James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois
Tel: 057 8664885

LABORATORY TEST REPORT

BRE Test Suite B - Greenfield Site

Project:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref. No.:**	ST 93430
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	08/04/2020
	Co. Cork	**Material:**	Soil
Order No.:	2003-104	**Date Tested:**	07/04/2020
Originator:	Ian Holley	**Specification:**	Client

Sample Details **XC219-CPRC02 Type D Sample 6**

Supplier:	Client Info	**Date of Sampling:**	Client Info.
Source:	Client Info	**Sampled By:**	Client
Sample Location:	2.0-3.0m	**Sampling Reason:**	Request

Parameter	RESULT
pH	8.1
Sulphate Aqueous Extract (SO4) (mg/l)	11
Sulphur as S, Total (%)	0.01
Sulphate as SO4, Total (%)	0.01

Comments:
None

Tested in accordance with the above specifications
Subcontracted to a laboratory UKAS accredited for this testing

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.

☐ **James Ward, Operations Manager**

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co.Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

MOISTURE CONTENT BS 1377 : Part 2 : 1990 Oven Drying Method cl 3.2

Site:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93428
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	27/03/2020
Order No:	2003-104	**Date Reported:**	02/04/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC219-CPRC02 Type D Sample 6

Sample Type:	Bulk	***Location:***	XC219-CPRC02 Type D Sample 6
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	2.0-3.0m	***Material Type:***	Soil

Moisture Content (%): 5.9

Tested in accordance with BS 1377: Part 2: 1990
Sample preperation by cone and quarter

Approved Signature
James Fisher Testing Services (Ireland) Ltd
James Ward, Operations Manager

UKAS TESTING
0955

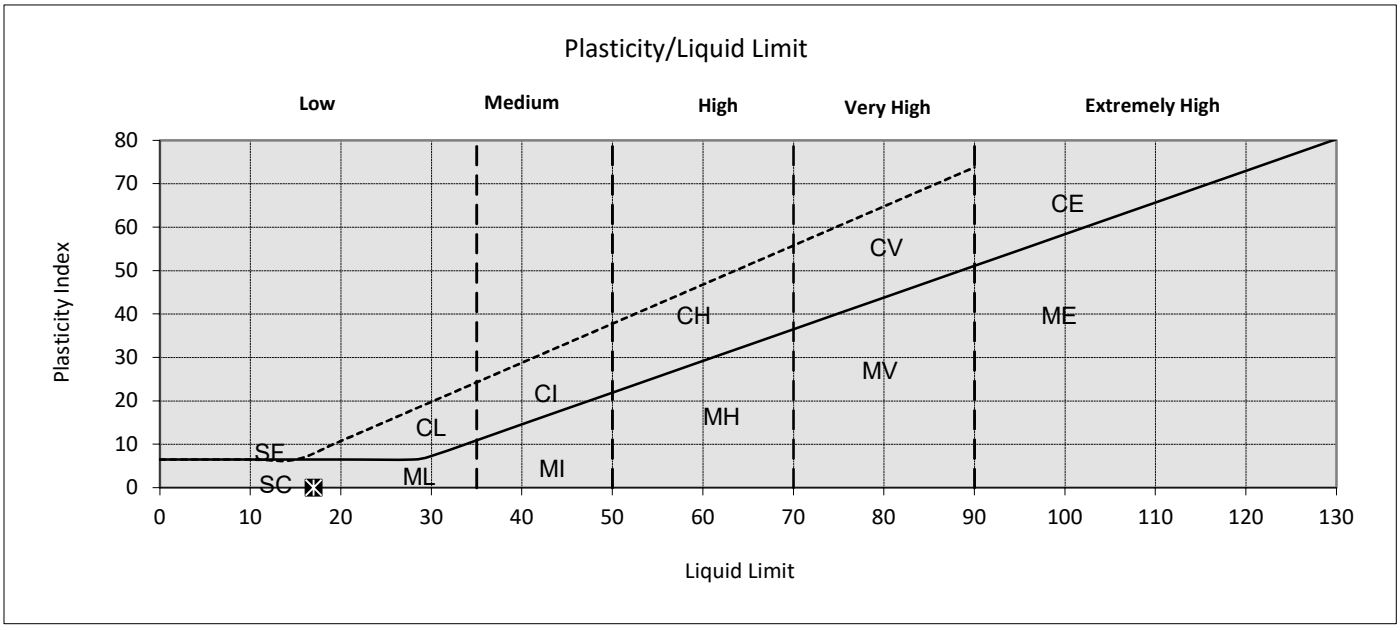
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93429
	Unit 1 Carrigogna	**Sample Ref.:**	XC219-CPRC02 2.0-3.0m Type D S.6
	Midleton	**Date Sampled:**	Client Info
	Co Cork	**Date Received:**	09/03/2020
Order No:	2003-104	**Date Tested:**	02/04/2020
Originator:	**Ian Holley**	**Date Reported:**	22/04/2020

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Bulk**
Sample Preparation Method	**Washed**
MATERIAL	**Soil**
Retained 425 micron (%)	**22**
Natural Moisture Content (%)	**10**
Liquid Limit (single point)(%)	**17**
Plastic Limit (%)	**Non-Plastic**
Plasticity Index	**N/A**



The stated result only relates to the item/location tested, this report shall not be reproduced except in full.

Approved Signature
James Fisher Testing Services Ltd
Phil Thorp, Laboratory Manager

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

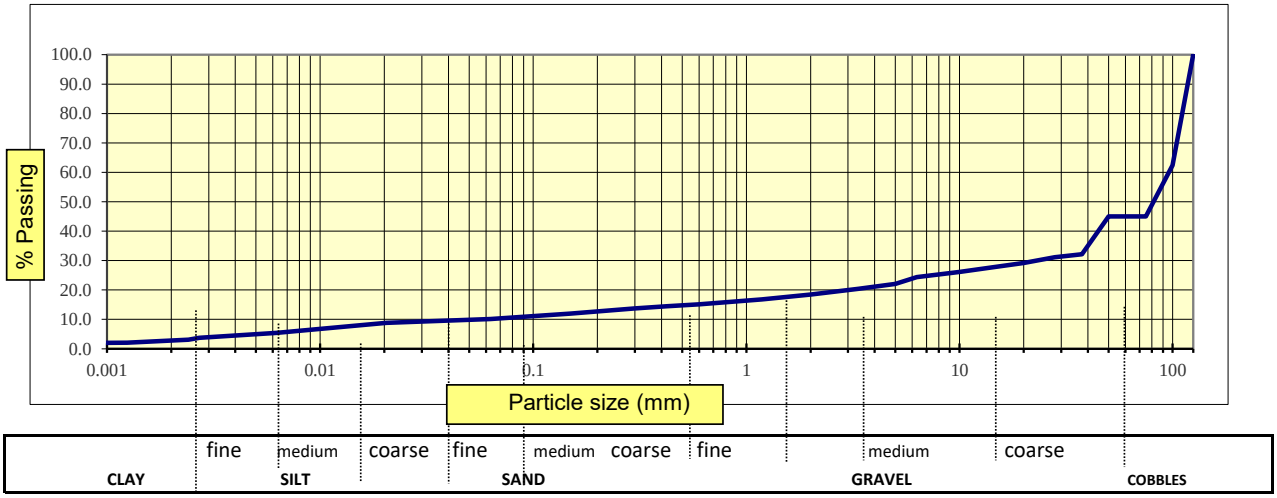
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

Determination of Particle Size Distribution (Hydrometer Sedimentation) - BS 1377 : Part 2 : 1990 Cl. 9.5

Project:	Cork Line Level Crossings	**Job No:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93427
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	02/04/2020
		Date Tested:	01/04/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Large Cobble, Dark Clay, Sandy

Client Ref.	**XC219-CPRC02 Type B Sample 5**
Location:	XC219-CPRC02 Type B Sample 5
Supplier:	Bulk
Source:	Client Info.
Depth (m):	2.0-3.0m
Sampling Reason:	Client Request
Sampled By:	Client
Specification:	Client
Preparation Method:	Without Organics Preparation
Notes:	Disturbed sample from cleanout

BS Sieve Size	% Passing	Specification
300 mm	100	
125 mm	100	
100 mm	62	
75 mm	45	
63 mm	45	
50 mm	45	
37.5 mm	32	
28 mm	31	
20 mm	29	
14 mm	28	
10 mm	26	
6.3 mm	24	
5 mm	22	
3.35 mm	20	
2 mm	18	
1.18 mm	17	
0.6 mm	15	
0.425 mm	15	
0.3 mm	14	
0.15 mm	12	
0.063 mm	10	
0.020 mm	9	
0.006 mm	5	
0.003 mm	4	
0.002 mm	3	
0.001 mm	2	



Tested in accordance with BS 1377: Part 2 : 1990 Clause 9.2 and 9.5

Sedimentation by Hydrometer - Not UKAS

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.
☐ **James Ward, Operations Manager**

UKAS TESTING 0955

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

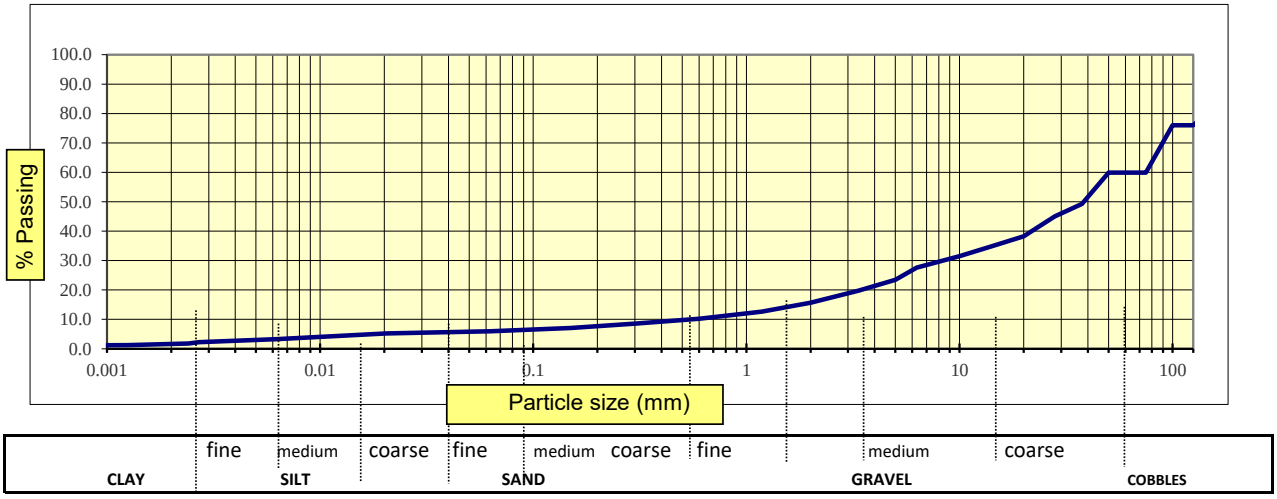
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

Determination of Particle Size Distribution (Hydrometer Sedimentation) - BS 1377 : Part 2 : 1990 Cl. 9.5

Project:	Cork Line Level Crossings	**Job No:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93431
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	02/04/2020
		Date Tested:	01/04/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Large Cobble, Dark Clay, Sandy

Client Ref.	**XC219-CPRC02 Type B Sample 7**
Location:	XC219-CPRC02 Type B Sample 7
Supplier:	Bulk
Source:	Client Info.
Depth (m):	3.0-3.4m
Sampling Reason:	Client Request
Sampled By:	Client
Specification:	Client
Preparation Method:	Without Organics Preparation
Notes:	Disturbed sample from cleanout

BS Sieve Size	% Passing	Specification
300 mm	100	
125 mm	76	
100 mm	76	
75 mm	60	
63 mm	60	
50 mm	60	
37.5 mm	49	
28 mm	45	
20 mm	38	
14 mm	35	
10 mm	32	
6.3 mm	28	
5 mm	24	
3.35 mm	20	
2 mm	16	
1.18 mm	13	
0.6 mm	10	
0.425 mm	9	
0.3 mm	9	
0.15 mm	7	
0.063 mm	6	
0.020 mm	5	
0.006 mm	3	
0.003 mm	2	
0.002 mm	2	
0.001 mm	1	



Tested in accordance with BS 1377: Part 2 : 1990 Clause 9.2 and 9.5

Sedimentation by Hydrometer - Not UKAS

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.
☐ **James Ward, Operations Manager**

UKAS TESTING 0955

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co.Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

MOISTURE CONTENT BS 1377 : Part 2 : 1990 Oven Drying Method cl 3.2

Site:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93432
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	27/03/2020
Order No:	2003-104	**Date Reported:**	02/04/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC219-CPRC03 Type D Sample 3

Sample Type:	Bulk	***Location:***	XC219-CPRC03 Type D Sample 3
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	0.5-1.2m	***Material Type:***	Soil

Moisture Content (%): 23

Tested in accordance with BS 1377: Part 2: 1990
Sample preperation by cone and quarter

Approved Signature
James Fisher Testing Services (Ireland) Ltd
James Ward, Operations Manager

UKAS TESTING
0955

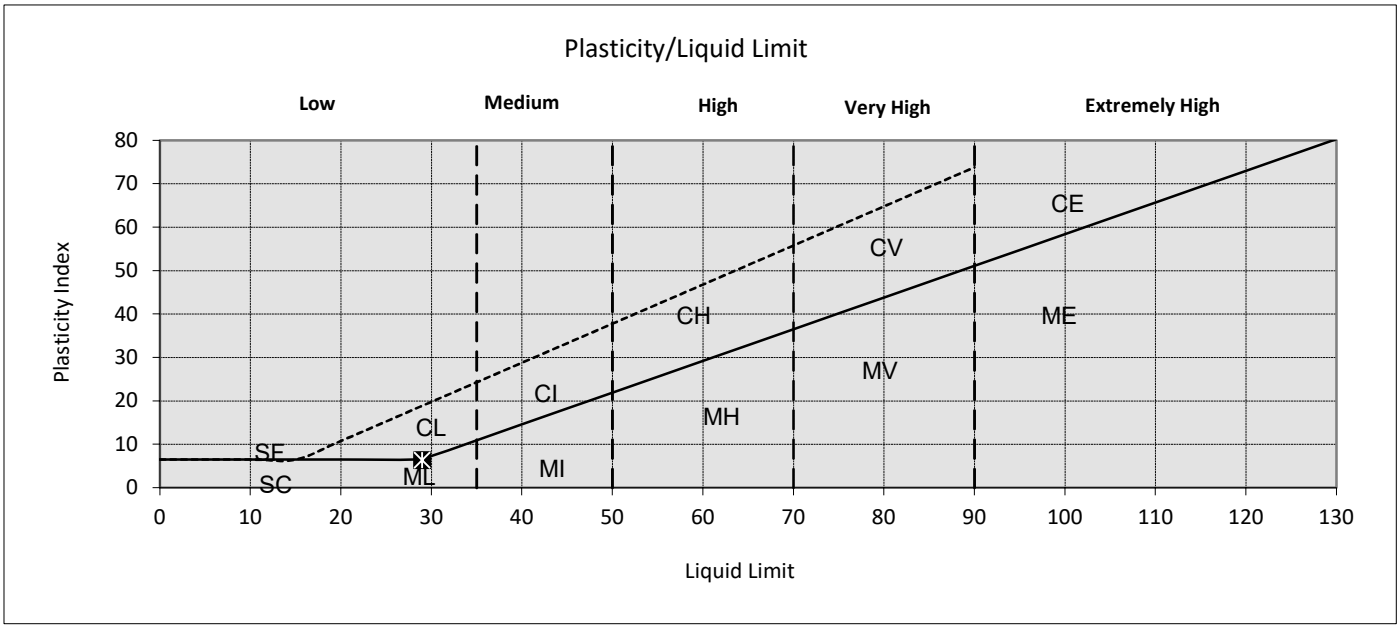
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93433
	Unit 1 Carrigogna	**Sample Ref.:**	XC219-CPRC03 0.5-1.2m Type D S.3
	Midleton	**Date Sampled:**	Client Info
	Co Cork	**Date Received:**	09/03/2020
Order No:	2003-104	**Date Tested:**	02/04/2020
Originator:	**Ian Holley**	**Date Reported:**	22/04/2020

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Bulk**
Sample Preparation Method	**Washed**
MATERIAL	**Soil**
Retained 425 micron (%)	**20**
Natural Moisture Content (%)	**20**
Liquid Limit (single point)(%)	**29**
Plastic Limit (%)	**22**
Plasticity Index	**6**



The stated result only relates to the item/location tested, this report shall not be reproduced except in full.

Approved Signature
James Fisher Testing Services Ltd
Phil Thorp, Laboratory Manager

UKAS TESTING 0955

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois
Tel: 057 8664885

LABORATORY TEST REPORT

BRE Test Suite B - Greenfield Site

Project:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref. No.:**	ST 93437
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	08/04/2020
	Co. Cork	**Material:**	Soil
Order No.:	2003-104	**Date Tested:**	07/04/2020
Originator:	Ian Holley	**Specification:**	Client

Sample Details **XC219-CPRC03 Type D Sample 5**

Supplier:	Client Info	**Date of Sampling:**	Client Info.
Source:	Client Info	**Sampled By:**	Client
Sample Location:	1.2-2.0m	**Sampling Reason:**	Request

Parameter	RESULT
pH	8.4
Sulphate Aqueous Extract (SO4) (mg/l)	11
Sulphur as S, Total (%)	0.01
Sulphate as SO4, Total (%)	0.02

Comments:
None

Tested in accordance with the above specifications
Subcontracted to a laboratory UKAS accredited for this testing

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.

☐ **James Ward, Operations Manager**

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co.Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

MOISTURE CONTENT BS 1377 : Part 2 : 1990 Oven Drying Method cl 3.2

Site:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93435
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	27/03/2020
Order No:	2003-104	**Date Reported:**	02/04/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC219-CPRC03 Type D Sample 5

Sample Type:	Bulk	***Location:***	XC219-CPRC03 Type D Sample 5
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	1.2-2.0m	***Material Type:***	Soil

Moisture Content (%): 5.1

Tested in accordance with BS 1377: Part 2: 1990
Sample preperation by cone and quarter

Approved Signature
James Fisher Testing Services (Ireland) Ltd
James Ward, Operations Manager

UKAS TESTING
0955

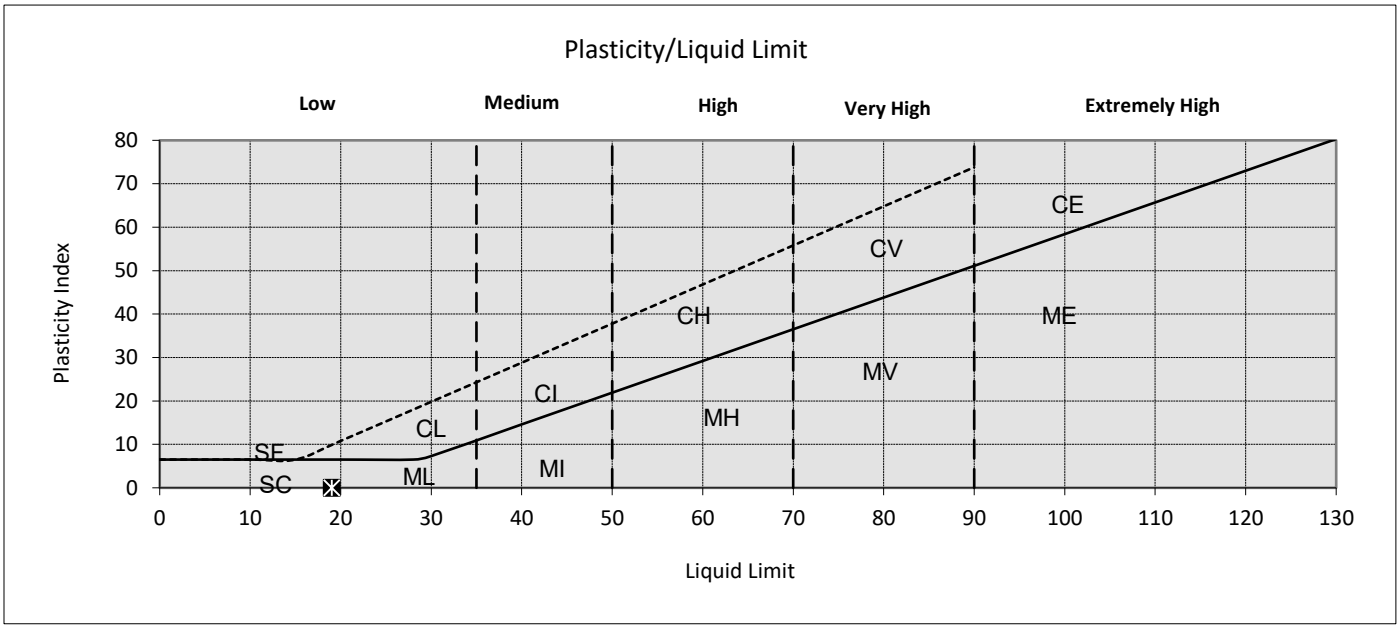
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93436
	Unit 1 Carrigogna	**Sample Ref.:**	XC219-CPRC03 1.2-2.0m Type D S.5
	Midleton	**Date Sampled:**	Client Info
	Co Cork	**Date Received:**	09/03/2020
Order No:	2003-104	**Date Tested:**	27/03/2020
Originator:	**Ian Holley**	**Date Reported:**	02/04/2020

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Bulk**
Sample Preparation Method	**Washed**
MATERIAL	**Soil**
Retained 425 micron (%)	**65**
Natural Moisture Content (%)	**7**
Liquid Limit (single point)(%)	**19**
Plastic Limit (%)	**Non-Plastic**
Plasticity Index	**N/A**



Approved Signature
James Fisher Testing Services Ltd
Phil Thorp, Laboratory Manager

UKAS TESTING 0955

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

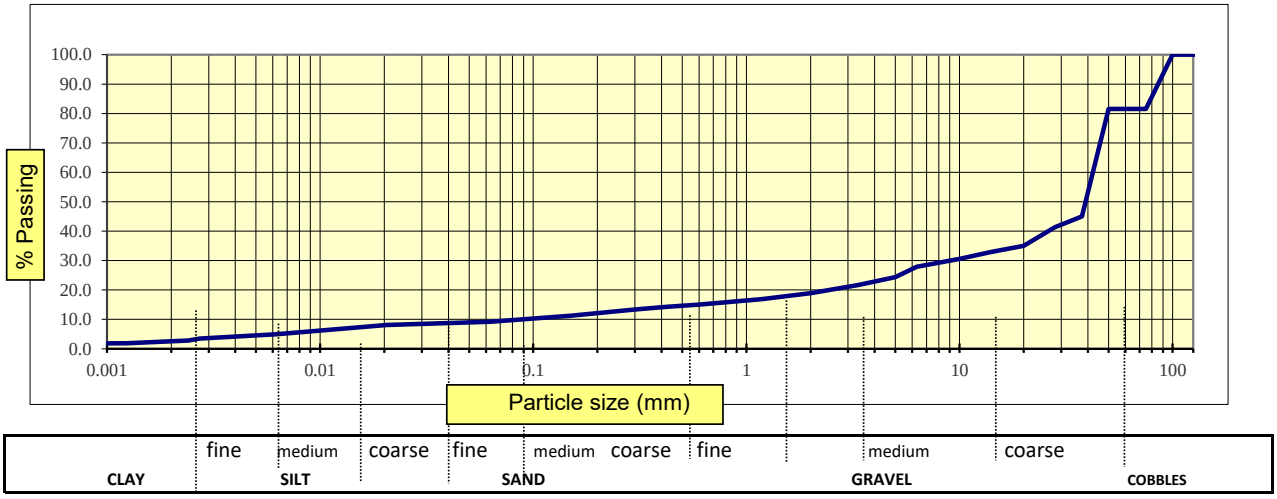
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

Determination of Particle Size Distribution (Hydrometer Sedimentation) - BS 1377 : Part 2 : 1990 Cl. 9.5

Project:	Cork Line Level Crossings	**Job No:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93434
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	02/04/2020
		Date Tested:	01/04/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Cobbly Clay, Sandy

Client Ref.	**XC219-CPRC03 Type B Sample 4**
Location:	XC219-CPRC03 Type B Sample 4
Supplier:	Bulk
Source:	Client Info.
Depth (m):	1.2-2.0m
Sampling Reason:	Client Request
Sampled By:	Client
Specification:	Client
Preparation Method:	Without Organics Preparation
Notes:	Disturbed sample from cleanout

BS Sieve Size	% Passing	Specification
300 mm	100	
125 mm	100	
100 mm	100	
75 mm	81	
63 mm	81	
50 mm	81	
37.5 mm	45	
28 mm	41	
20 mm	35	
14 mm	33	
10 mm	31	
6.3 mm	28	
5 mm	24	
3.35 mm	22	
2 mm	19	
1.18 mm	17	
0.6 mm	15	
0.425 mm	14	
0.3 mm	13	
0.15 mm	11	
0.063 mm	9	
0.020 mm	8	
0.006 mm	5	
0.003 mm	3	
0.002 mm	3	
0.001 mm	2	



Tested in accordance with BS 1377: Part 2 : 1990 Clause 9.2 and 9.5

Sedimentation by Hydrometer - Not UKAS

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.
☐ **James Ward, Operations Manager**

UKAS TESTING 0955

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

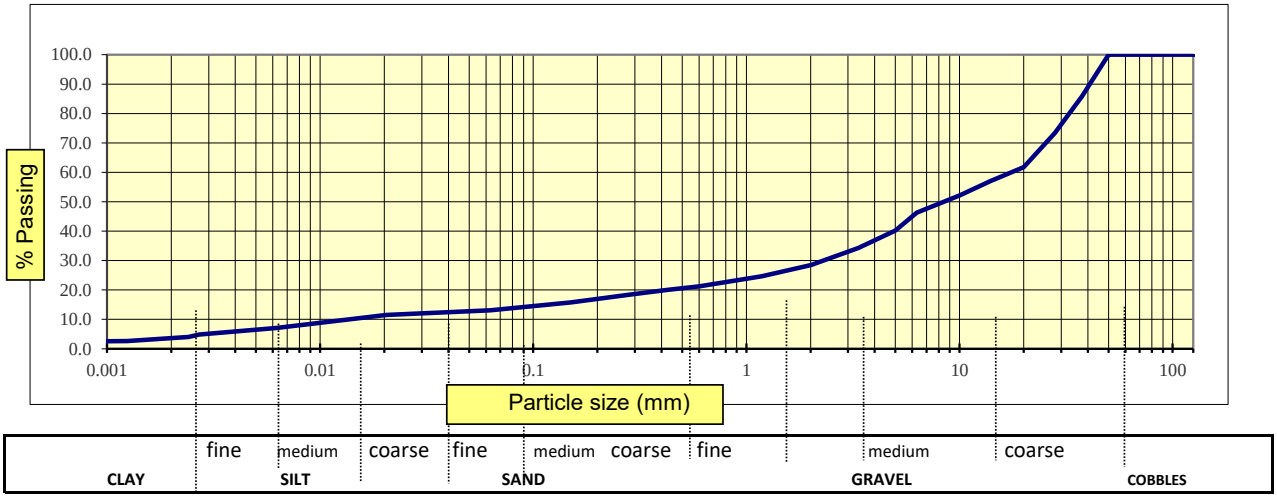
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

Determination of Particle Size Distribution (Hydrometer Sedimentation) - BS 1377 : Part 2 : 1990 Cl. 9.5

Project:	Cork Line Level Crossings	**Job No:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93438
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	02/04/2020
		Date Tested:	01/04/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Cobble, Light Clay, Sandy

Client Ref.	**XC219-CPRC03 Type B Sample 7**
Location:	XC219-CPRC03 Type B Sample 7
Supplier:	Bulk
Source:	Client Info.
Depth (m):	2.5-3.5m
Sampling Reason:	Client Request
Sampled By:	Client
Specification:	Client
Preparation Method:	Without Organics Preparation
Notes:	Disturbed sample from cleanout

BS Sieve Size	% Passing	Specification
300 mm	100	
125 mm	100	
100 mm	100	
75 mm	100	
63 mm	100	
50 mm	100	
37.5 mm	86	
28 mm	73	
20 mm	62	
14 mm	57	
10 mm	52	
6.3 mm	46	
5 mm	40	
3.35 mm	34	
2 mm	28	
1.18 mm	25	
0.6 mm	21	
0.425 mm	20	
0.3 mm	19	
0.15 mm	16	
0.063 mm	13	
0.020 mm	12	
0.006 mm	7	
0.003 mm	5	
0.002 mm	4	
0.001 mm	3	



Tested in accordance with BS 1377: Part 2 : 1990 Clause 9.2 and 9.5

Sedimentation by Hydrometer - Not UKAS

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.
☐ **James Ward, Operations Manager**

UKAS TESTING 0955

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois
Tel: 057 8664885

LABORATORY TEST REPORT

BRE Test Suite B - Greenfield Site

Project:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref. No.:**	ST 93442
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	09/04/2020
	Co. Cork	**Material:**	Soil
Order No.:	2003-104	**Date Tested:**	07/04/2020
Originator:	Ian Holley	**Specification:**	Client

Sample Details **XC219-CPRC03 Type B Sample 9**

Supplier:	Client Info	**Date of Sampling:**	Client Info.
Source:	Client Info	**Sampled By:**	Client
Sample Location:	3.5-4.5m	**Sampling Reason:**	Request

Parameter	RESULT
pH	8.2
Sulphate Aqueous Extract (SO4) (mg/l)	11
Sulphur as S, Total (%)	0.01
Sulphate as SO4, Total (%)	0.01

Comments:
None

Tested in accordance with the above specifications
Subcontracted to a laboratory UKAS accredited for this testing

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.

☐ **James Ward, Operations Manager**

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co.Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

MOISTURE CONTENT BS 1377 : Part 2 : 1990 Oven Drying Method cl 3.2

Site:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93439
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	27/03/2020
Order No:	2003-104	**Date Reported:**	02/04/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC219-CPRC03 Type D Sample 10

Sample Type:	Bulk	***Location:***	XC219-CPRC03 Type D Sample 10
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	3.5-4.5m	***Material Type:***	Soil

Moisture Content (%): 2.7

Tested in accordance with BS 1377: Part 2: 1990
Sample preperation by cone and quarter

Approved Signature
James Fisher Testing Services (Ireland) Ltd
James Ward, Operations Manager

UKAS TESTING
0955

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

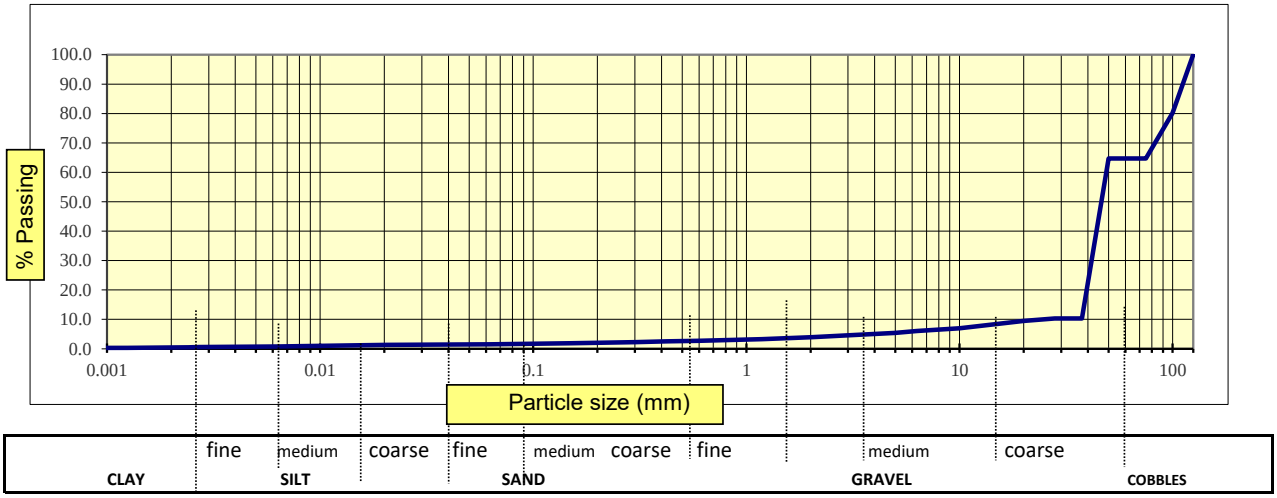
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

Determination of Particle Size Distribution (Hydrometer Sedimentation) - BS 1377 : Part 2 : 1990 Cl. 9.5

Project:	Cork Line Level Crossings	**Job No:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93441
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	02/04/2020
		Date Tested:	01/04/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Cobbly Clay, Sandy

Client Ref.	**XC219-CPRC03 Type B Sample 9**
Location:	XC219-CPRC03 Type B Sample 9
Supplier:	Bulk
Source:	Client Info.
Depth (m):	3.5-4.5m
Sampling Reason:	Client Request
Sampled By:	Client
Specification:	Client
Preparation Method:	Without Organics Preparation
Notes:	Disturbed sample from cleanout

BS Sieve Size	% Passing	Specification
300 mm	100	
125 mm	100	
100 mm	80	
75 mm	65	
63 mm	65	
50 mm	65	
37.5 mm	10	
28 mm	10	
20 mm	9	
14 mm	8	
10 mm	7	
6.3 mm	6	
5 mm	5	
3.35 mm	5	
2 mm	4	
1.18 mm	3	
0.6 mm	3	
0.425 mm	3	
0.3 mm	2	
0.15 mm	2	
0.063 mm	2	
0.020 mm	1	
0.006 mm	1	
0.003 mm	1	
0.002 mm	0	
0.001 mm	0	



Tested in accordance with BS 1377: Part 2 : 1990 Clause 9.2 and 9.5

Sedimentation by Hydrometer - Not UKAS

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.
☐ **James Ward, Operations Manager**

UKAS TESTING 0955

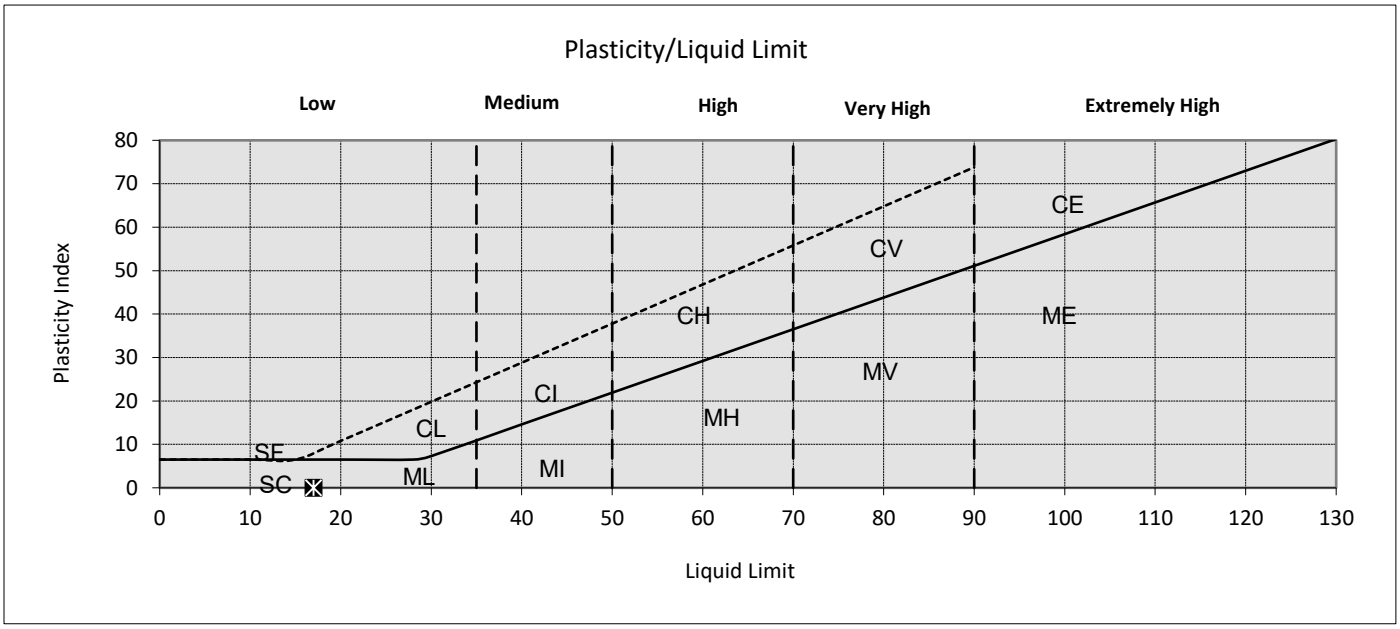
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93440
	Unit 1 Carrigogna	**Sample Ref.:**	XC219-CPRC03 3.5-4.5m Type D S.10
	Midleton	**Date Sampled:**	Client Info
	Co Cork	**Date Received:**	09/03/2020
Order No:	2003-104	**Date Tested:**	06/04/2020
Originator:	**Ian Holley**	**Date Reported:**	22/04/2020

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Bulk**
Sample Preparation Method	**Washed**
MATERIAL	**Soil**
Retained 425 micron (%)	**19**
Natural Moisture Content (%)	**3**
Liquid Limit (single point)(%)	**17**
Plastic Limit (%)	**Non-Plastic**
Plasticity Index	**N/A**



Approved Signature
James Fisher Testing Services Ltd
Phil Thorp, Laboratory Manager

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois
Tel: 057 8664885

LABORATORY TEST REPORT

BRE Test Suite B - Greenfield Site

Project:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref. No.:**	ST 93446
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	09/04/2020
	Co. Cork	**Material:**	Soil
Order No.:	2003-104	**Date Tested:**	07/04/2020
Originator:	Ian Holley	**Specification:**	Client

Sample Details **XC219-CPRC04 Type D Sample 4**

Supplier:	Client Info	**Date of Sampling:**	Client Info.
Source:	Client Info	**Sampled By:**	Client
Sample Location:	1.2-2.0m	**Sampling Reason:**	Request

Parameter	RESULT
pH	8.1
Sulphate Aqueous Extract (SO4) (mg/l)	11
Sulphur as S, Total (%)	<0.01
Sulphate as SO4, Total (%)	<0.01

Comments:
None

Tested in accordance with the above specifications
Subcontracted to a laboratory UKAS accredited for this testing

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.

☐ **James Ward, Operations Manager**

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co.Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

MOISTURE CONTENT BS 1377 : Part 2 : 1990 Oven Drying Method cl 3.2

Site:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93444
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	27/03/2020
Order No:	2003-104	**Date Reported:**	02/04/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC219-CPRC04 Type D Sample 4

Sample Type:	Bulk	***Location:***	XC219-CPRC04 Type D Sample 4
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	1.2-2.0m	***Material Type:***	Soil

Moisture Content (%): 5.7

Tested in accordance with BS 1377: Part 2: 1990
Sample preperation by cone and quarter

Approved Signature
James Fisher Testing Services (Ireland) Ltd
James Ward, Operations Manager

UKAS TESTING
0955

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

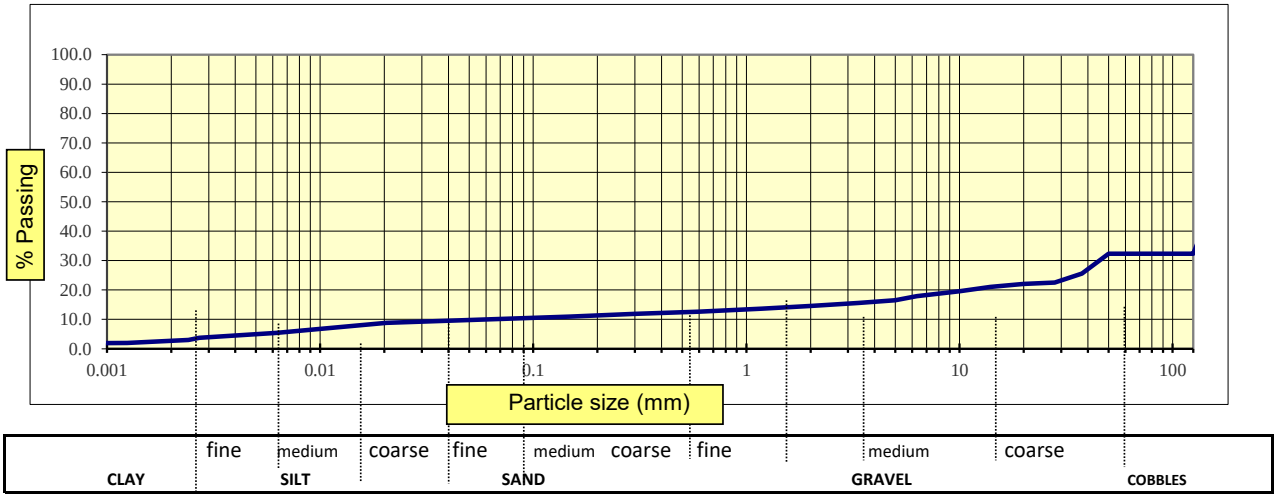
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

Determination of Particle Size Distribution (Hydrometer Sedimentation) - BS 1377 : Part 2 : 1990 Cl. 9.5

Project:	Cork Line Level Crossings	**Job No:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93443
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	02/04/2020
		Date Tested:	01/04/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Large Cobble, Light Clay, Sandy

Client Ref.	**XC219-CPRC04 Type B Sample 3**
Location:	XC219-CPRC04 Type B Sample 3
Supplier:	Bulk
Source:	Client Info.
Depth (m):	1.2-2.0m
Sampling Reason:	Client Request
Sampled By:	Client
Specification:	Client
Preparation Method:	Without Organics Preparation
Notes:	Disturbed sample from cleanout

BS Sieve Size	% Passing	Specification
300 mm	100	
125 mm	32	
100 mm	32	
75 mm	32	
63 mm	32	
50 mm	32	
37.5 mm	26	
28 mm	23	
20 mm	22	
14 mm	21	
10 mm	20	
6.3 mm	18	
5 mm	17	
3.35 mm	16	
2 mm	15	
1.18 mm	14	
0.6 mm	13	
0.425 mm	12	
0.3 mm	12	
0.15 mm	11	
0.063 mm	10	
0.020 mm	9	
0.006 mm	5	
0.003 mm	4	
0.002 mm	3	
0.001 mm	2	



Tested in accordance with BS 1377: Part 2 : 1990 Clause 9.2 and 9.5

Sedimentation by Hydrometer - Not UKAS

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.
☐ **James Ward, Operations Manager**

UKAS TESTING 0955

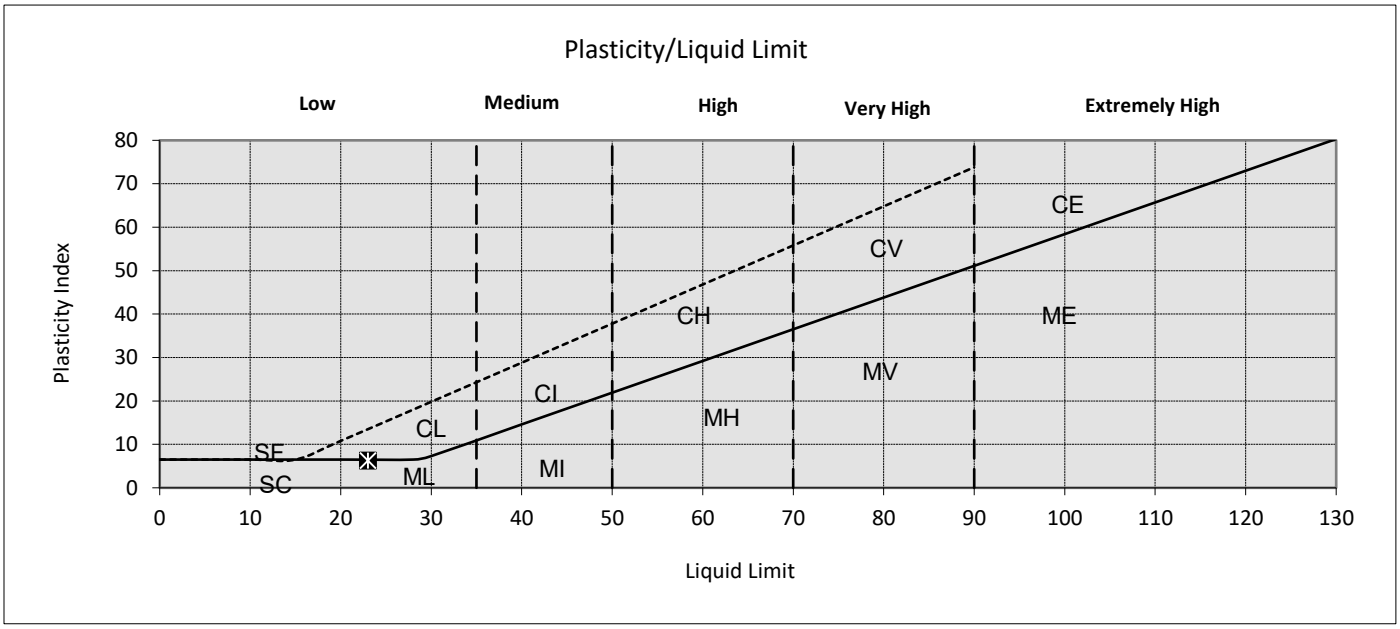
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93445
	Unit 1 Carrigogna	**Sample Ref.:**	XC219-CPRC04 1.2-2.0m Type D S.4
	Midleton	**Date Sampled:**	Client Info
	Co Cork	**Date Received:**	09/03/2020
Order No:	2003-104	**Date Tested:**	02/04/2020
Originator:	**Ian Holley**	**Date Reported:**	22/04/2020

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Bulk**
Sample Preparation Method	**Washed**
MATERIAL	**Soil**
Retained 425 micron (%)	**22**
Natural Moisture Content (%)	**18**
Liquid Limit (single point)(%)	**23**
Plastic Limit (%)	**17**
Plasticity Index	**6**



Approved Signature
James Fisher Testing Services Ltd
Phil Thorp, Laboratory Manager

UKAS TESTING 0955

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

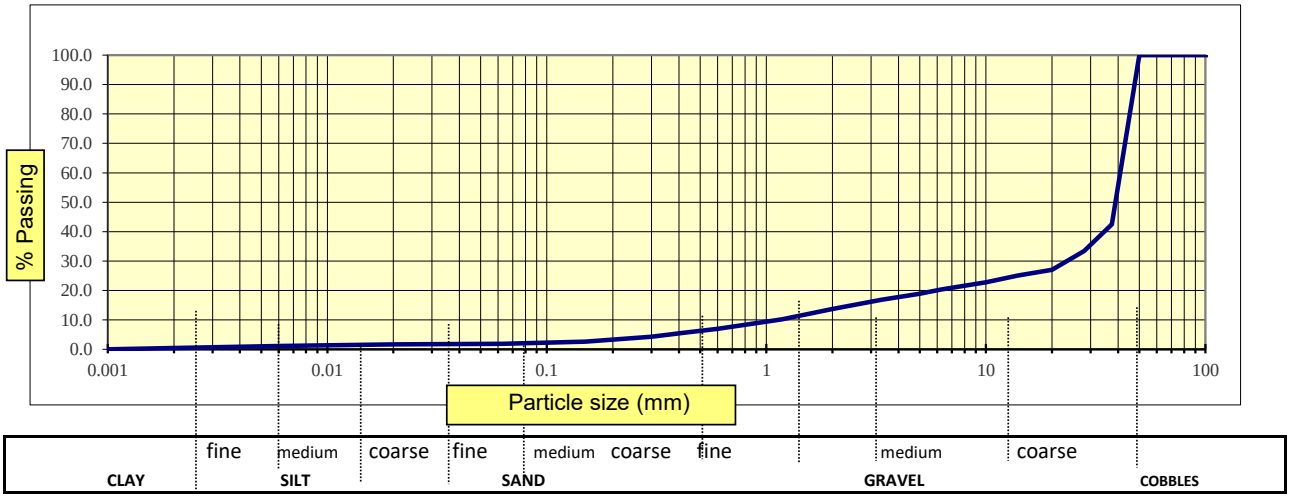
Determination of Particle Size Distribution (Hydrometer Sedimentation) - BS 1377 : Part 2 : 1990 Cl. 9.5

Moisture content to BS 1377: Part 2 : 1990 Oven Drying Method Cl 3.2

Project:	Cork Line Level Crossings	**Job No:**	19-135
Client:	OCB Geotechnical Unit 1 Carrigogna Midleton Co Cork	**Lab Ref No.:** **Date Received:** **Date Reported:** **Date Tested:**	ST 93449 09/03/2020 02/04/2020 31/03/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Cobbly, Sandy Clay

Client Ref.	**XC219-CRPC05 Type B Sample 3**
Location:	XC219-CRPC05 Type B Sample 3
Supplier:	Client Info.
Source:	Client Info.
Depth (m):	1.2-2.0m
Sampling Reason:	Client Request
Sampled By:	Client
Specification:	Client
Preparation Method:	Without Organics Preparation
Notes:	Disturbed sample from cleanout
Moisture Content%:	3

BS Sieve Size	% Passing	Specification
125 mm	100	
100 mm	100	
90 mm	100	
75 mm	100	
63 mm	100	
50 mm	100	
37.5 mm	43	
28 mm	33	
20 mm	27	
14 mm	25	
10 mm	23	
6.3 mm	20	
5 mm	19	
3.35 mm	17	
2 mm	14	
1.18 mm	10	
0.6 mm	7	
0.425 mm	6	
0.3 mm	4	
0.15 mm	3	
0.063 mm	2	
0.0205 mm	2	
0.0060 mm	1	
0.0029 mm	1	



Tested in accordance with BS 1377: Part 2 : 1990 Clause 3.2. 9.2 and 9.5
Sedimentation by Hydrometer - Not UKAS

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.
☐ **James Ward, Operations Manager**

UKAS TESTING 0955

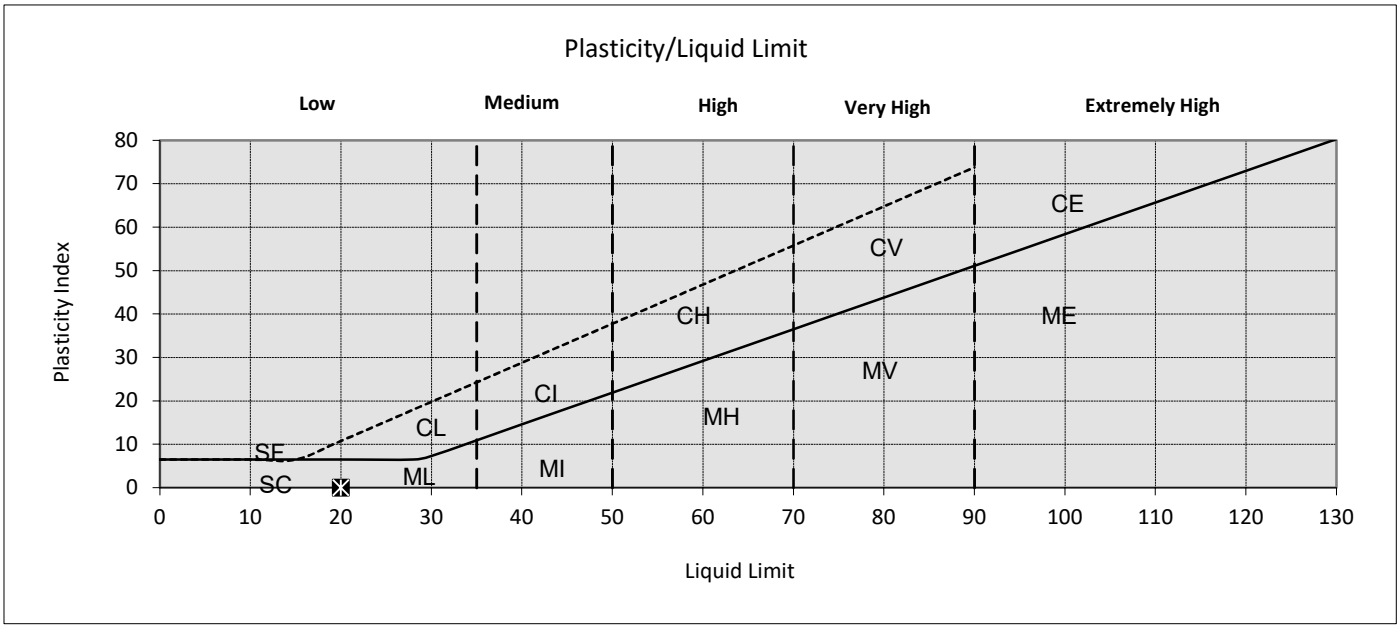
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93448
	Unit 1 Carrigogna	**Sample Ref.:**	XC219-CPRC05 1.2-2.0m Type B S.3
	Midleton	**Date Sampled:**	Client Info
	Co Cork	**Date Received:**	09/03/2020
Order No:	2003-104	**Date Tested:**	02/04/2020
Originator:	**Ian Holley**	**Date Reported:**	22/04/2020

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Bulk**
Sample Preparation Method	**Washed**
MATERIAL	**Soil**
Retained 425 micron (%)	**18**
Natural Moisture Content (%)	**3**
Liquid Limit (single point)(%)	**20**
Plastic Limit (%)	**Non-Plastic**
Plasticity Index	**N/A**



The stated result only relates to the item/location tested, this report shall not be reproduced except in full.

Approved Signature
James Fisher Testing Services Ltd
Phil Thorp, Laboratory Manager

UKAS TESTING 0955

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

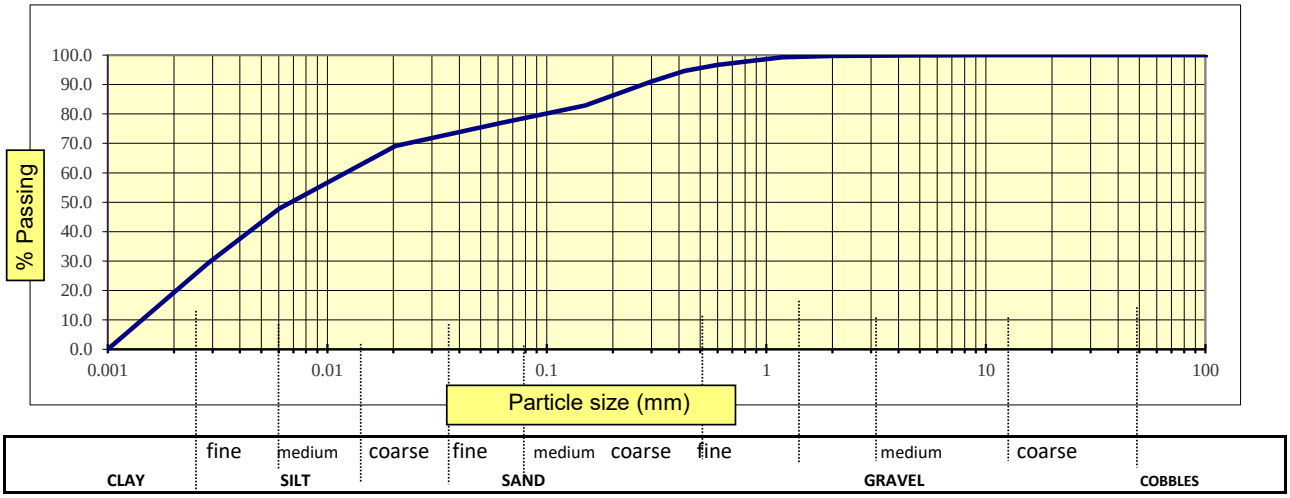
Determination of Particle Size Distribution (Hydrometer Sedimentation) - BS 1377 : Part 2 : 1990 Cl. 9.5

Moisture content to BS 1377: Part 2 : 1990 Oven Drying Method Cl 3.2

Project:	Cork Line Level Crossings	**Job No:**	19-135
Client:	OCB Geotechnical Unit 1 Carrigogna Midleton Co Cork	**Lab Ref No.:** **Date Received:** **Date Reported:** **Date Tested:**	ST 93452 09/03/2020 02/04/2020 31/03/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Dark Clay, Fine Sand

Client Ref.	**XC219-TP02 Type B Sample 3**
Location:	XC219-TP02 Type B Sample 3
Supplier:	Client Info.
Source:	Client Info.
Depth (m):	0.5-1.0m
Sampling Reason:	Client Request
Sampled By:	Client
Specification:	Client
Preparation Method:	Without Organics Preparation
Notes:	Disturbed sample from cleanout
Moisture Content%:	25

BS Sieve Size	% Passing	Specification
125 mm	100	
100 mm	100	
90 mm	100	
75 mm	100	
63 mm	100	
50 mm	100	
37.5 mm	100	
28 mm	100	
20 mm	100	
14 mm	100	
10 mm	100	
6.3 mm	100	
5 mm	100	
3.35 mm	100	
2 mm	100	
1.18 mm	99	
0.6 mm	97	
0.425 mm	95	
0.3 mm	91	
0.15 mm	83	
0.063 mm	77	
0.0205 mm	69	
0.0060 mm	48	
0.0029 mm	29	



Tested in accordance with BS 1377: Part 2 : 1990 Clause 3.2, 9.2 and 9.5
Sedimentation by Hydrometer - Not UKAS

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.
☐ **James Ward, Operations Manager**

UKAS TESTING 0955

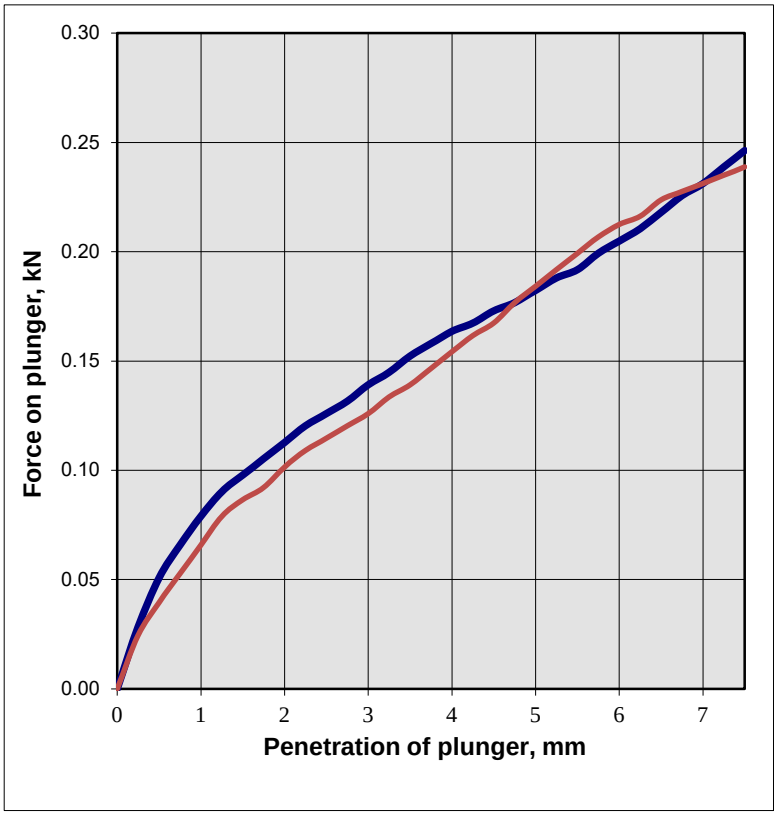
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

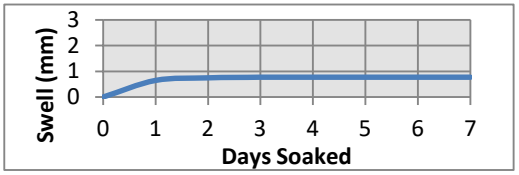
LABORATORY TEST REPORT

DETERMINATION OF CALIFORNIA BEARING RATIO - BS 1377 : Part 4 : 1990

Project :	Cork Line Level Crossings	**Job No:**	19-135
Client :	OCB Geotechnical	**Lab Ref No:**	ST 93453
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	14/04/2020
	Co Cork	**Date Reported:**	22/04/2020
Order No:	2003-104	**Sample Ref:**	XC219-TP02 Type D Sample 4
Originator :	**Ian Holley**	**Location:**	0.5-1.0m



Type of Reaction Load
Load Frame
Technician(s)
NW
Mass of Surcharge Weights
8.8Kg
Overburden Pressure
3.9kPa
Material Type
Soil
Density (Mg/m³)
2.03
Propertion of material removed from initial sample by dry mass (%)
5.6



Final Swell (mm):	0.77

Penetration (mm)	Force (kN)	Standard Force (kN)	Top CBR (%)
2.5	0.13	13.2	1.0
5.0	0.18	20.0	0.9
Moisture content : %	**24.3**	**Mean CBR value : %**	**0.9**

Penetration (mm)	Force (kN)	Standard Force (kN)	Bottom CBR (%)
2.5	0.11	13.2	0.9
5.0	0.18	20.0	0.9
Moisture content : %	**24.3**	**Mean CBR value : %**	**0.9**

Moisture content determined in accordance with BS 1377 : Part 2 : 1990 - oven drying method
CBR determined in accordance with BS 1377 : Part 4 : 1990

Approved Signature
James Fisher Testing Services Ltd
Phil Thorp, Laboratory Manager

UKAS TESTING
0955

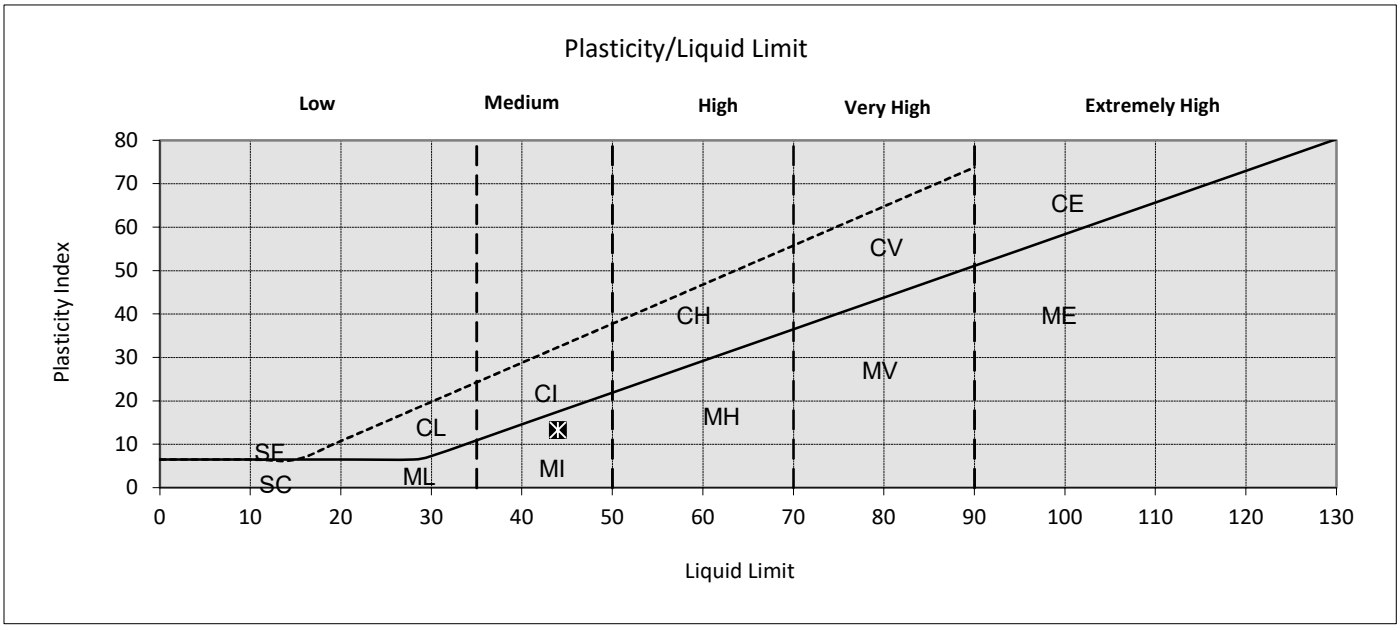
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93451
	Unit 1 Carrigogna	**Sample Ref.:**	XC219-TP02 0.5-1.0m Type B S.3
	Midleton	**Date Sampled:**	Client Info
	Co Cork	**Date Received:**	09/03/2020
Order No:	2003-104	**Date Tested:**	01/04/2020
Originator:	**Ian Holley**	**Date Reported:**	22/04/2020

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Bulk**
Sample Preparation Method	**Washed**
MATERIAL	**Soil**
Retained 425 micron (%)	**27**
Natural Moisture Content (%)	**33**
Liquid Limit (single point)(%)	**44**
Plastic Limit (%)	**31**
Plasticity Index	**13**



The stated result only relates to the item/location tested, this report shall not be reproduced except in full.

Approved Signature
James Fisher Testing Services Ltd
Phil Thorp, Laboratory Manager

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co.Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

MOISTURE CONTENT BS 1377 : Part 2 : 1990 Oven Drying Method cl 3.2

Site:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93454
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	26/03/2020
Order No:	2003-104	**Date Reported:**	06/04/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC219-TP02 Type B Sample 6

Sample Type:	Bulk	***Location:***	XC219-TP02 Type B Sample 6
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	1.3-1.8m	***Material Type:***	Soil

Moisture Content (%): 32

Tested in accordance with BS 1377: Part 2: 1990
Sample preperation by cone and quarter

Approved Signature
James Fisher Testing Services (Ireland) Ltd
James Ward, Operations Manager

UKAS TESTING
0955

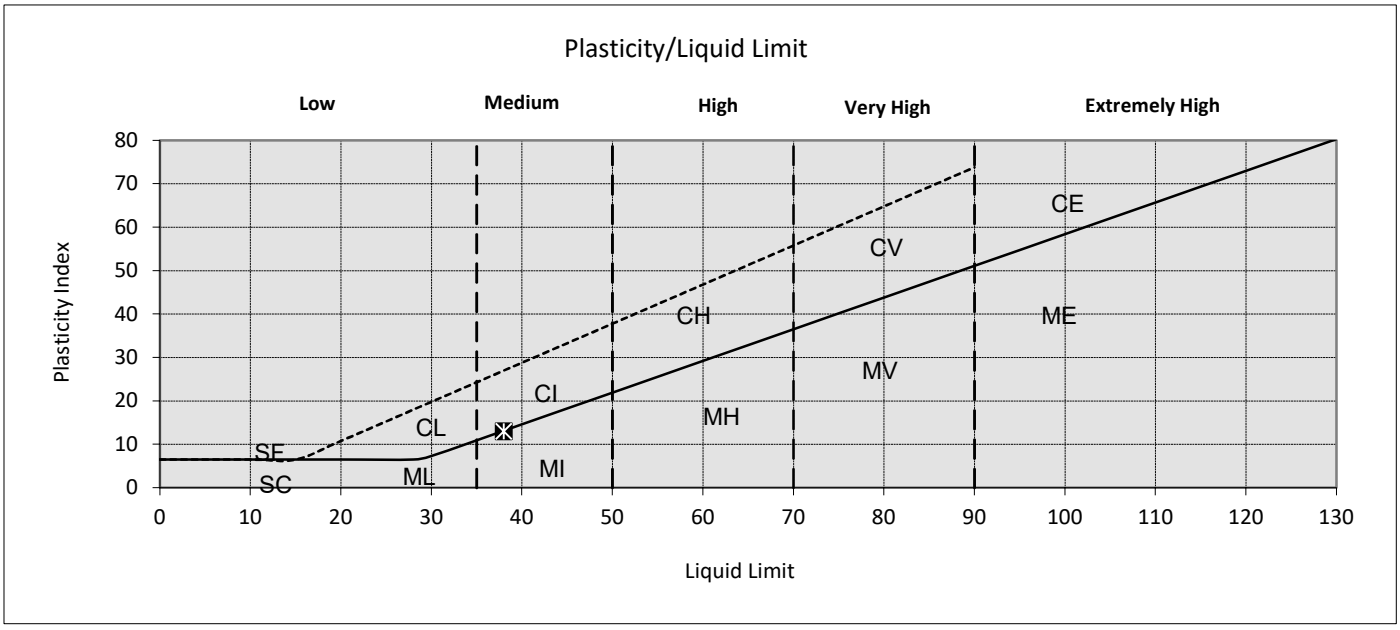
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93455
	Unit 1 Carrigogna	**Sample Ref.:**	XC219-TP02 1.3-1.8m Type B S.6
	Midleton	**Date Sampled:**	Client Info
	Co Cork	**Date Received:**	09/03/2020
Order No:	2003-104	**Date Tested:**	07/04/2020
Originator:	**Ian Holley**	**Date Reported:**	22/04/2020

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Bulk**
Sample Preparation Method	**Washed**
MATERIAL	**Soil**
Retained 425 micron (%)	**25**
Natural Moisture Content (%)	**31**
Liquid Limit (single point)(%)	**38**
Plastic Limit (%)	**25**
Plasticity Index	**13**



The stated result only relates to the item/location tested, this report shall not be reproduced except in full.

Approved Signature
James Fisher Testing Services Ltd
Phil Thorp, Laboratory Manager

UKAS TESTING 0955

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

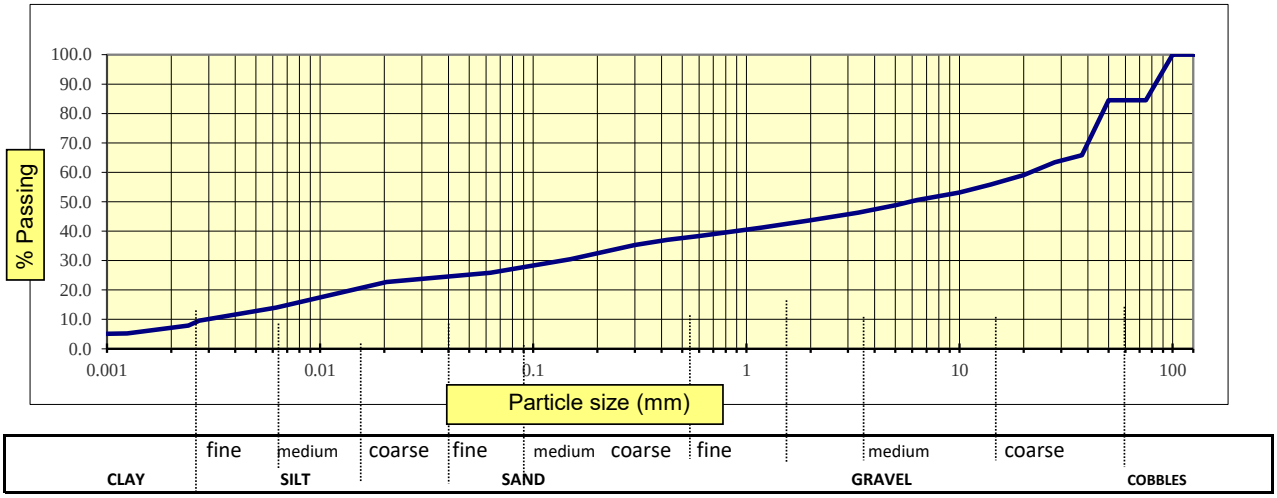
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

Determination of Particle Size Distribution (Hydrometer Sedimentation) - BS 1377 : Part 2 : 1990 Cl. 9.5

Project:	Cork Line Level Crossings	**Job No:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93456
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	02/04/2020
		Date Tested:	31/03/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Cobble, Light Clay, Sandy

Client Ref.	**XC219-TP02 Type B Sample 7**
Location:	XC219-TP02 Type B Sample 7
Supplier:	Bulk
Source:	Client Info.
Depth (m):	2.5-3.0m
Sampling Reason:	Client Request
Sampled By:	Client
Specification:	Client
Preparation Method:	Without Organics Preparation
Notes:	Disturbed sample from cleanout

BS Sieve Size	% Passing	Specification
300 mm	100	
125 mm	100	
100 mm	100	
75 mm	85	
63 mm	85	
50 mm	85	
37.5 mm	66	
28 mm	63	
20 mm	59	
14 mm	56	
10 mm	53	
6.3 mm	51	
5 mm	49	
3.35 mm	46	
2 mm	44	
1.18 mm	41	
0.6 mm	38	
0.425 mm	37	
0.3 mm	35	
0.15 mm	30	
0.063 mm	26	
0.020 mm	23	
0.006 mm	14	
0.003 mm	10	
0.002 mm	8	
0.001 mm	5	



Tested in accordance with BS 1377: Part 2 : 1990 Clause 9.2 and 9.5

Sedimentation by Hydrometer - Not UKAS

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.
☐ **James Ward, Operations Manager**

UKAS TESTING 0955

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois
Tel: 057 8664885

LABORATORY TEST REPORT

BRE Test Suite B - Greenfield Site

Project:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref. No.:**	ST 93457
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	09/04/2020
	Co. Cork	**Material:**	Soil
Order No.:	2003-104	**Date Tested:**	07/04/2020
Originator:	Ian Holley	**Specification:**	Client

Sample Details **XC219-TP02 Type B Sample 9**

Supplier:	Client Info	**Date of Sampling:**	Client Info.
Source:	Client Info	**Sampled By:**	Client
Sample Location:	3.5-4.0m	**Sampling Reason:**	Request

Parameter	RESULT
pH	8.2
Sulphate Aqueous Extract (SO4) (mg/l)	<10
Sulphur as S, Total (%)	<0.01
Sulphate as SO4, Total (%)	0.01

Comments:
None

Tested in accordance with the above specifications
Subcontracted to a laboratory UKAS accredited for this testing

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.

☐ **James Ward, Operations Manager**

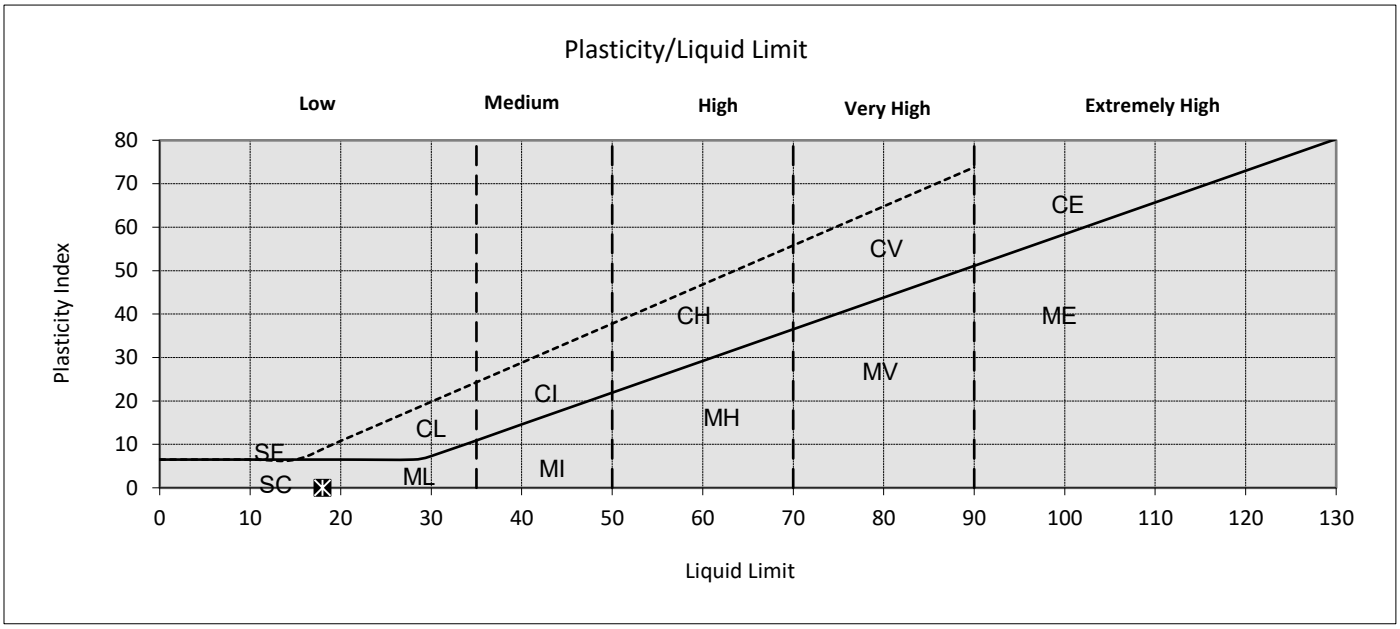
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93459
	Unit 1 Carrigogna	**Sample Ref.:**	XC219-TP03 0.3-0.55m Type B Sample
	Midleton	**Date Sampled:**	Client Info
	Co Cork	**Date Received:**	09/03/2020
Order No:	2003-104	**Date Tested:**	26/03/2020
Originator:	**Ian Holley**	**Date Reported:**	31/03/2020

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Bulk**
Sample Preparation Method	**Washed**
MATERIAL	**Soil**
Retained 425 micron (%)	**81**
Natural Moisture Content (%)	**21**
Liquid Limit (single point)(%)	**18**
Plastic Limit (%)	**Non-Plastic**
Plasticity Index	**N/A**



Approved Signature
James Fisher Testing Services Ltd
Phil Thorp, Laboratory Manager

UKAS TESTING 0955

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois
Tel: 057 8664885

James Fisher Testing Services

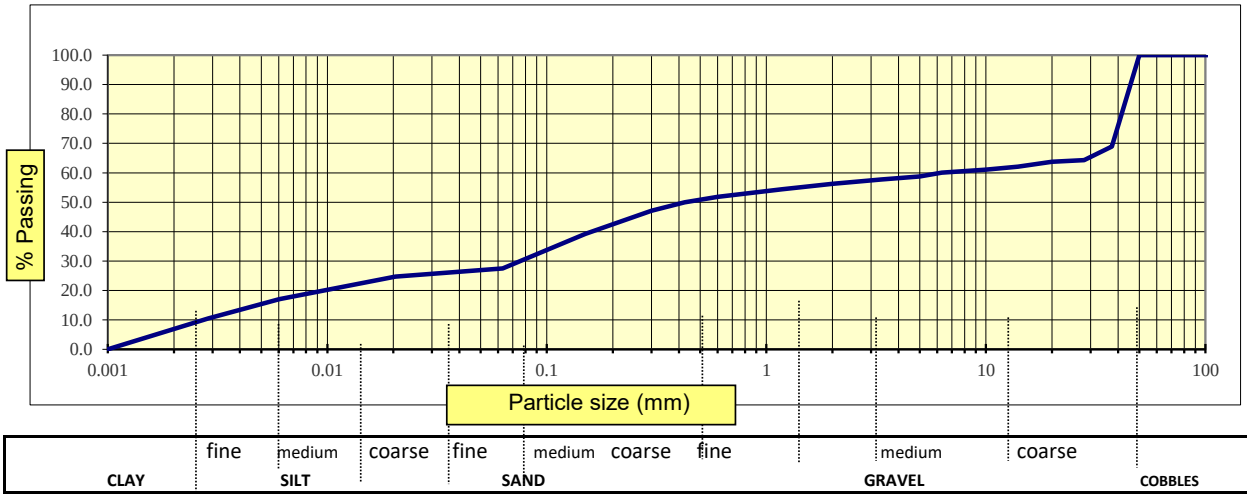
LABORATORY TEST REPORT

Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990
Determination of Particle Size Distribution (Hydrometer Sedimentation) - BS 1377 : Part 2 : 1990 Cl. 9.5
Moisture content to BS 1377: Part 2 : 1990 Oven Drying Method Cl 3.2

Project:	Cork Line Level Crossings	**Job No:**	19-135
Client:	OCB Geotechnical Unit 1 Carrigogna Midleton Co Cork	**Lab Ref No.:** **Date Received:** **Date Reported:** **Date Tested:**	ST 93460 09/03/2020 02/04/2020 31/03/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Cobble, Dark Clay

Client Ref.	**XC219-TP03 Type B Sample 2**
Location:	XC219-TP03 Type B Sample 2
Supplier:	Client Info.
Source:	Client Info.
Depth (m):	0.30-0.55m
Sampling Reason:	Client Request
Sampled By:	Client
Specification:	Client
Preparation Method:	Without Organics Preparation
Notes:	Disturbed sample from cleanout
Moisture Content%:	16

BS Sieve Size	% Passing	Specification
125 mm	100	
100 mm	100	
90 mm	100	
75 mm	100	
63 mm	100	
50 mm	100	
37.5 mm	69	
28 mm	64	
20 mm	64	
14 mm	62	
10 mm	61	
6.3 mm	60	
5 mm	59	
3.35 mm	58	
2 mm	56	
1.18 mm	54	
0.6 mm	52	
0.425 mm	50	
0.3 mm	47	
0.15 mm	39	
0.063 mm	28	
0.0205 mm	25	
0.0060 mm	17	
0.0029 mm	10	



Tested in accordance with BS 1377: Part 2 : 1990 Clause 3.2, 9.2 and 9.5
Sedimentation by Hydrometer - Not UKAS

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.
☐ **James Ward, Operations Manager**

UKAS TESTING 0955

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co.Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

MOISTURE CONTENT BS 1377 : Part 2 : 1990 Oven Drying Method cl 3.2

Site:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93461
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	13/03/2020
Order No:	2003-104	**Date Reported:**	25/03/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC219-TP03 Type B Sample 4

Sample Type:	Bulk	***Location:***	XC219-TP03 Type B Sample 4
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	0.7-1.2m	***Material Type:***	Soil

Moisture Content (%): 20

Tested in accordance with BS 1377: Part 2: 1990
Sample preperation by cone and quarter

Approved Signature
James Fisher Testing Services (Ireland) Ltd
James Ward, Operations Manager

UKAS TESTING
0955

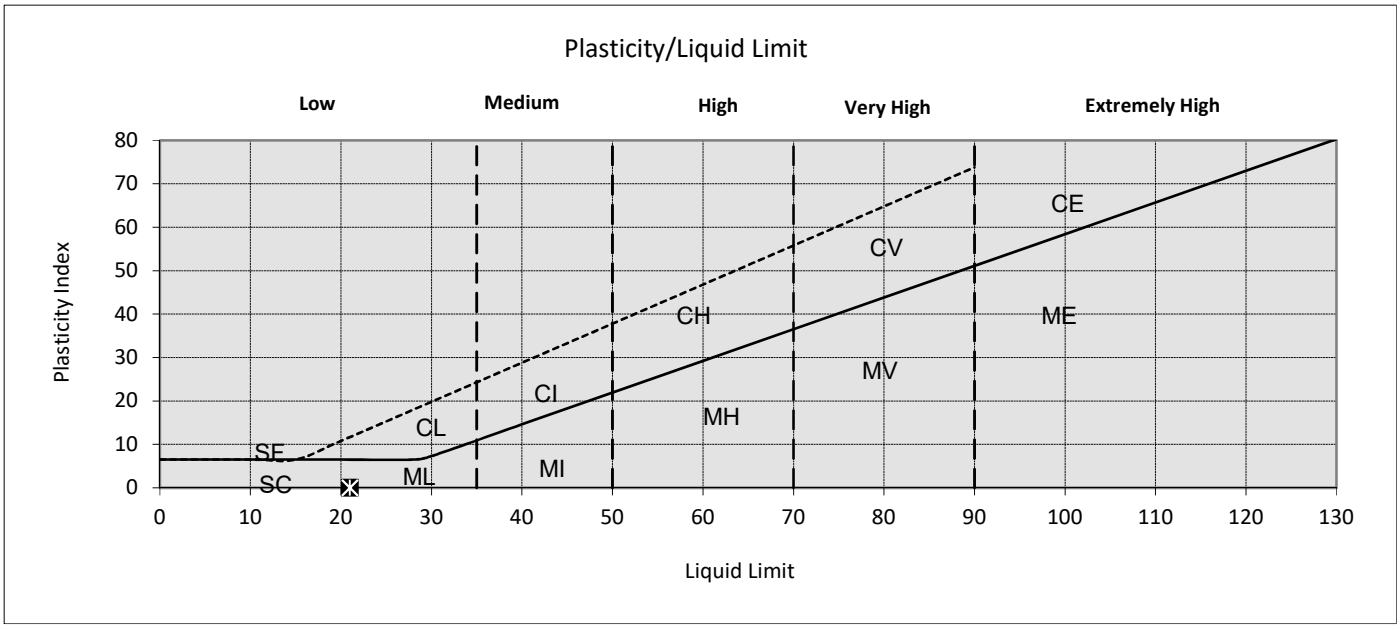
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93462
	Unit 1 Carrigogna	**Sample Ref.:**	XC219-TP03 0.7-1.2m Type B Sample 4
	Midleton	**Date Sampled:**	Client Info
	Co Cork	**Date Received:**	09/03/2020
Order No:	2003-104	**Date Tested:**	20/03/2020
Originator:	**Ian Holley**	**Date Reported:**	31/03/2020

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Bulk**
Sample Preparation Method	**Washed**
MATERIAL	**Soil**
Retained 425 micron (%)	**72**
Natural Moisture Content (%)	**16**
Liquid Limit (single point)(%)	**21**
Plastic Limit (%)	**Non-Plastic**
Plasticity Index	**N/A**



The stated result only relates to the item/location tested, this report shall not be reproduced except in full.

Approved Signature
James Fisher Testing Services Ltd
Phil Thorp, Laboratory Manager

UKAS TESTING 0955

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co.Laois
Tel: 057 8664885

James Fisher Testing Services

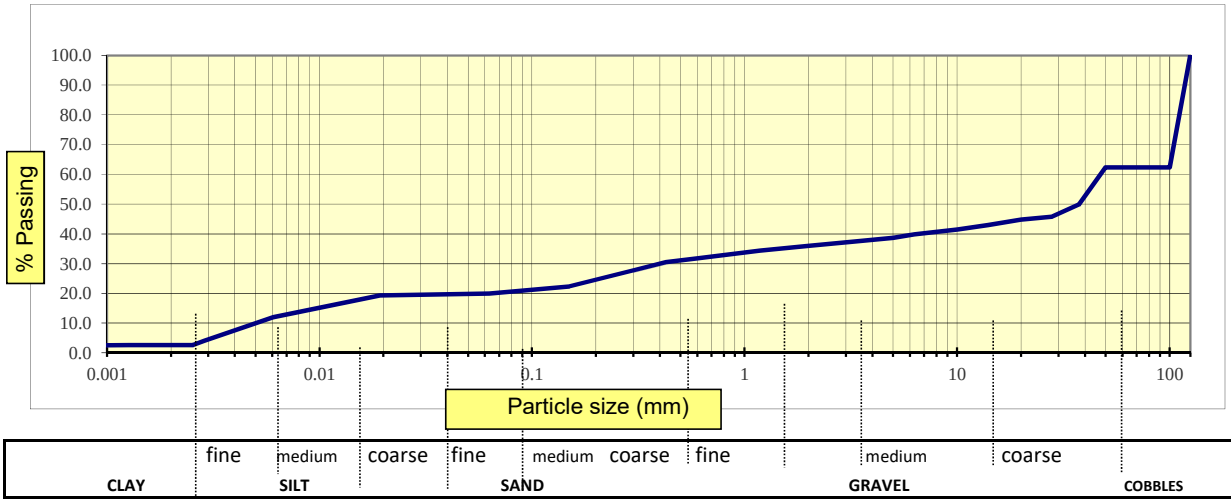
LABORATORY TEST REPORT

Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

Project:	Cork Line Level Crossings	**Job No:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93463
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	25/03/2020
		Date Tested:	23/03/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Cobbly, Dark Clay

Client Ref.	**XC219-TP03 Type B Sample 4**
Location:	XC219-TP03 Type B Sample 4
Supplier:	Bulk
Source:	Client Info.
Depth (m):	0.7-1.2m
Sampling Reason:	Client Request
Sampled By:	Client
Specification:	Client
Preparation Method:	Without Organics Preparation
Notes:	Disturbed sample from cleanout

BS Sieve Size	% Passing	Specification
300 mm	100	
125 mm	100	
100 mm	62	
75 mm	62	
63 mm	62	
50 mm	62	
37.5 mm	50	
28 mm	46	
20 mm	45	
14 mm	43	
10 mm	41	
6.3 mm	40	
5 mm	39	
3.35 mm	38	
2 mm	36	
1.18 mm	34	
0.6 mm	32	
0.425 mm	30	
0.3 mm	28	
0.15 mm	22	
0.063 mm	20	
0.019 mm	19	
0.006 mm	12	
0.003 mm	4	
0.003 mm	3	
0.001 mm	3	



Tested in accordance with BS 1377: Part 2 : 1990 Clause 3.2, 9.2 and 9.5

Sedimentation by Hydrometer - Not UKAS

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.
☐ **James Ward, Operations Manager**

UKAS TESTING 0955

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois
Tel: 057 8664885

LABORATORY TEST REPORT

BRE Test Suite B - Greenfield Site

Project:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref. No.:**	ST 93465
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	09/04/2020
	Co. Cork	**Material:**	Soil
Order No.:	2003-104	**Date Tested:**	07/04/2020
Originator:	Ian Holley	**Specification:**	Client

Sample Details **XC219-TP03 Type B Sample 7**

Supplier:	Client Info	**Date of Sampling:**	Client Info.
Source:	Client Info	**Sampled By:**	Client
Sample Location:	2.8-3.0m	**Sampling Reason:**	Request

Parameter	RESULT
pH	8.1
Sulphate Aqueous Extract (SO4) (mg/l)	<10
Sulphur as S, Total (%)	<0.01
Sulphate as SO4, Total (%)	0.01

Comments:
None

Tested in accordance with the above specifications
Subcontracted to a laboratory UKAS accredited for this testing

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.

☐ **James Ward, Operations Manager**

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

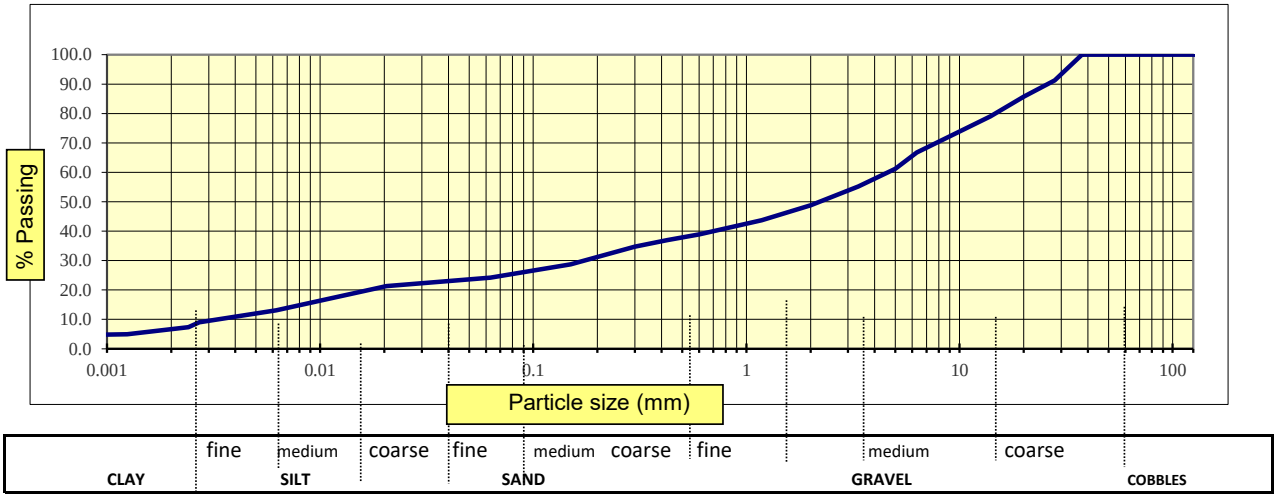
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

Determination of Particle Size Distribution (Hydrometer Sedimentation) - BS 1377 : Part 2 : 1990 Cl. 9.5

Project:	Cork Line Level Crossings	**Job No:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93464
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	02/04/2020
		Date Tested:	01/04/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Light Gravel, Sandy

Client Ref.	**XC219-TP03 Type B Sample 6**
Location:	XC219-TP03 Type B Sample 6
Supplier:	Bulk
Source:	Client Info.
Depth (m):	2.0-2.5m
Sampling Reason:	Client Request
Sampled By:	Client
Specification:	Client
Preparation Method:	Without Organics Preparation
Notes:	Disturbed sample from cleanout

BS Sieve Size	% Passing	Specification
300 mm	100	
125 mm	100	
100 mm	100	
75 mm	100	
63 mm	100	
50 mm	100	
37.5 mm	100	
28 mm	91	
20 mm	86	
14 mm	79	
10 mm	74	
6.3 mm	67	
5 mm	61	
3.35 mm	55	
2 mm	49	
1.18 mm	44	
0.6 mm	39	
0.425 mm	37	
0.3 mm	35	
0.15 mm	29	
0.063 mm	24	
0.020 mm	21	
0.006 mm	13	
0.003 mm	9	
0.002 mm	7	
0.001 mm	5	



Tested in accordance with BS 1377: Part 2 : 1990 Clause 9.2 and 9.5

Sedimentation by Hydrometer - Not UKAS

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.
☐ **James Ward, Operations Manager**

UKAS TESTING 0955

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois
Tel: 057 8664885

LABORATORY TEST REPORT

BRE Test Suite B - Greenfield Site

Project:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref. No.:**	ST 93468
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	09/04/2020
	Co. Cork	**Material:**	Soil
Order No.:	2003-104	**Date Tested:**	07/04/2020
Originator:	Ian Holley	**Specification:**	Client

Sample Details **XC219-TP04 Type B Sample 2**

Supplier:	Client Info	**Date of Sampling:**	Client Info.
Source:	Client Info	**Sampled By:**	Client
Sample Location:	0.3-0.8m	**Sampling Reason:**	Request

Parameter	RESULT
pH	7.6
Sulphate Aqueous Extract (SO4) (mg/l)	<10
Sulphur as S, Total (%)	<0.01
Sulphate as SO4, Total (%)	0.01

Comments:
None

Tested in accordance with the above specifications
Subcontracted to a laboratory UKAS accredited for this testing

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.

☐ **James Ward, Operations Manager**

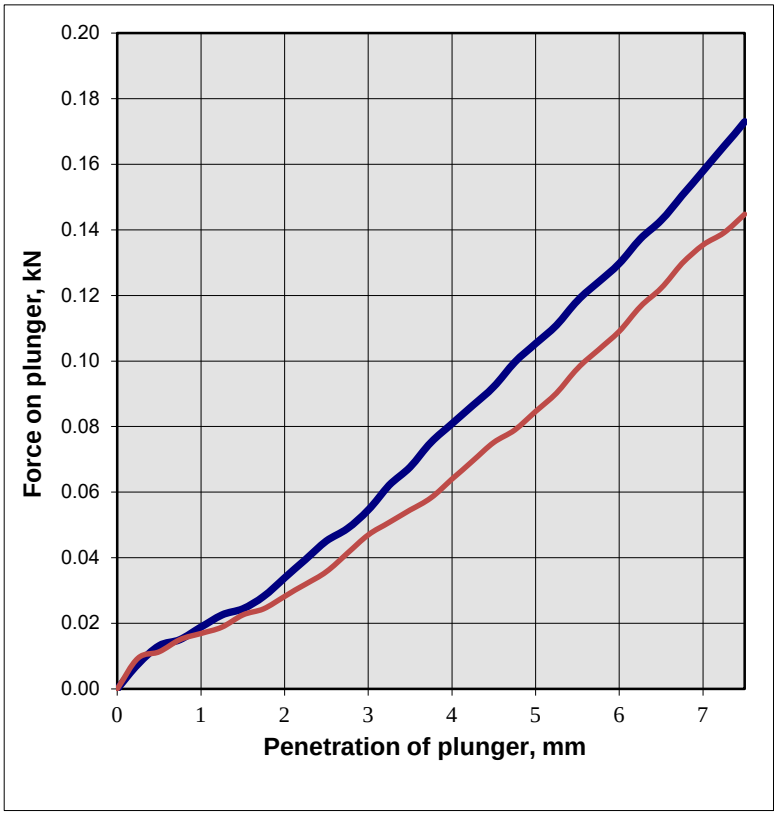
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

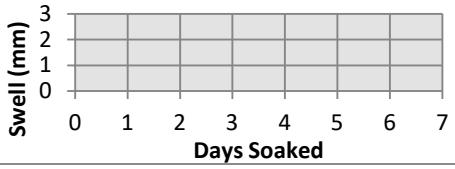
LABORATORY TEST REPORT

DETERMINATION OF CALIFORNIA BEARING RATIO - BS 1377 : Part 4 : 1990

Project :	Cork Line Level Crossings	**Job No:**	19-135
Client :	OCB Geotechnical	**Lab Ref No:**	ST 93469
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	17/04/2020
	Co Cork	**Date Reported:**	21/04/2020
Order No:	2003-104	**Sample Ref:**	XC219-TP04 Type B Sample 2
Originator :	**Ian Holley**	**Location:**	0.3-0.8m



Type of Reaction Load
Load Frame
Technician(s)
NW
Mass of Surcharge Weights
8.8Kg
Overburden Pressure
3.9kPa
Material Type
Soil
Density (Mg/m³)
2.18
Propertion of material removed from initial sample by dry mass (%)
12.7



Final Swell (mm):	N/A

Penetration (mm)	Force (kN)	Standard Force (kN)	Top CBR (%)
2.5	0.05	13.2	0.3
5.0	0.11	20.0	0.5
Moisture content : %	**22.8**	**Mean CBR value : %**	**0.4**

Penetration (mm)	Force (kN)	Standard Force (kN)	Bottom CBR (%)
2.5	0.04	13.2	0.3
5.0	0.08	20.0	0.4
Moisture content : %	**22.8**	**Mean CBR value : %**	**0.3**

Moisture content determined in accordance with BS 1377 : Part 2 : 1990 - oven drying method
CBR determined in accordance with BS 1377 : Part 4 : 1990

Approved Signature
James Fisher Testing Services Ltd
Phil Thorp, Laboratory Manager

UKAS TESTING
0955

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co.Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

MOISTURE CONTENT BS 1377 : Part 2 : 1990 Oven Drying Method cl 3.2

Site:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93466
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	27/03/2020
Order No:	2003-104	**Date Reported:**	02/04/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC219-TP04 Type D Sample 2

Sample Type:	Bulk	***Location:***	XC219-TP04 Type D Sample 2
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	0.3-0.8m	***Material Type:***	Soil

Moisture Content (%): 19

Tested in accordance with BS 1377: Part 2: 1990
Sample preperation by cone and quarter

Approved Signature
James Fisher Testing Services (Ireland) Ltd
James Ward, Operations Manager

UKAS TESTING
0955

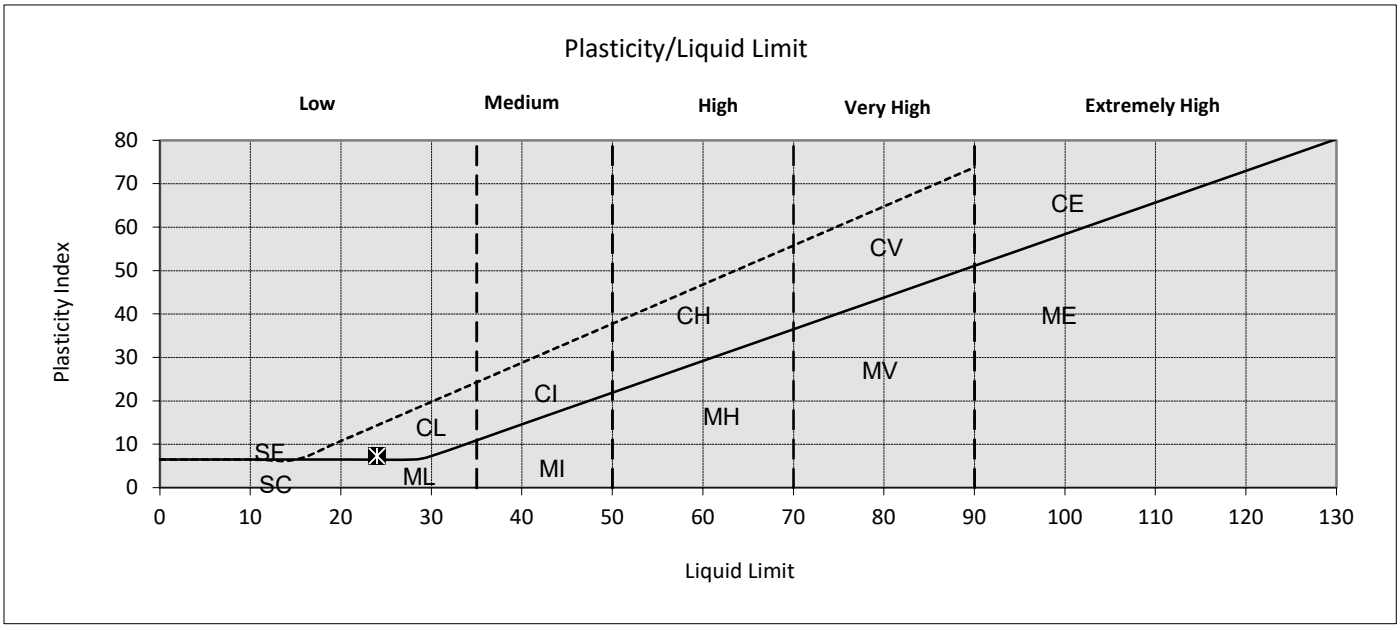
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93467
	Unit 1 Carrigogna	**Sample Ref.:**	XC219-TP04 0.3-0.8m Type B S.2
	Midleton	**Date Sampled:**	Client Info
	Co Cork	**Date Received:**	09/03/2020
Order No:	2003-104	**Date Tested:**	03/04/2020
Originator:	**Ian Holley**	**Date Reported:**	22/04/2020

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Bulk**
Sample Preparation Method	**Washed**
MATERIAL	**Soil**
Retained 425 micron (%)	**23**
Natural Moisture Content (%)	**19**
Liquid Limit (single point)(%)	**24**
Plastic Limit (%)	**17**
Plasticity Index	**7**



The stated result only relates to the item/location tested, this report shall not be reproduced except in full.

Approved Signature
James Fisher Testing Services Ltd
Phil Thorp, Laboratory Manager

UKAS TESTING 0955

James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

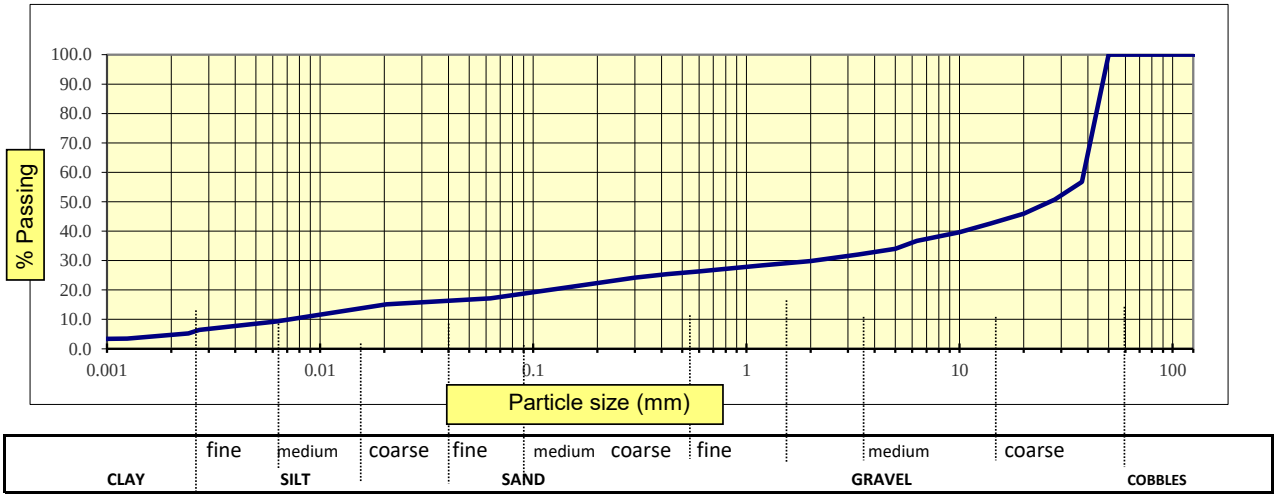
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

Determination of Particle Size Distribution (Hydrometer Sedimentation) - BS 1377 : Part 2 : 1990 Cl. 9.5

Project:	Cork Line Level Crossings	**Job No:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93470
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	02/04/2020
		Date Tested:	31/03/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Cobbly Dark Clay, Fine Sand

Client Ref.	**XC219-TP04 Type B Sample 5**
Location:	XC219-TP04 Type B Sample 5
Supplier:	Bulk
Source:	Client Info.
Depth (m):	1.0-1.5m
Sampling Reason:	Client Request
Sampled By:	Client
Specification:	Client
Preparation Method:	Without Organics Preparation
Notes:	Disturbed sample from cleanout

BS Sieve Size	% Passing	Specification
300 mm	100	
125 mm	100	
100 mm	100	
75 mm	100	
63 mm	100	
50 mm	100	
37.5 mm	57	
28 mm	51	
20 mm	46	
14 mm	43	
10 mm	40	
6.3 mm	37	
5 mm	34	
3.35 mm	32	
2 mm	30	
1.18 mm	28	
0.6 mm	26	
0.425 mm	25	
0.3 mm	24	
0.15 mm	21	
0.063 mm	17	
0.020 mm	15	
0.006 mm	9	
0.003 mm	6	
0.002 mm	5	
0.001 mm	3	



Tested in accordance with BS 1377: Part 2 : 1990 Clause 9.2 and 9.5

Sedimentation by Hydrometer - Not UKAS

UKAS TESTING 0955

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.
☐ **James Ward, Operations Manager**

INDEX PROPERTIES - SUMMARY OF RESULTS

Hole No.	Sample No.	Depth (m) from	Depth (m) to	type	Soil Description	ρ Mg/m3	ρ_d Mg/m3	w %	< 425 µm sieve %	W_L %	W_P %	I_P	ρ_s Mg/m3	Remarks
XC219-CPRC01	6	0.50	1.20	D	Brown slightly sandy slightly gravelly CLAY			21	78 s	34 a	20	14		

General notes: All above tests carried out to BS1377 : 1990 unless annotated otherwise. See Remarks for further details

Key : p bulk density, linear; *pd* dry density; *w* moisture content; * test carried out to BS EN ISO 17892

WL Liquid limit; a 4 point cone test; b 1 point cone test

WP Plastic limit; NP non - plastic; IP Plasticity Index

<425um preparation; n from natural soil; s sieved specimen; h removed by hand

ps particle density; -g = gas jar; -p = small pyknometer

QA Ref
SLR 1
Rev 2.95
Mar 17

SOCOTEC

Project No N9426-20

Project Name Cork Line Level Crossings

Figure

INDX

Printed: 20/11/2020 09:59

INDEX PROPERTIES - SUMMARY OF RESULTS

Hole No.	Sample No.	Depth (m) from	Depth (m) to	type	Soil Description	ρ Mg/m3	ρ_d Mg/m3	w %	< 425 µm sieve %	W_L %	W_P %	I_P	ρ_s Mg/m3	Remarks
XC219-CPRC01	8	1.20	2.00	D	Brown slightly sandy gravelly CLAY.			7	45 s	23 a	16	7		
XC219-CPRC01	11	2.00	2.40	D	Brown slightly sandy slightly gravelly CLAY.			25	95 h	44 a	23	21		
XC219-CPRC01	13	2.40	3.00	D				5.8						

General notes: All above tests carried out to BS1377 : 1990 unless annotated otherwise. See Remarks for further details

Key : p bulk density, linear; *pd* dry density; *w* moisture content; * test carried out to BS EN ISO 17892

WL Liquid limit; a 4 point cone test; b 1 point cone test

WP Plastic limit; NP non - plastic; IP Plasticity Index

<425um preparation: n from natural soil; s sieved specimen; h removed by hand

ps particle density; -g = gas jar; -p = small pyknometer

QA Ref
SLR 1
Rev 2.95
Mar 17

SOCOTEC

Project No N9426-20

Project Name Cork Line Level Crossings

Figure

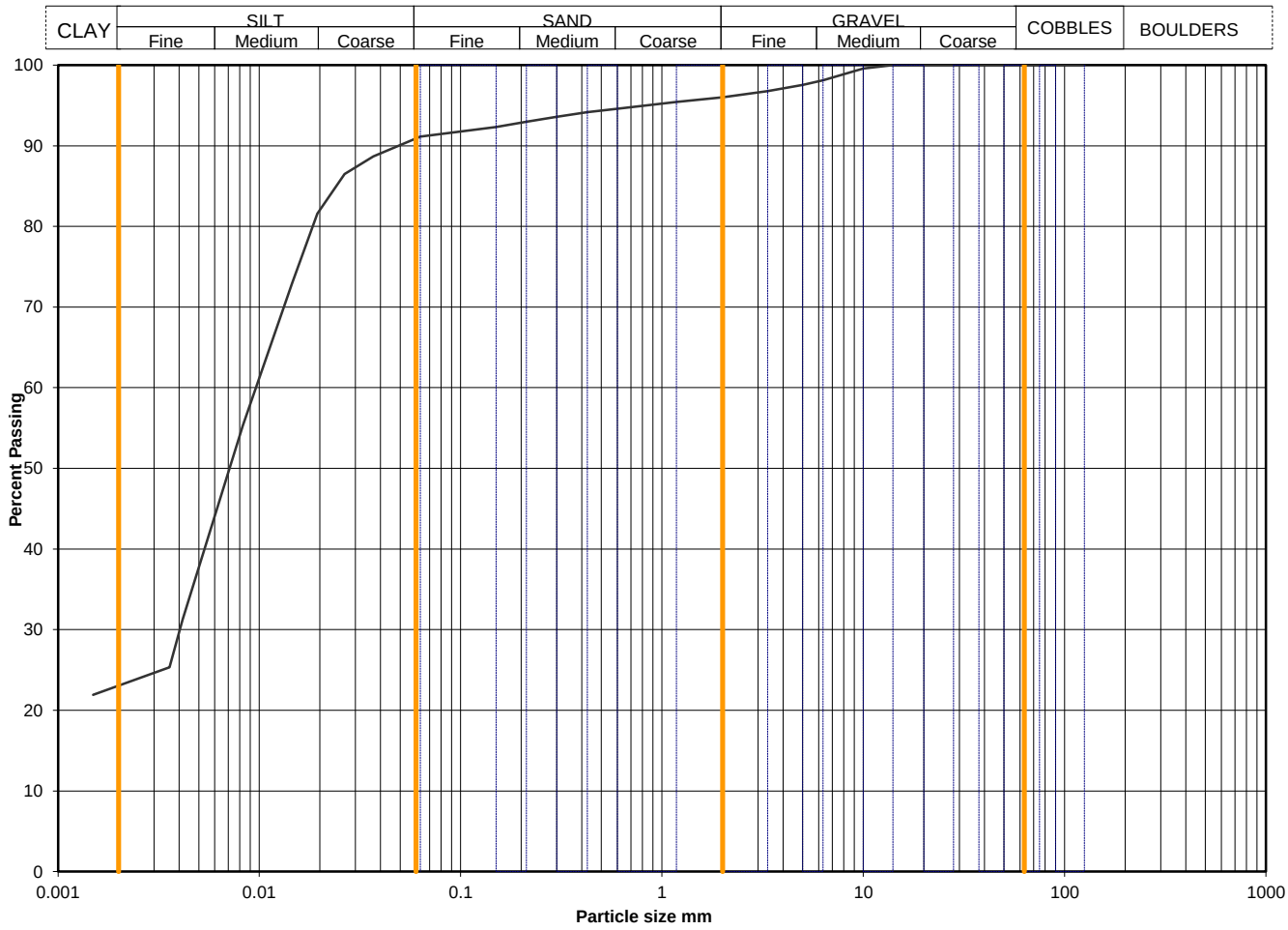
INDX

Printed: 20/11/2020 09:59

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020100237

Hole No	XC219-TP01
Sample Depth (m BGL)	0.50 - 1.00
Sample Type and No	B5
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	91
90	100	0.0369	89
75	100	0.0265	87
63	100	0.0194	82
50	100	0.0145	73
37.5	100	0.0083	55
28	100	0.0042	31
20	100	0.0036	25
14	100	0.0015	22
10	100		
6.3	98		
5.0	98		
3.35	97		
2.00	96		
1.18	95	Particle density, Mg/m3	
0.600	95		
0.425	94	2.65 assumed	
0.300	94	Dry mass of sample, kg	
0.212	93		
0.150	92	2.0	
0.063	91		

Soil description	Brown slightly sandy slightly gravelly silty CLAY with occasional rootlets.
Preparation / Pretreatment	Sieve: pre dried, Hydro: as BS1377
Remarks	

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	0.0	0.0
	Gravel	3.9	3.9
	Sand	4.9	4.9
*<60mm values to aid description only	Silt	68.1	68.1
	Clay	23.1	23.1

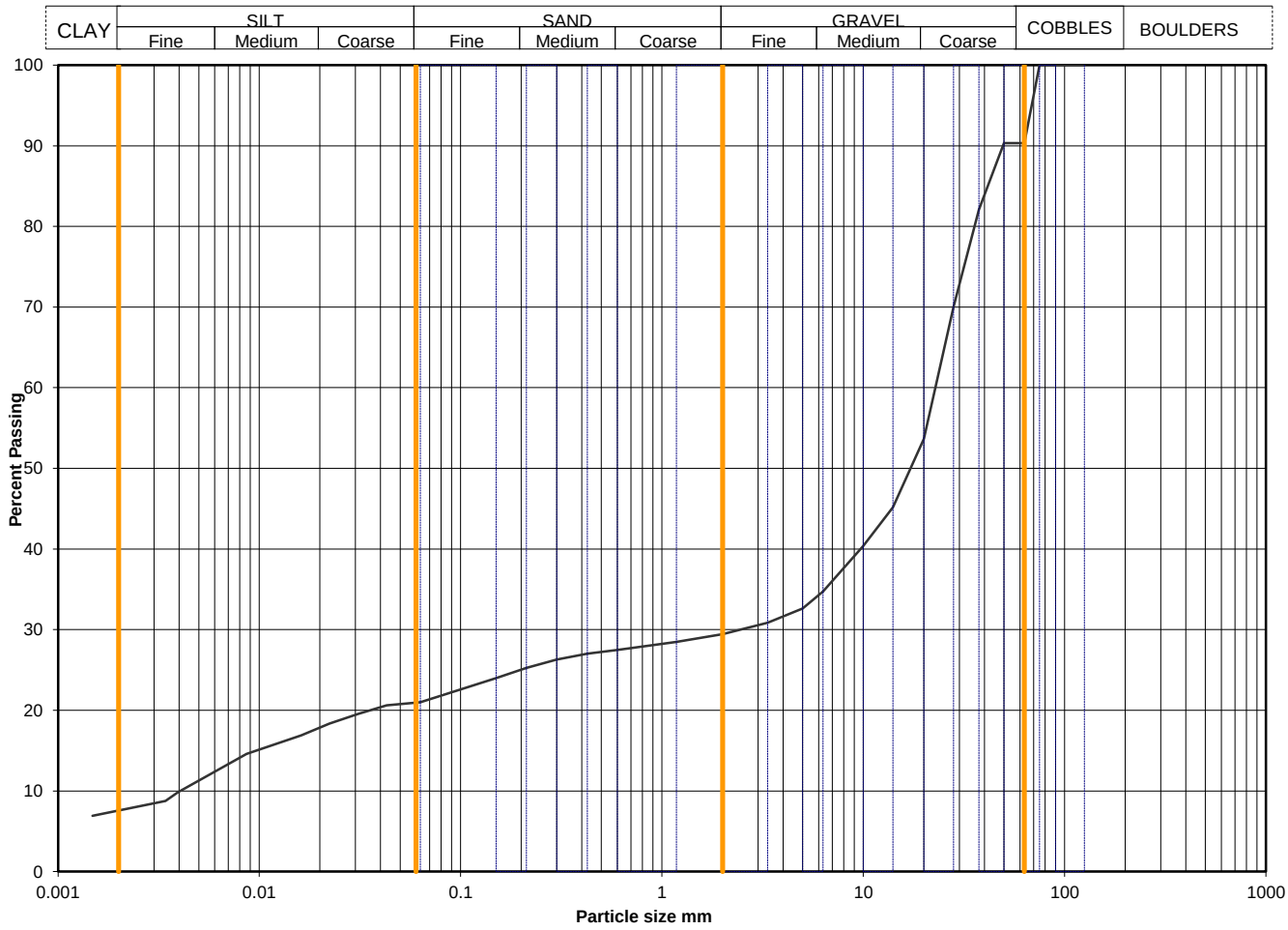
Uniformity Coefficient	D60 / D10	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020100243

Hole No	XC219-TP01
Sample Depth (m BGL)	2.30 - 2.50
Sample Type and No	B12
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	21
90	100	0.0429	21
75	100	0.0309	20
63	90	0.0223	18
50	90	0.0161	17
37.5	82	0.0086	15
28	70	0.0039	10
20	54	0.0034	9
14	45	0.0015	7
10	40		
6.3	35		
5.0	33		
3.35	31		
2.00	29		
1.18	28	Particle density, Mg/m3	
0.600	27		
0.425	27	2.65 assumed	
0.300	26	Dry mass of sample, kg	
0.212	25		
0.150	24	5.3	
0.063	21		

Soil description	Brown sandy clayey GRAVEL with one cobble.
Preparation / Pretreatment	Sieve: pre dried, Hydro: as BS1377
Remarks	

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	9.6	0.0
	Gravel	60.9	67.4
	Sand	8.5	9.4
*<60mm values to aid description only	Silt	13.4	14.8
	Clay	7.6	8.4

Uniformity Coefficient	D60 / D10	5605

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref
SLR 2,9
Rev 2.22
Jul 17

UKAS TESTING
0001

SOCOTEC

Project No N9425-20

Project Name Cork Line Level Crossings

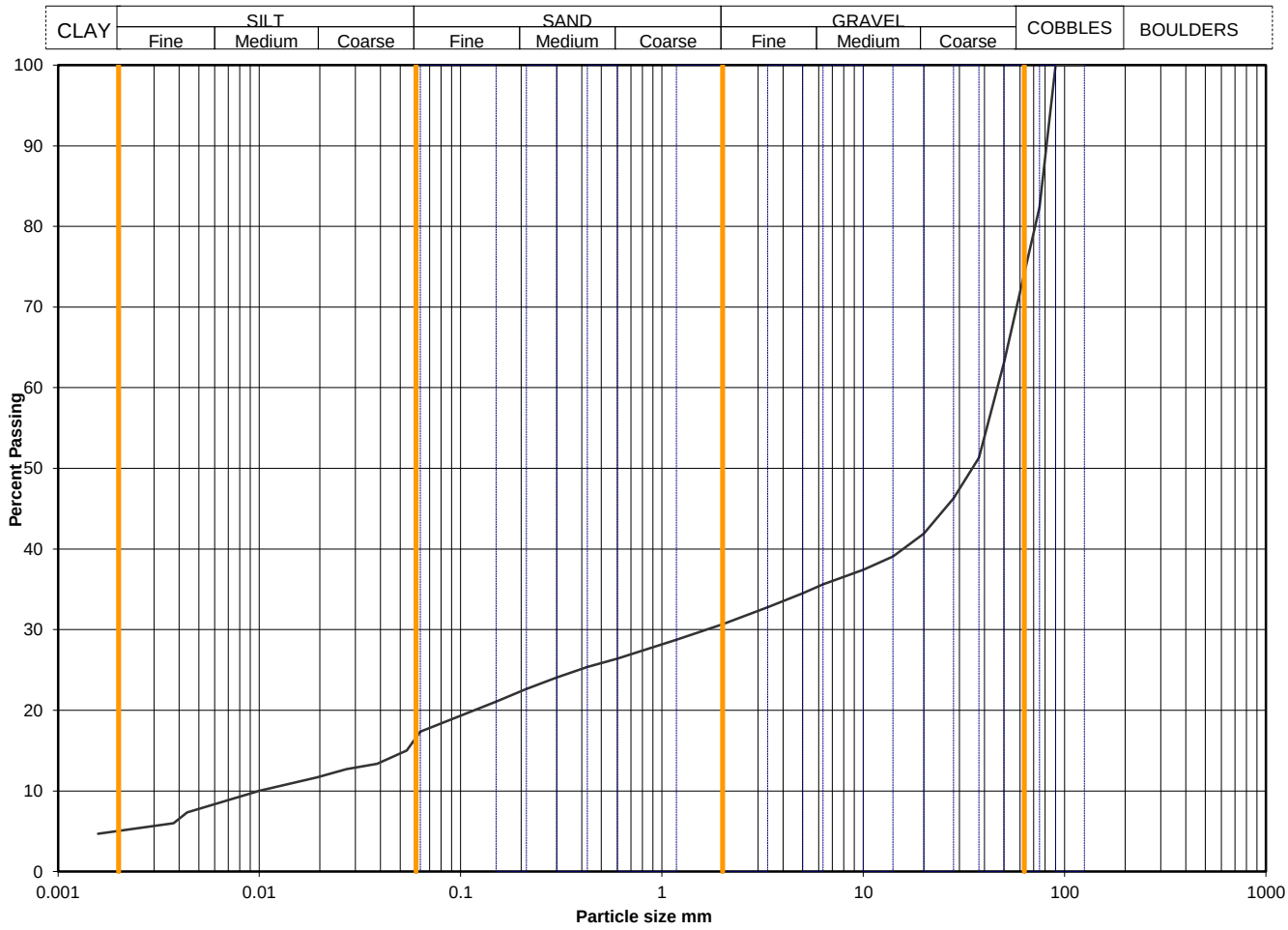
Figure
PSD

Printed: 20/11/2020 10:52

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020100679

Hole No	XC219-CPRC01
Sample Depth (m BGL)	1.20 - 2.00
Sample Type and No	B7
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	17
90	100	0.0539	15
75	82	0.0384	13
63	74	0.0272	13
50	63	0.0193	12
37.5	51	0.0100	10
28	46	0.0044	7
20	42	0.0037	6
14	39	0.0016	5
10	37		
6.3	36		
5.0	35		
3.35	33		
2.00	31		
1.18	29	Particle density, Mg/m3	
0.600	26		
0.425	25	2.65 assumed	
0.300	24	Dry mass of sample, kg	
0.212	23		
0.150	21	7.3	
0.063	17		

Soil description	Brown sandy clayey GRAVEL with two cobbles.
Preparation / Pretreatment	Sieve: pre dried, Hydro: as BS1377
Remarks	

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	25.8	0.0
	Gravel	43.6	58.8
	Sand	13.3	17.9
*<60mm values to aid description only	Silt	12.3	16.6
	Clay	5.0	6.7

Uniformity Coefficient	D60 / D10	4661

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref
SLR 2,9
Rev 2.22
Jul 17

UKAS TESTING
0001

SOCOTEC

Project No N9426-20

Project Name Cork Line Level Crossings

Figure

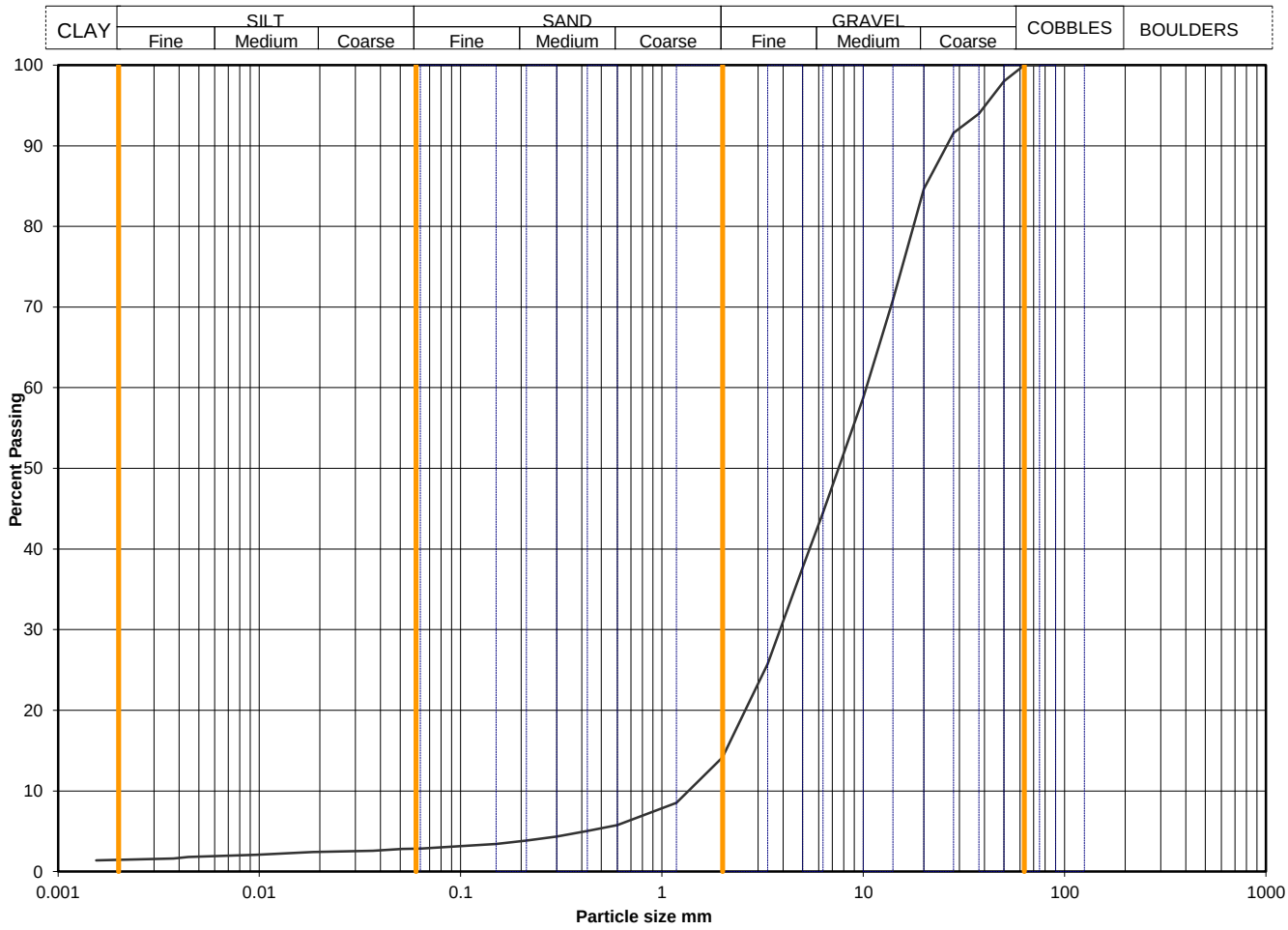
PSD

Printed: 20/11/2020 10:00

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020100685

Hole No	XC219-CPRC01
Sample Depth (m BGL)	3.00 - 4.00
Sample Type and No	B15
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	3
90	100	0.0513	3
75	100	0.0366	3
63	100	0.0260	3
50	98	0.0184	2
37.5	94	0.0096	2
28	92	0.0044	2
20	85	0.0038	2
14	71	0.0015	1
10	59		
6.3	45		
5.0	38		
3.35	26		
2.00	14		
1.18	9	Particle density, Mg/m3	
0.600	6		
0.425	5	2.65 assumed	
0.300	4	Dry mass of sample, kg	
0.212	4		
0.150	3	12.1	
0.063	3		

Soil description	Brown sandy slightly silty GRAVEL.
Preparation / Pretreatment	Sieve: pre dried, Hydro: as BS1377
Remarks	

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	0.0	0.0
	Gravel	85.8	85.8
	Sand	11.3	11.3
*<60mm values to aid description only	Silt	1.4	1.4
	Clay	1.5	1.5

Uniformity Coefficient	D60 / D10	8

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref
SLR 2,9
Rev 2.22
Jul 17

UKAS TESTING
0001

SOCOTEC

Project No N9426-20

Project Name Cork Line Level Crossings

Figure

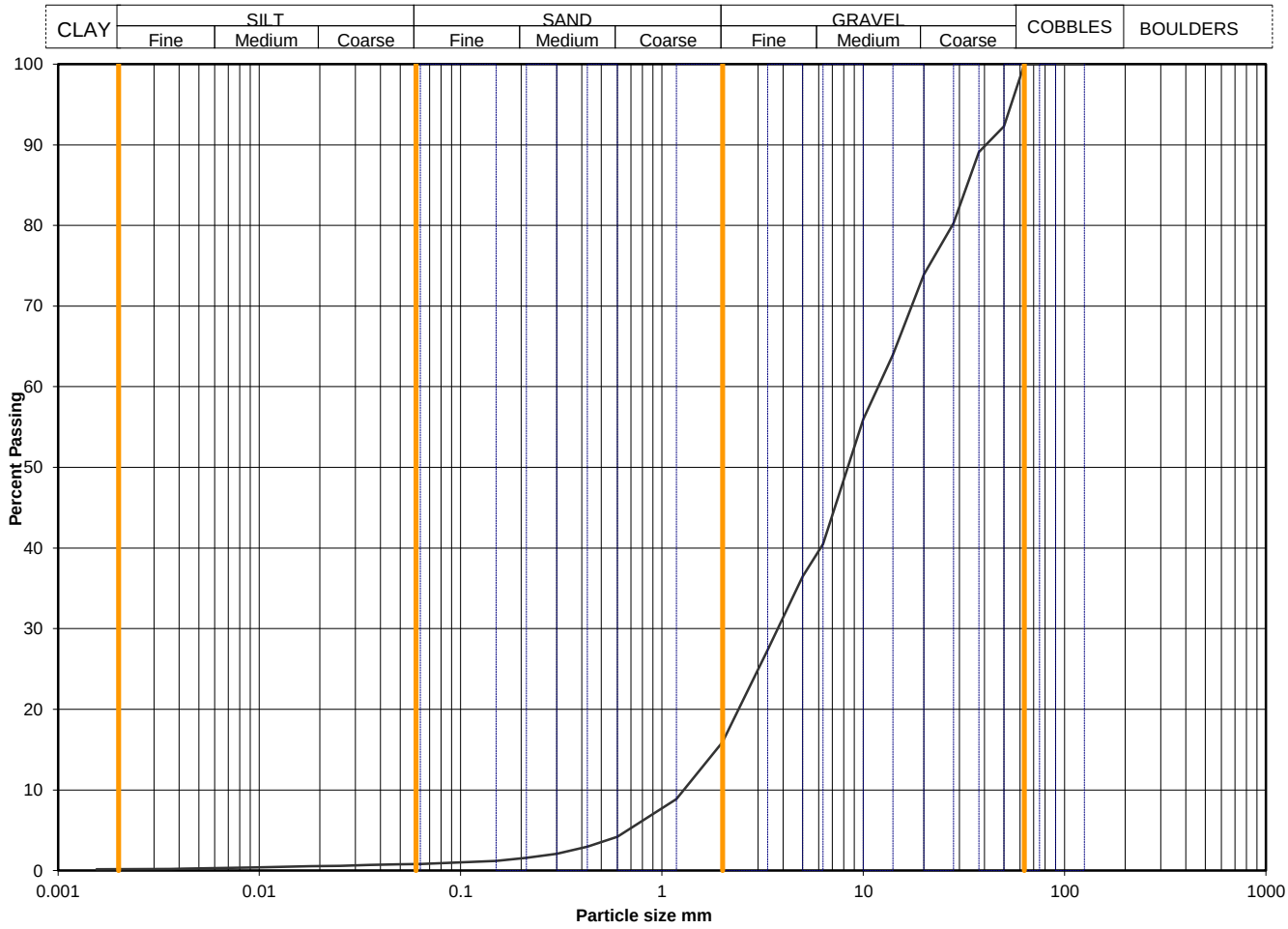
PSD

Printed: 20/11/2020 10:00

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020100691

Hole No	XC219-CPRC01
Sample Depth (m BGL)	6.00 - 7.00
Sample Type and No	B21
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	1
90	100	0.0487	1
75	100	0.0350	1
63	100	0.0253	1
50	92	0.0181	1
37.5	89	0.0096	0
28	80	0.0042	0
20	74	0.0036	0
14	64	0.0016	0
10	56		
6.3	40		
5.0	36		
3.35	27		
2.00	16		
1.18	9	Particle density, Mg/m3	
0.600	4		
0.425	3	2.65 assumed	
0.300	2	Dry mass of sample, kg	
0.212	2		
0.150	1	13.2	
0.063	1		

Soil description	Brown sandy GRAVEL.
Preparation / Pretreatment	Sieve: pre dried, Hydro: as BS1377
Remarks	

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	0.0	0.0
	Gravel	84.1	84.1
	Sand	15.1	15.1
*<60mm values to aid description only	Silt	0.6	0.6
	Clay	0.2	0.2

Uniformity Coefficient	D60 / D10	9

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref
SLR 2,9
Rev 2.22
Jul 17

UKAS TESTING
0001

SOCOTEC

Project No N9426-20

Project Name Cork Line Level Crossings

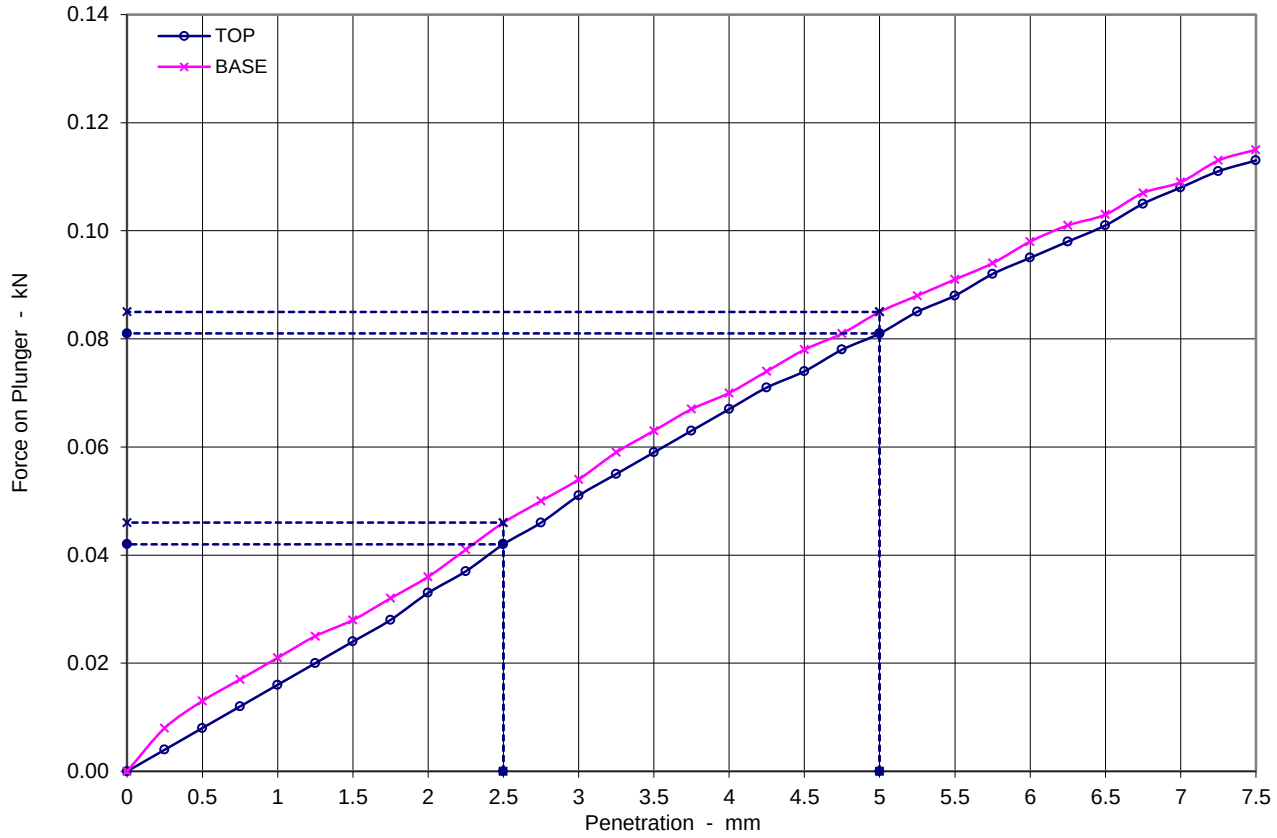
Figure
PSD

Printed: 20/11/2020 10:00

California Bearing Ratio (BS1377:1990:Part 4 , section 7)

Sample Details:	SAMPLE ID:
	SOCO2020100239

Hole No	XC219-TP01
Sample Depth (m)	1.20 - 1.70
Sample Type and No	B8
Specimen Ref	1



Soil description	Brown slightly sandy CLAY.

Test Conditions		
Sample Retained on 20 mm sieve	%	0

Preparation	Method of Compaction		
	Remoulded - Rammer compaction to specified density (2.5kg)		
	Soaked test		YES
	Soaking Period	days	4
	Amount of Swell	mm	0.69

Surcharge applied		
	kg	0
	kPa	0

Sample Conditions		
Initial Moisture Content	%	28.0
Bulk Density	Mg/m³	2.00
Dry Density	Mg/m³	1.56
Moisture Content - TOP	%	27.0
Moisture Content - BASE	%	28.0

Penetration mm	CBR Values %	
	TOP	BASE
2.5	0.3	0.4
5	0.4	0.4

Accepted CBR %	**0.4**	**0.4**

Notes :

QA Ref
SLR 4.7
Rev 2.8
Mar 17

UKAS TESTING
0001

SOCOTEC

Project No N9425-20

Project Name Cork Line Level Crossings

Figure
CBR

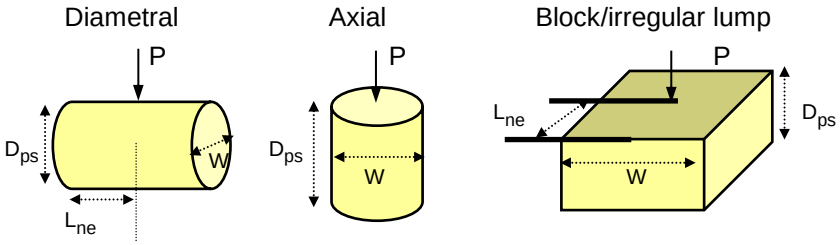
Printed: 20/11/2020 10:49

Appendix I Geotechnical Rock Core Laboratory Test Results

Point Load Index Test

All specimens tested at as received water content unless shown otherwise

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction (U = unknown or random)
L - parallel to planes of weakness
P - perpendicular to planes of weakness
Dimensions
Dps - Distance between platens (platen separation)
Dps' - at failure
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P



Borehole	Depth, m	Sample Ref	Sample Type	Specimen Ref	Specimen Depth	Rock type	Test Type see ISRM Fig 5 and 8		Failure Valid (Y/N)	Dimensions				LOAD P	De equivalent diameter, mm	Point Load Index MPa F = (De/50)0.45		Remarks
							Type (D, A, I, B)	Direction (L, P or U)		Lne mm	W mm	Dps mm	Dps' mm	kN		Is	Is(50)	
XC219-CPRC02	3.90		C	1		LIMESTONE	A	P	Y		73.8	62.0	57.0	14.60	73.17	2.73	3.24	
XC219-CPRC02	4.25		C	1		LIMESTONE	D	L	Y	60.0	75.5	76.0	74.0	1.02	74.74	0.18	0.22	
XC219-CPRC02	6.25		C	1		LIMESTONE	D	L	Y	80.0	77.7	66.0	64.0	1.61	70.51	0.32	0.38	
XC219-CPRC02	7.30		C	1		LIMESTONE	A	P	Y		75.8	84.0	78.0	15.66	86.73	2.08	2.67	
XC219-CPRC02	10.00		C	1		LIMESTONE	A	P	Y		75.7	90.0	86.0	14.33	91.07	1.73	2.26	
XC219-CPRC02	14.62		C	1		LIMESTONE	D	L	Y	70.0	75.9	76.0	62.0	14.16	68.62	3.01	3.47	
XC219-CPRC03	5.50		C	1		LIMESTONE	D	L	Y	80.0	77.5	76.0	75.0	17.97	76.23	3.09	3.74	
XC219-CPRC03	6.75		C	1		LIMESTONE	D	L	Y	100.0	78.8	76.0	69.0	14.88	73.73	2.74	3.26	
XC219-CPRC03	6.95		C	1		LIMESTONE	D	L	Y	50.0	74.6	75.0	71.0	18.65	72.80	3.52	4.17	
XC219-CPRC03	8.00		C	1		LIMESTONE	D	L	Y	55.0	76.1	77.0	66.0	11.63	70.87	2.32	2.71	
XC219-CPRC03	8.40		C	1		LIMESTONE	I	P	Y	50.0	75.6	62.0	59.0	15.80	75.35	2.78	3.35	
XC219-CPRC03	9.25		C	1		LIMESTONE	A	P	Y		76.1	71.0	66.0	17.67	79.95	2.76	3.41	

QA Ref
ISRM 85
Rev 2.10
Aug 17

UKAS TESTING
0001

SOCOTEC

Project No N9366-20

Project Name Irish Rail - Cork Line

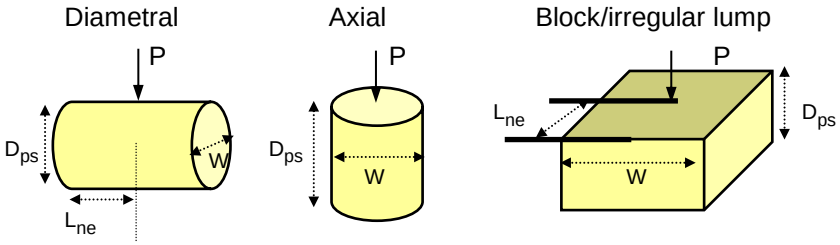
Figure
PLT

Sheet Printed
12/11/2020 09:13

Point Load Index Test

All specimens tested at as received water content unless shown otherwise

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction (U = unknown or random)
L - parallel to planes of weakness
P - perpendicular to planes of weakness
Dimensions
Dps - Distance between platens (platen separation)
Dps' - at failure
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P



Borehole	Depth, m	Sample Ref	Sample Type	Specimen Ref	Specimen Depth	Rock type	Test Type see ISRM Fig 5 and 8		Failure Valid (Y/N)	Dimensions				LOAD P	De equivalent diameter, mm	Point Load Index MPa F = (De/50)0.45		Remarks
							Type (D, A, I, B)	Direction (L, P or U)		Lne mm	W mm	Dps mm	Dps' mm	kN		Is	Is(50)	
XC219-CPRC04	2.70		C	1		LIMESTONE	I	P	Y	45.0	77.9	62.0	58.0	15.55	75.86	2.70	3.26	
XC219-CPRC04	3.00		C	1		LIMESTONE	D	L	Y	80.0	81.5	76.0	63.0	15.60	71.63	3.04	3.57	
XC219-CPRC04	3.70		C	1		LIMESTONE	D	L	Y	70.0	76.4	76.0	61.0	11.85	68.24	2.54	2.93	
XC219-CPRC05	3.00		C	1		LIMESTONE	D	L	Y	90.0	76.0	66.0	43.0	16.60	57.15	5.08	5.40	
XC219-CPRC05	3.45		C	1		LIMESTONE	D	L	Y	100.0	75.8	66.0	62.0	10.01	68.57	2.13	2.45	
XC219-CPRC05	3.90		C	1		LIMESTONE	D	L	Y	65.0	77.9	74.0	61.0	21.68	68.94	4.56	5.27	
XC219-CPRC05	5.10		C	1		LIMESTONE	D	L	Y	90.0	75.6	66.0	56.0	14.60	65.06	3.45	3.88	
XC219-CPRC05	8.75		C	1		LIMESTONE	D	L	Y	85.0	75.3	71.0	70.0	12.74	72.59	2.42	2.86	
XC219-CPRC05	11.30		C	1		LIMESTONE	D	L	Y	60.0	75.2	72.0	64.0	19.64	69.38	4.08	4.73	

QA Ref
ISRM 85
Rev 2.10
Aug 17

UKAS TESTING
0001

SOCOTEC

Project No N9366-20
Project Name Irish Rail - Cork Line

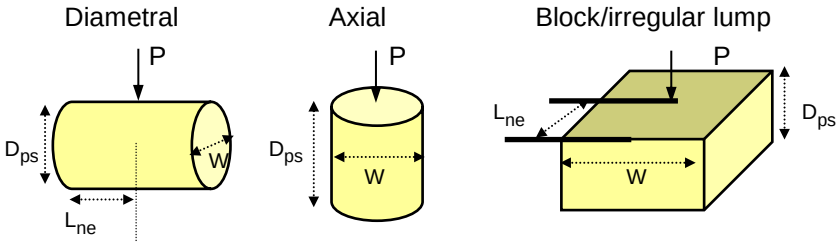
Figure
PLT

Sheet Printed
12/11/2020 09:13

Point Load Index Test

All specimens tested at as received water content unless shown otherwise

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction (U = unknown or random)
L - parallel to planes of weakness
P - perpendicular to planes of weakness
Dimensions
Dps - Distance between platens (platen separation)
Dps' - at failure
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P



Borehole	Depth, m	Sample Ref	Sample Type	Specimen Ref	Specimen Depth	Rock type	Test Type see ISRM Fig 5 and 8		Failure Valid (Y/N)	Dimensions				LOAD P	De equivalent diameter, mm	Point Load Index MPa F = (De/50)0.45		Remarks
							Type (D, A, I, B)	Direction (L, P or U)		Lne mm	W mm	Dps mm	Dps' mm	kN		Is	Is(50)	
XC219-CPRC01A	8.30		C	1		LIMESTONE	D	L	Y	60.0	75.8	74.0	66.0	26.60	70.74	5.32	6.21	8.30-8.45m
XC219-CPRC01A	8.30		C	2		LIMESTONE	D	L	Y	75.0	75.3	72.0	71.0	21.97	73.11	4.11	4.88	9.01-9.17m
XC219-CPRC06	5.30		C	1		LIMESTONE	D	L	Y	80.0	75.9	76.0	70.0	16.26	72.90	3.06	3.63	6.14-6.32m
XC219-CPRC06	6.80		C	1		LIMESTONE	D	L	Y	110.0	77.7	77.0	71.0	21.39	74.26	3.88	4.63	7.01-7.26m
XC219-CPRC06	6.80		C	2		LIMESTONE	D	L	Y	90.0	76.1	76.0	75.0	6.03	75.53	1.06	1.27	7.84-8.03m
XC219-CPRC07	3.70		C	2		LIMESTONE	D	L	Y	60.0	73.2	72.0	49.0	21.12	75.53	1.06	1.27	5.07-5.20m

QA Ref
ISRM 85
Rev 2.10
Aug 17

UKAS TESTING
0001

SOCOTEC

Project No N9435-20
Project Name Cork Line Level Crossings

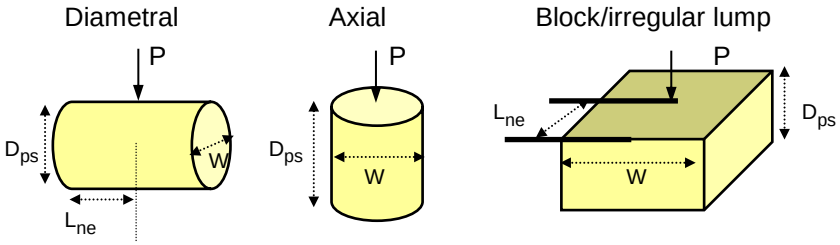
Figure
PLT

Sheet Printed
04/11/2020 11:34

Point Load Index Test

All specimens tested at as received water content unless shown otherwise

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction (U = unknown or random)
L - parallel to planes of weakness
P - perpendicular to planes of weakness
Dimensions
Dps - Distance between platens (platen separation)
Dps' - at failure
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P



Borehole	Depth, m	Sample Ref	Sample Type	Specimen Ref	Specimen Depth	Rock type	Test Type see ISRM Fig 5 and 8		Failure Valid (Y/N)	Dimensions				LOAD P	De equivalent diameter, mm	Point Load Index MPa F = (De/50)0.45		Remarks
							Type (D, A, I, B)	Direction (L, P or U)		Lne mm	W mm	Dps mm	Dps' mm	kN		Is	Is(50)	
XC219-CPRC07	6.70		C	1		LIMESTONE	A	P	Y		74.4	41.0	38.0	8.60	59.99	2.39	2.59	6.96-7.24m
XC219-CPRC07	6.70		C	2		LIMESTONE	D	L	Y	70.0	73.8	76.0	71.0	0.97	72.37	0.19	0.22	6.80-6.96m
XC219-CPRC07	8.20		C	2		LIMESTONE	D	L	Y	140.0	74.8	74.0	56.0	18.59	59.89	5.89	6.39	9.35-9.63m

QA Ref
ISRM 85
Rev 2.10
Aug 17

UKAS TESTING
0001

SOCOTEC

Project No N9435-20

Project Name Cork Line Level Crossings

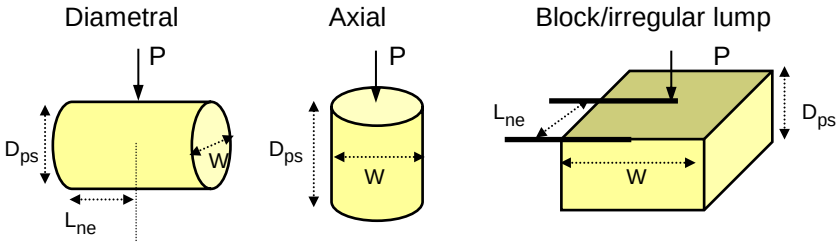
Figure
PLT

Sheet Printed
04/11/2020 11:34

Point Load Index Test

All specimens tested at as received water content unless shown otherwise

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction (U = unknown or random)
L - parallel to planes of weakness
P - perpendicular to planes of weakness
Dimensions
Dps - Distance between platens (platen separation)
Dps' - at failure
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P



Borehole	Depth, m	Sample Ref	Sample Type	Specimen Ref	Specimen Depth	Rock type	Test Type see ISRM Fig 5 and 8		Failure Valid (Y/N)	Dimensions				LOAD P	De equivalent diameter, mm	Point Load Index MPa F = (De/50)0.45		Remarks
							Type (D, A, I, B)	Direction (L, P or U)		Lne mm	W mm	Dps mm	Dps' mm	kN		Is	Is(50)	
XC219-CPRC08	5.40		C	1		LIMESTONE	D	L	Y	150.0	75.0	74.0	70.0	22.66	72.46	4.32	5.10	5.60-5.90m
XC219-CPRC08	5.40		C	2		LIMESTONE	A	P	Y		75.4	66.0	64.0	17.01	78.37	2.77	3.39	5.60-5.90m
XC219-CPRC08	5.40		C	3		LIMESTONE	D	L	Y	130.0	76.0	71.0	66.0	18.20	70.82	3.63	4.24	6.10-6.39m
XC219-CPRC08	5.40		C	4		LIMESTONE	A	P	Y		75.5	56.0	55.0	12.04	72.70	2.28	2.70	6.10-6.39m
XC219-CPRC08	6.90		C	1		LIMESTONE	A	P	Y		73.5	58.0	53.0	17.80	70.41	3.59	4.19	7.97-8.02m
XC219-CPRC08	6.90		C	2		LIMESTONE	I	P	Y	35.0	75.1	41.0	36.0	11.18	58.67	3.25	3.49	7.97-8.02m
XC219-CPRC08	6.90		C	3		LIMESTONE	A	P	Y		75.3	41.0	39.0	7.89	61.14	2.11	2.31	8.36-8.40m
XC219-CPRC08	6.90		C	4		LIMESTONE	I	P	Y	40.0	76.0	43.0	41.0	10.47	62.97	2.64	2.93	8.36-8.40m

QA Ref
ISRM 85
Rev 2.10
Aug 17

UKAS TESTING
0001

SOCOTEC

Project No N9436-20
Project Name Cork Line Level Crossings

Figure
PLT

Sheet Printed
04/11/2020 08:11

Uniaxial Compressive Strength Of Rock - Summary of Results

Hole No.	Sample				Rock Type	Specimen Dimensions [2]			Bulk Density [2]	Water Content [1]	Uniaxial Compression [3]				Remarks
	No.	Depth (m)		type		Dia.	Height	H/D			Stress Rate	Time to failure	Mode of failure	UCS	
		from	to			mm	mm		Mg/m 3	%	MPa/s	secs		MPa	
XC219-CPRC02		6.25	6.58	C	LIMESTONE	75.6	187.7	2.5	2.66	0.2	0.1	224	shear	19	
XC219-CPRC02		8.75	9.25	C	LIMESTONE	75.5	198.3	2.6	2.67	0.1	0.1	305	axial cleavage	25.1	
XC219-CPRC02		11.85	12.40	C	LIMESTONE	75.3	199.8	2.7	2.66	0.1	0.1	248	axial cleavage	30.2	
XC219-CPRC02		13.95	14.42	C	LIMESTONE	75.4	197.0	2.6	2.67	0.1	0.1	328	axial cleavage	18.9	
XC219-CPRC04		4.75	5.25	C	LIMESTONE	75.3	198.8	2.6	2.68	0.1	0.1	329	axial cleavage	39.4	
XC219-CPRC04		6.70	7.02	C	LIMESTONE	75.6	199.4	2.6	2.68	0.1	0.1	480	shear	12.8	
XC219-CPRC05		5.10	5.50	C	LIMESTONE	75.6	199.1	2.6	2.69	0.3	0.1	296	multiple shear	24.5	
XC219-CPRC05		8.75	9.30	C	LIMESTONE	75.4	196.4	2.6	2.69	0.2	0.1	338	axial cleavage	20.2	
XC219-CPRC05		11.55	12.00	C	LIMESTONE	75.5	202.5	2.7	2.70	0	0.1	400	axial cleavage	24.9	

Notes :

Test Specification : International Society for Rock Mechanics, The complete ISRM suggested methods for Rock Characterization Testing and Monitoring, 2007

1 ISRM p87 test 1, water content at 105 ± 3 oC, specimen as received at the laboratory

2 ISRM p86 clause (vii), Caliper method used for determination of bulk volume and derivation of bulk density

3 ISRM p153 part 1, determination of Uniaxial Compressive Strength (UCS) of Rock Materials

above notes apply unless annotated otherwise in the remarks

Mode of failure :

S - Single shear MS - multiple shear

AC - Axial cleavage F - Fragmented

QA Ref
RLR 2
Rev 2.19
Apr 19

UKAS TESTING
0001

SOCOTEC

Project No N9366-20

Project Name Irish Rail - Cork Line

Figure

RUCS

Printed: 12/11/2020 09:14

Uniaxial Compressive Strength Of Rock - Summary of Results

Hole No.	Sample				Rock Type	Specimen Dimensions [2]			Bulk Density [2]	Water Content [1]	Uniaxial Compression [3]				Remarks
	No.	Depth (m)		type		Dia.	Height	H/D			Stress Rate	Time to failure	Mode of failure	UCS	
		from	to			mm	mm		Mg/m 3	%	MPa/s	secs		MPa	
XC219-CPRC01		8.00	9.50	C	LIMESTONE	75.0	186.5	2.5	2.63	0.2	0.1	468	axial cleavage	36.9	
XC219-CPRC06		8.30	9.80	C	LIMESTONE	75.6	207.0	2.7	2.68	0.1	0.1	323	axial cleavage	50.2	
XC219-CPRC07		6.70	8.20	C	LIMESTONE	75.0	207.1	2.8	2.68	0.1	0.2	380	axial cleavage	60.5	

Notes :

Test Specification : International Society for Rock Mechanics, The complete ISRM suggested methods for Rock Characterization Testing and Monitoring, 2007

1 ISRM p87 test 1, water content at 105 ± 3 oC, specimen as received at the laboratory

2 ISRM p86 clause (vii), Caliper method used for determination of bulk volume and derivation of bulk density

3 ISRM p153 part 1, determination of Uniaxial Compressive Strength (UCS) of Rock Materials

above notes apply unless annotated otherwise in the remarks

Mode of failure :

S - Single shear MS - multiple shear

AC - Axial cleavage F - Fragmented

QA Ref
RLR 2
Rev 2.19
Apr 19

UKAS TESTING
0001

SOCOTEC

Project No N9435-20

Project Name Cork Line Level Crossings

Figure

RUCS

Printed: 04/11/2020 11:35

Uniaxial Compressive Strength Of Rock - Summary of Results

Hole No.	Sample				Rock Type	Specimen Dimensions [2]			Bulk Density [2]	Water Content [1]	Uniaxial Compression [3]				Remarks
	No.	Depth (m)		type		Dia.	Height	H/D			Stress Rate	Time to failure	Mode of failure	UCS	
		from	to			mm	mm		Mg/m 3	%	MPa/s	secs		MPa	
XC219-CPRC08		5.40	6.90	C	SILTSTONE	75.5	172.5	2.3	2.69	0.1	0.1	246	axial cleavage	37.5	Outside ISRM Specification. Tested between 6.48-6.82m
XC219-CPRC08		6.90	8.40	C	SILTSTONE	75.4	205.8	2.7	2.69	0.3	0.1	393	axial cleavage	61	

Notes :

Test Specification : International Society for Rock Mechanics, The complete ISRM suggested methods for Rock Characterization Testing and Monitoring, 2007

1 ISRM p87 test 1, water content at 105 ± 3 oC, specimen as received at the laboratory

2 ISRM p86 clause (vii), Caliper method used for determination of bulk volume and derivation of bulk density

3 ISRM p153 part 1, determination of Uniaxial Compressive Strength (UCS) of Rock Materials

above notes apply unless annotated otherwise in the remarks

Mode of failure :

S - Single shear MS - multiple shear

AC - Axial cleavage F - Fragmented

QA Ref
RLR 2
Rev 2.19
Apr 19

UKAS TESTING
0001

SOCOTEC

Project No N9436-20

Project Name Cork Line Level Crossings

Figure

RUCS

Printed: 04/11/2020 08:11

Certificate of Analysis

Certificate Number	20-19523	16-Oct-20
Client	Socotec - Geotechnical Lab Askern Road Doncaster DN6 8DG	

Our Reference	20-19523
Client Reference	N9366-20
Order No	N20-O-2198
Contract Title	Irish Rail- Cork Line
Description	13 Concrete samples.
Date Received	06-Oct-20
Date Started	06-Oct-20
Date Completed	16-Oct-20
Test Procedures	Identified by prefix DETSn (details on request).
Notes	Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Adam Fenwick
Contracts Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Concrete Samples

Our Ref 20-19523
Client Ref N9366-20
Contract Title Irish Rail- Cork Line

				Lab No	1738512	1738513	1738514	1738515	1738516	1738517	1738518	1738519	1738520	1738521	1738522
				Sample ID	XC219-CPRC02	XC219-CPRC02	XC219-CPRC02	XC219-CPRC03	XC219-CPRC03	XC219-CPR203	XC219-CPRC04	XC219-CPRC04	XC219-CPR204	XC219-CPRC05	XC219-CPRC05
				Depth	3.90-4.00	11.85-12.40	14.62-14.78	6.75-6.90	8.00-8.13	9.25-9.30	3.70-3.88	6.70-7.02	2.70-2.80	3.00-3.20	5.10-5.50
				Other ID											
				Sample Type	ES	ES	ES	ES	ES	ES	ES	ES	ES	ES	ES
				Sampling Date	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
				Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**												
Inorganics															
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l		750	77	61	15	12	12	17	34	34	23	45
Sulphate, Total Potential as SO4	*	0.03	%		0.27	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.09	0.05	0.04	0.03
Sulphide, Oxidisable as SO4	*	0.01	%		0.12	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.06	0.03	0.02	< 0.01
Sulphur as S, Total	DETSC 2320	0.01	%		0.09	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.03	0.02	0.01	0.01
Sulphate as SO4, Total	DETSC 2321#	0.01	%		0.15	0.03	0.03	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.03
Sulphate as SO4, Total	DETSC 2321#	100	mg/kg		1510	310	253	213	189	159	211	323	191	237	259

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Concrete Samples

Our Ref 20-19523
Client Ref N9366-20
Contract Title Irish Rail- Cork Line

			Lab No	1738523	1738524
			Sample ID	XC219-CPRC05	XC219-CPRC05
			Depth	8.75	11.30-11.40
			Other ID		
			Sample Type	ES	ES
			Sampling Date	n/s	n/s
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Inorganics					
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	76	1300
Sulphate, Total Potential as SO4	*	0.03	%	0.06	0.59
Sulphide, Oxidisable as SO4	*	0.01	%	0.03	0.16
Sulphur as S, Total	DETSC 2320	0.01	%	0.02	0.20
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.03	0.43
Sulphate as SO4, Total	DETSC 2321#	100	mg/kg	310	4300

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Information in Support of the Analytical Results

Our Ref 20-19523
Client Ref N9366-20
Contract Irish Rail- Cork Line

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1738512	XC219-CPRC02 3.90-4.00 CONCRETE		PG	Sample date not supplied	
1738513	XC219-CPRC02 11.85-12.40 CONCRETE		PG	Sample date not supplied	
1738514	XC219-CPRC02 14.62-14.78 CONCRETE		PG	Sample date not supplied	
1738515	XC219-CPRC03 6.75-6.90 CONCRETE		PG	Sample date not supplied	
1738516	XC219-CPRC03 8.00-8.13 CONCRETE		PG	Sample date not supplied	
1738517	XC219-CPR203 9.25-9.30 CONCRETE		PG	Sample date not supplied	
1738518	XC219-CPRC04 3.70-3.88 CONCRETE		PG	Sample date not supplied	
1738519	XC219-CPRC04 6.70-7.02 CONCRETE		PG	Sample date not supplied	
1738520	XC219-CPR204 2.70-2.80 CONCRETE		PG	Sample date not supplied	
1738521	XC219-CPRC05 3.00-3.20 CONCRETE		PG	Sample date not supplied	
1738522	XC219-CPRC05 5.10-5.50 CONCRETE		PG	Sample date not supplied	
1738523	XC219-CPRC05 8.75 CONCRETE		PG	Sample date not supplied	
1738524	XC219-CPRC05 11.30-11.40 CONCRETE		PG	Sample date not supplied	

Key: P-Plastic G-Bag

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report

Appendix J Environmental Laboratory Test Results

Environmental Chemistry
SOCOTEC UK
Ashby Rd, Bretby,
Burton-on-Trent, UK
DE15 0YZ

Certificate of Analysis

Project No: 20071478

Client: OCB Geotechnical Limited

Quote Number: BEC200710078

Project Reference: Irish Rail - Cork Line

Site Name: 19-135

Contact: Ian Holley

Address: Unit 1
Carrigogna
Midleton
County Cork

Post Code: Ireland

E-Mail: iholley@ocbgeotechnical.com

Phone No: 021 4638474

Number of Samples Received: 2

Date Received: 30/07/2020

Analysis Date: 11/08/2020

Date Issued: 11/08/2020

Job Status: Complete

Report Type: Final Version 01

This report supersedes any versions previously issued by the laboratory

Account Manager

Martin Elliott-Palmer

Authorised by the Operations Manager
Becky Batham

Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

Samples Analysed

Sample Reference	Text ID	Sample Date	Sample Type
XC219-TP01-4-ES-0.50-0.50	20071478-007	03/07/2020 17:00:00	SOLID

Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

Analysis Results

				Project ID		20071478		
				Sample ID		007		
				Customer ID		XC219-TP01-4-ES-0.50-0.50		
				Sample Type		LPL	SOLID	
				Sampling Date		03/07/2020	03/07/2020	
Analysis	Method Code	MDL	Units	Accred				
>C6-C8 Aliphatic	GROHSA/BTEXHSA	0.1	mg/l	N		<0.100		
>C7-C8 Aromatic	GROHSA/BTEXHSA	0.005	mg/l	N		<0.005		
>C8-C10 Aliphatic	GROHSA/BTEXHSA	0.1	mg/l	N		<0.100		
>C8-C10 Aromatic	GROHSA/BTEXHSA	0.02	mg/l	N		<0.020		
C5-C6 Aliphatic	GROHSA/BTEXHSA	0.1	mg/l	N		<0.100		
C5-C7 Aromatic	GROHSA/BTEXHSA	0.005	mg/l	N		<0.005		
Total GRO	GROHSA/BTEXHSA	0.1	mg/l	U		<0.100		
Free Cyanide	SFAPI	0.02	mg/l	U		<0.02		
Arsenic as As	ICPMSW (Dissolved)	0.001	mg/l	U		<0.001		
Cadmium as Cd	ICPMSW (Dissolved)	0.00002	mg/l	U		<0.00002		
Total Chromium as Cr	ICPMSW (Dissolved)	0.001	mg/l	U		<0.001		
Copper as Cu	ICPMSW (Dissolved)	0.001	mg/l	U		<0.001		
Lead as Pb	ICPMSW (Dissolved)	0.001	mg/l	U		<0.001		
Mercury as Hg	ICPMSW (Dissolved)	0.00003	mg/l	U		<0.00003		
Nickel as Ni	ICPMSW (Dissolved)	0.001	mg/l	U		<0.001		
Selenium as Se	ICPMSW (Dissolved)	0.001	mg/l	U		<0.001		
Vanadium as V	ICPMSW (Dissolved)	0.001	mg/l	U		<0.001		
Zinc as Zn	ICPMSW (Dissolved)	0.002	mg/l	U		0.003		
Barium as Ba	ICPWATVAR (Dissolved)	0.01	mg/l	U		<0.01		
Beryllium as Be	ICPWATVAR (Dissolved)	0.01	mg/l	N		<0.01		
Boron as B	ICPWATVAR (Dissolved)	0.01	mg/l	U		<0.01		
Benzene	BTEXHSA	5	µg/l	N		<5		
Ethylbenzene	BTEXHSA	5	µg/l	N		<5		
m/p-Xylene	BTEXHSA	10	µg/l	N		<10		
o-Xylene	BTEXHSA	5	µg/l	N		<5		

UKAS TESTING
1252

Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

Analysis Results

				Project ID		20071478		
				Sample ID		007		
				Customer ID		XC219-TP01-4-ES-0.50-0.50		
				Sample Type		LPL	SOLID	
				Sampling Date		03/07/2020	03/07/2020	
Analysis	Method Code	MDL	Units	Accred				
Toluene	BTEXHSA	5	µg/l	N		<5		
Acenaphthene	PAHMSW	0.01	µg/l	U		<0.02		
Acenaphthylene	PAHMSW	0.01	µg/l	U		<0.02		
Anthracene	PAHMSW	0.01	µg/l	U		<0.02		
Benzo[a]anthracene	PAHMSW	0.01	µg/l	U		<0.02		
Benzo[a]pyrene	PAHMSW	0.01	µg/l	U		<0.02		
Benzo[b]fluoranthene	PAHMSW	0.01	µg/l	U		<0.02		
Benzo[g,h,i]perylene	PAHMSW	0.01	µg/l	U		<0.02		
Benzo[k]fluoranthene	PAHMSW	0.01	µg/l	U		<0.02		
Chrysene	PAHMSW	0.01	µg/l	U		<0.02		
Dibenzo[a,h]anthracene	PAHMSW	0.01	µg/l	U		<0.02		
Fluoranthene	PAHMSW	0.01	µg/l	U		<0.02		
Fluorene	PAHMSW	0.01	µg/l	U		<0.02		
Indeno[1,2,3-cd]pyrene	PAHMSW	0.01	µg/l	U		<0.02*		
Naphthalene	PAHMSW	0.01	µg/l	U		0.22		
Phenanthrene	PAHMSW	0.01	µg/l	U		<0.02		
Pyrene	PAHMSW	0.01	µg/l	U		<0.02		
Total PAH 16	PAHMSW	0.16	µg/l	U		<0.47		
>C10-C12 (Aliphatic)	TPHFID (Aliphatic)	0.01	mg/l	U		0.14		
>C12-C16 (Aliphatic)	TPHFID (Aliphatic)	0.01	mg/l	U		<0.02		
>C16-C21 (Aliphatic)	TPHFID (Aliphatic)	0.01	mg/l	U		0.05		
>C21-C35 (Aliphatic)	TPHFID (Aliphatic)	0.01	mg/l	U		0.05		
>C35-C44 (Aliphatic)	TPHFID (Aliphatic)	0.01	mg/l	N		<0.02		
Total TPH (Aliphatic)	TPHFID (Aliphatic)	0.01	mg/l	U		<0.02		
>C10-C12 (Aromatic)	TPHFID (Aromatic)	0.01	mg/l	U		<0.02		

UKAS TESTING 1252

Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

Analysis Results

					Project ID	20071478		
					Sample ID		007	
					Customer ID		XC219-TP01-4-ES-0.50-0.50	
					Sample Type		LPL	SOLID
					Sampling Date		03/07/2020	03/07/2020
Analysis	Method Code	MDL	Units	Accred				
>C12-C16 (Aromatic)	TPHFID (Aromatic)	0.01	mg/l	U			<0.02	
>C16-C21 (Aromatic)	TPHFID (Aromatic)	0.01	mg/l	U			<0.02	
>C21-C35 (Aromatic)	TPHFID (Aromatic)	0.01	mg/l	U			0.05	
>C35-C44 (Aromatic)	TPHFID (Aromatic)	0.01	mg/l	N			<0.02	
Total TPH (Aromatic)	TPHFID (Aromatic)	0.01	mg/l	U			0.08	
Benzene	VOCHSAW	1	µg/l	N			<1	
Ethylbenzene	VOCHSAW	1	µg/l	N			<1	
m and p-Xylene	VOCHSAW	1	µg/l	N			<1	
MTBE	VOCHSAW	1	µg/l	N			<1	
o-Xylene	VOCHSAW	1	µg/l	N			<1	
Toluene	VOCHSAW	1	µg/l	N			<1	
Equivalent Weight of Dry Material (kg)	Leachate Preparation CEN 10:1		kg	N				0.090
Fraction above 4mm (%)	Leachate Preparation CEN 10:1		%	N				0
Fraction of non-crushable material (%)	Leachate Preparation CEN 10:1		%	N				0
Volume of Water for 10:1 Leach (ltr)	Leachate Preparation CEN 10:1		l	N				0.865
Weight of Sample Leached (kg)	Leachate Preparation CEN 10:1		kg	N				0.125

UKAS TESTING
1252

Report Number :

Additional Report Notes

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report
TPHFID-SI	001,003,005 007	Due to a limited amount of sample, a lower volume was used to complete the analysis. This resulted in a raised detection limit for these samples.
PAHMSW	001,003,005 ,007	The Primary process control data associated with this Test has not wholly met the requirements of the Laboratory Quality Management System QMS with one or more target analytes falling outside acceptable limits. However the remaining data gives the Laboratory confidence that the test has performed satisfactorily and that the validity of the data may not have been significantly affected. However in line with our QMS policy we have removed accreditation, where applicable, from the affected analytes (Indeno[1,2,3-cd[pyrene) . These circumstances should be taken into consideration when utilising the data.
PAHMSW	001,003,005 ,007	Due to a limited amount of sample, a lower volume was used to complete the analysis. This resulted in a raised detection limit for these samples.

LIMS-F002 - Report Notes

Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

Deviating Sample Report

Sample Reference	Text ID	Reported Name	Incorrect Container	Incorrect Label	Headspace	Incorrect/No Preservative	No Sampling Date	Holding Time	Handling Time

Analysis Method

Analysis	Analysis Type	Analysis Method
BTEXHSA	ORGANIC	UNFILTERED
GROHSA	ORGANIC	UNFILTERED
ICPMSW (Dissolved)	METALS	FILTERED
ICPWATVAR (Dissolved)	METALS	FILTERED
Leachate Preparation CEN 10:1	PHYS	As Received
PAHMSW	ORGANIC	FILTERED
SFAPI	INORGANIC	FILTERED
TPHFID (Aliphatic)	ORGANIC	FILTERED
TPHFID (Aromatic)	ORGANIC	FILTERED
VOCHSAW	ORGANIC	UNFILTERED

Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

Additional Information

This report refers to samples as received, and SOCOTEC Uk Ltd takes no responsibility for accuracy or competence of sampling by others.

Results within this report relate only to the samples tested.

In the accreditation column of analysis report the codes are as follows:

U = UKAS accredited analysis
M = MCERT accredited analysis
N = Unaccredited analysis

Any units marked with ^ signify results are reported on a dry weight basis of 105° C

All Air Dried and Ground Samples (ADG) are oven dried at less than 35° C.

This report shall not be reproduced except in full and with approval from the laboratory.

Opinions and interpretations given are outside the scope of our UKAS accreditation.

Any samples marked with * are not covered by our scope of UKAS accreditation, if applicable further report notes have been added.

Any solid samples where the Major Constituents are not one of the following (Sand, Silt, Clay, Made Ground) are not one of our accredited matrix types.

Any samples marked with ‡ have had MCERTS accreditation removed for this result

Any samples marked with a tick in the deviant table is deviant for the specific reason.

Any samples reported as IS, NA, ND mean the following:

IS = Insufficient Sample to complete analysis
NA = Sample is not amenable for the required analysis
ND = Results cannot be determined

Our deviating sample report does not include deviancy information for Subcontracted analysis. Please see the report from the Subcontracted lab for information regarding any deviancies for this analysis.

End of Certificate of Analysis

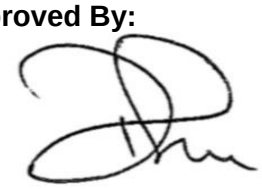
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	20-07190-1
Initial Date of Issue:	11-Mar-2020
Client	Environmental Laboratory Services Ltd
Client Address:	Acorn Business Campus Mahon Industrial Park Blackrock Cork Ireland
Contact(s):	Emer Kearney Results
Project	Soil Testing

Quotation No.:	Q20-19728	**Date Received:**	05-Mar-2020
Order No.:	6881	**Date Instructed:**	05-Mar-2020
No. of Samples:	2		
Turnaround (Wkdays):	5	**Results Due:**	11-Mar-2020
Date Approved:	11-Mar-2020		

Approved By:



Details: Darrell Hall, Director

Chemtest
The right chemistry to deliver results

Results - Leachate

Project: Soil Testing

Client: Environmental Laboratory Services Ltd				**Chemtest Job No.:**		20-07190	20-07190		
Quotation No.: Q20-19728				**Chemtest Sample ID.:**		981247	981248		
Order No.: 6881				Client Sample Ref.:		176306/001	176306/002		
				Client Sample ID.:		1.0m	0.05m		
				Sample Location:		TP02	TP02		
				Sample Type:		SOIL	SOIL		
				Date Sampled:		17-Feb-2020	17-Feb-2020		
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**				
pH	U	1010	10:1		N/A	8.7	8.1		
Cyanide (Free)	U	1300	10:1	mg/l	0.050	< 0.050	< 0.050		
Arsenic (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0		
Boron (Dissolved)	U	1450	10:1	µg/l	20	< 20	< 20		
Barium (Dissolved)	U	1450	10:1	µg/l	5.0	< 5.0	< 5.0		
Beryllium (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0		
Cadmium (Dissolved)	U	1450	10:1	µg/l	0.080	< 0.080	< 0.080		
Chromium (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0		
Copper (Dissolved)	U	1450	10:1	µg/l	1.0	1.1	1.9		
Mercury (Dissolved)	U	1450	10:1	µg/l	0.50	< 0.50	< 0.50		
Nickel (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0		
Lead (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0		
Selenium (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0		
Vanadium (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0		
Zinc (Dissolved)	U	1450	10:1	µg/l	1.0	2.2	< 1.0		
Aliphatic TPH >C5-C6	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10		
Aliphatic TPH >C6-C8	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10		
Aliphatic TPH >C8-C10	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10		
Aliphatic TPH >C10-C12	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10		
Aliphatic TPH >C12-C16	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10		
Aliphatic TPH >C16-C21	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10		
Aliphatic TPH >C21-C35	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10		
Aliphatic TPH >C35-C44	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10		
Total Aliphatic Hydrocarbons	N	1675	10:1	µg/l	5.0	[B] < 5.0	[B] < 5.0		
Aromatic TPH >C5-C7	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10		
Aromatic TPH >C7-C8	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10		
Aromatic TPH >C8-C10	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10		
Aromatic TPH >C10-C12	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10		
Aromatic TPH >C12-C16	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10		
Aromatic TPH >C16-C21	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10		
Aromatic TPH >C21-C35	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10		
Aromatic TPH >C35-C44	N	1680	10:1	µg/l	50.00	[B] < 50	[B] < 50		
Total Aromatic Hydrocarbons	N	1675	10:1	µg/l	5.0	[B] < 5.0	[B] < 5.0		
Total Petroleum Hydrocarbons	N	1675	10:1	µg/l	10	[B] < 10	[B] < 10		
Benzene	U	1760	10:1	µg/l	1.0	[B] < 1.0	[B] < 1.0		
Toluene	U	1760	10:1	µg/l	1.0	[B] < 1.0	[B] < 1.0		
Ethylbenzene	U	1760	10:1	µg/l	1.0	[B] < 1.0	[B] < 1.0		
m & p-Xylene	U	1760	10:1	µg/l	1.0	[B] < 1.0	[B] < 1.0		

Chemtest
The right chemistry to deliver results

Results - Leachate

Project: Soil Testing

Client: Environmental Laboratory Services Ltd				**Chemtest Job No.:**		20-07190	20-07190		
Quotation No.: Q20-19728				**Chemtest Sample ID.:**		981247	981248		
Order No.: 6881				Client Sample Ref.:		176306/001	176306/002		
				Client Sample ID.:		1.0m	0.05m		
				Sample Location:		TP02	TP02		
				Sample Type:		SOIL	SOIL		
				Date Sampled:		17-Feb-2020	17-Feb-2020		
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**				
o-Xylene	U	1760	10:1	µg/l	1.0	[B] < 1.0	[B] < 1.0		
Methyl Tert-Butyl Ether	N	1760	10:1	µg/l	1.0	[B] < 1.0	[B] < 1.0		
Naphthalene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10		
Acenaphthylene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10		
Acenaphthene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10		
Fluorene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10		
Phenanthrene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10		
Anthracene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10		
Fluoranthene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10		
Pyrene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10		
Benzo[a]anthracene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10		
Chrysene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10		
Benzo[b]fluoranthene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10		
Benzo[k]fluoranthene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10		
Benzo[a]pyrene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10		
Indeno(1,2,3-c,d)Pyrene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10		
Dibenz(a,h)Anthracene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10		
Benzo[g,h,i]perylene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10		
Total Of 16 PAH's	U	1800	10:1	µg/l	2.0	< 2.0	< 2.0		

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
981247	176306/001	1	TP02	17-Feb-2020	B	Amber Glass 250ml
981247	176306/001	1	TP02	17-Feb-2020	B	Plastic Tub 500g
981248	176306/002	2	TP02	17-Feb-2020	B	Amber Glass 250ml
981248	176306/002	2	TP02	17-Feb-2020	B	Plastic Tub 500g

Chemtest
The right chemistry to deliver results

Test Methods

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection
1680	Extractable Petroleum Hydrocarbons	Aliphatics: >C5–C6, >C6–C8, >C8– C10*, >C10–C12*, >C12–C16*, >C16–C21*, >C21–C35*, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10*, >C10–C12*, >C12–C16*, >C16–C21*, >C21– C35*, >C35– C44	Dichloromethane extraction / GCxGC FID detection
1760	Volatile Organic Compounds (VOCs) in Waters by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics. (cf. USEPA Method 8260)	Automated headspace gas chromatographic (GC) analysis of water samples with mass spectrometric (MS) detection of volatile organic compounds.
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

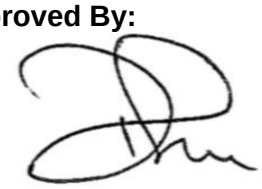
UKAS TESTING
2183

Final Report

Report No.:	20-07165-1
Initial Date of Issue:	12-Mar-2020
Client	Environmental Laboratory Services Ltd
Client Address:	Acorn Business Campus Mahon Industrial Park Blackrock Cork Ireland
Contact(s):	Emer Kearney Results
Project	Soil Samples

Quotation No.:	Q20-19728	**Date Received:**	05-Mar-2020
Order No.:	6897	**Date Instructed:**	05-Mar-2020
No. of Samples:	4		
Turnaround (Wkdays):	5	**Results Due:**	11-Mar-2020
Date Approved:	12-Mar-2020		

Approved By:



Details: Darrell Hall, Director

Chemtest
The right chemistry to deliver results

Results - Leachate

Project: Soil Samples

Client: Environmental Laboratory Services Ltd					**Chemtest Job No.:**	20-07165	20-07165			20-07165	20-07165
Quotation No.: Q20-19728					**Chemtest Sample ID.:**	981120	981121			981124	981125
Order No.: 6897					Client Sample Ref.:	176540/001	176540/002			176540/005	176540/006
					Client Sample ID.:	1	2			5	6
					Sample Location:	XC219-CPRC04	XC219-CPRC04			XC219-CP01	XC219-CP01
					Sample Type:	SOIL	SOIL			SOIL	SOIL
					Top Depth (m):	0.05	1.00			0.05	1.00
					Date Sampled:	20-Feb-2020	20-Feb-2020			27-Feb-2020	28-Feb-2020
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**						
pH	U	1010	10:1		N/A	8.9	8.8			8.9	8.8
Cyanide (Free)	U	1300	10:1	mg/l	0.050	< 0.050	< 0.050			< 0.050	< 0.050
Arsenic (Dissolved)	U	1450	10:1	µg/l	1.0	1.0	< 1.0			< 1.0	< 1.0
Boron (Dissolved)	U	1450	10:1	µg/l	20	< 20	< 20			< 20	< 20
Barium (Dissolved)	U	1450	10:1	µg/l	5.0	< 5.0	< 5.0			7.3	< 5.0
Beryllium (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0			< 1.0	< 1.0
Cadmium (Dissolved)	U	1450	10:1	µg/l	0.080	< 0.080	< 0.080			< 0.080	< 0.080
Chromium (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0			< 1.0	< 1.0
Copper (Dissolved)	U	1450	10:1	µg/l	1.0	1.0	< 1.0			1.2	1.2
Mercury (Dissolved)	U	1450	10:1	µg/l	0.50	< 0.50	< 0.50			0.66	< 0.50
Nickel (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0			< 1.0	< 1.0
Lead (Dissolved)	U	1450	10:1	µg/l	1.0	1.0	< 1.0			< 1.0	< 1.0
Selenium (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0			2.1	1.4
Vanadium (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0			< 1.0	< 1.0
Zinc (Dissolved)	U	1450	10:1	µg/l	1.0	1.1	< 1.0			< 1.0	< 1.0
Aliphatic TPH >C5-C6	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10			< 0.10	< 0.10
Aliphatic TPH >C6-C8	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10			< 0.10	< 0.10
Aliphatic TPH >C8-C10	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10			< 0.10	< 0.10
Aliphatic TPH >C10-C12	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10			< 0.10	< 0.10
Aliphatic TPH >C12-C16	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10			< 0.10	28
Aliphatic TPH >C16-C21	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10			< 0.10	350
Aliphatic TPH >C21-C35	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10			< 0.10	3300
Aliphatic TPH >C35-C44	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10			< 0.10	< 0.10
Total Aliphatic Hydrocarbons	N	1675	10:1	µg/l	5.0	< 5.0	< 5.0			< 5.0	3700
Aromatic TPH >C5-C7	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10			< 0.10	< 0.10
Aromatic TPH >C7-C8	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10			< 0.10	< 0.10
Aromatic TPH >C8-C10	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10			< 0.10	< 0.10
Aromatic TPH >C10-C12	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10			< 0.10	< 0.10
Aromatic TPH >C12-C16	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10			< 0.10	< 0.10
Aromatic TPH >C16-C21	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10			< 0.10	< 0.10
Aromatic TPH >C21-C35	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10			< 0.10	< 0.10
Aromatic TPH >C35-C44	N	1680	10:1	µg/l	50.00	< 50	< 50			< 50	< 50
Total Aromatic Hydrocarbons	N	1675	10:1	µg/l	5.0	< 5.0	< 5.0			< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	1675	10:1	µg/l	10	< 10	< 10			< 10	3700
Benzene	U	1760	10:1	µg/l	1.0	< 1.0	< 1.0			< 1.0	< 1.0
Toluene	U	1760	10:1	µg/l	1.0	< 1.0	< 1.0			< 1.0	< 1.0
Ethylbenzene	U	1760	10:1	µg/l	1.0	< 1.0	< 1.0			< 1.0	< 1.0

Chemtest
The right chemistry to deliver results

Results - Leachate

Project: Soil Samples

Client: Environmental Laboratory Services Ltd						**Chemtest Job No.:**	20-07165	20-07165			20-07165	20-07165
Quotation No.: Q20-19728						**Chemtest Sample ID.:**	981120	981121			981124	981125
Order No.: 6897						Client Sample Ref.:	176540/001	176540/002			176540/005	176540/006
						Client Sample ID.:	1	2			5	6
						Sample Location:	XC219-CPRC04	XC219-CPRC04			XC219-CP01	XC219-CP01
						Sample Type:	SOIL	SOIL			SOIL	SOIL
						Top Depth (m):	0.05	1.00			0.05	1.00
						Date Sampled:	20-Feb-2020	20-Feb-2020			27-Feb-2020	28-Feb-2020
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**							
m & p-Xylene	U	1760	10:1	µg/l	1.0		< 1.0	< 1.0			< 1.0	< 1.0
o-Xylene	U	1760	10:1	µg/l	1.0		< 1.0	< 1.0			< 1.0	< 1.0
Methyl Tert-Butyl Ether	N	1760	10:1	µg/l	1.0		< 1.0	< 1.0			< 1.0	< 1.0
Naphthalene	U	1800	10:1	µg/l	0.10		< 0.10	< 0.10			< 0.10	< 0.10
Acenaphthylene	U	1800	10:1	µg/l	0.10		< 0.10	< 0.10			< 0.10	< 0.10
Acenaphthene	U	1800	10:1	µg/l	0.10		< 0.10	< 0.10			< 0.10	< 0.10
Fluorene	U	1800	10:1	µg/l	0.10		< 0.10	< 0.10			< 0.10	< 0.10
Phenanthrene	U	1800	10:1	µg/l	0.10		< 0.10	< 0.10			< 0.10	< 0.10
Anthracene	U	1800	10:1	µg/l	0.10		< 0.10	< 0.10			< 0.10	< 0.10
Fluoranthene	U	1800	10:1	µg/l	0.10		< 0.10	< 0.10			< 0.10	< 0.10
Pyrene	U	1800	10:1	µg/l	0.10		< 0.10	< 0.10			< 0.10	< 0.10
Benzo[a]anthracene	U	1800	10:1	µg/l	0.10		< 0.10	< 0.10			< 0.10	< 0.10
Chrysene	U	1800	10:1	µg/l	0.10		< 0.10	< 0.10			< 0.10	< 0.10
Benzo[b]fluoranthene	U	1800	10:1	µg/l	0.10		< 0.10	< 0.10			< 0.10	< 0.10
Benzo[k]fluoranthene	U	1800	10:1	µg/l	0.10		< 0.10	< 0.10			< 0.10	< 0.10
Benzo[a]pyrene	U	1800	10:1	µg/l	0.10		< 0.10	< 0.10			< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1800	10:1	µg/l	0.10		< 0.10	< 0.10			< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	1800	10:1	µg/l	0.10		< 0.10	< 0.10			< 0.10	< 0.10
Benzo[g,h,i]perylene	U	1800	10:1	µg/l	0.10		< 0.10	< 0.10			< 0.10	< 0.10
Total Of 16 PAH's	U	1800	10:1	µg/l	2.0		< 2.0	< 2.0			< 2.0	< 2.0

Chemtest
The right chemistry to deliver results

Test Methods

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection
1680	Extractable Petroleum Hydrocarbons	Aliphatics: >C5–C6, >C6–C8, >C8– C10*, >C10–C12*, >C12–C16*, >C16–C21*, >C21–C35*, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10*, >C10–C12*, >C12–C16*, >C16–C21*, >C21– C35*, >C35– C44	Dichloromethane extraction / GCxGC FID detection
1760	Volatile Organic Compounds (VOCs) in Waters by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics. (cf. USEPA Method 8260)	Automated headspace gas chromatographic (GC) analysis of water samples with mass spectrometric (MS) detection of volatile organic compounds.
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Appendix K Geophysical Survey Report

XC219 Buttevant Level Crossing

Co. Cork

Geophysical Survey

Report Status: Final

MGX Project Number: 6508

MGX File Ref: 6508f-005.doc

9th November 2020

Confidential Report To:

OCB Geotechnical
Unit 11
Carrigogna
Midleton
Co. Cork

Report submitted by :
Minerex Geophysics Limited

Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare, W23X7Y5
Ireland
Tel.: 01-6510030
Email: info@mgx.ie

Issued by:

Author: Hartmut Krahn (Senior Geophysicist)

Reviewer: John Connaughton (Geophysicist)

Minerex Geophysics Limited

Subsurface Geophysical Investigations

EXECUTIVE SUMMARY

1. Minerex Geophysics Ltd. (MGX) carried out a geophysical survey consisting of 2D-Resistivity profiles at the proposed bridge development at the Buttevant Level Crossing XC219, Co Cork.
2. The main objectives of the survey were to determine the ground conditions and to check for the presence of karst features and karstified rock.
3. The ground model presented here shows clay-rich overburden over karstifiable limestone. The limestone is described as weathered karstified limestone and fresh compact limestone.
4. The interpretation shows that the rock quality is generally better and the rock is shallower on the east side of the railway. On the west side the rock is more weathered and karstified and also generally deeper.
5. Core holes 6 and 7 were targeted here on the west side where profiles R1 to R4 cross each other. This area seems quite complex, contains the clay-filled cavity found in core hole 3 and also might contain further karst features. The core hole show deep weathered or karstified rock.
6. At the eastern end of R6 from 85 to 106 m distance some localised weathered karstified limestone has been interpreted.
7. At the end of profiles R3 and R4 (105 m distance) could be the transition to the better limestone interpreted on the eastern side of the railway. Bore hole 8 was done here and it still shows some weathered rock but also generally better RQD values.
8. 2D-Resistivity profiles across the railway line could be carried out to image the area close to the railway line and below it
9. This final report was reviewed after targeted core hole information became available.

CONTENTS

List of Tables, Maps and Figures:

1. INTRODUCTION

1.1 Background

Minerex Geophysics Ltd. (MGX) carried out a geophysical survey at the XC219 Buttevant Level Crossing as a part of the Cork Line Level Crossings Project. It is proposed to replace the level crossing by a road-over-rail bridge. The survey was commissioned by OCB Geotechnical.

The role of geophysics as a non-destructive fast method is to allow later targeted direct investigations. Those results can be used to improve the initial results and interpretation.

The survey was aimed both at investigating the ground conditions and identifying any possible karst features.

Recommendations for targeted borehole were made after the draft report, and the results of targeted boreholes, where they were done, are included in this final report versions.

1.2 Objectives

The main objectives of the geophysical survey were:

- To determine the ground conditions under the site
- To detect lateral changes within the geological layers
- To detect possible karst features and karstified rock

1.3 Site Description

The site is located at the Level Crossing to the west of Buttevant, Co. Cork. The survey area is on both sides of the railway in relatively level fields. On the east side of the railway is a yard with gravel surface cover, on the west side is a derelict railway station building and a strip of protected vegetation.

1.4 Geology

Several cable percussive and rotary core holes had been carried out before this survey and they describe the geology as gravelly clay over limestone bedrock. The limestone shows sign of karstification, especially at core hole 3 where a clay filled cavity was found. The boreholes are shown on Map 1 and the abbreviated boreholes logs are indicated on the figures.

The bedrock geological map (GSI, 2020) indicates that the site is underlain by the Hazelwood Limestone Formation, described as pale-grey massive mud-grade limestone. This formation is liable to karstification and karst features have been mapped in the general area of Buttevant.

The main fault direction in the area is S to N and WSW to ENE though no fault has been mapped under the site.

1.5 Report

This report includes the results and interpretation of the geophysical survey. Maps, figures and tables are included to illustrate the results of the survey. More detailed descriptions of geophysical methods and measurements can be found in GSEG (2002), Milsom (1989) and Reynolds (1997).

The digital map provided by the client was used for reference as the background map (Map 1).

The interpretative nature and the non-invasive survey methods must be taken into account when considering the results of this survey and Minerex Geophysics Limited, while using appropriate practice to execute, interpret and present the data, give no guarantees in relation to the existing subsurface.

2. GEOPHYSICAL SURVEY

2.1 Methodology

The methodology was outlined in the tender documents and consisted of 2D-Resistivity profiles on the lines given by the engineers.

The survey locations are indicated on Map 1. The profiles and parameters are tabulated in Table 1 below.

All geophysical surveys are acquired, processed and reported in accordance with British Standards BS 5930:1999 +A2:2010 'Code of Practice for Site Investigations'.

Table 1: Geophysical Survey Locations and Acquisition Parameters

Profile Name	**Electrode Spacing/m**	**Number of Electrodes**	**Profile Length/m**
R1	3	36	105
R2	3	32	93
R3	3	41	120
R4	3	42	123
R5	3	36	105
R6	3	43	126
SUM			**672**

2.2 2D-Resistivity

2D-Resistivity profiles were surveyed with electrode spacing of 3 m, up to 43 electrodes per set-up and a maximum length of 126 m per profile. The readings were taken with a Tigre Resistivity Meter, Imager Cables, stainless steel electrodes, laptop and ImagerPro acquisition software.

During 2D-Resistivity surveying data is acquired in the form of linear profiles using a suite of metal electrodes. A current is injected into the ground via a pair of electrodes while a potential difference is measured across a second pair of electrodes. This allows for the recording of the apparent resistivity in a two-dimensional arrangement below the profile. The data is inverted after the survey to obtain a model of subsurface resistivities. The generated model resistivity values and their spatial distribution can then be related to typical values for different geological materials.

2D-Resistivity has previously proven zones of anomalous or karstified rock with lateral extents of 5 m and more.

2.3 Site Work

The data acquisition was carried out on the 18th of June 2020. The weather conditions were variable throughout the acquisition period. Health and safety standards were adhered to at all times. The electrode locations were surveyed with a Carlson NR3 RTK-GPS to accuracy < 0.05 m.

3. RESULTS AND INTERPRETATION

The interpretation of geophysical data was carried out utilising the known response of geophysical measurements, typical physical parameters for subsurface features that may underlay the site, and the experience of the authors. The interpretation is based solely on the 2D-Resistivity data as the only method carried out.

Ground investigation results were available and the abbreviated borehole logs are indicated on the sections. Boreholes provide accurate information for specific locations while geophysics provides a broader interpretation over a large volume of ground. The overburden is shown as 'Clay' which is the main component. Rock core descriptions with an RQD value < 65 are abbreviated as 'Weathered Limestone' and better rock with higher RQD values is shown as 'Limestone'.

3.1 2D-Resistivity

The 2D-Resistivity data was positioned and inverted with the RES2DINV inversion package. The programme uses a smoothness constrained least-squares inversion method to produce a 2D model of the subsurface model resistivities from the recorded apparent resistivity values. Three variations of the least squares method are available and for this project the Jacobian Matrix was recalculated for the first three iterations, then a Quasi-Newton approximation was used for subsequent iterations. Each dataset was inverted using seven iterations resulting in a typical RMS error of <3.6%. The resulting models were colour contoured with the same resistivity scale for all profiles and they are displayed as cross sections (Figures 1a and 1b).

Resistivities are characteristic for certain overburden and rock types. If there is a high content of clay minerals (which are electrically conductive) then the overburden resistivity will be lower than if there is a high content of clastic grains like sand or gravel. The purer the clay and the lower the sand/gravel content the lower the resistivity. The water content in the overburden also influences the resistivities but generally the clay content has a larger effect.

Karstified rock is defined in this report as a formerly intact clean limestone rock, liable to karstification, that has been partially dissolved by water over long geological time scales and where the cavities and voids have either remained empty (filled by air) or became filled by overburden sediment (clay, silt, sand), weathering product of the broken rock itself or water. This process would lead to a reduction of the resistivity of the overall rock and therefore karstified rock has a lower resistivity than intact clean limestone rock. This is generally indicated by lower resistivities embedded within high resistivity at depth. Only air-filled cavities would have a higher resistivity than the limestone itself.

Water strikes in the bore holes were generally between 2 and 4 m bgl therefore water levels are expected above the rock or close to the top of the rock. This means that open cavities within the rock would be filled

with water rather than air. This would result in a reduction of resistivities within water-filled cavities while an air-filled cavity would increase the resistivity.

The bedrock resistivities on this site are generally high, indicating that the limestone is liable to karstification. Karstified rock is typically identified by low resistivities within a high resistivity limestone bedrock.

The resistivities cover a range typical for materials from clay rich overburden to fresh compact unweathered limestone (high resistivities). The ranges and gradients have been taken into consideration for the interpretation. Low resistivity values (<250 to 500 Ohmm) and a shallow gradient typically indicate overburden with high clay content. Lower values at depth (< 1000 Ohmm) show weathered karstified bedrock. High resistivities (>1000 Ohmm) indicate fresh compact limestone.

The primary purpose of the resistivity survey is to propose targeted core holes. The interpretation below is done by following roughly criteria like resistivities and gradients, but the interpretation does not represent an exact ground condition. 2D-Resistivitiy only measures one parameter of the subsurface while some materials such as gravelly clay in overburden and a mix of rock and clay in weathered karstified rock can have the similar resistivities. Changes in the subsurface geology oblique to the direction of a profile leads to a “3D” result on a 2D model. This can be seen by contradictions in intersecting profiles. The fit between R5 and R6 on the eastern side of the railway is good which indicates little change in the geology around the profiles as well as across them, while the differences at the crossing on the western side show more geological complexity which is considered during the interpretation.

The 2D-Resistivity survey shows generally unweathered fresh limestone to the east of the railway with some exceptions such as an area near the end of Profile R6, while lower resistivities at depth to the west of the railway bridge, particularly at the start of profiles R1, R3 and R4 indicate a more weathered, karstified limestone. Figures 2a and 2b show an interpretation based solely on the 2D-Resistivity survey. Additional geotechnical locations are proposed on the maps and figures and are concentrated on areas where karstified rock may be present. Boreholes 4 and 5 show fresh limestone within the high resistivity area and it would be anticipated that additional borehole within the high resistivity areas would produce similar results.

Table 2: Summary of Interpretation

Layer	General Resistivity Range (Ohmm)	Interpretation
1	<250 to 500 and gradient	Clay-rich Overburden
2	< 1000	Weathered karstified Limestone
3	>1000	Fresh compact Limestone

4. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are made:

- The geophysical survey indicates clay-rich overburden over karstifiable limestone.
- The depth to rock is generally shallower on the east side of the railway than on the west side.
- Resistivities within the limestone indicate more karstification and weathering on the west side of the railway and a generally better rock on the eastern side.
- The area where profiles R1 to R4 cross each other seems to be the most geologically complex and disturbed area. This is where core hole 3 has found a clay-filled cavity from 9.90 to 11.3 m depth. This was not directly detected by the resistivity profiles but it is expected that more similar karst features exist in this area. Core holes 6 and 7 were targeted here and indicate deep weathered bedrock which could be also described as karstified rock.
- On profile R6 at the eastern end from 85 to 106 m distance low resistivity indicates weathered karstified rock and a core hole was recommended here in the draft report.
- There is an increase to high resistivities at the end of profiles R3 and R4 (105 m distance) and this could show the transition to the better limestone interpreted on the eastern side of the railway. Bore hole 8 was done here and it still shows some weathered rock but also generally better RQD values.
- It is recommended to carry out 2D-Resistivity profiles across the railway line. By feeding the resistivity cables under the rails this can be done while maintaining the train schedule and with only one person accessing the railway line.
- This final report version was reviewed after some targeted boreholes were carried out.

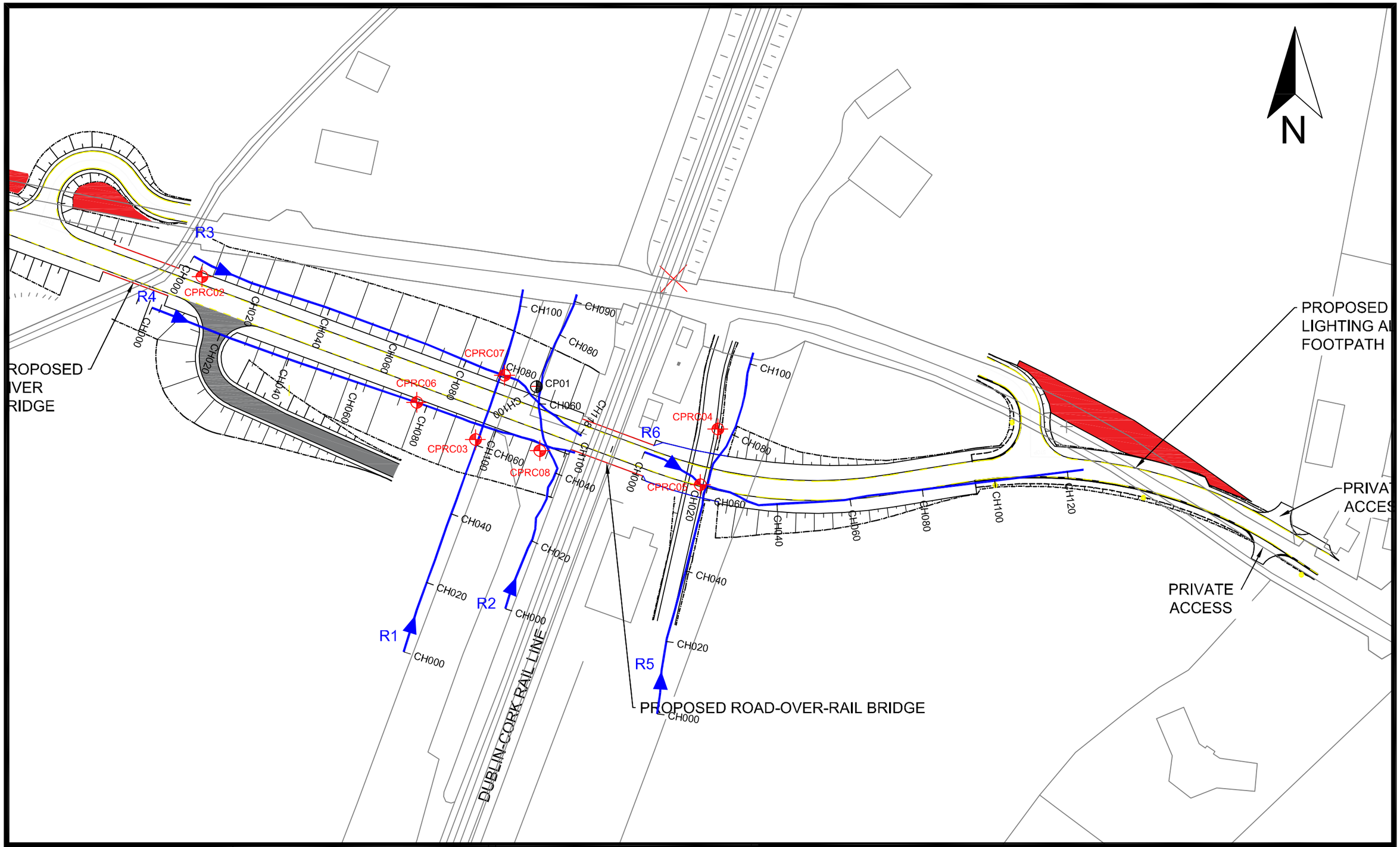
5. REFERENCES

1. **GSEG 2002.** Geophysics in Engineering Investigations. Geological Society Engineering Geology Special Publication 19, London, 2002.

2. **GSI, 2020.** Online Bedrock Geological Map of Ireland. Geological Survey of Ireland 2019.

3. **Milsom, 1989.** Field Geophysics. John Wiley and Sons.

4. **Reynolds, 1997.** An Introduction to Applied and Environmental Geophysics. John Wiley and Son.



Minerex
Geophysics Limited

Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare
Tel. (01) 6510030
Email: info@mgx.ie
Web: www.mgx.ie

CLIENT	OCB Geotechnical
PROJECT	Buttevant Level Crossing XC219 Geophysical Survey
TITLE	Map 1: Geophysical Survey Location Map

SCALE:	1:1000 @ A3
PROJECT:	6508
DRAWN:	HK
DATE:	9/11/2020
MGX FILE:	6508f_MapsFigs.dwg
STATUS:	Final

LEGEND:

Geophysical Survey Locations:

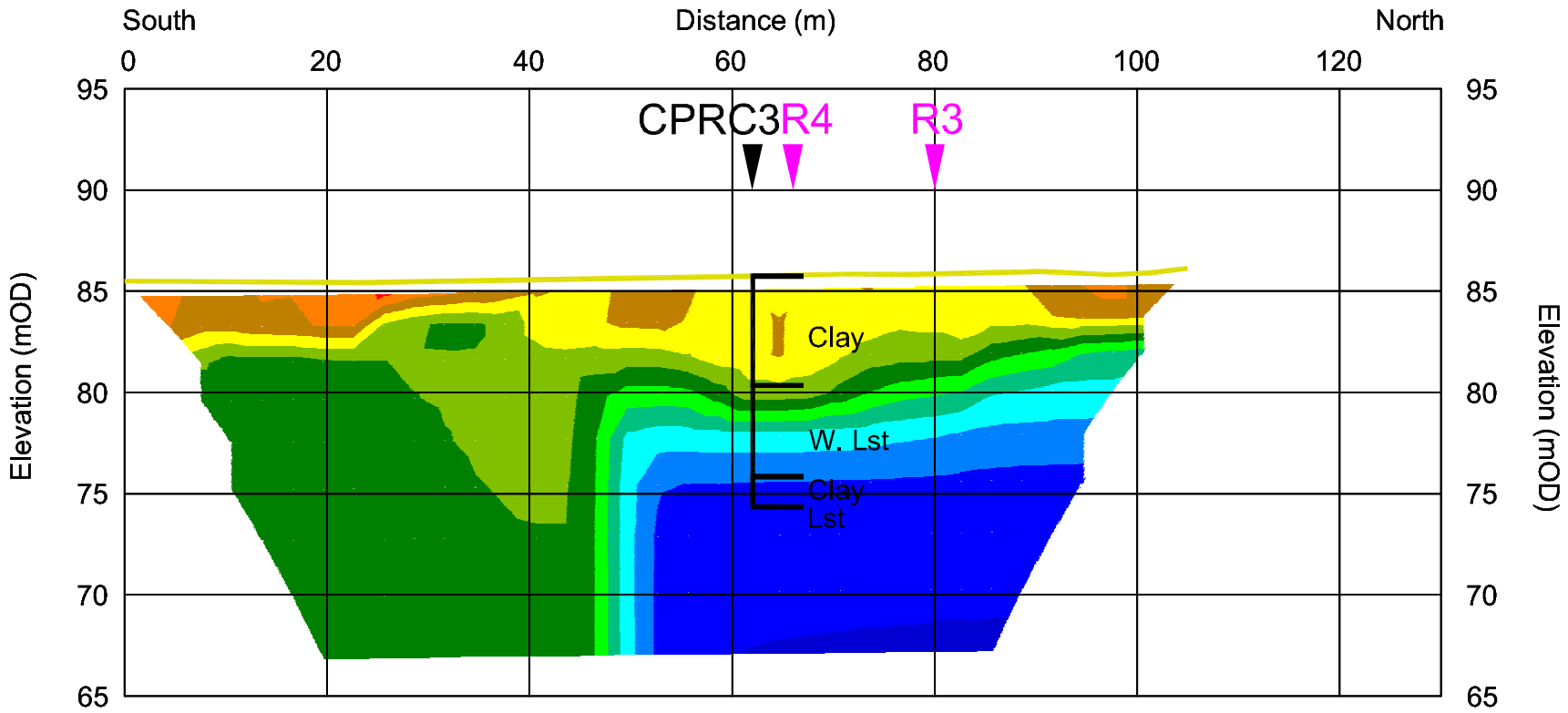
R2 — 2D-Resistivity Profile

CH020 — Distance along Profile

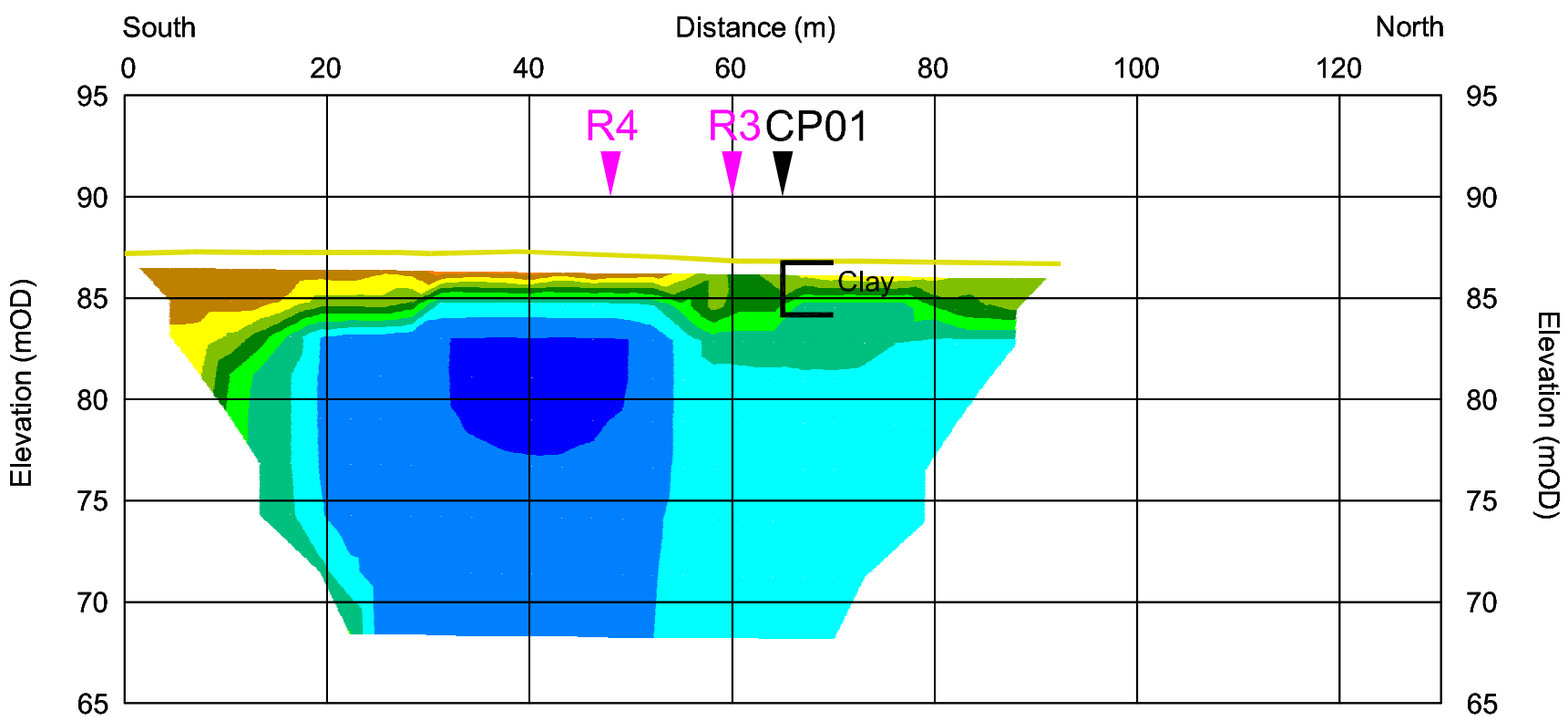
Direct Ground Investigation Locations:

XC219-CPRC03 — Borehole

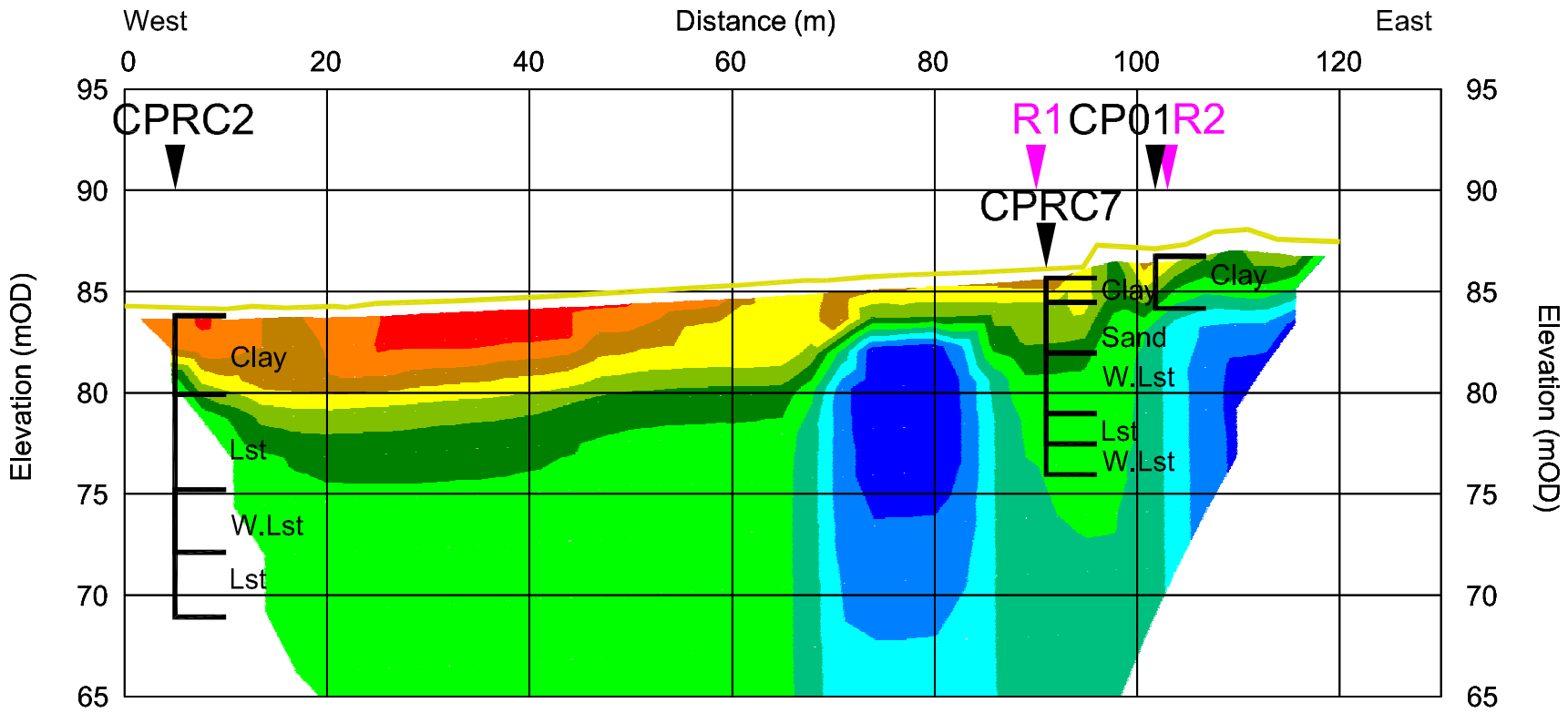
2D-Resistivity Profile R1 Model



2D-Resistivity Profile R2 Model



2D-Resistivity Profile R3 Model



Minerex
Geophysics Limited
Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare
Tel. (01) 6510030
Email: info@mgx.ie
Web: www.mgx.ie

CLIENT	OCB Geotechnical
PROJECT	Buttevant Railway Crossing XC219 Geophysical Survey
TITLE	Figure 1a: Models of Geophysical Survey

SCALE:	NTS @ A3, VE x 2
PROJECT:	6508
DRAWN:	HK
DATE:	9/11/2020
MGX FILE:	6508f_MapsFigs.dwg
STATUS:	Final

LEGEND: Resistivities (Ohmm) for 2D-Resistivity Model

31.3 62.5 125 250 500 1000 2000 4000

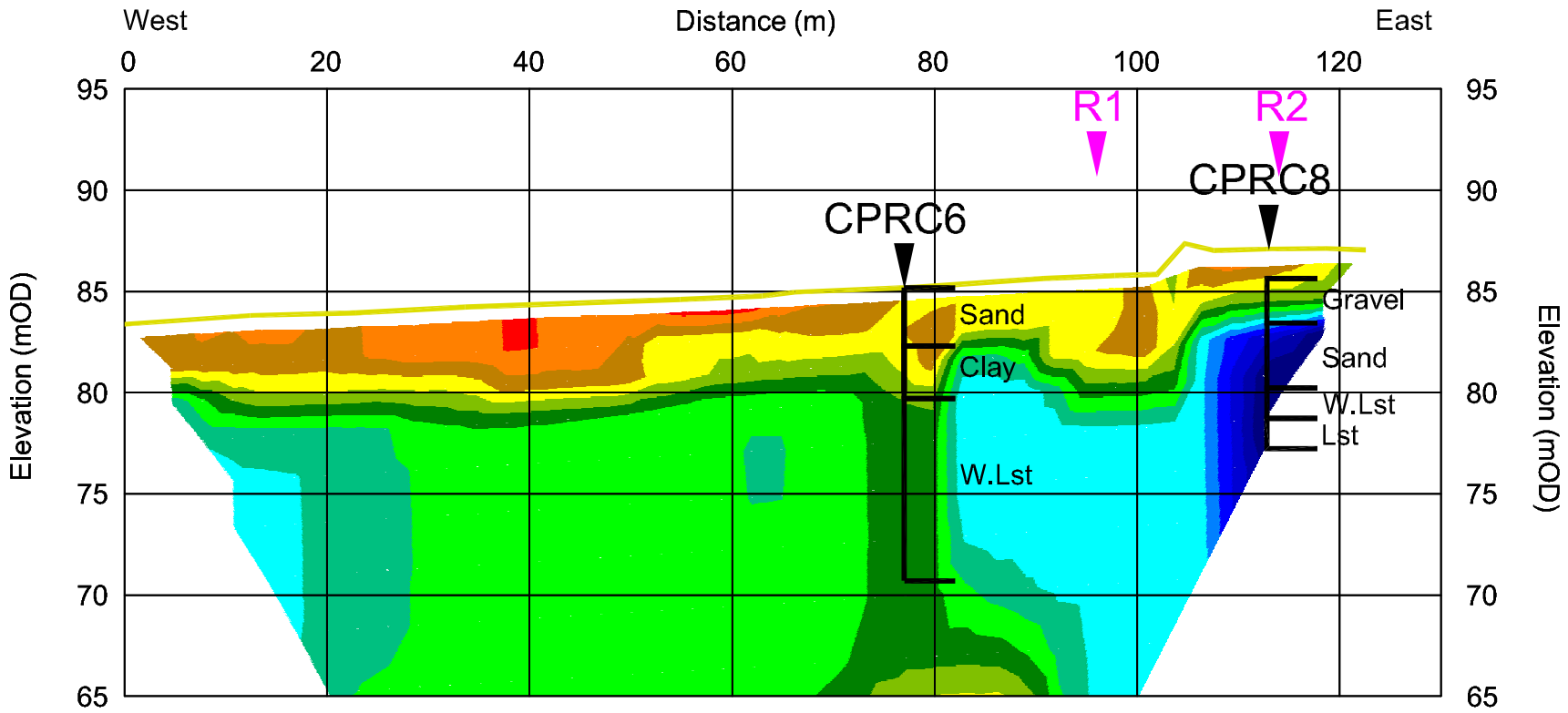
R5 Profile Crossing Borehole

CPRC5 Borehole

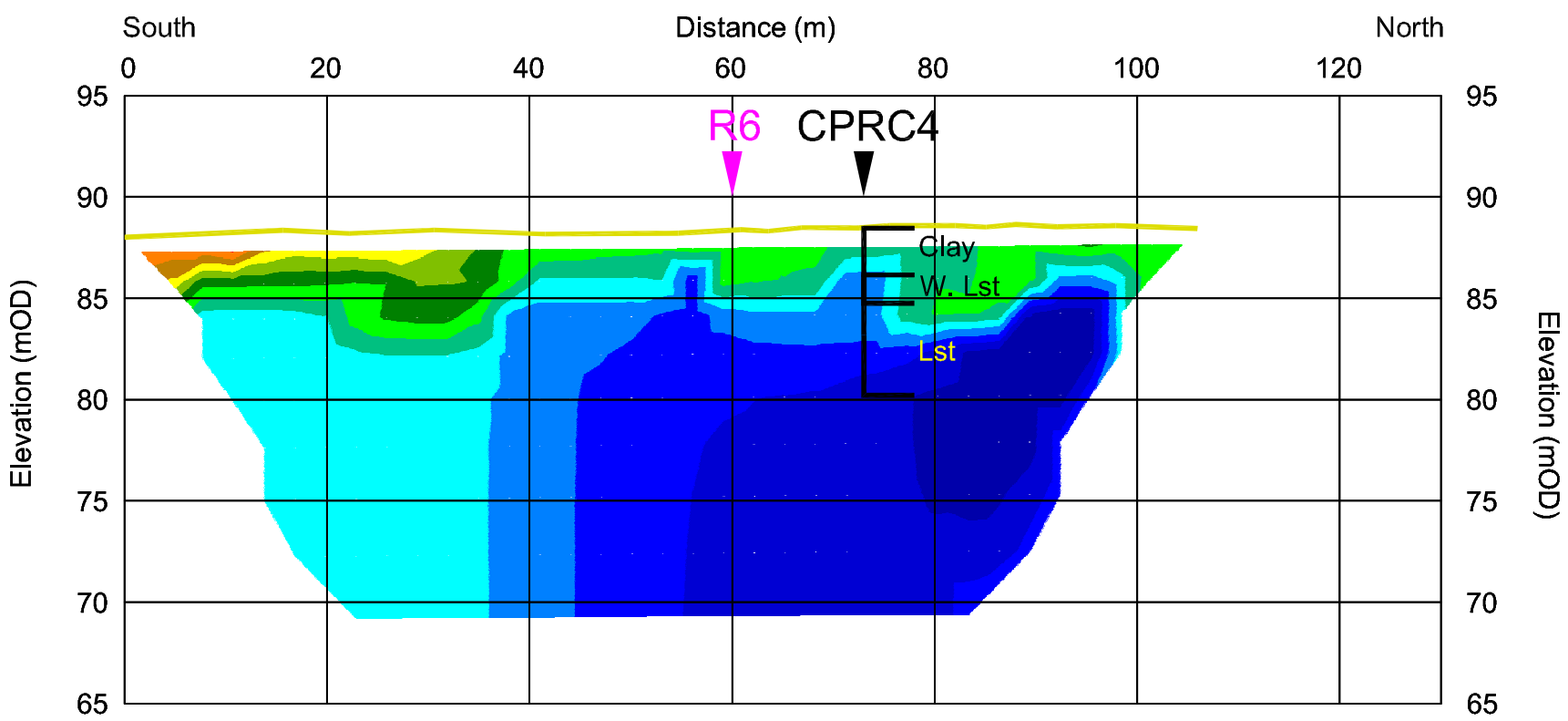
Abbreviated GI Logs:

Cl	Clay
W. Ls	Weathered Ls
Ls	Limestone

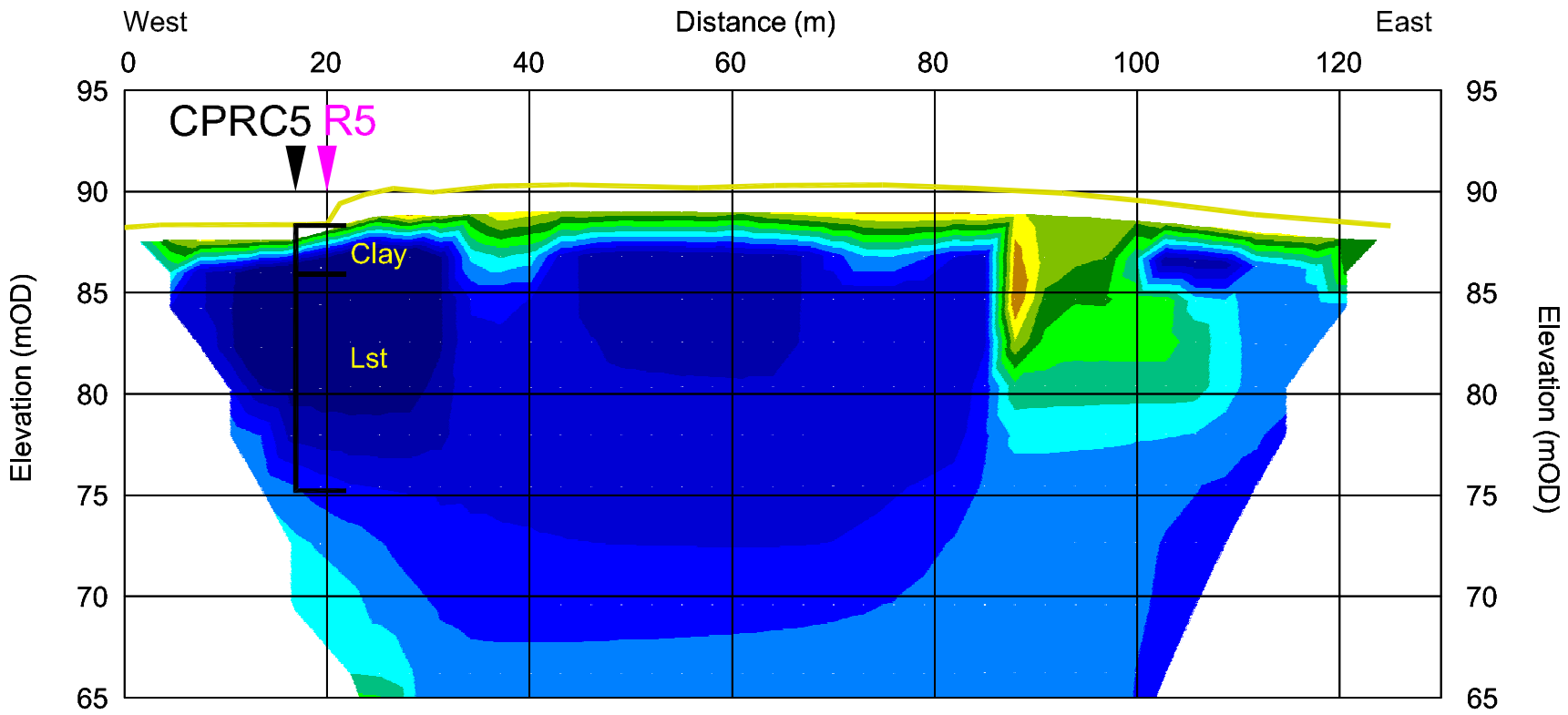
2D-Resistivity Profile R4 Model



2D-Resistivity Profile R5 Model



2D-Resistivity Profile R6 Model



Minerex
Geophysics Limited
Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare
Tel. (01) 6510030
Email: info@mgx.ie
Web: www.mgx.ie

CLIENT	OCB Geotechnical
PROJECT	Buttevant Railway Crossing XC219 Geophysical Survey
TITLE	Figure 1b: Models of Geophysical Survey

SCALE:	NTS @ A3, VE x 2
PROJECT:	6508
DRAWN:	HK
DATE:	9/11/2020
MGX FILE:	6508f_MapsFigs.dwg
STATUS:	Final

LEGEND: Resistivities (Ohmm) for 2D-Resistivity Model

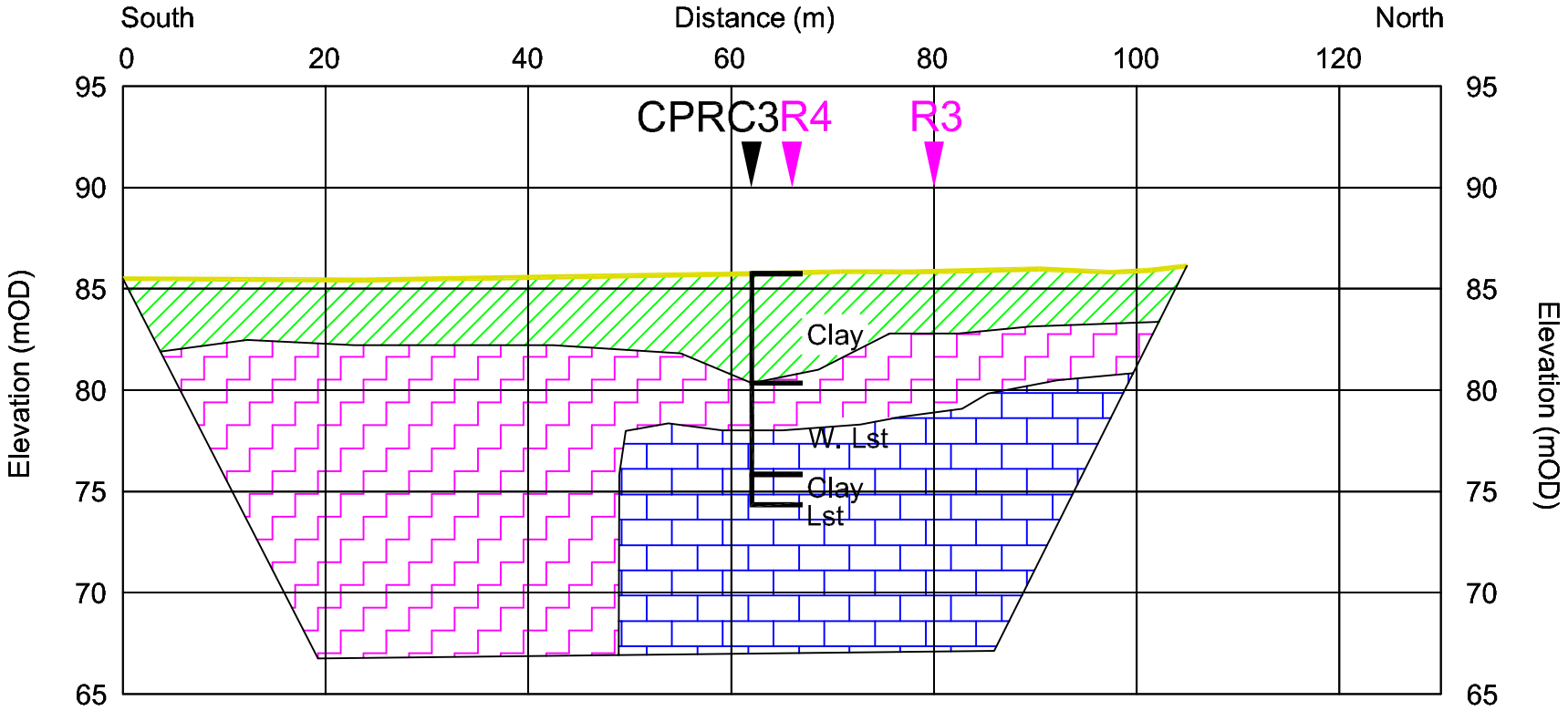
31.3 62.5 125 250 500 1000 2000 4000

R5 Profile Crossing
CPRC5 Borehole

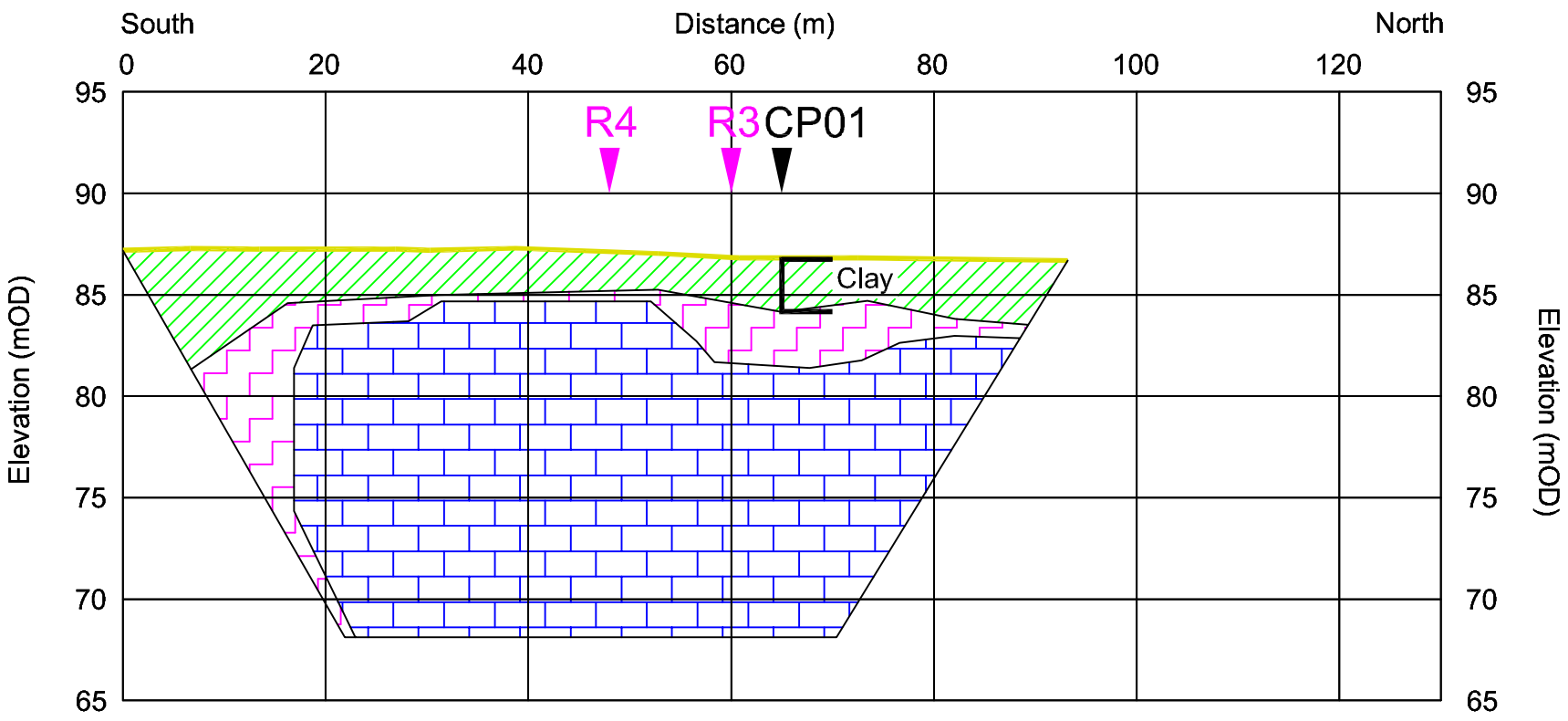
Abbreviated GI Logs:

Cl	Clay
W. Ls	Weathered Ls
Ls	Limestone

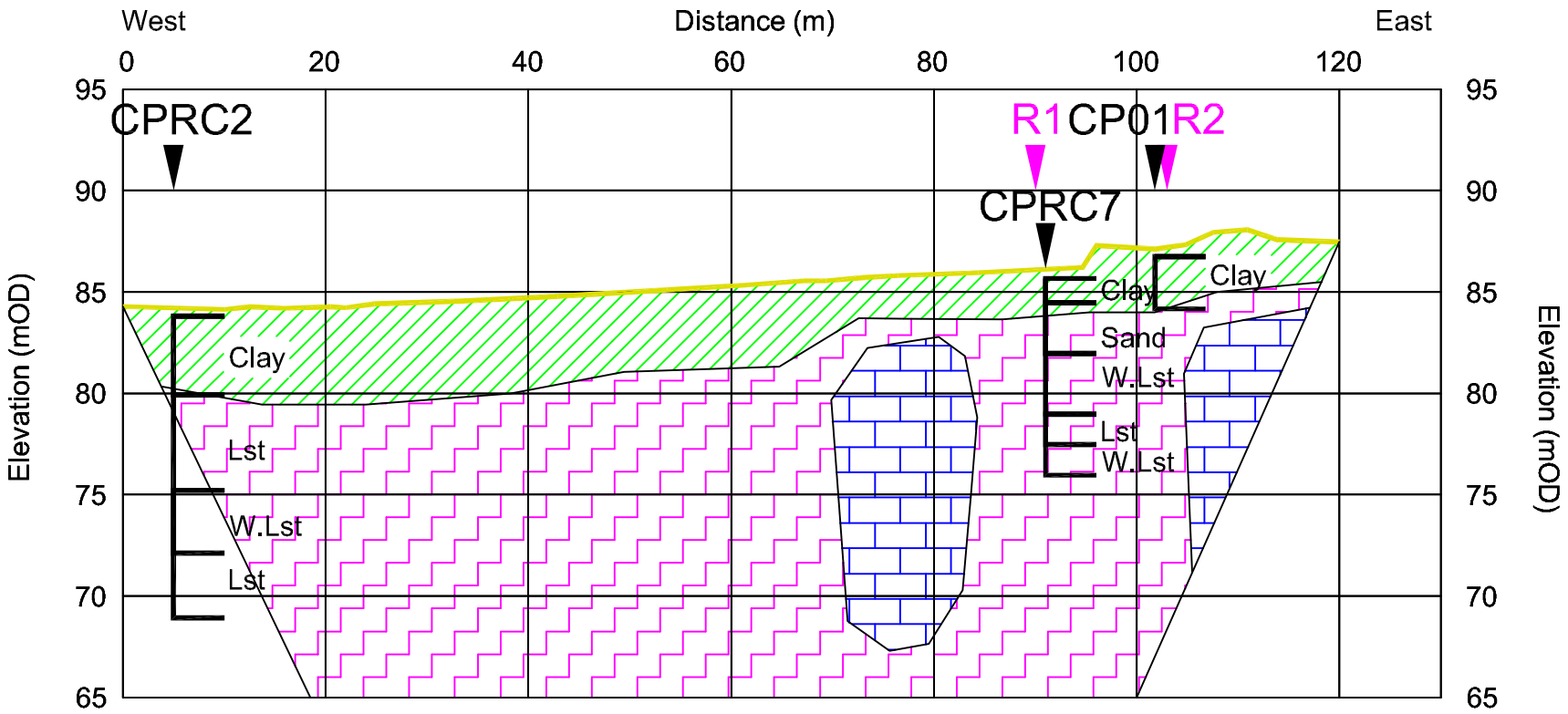
2D-Resistivity Profile R1 Interpretation



2D-Resistivity Profile R2 Interpretation



2D-Resistivity Profile R3 Interpretation



Minerex
Geophysics Limited
Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare
Tel. (01) 6510030
Email: info@mgx.ie
Web: www.mgx.ie

CLIENT	OCB Geotechnical
PROJECT	Buttevant Railway Crossing XC219 Geophysical Survey
TITLE	Figure 2a: Interpretation of Geophysical Survey

SCALE:	NTS @ A3, VE x 2
PROJECT:	6508
DRAWN:	HK
DATE:	9/11/2020
MGX FILE:	6508f_MapsFigs.dwg
STATUS:	Final

LEGEND:

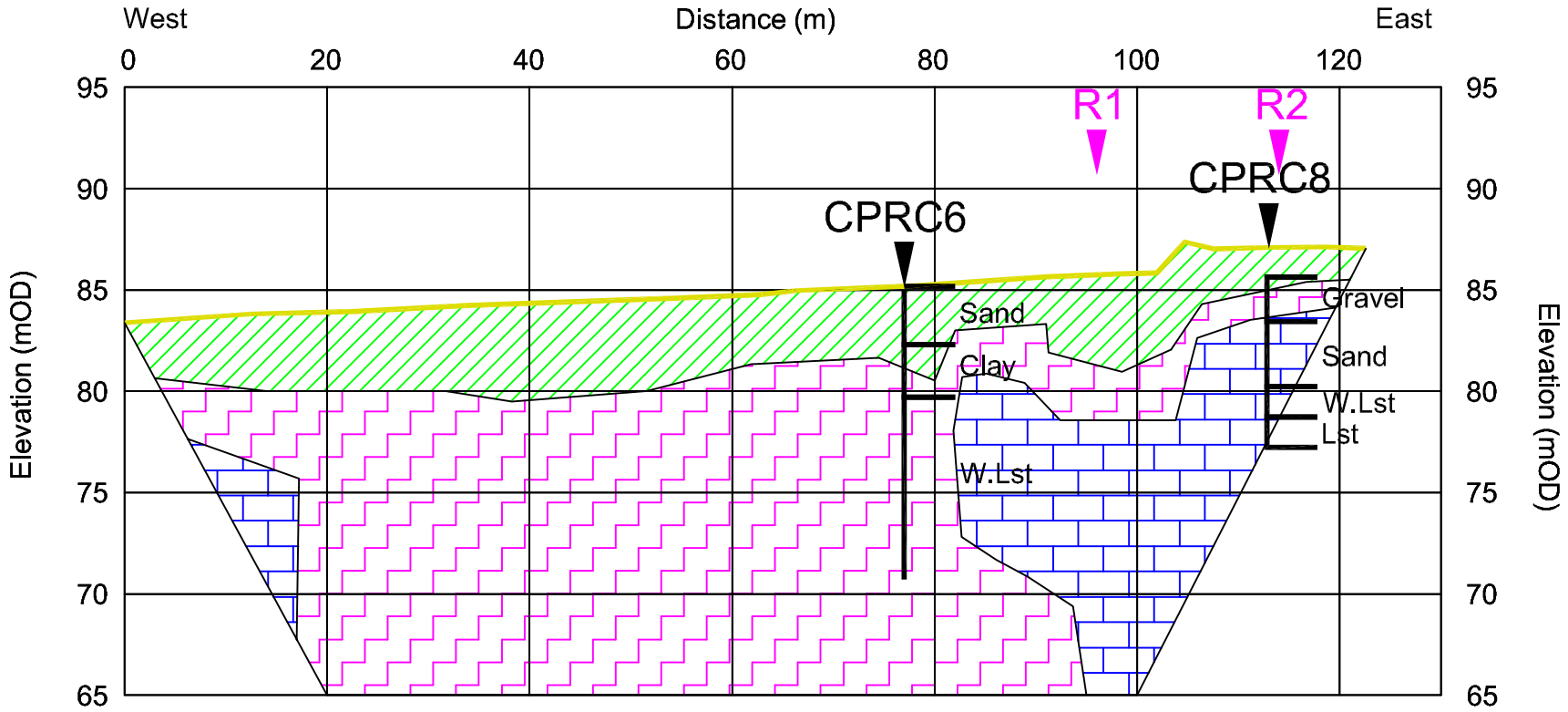
Interpretation of Resistivities:

1 Clay-rich Overburden

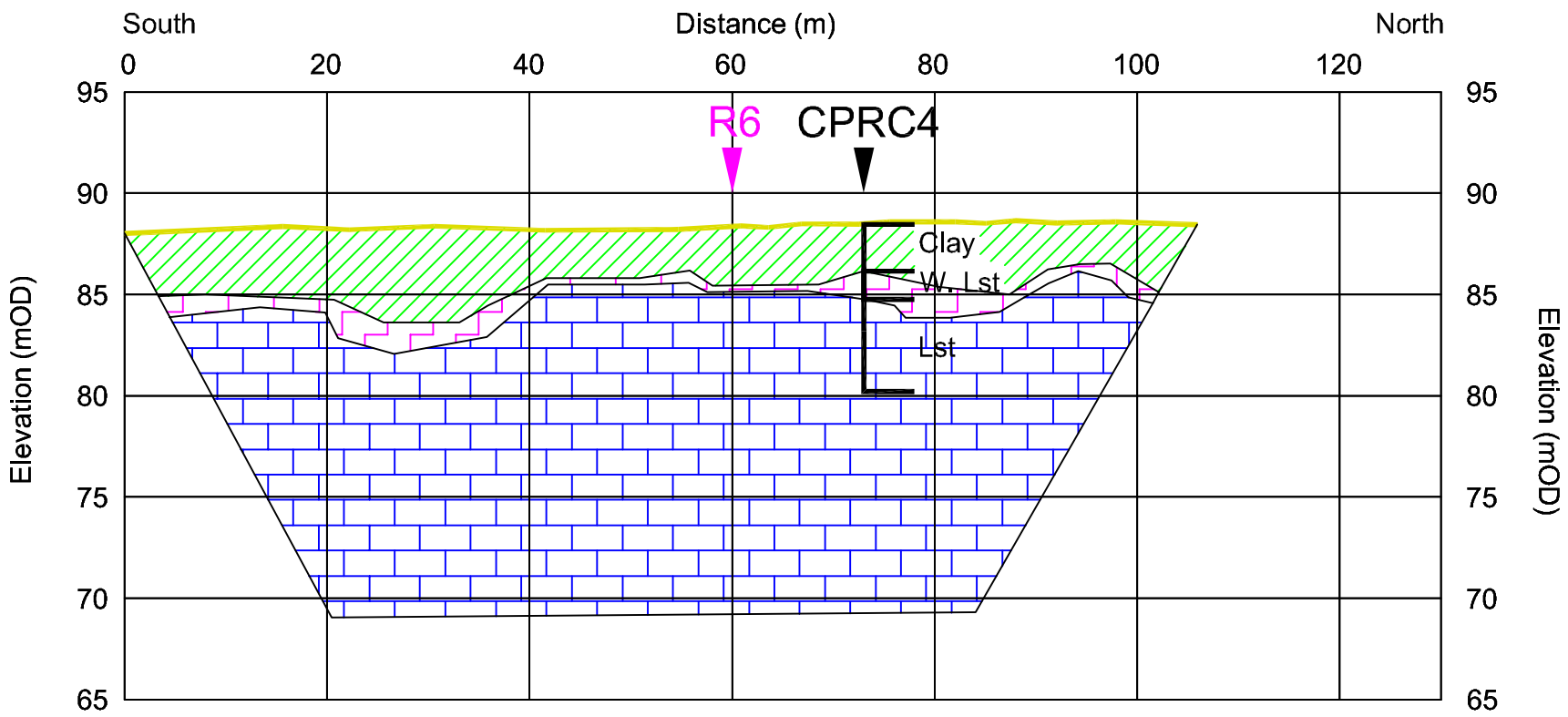
2 Weathered karstified Limestone

3 Fresh compact Limestone

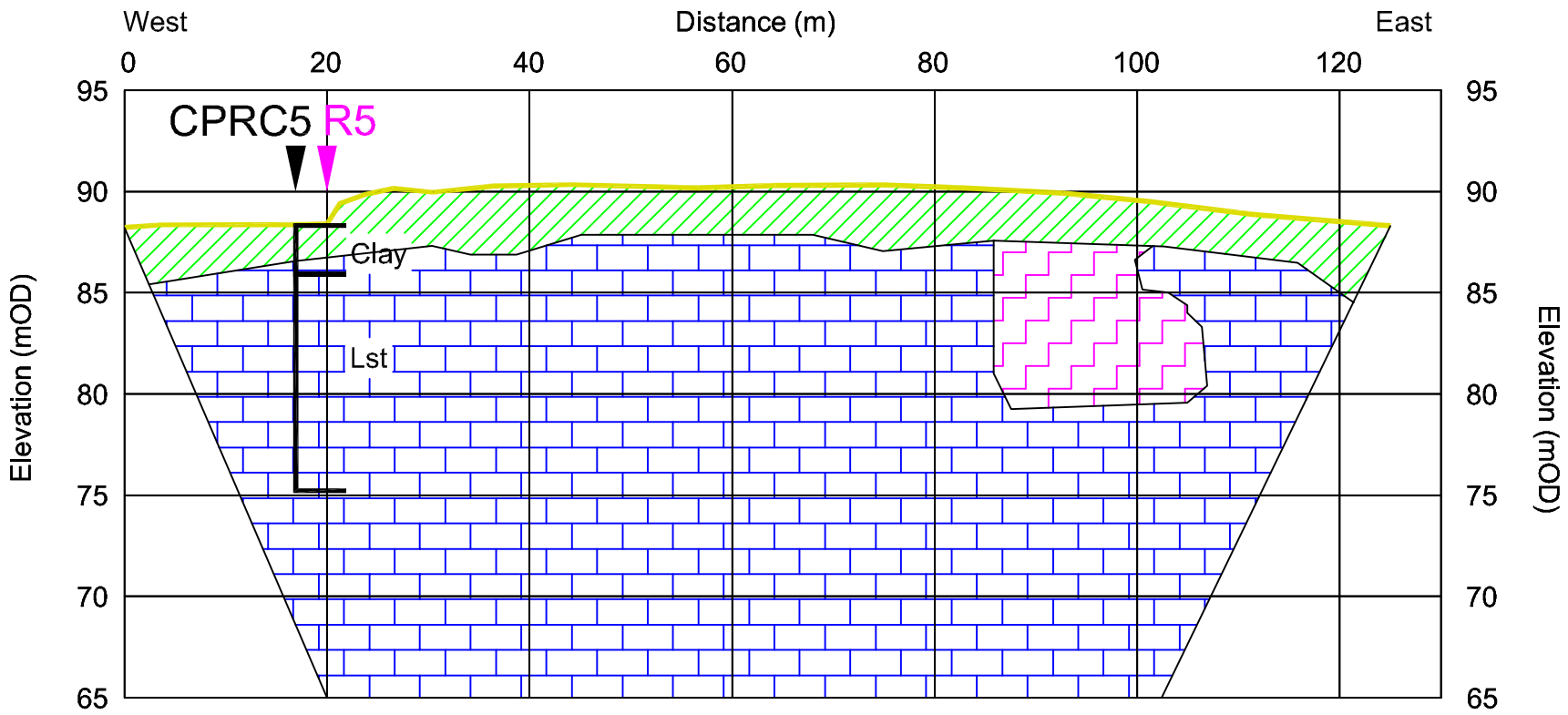
2D-Resistivity Profile R4 Interpretation



2D-Resistivity Profile R5 Interpretation



2D-Resistivity Profile R6 Interpretation



Minerex
Geophysics Limited
Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare
Tel. (01) 6510030
Email: info@mgx.ie
Web: www.mgx.ie

CLIENT	OCB Geotechnical
PROJECT	Buttevant Railway Crossing XC219 Geophysical Survey
TITLE	Figure 2b: Interpretation of Geophysical Survey

SCALE:	NTS @ A3, VE x 2
PROJECT:	6508
DRAWN:	HK
DATE:	9/11/2020
MGX FILE:	6508f_MapsFigs.dwg
STATUS:	Final

LEGEND:

Interpretation of Resistivities:

1 Clay-rich Overburden

2 Weathered karstified Limestone

3 Fresh compact Limestone

Appendix L Pre & Post Site Condition Photographs

Iarnród Éireann

Cork Line Level Crossings

XC219 (19-135-5)

XC219	
Pre Works Site Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	2020

Iarnród Éireann

Cork Line Level Crossings

XC219 (19-135-5)

XC219	
Pre Works Site Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	2020

	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	XC219 Pre Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020

Iarnród Éireann

Cork Line Level Crossings

XC219 (19-135-5)

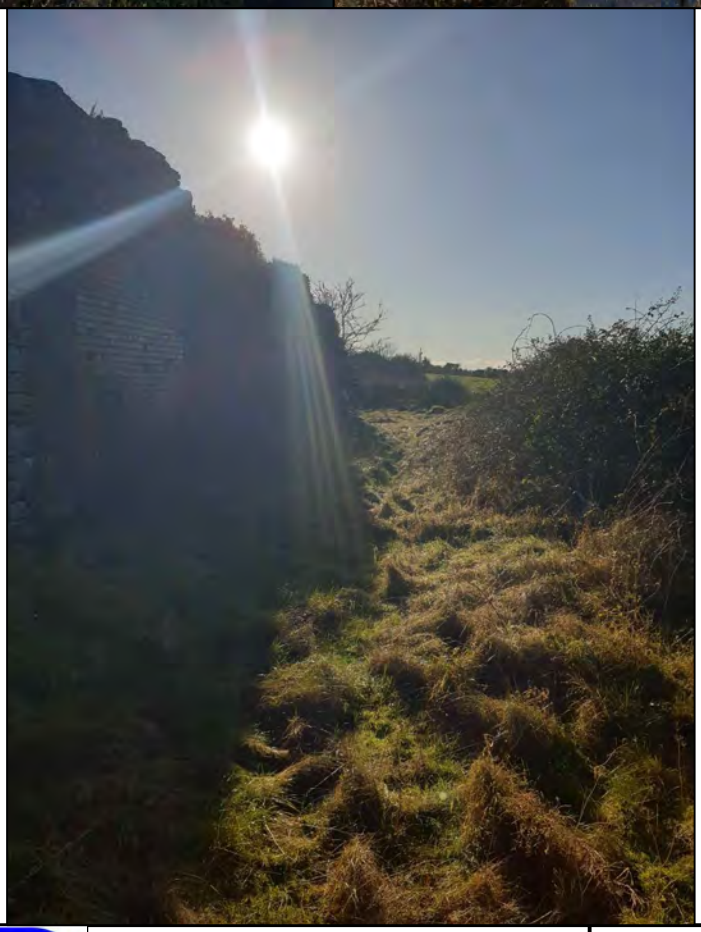
XC219

Pre Works Site Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: 2020



	XC219
Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	Pre Works Site Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: 2020

Iarnród Éireann

Cork Line Level Crossings

XC219 (19-135-5)

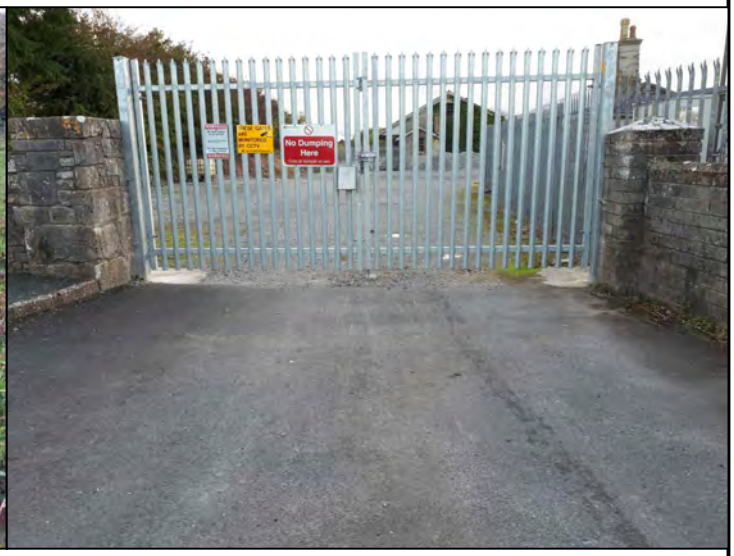
XC219

Post Works Site Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	XC219 Post Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020

ocbgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	XC219 Post Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020

	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	XC219 Post Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020