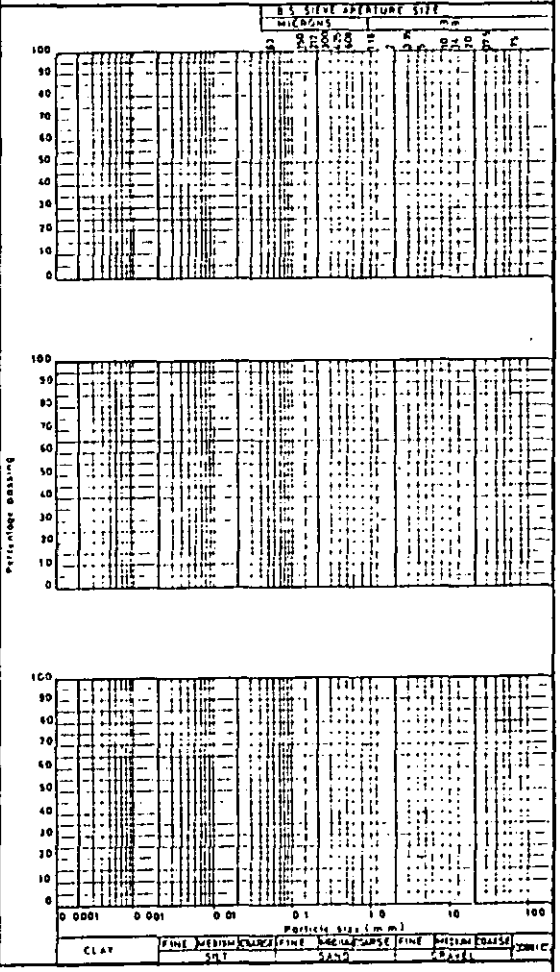
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 24/25.9.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66882.6 E
94517.3 N
Ground Level: 61.29 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
24.9.84	-	-						LIMESTONE CHIPPINGS (Motorway central reserve)		1	14				
			0.60	J1		0.60	60.69								
			1.00	J2				Firm becoming very stiff fissured silty very silty CLAY with many mudstone/siltstone lithorelicts. (KEUPER MARL : ZONE III)		3	15	1940			
			1.50							6	23		33	17	89
			1.85	(70)3				Occasional thin bands of highly weathered fissured very weak siltstone/mudstone at 1.60		8	16		37	20	100
			2.00	J4		2.00	59.59								
			2.00	S(63)				Highly weathered fissured red brown very weak calcareous SILTSTONE (KEUPER MARL : ZONE III)							
			2.45	J5											
			2.50	B6											
			2.70	J7		2.70	58.59								
			3.00					Very stiff red brown silty to very silty CLAY with many mudstone/siltstone lithorelicts. (KEUPER MARL : ZONE III)							
			3.00	S(111)											
			3.45	J8											
24.9.84	Nil	Dry						Occasional thin bands of highly weathered fissured very weak siltstone/mudstone.							
25.9.84	Nil	Dry	3.80	J9				Bands are weak to moderately weak at 3.80m							
			4.10	S(108 for 275mm)*											
25.9.84	Nil	Dry	4.50	J10		4.50	56.79								
								End of Shell and Auger Hole.							
								* Seating Blows – J10 = 20							
								Hard Strata – 3.40 – 3.60 and 3.60 – 4.10 1½ hours							
								Hole started by inspection pit to 1.20m							



Scale 1:

Disturbed Samples : W – Groundwater
● J – Jar ● S – S.P.T. ● B – Bulk ● M – Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V (30) – Vane shear strength in KN/m² ▼ Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R
▽ Sandbottle Density
▲ C B R
C or S S.P.T. (25) – N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B258

FIGURE A2

Sheet 1 of 2

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Air Flush with Water Injection
Dates : 25.9.84
Core Diameter : 76mm
Casing Dimensions : 133.35mm

Coordinates : 66882.6 E
94517.3 N
Ground Level : 61.29 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or If (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
									4.50	56.79	Drilled by Shell and Auger method to 4.50 See Fig A1									
25.9.84	-	3.80	4.50		75%	0%	NI 20 40				Highly weathered zones at: 4.50 - 4.60, 8.65 - 8.80 Moderately weak slightly weathered light grey green SILTSTONE band at 8.00 - 8.20, with some low amplitude ripple bedding and mudstone laminations.	Moderately weathered dark red brown very weak friable micaceous calcareous SILTSTONE with extremely and very closely spaced discontinuities containing some silty clay. (KEUPER MARL : ZONE II)			4.90 5.00 5.00 5.10 5.14 5.50 6.58 6.70	12	31	19		0.034 0.030 0.034
			4.90		97%	57%	NI 250 600													
			6.90 7.04		100%	18%	C NI 40 120			(80 for 146mmSB)										
			8.10		84%	21%	NI 30 180													

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mazi

Core Runs
50
100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) = N value

A - Axial
D - Diametral

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B258

FIGURE A2

Sheet 2 of 2

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of Casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or II (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
												See Sheet 1 of 2			9.43					0.05A
															9.55					
															9.74					0.09D
															9.85					
25.9.84	4.50		10.00				C		10.00	51.29										
			10.29				(3958, 79 for 143mm)			(3958, 79 for 143mm)		End of Rotary Hole.								

NI = Not Intact
SB = Seating Blows.

Scale 1 :

Disturbed Samples :
W = Groundwater
J = Jar
S = S.P.T.
B = Bulk
M = Maxi

Core Runs
core recovery %

Groundwater first struck

C or S = S.P.T. cone or spoon
(25) = N value

A = Axial
D = Diametral

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B258
FIGURE B
Sheet 1 of 1

Samples		Compaction			Shear Strength								Consolidation								Notes
					Stress at Failure		Strain at Failure			C	Ø	Type of Shear Test	Initial		Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1-\sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)							
1.50	U3				100	184	2.5			210	–	UU									* alternative interpretation
1.95					200	211	4	15	1940	(140	10)*										
					400	246	5.5														

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr.
k = $m/s \times 10^{-8}$
e = void ratio at U 100% for each increment

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Consulting Engineers & Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 - CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B259

FIGURE A1

Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 24.9.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

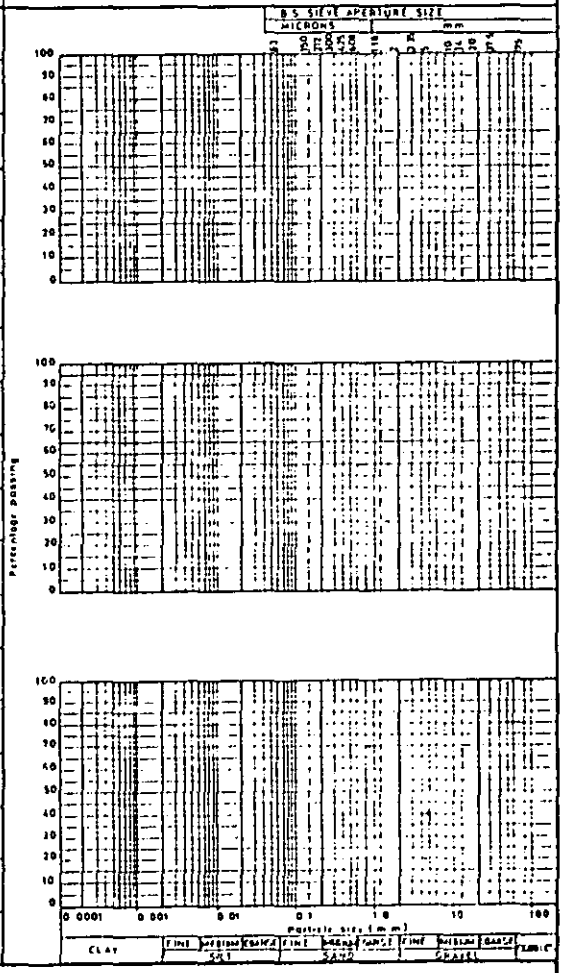
Coordinates: 66878.4 E
94477.6 N
Ground Level: 60.39 m O.D.

Laboratory Testing by:

Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata
24.9.84	-	-						LIMESTONE CHIPPINGS (Motorway central reserve)
			0.60	J1		0.60	59.79	
			1.00	J2				Firm red brown fissured silty to very silty CLAY with many siltstone lithorelicts. (KEUPER MARL : ZONE III)
			1.50	(70)3				Becoming very stiff below 1.50m
			1.95					
			2.00	J4				Band of highly weathered very weak siltstone at 2.00
			2.45	S(74)				
			2.50	J5 B6				Some thin bands of highly weathered red brown and grey green very weak to weak siltstone below 3.70m
			2.70	J7				
			3.00	(80)+				
			3.20	J8				
				S(111)				
			3.65	J9				
			3.80	J10				
			4.00	S(83 for 150mm)				
24.9.84	1.50	Dry	4.30	J11		4.30	56.09	
								End of Shell and Auger Hole.
								* Seating Blows - J11 = 38
								Hard Strata - 3.80 - 4.00 = ½ hour
								+ Failed U sample.
								Hole started by inspection pit to 1.20m

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	sulphate g/ltr / pH
	2	12					
	3	12	1935				
	6	22		35	19	100	0.06 / 7.8
	9	13					



Scale 1:

Disturbed Samples : W - Groundwater
● J - Jar
● S - S.P.T.
▮ B - Bulk
● M - Mazi

Undisturbed Samples : Soil Sample

Insitu Tests : V C30] - Vane shear strength in KN /m²
▼ Groundwater first struck
□ Core Cutter Density
■ Core Cutter Density/C.B.R
▽ Sandbottle Density
▲ C B R.
C or S - S.P.T. (cone or spoon (23) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 : CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B259

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Air Flush with Water Injection
Dates : 24/25.9.84
Core Diameter : 76mm
Casing Dimensions : 133.35mm

Coordinates : 66878.4 E, 94477.6 N
Ground Level : 60.39 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing(m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or ll (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details
									4.50	55.89	Drilled by Shell and Auger methods to 4.50 See Fig. A1		
24.9.84	-	Dry	4.50		97%	0%	NI 80 90				Slightly weathered grey green moderately strong bands at: 4.67 - 4.72, 6.00 - 6.15 8.29 - 8.42, 11.22 - 11.62. Highly weathered zones at: 4.93 - 5.20, 6.15 - 6.30. 45° discontinuities at: 9.26 - 9.38, 9.74 - 9.82. Sub-vertical discontinuities at: 10.20 - 10.50, 10.90 - 10.99.	Slightly weathered fissured to very fissured red brown occasionally grey green very weak to weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal smooth discontinuities. (KEUPER MARL : ZONE II/III) .	
		Water Inflow at 6.5	5.80		95%	0%	NI NI 90						
			6.50		100%	18%	NI NI 300						
			8.10		94%	27%	NI 100 160						

Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)

Scale 1 :
Disturbed Samples : W - Groundwater
J - Jar, S - S.P.T., B - Bulk, M - Maxi
Core Runs
Core recovery %
Groundwater first struck
C or S - S.P.T. cone or spoon (25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B259

FIGURE A2

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or II (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
			9.10				CPT			(4SB, 92 for 135mm)										
			9.39									See sheet 1 of 3								
					100%	45%	NI 110 160													
			11.50																	
					98%	48%	NI 130 630		13.36	47.03										
24.9.84	4.50	9.20										Slightly weathered occasionally fissured grey green moderately strong calcareous SILTSTONE. (KEUPER MARL : ZONE II)							
25.9.84	4.50	4.40	14.30																	
					95%	61%	NI 190 560		15.29	45.10					15.66					0.02A
															15.77					
															15.77					0.08A
															15.90					
											Slightly weathered grey green moderately strong bands at: 15.52 - 15.62, 16.36 - 16.60, 19.82 - 19.93.	Highly to moderately weathered fissured red brown occasionally grey green very weak calcareous SILTSTONE. Becoming slightly weathered below 17.50m Very to extremely closely spaced sub-horizontal rough discontinuities (KEUPER MARL : ZONE II/III)			15.90					0.02A
			16.50												16.03					
			16.77				CPT			(49SB, 50 for 42mm)										
					100%	51%	NI 70 330													

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

A - Axial
D - Diametral

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B259

FIGURE A2

Sheet 3 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling							Test or	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	CR %	R.Q.D. %	Jt (mm)	Legend	Depth (m)	Reduced Level	Detail	Main								
			18.10												18.53	13			1970	
							30								18.90					
					94%	54%	200								18.69					0.022
							360					See sheet 2 of 3			18.82					
25.9.84	4.50	9.20													18.82					0.020
			20.00						20.00	40.39					18.94					
												End of Rotary Hole.								
												NI = Not Intact								
												SB = Seating Blows.								

Scale 1 :

Disturbed Samples :
W - Groundwater

J - Jar
S - S.P.T.
B - Bulk
M - Mazi

50
100

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
N (25) = N value

A = Axial
D = Diametral

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Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B259
FIGURE B
Sheet 1 of 1

Sample		Compaction			Shear Strength									Consolidation								Notes
					Stress at Failure		Strain at Failure			C	ø	Type of Shear Test	Initial		Pressure Range (kN/m²)							
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1-\sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)								
1.50 1.95	U3				100	279	5.1			410 (105	- 29)*	UU			m_v							* alternative interpretation
					200	382	7.6	12	1935						c_v							
					400	568	13.2								k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
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															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p. measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p. measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p. measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s $\times 10^{-8}$
e = void ratio at U 100% for each increment

EXPLORATION ASSOCIATES (WARWICK) LIMITED, GEOTECHNICAL HOUSE, HATTON, WARWICK. CV35 7JL
Tel: (0926) 491743

DEPARTMENT OF TRANSPORT

EAST MIDLANDS REGIONAL OFFICE

A42 CASTLE DONINGTON NORTH

MAIN SITE INVESTIGATION : CONTRACT 2 (FEBRUARY 1985)

VOLUME 1 : PART 2 EXPLORATORY HOLE RECORDS AND FORMS B AND C

S4449

Employer for the Works

DEPARTMENT OF THE ENVIRONMENT
AND TRANSPORT
East Midlands Regional Office
52-54 Holly Walk
Leamington Spa
Warwickshire
CV32 4JE

Engineer for the Works

SCOTT WILSON KIRKPATRICK
AND PARTNERS
Bayheath House
Rose Hill West
Chesterfield
Derbyshire
S40 1JF

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A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B260

FIGURE A1

Sheet 1 of 1

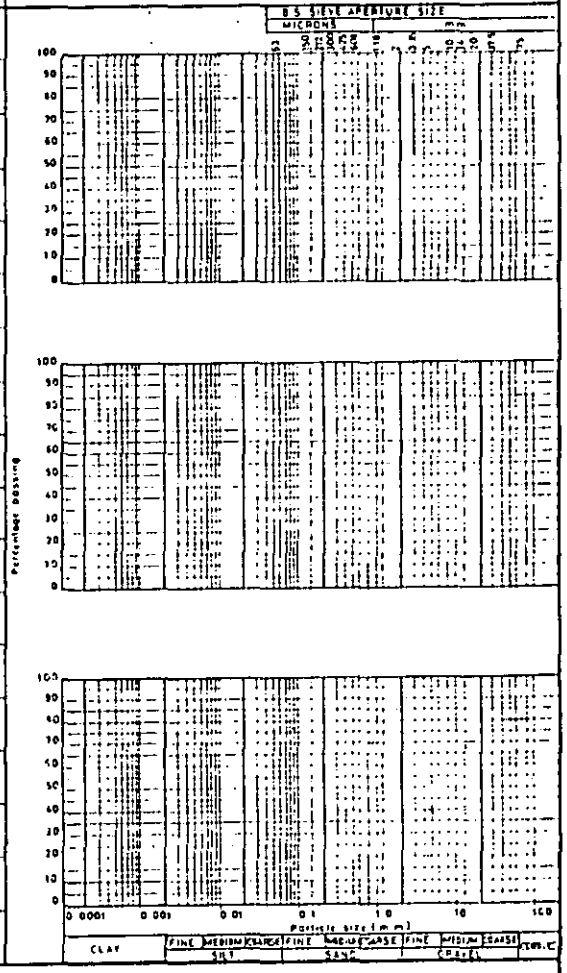
Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 19.9.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66903.9 E.
94564.8 N.
Ground Level: 61.76 m OD.

Laboratory testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Type & Number	Legend	Change of Strata Depth (m)	Reduced Level	Description of Strata
19.9.84	-	-						LIMESTONE CHIPPINGS, Motorway verge
			0.70	J1		0.70	61.06	
			1.00	J2				Firm to stiff red brown mottled grey green silty CLAY with occasional mudstone/siltstone lithorelicts (KEUPER MARL : ZONE IVa)
			1.50					
			1.95	(70)3				
			2.00	J4		2.00	59.76	
			2.45	S(85) J5				Highly weathered fissured very weak to weak red brown MUDSTONE. (KEUPER MARL : ZONE III)
			2.50	B6				
			2.70	J7		2.70	59.06	
			3.00					Very stiff red brown mottled green grey silty to very silty CLAY with some mudstone/siltstone lithorelicts. (KEUPER MARL : ZONE III)
			3.45	(50)8				
			3.50	J9				
				S(88)				Thin bands of highly weathered weak to very weak calcareous siltstone/mudstone below 3.50
			3.95	J10				
			4.00	B11				
			4.20	J12 *				
				S(99 for J13 225mm				
			4.55					
			4.70	J14		4.70	57.06	
			5.00	S(87 for * 150mm		5.00	56.76	Highly weathered red brown fissured very weak to weak calcareous mudstone (KEUPER MARL : ZONE III)
19.9.84	1.50	Dry	5.30	J15		5.30	56.46	Very stiff red brown and grey green silty CLAY with bands of highly weathered weak calcareous mudstone/ siltstone (KEUPER MARL : ZONE III)
								End of Shell and Auger Hole.
								* Seating Blows - J13 = 25 J15 = 31
								Hard Strata - 4.55 - 5.00 = 1 hour
								Hole started by inspection pit to 1.20m

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr / pH
	2	14					
	6	20					0.03 / 7.3
	8	17	1805	32	19	100	



Scale 1:

Disturbed Samples : W - Groundwater
● J - Jar ● S - S.P.T. ● B - Bulk ● M - Maxi

Undisturbed Samples : U100 Soil Sample

Insitu Tests : V C30 - Vane shear strength in KN/m²

▼ Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C.B.R

C or S SPT cone or spoon
f (25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B260

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring Air Flush with Water Injection
Dates : 20.9.84
Core Diameter : 76mm
Casing Dimensions : 114.30mm

Coordinates : 66903.9 E
94564.8 N
Ground Level : 61.76 m O.D

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of Casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or II (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
Hole dry at end of percussion boring 19.9.84									5.50	56.26	Drilled by Shell and Auger method to 5.50 See Fig A1									
20.9.84	Nil	0.60	5.50												5.63					0.14A
Water level probably influenced by torrential rain before drilling.															5.73					
															5.73					0.03D
															5.83					
							NI				Occasional moderately and highly weathered zones at: 6.95 - 7.10, 7.80 - 8.15, 9.50 - 9.70, 14.00 - 14.10. Occasionally moderately weak light grey green SILTSTONE 9.10 - 9.60, 12.50 - 12.65.	Moderately weathered very weak friable dark red brown calcareous micaceous SILTSTONE with very closely and extremely closely spaced sub-horizontal discontinuities with some black surface staining. (KEUPER MARL : ZONE I/II)			6.58					
					100%	42%	80								6.80	13	31	19	1830	
							330													
			7.90				C													
			8.10				NI			(6068, 50 for 58mm)										
					90%	10%	60													
							100													
			8.90																	

Scale 1 :

Disturbed Samples : W - Groundwater

J - Jar
S - S.P.T.
B - Bulk
M - Maxi

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

A - Axial
D - Diametral

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B260

FIGURE A2

Sheet 2 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : mO.D.

Laboratory Testing by :
Dates :

Drilling								Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength ((MN/m²)²)
Date	Depth of casing(m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or II (mm)	Legend	Depth (m)	Reduced Level	Detail	Main								
			9.70		91%	0%	NI 40 60					See Sheet 1 of 3			9.95 10.06 10.23 10.36 10.60 10.73					0.114 0.260 0.024
			12.20 12.27		92%	37%	NI 150 240 C			(50 for 72mmSB)										
			14.00 14.27		100%	41%	NI 80 210 C		14.35	(36SB, 80 for 122mm) 47.41		Slightly weathered moderately weak light grey green micaceous SILTSTONE with extremely closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE I)			13.44 13.54 13.54 13.65					0.304 0.333
			16.60		99%	40%	NI 110 260		14.70	47.06	Highly weathered zones at: 15.80 - 16.00	Moderately and highly weathered dark red brown mottled light grey green very weak calcareous micaceous SILTSTONE with extremely closely spaced discontinuities (KEUPER MARL : ZONE II/III)								
			17.90		100%	14%	NI 40 180		18.90	42.86		As sheet 3 of 3								

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mast

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

A - Axial
D - Diametral

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B260

FIGURE A2

Sheet 3 of 3

Field Work by : _____
Method : _____
Dates : _____
Core Diameter : _____
Casing Dimensions : _____

Coordinates : _____ E
_____ N
Ground Level : _____ m O.D

Laboratory Testing by : _____ Dates : _____

Drilling								Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
Dates	Depth of Casing/Hole (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or ∅ (mm)	Legend	Depth (m)	Reduced Level	Detail	Main							
20.9.84	5.50		20.00		95%	19%	NI 20 140		20.00	41.76		Slightly weathered light grey green micaceous SILTSTONE with closely spaced discontinuities. (KEUPER MARL : ZONE 1)							
												End of Rotary Hole.							

NI = Not Intact
SB = Seating Blows.

Scale 1 :

Disturbed Samples :
W = Groundwater
J = Jar
S = S.P.T.
B = Bulk
M = Maxi

50
100
Core Runs
core recovery %

Groundwater first struck

C or S = S.P.T. cone or spoon
(25) = N value

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Laboratory Testing by : Exploration Associates (Warwick) Limited
Dates :

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B260
FIGURE B
Sheet 1 of 1

Sample		Compaction			Shear Strength								Initial		Consolidation							Notes
					Stress at Failure		Strain at Failure			C	ø	Type of Shear Test			Pressure Range (kN/m²)							
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)		0 50	50 200	200 50	50 100	100 200	200 400	400 800	
3.00 3.45	U6				100	169	18			200	-	UU	13	1935	m_v	0.24	0.09	0.03	0.03	0.04	0.05	0.03	* Excessive Strain
					300	234	20	17	1805						c_v	-	38.16	-	59.18	19.23	25.80	21.47	
					600	*									k	-	3.43	-	17.42	7.55	12.65	6.32	
															e	0.351	0.333	0.338	0.336	0.331	0.317	0.300	
															m_v								
															c_v								
															k								
															e								
															m_v								
															c_v								
															k								
															e								
															m_v								
															c_v								
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															k								
															e								
															m_v								
															c_v								
															k								
															e								

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2 / MN
c_v = m^2 / yr
k = m/s x 10^{-8}
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B261

FIGURE A1

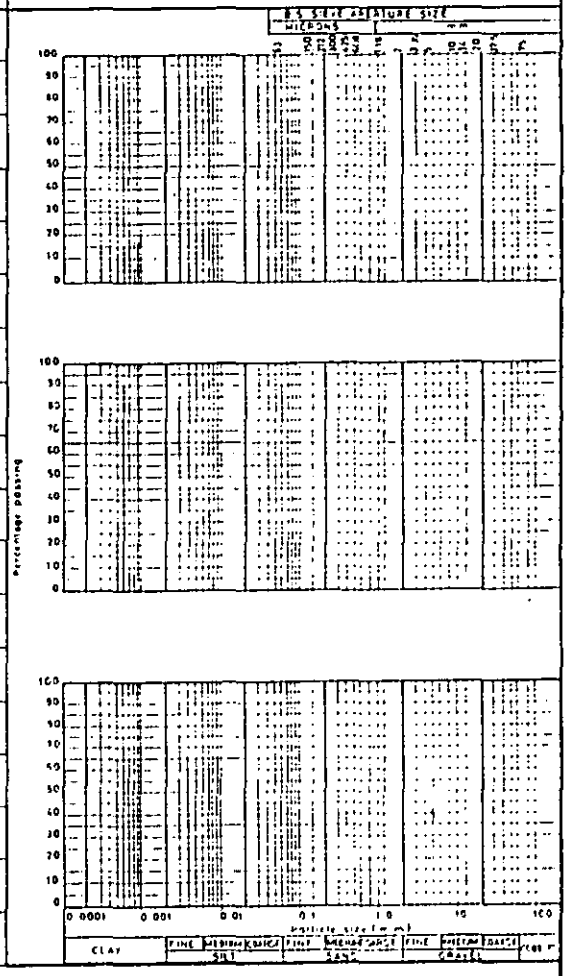
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 17.9.84
Hole Dimensions 150mm
Casing Dimensions 150mm

Coordinates: 66901.0 E.
94537.5 N.
Ground Level: 61.10 m O.D.

Laboratory testing by: Dates:

Dates	Depth of Casing	Depth to water	Sample/Insitu Test Depth	Sample/Insitu Test Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
17.9.84	-	-				0.40	60.70	STONE FILL, Motorway verge		1	16				
			1.00	J1				Soft red brown silty CLAY with many mudstone/ siltstone lithorelicts and some thin bands of highly weathered weak siltstone (KEUPER MARL : ZONE III)		3	9.7				
			1.50	J2		1.50	59.60			4	17		33	19	100
			1.60	S(89)				Moderately weathered fissured red brown weak to very weak calcareous SILTSTONE. (KEUPER MARL : ZONE II)		7	18				
			2.05	J3						8	9.6				
			2.50												
			3.00	B4											
			3.45	S(74) J5											
			3.50	B6											
			4.10	J7		4.10	57.00								
			4.50	S(100)		4.50	56.60	Soft grey green CLAY with many mudstone lithorelicts (KEUPER MARL : ZONE III)							
			4.95	J8				Moderately weathered fissured red brown occasionally mottled grey green weak calcareous SILTSTONE. (KEUPER MARL : ZONE II)							
		5.2													
		20 min	5.50	J9											
			6.00	S(73 for 150mm)*											
17.9.84	3.20	6.4	6.40	J10,W11		6.40	54.70								
		5.20						End of Shell and Auger Hole. * Seating Blows - J10 = 21 Hole started by inspection pit to 1.20m							



Scale 1:

Disturbed Samples: W - Groundwater
J - Jar, S - S.P.T., B - Bulk, M - Maxi

Undisturbed Samples: Soil Sample

Insitu Tests: V [30] - Vane shear strength in KN /m²
Groundwater first struck
Core Cutter Density
Core Cutter Density/C.B.R
Sandbottle Density
C B R
Cone, S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B261

FIGURE A2

Sheet 1 of 2

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Water Flush
Dates : 18.9.84
Core Diameter : 76mm
Casing Dimensions : 114.30mm

Coordinates : 66901.0 E
94537.5 N
Ground Level : 61.10 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of Casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or II (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Details	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details
17.9.84											Drilled by Shell and Auger method to 6.50m		
17.9.84	3.20	5.20	6.50						6.50	54.60			
18.9.84	3.20	1.40			70%	53%	10 100 130				Occasional bands of highly and moderately weathered very weak mudstone/siltstone.	Highly weathered red brown calcareous MUDSTONE degraded to stiff silty CLAY with many lithorelicts. (KEUPER MARL : ZONE III)	
			7.20		91%	11%	NI NI 100						
			8.10		89%	8%	NI 70 100		8.65	52.45			
												As sheet 2 of 2	

Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

Core Runs
50
100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B261

FIGURE A2

Sheet 2 of 2

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of Casing/Liner	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or II (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
			9.35				SPT 4			(71 for 125mmSB)	Moderately weathered bands of weak mudstone/siltstone.	Highly weathered fissured very weak micaceous red brown calcareous MUDSTONE with blue grey staining							
			9.48		87%	68%	50				9.30 - 9.90 7.86 - 7.97								
							140				10.02 - 10.20 8.89 - 9.92								
			10.15				170				10.93 - 11.04 10.82 - 10.94								
					98%	23%	NI				11.77 - 12.10								
							50				Completely weathered zone:	(KEUPER MARL : ZONE II/III)							
							220				10.62 - 10.82.								
			11.10								45° discontinuities 8.67 and 9.75.								
											Sub-vertical discontinuities 9.64 and 11.60								
					75%	13%	NI												
							60												
							200												
18.9.84	3.20	1.80	20.00						20.00	41.10		End of Rotary Hole.							
												NI = Not Intact							
												SB = Seating Blows.							

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mazi

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25)' - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B262

FIGURE A1

Sheet 1 of 1

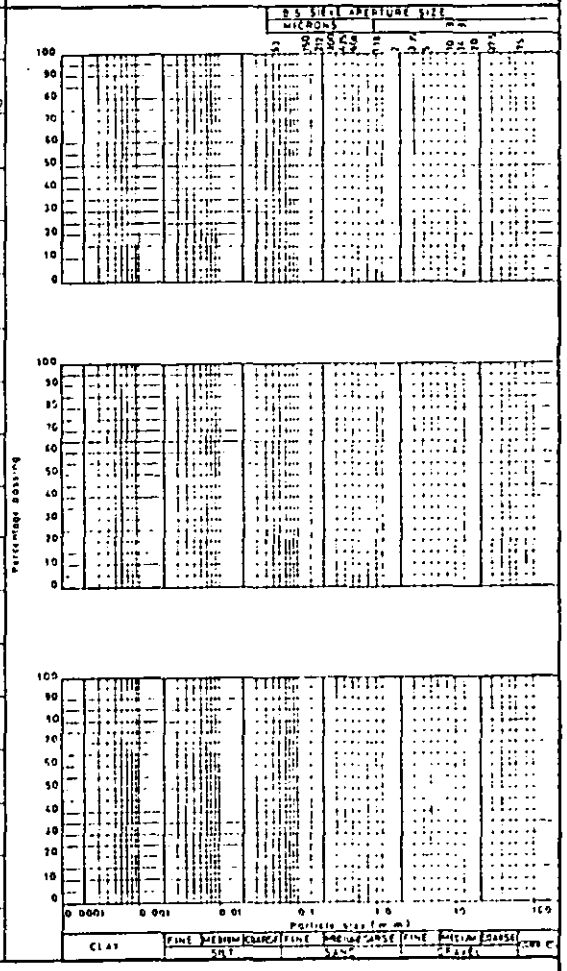
Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 19/20.9.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66896.8 E.
94491.8 N.
Ground Level: 60.20 m O.D.

Laboratory testing by: Dates:

Date	Depth of Casing	Depth to Water	Sample/Insitu test Depth	Type & Number	Change of Strata Legend	Depth	Reduced Level	Description of Strata
19.9.84	-	-				0.70	59.50	STONE FILL, (Motorway verge).
			1.00	J1				Very stiff red brown mottled grey green silty CLAY with some siltstone lithorelicts (KEUPER MARL : ZONE III)
			1.45	(100),				
			1.50	S(97)		1.50	58.70	
19.9.84	1.50	Nil	1.95	J2				Moderately weathered red brown very weak calcareous SILTSTONE (KEUPER MARL : ZONE II)
			2.00			2.00	58.20	
20.9.84	1.50	1.30	2.20	J3				Very stiff red brown mottled grey green silty CLAY with some mudstone/siltstone lithorelicts. (KEUPER MARL : ZONE III)
			2.50	B4				
			2.95	(70)5				
			3.00	J6				Occasional bands of highly weathered very weak calcareous siltstone at 3.00 - 3.70
			3.45	S(48) J7				
			3.50	B8				
			3.70	J9				
			4.00					
			4.45	(50)10				
		Water seepage at 4.5 rose to 4.0	4.50	J11		4.50	55.70	
			4.95	S(117) J12		5.00	55.20	Highly weathered fissured interstratified red brown weak MUDSTONE/SILTSTONE with residual silty CLAY (KEUPER MARL : ZONE III)
			5.50	J13				Very stiff red brown mottled grey green silty CLAY with some siltstone lithorelicts and occasional thin bands of moderately weathered fissured weak calcareous siltstone. (KEUPER MARL : ZONE II/III)
			6.00	S(79 for 150mm)*				
20.9.84	1.50	6.10	6.40	J14		6.40	53.80	
								End of Shell and Auger Hole.
								* Seating Blows - J14 = 32
								+ Failed U sample
								Hole started by inspection pit to 1.20m

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/l pH
	1	11					
	5	15	1865	31	19	69	0.04 8.2
	10	21	1700				



Scale 1:

Disturbed Samples: W - Groundwater; ● J - Jar, ● S - S.P.T., ● B - Bulk, ● M - Maxi

Undisturbed Samples: Soil Sample

Insitu Tests: V (30) - Vane shear strength in KN/m²; Groundwater first struck; Core Cutter Density; Core Cutter Density/C.B.R; Sandbottle Density; C B R; Cores S.P.T. - one or spoon; (25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B262

FIGURE A2

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring Air Flush with Water Injection
Dates : 21.9.84
Core Diameter : 76mm
Casing Dimensions : 133.35mm

Coordinates : 66896.8 E
94491.8 N
Ground Level : 60.20 m O.D.

Laboratory Testing by : Dates :

Drilling: Dates	Depth of casing/hole	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or ff (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details
19.9.84											Drilled by Shell and Auger method to 6.50 See Fig A1		
19.9.84		6.10	6.50						6.50	53.70			
21.9.84		3.70	6.50				NI				Slightly weathered grey green moderately strong band at: 7.86 - 8.14 Highly weathered zone at: 7.63 - 7.73 degraded to stiff silty clay with many lithorelicts.	Slightly weathered very fissured red brown very weak to weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal smooth discontinuities (KEUPER MARL : ZONE I/II)	
					90%	23%	40						
			7.90				190						
					100%	0%	NI						
							30						
							90						

Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)

Scale 1 :

Disturbed Samples : W - Groundwater

J - Jar
S - S.P.T.
B - Bulk
M - Mazi

50
100

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25)' - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B262

FIGURE A2

Sheet 2 of 2

Field Work by : _____
Method : _____
Dates : _____
Core Diameter : _____
Casing Dimensions : _____

Coordinates : _____ E
_____ N
Ground Level : _____ m O.D.

Laboratory Testing by : _____ Dates : _____

Drilling								Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Dates	Depth of casing(m)	Depth to water(m)	Depth (m)	Run	CR %	R.Q.D. %	Test or II (mm)	Legend	Depth (m)	Reduced Level	Detail	Main									
			9.10				CPT			(82 for 129 mm SB)											
			9.23				NI														
					100%	0%	20					As sheet 1 of 2									
22.8.86	6.50						70		10.00	50.20											
			10.00									End of Rotary Hole.									
												NI = Not Intact									
												SB = Seating Blows.									

Scale 1 :

Disturbed Samples :
W - Groundwater
• J - Jar
• S - S.P.T.
• B - Bulk
• M - Mast

50
100

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25)' - N value

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Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT / BOREHOLE No. B262
FIGURE B
Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation							Notes
					Stress at failure		Strain at failure			c	ø		Initial		Pressure Range (kN/m²)					
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	c' (kN/m²)	ø' (Degrees)	Type of Shear Test	Moisture Content (%)	Dry Density (kg/m³)		0 100	100 200	200 400	400 800	800 300	300 100	
2.50 2.95	U5				50	176	6			240 (115	- 19)*	UU			m_v							* alternative interpretation
					150	237	8.5	15	1865						c_v							
					300	311	10.0								k							
															e							
4.00 4.45	U10				100	163	11			200 (125	- 10)*	UU	21	1675	m_v	0.22	0.13	0.08	0.05	0.02	0.06	* alternative interpretation
					200	196	13.5	21	1700						c_v	-	15.34	16.95	14.39	-	-	
					400	227	16.5								k	-	19.56	13.30	7.06	-	-	
															e	0.542	0.522	0.498	0.470	0.485	0.501	
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
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															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
N B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2 /MN
c_v = m^2 / yr
k = m/s = 10^{-9}
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B263

FIGURE A1

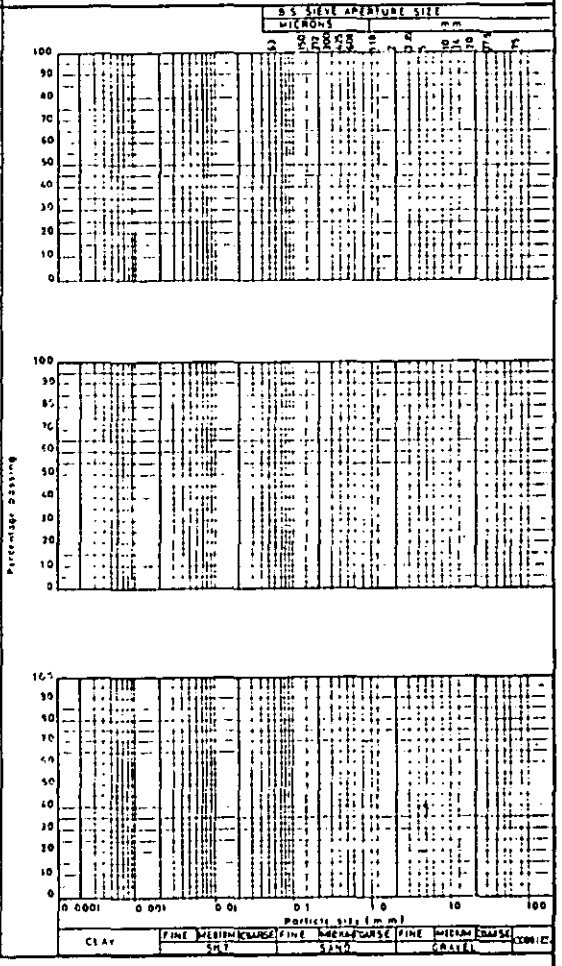
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 17.9.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 67150.4 E.
95087.2 N.
Ground Level: 66.22 m OD

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
17.9.84	-	-	0.30	J1				Very stiff red brown silty CLAY with occasional sub-angular gravel (chalk, flint, sandstone, siltstone and mudstone.) (GLACIAL TILL)		1	12				
			0.50												
				(85)2											
			0.95			1.00	65.22			2	11	1835			
			1.00	J3											
				S(35)				Very stiff red brown mottled grey green fissured silty CLAY with some thin bands of highly weathered calcareous mudstone/siltstone. (KEUPER MARL : ZONE III)							
			1.45	J4						6			26	17	100
			1.80	J5		1.80	64.42			10	18	1695	33	21	100
			2.00												
				(65)6				Stiff red brown mottled grey green silty CLAY with some siltstone lithorelicts. (KEUPER MARL : ZONE III)							
			2.45												
			2.50	J7						14	11				
				S(49)											
			2.95	J8											
			3.30	J9		3.30	62.92								
			3.50												
				(72)10				Very stiff red brown mottled grey green silty CLAY with many mudstone/siltstone lithorelicts and some thin bands of highly weathered mudstone/siltstone. (KEUPER MARL : ZONE II/III)							
			3.95												
			4.00	J11											
				S(62)											
			4.45	J12											
			4.80	J13		4.80	61.42								
			5.00	( )+											
			5.10	B14				Highly weathered weak to moderately weak fissured red brown and grey green calcareous SILTSTONE. (KEUPER MARL : ZONE III)							
				S(82 for J15 150mm											
17.9.84	3.00	Dry	5.40	C(82 for J16 125mm											
			5.50			5.50	60.72								
								End of Shell and Auger Hole.							
								+ Failed U sample.							
								* Seating Blows - J15 = 34							
								SB = Seating Blows only							



Scale 1:

Disturbed Samples : W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V (30) - Vane shear strength in KN/m²

Groundwater first struck

Core Cutter Density
Core Cutter Density/C.B.R

Sandbottle Density
C.B.R

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B263

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Water Flush
Dates : 18/19.9.84
Core Diameter : 76mm
Casing Dimensions : 114.30mm

Coordinates : 67150.4 E
95087.2 N
Ground Level : 66.22 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	CR %	RQD %	Test or fracture (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
									5.50	60.72	Drilled by Shell and Auger method to 5.50								
18.9.84	3.00	Dry	5.50		79%	20%	NI 80 100				Highly weathered zones degraded to very silty clay with many lithorelicts.	Highly weathered fissured very weak red brown calcareous MUDSTONE (KEUPER MARL : ZONE III)							
			6.50		93%	0%	NI NI 50												
			7.50		91%	0%	NI 60 90												
			9.00																

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mod.

Core Runs
50
100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B263

FIGURE A2

Sheet 2 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	CR %	R.Q.D. %	Test or fracture spacing (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details
					97%	0%	NI 60 330				Bands of moderately weathered weak to moderately weak siltstone at: 10.38 - 10.56, 11.80 - 11.85, 14.75 - 14.80, 16.94 - 17.00, 18.61 - 18.65, 19.15 - 19.55, Bands of moderately weathered weak to moderately weak mudstone at; 16.03 - 16.11, 18.38 - 18.42, 18.50 - 18.60, 19.62 - 19.74. Highly weathered zones at: 13.58 - 14.30, 15.30 - 15.40, 17.00 - 17.65, 18.12 - 18.31, 18.62 - 18.75, 18.81 - 19.34. degraded to stiff very silty clay with many mudstone lithorelicts.	Highly weathered fissured very weak red brown calcareous MUDSTONE (KEUPER MARL : ZONE II/III) Reduction in completely weathered zones below 13.50m	
			10.05		78%	0%	NI NI 60						
			10.50		88%	0%	NI NI 50						
18.9.84	3.00	1.30	11.70										
19.9.84	3.00	1.60			88%	0%	NI NI 50						
			13.30		96%	7%	NI 60 100						
			14.80		81%	0%	NI NI 40						
			15.80		95%	8%	NI 50 100						
			17.00		99%	16%	NI 90 130						

Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
	16.00					0.174
	16.11					0.346

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) * - N value

A - Axial
D - Diametral

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B263

FIGURE A2

Sheet 3 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling							Test or II (mm)	Change of Strata		Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
Dates	Depth of Casing (m)	Depth to water (m)	Depth (m)	Run	CR %	R.Q.D. %		Legend	Depth (m)	Reduced Level	Detail	Main							
					As sheet 2 of 3									18.50					0.402
			18.60											18.60					0.049
							30												
					95%	47%	90					As Sheet 2 of 3		19.43					0.258
							190							19.53					0.400
														19.61					0.083
														19.74					
19.9.84	3.00	1.90												19.74					0.040
			20.00						20.00	46.22				19.89					
												End of Rotary Hole.							
												NI = Not Intact							
												SB = Seating Blows.							

Scale 1 :

Disturbed Samples :
W = Groundwater
• J = Jar
• S = S.P.T.
• B = Bulk
• M = Mazi

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

A = Axial
D = Diametral

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Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B263
FIGURE B
Sheet 1 of 1

Sample Depth (m)	Sample Type & Number	Compaction Type of Test	Compaction Optimum Moisture Content (%)	Compaction Maximum Dry Density (kg/m³)	Shear Strength Stress at Failure σ_3 (kN/m²)	Shear Strength Stress at Failure $\frac{\sigma_1-\sigma_3}{2}$ (kN/m²)	Shear Strength Strain at Failure (%)	Shear Strength Moisture Content (%)	Shear Strength Dry Density (kg/m³)	Shear Strength C' (kN/m²)	Shear Strength ø' (Degrees)	Type of Shear Test	Initial Moisture Content (%)	Initial Dry Density (kg/m³)	Consolidation	Pressure Range (kN/m²)						Notes
																0 100	100 200	200 400	400 800	800 200	200 100	
0.50 0.95	U2				50	419	2			520 (235	- 26)*	UU			m_v							* alternative interpretation
					150	466	3	11	1835						c_v							
					300	669	5.5								k							
															e							
2.00 2.45	U6				50	104	4.2								m_v							
					146	182	3.2	18	1730			$\overline{CD}$			c_v							
					345	368	3.8			20	28				k							
															e							
3.50 3.95	U10				100	221	9	18	1775	220	-	UU	14	1875	m_v	0.24	0.11	0.07	0.02	0.02	0.05	
					200	250	11	18	1690						c_v	-	12.28	17.65	11.72	-	-	
					400	176	8	19	1620						k	-	13.25	12.12	2.30	-	-	
															e	0.384	0.369	0.349	0.340	0.352	0.360	
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2 / MN
c_v = m^2 / yr
k = m/s $\times 10^{-8}$
e = void ratio at U 100% for each increment

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BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B264

FIGURE A1

Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 20/21.9.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

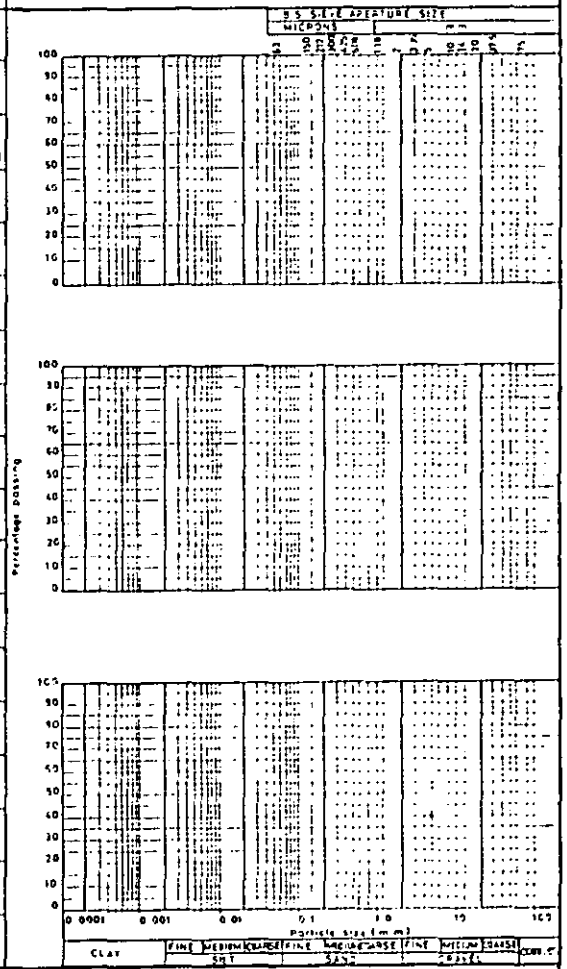
Coordinates: 67145.8 E.
95061.8 N.
Ground Level: 67.12 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% Passing 425 microns	Sulphate g/ltr / pH
20.9.84			0.30	J1		0.20	66.92	TOPSOIL		1	11					
			0.50	(50)2				Very stiff red brown grey green fissured silty CLAY with many mudstone lithorelicts. Occasional bands of thin highly weathered MUDSTONE/SILTSTONE. (KEUPER MARL : ZONE III)		2	20	1765	39	20	100	
			0.95 1.00	J3 S(47)												
			1.45	J4						6	13	1950				0.04 / 7.9
			1.80	J5				Soft red brown silty CLAY with many mudstone lithorelicts at 1.80		10	19	1760	31	19	100	
			2.00	(70)6												
			2.45 2.50	J7 S(62)						14	13	1945				
20.9.84	Nil	Dry	2.95	J8				Band of highly weathered weak to moderately weak SILTSTONE at 3.30m								
21.9.84	Nil	Dry	3.30	J9												
			3.50	(84)10												
			3.95 4.00	J11 S(72)												
			4.45	J12												
			4.80 5.00	J13												
			5.45 5.80	J15 *(71 for 150mm)*		5.50	61.62									
21.9.84	3.00	Dry	6.00	J16		6.00	61.12	Highly weathered fissured red brown very weak MUDSTONE. (KEUPER MARL : ZONE III)								
								End of Shell and Auger Hole.								

* Seating Blows – J16 = 35

Bentonite seal 4.40 – 4.90
Piezometer tip 5.70
Sand filter 4.90 – 5.80
Bentonite seal 5.80 – 6.00



Scale 1:

Disturbed Samples : W – Groundwater
● J – Jar
● S – S.P.T.
● B – Bulk
● M – Maxi

Undisturbed Samples : U(100) Soil Sample

Insitu Tests : V [30] – Vane shear strength in KN/m²

Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C.B.R

C or S SPT cone or spoon
(25) – N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B264

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Water Flush
Dates : 25/26.9.84
Core Diameter : 76mm
Casing Dimensions : 114.30mm

Coordinates : 67145.8 E
95061.8 N
Ground Level : 67.12 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of Casing	Depth to water (m)	Depth (m)	Run	CR %	R.Q.D. %	Test or Lf (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
									6.00	61.12	Drilled by Shell and Auger method to 6.00 See Fig A1								
25.9.84	3.00	Dry	6.00								Slightly weathered grey green Moderately weak band at: 12.43 - 12.64.	Highly weathered red brown occasionally grey green SILTSTONE degraded to stiff silty CLAY with many siltstone lithorelicts. Very to extremely closely spaced sub-horizontal rough discontinuities (KEUPER MARL : ZONE III)							
				1	87%	23%	NI 60 120												
			7.00																
					77%	24%	NI 70 180												
			8.50																
					Sheet 2 of 3														

Scale 1 :
Disturbed Samples : W - Groundwater
J - Jar, S - S.P.T., B - Bulk, M - MCAI
Core Runs
50 / 100 core recovery %
Groundwater first struck
C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B264

FIGURE A2

Sheet 2 of 3

Field Work by : _____
Method : _____
Dates : _____
Core Diameter : _____
Casing Dimensions : _____

Coordinates : _____ E _____ N
Ground Level : _____ m O.D.

Laboratory Testing by : _____
Dates : _____

Drilling							Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	CA %	R.Q.D %	Test or II (mm)	Legend	Depth (m)	Reduced Level	Detail	Main								
					89%	14%	NI NI 120					See sheet 1 of 3								
			10.00																	
					85%	18%	NI 100 180													
			11.00				CPT			(43SB, 81 for 150mm)										
			11.30		98%	22%	NI 80 130													
			12.30																	
					97%	28%	NI 70 180		13.35	53.77										
			13.50								Highly weathered zones at: 14.28 - 14.50, 16.42 - 17.52, degraded to stiff silty clay with many lithorelicts. Slightly weathered grey green moderately strong band at: 18.43 - 18.60.	Slightly weathered very fissured red brown very weak calcareous SILTSTONE. . Very to extremely closely spaced sub-horizontal rough discontinuities. (KEUPER MARL : ZONE II/III)								
					74%	0%	NI NI 50													
			14.50				CPT			(50SB, 49 for 75mm)										
25.9.84	3.00	2.30	14.73																	
26.9.84	3.00	6.00			68%	16%	NI 60 250													
			16.25																	
					37%	13%	NI NI 100													
			17.00				CPT			(45SB, 81 for 150mm)										
			17.30																	

Scale 1 :

Disturbed Samples :
W - Groundwater

♦ J - Jar
S - S.P.T.
B - Bulk
M - Mcal

50
100

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B264

FIGURE A2

Sheet 3 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling							Test or II (mm)	Change of Strata		Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	CR %	R.Q.D. %		Legend	Depth (m)	Detail	Main									
					56%	7%	NI NI 110													
			18.80								See sheet 2 of 3									
					52%	0%	NI 40 60													
26.9.84	3.00	2.40							20.00	47.12										
			20.00				CPT I													
			20.20				(50SB, 50 for 50mm)				End of Rotary Hole. NI = Not Intact SB = Seating blows.									

Scale 1 :

Disturbed Samples :
W = Groundwater
J = Jar
S = S.P.T.
B = Bulk
M = Mast

50
100

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B264
FIGURE B
Sheet 1 of 1

Laboratory Testing by : Exploration Associates (Warwick) Limited
Dates :

Sample		Compaction			Shear Strength								Consolidation							Notes
					Stress at failure		Strain at Failure			C	Ø	Type of Shear Test	Initial			Pressure Range (kN/m²)				
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)		0 50	50 200	200 50	50 100	100 200	200 400	
0.50 0.95	U2				50	370	2			370	-	UU									* Failed under 1st load
					100	"		20	1765												
					150																
2.00 2.45	U6				50	250	5	13	1940	260	-	UU									
					150	255	5	13	1960												
					300	290	8	14	1940												
3.50 3.95	U10				100	105	5	19	1745	170	-	UU	23	1635							
					200	113	18	20	1730												
					400	304	18	17	1805												
5.00 5.45	U14				100	224	3	13	1945	370 (98 | - 26)*	UU									* alternative interpretation
					250	342	10	13	1950												
					500	545	14	13	1930												

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B265

FIGURE A1

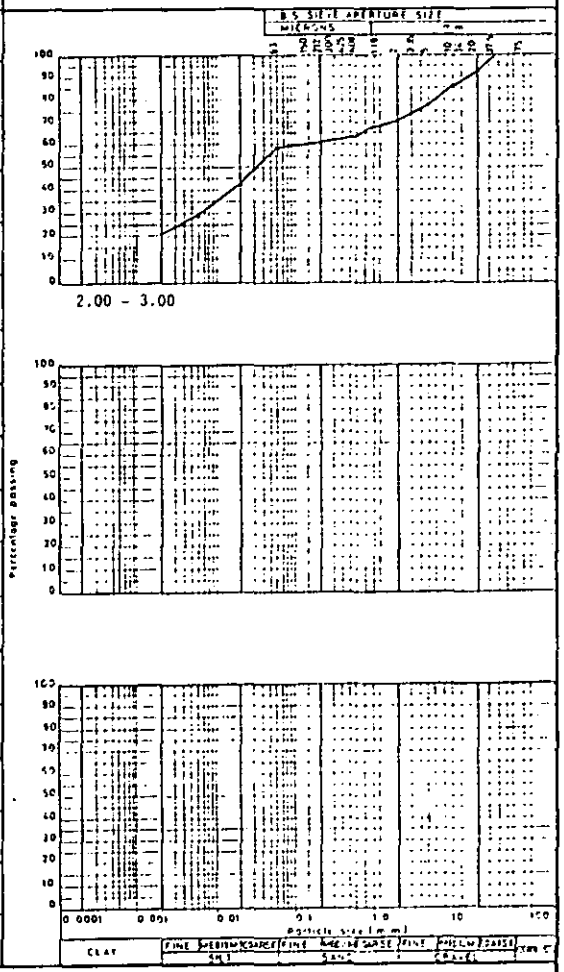
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 21.9.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 67052.3 E.
95185.5 N.
Ground Level: 76.34 m O.D.

Laboratory testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphates/ltr pH
21.9.84	Nil	Dry	0.30	J1		0.30	76.04	TOPSOIL								
			0.50	(25)2				Very stiff yellowish brown fissured sandy CLAY with occasional sub-angular fine to medium gravel (GLACIAL TILL)		1	10					
			0.95							2	10	1710	32	16	90	
			1.00	J3												
				S(9)		1.30	75.04			4	12					
			1.45	J4				Firm to stiff red brown mottled grey green fissured silty and very silty CLAY with many siltstone lithorelicts and occasional thin bands of moderately weathered grey green very weak siltstone. (KEUPER MARL : ZONE II/III)								
			1.70	J5						6	13	1895				
			2.00	(30)6												0.05
			2.45							9	17					7.7
			2.50	J7												
				S(28)				Becoming very stiff and stiff below 2.00m		11	22	1620	39	23	100	
			2.95	J8												
			3.00	B9												
			3.20	J10						16	11	2010				
			3.50	(50)11												
			3.95							20	13					
			4.00	J12												
				S(36)												
			4.45	J13												
			4.50	B14												
			4.70	J15												
			5.00	(90)16												
			5.40	J17												
			5.50													
				S(58)												
			5.95	J18				Band of siltstone become weak below 6.50m								
			6.30	J19												
			6.50	S(116)												
		seepage at 6.90	6.95	J20												
			7.10	J21												
			7.30	S(133)												
21.9.84	Nil	Dry	7.70	J22		7.70	68.64									
								End of Shell and Auger Hole. Hard Strata - 6.90 - 7.30 = 1 hour								



Scale 1:

Disturbed Samples: W - Groundwater
● J - Jar
● S - S.P.T.
B - Bulk
● M - Maxi

Undisturbed Samples: Soil Sample

Insitu Tests: V (30) - Vane shear strength in KN /m²

Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C.B.R

(Cone) S.P.T. cone or spoon
(175) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B265

FIGURE A2

Sheet 1 of 2

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring Air Flush with Water Injection
Dates : 2.10.84
Core Diameter : 76mm
Casing Dimensions : N/A

Coordinates : 67052.3 E
95185.5 N
Ground Level : 76.34 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of Casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or ff (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
									6.00	70.34	Rotary Open Holed through overburden alongside Shell and Auger Hole previously drilled to 6.00								
2.10.84	-	-	6.00		79%	0%	NI NI 95				Slightly weathered grey green moderately weak bands at: 7.00 - 7.14, 8.92 - 8.98, 10.83 - 10.99, 11.59 - 11.66, 13.91 - 14.19. Highly weathered zones at: 6.50 - 7.00, 10.38 - 10.66, 11.31 - 11.59, 13.34 - 13.54 degraded to stiff silty clay with many lithorelicts.	Moderately to slightly weathered very fissured red brown occasionally grey green very weak to weak calcareous SILTSTONE. Very to extremely closely spaced rough sub-horizontal discontinuities. (KEUPER MARL : ZONE II/III)							
			7.00		93%	29%	NI 100 220												
			8.20 8.25		100%	0%	CPT NI NI 70			(50 for 45mm/50)									

Scale 1 :

Disturbed Samples : • J - Jar, S - S.P.T., B - Bulk, M - Maxi
W - Groundwater

Core Runs: 50, 100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon (25)' - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B265

FIGURE A2

Sheet 2 of 2

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling: Date	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or Jt (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details
		Water Inflow at 9.0	9.00										
					98%	17%	NI 40 130						
			10.60							(50 for 70mmSB)			
			10.67				CPT-1						
					95%	9%	NI 30 110					See sheet 1 of 2	
			11.80										
					99%	0%	NI NI 50						
			13.50										
					93%	51%	NI 120 270						
			15.50						15.70	60.64		Slightly weathered fissured grey green moderately weak to moderately strong calcareous SILTSTONE. (KEUPER MARL : ZONE II)	
					98%	24%	NI 100 150						
2.10.84			17.00						17.00	59.34			
												End of Rotary Hole. NI = Not Intact. SB = Seating Blows Bentonite Seal 0.50 - 1.50, Gravel filter 1.50 - 6.00 Standpipe installed to 16.00	

Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)

Scale 1 :

Disturbed Samples :
W = Groundwater
J = Jar
S = S.P.T.
B = Bulk
M = Mazi

Core Runs
core recovery %

Groundwater first struck

C or S = S.P.T. cone or spoon
(25) = N value

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Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B265

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at failure		Strain at failure			C	Ø	Type of Shear Test	Initial		Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)		0 50	50 100	100 200	200 400	400 800	800 400	400 100	
0.50 0.95	U2				50	139	6.5			160 (85 | - 16)*	UU			m_v							* alternative interpretation
					100	166	12	10	1710						c_v							
					150	186	20								k							
															e							
2.00 2.45	U6				50	136	20	13	1890	200 (85 | - 20)*	UU			m_v							* alternative interpretation
					150	212	20	13	1900						c_v							
					300	242	20	13	1885						k							
															e							
3.50 3.95	U11				50	85	12	23	1640	110	-	UU	18	1830	m_v	0.37	0.10	0.08	0.06	0.04	0.01	0.04	
					200	138	20	21	1620						c_v	-	18.93	16.28	12.44	13.68	-	-	
					350	117	6	21	1585						k	-	18.57	12.78	7.32	5.37	-	-	
															e	0.422	0.415	0.404	0.388	0.367	0.373	0.389	
5.00 5.40	U16				100	171	3	12	1970	450 (70 | - 37)*	UU			m_v							* alternative interpretation
					200	440	6	11	2025						c_v							
					400	746	7	11	2040						k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s x 10^{-8}
e = void ratio at U 100% for each increment

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BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B266

FIGURE A1

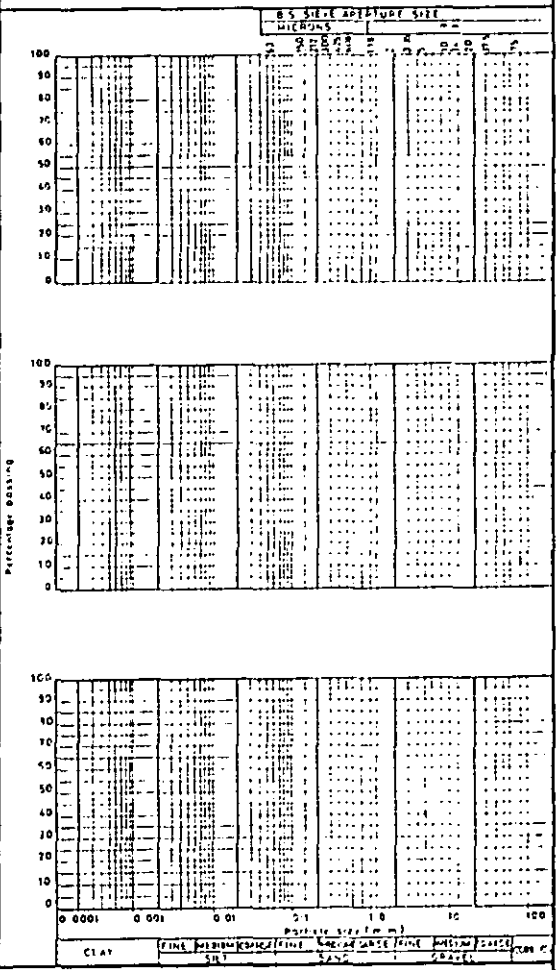
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 20/21.9.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 67059.4 E.
95206.5 N.
Ground Level: 75.72 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
20.9.84	Nil	Dry	0.30	J1		0.30	75.42	TOPSOIL							
			0.50	(30)2				Very stiff yellowish brown fissured sandy CLAY with occasional sub-angular medium gravel (sandstone and flint) (GLACIAL TILL)		1	12				
			0.95												
			1.00	J3						2	13	1840			
				S(15)											
			1.45	J4						6	15	1820	35	18	93
			1.70	J5		1.70	74.02			11	11	1995			
			2.00					Very stiff red brown fissured silty to very silty CLAY with many siltstone/mudstone lithorelicts. (KEUPER MARL: ZONE III)							
				(50)5											
			2.45							16	17	1840	31	17	100
			2.50	J7											
				S(33)											
			2.95	J8											
			3.00	B9											
			3.20	J10											
			3.50												
				(70)11											
20.9.84	Nil	Dry	3.95			4.00	71.72								
			4.00	J12											
21.9.84	Nil	Dry		S(34)				Very stiff red brown and grey green fissured silty CLAY with many siltstone lithorelicts and occasional bands of highly weathered fissured very weak calcareous siltstone with residual silty clay. (KEUPER MARL : ZONE III)							
			4.45	J13											
			4.50	B14											
			4.70	J15											
			5.00												
				(90)18											
			5.40	J17											
				S(85 for 225mm)											
			5.50	J18											
		Slight seepage at 6.2	5.85												
			6.10	J19											
			6.25	S(80 for 150mm)											
21.9.84	Nil	–	6.50	J20		6.50	69.22								
								End of Shell and Auger Hole.							
								Hard Strata – 5.80 – 6.20 = 1 hour							
								* Seating Blows – J18 = 17							
								J20 = 29							



Scale 1:

Disturbed Samples: W – Groundwater
J – Jar
S – S.P.T.
B – Bulk
M – Maxi

Undisturbed Samples: Soil Sample

Insitu Tests: V C30 – Vane shear strength in KN/m²

Groundwater first struck

Core Cutter Density
Core Cutter Density/C.B.R

Sandbottle Density
C B R

C or S S.P.T. – ne or spoon
(25) – N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B266

FIGURE A2

Sheet 1 of 2

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring Air Flush with Water Injection
Dates : 1.10.84
Core Diameter : 76mm
Casing Dimensions : N/A

Coordinates : 67059.4 E
95206.5 N
Ground Level : 75.72 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or ll (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Details	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details
											Rotary Open Holed alongside Shell and Auger Hole previously drilled to 5.00	...	
		▼	5.00						5.00	70.72			
1.10.84		Water Inflow at 5.0	5.00		81%	20%	NI NI 200					Highly weathered red brown siltstone degraded to stiff silty CLAY with many siltstone lithorelicts. (KEUPER MARL : ZONE III)	
			6.00		98%	0%	NI 50 90		6.08	69.64			
			6.70		96%	26%	NI 30 250					See Sheet 2 of 2	
			8.30 8.51				CPT			(303B, 50 for 58mm)			

Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)

Scale 1 :

Disturbed Samples :
W - Groundwater
• J - Jar
S - S.P.T.
B - Bulk
M - Moist

Core Runs
100
50
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B266

FIGURE A2

Sheet 2 of 2

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of Casing (m)	Depth to Water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or ll (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details
					100%	28%	NI 90 150				Slightly weathered grey green moderately weak bands at: 6.12 - 6.23, 6.32 - 6.47, 9.54 - 9.69, 12.60 - 13.00, 14.43 - 15.00 Highly weathered zones at: 7.50 - 7.67, 9.10 - 9.40 degraded to stiff silty clay with many lithorelicts. Sub-vertical discontinuities at: 11.15 11.24.	Slightly weathered fissured red brown occasionally grey green very weak to weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal rough discontinuities. (KEUPER MARL : ZONE II/III)	
			9.60										
					94%	27%	NI 60 270						
			11.00										
			11.29				CP1			(3658, 82 for 135mm)			
					100%	53%	NI 150 180						
			12.60										
1.10.84					95%	62%	NI 100 390		15.00	60.72			
			15.00									End of Rotary Hole NI = Not Intact SB = Seating Blows.	

Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
	9.50					0.384
	9.60					
	10.22					0.044
	10.34					
	10.34					0.020
	10.45					
	11.09					0.034
	11.20					
	12.20					0.204
	12.32					
	12.32					0.140
	12.46					
	13.24					0.104
	13.36					
	13.36					0.144
	13.46					
	14.48					0.504
	14.58					
	14.58					0.200
	14.69					
	14.69					0.304
	14.81					

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - MCAI

Core Runs
Core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) '- N value

A - Axial
D - Diametral

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Laboratory Testing by : Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B266
FIGURE B
Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at Failure		Strain at Failure			C	Ø	Type of Shear Test	Initial		Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)							
0.50	U2				50	306	9	13	1855	230	-	UU			m_v						
0.95					100	228	11	13	1855						c_v						
					150	171	10	14	1815						k						
															e						
2.00	U6				50	183	20			183	-	UU			m_v						* Excessive Strain
2.45					150	*		15	1820						c_v						
					300										k						
															e						
3.50	U11				50	211	6			290 (140	- 19)*	UU			m_v						* alternative interpretation
3.95					200	298	11.5	11	1995						c_v						
					350	355	14.5								k						
															e						
5.00	U16				100	164	6	17	1820	210 (115	- 12)*	UU			m_v						* alternative interpretation
5.40					200	222	10	17	1850						c_v						
					400	238	11	16	1850						k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s $\times 10^{-8}$
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B267

FIGURE A1

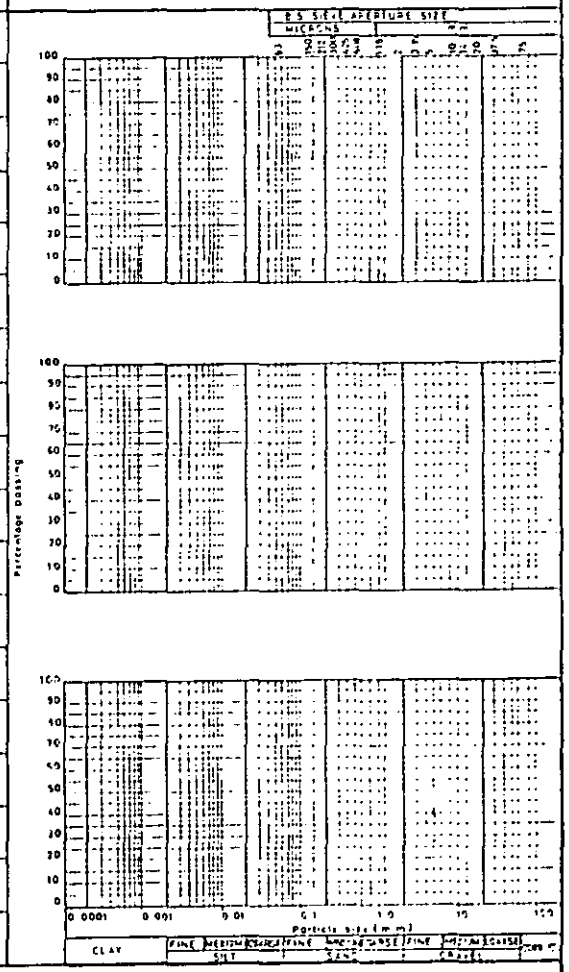
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 18.9.84
Hole Dimensions 150mm
Casing Dimensions 150mm

Coordinates: 67043.0 E.
95211.1 N.
Ground Level: 74.77 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr / pH
18.9.84	Nil	Dry						LIMESTONE CHIPPINGS, Motorway Verge		6	21		30	18	100	0.05 / 7.7
			1.00	J1		1.00	73.77			9	12					
			1.20	J2				Stiff to very stiff red brown mottled grey green fissured silty to very silty CLAY with some mudstone/siltstone lithorelicts.								
			1.50	(40)3												
			1.95					(KEUPER MARL : ZONE III)								
			2.00	J4												
			2.45	S(31) J5												
			2.50	B6												
			2.70	J7				Occasional thin bands of moderately weathered fissured weak calcareous siltstone below 2.00 and many mudstone/siltstone lithorelicts. Becoming mottled grey green below 2.70								
			3.00	(100)+												
			3.20	S(88 for* 225mm												
			3.30	B8												
			3.50	J9												
			3.65													
			4.00	S(88 for* 150mm												
			4.30	J10												
			4.50	J11												
			4.70	S(75 for* 150mm												
18.9.84	1.50	Dry	5.00	J12		5.00	69.77									
								End of Shell and Auger Hole.								
								Hard Strata - 4.30 - 4.70 m								
								* Seating Blows - J8 = 22 J10 = 25 J12 = 35								
								+ Failed U sample.								
								Hole started by inspection pit to 1.20m								



Scale 1:

Disturbed Samples : W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] - Vane shear strength in KN /m²

Groundwater first struck

Core Cutter Density
Core Cutter Density/C.B.R

Sandbottle Density
C B R

C or S S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B267

FIGURE A 2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Air Flush with Water Injection
Dates : 19.9.84
Core Diameter : 76mm
Casing Dimensions : 133.35mm

Coordinates : 67043.0 E
95211.1 N
Ground Level : 74.77 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of Casing (m)	Depth to Water (m)	Depth (m)	Run	CR %	RQD %	Test or II (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
									5.00	69.77	Drilled by Shell and Auger method to 5.00				5.50	13	31	19	1930	
															5.83					
															6.10					
19.9.84		2.60	5.00												6.20					0.304
					97%	45%	20								6.20					
							70								6.34					0.980
							350													
												See sheet 2 of 3								
			7.00												7.00					
			7.20				CPT			(4068, 50 for 52mm)					7.15					0.940
															7.15					
							NI								7.25					0.204
					100%	40%	90													
							280													
			8.50																	
					97%	0%	NI													
							30													
							90													

Scale 1 :

Disturbed Samples :
W - Groundwater
• J - Jar
S - S.P.T.
B - Bulk
M - Mokl

50
100
Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

A - Axial
D - Diametral

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B267
FIGURE A2
Sheet 2 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :
Coordinates : E N
Ground Level : m O.D.
Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing	Depth in water (m)	Depth (m)	Run	CR %	RQD %	Test or II (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
							Sheet 1 of 3													
			9.50				NI 160 290				Slightly weathered grey green moderately weak bands at: 5.43 - 5.49, 6.42 - 6.52, 6.62 - 6.66, 8.50 - 8.59, 8.71 - 8.76, 9.94 - 9.78, 13.56 - 14.07, 14.30 - 14.39, 14.85 - 15.44, 15.67 - 15.80, 17.29 - 17.51, 19.94 - 20.00	Slightly weathered fissured red brown occasionally grey green very weak to weak calcareous SILTSTONE Very to extremely closely spaced sub-horizontal smooth discontinuities. (KEUPER MARL : ZONE II)			10.76				0.03
					96%	56%									10.86					
															10.86					0.03
			11.50												11.00					
			11.56				CPT			(50 for 60mm SB)	Highly weathered zones at: 6.66 - 6.83, 8.24 - 8.36, 16.73 - 16.88, 17.00 - 17.29 degraded to stiff silty clay with many lithorelicts.									
											Sub-vertical discontinuities at: 7.66 - 7.76, 13.76 - 13.93, 15.00 - 15.20.									
											45° discontinuities at: 14.49 - 14.54				13.00					
					95%	56%	NI 90 560								13.30		29	19		
															13.35					0.03
															13.45					
															13.45					0.03
															13.55					
			14.30												13.55					0.03
					97%	0%	NI 50 100								13.66					
			14.75												13.66					0.03
			14.82				CPT			(50 for 70mmSB)					13.76					
															15.19					0.40
					100%	47%	NI 60 190								15.34					
															15.65					0.40
			15.80												15.80					
							NI 120 300													
					92%	41%									17.74					0.01
			17.40												17.84					
							Sheet 3 of 3													

Scale 1 :
Disturbed Samples : J - Jar, S - S.P.T., B - Bulk, M - Mazi
W - Groundwater
Core Runs: core recovery %
Groundwater first struck
C or S - S.P.T. cone or spoon (25) - N value
A = Axial
D = Diametral

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B267

FIGURE A2

Sheet 3 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by : Dates :

Drilling								Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
Dates	Depth of Casing (m)	Depth to water (m)	Depth (m)	Run	CR %	R.Q.D. %	Test or ↓ (mm)	Legend	Depth (m)	Reduced Level	Details	Main							
							30					See sheet 2 of 3							
					94%	51%	100												
							340												
10.9.84	5.00								20.00	54.77									
			20.00									End of Rotary Hole. NI = Not Intact SB = Seating Blows.							

Scale 1 :

Disturbed Samples :
W - Groundwater
• J - Jar
S - S.P.T.
B - Bulk
M - Mcal

50
100

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) * - N value

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Consulting Engineers & Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B268

FIGURE A1

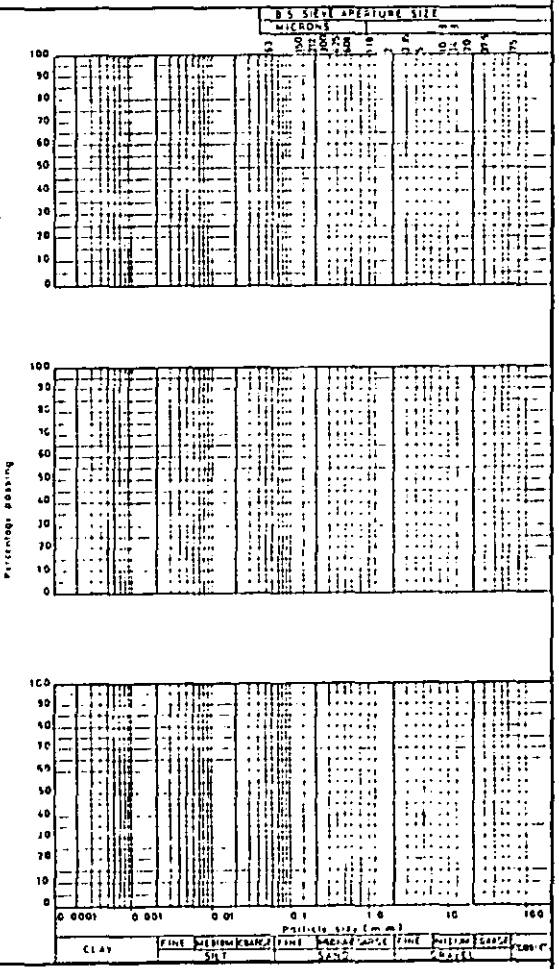
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 18.9.84
Hole Dimensions 150mm
Casing Dimensions: 150mm

Coordinates: 67049.2 E.
95230.6 N.
Ground Level: 75.00 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu test: Depth (m)	Sample/Insitu test: Type & Number	Change of Strata: Legend	Change of Strata: Depth (m)	Change of Strata: Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
18.9.84	-	-						LIMESTONE CHIPPINGS, Motorway Verge		3	17	1820			
			0.70	J1						6	20				
			1.20	J2		1.20	73.80			8	15	1865	35	20	100
			1.50					Very Stiff red brown fissured silty CLAY with many mudstone/siltstone lithorelicts (KEUPER MARL : ZONE III)							
				(50)3						11	19				
			1.95												
			2.00	J4											
				S(31)											
			2.45	J5											
			2.50	B6											
			2.70	J7											
			3.00												
				(75)8											
			3.45												
			3.50	J9		3.50	71.50								
				S(91)											
			3.95	J10											
			4.00					Stiff red brown and grey green fissured silty CLAY with many mudstone/siltstone lithorelicts and some thin bands of highly weathered fissured very weak to weak mudstone/siltstone. (KEUPER MARL : ZONE III)							
			4.50	B11											
			4.60	J12											
			4.70	S(80 for 150mm)*											
18.9.84	1.50	Dry	5.00	J13		5.00	70.00	End of Shell and Auger Hole.							
								* Seating Blows - J13 = 30							
								Hard Strata - 4.30 - 4.70 = 1 hour							
								Hole started by inspection pit to 1.20m							



Scale 1:

Disturbed Samples : W - Groundwater
● J - Jar
● S - S.P.T.
● B - Bulk
● M - Mazi

Undisturbed Samples : Soil Sample

Insitu Tests : V (30) - Vane shear strength in KN /m²

Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B268

FIGURE A2

Sheet 1 of 2

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring Air Flush with Water Injection
Dates : 19.9.84
Core Diameter : 76mm
Casing Dimensions : 133.35mm

Coordinates : 67049.2 E
95230.6 N
Ground Level : 75.00 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of Casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or ø (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details
									5.50	69.50	Drilled by Shell and Auger method to 5.00m, hole cleared of limestone chippings to 5.50 before coring		
19.9.84	-	3.90	5.50		90%	28%	NI 40 140				Moderately weathered bands weak mudstone: 5.70 - 5.77, 6.37 - 6.46, 6.79 - 6.97, 7.25 - 7.39, 8.36 - 8.43,	Highly weathered fissured very weak red brown calcareous MUDSTONE closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE II/III)	
			6.00		95%	26%	NI 70 230				Moderately weak siltstone 5.97 - 6.13		
			7.30		98%	19%	NI 80 150				45° discontinuity 7.37		
			8.10				CPT			(65 for 143mmSB)			
			8.24		100%	48%	NI 110 240						

Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		

Scale 1 :

Disturbed Samples : • J - Jar, S - S.P.T., B - Bulk, M - Maxi
W - Groundwater

Core Runs: 50 / 100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B268

FIGURE A2

Sheet 2 of 2

Field Work by : _____
Method : _____
Dates : _____
Core Diameter : _____
Casing Dimensions : _____

Coordinates : _____ E
_____ N
Ground Level : _____ m O.D.

Laboratory Testing by.: _____ Dates : _____

Drilling							Test or II (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Dates	Depth of Casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %		Legend	Depth (m)	Reduced Level	Detail	Main									
18.9.84	5.00		10.00						10.00	65.00	Highly weathered zone degraded to stiff silty clay with many lithorelicts: 8.45 - 8.78	See sheet 1 of 2									
												End of Rotary Hole. NI = Not Intact SB = Seating Blows.										

Scale 1 :

Disturbed Samples :
W = Groundwater
J = Jar
S = S.P.T.
B = Bulk
M = Mazi

50
100

Core Runs
core recovery %

Groundwater first struck

C or S = S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B268
FIGURE B
Sheet 1 of 1

Laboratory Testing by : Exploration Associates (Warwick) Limited
Dates:

Sample		Compaction			Shear Strength								Initial		Consolidation							Notes
					Stress at Failure		Strain at Failure			C	Ø	Type of Shear Test				Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)		0 54	54 214	214 54	54 107	107 214	214 428	
1.50 1.95	U3				50	223	4	17	1820	280 (155	- 16)*	UU			m_v							* alternative interpretation
					150	283	5	16	1840						c_v							
					350	331	6	18	1800						k							
															e							
3.00 3.45	U8				100	238	12	16	1850	300 (120	- 22)*	UU	14	1850	m_v	0.08	0.08	0.02	0.03	0.03	0.05	* alternative interpretation
					200	249	4	15	1895						c_v	-	20.02	-	32.20	22.94	19.51	
					400	416	9	14	1860						k	-	15.71	-	9.48	6.75	9.57	
															e	0.419	0.401	0.406	0.404	0.399	0.384	
2.00 4.50	B6+11	S	14.0	1815											m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
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															k							
															e							
															m_v							
															c_v							
															k							
															e							

for Sample Type see Sheet A

S = B.S. Standard
H = B.S. Heavy
M = B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s $\times 10^{-8}$
e = void ratio at U 100% for each increment

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Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B268
FIGURE C
Sheet 1 of 1

Sample No
Depth. 2.00 - 4.50 m
S.G.: 2.65 estimated / measured *
Max. Dry Density 1815 (kg/m³)
Optimum Moisture Content 14.0 (%)
% Retained on 19mm B.S. Sieve 0

Dry Density (kg/m³)
C.B.R. (%)
Moisture Content (%)
0%
5%
10%

Key to symbols:
*Compaction Standard / Heavy *
T (top)
or CBR (averaged if within 10% of mean)
B (base)

Sample No.:
Depth: m
S.G.: estimated / measured *
Max. Dry Density (kg/m³)
Optimum Moisture Content (%)
% Retained on 19mm B.S. Sieve

Dry Density (kg/m³)
C.B.R. (%)
Moisture Content (%)

Key to symbols:
*Compaction Standard / Heavy *
T (top)
or CBR (averaged if within 10% of mean)
B (base)

* Delete as necessary

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B269

FIGURE A1

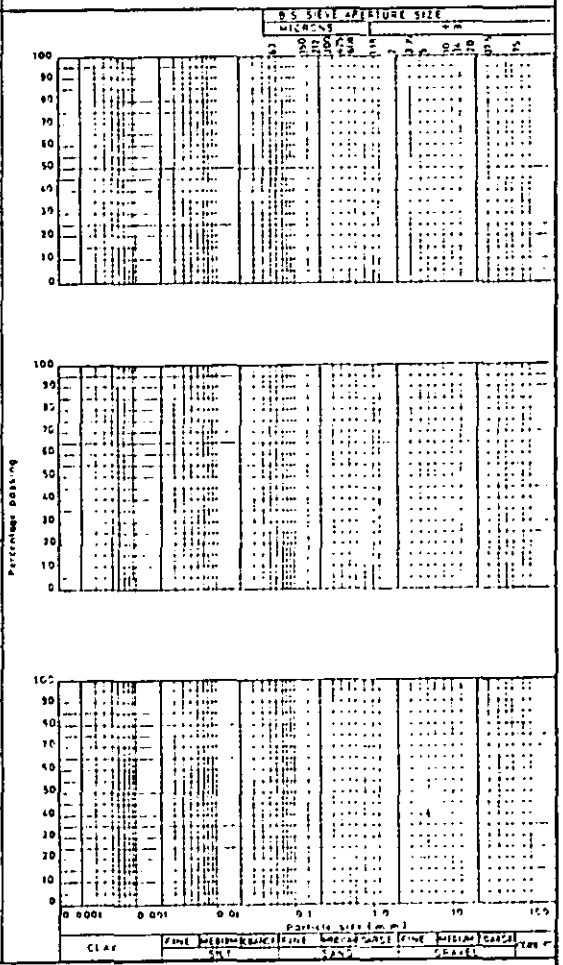
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 29.9.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 67030.7 E.
95228.6 N.
Ground Level: 75.33 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing	Depth to water	Sample/Insitu Test: Depth	Sample/Insitu Test: Type & Number	Change of Strata: Legend	Change of Strata: Depth	Change of Strata: Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 micron	Sulphate g/ltr / pH
29.9.84	-	-						LIMESTONE CHIPPINGS. (Motorway central reserve)		2	15					
			0.70	J1		0.70	74.63			6	22					0.07 / 7.8
			1.00	J2				Firm red brown fissured silty CLAY with many siltstone lithorelicts. (KEUPER MARL : ZONE III) Becoming stiff and very stiff with depth. Occasional thin bands of highly weathered very weak siltstone at 2.00		8	20	1815	29	17	100	
			1.50	(40)3						10	13					
			1.95 2.00	J4 S(39)												
			2.45 2.50	J5 B6						13	15	1860	28	16	78	
			2.80	J7												
			3.00	(70)8												
			3.45 3.50	J9		3.50	71.83									
				S(40)				Stiff red brown fissured silty CLAY with many mudstone/siltstone lithorelicts and occasional thin bands of highly weathered very weak to weak mudstone/ siltstone. (KEUPER MARL : ZONE III)								
			3.95 4.00 4.20	J10 B11 J12												
			4.50	(75)13												
			4.95 5.00	J14 S(129)				Mottled grey green at 5.00								
		Slight seepage at 5.5	5.45	J15												
			5.60 5.70	J16 S(56 for 150mm)*												
29.9.84	Nil		6.00	J17		6.00	69.33									
								End of Shell and Auger Hole.								
								* Seating Blows - J17 = 41								
								Hard Strata - 5.30 - 5.70 = 1 hour								
								Hole started by inspection pit to 1.20m								



Scale 1:

Disturbed Samples: W = Groundwater; J = Jar, S = S.P.T., B = Bulk, M = Maxi

Undisturbed Samples: Soil Sample

Insitu Tests: V [C30] = Vane shear strength in KN/m²; Groundwater first struck; Core Cutter Density; Core Cutter Density/C.B.R; Sandbottle Density; C B R; C or S SPT - one or spoon (25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B269

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring Air Flush with Water Injection
Dates : 26/27.9.84
Core Diameter : 76mm
Casing Dimensions : 133.35mm

Coordinates : 67030.7 E
95228.6 N
Ground Level : 75.33 m O.D.

Laboratory Testing by : Dates :

Drilling: Dates	Depth of Casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or Fl (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
											Drilled by Shell and Auger method to 6.0								
			6.00						6.00	69.33									
26.9.84	-	5.10	6.00		97%	26%	NI 70 190				Slightly weathered grey green moderately weak bands at: 6.66 - 6.72, 6.78 - 6.85, 7.61 - 7.81, 8.81 - 8.88, 8.85 - 8.99, 12.00 - 12.42. Highly weathered zone at: 9.22 - 9.46, degraded to stiff silty clay with many lithorelicts.	Slightly weathered fissured red brown very weak to weak calcareous SILTSTONE occasionally with thin interstratified mudstone. Very to extremely closely spaced rough sub-horizontal discontinuities. (KEUPER MARL : ZONE II/III)							
26.9.84	6.00	7.60	8.40				C↓			(50 for 65mm SB)									
27.9.84	6.00	6.30	8.46		100%	0%	NI 30 70												
			8.80																

Scale 1 :

Disturbed Samples : J - Jar, S - S.P.T., B - Bulk, M - Maxi
W - Groundwater

Core Runs 50 100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B269

FIGURE A2

Field Work by : _____
Method : _____
Dates : _____
Core Diameter : _____
Casing Dimensions : _____

Coordinates : _____ E
_____ N
Ground Level : _____ m O.D.

Laboratory Testing by : _____ Dates : _____

Drilling: Depth (m)	Run	C.R. %	R.Q.D. %	Test or Fl (mm)	Change of Strata: Depth (m)	Description of Strata: Detail	Description of Strata: Main	Reduced Level
9.50		94%	0%	NI 30 80		Sub-vertical discontinuities at: 7.36 - 7.60, 9.50 - 9.62, 10.47 - 10.55, 12.69 - 12.78, 13.28 - 13.40. 45° discontinuity at: 12.10 - 12.19, 12.52 - 12.59, 12.59 - 12.64	See sheet 1 of 3	
12.25		96%	23%	NI 70 230				
14.50		98%	54%	NI 130 410	13.81			61.52
						45° discontinuity at: 14.57 - 14.64	Slightly weathered grey green occasionally red brown moderately strong calcareous SILTSTONE. (KEUPER MARL : ZONE II)	
16.90		92%	57%	NI 150 470	15.59			59.74
17.01				CPT 1			See Sheet 3 of 3	(89 for 113mm58)
17.70		100%	26%	NI 70 180				

Field Records and Standpipe / Piezometer Installation Details

Sample Number	Depth (m)	Natural moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mazi

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B269

FIGURE A2

Sheet 3 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of Casing (m)	Depth to Water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or ll (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details
27.9.84			20.00		94%	43%	NI 70 580		20.00	55.33	Highly weathered zones at: 17.15 - 18.08, 18.63 - 19.25, degraded to stiff silty clay with many lithorelicts. Sub-vertical discontinuity at: 17.07 - 17.15	Slightly weathered fissured red brown occasionally grey green very weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal rough discontinuities. (KEUPER MARL : ZONE II/III)	
												End of Rotary Hole. NI = Not Intact SB = Seating Blows.	

Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)

Scale
1 :

Disturbed Samples :
W - Groundwater

J - Jar
S - S.P.T.
B - Bulk
M - Mazi

50
100

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B269
FIGURE B
Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at Failure		Strain at failure			C	ø	Type of Shear Test	Initial		Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1-\sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)		0 50	50 100	100 200	200 400	400 800	800 400	400 100	
3.00 3.45	U8				50	171	5			230 (125	– 14)*	UU	9.5	2010	m_v	0.16	0.05	0.05	0.04	0.03	0.008	0.03	* alternative interpretation
					200	238	7.5	20	1815						c_v	–	20.06	19.91	22.80	14.77	–	–	
					350	280	9								k	–	9.84	9.77	8.95	4.35	–	–	
															e	0.310	0.307	0.301	0.290	0.277	0.281	0.292	
4.50 4.95	U13				100	122	20			120	–	UU			m_v								* Excessive Strain
					250	*		15	1860						c_v								
					500										k								
															e								
															m_v								
															c_v								
															k								
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															k								
															e								

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s x 10^{-8}
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B270

FIGURE A1

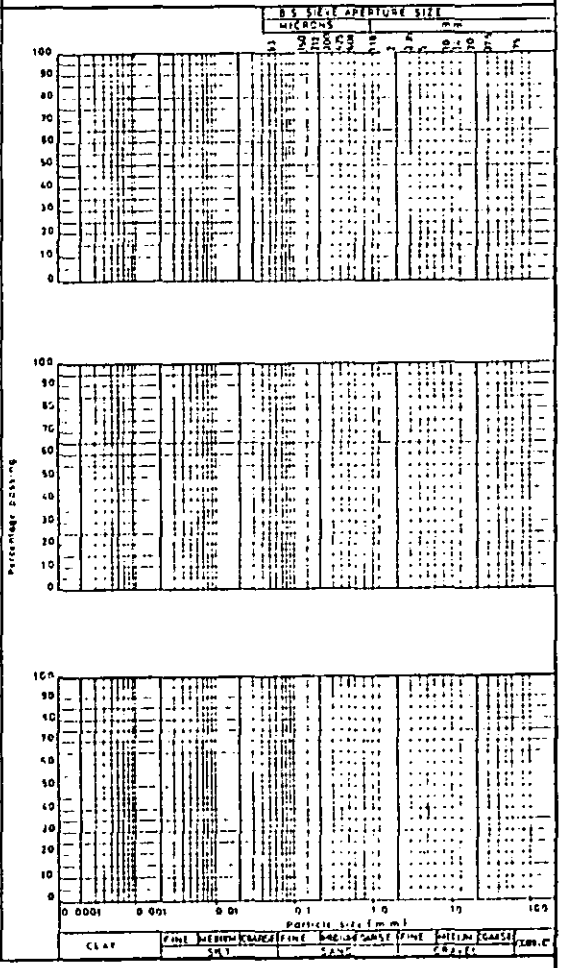
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 25/26.9.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 67037.1 E.
95246.1 N.
Ground Level: 75.59 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
26.9.84	-	-						LIMESTONE CHIPPINGS, (Motorway central reserve)		2	20				
			0.70	J1		0.70	74.89								
			1.00	J2				Firm red brown mottled grey green, fissured silty to very silty CLAY with many mudstone/siltstone lithorelicts. (KEUPER MARL : ZONE III) Occasional thin bands of highly weathered fissured red brown weak micaceous mudstone/siltstone at 1.00		6	22				
			1.50	(60)3						8	18	1825	29	17	100
			1.95			2.00	73.59			12	18	1745			
			2.00	J4 S(49)				Highly weathered fissured red brown very weak calcareous SILTSTONE with residual silty clay. (KEUPER MARL : ZONE III)							
25.9.84	Nil	Dry	2.45	J5											
			2.50	B6											
26.9.84	Nil	Dry	2.70	J7		2.70	72.89								
			3.00	(70)8				Stiff red brown fissured silty CLAY with some mudstone/siltstone lithorelicts. (KEUPER MARL : ZONE III)							
			3.45												
			3.50	J9 S(46)				Occasional bands of highly weathered fissured weak calcareous siltstone at 3.50.							
			3.95	J10											
			4.20	J11				Becoming very stiff below 4.20m							
			4.50	(80)1											
			4.95			5.00	70.59								
		Slight seepage at 5.4	5.00	J13 S(66)				Very stiff red brown mottled grey green fissured silty CLAY with many siltstone lithorelicts and some thin bands of highly weathered very weak calcareous siltstone (KEUPER MARL : ZONE III) Weak siltstone bands at 5.80. Clay becoming very stiff below 5.90m							
			5.45	J14											
			5.50	S(76 for 150mm)											
			5.80	J15 *											
			5.90	S(76 for 150mm)											
26.9.84	Nil		6.20	J17		6.20	69.39								
								End of Shell and Auger Hole.							
								* Seating Blows - J15 = 32 J17 = 31							
								Hard Strata - 5.70 - 5.90 = ½ hour							
								Hole started by inspection pit to 1.20m							



Scale 1:

Disturbed Samples: W - Groundwater
● J - Jar
● S - S.P.T.
● B - Bulk
● M - Mazi

Undisturbed Samples: Soil Sample

Insitu Tests: V (30) - Vane shear strength in KN/m²

Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R.

C or S S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B270

FIGURE A2

Sheet 1 of 2

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Water Flush
Dates : 27.9.84
Core Diameter : 76mm
Casing Dimensions : 114.30mm

Coordinates : 67037.1 E
95246.1 N
Ground Level : 75.59 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	CR %	RQD %	Test or ll (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
									6.20	69.39	Drilled by Shell and Auger method to 6.20								
27.9.84	-	-	6.20				NI				Highly weathered zones at: 6.00 - 6.17, 6.22 - 6.36, 8.20 - 8.56, 9.76 - 10.00 Slighlty weathered grey green moderately strong bands at: 6.17 - 6.22, 8.62 - 8.67, 8.82 - 8.90.	Slightly weathered very closely fissured red brown very weak to weak calcareous SILTSTONE. Very to extremely closely spaced rough sub-horizontal discontinuities. (KEUPER MARL : ZONE II/III)							
					68%	0%	70												
			7.00				95												
			7.23				CPT			(50SB, 49 for 75mm)									
							NI												
					89%	0%	NI												
			8.00				70												
							NI												
					97%	15%	NI												
			9.00				150												

Scale 1 :

Disturbed Samples :
W - Groundwater
• J - Jar
• S - S.P.T.
• B - Bulk
• M - Mazi

50 / 100 Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B270

FIGURE A2

Field Work by : _____
Method : _____
Dates : _____
Core Diameter : _____
Casing Dimensions : _____

Coordinates : _____ E
_____ N
Ground Level : _____ m O.D.

Laboratory Testing by : _____ Dates : _____

Drilling							Test or II (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
Dates	Depth of Casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %		Legend	Depth (m)	Reduced Level	Detail	Main								
			9.00				NI				Sub-vertical discontinuity at: 9.15 - 9.30	See sheet 1 of 2			9.32					0.11
					100%	14%	30				45° discontinuity at: 9.41 - 9.48				9.44					
27.9.84	3.00	2.30					140													
			10.00				CPT ↕		10.00	65.59										
			10.20							(46SB, 50 for 50mm)		End of Rotary Hole.								
												NI = Not Intact SB = Seating Blows.								

Scale 1 :

Disturbed Samples :
W = Groundwater
• J - Jar
S - S.P.T.
B - Bulk
M - Mazi

50
100
Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25)¹ - N value

A = Axial
D = Diametral

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B270
FIGURE B
Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation									Notes
					Stress at Failure		Strain at Failure			C	Ø		Initial		Pressure Ranges (kN/m²)							
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)	Type of Shear Test	Moisture Content (%)	Dry Density (kg/m³)								
3.00 3.45	U8				50	92	3.5			130 (65	- 12)*	UU			m_v							* alternative interpretation
					150	123	7	18	1825						c_v							
					350	174	12.5								k							
															e							
4.50 4.95	U12				100	154	12.5			190 (100	- 12)*	UU			m_v							* alternative interpretation
					200	188	9.5	18	1745						c_v							
					400	228	15								k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s x 10^{-8}
e = void ratio at U 100% for each increment

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BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B271

FIGURE A1

Sheet 1 of 1

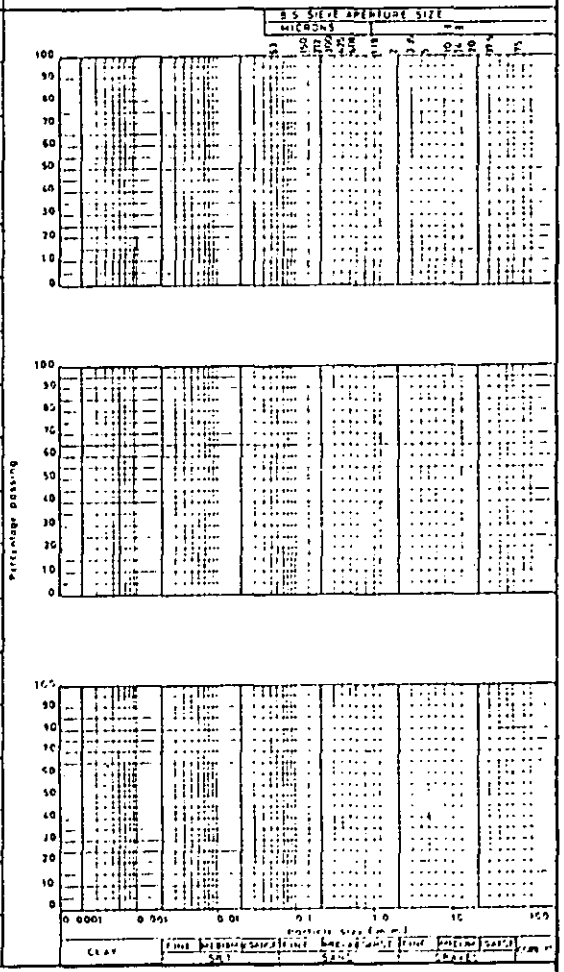
Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 10.9.84
Hole Dimensions 150ø
Casing Dimensions 150ø

Coordinates: 67018.5 E.
95250.9 N.
Ground Level: 75.09 m O.D.

Laboratory Testing by: Dates:

Date	Depth of Casing m	Depth to Water m	Sample/In-situ test: Depth m	Sample/In-situ test: Type & Number	Change of Strata: Legend	Change of Strata: Depth m	Change of Strata: Reduced Level	Description of Strata
10.9.84	-	-				0.40	74.69	Limestone Ballast (MADE GROUND, MOTORWAY VERGE)
			0.50	J1				Very stiff red brown silty CLAY with occasional mudstone lithorelicts and thin bands of highly weathered very weak calcareous mudstone, siltstone (KEUPER MARL : ZONE III)
			1.00	J2				
			1.50	(100)3				Band of moderately weak to weak calcareous mudstone at 2.00m
			1.95					
			2.00	U#				
			2.30	S(20 for 15mm)				
		20 2.85 ▼3.0	2.80	J6				
			3.00	B7				
			3.10	(50)8, J9				
				S(51)				
			3.60	J10				
			3.80	J11				
			4.00					
				S(88)				
			4.45	J12		4.50	70.59	
			4.80	J13				Very stiff red brown mottled grey green silty/very silty CLAY with occasional bands of highly weathered very weak calcareous mudstone. (KEUPER MARL : ZONE III)
			5.00					
				S(123)				
10.9.84	4.50	5.50	5.45	J14		5.50	69.59	
								End of Shell and Auger Hole.
								* Seating Blows – J5 = 29
								# SPT rod sheared
								Hard Strata 4.50 – 5.00 = 1½ hours
								Inspection pit dug G.L. to 1.50m

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/l / pH
	1	11					
	7	18		32	18	100	0.06 / 7.8
	10	14					



Scale 1:

Disturbed Samples : W – Groundwater ● J – Jar ● S – S.P.T. ● B – Bulk ● M – Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] – Vane shear strength in KN/m²

Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C.B.R

C or S S.P.T. – cone or spoon
(25) – N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B271

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Air Flush with Water Injection
Dates : 12.9.84
Core Diameter : 76mm
Casing Dimensions : 114.30mm

Coordinates : 67018.5 E
95250.9 N
Ground Level : 75.09 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or II (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
									5.50	69.59	Drilled by Shell and Auger method to 5.50								
12.9.84	Nil	Nil	5.50		98%	34%	NI 60 290				Highly weathered zones at: 6.95 - 7.30, 6.69 - 7.73, 8.56 - 8.68 degraded to stiff silty clay with many lithorelicts. Sub-vertical discontinuity at: 7.60	Highly to moderately weathered fissured very weak red brown occasionally grey green calcareous MUDSTONE blue grey staining on fissure surfaces with very and extremely closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE II/III)			5.73 5.98	6.8			2125
			7.10		99%	0%	NI 70 90												
			8.20																

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mbal

Core Runs
50
100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B271

FIGURE A2

Field Work by : _____
Method : _____
Dates : _____
Core Diameter : _____
Casing Dimensions : _____

Coordinates : _____ E
_____ N
Ground Level : _____ m O.D.

Laboratory Testing by : _____ Dates : _____

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	CR %	R.Q.D. %	Test or ll (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details
									9.30	65.79		See sheet 1 of 3	
					95%	41%	NI 28 39				Moderately weak bands at: 10.63 - 10.96, 11.10 - 11.17 Sub-vertical discontinuities at: 9.33, 10.83.	Moderately weathered slightly fissured very weak red brown mottled grey green calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal discontinuities. Becoming highly weathered and fissured below 11.76. (KEUPER MARL : ZONE II/III)	
		Water Inflow at 10.1	10.10				CPT			(84 for 113mm58)			
			10.21										
					100%	59%	NI 180 450						
									12.48	62.61			
			13.10								Highly weathered zones at: 13.89 - 13.95, 14.07 - 14.10, 14.17 - 14.19, 14.44 - 14.47, degraded to very silty clay.	Moderately weathered weak to moderately weak grey green calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE II/III)	
					97%	28%	NI 80 330						
									14.50	60.59			
			15.10				CPT			(2258, 80 for 105mm)	Highly weathered zones at: 14.98 - 17.29, 18.49 - 18.94, 19.11 - 19.27, 19.66 - 20.00 degraded to stiff very silty clay with many lithorelicts. Moderately weak siltstone moderately weathered bands at: 18.10 - 18.49	Highly weathered very weak fissured red brown and grey green SILTSTONE (KEUPER MARL : ZONE II/III)	
			15.36				NI						
					100%	83%	110 350						
			16.10										
					100%	55%	NI 190 325						

Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
	9.70					0.034
	9.80					
	9.80					0.040
	9.90					
	12.65					0.36?
	12.77					
	12.77					0.699
	12.90					
	13.73					0.68?
	13.84					
	13.91					1.190
	14.04					
	17.30					0.98?
	17.42					

Scale 1 :

Disturbed Samples : • J - Jar • S - S.P.T. • B - Bulk • M - Moist
W - Groundwater

Core Runs: 50 / 100 — core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

A - Axial
D - Diametral

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B271

FIGURE A2

Sheet 3 of 3

Field Work by : _____
Method : _____
Dates : _____
Core Diameter : _____
Casing Dimensions : _____

Coordinates : _____ E
_____ N
Ground Level : _____ m O.D.

Laboratory Testing by : _____ Dates : _____

Drilling								Test or Str (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
Dates	Depth of casing(m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %			Legend	Depth (m)	Reduced Level	Detail	Main								
			18.10													18.10					0.231
								NI								18.20					
					94%	35%		100					See sheet 2 of 3			18.20					0.480
								210								18.32					
19.9.84	5.00									20.00	55.09										
			20.00					C ↓													
			20.13								(81 for 136mmSB)		End of Rotary Hole								
													NI = Not Intact SB = Seating Blows.								

Scale 1 :

Disturbed Samples :
W = Groundwater
• J = Jar
• S = S.P.T.
• B = Bulk
• M = Maxi

Core Runs
core recovery %

Groundwater first struck

C or S = S.P.T. cone or spoon
(25) = N value

A = Axail
D = Diametral

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B272

FIGURE A1

Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 11.9.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 67024.7 E.
95269.3 N.
Ground Level: 75.29 m OD.

Laboratory Testing by: Dates:

Dates	Depth of Casing m	Depth to Water m	Samples/Insitu Test Depth m	Type & Number	Change of Strata Legend	Depth m	Reduced Level	Description of Strata
11.9.84	-	-				0.30	74.99	LIMESTONE BALLAST, (Motorway verge)
			0.50					Slightly weathered moderately weak red brown grey green calcareous SILTSTONE. (KEUPER MARL : ZONE II)
			1.00	B1				
			1.30	J2				
			1.50	(100)+				
			1.95			2.00	73.29	
			2.00	J4				Highly weathered very weak red brown micaceous MUDSTONE. (KEUPER MARL : ZONE III)
				S(42)				
			2.45	J5				
			2.80	J6				
			3.00	B7				
				(95)8				
			3.45					
			3.50	J9		3.50	71.79	
				S(37)				Very stiff red brown and grey green very silty CLAY with bands of highly weathered weak mudstone/siltstone. (KEUPER MARL : ZONE III)
			3.95	J10				
			4.30	J11				
			4.50	(50)+				
11.9.84	Nil	Dry	4.55	S(78 for 150SB		4.60	70.69	
			4.60	J12				
				S(50 for 0SB				

End of Shell and Auger Hole.

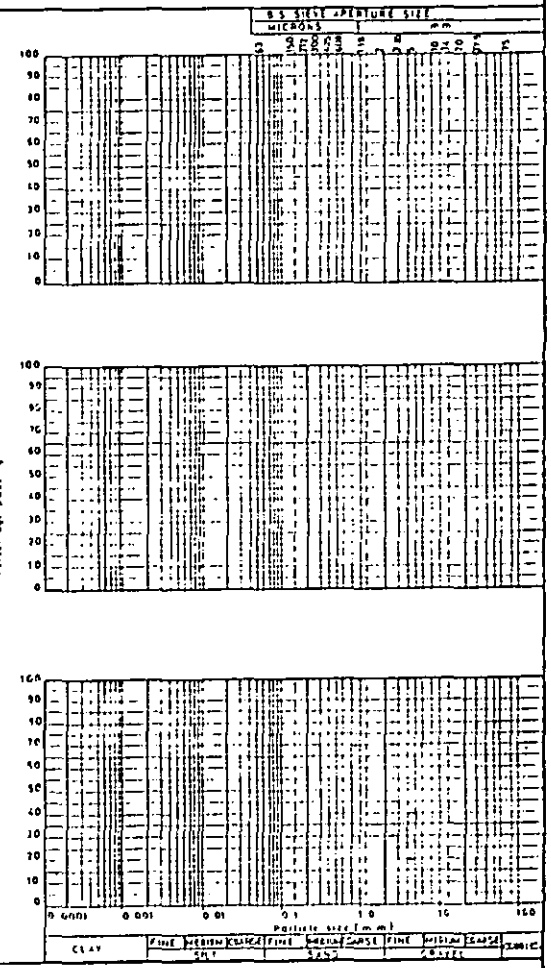
+ Failed U Samples.

SB = Seating Blows only

Hard Strata - 4.55 - 4.60 = 1 hour

Hole started by inspection pit to 1.20m

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
	2	8.3				
	7	15				
	8	15	1885	34	19	100
	10	20				



Scale 1:

Disturbed Samples : W - Groundwater
● J - Jar ● S - S.P.T. ● B - Bulk ● M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] - Vane shear strength in KN /m²

Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R.

C or S - S.P.T cone or spoon (25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B272

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring Air Flush with Water Injection
Dates : 12/13/14.9.84
Core Diameter : 76mm
Casing Dimensions : 133.35mm

Coordinates : 67024.7 E
95269.3 N
Ground Level : 75.29 m O.D.

Laboratory Testing by :
Dates :

Drilling								Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Dates	Depth of Casing/Bore (m)	Depth to Water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or II (mm)	Legend	Depth (m)	Reduced Level	Detail	Main									
									5.50	69.79	Drilled by Shell and Auger method to 4.60m, hole cleared of fallen limestone fragments before coring										
12.9.84			5.50				NI				Highly weathered zones at: 6.71 - 7.00, 8.25 - 8.39, 9.91 - 10.04, 11.68 - 11.95 Slightly weathered grey green moderately strong bands at: 7.00 - 7.23, 10.04 - 10.60	Slightly weathered fissured red brown very weak to weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal rough discontinuities. (KEUPER MARL : ZONE II)									
					97%	18%	60														
							150														
12.9.84	5.00	6.90	7.00																		
13.9.84	5.00	3.80	7.12				CPT			(79 for 120mm58)	Sub-vertical discontinuities at: 6.51 - 6.56, 10.42 - 10.50 45° discontinuities at: 6.19 - 6.23										
							NI														
					100%	11%	NI														
							100														
			8.00																		
							NI														
					95%	61%	140														
							840														

Scale 1 :

Disturbed Samples : • J - Jar • S - S.P.T. B - Bulk M - Mcal
W - Groundwater

50 100 Core Runs core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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Consulting Engineers and Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B272

FIGURE A2

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Drilling: Depth of casing/hole (m)	Drilling: Depth to water (m)	Drilling: Depth (m)	Drilling: Run	Drilling: C.R. %	Drilling: R.Q.D. %	Drilling: Test or fracture (mm)	Change of Strata: Legend	Change of Strata: Depth (m)	Change of Strata: Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
			9.60												10.00					0.034
					97%	33%	NI 55 335					See Sheet 1 of 3			10.10					
															10.10					0.040
			11.40												10.20					
					100%	0%	NI NI 70													
		Water Inflow at 11.9	11.90						11.95	63.34										
			12.12				CPT				Highly weathered zones at: 12.63 - 12.73, 13.21 - 13.30. degraded to stiff silty clay with many lithorelicts. 45° discontinuities at: 12.08 - 12.12, 13.52 - 13.58, 13.82 - 13.87.	Slightly weathered fissured grey green occasionally red brown moderately weak to moderately strong calcareous SILTSTONE. (KEUPER MARL : ZONE II/III)			12.05					0.190
					100%	50%	NI 100 240		(44SB, 50 for 60mm)						12.15					
			13.30												12.30					0.034
															12.40					
					100%	42%	NI 150 260		14.09	61.20										
			15.10									See sheet 3 of 3								
					93%	32%	NI 150 150													
13.9.84	5.00	8.70	16.10																	
14.9.84	5.00	3.90													16.30					0.104
															16.42					
															16.42					0.080
					95%	53%	NI 160 310								16.54					

Scale 1 :

Disturbed Samples :
W - Groundwater
• J - Jar
• S - S.P.T.
• B - Bulk
• M - Mazier

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

A - Axial
D - Diametral

Scott Wilson Kirkpatrick & Partners
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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B272

FIGURE A2

Sheet 3 of 3

Field Work by : _____
Method : _____
Dates : _____
Core Diameter : _____
Casing Dimensions : _____

Coordinates : _____ E
_____ N
Ground Level : _____ m O.D

Laboratory Testing by : _____ Dates : _____

Drilling							Test or Fl (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
Dates	Depth of casing(m)	Depth to water(m)	Depth (m)	Run	CR %	R.Q.D. %		Legend	Depth (m)	Reduced Level	Detail	Main							
			19.10								Slightly weathered grey green moderately weak bands at: 14.62 - 14.72, 15.03 - 15.31 15.94 - 16.03, 19.10 - 19.55, 20.41 - 20.50, 21.57 - 21.77, 22.00 - 22.05, 22.93 - 22.97, 23.32 - 23.55.	Moderately to slightly weathered fissured red brown occasionally grey green very weak calcareous SILTSTONE. Becoming slightly weathered below 19.10. Very to extremely closely spaced rough sub-horizontal discontinuities. (KEUPER MARL : ZONE II/III)							
			19.17				CPT			(50 for 70mm SB)									
					99%	59%	NI 210 340				Completely weathered zones at: 15.66 - 15.94, 18.29 - 18.42, 18.70 - 18.82, 21.77 - 22.00 24.52 - 24.67 degraded to stiff silty clay with many lithorelicts.								
			22.00								Sub-vertical discontinuities at: 22.83 - 22.97.								
					97%	27%	NI 70 255				45° discontinuities at: 14.37 - 14.46								
			23.40																
					96%	67%	NI 180 420												
14.9.84			25.00						25.00	50.29									
			25.29				CPT			(25SB, 86 for 140mm)		End of Rotary Hole. NI = Not Intact SB = Seating Blows.							

Scale 1 :

Disturbed Samples : J - Jar, S - S.P.T., B - Bulk, M - Mazi
W - Groundwater

Core Runs 50 100 core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

Laboratory Testing by : Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B272

FIGURE 8

Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation							Notes
					Stress at failure		Strain at Failure (%)			C	Ø	Type of Shear Test	Initial			Pressure Range (kN/m²)				
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)		Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)		0 50	50 200	200 50	50 100	100 200	200 400	
															m_v							
															c_v							
															k							
															e							
3.00 3.50	U8				100	273	6	15	1845	390 (112	- 27)*	UU	20	1735	m_v	0.28	0.06	0.04	0.04	0.05	0.07	* alternative interpretation
					200	383	6	14	1905						c_v	-	19.72	-	38.69	26.68	31.15	
					400	521	8	14	1905						k	-	11.61	-	15.18	13.09	21.39	
															e	0.511	0.498	0.507	0.504	0.496	0.475	
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2 / MN
c_v = m^2 / yr
k = m/s x 10^{-8}
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 8273

FIGURE A1

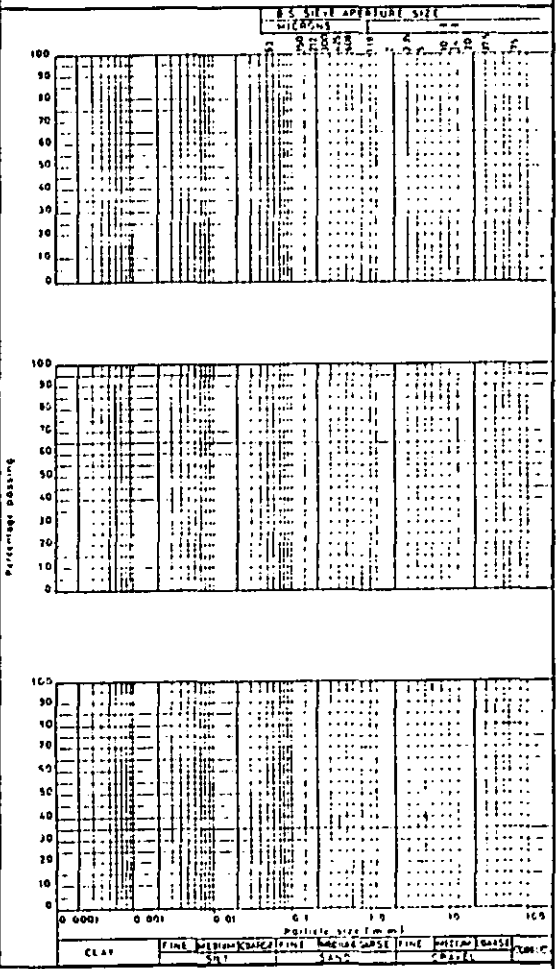
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 14/15.8.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 67001.2 E.
95269.7 N.
Ground Level: 79.03 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to water (m)	Sample/Insitu Test Depth (m)	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	%passing 425 microns	Sulphate g/ltr / pH
14.8.84	-	-	0.50	J1		0.50	78.53	TOPSOIL		2	28	1445				0.04 / 7.7
			0.95	(32)2		1.00	78.03	Firm-stiff red brown fissured silty CLAY with many sub-angular grey green fine to medium sized fragments of very weak siltstone. (KEUPER MARL:ZONE IV)		10	18					0.06 / 8.1
			1.00	J3												
				S(39)				Firm red brown mottled grey green silty CLAY and very silty CLAY with lithorelicts of siltstone becoming very stiff tending to very weak siltstone 1.10 - 1.30. Friable with no lithorelicts below 1.80m. (KEUPER MARL : ZONE III/IVa)		12	14	1945	34	20	100	
			1.45	J4												
			1.50	B5												
			1.80	J6						18	13	1905	37	20	93	
			2.00													
				(80)7						26	16		34	20	100	
			2.45													
			2.50	J8		2.50	76.53									
				S(52)				Stiff and very stiff red brown occasionally mottled grey green silty CLAY with lithorelicts of mudstone. (KEUPER MARL : ZONE III).								
			2.95	J9												
			3.00	B10												
			3.30	J11												
			3.50					Occasional thin bands of very weak mudstone and firm friable silty clay.								
				(100)12												
			3.95													
14.8.84	3.00	Dry	4.00	J13												
15.8.84	3.00	3.60	4.20	J14				Band of very weak mudstone 4.20								
			4.50													
				S(106 for 225 mm)*				Band of very weak grey green siltstone noted 4.80								
			4.95	J15												
			5.00	B16, J17												
				(110)18												
			5.45													
			5.50	J19		5.50	73.53									
				S(66)				Very Stiff red brown fissured silty CLAY and bands of grey green fissured clayey silt with many siltstone lithorelicts.								
			5.95	J20												
			6.00	B21												
			6.30	J22				Band of stiff friable silty clay 6.30m (KEUPER MARL : ZONE III)								
			6.50													
				(110)23												
			6.95													
			7.00	J24												
				S(93)												
			7.45	J25												
			7.50	B26												
			7.70	J27		7.70	71.33									
			8.00	( ) *				Firm red brown slightly mottled grey green friable silty CLAY with mudstone lithorelicts becoming stiff to very stiff below 8.30m. Band of very weak fissured mudstone at 8.20m and weak to moderately weak siltstone 8.40. (KEUPER MARL : ZONE III)								
			8.20	J28												
15.8.84	8.20	Dry	8.50	S(50 for 0mm)		8.50	70.53									
								End of Shell and Auger Hole. * Seating Blows - J15-22, J29-43 + Failed U Sample								



Scale 1:

Disturbed Samples : W - Groundwater
● J - Jar
● S - S.P.T.
● B - Bulk
● M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] - Vane shear strength in KN /m²

▼ Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R.

C or S S.P.T. - cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B273

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Water Flush
Dates : 9/10/11.10.84
Core Diameter : 76mm
Casing Dimensions : 133.35mm

Coordinates : 67001.2 E
95262.7 N
Ground Level : 79.03 m O.D.

Laboratory Testing by :
Dates :

Drilling								Test or Fl (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
Dates	Depth of casing(m)	Depth to water (m)	Depth (m)	Run	CR %	R.Q.D %			Legend	Depth (m)	Reduced Level	Detail	Main							
										7.00	72.03	Drilled by Shell and Auger method to 7.00								
9.10.84	-	-	7.00									Highly weathered zone at: 7.00 - 7.25 degraded to stiff silty clay with many lithorelicts.	Moderately to highly weathered friable weak to very weak red brown mottled grey green calcareous SILTSTONE. Extremely closely spaced sub-horizontal discontinuities containing some clay. (KEUPER MARL : ZONE II/III)							
					80%	0%		NI NI 20												
			8.00		93%	7%		NI 20 110												

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mazi

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B273

FIGURE A2

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of Casing (m)	Depth to Water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or ff (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
9.10.84	3.00	1.00	9.50						9.55	69.48		See sheet 1 of 3							
10.10.84	3.00	2.60	9.65		88%	0%	CPT ↓ NI 40 60			(76 for 150mmSB)	Highly weathered zones at: 10.45 - 10.90, 11.15 - 11.45 degraded to stiff silty clay with many lithorelicts. Very weak highly weathered zones at: 15.10 - 15.15, 16.80 - 16.90. Sub-vertical discontinuities at: 14.80 - 15.20, 15.60 - 15.70	Moderately to slightly weathered weak to moderately weak red brown mottled grey green calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE II/III)							
			9.90		96%	16%	NI 80 200												
			11.15		90%	15%	NI 20 150												
			12.15 12.30				CPT ↓			(81 for 150mmSB)									
					56%	7%	NI 40 110												
			13.80		85%	33%	NI 60 110												
10.10.84	3.00	2.30	14.80																
11.10.84	3.00	3.40			81%	22%	NI 40 150												
			17.00		100%	42%	20 60 350		17.00	62.03	Some solution cavities upto 40mm across and 60mm long	Slightly weathered moderately weak to moderately strong grey green SILTSTONE. Very closely and closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE II)							

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mazi

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25). - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B273

FIGURE A2

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling								Test or II (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Dates	Depth of Casing/Hole (m)	Depth to water (m)	Depth (m)	Run	CR %	RQD %			Legend	Depth (m)	Reduced Level	Detail	Main									
			18.75										See sheet 2 of 3									
								NI		19.00	60.03											
					76%	44%		120 250				Slightly weathered moderately strong band at: 19.95 - 20.00	Moderately to highly weathered very weak friable red brown calcareous SILTSTONE. Very closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE II/III)										
11.10.84	3.00	2.20								20.00	59.03											
			20.00 20.05					CPT ↕			(50 for 50mmSB)		(II/III) End of Rotary Hole. NI = Not Intact SB = Seating Blows. Bentonite seal 0.50 - 1.50 Gravel filter 1.50 - 19.00 Standpipe installed to 19.00										

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B273
FIGURE 8
Sheet 1 of 1

Sample Depth (m)	Sample Type & Number	Compaction Type of Test	Compaction Optimum Moisture Content (%)	Compaction Maximum Dry Density (kg/m³)	Shear Strength Stress at Failure σ_3 (kN/m²)	Shear Strength Stress at Failure $\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	Shear Strength Strain at Failure (%)	Shear Strength Moisture Content (%)	Shear Strength Dry Density (kg/m³)	Shear Strength C / C' (kN/m²)	Shear Strength Ø / Ø' (Degrees)	Type of Shear Test	Initial Moisture Content (%)	Initial Dry Density (kg/m³)	Consolidation	Pressure Range (kN/m²)	Notes
0.50 0.95	U2				50	59	7			75 (38	- 12)*	UU			m_v	0 54	* alternative interpretation
					100	75	11	28	1445						c_v	54 214	
					200	100	15.5								k	214 54	
															e	54 214	
2.00 2.45	U7														m_v	214 54	
															c_v	54 107	
															k	107 214	
															e	214 428	
3.50 3.95	U12				Untestable										m_v	428 856	
								14	1945				15	1905	c_v	0.31 0.12 0.03 0.04 0.04 0.05 0.03	
			•		Insufficient Material										k	- 25.17 - 44.23 35.59 17.88 17.42	
															e	- 29.63 - 17.36 13.97 6.77 5.13	
5.00 5.45	U18				100	252	10	13	1915	360 (85	- 30)*	UU			m_v	0.397 0.370 0.377 0.375 0.368 0.353 0.333	* alternative interpretation
					200	266	10	14	1885						c_v		
					400	548	9	13	1915						k		
															e		
															m_v		
															c_v		
															k		
															e		
															m_v		
															c_v		
															k		
															e		
															m_v		
															c_v		
															k		
															e		
															m_v		
															c_v		
															k		
															e		
															m_v		
															c_v		
															k		
															e		

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2 / MN
c_v = m^2 / yr
k = m/s $\times 10^{-9}$
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 8274

FIGURE A1

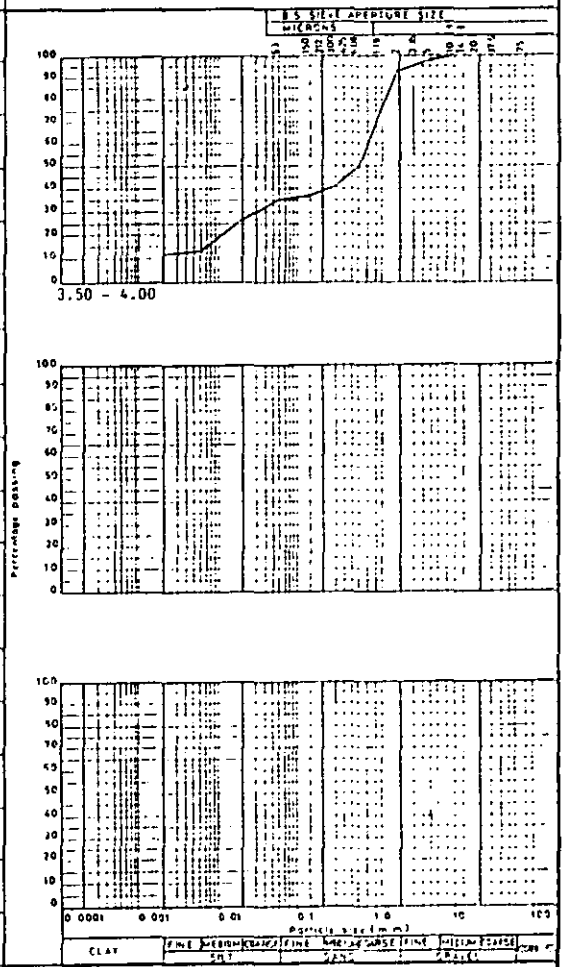
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 16.8.84
Hole Dimensions 150mm
Casing Dimensions 150mm

Coordinates: 67006.6 E.
95283.2 N.
Ground Level: 78.85 m OD.

Laboratory Testing by. Dates:

Date	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr / pH
16.8.84	-	-	0.50	J1		0.50	78.35	TOPSOIL		2	13	-	45	20	100	
			0.95	(80)2		1.00	77.85	Very stiff red brown mottled light brown fissured silty CLAY with mudstone lithorelicts and rootlets (KEUPER MARL : ZONE III)		4	12					0.01 / 8.1
			1.00	J3						6	8.6	2040	33	18	100	
			1.45	S(37) J4				Very stiff red brown slightly mottled grey green fissured silty CLAY with mudstone lithorelicts becoming firm to stiff sand friable in zones.		8	10					
			1.70	J5						9	11					
			2.00					Bands of weak to very weak grey green siltstone at 1.00m, 2.40m		11						
			2.45	(100)6												
			2.50	J7												
			2.95	S(57) J8												
			3.50	+				Tending to very weak and weak mudstone in zone below 3.50m (KEUPER MARL : ZONE II/III)								
			3.95													
			4.00	B9, J10												
16.8.84	3.00	Dry	4.30	S(50 for 75mm) J11		4.30	74.55									
								End of Shell and Auger Hole.								
								* Seating Blows - J11 = 39								
								+ Failed U Sample.								



Scale 1:

Disturbed Samples : W - Groundwater
J - Jar, S - S.P.T., B - Bulk, M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] - Vane shear strength in KN/m²

Groundwater first struck

Core Cutter Density
Core Cutter Density/C.B.R

Sandbottle Density
C B R

Cone S.P.T. - cone or spoon
(35) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº 8274

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Water Flush
Dates : -/5/8.10.84
Core Diameter : 76mm
Casing Dimensions : 114.30mm

Coordinates : 67006.6 E, 95283.2 N
Ground Level : 78.85 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or if (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
4.10.84	-	-									Rotary Open Holed through previously drilled Shell and Auger Hole to 3.00									
4.10.84	3.00	Dry	3.00						3.00	75.85										
5.10.84	3.00	Dry	3.00		71%	22%	NI 45 160					Highly weathered fissured red brown very weak SILTSTONE (KEUPER MARL : ZONE III)								
			3.70						3.90	74.95										
					94%	20%	NI 60 100				Highly weathered zones at: 4.32 - 4.53, 5.88 - 6.05	Slightly weathered fissured red brown occasionally grey green very weak SILTSTONE. Very to extremely closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE II)								
			4.70								Slightly weathered grey green moderately weak bands at: 4.90 - 4.95, 6.05 - 6.10, 6.77 - 7.34, 7.54 - 7.83, 8.86 - 8.92				5.23		31	18		
					99%	53%	NI 130 420								5.66					
			6.20				CPT			(71 for 150mmSB)										
			6.35																	
					100%	49%	NI 130 290													
			7.90												8.20					
					97%	48%	NI 135 180								8.30				0.93A	

Scale 1 :
Disturbed Samples : J - Jar, S - S.P.T., B - Bulk, M - Mcal
W - Groundwater
Core Runs: 50, 100
core recovery %
Groundwater first struck
C or S - S.P.T. cone or spoon
(25) - N value
A - Axial
D - Diametral

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B274

FIGURE A2

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling								Test or Fl (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
Dates	Depth of casing(m)	Depth to water (m)	Depth (m)	Run	CR %	RQD %			Legend	Depth (m)	Reduced Level	Details	Main								
										9.32	69.53		As sheet 1 of 3								
			9.40					NI					Slightly weathered very fissured red brown and grey green weak to moderately weak calcareous SILTSTONE (KEUPER MARL : ZONE II)								
					98%	0%		NI													
5.10.84	3.00	2.10	10.50					50													
8.10.84	3.00	3.60	10.58					CPT			(50 for 75mmSB)										
										10.90	67.95										
								NI				Slightly weathered grey green moderately weak bands at: 11.35 - 11.84 Sub-vertical discontinuities at: 10.20 - 10.46.	Highly weathered fissured red brown mottled grey green very weak to weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal rough discontinuities. (KEUPER MARL : ZONE III)								
					100%	43%		110													
			11.75					260													
										12.18	66.7										
								NI				Slightly weathered grey green moderately weak band at: 15.00 - 15.21 Sub-vertical discontinuities at: 13.35 - 13.56 45° discontinuities at: 13.90 - 13.96, 16.83 - 16.90	Slightly weathered fissured to very fissured red brown very weak to weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE II)			12.64					0.370
					94%	33%		110									12.78					
								150									12.96					0.172
			13.45														13.09					
								NI														
					85%	21%		60														
								210														
			15.00														14.86					0.284
			15.23					CPT			(49SB, 50 for 75mm)						14.97					
																	14.97					0.330
																	15.10					
																	15.42					0.354
								NI									15.52					
					92%	29%		90									15.52					0.130
								195									15.62					
			16.85																			
								NI									17.74					0.172
					69%	48%		120									17.84					
								175									17.94					0.100
			17.85							17.71	61.14						17.98					
													See sheet 3 of 3								

Scale 1 :

Disturbed Samples : J - Jar, S - S.P.T., B - Bulk, M - Mast
W - Groundwater

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

A = Axial
D = Diametral

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B274

FIGURE A2

Sheet 3 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D

Laboratory Testing by :
Dates :

Drilling							Test or ll (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
Dates	Depth of Casing(m)	Depth to water(m)	Depth (m)	Run	C.R. %	R.Q.D. %		Legend	Depth (m)	Reduced Level	Detail	Main							
					100%	32%	NI 40 180				Sub-vertical discontinuities at: 19.37 - 19.54, 19.75 - 19.84.	Slightly weathered fissured grey green moderately weak to moderately strong calcareous SILTSTONE. (KEUPER MARL : ZONE II)								
			18.85																
					81%	59%	NI 100 190												
3.10.84	3.00	2.10	20.00						20.00	58.85		End of Rotary Hole. NI = Not Intact SB = Seating Blows.							

Scale 1 :

Disturbed Samples :
W - Groundwater
• J - Jar
• S - S.P.T.
• B - Bulk
• M - Maxi

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B274
Drillhole
FIGURE B
Sheet 1 of 1

Laboratory Testing by : Exploration Associates (Warwick) Limited
Dates :

Sample		Compaction			Shear Strength					C	Ø		Initial		Consolidation	Notes
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	Stress at failure σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	Strain at Failure (%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)	Type of Shear Test	Moisture Content (%)	Dry Density (kg/m³)	Pressure Range (kN/m²)	
0.50 0.95	U2				Untestable due to Nature of material.			13							m_v c_v k e	
2.00 2.45	U6				50 150 300	164 219 254	2.5 4 5	8.6	2040	210 (112	– 15)*	UU			m_v c_v k e	* alternative interpretation
5.23 5.66	C				150 298	393 500	3.8 2.7	11	2010	170	25	$\overline{CD}$			m_v c_v k e	Effective stress parameters from two-stage test on rock core
															m_v c_v k e	
															m_v c_v k e	
															m_v c_v k e	
															m_v c_v k e	
															m_v c_v k e	
															m_v c_v k e	

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p. measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p. measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p. measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s = 10^{-8}
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 275

FIGURE A1

Sheet 1 of 1

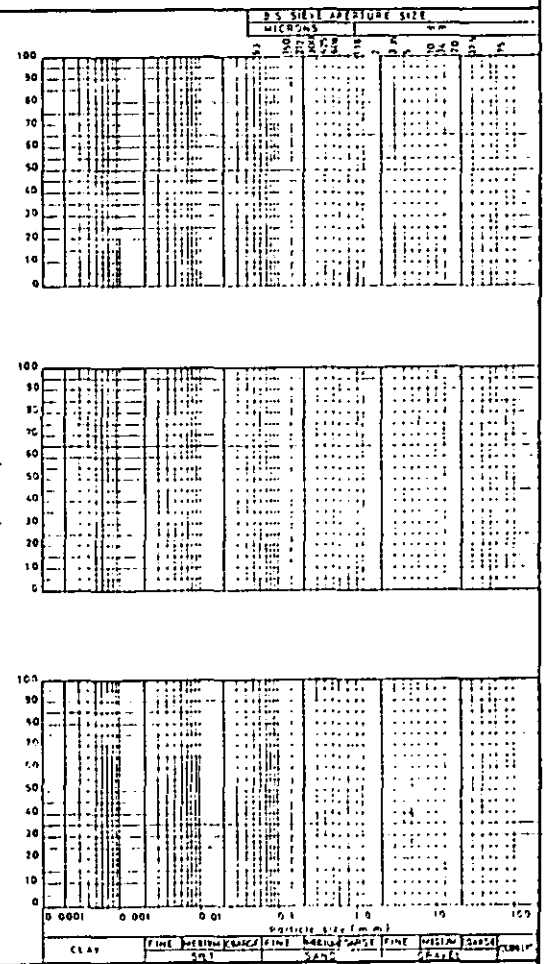
Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 16.8.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 66924.1 E.
95366.7 N.
Ground Level: 84.29 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr pH
16.8.84	-	-	0.40	J1				Very stiff red brown, brown silty CLAY with sub-angular fine to medium gravel (fragments of siltstone and sandstone) and carbonaceous material (GLACIAL TILL)		2	19		41	21	100	
			0.50	(70)2						4	15					
			0.95			1.00	83.29									
			1.00	J3				Stiff and very stiff red brown mottled grey green fissured silty CLAY occasional lithorelicts and carbonaceous material. (KEUPER MARL : ZONE III)		5	14 20**		32	17	100	0.06 8.1
			1.45	J4												
			2.00							7	16		35	17	100	
		slight seepage	2.45	(65)5												
		2.50	2.50	J6		2.50	81.79									
				S(26)				Firm red brown mottled grey green fissured silty CLAY with occasional pockets of sand and lithorelicts								
		Sealed off at 4.5m	2.95	J7												
			3.30	J8				Bands of very weak laminated mudstone and weak to moderately weak siltstone at 2.50m and 4.00m (KEUPER MARL : ZONE III)								
			3.50													
			3.95	(85)9												
			4.00													
				S(111)												
			4.45	J10												
						4.70	79.59									
16.8.84	4.50	Dry	5.00	J11		5.00	79.29	Soft red brown friable very silty CLAY tending to clayey silt with many lithorelicts of mudstone and siltstone. (KEUPER MARL : ZONE III)								
								End of Shell and Auger Hole.								

** Microwave Determination



Scale 1:

Disturbed Samples: W - Groundwater
● J - Jar
● S - S.P.T.
B - Bulk
● M - Maxi

Undisturbed Samples: U100 Soil Sample

Insitu Tests: V C30 - Vane shear strength in KN /m²
Groundwater first struck
□ Core Cutter Density
■ Core Cutter Density/C.B.R
▽ Sandpottle Density
▲ C B R
C or S S.P.T. cone or spoon
(25) - N value

SCOTT WILSON KIRKPATRICK & PARTNERS
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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 276

FIGURE A1

Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 17.8.84
Hole Dimensions 150mm
Casing Dimensions 150mm

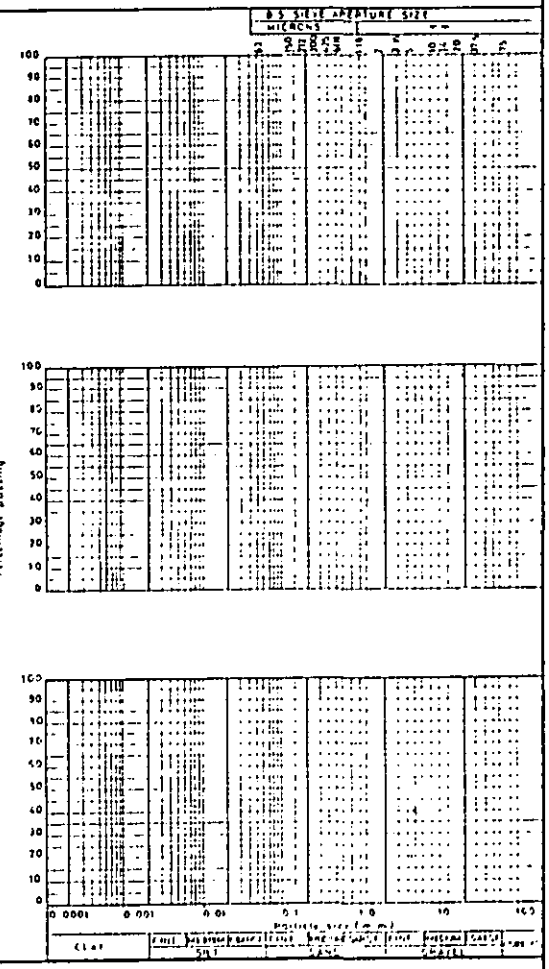
Coordinates: 66846.9 E.
95486.9 N.
Ground Level: 86.63 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata
17.8.84	-	-				0.20	86.43	TOPSOIL
			0.40 0.50	J1				Very stiff red brown slightly mottled grey green silty CLAY and slightly sandy silty clay with fine gravel (fragments of sandstone, siltstone, mudstone and flint). Traces of carbonaceous material (GLACIAL TILL)
			0.95 1.00	(75)2 J3		1.00	85.63	
			1.45	S(39) J4				Very stiff red brown slightly mottled grey green fissured silty CLAY becoming firm & stiff with occasional lithorelicts in zones. (KEUPER MARL : ZONE III)
			2.00	B5				
			2.45 2.50	(70)6 J7				
			2.95 3.00	S(35) J8 B9				Band of weak to moderately weak, grey green calcareous siltstone noted at 2.50, 4.00 and 4.40m
			3.50					
		slight seepage 4.00	3.95 4.00	(70)11 S(86 for 225mm)*				Many fine to coarse gravel sized lithorelicts of mudstone at 5.00m
			4.45	J11				
17.8.84	3.00	4.90	5.00	J12		5.00	81.63	
								End of Shell and Auger Hole.
								* Seating blows - J11 = 26

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/litre / pH
	2	17		36	22	100	
	4	13					
	6	14	1890				
	9	20 18**		35	19	100	0.04 8.1
	11	10					

** Microwave Determination



Scale 1:

Disturbed Samples : W — Groundwater
● J — Jar
● S — S.P.T.
● B — Bulk
● M — Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V C30 — Vane shear strength in KN/m²

Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S S P T cone or spoon
(25) - N value

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Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 276
FIGURE B
Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation			Notes
					Stress at Failure		Strain at Failure (%)			C	Ø	Type of Shear Test	Initial		Pressure Range (kN/m²)	
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)		Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)		
2.00 2.45	U6				50	120	6			120	–	UU			m_v	* Failed under 1st load
					100	*		14	1890						c_v	
					150										k	
															e	
2.50 3.00	B9	S	11.0	1875											m_v	
															c_v	
															k	
															e	
															m_v	
															c_v	
															k	
															e	
															m_v	
															c_v	
															k	
															e	
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															e	
															m_v	
															c_v	
															k	
															e	
															m_v	
															c_v	
															k	
															e	

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2 / MN
c_v = m^2 / yr
k = m/s $\times 10^{-8}$
e = void ratio at U 100% for each increment

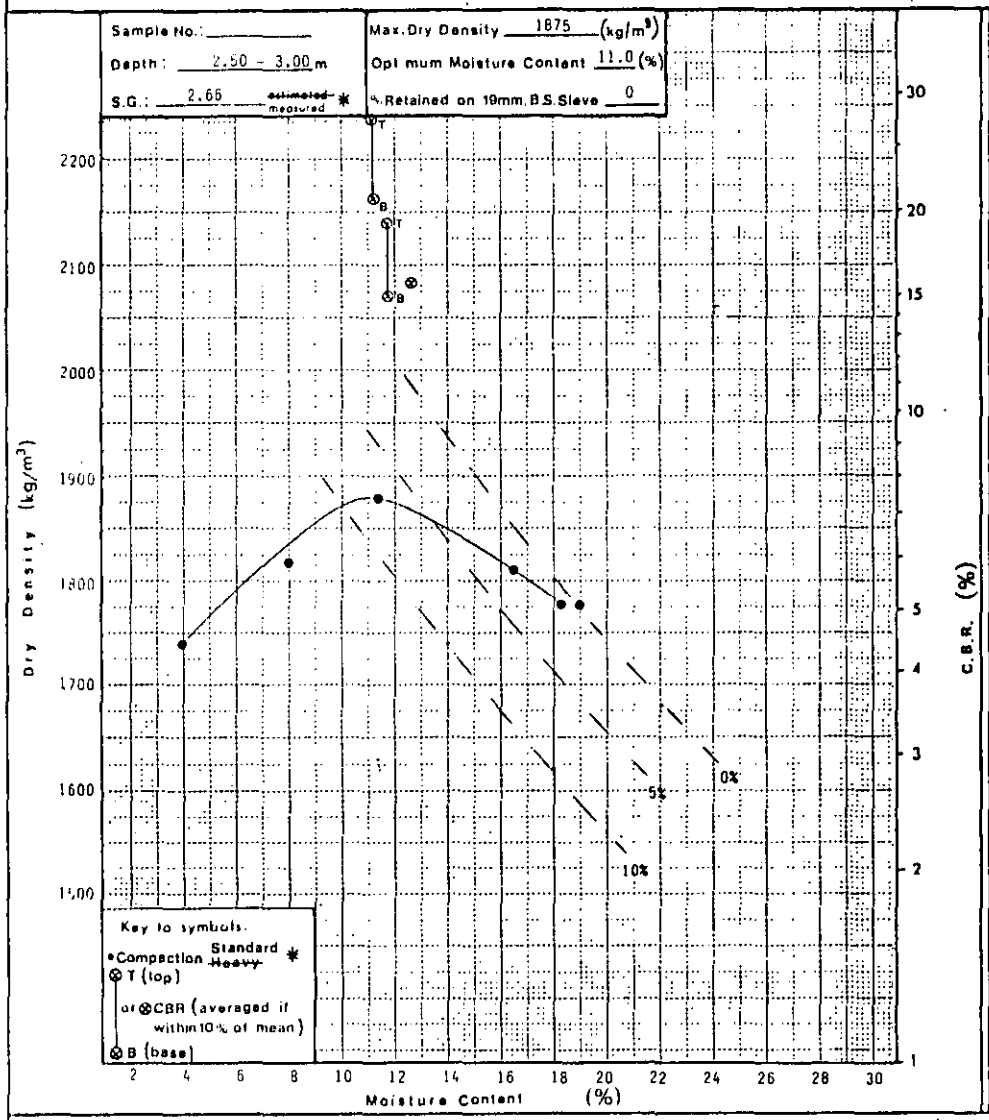
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Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

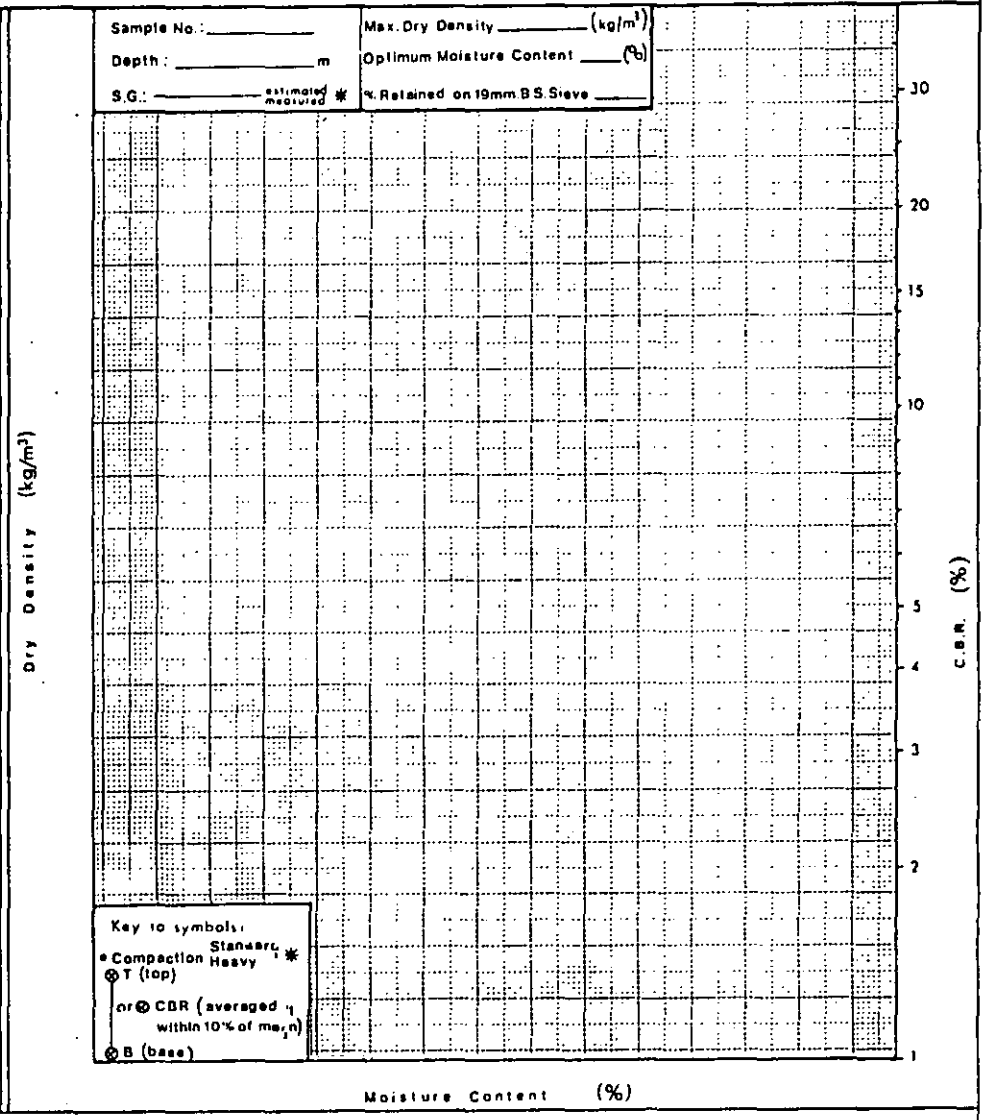
BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 276
FIGURE C
Sheet 1 of 1

Sample No.:
Depth: 2.50 - 3.00 m
S.G.: 2.66 estimated / measured *
Max. Dry Density 1875 (kg/m³)
Optimum Moisture Content 11.0 (%)
% Retained on 19mm B.S. Sieve 0



Sample No.:
Depth: m
S.G.: estimated / measured *
Max. Dry Density (kg/m³)
Optimum Moisture Content (%)
% Retained on 19mm B.S. Sieve



* Delete as necessary

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BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 277

FIGURE A1

Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 20.8.84
Hole Dimensions 150mm
Casing Dimensions 150mm

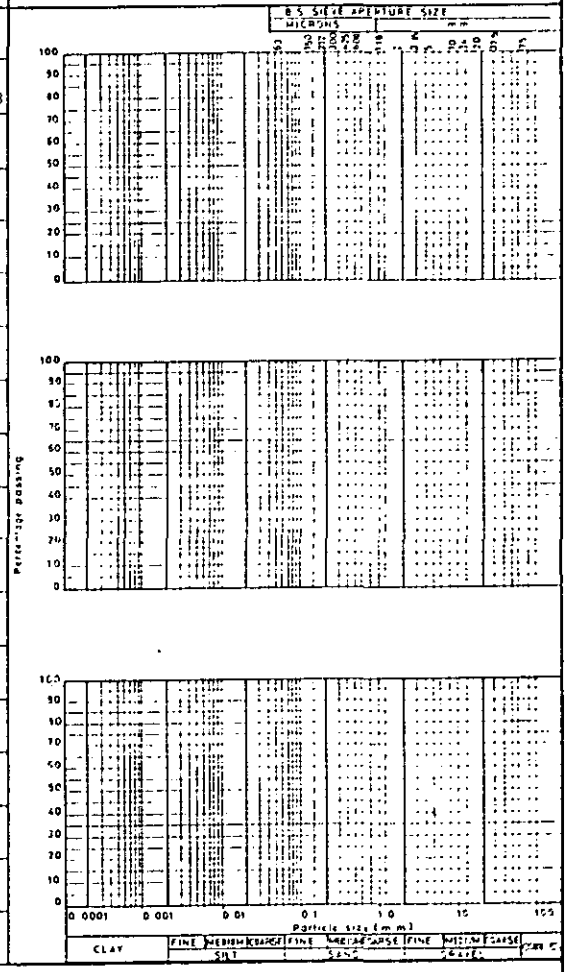
Coordinates: 66960.0 E.
95489.9 N.
Ground Level: 83.05 m OD.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata
20.8.84	-	-	0.40	J1		0.20	82.85	TOPSOIL
			0.50	(60)2		0.40	82.65	Stiff brown silty CLAY. (GLACIAL TILL)
			0.95					Very stiff red brown mottled grey green fissured silty CLAY with many lithorelicts of mudstone. (KEUPER MARL : ZONE II/III)
			1.00	J3				
				S(33)				
			1.45	J4				
								Band of moderately weak to moderately strong siltstone at 1.00m
			2.00	B5, J6				
			2.20	B7, J8				Tending to very weak mudstone below 2.20m
			2.45	( )+				
			2.65	S(73),.0				
			3.30	J10				
			3.50			3.50	79.55	
			3.95					Weak and very weak red brown slightly mottled grey green fissured MUDSTONE. (KEUPER MARL : ZONE II/III)
			4.00	B11, J12				
				S(110 for 225mm)				
			4.45	J13				
			4.50	J14				
				S(85)				
20.8.84	4.50	Dry	5.00	J15		5.00	78.05	Tending to very stiff silty clay with many lithorelicts below 4.5
								End of Shell and Auger Hole.
								+ Failed U sample
								* Seating Blows J13 = 22

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr / pH
	2	16		44	20	100	
	5	16 15**				-	0.05 7.8
	7	12		36	19	100	

** Microwave Determination



Scale 1:

Disturbed Samples : W – Groundwater
● J – Jar
● S – S.P.T.
B – Bulk
● M – Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V C30] – Vane shear strength in KN /m²

Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R
▽ Sandbottle Density
▲ C B R

C or S S P T – cone or spoon
(25) – N value

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Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 277

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength									Consolidation								Notes
					Stress at failure		Strain at Failure			C	Ø	Type of Shear Test	Initial		Pressure Range (kN/m²)							
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)								
1.00	B	S	15.0	1785											m_v							
2.00															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
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															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type Tee Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
ŪŪ = Ditto, with p.w.p measurement
CD = Consolidated Drained
C̄D̄ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
C̄Ū = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

$m_v = m^2/MN$
$c_v = m^2/yr$
$k = m/s \times 10^{-8}$
e = void ratio at U 100% for each increment

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 277
FIGURE C
Sheet 1 of 1

Sample No.:
Depth: 1.00 - 2.00 m
S.G.: 2.65 estimated / measured *
Max. Dry Density 1785 (kg/m³)
Optimum Moisture Content 15.0 (%)
% Retained on 19mm B.S Sieve 0

Dry Density (kg/m³)
2200
2100
2000
1900
1800
1700
1600
1500

C.B.R. (%)
30
20
15
10
5
4
3
2
1

0%
5%
10%

Key to symbols:
• Compaction Standard / Heavy *
⊗ T (top)
or ⊗ CBR (averaged if within 10% of mean)
⊗ B (base)

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Moisture Content (%)

Sample No.:
Depth: m
S.G.: estimated / measured *
Max. Dry Density (kg/m³)
Optimum Moisture Content (%)
% Retained on 19mm B.S. Sieve

Dry Density (kg/m³)
C.B.R. (%)
30
20
15
10
5
4
3
2
1

Key to symbols:
• Compaction Standard / Heavy *
⊗ T (top)
or ⊗ CBR (averaged if within 10% of mean)
⊗ B (base)

Moisture Content (%)

* Delete as necessary

SCOTT WILSON KIRKPATRICK & PARTNERS
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BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 278

FIGURE A1

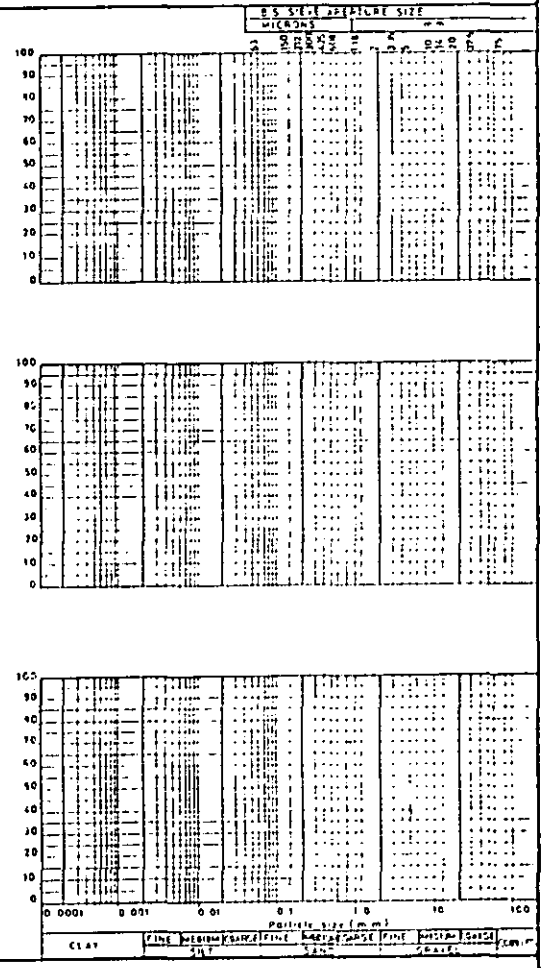
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 20.8.84
Hole Dimensions 150mm
Casing Dimensions 150mm

Coordinates: 67024.0 E.
95618.5 N.
Ground Level: 75.12 m O.D.

Laboratory Testing by. Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
20.8.84	-	-				0.20	74.92	TOPSOIL							
			0.40	J1				Stiff red brown mottled grey, green fissured silty CLAY with traces of carbonaceous material (KEUPER MARL : ZONE IVa)		1	13				
			0.50												
			0.95	(29)2						2	25	1565	48	26	100
			1.00	J3		1.00	74.12								
				S(33)				Stiff red brown mottled grey green silty CLAY with some mudstone/siltstone lithorelicts and bands of highly weathered very weak calcareous mudstone/siltstone. (KEUPER MARL : ZONE III)		5	25		45	23	100
			1.45	J4											
			1.50	B5											
			1.70	J6											
			2.00												
				(120)7											
			2.45												
			2.50	J8				Bands of highly weathered mudstone at 2.50m, 3.50,							
				S(91)											
			2.95	J9											
			3.30	J10											
			3.50												
				S(120)											
			3.95	J11				Band of highly weathered grey green calcareous siltstone at 4.50m							
			4.20	J12											
			4.50												
				S(90)											
20.8.84	4.50	Dry	4.95	J13		5.00	70.12	End of Shell and Auger Hole.							



Scale 1:

Disturbed Samples : W – Groundwater
● J – Jar ● S – S.P.T. ● B – Bulk ● M – Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V (30) – Vane shear strength in KN /m²

▼ Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S S.P.T. – cone or spoon
(25) – N value

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Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 278

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at Failure		Strain at Failure			C	Ø		Initial		Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1-\sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)	Type of Shear Test	Moisture Content (%)	Dry Density (kg/m³)							
0.50	U2				50	128	3	26	1545	140	–	UU			m_v						
0.95					100	156	6	24	1580						c_v						
					150	144	15	25	1565						k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
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															m_v						
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															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2 / MN
c_v = m^2 / yr
k = m/s $\times 10^{-8}$
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 279

FIGURE A1

Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 2.10.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 67356.9 E.
96648.9 N.
Ground Level: 62.95 m OD.

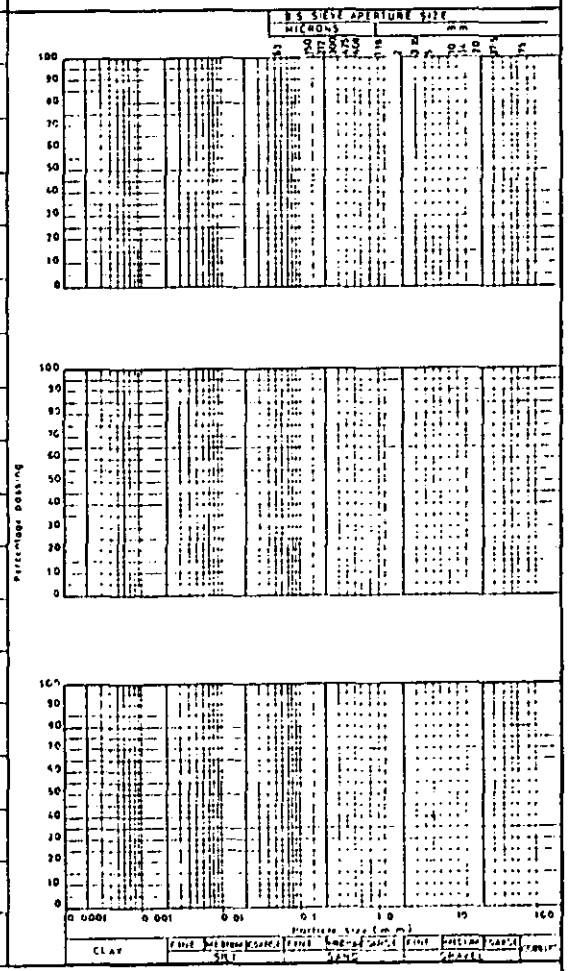
Laboratory Testing by: Dates:

Date	Depth of Casing (m)	Depth to water (m)	Sample/Insitu Test Depth (m)	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata
2.10.84	-	-	0.30	J1		0.30	62.65	TOPSOIL.
			0.50	(25)2		0.80	62.15	Soft to firm brown fissured silty sandy clay with occasional sub-angular gravel (sandstone, quartz) (GLACIAL TILL)
			0.95					
			1.00	J3				Very stiff red brown fissured silty to very silty CLAY with many siltstone lithorelicts. Occasional bands of highly weathered fissured weak siltstone at 1.00. (KEUPER MARL : ZONE II/III
			1.00	S(11)				
			1.45	J4				
			1.50	B5				
			1.80	J6				
			2.00	(36)7				Firm to stiff in parts.
			2.45					
			2.50	J8		2.50	60.45	
			2.50	S(27)				Stiff red brown and grey green fissured inter-stratified silty CLAY sand highly weathered fissured very weak mudstone/siltstone (KEUPER MARL : ZONE III)
			2.95	J9				
			3.00					
			3.10	J10 *		3.10	59.85	
			3.10	S(108 for J11 200mm				Soft red brown fissured silty CLAY with many mudstone/siltstone lithorelicts and many thin bands of highly weathered interstratified very weak mudstone/siltstone. (KEUPER MARL : ZONE III)
			3.45	B12				
			3.50					
			3.70	J13				
			3.80	S(81 for 150mm				
2.10.84	Nil	Dry	4.10	J14		4.10	58.85	End of Shell and Auger Hole.

* Seating Blows - J11 = 20
J14 = 31

Hard Strata - 3.40 - 3.80 = 1½ hours

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
	1	15				
	2	13	1790	27	17	100
	5	22				
	7	26	1645	32	18	87



Scale 1:

Disturbed Samples : W - Groundwater
● J - Jar
● S - S.P.T.
B - Bulk
● M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V (30) - Vane shear strength in KN /m²

▼ Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S S.P.T. cone or spoon
(25) - N value

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Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

~~TRIAL PIT~~
~~BOREHOLE~~ BOREHOLE No. 279
FIGURE B
Sheet 1 of 1

Sample		Compaction			Shear Strength									Consolidation								Notes
					Stress at failure		Strain at Failure			C	Ø		Initial			Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1-\sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)	Type of Shear Test	Moisture Content (%)	Dry Density (kg/m³)		0 25	25 50	50 100	100 200	200 400		
0.50 0.95	U2				50	200	3			230 (120	- 21)*	UU	16	1690	m_v	0.37	0.18	0.16	0.09	0.06		
					100	219	4	13	1790						c_v	-	26.57	13.07	14.50	18.53		
					150	260	10								k	-	46.92	20.51	12.80	5.02		
															e	0.545	0.538	0.525	0.511	0.492		
2.00 2.45	U7				50	75	18			85	-	UU			m_v							
					100	84	19.5	26	1645						c_v							
					200	91	20								k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
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															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

* alternative interpretation

Bottom of sample tested.

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2 /MN
c_v = m^2 / yr
k = m/s $\times 10^{-8}$
e = void ratio at U 100% for each increment

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BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 280

FIGURE A1

Sheet 1 of 1

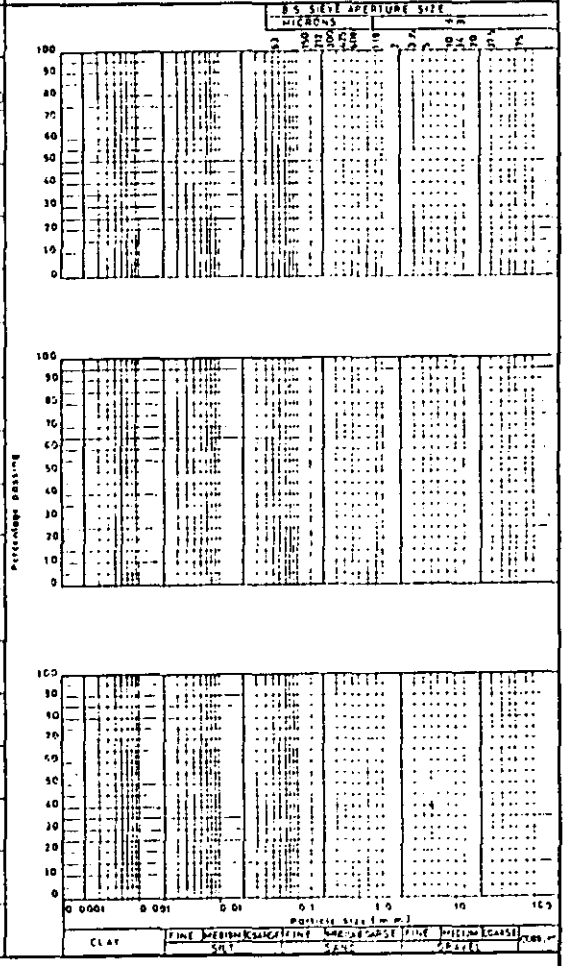
Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 3.10.84
Hole Dimensions 150mm
Casing Dimensions. 150mm

Coordinates: 67404.6 E.
96797.0 N.
Ground Level: 57.18 m O.D.

Laboratory testing by. Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/In-situ Test Depth (m)	Sample/In-situ Test Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata
3.10.84	-	-	0.30	J1		0.30	56.88	TOPSOIL
			0.50	(36)2				Very stiff red brown fissured silty CLAY with occasional sub-rounded fragments of quartz, sandstone. Rootlets. (GLACIAL TILL)
			0.95 1.00	J3		1.00	56.18	
				S(28)				Stiff and very stiff red brown mottled grey green fissured silty CLAY with many mudstone and siltstone lithorelicts. (KEUPER MARL : ZONE III) Many mudstone/siltstone lithorelicts and many thin bands of highly weathered fissured red brown and grey green very weak calcareous mudstone/siltstone below 2.50.
			1.45 1.50	J4 B5				
			1.80	J6				
			2.00	(50)7				
			2.45 2.50	J8				
				S(25)				
			2.95 3.00	J9 B10				
			3.30	J11				
			3.40	S(79)				
			3.85	J12				Becoming very silty below 5.50m
			4.50	J13				
			4.70	S(70 for 150mm)*				
			5.00	J14				
			5.40 5.50	J15 S(117 for 225mm)*				
3.10.84	Nil	Dry	5.90	J16		5.90	51.28	
								End of Shell and Auger Hole.
								Hard Strata - 5.00 - 5.50 = 1 hour.
								* Seating Blows - J14 = 28 J16 = 33

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr / pH
	1	14					
	2	11	1995	32	18	100	0.04 / 8.0
	5	24					
	7	13	1865	22	NP	100	



Scale 1:

Disturbed Samples : W – Groundwater
J – Jar
S – S.P.T.
B – Bulk
M – Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] – Vane shear strength in KN /m²

Groundwater first struck

Core Cutter Density
Core Cutter Density/C.B.R

Sandbottle Density
C B R

C or S S P T : ⁿᵉ or spoon
(25) – N value

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 280

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at Failure		Strain at Failure			C	Ø	Type of Shear Test	Initial			Pressure Range (kN/m²)					
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)		0 - 54	54 - 107	107 - 214	214 - 428	428 - 214	214 - 107	
0.50 - 0.95	U2				50	288	3.3			330 (160 | - 26)*	UU			m_v							* alternative interpretation
					100	335	5.4	11	1995						c_v							
					150	365	8.7								k							
															e							
2.00 - 2.45	U7				50	149	1.5			220 (58 | - 30)*	UU	23	1640	m_v	0.72	0.20	0.15	0.09	0.005	0.12	* alternative interpretation
					100	201	2.5	13	1865						c_v	-	4.03	6.12	9.42	-	-	
					200	301	4								k	-	7.91	9.01	8.32	-	-	
															e	0.550	0.533	0.509	0.479	0.480	0.500	
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
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															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s = 10^{-8}
e = void ratio at U 100% for each increment

SCOTT WILSON KIRKPATRICK & PARTNERS
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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B281

FIGURE A1

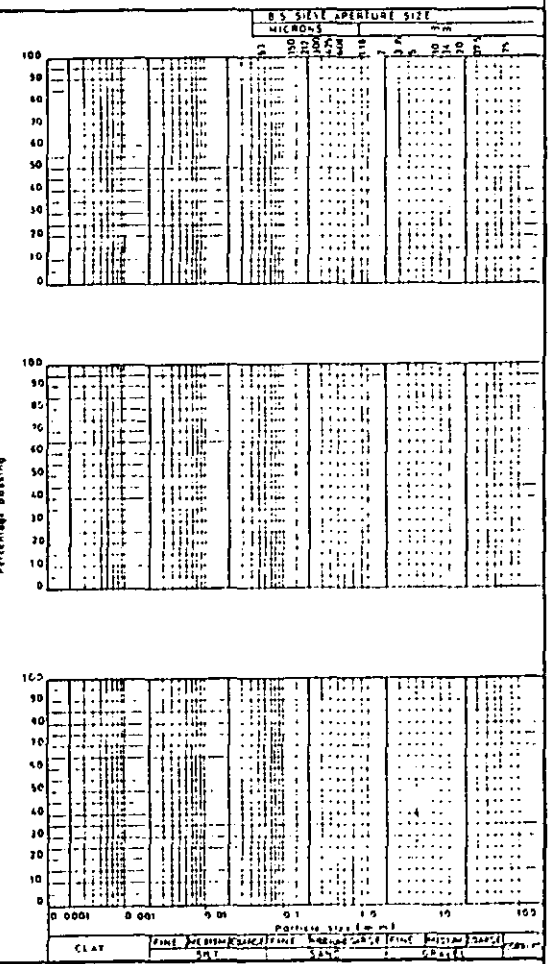
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 1.10.84
Hole Dimensions 150mm
Casing Dimensions 150mm

Coordinates: 67053.6 E.
95421.1 N.
Ground Level: 79.62 m O.D.

Laboratory testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/litre / pH
1.10.84	-	-	0.30	J1		0.30	79.32	TOPSOIL		4	13					
			0.50					Very stiff red brown silty CLAY with some mudstone/ siltstone lithorelicts, becoming mottled grey/green below 1.00m (KEUPER MARL : ZONE III)		6	14	1875	30	17	100	0.04 / 8.1
			0.95	(75)2												
			1.00	J3 S(68)						6						
			1.45	J4				Thin band of highly weathered fissured weak calcareous siltstone with residual silty clay at 1.80m								
			1.80	J5						8	13		33	19	100	
			2.00													
			2.45	(98)6												
			2.50	J7 S(39)				Clay becoming stiff at 2.50 with occasional thin bands of highly weathered fissured red brown very weak calcareous siltstone with residual silty clay.								
			2.95	J8												
			3.30	J9		3.30	76.32									
			3.50					Very stiff red brown fissured silty CLAY with some siltstone lithorelicts.								
			3.95	(100)+												
			4.00	J10 S(30)												
			4.45	J11				Some thin bands of highly weathered fissured red brown and grey green weak calcareous siltstone with residual silty clay between 4.00 and 5.50. (KEUPER MARL : ZONE III/IVa)								
			4.80	J12												
			5.00													
			5.45	(100)+												
			5.50	J13 * S(50 for J14 62mm												
1.10.84	3.00	Dry	5.75	S(50 for J15 50mm		6.00	73.62									
			6.00					End of Shell and Auger Hole.								
								Hard Strata - 5.50 - 7.50 = 1 hour								
								* Seating Blows - J14 = 44 J15 = 55								
								+ Failed U sample								



Scale 1:

Disturbed Samples : W - Groundwater
● J - Jar
● S - S.P.T.
B - Bulk
● M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V (30) - Vane shear strength in KN /m²

Groundwater first struck

Core Cutter Density
Core Cutter Density/C.B.R

Sandbottle Density
C B R

C or S S P T core or spoon
(25) - N value

Scott Wilson Kirkpatrick & Partners
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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B281

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Water Flush
Dates : 2/3.10.84
Core Diameter : 76mm
Casing Dimensions : 114.30mm

Coordinates : 67053.6 E
95421.1 N
Ground Level : 79.62 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of Casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or II (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
									6.00	73.62	Drilled by Shell and Auger method to 6.00m See Fig A1								
2.10.84	3.00	Dry	6.00									Slightly weathered laminated and thinly bedded red brown fine grained very weak to weak SILTSTONE With bands (up to 150mm) of highly weathered very weak clayey silt-stone between 6.00 - 9.50m (KEUPER MARL : ZONE II)							
					83%	10%	NI NI 100												
			7.00								Siltstone very fractured between 6.00 and 11.20. Generally intact below 11.20m								
					84%	0%	NI NI 35												
			8.00																
					85%	15%	NI NI 150												
			9.00																

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mcal

50
100

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) . - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B281

FIGURE A2

Sheet 2 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling								Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or Lf (mm)	Legend	Depth (m)	Reduced Level	Detail	Main							
					100%	0%	NI NI 80				Siltstone very fractured between 6.00 and 11.20m	Slightly weathered laminated and thinly bedded red brown fine grained very weak to weak SILTSTONE. (KEUPER MARL : ZONE II)							
			10.50																
			10.65		93%	19%	CPT NI 40 150			(81 for 125mmSB)									
2.10.84	3.00	1.30																	
3.10.84	3.00	2.40	12.00																
					100%	37%	NI 60 430												
			13.50																
					100%	41%	NI 70 240		14.90	64.72									
			15.00																
			15.15		100%	69%	CPT 25 140 300		16.00	(79 for 150mmSB) 63.62		Slightly weathered to fresh very thinly and thinly bedded green grey occasionally red brown fine grained weak to moderately weak SILTSTONE. (KEUPER MARL : ZONE I)								
			16.65		94%	43%	NI, 40 150				Highly weathered zone of very weak clayey siltstone at 16.95 - 17.05	Slightly weathered very thinly and thinly bedded red brown occasionally green grey fine grained very weak to weak SILTSTONE (KEUPER MARL : ZONE I/II)								
			17.00																
					85%	62%	NI 230 330												

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

50
100

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

Scott Wilson Kirkpatrick & Partners
Consulting Engineers and Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B281

FIGURE A2

Sheet 3 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	CA %	RQD %	Test or II (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Details	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
			18.50								Highly weathered zone of very weak clayey siltstone at: 18.10 - 18.30	Slightly weathered very thinly and thinly bedded red brown occasionally green grey fine grained very weak to weak SILTSTONE. (KEUPER MARL : ZONE I/II)							
					99%	90%	90 170 300												
3.10.84	3.00	2.10	20.00				CPT 1		20.00	59.62									
			20.15							(91 for 150mmSB)		End of Rotary Hole. NI = Not Intact SB = Seating Blows. Bentonite seal 0.50 - 1.50 Gravel filter 1.50 - 15.00 Standpipe installed to 15.00							

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mazi

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25)¹ - N value

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 281

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at failure		Strain at failure			C	ø	Type of Shear Test	Initial		Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1-\sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)							
2.00 2.45	U5				50	148	3	14	1895	210	-	UU			m_v						
					150	237	5	14	1870						c_v						
					300	238	8	15	1860						k						
															e						
2.00 2.45	U6				50	81	5.1					$\overline{CD}$			m_v						
					147	175	3.4	13	1900						c_v						
					299	240	3.1			20	27				k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						

For Sample Type see Sheet A

S B.S Standard
H B.S Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

$m_v = m^2/MN$
$c_v = m^2/yr$
k = m/s x 10^{-9}
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B282

FIGURE A1

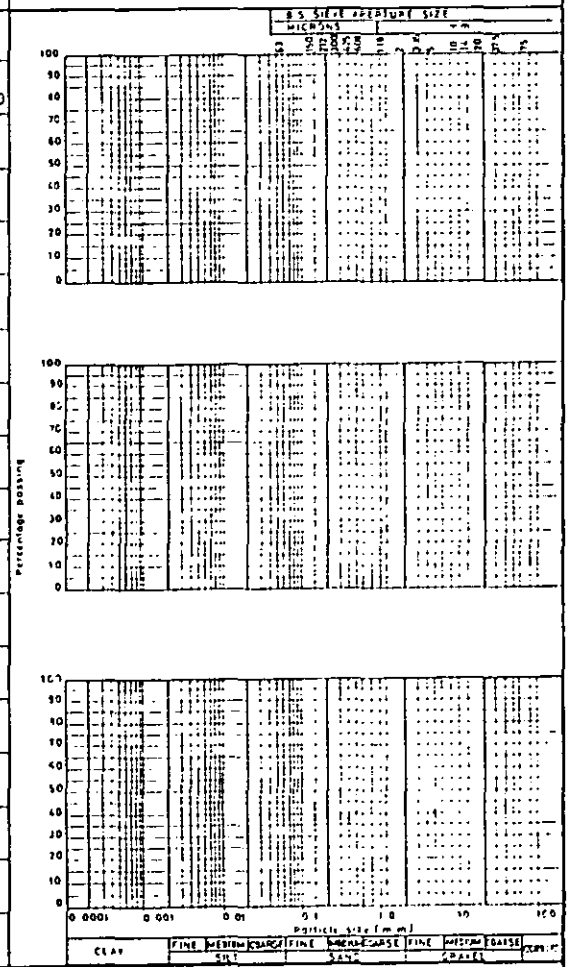
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 10.9.84
Hole Dimensions: 150mm
Casing Dimensions N/A

Coordinates: 67073.1 E.
95426.2 N.
Ground Level: 76.57 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing	Depth to water	Sample/Insitu Test Depth	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/l pH
10.9.84	-	-	0.50	J1		0.50	76.07	Limestone Ballast (MADE GROUND, MOTORWAY VERGE)		1..	9.3					0.02
			1.00	J2				Firm red brown friable very silty CLAY with thin bands of highly weathered very weak calcareous mudstone. (KEUPER MARL : ZONE III)		3	16					8.0
			1.50	B3						4	18	1760	39	22	100	
			1.50	(45)4						7	19		32	17	88	
			1.95 2.00	J5		2.00	74.57									
			2.45	S(58) J6				Stiff red brown slightly mottled grey green fissured silty CLAY with many mudstone lithorelicts occasional pockets of sand and bands of highly weathered weak and moderately weak calcareous mudstone/siltstone (KEUPER MARL : ZONE II/III)		10	8.6					
			2.70	B7												
			2.80	J8												
			2.90	J9 *												
			3.00	S(87 for												
10.9.84	Nil	Dry	3.30	J10 150		3.30	73.27									
								End of Shell and Auger Hole.								
								* Seating Blows - J10 = 29								
								Inspection pit dug G.L. to 1.20m								



Scale 1:

Disturbed Samples : W - Groundwater
● J - Jar
● S - S.P.T.
B - Bulk
● M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] - Vane shear strength in KN /m²

Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S S.P.T. - cone or spoon
f (25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B282

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring Air Flush with Water Injection
Dates : 11.9.84
Core Diameter : 76mm
Casing Dimensions : N/A

Coordinates : 67073.1 E, 95426.2 N
Ground Level : 76.57 m O.D

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	CR %	RQD %	Test or II (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
									3.50	73.07	Drilled by Shell and Auger method to 3.50 See Fig A1									
11.9.84			3.50		98%	12%	NI 80 190			(64 for 110mmSB)	Highly weathered zone at: 4.68 - 5.14 degraded to stiff silty clay with many lithorelicts. Slightly weathered grey green moderately weak bands at: 5.14 - 5.21, 6.35 - 6.38, 8.34 - 8.60, 9.40 - 9.50. Sub-vertical discontinuities at: 4.12 - 4.20, 6.40 - 6.50, 8.00 - 8.50, 9.04 - 9.12	Slightly weathered fissured red brown occasionally mottled grey green very weak to weak calcareous SILTSTONE. Very to extremely closely spaced rough sub-horizontal discontinuities. (KEUPER MARL : ZONE II)								
			5.00 5.11				CPT													
					84%	5%	NI 80 100													
			6.80																	
					100%	51%	NI 150 300								7.60 7.72					0.0

Scale 1 :
Disturbed Samples : W - Groundwater
J - Jar, S - S.P.T., B - Bulk, M - Mazier
Core Runs: 50, 100 — core recovery %
Groundwater first struck
C or S - S.P.T. cone or spoon
(25) - N value
A = Axial
D = Diametral

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B282

FIGURE A2

Sheet 2 of 3

Field Work by : _____
Method : _____
Dates : _____
Core Diameter : _____
Casing Dimensions : _____

Coordinates : _____ E
_____ N
Ground Level : _____ m O.D.

Laboratory Testing by : _____ Dates : _____

Drilling							Test or	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
Dates	Depth of casing(m)	Depth to water(m)	Depth (m)	Run	CR %	RQD %	II (mm)	Legend	Depth (m)	Reduced Level	Detail	Main								
			9.50				CPT			(50 for 42mmSB)										
			9.54												10.08					0.014
															10.19					
															10.40					7.002
															10.52					
					94%	41%	NI 140 230				Very weak siltstone at: 11.12 - 11.27 45° discontinuity at: 10.83 - 10.91	Slightly weathered fissured grey green moderately weak to moderately strong calcareous SILTSTONE. (KEUPER MARL : ZONE II)			10.53					1.200
															10.64					
		Water Inflow at 11.8	11.80												12.05					
															12.17					1.003
									12.43	64.14					12.17					1.834
					100%	47%	NI 100 560				Grey green moderately weak siltstone at: 12.72 - 12.80, 15.00 - 15.07 17.67 - 17.90, 19.49 - 19.75. Highly weathered zones at: 19.09 - 19.48. Sub-vertical discontinuities at: 16.65 - 16.76	Slightly weathered fissured red brown occasionally grey green very weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal rough discontinuities. (KEUPER MARL : ZONE II)			12.29					
			13.80																	
					94%	32%	NI 110 330													
			15.00												15.38					0.054
															15.50					9.140
															16.14					
															16.25					0.038
					96%	68%	NI 150 260								16.25					0.030
															16.37					
															17.27					0.154
															17.37					
															17.47					0.088
			17.90																	

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

A - Axial
D - Diametral

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B282

FIGURE A2

Sheet 3 of 3

Field Work by : _____
Method : _____
Dates : _____
Core Diameter : _____
Casing Dimensions : _____

Coordinates : _____ E
_____ N
Ground Level : _____ m O.D.

Laboratory Testing by : _____ Dates : _____

Drilling							Test or Fl (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
Dates	Depth of casing(m)	Depth to water (m)	Depth (m)	Run	CR %	R.Q.D %		Legend	Depth (m)	Reduced Level	Details	Main								
							15								19.50					0.154
					97%	68%	220								19.62					
							360					See sheet 2 of 3			19.62					0.250
11.9.84	Nil														19.72					
			20.00						20.00	56.57										
12.9.84		5.80	20.13				CPT ↕			(61 for 131mmSB)		End of Rotary Hole. SB = Seating Blows NI = Not Intact								

Scale 1 :

Disturbed Samples :
W - Groundwater

• J - Jar
• S - S.P.T.
• B - Bulk
• M - Maxi

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

A - Axial
D - Diametral

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Consulting Engineers & Transportation Planners

Laboratory Testing by : Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B282

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at Failure					C	Ø		Initial		Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	Strain at Failure (%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)	Type of Shear Test	Moisture Content (%)	Dry Density (kg/m³)							
1.50	B4				50	148	7	18	1765	210	-	UU			m_v						* alternative interpretation
1.95					150	192	12	18	1740	(82	20)*				c_v						
					300	283	11	17	1775						k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
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															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						

For Sample Type see Sheet A

S B.S Standard
H B.S Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s x 10^{-8}
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B283

FIGURE A1

Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 10.9.84
Hole Dimensions: 150mm
Casing Dimensions: N/A

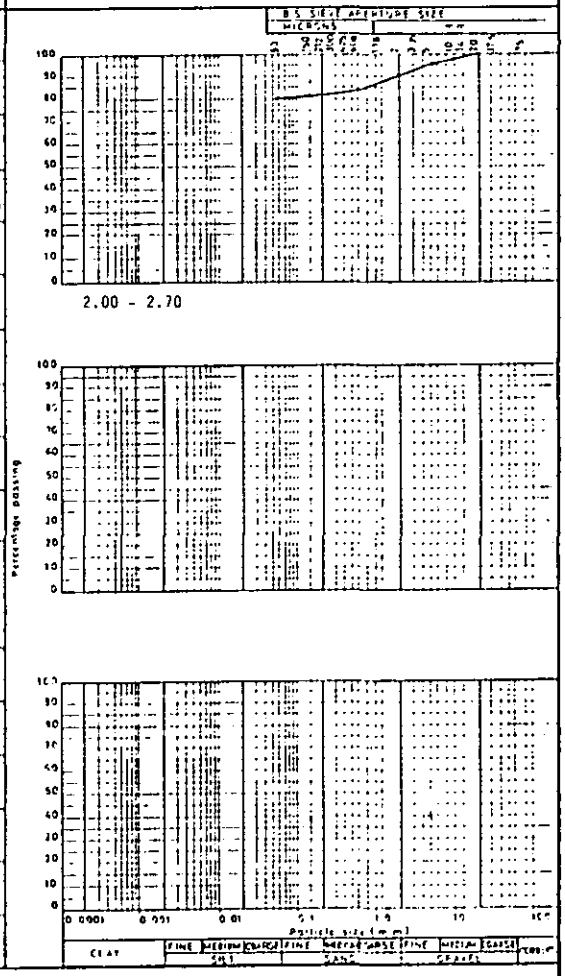
Coordinates: 67070.0 E.
95415.9 N.
Ground Level: 76.54 m OD.

Laboratory Testing by:

Dates:

Dates	Depth of Casing	Depth to Water	Sample/Insitu Test: Depth	Sample/Insitu Test: Type & Number	Change of Strata: Legend	Change of Strata: Depth (m)	Change of Strata: Reduced Level	Description of Strata
10.9.84	-	-						Limestone chippings (MADE GROUND, MOTORWAY VERGE)
			0.60	J1		0.60	75.94	
			1.00	J2				Highly weathered very weak fissured calcareous MUDSTONE tending to stiff and very stiff silty clay. (KEUPER MARL : ZONE III)
			1.50	B3 (50)4				
			1.95			2.00	74.54	
			2.00	J5 S(50)				Very stiff red brown silty CLAY with bands of highly weathered very weak calcareous MUDSTONE. (KEUPER MARL : ZONE III)
			2.45	J6				
			2.70	B7				Becoming very silty clay with zones of clayey silt.
			2.80	J8				
			3.00	(100)*				
			3.20	J10				Band of moderately weak to weak red brown calcareous mudstone at 3.20m
10.9.84	Nil	Dry	3.50	J11 S(81 for J11 150mm		3.50	73.04	
								End of Shell and Auger.
								* Seating Blows - J11 = 27
								Inspection pit dug G.L. to 1.30m

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr / pH
	1	13					
	3	19					
	4	20	1670				
	7	25		38	22	100	0.04 / 8.2
	11	11					



Scale 1:

Disturbed Samples : W - Groundwater
● J - Jar ● S - S.P.T. ● B - Bulk ● M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V C30] - Vane shear strength in KN /m²

Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

Core S.P.T. - no. of spoon (25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B283

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring Air Flush with Water Injection
Dates : 10/11.9.84
Core Diameter : 76mm
Casing Dimensions : 133.35mm

Coordinates : 67070.0 E
95415.9 N
Ground Level : 76.54 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of Casing (m)	Depth to Water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or U (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
									3.50	73.04	Drilled by Shell and Auger method to 3.50.									
10.9.84			3.50		100%	36%	NI 110 225				Highly weathered zone at: 4.56 - 4.90 degraded to stiff silty clay with many lithorelicts. Slightly weathered red brown and grey green moderately weak bands at: 4.90 - 5.11, 5.20 - 5.23, 5.65 - 5.70, 8.28 - 8.50. Sub-vertical discontinuities at: 7.63 - 7.80m	Slightly weathered fissured red brown very weak to weak SILTSTONE Very to extremely closely spaced sub-horizontal rough and smooth discontinuities. (KEUPER MARL : ZONE II)			3.97 - 4.07					0.133
			5.00		91%	41%	NI 300 480								4.07 - 4.18					0.350
			6.90		97%	41%	NI 170 380								6.50 - 6.62					0.040
			8.50																	

Scale 1 :
Disturbed Samples : J - Jar, S - S.P.T., B - Bulk, M - Mast
W - Groundwater
Core Runs
Core recovery %
Groundwater first struck
C or S - S.P.T. cone or spoon (25) . - N value
A - Axial
D - Diametral

Scott Wilson Kirkpatrick & Partners
Consulting Engineers and Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B283

FIGURE A2

Sheet 2 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : mO.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or II (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details
					96%	62%	NI 320 500		10.40	66.14			
		Water Inflow at 11.5	11.50								Moderately weathered zones at: 10.98 - 11.10, 11.26 - 11.34 45° discontinuities at: 11.19 - 11.23, 11.34 - 11.38. Occasional voids approx 20mm dia containing completely weathered siltstone between 10.68 - 10.89.	Slightly weathered grey green occasionally red brown moderately weak to moderately strong SILTSTONE. Very to extremely closely spaced sub-horizontal rough discontinuities. (KEUPER MARL : ZONE II)	
									12.32	64.22			
					98%	51%	NI 120 430				Grey green moderately weak bands at: 12.62 - 12.70, 13.10 - 13.46, 17.77 - 18.03, 18.38 - 18.42. Highly weathered zones at: 13.46 - 13.61, 13.93 - 14.10, 15.20 - 15.28 degraded to stiff silty clay with many lithorelicts.	Slightly weathered fissured red brown occasionally grey green very weak to weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal rough discontinuities. (KEUPER MARL : ZONE II/III)	
10.9.84	3.50		14.10							(2750, 77 for 22mm)			
11.9.84	3.50	5.60	14.48				CPT						
					98%	75%	60 150 460						
			17.10										

Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
10.50					
10.91			24	16	

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mast

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) . - N value

Scott Wilson Kirkpatrick & Partners
Consulting Engineers and Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B283

FIGURE A2

Sheet 3 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by : Dates :

Drilling: Dates	Depth of Casing (m)	Depth to Water (m)	Depth (m)	Run	CR %	RQD %	Test or Bit (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
							NI					See sheet 2 of 3							
					97%	65%	140												
							430		19.36	57.18									
											Slightly weathered grey green moderately strong siltstone at: 19.61 - 19.77 45° discontinuity at: 19.74 - 19.79	Highly weathered fissured red brown and grey green very weak calcareous SILTSTONE. (KEUPER MARL : ZONE III)							
11.9.84			20.00						20.00	56.54									
			20.06				CPT			(50 for 63mmSB)		End of Rotary Hole.							

NI = Not Intact
SB = Seating Blows.

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mazier

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25), - N value

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

Laboratory Testing by : Exploration Associates (Warwick) Limited

Dates :

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B283

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength								Type of Shear Test	Consolidation										Notes
					Stress at Failure		Strain at Failure			C	Ø		Initial		Pressure Range (kN/m²)									
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1-\sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)			Moisture Content (%)	Dry Density (kg/m³)										
1.00 1.50	B3	S	16.0	1815												m_v								
																c_v								
																k								
																e								
1.50 1.95	U4				100	115	3	21	1600	140	–		UU			m_v								
					200	162	7	20	1690							c_v								
					400	151	8	20	1660							k								
																e								
																m_v								
																c_v								
																k								
																e								
																m_v								
																c_v								
																k								
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																m_v								
																c_v								
																k								
																e								
																m_v								
																c_v								
																k								
																e								

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2 / MN
c_v = m^2 / yr
k = m/s x 10^{-8}
e = void ratio at U 100% for each increment

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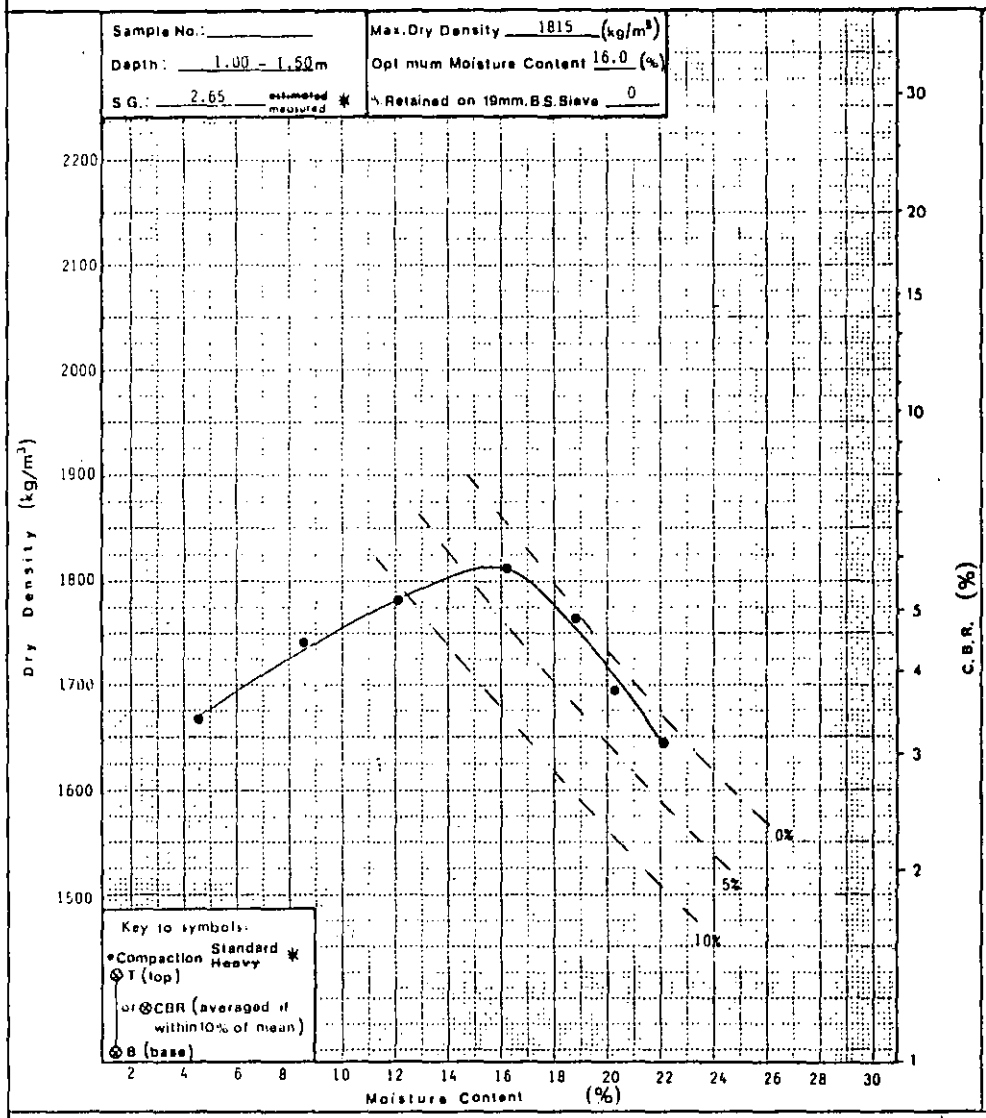
Laboratory Testing by: Exploration Associates (Warwick) Limited Dates:

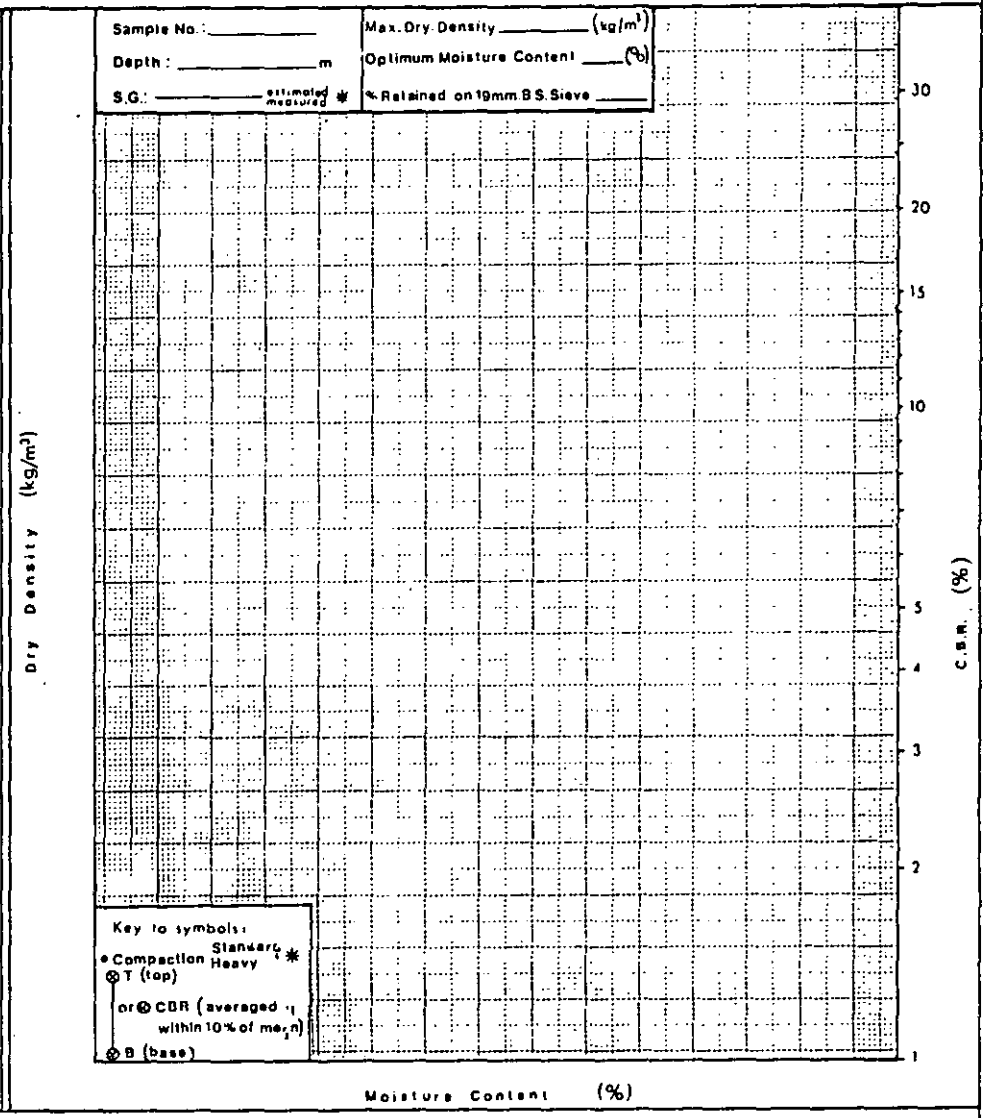
BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B283

FIGURE C

Sheet 1 of 1





* Delete as necessary

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B284

FIGURE A1

Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 27.9.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 67090.5 E.
95420.5 N.
Ground Level: 77.04 m O.D.

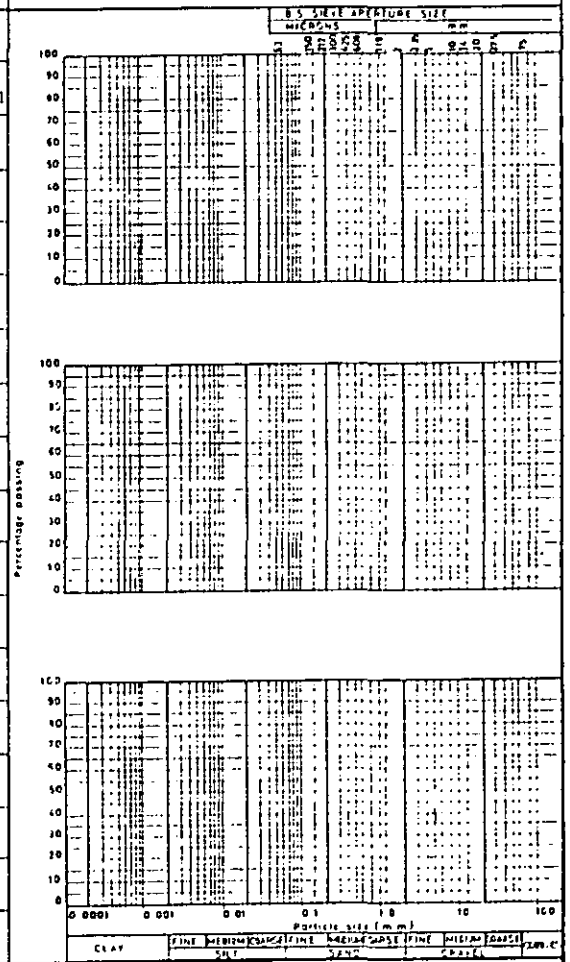
Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/litre / pH
27.9.84	-	-						LIMESTONE CHIPPINGS, (Motorway central reserve)		3	14					
			0.70	J1		0.70	76.34			7	19					0.04 / 8.1
			1.00	J2				Firm red brown mottled grey green fissured silty CLAY with many mudstone/siltstone lithorelicts. (KEUPER MARL : ZONE III)								
			1.40	J3		1.40	75.64			9	15	1935	31	18	100	
			1.50	(45)4				Firm red brown fissured silty CLAY with occasional mudstone/siltstone lithorelicts. (KEUPER MARL : ZONE IVa)								
			1.95			2.00	75.04									
			2.00	J5				Stiff red brown mottled grey green fissured silty to very silty CLAY with many mudstone/siltstone lithorelicts. (KEUPER MARL : ZONE II/III) Occasional thin bands of highly weathered very weak calcareous siltstone at 2.00 Very stiff towards base.								
			2.00	S(25)												
			2.45	J6												
			2.50	B7												
			2.80	J8												
			3.00	(90)9												
			3.45			3.50	73.54									
			3.50	J10 *				Highly weathered fissured red brown very weak calcareous SILTSTONE with residual silty clay. (KEUPER MARL : ZONE III)								
			3.50	S(82 for 125mm) J11 *												
			3.80													
			4.20	S(89 for 150mm)												
27.9.84	Nil	Dry	4.50	J12		4.50	72.54	End of Shell and Auger Hole.								

* Seating Blows - J11 = 22
J12 = 45

Hard Strata - 3.70 - 4.20 = 1 hour

Hole started by inspection pit to 1.20m



Scale 1:

Disturbed Samples : W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] - Vane shear strength in KN /m²

Groundwater first struck

Core Cutter Density
Core Cutter Density/C.B.R

Sandbottle Density
C.B.R.

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B284

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring Air Flush with Water Injection
Dates : 27/28.9.84
Core Diameter : 76mm
Casing Dimensions : 133.35mm

Coordinates : 67090.5 E
95420.5 N
Ground Level : 77.04 m O.D.

Laboratory Testing by :
Dates :

Drilling							Test or Fr (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
Dates	Depth of Casing(m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %		Legend	Depth (m)	Reduced Level	Detail	Main								
									4.50	72.54	Drilled by Shell and Auger method to 4.50 See Fig A1									
27.9.84	-	Dry	4.50		98%	53%	NI 170 360				Slightly weathered grey green moderately weak bands at; 6.62 - 6.68, 9.75 - 9.95, 10.75 - 10.81. Highly weathered zones at: 6.22 - 6.40, 6.80 - 7.16 degraded to stiff silty clay with many lithorelicts. 45° discontinuity at: 5.24 - 5.38 Sub-vertical discontinuity at: 9.60 - 9.69.	Moderately to slightly weathered fissured red brown very weak calcareous SILTSTONE with occasional thin mudstone bands Very to extremely closely spaced rough sub-horizontal discontinuities. (KEUPER MARL : ZONE II/III)			5.54 5.90	14			1935	
			6.50 6.57				CPT ↓			(50 for 65mmSB)										
					100%	18%	NI 70 110													
			7.90																	
					97%	46%	NI 130 300								8.59 8.70					3.034

Scale 1 :

Disturbed Samples : • J - Jar, S - S.P.T., B - Bulk, M - Mazi
W - Groundwater

Core Runs 50 100 core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25), - N value

A = Axial
D = Diametral

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B284

FIGURE A2

Sheet 2 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling								Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
Dates	Depth of Casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or ↓ (mm)	Legend	Depth (m)	Reduced Level	Detail	Main								
			9.95				NI 110 620		11.64	65.40		See Sheet 1 of 3			10.30 10.40 10.40 10.50					0.033 0.029
			12.60		95%	58%					Moderately weathered zones at: 11.97 - 12.07, 12.28 - 12.32. Sub-vertical discontinuities at: 12.12 - 12.16.	Slightly weathered grey green moderately weak to moderately strong calcareous SILTSTONE. (KEUPER MARL : ZONE II)			11.40 11.50 11.50 11.64 11.64 11.76 11.76 11.88					0.184 0.020 0.254 0.262
27.9.84	4.50		13.30		95%	54%	NI 50 290		13.30	63.74					13.08 13.19 13.30 13.30					0.204
28.9.84	4.50	5.70									Slightly weathered grey green moderately weak bands at: 13.63 - 13.68, 15.00 - 15.09, 18.00 - 18.10. Completely weathered zones at: 14.14 - 14.24, 14.80 - 15.00 18.62 - 18.70, degraded to stiff silty clay with many lithorelicts.	Moderately to slightly weathered fissured red brown occasionally grey green very weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal rough discontinuities. (KEUPER MARL : ZONE II/III)			13.75 14.12	12			2113	
			15.00 15.27 15.70		100%	25%	CPT ↕ NI 50 110			(2558, 79 for 120mm)					16.27 16.38 16.38 16.50					0.962 0.960
					97%	58%	NI 130 440													

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mazi

Core Runs
50
100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

A - Axial
D - Diametral

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B284

FIGURE A2

Sheet 3 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Drilling: Depth of casing	Drilling: Depth to water (m)	Drilling: Depth (m)	Drilling: Run	Drilling: C.R. %	Drilling: R.Q.D. %	Test or Fracture (mm)	Change of Strata: Legend	Change of Strata: Depth (m)	Change of Strata: Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
			18.10												18.10					0.084
															18.20					
															18.20					0.049
															18.30					
							80								19.10					0.031
					96%	81%	180					See sheet 2 of 3			19.21					
							460								19.21					0.060
28.9.64															19.33					
			20.00						20.00	57.04										
												End of Rotary Hole								
												NI = Not Intact SB = Seating Blows.								

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mazi

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25), - N value

A = Axial
D = Diametral

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Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B284

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength									Consolidation								Notes
					Stress at Failure		Strain at Failure			C	Ø	Type of Shear Test	Initial			Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1-\sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)		0 50	50 200	200 50	50 100	100 200	200 400	400 800	
3.00 3.45	U9				100	267	3.5			370 (120 | - 25)*	UU	12	1875	m_v	0.27	0.18	0.03	0.04	0.04	0.08	0.05	* alternative interpretation
					200	350	6	15	1935						c_v	-	37.17	-	16.20	18.48	12.28	13.36	
					400	495	13.5								k	-	65.63	-	6.36	7.25	9.63	6.55	
															e	0.398	0.361	0.368	0.365	0.359	0.337	0.310	
															m_v								
															c_v								
															k								
															e								
															m_v								
															c_v								
															k								
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															e								
															m_v								
															c_v								
															k								
															e								

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s x 10^{-8}
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B285

FIGURE A1

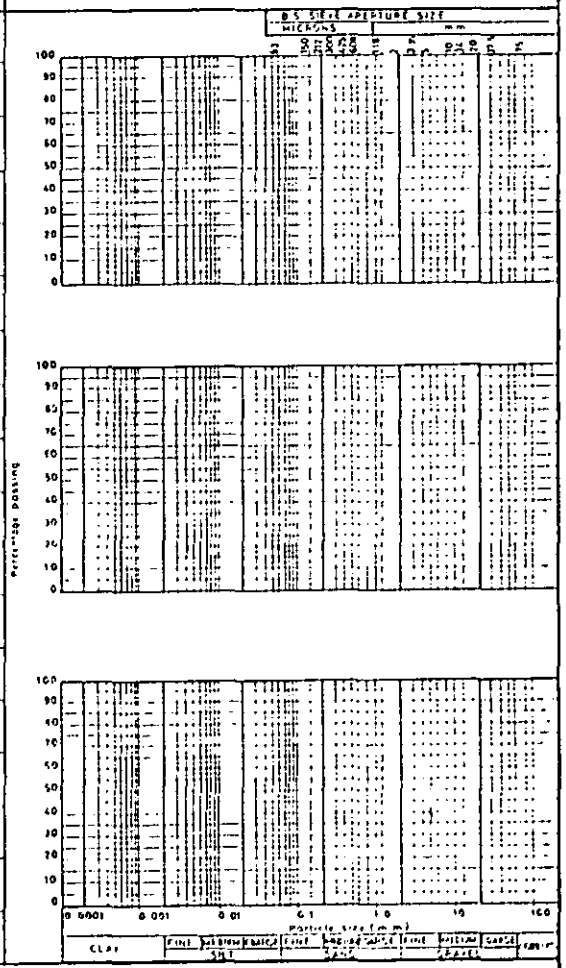
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 27.9.84
Hole Dimensions 150mm
Casing Dimensions 150mm

Coordinates: 67086.7 E.
95409.9 N.
Ground Level: 76.94 m O.D.

Laboratory testing by: Dates:

Date	Depth of Casing (m)	Depth to water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
27.9.84	-	-						LIMESTONE CHIPPINGS. (Motorway central reserve)		2	14				
			0.70	J1		0.70	76.24								
			1.00	J2				Stiff becoming very stiff red brown fissured silty CLAY with occasional mudstone/siltstone lithorelicts (KEUPER MARL : ZONE III/IV)		6	19				
			1.50	(40)3						8	13	1865	29	19	100
			1.95					Occasional bands of highly weathered very weak mudstone/siltstone below 2.00							
			2.00	J4 S(37)						9	14		35	20	100
			2.45	J5											
			2.50	B6											
			2.80	J7											
			3.00	(90)8											
			3.45												
			3.50	J8,S(47 for 75)		3.50	73.44								
			3.72	J10		3.85	73.09	Very stiff red brown mottled grey green fissured silty to very silty CLAY with some bands of highly weathered very weak mudstone/siltstone. (KEUPER MARL : ZONE III)							
27.9.84	Nil	Dry	3.85	S(43 for		4.00	72.94								
			4.00	J11 25mm				Highly to moderately weathered intact red brown and grey green very weak calcareous SILTSTONE with residual silty clay. (KEUPER MARL : ZONE II)							
								End of Shell and Auger Hole.							
								* Seating Blows - J10 = 37 J11 = 46							
								Hard Strata - 3.50 - 3.85 = ½ hour							
								Hole started by inspection pit to 1.20m							



Scale 1:

Disturbed Samples : W - Groundwater
● J - Jar
● S - S.P.T.
B - Bulk
● M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] - Vane shear strength in KN /m²

Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S S.P.T. mine or spoon
(25) - N value

Scott Wilson Kirkpatrick & Partners
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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B285

FIGURE A2

Sheet 1 of 1

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Water Flush
Dates : 28.9.84
Core Diameter : 76mm
Casing Dimensions : 114.30mm

Coordinates : 67086.7 E
95409.9 N
Ground Level : 76.94 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing(m)	Depth to water(m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or If (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
									4.00	72.94	Drilled by Shell and Auger method to 4.00								
23.9.84	-	-	4.00								Highly weathered zone at: 4.46 - 4.65 Moderately strong band at: 4.30 - 4.37 Sub-vertical discontinuity at: 4.30 - 4.37	Slightly weathered fissured to very fissured red brown very weak to weak calcareous SILTSTONE. Very to extremely closely spaced rough sub-horizontal discontiniuities. (KEUPER MARL : ZONE 11)							
					44%	0%	NI 70 90												
			5.50				CPT			(40SB, 80 for 150mm)									
			5.80																
					52%	6%	NI 30 100												
28.9.84	3.00	1.30	7.30						7.30	69.64									
			7.50				CPT			(57SB, 50 for 50mm)		End of Rotary Hole. NI = Not Intact SB = Seating Blows.							

Scale 1 :

Disturbed Samples : • J - Jar • S - S.P.T. • B - Bulk • M - Mast
W - Groundwater

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25)$_N$ - N value

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Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B285
FIGURE B
Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation									Notes
					Stress at Failure		Strain at Failure			c	ø	Type of Shear Test	Initial		Pressure Range (kN/m²)							
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	c' (kN/m²)	ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)								
3.00 3.45	U6				50	264	6	13	1815	400 (110	– 27)*	UU			m_v							* alternative interpretation
					200	406	8	13	1905						c_v							
					400	517	8	13	1875						k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
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															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

$m_v = m^2/MN$
$c_v = m^2/yr$
$k = m/s \times 10^{-8}$
e = void ratio at U 100% for each increment

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BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B286

FIGURE A1

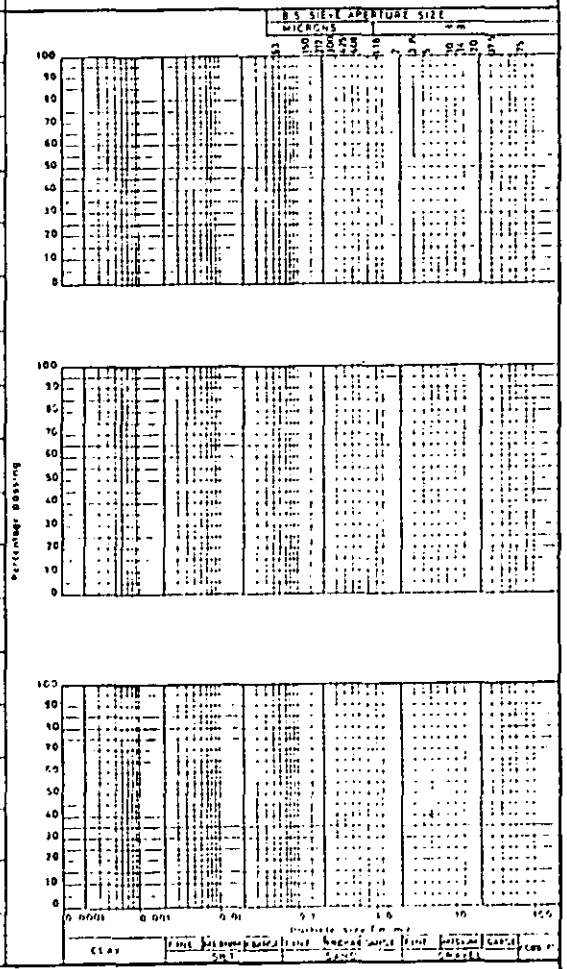
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 17.9.84
Hole Dimensions: 150mm
Casing Dimensions: 150mm

Coordinates: 67109.1 E.
95424.2 N.
Ground Level: 76.51 m OD.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/In-situ Test Depth (m)	Sample/In-situ Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
17.9.84	-	-						LIMESTONE CHIPPINGS, (Motorway verge)		2	23				
			0.70 ●	J1		0.70	75.81			5	23				
			1.00 ●	J2				Firm red brown mottled grey green fissured very silty CLAY with many mudstone/siltstone lithorelicts (KEUPER MARL : ZONE II/III)		7	12	1940			
			1.50	(35)3				Becoming stiff and very stiff with depth. Occasional thin bands of highly weathered fissured grey green weak to very weak siltstone at 1.00, 2.00m		10	13		30	17	100
			1.95 2.00 ●	J4											
			2.45	S(28) J5											
			2.70 ●	J6											
			3.00	(100)7											
			3.45	J8		3.45	73.06								
			3.75	S(71 for 150mm) J9				Highly weathered fissured red brown mottled grey green very weak SILTSTONE with residual silty clay. (KEUPER MARL : ZONE III)							
			4.00 ●	J10											
			4.20	S(81 for 150mm)				Moderately weak at 4.00m							
17.9.84	1.50	Dry	4.50	J11		4.50	72.01								
								End of Shell and Auger Hole.							
								* Seating blows – J9 = 20 J11 = 29							
								Hard Strata – 3.70 – 4.20 = 1½ hours							
								Hole started by inspection pit to 1.20m							



Scale 1:

Disturbed Samples: W – Groundwater
● J – Jar
● S – S.P.T.
● B – Bulk
● M – Maxi

Undisturbed Samples: Soil Sample

Insitu Tests: V C30 – Vane shear strength in KN/m²

▼ Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandcastle Density
▲ C B R.

C or S S.P.T. cone or spoon
N (25) – N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B286

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Air Flush with Water Injection
Dates : 17/18.9.84
Core Diameter : 76mm
Casing Dimensions : 133.35mm

Coordinates : 67109.1 E
95424.2 N
Ground Level : 76.51 m O.D.

Laboratory Testing by :
Dates :

Drilling								Test or II (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
Date	Depth of Casing (m)	Depth to water (m)	Depth (m)	Run	CR %	R.Q.D. %			Legend	Depth (m)	Reduced Level	Detail	Main							
										4.50	72.01	Drilled by Shell and Auger method to 4.50								
17.9.84	4.50	Dry	4.50		98%	60%	NI 120 500					Highly weathered zones at: 5.01 - 5.48 Slightly weathered grey green moderately weak bands at: 5.48 - 5.62, 6.65 - 6.69, 8.50 - 8.78, 8.89 - 8.96, 9.66 - 9.72. Sub-vertical discontinuities 7.85 - 8.00, 9.72 - 9.90.	Slightly weathered fissured red brown very weak to weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal rough discontinuities. (KEUPER MARL : ZONE II)							
			5.50		98%	34%	NI 160 270													
			7.00		94%	60%	NI 270 410													
			8.50 8.60				CPT				(88 for 99mmSB)									

Scale 1 :

Disturbed Samples : W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - MCAI

Core Runs
50
100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25), - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B286

FIGURE A2

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling								Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Date	Depth of casing/hole	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or ll (mm)	Legend	Depth (m)	Reduced Level	Details	Main									
					99%	27%	NI 70 230		10.50	66.01		See sheet 1 of 3			10.50 10.74	9.1			2013		
			11.35 11.56				CPT			(68SB, 50 for 60mm)	Highly weathered very weak zones at: 10.92 - 10.98, 11.21 - 11.26, 11.50 - 11.64.	Slightly weathered grey green moderately strong calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal rough discontinuities. (KEUPER MARL : ZONE II)									
					100%	69%	40 130 170		12.60	63.91											
17.9.84	4.50		13.10									Moderately weathered fissured red brown occasionally mottled grey green very weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal discontinuities (KEUPER MARL : ZONE II)										
18.9.84	4.50	4.00			97%	49%	NI 200 320		14.50	62.01											
			14.50 14.56				CPT			(50 for 62mmSB)	Slightly weathered grey green moderately strong bands at: 17.38 - 17.73, 19.68 - 19.84 45° discontinuities at: 15.67 - 15.74	Slightly weathered fissured red brown occasionally mottled grey green very weak to weak calcareous SILTSTONE. Very to extremely closely spaced smooth sub-horizontal discontinuities. (KEUPER MARL : ZONE II)									
					100%	62%	NI 120 440														
			17.50																		

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
U - U100

50
100
Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B286

FIGURE A2

Sheet 3 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling							Test or II (mm)	Change of Strata		Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	CR %	R.Q.D. %		Legend	Depth (m)	Reduced Level	Details	Main						
18.9.84			20.00		99%	66%	NI 140 740		20.00	56.51		See sheet 2 of 3						
												End of Rotary Hole. NI = Not Intact SB = Seating Blows.						

Scale 1 :

Disturbed Samples :
W - Groundwater

• J - Jar
S - S.P.T.
B - Bulk
M - Mcxi

50
100

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25). - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B286
FIGURE B
Sheet 1 of 1

Laboratory Testing by : Exploration Associates (Warwick) Limited
Dates:

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at failure		Strain at failure			C	Ø	Type of Shear Test	Initial		Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)							
3.00 3.45	U7				100	190	3.5			290 (85	– 22)*	UU			m_v						* alternative interpretation
					200	249	5.5	12	1940						c_v						
					400	373	11								k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						
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															k						
															e						
															m_v						
															c_v						
															k						
															e						

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s $\times 10^{-9}$
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B287

FIGURE A1

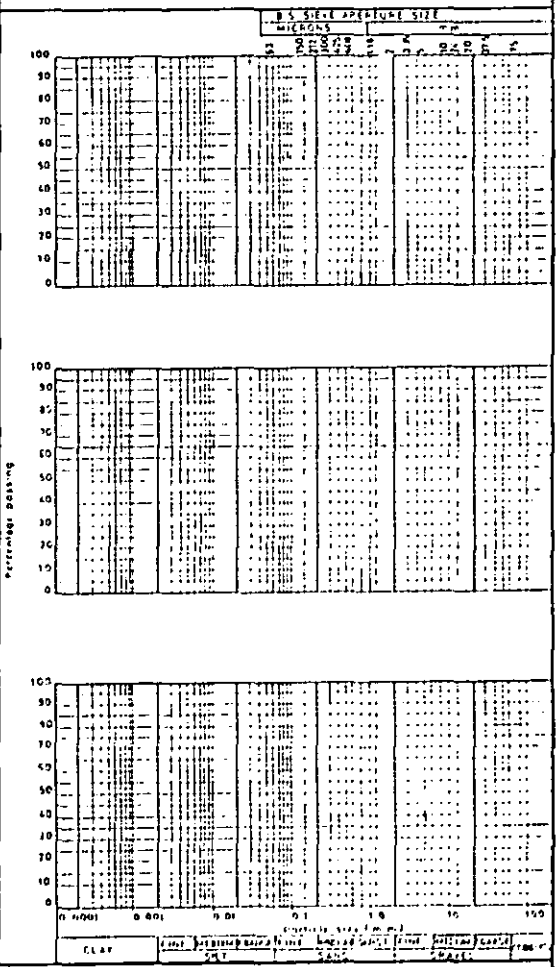
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 17.9.84
Hole Dimensions 150mm
Casing Dimensions 150mm

Coordinates: 67105.4 E.
95411.7 N.
Ground Level: 76.50 m O.D.

Laboratory Testing by: Dates:

Date	Depth of Casing (m)	Depth to water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr / pH
17.9.84	-	-								2	16					
			0.70	J1		0.70	75.80	LIMESTONE CHIPPINGS, (Motorway verge)								
			1.10	J2				Firm red brown occasionally mottled grey green fissured silty CLAY with occasional mudstone/ siltstone lithorelicts. (KEUPER MARL : ZONE III/IV)		5	17					
			1.50	(50)3						7	14	2090	33	20	100	
			1.95							10	22					0.01
			2.00	J4				Occasional thin bands of highly weathered very weak siltstone mudstone at 2.00								8.1
			2.00	S(17)												
			2.45	J5												
			2.70	J6												
			3.00	(100)7												
			3.40	J8		3.40	73.10									
			3.75	S(165 for 72mm) J9				Highly weathered fissured red brown very weak to weak SILTSTONE with residual silty clay. (KEUPER MARL : ZONE III)								
			4.00	B10												
			4.20	S(77 for 150mm)*												
17.9.84	1.50	Dry	4.50	J11		4.50	72.00									
								End of Shell and Auger Hole.								
								* Seating Blows - J9 = 37 J11 = 33								
								Hard Strata - 3.70 - 4.20 = 1¼ hours								
								Hole started by inspection pit to 1.20m								



Scale 1:

Disturbed Samples : W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] - Vane shear strength in KN /m²

Groundwater first struck

Core Cutter Density
Core Cutter Density/C.B.R

Sandbottle Density
C B R

C or S S.P.T. - cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE No B287

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring Air Flush with Water Injection
Dates : 18.9.84
Core Diameter : 76mm
Casing Dimensions :

Coordinates : 67105.4 E
95411.7 N
Ground Level : 76.50 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of Casing (m)	Depth to water (m)	Depth (m)	Run	CR %	R.Q.D. %	Test or If (mm)
18.9.84	-	-	4.50				
			5.90		100%	39%	NI 150 450
			7.00		91%	0%	NI 40 90
			7.03				C 4
					100%	32%	10 100 500

Change of Strata: Legend	Depth (m)	Reduced Level
	4.50	72.00
		(50 for 38mm SR)

Description of Strata: Detail	Main
Drilled by Shell and Auger method to 4.50 See Fig A1	
Completely weathered zone at: 5.70 - 5.90 Becoming weak between 7.00 - 7.25 Closely spaced discontinuities between 9.00 - 12.0 Moderately weak light grey green SILTSTONE/fine grained sandstone band 9.00 - 9.20	Moderately weathered dark red brown mottled light grey green very weak and weak friable SILTSTONE thinly bedded with very closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE II)

Field Records and Standpipe / Piezometer Installation Details

Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
	7.40					0.96
	7.50					
	7.50	9.7	24	18		
	7.80					

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mexi

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

A = Axial
D = Diametral

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B287

FIGURE A2

Sheet 2 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or ↓ (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
			9.20												9.60					0.114
															9.72					
															9.72					0.040
															9.84					
					98%	76%	40													
							200													
							850		10.70	65.80		See sheet 1 of 3								
															10.96					0.334
															11.07					
															11.07					0.355
			11.70												11.19					
							10													
					55%	40%	80		13.30	63.20										
							200													
											Slickenside surface at approximately 15.70				14.79					0.084
															14.89					
															14.89					0.096
			14.35												15.00					
			14.65				C			(15SB, 90 for 215mm)										
															15.86					0.158
															15.97					
															15.97					0.040
							NI								16.08					
					93%	36%	120													
							320													
			17.00																	
					100%	68%	20													
							150													
							650													

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mcsi

Core Runs
50
100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon (25). - N value

A = Axial
D = Diametral

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B287

FIGURE A2

Sheet 3 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling							Test or II (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (kN/m²)
Dates	Depth of Casing/Hole (m)	Depth to Water (m)	Depth (m)	Run	CR %	R.Q.D. %		Legend	Depth (m)	Reduced Level	Detail	Main								
												See sheet 2 of 3			18.50 18.60 18.60 18.70					0.104 0.042
18.9.84	-	-	20.00						20.00	56.50										
												End of Rotary Hole. NI = Not Intact								

Scale 1 :

Disturbed Samples :
W - Groundwater
• J - Jar
• S - S.P.T.
• B - Bulk
• M - Mazi

50
100
Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

A = Axial
D = Diametral

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Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B287
FIGURE B
Sheet 1 of 1

Sample Depth (m)	Sample Type & Number	Compaction: Type of Test	Compaction: Optimum Moisture Content (%)	Compaction: Maximum Dry Density (kg/m³)	Shear Strength: Stress at Failure σ_3 (kN/m²)	Shear Strength: Stress at Failure $\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	Shear Strength: Strain at Failure (%)	Shear Strength: Moisture Content (%)	Shear Strength: Dry Density (kg/m³)	Shear Strength: C (kN/m²)	Shear Strength: C' (kN/m²)	Shear Strength: Ø (Degrees)	Shear Strength: Ø' (Degrees)	Shear Strength: Type of Shear Test	Consolidation: Initial Moisture Content (%)	Consolidation: Initial Dry Density (kg/m³)	Consolidation: Pressure Range (kN/m²)	0 - 54	54 - 107	107 - 214	214 - 428	428 - 856			Notes
3.00	U7																							
3.40								14	2090						12	1975								
																	m_v	0.29	0.13	0.09	0.06	0.03			
																	c_v	-	26.78	22.44	14.49	18.43			
																	k	-	34.15	19.81	8.53	5.42			
																	e	0.320	0.311	0.298	0.282	0.264			
																	m_v								
																	c_v								
																	k								
																	e								
																	m_v								
																	c_v								
																	k								
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																	e								
																	m_v								
																	c_v								
																	k								
																	e								

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2 / MN
c_v = m^2 / yr
k = m/s x 10^{-8}
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B288

FIGURE A1

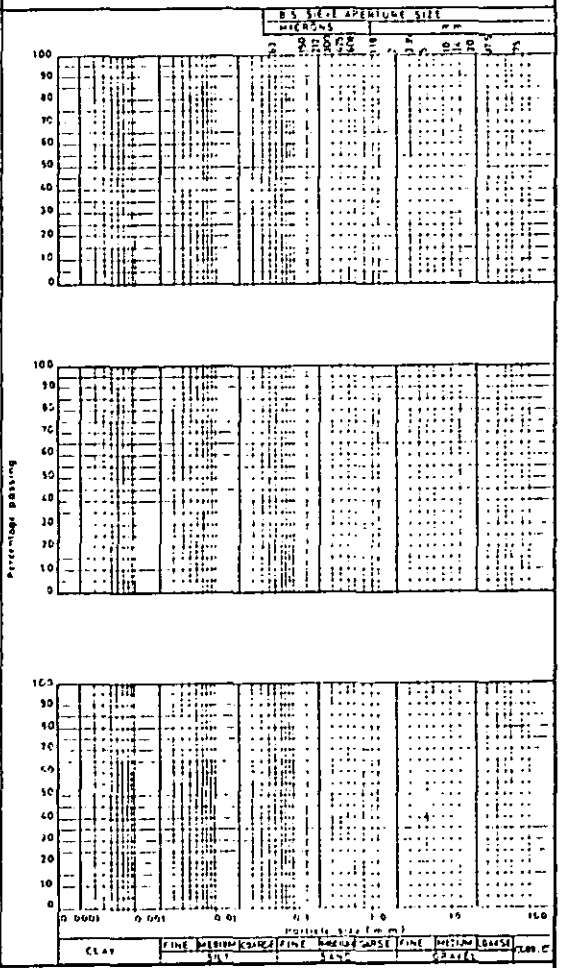
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 1.10.84
Hole Dimensions 150mm
Casing Dimensions 150mm

Coordinates: 67120.6 E.
95405.4 N.
Ground Level: 75.60 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing	Depth to water	Sample/Insitu Test Depth	Type & Number	Legend	Change of Strata Depth	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	%passing 425 microns	Sulphate g/litre	pH
1.10.84	-	-	0.30	J1		0.30	75.30	Turf onto TOPSOIL		2	19	1655	49	23	87		
			0.50	(40)2				Very stiff red brown mottled grey green fissured silty CLAY with many mudstone/siltstone lithorelicts and occasional thin bands of highly weathered very weak to weak siltstone (KEUPER MARL : ZONE III)		5	23					0.04	7.9
			0.95			1.00	74.60										
			1.00	J3				Stiff red brown and grey green fissured silty to very silty CLAY with some siltstone lithorelicts and occasional thin bands of highly weathered very weak siltstone. (KEUPER MARL : ZONE III)		7	14	1930	31	19	100		
				S(28)													
			1.45	J4													
			1.50	B5													
			1.70	J6		1.70	73.90										
			2.00					Highly weathered fissured red brown very weak MUDSTONE/SILTSTONE with residual silty clay. (KEUPER MARL : ZONE III)		9	9.4						
				(70)7													
			2.45														
			2.50	J8		2.50	73.10										
				S(76)				Very stiff red brown fissured silty CLAY with many siltstone lithorelicts. (KEUPER MARL : ZONE II/III) Some thin bands of highly weathered fissured grey green very weak siltstone.									
			2.95	J9													
			3.20	J10													
			3.50	(100)+													
			3.70	J11		3.70	71.90										
			4.00					Moderately weathered fissured red brown and grey green weak calcareous SILTSTONE. (KEUPER MARL : ZONE II)									
				S(126)													
			4.45	J12													
			4.50	B13													
			4.60	J14													
			4.90	S(89) for 150mm*				Becoming just red brown below 4.90									
1.10.84	Nil	Dry	5.20	J15		5.20	70.40										
								End of Shell and Auger Hole.									
								* Seating blows - J15 = 46									
								Hard Strata - 4.50 - 4.90 = 1 hour									
								+ Failed U sample.									



Scale 1:

Disturbed Samples: W - Groundwater
● J - Jar
● S - S.P.T.
B - Bulk
● M - Maxi

Undisturbed Samples: Soil Sample

Insitu Tests: V [30] - Vane shear strength in KN /m²

▼ Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

[Cor S S P T - ne or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B288

FIGURE A2

Sheet 1 of 2

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring with Air Flush with Water Injection.
Dates : 4.10.84
Core Diameter : 76mm
Casing Dimensions : N/A

Coordinates : 67120.6 E
95405.4 N
Ground Level : 75.60 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	CR %	RQD %	Fract or II (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
4.10.84	-	-									Open hole adjacent to previously drilled percussion hole								
									4.00	71.60									
4.10.84			4.00		100%	20%	NI 30 140				Occasional highly weathered bands of very weak clayey siltstone (upto 50mm thick)	Slightly occasionally moderately weathered laminated to thinly bedded red brown occasionally green grey fine grained very weak occasionally weak SILTSTONE. (KEUPER MARL : ZONE II)							
			4.70		98%	34%	NI 80 160				Several short sub-vertical discontinuities with silty clay infill.								
			7.00		100%	9%	NI NI 110												
		8.30	8.20				CPT NI 40 220			(78 for 145mmSII)									
			8.35		98%	26%													

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mazi

Core Runs
50
100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B288

FIGURE A2

Field Work by : _____
Method : _____
Dates : _____
Core Diameter : _____
Casing Dimensions : _____

Coordinates : _____ E
_____ N
Ground Level : _____ m O.D.

Laboratory Testing by : _____ Dates : _____

Drilling							Test or ll (mm)	Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)		
Dates	Depth of casing/ins	Depth to water (m)	Depth (m)	Run	CR %	R.Q.D. %		Legend	Depth (m)	Reduced Level	Detail	Main									
									9.50	66.10		See sheet 1 of 2									
			9.80								Fractured very weak zone at 10.00 - 10.10	Slightly weathered thinly bedded green grey occasionally red brown fine grained weak and moderately weak SILTSTONE. (KEUPER MARL : ZONE I)									
					98%	50%	NI 130 410		11.45	64.15											
			12.50								Some highly weathered very clayey zones present (upto 100mm thick)	Slightly to moderately weathered laminated to very thinly bedded red brown occasionally green grey fine grained very weak clayey SILTSTONE. (KEUPER MARL : ZONE II)									
			12.55				CP1			(50 for 50mmSB)											
					97%	50%	NI 110 300														
			13.80																		
					67%	19%	NI 40 230														
4.10.84	Nil	-	15.00						15.00	60.60		End of Rotary Hole. NI = Not Intact SB = Seating Blows. Bentonite seal 0.50 - 1.50 Gravel filter 1.50 - 15.00 Standpipe installed to 15.00										

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

50
100

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B288

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at Failure		Strain at Failure			C	Ø	Type of Shear Test	Initial		Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)		0 50	50 200	200 50	50 100	100 200	200 400	
0.50 0.95	U2				50	251	6	20	1645	270	-	UU			m_v							
					100	256	8	17	1650						c_v							
					200	291	10	18	1680						k							
															e							
1.00 1.50	B5				50	110	14	23	1625	120	-	REM UU			m_v							
					100	121	17	23	1645						c_v							
					200	125	20	23	1615						k							
															e							
2.00 2.45	U7				100	289	4	15	1910	370 (150 | - 23)*	UU	15	1905	m_v	0.28	0.08	0.04	0.03	0.04	0.05	* alternative interpretation
					200	348	7	14	1945						c_v	-	18.96	-	18.91	18.80	14.19	
					400	478	6	13	1945						k	-	14.88	-	5.56	7.38	6.96	
															e	0.367	0.350	0.358	0.356	0.350	0.337	
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2 / MN
c_v = m^2 / yr
k = m/s x 10^{-9}
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No B289

FIGURE A1

Sheet 1 of 1

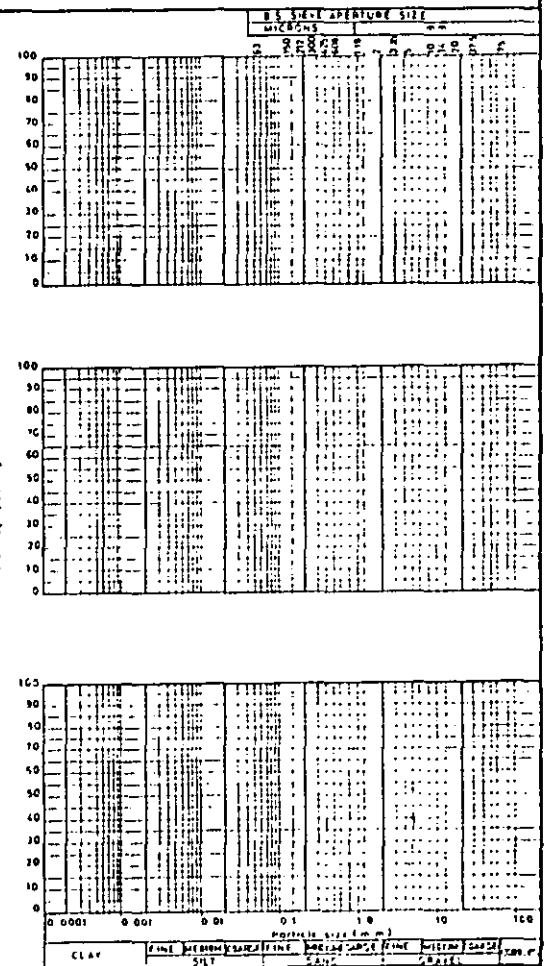
Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 28.9.84
Hole Dimensions 150mm
Casing Dimensions 150mm

Coordinates: 67125.8 E.
95422.3 N.
Ground Level: 75.50 m O.D.

Laboratory Testing by. Dates:

Dates	Depth of Casing	Depth to Water	Sample/Insitu Test Depth	Type & Number	Change of Strata Legend	Depth	Reduced Level	Description of Strata
28.9.84	-	-	0.30	J1		0.30	75.20	Turf onto TOPSOIL
			0.50	(40)2				Very stiff and stiff red brown fissured silty to very stiff CLAY with many siltstone lithorelicts. (KEUPER MARL : ZONE III)
			0.95					
			1.00	J3				
				S(20)				
			1.45	J4				Some thin bands of highly weathered weak to moderately weak siltstone below 0.30.
			1.50	B5				
			1.70	J6				
			2.00	(70)+				Becoming mottled grey green below 1.70.
			2.20	J7		2.20	73.30	
			2.50			2.50	73.00	Moderately weathered fissured grey green weak to moderately weak calcareous SILTSTONE. (KEUPER MARL : ZONE II)
				S(49)				
			2.95	J8				Very stiff red brown fissured silty CLAY with many mudstone/siltstone lithorelicts and occasional thin bands of highly weathered very weak mudstone/ siltstone. (KEUPER MARL : ZONE II/III)
			3.20	J9		3.20	72.30	
						3.30	72.20	Moderately weathered fissured grey green weak to moderately weak calcareous SILTSTONE (KEUPER MARL : ZONE II)
			3.50					
				S(104)				
			3.95	J10				
			4.00	B11				Very stiff red brown mottled grey green silty to very silty CLAY with some thin bands of highly weathered weak calcareous siltstone. (KEUPER MARL: ZONE III)
			4.30	J12				
			4.40					
				S(126)				
28.9.84	Nil	Dry	4.85	J13		4.85	70.65	
								End of Shell and Auger Hole.
								Hard Strata - 3.90 - 4.40 = 1 hour
								+ Failed U sample.

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr / pH
	2	13	1485	40	20	100	
	5	23					0.07 / 8.0
	8						
	11	23		39	20	100	



Scale 1:

Disturbed Samples : W - Groundwater
J - Jar, S - S.P.T., B - Bulk, M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V (30) - Vane shear strength in KN /m²

Groundwater first struck

Core Cutter Density
Core Cutter Density/C.B.R

Sandbottle Density
C B R

C or S S.P.T. - core or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B289

FIGURE A2

Sheet 1 of 3

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring Air Flush with Water Injection
Dates : 3.10.84
Core Diameter : 76mm
Casing Dimensions : N/A

Coordinates : 67125.8 E
95422.3 N
Ground Level : 75.50 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing/flush (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or Fracture Index (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)	Point Load Strength (MN/m²)
									4.00	71.50	Rotary Open Holed through overburden alongside Shell and Auger Hole previously drilled to 4.00									
3.10.84			4.00		100%	44%	NI 120 230				Slightly weathered moderately weak bands at: 4.00 - 4.09, 4.23 - 4.29	Highly weathered very fissured red brown very weak calcareous SILTSTONE. Very to extremely closely spaced rough sub-horizontal discontinuities. (KEUPER MARL : ZONE III)			6.27 6.56	12			1970	
			5.50						6.27	69.23										
					96%	33%	NI 110 300				Slightly weathered grey green moderately weak band at: 7.37 - 7.60 Sub-vertical discontinuities at: 7.10 - 7.19, 7.94 - 7.99, 8.80 - 8.89 45° discontinuities at: 8.00 - 8.05, 9.07 - 9.11, 9.17 - 9.21.	Slightly weathered fissured red brown very weak to weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal rough discontinuities. (KEUPER MARL : ZONE II)			7.71 7.81 7.81 7.91 8.50 8.60 8.60 8.71					0.264 0.320 0.134 0.960
			8.50 8.56				CPT			(50 for 54mmSB)										

Scale 1 :

Disturbed Samples : J - Jar, S - S.P.T., B - Bulk, M - Mazi
W - Groundwater

Core Runs: 50, 100 — core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

A = Axial
D = Diametral

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B289

FIGURE A2

Sheet 2 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing(m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or bit (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
									9.36	66.14		See sheet 1 of 3							
					97%	39%	NI 90 370				Very weak band at: 10.27 - 10.34	Slightly weathered grey green moderately weak to moderately strong calcareous SILTSTONE. (KEUPER MARL : ZONE II)							
		Water Inflow @ 10.5	10.50						11.05	64.45									
					95%	50%	NI 180 220				Slightly weathered grey green moderately strong bands at: 11.37 - 11.46, 12.00 - 12.20, 16.00 - 16.15, 16.85 - 16.93, 18.00 - 18.42, 19.67 - 19.93. Highly weathered zones at: 12.20 - 12.66, 13.46 - 13.60, 15.00 - 15.44, 18.42 - 18.70, 21.00 - 21.84, 24.17 - 24.42 degraded to stiff silty clay with many lithorelicts.	Moderately to slightly weathered fissured red brown occasionally grey green very weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal smooth discontinuities. (KEUPER MARL : ZONE II/III)							
			12.50							(20SB, 108 for 192mm)									
			12.84				CPT												
					100%	74%	NI 330 600												
			15.20																
					94%	41%	NI 95 440												
			17.00							(72 for 137mmSB)									
			17.14				CPT												
					100%	66%	NI 95 620												

Scale 1 :

Disturbed Samples :
W = Groundwater
J = Jar
S = S.P.T.
B = Bulk
M = Mazi

Core Runs
core recovery %

Groundwater first struck

C or S = S.P.T. cone or spoon
(25) = N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº B289

FIGURE A2

Sheet 3 of 3

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling								Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or II (mm)	Legend	Depth (m)	Reduced Level	Detail	Main							
			18.30																
					96%	23%	NI 100 130												
			19.80																
					97%	30%	NI 90 340					See Sheet 2 of 3							
			22.00																
					97%	30%	NI 200 230												
			24.50																
3.10.84					88%	0%	NI 40 70		25.00	50.50									
			25.00									End of Rotary Hole. NI = Not Intact SB = Seating Blows.							

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mazi

50
100
Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. B289
FIGURE B
Sheet 1 of 1

Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at Failure		Strain at Failure			C	Ø	Type of Shear Test	Initial		Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)							
1.00 1.50	B5				50	43	16	20	1645	45	-	REM UU			m_v						
					100	46	20	20	1655						c_v						
					200	52	20	20	1660						k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						
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															k						
															e						
															m_v						
															c_v						
															k						
															e						

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s x 10^{-8}
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 290

FIGURE A1

Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 2.10.84
Hole Dimensions 150mm
Casing Dimensions 150mm

Coordinates: 67209.4 E.
95445.9 N.
Ground Level: 71.43 m O.D.

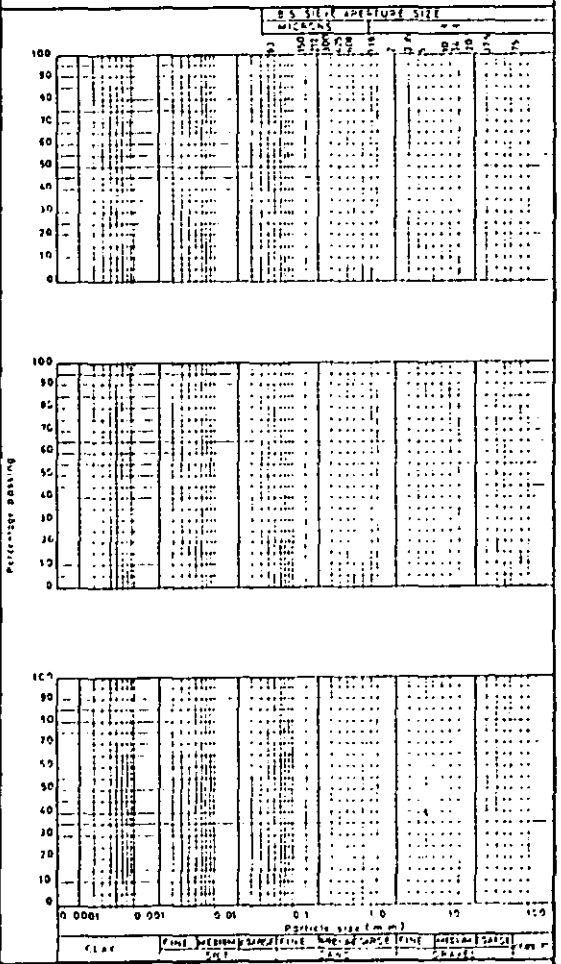
Laboratory Testing by: Dates:

Dates	Depth of Casing m	Depth to water m	Sample/Insitu Test Depth m	Type & Number	Change of Strata Legend	Depth m	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	%passing 425 microns	sulphate g/litre / pH
2.10.84	-	-	0.30	J1		0.30	71.13	Turf onto TOPSOIL		1	18					
			0.50	(35)2				Very stiff red brown mottled green grey fissured silty CLAY with many mudstone/siltstone lithorelicts. Occasional thin bands of highly weathered very weak mudstone/siltstone at 0.30 (KEUPER MARL: ZONE II/III)		2	18	1770	38	21	100	
			0.95													
			1.00	J3 S(17)						5	23					0.05
			1.45	J4												8.1
			1.50	B5						7	15 12	1875	29	18	100	
			1.70	J6												
			2.00	(75)7						9	11					
			2.45													
			2.50	J8		2.50	68.93									
				S(61)				Very stiff red brown fissured silty CLAY with many siltstone lithorelicts. (KEUPER MARL : ZONE III)								
			2.95	J9		3.00	68.43									
			3.00	J10 *				Highly weathered fissured red brown mottled grey green weak to very weak calcareous SILTSTONE with residual silty clay. (KEUPER MARL : ZONE III)								
			3.10	S(76 for												
			3.60	J11 150mm												
			3.50	B12												
				(100)												
			3.70	J13												
				S(95 for												
			4.05	J14 225mm												
			4.15	S(11 for												
				* 225mm)												
2.10.84	Nil	Dry	4.50	J15		4.50	66.93	End of Shell and Auger Hole.								

* Seating Blows - J11 = 29
J14 = 26
J15 = 27

Hard Strata - 3.30 - 3.50 and 3.80 - 4.15 = 1¼ hours

+ Failed U sample



Scale 1:

Disturbed Samples : W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] - Vane shear strength in KN /m²

Groundwater first struck

Core Cutter Density
Core Cutter Density/C.B.R

Sandbottle Density
C B R

Cor S S.P.T. cone or spoon
[25] - N value

Scott Wilson Kirkpatrick & Partners
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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº 290

FIGURE A2

Sheet 1 of 2

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring Air Flush with Water Injection
Dates : 8.10.84
Core Diameter : 76mm
Casing Dimensions : N/A

Coordinates : 67209.4 E, 95445.9 N
Ground Level : 71.43 m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing(m)	Depth to water(m)	Depth (m)	Run	CR %	R.Q.D. %	Test or II (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe/Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
8.10.84									4.00	67.43	Rotary Open Holed through overburden alongside previously drilled Shell and Auger Hole to 4.00								
			4.00				NI 50 410		4.65	66.78		Slightly weathered fissured red brown very weak to weak calcareous SILTSTONE. (KEUPER MARL : ZONE II)							
					98%	34%			6.53	64.90	Highly weathered zones at: 5.05 - 5.20, 5.25 - 5.36 45° discontinuities at: 6.10 - 6.14, 6.14 - 6.19, 6.28 - 6.32. Sub-vertical discontinuities at: 5.36 - 5.83.	Slightly weathered fissured grey green moderately weak calcareous SILTSTONE. Closely spaced sub-horizontal rough discontinuities (KEUPER MARL : ZONE II)							
			5.70																
		Water inflow at 7.0	7.00		96%	46%	NI 55 250					See sheet 2 of 2							
					99%	52%	NI 110 160												
			8.50				CPT			(40SB, 80 for 130ss)									
			8.78																

Scale 1 :

Disturbed Samples : W - Groundwater
J - Jar, S - S.P.T., B - Bulk, M - Maxi

Core Runs: core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº 290

FIGURE A2

Sheet 2 of 2

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or If (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details
					100%	68%	NI 70 290				Slightly weathered grey green moderately weak bands at: 6.70 - 6.78, 7.67 - 7.76, 11.70 - 11.92, 13.78 - 14.29, 15.07 - 15.20, 15.59 - 16.00. Highly weathered zones at: 7.92 - 8.50, 13.51 - 13.78 degraded to stiff silty clay with many lithorelicts. Sub-vertical discontinuities at: 9.50 - 9.62	Slightly weathered fissured red brown occasionally grey green very weak calcareous SILTSTONE. Closely spaced sub-horizontal rough discontinuities. (KEUPER MARL : ZONE II)	
			9.50		95%	68%	40 250 270						
			11.70 11.74				CPT			(50 for 40mmSB)			
					99%	67%	NI 230 710						
			13.90		94%	46%	NI 190 340						
8.10.84			16.00						16.00	55.43		End of Rotary Hole. NI = Not Intact SB = Seating Blows.	

Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)

Scale 1 :

Disturbed Samples :
W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Mazi

Core Runs
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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Consulting Engineers & Transportation Planners

Laboratory Testing by : Exploration Associates (Warwick) Limited

Dates: _____

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 290

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at Failure					C	ø		Initial			Pressure Range (kN/m²)					
Depth (m)	Type & Number	Type of test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1-\sigma_3}{2}$ (kN/m²)	Strain at Failure (%)	Moisture Content (%)	Dry Density (kg/m³)	c' (kN/m²)	ø' (Degrees)	Type of Shear Test	Moisture Content (%)	Dry Density (kg/m³)		0 50	50 100	100 200	200 400	400 100		
0.50 0.95	U2				50	209	10	19	1740	250 (120 | – 23)*	UU			m_v							* alternative interpretation
					100	253	5	18	1785						c_v							
					200	306	6	18	1785						k							
															e							
2.00 2.45	U7				50	262	6	15	1890	270	–	UU	14	1920	m_v	0.19	0.07	0.05	0.04	0.02		
					100	228	8	15	1890						c_v	–	17.42	26.97	26.62	–		
					200	329	6	16	1850						k	–	11.96	13.22	10.44	–		
															e	0.368	0.363	0.356	0.345	0.354		
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
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															k							
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															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2 / MN
c_v = m^2 / yr
k = m/s x 10^{-8}
e = void ratio at U 100% for each increment

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BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No 291

FIGURE A1

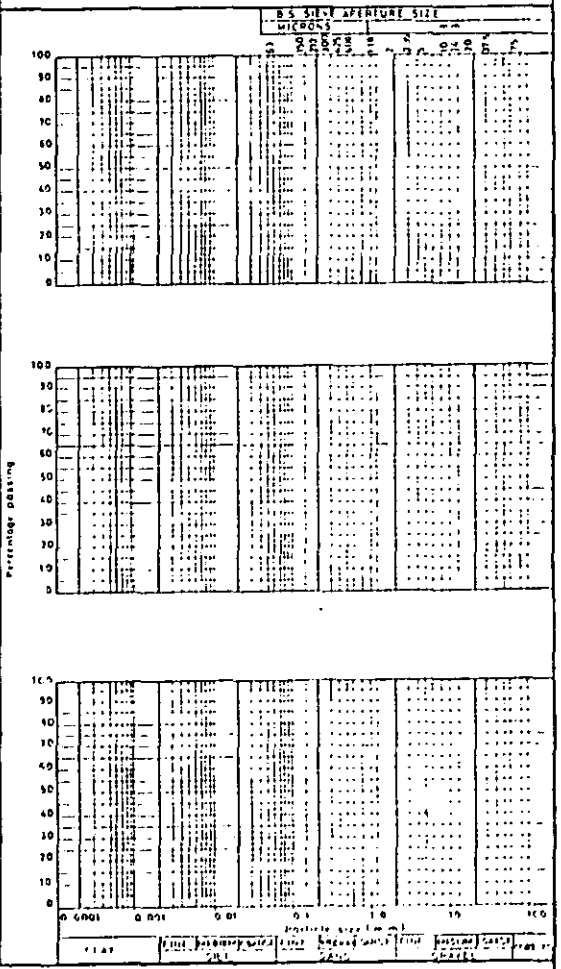
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Cable Percussion
Dates: 1.10.84
Hole Dimensions 150mm
Casing Dimensions 150mm

Coordinates: 67232.6 E.
95400.2 N.
Ground Level: 70.34 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing	Depth to Water	Sample/Insitu Test Depth	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
1.10.84	-	-	0.30	J1		0.30	70.04	Turf onto TOPSOIL		1	10				
			0.50	(30)2				Firm red brown fissured silty CLAY with occasional mudstone/siltstone lithorelicts. (KEUPER MARL : ZONE IVa)		2			59	28	100
			0.95												
			1.00	J3 S(11)						5	19				
			1.45	J4				Firm to stiff towards base.							
			1.50	B5						7	21	1660	37	21	76
			1.80	J6											
			2.00	(40)7						9	22				
			2.45												
			2.50	J8		2.50	67.84								
			2.95	S(20) J9				Firm grey green fissured silty CLAY with many siltstone lithorelicts and occasional thin bands of highly weathered weak siltstone. (KEUPER MARL : ZONE III)		11	12	1990	29	19	100
			3.20	J10		3.20	67.14								
			3.50					Very stiff red brown fissured silty CLAY with many siltstone lithorelicts and occasional thin bands of highly weathered weak siltstone. (KEUPER MARL : ZONE III)							
			3.95	(65)11											
			4.00	J12 * S(28 for 315/150mm)		4.00	66.34								
			4.30					Highly weathered fissured red brown very weak SILTSTONE with residual silty clay. (KEUPER MARL : ZONE III) Becoming red brown and grey green below 4.50							
			4.50	J14, B15											
			4.70	S(87 for 150mm)		4.70	65.64								
1.10.84	Nil	Dry	5.00	J16		5.00	65.34	Stiff red brown and grey green fissured silty to very silty CLAY with many siltstone lithorelicts and many thin bands of highly weathered very weak siltstone. (KEUPER MARL : ZONE III)							
								End of Shell and Auger Hole.							
								* Seating Blows – J13 = 32 J16 = 39							
								Hard Strata – 4.30 – 4.70 = 1 hour							



Scale 1:

Disturbed Samples : W – Groundwater
● J – Jar
● S – S.P.T.
● B – Bulk
● M – Mazi

Undisturbed Samples : Soil Sample

Insitu Tests : V (30) – Vane shear strength in KN/m²

Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S SPT cone or spoon
(25) – N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº 291

FIGURE A2

Sheet 1 of 2

Field Work by : Exploration Associates (Warwick) Limited
Method : Rotary Coring Air Flush with Water Injection
Dates : 5/8.10.84
Core Diameter : 76mm
Casing Dimensions : N/A

Coordinates : 67232.6 E
95400.2 N
Ground Level : 70.34 m O.D

Laboratory Testing by :
Dates :

Drilling: Dates	Depth of casing (m)	Depth to water (m)	Depth (m)	Run	C.R. %	R.Q.D. %	Test or Fracture Index (mm)	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata: Detail	Description of Strata: Main	Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
5.10.84											Rotary Open Holed through overburden alongside Shell and Auger Hole previously drilled to 4.00								
5.10.84			4.00						4.00	66.34									
5.10.84	-	-	4.00				NI 90 110				Highly weathered zone at: 4.44 - 4.72.	Slightly weathered fissured grey green moderately weak SILTSTONE. Very to extremely closely spaced sub-horizontal rough discontinuities. (KEUPER MARL : ZONE II)							
			5.20		100%	16%													
					92%	54%	40 160 180												
			6.10						6.41	63.93									
					100%	12%	NI 90 170				Slightly weathered siltstone at: 6.71 - 7.54	Moderately weathered fissured red brown occasionally grey green very weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE II)							
		Water Inflow at 7.4	7.40																
			7.48				CPT			(50 for 57mmSB)									
					100%	32%	NI 100 200		8.30	62.04									
			8.50									See sheet 2 of 2							

Scale 1 :

Disturbed Samples : J - Jar, S - S.P.T., B - Bulk, M - MCAI
W - Groundwater

Core Runs: 50, 100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

DRILLHOLE Nº 291

FIGURE A2

Sheet 2 of 2

Field Work by :
Method :
Dates :
Core Diameter :
Casing Dimensions :

Coordinates : E
N
Ground Level : m O.D.

Laboratory Testing by : Dates .

Drilling								Change of Strata			Description of Strata		Field Records and Standpipe / Piezometer Installation Details	Sample Number	Depth (m)	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Natural Dry Density (kg/m³)
Dates	Depth of casing/ hole (m)	Depth to water (m)	Depth (m)	Run	CR %	RQD %	Test or II (mm)	Legend	Depth (m)	Reduced Level	Detail	Main							
5.10.84	Nil	Dry			93%	26%	NI 60 190				Highly weathered zones at: 10.62 - 10.90, 13.46 - 13.60, degraded to stiff silty clay with many lithorelicts. Slightly weathered grey green moderately weak bands at: 11.59 - 11.82, 13.60 - 14.03, 14.52 - 14.62, 14.80 - 15.00, 15.30 - 15.66.	Slightly weathered fissured red brown occasionally mottled grey green very weak to weak calcareous SILTSTONE. Very to extremely closely spaced sub-horizontal discontinuities. (KEUPER MARL : ZONE II/III)							
6.10.84	Nil	3.00	10.30		88%	17%	NI NI 170												
			11.20				CPT 1			(87 for 143mmSB)									
			11.34		96%	71%	NI 140 420												
			13.80																
					94%	58%	40 140 290												
8.10.84			16.00						16.00	54.34		End of Rotary Hole. NI = Not Intact SB = Seating Blows. Bentonite seal 0.50 - 1.50 Gravel filter 1.50 - 16.00 Standpipe installed to 16.00							

Scale 1 :

Disturbed Samples : J - Jar, S - S.P.T., B - Bulk, M - Maxi
W - Groundwater

Core Runs 50 / 100
core recovery %

Groundwater first struck

C or S - S.P.T. cone or spoon
(25) - N value

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Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

BOREHOLE No. 291

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at failure		Strain at failure			C	Ø	Type of Shear Test	Initial		Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)		0 50	50 200	200 50	50 100	100 200	200 400	
0.50 0.95	U2				55	55	4.8	27	1560						m_v							
					79	76	4.1	27	1570			$\overline{CU}$			c_v							
					138	110	5.1	28	1550	15	22				k							
															e							
2.00 2.45	U7				50	81	11.5			90 (67 | - 8)*				m_v							* alternative interpretation
					100	91	15	21	1660			UU			c_v							
					200	107	20								k							
															e							
3.50 3.95	U11				50	322	4	12	2005	320	-				m_v	0.19	0.08	0.03	0.03	0.03	0.04	
					100	288	6	12	1980			UU			c_v	-	59.33	-	46.66	-	16.54	
					200	384	8	13	1975				13	1975	k	-	46.56	-	13.73	-	6.49	
															e	0.338	0.322	0.328	0.326	0.321	0.311	
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
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															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2/MN
c_v = m^2/yr
k = m/s $\times 10^{-9}$
e = void ratio at U 100% for each increment

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT No 438

FIGURE A1

Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: JCB 3C
Dates: 19.9.84
Hole Dimensions: 1.0m x 3.0m
Casing Dimensions: N/A

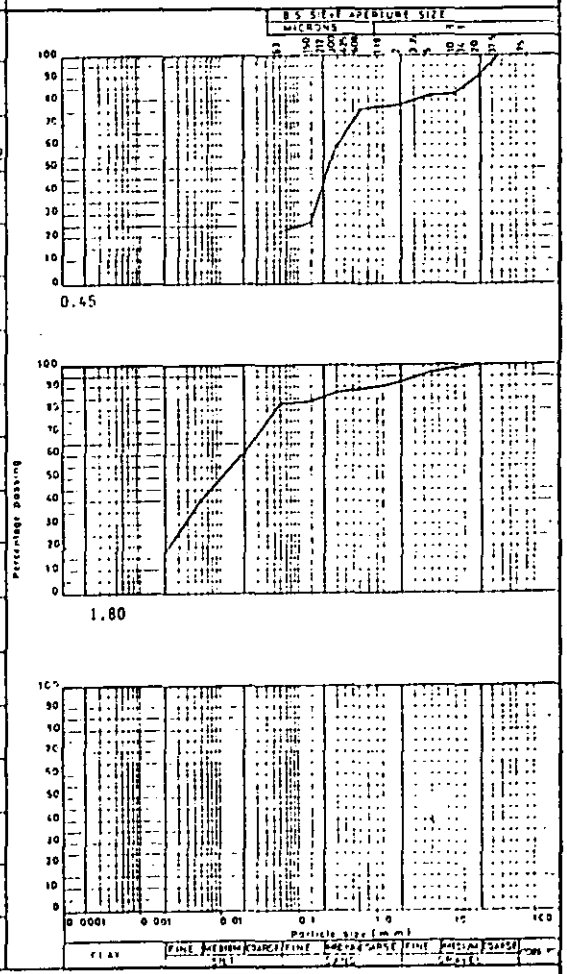
Coordinates: 66453.0 E.
93963.0 N.
Ground Level: 53.83 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing	Depth to Water	Sample/Insitu Test Depth	Sample/Insitu Test Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata
19.9.84				B1		0.30	53.53	Friable very sandy CLAY with many sub-rounded gravel (TOPSOIL)
			0.45	B2 J3				
				B4		0.70	53.13	Brown medium SAND and sub-rounded fine to coarse GRAVEL. (GLACIAL SAND and GRAVEL)
			0.80	B5 J6				
						1.50	52.33	Stiff fissured red-brown occasionally green-grey silty slightly sandy CLAY with some sub-rounded fine to coarse gravel and bands of brown medium sand and gravel. (GLACIAL TILL)
			1.80	B7 B8 J9				
						2.10	51.73	Soft to firm red-brown very silty slightly sandy CLAY with some sub-rounded fine to coarse gravel and occasional cobbles. (GLACIAL TILL)
				B10				
			2.40	B11 J12				Firm and firm to stiff red-brown and green-grey very silty CLAY with siltstone lithorelicts and thin bands of very weak siltstone. (KEUPER MARL : ZONE IV)
				B13 B14				
19.9.84	-	Dry	3.00	J15		3.00	50.83	Becoming friable towards base.
								Base of Pit.
								Pit sides stable.
			1.90	Cv = 38/39/30				Cv = Hand Vane Shear Strength (kN/m²)
				Cp = 50/60/45				Cp = Hand Penetrometer Shear Strength (kN/m²)

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	%-passing 425 microns	Sulphate g/ltr / pH
	1	11					
	2	-					
	4	16 19* 17**		39	16	74	0.07 / 7.2
	5	-					
	7	28					
	8	-					
	10	27 26**		39	20	100	
	11	-					
	13	21		38	22	100	
	14	-					

* Without Gravel
** Microwave Determination



Scale 1:

Disturbed Samples: W — Groundwater
J — Jar
S — S.P.T.
B — Bulk
M — Maxi

Undisturbed Samples: Soil Sample

Insitu Tests: V (30) — Vane shear strength in KN/m²

Groundwater first struck

Core Cutter Density
Core Cutter Density/C.B.R

Sandbottle Density
C B R

Cor S SPT - no or spoon
(25) - N value

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Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT ~~BOREHOLE~~ No. 438

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation									Notes
					Stress at Failure		Strain at Failure			C	ø	Type of Shear Test	Initial		Pressure Range (kN/m²)							
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)								
0.45	B1+2	S	8.0	2030											m_v							
															c_v							
															k							
															e							
1.80	B7+8	H	13.0	1855											m_v							
															c_v							
															k							
															e							
3.00	B13+14				50	180	13	17	1770	180	-	REM UU			m_v							
					100	181	19	17	1750						c_v							
					150	185	19	18	1735						k							
															e							
															m_v							
															c_v							
															k							
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															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

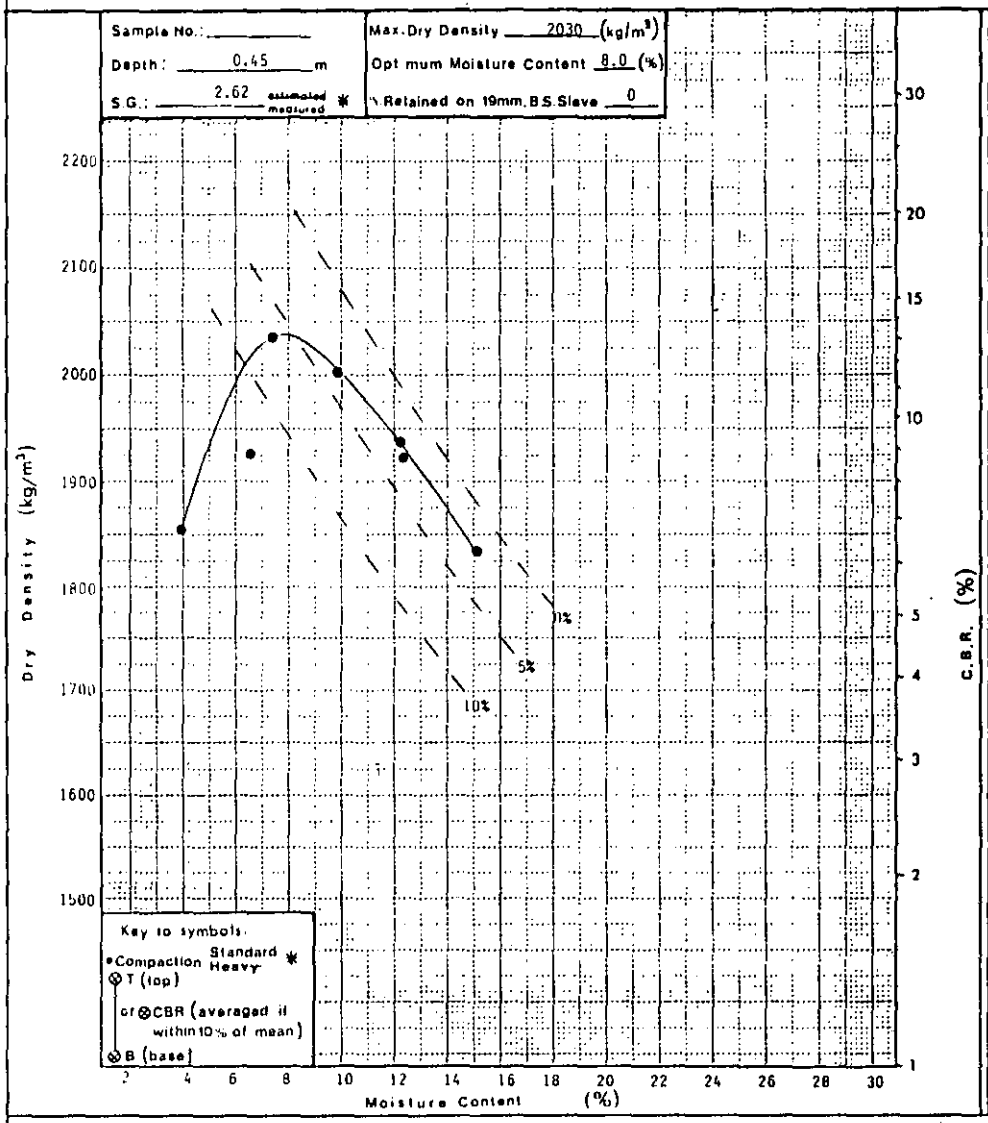
m_v = m^2/MN
c_v = m^2/yr
k = m/s x 10^{-9}
e = void ratio at U 100% for each increment

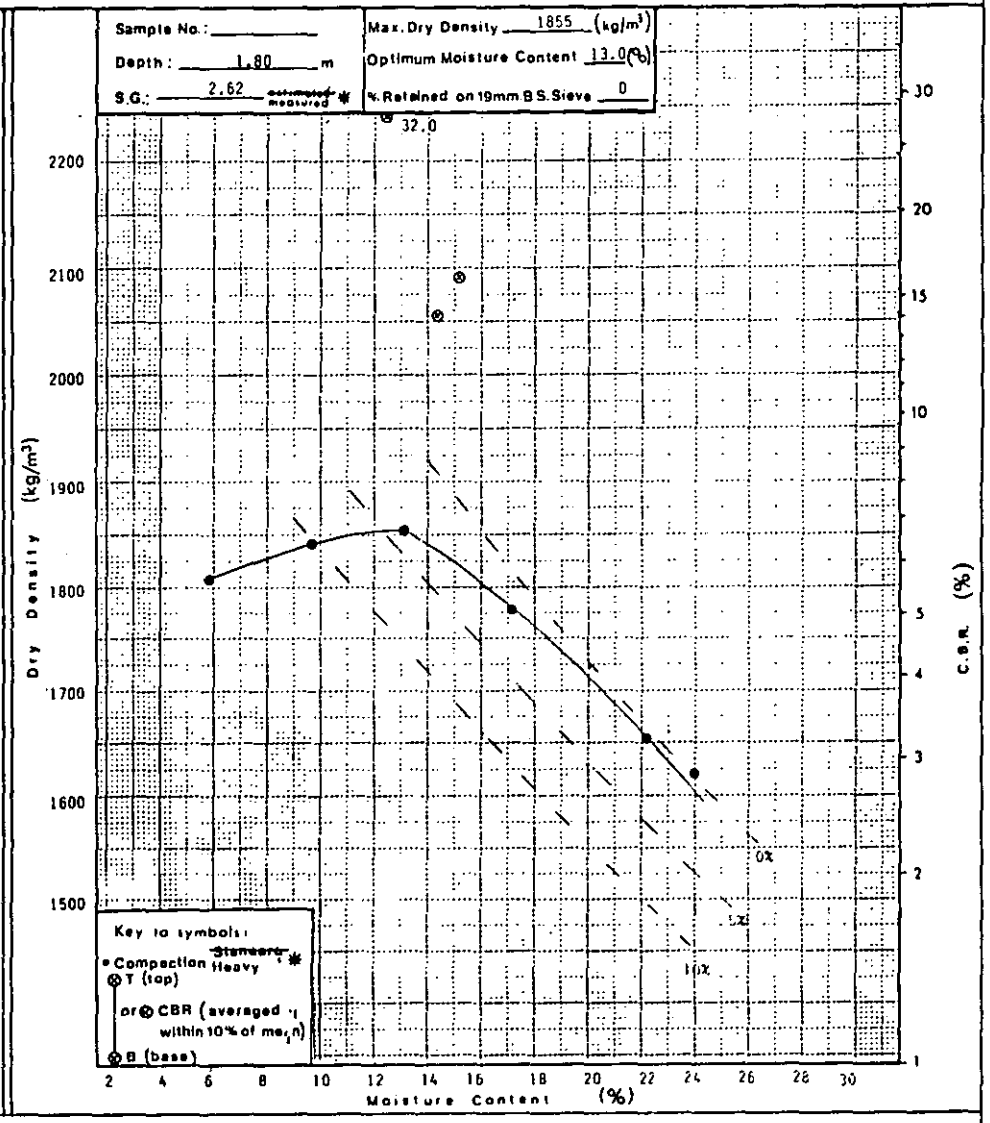
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Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT No. 438
FIGURE C
Sheet 1 of 1





* Delete as necessary

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT No 439

FIGURE A1

Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: JCB 3C
Dates: 19.9.84
Hole Dimensions: 1.0m x 3.0m
Casing Dimensions: N/A

Coordinates: 66820.0 E.
94699.0 N.
Ground Level: 65.23 m OD.

Laboratory Testing by: Dates:

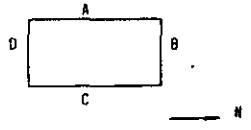
Dates	Depth of Casing	Depth to Water	Sample/Insitu Test: Depth	Sample/Insitu Test: Type & Number	Change of Strata: Legend	Change of Strata: Depth	Change of Strata: Reduced Level	Description of Strata
19.9.84	-	-				0.30	64.93	Grass over friable silty very sandy CLAY. (TOPSOIL)
			0.60	B1, B2, J3		1.00	64.23	Stiff to very stiff fissured red-brown silty sandy CLAY with occasional sub-rounded fine to coarse gravel. (GLACIAL TILL)
			1.20	B4, B5, J6				Firm to stiff and stiff occasionally fissured red-brown silty sandy CLAY with some sub-angular fine gravel. Very sandy in parts with occasional soft to firm zones. (GLACIAL TILL)
			1.8-2.2	J7**				
			2.30	B8, B9, J10, B11, B12		2.30	62.93	Stiff and firm red-brown occasionally green-grey silty CLAY with occasional siltstone lithorelicts. (KEUPER MARL : ZONE IV)
19.9.84	-	Dry	3.00	J13		3.00	62.23	Base of Pit.

* Strata moist below 2.3 metres

Zone of brown clayey silty fine to medium SAND present in face A between 1.8 and 2.2 metres.

** Sample from face A.

Pit sides stable.

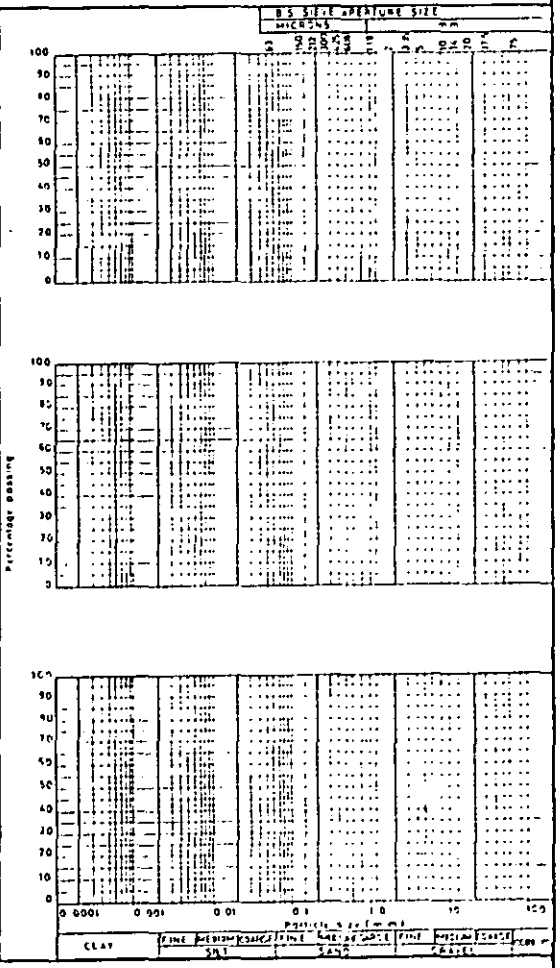


1.40	Cv =	38/35/30
	Cp =	100/120/110
2.40	Cv =	40/50/56
	Cp =	120/130/130

Cv = Hand Vane Shear Strength (kN/m²)
Cp = Hand Penetrometer Shear Strength (kN/m²)

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr / pH
	1	12 11*					0.07 7.6
	2	-					
	4	18 19**		34	16	100	
	5	-					
	7	17					
	8	28					
	9	-					
	11	22 24**		36	19	78	
	12	-					

* Without gravel
** Microwave Determination



Scale 1:

Disturbed Samples: W – Groundwater; ● J – Jar, ● S – S.P.T., ● B – Bulk, ● M – Maxi

Undisturbed Samples: Soil Sample

Insitu Tests: V [30] – Vane shear strength in KN/m²; Groundwater first struck; Core Cutter Density; Core Cutter Density/C.B.R; Sandbottle Density; C B R; C or S SPT – ne or spoon; (25) – N value

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Consulting Engineers & Transportation Planners

Laboratory Testing by : Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT [redacted] No. 439
FIGURE B
Sheet 1 of 1

Sample		Compaction			Shear Strength									Consolidation								Notes
					Stress at Failure		Strain at Failure			C	Ø	Type of Shear Test	Initial		Pressure Range (kN/m²)							
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)								
0.60	B162	H	10.0	1940											m_v							
															c_v							
															k							
															e							
2.30	B869	S	15.0	1770											m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
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															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p. measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p. measurement
V = Vane Shear
S = Shear Box

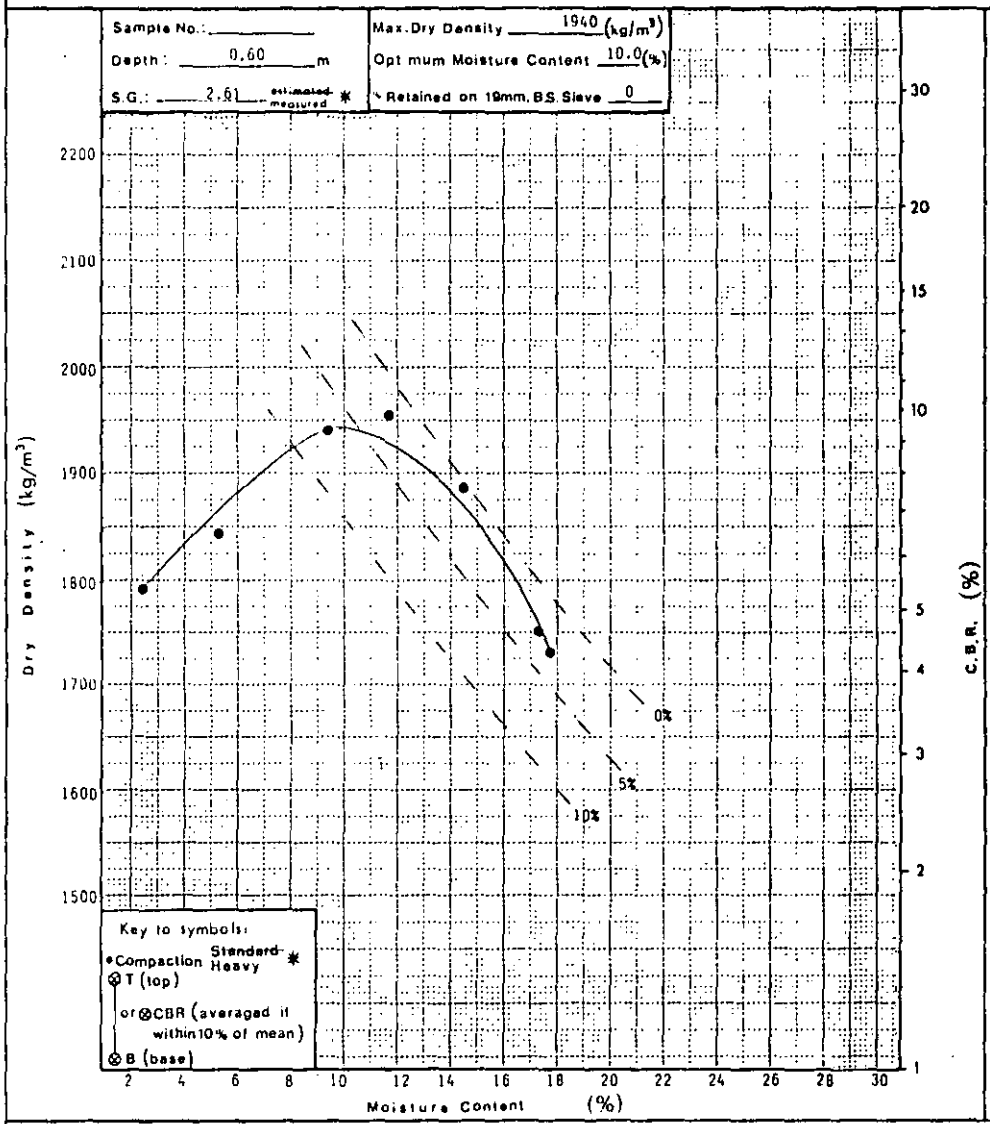
$m_v = m^2/MN$
$c_v = m^2/yr$
$k = m/s \times 10^{-9}$
e = void ratio at U 100% for each increment

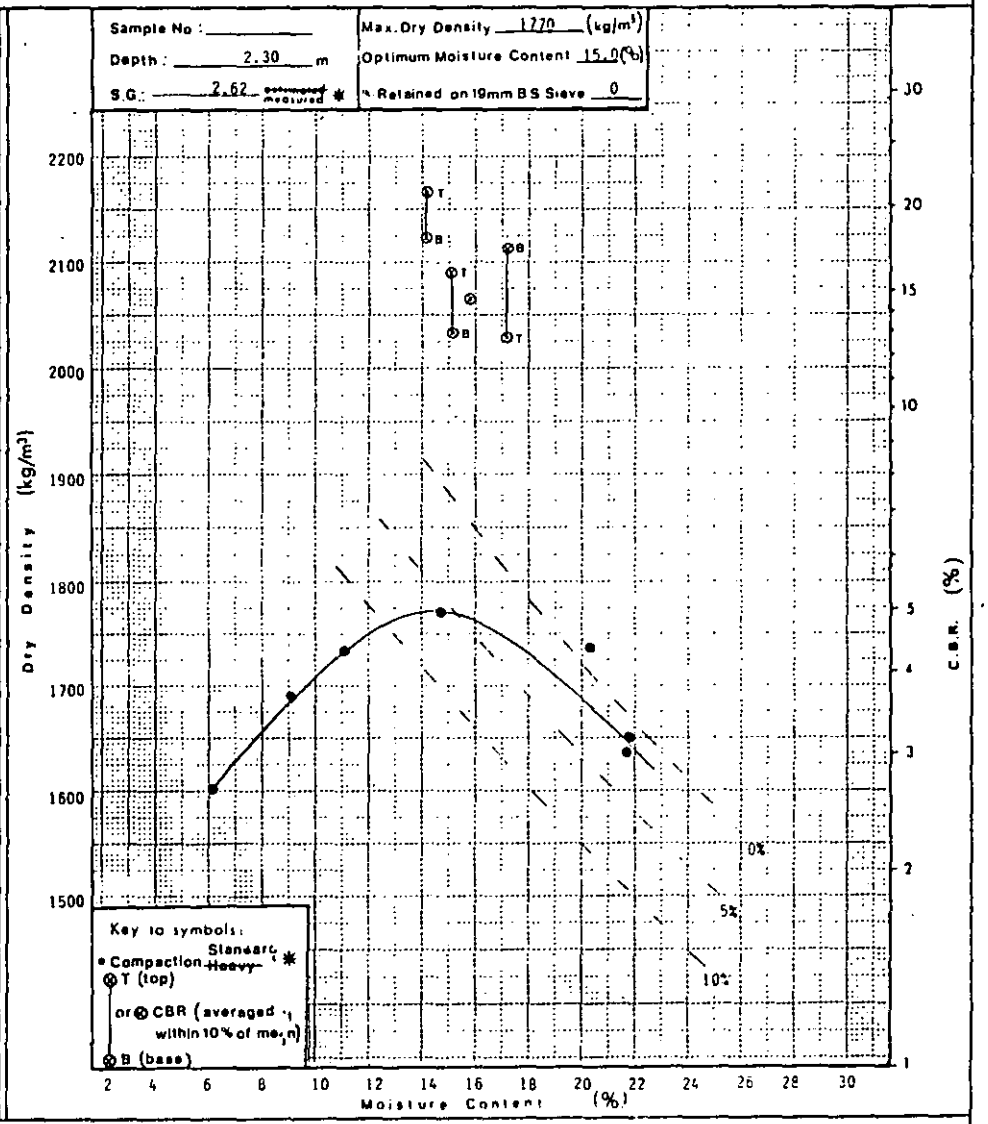
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Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT No. 439
FIGURE C
Sheet 1 of 1





* Delete as necessary

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT No 440

FIGURE A1

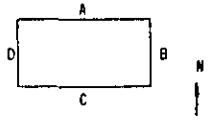
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: JCB 3C
Dates: 18.9.84
Hole Dimensions: 1.0m x 2.9m
Casing Dimensions: N/A

Coordinates: 66934.0 E.
95077.0 N.
Ground Level: 80.60 m O.D.

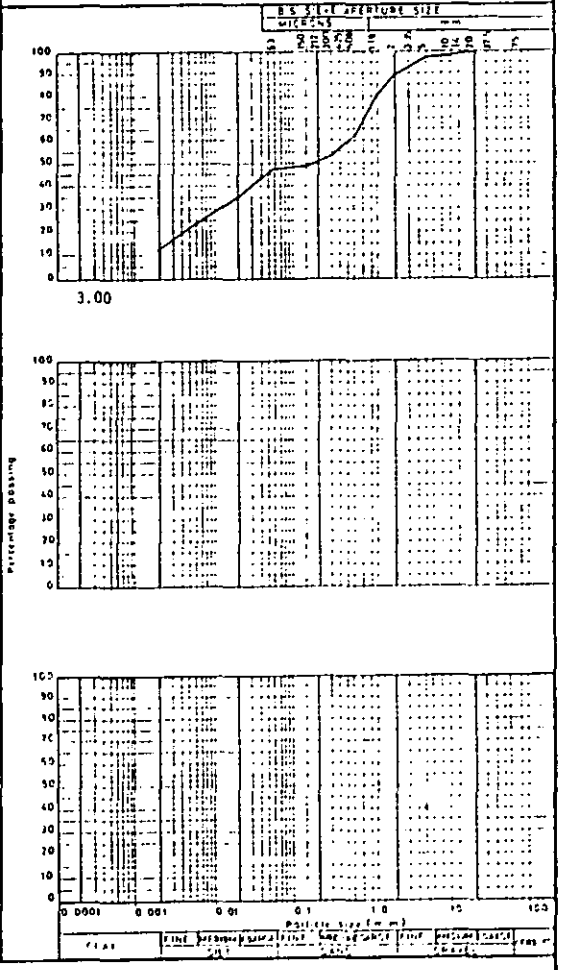
Laboratory testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test: Depth (m)	Type & Number	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata
18.9.84	-	-				0.30	80.30	Stubble over friable silty very sandy CLAY with gravel. (TOPSOIL)
			0.50	B1 J2				Stiff to very stiff fissured red-brown silty slightly sandy CLAY with occasional sub-angular fine to coarse gravel. (GLACIAL TILL)
						1.00	79.60	
			1.30	B3 J4				Stiff to very stiff fissured friable red-brown occasionally green-grey silty CLAY. (KEUPER MARL : ZONE IV). Becoming highly weathered laminated very weak very friable siltstone/mudstone with some friable clay matrix. (KEUPER MARL : ZONE III)
				B5 B6				
			2.50	J7				
18.9.84	-	Dry	3.00	B8 J9		3.00	77.60	
								Base of Pit.
								Pit sides stable.



Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
	1	12 12* 19**		33	15	100
	3	23				
	5	11 13**		32	15	100
	6	-				
	8	15				

* Without gravel
** Microwave Determination



Scale 1:

Disturbed Samples: W - Groundwater
● J - Jar ● S - S.P.T. ● B - Bulk ● M - Maxi

Undisturbed Samples: Soil Sample

Insitu Tests: V [30] - Vane shear strength in KN /m²
▼ Groundwater first struck
□ Core Cutter Density
■ Core Cutter Density/C.B.R
▽ Sandbottle Density
▲ C B R
C or S S.P.T. cone or spoon (25) - N value

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Laboratory Testing by : Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT [redacted] No. 440

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at Failure		Strain at Failure			C	Ø	Type of Shear Test	Initial		Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)							
1.30	B3	S	15.0	1725											m_v						
															c_v						
															k						
															e						
2.50	B	S	12.0	1915											m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
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															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

m_v = m^2 / MN
c_v = m^2 / yr
k = m/s $\times 10^{-8}$
e = void ratio at U 100% for each increment

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Consulting Engineers & Transportation Planners

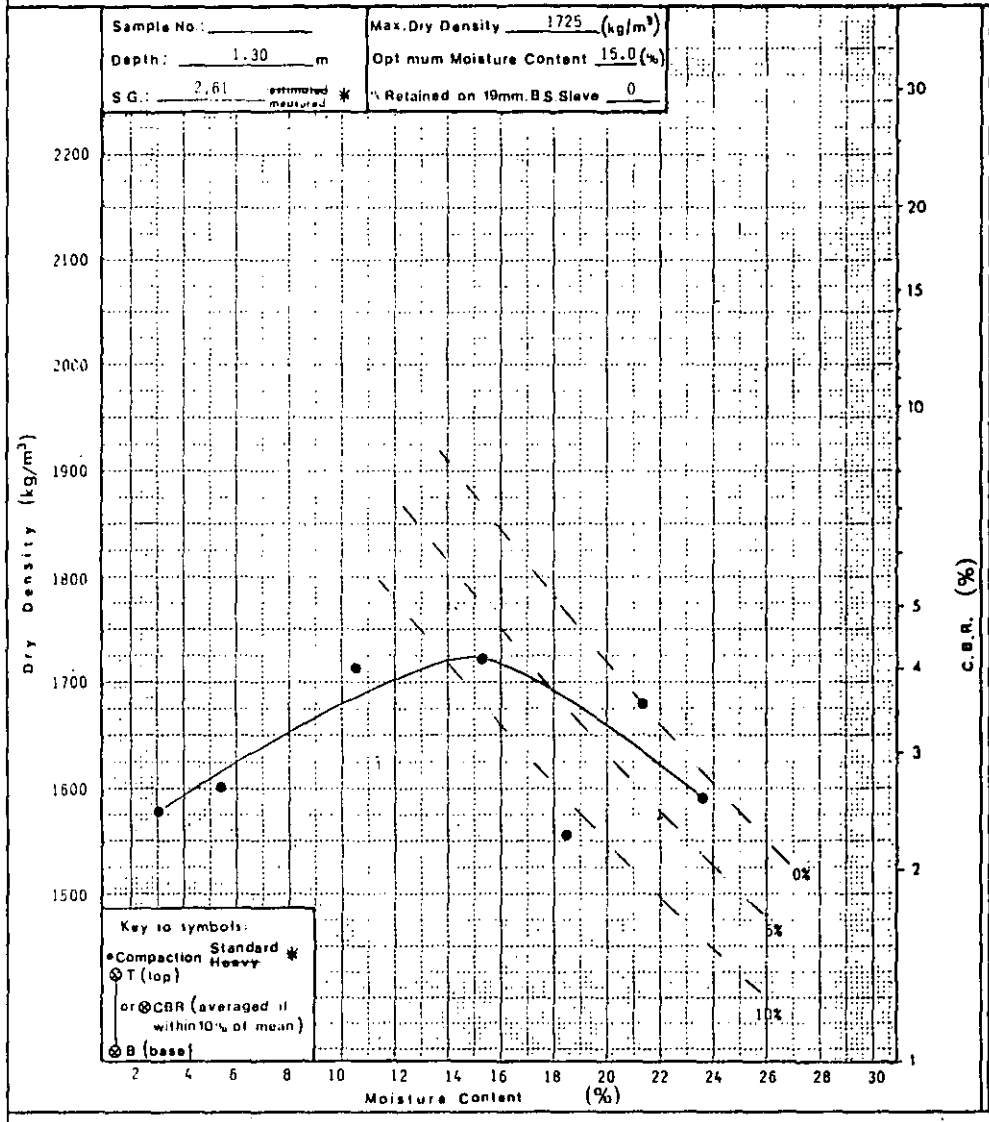
Laboratory Testing by: Exploration Associates (Warwick) Limited Dates:

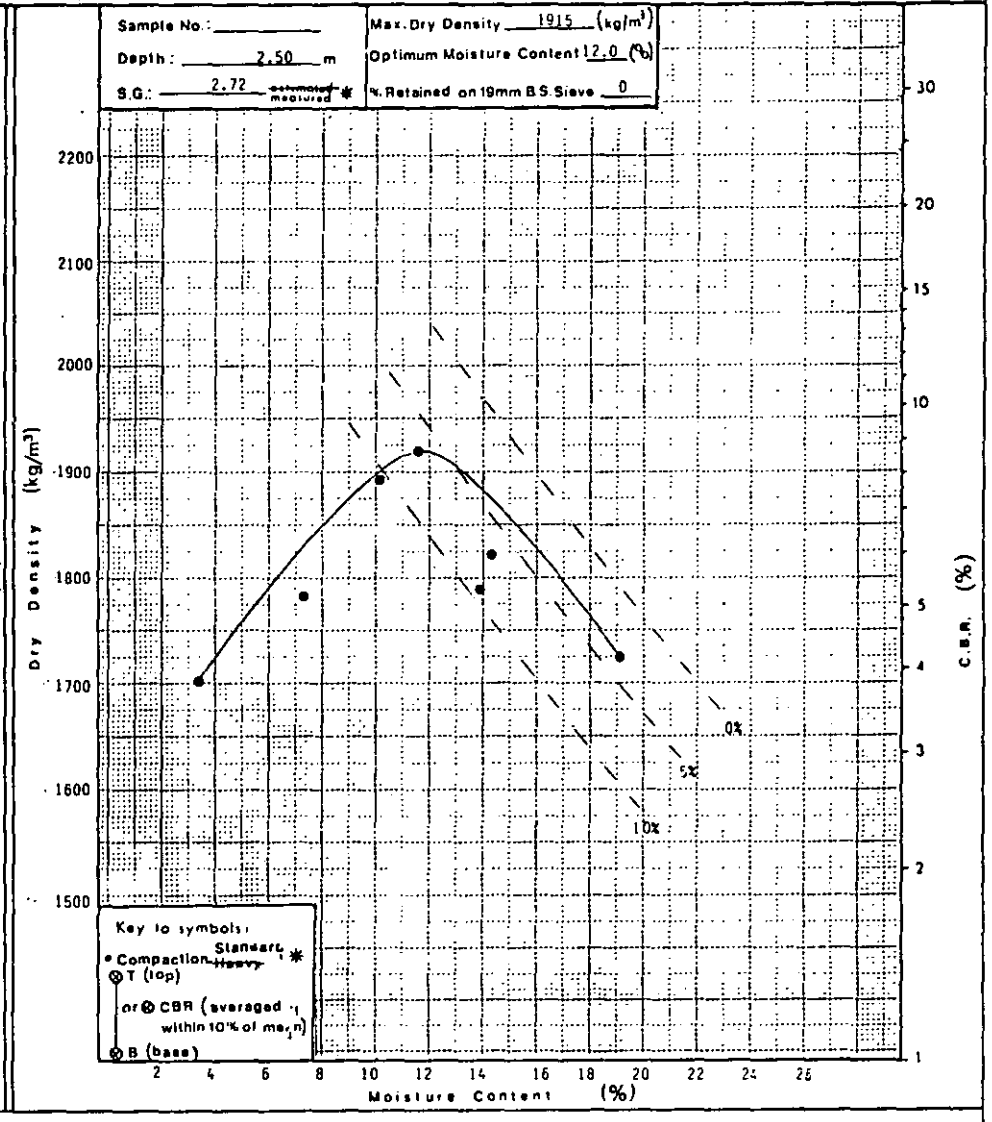
BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT No. 440

FIGURE C

Sheet 1 of 1





* Delete as necessary

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BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT No 441

FIGURE A1

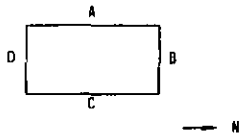
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: JCB 3C
Dates: 18.9.84
Hole Dimensions: 1.0m x 3.2m
Casing Dimensions: N/A

Coordinates: 67011.0 E.
94887.0 N.
Ground Level: 77.05 m O.D.

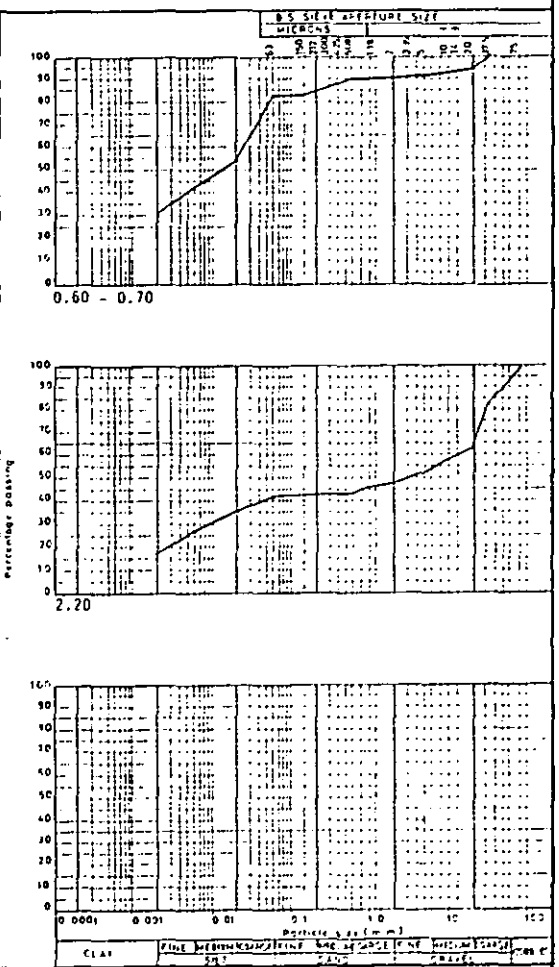
Laboratory testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata
18.9.84	-	-				0.25	76.80	Stubble over friable silty very sandy CLAY with some sub-rounded fine to coarse gravel. (TOPSOIL)
			0.6-0.7	B1, B2, J3		0.40	76.65	Firm to stiff brown silty very sandy CLAY with occasional sub-rounded fine to coarse gravel. (GLACIAL TILL)
						1.00	76.05	Stiff fissured red-brown and green-grey silty slightly sandy CLAY with occasional very weak siltstone lithorelicts. (KEUPER MARL : ZONE IV)
			1.20	B4, B5, J6				
				B7		2.00	75.05	Highly weathered poorly laminated red-brown and green-grey very weak SILTSTONE and MUDSTONE with some silty clay matrix (KEUPER MARL: ZONE III)
			2.20	B8, J9				Moderately becoming slightly weathered laminated red-brown and green-grey very weak to weak SILTSTONE silty clay matrix rare or absent. (KEUPER MARL : ZONE II/III)
				B10, B11				
18.9.84	-	Dry	3.20	J12		3.20	73.85	
								Base of Pit.
								Zone of red-brown slightly silty medium SAND with occasional gravel at 1.0 to 1.2 metres in face C at the northern end of the pit.
								Pit sides stable.



Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr pH
	1	19 17* 18**		45	21	89	0.07 7.8
	2	-					
	4	14		40	20	88	
	5	-					
	7	15 14**					
	8	-					
	10	13		28	18	100	
	11	-					

* Without gravel
** Microwave Determination



Scale 1:

Disturbed Samples : W – Groundwater
● J – Jar
● S – S.P.T.
● B – Bulk
● M – Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] – Vane shear strength in KN /m²

▼ Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C.B.R

Cor.S S.P.T. – no of spoon
(25/0) – N value

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Laboratory Testing by : Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT [redacted] No. 441

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation									Notes
					Stress at failure		Strain at Failure			C	Ø	Type of Shear Test	Initial		Pressure Range (kN/m²)							
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)								
0.60	B1+2	S	16.0	1775											m_v							
0.70															c_v							
															k							
															e							
2.20	B7+8	S	13.0	1865											m_v							
															c_v							
															k							
															e							
3.20	B	S	12.0	1850											m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
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															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S Standard
H B.S Heavy
M B.S Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

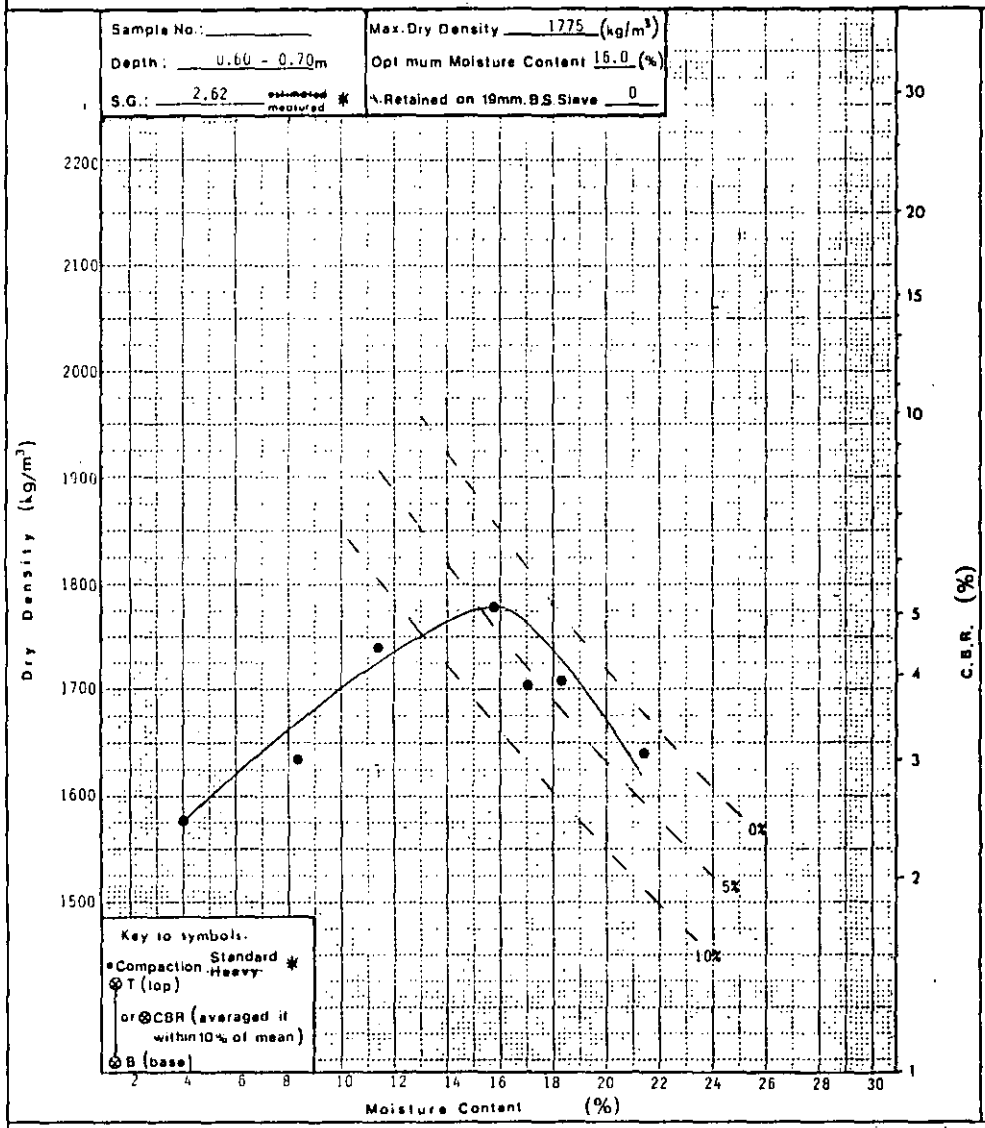
m_v = m^2/MN
c_v = m^2/yr
k = m/s x 10^{-8}
e = void ratio at U 100% for each increment

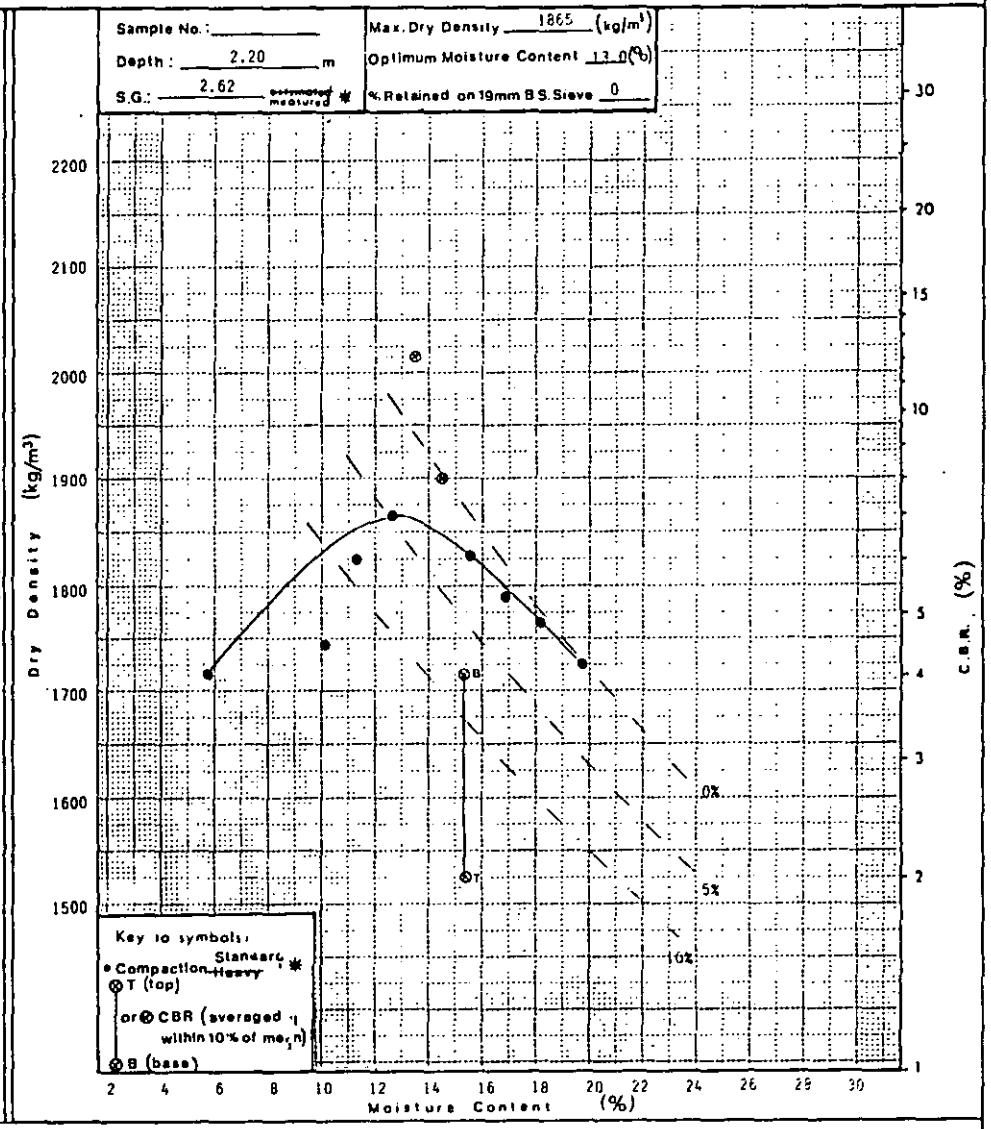
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Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT No. 441
FIGURE C
Sheet 1 of 2





* Delete as necessary

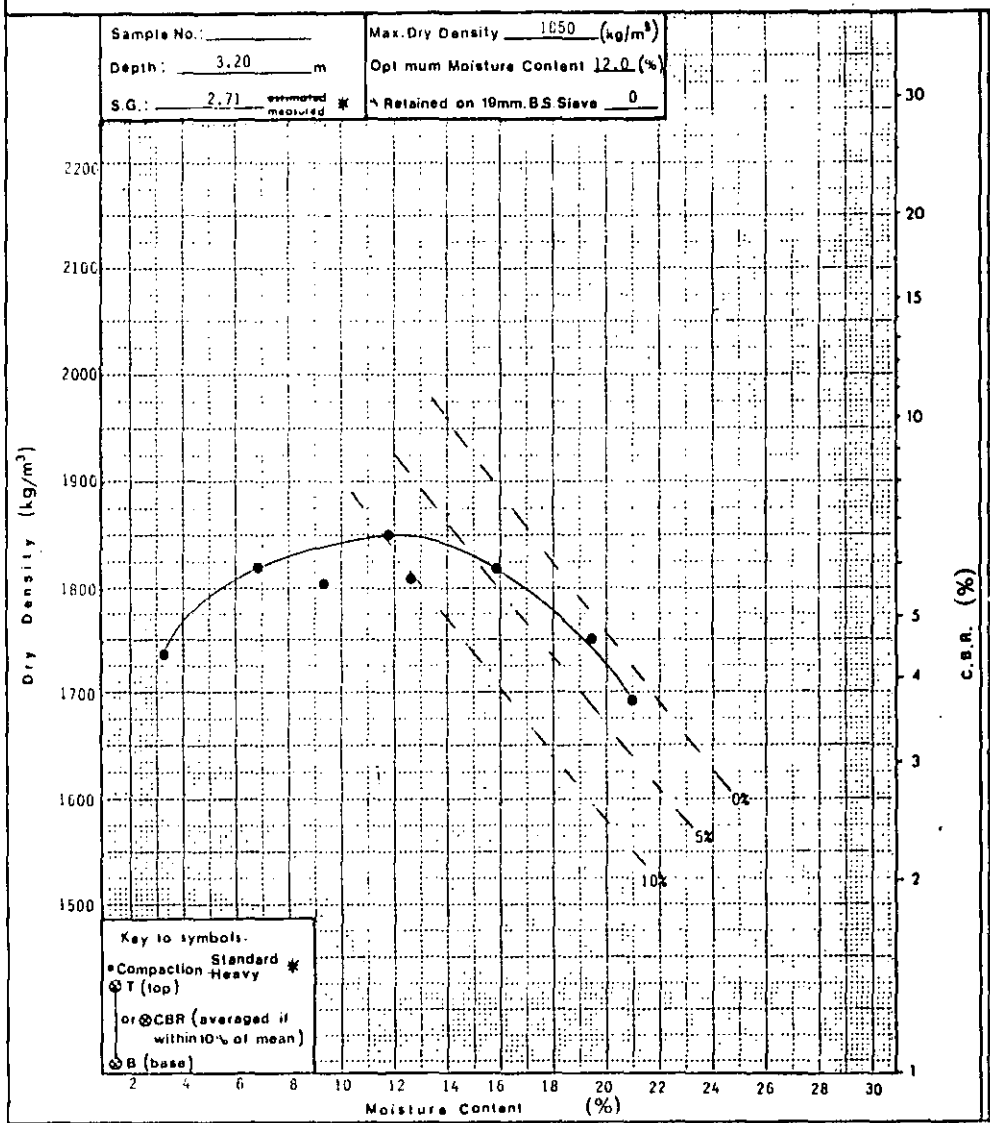
SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

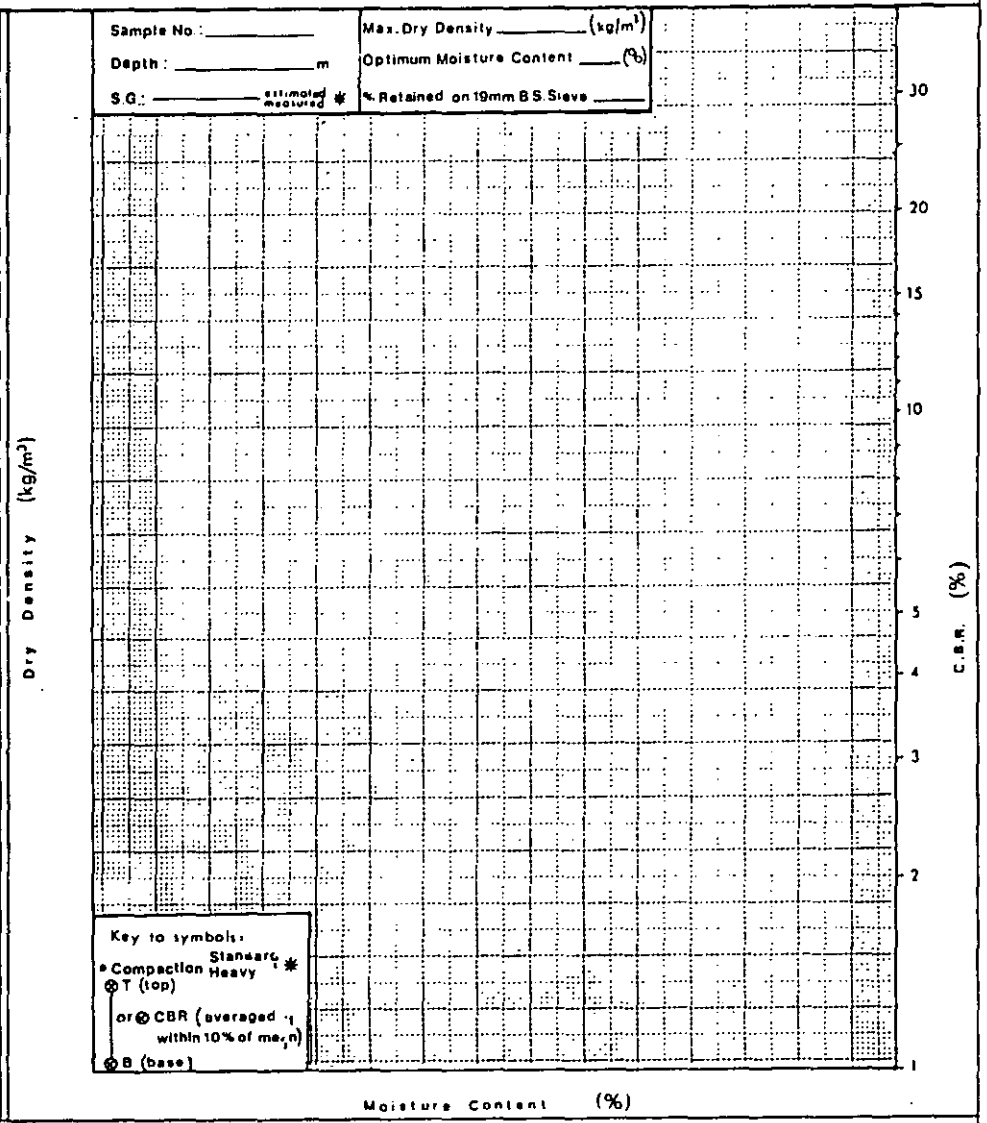
BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT No. 441
FIGURE C
Sheet 2 of 2

Sample No.:
Depth: 3.20 m
S.G.: 2.71 estimated / measured *
Max. Dry Density 1850 (kg/m³)
Optimum Moisture Content 12.0 (%)
% Retained on 19mm B.S. Sieve 0



Sample No.:
Depth: m
S.G.: estimated / measured *
Max. Dry Density (kg/m³)
Optimum Moisture Content (%)
% Retained on 19mm B.S. Sieve



* Delete as necessary

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT No 442

FIGURE A1

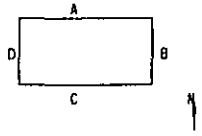
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: JCB 3C
Dates: 18.9.84
Hole Dimensions: 1.0m x 3.2m
Casing Dimensions: N/A

Coordinates: 67048.0 E.
94740.0 / N.
Ground Level: 77.96 m O.D.

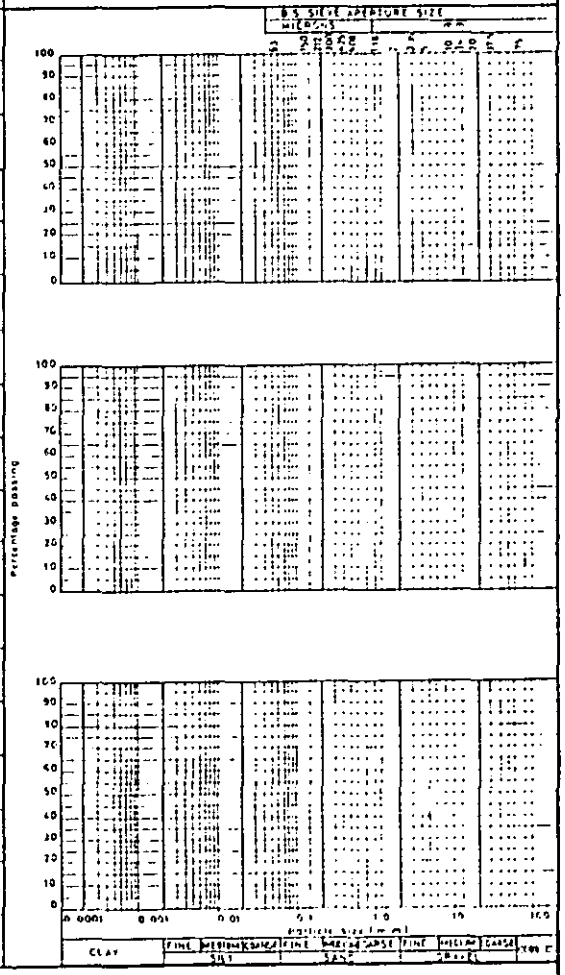
Laboratory testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test: Depth (m)	Sample/Insitu Test: Type & Number	Change of Strata: Legend	Change of Strata: Depth (m)	Change of Strata: Reduced Level	Description of Strata
18.9.84	-	-				0.25	77.71	Stubble over friable silty very sandy CLAY. (TOPSOIL)
			0.60	B1, B2, J3				Stiff to very stiff fissured brown and grey silty slightly sandy CLAY with rare (occasional sub-angular fine to medium gravel. (GLACIAL TILL). Very sandy in upper region. Increasing chalk and flint content below 0.6m
						1.20	76.76	
			1.7-1.8	B4, B5, J6				Stiff to very stiff grey and brown fissured silty sandy CLAY with sub-angular fine to coarse gravel, occasional cobble and boulders and rare coal fragments (GLACIAL TILL). Becoming predominantly red-brown below 2.0m
				B7, B8		2.80	75.16	
18.9.84	-	Dry	3.00	J9		3.00	74.96	Moderately to slightly weathered poorly laminated red-brown fine grained very weak SILTSTONE/MUDSTONE. (KEUPER MARL : ZONE II/III)
								Base of Pit.
								Pit sides stable.



Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr / pH
	1	25					0.06 / 7.7
	2	-					
	4	15 10* 15**		39	18	100	
	5	-					
	7	15					
	8	-					

* Without Gravel
** Microwave Determination



Scale 1:

Disturbed Samples: W - Groundwater; J - Jar, S - S.P.T., B - Bulk, M - Maxi

Undisturbed Samples: Soil Sample

Insitu Tests: V C30 - Vane shear strength in KN/m²; Groundwater first struck; Core Cutter Density; Core Cutter Density/C.B.R; Sandbottle Density; C B R; C or S SPT - type of spoon; (25) - N value

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Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT ~~BOREHOLE~~ ~~DRILLHOLE~~ No. 442

FIGURE B

Sheet 1 of 1

Sample		Compaction			Shear Strength									Consolidation								Notes
					Stress at Failure		Strain at Failure			C	Ø	Type of Shear Test	Initial			Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ'_3 (kN/m²)	$\frac{\sigma'_1 - \sigma'_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)								
0.60	B1+2	S	13.0	1800											m_v							
															c_v							
															k							
															e							
1.70 1.80	B	S	13.0	1835											m_v							
															c_v							
															k							
															e							
3.00	B7+8	H	12.0	1975											m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							
															m_v							
															c_v							
															k							
															e							

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
(UU) = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
$\overline{CU}$ = Consolidated Undrained
V = Vane Shear
S = Shear Box

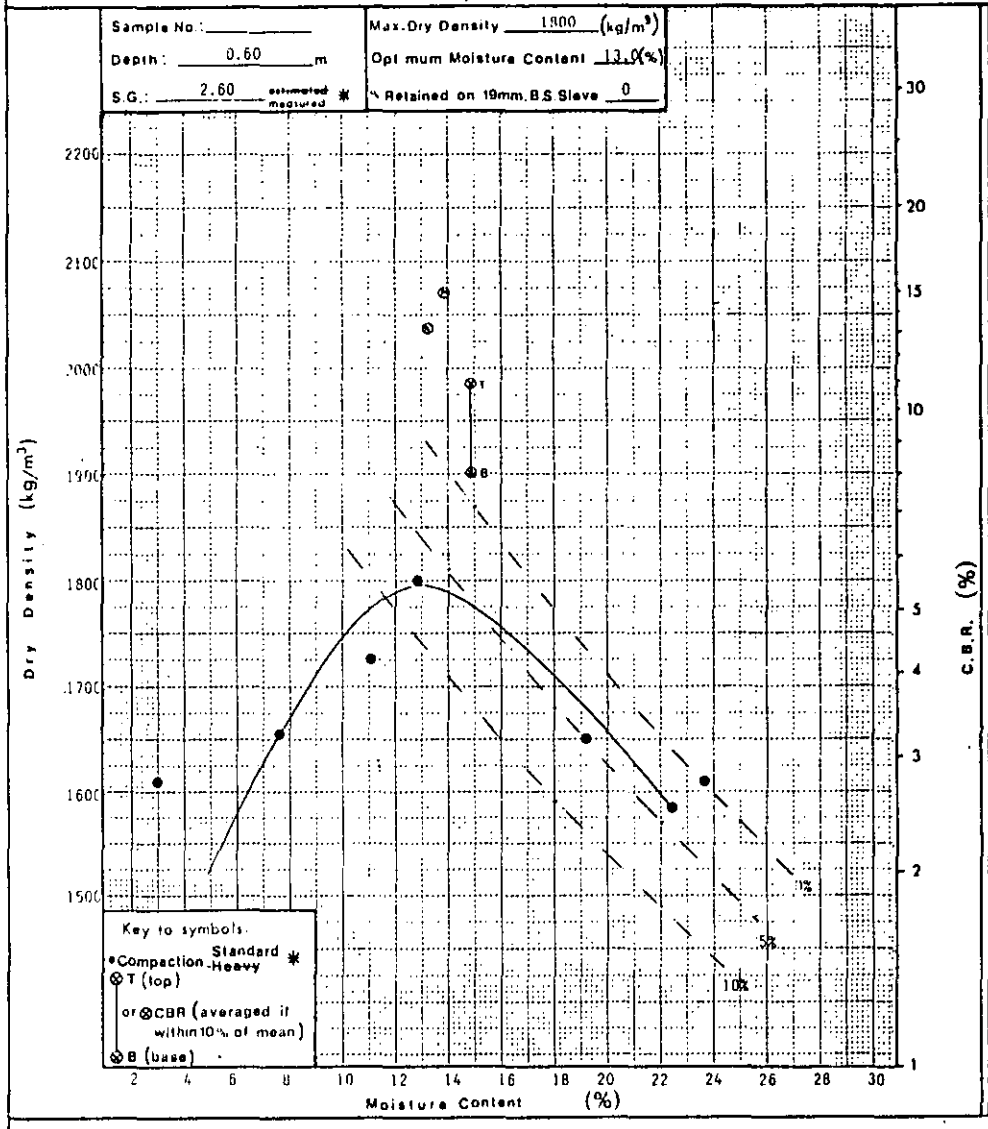
$m_v = m^2/MN$
$c_v = m^2/yr$
k = m/s x 10^{-8}
e = void ratio at U 100% for each increment

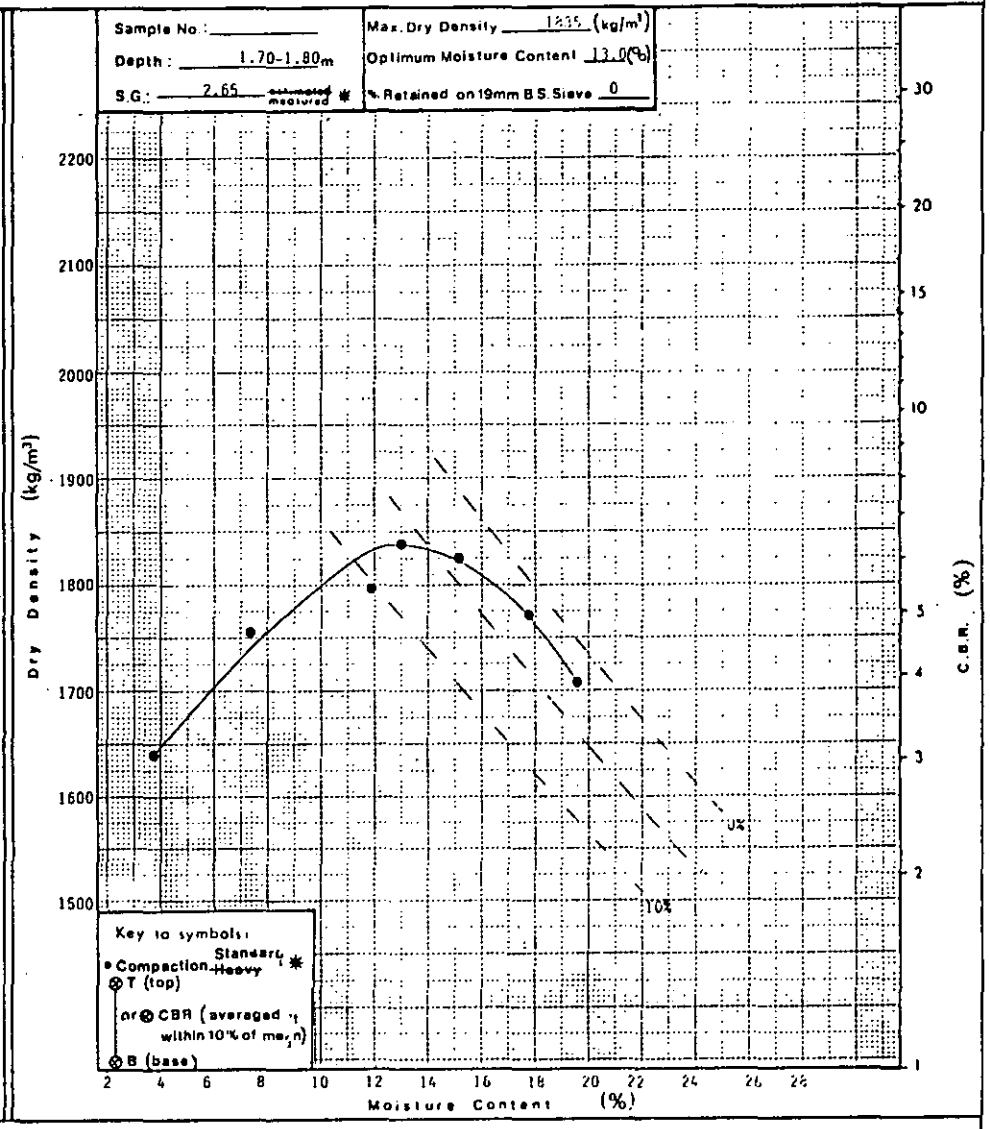
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Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT ~~EXPLORATORY~~ No. 442
FIGURE C
Sheet 1 of 2





* Delete as necessary

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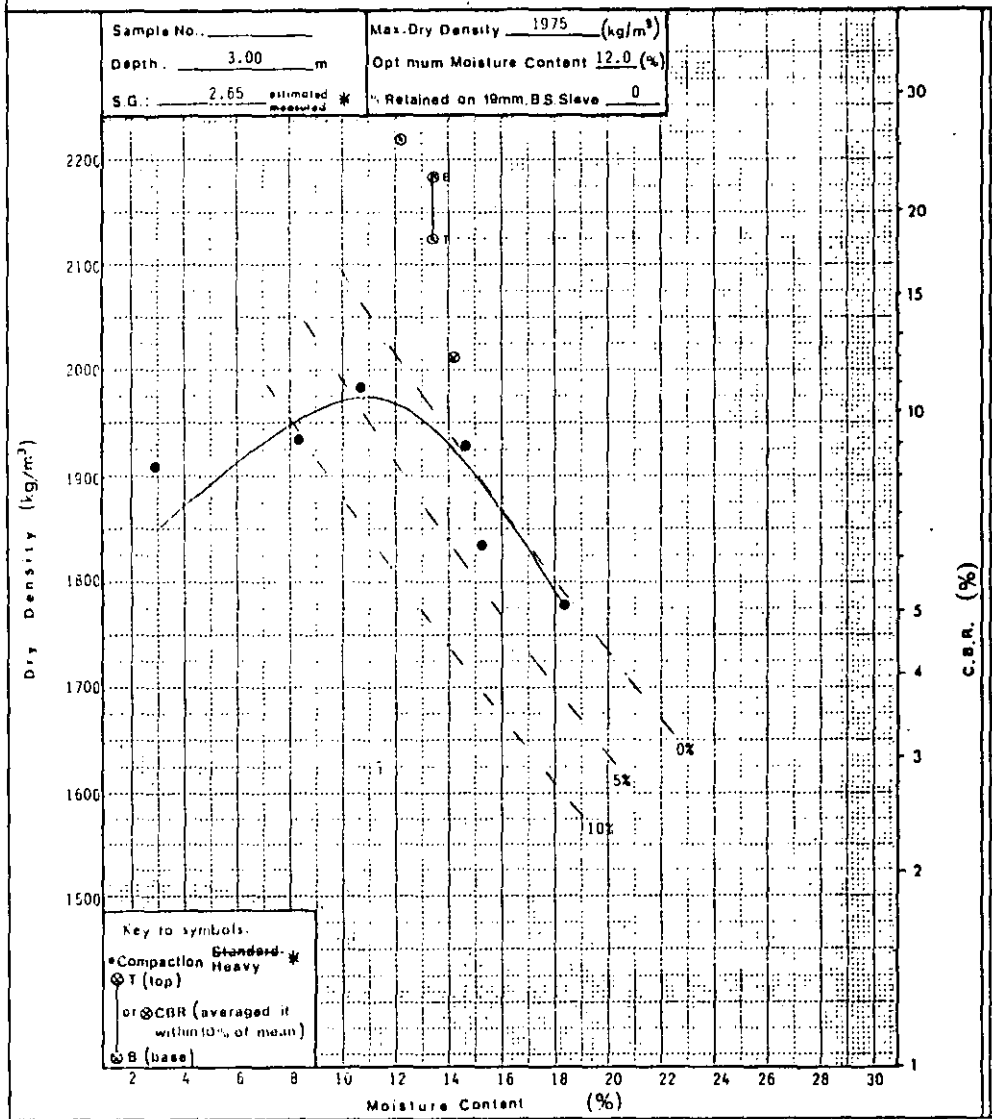
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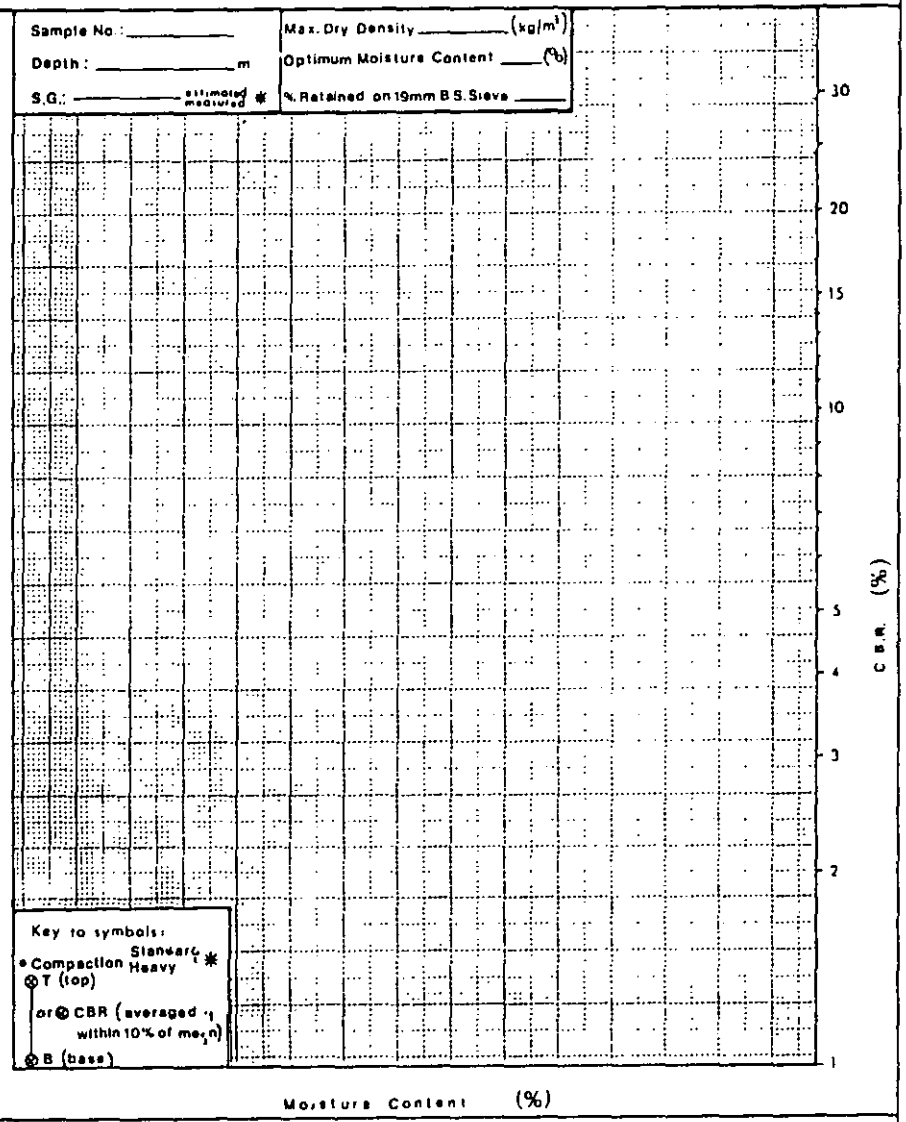
BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT No. 442

FIGURE C

Sheet 2 of 2





* Delete as necessary

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT No 443

FIGURE A1

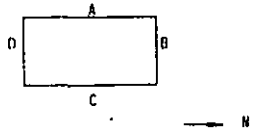
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: JCB 3C
Dates: 18.9.84
Hole Dimensions: 1.0m x 3.4m
Casing Dimensions: N/A

Coordinates: 66958.0 E.
94870.0 N.
Ground Level: 79.94 m O.D.

Laboratory Testing by: Dates:

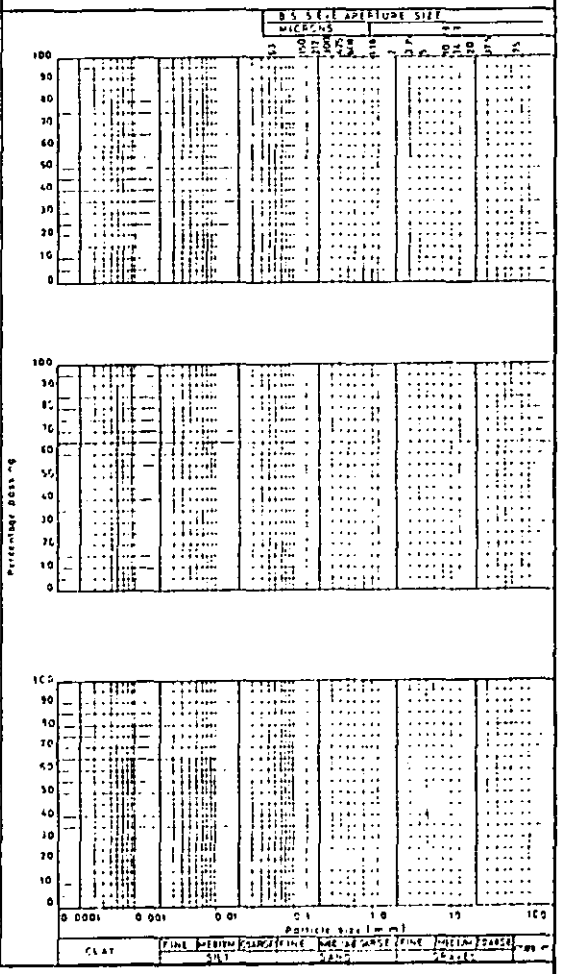
Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test: Depth (m)	Type & Number	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata
18.9.84	-	-				0.30	79.64	Friable silty very sandy CLAY. (TOPSOIL)
			0.60	● B1 ● J2				Very stiff and stiff fissured red-brown silty sandy CLAY with some sub-angular fine to coarse gravel of predominantly chalk and flint. (GLACIAL TILL). Slightly friable in parts. Gravel rare between 0.3 to 0.5m
						1.65	78.29	
			1.80	● B3 ● J4				Highly weathered red-brown occasionally green-grey fine grained very weak SILTSTONE and MUDSTONE with some friable silty sandy clay matrix. (KEUPER MARL : ZONE III).
			2.80	● B5 ● J6				
18.9.84	-	Dry				3.00	76.94	Base of Pit.



Pit sides stable

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
	1	18 15**		49	23	100
	3	15				
	5	19 18**		34	22	79

** Microwave Determination



Scale 1:

Disturbed Samples: W – Groundwater
● J – Jar ● S – S.P.T. ● B – Bulk ● M – Maxi

Undisturbed Samples: Soil Sample

Insitu Tests: V (30) – Vane shear strength in KN/m²
Groundwater first struck
□ Core Cutter Density
■ Core Cutter Density/C.B.R
▽ Sandbottle Density
▲ C.B.R
C or S – S.P.T. cone or spoon
f (25) – N value

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Laboratory Testing by: Exploration Associates (Warwick) Limited

Dates:

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT [redacted] No. 443

FIGURE 8

Sheet 1 of 1

Sample		Compaction			Shear Strength								Consolidation								Notes
					Stress at failure		Strain at failure			C	Ø	Type of Shear Test	Initial		Pressure Range (kN/m²)						
Depth (m)	Type & Number	Type of Test	Optimum Moisture Content (%)	Maximum Dry Density (kg/m³)	σ_3 (kN/m²)	$\frac{\sigma_1 - \sigma_3}{2}$ (kN/m²)	(%)	Moisture Content (%)	Dry Density (kg/m³)	C' (kN/m²)	Ø' (Degrees)		Moisture Content (%)	Dry Density (kg/m³)							
0.80	B1	S	14.0	1810											m_v						
															c_v						
															k						
															e						
1.80	B3	H	14.0	1925											m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						
															m_v						
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															m_v						
															c_v						
															k						
															e						
															m_v						
															c_v						
															k						
															e						

For Sample Type see Sheet A

S B.S. Standard
H B.S. Heavy
M B.S. Heavy Mod

UU = Unconsolidated Undrained
$\overline{UU}$ = Ditto, with p.w.p measurement
CD = Consolidated Drained
$\overline{CD}$ = Ditto, with p.w.p measurement
CU = Consolidated Undrained
$\overline{CU}$ = Ditto, with p.w.p measurement
V = Vane Shear
S = Shear Box

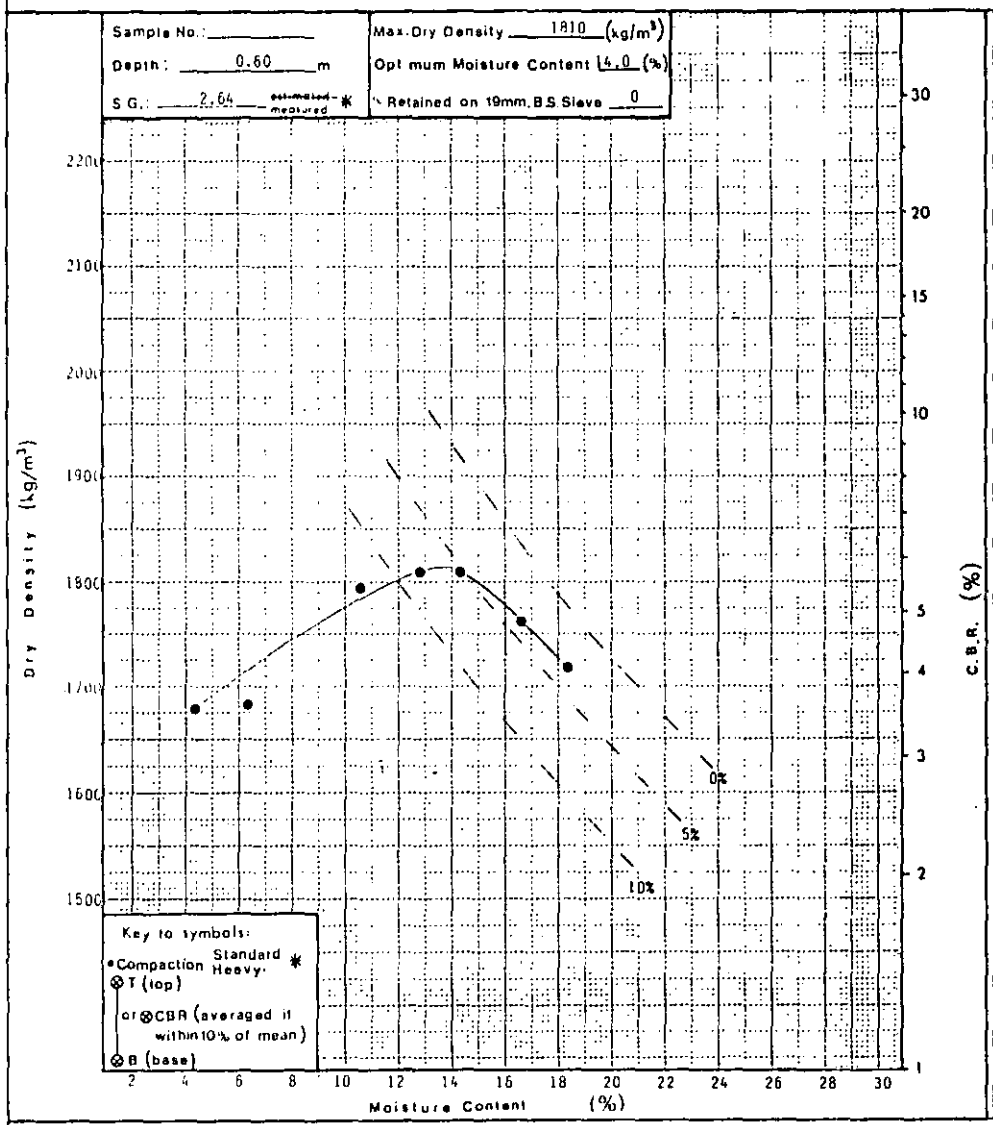
m_v = m^2 / MN
c_v = m^2 / yr
k = $m/s \times 10^{-8}$
e = void ratio at U 100% for each increment

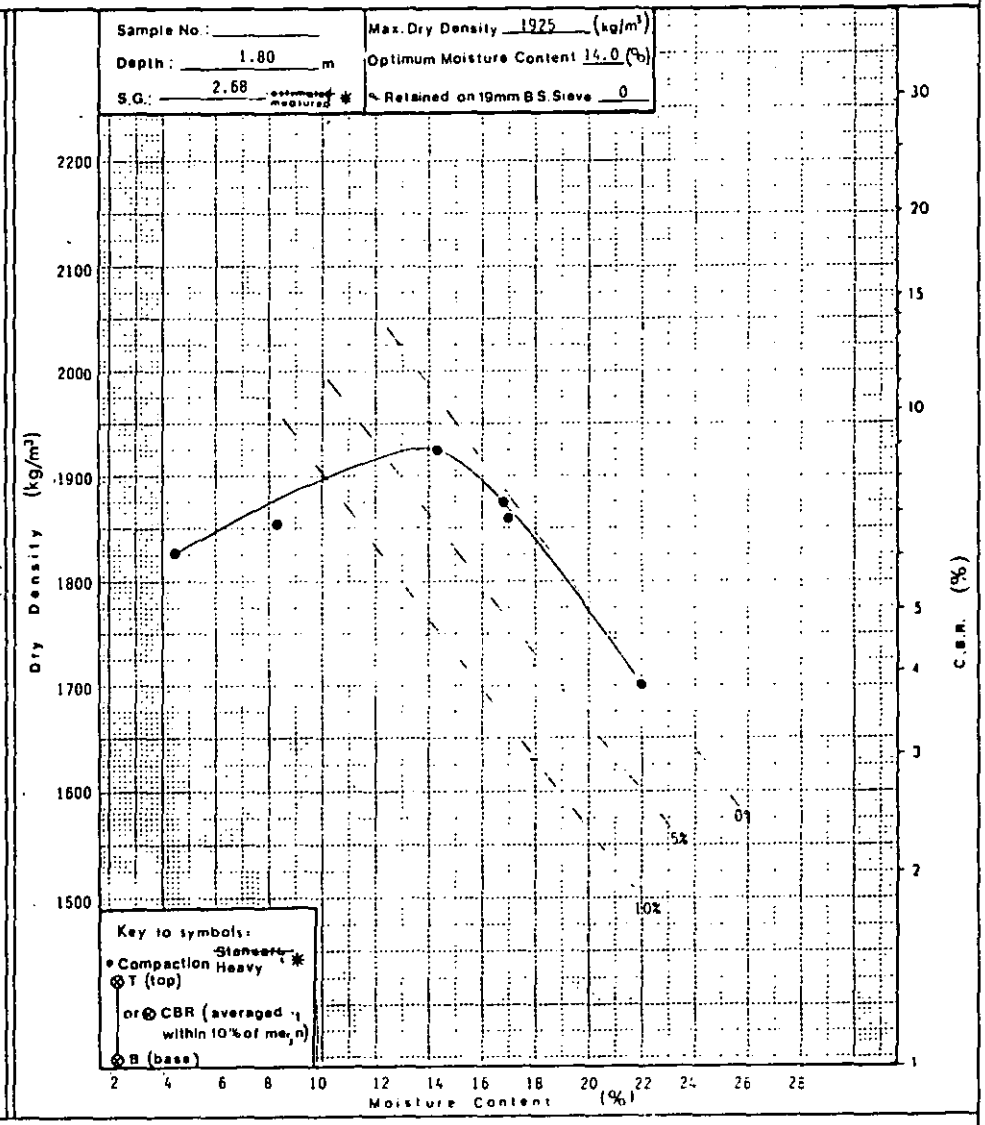
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Laboratory Testing by: Exploration Associates (Warwick) Limited
Dates:

BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT No. 443
FIGURE C
Sheet 1 of 1





* Delete as necessary

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT No 444

FIGURE A1

Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: JCB 3C
Dates: 20.9.84
Hole Dimensions: 1.0m x 3.0m
Casing Dimensions: N/A

Coordinates: 67294.0 E.
95440.0 N.
Ground Level: 68.26 m O.D.

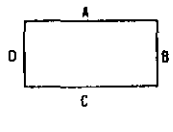
Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu test Depth (m)	Sample/Insitu test Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata
20.9.84	-	-				0.20	68.06	Grass over friable silty very sandy CLAY (TOPSOIL)
			0.45	B1 B2 J3				Stiff fissured red-brown silty CLAY with rootlets and some infilling of fissures with silt and sand (GLACIAL TILL)
						0.70	67.56	
		▼ Slight seepage	1.00	B4 B5 J6		1.20	67.06	Soft to firm becoming firm grey-brown mottled red-brown silty slightly sandy CLAY with some decayed rootlets (GLACIAL TILL). Fissured in parts. Band of yellow-brown very clayey fine to medium SAND/very sandy CLAY between 1.05m and 1.2m
			1.50	B7 B8 J9				
				B10		1.70	66.56	Soft to firm and firm red-brown silty sandy CLAY with some sub-angular fine to medium gravel. (GLACIAL TILL)
		* 2.25	2.10	B11 J12				
		2.50 ▼ Rapid ingress		B13 B15				
20.9.84	-		2.50	W16		2.50	65.76	Firm to stiff and firm red-brown and green-grey silty CLAY with many siltstone lithorelicts. (KEUPER MARL : ZONE IV) Tending to very weak/weak SILTSTONE with some clay matrix towards base.
						2.60	65.66	Slightly weathered green-grey fine grained weak to moderately weak SILTSTONE (KEUPER MARL : ZONE I/II)

Base of Pit.

Pit sides stable.

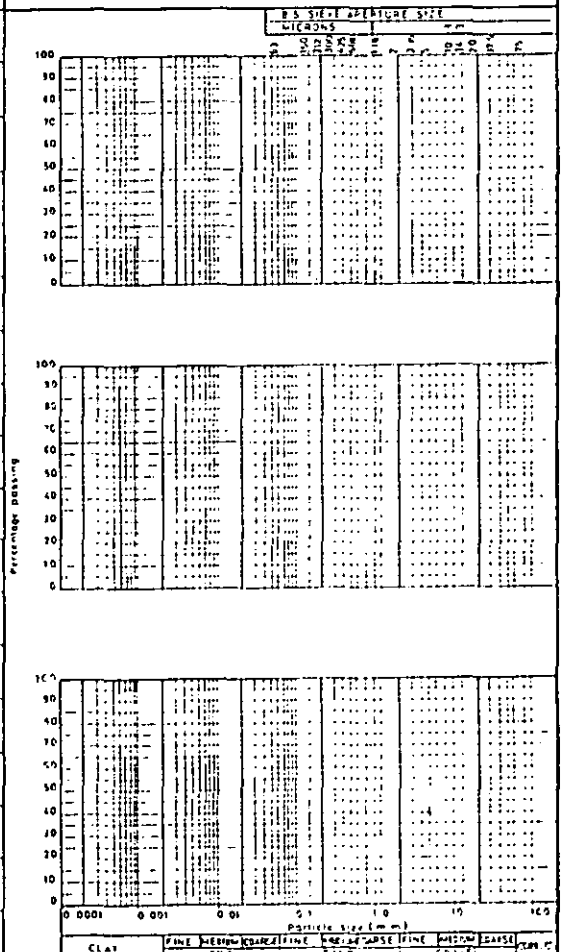
* Water struck at 2.5m, rose to 2.25m in 5 minutes.



0.70	Cv =	100/106
1.00	Cv =	46/46/44
	Cp =	50/30/30
1.50	Cv =	36/36/40
	Cp =	50/40/40

Cv = Hand Vane Shear Strength (kN/m²)
Cp = Hand Penetrometer Shear Strength (kN/m²)

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/litre	pH
	1	20						
	2	-						
	4	19						
	5	-						
	7	20						
	8	-						
	10	21						
	11	-						
	16	-					0.13	8.0



Scale 1:

Disturbed Samples: W – Groundwater; ●J – Jar, ●S – S.P.T., ●B – Bulk, ●M – Maxi

Undisturbed Samples: Soil Sample

Insitu Tests: V (30) – Vane shear strength in KN/m²; ▼ Groundwater first struck; □ Core Cutter Density; ■ Core Cutter Density/C.B.R; ▽ Sandbottle Density; ▲ C.B.R; Cor.S S.P.T. – ne or spoon; (25) – N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH.
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT No 445

FIGURE A1

Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: JCB 3C
Dates: 20.9.94
Hole Dimensions: 1.0m x 4.0m
Casing Dimensions: N/A

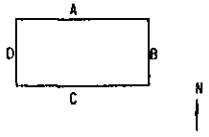
Coordinates: 67297.0 E.
95475.0 N.
Ground Level: 68.28 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to water (m)	Sample/Insitu Test: Depth (m)	Sample/Insitu Test: Type & Number	Change of Strata: Legend	Change of Strata: Depth (m)	Change of Strata: Reduced Level	Description of Strata
20.9.94	-	-				0.20	68.08	Grass over friable sandy CLAY. (TOPSOIL)
				B1				Stiff fissured red-brown silty sandy CLAY.
			0.60	B2				(GLACIAL TILL)
				J3		0.70	67.58	
						0.90	67.38	Firm to stiff grey-brown silty very sandy CLAY with some sub-angular fine to coarse gravel.(GLACIAL TILL)
				B4				
			1.20	B5				Stiff and firm to stiff fissured red-brown occasionally green-grey silty CLAY with rare very weak siltstone/mudstone lithorelicts (KEUPER MARL : ZONE IV)
				J6		1.60	66.68	
				B7				
			1.80	B8				Very weak siltstone lithorelicts in a matrix of soft to firm silty CLAY. (KEUPER MARL : ZONE IV)
				J9				
		2.30 ▼ slight seepage		B10		2.30	65.98	
20.9.94	-		2.50	B11				Slightly weathered laminated/thinly bedded green-grey occasionally red-brown weak SILTSTONE with some minor silty clay matrix. (KEUPER MARL : ZONE II).
				J12		2.50	65.78	

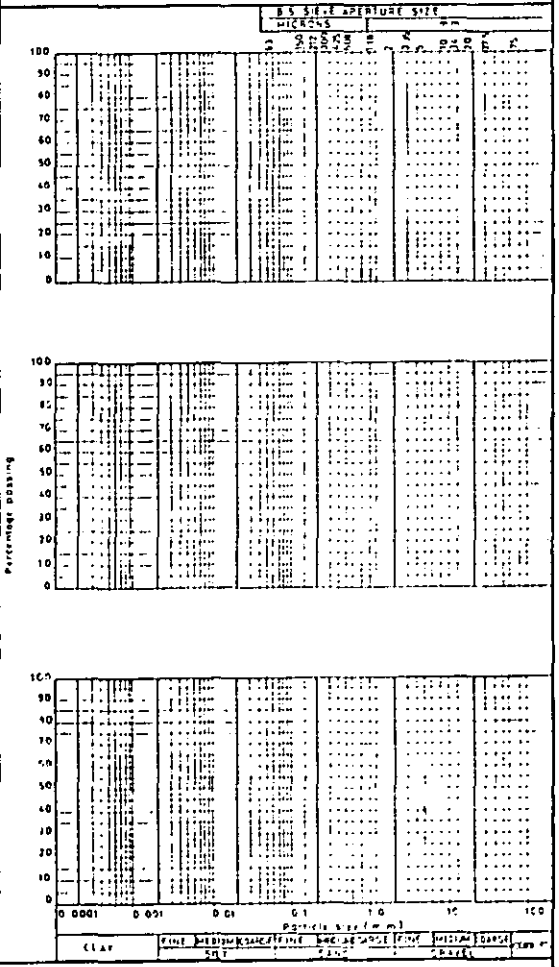
Base of Pit.

Pit sides stable.



1.00	Cv	78/72/90	Cv = Hand Vane Shear Strength (kN/m²)
	Cp	90/100	Cp = Hand Penetrometer Shear Stength (kN/m²)

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	
	1	16					
	2	-					
	4	20		36	17	89	
	5	-					



Scale 1:

Disturbed Samples: W = Groundwater; ● J = Jar, ● S = S.P.T., ● B = Bulk, ● M = Mazi

Undisturbed Samples: Soil Sample

Insitu Tests: V [30] = Vane shear strength in KN/m²; ▼ Groundwater first struck; □ Core Cutter Density; ■ Core Cutter Density/C.B.R; ▽ Sandbottle Density; ▲ C B R; C or S S.P.T. cone or spoon; (42/5) = N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT No 446

FIGURE A1

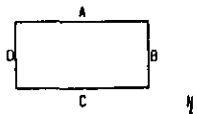
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: JCB 3C
Dates: 20.9.84
Hole Dimensions: 1.0m x 3.4m
Casing Dimensions: N/A

Coordinates: 67290.0 E.
95407.0 N.
Ground Level: 68.20 m O.D.

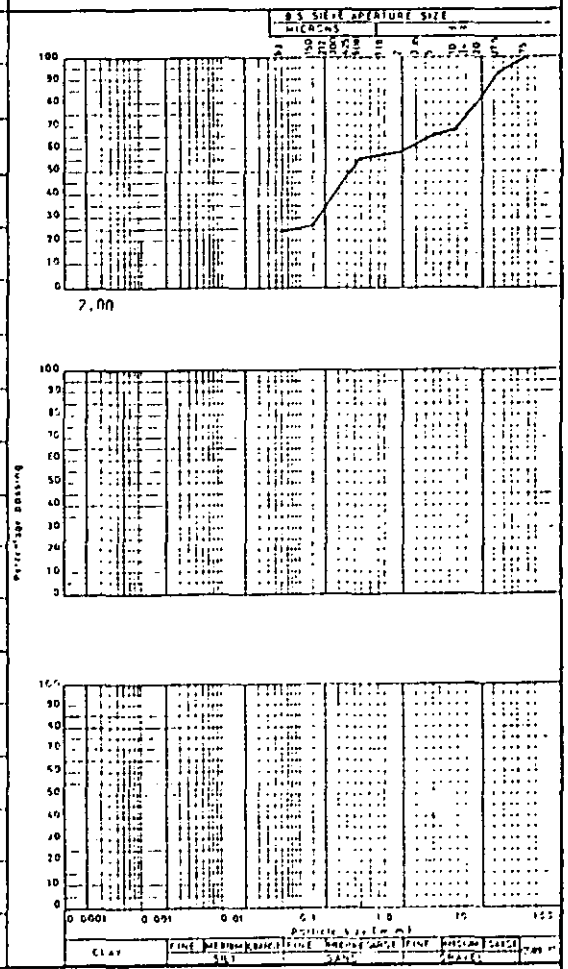
Laboratory testing by: Dates:

Date	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Type & Number	Legend	Change of Strata Depth (m)	Reduced Level	Description of Strata
20.9.84	-	-				0.20	68.00	Grass over friable silty sandy CLAY (TOPSOIL)
			0.45	B1 J2				Stiff fissured red-brown silty CLAY. (GLACIAL TILL)
						1.00	67.20	
			1.20	B3 J4				Firm fissured grey, brown and red-brown silty CLAY. (GLACIAL TILL)
						1.60	66.60	
			2.00	B5 J6				Brown slightly clayey medium to coarse SAND and sub-angular to sub-rounded medium to coarse GRAVEL. (FLUVIO GLACIAL SAND AND GRAVEL)
						2.20	66.00	
			2.80	B7 J8				Firm and firm to stiff fissured red-brown silty CLAY with many siltstone lithorelicts. (KEUPER MARL : ZONE IV)
						3.00	65.20	
20.9.84	-	Dry	3.50	B9 J10		3.50	64.70	Slightly weathered laminated/thinly bedded green-grey occasionally red-brown weak to moderately weak SILTSTONE with some silty clay matrix. (KEUPER MARL : ZONE II/III)
								Base of Pit.
								Very slight groundwater seepage at 3.50m
								Pit sides stable.
			1.20	Cv =		40/52/50/48		
				Cp =		60/70/80		
			2.00	Cv =		62/70		



Cv = Hand Vane Shear Strength (kN/m²)
Cp = Hand Penetrometer Shear Strength (kN/m²)

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
	1	24	-	52	26	100
	3	31				
	5	18				
	7	20				



Scale 1:

Disturbed Samples: W = Groundwater; J = Jar, S = S.P.T., B = Bulk, M = Maxi

Undisturbed Samples: Soil Sample

Insitu Tests: V [30] = Vane shear strength in KN/m²; Groundwater first struck; Core Cutter Density; Core Cutter Density/C.B.R; Sandbottle Density; C B R; C or S = SPT cone or spoon; (35) = N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT No 447

FIGURE A1

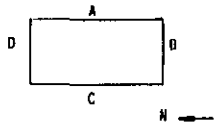
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: JCB 3C
Dates: 20.9.84
Hole Dimensions: 1.0m x 3.0m
Casing Dimensions: N/A

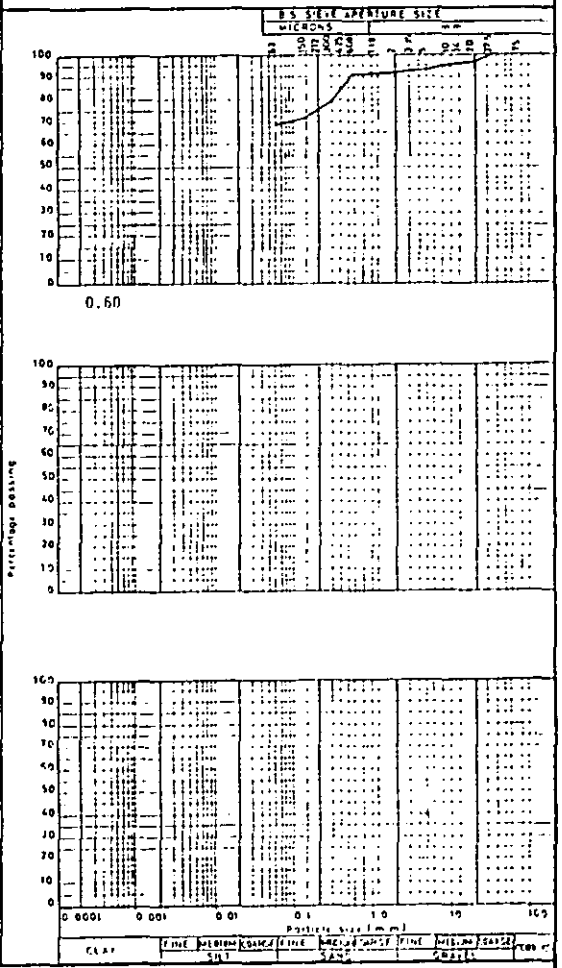
Coordinates: 67341.0 E.
95447.0 N.
Ground Level: 65.51 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	%passing 425 microns
20.9.84	-	-				0.30	65.21	Grass over friable silty very sandy CLAY (TOPSOIL)		1	10		29	14	100
			0.60	B1 J2		1.10	64.41	Stiff fissured friable red-brown silty sandy CLAY with sub-angular fine to medium occasionally coarse gravel and some pockets of sand. (GLACIAL TILL). Band of red-brown medium SAND and sub-rounded fine to medium GRAVEL at 0.85 to 1.0m.		3	15		32	16	100
			1.30	B3 J4		1.90	63.61	Stiff and firm to stiff fissured silty CLAY with many very weak siltstone lithorelicts and occasional lenses of green-grey weak to moderately weak siltstone. (KEUPER MARL : ZONE IV)		5	22 21*				
		▼	2.30	B5 J6				Red-brown occasionally green-grey very weak siltstone lithorelicts in a soft to firm friable silty clay matrix. Matrix becoming sparse with depth and tending to very weak laminated SILTSTONE.							
20.9.84	-	-	3.00	B7 J8		3.00	62.51	(KEUPER MARL : ZONE IV/III)							
								Base of Pit.							
								Strata moist below 2.5m							
								Seepage at 2.20 - 2.30m							
								Pit sides stable.							
			1.30	Cp = 150/155				Cp = Hand Penetrometer Shear Strength (kN/m²)							



* Without gravel



Scale 1:

Disturbed Samples: W - Groundwater; J - Jar, S - S.P.T., B - Bulk, M - Maxi

Undisturbed Samples: U4 Soil Sample

Insitu Tests: V [30] - Vane shear strength in KN/m²; ▼ Groundwater first struck; □ Core Cutter Density; ■ Core Cutter Density/C.B.R; ▽ Sandbottle Density; ▲ C B R; C or S SPT cone or spoon; (35) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT No 448

FIGURE A1

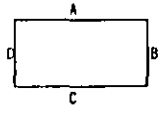
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: JCB 3C
Dates: 20.9.84
Hole Dimensions: 1.0m x 3.0m
Casing Dimensions: N/A

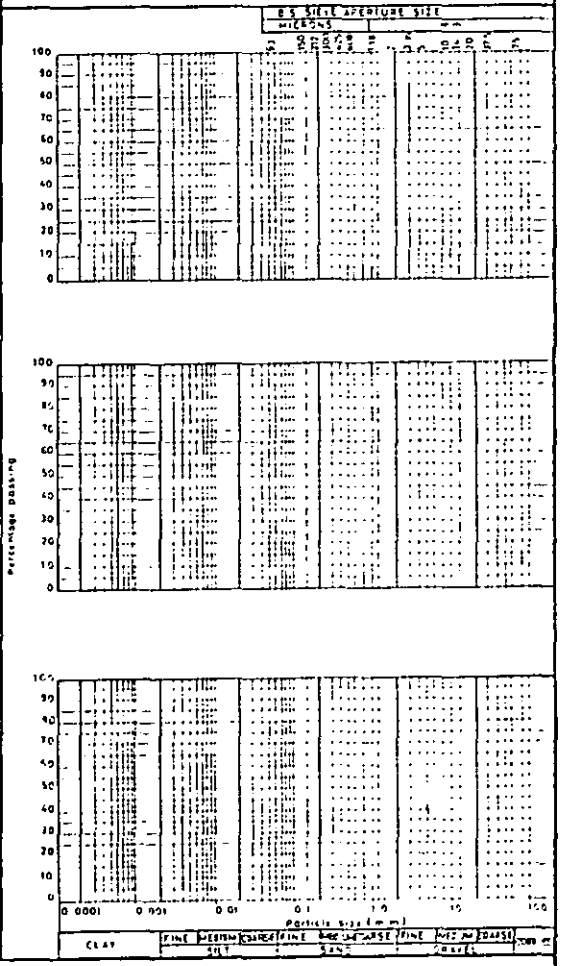
Coordinates: 67366.0 E.
95467.0 N.
Ground Level: 64.27 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Type & Number	Legend	Change of Strata Depth (m)	Reduced Level	Description of Strata
20.9.84	-	-				0.20	64.07	Grass over friable silty sandy CLAY (TOPSOIL)
			0.70	B1 J2				Stiff fissured red-brown silty slightly sandy CLAY with occasional sub-angular fine to coarse gravel. (GLACIAL TILL). Becoming very sandy toward base with some sub-angular cobbles and boulders of siltstone.
						1.20	63.07	
			1.50	B3 J4				Stiff and firm to stiff fissured friable green-grey and red-brown silty CLAY with many siltstone lithorelicts (KEUPER MARL : ZONE IV). Some tree roots present in upper regions.
						1.75	62.52	
		2.00 ▼ slight seepage	2.20	B5 J6				Moderately becoming slightly weathered poorly laminated red-brown and green-grey friable very weak SILTSTONE with some clay matrix and lenses of moderately weak green-grey siltstone below 2.5m (KEUPER MARL : ZONE III)
		Heavy seepage ▼ 3.10	3.10	B7 J8		3.10	61.17	
20.9.84	-	-				3.30	60.97	Slightly weathered laminated/thinly bedded green-grey weak to moderately weak SILTSTONE with occasional silty clay zones. (KEUPER MARL : ZONE II)
								Base of Pit.
								Heavy seepage at 3.10m
								Ponding occured in base after 2 mins.
								Pit sides stable.
			0.70	Cv = 90/94/94				Cv = Hand Vane Shear Strength (kN/m²)
				Cp = 150/160				Cp = Hand Penetrometer Shear Strength (kN/m²)



Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
	1	16				
	3	20				



Scale 1:

Disturbed Samples : w - Groundwater
● J - Jar ● S - S.P.T. ● B - Bulk ● M - Mazi

Undisturbed Samples : Soil Sample

Insitu Tests : V (30) - Vane shear strength in KN /m²

▼ Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C.B.R

(Cor.) S.P.T. - ne or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT No 460

FIGURE A1

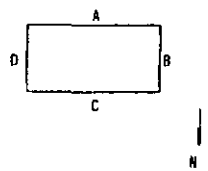
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: JCB 3C
Dates: 19.9.84
Hole Dimensions: 1.0m x 2.8m
Casing Dimensions: N/A

Coordinates: 66555.0 E.
94097.0 N.
Ground Level: 49.20 m O.D.

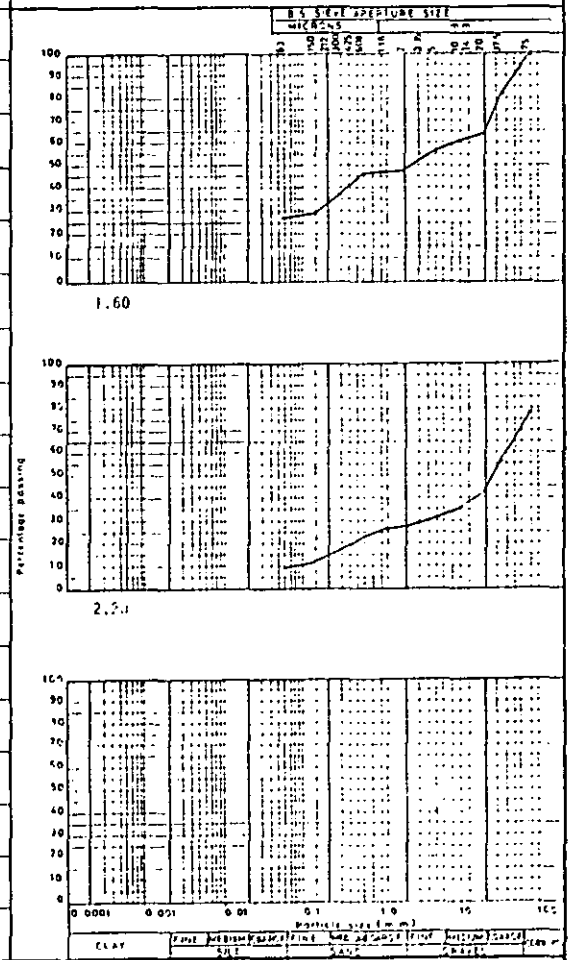
Laboratory testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata
19.9.84	-	-				0.30	48.90	Grass over friable very sandy CLAY (TOPSOIL)
			0.50	B1 J2		0.75	48.45	Stiff becoming firm to stiff fissured red-brown silty CLAY (ALLUVIUM)
			1.10	B3 J4		1.30	47.90	Firm and soft to firm grey-brown very silty CLAY. (ALLUVIUM)
		1.60 ▼ slight seepage	1.60	B5 J6		2.00	47.00	Soft and very soft grey and light brown silty sandy CLAY with many sub-rounded fine to coarse gravel, some cobbles, boulders and zones of silty medium sand. (ALLUVIUM). Tending to clay bound GRAVEL in parts.
		2.20 ▼ slight seepage	2.20	B7 J8		2.50	46.70	Red-brown silty fine to medium SAND and sub-rounded fine to coarse GRAVEL with some cobbles (ALLUVIUM). Tending to sandy GRAVEL in parts.
19.9.84	-							Base of Pit.
								Pit sides collapsed between 1.30 - 2.30m after 5 minutes. After 10 minutes clays between 0.40 - 1.30 collapsed due to undermining.
								Failure planes coincide with 2 sets of rough planar vertical fissures.
			0.70	Cv - 72/70/76				
				Cp - 100/100				
			1.30	Cv = 24/28/30				
				Cp = 35/30/30				
			1.70	Cv = 0/8				



Cv = Hand Vane Shear Strength (kN/m²)
Cp = Hand Penetrometer Shear Strength (kN/m²)

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	Sulphate g/ltr / pH
	1	15					
	3	44		54	30	100	
	5	9.7		28	16	78	0.06 / 7.5
	7	9.8					



Scale 1:

Disturbed Samples: W = Groundwater; ● J = Jar, ● S = S.P.T., ● B = Bulk, ● M = Maxi

Undisturbed Samples: U = Soil Sample

Insitu Tests: V [30] = Vane shear strength in KN/m²; ▼ = Groundwater first struck; □ Core Cutter Density; ■ Core Cutter Density/C.B.R; ▽ Sandbottle Density; ▲ C.B.R; C or S S.P.T. cone or spoon (25) = N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT No 461

FIGURE A1

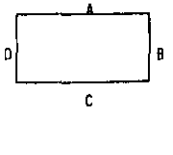
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: JCB 3C
Dates: 19.9.84
Hole Dimensions: 1.0m x 3.0m
Casing Dimensions: N/A

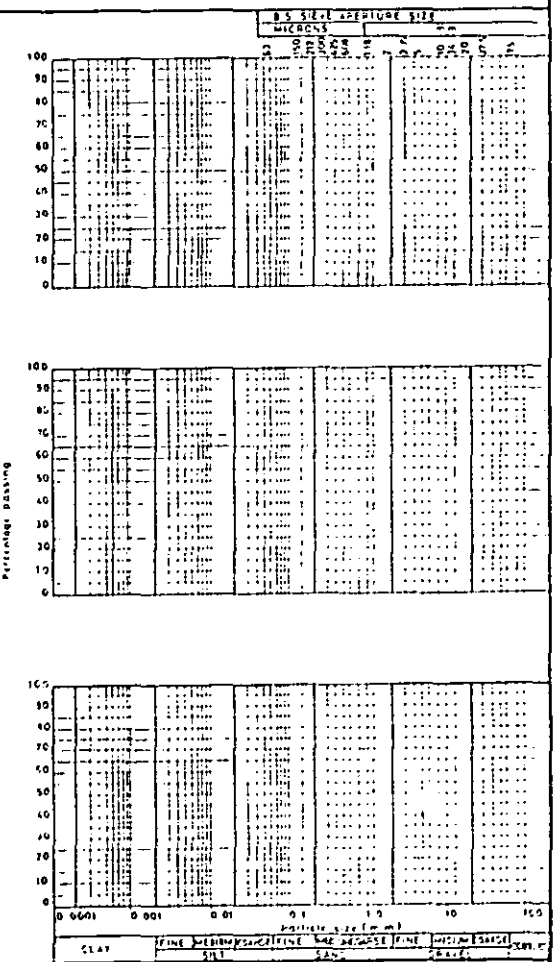
Coordinates: 66621.0 E.
94180.0 N.
Ground Level: 49.07 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Type & Number	Change of Strata Legend	Depth (m)	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	%passing 425 microns	Sulphate g/ltr / pH
19.9.84	-	-				0.30	48.77	Grass over friable silty very sandy CLAY (TOPSOIL)		1	50					
			0.70	B1 J2		1.10	47.97	Firm becoming soft grey-brown very silty CLAY. (ALLUVIUM) Very soft zones at 0.70m		3	28		61	21	100	org 4.17%
			1.40	B3 J4		1.60	47.47	Soft to firm and firm fissured red-brown silty CLAY with some organic traces. (ALLUVIUM)		5	-					0.64 7.6
		1.90 ▼ Fast Seepage	1.90 2.00	W5 B6 J7 B8				Firm friable red-brown occasionally green-grey silty CLAY with rare siltstone lithorelicts. (KEUPER MARL : ZONE IV). Siltstone lithorelicts		6	29		35	20	100	
19.9.84	-	-	2.50	J9		2.50	46.57	increasing with depth.		8	21					
								Base of Pit.								
								Pit sides stable.								
			0.50	Cv	34/43											
				Cp	50/40											
			0.60	Cv	30/2[illegible]											
			0.70	Cv	34/19/17											
			1.50	Cv	60/80/70/63											



Cv = Hand Vane Shear Strength (kN/m²)
Cp = Hand Penetrometer Shear Strength (kN/m²)



Scale 1:

Disturbed Samples : W—Groundwater ● J—Jar ● S—S.P.T. ● B—Bulk ● M—Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V [30] - Vane shear strength in KN/m² ▼ Groundwater first struck

□ Core Cutter Density ■ Core Cutter Density/C.B.R ▽ Sandbottle Density ▲ C B R

Cor S S P T - ne or spoon (25) - N value

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Consulting Engineers & Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

TRIAL PIT No 462

FIGURE A1

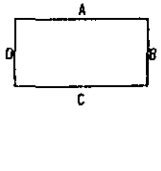
Sheet 1 of 1

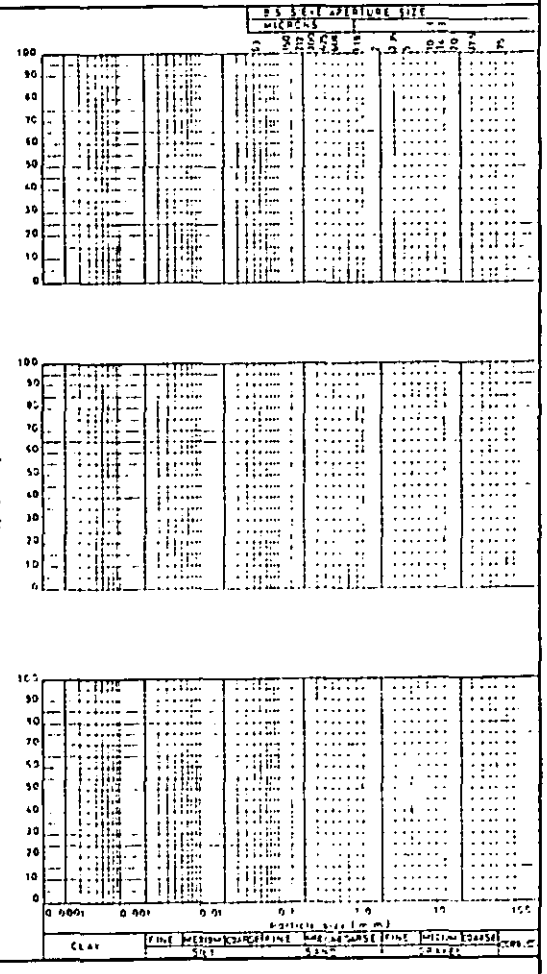
Field Work by: Exploration Associates (Warwick) Limited
Method: JCB 3C
Dates: 19.9.84
Hole Dimensions 1.0m x 2.9m
Casing Dimensions N/A

Coordinates: 66687.0 E.
94276.0 N.
Ground Level: 51.00 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing	Depth to Water	Sample/Insitu Test Depth	Type & Number	Legend	Change of Strata Depth (m)	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
19.9.84	-	-				0.20	50.80	Grass over friable silty very sandy CLAY (TOPSOIL)							
			0.50	B1 J2				Stiff fissured red-brown silty CLAY (ALLUVIUM)							
						0.80	50.20			3	39		63	28	100
			1.00	B3 J4				firm and soft to firm grey mottled brown silty to very silty CLAY. (ALLUVIUM). Band of clay bound fine to coarse gravel at 1.3 to 1.5m		5	26		49	24	100
		1.50 ▼ slight seepage				1.50	49.50								
			1.75	B5 J6		1.85	49.15	Firm to stiff and firm fissured red-brown and green-grey silty CLAY with many siltstone/mudstone lithorelicts. (KEUPER MARL : ZONE IV)		7	25				
19.9.84	-		2.00	B7 J8		2.00	49.00	Slightly weathered green-grey weak SILTSTONE with some silty clay matrix. (KEUPER MARL : ZONE II/III)							
								Base of Pit.							
								Pit sides stable.							
			0.70	Cv = 85/9 Cp = 100/110/100				Cv = Hand Vane Shear Strength (kN/m²) Cp = Hand Penetrometer Shear Strength (KN/m²)							
			1.10	Cv = 60/6 Cp = 70/80/80											





Scale 1:

Disturbed Samples : W – Groundwater ● J – Jar ● S – S.P.T. ● B – Bulk ● M – Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V (30) – Vane shear strength in KN/m²

▼ Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C.B.R

C or S S.P.T. – no of spoon (<25) – N value

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BIRMINGHAM – NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

Hand Auger No HA1
FIGURE A1
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Hand Auger
Dates: 10.10.84
Hole Dimensions: 100mm
Casing Dimensions: None

Coordinates: 66300.0 E.
93976.0 N.
Ground Level: 53.8 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to water (m)	Sample/Insitu Test: Depth (m)	Sample/Insitu Test: Type & Number	Change of Strata: Legend	Change of Strata: Depth (m)	Change of Strata: Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
						0.30		TOPSOIL – Grey brown silty sandy CLAY with a little fine sub-angular to rounded gravel.							
10.10.84	Nil	Dry	0.45 ●	J1		0.45		Dense brown slightly clayey silty fine medium and coarse SAND and fine medium and coarse sub-angular to rounded GRAVEL. (GLACIAL TILL)							
								Hole abandoned at 0.45m unable to auger into dense stratum.							
								No groundwater encountered.							

Percentage passing

B.S. Sieve aperture size (microns)

Particle size (mm)

CLAY | FINE | MEDIUM | COARSE | FINE | MEDIUM | COARSE | FINE | MEDIUM | COARSE | GRAVEL

Scale 1:

Disturbed Samples: W – Groundwater; ● J – Jar, ● S – S.P.T., B – Bulk, ● M – Mast

Undisturbed Samples: Soil Sample

Insitu Tests: V (30) – Vane shear strength in KN/m²; Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R
▽ Sandbottle Density
▲ C B R
C or S S.P.T. cone or spoon
(25) – N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

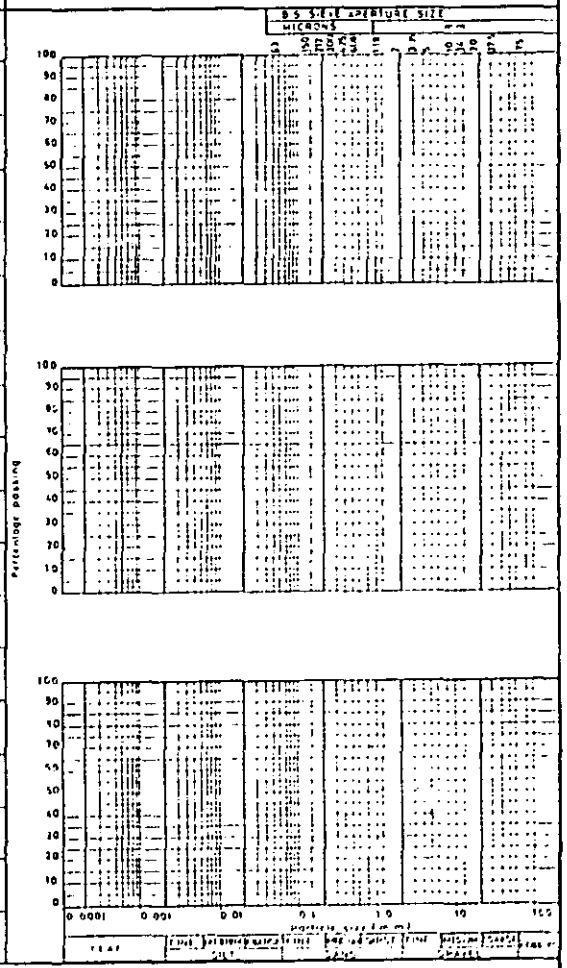
Hand Auger No HA 2
FIGURE A1
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Hand Auger
Dates: 4.10.84
Hole Dimensions: 100mm
Casing Dimensions: None

Coordinates: 66348.0 E.
93953.0 N.
Ground Level: 55.0 m O.D.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/In-situ Test: Depth (m)	Sample/In-situ Test: Type & Number	Change of Strata: Legend	Change of Strata: Depth (m)	Change of Strata: Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
						0.30		TOPSOIL - Dark brown silty sandy clay with some fine to coarse gravel rootlets and organic traces.							
			0.50	J1				Firm red brown slightly sandy silty CLAY with much fine to coarse sub-angular to rounded GRAVEL and occasional small rounded cobbles (GLACIAL TILL)							
			0.85	J2		0.80									
			0.95	J3		0.90		Red brown slightly clayey silty SAND and fine to coarse sub-angular to rounded GRAVEL.							
						1.10		Fine to coarse angular to rounded GRAVEL in a matrix of soft to firm red brown silty CLAY. (GLACIAL TILL							
			1.20	J4				Firm red brown silty CLAY with fine gravel size lithorelicts of green siltstone and red brown mudstone (KEUPER MARL : ZONE IV)							
4.10.84	Nil	Dry				1.35		End of Auger Hole.							
								No Groundwater encountered.							



Scale 1:

Disturbed Samples: W - Groundwater
● J - Jar
● S - S.P.T.
● B - Bulk
● M - Mazi

Undisturbed Samples: Soil Sample

Insitu Tests: V [30] - Vane shear strength in KN/m²

Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R

▽ Sandbottle Density
▲ C B R

C or S S.P.T. cone or spoon
(25) - N value

SCOTT WILSON KIRKPATRICK & PARTNERS
Consulting Engineers & Transportation Planners

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

Hand Auger No HA3
FIGURE A1
Sheet 1 of 1

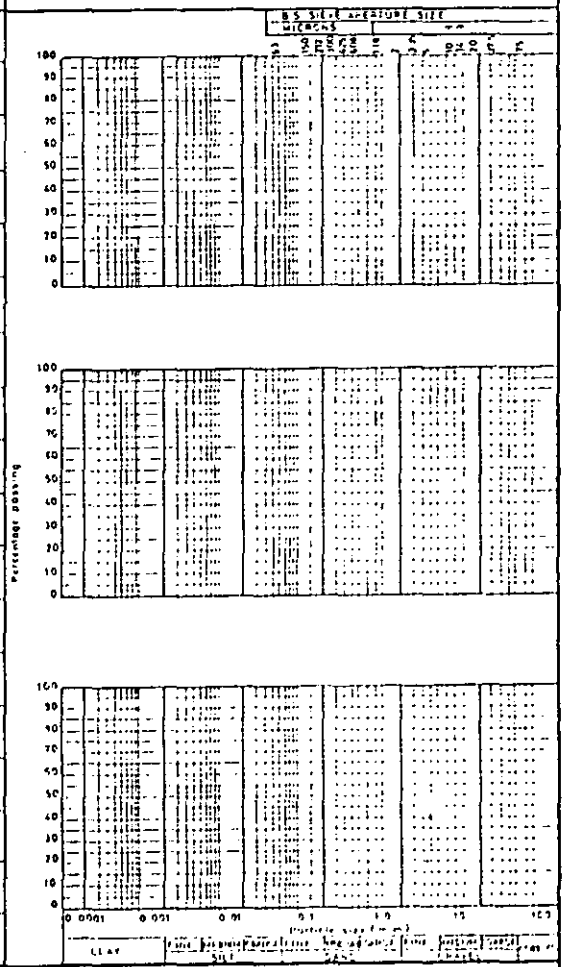
Field Work by: Exploration Associates (Warwick) Limited
Method: Hand Auger
Dates: 4.10.84
Hole Dimensions 100mm
Casing Dimensions None

Coordinates: 66488.0 E.
93689.0 N.
Ground Level: 51.5 m O.D.

Laboratory Testing by. Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata
						0.30		TOPSOIL - Dark grey brown silty sandy clay with occasional fine gravel rootlets and organic traces.
			0.50	J1		0.60		Soft friable in pockets, red brown silty CLAY with some fine to coarse sub-angular rounded gravel and occasional small cobbles. (GLACIAL TILL)
			0.75	J2				Firm to stiff red brown silty CLAY with some fine to coarse angular to rounded gravel and occasional small cobbles. (GLACIAL TILL)
4.10.84	Nil	Dry	0.95	J3		1.10		becoming stiffer and more gravelly with depth.
								Hole abandoned at 1.10m unable to auger into more gravelly horizon.
								No groundwater encounterd.

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns	



Scale 1:

Disturbed Samples : W - Groundwater
J - Jar
S - S.P.T.
B - Bulk
M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V (30) - Vane shear strength in KN /m²

Groundwater first struck

Core Cutter Density
Core Cutter Density/C.B.R

Sandbottle Density
C B R

C or S S.P.T. - ne or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

Hand Auger No HA4
FIGURE A1
Sheet 1 of 1

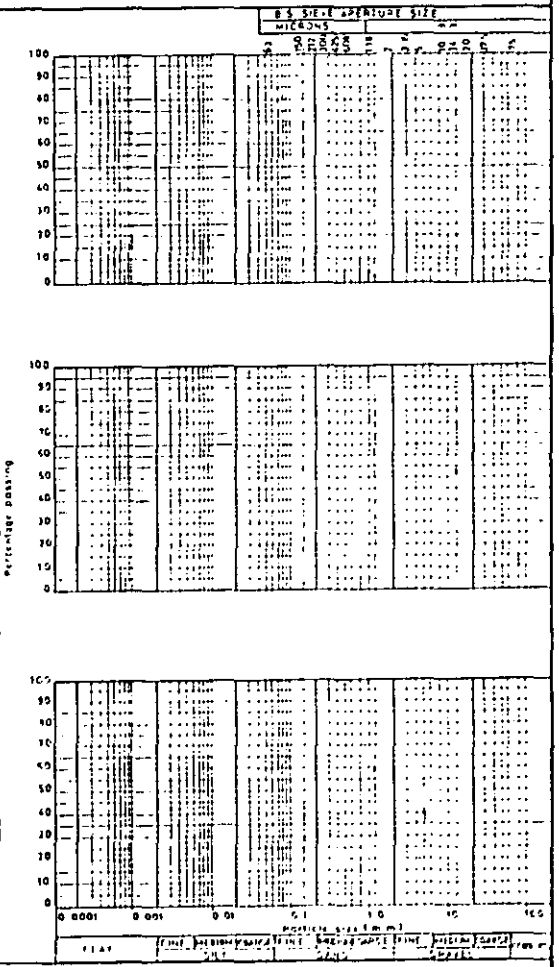
Field Work by: Exploration Associates (Warwick) Limited
Method: Hand Auger
Dates: 4.10.84
Hole Dimensions: 100mm
Casing Dimensions: None

Coordinates: 66524.0 E.
93836.0 N.
Ground Level: 49.5 m OD.

Laboratory Testing by: Dates:

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata
						0.30		TOPSOIL - Dark grey brown sandy clayey silt with some gravel occasional cobbles, decaying rootlets and plant debris.
			0.50	● J1		0.65		Soft red brown very sandy silty CLAY with much fine to coarse angular to rounded gravel and occasional cobbles. (ALLUVIUM)
			0.70	● J2				Red brown slightly clayey silty fine to medium SAND with occasional fine to medium gravel and pockets of very soft and soft grey green silty clay. (ALLUVIUM)
			0.95	● J3		1.00		
			1.05	● J4		1.10		Soft with small pockets of very soft red brown sandy to very sandy silty CLAY with a little fine to medium angular to rounded gravel. (ALLUVIUM)
			1.15	● J5				
			1.50	● J6				Firm to stiff red brown variegated green silty CLAY with a little fine and medium gravel and with pockets of very soft grey brown very sandy very gravelly clay below 1.50m (ALLUVIUM)
		Rose to 1.80				1.85		
4.10.84	Nil	▼ 1.95	1.90	● J7		2.00		Fine to coarse angular to rounded GRAVEL in a matrix of very soft to soft red brown sandy silty clay. (ALLUVIUM)
		1.80						End of Auger Hole.
								Groundwater struct at 1.95m, rose to 1.80m after 10 minutes.

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	%passing 425 microns



Scale 1:

Disturbed Samples: W - Groundwater
● J - Jar
● S - S.P.T.
● B - Bulk
● M - Maxi

Undisturbed Samples: Soil Sample

Insitu Tests: V (30) - Vane shear strength in KN/m²
▼ Groundwater first struck
□ Core Cutter Density
■ Core Cutter Density/C.B.R
▽ Sandbottle Density
▲ C B R
(Cor S - S.P.T. core or spoon
(+25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

Hand Auger No HA5
FIGURE A1
Sheet 1 of 1

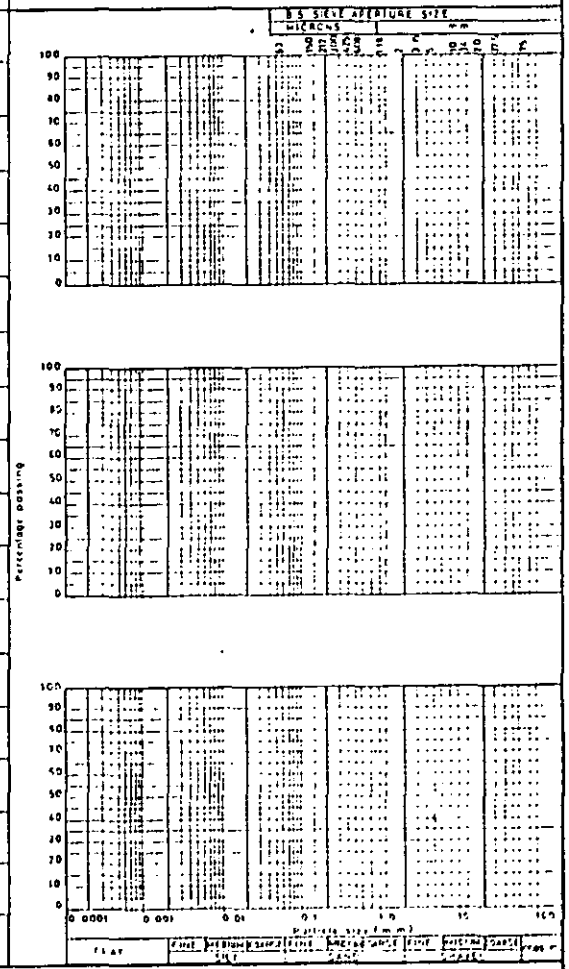
Field Work by : Exploration Associates (Warwick) Limited
Method : Hand Auger
Dates : 4.10.84
Hole Dimensions 100mm
Casing Dimensions None

Coordinates : 66573.0 E.
93796.0 N.
Ground Level : 48:4 m OD

Laboratory Testing by : Dates :

Dates	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test Depth (m)	Sample/Insitu Test Type & Number	Change of Strata Legend	Change of Strata Depth (m)	Change of Strata Reduced Level	Description of Strata
						0.40		TOPSOIL - Dark brown silty sandy clay with rootlets.
			0.50	J1				Firm brown mottled grey silty CLAY with a little fine and medium angular to sub-rounded gravel rootlets and organic traces. (ALLUVIUM)
			0.80	J2				
		Rose to 1.05 in 20 mins	1.05	J3		1.00		
		1.15				1.20		Soft orange brown silty sandy CLAY with thin partings of yellow brown fine to medium sand. (ALLUVIUM)
			1.25	J4				Very soft grey variegated brown silty very sandy CLAY with occasional fine to coarse angular to rounded gravel. (ALLUVIUM)
			1.50	J5				Gravel content increases with depth, becoming clay-bound gravel below about 1.70.
4.10.84	Nil	1.05				1.80		End of Auger Hole.
								Groundwater struck at 1.15m, rose to 1.05 after 20 minutes.

Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns



Scale 1:

Disturbed Samples : W - Groundwater
● J - Jar
● S - S.P.T.
● B - Bulk
● M - Maxi

Undisturbed Samples : Soil Sample

Insitu Tests : V (30) - Vane shear strength in KN /m²
Groundwater first struck

□ Core Cutter Density
■ Core Cutter Density/C.B.R
▽ Sandbottle Density
▲ C.B.R
C or S S.P.T. cone or spoon
(25) - N value

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BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
MAIN SITE INVESTIGATION
CONTRACT 2

Hand Auger No HA6

FIGURE A1

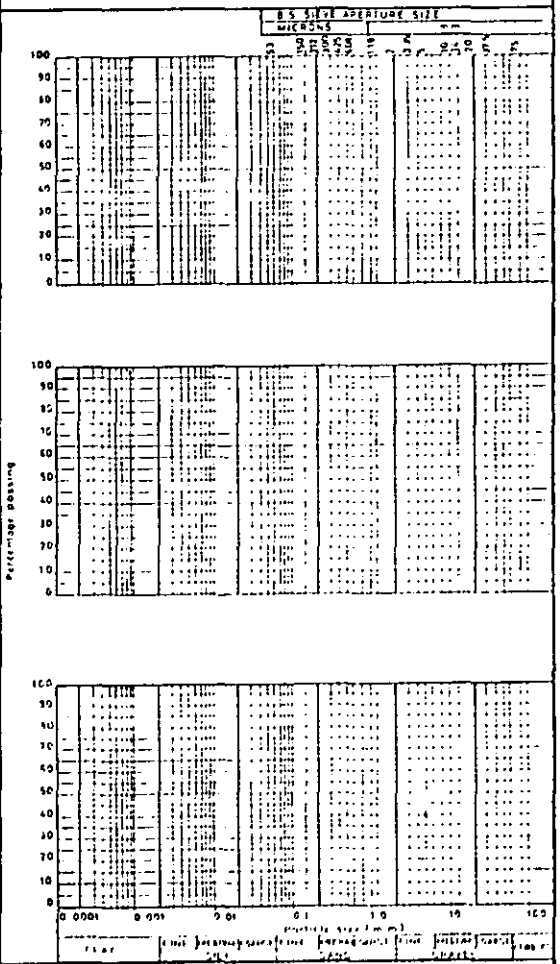
Sheet 1 of 1

Field Work by: Exploration Associates (Warwick) Limited
Method: Hand Auger
Dates: 10.10.84
Hole Dimensions: 100mm
Casing Dimensions: None

Coordinates: 66280.0 E.
93983.0 N.
Ground Level: 52.8 m O.D.

Laboratory Testing by: Dates:

Date	Depth of Casing (m)	Depth to Water (m)	Sample/Insitu Test: Depth (m)	Type & Number	Change of Strata: Legend	Depth (m)	Reduced Level	Description of Strata	Standpipe/Piezometer Installation	Sample Number	Natural Moisture Content (%)	Natural Dry Density (kg/m³)	Liquid Limit (%)	Plastic Limit (%)	% passing 425 microns
						0.30		TOPSOIL - Brown silty clayey sand with a little gravel.							
			0.45	J1		0.70		Brown silty clayey fine and medium SAND with occasional fine to coarse gravel.							
			0.80	J2				Soft very sandy silty CLAY with some fine to coarse angular to rounded gravel. (ALLUVIUM)							
			0.95	J3		0.95									
			1.15	J4				Firm becoming stiff with depth, red brown variegated pale green poorly laminated, fissured silty CLAY with occasional fine and medium angular to rounded gravel and pinhead size black carboanceous traces. (GLACIAL TILL)							
10.10.84	Nil	Dry	1.55	J5		1.55									
								End of Auger Hole.							
								No groundwater encountered.							



Scale 1:

Disturbed Samples: W - Groundwater; ● J - Jar, ● S - S.P.T., ● B - Bulk, ● M - Mazi

Undisturbed Samples: Soil Sample

Insitu Tests: V (30) - Vane shear strength in KN/m²; Groundwater first struck; Core Cutter Density; Core Cutter Density/C.B.R; Sandbottle Density; C B R; C or S S.P.T. - ... or spoon; (25) - N value

EXPLORATION ASSOCIATES (WARWICK) LIMITED, GEOTECHNICAL HOUSE, HATTON, WARWICK. CV35 7JL
Tel: (0926) 491743

DEPARTMENT OF TRANSPORT

EAST MIDLANDS REGIONAL OFFICE

A42 CASTLE DONINGTON NORTH

MAIN SITE INVESTIGATION : CONTRACT 2 (FEBRUARY 1985)

VOLUME 2 : PART 1 LABORATORY TEST RESULTS AND SUMMARY SHEETS

S4449

Employer for the Works

DEPARTMENT OF THE ENVIRONMENT
AND TRANSPORT
East Midlands Regional Office
52-54 Holly Walk
Leamington Spa
Warwickshire
CV32 4JE

Engineer for the Works

SCOTT WILSON KIRKPATRICK
AND PARTNERS
Bayheath House
Rose Hill West
Chesterfield
Derbyshire
S40 1JF

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S4449 Volume 2 - Part 1

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Volume 1 : Part 2

Exploratory Hole Record Sheets (Forms A1 and A2) and Laboratory Test Results (Forms B and C)	Boreholes/Drillholes and Trial Pits

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Samples				Water Content		Density			Shear Strength							
Hole	Depth	Type	Description	Initial %	Final %	Initial Mg/m3	Final Mg/m3	Dry Mg/m3	Prep.	Test	P'o kN/m2	u_f kN/m2	$\sigma_1'-\sigma_3'$ kN/m2	c' kN/m2	$\phi'°$
B219	2.00	U	Soft red brown occasionally mottled grey green silty CLAY with fine siltstone fragments.	28	23	1.94	2.03	1.52	Natural	CDT 38	50	-2	142	20	27
				32	25	2.00	2.25	1.52			150	+2	331		
				30	23	2.00	2.15	1.54			300	+3	582		
B220	3.50	U	Firm red brown clayey SILT with fine weak mudstone fragments.	21	20	2.03	2.13	1.68	Natural	CDT 38	100	-1	420	60	30
				19	18	2.12	2.23	1.78			200	0	619		
				19	17	2.15	2.31	1.81			300	0	812		
B221	6.50	U	Soft red brown clayey SILT with fine weak mudstone fragments.	24	24	1.99	2.04	1.60	Natural	CDT 38	100	0	275	20	28
				26	21	2.04	2.18	1.62			200	-1	436		
				28	20	2.07	2.32	1.62			400	+1	794		
B222	4.00	B	Remoulded soft red brown silty CLAY.	21	21	2.05	2.09	1.69	Remould	CDT 38	50	0	105	0	29
				22	19	2.05	2.08	1.68			100	0	215		
				22	19	2.05	2.17	1.68			200	+1	409		
B223	3.50	U	Soft red brown clayey SILT with fine weak mudstone fragments.	24	25	1.93	1.98	1.56	Natural	CDT 38	50	0	151	0	31
				25	23	1.98	2.04	1.58			150	+3	307		
				25	20	1.98	2.08	1.58			300	+2	657		
235	2.00	U	Firm brown silty sandy CLAY with occasional sand pockets and gravel.	18	17	2.00	2.03	1.69	Natural	CDT 38	50	+1	136	0	32
				17	15	2.08	2.15	1.78			100	+2	213		
				15	11	2.12	2.19	1.84			150	+1	356		
	3.50	U	Remoulded firm red brown silty CLAY.	25	31	1.93	2.06	1.54	Remould	CUT 38	50	26	72	10	26
				24	27	1.94	2.06	1.56			100	43	127		
				25	27	1.94	2.10	1.55			200	96	204		
236	0.50	U	Remoulded soft red brown silty CLAY.	19	19	1.94	1.97	1.63	Remould	CUT 38	50	29	70	10	25
				17	16	1.94	2.00	1.66			100	51	109		
				20	18	1.93	2.07	1.61			150	85	130		

Remarks

Laboratory Results – Triaxial Effective Stress

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Main Site Investigation – Contract 2

Contract S4449

Figure 2.1

EX 4

Samples				Water Content		Density			Shear Strength							
Hole	Depth	Type	Description	Initial %	Final %	Initial Mg/m³	Final Mg/m³	Dry Mg/m³	Prep.	Test	P'o kN/m²	u_f kN/m²	$\sigma_1'-\sigma_3'$ kN/m²	c' kN/m²	$\phi'°$
239	3.50	U	Firm red brown clayey SILT with occasional weak mudstone and sandstone fragments.	16	17	2.01	2.09	1.73	Natural	CDT 106	50 100 150	+1 0 +2	133 244 288	0	30
240	0.50	U	Remoulded firm red brown silty CLAY.	15 16 15	17 17 15	1.97 1.96 1.96	2.06 2.12 2.12	1.71 1.69 1.70	Remould	CDT 38	50 100 150	+2 0 0	85 175 269	0	27
	2.00	U	Stiff grey brown mottled blue grey silty CLAY with rock chalk.	24	25	2.12	2.22	1.71	Natural	CDT 106	50 100 150	0 -1 0	107 181 272	10	26
	3.50	U	Firm red brown silty slightly sandy CLAY with siltstone fragments	16	17	1.84	2.11	1.59	Remould	CDT 106	50 100 200	+2 +1 +4	70 180 341	0	27
241	0.50	U	Firm red brown silty CLAY.	19 19 18	22 21 21	2.06 2.06 2.08	2.18 2.19 2.29	1.73 1.73 1.76	Remould	CUT 38	50 100 200	23 47 83	90 80 231	15	25
241	3.50	U	Red brown occasionally mottled grey green slightly clayey SILT with abundant weak siltstone fragments.	15	15	2.06	2.14	1.79	Natural	CDT 106	50 100 150	0 +4 +3	199 273 353	25	28
B263	2.00	U	Red brown mottled grey green clayey SILT with abundant weak siltstone fragments.	18	16	2.04	2.14	1.73	Natural	CDT 106	50 150 350	0 +4 +5	208 364 737	20	28

Remarks

Laboratory Results – Triaxial Effective Stress

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Figure 2.2

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EX 4

Samples				Water Content		Density			Shear Strength							
Hole	Depth	Type	Description	Initial %	Final %	Initial Mg/m³	Final Mg/m³	Dry Mg/m³	Prep.	Test	P'o kN/m²	u_f kN/m²	$\sigma'_1-\sigma'_3$ kN/m²	c' kN/m²	ϕ'°
B274	5.23 5.66	C	Red brown silty MUDSTONE	11	11	2.23	2.49	2.01	Natural	CDT 76	150 300	0 2	786 1000	170	25
B281	2.00	U	Stiff red brown occasionally mottled grey green very silty CLAY with siltstone fragments.	13	11	2.15	2.27	1.90	Natural	CDT 106	50 150 300	0 +3 +1	163 350 480	20	27
291	0.50	U	Firm red brown slightly silty CLAY.	27 27 28	29 28 28	1.98 2.00 1.99	2.06 2.10 2.14	1.56 1.57 1.55	Natural	CUT 38	50 100 200	-5 21 62	111 151 220	15	22

Remarks

Laboratory Results– Triaxial Effective Stress

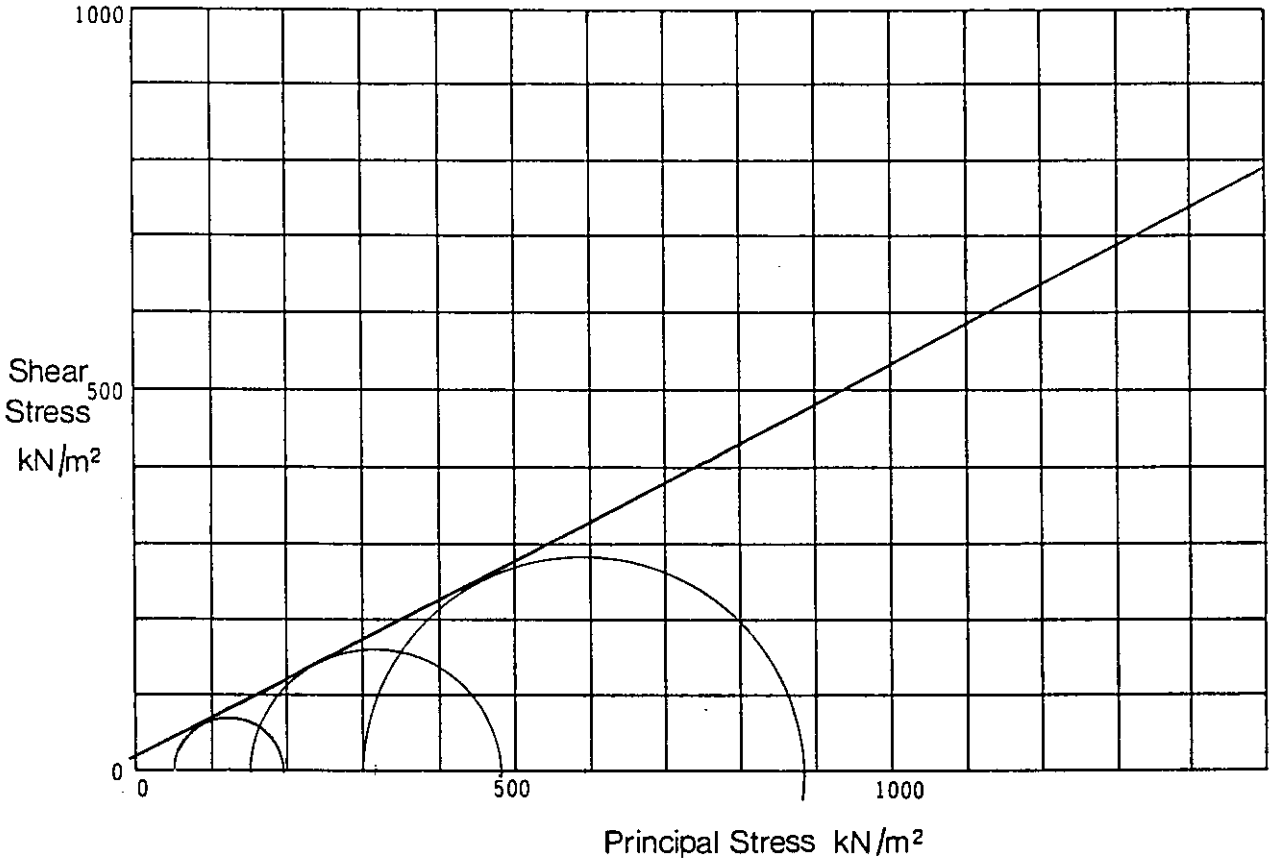
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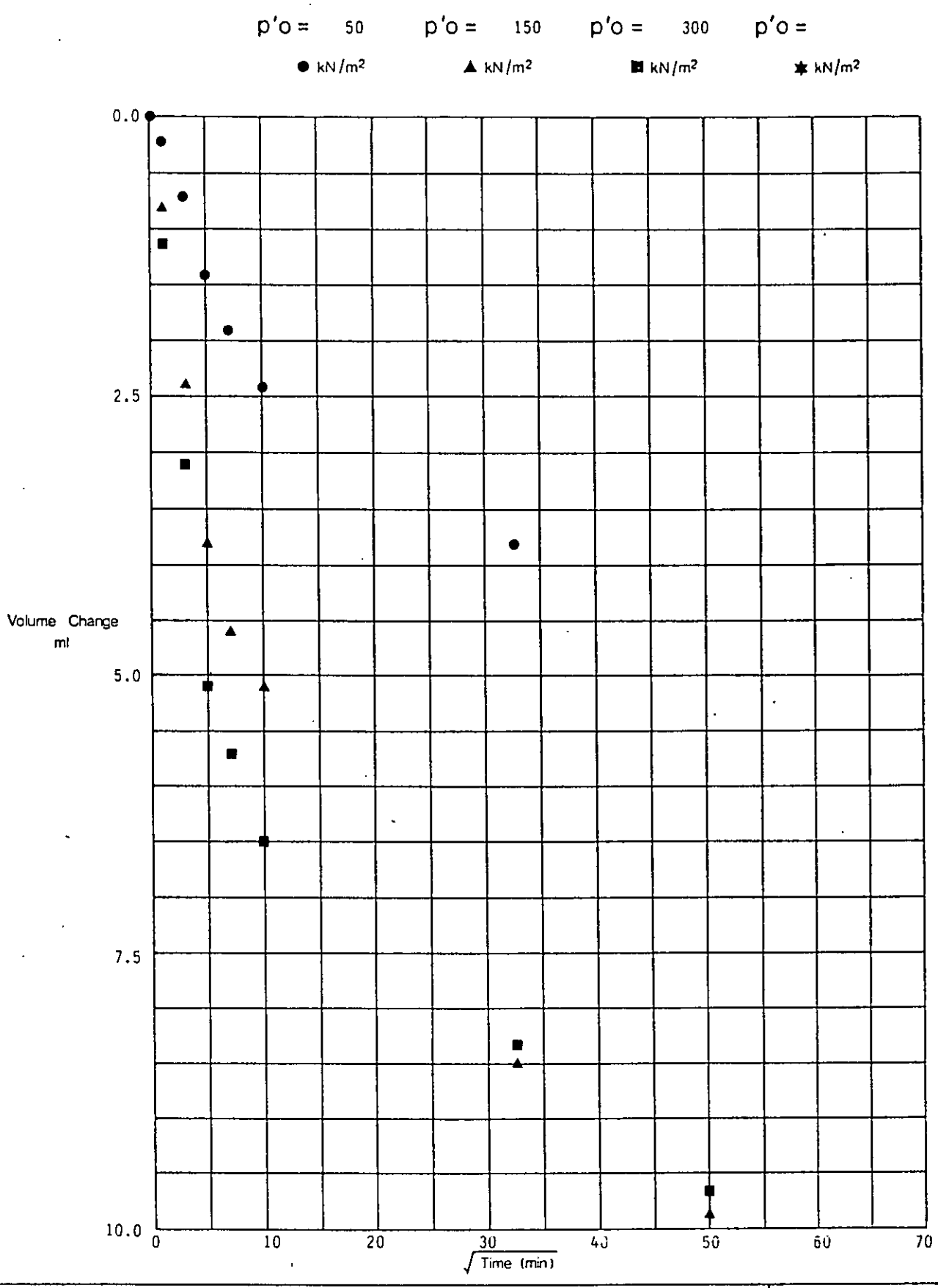
Figure 2.3

EX 4



B	(Initial)		0.74	0.67	0.65	
B_s	(After application of Back Pressure)		0.98	0.99	0.99	
ε	(Rate of Strain)	% min	0.003	0.003	0.003	
σ_3	(Cell Pressure during Shear)	kN/m²	250	350	500	
u_0	(Applied Back Pressure)	kN/m²	200	200	200	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	50	150	300	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	142	331	582	

Triaxial Compression Test Consolidated Drained	Description Silty CLAY with fine siltstone fragments. **Mohr Circles and Summary**	C' 20 kN/m² Φ' 27 Degrees Depth 2.00 Borehole B219
Remarks 3 x 38mm dia samples.		
Laboratory - Effective Stress **exploration associates**	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449 **Figure** 2.4



Triaxial Consolidation – Volume Change / $\sqrt{\text{Time}}$

Depth 2.00
Borehole B219

Remarks

Laboratory–Effective Stress

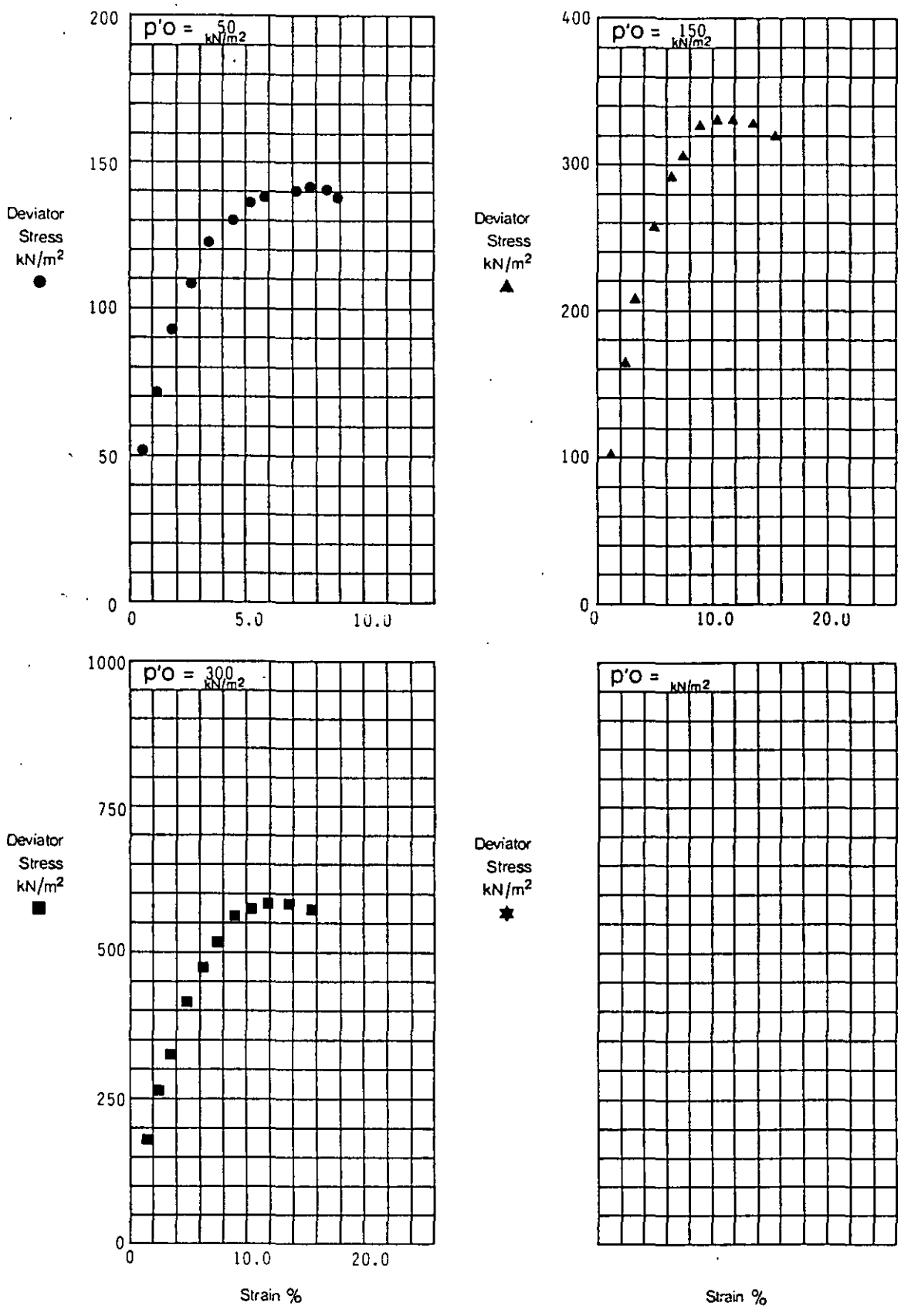
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Main Site Investigation - Contract 2

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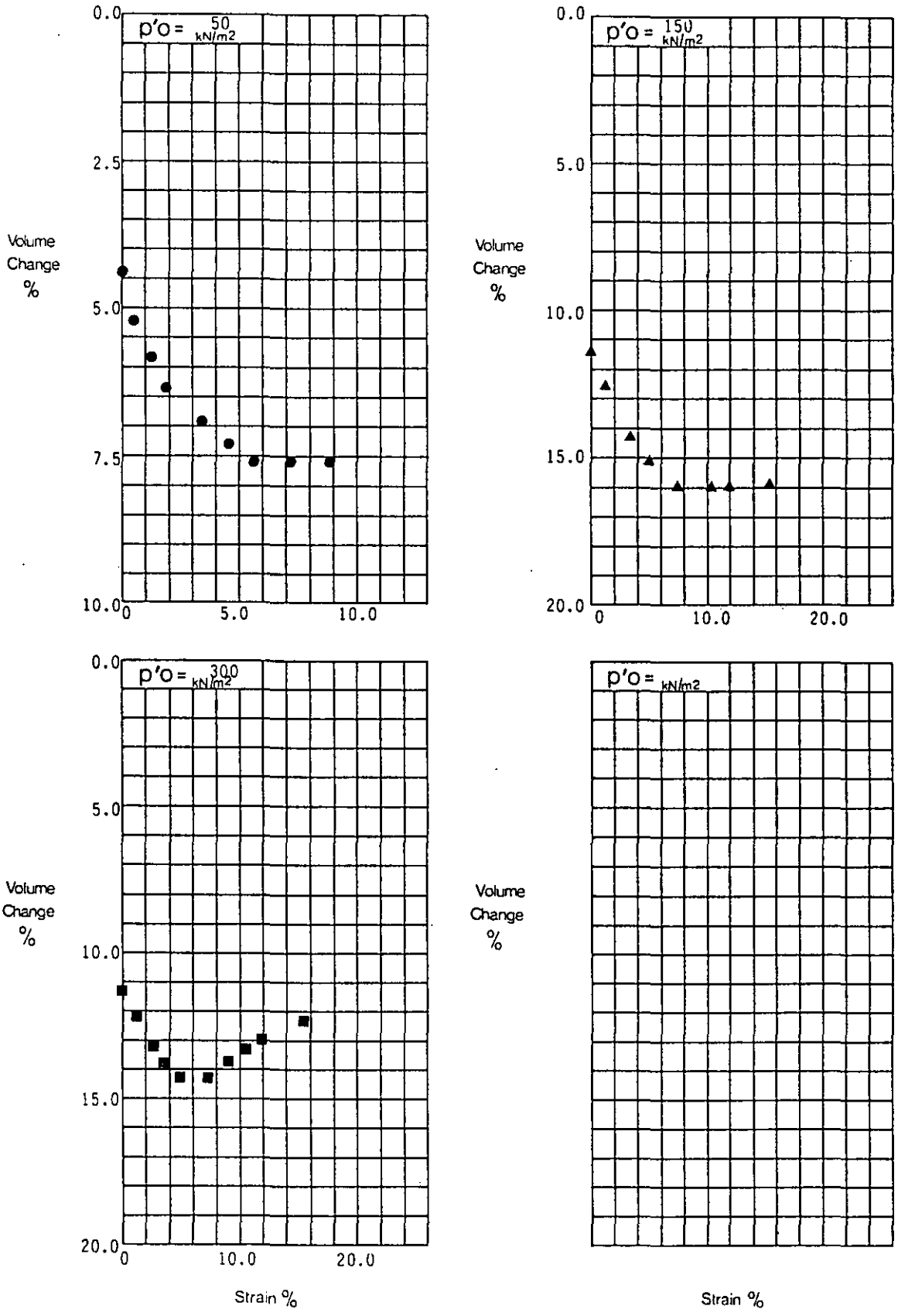
Figure 2.5

EX3



Deviator Stress / Strain	Depth 2.00 Borehole B219
Remarks	
Laboratory - Effective Stress	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2
exploration associates	Contract S4449 **Figure** 2.6

EX3



Volume Change % / Strain %

Depth 2.00
Borehole B219

Remarks

Laboratory - Effective Stress

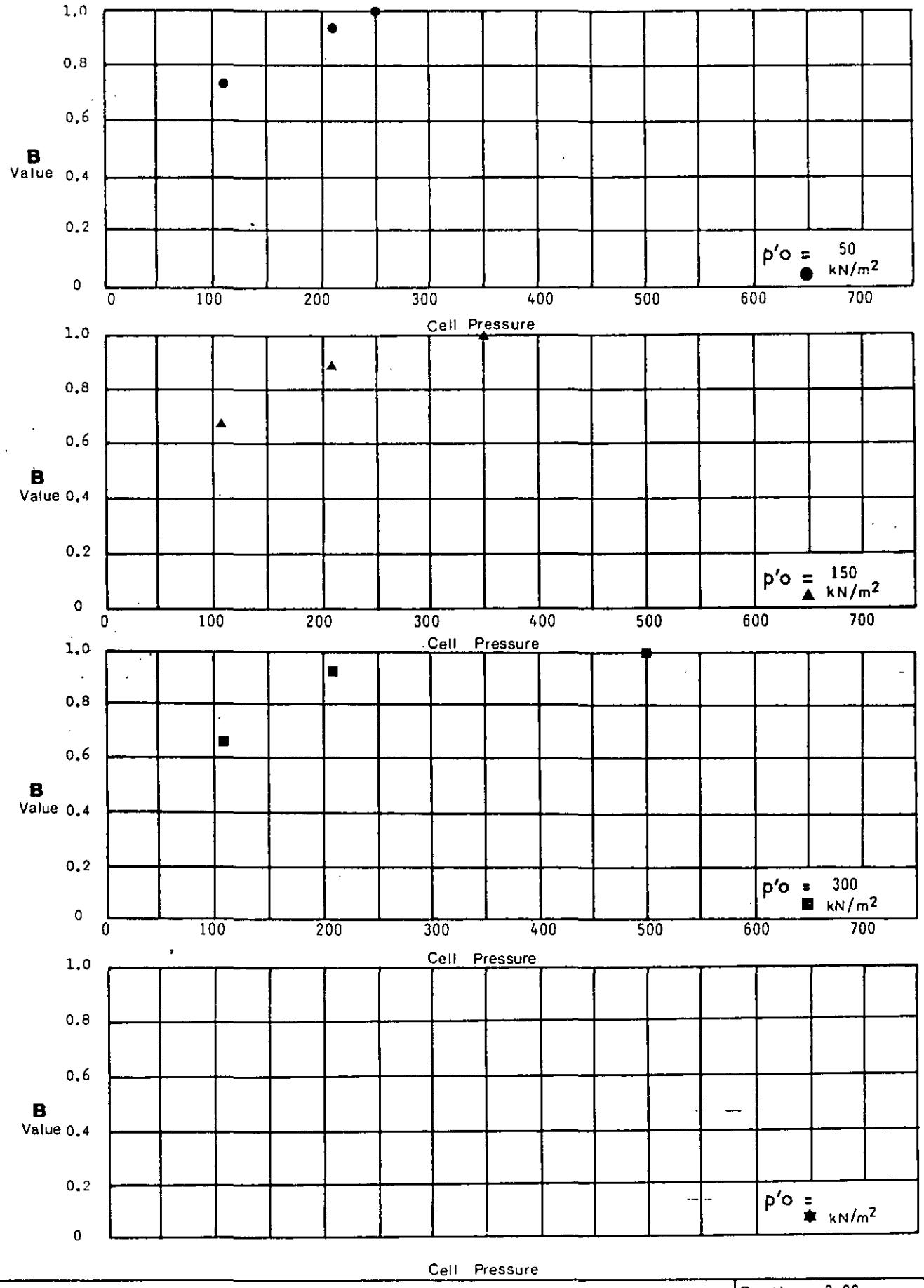
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Main Site Investigation - Contract 2

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Figure 2.7

EX3



B Value / Cell Pressure

Depth 2.00
Borehole B219

Remarks

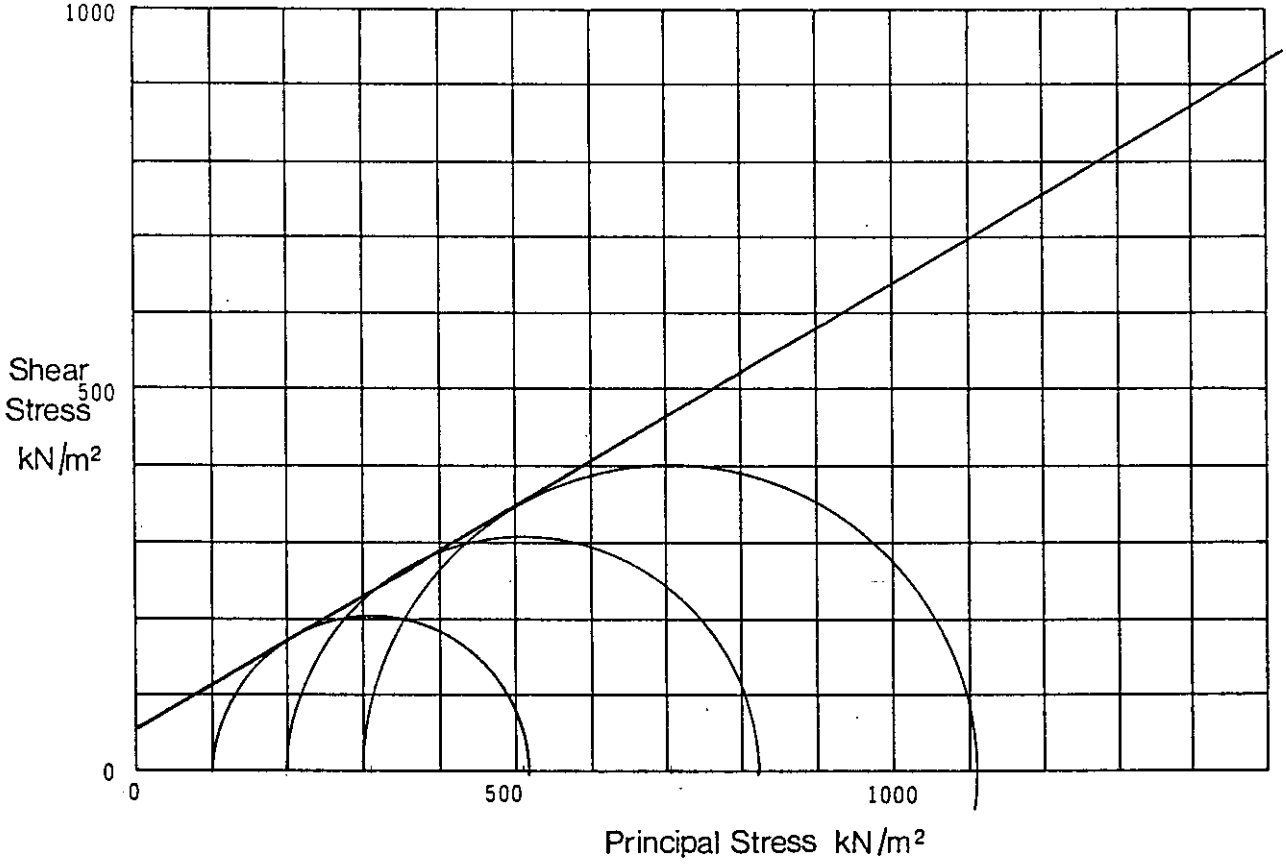
Laboratory Effective Stress

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A42 Castle Donington North
Main Site Investigation - Contract 2

Contract S4449

Figure 2.8



B	(Initial)		0.75	0.76	0.82	
B_s	(After application of Back Pressure)		0.99	0.98	0.99	
ε	(Rate of Strain)	% min	0.008	0.008	0.008	
σ_3	(Cell Pressure during Shear)	kN/m²	300	400	500	
u_0	(Applied Back Pressure)	kN/m²	200	200	200	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	100	200	300	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	420	619	812	

Triaxial Compression Test
Consolidated
Drained

Description Clayey SILT with fine weak mudstone fragments.

Mohr Circles and Summary

C' 60 kN/m²
Φ' 30 Degrees
Depth 3.50
Borehole B220

Remarks 3 x 38mm dia samples

Laboratory - Effective Stress

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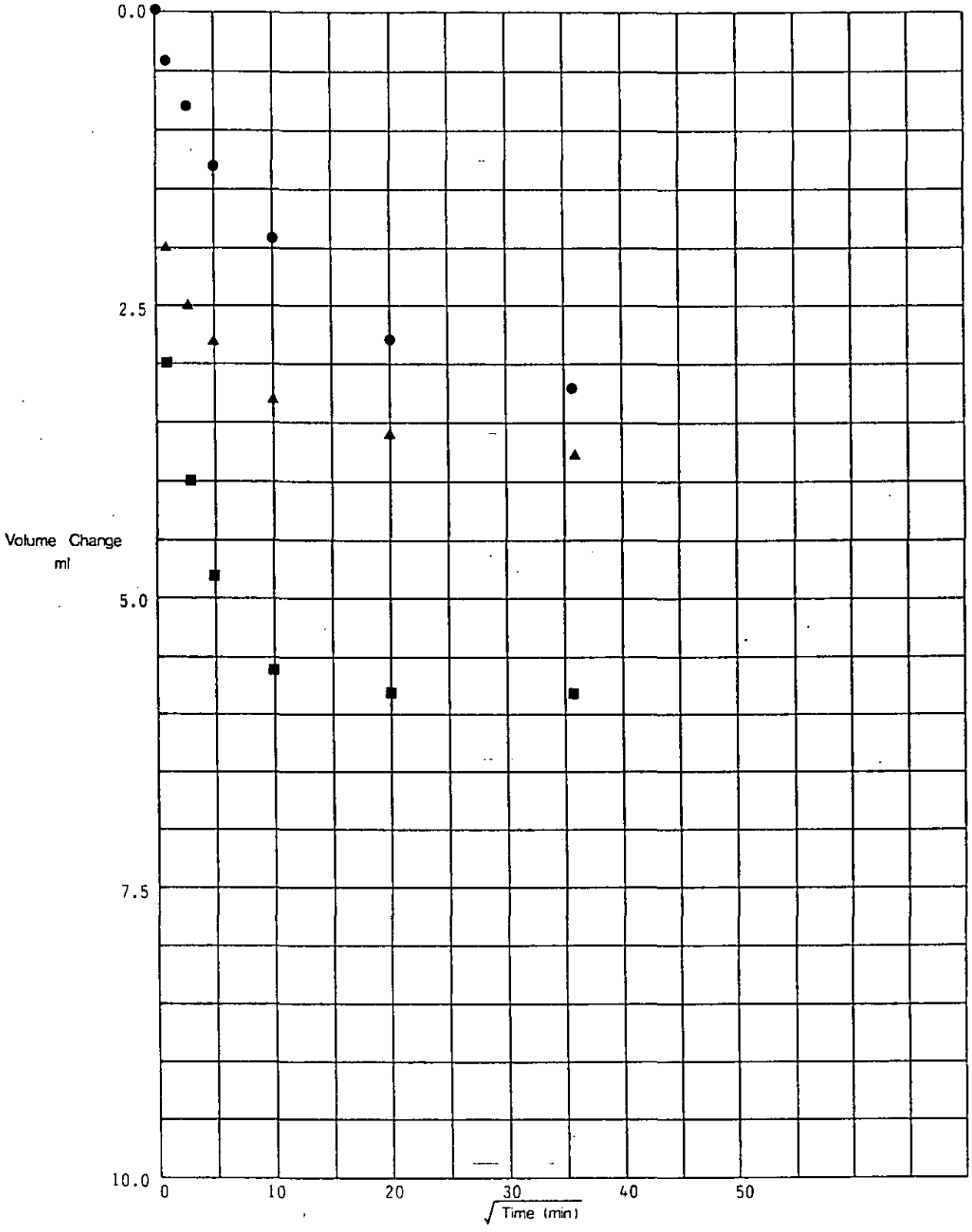
Project Department of Transport
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A42 Castle Donington North
Main Site Investigation - Contract 2

Contract S4449

Figure 2.9

EX3

p'o = 100 kN/m² ● p'o = 200 kN/m² ▲ p'o = 300 kN/m² ■ p'o = kN/m² ✱



Triaxial Consolidation – Volume Change / √Time

Depth 3.50
Borehole B220

Remarks

Laboratory–Effective Stress

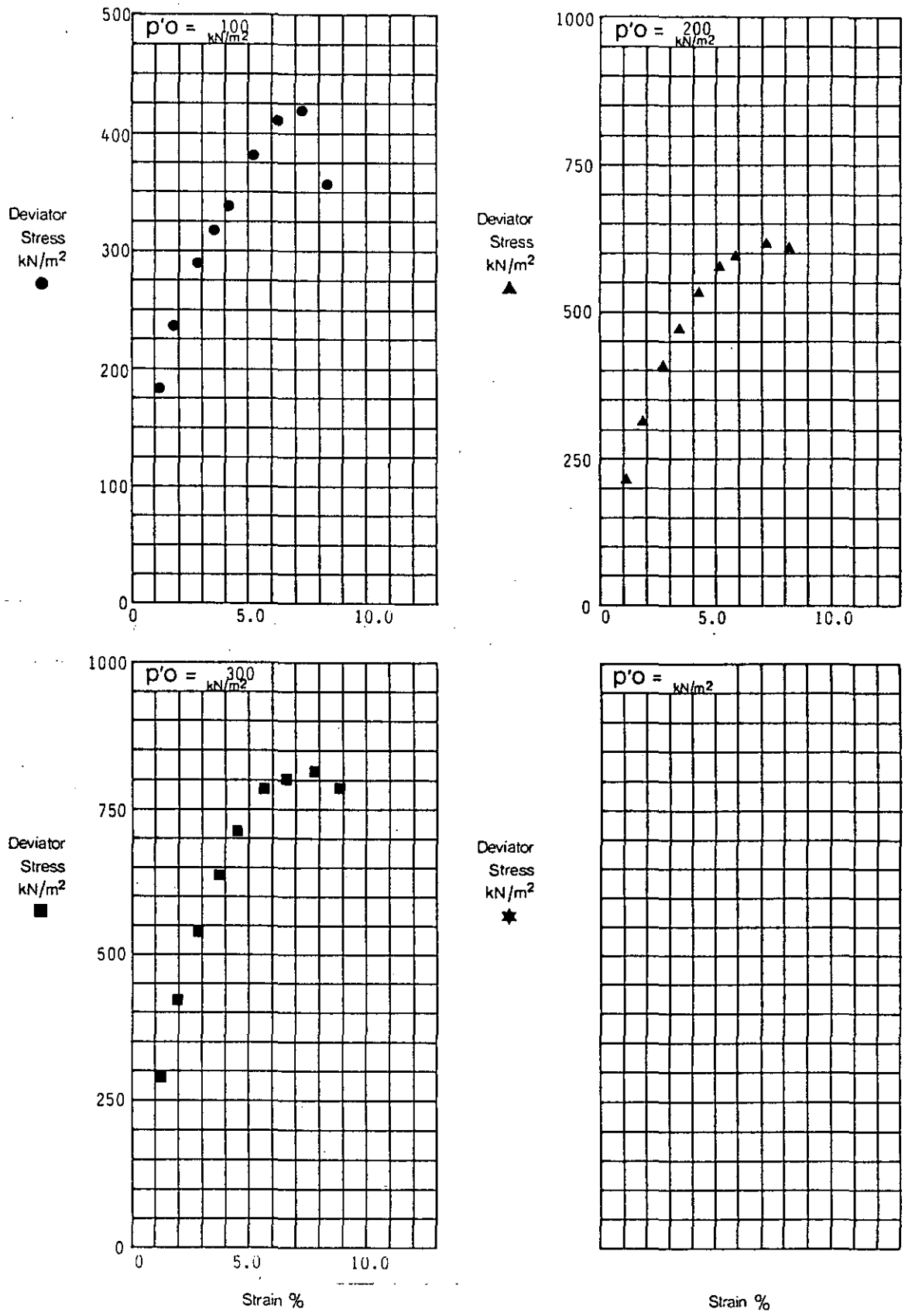
Project Department of Transport
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Main Site Investigation – Contract 2

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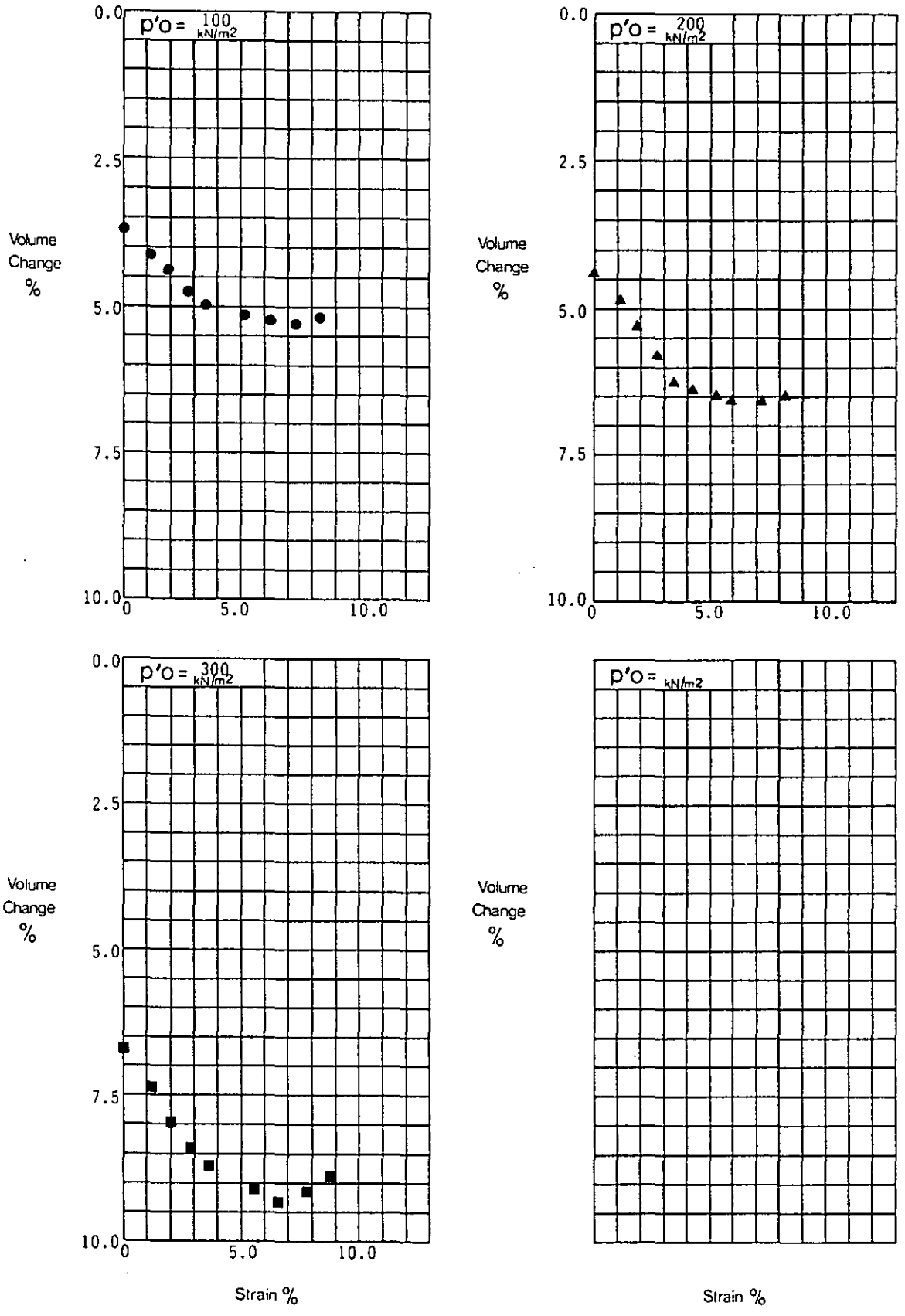
Figure 2.10

EX3



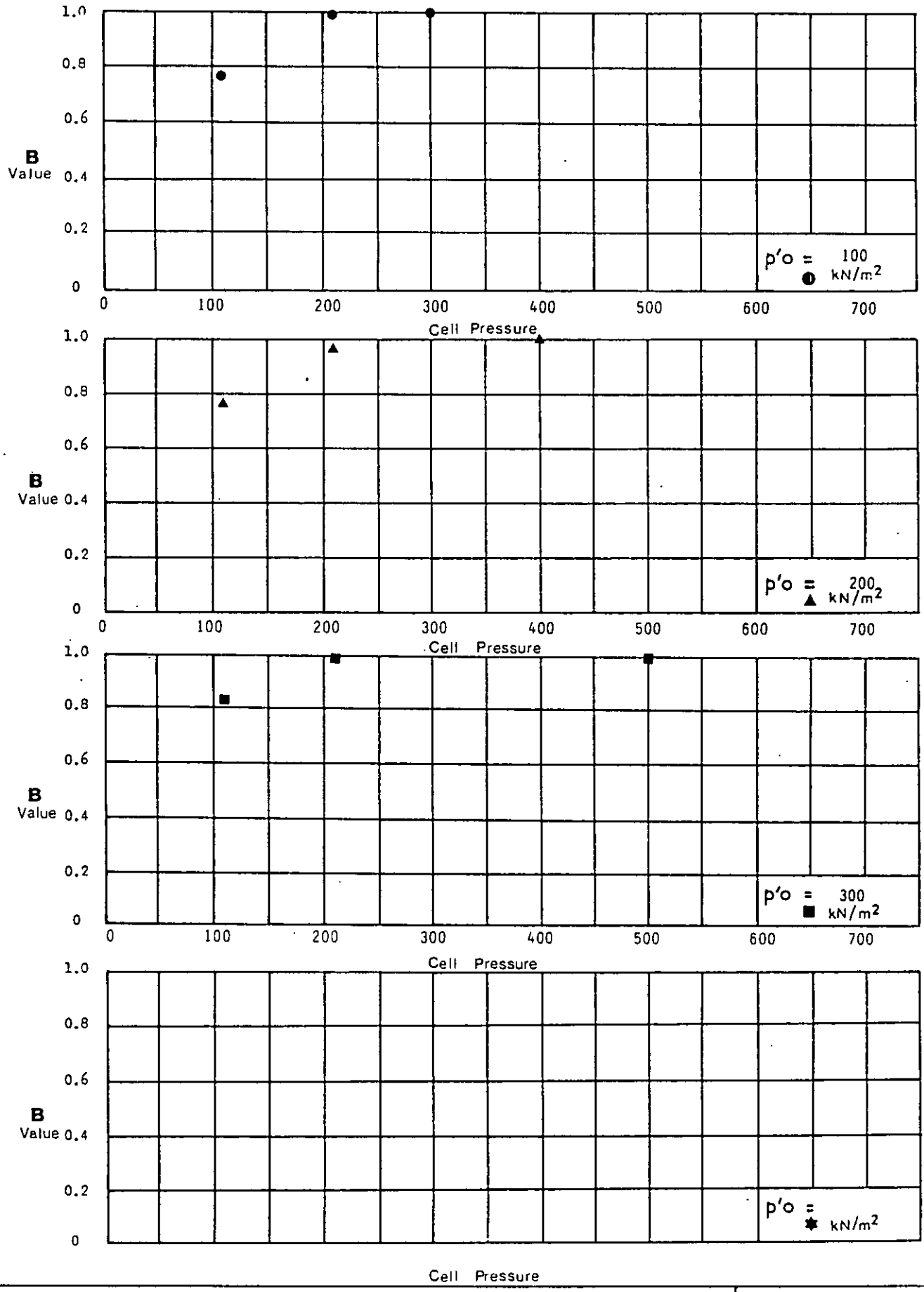
Deviator Stress / Strain		Depth 3.50 Borehole B220
Remarks		
Laboratory - Effective Stress	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449
exploration associates		**Figure** 2.11

EX3



Volume Change % / Strain %	Depth 3.50 Borehole B220
Remarks	
Laboratory - Effective Stress **exploration associates**	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2
	Contract S4449
	Figure 2.12

EX3



B Value / Cell Pressure

Depth 3.50
Borehole B220

Remarks

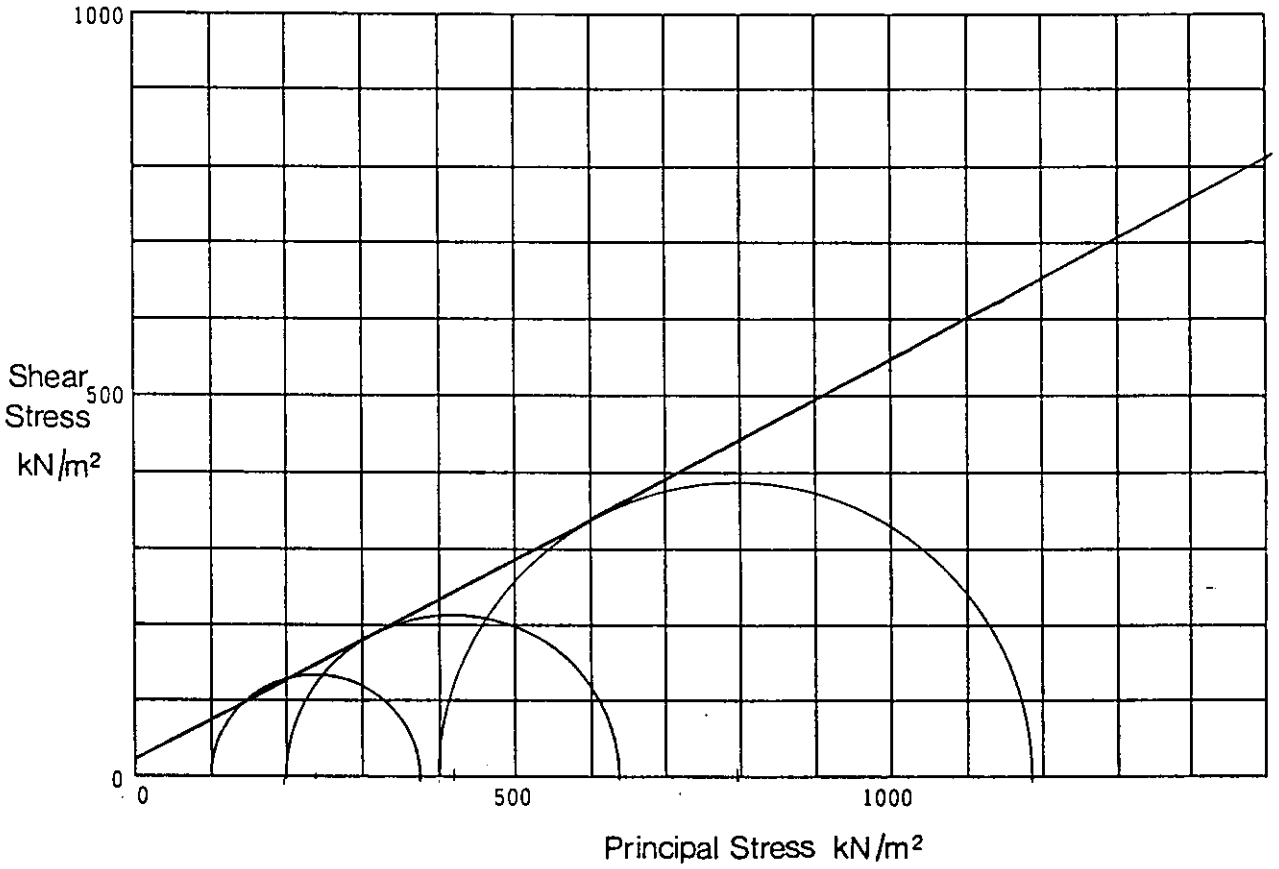
Laboratory Effective Stress

exploration associates

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Contract S4449

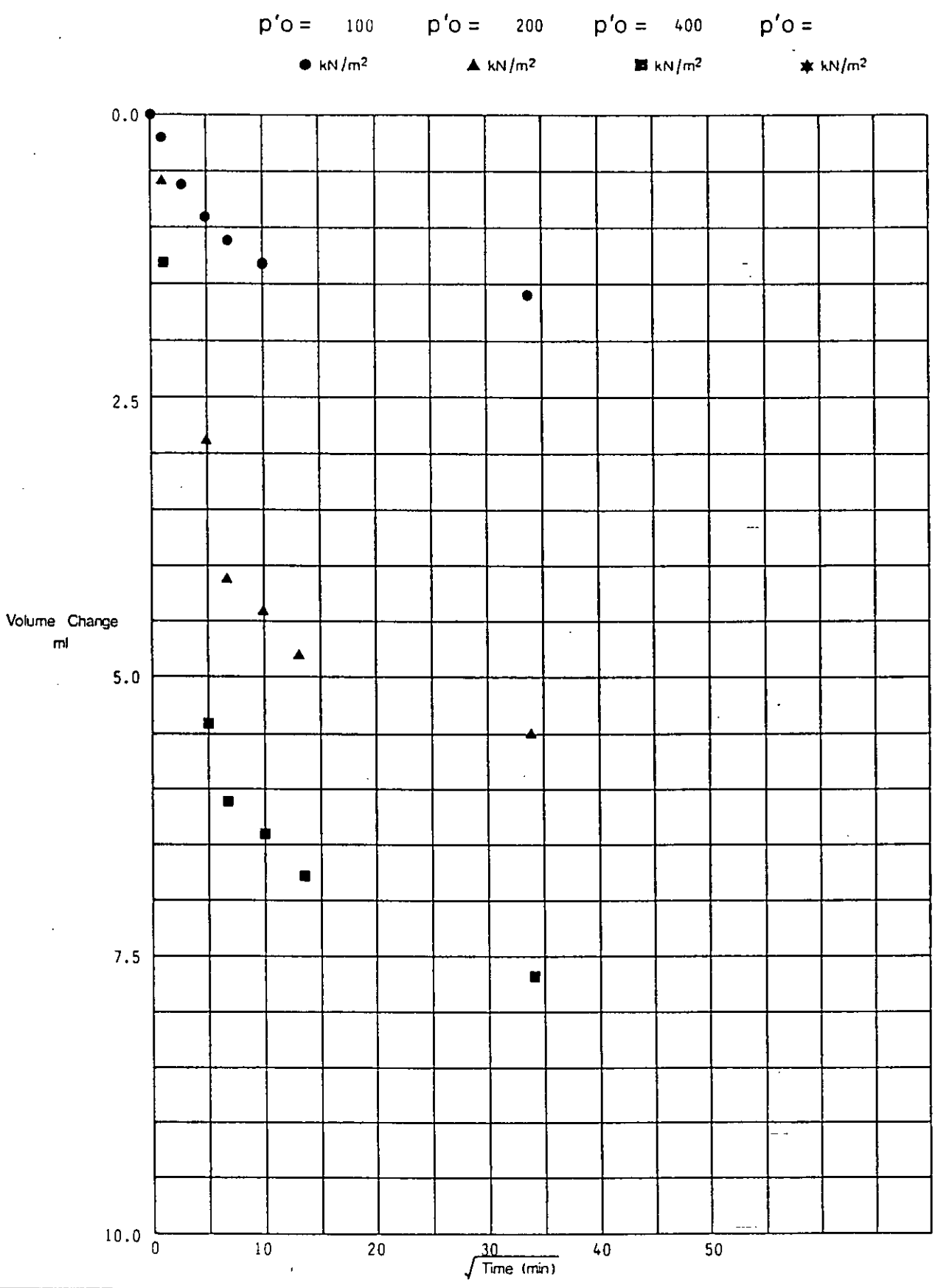
Figure 2.13



B	(Initial)		0.77	0.82	0.82	
B_s	(After application of Back Pressure)		0.99	0.98	0.99	
ε	(Rate of Strain)	% min	0.004	0.004	0.004	
σ_3	(Cell Pressure during Shear)	kN/m²	300	400	600	
u_0	(Applied Back Pressure)	kN/m²	200	200	200	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	100	200	400	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	275	436	794	

Triaxial Compression Test Consolidated Drained	Description Clayey SILT with fine weak mudstone fragments.	C' 20 kN/m² Φ' 28 Degrees	
	Mohr Circles and Summary	Depth 6.50 Borehole B221	
Remarks 3 x 38mm dia samples.			
Laboratory – Effective Stress	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449	
exploration associates		**Figure** 2.14	

EX3



Triaxial Consolidation – Volume Change / $\sqrt{\text{Time}}$

Depth 6.50
Borehole B221

Remarks

Laboratory – Effective Stress

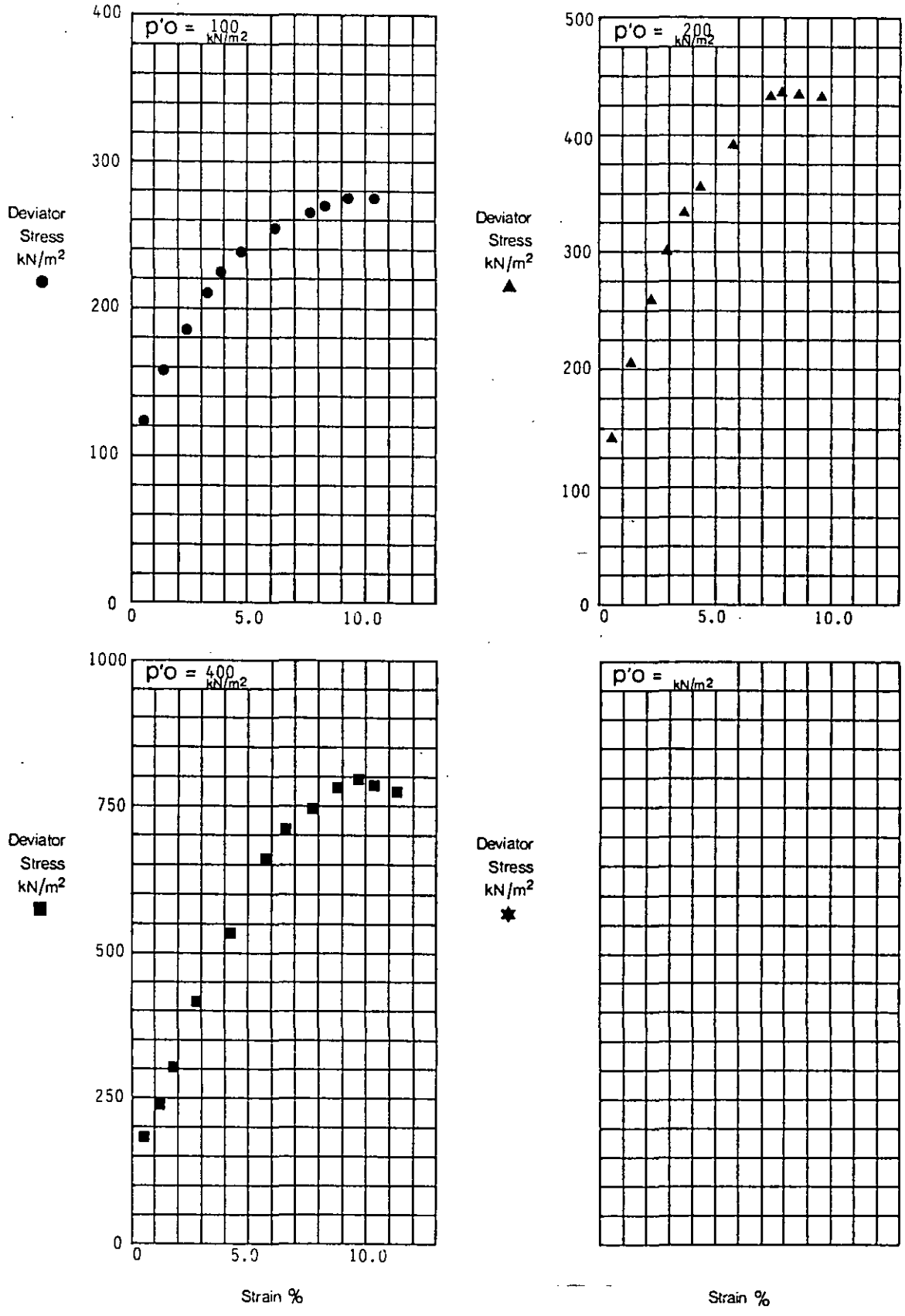
exploration associates

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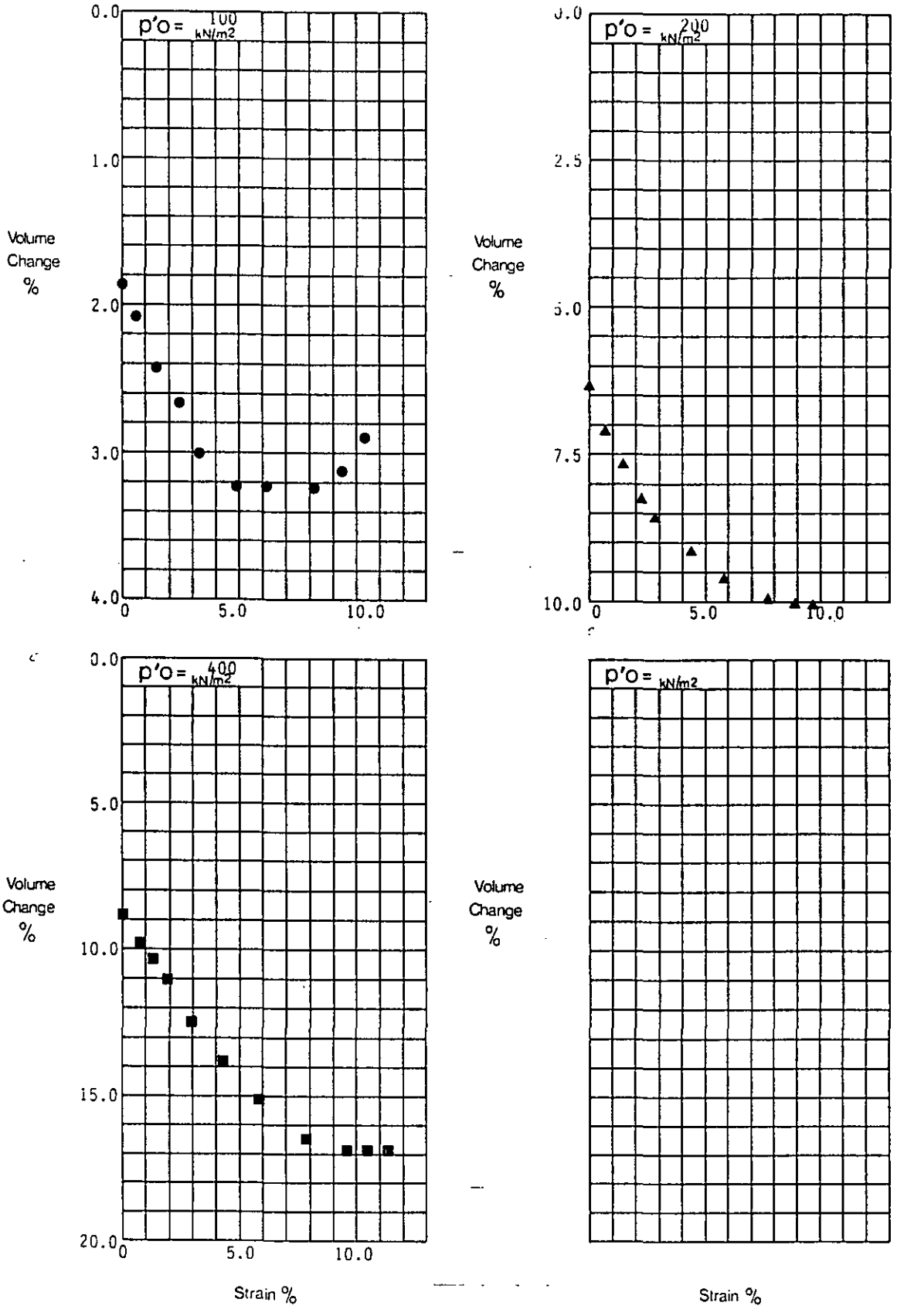
Figure 2.15

EX3



Deviator Stress / Strain	Depth 6.50 Borehole B221
Remarks	
Laboratory - Effective Stress	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2
exploration associates	Contract S4449 **Figure** 2.16

EX3



Volume Change % / Strain %

Depth 6.50
Borehole B221

Remarks

Laboratory - Effective Stress

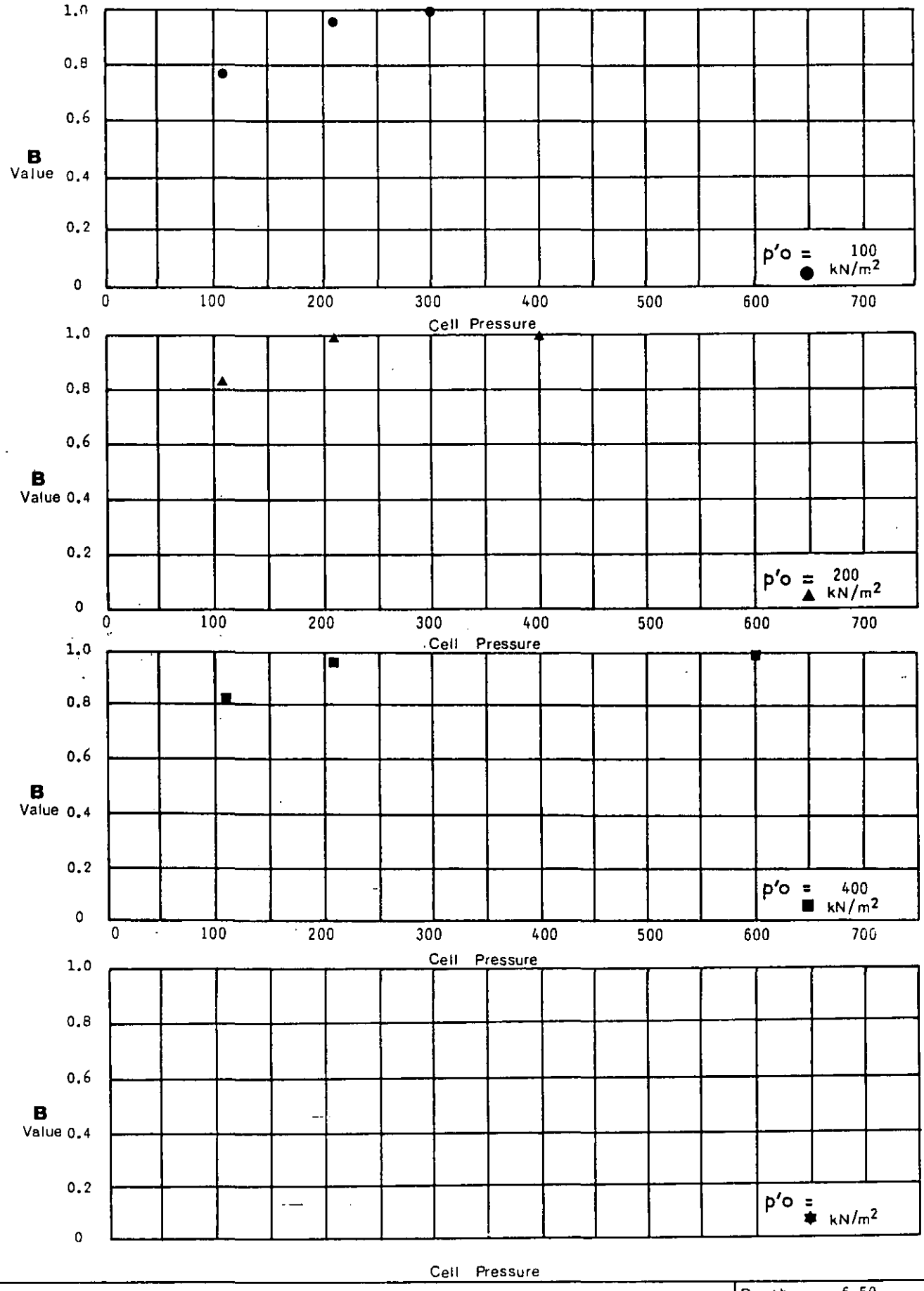
exploration associates

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Figure 2.17

EX3



B Value / Cell Pressure

Depth 6.50
Borehole B221

Remarks

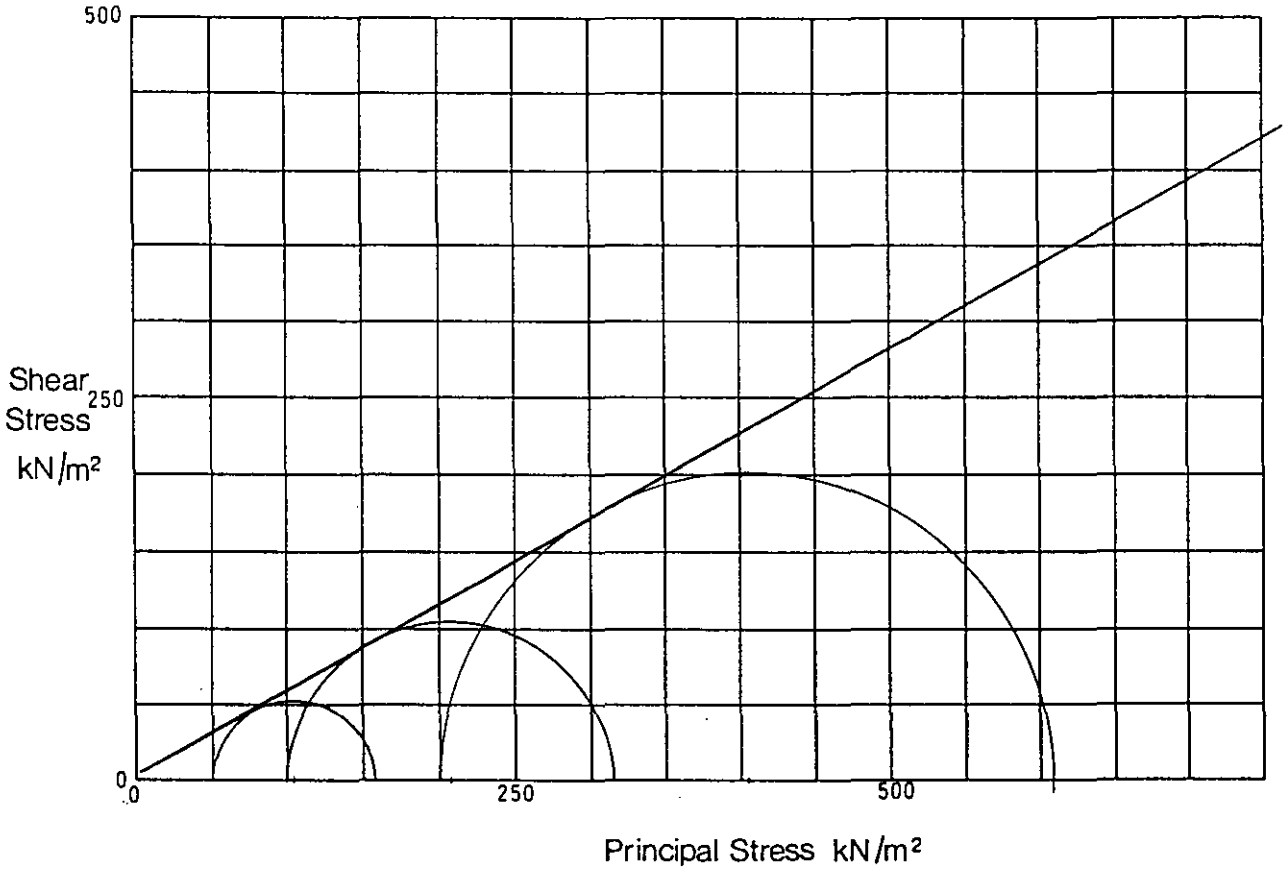
Laboratory Effective Stress

exploration associates

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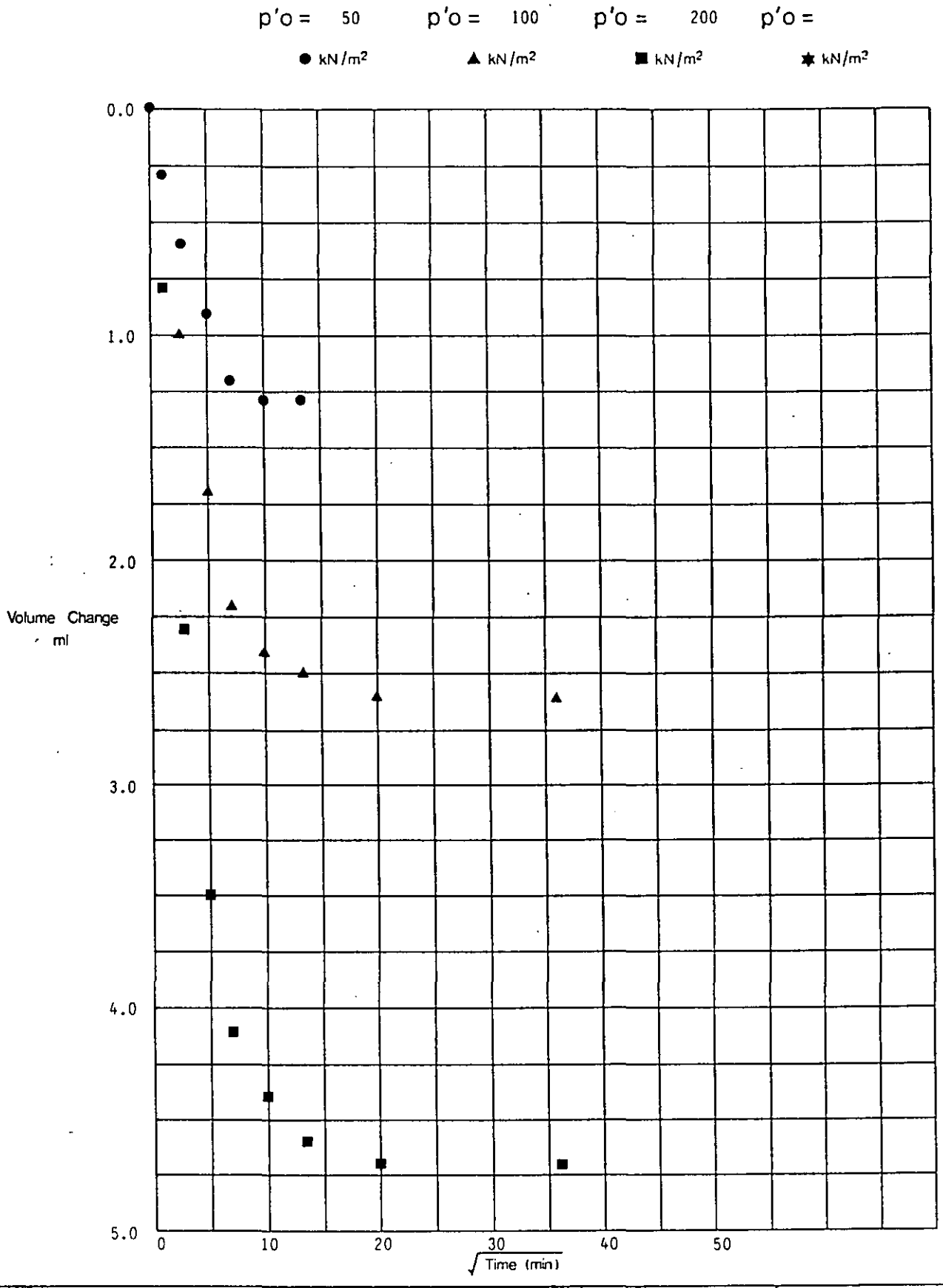
Contract S4449

Figure 2.18



B	(Initial)		0.85	0.83	0.85	
B_s	(After application of Back Pressure)		0.98	1.00	1.00	
ε	(Rate of Strain)	% min	0.008	0.008	0.008	
σ_3	(Cell Pressure during Shear)	kN/m²	250	300	400	
u_0	(Applied Back Pressure)	kN/m²	200	200	200	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	50	100	200	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	105	215	409	

Triaxial Compression Test Consolidated Drained	Description Remoulded silty CLAY **Mohr Circles and Summary**	C' 0 kN/m² Φ' 29 Degrees Depth 4.00 Borehole B222
Remarks 3 x 38mm dia samples.		
Laboratory - Effective Stress **exploration associates**	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449 **Figure** 2.19



Triaxial Consolidation – Volume Change / $\sqrt{\text{Time}}$

Depth 4.00
Borehole B222

Remarks

Laboratory – Effective Stress

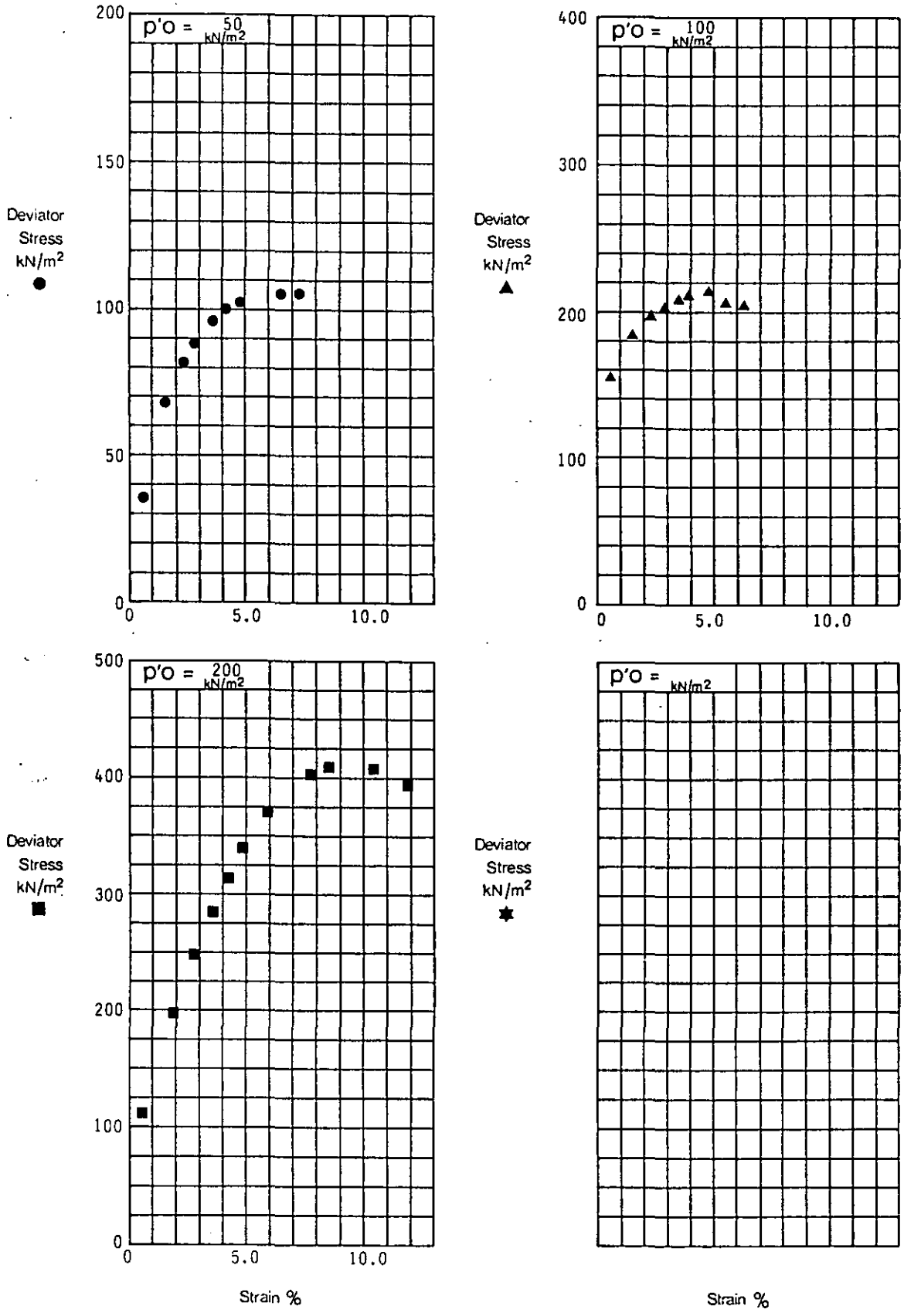
exploration associates

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Figure 2.20

EX3



Deviator Stress / Strain

Depth 4.00
Borehole B222

Remarks

Laboratory-Effective Stress

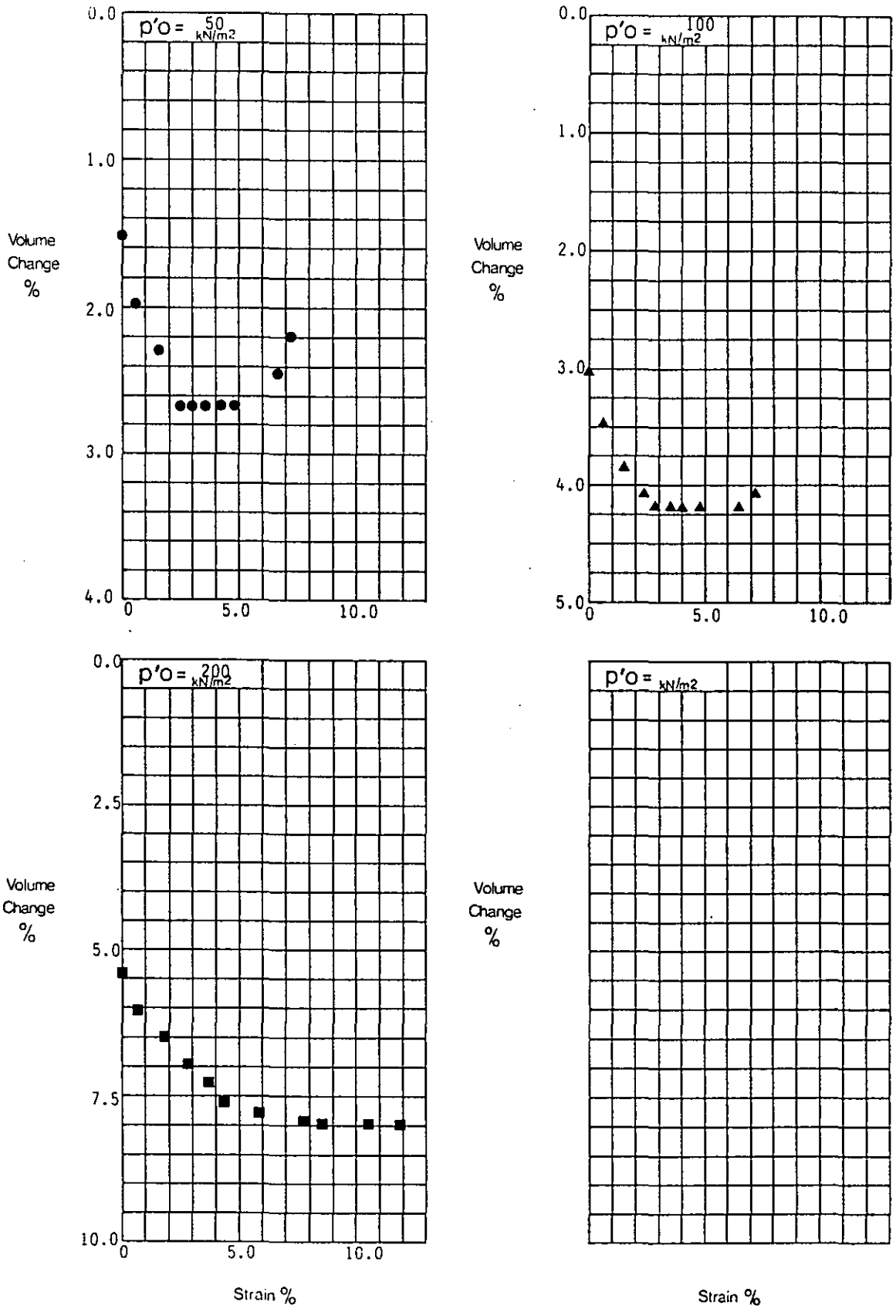
exploration associates

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Contract S4449

Figure 2.21

EX3



Volume Change % / Strain %

Depth 4.00
Borehole B222

Remarks

Laboratory - Effective Stress

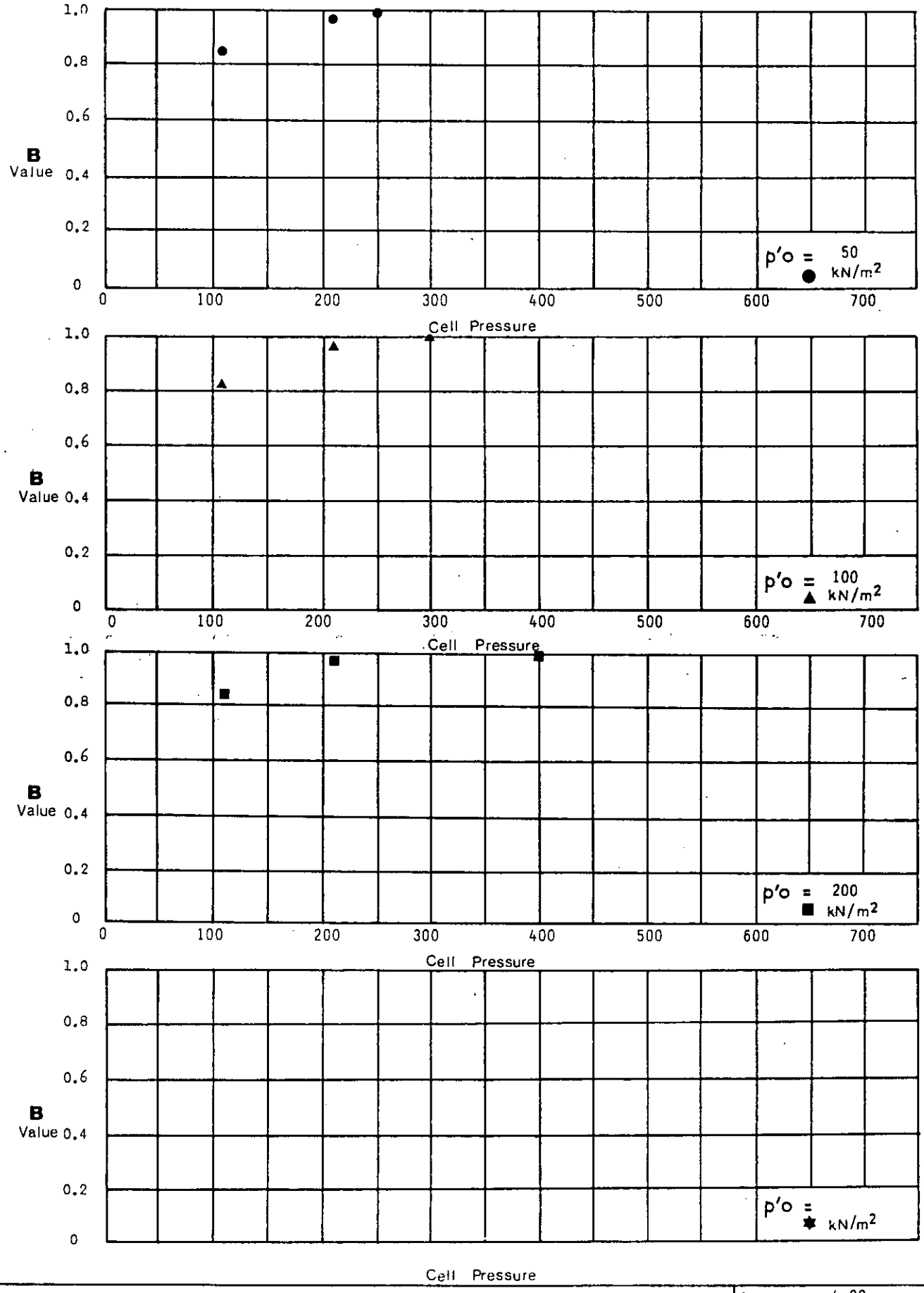
exploration associates

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Figure 2.22

EX3



B Value / Cell Pressure

Depth 4.00
Borehole B222

Remarks

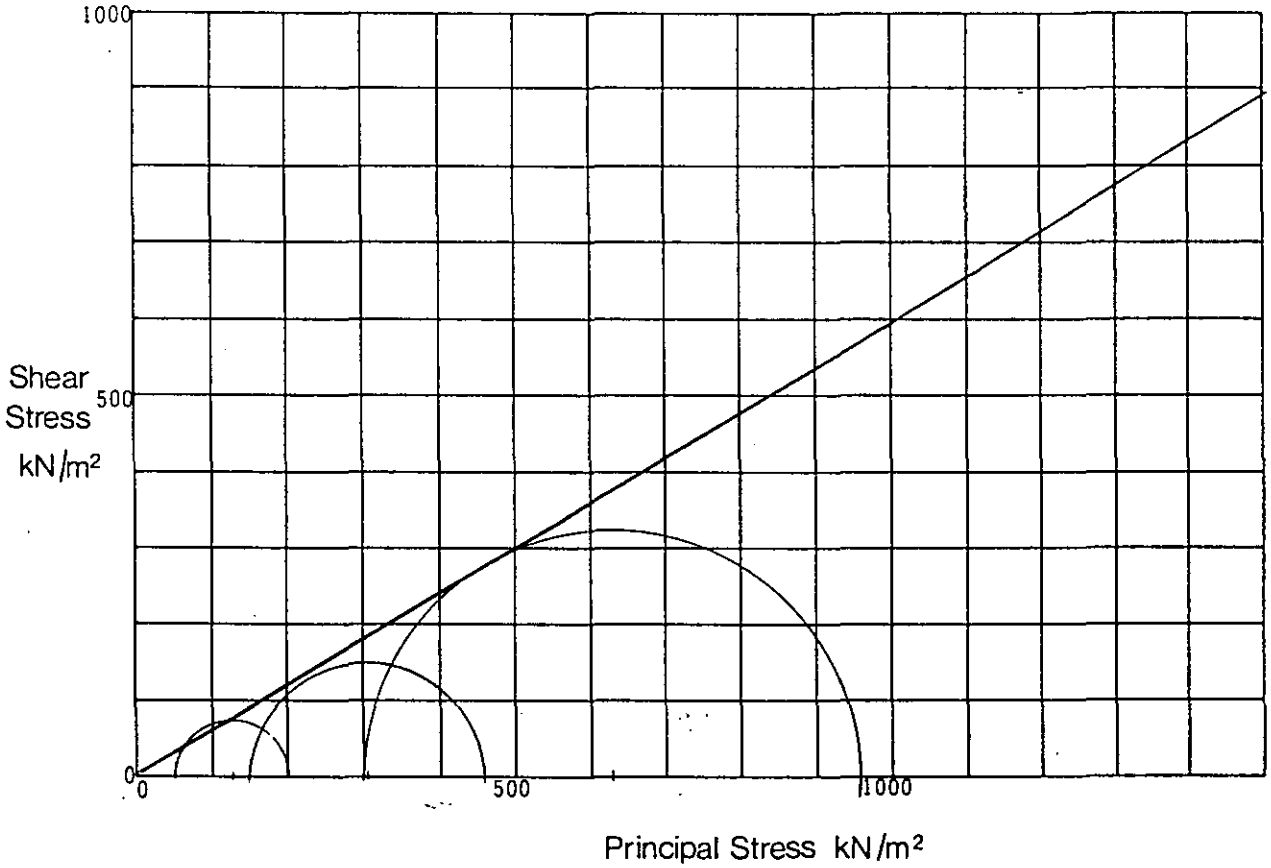
Laboratory Effective Stress

exploration associates

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Figure 2.23



B	(Initial)		0.79	0.85	0.90	
B_s	(After application of Back Pressure)		1.00	0.99	1.00	
ε	(Rate of Strain)	% min	0.013	0.004	0.004	
σ_3	(Cell Pressure during Shear)	kN/m²	250	350	500	
u_0	(Applied Back Pressure)	kN/m²	200	200	200	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	50	150	300	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	151	307	657	

Triaxial Compression Test
Consolidated
Drained

Description Clayey SILT with fine weak mudstone fragments.

C' 0 kN/m²
φ' 31 Degrees

Mohr Circles and Summary

Depth 3.50
Borehole B223

Remarks 3 x 38mm dia samples.

Laboratory - Effective Stress

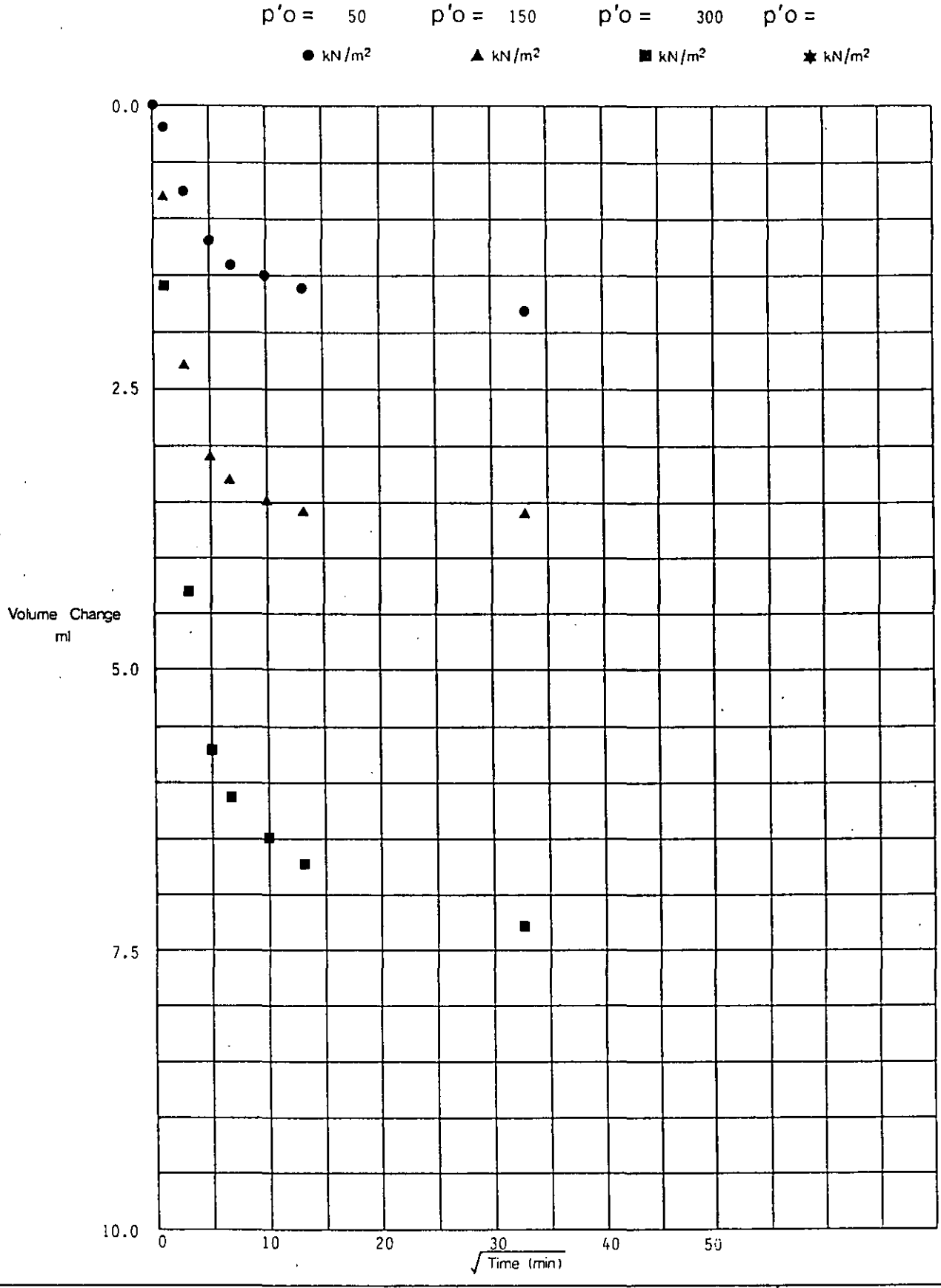
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Figure 2.24

EX3



Triaxial Consolidation – Volume Change / $\sqrt{\text{Time}}$

Depth 3.50
Borehole B223

Remarks

Laboratory – Effective Stress

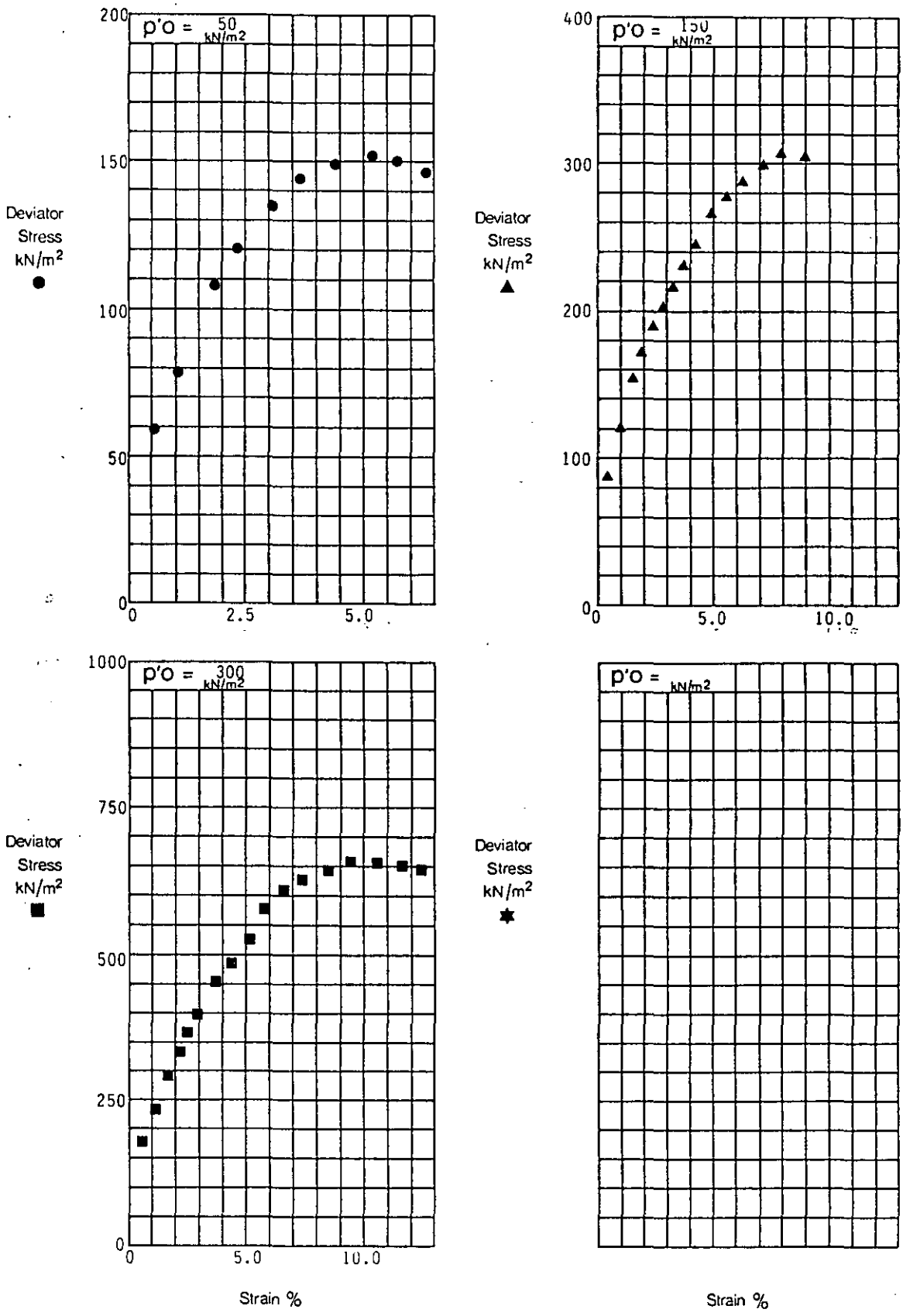
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Figure 2.25

EX3



Deviator Stress / Strain

Depth 3.50
Borehole B223

Remarks

Laboratory - Effective Stress

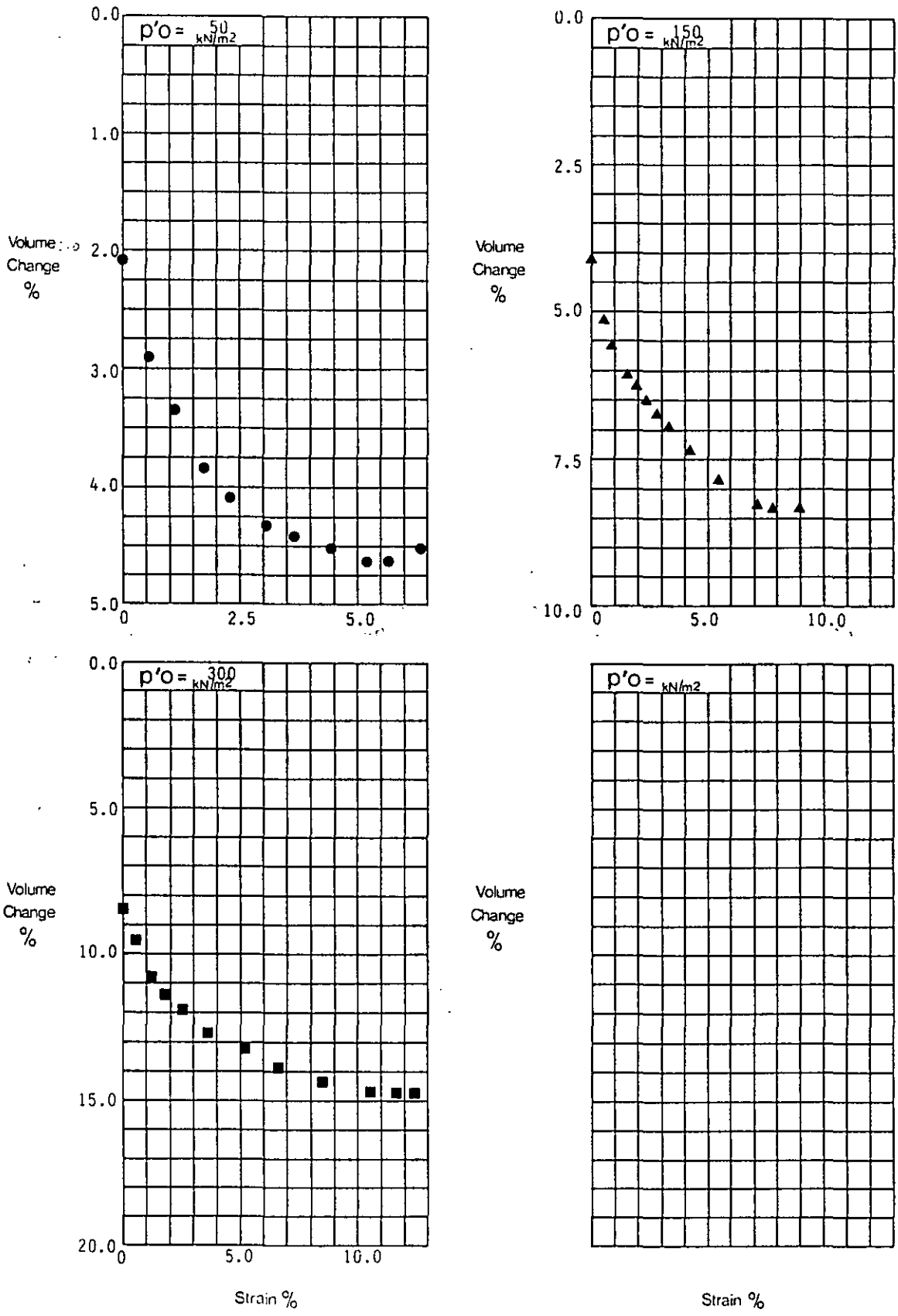
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Figure 2.26

EX3



Volume Change % / Strain %

Depth 3.50
Borehole B223

Remarks

Laboratory - Effective Stress

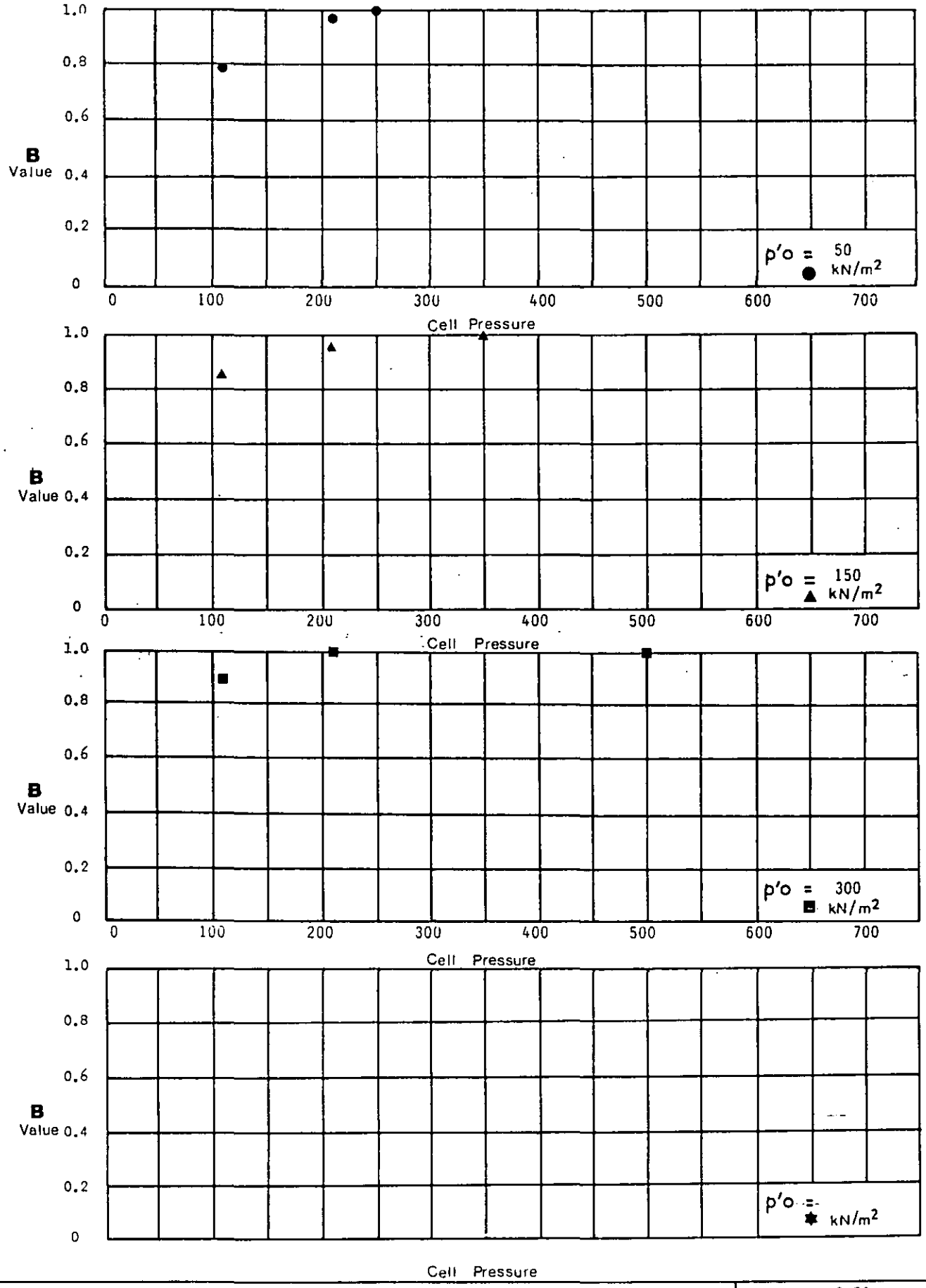
exploration associates

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Figure 2.27

EX3



B Value / Cell Pressure

Depth 3.50
Borehole B223

Remarks

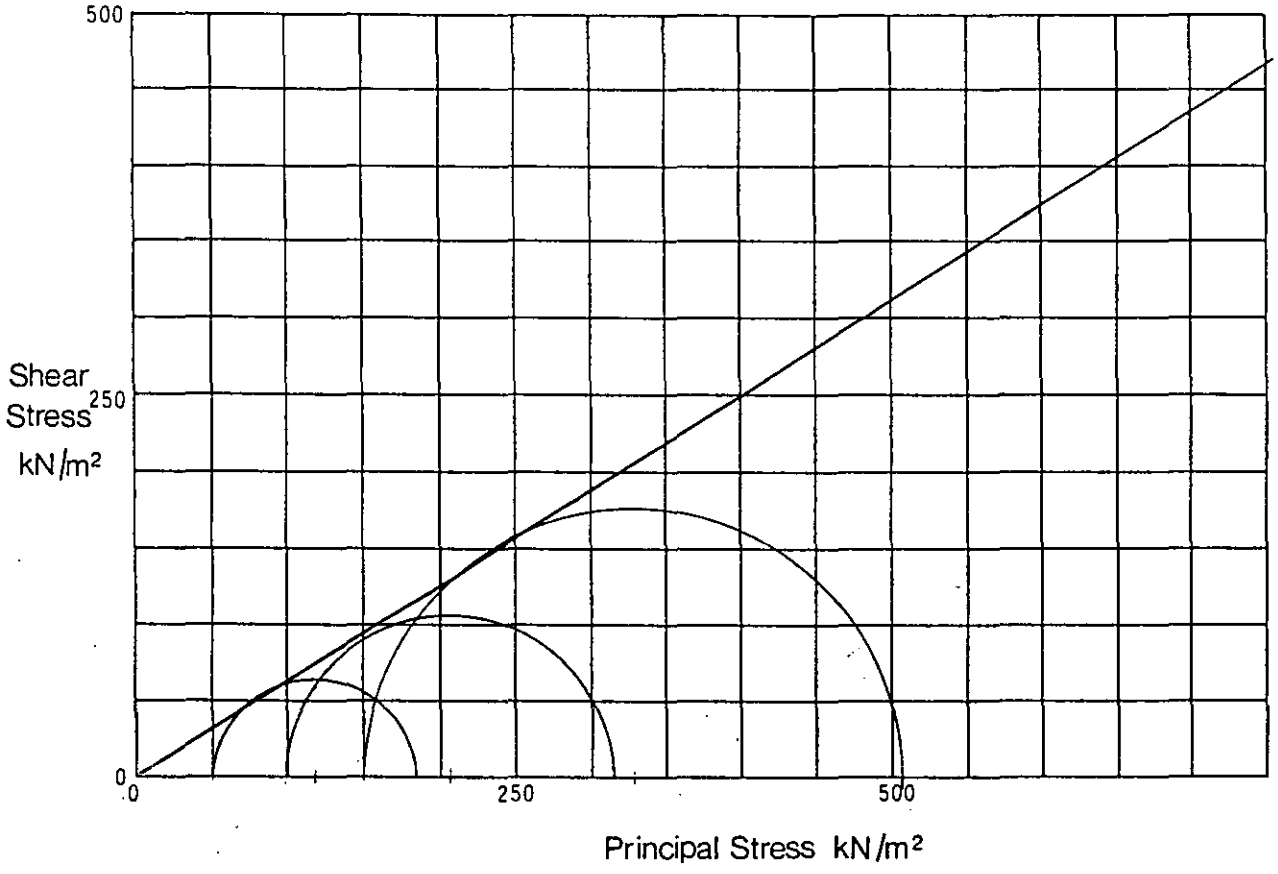
Laboratory Effective Stress

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Figure 2.28



B	(Initial)		0.81	0.83	0.77	
B_s	(After application of Back Pressure)		1.00	0.99	1.00	
ε	(Rate of Strain)	% min	0.008	0.008	0.0016	
σ_3	(Cell Pressure during Shear)	kN/m²	250	300	350	
u_0	(Applied Back Pressure)	kN/m²	200	200	200	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	50	100	150	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	136	213	356	

Triaxial Compression Test
Consolidated
Drained

Description Silty sandy CLAY with occasional sand pockets and gravel.

C' 0 kN/m²
Φ' 32 Degrees

Mohr Circles and Summary

Depth 2.00
Borehole 235

Remarks 3 x 38mm dia samples.

Laboratory - Effective Stress

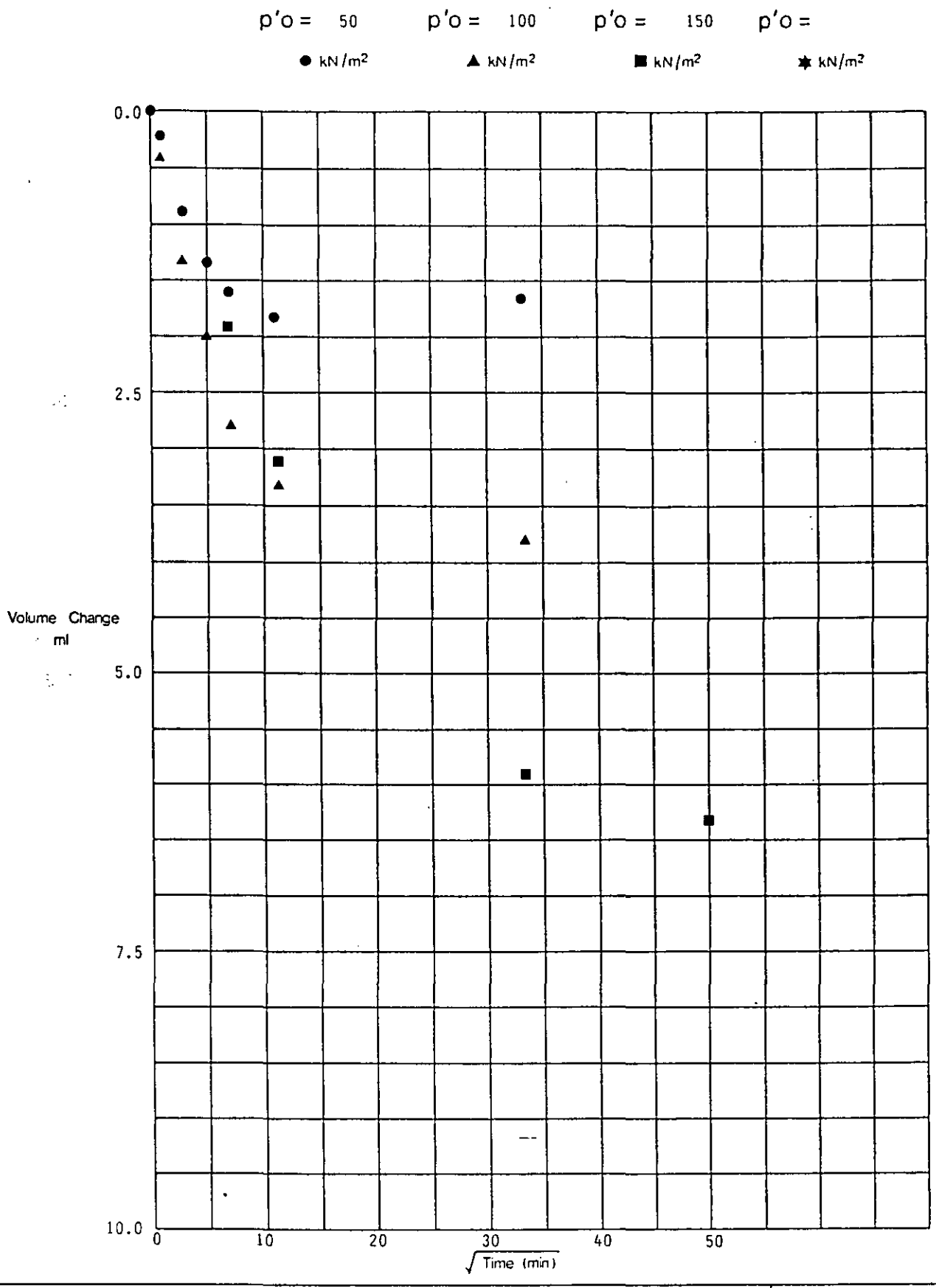
exploration associates

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Figure 2.29

EX3



Triaxial Consolidation – Volume Change / $\sqrt{\text{Time}}$

Depth 2.00
Borehole 235

Remarks

Laboratory – Effective Stress

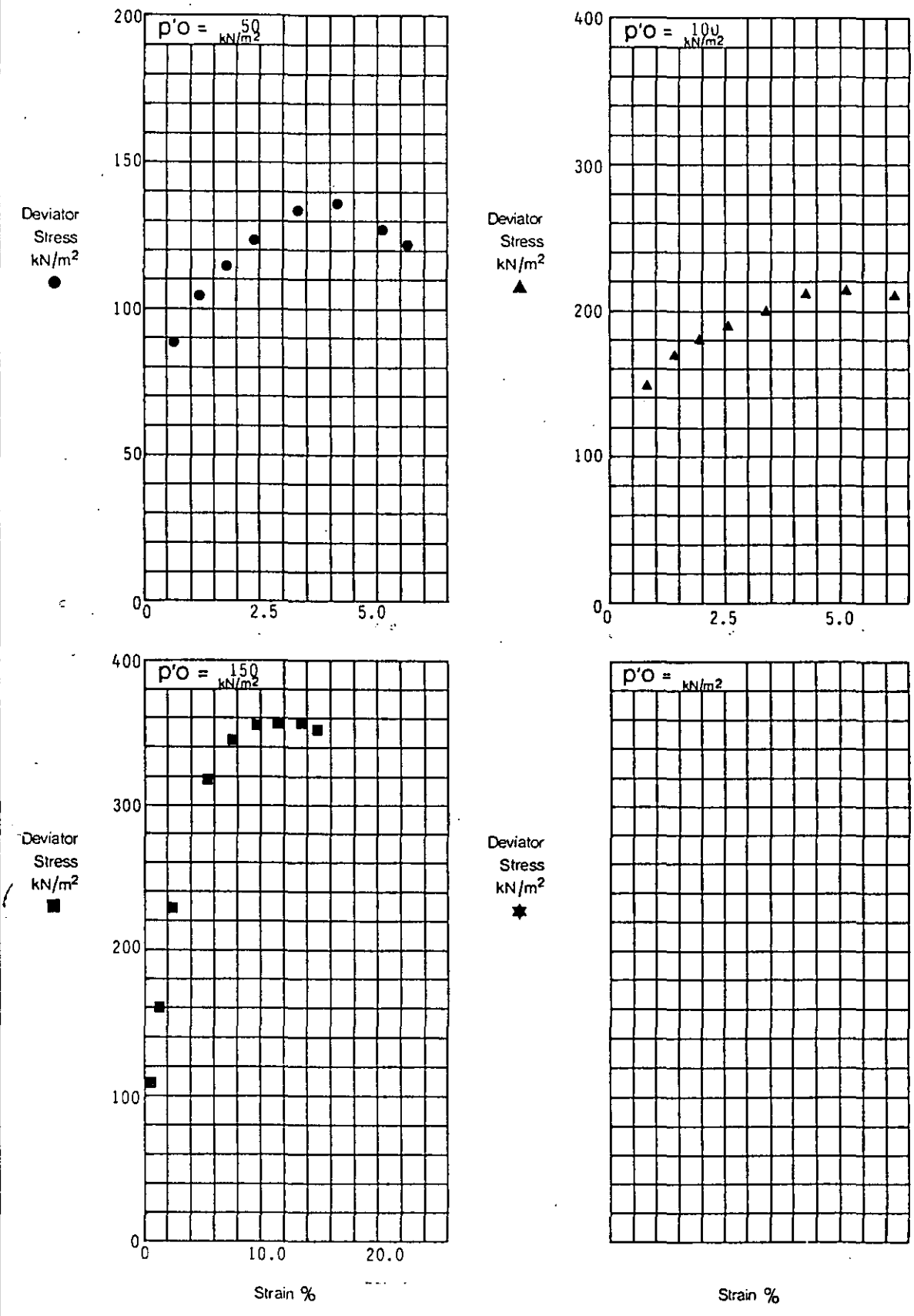
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Contract S4449

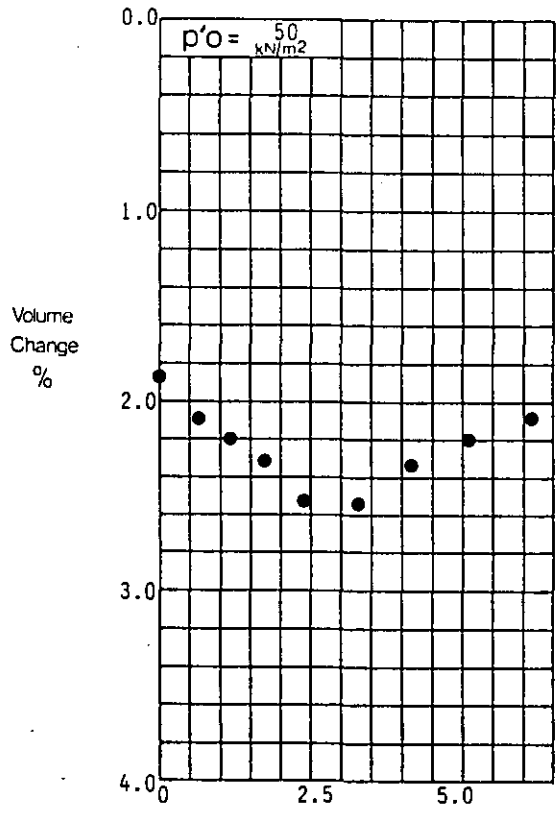
Figure 2.30

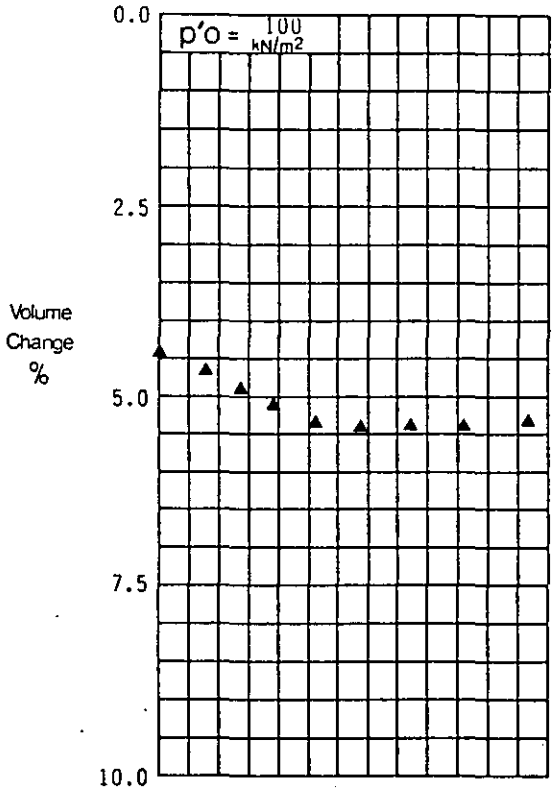
EX3

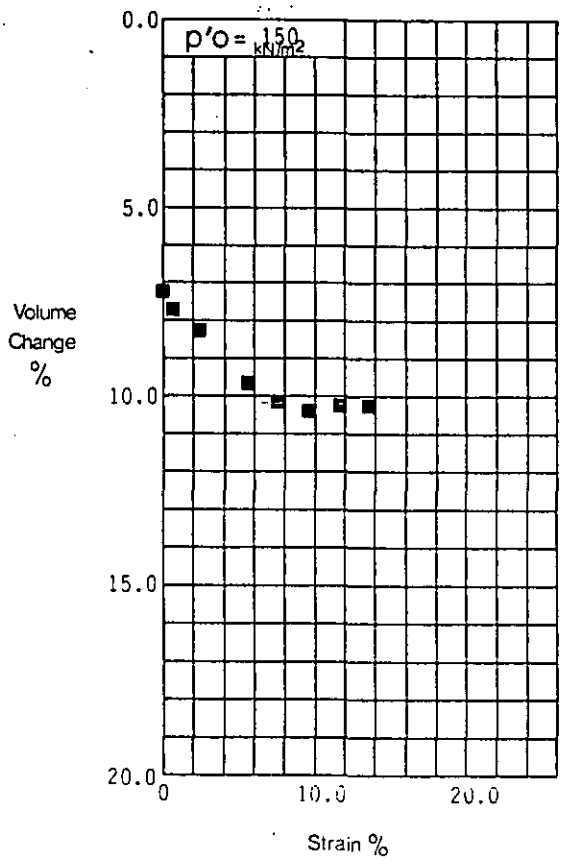


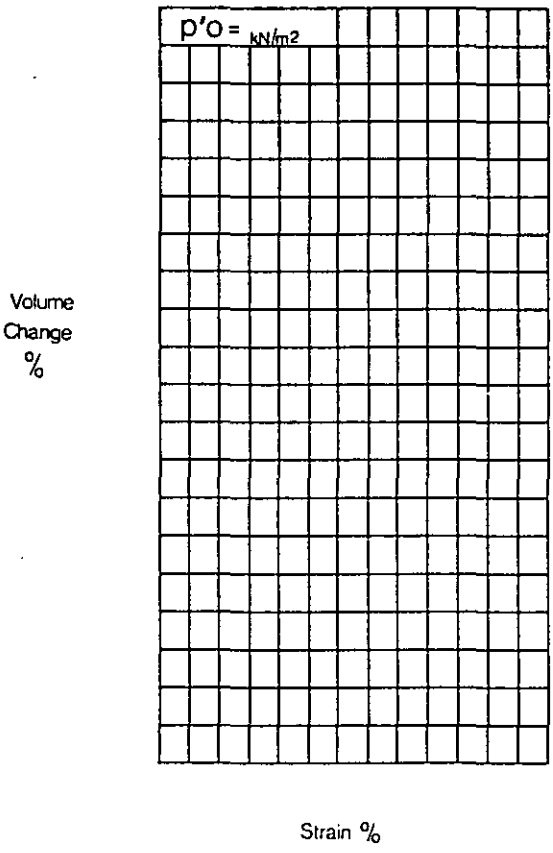
Deviator Stress / Strain	Depth 2.00 Borehole 235
Remarks	
Laboratory - Effective Stress **exploration associates**	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2
	Contract S4449 **Figure** 2.31

EX3









Volume Change % / Strain %

Depth 2.00
Borehole 235

Remarks

Laboratory - Effective Stress

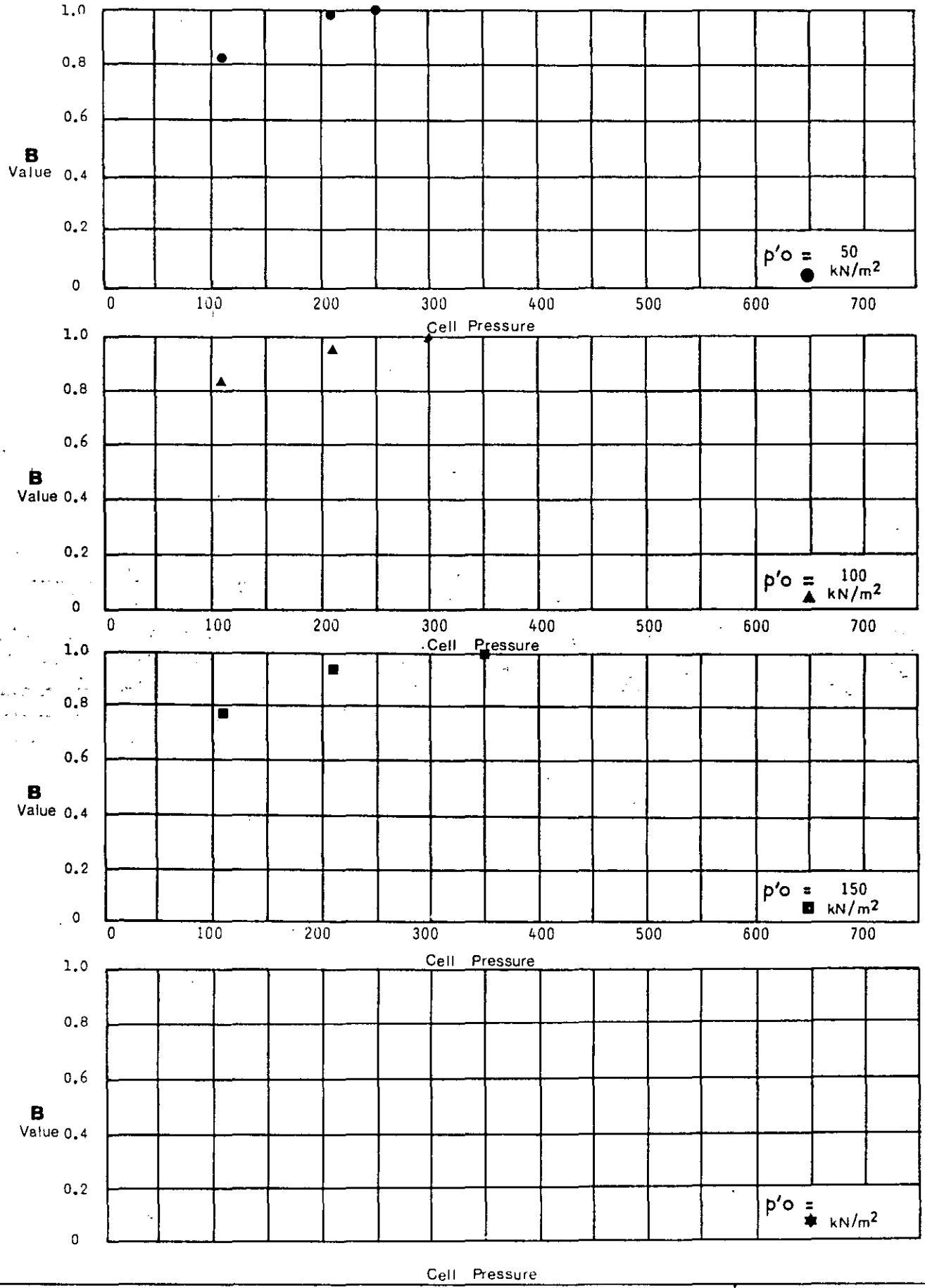
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Figure 2.32

EX3



B Value / Cell Pressure

Depth 2.00
Borehole 235

Remarks

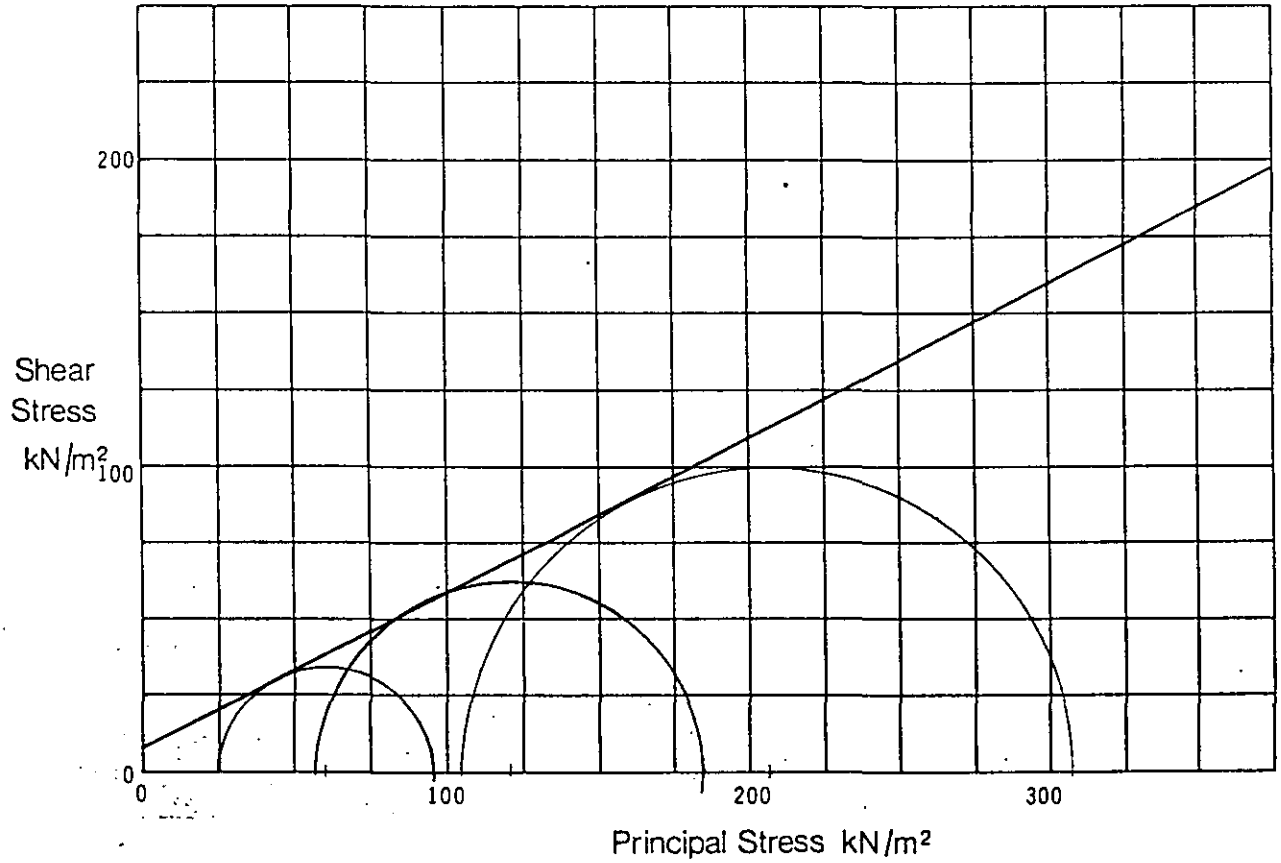
Laboratory Effective Stress

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Figure 2.33



B	(Initial)		0.56	0.51	0.45	
B_s	(After application of Back Pressure)		1.00	0.99	1.00	
ε	(Rate of Strain)	% min	0.0027	0.0027	0.0027	
σ_3	(Cell Pressure during Shear)	kN/m²	350	400	500	
u_0	(Applied Back Pressure)	kN/m²	300	300	300	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	50	100	200	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	72	127	204	
$\Delta u_f = u_f - u_0$	(Pore Pressure Change to Failure)	kN/m²	26	43	96	
A_f	(Failure)		0.36	0.34	0.47	

Triaxial Compression Test
Consolidated
Undrained

Description Remoulded silty CLAY

Mohr Circles and Summary

C'	10	kN/m²
Φ'	26	Degrees
Depth	3.50	
Borehole	235	

Remarks 3 x 38mm dia samples.

Laboratory - Effective Stress

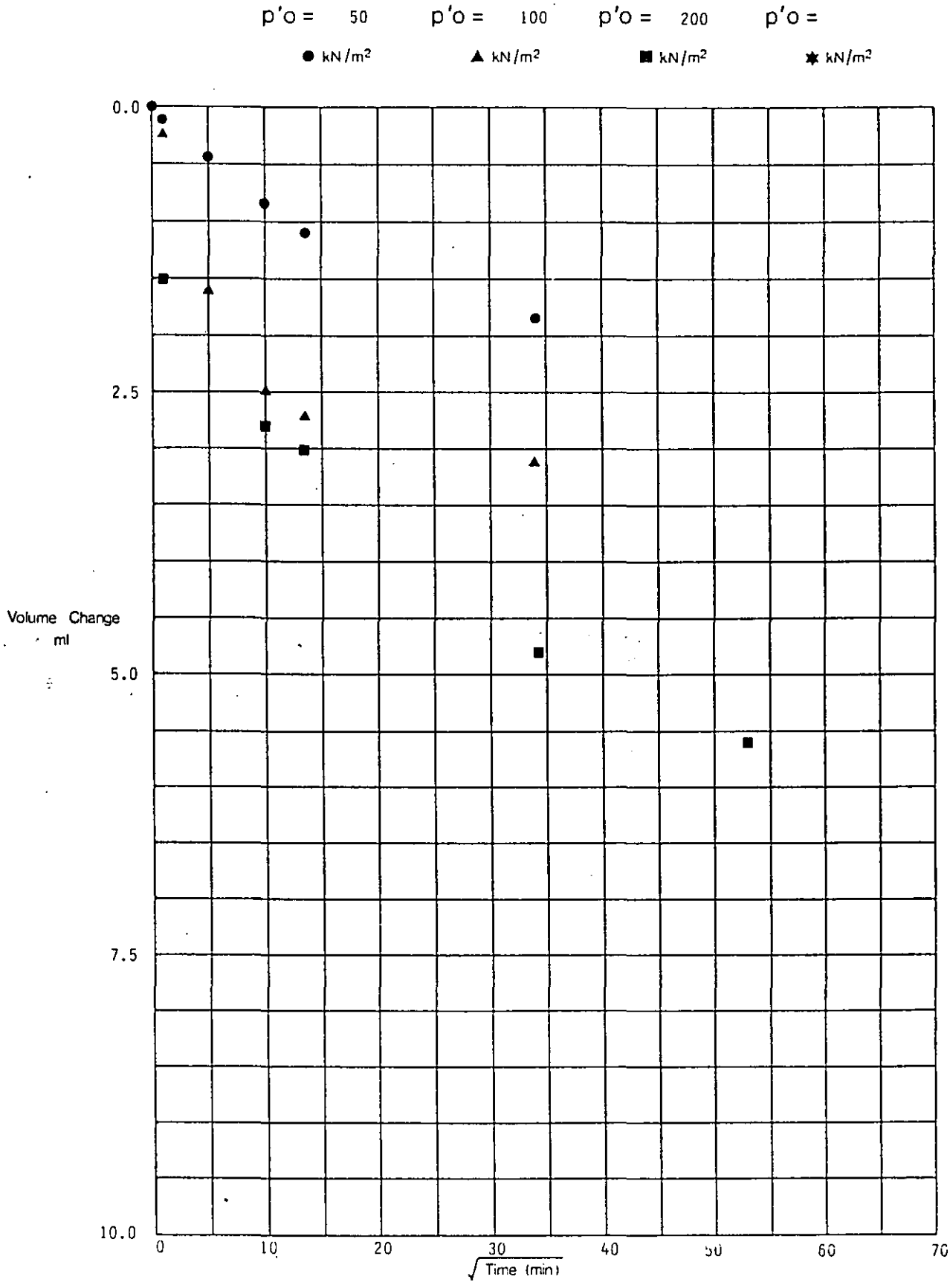
exploration associates

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Main Site Investigation - Contract 2

Contract S4449

Figure 2.34

EX3



Triaxial Consolidation – Volume Change / $\sqrt{\text{Time}}$

Depth 3.50
Borehole 235

Remarks

Laboratory – Effective Stress

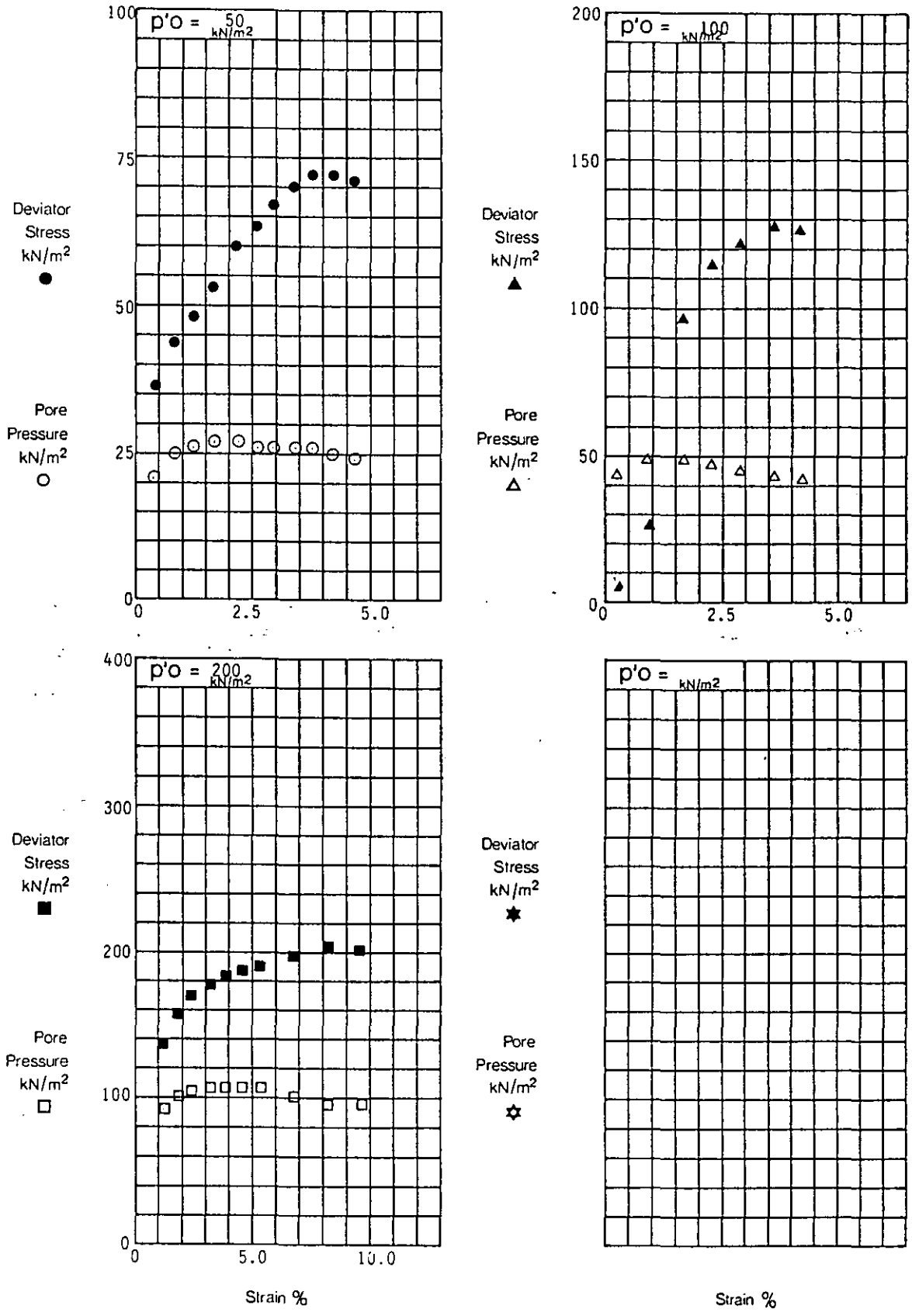
exploration associates

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A42 Castle Donington North
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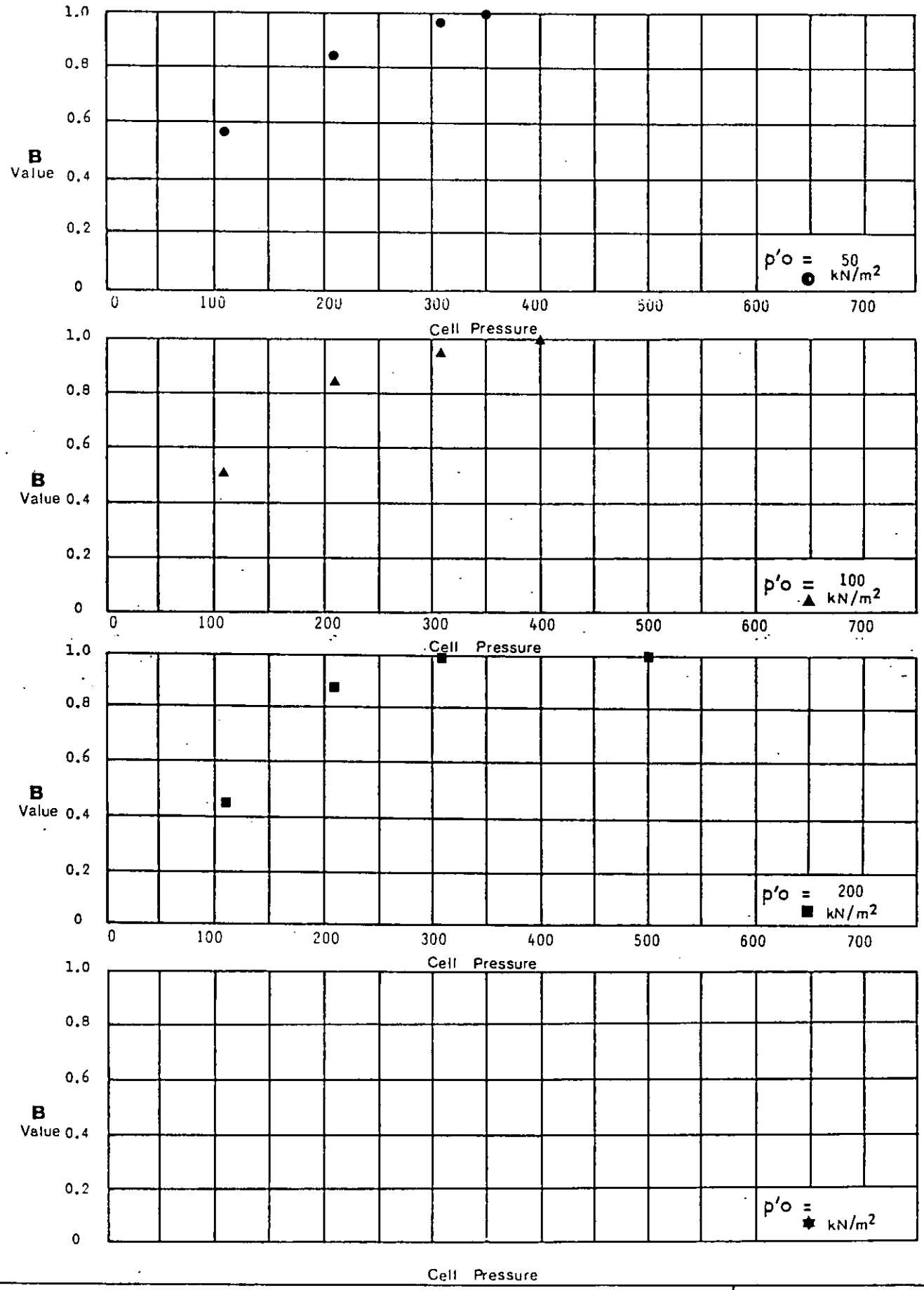
Figure 2.35

EX3



Deviator Stress / Strain Pore Pressure / Strain		Depth 3.50 Borehole 235
Remarks		
Laboratory-Effective Stress	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449
exploration associates		**Figure** 2.36

EX3



B Value / Cell Pressure

Depth 3.50
Borehole 235

Remarks

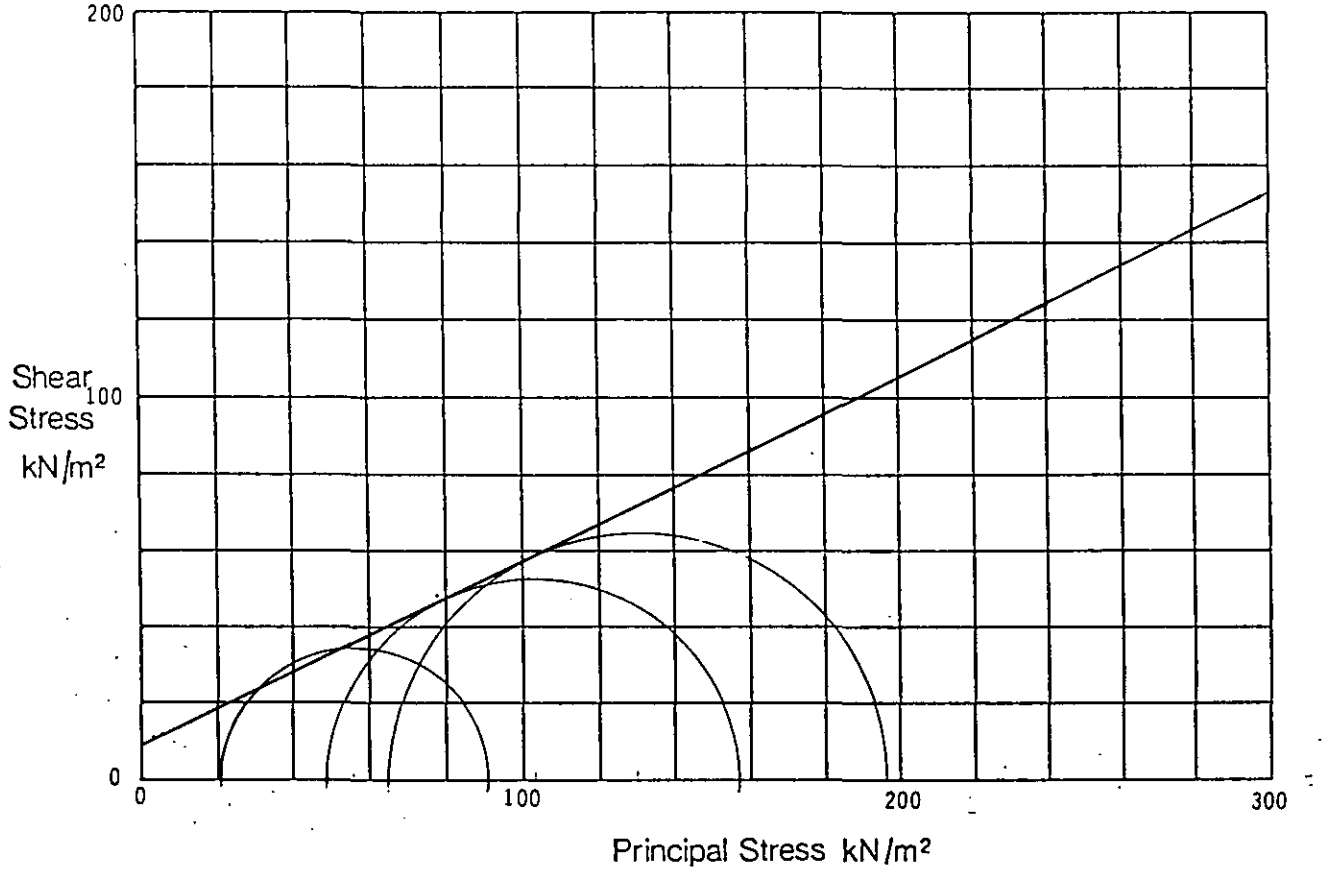
Laboratory Effective Stress

exploration associates

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East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation - Contract 2

Contract S4449

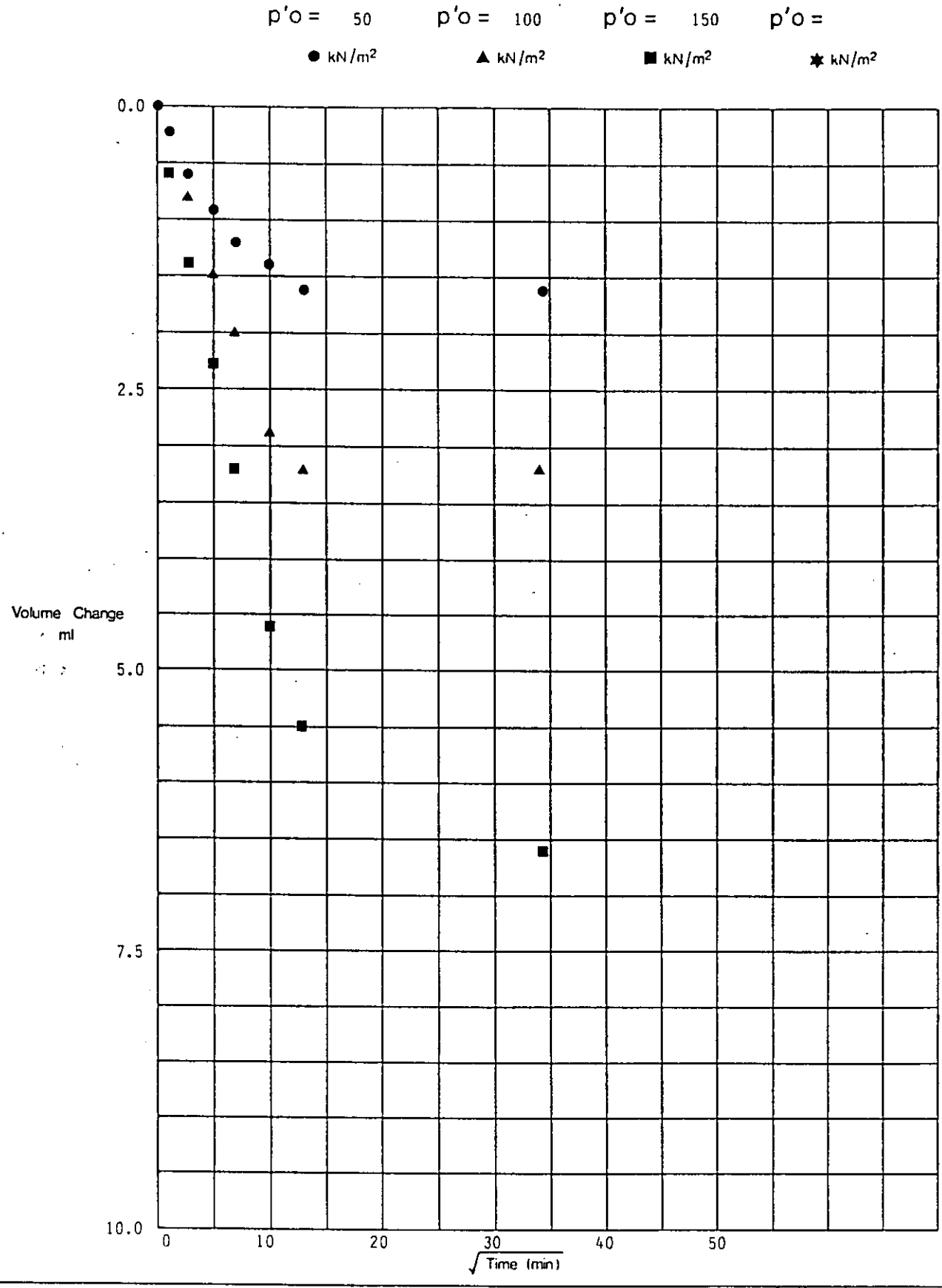
Figure 2.37



B	(Initial)		0.92	0.84	0.90	
B_s	(After application of Back Pressure)		0.98	0.99	0.99	
ε	(Rate of Strain)	% min	0.003	0.003	0.003	
σ_3	(Cell Pressure during Shear)	kN/m²	350	400	450	
u_0	(Applied Back Pressure)	kN/m²	300	300	300	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	50	100	150	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	70	109	130	
$\Delta u_f = u_f - u_0$	(Pore Pressure Change to Failure)	kN/m²	29	51	85	
A_f	(Failure)		0.41	0.47	0.65	

Triaxial Compression Test Consolidated Undrained	Description Remoulded silty CLAY. **Mohr Circles and Summary**	C' 10 kN/m² Φ' 25 Degrees Depth 0.50 Borehole 236
Remarks 3 x 38mm dia samples.		
Laboratory - Effective Stress **exploration associates**	Project Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract 34449 Figure 2.38

EX3



Triaxial Consolidation – Volume Change / √Time

Depth 0.50
Borehole 236

Remarks

Laboratory–Effective Stress

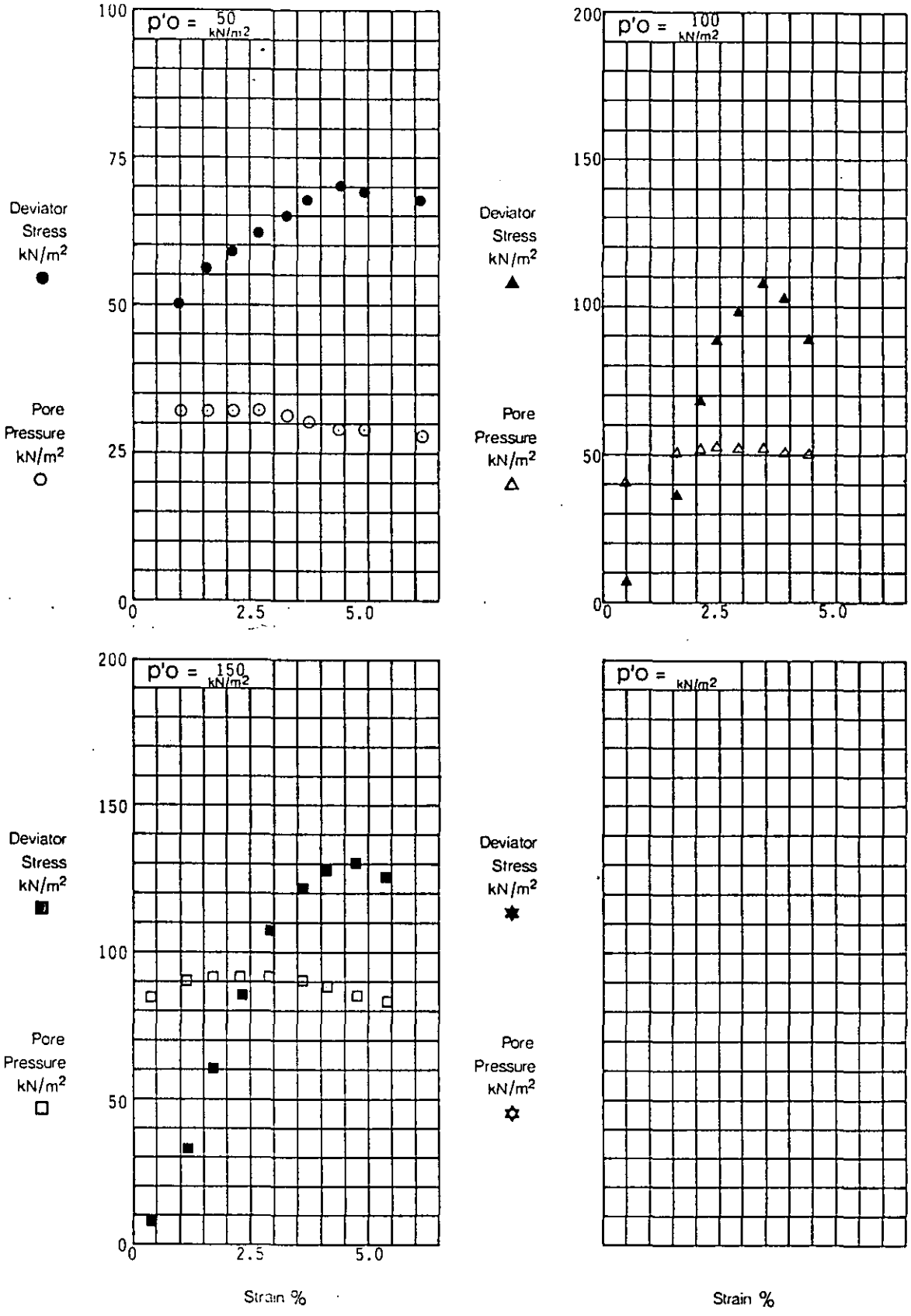
exploration associates

Project Department of Trsnsport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation - Contract 2

Contract S4449

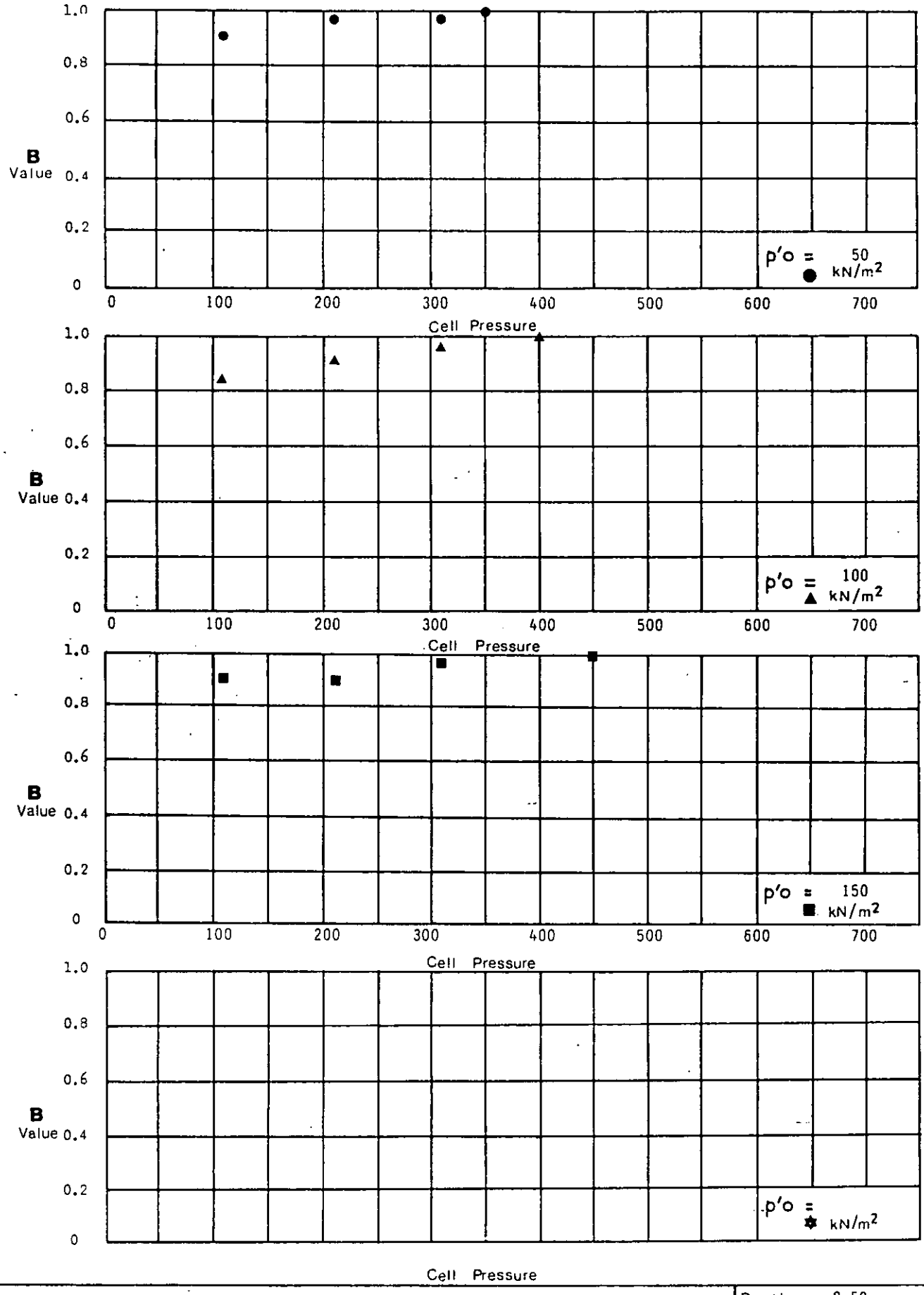
Figure 2.39

EX3



Deviator Stress / Strain Pore Pressure / Strain		Depth 0.50 Borehole 236
Remarks		
Laboratory - Effective Stress	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract 34449
exploration associates		**Figure** 2.40

EX3



B Value / Cell Pressure

Depth 0.50
Borehole 236

Remarks

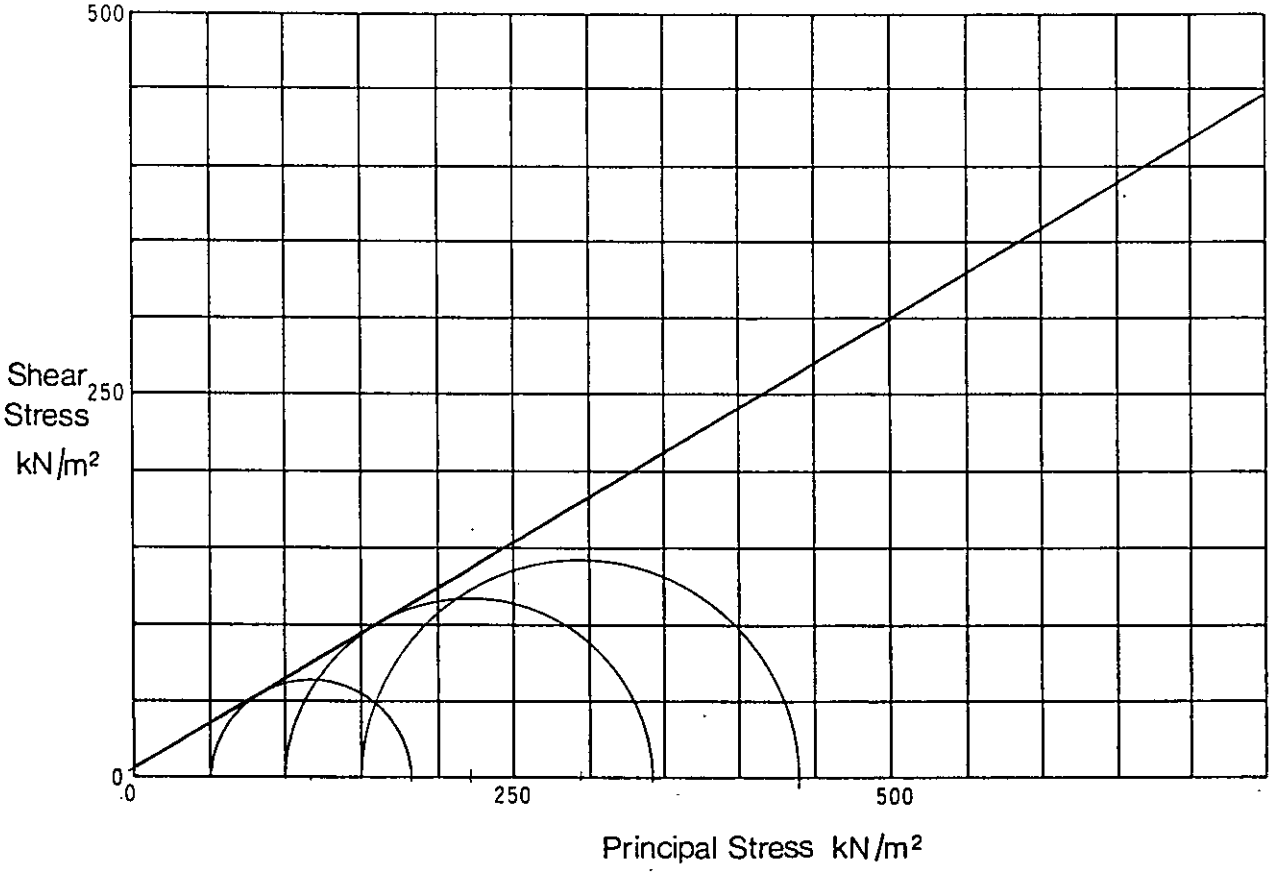
Laboratory Effective Stress

exploration associates

Project
Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation - Contract 2

Contract S4449

Figure 2.41



B	(Initial)		0.29	0.80	0.88	
B_s	(After application of Back Pressure)		1.00	1.00	1.00	
ε	(Rate of Strain)	% min	0.006	0.0015	0.0015	
σ_3	(Cell Pressure during Shear)	kN/m²	450	500	550	
u_0	(Applied Back Pressure)	kN/m²	400	400	400	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	50	100	150	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	133	244	288	

Triaxial Compression Test
Consolidated
Drained

Description Clayey SILT with occasional weak mudstone and sandstone fragments.

C' 0 kN/m²
Φ' 30 Degrees

Mohr Circles and Summary

Depth 3.50
Borehole 239

Remarks 106mm dia multistage

Laboratory - Effective Stress

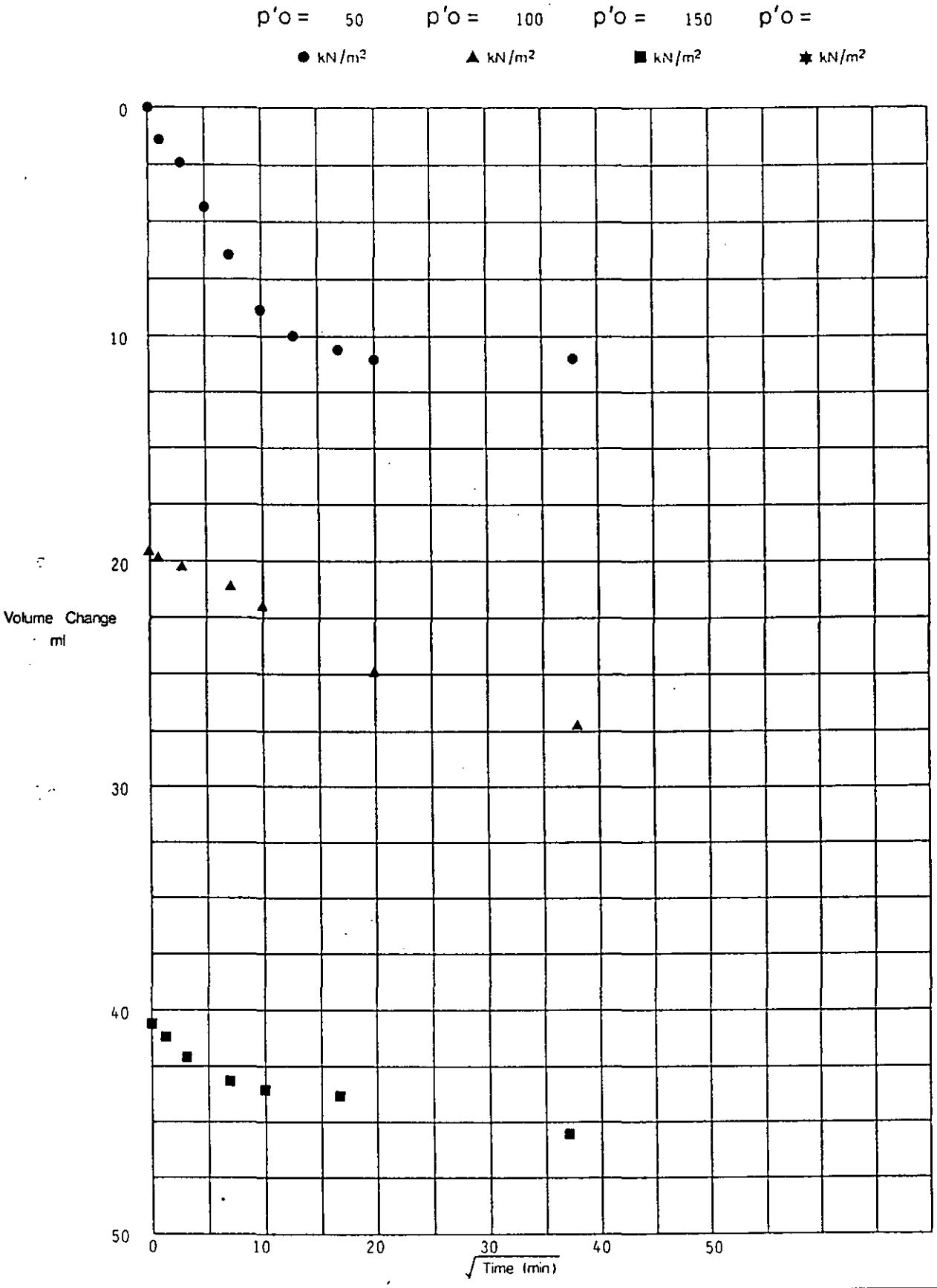
exploration associates

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East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation - Contract 2

Contract S4449

Figure 2.42

EX3



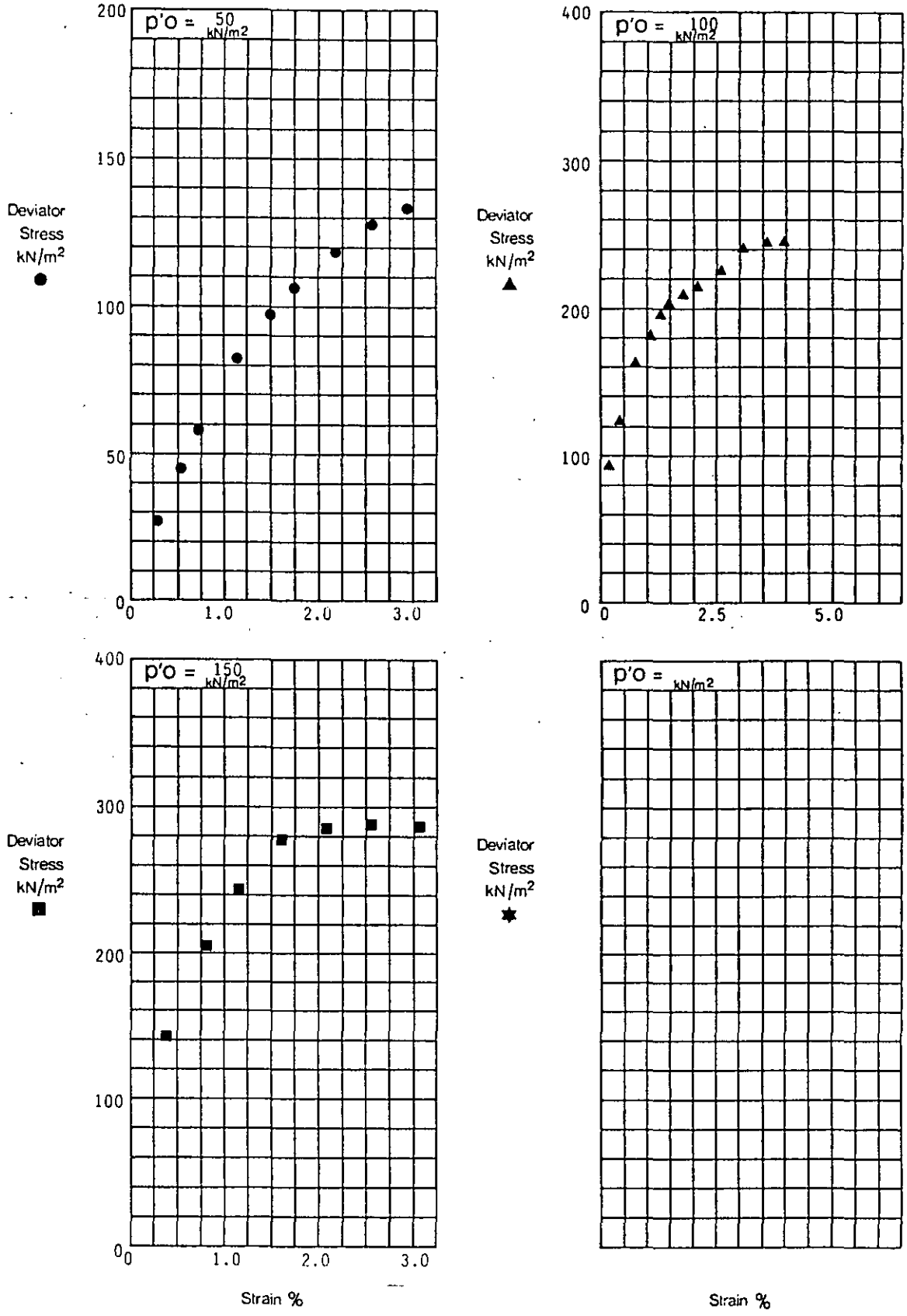
Triaxial Consolidation – Volume Change / $\sqrt{\text{Time}}$

Depth	3.50
Borehole	239

Remarks

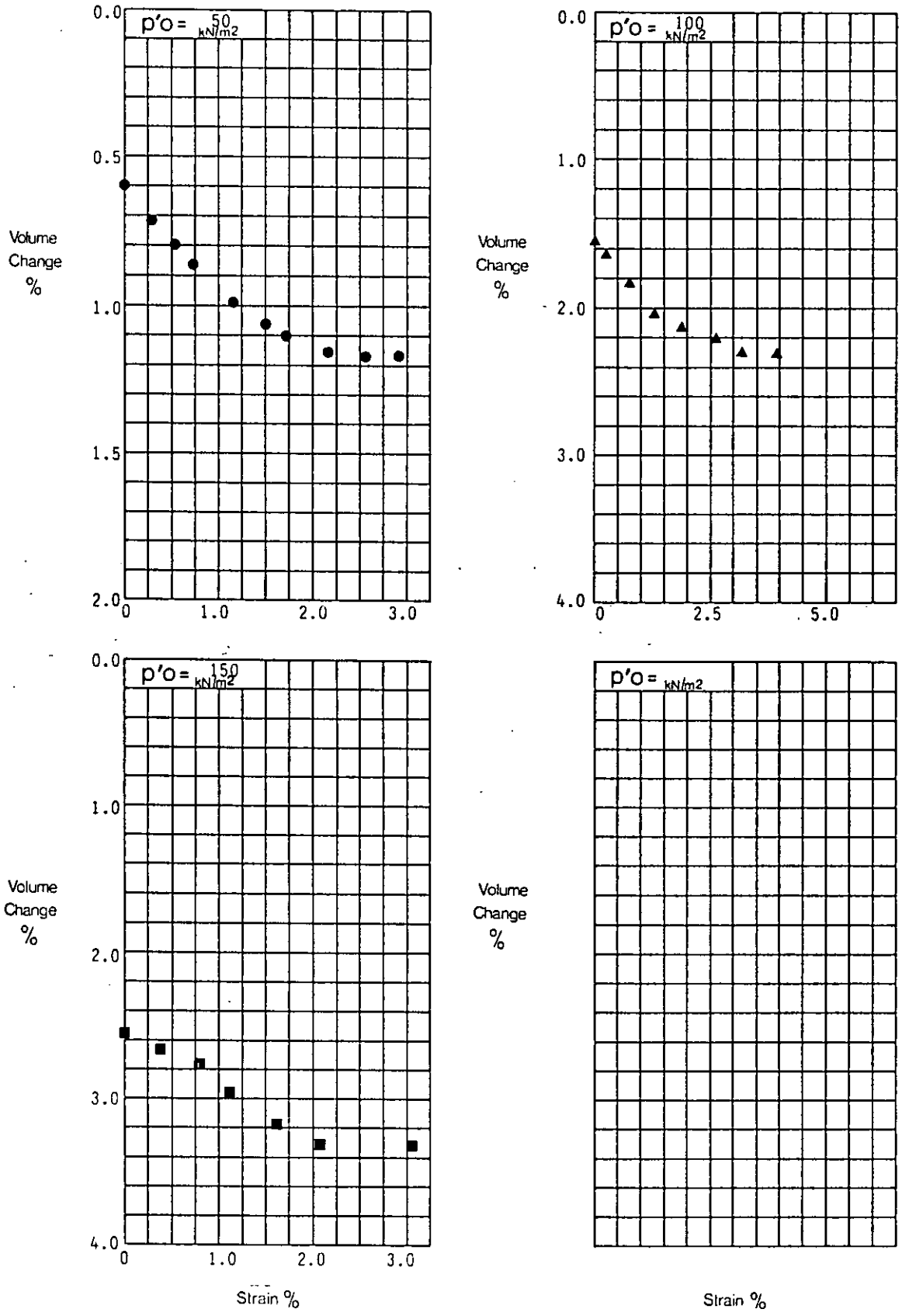
Laboratory – Effective Stress	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449
exploration associates		**Figure** 2.43

EX3



Deviator Stress / Strain	Depth 3.50 Borehole 239
Remarks	
Laboratory - Effective Stress	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2
exploration associates	Contract S4449 **Figure** 2.44

EX3



Volume Change % / Strain %

Depth 3.50
Borehole 239

Remarks

Laboratory - Effective Stress

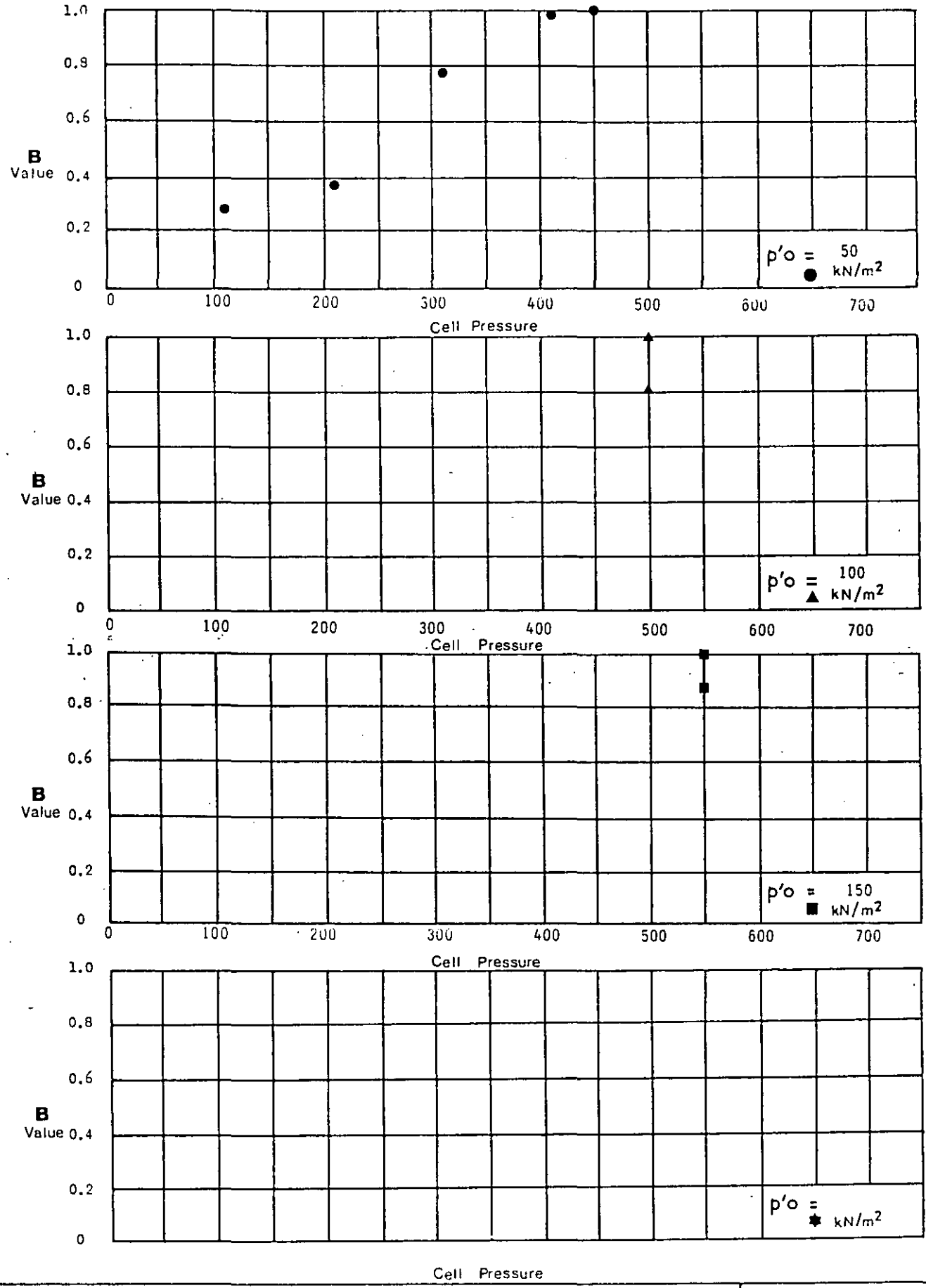
exploration associates

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East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation - Contract 2

Contract S4449

Figure 2.45

EX3



B Value / Cell Pressure

Depth 3.50
Borehole 239

Remarks

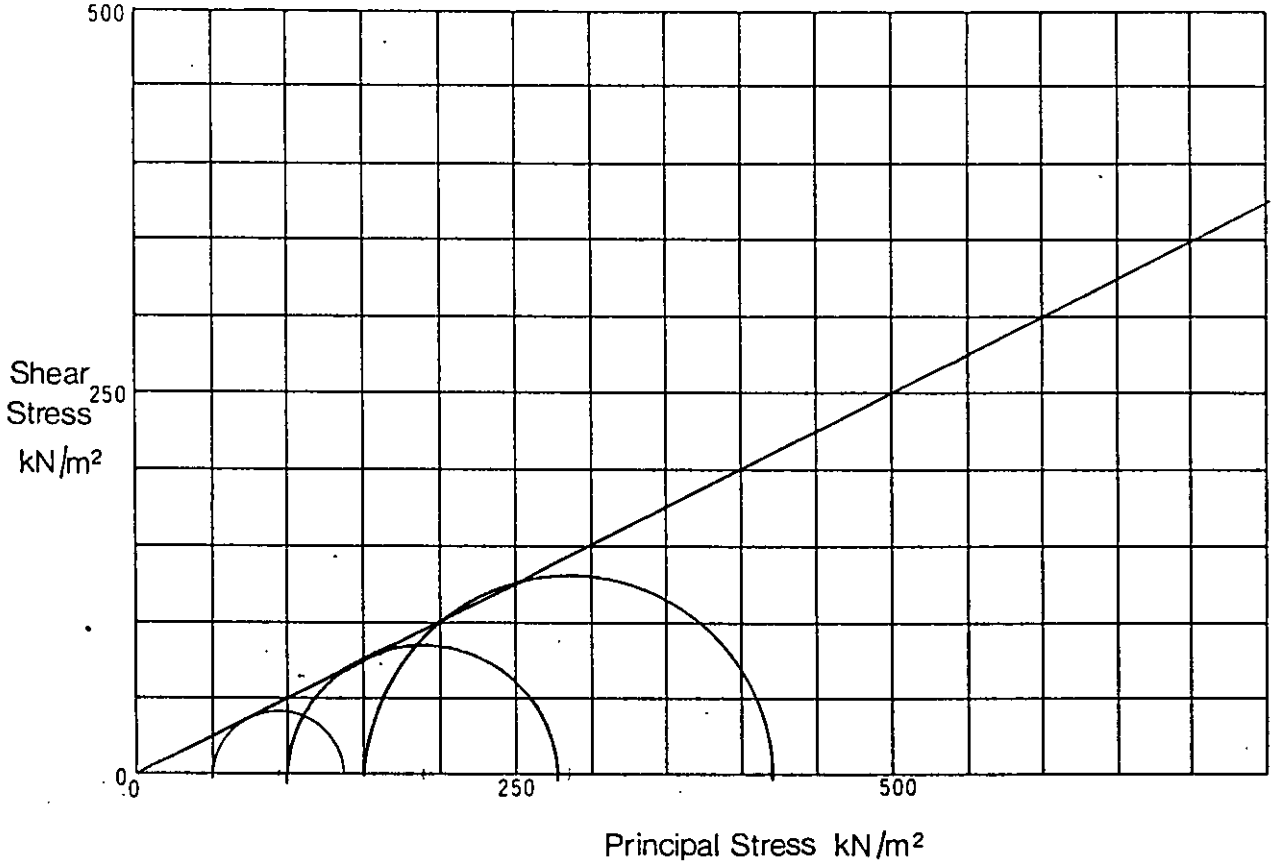
Laboratory Effective Stress

exploration associates

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Department of Transport
East Midlands Regional Office
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Main Site Investigation

Contract S4449

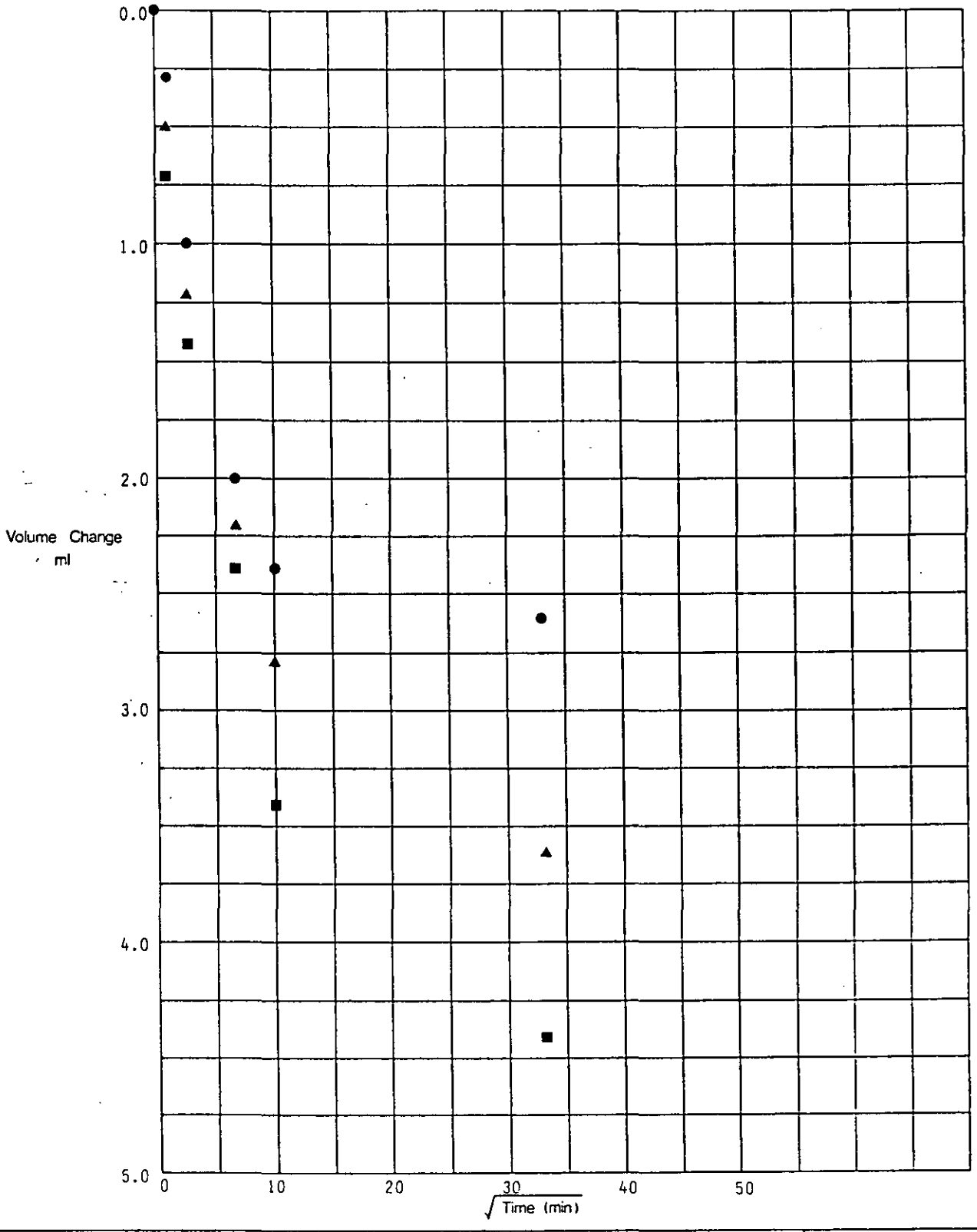
Figure 2.46



B	(Initial)		0.57	0.37	0.44	
B_s	(After application of Back Pressure)		0.98	0.99	0.99	
ε	(Rate of Strain)	% min	0.003	0.003	0.003	
σ_3	(Cell Pressure during Shear)	kN/m²	350	400	450	
u_0	(Applied Back Pressure)	kN/m²	300	300	300	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	50	100	150	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	85	175	269	

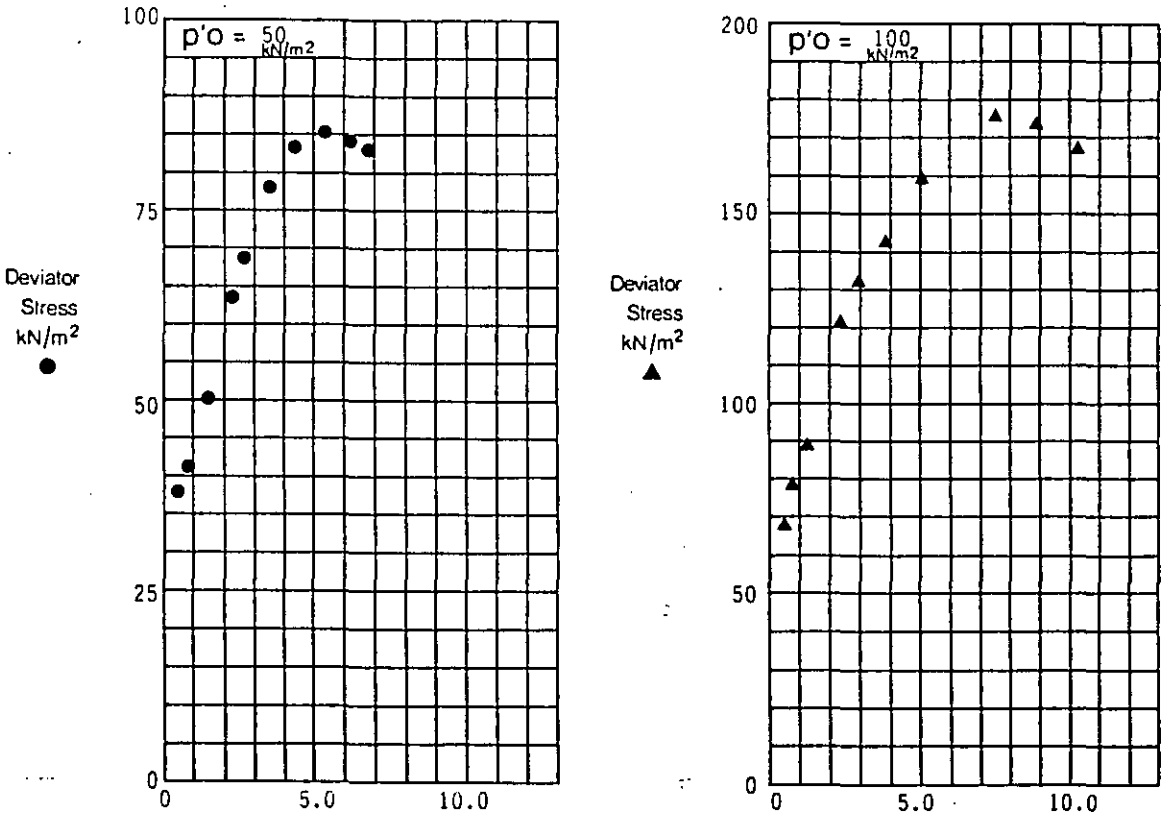
Triaxial Compression Test Consolidated Drained	Description Remoulded **Mohr Circles and Summary**	C' 0 kN/m² Φ' 27 Degrees Depth 0.50 Borehole 240
Remarks 3 x 38mm dia sample.		
Laboratory - Effective Stress **exploration associates**	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449 **Figure** 2.47

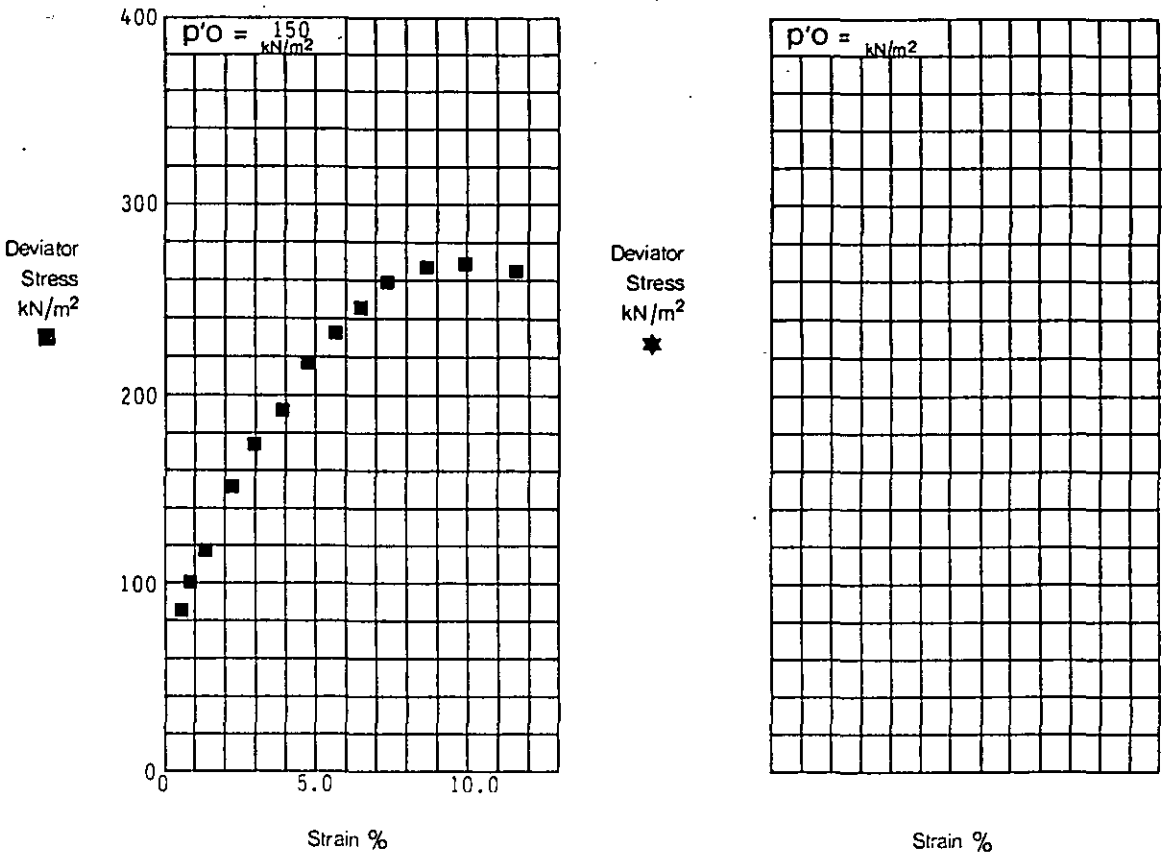
EX3



Triaxial Consolidation – Volume Change / √Time	Depth 0.50 Borehole 240
Remarks	
Laboratory – Effective Stress	Project: Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation – Contract 2
exploration associates	Contract S4449 Figure 2.48

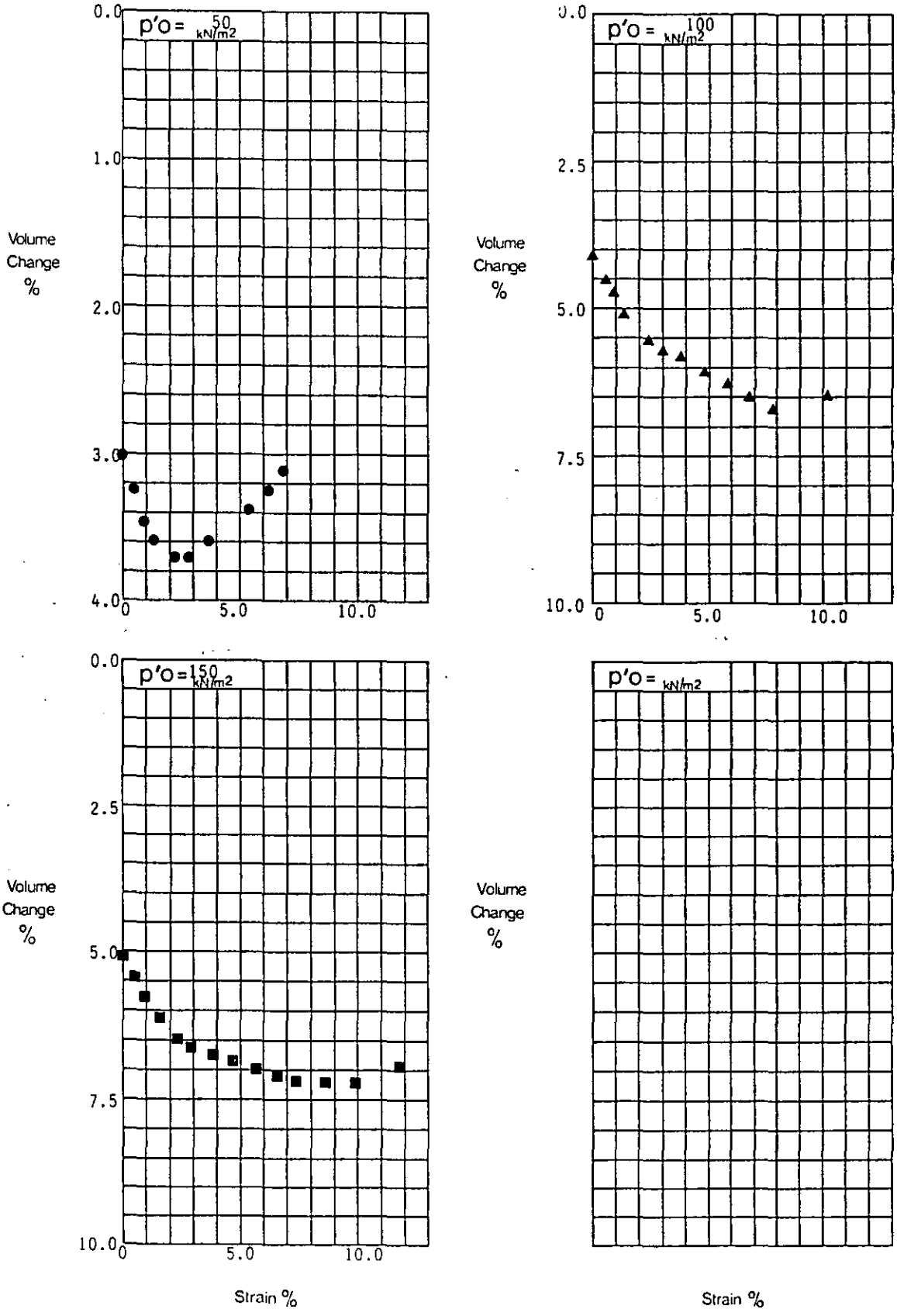
EX3





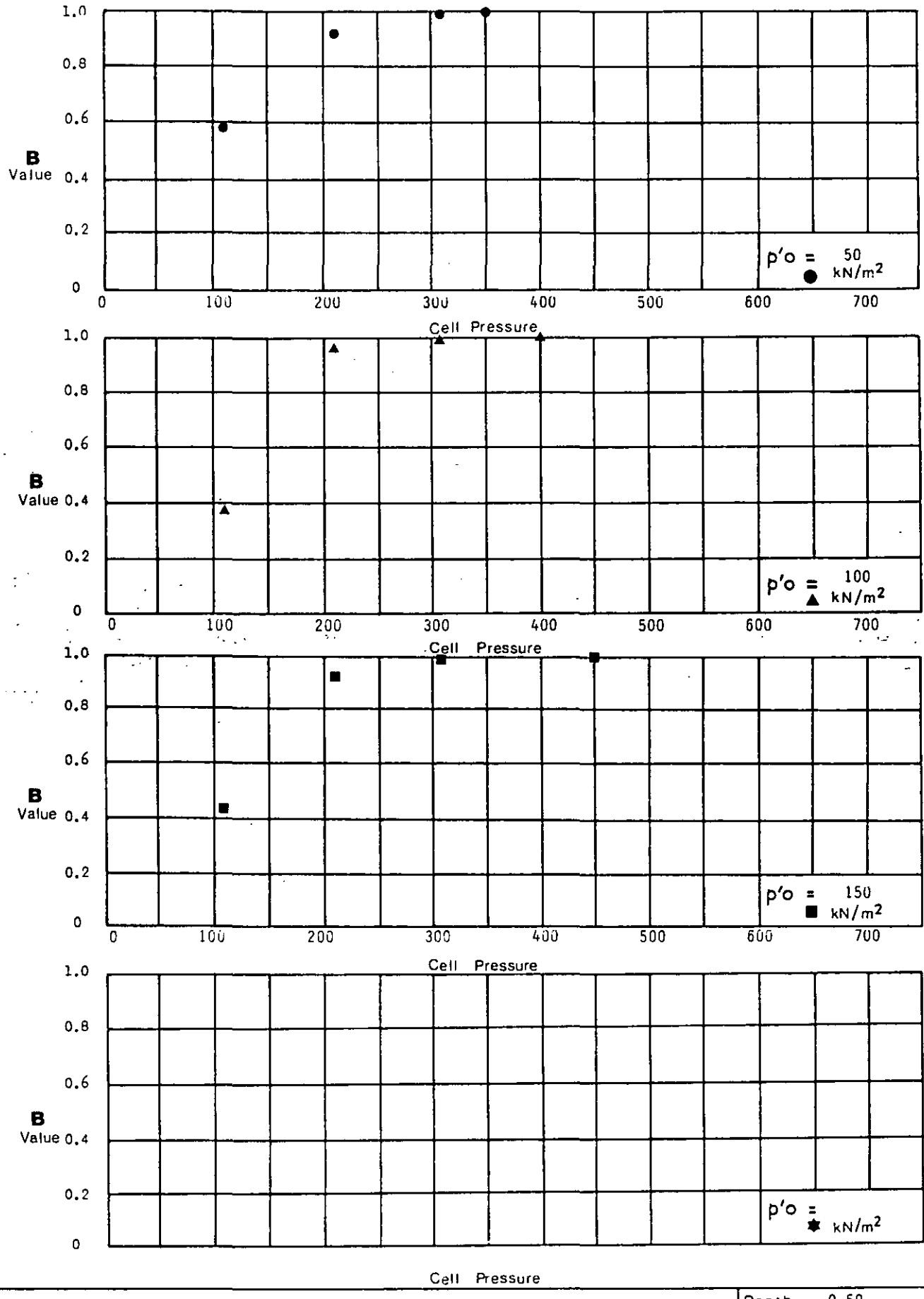
Deviator Stress / Strain		Depth 0.50 Borehole 240
Remarks		
Laboratory - Effective Stress	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449
exploration associates		**Figure** 2.49

EX3



Volume Change % / Strain %	Depth 0.50 Borehole 240
Remarks	
Laboratory - Effective Stress	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2
exploration associates	Contract S4449 **Figure** 2.50

EX3



B Value / Cell Pressure

Depth 0.50
Borehole 240

Remarks

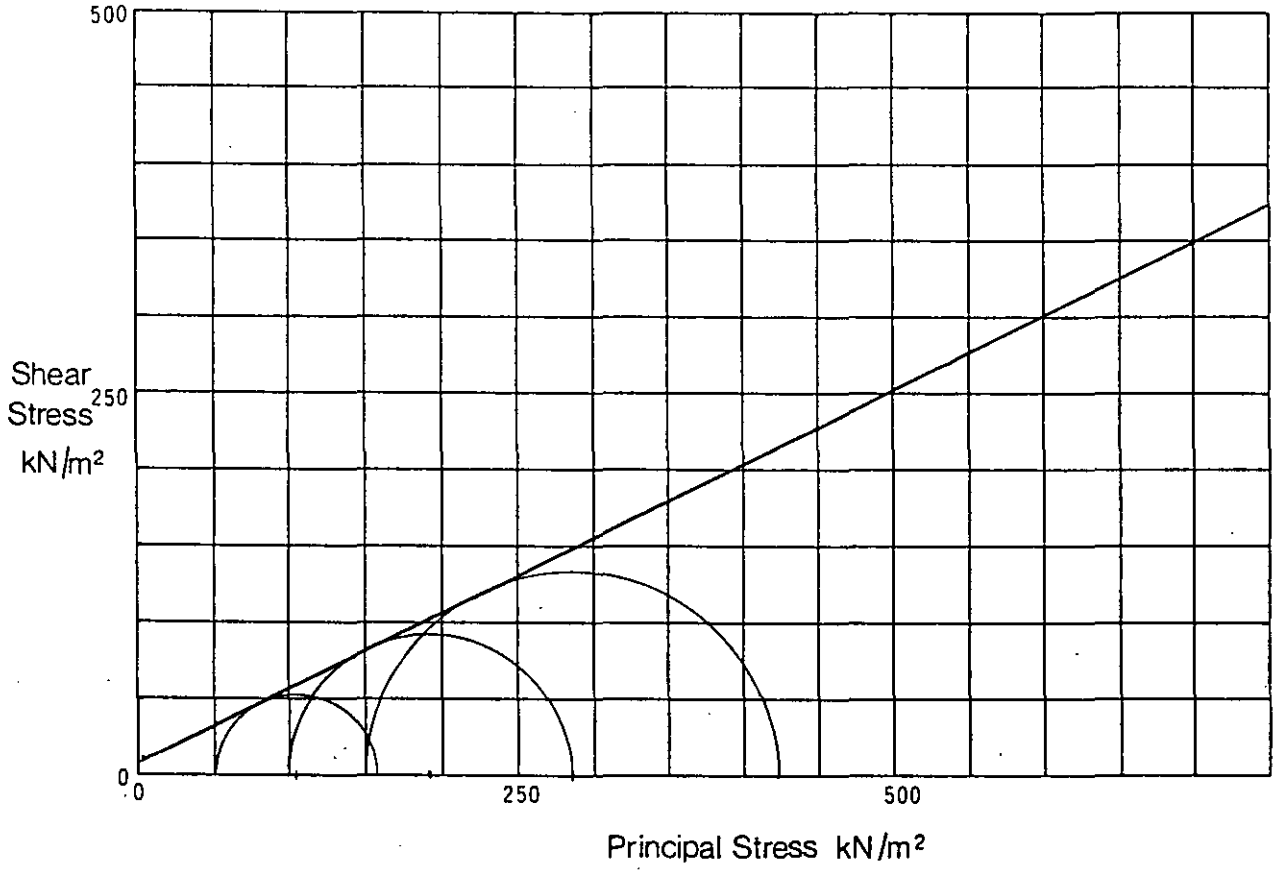
Laboratory Effective Stress

exploration associates

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Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation - Contract 2

Contract S4449

Figure 2.51



B	(Initial)		0.48	0.96	0.94	
B_s	(After application of Back Pressure)		1.00	1.00	1.00	
ε	(Rate of Strain)	% min	0.0015	0.0015	0.0015	
σ_3	(Cell Pressure during Shear)	kN/m²	450	500	550	
u_0	(Applied Back Pressure)	kN/m²	400	400	400	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	50	100	150	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	107	181	272	

Triaxial Compression Test
Consolidated
Drained

Description Silty CLAY with rock chalk

Mohr Circles and Summary

C' 10 kN/m²
Φ' 26 Degrees

Depth 2.00
Borehole 240

Remarks 106mm dia multistage

Laboratory - Effective Stress

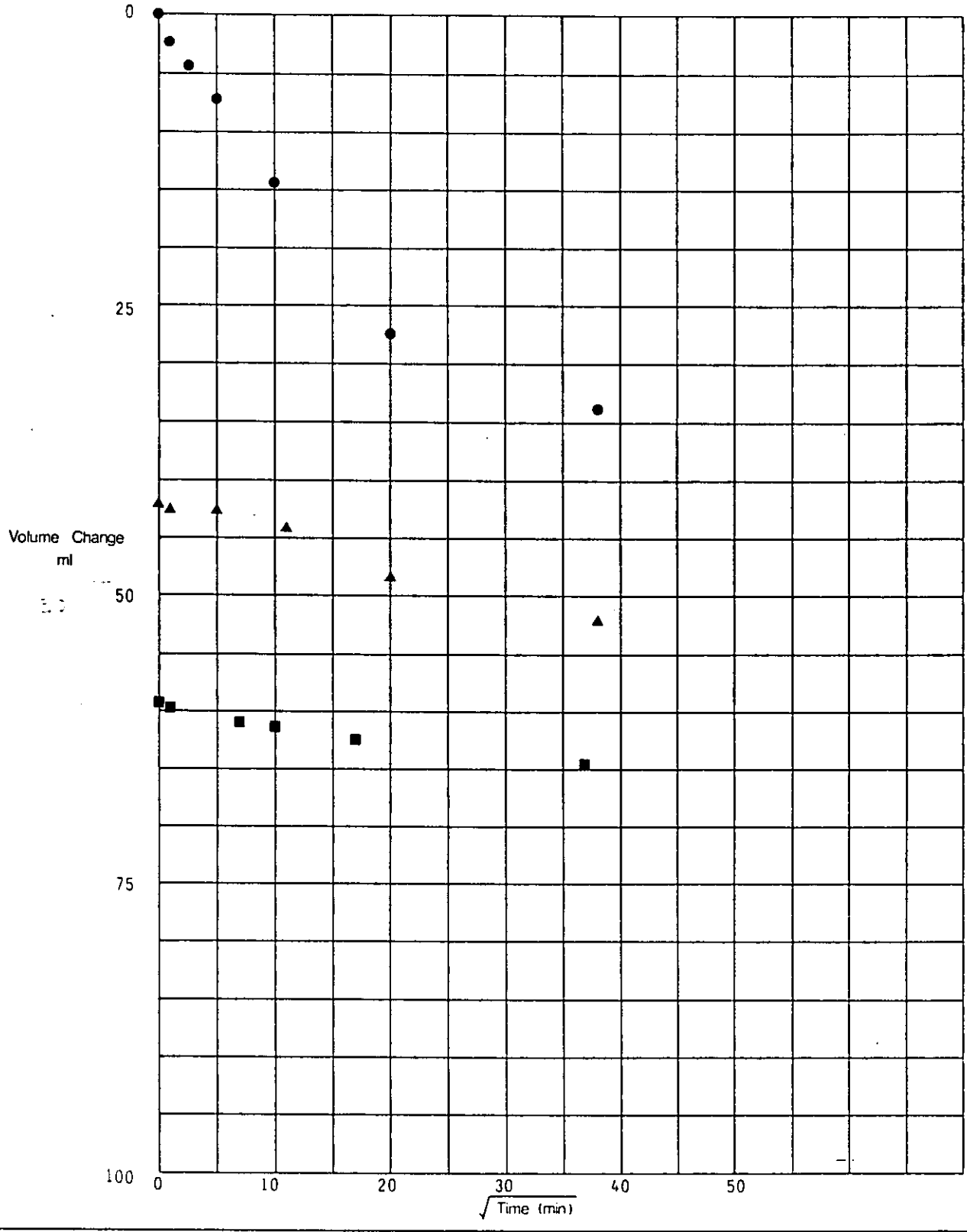
exploration associates

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A42 Castle Donington North
Main Site Investigation - Contract 2

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Figure 2.52

EX3



Triaxial Consolidation – Volume Change / √Time

Depth 2.00
Borehole 240

Remarks

Laboratory – Effective Stress

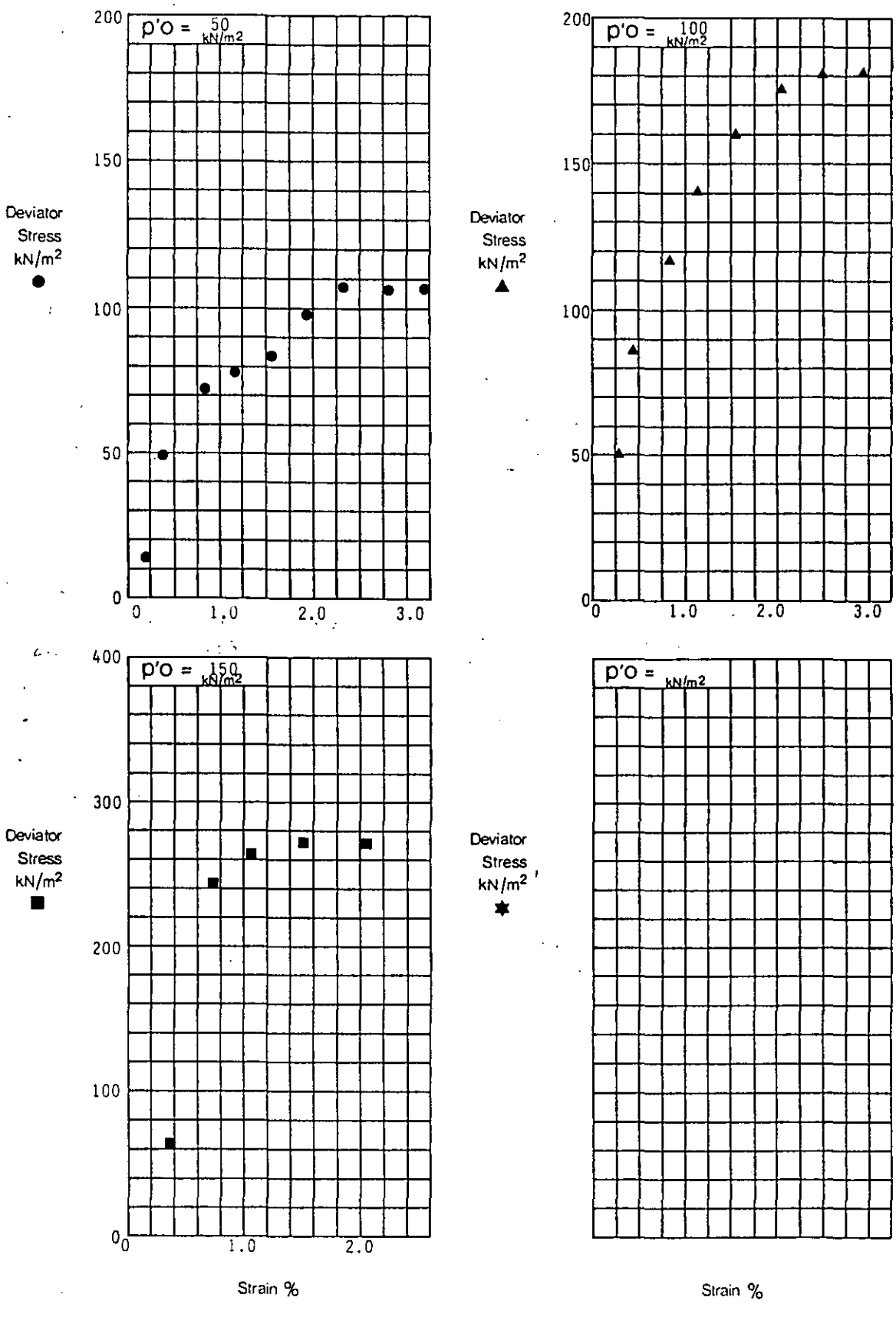
exploration associates

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Main Site Investigation - Contract 2

Contract S4449

Figure 2.53

EX3



Deviator Stress / Strain

Depth 2.00
Borehole 240

Remarks

Laboratory - Effective Stress

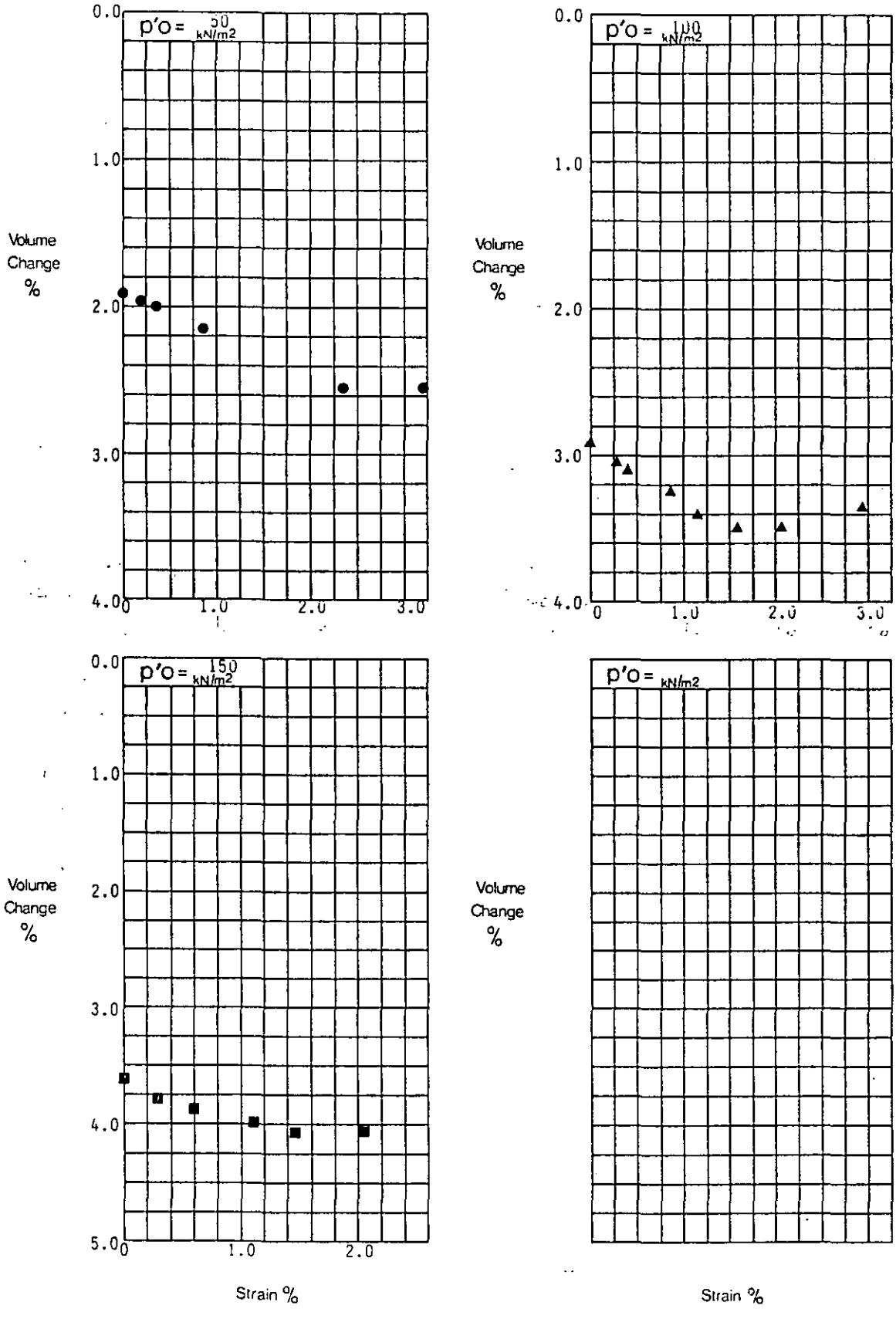
exploration associates

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Figure 2.54

EX3



Volume Change % / Strain %

Depth 2.00
Borehole 240

Remarks

Laboratory - Effective Stress

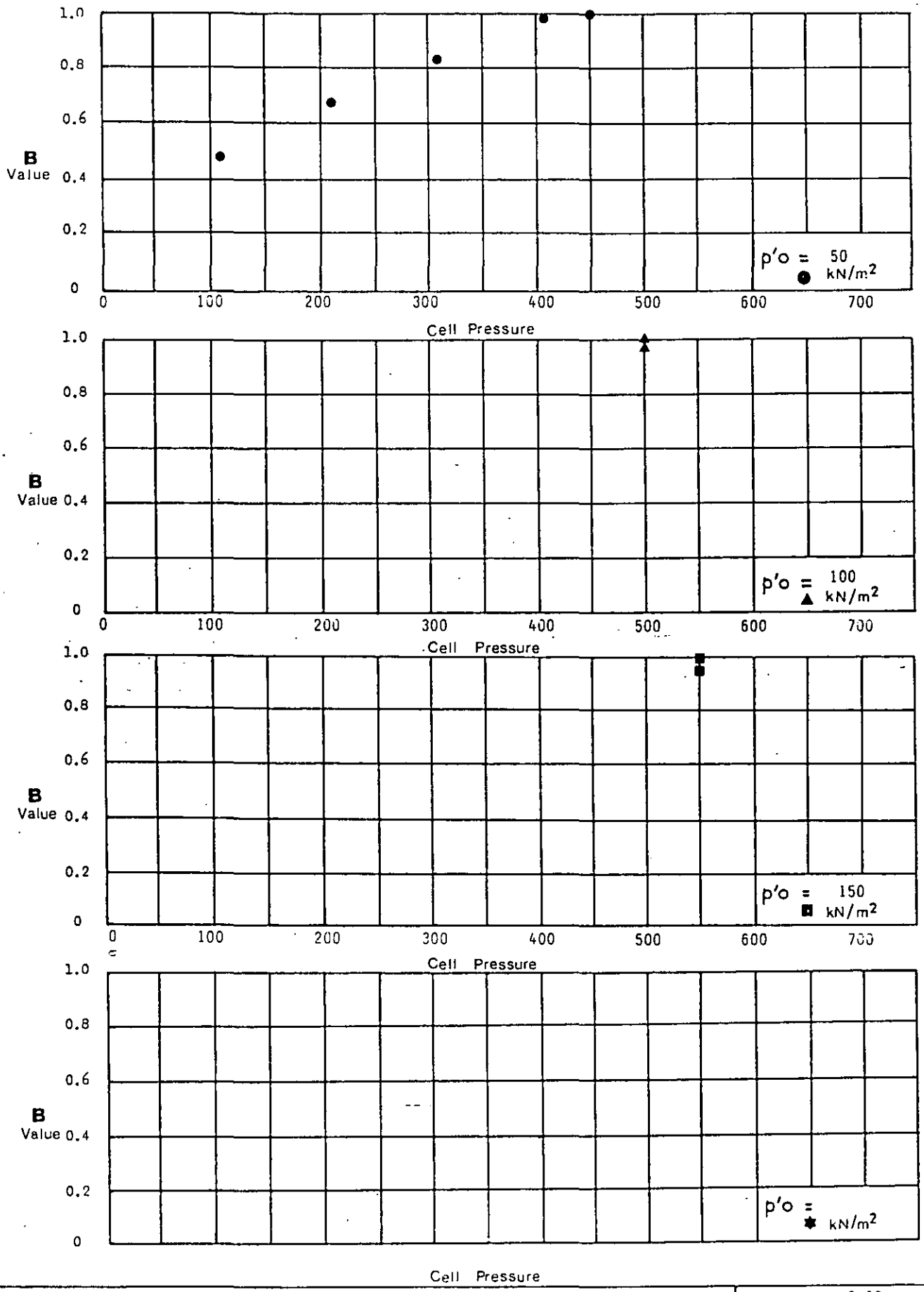
exploration associates

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A42 Castle Donington North
Main Site Investigation - Contract 2

Contract S4449

Figure 2.55

EX3



B Value / Cell Pressure

Depth 2.00
Borehole 240

Remarks

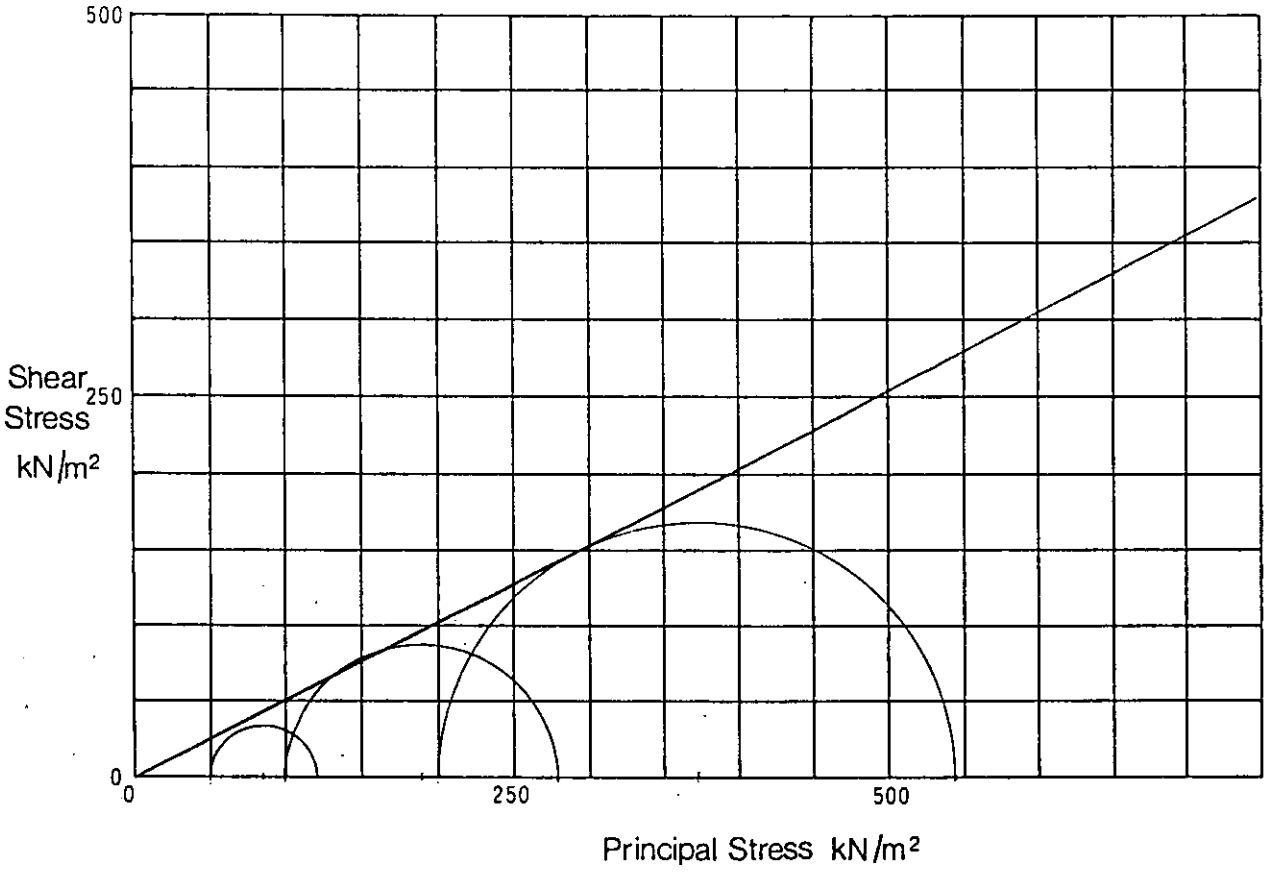
Laboratory Effective Stress

exploration associates

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Main Site Investigation

Contract S4449

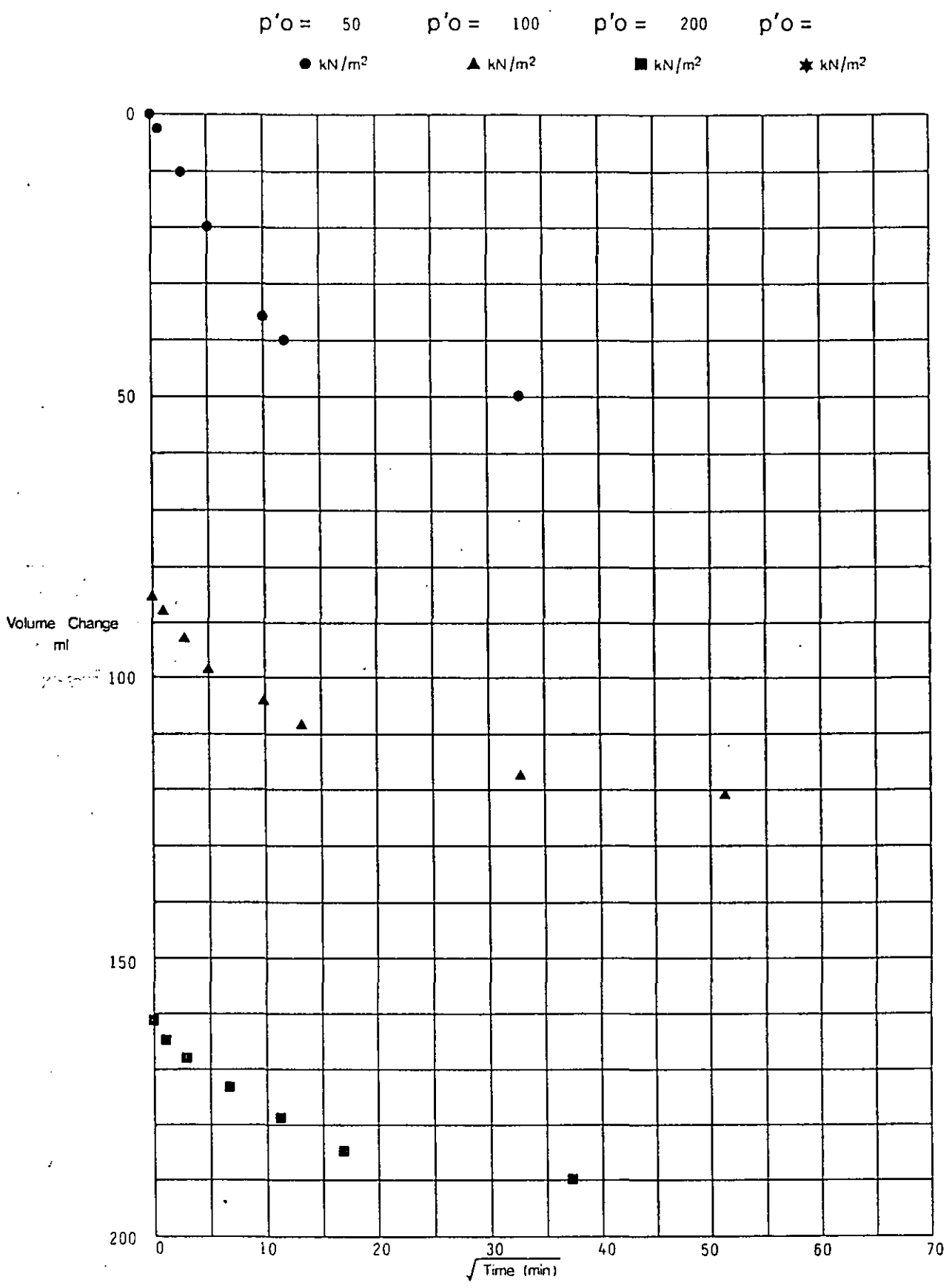
Figure 2.56



B	(Initial)		0.25	0.94	1.00	
B_s	(After application of Back Pressure)		1.00	1.00	1.00	
ε	(Rate of Strain)	% min	0.005	0.004	0.002	
σ_3	(Cell Pressure during Shear)	kN/m²	350	400	500	
u_0	(Applied Back Pressure)	kN/m²	300	300	300	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	50	100	200	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	70	180	341	

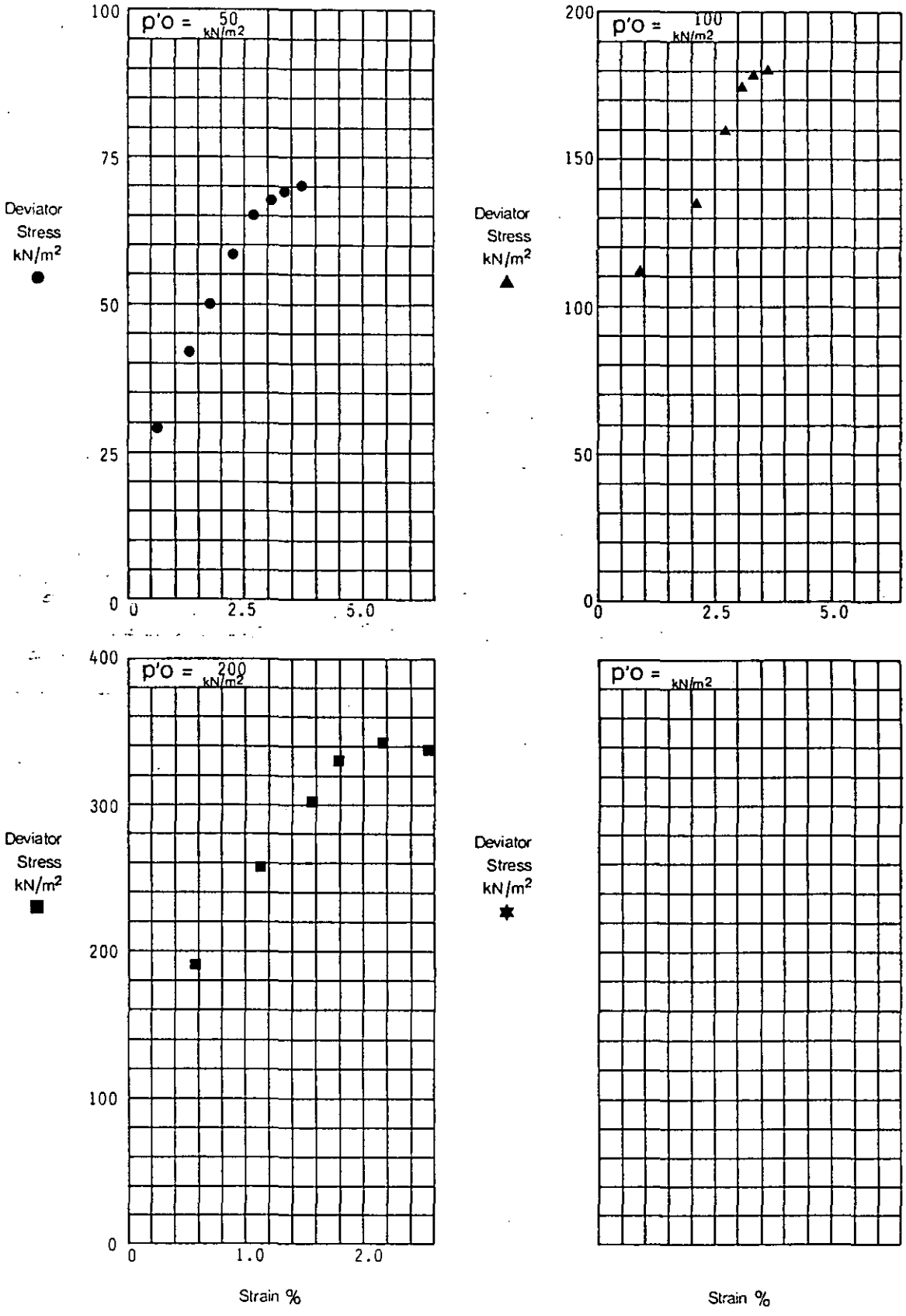
Triaxial Compression Test Consolidated Drained	Description Remoulded **Mohr Circles and Summary**	C′ 0 kN/m² Φ′ 27 Degrees Depth 3.50 Borehole 240
Remarks 106mm dia multistage		
Laboratory - Effective Stress **exploration associates**	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449 **Figure** 2.57

EX3



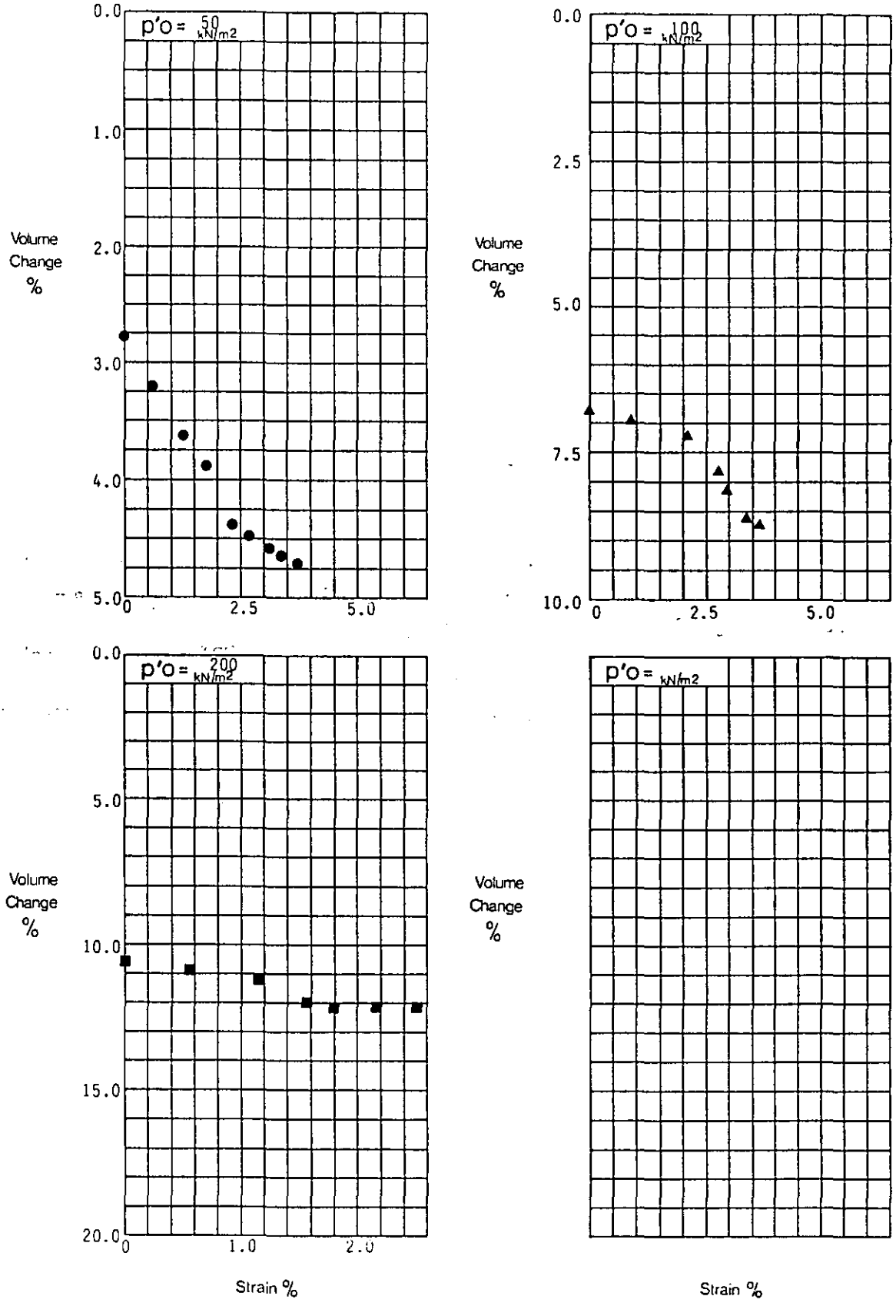
Triaxial Consolidation – Volume Change / $\sqrt{\text{Time}}$	Depth 3.50 Borehole 240
Remarks	
Laboratory–Effective Stress	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2
exploration associates	Contract S4449 **Figure** 2.58

EX3



Deviator Stress / Strain	Depth 3.50 Borehole 240
Remarks	
Laboratory - Effective Stress	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2
exploration associates	Contract S4449 **Figure** 2.59

EX3



Volume Change % / Strain %

Depth 3.50
Borehole 240

Remarks

Laboratory - Effective Stress

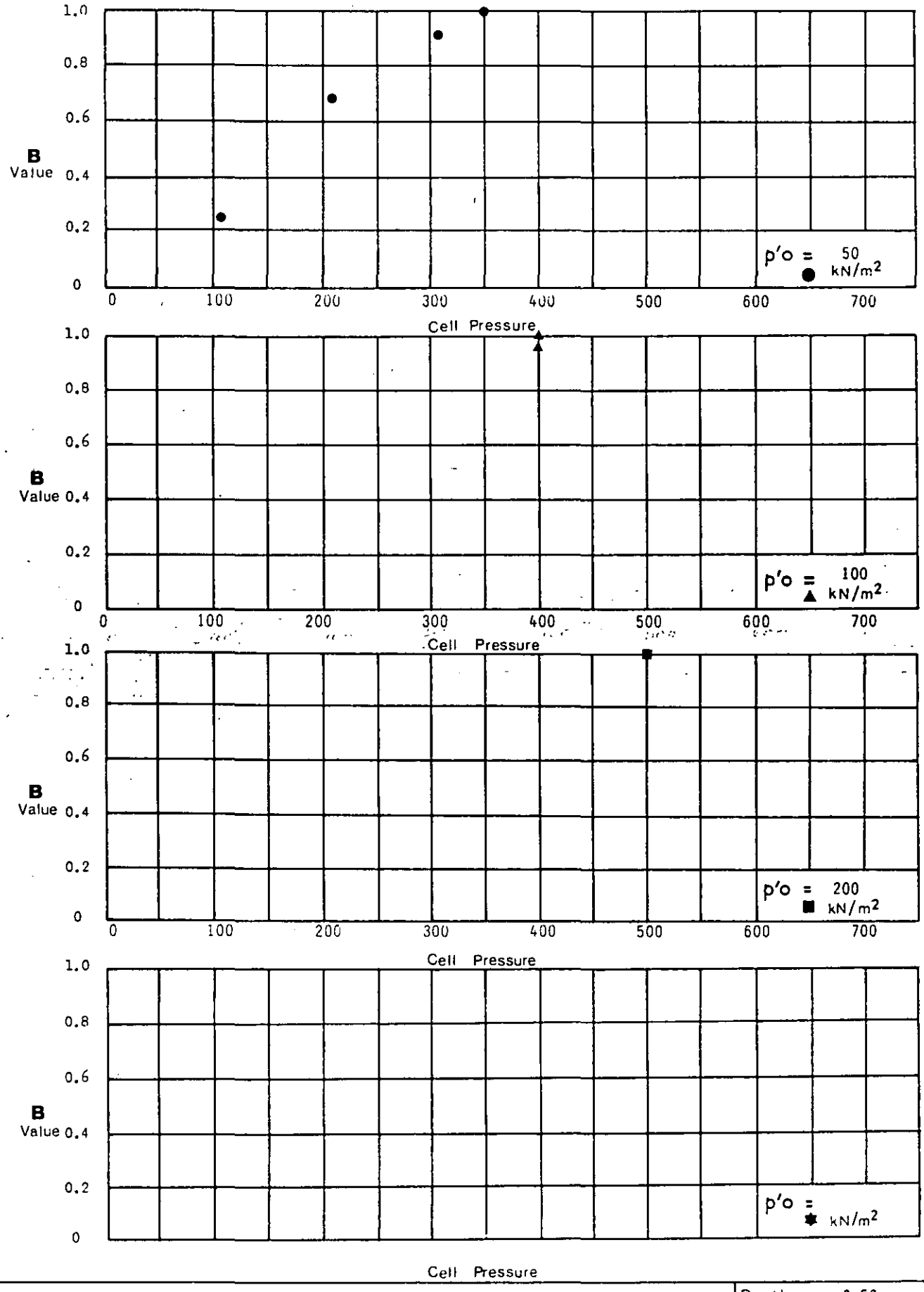
exploration associates

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Figure 2.60

EX3



B Value / Cell Pressure

Depth 3.50
Borehole 240

Remarks

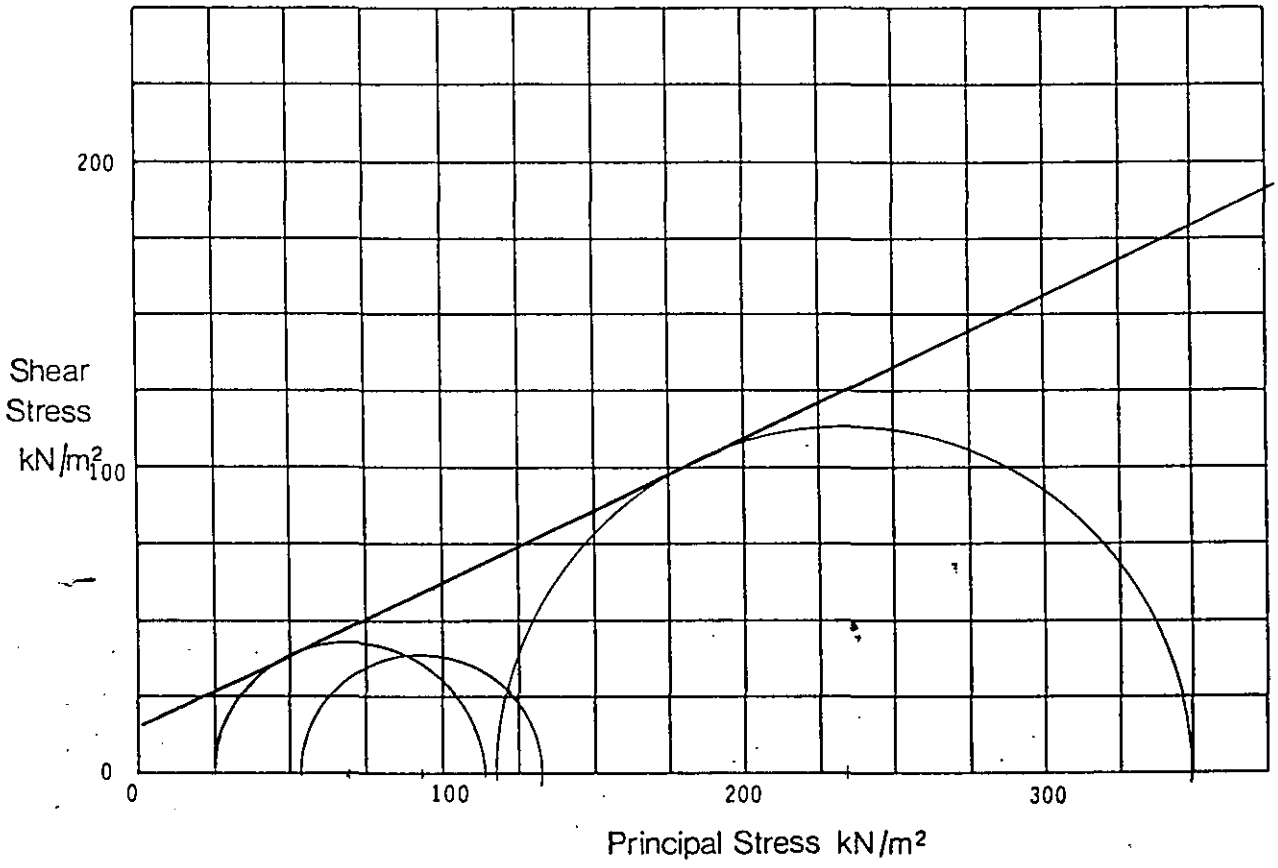
Laboratory Effective Stress

exploration associates

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Figure 2.61



B	(Initial)		0.27	0.27	0.25	
B_s	(After application of Back Pressure)		0.98	1.00	1.00	
ε	(Rate of Strain)	% min	0.009	0.009	0.009	
σ_3	(Cell Pressure during Shear)	kN/m²	350	400	500	
u_0	(Applied Back Pressure)	kN/m²	300	300	300	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	50	100	200	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	90	80	231	
$\Delta u_f = u_f - u_0$	(Pore Pressure Change to Failure)	kN/m²	23	47	83	
A_f	(Failure)		0.26	0.59	0.36	

Triaxial Compression Test
Consolidated
Undrained

Description Remoulded silty CLAY

Mohr Circles and Summary

C' 15 kN/m²
Φ' 25 Degrees

Depth 0.50
Borehole 241

Remarks 3 x 38mm dia samples.

Laboratory – Effective Stress

exploration associates

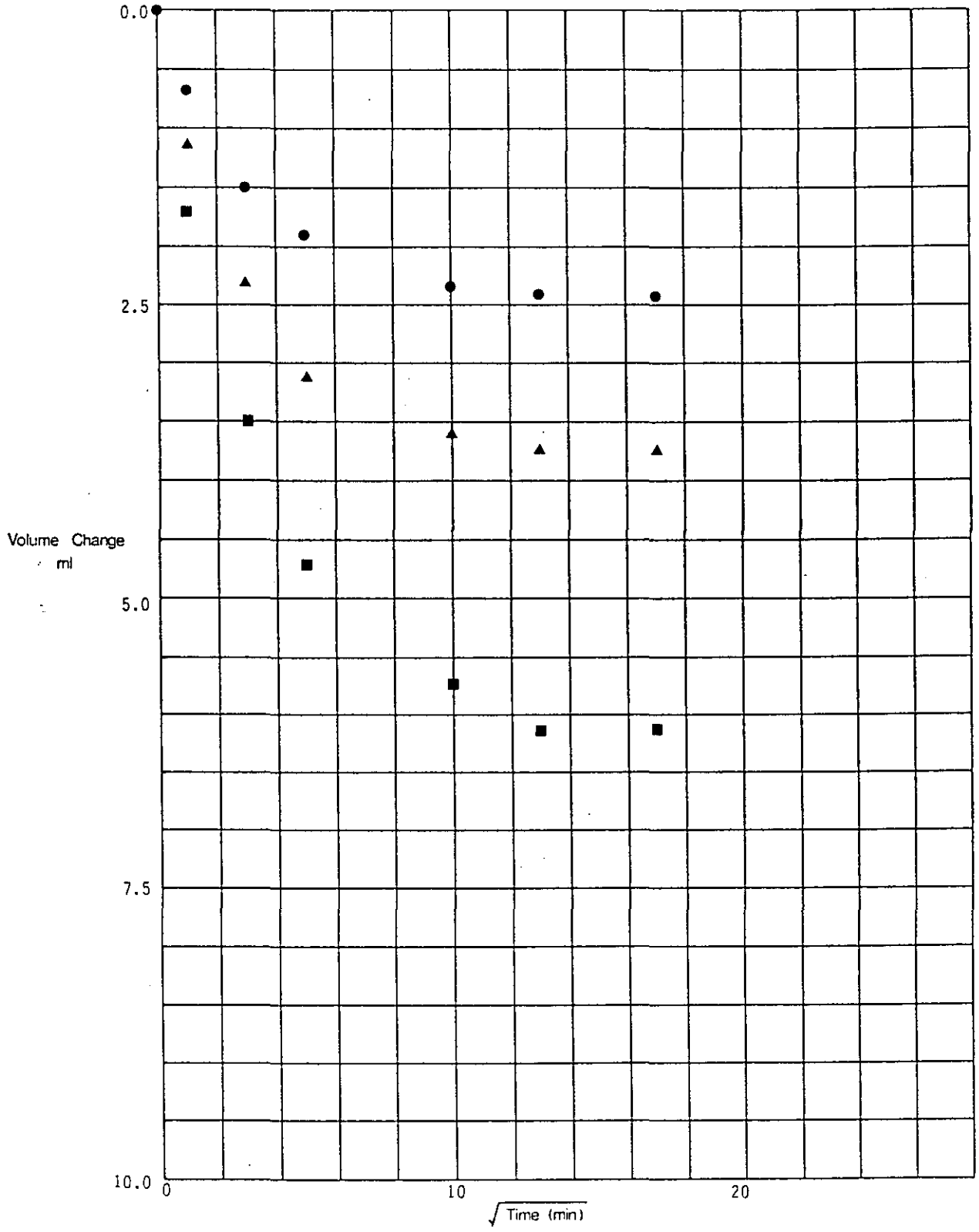
Project Department of Transport
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Contract S4449

Figure 2.62

EX3

p'o = 50 kN/m² ● p'o = 100 kN/m² ▲ p'o = 200 kN/m² ■ p'o = ✱ kN/m²



Triaxial Consolidation – Volume Change / √Time

Depth 0.50
Borehole 241

Remarks

Laboratory – Effective Stress

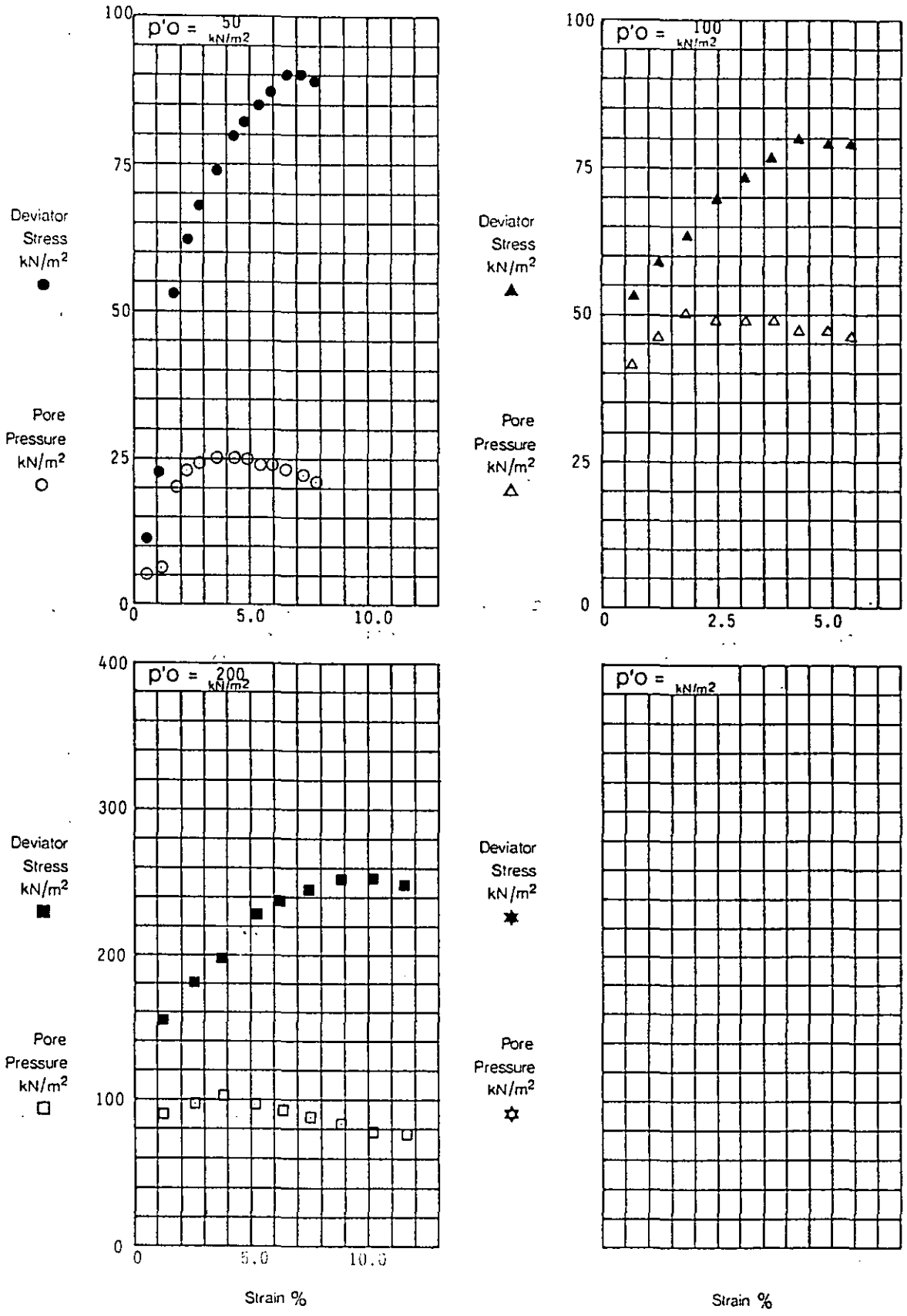
exploration associates

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Main Site Investigation - Contract 2

Contract S4449

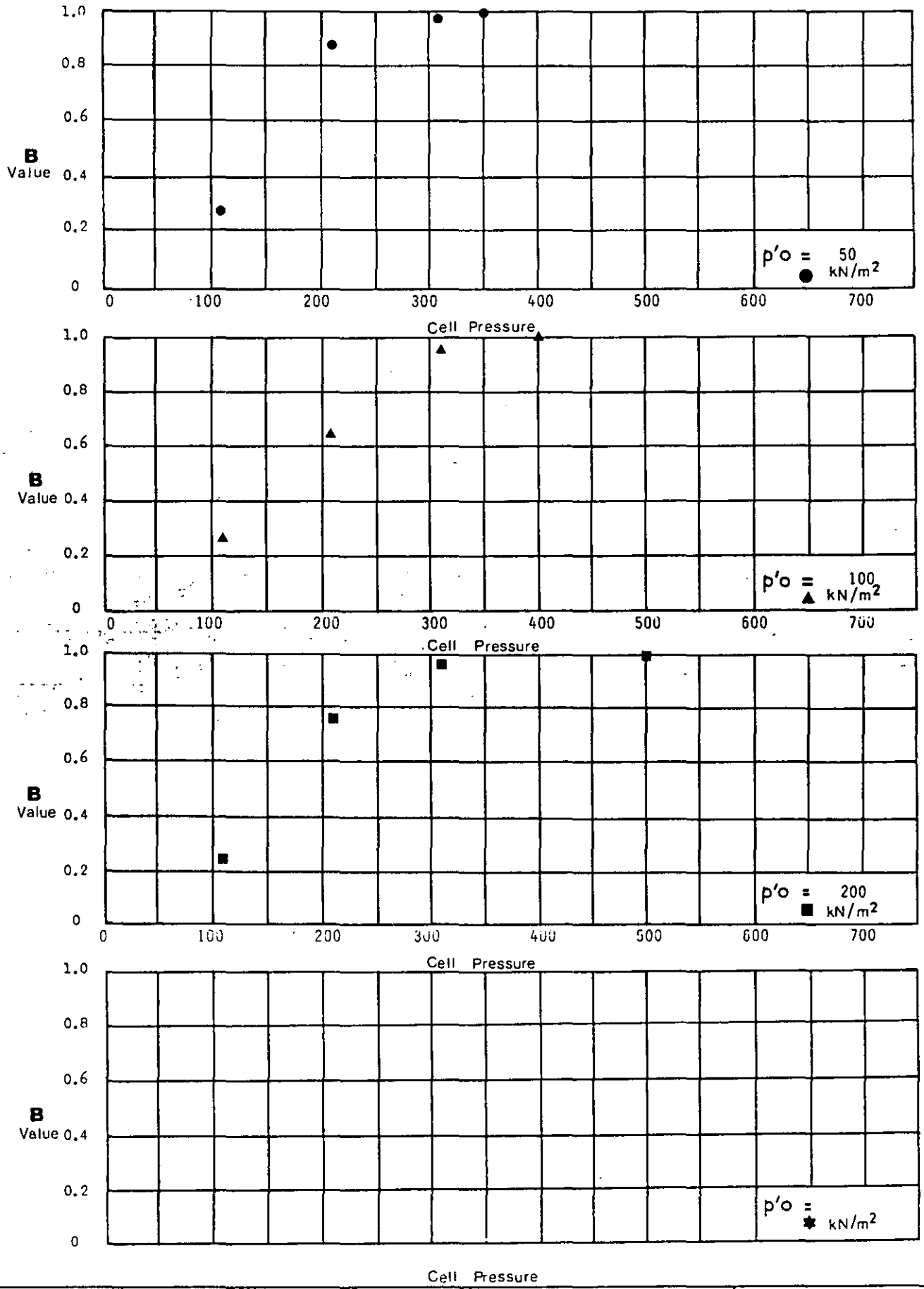
Figure 2.63

EX3



Deviator Stress / Strain Pore Pressure / Strain		Depth 0.50 Borehole 241
Remarks		
Laboratory-Effective Stress	Project Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449
exploration associates		Figure 2.64

EX3



B Value / Cell Pressure

Depth 0.50
Borehole 241

Remarks

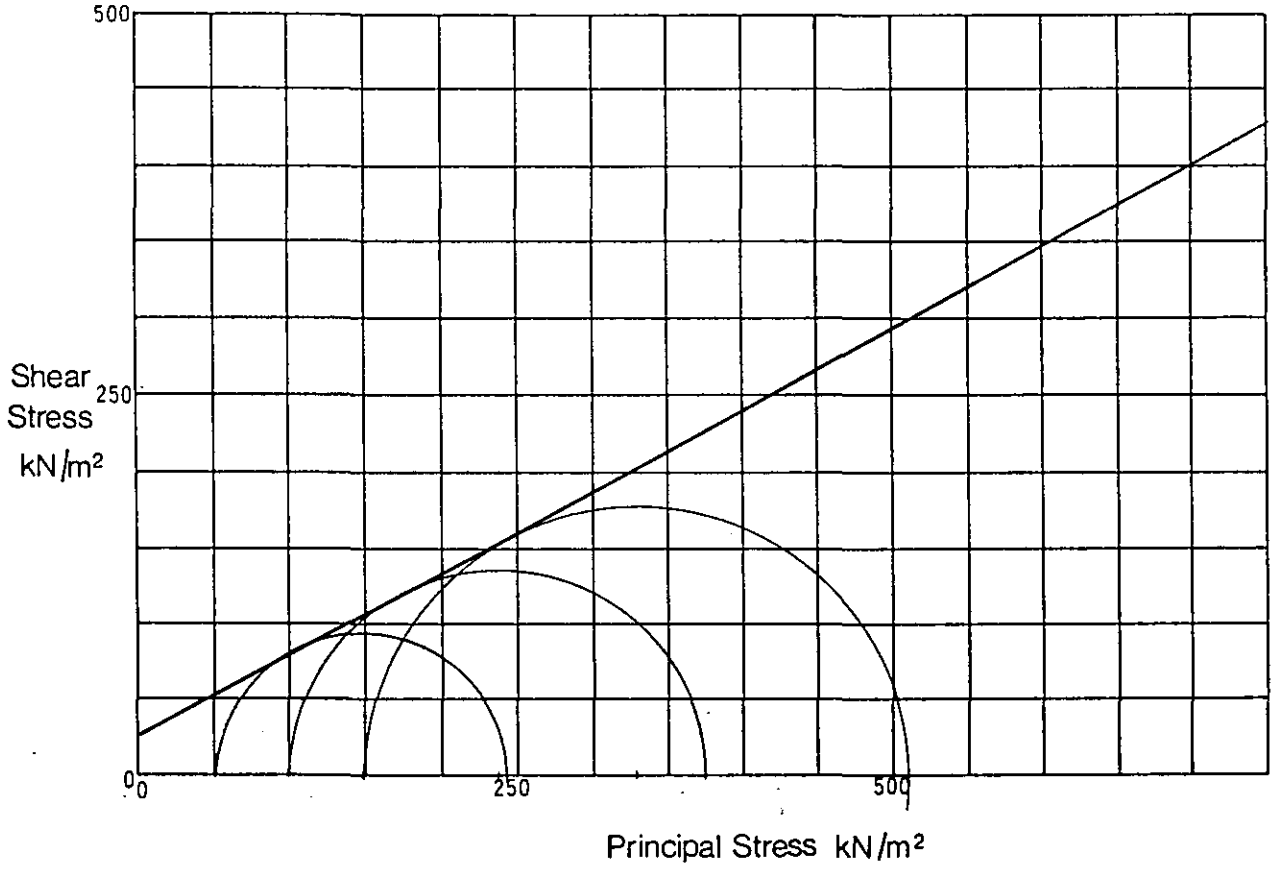
Laboratory Effective Stress

exploration associates

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East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation - Contract 2

Contract S4449

Figure 2.65



B	(Initial)		0.45	0.84	0.96	
B_s	(After application of Back Pressure)		0.97	1.00	1.00	
ε	(Rate of Strain)	% min	0.003	0.0015	0.0015	
σ_3	(Cell Pressure during Shear)	kN/m²	350	400	450	
u_0	(Applied Back Pressure)	kN/m²	300	300	300	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	50	100	150	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	199	273	353	

Triaxial Compression Test
Consolidated
Drained

Description Slightly clayey SILT with abundant siltstone fragments.

Mohr Circles and Summary

C' 25 kN/m²
Φ' 28 Degrees

Depth 3.50
Borehole 241

Remarks 106mm dia multistage.

Laboratory - Effective Stress

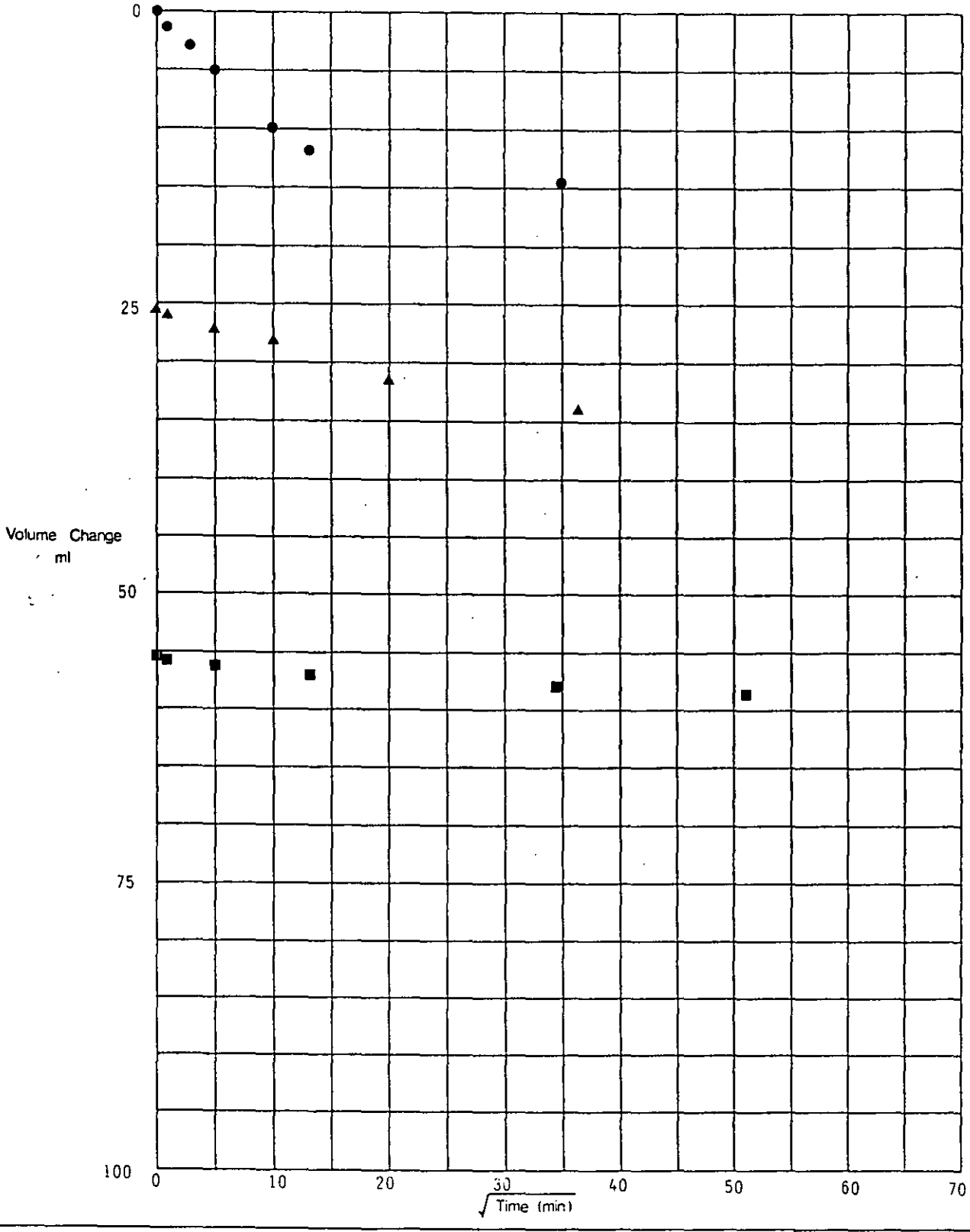
exploration associates

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A42 Castle Donington North
Main Site Investigation - Contract 2

Contract S4449

Figure 2.66

EX3



Triaxial Consolidation – Volume Change / $\sqrt{\text{Time}}$

Depth 3.50
Borehole 241

Remarks

Laboratory – Effective Stress

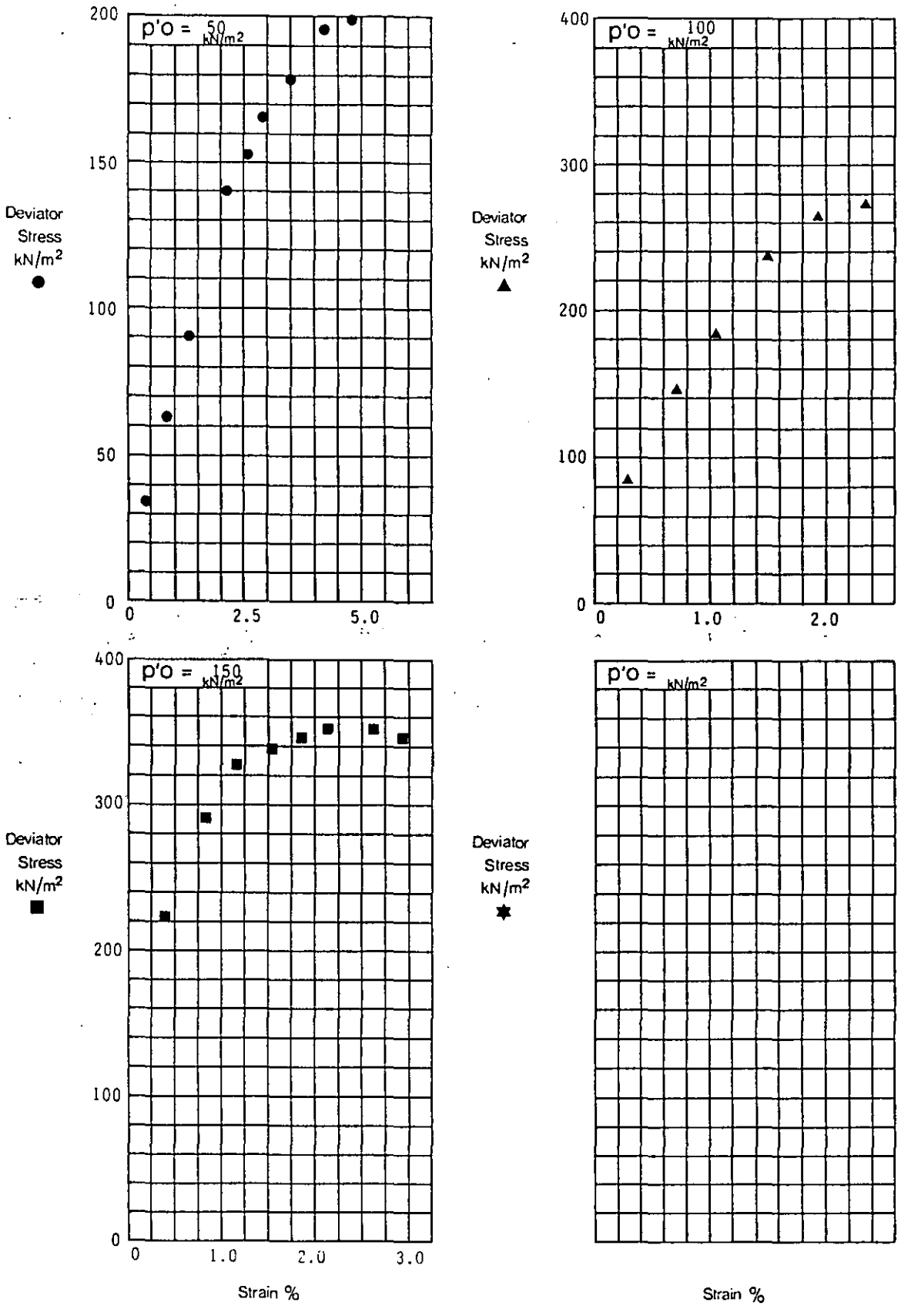
exploration associates

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A42 Castle Donington North
Main Site Investigation - Contract 2

Contract S4449

Figure 2.67

EX3



Deviator Stress / Strain

Depth 3.50
Borehole 241

Remarks

Laboratory - Effective Stress

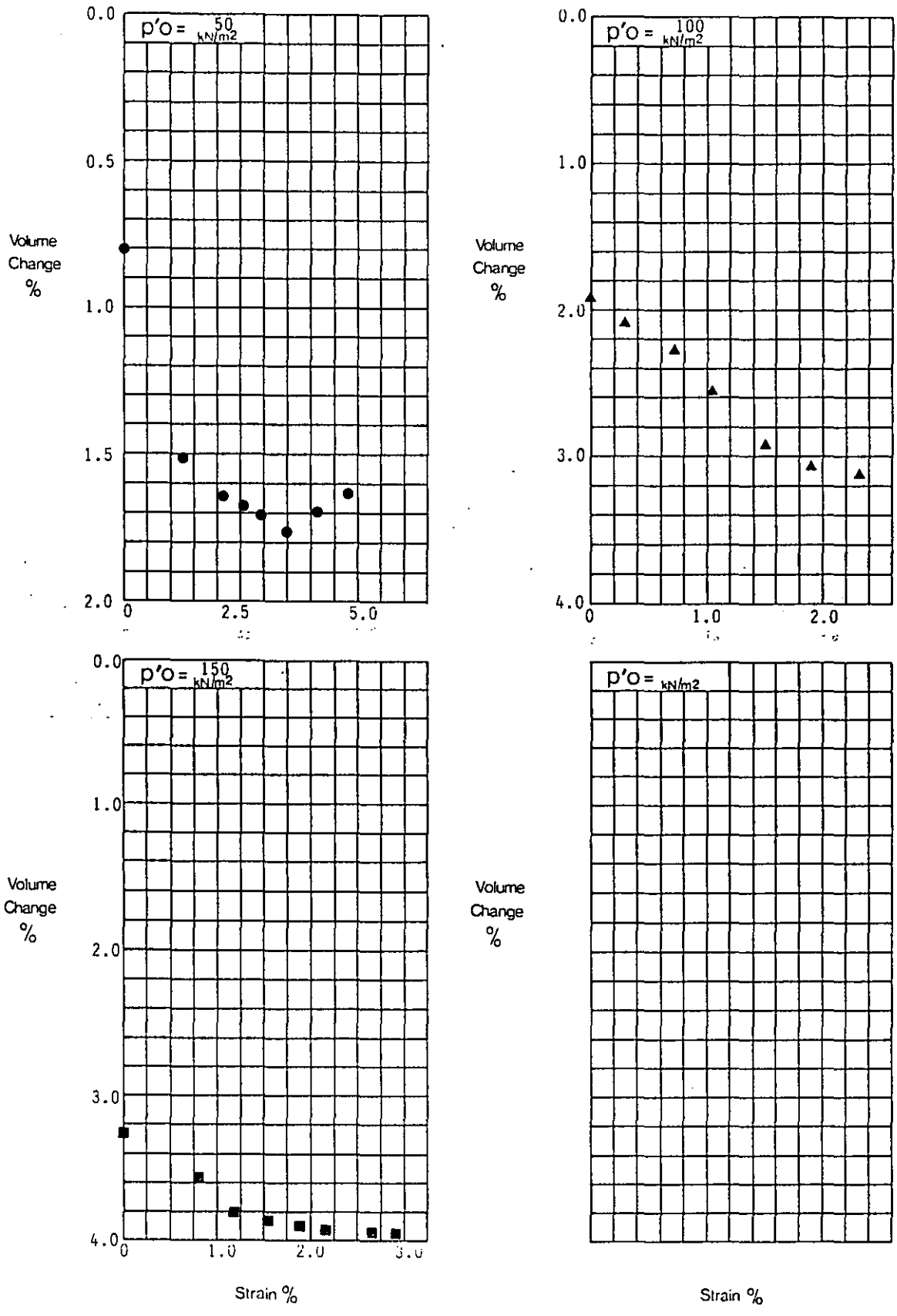
Project Department of Transport
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Main Site Investigation - Contract 2

Contract S4449

Figure 2.68

exploration associates

EX3



Volume Change % / Strain %

Depth 3.50
Borehole 241

Remarks

Laboratory - Effective Stress

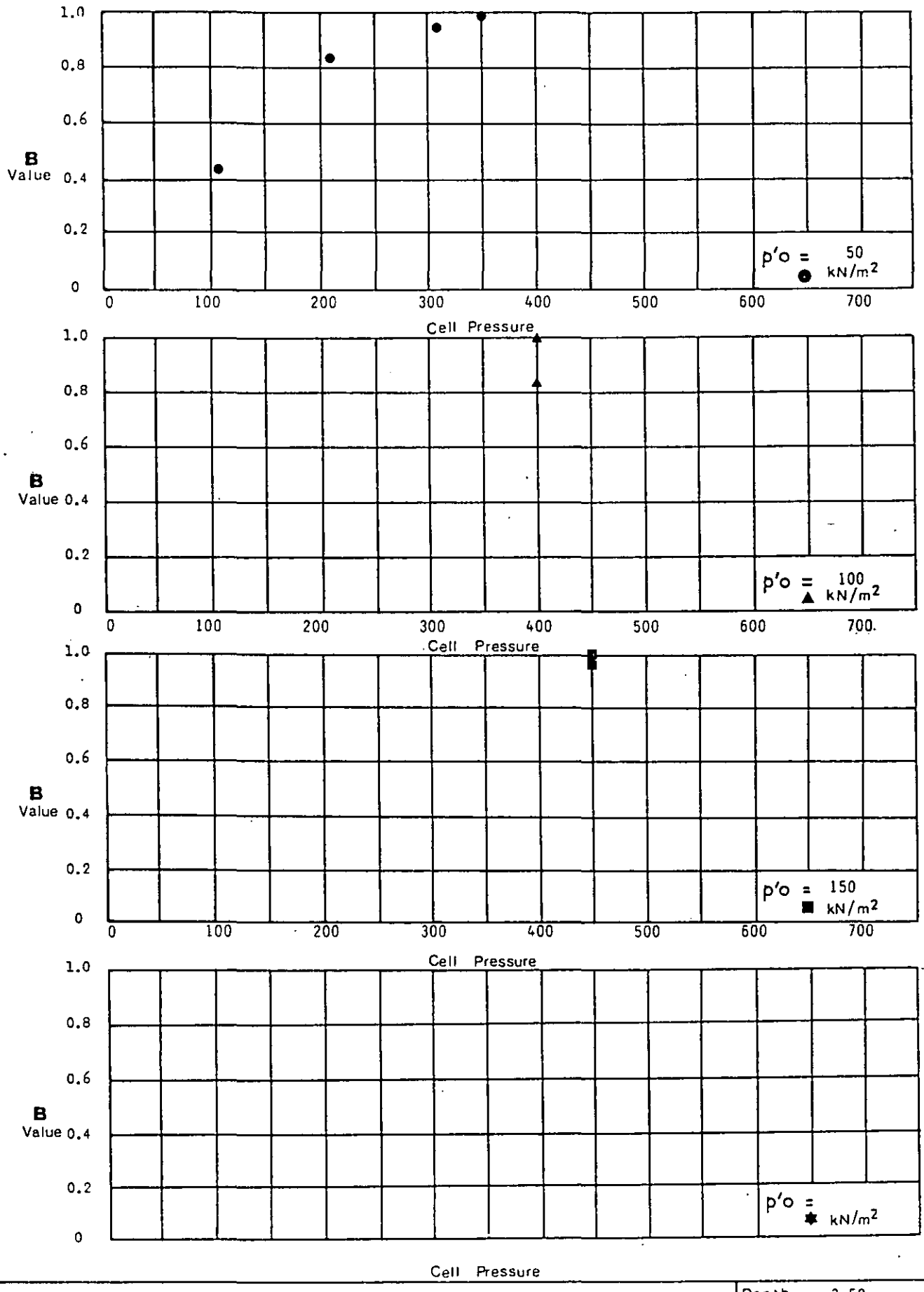
exploration associates

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A42 Castle Donington North
Main Site Investigation - Contract 2

Contract S4449

Figure 2.69

EX3



B Value / Cell Pressure

Depth 3.50
Borehole 241

Remarks

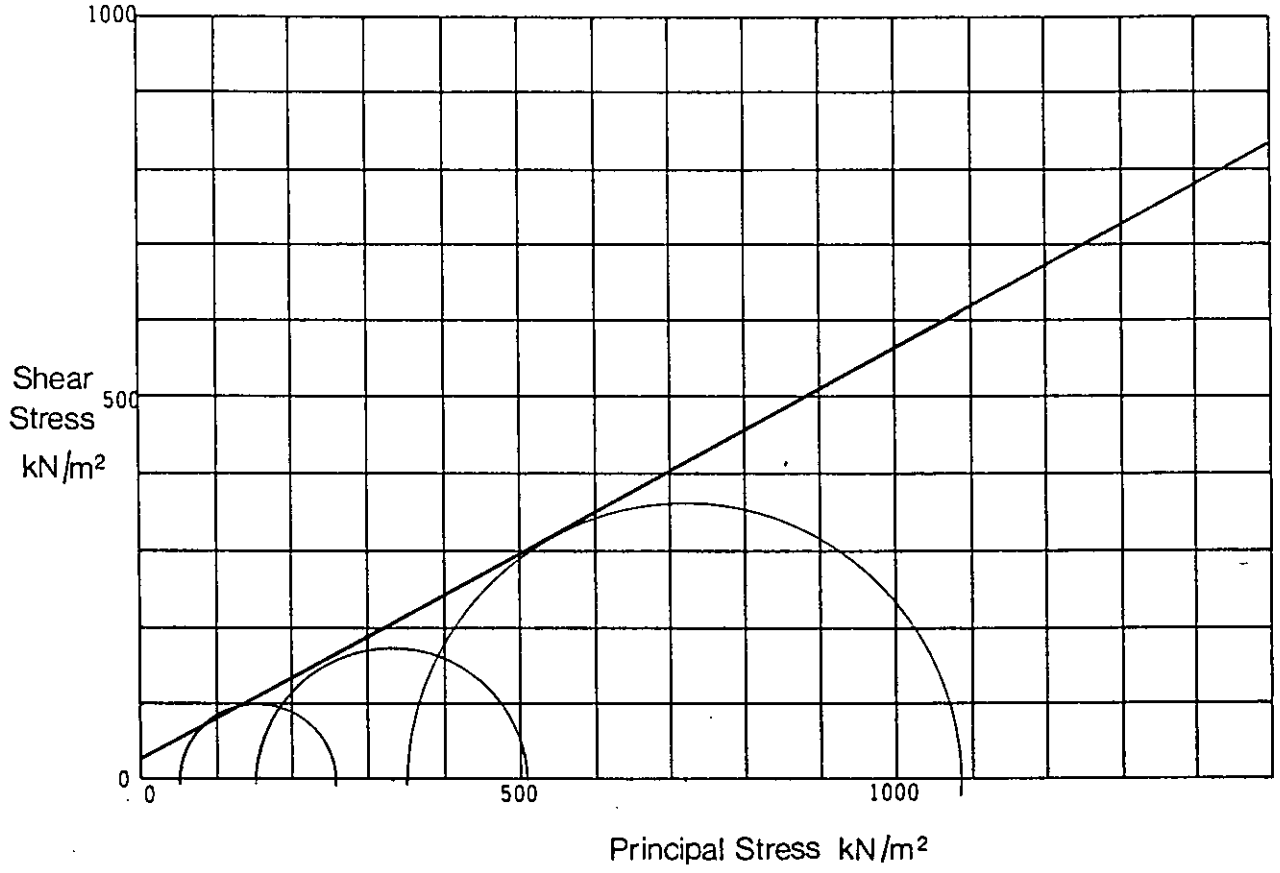
Laboratory Effective Stress

exploration associates

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Main Site Investigation - Contract 2

Contract S4449

Figure 2.70



B	(Initial)		0.41	0.98	0.97	
B_s	(After application of Back Pressure)		1.00	1.00	1.00	
ε	(Rate of Strain)	% min	0.015	0.0015	0.0015	
σ_3	(Cell Pressure during Shear)	kN/m²	450	550	750	
u_0	(Applied Back Pressure)	kN/m²	400	400	400	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	50	150	350	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	208	364	737	

Triaxial Compression Test
Consolidated
Drained

Description: Clayey SILT with abundant weak siltstone fragments.

Mohr Circles and Summary

C'	20	kN/m²
Φ'	28	Degrees
Depth	2.00	
Borehole	B263	

Remarks 106mm dia multistage

Laboratory - Effective Stress

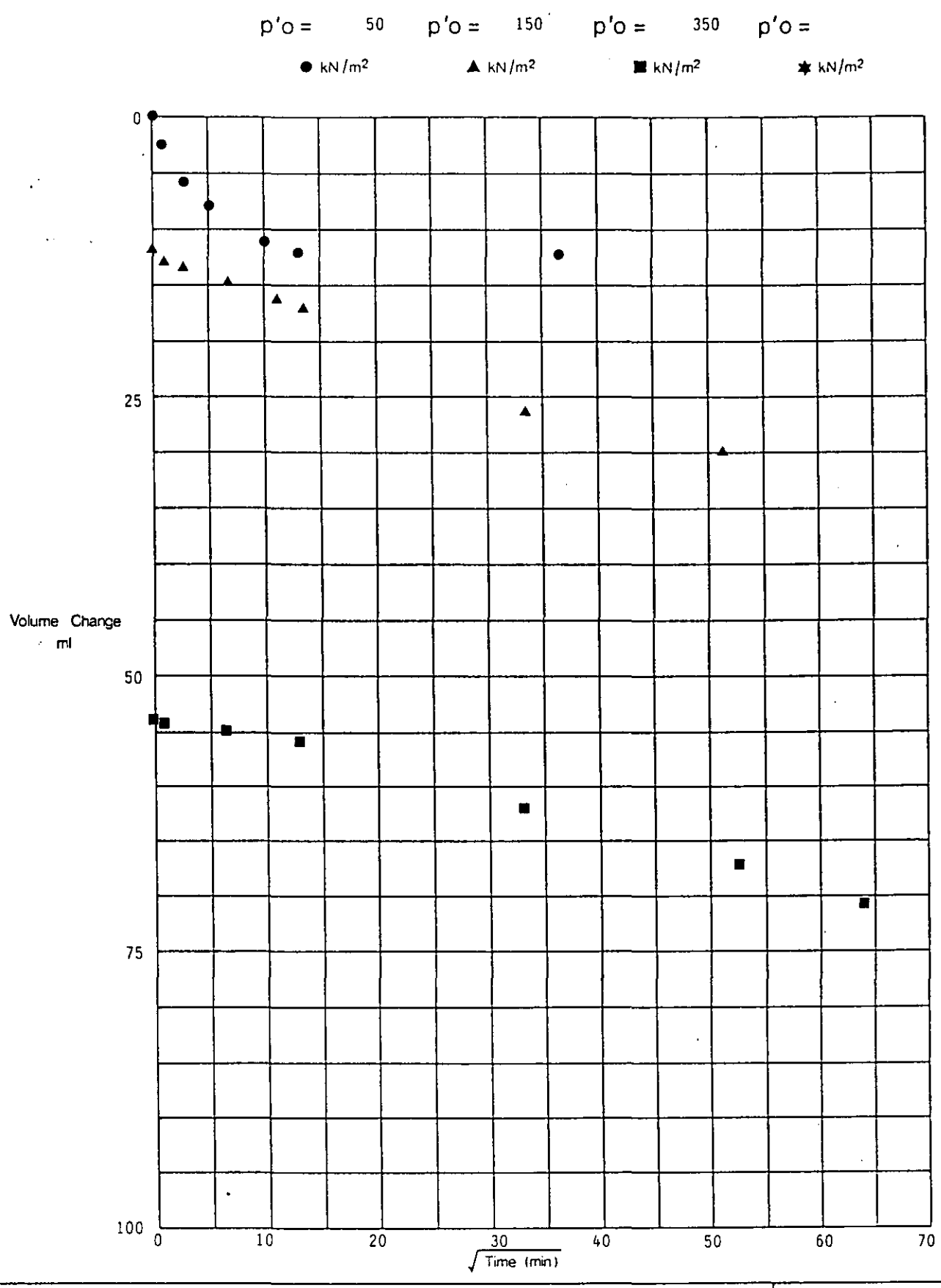
exploration associates

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Figure 2.71

EX3



Triaxial Consolidation – Volume Change / $\sqrt{\text{Time}}$

Depth 2.00
Borehole B263

Remarks

Laboratory–Effective Stress

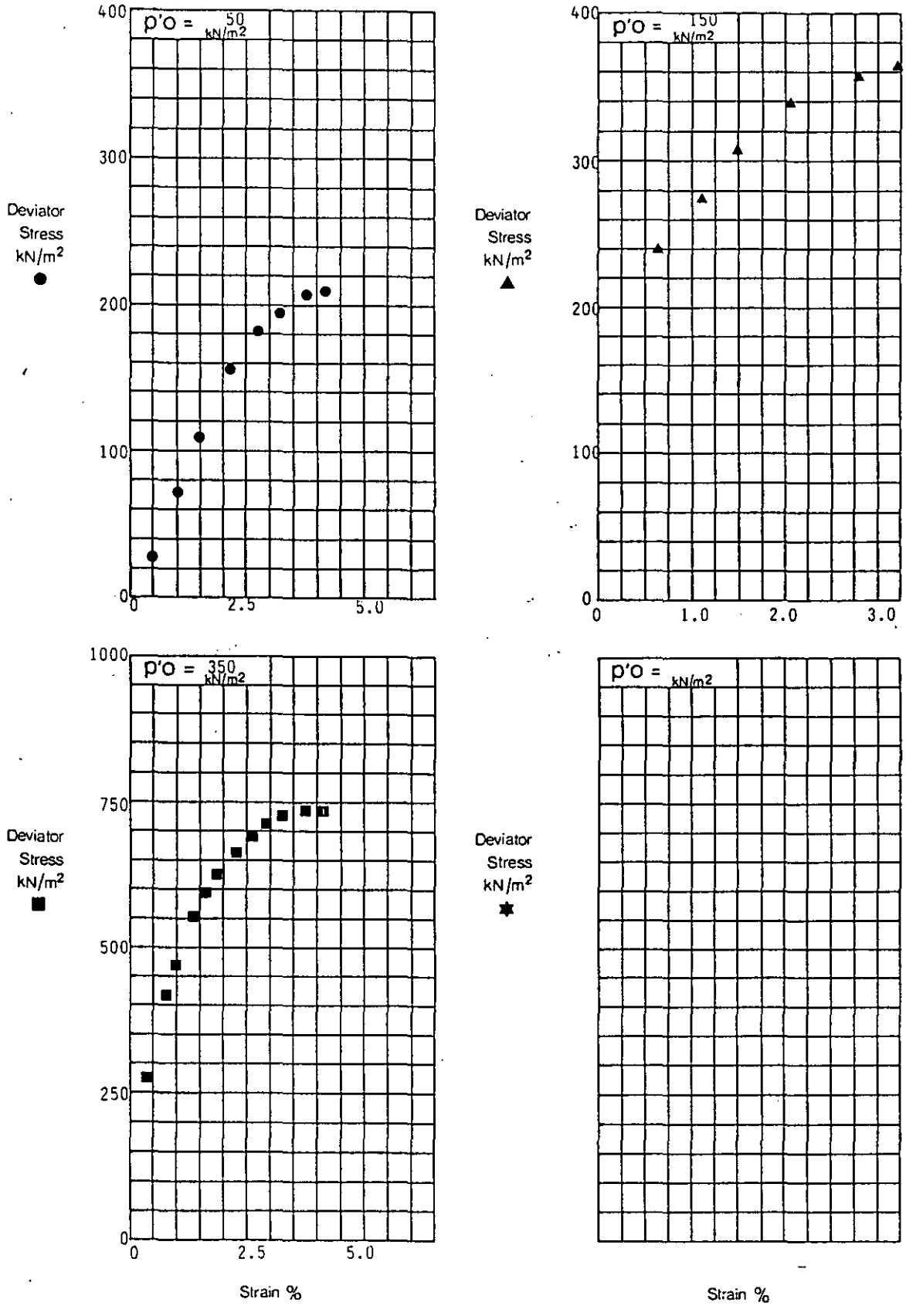
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Figure 2.72

EX3



Deviator Stress / Strain

Depth 2.00
Borehole B263

Remarks

Laboratory - Effective Stress

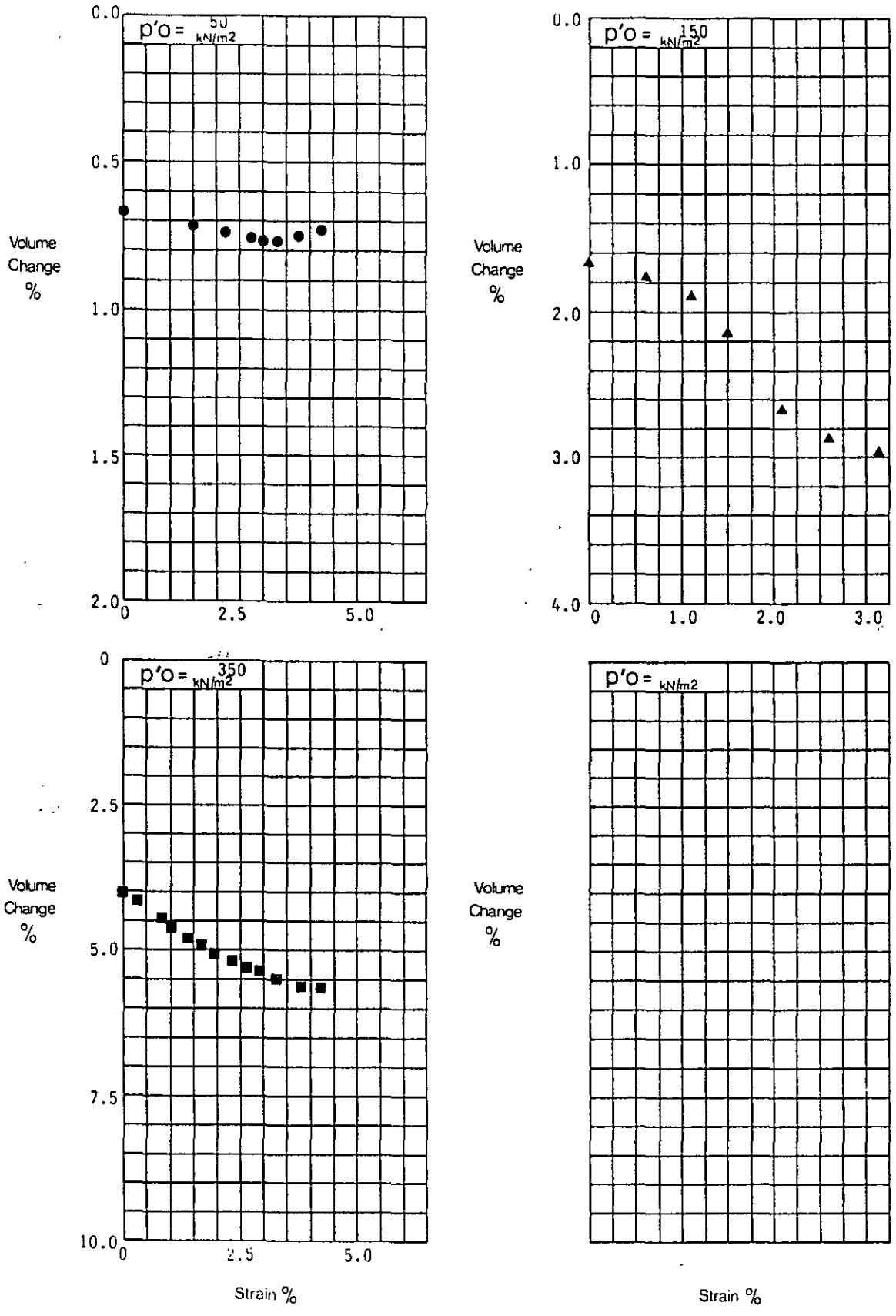
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Figure 2.73

EX3



Volume Change % / Strain %

Depth 2.00
Borehole B263

Remarks

Laboratory - Effective Stress

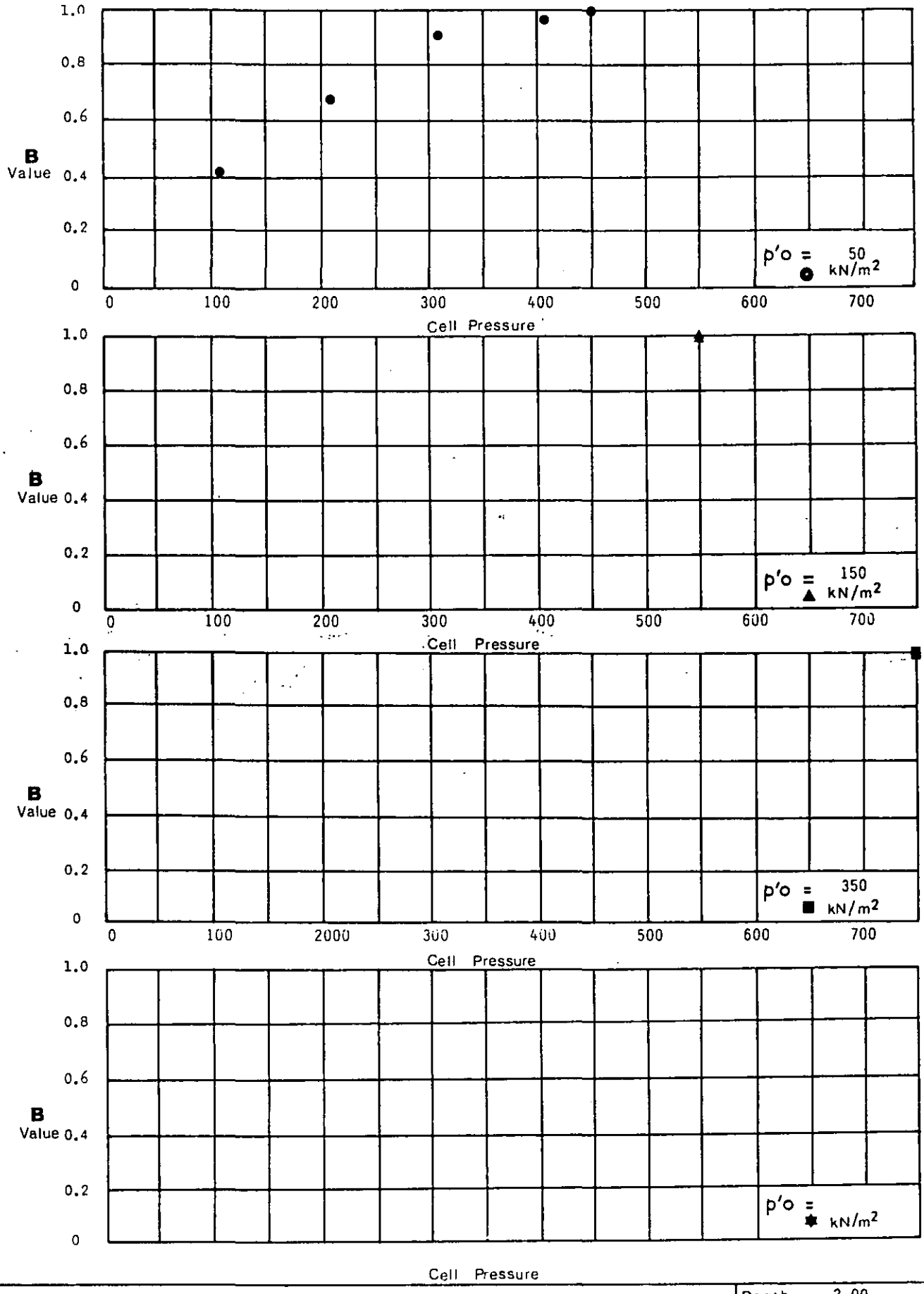
exploration associates

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Figure 2.74

EX3



B Value / Cell Pressure

Depth 2.00
Borehole B263

Remarks

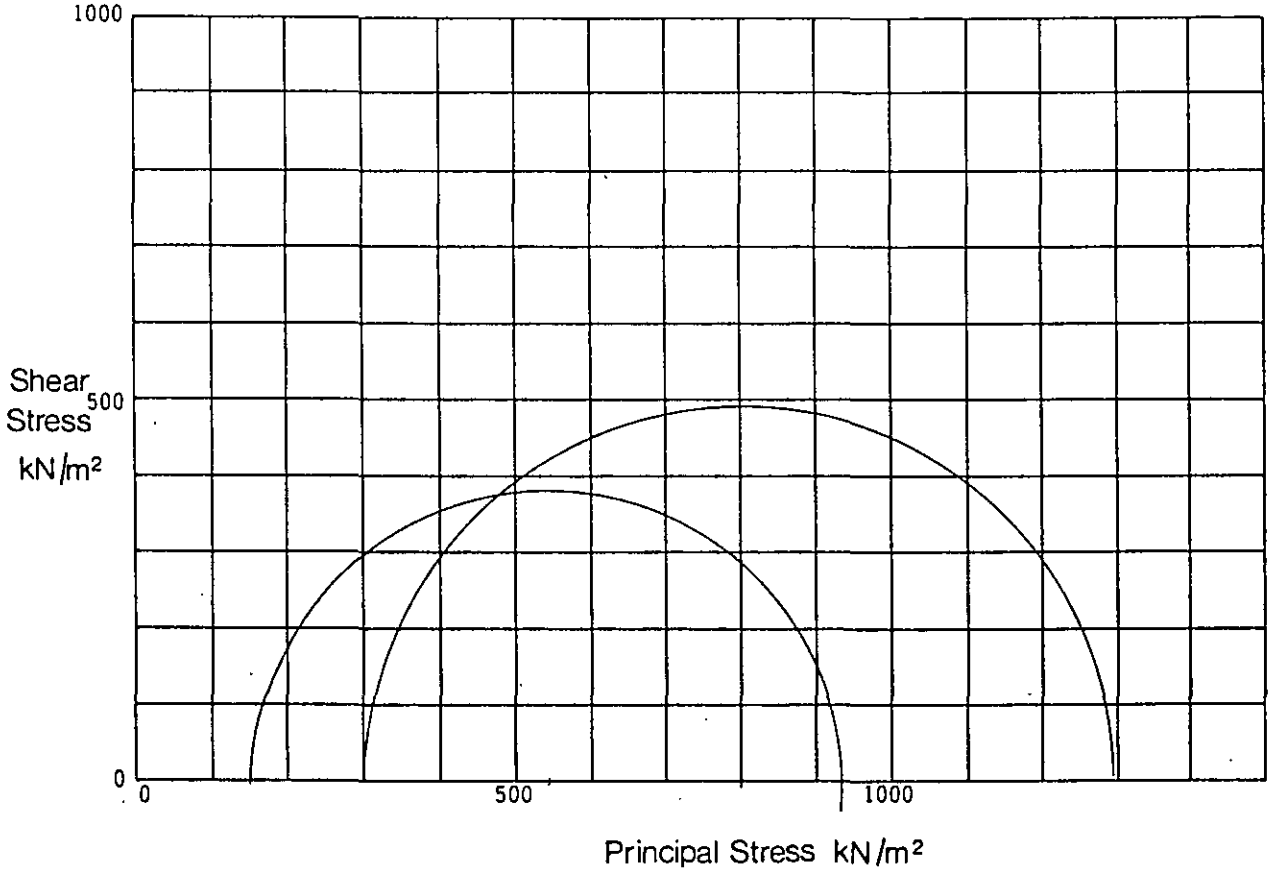
Laboratory Effective Stress

exploration associates

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Figure 2.75



B	(Initial)		0.48	1.00	-	
B_s	(After application of Back Pressure)		1.00	1.00	-	
ε	(Rate of Strain)	% min	0.021	0.007	-	
σ_3	(Cell Pressure during Shear)	kN/m²	350	500	-	
u_0	(Applied Back Pressure)	kN/m²	200	200	-	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	150	300	-	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	786	1000	-	

*

Triaxial Compression Test
Consolidated
Drained

Description Silty MUDSTONE

Mohr Circles and Summary

C' kN/m²
Φ' Degrees

Depth 5.23 - 5.66
Borehole B274

Remarks 76mm dia multistage * Sample sheared on second stage

Laboratory - Effective Stress

exploration associates

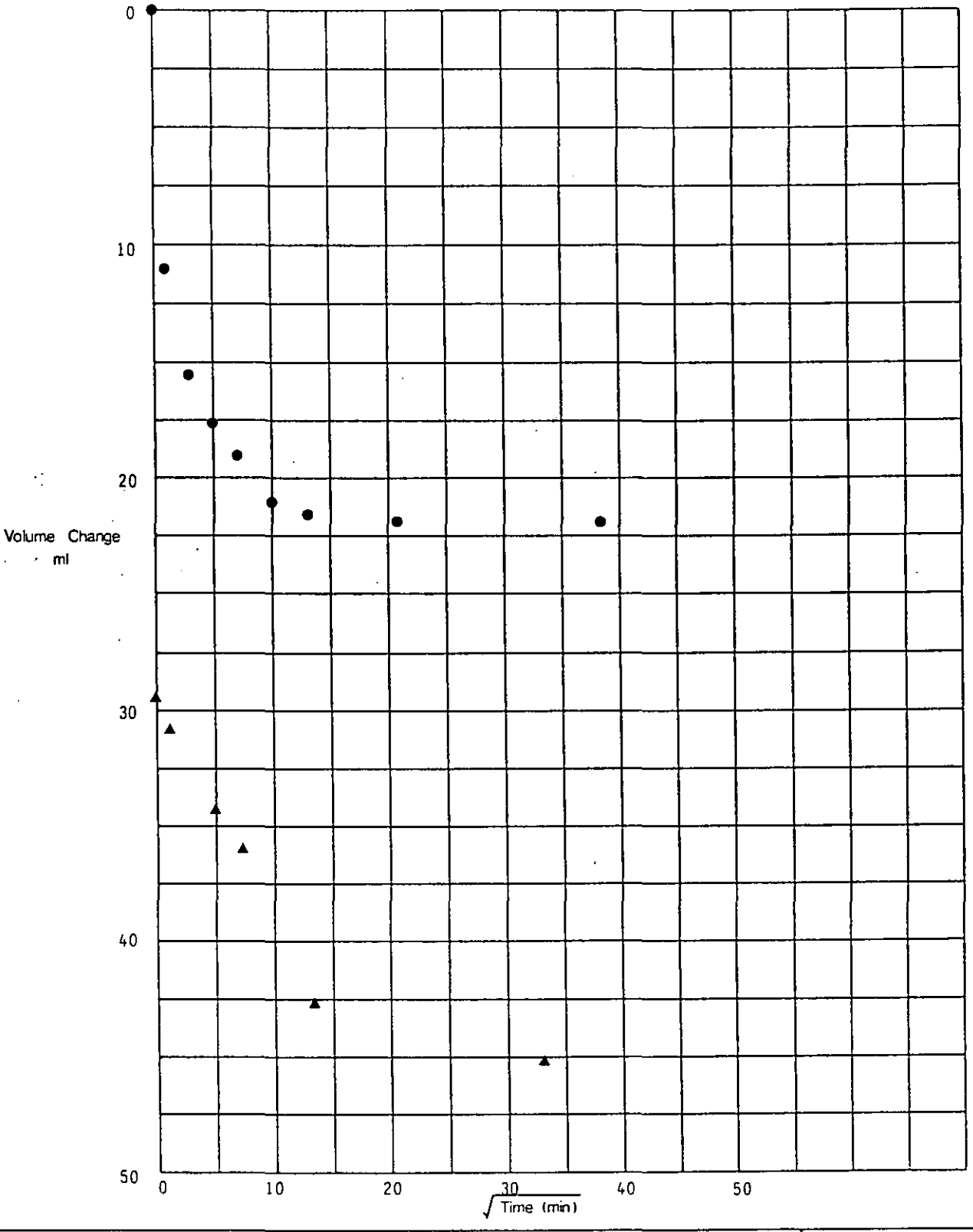
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Figure 2.76

EX3

p'o = 150 kN/m² ● p'o = 300 kN/m² ▲ p'o = ■ kN/m² p'o = ✱ kN/m²



Triaxial Consolidation – Volume Change / √Time

Depth 5.23 - 5.66
Borehole B274

Remarks

Laboratory – Effective Stress

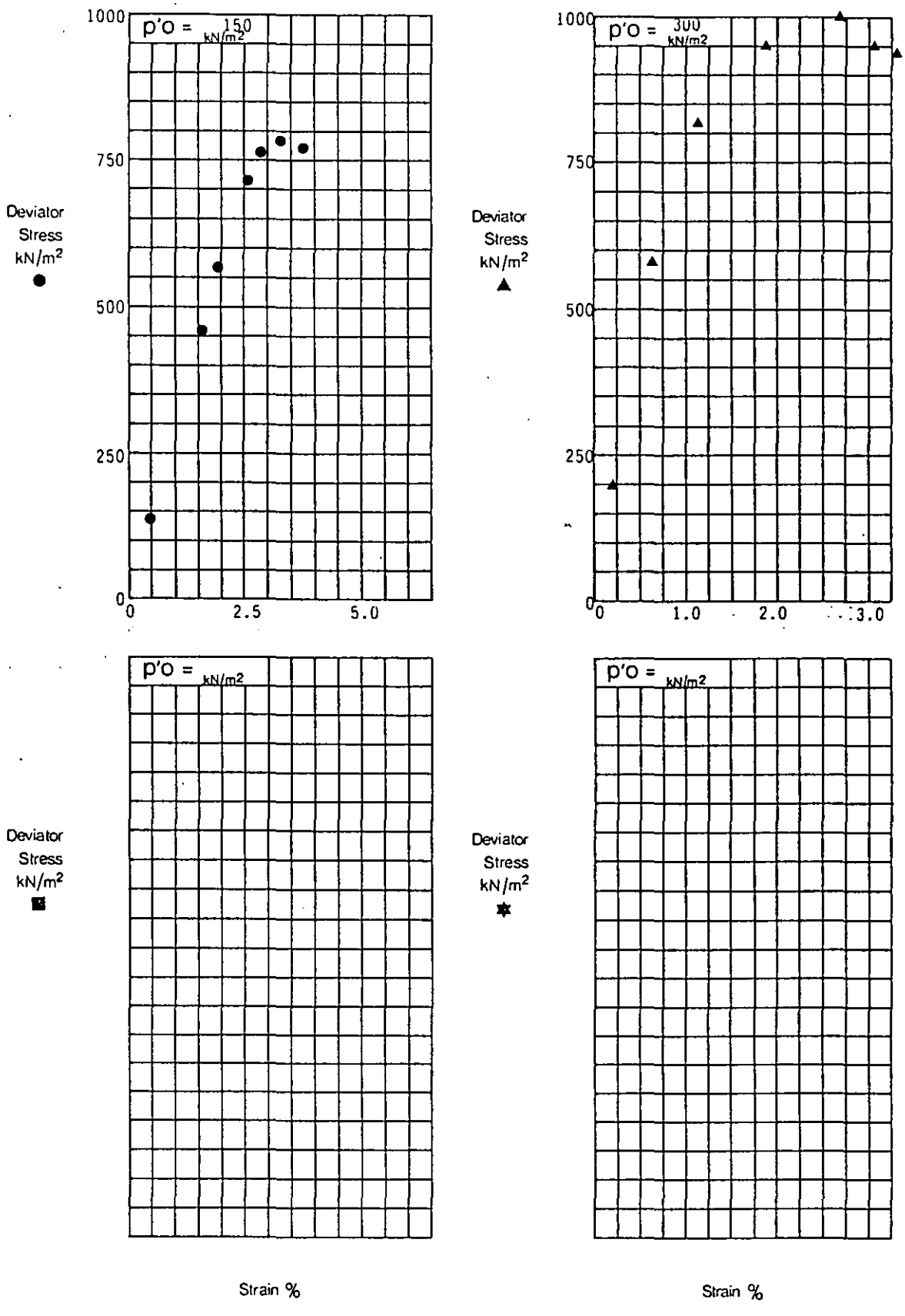
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Figure 2.77

EX3



Deviator Stress / Strain

Depth 5.23 - 5.66
Borehole B274

Remarks

Laboratory - Effective Stress

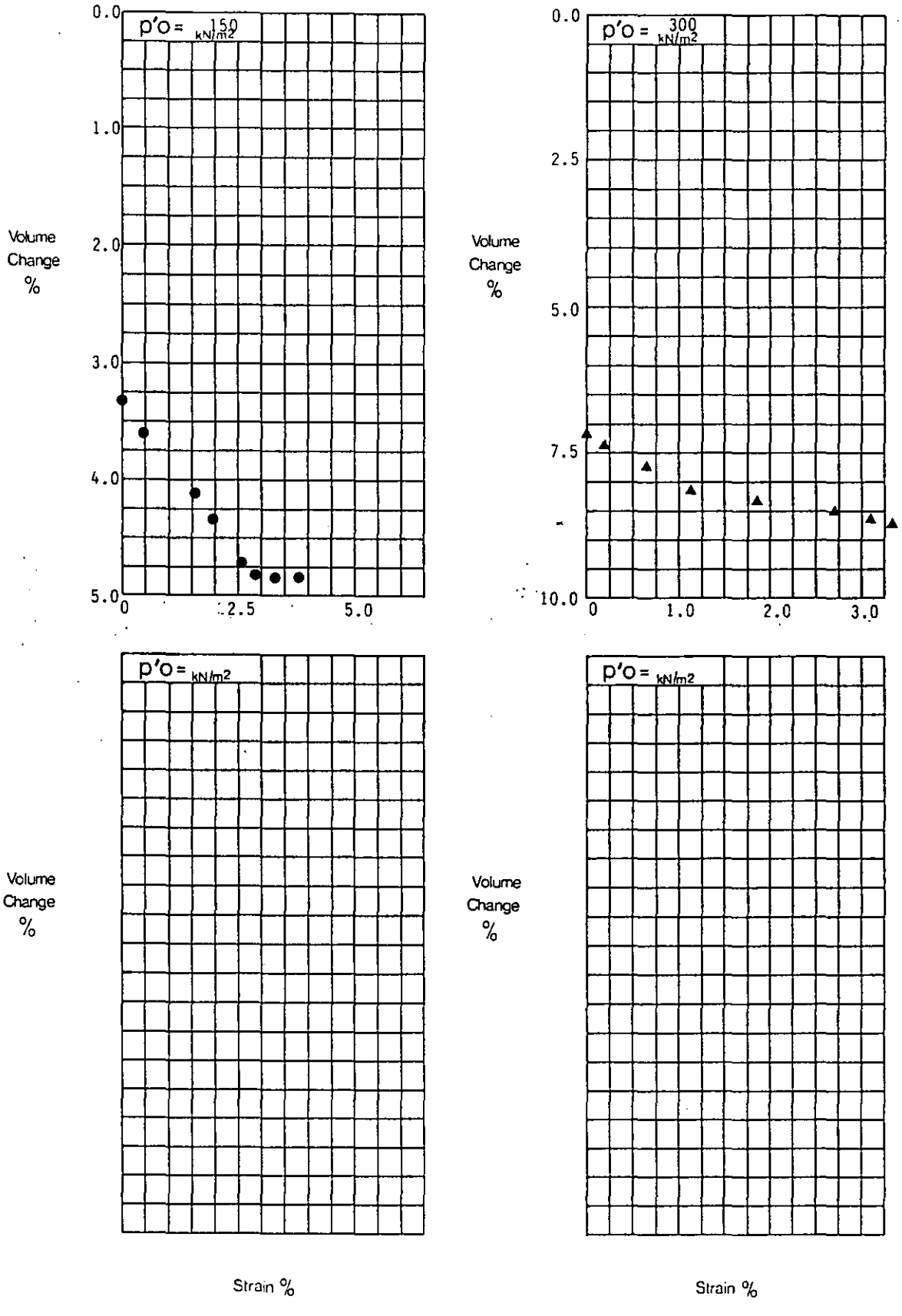
exploration associates

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Figure 2.78

EX3



Volume Change % / Strain %

Depth 5.23 - 5.66
Borehole B274

Remarks

Laboratory - Effective Stress

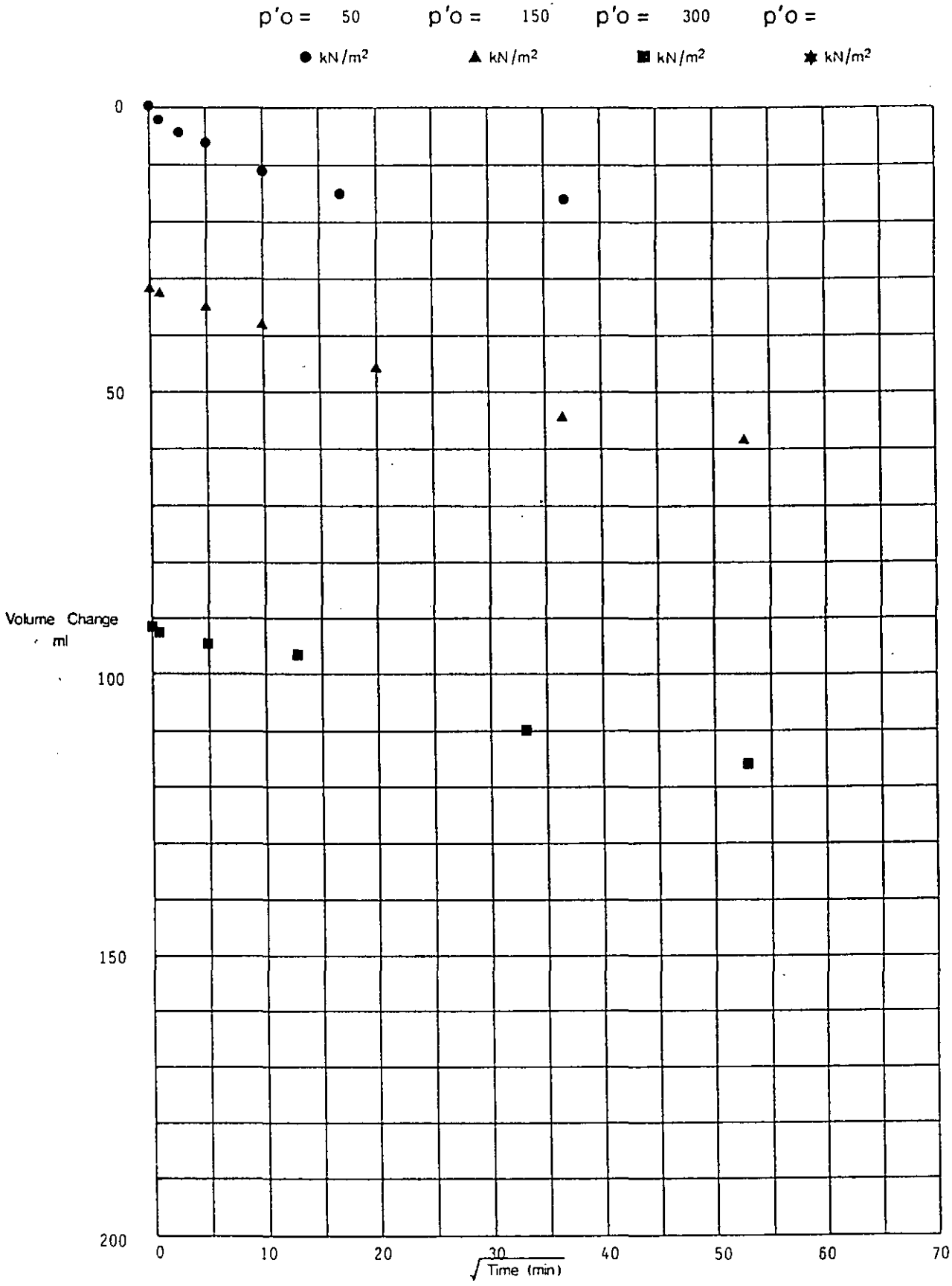
exploration associates

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Contract S4449

Figure 2.79

EX3



Triaxial Consolidation – Volume Change / $\sqrt{\text{Time}}$

Depth 2.00
Borehole B281

Remarks

Laboratory – Effective Stress

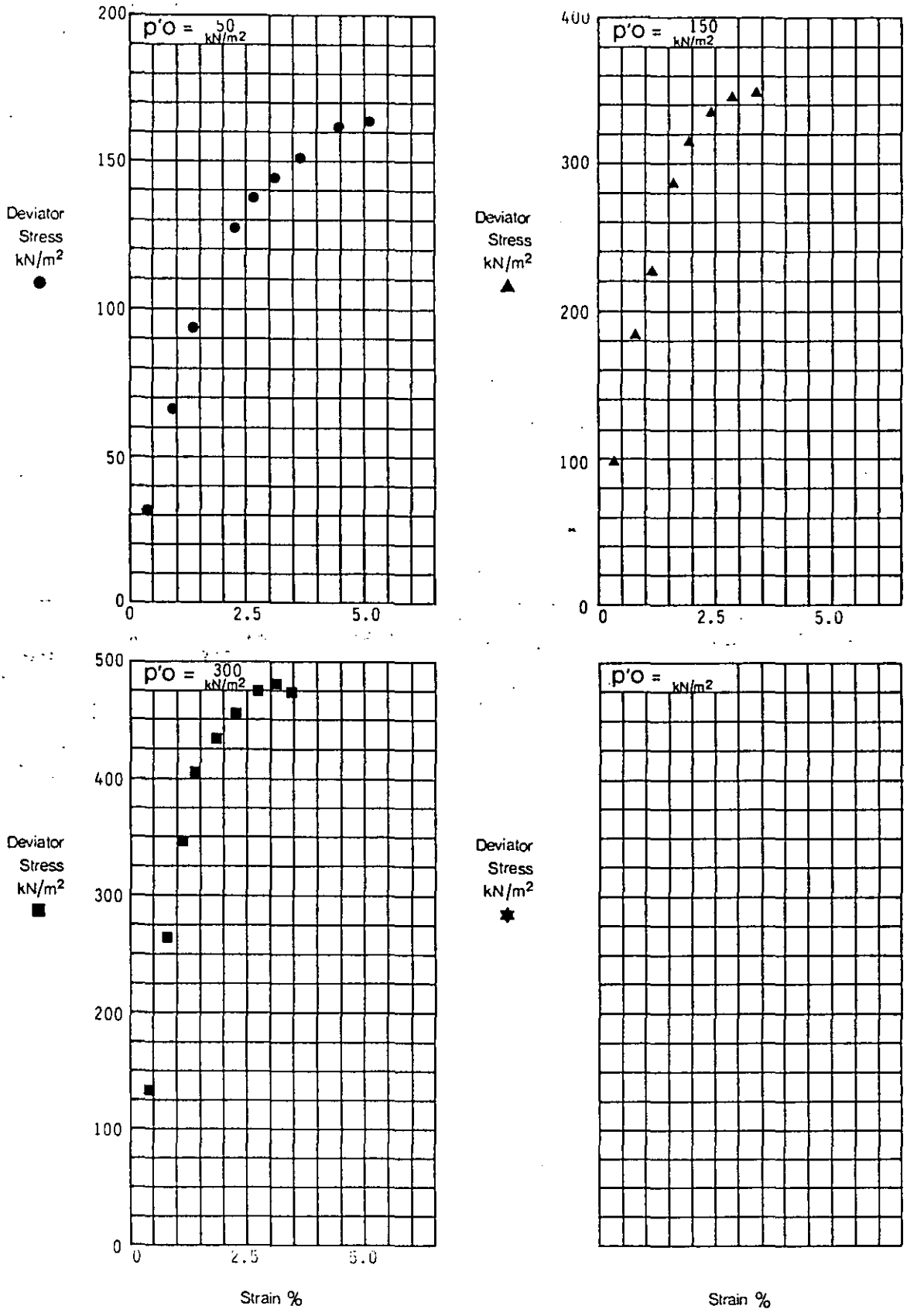
exploration associates

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Contract S4449

Figure 2.82

EX3



Deviator Stress / Strain

Depth 2.00
Borehole B281

Remarks

Laboratory - Effective Stress

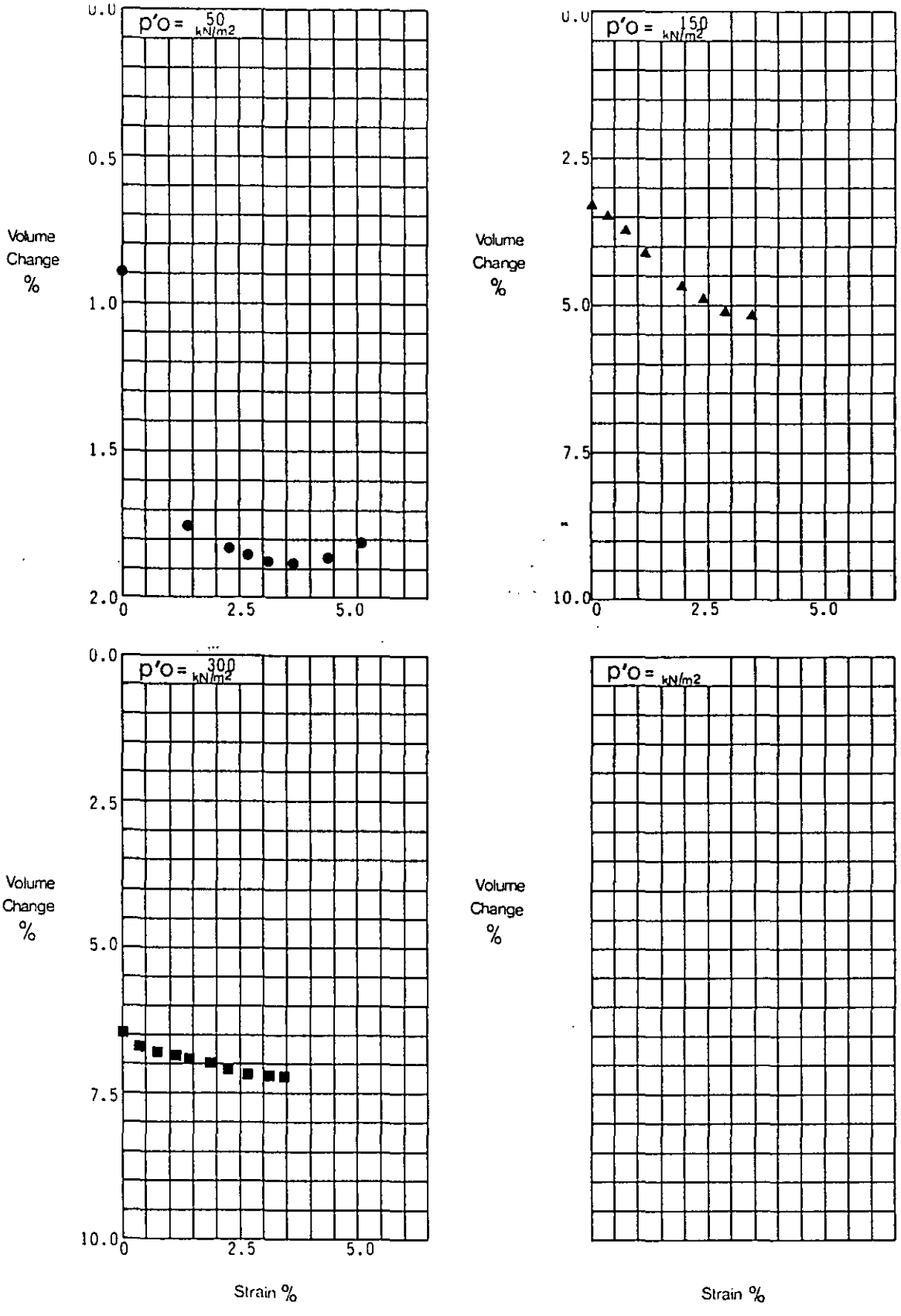
exploration associates

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Contract S4448

Figure 2.83

EX3



Volume Change % / Strain %

Depth 2.00
Borehole B281

Remarks

Laboratory - Effective Stress

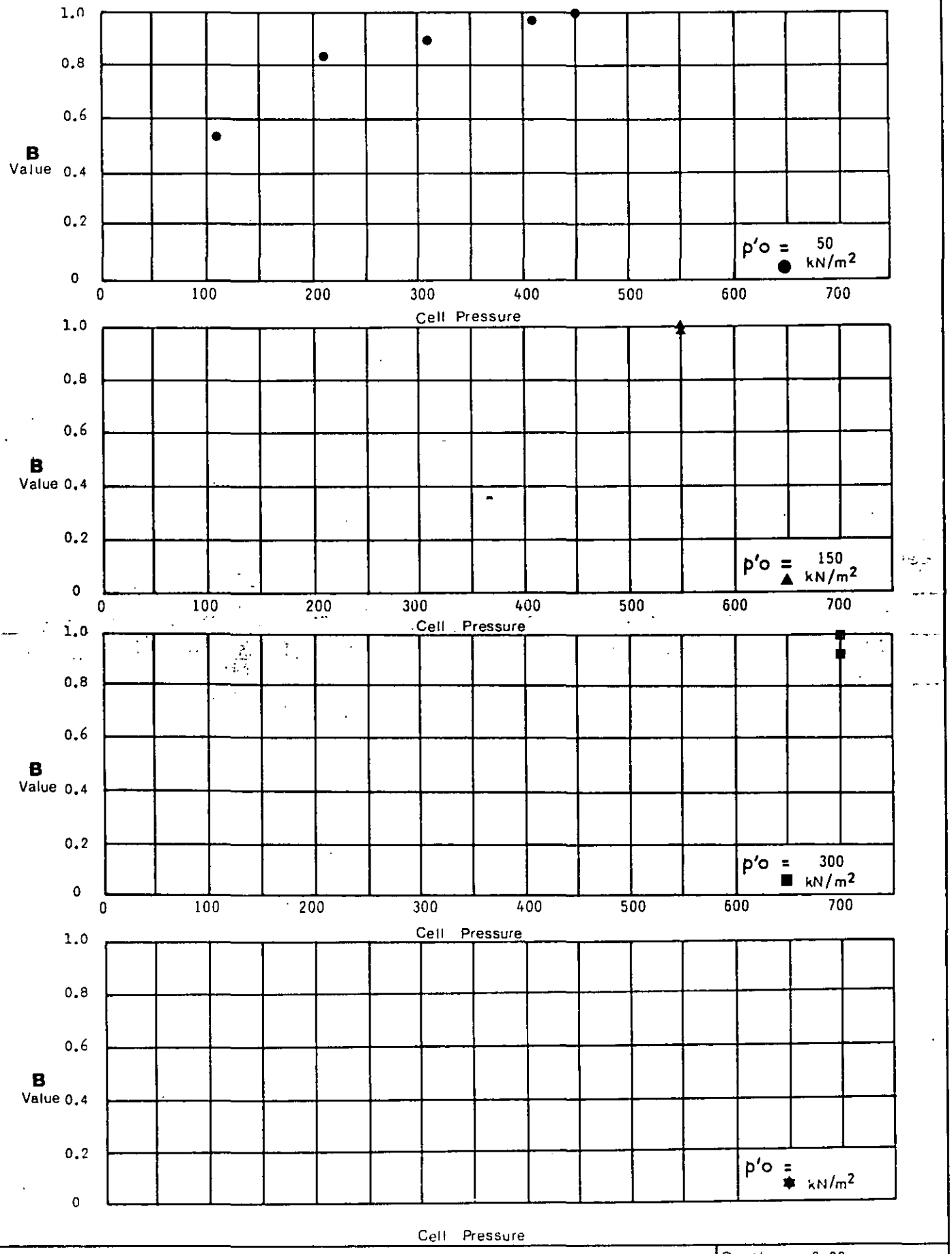
exploration associates

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Contract S4449

Figure 2.84

EX3



B Value / Cell Pressure

Depth 2.00
Borehole B281

Remarks

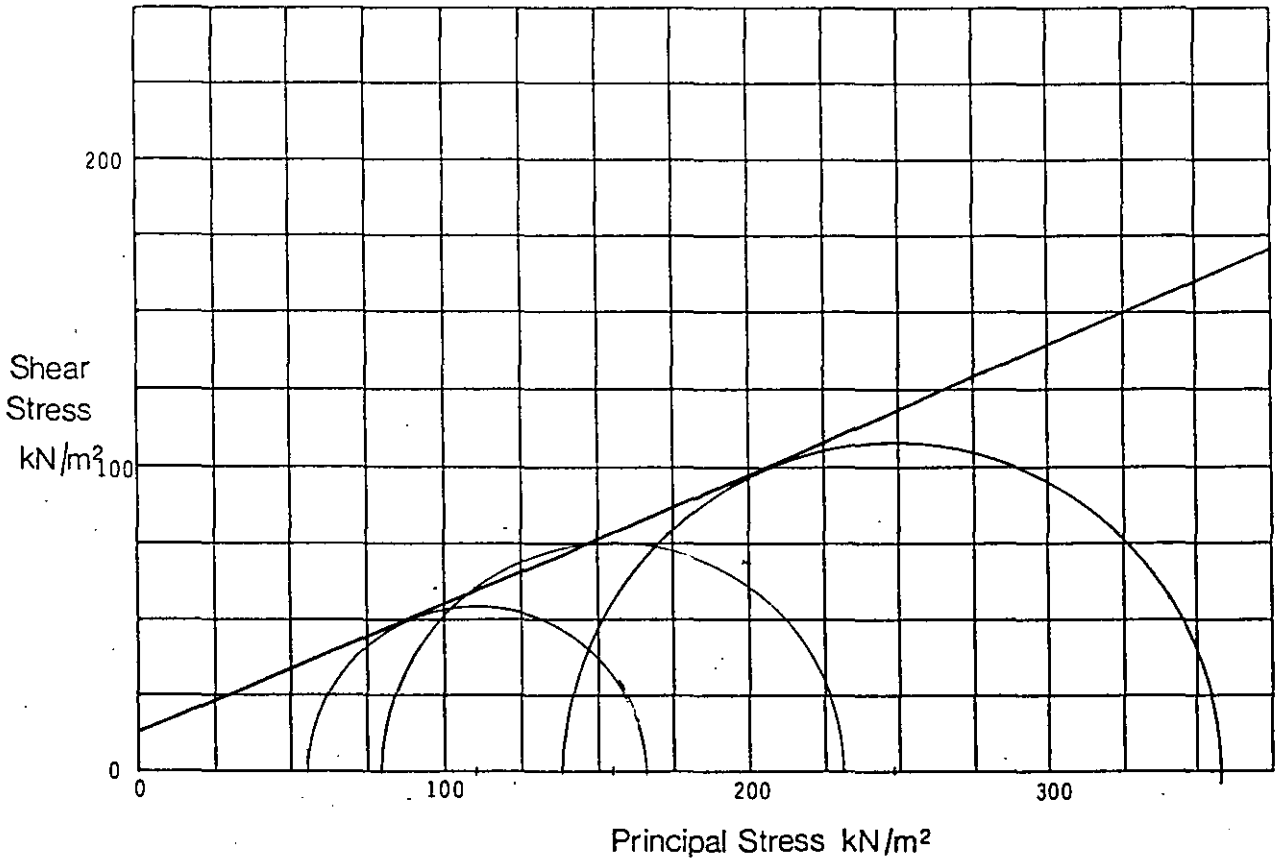
Laboratory Effective Stress

exploration associates

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Contract S4449

Figure 2.85



B	(Initial)		0.34	0.42	0.45	
B_s	(After application of Back Pressure)		0.98	0.99	1.00	
ε	(Rate of Strain)	% min	0.003	0.003	0.003	
σ_3	(Cell Pressure during Shear)	kN/m²	350	400	500	
u_0	(Applied Back Pressure)	kN/m²	300	300	300	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	50	100	200	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	111	151	220	
$\Delta u_f = u_f - u_0$	(Pore Pressure Change to Failure)	kN/m²	-5	21	62	
A_f	(Failure)		-0.04	0.14	0.28	

Triaxial Compression Test
Consolidated
Undrained

Description Slightly silty CLAY.

Mohr Circles and Summary

C' 15 kN/m²
Φ' 22 Degrees

Depth 0.50
Borehole 291

Remarks 3 x 38mm dia sample.

Laboratory - Effective Stress

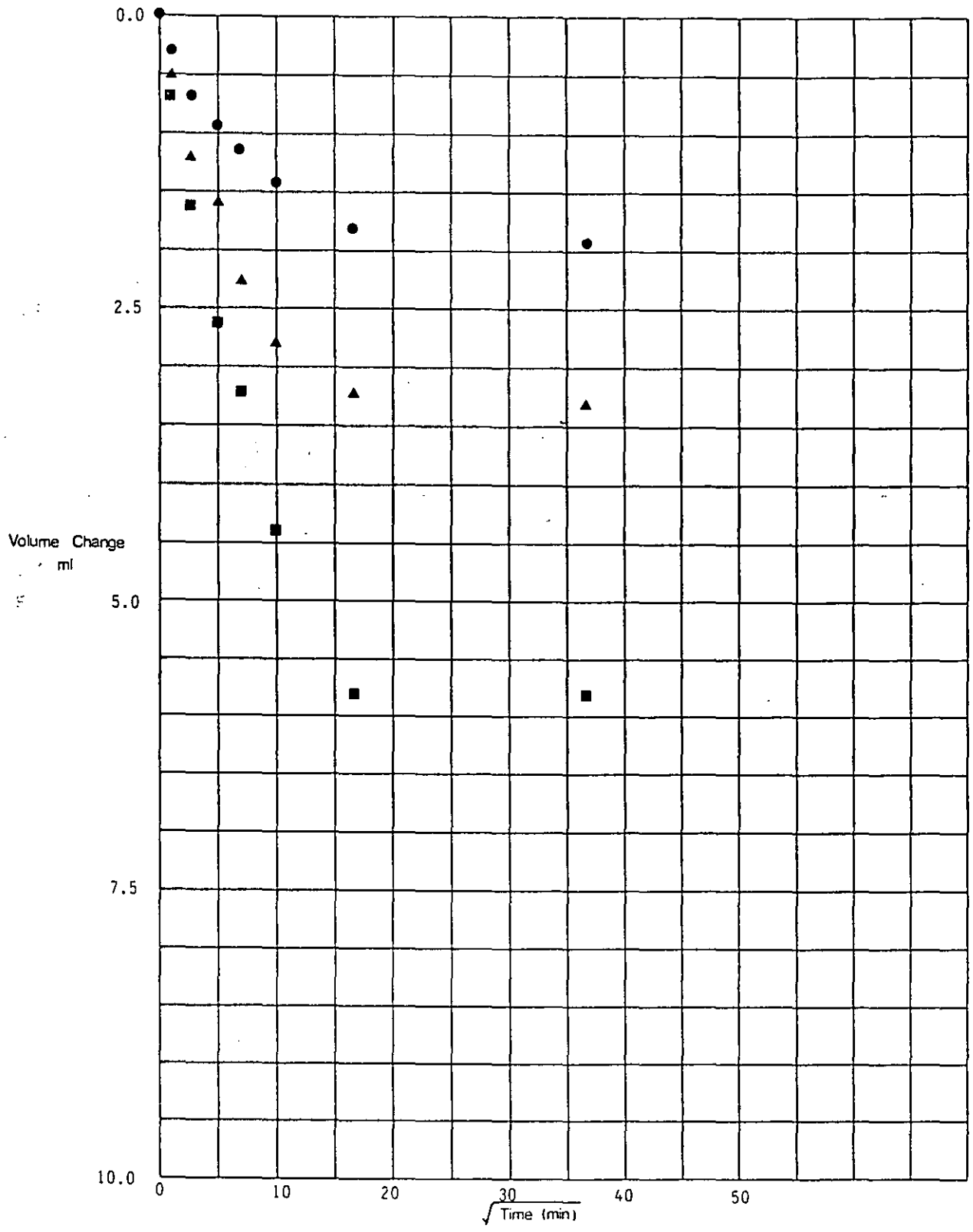
exploration associates

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Main Site Investigation - Contract 2

Contract 34449

Figure 2.86

EX3



Triaxial Consolidation – Volume Change / $\sqrt{\text{Time}}$

Depth 0.50
Borehole 291

Remarks

Laboratory – Effective Stress

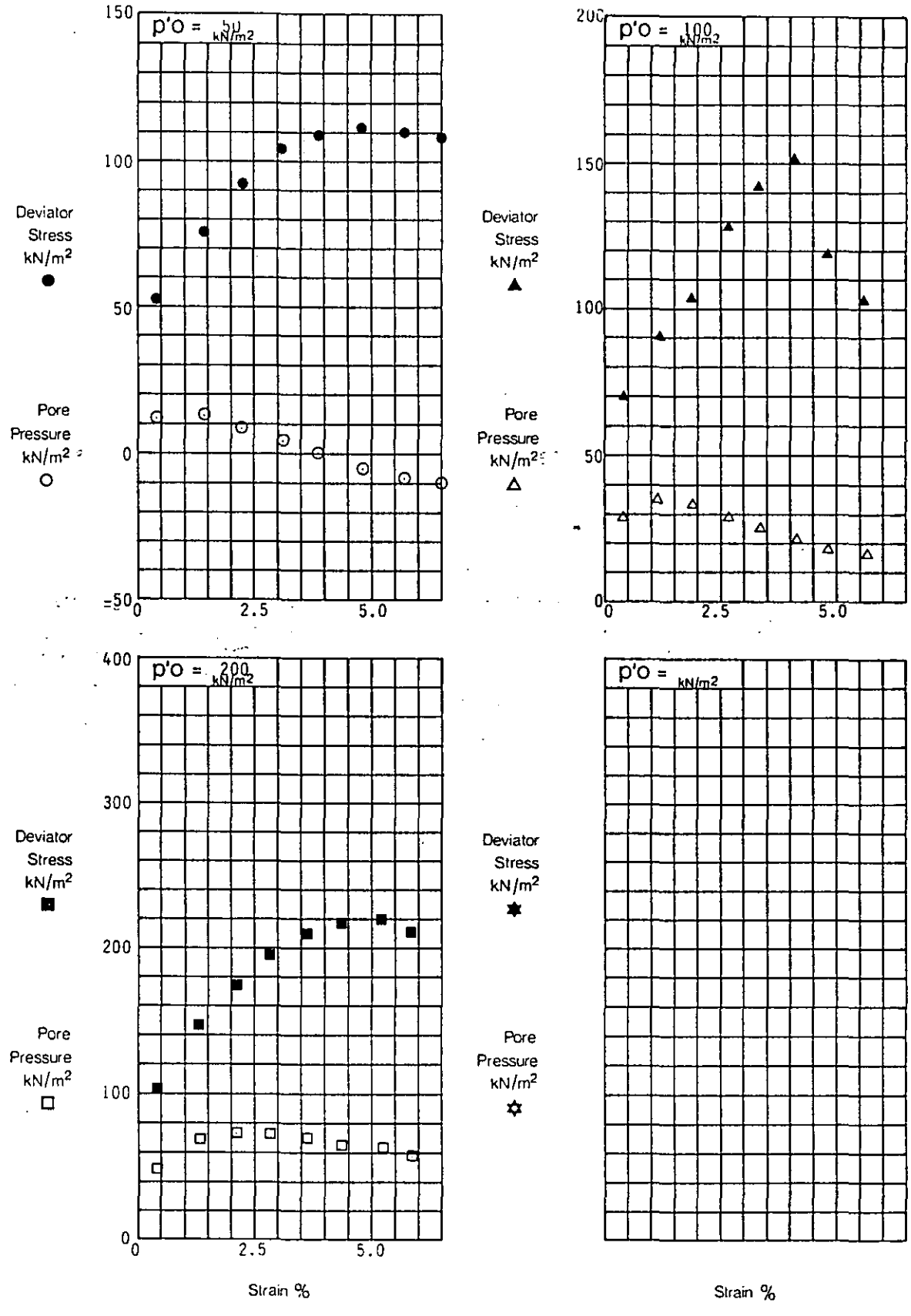
exploration associates

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Contract S4449

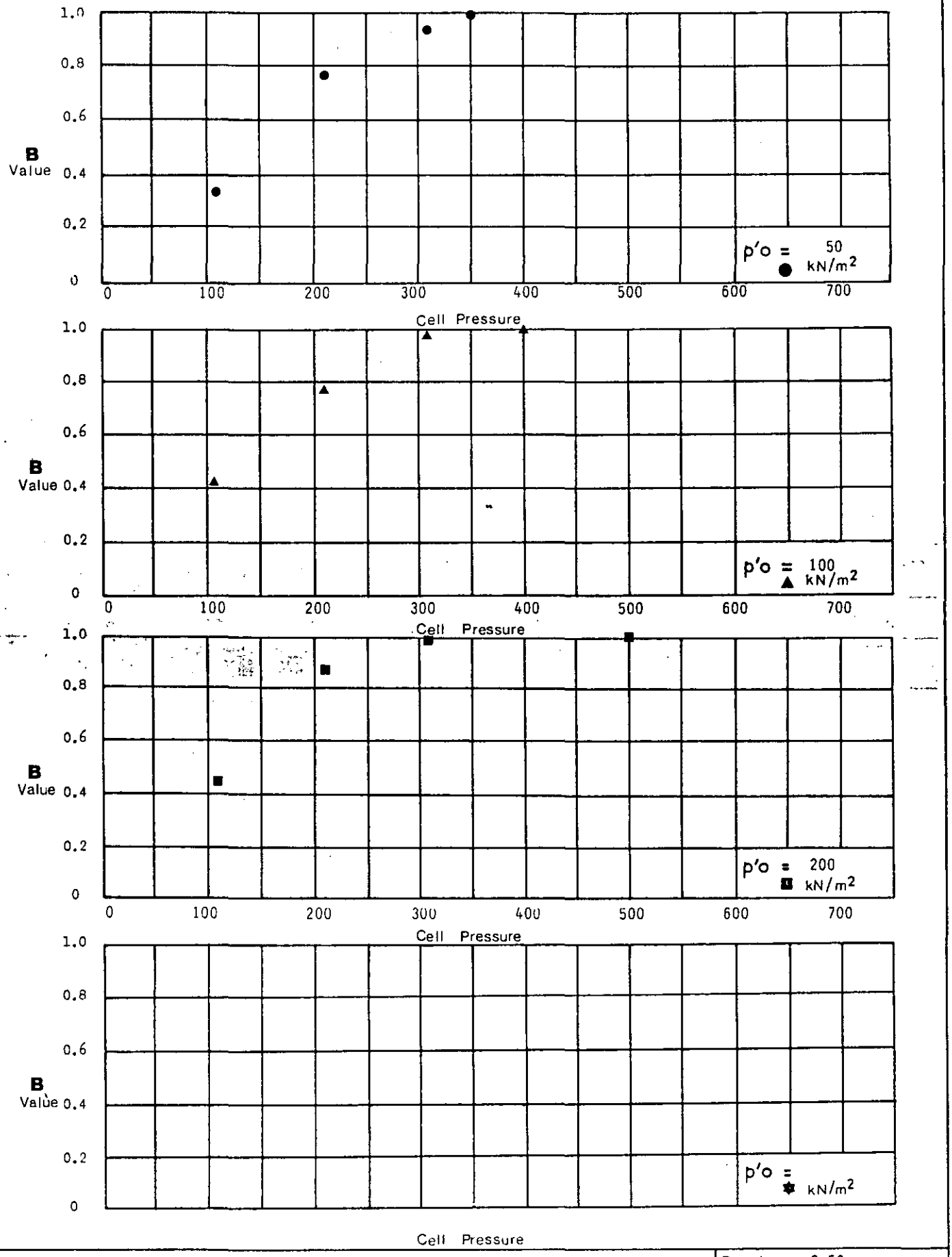
Figure 2.87

EX3



Deviator Stress / Strain Pore Pressure / Strain		Depth 0.50 Borehole 291
Remarks		
Laboratory-Effective Stress **exploration associates**	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449 **Figure** 2.88

EX3



B Value / Cell Pressure

Depth 0.50
Borehole 291

Remarks

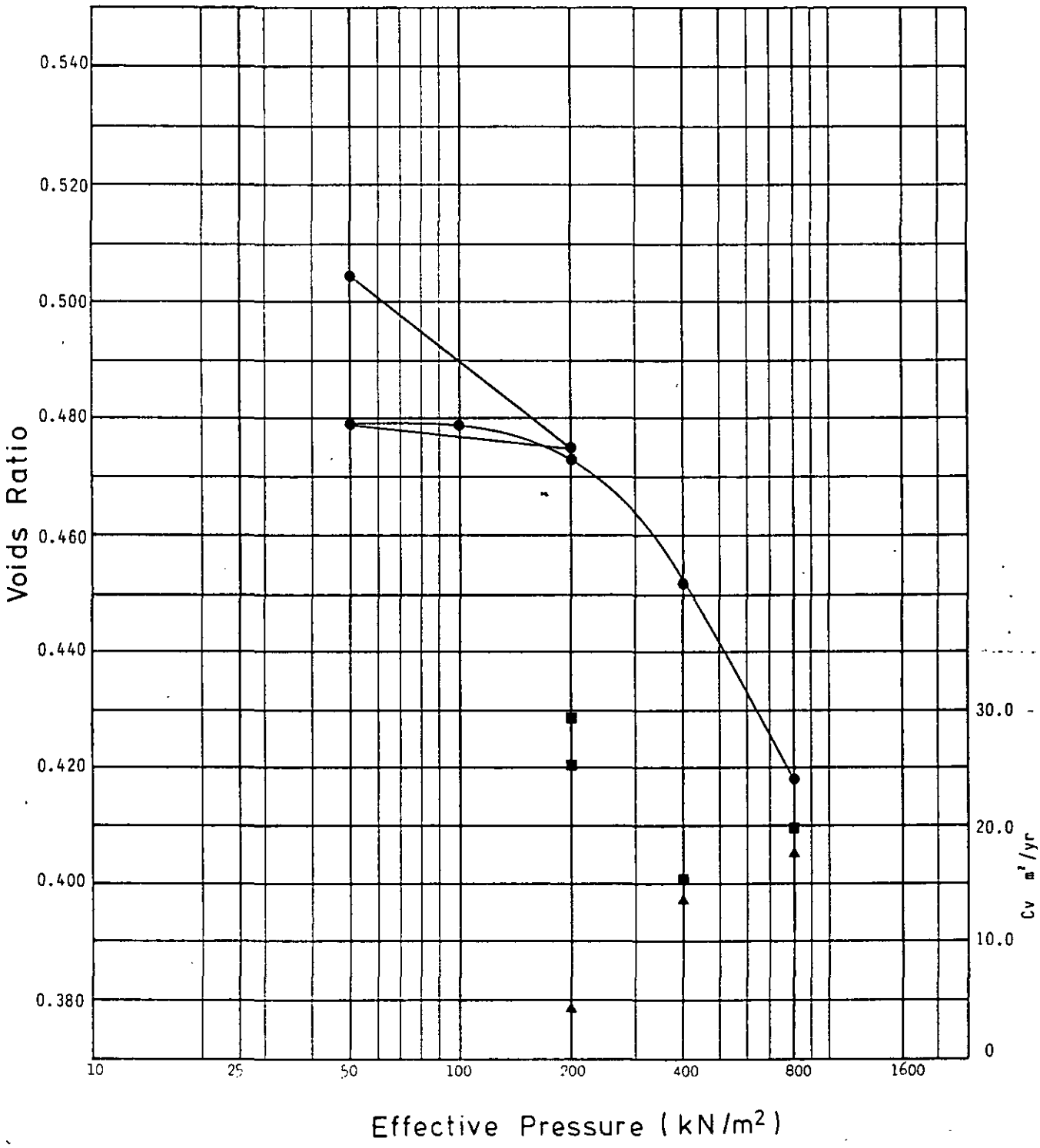
Laboratory Effective Stress

exploration associates

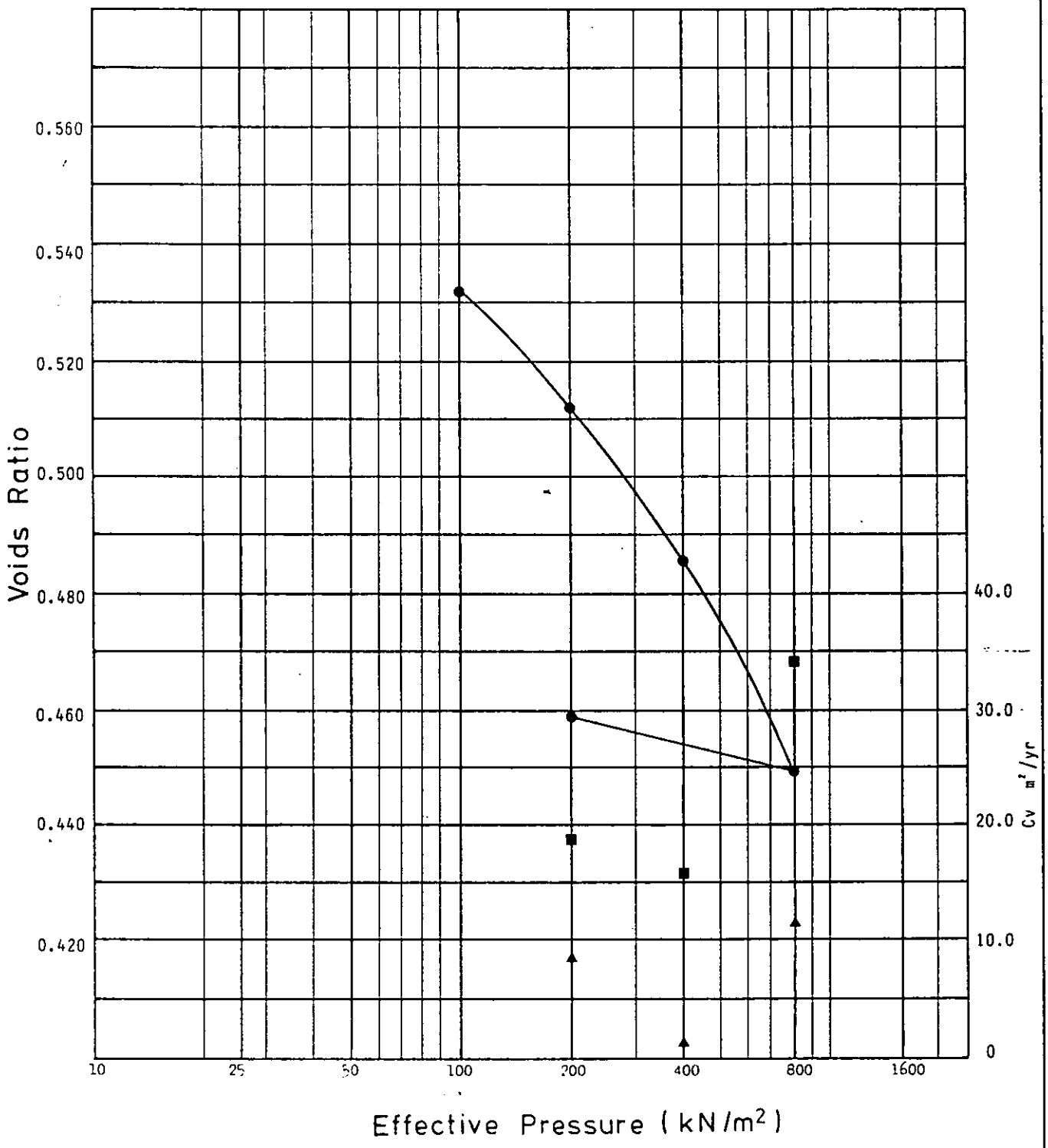
Project
Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation - Contract 2

Contract S4449

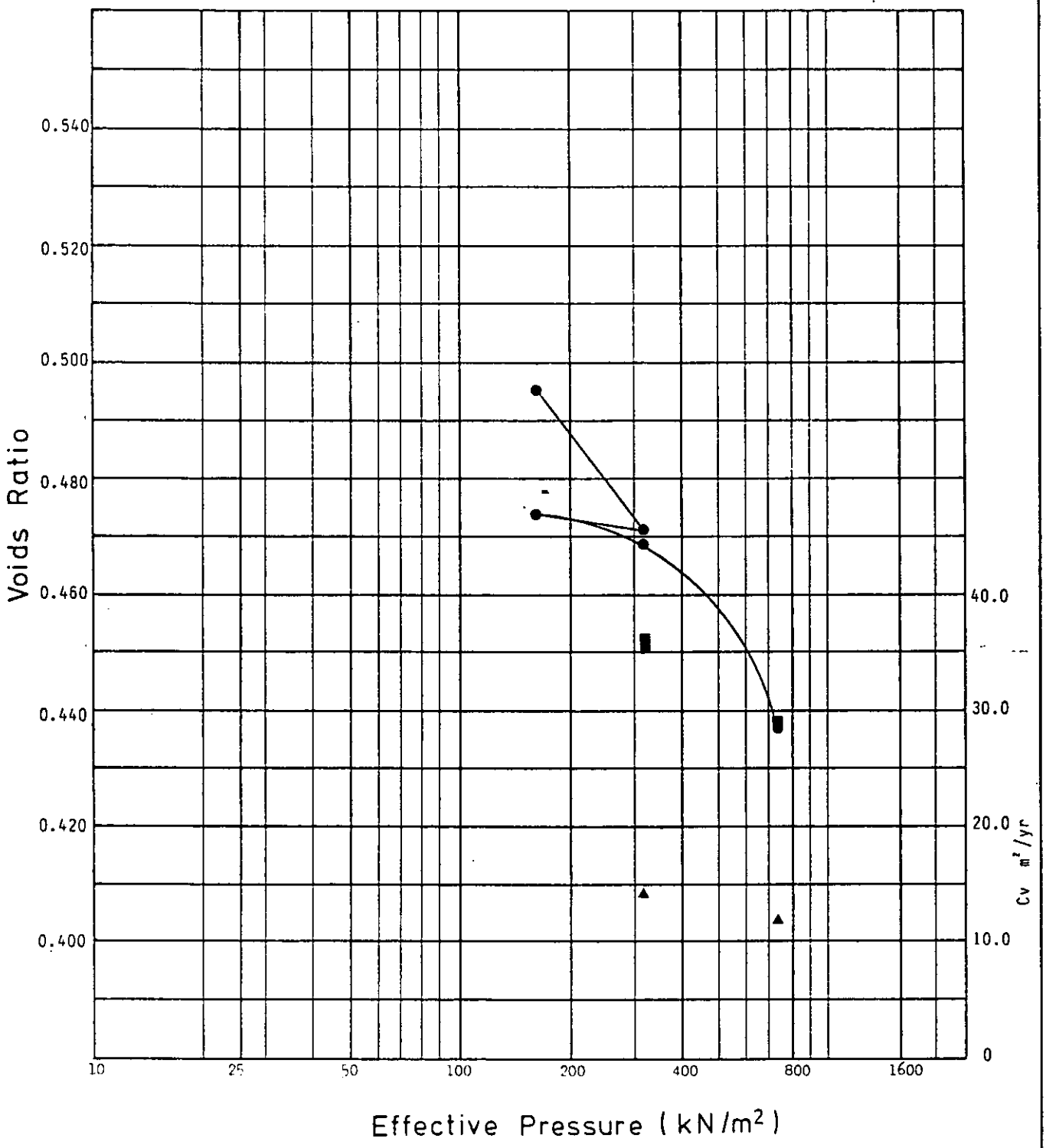
Figure 2.89



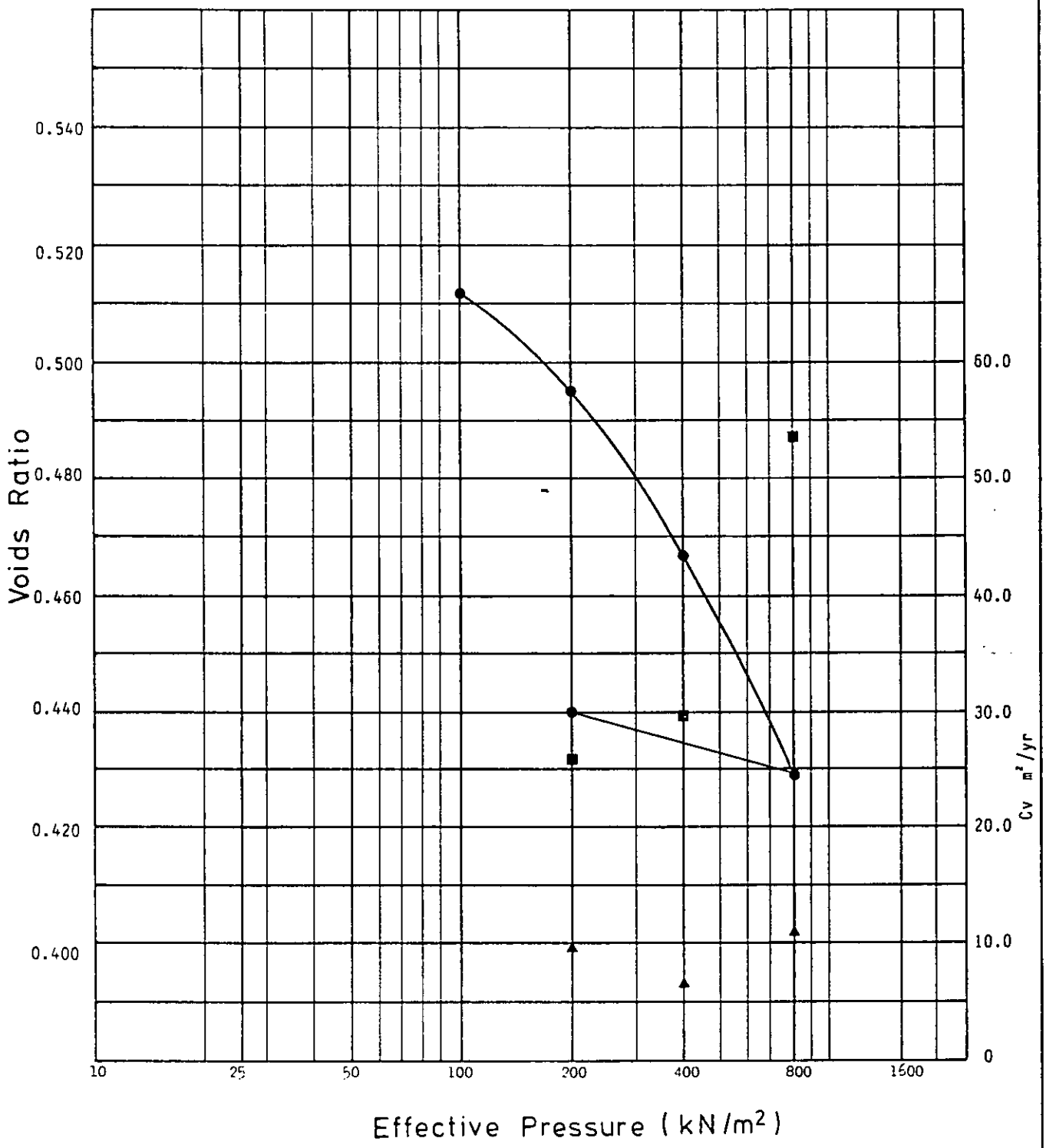
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.533	Depth 3.50 - 3.95 Hole B219
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.90



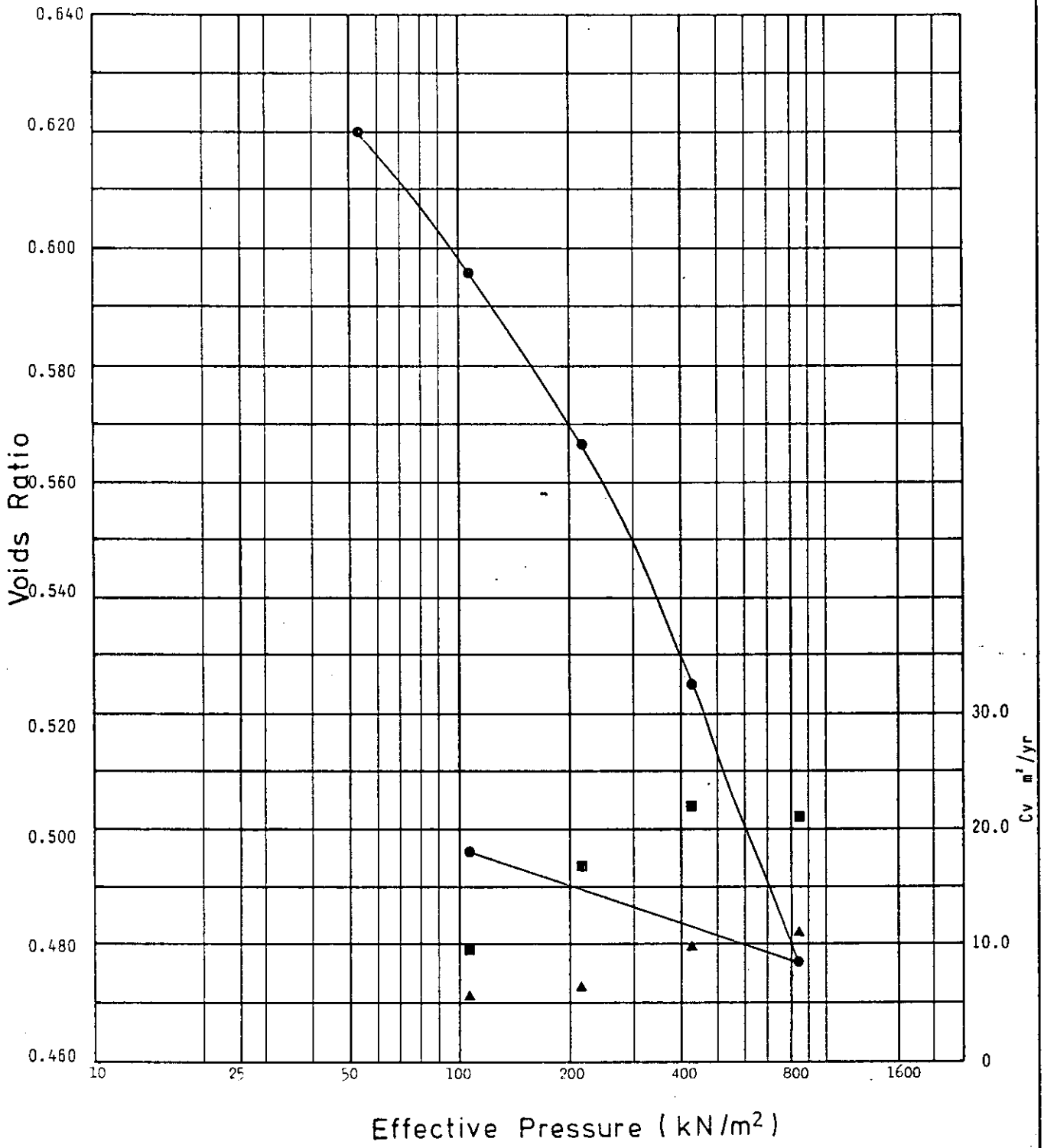
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.581	Depth 8.00 - 8.45 Hole B221
Remarks ▲ t50 ■ t90		
Laboratory – e/logP	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.91



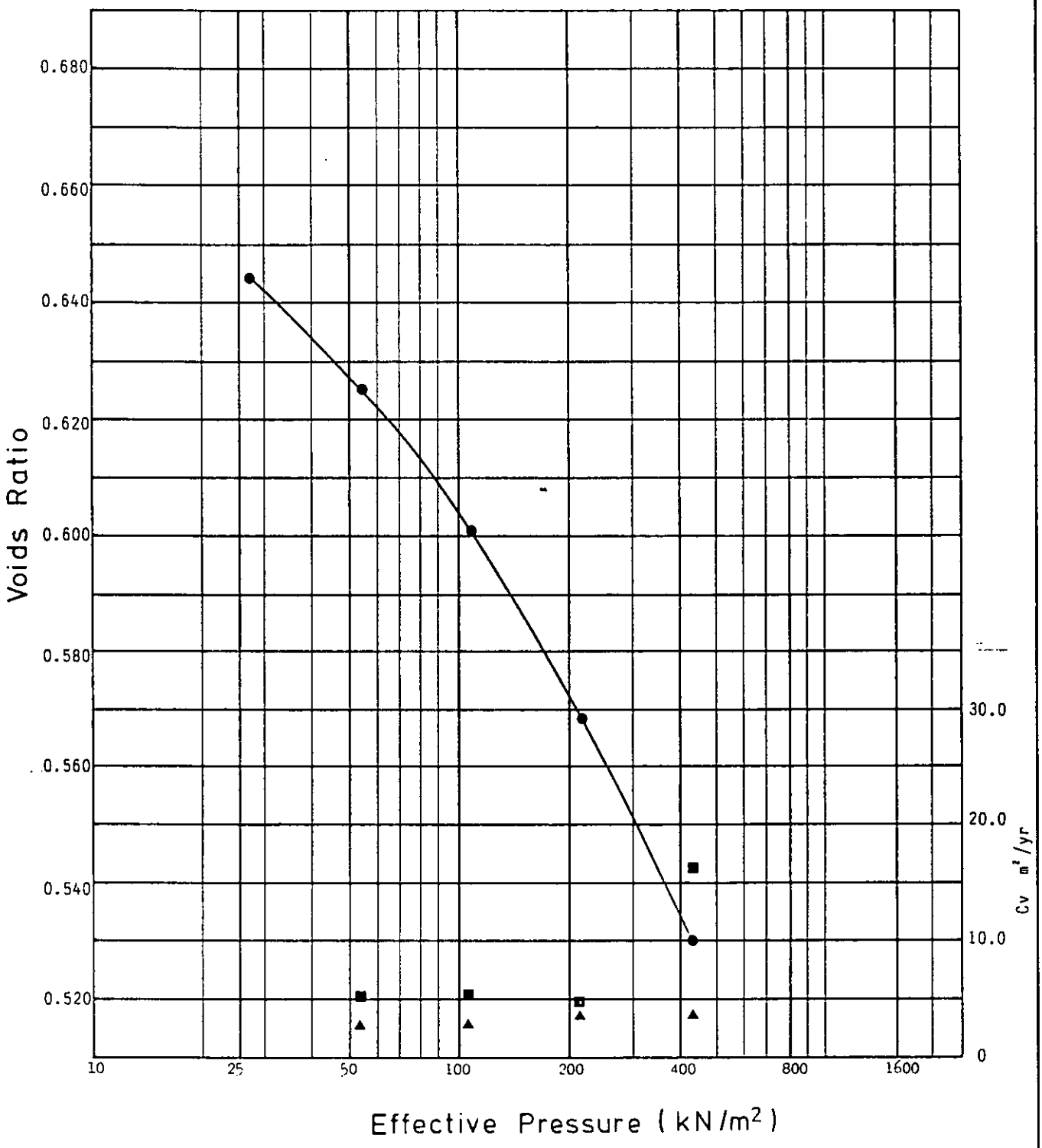
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.560	Depth 8.00 - 8.45 Hole B222
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.92



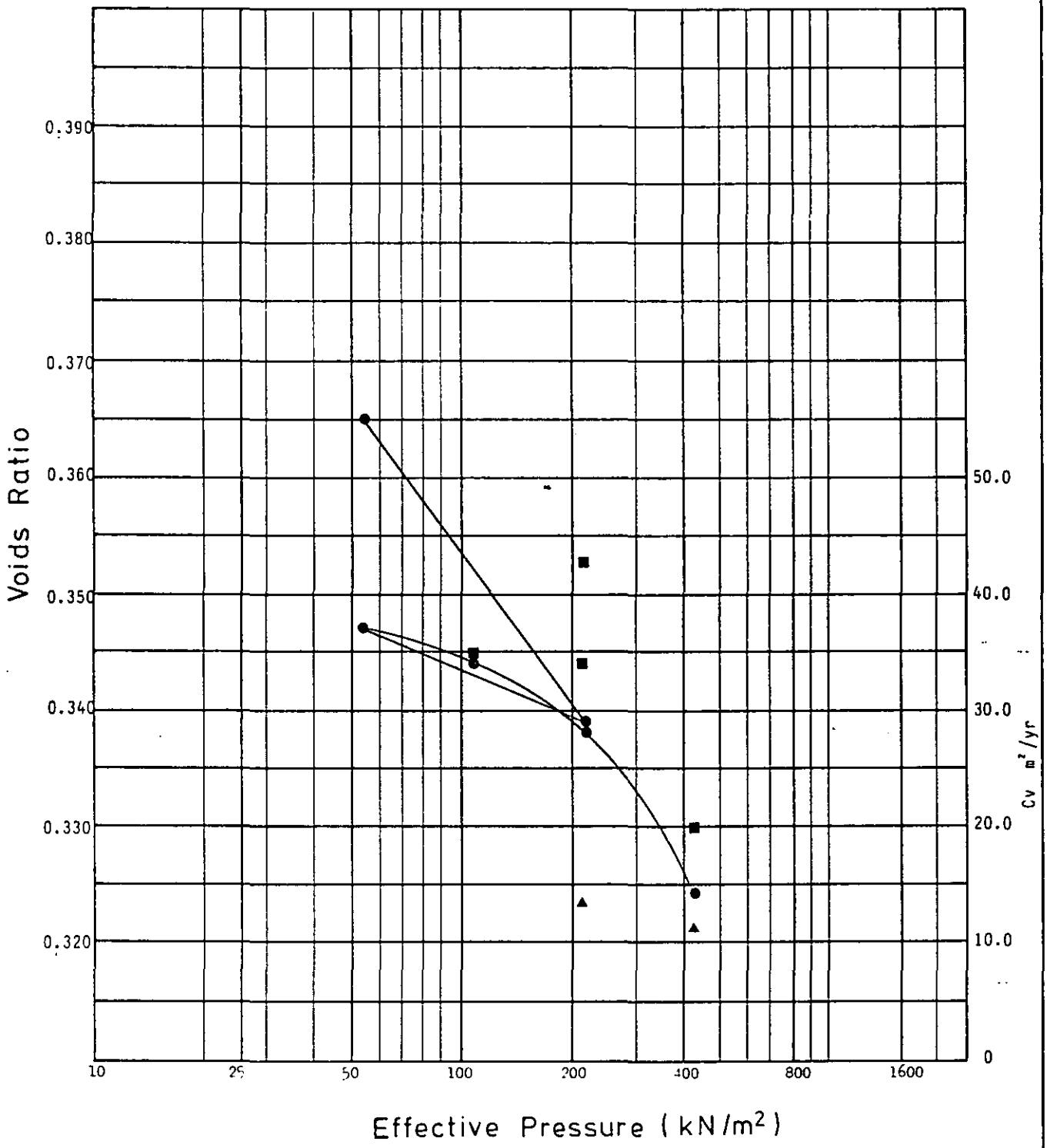
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.564	Depth 5.00 - 5.45 Hole B224
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.93



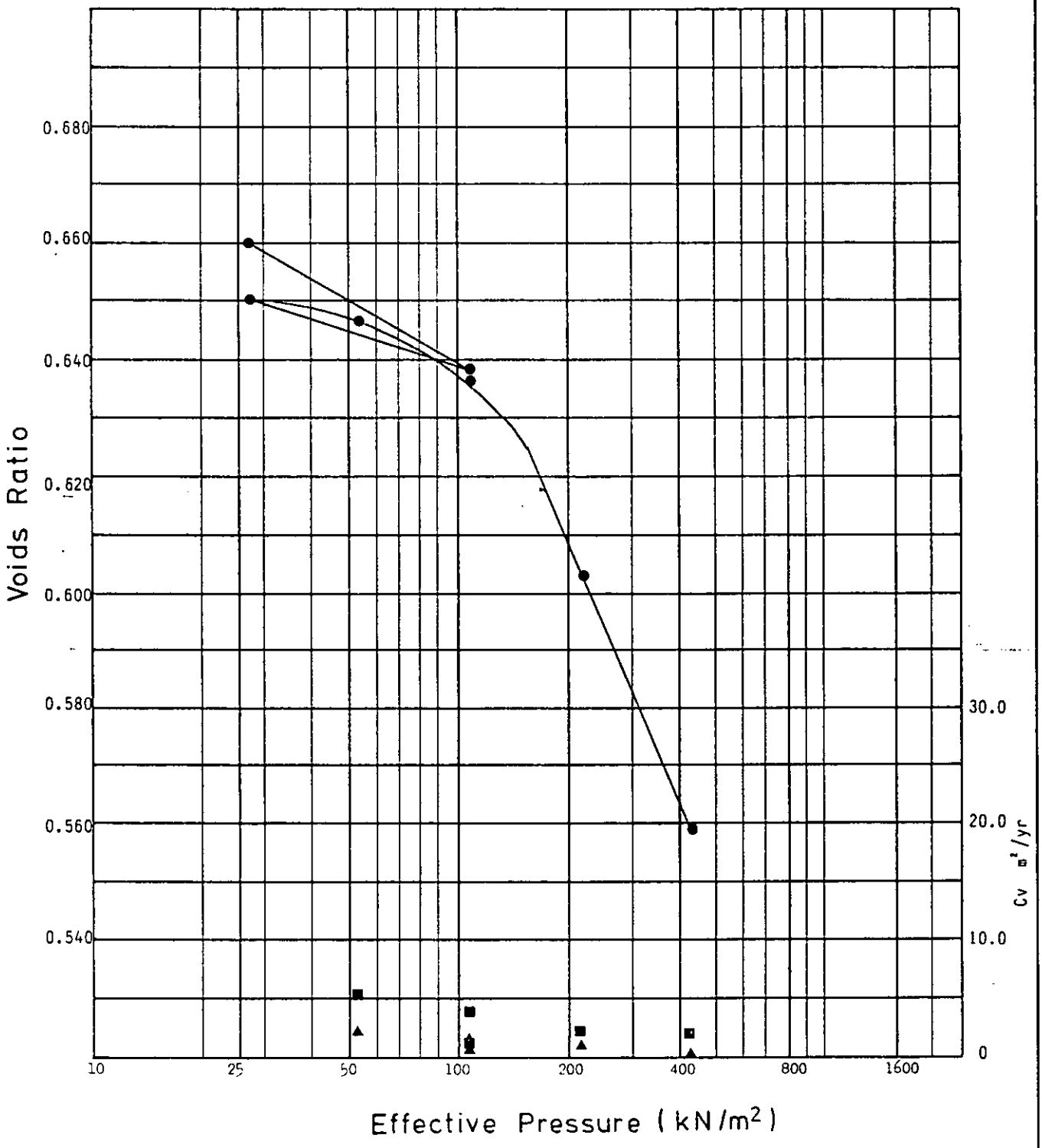
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.697	Depth 3.50 - 3.95 Hole 228
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.94



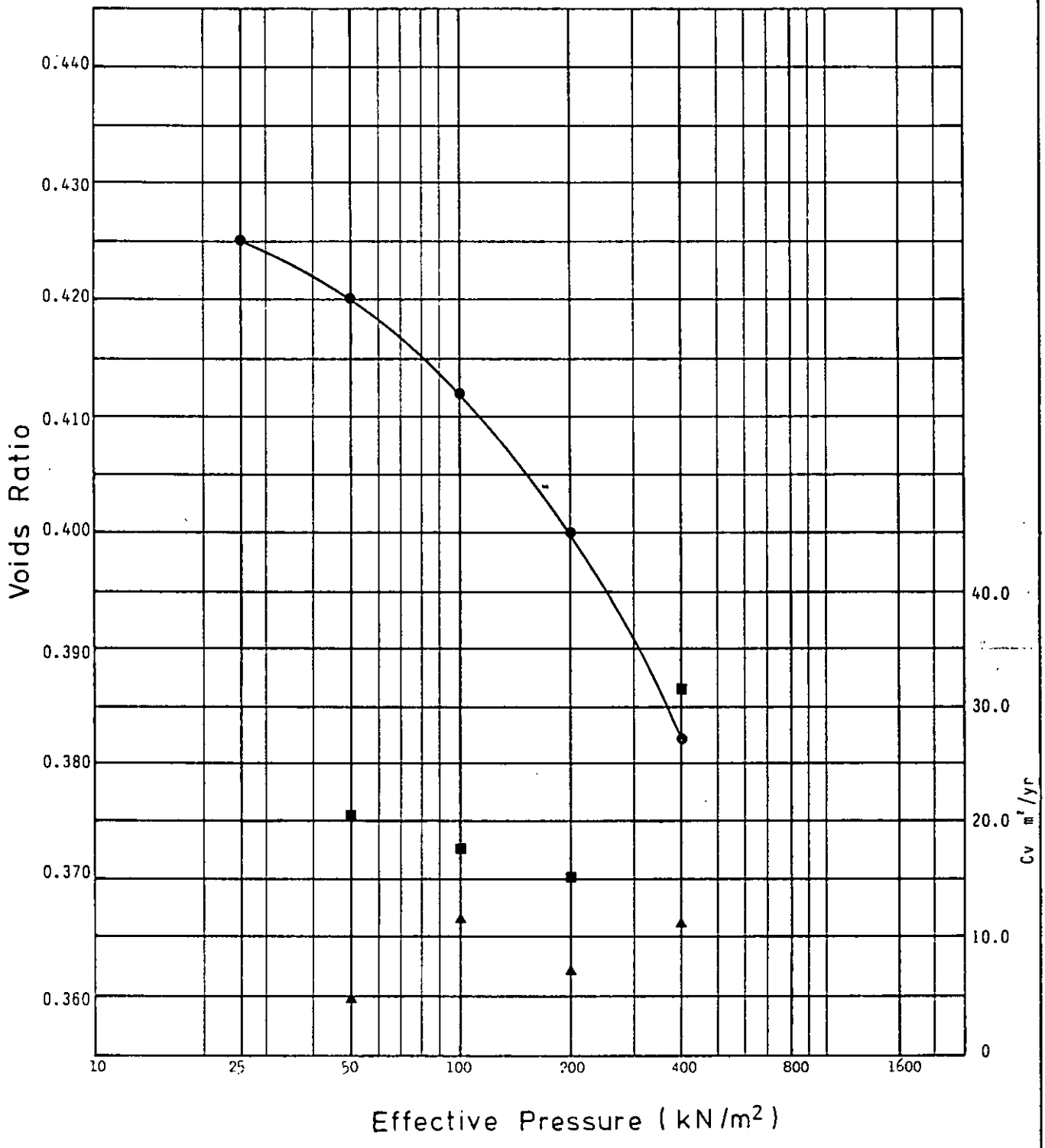
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.682	Depth 1.50 - 1.95 Hole 230
Remarks ▲ t50 ■ t90		
Laboratory – e/logP	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.95



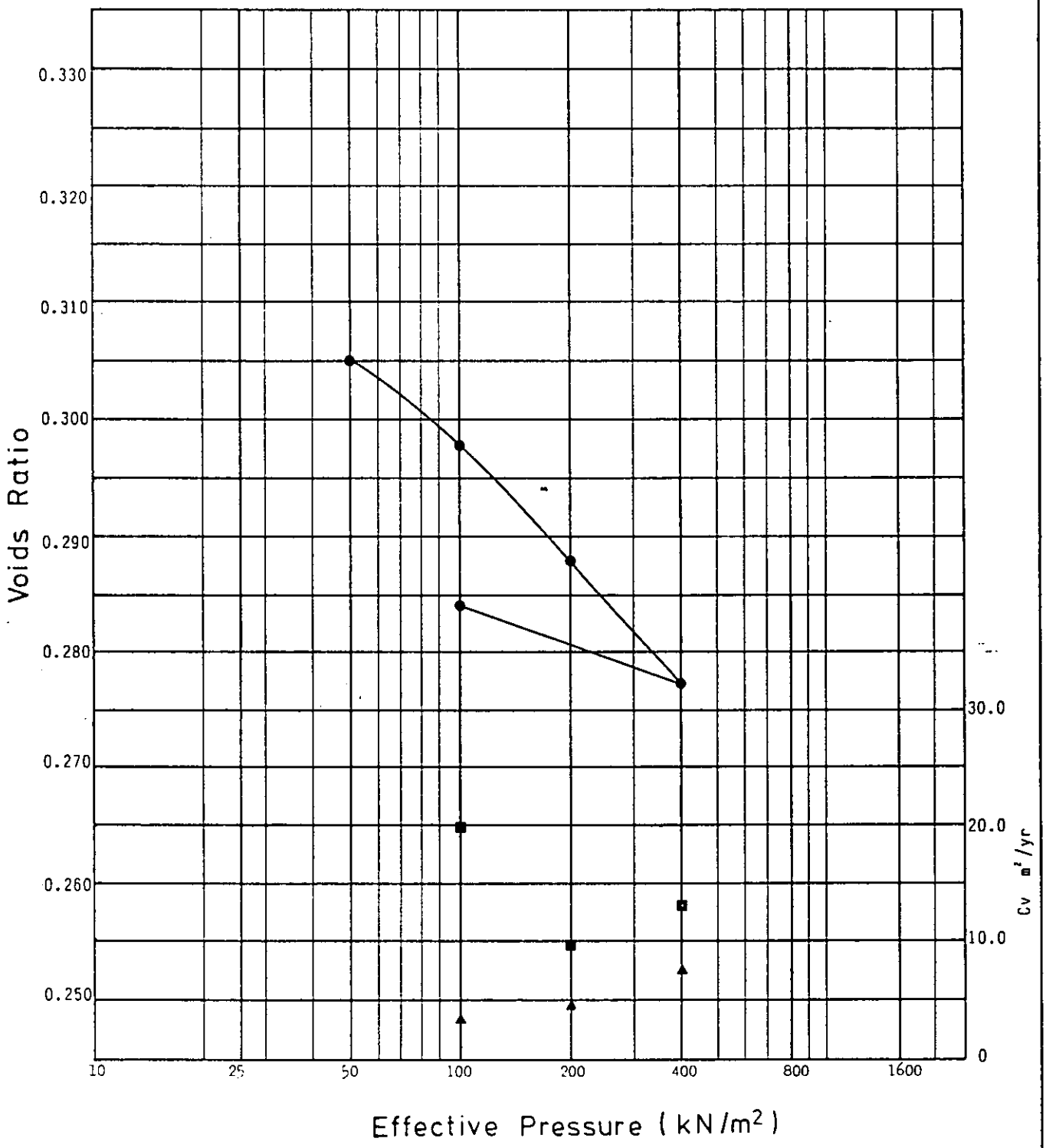
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.397	Depth 3.00 - 3.45 Hole 230
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.96



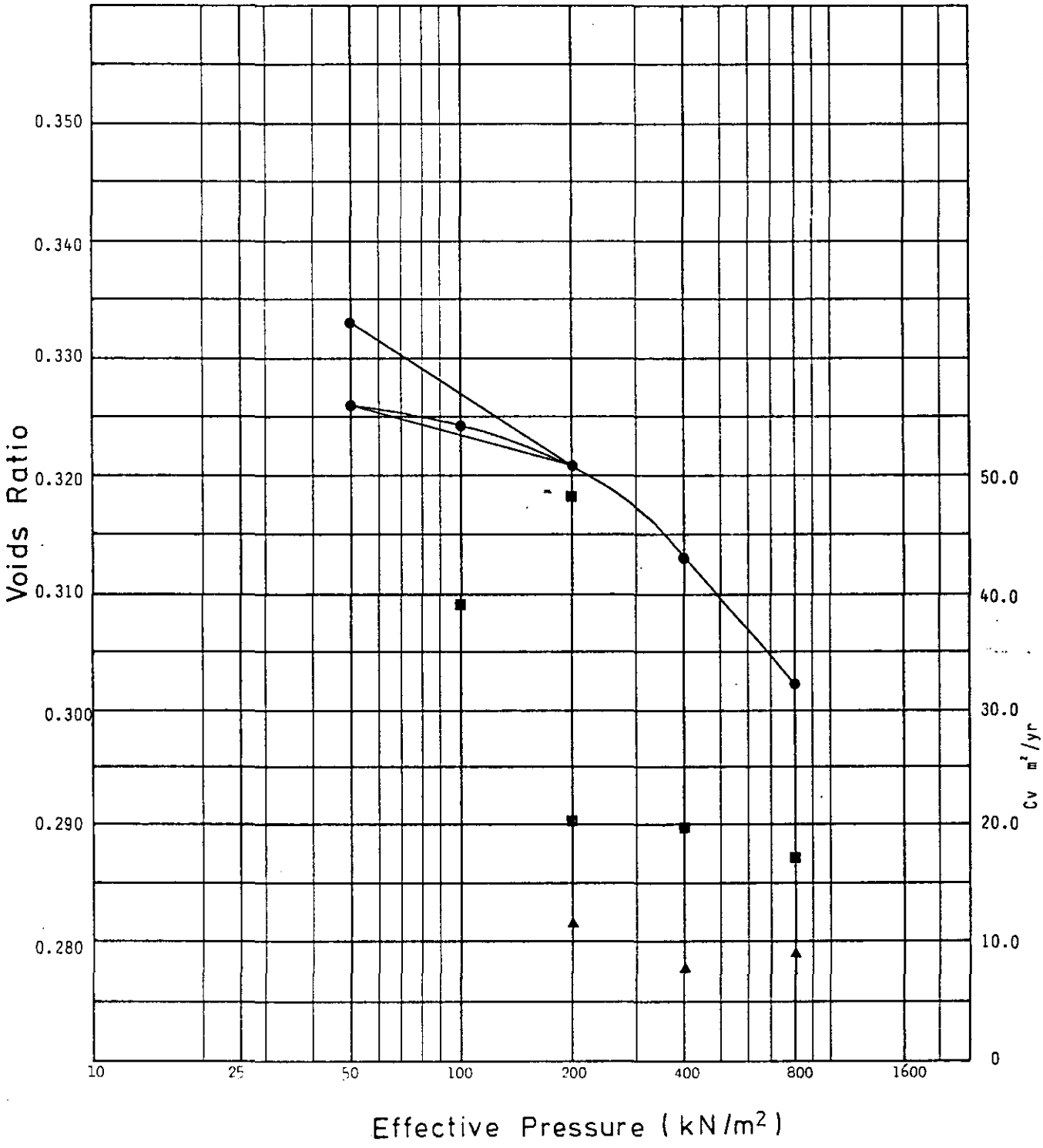
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.693	Depth 1.50 - 1.95 Hole 231
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.97



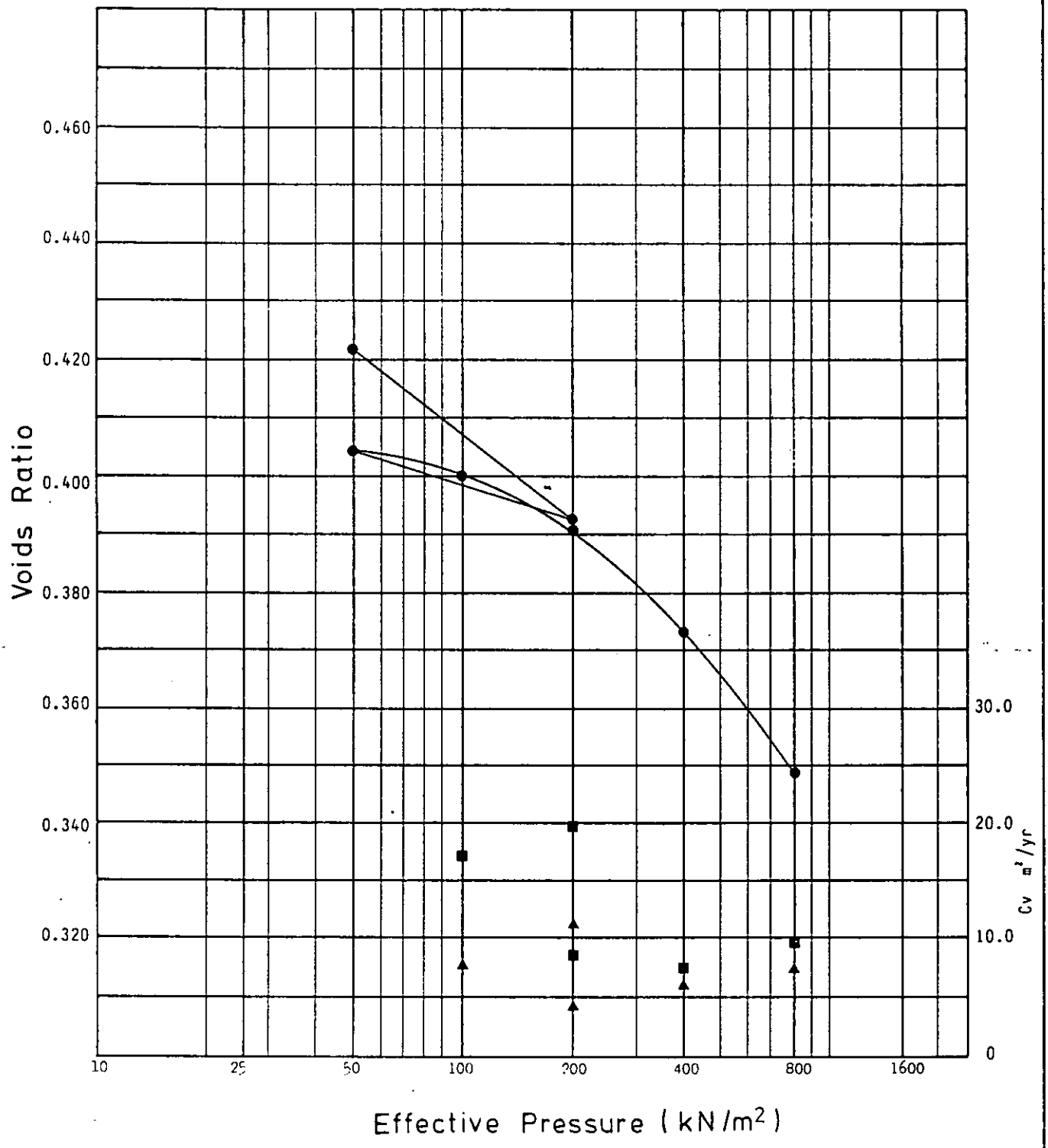
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.429	Depth 0.50 - 0.95 Hole 233
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.98



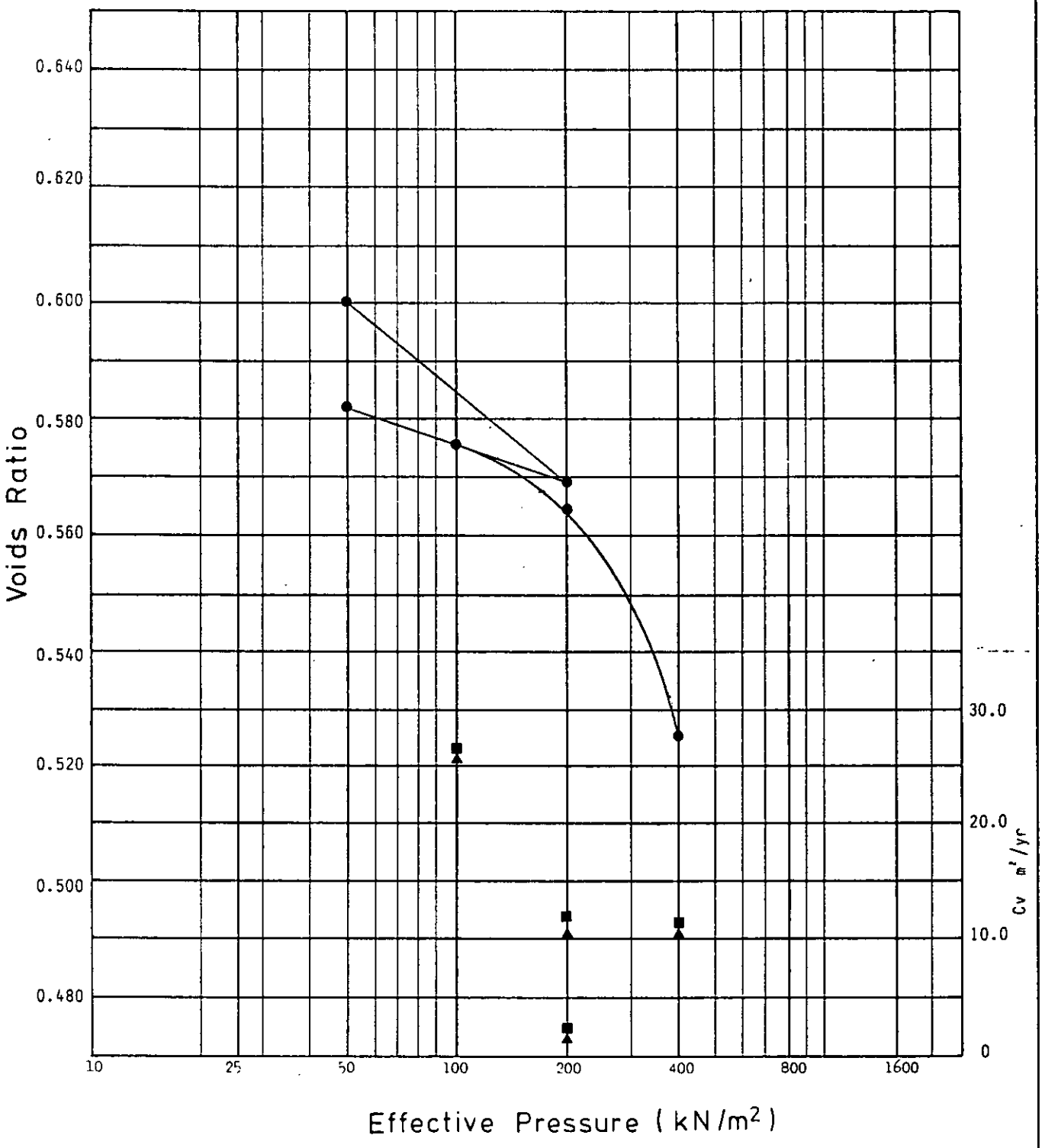
Consolidation Test	Specific Gravity 2.68 (Measured) Initial Voids Ratio 0.322	Depth 2.00 - 2.45 Hole 234
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.99



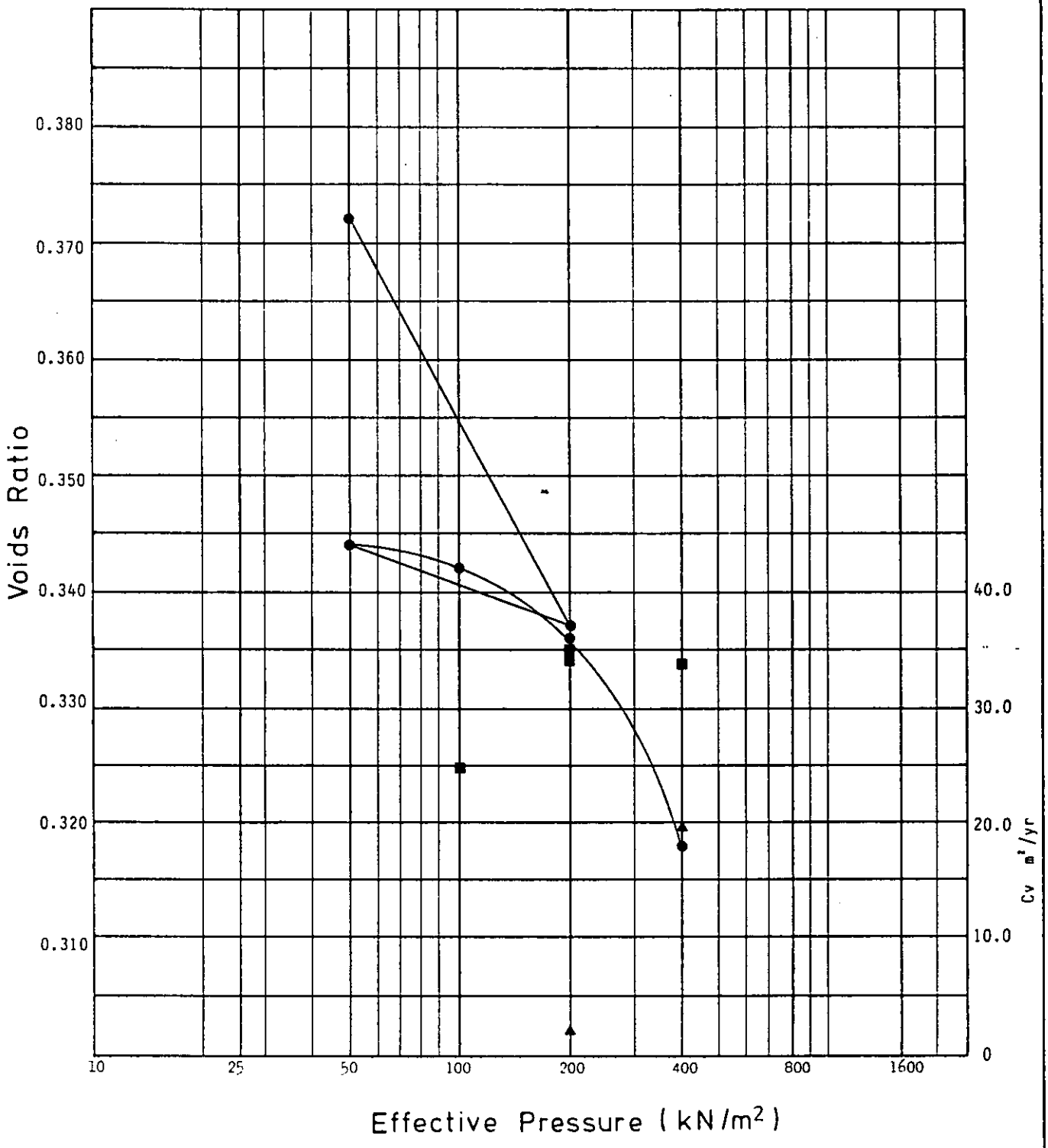
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.341	Depth 3.50 - 3.95 Hole B243
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.100



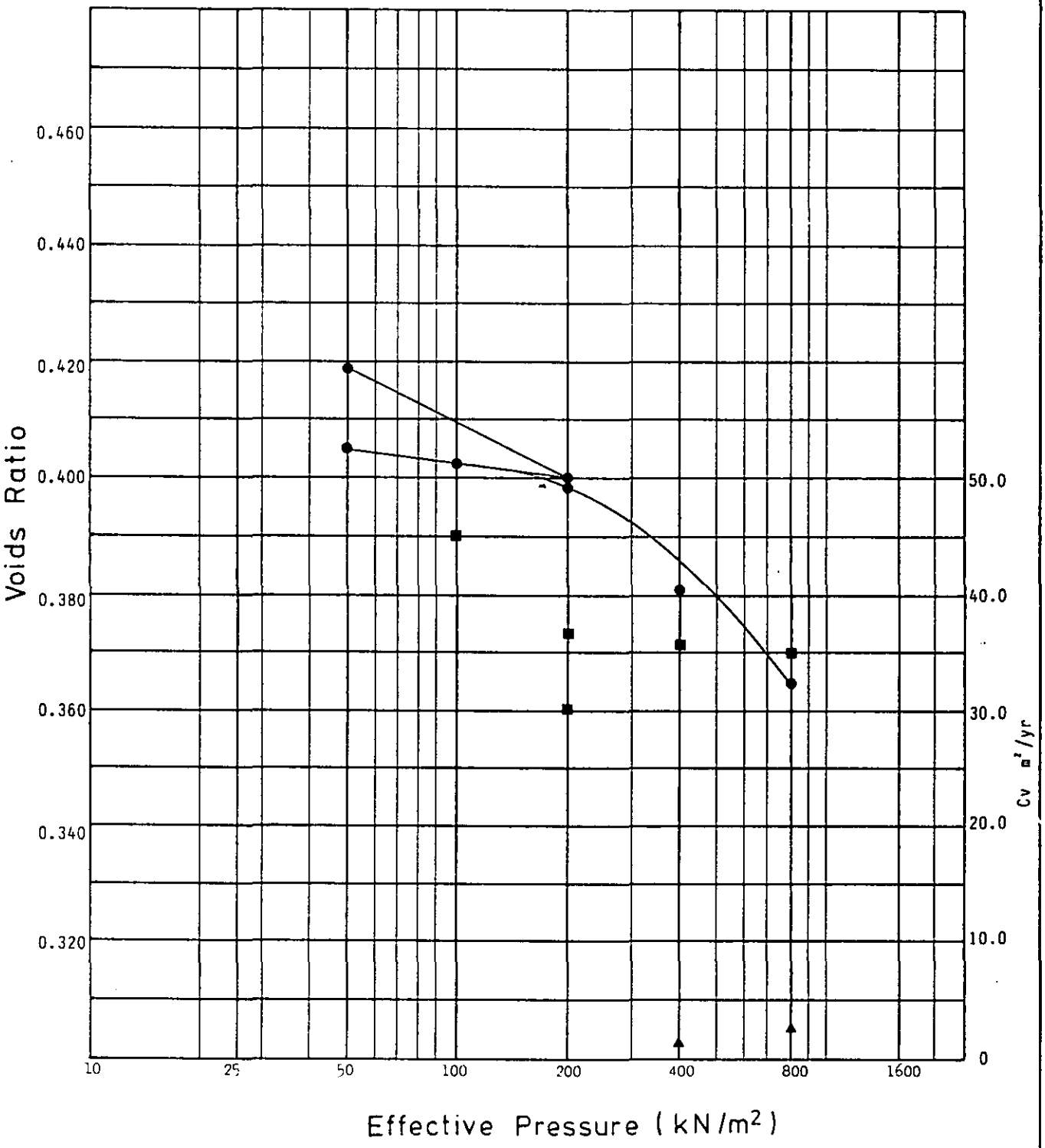
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.485	Depth 3.50 - 3.95 Hole B244
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.101



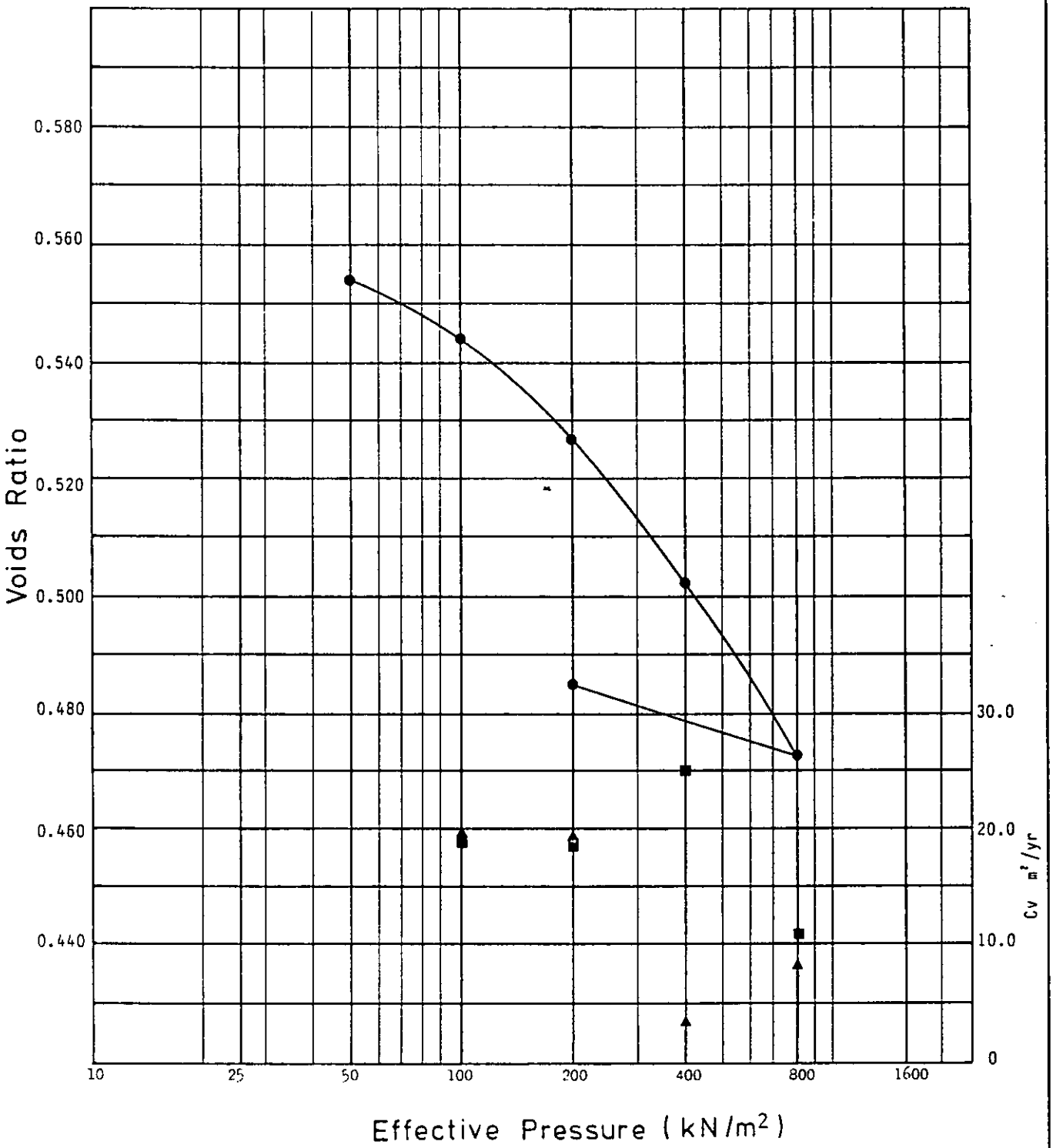
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.625	Depth 3.50 - 3.95 Hole 8247
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.102



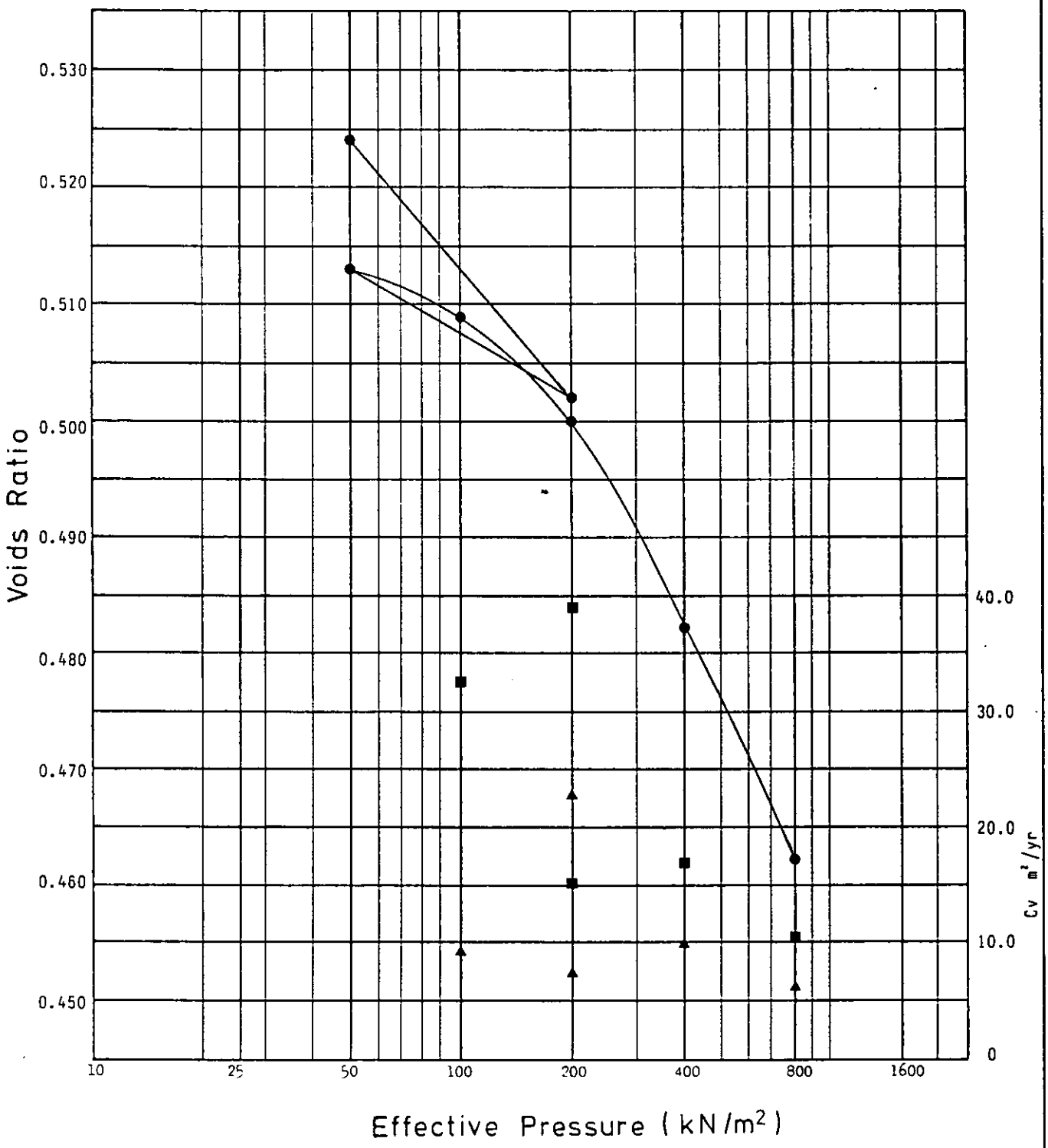
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.390	Depth 2.00 - 2.45 Hole B248
Remarks ▲ t50 ■ t90		
Laboratory – e/logP	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.103



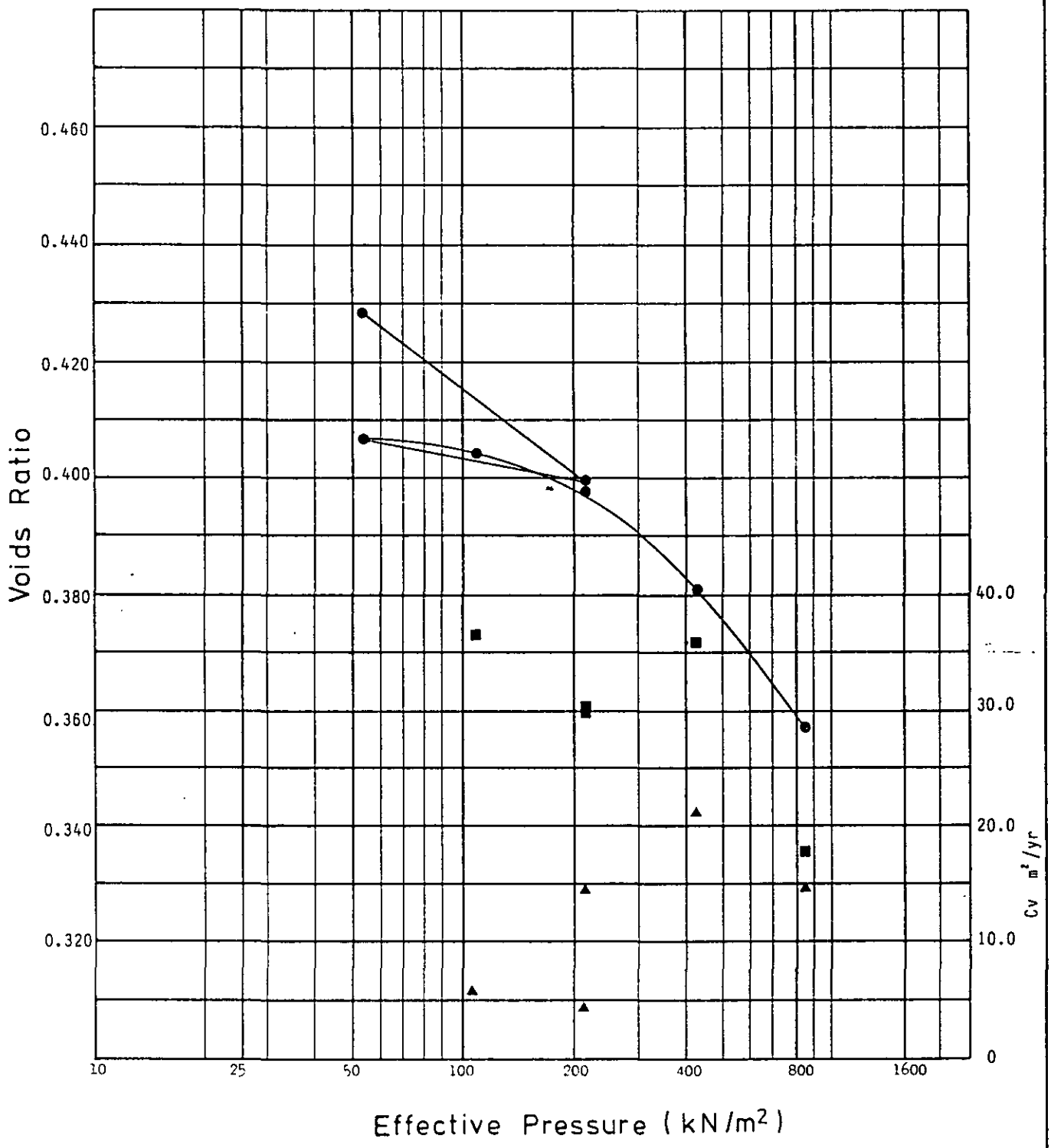
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.438	Depth 2.00 - 2.45 Hole B249
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.104



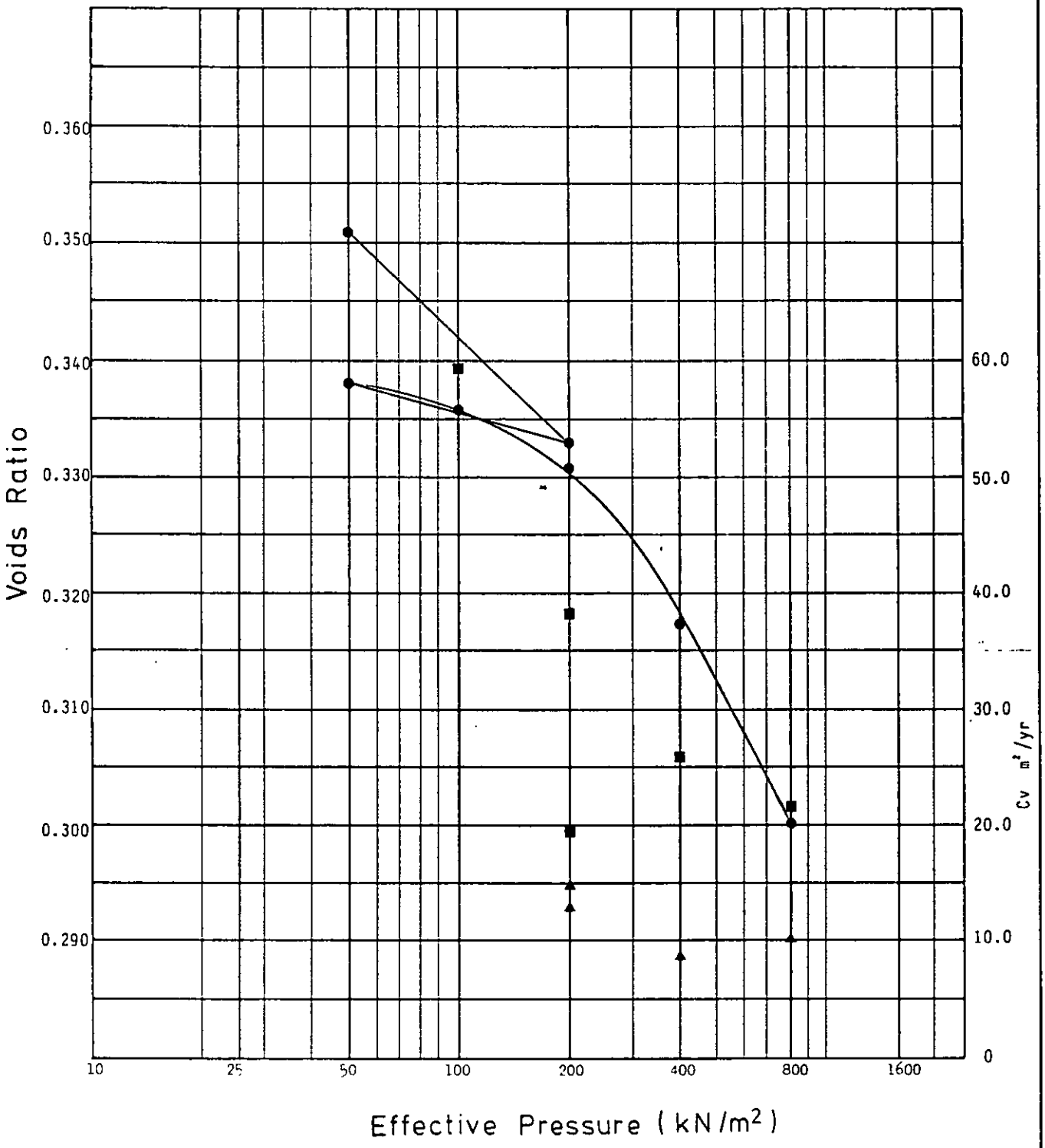
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.574	Depth 3.50 - 3.95 Hole B251
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.105



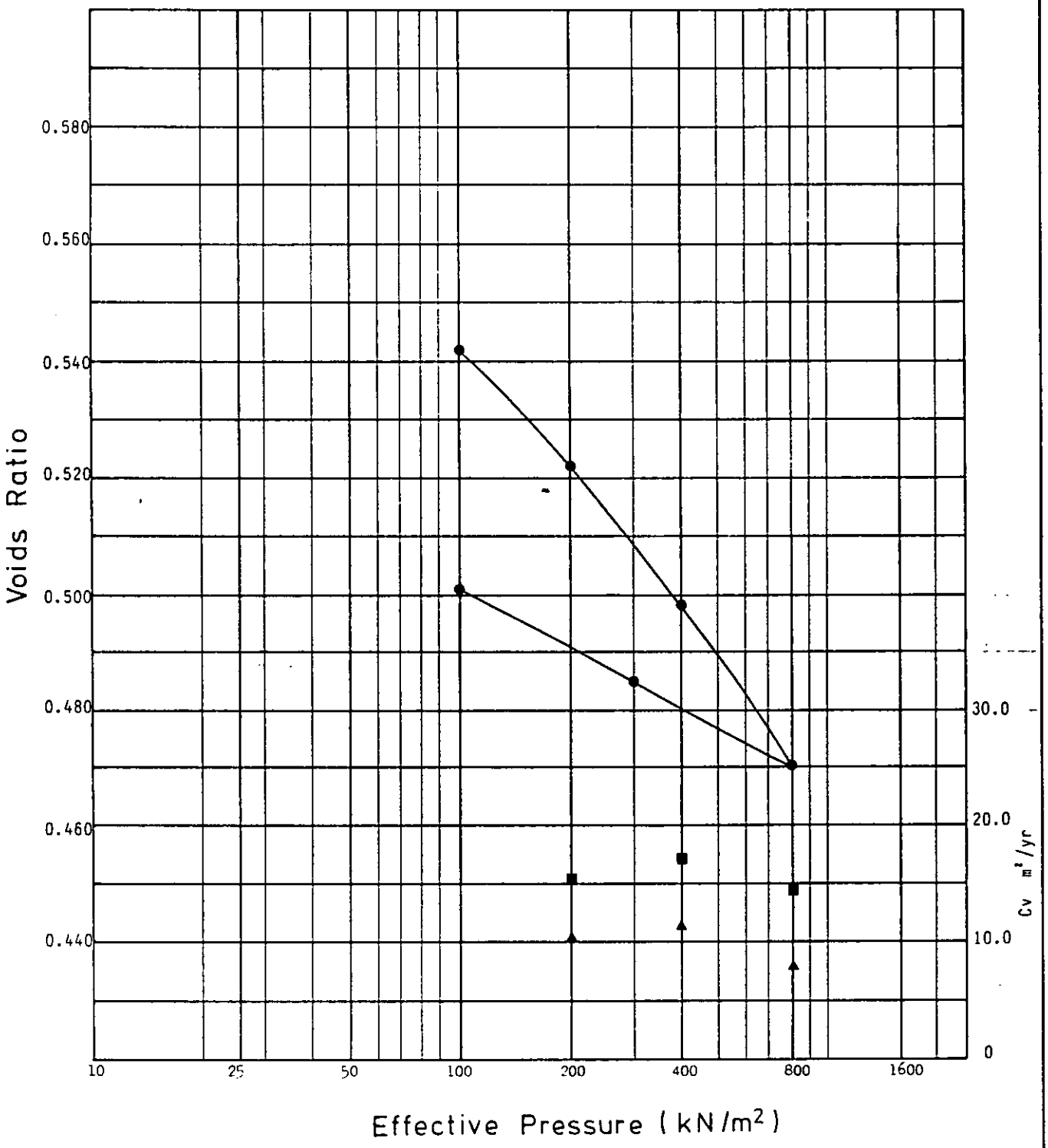
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.529	Depth 4.00 - 4.45 Hole B253
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.106



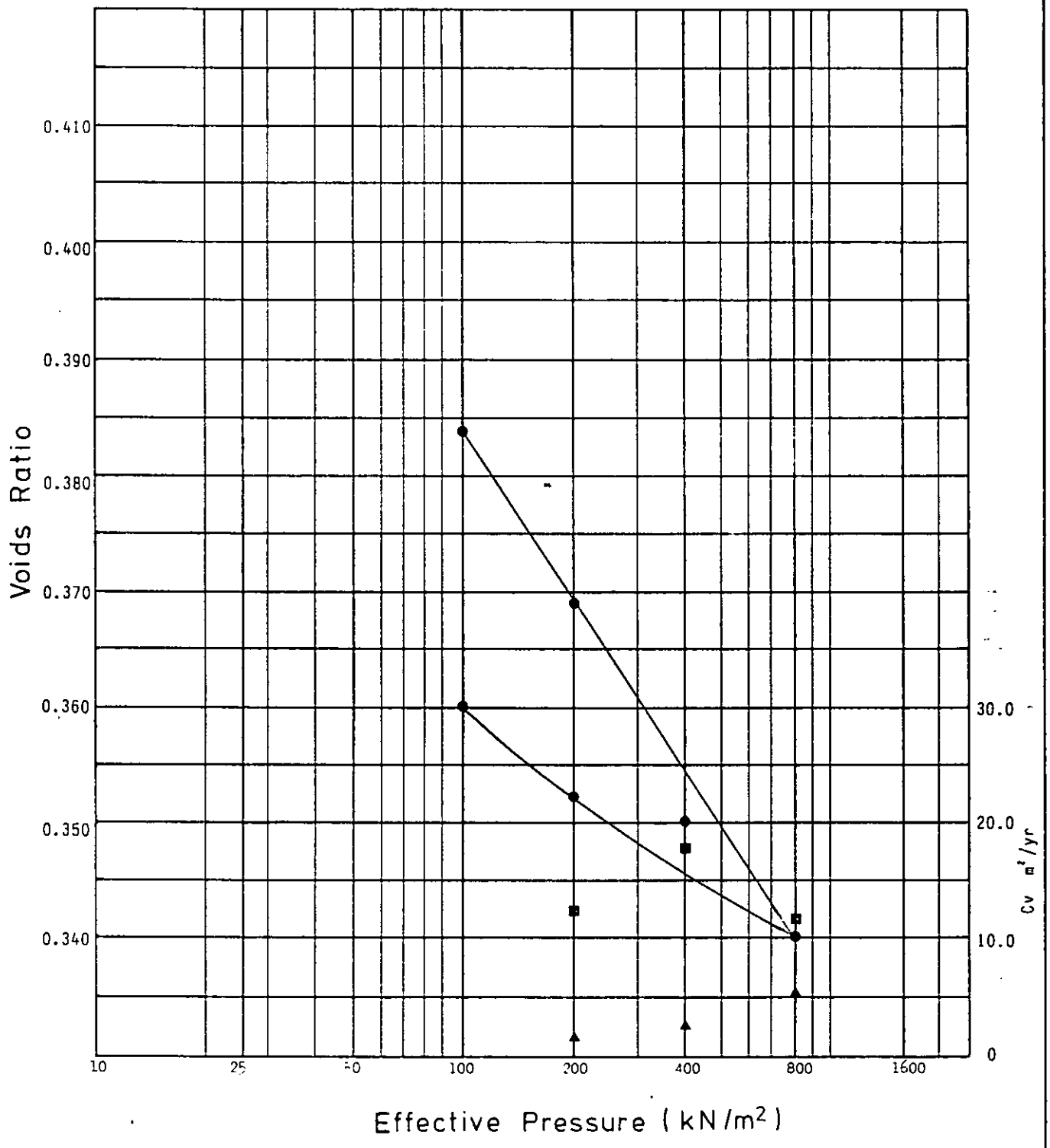
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.450	Depth 3.00 - 3.45 Hole B255
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.107



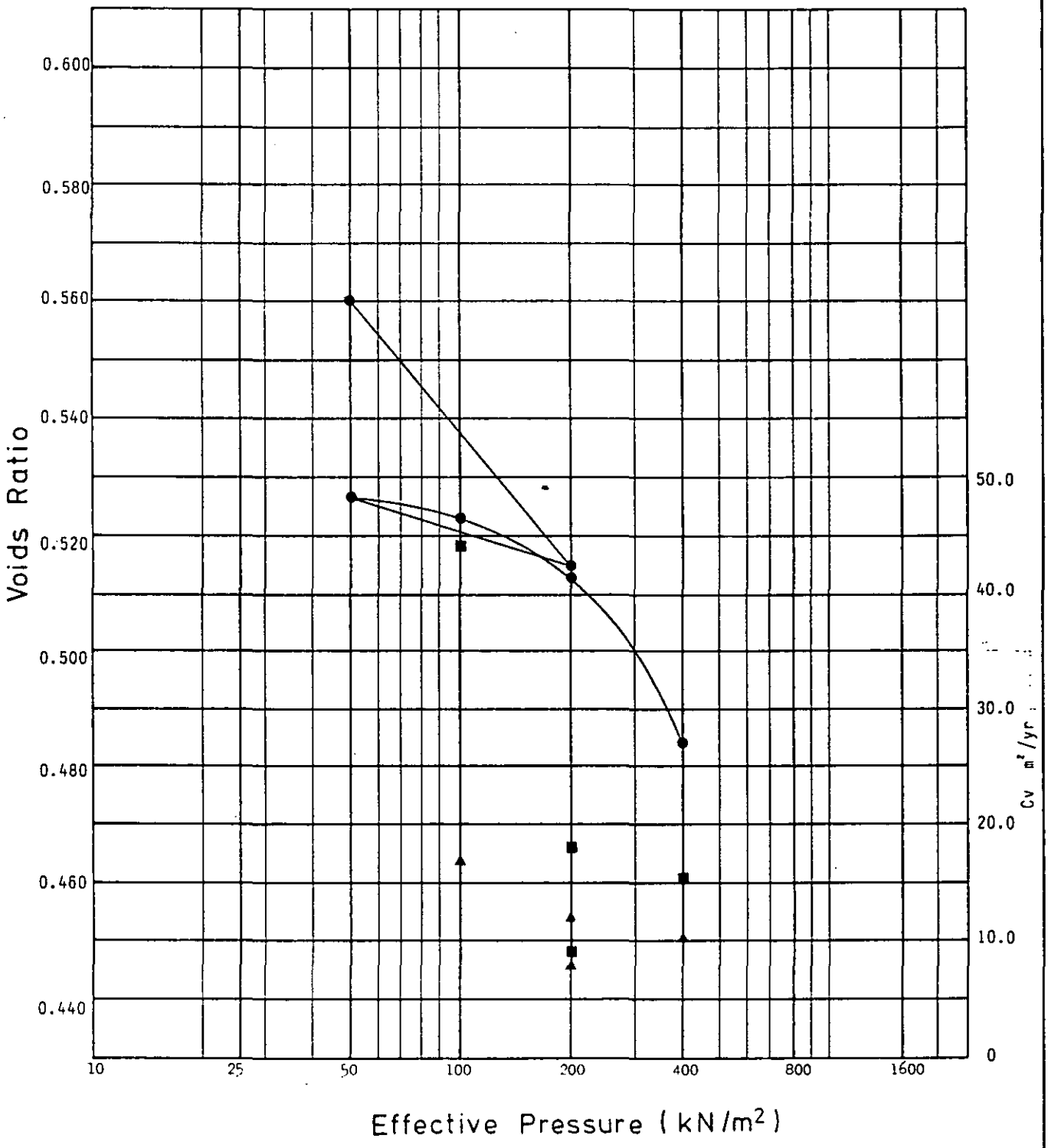
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.368	Depth 3.00 - 3.45 Hole 8260
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.108



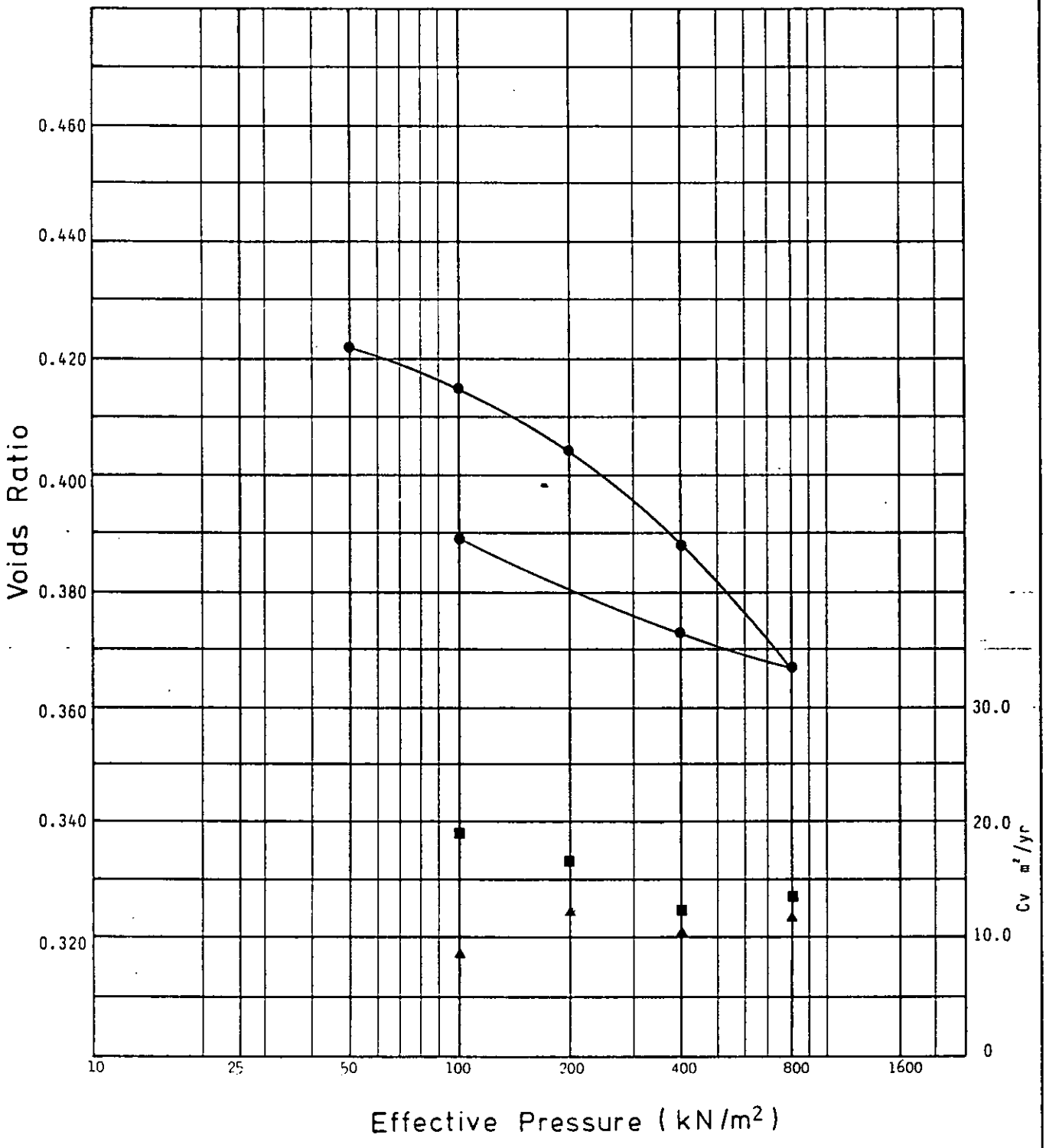
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.577	Depth 4.00 - 4.45 Hole B262
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.109



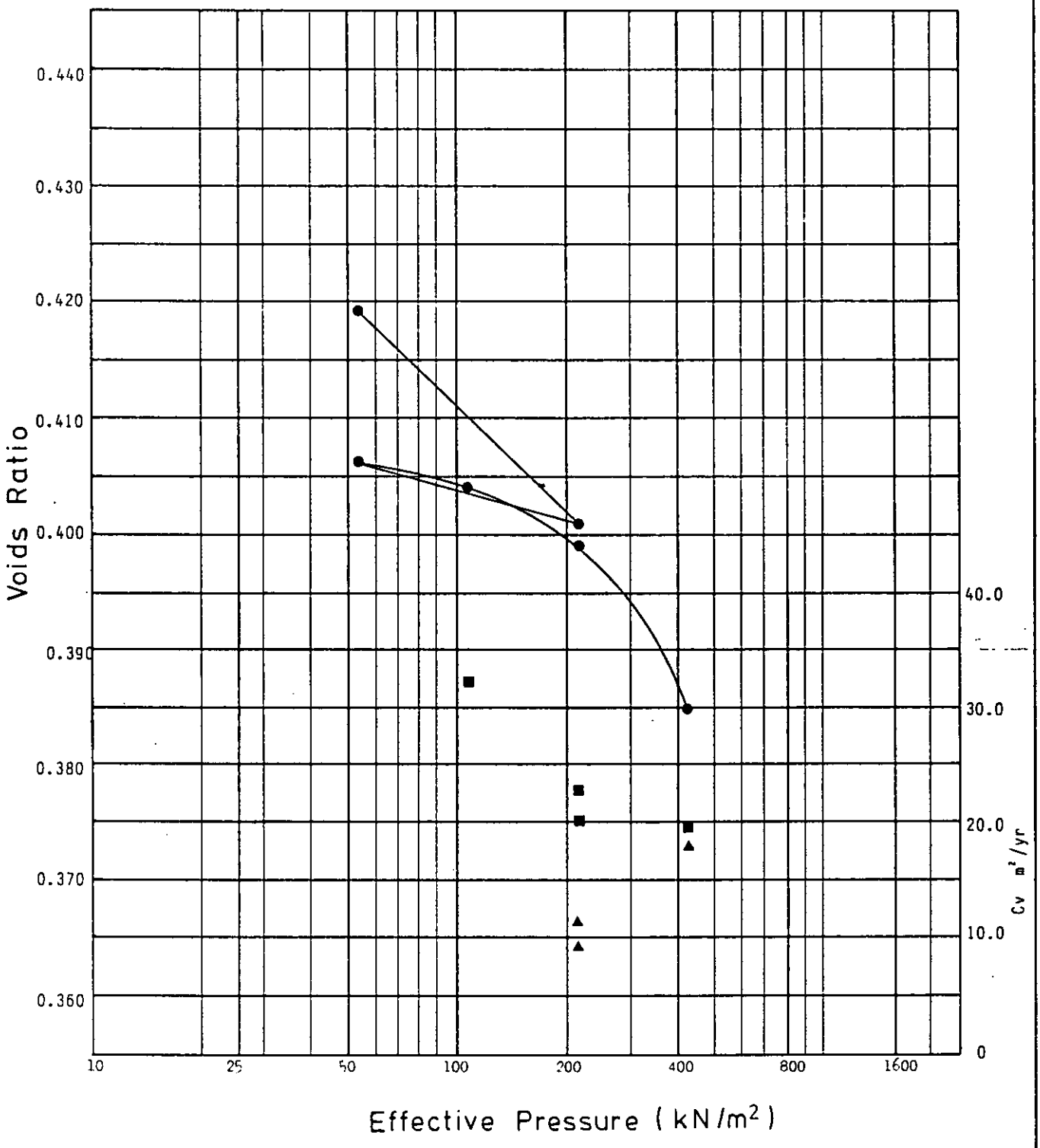
Consolidation Test	Specific Gravity 2.66 (measured) Initial Voids Ratio 0.418	Depth 3.50 - 3.95 Hole B263
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.110



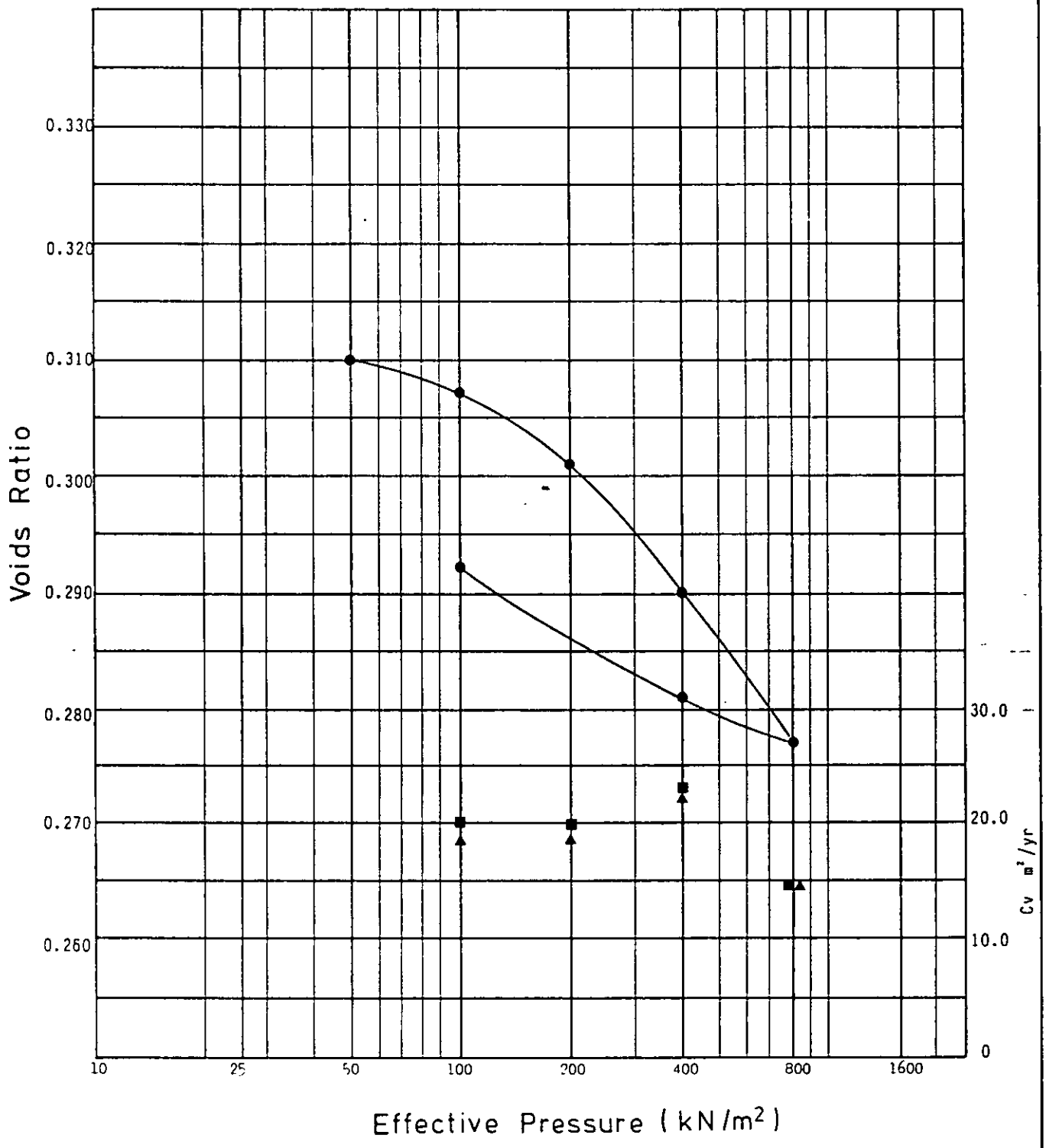
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.618	Depth 3.50 - 3.95 Hole B264
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.111



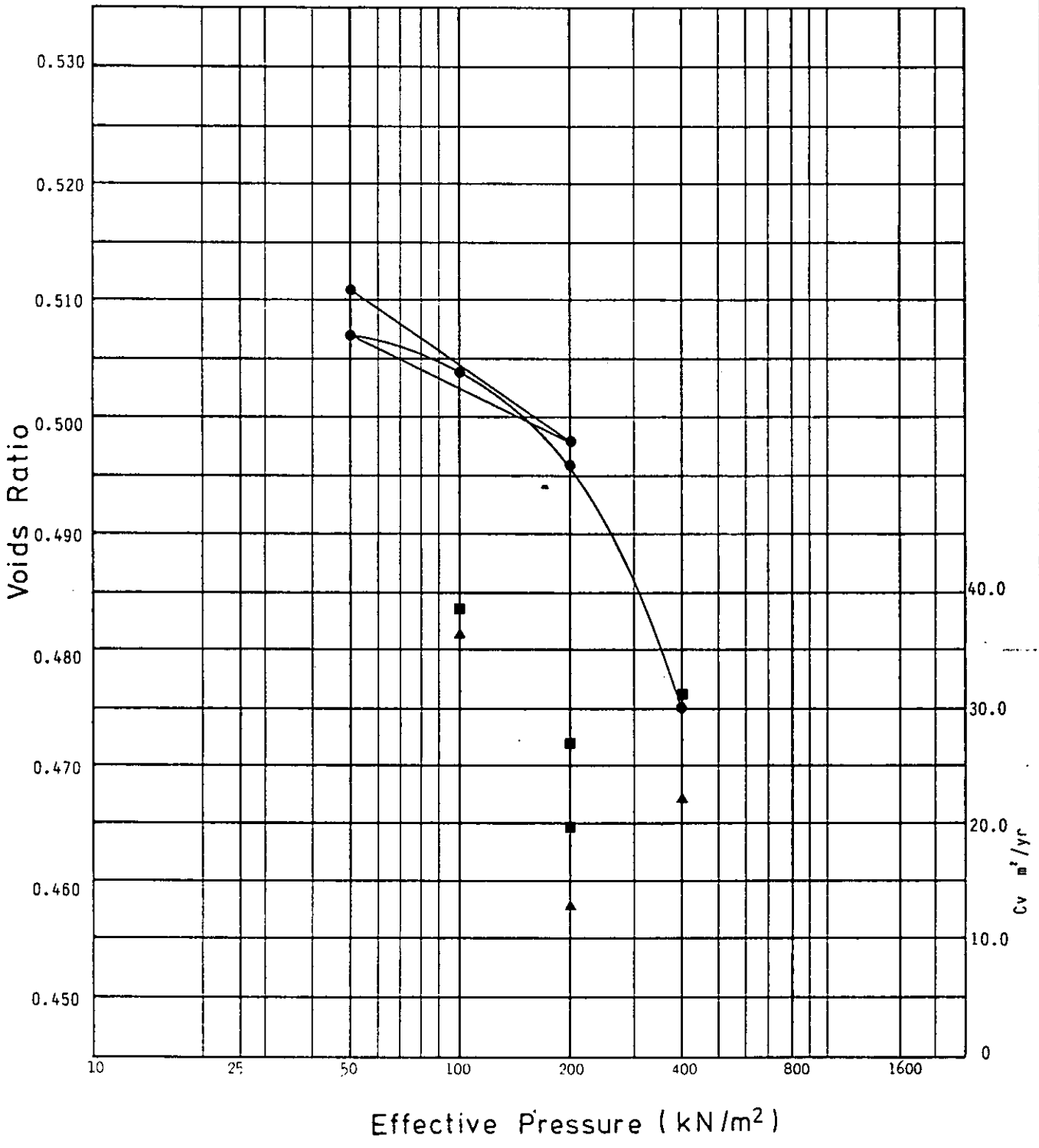
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.449	Depth 3.50 - 3.95 Hole B265
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.112



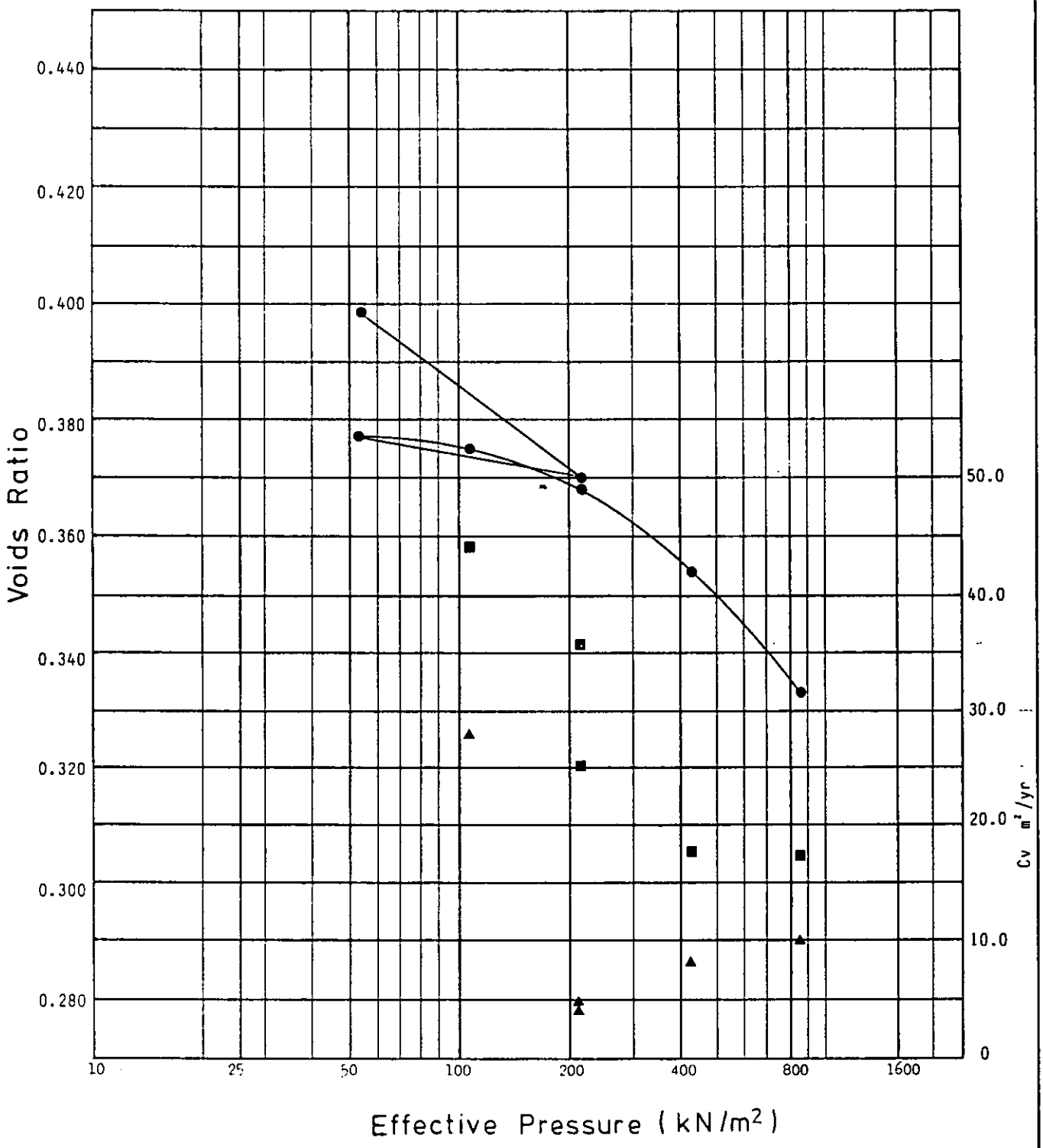
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.425	Depth 3.00 - 3.45 Hole B268
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.113



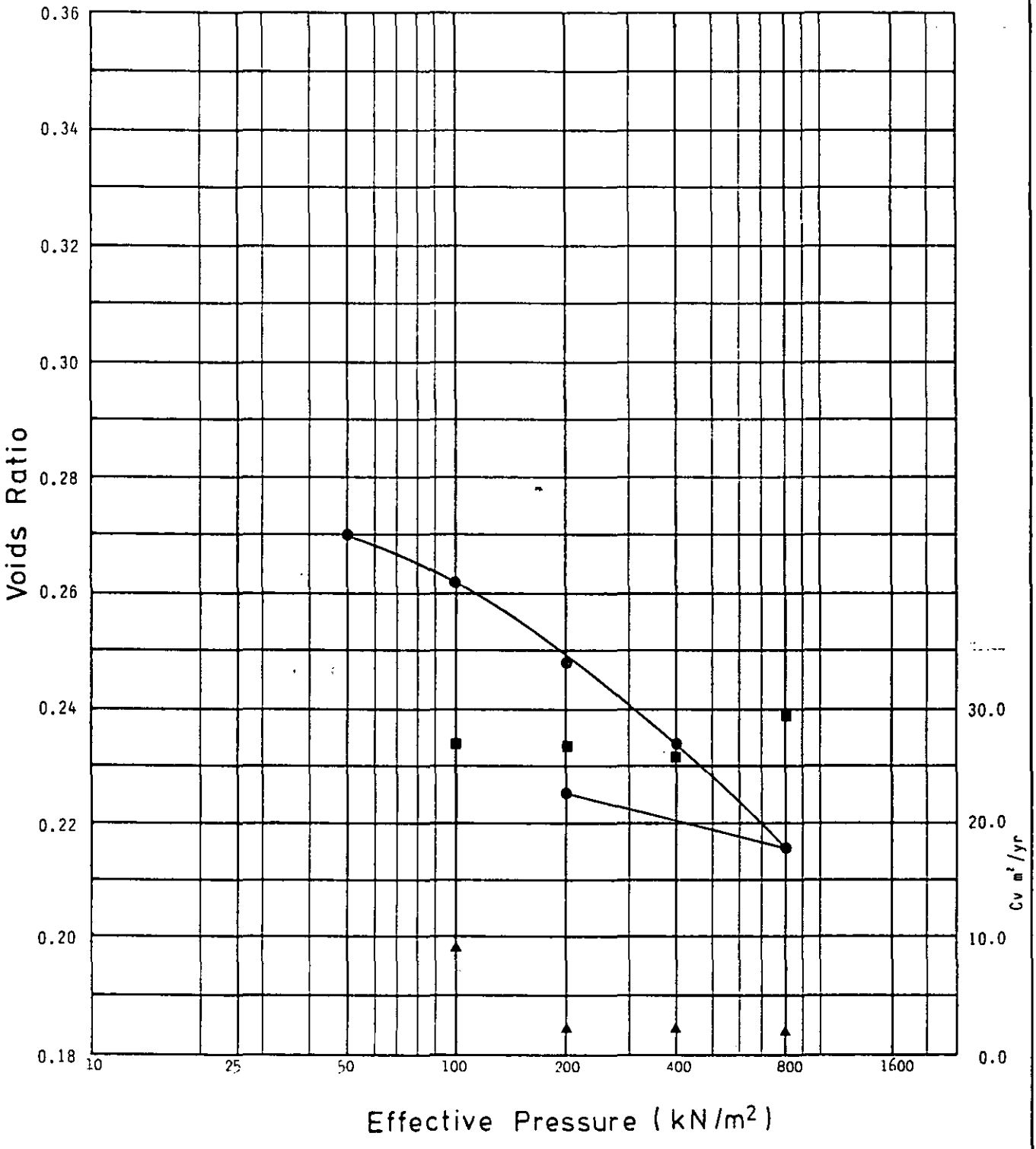
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.321	Depth 3.00 - 3.45 Hole B269
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.114



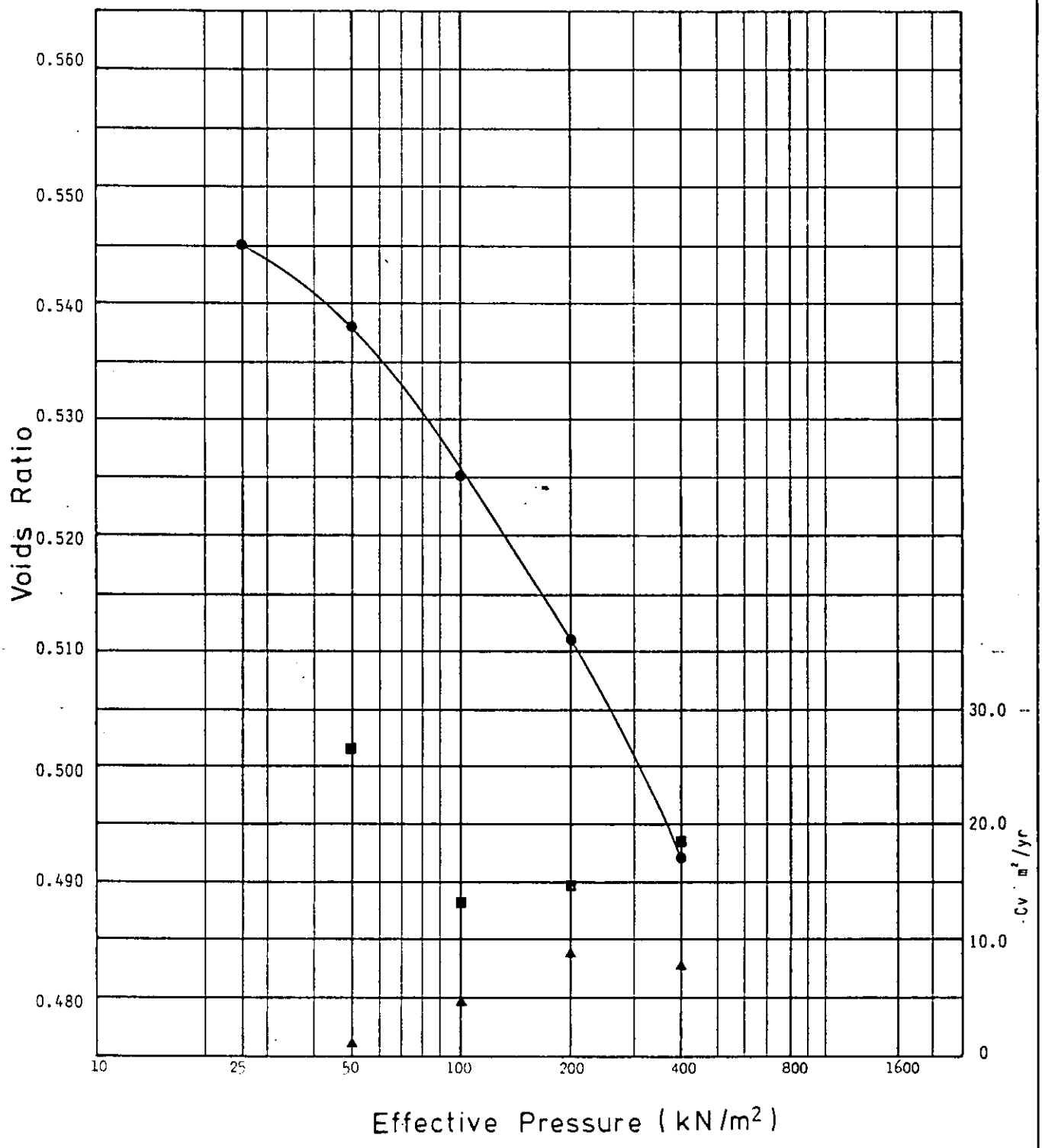
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.533	Depth 3.00 - 3.45 Hole B272
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.115



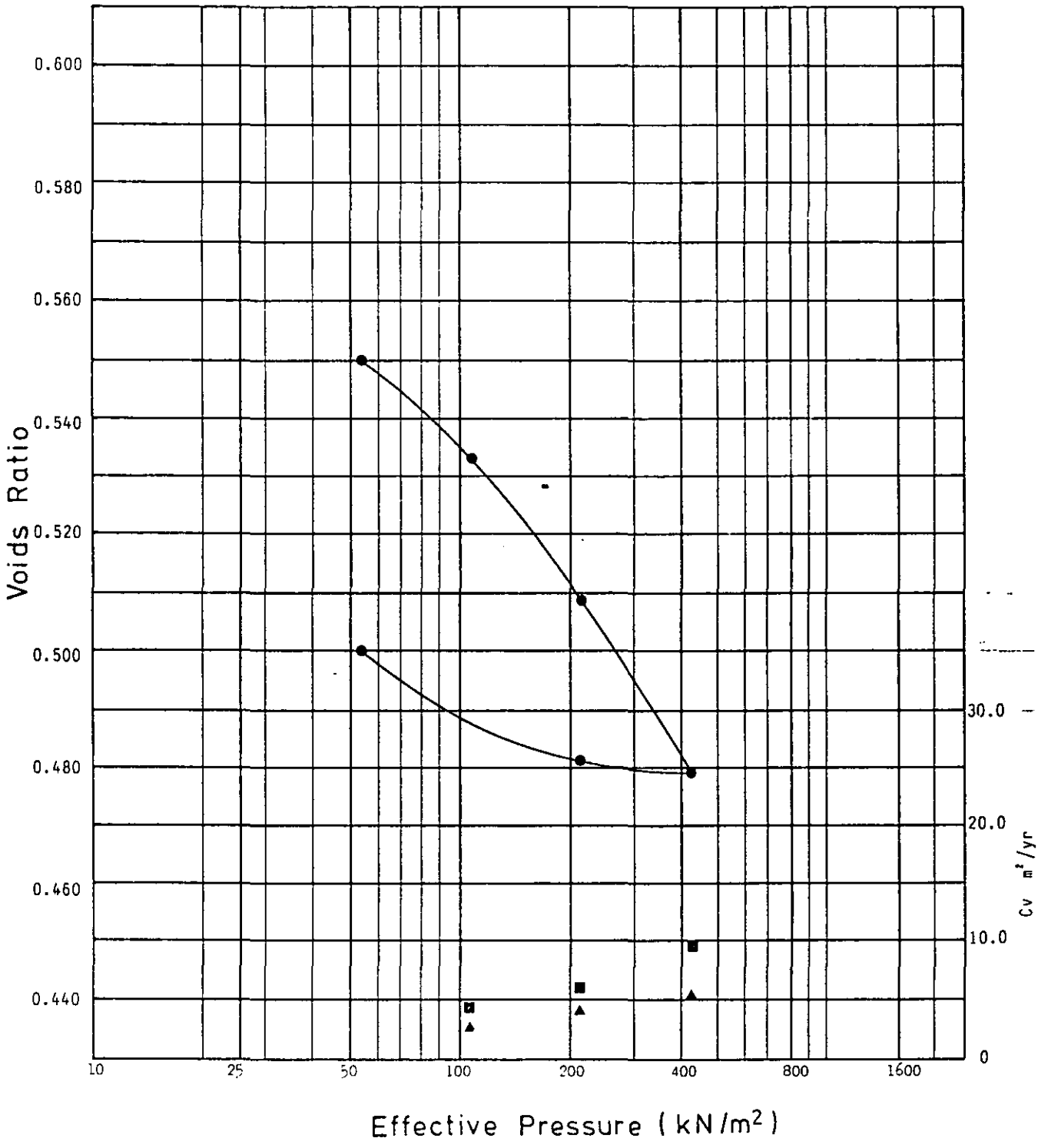
Consolidation Test	Specific Gravity 2.70 (Measured) Initial Voids Ratio 0.422	Depth 3.50 - 3.95 Hole B273
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.116



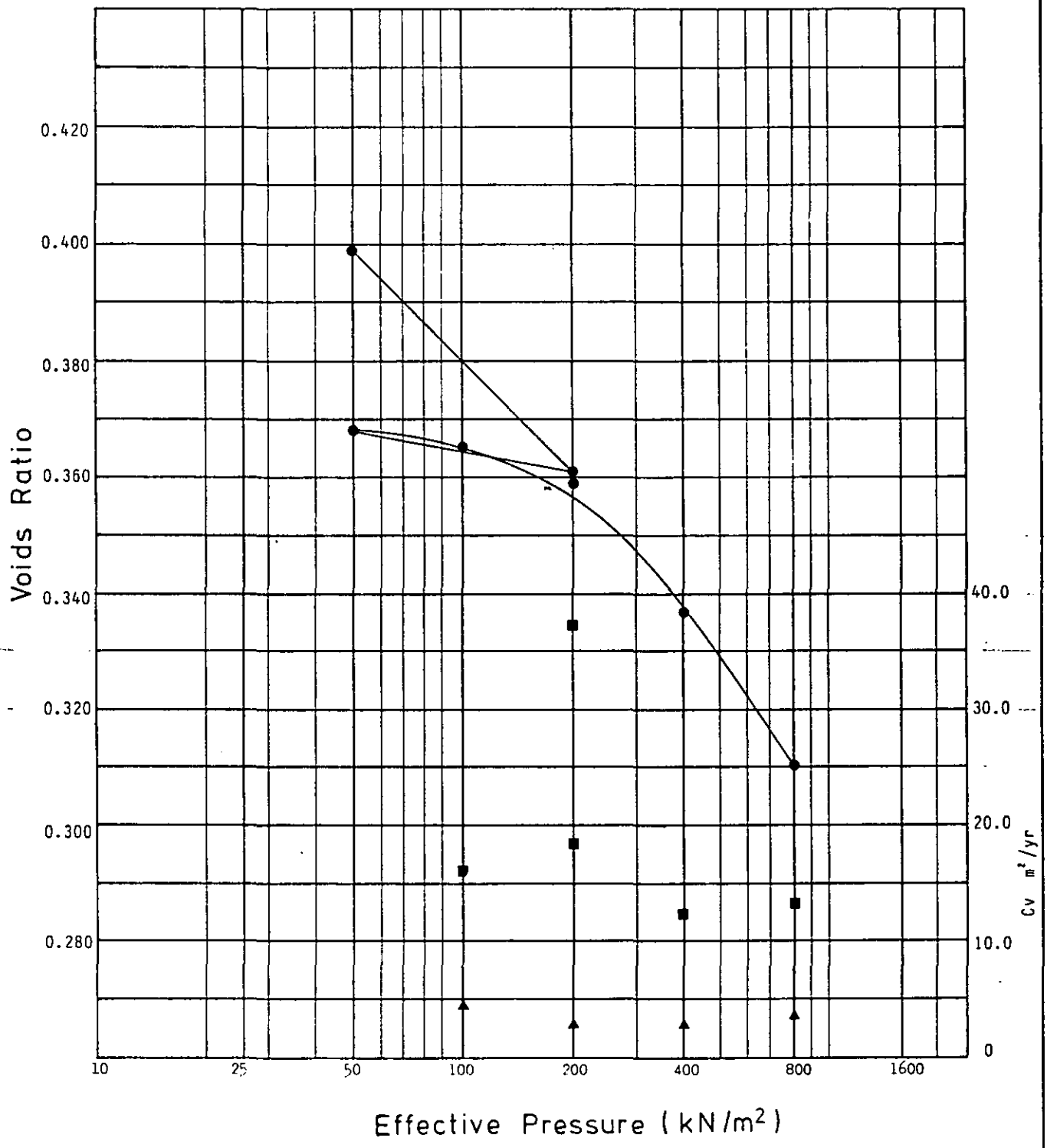
Consolidation Test	Specific Gravity 2.45 (assumed) Initial Voids Ratio 0.287	Depth 2.00 - 2.45 Hole B274
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449
exploration associates		**Figure** 2.117



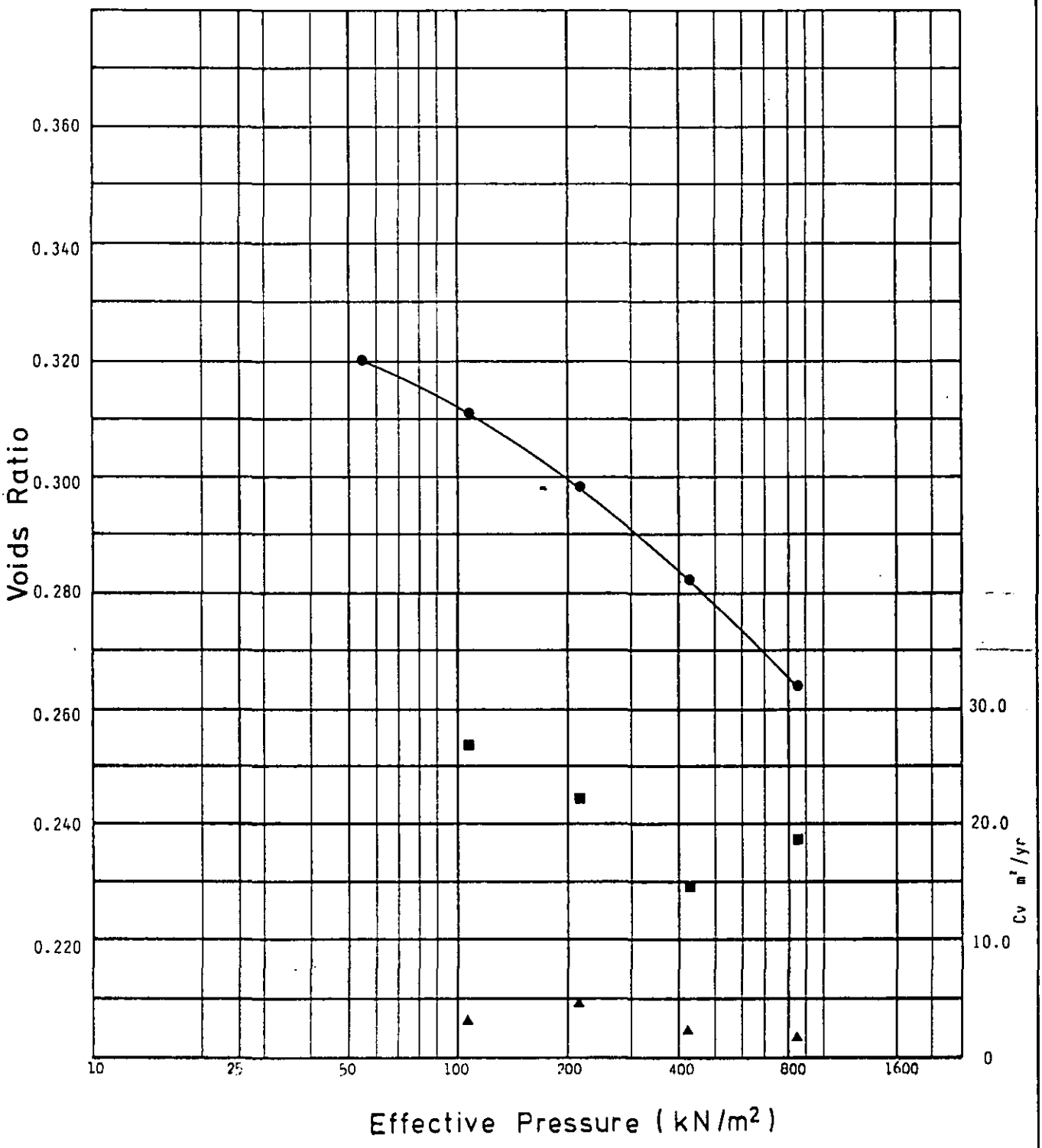
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.559	Depth 0.50 - 0.95 Hole 279
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.118



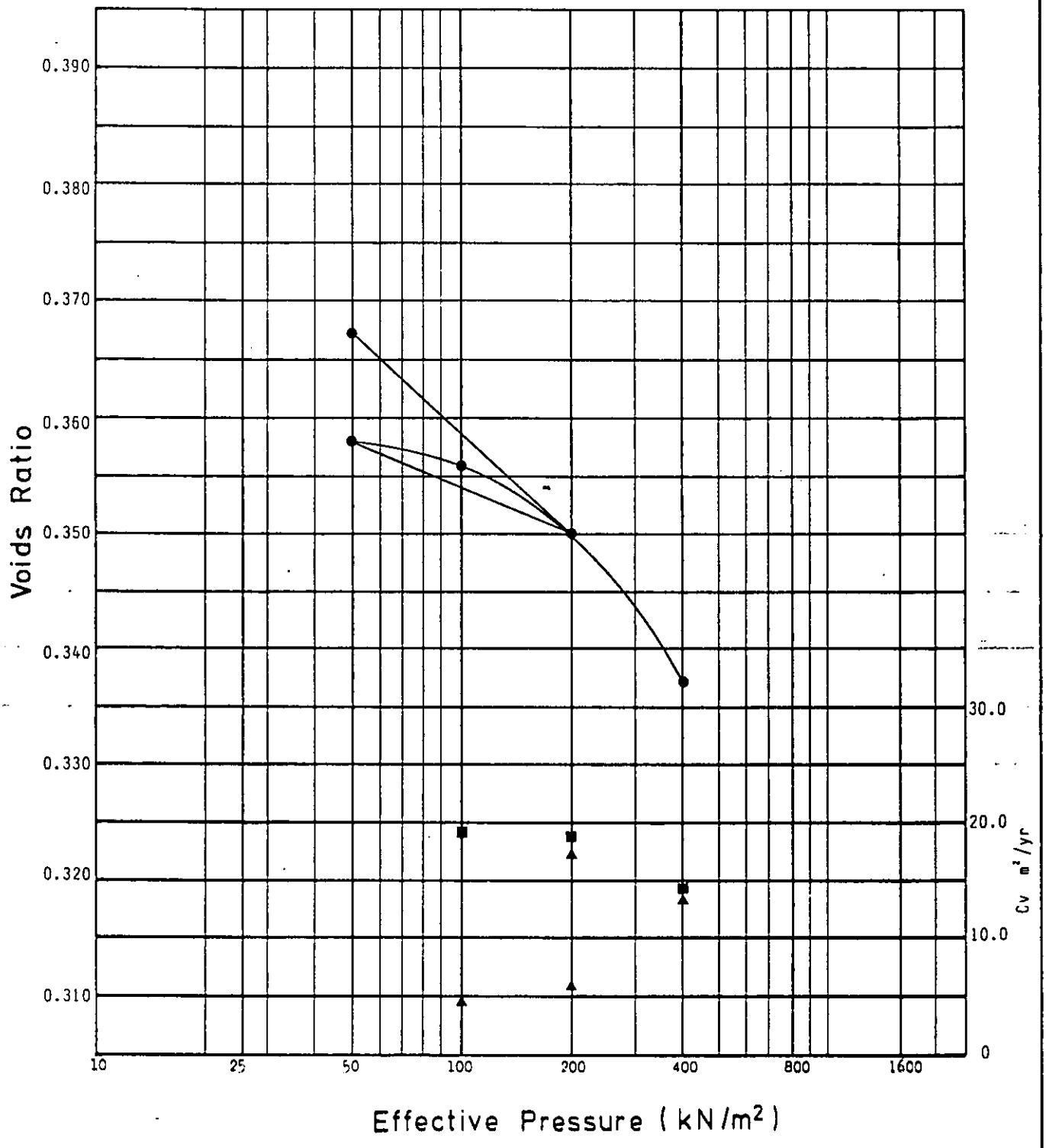
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.613	Depth 2.00 - 2.45 Hole 280
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.119



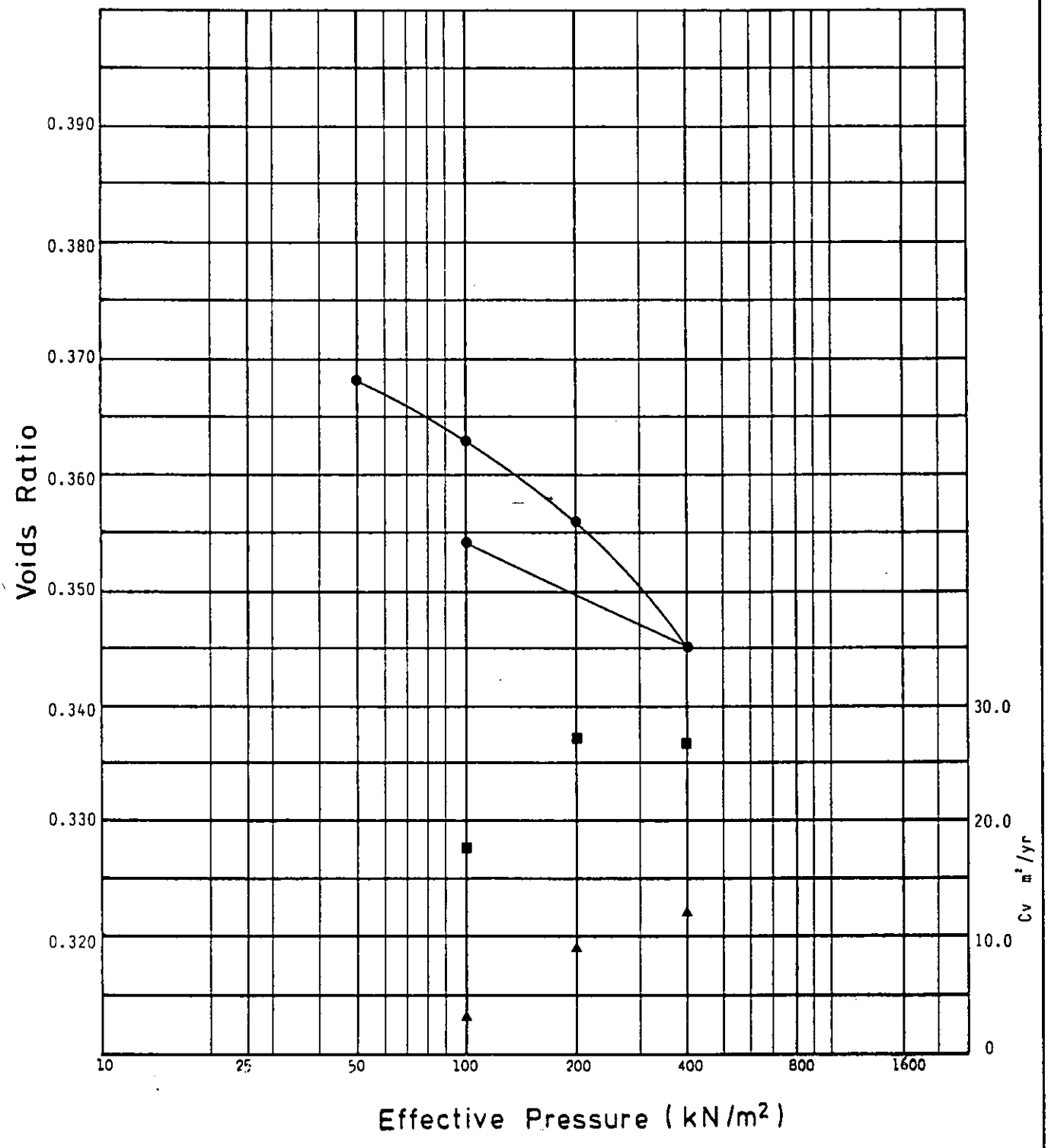
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.418	Depth 3.00 - 3.45 Hole B284
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.120



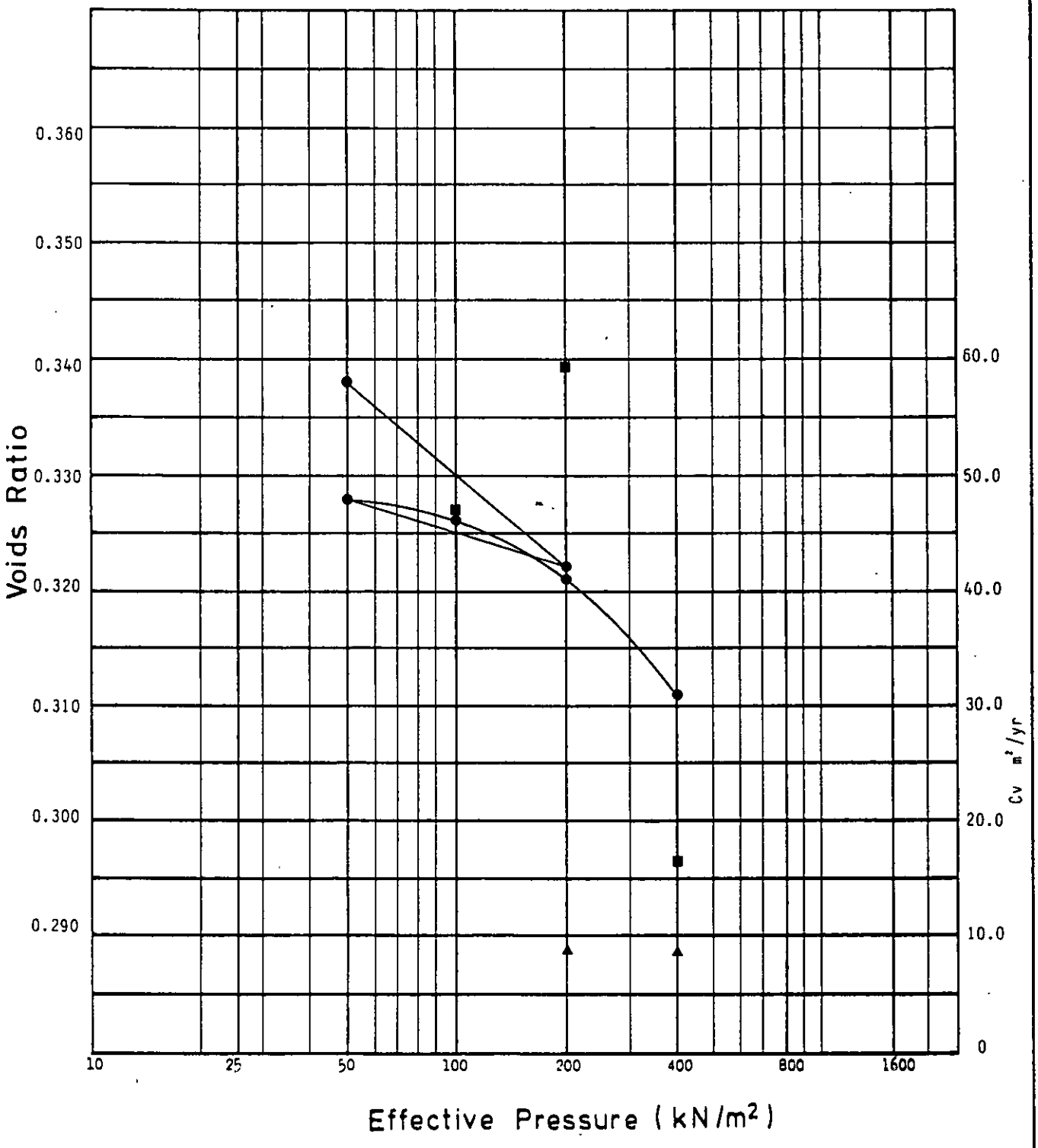
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.341	Depth 3.00 - 3.40 Hole B287
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.121



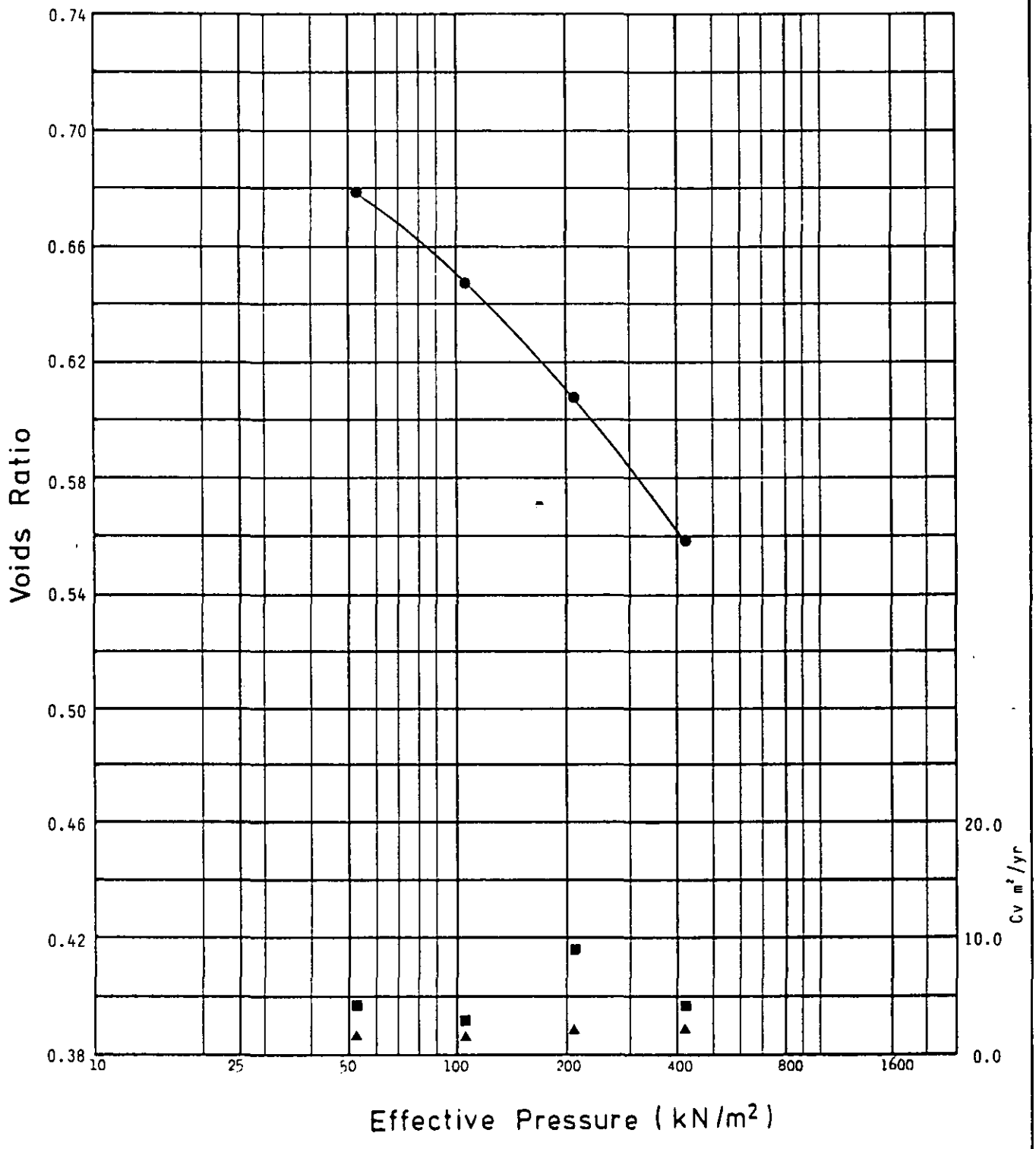
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.387	Depth 2.00 - 2.45 Hole B288
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.122



Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.381	Depth 2.00 - 2.45 Hole.. 290
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.123

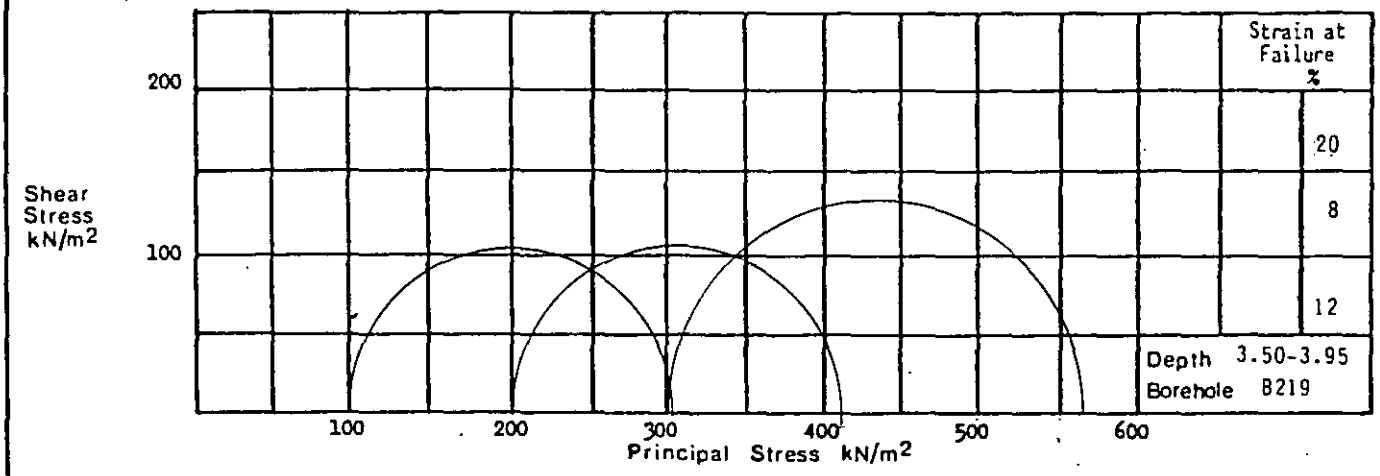


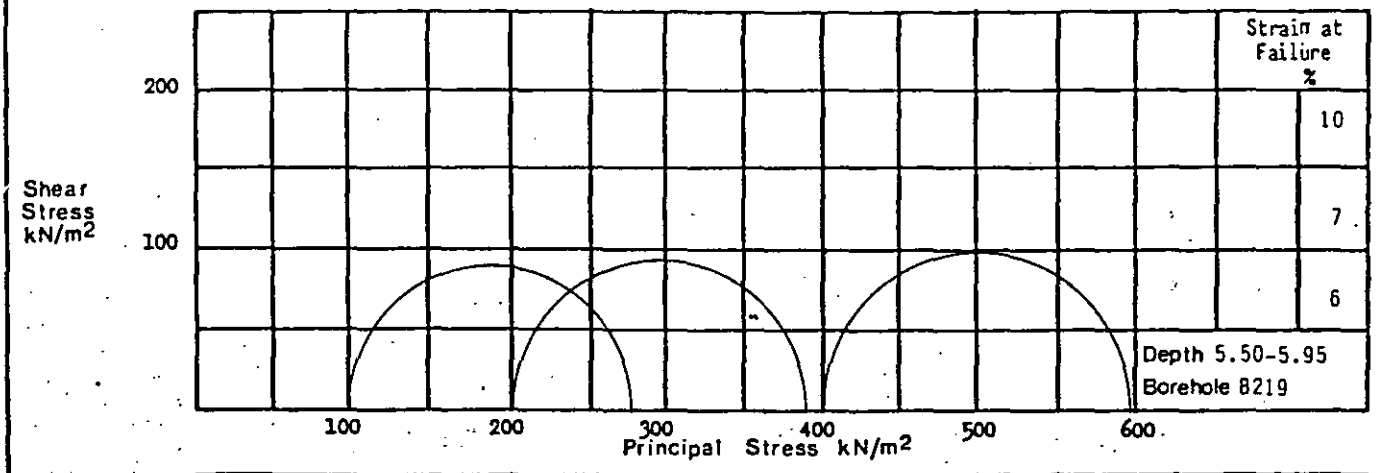
Consolidation Test	Specific Gravity 2.65 (Assumed) Initial Voids Ratio 0.350	Depth 3.50 - 3.95 Hole 291
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.124

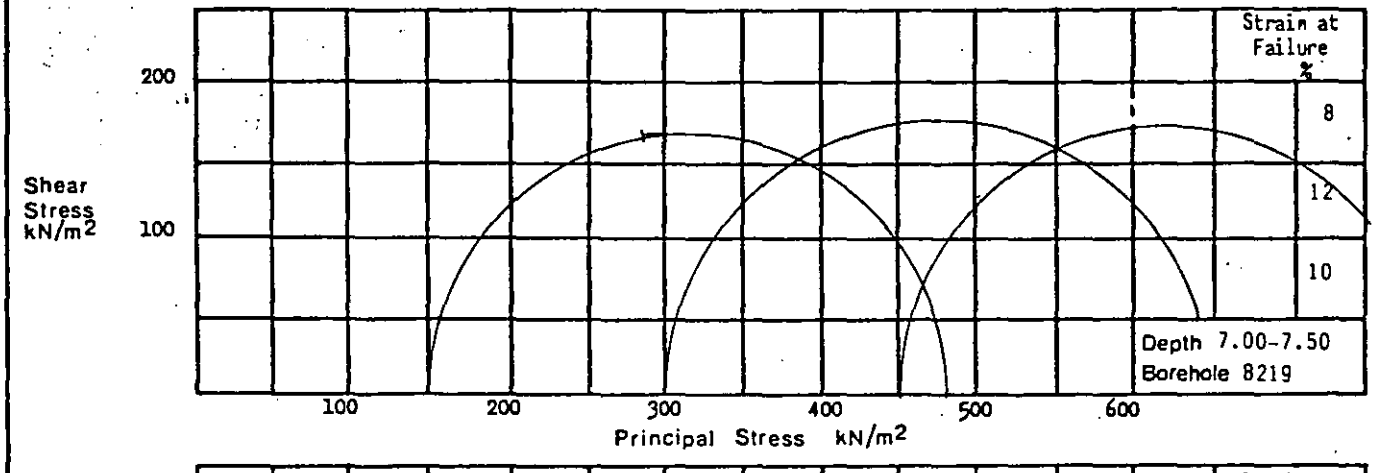


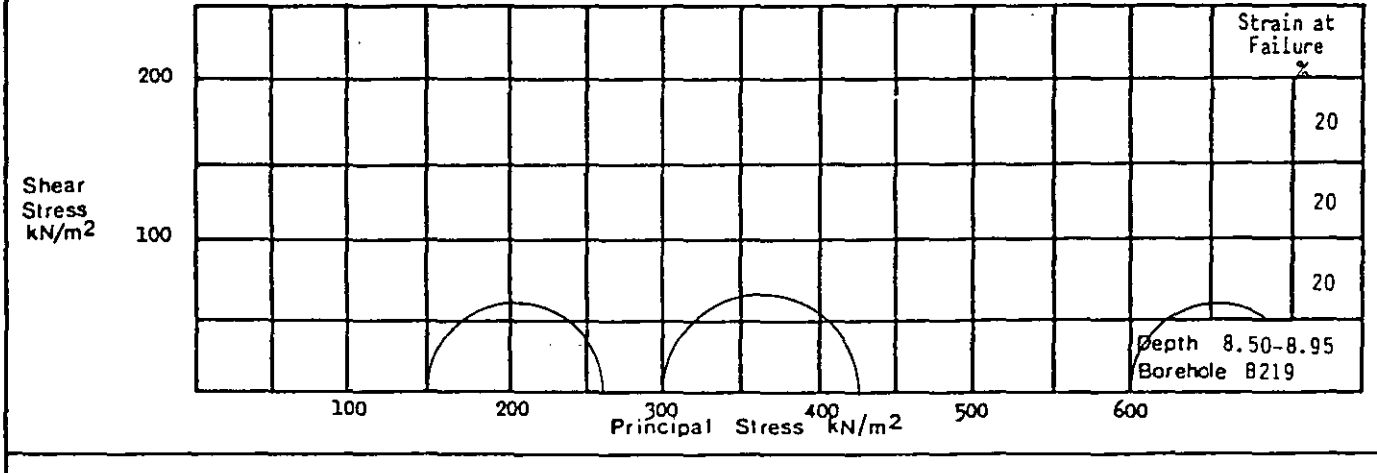
Remoulded to 5% air voids

Consolidation Test	Specific Gravity 2.65 (assumed) Initial Voids Ratio 0.731	Depth 3.00 Hole 438
Remarks ▲ t50 ■ t90		
Laboratory – e / log P	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449
exploration associates		**Figure** 2.125









Undrained Triaxial Compression - Rate of Strain 2%.

Remarks

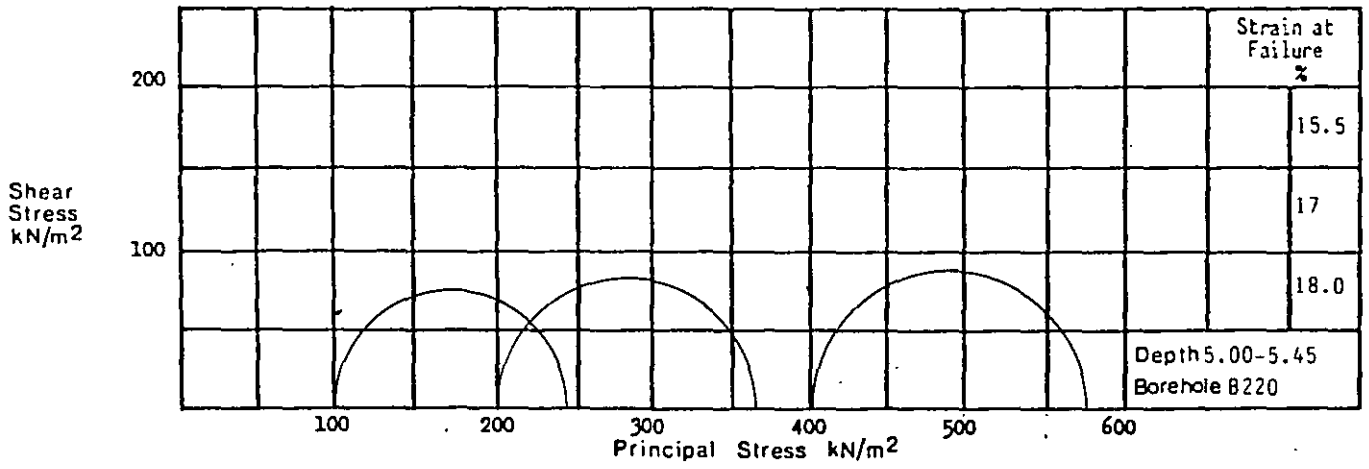
Laboratory – Mohr's Circles

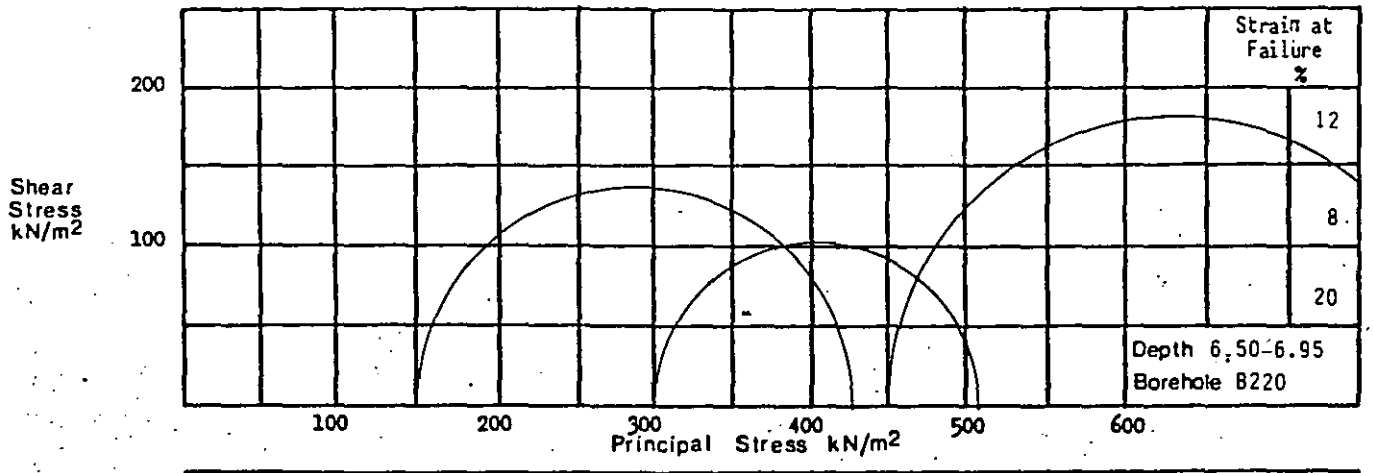
exploration associates

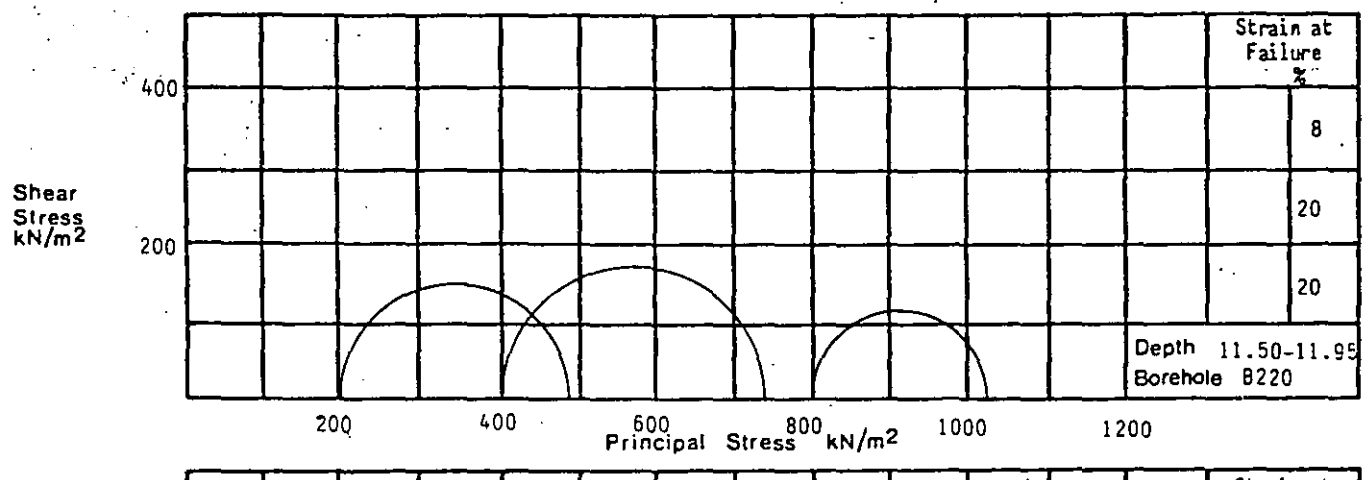
Project Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation : Contract 2

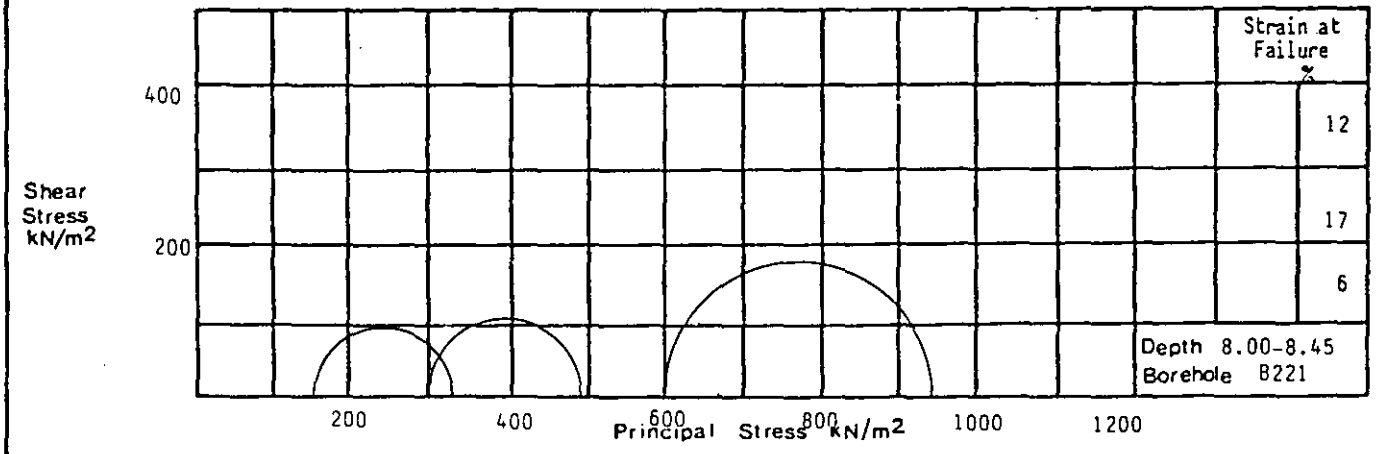
Contract S4449

Figure 2.126





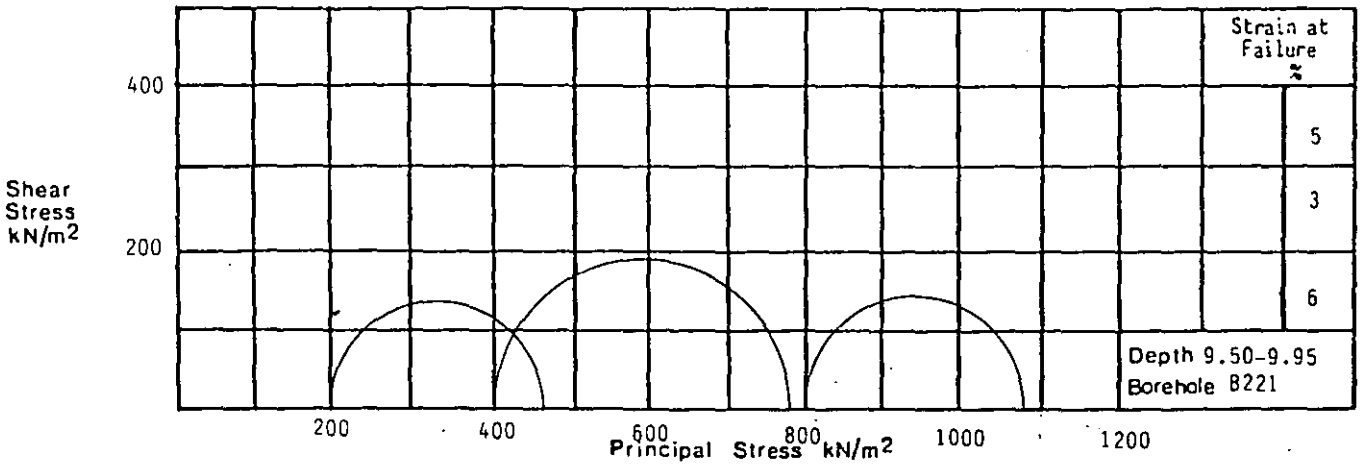


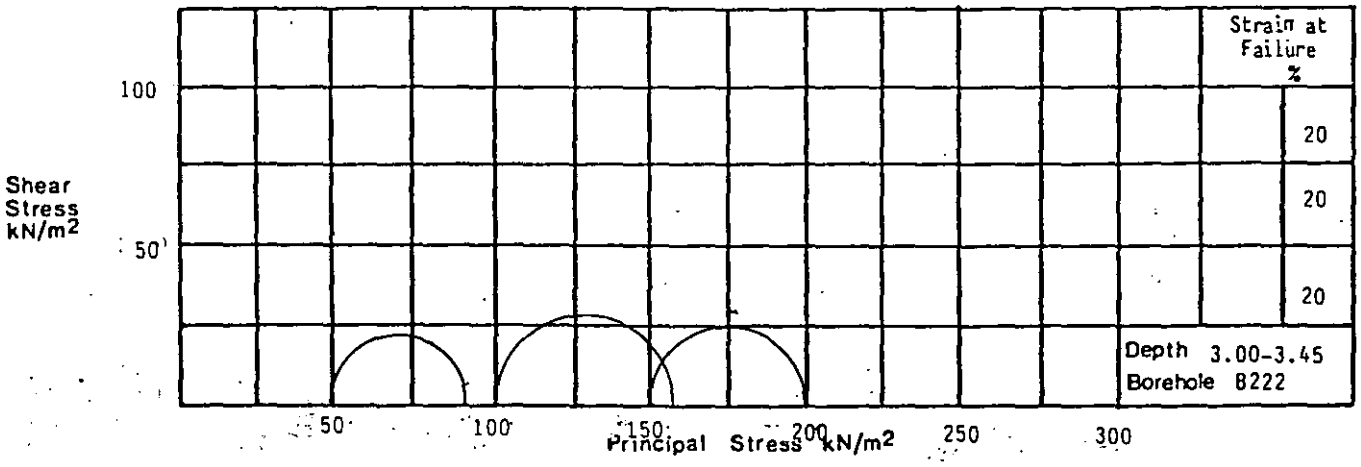


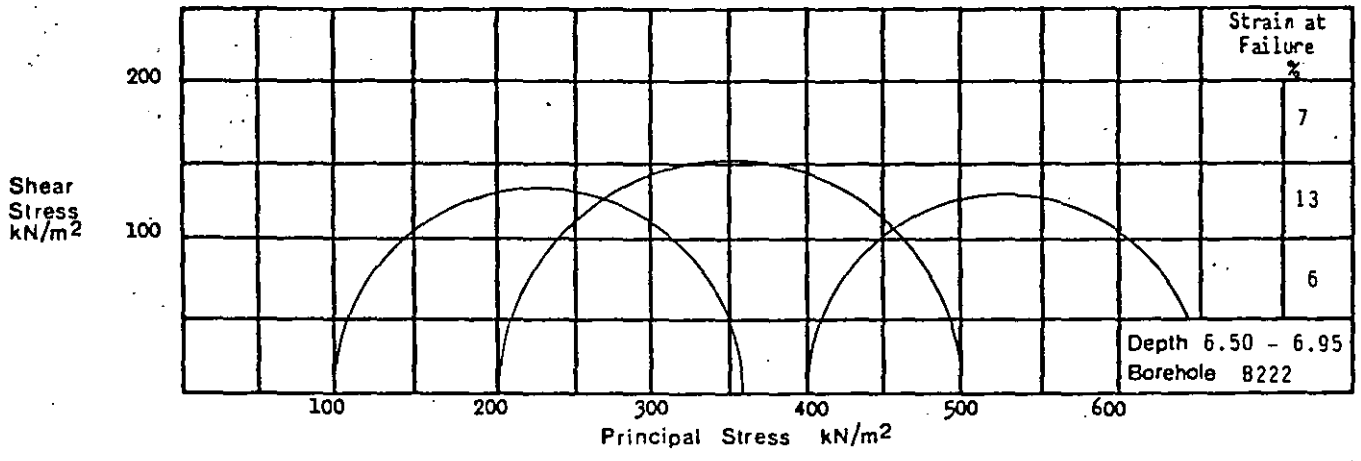
Undrained Triaxial Compression - Rate of Strain 2%.

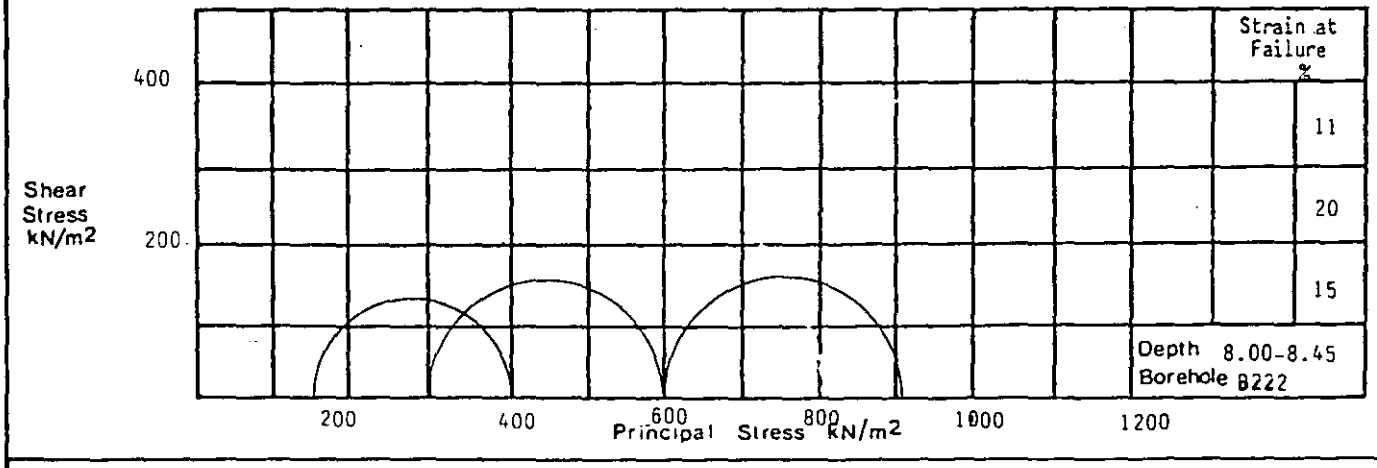
Remarks

Laboratory – Mohr's Circles	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.127





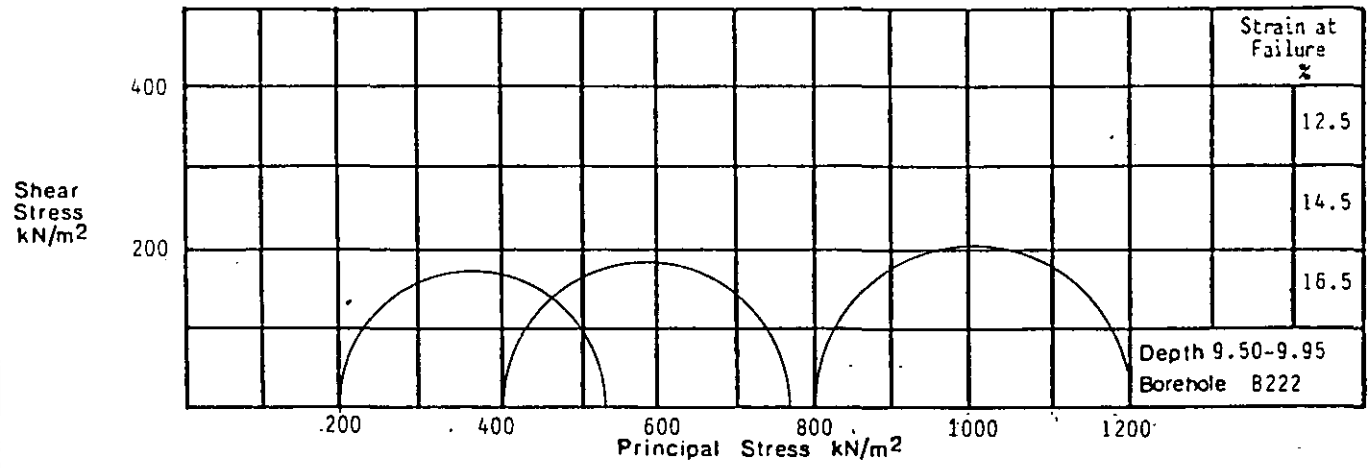


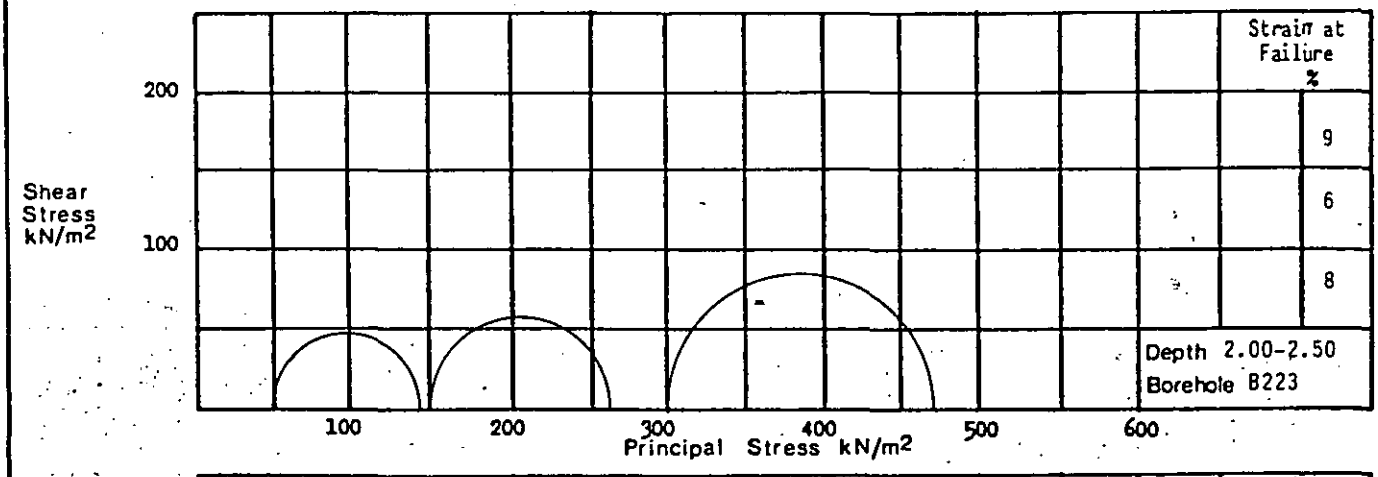


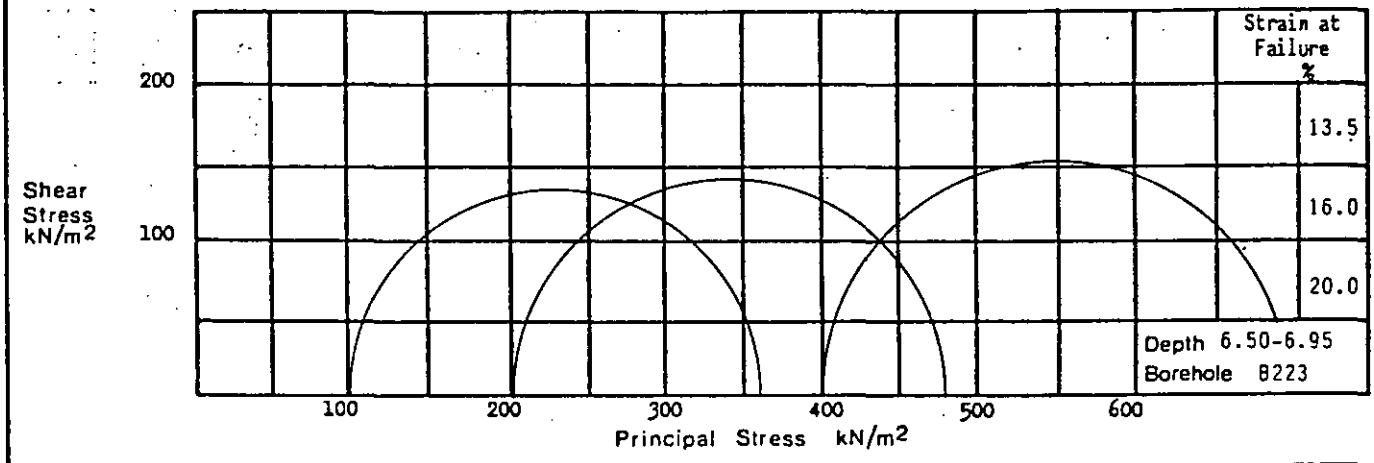
Undrained Triaxial Compression - Rate of Strain 2%.

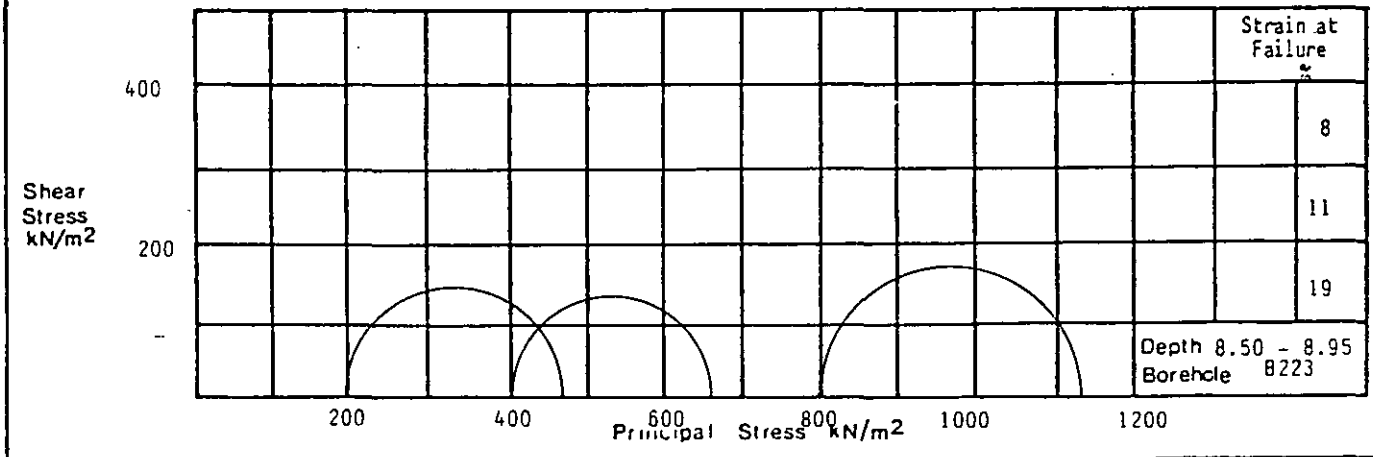
Remarks

Laboratory – Mohr's Circles	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.128









Undrained Triaxial Compression - Rate of Strain 2%.

Remarks

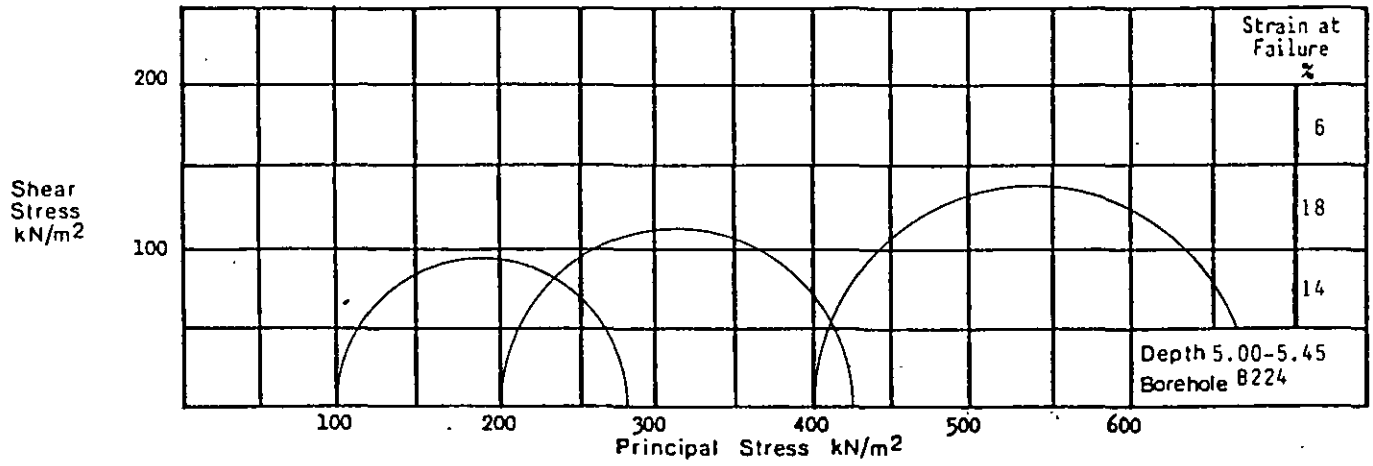
Laboratory – Mohr's Circles

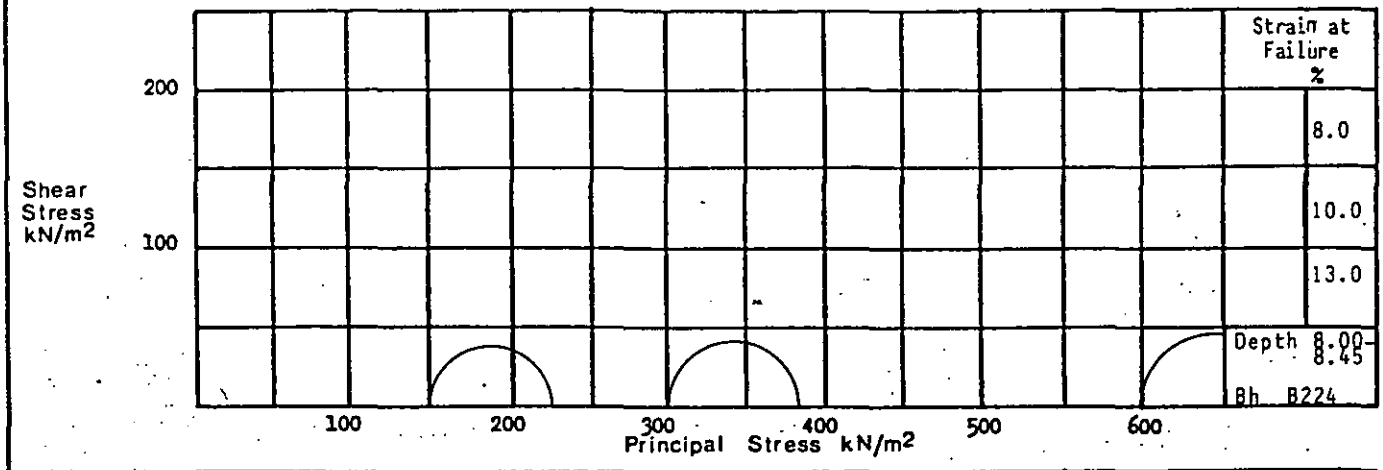
exploration associates

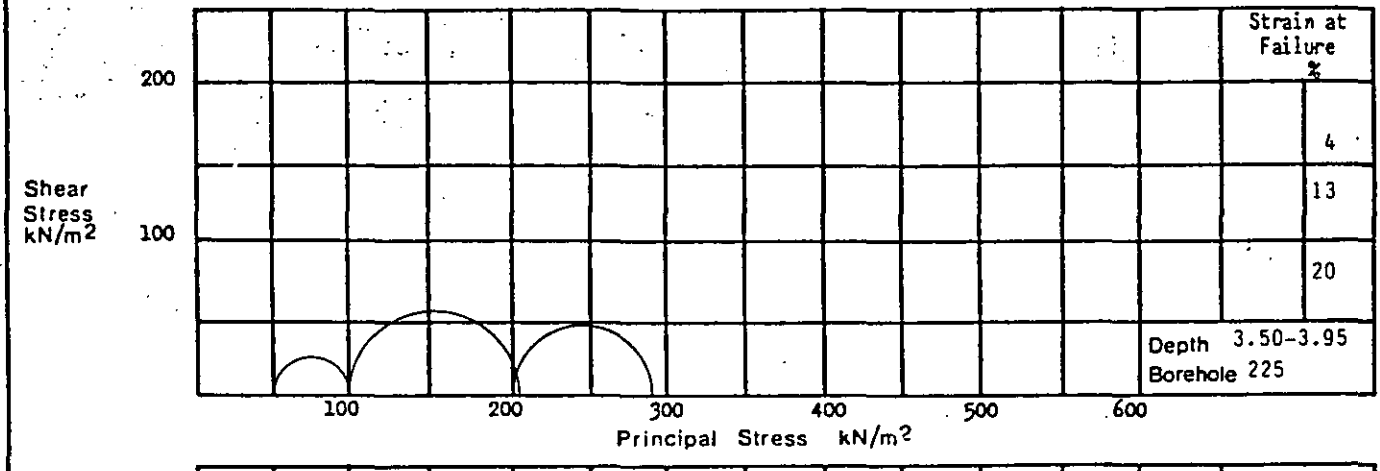
Project Department of Transport
East Midlands Regional Office
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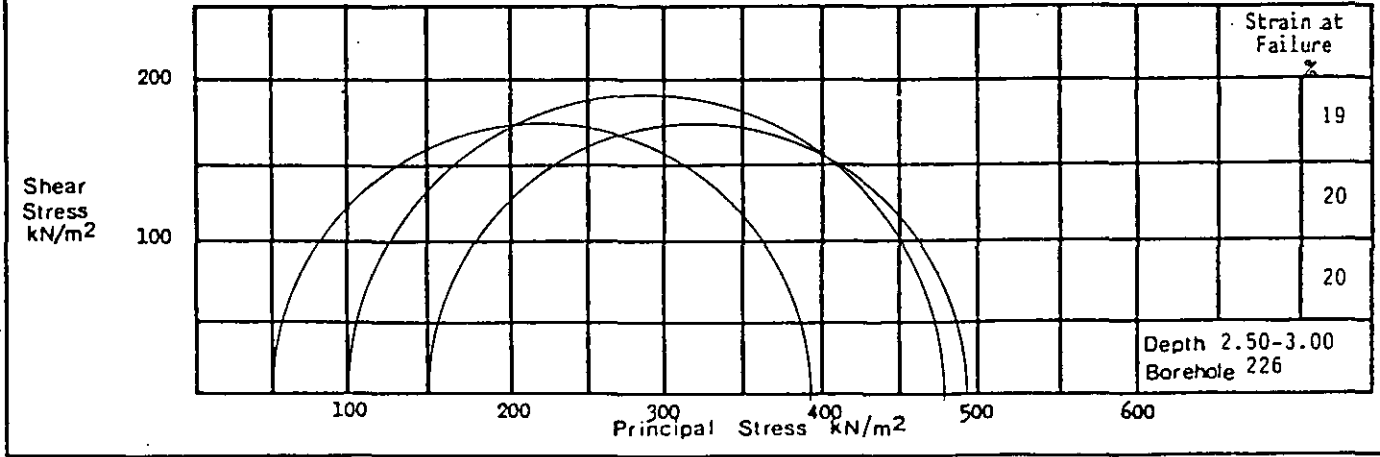
Contract S4449

Figure 2.129





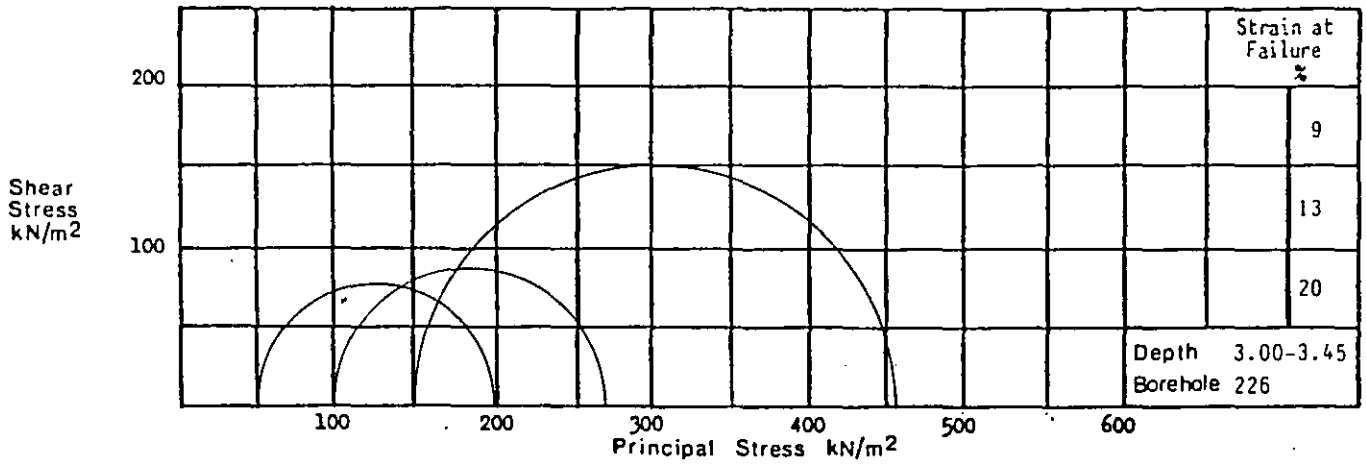


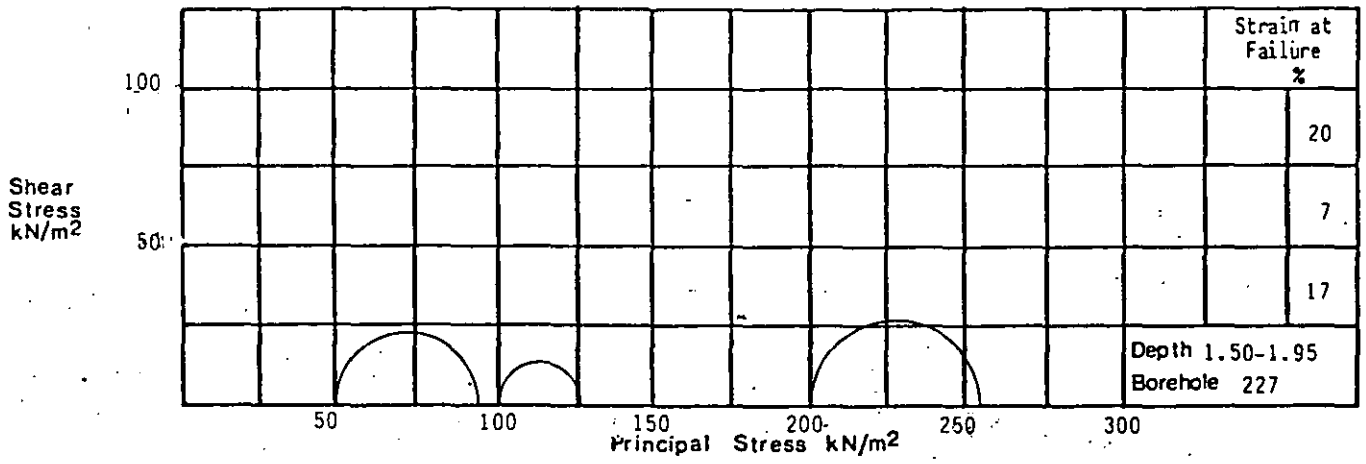


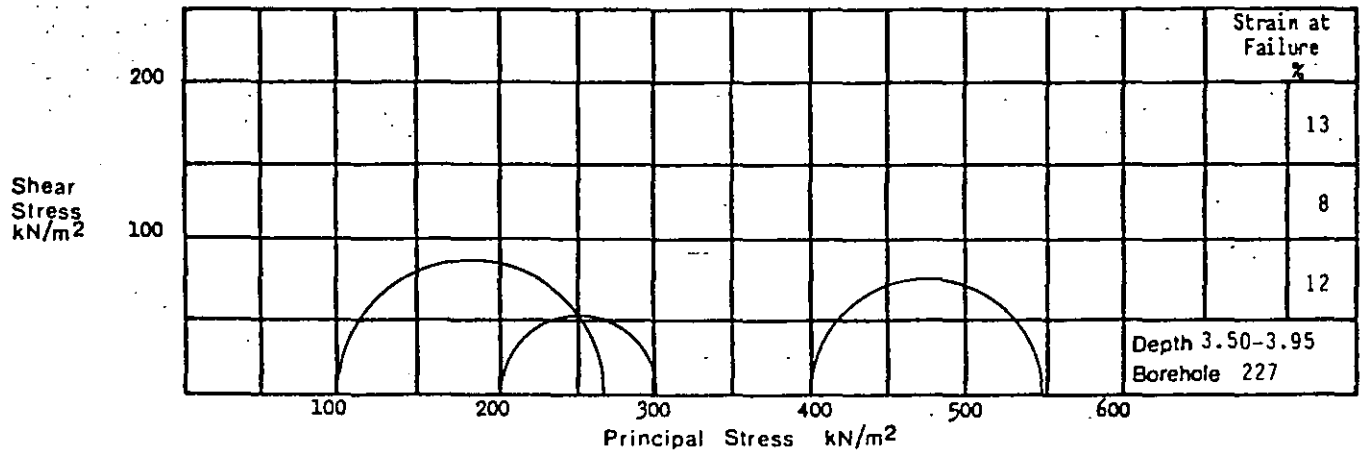
Undrained Triaxial Compression - Rate of Strain 2%.

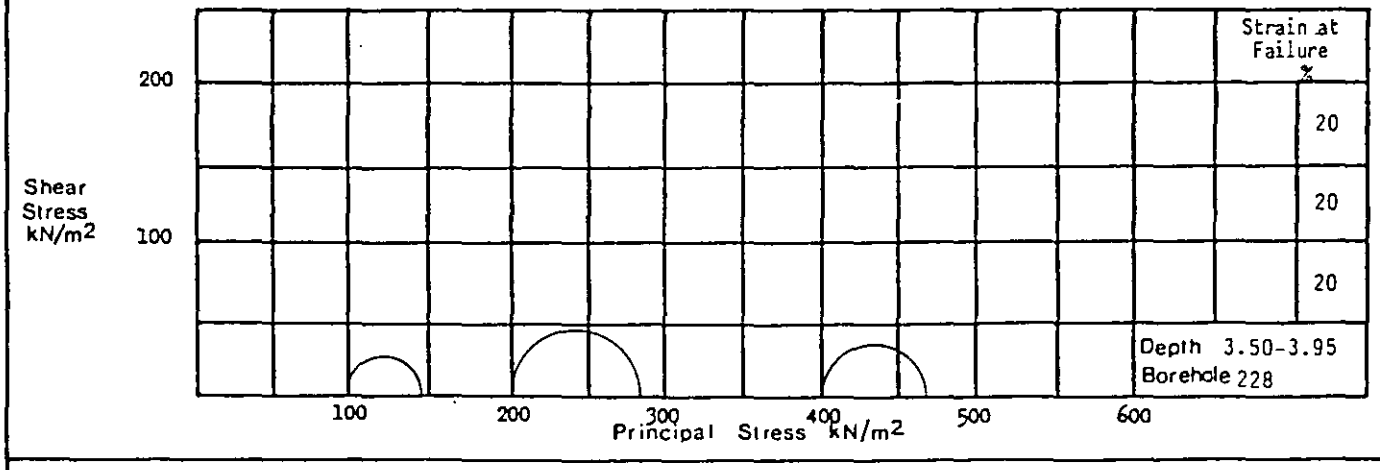
Remarks

Laboratory – Mohr's Circles	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.130









Undrained Triaxial Compression – Rate of Strain 2%.

Remarks

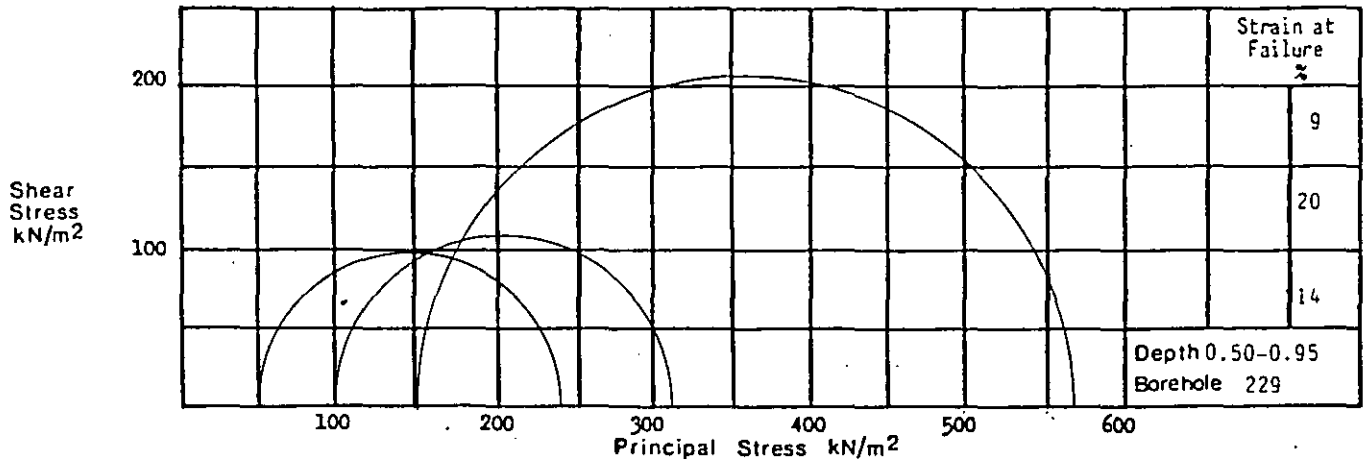
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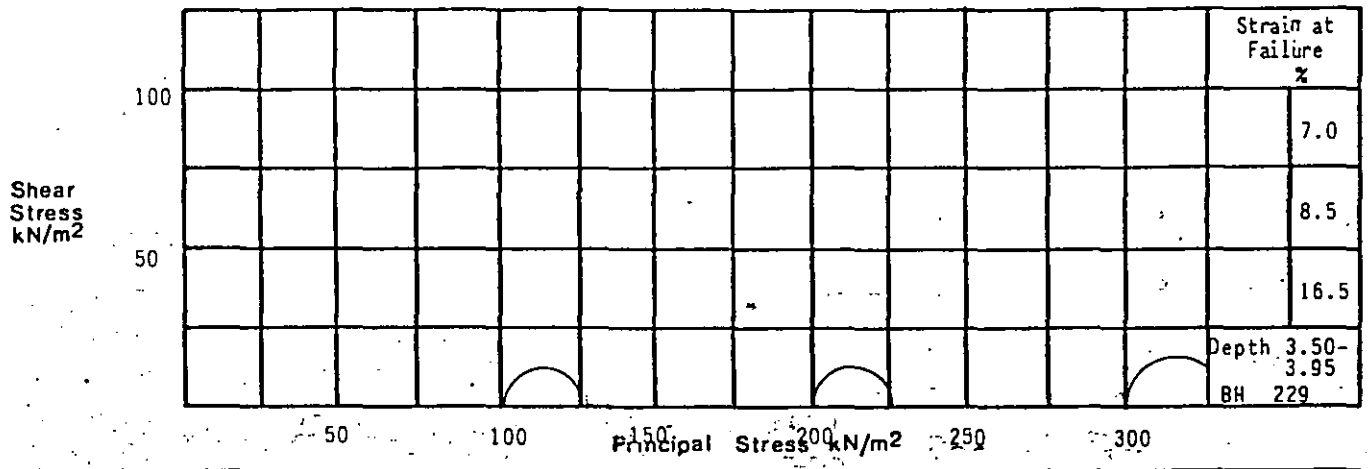
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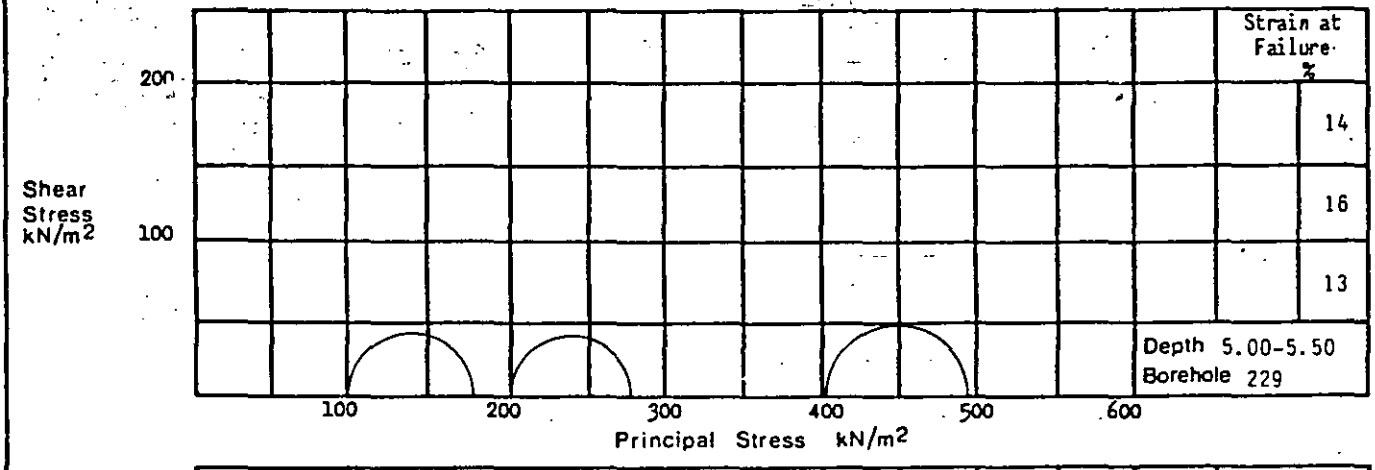
Project Department of Transport
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A42 Castle Donington North
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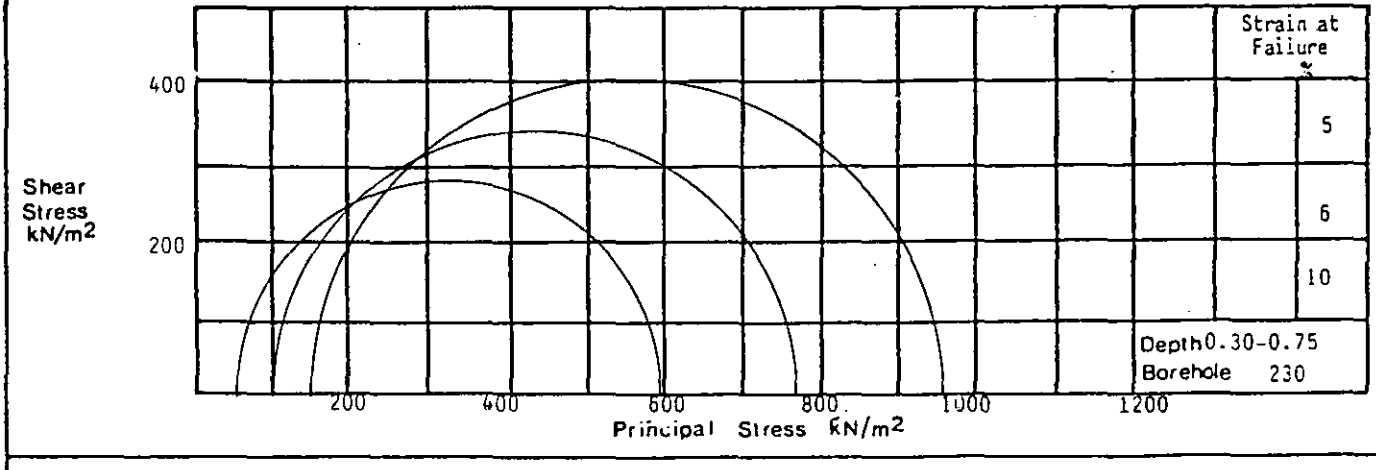
Contract S4449

Figure 2.131









Undrained Triaxial Compression – Rate of Strain 2%.

Remarks

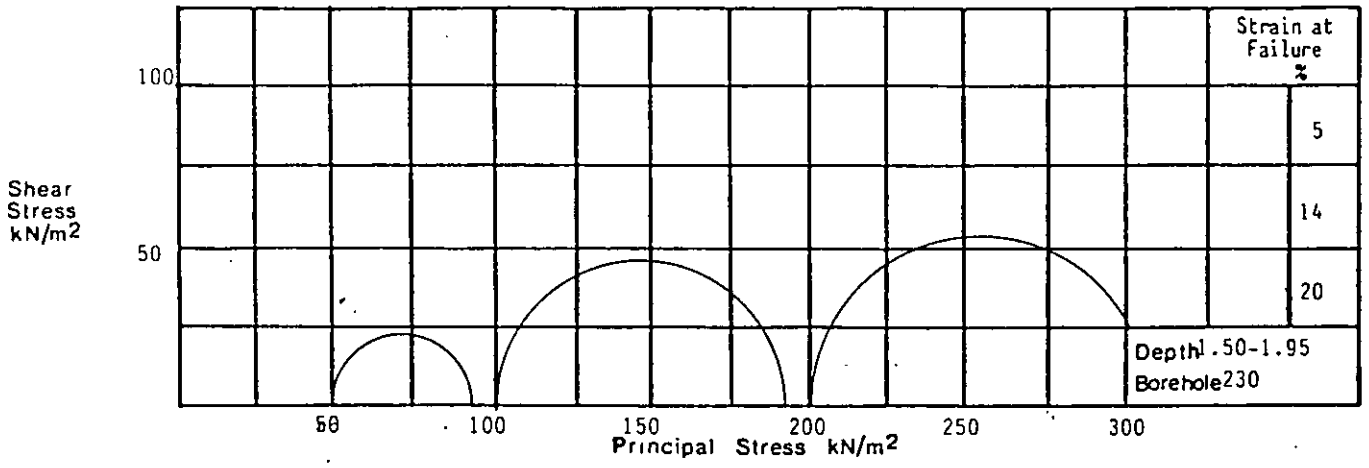
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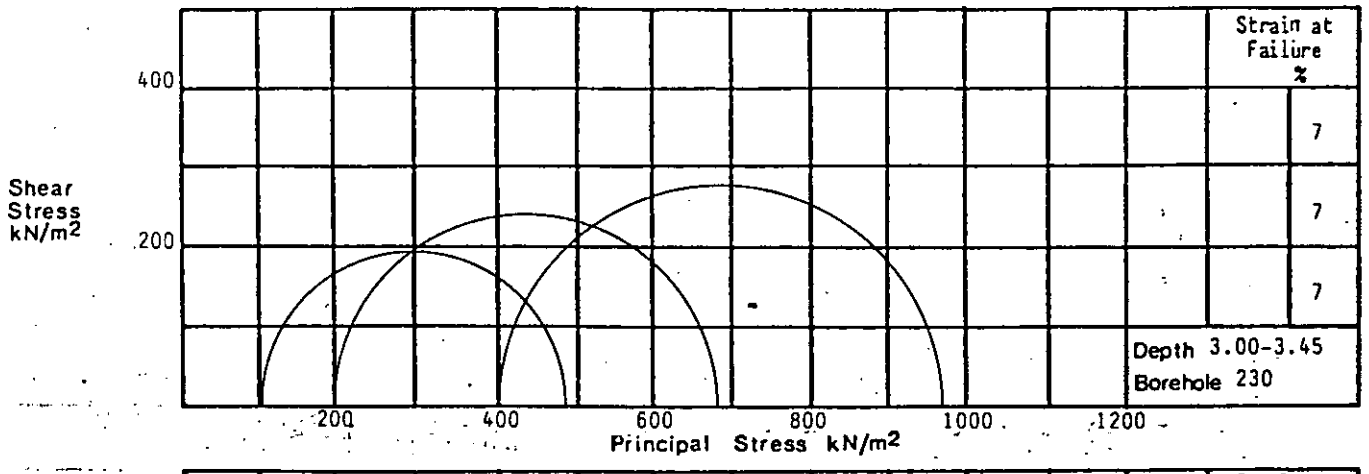
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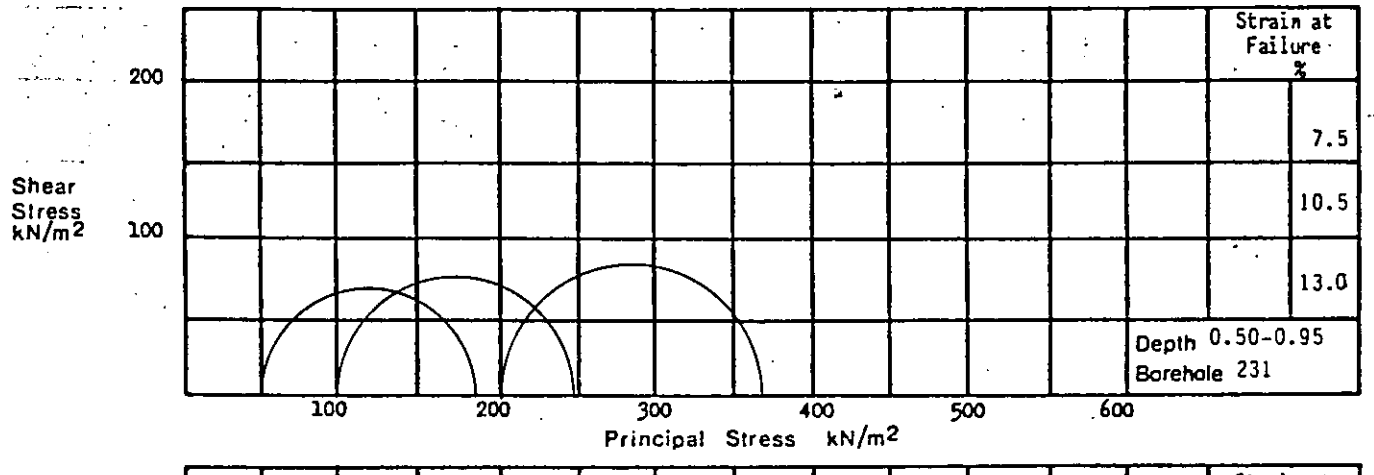
Project Department of Transport
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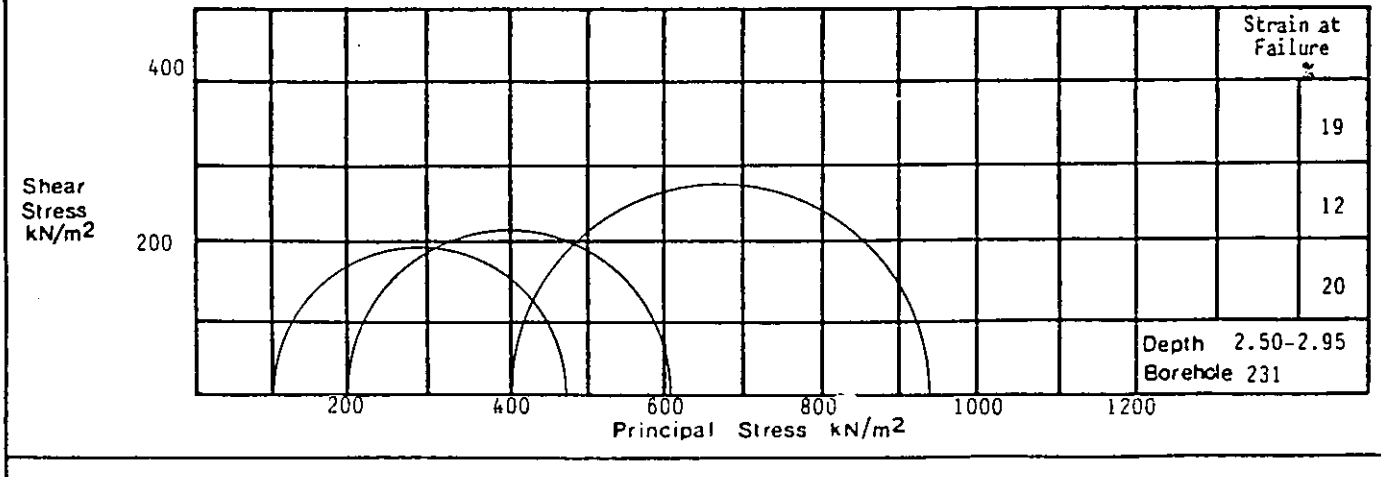
Contract S4449

Figure 2.132









Undrained Triaxial Compression – Rate of Strain 2%.

Remarks

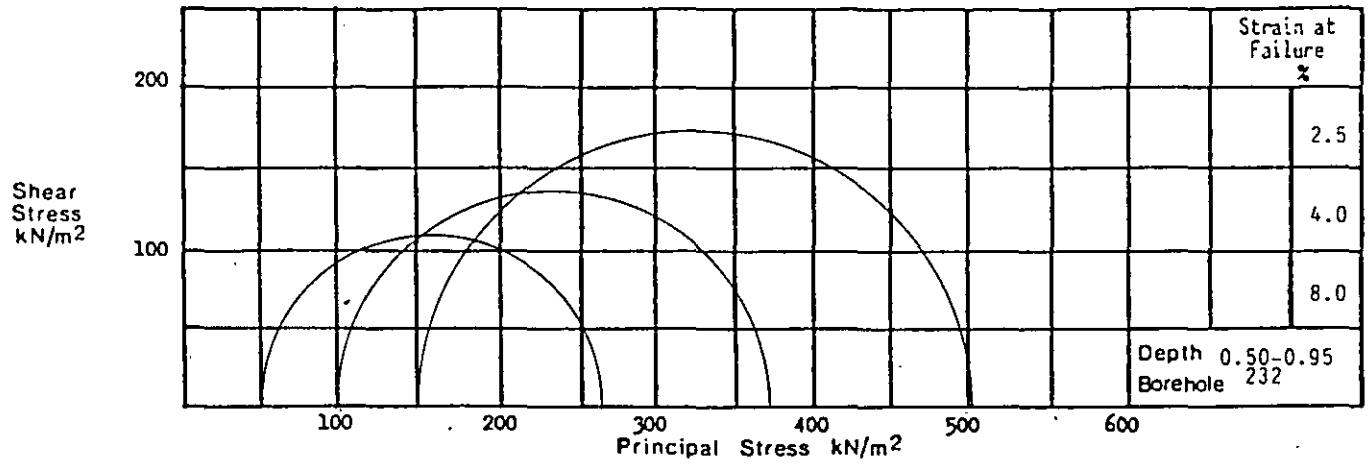
Laboratory – Mohr's Circles

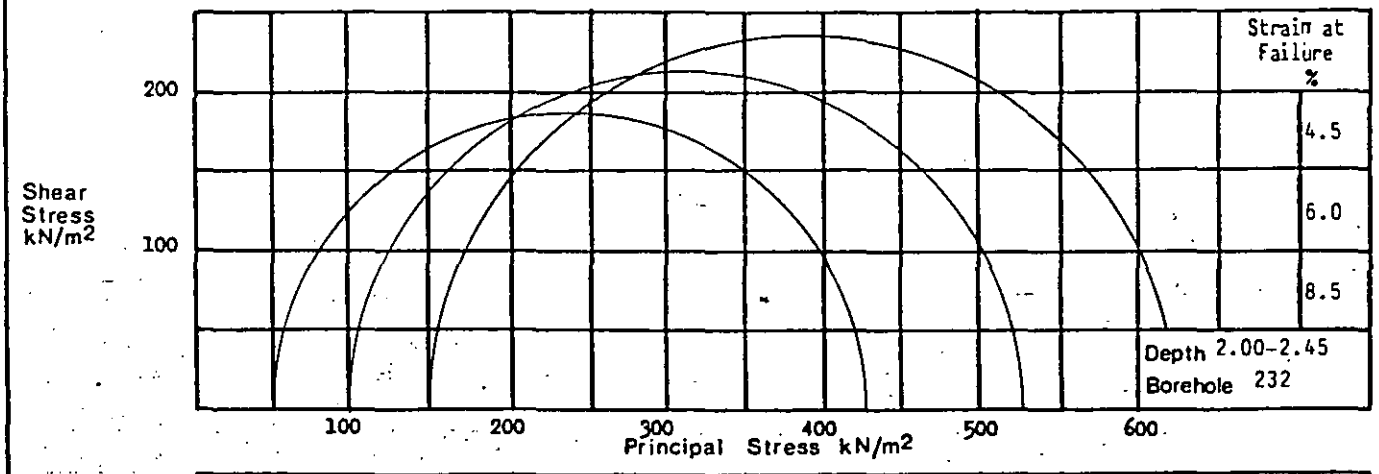
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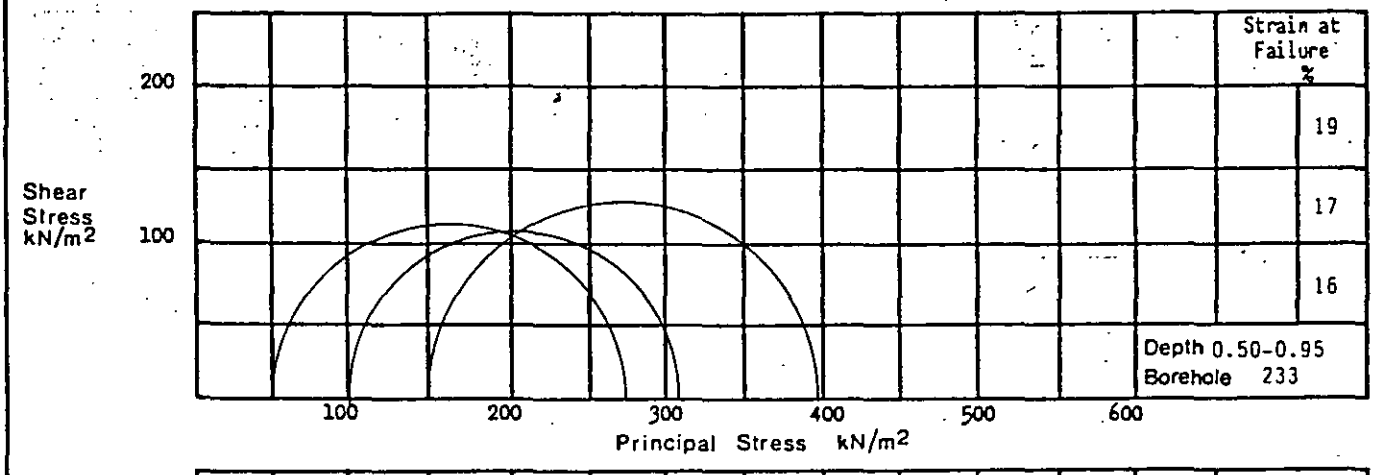
Project Department of Transport
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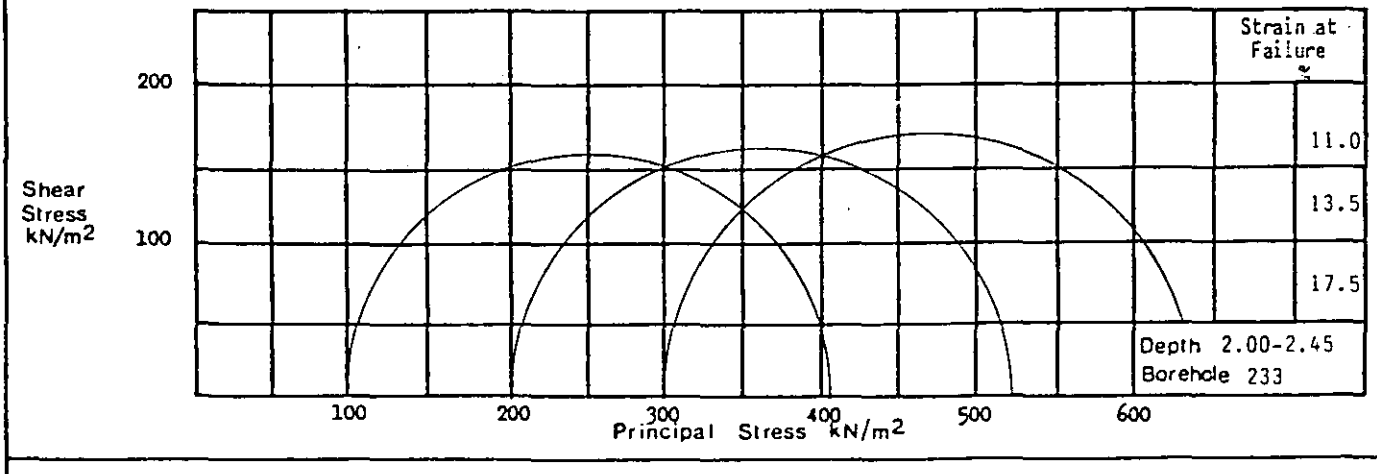
Contract S4449

Figure 2.133









Undrained Triaxial Compression - Rate of Strain 2%.

Remarks

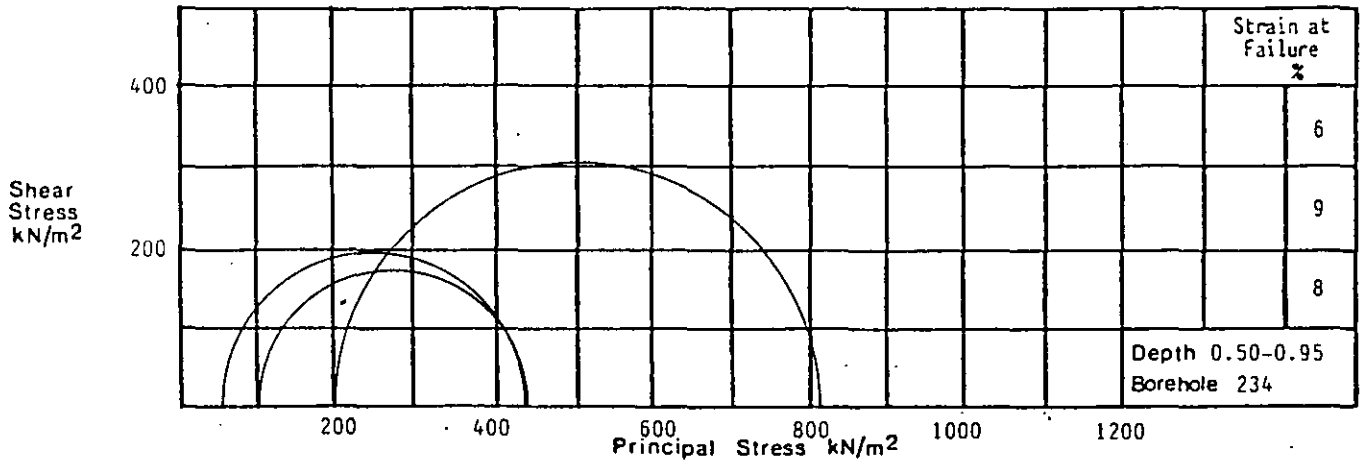
Laboratory – Mohr's Circles

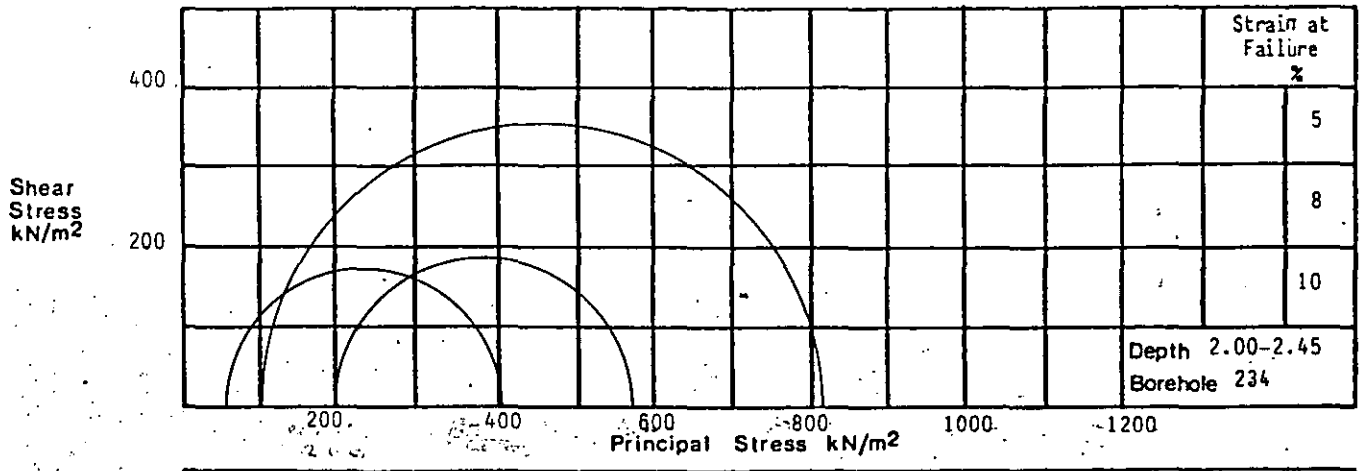
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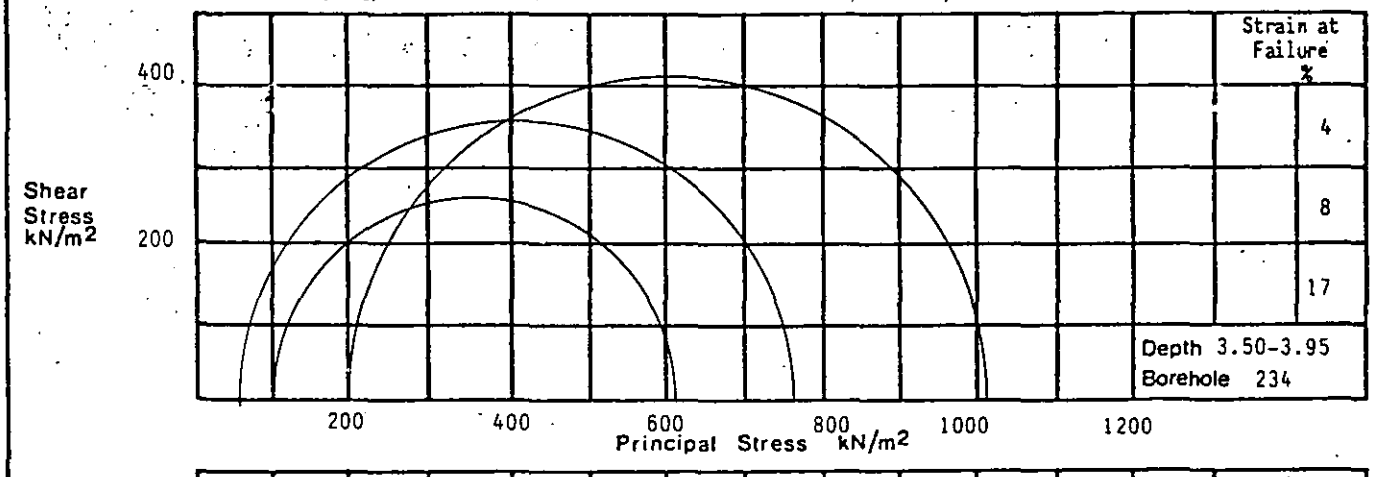
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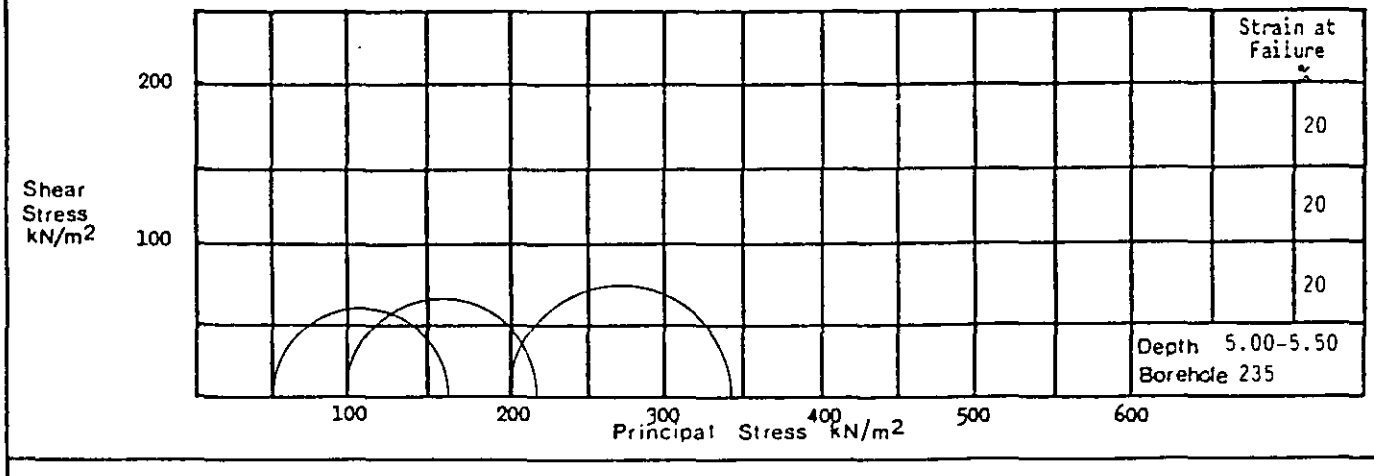
Contract S4449

Figure 2.134









Undrained Triaxial Compression – Rate of Strain 2%.

Remarks

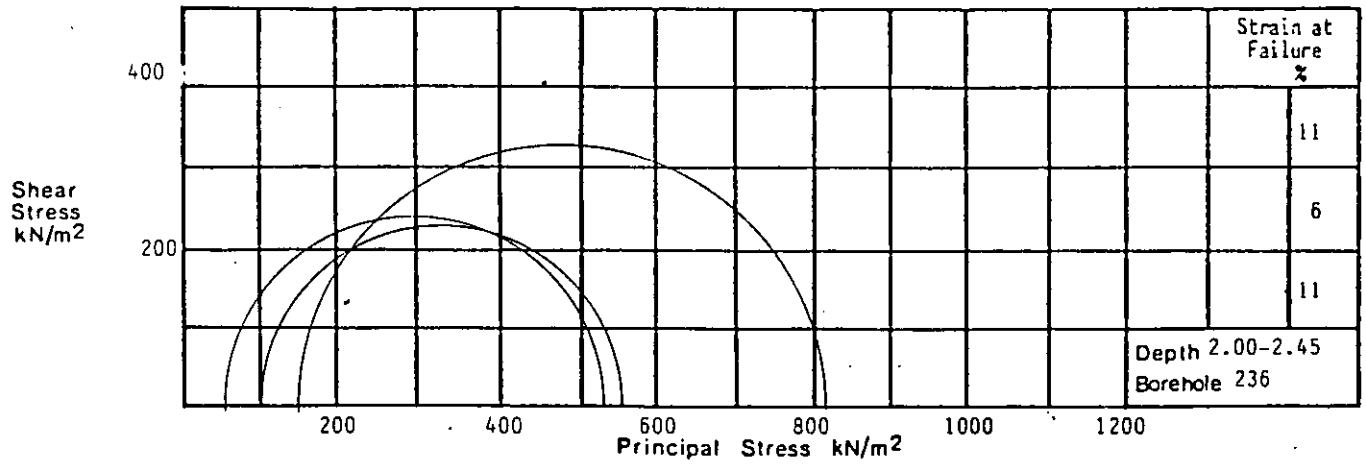
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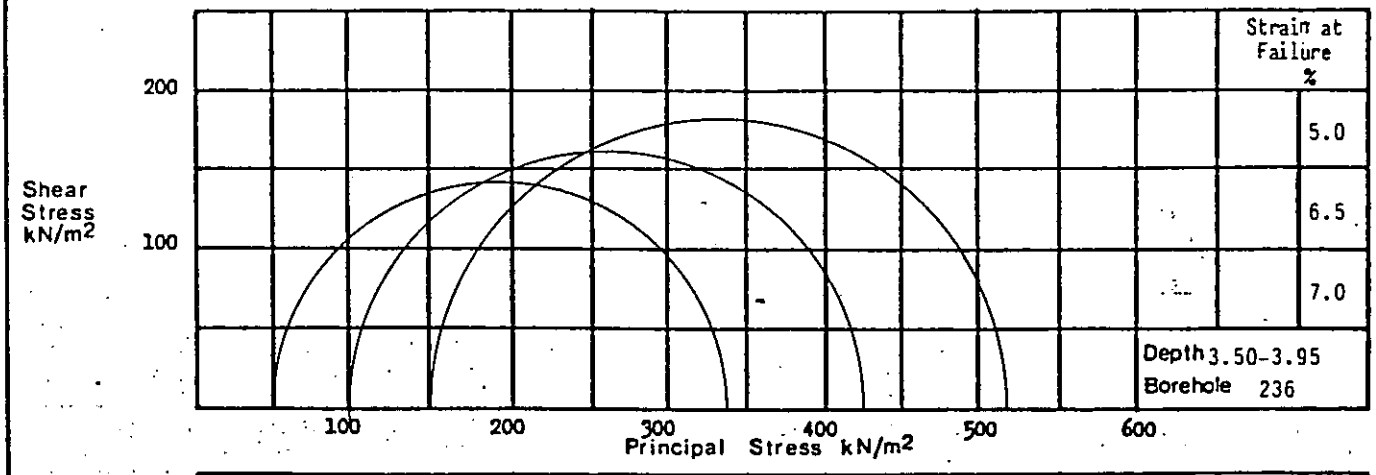
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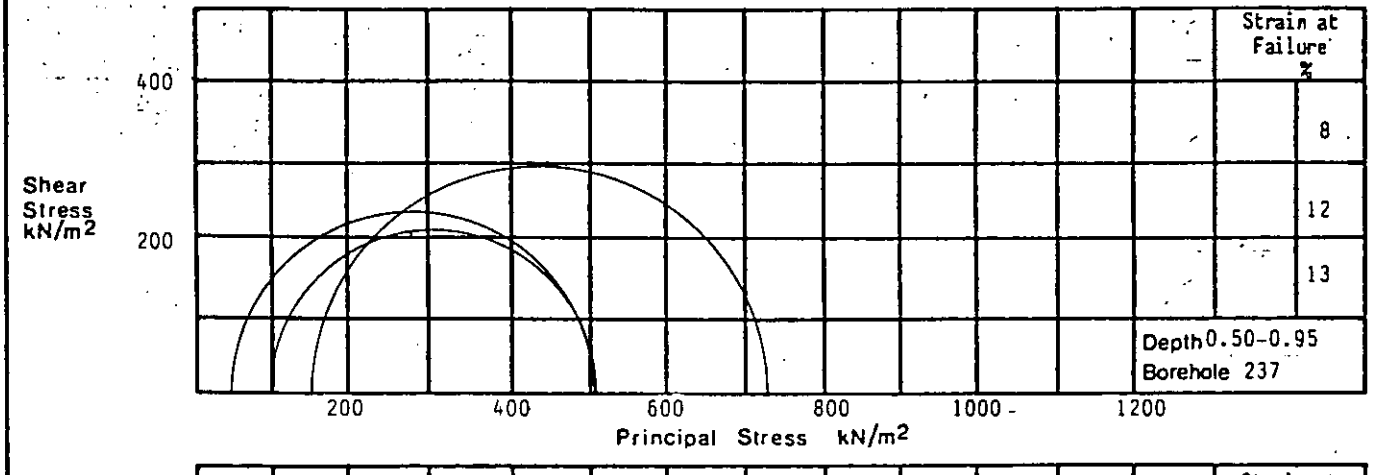
Project Department of Transport
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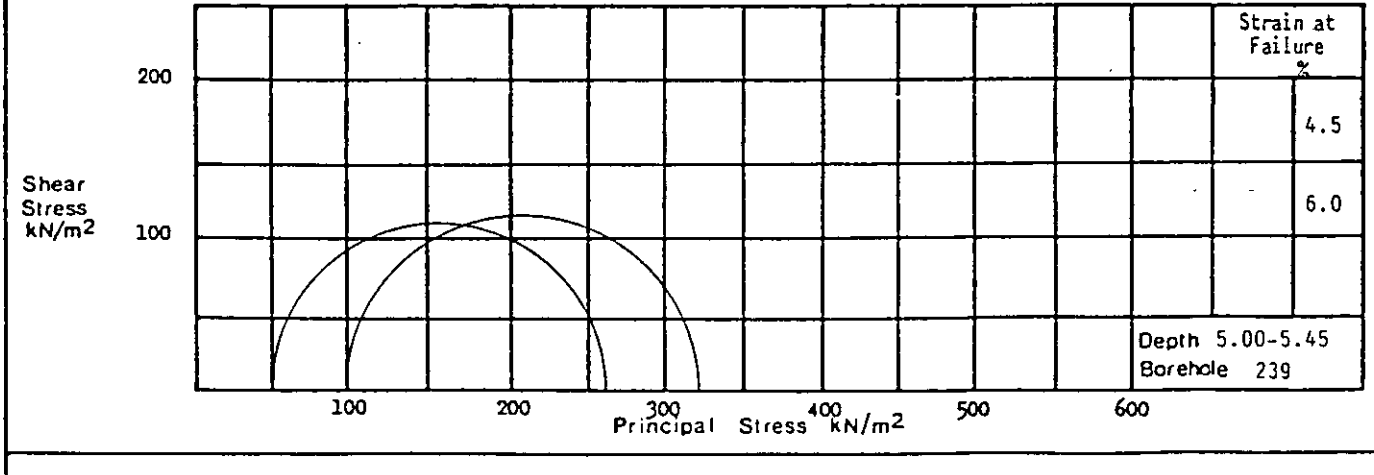
Contract S4449

Figure 2.135









Undrained Triaxial Compression – Rate of Strain 2%.

Remarks

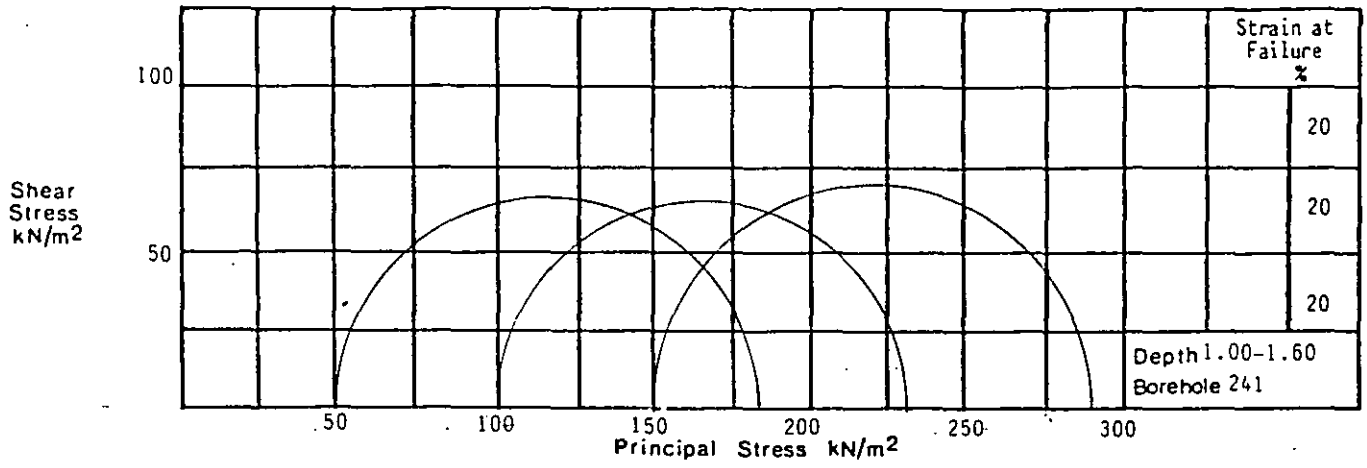
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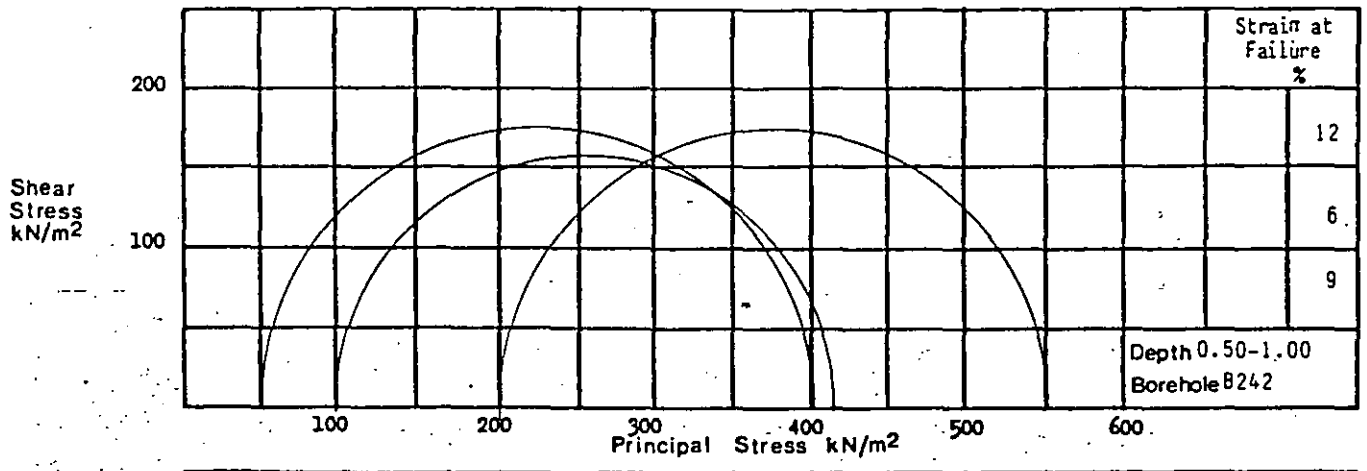
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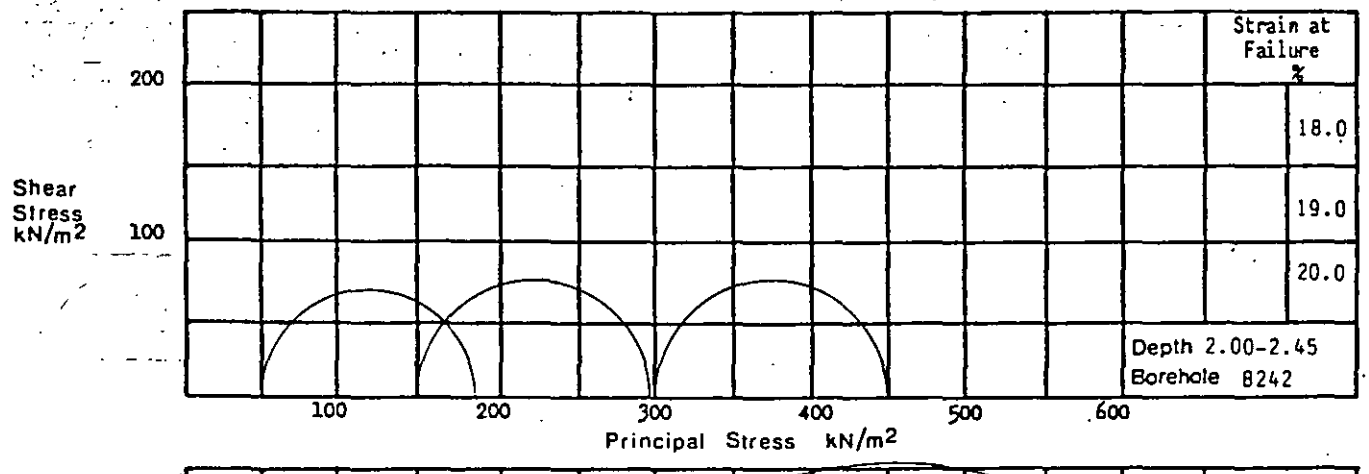
Project Department of Transport
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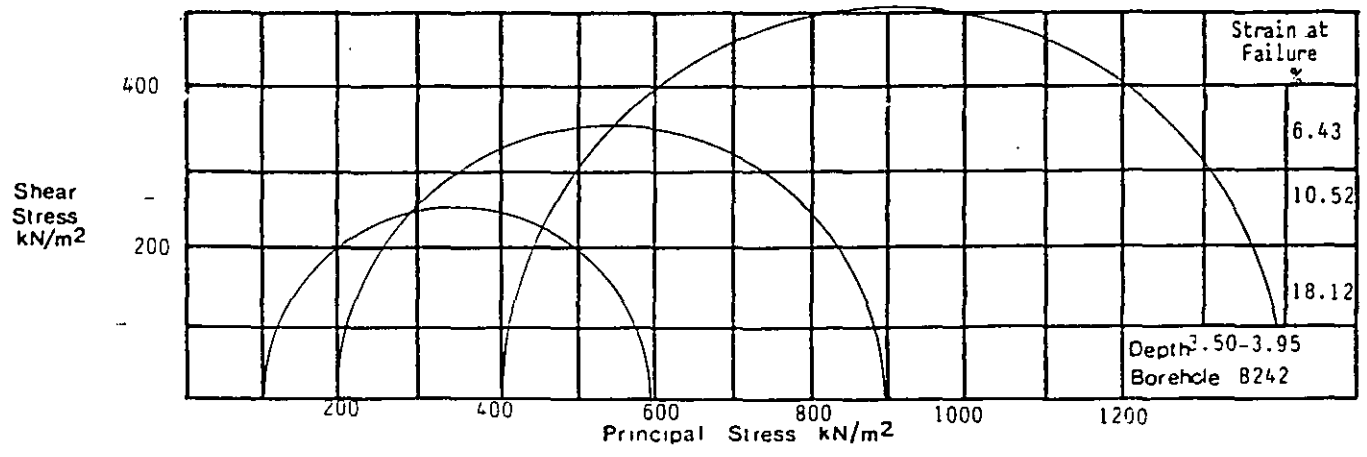
Contract S4449

Figure 2.136









Undrained Triaxial Compression - Rate of Strain 2%.

Remarks

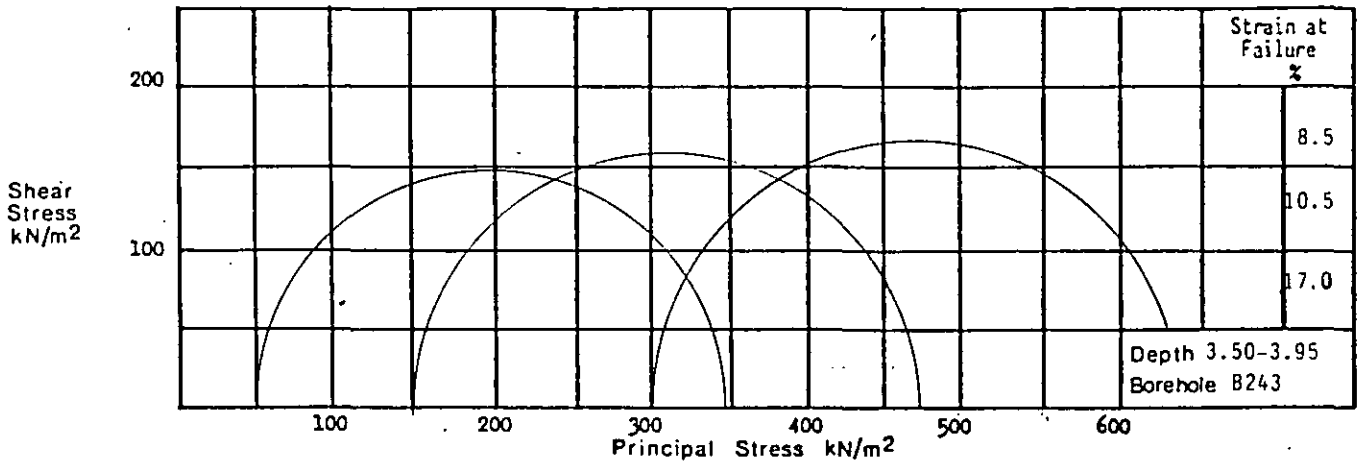
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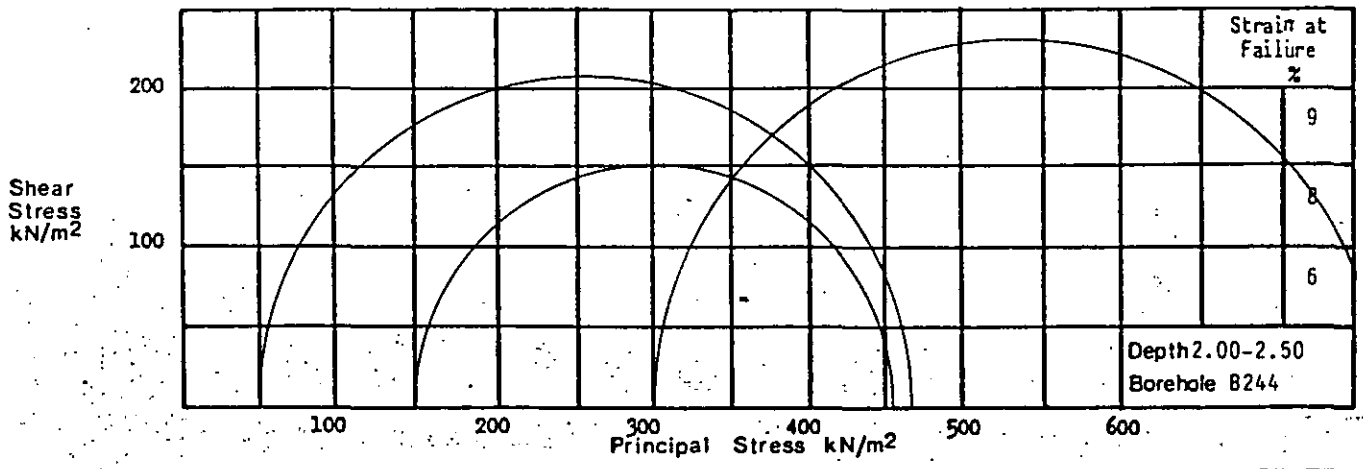
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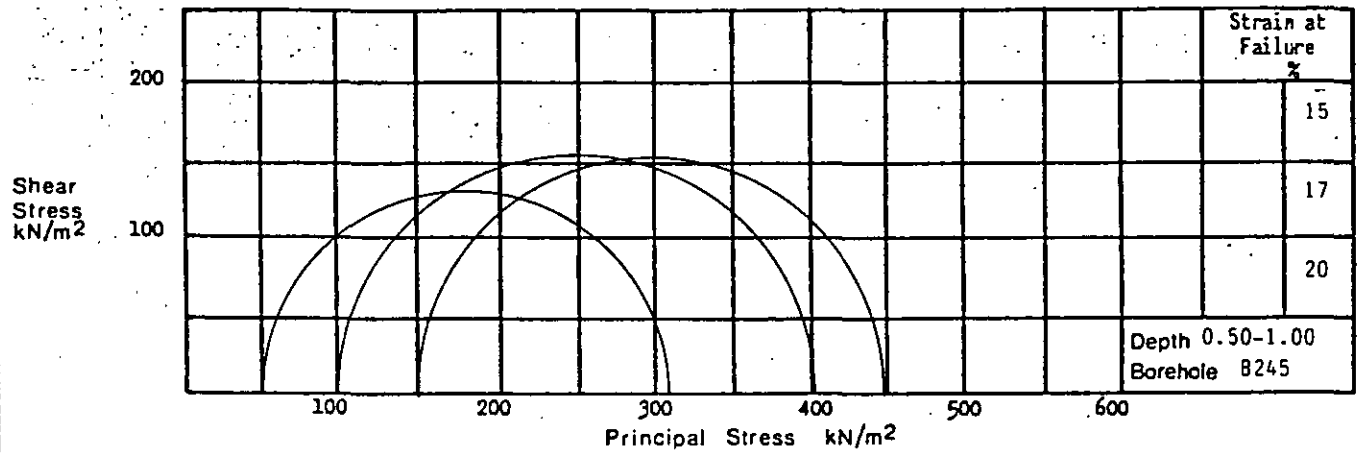
Project Department of Transport
East Midlands Regional Office
A42 Castle Donington North
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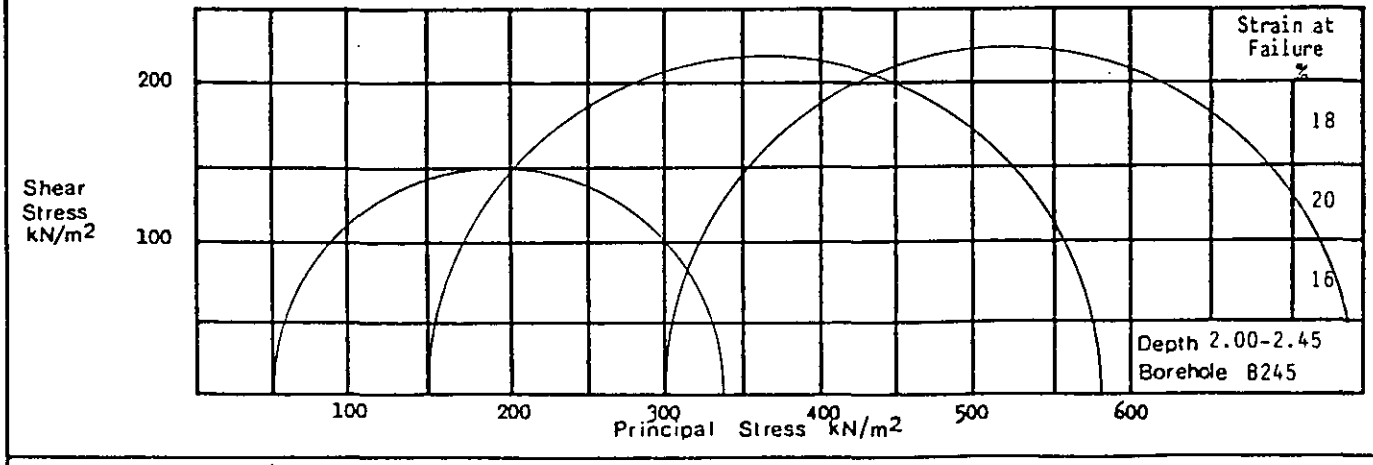
Contract S4449

Figure 2.137









Undrained Triaxial Compression – Rate of Strain 2%.

Remarks

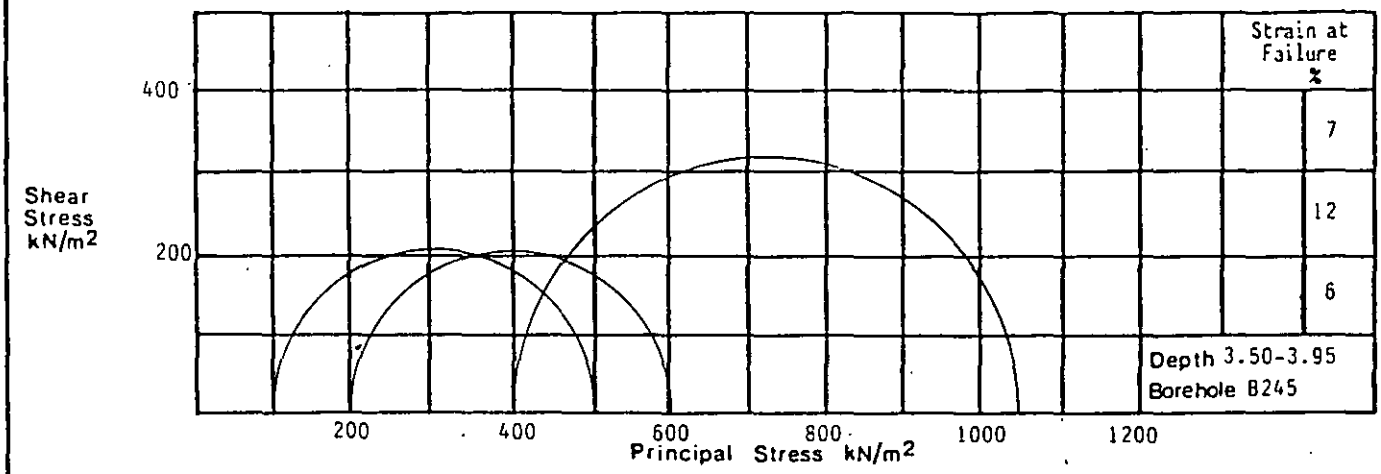
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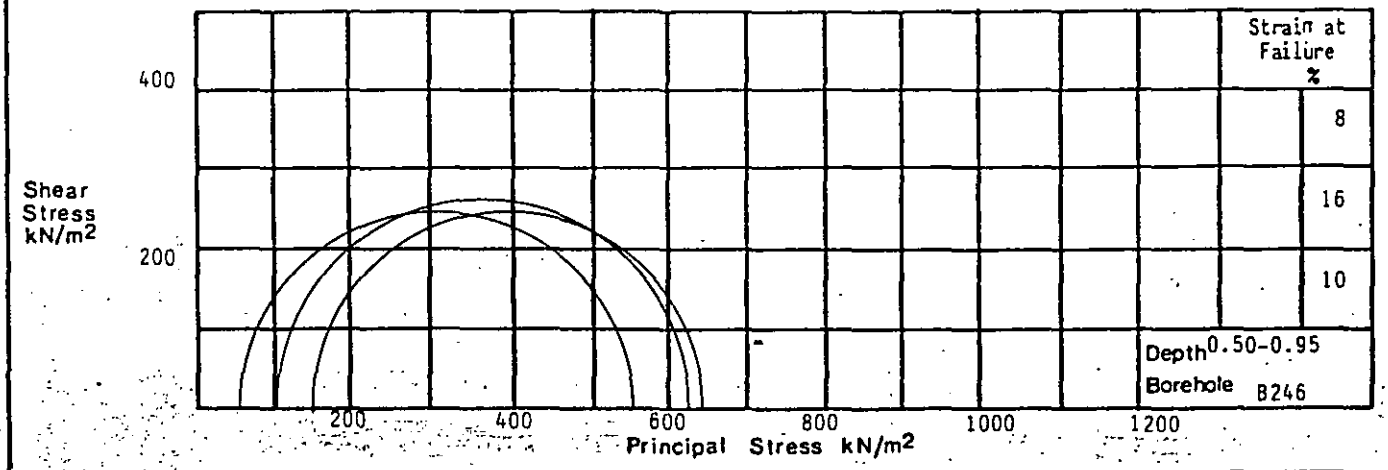
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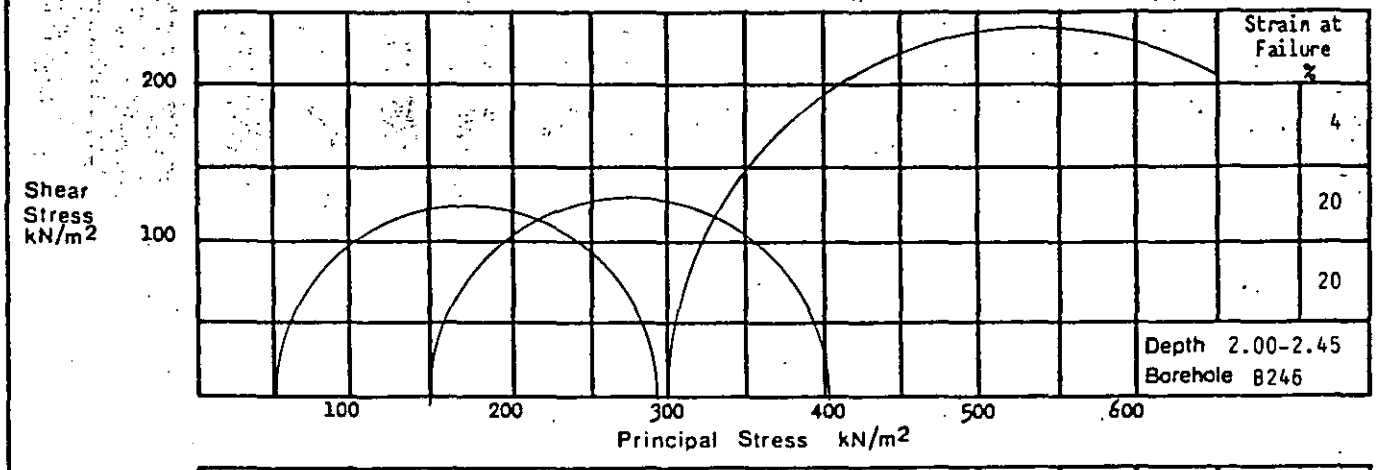
Project Department of Transport
East Midlands Regional Office
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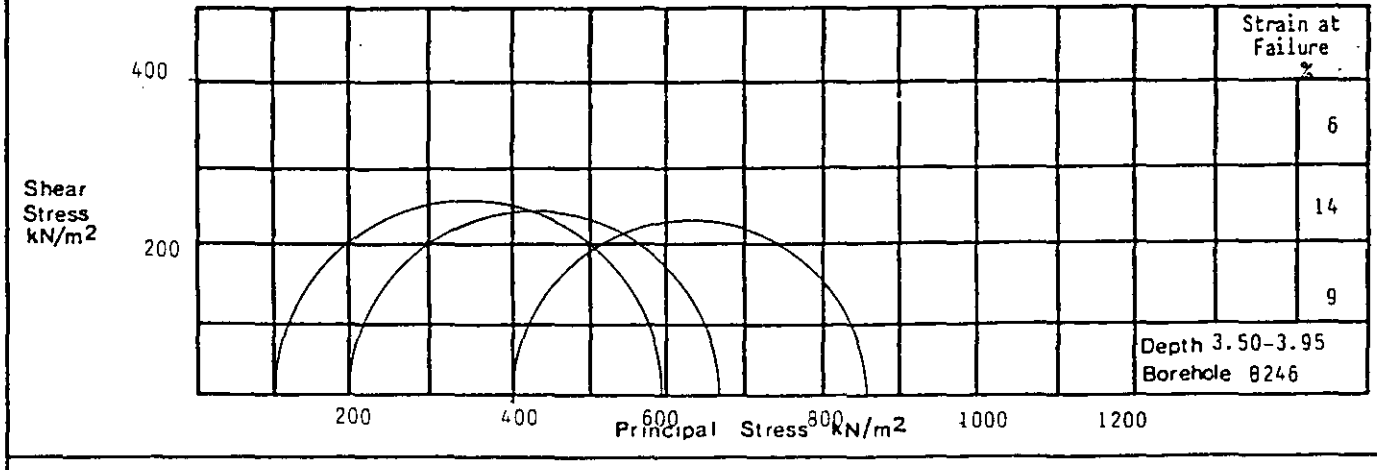
Contract S4449

Figure 2.138





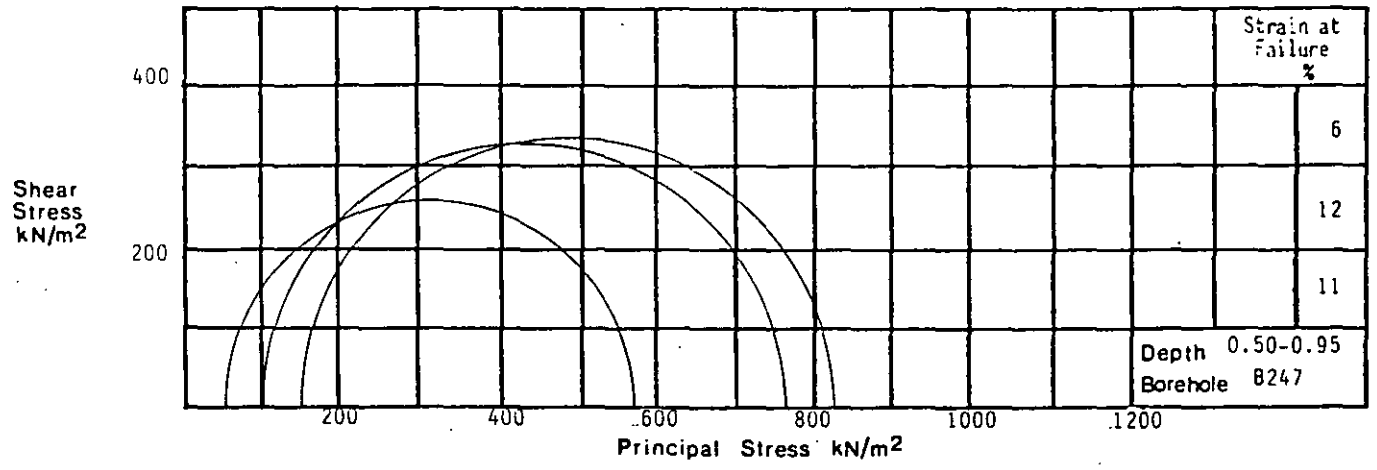


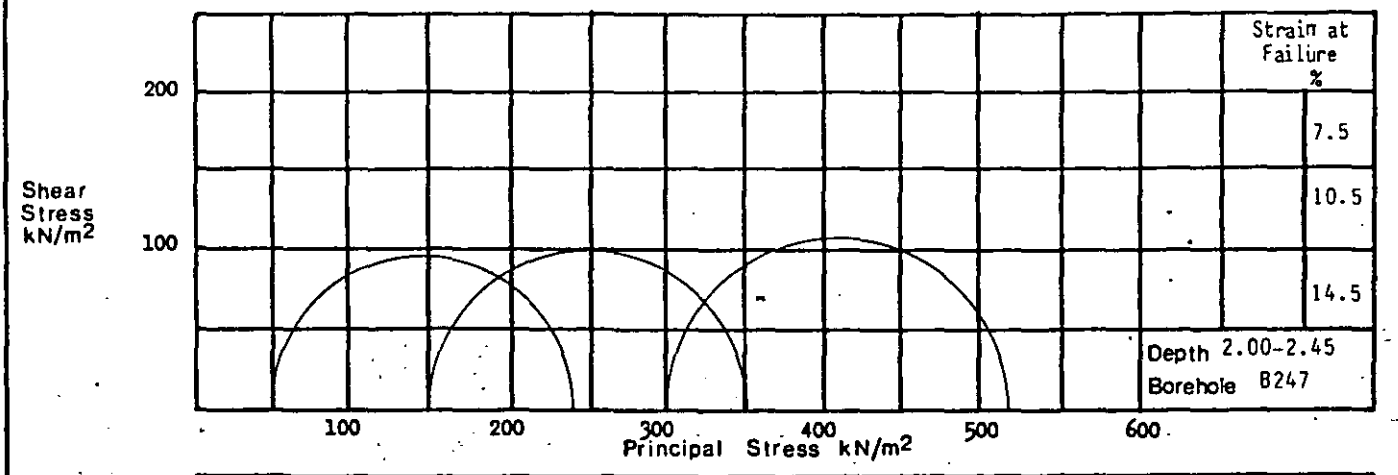


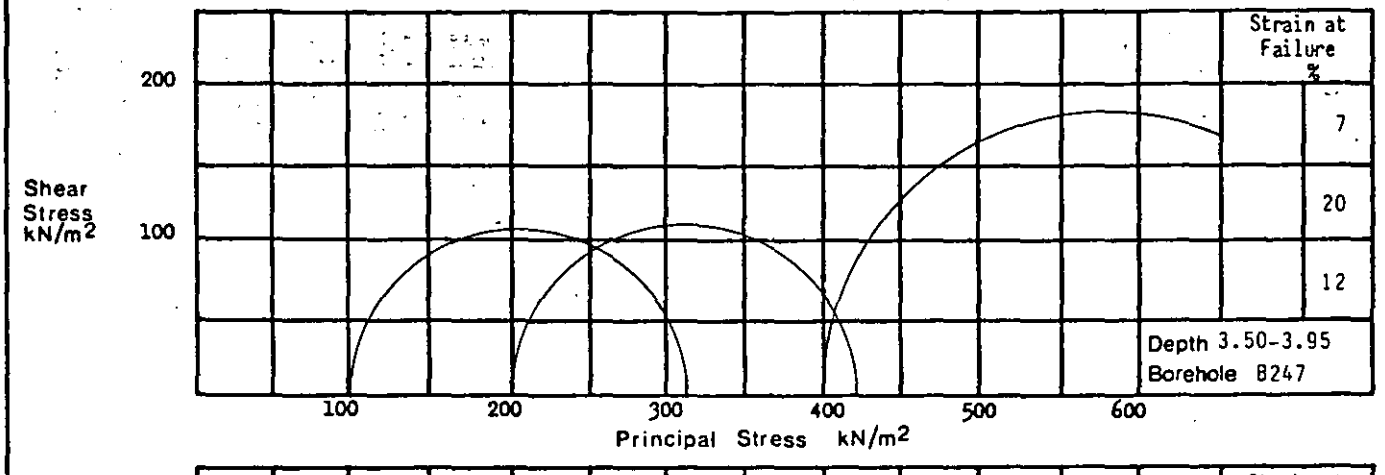
Undrained Triaxial Compression - Rate of Strain 2%.

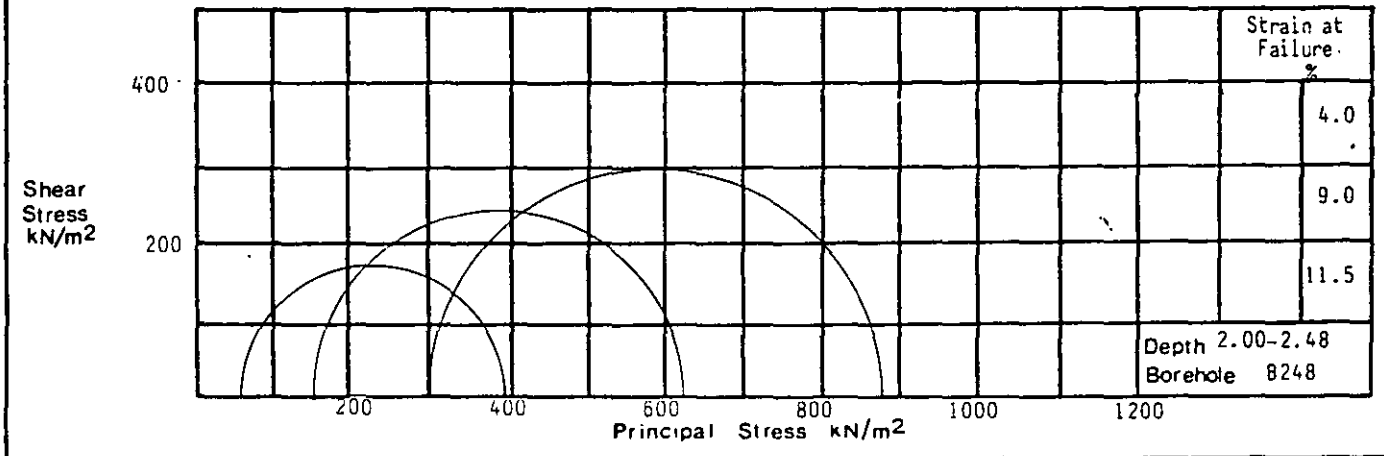
Remarks

Laboratory – Mohr's Circles	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.139





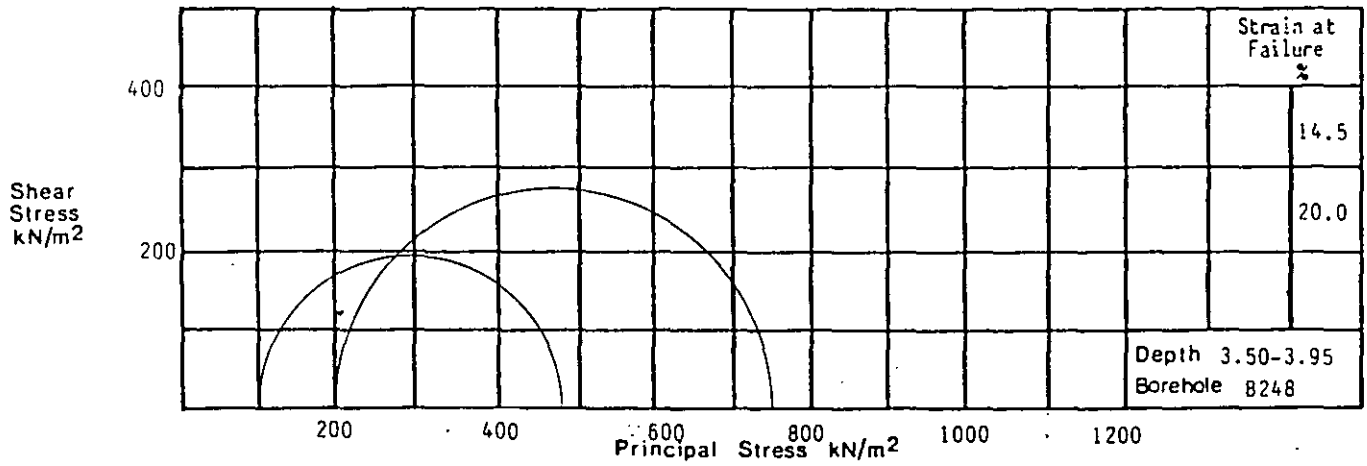


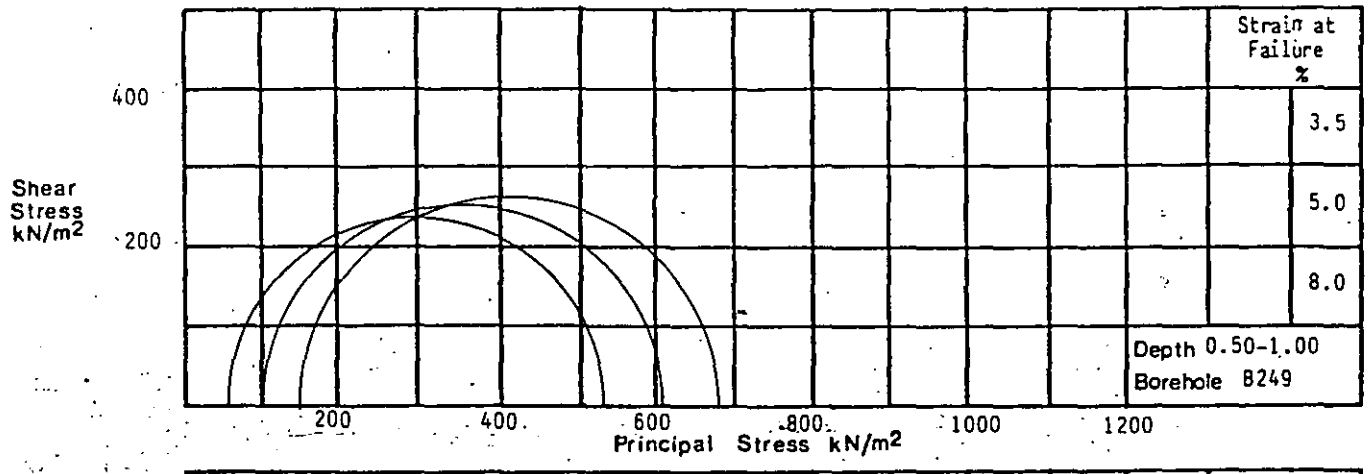


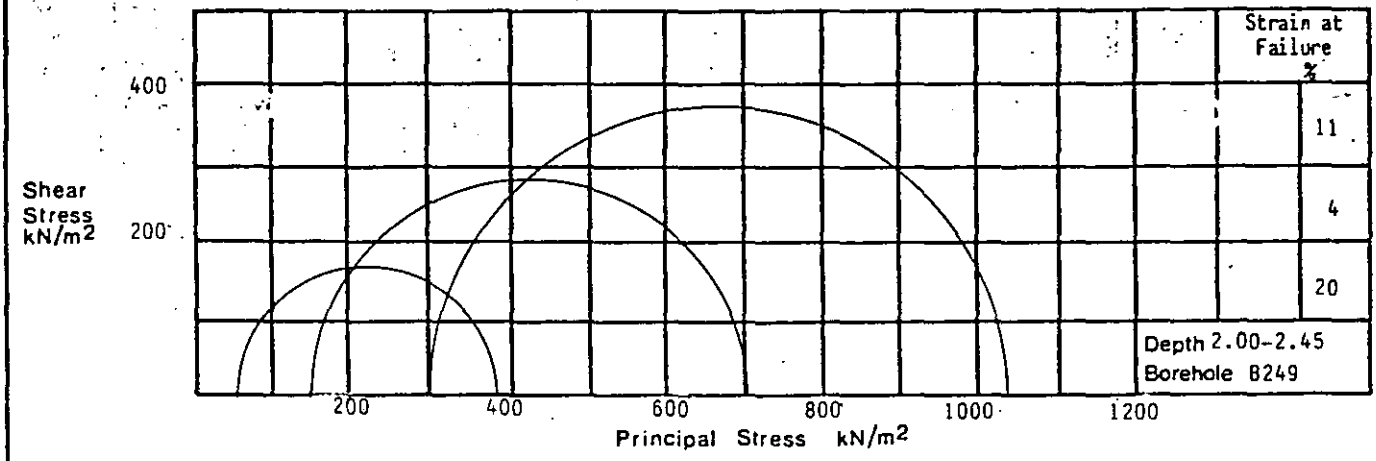
Undrained Triaxial Compression - Rate of Strain 2%.

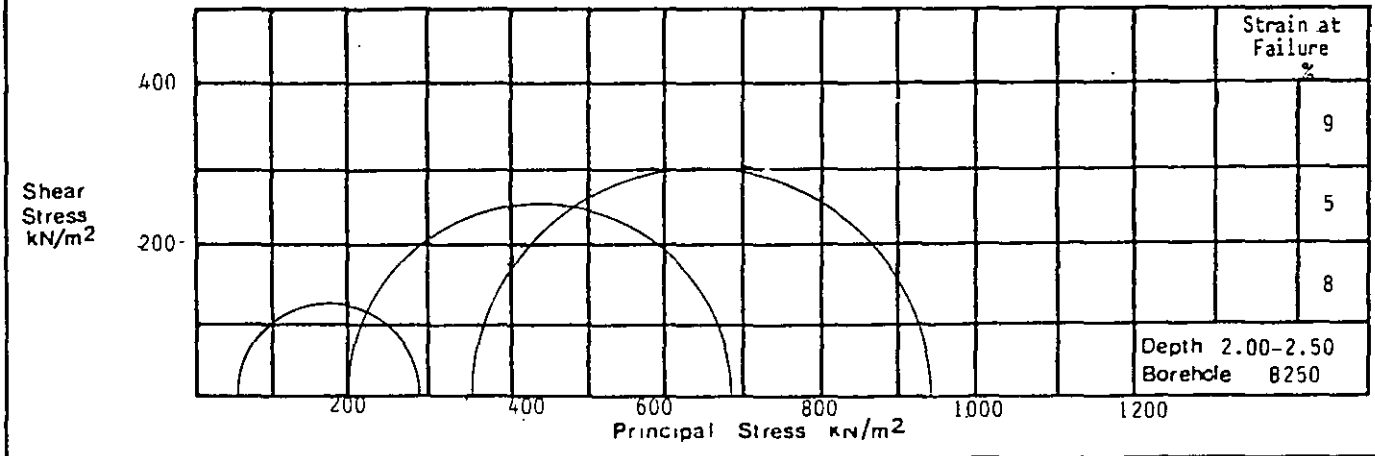
Remarks

Laboratory – Mohr's Circles	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.140





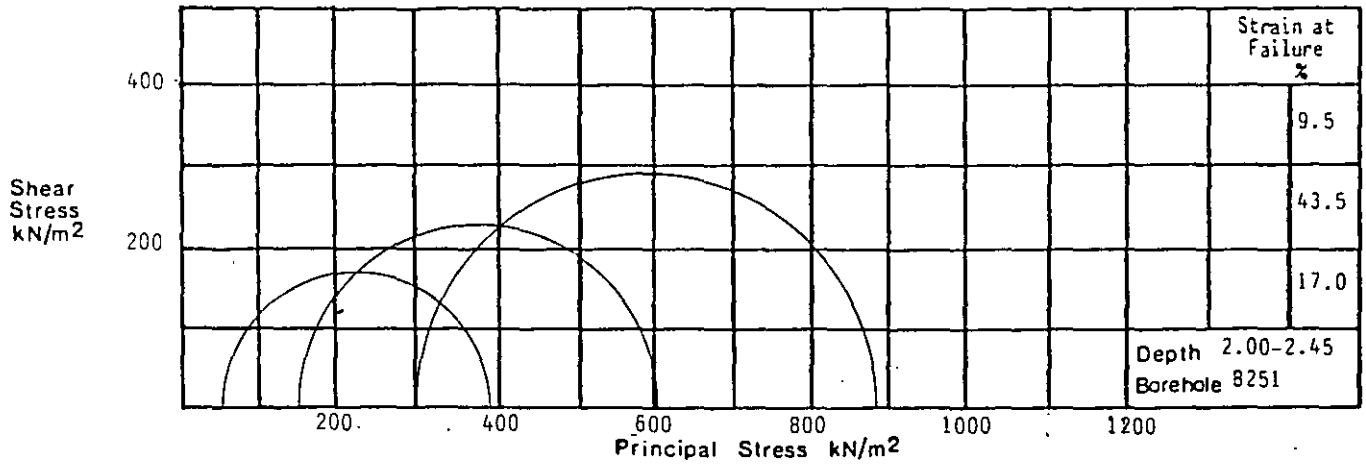


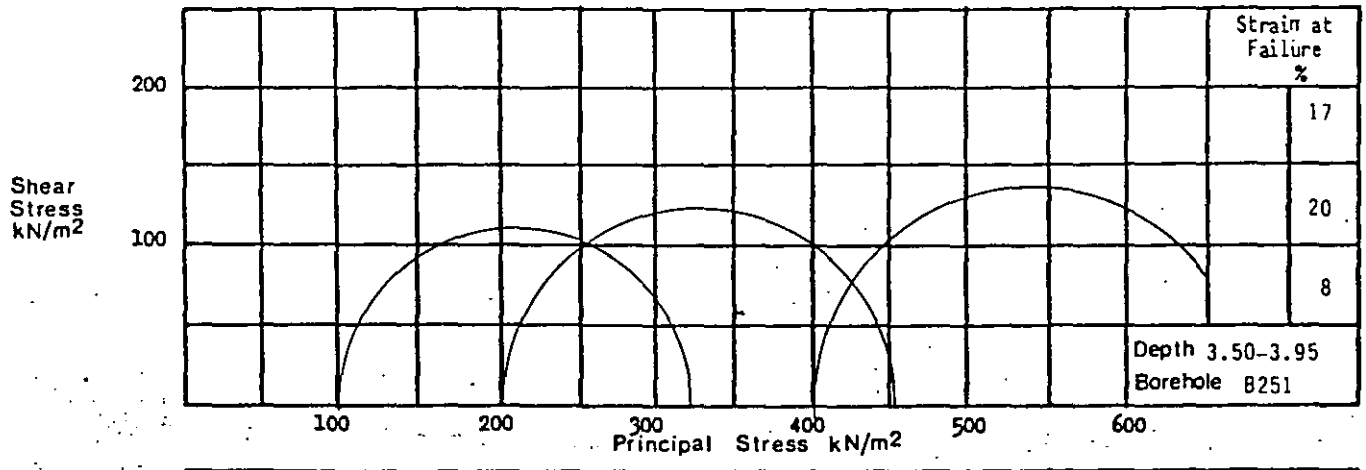


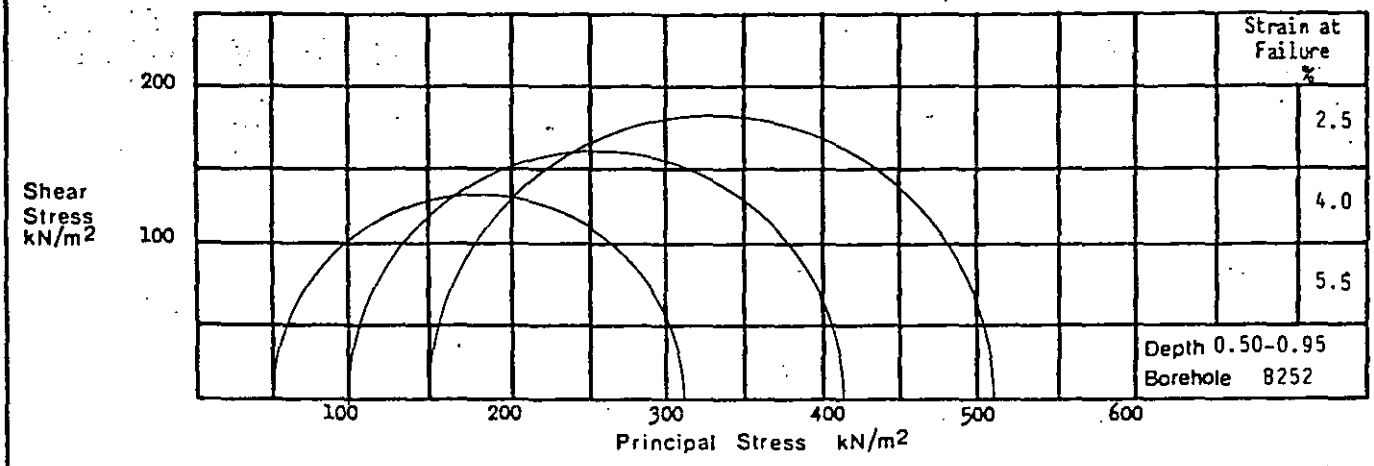
Undrained Triaxial Compression - Rate of Strain 2%.

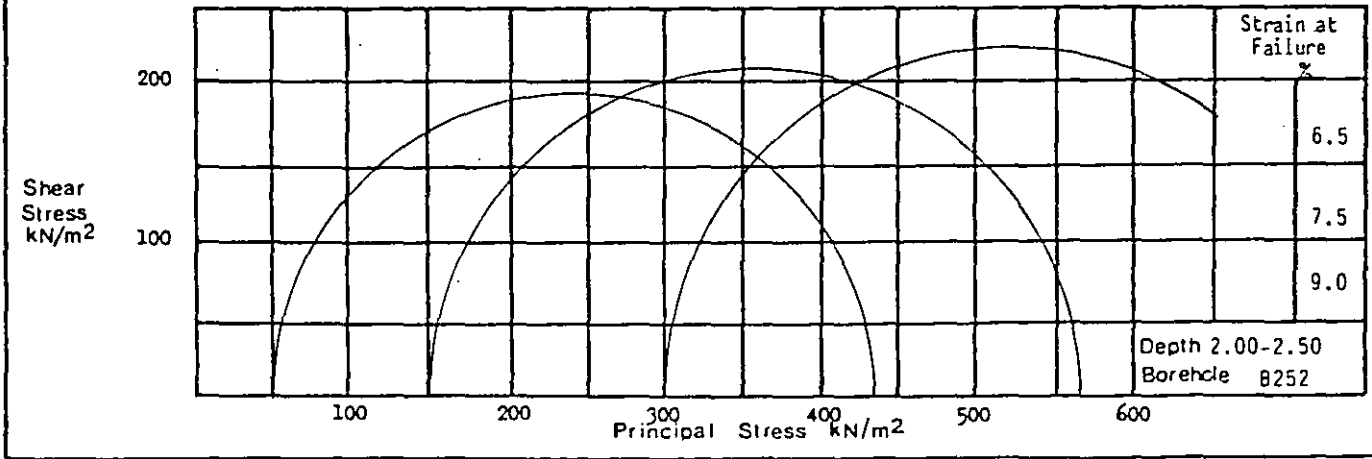
Remarks

Laboratory – Mohr's Circles	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.141





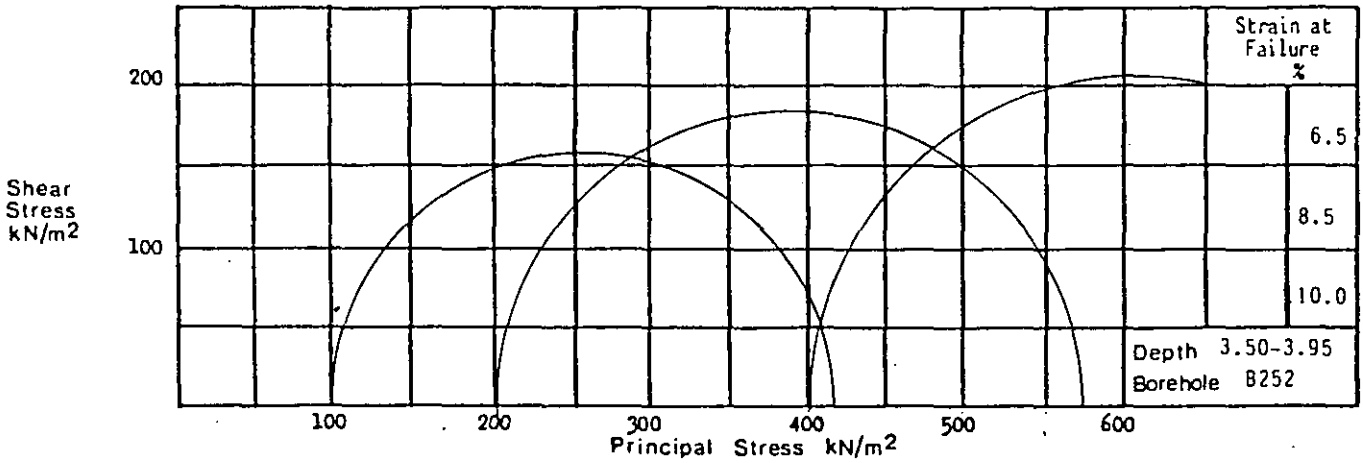


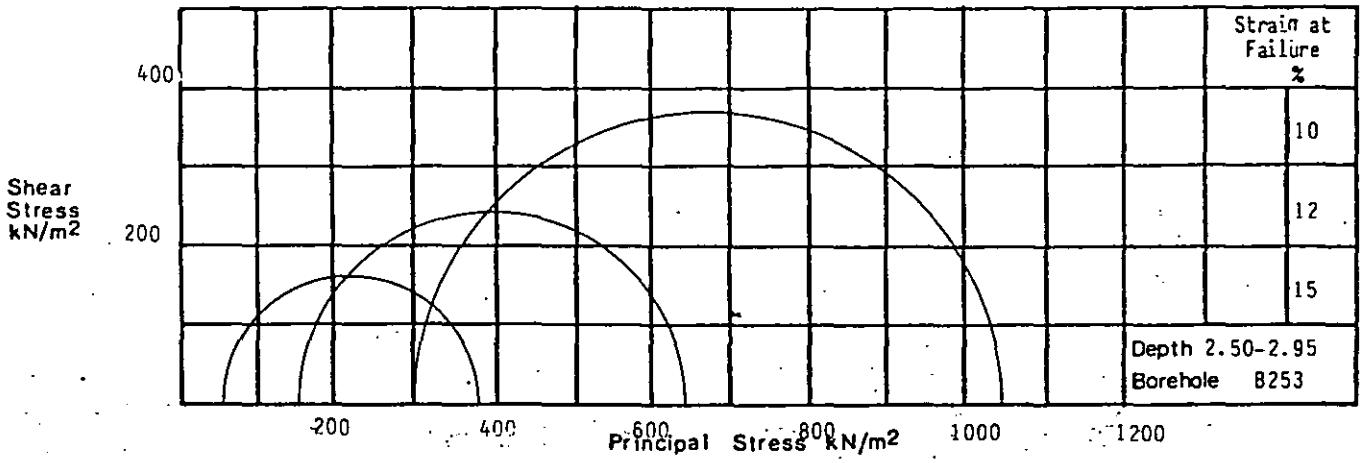


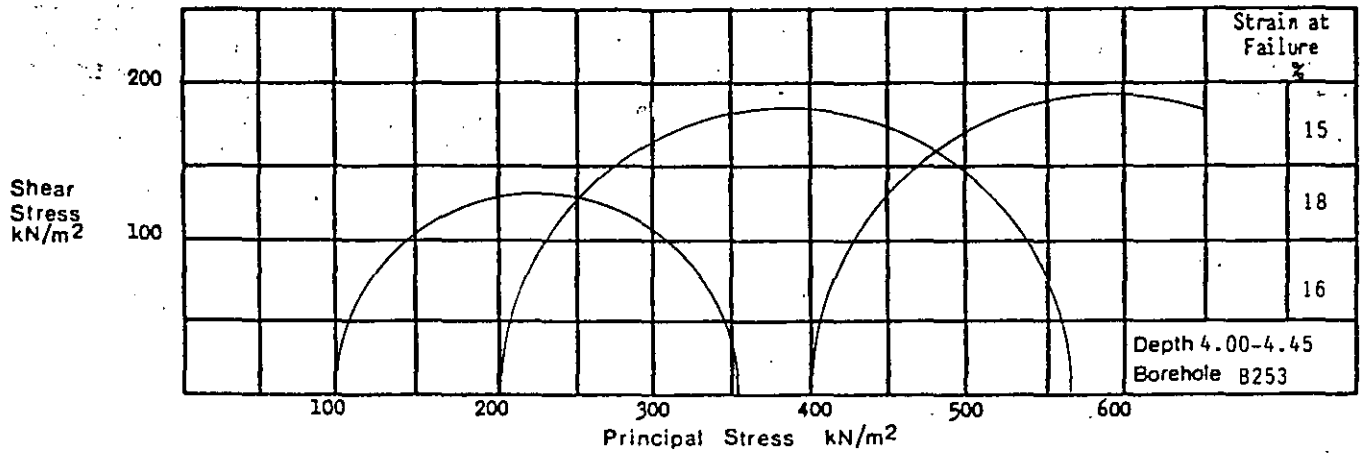
Undrained Triaxial Compression - Rate of Strain 2%.

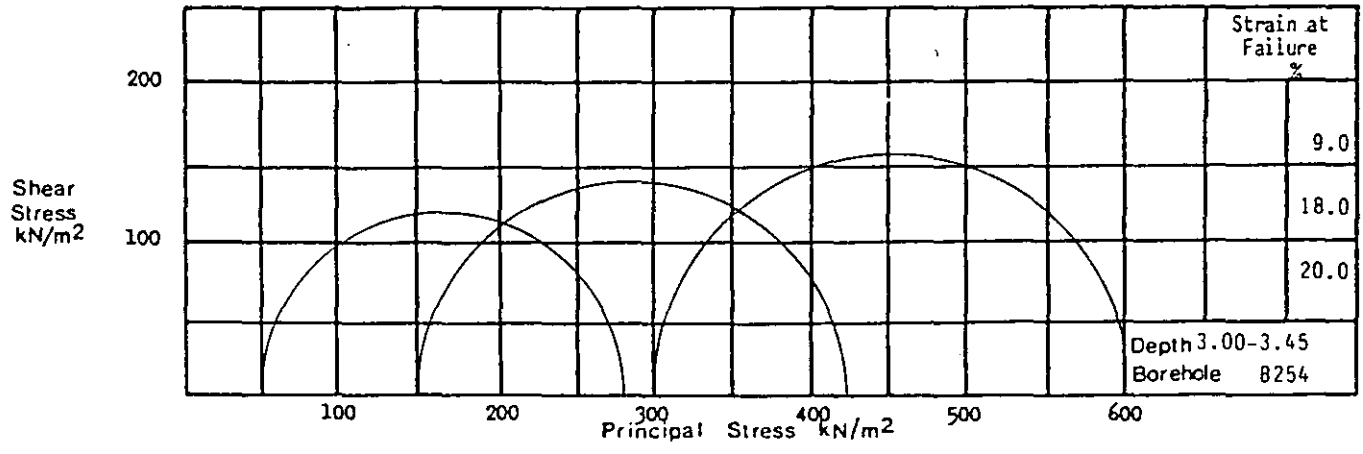
Remarks

Laboratory – Mohr's Circles	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.142





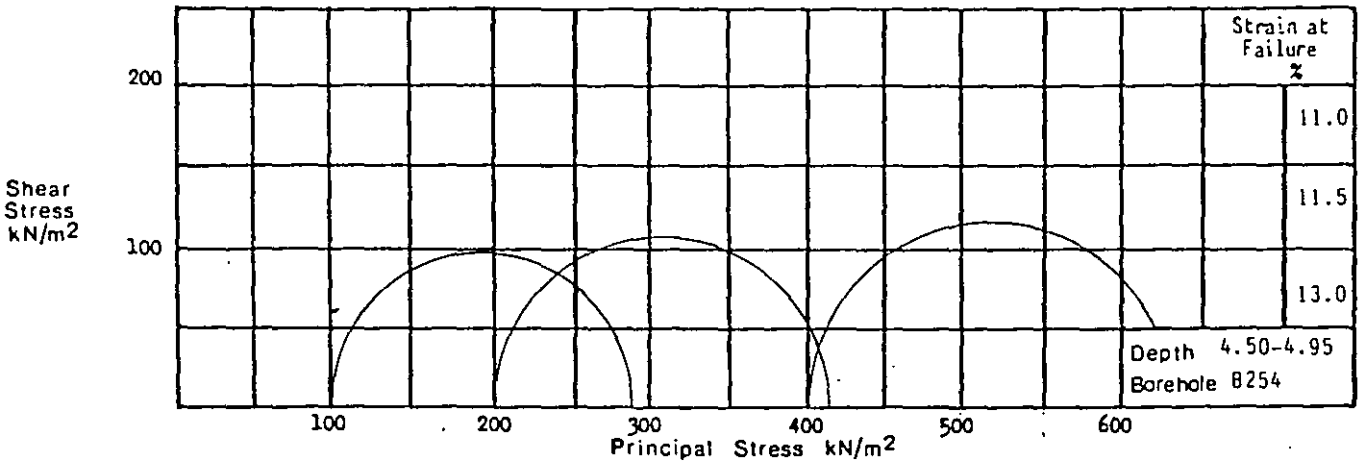


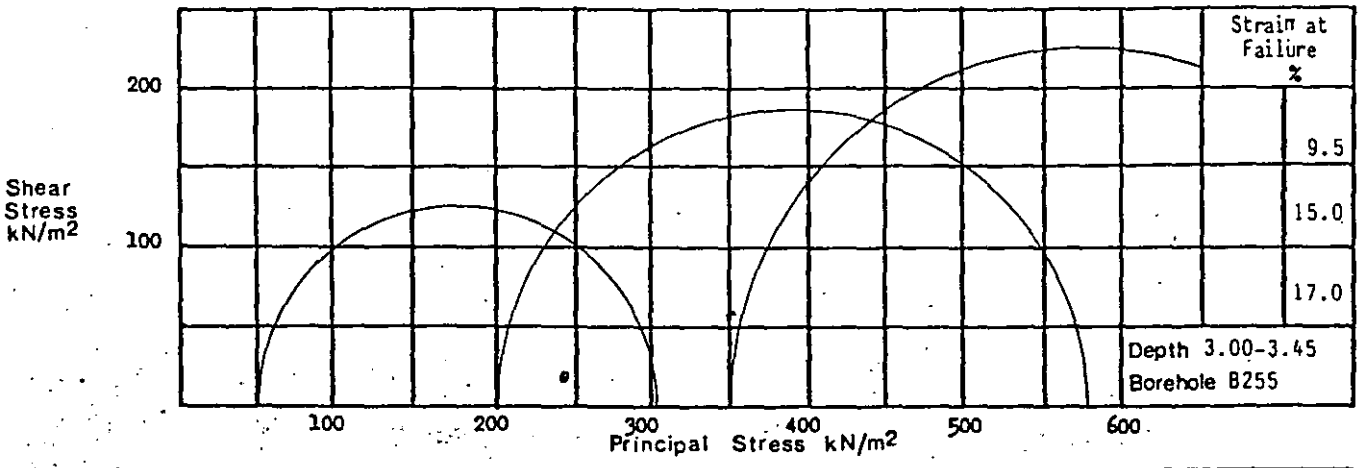


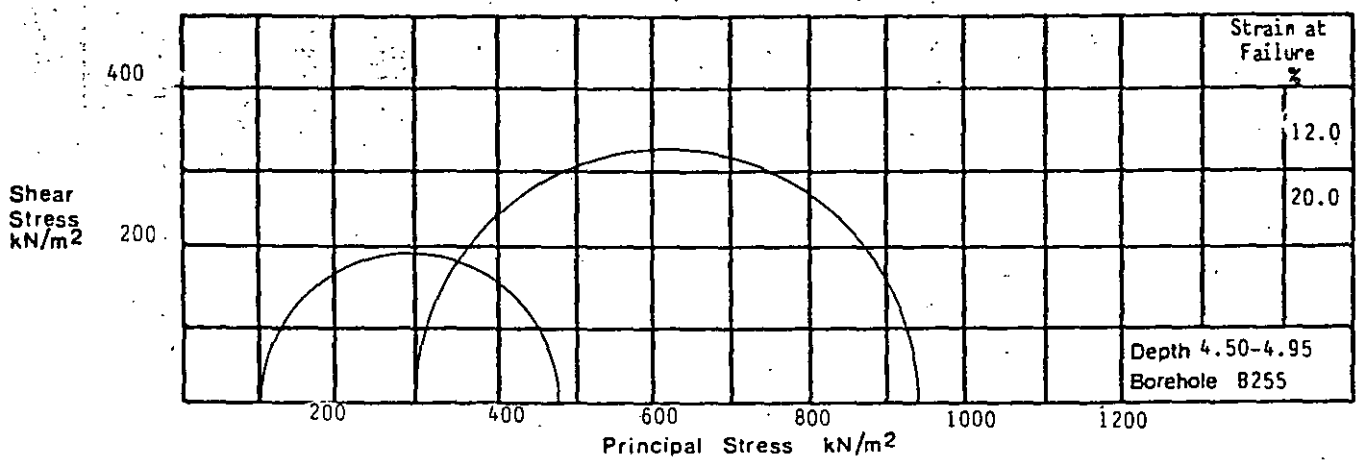
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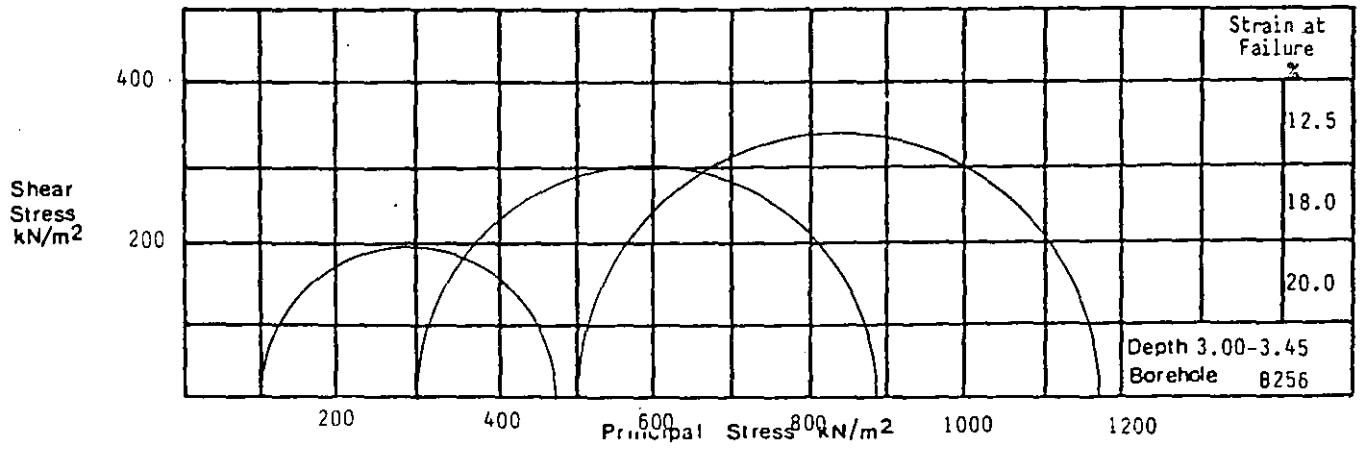
Remarks

Laboratory – Mohr's Circles	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.143





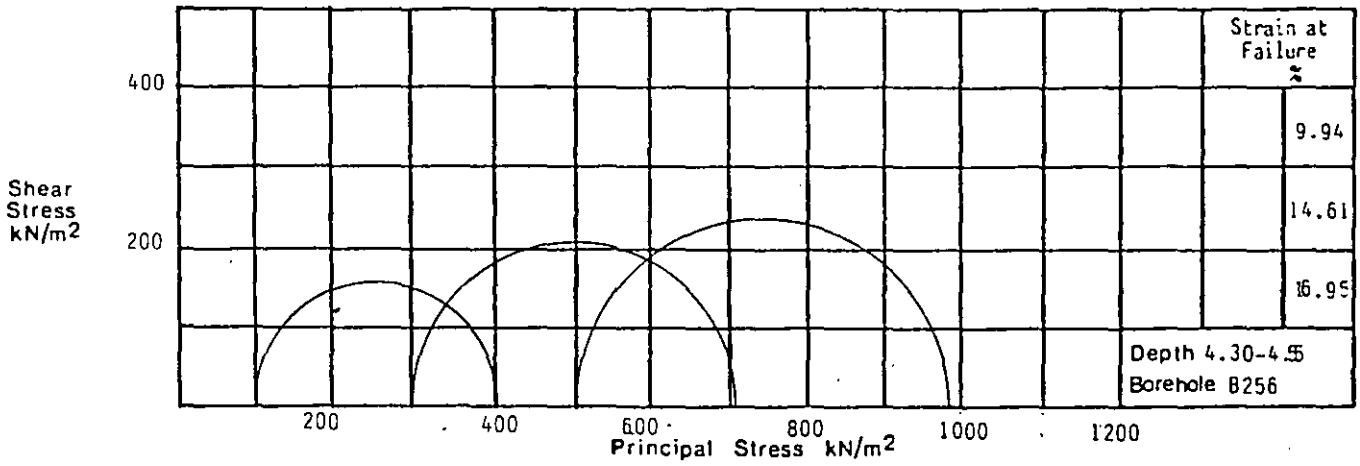


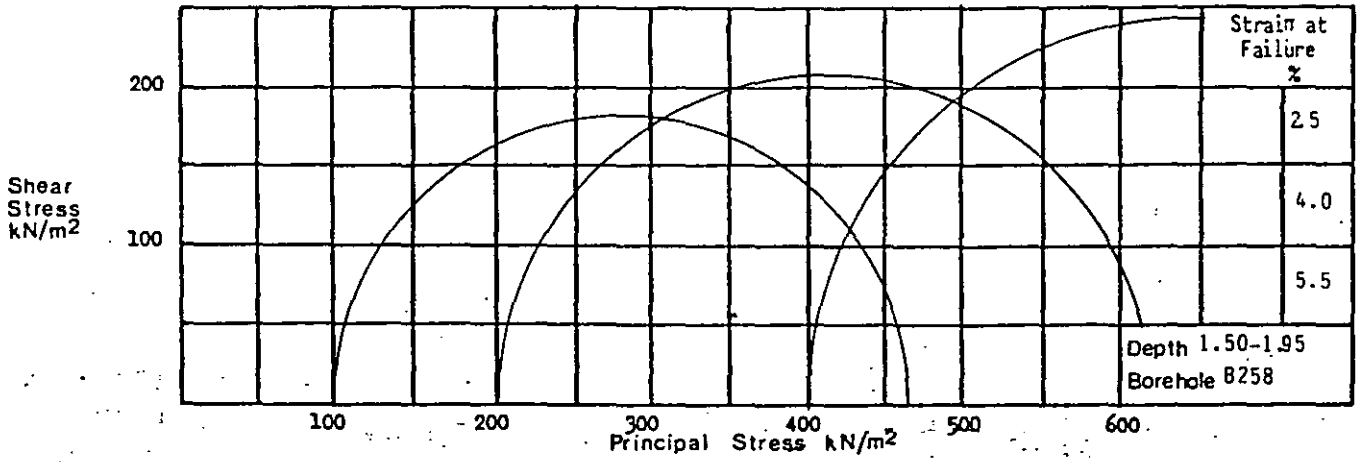


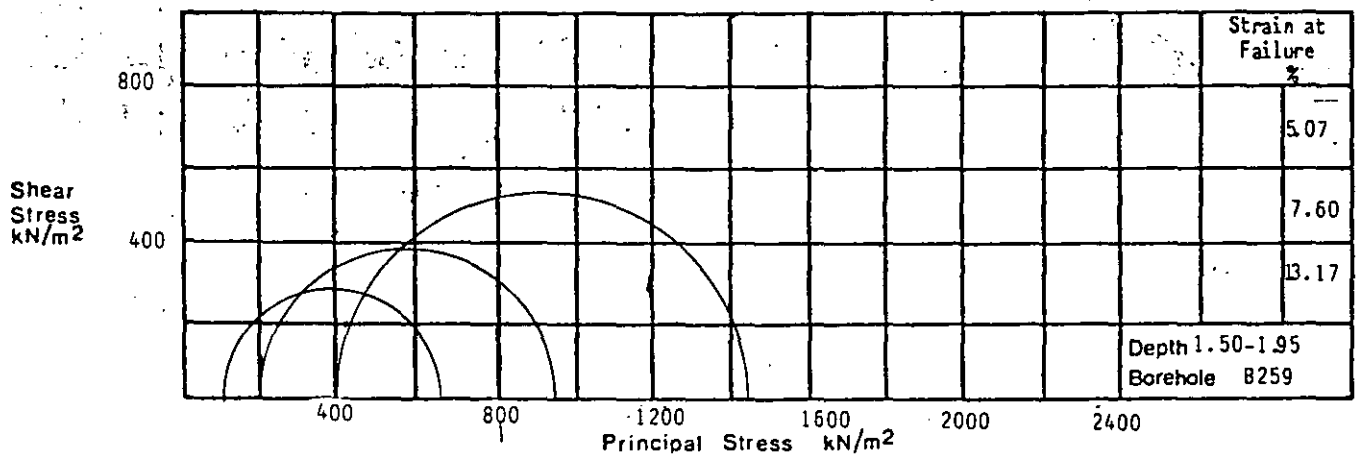
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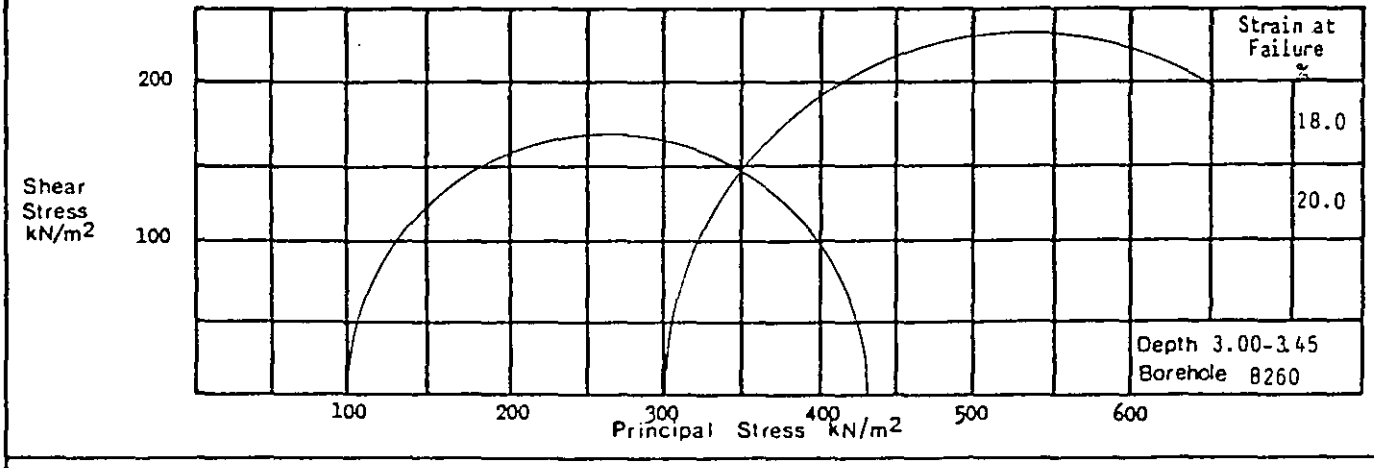
Remarks

Laboratory – Mohr's Circles	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.144









Undrained Triaxial Compression – Rate of Strain 2%.

Remarks

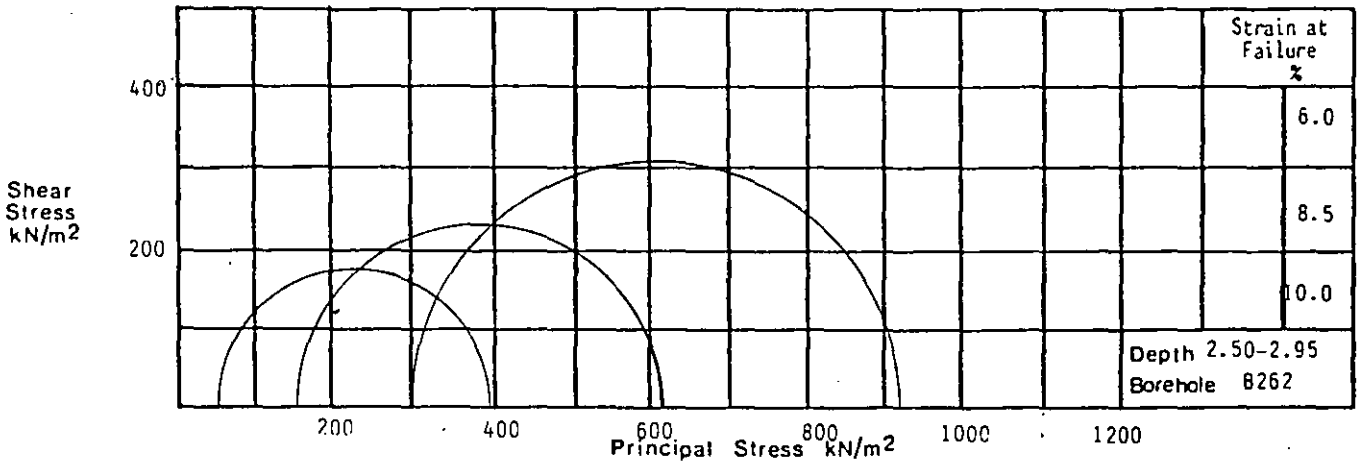
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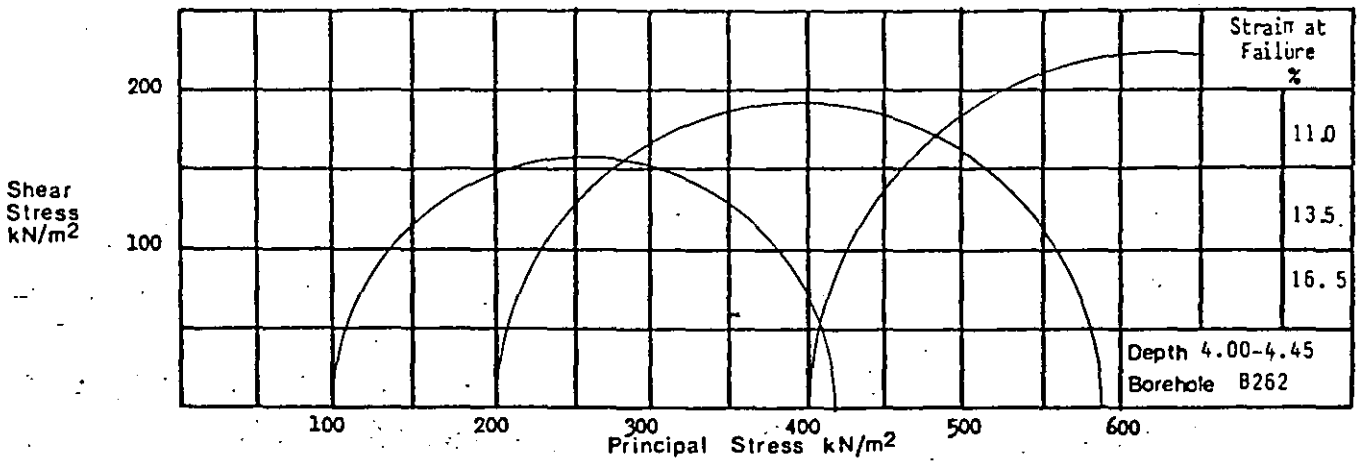
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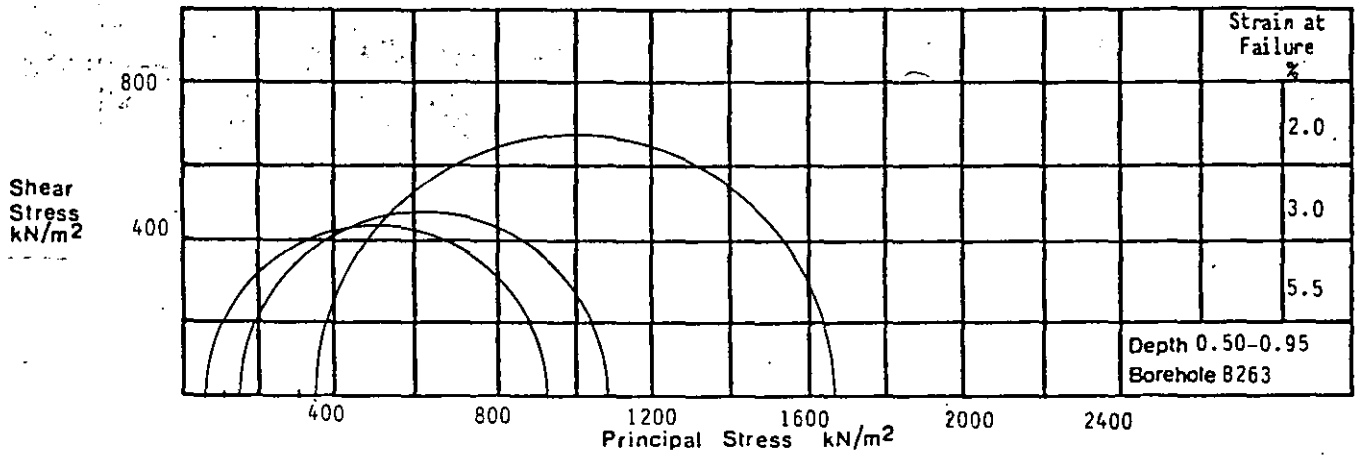
Project Department of Transport
East Midlands Regional Office
A42 Castle Donington North
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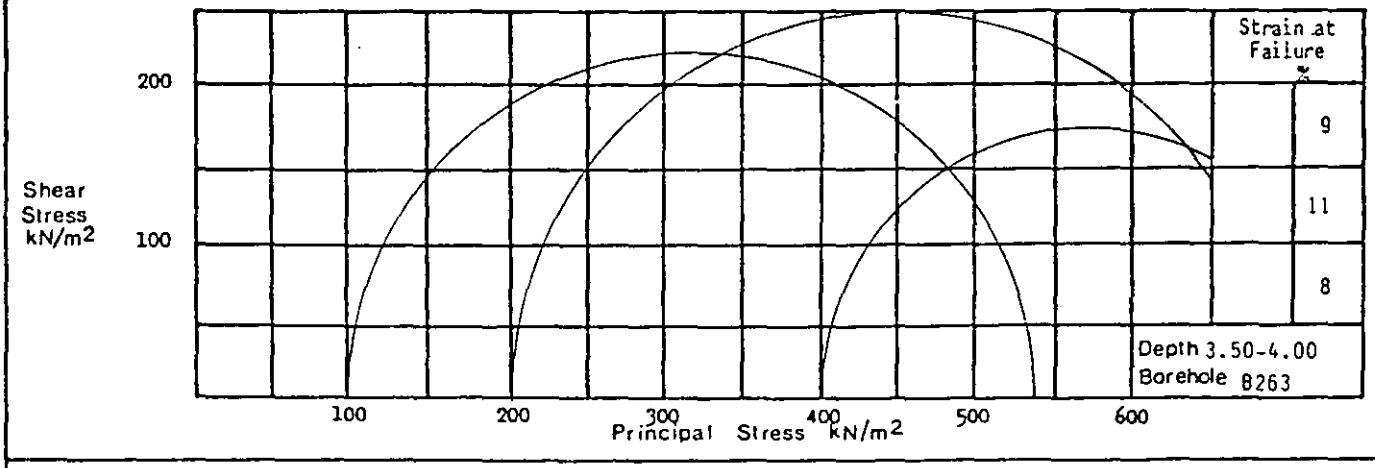
Contract S4449

Figure 2.145





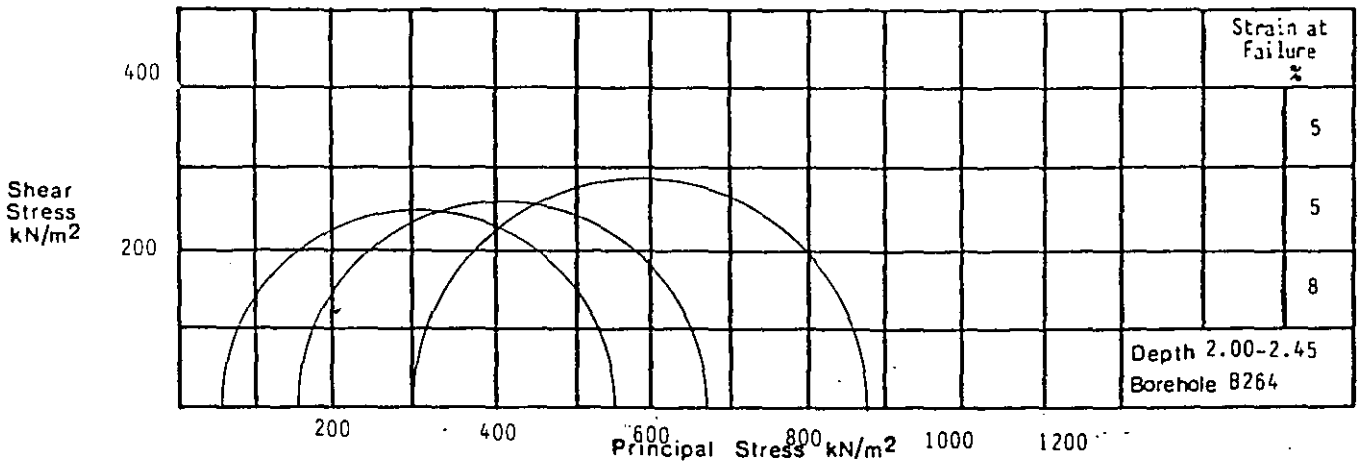


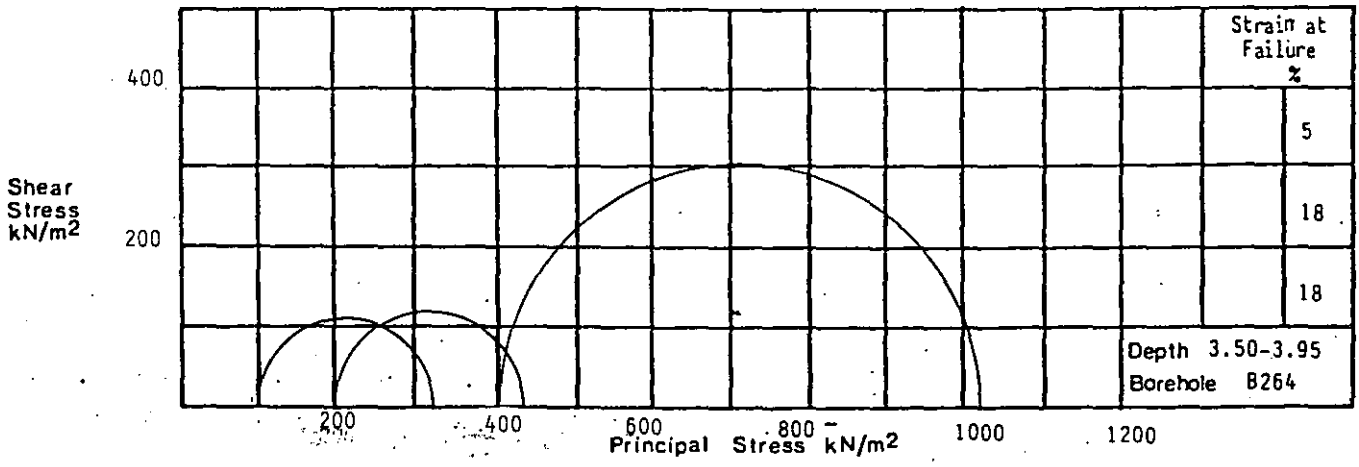


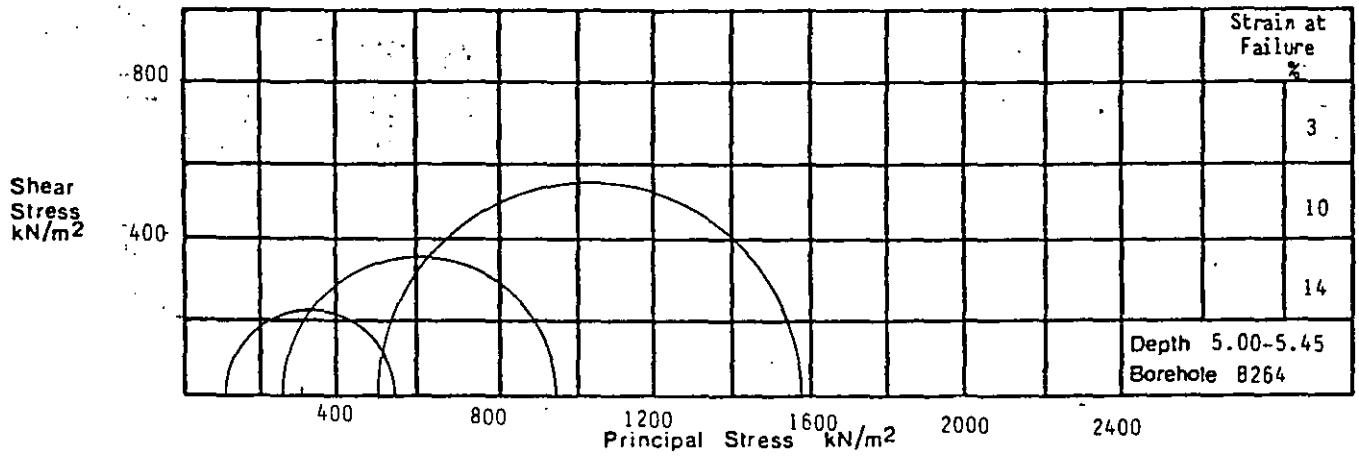
Undrained Triaxial Compression - Rate of Strain 2%.

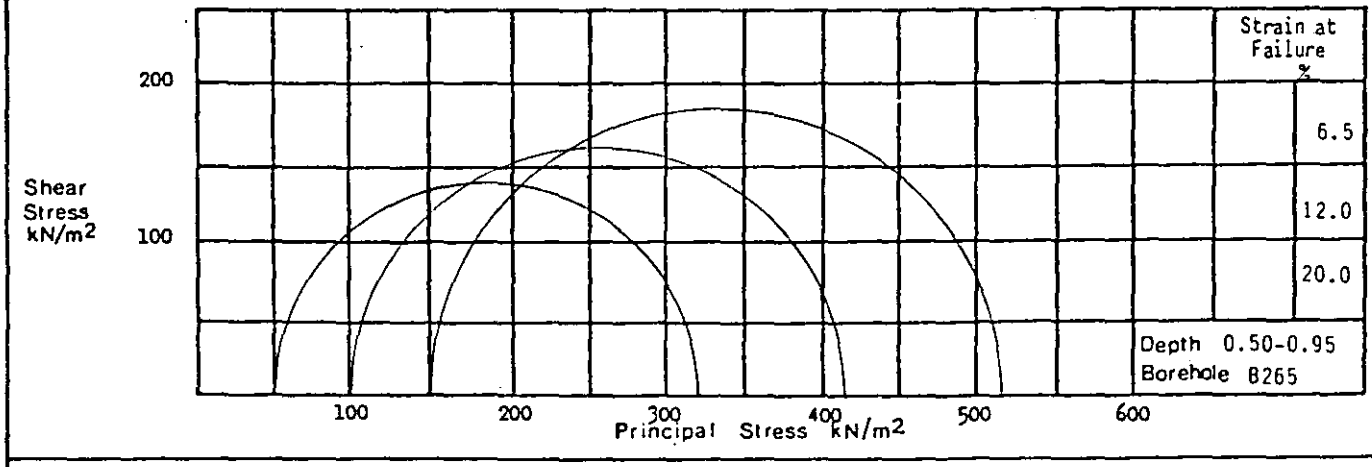
Remarks

Laboratory – Mohr's Circles	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.146





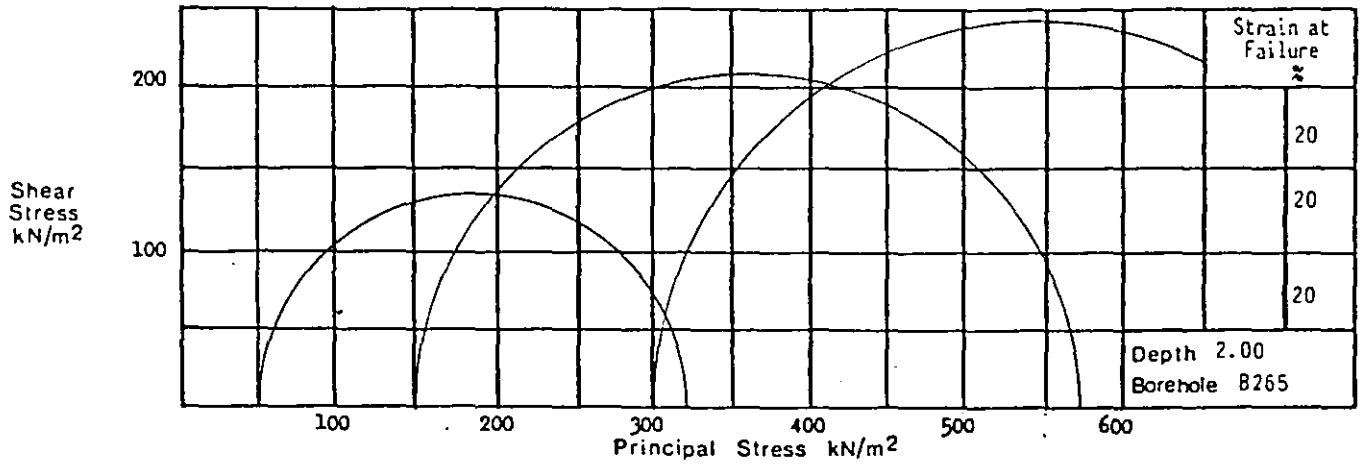


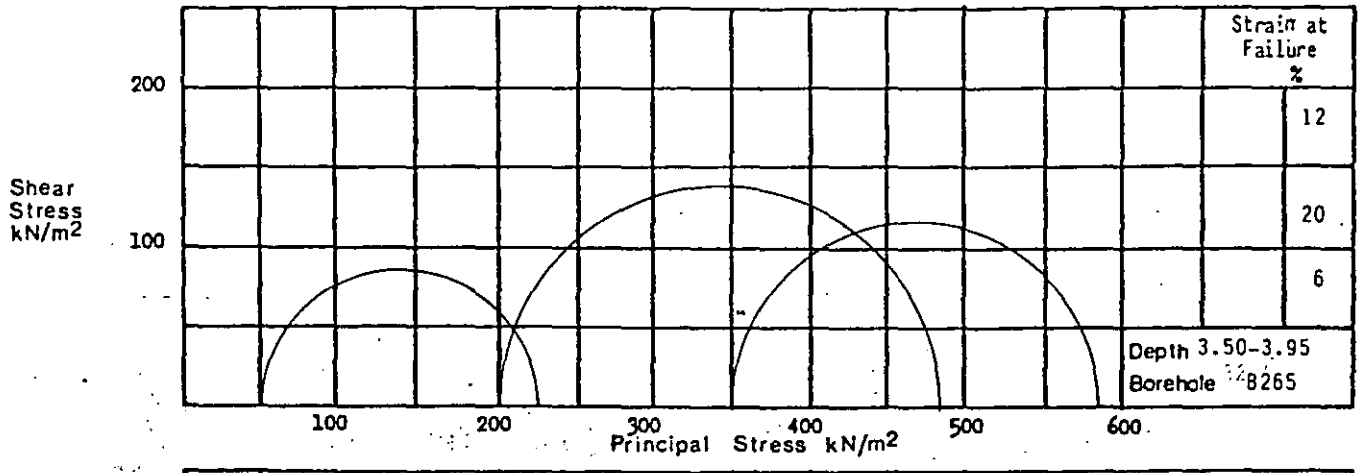


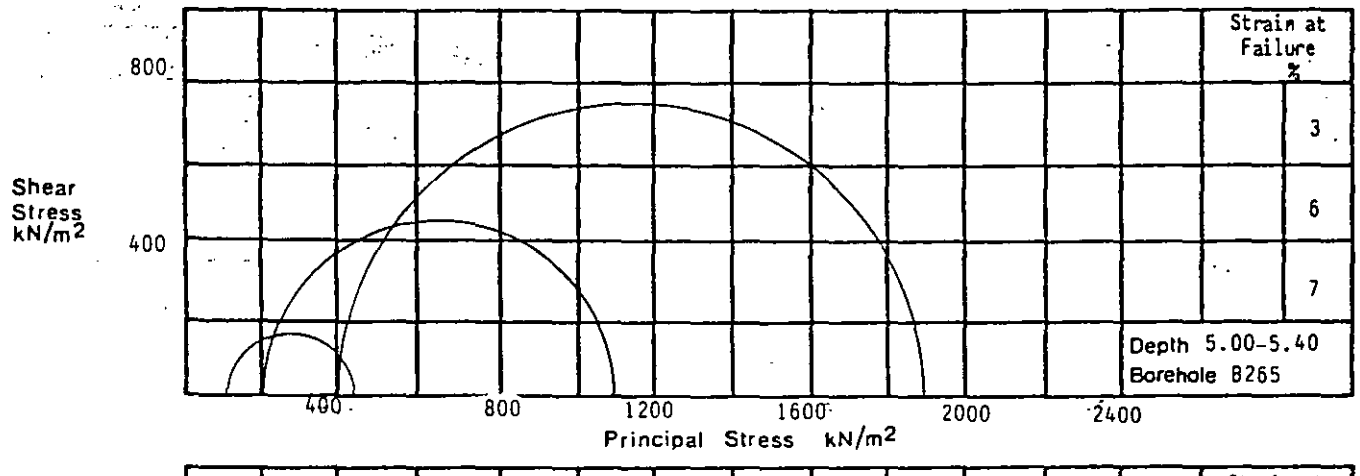
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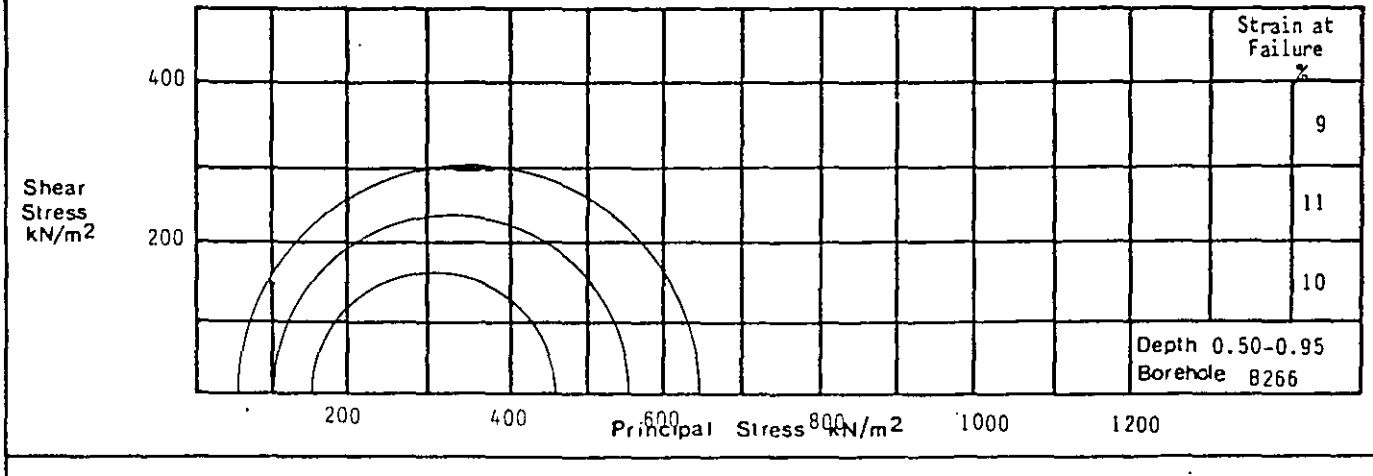
Remarks

Laboratory – Mohr's Circles	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.147





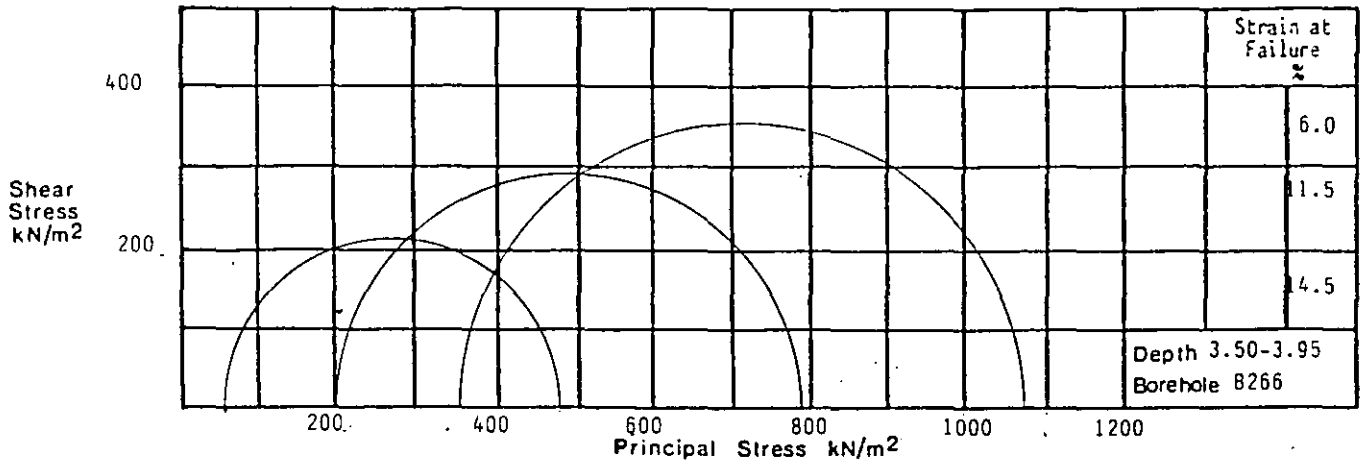


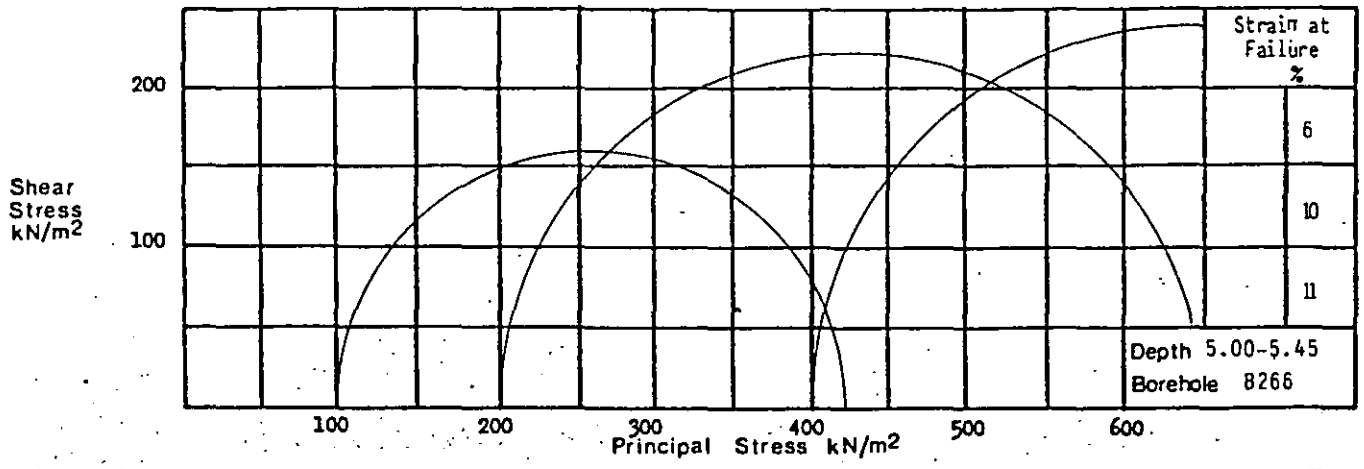


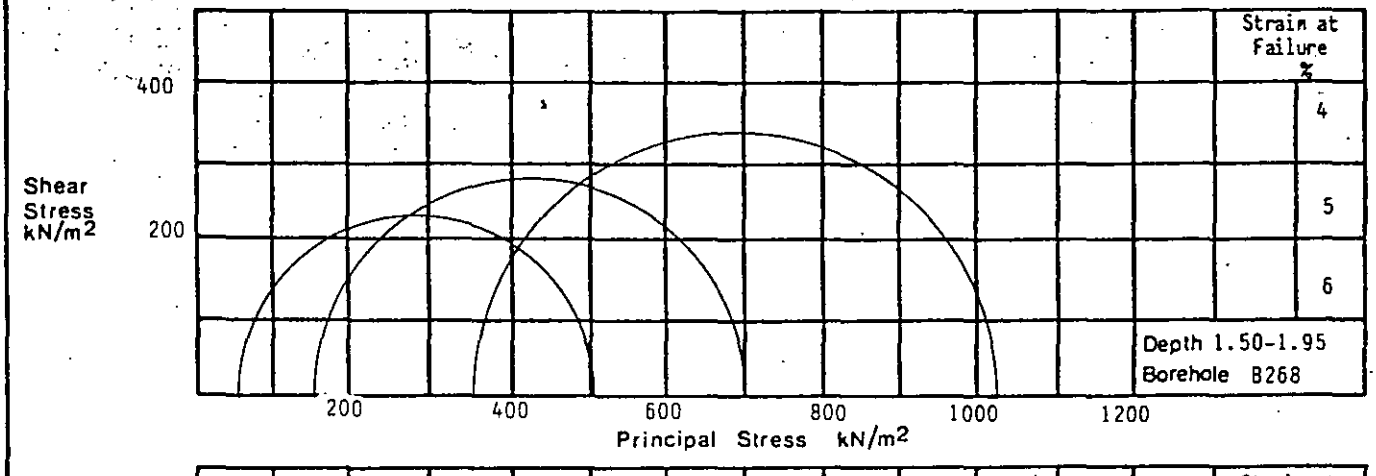
Undrained Triaxial Compression - Rate of Strain 2%.

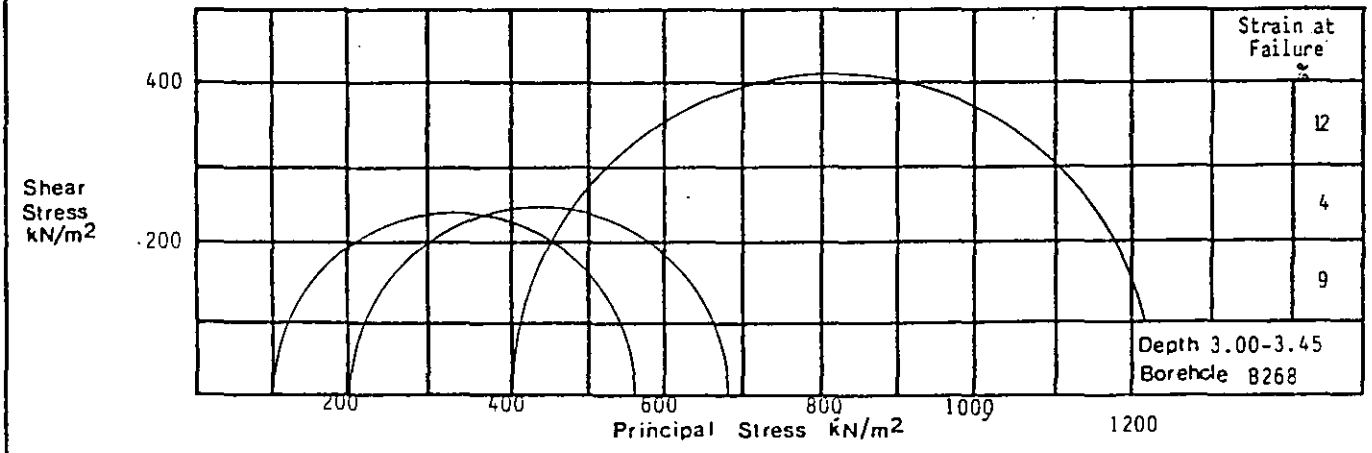
Remarks

Laboratory – Mohr's Circles	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.148





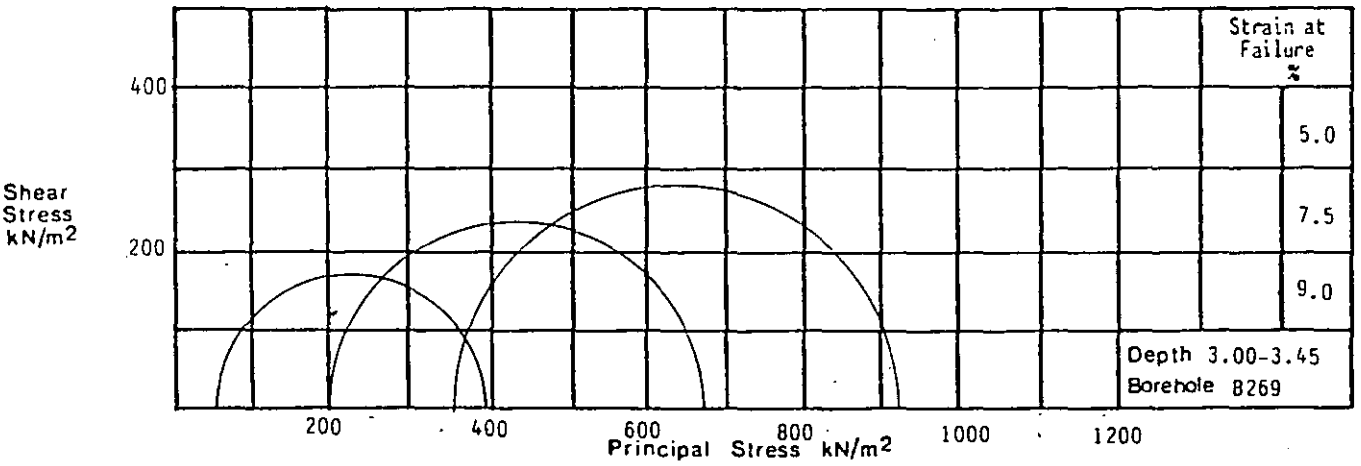


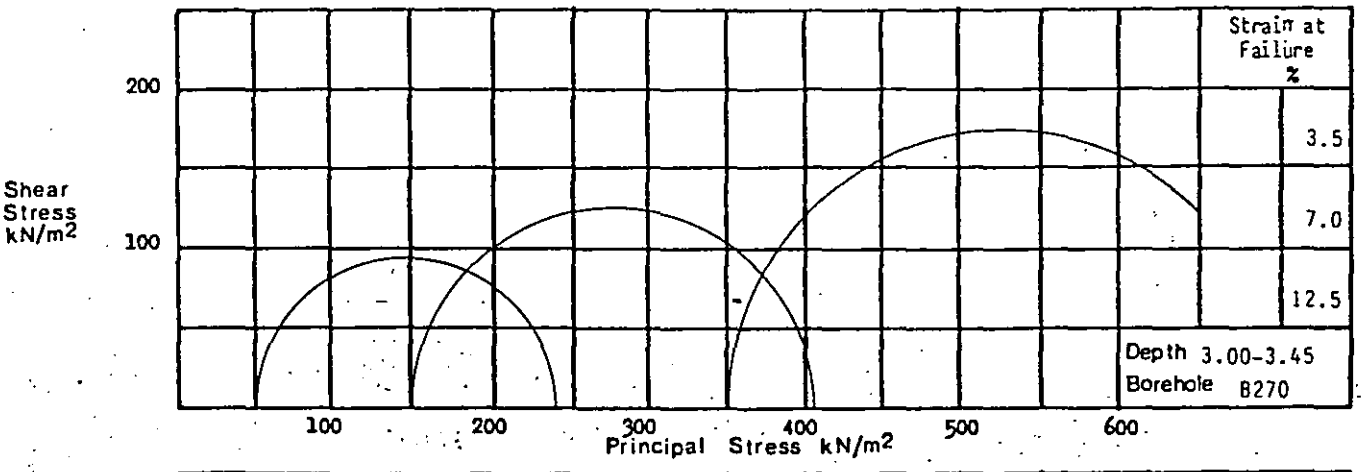


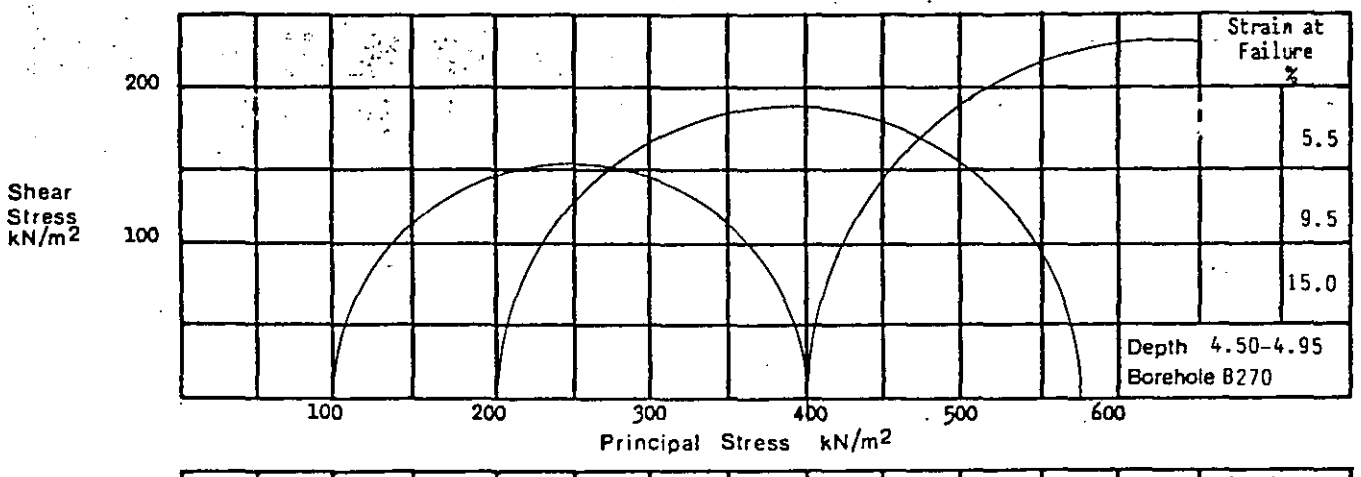
Undrained Triaxial Compression - Rate of Strain 2%.

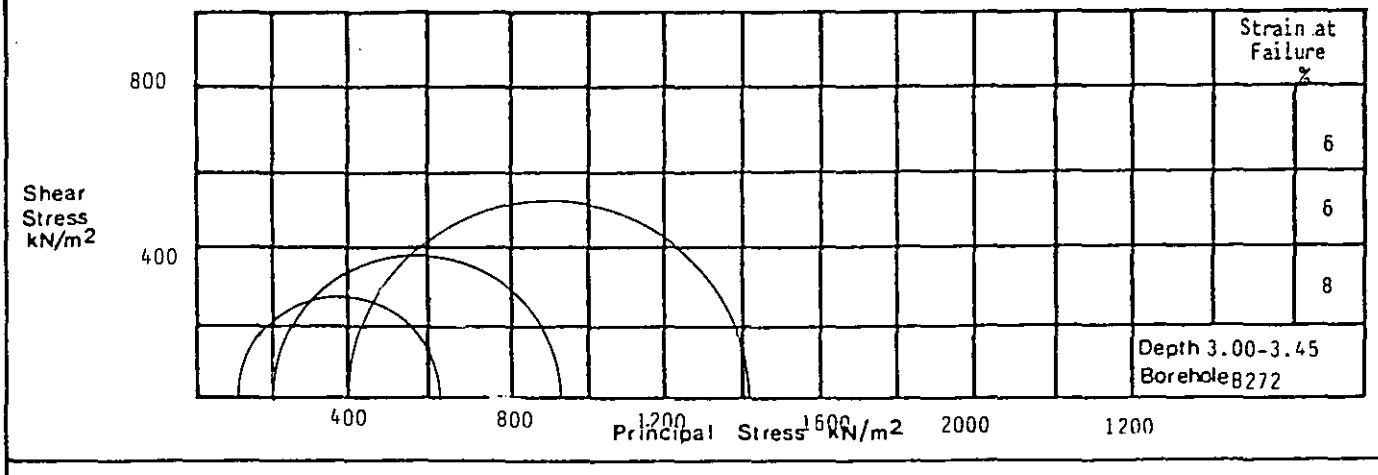
Remarks

Laboratory – Mohr's Circles	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.149









Undrained Triaxial Compression - Rate of Strain 2%.

Remarks

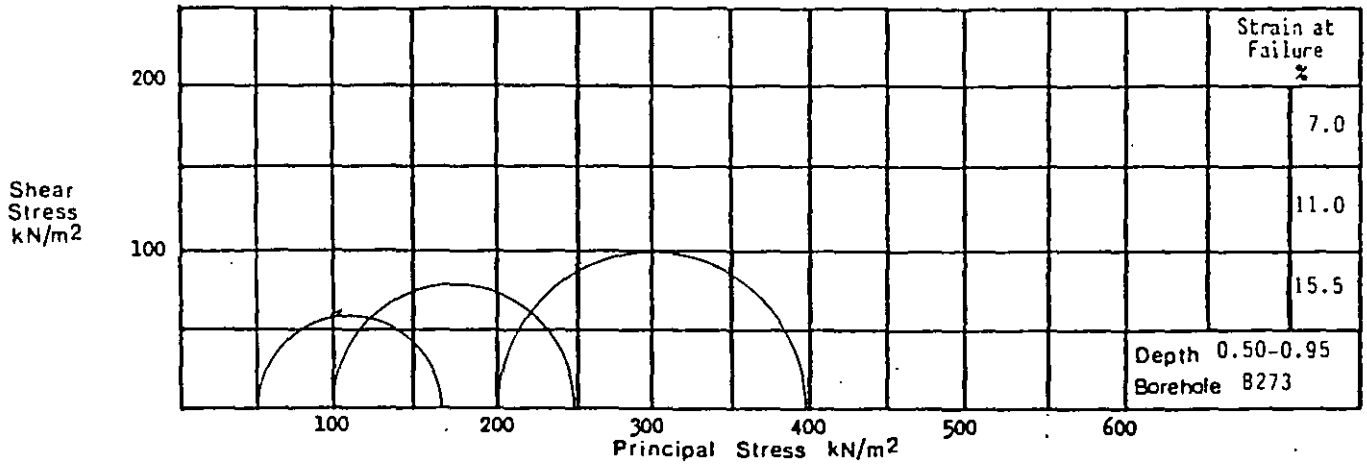
Laboratory – Mohr's Circles

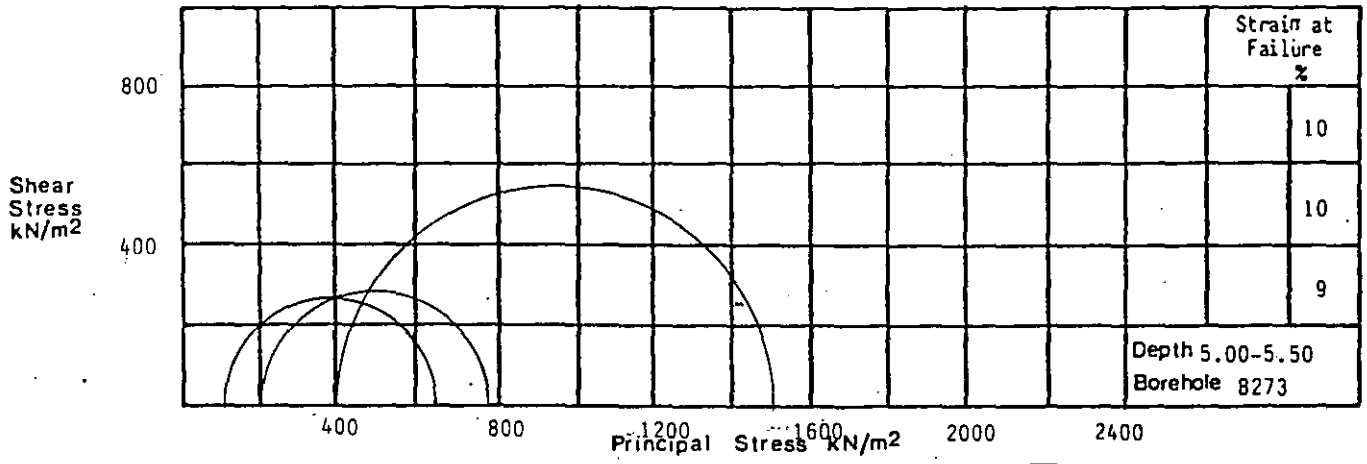
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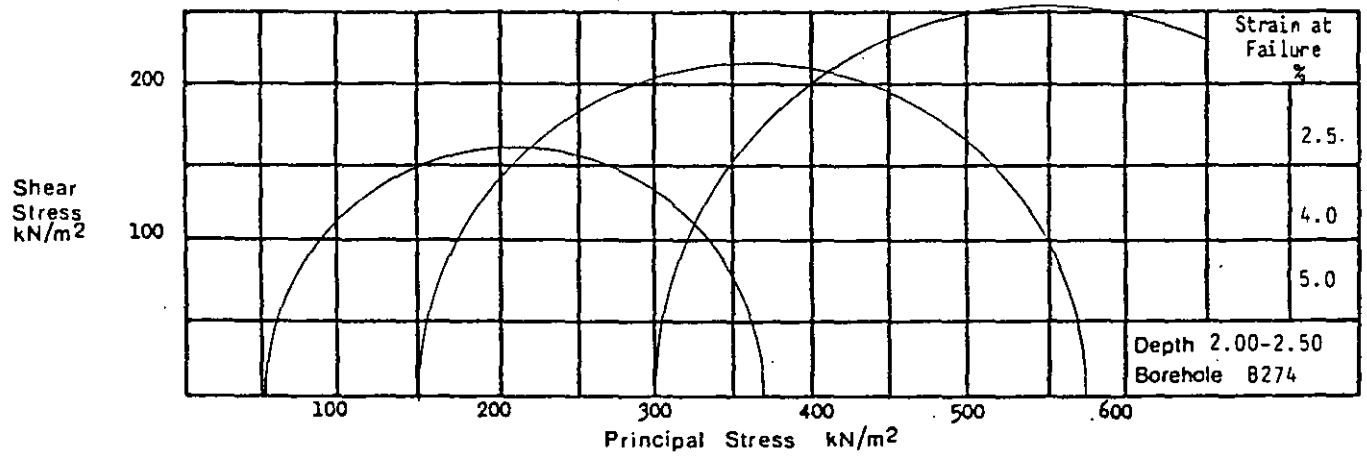
Project Department of Transport
East Midlands Regional Office
A42 Castle Donington North
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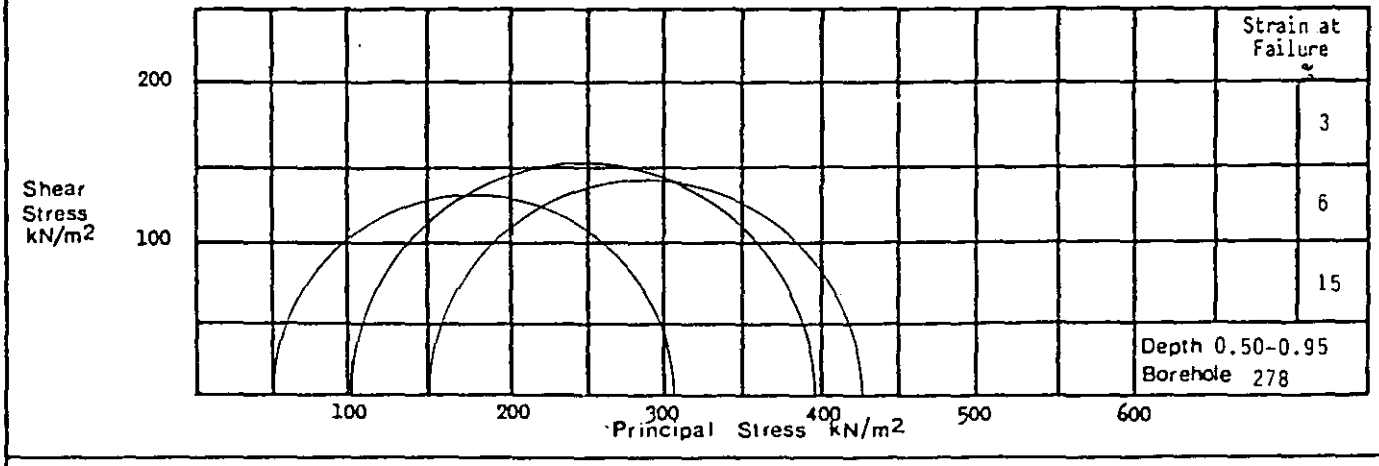
Contract S4449

Figure 2.150





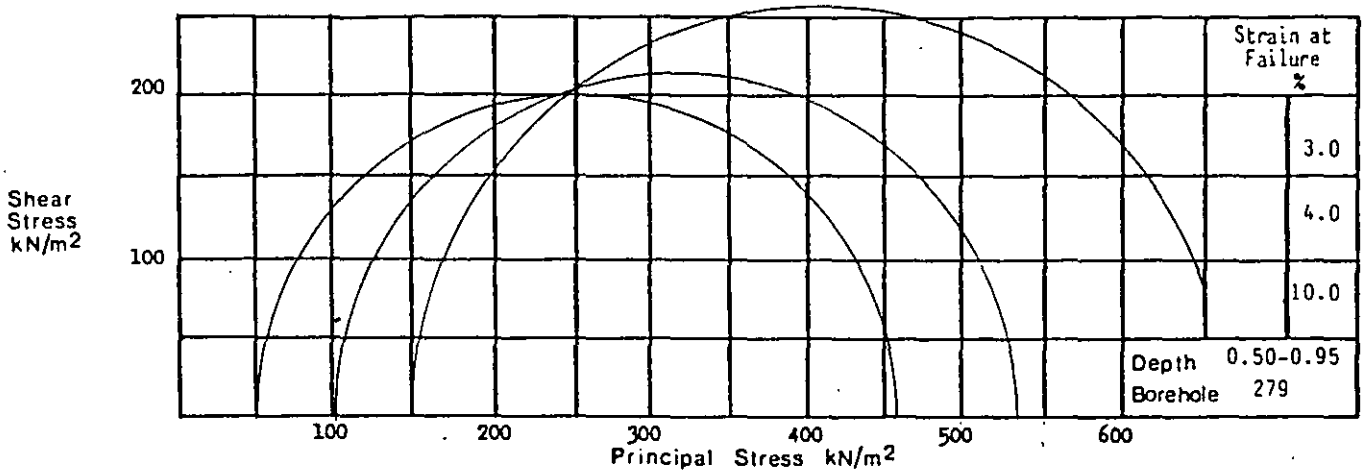


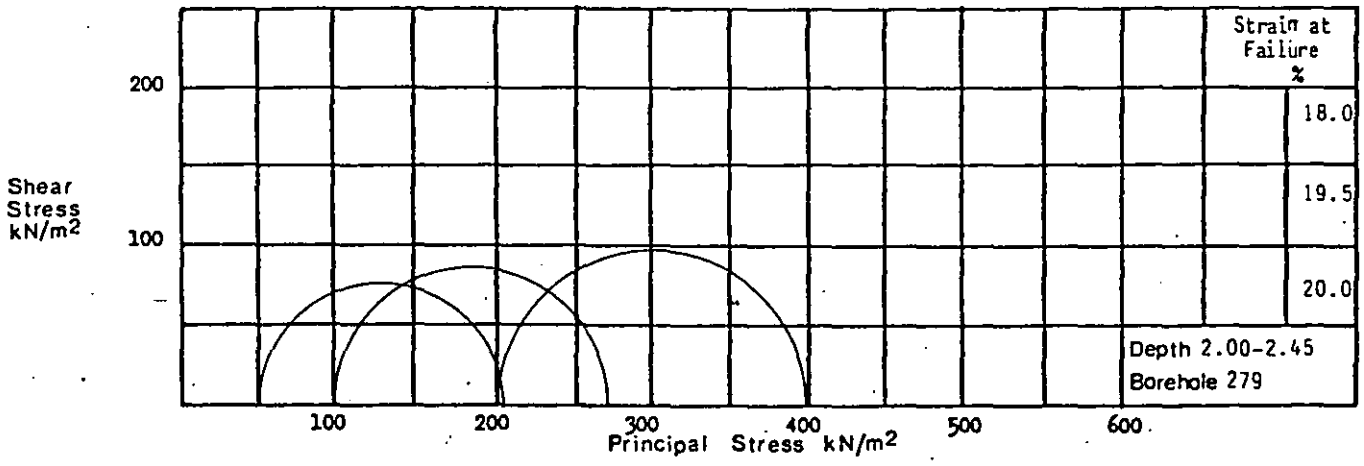


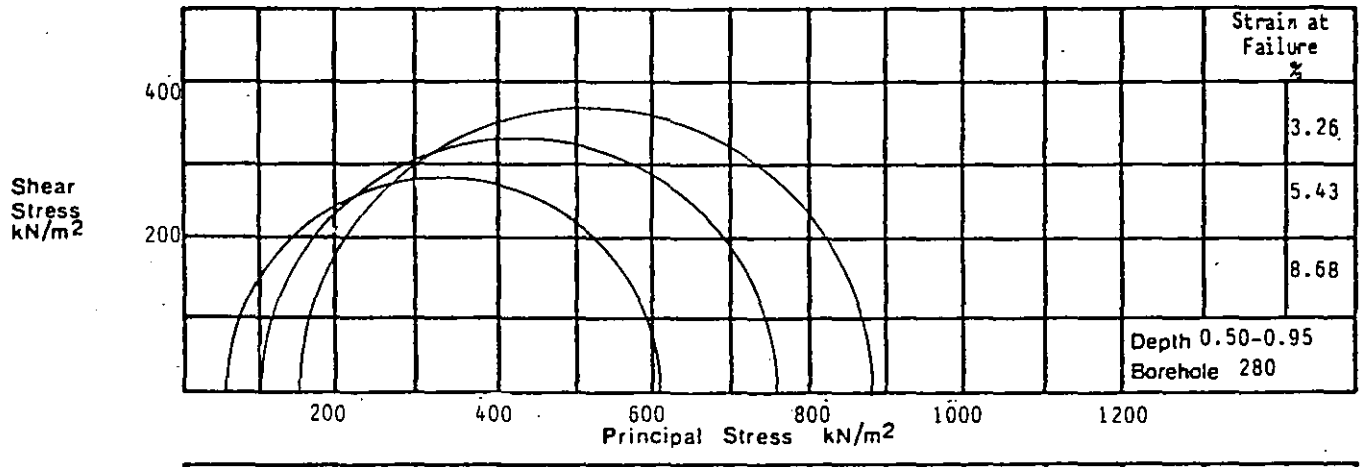
Undrained Triaxial Compression - Rate of Strain 2%.

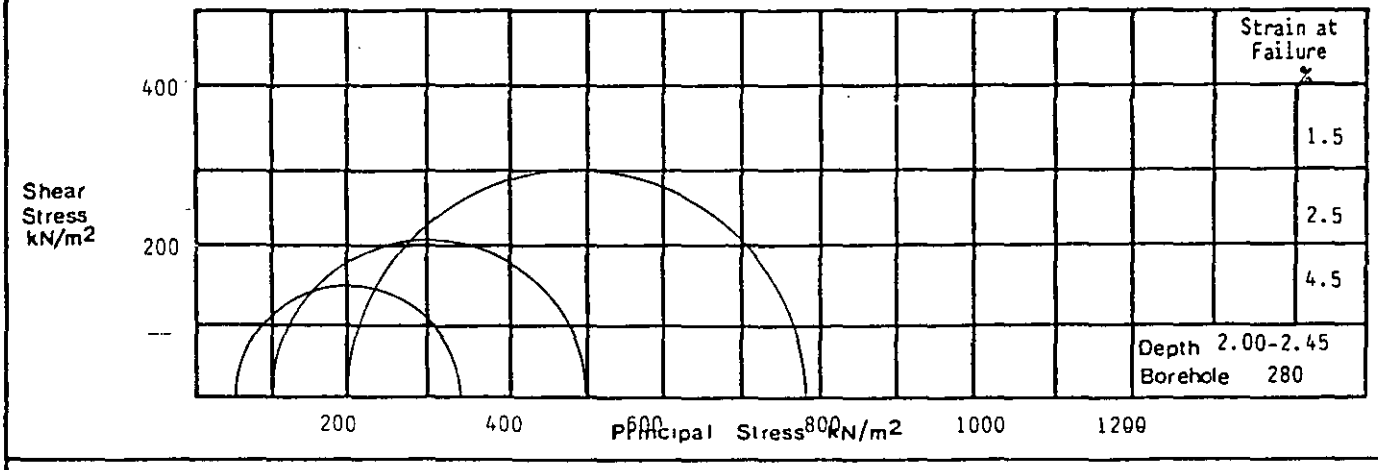
Remarks

Laboratory – Mohr's Circles	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.151





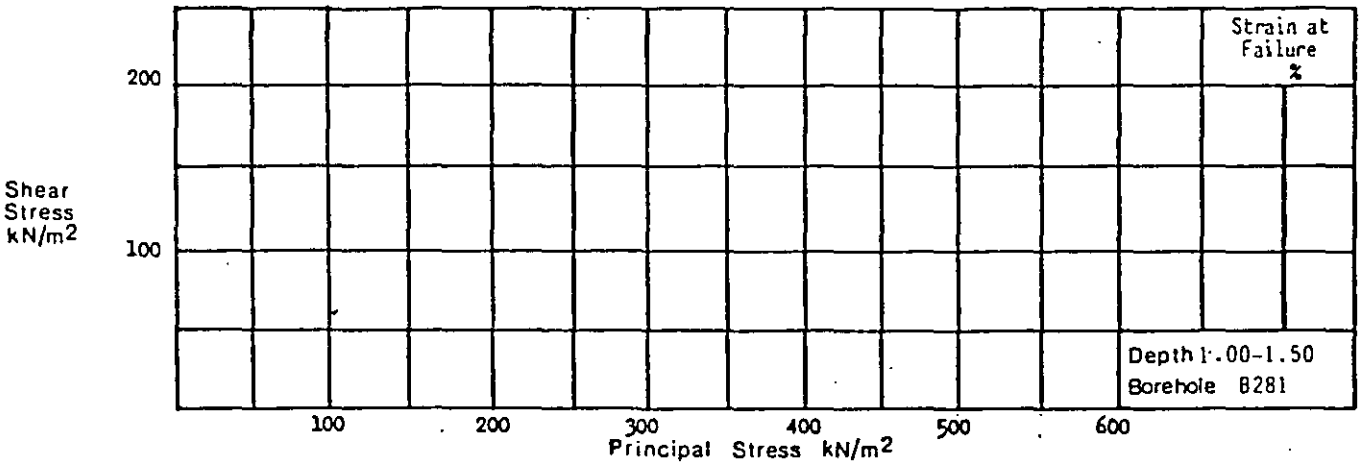


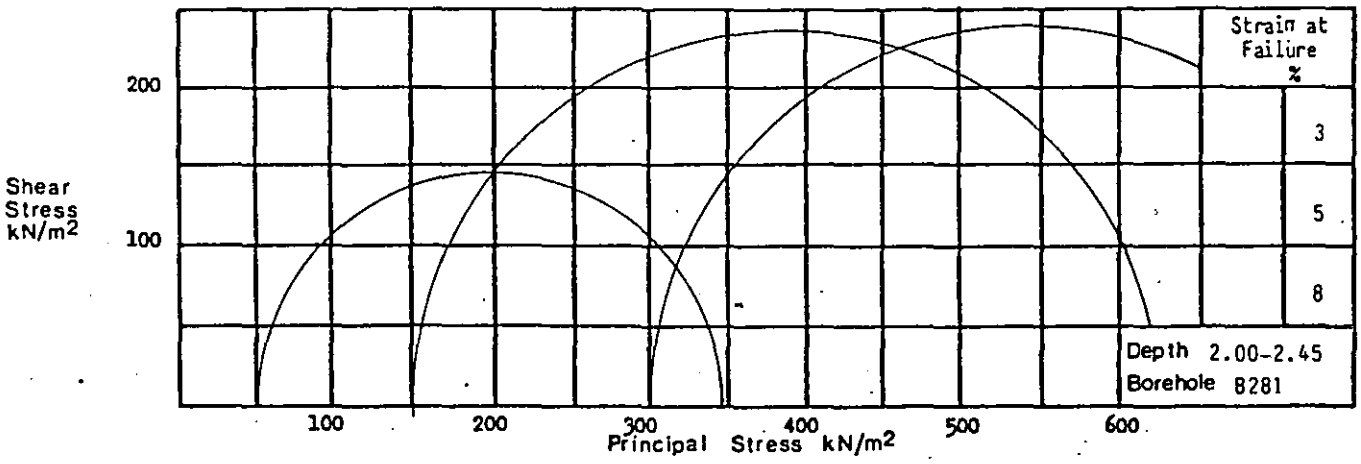


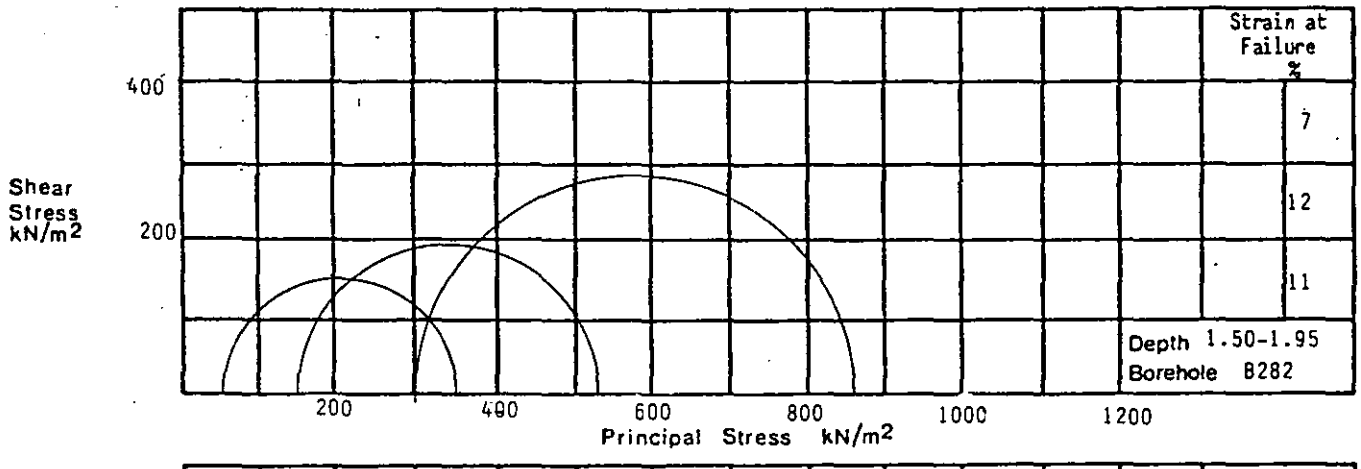
Undrained Triaxial Compression - Rate of Strain 2%.

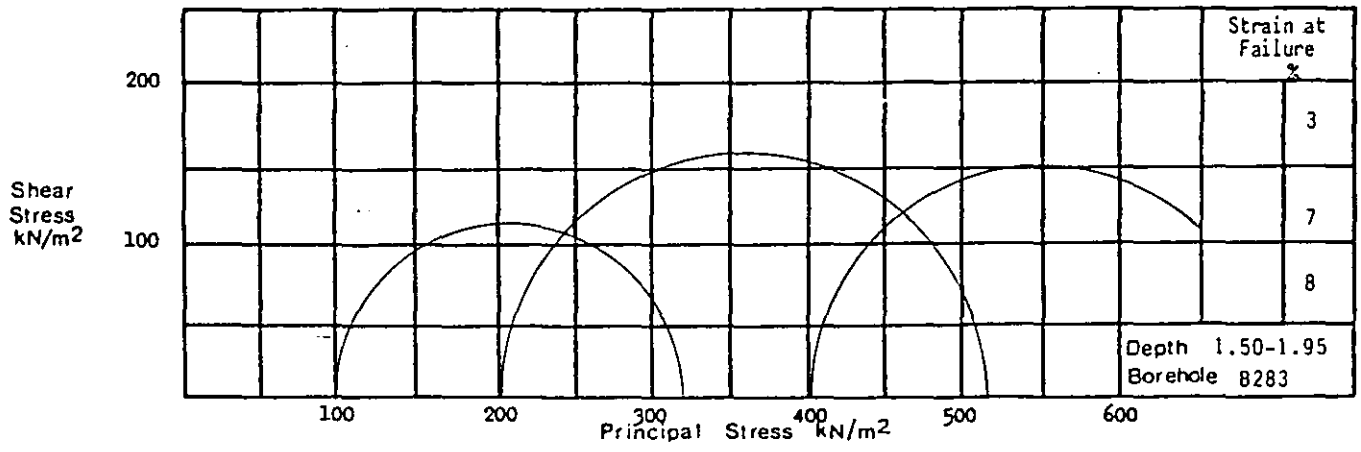
Remarks

Laboratory – Mohr's Circles	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.152









Undrained Triaxial Compression - Rate of Strain 2%.

Remarks

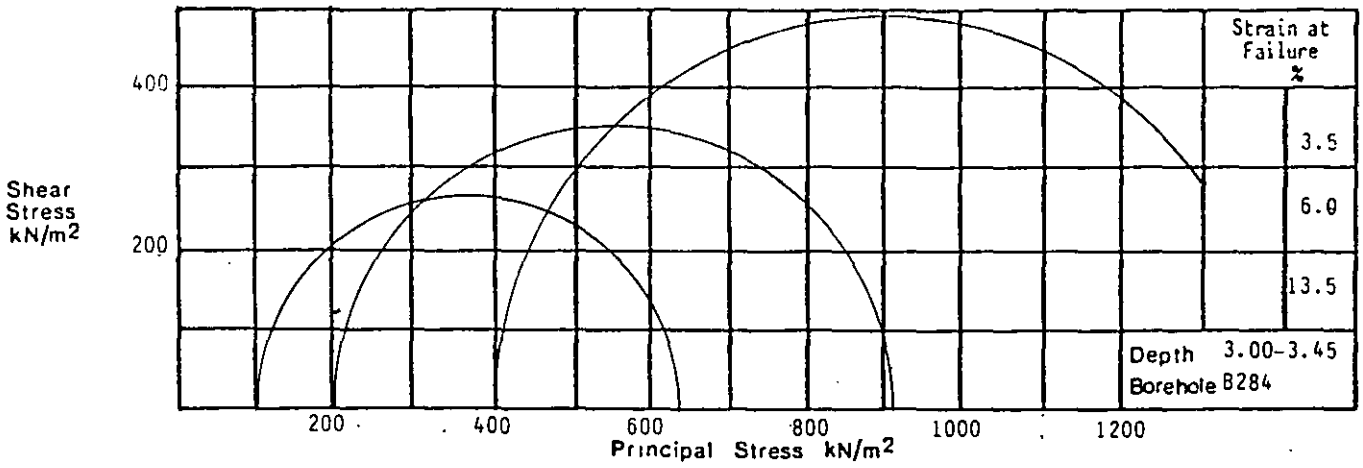
Laboratory – Mohr's Circles

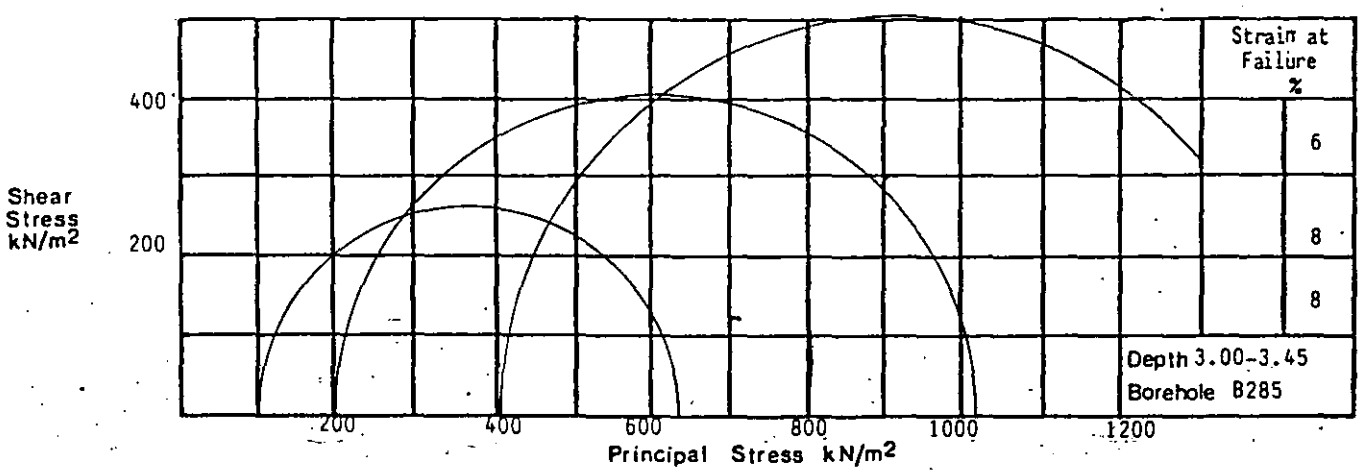
exploration associates

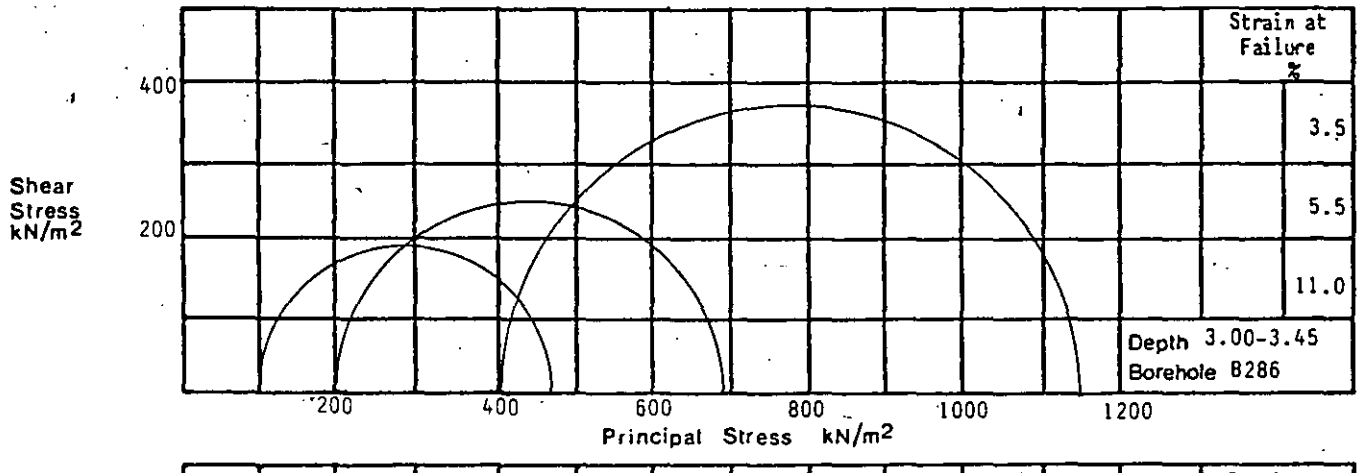
Project Department of Transport
East Midlands Regional Office
A42 Castle Donington North
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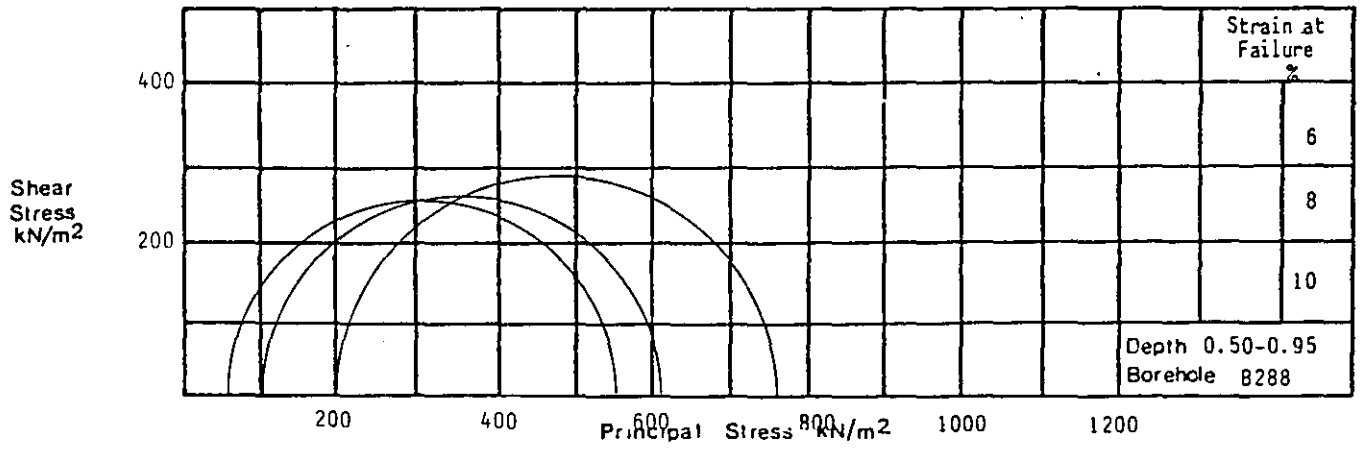
Contract S4449

Figure 2.153





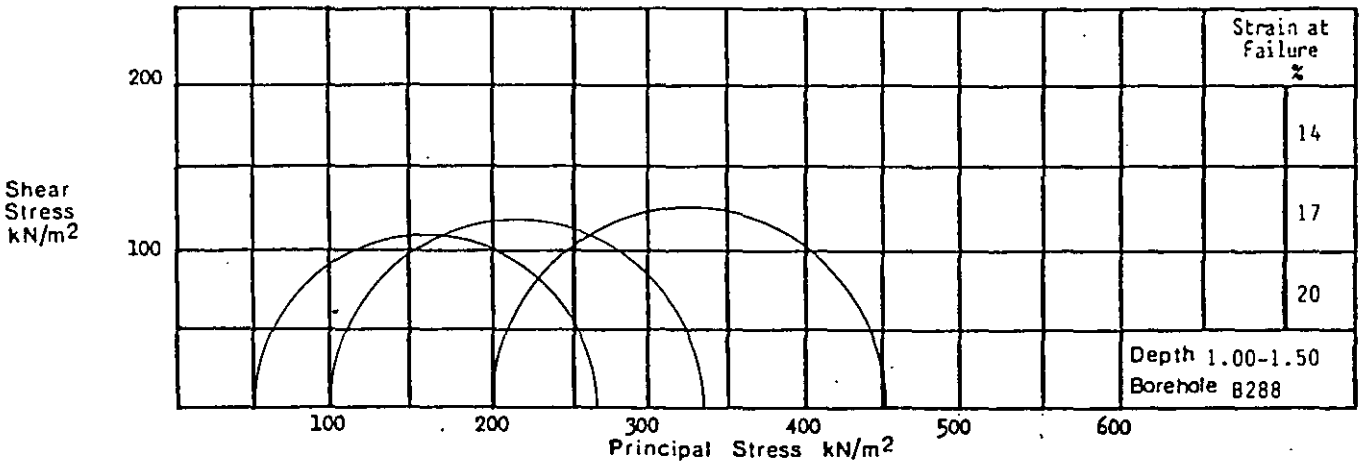


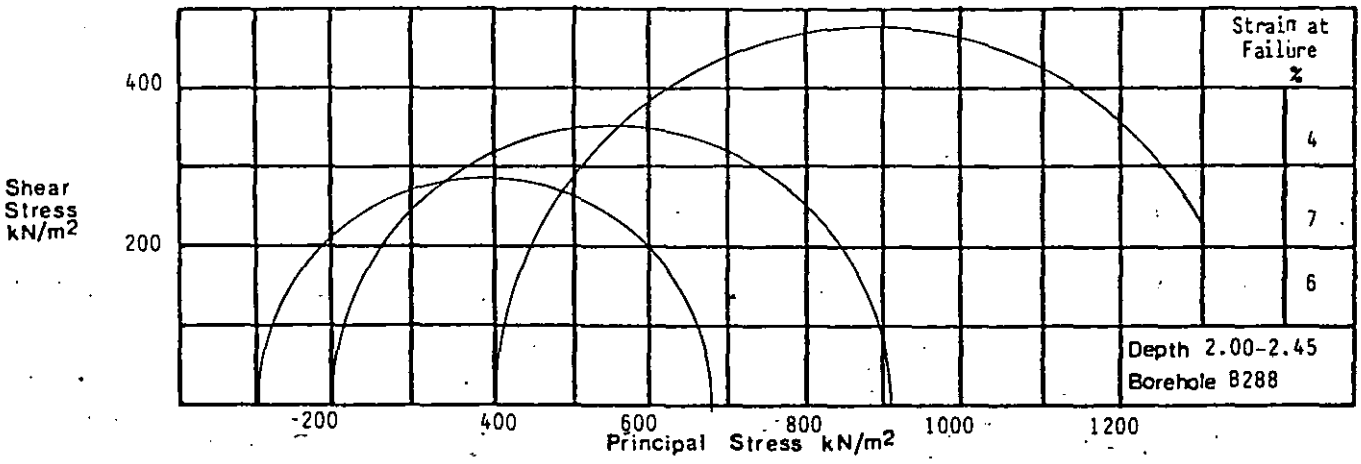


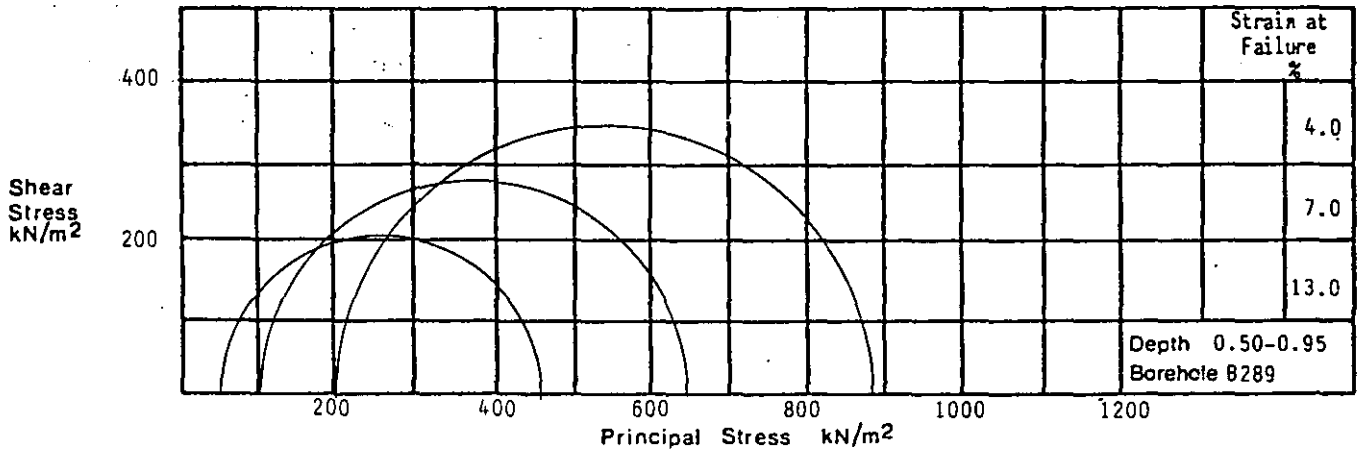
Undrained Triaxial Compression – Rate of Strain 2%.

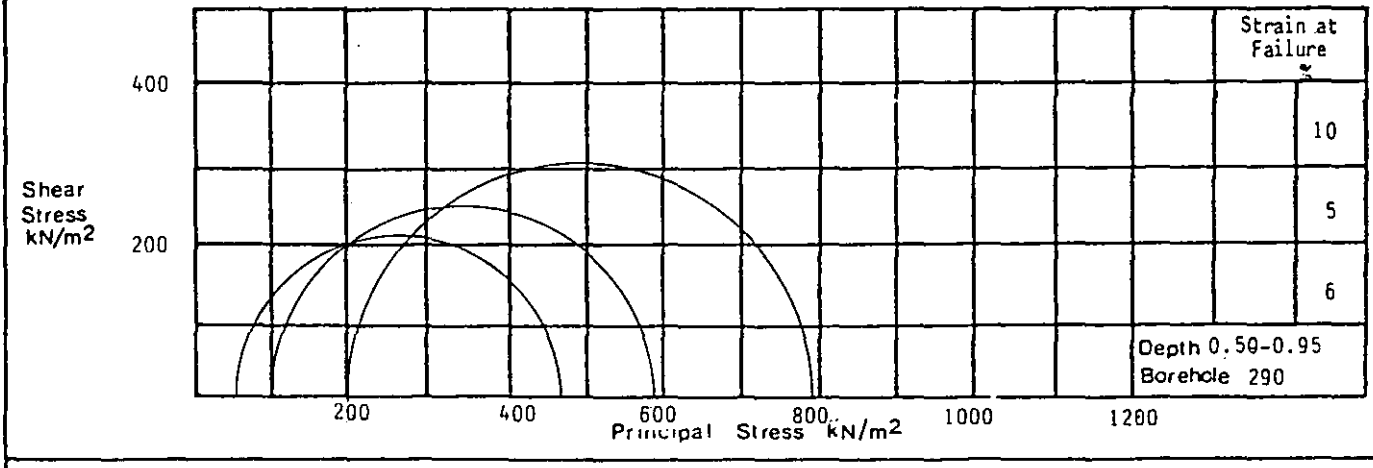
Remarks

Laboratory – Mohr's Circles	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.154





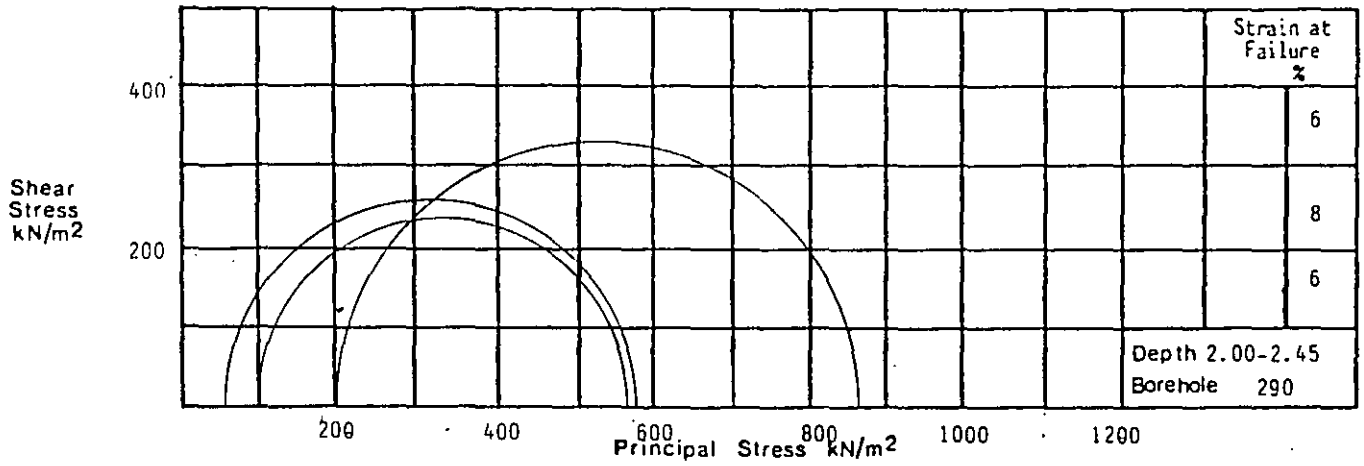


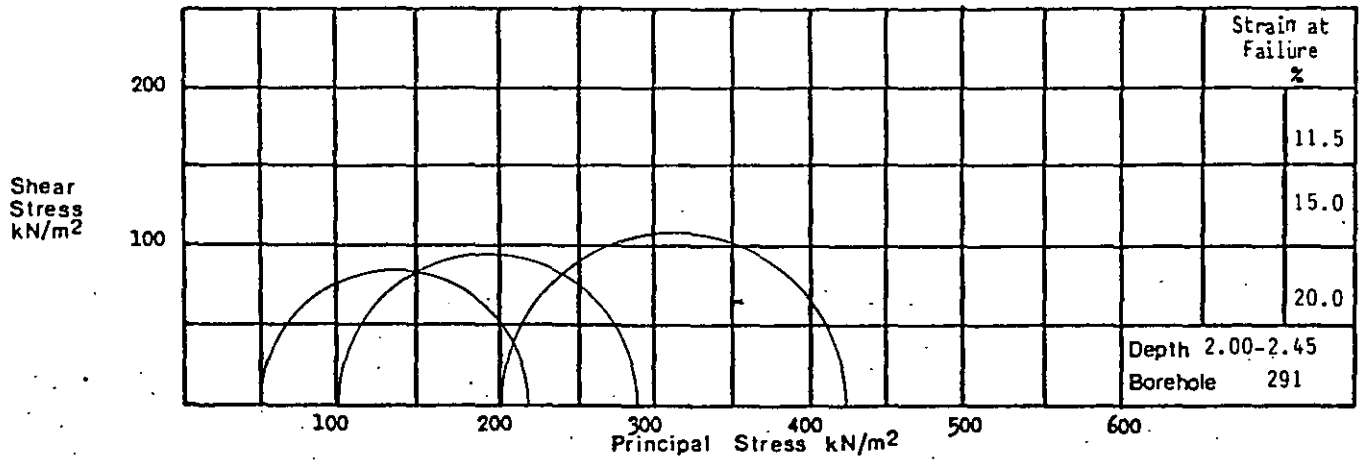


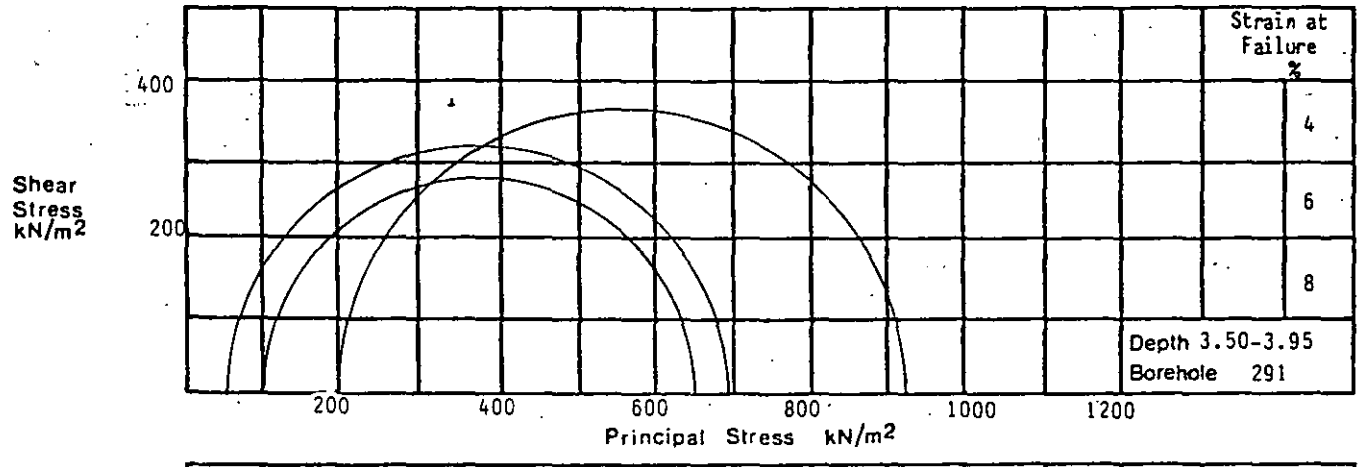
Undrained Triaxial Compression - Rate of Strain 2%.

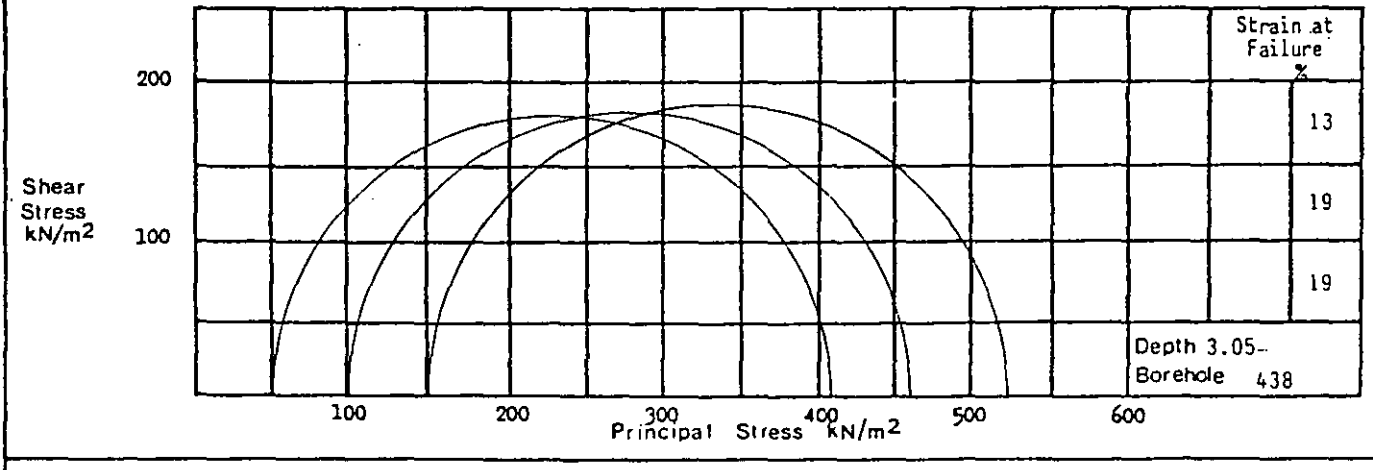
Remarks

Laboratory – Mohr's Circles	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.155





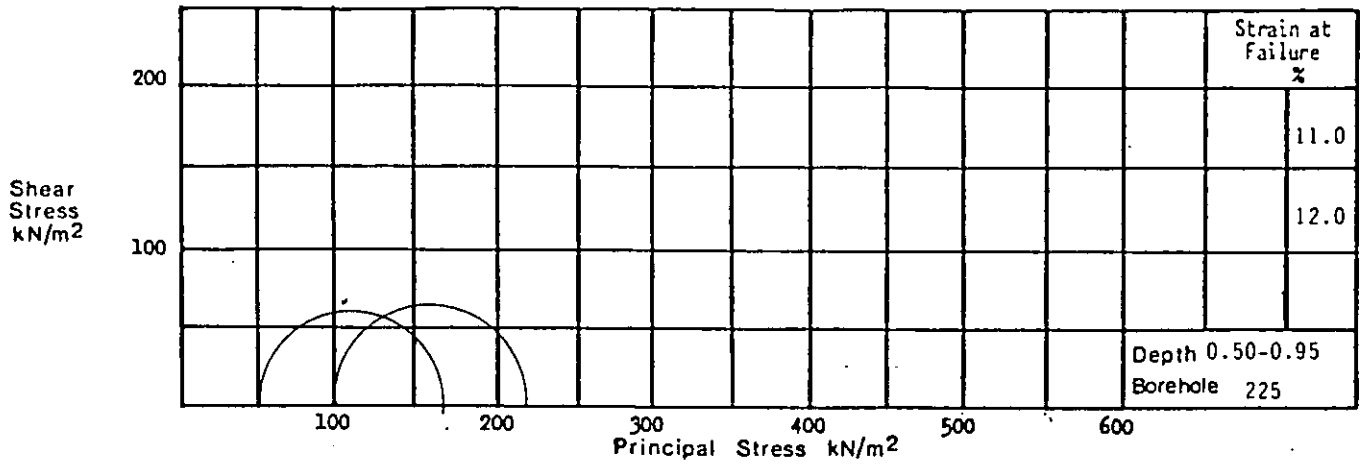


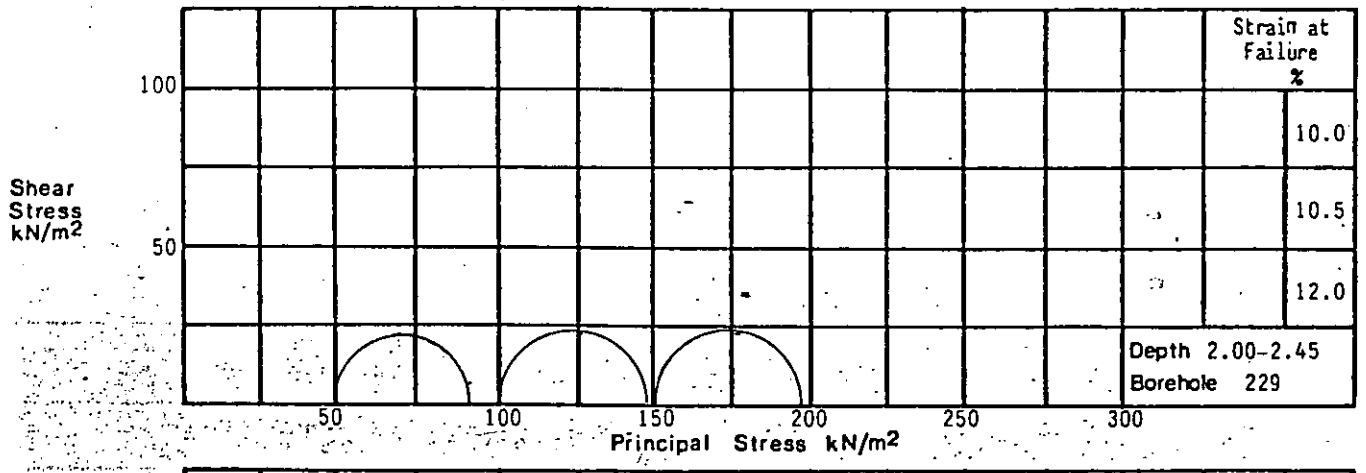


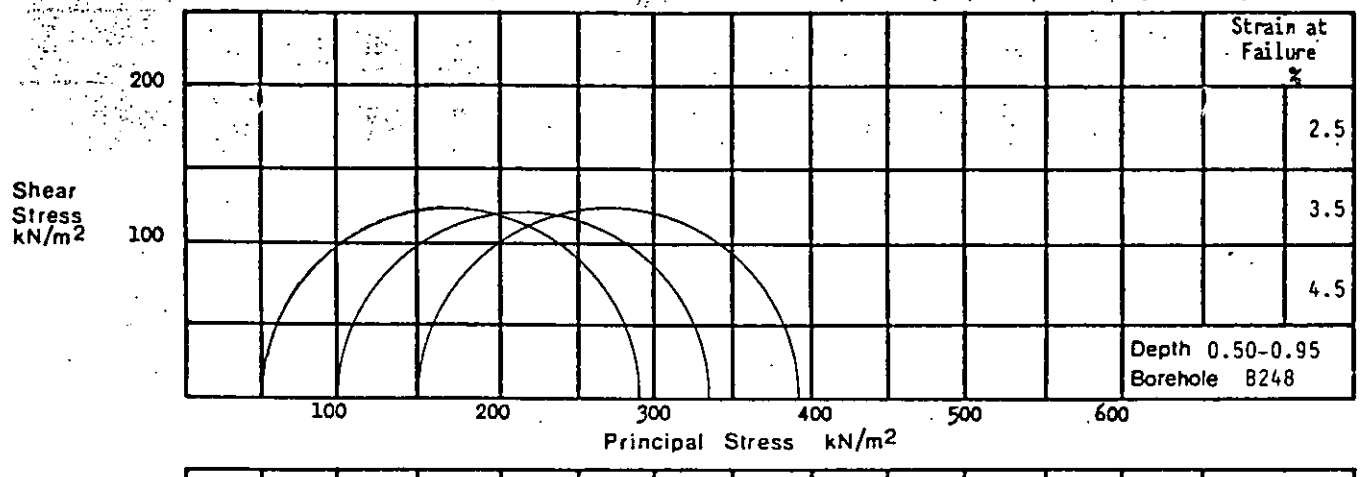
Undrained Triaxial Compression - Rate of Strain 2%.

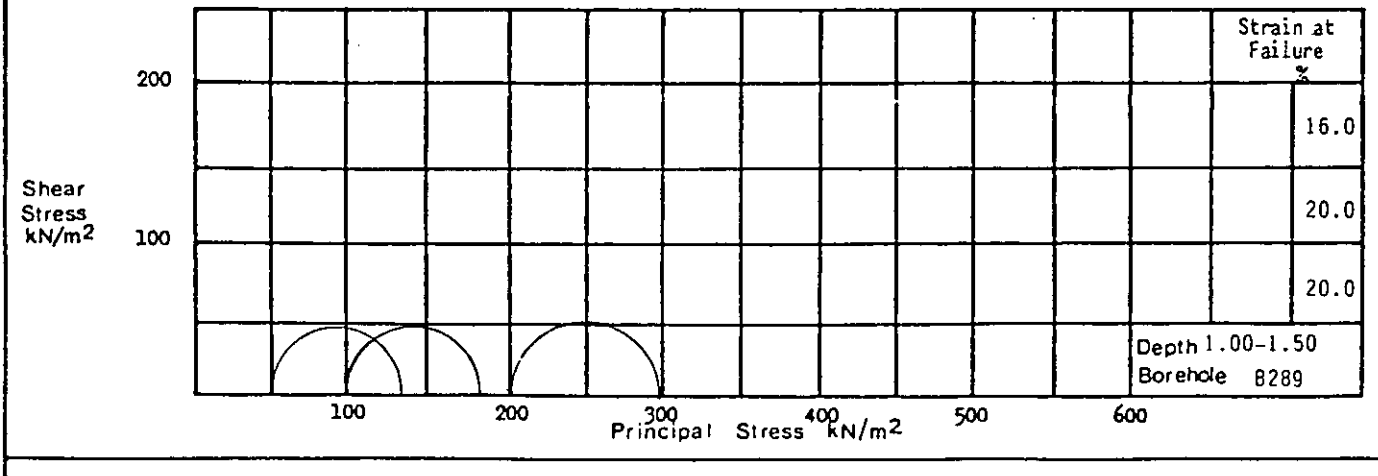
Remarks

Laboratory – Mohr's Circles	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.156









Undrained Triaxial Compression – Rate of Strain 2%.

Remarks

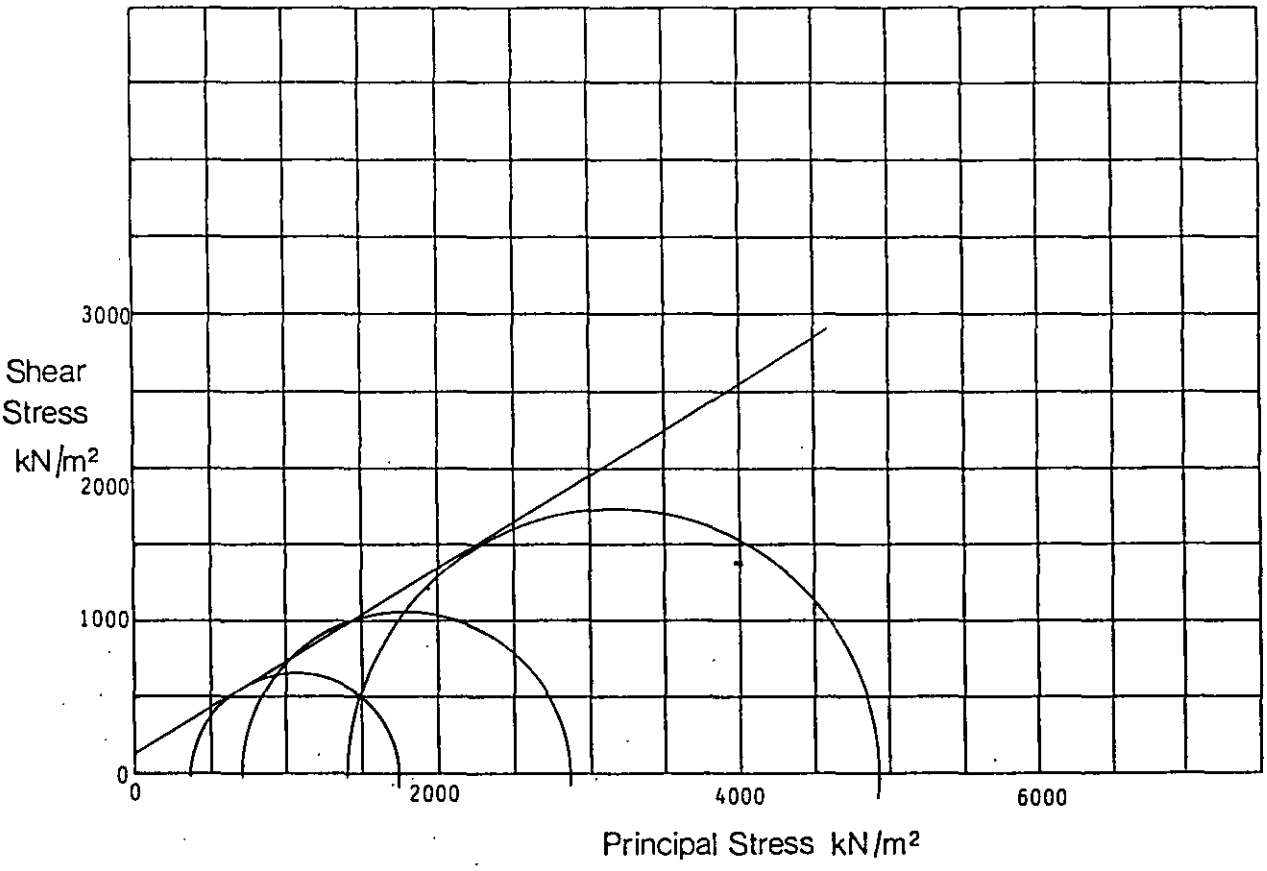
Laboratory – Mohr's Circles

exploration associates

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Department of Transport
East Midlands Regional Office
A42 Castle Donington North
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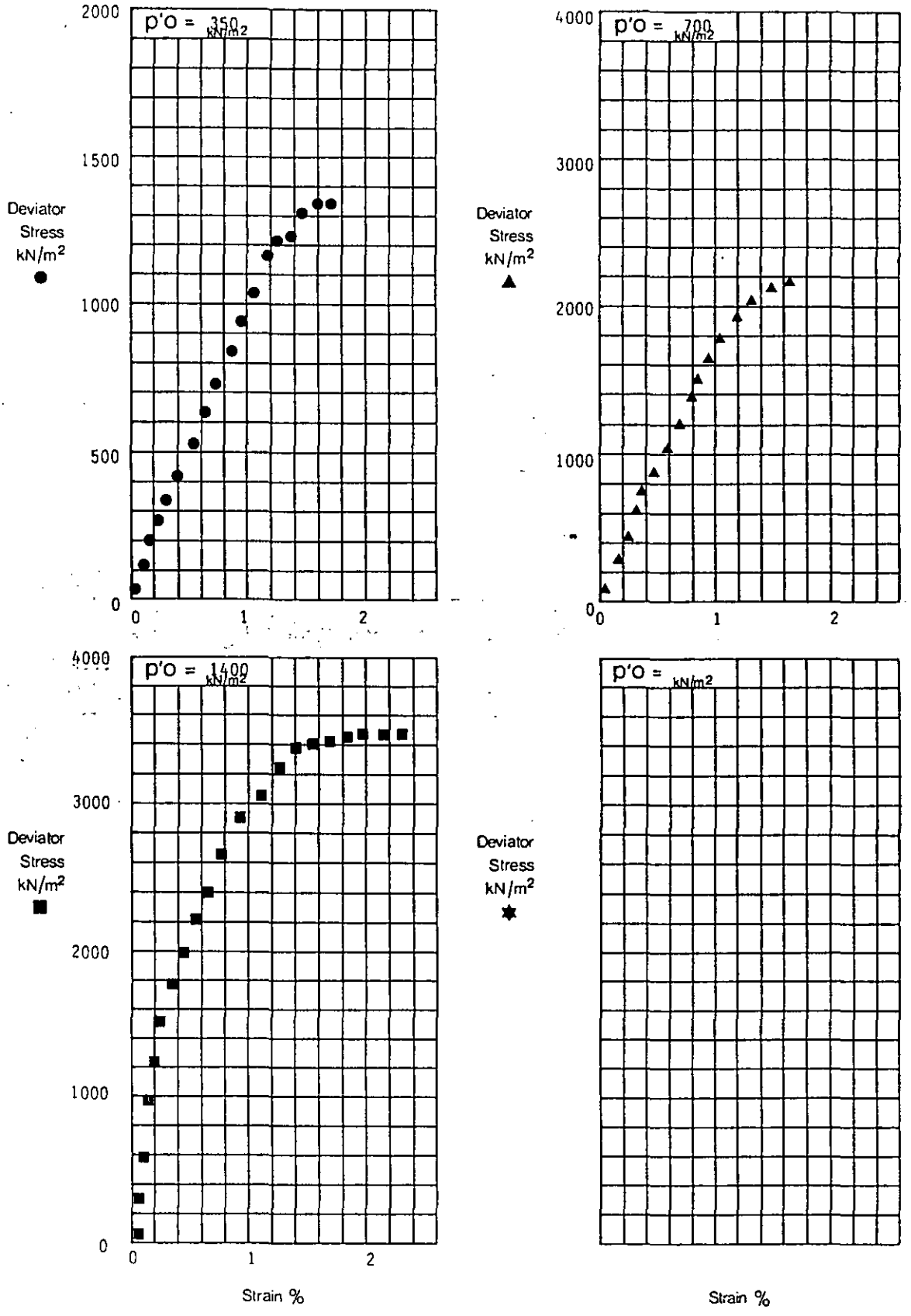
Figure 2.157



B	(Initial)		-	-	-	
B_s	(After application of Back Pressure)		-	-	-	
ε	(Rate of Strain)	% min	0.1	0.1	0.1	
σ_3	(Cell Pressure during Shear)	kN/m²	350	700	1400	
u_0	(Applied Back Pressure)	kN/m²	-	-	-	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	-	-	-	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	1350	2150	3500	

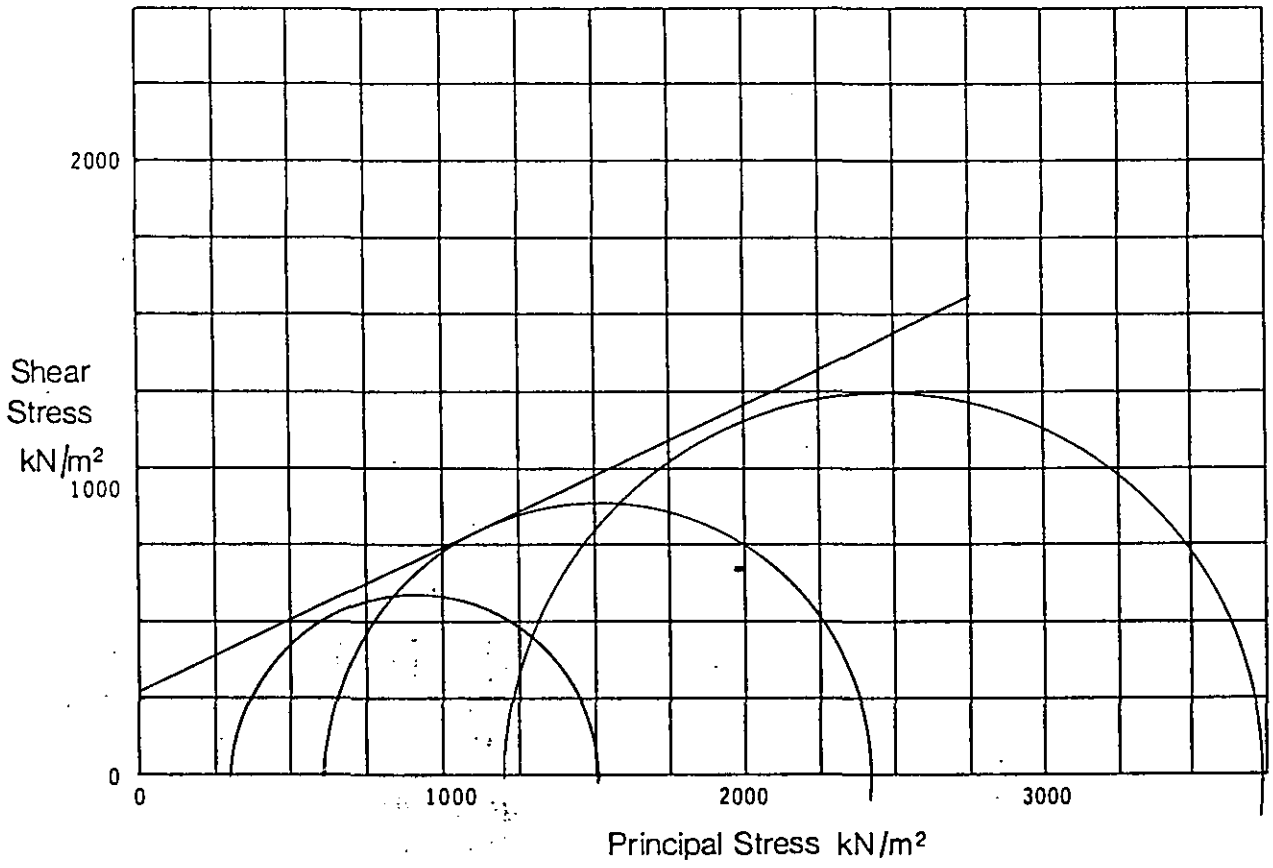
Triaxial Compression Test Consolidated Undrained	Description Red brown and grey green calcareous SILTSTONE **Mohr Circles and Summary**	C' 150 kN/m² Φ' 31 Degrees Depth 17.14 - 17.47 Borehole B219
Remarks HOEK CELL TEST		
Laboratory - Effective Stress **exploration associates**	Project Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449 Figure 2.158

EX3



Deviator Stress / Strain	Depth 17.14 - 17.47 Borehole 8219
Remarks	
Laboratory - Effective Stress	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2
exploration associates	Contract S4449 **Figure** 2.159

EX3



B	(Initial)		-	-	-	
B_s	(After application of Back Pressure)		-	-	-	
ε	(Rate of Strain)	% min	0.1	0.1	0.1	
σ_3	(Cell Pressure during Shear)	kN/m²	300	600	1200	
u_0	(Applied Back Pressure)	kN/m²	-	-	-	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	-	-	-	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	1200	1770	2500	

Triaxial Compression Test
Consolidated
Undrained

Description Red brown very weak calcareous SILTSTONE

Mohr Circles and Summary

C' 260 kN/m²
Φ' 24 Degrees

Depth 12.24 - 12.43
Borehole B221

Remarks HOEK CELL TEST

Laboratory - Effective Stress

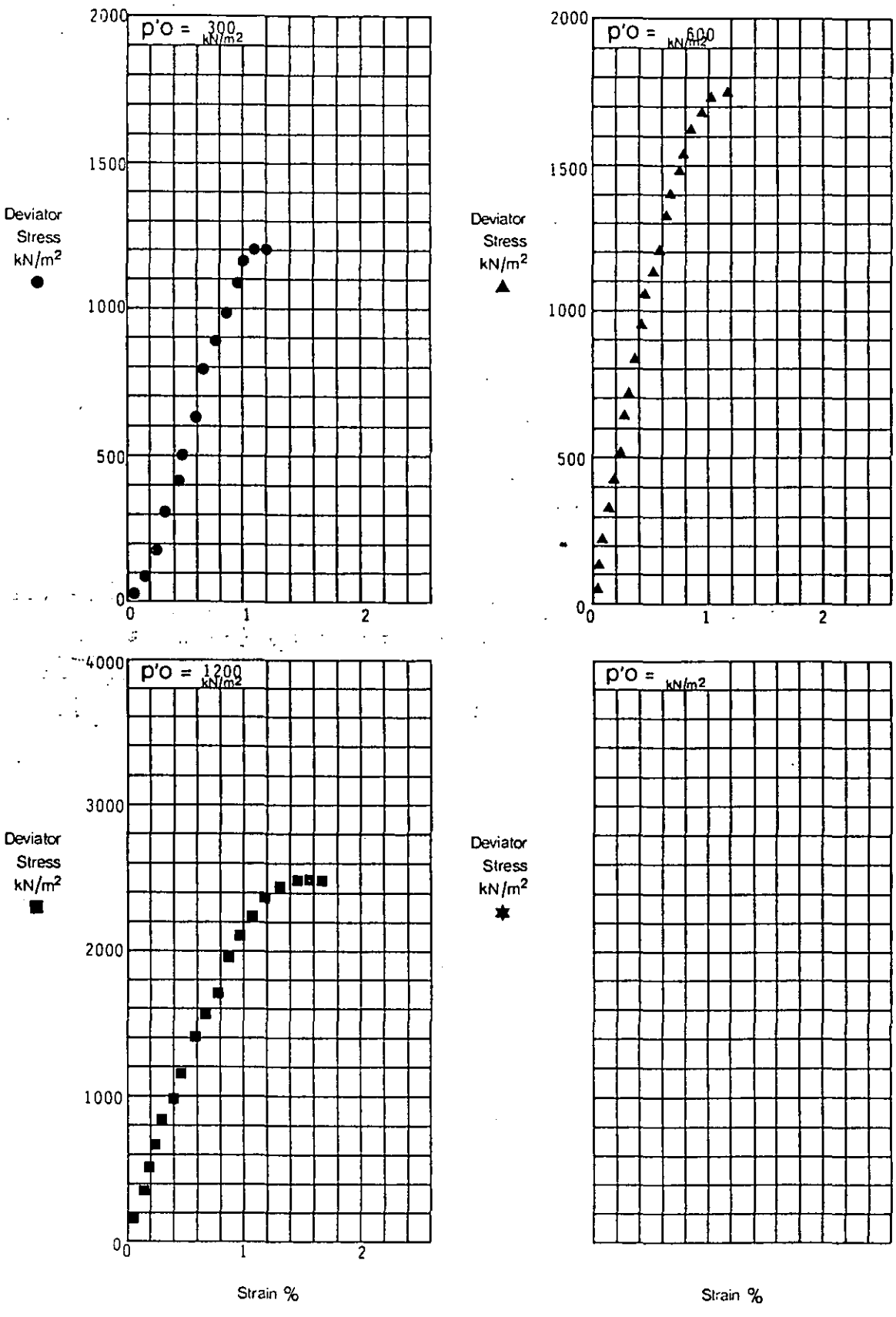
exploration associates

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Main Site Investigation - Contract 2

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Figure 2.160

EX3



Deviator Stress / Strain

Depth 12.24 - 12.43
Borehole B221

Remarks

Laboratory - Effective Stress

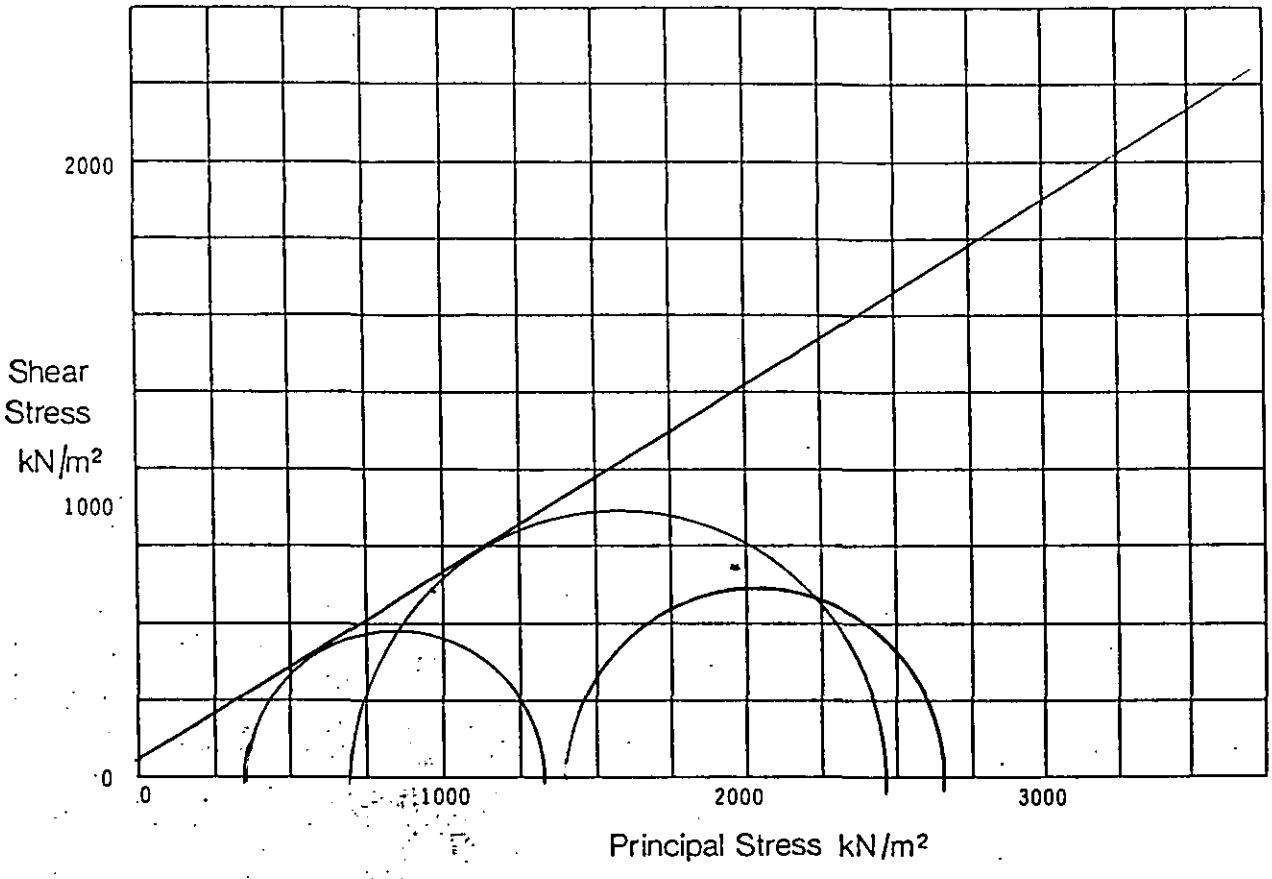
Project Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation - Contract 2

Contract S4449

Figure 2.161

exploration associates

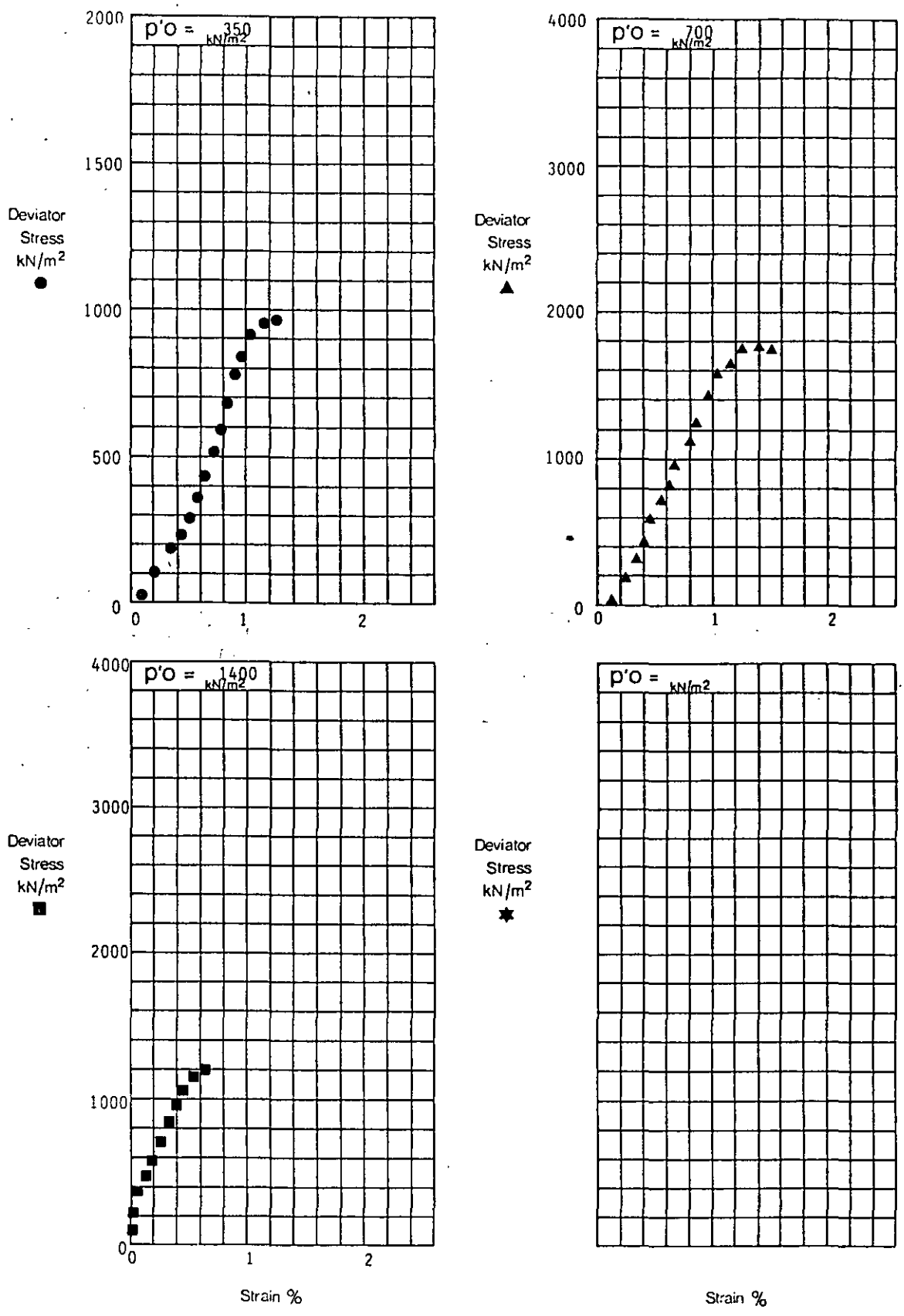
EX3



B	(Initial)		-	-	-	
B_s	(After application of Back Pressure)		-	-	-	
ε	(Rate of Strain)	% min	0.1	0.1	0.1	
σ_3	(Cell Pressure during Shear)	kN/m²	350	700	1400	
u_0	(Applied Back Pressure)	kN/m²	-	-	-	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	-	-	-	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	975	1750	1210	

Triaxial Compression Test Consolidated Undrained	Description Red brown very weak calcareous SILTSTONE	C' 75 kN/m² ϕ' 31 Degrees
	Mohr Circles and Summary	Depth 18.00 - 18.40 Borehole B221
Remarks HOEK CELL TEST		
Laboratory - Effective Stress	Project Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract 34449
exploration associates		Figure 2.162

EX3



Deviator Stress / Strain

Depth 18.00 - 18.40
Borehole B221

Remarks

Laboratory - Effective Stress

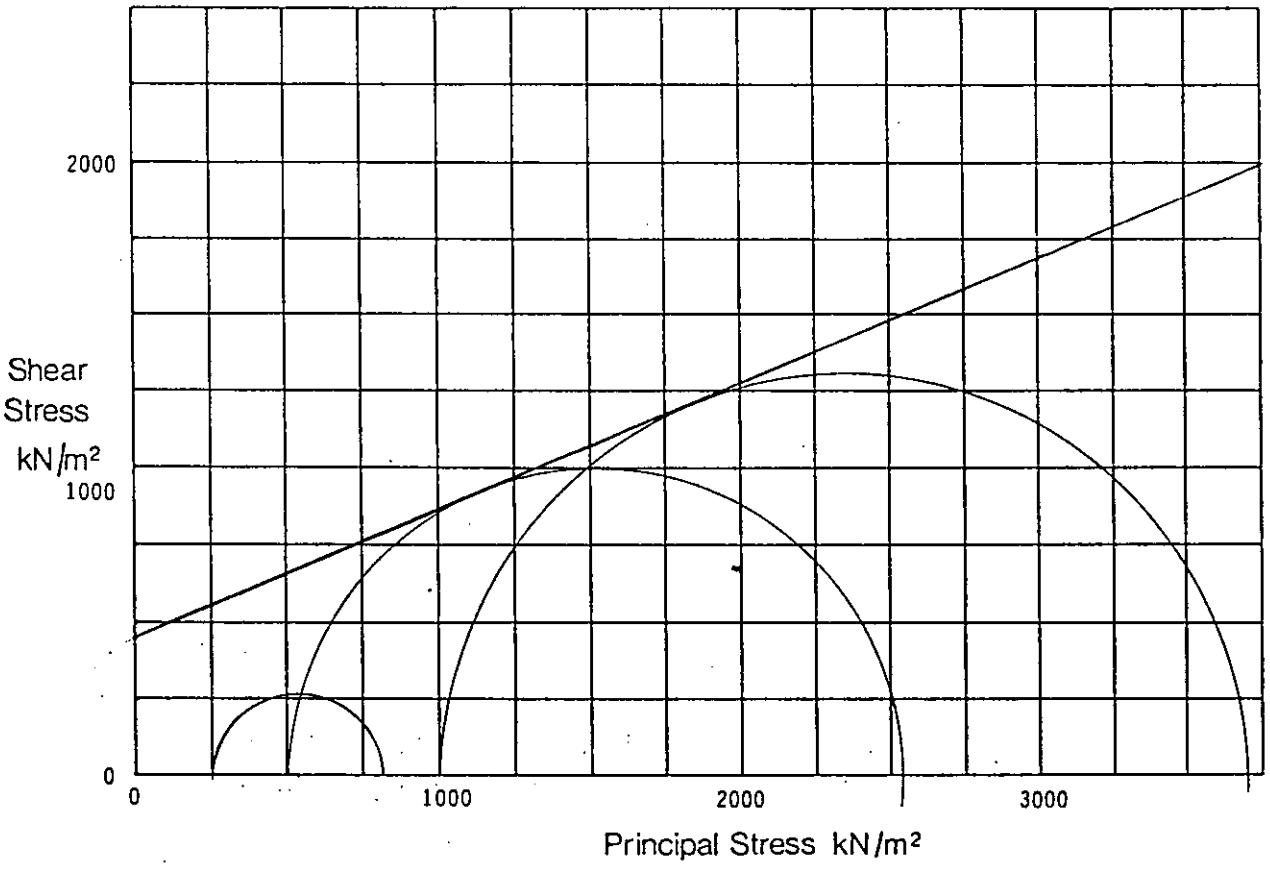
exploration associates

Project Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation - Contract 2

Contract S4449

Figure 2.163

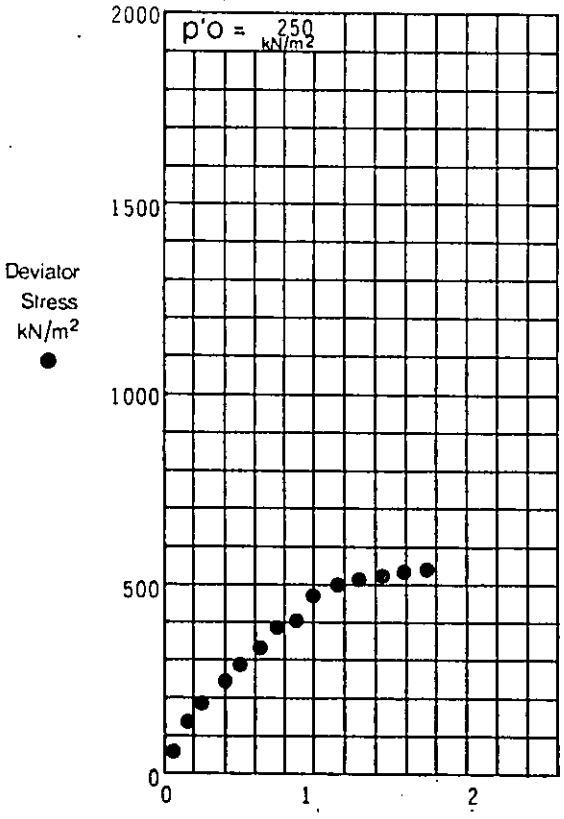
EX3

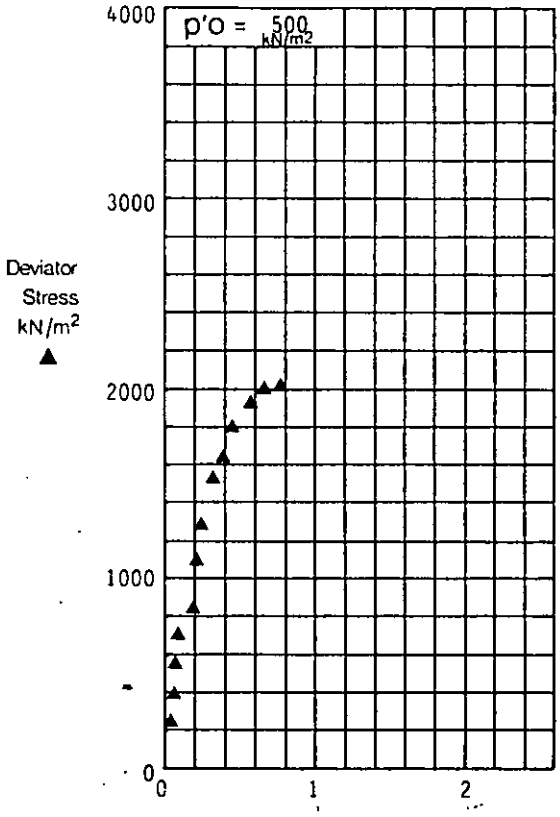


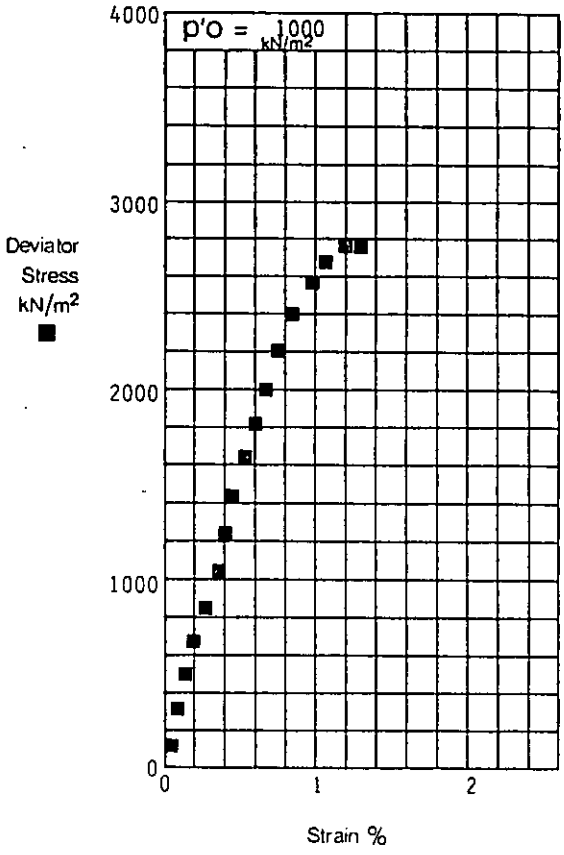
B	(Initial)		-	-	-	
B_s	(After application of Back Pressure)		-	-	-	
ε	(Rate of Strain)	% min	0.1	0.1	0.1	
σ_3	(Cell Pressure during Shear)	kN/m²	250	500	1000	
u_0	(Applied Back Pressure)	kN/m²	-	-	-	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	-	-	-	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	550	2010	2750	

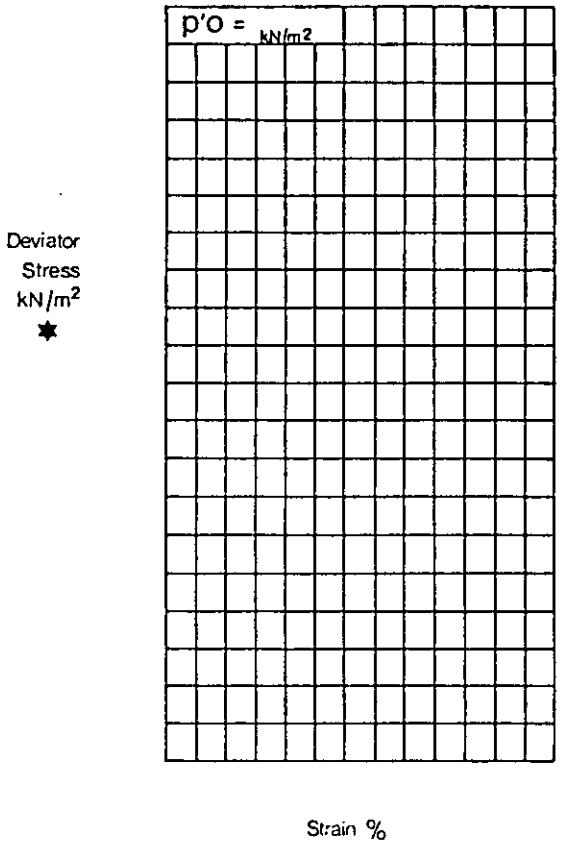
Triaxial Compression Test Consolidated Undrained	Description Red brown weak SILTSTONE **Mohr Circles and Summary**	C' 450 kN/m² Φ' 22 Degrees Depth 10.53 - 10.95 Borehole B 244
Remarks HOEK CELL TEST		
Laboratory - Effective Stress **exploration associates**	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449 Figure 2.164

EX3









Deviator Stress / Strain

Depth 10.53 - 10.95
Borehole B244

Remarks

Laboratory - Effective Stress

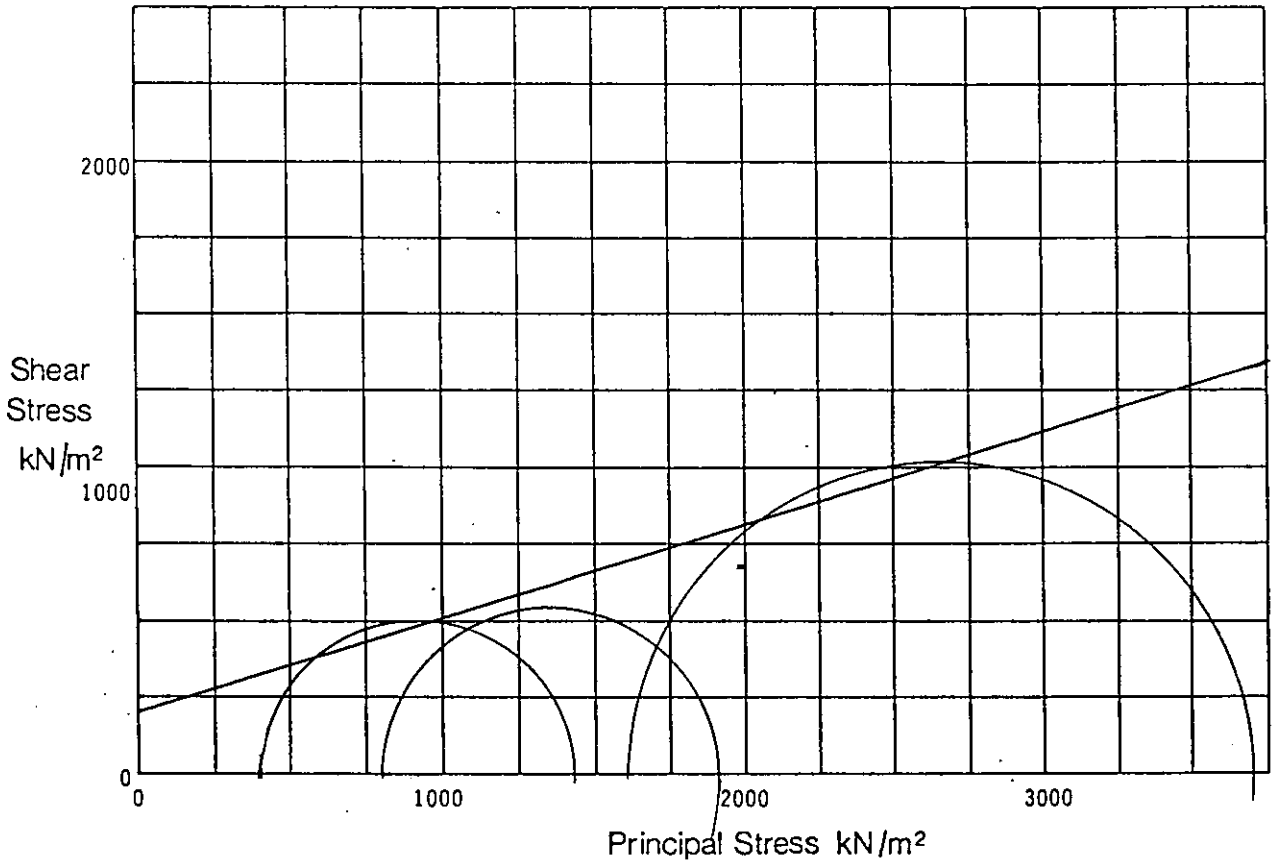
exploration associates

Project Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation - Contract 2

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Figure 2.165

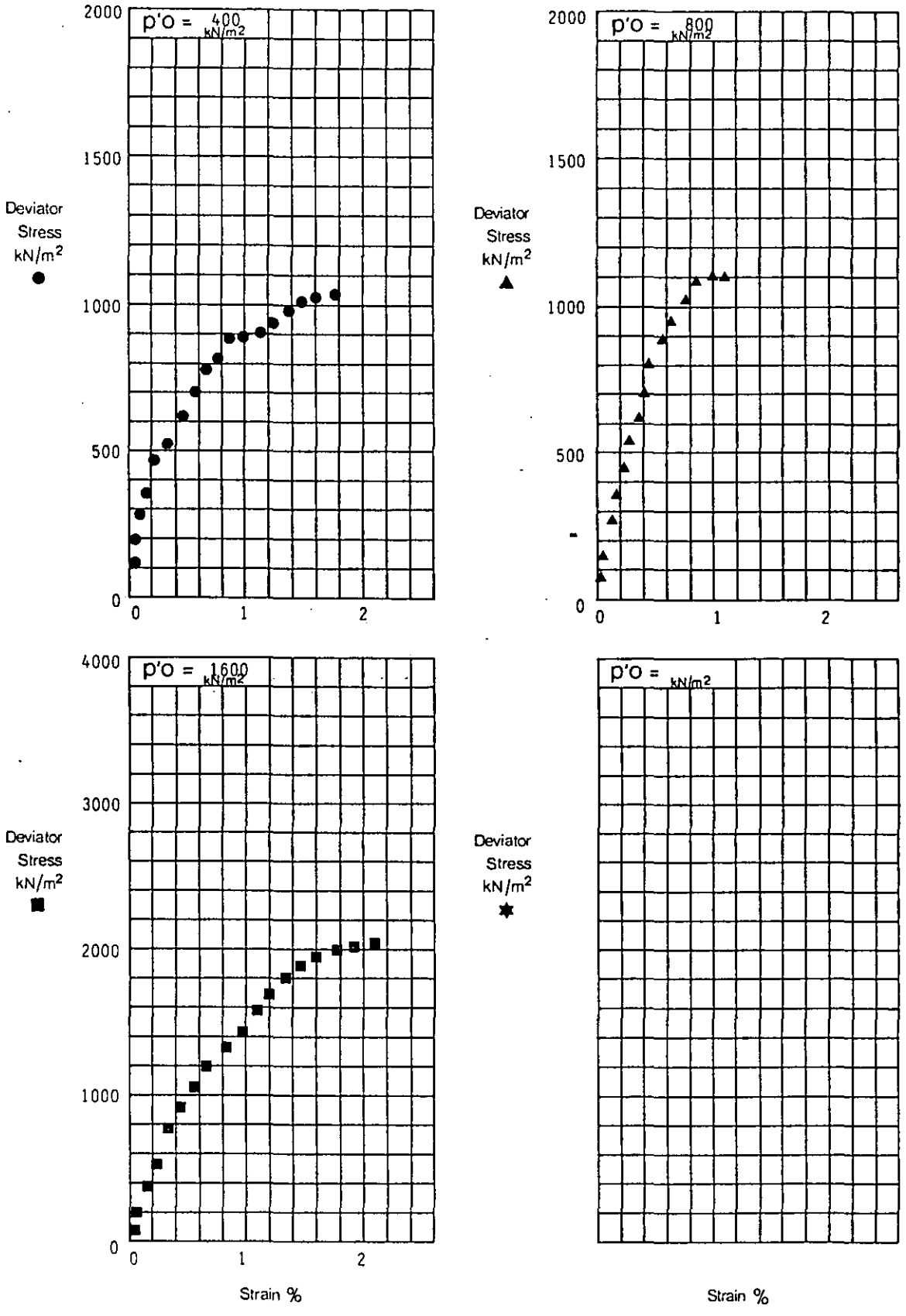
EX3



B	(Initial)		-	-	-	
B_s	(After application of Back Pressure)		-	-	-	
ε	(Rate of Strain)	% min	0.1	0.1	0.1	
σ_3	(Cell Pressure during Shear)	kN/m²	400	800	1600	
u_0	(Applied Back Pressure)	kN/m²	-	-	-	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	-	-	-	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	1050	1100	2050	

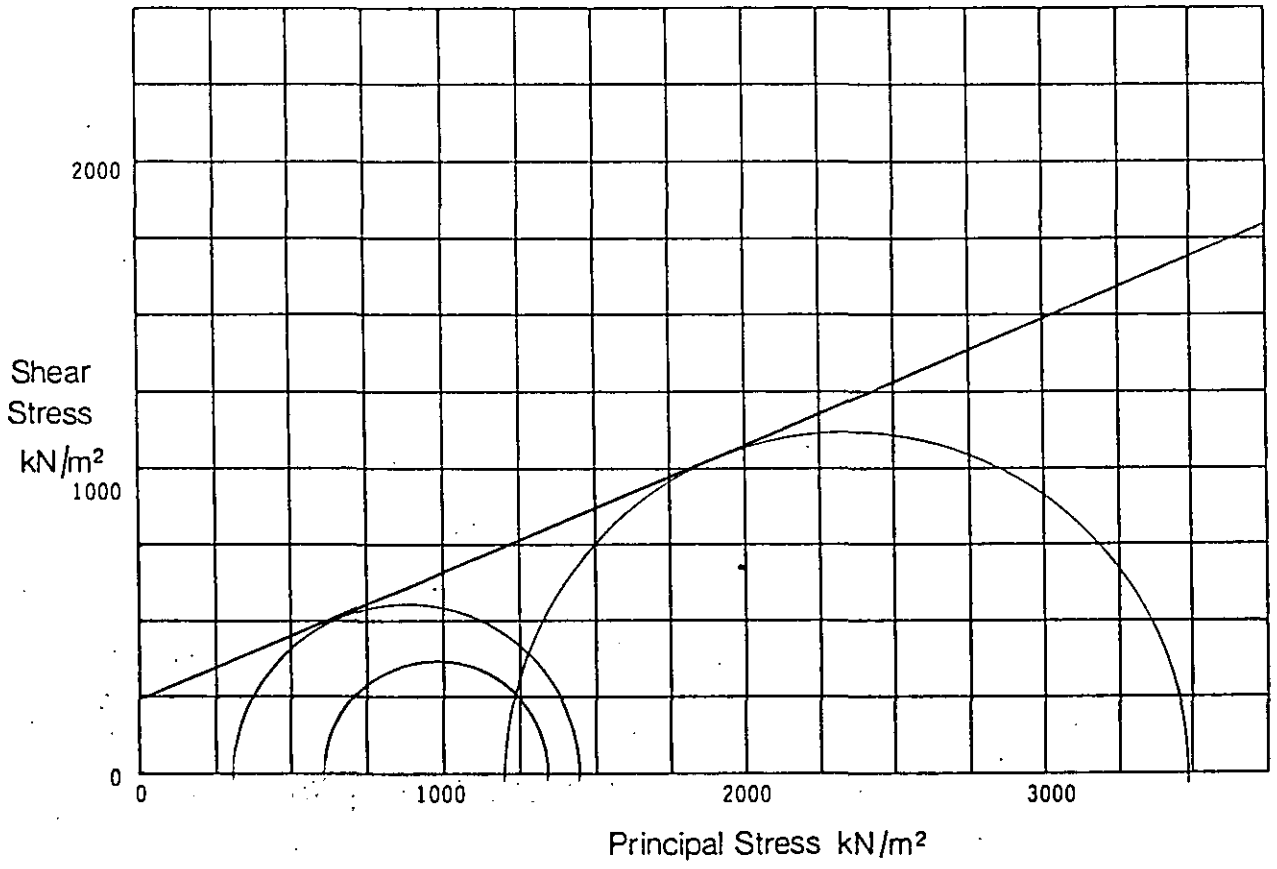
Triaxial Compression Test Consolidated Undrained	Description Highly weathered SILTSTONE/very stiff silty CLAY	C' 200 kN/m² Φ' 17 Degrees
	Mohr Circles and Summary	Depth 7.75 - 8.00 Borehole B245
Remarks HOEK CELL TEST		
Laboratory - Effective Stress	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449
exploration associates		**Figure** 2.166

EX3



Deviator Stress / Strain	Depth 7.75 - 8.00 Borehole B245
Remarks	
Laboratory - Effective Stress	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation Contract - 2
exploration associates	Contract S4449 **Figure** 2.167

EX3



B	(Initial)		-	-	-	
B_s	(After application of Back Pressure)		-	-	-	
ε	(Rate of Strain)	% min	0.1	0.1	0.1	
σ_3	(Cell Pressure during Shear)	kN/m²	300	600	1200	
u_0	(Applied Back Pressure)	kN/m²	-	-	-	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	-	-	-	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	1150	725	2250	

Triaxial Compression Test
Consolidated
Undrained

Description Red brown very weak calcareous SILTSTONE

Mohr Circles and Summary

C' 250 kN/m²
ϕ' 22 Degrees

Depth 13.00 - 13.30
Borehole B267

Remarks HOEK CELL TEST

Laboratory - Effective Stress

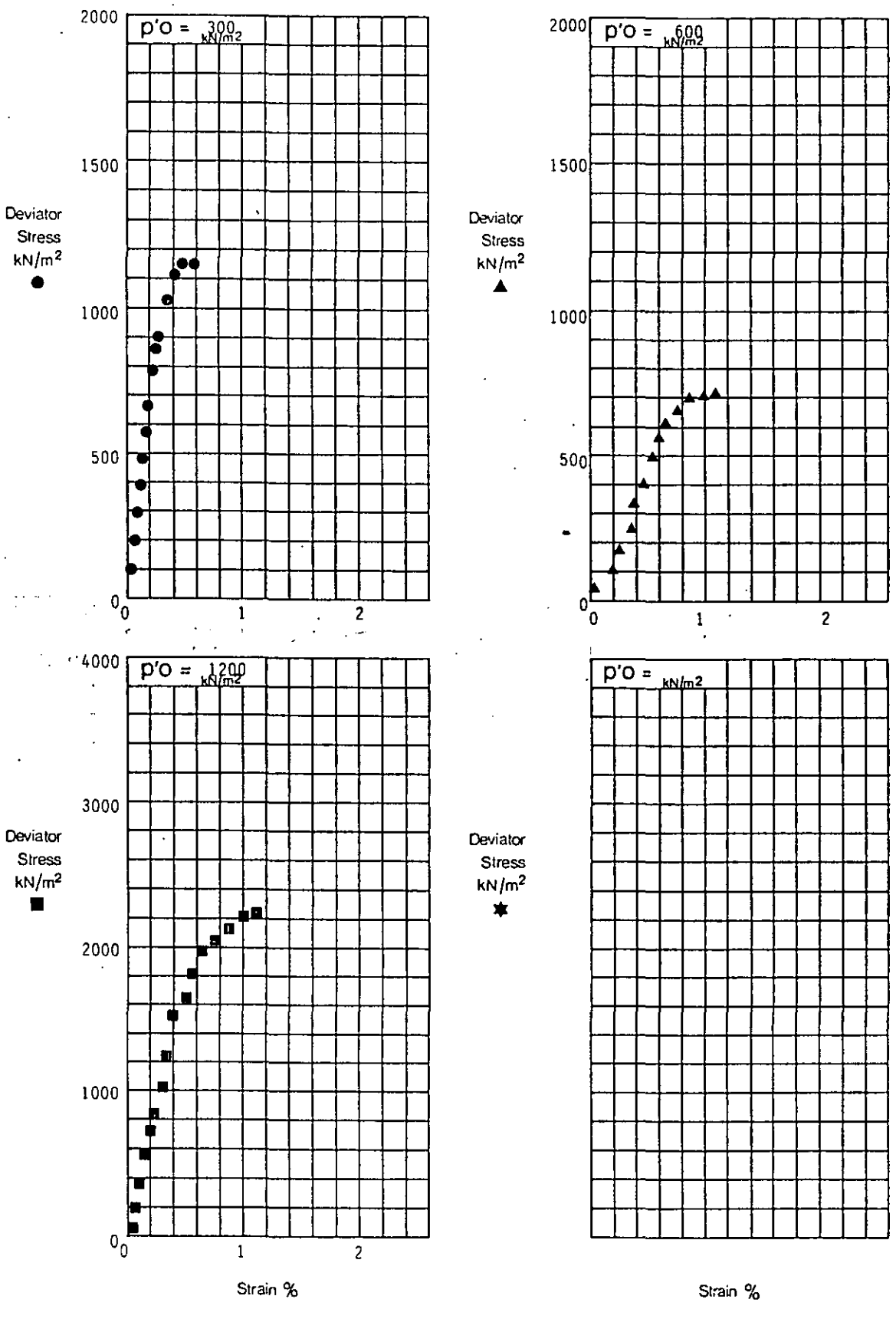
exploration associates

Project Department of Transport
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Figure 2.168

EX3



Deviator Stress / Strain

Depth 13.00 - 13.30
Borehole B267

Remarks

Laboratory - Effective Stress

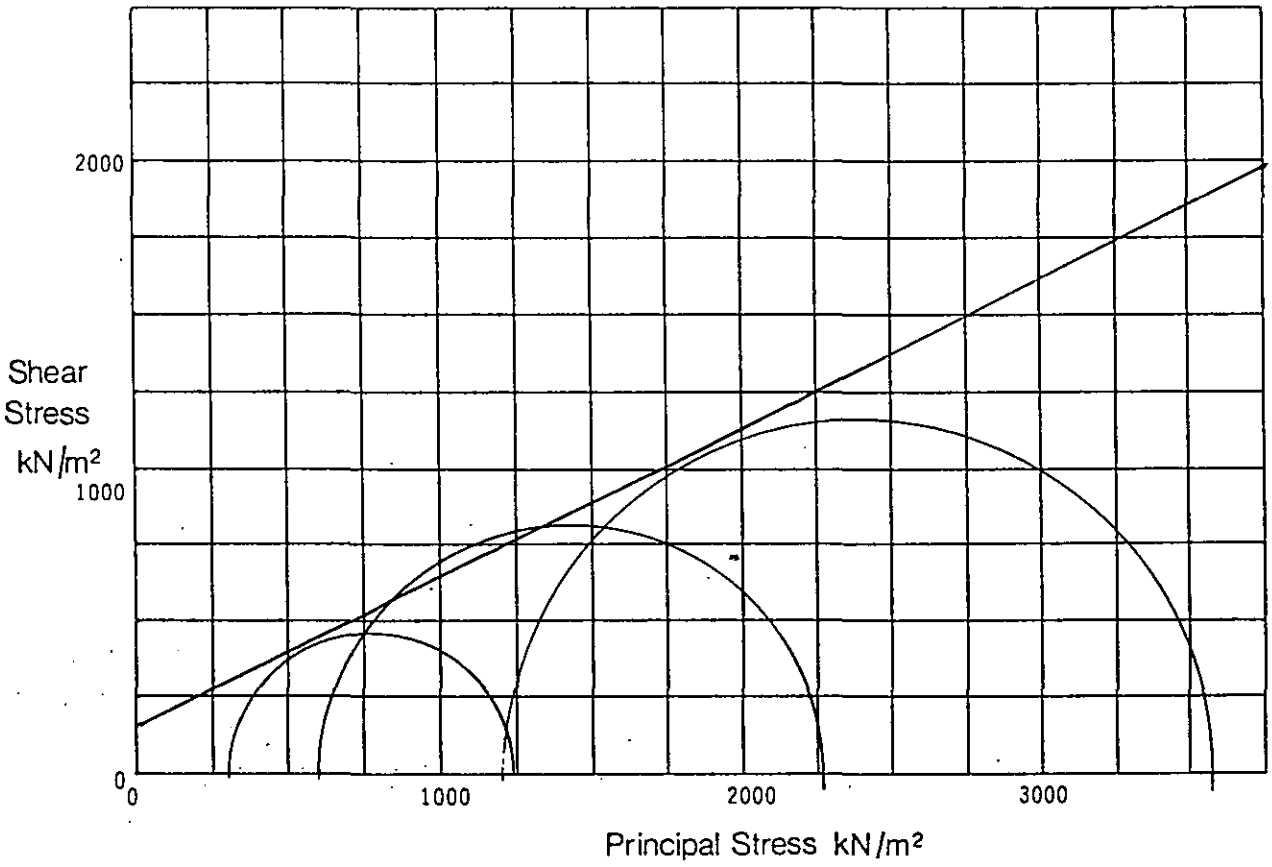
exploration associates

Project Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation - Contract 2

Contract S4449

Figure 2.169

EX3



B	(Initial)		-	-	-	
B_s	(After application of Back Pressure)		-	-	-	
ε	(Rate of Strain)	% min	0.1	0.1	0.1	
σ_3	(Cell Pressure during Shear)	kN/m²	300	600	1200	
u_0	(Applied Back Pressure)	kN/m²	-	-	-	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	-	-	-	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	925	1675	2325	

Triaxial Compression Test
Consolidated
Undrained

Description Red brown and grey green very weak SILTSTONE

Mohr Circles and Summary

C' 150 kN/m²
Φ' 26 Degrees

Depth 12.10 - 12.40
Borehole B271

Remarks HOEK CELL TEST

Laboratory - Effective Stress

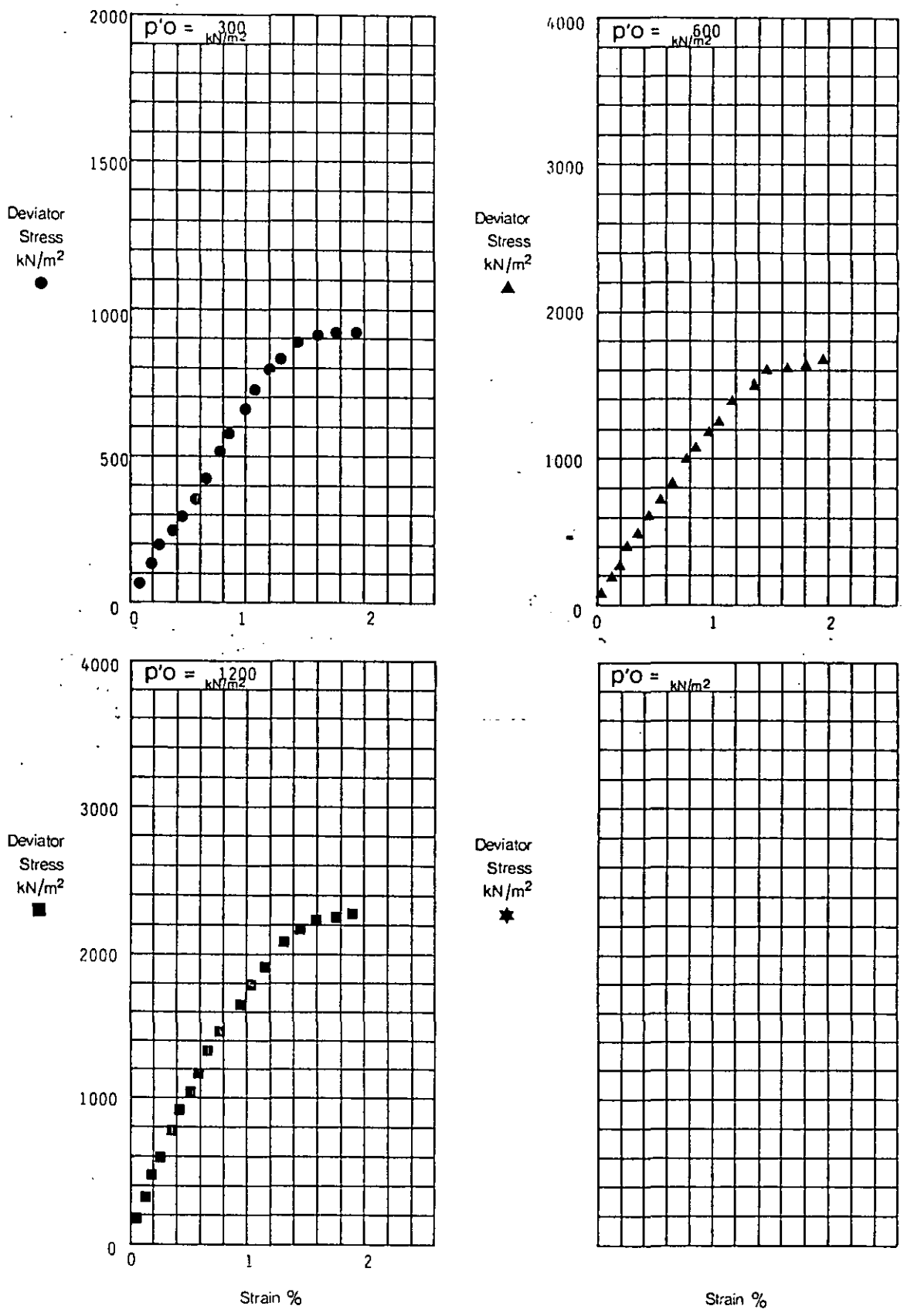
exploration associates

Project Department of Transport
East Midlands Regional Office
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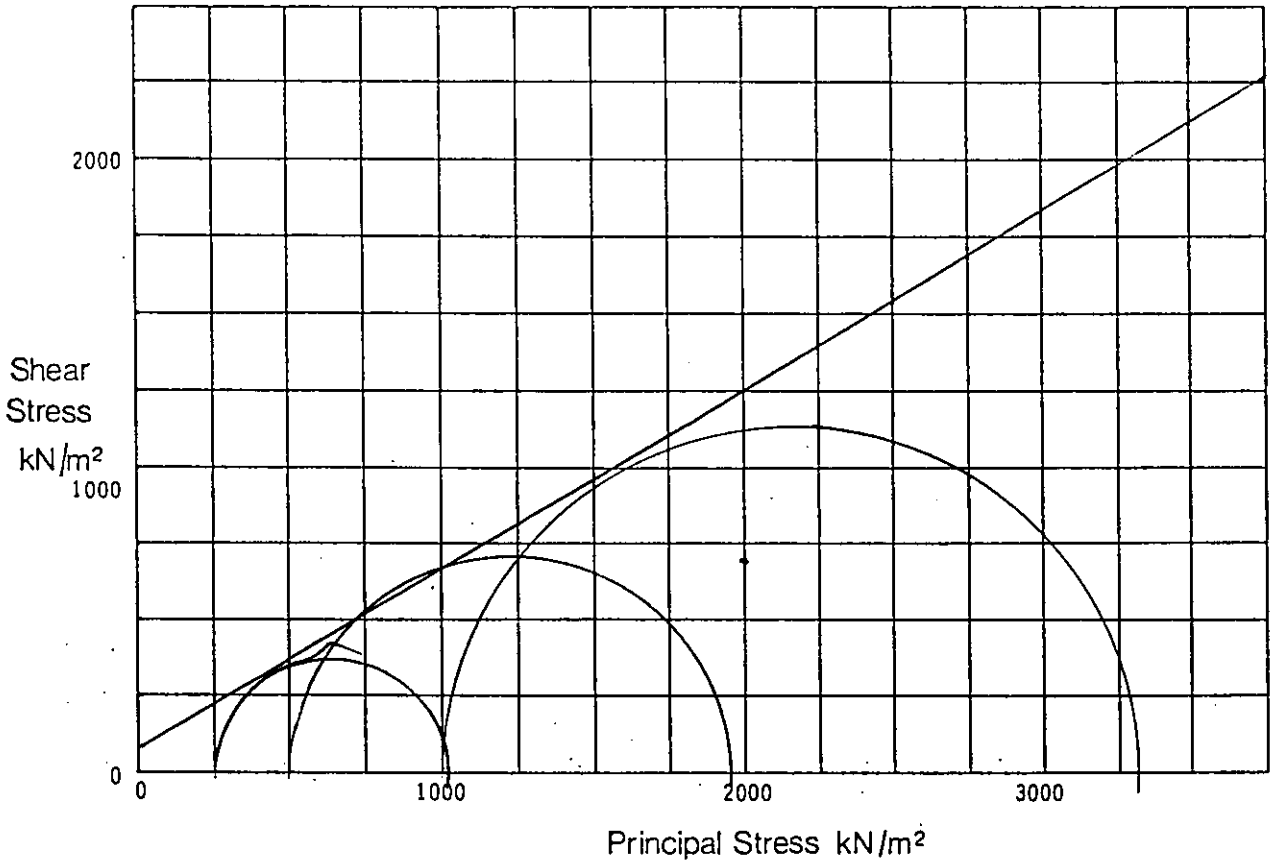
Figure 2.170

EX3



Deviator Stress / Strain		Depth 12.10 - 12.40 Borehole B271
Remarks		
Laboratory - Effective Stress	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449
exploration associates		**Figure** 2.171

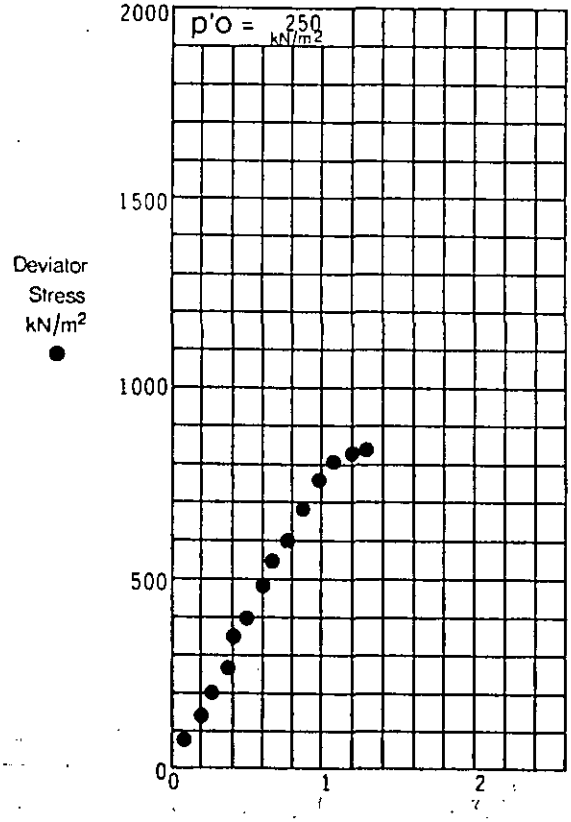
EX3

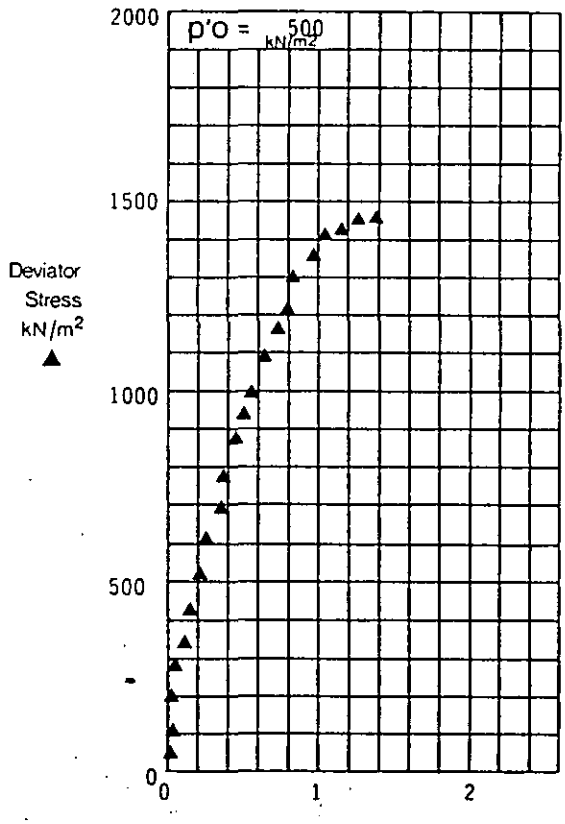


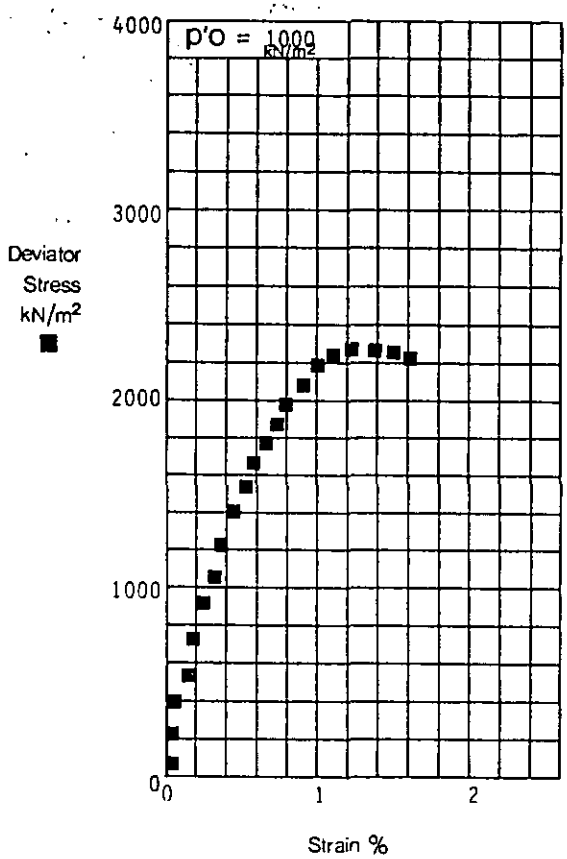
B	(Initial)		-	-	-	
B_s	(After application of Back Pressure)		-	-	-	
ε	(Rate of Strain)	% min	0.1	0.1	0.1	
σ_3	(Cell Pressure during Shear)	kN/m²	250	500	1000	
u_0	(Applied Back Pressure)	kN/m²	-	-	-	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	-	-	-	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	755	1475	2270	

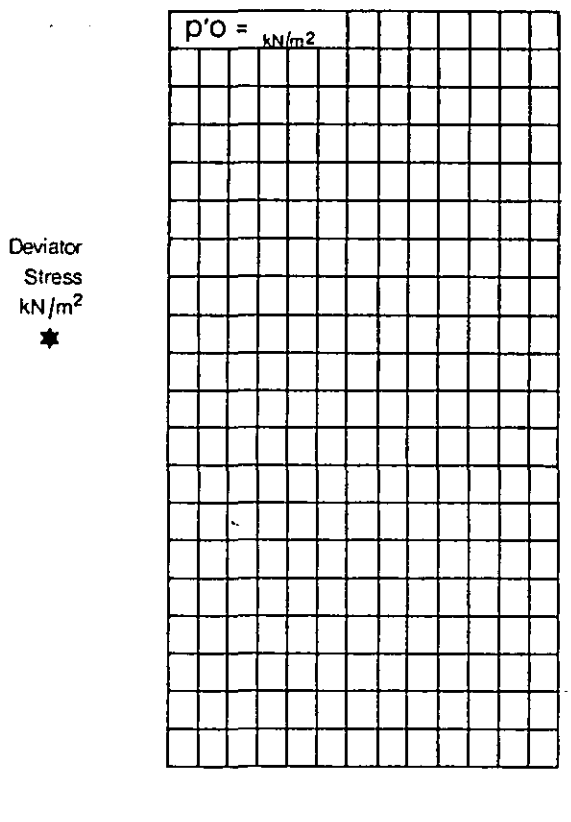
Triaxial Compression Test Consolidated Undrained	Description Grey green occasionally red brown SILTSTONE	C' 75 kN/m² Φ' 30 Degrees
	Mohr Circles and Summary	Depth 10.50 - 10.91 Borehole 8283
Remarks HOEK CELL TEST		
Laboratory - Effective Stress exploration associates	Project Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449 Figure 2.172

EX3









Deviator Stress / Strain

Depth 10.50 - 10.91
Borehole B283

Remarks

Laboratory - Effective Stress

exploration associates

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Figure 2.173

EX3

B.H. No.	DEPTH m	DIAMETER mm	LENGTH mm	DENSITY mg/m³	LOAD AT FAILURE tons	APPARENT STRENGTH MN/m²	CORRECTED STRENGTH MN/m²
B220	15.27 15.50	76	Sample fractured during preparation				
	18.88 19.23	76	106	2.09	1.50	-	3.13
B221	15.21 15.45	76	Sample fractured during preparation				
B223	18.24 18.49	76	84	2.23	0.50	-	1.02

Laboratory – Uniaxial Compression Test	**Project**	Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates			**Figure** 2.174

B.H. No.	DEPTH m	DIAMETER mm	LENGTH mm	DENSITY mg/m³	LOAD AT FAILURE tons	APPARENT STRENGTH MN/m²	CORRECTED STRENGTH MN/m²
B243	10.87 11.10	76	152	2.29	0.25	-	0.55
	13.64 13.86	76	152	2.20	0.25	-	0.55
B251	11.46 11.70	76	146	2.31	1.00	-	2.18
B257	4.88 5.10	76	Sample fractured during preparation				
B259	18.53 18.90	76	95	2.22	0.25	-	0.52

Laboratory – Uniaxial Compression Test	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.175

EX 4

B.H. No.	DEPTH m	DIAMETER mm	LENGTH mm	DENSITY mg/m³	LOAD AT FAILURE tons	APPARENT STRENGTH MN/m²	CORRECTED STRENGTH MN/m²
B260	6.58 6.80	76	136	2.07	0.50	-	1.08
B267	5.50 5.85	76	93	2.18	0.50	-	1.03
B271	5.73 5.98	76	87	2.27	1.50	-	3.06
B284	5.54 5.90	76	120	2.21	0.50	-	1.06
	13.75 14.12	74	150	2.36	0.25	-	0.59

Laboratory – Uniaxial Compression Test

exploration associates

Project Department of Transport
East Midlands Regional Office
A42 Castle Donington North
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Figure 2.176

EX 4

B.H. No.	DEPTH m	DIAMETER mm	LENGTH mm	DENSITY mg/m³	LOAD AT FAILURE tons	APPARENT STRENGTH MN/m²	CORRECTED STRENGTH MN/m²
B286	10.50 10.74	76	152	2.19	2.00	-	4.39
B289	6.27 6.56	74	68	2.35	0.50	-	1.06

Laboratory – Uniaxial Compression Test	**Project**	Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates			**Figure** 2.177

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m²)	Is (50) MN/m²	Unconfined Compressive Strength MN/m²	Strength Consistency	Remarks
Bh B219							
19.35-19.51	160	6.00A	0.234	0.30	7.20	MW	
19.35-19.51	76	4.00D	0.693	0.82	19.68	MS	
19.71-19.84	130	7.50A	0.444	0.52	12.48	MW	
19.71-19.84	76	5.60D	0.970	1.20	28.80	MS	
Bh B221							
20.10-20.24	140	10.50A	0.536	0.68	16.32	MS	
20.10-20.24	76	6.60D	1.143	1.38	33.12	MS	

NOTES: VW = Very Weak
W = Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

0.50 A*
1.13 D*
*Average Is (50) MN/m² Value based on the above test results.

Point Load Strength

exploration associates

Project Department of Transport
East Midlands Regional Office
A42 Castle Donnington North
Main Site Investigation Contract2

Contract S4449

Figure 2.178

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m²)	Is (50) MN/m²	Unconfined Compressive Strength MN/m²	Strength Consistency	Remarks
Bh B220							
16.00-16.11	110	3.20A	0.264	0.32	7.68	MW	
16.00-16.11	76	1.30D	0.225	0.28	6.72	MW	
17.24-17.36	120	0.80A	0.056	0.07	1.68	W	
17.24-17.36	76	0.80D	0.139	0.18	4.32	W	
18.14-18.25	110	23.00A	1.901	2.40	57.50	S	
18.14-18.25	76	6.20D	1.073	1.25	30.00	MS	
18.37-18.50	130	5.00A	0.296	0.38	9.12	MW	
18.37-18.50	76	4.50D	0.779	1.00	24.00	MS	
Bh B221							
14.70-14.83	130	0.70A	0.041	0.05	1.20	VW	
14.70-14.83	76	1.00D	0.173	0.25	6.00	MW	
16.31-16.45	140	1.30A	0.066	0.08	1.92	W	
16.31-16.45	76	1.40D	0.242	0.30	7.20	MW	
16.52-16.66	140	1.50D	0.077	0.09	2.16	W	
16.52-16.66	76	1.00D	0.173	0.25	6.00	MW	
Bh B222							
14.83-14.95	120	0.40A	0.028	0.04	0.96	VW	
14.83-14.95	76	0.40D	0.069	0.08	1.92	W	
Bh B224							
18.00-18.15	150	0.40A	0.018	0.025	0.60	VW	
18.15-18.32	170	0.00A	——	——	——	VW	

NOTES: VW = Very weak
W = Weak
MW = Moderately weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

0.38 A*
0.45 D*
*Average Is (50) MN/m² value based on the above test results.

Point Load Strength	**Project** Department of Transport East Midlands Regional Office A42 Castle Donnington North Main Site Investigation contract 2	Contract S4449
exploration associates		**Figure** 2.179

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m^2)	Is (50) MN/m^2	Unconfined Compressive Strength MN/m^2	Strength Consistency	Remarks
Bh B242							
11.09-11.22	130	8.40A	0.497	0.61	14.64	MS	
11.09-11.22	76	5.90D	1.021	1.20	28.80	MS	
12.44-12.55	110	0.30A	0.025	0.03	0.72	VW	
12.44-12.55	76	0.10D	0.017	0.02	0.48	VW	
Bh B243							
9.37-9.50	130	1.70A	0.101	0.12	2.88	W	
9.37-9.50	76	0.70D	0.121	0.14	3.36	W	
Bh B244							
8.09-8.19	76	0.20D	0.035	0.04	0.96	VW	
8.19-8.30	110	0.50A	0.041	0.05	11.20	VW	
12.80-12.90	100	0.50A	0.050	0.06	1,44	W	
12.90-13.00	76	0.20D	0.035	0.04	0.96	VW	
13.19-13.30	110	10.50A	0.868	1.05	25.20	MS	
13.30-13.47	76	3.80D	0.658	0.80	19.20	MS	
14.00-14.12	120	0.40A	0.028	0.04	0.96	VW	
14.12-14.22	76	0.30D	0.052	0.06	1.44	W	
14.70-14.81	110	0.20A	0.017	0.02	0.48	VW	
14.81-14.95	76	0.30D	0.052	0.06	1.44	W	
Bh B245							
11.30-11.42	120	0.40A	0.028	0.04	0.96	VW	
11.42-11.54	76	0.10D	0.017	0.02	0.48	VW	

NOTES:
VW = Very Weak
W = Weak
MW = Moderately Weak
MS = Moderately Strong
S= Strong

A = Axial
D = Diametral

Point Load Strength

exploration associates

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Main Site Investigation Contract 2

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Figure 2.180

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m^2)	Is (50) MN/m^2	Unconfined Compressive Strength MN/m^2	Strength Consistency	Remarks
Bh B245							
12.73-12.83	100	4.70A	0.470	0.61	14.64	MS	
12.83-13.00	76	4.60D	0.796	1.00	24.00	MS	

NOTES: VW = Very Weak
W = Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A= Axial
D= Diametral

0.263A*
0.338D*

* Average Is (50) MN/m^2 Value based on the above test results.

Point Load Strength

exploration associates

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Main Site Investigation Contract 2

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Figure 2.181

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m^2)	Is (50) MN/m^2	Unconfined Compressive Strength MN/m^2	Strength Consistency	Remarks
Bh B243							
13.00-13.12	120	4.00A	0.278	0.38	9.12	MW	
13.00-13.12	76	2.20D	0.381	0.45	10.80	MW	
14.78-14.92	140	0.10A	0.005	0.006	0.144	VW	
14.78-14.92	76	0.00D	——	——	——		
Bh B244							
9.84-9.94	100	2.00 A	0.200	0.25	6.00	MW	
9.94-10.04	76	2.30D	0.398	0.47	11.28	MW	
10.97-11.07	76	0.40D	0.069	0.08	1.92	W	
11.07-11.19	120	0.40A	0.028	0.04	0.96	VW	
11.55-11.65	76	0.00D	——	——	——		
11.65-11.77	120	0.30D	0.021	0.03	0.72	VW	

NOTES: VW = Very Weak
W = Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A= Axial
D= Diametral

0.141 A*
0.333 D*

* Average Is(50) MN/m^2 Value based on the above test results

Point Load Strength

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Figure 2.182

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m^2)	Is (50) MN/m^2	Unconfined Compressive Strength MN/m^2	Strength Consistency	Remarks
Bh B248							
9.33-9.44	110	0.20A	0.017	0.03	0.72	VW	
9.44-9.56	76	0.10D	0.017	0.03	0.72	VW	
Bh B249							
12.60-12.71	110	10.60A	0.876	1.10	26.40	MS	
12.71-12.88	76	2.90D	0.502	0.60	14.40	MS	
Bh B250							
9.24-9.37	76	1.60D	0.277	0.36	8.64	MW	
9.46-9.56	100	3.80A	0.380	0.47	11.28	MW	
10.15-10.25	100	0.20A	0.020	0.03	0.72	VW	
10.25-10.35	76	0.30D	0.052	0.06	1.44	W	
12.64-12.74	100	15.00A	1.500	1.90	45.6	MS	
12.74-12.84	76	8.00D	1.385	1.70	40.80	MS	
14.49-14.60	110	0.20A	0.017	0.03	0.72	VW	
14.60-14.70	76	0.20D	0.035	0.04	0.96	VW	
Bh B251							
9.37-9.48	110	0.80A	0.066	0.08	1.92	W	
9.37-9.48	76	1.20D	0.208	0.26	6.24	MW	
12.10-12.20	100	2.60A	0.260	0.32	7.68	MW	
12.20-12.30	76	2.00D	0.346	0.40	9.60	MW	
13.70-13.80	100	16.00A	1.600	2.00	48.00	MS	
13.80-13.90	76	10.00	1.731	2.10	50.40	S	

NOTES: VW = Very Weak
W = Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

Point Load Strength

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Figure 2.183

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m^2)	Is (50) MN/m^2	Unconfined Compressive Strength MN/m^2	Strength Consistency	Remarks
Bh B252							
16.61-16.72	110	0.30A	0.025	0.03	0.72	VW	
16.72-16.83	76	0.20D	0.035	0.04	0.96	VW	

NOTES:
VW = Very Weak
W = Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

0.616 A*
0.559D*

*Average Is(50) $MN3m^2$ Value based on the above test results.

Point Load Strength

exploration associates

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Main Investigation Site Contract 2

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Figure 2.184

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m^2)	Is (50) MN/m^2	Unconfined Compressive Strength MN/m^2	Strength Consistency	Remarks
Bh B257							
6.80-6.90	100	0.30A	0.030	0.04	0.96	VW	
6.90-7.00	76	0.10D	0.017	0.03	0.72	VW	
8.24-8.34	100	1.40A	0.140	0.20	4.80	W	
9.20-9.30	100	3.00A	0.300	0.38	9.12	MW	
9.30-9.40	76	1.30D	0.225	0.28	6.72	MW	
12.20-12.30	100	0.60A	0.060	0.07	1.68	W	
12.30-12.40	76	0.50D	0.087	0.11	2.64	W	
					-		
Bh B258							
4.90-5.00	100	0.20A	0.020	0.03	0.72	VW	
5.00-5.10	76	0.10D	0.017	0.03	0.72	VW	
6.58-6.70	120	0.20A	0.014	0.03	0.72	VW	
6.70-6.84	76	0.00D	-	-	-	-	
9.43-9.55	120	0.60A	0.042	0.05	1.20	VW	
9.74-9.85	76	0.40D	0.069	0.08	1.92	W	
Bh B260							
5.63-5.73	100	1.20A	0.120	0.14	3.36	W	
5.73-5.83	76	0.10D	0.017	0.03	0.72	VW	
9.95-10.06	110	1.10A	0.091	0.11	2.64	W	
10.23-10.36	76	1.30D	0.225	0.26	6.72	MW	
10.60-10.73	130	0.20A	0.012	0.02	0.48	VW	
13.44-13.54	100	2.30A	0.230	0.30	7.20	MW	
13.54-13.65	76	1.30D	0.225	0.30	7.20	MW	

NOTES:

W = Weak
VW = Very Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

0.12A*
0.13D*

* Average Is(50)MN/m^2 value based on the above test results.

Point Load Strength

exploration associates

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Figure 2.185

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m^2)	Is (50) MN/m^2	Unconfined Compressive Strength MN/m^2	Strength Consistency	Remarks
Bh B256							
13.00-13.10	76	3.90D	0.675	0.80	19.20	MS	
13.10-13.23	130	4.70A	0.278	0.36	8.64	MW	
Bh B263							
16.00-16.11	110	1.20A	0.099	0.12	2.88	W	
16.00-16.11	76	1.00D	0.173	0.24	5.76	MW	
18.50-18.60	100	0.30A	0.030	0.04	0.96	VW	
18.50-18.60	76	0.20D	0.035	0.04	0.96	VW	
19.43-19.53	100	2.00A	0.200	0.25	6.00	MW	
19.43-19.53	76	2.00D	0.346	0.40	9.60	W	
19.61-19.74	130	1.00A	0.059	0.08	1.92	W	
19.74-19.89	76	0.02D	0.035	0.04	0.96	VW	

NOTES:

W = Weak
VW = Very Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

* A = Axial 0.17A*
* D = Diametral 0.30D*

* Average Is(50)MN/m^2 based on the above test results.

Point Load Strength

exploration associates

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Figure 2.186

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m²)	Is (50) MN/m²	Unconfined Compressive Strength MN/m²	Strength Consistency	Remarks
Bh B254							
17.30-17.40	100	0.10A	0.010	0.01	0.24	VW	
17.40-17.52	76	0.10D	0.017	0.02	0.48	VW	
17.60-17.70	100	3.90A	0.390	0.50	12.00	MW	
Bh B256							
15.30-15.43	130	0.20A	0.012	0.02	0.48	VW	
15.30-15.43	76	0.10D	0.017	0.02	0.48	VW	
Bh B259							
15.66-15.77	110	0.20A	0.017	0.02	0.48	VW	
15.77-15.90	76	0,40D	0.069	0.08	1.92	W	
15.90-16.03	130	0.20A	0.012	0.02	0.48	VW	
18.69-18.82	130	0.20A	0.012	0.02	0.48	VW	
18.82-18.94	76	0.10D	0.017	0.02	0.48	VW	

NOTES:

W = Weak
VW = Very Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

0.09A*
0.04D*

* Average Is(50)MN/m² value based on the above test results.

Point Load Strength

exploration associates

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Main Site Investigation : Contract 2

Contract S4449

Figure 2.187

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m^2)	Is (50) MN/m^2	Unconfined Compressive Strength MN/m^2	Strength Consistency	Remarks
Bh B256							
18.00-18.10	76	0.10D	0.017	0.02	0.48	VW	
18.10-18.23	130	0.40A	0.024	0.03	0.72	VW	
18.25-18.35	100	0.20A	0.20	0.03	0.72	VW	
18.35-18.45	76	0.30D	0.052	0.06	1.44	W	
19.90-20.00	100	1.70A	0.170	0.25	6.00	MW	
19.90-20.00	76	0.50D	0.087	0.11	2.64	W	
Bh B257							
18.10-18.22	120	0.20A	0.014	0.02	0.48	VW	
18.22-18.35	76	0.00D	-	-	-	-	
19.25-19.37	120	0.30A	0.021	0.03	0.72	VW	
19.37-19.50	76	0.10D	0.017	0.02	0.48	VW	

NOTES:
W = Weak
VW = Very Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

0.07A*
0.05D*

* Average Is(50)MN/m^2 value based on the above test results.

Point Load Strength

exploration associates

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Figure 2.188

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m^2)	Is (50) MN/m^2	Unconfined Compressive Strength MN/m^2	Strength Consistency	Remarks
Bh B266							
9.50-9.60	100	2.70A	0.270	0.38	9.12	MW	
10.22-10.34	120	0.50A	0.035	0.04	0.96	VW	
10.34-10.45	76	0.10D	0.017	0.02	0.48	VW	
11.09-11.20	110	0.20A	0.017	0.02	0.48	VW	
12.20-12.32	120	2.30A	0.160	0.20	4.80	W	
12.32-12.46	76	0.60D	0.104	0.14	3.36	W	
13.24-13.36	120	0.10A	0.007	0.10	2.40	W	
13.36-13.46	76	0.60D	0.104	0.14	3.36	W	
14.48-14.58	100	4.00A	0.400	0.50	12.00	MW	
14.58-14.69	76	0.80D	0.139	0.20	4.80	W	
14.69-14.81	120	4.00A	0.278	0.39	9.36	MW	
Bh B267							
6.10-6.20	100	1.80A	0.180	0.20	4.80	W	
6.20-6.34	76	0.40D	0.069	0.08	1.92	W	
7.00-7.15	76	0.20D	0.035	0.04	0.96	VW	
7.15-7.25	100	1.20A	0.120	0.20	4.80	W	
10.76-10.86	100	0.60A	0.060	0.08	1.92	W	
10.86-11.30	76	0.10D	0.017	0.02	0.48	VW	
13.35-13.45	100	0.40A	0.040	0.05	1.20	VW	
13.45-13.55	76	0.10D	0.017	0.02	0.48	VW	
13.55-13.66	110	3.80A	0.314	0.39	9.36	MW	
13.66-13.76	100	2.60D	0.260	0.32	7.68	MW	
15.19-15.34	76	2.10D	0.363	0.42	10.08	MW	

NOTES:

W = Weak
VW = Very Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

Point Load Strength

exploration associates

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Figure 2.189

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m²)	Is (50) MN/m²	Unconfined Compressive Strength MN/m²	Strength Consistency	Remarks
Bh B267							
15.66-15.80	140	6.60A	0.337	0.40	9.60	MW	
17.74-17.86	120	0.10A	0.007	0.01	0.24	VW	
17.86-18.00	76	0.00D	-	-	-	-	
Bh B270							
9.32-9.44	120	1.30A	0.090	0.11	2.64	W	
Bh B271							
9.70-9.80	100	0.20A	0.020	0.03	0.72	VW	
9.80-9.90	76	0.20D	0.035	0.04	0.96	VW	
Bh B274							
8.20-8.30	100	0.20A	0.020	0.03	0.72	VW	
8.30-8.44	76	0.00D	-	-	-	-	

NOTES:

W = Weak
VW = Very Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

0.18A*
0.13D*

* Average Is(50)MN/m² value based on the above test results.

Point Load Strength

exploration associates

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Figure 2.190

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m^2)	Is (50) MN/m^2	Unconfined Compressive Strength MN/m^2	Strength Consistency	Remarks
Bh B271							
12.65-12.77	120	4.40A	0.306	0.38	9.12	MW	
12.77-12.90	76	2.80D	0.485	0.60	14.40	MS	
13.73-13.84	110	6.80A	0.562	0.68	16.32	MS	
13.91-14.04	76	5.30D	0.918	1.10	26.40	MS	
Bh B272							
10.00-10.10	100	0.20A	0.020	0.03	0.72	VW	
10.10-10.20	76	0.10D	0.017	0.02	0.48	VW	
12.05-12.15	76	0.50D	0.087	0.10	2.40	W	
12.30-12.40	100	0.20A	0.020	0.03	0.72	VW	
16.30-16.42	120	1.20A	0.083	0.10	2.40	W	
16.42-16.54	76	0.40D	0.069	0.08	1.92	W	

NOTES:

W = Weak
VW = Very Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

0.24A*
0.32D*

* Average Is(50)MN/m^2 value based on the above test results.

Point Load Strength

exploration associates

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East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation : Contract 2

Contract S4449

Figure 2.191

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m^2)	Is (50) MN/m^2	Unconfined Compressive Strength MN/m^2	Strength Consistency	Remarks
8h B271							
17.30-17.42	120	1.00A	0.069	0.08	1.92	W	
18.10-18.20	100	1.50A	0.150	0.20	4.80	W	
18.20-18.32	76	2.20D	0.381	0.48	11.52	MW	
8h B274							
12.64-12.78	76	1.70D	0.294	0.37	8.88	MW	
12.96-13.09	130	2.20A	0.130	0.17	4.08	W	
14.86-14.97	110	2.40A	0.198	0.28	6.72	MW	
14.97-15.10	76	1.60D	0.277	0.33	7.92	MW	
15.42-15.52	100	2.70A	0.270	0.35	8.40	MW	
15.52-15.62	100	1.40D	0.140	0.18	4.32	W	
17.74-17.85	110	1.60A	0.132	0.17	4.08	W	
17.85-17.96	76	0.50D	0.087	0.10	2.40	W	

NOTES:

W = Weak
VW = Very Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

0.21A*
0.29D*

* Average Is(50)MN/m^2 value based on the above test results.

Point Load Strength

exploration associates

Project Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation : Contract 2

Contract S4449

Figure 2.192

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m^2)	Is (50) MN/m^2	Unconfined Compressive Strength MN/m^2	Strength Consistency	Remarks
Bh B282							
7.60-7.72	120	0.20A	0.014	0.02	0.48	VW	
7.72-7.82	76	0.00D	-	-	-	-	
10.08-10.19	110	0.10A	0.008	0.01	0.24	VW	
10.19-10.30	76	0.00D	-	-	-	-	
Bh B283							
3.97-4.07	100	1.00A	0.100	0.13	3.12	W	
4.07-4.18	76	1.20D	0.208	0.26	6.24	MW	
6.50-6.62	76	0.20D	0.035	0.04	0.96	VW	
Bh B284							
8.59-8.70	110	0.20A	0.017	0.02	0.48	VW	
8.70-8.82	76	0.00D	-	-	-	-	
10.30-10.40	100	0.10A	0.010	0.02	0.48	VW	
10.40-10.50	76	0.10D	0.017	0.02	0.48	VW	
11.40-11.50	100	1.20A	0.120	0.15	3.60	W	
11.50-11.64	76	0.10D	0.017	0.02	0.48	VW	
Bh B287							
7.40-7.50	100	0.40A	0.040	0.05	1.20	VW	
9.60-9.72	120	1.30A	0.090	0.11	2.64	W	
9.72-9.84	120	0.40D	0.028	0.04	0.96	VW	

NOTES:

W = Weak
VW = Very Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

Point Load Strength

exploration associates

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Main Site Investigation : Contract 2

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Figure 2.193

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m^2)	Is (50) MN/m^2	Unconfined Compressive Strength MN/m^2	Strength Consistency	Remarks
Bh B289							
7.71-7.81	100	2.00A	0.200	0.26	6.24	MW	
7.81-7.91	76	1.60D	0.277	0.32	7.68	MW	
8.50-8.60	100	1.00A	0.100	0.13	3.12	W	
8.60-8.71	76	0.20D	0.035	0.04	0.96	VW	

NOTES:

W = Weak
VW = Very Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

0.09A*
0.12D*

* Average Is(50)MN/m^2 value based on the above test results.

Point Load Strength

exploration associates

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A42 Castle Donington North
Main Site Investigation : Contract 2

Contract S4449

Figure 2.194

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m²)	Is (50) MN/m²	Unconfined Compressive Strength MN/m²	Strength Consistency	Remarks
Bh B282							
10.50-10.52	20	6.70A	16.750	7.00	168.00	VS	
10.52-10.64	76	5.70D	0.987	1.20	28.80	MS	
12.05-12.17	120	12.00A	0.833	1.00	24.00	MS	
12.17-12.29	76	14.00D	2.424	2.80	67.20	S	
Bh B284							
11.64-11.76	120	2.60A	0.181	0.26	6.24	MW	
11.76-11.88	76	1.10D	0.190	0.26	6.24	MW	
13.08-13.19	110	21.00A	1.736	2.00	48.00	MS	
13.19-13.30	76	17.00D	2.943	3.60	86.40	S	
Bh B287							
10.96-11.07	110	3.00A	0.248	0.32	7.68	MW	
11.07-11.19	76	1.60D	0.277	0.36	8.64	MW	

NOTES:

W = Weak
VW = Very Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong
VS = Very Strong

A = Axial
D = Diametral

2.12A*
1.64D*

* Average Is(50)MN/m² value based on the above test resutlts.

Point Load Strength

exploration associates

Project: Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation : Contract 2

Contract S4449

Figure 2.195

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m^2)	Is (50) MN/m^2	Unconfined Compressive Strength MN/m^2	Strength Consistency	Remarks
Bh B282							
15.38-15.50	120	0.60A	0.042	0.05	1.20	VW	
15.38-15.50	76	0.60D	0.104	0.14	3.36	W	
16.14-16.25	110	0.30A	0.025	0.03	0.72	VW	
16.25-16.37	76	0.10D	0.017	0.02	0.48	VW	
17.27-17.37	100	1.10A	0.110	0.15	3.60	W	
17.37-17.47	76	0.40D	0.069	0.08	1.92	W	
19.50-19.62	120	1.70A	0.118	0.15	3.60	W	
19.62-19.72	76	1.00D	0.173	0.25	6.00	MW	
Bh B284							
16.27-16.38	110	0.80A	0.066	0.08	1.92	W	
16.38-16.50	76	0.10D	0.017	0.02	0.48	VW	
18.10-18.20	100	0.60A	0.060	0.08	1.92	W	
18.20-18.30	76	0.20D	0.035	0.04	0.96	VW	
19.10-19.21	110	0.30A	0.025	0.03	0.72	VW	
19.21-19.33	76	0.40D	0.069	0.08	1.92	W	
Bh B287							
14.79-14.89	100	0.60A	0.060	0.08	1.92	W	
14.89-15.00	76	0.10D	0.017	0.02	0.48	VW	
15.86-15.97	110	1.40A	0.116	0.15	3.60	W	
15.97-16.08	76	0.20D	0.035	0.04	0.96	VW	
18.50-18.60	100	0.80A	0.080	0.10	2.40	W	
18.60-18.70	76	0.20D	0.035	0.04	0.96	VW	

NOTES:

W = Weak
VW = Very Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

0.09A*
0.07D*

* Average Is(50)MN/m^2 value based on the above test results.

Point Load Strength

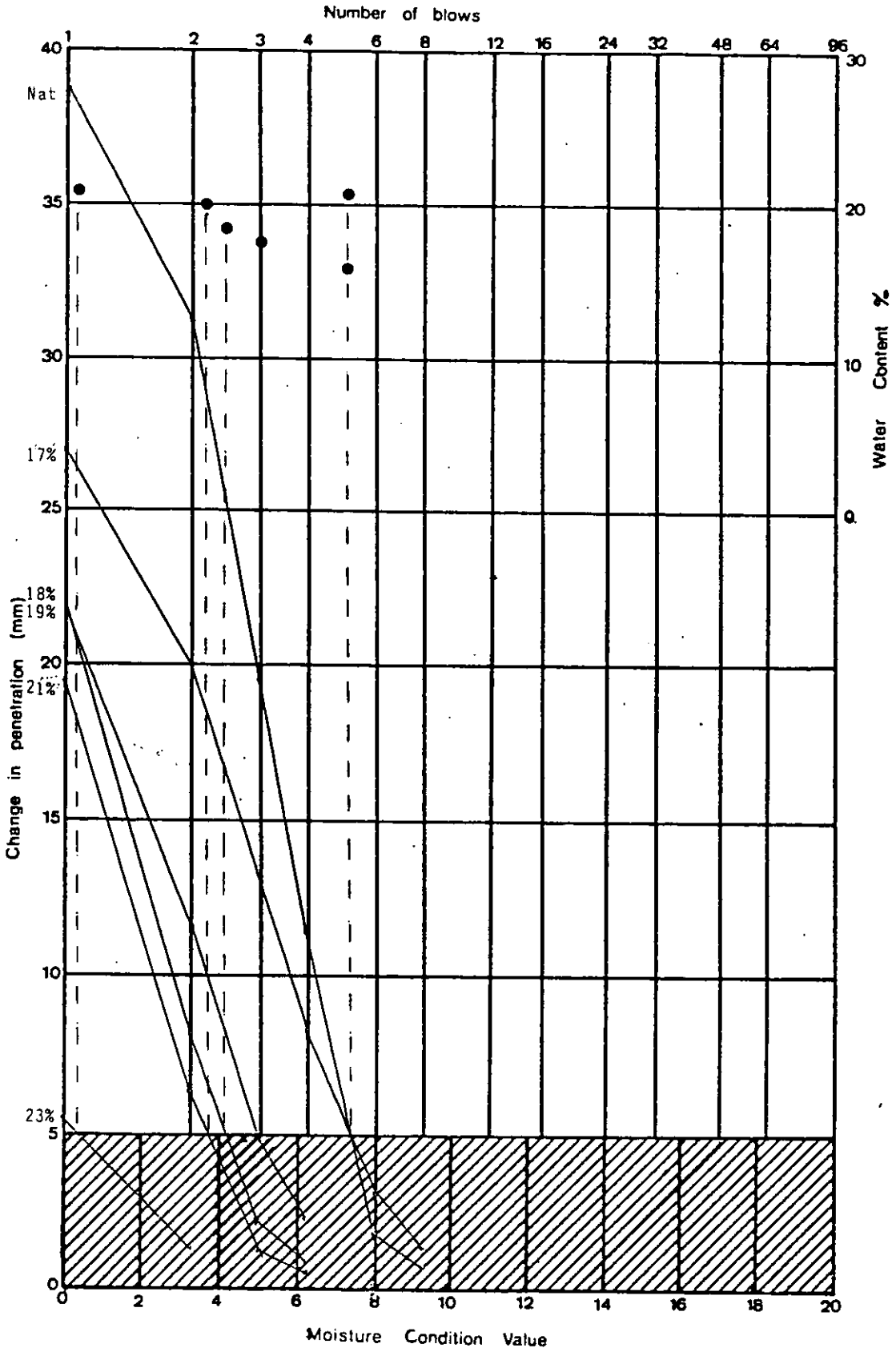
exploration associates

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A42 Castle Donington North
Main Site Investigation : Contract 2

Contract S4449

Figure 2.196

EX 4



Liquid Limit

Plastic Limit

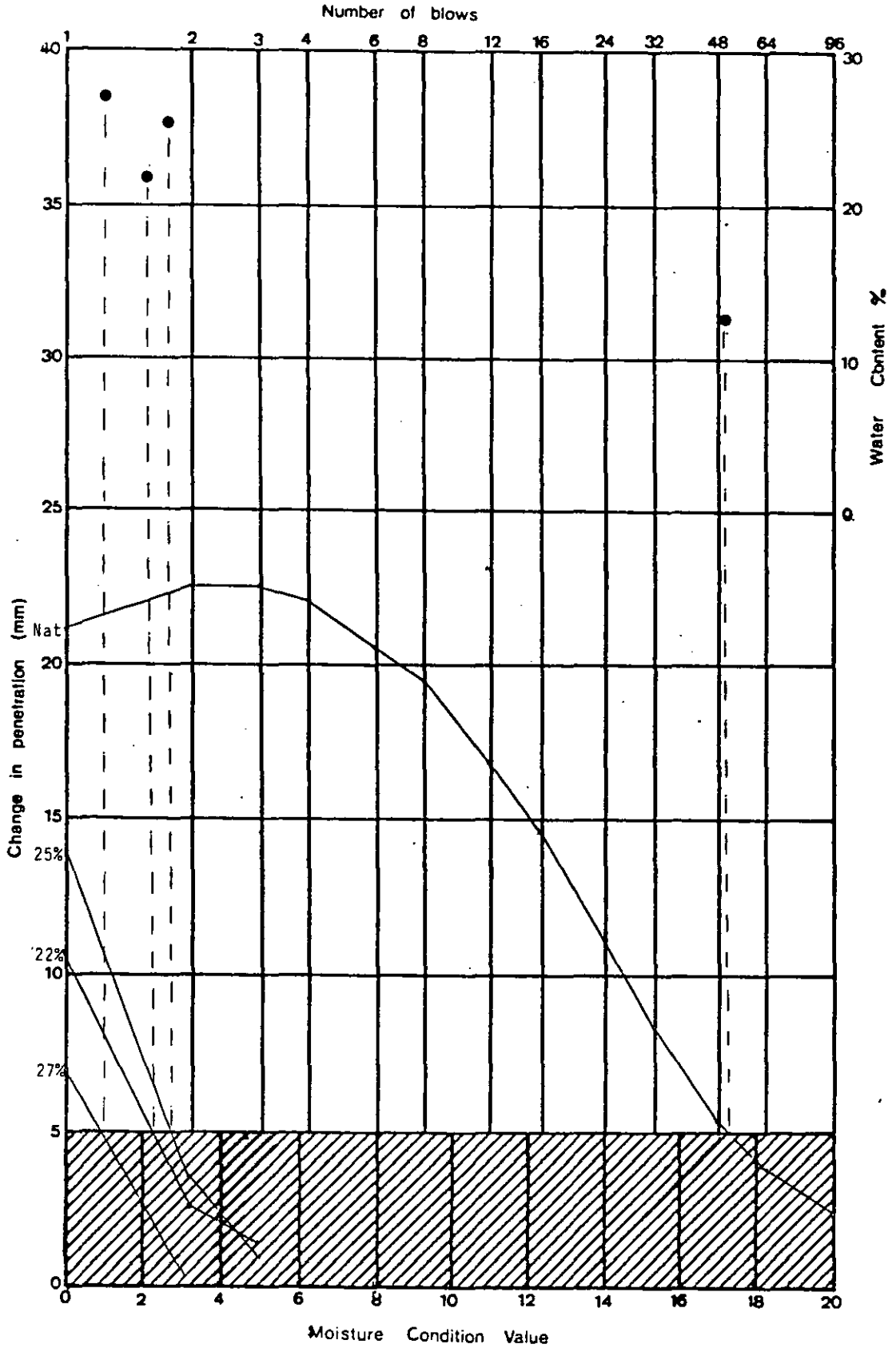
Natural Water Content

Borehole 235

Depth 2.50 - 3.00

Moisture Condition Value	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449
exploration associates		**Figure** 2.197

EX 4



Liquid Limit

Plastic Limit

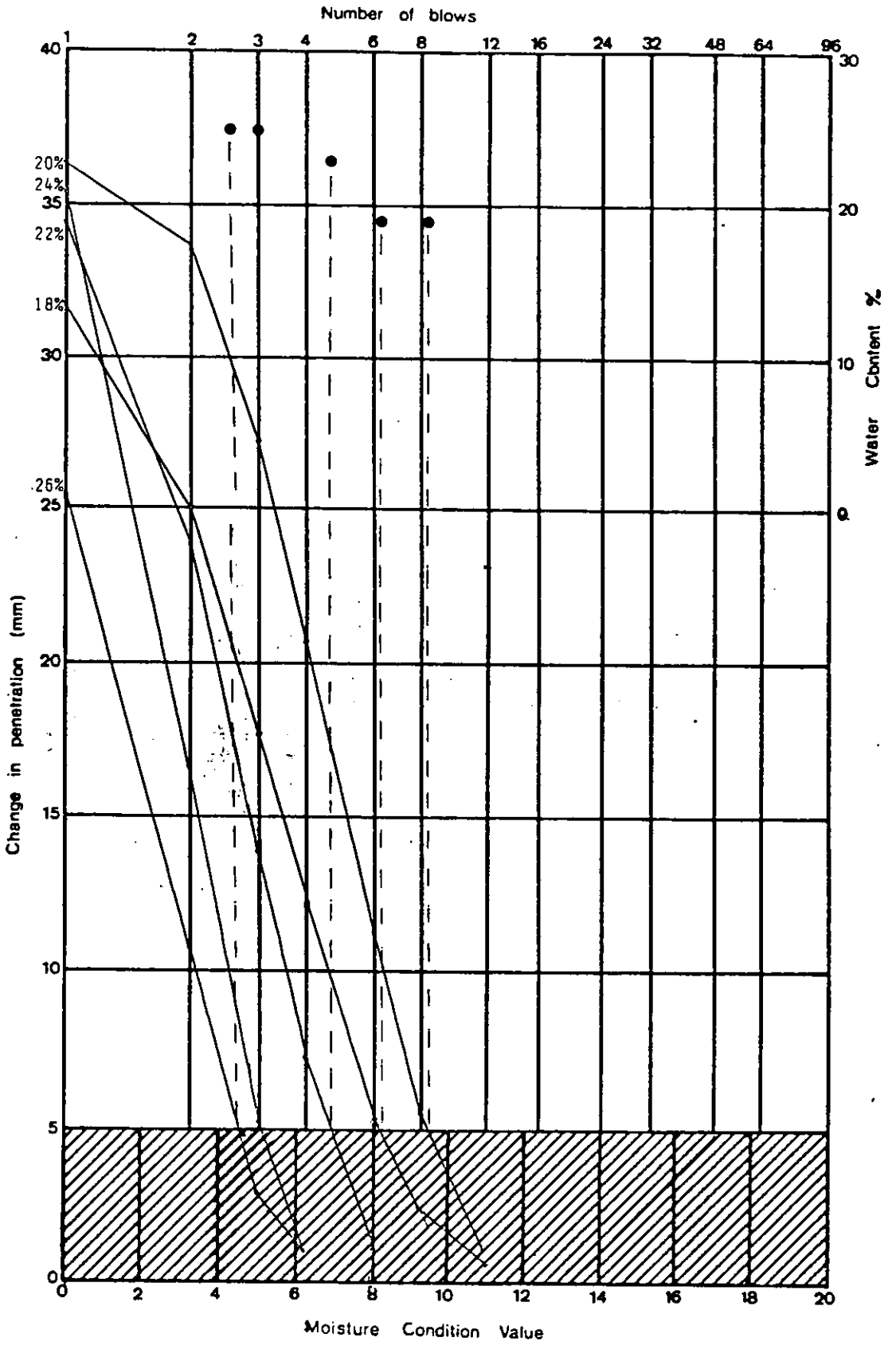
Natural Water Content

Borehole 239

Depth 0.50 - 2.00

Moisture Condition Value	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449
exploration associates		**Figure** 2.198

EX 4



Liquid Limit

Plastic Limit

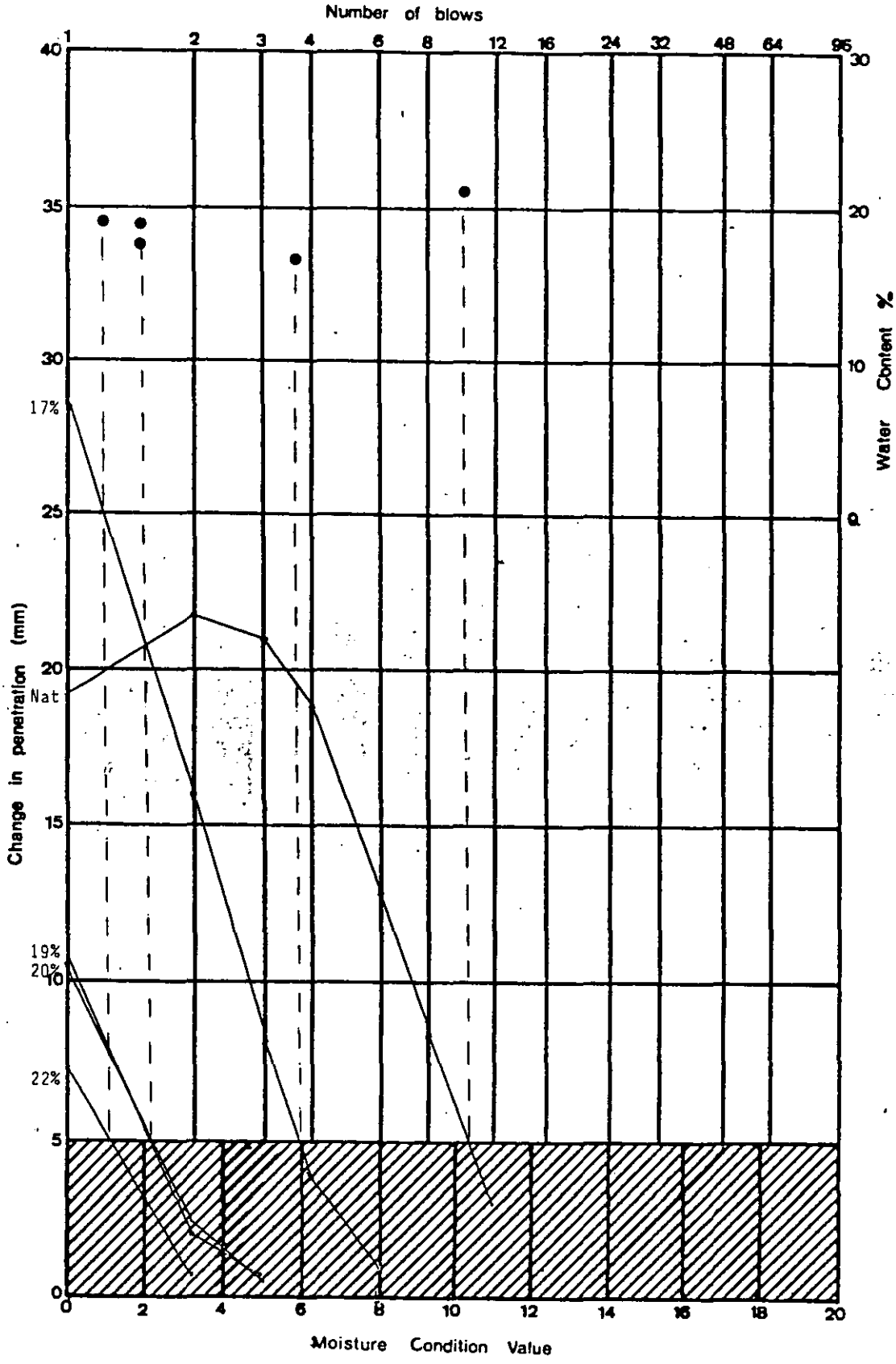
Natural Water Content

Borehole 241

Depth 1.00 - 1.60

Moisture Condition Value	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449
exploration associates		**Figure** 2.199

EX 4



Liquid Limit

Plastic Limit

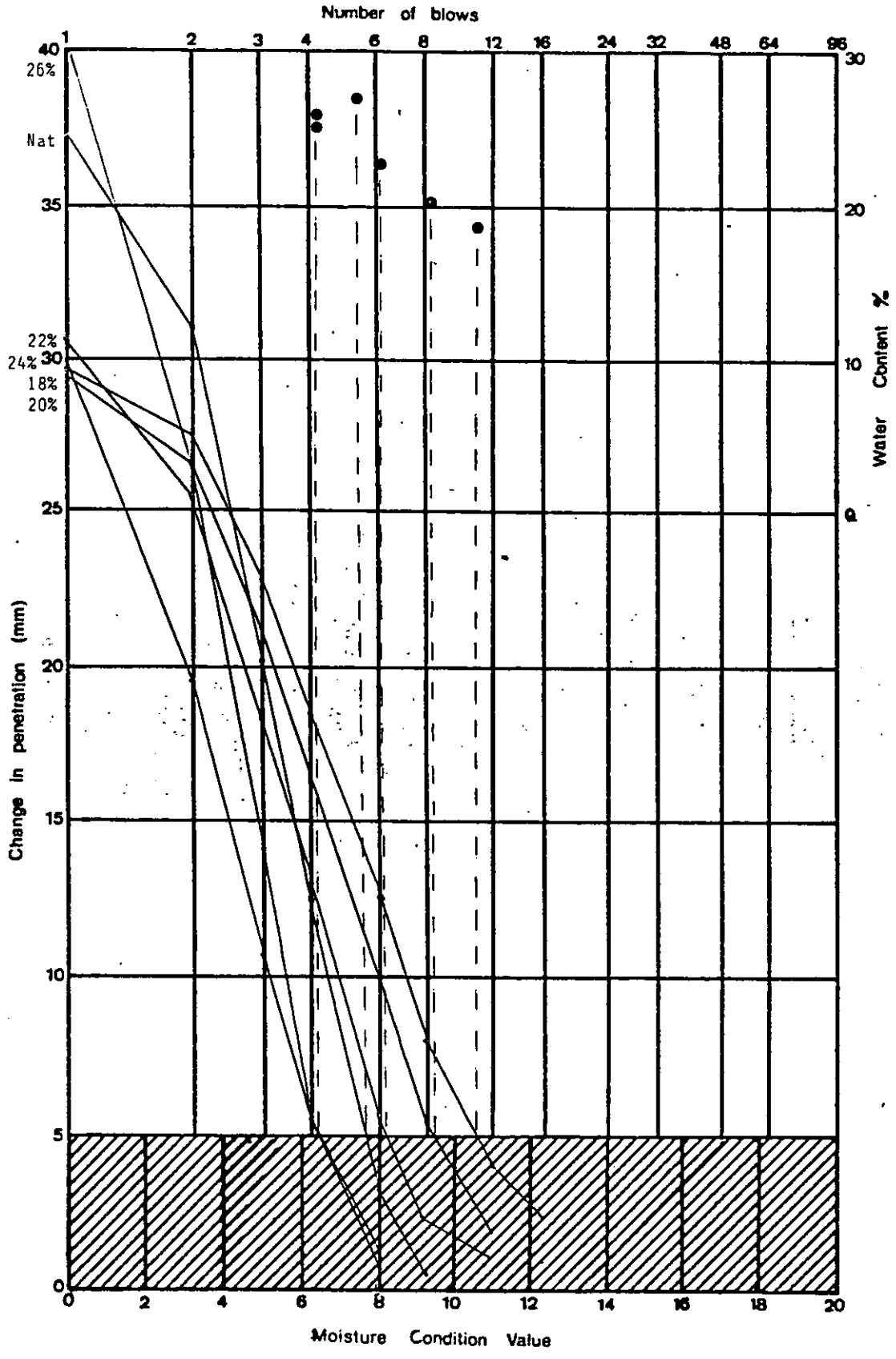
Natural Water Content

Trial Pit 439

Depth 0.80

Moisture Condition Value	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449
exploration associates		**Figure** 2.200

EX 4



Liquid Limit

Plastic Limit

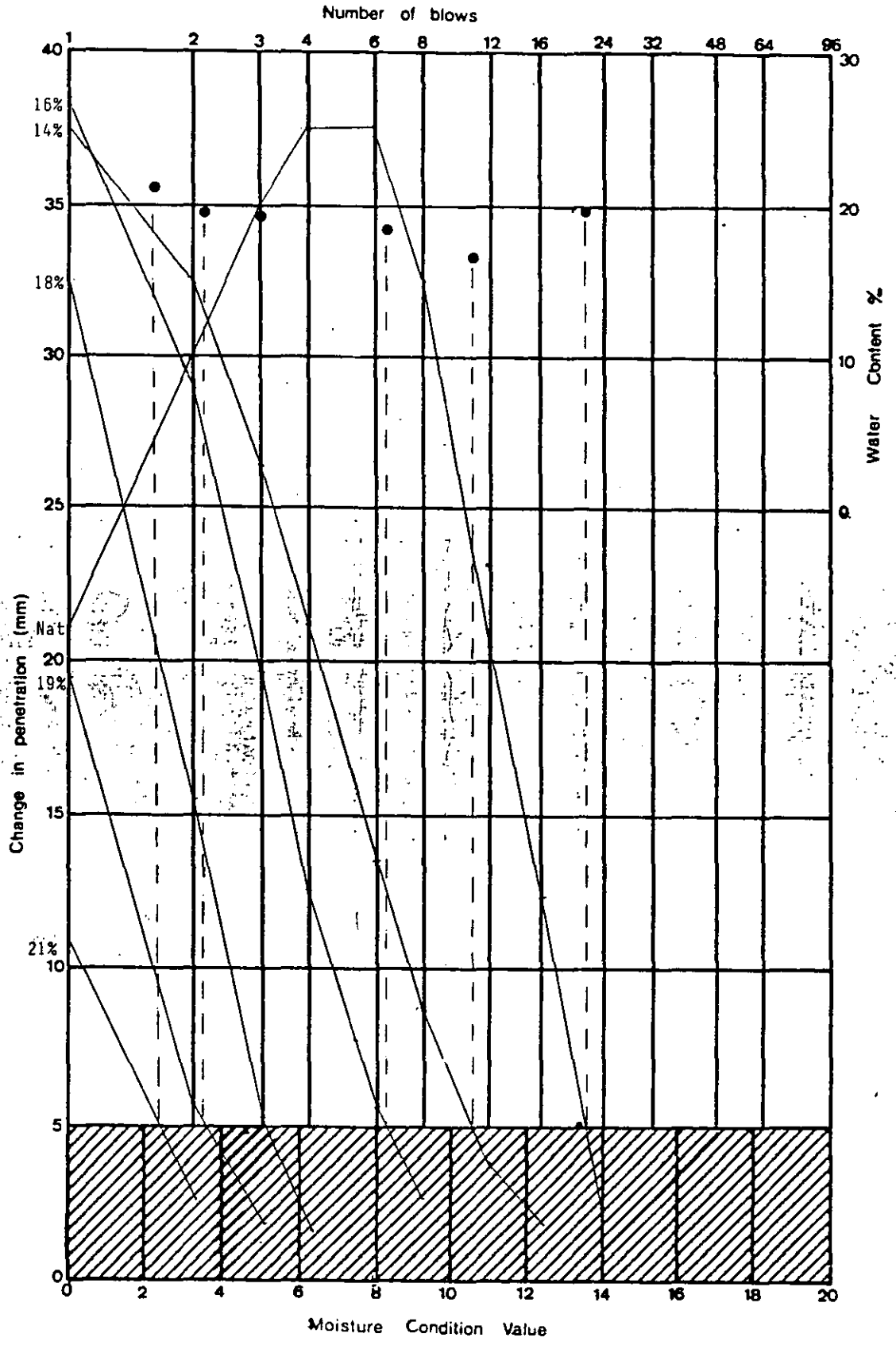
Natural Water Content

Trial Pit 438

Depth 2.40

Moisture Condition Value	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449
exploration associates		**Figure** 2.201

EX 4



Liquid Limit

Plastic Limit

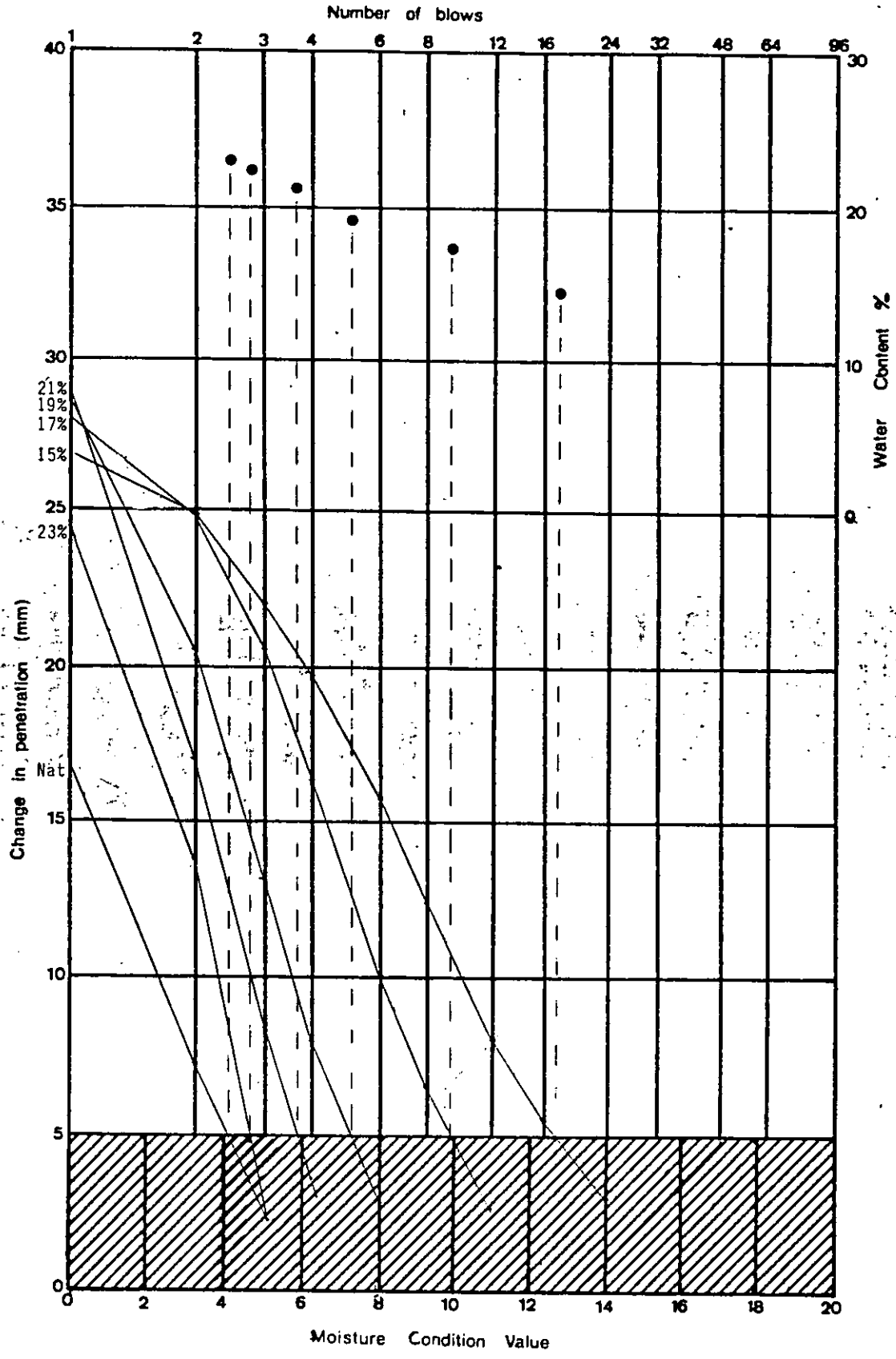
Natural Water Content

Trial Pit 439

Depth 1.20

Moisture Condition Value	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.202

EX 4



Liquid Limit

Plastic Limit

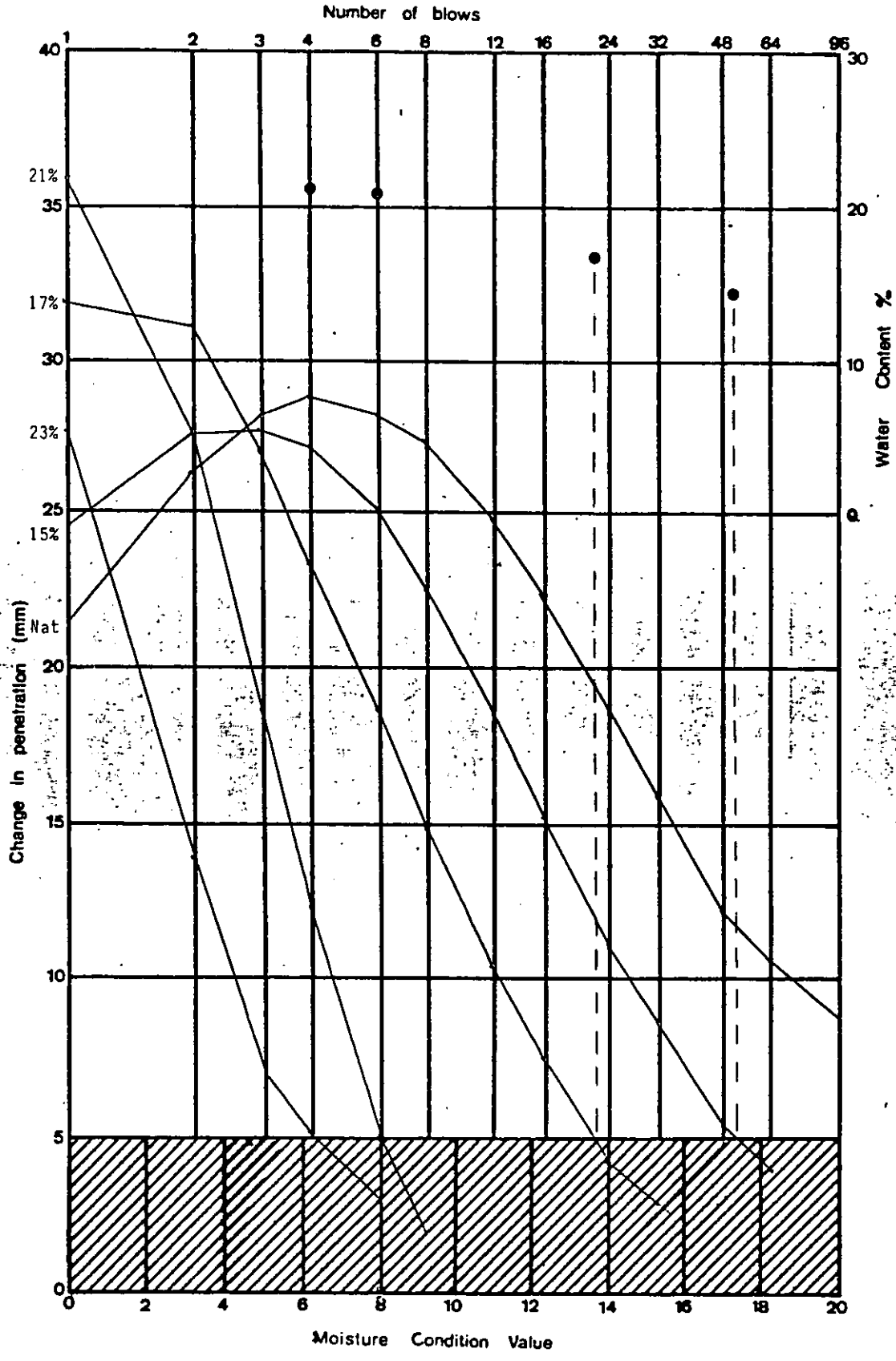
Natural Water Content

Trial Pit 439

Depth 3.00

Moisture Condition Value	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.203

EX 4



Liquid Limit

Plastic Limit

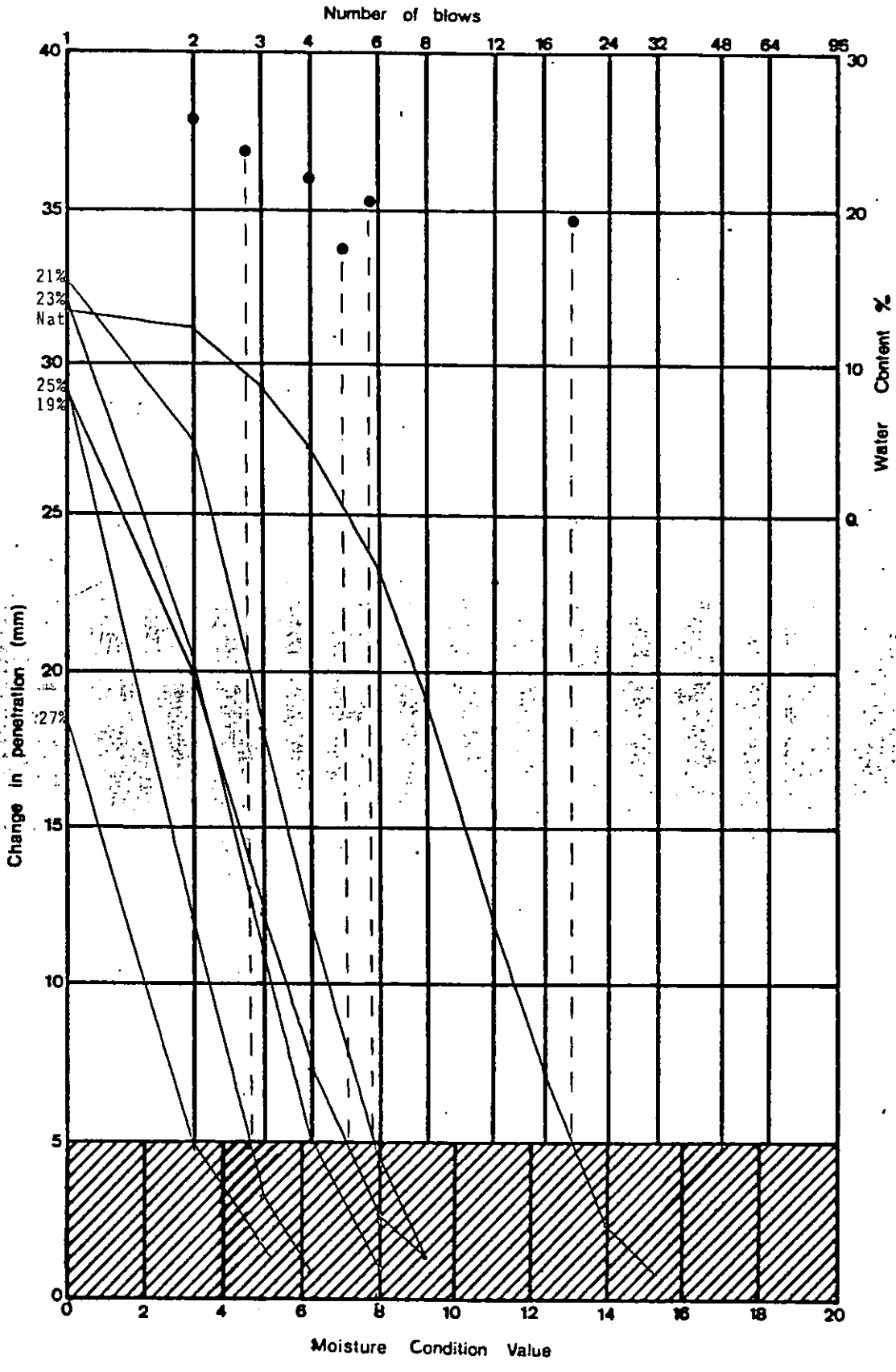
Natural Water Content

Trial Pit 440

Depth 0.50

Moisture Condition Value	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449
exploration associates		**Figure** 2.204

EX 4



Liquid Limit

Plastic Limit

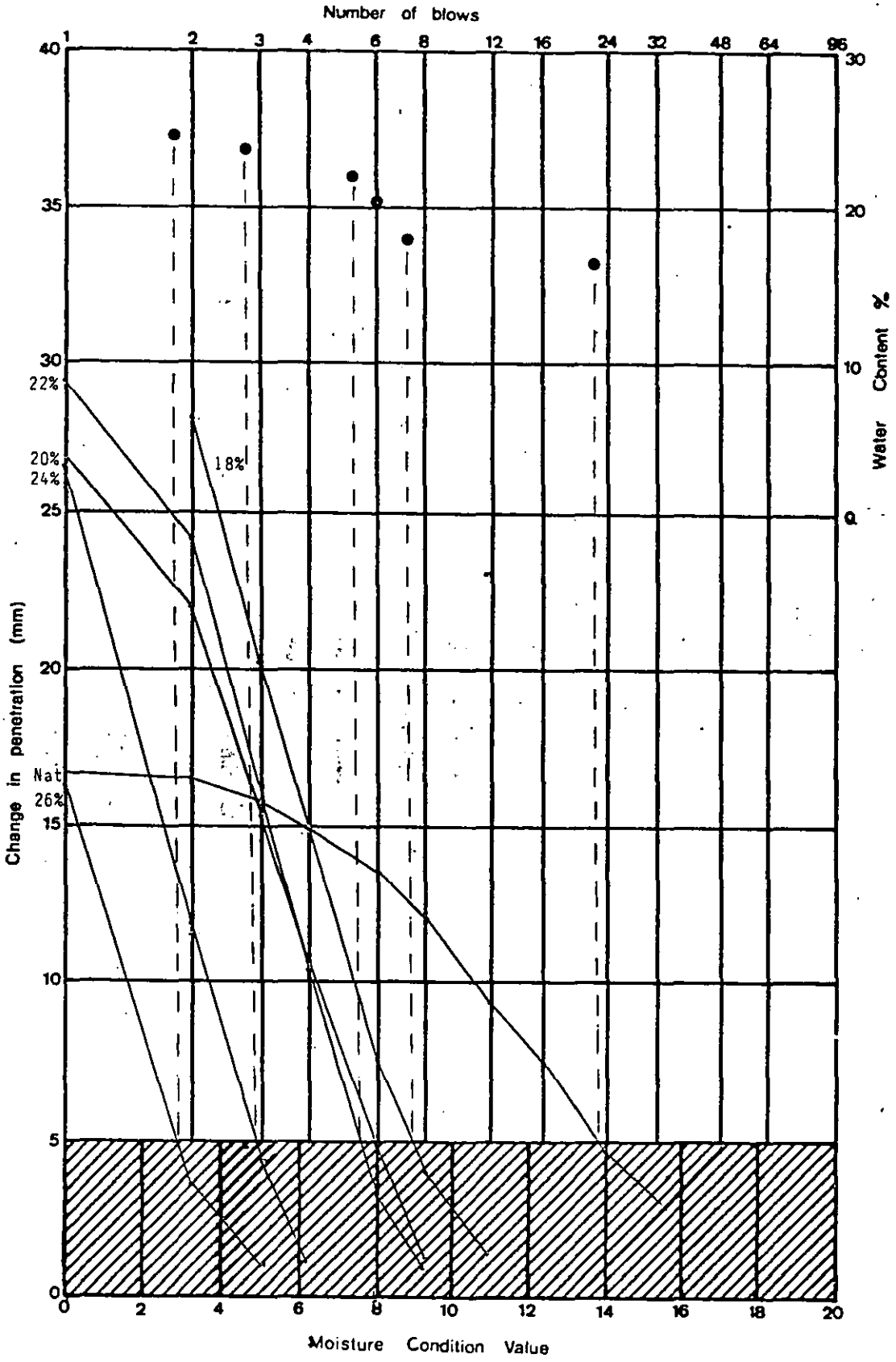
Natural Water Content

Trial Pit 441

Depth 1.20

Moisture Condition Value	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449
exploration associates		**Figure** 2.205

EX 4



Liquid Limit

Plastic Limit

Natural Water Content

Trial Pit 443

Depth 2.80

Moisture Condition Value	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449
exploration associates		**Figure** 2.206

EX 4

EXPLORATION ASSOCIATES (WARWICK) LIMITED, GEOTECHNICAL HOUSE, HATTON, WARWICK. CV35 7JL
Tel: (0926) 491743

DEPARTMENT OF TRANSPORT

EAST MIDLANDS REGIONAL OFFICE

A42 CASTLE DONINGTON NORTH

MAIN SITE INVESTIGATION : CONTRACT 2 (FEBRUARY 1985)

VOLUME 2 : PART 2 LABORATORY TEST RESULTS AND SUMMARY SHEETS

S4449

Employer for the Works

DEPARTMENT OF THE ENVIRONMENT
AND TRANSPORT
East Midlands Regional Office
52-54 Holly Walk
Leamington Spa
Warwickshire
CV32 4JE

Engineer for the Works

SCOTT WILSON KIRKPATRICK
AND PARTNERS
Bayheath House
Rose Hill West
Chesterfield
Derbyshire
S40 1JF

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Volume 1 : Part 2

Exploratory Hole Record Sheets (Forms A1 and A2) and Laboratory Test Results (Forms B and C)	Boreholes/Drillholes and Trial Pits

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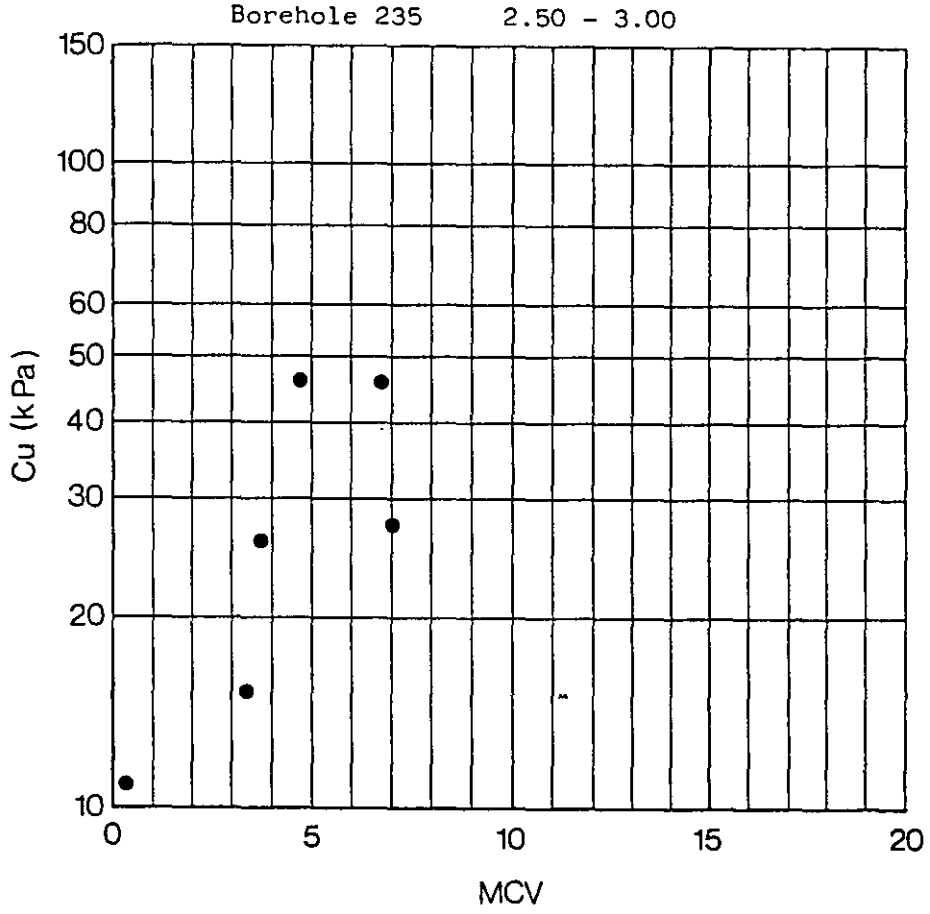
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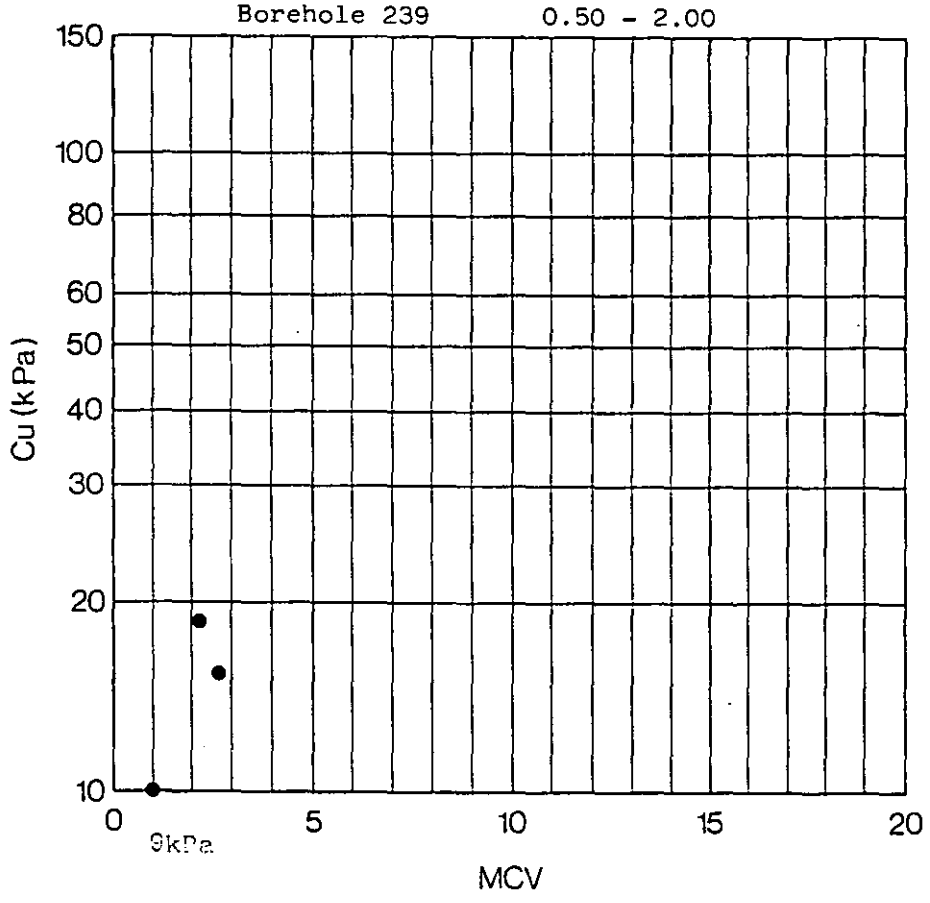
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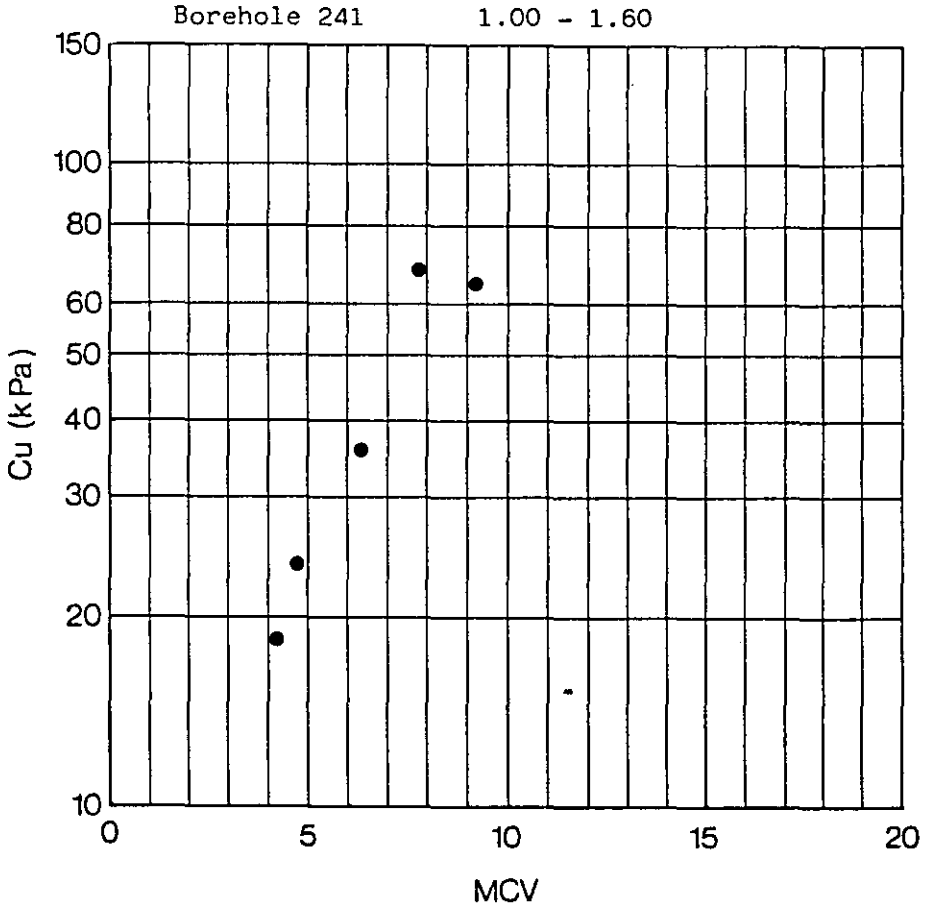
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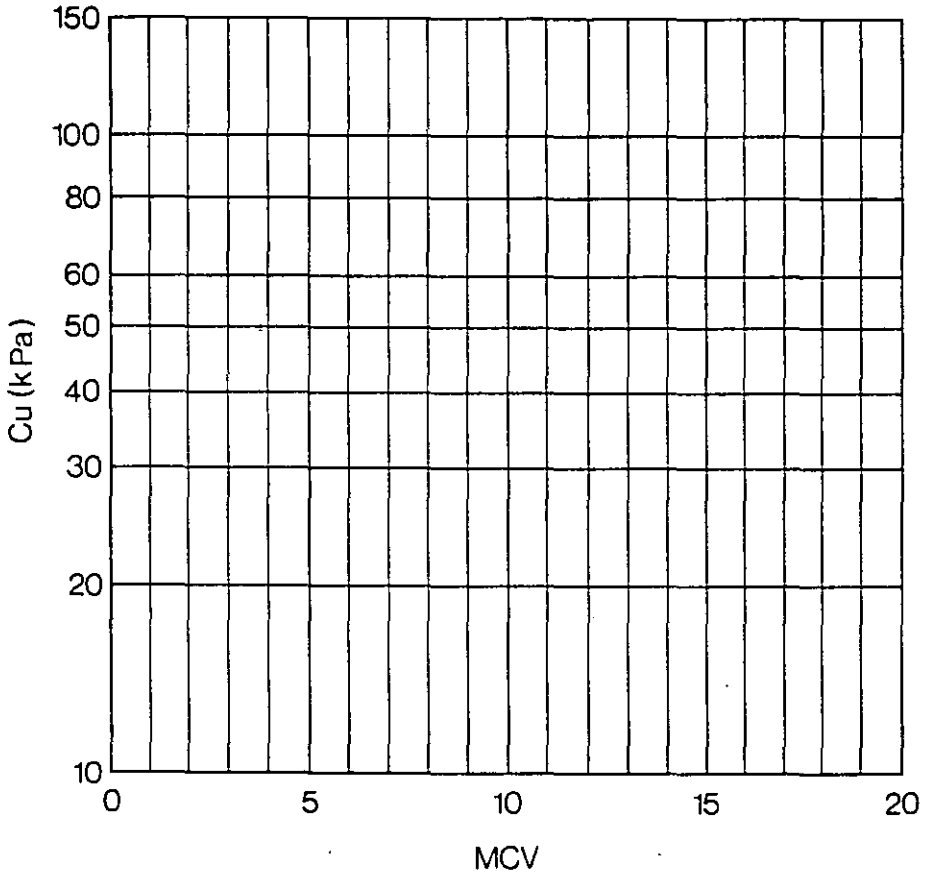




exploration associates	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449 **Figure** 2.207

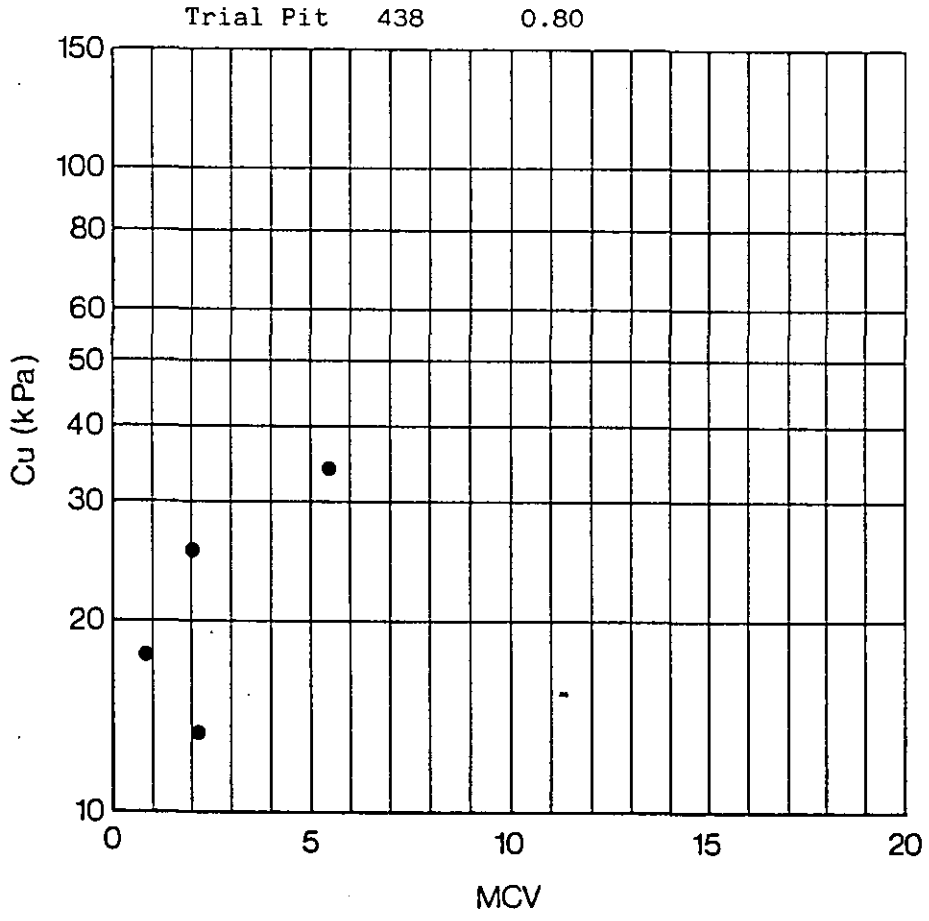
EX3

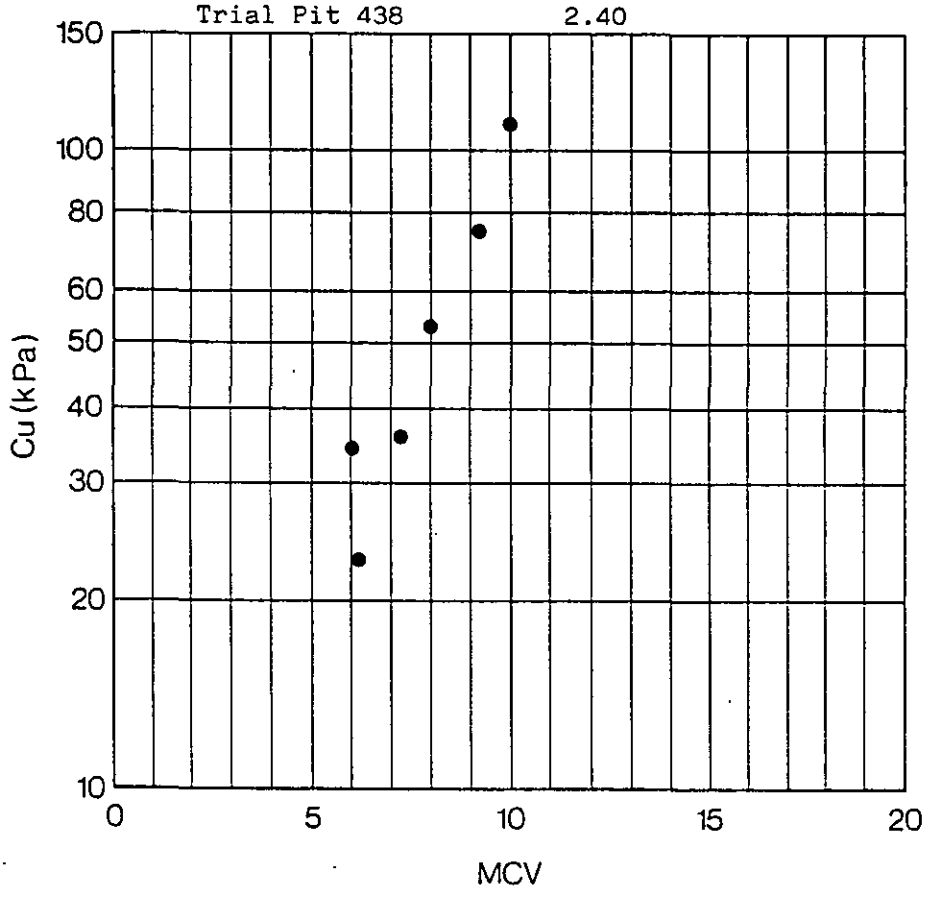




exploration associates	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449 **Figure** 2.208

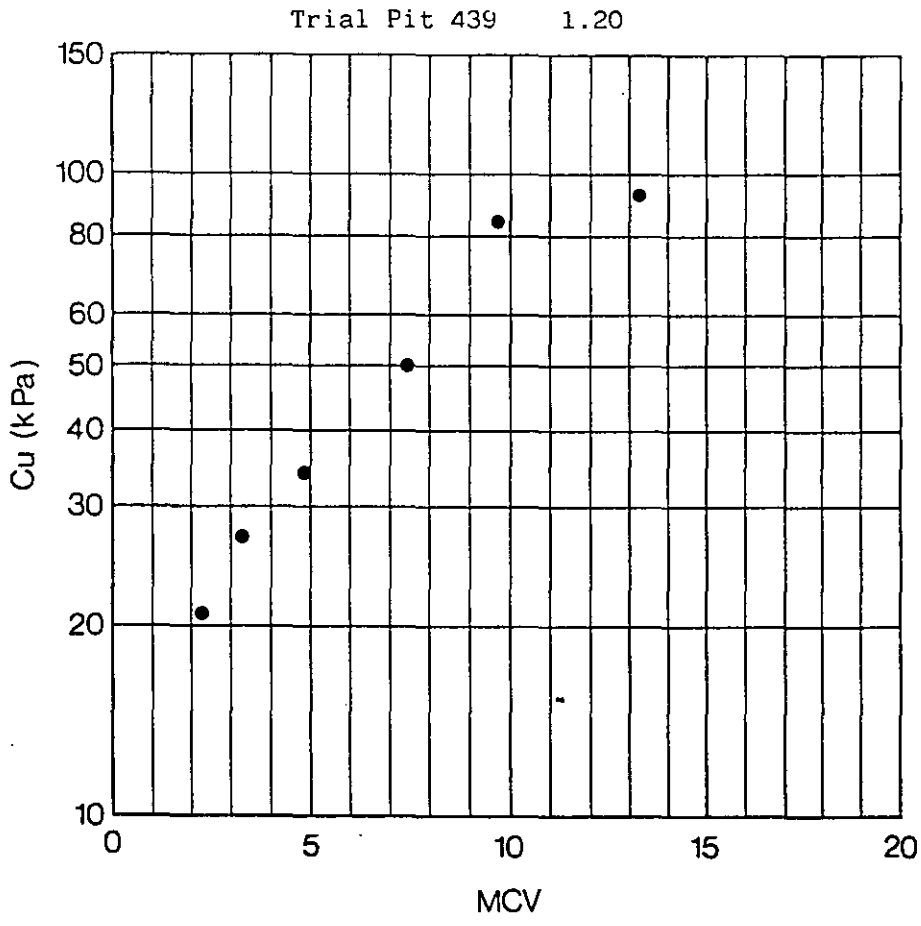
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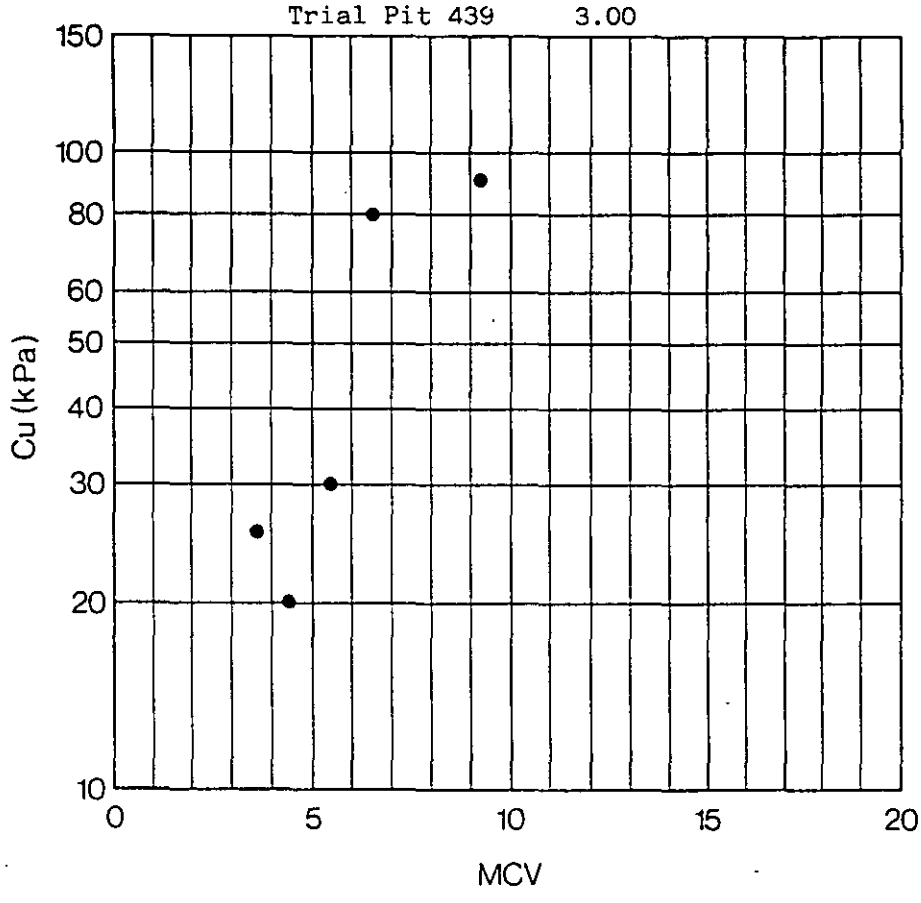




exploration associates	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449 **Figure** 2.209

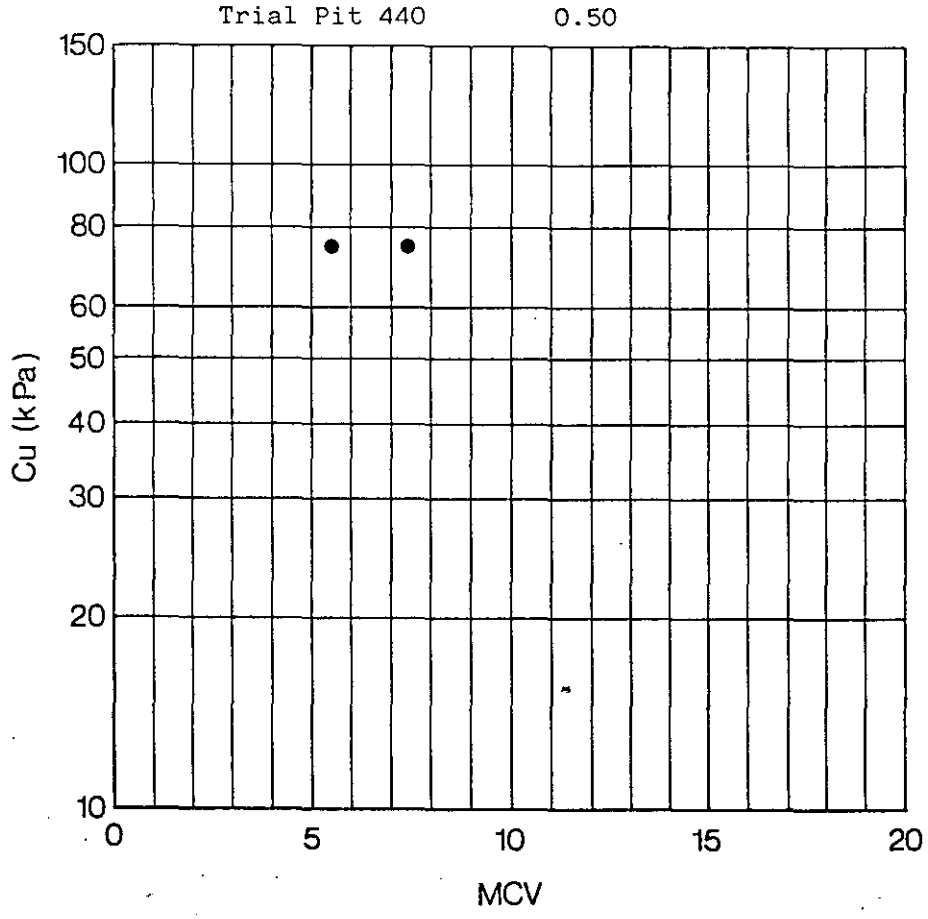
EX3

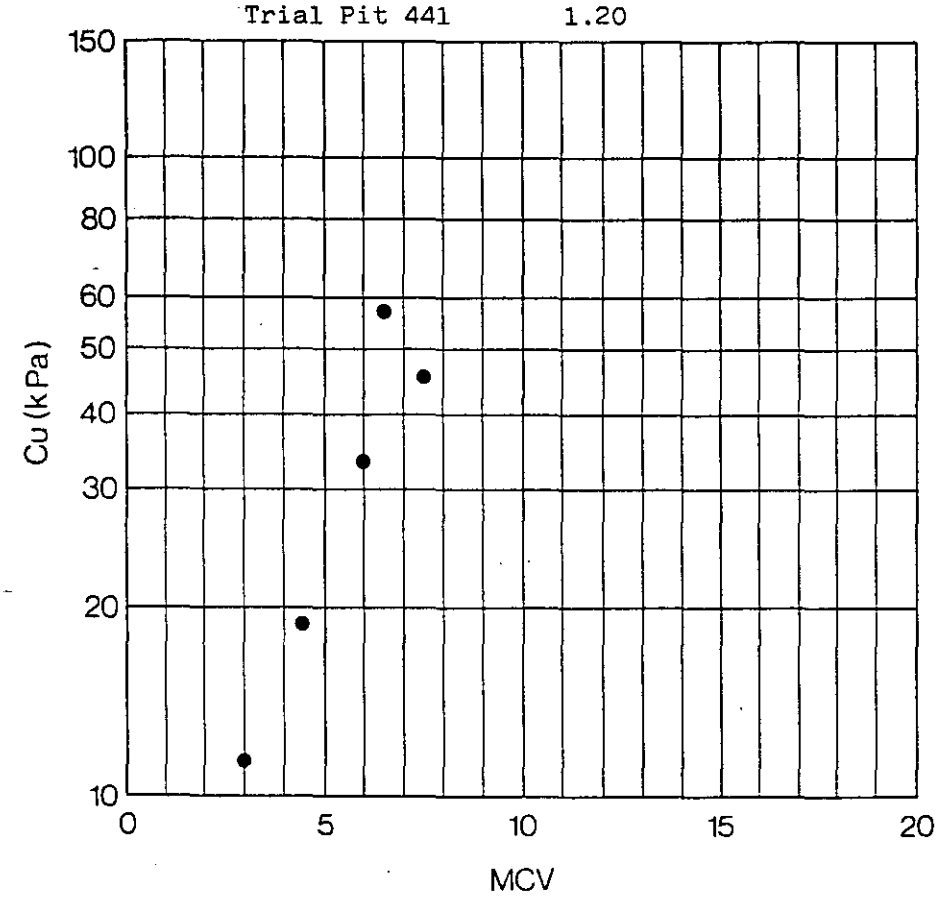




MCV Value/ undrained shear strength	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.210

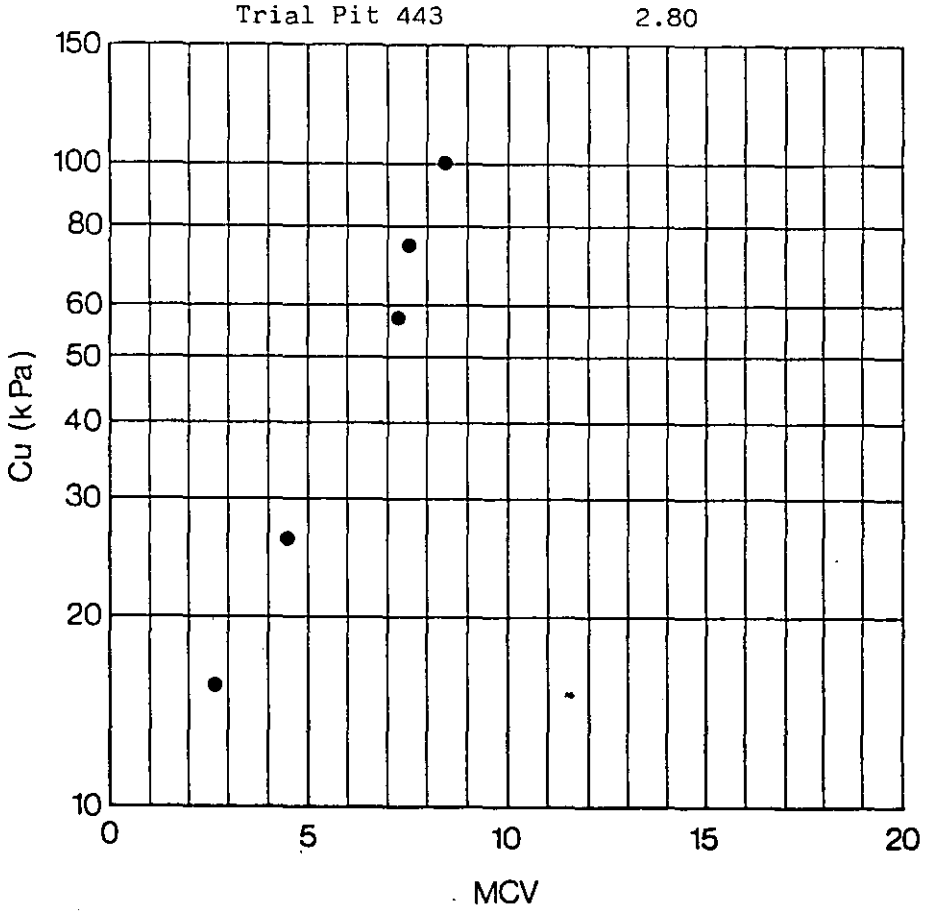
EX3

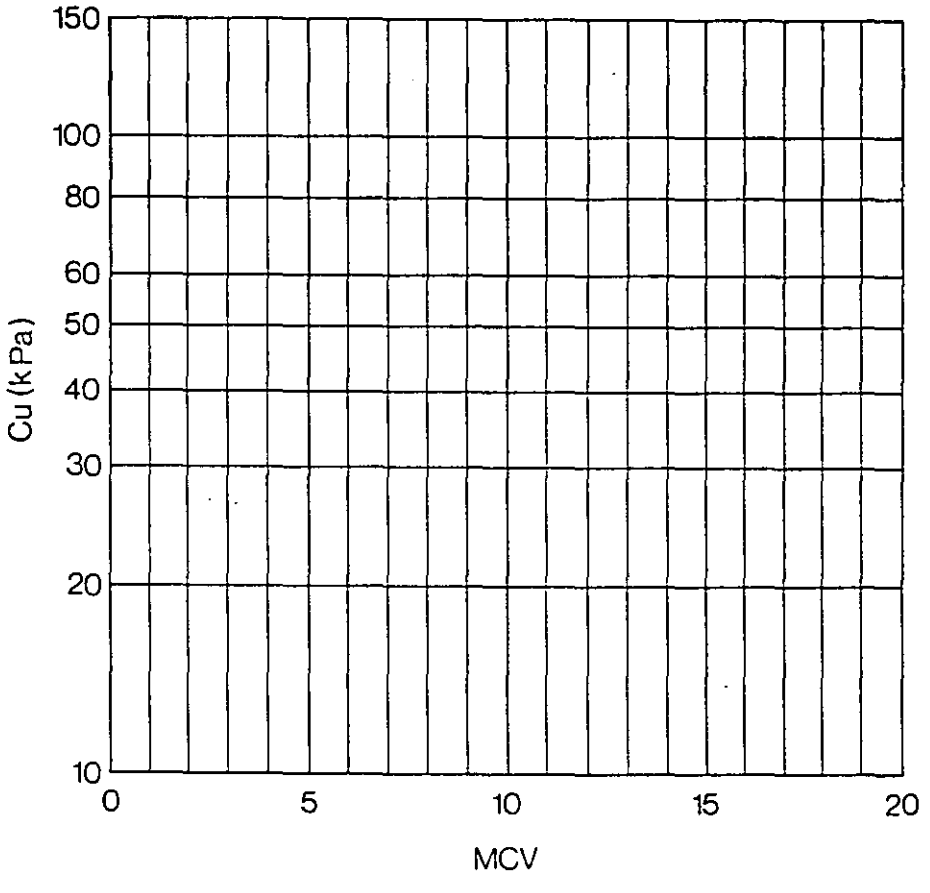




exploration associates	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449 **Figure** 2.211

EX3





exploration associates

Project Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation-Contract 2

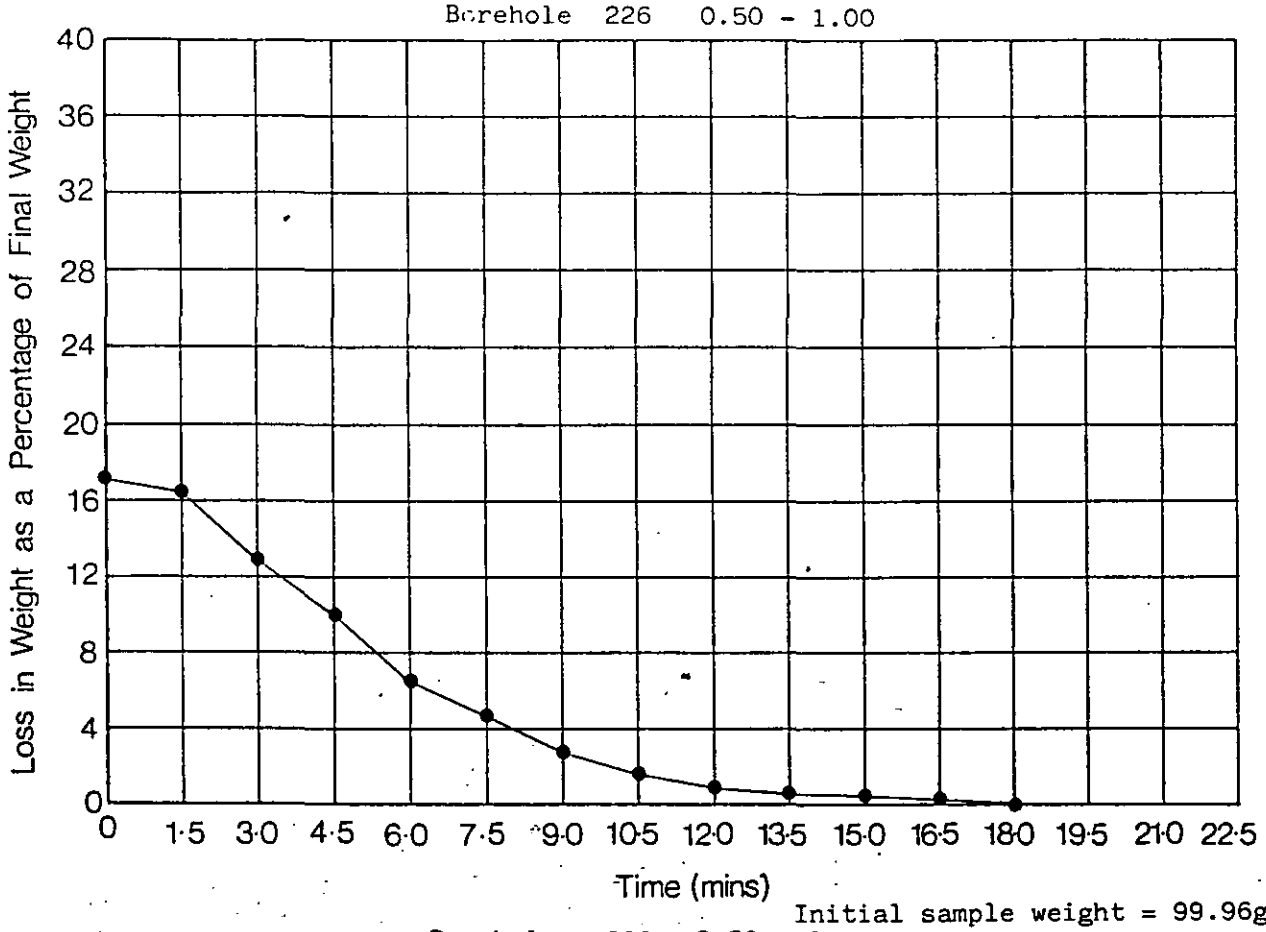
Contract S4449

Figure 2.212

EX3

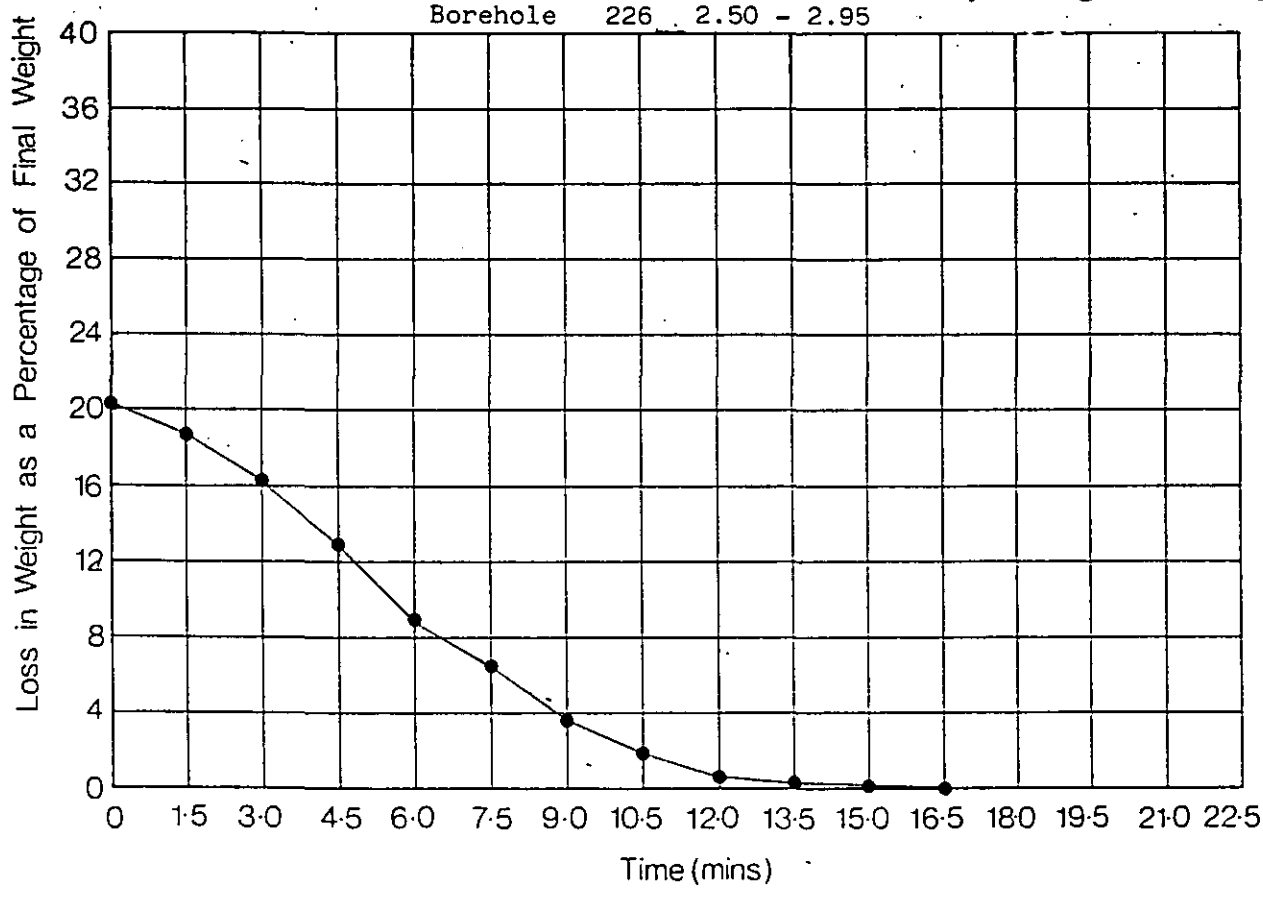
Initial sample weight = 99.98grms

Borehole 226 0.50 - 1.00



Initial sample weight = 99.96grms

Borehole 226 2.50 - 2.95

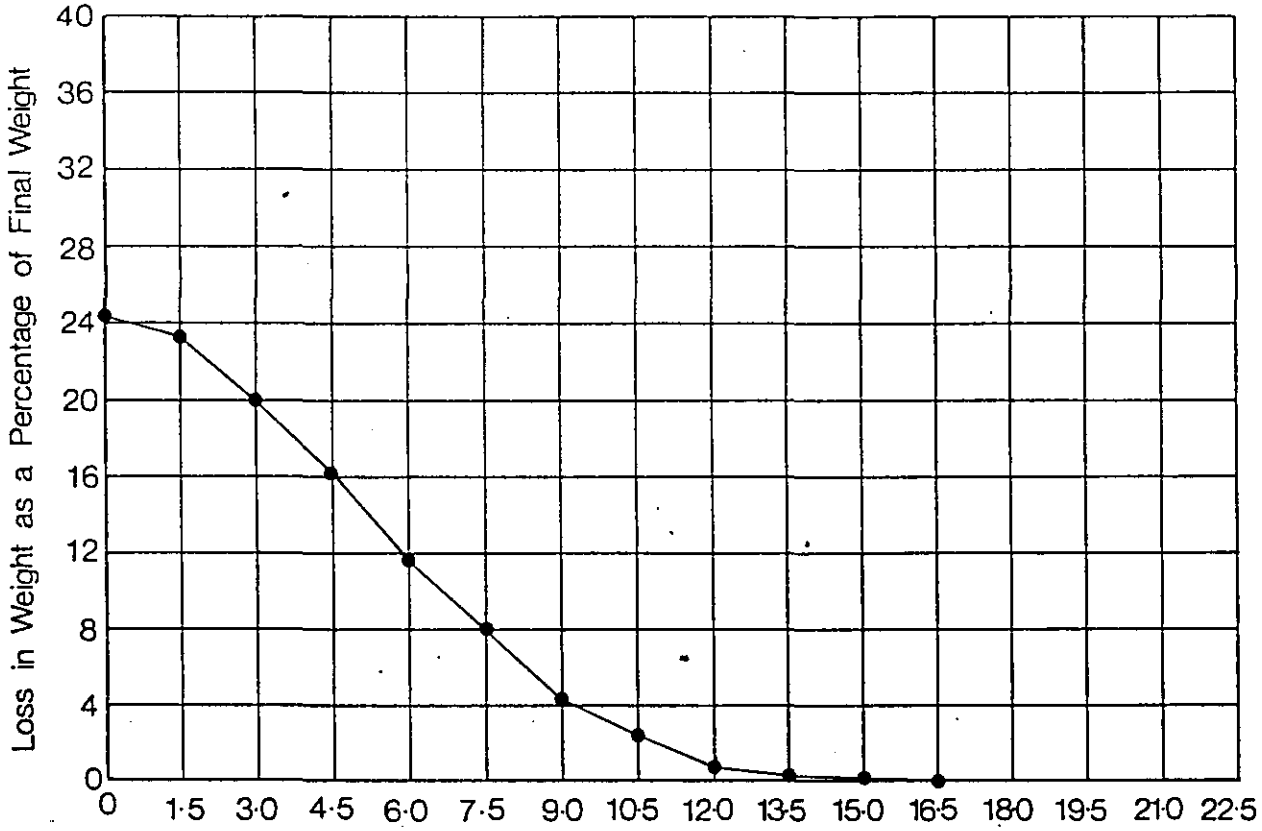


MICROWAVE MOISTURE CONTENT	Project Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		Figure 2.213

EX3

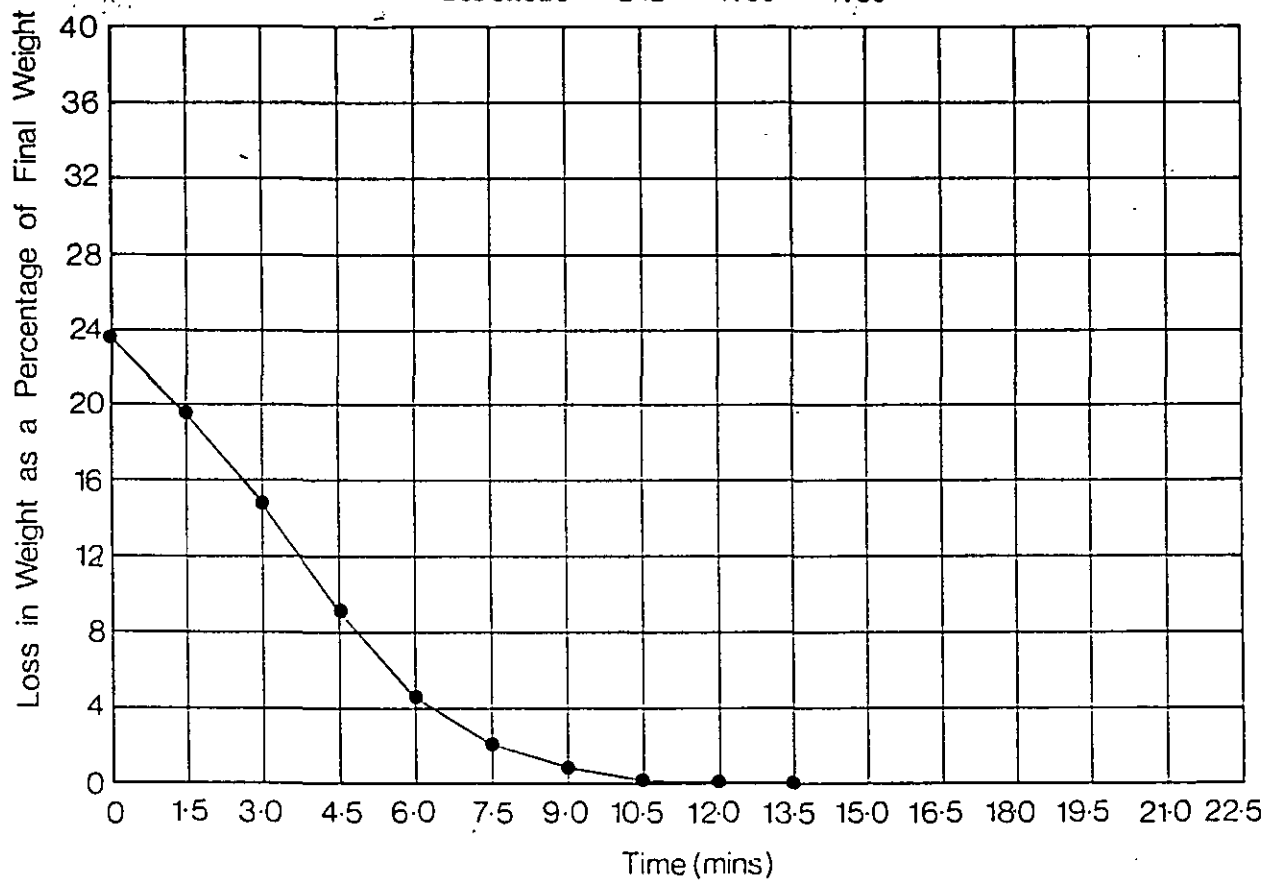
Initial sample weight = 100.33grms

Borehole 236 1.00 - 1.70



Inital sample weight = 100.25grams

Borehole 241 4.00 - 4.50

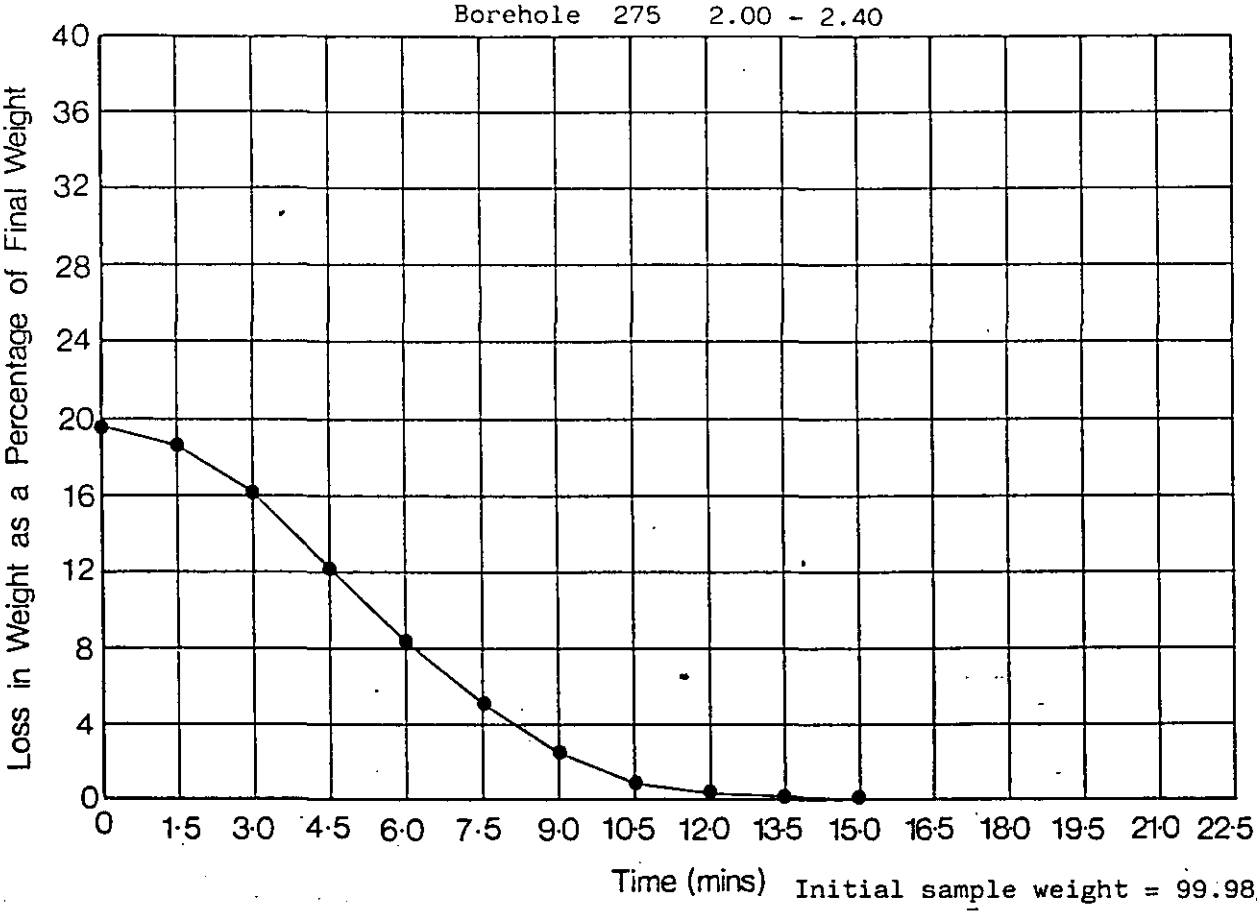


MIRCOWAVE MOISTURE CONTENT	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.214

EX3

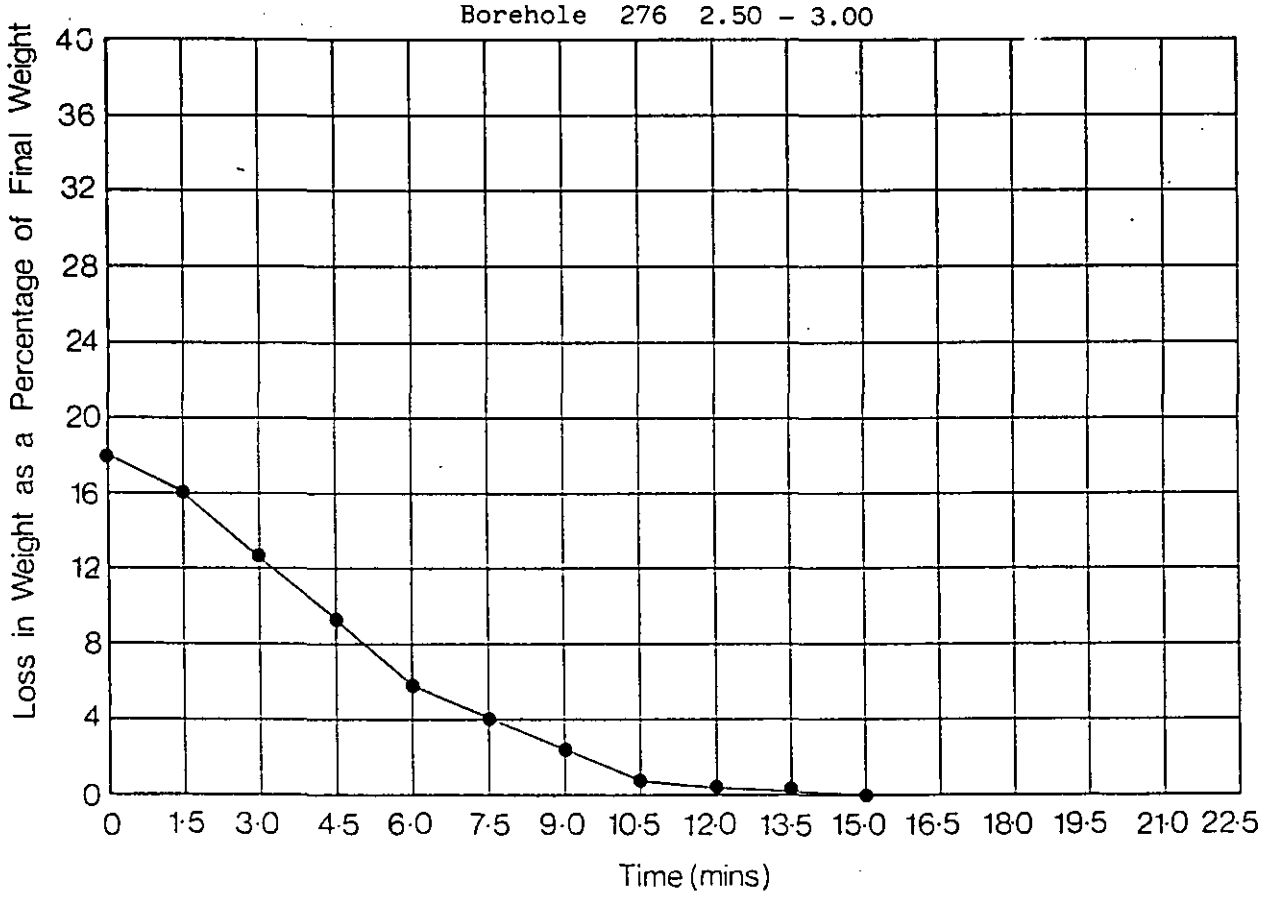
Initial sample weight = 100.06grms

Borehole 275 2.00 - 2.40



Initial sample weight = 99.98grms

Borehole 276 2.50 - 3.00

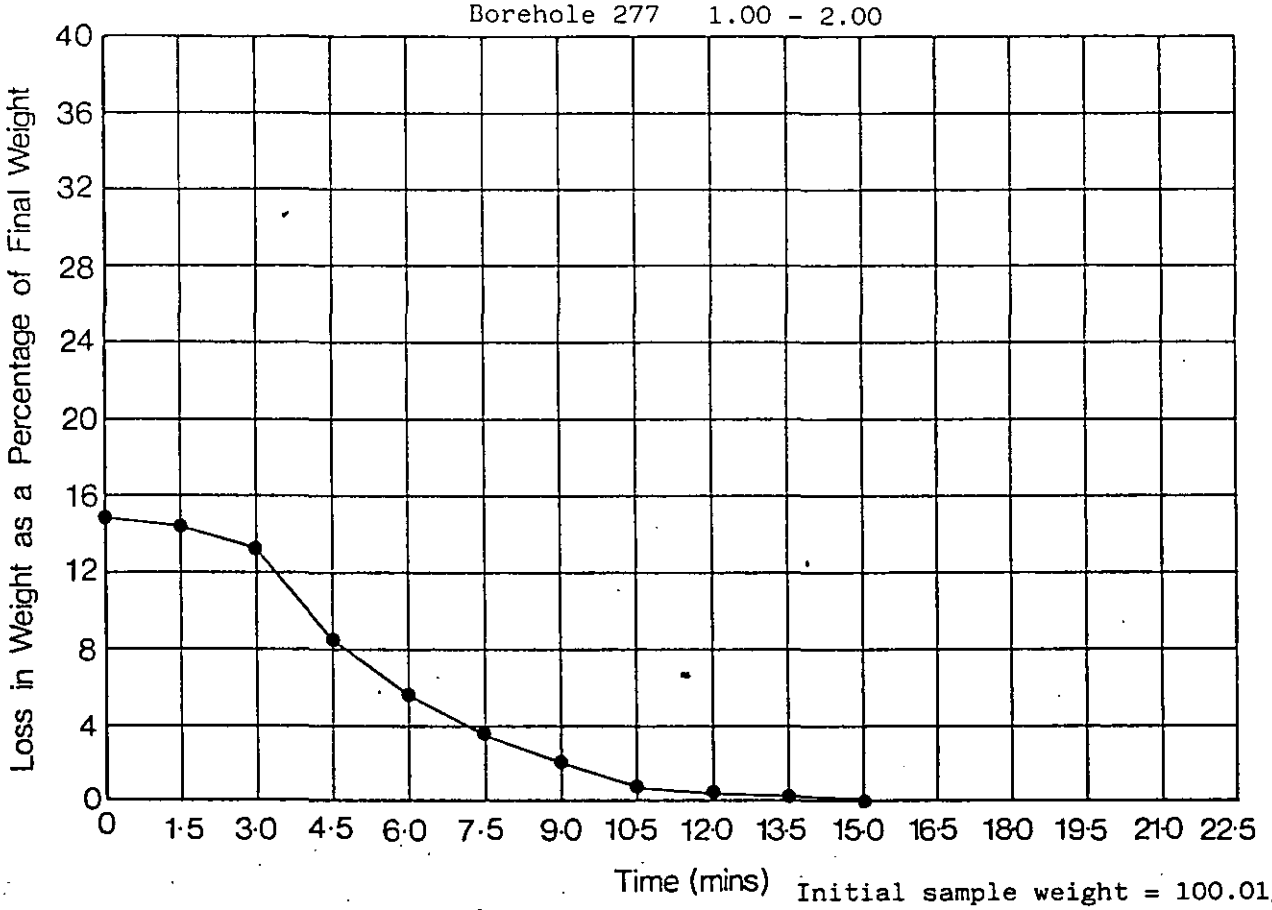


MICROWAVE MOISTURE CONTENT	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.215

EX3

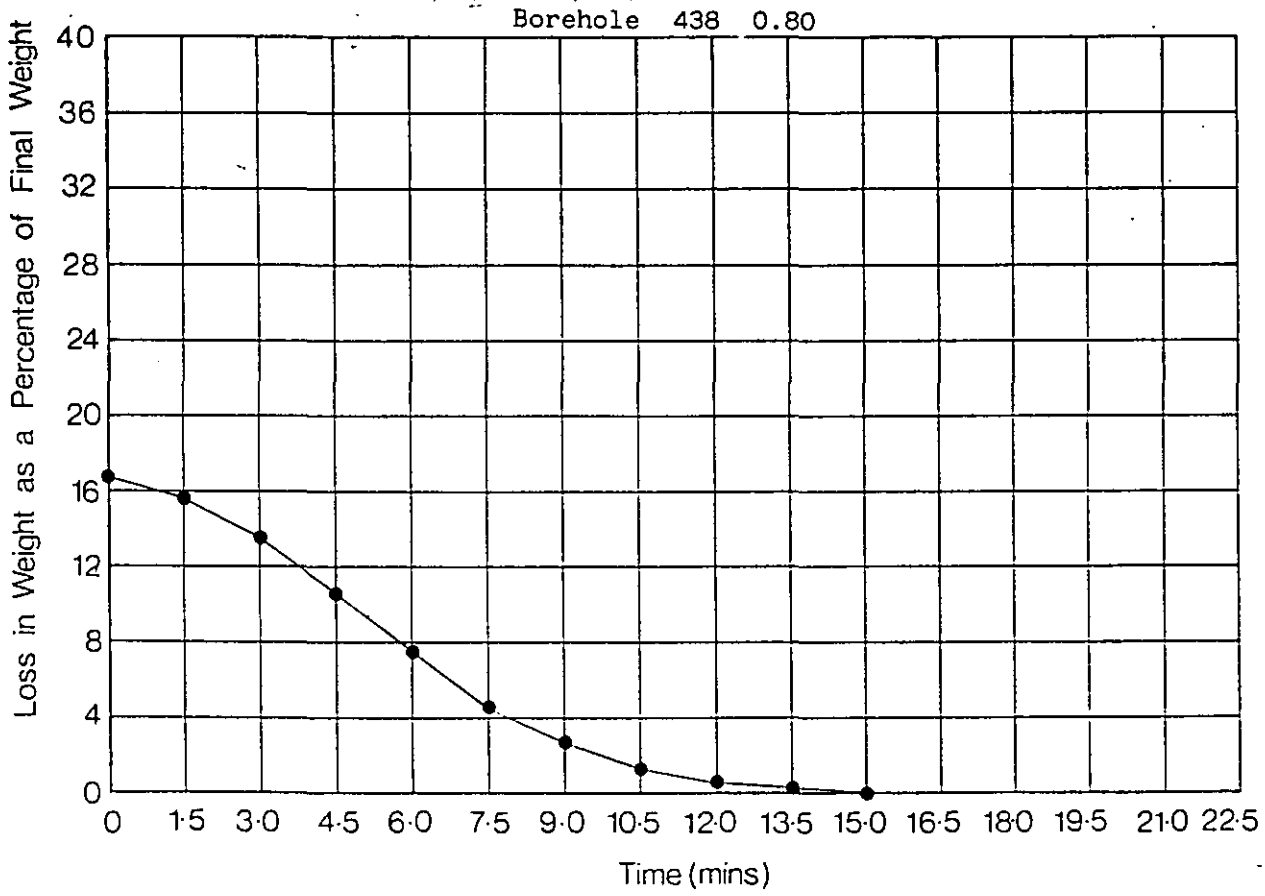
Initial sample weight = 99.87grms

Borehole 277 1.00 - 2.00



Initial sample weight = 100.01grms

Borehole 438 0.80

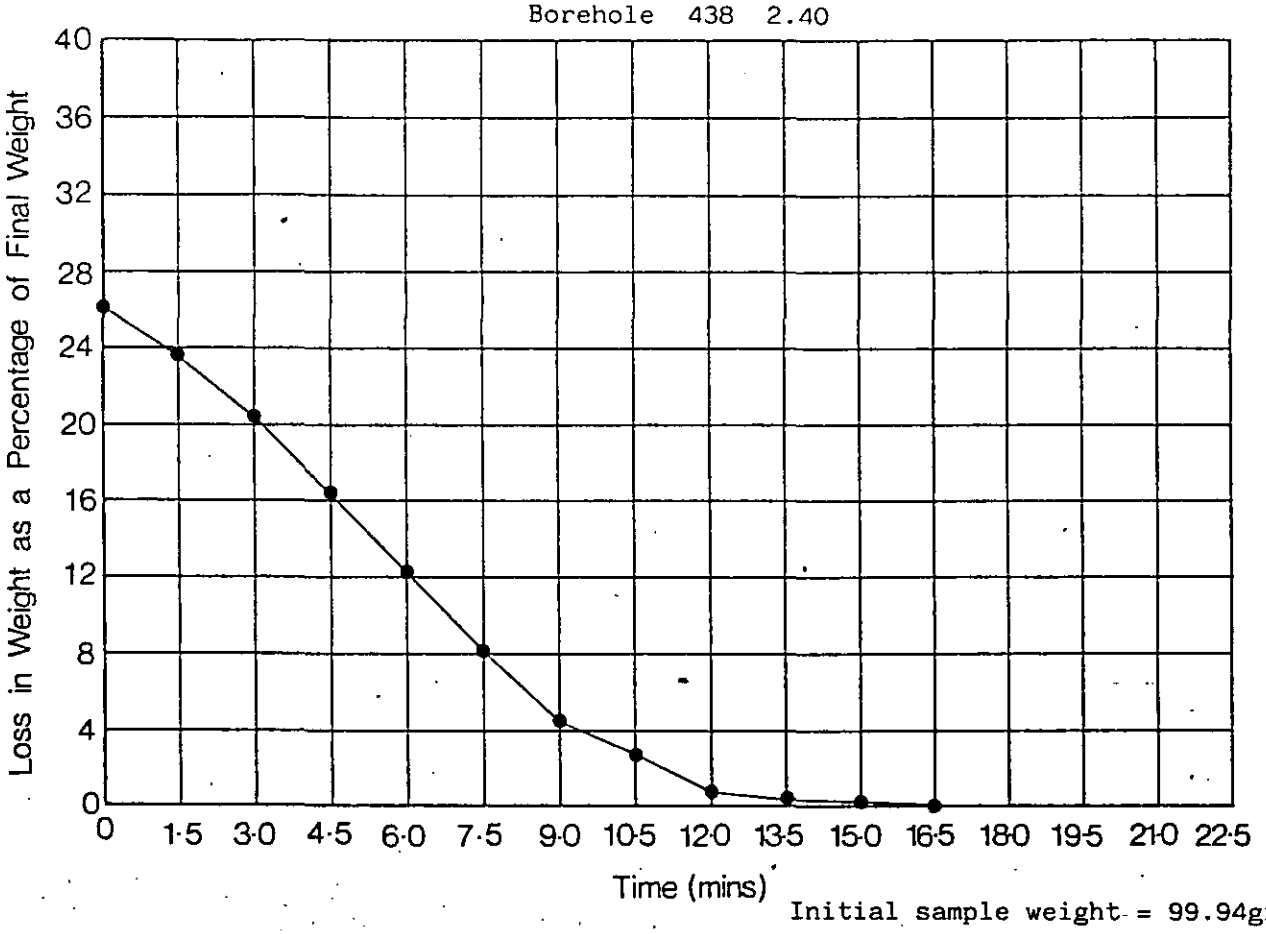


MICROWAVE MOISTURE CONTENT	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract	S4449
exploration associates		**Figure**	2.216

EX3

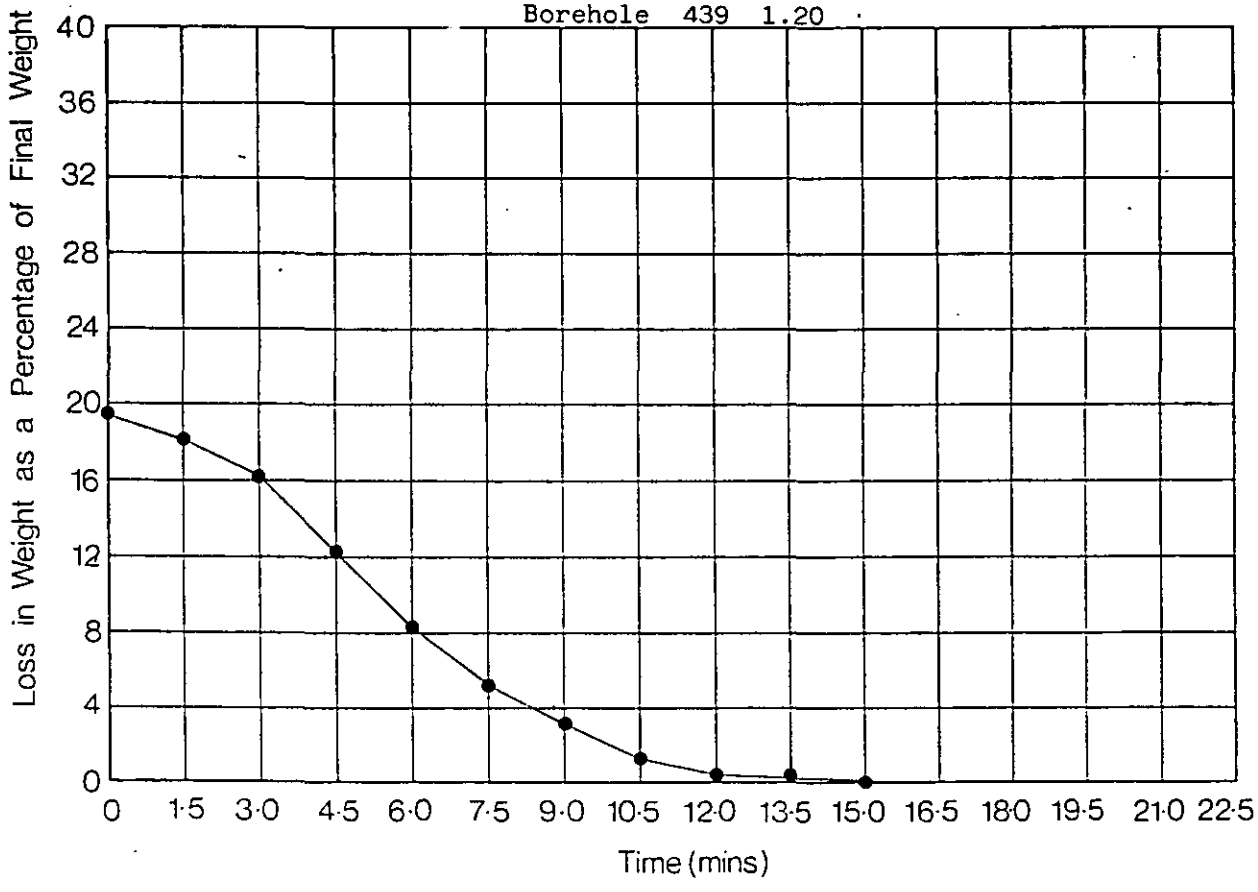
Initial sample weight = 99.55grms

Borehole 438 2.40



Initial sample weight = 99.94grms

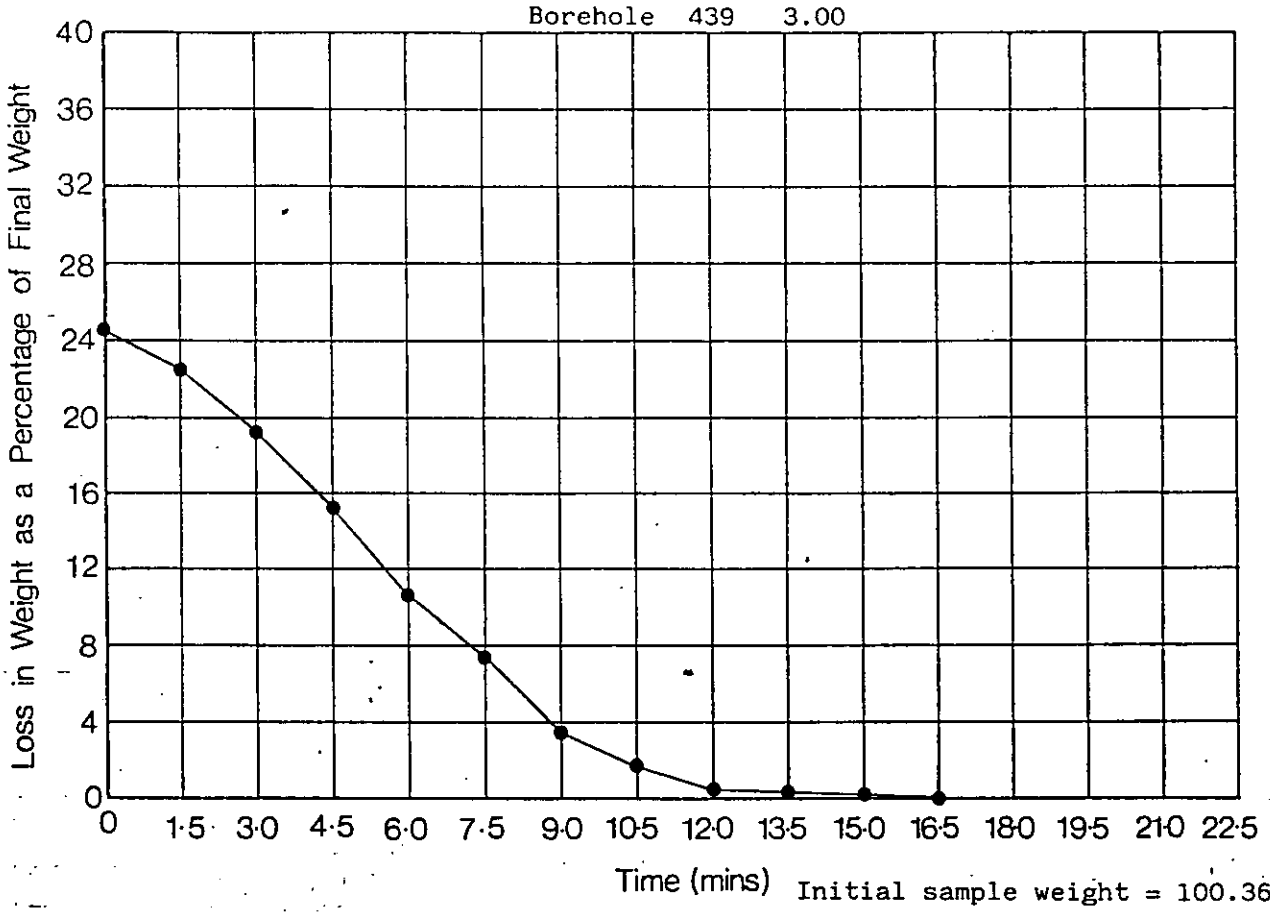
Borehole 439 1.20



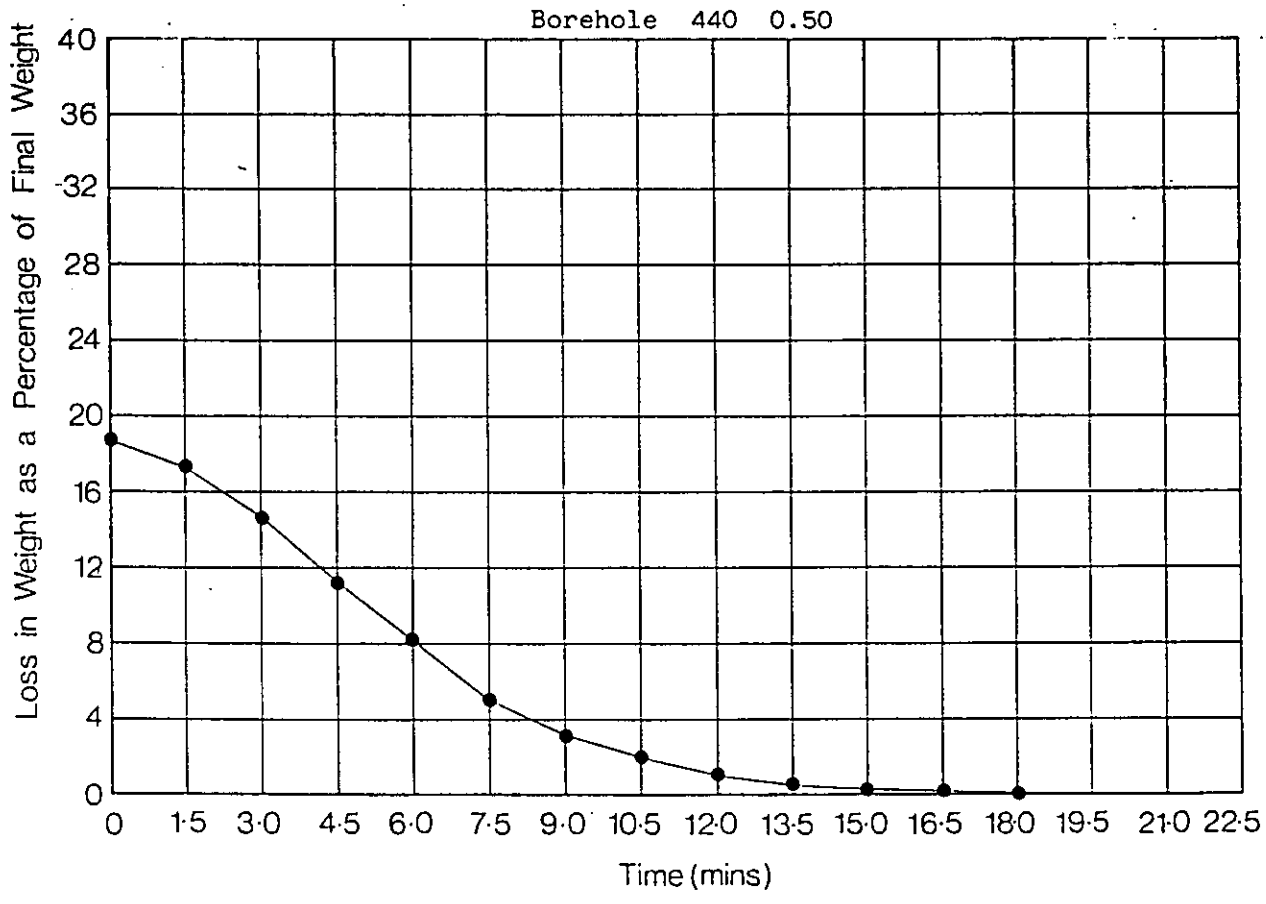
MICROWAVE MOISTURE CONTENT	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.217

EX3

Initial sample weight = 99.84grms



Initial sample weight = 100.36grms

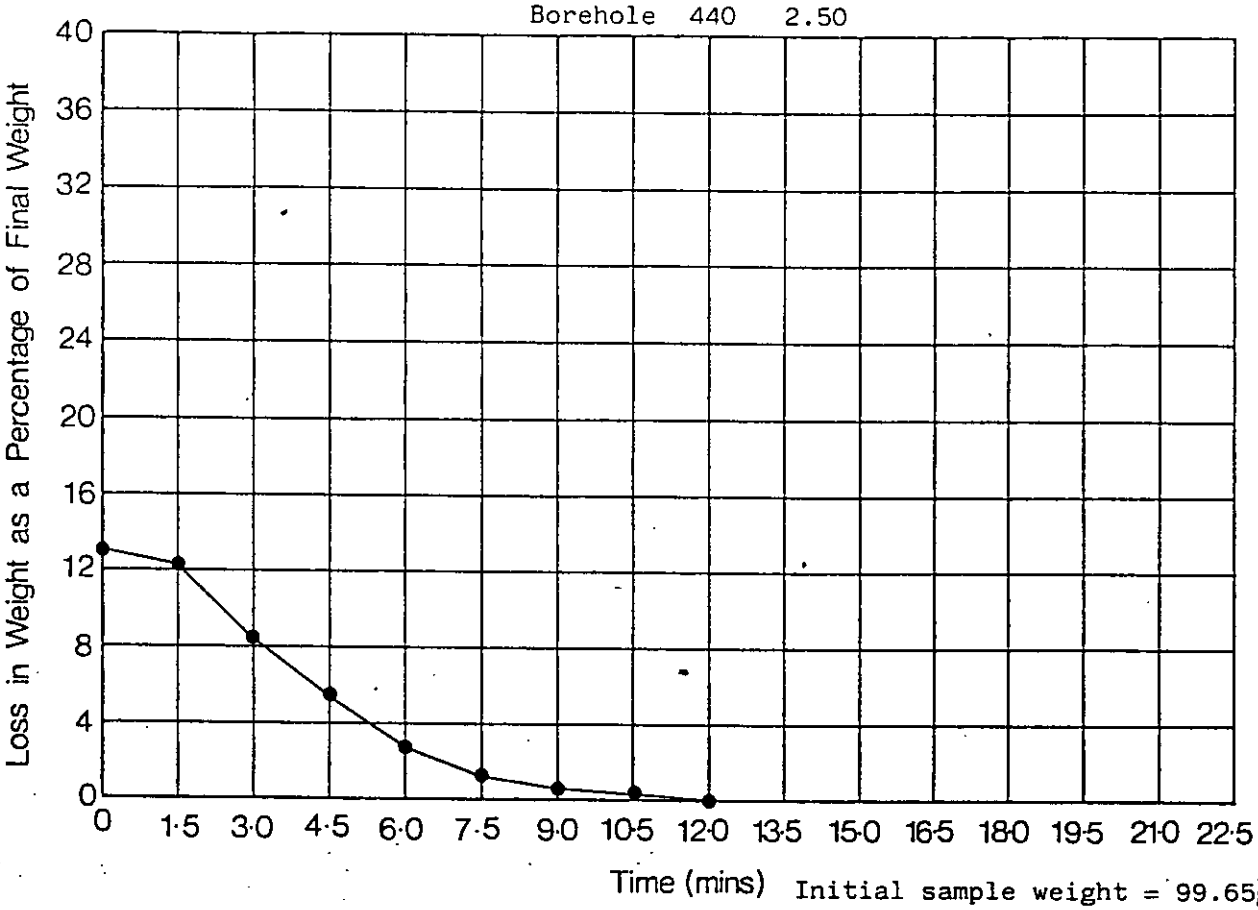


MMCROWAVE MOISTURE CONTENT	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.218

EX3

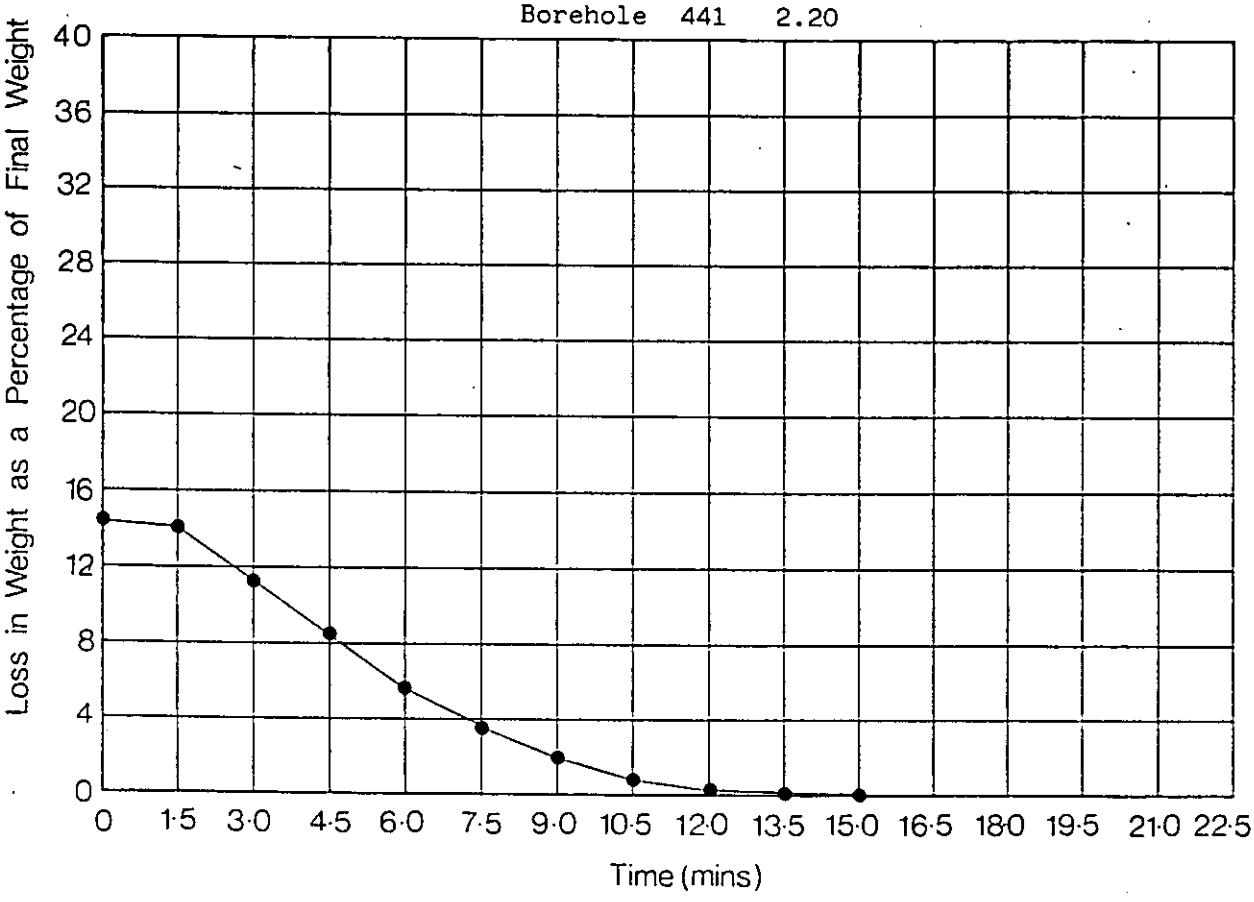
Initial sample weight = 100.91grms

Borehole 440 2.50



Initial sample weight = 99.65grms

Borehole 441 2.20

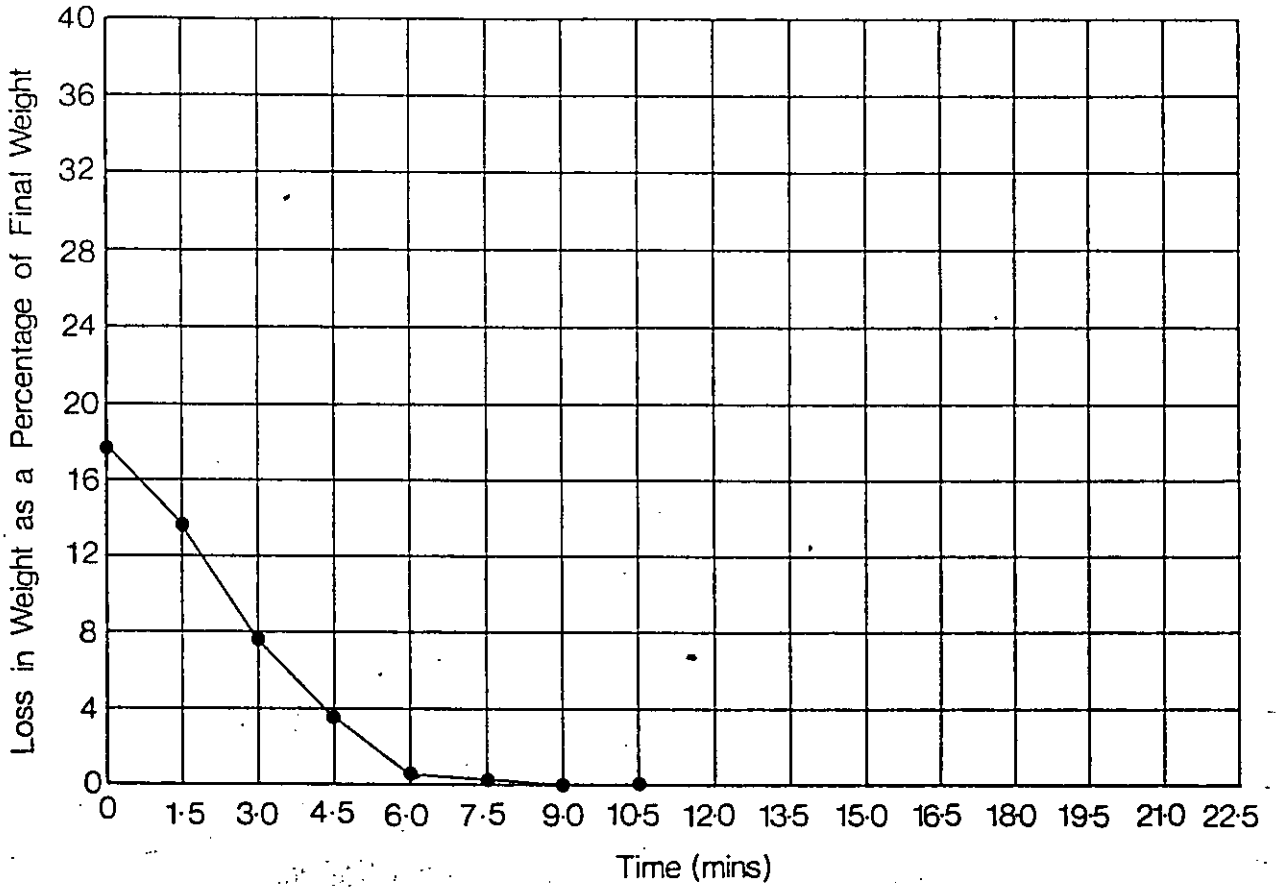


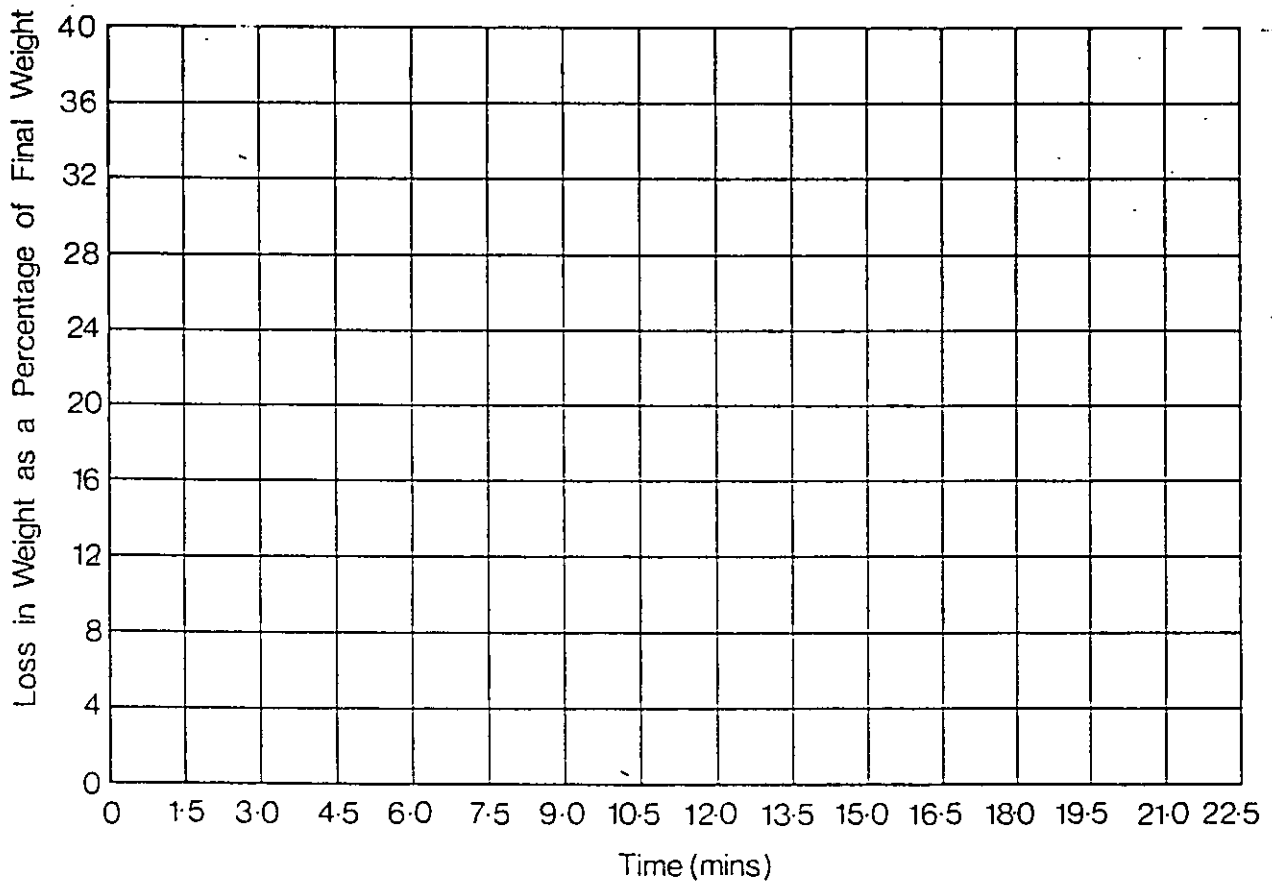
MICROWAVE MOISTURE CONTENT	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.219

EX3

Initial sample weight = 99.90grms

Trial Pit 441 0.60 - 0.70



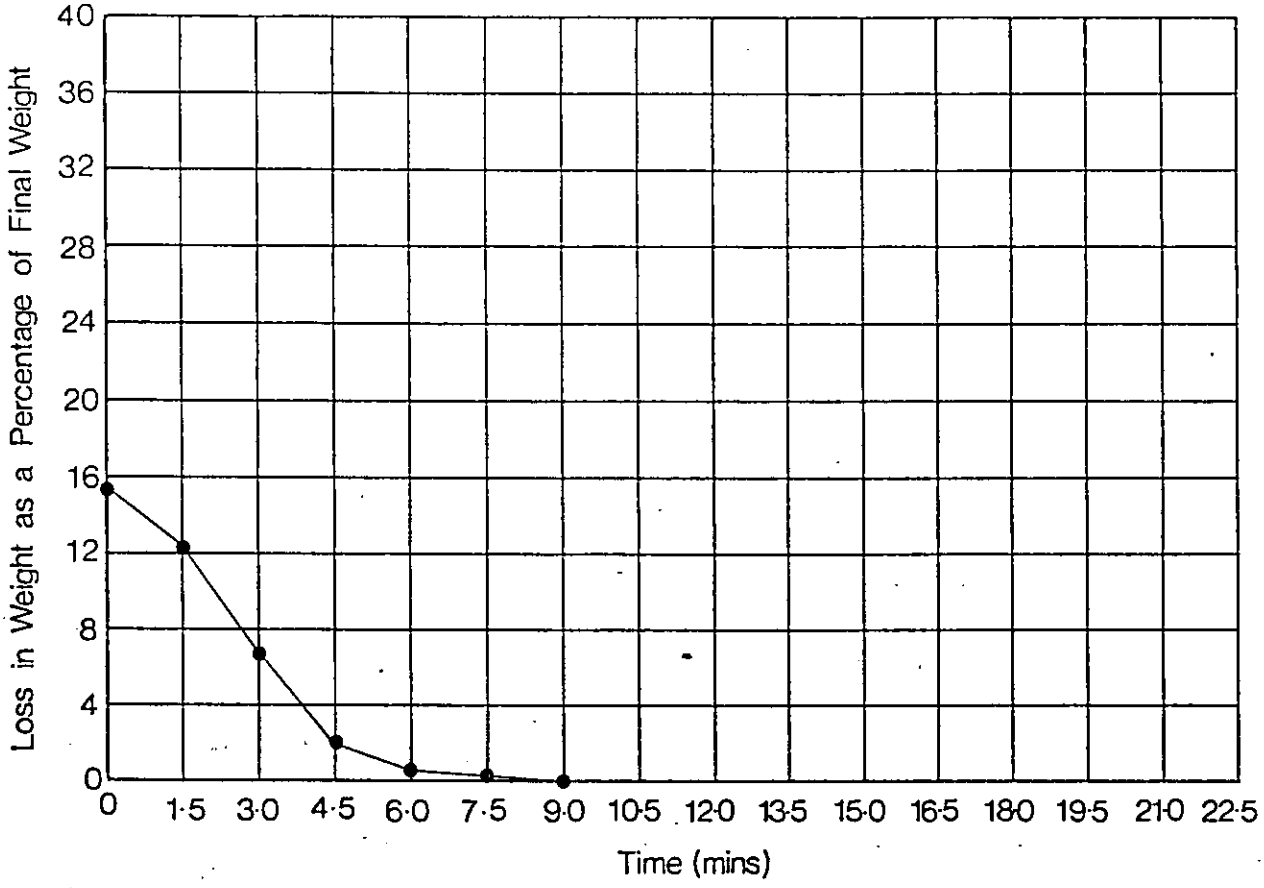


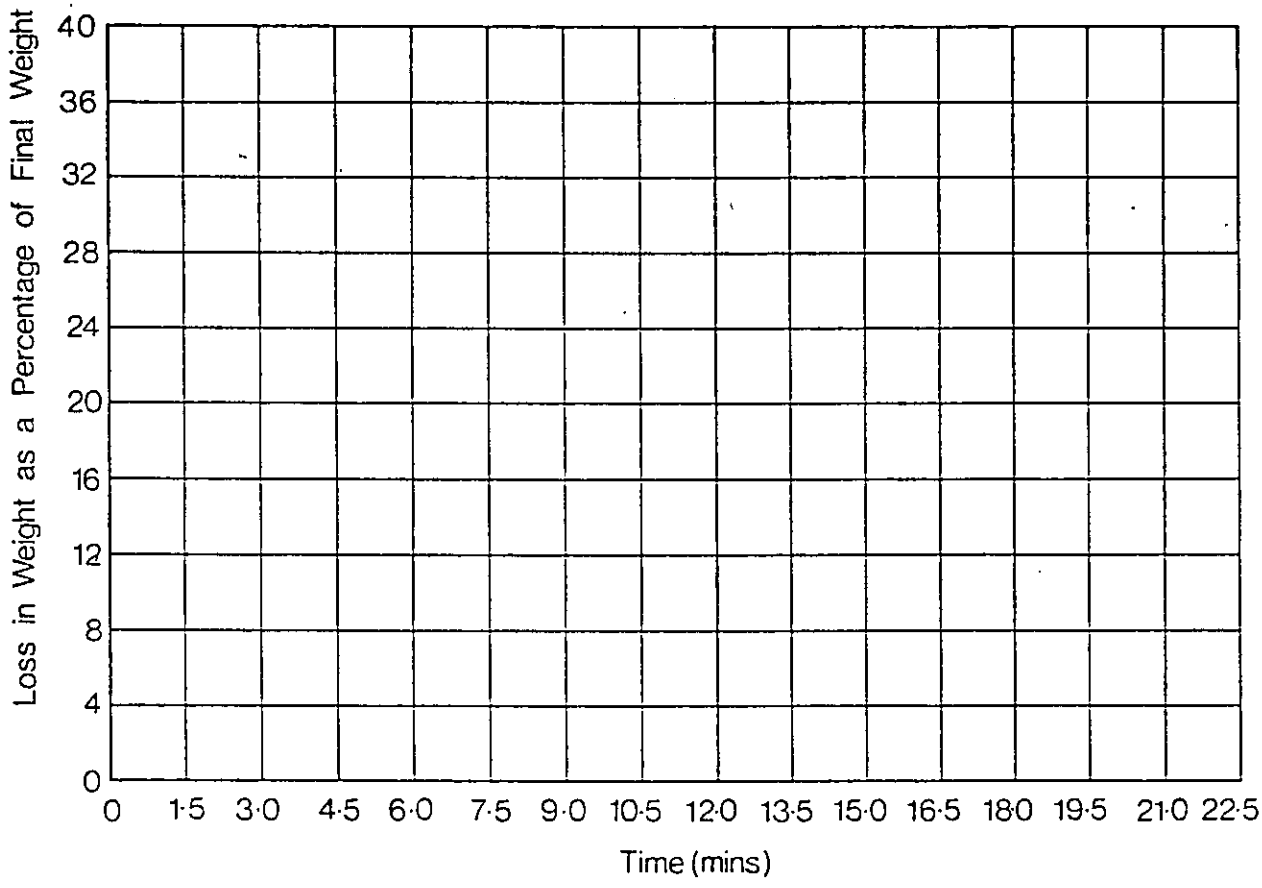
MICROWAVE DETERMINATION	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.220

EX3

Initial sample weight = 101.14grms

Trial Pit 442 1.70 - 1.80



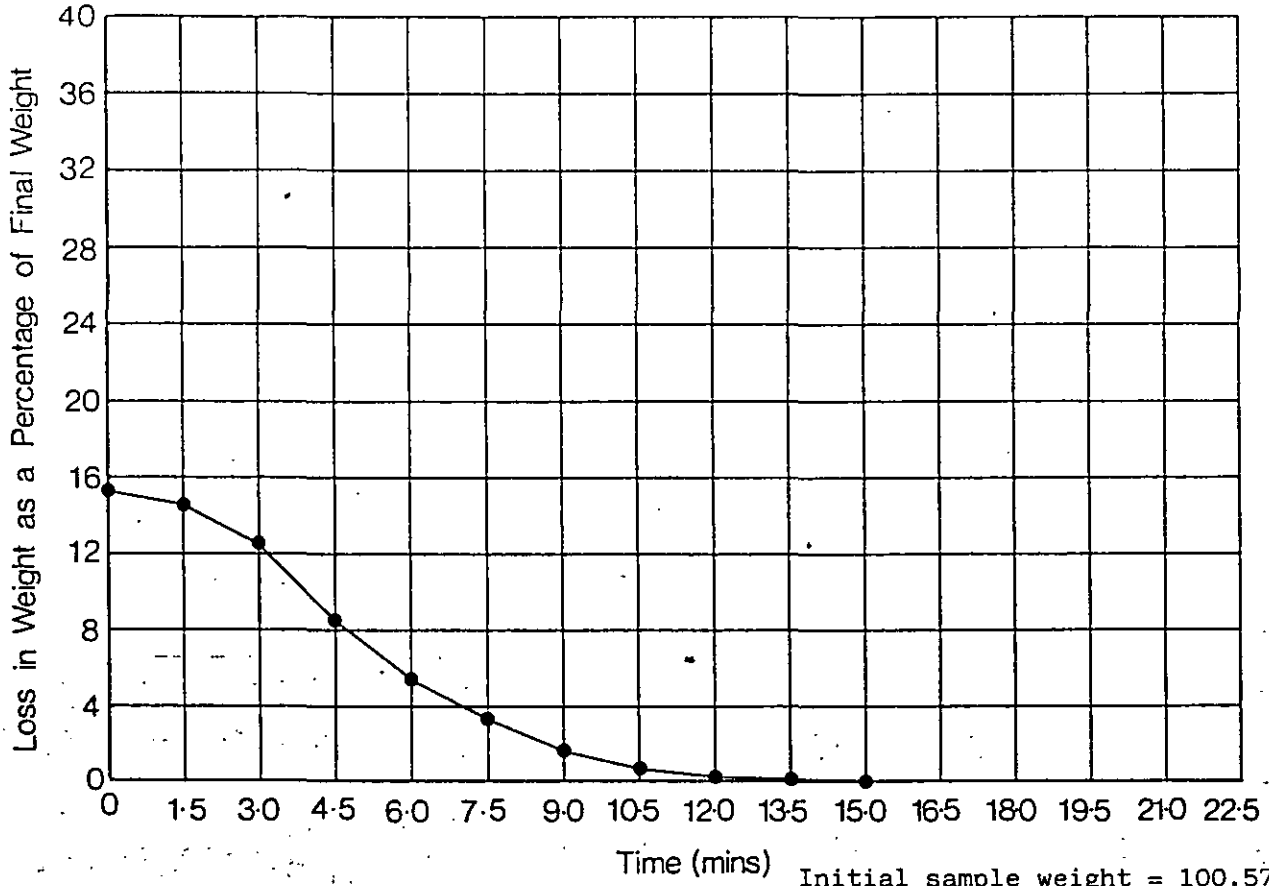


MICROWAVE DETERMINATION	Project: Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		Figure 2.221

EX3

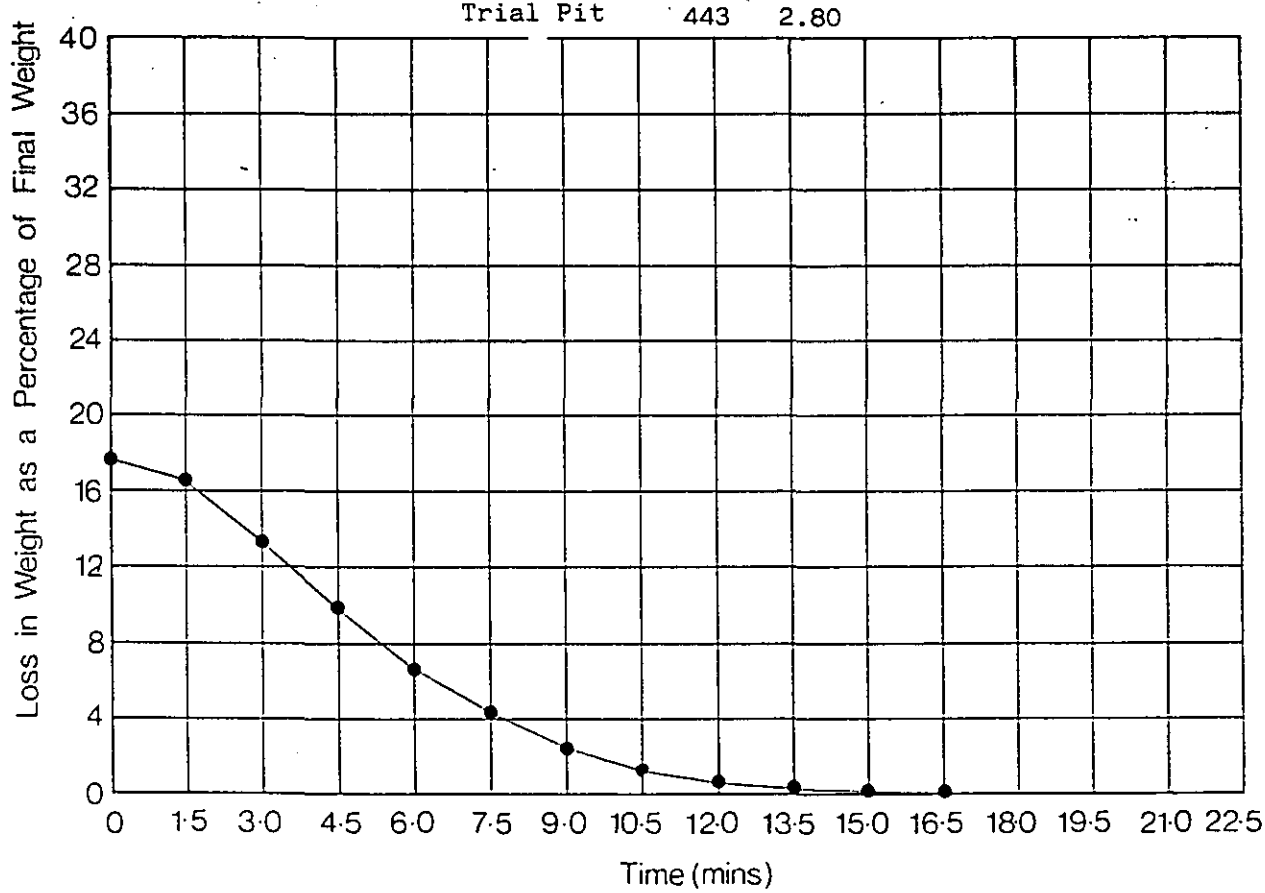
Initial sample weight = 100.59grms

Trial Pit 443 0.60



Initial sample weight = 100.57grms

Trial Pit 443 2.80



MICROWAVE MOISTURE CONTENT	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.222

EX3

Borehole TP440 Depth 2.50

* Dry Density 1.92 mg/m³

* Optimum Moisture Content 12%

Moisture Content after Freezing -

Heave of Cylinder after 250 hours (mm)	Specimen 1	Specimen 2	Specimen 3	Mean
	14.5	28	29	24

The material is classified as Frost Susceptible

* As determined by Compaction Test

The material is

Borehole TP441 Depth 3.20

* Dry Density 1.85 mg/m³

* Optimum Moisture Content 12%

Moisture Content after Freezing 21%

Heave of Cylinder after 250 hours (mm)	Specimen 1	Specimen 2	Specimen 3	Mean
	21	18	23	21

The material is classified as Frost Susceptible

* Determined by Compaction Test

To MM64 specification Frost Heave Criteria is 10mm

FROST SUSCEPTIBILITY	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract: S4449
exploration associates		**Figure** 2.223

EX-

Borehole TP442 Depth 1.70 - 1.80

* Dry Density 1.83 mg/m³

* Optimum Moisture Content 13%

Moisture Content after Freezing -

Heave of Cylinder after 250 hours (mm)	Specimen 1	Specimen 2	Specimen 3	Mean
	21	31	33	28

The material is Classified as Frost Susceptible

* As determined by Compaction Test

FROST SUSCEPTIBILITY

exploration associates

Project Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation : Contract 2

Contract S4449

Figure 2.224

EX 4

Section 4

LABORATORY TEST RESULTS SUMMARY SHEETS

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B219	0.50 0.95	U	Red brown and green grey clayey silty SAND with much gravel. (GLACIAL TILL)	7.8	++ 0.04 g/ltr				17						
	2.00 2.45	U	Stiff red brown mottled grey green friable silty CLAY with occasional gravel and rootlets. (GLACIAL TILL)			100% 20	39	19							
	2.50 2.95	D	Stiff red brown mottled grey green silty CLAY with occasional siltstone fragments. (KEUPER MARL:ZONE IV)	7.5	++ 0.05 g/ltr				14						
	3.50 3.95	U	Stiff red brown mottled grey green friable slightly sandy silty CLAY tending to clayey silt in zones (KEUPER MARL:ZONE IVa)						21 20 20	2.04 2.10 2.11	UT 38	100 200 300	217 220 269	120	-
	5.50 5.95	U	Very stiff red brown fissured and friable slightly sandy very silty CLAY. (KEUPER MARL:ZONE IVa)			100% 13	31	18	21 21 22	2.10 2.10 2.11	UT 38	100 200 400	172 184 195	90	-
	6.00 6.50	D	Stiff and very stiff red brown fissured silty CLAY. (KEUPER MARL:ZONE IVb)						13						
	7.00 7.45	U	Very stiff red brown mottled green grey silty CLAY with siltstone and mudstone fragments. (KEUPER MARL:ZONE III)	7.9	++ 0.02 g/ltr	100% 18	35	17	18 21 22	2.10 2.09 2.08	UT 38	150 300 450	341 356 342	170	-

Remarks ++ Sulphate test in accordance with BRE250

Laboratory Results – Summary

exploration associates

Project
Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation : Contract 2

Contract S4449

Figure 2.225

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B219	8.50 8.95	U	Stiff red brown mottled green grey fissured silty CLAY with mudstone fragments. (KEUPER MARL : ZONE III/IV)			100% 16	35	19	26 26 27	2.01 2.03 1.98	UT 38	150 300 600	122 132 119	60	-
	12.00 12.45	D	Red brown and grey green very weak MUDSTONE (KEUPER MARL:ZONE III)						12						
	13.00	W	Groundwater	7.5	0.15 g/ltr										
	13.50 13.95	D	Stiff to very stiff red brown mottled grey green silty CLAY with many mudstone and siltstone fragments. (KEUPER MARL:ZONE III)			100%+ 13	31	18	15						
	14.50 14.95	D	Very stiff red brown mottled grey green fissured silty CLAY. (KEUPER MARL:ZONE IV)						9						
B220	0.50 0.95	U	Firm red brown friable very sandy silty CLAY with gravel. (GLACIAL TILL)	7.7	++ 0.03 g/ltr				19						
	2.00 2.45	U	Firm to stiff red brown mottled grey green fissured silty CLAY with mudstone fragments. (KEUPER MARL:ZONE III)	8.2	++ 0.04 g/ltr	100% 15	33	18	22	2.05	UM 105	50 150 300	151 Ø- -	75	-
	2.50 2.95	D	Firm red brown and grey green fissured very silty CLAY/very clayey silt. (KEUPER MARL:ZONE IVb)						13						

Remarks Ø Excessive Strain
++ Sulphate test in accordance with BRE250

Laboratory Results – Summary

exploration associates

Project
Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation : Contract 2

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Figure 2.226

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B220	3.50 3.95	U	Firm red brown mottled mottled green grey clayey SILT/very silty clay. (KEUPER MARL:ZONE IVa)			100% 15	33	18							
	5.00 5.45	U	Firm to stiff red brown fissured very silty CLAY (KEUPER MARL:ZONE IV)	8.2	++ 0.06 g/ltr				20	2.02	UM 105	100 200 400	148 167 182	85	-
	6.50 6.95	U	Stiff red brown [illegible] fissured silty CLAY with occasional siltstone fragments. (KEUPER MARL:ZONE III)			100% 11	30	19	20 19 19	2.12 2.11 2.12	UT 38	150 300 450	278 204 361	140	-
	8.00	W	Groundwater	7.0	0.16 g/ltr										
	10.00 10.45	U	Very stiff red brown mottled grey green fissured silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)	8.0	++ 0.03 g/ltr				18						
	10.50 10.95	D	Stiff to very stiff red brown mottled grey green fissured silty CLAY with many siltstone fragments. (KEUPER MARL : ZONE II/III)						10						
	11.50 11.95	U	Very stiff red brown friable with CLAY (KEUPER MARL:ZONE IVa)			100% 11	33	22	22 22 22	2.05 2.04 2.06	UT 38	200 400 800	291 348 234	150	-
	13.00 13.45	U	Very stiff red brown mottled grey green fissured very silty CLAY tending to very weak siltstone in parts (KEUPER MARL : ZONE II/III)			100% 10	33	23	19						

Remarks ++ Sulphate test in accordance with BRE250

Laboratory Results – Summary

exploration associates

Project
Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation : Contract 2

Contract S4449

Figure 2.227

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B221	1.00	D	Firm red brown slightly mottled grey green fissured silty sandy CLAY with occasional mudstone and siltstone fragments. (KEUPER MARL : ZONE III/IVa)						18						
	2.50 2.95	D	Stiff red brown friable very silty CLAY (KEUPER MARL:ZONE IVa)						19						
	5.50 5.95	D	Stiff red brown fissured very silty CLAY. (KEUPER MARL:ZONE IV)						19						
	6.50 6.95	U	Stiff red brown very silty CLAY with bands of siltstone. (KEUPER MARL : ZONE II/III)	7.5	++ 0.03 g/ltr	100% 16	32	16							
	7.00 7.45	D	Red brown very weak to weak SILTSTONE. (KEUPER MARL : ZONE II/III)						17						
	8.00 8.45	U	Stiff red brown very silty CLAY with mudstone and siltstone fragments. (KEUPER MARL : ZONE II/III)	8.1	++ 0.04 g/ltr	100% 13	32	19	23 22 22	2.05 2.01 2.06	UT 38	150 300 600	193 203 358	130	-
	9.50 9.95	U	Very stiff red brown very silty CLAY with mudstone and siltstone fragments. (KEUPER MARL : ZONE II/III)						21 21 21	2.05 2.05 2.06	UT 38	200 400 800	263 271 381	150	-

Remarks ++ Sulphate test in accordance with BRE250

Laboratory Results – Summary

exploration associates

Project
Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation : Contract 2

Contract S4449

Figure 2.228

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	σ_1-σ_3 kN/m²	c kN/m²	$\phi°$
B221	10.00 10.45	D	Stiff and very stiff red brown mottled grey green fissured very silty CLAY with some siltstone fragments. (KEUPER MARL : ZONE II/III)						19						
	12.60	D	Stiff and very stiff red brown mottled grey green fissured very silty CLAY with some siltstone fragments. (KEUPER MARL : ZONE II/III)						14						
B222	0.30	D	Red brown clayey silty SAND with some gravel (GLACIAL TILL)						11						
	0.50 0.95	U	Soft red brown silty very sandy CLAY with much gravel. (GLACIAL TILL)			47% 22	37	15	12						
	1.80	U	Stiff red brown mottled grey green fissured silty CLAY. (KEUPER MARL:ZONE IVa)						23						
	3.00 3.50	B	Red brown and grey green fissured very silty CLAY with many mudstone and siltstone fragments. (KEUPER MARL:ZONE III)			79% 15	34	19	22 24 24 24	 2.01 2.04 2.04	REM UT 38	50 100 150	45 52 50	24	-
	4.00 4.50	D	Firm red brown fissured silty CLAY (KEUPER MARL:ZONE IVa)			100% 14	33	19	21						
	6.50 6.95	U	Stiff red brown very silty CLAY with some mudstone fragments. (KEUPER MARL:ZONE IVa)						16 16 20	2.12 2.12 2.14	UT 38	100 200 400	267 304 263	140	-

Remarks △ Remoulded to Proctor effort.

Laboratory Results – Summary

exploration associates

Project
Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation : Contract 2

Contract S4449

Figure 2.229

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B222	8.00 8.45	U	Very stiff red brown fissured silty CLAY with mudstone and siltstone fragments. (KEUPER MARL:ZONE III)						20 20 21	2.09 2.09 2.08	UT 38	150 300 600	258 333 309	150 (100 dr	- 5)
	9.50 9.95	U	Very stiff red brown fissured silty CLAY with mudstone and siltstone fragments. (KEUPER MARL:ZONE III)			100% 16	38	22	29	2.04	UM 105	200 400 800	351 387 404	190	-
	10.00 10.45	D	Very stiff red brown mottled grey green fissured silty CLAY with many mudstone fragments. (KEUPER MARL : ZONE II/III)						16						
B223	0.30	D	Red brown clayey silty SAND with some gravel. (GLACIAL TILL)						10						
	1.00 1.45	D	Firm red brown fissured silty sandy CLAY with some gravel. (GLACIAL TILL)						19						
	2.00 2.45	U	Firm red brown silty CLAY with occasional mudstone fragments. (KEUPER MARL:ZONE III)			100% 26	47	21	26 26 26	1.88 1.88 1.90	UT 38	50 150 300	93 113 158	60 (36 dr	- 7)
	3.50 3.95	U	Firm red brown and grey green silty CLAY with mudstone and siltstone fragments. (KEUPER MARL:ZONE III)			100% 18	37	19							
	6.50 6.95	U	Stiff red brown mottled green grey fissured silty CLAY with mudstone and siltstone fragments. (KEUPER MARL:ZONE III)			100% 13	32	19	19	2.11	UM 105	100 200 400	260 283 302	140 (119 dr	- 3)

Remarks

Laboratory Results – Summary

exploration associates

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Figure 2.230

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B223	8.50	U	Very stiff red brown						18	2.12	UT	200	281		
	8.95		mottled green grey						19	2.09	38	400	346	150	-
			fissured silty CLAY						17	2.10		800	256		
			with mudstone and siltstone fragments. (KEUPER MARL:ZONE III)												
	9.00	D	Stiff red brown and						23						
	9.50		grey green very silty CLAY/very clayey silt with mudstone and siltstone fragments. (KEUPER MARL : ZONE II/III)												
	9.80	W	Groundwater	7.1	++ 0.15 g/ltr										
	10.50	D	Stiff red brown and						14						
	10.95		grey green very silty CLAY/very clayey silt with mudstone and siltstone fragments. (KEUPER MARL : ZONE II/III)												
	14.50	D	Red brown and grey			100% / 16	34	18	17						
	14.95		green very weak SILTSTONE with some silty clay. (KEUPER MARL:ZONE II)												
B224	0.30	D	Dark brown clayey SILT with some gravel. (GLACIAL TILL)						8						
	1.00	D	Soft red brown and						29						
	1.45		grey green silty CLAY with some siltstone fragments and pockets of sand. (KEUPER MARL:ZONE III)												

Remarks ++Sulphate test in accordance with BRE250

Laboratory Results – Summary

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Figure 2.231

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B224	2.00 2.45	U	Soft red brown and grey green silty CLAY with some siltstone fragments and pockets of sand. (KEUPER MARL:ZONE III)			89% 22	41	19	33	1.87	UM 105	50 150 300	76 81 84	40	-
	2.00 2.50	B	Soft red brown and grey green silty CLAY with some siltstone fragments and pockets of sand. (KEUPER MARL:ZONE III)	7.9	++ 0.01 g/ltr				29						
	2.50 2.95	D	Soft to firm red brown mottled grey green very silty CLAY with zones of very weak siltstone (KEUPER MARL : ZONE III/IV)						18						
	5.00 5.45	U	Stiff red brown mottled grey green very silty CLAY with zones of very weak siltstone. (KEUPER MARL : ZONE III/IV)			100% 14	33	19	21 22 21	2.03 2.04 2.05	UT 38	100 200 400	182 233 274	110 (69 or 8)	-
	8.00 8.45	U	Soft red brown mottled grey green very silty CLAY with zones of very weak siltstone (KEUPER MARL : ZONE III/IV)			100% 14	33	19	34	2.02	UM 105	150 300 600	70 75 88	40	-
	10.00 10.45	D	Stiff red brown very silty CLAY with many siltstone lithorelicts (KEUPER MARL : ZONE II/III)			100% 15	30	15	19						
	12.00	W	Groundwater	7.0	++ 0.15 g/ltr										

Remarks ++ Sulphate test in accordance with BRE250

Laboratory Results – Summary

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Figure 2.232

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B224	13.00 13.45	D	Red brown and green grey very weak SILTSTONE (KEUPER MARL : ZONE II/III)						13						
	14.50 15.00	D	Red brown and green grey very weak SILTSTONE (KEUPER MARL : ZONE II/III)						19						
225	0.50 0.95	U	Firm yellow brown fissured slightly sandy silty CLAY with some gravel. (GLACIAL TILL)			83% 7	20	13	17	2.21	UM 105	50 100 150	123 128 **	60	-
	1.50 1.95	U	Red brown clayey silty SAND/silty sandy CLAY with much gravel. (GLACIAL TILL)						11	2.21					
	2.30	D	Red brown clayey silty fine SAND (GLACIAL TILL)						14						
	3.00	D	Stiff red brown silty CLAY with many mudstone and siltstone fragments. (KEUPER MARL : ZONE II/III)						16						
	3.50 3.95	U	Soft to firm red brown silty CLAY with many mudstone and siltstone fragments. (KEUPER MARL : ZONE II/III)			100% 14	32	18	26 26 26	2.01 2.01 2.01	UT 38	50 100 200	49 111 96	40	-

Remarks ** Failed under 2nd loading.

Laboratory Results – Summary

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Figure 2.233

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
226	0.50 1.00	B	Very stiff red brown fissured silty CLAY with many mudstone fragments, rootlets and occasional gravel. (GLACIAL TILL)			87% 20	40	20	17						
	2.00	D	Stiff red brown mottled grey green fissured silty CLAY with some mudstone fragments. (KEUPER MARL:ZONE III)						14						
	2.50	B	Very stiff red brown		++				20+ 20						
	3.00		fissured very silty CLAY. (KEUPER MARL:ZONE IVa)	8.0	0.05 g/ltr	100% 17	38	21	19 19 19	2.05 2.11 2.09	REM UT 38	50 100 150	343 385 346	180	-
	3.00 3.45	U	Stiff red brown fissured very silty CLAY (KEUPER MARL:ZONE IVa)						21 21 21	2.10 2.08 2.11	UT 38	50 100 150	147 174 304	100 (72 dr	- 26)
	3.50 3.95	D	Stiff red brown fissured very silty CLAY tending to very clayey silt in parts. (KEUPER MARL:ZONE IVa)			100% 18	38	20	17						
	5.00 5.45	D	Very stiff red brown fissured very silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)						20						
227	1.00 1.50	B	Firm to stiff red brown fissured very silty CLAY with rootlets and zones of clayey silt. (KEUPER MARL : ZONE III/IV)	8.0	++ 0.05 g/ltr				19						

Remarks Remoulded to Proctor effort. + Microwave determination
++ Sulphate in accordance with BRE 250

Laboratory Results – Summary

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Figure 2.234

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
227	1.50 1.95	U	Soft red brown fissured very silty CLAY with rootlets and zones of clayey silt. (KEUPER MARL : ZONE III/IV)			100% 9	25	16	30 30 29	1.92 1.92 1.91	UT 38	50 100 200	46 25 55	21	-
	2.50 2.95	U	Firm to stiff red brown fissured very silty CLAY with rootlets and zones of clayey silt. (KEUPER MARL : ZONE III/IV)						17	2.17	UM 105	50 100 200	151 Ø- -	75	-
	3.50 3.95	U	Firm red brown clayey SILT with some siltstone and mudstone fragments. (KEUPER MARL : ZONE II/III)			100% 15	32	17	26 26 25	2.02 2.01 2.03	UT 38	100 200 400	161 103 149	70	-
228	0.50 0.95	U	Red brown silty fine SAND with rootlets and pockets of sand. (GLACIAL TILL)	7.9	++ 0.04 g/ltr Organic 9.93%				13	1.68					
	1.00 1.45	D	Red brown clayey silty SAND with occasional gravel. (GLACIAL TILL)						10						
	2.00 2.45	U	Firm red brown silty sandy CLAY with pockets of sand and mudstone fragments. (KEUPER MARL : ZONE II/III)	7.9	++ 0.04 g/ltr	100% 15	31	16	13	2.09		Untestable.			
	2.50 2.95	D	Firm red brown sandy silty CLAY with some siltstone fragments. (KEUPER MARL : ZONE II/III)						13						

Remarks Ø Excessive strain ++ Sulphate test in accordance with BRE 250

Laboratory Results – Summary

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Figure 2.235

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
228	3.50 3.95	U	Soft red brown sandy silty CLAY with some siltstone fragments. (KEUPER MARL : ZONE II/III)			100% 14	33	19	25 25 24	2.04 2.02 2.04	UT 38	100 200 400	53 92 68	35	-
229	0.50 0.95	U	Stiff brown fissured silty CLAY with rootlets and carbonaceous traces. (GLACIAL TILL)			100% 30	55	25	21 23 19	1.90 1.94 1.98	UT 38	50 100 150	195 218 431	140 (20 cr	- 32)
	1.00 1.45	D	Stiff brown fissured silty CLAY with rootlets and carbonaceous traces. (GLACIAL TILL)	8.0	++ 0.20 g/ltr				34						
	1.00 1.50	B	Stiff brown mottled red-brown silty CLAY with much gravel. carbonaceous traces and rotlets. (GLACIAL TILL)	Organic 1.36%					33						
	2.00 2.45	U	Soft red brown and green grey sandy clayey SILT/silty sandy CLAY with gravel. (GLACIAL TILL)						17	2.17	UM 105	50 100 150	38 41 41	20	-
	2.50 2.95	D	Soft red brown and green grey sandy clayey SILT/silty sandy CLAY with gravel. (GLACIAL TILL)						15						
	3.50 3.95	U	Very soft red brown very silty CLAY with some mudstone fragments (KEUPER MARL:ZONE IV)			100% 14	31	17	22	2.05	UM 105	100 200 300	25 28 35	14	-
	5.00 5.45	U	Soft to firm red brown clayey SILT. (KEUPER MARL:ZONE IV)			100% 12	29	17	24 25 24	2.07 2.06 2.06	UT 38	100 200 400	85 80 99	45	-

Remarks ++ Sulphate in accordance with BRE 250

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exploration associates

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Figure 2.236

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	ϕ°
229	5.50 6.00	D	Stiff red brown very silty CLAY (KEUPER MARL : ZONE III)			100% 14	34	20	21						
230	0.30 0.75	U	Very stiff red brown silty CLAY with rootlets. (GLACIAL TILL)	7.7	++ 0.03 g/ltr	91% 20	38	18	13 15 14	2.03 2.05 2.04	UT 38	50 100 150	558 669 819	340 (120 dr	- 34)
	1.50 1.95	U	Soft to firm red brown fissured silty CLAY with mudstone fragments (KEUPER MARL : ZONE III/IV)						32 28 29	1.84 1.90 1.90	UT 38	50 100 200	47 94 108	40	-
	3.00 3.45	U	Very stiff red-brown silty CLAY with pockets of silt and mudstone (KEUPER MARL : ZONE III/IV)			92% 10	28	18	14 13 14	2.19 2.21 2.20	UT 38	100 200 400	384 464 564	240 (120 dr	- 15)
	3.50 3.95	D	Stiff red brown fissured very silty CLAY with zones of siltstone and mudstone (KEUPER MARL:ZONE III)						12						
231	0.30	D	Firm brown and orange brown very silty CLAY with occasional gravel. (GLACIAL TILL)						22						
	0.50 0.95	U	Firm to stiff red brown mottled grey silty CLAY with some gravel. (GLACIAL TILL)	7.5	++ 0.03 g/ltr	100% 20	37	17	21	2.00	UM 105	50 100 200	139 148 155	75	-
	1.00	D	Firm to stiff red brown mottled grey silty CLAY with some gravel. (GLACIAL TILL)						23						

Remarks ++ Sulphate test in accordance with BRE 250

Laboratory Results – Summary

exploration associates

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Figure 2.237

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
231	1.50 1.95	U	Firm and stiff red brown green grey silty CLAY with some siltstone fragments. (KEUPER MARL:ZONE III)												
	2.50 2.95	U	Very stiff red brown mottled green grey silty CLAY with some siltstone fragments. (KEUPER MARL:ZONE III)			100% 13	31	18	16 16 16	2.17 2.18 2.18	UT 38	100 200 400	395. 426 561	230	-
	3.00 3.45	D	Very stiff red brown mottled green grey silty CLAY with some siltstone fragments. (KEUPER MARL:ZONE III)						12						
	3.50	W	Groundwater	6.9	++ 0.28 g/ltr										
	4.50 4.95	D	Very stiff red brown mottled green grey silty CLAY with some siltstone fragments. (KEUPER MARL:ZONE III)			100% 15	33	18	11						
232	0.50 0.95	U	Stiff red brown and grey green fissured silty CLAY with mudstone and siltstone fragments. (KEUPER MARL : ZONE II/III)			100% 12	31	19	15	2.12	UM 105	50 100 150	226 278 348	140 (56 or	- 22)
	2.00 2.45	U	Very stiff red brown and grey green fissured silty CLAY with mudstone and siltstone fragments. (KEUPER MARL : ZONE II/III)						16	2.21	UM 105	50 100 150	372 433 468	212 (119 or	- 18)

Remarks ++ Sulphate test in accordance with BRE 250

Laboratory Results – Summary

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Figure 2.238

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
232	3.30	D	Very stiff red brown and green grey fissured silty CLAY with many mudstone fragments. (KEUPER MARL : ZONE II/III)						19						
	4.00 4.45	D	Very stiff red brown and green grey fissured silty CLAY wtih many mudstone fragments. (KEUPER MARL : ZONE II/III)						16						
233	0.30	D	Red brown clayey SILT with rootlets and carbonaceous traces. (TOPSOIL)						11						
	0.50 0.95	U	Stiff red brown silty CLAY (KEUPER MARL:ZONE IV)			100% 17	35	18	18 19 19	2.10 2.10 2.09	UT 38	50 100 150	228 213 259	120	-
	2.00 2.45	U	Very stiff red brown silty CLAY. (KEUPER MARL:ZONE IV)						13	2.02	UM 105	100 200 300	320 338 347	170	-
	3.30	D	Red brown very weak MUDSTONE and SILTSTONE. (KEUPER MARL:ZONE II)						12						
	3.95 4.10	D	Red brown very weak MUDSTONE and SILTSTONE (KEUPER MARL:ZONE II)						-						
234	0.50 0.95	U	Very stiff red brown silty CLAY with occasional siltstone fragments. (KEUPER MARL:ZONE II)			100% 22	43	21	18 21 17	2.05 1.93 2.03	UT 38	50 100 200	395 357 604	230	-

Remarks

Laboratory Results – Summary

exploration associates

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Figure 2.239

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
234	1.00 1.50	B	Stiff red brown and green grey fissured silty to very silty CLAY with some siltstone fragments. (KEUPER MARL:ZONE III)						25						
	2.00 2.45	U	Very stiff red brown and green grey fissured silty to very silty CLAY with some siltstone fragments. (KEUPER MARL:ZONE III)			100% 17	37	20	14 12 14	2.20 2.23 2.20	UT 38	50 100 200	347 705 377	240	-
	2.50 3.00	B	Stiff red brown and green grey fissured silty to very silty CLAY with some siltstone fragments. (KEUPER MARL:ZONE III)						23						
	3.50 3.95	U	Very stiff red brown and green grey fissured silty to very silty CLAY with some siltstone fragments. (KEUPER MARL:ZONE III)						11 12 12	2.26 2.17 2.22	UT 38	50 100 200	712 533 823	340	-
	3.50 4.00	B	Very stiff red brown and green grey fissured silty to very silty CLAY with some siltstone fragments. (KEUPER MARL:ZONE III)						24						
235	0.30	D	Firm to stiff brown silty CLAY with occasional gravel. (GLACIAL TILL)												
	1.00 1.60	B	Firm to stiff brown silty CLAY with occasional gravel. (GLACIAL TILL)			100% 16	36	20	22						

Remarks

Laboratory Results – Summary

exploration associates

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Figure 2.240

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
235	2.00 2.45	U	Firm to stiff brown silty CLAY with occasional gravel. (GLACIAL TILL)			100% 14	28	14							
	2.50 3.00	B	Firm brown very silty CLAY with occasional gravel and carbonaceous traces. (GLACIAL TILL)			100% 16	31	15	21						
	3.50 3.95	U	Stiff red brown fissured silty CLAY with mudstone fragments. (KEUPER MARL : ZONE II/III)			100% 18	39	21	22						
	4.00 4.50	B	Stiff red brown fissured silty CLAY with mudstone fragments. (KEUPER MARL : ZONE II/III)						24						
	5.00 5.45	U	Stiff red brown fissured silty CLAY with mudstone fragments. (KEUPER MARL:ZONE II/III)						20 20 21 20	 2.01 2.03 2.05	 REM UT 38	 50 100 200	 111 115 149	 60 (48°	 - 6)
236	0.30	D	Stiff red brown silty CLAY with occasional gravel. (GLACIAL TILL)						15						
	0.50 0.95	U	Stiff red brown silty CLAY with occasional gravel. (GLACIAL TILL)			100% 17	38	21	16						
	1.00 1.70	B	Firm to stiff red brown mottled green grey fissured silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)	7.8	++ 0.01 g/ltr				24 24+						

Remarks ++ Sulphate in accordance with BRE 250

Laboratory Results – Summary

exploration associates

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Department of Transport
East Midlands Regional Office
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Figure 2.241

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
236	2.00 2.45	U	Very stiff red brown mottled green grey fissured silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)			100% 17	34	17	15 15 15	2.12 2.14 2.17	UT 38	50 100 150	493 467 662	270	-
	3.00 4.00	B	Very stiff red brown mottled green grey fissured silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)	- 7.5	++ 0.04 g/ltr	100% 20	42	22	22						
	3.50 3.95	U	Very stiff red brown mottled green grey fissured silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)						15	2.20	UM 105	50 100 150	281 323 362	160 (90 cr	- 17)
	4.05 4.50	D	Very stiff red brown mottle green grey fissured silty CLAY with many mudstone fragments (KEUPER MARL:ZONE III)						12						
237	0.50 0.95	U	Very stiff red brown fissured silty CLAY with many mudstone and siltstone fragments. (KEUPER MARL:ZONE III)			100% 19	38	19	16 18 16	2.10 2.12 2.14	UT 38	50 100 150	459 404 594	240	-
	1.00 1.50	B	Stiff red brown fissured silty CLAY with many mudstone and siltstone fragments. (KEUPER MARL:ZONE III)	8.1	++ 0.04 g/ltr	100% 20	40	20	17						
	2.50 3.00	B	Stiff red brown and green grey fissured silty CLAY. (KEUPER MARL : ZONE II/III)			100% 15	34	19	19						

Remarks
+ Microwave determination
++ Sulphate test in accordance with BRE250

Laboratory Results – Summary

exploration associates

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Figure 2.242

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
238	0.30	D	Firm red brown fissured silty to very silty CLAY with occasional siltstone fragments. (KEUPER MARL : ZONE II/III)						15						
	0.50 0.95	U	Firm red brown fissured silty to very silty CLAY with occasional siltstone fragments. (KEUPER MARL : ZONE II/III)						19						
	1.00 1.50	D	Firm red brown fissured silty to very silty CLAY with occasional siltstone fragments. (KEUPER MARL : ZONE II/III)						17		-				
	2.00 2.45	U	Firm red brown fissured silty to very silty CLAY with occasional siltstone fragments. (KEUPER MARL : ZONE II/III)						20						
	0.50 2.45	2xU 1xD	Firm red brown fissured silty to very silty CLAY with occasional siltstone fragments. (KEUPER MARL : ZONE II/III)			100% 23	43	20							
	2.50 3.00	D	Firm red brown fissured silty to very silty CLAY with occasional siltstone fragments. (KEUPER MARL : ZONE II/III)						18						

Remarks

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Figure 2.243

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
239	0.30	D	Stiff orange brown sandy silty CLAY with gravel and zones of sand. (GLACIAL TILL)						12						
	0.50 0.95	U	Stiff red brown and grey green silty CLAY with occasional gravel. (KEUPER MARL:ZONE III)			100% 32	57	25	20						
	2.00 2.45	U	Stiff red brown and grey green silty CLAY with occasional gravel. (KEUPER MARL:ZONE III)						13						
	2.00 3.00	B	Stiff red brown and grey green silty CLAY with occasional gravel (KEUPER MARL:ZONE III)						19						
	3.50 3.95	U	Stiff red brown very silty CLAY with mudstone fragments (KEUPER MARL: ZONE II/III)			100% 11	27	16							
	4.00 5.00	B	Stiff red brown very silty CLAY with mudstone fragments. (KEUPER MARL : ZONE II/III)	7.8	++ 0.03 g/ltr				19						
	5.00 5.45	U	Stiff red brown very silty CLAY with mudstone fragments. (KEUPER MARL : ZONE II/III)						11	2.17	UM 105	50 100 150	216 239 **	114	-
	5.50 5.95	D	Stiff red brown very silty CLAY with mudstone fragments. (KEUPER MARL : ZONE II/III)						16						

Remarks ** Failed under 2nd loading.
++ Sulphate test in accordance with BRE250

Laboratory Results – Summary

exploration associates

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Figure 2.244

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
240	0.30	D	Stiff orange brown sandy silty CLAY with occasional gravel. (GLACIAL TILL)						12						
	0.50 0.95	U	Stiff orange brown sandy silty CLAY with occasional gravel. (GLACIAL TILL)			100% 26	46	20	15						
	2.00 2.45	U	Stiff orange brown sandy silty CLAY with some gravel. (GLACIAL TILL)			73% 20	38	18							
	2.50 2.95	D	Firm red brown mottled green grey very silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)			100% 23	43	20	15						
	2.95 4.00	B	Firm red brown mottled green grey very silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)												
	3.50 3.95	U	Firm red brown mottled green grey very silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE II/III)			100% 17	35	18							
	5.50 6.00	B	Stiff red brown very silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)	8.1	++ 0.06 g/ltr	100% 17	36	19	20						
241	0.30	D	Stiff brown silty CLAY with occasional gravel. (GLACIAL TILL)						10						

Remarks ++ Sulphate in accordance with BRE 250

Laboratory Results – Summary

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Department of Transport
East Midlands Regional Office
A42 Castle Donington North
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Figure 2.245

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
241	0.50 0.95	U	Stiff brown silty CLAY with occasional gravel. (GLACIAL TILL)			100% 25	45	20	14						
	1.00 1.60	B	Firm and stiff red brown silty CLAY with some mudstone fragments. (KEUPER MARL:ZONE III)			100% 19	41	22	18 20 21 21	 1.99 2.00 1.94	 REM UT 38	 50 100 150	 136 134 140	 70	 -
	3.50 3.95	U	Stiff red brown silty CLAY with some mudstone fragments. (KEUPER MARL:ZONE III)			100% 16	36	20							
	4.00 4.50	B	Stiff red brown silty CLAY with some mudstone fragments. (KEUPER MARL:ZONE III)						23 24+						
	6.00 7.00	B	Very stiff red brown silty CLAY tending to very weak mudstone (KEUPER MARL : ZONE II/III)						20						
B242	0.50 0.95	U	Very stiff red brown mottled green grey sandy very silty CLAY with occasional mudstone fragments. (KEUPER MARL:ZONE III)			100% 27	49	22	19 17 18	2.01 2.01 2.01	 UT 38	50 100 200	351 312 350	 170	 -
	1.00 1.45	D	Firm red brown mottled green grey sandy very silty CLAY with occasional mudstone fragments. (KEUPER MARL: ZONE IV)						23						
	2.00 2.45	U	Firm to stiff red brown mottled green grey sandy very silty CLAY with occasional mudstone fragments. (KEUPER MARL : ZONE III/IV)			100% 20	40	20	19	2.02	UM 105	50 150 300	139 148 151	75	-

Remarks + Microwave determination

Laboratory Results – Summary

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A42 Castle Donington North
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Figure 2.246

EX2

Samples				Chemical		Classification					Strength					
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B242	3.50 3.95	U	Very stiff red brown and green grey fissured silty CLAY tending to very weak mudstone. (KEUPER MARL : ZONE II/III)			100% 15 –	33	18	8	2.19	UM 105	100 200 400	521 710 1032	380 (110 or	– 27)
	4.00 4.45	D	Very stiff red brown and green grey fissured silty CLAY tending to very weak mudstone (KEUPER MARL : ZONE II/III)						16						
	6.50 6.95	D	Very stiff red brown and green grey fissured silty CLAY tending to very weak mudstone (KEUPER MARL:: ZONE II/III)						13						
	9.60 10.00	D	Red brown and green grey weak MUDSTONE (KEUPER MARL : ZONE I)						10						
B243	0.50 0.95	U	Firm red brown and green grey fissured silty CLAY with occasional mudstone fragments. (KEUPER MARL:ZONE III)	7.7	++ 0.07 g/ltr				23						
	1.80	D	Stiff red brown and green grey fissured silty CLAY with occasional mudstone fragments. (KEUPER MARL:ZONE III)						20						
	3.50 3.95	U	Very stiff red brown and green grey fissured silty CLAY with occasional mudstone fragments tending to very weak mudstone in parts (KEUPER MARL:ZONE III)			88% 19	38	19	18	2.09	UM 105	50 150 300	299 319 327	160	–

Remarks ++ Sulphate test in accordance with BRE250

Laboratory Results – Summary

exploration associates

Project
Department of Transport
East Midlands Regional Office
A42 Castle Donington North
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Figure 2.247

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B243	5.50 5.95	D	Very stiff red brown and green grey fissured silty CLAY with occasional mudstone fragments tending to very weak mudstone in parts. (KEUPER MARL : ZONE II/III)			100% 12	31	19	11						
	7.00 7.45	D	Red brown mottled green grey very weak MUDSTONE. (KEUPER MARL : ZONE II/III)			100% 17	30	13	13						
	9.70 9.90	D	Red brown mottled green grey very weak MUDSTONE (KEUPER MARL : ZONE II/III)						13 8.6						
B244	0.40	D	Very stiff red brown and light brown fissured silty CLAY with some mudstone fragments. (KEUPER MARL:ZONE III)						13						
	0.50 0.95	U	Very stiff red brown and light brown fissured silty CLAY with some mudstone fragments. (KEUPER MARL:ZONE III)	7.5	++ 0.05 g/ltr	88% 20	42	22	19						
	2.00 2.45	U	Very stiff red brown and grey green silty CLAY with some mudstone and siltstone fragments. (KEUPER MARL:ZONE III)			100% 14	33	19	15 17 16	2.19 2.15 2.17	UT 38	50 150 300	413 301 476	200	–

Remarks ++ Sulphate in accordance with BRE 250

Laboratory Results – Summary

exploration associates

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Department of Transport
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A42 Castle Donington North
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Figure 2.248

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_1 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B244	3.50 3.95	U	Stiff red brown and grey green silty CLAY with bands of silt-stone (KEUPER MARL: ZONE III)						22	2.20		Untestable			
	5.20	D	Stiff and very stiff grey green silty CLAY with bands of silt-stone. (KEUPER MARL: ZONE III)						13						
	5.50	D	Red brown and grey green very weak MUDSTONE/SILTSTONE (KEUPER MARL:ZONE I)			100% 15	32	17	12						
B245	0.50 0.95	U	Very stiff red brown mottled grey green silty CLAY with some carbonaceous traces. (GLACIAL TILL)						20 21 22	2.00 1.99 2.01	UT 38	50 100 150	265 313 302	150	-
	1.00 1.45	D	Firm to stiff red brown mottled grey green silty CLAY with some mudstone and siltstone fragments. (KEUPER MARL:ZONE III)						12						
	2.00 2.45	U	Very stiff red brown mottled grey green silty CLAY with some mudstone and siltstone fragments. (KEUPER MARL:ZONE III)	8.0	++ 0.04 g/ltr	100% 15	35	20	18 17 18	2.10 2.12 2.09	UT 38	50 150 300	300 443 450	200	-
	3.50 3.95	U	Very stiff red brown fissured silty CLAY tending to very weak mudstone in parts. (KEUPER MARL : ZONE II/III)			100% 14	33	19	16 18 16	2.13 2.05 2.13	UT 38	100 200 400	410 404 634	240	-

Remarks ++ Sulphate test in accordance with BRE250

Laboratory Results – Summary

exploration associates

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Department of Transport
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A42 Castle Donington North
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Figure 2.249

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B245	4.00 4.45	D	Very stiff red brown fissured silty CLAY tending to very weak mudstone in parts. (KEUPER MARL : ZONE II/III)						12						
	5.50 5.95	D	Very stiff red brown fissured silty CLAY tending to very weak mudstone in parts. (KEUPER MARL : ZONE II/III)						8						
B246	0.50 0.95	U	Very stiff red brown silty CLAY with some gravel. (GLACIAL TILL)						21 20 21	2.01 1.99 2.00	UT 38	50 100 150	500 516 501	250	–
	1.00 1.45	D	Firm red brown and grey green silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)						16						
	2.00 2.45	U	Very stiff red brown and grey green silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)	8.0	++ 0.04 g/ltr	100% 13	30	17	17 17 17	2.10 2.12 2.11	UT 38	50 150 300	251 260 485	170	–
	3.50 3.95	U	Very stiff red brown silty CLAY tending to very weak mudstone in parts (KEUPER MARL:ZONE III)			92% 12	32	20	18 18 19	2.12 2.11 2.09	UT 38	100 200 400	508 494 475	250	–
	5.50 5.95	D	Very stiff red brown silty CLAY tending to very weak mudstone in parts. (KEUPER MARL:ZONE III)						10						

Remarks ++ Sulphate test in accordance with BRE250

Laboratory Results – Summary

exploration associates

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Figure 2.250

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B246	7.20 7.50	D	Very stiff red brown silty CLAY tending to very weak mudstone in parts. (KEUPER MARL:ZONE III)						8						
B247	0.50 0.95	U	Very stiff red brown silty CLAY with occasional weak siltstone fragments (KEUPER MARL ZONE III)						15 16 15	2.15 2.17 2.14	UT 38	50 100 150	518 654 659	305 (142 or	- 24)
	2.00 2.45	U	Stiff red brown occasionally mottled green grey silty CLAY with some mudstone fragments. (KEUPER MARL:ZONE III)			100% 17	39	22	16	2.09	UM 105	50 150 300	183 200 214	100	-
	2.50 2.95	D	Stiff red brown and grey green silty to very silty CLAY with many mudstone and siltstone fragments. (KEUPER MARL : ZONE II/III)						15						
	3.50 3.95	U	Stiff red brown and grey green silty to very silty CLAY with many mudstone and siltstone fragments. (KEUPER MARL : ZONE II/III)			84% 14	34	20	24 25 25	1.89 1.96 1.96	UT 38	100 200 400	223 226 371	140	-
	7.00 7.45	D	Very stiff red brown and grey green silty to very silty CLAY with many mudstone and siltstone fragments tending to very weak mudstone. (KEUPER MARL : ZONE II/III)			100% 14	33	19	14						

Remarks

Laboratory Results – Summary

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Figure 2.251

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B248	0.50 0.95	U	Stiff red brown mottled grey green silty CLAY with some mudstone and siltstone fragments. (KEUPER MARL : ZONE II/III)			100% 22	45	23	20	1.89	UM 105	50 100 150	256 256 258	130	-
	2.00 2.45	U	Very stiff red brown mottled grey green silty CLAY with some mudstone and siltstone fragments. (KEUPER MARL : ZONE II/III)	8.1	++ 0.03 g/ltr	100% 13	31	18	15	2.19	UM 105	50 150 300	356 467 600	240 (110 or	- 19)
	3.50 3.95	U	Very stiff red brown mottled grey green silty CLAY with some mudstone and siltstone fragments. (KEUPER MARL : ZONE II/III)						13	2.07	UM 105	100 200 400	399 552 ø-	240	-
	4.00 4.45	D	Red brown green grey very weak MUDSTONE/ SILTSTONE (KEUPER MARL:ZONE III)			100% 14	33	19	6						
	6.00	W	Groundwater	7.1	++ 0.04 g/ltr										
	6.00 6.45	D	Red brown green grey very weak MUDSTONE/ SILTSTONE (KEUPER MARL:ZONE III)						9						
B249	0.40	D	Stiff red brown and grey green very silty CLAY with mudstone fragments. (KEUPER MARL:ZONE III)						13						
	0.50 0.95	U	Very stiff red brown grey green very silty CLAY with mudstone fragments. (KEUPER MARL:ZONE III)	7.9	++ 0.01 g/ltr	100% 19	38	19	14	2.08	UM 105	50 100 150	462 500 539	250	-

Remarks ++ Sulphate test in accordance with BRE250

Laboratory Results – Summary

exploration associates

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Department of Transport
East Midlands Regional Office
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Main Site Investigation : Contract 2

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Figure 2.252

Samples				Chemical		Classification					Strength					
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B249	2.00 2.45	U	Very stiff red brown and grey green very silty CLAY with mudstone fragments tending to very weak mudstone. (KEUPER MARL:ZONE III)			100% 12	31	19	14 13 13	2.17 2.20 2.17	UT 38	50 150 300	342 570 741	280 (90 or	- 26)
B250	1.00	D	Stiff red brown and grey green very silty CLAY with some mudstone fragments. (KEUPER MARL:ZONE III)						25						
	2.00 2.45	U	Very stiff red brown and grey green very silty CLAY with some mudstone fragments. (KEUPER MARL:ZONE III)	8.0	++ 0.02 g/ltr	100% 17	35	18	15 14 14	2.09 2.14 2.09	UT 38	50 200 350	249 529 607	230 (67 or	- 22)
	2.50 2.95	D	Stiff grey green very silty CLAY with zones of very weak siltstone (KEUPER MARL : ZONE II/III)						16						
	5.00 5.40	D	Very stiff red brown mottled green grey very silty CLAY with some mudstone fragments. (KEUPER MARL : ZONE III)			14	33	19	9						
B251	0.50	D	Stiff red brown mottled grey green silty CLAY with mudstone fragments (KEUPER MARL:ZONE III)						16						
	1.00 1.45	D	Stiff red brown mottled greey green silty CLAY with mudstone fragments. (KEUPER MARL:ZONE III)						13						

Remarks ++ Sulphate test in accordacne with BRE250

Laboratory Results – Summary

exploration associates

Project
Department of Transport
East Midlands Regional Office
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Figure 2.253

EX2

Samples				Chemical		Classification					Strength					
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B251	2.00 2.45	U	Very stiff red brown mottled grey green silty CLAY with mudstone fragments. (KEUPER MARL:ZONE III)			100% 13	31	18	14	2.20	UM 105	50 150 300	351 453 587	230 (115 dr	- 18)
	3.50 3.95	U	Stiff red brown very silty CLAY with bands of very weak siltstone (KEUPER MARL: ZONE III)			92% 13	36	23	21 22 21	1.99 1.94 2.00	UT 38	100 200 400	238 250 274	130	-
B252	0.40	D	Stiff red brown mottled grey green silty CLAY with many mudstone fragments (KEUPER MARL : ZONEIII)						14						
	0.50 0.95	U	Very stiff red brown mottled grey green silty CLAY with many mudstone fragments (KEUPER MARL: ZONEIII)	8.0	++ 0.08 g/ltr	100% 19	36	17	10	2.10	UM 105	50 100 150	266 323 357	160	-
	2.00 2.45	U	Very stiff red brown mottled grey green silty CLAY with many mudstone fragments (KEUPER MARL: ZONEIII)			82% 13	33	20	16	2.19	UM 105	50 150 300	381 415 448	210	-
	3.50 3.95	U	Very stiff red brown silty CLAY with bands of very weak mudstone/ SILTSTONE. (KEUPER MARL: ZONE III)	7.7	++ 0.04 g/ltr	100% 16	38	22	21	2.06	UM 105	100 200 400	320 361 408	180 (128°	- 7)

Remarks ++ Sulphate test in accordance with BRE250

Laboratory Results – Summary

exploration associates

Project
Department of Transport
East Midlands Regional Office
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Figure 2.254

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	ϕ°
B253	0.50 1.00	B	Stiff to very stiff red brown silty CLAY with occasional gravel (GLACIAL TILL)			100% 19	37	18	14						
	1.45	D	Stiff red brown silty CLAY with occasional siltstone fragments. (KEUPER MARL: ZONE IVa)						24						
	2.50 2.95	U	Very stiff red brown mottled grey green fissured silty to very silty CLAY with many mudstone/siltstone fragments. (KEUPER MARL: ZONE III)						14 14 15	2.11 2.13 2.13	UT 38	50 150 300	324 479 746	260 (75°	- 27)
	4.00 4.45	U	Very stiff red brown mottled grey green fissured silty to very silty CLAY with many mudstone/siltstone fragments. (KEUPER MARL: ZONE III)			100% 15	38	23	19 21 21	2.00 2.00 2.01	UT 38	100 200 400	271 366 383	170	-
	4.95	D	Very stiff red brown mottled grey green fissured silty to very silty CLAY with many mudstone/siltstone fragments. (KEUPER MARL: ZONE III)						13						

Remarks

Laboratory Results – Summary

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Figure 2.255

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B254	0.50 1.00	B	Stiff red brown mottled green grey silty CLAY with mudstone fragments. (KEUPER MARL : ZONE III)	7.8	++ 0.07 g/ltr				16						
	2.50 3.50	B	Stiff red brown mottled green grey silty CLAY with mudstone fragments. (KEUPER MARL : ZONE III)						20						
	3.00 3.45	U	Stiff red brown mottled green grey silty CLAY with mudstone fragments. (KEUPER MARL : ZONE III)			100% 15	33	18	14	2.15	UM 105	50 150 300	239 287 312	140 (98 or	- 7)
	4.50 4.95	U	Stiff red brown mottled green grey silty CLAY with mudstone fragments. (KEUPER MARL : ZONE III)			100% 16	38	22	18	2.12	UM 105	100 200 400	199 225 239	110	-
	5.50 5.80	D	Stiff red brown mottled green grey silty CLAY with mudstone fragments (KEUPER MARL : ZONE III)						11						
B255	1.00 1.50	B	Stiff red brown mottled green grey silty CLAY with mudstone and siltstone fragments. (KEUPER MARL : ZONE III)						19						
	1.90 2.50	B	Stiff red brown silty CLAY with siltstone fragments. (KEUPER MARL: ZONE III)	8.2	++ 0.09 g/ltr				19						

Remarks ++ Sulphate test in accordance with BRE250

Laboratory Results – Summary

exploration associates

Project
Department of Transport
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Figure 2.256

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B255	3.00 3.45	U	Very stiff red brown and green grey very silty CLAY with mudstone fragments. (KEUPER MARL : ZONE III)			100% 13	32	19	18	2.11	UM 105	50 200 350	254 374 455	180 (88^{ar}	- 14)
	4.50 4.95	U	Very stiff red brown and green grey very silty CLAY with mudstone fragments. (KEUPER MARL : ZONE III)			82% 11	30	19	14	2.11	UM 105	100 300 500	381 649 ø-	260 (80^{ar}	- 24
	6.30	D	Red brown very weak MUDSTONE (KEUPER MARL:ZONE III)						12						
B256	0.60	D	Firm red brown mottled grey green silty CLAY with mudstone fragments (KEUPER MARL: ZONE III)						11						
	1.00 1.50	B	Very stiff red brown occasionally mottled green grey silty CLAY with many mudstone fragments. (KEUPER MARL : ZONE III)			100% 15	34	19	15						
	2.00 2.70	B	Very stiff red brown occasionally mottled green grey silty CLAY with many mudstone fragments. (KEUPER MARL : ZONE III)						20						
	3.00 3.45	U	Very stiff red brown occasionally mottled green grey silty CLAY with many mudstone fragments. (KEUPER MARL : ZONE III)			100% 15	35	20	16	2.17	UM 105	100 300 500	390 618 672	280 (128^{ar}	- 14)

Remarks

Laboratory Results – Summary

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Department of Transport
East Midlands Regional Office
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Main Site Investigation : Contract 2

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Figure 2.257

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B256	3.50 4.00	B	Very stiff red brown occasionally mottled green grey silty CLAY with many mudstone fragments. (KEUPER MARL : ZONE III)	8.2	++ 0.09 g/ltr				19						
	4.30 4.55	U	Very stiff red brown occasionally mottled green grey silty CLAY with many mudstone fragments. (KEUPER MARL : ZONE III)			100% 17	40	23	12	2.06	UM 105	100 300 500	321 426 480	200 (120 dr	- 9°)
	4.80 5.10	D	Very stiff red brown occasionally mottled green grey silty CLAY with many mudstone fragments. (KEUPER MARL : ZONE III)						14						
B257	1.10	D	Red brown very weak SILTSTONE (KEUPER MARL:ZONE III)						12						
	1.50 1.90	U	Red brown very weak SILTSTONE tending to very stiff silty CLAY (KEUPER MARL: ZONE III)						12	2.41		Untestable			
	1.90 2.40	B	Red brown very weak SILTSTONE (KEUPER MARL:ZONE III)	7.7	++ 0.01 g/ltr				21						
	3.00 3.50	B	Very stiff red brown fissured silty to very silty CLAY with zones of mudstone/siltstone (KEUPER MARL : ZONE III)			100% 16	34	18	19						

Remarks ++ Sulphate test in accordance with BRE250

Laboratory Results – Summary

exploration associates

Project
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Figure 2.258

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B258	0.60	D	Firm red brown fissured silty CLAY with many mudstone/ siltstone fragments. (KEUPER MARL:ZONE III)						14						
	1.50 1.95	U	Very stiff red brown silty to very silty CLAY with mudstone fragments. (KEUPER MARL:ZONE III)						15	2.23	UM 105	100 200 400	369 422 493	210 (140 or	- 10)
	2.00 2.50	B	Red brown very weak SILTSTONE with some silty clay. (KEUPER MARL:ZONE II)			89% 16	33	17	23						
	3.00	D	Very stiff red brown fissured silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE II/III)			100% 17	37	20	16						
B259	1.00	D	Firm red brown fissured silty to very silty CLAY with some mudstone fragments. (KEUPER MARL:ZONE III)						12						
	1.50 1.95	U	Very stiff red brown silty CLAY tending to very weak siltstone. (KEUPER MARL : ZONE III)						12	2.17	UM 105	100 200 400	559 756 1136	410 (105 or	- 29)
	2.00 2.50	B	Very stiff red brown silty CLAY tending to very weak siltstone (KEUPER MARL : ZONE III)	7.8	++ 0.06 g/ltr	100% 16	35	19	22						
	3.20	D	Very stiff red brown silty CLAY tending to very weak siltstone (KEUPER MARL:ZONE III)						13						

Remarks ++ Sulphate test in accordance with BRE250

Laboratory Results – Summary

exploration associates

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Figure 2.259

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_p	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B260	1.00	D	Firm to stiff red brown mottled green grey silty CLAY with occasional mudstone/ siltstone fragments. (KEUPER MARL:ZONE IVa)						14						
	2.00 2.50	B	Red brown very weak MUDSTONE (KEUPER MARL:ZONE III)	7.3	++ 0.03 g/ltr				20						
	3.00 3.45	U	Very stiff red brown mottled green grey silty CLAY with mudstone fragments. (KEUPER MARL : ZONE III)			100% 13	32	19	17	2.12	UM 105	100 300 600	338 469 Ø-	200	-
B261	1.00	D	Soft red brown silty CLAY with many mudstone/siltstone fragements. (KEUPER MARL:ZONE III)						16						
	1.60 2.05	D	Red brown very weak to weak SILTSTONE (KEUPER MARL:ZONE II)						10						
	2.50 2.95	B	Red brown very weak to weak SILTSTONE (KEUPER MARL:ZONE II)			100% 14	33	19	17						
	4.10	D	Soft green grey silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)						18						
	4.50 4.95	D	Red brown occasionally mottled green grey weak SILTSTONE. (KEUPER MARL:ZONE II)						10						

Remarks Ø Excessive Strain
++ Sulphate in accordance with BRE 250

Laboratory Results – Summary

exploration associates

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Department of Transport
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Figure 2.260

EX2

Samples				Chemical		Classification					Strength					
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B262	1.00	D	Very stiff red brown mottled green grey silty CLAY with some siltstone fragments. (KEUPER MARL:ZONE III)						11						
	2.50 2.95	U	Very stiff red brown mottled green grey silty CLAY with some siltstone fragments. (KEUPER MARL : ZONE III)	8.2	++ 0.04 g/ltr	69% 12	31	19	15	2.14	UM 105	50 150 300	353 474 623	240 (115 or	- 19)
	4.00 4.45	U	Very stiff red brown mottled green grey silty CLAY with some siltstone fragments. (KEUPER MARL : ZONE III)						21	2.06	UM 105	100 200 400	326 393 454	200 (125 or	- 10)
B263	0.30	D	Very stiff red brown silty CLAY with occasionally gravel. (GLACIAL TILL)						12						
	0.50 0.95	U	Very stiff red brown silty CLAY with occasional gravel. (GLACIAL TILL)						11	2.04	UM 105	50 150 350	838 932 1339	520 (235 or	- 26)
	2.00 2.45	U	Stiff red brown mottled green grey silty CLAY with some siltstone fragments. (KEUPER MARL:ZONE III)			100% 9	26	17							
	3.50 3.95	U	Very stiff red brown and green grey silty CLAY with many mudstone fragments. (KEUPER MARL : ZONE II/III)			100% 14	33	21	18 18 19	2.09 1.99 1.94	UT 38	100 200 400	442 500 352	220	-
	5.00 5.10	B	Red brown and green grey weak SILTSTONE (KEUPER MARL:ZONE III)						11						

Remarks ++ Sulphate test in accordance with BRE250

Laboratory Results – Summary

exploration associates

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Department of Transport
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Figure 2.261

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B264	0.30	D	Very stiff red brown and grey green silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)						11						
	0.50	U	Very stiff red brown			100%						50	741		
	0.95		and grey green silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)			19	39	20	20	2.11	UM 105	100	*-	370	-
												150	-		
	2.00	U	Very stiff red brown		++				13	2.20		50	501		
	2.45		and grey green silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)	7.9	0.04 g/ltr				13	2.22	UT 38	150	510	260	-
									14	2.21		300	580		
	3.50	U	Very stiff red brown			100%			19	2.08		100	211		
	3.95		and grey green silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)			12	31	19	20	2.02	UT 38	200	227	170	-
									17	2.12		400	608		
	5.00	U	Very stiff red brown						13	2.20		100	448		
	5.45		and grey green silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)						13	2.20	UT 38	250	685	370	-
									13	2.18		500	1091	(98 cr	26)
B265	0.30	D	Firm to stiff yellow brown fissured sandy CLAY with occasional gravel. (GLACIAL TILL)						10						
	0.50	U	Very stiff red brown			90%						50	279		
	0.95		mottled grey green silty CLAY with mudstone fragments. (KEUPER MARL : ZONE II/III)			16	32	16	10	1.88	UM 105	100	332	160	-
												150	373	(85 cr	18)

Remarks * Failed under 1st loading.
++ Sulphate test in accordance with BRE250

Laboratory Results – Summary

exploration associates

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Department of Transport
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Figure 2.262

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B265	1.00 1.45	D	Firm/stiff red brown mottled grey green silty CLAY with mudstone fragments. (KEUPER MARL : ZONE II/III)						12						
	2.00 2.45	U	Very stiff red brown mottled grey green silty CLAY with mudstone fragments. (KEUPER MARL : ZONE II/III)						13 13 13	2.14 2.15 2.14	UT 38	50 150 300	272 425 485	200 (85 or	- 18)
	2.00 3.00	B	Very stiff red brown mottled grey green silty CLAY with mudstone fragments. (KEUPER MARL : ZONE II/III)	7.7	++ 0.05 g/ltr				17						
	3.50 3.95	U	Stiff red brown mottled grey green silty CLAY with mudstone fragments (KEUPER MARL : ZONE II/III)			100% 16	39	23	23 21 21	2.01 1.98 1.92	UT 38	50 200 350	170 276 235	110	-
	5.00 5.40	U	Very stiff red brown mottled grey green silty CLAY with mudstone fragments. (KEUPER MARL : ZONE II/III)						12 11 11	2.21 2.25 2.26	UT 38	100 200 400	342 880 1493	450 (70 or	- 37)
	6.50	D	Very stiff red brown mottled grey green silty CLAY with mudstone fragments tending to weak siltstone. (KEUPER MARL : ZONE II/III)						13						

Remarks ++ Sulphate test in accordance with BRE 250

Laboratory Results – Summary

exploration associates

Project
Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation : Contract 2

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Figure 2.263

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B266	0.30	D	Firm to stiff yellow brown fissured sandy CLAY with occasional gravel. (GLACIAL TILL)						12						
	0.50	U	Very stiff yellow						13	2.09	UT	50	613		
	0.95		brown fissured sandy CLAY with occasional gravel. (GLACIAL TILL)						13	2.10		100	458	230	-
									14	2.07	38	150	343		
	2.00	U	Very stiff red brown			93%						50	367		
	2.45		fissured silty CLAY with many siltstone fragments. (KEUPER MARL:ZONE III)			17	35	18	15	2.10	UM 105	150	Ø-	180	-
												300	--		
	3.50	U	Very stiff red brown									50	423		
	3.95		fissured silty CLAY with many siltstone fragments. (KEUPER MARL:ZONE III)						11	2.21	UM 105	200	597	290	-
												350	711	(140^{ar}	19)
	5.00	U	Very stiff red brown			100%			17	2.14		100	329		
	5.40		and green grey silty CLAY with many siltstone fragments. (KEUPER MARL : ZONE III)			14	31	17	17	2.16	UT 38	200	445	210	-
									16	2.16		400	476	(115^{ar}	12)
B267	2.00	B	Stiff and very stiff		++	100%									
	2.50		red brown mottled grey green silty CLAY with some mudstone/siltstone fragments. (KEUPER MARL:ZONE III)	7.7	0.05 g/ltr	12	30	18	21						
	3.30	D	Stiff and very stiff red brown mottled grey green silty CLAY with some mudstone/siltstone fragments. (KEUPER MARL:ZONE III)						12						

Remarks Ø Excessive Strain
++ Sulphate in accordanace with BRE 250

Laboratory Results – Summary

exploration associates

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Department of Transport
East Midlands Regional Office
A42 Castle Donington North
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Contract S4449

Figure 2.264

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_4	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B268	1.50	U	Very stiff red brown						17	2.13		50	446		
	1.95		fissured silty CLAY						16	2.14	UT	150	567	280	-
			with many mudstone and						18	2.11	38	350	662	(155 dr	16)
			siltstone fragments.												
			(KEUPER MARL:ZONE III)												
	2.00	B	Very stiff red brown						20						
	2.50		fissured silty CLAY												
			with many mudstone and												
			siltstone fragments.												
			(KEUPER MARL:ZONE III)												
	3.00	U	Very stiff red brown			100%			16	2.14		100	476		
	3.45		fissured silty CLAY			15	35	20	15	2.18	UT	200	498	300	-
			with many mudstone and						14	2.13	38	400	833	(120 dr	22)
			siltstone fragments.												
			(KEUPER MARL:ZONE III)												
	4.00	B	Stiff red brown and						19						
	4.50		grey green fissured silty												
			silty CLAY with many												
			mudstone/siltstone												
			fragments												
			(KEUPER MARL:ZONE III)												
B269	1.00	D	Firm red brown fissured						15						
			silty CLAY with many												
			siltstone fragments.												
			(KEUPER MARL:ZONE III)												
	2.00	B	Very stiff red brown		++										
	2.50		fissured silty CLAY	7.8	0.07 g/ltr				22						
			with many siltstone												
			fragments.												
			(KEUPER MARL:ZONE III)												
	3.00	U	Very stiff red brown			100%						50	343		
	3.45		fissured silty CLAY			12	29	17	20	2.18	UM	200	476	230	-
			with many siltstone								105	350	561	(125 dr	14)
			fragments.												
			(KEUPER MARL : ZONE III)												

Remarks ++ Sulphate test in accordance with BRE250

Laboratory Results – Summary

exploration associates

Project
Department of Transport
East Midlands Regional Office
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Figure 2.265

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B269	3.50	D	Stiff red brown fissured silty CLAY with mudstone/siltstone fragments. (KEUPER MARL : ZONE III)						13						
	4.50 4.95	U	Stiff red brown fissured silty CLAY with mudstone/siltstone fragments. (KEUPER MARL : ZONE III)			78% 12	28	16	15	2.13	UM 105	100 250 500	244 Ø- -	120	-
B270	1.00	D	Firm red brown mottled grey green fissured silty CLAY with many mudstone/ siltstone fragments. (KEUPER MARL:ZONE III)						20						
	2.00 2.50	B	Red brown very weak SILTSTONE with some silty clay. (KEUPER MARL:ZONE III)						22						
	3.00 3.45	U	Stiff red brown fissured silty CLAY with some mudstone/ siltstone fragments. (KEUPER MARL : ZONE III)			100% 12	29	17	18	2.15	UM 105	50 150 350	184 247 349	130 (65	- 12)
	4.50 4.95	U	Very stiff red brown fissured silty CLAY with some mudstone/ siltstone fragments (KEUPER MARL : ZONE III)						18	2.06	UM 105	100 200 400	309 376 457	190 (100	- 12)
B271	0.50	D	Very stiff red brown silty CLAY with occasional mudstone fragments. (KEUPER MARL : ZONE III)						11						

Remarks Ø Excessive Strain

Laboratory Results – Summary

exploration associates

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Department of Transport
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Figure 2.266

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B271	2.00 3.00	B	Very stiff red brown silty CLAY with occasional mudstone fragments. (KEUPER MARL : ZONE III)	7.8	++ 0.06 g/ltr	100% 14	32	18	18						
	3.10 3.60	D	Very stiff red brown silty CLAY with occasional mudstone fragments. (KEUPER MARL : ZONE III)						14						
B272	1.30	D	Red brown and grey green very weak SILTSTONE (KEUPER MARL:ZONE II)						8						
	2.00 2.50	D	Red brown very weak micaceous mudstone (KEUPER MARL:ZONE III)						15						
	3.00 3.45	U	Red brown very weak micaceous MUDSTONE (KEUPER MARL:ZONE III)			100% 15	34	19	15 14 14	2.12 2.18 2.18	UT 38	100 200 400	547 767 1043	390 (112	- or 27)
	3.50 4.00	D	Very stiff red brown and grey green silty CLAY tending to very weak mudstone (KEUPER MARL : ZONE III)						20						
B273	0.50 0.95	U	Firm to stiff red brown fissured silty CLAY with many siltstone fragments. (KEUPER MARL:ZONE IV)	7.7	++ 0.04 g/ltr				28	1.85	UM 105	50 100 200	118 150 201	75 (38	- 12)

Remarks ++ Sulphate test in accordance with BRE 250

Laboratory Results – Summary

exploration associates

Project
Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation : Contract 2

Contract S4449

Figure 2.267

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B273	2.00 2.45	U	Very stiff red brown mottled grey green silty CLAY with siltstone fragments. (KEUPER MARL : ZONE III/IV)	7.7	++ 0.04 g/ltr										
	2.50 3.00	B	Stiff and very stiff red brown occasionally green grey silty CLAY tending to very weak siltstone in parts. (KEUPER MARL:ZONE III)	8.1	++ 0.06 g/ltr				18						
	3.50 3.95	U	Stiff and very stiff red brown occasionally green grey silty CLAY tending to very weak siltstone in parts. (KEUPER MARL:ZONE III)			100% 14	34	20	14	2.22		Untestable			
	5.00 5.45	U	Stiff and very stiff red brown occasionally green grey silty CLAY tending to very weak siltstone in parts. (KEUPER MARL:ZONE III)			93% 17	37	20	13 14 13	2.17 2.16 2.16	UT 38	100 200 400	505 532 1097	360 (85 dr	– 30)
	7.00 7.50	B	Stiff and very stiff red brown occasionally green grey silty CLAY tending to very weak siltstone in parts. (KEUPER MARL:ZONE III)			100% 14	34	20	16						
B274	0.50 0.95	U	Very stiff red brown mottled light brown fissured silty CLAY with mudstone fragments and rootlets. (KEUPER MARL:ZONE III)			100% 25	45	20	13			Untestable			

Remarks ++ Sulphate test in accordance with BRE 250

Laboratory Results – Summary

exploration associates

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Department of Transport
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Figure 2.268

Samples				Chemical		Classification					Strength					
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	ϕ°
8274	1.00 1.45	D	Very stiff red brown mottled green grey fissured silty CLAY with mudstone fragments (KEUPER MARL : ZONE II/III)	8.1	++ 0.01 g/ltr				12						
	2.00 2.45	U	Very stiff red brown mottled green grey fissured silty CLAY with mudstone fragments (KEUPER MARL : ZONE II/III)			100% 15	33	18	9	2.21	UM 105	50 150 300	329 438 508	210 (112	- or 15)
	2.50 2.95	D	Very stiff red brown mottled green grey fissured silty CLAY with mudstone fragments (KEUPER MARL : ZONE II/III)						10						
	3.50 4.00	B	Very stiff red brown mottled green grey fissured silty CLAY with mudstone fragments (KEUPER MARL : ZONE II/III)						11						
275	0.50 0.95	U	Very stiff red brown silty CLAY with gravel (GLACIAL TILL)			100% 20	41	21	19						
	1.00 1.45	D	Stiff and very stiff red brown and grey green silty CLAY with occasional mudstone fragments. (KEUPER MARL:ZONE III)						15						
	2.00 2.45	U	Stiff and very stiff red brown and grey green silty CLAY with occasional mudstone fragments. (KEUPER MARL:ZONE III)	8.1	++ 0.06 g/ltr	100% 15	32	17	14 20+						

Remarks + Microwave Determination
++ Sulphate in accordance with BRE 250

Laboratory Results – Summary

exploration associates

Project
Department of Transport
East Midlands Regional Office
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Figure 2.269

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
275	2.50 2.95	D	Stiff red brown and grey green fissured silty CLAY with mudstone fragments. (KEUPER MARL:ZONE III)			100% 18	35	17	16						
276	0.50 0.95	U	Very stiff red brown mottled grey green silty CLAY with some gravel. (GLACIAL TILL)			100% 14	36	22	17 17+						
	1.00 1.45	D	Very stiff red brown mottled grey green fissured silty CLAY with some mudstone fragments. (KEUPER MARL : ZONE III)						13						
	2.00 2.45	U	Stiff red brown mottled grey green fissured silty CLAY with some mudstone fragments. (KEUPER MARL : ZONE III)						14	2.16	UM 105	50 100 150	240 *- -	120	-
	2.50 3.00	B	Very stiff red brown mottled grey green fissured silty CLAY with some mudstone fragments. (KEUPER MARL : ZONE III)	8.1	++ 0.04 g/ltr	100% 16	35	19	20 18+						
	4.00 4.45	D	Very stiff red brown mottled grey green fissured silty CLAY with some mudstone fragments tending to very weak siltstone in parts. (KEUPER MARL : ZONE III)						10						

Remarks * Failed under 1st Loading ++ Sulphate in accordance with BRE 250
+ Microwave Determination

Laboratory Results – Summary

exploration associates

Project
Department of Transport
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Figure 2.270

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
277	0.50 0.95	U	Very stiff red brown and grey green fissured silty CLAY with many mudstone fragments. (KEUPER MARL : ZONE II/III)			100% 24	44	20	16						
	1.00 2.00	B	Very stiff red brown and grey green fissured silty CLAY with many mudstone fragments tending to weak siltstone in parts. (KEUPER MARL : ZONE II/III)	7.8	++ 0.05 g/ltr				16 15+						
	2.00 2.20	B	Very stiff red brown and grey green fissured silty CLAY with many mudstone fragments tending to weak siltstone in parts. (KEUPER MARL : ZONE II/III)			100% 17	36	19	12						
278	0.40	D	Stiff red brown mottled grey green fissured silty CLAY with carboanceous traces. (KEUPER MARL:ZONE IVa)						13						
	0.50 0.95	U	Stiff red brown mottled grey green silty CLAY with some siltstone/mudstone fragments. (KEUPER MARL : ZONE III)			100% 22	48	26	26 24 25	1.94 1.97 1.96	UT 38	50 100 150	256 312 289	140	-
	1.00 1.50	B	Stiff red brown mottled grey green silty CLAY with some siltstone/mudstone fragments. (KEUPER MARL : ZONE III)			100% 22	45	23	25						

Remarks + Microwave Determination
++ Sulphate in accordance with BRE 250

Laboratory Results – Summary

exploration associates

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A42 Castle Donington North
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Figure 2.271

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	ϕ°
279	0.30	D	Soft to firm brown fissured silty sandy CLAY with occasional gravel. (GLACIAL TILL)						15						
	0.50 0.95	U	Very stiff red brown fissured silty CLAY with many siltstone fragments (KEUPER MARL : ZONE II/III)			100% 10	27	17	13	2.02	UM 105	50 100 150	400 438 521	230 or (120	- 21)
	1.00 1.50	B	Very stiff red brown fissured silty CLAY with many siltstone fragments (KEUPER MARL : ZONE II/III)						22						
	2.00 2.45	U	Firm to stiff red brown fissured silty CLAY with many siltstone fragments (KEUPER MARL : ZONE II/III)			87% 14	32	18	26	2.08	UM 105	50 100 200	150 168 182	85	-

Remarks

Laboratory Results – Summary

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Figure 2.272

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
280	0.30	D	Firm to stiff red brown fissured silty CLAY with occasional gravel and rootlets. (GLACIAL TILL)						14						
	0.50	U	Very stiff red brown		++	100%						50	577		
	0.95		fissured silty CLAY	8.0	0.04	14	32	18	11	2.22	UM	100	670	330	-
			with occasional gravel and rootlets. (GLACIAL TILL)		g/ltr						105	150	731	(160^{dr}	26)
	1.00	B	Stiff and very stiff												
	1.50		red brown mottled grey green fissured silty CLAY with mudstone/siltstone fragments. (KEUPER MARL:ZONE III)						24						
	2.00	U	Very stiff red brown			100%						50	299		
	2.45		mottled grey green fissured silty CLAY with mudstone/siltstone fragments. (KEUPER MARL:ZONE III)			Non Plastic -	22	-	13	2.12	UM 105	100 200	402 602	220 (58^{dr}	- 30)
B281	1.00	D	Very stiff red brown												
	1.45		silty CLAY with some mudstone/siltstone fragments. (KUEPER MARL:ZONE III)						13						
	2.00	U	Very stiff red brown		++	100%			14	2.16		50	296		
	2.45		silty CLAY with some mudstone/siltstone fragments. (KEUPER MARL:ZONE III)	8.1	0.04 g/ltr	13	30	17	14 14	2.14 2.14	UT 38	150 300	474 476	210	-

Remarks ++ Sulphate test in accordance with BRE250

Laboratory Results – Summary

exploration associates

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Figure 2.273

EX2

Samples				Chemical		Classification					Strength					
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B281	2.50 2.95	D	Very stiff red brown silty CLAY with some mudstone/siltstone fragments. (KEUPER MARL:ZONE III)			100% 14	33	19	13						
B282	0.50	D	Firm red brown friable very silty CLAY with some mudstone fragments. (KEUPER MARL:ZONE III)						9						
	1.00 1.50	B	Firm red brown friable very silty CLAY with some mudstone fragments. (KEUPER MARL:ZONE III)	8.0	++ 0.02 g/ltr				16						
	1.50 1.95	U	Very stiff red brown silty CLAY tending to very weak mudstone (KEUPER MARL : ZONE III)			100% 17	39	22	18 18 17	2.08 2.06 2.08	UT 38	50 150 300	296 384 566	210 (82	– or 20)
	2.00 2.70	B	Stiff and very stiff red brown occasionally green grey fissured silty CLAY with many mudstone fragments. (KEUPER MARL : ZONE II/III)			88% 15	32	17	19						
	3.00 3.30	D	Stiff and very stiff red brown occasionally green grey fissured silty CLAY with many mudstone fragments. (KEUPER MARL : ZONE II/III)						9						
B283	0.60	D	Red brown very weak MUDSTONE with zones of silty clay. (KEUPER MARL:ZONE III)						13						

Remarks ++ Sulphate test in accordance with BRE250

Laboratory Results – Summary

exploration associates

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Figure 2.274

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B283	1.00 1.50	B	Red brown very weak MUDSTONE with zones of silty clay. (KEUPER MARL:ZONE III)						19						
	1.50 1.95	U	Stiff red brown silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)						21 20 20	2.01 2.02 2.00	UT 38	100 200 400	230 325 303	140	-
	2.00 2.70	B	Very stiff red brown silty CLAY with zones of mudstone. (KEUPER MARL : ZONE III)	8.2	++ 0.04 g/ltr	100% 16	38	22	25						
	3.00 3.20	D	Very stiff red brown silty CLAY with zones of mudstone (KEUPER MARL : ZONE III)						11						
B284	1.40	D	Firm and stiff red brown and grey green silty CLAY with mudstone fragments. (KEUPER MARL:ZONE III)						14						
	2.00 2.50	B	Stiff red brown mottled green grey fissured silty CLAY with many mudstone fragments. (KEUPER MARL : ZONE II/III)	8.1	++ 0.04 g/ltr				19						
	3.00 3.45	U	Very stiff red brown mottled green grey fissured silty CLAY with many mudstone fragments. (KEUPER MARL : ZONE II/III)			100% 13	31	18	15	2.22	UM 105	100 200 400	534 701 991	370 (120 or	- 25)

Remarks ++ Sulphate test in accordance with BRE250

Laboratory Results – Summary

exploration associates

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Figure 2.275

EX2

Samples				Chemical		Classification					Strength					
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B285	1.00	D	Firm to stiff red brown fissured silty CLAY with some mudstone fragments. (KEUPER MARL : ZONE III/IV)						14						
	2.00 2.50	B	Stiff to very stiff red brown fissured silty CLAY with some mudstone fragments. (KEUPER MARL : ZONE III/IV)						19						
	3.00 3.45	U	Red brown very weak MUDSTONE/SILTSTONE (KEUPER MARL:ZONE III)			100% 10	29	19	13 13 13	2.06 2.16 2.12	UT 38	100 200 400	528 813 1034	400 (110 or	- 27)
	3.50	D	Red brown very weak MUDSTONE/SILTSTONE (KEUPER MARL:ZONE III)			100% 15	35	20	14						
B286	1.00	D	Firm red brown mottled green grey very silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)						23						
	2.00 2.45	D	Stiff red brown mottled green grey very silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)						23						
	3.00 3.45	U	Very stiff red brown mottled green grey very silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)						12	2.18	UM 105	100 200 400	381 499 746	290 (85 or	- 22)
	4.00	D	Red brown mottled grey green very weak SILTSTONE with some silty clay. (KEUPER MARL:ZONE III)			100% 13	30	17	13						

Remarks

Laboratory Results – Summary

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Figure 2.276

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B287	1.10	D	Firm red brown occasionally mottled grey green fissured silty CLAY with occasional mudstone fragments. (KEUPER MARL : ZONE III/IV)						16						
	2.00 2.45	D	Firm red brown occasionally mottled grey green fissured silty CLAY with occasional mudstone fragments. (KEUPER MARL : ZONE III/IV)						17						
	3.00 3.40	U	Very stiff red brown very silty CLAY with some siltstone fragments. (KEUPER MARL : ZONE III/IV)			100% 13	33	20	14	2.39		Untestable			
	3.40 4.00	B	Red brown very weak SILTSTONE with some silty clay. (KEUPER MARL:ZONE III)	8.1	++ 0.01 g/ltr				22						
B288	0.50 0.95	U	Very stiff red brown mottled grey green fissured silty CLAY with many mudstone fragments. (KEUPER MARL : ZONE III)			87% 26	49	23	20 17 18	1.98 1.94 1.98	UT 38	50 100 200	503 512 582	270	-
	1.00 1.50	B	Red brown and green grey fissured silty CLAY with some siltstone fragments. (KEUPER MARL : ZONE III)	7.9	++ 0.04 g/ltr				23 23 23 23	 2.00 2.03 Δ 1.99	 REM UT 38	 50 100 200	 220 242 251	 120	 -

Remarks Δ Remoulded to Proctor effort
++ Sulphate test in accordance with BRE250

Laboratory Results – Summary

exploration associates

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Figure 2.277

EX2

Samples				Chemical		Classification					Strength					
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
B288	2.00 2.45	U	Red brown very weak MUDSTONE/SILTSTONE with some silty clay (KEUPER MARL:ZONE III)			100% 12	31	19	15 14 13	2.19 2.22 2.20	UT 38	100 200 400	579 696 957	370 (150 dr	- 23)
	2.50	D	Very stiff red brown fissured silty CLAY with many siltstone fragments. (KEUPER MARL : ZONE III)						9						
B289	0.50 0.95	U	Very stiff red brown fissured silty to very silty CLAY with many siltstone fragments. (KEUPER MARL : ZONE III)			100% 20	40	20	13	1.69	UM 105	50 100 200	404 500 699	280 (100 dr	- 29)
	1.00 1.50	B	Stiff red brown fissured silty to very silty CLAY with many siltstone fragments. (KEUPER MARL : ZONE III)	8.0	++ 0.07 g/ltr				23 20 20 20	1.98 1.99 1.98	REM UT 38	50 100 200	87 93 105	45	-
	2.95	D	Very stiff red brown fissured silty CLAY with many mudstone/ siltstone framgents. (KEUPER MARL : ZONE II/III)												
	3.50 4.00	B	Very stiff red brown mottled grey green silty to very silty CLAY with siltstone fragments. (KEUPER MARL : ZONE III)			100% 19	39	20	23						

Remarks

Laboratory Results – Summary

exploration associates

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Figure 2.278

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
290	0.30	D	Firm red brown mottled grey green fissured silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)						18						
	0.50	U	Very stiff red brown			100%			19	2.08		50	418		
	0.95		mottled grey green fissured silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)			17	38	21	18	2.10	UT	100	507	250	-
									18	2.11	38	200	612	(120^{dr}	23)
	1.00	B	Stiff red brown		++										
	1.50		mottled grey green fissured silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)	8.1	0.05 g/ltr				23						
	2.00	U	Very stiff red brown			100%			15	2.18		50	525		
	2.45		mottled grey green fissured silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)			11	29	18	15	2.18	UT	100	457	270	-
									16	2.15	38	200	659		
	3.00	D	Red brown mottled grey green very weak and weak SILTSTONE with some silty clay. (KEUPER MARL:ZONE III)						11						
291	0.30	D	Firm red brown fissured silty CLAY with occasional mudstone fragments. (KEUPER MARL:ZONE IVa)						10						
	0.50	U	Firm red brown			100%									
	0.95		fissured silty CLAY with occasional mudstone fragments. (KEUPER MARL:ZONE IVa)			31	59	28							

Remarks ++ Sulphate test in accordance with BRE250

Laboratory Results – Summary

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Main Site Investigation : Contract 2

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Figure 2.279

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
291	1.00 1.50	D	Firm red brown fissured silty CLAY with occasional mudstone fragments. (KEUPER MARL:ZONE IVa)						19						
	2.00 2.45	U	Firm to stiff red brown fissured silty CLAY with occasional mudstone fragments. (KEUPER MARL:ZONE IVa)			76% 16	37	21	21	2.01	UM 105	50 100 200	162 183 215	90 (67	- 8)
	2.50 2.95	D	Firm grey green fissured silty CLAY with many siltstone fragments. (KEUPER MARL : ZONE III)						22						
	3.50 3.95	U	Very stiff red brown fissured silty CLAY with occasional siltstone fragments. (KEUPER MARL: ZONE III)			100% 10	29	19	12 12 13	2.25 2.23 2.23	UT 38	50 100 200	644 577 728	320	-

Remarks

Laboratory Results – Summary

exploration associates

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Figure 2.280

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	ϕ°
438	0.45	B	Brown medium SAND and sub-rounded fine to coarse GRAVEL. (GLACIAL SAND and GRAVEL)						11						
	0.80	B	Stiff red brown occasionally green grey silty slightly sandy CLAY with some gravel and sand. (GLACIAL TILL)	7.2	++ 0.07 g/ltr	74% 23	39	16	16 19# 17+						
	1.80	B	Soft to firm red brown very silty CLAY with some gravel and occasional cobbles. (GLACIAL TILL)						28						
	2.40	B	Firm to stiff red brown and green grey very silty CLAY with siltstone fragments. (KEUPER MARL:ZONE IV)			100% 19	39	20	27 26+						
	3.00	B	Firm to stiff red brown and green grey very silty CLAY with siltstone fragments (KEUPER MARL:ZONE IV)			100% 16	38	22	21 17 17 18	 2.08 2.06 2.04	 REM UT 38	 50 100 150	 361 362 370	 180	 -
439	0.60	B	Stiff to very stiff fissured red brown silty sandy CLAY with occasional gravel. (GLACIAL TILL)	7.6	++ 0.07 g/ltr				12 11#						
	1.20	B	Firm to stiff red brown silty sandy CLAY with some gravel (GLACIAL TILL)			100% 18	34	16	18 19+						

Remarks # M/C without gravel
+ Microwave Determination
▽ BS Test 16 remoulded to 5% Air Voids
++ Sulphate in accordance with BRE 250

Laboratory Results – Summary

exploration associates

Project
Department of Transport
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Main Site Investigation : Contract 2

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Figure 2.281

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
439	1.80 2.20	D	Firm to stiff red brown silty sandy CLAY with some gravel. (GLACIAL TILL)						17						
	2.30	B	Stiff and firm red brown occasionally green grey silty CLAY with occasional siltstone fragments. (KEUPER MARL:ZONE IV)						28						
	3.00	B	Stiff and firm red brown occasionally green grey silty CLAY with occasional siltstone fragments. (KEUPER MARL:ZONE IV)			78% 17	36	19	22 24+						
440	0.50	B	Stiff to very stiff red brown fissured silty slightly sandy CLAY with occasional gravel (GLACIAL TILL)			100% 18	33	15	12# 12 19+						
	1.30	B	Stiff to very stiff red brown occasionally green grey fissured silty CLAY. (KEUPER MARL:ZONE IV)						23						
	2.50	B	Stiff to very stiff red brown occasionally green grey fissured silty CLAY (KEUPER MARL:ZONE IV)			100% 17	32	15	11 13+						
	3.00	B	Stiff to very stiff red brown occasionally green grey fissured silty CLAY tending to very weak siltstone. (KEUPER MARL:ZONE III/IV)						15						

Remarks # M/C without gravel.
+ Microwave Determination

Laboratory Results – Summary

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Figure 2.282

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
441	0.60 0.70	B	Stiff fissured red brown and green grey silty CLAY with occasional siltstone fragments. (KEUPER MARL:ZONE IV)	7.8	++ 0.07 g/ltr	89% 24	45	21	19 17# 18+						
	1.20	B	Red brown and green grey very weak SILTSTONE with some silty clay. (KEUPER MARL:ZONE III)			86% 20	40	20	14						
	2.20	B	Red brown and green grey very weak to weak SILTSTONE (KEUPER MARL : ZONE I/II)						15 14+						
	3.20	B	Red brown and green grey very weak to weak SILTSTONE (KEUPER MARL : ZONE I/II)			100% 10	28	18	13						
442	0.60	B	Stiff to very stiff brown and grey fissured silty CLAY with some gravel. (GLACIAL TILL)	7.7	++ 0.06 g/ltr				25						
	1.70 1.80	B	Stiff to very stiff grey and brown fissured silty sandy CLAY with gravel and occasional cobbles. (GLACIAL TILL)			100% 21	39	18	15 19# 15+						
	3.00	B	Red brown very weak MUDSTONE/SILTSTONE (KEUPER MARL : ZONE II/III)						15						

Remarks # M/C without gravel ++ Sulphate in accordance with BRE 250
+ Microwave Determination

Laboratory Results – Summary

exploration associates

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Figure 2.283

Samples				Chemical		Classification					Strength					
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	σ_1-σ_3 kN/m²	c kN/m²	$\phi°$
443	0.60	B	Very stiff and stiff fissured red brown silty sandy CLAY with some gravel. (GLACIAL TILL)			100% / 26	49	23	18 15+						
	1.80	B	Red brown occasionally green grey very weak SILTSTONE and MUDSTONE (KEUPER MARL:ZONE III)						15						
	2.80	B	Red brown occasional green grey very weak SILTSTONE and MUDSTONE (KEUPER MARL:ZONE III)			79% / 12	34	22	19 18+						
444	0.45	B	Stiff red brown fissured silty CLAY with rootlets. (GLACIAL TILL)						20						
	1.00	B	Firm grey brown mottled red brown silty slightly sandy CLAY with some decayed rootlets and pockets of sand. (GLACIAL TILL)						19						
	1.50	B	Soft to firm and firm red brown silty sandy CLAY with some gravel. (GLACIAL TILL)												
	2.10	B	Firm to stiff and firm red brown and green grey silty CLAY with many siltstone fragments. (KEUPER MARL:ZONE IV)						21						
	2.50	W	Groundwater	8.0	0.13 g/ltr										

Remarks + Microwave Determination

Laboratory Results – Summary

exploration associates

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Department of Transport
East Midlands Regional Office
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Figure 2.284

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
445	0.60	B	Stiff fissured red brown silty sandy CLAY (GLACIAL TILL)						16						
	1.20	B	Stiff and firm to stiff fissured red brown occasionally green grey silty CLAY with rare siltstone fragments. (KEUPER MARL:ZONE IV)			89% / 19	36	17	20						
446	0.45	B	Stiff fissured red brown silty CLAY (GLACIAL TILL)			100% / 26	52	26	24						
	1.20	B	Firm grey and brown fissured silty CLAY (GLACIAL TILL)						31						
	2.00	B	Brown slightly clayey SAND and GRAVEL. (FLUVIO-GLACIAL SAND and GRAVEL)						18						
	2.80	B	Firm to stiff red brown fissured silty CLAY with many siltstone fragments. (KEUPER MARL:ZONE IV)						20						
447	0.60	B	Stiff red brown friable silty sandy CLAY with gravel and pockets of sand. (GLACIAL TILL)			100% / 15	29	14	10						
	1.30	B	Stiff red brown fissured silty CLAY with many siltstone fragments. (KEUPER MARL:ZONE IV)			100% / 16	32	16	15						

Remarks

Laboratory Results – Summary

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Figure 2.285

Samples				Chemical		Classification					Strength					
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
447	2.30	B	Red brown and green grey very weak SILTSTONE with much silty clay. (KEUPER MARL:ZONE III)						22 21#						
448	0.70	D	Stiff red brown fissured silty CLAY with occasional gravel. (GLACIAL TILL)						16						
	1.50	B	Firm and stiff green grey and red brown friable silty CLAY with many siltstone fragments. (KEUPER MARL:ZONE IV)						20						
460	0.50	B	Stiff red brown fissured silty CLAY (ALLUVIUM)						15						
	1.10	B	Soft to firm grey brown very silty CLAY (ALLUVIUM)			100% 24	54	30	44						
	1.60	B	Soft and very soft grey and brown silty sandy CLAY with much gravel some cobbles and zones of sand. (ALLUVIUM)			78% 12	28	16	10						
	2.20	B	Red brown silty SAND and GRAVEL with some cobbles. (ALLUVIUM)												
461	0.70	B	Soft to very soft brown very silty CLAY (ALLUVIUM)						50						

Remarks # M/C without gravel

Laboratory Results – Summary

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Figure 2.286

EX2

Samples				Chemical		Classification					Strength					
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
461	1.40	D	Soft to firm red brown silty CLAY with some organic traces. (ALLUVIUM)	Organic 4.1%		100% 40	61	21	28						
	1.90	W	Groundwater	7.6	0.64 g/ltr										
	2.00	B	Firm red brown occasionally green grey silty CLAY with some siltstone fragments. (KEUPER MARL:ZONE IV)			100% 15	35	20	29						
	2.50	B	Firm friable red brown occasionally green grey silty CLAY with rare siltstone fragments (KEUPER MARL:ZONE IV)						21						
462	0.60	B	Stiff red brown fissured silty CLAY (ALLUVIUM)												
	1.00	B	Soft to firm grey mottled brown silty CLAY (ALLUVIUM)			100% 35	63	28	39						
	1.75	B	Firm to stiff red brown and green grey fissured silty CLAY with many siltstone fragments. (KEUPER MARL:ZONE IV)			100% 25	49	24	26						
	2.00	B	Green grey weak SILTSTONE with some silty clay. (KEUPER MARL : ZONE II/III)						25						

Remarks

Laboratory Results – Summary

exploration associates

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Figure 2.287

EX2

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
438	1.90		Firm red brown silty sandy CLAY with some gravel and cobbles. (GLACIAL TILL)								Cv			38	
														39	
														30	
											Cp			50	
														60	
														45	
439	1.40		Firm and stiff fissured red brown silty sandy CLAY with some gravel. (GLACIAL TILL)								Cv			38	
														36	
														30	
											Cp			100	
														120	
														110	
	2.40		Firm and stiff red brown occasionally green grey silty CLAY (KEUPER MARL:ZONE IV)								Cv			40	
														50	
														56	
											Cp			120	
														130	
														130	
444	0.70		Soft to firm grey brown mottled red brown silty sandy CLAY (GLACIAL TILL)								Cv			100	
														106	
	1.00		Soft to firm grey brown mottled red brown silty sandy CLAY (GLACIAL TILL)								Cv			46	
														46	
														44	
											Cp			50	
														30	
														30	
	1.50		Soft to firm red brown silty sandy CLAY with some gravel. (GLACIAL TILL)								Cv			36	
														34	
														40	
											Cp			50	
														40	
														40	

Remarks

Cv - Hand Vane Shear Strength (kN/m²)
Cp - Hand Penetrometer Shear Strength (kN/m²)

Laboratory Results – Summary

exploration associates

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Figure 2.288

Samples				Chemical		Classification					Strength				
Hole	Depth	Type	Description	pH	SO_3	I_p	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
445	1.00		Stiff and firm fissured red brown occasionally green grey silty CLAY (KEUPER MARL:ZONE IV)								Cv			78	
														72	
														90	
											Cp			90	
														100	
446	1.20		Firm fissured grey brown and red brown silty CLAY (GLACIAL TILL)								Cv			40	
														52	
														50	
														48	
											Cp			60	
														70	
														80	
	2.00		Brown slightly clayey SAND with some gravel. (FLUVIO-GLACIAL SAND AND GRAVEL)								Cv			62	
														70	
447	1.30		Stiff and firm fissured silty CLAY. (KEUPER MARL:ZONE IV)								Cp			150	
														155	
448	0.70		Stiff fisssured red brown silty sandy CLAY with some gravel. (GLACIAL TILL)								Cv			90	
														96	
														94	
											Cp			150	
														160	
460	0.70		Stiff and firm grey brown very silty CLAY (ALLUVIUM)								Cv			72	
														70	
														76	
											Cp			100	
														100	

Remarks

Cv - Hand Vane Shear Strength (kN/m²)
Cp - Hand Penetrometer Shear Strength (kN/m²)

Laboratory Results – Summary

exploration associates

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Figure 2.289

EX2

Samples				Chemical		Classification					Strength					
Hole	Depth	Type	Description	pH	SO_3	I_P	w_L	w_P	w %	γ_b Mg/m³	Test	σ_3 kN/m²	$\sigma_1-\sigma_3$ kN/m²	c kN/m²	$\phi°$
460	1.30		Soft and very soft grey and light brown silty sandy CLAY with some gravel. (ALLUVIUM)								Cv			24	
														28	
														30	
											Cp			35	
														30	
														30	
	1.70		Soft and very soft grey and light brown silty sandy CLAY with some gravel (ALLUVIUM)								Cv			0	
														80	
461	0.50		Firm becoming soft grey brown very silty CLAY. (ALLUVIUM)								Cv			34	
														43	
											Cp			50	
														40	
	0.60		Firm becoming soft grey brown very silty CLAY. (ALLUVIUM)								Cv			30	
														24	
	0.70		Firm becoming soft grey brown very silty CLAY (ALLUVIUM)								Cv			14	
														17	
														17	
	1.40		Soft to firm fissured red brown silty CLAY. (ALLUVIUM)								Cv			60	
														80	
														70	
														63	
462	0.70		Stiff fissured red brown silty CLAY (ALLUVIUM)								Cv			85	
														92	
											Cp			100	
														110	
														100	
	1.10		Firm and soft grey mottled brown silty CLAY. (ALLUVIUM)								Cv			60	
														64	
											Cp			70	
														80	
														80	

Remarks

Cv - Hand Vane Shear Strength (kN/m²)
Cp - Hand Penetrometer Shear Strength (kN/m²)

Laboratory Results – Summary

exploration associates

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Figure 2.290

EX2

Samples				Class		Stress Ranges	Mv	Cv	K	e
Hole	Depth	Type	Description	w %	γ_b Mg/m^3	KN/m^2	m^2/MN	m^2/yr	m/s×10^{-9}	
B219	3.50 3.95	U	Stiff red brown and green and grey friable slightly sandy silty CLAY. (KEUPER MARL:ZONE IVa)	21	2.09	0 - 50 50 - 200 200 - 50 50 - 100 100 - 200 200 - 400 400 - 800	0.36 0.19 0.02 *- 0.03 0.07 0.06	- 25.08 - - 29.31 15.47 19.38	- 34.44 - - 8.63 10.62 11.67	0.505 0.475 0.479 0.479 0.474 0.452 0.418
B221	8.00 8.45	U	Stiff red brown very silty CLAY with mudstone fragments. (KEUPER MARL : ZONE II/III)	22	2.05	0 - 100 100 - 200 200 - 400 400 - 800 800 - 200	0.31 0.13 0.08 0.06 0.01	- 18.75 15.84 34.17 -	- 23.91 12.43 20.11 -	0.532 0.512 0.486 0.449 0.459
B222	8.00 8.45	U	Stiff red brown fissured silty CLAY with occasional mudstone fragments. (KEUPER MARL : ZONE III)	23	2.10	0 - 161 161 - 322 322 - 161 161 - 322 322 - 644	0.26 0.10 0.01 0.02 0.07	- 36.20 - 35.65 28.73	- 35.51 -- 6.99 19.73	0.495 0.471 0.474 0.469 0.437
B224	5.00 5.45	U	Firm red brown mottled green grey very silty CLAY with occasional mudstone/siltstone fragments. (KEUPER MARL : ZONE IV)	23	2.08	0 - 100 100 - 200 200 - 400 400 - 800 800 - 200	0.33 0.12 0.09 0.06 0.01	- 25.66 29.62 53.55	- 30.21 26.15 31.52	0.512 0.495 0.467 0.429 0.440
228	3.50 3.95	U	Firm red brown sandy silty CLAY with some mudstone fragments. (KEUPER MARL : ZONE III)	28	1.99	0 - 54 54 - 107 107 - 214 214 - 428 428 - 856 856 - 107	0.83 0.28 0.19 0.12 0.07 0.02	- 9.52 16.92 21.98 20.77	- 26.15 31.53 25.87 14.26	0.620 0.596 0.564 0.524 0.477 0.495
230	1.50 1.95	U	Firm red brown very silty CLAY with pockets of silt. (KEUPER MARL : ZONE III/IV)	25	1.97	0 - 27 27 - 54 54 - 107 107 - 214 214 - 428	0.85 0.42 0.28 0.19 0.11	- 5.21 5.49 4.90 16.15	- 21.47 15.08 9.13 17.42	0.644 0.625 0.601 0.568 0.530

Remarks *No change.

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Figure 2.291

EX 8

Samples				Class		Stress Ranges	Mv	Cv	K	e
Hole	Depth	Type	Description	w %	γ_b Mg/m³	KN/m²	m²/MN	m²/yr	m/s x10⁻⁹	
230	3.00 3.45	U	Stiff red brown fissured very silty CLAY with siltstone fragments. (KEUPER MARL : ZONE III/IV)	16	2.20	0 - 54	0.41	-	-	0.365
						54 - 214	0.21	42.78	50.36	0.339
						214 - 54	0.03	-	-	0.346
						54 - 107	0.04	34.31	13.46	0.344
						107 - 214	0.04	34.10	13.38	0.338
						214 - 428	0.05	19.88	9.75	0.324
231	1.50 1.95	U	Firm red brown and green grey very silty CLAY with some siltstone fragments. (KEUPER MARL : ZONE III)	27	1.98	0 - 27	0.72	-	-	0.660
						27 - 107	0.16	1.77	2.78	0.638
						107 - 27	0.09	-	-	0.650
						27 - 54	0.07	5.31	3.65	0.647
						54 - 107	0.12	3.95	4.65	0.637
						107 - 214	0.19	2.16	4.03	0.603
						214 - 428	0.13	2.06	2.63	0.559
233	0.50 0.95	U	Stiff red brown silty CLAY. (KEUPER MARL : ZONE IV)	16	2.15	0 - 25	0.11	-	-	0.425
						25 - 50	0.14	20.26	27.83	0.420
						50 - 100	0.12	17.48	20.58	0.412
						100 - 200	0.09	15.14	13.37	0.400
						200 - 400	0.06	31.36	18.46	0.382
234	2.00 2.45	U	Stiff red brown mottled green grey fissured very silty CLAY with some siltstone fragments. (KEUPER MARL : ZONE III)	12	2.26	0 - 50	0.26	-	-	0.305
						50 - 100	0.11	19.82	21.39	0.298
						100 - 200	0.07	9.59	6.59	0.288
						200 - 400	0.04	13.06	5.12	0.277
						400 - 100	0.02			0.284
B243	3.50 4.00	U	Stiff red brown fissured silty CLAY with mudstone fragments. (KEUPER MARL: ZONE III)	13	2.24	0 - 50	0.11	-	-	0.333
						50 - 200	0.06	20.12	11.84	0.321
						200 - 50	0.02	-	-	0.326
						50 - 100	0.02	39.30	7.71	0.324
						100 - 200	0.02	48.36	9.49	0.321
						200 - 400	0.03	19.82	5.83	0.313
						400 - 800	0.02	17.01	3.34	0.302

Remarks

Laboratory – Consolidation

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Figure 2.292

EX 8

Samples				Class		Stress Ranges	Mv	Cv	K	e
Hole	Depth	Type	Description	w %	γ_b Mg/m^3	KN/m^2	m^2/MN	m^2/yr	m/s x10^{-9}	
B244	3.50	U	Very stiff red brown			0 - 50	0.85	-	-	0.422
	3.95		and green grey silty	19	2.12	50 - 200	0.19	8.40	11.54	0.393
			CLAY with some			200 - 50	0.05	-	-	0.404
			siltstone and mudstone			50 - 100	0.05	17.00	8.34	0.400
			fragments.			100 - 200	0.06	19.55	11.51	0.391
			(KEUPER MARL : ZONE			200 - 400	0.07	7.34	5.04	0.373
			III)			400 - 800	0.04	9.69	3.80	0.348
B247	3.50	U	Stiff red brown and			0 - 50	0.31	-	-	0.600
	3.95		grey green very silty	24	2.03	50 - 200	0.13	11.76	15.00	0.569
			CLAY with mudstone			200 - 50	0.06	-	-	0.582
			fragments.			50 - 100	0.08	26.26	20.61	0.576
			(KEUPER MARL : ZONE			100 - 200	0.07	2.34	1.61	0.565
			II/III)			200 - 400	0.13	11.17	14.25	0.524
B248	2.00	U	Firm red brown mottled			0 - 50	0.25	-	-	0.372
	2.45		green grey silty CLAY	13	2.16	50 - 200	0.17	35.08	58.50	0.337
			with some mudstone			200 - 50	0.04	-	-	0.344
			fragments.			50 - 100	0.03	24.65	7.25	0.342
			(KEUPER MARL : ZONE			100 - 200	0.05	34.28	16.81	0.336
			II/III)			200 - 400	0.07	33.66	23.11	0.318
B249	2.00	U	Stiff red brown and			0 - 50	0.27	-	-	0.419
	2.45		grey green very silty	17	2.16	50 - 200	0.09	36.80	32.49	0.400
			CLAY with some mudstone			200 - 50	0.02	-	-	0.405
			fragments.			50 - 100	0.03	45.08	13.26	0.403
			(KEUPER MARL : ZONE			100 - 200	0.03	30.05	8.84	0.399
			II/III)			200 - 400	0.06	35.80	21.07	0.381
						400 - 800	0.03	34.90	10.27	0.364
B251	3.50	U	Very stiff red brown			0 - 50	0.25	-	-	0.554
	3.95		very silty CLAY.	22	2.06	50 - 100	0.13	19.14	24.41	0.544
			(KEUPER MARL : ZONE			100 - 200	0.11	18.80	20.29	0.527
			III)			200 - 400	0.08	24.90	19.54	0.502
						400 - 800	0.05	10.67	5.23	0.471
						800 - 200	0.02	-	-	0.485

Remarks

Laboratory — Consolidation

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Figure 2.293

EX 8

Samples				Class		Stress Ranges	Mv	Cv	K	e
Hole	Depth	Type	Description	w %	γ_b Mg/m^3	KN/m^2	m^2/MN	m^2/yr	m/s×10^{-9}	
B253	4.00 4.45	U	Stiff red brown mottled grey green fissured silty CLAY with mudstone/siltstone fragments. (KEUPER MARL : ZONE III)	20	2.08	0 - 50 50 - 200 200 - 50 50 - 100 100 - 200 200 - 400 400 - 800	0.60 0.10 0.05 0.05 0.06 0.06 0.03	- 15.33 - 32.34 38.80 16.94 10.29	- 15.04 - 15.86 22.84 9.97 3.03	0.524 0.502 0.513 0.509 0.500 0.482 0.462
B255	3.00 3.45	U	Stiff red and brown very silty CLAY tending to very weak mudstone (KEUPER MARL : ZONE III)	16	2.12	0 - 54 54 - 214 214 - 54 54 - 107 107 - 214 214 - 428 428 - 856	0.29 0.12 0.03 0.04 0.04 0.06 0.04	- 30.61 - 36.63 30.08 35.80 17.73	- 36.03 - 14.38 11.80 21.07 6.96	0.428 0.399 0.407 0.404 0.398 0.381 0.357
B260	3.00 3.45	U	Stiff red brown mottled grey green silty to very silty CLAY with some siltstone fragments. (KEUPER MARL : ZONE III)	13	2.20	0 - 50 50 - 200 200 - 50 50 - 100 100 - 200 200 - 400 400 - 800	0.24 0.09 0.03 0.03 0.04 0.05 0.03	- 38.16 - 59.18 19.23 25.80 21.47	- 3.43 - 17.42 7.55 12.65 6.32	0.351 0.333 0.338 0.336 0.331 0.317 0.300
B262	4.00 4.45	U	Very stiff red brown mottled grey green very silty CLAY with some mudstone/siltstone fragments. (KEUPER MARL : ZONE III)	21	2.03	0 - 100 100 - 200 200 - 400 400 - 800 800 - 300 300 - 100	0.22 0.13 0.08 0.05 0.02 0.06	- 15.34 16.95 14.39 - -	- 19.56 13.30 7.06 - -	0.542 0.522 0.498 0.470 0.485 0.501
B263	3.50 4.00	U	Very stiff red brown and grey green silty CLAY with many mudstone/siltstone fragments. (KEUPER MARL : ZONE II/III)	14	2.14	0 - 100 100 - 200 200 - 400 400 - 800 800 - 200 200 - 100	0.24 0.11 0.07 0.02 0.02 0.05	- 12.28 17.65 11.72 - -	- 13.25 12.12 2.30 - -	0.384 0.369 0.349 0.340 0.352 0.360

Remarks

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Figure 2.294

EX 3

Samples				Class		Stress Ranges	Mv	Cv	K	e
Hole	Depth	Type	Description	w %	γ_b Mg/m³	KN/m²	m²/MN	m²/yr	m/s×10⁻⁹	
B264	3.50 3.95	U	Very stiff red brown and grey green very silty CLAY with mudstone fragments. (KEUPER MARL : ZONE III)	23	2.01	0 - 50	0.72	-	-	0.560
						50 - 200	0.19	9.05	16.87	0.515
						200 - 50	0.05	-	-	0.527
						50 - 100	0.05	43.96	21.56	0.523
						100 - 200	0.07	17.99	12.35	0.513
						200 - 400	0.10	15.27	14.98	0.484
B265	3.50 3.95	U	Stiff to very stiff red brown mottled grey green fissured very silty CLAY. (KEUPER MARL : ZONE II/III)	18	2.16	0 - 50	0.37	-	-	0.422
						50 - 100	0.10	18.93	18.57	0.415
						100 - 200	0.08	16.28	12.78	0.404
						200 - 400	0.06	12.44	7.32	0.388
						400 - 800	0.04	13.68	5.37	0.367
						800 - 400	0.01	-	-	0.373
						400 - 100	0.04	-	-	0.389
B268	3.00 3.45	U	Stiff red brown fissured silty CLAY with many mudstone/ siltstone fragments. (KEUPER MARL : ZONE III)	14	2.11	0 - 54	0.08	-	-	0.419
						54 - 214	0.08	20.02	15.71	0.401
						214 - 54	0.02	-	-	0.406
						54 - 107	0.03	32.20	9.48	0.404
						107 - 214	0.03	22.94	6.75	0.399
						214 - 428	0.05	19.51	9.57	0.384
B269	3.00 3.45	U	Stiff to very stiff red brown very silty CLAY. (KEUPER MARL : ZONE III)	9.5	2.20	0 - 50	0.16	-	-	0.310
						50 - 100	0.05	20 06	9.84	0.307
						100 - 200	0.05	19.91	9.77	0.301
						200 - 400	0.04	22.80	8.95	0.290
						400 - 800	0.03	14.77	4.35	0.277
						800 - 400	0.008	-	-	0.281
						400 - 100	0.03	-	-	0.292
B272	3.00 3.45	U	Red brown very weak micaceous MUDSTONE (KEUPER MARL : ZONE III)	20	2.08	0 - 50	0.28	-	-	0.511
						50 - 200	0.06	19.72	11.61	0.498
						200 - 50	0.04	-	-	0.507
						50 - 100	0.04	38.69	15.18	0.504
						100 - 200	0.05	26.68	13.09	0.496
						200 - 400	0.07	31.15	21.39	0.475

Remarks

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Figure 2.295

EX 8

Samples				Class		Stress Ranges	Mv	Cv	K	e
Hole	Depth	Type	Description	w %	γ_b Mg/m³	KN/m²	m²/MN	m²/yr	m/s×10⁻⁹	
B273	3.50 3.95	U	Very stiff red brown silty CLAY with mud-stone fragments (KEUPER MARL : ZONE II)	15	2.19	0 - 54	0.31	-	-	0.397
						54 - 214	0.12	25.17	29.63	0.370
						214 - 54	0.03	-	-	0.377
						54 - 107	0.04	44.23	17.36	0.375
						107 - 214	0.04	35.59	13.97	0.368
						214 - 428	0.05	17.88	8.77	0.353
						428 - 856	0.03	17.42	5.13	0.333
B274	2.00 2.45	U	Very stiff red brown fissured silty CLAY with mudstone fragments (KEUPER MARL : ZONE II/III)	11	2.12	0 - 50	0.27	-		0.270
						50 - 100	0.13	26.90	34.30	0.261
						100 - 200	0.10	26.45	25.95	0.248
						200 - 400	0.06	25.87	15.23	0.234
						400 - 800	0.04	29.98	11.76	0.216
						800 - 200	0.01	18.39	1.80	0.225
279	0.50 0.95	U	Firm red brown very sil silty CLAY with silt-stone fragments. (KEUPER MARL : ZONE II/III)			0 - 25	0.37	-	-	0.545
						25 - 50	0.18	26.57	46.92	0.538
						50 - 100	0.16	13.07	20.51	0.525
						100 - 200	0.09	14.50	12.80	0.511
						200 - 400	0.06	18.53	5.02	0.492
280	2.00 2.45	U	Stiff red brown mottled grey green fissured silty CLAY with some mudstone and siltstone fragments. (KEUPER MARL: ZONE III)	23	2.02	0 - 54	0.72	-	-	0.550
						54 - 107	0.20	4.03	7.91	0.533
						107 - 214	0.15	6.12	9.01	0.509
						214 - 248	0.09	9.42	8.32	0.479
						428 - 214	0.005	-	-	0.480
						214 - 107	0.12	-	-	0.500
B284	3.00 3.45	U	Stiff red brown mottled green grey silty CLAY with many siltstone fragments. (KEUPER MARL : ZONE II/III)	12	2.10	0 - 50	0.27	-	-	0.398
						50 - 200	0.18	37.17	65.63	0.361
						200 - 50	0.03	-	-	0.368
						50 - 100	0.04	16.20	6.36	0.365
						100 - 200	0.04	18.48	7.25	0.359
						200 - 400	0.08	12.28	9.63	0.337
						400 - 800	0.05	13.36	6.55	0.310

Remarks

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Figure 2.296

EX 8

Samples				Class		Stress Ranges	Mv	Cv	K	e
Hole	Depth	Type	Description	w %	γ_b Mg/m^3	KN/m^2	m^2/MN	m^2/yr	m/s x10^{-9}	
B287	3.00 3.40	U	Stiff red brown occasional green grey fissured silty CLAY (KEUPER MARL : ZONE III/IV)	12	2.21	0 - 54	0.29	-	-	0.320
						54 - 107	0.13	26.78	34.15	0.311
						107 - 214	0.09	22.44	19.81	0.298
						214 - 428	0.06	14.49	8.53	0.282
						428 - 856	0.03	18.43	5.42	0.264
B288	2.00 2.45	U	Red brown very weak MUDSTONE with residual silty clay (KEUPER MARL : ZONE III)	15	2.19	0 - 50	0.28	-	-	0.367
						50 - 200	0.08	18.96	14.88	0.350
						200 - 50	0.04	---	-	0.358
						50 - 100	0.03	18.91	5.56	0.356
						100 - 200	0.04	18.80	7.38	0.350
						200 - 400	0.05	14.19	6.96	0.337
290	2.00 2.45	U	Firm red brown mottled grey green fissured silty CLAY with many mudstone/siltstone fragments. (KEUPER MARL : ZONE II/III)	14	2.19	0 - 50	0.19	-	-	0.368
						50 - 100	0.07	17.42	11.96	0.363
						100 - 200	0.05	26.97	13.22	0.356
						200 - 400	0.04	26.62	10.44	0.345
						400 - 100	0.02	-	-	0.354
291	3.50 3.95	U	Stiff red brown fissured silty CLAY (KEUPER MARL : ZONE III/IV)	13	2.23	0 - 50	0.19	-	-	0.338
						50 - 200	0.08	59.33	46.56	0.322
						200 - 50	0.03	-	-	0.328
						50 - 100	0.03	46.66	13.73	0.326
						100 - 200	0.03	-	-	0.321
						200 - 400	0.07	16.54	6.49	0.311
438	3.00	B Rem	Red brown and green grey very silty CLAY with siltstone fragments. (KEUPER MARL : ZONE IV)	24	1.90*	0 - 27	0.61	-	-	0.700
						27 - 54	0.46	4.36	19.67	0.679
						54 - 107	0.35	2.78	9.54	0.647
						107 - 214	0.23	9.10	20.53	0.608
						214 - 428	0.14	4.09	5.62	0.558

Remarks * Remoulded to 5% Air voids

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Figure 2.297

EX 8

Samples				CBR							Compaction				
Hole	Depth	Type	Description	Top	Base	Top w%	Base w%	Surch. kg.	Nat w%	γ_b Mg/m^3	Type	Opt. w%	γ_d Max.	Mg/m^3 At Nat w.	G_s
226	0.50 1.00	B	Very stiff red brown fissured silty CLAY with many mudstone fragments, rootlets and occasional gravel. (GLACIAL TILL)	SOAK – Sample swelled 0.126mm in 88 hours						1.87	* Before Soak				
				1.5	2.5	28.2	27.6	13.6	17	2.00	After Soak				
234	1.00 3.00	2xB	Stiff red brown and green grey fissured silty to very silty CLAY with some siltstone fragments. (KEUPER MARL:ZONE III)						24	1.94 ⊛	Std	12.0	1.83	1.74	2.69
				26.0	24.0	10.4	12.0	13.6	24	–					
										1.99 ⊛					
				23.0	21.0	12.6	12.7	13.6	24	–					
										2.03 ⊛					
				22.0	18.0	13.5	13.2	13.6	24	–					
	3.50 4.00	B	Very stiff red brown and green grey fissured silty to very silty CLAY with some siltstone fragments. (KEUPER MARL:ZONE III)							1.96	*				
				1.0	1.0	21.1	21.1	13.6	24	–					
235	1.00 1.60	B	Firm to stiff brown silty CLAY with occasional gravel. (GLACIAL TILL)						22		Std	14.0	1.84	1.73	2.61
			Natural								PVT = 93 kN/m^2				
											RVT = 55 kN/m^2				
			Point 1								VT > 120 kN/m^2				
			Point 2								VT > 120 kN/m^2				
			Point 3								VT > 120 kN/m^2				
			Point 4								VT > 120 kN/m^2				
			Point 5								VT > 120 kN/m^2				
			Point 6								PVT = 64 kN/m^2				
											RVT = 33 kN/m^2				
			Point 7								PVT = 41 kN/m^2				
											RVT = 23 kN/m^2				

Remarks VT = Hand Vane Test, PVT = Hand Vane Test Peak, RVT = Hand Vane Test Remoulded
⊛ Remoulded to BS Test 16 2.5kg rammer method. * BS Test 16 remoulded to 5% Air Voids

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Figure 2.298

EX 7

Samples				CBR							Compaction				
Hole	Depth	Type	Description	Top	Base	Top w%	Base w%	Surch. kg.	Nat w%	γ_b Mg/m^3	Type	Opt. w%	γ_d Max.	Mg/m^3 At Nat w.	G_s
235	2.50 3.00	B	Firm brown very silty CLAY with occasional gravel and carbonaceous traces. (GLACIAL TILL)						21						
			Natural						20 21	Before Test After Test	MCV = 7.0 PVT = 27kN/m^2 RVT = 14kN/m^2				
			Point 1						16 15	Before Test After Test	MCV = 6.8 PVT = 45kN/m^2 RVT = 25kN/m^2				
			Point 2						19 17	Before Test After Test	MCV = 3.7 PVT = 25kN/m^2 RVT = 11kN/m^2				
			Point 3						18 17	Before Test After Test	MCV = 4.8 PVT = 27kN/m^2 RVT = 14kN/m^2				
			Point 4						20 20	Before Test After Test	MCV = 3.4 PVT = 16kN/m^2 RVT = 10kN/m^2				
			Point 5						22 18	Before Test After Test	MCV = 0.4 PVT = 12kN/m^2 RVT = 6kN/m^2				
	4.00 4.50	B	Stiff red brown fissured silty CLAY with mudstone fragments (KEUPER MARL : ZONE II/III)	SOAK - sample swelled 0.338mm in 70 hours. 0.40	4.0	27.0	17.8	13.6	24	1.91 1.94	* Before Soak After Soak				

Remarks * BS Test 16 remoulded to 5% Air Voids
PVT - Hand Vane Test Peak, RVT - Hand Vane Test Remoulded

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Figure 2.299

EX 7

Samples				CBR							Compaction				
Hole	Depth	Type	Description	Top	Base	Top w%	Base w%	Surch. kg.	Nat w%	γ_b Mg/m^3	Type	Opt. w%	γ_d Max.	Mg/m^3 At Nat w.	G_s
236	1.00 1.70	B	Firm to stiff red brown mottled green grey fissured silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)	0.5	0.4	29.4	28.5	13.6	24	1.81 -	*				
238	0.50 2.45	2xU 1xD	Firm red brown fissured silty to very silty CLAY with occasional siltstone fragments. (KEUPER MARL : ZONE II/III)	SOAK	- Sample swelled 0.738mm in 66 hours					2.04 2.09	* Before Soak After Soak				
				5.0	2.0	15.9	18.5	13.6	19		Std	14.0	1.80	1.78	2.64
239	0.50 2.45	2xU	Stiff red brown and grey green silty CLAY with occasional gravel. (KEUPER MARL:ZONE III)						13 20						
			Natural						12 12	- Before Test - After Test MCV = 17.0 VT > 120kN/m^2					
			Point 1						22 22	- Before Test - After Test MCV = 2.2 PVT = 19kN/m^2 RVT = 10kN/m^2					
			Point 2						25 26	- Before Test - After Test MCV = 2.6 PVT = 16kN/m^2 RVT = 8kN/m^2					

Remarks * BS test 16 remoulded to 5% Air voids
VT - Hand Vane Test, PVT - Hand Vane Test Peak, RVT - Hand Vane Test Remoulded

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Figure 2.300

EX 7

Samples				CBR							Compaction				
Hole	Depth	Type	Description	Top	Base	Top w%	Base w%	Surch. kg.	Nat w%	γ_b Mg/m³	Type	Opt. w%	γ_d Max.	Mg/m³ At Nat w.	G_s
239	0.50 2.45	2xU	Stiff red brown and grey green silty CLAY with occasional gravel (KEUPER MARL:ZONE III)												
			Point 3						28 – Before Test 26 – After Test		MCV = 1.0 PVT = 9kN/m² RVT = 5kN/m²				
	2.00 3.00	B	Stiff red brown and grey green silty CLAY with occasional gravel (KEUPER MARL:ZONE III)	0.5	0.4	27.5	26.4	13.6		1.84 –	*				
	4.00 5.00	B	Stiff red brown very silty CLAY with mudstone fragments (KEUPER MARL : ZONE II/III)						19		Hvy	12.0	1.95	1.77	
			Natural								PVT = 93 kN/m² RVT = 43 kN/m²				
			Point 1								VT > 120 kN/m²				
			Point 2								VT > 120 kN/m²				
			Point 3								VT > 120 kN/m²				
			Point 4								VT > 120 kN/m²				
			Point 5								PVT = 47 kN/m² RVT = 28 kN/m²				
240	2.95 4.00	B	Firm red brown mottled green grey very silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)								Std	16	1.76	1.70	2.63
			Natural								PVT = 70 kN/m² RVT = 30 kN/m²				
			Point 1								VT > 120 kN/m²				
			Point 2								VT > 120 kN/m²				
			Point 3								VT > 120 kN/m²				
			Point 4								PVT = 96 kN/m² RVT = 22 kN/m²				

Remarks VT = Hand Vane Test, PVT = Hand Vane Test Peak, RVT = Hand Vane Test Remoulded
* BS Test 16 remoulded to 5% air voids

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Figure 2.301

Samples				CBR							Compaction				
Hole	Depth	Type	Description	Top	Base	Top w%	Base w%	Surch. kg.	Nat w%	γ_b Mg/m^3	Type	Opt. w%	γ_d Max.	Mg/m^3 At Nat w.	G_s
240	2.95 4.00	B	Point 5								PVT = 67 kN/m^2 RVT = 22 kN/m^2				
			Point 6								PVT = 48 kN/m^2 RVT = 26 kN/m^2				
			Point 7								PVT = 28 kN/m^2 RVT = 11 kN/m^2				
	5.50 6.00	B	Stiff red brown very silty CLAY with many mudstone fragments. (KEUPER MARL:ZONE III)	SOAK	- Sample swelled 0.06mm in 71 hours					1.97 2.01	* Before Test After Test				
				1.5	1.5	22.4	21.6	13.6	20						
241	1.00 1.60	B	Firm and stiff red brown silty CLAY with some mudstone fragments (KEUPER MARL:ZONE III)	1.5	1.5	20.7	20.5	13.6	18	1.96 -	*				
			Natural		Insufficient Natural material available										
			Point 1						19	- Before Test 19 - After Test	MCV = 7.9 PVT = 69kN/m^2 RVT = 37kN/m^2				
			Point 2						18	- Before Test 19 - After Test	MCV = 9.1 PVT 63kN/m^2 RVT = 37kN/m^2				
			Point 3						23	- Before Test 23 - After Test	MCV = 6.4 PVT = 36kN/m^2 RVT = 21kN/m^2				
			Point 4						25	- Before Test 25 - After Test	MCV = 4.8 PVT = 23kN/m^2 RVT = 14kN/m^2				
			Point 5						23	- Before Test 26 - After Test	MCV = 4.2 PVT = 19kN/m^2 RVT = 10kN/m^2				

Remarks PVT = Hand Vane Test Peak, RVT = Hand Vane Test Remoulded.
* BS test 16 remoulded to 5% air voids

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Figure 2.302

EX 7

Samples				CBR							Compaction				
Hole	Depth	Type	Description	Top	Base	Top w%	Base w%	Surch. kg.	Nat w%	γ_b Mg/m^3	Type	Opt. w%	γ_d Max.	Mg/m^3 At Nat w.	G_s
241	4.00 4.50	B	Stiff red brown silty CLAY with some mudstone fragments. (KEUPER MARL:ZONE III)						23						
	6.00 7.00	B	Very stiff red brown silty CLAY tending to very weak mudstone (KEUPER MARL : ZONE II/III)	SOAK 0.7	- Sample compressed 0. 1.5	324mm in 67 20.6	hours 19.4	13.6	20	1.97 2.00	* Before Soak After Soak				
B263	5.00 5.10	B	Red brown and green grey weak SILTSTONE (KEUPER MARL:ZONE III)						11						
B268	2.00 4.50	2xB	Very stiff red brown fissured silty CLAY with many mudstone and siltstone fragments. (KEUPER MARL:ZONE III)						20		Std	14.0	1.81	1.74	2.66
										2.09	Ⓐ				
				12.0	13.0	15.0	14.1	13.6	20	-					
										2.07	Ⓐ				
				8.0	6.0	18.3	13.3	13.6	20	-					
										2.10	Ⓐ				
				8.0	6.0	16.4	16.4	13.6	20	-					
B272	2.00 2.50	B	Red brown very weak micaceous MUDSTONE (KEUPER MARL:ZONE III)						15						2.66
275	2.00 2.45	U	Stiff and very stiff red brown and grey green silty CLAY with occasional mudstone fragments. (KEUPER MARL:ZONE III)							2.03	*				
				4.0	3.0	16.3	15.7	13.6	14	-					

Remarks * BS Test 16 remoulded to 5% air voids
Ⓐ Remoulded to BS Test 16 2.5kg rammer method

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Figure 2.303

Samples				CBR							Compaction				
Hole	Depth	Type	Description	Top	Base	Top w%	Base w%	Surch. kg.	Nat w%	γ_b Mg/m^3	Type	Opt. w%	γ_d Max.	Mg/m^3 At Nat w.	G_s
276	2.50 3.00	B	Very stiff red brown mottled grey green fissured silty CLAY with some mudstone fragments. (KEUPER MARL : ZONE III)						20	-	Std	11.0	1.87	1.78	2.66
										1.95 ⊛					
				26.0	21.0	11.4	11.2	13.6	20	-					
										1.97 ⊛					
				19.0	15.0	11.6	12.0	13.6	20	-					
										2.03 ⊛					
				17.0	15.0	12.9	12.4	13.6	20	-					
277	1.00 2.00	B	Very stiff red brown and grey green fissured silty CLAY with many mudstone fragments tending to weak siltstone in parts (KEUPER MARL : ZONE II/III)			-			16		Std	15.0	1.79	1.71	2.65
			Natural								VT > 120 kN/m^2				
			Point 1								VT > 120 kN/m^2				
			Point 2								VT > 120 kN/m^2				
			Point 3								VT > 120 kN/m^2				
			Point 4								PVT = 85 kN/m^2				
											RVT = 28 kN/m^2				
			Point 5								PVT = 35 kN/m^2				
											RVT = 18 kN/m^2				
			Point 6								PVT = 23 kN/m^2				
											RVT = 13 kN/m^2				
	2.00 2.20	B	Very stiff red brown and grey green fissured silty CLAY with many mudstone fragments tending to weak siltstone in parts. (KEUPER MARL : ZONE II/III)	Insufficient material for soak CBR					12						

Remarks ⊛ Remoulded to BS Test 16 2.5kg rammer method.
VT = Hand Vane Test, PVT = Hand Vane Test Peak, RVT = Hand Vane Test Remoulded

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Figure 2.304

Samples				CBR							Compaction				
Hole	Depth	Type	Description	Top	Base	Top w%	Base w%	Surch. kg.	Nat w%	γ_b Mg/m^3	Type	Opt. w%	γ_d Max.	Mg/m^3 At Nat w.	G_s
278	1.00 1.50	B	Stiff red brown mottled grey green silty CLAY with some siltstone/mudstone fragments. (KEUPER MARL : ZONE III)						25						
B283	1.00 1.50	B	Red brown very weak MUDSTONE with zones of silty clay. (KEUPER MARL:ZONE III)						19		Std	16	1.81	1.77	2.65
			Natural								VT > 120 kN/m^2				
			Point 1								VT > 120 kN/m^2				
			Point 2								VT > 120 kN/m^2				
			Point 3								VT > 120 kN/m^2				
			Point 4								VT > 120 kN/m^2				
			Point 5								PVT = 20 kN/m^2				
											RVT = 14 kN/m^2				
			Point 6								PVT = 11 kN/m^2				
											RVT = 8 kN/m^2				
B287	3.40 4.00	B	Red brown very weak SILTSTONE with some silty clay. (KEUPER MARL:ZONE III)	5.0	5.0	23.5	21.8	13.6	22	1.89	*				
B289	3.50 4.00	B	Very stiff red brown mottled grey green silty to very silty CLAY with siltstone fragments. (KEUPER MARL : ZONE III)	4.0	4.0	19.0	19.1	13.6	23	1.97 -	*				

Remarks * BS Test 16 remoulded to 5% Air Voids
VT = Hand Vane Test, PVT = Hand Vane Test Peak, RVT = Hand Vane Test Remoulded

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Figure 2.305

EX 7

Samples				CBR							Compaction				
Hole	Depth	Type	Description	Top	Base	Top w%	Base w%	Surch. kg.	Nat w%	γ_b Mg/m^3	Type	Opt. w%	γ_d Max.	Mg/m^3 At Nat w.	G_s
438	0.45	B	Brown medium SAND and sub-rounded fine to coarse GRAVEL. (GLACIAL SAND and GRAVEL)						11		92% passing 20mm sieve Std	8.0	2.03	1.94	2.62
	0.80	B	Stiff red brown occasionally green grey silty slightly sandy CLAY with some gravel and sand. (GLACIAL TILL)						16 19#						
			Natural						20 - Before Test 22 - After Test		MCV = 7.2 VT > 120kN/m^2				
			Point 1						17 - Before Test 17 - After Test		MCV = 5.5 PVT = 33kN/m^2 RVT = 13kN/m^2				
			Point 2						20 - Before Test 18 - AfterTest		MCV =2.0 PVT = 25kN/m^2 RVT = 11kN/m^2				
			Point 3						17 - Before Test 18 - After Test		MCV = 2.1 PVT = 15kN/m^2 RVT = 8kN/m^2				
			Point 4						21 - Before Test 18 - After Test		MCV = 0.8 PVT = 18kN/m^2 RVT = 8kN/m^2				

Remarks # M/C without gravel.
VT - Hand Vane Test, PVT - Hand Vane Test Peak, RVT - Hand Vane Test Remoulded

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Figure 2.306

EX 7

Samples				CBR							Compaction					
Hole	Depth	Type	Description	Top	Base	Top w%	Base w%	Surch. kg.	Nat w%	γ_b Mg/m³	Type	Opt. w%	γ_d Max. Mg/m³	At Nat w. Mg/m³	G_s	
438	1.80	B	Soft to firm red brown very silty CLAY with some gravel and occasional cobbles (GLACIAL TILL)						28		Hvy	13.0	1.85	1.62	2.62	
										2.03 ⊛						
				33.0	32.0	12.3	12.7	13.6	28	–						
										2.09 ⊛						
				14.0	14.0	14.3	14.6	13.6	28	–						
										2.10 ⊛						
				15.0	17.0	15.0	15.3	13.6	28	–						
	2.40	B	Firm to stiff red brown and green grey very silty CLAY with siltstone fragments. (KEUPER MARL:ZONE IV)						26							
			Natural						25 – Before Test 28 – After Test MCV = 7.3 PVT = 36kN/m² RVT = 18kN/m²							
			Point 1						19 – Before Test 19 – After Test MCV = 10.0 PVT = 109kN/m² RVT = 44kN/m²							
			Point 2						20 – Before Test 20 – After Test MCV = 9.2 PVT = 74kN/m² RVT = 28kN/m²							
			Point 3						23 – Before Test 22 – After Test MCV = 8.0 PVT = 52kN/m² RVT = 25kN/m²							

Remarks ⊛ Remoulded to BS Test 16 4.5kg rammer method
PVT – Hand Vane Test Peak, RVT – Hand Vane Test Remoulded

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Figure 2.307

EX 7

Samples				CBR							Compaction				
Hole	Depth	Type	Description	Top	Base	Top w%	Base w%	Surch. kg.	Nat w%	γ_b Mg/m^3	Type	Opt. w%	γ_d Max.	Mg/m^3 At Nat w.	G_s
438	2.40	B	Firm red brown and green grey very silty CLAY with siltstone fragments (KEUPER MARL:ZONE IV)	Point 4					25 – Before Test 25 – After Test		MCV = 6.0 PVT = 34kN/m^2 RVT = 20kN/m^2				
			Point 5						25 – Before Test 27 – After Test		MCV = 6.1 PVT = 22kN/m^2 RVT = 12kN/m^2				
	3.00	B	Firm to stiff red brown and green grey very silty CLAY with siltstone fragments. (KEUPER MARL:ZONE IV)	SOAK – sample compressed 0.176mm in 91 hours						1.96 1.99	* Before Soak After Soak				
				4.0	3.0	22.4	23.2	13.6	21						
439	0.60	B	Stiff to very stiff fissured red brown silty sandy CLAY with occasional gravel. (GLACIAL TILL)						12 11#	--	Hvy	10.0	1.94	1.96	2.61
			Natural								VT>120 kN/m^2				
			Point 4								VT>120 kN/m^2				
			Point 5								PVT = 41 kN/m^2 RVT = 27 kN/m^2				
			Point 6								PVT = 28 kN/m^2 RVT = 17 kN/m^2				
	1.20	B	Firm to stiff red brown silty sandy CLAY with some gravel. (GLACIAL TILL)						18						
			Natural						20 – Before Test 19 – After Test		MCV = 13.2 VT> 95 kN/m^2				
			Point 1						17 – After Test		MCV = 9.8 PVT = 85 kN/m^2 RVT = 34 kN/m^2				

Remarks # M/C without gravel. * BS Test 16 remoulded to 5% air voids
VT = Hand Vane Test, PVT = Hand Vane Test Peak, RVT = Hand Vane Test Remoulded.

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Figure 2.308

EX 7

Samples				CBR							Compaction				
Hole	Depth	Type	Description	Top	Base	Top w%	Base w%	Surch. kg.	Nat w%	γ_b Mg/m³	Type	Opt. w%	γ_d Max.	Mg/m³ At Nat w.	G_s
439	1.20	B	Point 2						19	- Before Test					
									18	- After Test					
										MCV = 7.4					
										PVT = 50 kN/m²					
										RVT = 21 kN/m²					
			Point 3						19	- Before Test					
									19	- After Test					
										MCV = 4.9					
										PVT = 34 kN/m²					
										RVT = 14 kN/m²					
			Point 4						19	- Before Test					
									19.5	- After Test					
										MCV = 3.2					
										PVT = 28 kN/m²					
										RVT = 10 kN/m²					
			Point 5						21	- Before Test					
									21	- After Test					
										MCV = 2.2					
										PVT = 21 kN/m²					
										RVT = 9 kN/m²					
	2.30	B	Stiff and firm red brown occasionally green grey silty CLAY with occasionally siltstone fragments. (KEUPER MARL:ZONE IV)						28		Std	15.0	1.77	1.74	2.62
										2.00 (*)					
				21.0	18.0	14.8	13.4	13.6	28	-					
										1.98 (*)					
				16.0	13.0	15.2	15.2	13.6	28	-					
										1.98 (*)					
				15.0	14.0	15.4	15.7	13.6	28	-					
										2.05 (*)					
				13.0	17.0	18.0	16.2	13.6	28	-					

Remarks PVT = Hand Vane Peak, RVT = Hand Vane Remoulded
(*) Remoulded to BS Test 16 2.5kg rammer method

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Figure 2.309

EX 7

Samples				CBR							Compaction				
Hole	Depth	Type	Description	Top	Base	Top w%	Base w%	Surch. kg.	Nat w%	γ_b Mg/m^3	Type	Opt. w%	γ_d Max.	Mg/m^3 At Nat w.	G_s
439	3.00	B	Stiff and firm red brown occasionally green grey silty CLAY with occasional siltstone fragments. (KEUPER MARL:ZONE IV)						22						
			Natural						22 - Before Test 23 - After Test MCV = 3.7 VT = 26 kN/m^2						
			Point 1						14.5 - Before Test 14.5 - After Test MCV = 11.7 VT>120 kN/m^2						
			Point 2						18.5 - Before Test 17.0 - After Test MCV = 9.2 PVT = 92 kN/m^2 RVT = 36 kN/m^2						
			Point 3						19 - Before Test 19 - After Test MCV = 6.7 PVT = 80 kN/m^2 RVT = 35 kN/m^2						
			Point 4						21 - Before Test 21.5 - After Test MCV = 5.5 PVT = 30 kN/m^2 RVT = 17 kN/m^2						
			Point 5						23 - Before Test 22 - After Test MCV = 4.3 PVT = 20 kN/m^2 RVT = 9 kN/m^2						
440	0.50	B	Stiff to very stiff red brown fissured silty slightly sandy CLAY with occasional gravel. (GLACIAL TILL)						12						

Remarks VT = Hand Vane Test, PVT = Hane Vane Test Peak, RVT = Hand Vane Test Remoulded.

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Figure 2.310

Samples				CBR							Compaction				
Hole	Depth	Type	Description	Top	Base	Top w%	Base w%	Surch. kg.	Nat w%	γ_b Mg/m³	Type	Opt. w%	γ_d Max.	Mg/m³ At Nat w.	G_s
440	0.50	B	Natural						18 - Before Test 14 - After Test MCV >20 VT >120kN/m²						
			Point 1						15 - Before Test 13 - After Test MCV = 16.6 VT>120kN/m²						
			Point 2						18 - Before Test 15 - After Test MCV 12.8 VT > 120kN/m²						
			Point 3						19 - Before Test 22 - After Test MCV = 7.4 PVT = 73kN/m² RVT = 30kN/m²						
			Point 4						23 - Before Test 19 - After Test MCV = 5.4 PVT 77[illegible] PVT = 73kN/m² RVT = 26kN/m²						
	1.30	B	Stiff to very stiff red brown occasionally green grey fissured silty CLAY (KEUPER MARL:ZONE III)						23	-	Std	15.0	1.72	1.56	2.61
			Natural									VT> 120 kN/m²			
			Point 4									VT> 120 kN/m²			
			Point 5									PVT = 95kN/m² RVT = 25kN/m²			
			Point 6									PVT = 55kN/m² RVT = 24kN/m²			
			Point 7									PVT = 45kN/m² RVT = 32kN/m²			

Remarks PVT = Hand Vane Peak, RVT = Hand Vane Test Remoulded. VT - Hand Vane Test

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Figure 2.311

EX 7

Samples				CBR							Compaction				
Hole	Depth	Type	Description	Top	Base	Top w%	Base w%	Surch. kg.	Nat w%	γ_b Mg/m³	Type	Opt. w%	γ_d Max.	Mg/m³ At Nat w.	G_s
440	2.50	B	Stiff to very stiff red brown occasionally green grey fissured silty CLAY (KEUPER MARL:ZONE III)						11		Std	12.0	1.92	1.79	2.72
441	0.60 0.70	B	Stiff fissured red brown and green grey silty CLAY with occasional siltstone fragments. (KEUPER MARL:ZONE IV)						19 17#		Std	16	1.78	1.70	2.62
			Natural								VT > 120 kN/m²				
			Point 1								VT > 120 kN/m²				
			Point 2								VT > 120 kN/m²				
			Point 3								VT > 120 kN/m²				
			Point 4								VT > 120 kN/m²				
			Point 5								PVT = 44 kN/m²				
											RVT = 25 kN/m²				
			Point 6								PVT = 35 kN/m²				
											RVT = 21 kN/m²				
	1.20	B	Red brown and green grey very weak SILTSTONE with some silty clay. (KEUPER MARL:ZONE III)	SOAK - Sample swelled 3.26mm in 117 hours						2.09	* Before Soak				
				4.0	10.0	19.1	15.7	13.6	14	2.12	After Soak				
			Natural						19		Before Test				
									19		After Test				
											MCV = 12.7				
											VT >120kN/m²				
			Point 1						18		Before Test				
									18		After Test				
											MCV = 6.6				
											PVT = 57kN/m²				
											RVT = 21kN/m²				
			Point 2						21		Before Test				
									20		After Test				
											MCV = 7.4				
											PVT = 45kN/m²				
											RVT = 24kN/m²				

Remarks VT = Hand Vane Test, PVT = Hand Vane Test Peak, RVT = Hand Vane Test Remoulded.
M/C without gravel. * BS Test 16 remoulded to 5% air voids

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Figure 2.312

EX 7

Samples				CBR							Compaction				
Hole	Depth	Type	Description	Top	Base	Top w%	Base w%	Surch. kg.	Nat w%	γ_b Mg/m^3	Type	Opt. w%	γ_d Max.	Mg/m^3 At Nat w.	G_s
441	1.20	B	Red brown and green grey very weak SILTSTONE and MUDSTONE with some silty clay (KEUPER MARL:ZONE III)												2.63
			Point 3						22	- Before Test					
									22	- After Test					
										MCV = 6.0					
										PVT = 33kN/m^2					
										RVT = 17kN/m^2					
			Point 4						24	- Before Test					
									23	- After Test					
										MCV = 4.4					
										PVT = 19kN/m^2					
										RVT = 12kN/m^2					
			Point 5						26	- Before Test					
									25	- After Test					
										MCV = 3.0					
										PVT = 12kN/m^2					
										RVT = 6kN/m^2					
	2.20	B	Red brown and green grey very weak to weak SILTSTONE (KEUPER MARL : ZONE I/II)						15		Std	13.0	1.86	1.79	2.62
										2.09	⊛				
				13.0	12.0	13.7	13.4	13.6	15	-					
										2.12	⊛				
				8.0	8.0	14.5	14.4	13.6	15	-					
										2.06	⊛				
				2.0	4.0	16.1	14.7	13.6	15	-					

Remarks ⊛ Remoulded to BS Test 16 2.5kg rammer method

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Figure 2.313

EX 7

Samples				CBR							Compaction				
Hole	Depth	Type	Description	Top	Base	Top w%	Base w%	Surch. kg.	Nat w%	γ_b Mg/m^3	Type	Opt. w%	γ_d Max.	Mg/m^3 At Nat w.	G_s
441	3.20	B	Red brown and green grey very weak to weak SILTSTONE (KEUPER MARL : ZONE I/II)						13		Std	12	1.85	1.81	2.71
442	0.60	B	Stiff to very stiff brown and grey fissured silty CLAY with some gravel. (GLACIAL TILL)						25	-	Std	13	1.80	1.61	2.60
										1.99	Ⓐ				
				13.0	13.0	13.5	12.9	13.6	25	-					
										1.93	Ⓐ				
				15.0	14.0	13.7	13.9	13.6	25	-					
										1.99	Ⓐ				
				11.0	8.0	14.6	15.3	13.6	25	-					
	1.70 1.80	B	Stiff to very stiff grey and brown fissured silty sandy CLAY with gravel and occasional cobbles. (GLACIAL TILL)						15 19#		Std	13	1.84	1.65	2.65
	3.00	B	Red brown very weak MUDSTONE/SILTSTONE (KEUPER MARL : ZONE II/III)						15		Hvy	12.0	1.97	1.93	2.65
										2.16	Ⓐ -				
				24.0	27.0	12.6	12.0	13.6	15	-					
										2.22	Ⓐ -				
				18.0	22.0	13.5	13.4	13.6	15	-					
										2.22	Ⓐ -				
				13.0	11.0	13.7	14.8	13.6	15	-					

Remarks # M/C Without gravel. Ⓐ - Remoulded to BS Test 16 4.5kg rammer method
Ⓐ Remoulded to BS Test 16 2.5kg rammer method

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Figure 2.314

EX 7

Samples				CBR							Compaction				
Hole	Depth	Type	Description	Top	Base	Top w%	Base w%	Surch. kg.	Nat w%	γ_b Mg/m^3	Type	Opt. w%	γ_d Max.	Mg/m^3 At Nat w.	G_s
443	0.60	B	Very stiff and stiff fissured red brown silty sandy CLAY with some gravel. (GLACIAL TILL)						18	-	Std	14.0	1.81	1.62	2.64
			Natural								VT> 120 kN/m^2				
			Point 4								VT> 120 kN/m^2				
			Point 5								PVT = 88 kN/m^2				
											RVT = 42 kN/m^2				
			Point 6								PVT = 59 kN/m^2				
											RVT = 28 kN/m^2				
			Point 7								PVT = 33 kN/m^2				
											RVT = 18 kN/m^2				
	1.80	B	Red brown occasionally green grey very weak SILTSTONE and MUDSTONE (KEUPER MARL:ZONE III)						15	-	Hvy	14.0	1.92	1.86	2.68
			Natural								VT> 120 kN/m^2				
			Point 4								VT> 120 kN/m^2				
			Point 5								PVT = 100 kN/m^2				
											RVT = 37 kN/m^2				
			Point 6								PVT = 37 kN/m^2				
											RVT = 28 kN/m^2				
	2.80	B	Red brown occasionally green grey very weak SILTSTONE and MUDSTONE (KEUPER MARL:ZONE III)						19						
			Natural						16	-	Before Test				
									16	-	After Test				
											MCV = 13.7				
											VT >120kN/m^2				
			Point 1						18	-	Before Test				
									18	-	After Test				
											MCV = 8.4				
											PVT = 100kN/m^2				
											RVT = 50kN/m^2				
			Point 2						20	-	Before Test				
									20	-	After Test				
											MCV = 76				
											PVT = 75kN/m^2				
											RVT = 34kN/m^2				

Remarks PVT = Hand Vane Test Peak, RVT = Hand Vane Test Remoulded,
VT - Hand Vane Test

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Figure
2.315

Samples				CBR							Compaction				
Hole	Depth	Type	Description	Top	Base	Top w%	Base w%	Surch. kg.	Nat w%	γ_b Mg/m^3	Type	Opt. w%	γ_d Max.	Mg/m^3 At Nat w.	G_s
443	2.80	B	Point 3						23 - Before Test 21 - After Test MCV = 7.2 PVT = 56kN/m^2 RVT = 32kN/m^2						
			Point 4						23 - Before Test 24 - After Test MCV = 4.4 PVT = 25kN/m^2 RVT = 14kN/m^2						
			Point 5						25 - Before Test 24 - After Test MCV = 2.7 PVT = 16kN/m^2 RVT = 9kN/m^2						

Remarks PVT - Hand Vane Test Peak, RVT - Hand Vane Test Remoulded

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Figure 2.316

Samples				Water Content		Density			Shear Strength							
Hole	Depth	Type	Description	Initial %	Final %	Initial Mg/m³	Final Mg/m³	Dry Mg/m³	Prep.	Test	P'o kN/m²	u_f kN/m²	$\sigma'_1-\sigma'_3$ kN/m²	c' kN/m²	ϕ'
B219	2.00	U	Soft red brown occasionally mottled grey green silty CLAY with fine siltstone fragments. (GLACIAL TILL)	28	23	1.94	2.03	1.52	Natural	CDT 38	50	-2	142	20	27
				32	25	2.00	2.25	1.52			150	+2	331		
				30	23	2.00	2.15	1.54			300	+3	582		
B220	3.50	U	Firm red brown clayey SILT with fine weak mudstone fragments. (KEUPER MARL : ZONE IVa)	21	20	2.03	2.13	1.68	Natural	CDT 38	100	-1	420	60	30
				19	18	2.12	2.23	1.78			200	0	619		
				19	17	2.15	2.31	1.81			300	0	812		
B221	6.50	U	Soft red brown clayey SILT with fine weak mudstone fragments. (KEUPER MARL : ZONE IVa)	24	24	1.99	2.04	1.60	Natural	CDT 38	100	0	275	20	28
				26	21	2.04	2.18	1.62			200	-1	436		
				28	20	2.07	2.32	1.62			400	+1	794		
B222	4.00	B	Remoulded soft red brown silty CLAY. (KEUPER MARL : ZONE IVa)	21	21	2.05	2.09	1.69	Remould	CDT 38	50	0	105	0	29
				22	19	2.05	2.09	1.68			100	0	215		
				22	19	2.05	2.17	1.68			200	+1	409		
B223	3.50	U	Soft red brown clayey SILT with fine weak mudstone fragments. (KEUPER MARL : ZONE III)	24	25	1.93	1.98	1.56	Natural	CDT 38	50	0	151	0	31
				25	23	1.98	2.04	1.58			150	+3	307		
				25	20	1.98	2.08	1.58			300	+2	657		
235	2.00	U	Firm brown silty sandy CLAY with occasional sand pockets and gravel. (GLACIAL TILL)	18	17	2.00	2.03	1.69	Natural	CDT 38	50	+1	136	0	32
				17	15	2.08	2.15	1.78			100	+2	213		
				15	11	2.12	2.19	1.84			150	+1	356		
	3.50	U	Remoulded firm red brown silty CLAY. (KEUPER MARL : ZONE III)	25	31	1.93	2.06	1.54	Remould	CUT 38	50	26	72	10	26
				24	27	1.94	2.06	1.56			100	43	127		
				25	27	1.94	2.10	1.55			200	96	204		
236	0.50	U	Remoulded soft red brown silty CLAY. (GLACIAL TILL)	19	19	1.94	1.97	1.63	Remould	CUT 38	50	29	70	10	25
				17	16	1.94	2.00	1.66			100	51	109		
				20	18	1.93	2.07	1.61			150	85	130		

Remarks

Laboratory Results – Triaxial Effective Stress

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Figure 2.317

EX 4

Samples				Water Content		Density			Shear Strength							
Hole	Depth	Type	Description	Initial %	Final %	Initial Mg/m3	Final Mg/m3	Dry Mg/m3	Prep.	Test	P'o kN/m2	u_f kN/m2	σ'_3 kN/m2	σ'_1 kN/m2	c' kN/m2	ϕ'°
239	3.50	U	Firm red brown clayey SILT with occasional weak mudstone and sandstone fragments. (KEUEPR MARL : ZONE III)	16	17	2.01	2.09	1.73	Natural	CDT 106	50 100 150	+1 0 +2	133 244 288		0	30
240	0.50	U	Remoulded firm red brown silty CLAY. (GLACIAL TILL)	15 16 15	17 17 15	1.97 1.96 1.96	2.06 2.12 2.12	1.71 1.69 1.70	Remould	CDT 38	50 100 150	+2 0 0	85 175 269		0	27
	2.00	U	Stiff grey brown mottled blue grey silty CLAY with rock chalk. (GLACIAL TILL)	24	25	2.12	2.22	1.71	Natural	CDT 106	50 100 150	0 -1 0	107 181 272		10	26
	3.50	U	Firm red brown silty slightly sandy CLAY with siltstone fragments (KEUPER MARL : ZONE II/III)	16	17	1.84	2.11	1.59	Remould	CDT 106	50 100 200	+2 +1 +4	70 180 341		0	27
241	0.50	U	Firm red brown silty CLAY. (GLACIAL TILL)	19 19 18	22 21 21	2.06 2.06 2.08	2.18 2.19 2.29	1.73 1.73 1.76	Remould	CUT 38	50 100 200	23 47 83	90 80 231		15	25
241	3.50	U	Red brown occasionally mottled grey green slightly clayey SILT with abundant weak siltstone fragments. (KEUPER MARL : ZONE III)	15	15	2.06	2.14	1.79	Natural	CDT 106	50 100 150	0 +4 +3	199 273 353		25	28
B263	2.00	U	Red brown mottled grey green clayey SILT with abundant weak siltstone fragments. (KEUPER MARL : ZONE III)	18	16	2.04	2.14	1.73	Natural	CDT 106	50 150 350	0 +4 +5	208 364 737		20	28

Remarks

Laboratory Results – Triaxial Effective Stress

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Figure 2.318

EX 4

Samples				Water Content		Density			Shear Strength							
Hole	Depth	Type	Description	Initial %	Final %	Initial Mg/m3	Final Mg/m3	Dry Mg/m3	Prep.	Test	P'o kN/m2	u_f kN/m2	$\sigma_1'-\sigma_3'$ kN/m2	c' kN/m2	ϕ' °
B274	5.23 5.66	C	Red brown silty MUDSTONE (KEUPER MARL:ZONE II)	11	11	2.23	2.49	2.01	Natural	CDT 76	150 300	0 2	786 1000	170	25
B281	2.00	U	Stiff red brown occasionally mottled grey green very silty CLAY with siltstone fragments. (KEUPER MARL : ZONE III)	13	11	2.15	2.27	1.90	Natural	CDT 106	50 150 300	0 +3 +1	163 350 480	20	27
291	0.50	U	Firm red brown slightly silty CLAY. (KEUPER MARL : ZONE IVa)	27 27 28	29 28 28	1.98 2.00 1.99	2.06 2.10 2.14	1.56 1.57 1.55	Natural	CUT 38	50 100 200	-5 21 62	111 151 220	15	22

Remarks

Laboratory Results – Triaxial Effective Stress

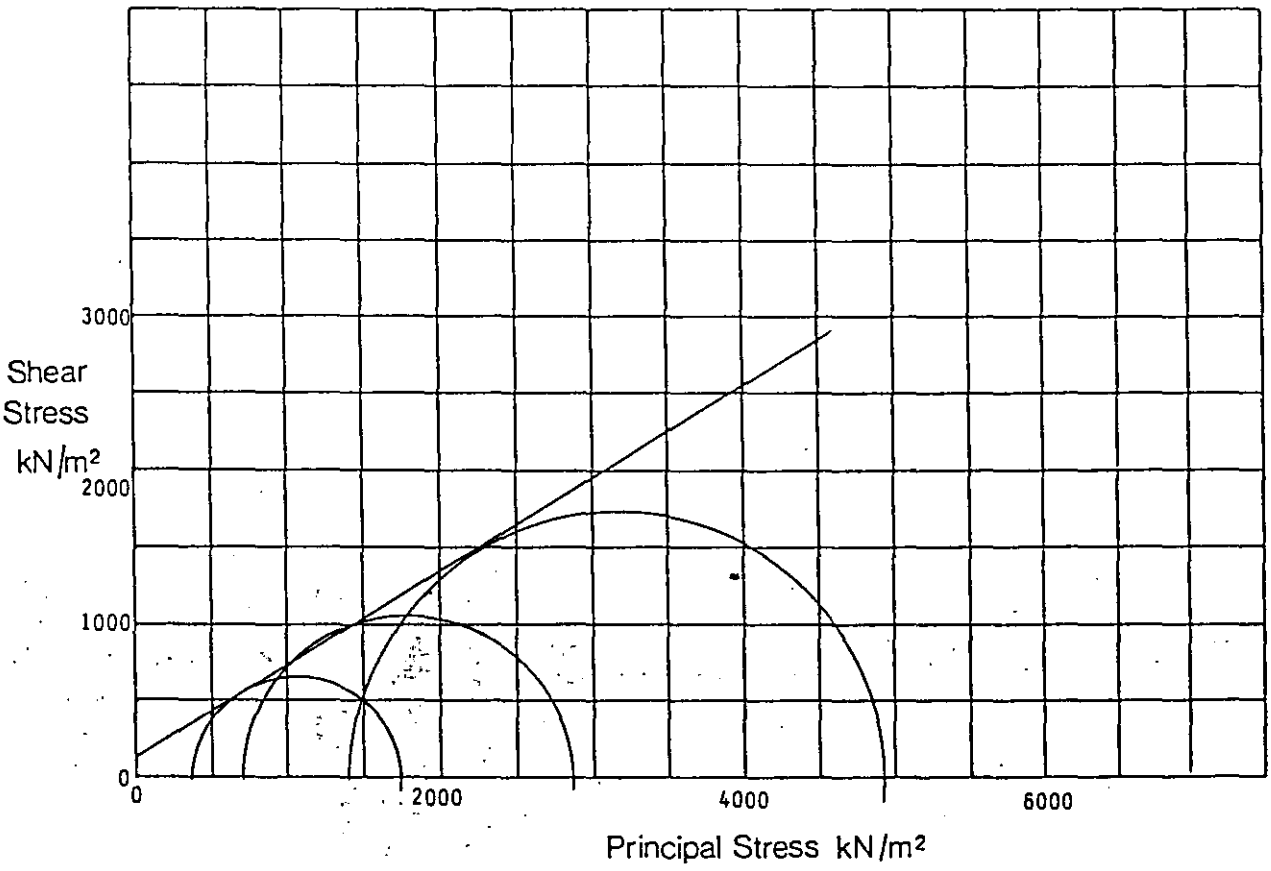
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Figure 2.319

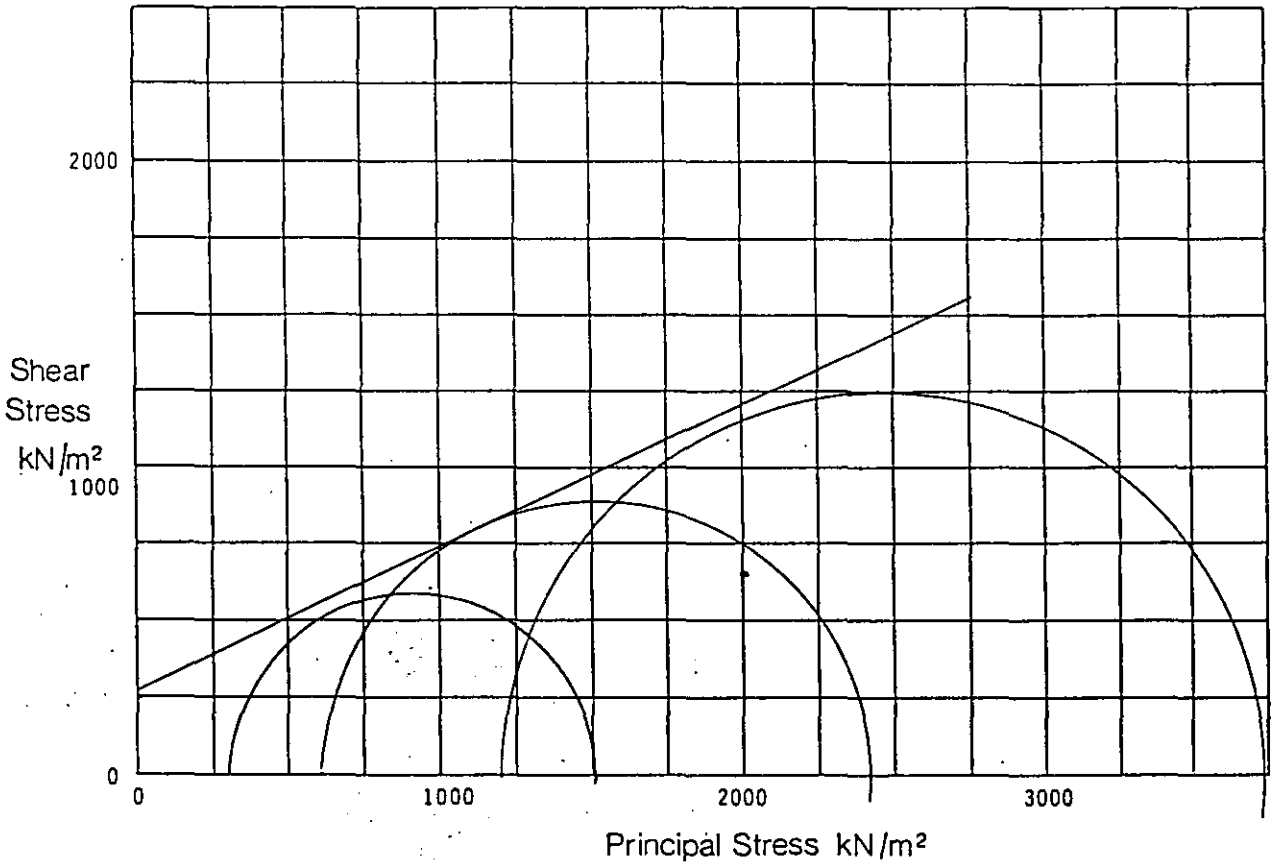
EX 4



B	(Initial)		-	-	-	
B_s	(After application of Back Pressure)		-	-	-	
ε	(Rate of Strain)	% min	0.1	0.1	0.1	
σ_3	(Cell Pressure during Shear)	kN/m²	350	700	1400	
u_0	(Applied Back Pressure)	kN/m²	-	-	-	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	-	-	-	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	1350	2150	3500	

Triaxial Compression Test Consolidated Undrained	Description Red brown and grey green calcareous SILTSTONE (KEUPER MARL:ZONE II/III) Mohr Circles and Summary	C' 150 kN/m² Φ' 31 Degrees Depth 17.14 - 17.47 Borehole B219
Remarks HOEK CELL TEST		
Laboratory - Effective Stress exploration associates	Project Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449 Figure 2.320

EX3



B	(Initial)		-	-	-	
B_s	(After application of Back Pressure)		-	-	-	
ε	(Rate of Strain)	% min	0.1	0.1	0.1	
σ_3	(Cell Pressure during Shear)	kN/m²	300	600	1200	
u_0	(Applied Back Pressure)	kN/m²	-	-	-	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	-	-	-	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	1200	1770	2500	

Triaxial Compression Test
Consolidated
Undrained

Description Red brown very weak calcareous SILTSTONE (KEUPER MARL:ZONE II)

Mohr Circles and Summary

C' 260 kN/m²
Φ' 24 Degrees

Depth 12.24 - 12.43
Borehole B221

Remarks HOEK CELL TEST

Laboratory - Effective Stress

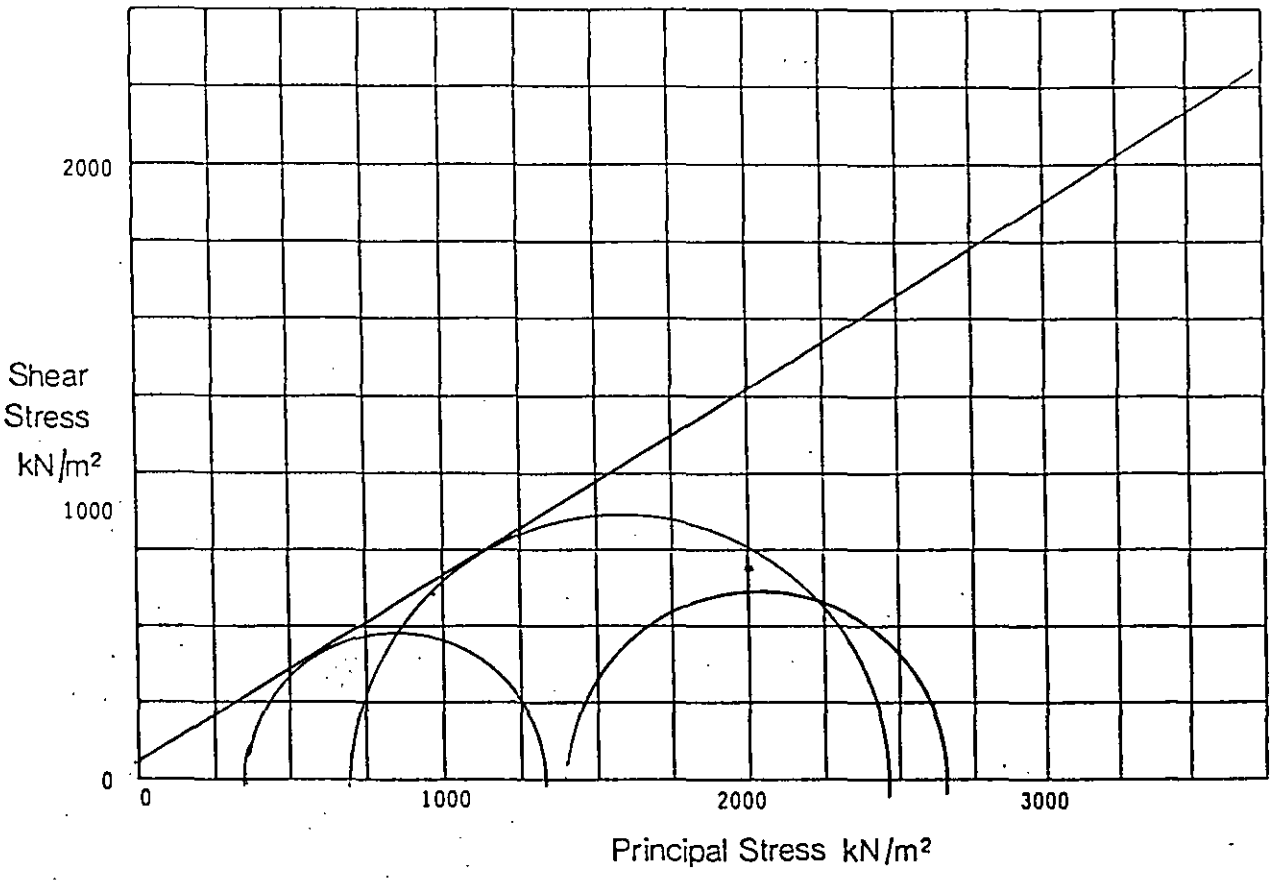
exploration associates

Project Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation - Contract 2

Contract S4449

Figure 2.321

EX3



B	(Initial)		-	-	-	
B_s	(After application of Back Pressure)		-	-	-	
ε	(Rate of Strain)	% min	0.1	0.1	0.1	
σ_3	(Cell Pressure during Shear)	kN/m²	350	700	1400	
u_0	(Applied Back Pressure)	kN/m²	-	-	-	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	-	-	-	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	975	1750	1210	

Triaxial Compression Test
Consolidated
Undrained

Description Red brown very weak calcareous SILTSTONE (KEUPER MARL:ZONE II)

C' 75 kN/m²
Φ' 31 Degrees

Mohr Circles and Summary

Depth 18.00 - 18.40
Borehole B221

Remarks HOEK CELL TEST

Laboratory - Effective Stress

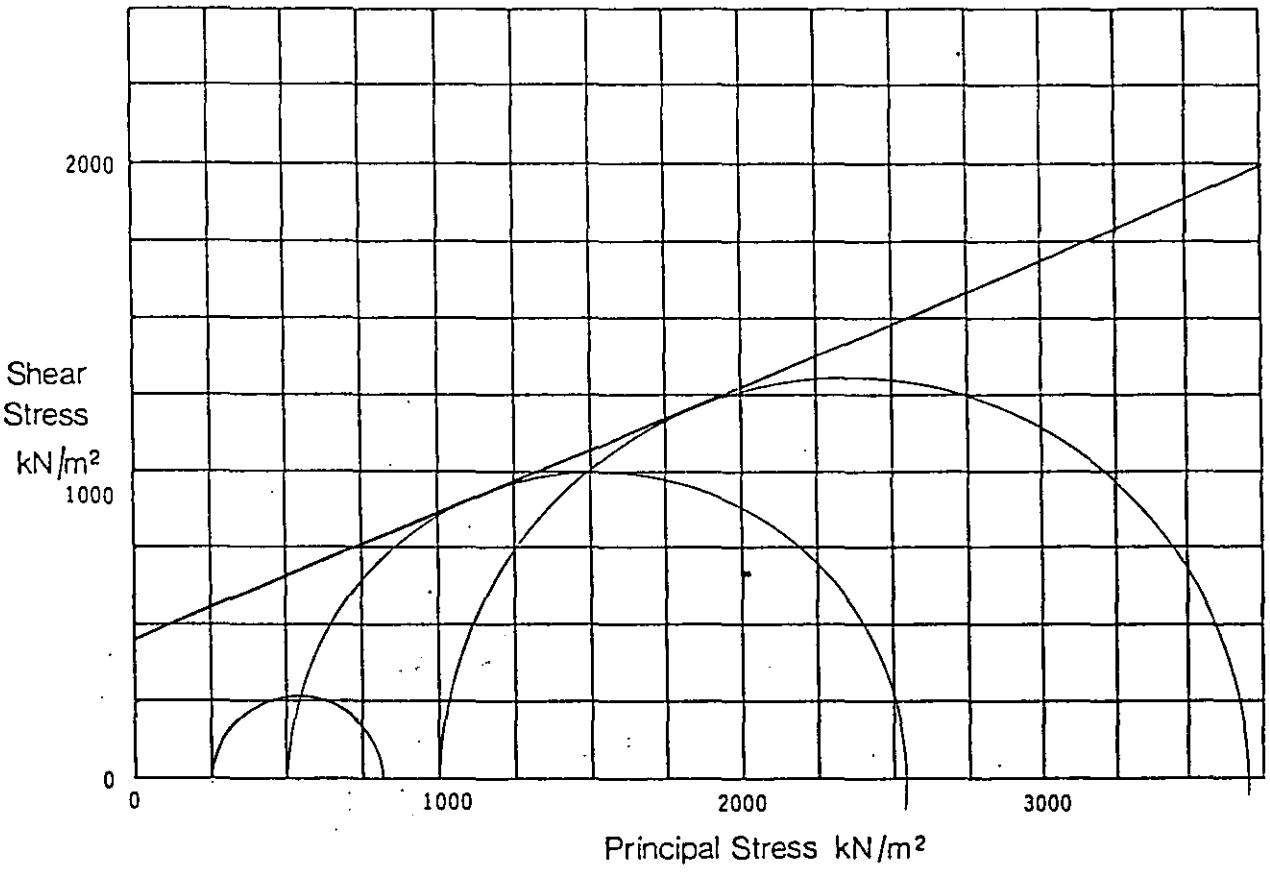
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Project Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation - Contract 2

Contract S4449

Figure 2.322

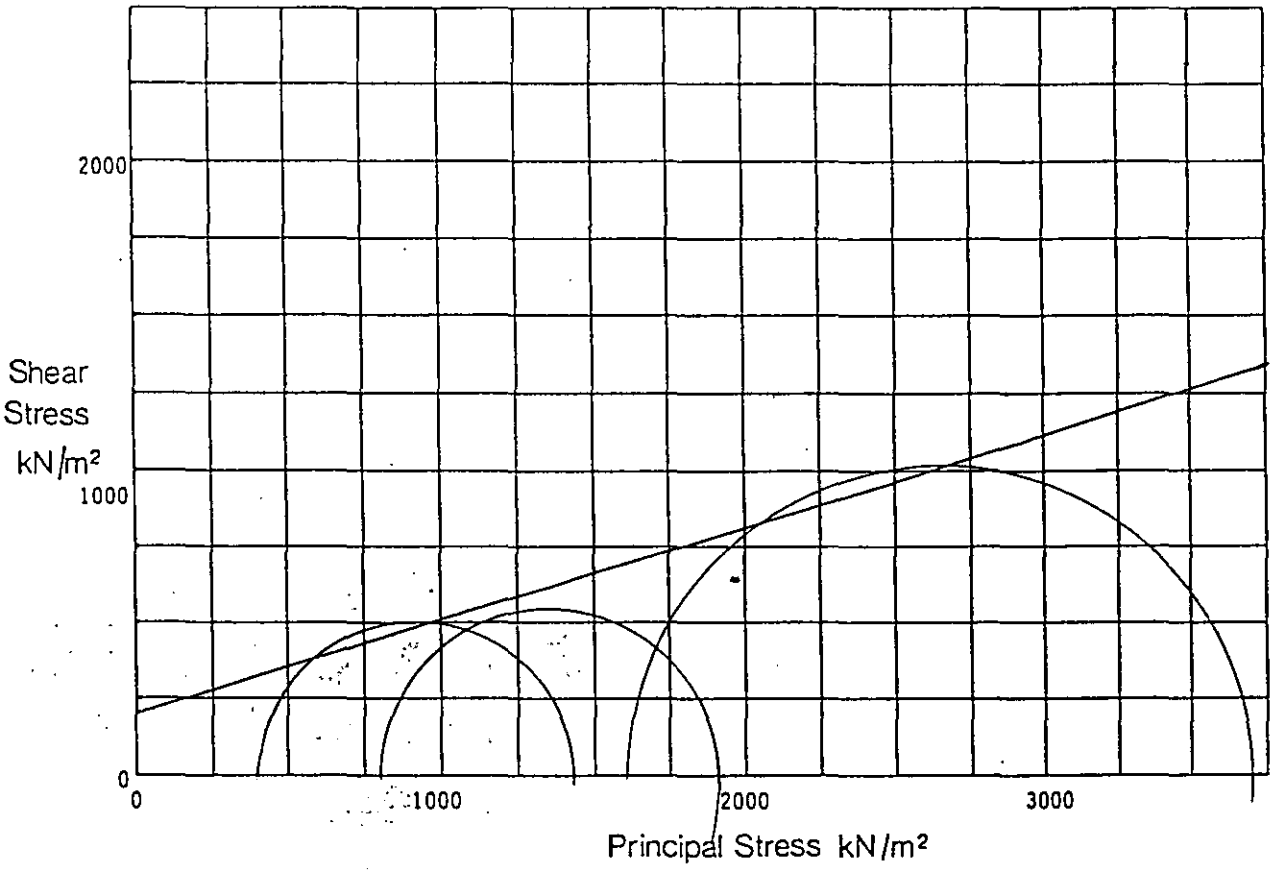
EX3



B	(Initial)		-	-	-	
B_s	(After application of Back Pressure)		-	-	-	
ε	(Rate of Strain)	% min	0.1	0.1	0.1	
σ_3	(Cell Pressure during Shear)	kN/m²	250	500	1000	
u_0	(Applied Back Pressure)	kN/m²	-	-	-	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	-	-	-	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	550	2010	2750	

Triaxial Compression Test Consolidated Undrained	Description Red brown weak SILTSTONE (KEUPER MARL:ZONE I) Mohr Circles and Summary	C' 450 kN/m² Φ' 22 Degrees Depth 10.53 - 10.95 Borehole B 244
Remarks HOEK CELL TEST		
Laboratory - Effective Stress exploration associates	Project Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449 Figure 2.323

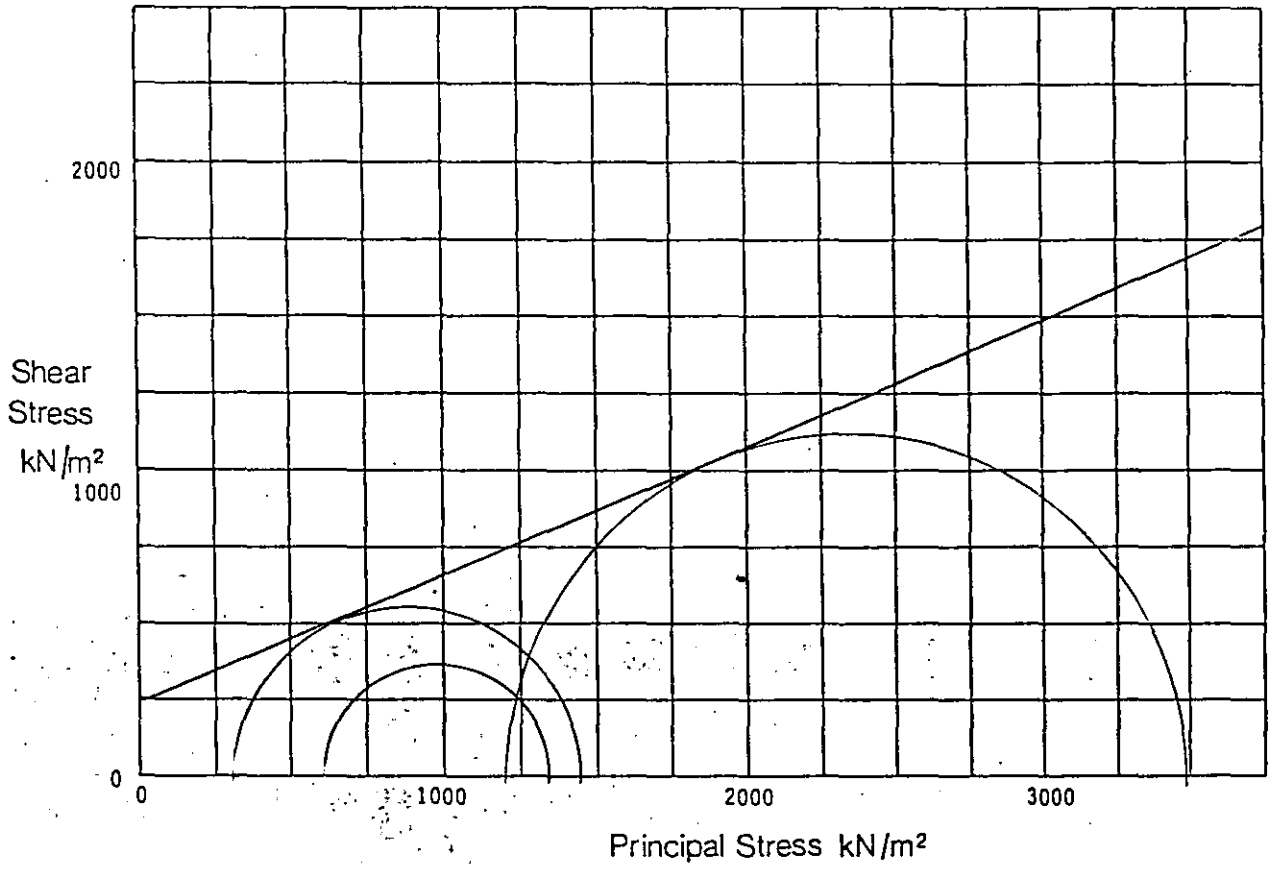
EX3



B	(Initial)		-	-	-	
B_s	(After application of Back Pressure)		-	-	-	
ε	(Rate of Strain)	% min	0.1	0.1	0.1	
σ_3	(Cell Pressure during Shear)	kN/m²	400	800	1600	
u_0	(Applied Back Pressure)	kN/m²	-	-	-	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	-	-	-	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	1050	1100	2050	

Triaxial Compression Test Consolidated Undrained	Description Highly weathered SILTSTONE/very stiff silty CLAY (KEUPER MARL:ZONE III) Mohr Circles and Summary	C' 200 kN/m² Φ' 17 Degrees Depth 7.75 - 8.00 Borehole B245
Remarks HOEK CELL TEST		
Laboratory - Effective Stress exploration associates	Project Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449 Figure 2.324

EX3



B	(Initial)		-	-	-	
B_s	(After application of Back Pressure)		-	-	-	
ε	(Rate of Strain)	% min	0.1	0.1	0.1	
σ_3	(Cell Pressure during Shear)	kN/m²	300	600	1200	
u_0	(Applied Back Pressure)	kN/m²	-	-	-	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	-	-	-	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	1150	725	2250	

Triaxial Compression Test
Consolidated
Undrained

Description Red brown very weak calcareous SILTSTONE (KEUPER MARL:ZONE II/III)

Mohr Circles and Summary

C' 250 kN/m²
Φ' 22 Degrees

Depth 13.00 - 13.30
Borehole 8267

Remarks HOEK CELL TEST

Laboratory - Effective Stress

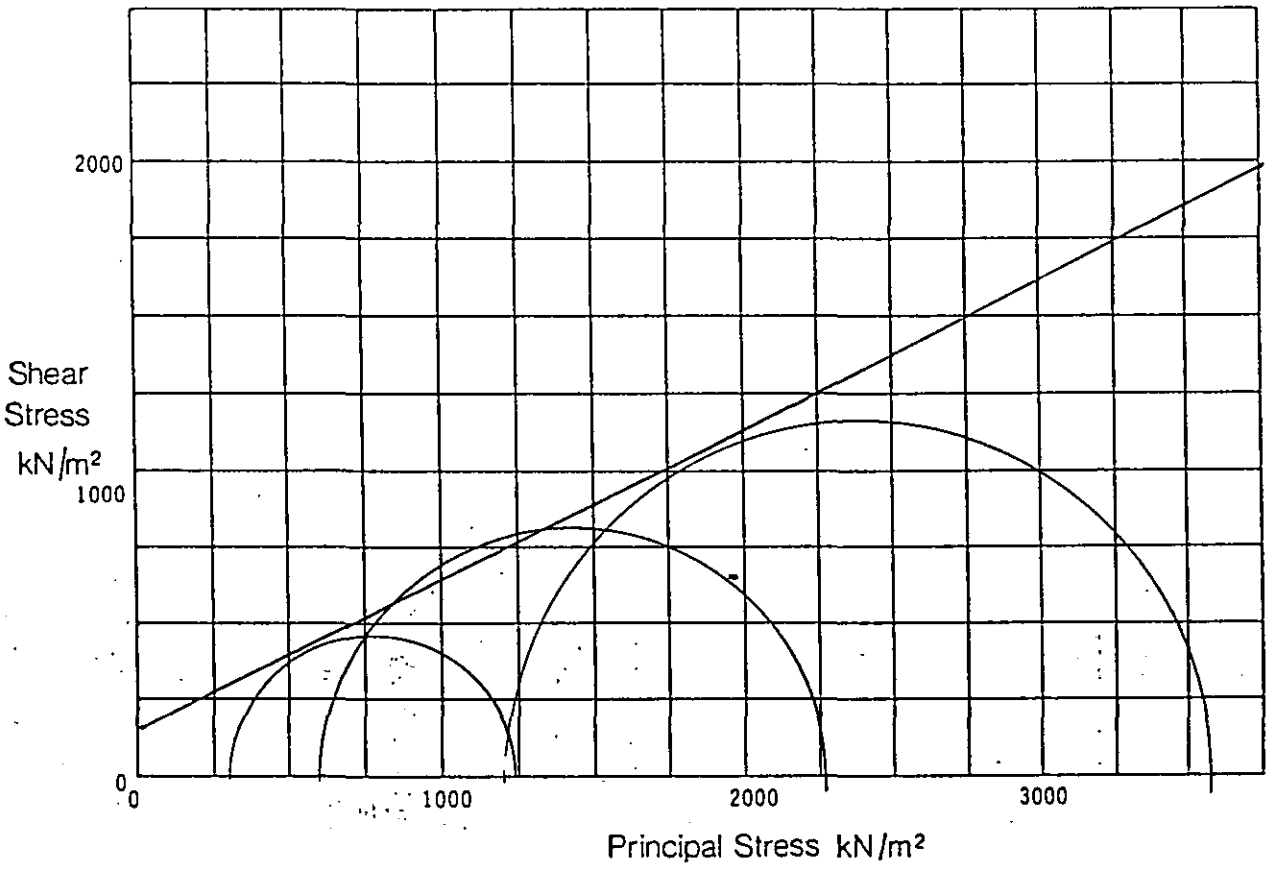
exploration associates

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A42 Castle Donington North
Main Site Investigation - Contract 2

Contract S4449

Figure 2.325

EX3



B	(Initial)		-	-	-	
B_s	(After application of Back Pressure)		-	-	-	
ε	(Rate of Strain)	% min	0.1	0.1	0.1	
σ_3	(Cell Pressure during Shear)	kN/m²	300	600	1200	
u_0	(Applied Back Pressure)	kN/m²	-	-	-	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	-	-	-	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	925	1675	2325	

Triaxial Compression Test
Consolidated
Undrained

Description Red brown and grey green very weak SILTSTONE (KEUPER MARL:ZONE II/III)

Mohr Circles and Summary

C' 150 kN/m²
Φ' 26 Degrees

Depth 12.10 - 12.40
Borehole B271

Remarks HOEK CELL TEST

Laboratory - Effective Stress

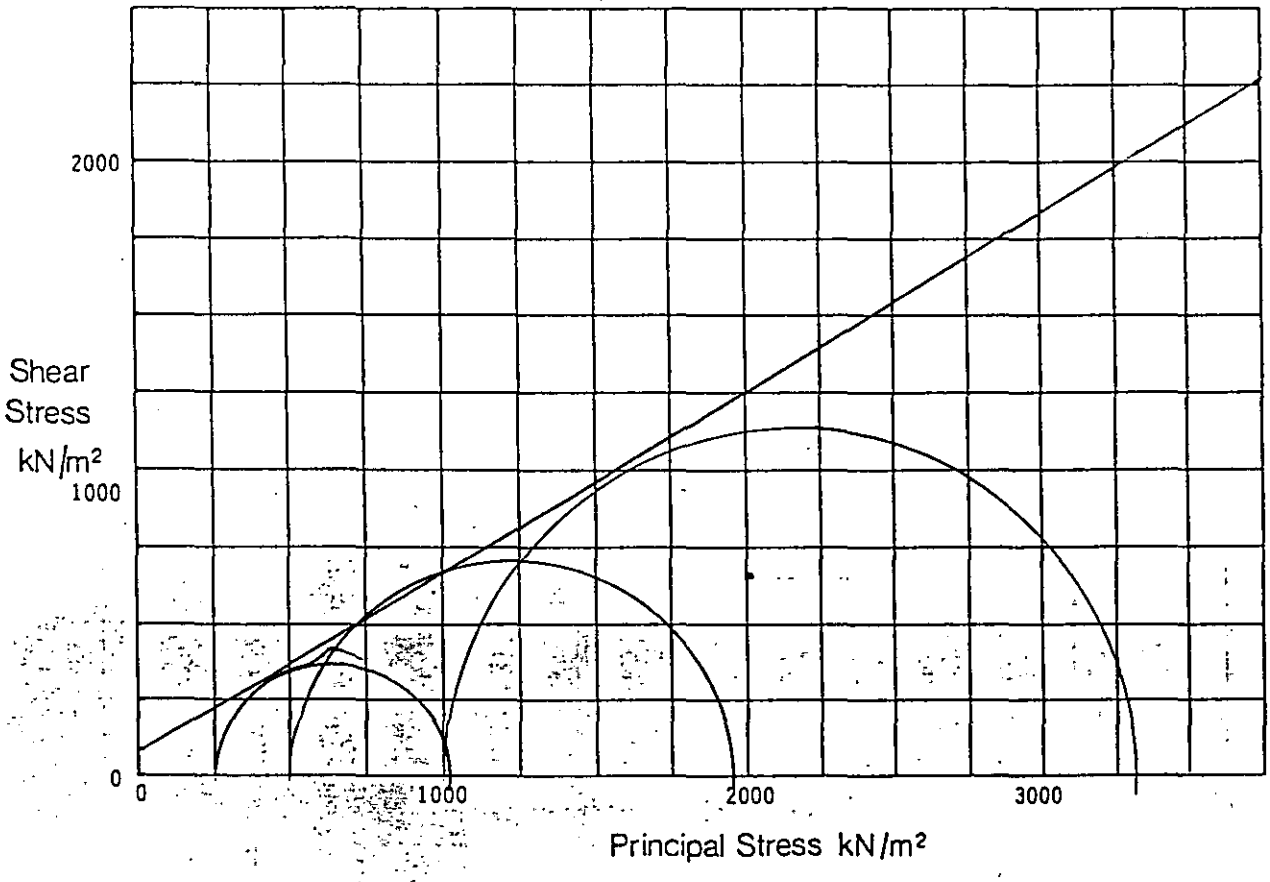
exploration associates

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East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation - Contract 2

Contract S4449

Figure 2.326

EX3



B	(Initial)		-	-	-	
B_s	(After application of Back Pressure)		-	-	-	
ε	(Rate of Strain)	% min	0.1	0.1	0.1	
σ_3	(Cell Pressure during Shear)	kN/m²	250	500	1000	
u_0	(Applied Back Pressure)	kN/m²	-	-	-	
$P'_0 = \sigma_3 - u_0$	Mean effective stress prior to shear=Consolidation Pressure	kN/m²	-	-	-	
$(\sigma_1 - \sigma_3)_f$	(Maximum Deviator Stress)	kN/m²	755	1475	2270	

Triaxial Compression Test Consolidated Undrained	Description Grey green occasionally red brown SILTSTONE (KEUPER MARL:ZONE II) Mohr Circles and Summary	C' 75 kN/m² Φ' 30 Degrees Depth 10.50 - 10.91 Borehole B283
Remarks HOEK CELL TEST		
Laboratory - Effective Stress exploration associates	Project Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449 Figure 2.327

EX3

B.H. No.	DEPTH m	DIAMETER mm	LENGTH mm	DENSITY mg/m³	LOAD AT FAILURE tons	DESCRIPTION	CORRECTED STRENGTH MN/m²
B220	15.27 15.50	76	Sample fractured during preparation			Red brown mottled green grey SILTSTONE (KEUPER MARL : ZONE II)	
	18.88 19.23	76	106	2.09	1.50		3.13
B221	15.21 15.45	76	Sample fractured during preparation			Red brown SILTSTONE (KEUPER MARL : ZONE II)	
B223	18.24 18.49	76	84	2.23	0.50	Red brown very weak clayey SILTSTONE (KEUPER MARL : ZONE III)	1.02

Laboratory – Uniaxial Compression Test

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East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation : Contract 2

Contract S4449

Figure 2.328

EX 4

B.H. No.	DEPTH m	DIAMETER mm	LENGTH mm	DENSITY mg / m³	LOAD AT FAILURE tons	DESCRIPTION	CORRECTED STRENGTH MN / m²
B243	10.87 11.10	76	152	2.29	0.25	Dark red brown mottled light grey green SILTSTONE (KEUPER MARL : ZONE II)	0.55
	13.64 13.86	76	152	2.20	0.25		0.55
B251	11.46 11.70	76	146	2.31	1.00	Red brown and green grey MUDSTONE/SILTSTONE (KEUPER MARL : ZONE II/III	2.18
B257	4.88 5.10	76	Sample fractured during preparation			Red brown very weak SILTSTONE (KEUPER MARL : ZONE II)	
B259	18.53 18.90	76	95	2.22	0.25	Red brown occasionally green grey SILTSTONE (KEUPER MARL : ZONE II/III)	0.52

Laboratory – Uniaxial Compression Test

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A42 Castle Donington North
Main Site Investigation : Contract 2

Contract S4449

Figure 2.329

EX 4

B.H. No.	DEPTH m	DIAMETER mm	LENGTH mm	DENSITY mg/m³	LOAD AT FAILURE tons	DESCRIPTION	CORRECTED STRENGTH MN/m²
B260	6.58 6.80	76	136	2.07	0.50	Dark red brown SILTSTONE (KEUPER MARL : ZONE I/II)	1.08
B267	5.50 5.85	76	93	2.18	0.50	Red brown occasionally green grey SILTSTONE (KEUPER MARL : ZONE II)	1.03
B271	5.73 5.98	76	87	2.27	1.50	Red brown occasionally green grey MUDSTONE (KEUPER MARL : ZONE II/III)	3.06
B284	5.54 5.90	76	120	2.21	0.50	Red brown SILTSTONE (KEUPER MARL : ZONE II/III)	1.06
	13.75 14.12	74	150	2.36	0.25	Red brown occasionally green grey SILTSTONE (KEUPER MARL : ZONE II/III)	0.59

Laboratory – Uniaxial Compression Test

exploration associates

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East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation : Contract 2

Contract S4449

Figure 2.330

B.H. No.	DEPTH m	DIAMETER mm	LENGTH mm	DENSITY mg/m³	LOAD AT FAILURE tons	DESCRIPTION	CORRECTED STRENGTH MN/m²
B286	10.50 10.74	76	152	2.19	2.00	Grey green SILTSTONE (KEUPER MARL : ZONE II)	4.39
B289	6.27 6.56	74	68	2.35	0.50	Red brown SILTSTONE (KEUPER MARL : ZONE II)	1.06

Laboratory – Uniaxial Compression Test	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.331

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m²)	Is (50) MN/m²	Unconfined Compressive Strength MN/m²	Strength Consistency	Description
Bh B219							
19.35-19.51	160	6.00A	0.234	0.30	7.20	MW	Green grey SILTSTONE (KEUPER MARL : ZONE II)
19.35-19.51	76	4.00D	0.693	0.82	19.68	MS	
19.71-19.84	130	7.50A	0.444	0.52	12.48	MW	
19.71-19.84	76	5.60D	0.970	1.20	28.80	MS	
Bh B221							
20.10-20.24	140	10.50A	0.536	0.68	16.32	MS	Green grey SILTSTONE (KEUPER MARL:ZONE II)
20.10-20.24	76	6.60D	1.143	1.38	33.12	MS	

NOTES: VW = Very Weak
W = Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

0.50 A*
1.13 D*

*Average Is (50) MN/m² Value based on the above test results.

Point Load Strength

exploration associates

Project Department of Transport
East Midlands Regional Office
A42 Castle Donnington North
Main Site Investigation Contract2

Contract S4449

Figure 2.332

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m^2)	Is (50) MN/m^2	Unconfined Compressive Strength MN/m^2	Strength Consistency	Description
Bh B220							
16.00-16.11	110	3.20A	0.264	0.32	7.68	MW	
16.00-16.11	76	1.30D	0.225	0.28	6.72	MW	
17.24-17.36	120	0.80A	0.056	0.07	1.68	W	Green grey SILTSTONE (KEUPER MARL : ZONE II)
17.24-17.36	76	0.80D	0.139	0.18	4.32	W	
18.14-18.29	110	23.00A	1.901	2.40	57.50	S	
18.14-18.29	76	6.20D	1.073	1.25	30.00	MS	
18.37-18.50	130	5.00A	0.296	0.38	9.12	MW	
18.37-18.50	76	4.50D	0.779	1.00	24.00	MS	
Bh B221							
14.70-14.83	130	0.70A	0.041	0.05	1.20	VW	Red brown SILTSTONE (KEUPER MARL : ZONE II)
14.70-14.83	76	1.00D	0.173	0.25	6.00	MW	
16.31-16.45	140	1.30A	0.066	0.08	1.92	W	
16.31-16.45	76	1.40D	0.242	0.30	7.20	MW	
16.52-16.66	140	1.50D	0.077	0.09	2.16	W	Green grey SILTSTONE (KEUPER MARL : ZONE II)
16.52-16.66	76	1.00D	0.173	0.25	6.00	MW	
Bh B222							
14.83-14.95	120	0.40A	0.028	0.04	0.96	VW	Red brown SILTSTONE (KEUPER MARL : ZONE II/III)
14.83-14.95	76	0.40D	0.069	0.08	1.92	W	
Bh B224							
18.00-18.15	150	0.40A	0.018	0.025	0.60	VW	Red brown SILTSTONE (KEUPER MARL : ZONE II)
18.15-18.32	170	0.00A	——	——	——	VW	

NOTES:
VW = Very weak
W = Weak
MW = Moderately weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

0.38 A*
0.45 D*
*Average Is (50) MN/m^2 value based on the above test results.

Point Load Strength

exploration associates

Project Department of Transport
East Midlands Regional Office
A42 Castle Donnington North
Main Site Investigation contract 2

Contract: S4449

Figure 2.333

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m^2)	Is (50) MN/m^2	Unconfined Compressive Strength MN/m^2	Strength Consistency	Description
Bh B242							
11.09-11.22	130	8.40A	0.497	0.61	14.64	MS	Grey green SILT-STONE (KEUPER MARL:ZONE II)
11.09-11.22	76	5.90D	1.021	1.20	28.80	MS	
12.44-12.55	110	0.30A	0.025	0.03	0.72	VW	Red brown SILT-STONE (KEUPER MARL:ZONE II)
12.44-12.55	76	0.10D	0.017	0.02	0.48	VW	
Bh B243							
9.37-9.50	130	1.70A	0.101	0.12	2.88	W	Red brown SILT-STONE (KEUPER MARL : ZONE II)
9.37-9.50	76	0.70D	0.121	0.14	3.36	W	
Bh B244							
8.09-8.19	76	0.20D	0.035	0.04	0.96	VW	Red brown SILTSTONE (KEUPER MARL : ZONE I/II)
8.19-8.30	110	0.50A	0.041	0.05	1.20	VW	
12.80-12.90	100	0.50A	0.050	0.06	1,44	W	
12.90-13.00	76	0.20D	0.035	0.04	0.96	VW	
13.19-13.30	110	10.50A	0.868	1.05	25.20	MS	Green grey SILT-STONE (KEUPER MARL : ZONE II)
13.30-13.47	76	3.80D	0.658	0.80	19.20	MS	
14.00-14.12	120	0.40A	0.028	0.04	0.96	VW	Red brown SILT-STONE (KEUPER MARL : ZONE II)
14.12-14.22	76	0.30D	0.052	0.06	1.44	W	
14.70-14.81	110	0.20A	0.017	0.02	0.48	VW	
14.81-14.95	76	0.30D	0.052	0.06	1.44	W	
Bh B245							
11.30-11.42	120	0.40A	0.028	0.04	0.96	VW	Red brown SILT-STONE (KEUPER MARL : ZONE I/II)
11.42-11.54	76	0.10D	0.017	0.02	0.48	VW	

NOTES:
VW = Very Weak
W = Weak
MW = Moderately Weak
MS = Moderately Strong
S= Strong
A = Axial
D = Diametral

Point Load Strength

exploration associates

Project Department of Transport
East Midlands Regional Office
A42 Castle Donnington North
Main Site Investigation Contract 2

Contract: S4449

Figure 2.334

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m^2)	Is (50) MN/m^2	Unconfined Compressive Strength MN/m^2	Strength Consistency	Description
Bh B245							
12.73-12.83	100	4.70A	0.470	0.61	14.64	MS	Green grey SILTSTONE (KEUPER MARL : ZONE I/II)
12.83-13.00	76	4.60D	0.796	1.00	24.00	MS	

NOTES: VW = Very Weak
W = Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A= Axial
D= Diametral

0.263A*
0.338D*

* Average Is (50) MN/m^2 Value based on the above test results.

Point Load Strength

exploration associates

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East Midlands Regional Office
A42 Castle Donnington North
Main Site Investigation Contract 2

Contract: S4449

Figure 2.335

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m^2)	Is (50) MN/m^2	Unconfined Compressive Strength MN/m^2	Strength Consistency	Description
Bh B243							
13.00-13.12	120	4.00A	0.278	0.38	9.12	MW	Green grey SILT-STONE (KEUPER MARL : ZONE I)
13.00-13.12	76	2.20D	0.381	0.45	10.80	MW	
14.78-14.92	140	0.10A	0.005	0.006	0.144	VW	Red brown SILT-STONE (KEUPER MARL : ZONE III)
14.78-14.92	76	0.00D	———	———	———		
Bh B244							
9.84-9.94	100	2.00 A	0.200	0.25	6.00	MW	Red brown SILTSTONE (KEUPER MARL : ZONE I)
9.94-10.04	76	2.30D	0.398	0.47	11.28	MW	
10.97-11.07	76	0.40D	0.069	0.08	1.92	W	
11.07-11.19	120	0.40A	0.028	0.04	0.96	VW	
11.55-11.65	76	0.00D	———	———	———		
11.65-11.77	120	0.30D	0.021	0.03	0.72	VW	

NOTES: VW = Very Weak
W = Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A= Axial
D= Diametral

0.141 A*
0.333 D*

* Average Is(50) MN/m^2 Value based on the above test results

Point Load Strength

exploration associates

Project Department of Transport
East Midlands Regional Office
A42 Castle Donnington North
Main Site Investgiation Contract 2

Contract: S4449

Figure 2.336

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m^2)	Is (50) MN/m^2	Unconfined Compressive Strength MN/m^2	Strength Consistency	Description
Bh B248							
9.33-9.44	110	0.20A	0.017	0.03	0.72	VW	Red brown SILT-STONE (KEUPER MARL : ZONE III)
9.44-9.56	76	0.10D	0.017	0.03	0.72	VW	
Bh B249							
12.60-12.71	110	10.60A	0.876	1.10	26.40	MS	Green grey SILT-STONE (KEUPER MARL : ZONE II)
12.71-12.88	76	2.90D	0.502	0.60	14.40	MS	
Bh B250							
9.24-9.37	76	1.60D	0.277	0.36	8.64	MW	Green grey SILT-STONE (KEUPER MARL : ZONE II)
9.46-9.56	100	3.80A	0.380	0.47	11.28	MW	
10.15-10.25	100	0.20A	0.020	0.03	0.72	VW	Red brown SILT-STONE (KEUPER MARL : ZONE II)
10.25-10.35	76	0.30D	0.052	0.06	1.44	W	
12.64-12.74	100	15.00A	1.500	1.90	45.6	MS	Green grey SILT-STONE (KEUPER MARL : ZONE II)
12.74-12.84	76	8.00D	1.385	1.70	40.80	MS	
14.49-14.60	110	0.20A	0.017	0.03	0.72	VW	Red brown SILT-STONE (KEUPER MARL : ZONE II)
14.60-14.70	76	0.20D	0.035	0.04	0.96	VW	
Bh B251							
9.37-9.48	110	0.80A	0.066	0.08	1.92	W	Red brown SILT-STONE (KEUPER MARL : ZONE II/III)
9.37-9.48	76	1.20D	0.208	0.26	6.24	MW	
12.10-12.20	100	2.60A	0.260	0.32	7.68	MW	Green grey SILTSTONE (KEUPER MARL : ZONE II/III)
12.20-12.30	76	2.00D	0.346	0.40	9.60	MW	
13.70-13.80	100	16.00A	1.600	2.00	48.00	MS	
13.80-13.90	76	10.00	1.731	2.10	50.40	S	

NOTES: VW = Very Weak
W = Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

Point Load Strength

exploration associates

Project Department of Transport
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A42 Castle Donnington North
Main Site Investigation Contract 2

Contract: S4449

Figure 2.337

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m^2)	Is (50) MN/m^2	Unconfined Compressive Strength MN/m^2	Strength Consistency	Description
BH B252							
16.61-16.72	110	0.30A	0.025	0.03	0.72	VW	Red brown SILT-STONE (KEUPER MARL : ZONE II/III)
16.72-16.83	76	0.20D	0.035	0.04	0.96	VW	

NOTES:
VW = Very Weak
W = Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

0.616 A*
0.559D*

*Average Is(50) MN/m^2 Value based on the above test results.

Point Load Strength

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East Midlands Regional Office
A42 Castle Donnington North
Main Investigation Site Contract 2

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Figure 2.338

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m^2)	Is (50) MN/m^2	Unconfined Compressive Strength MN/m^2	Strength Consistency	Description
Bh 8257							
6.80-6.90	100	0.30A	0.030	0.04	0.96	VW	
6.90-7.00	76	0.10D	0.017	0.03	0.72	VW	
8.24-8.34	100	1.40A	0.140	0.20	4.80	W	Red brown SILTSTONE (KEUPER MARL : ZONE II)
9.20-9.30	100	3.00A	0.300	0.38	9.12	MW	
9.30-9.40	76	1.30D	0.225	0.28	6.72	MW	
12.20-12.30	100	0.60A	0.060	0.07	1.68	W	
12.30-12.40	76	0.50D	0.087	0.11	2.64	W	
Bh 8258							
4.90-5.00	100	0.20A	0.020	0.03	0.72	VW	
5.00-5.10	76	0.10D	0.017	0.03	0.72	VW	
6.58-6.70	120	0.20A	0.014	0.03	0.72	VW	Red brown SILTSTONE (KEUPER MARL : ZONE II)
6.70-6.84	76	0.00D	-	-	-	-	
9.43-9.55	120	0.60A	0.042	0.05	1.20	VW	
9.74-9.85	76	0.40D	0.069	0.08	1.92	W	
Bh 8260							
5.63-5.73	100	1.20A	0.120	0.14	3.36	W	
5.73-5.83	76	0.10D	0.017	0.03	0.72	VW	Red brown SILTSTONE (KEUPER MARL : ZONE I/II
9.95-10.06	110	1.10A	0.091	0.11	2.64	W	
10.23-10.36	76	1.30D	0.225	0.26	6.72	MW	
10.60-10.73	130	0.20A	0.012	0.02	0.48	VW	
13.44-13.54	100	2.30A	0.230	0.30	7.20	MW	Grey Green SILTSTONE (KEUPER MARL : ZONE I/II)
13.54-13.65	76	1.30D	0.225	0.30	7.20	MW	

NOTES:

W = Weak
VW = Very Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

0.12A*
0.13D*

* Average Is(50)MN/m^2 value based on the above test results.

Point Load Strength

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Project Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation : Contract 2

Contract: S4449

Figure 2.339

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m²)	Is (50) MN/m²	Unconfined Compressive Strength MN/m²	Strength Consistency	Description
Bh B256							
13.00-13.10	76	3.90D	0.675	0.80	19.20	MS	Grey green SILTSTONE (KEUPER MARL : ZONE II/III)
13.10-13.23	130	4.70A	0.278	0.36	8.64	MW	
Bh B263							
16.00-16,11	110	1.20A	0.099	0.12	2.88	W	Red brown SILTSTONE (KEUPER MARL : ZONE II/III)
16.00-16.11	76	1.00D	0.173	0.24	5.76	MW	
18.50-18.60	100	0.30A	0.030	0.04	0.96	VW	
18.50-18.60	76	0.20D	0.035	0.04	0.96	VW	Grey green
19.43-19.53	100	2.00A	0.200	0.25	6.00	MW	Grey Green SILTSTONE (KEUPER MARL : ZONE II/III
19.43-19.53	76	2.00D	0.346	0.40	9.60	W	
19.61-19.74	130	1.00A	0.059	0.08	1.92	W	Red brown SILTSTONE (KEUPER MARL : ZONE II/III
19.74-19.89	76	0.02D	0.035	0.04	0.96	VW	

NOTES:

W = Weak
VW = Very Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

* A = Axial
* D = Diametral

0.17A*
0.30D*

* Average Is(50)MN/m² based on the above test results.

Point Load Strength

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Project Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation : Contract 2

Contract S4449

Figure 2.340

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m²)	Is (50) MN/m²	Unconfined Compressive Strength MN/m²	Strength Consistency	Description
Bh B254							
17.30-17.40	100	0.10A	0.010	0.01	0.24	VW	Red brown SILTSTONE (KEUPER MARL : ZONE III)
17.40-17.52	76	0.10D	0.017	0.02	0.48	VW	
17.60-17.70	100	3.90A	0.390	0.50	12.00	MW	Grey Green SILTSTONE (KM Z II/III
Bh B256							
15.30-15.43	130	0.20A	0.012	0.02	0.48	VW	Red brown SILTSTONE (KEUPER MARL : ZONE II/III
15.30-15.43	76	0.10D	0.017	0.02	0.48	VW	
Bh B259							
15.66-15.77	110	0.20A	0.017	0.02	0.48	VW	Red brown SILTSTONE (KEUPER MARL : ZONE II/III)
15.77-15.90	76	0,40D	0.069	0.08	1.92	W	
15.90-16.03	130	0.20A	0.012	0.02	0.48	VW	
18.69-18.82	130	0.20A	0.012	0.02	0.48	VW	
18.82-18.94	76	0.10D	0.017	0.02	0.48	VW	

NOTES:

W = Weak
VW = Very Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

0.09A*
0.04D*

* Average Is(50)MN/m² value based on the above test results.

Point Load Strength

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Project Department of Transport
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A42 Castle Donington North
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Figure 2,341

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m²)	Is (50) MN/m²	Unconfined Compressive Strength MN/m²	Strength Consistency	Description
Bh B256							
18.00-18.10	76	0.10D	0.017	0.02	0.48	VW	Red brown SILTSTONE (KEUPER MARL : ZONE II/III)
18.10-18.23	130	0.40A	0.024	0.03	0.72	VW	
18.25-18.35	100	0.20A	0.20	0.03	0.72	VW	
18.35-18.45	76	0.30D	0.052	0.06	1.44	W	
19.90-20.00	100	1.70A	0.170	0.25	6.00	MW	Grey green SILTSTONE (KEUPER MARL : ZONE II/III
19.90-20.00	76	0.50D	0.087	0.11	2.64	W	
Bh B257							
18.10-18.22	120	0.20A	0.014	0.02	0.48	VW	Red brown SILTSTONE (KEUPER MARL: ZONE II)
18.22-18.35	76	0.00D	-	-	-	-	
19.25-19.37	120	0.30A	0.021	0.03	0.72	VW	
19.37-19.50	76	0.10D	0.017	0.02	0.48	VW	

NOTES:

W = Weak
VW = Very Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

0.07A*
0.05D*

* Average Is(50)MN/m² value based on the above test results.

Point Load Strength

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Main Site Investigation : Contract 2

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Figure 2.342

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m^2)	Is (50) MN/m^2	Unconfined Compressive Strength MN/m^2	Strength Consistency	Description
Bh B266							
9.50-9.60	100	2.70A	0.270	0.38	9.12	MW	Red brown SILTSTONE (KEUPER MARL : ZONE II/III)
10.22-10.34	120	0.50A	0.035	0.04	0.96	VW	
10.34-10.45	76	0.10D	0.017	0.02	0.48	VW	
11.09-11.20	110	0.20A	0.017	0.02	0.48	VW	
12.20-12.32	120	2.30A	0.160	0.20	4.80	W	
12.32-12.46	76	0.60D	0.104	0.14	3.36	W	
13.24-13.36	120	0.10A	0.007	0.10	2.40	W	
13.36-13.46	76	0.60D	0.104	0.14	3.36	W	
14.48-14.58	100	4.00A	0.400	0.50	12.00	MW	Grey green SILTSTONE (KEUPER MARL: ZONE II/III)
14.58-14.69	76	0.80D	0.139	0.20	4.80	W	
14.69-14.81	120	4.00A	0.278	0.39	9.36	MW	
Bh B267							
6.10-6.20	100	1.80A	0.180	0.20	4.80	W	Red brown SILTSTONE (KEUPER MARL ZONE II)
6.20-6.34	76	0.40D	0.069	0.08	1.92	W	
7.00-7.15	76	0.20D	0.035	0.04	0.96	VW	
7.15-7.25	100	1.20A	0.120	0.20	4.80	W	
10.76-10.86	100	0.60A	0.060	0.08	1.92	W	
10.86-11.00	76	0.10D	0.017	0.02	0.48	VW	
13.35-13.45	100	0.40A	0.040	0.05	1.20	VW	
13.45-13.55	76	0.10D	0.017	0.02	0.48	VW	
13.55-13.66	110	3.80A	0.314	0.39	9.36	MW	Grey green SILTSTONE (KEUPER MARL: ZONE II)
13.66-13.76	100	2.60D	0.260	0.32	7.68	MW	
15.19-15.34	76	2.10D	0.363	0.42	10.08	MW	

NOTES:
W = Weak
VW = Very Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong
A = Axial
D = Diametral

Point Load Strength

exploration associates

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A42 Castle Donington North
Main Site Investigation : Contract 2

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Figure 2343

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m²)	Is (50) MN/m²	Unconfined Compressive Strength MN/m²	Strength Consistency	Description
Bh B267							
15.65-15.80	140	6.60A	0.337	0.40	9.60	MW	Grey green SILT-STONE (KM Z II)
17.74-17.86	120	0.10A	0.007	0.01	0.24	VW	Red brown SILTSTONE (KEUPER MARL : ZONE II)
17.86-18.00	76	0.00D	-	-	-	-	
Bh B270							
9.32-9.44	120	1.30A	0.090	0.11	2.64	W	Red brown SILT-STONE (KM Z II/III)
Bh B271							
9.70-9.80	100	0.20A	0.020	0.03	0.72	VW	Red brown SILTSTONE (KEUPER MARL : ZONE II/III)
9.80-9.90	76	0.20D	0.035	0.04	0.96	VW	
Bh B274							
8.20-8.30	100	0.20A	0.020	0.03	0.72	VW	Red brown SILTSTONE (KEUPER MARL : ZONE II)
8.30-8.44	76	0.00D	-	-	-	-	

NOTES:
W = Weak
VW = Very Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

0.18A*
0.13D*

* Average Is(50)MN/m² value based on the above test results.

Point Load Strength

exploration associates

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A42 Castle Donington North
Main Site Investigation : Contract 2

Contract S4449

Figuro 2,344

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m²)	Is (50) MN/m²	Unconfined Compressive Strength MN/m²	Strength Consistency	Description
Bh B271							
12.65-12.77	120	4.40A	0.306	0.38	9.12	MW	Grey green SILTSTONE (KEUPER MARL: ZONE II/III)
12.77-12.90	76	2.80D	0.485	0.60	14.40	MS	
13.73-13.84	110	6.80A	0.562	0.68	16.32	MS	
13.91-14.04	76	5.30D	0.918	1.10	26.40	MS	
Bh B273							
10.00-10.10	100	0.20A	0.020	0.03	0.72	VW	Red brown SILTSTONE (KEUPER MARL : ZONE II/III)
10.10-10.20	76	0.10D	0.017	0.02	~0.48	VW	
12.05-12.15	76	0.50D	0.087	0.10	2.40	W	
12.30-12.40	100	0.20A	0.020	0.03	0.72	VW	
16.30-16.42	120	1.20A	0.083	0.10	2.40	W	
16.42-16.54	76	0.40D	0.069	0.08	1.92	W	

NOTES:

W = Weak
VW = Very Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

0.24A*
0.32D*

* Average Is(50)MN/m² value based on the above test results.

Point Load Strength

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Figure 2.345

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m^2)	Is (50) MN/m^2	Unconfined Compressive Strength MN/m^2	Strength Consistency	Description
Bh B271							
17.30-17.42	120	1.00A	0.069	0.08	1.92	W	Red brown SILTSTONE (KEUPER MARL: ZONE II/III
18.10-18.20	100	1.50A	0.150	0.20	4.80	W	Grey green SILTSTONE (KEUPER MARL : ZONE II)
18.20-18.32	76	2.20D	0.381	0.48	11.52	MW	
Bh B274							
12.64-12.78	76	1.70D	0.294	0.37	8.88	MW	Red brown SILTSTONE (KEUPER MARL : ZONE II)
12.96-13.09	130	2.20A	0.130	0.17	4.08	W	
14.86-14.97	110	2.40A	0.198	0.28	6.72	MW	
14.97-15.10	76	1.60D	0.277	0.33	7.92	MW	
15.42-15.52	100	2.70A	0.270	0.35	8.40	MW	
15.52-15.62	100	1.40D	0.140	0.18	4.32	W	
17.74-17.85	110	1.60A	0.132	0.17	4.08	W	Grey green SILTSTONE (KEUPER MARL : ZONE II)
17.85-17.96	76	0.50D	0.087	0.10	2.40	W	

NOTES:

W = Weak
VW = Very Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

0.21A*
0.29D*

* Average Is(50)MN/m^2 value based on the above test results.

Point Load Strength

exploration associates

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A42 Castle Donington North
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Figure 2.346

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m^2)	Is (50) MN/m^2	Unconfined Compressive Strength MN/m^2	Strength Consistency	Description
Bh B282							
7.60-7.72	120	0.20A	0.014	0.02	0.48	VW	Red brown SILTSTONE (KEUPER MARL: ZONE II)
7.72-7.82	76	0.00D	-	-	-	-	
10.08-10.19	110	0.10A	0.008	0.01	0.24	VW	
10.19-10.30	76	0.00D	-	-	-	-	
Bh B283							
3.97-4.07	100	1.00A	0.100	0.13	3.12	W	Red brown SILTSTONE (KEUPER MARL: ZONE II)
4.07-4.18	76	1.20D	0.208	0.26	6.24	MW	
6.50-6.62	76	0.20D	0.035	0.04	0.96	VW	
Bh B284							
8.59-8.70	110	0.20A	0.017	0.02	0.48	VW	Red brown SILTSTONE (KEUPER MARL: ZONE II/III)
8.70-8.82	76	0.00D	-	-	-	-	
10.30-10.40	100	0.10A	0.010	0.02	0.48	VW	
10.40-10.50	76	0.10D	0.017	0.02	0.48	VW	
11.40-11.50	100	1.20A	0.120	0.15	3.60	W	
11.50-11.64	76	0.10D	0.017	0.02	0.48	VW	
Bh B287							
7.40-7.50	100	0.40A	0.040	0.05	1.20	VW	Red brown SILTSTONE (KEUPER MARL: ZONE II)
9.60-9.72	120	1.30A	0.090	0.11	2.64	W	
9.72-9.84	120	0.40D	0.028	0.04	0.96	VW	

NOTES:

W = Weak
VW = Very Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

Point Load Strength

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Figure 2.347

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m²)	Is (50) MN/m²	Unconfined Compressive Strength MN/m²	Strength Consistency	Description
Bh B289							
7.71-7.81	100	2.00A	0.200	0.26	6.24	MW	Red brown SILTSTONE (KEUPER MARL : ZONE II)
7.81-7.91	76	1.60D	0.277	0.32	7.68	MW	
8.50-8.60	100	1.00A	0.100	0.13	3.12	W	
8.60-8.71	76	0.20D	0.035	0.04	0.96	VW	

NOTES:

W = Weak
VW = Very Weak
MW = Moderately Weak
MS = Modecately Strong
S = Strong

A = Axial
D = Diametral

0.09A*
0.12D*

* Average Is(50)MN/m² value based on the above test results.

Point Load Strength

exploration associates

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Figure 2.348

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m²)	Is (50) MN/m²	Unconfined Compressive Strength MN/m²	Strength Consistency	Description
Bh B282							
10.50-10.52	20	6.70A	16.750	7.00	168.00	VS	Grey green SILTSTONE (KEUPER MARL: ZONE II)
10.52-10.64	76	5.70D	0.987	1.20	28.80	MS	
12.05-12.17	120	12.00A	0.833	1.00	24.00	MS	
12.17-12.29	76	14.00D	2.424	2.80	67.20	S	
Bh B284							
11.64-11.76	120	2.60A	0.181	0.26	6.24	MW	Grey green SILTSTONE (KEUPER MARL ZONE II)
11.76-11.88	76	1.10D	0.190	0.26	6.24	MW	
13.08-13.19	110	21.00A	1.736	2.00	48.00	MS	
13.19-13.30	76	17.00D	2.943	3.60	86.40	S	
Bh B287							
10.96-11.07	110	3.00A	0.248	0.32	7.68	MW	Grey green SILTSTONE (KEUPER MARL ZONE: I)
11.07-11.19	76	1.60D	0.277	0.36	8.64	MW	

NOTES:

W = Weak
VW = Very Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong
VS = Very Strong

A = Axial
D = Diametral

2.12A*
1.64D*

* Average Is(50)MN/m² value based on the above test resutlts.

Point Load Strength

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Figure 2.349

EX 4

Depth (m)	Distance Between Platens (mm)	Failure Load (kN)	(Is) Point Load Strength (Is) (MN/m²)	Is (50) MN/m²	Unconfined Compressive Strength MN/m²	Strength Consistency	Description
Bh B282							
15.38-15.50	120	0.60A	0.042	0.05	1.20	VW	Red brown SILTSTONE (KEUPER MARL : ZONE II)
15.38-15.50	76	0.60D	0.104	0.14	3.36	W	
16.14-16.25	110	0.30A	0.025	0.03	0.72	VW	
16.25-16.37	76	0.10D	0.017	0.02	0.48	VW	
17.27-17.37	100	1.10A	0.110	0.15	3.60	W	
17.37-17.47	76	0.40D	0.069	0.08	1.92	W	
19.50-19.62	120	1.70A	0.118	0.15	3.60	W	Grey green SILTSTONE (KEUPER MARL: ZONE II)
19.62-19.72	76	1.00D	0.173	0.25	6.00	MW	
Bh B284							
16.27-16.38	110	0.80A	0.066	0.08	1.92	W	Red brown SILTSTONE (KEUPER MARL : ZONE II/III)
16.38-16.50	76	0.10D	0.017	0.02	0.48	VW	
18.10-18.20	100	0.60A	0.060	0.08	1.92	W	
18.20-18.30	76	0.20D	0.035	0.04	0.96	VW	
19.10-19.21	110	0.30A	0.025	0.03	0.72	VW	
19.21-19.33	76	0.40D	0.069	0.08	1.92	W	
Bh B287							
14.79-14.89	100	0.60A	0.060	0.08	1.92	W	Red brown SILTSTONE (KEUPER MARL: ZONE II)
14.89-15.00	76	0.10D	0.017	0.02	0.48	VW	
15.86-15.97	110	1.40A	0.116	0.15	3.60	W	
15.97-16.08	76	0.20D	0.035	0.04	0.96	VW	
18.50-18.60	100	0.80A	0.080	0.10	2.40	W	
18.60-18.70	76	0.20D	0.035	0.04	0.96	VW	

NOTES:

W = Weak
VW = Very Weak
MW = Moderately Weak
MS = Moderately Strong
S = Strong

A = Axial
D = Diametral

0.09A*
0.07D*

* Average Is(50)MN/m² value based on the above test results.

Point Load Strength

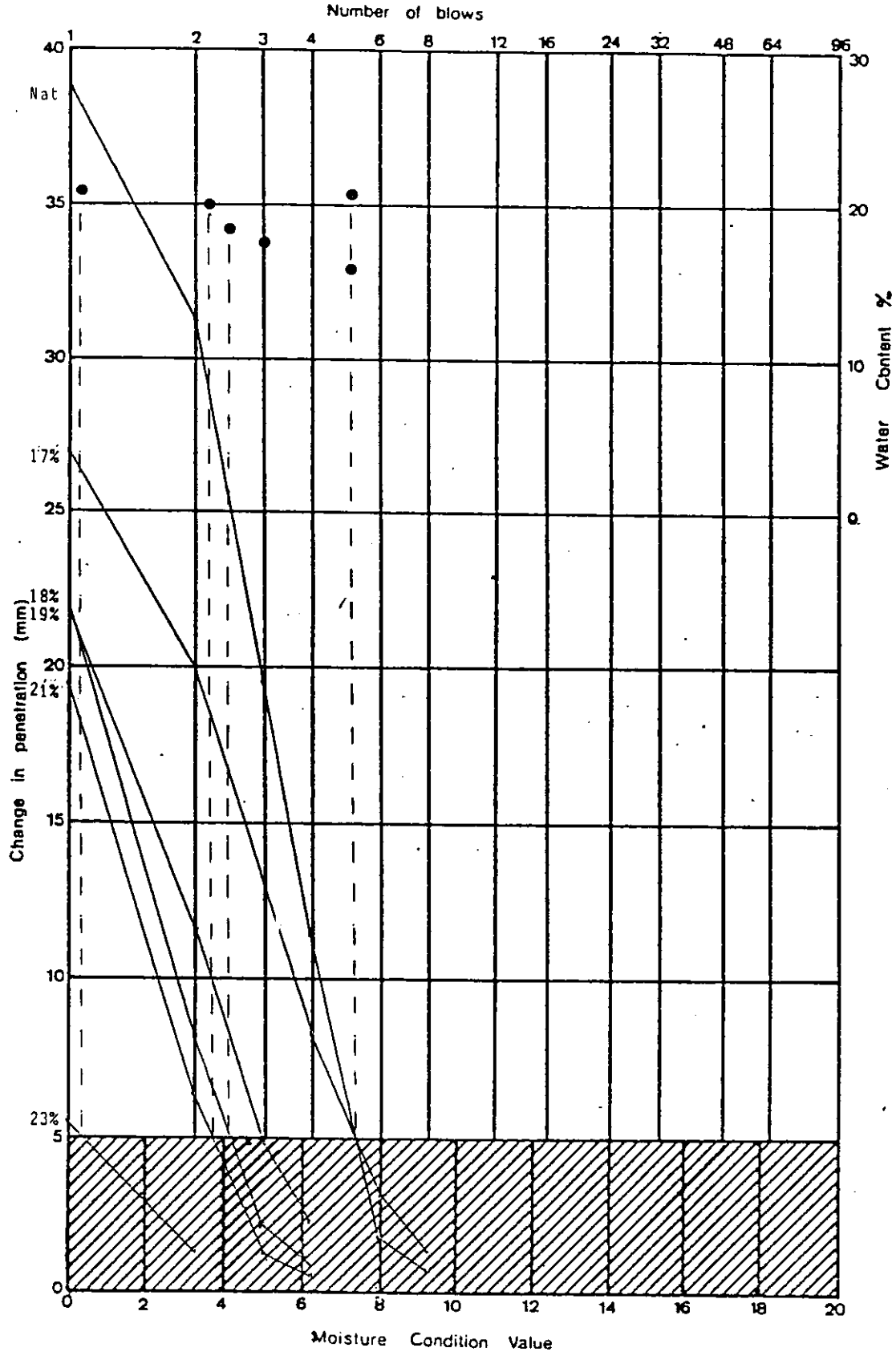
exploration associates

Project: Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation : Contract 2

Contract S4449

Figure 2.350

EX 4



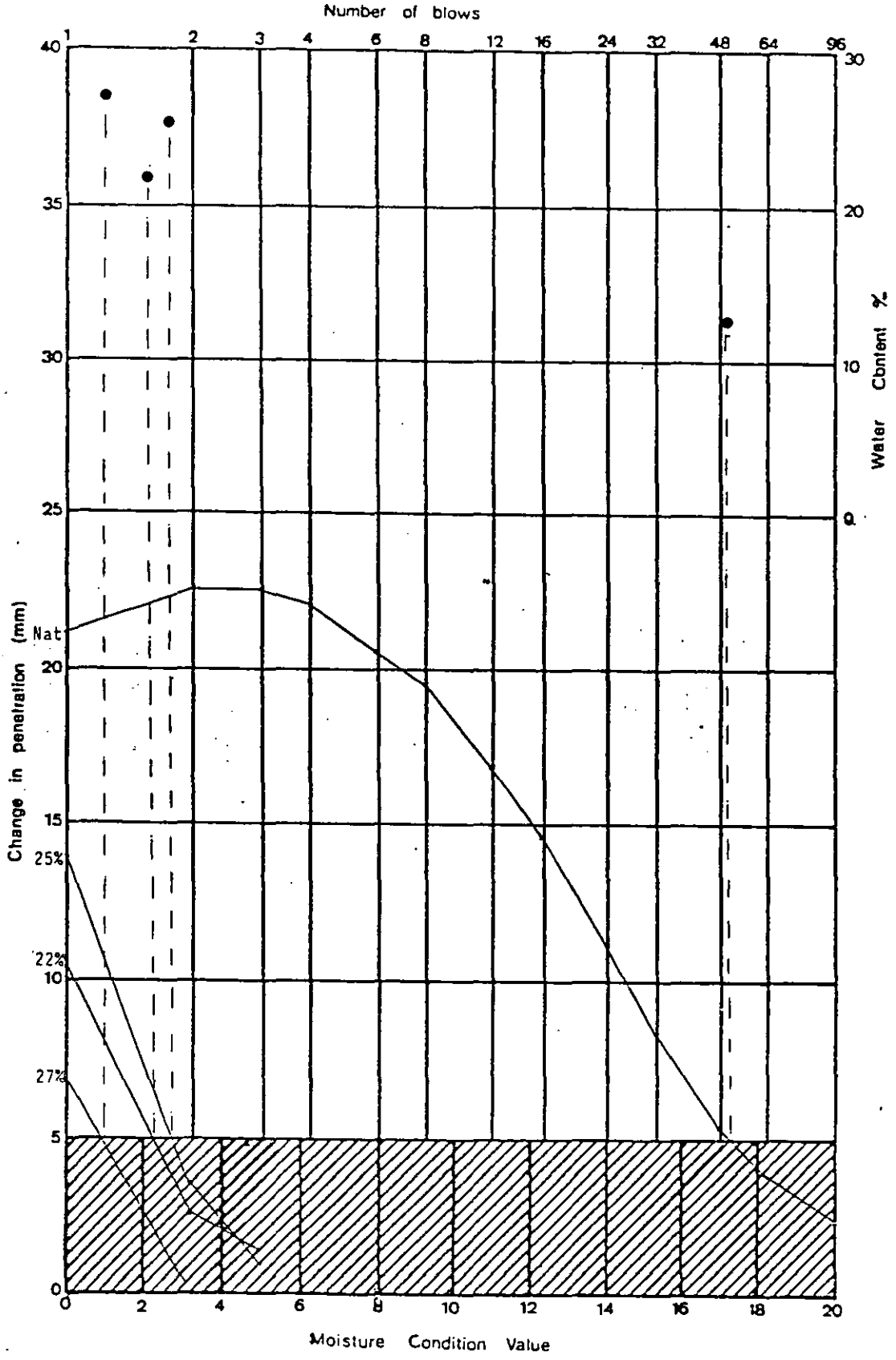
Firm brown very silty CLAY with occasional gravel and carbonaceous traces.
(GLACIAL TILL)

Borehole 235

Depth 2.50 - 3.00

Moisture Condition Value	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449
exploration associates		**Figure** 2.351

EX 4



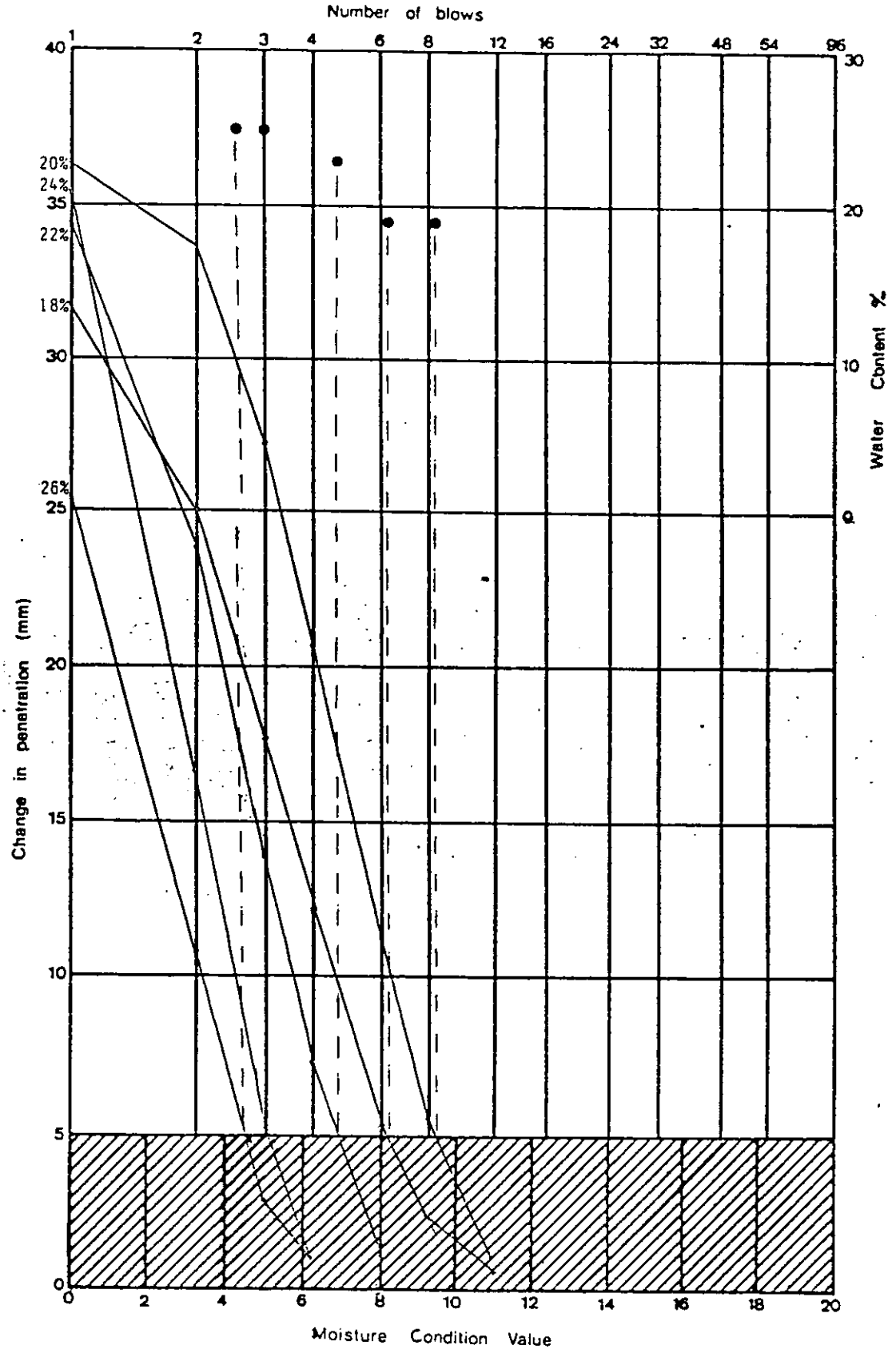
Stiff red brown and grey green
silty CLAY with occasional gravel
(KEUPER MARL : ZONE III)

Borehole 239

Depth 0.50 - 2.45

Moisture Condition Value	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract 54449
exploration associates		**Figure** 2.352

EX 4



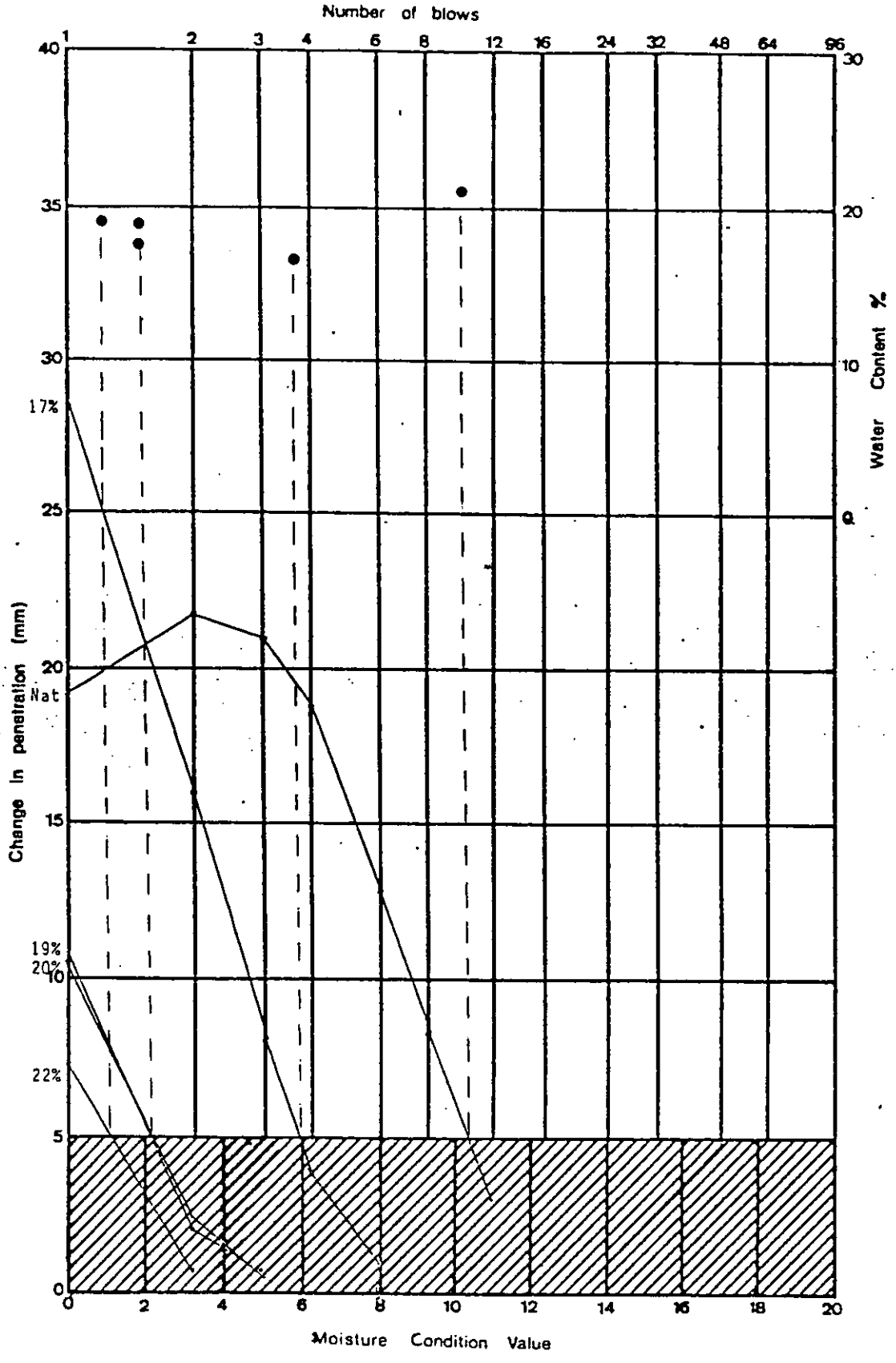
Firm and stiff red brown silty CLAY
with some mudstone fragments
(KEUPER MARL : ZONE III)

Borehole 241

Depth 1.00 - 1.50

Moisture Condition Value	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449
exploration associates		**Figure** 2.353

EX 4



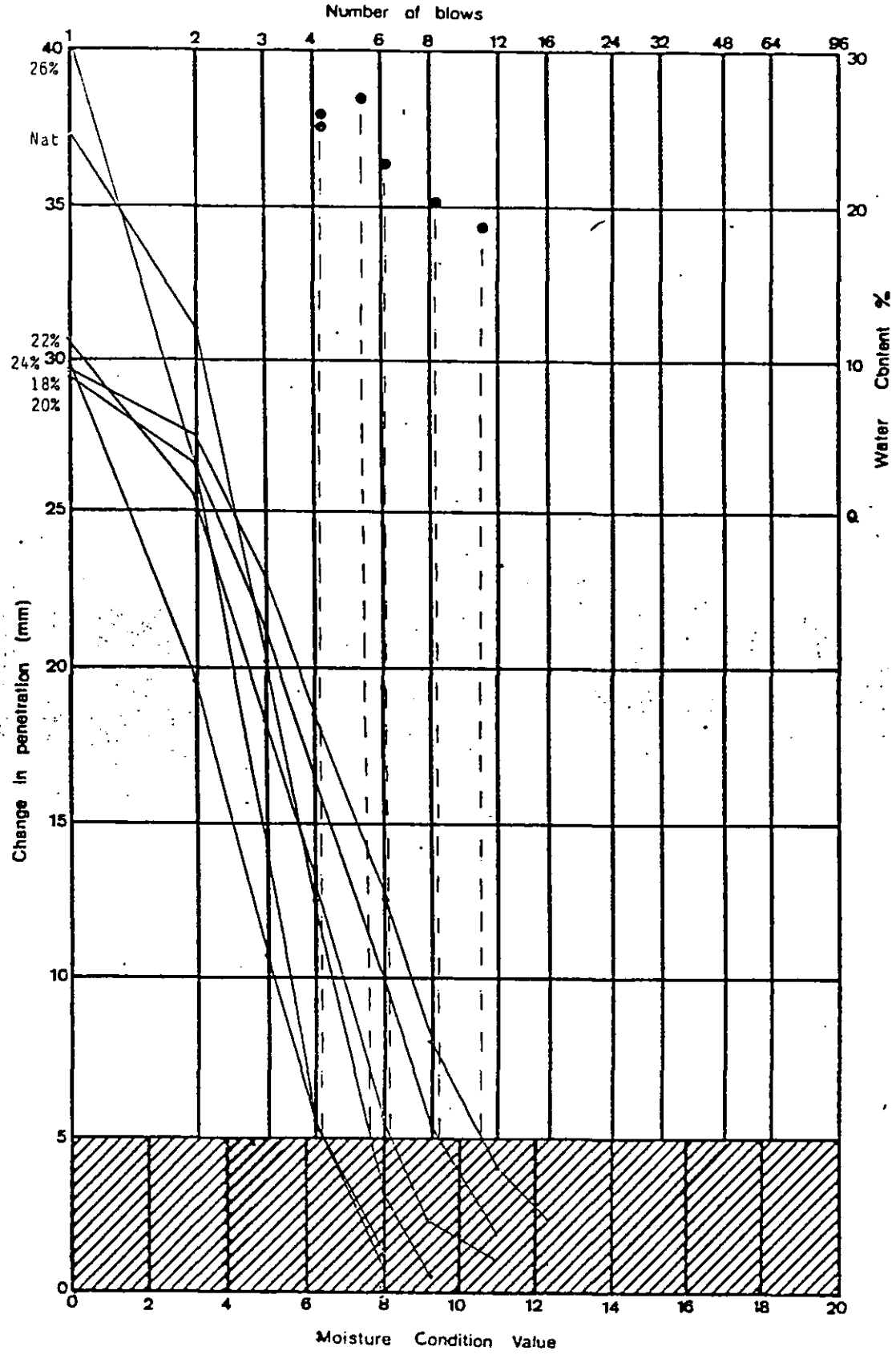
Stiff red brown occasionally grey green silty slightly sandy CLAY with some gravel and sand.
(GLACIAL:TILL)

Trial Pit 438

Depth 0.80

Moisture Condition Value	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 3	Contract S4449
exploration associates		**Figure** 2.354

EX 4



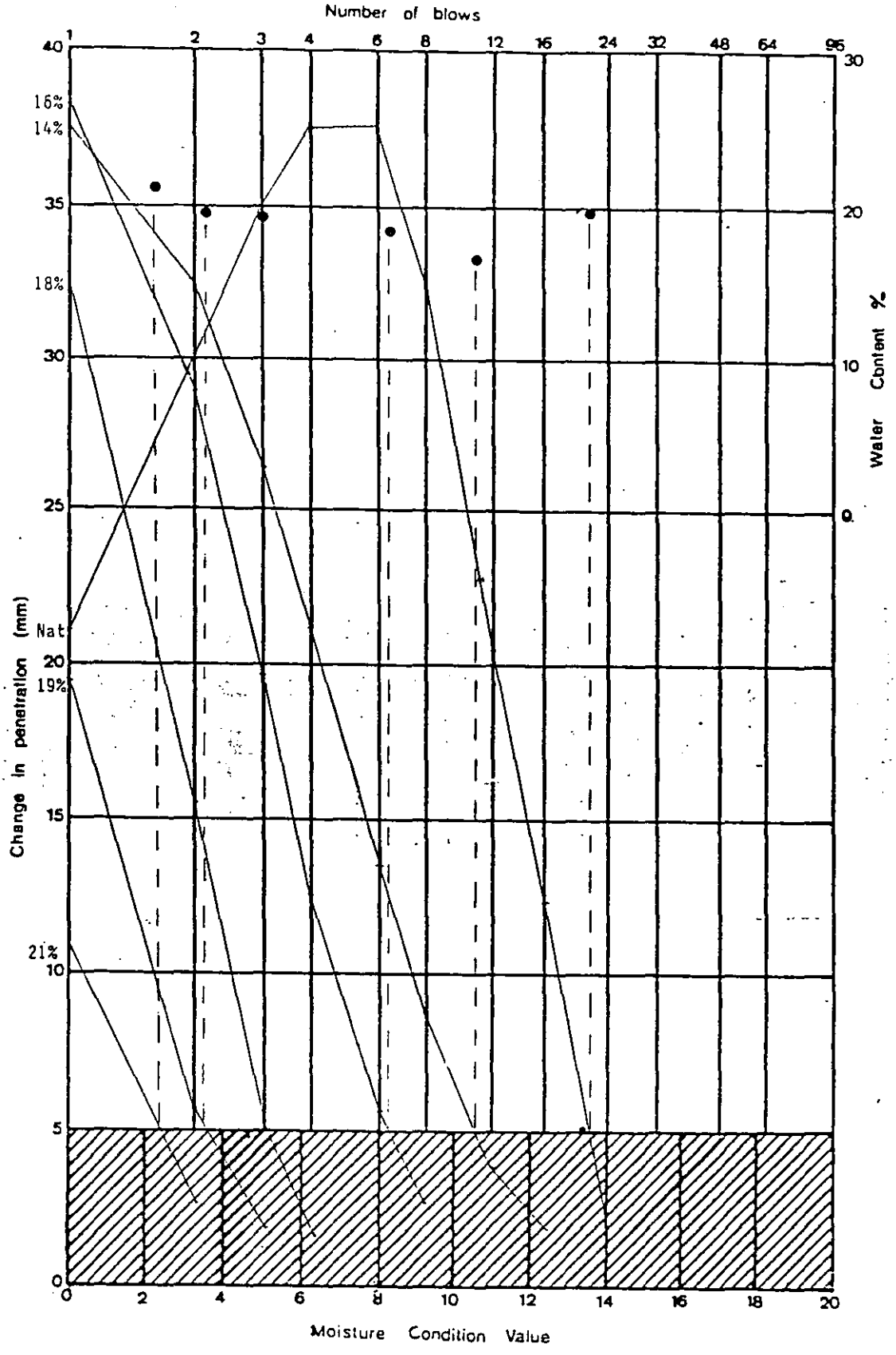
Firm to stiff red brown and green grey
very silty CLAY with siltstone fragments
(KEUPER MARL : ZONE IV)

Trial Pit 438

Depth 2.40

Moisture Condition Value	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449
exploration associates		**Figure** 2.355

EX 4



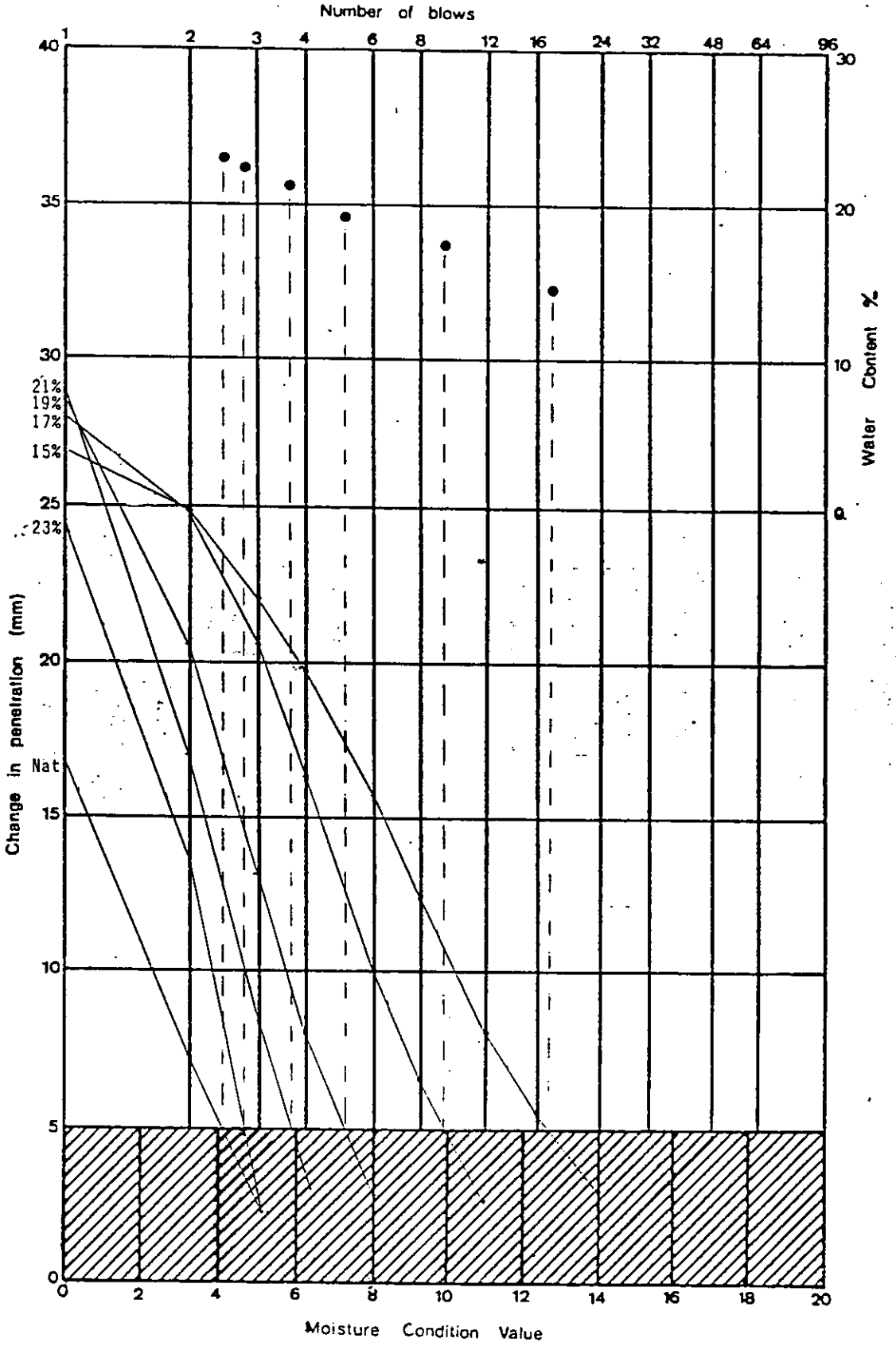
Firm to stiff red brown silty sandy
CLAY with some gravel
(GLACIAL TILL)

Trial Pit 439

Depth 1.20

Moisture Condition Value	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.356

EX 4



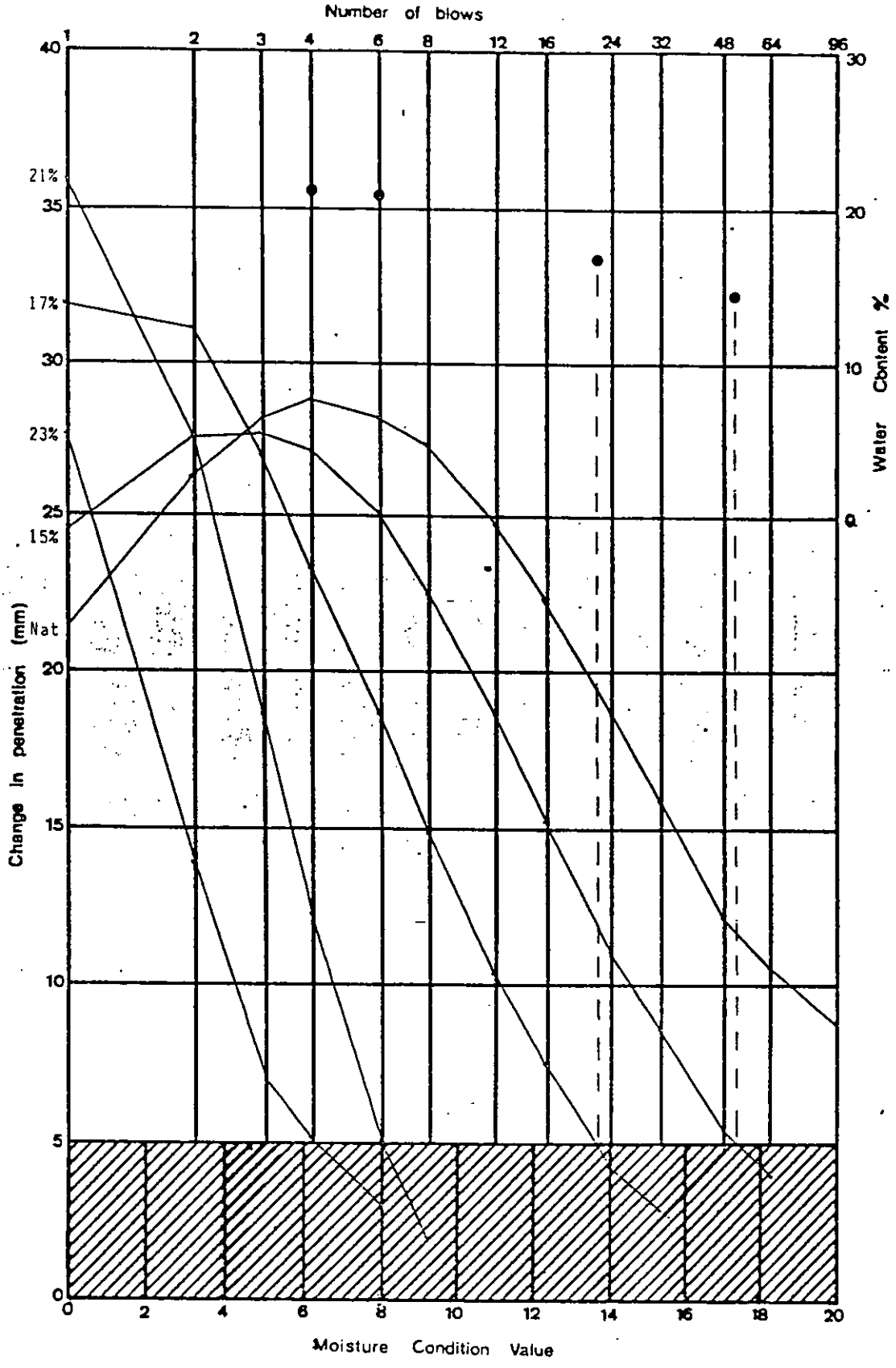
Stiff and firm red brown occasionally grey grey silty CLAY with occasional siltstone fragments
(KEUPER MARL : ZONE IV)

Trial Pit 439

Depth 3.00

Moisture Condition Value	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		**Figure** 2.357

EX 4

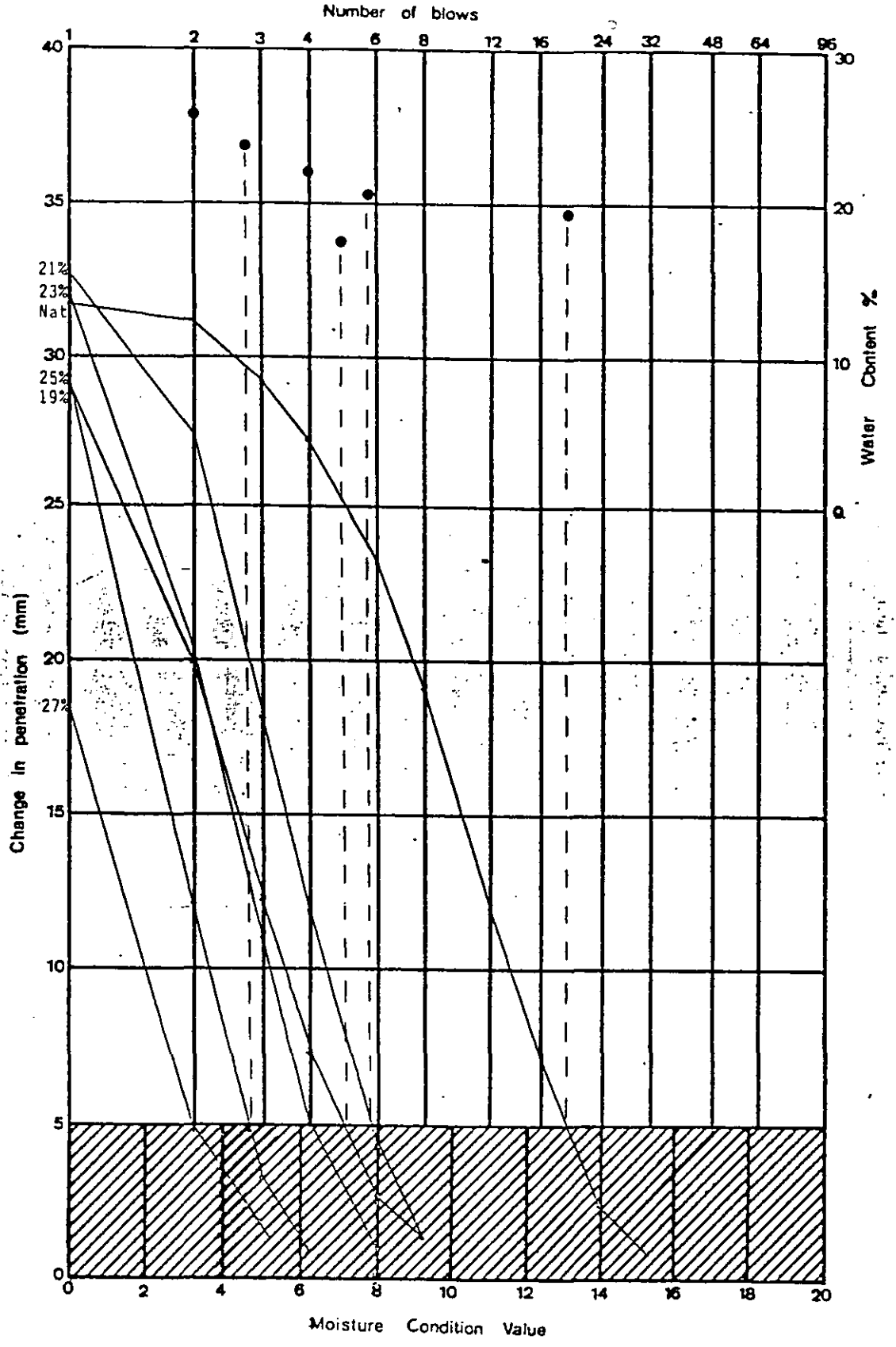


Stiff to very stiff red brown fissured silty slightly sandy CLAY with occasional gravel (GLACIAL TILL)

Trial Pit 440

Depth 0.50

Moisture Condition Value	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449
exploration associates		**Figure** 2.358



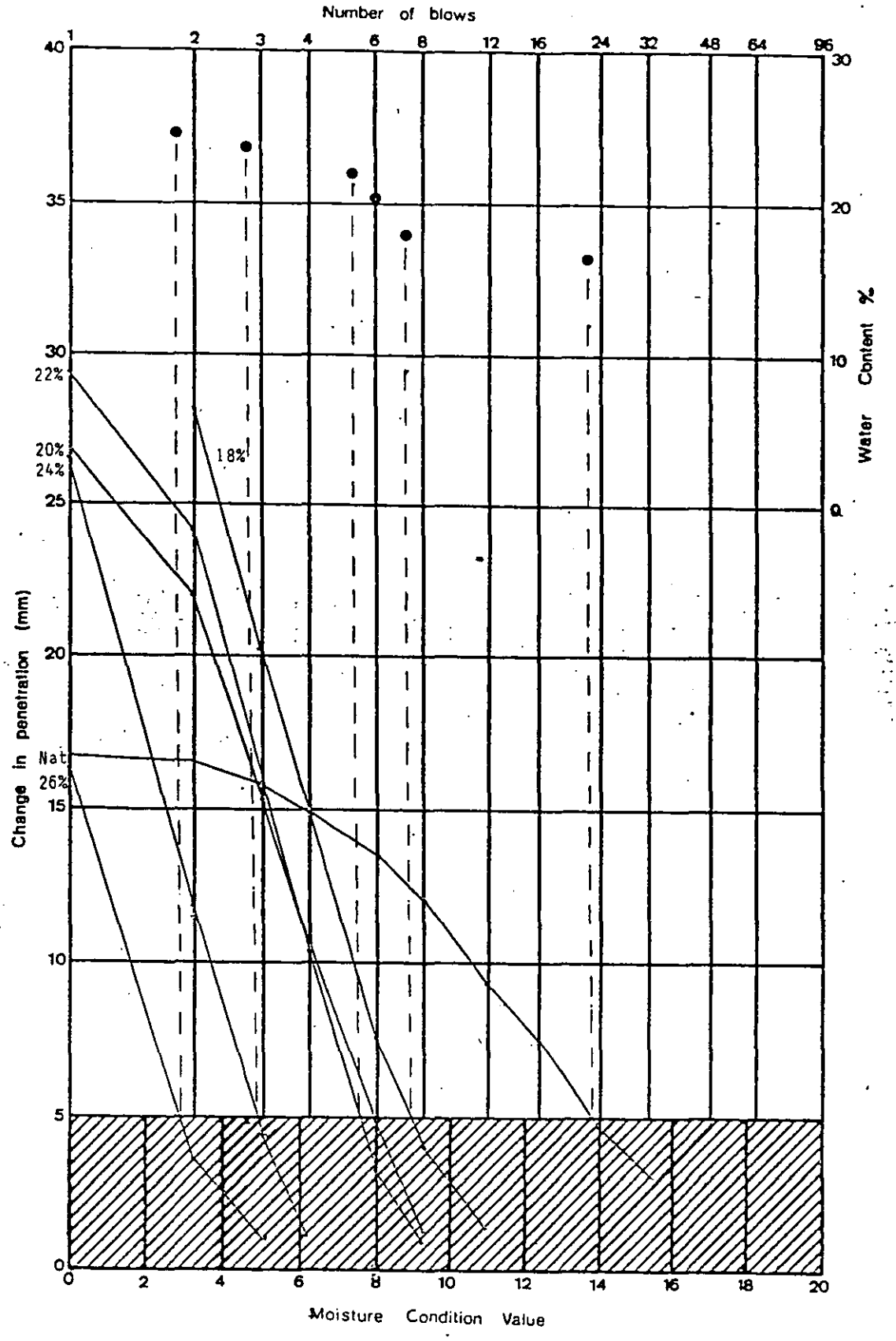
Red brown and green grey very weak
SILTSTONE with some silty clay
(KEUPER MARL : ZONE III)

Trial Pit 441

Depth 1.20

Moisture Condition Value	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449
exploration associates		**Figure** 2.359

EX 4



Red brown occasional green grey very weak SILTSTONE and MUDSTONE (KEUPER MARL : ZONE III)

Trial Pit 443

Depth 2.80

Moisture Condition Value	**Project** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation - Contract 2	Contract S4449
exploration associates		**Figure** 2.360

Borehole TP440 Depth 2.50

* Dry Density 1.92 mg/m³

* Optimum Moisture Content 12%

Moisture Content after Freezing -

Stiff to very stiff friable red brown occasionally green grey silty CLAY tending to very weak SILTSTONE/ MUDSTONE.
(KEUPER MARL : ZONE III)

Heave of Cylinder after 250 hours (mm)	Specimen 1	Specimen 2	Specimen 3	Mean
	14.5	28	29	24

The material is classified as Frost Susceptible

* As determined by Compaction Test

Borehole TP441 Depth 3.20

* Dry Density 1.85 mg/m³

* Optimum Moisture Content 12%

Moisture Content after Freezing 21%

Red brown and green grey very weak SILTSTONE
(KEUPER MARL : ZONE II/III)

Heave of Cylinder after 250 hours (mm)	Specimen 1	Specimen 2	Specimen 3	Mean
	21	18	23	21

The material is classified as Frost Susceptible

* Determined by Compaction Test

To MM64 specification Frost Heave Criteria is 10mm

FROST SUSCEPTIBILITY	Project Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract S4449
exploration associates		Figure 2.361

Borehole TP442

Depth 1.70 - 1.80

Stiff to very stiff grey and brown fissured silty sandy CLAY with gravel.
(GLACIAL TILL)

* Dry Density 1.83 mg/m'

* Optimum Moisture Content 13%

Moisture Content after Freezing -

Heave of Cylinder after 250 hours (mm)	Specimen 1	Specimen 2	Specimen 3	Mean
	21	31	33	28

The material is Classified as Frost Susceptible

* As determined by Compaction Test

FROST SUSCEPTIBILITY	**Project:** Department of Transport East Midlands Regional Office A42 Castle Donington North Main Site Investigation : Contract 2	Contract: S4449
exploration associates		Figure 2.362

EXPLORATION ASSOCIATES (WARWICK) LIMITED, GEOTECHNICAL HOUSE, HATTON, WARWICK. CV35 7JL
Tel: (0926) 491743

DEPARTMENT OF TRANSPORT

EAST MIDLANDS REGIONAL OFFICE

A42 CASTLE DONINGTON NORTH

MAIN SITE INVESTIGATION : CONTRACT 2 (FEBRUARY 1985)

VOLUME 3 FIELD TEST RESULTS

S4449

Employer for the Works

DEPARTMENT OF THE ENVIRONMENT
AND TRANSPORT
East Midlands Regional Office
52-54 Holly Walk
Leamington Spa
Warwickshire
CV32 4JE

Engineer for the Works

SCOTT WILSON KIRKPATRICK
AND PARTNERS
Bayheath House
Rose Hill West
Chesterfield
Derbyshire
S40 1JF

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BOREHOLE No	B219(p)	B220(s)	B222(s)	229(p)	230(s)	235(s)	240(s)
DATE INSTALLED	17.8.84	17.8.84	23.8.84	4.9.84	5.9.84	13.9.84	13.9.84
DEPTH TO BASE	4.50	13.50	12.00	1.40	6.00	7.80	7.80
GROUND LEVEL mAOD	53.02	52.69	53.02	49.06	49.74	72.54	78.35
DATE	DEPTH TO WATER FROM GROUND LEVEL						
21.8.84	2.73	2.55	-	-	-	-	-
29.8.84	2.80	2.60	3.45	-	-	-	-
3.9.84	2.83	2.63	3.36	-	-	-	-
10.9.84	2.86	2.65	3.33	1.24	1.01	-	-
18.9.84	2.90	2.68	3.36	1.06	0.94	-	-
25.9.84	2.81	2.60	3.28	1.06	0.88	5.68	6.64
2.10.84	2.84	2.62	3.31	1.06	0.87	5.19	6.73
8.10.84	2.82	2.63	3.42	1.10	0.93	5.70	6.83

Remarks (P) Piezometer
(S) Standpipe

Data Sheet – Standpipe Readings

exploration associates

Project Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation - Contract 2

Contract S4449

Figure 3.1

BOREHOLE No	B247(p)	B252(p)	B264(p)	B265(s)	B273(s)	B281(s)	B288(s)
DATE INSTALLED	4.10.84	10.9.84	27.9.84	2.10.84	11.10.84	4.10.84	4.10.84
DEPTH TO BASE	4.40	4.90	5.70	16.00	19.00	15.00	15.00
GROUND LEVEL mAOD	62.17	60.11	67.12	76.34	79.03	79.62	75.60
DATE	DEPTH TO WATER FROM GROUND LEVEL						
3.9.84	2.89	–	–	–	–	–	–
10.9.84	2.93	–	–	–	–	–	–
18.9.84	2.92	2.80	–	–	–	–	–
25.9.84	2.91	2.75	–	–	–	–	–
2.10.84	2.92	2.76	5.70	–	–	–	–
8.10.84	2.99	2.82	5.24	5.22	–	6.82	3.23
15.10.84	–	–	–	–	5.29	–	–

Remarks (P) Piezometer
(S) Standpipe

Data Sheet – Standpipe Readings

exploration associates

Project Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation – Contract 2

Contract S4449

Figure 3.2

EX 4

BOREHOLE No	291(s)						
DATE INSTALLED	8.10.84						
DEPTH TO BASE	15.90						
GROUND LEVEL mAOD	70.34						
DATE	DEPTH TO WATER FROM GROUND LEVEL						
8.10.84	6.76						

Remarks (P) Piezometer
(S) Standpipe

Data Sheet – Standpipe Readings

exploration associates

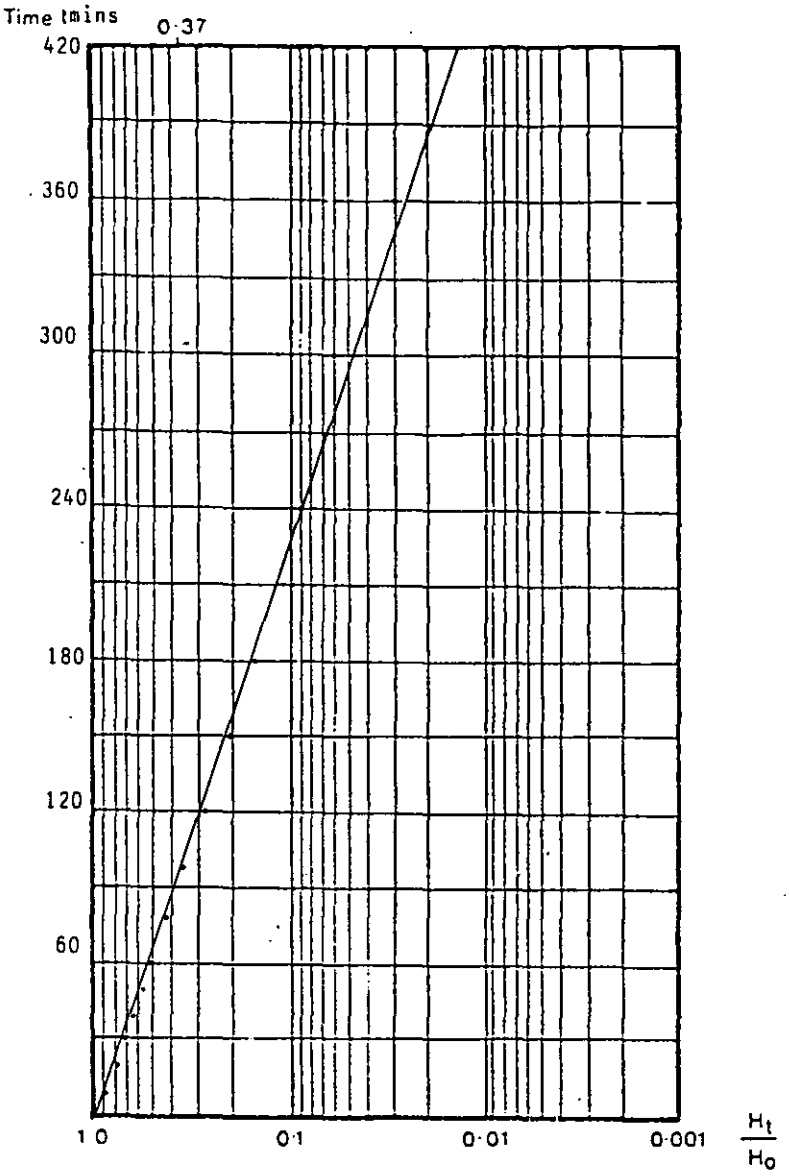
Project Department of Transport
East Midlands Regional Office
A42 Castle Donington North
Main Site Investigation - Contract 2

Contract S4449

Figure 3.3

EX 4

Date	Time Elapsed Mins	Depth at Time t (m)	H_t	$\frac{H_t}{H_o}$
4.10.84	0.00	0.00	2.850	1.00
	.17	0.070	2.780	0.98
	0.33	0.090	2.760	0.91
	0.50	0.100	2.750	0.97
	0.66	0.120	2.730	0.96
	0.83	0.125	2.725	0.96
	1.00	0.130	2.720	0.95
	1.50	0.140	2.710	0.95
	2.00	0.150	2.700	0.95
	2.50	0.155	2.695	0.95
	3.00	0.170	2.680	0.94
	3.50	0.190	2.660	0.93
	4.00	0.200	2.650	0.93
	4.50	0.205	2.645	0.93
	5.00	0.210	2.640	0.93
	6.00	0.215	2.635	0.92
	7.00	0.220	2.630	0.92
	8.00	0.250	2.600	0.91
	9.00	0.280	2.570	0.90
	10.00	0.310	2.540	0.89
	12.00	0.370	2.480	0.87
	14.00	0.425	2.425	0.85
	16.00	0.480	2.370	0.83
	18.00	0.540	2.310	0.81
	20.00	0.590	2.260	0.79
	25.00	0.710	2.140	0.75
	30.00	0.830	2.020	0.71
	40.00	1.035	1.815	0.64
	50.00	1.220	1.630	0.57
	60.00	1.390	1.460	0.51
	80.00	1.655	1.195	0.42
	100.00	1.865	0.985	0.35
	120.00	2.050	0.800	0.28
	150.00	2.240	0.610	0.21
	180.00	2.400	0.450	0.16
	240.00	2.590	0.260	0.09
	300.00	2.680	0.170	0.06
	360.00	2.760	0.090	0.03
	420.00	2.800	0.050	0.02
	480.00	2.835	0.015	0.01



Depth to Standing Water Level = 2.85 m

H_o–induced head differential = 2.85 m

H_t–head differential at time t.

From graph, when H_t/H_o 0·37, T = 5820 Secs

Diameter of Borehole D = 0.15 m

Diameter of Piezometer d = 0.019 m

Area of Borehole, A = m^2

Area of Piezometer, A = 0.00028 m^2

Shape Factor F = 2.72

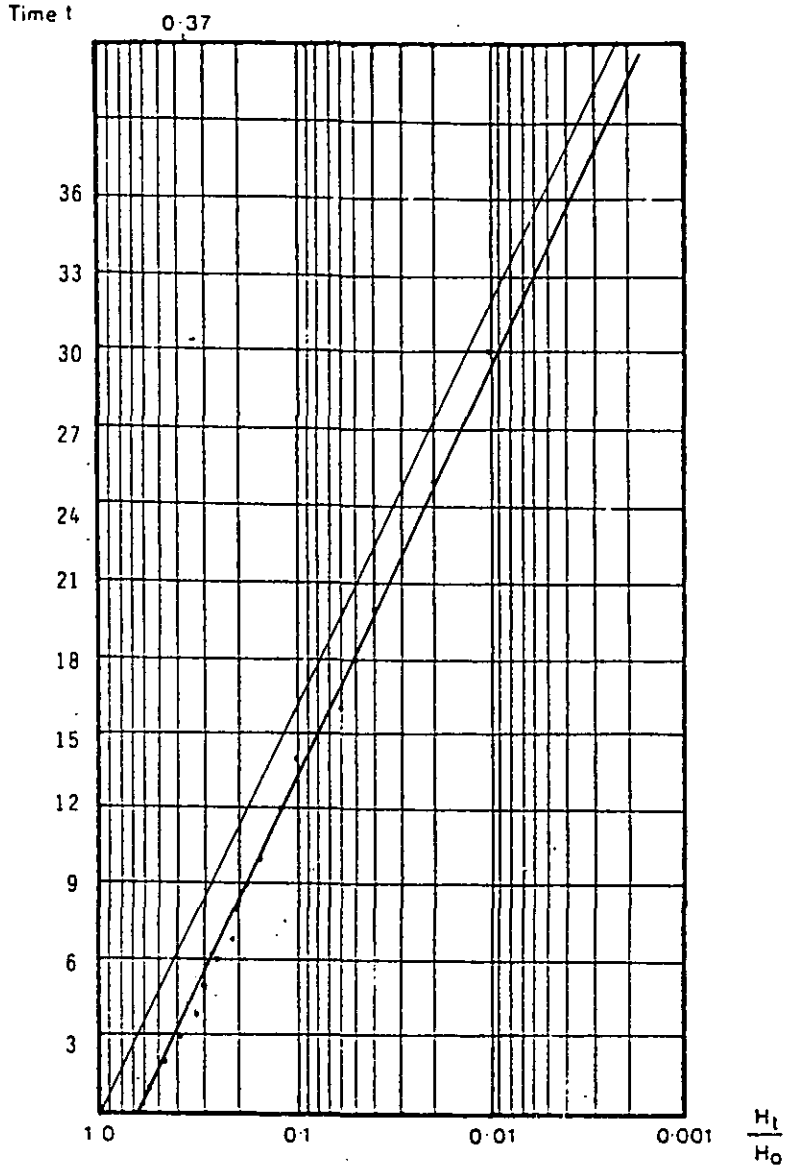
Permeability $\frac{A}{FT}$ = $\frac{0.00028}{2.72 \times 5820}$ m/sec

= $\underline{\underline{1.74 \times 10^{-8}}}$

Type of Test: Piezometer ~~Rising Head~~ Falling Head		Borehole B219 Test Section 3.7 – 4.7
Insitu Permeability Test	Project: Department of Transport, East Midlands Regional Office, A42 Castle Donnington North, Main Site Investigation Contract 2	Contract S4449
exploration associates		Figure 3.4

FX 4

Date	Time Elapsed t_{min}	Depth at Time t (m)	H_t	$\frac{H_t}{H_o}$
4.10.84	0.0	0.00	1.040	1.00
	0.17	0.170	0.870	0.84
	0.33	0.270	0.770	0.74
	0.50	0.320	0.720	0.69
	0.66	0.390	0.650	0.625
	0.83	0.420	0.620	0.60
	1.00	0.450	0.590	0.57
	1.17	0.470	0.570	0.55
	1.33	0.500	0.540	0.52
	1.50	0.520	0.520	0.50
	1.66	0.530	0.510	0.49
	1.83	0.550	0.490	0.47
	2.00	0.560	0.480	0.46
	2.50	0.600	0.440	0.42
	3.00	0.640	0.400	0.39
	3.50	0.670	0.370	0.36
	4.00	0.700	0.340	0.33
	4.50	0.710	0.330	0.32
	5.00	0.725	0.315	0.30
	6.00	0.765	0.275	0.26
	7.00	0.810	0.230	0.22
	8.00	0.830	0.210	0.20
	9.00	0.850	0.190	0.18
	10.00	0.870	0.170	0.16
	12.00	0.905	0.135	0.13
	14.00	0.935	0.105	0.10
	16.00	0.970	0.070	0.06
	18.00	0.985	0.055	0.05
	20.00	0.995	0.045	0.04
	25.00	1.015	0.025	0.02
	30.00	1.030	0.010	0.01
	35.00	1.040	0.000	0.00



Depth to Standing Water Level = 1.04 m

H_o–induced head differential = 1.04 m

H_t–head differential at time t.

From graph, when H_t/H_o 0·37, T = 420 Secs

Diameter of Borehole D = 0.15 m

Diameter of Piezometer d = 0.019 m

Area of Borehole, A = m^2

Area of Piezometer, A = 0.00028 m^2

Shape Factor F = 1.85

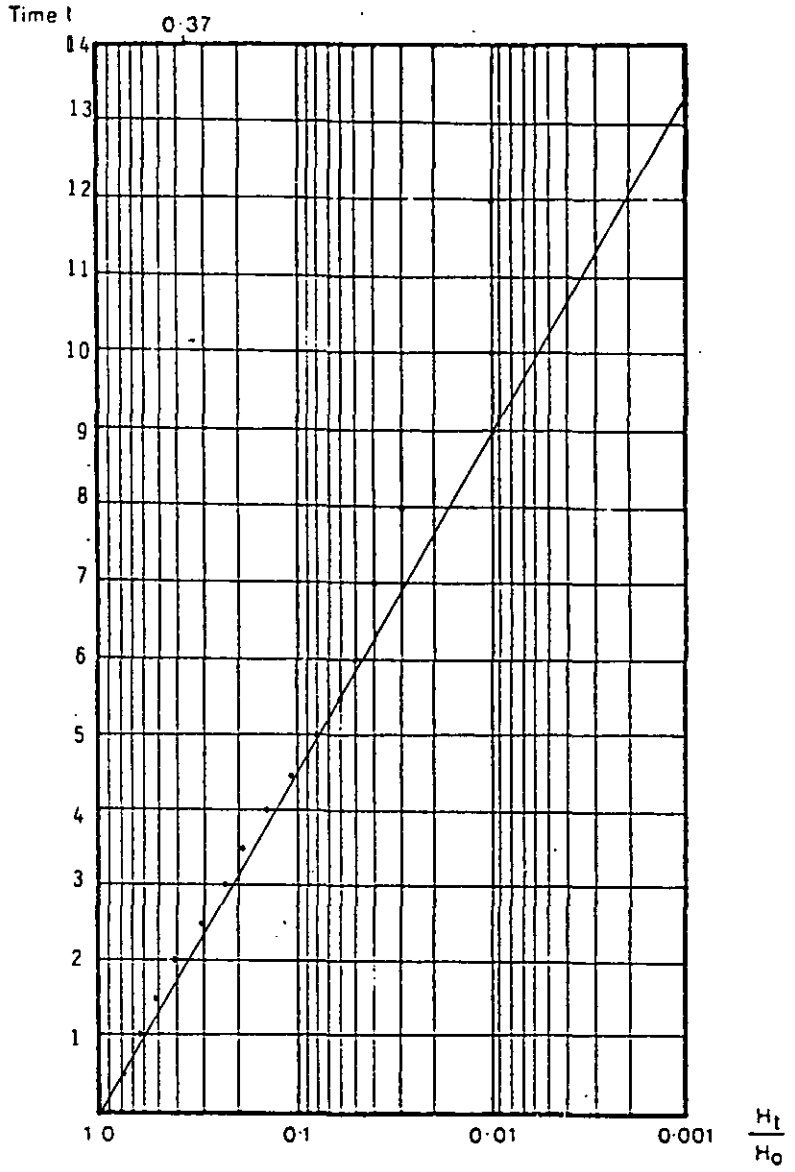
Permeability $\frac{A}{FT}$ = $\frac{.00028}{1.85 \times 420}$ m/sec

= 3.60×10^{-7}

Type of Test: Borehole / ~~Borehole~~ Piezometer — Rising Head / ~~Rising Head~~ Falling Head		Borehole 229 Test Section 1.0-1.5
Insitu Permeability Test	**Project** Department of Transport East Midlands Regional Office A42 Castle Donnington North Main Site Investigation Contract 2	Contract S4449
exploration associates		**Figure** 3.5

FX 4

Date	Time Elapsed t	Depth at Time t (m)	H_t	$\frac{H_t}{H_o}$
5.10.84	0.00	0.00	2.95	1.00
	0.17	0.27	2.68	0.91
	0.33	0.54	2.41	0.82
	0.50	0.61	2.34	0.79
	0.66	0.75	2.20	0.75
	0.83	0.90	2.05	0.69
	1.00	1.10	1.85	0.63
	1.17	1.22	1.73	0.59
	1.33	1.31	1.64	0.56
	1.50	1.43	1.52	0.52
	1.66	1.56	1.39	0.47
	1.83	1.67	1.28	0.43
	2.00	1.75	1.20	0.41
	2.17	1.84	1.11	0.38
	2.33	1.95	1.00	0.34
	2.50	2.03	0.92	0.31
	2.66	2.09	0.86	0.29
	2.83	2.15	0.80	0.27
	3.00	2.23	0.72	0.24
	3.50	2.38	0.57	0.19
	4.00	2.51	0.44	0.15
	4.50	2.61	0.34	0.12
	5.00	2.71	0.24	0.08
	5.50	2.77	0.18	0.06
	6.00	2.80	0.15	0.05
	7.00	2.83	0.12	0.04
	8.00	2.86	0.09	0.03
	9.00	2.91	0.04	0.01
	10.00	2.92	0.03	0.01
	12.00	2.93	0.02	0.01
	14.00	2.94	0.01	0.003
	16.00	2.945	0.01	0.003
	18.00	2.95	0.00	0.00
	20.00	2.95	0.00	0.00



Depth to Standing Water Level = 3.03 m

H_o–induced head differential = 2.95 m

H_t–head differential at time t.

From graph, when H_t/H_o 0·37, T = 110 Secs

Diameter of Borehole D = 0.15 m

Diameter of Piezometer d = 0.019 m

Area of Borehole, A = m^2

Area of Piezometer, A = 0.00028 m^2

Shape Factor F = 2.72

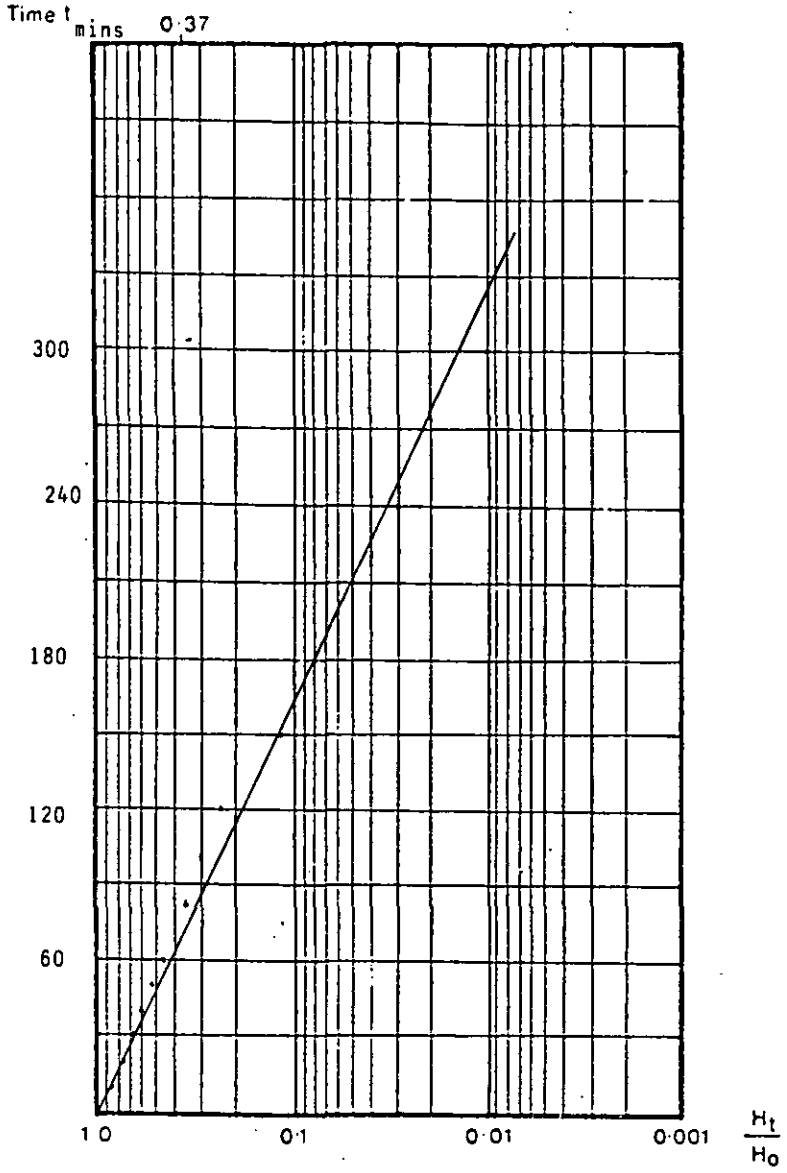
Permeability $\frac{A}{FT}$ = $\frac{0.00028}{2.72 \times 110}$ m/sec

= $\underline{\underline{9.35 \times 10^{-7}}}$

Type of Test: ~~Borehole~~ Piezometer; ~~Rising Head~~ Falling Head		Borehole 8247 Test Section 3.5-4.5
Insitu Permeability Test	**Project** Department of Transport, East Midlands Regional Office, A42 Castle Donnington North, Main Site investigation contract 2	Contract S4449
exploration associates		**Figure** 3.6

FX 4

Date	Time Elapsed t (min)	Depth at Time t (m)	H_t	$\frac{H_t}{H_o}$
3.10.84	0.00	0.00	2.77	1.00
	0.17	0.10	2.67	0.96
	0.33	0.115	2.655	0.96
	0.50	0.120	2.65	0.96
	0.75	0.15	2.62	0.95
	1.00	0.19	2.58	0.93
	1.50	0.20	2.57	0.93
	2.00	0.21	2.56	0.92
	2.50	0.22	2.55	0.92
	3.00	0.225	2.545	0.92
	3.50	0.23	2.54	0.92
	4.00	0.235	2.535	0.92
	4.50	0.26	2.51	0.91
	5.00	0.265	2.505	0.90
	10.00	0.415	2.355	0.85
	15.00	0.55	2.22	0.80
	20.00	0.67	2.10	0.76
	30.00	0.905	1.865	0.67
	40.00	1.105	1.665	0.60
	50.00	1.29	1.48	0.53
	60.00	1.46	1.31	0.47
	80.00	1.73	1.04	0.36
	100.00	1.95	0.83	0.30
	120.00	2.11	0.66	0.24
	150.00	2.41	0.36	0.13
	180.00	2.56	0.21	0.08
	240.00	2.695	0.075	0.03
	300.00	2.79	0.02	0.01



Depth to Standing Water Level = 2.87 m

H_o – induced head differential = 2.77 m

H_t – head differential at time t.

From graph, when H_t/H_o 0·37, T = 3900 Secs

Diameter of Borehole D = 0.15 m

Diameter of Piezometer d = 0.019 m

Area of Borehole, A = m²

Area of Piezometer, A = 0.00028 m²

Shape Factor F = 2.72

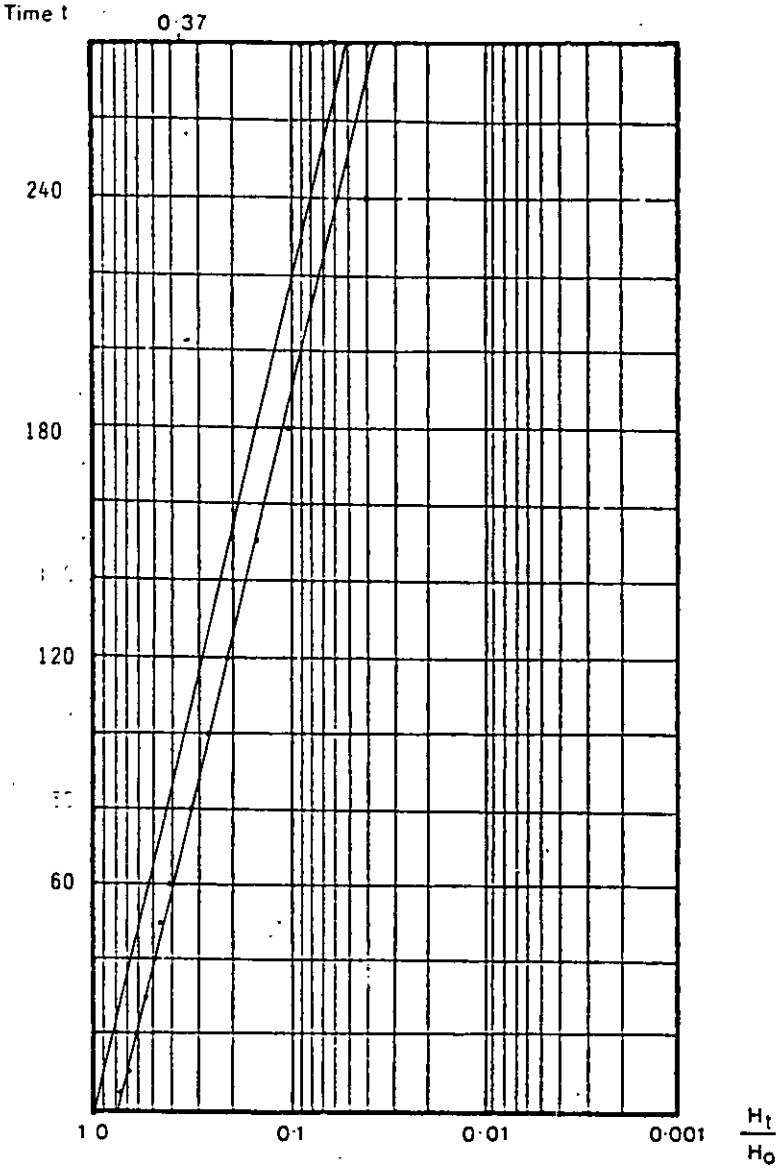
Permeability $\frac{A}{FT}$ = $\frac{0.00028}{2.72 \times 3900}$ m/sec

= 2.63×10^{-8}

Type of Test: Piezometer — Falling Head		Borehole B252 Test Section: 4.0 - 5.0
Insitu Permeability Test	**Project** Department of Transport East Midlands Regional Office A42 Castle Donnington North Main Site Investigation Contract 2	Contract S4449
exploration associates		**Figure** 3.7

EX 4

Date	Time Elapsed t (min)	Depth at Time t (m)	H_t	$\frac{H_t}{H_o}$
10.10.84	0.00	0.53	4.78	1.00
	0.17	0.57	4.21	0.88
	0.33	0.60	4.18	0.87
	0.50	0.64	4.14	0.87
	0.66	0.68	4.10	0.86
	0.83	0.71	4.07	0.85
	1.00	0.74	4.04	0.85
	1.17	0.78	4.00	0.84
	1.33	0.81	3.97	0.83
	1.50	0.83	3.95	0.83
	1.66	0.86	3.92	0.82
	1.87	0.90	3.88	0.81
	2.00	0.91	3.87	0.81
	2.50	0.97	3.81	0.80
	3.00	1.04	3.74	0.78
	3.50	1.08	3.70	0.77
	4.00	1.12	3.66	0.77
	4.50	1.16	3.62	0.76
	5.00	1.21	3.57	0.75
	6.00	1.29	3.45	0.72
	7.00	1.35	3.43	0.72
	8.00	1.41	3.37	0.71
	9.00	1.47	3.31	0.69
	10.00	1.515	3.265	0.68
	12.00	1.585	3.195	0.67
	14.00	1.65	3.13	0.66
	16.00	1.74	3.04	0.64
	18.00	1.82	2.96	0.62
	20.00	1.88	2.90	0.61
	25.00	2.04	2.74	0.57
	30.00	2.19	2.59	0.54
	35.00	2.325	2.455	0.51
	40.00	2.425	2.355	0.49
	50.00	2.635	2.145	0.45
	60.00	2.83	1.95	0.41
	80.00	3.19	1.59	0.33
	100.00	3.51	1.27	0.27
	120.00	3.74	1.04	0.22
	150.00	4.03	0.75	0.16
	180.00	4.27	0.51	0.11
	240.00	4.59	0.19	0.04



Depth to Standing Water Level = 5.31 m

H_o–induced head differential = 4.78 m

H_t–head differential at time t.

From graph, when H_t/H_o 0·37, T = 5700 Secs

Diameter of Borehole D = 0.15 m

Diameter of Piezometer d = 0.019 m

Area of Borehole, A = m^2

Area of Piezometer, A = 0.00028 m^2

Shape Factor F = 2.72

Permeability $\frac{A}{FT} = \frac{0.00028}{2.72 \times 5700}$ m/sec

$= 1.81 \times 10^{-8}$

Type of Test: Piezometer — Falling Head		Borehole 8264 Test Section 5.0 - 6.0
Insitu Permeability Test	Project: Department of Transport, East Midlands Regional Office, A42 Castle Donnington North, Main Site Investigation contract2	Contract
exploration associates		Figure 3.8

FX 4

EXPLORATION ASSOCIATES (WARWICK) LIMITED, GEOTECHNICAL HOUSE, HATTON, WARWICK. CV35 7JL
Tel: (0926) 491743

DEPARTMENT OF TRANSPORT

EAST MIDLANDS REGIONAL OFFICE

A42 CASTLE DONINGTON NORTH

MAIN SITE INVESTIGATION : CONTRACT 2 (FEBRUARY 1985)

VOLUME 4 EXPLORATORY HOLE LOCATION PLANS AND LONGITUDINAL SECTIONS

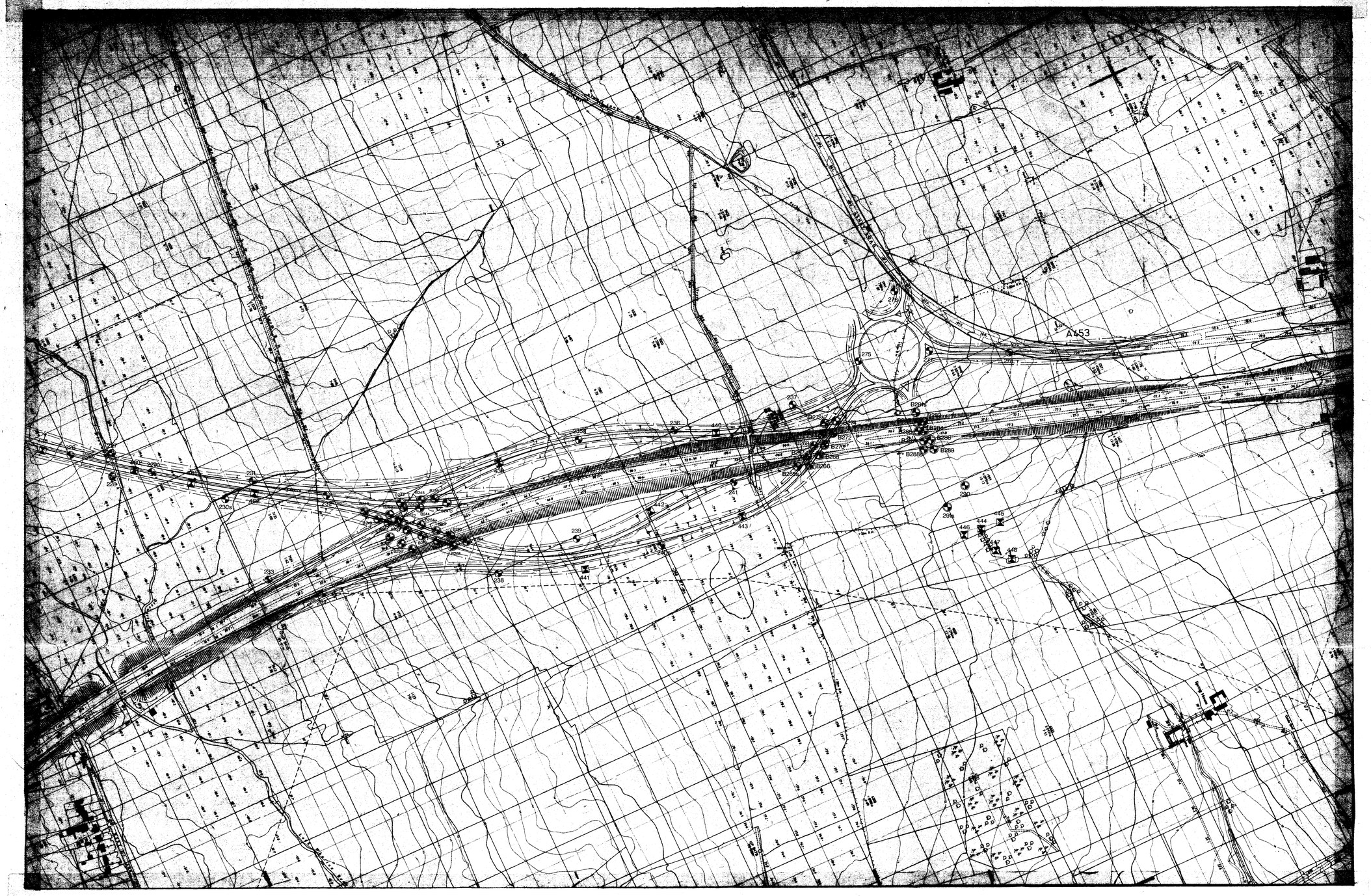
S4449

Employer for the Works

DEPARTMENT OF THE ENVIRONMENT
AND TRANSPORT
East Midlands Regional Office
52-54 Holly Walk
Leamington Spa
Warwickshire
CV32 4JE

Engineer for the Works

SCOTT WILSON KIRKPATRICK
AND PARTNERS
Bayheath House
Rose Hill West
Chesterfield
Derbyshire
S40 1JF



NOTES

PLAN KEY

- BOREHOLE
- BOREHOLE ADVANCED BY ROTARY DRILLING/ ROTARY DRILL HOLE
- TRIAL PIT
- HAND AUGER HOLES
- X PROBE LOCATION
- P PIEZOMETER
- S STANDPIPE

LONGITUDINAL PROFILE KEY

m 15.0	MOISTURE CONTENT %
30/15/15	LIQUID LIMIT/PLASTIC LIMIT/PLASTICITY INDEX
N82 (100)	STANDARD PENETRATION TEST BLOW COUNT. IF PENETRATION LIMITED TOTAL NUMBER OF BLOWS FOR TOTAL PENETRATION (INCLUDING SEATING) IS GIVEN IN BRACKETS.
Cu 5 ϕu30	UNDRAINED SHEAR STRENGTH PARAMETERS COHESION (KN/M²) ANGLE OF SHEARING RESISTANCE (DEGREES)
C'5,ϕ'30	DRAINED SHEAR STRENGTH PARAMETERS COHESION (KN/M²) ANGLE OF SHEARING RESISTANCE (DEGREES)
Qu 800	UNIAXIAL COMPRESSIVE STRENGTH OF ROCK (KN/M²)
I,II,III,IV	I, II AND III CATEGORIES OF SOIL AS DEFINED IN DTP SPECIFICATION FOR ROAD AND BRIDGE WORKS (CLAUSE 601.2) IV ROCK AS DEFINED IN THE MODEL SPECIFICATION FOR SITE INVESTIGATIONS (CLAUSE 5.06.3)
▼	MAXIMUM WATER LEVEL IN STANDPIPE OR PIEZOMETER.
▽	STANDING WATER LEVEL DURING ADVANCEMENT OF HOLE.
▲ (20)	LEVEL WATER ROSE TO IN 20 MINUTES
▼	LEVEL WATER STRUCK
~~	SEEPAGE

Revision Details	By	Date	Suffix
INTERCHANGE LAYOUT AMENDED	C.M.	3/2/84	A

Revision →

83040/7/27

Scale 1:2500

DRAWN	TRACED	CHECKED	DATE
			JUNE 1984

DEPARTMENT OF TRANSPORT
EAST MIDLANDS REGIONAL OFFICE
(LEAMINGTON SPA)

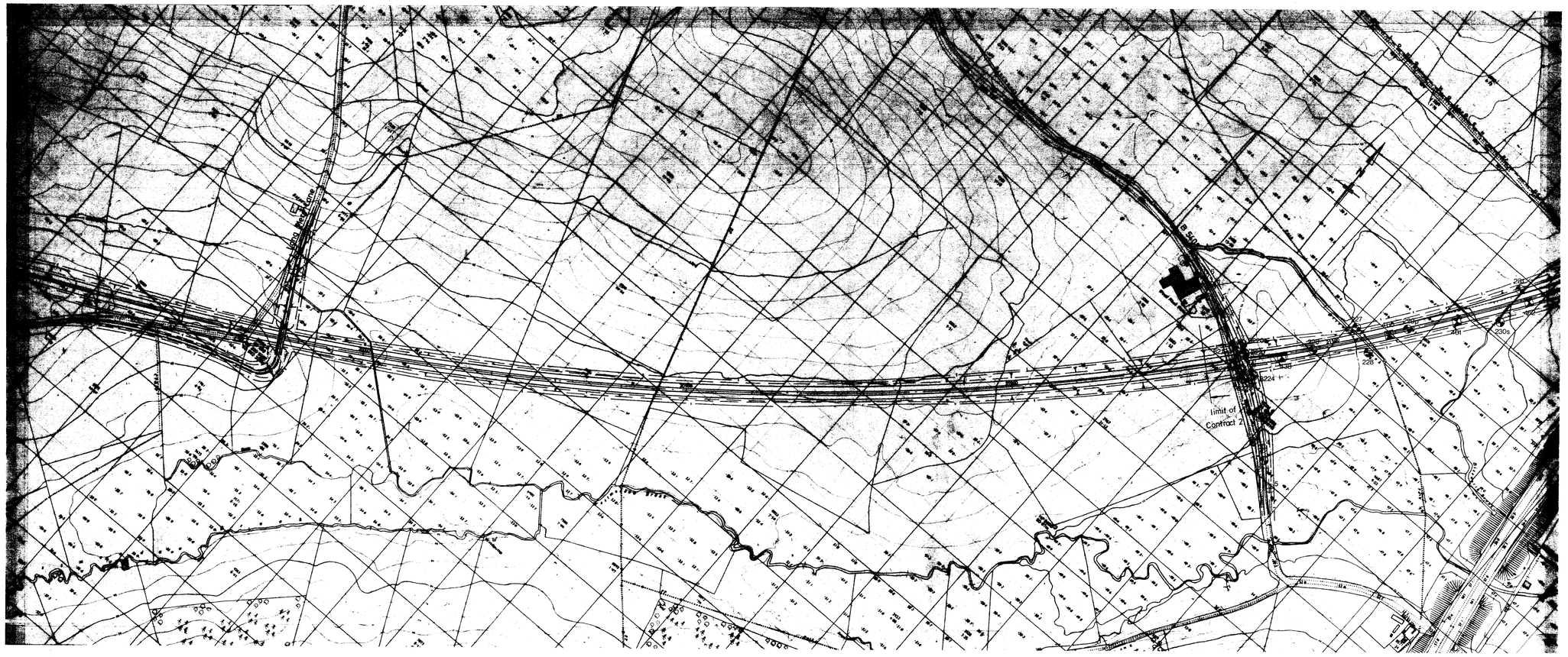
exploration associates limited

BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
AND
A6 KEGWORTH BYPASS

MAIN SITE INVESTIGATION
CONTRACT 2
HOLE LOCATION PLAN
SHEET 2 of 4
(CASTLE DONINGTON NORTH)

Scott Wilson Kirkpatrick & Partners
Consulting Engineers and Transportation Planners
Bayheath House · Rose Hill West · Chesterfield
Derbyshire S40 1JF

ORIGINAL DRG SIZE 841 x 1189 (AO)



NOTES

PLAN KEY

- BOREHOLE
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▽	STANDING WATER LEVEL DURING ADVANCEMENT OF HOLE
▲ (20)	LEVEL WATER ROSE TO IN 20 MINUTES
▼	LEVEL WATER STRUCK
~~	SEEPAGE

LEGEND

- Topsoil
- Made Ground
- Clay
- Silt
- Sand
- Gravel
- Mudstone
- Siltstone
- Sandstone

Revision Details	By	Date	Suffix
			Revision →

83040/7/26

Scale
HORIZONTAL 1:2500 VERTICAL 1:250

DRAWN	TRACED	CHECKED	DATE
	S.W.	A.R.M.	JUNE 1984

DEPARTMENT OF TRANSPORT
EAST MIDLANDS REGIONAL OFFICE
(LEAMINGTON SPA)

exploration associates limited

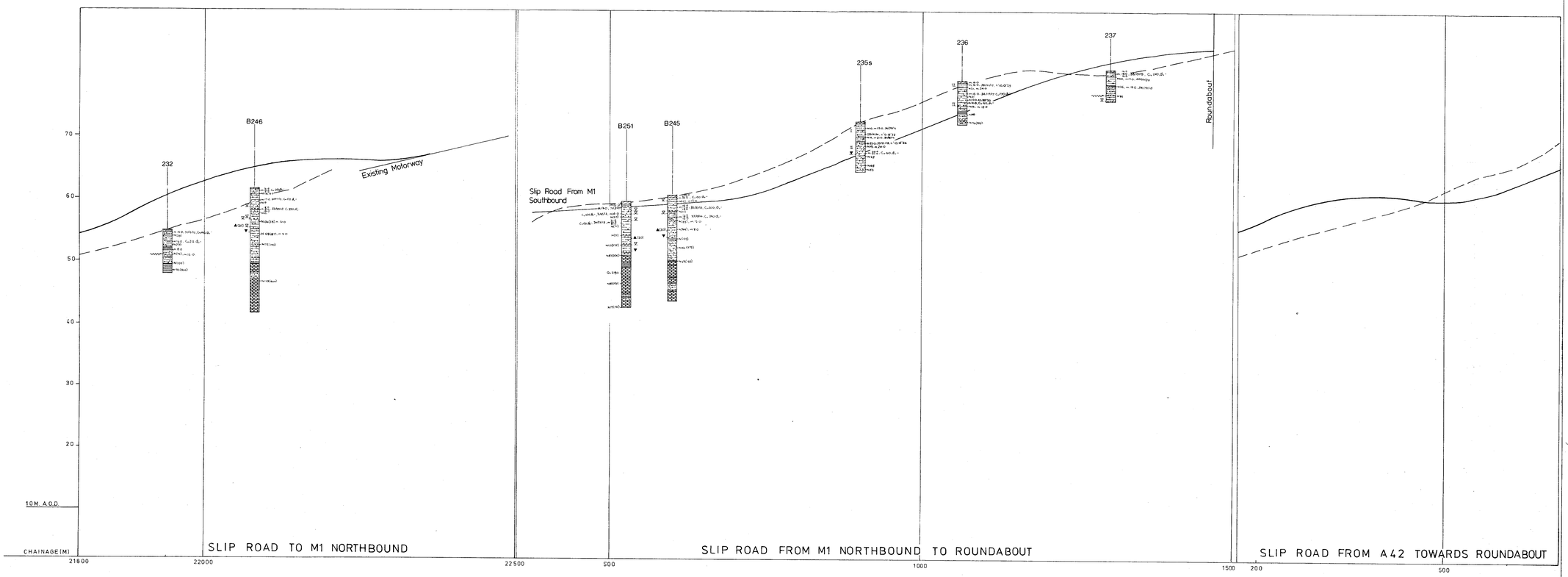
BIRMINGHAM - NOTTINGHAM ROUTE

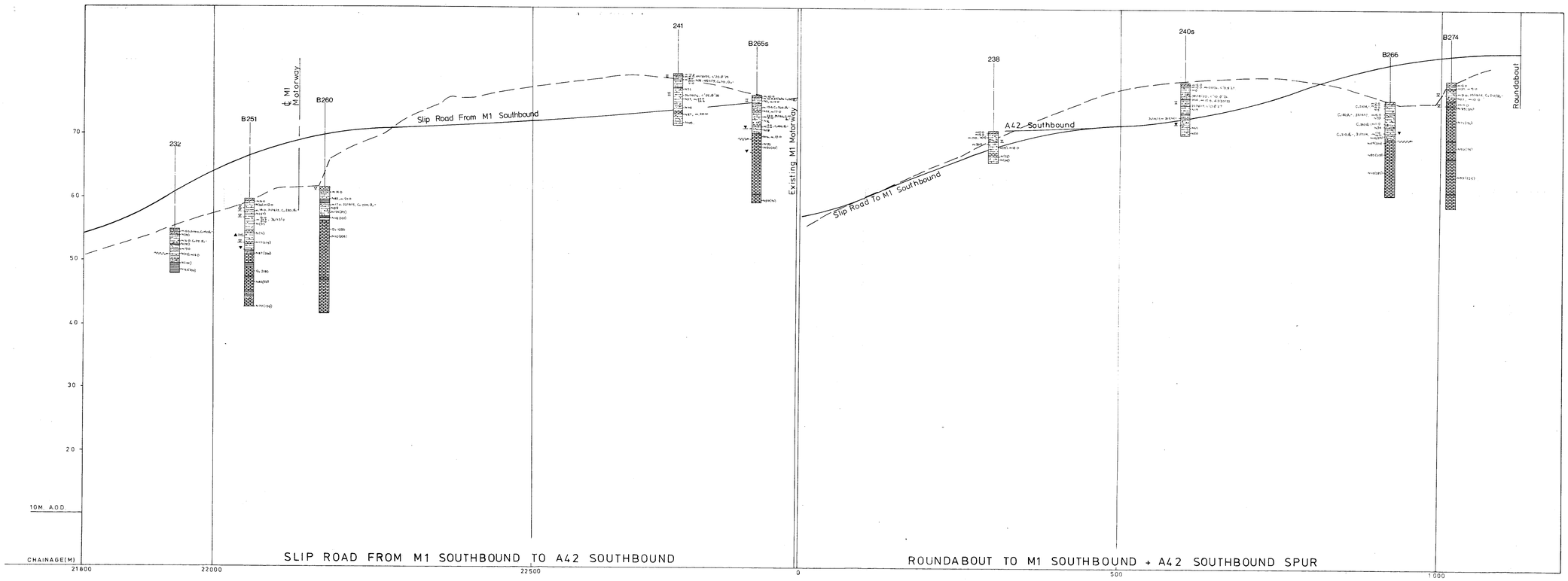
A42 CASTLE DONINGTON NORTH

MAIN SITE INVESTIGATION
CONTRACT 2
HOLE LOCATION PLAN AND
LONGITUDINAL PROFILE
SHEET 1 of 4

Scott Wilson Kirkpatrick & Partners
Consulting Engineers and Transportation Planners
Bayheath House · Rose Hill West · Chesterfield
Derbyshire · S40 1JF

ORIGINAL DRG SIZE 841 x 1189 (A0)





NOTES

PLAN KEY

- BOREHOLE
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- HAND AUGER HOLES
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- P PIEZOMETER
- S STANDPIPE

LONGITUDINAL PROFILE KEY

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C'5,Ø'30	DRAINED SHEAR STRENGTH PARAMETERS COHESION (KN/M^2) ANGLE OF SHEARING RESISTANCE (DEGREES)
Qu 600	UNIAXIAL COMPRESSIVE STRENGTH OF ROCK (KN/M^2)
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▼	LEVEL WATER STRUCK
~~	SLIPPAGE

LEGEND

- Topsoil
- Made Ground
- Clay
- Silt
- Sand
- Gravel
- Mudstone
- Siltstone
- Sandstone

Revision Details	By	Date	Suffix
Revised Slip Roads To M1	R.M.Q.	7.84	A

Revision

83040/7/28 A

Scale
HORIZONTAL 1:2500 VERTICAL 1:250

DRAWN	TRACED	CHECKED	DATE
R.M.Q.	E.H.	A.R.M.	JULY 1984

DEPARTMENT OF TRANSPORT
EAST MIDLANDS REGIONAL OFFICE
(LEAMINGTON SPA)

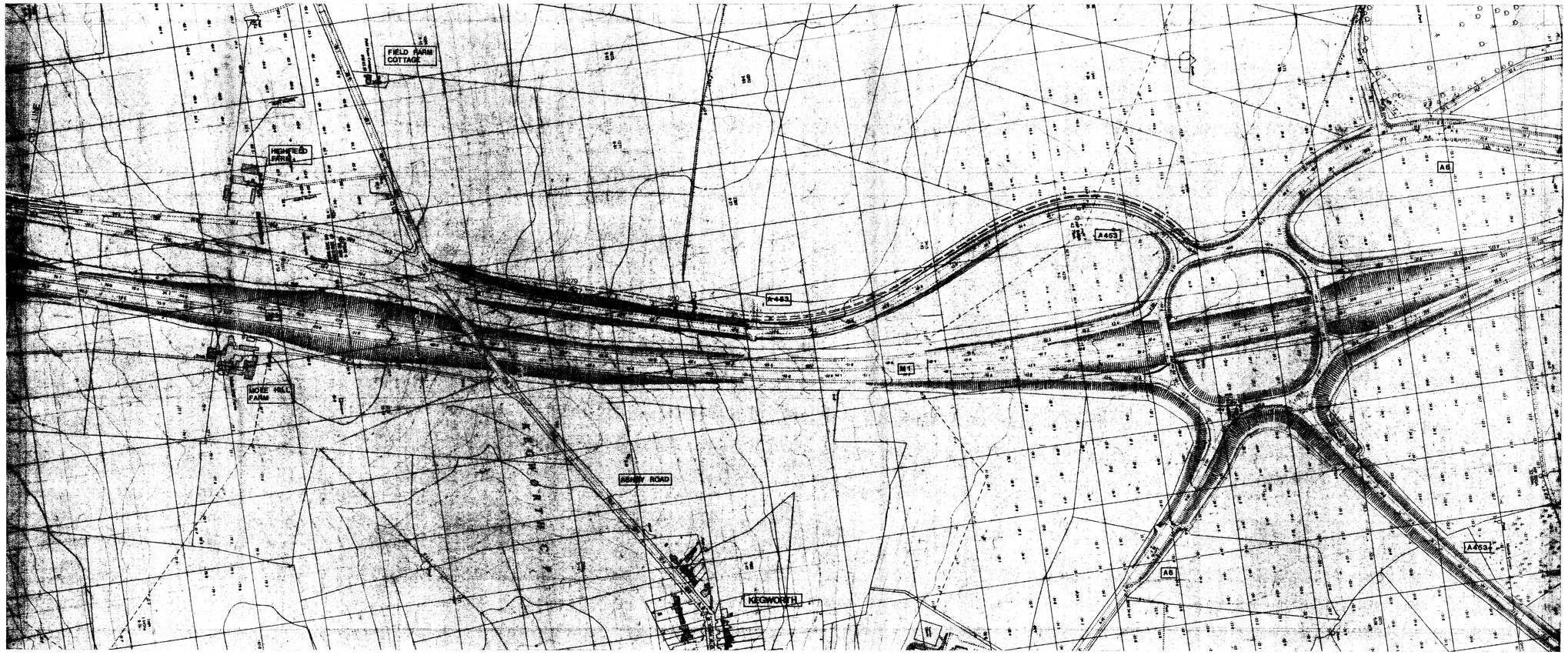
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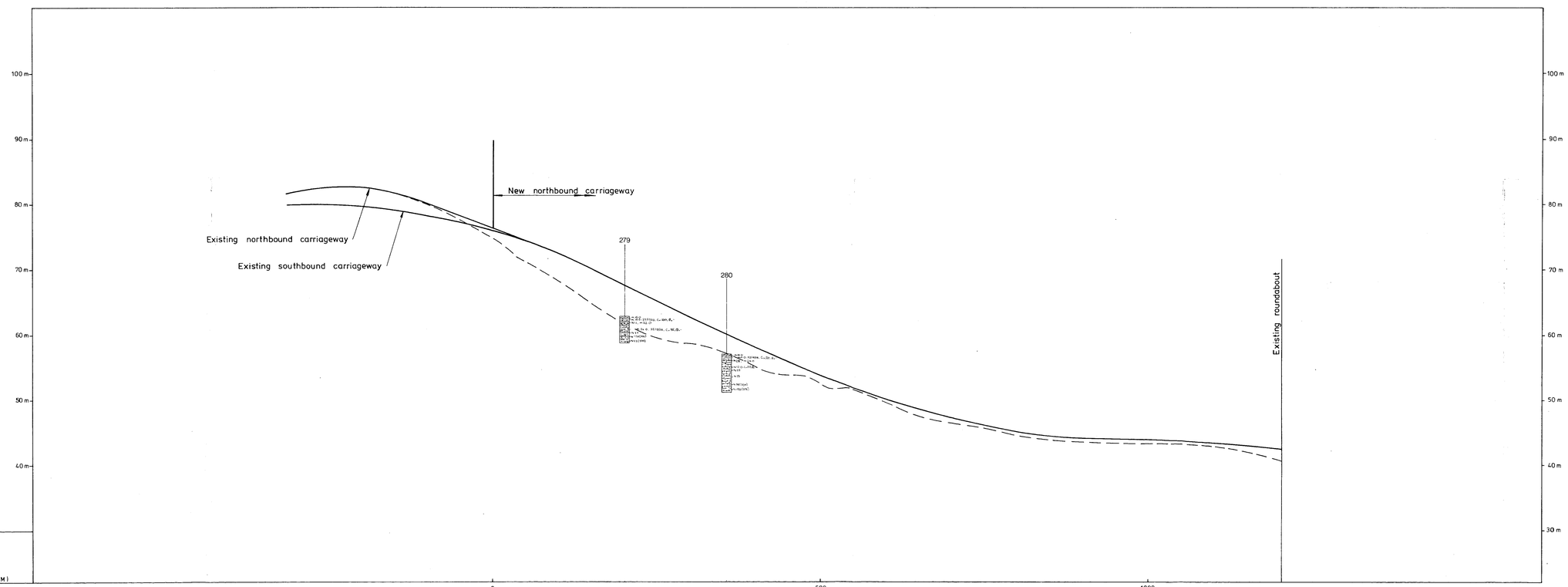
BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
AND
A6 KEGWORTH BYPASS

MAIN SITE INVESTIGATION
CONTRACT 2
LONGITUDINAL PROFILE
SHEET 3 of 4
(CASTLE DONINGTON NORTH)

Scott Wilson Kirkpatrick & Partners
Consulting Engineers and Transportation Planners
Bayheath House · Rose Hill West · Chesterfield
Derbyshire · S40 1JF

ORIGINAL DRG SIZE 841 x 1189 (A0)





NOTES

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- STANDING WATER LEVEL DURING ADVANCEMENT OF HOLE
- (2U) LEVEL WATER ROSE TO IN 2U MINUTES
- LEVEL WATER STRUCK
- SEEPAGE

LEGEND

- Topsoil
- Made Ground
- Clay
- Silt
- Sand
- Gravel
- Mudstone
- Siltstone
- Sandstone

Revision Details	By	Date	Suffix
			Revision →

83040/7/29

Scale
HORIZONTAL 1:2500 VERTICAL 1:250

DRAWN	TRACED	CHECKED	DATE
			JUNE 1984

DEPARTMENT OF TRANSPORT
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(LEAMINGTON SPA)

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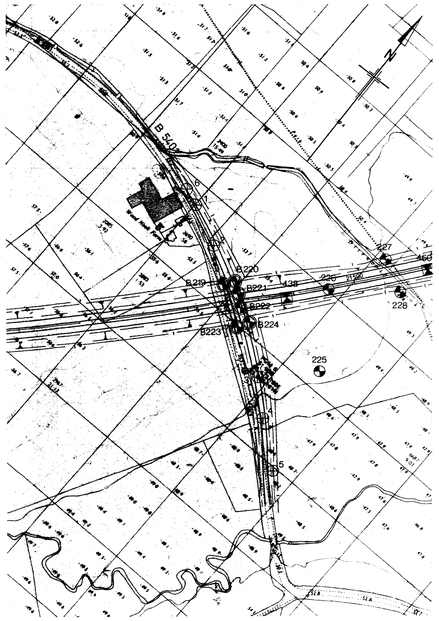
BIRMINGHAM - NOTTINGHAM ROUTE
A42 CASTLE DONINGTON NORTH
AND
A6 KEGWORTH BYPASS

MAIN SITE INVESTIGATION
CONTRACT 2
HOLE LOCATION PLAN AND
LONGITUDINAL PROFILE
SHEET 4 of 4
(CASTLE DONINGTON NORTH)

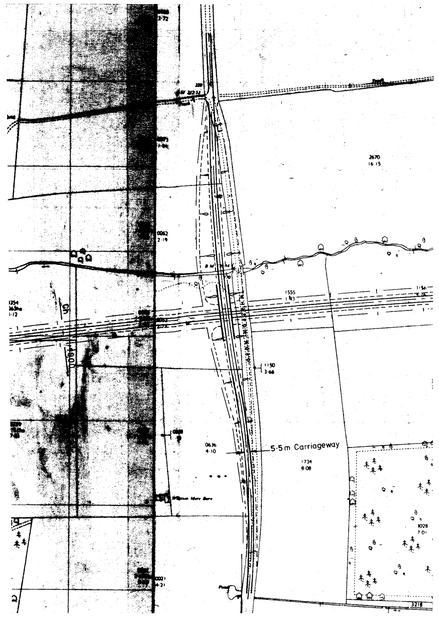
Scott Wilson Kirkpatrick & Partners
Consulting Engineers and Transportation Planners
Bayheath House · Rose Hill West · Chesterfield
Derbyshire · S40 1JF

ORIGINAL DRG SIZE 841 x 1189 (A0)

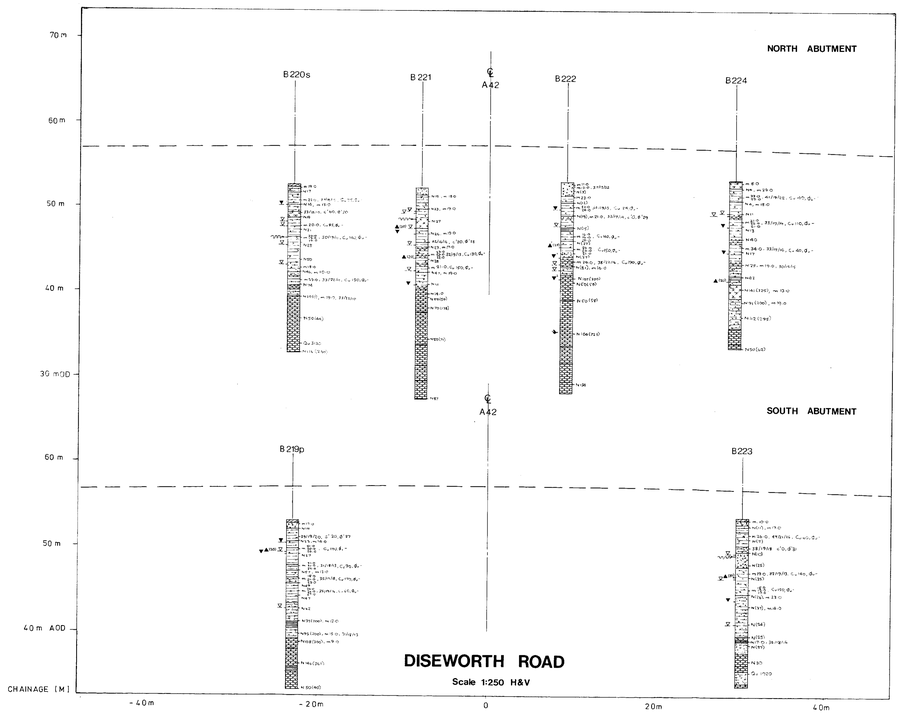
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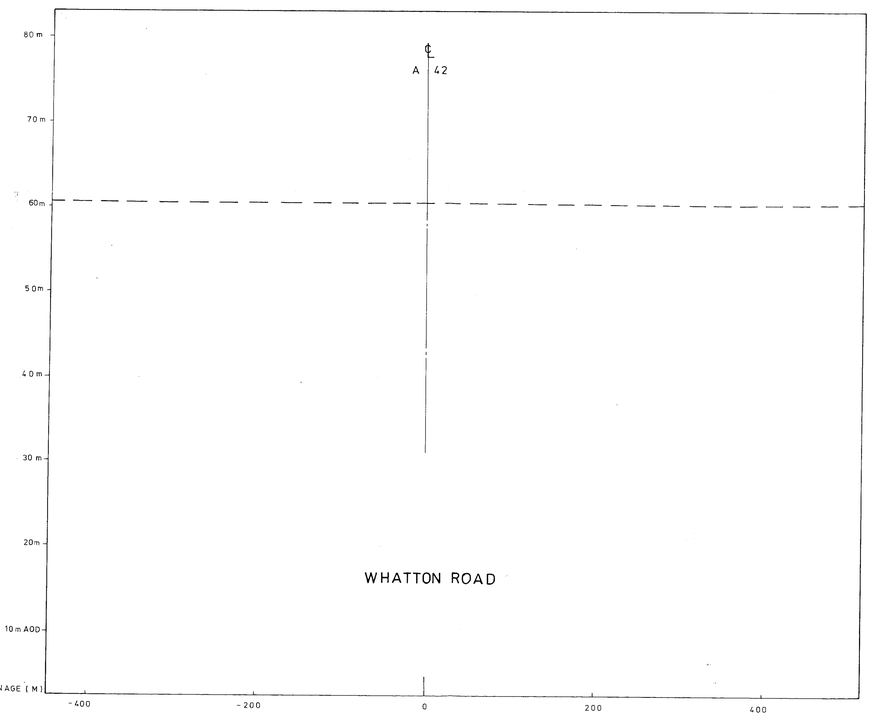
DISEWORTH ROAD
Scale 1:2500



WHATTON ROAD
Scale 1:2500



DISEWORTH ROAD
Scale 1:250 H&V



NOTES

PLAN KEY

- BOREHOLE
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- TRIAL PIT
- HAND AUGER HOLES
- X PROBE LOCATION
- P PIEZOMETER
- S STANDPIPE

LONGITUDINAL PROFILE KEY

- m 15.0 MOISTURE CONTENT %
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- N82 (100) STANDARD PENETRATION TEST BLOW COUNT. IF PENETRATION LIMITED TOTAL NUMBER OF BLOWS FOR TOTAL PENETRATION (INCLUDING SEATING) IS GIVEN IN BRACKETS.
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- STANDING WATER LEVEL DURING ADVANCEMENT OF HOLE
- ▲ (20) LEVEL WATER ROSE TO IN 20 MINUTES
- ▼ LEVEL WATER STRUCK
- SEEPAGE

LEGEND

- Topsoil
- Made Ground
- Clay
- Silt
- Sand
- Gravel
- Mudstone
- Siltstone
- Sandstone

Revision Details	By	Date	Suffix
			Revision →

83040/7/33

Scale SECTIONS
HORIZONTAL 1:250 VERTICAL 1:250

DRAWN	TRACED	CHECKED	DATE
M A	C F	C B	1984

DEPARTMENT OF TRANSPORT
EAST MIDLANDS REGIONAL OFFICE
(LEAMINGTON SPA)

exploration associates limited

BIRMINGHAM - NOTTINGHAM ROUTE

A 42 CASTLE DONINGTON NORTH

MAIN SITE INVESTIGATION
CONTRACT 2
HOLE LOCATION PLAN AND
LONGITUDINAL PROFILE
DISEWORTH ROAD AND
WHATTON ROAD

Scott Wilson Kirkpatrick & Partners
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Bayheath House · Rose Hill West · Chesterfield
Derbyshire · S40 1JF

ORIGINAL DRG SIZE 841 x 1189 (A0)

KARDUE 4884(5)

Geotechnical Design Report

East Midlands Gateway Strategic Rail Freight Interchange

M1 Overbridge

Phase - R

Element – 11

Highway Components vi & vii

HAGDMS Ref: 29800

for

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Issued by: Hydrock Consultants Limited
2-4 Hawthorn Park
Holdenby Road
Spratton
Northamptonshire
NN6 8LD

Tel: 01604 842 888
Fax: 01604 842 666
[redacted]

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1.0 INTRODUCTION

Roxhill Kegworth Ltd (Roxhill) is undertaking the construction of the East Midlands Gateway Strategic Rail Freight Interchange. The development site covers approximately 374 ha in total of which the area covered by this report forms part. The site was previously, to the commencement of the onsite works, largely agricultural land associated with the Lockington Estate, along with smaller areas of other ownership. Earthworks on the Main Site, highway improvements to the A453 and the off-site highways (Junction 24, 24A and the A50) are in progress at the time of writing this report. The HAGDMS reference for this report is 29800.

The proposed overall development is to comprise a Strategic Rail Freight Interchange (SRFI), incorporating several large warehouses and associated infrastructure, a rail freight container terminal and a landscape bund to the north providing visual screening for the villages of Lockington and Hemington. The development will necessitate major improvements to Junctions 24 & 24A of the M1, creation of a new junction on the A453 dual carriageway to serve the SRFI and provision of a southern bypass for Kegworth. This report covers the M1 Overbridge, associated with the construction of the Kegworth bypass.

The development of the site has been subdivided into a series of phases, as identified on BWB Drawing NTH/209/SK212 Revision 3, entitled DCO Phasing, dated April 2016 and presented at Annex A. Hydrock Drawing EMG-HYD-HGT-ZZ-DR-GE-0641 presents a plan of the report coverage in terms of Geotechnical Interpretive and Geotechnical Design Reports. A copy of this drawing is presented at Annex A.

The content of this report covers the geotechnical design elements associated with the M1 Overbridge Phase R, comprising the A6 Kegworth Bypass, Highway Components vi and vii. In terms of contractual responsibility, as identified on BWB Drawing NRH/209/SK173 Rev P6, entitled Contract Assembly, dated March 2016 the work covered by this report is identified as Element 11. A copy of this drawing is presented at Annex A.

In January 2017, Hydrock was commissioned by Roxhill to undertake the ground investigation and complete a Geotechnical Design Report (GDR) to cover the proposed earthworks required for the M1 Overbridge and the A6 Kegworth Bypass. The content of this report has been prepared following the guidance and in accordance with the requirements of DMRB HD 22/08.

A phase of additional site investigation works was undertaken in May 2017, once access to the location of bridge abutments was facilitated as part of the Smart Motorway highway improvement works. The content of the GDR has been reviewed and revised accordingly based upon the findings of the most recent investigation works.

The findings from the previous phases of investigation for the areas of the site associated with the M1 Overbridge are presented in the following reports, with copies of those reports prepared by other consultants provided for the production of the GDR:

- East Midlands Gateway Strategic Rail Freight Interchange: Geotechnical Interpretive Report, M1 Overbridge and Kegworth By-pass, prepared by Hydrock Consultants Ltd on behalf of Roxhill Kegworth Ltd, Hydrock Report R/14792/013 dated July 2017.

- East Midlands Gateway Strategic Rail Freight Interchange: Zone 4 Kegworth Bypass. Preliminary Sources Study Report, prepared by RSK, reference 312494/4-02 (00), on behalf of Roxhill Developments Ltd, dated November 2013.

- East Midlands Gateway Strategic Rail Freight Interchange: Zone 4 Kegworth Bypass. Factual Ground Investigation Report, prepared by RSK, reference 312494/4-03 (00), on behalf of Roxhill Developments Ltd, dated December 2013.

- East Midlands Gateway Strategic Rail Freight Interchange: Zone 4 Kegworth Bypass. Preliminary Ground Investigation Report, prepared by RSK, reference 312494/4-04 (00), on behalf of Roxhill Developments Ltd, dated December 2013.

- Stage 1 Preliminary Ground Investigation at Kegworth, for Waterman Transport and Developments Limited. Project Number PC124998, dated October 2012.

Additional reference has been made to previous phases of ground investigation and geotechnical design completed by Hydrock on the other elements within the wider development. Supporting information has been taken from the following reports prepared by Hydrock.

- East Midlands Gateway Strategic Rail Freight Interchange: Factual Ground Investigation Report, prepared by Hydrock Consultants Ltd on behalf of Roxhill Developments Ltd, Hydrock Report R/14792/003 dated June 2016.

- East Midlands Gateway Strategic Rail Freight Interchange: Main Site. Geo-environmental Report, prepared by Hydrock Consultants Ltd on behalf of Roxhill Developments Ltd, Hydrock Report R/14792/004 dated May 2016.

- East Midlands Gateway Strategic Rail Freight Interchange: Rail Container Terminal and A453 Site Access Junction. Geotechnical Interpretive Report, prepared by Hydrock Consultants Ltd on behalf of Roxhill Kegworth Ltd, Hydrock Report R/14792/006 dated June 2016.

- East Midlands Gateway Strategic Rail Freight Interchange: A453 Site Access Junction. Geotechnical Design Report, prepared by Hydrock Consultants Ltd on behalf of Roxhill Kegworth Ltd, Hydrock Report R/14792/008 dated November 2016.

The content of the reports listed above have been reviewed and relied upon by Hydrock in the formation of this GDR and are considered to provide sufficient information to satisfy the requirements for the purposes of drafting this GDR in terms of the Preliminary Sources Study Report (PSSR) and Ground Investigation Report (GIR) as described by HD 22/08, Managing Geotechnical Risk.

Cass Hayward LLP (Cass Hayward) have been separately appointed by Roxhill to undertake the structural design of the M1 Overbridge, which is presented under a separate cover. BWB Consulting Ltd (BWB) have been appointed by the Client to undertake the highway and civil engineering design elements, with their submission presented under a separate cover. Selected Cass Hayward and BWB drawings have been included in Annex A of this GDR to support the geotechnical design elements completed by Hydrock.

The GDR has been prepared for Roxhill for the purposes of identifying geotechnical characteristic design values for the structural design of the M1 Overbridge. The GDR has been written in accordance with the requirements of DMRB HD 22/08. The report structure has followed the general requirements of HD 22/08, with the addition of Section 1 Introduction. The inclusion of the Introduction section his intended to aid in the understanding of the reader and set out the correct sequence of reports and documents used in the generation of the GDR.

BS EN ISO 1997: Section 2 advocates the use of geotechnical categorization of the proposed structures to establish the design requirements; i.e. the geotechnical assessment for the bridge abutment, selected

backfill to structures, associated earthworks and the placement of fill, have been determined to be Category 2.

The Geotechnical Category has been re-assessed at the design stage and this GDR covers the elements of the development which have been deemed to be Category 2.

Further to the reference to BS EN ISO 1997, additional consideration has been given to DMRB BD 2/12 (Technical approval of Highway Structures) to ensure the selected categorisation for the GDR is in accordance with this publication. From reference to Section 3 of BD 2/12, the geotechnical design of the M1 Overbridge is considered to be Category 2.

A number of abbreviations have been included in the text of the report and the accompanying earthworks specification. For clarity, the following abbreviations with their corresponding description have been used.

- DA: Design Approach, as defined by BS EN 1997 (Eurocode 7, EC 7) with a corresponding number defining which approach and combination has been used, e.g. reference to DA1/1 would be Design Approach 1, combination 1.
- DCO: Development Consent Order.
- DMRB: Design Manual for Roads and Bridges.
- EC 7: Eurocode 7, BS EN 1997-1: 2004 + A1:2013 and BS EN 1997-2: 2007.
- EGL: Existing Ground Level, at the time of drafting the report and/or ground investigation works.
- FGL: Final Ground Level.
- HAPMS: Highways Agency Pavement Management System, where the Highways Agency has now been replaced by Highways England.
- HAGDMS: Highways Agency Geotechnical Data Management System, where the Highways Agency has now been replaced by Highways England.
- MAGLE: Managing Agents Geotechnical Liaison Engineer.
- MCerts: Environment Agency Monitoring Certification Scheme.
- m OD: reduced ground level, presented in terms of m Ordnance Datum, with a positive value representing a level above Ordnance Datum and a negative value below Ordnance Datum.
- MMG: Mercia Mudstone Group, the prevailing geology which underlies the majority of the site, comprising a range of mudstone, siltstone and sandstone materials, broadly split into five main groups and weathering grades.
- MMP: Materials Management Plan, developed by the appointed Contractor to manage materials on site including the methodology for demonstrating certainty of use, quantity of material required and the acceptability of the site won soils to be used as engineered fill.
- NB: Northbound carriageway.

- NR: Nominated Representative, the Client's representative or representatives who have been nominated by the Client with responsibility for supervision of specific aspects of the works (earthworks).

- RMS: Remediation Method Statement, covering aspects and protocols to be followed by the Contractor associated with contamination, including the protection of Controlled Waters, Human Health and the Environment.

- SB: Southbound carriageway.

- SHW: Manual of Contract Document for Highway Works, Volume 1, Specification for Highway Works.

- UKAS: United Kingdom Accreditation Service.

The document referencing system used for the East Midlands Gateway development follows the guidance from BS 1192:2007 Collaborative production of architectural, engineering and construction information, Code of practice. In accordance with this system, documents include a reference to the status at time of issue. The following status references are of note when reviewing this report:

- S2, the document is suitable for information and has been issued for comment; and

- S4, the document is suitable for construction approval.

Once a document has been approved for construction, only the status reference will be changed, with no further amendments. As built records will include a status reference prefixed with CR.

2.0 EARTHWORKS

The following section provides an overview of the geotechnical parameters, as appropriate to the proposed new embankments and the underlying soils associated with the M1 Overbridge. A series of slope stability assessments have been completed utilising the findings from previous phases of ground investigation.

2.1 Slope Stability

The redevelopment of the site requires a number of temporary and permanent cuttings, embankments and slopes to be formed, as identified on the BWB drawings. In terms of the new M1 Overbridge, the location of the bridge spans across an existing cutting of the M1. The bridge is to be supported on ground bearing abutments. As such there will be a requirement to place fill, including selected fill to structures, to in fill behind the bridge abutments and the existing slopes. All fill is to be benched in to existing slopes, in accordance with the Earthworks Specification. The contract specific requirements of the Earthworks Specification are presented at Annex A of this report.

The following sections detail the stability of the proposed cutting slopes and engineered slopes in both short-term temporary and long-term permanent conditions.

2.1.1 Methods of Analysis

In accordance with Design Approach 1 from BS EN ISO 1997, all calculations have applied the reduction to the actions and soil parameters using Combination 1 and 2 (DA1/1 and DA1/2) for STR and GEO Limit States. This approach has been used for geotechnical analysis in accordance with definitions and methodology specified in BS EN ISO 1997.

Appendix 0/4 List B provides a comprehensive list of design standards, guides, codes of practice and additional resources which have been used in the formation of this design. In particular, the following publications have been used:

- BRITISH STANDARDS INSTITUTION. 1990. Method of tests for soils for civil engineering purposes. BS 1377. Parts 1 - 9. BSI, London.
- BRITISH STANDARDS INSTITUTION. 2004. Eurocode 7 – Geotechnical Design, Part 1 General rules, BS EN 1997-1:2004 + A1 2013. BSI, London.
- BRITISH STANDARDS INSTITUTION. 2007. Eurocode 7 – Geotechnical Design, Part 2 Ground investigation and testing, BS EN 1997-2. BSI, London.
- BRITISH STANDARDS INSTITUTION. 2008 + A1:2011. Code of practice for temporary works procedures and the permissible stress design of falsework. BS 5975. BSI London.
- BRITISH STANDARDS INSTITUTION, 2009. Code of practice for earthworks. BS 6031. BSI London.
- BRITISH STANDARDS INSTITUTION. 2015. Foundations, BS 8004. BSI, London.
- BRITISH STANDARDS INSTITUTION. 2016. Code of practice for strengthened/reinforced soils and other fills. BS 8006-1:2010. BSI London.
- BRITISH STANDARDS INSTITUTION. 2003. Aggregates for unbound and hydraulically bound materials for use in civil engineering works and road construction. Guidance on the use of BS EN 13242. PD 6682-6: 2003. BSI, London.
- BRITISH STANDARDS INSTITUTION. Geotechnical investigation and testing – Field testing. BS EN ISO 22476. BSI London
- BUILDING RESEARCH ESTABLISHMENT. 2001. Building on fill: geotechnical aspects, 2nd Edition. BRE BR424. BRE, Garston.
- BUILDING RESEARCH ESTABLISHMENT. 2015. Building on fill: geotechnical aspects, 3rd Edition. BRE FB75. BRE Garston.
- BUILDING RESEARCH ESTABLISHMENT. 2005. Brownfield sites, an integrated ground engineering strategy. BRE BR485. BRE, Garston.
- THE HIGHWAYS AGENCY. 1991. Design Manual, Road and Bridges: Volume 4, Geotechnics and Drainage; Section 1, Earthworks; Part 1, HA 44/91, Design and preparation of contract documents. HA 44/91.

- THE HIGHWAYS AGENCY. 2012. Design Manual for Roads and Bridges. Volume 1, Highway Structures Approval Procedures and General Design. Approval Procedures. BD 2/12.
- THE HIGHWAYS AGENCY. 1987. Design Manual for Roads and Bridges. Volume 2, Highway Structures Design (Substructures, special structures and materials) Substructures. Backfilled retaining walls and bridge abutments. BD 30/87.
- THE HIGHWAYS AGENCY. 2003. Design Manual for Roads and Bridges. Volume 2, Highway Structures Design (Substructures, special structures and materials) Substructures. Strengthened/reinforced soils and other fills for retaining walls and bridge abutments. BD 70/03.
- THE HIGHWAYS AGENCY. 2000. Design Manual for Roads and Bridges. Volume 2, Highway Structures Design (Substructures, special structures and materials) Substructures. Foundations. BD 74/00.
- THE HIGHWAYS AGENCY. 2008. Design Manual for Roads and Bridges. Volume 4, Geotechnics and Drainage. Section 1 Earthworks, Part 2, Managing Geotechnical Risk. HD 22/08.
- THE HIGHWAYS AGENCY. 2009. Design guidance for road pavement foundations (Draft HD 25). Interim Advice Note 73/06 Revision 1. IAN 73/06 Rev 1.
- THE HIGHWAYS AGENCY. 1994. Design Manual, Road and Bridges: Volume 4, Geotechnics and Drainage; Section 1, Earthworks; Part 5, HA 68/94 Design methods for the Reinforcement for Highway Slopes by Reinforced Soil and Soil Nailing Techniques. HA 68/94.
- THE HIGHWAYS AGENCY. 1994. Design Manual, Road and Bridges: Volume 4, Geotechnics and Drainage; Section 1, Earthworks; Part 5, HA 70/94, Construction of Highway earthworks. HA 70/94.
- THE HIGHWAYS AGENCY. 2007. Design Manual, Road and Bridges: Volume 4, Geotechnics and Drainage; Section 1, Earthworks; Part 6, HA 74/07, Treatment of Fill and Capping Materials Using Either Lime or Cement or Both. HA 74/07.
- HIGHWAYS ENGLAND. 2016. Manual of Contract Documents for Highway Works, Specification for Highway Works: Volume 1. SHW.
- INSTITUTION OF CIVIL ENGINEERS. 1987. Specification for ground treatment. ICE Geotechnical Engineering Group; Ebook ISBN : 978-0-7277-4943-7; Publication Date: April 1987.
- INSTITUTION OF CIVIL ENGINEERS. 2012. ICE Manual of Geotechnical Engineering. Volume 1 Geotechnical Engineering Principals, Problematic Soils and Site Investigation. ICE Publishing, 2012. ISBN 978-0-72777-5707-4.
- INSTITUTION OF CIVIL ENGINEERS. 2012. ICE Manual of Geotechnical Engineering. Volume 2 Geotechnical Design, Construction and Verification. ICE Publishing, 2012. ISBN 978-0-72777-5709-8.

All geotechnical and geostructural analysis undertaken as part of the assessment of cutting stability has been completed using the FINE GEO5 Geostructural Software Suite 2017. The complete software suite allows the user to preselect the method of analysis, design approach and geotechnical parameters and presents the findings as a complete report for each analysis undertaken along with a series of plans in 2D and 3D of the model under assessment.

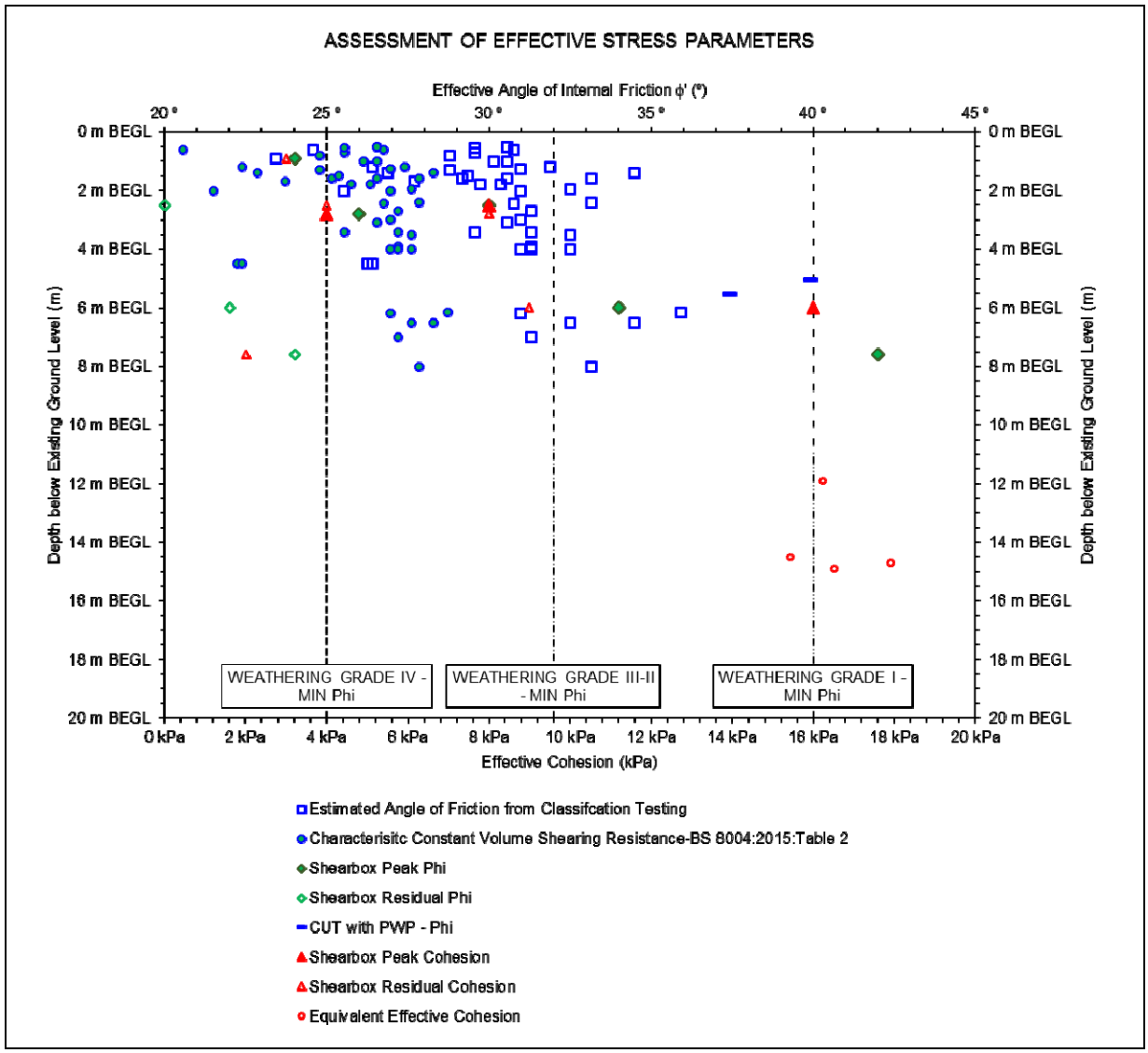
2.1.2 Soil Parameters

The soil parameters used in the assessment of the slope stability are based upon the findings and recommendations of the Geotechnical Investigation Report (GIR), presented as Hydrock Report R/14792/013, and a review of previous GIRs for other phases of the wider site, as detailed in Section 1.

Figure 2.1 presents the findings of the direct and indirect assessment of effective stress parameters, plotted against the depth below Existing Ground Level (EGL) for effective cohesion (c') and effective angle of friction (ϕ'), including peak ($_{pk}$), critical ($_{cr}$) and residual values ($_{res}$). Figure 2.1 plots the derivation of soil parameters for effective cohesion and effective angle of friction.

Figure 2.1 has been used in the derivation of appropriate values for c' and ϕ' to be used in the geotechnical modelling, including the slope stability analysis as well as the assessment of the ground bearing bridge abutments. Following responses to previous reviews for GDR covering other aspects of the wider site, a sensitivity analysis on the lower bound values, in particular the use of effective cohesion for the weathered MMG has been completed. This is presented within the subsequent sections of this report.

Figure 2.1: Derivation of Effective Stress Parameters for Slope Stability



On the basis of the encountered geology summarised in the GIR, the geostructural design reports presented at Annex B and the requirements from Table 6/1, a set of geotechnical design characteristic values have been determined for each stratum to be used in the geostructural assessment. This information is summarised in Table 2.1.

Design Parameters and Characteristic Values have been adopted directly from the previous GIR listed in Section 1, or correlated to design values using the methodologies defined in Annex C. In terms of deriving appropriate effective stress parameters, a number of direct and indirect assessments have been completed. The indirect assessment of these parameters has made reference to the findings of the previous phases of investigation and testing, as well as the British Standards and Design Guides previously listed in Section 2.1.1.

For the purposes of the GDR, soils have been grouped by weathering grade and engineering designation, as opposed to the geological grouping adopted in the GIR, to aid in the understanding of the future engineering works by the Contractor and to allow for direct correlation between published values for geotechnical parameters and the characteristic values used in the GDR. A comprehensive assessment was completed, comparing the geological group and the weathering grade as recorded during the GIR phase. It was concluded that for the purposes of the GDR and subsequent earthworks operation, the use of the weathering grade as opposed to the parent geological group was more beneficial in understanding the geotechnical characteristics, and this is the approach adopted in the GDR.

Table 2.1: Design Parameters and Characteristic Values

Stratum Description	**Parameter**					
	Bulk Unit Weight	Undrained cohesion	Drained Cohesion	Effective Angle of Internal Friction	Oedometric Modulus	Elastic Modulus Small Strain
	γ_b kN/m³	S_u kN/m²	c′ kN/m²	ϕ' º	E_{oed} MPa	E_s MPa
Topsoil / Subsoil[2]	16.50	35	0	25	2.5	3.5
Firm to stiff red brown CLAY MMG IVB[1]	19.50	65	2 (< 20)[3]	25 (25 – 32)[3]	12.5	30
Stiff red brown CLAY MMG IVA[1]	20.50	90	4 (< 20)[3]	32 (25 – 32)[3]	15.0	37
Mercia Mudstone MMG III[1]	22.00	Fig 2.2 & Fig 2.3	10 (< 20)[3]	32 (32 – 42)[3]	Table 2.3	Table 2.3
Mercia Mudstone MMG II[1]	22.50	Fig 2.2 & Fig 2.3	16 (> 25)[3]	42 (> 40)[3]	Table 2.3	Table 2.3
Intact Mudstone MMG I[1]	23.00	Fig 2.2 & Fig 2.3	25 (> 25)[3]	42 (>40)[3]	Table 2.3	Table 2.3
Bromsgrove Sandstone – interbedded Mudstone and Sandstone	22.50	150	8	40	250	625

Stratum Description	**Parameter**					
	Bulk Unit Weight	Undrained cohesion	Drained Cohesion	Effective Angle of Internal Friction	Oedometric Modulus	Elastic Modulus Small Strain
	γ_b kN/m³	S_u kN/m²	c' kN/m²	ϕ' º	E_{oed} MPa	E_s MPa
Class 2 Cohesive General Fill (2A & 2C)	19.50	50[2]	2	25	8.5	20
Class 6F/9E Capping	21.00	-	-	35	30	75
Class 6N Selected Fill to Structures	23.00	-	-	$\phi'_{pk} \leq 44º$ $\phi'_{crit} \leq 38º$	100	150
Class 7A Selected cohesive fill to Structures	20.50	100	2	25	20	45

Notes: [1] The reference to MMG describes the material is derived from the general sequence of the Mercia Mudstone Group, with an appropriate weathering grade (IVB to I) are taken from CIRIA C570.

[2] Minimum value for undrained shear strength specified to be 50 kN/m².

[3] Values presented in brackets () have been taken from CIRIA C570 on typical parameters for the MMG.

Testing of the site won soils has indicated that when fill materials are placed in accordance with the guidance from SHW Table 6/4, the undrained shear strength of all materials is likely to be in excess of 65 kN/m². However, the values recorded in Table 2.1 are considered to be the least credible, lowest permissible parameters. This has been used in order to demonstrate that overall geotechnical design is compliant even where the lowest permissible strength is considered.

BS 8004 refers the designer to CIRIA C570, where the values for effective cohesion presented in Table 2.1 have been derived. Effective cohesion is not a parameter used in the current design process for the M1 Overbridge; however, for completeness it has been left included in the document to show consistency with the other GDRs that form part of the wider EMG site.

Soils parameters used in the derivation of earth pressure coefficients are based on a soil with shear resistance ϕ'_{crit} value = 38° and ϕ'_{max} plane strain = 44°. The specification of the backfill has a requirement for shear box testing of Class 6N backfill (compacted to a Dr of 92%) to demonstrate that the ϕ'_{crit} value and ϕ'_{max} plane strain values do not exceed those used in the design.'

These values combine to give a max design value of 0.4 x 38 + 0.6 x 44 = 41.6, i.e. as the 41.5º adopted in the geostructural analysis design process.

The process has been replicated in order to determine the minimum parameters for shear resistance ϕ'_{crit} value of 31.5° and ϕ'_{max} plane strain = 37.5°. This will return a lower bound design value of 35º.

The structural design of the M1 Overbridge, which is a single span integral bridge, is to comprise ground bearing abutments, founded at a level in the order of 66.5 to 66.8 m OD. The structural design of the Bridge, including the wing walls and the retaining walls, has been undertaken by Cass Hayward. Reference should be made to the Cass Hayward structural design and accompanying drawings. A selection of drawings has been provided to Hydrock, which are replicated in Annex A of this report.

In terms of the assessment on slope stability, this section concentrates on the temporary slope stability required during construction. This section also considers the long-term stability of the existing cutting. Section 3 of this design report considers the proposed highway structures from a geotechnical design perspective. This includes the derivation of the safe and permissible bearing pressure for the foundation of the proposed retaining wall, with the indicative location shown on Hydrock drawing EMG-HYD-C4-M1OB-DR-GE-0636, a copy of which is presented at Annex A. The geotechnical assessment of the retaining walls includes the global stability, with the geotechnical parameters as defined in this section of the report.

In addition to being used in the slope stability analysis, the geotechnical design parameters defined in Table 2.1 have been adopted for the other subsequent analysis, including the prediction of settlement resulting from changes in imposed load. Where additional geotechnical parameters have been used in the analysis, the values are presented on the accompanying geostructural reports, presented at Annex B.

At the foundation level of the abutment historical records have indicated the geology will comprise the lower level of the MMG weathering Grade III to Grade II. At this reduced level the strength characteristics of the material are in the range of an extremely high strength soil (S_u > 300 kN/m²) and an extremely weak rock (UCS <1000 kN/m² and where S_u = UCS/2). Following the completion of the additional boreholes at the proposed abutment locations, a detailed assessment on the strength and stiffness profile of the underlying MMG has been completed.

Figure 2.2 presents the results of the statistical analysis of the strength profile of the MMG, This is based upon a total of 291 individual strength measurements. A small number of the values used are derived from direct measurement of the undrained shear strength, with the remainder based upon correlated unconfined compressive strength and point load tests.

Figure 2.2 presents the strength profile against the reduced ground level. Data has been combined from individual measurements and presented per 1.0m of change in reduced ground level. The calculated upper and lower quartile values for each zone of assessment have been used to form the solid blue block, with the upper and lower error bars presented.

Figure 2.2: Analysis of Strength vs Depth – Statistical Analysis following May 2017 Boreholes

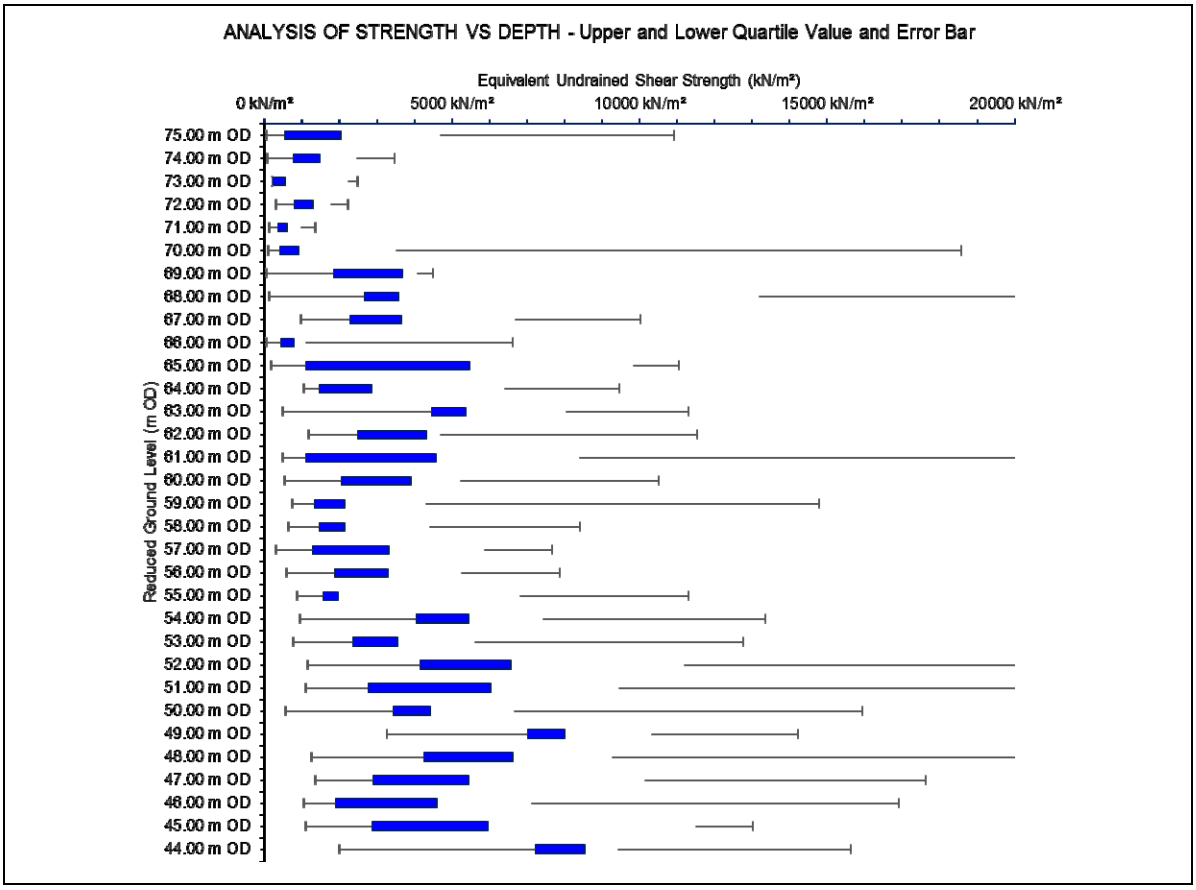
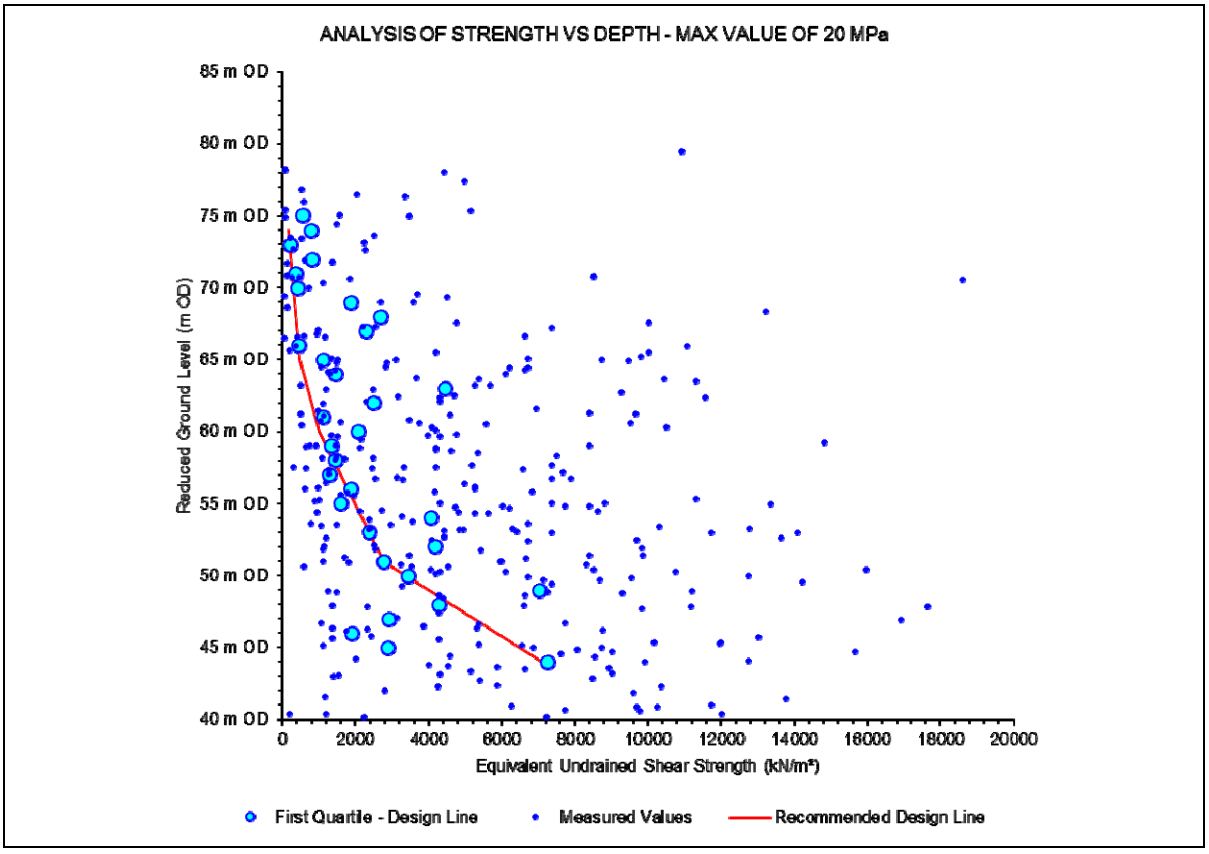


Figure 2.3: Analysis of Strength vs Depth - Design Line



For clarity, the horizontal scale has been limited to 20,000 kN/m² (20 MPa). However, values in excess of 20 MPa were locally recorded, with a maximum value in excess of 50 MPa.

The lower (first) quartile value for each level has been used to define the Design Line for the strength profile of the MMG. This is presented on Figure 2.3, with the specific lower quartile value for each level shown as a large blue circle, and the design line as a solid red line.

Using the design line presented in Figure 2.3, a series of regression analysis parameters were derived, which relates the reduced level in m OD to a corresponding undrained shear strength based upon the first (e.g. lower) quartile value. The parameters derived from this assessment are presented in Table 2.2.

Table 2.2: Regression Analysis Parameters for Strength derived from Reduced Ground Level

Reduced Ground Level		Undrained Shear Strength at upper level	Linear Regression Parameters		Modulus Values	
From	To		S_u = (A x Level m OD) + B		Oedometric Modulus E_{oed}	Elastic Modulus E_s
			A	B		
74.00 m OD	65.00 m OD	150 kN/m²	-33.333	2616.667	(S_u kN/m² x 0.166) MN/m²	(S_u kN/m² x 0.400) MN/m²
65.00 m OD	60.00 m OD	450 kN/m²	-110.000	7600.000	(S_u kN/m² x 0.166) MN/m²	(S_u kN/m² x 0.400) MN/m²
60.00 m OD	51.00 m OD	1,000 kN/m²	-194.444	12666.667	(S_u kN/m² x 0.166) MN/m²	(S_u kN/m² x 0.400) MN/m²
51.00 m OD	44.00 m OD	2,750 kN/m²	-621.429	34442.857	(S_u kN/m² x 0.166) MN/m²	(S_u kN/m² x 0.400) MN/m²

Table 2.2 includes the corresponding correlation between the undrained shear strength and the Oedometric modulus (E_{oed}) and Elastic Modulus (E_s). The derivation of the correlation parameters is presented in the detailed discussion on analysis methods presented in Annex C with specific reference to Figure C.6 and C.7.

In order to determine Oedometric Modulus values for a specific reduced ground level, the initial calculation will be to derive the corresponding undrained shear strength. As an example, considering the reduced level of 66.5 m OD, then the equation for deriving the equivalent shear strength (S_u) would be as follows.

S_u = (-33.333 x 66.5) + 2616.667 = 400 kN/m²

Taking this derived value for shear strength, then the corresponding Oedometric Modulus (E_{oed}) would be.

E_{oed} = 400 kN/m² x 0.166 = 66.4 MN/m²

The same process can be used to estimate a derived value for the Elastic Modulus (E_s).

E_s = 400 kN/m² x 0.400 = 160.0 MN/m²

At the proposed foundation level of around 66.5 to 66.8m OD, the corresponding undrained shear strength using the lower quartile value has been determined to be in the order of 390 kN/m² to 400

kN/m². This would be an equivalent Unconfined Compressive Strength of 780 kN/m² to 800 kN/m². The assessed strength is in accordance with the previous assessment as noted previously, prior to the drilling of the additional boreholes in May 2017.

A table of values of derived geotechnical parameters is presented in Annex B. This is based upon the strength and stiffness per 1.0m increment, starting at a maximum elevation of 78 m OD and reducing to less than 60 m OD. The maximum elevation of 78 m OD has been taken from the maximum elevation of the embankment to the outside of the cutting. The weathering grade used in this table is based upon Hydrock Drawing EMG-HYD-C4-M1OB-DR-GE-0636. Reference is made in the notes at the bottom of the table as to how each parameter has been derived.

2.2.3 Drainage and Groundwater Characteristics

This GDR is limited in coverage to the M1 Overbridge. The location of the bridge spans a pre-existing cut in the MMG, as identified on Hydrock Drawing EMG-HYD-C4-M1OB-DR-GE-0636, a copy of which is presented at Annex A.

Groundwater modelling has identified that the prevailing ground water profile is present within the underlying Bromsgrove Sandstone. Therefore, where the geotechnical model extends to a depth to include the Bromsgrove Sandstone, the ground water profile is included in the analysis. For the majority of the analysis included in this report the groundwater profile is below that base of the model. Consideration on the intrinsic permeability and also the rate at which consolidation is expected to occur is discussed in more detail in Section 2.4.

The GEO5 software includes an option to consider the effects of water on the stability of the slope in terms of a ground water level pore water coefficient (r_u), pore pressure, ground water pressure and suction surface or rapid draw down. For the purposes of the slope stability analysis the groundwater profile option had been selected, based upon the measured levels, for the long-term effective stress condition.

Details of permanent drainage are presented on the BWB drawings and accompanying specification.

2.2.4 Slope Suitability Assessment

The location of the new M1 Overbridge spans an existing cutting for the M1 Motorway. No unsupported slopes are proposed. However, temporary slopes will need to be cut to permit the construction of the bridge abutments. Temporary slopes to permit construction are based on a short-term undrained analysis. To complete the assessment of slope stability, the long-term stability under fully drained conditions of the pre-existing M1 cutting has been included. The following GEO5 Geostructural analysis reports related to slope stability are presented in Annex B.

- EMG-HYD-C4-M1OB-CA-GE-0661: Long-term slope stability of pre-existing M1 Cutting.

- EMG-HYD-C4-M1OB-CA-GE-0662: Short-term temporary stability during construction of new M1 Overbridge Abutment.

Table 2.3 presents a summary of the analysis completed on the long-term stability of the pre-existing M1 Cutting.

Table 2.3: Long-term Stability of pre-existing M1 Cutting - EMG-HYD-C4-M1OB-CA-GE-0661

Embankment	Slip Surface	Slope Stability Result		Comments
		Maximum Utilisation	Minimum Over Design Ratio Γ	
West Embankment (Northbound M1)	Circular	73.7 %	1.35	Acceptable
	Non-circular	74.6 %	1.34	Acceptable
East Embankment (Southbound M1)	Circular	65.9 %	1.52	Acceptable
	Non-circular	66.4 %	1.51	Acceptable

The maximum degree of utilisation for the pre-existing cutting was 74.6%, which is the equivalent Over Design Ratio of 1.34. In each instance, the highest degree of utilisation was recorded for DA 1/2.

Table 2.4 presents a summary of the analysis completed on the short-term stability during the construction of the new bridge abutments. The sequence of activities described in the following analysis is presented on Hydrock Drawing EMG-HYD-C4-M1OB-DR-GE-0654-S4-P2, a copy of which is presented at Annex A.

Table 2.4: Short-term Stability during Construction – EMG-HYD-C4-M1OB-CA-GE-0662-S4-P2

Construction Stage	Slip Surface	Slope Stability Result		Comments
		Maximum Utilisation	Minimum Over Design Ratio Γ	
Stage 1 – Pre-existing Condition	Circular	24.8 % [2]	4.03	Acceptable
	Non-circular	23.8 % [2]	4.20	Acceptable
Stage 2 – Excavation of Foundations	Circular	27.9 % [2]	3.58	Acceptable Excavation exposed for minimum period
	Non-circular	27.9 % [2]	3.58	
Stage 3 – Excavation including site plant	Circular	26.1 % [2]	3.83	Acceptable Excavation exposed for minimum period
	Non-circular	23.2 % [2]	4.20	
Stage 4 to 6 – Foundation & Abutment Cast	Circular	Not analysed	-	Construction activities covered by previous analysis
	Non-circular	Not analysed	-	
Stage 7 – Granular Backfill to Abutment	Circular	24.1 % [1]	4.15	Bench cut at time of fill placement
	Non-circular	22.6 % [1]	4.42	
Stage 8 – Foundation to retaining wall	Circular	Not analysed	-	Construction activities covered by previous analysis
	Non-circular	Not analysed	-	
Stage 9 – Granular Backfill to Abutment	Circular	22.3 % [2]	4.48	Acceptable
	Non-circular	21.5 % [1]	4.65	Acceptable
Stage 10 & 11- Foundation to retaining wall	Circular	Not analysed	-	Construction activities covered by previous analysis
	Non-circular	Not analysed	-	
Stage 12 – Granular	Circular	30.4 % [2]	3.29	Acceptable

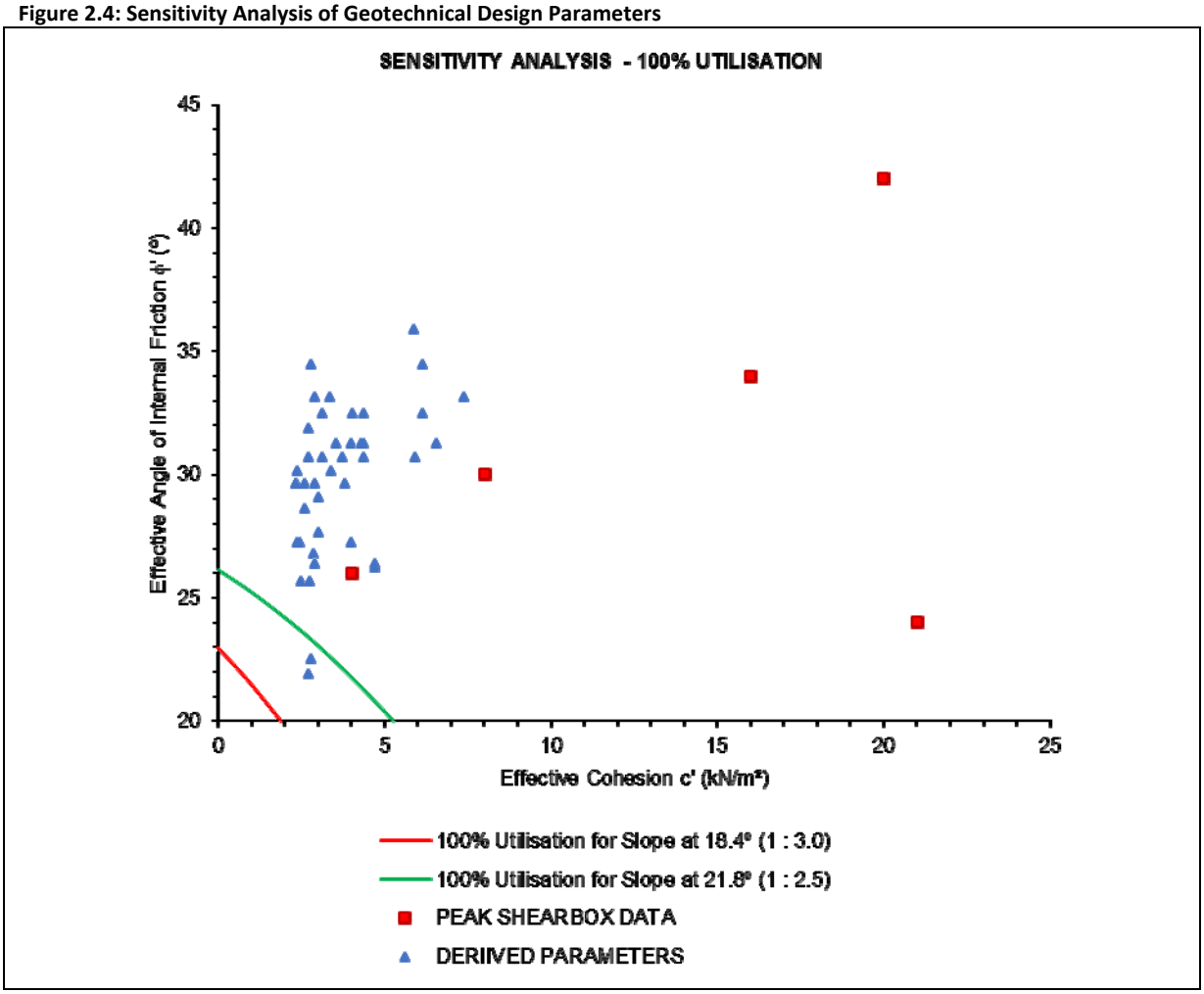
Construction Stage	Slip Surface	Slope Stability Result		Comments
		Maximum Utilisation	Minimum Over Design Ratio Γ	
Backfill to Abutment	Non-circular	35.0 % [2]	2.86	Acceptable
Stage 13 – Application of Highway UDL 20 kPa	Circular	30.4 % [2]	3.29	Acceptable
	Non-circular	35.0 % [2]	2.86	Acceptable

Notes: [1] Indicates highest degree of utilisation derived using DA 1/1

[2] Indicates highest degree of utilisation derived using DA 1/2

The maximum degree of utilisation for the pre-existing cutting was 35.0%, which is the equivalent Over Design Ratio of 2.86.

Figure 2.4: Sensitivity Analysis of Geotechnical Design Parameters



In assessing the stability model associated with the embankments to the M1 Overbridge, in all instances and in all combinations, the degree of utilisation returned was less than 100% with the corresponding Over Design Ratio (Γ) in excess of 1.0, which is acceptable in terms of compliance with the requirements of BS EN 1997.

In deriving the acceptability of the slopes which are to be formed in areas of cut, consideration has been given to the long-term performance of the material with specific emphasis on the potential for the

mudstone materials to degrade through weathering should they be left exposed. As such, the maximum slope to be formed either through the placement of engineered fill derived from the MMG or by cutting has been set at 1:2.5 (21.8º), which should be sufficient to provide an acceptable profile to allow topsoil to be placed and vegetation to become established. This will require an appropriate level of preparation of the surface of the slopes, and this is discussed separately.

To complete the analysis on the stability of the new slopes, a sensitivity check has been undertaken on a range of geotechnical parameter.

In completing this assessment a range of effective cohesion values between 0 and 4 kN/m² has been used in conjunction with effective angles of friction between 20 and 28º. Two slope profiles have been used in this assessment, the first with a final landform profile of 1:3 (18.4º) and the second of 1:2.5 (21.8º). The results of this assessment have been used to derive a line for each slope profile where the combination of the selected values for effective cohesion and friction would return a degree of utilisation of 100%. This is presented on Figure 2.3.

Figure 2.4 presents two series of data, as lines,

- a solid red line representing 100% utilisation for a slope of 1:3 (18.4º) for a combination of c' and ϕ'; and
- a solid green line represents 100% utilisation for a slope of 1:2.5 (21.8º) for combination of c' and ϕ'.

As the value for effective cohesion (c') increases, the minimum value for effective friction (ϕ') will decrease and still achieve a corresponding degree of utilisation of 100%. Included on Figure 2.2 are the results of the actual test data for the measured c' and ϕ' from the remoulded shearboxes. Of note is that one value for c' has been reduced from 80 kPa to 20 kPa, so that it could be plotted on the figure. The data from the shearboxes is presented as a series of red squares. Further to this, inferred values of c' and ϕ' derived following BS 8004: 2015 are plotted as blue triangles.

Where data is plotted above the line, the resultant degree of utilisation will be less than 100%, or alternatively when reported as the Over Design Ratio (Γ), a value in excess of 1. Following a traditional, pre EC 7 approach, then a Γ of 1 would be equivalent to a global factor of safety of 1.5.

Based upon the results of the sensitivity analysis, in order for a degree of utilisation to be less than 100%, an effective angle of internal friction (ϕ') of at least 26º (25.8º) is required, where there is no benefit from effective cohesion, for slopes of up to 1:2.5 (21.8º). When considering a shallower slope of 1:3 (18.4º), the minimum friction angle for the material will reduce to 23º (22.6º), where the effective cohesion is 0 kN/m².

With respect to the recorded values for effective cohesion and effective friction, there are only two instances where the combined friction and cohesion plots data below either of the lines. This data relates to inferred values for ϕ' and c' from soils within the upper superficial material which in turn is required to be removed and re-engineered as part of the earthworks cut to fill exercise.

Whilst limited data and investigation positions are within the footprint of the proposed highway embankment for the new A453 site access, geotechnical data has been derived from across the wider site as well as published values.

Figure 2.5 expands on the records presented in Figure 2.4, with the inclusion of published values for each weathering grade of the MMG and a series of data points representing the characteristic values from Table 2.1.

Figure 2.5: Sensitivity Analysis of Geotechnical Design Parameters and Characteristic Values

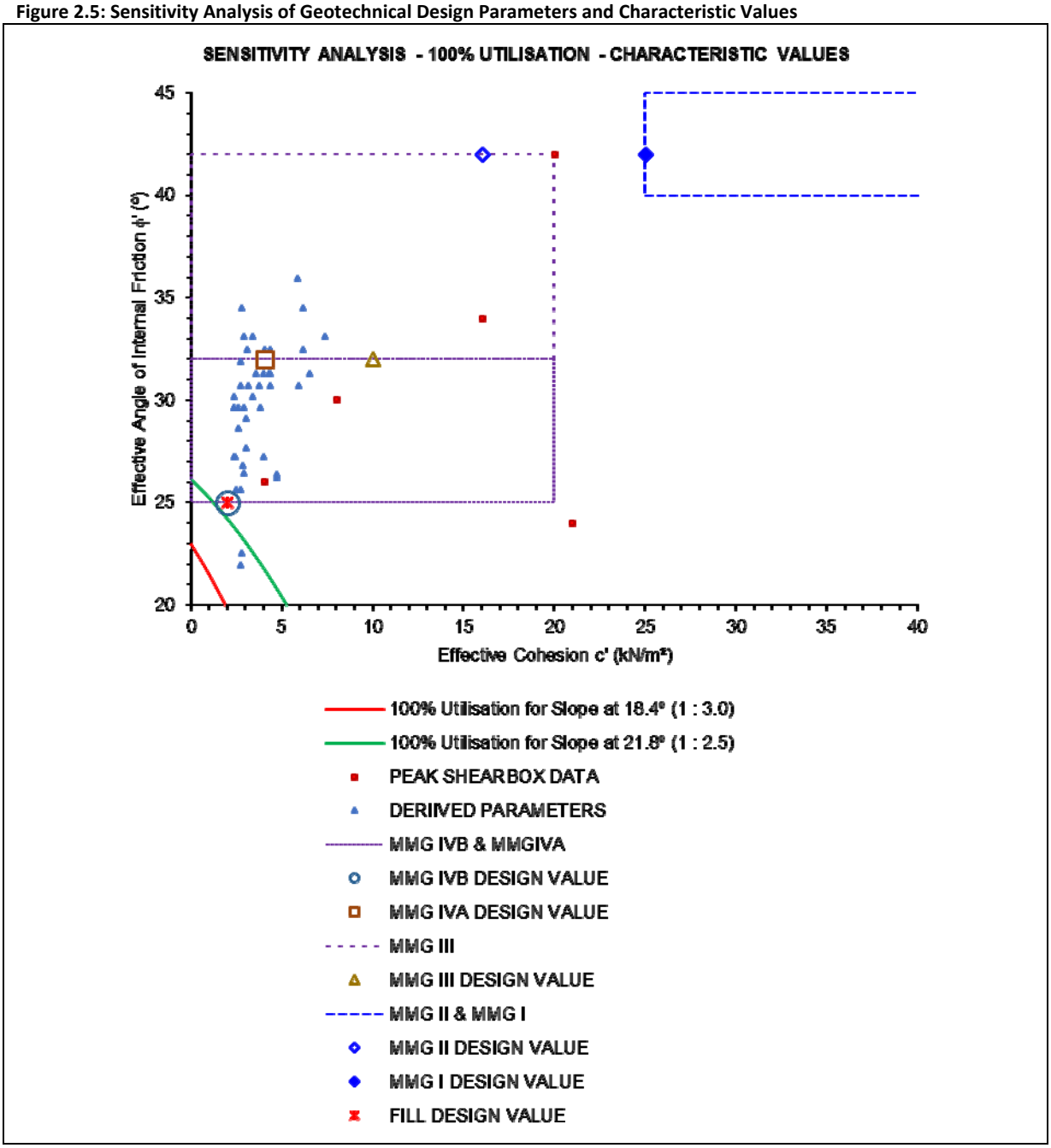


Figure 2.5 presents a series of zones covering the range of published values for the various weathering grades, as presented in brackets in Table 2.1. It should be noted that the selected characteristic values for the MMG II material is actually plotted outside of the published zone for the same weathering grade, due to the selection of a lower, more conservative value for effective cohesion.

For a minimum angle of friction of 25º, as defined in the published values for MMG and with no contribution from effective cohesion, the maximum steepness of a slope with a degree of utilisation of 100% is 1:2.6 (20.9º).

Overall, adopted values for effective cohesion are at the lower end of published values, and the sensitivity analysis has shown that so long as the effective angle of friction is at least 26º, the value of effective cohesion is not critical to the global stability. For slopes slacker than 1:2.6, an effective angle of friction of 25º will return an acceptable degree of utilisation with no additional benefit from effective cohesion.

Further to the completion of the sensitivity checks on a range of geotechnical parameters, a notional r_u value has been added to the slope stability model in order to replicate the potential impact of water infiltrating the ground. The slope model assessed has had a pore water pressure coefficient r_u value of 0.1 added into the model to replicate the infiltration of water.

The assessment of the typical slope model was undertaken for each construction stage with a corresponding increase in degree of utilisation due to the inclusion of r_u. The assessment has increased the degree of utilisation from the previous maximum of 77.8% (Γ = 1.29) to 80.3% (Γ = 1.25).

A series of assumptions have been made in terms of the degree of saturation which could occur in the embankment and the likely duration of this could have an impact on the global stability. For the final construction stage with the highway open, a range of r_u values have been utilised, with a value of 0.01 with supplementary interfaces set at an r_u of 0.05 at approximately 0.3m below the surface, an r_u of 0.10 at around 0.60m below the surface and a deeper profile set at an r_u of 0.2 within the core of the embankment. The re-evaluated onerous condition has increased the degree of utilisation from an initial value 88.7% (Γ = 1.13) to 95.25% (Γ = 1.05).

In assessing the stability of all slopes, the location of drainage channels has been assessed on the potential impact on the long-term stability of the slopes, including the new embankments and environmental bunds which form part of the A6 Kegworth Bypass. The assessment has included an assessment on the potential instability at the toe of the slope due to localised softening of the soils where these are left in a perpetual wet condition. Where a risk has been identified, the drainage feature has either been relocated a sufficient distance away from the affected slope, or replaced with an appropriate design of a fin drain.

Surface drainage of the slopes will be required where the prevailing groundwater table is encountered, in conjunction with drains at the crest and toe of all slopes to collect surface water and prevent inundation, as identified on the BWB drawings. Copies of geostructural design assessments are presented at Annex B.

2.2.6 Summary of Slope Angles

The geostructural analyses undertaken for the proposed cuttings, embankment widening and new embankments have returned acceptable degrees of utilisation for all scenarios assessed. The maximum steepness of all slopes in the geotechnical model, whether they are cut or formed from engineered fill, has been set at 1 vertical to 2.5 horizontal, equivalent to 21.8º or slopes of 40%.

All permanent slopes associated with the location of the new M1 Overbridge are pre-existing and based upon supplied topographical data are in the range of 1: 2.5 to 1 : 3. The construction of the new bridge does not alter the steepness of the existing slopes.

Sensitivity analysis has determined that where the effective angle of friction is in excess of 26º, there is no long-term reliance upon effective cohesion, for slopes of up to 1:2.5 (21.8º). Testing undertaken on recompacted samples of the proposed fill have returned values for effective cohesion in excess of 4 kN/m² with a maximum value of 80 kN/m².

2.3 California Bearing Ratio and Subgrade Surface Stiffness

Table 2.1 presents the characteristic CBR and Subgrade Modulus values for each of the materials under consideration within the geotechnical model. Guidance on appropriate values for the subgrade stiffness have been based in part from the recommendations contained within the GIR as well as the guidance from DMRB IAN 73/06 Rev 1 Table 5.1.

From reference to DMRB IAN 73/06, the value of the modulus of subgrade reaction (k) and subgrade surface stiffness modulus I can be related to an equivalent CBR value, as summarised in Table 2.2. The pavement design has a Class 3 foundation as defined by BWB in their design presented under a separate cover. In order to comply with the BWB pavement design the subgrade surface stiffness modulus will need to achieve an equivalent CBR of more than 10%, equivalent to subgrade stiffness modulus of 77Mpa.

The available fill materials for the land raise to construct the new highway embankment are to be derived from the upper weathered horizons of the Gunthorpe Member and Tarporley Formation, corresponding to Mercia Mudstone weathering grade IVB and IVA as defined by CIRIA C570. In consideration of the likely long-term engineering performance of this material, and with full reference to DMRB IAN 73/06 Rev Table 5.1, it is considered unlikely that the material in an untreated state would achieve the requisite stiffness for the final layers of fill and further to this a higher stiffness could not be relied upon under long-term equilibrium conditions.

As such, the use of hydraulic binders, following the full guidance from DMRB HA 740/7, has been included in the specification appendices, subject to appropriate mix design trials and testing demonstrating the long-term performance of the treated soils is acceptable. Sulphate testing undertaken on representative samples of the Gunthorpe and Tarporley deposits, and the results have returned Total Potential Sulphates of less than 0.25% which is indicative that the soils should be suitable for treatment with hydraulic binders, subject to the testing defined in HA 74/07.

In consideration of the likely classification of the fill material pre and post treatment with hydraulic binders, the parent soils derived from the weathered MMG comparable to Grades IVB and IVA can be designated as either Class 2A (wet) or Class 2C (stony) cohesive general fill. They would be re-designated as Class 7E or 7I to allow treatment with lime to form a Class 9D or lime and cement to form a Class 9E.

Cement is to be used to modify the upper layers of material, and as such the re-designation of this material will be as a Class 9E following treatment. Trials have indicated a minimum cement content of 1% will be required, subject to confirmatory testing at time of treatment. Details of actual binder type and addition, in conjunction with all associated test results, will be provided in the Geotechnical Feedback Report (GFR) upon completion of the works.

Whilst the designation of both Class 9D and 9E are strictly used to define a capping material, it is considered that lime will be required in order to stiffen the upper layers of the engineered fill in order to arrive at a subgrade surface stiffness modulus in excess of 77 Mpa at the top of the earthworks fill prior to the placement of the remainder of the pavement foundation. The use of cement is considered unlikely to be required for the engineered fill to achieve 77Mpa.The use of hydraulic binders is covered by the requirements defined in Appendix 6/1 and 6/3.

Table 2.5 provides a summary of the Design Subgrade Surface Stiffness and CBR values, which have been used in the generation of the GDR and accompanying specification appendices, which includes the use of hydraulic binders on the final 0.60m of engineered fill in order to elevate the subgrade stiffness modulus to in excess of 77Mpa.

Table 2.5: Design Subgrade Surface Stiffness & CBR Values

Stratum and Fill Designation	**Parameter**			
	Young's Modulus	Modulus of Subgrade Reaction	Subgrade Surface Stiffness	Equivalent CBR
	E'	k	E	CBR
	Mpa	MN/m³	Mpa	%
Firm to stiff red brown CLAY MMG IVB[1]	12.5	32	43	4
Stiff red brown CLAY MMG IVA[1]	15.0	37	49	5
Class 2[2] (Site won MMG IV[1] reused as fill)	12.5	32	43	4
Class 9 Lime or cement Modified Fill. Upper layer(S) of Engineer Fill below all pavements	25.0	55	77[3]	10

Notes: [1] The reference to MMG describes the material is derived from the general sequence of the Mercia Mudstone Group, with an appropriate weathering grade taken from CIRIA C570.

[2] The CBR and modulus of subgrade reaction values are based upon DMRB IAN 73/06 Rev 1 Table 5.1.

[3] The value for Class 9 should be considered to be the minimum permissible value, it is the responsibility of the Contractor to derive the correct mix design to achieve this value.

2.4 Settlement

An initial assessment of settlement due to the construction of the new highway embankment has been completed using the settlement program from the GEO5 suite. The assessment of settlement will be refined following completion of the current phase of ground investigation.

Settlement will not be limited to the changes in imposed load from the embankment construction and as such the following scenarios which can cause settlement have been considered:

- the potential contribution from ongoing self-weight settlement within selected fill mass backfill to the bridge abutment up to a maximum thickness of 10.5m;
- settlements induced within the existing soils as a result of the imposed load from the embankment construction;

- the proportion of the above settlements that may continue after the earthworks have been completed and the carriageway is open; and
- settlements induced at the foundation level of the bridge abutments, which are typically 1.50m below current ground level.

2.4.1 Self-Weight Settlement

An assessment has been made as to the potential magnitude of self-weight settlement within the engineered fill placed during the highway embankment construction. This assessment assumes a minimum degree of compaction of 95% of the maximum dry density, and that all fill used behind the abutments will comprise a Class 6N Selected Granular fill.

The assessment of self-weight settlement has been undertaken based upon a derived Constrained Soil Modulus Value (M). In accordance with SHW Clause 642, the Constrained Soil Modulus may be taken as the reciprocal of the coefficient of volume compressibility (m_v). Therefore, the basis of the calculation of the self-weight settlement of the newly placed fill is that it will have a maximum coefficient of volume compressibility (m_v) of no more than 0.01m²/MN with a corresponding constrained modulus of M of 100 MN/m². Based on BS 6031:2009: Clause 7.6.3.2, the prediction of self-weight settlement can be estimate from:

Total self-weight settlement = [0.5 x (γ_b x H²)]/ D, where:

γ_b is the unit weight of the fill, taken as 23.0 KN/m³ from Table 2.1

H is the height, with a maximum thickness of 10.5m

D is the constrained modulus (referred to by the symbol M from SHW Clause 642)

For the maximum fill thickness of 10.5m, the predicted self-weight settlement would be 13mm, or <0.01% of the fill thickness. The greater thickness of fill will induce a higher proportion of self-weight settlement in the material at the base. As the material is granular in nature, the duration over which self-weight settlement will occur is likely to be very short. It is expected that all self-weight settlement will be complete by the time the permanent surfacing is placed.

The current profile of the cutting at the location of the M1 Overbridge has been formed to 1 vertical to 2.5 horizontal (21.8º). The indicative length of the foundation to the bridge abutment is in the order of 8.0m. The profile of the Class 6N has been set at 45º and starts from the rear of the abutment foundation. By overlaying this profile of Class 6N fill, it has identified that only Class 6N will be required, which will need to be benched into the current embankment. Details of the benching details will be provided in the finalised version of the GDR, but given the design profile each bench will be the same height as it is long.

Therefore, in terms of self-weight settlement, consideration has only been given to the properties of the Class 6N fill.

2.4.2 Settlement Due to Land Raising

An initial assessment has been completed on the predicted settlement of the underlying soils due to the placement of the selected fill behind the abutment.

The greatest change in pressure occurs at the rear of the foundation where the thickness of Class 6N is the greatest. The underlying soils in this region, other than a thin veneer of superficially weathered soils, are expected to be bedrock of the lowest weathering grade and of greatest stiffness. These materials are least likely to be susceptible to load induced settlement. Settlement due the abutment is considered separately.

Further to this, prior to the construction of the M1, these materials would have been surcharged by overlying soils of comparable thickness to the depth of Class 6N. As such, any load induced settlement within these materials is considered to be extremely small and any such settlement will occur very quickly upon loading. It is not considered that significant settlement will occur post construction.

For a maximum thickness of Class 6N of 10.5m the change in imposed load is likely to be in the order of 240 kN/m². Derived correlated Oedometric Modulus values at the level of the foundation are in the order of 72 MN/m². The maximum settlement predicted under this global change in load and corresponding stiffness, irrespective of previous ground loads, would be in the order 5mm within the upper 1m of soil. Below this level, the weathering grade reduces to grade II, with a corresponding increase in stiffness. On this basis it is not anticipated that load induced settlement would occur below 1.0m given the previous loading on the ground (before the M1 cutting).

2.4.3 Predicted Rate of Load Induced Settlement (Consolidation)

The underlying natural soils present below the proposed bridge abutment and selected backfill comprise competent deposits derived from the Mercia Mudstone Group. The consolidation characteristics of these deposits are such that any settlement due to change in load are likely to occur very quickly. This is due in part to the soils being previously surcharged by overburden before the excavation of the cutting during the construction of the M1 motorway in the 1960's. On this basis any settlement due to changes in load from construction will be negligible following completion of the bridge construction.

2.4.4 Settlement below M1 Overbridge Abutment

The assessment of settlement below the proposed bridge abutments is discussed in Section 3.0. In summary, total load induced settlement is predicted to be less than 20mm, with a large proportion of this occurring during the construction process. The tolerable service limits for the M1 Overbridge structure have been provided by Cass Hayward, which are a total settlement for each abutment of no more than 25mm, and a differential between each abutment of no more than 25mm. The predicted settlement complies with the service limit requirements for the M1 Overbridge.

The assessment of rate of settlement has indicated that the majority of any load induced movement will occur within the first 12 months, with most of this occurring during the earthworks fill placement.

2.5 Reuse of Materials

An assessment has been undertaken on the suitability of the site won materials to be re-used as part of the general and selected fill, required to raise the ground level in line with the proposed formation as identified on the drawings.

The basis for the Specification is the Manual of Contract Documents for Highway Works (MCHW), Volume 1, and Specification for Highway Works (SHW) Series 600 published by HMSO. Where appropriate additional reference has been made to the general requirements of BS 6031:2009, Code of practice for earthworks; BS 8000-1, workmanship on building sites and BS EN 13242, Hydraulically bound and unbound materials for use in civil engineering and highway construction.

From a review of the geotechnical testing previously undertaken and reported in the GIR it has been indicated that the upper weathered horizons of the MMG, in particular weathering grades IVB and IVA derived from the Tarporley and Gunthopre Members, are suitable for immediate re-use with no modification. These deposits are located within the area of cut required for the rail terminal and are expected to be encountered from approximately 0.7m to 2.0m below existing ground level. Below this depth, the weathering grade reduces with a correspondingly higher proportion of mudstones present. As such it is recommended to limit the earthworks fill for the highway from materials within weathering Grade IVB and IVA. The designation of this fill material would comply with a Class 2 general cohesive fill as defined by Table 6/1 of the SHW.

Section 9 of the GDR discusses the requirements for the earthworks materials in more detail, with the Specification appendices presented at Annex A. A number of different classes of fill have been identified, to be used during the earthworks, as summarised in Table 2.6, which includes the minimum compaction requirements to be met, which in turn have been used in the development of the geotechnical design.

Table 2.6: Earthworks Fill Class and Minimum Compaction Requirements

Earthworks Class and Description	Typical Use	Compaction Control
Class 1 General Fill (Site won Sands & Gravels)	Earthworks to highway embankment	SHW Table 6/4 Method 2, modified as required to ensure a minimum 95% MDD and a CBR of 5%.
Class 2A general wet cohesive fill (Site won MMG IV)	Earthworks to highway embankment	SHW Table 6/4 Method 1, modified as required to ensure a minimum 95% MDD and a minimum shear strength (Cu) of 50 KN/m² with a target 70 KN/m²
Class 2B general dry cohesive fill (Site Won MMG II – I)	Earthworks to highway embankment	SHW Table 6/4 Method 2, modified as required to ensure a minimum 95% MDD and a minimum shear strength (Cu) of 80 KN/m² and a target of 100 KN/m²
Class 2C general stony cohesive fill (Site won MMG IV – III)	Earthworks to highway embankment	SHW Table 6/4 Method 2, modified as required to ensure a minimum 95% MDD and a minimum shear strength (Cu) of 50 KN/m² and a target of 70 KN/m²
Class 6F selected granular capping (imported)	Capping to highways	SHW Table 6/4 Method 6, modified as required to ensure a minimum 95% MDD and a CBR of 15%

Earthworks Class and Description	Typical Use	Compaction Control
Class 6N selected well graded granular material	Backfill to structures, abutments and retaining walls	End Product, minimum 95% MDD of Vibrating Hammer. Equivalent CBR of 15%
Class 7E selected cohesive fill for modification with Lime	Following treatment, upper 0.60m of earthworks fill to highways	See Class 9D
Class 7I selected cohesive fill for stabilisation with Lime & cement	Stabilised to form Capping Replacement material to highways	See Class 9E
Class 9D Lime modified fill	Upper 0.60m of earthworks fill	End product, minimum 95% MDD, CBR of 10% and/or E of 77 Mpa before capping.
Class 9E Lime and cement stabilised	Capping to highways	End product, minimum 95% MDD, CBR of 15%

The review of the testing requirements as defined by the Specification, when compared against the findings of the GIR have indicated that the site won materials which are required to be excavated as part of the cut operation are likely to comply with Class 2. Within the wider site to the north, which is outside of the area of the M1 Overbridge and Kegworth Bypass, River Terrace deposits have been identified. Based upon the current program of works, it is considered unlikely that material derived from the River Terrace deposits will be available for inclusion in the M1 Overbridge, or Kegworth bypass, however they have been included in Table 6/1 for completeness.

The design of the pavements has been undertaken by BWB, with their design and accompanying specification presented under a separate cover. In summary the highway pavement foundation will include a layer of CBGM. In order to provide a smoother transition in stiffness, over the design life of the pavement, between the engineered fill and CBGM the upper layer(s) of the earthworks fill are to be treated with cement. The thickness of treated material will be a function of the performance of the engineered fill, and shall comprise a minimum of 0.30m to a maximum of 0.60m where only the minimum performance defined in the GDR has been met. Confirmation on the thickness of treated material will be provided in the GFR.

Section 8 and Annex A of the GDR have been written in such a way as to permit the use of hydraulic binders to modify and improve the site won fill material (derived from the weathered Gunthorpe and Tarporley formations only) in order to achieve the specification requirements. This will be subject to appropriate mix design trials completed to the satisfaction of Hydrock. The Branscombe Mudstone located to the north and north east of the wider site, and weathered soils derived from this formation, are not considered suitable for treatment with hydraulic binders, due to the potential for elevated sulphates which are locally present within this soil. However, there are no soils derived from the Branscombe Mudstone within the vicinity of the M1 Overbridge and there are no proposals to include these materials as part of the earthworks operation covered by this GDR.

Annex A of the GDR includes the appropriate Appendix 1/5 (testing to be undertaken by the Contractor) and Table 6/1 (acceptability limits), and this shall be undertaken as part of the site preparation and enabling works.

The minimum engineering performance of the fill is specified in the relevant appendices, in Table 6/1 presented at Annex A of the GDR.

The moisture content (MC) range defined in the specification considers an upper and lower bound value based on the required performance for the fill, the compaction control to be used and the end use of

the material. As an example, for a Class 2A wet cohesive fill, this is controlled by Method Placement (as defined in HA 70/94), where method compaction should achieve typically less than 10% air voids at a conservative (low) moisture content. HA 70/94 and BS 6031 also provide guidance on the minimum undrained shear strength to allow for trafficking by construction plant, with values in the order of 45 kN/m².

The GDR has used a series of lower bound values in the design process and based on these findings a series of compliance values have been defined which are reflected in the specification and Table 6/1. For the Class 2A example, the lower MC should be the equivalent of 105% of the MDD with an air void content of 5%. The upper MC should be either the MC where 95% of the MDD on the wet side of the curve is achieved, or where the undrained shear strength is at least 50 kN/m².

In order to define the upper MC, the contractor is required to undertake measurement of the undrained shear strength at each point of the compaction curve, using a calibrated hand vane (as defined in Appendix 1/5). This is then supported by a remoulded triaxial at the OMC. This will then allow a plot of the MC vs the undrained shear strength to be made. On this basis the upper MC can be confirmed as either the MC equivalent to 95% MDD or a Cu of 50 kN/m². A series of figures are provided in the specification to assist the contractor in understanding this requirement and other similar restrictions for different classes of fill. For example, as a Class 2B is a dry cohesive fill, the method of compaction is obviously increased to the 4.5kg rammer and the minimum Cu is set to 80 kN/m².

3.0 HIGHWAY STRUCTURES

Reference should be made to Cass Hayward LLP design and drawings for the structural design of the M1 Overbridge, which is presented under a separate cover.

The following section discusses the geotechnical design aspects associated with the M1 Overbridge. The bridge is a single span integral structure, which includes wing walls. At the rear of each wing wall, a short section of retaining wall is required in order to support the granular backfill to the bridge. Reference should be made to Cass Hayward drawing EMG-CH-SBR-HW21-DR-CB-6001 and Hydrock Drawing EMG-HYD-C4-M1OB-DR-GE-0636 which present the general arrangement of the bridge, abutments, wing walls and retaining wall sections. The final detailed design drawings produced by Cass Hayward are to be provided separately. Should the detailed design by Cass Hayward result in any significant change to foundation geometry and level, the design will be checked by Hydrock and submitted for a separate review and geotechnical certification by HE.

All geotechnical assessments have been undertaken using the GEO5 Fine geostructural analysis suite, 2017, and in particular the packages Abutment, Earth Pressures and Spread Footing.

The structure has been designed as an integral bridge, which has allowed the loads to be taken at the centre of the bridge foundation. Design loads and moments have been provided by Cass Hayward LLP. The moments provided to Hydrock allow for eccentricity effects built up over the different stages of construction and use.

In broad terms, the bridge is to be supported on a ground bearing foundation, nominally 8.0m in length and 21.0m in width across the carriageway. The indicative base of foundation is around 66.5 m OD (circa a minimum of 1.50m below current ground level), and will be founded at a level coincident between the change in the MMG weathering Grade III and II.

Cass Hayward have provided a series of design loads and load contributions, as summarised in Table 3.1.

Table 3.1: Cass Hayward load contributions M1 Overbridge August 2017

Load Case		Load Contribution making up Load Case		
Contribution	**Action**	**Magnitude**	**Set A1**	**Set A2**
Load Case 1 Permanent & Traffic	Vertical	50,963 kN	68,800 kN	51,835 kN
	Moment	17,295 kNm	23,308 kNm	18,554 kNm
	Horizontal	-1,795 kN	-1,726 kN	-2,404 kN
Load Case 2 Permanent and Thermal	Vertical	45,151 kN	60,954 kN	45,151 kN
	Moment	21,162 kNm	31,346 kNm	25,328 kNm
	Horizontal	5,215 kN	8,327 kN	6,101 kN
Load Case 3 Permanent, Traffic and 0.6 x Thermal	Vertical	50,963 kN	68,880 kN	51,835 kN
	Moment	24,759 kNm	35,091 kNm	28,548 kNm
	Horizontal	2,379 kN	4,263 kN	2,302 kN
Load Case 4 Permanent, Thermal and 0.75 x Traffic	Vertical	49,510 kN	66,839 kN	50,164 kN
	Moment	27,607 kNm	40,047 kNm	32,740 kNm
	Horizontal	2,172 kN	4,219 kN	2,601 kN

The partial factors for design values are based on Table NA.A2.4(B), for BS EN 1997-1 Set A1 and Table NA.2.4(C) for set A2, in accordance with NA+A1:2004 to BS EN 1997-1.

3.1 M1 Overbridge Abutment Design Check

Using the supplied four load cases provided by Cass Hayward, as summarised in Table 3.1, the GEO5 FINE program Abutment has been used, in conjunction with Cass Hayward, to derive the geotechnical design values. This has been an iterative process, requiring a number of cross-checks to be completed by Hydrock and Cass Hayward in order to derive the correct parameters to be adopted for the structural design.

Hydrock geostructural analysis report, EMG-HYD-C4-M1OB-CA-GE-0649-S4-P4 presents the findings of the Hydrock assessment. A copy of this report is presented at Annex B. Table 3.2 provides a summary of the key findings from Hydrock assessment.

Table 3.2: Summary of Geostructural Analysis M1 Overbridge Abutment– Utilising CASS Hayward Load Cases

Verification	Load Case 1		Load Case 2		Load Case 2		Load Case 3	
	A1	**A2**	**A1**	**A2**	**A1**	**A2**	**A1**	**A2**
Resisting Moment M_{res} kNm/m	10,323	10,323	9,769	9,769	10,323	10,322	10,185	10,185
Overturning Moment M_{ovr} kNm/m	2,648	2,474	-123.9	-296	997	824	1,079	906
Satisfactory – Overturning	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Verification	Load Case 1		Load Case 2		Load Case 2		Load Case 3	
	A1	A2	A1	A2	A1	A2	A1	A2
Resisting Horizontal H_{res} kN/m	2,417	1,934	2,259	1,808	2,425	1,940	2,382	1906
Active Horizontal H_{act} kN/m	666	575	332	241	467	376	477	386
Satisfactory – Horizontal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maximum stress in footing bottom kPa	942	921	651	618	780	761	769	751
Bearing Capacity Foundation Soil R_d kPa	2,530		3,516		3,086		3,052	
Extreme Contact Stress kPa	883		597		735		725	
Satisfactory – Bearing Capacity	Yes		Yes		Yes		Yes	
Foundation Settlement mm	19.2		17.3		18.5		18.2	
Satisfactory – Settlement	<25 mm		<25 mm		<25 mm		<25 mm	

Cass Hayward have confirmed that for the structural design of the bridge, the total settlement limit is 25mm with a differential between each bridge abutment of no more than 25 mm. As summarised in Table 3.2, the maximum predicted settlement is less than 25 mm. Further to this, running a sensitivity analysis between the ground profile of each abutment has returned a maximum differential between each abutment of no more than 10mm.

On this basis the serviceability limit states for total and differential settlement requirements have been met.

3.2 Retaining Wall

A short section of retaining wall is to be constructed at the rear of each wing wall. The structural design of the retaining wall has been undertaken by Cass Hayward. Hydrock have undertaken a geotechnical assessment of the foundations in order to advise on the permissible bearing pressure to be used by Cass Hayward in their design.

Reference should be made to the geostructural analysis report, EMG-HYD-C4-M1OB-CA-GE-0663 presented at Annex B for full details of the retaining wall assessment. A summary of the key findings are presented in Table 3.3 below.

Table 3.3 presents the results of the most onerous combination, which comprises the highest retaining wall of 6.0m, with the minimum Class 6N below the footing of 0.50m, and the lowest surcharge thickness of fill in front of the wall of 1.0m, equivalent to the thickness of the footing.

Table 3.3: Summary of Geostructural Analysis Embankment Retaining Wall – Utilising CASS Hayward Load Cases

Verification	Most Onerous Load Case	
	A1	A2
Resisting Moment M_{res} kNm/m	2,036	1,982
Overturning Moment M_{ovr} kNm/m	260	308
Satisfactory – Overturning	Yes	Yes
Resisting Horizontal H_{res} kN/m	498	399
Active Horizontal H_{act} kN/m	99	131
Satisfactory – Horizontal	Yes	Yes
Maximum stress in footing bottom kPa	228	177
Bearing Capacity Foundation Soil R_d kPa	1,466	
Extreme Contact Stress kPa	169	
Satisfactory – Bearing Capacity	Yes	
Foundation Settlement mm	2.0	
Satisfactory – Settlement	<25 mm	

As for the bridge itself, the serviceability limits for the retaining wall have been defined as no more than 25mm total settlement, and no more than 10mm differential between each retaining wall. Total predicted settlement is less than 5mm (maximum predicted of 2.0mm), with differential of no more than 2mm. Therefore, the structural design complies with the service limit requirements.

3.3 Assessment of Chemical Attack

Little evidence of sulphate bearing minerals (gypsum, anhydrite) is apparent within the geological units present in the location of the M1 Overbridge. However, elevated sulphates are present within other geological units of the MMG, as has been recorded to the north of this study area, within the wider site.

Records from previous phases of investigation have been extracted and replicated in Table 3.4. In accordance with BRE (Special Digest 1), the Design Sulphate (DS) classification and the Aggressive Chemical Environment for Concrete (ACEC) classification for the strata present are presented in Table 3.4.

Table 3.4: Aggressive Chemical Environment Concrete Classification

Stratum	No. Tests	DS	ACEC
Gunthorpe Member	7	DS-1	AC-1
Tarporley Siltstone Member	6	DS-1	AC-1
Bromsgrove Sandstone Formation	3	DS-1	AC-1
Groundwater	8	DS-1	AC-1

Additional sampling and testing is currently in progress at the time of writing as part of the on-going supplementary geotechnical investigation for the M1 Overbridge and A6 Kegworth Bypass. Values presented in Table 3.4 will be reviewed and revised accordingly upon completion of the supplementary investigation.

4.0 STRENGTHENED EARTHWORKS

There are currently no proposed strengthened earthworks associated with the M1 Overbridge.

5.0 DRAINAGE

Permanent drainage design is the responsibility of BWB, which is presented under a separate cover. Except where located on granular materials with sufficient infiltration rates, the pavement foundation will be drained by use of fin drains, narrow filter drains or combined filter and carrier drains, as appropriate to each location. These are shown on the detailed drainage design drawings prepared by BWB.

BWB drawing EMG-BWB-HDG-HW21a-DR-D-500-S4-P1 sets out the drainage layout around the M1 Overbridge structure, a copy of this drawing is presented at Annex A.

Surface drainage should be designed to prevent infiltration of water to the embankment. This is of particular importance where fin drains (F) and/or narrow fin drains (NF) as defined by HA 44/91 are to be installed on the outside verge, close to the crest of proposed slopes and embankments.

6.0 PAVEMENT DESIGN, SUBGRADE AND CAPPING

Reference should be made to the recommended subgrade surface stiffness values presented in Section 2. Pavement design, and associated specification of materials have been undertaken by BWB and are presented under separate cover.

The pavement design has been undertaken using DMRB standards HD24/06, IAN73/06r1 and HD26/06 (along with other DMRB standards for the surface course design but these are not considered relevant to a GDR). Calculation of design traffic has been undertaken using traffic data for HGVs generated from the approved traffic model for the East Midlands Gateway development and the calculated values using HD24 for the links relevant to this GDR are as follows:

- A6 Kegworth Bypass: 25msa.

Where the design traffic is less than or equal to 80msa a traditional recipe Class 2 foundation can be provided and this has been specified for Kegworth Bypass. This utilises Type 1 sub-base to SHW Clause 803 with or without 6F2 or 6F5 capping to SHW Clause 613, and the thickness of each material is based on the foundation surface modulus and equivalent CBR in accordance with IAN73.

As noted at Section 2 of this report the foundation surface modulus on the untreated embankment fill is expected to give an equivalent CBR of around 4-5%.

The pavement design, based on the above, is specified within Appendix 7/1 included within the BWB design submission.

7.0 ASSESSMENT OF POTENTIAL CONTAMINATION

The previous phases of investigation have not identified any potential areas of concern with respect to contamination or the need for remediation. The GDR has been written in line with the findings and the recommendations of the previous phases of investigation and in particular Hydrock Report R/14792/003 which covers the geo-environmental issues across the entire site.

All Made Ground, from whatever source, shall be tested in accordance with the requirements of Appendix 6/14 and 6/15, at a frequency of 1 contamination suite per 500m³, unless otherwise agreed with Hydrock.

8.0 GROUND TREATMENT

Based upon the findings of the GIR and the proposed changes in level following the cut to fill operation, there is no requirement to undertake any form of ground treatment, other that the use of hydraulic binders to improve the stiffness of the upper 0.60m of fill below Class 3 pavement foundations. The use of hydraulic binders is discussed in the previous sections and covered by the requirements in Appendix 6/1 and 6/3.

9.0 SPECIFICATION APPENDICES

The basis for the Specification is the Manual of Contract Documents for Highway Works (MCHW), Volume 1, and Specification for Highway Works (SHW) Series 600 published by HMSO.

Annex A contains Appendix 1/5 detailing the testing to be undertaken by the Contractor, Appendix 1/24 for the Quality Control measures and an up-dated Table 6/1 presenting the compliance limits to be met. These should be read in conjunction with the site wide environmental report, Hydrock Report R/14792/004, document reference EMG-HYD-HGT-XXX-RP-GE-0004.

10.0 INSTRUMENTATION AND MONITORING

There are currently no requirement defined for instrumentation and monitoring associated with the proposed construction of the M1 Overbridge.

ANNEX A

SPECIFICATION APPENDICES & DRAWINGS

APPENDIX 0/3: LIST OF NUMBERED APPENDICES REFERRED TO IN THE SPECIFICATION AND INCLUDED IN THE CONTRACT

Appendix No.	Title.
	INTRODUCTION
0/3	List of numbered appendices referred to in the specification and included in the contract
0/4	List of drawings included in the contract
	PRELIMINARIES
1/5	Testing to be carried out by Contractor
1/23	Risks to Health and Safety from Materials or Substances
1/24	Quality Management System
	EARTHWORKS
6/1	Requirements for Acceptability & Testing etc. of Earthworks Materials
6/2	Requirements for dealing with Class U1B and class U2 unsuitable materials
6/3	Requirements For Excavation, Deposition, Compaction (Other Than Dynamic Compaction)
6/6	Fill to Structures and fill above Structural Foundations
6/7	Sub-formation and Capping Preparation & Surface Treatment Formation
6/8	Topsoiling
6/9	Earthwork Environmental Bunds, Landscape Areas and Strengthening Embankments
6/12	Instrumentation and Monitoring
6/14	Limiting Values for Pollution of Controlled Waters
6/15	Limiting Values for Harm to Human Health and the Environment

APPENDIX 0/4: LIST OF DRAWINGS INCLUDED IN THE CONTRACT

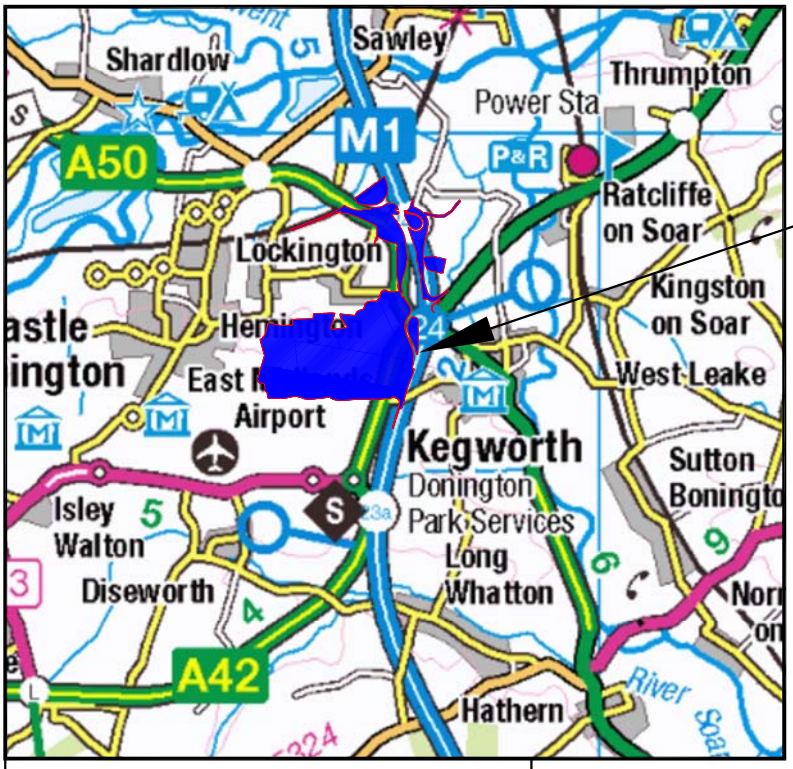
List A of Employer's Drawing is included below:

Drawing No.	**Drawing Title**
14792/D001	Site Location Plan
EMG-HYD-C4-M1OB-DR-GE-0636	M1 Overbridge Recorded Geology and Site Investigation Plan
EMG-HYD-HGT-ZZ-DR-GE-0641	Hydrock Report Coverage
EMG-HYD-C4-M1OB-DR-GE-0654	M1 Overbridge – General Earthworks Construction Sequence
BWB	
EMG-BWB-GEN-XX-SK-D-SK173 P6	Contract Assembly
EMG-BWB-GEN-XX-SK-D-SK212 P3	DCO Phasing Plan
EMG-BWB-HDG-HW21a-DR-D-500	Drainage Layout Sheet 21A
BWB Highway Drawing Series	Refer to BWB submission presented under a separate cover
170627-SK	Annotated sketch of Kegworth Bypass Bridge Maintenance Schedule
Cass Hayward	
EMG-CH-SBR-HW21-DR-CB-6001-S4-P04	Kegworth Bypass M1 Overbridge General Arrangement

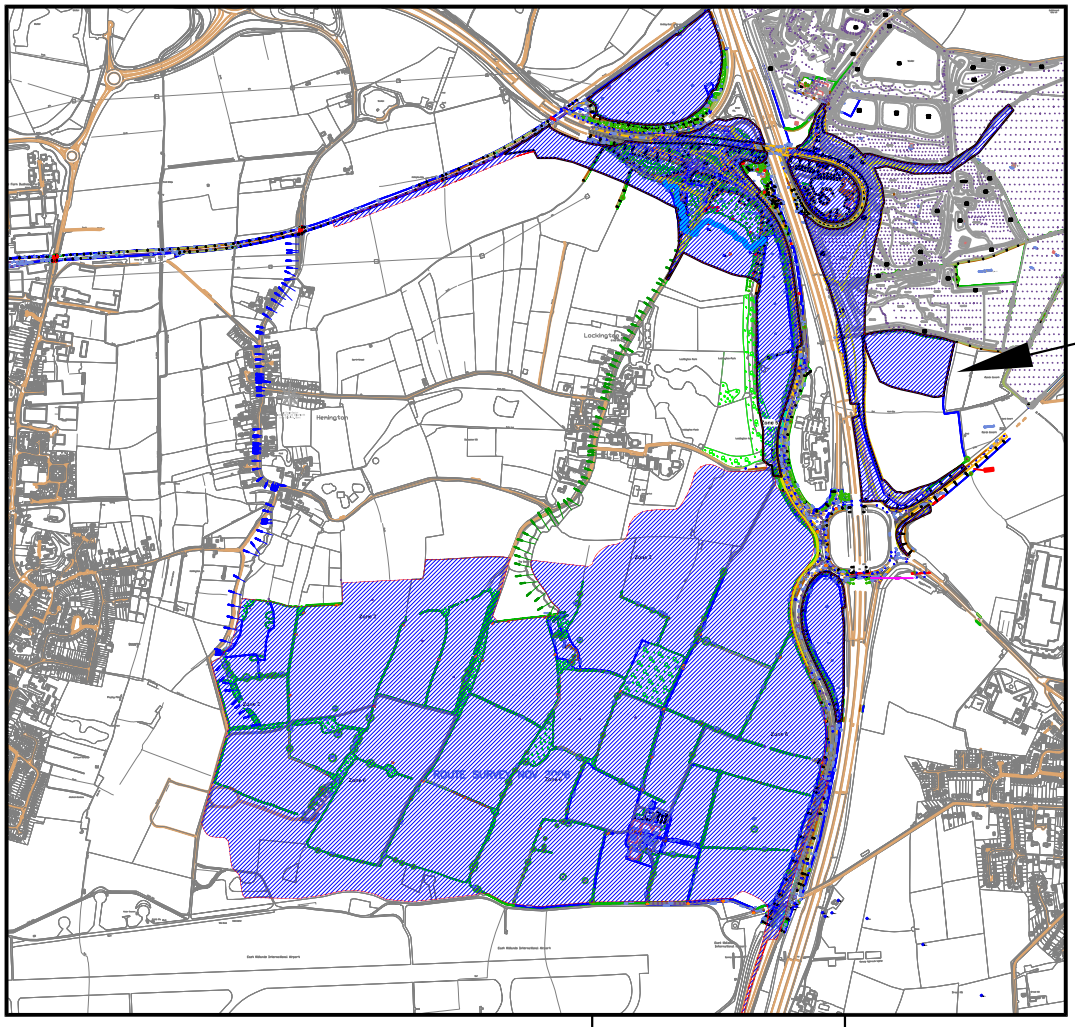
List B: List of Documents Brought into the Contract by Reference
East Midlands Gateway Strategic Rail Freight Interchange: Factual Ground Investigation Report, prepared by Hydrock Consultants Ltd on behalf of Roxhill Developments Ltd, Hydrock Report R/14792/003 dated June 2016.
East Midlands Gateway Strategic Rail Freight Interchange: Main Site. Geo-environmental Report, prepared by Hydrock Consultants Ltd on behalf of Roxhill Developments Ltd, Hydrock Report R/14792/004 dated May 2016.
East Midlands Gateway Strategic Rail Freight Interchange: Rail Container Terminal and A453 Site Access Junction. Geotechnical Interpretive Report, prepared by Hydrock Consultants Ltd on behalf of Roxhill Kegworth Ltd, Hydrock Report R/14792/006 dated June 2016.
East Midlands Gateway Strategic Rail Freight Interchange: A453 Site Access Junction. Geotechnical Design Report, prepared by Hydrock Consultants Ltd on behalf of Roxhill Kegworth Ltd, Hydrock Report R/14792/008 dated November 2016
East Midlands Gateway Strategic Rail Freight Interchange: Geotechnical Interpretive Report, M1 Overbridge and Kegworth By-pass, prepared by Hydrock Consultants Ltd on behalf of Roxhill Kegworth Ltd, Hydrock Report R/14792/013 dated July 2017.
East Midlands Gateway Strategic Rail Freight Interchange: Zone 1 Main Development Plateau and Rail Freight Terminal. Preliminary Sources Study Report, prepared by RSK Environmental Ltd (RSK), reference 312494 on behalf of Roxhill Developments Ltd, dated November 2013.
East Midlands Gateway Strategic Rail Freight Interchange: Zone 1 Main Development Plateau and Rail Freight Terminal. Factual Ground Investigation Report, prepared by RSK, reference 312494-01-02 (00) on behalf of Roxhill Developments Ltd, dated December 2013

Notes:

1. Contains Ordnance Survey data © Crown copyright and database right 2015







Rev	Date	Description	By	Ckd

Architect :

Hydrock

Hydrock Consultants Ltd
3 Hawthorn Park
Holdenby Road
Spratton, Northampton
NN6 8LD
T +44 (0)1604 842888
northampton@hydrock.com
www.hydrock.com

Client : ROXHILL

Project Title: EAST MIDLANDS GATEWAY
STRATEGIC RAIL FREIGHT INTERCHANGE

Drawing Title: Site Location Plan

Drawing Status: FINAL

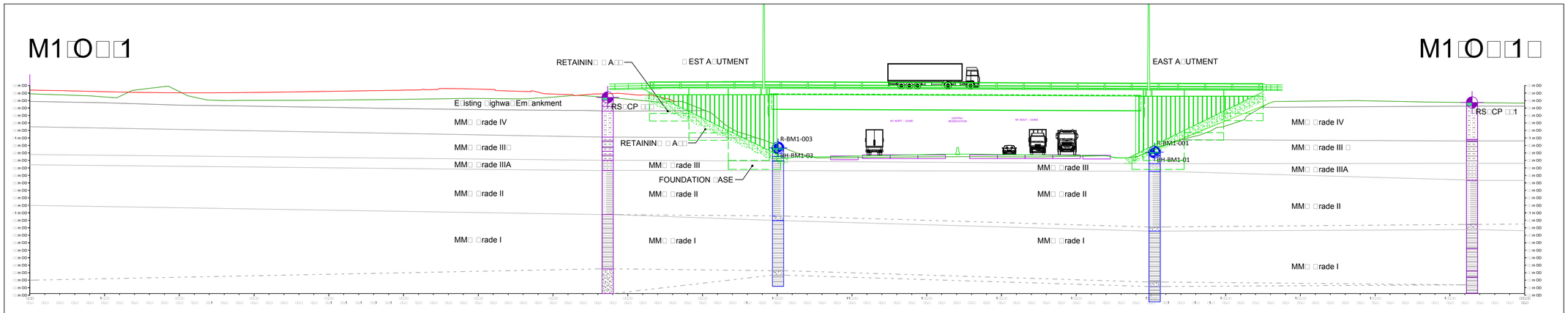
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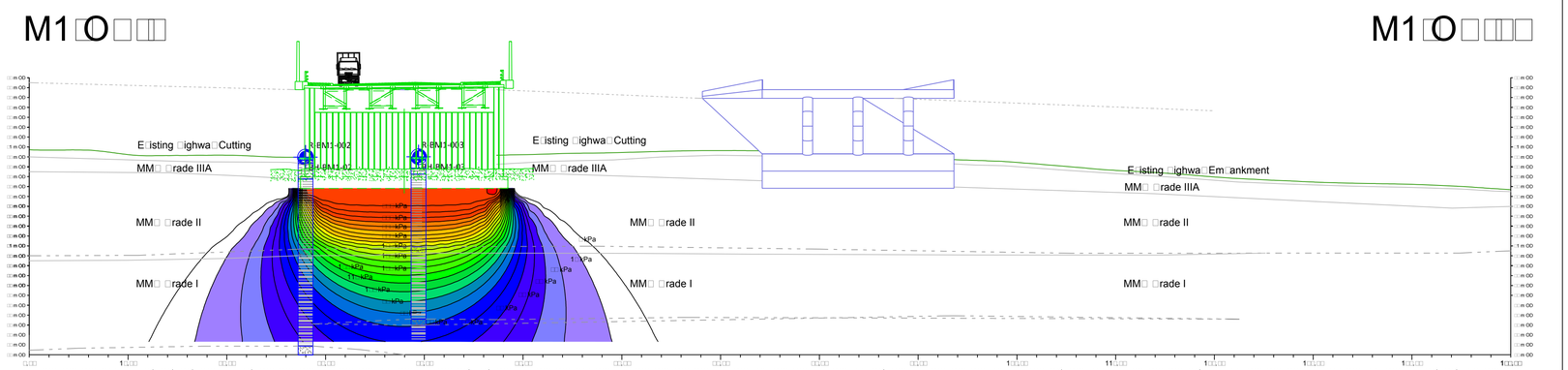
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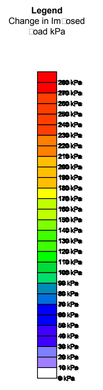
Drawing Number: C14792/D001

Revision: -

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HTP001 and e cavated Trial Pit

TP001 Machine e cavated Trial Pit

TPSA001 Trial Pit Infiltration Test

BH001 Ca le Percussion orehole

R001 Rotar orehole

CPT001 Static Cone Penetration Test

WS001 indow Sam le orehole

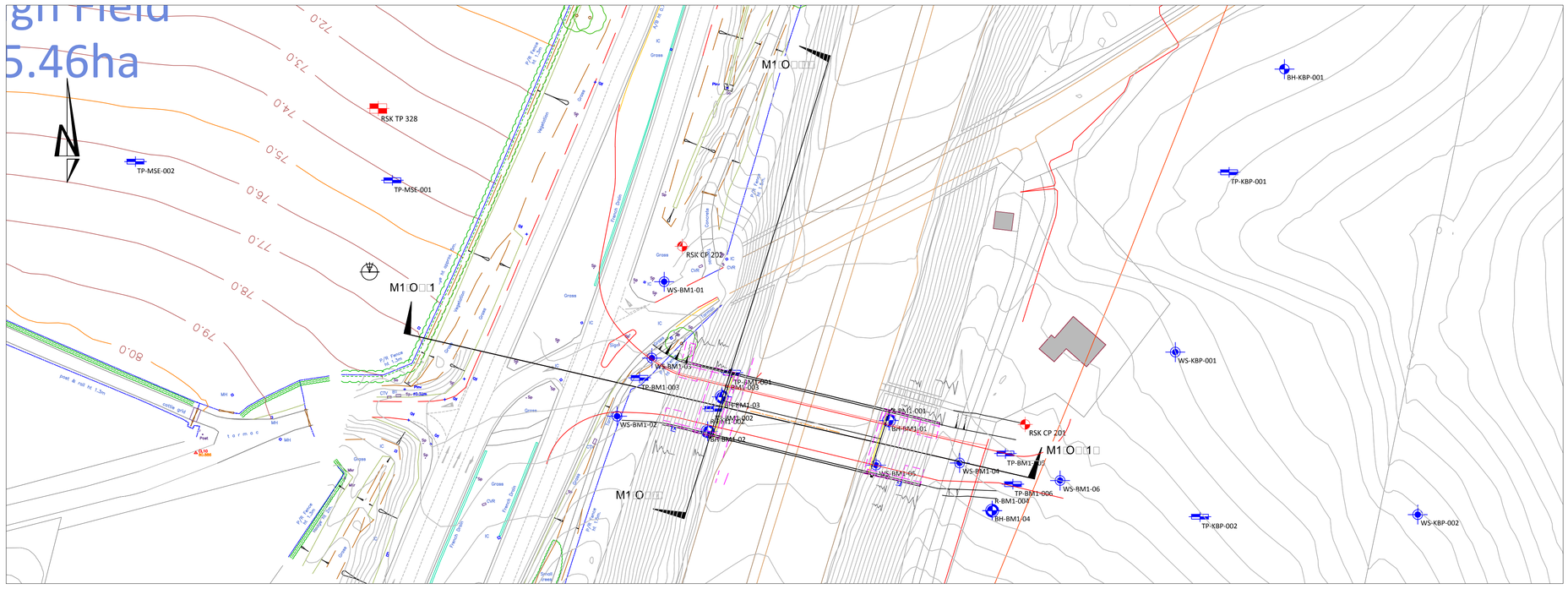
DCP001 D namic Cone Penetrometer

CBR001 *In Situ* C R Assessment

DP001 D namic Pro e

RSK TP Previous Trial Pit RS

RSK CP Previous orehole RS



Notes:

1. All dimensions are to be checked on site before the commencement of works. Any discrepancies are to be reported to the Architect & Engineer for verification. Figured dimensions only are to be taken from this drawing.
2. This drawing is to be read in conjunction with all relevant Engineers' and Service Engineers' drawings and specifications.

egend

To soil / Su soil

Alluvium

Terrace De osits
Soft to firm sand gravell C A

Terrace De osits
Sands & ravels

ighwa Em ankment

Mercia Mudstone rou MM IV
Mudstone

Mercia Mudstone rou MM III
Mudstone

Mercia Mudstone rou MM
IIAI Mudstone

Mercia Mudstone rou
Sandstone

Mercia Mudstone rou MM II
Mudstone

Mercia Mudstone rou MM I
Mudstone

romsgrove Sandstone

Indicative ridge Arrangement

E isting Skewed ridge
indicative Arrangement

Rev	Date	Description		Ckd
P4	01/08/17	Revised M1 Over Bridge from Cass Hayward drawing EMG-CH-SBR-HW21-DR-CB-S4-P04		CV
P3	20/07/17	Revised with M1 Bridge added and cross-section of pressure distribution from new construction		CV
P2	05/07/17	Revised following May 2017 Ground Investigation		CV

Architect :

Hydrock

Hydrock Consultants Ltd
3 Hawthorn Park
Holdenby Road
Spratton, Northampton
NN6 8LD

Client :

ROXHILL KEGWORTH LTD

Project Title:

EAST MIDLANDS GATEWAY
STRATEGIC RAIL FREIGHT
INTERCHANGE

Drawing Title:

M1 Overbridge
Geological Ground Profile

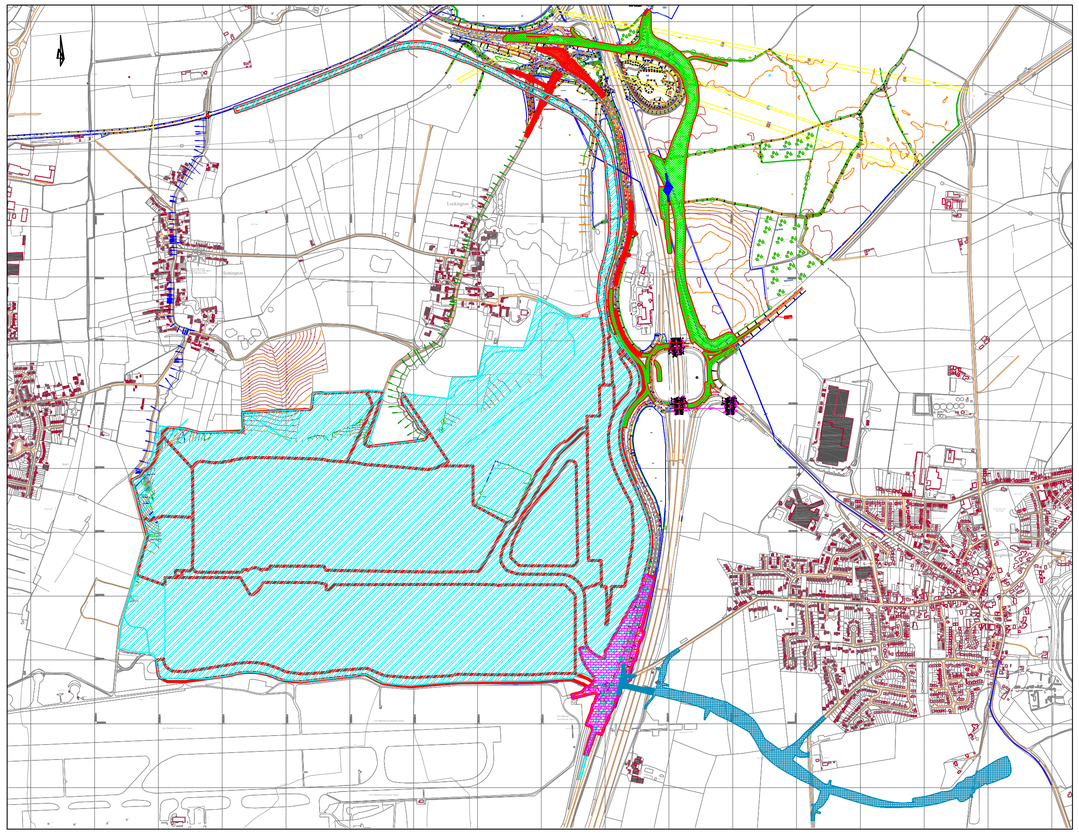
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S4	P4

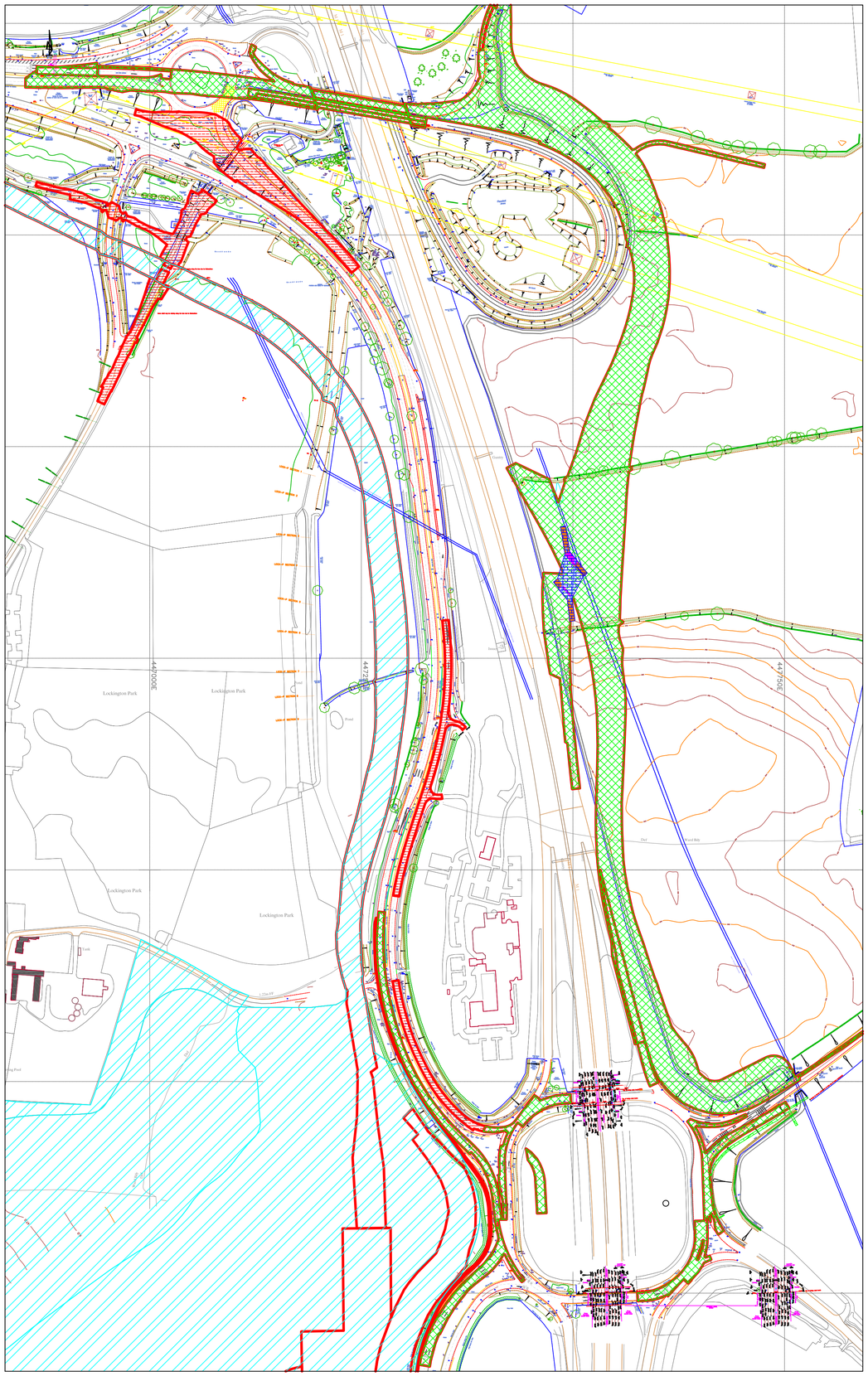
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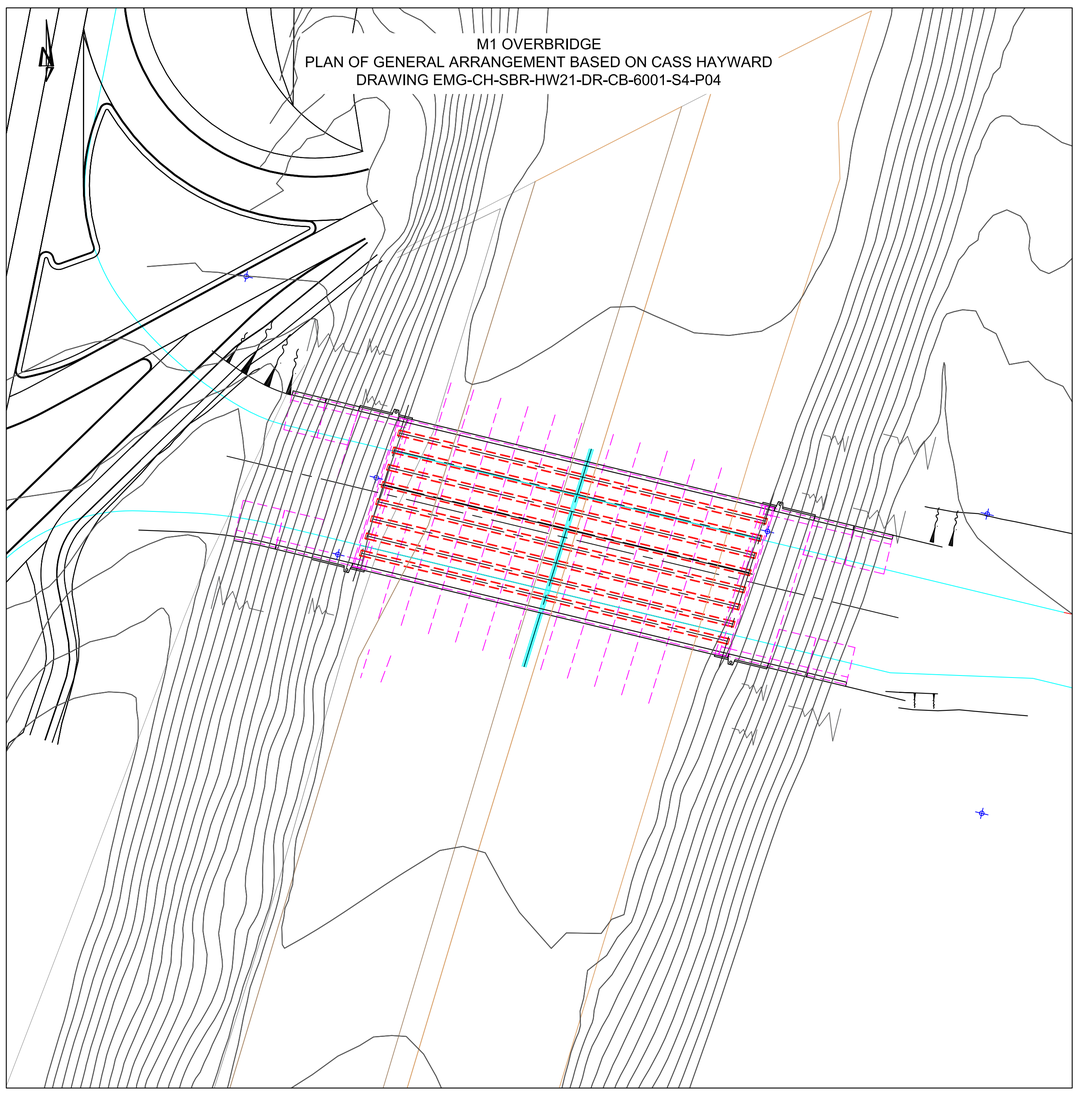
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IG	LW	Not to Scale	16/01/17	16/01/17

Drawing Number: EMG-HYD-C4-M1OB-DR-GE-0636

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Lockington Park
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Lockington Park
Lockington Park
Lockington Park
Pond
Pond
Pond



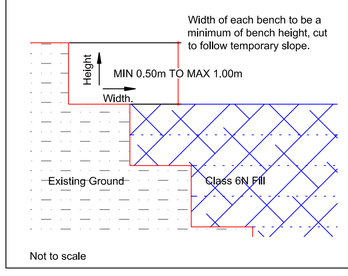
APPENDIX 1/5: TESTING TO BE CARRIED OUT BY THE CONTRACTOR
Table 1/5.1 - Earthworks testing requirements

CLAUSE	WORKS, GOODS OR MATERIAL		TEST	FREQUENCY By Volume from Source	COMPLIANCE
Series 600	Earthworks				
601, 631 to 637, 640	Acceptable Limits				
	Class	General Description			
	1	General granular fill	MC, Grading & UC (U)	1 per 500m³	SHW Table 6/2 Appendix 6/1
			TPS Sulphate Suite	1 per 500m³ minimum of 5	Appendix 6/1
			OMC/MDD (U) (Vib Hammer)	1 per 500m³	Declared
			CBR at OMC (U)	1 per 500m³	5%
	2	General cohesive fill	MC, PI, Grading (U)	1 per 500m³	SHW Table 6/2 Appendix 6/1
			OMC/MDD Particle Density & HSV (U)	1 per 1,000m³	Declared
			TPS Sulphate Suite	1 per 500m³ minimum 5	Declared
			Undrained Triaxial (U)	1 per 1,000m³	50 kN/m² for 2A, 2C 80kN/m² for 2B
	4	Fill to Landscape Areas	MC (U)	1 per 500m³	Appendix 6/1
			Hand shear vane	1 per 500m³	45 kN/m²
			Grading (U)	1 per 1,000m³	Appendix 6/1
	6	Selected granular fill	Grading, UC, MC (U)	1 per 500m³	SHW Table 6/2 Appendix 6/1
			OMC/MDD (U) (Vib Hammer)	1 per 1,000m³, minimum 3 per source	Declared
			CBR at OMC (U)	1 per 1,000m³, minimum 3 per source	≥ 15% for 6F ≥ 15% for 6N
			Los Angeles (U)	Source approval, as delivered to site	≤60 for 6F ≤40 for 6N
			Organic Matter (U)	1 per 500m³, minimum 5 per source	≤ 2%
			SO_3, S, TPS, OS (U)	1 per 500m³, minimum 5 per source	Declared, to Inform Concrete Class
			Bitumen Content (U)	1 per 1,000m³	Class 6F3 only Appendix 6/1
			Drained shear parameters	Source Approval and 1 per bridge abutment as delivered to site	ϕ'_{cv}= 37.5° to 44° ϕ'_{cv}= 31.5° to 38° (ϕ'_{res} 35.0° to 41.5°)

APPENDIX 1/5: TESTING TO BE CARRIED OUT BY THE CONTRACTOR
Table 1/5.1 - Earthworks testing requirements

CLAUSE	WORKS, GOODS OR MATERIAL		TEST	FREQUENCY By Volume from Source	COMPLIANCE
Series 600	Earthworks				
601, 631 to 637, 640	Acceptable Limits				
	Class	General Description			
	7	Selected cohesive fill	MC, PI, Grading (U)	1 per 500m³	SHW Table 6/2 Appendix 6/1
			OMC/MDD HSV,Particle Density & Triaxial (U)	1 per 1,000m³, minimum 3 per source	Declared, min Cu 80 kN/m²
			SO_3, S, TPS, OS & Organic Matter(U)	1 per 500m³ minimum of 5 per source	Declared, to inform Concrete Class, Organic < 2%
			Drained shear parameters (U)	Source Approval	ϕ'_{cv} = 25°
	9	Stabilised material	Pulverization	1 per 625m²	≥30%, HA 74/07 BS 1924
			Bearing ratio, (CBR), recompacted	1 per day	15%
			MCV (U)	1 per 250m³, max 5 per day	To permit compaction, as per mix design trial
612	Compaction of Fills				
		Method Compaction	Field Dry Density (U)	1 per 400m³ per layer	95% MDD Appendix 6/1
			In situ CBR - granular fill only	1 per 400m³ per layer	Appendix 6/1
			In situ HSV - cohesive fill only	1 per 400m³ per layer	Appendix 6/1
			Compaction trial	1 per method, per source. To be witnessed by Hydrock	To confirm method is suitable
			Dual Cycle Plate Load Test	1 per 20m x 20m per 1m of fill and at final earthworks formation.	Equivalent CBR Appendix 6/1
		End Product	Field Dry Density (U)	1 per 200m³ per layer	95% MDD Appendix 6/1
			Air Void Content - cohesive only (U)	1 per 200m³ per layer	≤ 5% air voids Appendix 6/1
			In situ CBR - granular fill only	1 per 200m³ per layer	Appendix 6/1
			In situ HSV - cohesive fill only	1 per 200m³ per layer	Appendix 6/1
			Compaction trial	1 per method, per source. To be witnessed by Hydrock	To confirm method is suitable
			Dual Cycle Plate Load Test	1 per 20m x 20m per 1m of fill, base of foundations and at final formation.	Equivalent CBR Appendix 6/1

TYPICAL BENCHING DETAIL



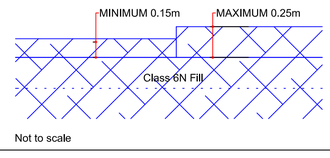
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MINIMUM CLASS 6N BELOW RETAINING WALL FOUNDATION

Not to scale

CLASS 6N MINIMUM & MAXIMUM COMPACTED LAYER THICKNESS

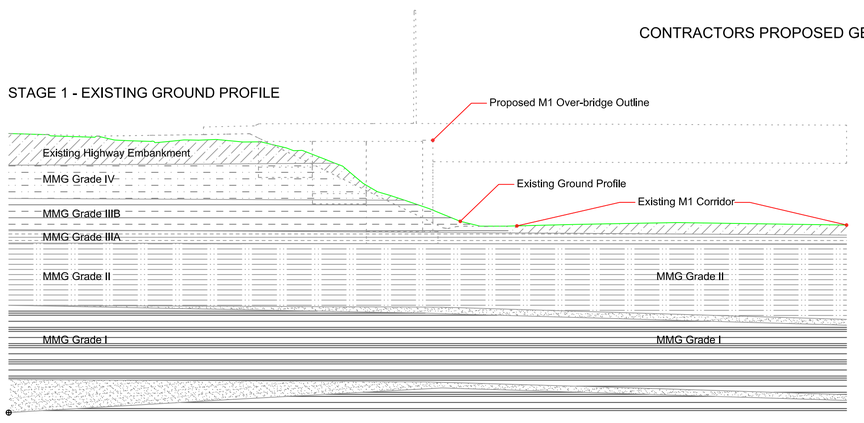
Compaction control by End Product
Minimum 95% MDD by Vibrating Hammer
In situ density at a rate of 1 per 200m³ per layer
Dual cycle static plate load, tested at
- 1 per 20m x 20m per 1.0m of fill;
- 1 per 20m x 20m at the base of each retaining wall foundation; and
- 1 per 20m x 20m at final formation of Class 6N.



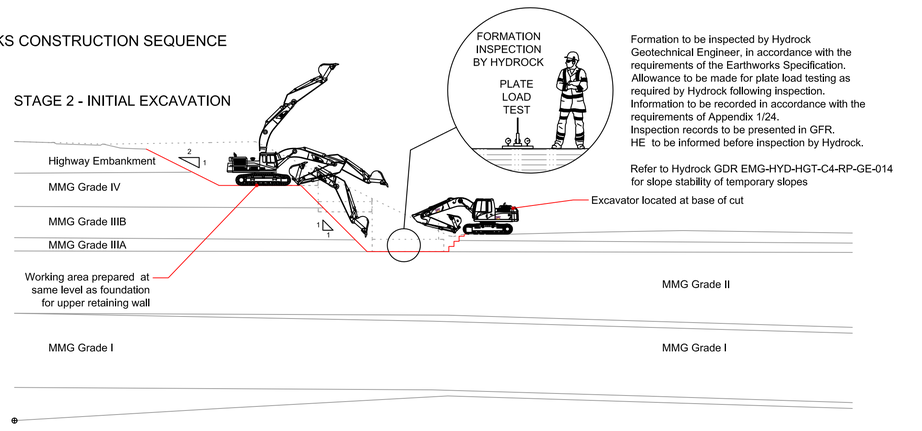
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M1 OVERBRIDGE
CONTRACTORS PROPOSED GENERAL EARTHWORKS CONSTRUCTION SEQUENCE

STAGE 1 - EXISTING GROUND PROFILE



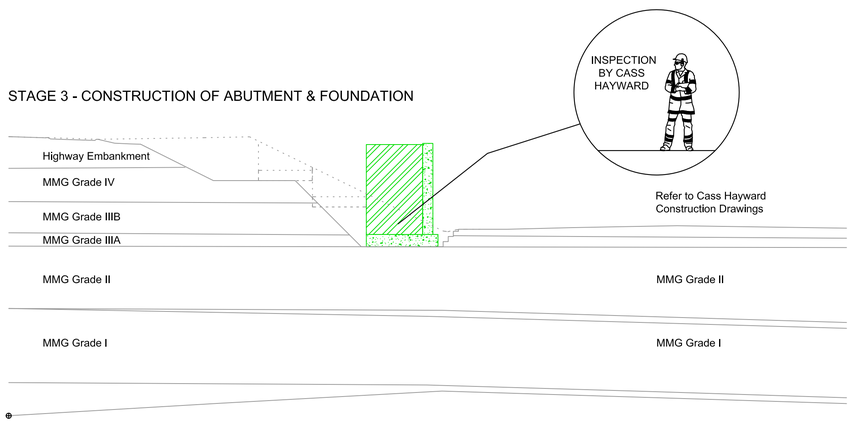
STAGE 2 - INITIAL EXCAVATION



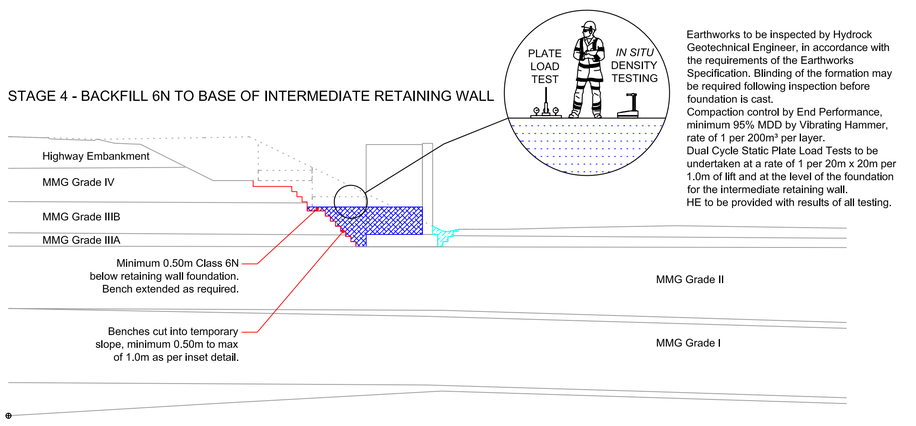
Formation to be inspected by Hydrock Geotechnical Engineer, in accordance with the requirements of the Earthworks Specification. Allowance to be made for plate load testing as required by Hydrock following inspection. Information to be recorded in accordance with the requirements of Appendix 1/24. Inspection records to be presented in GFR. HE to be informed before inspection by Hydrock.

Refer to Hydrock GDR EMG-HYD-HGT-C4-RP-GE-014 for slope stability of temporary slopes

STAGE 3 - CONSTRUCTION OF ABUTMENT & FOUNDATION

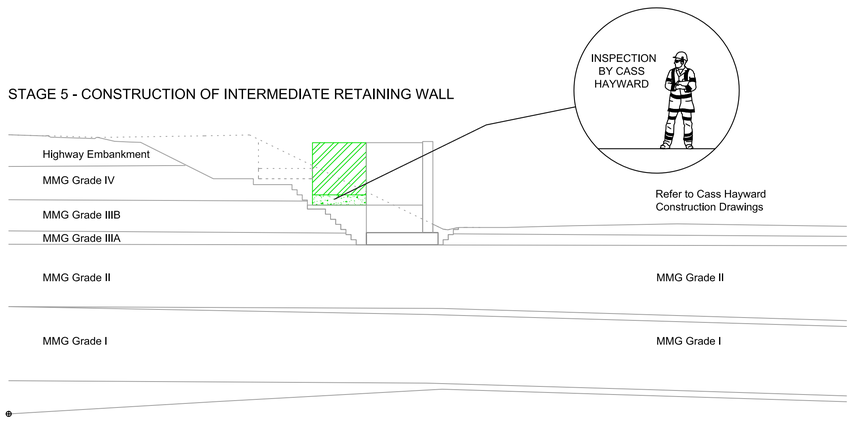


STAGE 4 - BACKFILL 6N TO BASE OF INTERMEDIATE RETAINING WALL

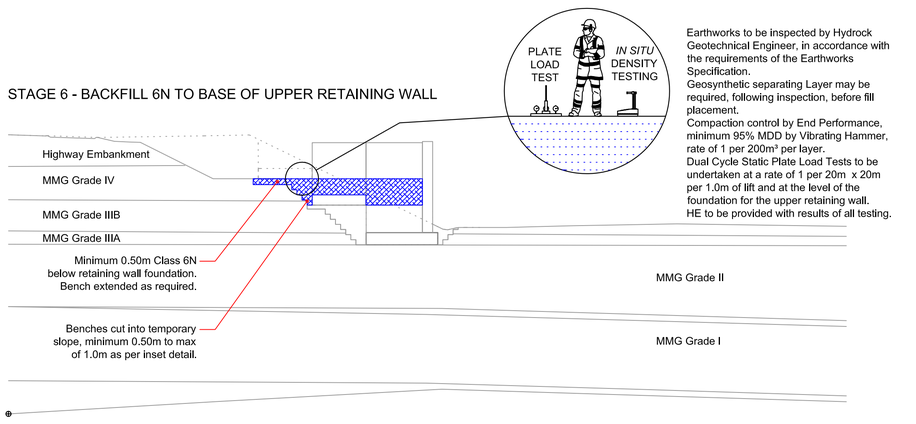


Earthworks to be inspected by Hydrock Geotechnical Engineer, in accordance with the requirements of the Earthworks Specification. Blinding of the formation may be required following inspection before foundation is cast.
Compaction control by End Performance, minimum 95% MDD by Vibrating Hammer, rate of 1 per 200m³ per layer.
Dual Cycle Static Plate Load Tests to be undertaken at a rate of 1 per 20m x 20m per 1.0m of lift and at the level of the foundation for the intermediate retaining wall.
HE to be provided with results of all testing.

STAGE 5 - CONSTRUCTION OF INTERMEDIATE RETAINING WALL

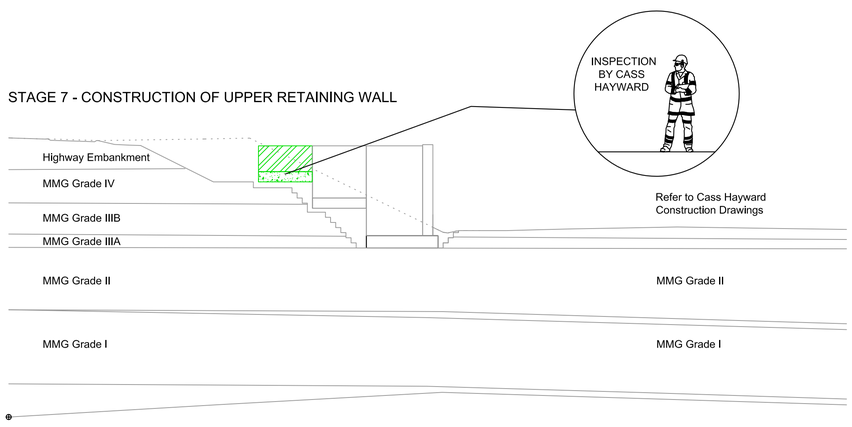


STAGE 6 - BACKFILL 6N TO BASE OF UPPER RETAINING WALL

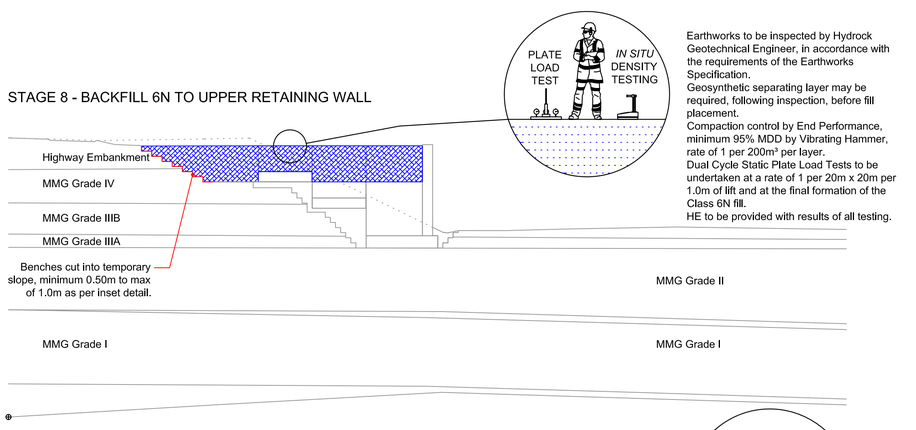


Earthworks to be inspected by Hydrock Geotechnical Engineer, in accordance with the requirements of the Earthworks Specification.
Geosynthetic separating Layer may be required, following inspection, before fill placement.
Compaction control by End Performance, minimum 95% MDD by Vibrating Hammer, rate of 1 per 200m³ per layer.
Dual Cycle Static Plate Load Tests to be undertaken at a rate of 1 per 20m x 20m per 1.0m of lift and at the level of the foundation for the upper retaining wall.
HE to be provided with results of all testing.

STAGE 7 - CONSTRUCTION OF UPPER RETAINING WALL

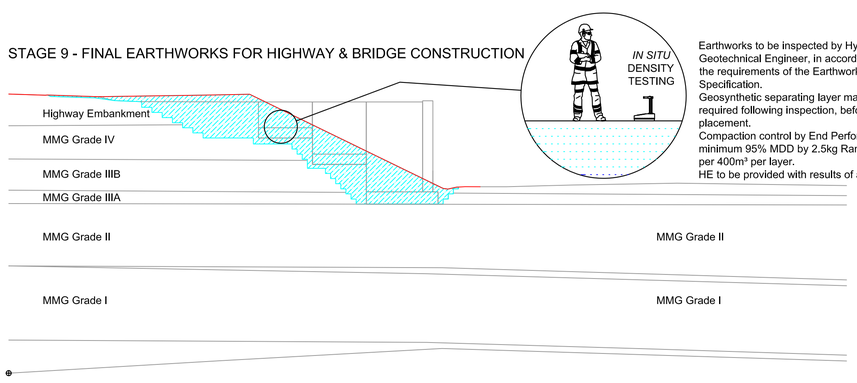


STAGE 8 - BACKFILL 6N TO UPPER RETAINING WALL



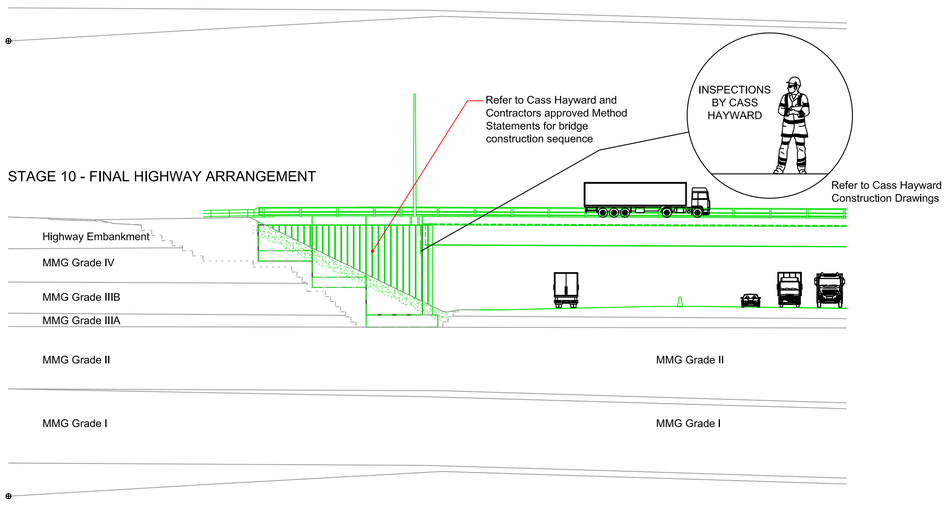
Earthworks to be inspected by Hydrock Geotechnical Engineer, in accordance with the requirements of the Earthworks Specification.
Geosynthetic separating layer may be required, following inspection, before fill placement.
Compaction control by End Performance, minimum 95% MDD by Vibrating Hammer, rate of 1 per 200m³ per layer.
Dual Cycle Static Plate Load Tests to be undertaken at a rate of 1 per 20m x 20m per 1.0m of lift and at the final formation of the Class 6N fill.
HE to be provided with results of all testing.

STAGE 9 - FINAL EARTHWORKS FOR HIGHWAY & BRIDGE CONSTRUCTION



Earthworks to be inspected by Hydrock Geotechnical Engineer, in accordance with the requirements of the Earthworks Specification.
Geosynthetic separating layer may be required following inspection, before fill placement.
Compaction control by End Performance, minimum 95% MDD by 2.5kg Rammer, 1 per 400m³ per layer.
HE to be provided with results of all testing.

STAGE 10 - FINAL HIGHWAY ARRANGEMENT



Notes:

1. All dimensions are to be checked on site before the commencement of works, Any discrepancies are to be reported to the relevant Engineer for verification, Figured dimensions only are to be taken from this drawing.
2. This drawing is to be read in conjunction with all relevant Engineers' and Service Engineers' drawings and specifications.
3. As defined in Appendix 1/24, the Contractor is responsible for providing a information to Hydrock, including an up to date review of the works completed, It is recognized by Hydrock that tests may have been carried out in the preceding week for which no results have been provided. However the report reference and type shall be included in the summary in terms of compliance testing, Weekly reporting shall include the following records, to be provided by midday of the first working day per week:
   - sequential test number,
   - date of test;
   - coordinated position to include easting & northing, correct to National Grid Reference;
   - reduced level, to meters above Ordnance Datum;
   - site reference;
   - test grid reference;
   - layer number (during placement of fill);
   - test type;
   - whether results are Draft (before the issue of certificate) or Final (certificate issued and received by Contractor); and
   - the results of the testing, compliance with the Specification and any comments relating to the test .
4. As defined in Appendix 1/24, at the completion of the Earthworks, the Contractor is responsible for providing a factual Validation Report, covering all activities which have been completed, The Validation Report shall include the following information:
   - daily record sheets to include a summary of the day's activities;
   - progress photographs;
   - general description of the works completed, including any earthworks, excavations (including excavations of hard obstructions or foundations), placement and compaction methodology and plant used;
   - detailed weather conditions;
   - formation and foundation treatment, including drainage and treatment of soft areas;
   - plant, personnel and visitors present;
   - aspects relating to Health and Safety, Environmental control;
   - waste transfer notes;
   - application of acceptability criteria and summary of control test results for each specific earthworks material placed during the earthworks operations;
   - chemical and geotechnical test certificates and monitoring data including location and level with associated drawings;
   - as built surveys, including base of excavations to include drawings;
   - coordinates, levels, invert levels and diameters of services remaining on site;
   - drawings showing the location and level of each specific earthworks material placed during the earthworks operations, any feature or operation relevant to the earthworks including any instrumentation and the location of trial areas and control tests; and
   - all correspondence with Statutory Authorities
4. All earthworks are to be undertake in accordance with BS 6031:2009 (Code of practice for earthworks) and BS EN 13242 (Hydraulically bound and unbound materials for use in Civil Engineering, using the Specification for Highway Works as the model specification, Additional reference shall be made to the recommendations and model specification for earthworks defined in BRE FB 57 Building on fill, geotechnical aspects version 3: 2015. Site specific testing requirements for fill materials are as detailed on this drawing and should be read in conjunction with the above publications,
5. Where there is a perceived to be a conflict in requirements between the various documents detailed above and the content of this drawing, the Contractor shall assume the most onerous requirement and immediately inform Hydrock as to the exact requirements to be met.
6. The Contractor shall be responsible for ensuring all testing is undertaken, and is permitted to self-certify the works, in accordance with the requirements of the Specification, The right of self-certification is not to be delegated or extended to any of the following parties:
   - Subcontractors, employed by the Contractor,
   - Service owners contractors undertaking backfilling of diverted service trenches,
   - Other third party contractors undertaking works on the site.
7. Should any material be placed which has not been given prior written approval from Hydrock, the Contractor will have done this at their own risk and they will be responsible for any and all remedial works required to rectify the situation, All costs associated with this remedial work are to be borne by the Contractor.
8. All works and associated costs relating the control and management of water on site, from existing, proposed or redundant watercourses or from any other source including groundwater, rainfall and surface water is the responsibility of the Contractor, All costs for the control and management of water are to be borne by the Contractor and the Contractor is deemed to have read, understood and fully accounted for these costs within their Tender submission, Any uncertainty over the issues associated with water or groundwater control should be submitted to the Engineer for clarification, as soon as any such issue is noted or identified by any party.
9. The structural design of the M1 Overbridge has been undertaken by Cass Hayward, Reference shall be made to the construction drawings prepared by Cass Hayward,
10. The design of all temporary works is the responsibility of the Contractor.
11. The general sequence set out on this drawing is to be undertaken for the Western and the Eastern Embankment.
12. The general construction is to be confirmed by the Contractor in their Detailed Method Statements, once the structural design has been completed by Cass Hayward and it has been approved by HE.
13. The Contractor is to prepare all detailed Method Statements required to undertake the works, Copies of the Method Statements are to be made available to HE upon request.
14. This drawing is only intended to show the general sequence of earthworks operations. Reference should be made to the Cass Hayward construction drawings and the approved Contractors Method Statements for details on the construction sequence for the bridge.

Legend

- Topsoil / Subsoil
- Alluvium
- Terrace Deposits Soft to firm sandy gravelly CLAY
- Terrace Deposits Sands & Gravels
- Highway Embankment, General Fill Class 1 and Class 2
- Class 6N Selected Backfill
- Mercia Mudstone Group MMG IV (Mudstone)
- Mercia Mudstone Group MMG IIIB (Mudstone)
- Mercia Mudstone Group MMG IIIA (Mudstone)
- Mercia Mudstone Group (Sandstone)
- Mercia Mudstone Group MMG II (Mudstone)
- Mercia Mudstone Group MMG I (Mudstone)
- Bromsgrove Sandstone
- Indicative Bridge Arrangement
- Existing Skewed Bridge Indicative Arrangement

Rev	Date	Description	By	Ckd
P3	08/08/17	Up-dated to identify potential requirement for static plate load tests at bridge abutment location.	IG	CV
P2	03/08/17	Up-dated to S4, commentary added regarding possible requirements for blinding and geosynthetic material.	IG	CV

Architect :

Hydrock
Hydrock Consultants Ltd
3 Hawthorn Park
Holdenby Road
Spratton, Northampton
NN6 8LD
T +44 (0)1604 842888
northampton@hydrock.com
[redacted]

Client :
ROXHILL KEGWORTH LTD

Project Title:
EAST MIDLANDS GATEWAY - STRATEGIC RAIL FREIGHT INTERCHANGE

Drawing Title:
M1 Overbridge - General Earthworks Construction Sequence

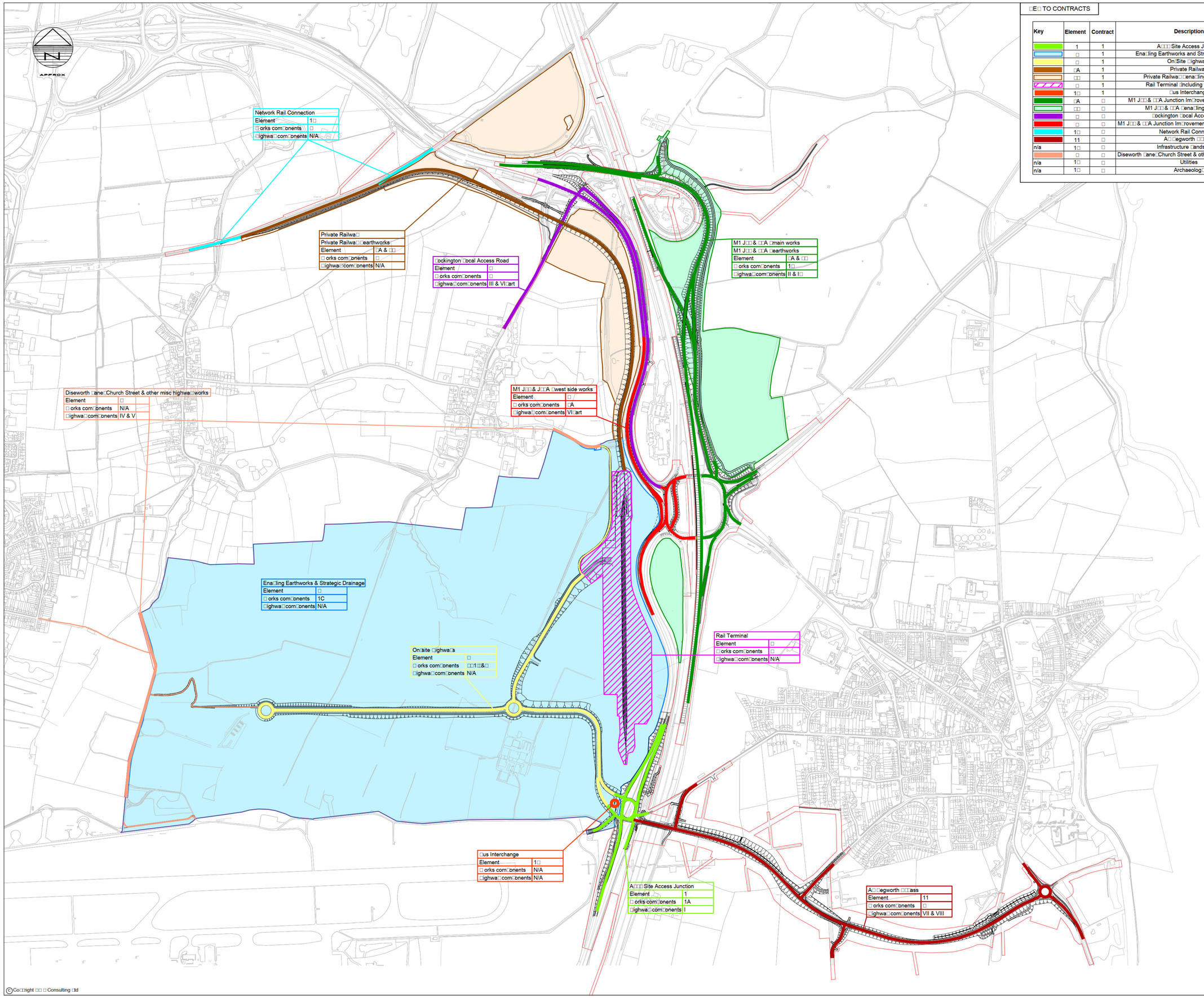
Drawing Status:	Revision:
S4	P3

Hydrock Job No:
C/14792

Drawn	Checked	Scale @ A0	Date	Issue Date
IG	CV	Not to scale	01/08/17	02/08/17

Drawing Number:
EMG-HYD-C4-M1OB-DR-GE-0654

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□E□ TO CONTRACTS

Key	Element	Contract	Description	Principal Adopting Authority	□ ork Com□onents □NT□/□□□/S□□/1□	□ighwa□ Com□onents □NT□/□□□/1□□□1□
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	□	1	Ena□ling Earthworks and Strategic Drainage	n/a	1C	n/a
	□	1	On□Site □ighwa□s	n/a	□□1□□□□ and □□□	n/a
	□A	1	Private Railwa□	n/a	□	n/a
	□□	1	Private Railwa□□ena□ling earthworks	n/a	□	n/a
	□	1	Rail Terminal □ncluding tracks etc..□	n/a	□	n/a
	1□	1	□us Interchange	n/a	n/a	n/a
	□A	□	M1 J□□ & □□A Junction Im□rovement □main works	□ighwa□s England	1□	II & I□
	□□	□	M1 J□□ & □□A □ena□ling earthworks	□ighwa□s England	1□	Various
	□	□	□ockington □ocal Access Road	□eicestershire CC	□	III & VI □art□
	□	□	M1 J□□ & □□A Junction Im□rovement □J□□west side works	□ighwa□s England	□A	VI □art□
	1□	□	Network Rail Connection	Network Rail	□	n/a
	11	□	A□□egworth □□□ass	□eicestershire CC	□	VII & VIII
n/a	1□	□	Infrastructure □andsca□ing	n/a	n/a	n/a
	□	□	Diseworth □ane□Church Street & other misc highwa□works	□eicestershire CC	n/a	IV & V
n/a	1□	□	Utilities	n/a	n/a	n/a
n/a	1□	□	Archaeolog□	n/a	n/a	n/a

NOTES

1. DO NOT SCA□E T□IS DRA□ IN□. A□□DIMENSIONS MUST □E C□EC□ED/ VERIFIED ON SITE. IF IN DOU□T AS□.

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Rev	Date	Details of issue / revision	Drw	Rev
P□	□□.□□.1□	TA□□E AMENDED	SR□	SR□
P□	1□.1□.1□	TA□□E AMENDED	SR□	SR□
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P1	□1.□□.1□	PRE□IMINAR□ ISSUE	SR□	SR□

ISSUES & REVISIONS

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□ **Manchester** □□/□/□ □□□ □□□□
□ **Nottingham** □□/11□□□□ 11□□

Client

ROXHILL

Project Title

EAST MIDLANDS GATEWAY STRATEGIC RAIL FREIGHT INTERCHANGE

Drawing Title

CONTRACT ASSEMBLY

Drawing Status

PRELIMINARY

Drawing No.	Revision
NTH/209/SK173	**P6**

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Network Rail Connection □East□	
Phase	S
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Network Rail Connection □□ est□	
Phase	N
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Railwa□	
Phase	□
□ighwa□com□onents	N/A

□ockington □ocal Access Road	
Phase	D
□ighwa□com□onents	iii

M1 J□□ & J□□A □ west side works	
Phase	E
□ighwa□com□onents	vi

Church Street	
Phase	J
□ighwa□com□onents	v

Earthworks incl Flood Com□ensation	
Phase	A
□ighwa□com□onents	N/A

M1 J□□ & □□A □main works & earthworks	
Phase	C
□ighwa□com□onents	ii & i□

Inter□modal Area	
Phase	□
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Rail Terminal □to □e su□divided□	
Phase	□
□ighwa□com□onents	N/A

Diseworth □ane	
Phase	□
□ighwa□com□onents	iv

Infrastructure □andsca□ing	
Phase	M
□ighwa□com□onents	N/A

SRFI Roads□ Drainage & Utilities	
Phase	F
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□uildings □To □e Su□divided□	
Phase	P
□ighwa□com□onents	N/A

□us Interchange	
Phase	□
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A□□ Site Access Junction	
Phase	□
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A□□egworth □□ass	
Phase	R
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NOTES

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□ AN□ DISCREPANCIES NOTED ON SITE ARE TO □E REPORTED TO T□E EN□INEER IMMEDIATE□□.

Rev	Date	Details of issue / revision	Drw	Rev
P□	□□.□□.1□	RAI□□ANDSCAPIN□ INC□UDED IN P□ASE M	SR□	SR□
P□	□□.□□.1□	UPDATED FO□□D□ IN□ REVIE□	SR□	SR□
P1	□□.□□.1□	PRE□IMINAR□ ISSUE	SR□	SR□

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Manchester □□1□1 □□□ □□□□
Nottingham □□11□ □□□ 11□□

Client

ROXHILL

Project Title

EAST MIDLANDS GATEWAY STRATEGIC RAIL FREIGHT INTERCHANGE

Drawing Title

DCO PHASING

[redacted]

Drawing Status

PRELIMINARY

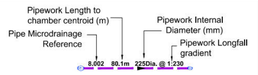
Drawing No.

NTH/209/SK212

Revision

P3

Pipework Schematic



Legend

- Proposed Combined Filter / Carrier Drain System — 8.002 80.1m 225Dia. @ 1:230
- Proposed Filter Drain System — 8.002 80.1m 225Dia. @ 1:230
- Proposed Surface Water Gravity Sewer System — 8.002 80.1m 225Dia. @ 1:230
- Proposed narrow fin drain Type 8 as to HCD Drg F18 — NF
- Proposed ditch, 1 in 2 Side Slopes Base width 0.5m
- Existing Highway Drainage System to remain unaltered — 8.002 80.1m 225Dia. @ 1:230
- Proposed Linear Combined Kerb Drainage System - ACO Kerbdrain or equivalent approved — KD1
- Indicative position of Kerb/Channel drain access box - details to be confirmed by manufacturer — [AB]
- Indicative position of Kerb/Channel drain outlet point - details to be confirmed by manufacturer — [OB]
- Proposed Gully Pot and Lateral Connection to Sewer. See Note 10 — 225ø
- Proposed precast concrete headwalls. See Note 14
- Proposed LCC Catchpits to be Type CP1 As To 6Cs design SD/5/19, See Note 7
- Proposed HE Catchpits to be Type Type 7, See Note 9
- Existing Catchpit

Notes

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in metres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.
5. Drawings should be printed in colour.
7. LCC Highway Chambers to be Type CP1 as to 6Cs Design Drg SD/5/19 unless shown otherwise.
8. For LCC Network, trench and pipe bedding shall be in accordance with 6Cs Design Drg SD/5/2 & SD/5/4. For Highways England Network refer to HCD Drg F1 & F2 unless shown otherwise.
9. For pipes up to 450mmØ, Highway Chambers shall be Type 7 as to HCD Drg F11. For pipe diameters greater than 450mm then chamber dia size shall increase as to the manufactures guidelines unless shown otherwise.
10. Type 8 Narrow Filter drains as to HCD Drg F18 shall outfall into the next downstream Chamber along that particular drainage run.
11. All gully gratings, manhole frames and covers to have hinged openings. For details of gully and manhole frames refer to Appendix 5/1.
10. All LCC road gullies shall be trapped and shall be in accordance with 6Cs Design Drg SD/5/13 unless shown otherwise.
11. Where new gullies discharge directly into the proposed highway ditches then ACO SuDS Swale Inlets (or equivalent approved.) shall be be used. Refer to ACO Standard Details.
12. Pipe Strengths and material type shall be in accordance with Appendix 5/1 of the Contract Specification and DMRB Volume 4 HA 40/01 Section 2, Part 5, Appendix C.
13. Precast concrete rings to be constructed to BS EN 1917 and BS EN 5911-3.
14. All Headwalls shall be Althon precast concrete headwalls or equivalent approved unless shown otherwise.
    For pipe diameters up to 300mm and backwall height less than 1m = Althon H3C Headwall Range
    For pipe diameters up to 525mm and backwall height between 1.1m to 2m = Althon H6C Headwall Range
    For pipe diameters up to 900mm = Althon H10C Headwall Range
15. Mortar to be designation (I) to SHW Series 2400.
16. Pipes to be built into chamber with designation (I) mortar.
17. See SHW, sub-clause 507.7, regarding backfill arrangements/surrounds to chamber.
18. All ST concrete shall be to SHW Clause 2602.
19. Sump dimensions are indicative and are subject to manufacturers requirements upon final selection of flow control device.
20. The Contractor is to refer to Drg No. EMG-BWB-VTO-HW-DR-D-092 for site specific/extraordinary hazards which have been identified during the detailed design stage.

Rev	Date	Details of issue / revision	Drw	Rev
P1	10.07.17	FOR LCC & HE APPROVAL	GJ	NL
T1	29.03.17	FOR TENDER	RJT	NL

Issues & Revisions

BWB CONSULTANCY | ENVIRONMENT INFRASTRUCTURE | BUILDING
Birmingham | 0121 233 3322
Leeds | 0113 233 8000
London | 020 7407 3879
Manchester | 0161 233 4260
Nottingham | 0115 924 1100

Client

ROXHILL

Project Title

THE EAST MIDLANDS GATEWAY RAIL FREIGHT INTERCHANGE

Drawing Title

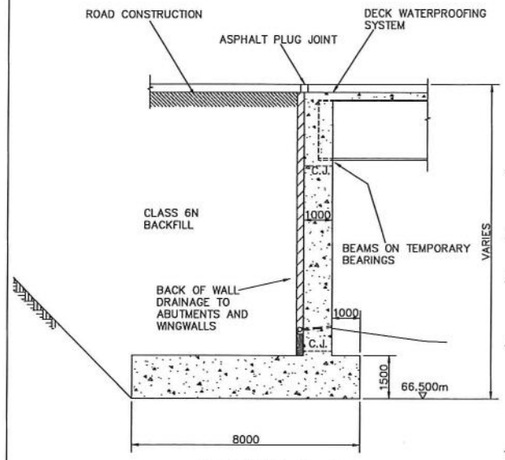
DRAINAGE LAYOUT SHEET 21A

Drawing Status

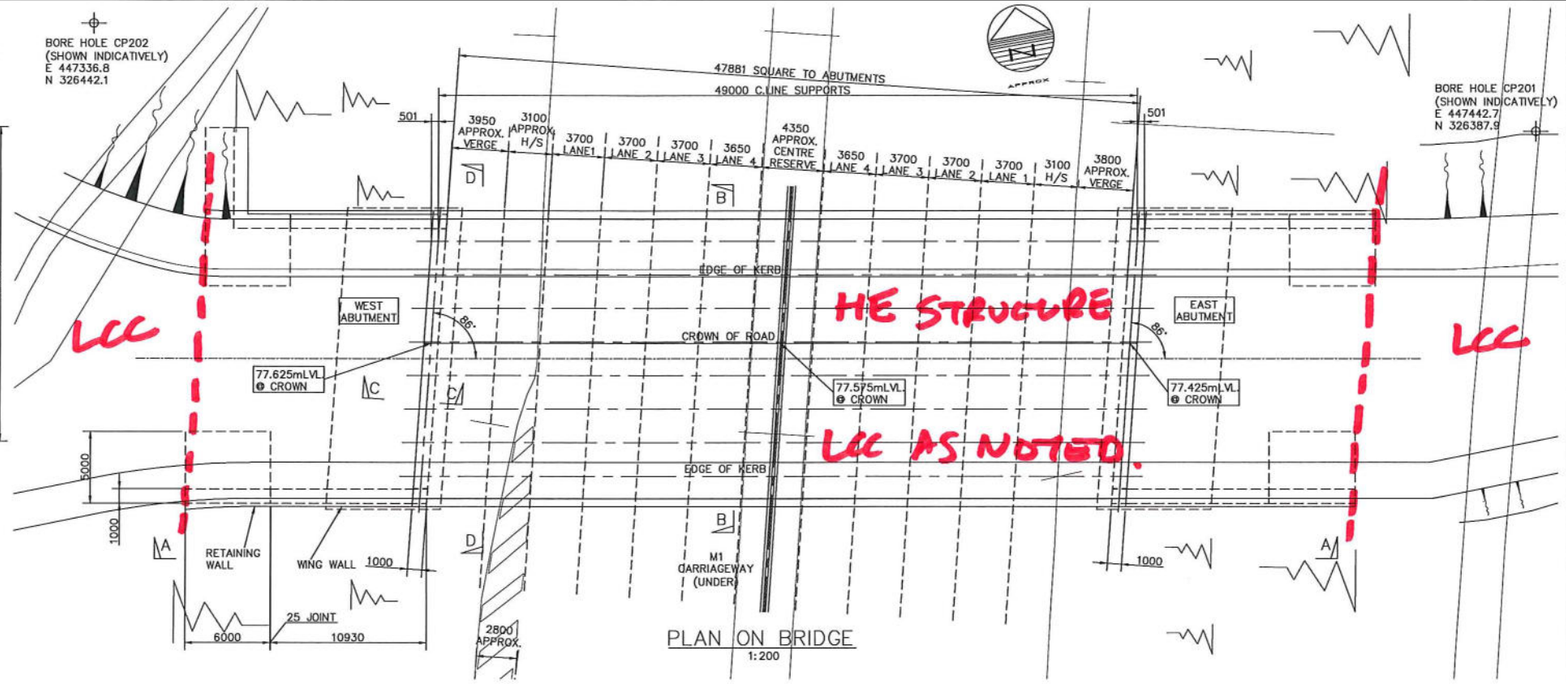
FOR APPROVAL

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
EMG-BWB-HDG-HW21a-DR-D-500	S4	P1

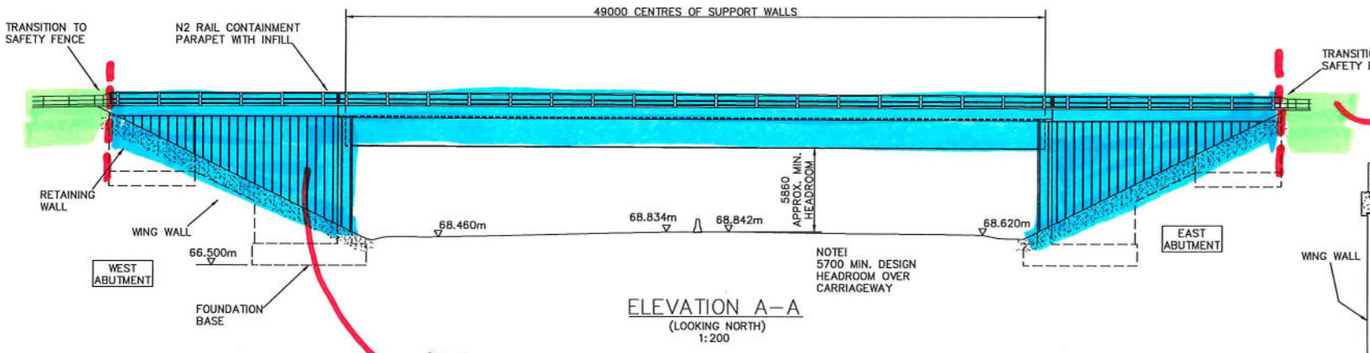
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SECTION C–C
1:100

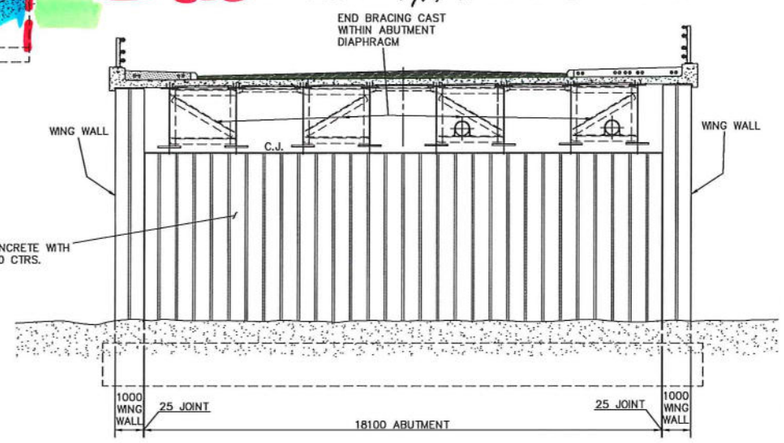


PLAN ON BRIDGE
1:200



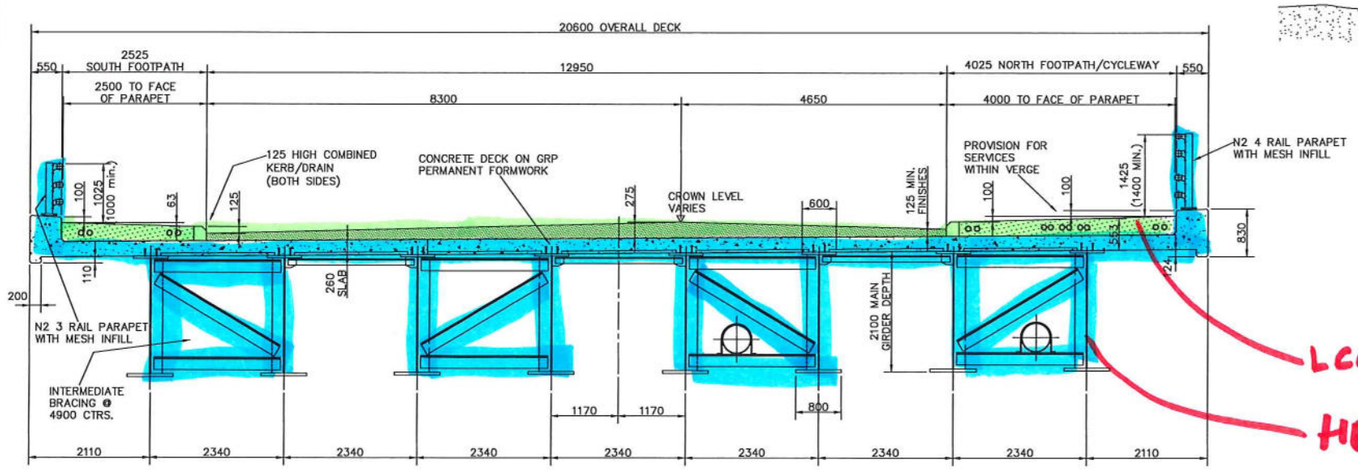
ELEVATION A–A
(LOOKING NORTH)
1:200

HE: STRUCTURE : INCLUDING WINGWALLS AND STRUCTURAL BACKFILL



SECTION D–D – WEST ABUTMENT
(EAST ABUTMENT SIMILAR)
1:100

LCC: HIGHWAY, APPROACH SLABS + VRS



SECTION B–B
1:50

LCC: PAVEMENTS + KERBS (& LIGHTING)

HE: STRUCTURE + PARAPETS + WATERPROOFING &

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS IN METRES A.O.D. UNLESS NOTED OTHERWISE.
3. STEELWORK TO BE WEATHERING STEEL. (S355 J2W+N)

26/07/17
KEGWORTH BYPASS BRIDGE! MAINTENANCE RESPONSIBILITIES.

Rev	Date	Details of issue / revision	Drw	Chk
P01	28/02/17	FIRST ISSUE	RPF	JDP

ISSUES & REVISIONS

CASS HAYWARD CONSULTING ENGINEERS

ROXHILL

THE EAST MIDLANDS GATEWAY RAIL FREIGHT INTERCHANGE

Drawing Title

Structure Key 35229
Structure Number M1//183.90.//
KEGWORTH BYPASS
M1 OVERBRIDGE
GENERAL ARRANGEMENT

Scale	As Shown	Drawn	RPF
Size	A1	Reviewed	JDP
Regulation		Document	-

Drawing Status
FOR APPROVAL

Drawing No.	Revision
EMG-CH-SBR-HW21-DR-CB-6001-S4	P01