James Fisher Testing Services Ltd
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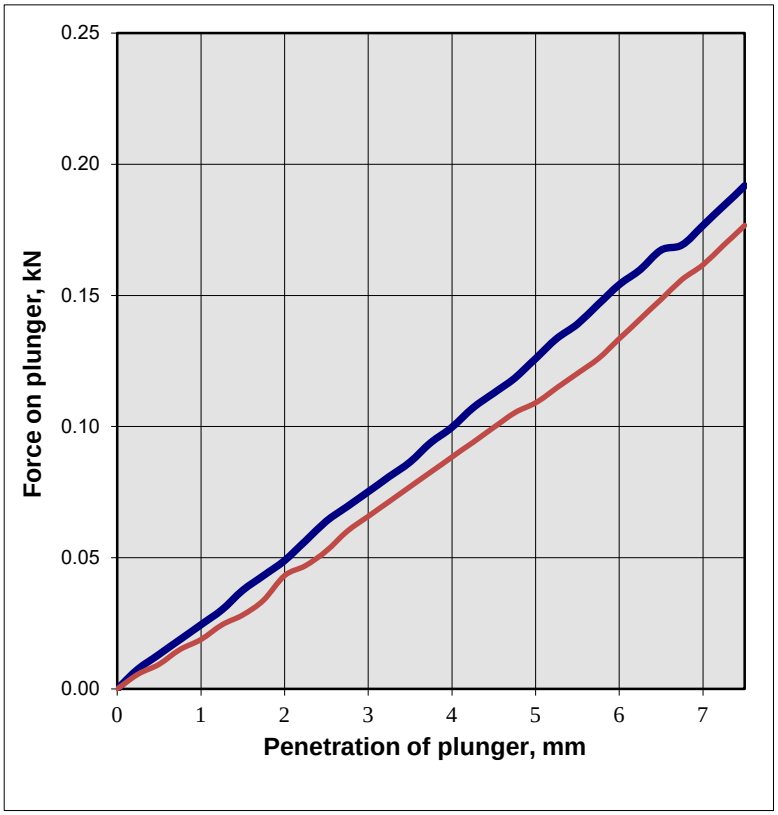
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

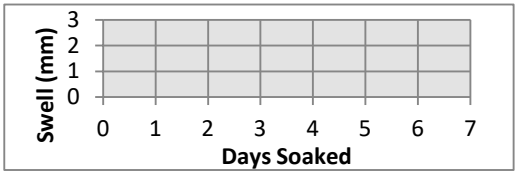
LABORATORY TEST REPORT

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 93384
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	13/04/2020
	Co Cork	**Date Reported:**	21/04/2020
Order No:	2003-104	**Sample Ref:**	XC215-TP03 Type B Sample 5
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)
2.14
Propertion of material removed from initial sample by dry mass (%)
9.1



Final Swell (mm):	N/A

Penetration (mm)	Force (kN)	Standard Force (kN)	Top CBR (%)
2.5	0.06	13.2	0.5
5.0	0.13	20.0	0.6
Moisture content : %	**20.4**	**Mean CBR value : %**	**0.6**

Penetration (mm)	Force (kN)	Standard Force (kN)	Bottom CBR (%)
2.5	0.05	13.2	0.4
5.0	0.11	20.0	0.5
Moisture content : %	**20.4**	**Mean CBR value : %**	**0.5**

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
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Phil Thorp, Laboratory Manager

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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 93381
	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 **XC215-TP03 Type B**

Supplier:	Client Info	**Date of Sampling:**	Client Info.
Source:	Client Info	**Sampled By:**	Client
Sample Location:	0.25-0.50m	**Sampling Reason:**	Request

Parameter	RESULT
pH	7
Sulphate Aqueous Extract (SO4) (mg/l)	16
Sulphur as S, Total (%)	0.02
Sulphate as SO4, Total (%)	0.04

Comments:
None

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

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JAMES FISHER TESTING SERVICES (IRELAND) LTD.

☐ **James Ward, Operations Manager**

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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 93379
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	26/03/2020
Order No:	2003-104	**Date Reported:**	03/04/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC215-TP03 Type D

Sample Type:	Bulk	***Location:***	XC215-TP03 Type D
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	0.25-0.5m	***Material Type:***	Soil

Moisture Content (%): 35

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

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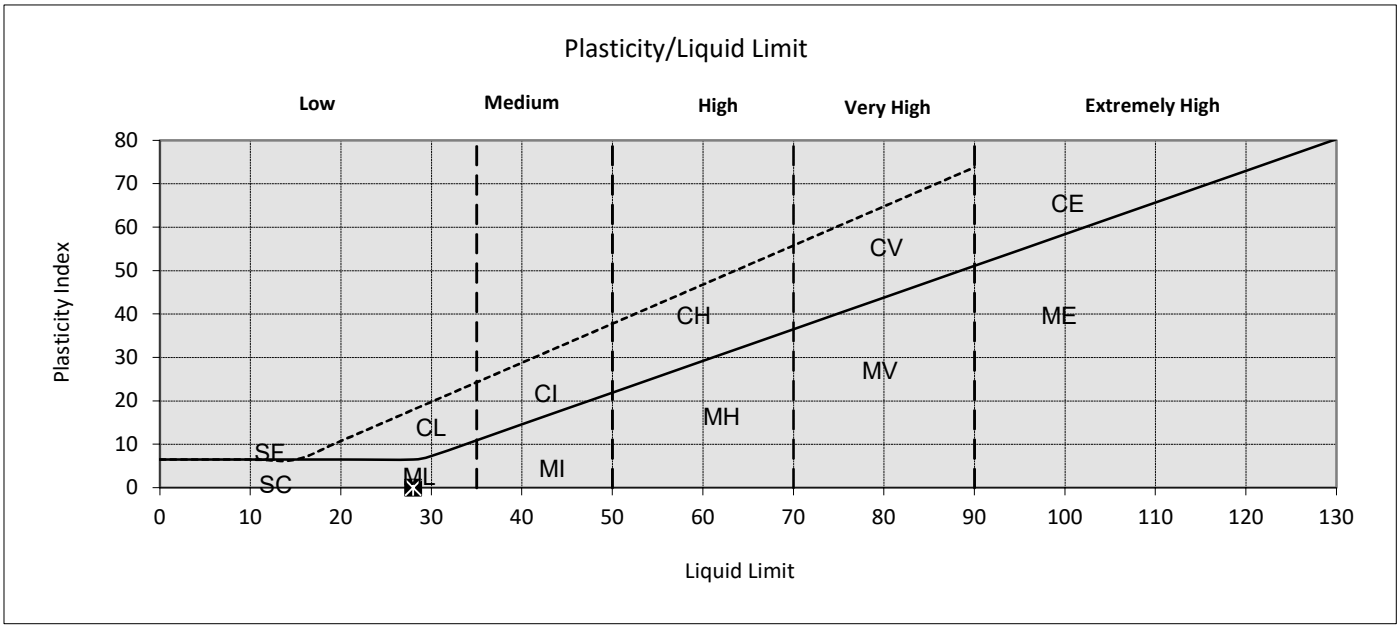
LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93380
	Unit 1 Carrigogna	**Sample Ref.:**	XC215-TP03 0.25-0.5m Type B
	Midleton	**Date Sampled:**	Client Info
	Co Cork	**Date Received:**	09/03/2020
Order No:	2003-104	**Date Tested:**	28/03/2020
Originator:	**Ian Holley**	**Date Reported:**	21/04/2020

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Bulk**
Sample Preparation Method	**Washed**
MATERIAL	**Soil**
Retained 425 micron (%)	**23**
Natural Moisture Content (%)	**28**
Liquid Limit (single point)(%)	**28**
Plastic Limit (%)	**Non-Plastic**
Plasticity Index	**N/A**



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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 93388
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	26/03/2020
Order No:	2003-104	**Date Reported:**	02/04/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC215-TP04 Type D Sample 3

Sample Type:	Bulk	***Location:***	XC215-TP04 Type D Sample 3
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	0.3-0.7m	***Material Type:***	Soil

Moisture Content (%): 22

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

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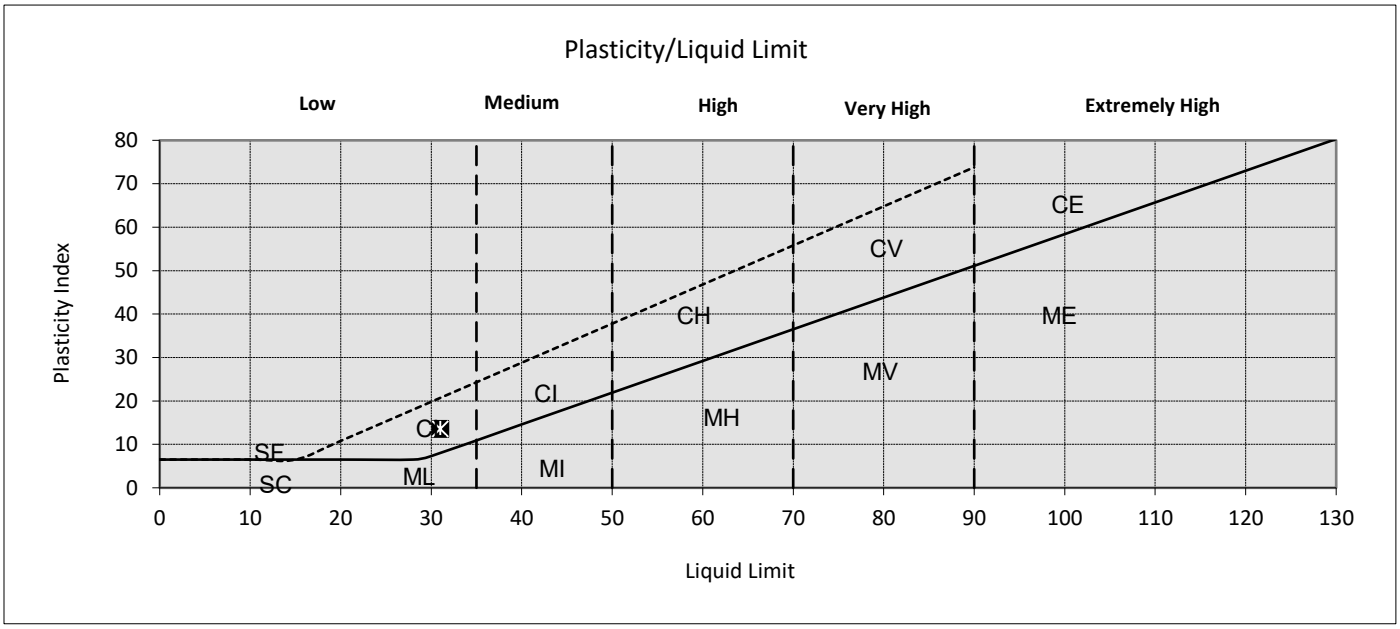
LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93389
	Unit 1 Carrigogna	**Sample Ref.:**	XC215-TP04 0.3-0.7m Type D Sample 3
	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 (%)	**20**
Natural Moisture Content (%)	**21**
Liquid Limit (single point)(%)	**31**
Plastic Limit (%)	**17**
Plasticity Index	**14**



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LABORATORY TEST REPORT

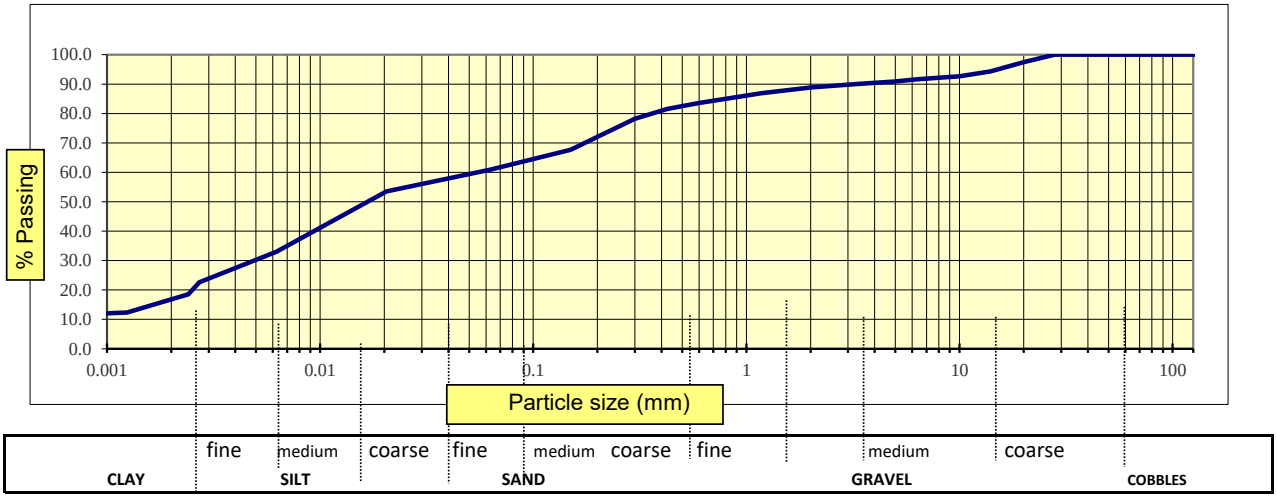
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 93387
	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**	Light Clay

Client Ref.	**XC215-TP04 Type B Sample 2**
Location:	XC215-TP04 Type B Sample 2
Supplier:	Bulk
Source:	Client Info.
Depth (m):	0.3-0.7m
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	100	
20 mm	97	
14 mm	94	
10 mm	93	
6.3 mm	92	
5 mm	91	
3.35 mm	90	
2 mm	89	
1.18 mm	87	
0.6 mm	84	
0.425 mm	82	
0.3 mm	78	
0.15 mm	68	
0.063 mm	61	
0.020 mm	54	
0.006 mm	33	
0.003 mm	23	
0.002 mm	19	
0.001 mm	12	



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

Sedimentation by Hydrometer - Not UKAS

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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 93391
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	26/03/2020
Order No:	2003-104	**Date Reported:**	03/04/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC215-TP04 Type D Sample 6

Sample Type:	Bulk	***Location:***	XC215-TP04 Type D Sample 6
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	0.7-1.0m	***Material Type:***	Soil

Moisture Content (%): 15

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

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James Ward, Operations Manager

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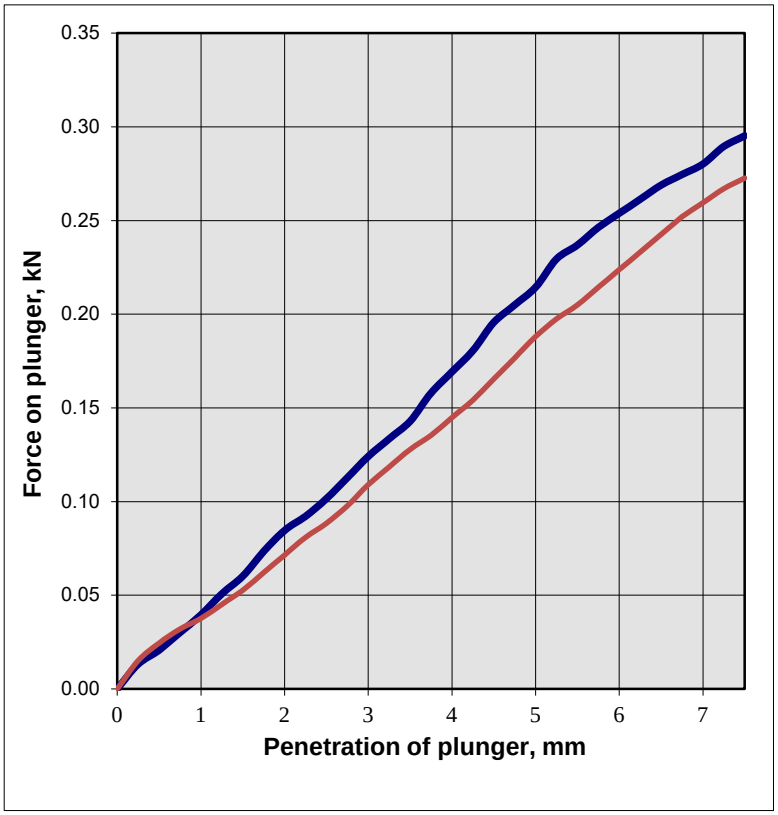
James Fisher Testing Services

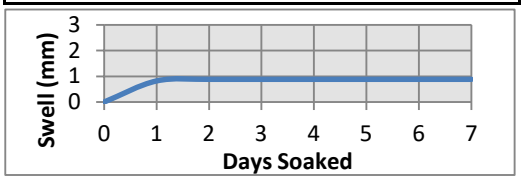
LABORATORY TEST REPORT

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 93390
	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:**	XC215-TP04 Type B Sample 5
Originator :	**Ian Holley**	**Location:**	0.7-1.0m



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)
2.14
Propertion of material removed from initial sample by dry mass (%)
5.6



Final Swell (mm):	0.88

Penetration (mm)	Force (kN)	Standard Force (kN)	Top CBR (%)
2.5	0.10	13.2	0.8
5.0	0.21	20.0	1.1
Moisture content : %	**25.6**	**Mean CBR value : %**	**0.9**

Penetration (mm)	Force (kN)	Standard Force (kN)	Bottom CBR (%)
2.5	0.09	13.2	0.7
5.0	0.19	20.0	0.9
Moisture content : %	**25.6**	**Mean CBR value : %**	**0.8**

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
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Phil Thorp, Laboratory Manager

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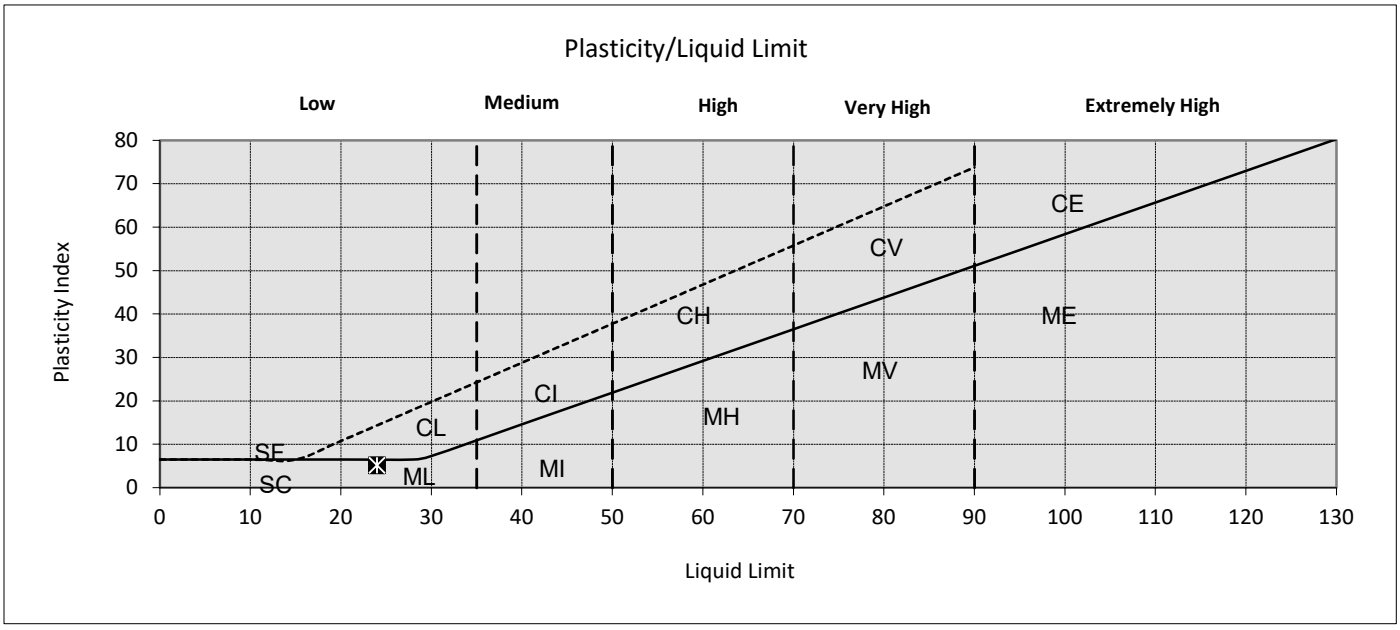
LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93392
	Unit 1 Carrigogna	**Sample Ref.:**	XC215-TP04 0.7-1.0m 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:**	21/04/2020

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Bulk**
Sample Preparation Method	**Washed**
MATERIAL	**Soil**
Retained 425 micron (%)	**27**
Natural Moisture Content (%)	**18**
Liquid Limit (single point)(%)	**24**
Plastic Limit (%)	**19**
Plasticity Index	**5**



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LABORATORY TEST REPORT

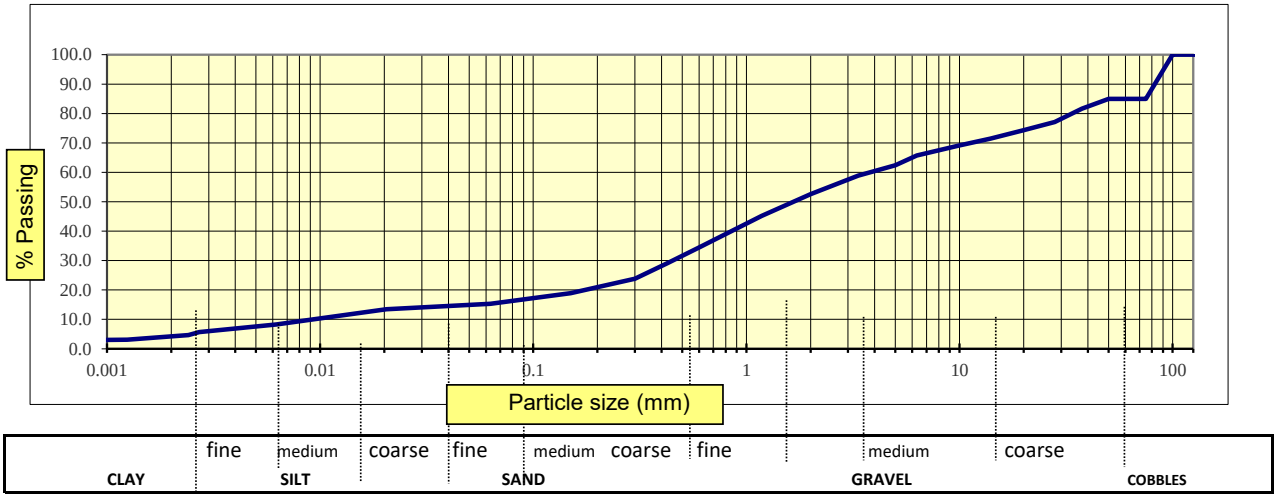
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 93393
	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 Sandy Clay

Client Ref.	**XC215-TP04 Type B Sample 6**
Location:	XC215-TP04 Type B Sample 6
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	85	
63 mm	85	
50 mm	85	
37.5 mm	82	
28 mm	77	
20 mm	74	
14 mm	71	
10 mm	69	
6.3 mm	66	
5 mm	62	
3.35 mm	59	
2 mm	53	
1.18 mm	45	
0.6 mm	34	
0.425 mm	29	
0.3 mm	24	
0.15 mm	19	
0.063 mm	15	
0.020 mm	13	
0.006 mm	8	
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

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☐ **James Ward, Operations Manager**

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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 93395
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	26/03/2020
Order No:	2003-104	**Date Reported:**	03/04/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC215-TP05 Type D Sample 4

Sample Type:	Bulk	***Location:***	XC215-TP05 Type D Sample 4
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	0.5-1.0m	***Material Type:***	Soil

Moisture Content (%): 18

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

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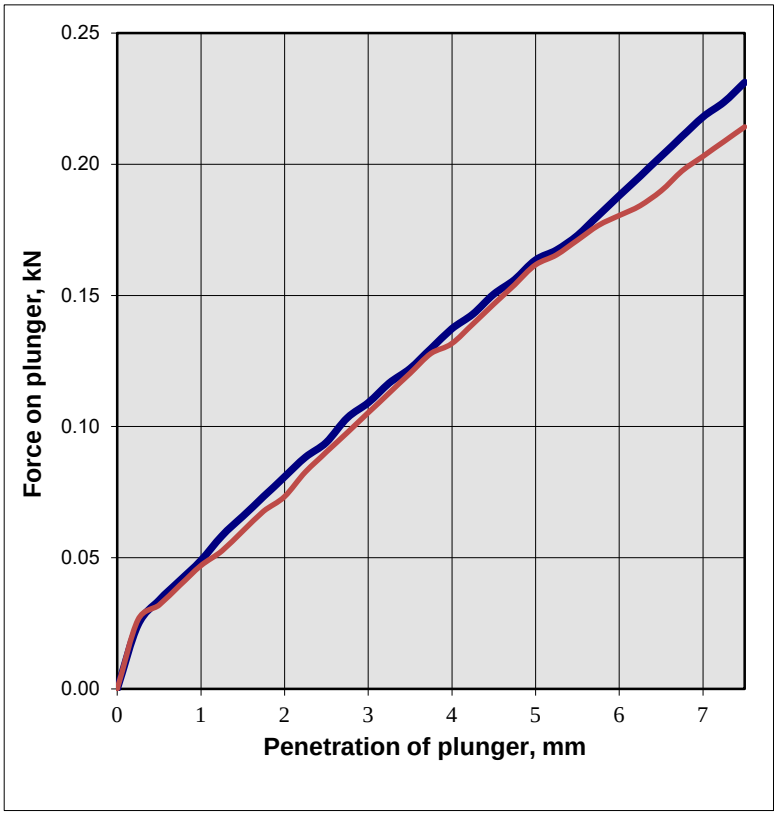
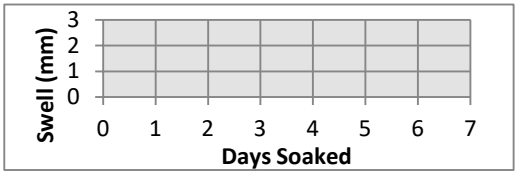
LABORATORY TEST REPORT

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 93394
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	14/04/2020
	Co Cork	**Date Reported:**	21/04/2020
Order No:	2003-104	**Sample Ref:**	XC215-TP05 Type B Sample 3
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)
2.15
Propertion of material removed from initial sample by dry mass (%)
7.2



Final Swell (mm):	N/A

Penetration (mm)	Force (kN)	Standard Force (kN)	Top CBR (%)
2.5	0.09	13.2	0.7
5.0	0.16	20.0	0.8
Moisture content : %	**21.3**	**Mean CBR value : %**	**0.8**

Penetration (mm)	Force (kN)	Standard Force (kN)	Bottom CBR (%)
2.5	0.09	13.2	0.7
5.0	0.16	20.0	0.8
Moisture content : %	**21.3**	**Mean CBR value : %**	**0.7**

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

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Phil Thorp, Laboratory Manager

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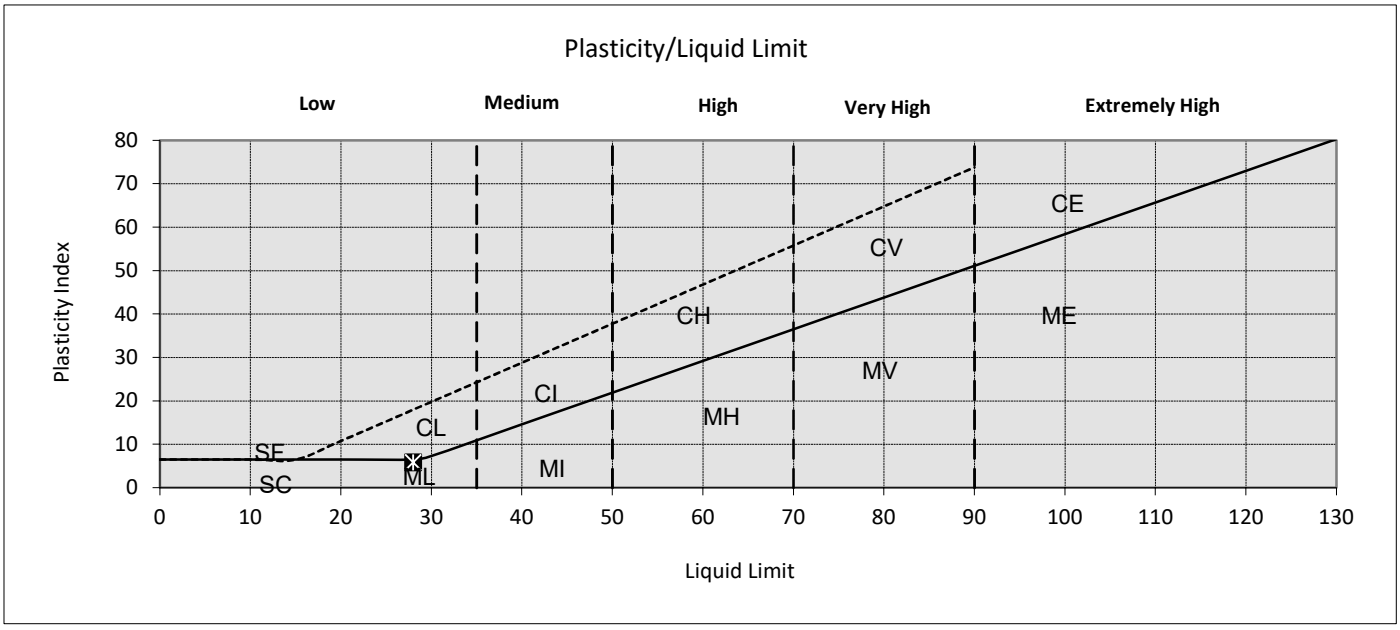
LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93396
	Unit 1 Carrigogna	**Sample Ref.:**	XC215-TP05 0.5-1.0m Type D S.4
	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 (%)	**25**
Natural Moisture Content (%)	**20**
Liquid Limit (single point)(%)	**28**
Plastic Limit (%)	**22**
Plasticity Index	**6**



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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 93398
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	26/03/2020
Order No:	2003-104	**Date Reported:**	02/04/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC215-TP05 Type D Sample 7

Sample Type:	Bulk	***Location:***	XC215-TP05 Type D Sample 7
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	1.1-1.6m	***Material Type:***	Soil

Moisture Content (%): 16

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
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James Fisher Testing Services Ltd
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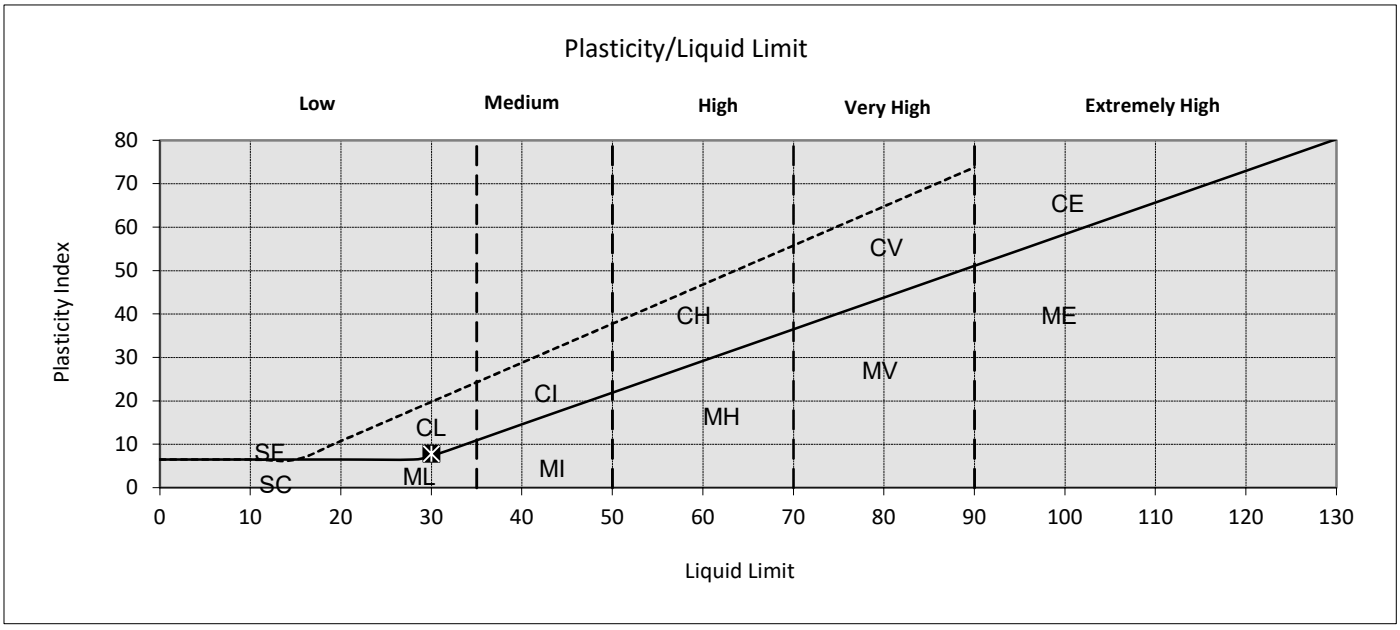
Tel: 01925286880

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 93399
	Unit 1 Carrigogna	**Sample Ref.:**	XC215-TP05 1.1-1.6m Type D S.7
	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 (%)	**27**
Natural Moisture Content (%)	**18**
Liquid Limit (single point)(%)	**30**
Plastic Limit (%)	**22**
Plasticity Index	**8**



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James Fisher Testing Services

LABORATORY TEST REPORT

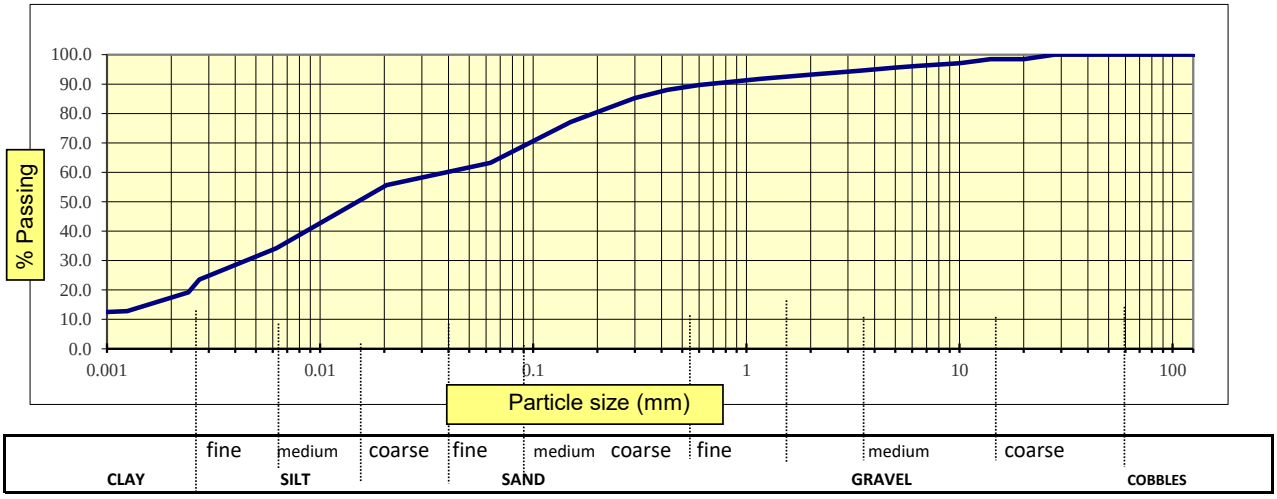
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 93397
	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**	Grey/Brown Clay, Fine Sand

Client Ref.	**XC215-TP05 Type B Sample 6**
Location:	XC215-TP05 Type B Sample 6
Supplier:	Bulk
Source:	Client Info.
Depth (m):	1.1-1.6m
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	100	
20 mm	98	
14 mm	98	
10 mm	97	
6.3 mm	96	
5 mm	96	
3.35 mm	94	
2 mm	93	
1.18 mm	92	
0.6 mm	90	
0.425 mm	88	
0.3 mm	85	
0.15 mm	77	
0.063 mm	63	
0.020 mm	56	
0.006 mm	34	
0.003 mm	24	
0.002 mm	19	
0.001 mm	13	



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

Sedimentation by Hydrometer - Not UKAS

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

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LABORATORY TEST REPORT

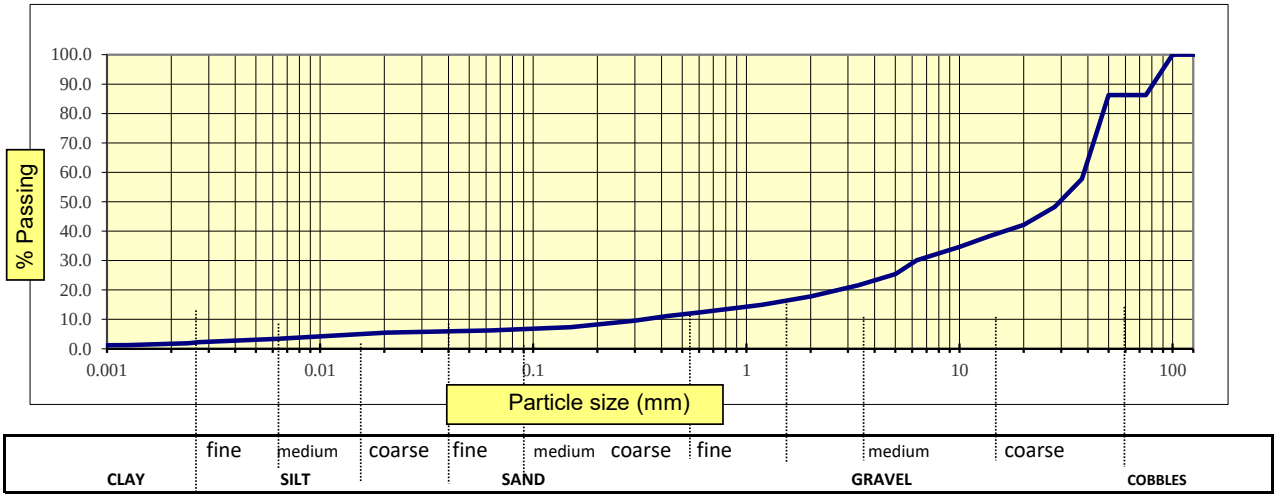
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 93400
	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.	**XC215-TP05 Type B Sample 8**
Location:	XC215-TP05 Type B Sample 8
Supplier:	Bulk
Source:	Client Info.
Depth (m):	1.7-2.2m
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	100	
75 mm	86	
63 mm	86	
50 mm	86	
37.5 mm	58	
28 mm	48	
20 mm	42	
14 mm	38	
10 mm	35	
6.3 mm	30	
5 mm	25	
3.35 mm	22	
2 mm	18	
1.18 mm	15	
0.6 mm	12	
0.425 mm	11	
0.3 mm	10	
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

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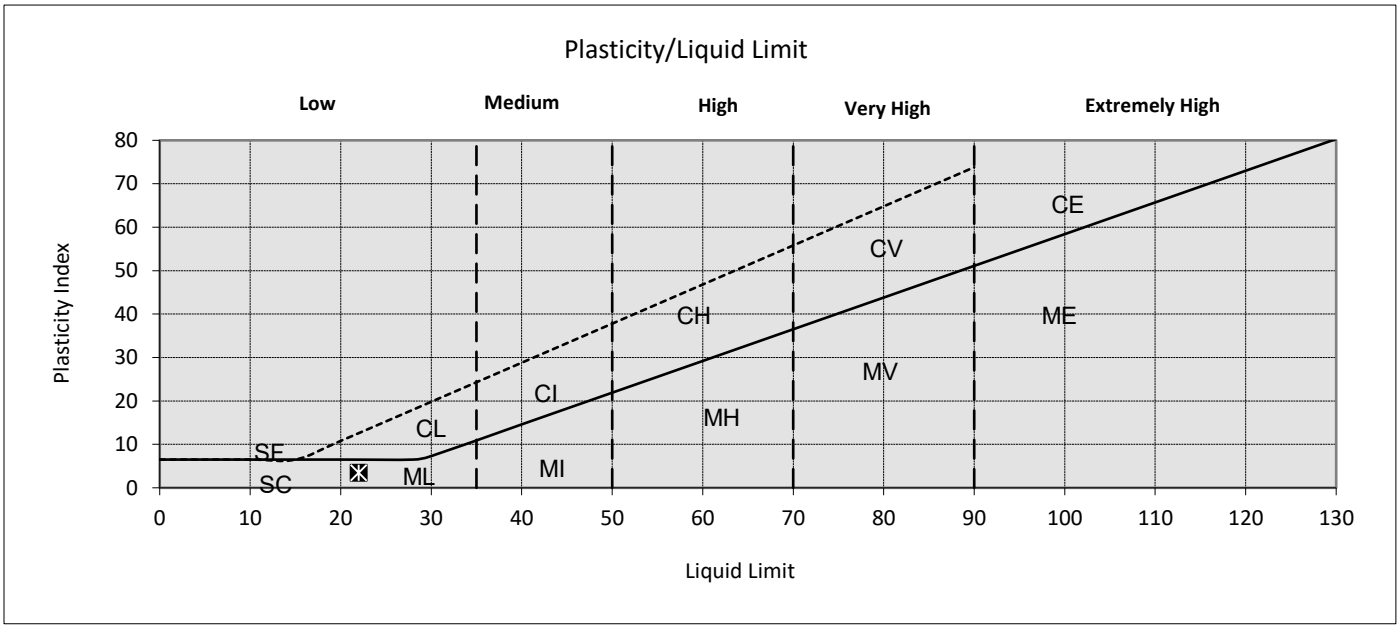
LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93402
	Unit 1 Carrigogna	**Sample Ref.:**	XC215-TP06 0.5-1.0m Type B Sample 3
	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 (%)	**21**
Natural Moisture Content (%)	**18**
Liquid Limit (single point)(%)	**22**
Plastic Limit (%)	**19**
Plasticity Index	**3**



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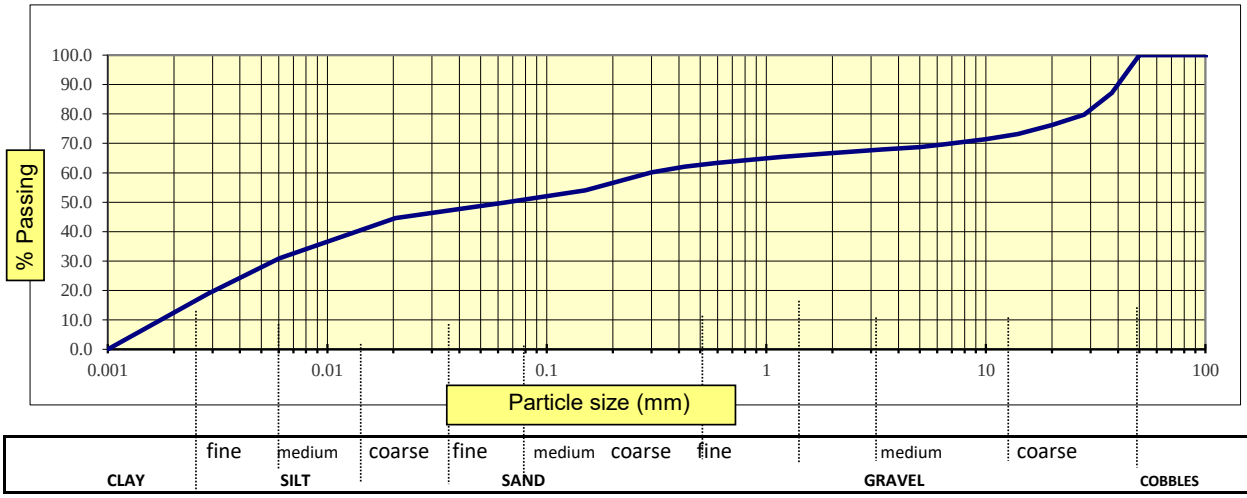
LABORATORY TEST REPORT

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 93403 09/03/2020 02/04/2020 01/04/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Grey/Brown Clay, Sandy

Client Ref.	**XC215-TP06 Type B Sample 3**
Location:	XC215-TP06 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%:	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	87	
28 mm	80	
20 mm	76	
14 mm	73	
10 mm	71	
6.3 mm	70	
5 mm	69	
3.35 mm	68	
2 mm	67	
1.18 mm	65	
0.6 mm	63	
0.425 mm	62	
0.3 mm	60	
0.15 mm	54	
0.063 mm	50	
0.0205 mm	45	
0.0060 mm	31	
0.0029 mm	19	



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

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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 93407
	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 **XC215-TP06 Type B Sample 6**

Supplier:	Client Info	**Date of Sampling:**	Client Info.
Source:	Client Info	**Sampled By:**	Client
Sample Location:	1.5-2.0m	**Sampling Reason:**	Request

Parameter	RESULT
pH	8
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

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☐ **James Ward, Operations Manager**

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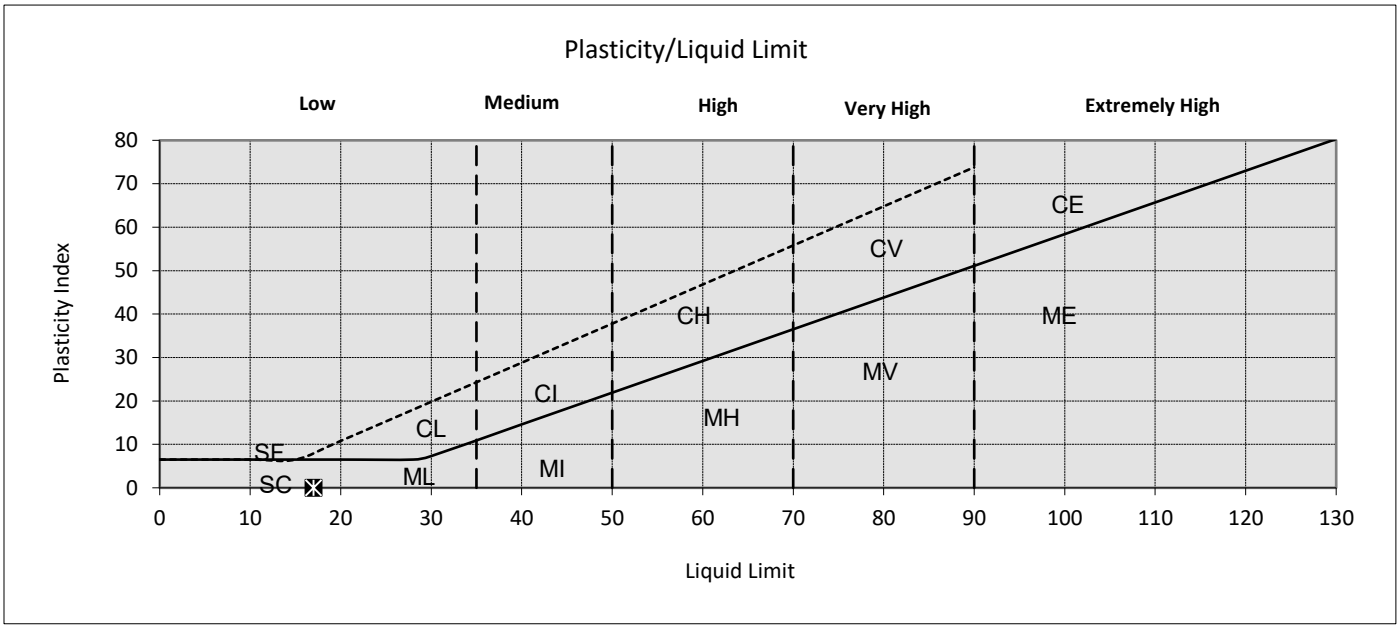
James Fisher Testing Services

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 93405
	Unit 1 Carrigogna	**Sample Ref.:**	XC215-TP06 1.5-2.0m Type B Sample 6
	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 (%)	**50**
Natural Moisture Content (%)	**7**
Liquid Limit (single point)(%)	**17**
Plastic Limit (%)	**Non-Plastic**
Plasticity Index	**N/A**



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Phil Thorp, Laboratory Manager

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James Fisher Testing Services

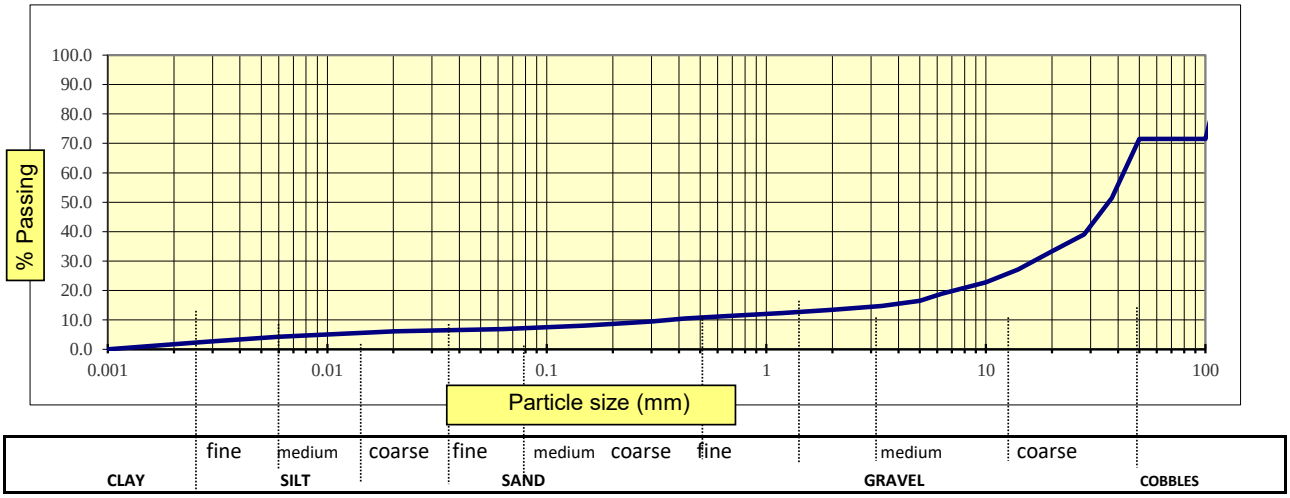
LABORATORY TEST REPORT

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 93406 09/03/2020 02/04/2020 31/03/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Cobbly Dark Clay, Sandy

Client Ref.	**XC215-TP06 Type B Sample 6**
Location:	XC215-TP06 Type B Sample 6
Supplier:	Client Info.
Source:	Client Info.
Depth (m):	1.5-2.0m
Sampling Reason:	Client Request
Sampled By:	Client
Specification:	Client
Preparation Method:	Without Organics Preparation
Notes:	Disturbed sample from cleanout
Moisture Content%:	6

BS Sieve Size	% Passing	Specification
125 mm	100	
100 mm	72	
90 mm	72	
75 mm	72	
63 mm	72	
50 mm	72	
37.5 mm	51	
28 mm	39	
20 mm	33	
14 mm	27	
10 mm	23	
6.3 mm	19	
5 mm	16	
3.35 mm	15	
2 mm	13	
1.18 mm	12	
0.6 mm	11	
0.425 mm	10	
0.3 mm	9	
0.15 mm	8	
0.063 mm	7	
0.0205 mm	6	
0.0060 mm	4	
0.0029 mm	3	



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

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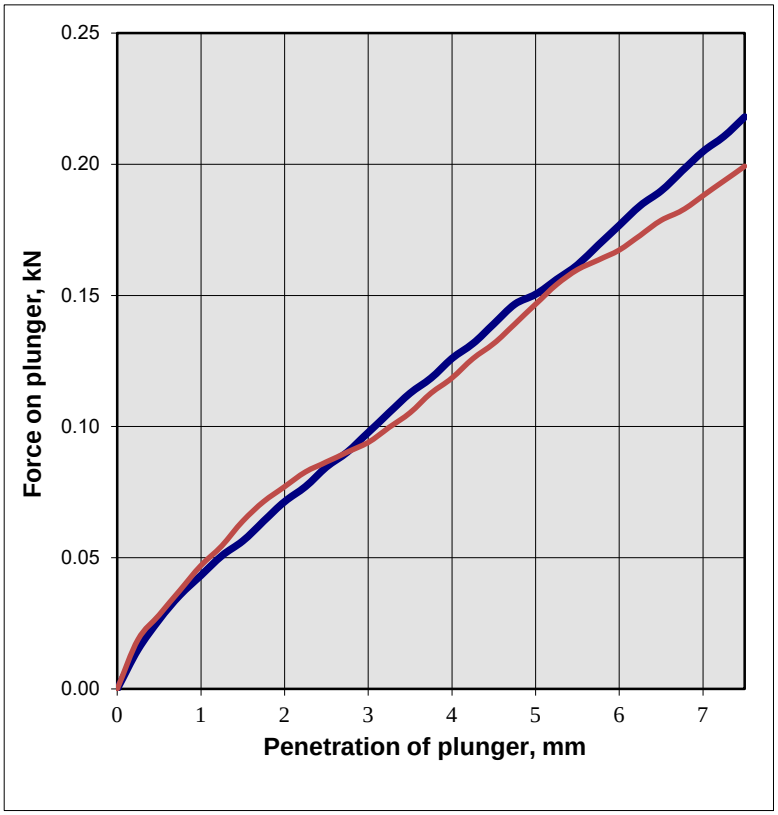
James Fisher Testing Services

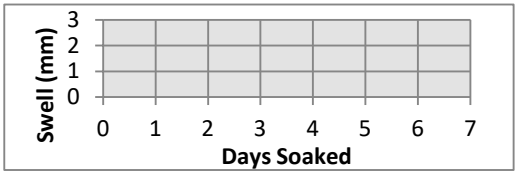
LABORATORY TEST REPORT

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 93408
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	13/04/2020
	Co Cork	**Date Reported:**	22/04/2020
Order No:	2003-104	**Sample Ref:**	XC215-TP07 Type B Sample 2
Originator : Ian Holley		**Location:**	0.4-0.8m



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)
2.04
Propertion of material removed from initial sample by dry mass (%)
5.6



Final Swell (mm):	N/A

Penetration (mm)	Force (kN)	Standard Force (kN)	Top CBR (%)
2.5	0.08	13.2	0.6
5.0	0.15	20.0	0.8
Moisture content : %	**24.3**	**Mean CBR value : %**	**0.7**

Penetration (mm)	Force (kN)	Standard Force (kN)	Bottom CBR (%)
2.5	0.09	13.2	0.7
5.0	0.15	20.0	0.7
Moisture content : %	**24.3**	**Mean CBR value : %**	**0.7**

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

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James Fisher Testing Services Ltd
Phil Thorp, Laboratory Manager

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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 93409
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	26/03/2020
Order No:	2003-104	**Date Reported:**	02/04/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC215-TP07 Type D Sample 3

Sample Type:	Bulk	***Location:***	XC215-TP07 Type D Sample 3
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	0.4-0.8m	***Material Type:***	Soil

Moisture Content (%): 28

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

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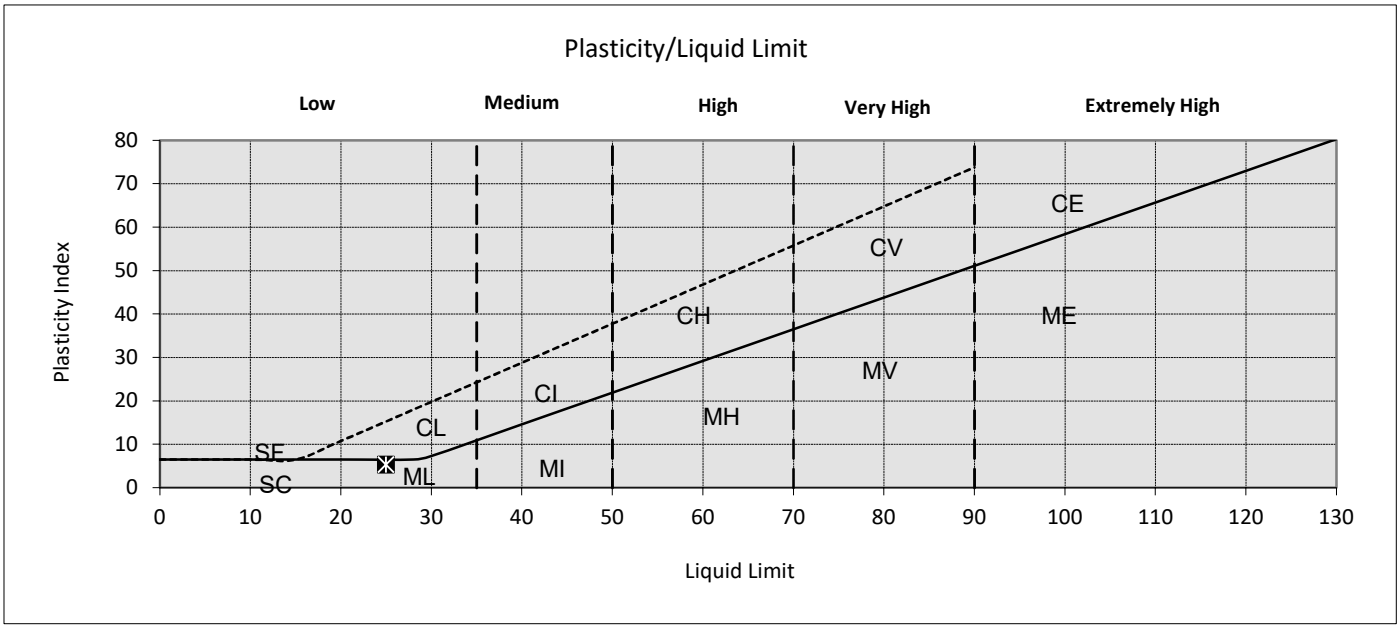
LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93410
	Unit 1 Carrigogna	**Sample Ref.:**	XC215-TP07 0.4-0.8m Type D S.3
	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 (%)	**23**
Natural Moisture Content (%)	**17**
Liquid Limit (single point)(%)	**25**
Plastic Limit (%)	**20**
Plasticity Index	**5**



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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 93412
	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: XC215-TP07 Type D Sample 6

Sample Type:	Bulk	***Location:***	XC215-TP07 Type D Sample 6
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	0.9-1.4m	***Material Type:***	Soil

Moisture Content (%): 20

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

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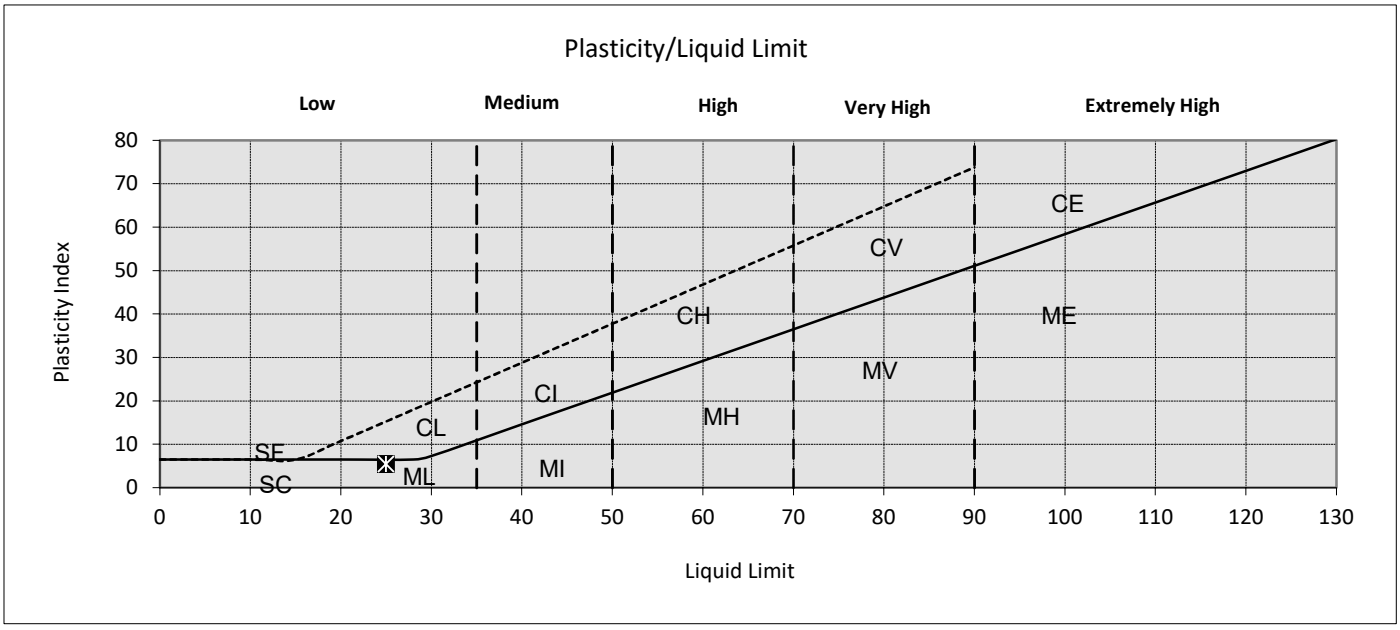
LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93413
	Unit 1 Carrigogna	**Sample Ref.:**	XC215-TP07 0.9-1.4m Type D S.6
	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 (%)	**28**
Natural Moisture Content (%)	**20**
Liquid Limit (single point)(%)	**25**
Plastic Limit (%)	**19**
Plasticity Index	**5**



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LABORATORY TEST REPORT

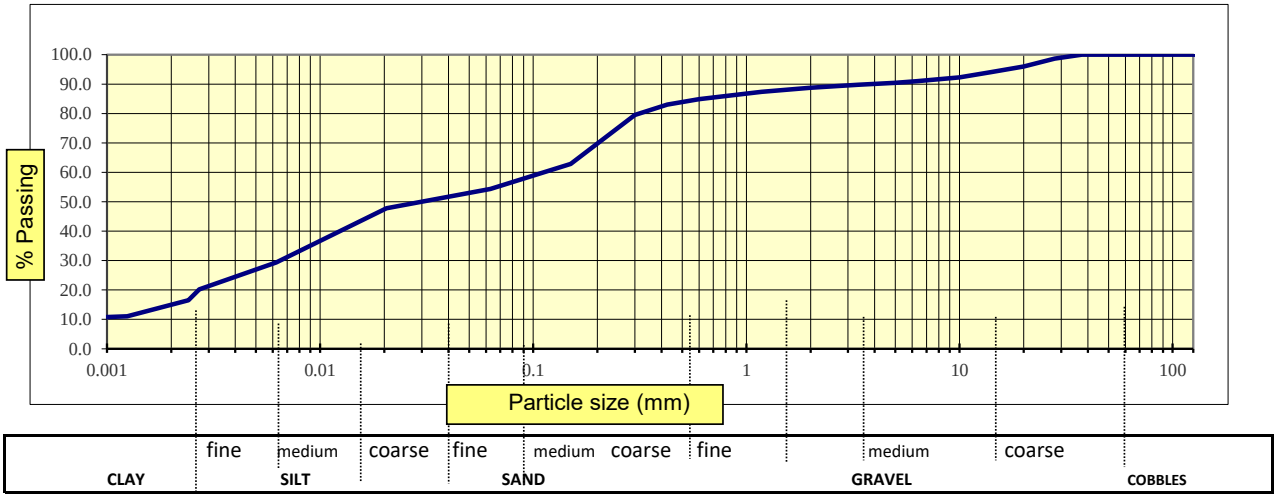
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 93411
	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 Clay, Fine, Sandy

Client Ref.	**XC215-TP07 Type B Sample 5**
Location:	XC215-TP07 Type B Sample 5
Supplier:	Bulk
Source:	Client Info.
Depth (m):	0.9-1.4m
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	100	
100 mm	100	
75 mm	100	
63 mm	100	
50 mm	100	
37.5 mm	100	
28 mm	99	
20 mm	96	
14 mm	94	
10 mm	92	
6.3 mm	91	
5 mm	90	
3.35 mm	90	
2 mm	89	
1.18 mm	87	
0.6 mm	85	
0.425 mm	83	
0.3 mm	80	
0.15 mm	63	
0.063 mm	54	
0.020 mm	48	
0.006 mm	29	
0.003 mm	20	
0.002 mm	17	
0.001 mm	11	



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

Sedimentation by Hydrometer - Not UKAS

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☐ **James Ward, Operations Manager**

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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 93415
	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 **XC215-TP07 Type D Sample 9**

Supplier:	Client Info	**Date of Sampling:**	Client Info.
Source:	Client Info	**Sampled By:**	Client
Sample Location:	1.6-2.1m	**Sampling Reason:**	Request

Parameter	RESULT
pH	7.2
Sulphate Aqueous Extract (SO4) (mg/l)	51
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

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LABORATORY TEST REPORT

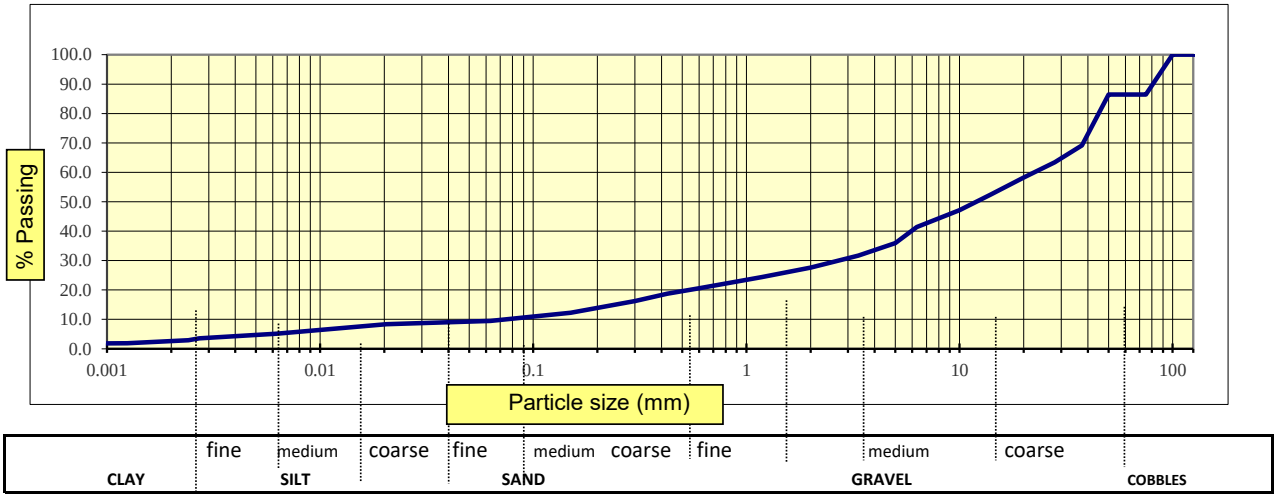
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 93414
	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, Dark Clay, Sandy

Client Ref.	**XC215-TP07 Type B Sample 8**
Location:	XC215-TP07 Type B Sample 8
Supplier:	Bulk
Source:	Client Info.
Depth (m):	1.6-2.1m
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	86	
63 mm	86	
50 mm	86	
37.5 mm	69	
28 mm	63	
20 mm	58	
14 mm	52	
10 mm	47	
6.3 mm	41	
5 mm	36	
3.35 mm	32	
2 mm	28	
1.18 mm	24	
0.6 mm	21	
0.425 mm	19	
0.3 mm	16	
0.15 mm	12	
0.063 mm	9	
0.020 mm	8	
0.006 mm	5	
0.003 mm	4	
0.002 mm	3	
0.001 mm	2	



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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 93417
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	26/03/2020
Order No:	2003-104	**Date Reported:**	03/04/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC215-TP08 Type D Sample 4

Sample Type:	Bulk	***Location:***	XC215-TP08 Type D Sample 4
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	0.5-1.0m	***Material Type:***	Soil

Moisture Content (%): 18

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

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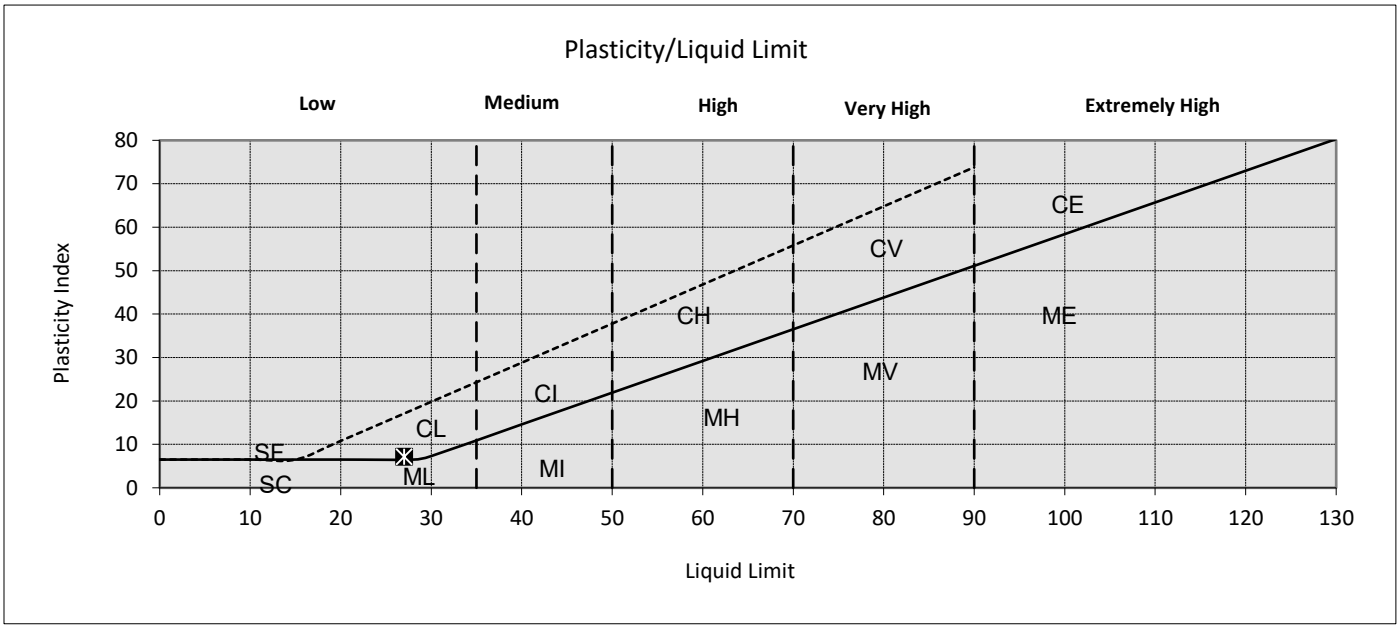
James Fisher Testing Services

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 93418
	Unit 1 Carrigogna	**Sample Ref.:**	XC215-TP08 0.5-1.0m Type D Sample 4
	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 (%)	**20**
Natural Moisture Content (%)	**26**
Liquid Limit (single point)(%)	**27**
Plastic Limit (%)	**20**
Plasticity Index	**7**



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James Fisher Testing Services

LABORATORY TEST REPORT

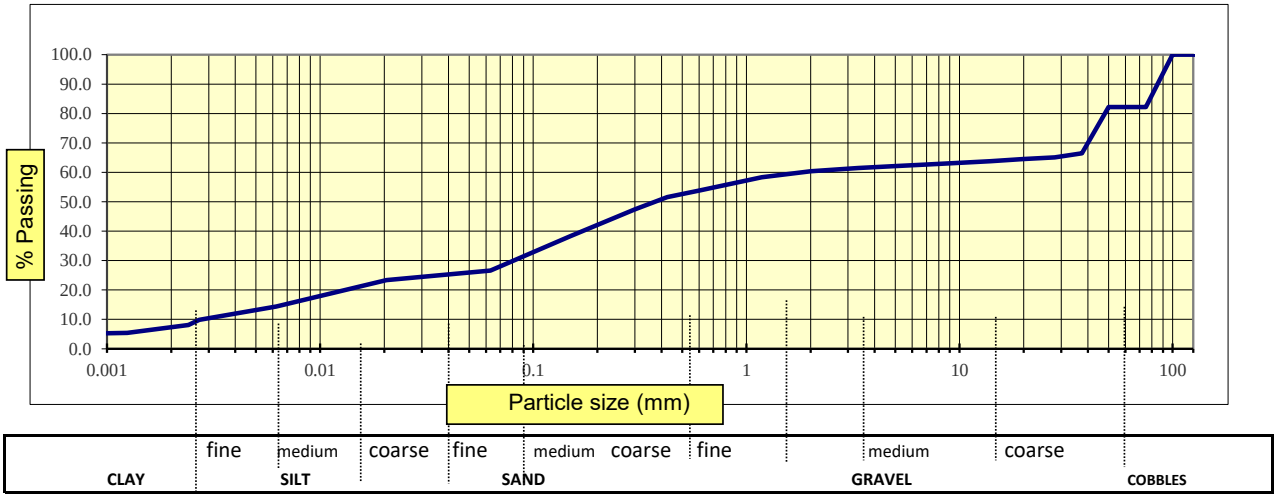
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 93416
	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, Dark Clay, Fine Sand

Client Ref.	**XC215-TP08 Type B Sample 3**
Location:	XC215-TP08 Type B Sample 3
Supplier:	Bulk
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

BS Sieve Size	% Passing	Specification
300 mm	100	
125 mm	100	
100 mm	100	
75 mm	82	
63 mm	82	
50 mm	82	
37.5 mm	66	
28 mm	65	
20 mm	64	
14 mm	64	
10 mm	63	
6.3 mm	62	
5 mm	62	
3.35 mm	61	
2 mm	60	
1.18 mm	58	
0.6 mm	54	
0.425 mm	52	
0.3 mm	47	
0.15 mm	38	
0.063 mm	27	
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

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LABORATORY TEST REPORT

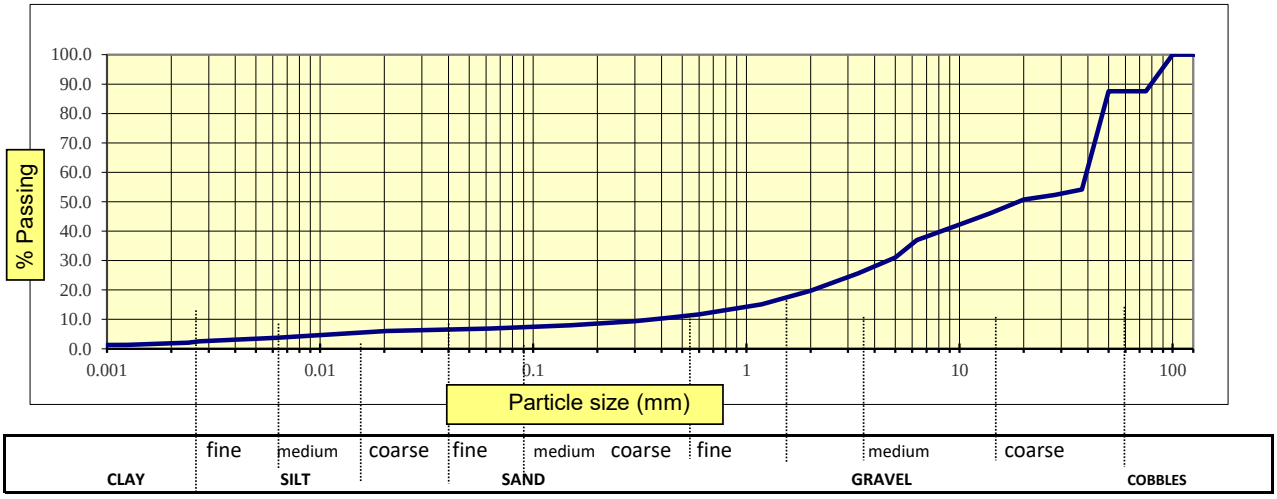
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 93419
	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.	**XC215-TP08 Type B Sample 6**
Location:	XC215-TP08 Type B Sample 6
Supplier:	Bulk
Source:	Client Info.
Depth (m):	1.4-1.8m
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	88	
63 mm	88	
50 mm	88	
37.5 mm	54	
28 mm	52	
20 mm	51	
14 mm	46	
10 mm	42	
6.3 mm	37	
5 mm	31	
3.35 mm	26	
2 mm	20	
1.18 mm	15	
0.6 mm	12	
0.425 mm	10	
0.3 mm	9	
0.15 mm	8	
0.063 mm	7	
0.020 mm	6	
0.006 mm	4	
0.003 mm	3	
0.002 mm	2	
0.001 mm	1	



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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 93425
	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 **XC215-TP09 Type D Sample 6**

Supplier:	Client Info	**Date of Sampling:**	Client Info.
Source:	Client Info	**Sampled By:**	Client
Sample Location:	0.6-1.1m	**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 (%)	0.02

Comments:
None

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

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LABORATORY TEST REPORT

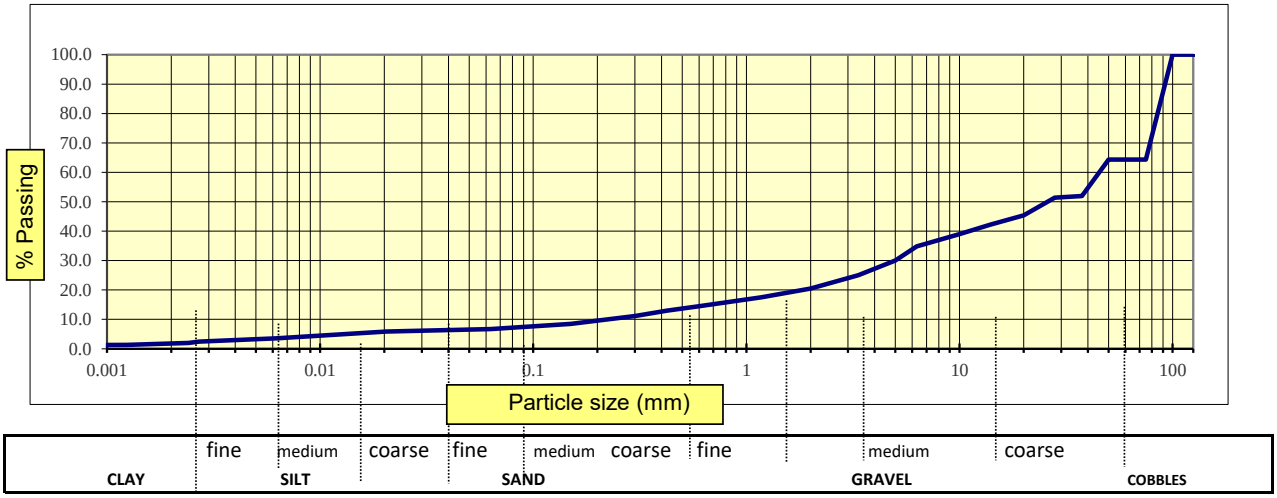
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 93424
	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

Client Ref.	**XC215-TP09 Type B Sample 5**
Location:	XC215-TP09 Type B Sample 5
Supplier:	Bulk
Source:	Client Info.
Depth (m):	0.6-1.1m
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	64	
63 mm	64	
50 mm	64	
37.5 mm	52	
28 mm	51	
20 mm	45	
14 mm	42	
10 mm	39	
6.3 mm	35	
5 mm	30	
3.35 mm	25	
2 mm	21	
1.18 mm	18	
0.6 mm	14	
0.425 mm	13	
0.3 mm	11	
0.15 mm	8	
0.063 mm	7	
0.020 mm	6	
0.006 mm	4	
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

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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 93421
	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: XC215-TP09 Type D Sample 3

Sample Type:	Bulk	***Location:***	XC215-TP09 Type D Sample 3
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	0.35-0.60m	***Material Type:***	Soil

Moisture Content (%): 14

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

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James Ward, Operations Manager

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Tel: 057 8664885

LABORATORY TEST REPORT

To determine the Organic Content of Soil
in accordance with BS 1377

Project:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref. No.:**	ST 93423
	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 **XC215-TP09 Type D Sample 3**

Supplier:	Client Info	**Date of Sampling:**	Client Info
Source:	Client Info	**Sampled By:**	Client
Sample Location:	0.35-0.60m	**Sampling Reason:**	Request

Result:

Organic Matter (%)	**6.2**

Comments:
None

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

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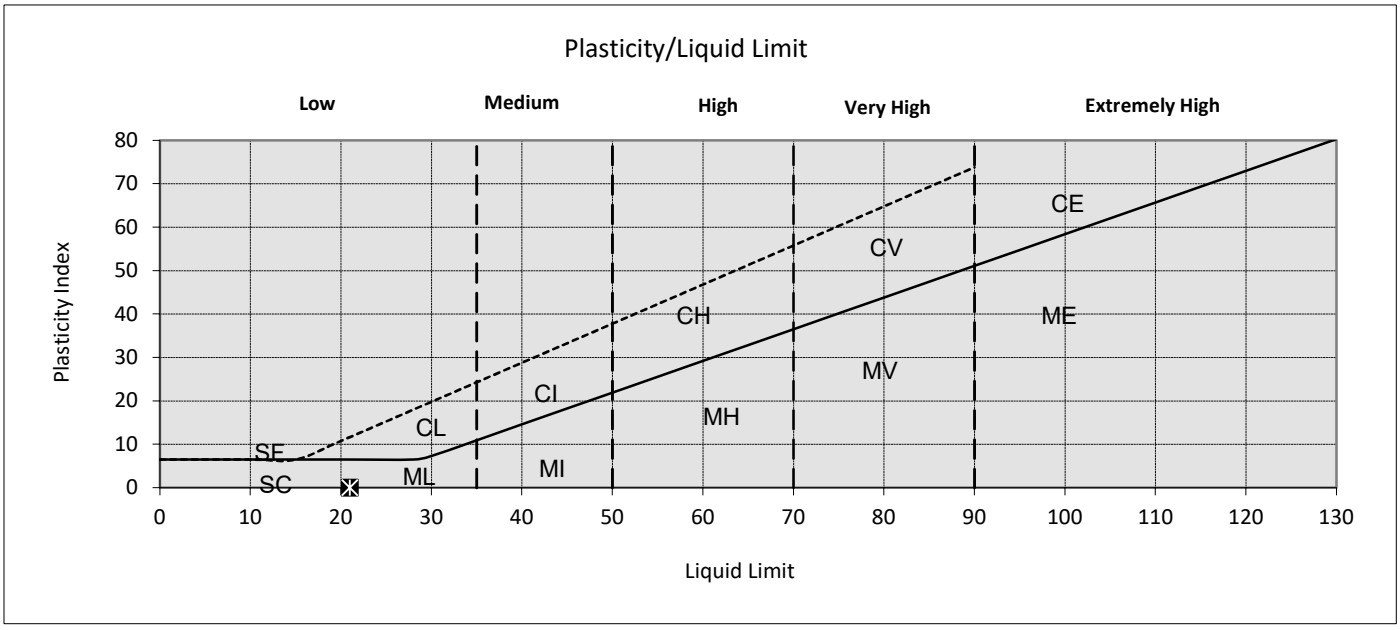
James Fisher Testing Services

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 93422
	Unit 1 Carrigogna	**Sample Ref.:**	XC215-TP09 0.35-0.6m Type D S.3
	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 (%)	**21**
Natural Moisture Content (%)	**18**
Liquid Limit (single point)(%)	**21**
Plastic Limit (%)	**Non-Plastic**
Plasticity Index	**N/A**



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LABORATORY TEST REPORT

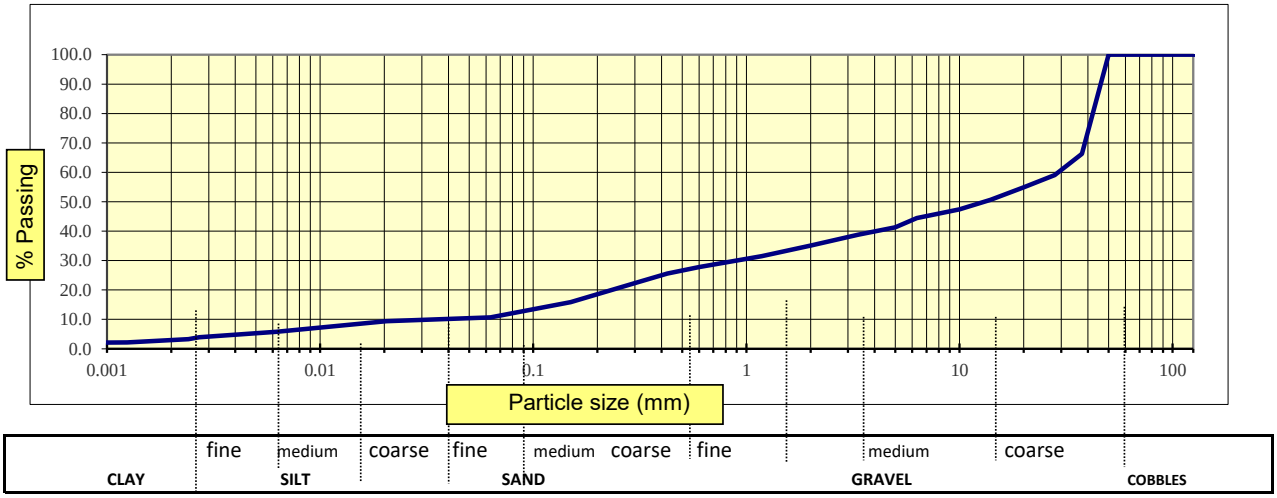
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 93420
	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, Dark Clay, Sandy

Client Ref.	**XC215-TP09 Type B Sample 2**
Location:	XC215-TP09 Type B Sample 2
Supplier:	Bulk
Source:	Client Info.
Depth (m):	0.35-0.6m
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	66	
28 mm	59	
20 mm	55	
14 mm	51	
10 mm	47	
6.3 mm	44	
5 mm	41	
3.35 mm	39	
2 mm	35	
1.18 mm	31	
0.6 mm	28	
0.425 mm	26	
0.3 mm	22	
0.15 mm	16	
0.063 mm	11	
0.020 mm	9	
0.006 mm	6	
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

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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
XC215-CP01	5	1.20	2.00	B	Brown sandy slightly silty GRAVEL. Gravel is granite.						NP			
XC215-CP01	9	2.00	3.00	D				4.7						
XC215-CP01	14	3.60	4.50	D	Brown mottled grey slightly sandy slightly gravelly CLAY.				56 s	24 a	15	9		
XC215-CP01	19	6.00	6.80	B	Brown sandy clayey GRAVEL.				15 s	24 a	15	9		
XC215-CPRC01	3	0.30	1.20	D	Brown slightly gravelly clayey SAND.				58 s	27 a	18	9		
XC215-CPRC01	12	3.00	4.00	D	Brown sandy slightly clayey GRAVEL.			6.6						
XC215-CPRC01	16	4.70	6.00	D	Brown slightly sandy slightly gravelly silty CLAY.				64 s	26 a	18	8		
XC215-CPRC02	3	1.20	2.00	B	Brown slightly sandy slightly silty GRAVEL. Gravel is granite.						NP			
XC215-CPRC02	6	2.00	3.00	D	Brown sandy slightly clayey GRAVEL.			5.5						
XC215-CPRC02	12	4.20	5.00	D	Brown slightly sandy slightly gravelly CLAY.				56 s	24 a	17	7		
XC215-CPRC02	16	6.00	6.20	D	Brown slightly sandy clayey GRAVEL. Gravel is granite.				37 s	27 b	17	10		

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 2.94
Mar 17

SOCOTEC

Project No N9390-20

Project Name Cork Line Level Crossings

Figure

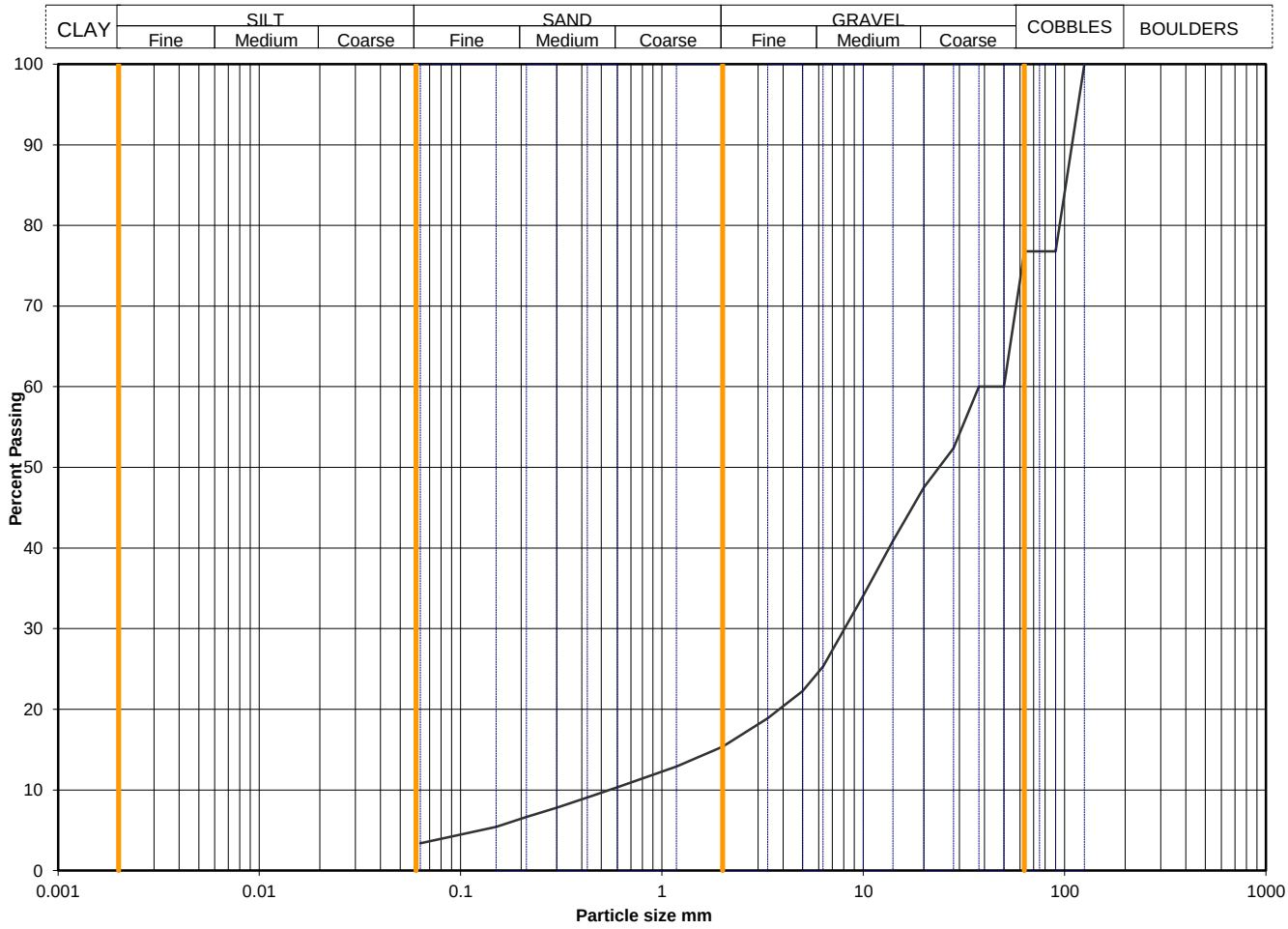
INDX

Printed: 19/08/2020 14:28

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020080434

Hole No	XC215-CP01
Sample Depth (m BGL)	2.00 - 3.00
Sample Type and No	B8
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	77		
75	77		
63	77		
50	60		
37.5	60		
28	52		
20	48		
14	41		
10	34		
6.3	25		
5.0	22		
3.35	19		
2.00	15		
1.18	13		
0.600	10		
0.425	9		
0.300	8	Dry mass of sample, kg	
0.212	7	6.7	
0.150	5		
0.063	3		

Soil description	Reddish brown sandy slightly silty GRAVEL with one cobble.		
Preparation / Pretreatment	Sieve: pre dried,		
Remarks			
Sample Proportions		Whole	*<60mm
	Cobbles / boulders	23.1	0.0
	Gravel	61.5	80.0
	Sand	12.0	15.6
*<60mm values to aid description only	Silt	silt+clay =	
	Clay	3.4	4.4

Uniformity Coefficient	**D60 / D10**	91

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

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Project Name Cork Line Level Crossings

Figure

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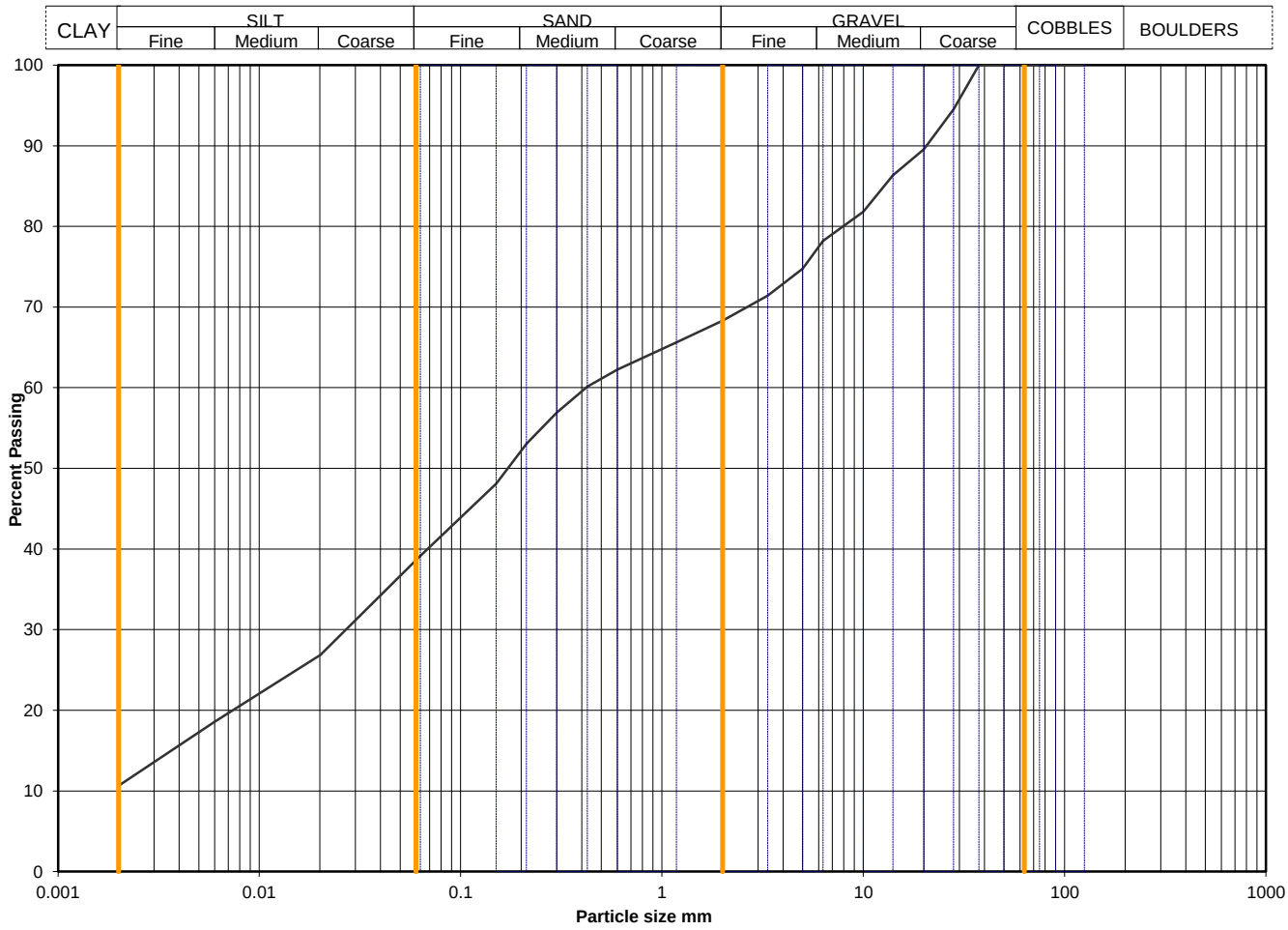
Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020080436

Hole No	XC215-CP01
Sample Depth (m BGL)	3.60 - 4.50
Sample Type and No	B13
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0201	27
90	100	0.0060	19
75	100	0.0020	11
63	100		
50	100		
37.5	100		
28	95		
20	90		
14	86		
10	82		
6.3	78		
5.0	75		
3.35	71		
2.00	68		
1.18	66	Particle density, Mg/m3	
0.600	62		
0.425	60	2.65 assumed	
0.300	57	Dry mass of sample, kg	
0.212	53		
0.150	48	1.8	
0.063	39		

Soil description	Brown mottled grey slightly gravelly slightly sandy silty CLAY		
Preparation / Pretreatment	Sieve: pre dried, Pipette: as BS1377		
Remarks			
Sample Proportions		Whole	*<60mm
	Cobbles / boulders	0.0	0.0
	Gravel	31.7	31.7
	Sand	29.2	29.2
*<60mm values to aid description only	Silt	28.5	28.5
	Clay	10.6	10.6

Uniformity Coefficient	**D60 / D10**	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

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Figure

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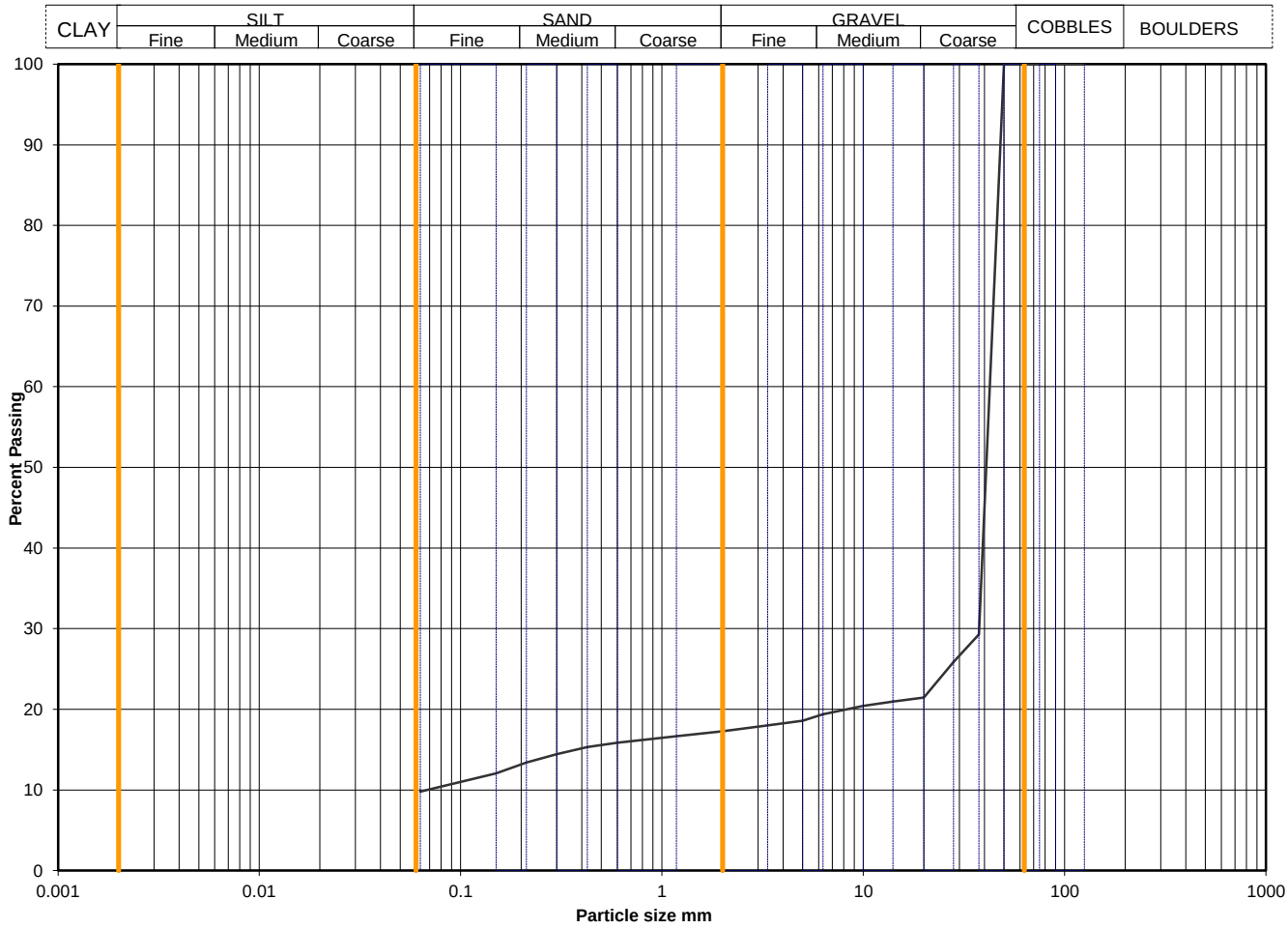
Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020080438

Hole No	XC215-CP01
Sample Depth (m BGL)	6.00 - 6.80
Sample Type and No	B19
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	29		
28	26		
20	21		
14	21		
10	20		
6.3	19		
5.0	19		
3.35	18		
2.00	17		
1.18	17		
0.600	16		
0.425	15		
0.300	14	Dry mass of sample, kg	
0.212	13		
0.150	12	2.2	
0.063	10		

Soil description	Brown sandy clayey GRAVEL.
Preparation / Pretreatment	Sieve: pre dried,
Remarks	

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	0.0	0.0
	Gravel	82.7	82.7
	Sand	7.5	7.5
*<60mm values to aid description only	Silt	silt+clay =	
	Clay	9.8	9.8

Uniformity Coefficient	D60 / D10	627

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

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Figure

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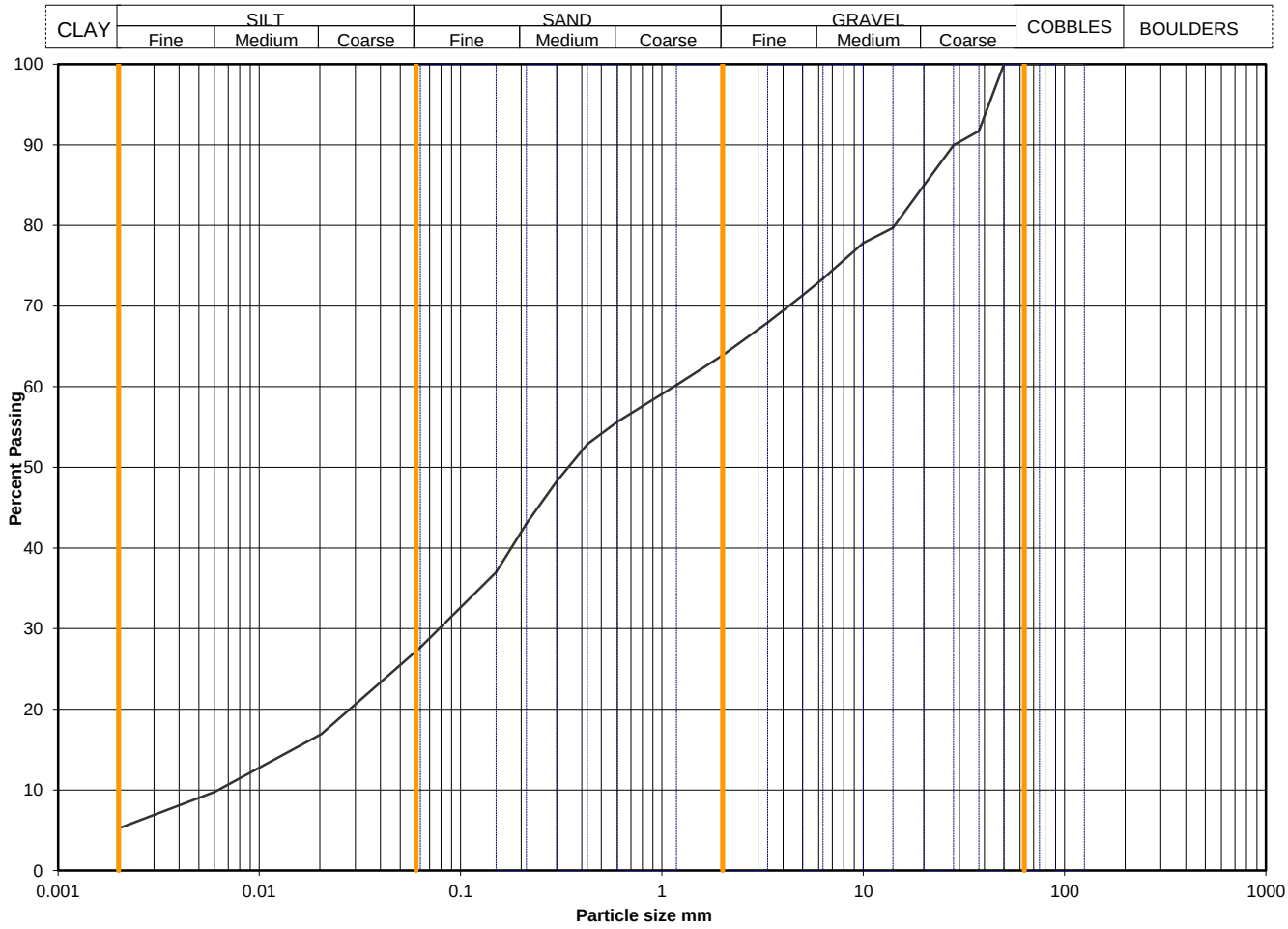
Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020080439

Hole No	XC215-CPRC01
Sample Depth (m BGL)	0.30 - 1.20
Sample Type and No	B2
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0203	17
90	100	0.0060	10
75	100	0.0020	5
63	100		
50	100		
37.5	92		
28	90		
20	85		
14	80		
10	78		
6.3	73		
5.0	71		
3.35	68		
2.00	64		
1.18	60	Particle density, Mg/m3	
0.600	56		
0.425	53	2.65 assumed	
0.300	48	Dry mass of sample, kg	
0.212	43		
0.150	37	2.2	
0.063	28		

Soil description	Brown sandy gravelly clayey SILT.		
Preparation / Pretreatment	Sieve: pre dried, Pipette: as BS1377		
Remarks			
Sample Proportions		Whole	*<60mm
	Cobbles / boulders	0.0	0.0
	Gravel	36.2	36.2
	Sand	36.2	36.2
*<60mm values to aid description only	Silt	22.4	22.4
	Clay	5.2	5.2

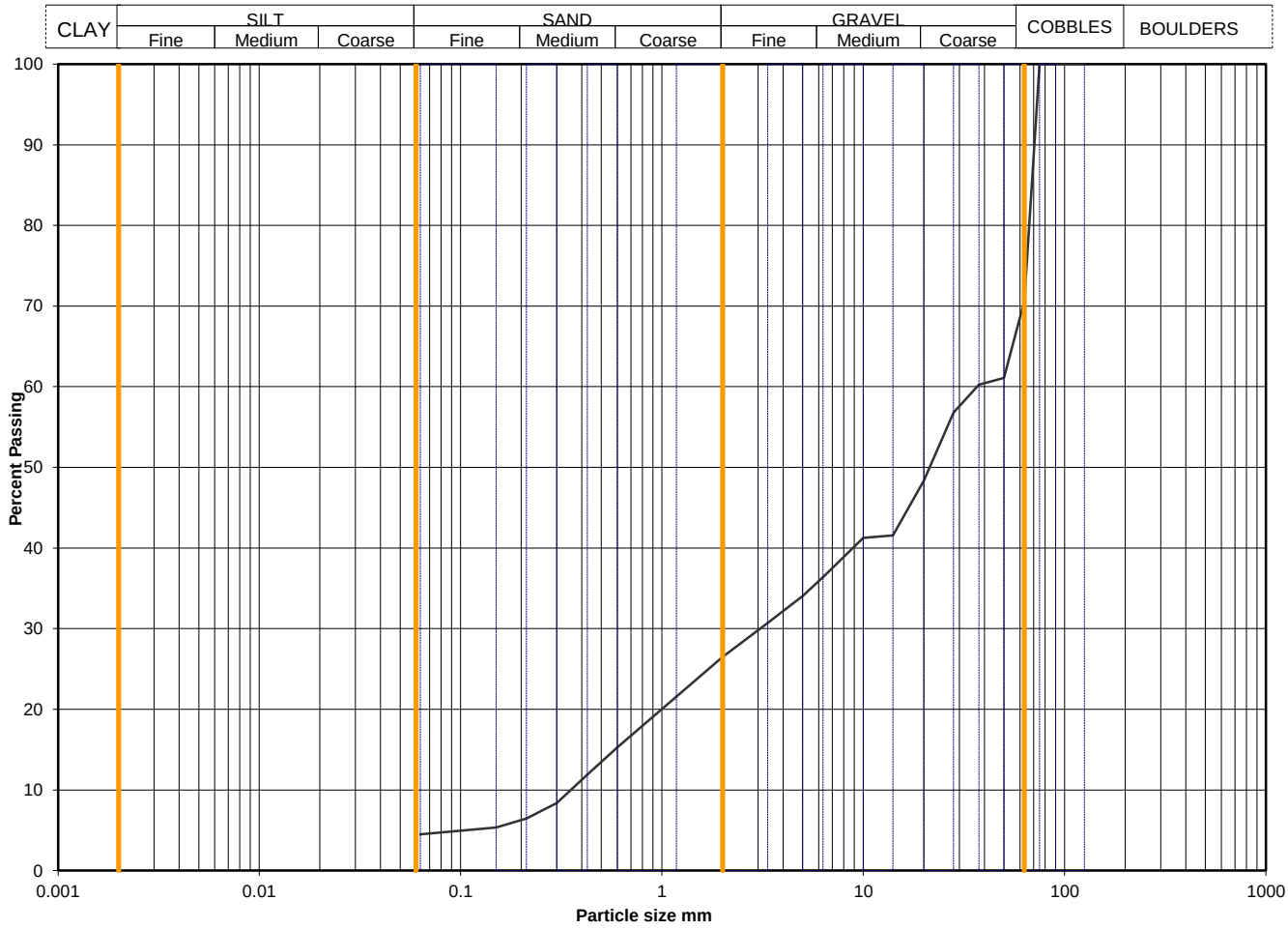
Uniformity Coefficient	**D60 / D10**	184

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020080442

Hole No	XC215-CPRC01
Sample Depth (m BGL)	3.00 - 4.00
Sample Type and No	B11
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	71		
50	61		
37.5	60		
28	57		
20	48		
14	42		
10	41		
6.3	36		
5.0	34		
3.35	31		
2.00	26		
1.18	22		
0.600	15		
0.425	12		
0.300	8	Dry mass of sample, kg	
0.212	6		
0.150	5	4.6	
0.063	5		

Soil description	Brown very sandy clayey GRAVEL with three cobbles.		
Preparation / Pretreatment	Sieve: pre dried,		
Remarks			
Sample Proportions		Whole	*<60mm
	Cobbles / boulders	29.3	0.0
	Gravel	44.2	62.5
	Sand	22.0	31.1
*<60mm values to aid description only	Silt	silt+clay =	
	Clay	4.5	6.4

Uniformity Coefficient	**D60 / D10**	138

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

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Figure

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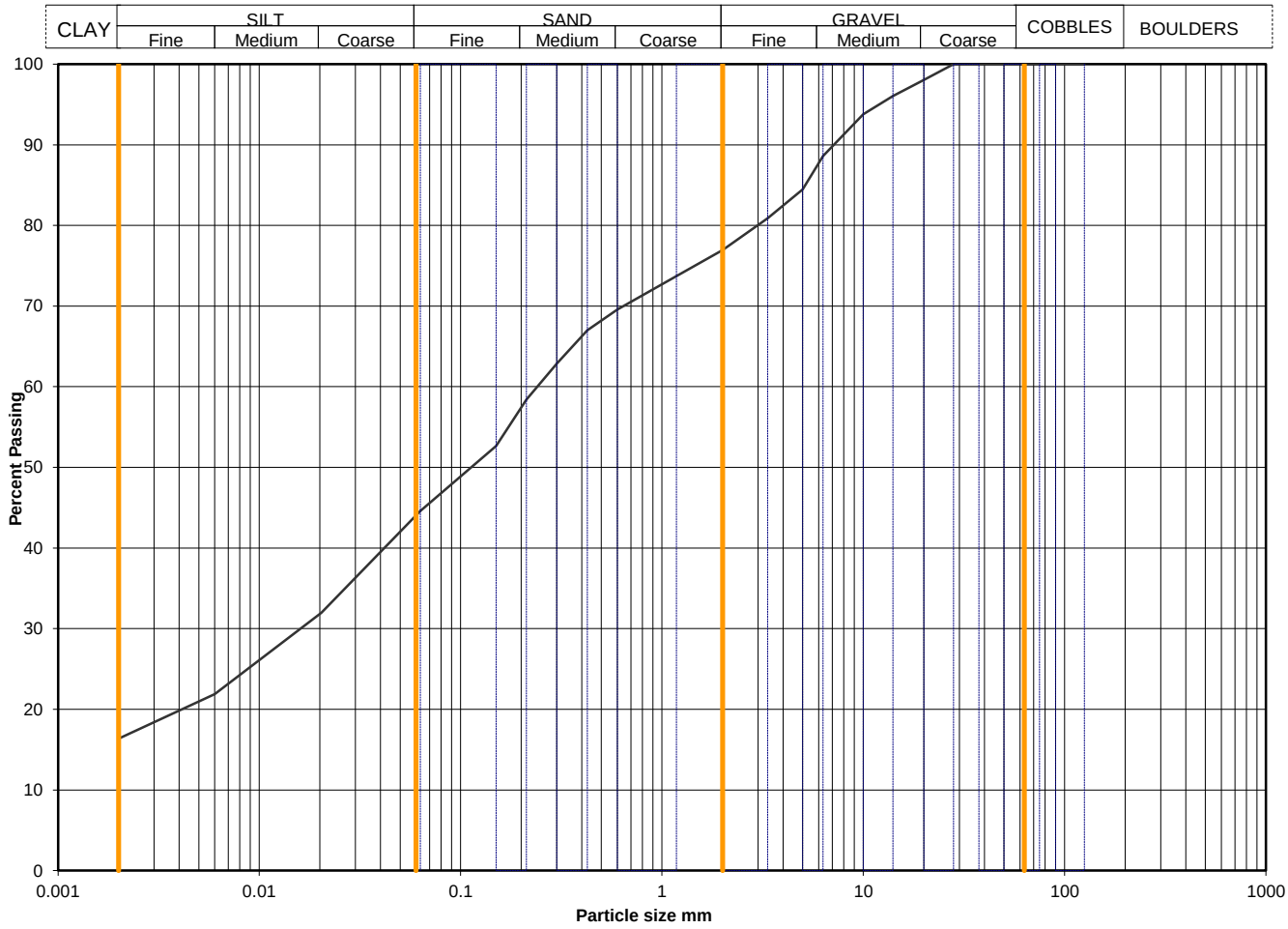
Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020080444

Hole No	XC215-CPRC01
Sample Depth (m BGL)	4.70 - 6.00
Sample Type and No	B15
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0203	32
90	100	0.0060	22
75	100	0.0020	16
63	100		
50	100		
37.5	100		
28	100		
20	98		
14	96		
10	94		
6.3	89		
5.0	84		
3.35	81		
2.00	77		
1.18	74	Particle density, Mg/m3	
0.600	70		
0.425	67	2.65 assumed	
0.300	63	Dry mass of sample, kg	
0.212	58		
0.150	53	1.7	
0.063	45		

Soil description	Brown slightly gravelly slightly sandy silty CLAY		
Preparation / Pretreatment	Sieve: pre dried, Pipette: as BS1377		
Remarks			
Sample Proportions		Whole	*<60mm
	Cobbles / boulders	0.0	0.0
	Gravel	23.2	23.2
	Sand	32.3	32.3
*<60mm values to aid description only	Silt	28.2	28.2
	Clay	16.3	16.3

Uniformity Coefficient	**D60 / D10**	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

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Project Name Cork Line Level Crossings

Figure

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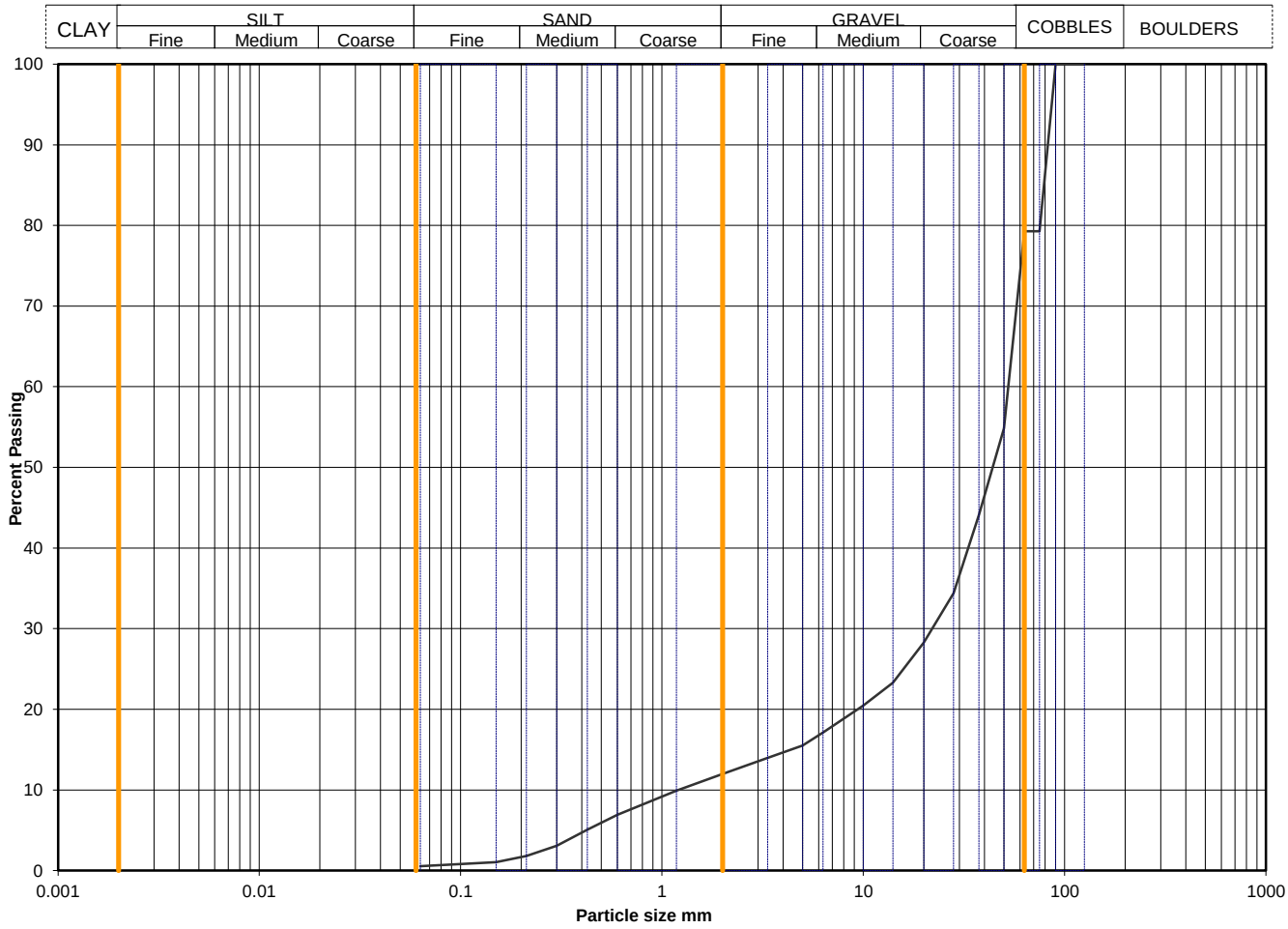
Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020080446

Hole No	XC215-CPRC02
Sample Depth (m BGL)	1.20 - 2.00
Sample Type and No	B3
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	79		
63	79		
50	55		
37.5	44		
28	34		
20	28		
14	23		
10	20		
6.3	17		
5.0	16		
3.35	14		
2.00	12		
1.18	10		
0.600	7		
0.425	5		
0.300	3	Dry mass of sample, kg	
0.212	2		
0.150	1	9.4	
0.063	1		

Soil description	Brown slightly sandy slightly silty GRAVEL. Gravel is granite.		
Preparation / Pretreatment	Sieve: pre dried,		
Remarks			
Sample Proportions		Whole	*<60mm
	Cobbles / boulders	20.7	0.0
	Gravel	67.3	84.9
	Sand	11.4	14.4
*<60mm values to aid description only	Silt	silt+clay =	
	Clay	0.6	0.8

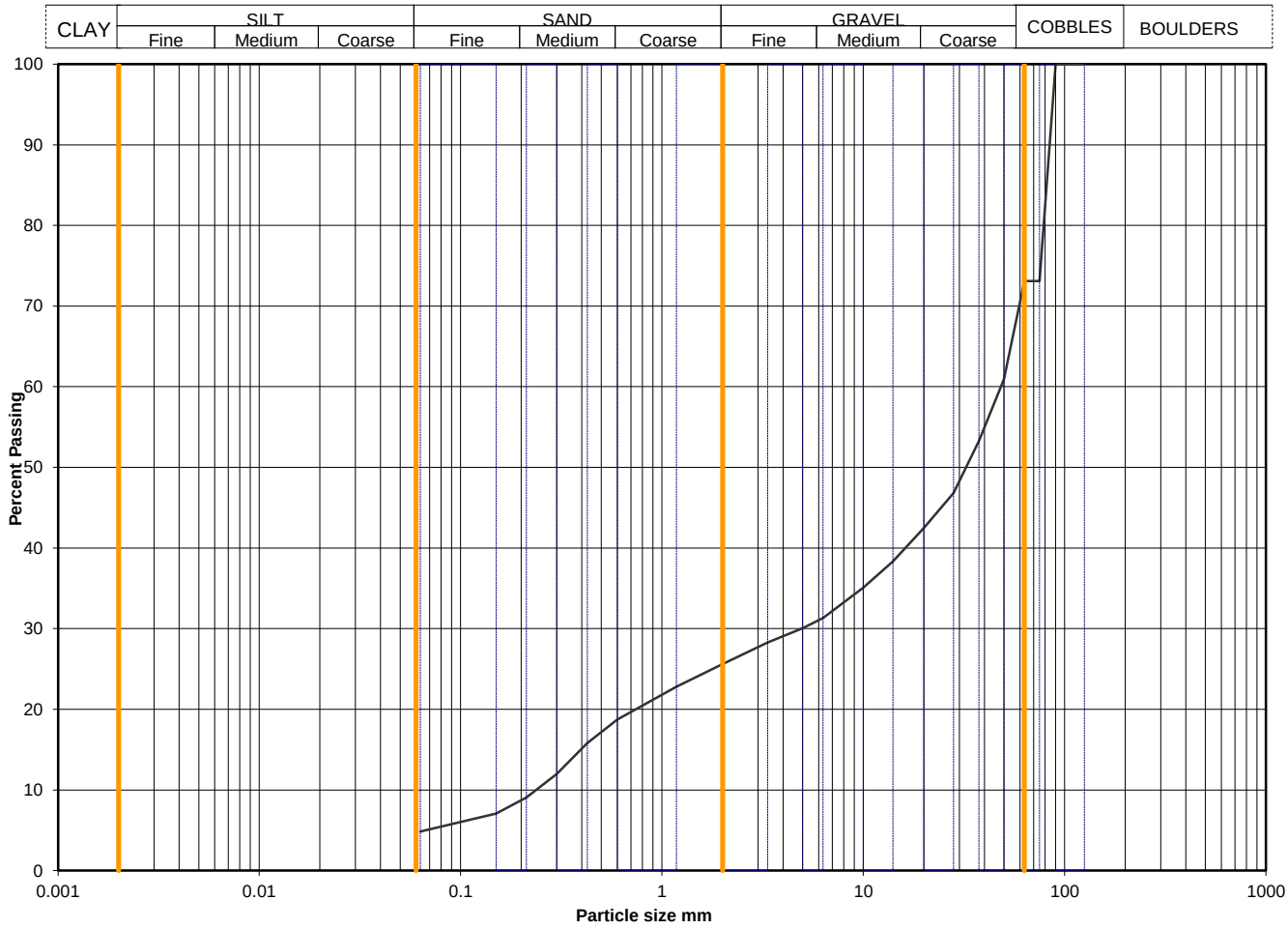
Uniformity Coefficient	**D60 / D10**	44

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020080447

Hole No	XC215-CPRC02
Sample Depth (m BGL)	2.00 - 3.00
Sample Type and No	B5
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	73		
63	73		
50	61		
37.5	53		
28	47		
20	43		
14	38		
10	35		
6.3	31		
5.0	30		
3.35	28		
2.00	26		
1.18	23		
0.600	19		
0.425	16		
0.300	12	Dry mass of sample, kg	
0.212	9	7.9	
0.150	7		
0.063	5		

Soil description	Brown very sandy clayey GRAVEL with one cobble.		
Preparation / Pretreatment	Sieve: pre dried,		
Remarks			
Sample Proportions		Whole	*<60mm
	Cobbles / boulders	26.9	0.0
	Gravel	47.5	65.0
	Sand	20.7	28.3
*<60mm values to aid description only	Silt	silt+clay =	
	Clay	4.9	6.7

Uniformity Coefficient	**D60 / D10**	207

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

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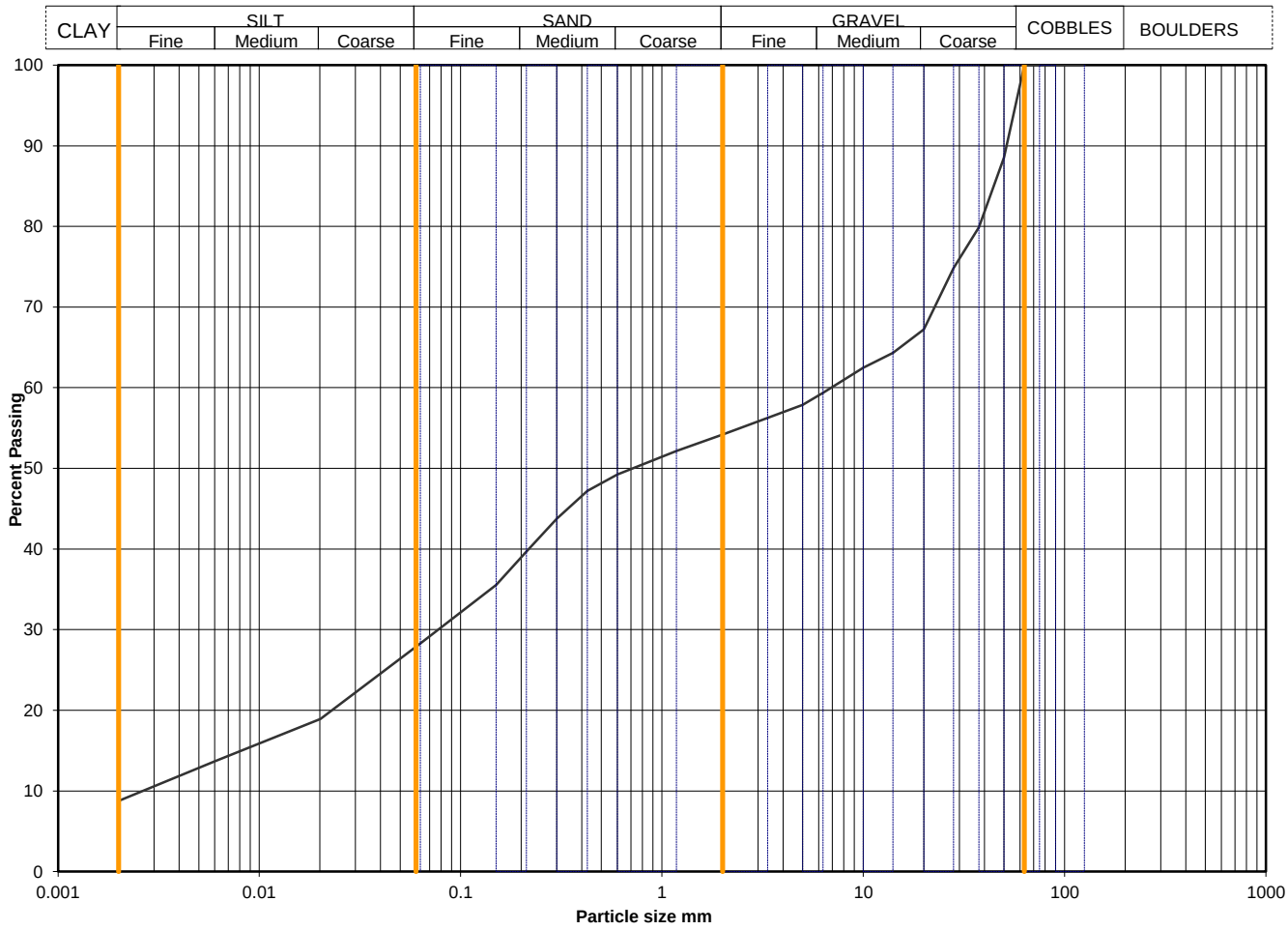
Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020080449

Hole No	XC215-CPRC02
Sample Depth (m BGL)	4.20 - 5.00
Sample Type and No	B11
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0201	19
90	100	0.0060	14
75	100	0.0020	9
63	100		
50	89		
37.5	80		
28	75		
20	67		
14	64		
10	62		
6.3	59		
5.0	58		
3.35	56		
2.00	54		
1.18	52	Particle density, Mg/m3	
0.600	49		
0.425	47	2.65 assumed	
0.300	44	Dry mass of sample, kg	
0.212	40		
0.150	36	3.0	
0.063	28		

Soil description	Brown gravelly slightly sandy silty CLAY		
Preparation / Pretreatment	Sieve: pre dried, Pipette: as BS1377		
Remarks			
Sample Proportions		Whole	*<60mm
	Cobbles / boulders	0.0	0.0
	Gravel	45.8	45.8
	Sand	25.9	25.9
*<60mm values to aid description only	Silt	19.5	19.5
	Clay	8.8	8.8

Uniformity Coefficient	**D60 / D10**	2432

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

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Project No N9390-20

Project Name Cork Line Level Crossings

Figure

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Determination of shear strength by direct shear (Small shearbox apparatus)
(BS1377 : Part 7 : clause 4 : 1990)

Project No	N9390-20	Sample Details:	Hole No.	XC215-CP01		
Project Name	Cork Line Level Crossings		Depth (m BGL)	1.20 - 2.00		
			Sample No	5	Type	B
			ID			
			Spec Ref			

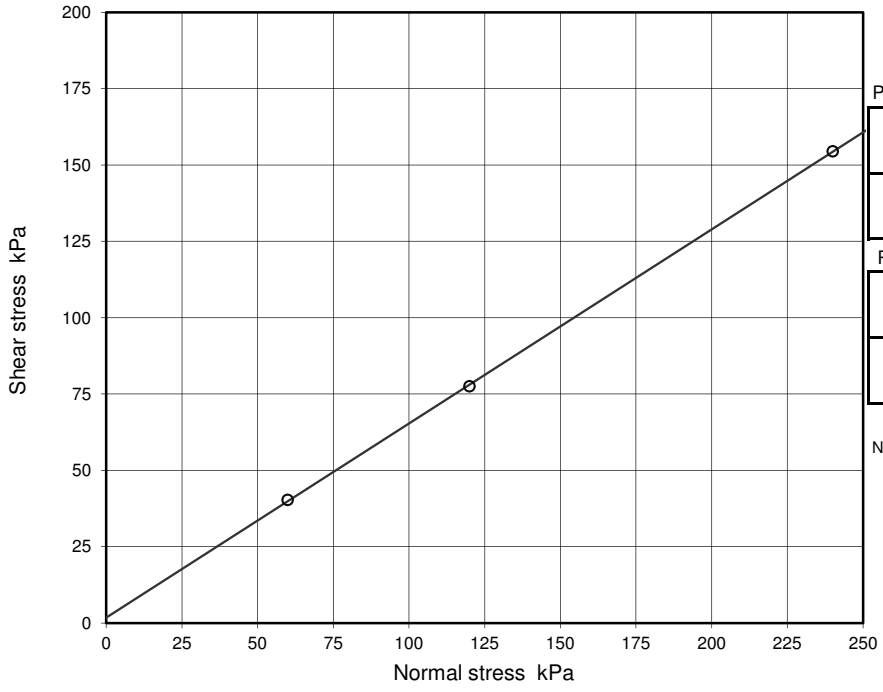
Soil Description	Brown SAND.
Specimen Type /Preparation	-2mm material. Recompacted to 2Mg/m3 at as received moisture content.

Specimen(s) nominally 60mm x 60mm square
Test(s) carried out in submerged condition
Particle density, assumed 2.65 Mg/m^3

Specimen Details		No.	1	2	3	4	5	6
Initial	Height	mm	25.0	25.0	25.0			
	Bulk Density	Mg/m^3	2.00	2.00	2.00			
	Water Content	%	5.9	5.9	5.9			
	Dry density	Mg/m^3	1.89	1.89	1.89			
	Voids ratio		0.403	0.405	0.405			
	Degree of Saturation	%	39	39	39			
Consol^n	Consolidation / Normal Stress applied	kPa	**60**	**120**	**240**			
	Change in height during consolidation	mm	-0.324	-0.588	-0.822			
	Voids ratio after consolidation		0.385	0.372	0.359			
Shear see note 1	Voids ratio at end of test		0.381	0.348	0.313			
	Moisture content at end of test	%	14.4	13.1	11.8			
	Saturation at end of test	%	100	100	100			

Shearing stage

Rate of displacement	Peak	mm/min	0.600	0.600	0.600			
	Residual	mm/min						
Peak values, (o)	Relative displacement	mm	10.00	5.00	8.00			
	Shear stress	kPa	40.2	77.5	154.4			
Residual values, (x)	No. of reversals							
	Relative displacement	mm						
	Shear stress	kPa						



Shear Strength Parameters

Peak strength, (o)		Regression	Manual
c '	kPa	1.8	-
Ø '	degrees	32½	-

Residual strength, (x)			
c'_R	kPa	-	-
$Ø'_R$	degrees	-	-

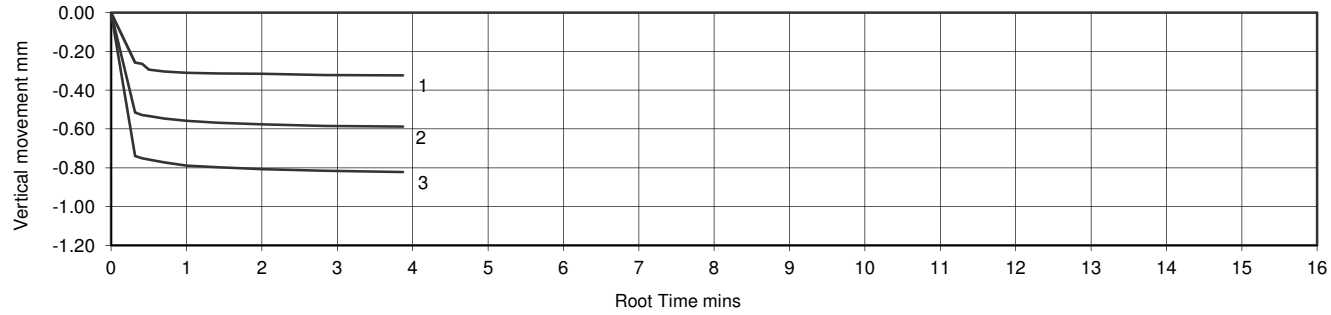
Notes :

1. After shear values based on BS1377. Pt 7 cl. 4.6.1.6 using δH calculated from consolidation and shear stages.

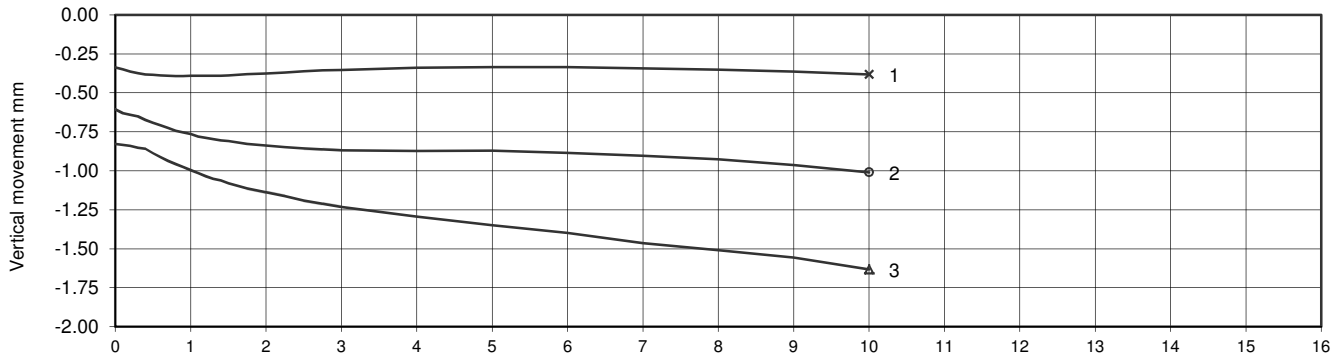
Determination of shear strength by direct shear (Small shearbox apparatus)
(BS1377 : Part 7 : clause 4 : 1990)

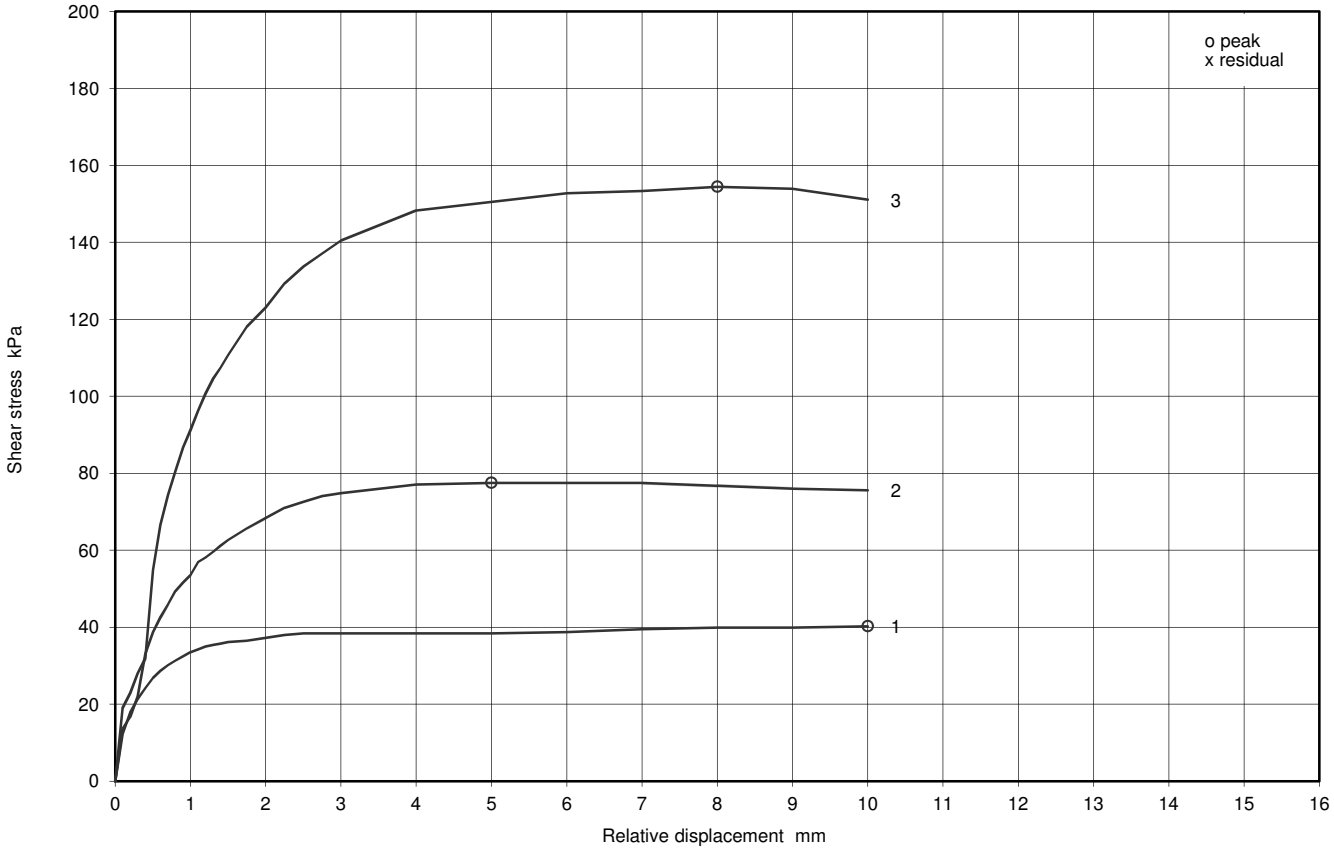
Project No	N9390-20	Sample Details:	Hole No.	XC215-CP01		
Project Name	Cork Line Level Crossings		Depth (m BGL)	1.20 - 2.00		
			Sample No	5	Type	B
			ID			
			Spec Ref			

Consolidation stage(s)



Shearing stage(s)





Ref			Figure
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Certificate of Analysis

Certificate Number 20-15912

25-Aug-20

Client Socotec - Geotechnical Lab
Askern Road
Doncaster
DN6 8DG

Our Reference 20-15912

Client Reference N9390-20

Order No (not supplied)

Contract Title Cork Line Level Crossing

Description 2 Soil samples.

Date Received 21-Aug-20

Date Started 21-Aug-20

Date Completed 25-Aug-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
Soil Samples

Our Ref 20-15912
Client Ref N9390-20
Contract Title Cork Line Level Crossing

			Lab No	1715660	1715661
			Sample ID	XC215-CPR02	XC215-CPR01
			Depth	1.20-2.00	1.20-2.00
			Other ID		
			Sample Type	B	B
			Sampling Date	11/08/2020	11/08/2020
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Inorganics					
pH	DETSC 2008#		pH	8.0	8.0
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	82	140
Sulphur as S, Total	DETSC 2320	0.01	%	0.02	0.02
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.05	0.05

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

Information in Support of the Analytical Results

Our Ref 20-15912
Client Ref N9390-20
Contract Cork Line Level Crossing

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1715660	XC215-CPR02 1.20-2.00 SOIL	11/08/20	PT 1L	Total Sulphur ICP (7 days), pH + Conductivity (7 days)	
1715661	XC215-CPR01 1.20-2.00 SOIL	11/08/20	PT 1L	Total Sulphur ICP (7 days), pH + Conductivity (7 days)	

Key: P-Plastic T-Tub

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

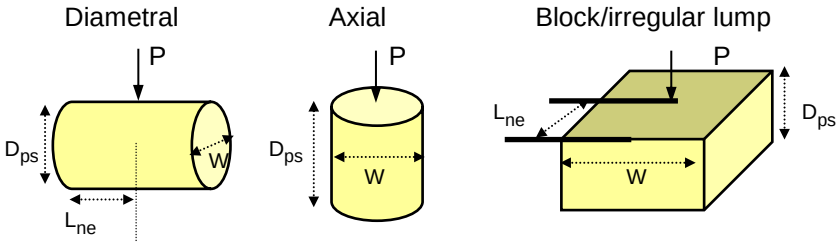
End of Report

Appendix 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)	
XC215-CPRC01	9.60		C	1		LIMESTONE	D	L	Y	50.0	75.5	74.0	71.0	21.68	73.19	4.05	4.80	9.91-10.03m
XC215-CPRC01	11.10		C	1		MUDSTONE	D	L	Y	60.0	74.7	74.0	72.0	0.10	73.33	0.02	0.02	11.84-11.96m
XC215-CPRC01	11.10		C	2		MUDSTONE	A	P	Y		75.7	74.0	68.0	0.10	80.95	0.02	0.02	12.38-12.45m
XC215-CPRC01	12.60		C	1		LIMESTONE	I	P	Y	40.0	75.1	56.0	52.0	0.10	70.50	0.02	0.02	13.12-13.20m
XC215-CPRC02	6.20		C	1		LIMESTONE	D	L	Y	60.0	76.7	76.0	76.0	41.67	76.34	7.15	8.65	6.90-7.03m
XC215-CPRC02	6.20		C	2		LIMESTONE	D	L	Y	50.0	64.0	62.0	61.0	0.10	62.46	0.03	0.03	7.21-7.33m

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

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Appendix J Environmental Laboratory Test Results

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.:	20-15386-1
Initial Date of Issue:	24-Jun-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.:		**Date Received:**	18-Jun-2020
Order No.:	7339	**Date Instructed:**	18-Jun-2020
No. of Samples:	2		
Turnaround (Wkdays):	5	**Results Due:**	24-Jun-2020
Date Approved:	24-Jun-2020		

Approved By:

Details: Glynn Harvey, Technical Manager

Chemtest
The right chemistry to deliver results

Results - Leachate

Project: Soil Testing

Client: Environmental Laboratory Services Ltd				**Chemtest Job No.:**		20-15386	20-15386
Quotation No.:				**Chemtest Sample ID.:**		1018890	1018891
Order No.: 7339				Client Sample Ref.:		182115/001	182115/002
				Client Sample ID.:		1	2
				Sample Type:		SOIL	SOIL
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**		
pH	U	1010	10:1		N/A	9.9	8.8
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	1.5	< 1.0
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	1.7	< 1.0
Aliphatic TPH >C5-C6	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aliphatic TPH >C6-C8	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aliphatic TPH >C8-C10	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aliphatic TPH >C10-C12	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aliphatic TPH >C12-C16	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aliphatic TPH >C16-C21	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aliphatic TPH >C21-C35	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aliphatic TPH >C35-C44	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Total Aliphatic Hydrocarbons	N	1675	10:1	µg/l	5.0	[A] < 5.0	[A] < 5.0
Aromatic TPH >C5-C7	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aromatic TPH >C7-C8	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aromatic TPH >C8-C10	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aromatic TPH >C10-C12	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aromatic TPH >C12-C16	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aromatic TPH >C16-C21	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aromatic TPH >C21-C35	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aromatic TPH >C35-C44	N	1680	10:1	µg/l	50.00	[A] < 50	[A] < 50
Total Aromatic Hydrocarbons	N	1675	10:1	µg/l	5.0	[A] < 5.0	[A] < 5.0
Total Petroleum Hydrocarbons	N	1675	10:1	µg/l	10	[A] < 10	[A] < 10
Benzene	U	1760	10:1	µg/l	1.0	[A] < 1.0	[A] < 1.0
Toluene	U	1760	10:1	µg/l	1.0	[A] < 1.0	[A] < 1.0
Ethylbenzene	U	1760	10:1	µg/l	1.0	[A] < 1.0	[A] < 1.0
m & p-Xylene	U	1760	10:1	µg/l	1.0	[A] < 1.0	[A] < 1.0
o-Xylene	U	1760	10:1	µg/l	1.0	[A] < 1.0	[A] < 1.0
Methyl Tert-Butyl Ether	N	1760	10:1	µg/l	1.0	[A] < 1.0	[A] < 1.0

Chemtest
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Results - Leachate

Project: Soil Testing

Client: Environmental Laboratory Services Ltd				**Chemtest Job No.:**		20-15386	20-15386
Quotation No.:				**Chemtest Sample ID.:**		1018890	1018891
Order No.: 7339				Client Sample Ref.:		182115/001	182115/002
				Client Sample ID.:		1	2
				Sample Type:		SOIL	SOIL
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**		
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:
1018890	182115/001	1			A	Amber Glass 250ml
1018890	182115/001	1			A	Plastic Tub 500g
1018891	182115/002	2			A	Amber Glass 250ml
1018891	182115/002	2			A	Plastic Tub 500g

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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.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

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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 Pre & Post Site Condition Photographs

Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

XC215

Pre Works Site Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: 2020

Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

XC215

Pre Works Site Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: 2020

ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	XC215 - South Landowner Post Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020

ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	XC215 - South Landowner Post Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020

ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	XC215 - North Landowner Post Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020

	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	XC215 - North Landowner Post Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020

	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	XC215 - North Landowner Post Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020

Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	XC215 - North Landowner Post Works Site Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: 2020

Cork Line Level Crossings – XC219
Ground Investigation

Primary Author:	Ian Holley
Client:	Irish Rail
Client's Representative:	JACOBS
Report Date:	25th November 2020
Report No.:	OCB19-135-5
File Location:	OCB19-135-5/Reporting/XC219

OCB Geotechnical
Unit 1 Carrigogna
Midleton
Co. Cork

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Document Control Sheet

Report No.:	OCB19-135-5
Project title:	Cork Line Level Crossings – XC219
Client:	Irish Rail
Client's Representative:	JACOBS

Revision	Status	Report prepared by:	Report reviewed by:	Report approved by:	Issue date
001	Draft	Ian Holley	Glen Byrne	Michael O'Connell	1st October 2020
002	Final Factual	Ian Holley	Glen Byrne	Michael O'Connell	25th November 2020

The works were conducted in accordance with:

Specification And Related Documents For Ground Investigation In Ireland. (2016) 2nd ed. Engineers Ireland.

BS EN 1997: *Eurocode 7 - Geotechnical Design – Parts 1 & 2* (2007)

UK Specification for Ground Investigation 2nd Edition (2012)

British Standards Institute (2010) BS 5930:1999 + A2: 2010, Code of practice for site investigations. Incorporating Amendment Nos. 1 and 2, as partially replaced by:

- BS EN ISO 22475-1:2006: Geotechnical investigation and testing. Sampling methods and groundwater measurements. Technical principles for execution
- BS EN ISO 14688-1:2002/Amd 1:2013: Geotechnical investigation and testing. Identification and classification of soil. Identification and description
- BS EN ISO 14688-2:2004/Amd 1:2013: Geotechnical investigation and testing. Identification and classification of soil. Principles for a classification
- BS EN ISO 14689-1:2003: Geotechnical investigation and testing. Identification and classification of rock. Identification and description
- BS EN ISO 22476-2:2005/Amd 1:2011: Geotechnical investigation and testing. Field testing. Dynamic probing
- BS EN ISO 22476-3:2005/Amd 1:2011: Geotechnical investigation and testing. Field testing. Standard penetration test

METHODS OF DESCRIBING SOILS AND ROCKS

Soil and rock descriptions are based on the guidance in Section 6 of BS 5930: 1999 + A2: 2010, The Code of Practice for Site Investigation. The amendments revised the Standard to remove text superseded by BS EN ISO 14688-1:2002, BS EN ISO 14688-2:2004 and EN ISO 14689-1:2003 and refers to the relevant standard for each affected subclause. However, the following terms are used in the description of fine-grained soils, where applicable:

- Soft to Firm: fine-grained soil with consistency description close to the boundary between soft and firm soil (Table 13 of BS5930).
- Firm to Stiff: fine-grained soil with consistency description close to the boundary between firm and stiff soil (Table 13 of BS5930).

Abbreviations used on exploratory hole logs	
U	Nominal 100mm diameter undisturbed open tube sample
P	Nominal 100mm diameter undisturbed piston sample
B	Bulk disturbed sample
D	Small disturbed sample
W	Water sample
ES / EW	Soil sample for environmental testing / Water sample for environmental testing
SPT	Standard penetration test using a split spoon sampler (small disturbed sample obtained)
SPT (C)	Standard penetration test using 60-degree solid cone
x,x/x,x,x,x	Blows per increment during the standard penetration test. The initial two values relate to the seating drive (150mm) and the remaining four to the 75mm increments of the test length. The length achieved is stated (mm) for any test increment less than 75mm
N=X	SPT blow count 'N' given by the summation of the blows 'X' required to drive the full test length (300mm)
N=X/Z	Incomplete standard penetration test where the full test length was not achieved. The blows 'X' represent the total blows for the given test length 'Z' (mm)
V VR	Shear vane test (borehole) Hand vane test (trial pit) Shear strength stated in kPa V: undisturbed vane shear strength VR: remoulded vane shear strength
dd/mm/yy: 1.0 dd/mm/yy: dry	Date & water level at the borehole depth at the end of shift and the start of the following shift
Abbreviations relating to rock core – reference Clause 44.4.4 of BS 5930: 1999	
TCR (%)	Total Core Recovery: Ratio of rock/soil core recovered (both solid and non-intact) to the total length of core run.
SCR (%)	Solid Core Recovery: Ratio of solid core to the total length of core run. Solid core has a full diameter, uninterrupted by natural discontinuities, but not necessarily a full circumference and is measured along the core axis between natural fractures.
RQD (%)	Rock Quality Designation: Ratio of total length of solid core pieces greater than 100mm to the total length of core run.
FI	Fracture Index: Number of natural discontinuities per metre over an indicated length of core of similar intensity of fracturing.
NI	Non-Intact: Used where the rock material was recovered fragmented, for example as fine to coarse gravel size particles.
AZCL	Assessed zone of core loss: The estimated depth range where core was not recovered.
DIF	Drilling induced fracture: A fracture of non-geological origin brought about by the rock coring.

Cork Line Level Crossings – XC219

1 AUTHORITY

On the instructions of Iarnród Éireann / Irish Rail, a ground investigation was undertaken at multiple locations along the Cork to Dublin railway line, between Limerick Junction and Mallow stations, to provide geotechnical and environmental information for input to the design and construction of proposed overbridges, embankments, culverts, access roads and footpaths to enable the closure of five manned level crossings

This report details the work carried out both on site at XC219 and in the geotechnical and chemical testing laboratories; it contains a description of the site and the works undertaken, the exploratory hole logs and the laboratory test results.

All information given in this report is based upon the ground conditions encountered during the site investigation works, and on the results of the laboratory and field tests performed. However, there may be conditions at the site that have not been taken into account, such as unpredictable soil strata, contaminant concentrations, and water conditions between or below exploratory holes. It should be noted that groundwater levels usually vary due to seasonal and/or other effects and may at times differ to those measured during the investigation.

This report was prepared by OCB Geotechnical Ltd for the use of Iarnród Éireann / Irish Rail in response to particular instructions. Any other parties using the information contained in this report do so at their own risk and any duty of care to those parties is excluded.

2 SCOPE

The extent of the investigation, as instructed by the JACOBS, included boreholes, trial pits, indirect CBR testing, installation of standpipes, water purging, soil and rock core sampling, in-situ and laboratory testing, a geophysical survey report and the preparation of a factual report on the findings.

3 DESCRIPTION OF SITE

As shown on the site location plan in Appendix A, level crossing XC219 is located in the Creggane and Bregoge townlands, 0.9km west of Buttevant. The site is located in a rural area, surrounded by agricultural land with a number of houses and farms in the area.

The existing site is presented on the site and exploratory hole location plans in Appendix A.

4 SITE OPERATIONS

Site operations, which were conducted between 17th February 2020 and 8th September 2020, included:

- One (1) Cable Percussion Borehole
- Four (4) Rotary Boreholes
- Five (5) Cable Percussion with Rotary follow-on Boreholes
- A Standpipe Installation in five (5) Boreholes
- Four (4) Trial Pits
- Indirect CBR tests at eight (8) locations
- Water Purging in four (4) locations
- A Geophysical Survey was carried out by Minerex

The exploratory holes and in situ tests were located as instructed by the Client's Representative, as shown on the exploratory hole location plan in Appendix A.

4.1 Boreholes

A total of ten boreholes were put down in a minimum diameter of 101mm through soils and rock strata to their completion depths by a combination of methods, including cable percussion boring by Pilcon rigs, and rotary drilling by a T44 rig.

The borehole logs state the methodology and plant used for each location, as well as the appropriate depth ranges.

A summary of the boreholes, subdivided by category in accordance with the methods employed for their completion, is presented in the following sub-sections.

Appendix B presents the borehole logs.

4.1.1 Cable Percussion Boreholes

One borehole (CP01) was put down to completion in minimum 200mm diameter using a Pilcon cable percussion soil boring rig. the borehole was terminated on encountering virtual refusal on obstructions, including large boulders and weathered bedrock.

Hand dug inspection pits were carried out between ground level and 1.2m depth to ensure boreholes were put down at locations clear of services or subsurface obstructions.

Disturbed (bulk bag and tub) samples were taken within the encountered strata. Environmental samples were taken at standard intervals, as directed by Jacobs.

Standard penetration tests were carried out in accordance with EC7 at standard depth intervals using the split spoon sampler (SPT). The penetrations are stated for those tests for which the full 150mm seating drive or 300mm test drive was not possible. The N-values provided on the borehole logs are uncorrected and no allowance has been made for energy ratio corrections.

Any water strikes encountered during boring were recorded along with any changes in their levels as the borehole proceeded.

Where water was added to assist with boring, a note has been added to the log to account for same.

Appendix B presents the borehole logs.

4.1.2 Boreholes by Combined Percussion Boring and Rotary Follow-On Drilling

Five boreholes (CPRC01, CPRC02, CPRC03, CPRC04 & CPRC05) were put down by a combination of cable percussion boring and rotary follow-on open hole and coring drilling techniques. Where the cable percussion borehole had not been advanced onto bedrock, rotary percussive methods were employed to advance the borehole to completion/obstruction.

Hand dug inspection pits were carried out between ground level and 1.2m depth to ensure boreholes were put down at locations clear of services or subsurface obstructions.

Disturbed (bulk bag and tub) samples were taken within the encountered strata. Environmental samples were taken at standard intervals, as directed by Jacobs.

Standard penetration tests were carried out in accordance with EC7 at standard depth intervals throughout the overburden using the split spoon sampler (SPT). The penetrations are stated for those tests for which the full 150mm seating drive or 300mm test drive was not possible. The N-values provided on the borehole logs are uncorrected and no allowance has been made for energy ratio corrections.

Any water strikes encountered during boring were recorded along with any changes in their levels as the borehole proceeded.

Where water was added to assist with boring, a note has been added to the log to account for same.

Where coring was carried out within bedrock strata, Geobor S Coring was used. The core was extracted in up to 1.5m lengths using a SK6L core barrel, which produced core of nominal 102mm diameter, and was placed in single channel wooden core boxes.

The core was subsequently photographed and examined by a qualified and experienced Engineering Geologist, thus enabling the production of an engineering log in accordance with *BS 5930:1999 + A2: 2010, Code of practice for site investigations* (Incorporating Amendment Nos. 1 and 2).

Core logging was carried out both on and off site by the OCB Geotechnical Engineering Geologist.

Appendix B presents the borehole logs, with core photographs presented in Appendix C.

4.1.3 Rotary Drilled Boreholes

Four boreholes (CPRC01A, CPRC06, CPRC07 & CPRC08) were put to their completion by rotary drilling techniques only. The boreholes were completed using a T44 rig.

Symmetrix-cased full hole rotary percussive drilling techniques were employed to advance the boreholes to bedrock, after which rotary coring was employed to recover core samples of the bedrock. SPTs were carried out at standard intervals throughout the overburden, with small and bulk disturbed samples obtained where possible through the soils strata.

Where coring was carried out within bedrock strata, Geobor S Coring was used. The core was extracted in up to 1.5m lengths using a SK6L core barrel, which produced core of nominal 102mm diameter, and was placed in single channel wooden core boxes.

The core was subsequently photographed and examined by a qualified and experienced Engineering Geologist, thus enabling the production of an engineering log in accordance with *BS 5930:1999 + A2: 2010, Code of practice for site investigations* (Incorporating Amendment Nos. 1 and 2).

Core logging was carried out both on and off site by the OCB Geotechnical Engineering Geologist.

Appendix B presents the borehole logs, with core photographs presented in Appendix C.

4.2 Standpipe Installations

A groundwater monitoring standpipe was installed in boreholes CP01, CPRC01A, CPRC02, CPRC04 and CPRC05.

Details of the installations, including the diameter of the pipe and depth range of the response zone, are provided in Appendix B on the individual borehole logs.

Following the completion of the intrusive investigation work groundwater monitoring was undertaken at the site on four occasions. The results of the monitoring are presented in the report below in Section 6.3.

4.3 Trial Pits

Four trial pits (TP01–TP04) were excavated using a 15t tracked excavator fitted with a 600mm wide bucket, to depths between 1.90m and 4.30m bgl. Trial pit TP01 was terminated at 2.50m due to rapid water inflow causing pit walls to collapse. Trial pit TP02 was terminated at 4.30m due to pit walls collapsing. Trial pits TP03 and TP04 were terminated upon encountering refusal on presumed weathered bedrock at 3.00m and 1.90m respectively.

Environmental samples were taken at depths of 0.05m, 0.50m, 1.0m and 3.0m in each trial pit.

Disturbed (small tub and bulk bag) samples were taken at standard depth intervals and at change of strata.

Hand Vane testing was completed successfully where appropriate and where specified by Jacobs.

Any water strikes encountered during excavation were recorded along with any changes in their levels as the excavation proceeded. The stability of the trial pit walls was noted on completion.

Appendix D presents the trial pit logs with photographs of the pits and arising provided in Appendix E.

4.4 Indirect CBR Tests

An indirect CBR test was conducted at eight locations (CBR-TP01-1 to TRL08) using a Dynamic Cone Penetrometer (DCP). The equipment was developed in conjunction with the UK Transport Research Laboratory, is used widely throughout the world, and is referred to in the UK Highway Agency Interim Advice Note 73/06.

The test results are presented in Appendix F in the form of plots of the variation with depth of the cumulative blow count. Straight lines have been fitted to the plots and the CBR for each depth range estimated using the following relationship, as proposed by DTP Interim Advice Note 73/06 (Design Guidance for Road Pavement Foundations):

$$\text{Log CBR} = 2.48 - 1.057 \text{ Log (mm/blow)}$$

The occasionally elevated CBR values could be a consequence of the coarse-grained content of the penetrated soils and are often not representative of the soil matrix.

4.5 Water Purging

Prior to sampling from each standpipe (in CPRC01A, CPRC02, CPRC04 & CPRC05) water purging was carried out.

Appendix G presents the water purging data logs.

4.6 Surveying

A broad survey of the site using a handheld CAT scanner to identify any existing buried services or old foundations/obstructions to excavation was carried out before commencement of excavation works. A GPR survey to PAS 128 specification was carried out at each location prior to excavation. The GPR survey report is presented in an addendum to follow issuance of this report.

The as-built exploratory hole positions were surveyed following completion of site operations by a Site Engineer from OCB Geotechnical. Surveying was carried out using a Trimble R6 GPS system employing VRS and real time kinetic (RTK) techniques.

The plan coordinates (Irish Transverse Mercator, ITM) and ground elevation (mOD Malin) at each location are recorded on the individual exploratory hole logs. The exploratory hole plan presented in Appendix A shows these as-built positions.

Pre-work site conditions were surveyed and upon completion of all site works at each site a post-work site condition survey was carried out. The pre and post site condition photographs are presented in Appendix L.

4.6.1 Geophysical Survey

A geophysical survey was carried out by Minerex consisting of 2D-Resistivity profiles at the proposed bridge location.

The Minerex Geophysical Survey report is presented in Appendix K.

5 LABORATORY WORK

Upon their receipt in the laboratory, all disturbed samples were carefully examined and accurately described and their descriptions incorporated into the borehole logs.

5.1 Geotechnical Laboratory Testing of Soils

Laboratory testing of soils comprised:

- **soil classification:** Moisture Content measurement, Atterberg Limit tests and Particle Size Distribution analysis.
- **soil chemistry:** pH, Sulphur content and water-soluble and total Sulphate content.

Laboratory testing of soils samples was carried out in accordance with British Standards Institute (1990) *BS 1377:1990, Methods of test for soils for civil engineering purposes. Parts 1 to 9.*

The test results are presented in Appendix H.

5.2 Geotechnical Laboratory Testing of Rock

Laboratory testing of rock sub-samples comprised:

- point load index
- unconfined compressive strength (UCS) tests

Test	Test carried out in accordance with
Point load index	ISRM Suggested Methods (1985) Suggested method for determining point-load strength. Int. J. Rock Mech. Min. Sci. Geomech. Abstr. 22, pp. 53–60
Uniaxial compression strength tests	ISRM Suggested Methods (1981) Suggested method for determining deformability of rock materials in uniaxial compression, Part 2 and ISRM (2007) Ulusay R, Hudson JA (eds) The complete ISRM suggested methods for rock characterization, testing and monitoring, 2007

The test results are presented in Appendix I.

5.3 Environmental Laboratory Testing of Soils

In addition, environmental testing, as specified by Jacobs was conducted on selected environmental samples by Socotec at its laboratory in Burton-on-Trent, United Kingdom. Results of environmental testing are presented in Appendix J.

6 GROUND CONDITIONS

6.1 General Geology of the Area

Teagasc soil mapping indicates that the site vicinity is underlain by Glacial Till derived chiefly from Namurian rocks with an approximate south-southwest to north-northeast orientated deposit of younger Alluvium overlying the Till in the more low-lying area to the west of the railroad.

The Geological Survey of Ireland (GSI) bedrock mapping database indicates that soils in the site area are underlain at depth by the Lower Carboniferous-age Hazelwood Limestone Formation, which consists of pale to medium grey massive skeletal calcilutite and rare calcarenites which show significant internal variation, similar to the Waulsortian Limestones facies..

The Lower Carboniferous limestones form part of Middle Devonian to Namurian (Upper Carboniferous) age sedimentary sequence in Munster which was subjected to compressional deformation during the Variscan Orogeny in Late Carboniferous and Early Permian times, resulting in the formation of a west-southwest to east-northeast orientated fold-thrust belt. The site vicinity is located between a west-southwest to east-northeast orientated fault and thrust fault and is also transected by north-south orientated faults. Bedrock in this area dips in variable directions, primarily to the north and south, having undergone buckle folding and contractional thrust faulting.

The site is underlain by a regionally important Karstified (diffuse) bedrock aquifer and has a high to extreme groundwater vulnerability. Numerous Karst features, such as depressions, swallow holes, caves and springs, occur in areas underlain by limestone in north County Cork.

6.2 Ground Types Encountered During Investigation of the Site

A summary of the ground types encountered in the exploratory holes is listed below, in approximate stratigraphic order:

- Topsoil: encountered typically in 100mm to 300mm thickness.
- Made Ground (Fill): CP01, CPRC04, CPRC05 and CPRC08 have approximately up to 1.20m of granular fill.
- Glacial Till: sandy gravelly silty clay, frequently with cobble content, typically soft to firm in upper horizons, becoming very stiff with increasing depth.
- Fluvioglacial deposits: Typically medium dense sandy gravels.
- Bedrock (Limestone): Rockhead was encountered at levels between 2.30m and 8.30m bgl. Mostly medium strong to strong Limestone.

6.3 Groundwater

Details of the individual groundwater strikes, along with any relative changes in levels as works proceeded, are presented on the exploratory hole logs for each location.

It should be noted that any groundwater strikes within bedrock may have been masked by the fluid used as the drilling flush medium.

Groundwater monitoring to date in standpipe installations, yielded the following results:

Date	Depth to standing water level (m)				
	CP01	CPRC01A	CPRC02	CPRC04	CPRC05
13/08/20	Dry	1.13	2.21	7.15	6.29
17/08/20	Dry	0.95	2.13	7.05	6.7
21/08/20	Dry	Field Flooded (above GL)	0.64	5.22	5.07
29/09/20	Dry	0.66	1.76	6.47	6.35

Continued monitoring of the two installed standpipes will give an indication of the seasonal variation in groundwater level.

7 DISCUSSION

7.1 Proposed Construction

It is proposed to construct overbridges, embankments, culverts, access roads and footpaths to enable the closure of five manned level crossings.

No further details were available to OCB Geotechnical at the time of preparing this report.

8 REFERENCES

Specification And Related Documents For Ground Investigation In Ireland. (2016) 2nd ed. Engineers Ireland.

BS EN 1997-1: 2007. *Eurocode 7 - Geotechnical design - Part 1 General Rules*. British Standards Institution, London.

BS EN 1997-2: 2007. *Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing*. British Standards Institution, London.

BS 1377: 1990. *Methods of test for soils for civil engineering purposes*. British Standards Institution, London.

BS 5930: 2015. *Code of practice for ground investigations*. British Standards Institution, London.

BS EN ISO 14688-1: 2002. *Geotechnical investigation and testing - Identification and classification of soil - Part 1 Identification and description*. British Standards Institution, London.

BS EN ISO 14689-1: 2003. *Geotechnical investigation and testing - Identification and classification of rock - Part 1 Identification and description*. British Standards Institution, London.

Building Research Establishment, 2005. BRE Special Digest 1, Concrete in aggressive ground.

Building Research Establishment, 2007. BRE Digest 365: Soakaways.

BS EN 12457-2: 2002 Characterisation of waste. Leaching. Compliance test for leaching of granular waste materials and sludges. One stage batch test at a liquid to solid ratio of 10 l/kg for materials with particle size below 4 mm (without or with size reduction).

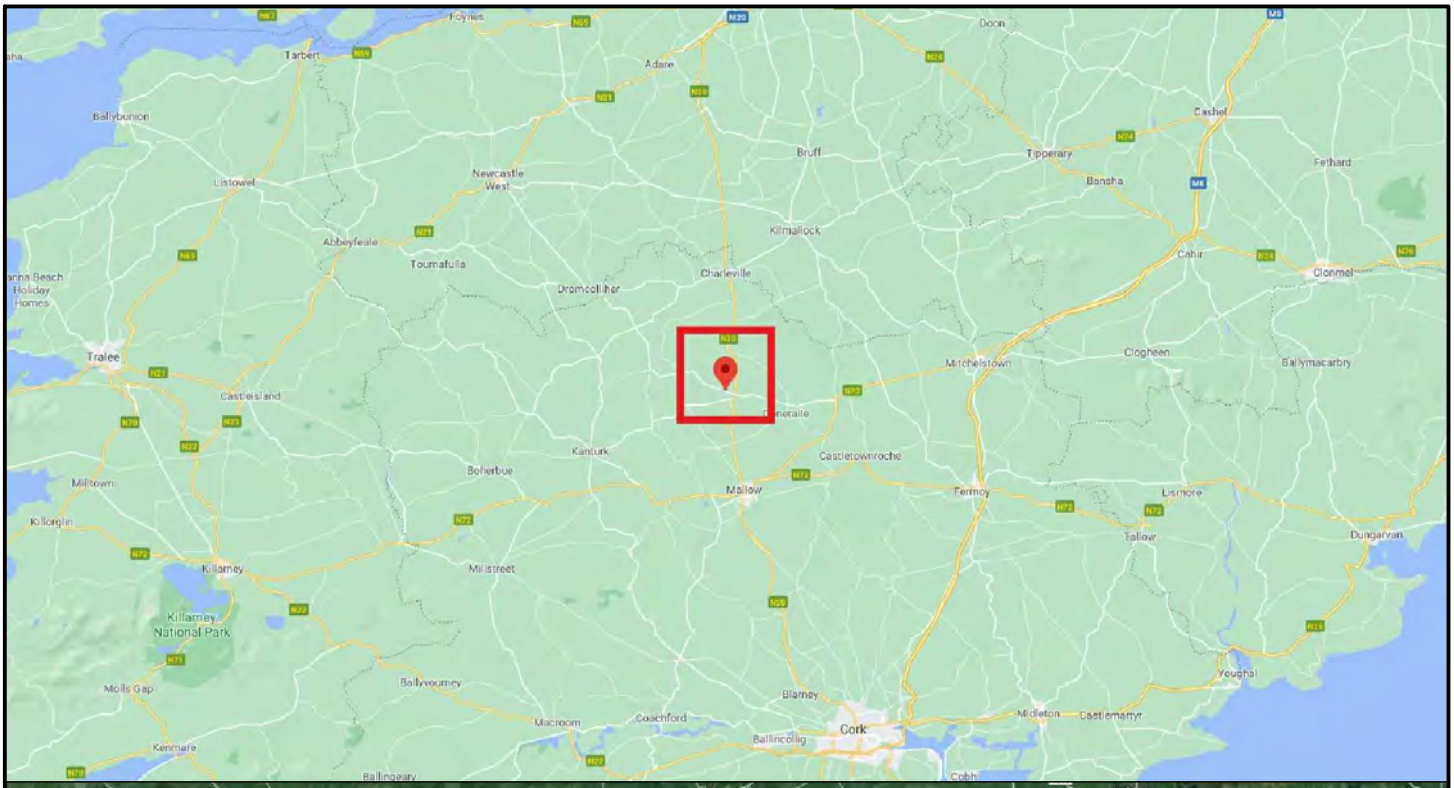
Environmental Protection Agency / Draft Guidance Note on Soil Recovery Waste Acceptance Criteria. December 2017.
http://www.epa.ie/pubs/consultation/soilrecoveryconsultation/

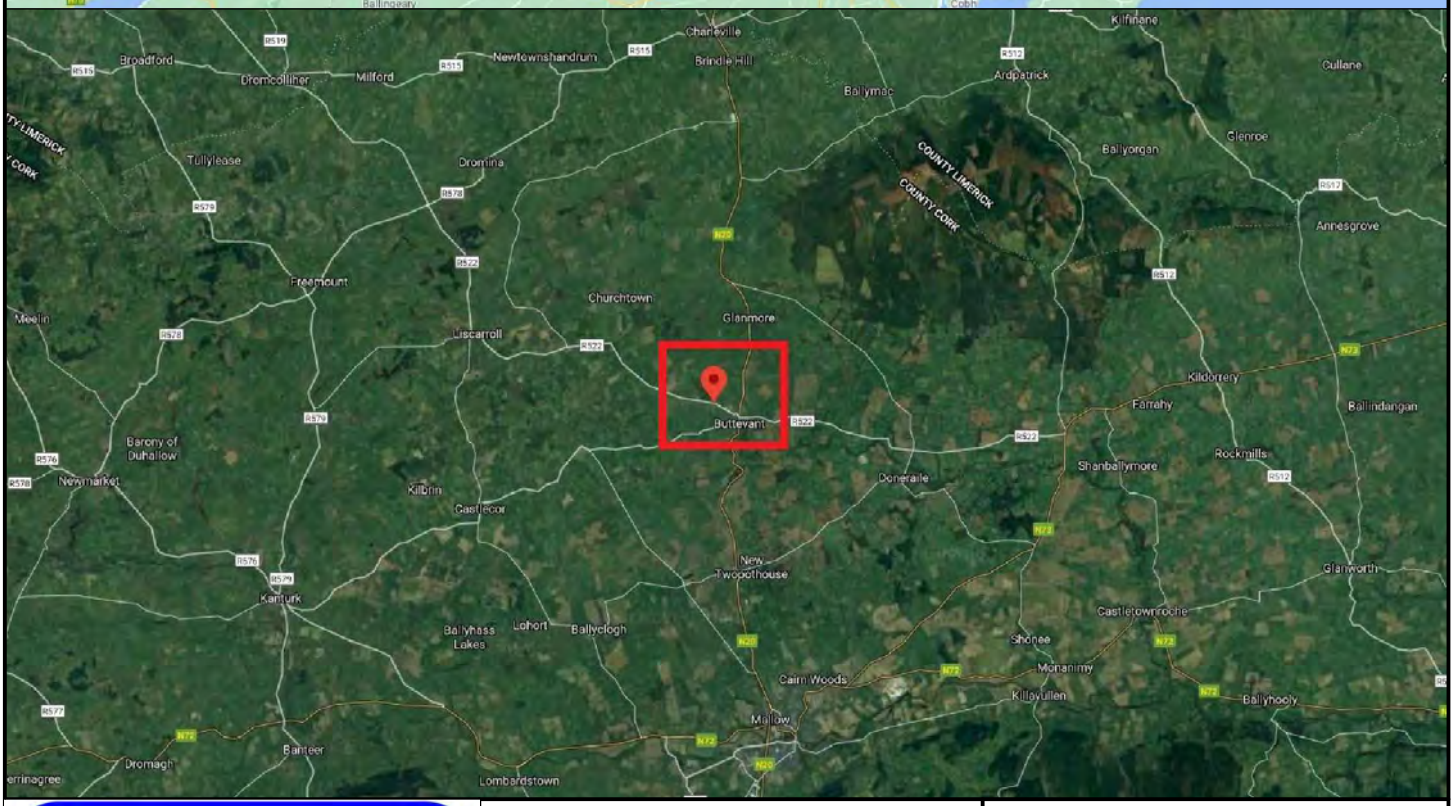
Environmental Protection Agency / Waste Classification List of Waste & Determining if Waste is Hazardous or Non-hazardous. 1st June 2015
https://www.epa.ie/pubs/reports/waste/stats/wasteclassification/EPA_Waste_Classification_2015_Web.pdf

Environment Agency UK (2009). Soil Guideline Values (SGVs).
https://www.gov.uk/government/collections/land-contamination-technical-guidance

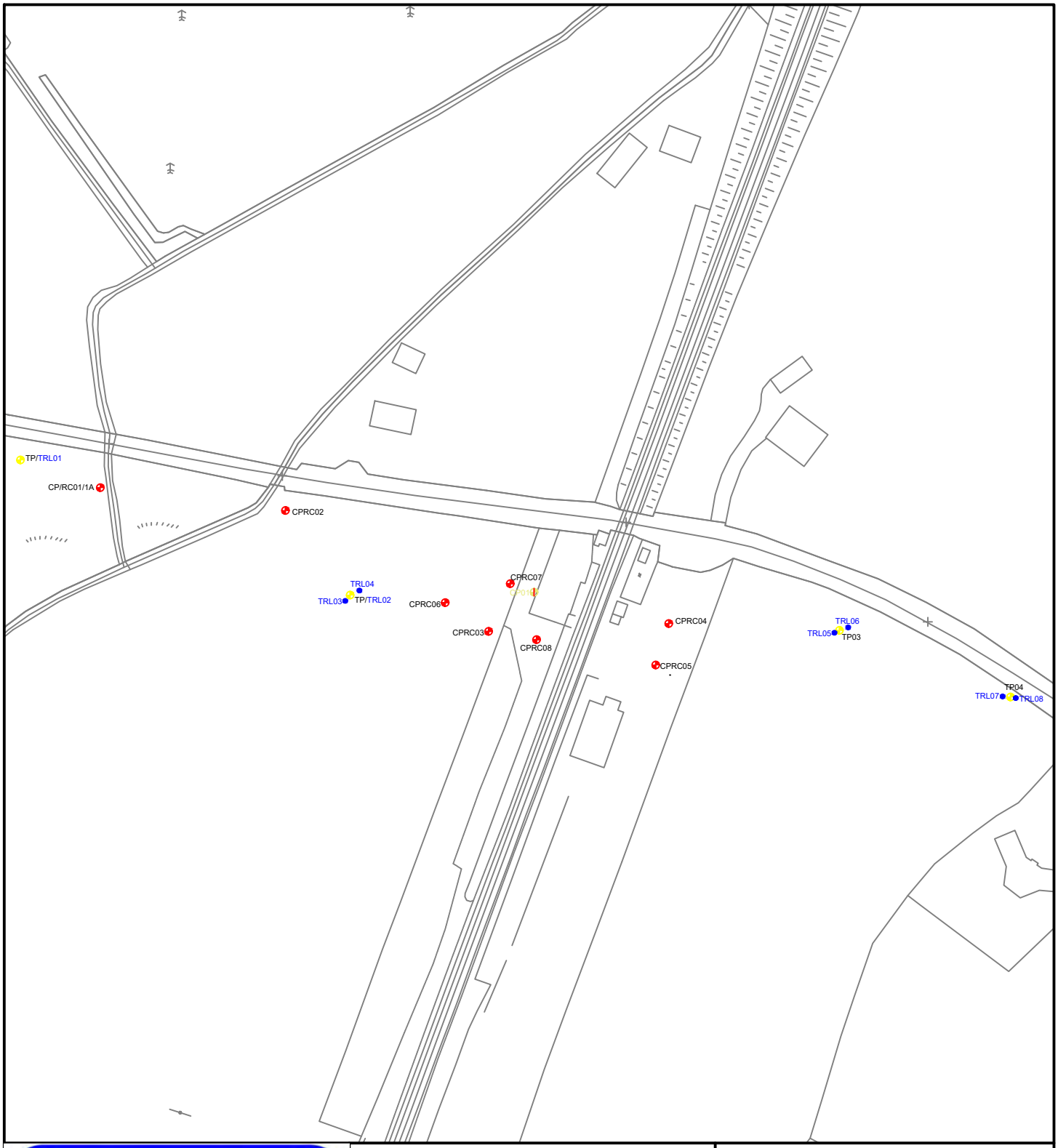
Soil Remediation Circular 2013, Ministry for Environment and Infrastructure, The Hague, Netherlands.
https://rwsenvironment.eu/subjects/soil/legislation-and/soil-remediation/

Appendix A Site and Exploratory Hole Location Plans





ocbgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	SITE LOCATION MAPS Client: Iarnród Éireann Engineer: Jacob's Date: Feb - March & July - Sep 2020



Iarnród Éireann
Cork Line Level Crossings
XC219 (19-135-5)

Exploratory Hole Locations

Client: Iarnród Éireann

Engineer: Jacob's

Date: Feb - March & July - Sep 2020

Appendix B Borehole Logs

Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC219-CP01
Coordinates: 553292.77 E 609817.96 N	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 1
Method: Cable Percussion	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon	**Ground Level:** 86.74 mOD	**Dates:** 26/02/2020 - 27/02/2020	**Driller:** AA **Logger:** IH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0.05	ES1					(0.50)		MADE GROUND: Black slightly gravelly sandy silty CLAY with low cobble content, occasional rootlets and slight organic odour (Reworked / fill material). Sand is fine to coarse.. Gravel is fine to coarse, subangular to subrounded. Cobbles are subrounded.		
0.50	ES2				86.24	0.50		MADE GROUND: Black slightly gravelly slightly sandy silty CLAY with some rootlets and slight organic odour. (Reworked / fill material). Sand is fine to coarse. Gravel is fine to medium, subangular.		
0.50 - 1.00	B3					(0.70)				
1.00	ES4									
1.20 - 1.70	B5				85.54	1.20		Stiff to very stiff brown with black mottling slightly sandy slightly silty gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, subrounded. Cobbles are subangular to subrounded.		
1.20 - 1.70	D6									
1.20 - 1.65	SPT (C) N=29			N=29 (4,5/5,7,8,9)		(0.50)				
1.70 - 2.20	B7				85.04	1.70		Very stiff light brown slightly silty slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, subrounded. Cobbles are subangular to subrounded.		
1.70 - 2.20	D8					(0.50)				
2.00 - 2.18	SPT (C)			75 (11,25/75 for 30mm)						
2.20 - 2.45	D9				84.54	2.20		Yellowish / light brown slightly gravelly silty very sandy CLAY. Sand is fine to coarse. Gravel is fine to medium, subangular.		
						(0.38)				
					84.16	2.58		End of borehole at 2.580m		

Remarks
Chiselling Continued: 2.58m - 2.58m (1 Hour)

Terminated at 2.58m due to probable boulder obstruction.

Water Added	
From (m)	To (m)

Water Strike - General			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Casing Details	
To (m)	Diam (mm)
2.20	200

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
0.00	0.30	00:30
2.20	2.45	01:00
2.45	2.58	01:00

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC219-CPRC01
	Coordinates: 553132.91 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 2
Method: Cable Percussion+Rotary Open+Rotary Coring	609856.42 N	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon+T44	**Ground Level:** 82.62 mOD	**Dates:** 22/06/2020 - 29/06/2020	**Driller:** AA +NOB
			Logger: IH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
0.05	ES1				82.52	(0.10) 0.10		TOPSOIL
0.10 - 0.50	B2					(0.40)		SUBSOIL: Greyish brown slightly gravelly sandy CLAY. Gravel is fine to coarse, angular to subrounded. Sand is fine to coarse.
0.10 - 0.50	D3							
0.50	ES4				82.12	0.50		Soft brown slightly gravelly sandy clayey GRAVEL with low cobble content. Gravel is fine to coarse, angular to subrounded. Sand is fine to coarse.
0.50 - 1.20	B5							
0.50 - 1.20	D6							
1.20 - 2.00	B7					(1.50)		
1.20 - 2.00	D8							
1.20 - 1.65	SPT (C) N=6			N=6 (0,1/1,2,1,2)				
1.50	ES9							
2.00 - 2.40	B10				80.62	2.00		Soft brownish grey silty CLAY.
2.00 - 2.40	D11					(0.40)		
2.00 - 2.45	SPT (C) N=6			N=6 (1,2/2,1,2,1)				
2.40 - 3.00	B12				80.22	2.40		Very Dense grey slightly silty sandy GRAVEL. Gravel is fine to coarse, angular to subrounded. Sand is fine to coarse.
2.40 - 3.00	D13							
3.00	ES14					(1.10)		
3.00 - 4.00	B15							
3.00 - 4.00	D16							
3.00 - 3.45	SPT (C) N=60			N=60 (9,10/14,18,13,15)	79.12	3.50		Medium Dense grey slightly clayey sandy GRAVEL. Gravel is fine to coarse, angular to subrounded. Sand is fine to coarse.
4.00 - 5.00	B17							
4.00 - 5.00	D18							
4.00 - 4.45	SPT (C) N=29			N=29 (8,9/7,7,7,8)				
5.00 - 6.00	B19							
5.00 - 6.00	D20							
5.00 - 5.45	SPT (C) N=24			N=24 (5,6/6,5,7,6)		(4.00)		
6.00 - 7.00	B21							
6.00 - 7.00	D22							
6.00 - 6.45	SPT (C) N=21			N=21 (4,5/4,6,6,5)				
7.00 - 7.50	B23							
7.00 - 7.50	D24							
7.00 - 7.45	SPT (C) N=22			N=22 (5,9/5,6,6,5)				
					75.12	7.50		Possible BOULDER obstruction, rotary open hole techniques employed to blast past. (Possible weathered bedrock)
						(0.50)		
8.00 - 8.00	SPT (C) 50 (25 for 0mm/50 for 0mm)			50 (25 for 0mm/50 for 0mm)	74.62	8.00		Medium Strong to Strong, light grey LIMESTONE with some quartz veining. Distinctly weathered with some clay staining and infilling of discontinuities and some orange oxide staining on discontinuity surfaces. Discontinuities: -Mostly non-intact -Rough, undulating, extremely closely spaced.
9.50						(3.00)		
	TCR 37 / 17	SCR 20 / 10	RQD 17 / 6	FI NI				Continued on Next Page

Remarks

Water Added	
From (m)	To (m)
2.40	4.00

Water Strike - General			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
0.70		20	0.70
2.40	2.40	20	2.10
6.60	6.60	20	4.60

Casing Details	
To (m)	Diam (mm)
8.00	200
11.00	101

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
7.50	7.50	01:00

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC219-CPRC01
	Coordinates: 553132.91 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 2 of 2
Method: Cable Percussion+Rotary Open+Rotary Coring	609856.42 N	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon+T44	**Ground Level:** 82.62 mOD	**Dates:** 22/06/2020 - 29/06/2020	**Driller:** AA +NOB
			Logger: IH

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
11.00						71.62	11.00		End of borehole at 11.000m		

Remarks

Water Added	
From (m)	To (m)
2.40	4.00

Water Strike - General			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
0.70		20	0.70
2.40	2.40	20	2.10
6.60	6.60	20	4.60

Casing Details	
To (m)	Diam (mm)
8.00	200
11.00	101

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
7.50	7.50	01:00

Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC219-CPRC01A
Coordinates: E N	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 2
Method: Rotary Open+Rotary Coring	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: T44	**Ground Level:** mOD	**Dates:** 01/07/2020 -	**Driller:** NOB
			Logger: IH

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
							(7.50)		Open Hole Boring, See XC219-CPRC01 for overburden details.
							7.50		Open Hole Boring, Drillers Description: Boulder CLAY
							(0.80)		
							8.30		Medium Strong to Strong, dark grey LIMESTONE with some quartz veining. Partially weathered with occasional brown clay staining and infilling of discontinuities.
9.50 - 9.50	55	44	21	NI	50 (25 for 0mm/50 for 0mm)		(1.50)		Discontinuities: -Mostly non-intact -Subhorizontal, undulating, smooth.
9.80							9.80		Open Hole Boring, Drillers Description:
	TCR	SCR	RQD	FI					Continued on Next Page

Water

Backfill

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5

Remarks

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
		11.50	11.50	20	8.00
		15.50	15.50	20	13.00

Casing Details		Chiselling Details		
To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)
18.50	151			

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC219-CPRC01A
	Coordinates: E	**Client:** Iarnród Éireann / Irish Rail	Sheet 2 of 2
Method: Rotary Open+Rotary Coring	N	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: T44	**Ground Level:** mOD	**Dates:** 01/07/2020 -	**Driller:** NOB
			Logger: IH

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
									Boulder CLAY		
13.00 - 13.45					N=24 (6,6/6,6,6,6)						
							(8.70)				
16.00 - 16.00					50 (25 for 0mm/50 for 0mm)						
17.50 - 17.50					50 (25 for 0mm/50 for 0mm)						
18.50 - 18.50					50 (25 for 0mm/50 for 0mm)		18.50		End of borehole at 18.500m		
	TCR	SCR	RQD	FI							

10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5 15.0 15.5 16.0 16.5 17.0 17.5 18.0 18.5 19.0 19.5

Remarks

Water Added	
From (m)	To (m)

Water Strike - General			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
11.50	11.50	20	8.00
15.50	15.50	20	13.00

Casing Details	
To (m)	Diam (mm)
18.50	151

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC219-CPRC02
	Coordinates: 553201.13 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 2
Method: Cable Percussion+Rotary Open+Rotary Coring	609848.01 N	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon+T44	**Ground Level:** 83.81 mOD	**Dates:** 21/02/2020 - 19/03/2020	**Driller:** AA +NOB **Logger:** IH +MN

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
						(0.50)		TOPSOIL: Dark brown CLAY.		
0.50	ES1				83.31	0.50				
0.50 - 1.20	B2							Dark brown slightly sandy slightly silty slightly gravelly CLAY with occasional rootlets. Sand is fine to coarse. Gravel is fine to medium, subangular.		
0.50 - 1.20	D3					(0.70)				
1.00	ES4									
1.20 - 2.00	B5				82.61	1.20				
1.20 - 2.00	D6							Stiff brown slightly silty slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to medium, subangular to subrounded.		
1.20 - 1.65	SPT (C) N=25			N=25 (3,5/7,7,5,6)		(0.80)				
2.00 - 3.00	B7				81.81	2.00				
2.00 - 3.00	D8							Firm to stiff brown slightly silty slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to medium, subangular to subrounded.		
2.00 - 2.45	SPT (C) N=16			N=16 (3,3/3,4,4,5)		(1.00)				
3.00	ES11				80.81	3.00				
3.00 - 3.50	B9							Very stiff to hard brown slightly silty slightly gravelly CLAY with medium cobble and low boulder content. Sand is fine to coarse. Gravel is fine to medium, subangular to subrounded. Cobbles and boulders are subangular to subrounded.		
3.00 - 3.50	D10									
3.00 - 3.38	SPT (C)			N=85 (3,1/85 for 225mm)		(0.90)				
3.90 - 4.05	SPT (C)			50 (3,8/50 for 0mm)		3.90				
3.90 - 4.05				50 (3,8/50 for 0mm)	79.91			Medium Strong light to medium grey fine grained micritic LIMESTONE with frequent irregular - shaped calcite veins and pockets (up to 30mm thick). Distinctly weathered with some yellowish brown discolouration and occasional cavities along calcite veins. Discontinuities: Closely to medium spaced, undulating rough.		
	100 93 87 8									
5.45										
	100 100 95 9									
7.00						(6.25)				
	100 93 80 6									
8.60										
	99 75 61 10									
10.15					73.66	10.15		Medium Strong light to medium grey fine grained micritic LIMESTONE with		
	TCR SCR RQD FI							Continued on Next Page		

Remarks

Cable Percussion terminated at 3.40m due to probable boulder obstruction. Rotary Open Hole techniques employed to 3.90m followed by Rotary Coring to 14.90m.

Water Added	
From (m)	To (m)
1.10	3.40

Water Strike - General			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
1.10	1.10	20	0.75
6.90		20	5.90

Casing Details	
To (m)	Diam (mm)
3.40	200
3.90	152

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
3.20	3.30	01:00
3.30	3.40	01:00

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC219-CPRC02
	Coordinates: 553201.13 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 2 of 2
Method: Cable Percussion+Rotary Open+Rotary Coring	609848.01 N	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon+T44	**Ground Level:** 83.81 mOD	**Dates:** 21/02/2020 - 19/03/2020	**Driller:** AA +NOB **Logger:** IH +MN

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
	100	90	63	3			(1.55)		frequent irregular - shaped calcite veins and pockets (up to 30mm thick). Distinctly weathered with some yellowish brown discolouration and occasional cavities along calcite veins. Discontinuities: Medium spaced, undulating rough.		
11.70						72.11	11.70				
	100	100	98	1			(1.55)		Medium Strong light to medium grey fine grained micritic LIMESTONE with frequent irregular - shaped calcite veins and pockets (up to 30mm thick). Slightly weathered with frequent irregular - shaped calcite pockets (up to 60mm) Discontinuities: Medium spaced, undulating rough.		
13.25						70.56	13.25				
	100	96	90	4			(1.65)		Medium Strong light to medium grey fine grained micritic LIMESTONE with frequent irregular - shaped calcite veins and pockets (up to 30mm thick). Slightly weathered with frequent irregular - shaped calcite pockets (up to 60mm) Discontinuities: Closely to medium spaced, undulating rough.		
14.90						68.91	14.90		End of borehole at 14.900m		
	TCR	SCR	RQD	FI							

Remarks

Cable Percussion terminated at 3.40m due to probable boulder obstruction. Rotary Open Hole techniques employed to 3.90m followed by Rotary Coring to 14.90m.

Water Added	
From (m)	To (m)
1.10	3.40

Water Strike - General			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
1.10	1.10	20	0.75
6.90		20	5.90

Casing Details	
To (m)	Diam (mm)
3.40	200
3.90	152

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
3.20	3.30	01:00
3.30	3.40	01:00

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC219-CPRC03
	Coordinates: 553276.00 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 2
Method: Cable Percussion+Rotary Open+Rotary Coring	609803.38 N	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon	**Ground Level:** 85.72 mOD	**Dates:** 24/02/2020 - 23/03/2020	**Driller:** AA
			Logger: MN

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0.05	ES1					(0.50)		TOPSOIL: Dark brown CLAY.		
0.50	ES2				85.22	0.50				
0.50 - 1.20	B3							Brown slightly gravelly slightly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to coarse, subrounded.		
0.50 - 1.20	D4					(0.70)				
1.00	ES5									
1.20 - 2.00	B6				84.52	1.20				
1.20 - 2.00	D7							Soft brown slightly sandy slightly silty gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are angular to subangular.		
1.20 - 1.65	SPT (C) N=6			N=6 (1,1/1,2,1,2)		(0.80)				
2.00 - 2.50	B8				83.72	2.00				
2.00 - 2.18	SPT (C)			75 (17,21/75 for 30mm)		(0.50)		Stiff brown slightly sandy slightly silty gravelly CLAY with high cobble content and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles and boulders are angular to subangular.		
2.50 - 3.50	B9				83.22	2.50				
2.50 - 3.50	D10							Soft light brown slightly sandy slightly silty gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are angular to subangular.		
3.00	ES13					(1.00)				
3.00 - 3.45	SPT (C) N=7			N=7 (1,1/1,3,2,1)						
3.50 - 4.50	B11				82.22	3.50				
3.50 - 4.50	D12							Very stiff to hard light brown slightly sandy slightly silty gravelly CLAY with medium cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles and boulders are angular to subangular.		
4.00 - 4.34	SPT (C)			N=95 (10,15/95 for 185mm)						
						(1.90)				
5.00 - 5.08	SPT (C)			50 (19 for 75mm/50 for 0mm)						
5.40 - 5.59	SPT (C)			75 (3,9/75 for 40mm)		5.40				
5.40 - 5.59			7	75 (3,9/75 for 40mm)	80.32	(0.36)		Weak to Medium Strong light yellowish grey and light brown possibly partially dolomitized fine grained micritic LIMESTONE.		
					79.96	5.76				
	80	25	25	NI				Distinctly to highly weathered with yellowish brown discoloration on cavity surfaces.		
						(1.14)		Discontinuities: Very closely to closely spaced undulating rough.		
				6				Weak to Medium Strong light grey fine grained micritic LIMESTONE.		
6.90					78.82	6.90		Distinctly weathered with some brown slightly sandy silty clay infilling and brown discolouration on discontinuity surfaces. Occasional thin calcite veins and pockets up to 10mm wide.		
	98	58	44					Discontinuities: Very closely to closely spaced, planar to undulating, rough. Weak to Medium Strong light grey fine grained micritic LIMESTONE with occasional calcite veins and pockets up to 15mm wide.		
								Distinctly weathered with some yellowish brown discolouration on discontinuity surfaces and along occasional stylolites.		
8.40			20			(3.00)		Discontinuities: Very closely to closely spaced. 1.: Subhorizontal, planar to undulating, rough. 2.: Steep to subvertical, planar to undulating, rough.		
	99	65	18							
9.90					75.82	9.90		Soft yellowish brown slightly sandy slightly gravelly silty CLAY.		
	TCR	SCR	RQD	FI				Continued on Next Page		

Remarks

Cable Percussion terminated at 5.10m due to probable boulder obstruction. Rotary Open Hole techniques employed to 5.90m followed by Rotary Coring to 11.40m.

Water Added	
From (m)	To (m)
4.00	5.00

Water Strike - General			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
4.00	4.00	20	2.20

Casing Details	
To (m)	Diam (mm)
5.10	200
6.90	152

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
2.40	2.60	01:00
2.60	3.00	00:40
4.50	5.00	00:45

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC219-CPRC03
	Coordinates: 553276.00 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 2 of 2
Method: Cable Percussion+Rotary Open+Rotary Coring	609803.38 N	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon	**Ground Level:** 85.72 mOD	**Dates:** 24/02/2020 - 23/03/2020	**Driller:** AA **Logger:** MN

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
	67	0	0	NI			(1.40)				
11.40						74.42 74.32	11.30 11.40		Medium Strong light grey fine grained LIMESTONE. End of borehole at 11.400m		
	TCR	SCR	RQD	FI							

Remarks

Cable Percussion terminated at 5.10m due to probable boulder obstruction. Rotary Open Hole techniques employed to 5.90m followed by Rotary Coring to 11.40m.

Water Added	
From (m)	To (m)
4.00	5.00

Water Strike - General			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
4.00	4.00	20	2.20

Casing Details	
To (m)	Diam (mm)
5.10	200
6.90	152

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
2.40	2.60	01:00
2.60	3.00	00:40

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC219-CPRC04
	Coordinates: 553342.39 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 1
Method: Cable Percussion+Rotary Open+Rotary Coring	609806.33 N	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon+T44	**Ground Level:** 88.45 mOD	**Dates:** 20/02/2020 - 13/03/2020	**Driller:** AA +NOB **Logger:** MN

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0.00 - 1.20	B4				88.25	(0.20)		MADE GROUND: Granular fill material. Clause 804 angular gravel		
0.00 - 1.20	D5					0.20		Brown slightly sandy slightly silty gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are angular to subrounded.		
0.05	ES1									
0.50	ES2					(1.00)				
1.00	ES3									
1.20 - 2.00	B6				87.25	1.20		Very stiff orange brown slightly sandy slightly silty gravelly CLAY with medium cobble content and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles and boulders are subangular to subrounded.		
1.20 - 2.00	D7									
1.20 - 1.58	SPT (C)			N=73 (1,1/73 for 225mm)		(1.10)				
2.00 - 2.12	SPT (C)			50 (46 for 115mm/50 for 0mm)						
2.30 - 2.30	SPT (C)			50 (25 for 0mm/50 for 0mm)	86.15	2.30		Strong light grey fine grained micritic LIMESTONE with occasional irregular calcite pockets and fossil debris including crinoid ossicles. Distinctly weathered with light yellowish brown discolouration along open and incipient discontinuities. and yellowish brown clay infill of discontinuities. Discontinuities are mostly closely to medium spaced. Mostly planar to undulating rough.		
2.30 - 2.30	SPT (C)			50 (25 for 0mm/50 for 0mm)						
3.70	91 62 49		12			(1.90)				
	100 96 96		4		84.25	4.20		Strong light grey fine grained micritic LIMESTONE with occasional irregular calcite pockets and fossil debris including crinoid ossicles. Slightly weathered with light yellowish brown discolouration along open and incipient discontinuities and occasional to frequent irregular calcite pockets and veins. Clay infill of discontinuity at 5.30m. Discontinuities are mostly medium spaced. Mostly planar to undulating rough.		
5.25	99 97 97		2			(2.50)				
6.70	89 86 86		3		81.75	6.70		Strong light grey fine grained micritic LIMESTONE with occasional irregular calcite pockets and fossil debris including crinoid ossicles. Unweathered to slightly weathered with light yellowish brown discolouration along open and incipient discontinuities and occasional to frequent irregular calcite pockets and veins. Discontinuities are mostly medium to widely spaced. Subhorizontal undulating rough.		
8.25					80.20	(1.55) 8.25		End of borehole at 8.250m		
	TCR SCR RQD FI									

Remarks
Flush lost down hole from 3.80m.

Cable Percussion terminated at 2.00m due to bedrock obstruction. Rotary Open Hole techniques employed to 2.30m followed by Rotary Coring to 6.30m.

Water Added	
From (m)	To (m)

Water Strike - General			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Casing Details	
To (m)	Diam (mm)
2.00	200
2.30	151

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
2.00	2.00	01:00

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC219-CPRC05
	Coordinates: 553337.58 E 609791.07 N	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 2
Method: Cable Percussion+Rotary Open+Rotary Coring		**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon+T44	**Ground Level:** 88.32 mOD	**Dates:** 18/02/2020 - 11/03/2020	**Driller:** AA +NOB **Logger:** MN

Depth (m)	Sample / Tests	TCR	SCR	RQD	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
0.05	ES1								(0.20)		MADE GROUND: Granular fill material. Clause 804 angular gravel.
0.20 - 1.20	B4							88.12	0.20		Light brown slightly sandy slightly silty gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subangular to subrounded.
0.20 - 1.20	D5										
0.50	ES2								(1.00)		
1.00	ES3										
1.20 - 2.00	B6							87.12	1.20		Stiff light brown slightly sandy slightly silty very gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles are subangular.
1.20 - 2.00	D7										
1.20 - 1.65	SPT (C) N=16						N=16 (2,1/2,3,4,7)				
2.00 - 2.15	SPT (C)						50 (11,18/50 for 0mm)		(1.20)		
2.40 - 2.40	SPT (C)						50 (25 for 0mm/50 for 0mm)				
2.40 - 2.40							50 (25 for 0mm/50 for 0mm)	85.92	2.40		Strong light grey fine grained micritic LIMESTONE with occasional wavy stylolites. Slightly weathered with some lighter coloured discolouration on discontinuity surfaces. Clay infill of discontinuities up to 3.40m. Discontinuities are closely to medium spaced, planar to undulating, rough.
		100	93	83							
									(2.65)		
3.90		100	96	96		4					
5.05								83.27	5.05		Strong light grey fine grained micritic LIMESTONE with occasional wavy stylolites. Slightly weathered with some lighter coloured discolouration on discontinuity surfaces. Discontinuities are closely to widely spaced, planar to undulating, rough.
		99	95	95					(1.05)		
								82.22	6.10		Strong light grey fine grained micritic LIMESTONE with occasional wavy stylolites. Slightly weathered with some lighter coloured discolouration on discontinuity surfaces. Discontinuities are medium to widely spaced, planar to undulating, rough.
									(0.50)		
6.60								81.72	6.60		Strong light grey fine grained micritic LIMESTONE with occasional to some fossil debris (primarily crinoid ossicles) and occasional black wavy stylolites. Slightly weathered with occasional light yellowish brown discolouration on discontinuity surfaces. Discontinuities are medium to widely spaced, planar to undulating, rough.
		100	100	97		3					
8.15									(6.50)		
		100	94	86		3					
9.75											
		TCR	SCR	RQD		FI					Continued on Next Page

Water: Backfill

Remarks

Cable Percussion terminated at 2.00m due to bedrock obstruction. Rotary Open Hole techniques employed to 2.40m followed by Rotary Coring to 13.00m.

Water Added	
From (m)	To (m)
1.50	2.00

Water Strike - General			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
3.40		0	0.00

Casing Details	
To (m)	Diam (mm)
2.00	200
2.40	151

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
1.50	2.00	02:00

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC219-CPRC05
	Coordinates: 553337.58 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 2 of 2
Method: Cable Percussion+Rotary Open+Rotary Coring	609791.07 N	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon+T44	**Ground Level:** 88.32 mOD	**Dates:** 18/02/2020 - 11/03/2020	**Driller:** AA +NOB **Logger:** MN

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
	100	90	90	3							
11.30	100	96	96	1							
11.55	100	100	100	2							
13.10						75.22	13.10		End of borehole at 13.100m		
	TCR	SCR	RQD	FI							

Remarks

Cable Percussion terminated at 2.00m due to bedrock obstruction. Rotary Open Hole techniques employed to 2.40m followed by Rotary Coring to 13.00m.

Water Added	
From (m)	To (m)
1.50	2.00

Water Strike - General			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
3.40		0	0.00

Casing Details	
To (m)	Diam (mm)
2.00	200
2.40	151

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
1.50	2.00	02:00

Project No.: 19-135	**Project Name:** Cork Line Level Crossings		**Borehole No.:** XC219-CPRC06
Coordinates: 553259.99 E	**Client:** Iarnród Éireann / Irish Rail		Sheet 1 of 2
Method: Rotary Open+Rotary Coring	**Coordinates:** 609814.04 N	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: T44	**Ground Level:** 85.00 mOD	**Dates:** 13/08/2020 - 13/08/2020	**Driller:** NOB
			Logger: MN

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
							(0.30)		Hand Dug Inspection Pit to 1.2m. Driller describes: TOPSOIL
						84.70	0.30		Hand Dug Inspection Pit to 1.2m. Driller describes: Sand and Gravel
							(0.90)		
						83.80	1.20		Rotary Open Hole Drilling: Driller describes: Sand, Gravel, Boulders
							(1.50)		
						82.30	2.70		Rotary Open Hole Drilling: Driller describes: Boulder with Sand and Clay
							(1.50)		
						80.80	4.20		Rotary Open Hole Drilling: Driller describes: Clay with Sand and Gravel
							(1.10)		
						79.70	5.30		Medium strong light grey and yellowish brown to brown partially dolomitised micritic LIMESTONE with frequent irregular-shaped white calcite veins / pockets. Distinctly weathered with much yellowish brown discolouration locally penetrating from discontinuity surfaces and with a little sandy gravelly silty clay infilling. Discontinuities: Very closely to closely spaced multiple orientations but commonly subhorizontal and subvertical, planar to undulating, rough.
	100	39	11	NI			(0.85)		
				12		78.85	6.15		
							(0.85)		
6.80						78.00	7.00		Strong light grey fine grained micritic LIMESTONE with occasional thin calcite veins and frequent wavy stylolites. Distinctly weathered with much yellowish brown discolouration along stylolites and some discontinuities and some brown sandy gravelly silty Clay infilling. Discontinuities: Very closely to closely spaced. commonly subhorizontal and subvertical, planar to undulating, rough.
	100	67	50	8					
8.30							(2.80)		Strong light grey fine grained micritic LIMESTONE with occasional thin calcite veins and irregular shaped pockets and occasional, locally frequent, wavy stylolites. Distinctly weathered with yellowish brown discolouration along stylolites and some discontinuity surfaces. Becoming less weathered with depth. Discontinuities: Closely up to to medium spaced. 1.) Subhorizontal to subangular, planer to undulating rough.
	70	63	63	3					
9.80						75.20	9.80		
	TCR	SCR	RQD	FI					Continued on Next Page

Water

Backfill

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5

Remarks

Rotary Open Hole Drilling to 5.3m followed by Rotary Coring.

Water Added	
From (m)	To (m)

Water Strike - General			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
4.70	4.70	20	4.70

Casing Details	
To (m)	Diam (mm)
5.30	151
11.30	101

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC219-CPRC06
	Coordinates: 553259.99 E 609814.04 N	**Client:** Iarnród Éireann / Irish Rail	Sheet 2 of 2
Method: Rotary Open+Rotary Coring		**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: T44	**Ground Level:** 85.00 mOD	**Dates:** 13/08/2020 - 13/08/2020	**Driller:** NOB
			Logger: MN

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
									2.) Steep to subvertical planar rough, 3.) 45° - 65° planar to undulating, rough.		
									End of borehole at 11.300m		
	TCR	SCR	RQD	FI							

Remarks

Rotary Open Hole Drilling to 5.3m followed by Rotary Coring.

Water Added	
From (m)	To (m)

Water Strike - General			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
4.70	4.70	20	4.70

Casing Details	
To (m)	Diam (mm)
5.30	151
11.30	101

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

Project No.: 19-135	**Project Name:** Cork Line Level Crossings		**Borehole No.:** XC219-CPRC07
Coordinates: 553283.99 E 609821.03 N	**Client:** Iarnród Éireann / Irish Rail		Sheet 1 of 2
Method: Rotary Open+Rotary Coring	**Client's Representative:** JACOBS		**Scale:** 1:50
Plant: T44	**Ground Level:** 85.66 mOD	**Dates:** 19/08/2020 - 19/08/2020	**Driller:** NOB
			Logger: IH

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
							(1.20)		Rotary Open Hole Drilling: Driller describes: Topsoil with sandy CLAY		
						84.46	1.20		Rotary Open Hole Drilling: Driller describes: Slightly clayey SAND with boulders.		
							(2.50)				
						81.96	3.70		Very low recovery.		
	40	14	9						Medium strong, light grey, micritic LIMESTONE. Distinctly weathered (Completely destructured locally) with much brown sandy, slightly gravelly clay infill and staining and occasional yellow / orange oxide staining.		
5.20				NI			(3.00)		Discontinuities: Completely non-intact		
	7	0	0								
6.70						78.96	6.70		Strong to very strong light grey micritic LIMESTONE with some thin calcite veining.		
	87	80	69	7			(1.20)		Partially weathered with occasional brown clay staining and orange oxide staining on discontinuity surfaces. Discontinuities: 1.) Subhorizontal - 15°, undulating, rough, closely spaced.		
						77.76	7.90		2.) 60° - 75°, undulating, smooth, medium spaced.		
8.20									Medium strong to strong, light grey micritic LIMESTONE.		
	93	53	40	NI			(1.30)		Distinctly weathered with some brown clay infill and staining, some orange oxide staining on discontinuity surfaces and occasional calcite veins which have ben weathered out and replaced with orange oxide. Discontinuities: Mostly subhorizontal, undulating, rough extremely closely to very closely spaced.		
				3		76.46	9.20		As 6.7m - 7.9m:		
							(0.50)				
9.70						75.96	9.70		Strong to very strong light grey micritic LIMESTONE with some thin calcite		
	TCR	SCR	RQD	FI					Continued on Next Page		

Remarks

Rotary Open Hole Drilling to 3.7m followed by Rotary Coring.

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Casing Details		Chiselling Details		
To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)
3.70	151			
9.70	101			

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC219-CPRC07
	Coordinates: 553283.99 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 2 of 2
Method: Rotary Open+Rotary Coring	609821.03 N	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: T44	**Ground Level:** 85.66 mOD	**Dates:** 19/08/2020 - 19/08/2020	**Driller:** NOB
			Logger: IH

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
									veining. Partially weathered with occasional brown clay staining and orange oxide staining on discontinuity surfaces. Discontinuities: 1.) Subhorizontal - 15°, undulating, rough, closely spaced. 2.) 60° - 75°, undulating, smooth, medium spaced. End of borehole at 9.700m		
	TCR	SCR	RQD	FI							

Remarks

Rotary Open Hole Drilling to 3.7m followed by Rotary Coring.

Water Added	
From (m)	To (m)

Water Strike - General			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Casing Details	
To (m)	Diam (mm)
3.70	151
9.70	101

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC219-CPRC08
	Coordinates: 553293.67 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 1
Method: Rotary Open+Rotary Coring	609800.39 N	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: T44	**Ground Level:** 85.63 mOD	**Dates:** 08/09/2020 - 09/09/2020	**Driller:** NOB
			Logger: IH

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
						85.43	(0.20) 0.20		Rotary Open Hole Drilling: Driller describes: TOPSOIL		
							(1.00)		Rotary Open Hole Drilling: Driller describes: MADE GROUND, Clause 804 fill.		
						84.43	1.20		Rotary Open Hole Drilling: Driller describes: Sandy GRAVEL with boulders.		
							(1.00)				
						83.43	2.20		Rotary Open Hole Drilling: Driller describes: Clayey SAND with Boulders		
							(3.20)				
				NI		80.23	5.40		Light grey strong LIMESTONE with occasional calcite veining. Partially to distinctly weathered with some grey sandy clay staining and infill of discontinuity surfaces, occasional orange oxide staining and some localised zones of weakness. Discontinuities: 1.) ~45° Planar, smooth, medium spacing. 2.) Subhorizontal, planar, smooth, very closely spaced.		
				2							
				NI							
	93	68	68	6							
6.90				1							
	100	79	47				(4.50)				
				NI							
8.40											
	90										
9.90						75.73	9.90		End of borehole at 9.900m		
	TCR	SCR	RQD	FI							

Remarks

Rotary Open Hole Drilling to 5.4m followed by Rotary Coring.

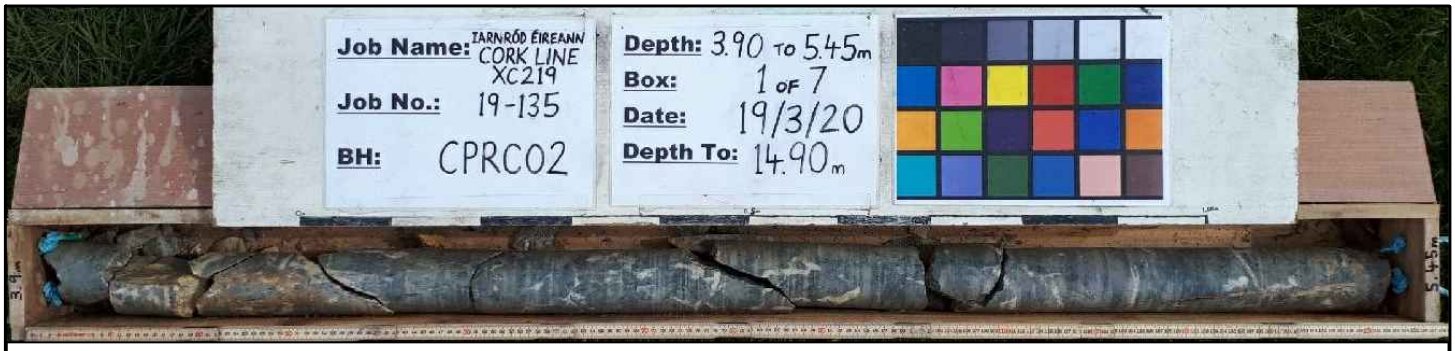
Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
		4.90	4.90	20	0.00

Casing Details		Chiselling Details		
To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)
5.40	151			
9.90	101			

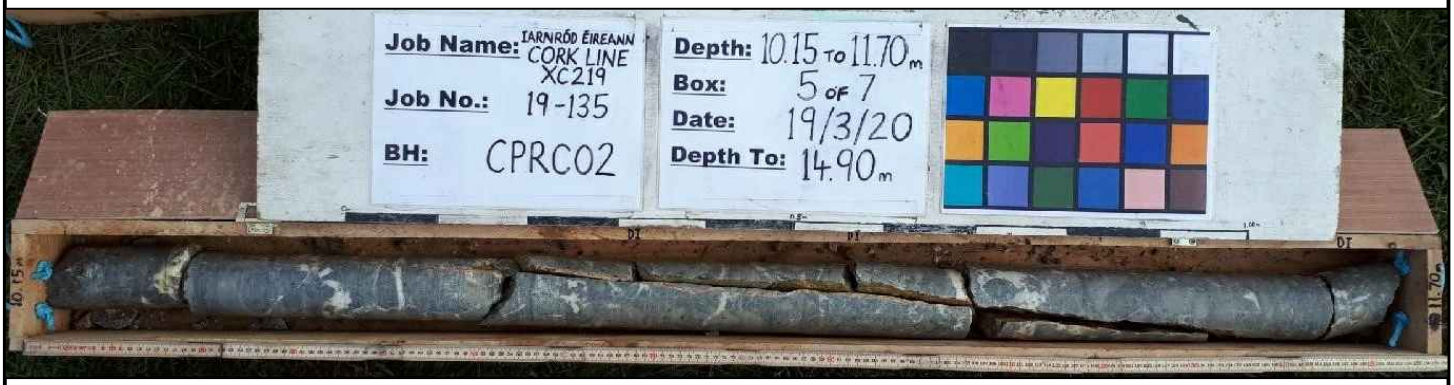
Appendix C Rock Core Photographs

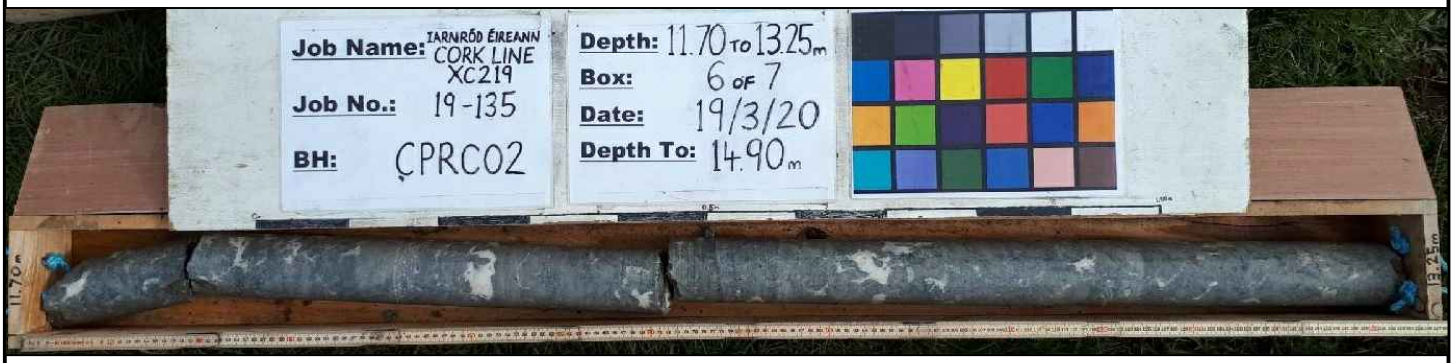
ocbgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	C.P/R.C01 Rock Core Photographs Client: Iarnród Éireann Engineer: Jacob's Date: Feb-March & Jun-Sep 2020

	C.P/R.C01A
Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	Rock Core Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: Feb-March & Jun-Sep 2020

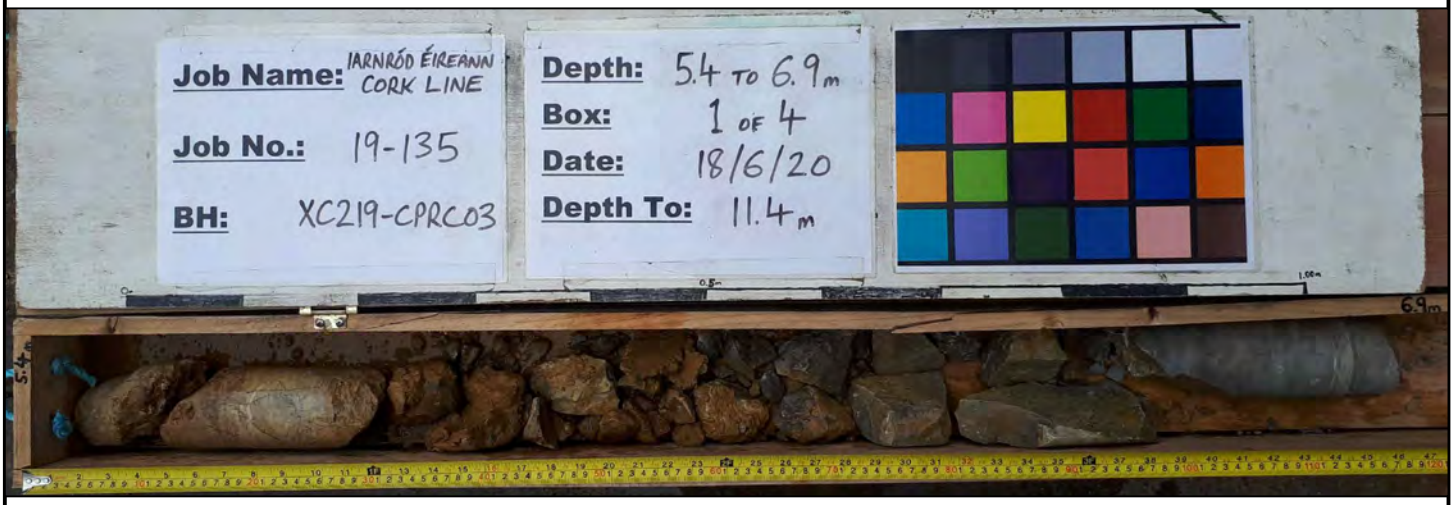


	C.P/R.C02
Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	Rock Core Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: Feb-March & Jun-Sep 2020

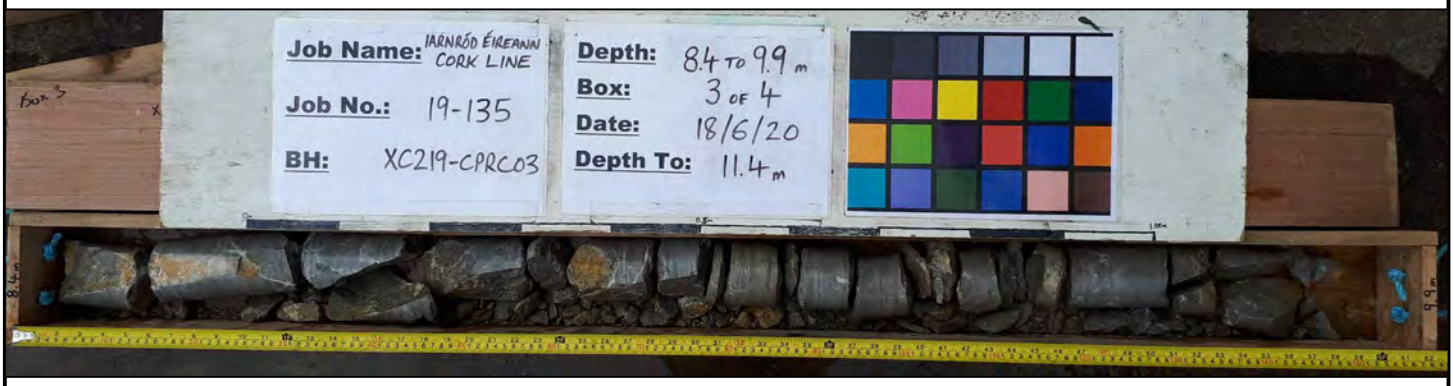




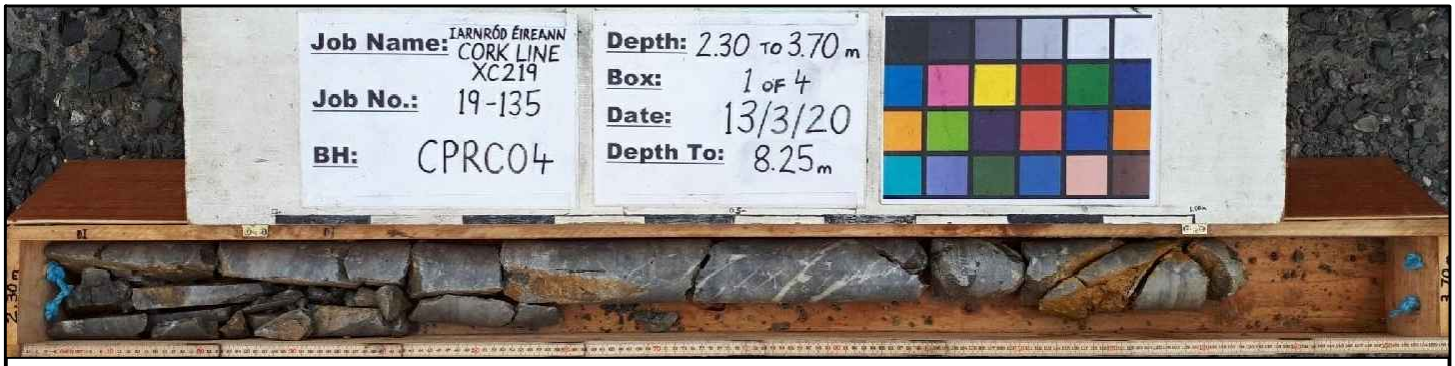
Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	C.P/R.C02 Rock Core Photographs Client: Iarnród Éireann Engineer: Jacob's Date: Feb-March & Jun-Sep 2020

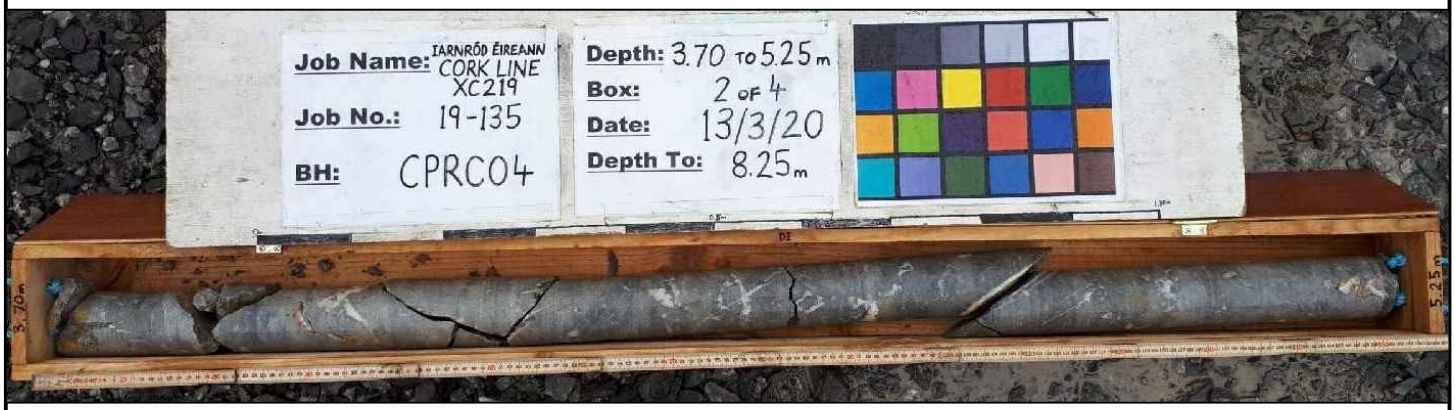


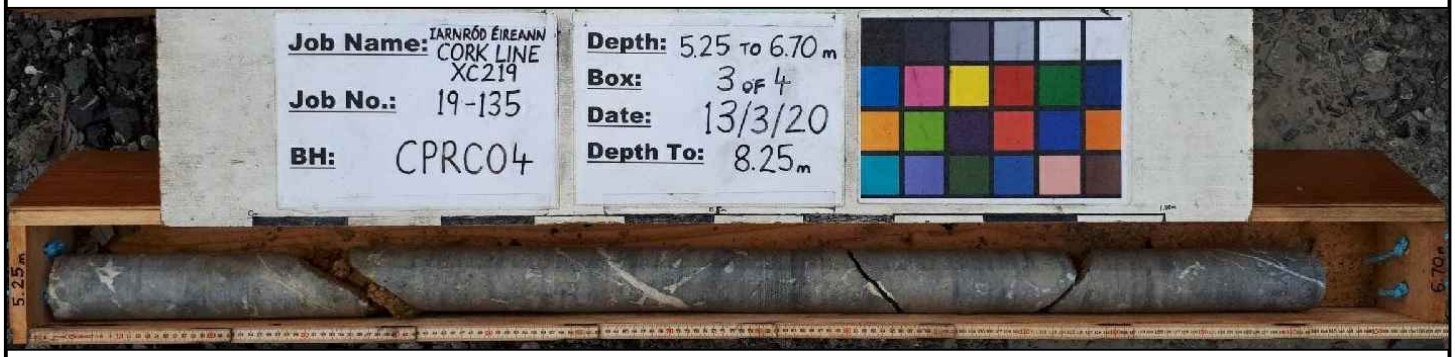
obgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	C.P/R.C04 Rock Core Photographs Client: Iarnród Éireann Engineer: Jacob's Date: Feb-March & Jun-Sep 2020

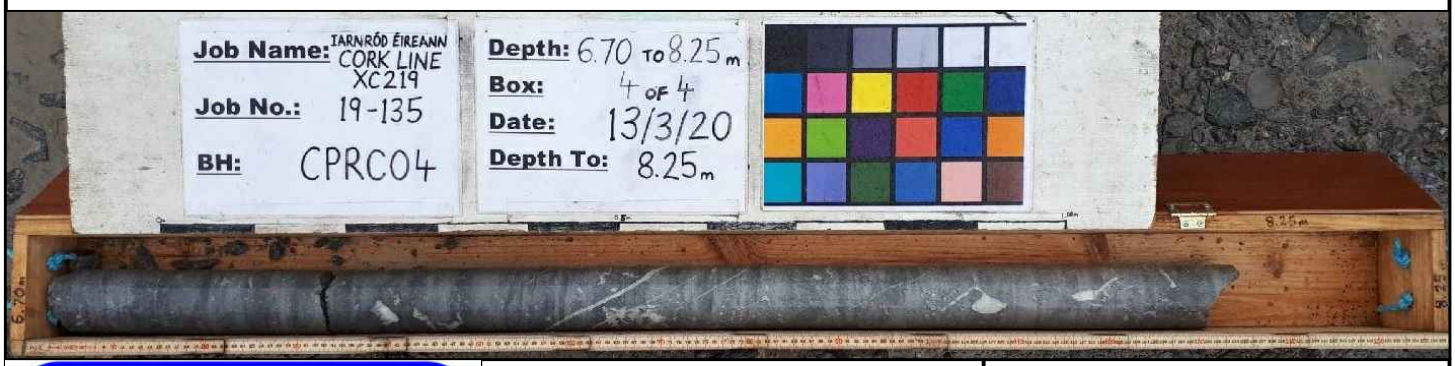


ocbgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	C.P/R.C03 Rock Core Photographs Client: Iarnród Éireann Engineer: Jacob's Date: Feb-March & Jun-Sep 2020









	C.P/R.C04
Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	Rock Core Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: Feb-March & Jun-Sep 2020