Cork Line Level Crossings – XC201
Ground Investigation

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Document Control Sheet

Report No.:	OCB19-135-1
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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 The amendments revised the Standard to remove text superseded by BS EN ISO 14688-1:2002, BS EN ISO 14688-2:2004 and EN ISO 14689-1:2003 and refers to the relevant standard for each affected subclause.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 – XC201

1 AUTHORITY

On the instructions of JACOBS on behalf 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 XC201 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 and JACOBS 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 sampling, in-situ and laboratory testing, 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 XC201 is located in the Thomastown townland, 4.9km southeast of Charleville, Co. Cork. An unnamed road crosses the Dublin-Cork railway line approximately 200m east of the N20. The level crossing is currently manned with a house and cabin located adjacent to the east of the railway line. The site is surrounded by agricultural land with a number of residential homes and farms in the area.

The site is relatively flat throughout. The main works areas are within agricultural fields, some may be marshy depending on weather conditions.

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 5th June 2020 and 7th August 2020, included:

- Three (3) Cable Percussion Boreholes
- Three (3) Cable Percussion with Rotary follow-on Boreholes
- A Standpipe Installation in two (2) Boreholes
- Four (4) Trial Pits
- Indirect CBR tests at eight (8) locations
- Water Purging in two (2) locations

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 six boreholes were put down in a minimum diameter of 150mm through soil 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

Three boreholes (CP01, CP01A & CP02) were put down to completion in minimum 200mm diameter using a Pilcon cable percussion soil boring rig. All boreholes were terminated either at their scheduled

completion depths, on instruction from a Jacobs engineer or else 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

Three boreholes (CPRC01, CPRC01A & CPRC02) were put down by a combination of cable percussion boring and rotary follow-on open hole 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.

No rock core recovered.

Appendix B presents the borehole logs.

4.2 Standpipe Installations

A groundwater monitoring standpipe was installed in boreholes CPRC01A and CPRC02.

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 2.70m and 3.60m. The trial pits were all terminated upon encountering obstructions or upon the pit walls collapsing.

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 a tempted unsuccessfully due to the relatively high granular content of the strata.

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

4.4 Indirect CBR Tests

An indirect CBR test was conducted at eight locations (CBR-TP01-1 to CBRTP04-2) 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 E 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):

Log CBR = 2.48-1.057 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 and CPRC02) water purging was carried out.

Appendix F 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 I.

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, Ammonia content, Chloride content, Nitrate content, 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 G.

5.2 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 H.

6 GROUND CONDITIONS

6.1 General Geology of the Area

Teagasc soil mapping indicates that the Thomastown area is underlain by Glacial Till derived chiefly from Devonian sandstones.

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 undifferentiated Visean Limestones. The Lower Carboniferous strata were subjected to compressional deformation (tectonic shortening) during the Variscan Orogeny in Late Carboniferous and Early Permian times. Bedrock strata in the site vicinity typically strike west-southwest to east-northeast with variable dips having undergone folding and faulting.

The site is underlain by a locally important aquifer, consisting of bedrock which is moderately productive only in local zones, and has a moderate groundwater vulnerability. Numerous Karst features, such as depressions, swallow holes, caves and springs, occur in the valley underlain by limestones to the north-northwest of the Ballyhoura Mountains.

Note: Bedrock level assumed approximately >30m bgl based on a historic ground investigation in the area.

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 200mm thickness, with topsoil and subsoil extending to 400mm depth noted in the Trial Pits.
- Glacial Till: Sandy gravelly silty clay, frequently with cobble and boulder content, typically soft or firm in upper horizons, becoming very stiff with increasing depth.
- Bedrock: Rockhead was not encountered to a maximum depth of 19.70m in CPRC02.

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.

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

Date	Depth to standing water level (m)	
	CPRC01A	CPRC02
13/08/20	0.63	0.92
17/08/20	0.5	0.86
21/08/20	0.2	0.31
29/09/20	0.795	1.06

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.

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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).

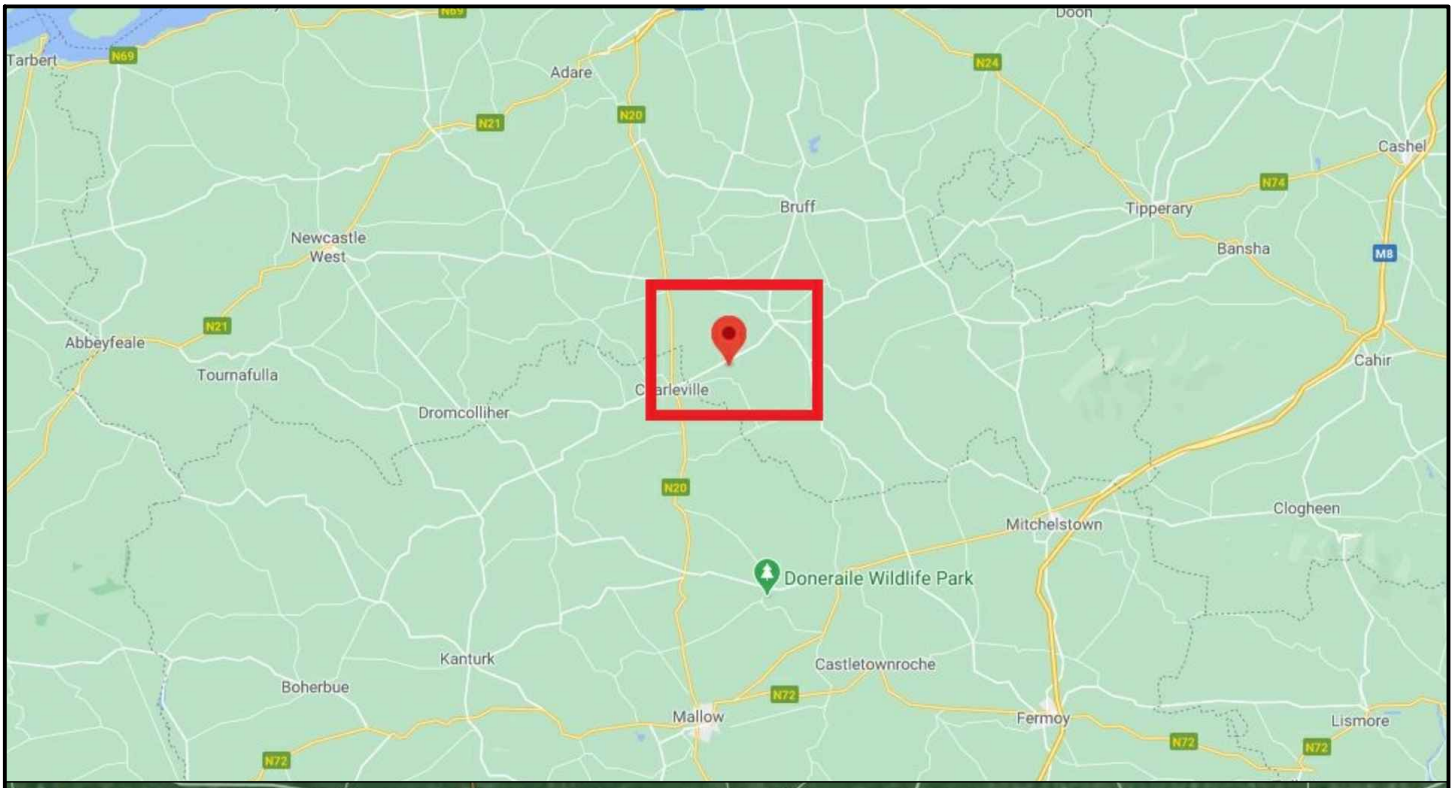
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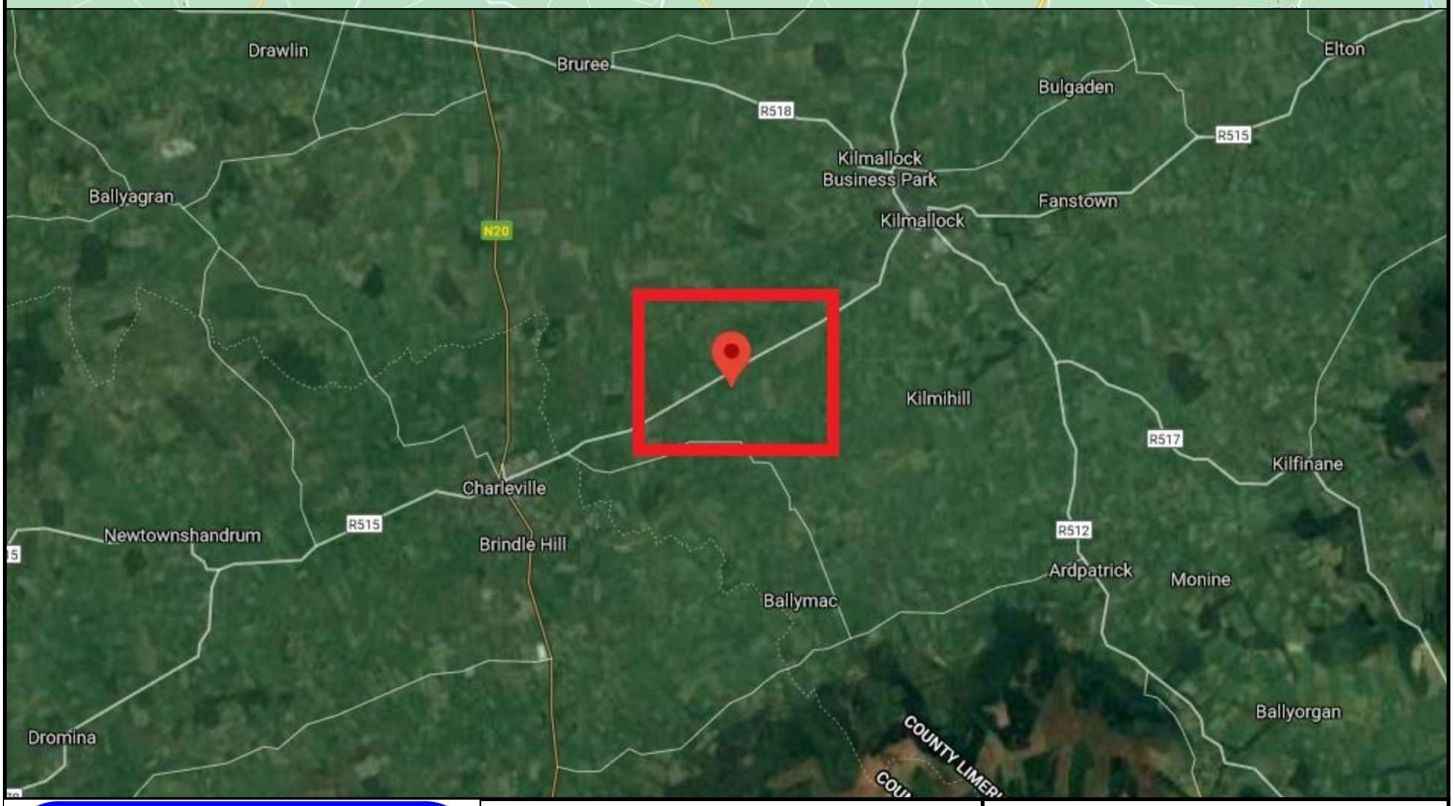
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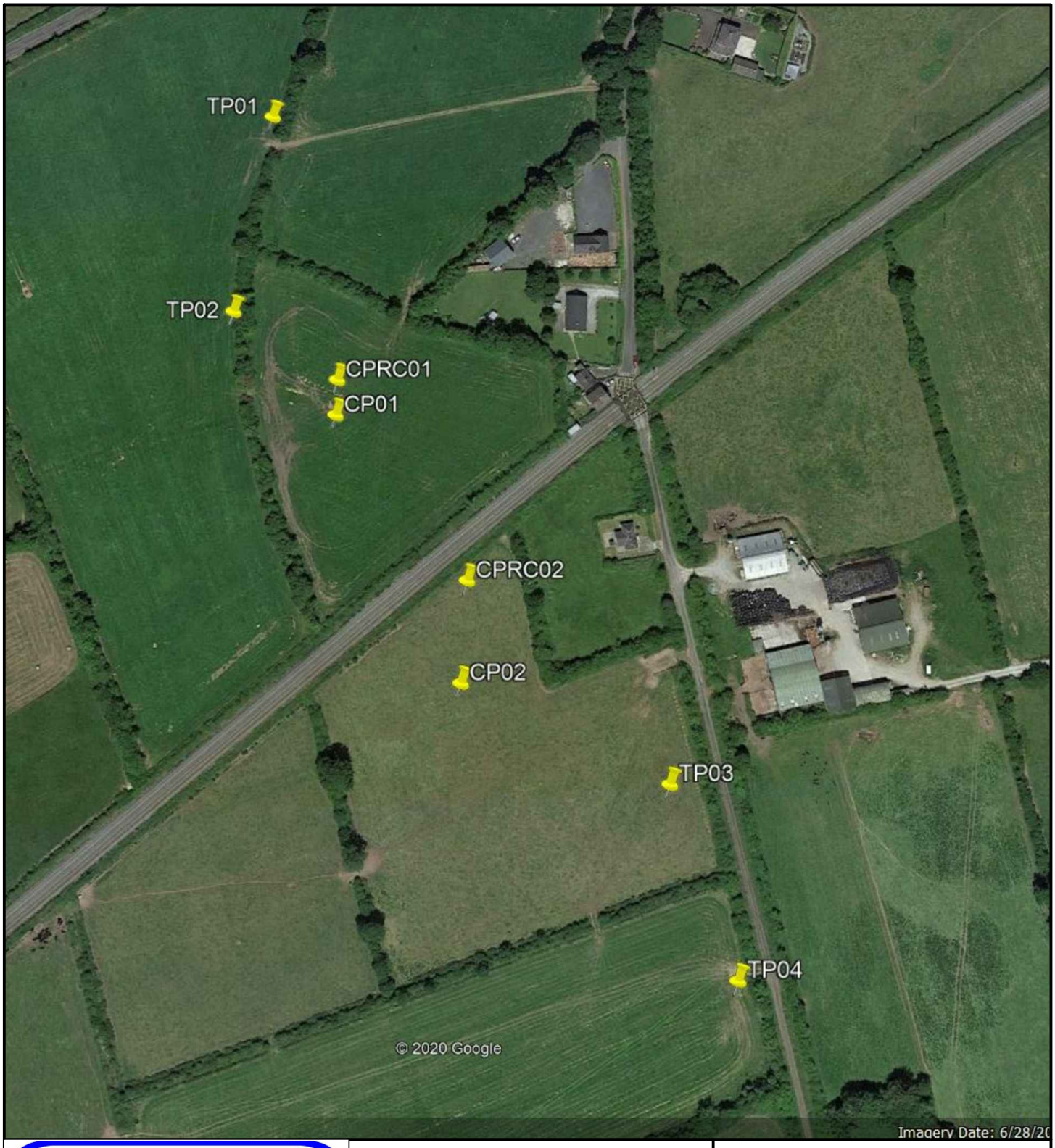
Soil Remediation Circular 2013, Ministry for Environment and Infrastructure, The Hague, Netherlands.
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Appendix A Site and Exploratory Hole Location Plans





	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	SITE LOCATION MAPS
		Client: Iarnród Éireann
		Engineer: Jacob's
		Date: June/July 2020



Iarnród Éireann

Cork Line Level Crossings

XC201 (19-135-1)

Exploratory Hole Locations

Client: Iarnród Éireann

Engineer: Jacob's

Date: June/July 2020

Appendix B Borehole Logs

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC201-CP01
	Coordinates: 557500.72 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 1
Method: Cable Percussion	624573.03 N	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon	**Ground Level:** 80.60 mOD	**Dates:** 05/06/2020 - 05/06/2020	**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				80.40	(0.20) 0.20		TOPSOIL		
0.20 - 1.20	B2							Firm light greyish brown with some yellow mottling slightly sandy slightly gravelly silty CLAY with frequent rootlets. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded.		
0.20 - 1.20	D3									
0.50	ES4					(1.00)				
1.20 - 2.00	B5				79.40	1.20		Firm light brown modeled grey slightly sandy gravelly SILT with low to medium cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles and boulders are subrounded.		
1.20 - 2.00	D6									
1.20 - 1.65	SPT (C) N=9			N=9 (2,1/2,2,3,2)		(0.80)				
1.50	ES7									
2.00 - 2.45	SPT (C) N=7			N=7 (3,2/1,2,2,2)	78.60	2.00		End of borehole at 2.000m		

Remarks
Instructed by clients engineer to relocate borehole at 2.00m.

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)
2.00	200			

Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC201-CP01A
Coordinates: E N	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 1
Method: Cable Percussion	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon	**Ground Level:** mOD	**Dates:** 08/06/2020 - 08/06/2020	**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
						(0.20)		TOPSOIL		
0.20 - 1.20	B1					0.20		Brown slightly silty slightly sandy slightly gravelly CLAY with frequent rootlets and low cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subrounded.		
0.20 - 1.20	D2									
0.50	ES3					(1.00)				
1.20 - 2.00	B4					1.20		Soft brown slightly silty slightly sandy slightly gravelly CLAY with frequent rootlets and medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subangular to subrounded.		
1.20 - 2.00	D5									
1.20 - 1.65	SPT (C) N=7			N=7 (1,1/2,1,2,2)		(0.80)				
1.50	ES6									
2.00 - 3.00	B7					2.00		Soft to Firm greyish brown slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subrounded.		
2.00 - 3.00	D8									
2.00 - 2.45	SPT (C) N=7			N=7 (2,2/1,2,2,2)		(1.00)				
3.00	ES9					3.00		Very Stiff greyish brown slightly sandy silty gravelly CLAY with high cobble and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles and boulders are subangular to subrounded, grey Limestone.		
3.00 - 3.40	B10					(0.40)				
3.00 - 3.40	D11					3.40		End of borehole at 3.400m		
3.00 - 3.40	SPT (C)			N=48 (1,1/48 for 255mm)						
3.40 - 3.40	SPT (C)			50 (25 for 0mm/50 for 0mm)						

Remarks

Cable Percussion terminated at 3.40m due to probable boulder obstruction.

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)
3.40	200	3.40	3.40	01:00

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC201-CP02
	Coordinates: 557552.80 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 1
Method: Cable Percussion	624458.19 N	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon	**Ground Level:** 82.31 mOD	**Dates:** 10/06/2020 - 10/06/2020	**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					(0.20)		TOPSOIL		
0.20 - 1.20	B2				82.11	0.20		Light brown slightly sandy gravelly silty 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	D3									
0.50	ES4					(1.00)				
1.20 - 2.00	B5				81.11	1.20		Stiff brown slightly sandy slightly gravelly silty CLAY with low cobble content and occasional rootlets. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles are subangular.		
1.20 - 2.00	D6									
1.20 - 1.65	SPT (C) N=26			N=26 (1,1/4,11,7,4)		(0.80)				
1.50	ES7									
2.00 - 2.20	B8				80.31	2.00				
2.00 - 2.20	D9					(0.20)				
2.00 - 2.00	SPT (C)			50 (50 for 2mm/50 for 0mm)	80.11	2.20		Brown slightly sandy gravelly sandy CLAY with high cobble and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles and boulders are subangular, predominantly limestone.		
2.20 - 2.20	SPT (C)			50 (25 for 0mm/50 for 0mm)				End of borehole at 2.200m		

Remarks

Cable Percussion terminated at 2.20m due to possible boulder obstruction.

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)
2.20	200	2.20	2.20	01:00

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC201-CPRC01
	Coordinates: 557501.38 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 1
Method: Cable Percussion+Rotary Open	624588.30 N	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon+T44	**Ground Level:** 80.47 mOD	**Dates:** 04/06/2020 - 19/06/2020	**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
0.05	ES1				80.26	(0.20) 0.20		TOPSOIL		
0.20 - 0.50	B2					(0.30)		Light yellowish brown mottled light greyish brown slightly sandy slightly gravelly silty CLAY with low cobble content and occasional rootlets, moist. Sand is fine to coarse. Gravel is fine to coarse, subangular. Cobbles are subangular, predominantly limestone.		
0.20 - 0.50	D3				79.96	0.50				
0.50	ES4									
0.50 - 1.20	B5					(0.70)		Yellowish brown mottled light grey and orange brown slightly sandy gravelly silty CLAY with low cobble content, moist. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subangular to subrounded, predominantly limestone.		
0.50 - 1.20	D6									
1.20 - 2.00	B7				79.26	1.20				
1.20 - 2.00	D8									
1.20 - 1.65	SPT (C) N=6			N=6 (0,1/1,2,2,1)		(0.80)		Soft yellowish brown with occasional light greyish brown mottling slightly sandy gravelly silty CLAY with low cobble content, moist. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subangular to subrounded.		
1.50	ES9									
2.00 - 3.00	B10				78.46	2.00				
2.00 - 3.00	D11									
2.00 - 2.45	SPT (C) N=17			N=17 (1,1/2,4,6,5)		(1.20)		Stiff yellowish brown slightly sandy gravelly silty CLAY with low cobble content, moist. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subangular to subrounded, predominantly limestone.		
3.00	ES14									
3.00 - 3.20	B12				77.26	3.20				
3.00 - 3.20	D13							Yellowish brown sandy gravelly clayey SILT. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular.		
3.00 - 3.20	SPT (C)			75 (4,5/75 for 50mm)		(0.50)				
3.20 - 3.70	B15				76.76	3.70		Open Hole Boring, Driller Described: BOULDERS		
3.20 - 3.70	D16									
3.70 - 3.70	SPT (C)			50 (25 for 0mm/50 for 0mm)		(1.40)				
5.10 - 5.18	SPT (C)			50 (50 for 75mm/50 for 0mm)	75.36	5.10		End of borehole at 5.100m		

Remarks
Cable Percussion terminated at 3.70m due to possible boulder obstruction. Rotary Open Hole techniques employed to 5.10m upon encountering a boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.

Water Added	
From (m)	To (m)
3.20	3.60

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

Casing Details	
To (m)	Diam (mm)
3.70	200
5.10	151

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
3.20	3.40	00:40
3.60	3.70	00:30

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC201-CPRC01A
	Coordinates: E	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 2
Method: Cable Percussion+Rotary Open	N	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon+T44	**Ground Level:** mOD	**Dates:** 08/06/2020 - 22/06/2020	**Driller:** AA +NOB
			Logger: IH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
0.20 - 0.50	B1					(0.20) 0.20		TOPSOIL
0.20 - 0.50	D2							Brown slightly silty slightly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles are angular to subrounded, predominantly grey limestone.
0.50	ES3							
0.50 - 1.20	B4					(1.00)		
0.50 - 1.20	D5							
1.20 - 2.00	B6					1.20		
1.20 - 2.00	D7							Soft brown mottled grey slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles are angular to subrounded, predominantly grey limestone.
1.20 - 1.65	SPT (C) N=6			N=6 (1,1/1,2,1,2)		(0.80)		
1.50	ES8							
2.00 - 2.20	B9					2.00 (0.20)		
2.00 - 2.20	D10					2.20		Firm brown slightly sandy slightly gravelly silty CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subangular to subrounded.
2.00 - 2.45	SPT (C) N=11			N=11 (1,3/2,3,3,3)		(0.20) 2.40		
2.20 - 2.40	B11							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.
2.20 - 2.40	D12							
2.40 - 3.40	B13					(1.00)		
2.40 - 3.40	D14							Very Stiff - Hard grey / brown slightly sandy gravelly CLAY with medium to high cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subrounded.
3.00	ES15							
3.00 - 3.46	SPT (C) N=68			N=68 (3,5/68 for 305mm)		3.40 (0.20)		
3.40 - 3.60	B16					3.60		Dark grey slightly clayey sandy very gravelly subangular Limestone COBBLES with low boulder content.
3.40 - 3.60	D17							Open Hole Boring, Driller Described: BOULDERS with sand and gravel.
3.40 - 3.40	SPT (C)			50 (25 for 0mm/50 for 0mm)				
5.10 - 5.18	SPT (C)			50 (25 for 75mm/50 for 0mm)		(4.50)		
6.60 - 6.90	SPT (C)			88 (16,18/88 for 150mm)				
8.10 - 8.25	SPT (C)			50 (14,20/50 for 0mm)		8.10		Open Hole Boring, Driller Described: BOULDERS
9.60 - 9.68	SPT (C)			50 (25 for 75mm/50 for 0mm)				
								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 10.0

Remarks

Cable Percussion terminated at 3.60m due to possible boulder obstruction. Rotary Open Hole techniques employed to 19.60m.

Water Added

From (m)	To (m)
2.20	3.40

Water Strike - General

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
2.20		20	2.20
5.60	5.60	20	4.90
8.60	7.60	20	7.60
9.60	8.50	20	8.50

Casing Details

To (m)	Diam (mm)
3.60	200
19.60	151

Chiselling Details

From (m)	To (m)	Time (hh:mm)
3.40	3.60	01:00

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC201-CPRC01A
	Coordinates: E	**Client:** Iarnród Éireann / Irish Rail	Sheet 2 of 2
Method: Cable Percussion+Rotary Open	N	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon+T44	**Ground Level:** mOD	**Dates:** 08/06/2020 - 22/06/2020	**Driller:** AA +NOB
			Logger: IH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
10.60 - 10.90	SPT (C)			85 (14,16/85 for 150mm)		(6.00)				
13.60 - 13.90	SPT (C)			89 (14,16/89 for 150mm)						
						14.10		Open Hole Boring, Driller Described: Sandy gravelly CLAY		
						(1.50)				
						15.60		Open Hole Boring, Driller Described: Sandy CLAY with boulders.		
16.60 - 17.05	SPT (C) N=81			N=81 (11,11/16,20,20,25)		(1.50)				
						17.10		Open Hole Boring, Driller Described: BOULDERS		
						(2.50)				
19.60 - 19.82	SPT (C)			70 (17,19/70 for 75mm)		19.60		End of borehole at 19.600m		

Remarks

Cable Percussion terminated at 3.60m due to possible boulder obstruction. Rotary Open Hole techniques employed to 19.60m.

Water Added	
From (m)	To (m)
2.20	3.40

Casing Details	
To (m)	Diam (mm)
3.60	200
19.60	151

Water Strike - General			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
2.20		20	2.20
5.60	5.60	20	4.90
8.60	7.60	20	7.60
9.60	8.50	20	8.50

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
3.40	3.60	01:00

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC201-CPRC02
	Coordinates: 557555.87 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 2
Method: Cable Percussion+Rotary Open	624501.31 N	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon+T44	**Ground Level:** 81.98 mOD	**Dates:** 09/06/2020 - 17/06/2020	**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				81.78	(0.20) 0.20		TOPSOIL
0.20 - 1.20	B2							Orange brown slightly sandy gravelly CLAY with low cobble content and frequent rootlets. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded.
0.20 - 1.20	D3							
0.50	ES4					(1.00)		
1.20 - 2.00	B5				80.78	1.20		Firm light brown slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subangular to subrounded.
1.20 - 2.00	D6							
1.20 - 1.65	SPT (C) N=13			N=13 (2,4/3,3,3,4)		(0.80)		
1.50	ES7							
2.00 - 2.50	B8				79.98	2.00		Stiff light brown slightly gravelly sandy silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subangular to subrounded.
2.00 - 2.50	D9					(0.50)		
2.00 - 2.45	SPT (C) N=27			N=27 (1,1/4,5,8,10)	79.48	2.50		Light brown slightly gravelly sandy CLAY with low to medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subangular to subrounded.
2.50 - 2.80	B10							
2.50 - 2.80	D11							
2.80 - 3.30	D12					(0.80)		
2.80 - 3.30	D13							
3.00	ES14							
3.00 - 3.00	SPT (C)			50 (25 for 0mm/50 for 0mm)	78.68	3.30		Open Hole Boring, Driller Described: Boulder CLAY.
3.30 - 3.30	SPT (C)			50 (25 for 0mm/50 for 0mm)				
						(2.40)		
4.70 - 5.01	SPT (C)			N=107 (9,11/107 for 160mm)				
					76.28	5.70		Open Hole Boring, Driller Described: Sandy gravelly boulder CLAY.
6.20 - 6.51	SPT (C)			N=103 (10,12/103 for 160mm)				
						(3.00)		
					73.28	8.70		Open Hole Boring, Driller Described: Sandy CLAY
9.20 - 9.60	SPT (C)			N=67 (9,9/67 for 255mm)				
						(2.00)		
								Continued on Next Page

Water: Backfill

Remarks

Cable Percussion terminated at 3.30m due to probable boulder obstruction. Rotary Open Hole techniques employed to 19.70m.

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)
3.30	200
19.70	151

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
2.60	2.60	00:15
3.00	3.00	00:20
3.30	3.30	00:15

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC201-CPRC02
	Coordinates: 557555.87 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 2 of 2
Method: Cable Percussion+Rotary Open	624501.31 N	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon+T44	**Ground Level:** 81.98 mOD	**Dates:** 09/06/2020 - 17/06/2020	**Driller:** AA +NOB
			Logger: IH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
10.70 - 11.10	SPT (C)			N=70 (14,14/70 for 255mm)	71.28	10.70		Open Hole Boring, Driller Described: Gravelly SAND with boulders.		
						(2.00)				
					69.28	12.70		Open Hole Boring, Driller Described: SAND with boulders.		
13.70 - 13.78	SPT (C)			50 (25 for 75mm/50 for 0mm)		(2.00)				
					67.28	14.70		Open Hole Boring, Driller Described: Boulder CLAY.		
						(1.00)				
					66.28	15.70		Open Hole Boring, Driller Described: Gravelly SAND with boulders.		
16.70 - 17.00	SPT (C)			78 (10,16/78 for 150mm)		(3.00)				
					63.28	18.70		Open Hole Boring, Driller Described: Very sandy CLAY with boulders.		
						(1.00)				
19.70 - 20.00	SPT (C)			78 (11,17/78 for 150mm)	62.28	19.70		End of borehole at 19.700m		

Remarks

Cable Percussion terminated at 3.30m due to probable boulder obstruction. Rotary Open Hole techniques employed to 19.70m.

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)
3.30	200
19.70	151

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
2.60	2.60	00:15
3.00	3.00	00:20
3.30	3.30	00:15

Appendix C Trial Pit Logs

Project No.: 19-135	**Project Name:** Cork Line Level Crossings		**Trial Pit No.:** XC201-TP01
Co-ordinates: 557473.29 E	**Client:** Iarnród Éireann / Irish Rail		Sheet 1 of 1
Method: Excavation	624706.32 N	**Client's Representative:** JACOBS	**Scale:** 1:20
Plant: Kobelco SK140SRLC	**Ground Level:** 79.59 mOD	**Date:** 03/07/2020	**Driver:** AL / **Logger:** MN

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1			(0.20)		TOPSOIL: Soft dark brown slightly sandy silty CLAY with occasional gravel and frequent rootlets, moist	
			79.39	0.20		SUBSOIL: Firm orange brown slightly sandy slightly gravelly silty CLAY with occasional rootlets, moist. Sand fine to coarse. Gravel fine to coarse predominantly limestone.	
				(0.20)			
			79.19	0.40		Stiff yellowish brown and light grey sandy gravelly silty CLAY with medium cobble and small boulder content, moist. Sand fine to coarse. Gravel fine to coarse. Gravel, cobbles and boulders subangular to subrounded predominantly light and dark grey limestone.	
0.50	ES2						
0.50 - 1.00	B3						
0.50 - 1.00	D4						
1.00	ES5			(1.30)			
1.70 - 2.20	B6		77.89	1.70		Firm yellowish brown sightly sandy slightly gravelly CLAY with medium cobble and boulder content, very moist becoming wet. Sand fine to coarse. Gravel fine to coarse. Gravel, cobbles and boulders subangular to subrounded predominantly light and dark grey limestone. Boulders up to 1.0m x 0.6m x 0.5m.	
1.70 - 2.20	D7						
				(0.80)			
2.20 - 2.50	B8						
2.20 - 2.50	D9						
			77.09	2.50		Very stiff yellowish to greyish brown slightly sandy gravelly CLAY with medium cobble and boulder content, moist. Sand fine to coarse. Gravel fine to coarse, angular to subrounded. Cobbles and boulders subangular to subrounded light and dark grey limestone.	▼
2.70 - 3.20	B10						
2.70 - 3.20	D11						
				(0.70)			
3.00	ES12						
			76.39	3.20		End of trial pit at 3.200m	

Remarks
Hand Vane Tests attempted unsuccessfully due to relatively high granular content.

Trial Pit terminated at 3.20m on either a large limestone boulder or possible bedrock.

Water Strikes:

Struck at (m):	Remarks:
2.50	

Stability: Sides collapsing

Width: 2.00

Length: 4.50

Project No.: 19-135	**Project Name:** Cork Line Level Crossings		**Trial Pit No.:** XC201-TP02
Co-ordinates: 557456.95 E 624618.69 N	**Client:** Iarnród Éireann / Irish Rail		Sheet 1 of 1
Method: Excavation	**Client's Representative:** JACOBS		**Scale:** 1:20
Plant: Kobelco SK140SRLC	**Ground Level:** 80.24 mOD	**Date:** 03/07/2020	**Driver:** AL / **Logger:** MN

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1			(0.20)		TOPSOIL: Soft dark brown slightly sandy silty CLAY with occasional gravel, frequent rootlets and occasional roots, moist	
			80.04	0.20			
				(0.20)		SUBSOIL: Firm light brown mottled orange slightly sandy slightly gravelly silty CLAY with occasional roots and rootlets, moist. Sand fine to coarse. Gravel fine to coarse predominantly limestone.	
			79.84	0.40			
0.50	ES2					Stiff becoming very stiff yellowish brown and light grey sandy gravelly silty CLAY with medium cobble and low small boulder content, moist. Sand fine to coarse. Gravel fine to coarse. Gravel, cobbles and boulders subangular to subrounded predominantly light and dark grey limestone.	
0.50 - 1.00	B3						
0.50 - 1.00	D4						
				(0.70)			
1.00	ES5						
			79.14	1.10			
						Firm, locally soft, yellowish brown sandy gravelly silty CLAY with medium cobble and boulder content, very moist. Sand fine to coarse. Gravel fine to coarse. Gravel, cobbles and boulders subangular to subrounded predominantly light and dark grey limestone with occasional purple conglomerate.	
1.50 - 2.00	B6						
1.50 - 2.00	D7						
				(1.30)			
			77.84	2.40			
						Very stiff yellowish to greyish brown sandy gravelly silty CLAY with medium cobble and boulder content, moist with occasional wet pockets. Sand fine to coarse. Gravel fine to coarse, angular to subrounded. Cobbles and boulders subangular to subrounded light and dark grey limestone. Largest boulder is 0.7m x 0.45m x 0.4m.	
2.60 - 3.10	B8						
2.60 - 3.10	D9						
				(0.90)			
3.00	ES10						
			76.94	3.30			
						End of trial pit at 3.300m	

Remarks
Hand Vane Tests attempted unsuccessfully due to relatively high granular content.

Trial Pit terminated at 3.30m due to a large boulder in the south-west corner obstructing further excavation.

Water Strikes:

Struck at (m):	Remarks:
2.40	

Stability: Sides spalling

Width: 1.40

Length: 5.60

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Trial Pit No.:** XC201-TP03
	Co-ordinates: 557638.45 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 1
Method: Excavation	624415.67 N	**Client's Representative:** JACOBS	**Scale:** 1:20
Plant: Kobelco SK140SRLC	**Ground Level:** 82.90 mOD	**Date:** 03/07/2020	**Driver:** AL **Logger:** MN

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1			(0.20)		TOPSOIL: Soft dark brown slightly sandy silty CLAY with occasional gravel and frequent rootlets, moist	
			82.70	0.20		SUBSOIL: Firm light brown and orange brown slightly sandy slightly gravelly silty CLAY with occasional rootlets, moist. Sand fine to coarse. Gravel fine to coarse predominantly limestone.	
				(0.20)			
			82.50	0.40		Firm to stiff becoming firm yellowish brown and light grey sandy gravelly silty CLAY with medium to high cobble and medium small boulder content, moist. Occasional large boulders. Sand fine to coarse. Gravel fine to coarse. Gravel, cobbles and boulders subangular to subrounded predominantly light and dark grey limestone with occasional purple conglomerate.	
0.50	ES2						
0.50 - 1.00	B3						
0.50 - 1.00	D4						
1.00	ES5						
				(1.50)			
1.40 - 1.90	B6						
1.40 - 1.90	D7						
			81.00	1.90		Firm, locally soft, yellowish brown slightly sandy gravelly CLAY with medium to high cobble and boulder content, wet. Sand fine to coarse. Gravel fine to coarse. Gravel, cobbles and boulders subangular to subrounded predominantly light and dark grey limestone.	
2.20 - 2.70	B8						
2.20 - 2.70	D9						
				(1.10)			
3.00	ES10		79.90	3.00		Very stiff yellowish to greyish brown sandy gravelly silty CLAY with medium cobble and boulder content, moist. Sand fine to coarse. Gravel fine to coarse, angular to subrounded. Cobbles and boulders subangular to subrounded predominantly light and dark grey limestone.	
3.00 - 3.50	B11						
3.00 - 3.50	D12						
				(0.60)			
			79.30	3.60		End of trial pit at 3.600m	

Remarks
Hand Vane Tests attempted unsuccessfully due to relatively high granular content.

Trial Pit terminated at 3.60m due to pit walls collapsing.

Water Strikes:

Struck at (m):	Remarks:
1.90	

Stability: Sides collapsing

Width: 2.30

Length: 4.80

Project No.: 19-135	**Project Name:** Cork Line Level Crossings		**Trial Pit No.:** XC201-TP04
Co-ordinates: 557663.87 E 624336.31 N	**Client:** Iarnród Éireann / Irish Rail		Sheet 1 of 1
Method: Excavation	**Client's Representative:** JACOBS		**Scale:** 1:20
Plant: Kobelco SK140SRLC	**Ground Level:** 84.20 mOD	**Date:** 03/07/2020	**Driver:** AL / **Logger:** MN

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1			(0.20)		TOPSOIL: Soft dark brown slightly sandy silty CLAY with occasional gravel and frequent rootlets, moist	
			84.00	0.20			
				(0.20)		SUBSOIL: Firm light brown, light greyish brown and orange brown slightly sandy slightly gravelly silty CLAY with occasional rootlets, moist. Sand fine to coarse. Gravel fine to coarse predominantly limestone.	
			83.80	0.40			
0.50	ES2					Firm/stiff yellowish brown and light grey sandy gravelly silty CLAY with medium to high cobble and small boulder content, moist. Sand fine to coarse. Gravel fine to coarse. Gravel, cobbles and boulders subangular to subrounded predominantly light and dark grey limestone.	
0.60 - 1.10	B3						
0.60 - 1.10	D4						
				(0.90)			
1.00	ES5						
1.30 - 1.80	B6		82.90	1.30			
1.30 - 1.80	D7					Firm yellowish brown slightly sandy gravelly CLAY with medium to high cobble and boulder content, wet. Sand fine to coarse. Gravel fine to coarse. Gravel, cobbles and boulders subangular to subrounded predominantly light and dark grey limestone. Boulders up to 0.7m. Pocket of medium to dark grey gravelly sand from 1.6m to 1.8m at southeast corner.	
				(0.60)			
			82.30	1.90			
2.00 - 2.50	B8					Very stiff yellowish to greyish brown sandy gravelly silty CLAY with medium cobble and boulder content, moist. Sand fine to coarse. Gravel fine to coarse, angular to subrounded. Cobbles and boulders subangular to subrounded light and dark grey	
2.00 - 2.50	D9						
				(0.80)			
			81.50	2.70		End of trial pit at 2.700m	

Remarks
Hand Vane Tests attempted unsuccessfully due to relatively high granular content.

Trial Pit terminated at 2.70m due to large boulder obstructions.

Water Strikes:

Struck at (m):	Remarks:
1.20	

Stability: Sides collapsing

Width: 2.70

Length: 4.60

Appendix D Trial Pit Photographs



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT1 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT1
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT1 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT1
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: July 2020



Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT1
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: July 2020



	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT1 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



Iarnród Éireann

Cork Line Level Crossings

XC201 (19-135-1)

T.PIT1	
Trial Pit Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT1 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT1 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT1 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



Iarnród Éireann

Cork Line Level Crossings

XC201 (19-135-1)

T.PIT1	
Trial Pit Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT2 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT2 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT2 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT2
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT2 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



Iarnród Éireann

Cork Line Level Crossings

XC201 (19-135-1)

T.PIT2	
Trial Pit Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT2 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT2 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT2 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT2 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT2
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: July 2020



Iarnród Éireann

Cork Line Level Crossings

XC201 (19-135-1)

T.PIT2	
Trial Pit Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	July 2020



Iarnród Éireann

Cork Line Level Crossings

XC201 (19-135-1)

T.PIT3

Trial Pit Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT3 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT3 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT3
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT3 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



Iarnród Éireann

Cork Line Level Crossings

XC201 (19-135-1)

T.PIT3	
Trial Pit Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT3 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



Iarnród Éireann

Cork Line Level Crossings

XC201 (19-135-1)

T.PIT3	
Trial Pit Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT3 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT3 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT3 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT3 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT3 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT3 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



Iarnród Éireann

Cork Line Level Crossings

XC201 (19-135-1)

T.PIT4

Trial Pit Photographs

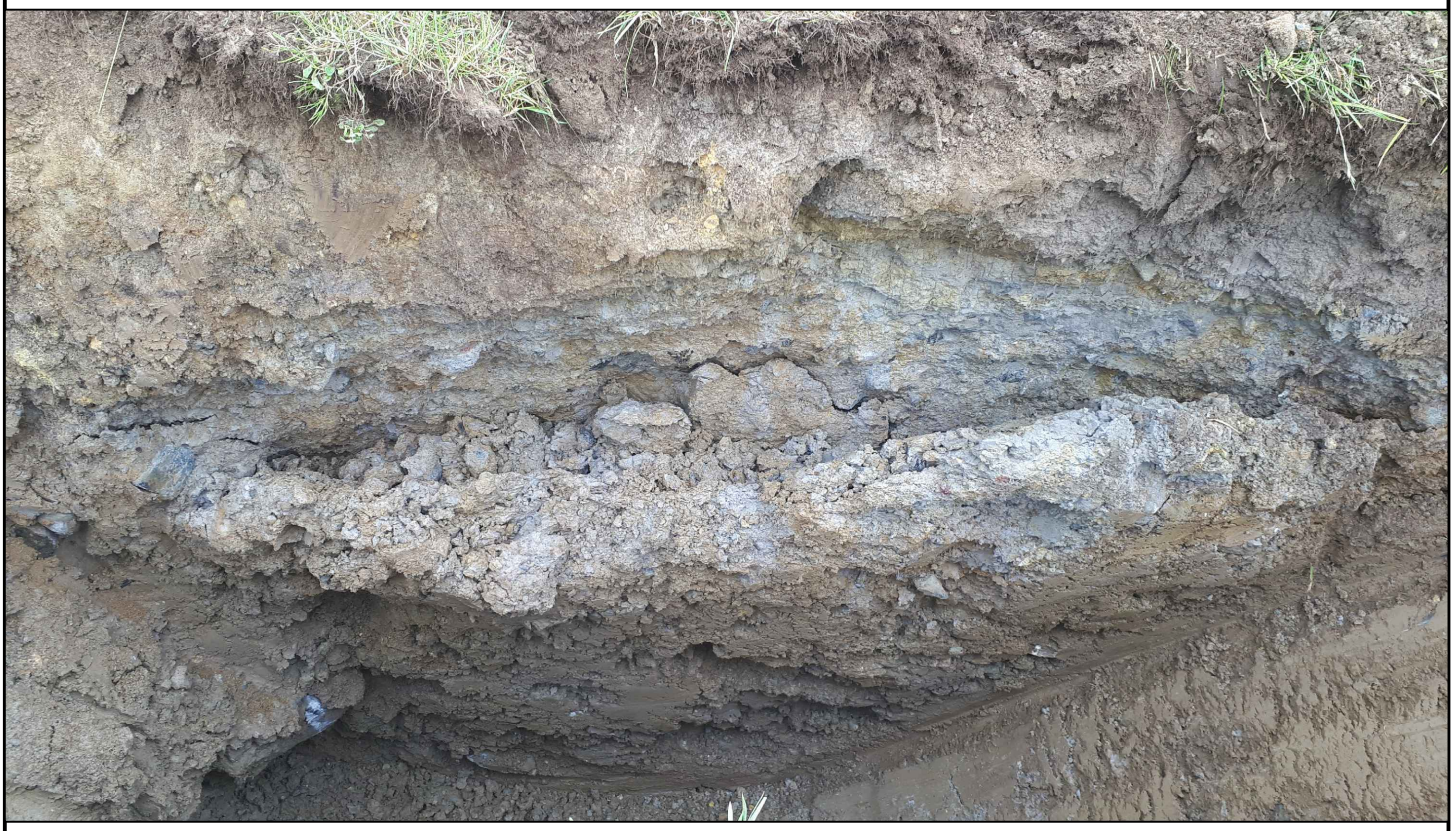
Client: Iarnród Éireann

Engineer: Jacob's

Date: July 2020



Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT4
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT4 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



Iarnród Éireann

Cork Line Level Crossings

XC201 (19-135-1)

T.PIT4	
Trial Pit Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT4 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020



Iarnród Éireann

Cork Line Level Crossings

XC201 (19-135-1)

T.PIT4	
Trial Pit Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	T.PIT4 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: July 2020

Appendix E Indirect CBR Test Data

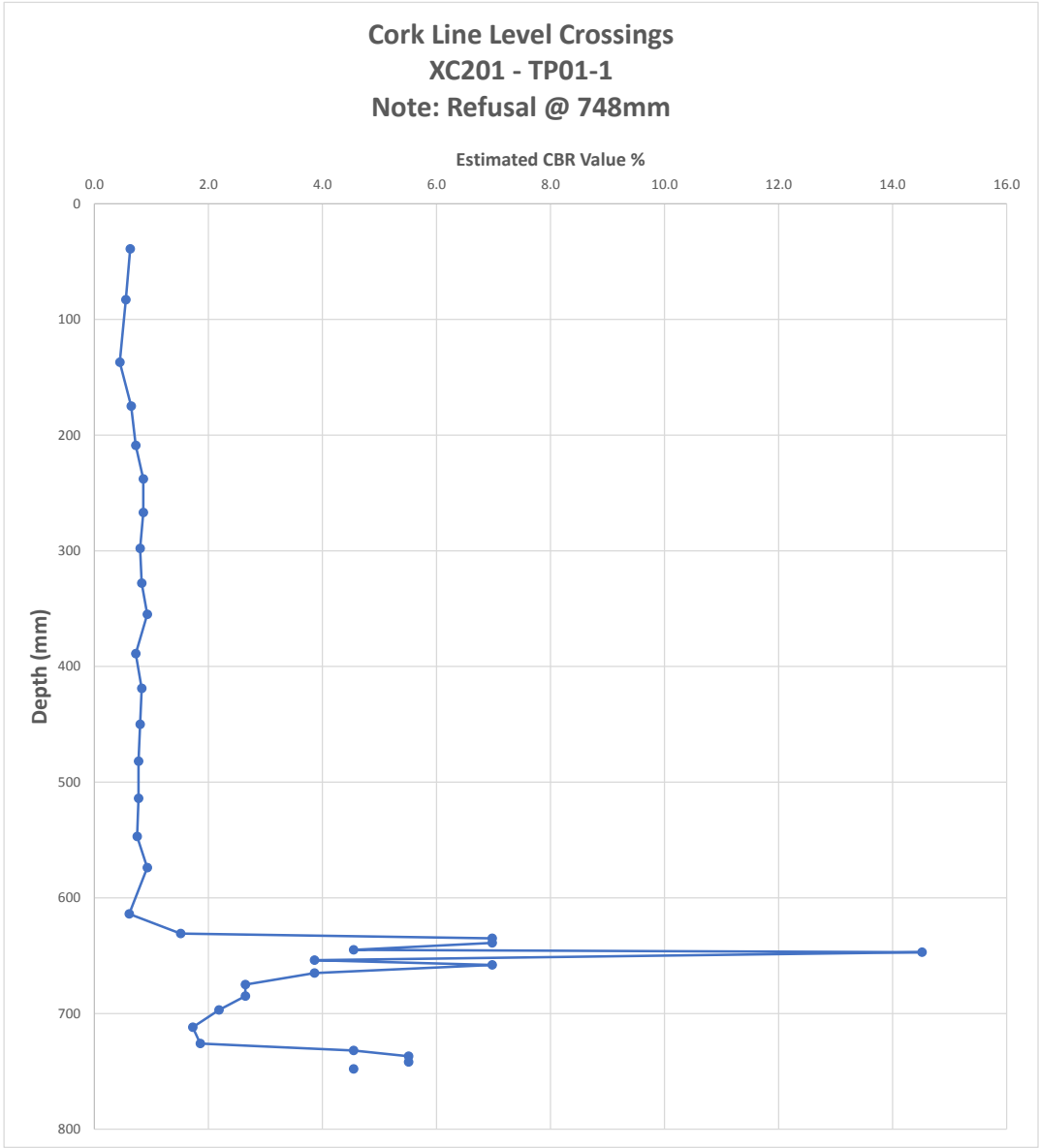
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC201 - TP01-1**	Job No	19-135

Easting	Northing	Elevation

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1140	mm	14/07/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1101	39	39	0.6
2	1057	44	83	0.6
3	1003	54	137	0.4
4	965	38	175	0.6
5	931	34	209	0.7
6	902	29	238	0.9
7	873	29	267	0.9
8	842	31	298	0.8
9	812	30	328	0.8
10	785	27	355	0.9
11	751	34	389	0.7
12	721	30	419	0.8
13	690	31	450	0.8
14	658	32	482	0.8
15	626	32	514	0.8
16	593	33	547	0.7
17	566	27	574	0.9
18	526	40	614	0.6
19	509	17	631	1.5
20	505	4	635	7.0
21	501	4	639	7.0
22	495	6	645	4.5
23	493	2	647	14.5
24	486	7	654	3.9
25	482	4	658	7.0
26	475	7	665	3.9
27	465	10	675	2.6
28	455	10	685	2.6
29	443	12	697	2.2
30	428	15	712	1.7
31	414	14	726	1.9
32	408	6	732	4.5
33	403	5	737	5.5
34	398	5	742	5.5
35	398	0	742	
36	392	6	748	4.5
37	392	0	748	
38	392	0	748	



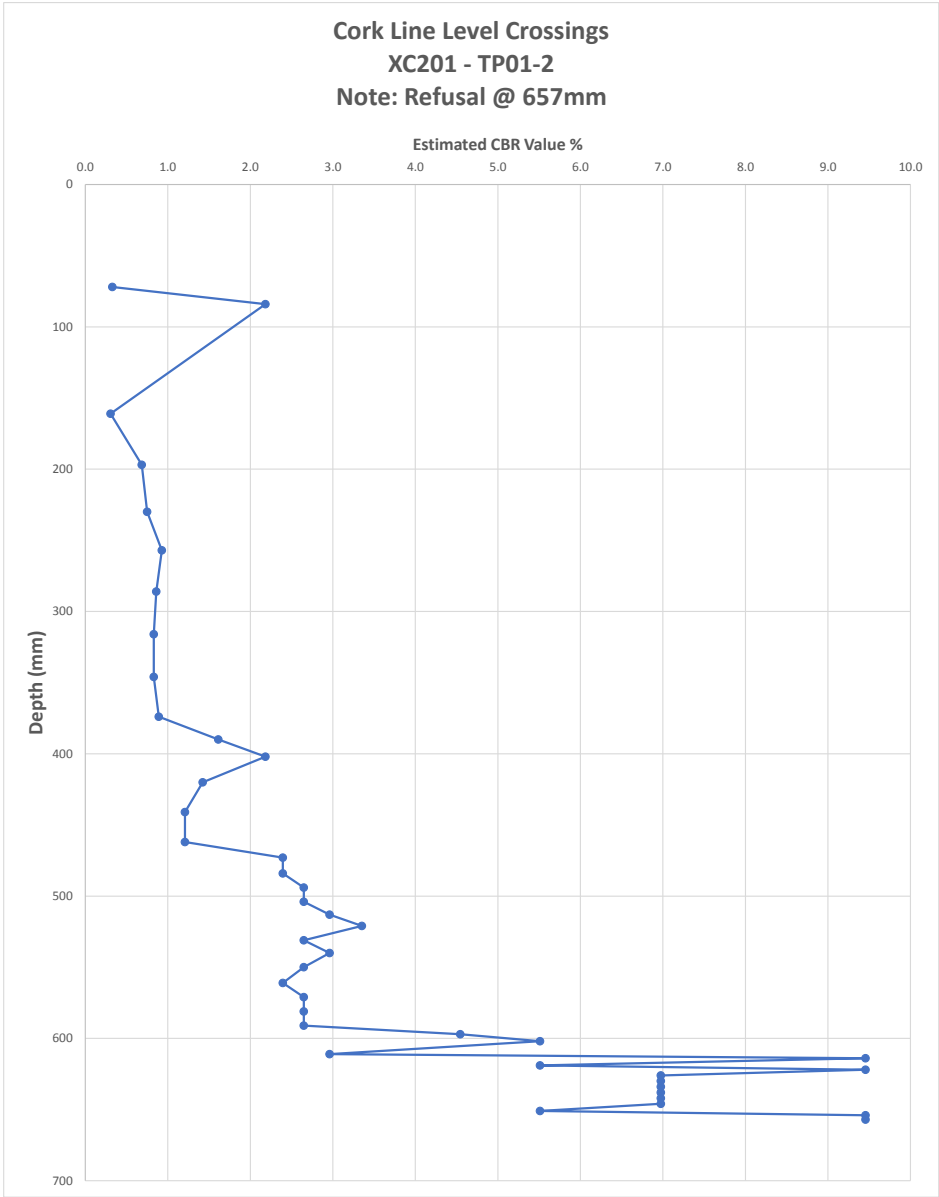
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC201 - TP01-2**	Job No	19-135

Easting	Northing	Elevation

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1140	mm	14/07/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1068	72	72	0.3
2	1056	12	84	2.2
3	979	77	161	0.3
4	943	36	197	0.7
5	910	33	230	0.7
6	883	27	257	0.9
7	854	29	286	0.9
8	824	30	316	0.8
9	794	30	346	0.8
10	766	28	374	0.9
11	750	16	390	1.6
12	738	12	402	2.2
13	720	18	420	1.4
14	699	21	441	1.2
15	678	21	462	1.2
16	667	11	473	2.4
17	656	11	484	2.4
18	646	10	494	2.6
19	636	10	504	2.6
20	627	9	513	3.0
21	619	8	521	3.4
22	609	10	531	2.6
23	600	9	540	3.0
24	590	10	550	2.6
25	579	11	561	2.4
26	569	10	571	2.6
27	559	10	581	2.6
28	549	10	591	2.6
29	543	6	597	4.5
30	538	5	602	5.5
31	529	9	611	3.0
32	526	3	614	9.5
33	521	5	619	5.5
34	518	3	622	9.5
35	514	4	626	7.0
36	510	4	630	7.0
37	506	4	634	7.0
38	502	4	638	7.0
39	498	4	642	7.0
40	494	4	646	7.0
41	489	5	651	5.5
42	486	3	654	9.5
43	483	3	657	9.5
44	483	0	657	
45	483	0	657	



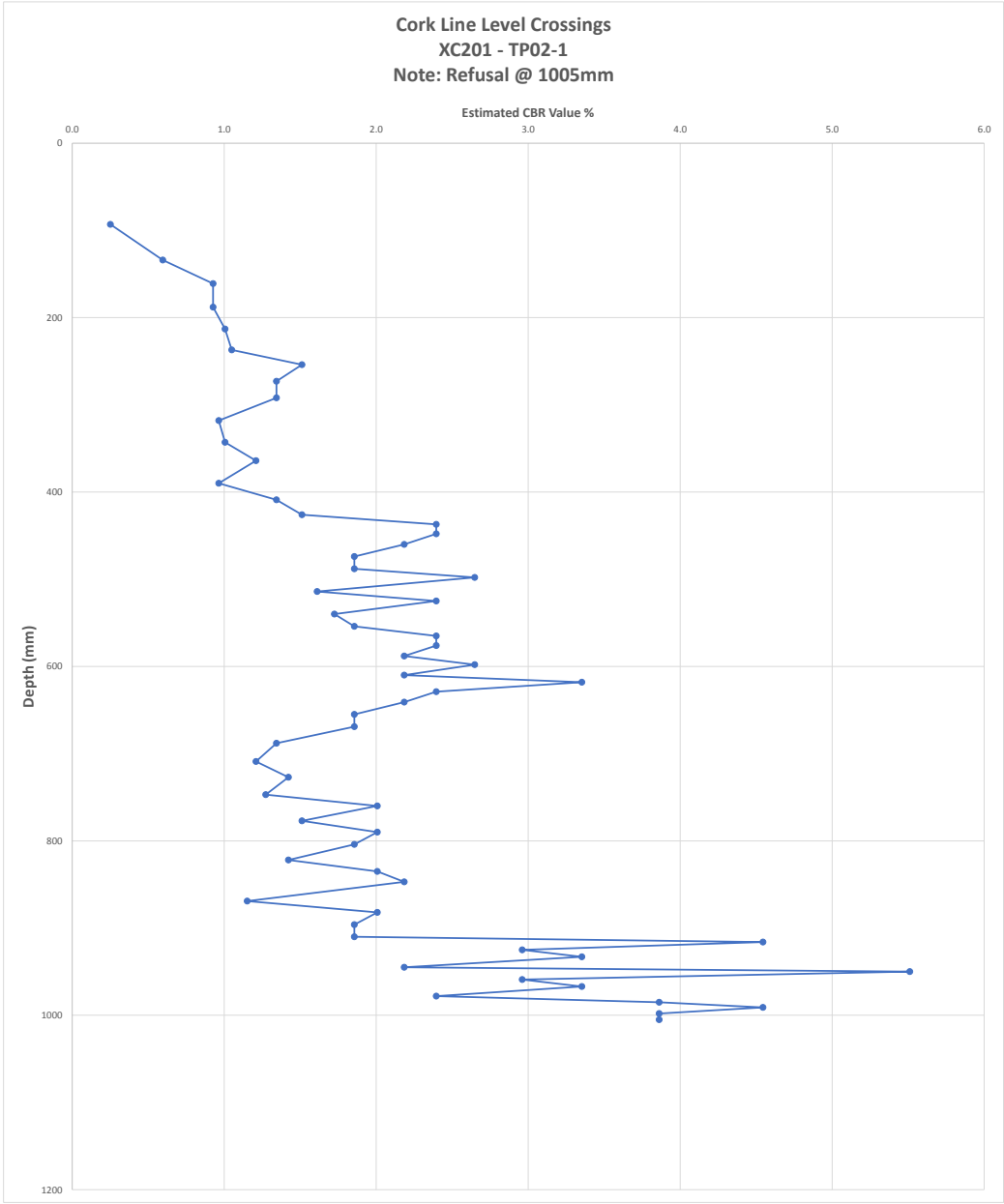
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC201 - TP02-1**	Job No	19-135

Easting	Northing	Elevation

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1123	mm	14/07/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1030	93	93	0.3
2	989	41	134	0.6
3	962	27	161	0.9
4	935	27	188	0.9
5	910	25	213	1.0
6	886	24	237	1.0
7	869	17	254	1.5
8	850	19	273	1.3
9	831	19	292	1.3
10	805	26	318	1.0
11	780	25	343	1.0
12	759	21	364	1.2
13	733	26	390	1.0
14	714	19	409	1.3
15	697	17	426	1.5
16	686	11	437	2.4
17	675	11	448	2.4
18	663	12	460	2.2
19	649	14	474	1.9
20	635	14	488	1.9
21	625	10	498	2.6
22	609	16	514	1.6
23	598	11	525	2.4
24	583	15	540	1.7
25	569	14	554	1.9
26	558	11	565	2.4
27	547	11	576	2.4
28	535	12	588	2.2
29	525	10	598	2.6
30	513	12	610	2.2
31	505	8	618	3.4
32	494	11	629	2.4
33	482	12	641	2.2
34	468	14	655	1.9
35	454	14	669	1.9
36	435	19	688	1.3
37	414	21	709	1.2
38	396	18	727	1.4
39	376	20	747	1.3
40	363	13	760	2.0
41	346	17	777	1.5
42	333	13	790	2.0
43	319	14	804	1.9
44	301	18	822	1.4
45	288	13	835	2.0
46	276	12	847	2.2
47	254	22	869	1.2
48	241	13	882	2.0
49	227	14	896	1.9
50	213	14	910	1.9
51	207	6	916	4.5
52	198	9	925	3.0
53	190	8	933	3.4
54	178	12	945	2.2
55	173	5	950	5.5
56	164	9	959	3.0
57	156	8	967	3.4
58	145	11	978	2.4
59	138	7	985	3.9
60	132	6	991	4.5
61	125	7	998	3.9
62	118	7	1005	3.9



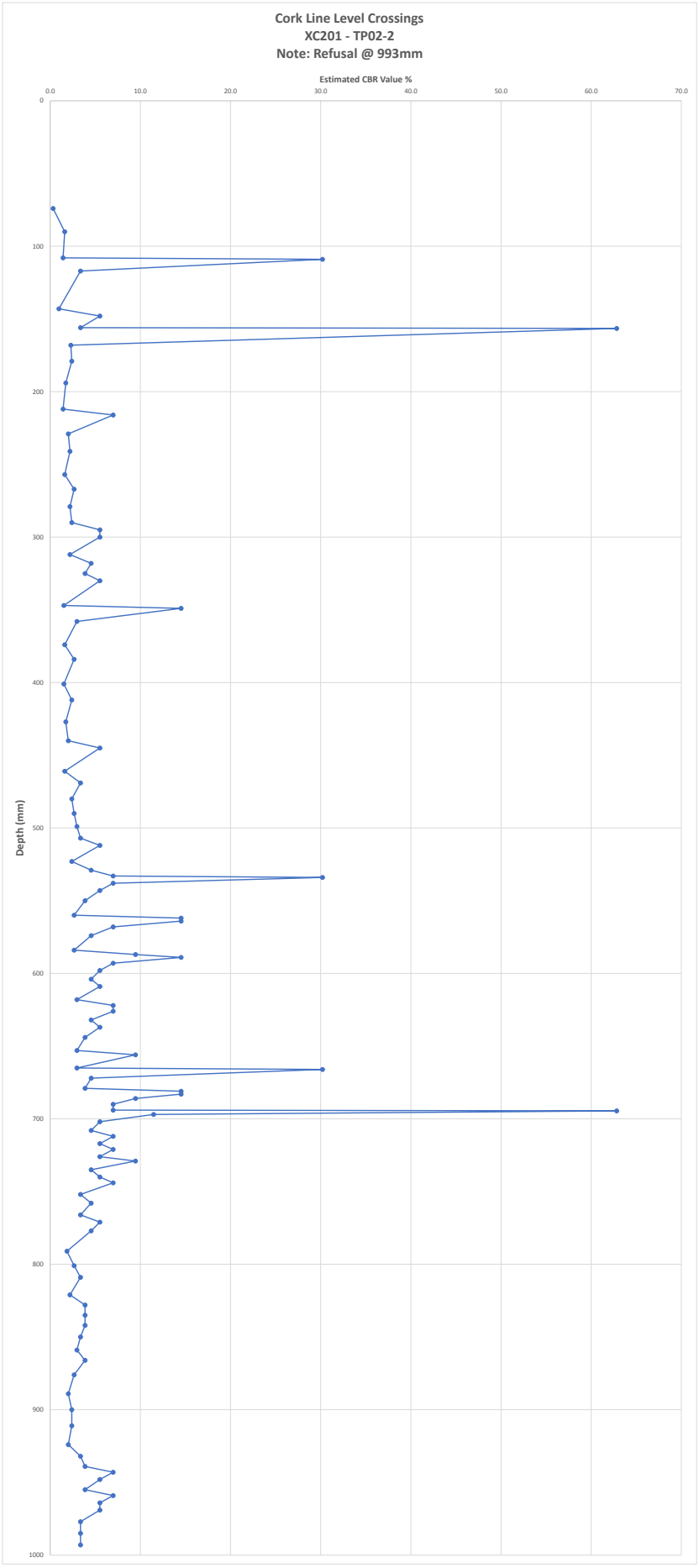
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	XC201 - TP02-2	Job No	19-135

Easting	Northing	Elevation

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1154	mm	14/07/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1080	74	74	0.3
2	1064	16	90	1.6
3	1046	18	108	1.4
4	1045	1	109	30.2
5	1037	8	117	3.4
6	1011	26	143	1.0
7	1006	5	148	5.5
8	998	8	156	3.4
9	997.5	0.5	156.5	62.8
10	986	11.5	168	2.3
11	975	11	179	2.4
12	960	15	194	1.7
13	942	18	212	1.4
14	938	4	216	7.0
15	925	13	229	2.0
16	913	12	241	2.2
17	897	16	257	1.6
18	887	10	267	2.6
19	875	12	279	2.2
20	864	11	290	2.4
21	859	5	295	5.5
22	854	5	300	5.5
23	842	12	312	2.2
24	836	6	318	4.5
25	829	7	325	3.9
26	824	5	330	5.5
27	807	17	347	1.5
28	805	2	349	14.5
29	796	9	358	3.0
30	780	16	374	1.6
31	770	10	384	2.6
32	753	17	401	1.5
33	742	11	412	2.4
34	727	15	427	1.7
35	714	13	440	2.0
36	709	5	445	5.5
37	693	16	461	1.6
38	685	8	469	3.4
39	674	11	480	2.4
40	664	10	490	2.6
41	655	9	499	3.0
42	647	8	507	3.4
43	642	5	512	5.5
44	631	11	523	2.4
45	625	6	529	4.5
46	621	4	533	7.0
47	620	1	534	30.2
48	616	4	538	7.0
49	611	5	543	5.5
50	604	7	550	3.9
51	594	10	560	2.6
52	592	2	562	14.5
53	590	2	564	14.5
54	586	4	568	7.0
55	580	6	574	4.5
56	570	10	584	2.6
57	567	3	587	9.5
58	565	2	589	14.5
59	561	4	593	7.0
60	556	5	598	5.5
61	550	6	604	4.5
62	545	5	609	5.5
63	536	9	618	3.0
64	532	4	622	7.0
65	528	4	626	7.0
66	522	6	632	4.5
67	517	5	637	5.5
68	510	7	644	3.9
69	501	9	653	3.0
70	498	3	656	9.5
71	489	9	665	3.0
72	488	1	666	30.2
73	482	6	672	4.5
74	475	7	679	3.9
75	473	2	681	14.5
76	471	2	683	14.5
77	468	3	686	9.5
78	464	4	690	7.0
79	460	4	694	7.0
80	459.5	0.5	694.5	62.8
81	457	2.5	697	11.5
82	452	5	702	5.5
83	446	6	708	4.5
84	442	4	712	7.0
85	437	5	717	5.5
86	433	4	721	7.0
87	428	5	726	5.5
88	425	3	729	9.5
89	419	6	735	4.5
90	414	5	740	5.5
91	410	4	744	7.0
92	402	8	752	3.4
93	396	6	758	4.5
94	388	8	766	3.4
95	383	5	771	5.5
96	377	6	777	4.5
97	363	14	791	1.9
98	353	10	801	2.6
99	345	8	809	3.4
100	333	12	821	2.2
101	326	7	828	3.9
102	319	7	835	3.9
103	312	7	842	3.9
104	304	8	850	3.4
105	295	9	859	3.0
106	288	7	866	3.9
107	278	10	876	2.6
108	265	13	889	2.0
109	254	11	900	2.4
110	243	11	911	2.4
111	230	13	924	2.0
112	222	8	932	3.4
113	215	7	939	3.9
114	211	4	943	7.0
115	206	5	948	5.5
116	199	7	955	3.9
117	195	4	959	7.0
118	190	5	964	5.5
119	185	5	969	5.5
120	177	8	977	3.4
121	169	8	985	3.4
122	161	8	993	3.4



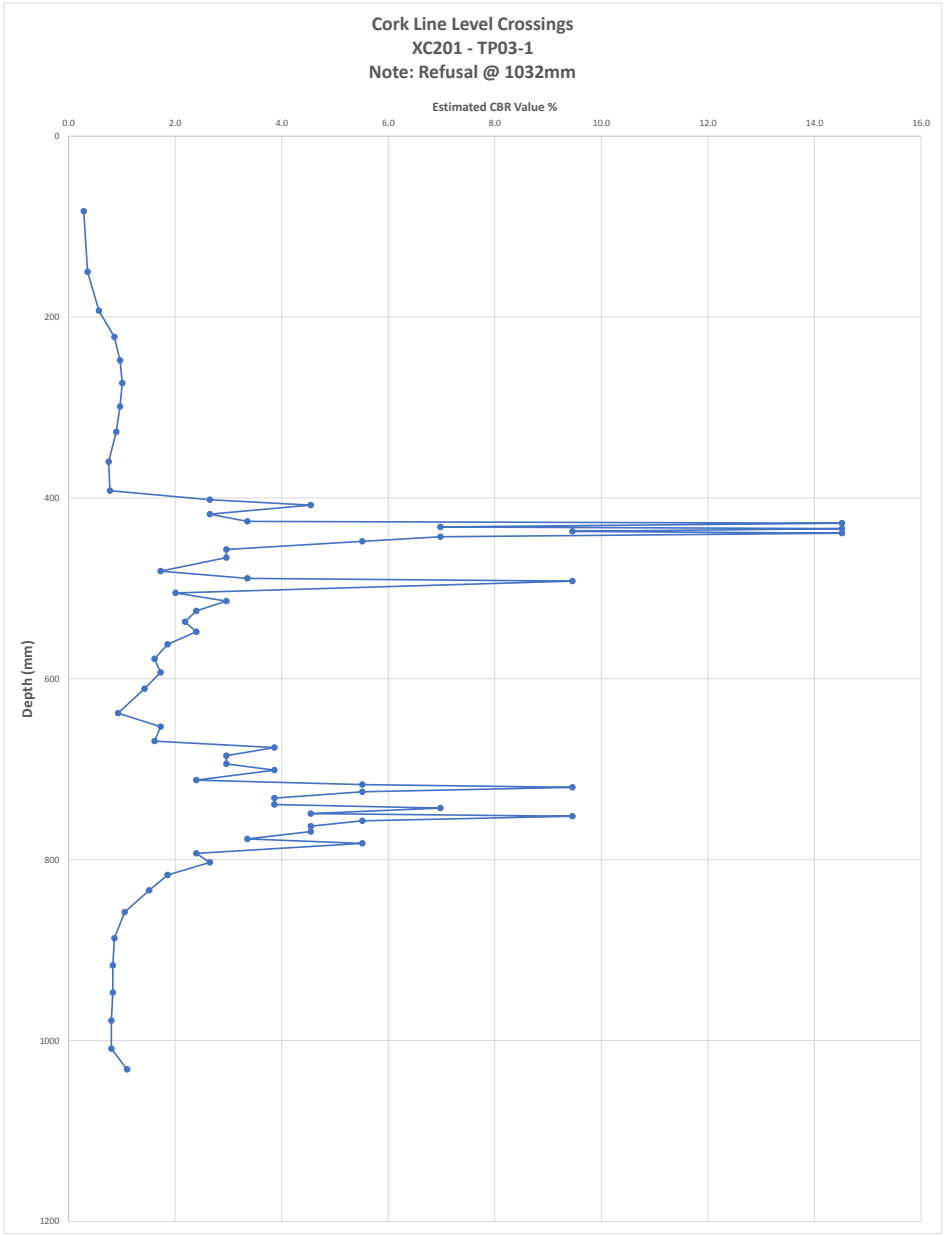
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC201 - TP03-1**	Job No	19-135

Easting	Northing	Elevation

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1143	mm	14/07/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1060	83	83	0.3
2	993	67	150	0.4
3	950	43	193	0.6
4	921	29	222	0.9
5	895	26	248	1.0
6	870	25	273	1.0
7	844	26	299	1.0
8	816	28	327	0.9
9	783	33	360	0.7
10	751	32	392	0.8
11	741	10	402	2.6
12	735	6	408	4.5
13	725	10	418	2.6
14	717	8	426	3.4
15	715	2	428	14.5
16	711	4	432	7.0
17	709	2	434	14.5
18	706	3	437	9.5
19	704	2	439	14.5
20	700	4	443	7.0
21	695	5	448	5.5
22	686	9	457	3.0
23	677	9	466	3.0
24	662	15	481	1.7
25	654	8	489	3.4
26	651	3	492	9.5
27	638	13	505	2.0
28	629	9	514	3.0
29	618	11	525	2.4
30	606	12	537	2.2
31	595	11	548	2.4
32	581	14	562	1.9
33	565	16	578	1.6
34	550	15	593	1.7
35	532	18	611	1.4
36	505	27	638	0.9
37	490	15	653	1.7
38	474	16	669	1.6
39	467	7	676	3.9
40	458	9	685	3.0
41	449	9	694	3.0
42	442	7	701	3.9
43	431	11	712	2.4
44	426	5	717	5.5
45	423	3	720	9.5
46	418	5	725	5.5
47	411	7	732	3.9
48	404	7	739	3.9
49	400	4	743	7.0
50	394	6	749	4.5
51	391	3	752	9.5
52	386	5	757	5.5
53	380	6	763	4.5
54	374	6	769	4.5
55	366	8	777	3.4
56	361	5	782	5.5
57	350	11	793	2.4
58	340	10	803	2.6
59	326	14	817	1.9
60	309	17	834	1.5
61	285	24	858	1.0
62	256	29	887	0.9
63	226	30	917	0.8
64	196	30	947	0.8
65	165	31	978	0.8
66	134	31	1009	0.8
67	111	23	1032	1.1



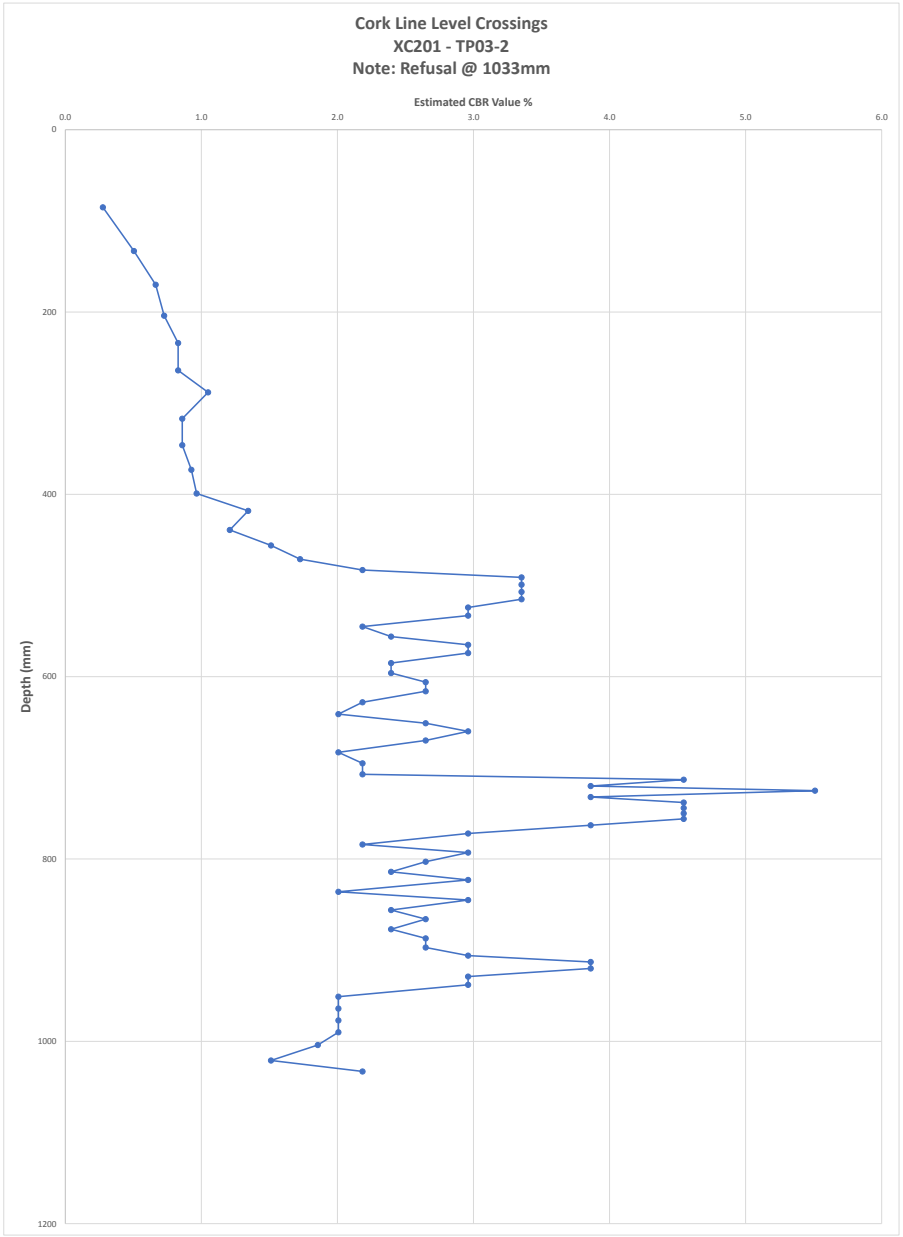
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC201 - TP03-2**	Job No	19-135

Easting	Northing	Elevation

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1139	mm	14/07/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1054	85	85	0.3
2	1006	48	133	0.5
3	969	37	170	0.7
4	935	34	204	0.7
5	905	30	234	0.8
6	875	30	264	0.8
7	851	24	288	1.0
8	822	29	317	0.9
9	793	29	346	0.9
10	766	27	373	0.9
11	740	26	399	1.0
12	721	19	418	1.3
13	700	21	439	1.2
14	683	17	456	1.5
15	668	15	471	1.7
16	656	12	483	2.2
17	648	8	491	3.4
18	640	8	499	3.4
19	632	8	507	3.4
20	624	8	515	3.4
21	615	9	524	3.0
22	606	9	533	3.0
23	594	12	545	2.2
24	583	11	556	2.4
25	574	9	565	3.0
26	565	9	574	3.0
27	554	11	585	2.4
28	543	11	596	2.4
29	533	10	606	2.6
30	523	10	616	2.6
31	511	12	628	2.2
32	498	13	641	2.0
33	488	10	651	2.6
34	479	9	660	3.0
35	469	10	670	2.6
36	456	13	683	2.0
37	444	12	695	2.2
38	432	12	707	2.2
39	426	6	713	4.5
40	419	7	720	3.9
41	414	5	725	5.5
42	407	7	732	3.9
43	401	6	738	4.5
44	395	6	744	4.5
45	389	6	750	4.5
46	383	6	756	4.5
47	376	7	763	3.9
48	367	9	772	3.0
49	355	12	784	2.2
50	346	9	793	3.0
51	336	10	803	2.6
52	325	11	814	2.4
53	316	9	823	3.0
54	303	13	836	2.0
55	294	9	845	3.0
56	283	11	856	2.4
57	273	10	866	2.6
58	262	11	877	2.4
59	252	10	887	2.6
60	242	10	897	2.6
61	233	9	906	3.0
62	226	7	913	3.9
63	219	7	920	3.9
64	210	9	929	3.0
65	201	9	938	3.0
66	188	13	951	2.0
67	175	13	964	2.0
68	162	13	977	2.0
69	149	13	990	2.0
70	135	14	1004	1.9
71	118	17	1021	1.5
72	106	12	1033	2.2



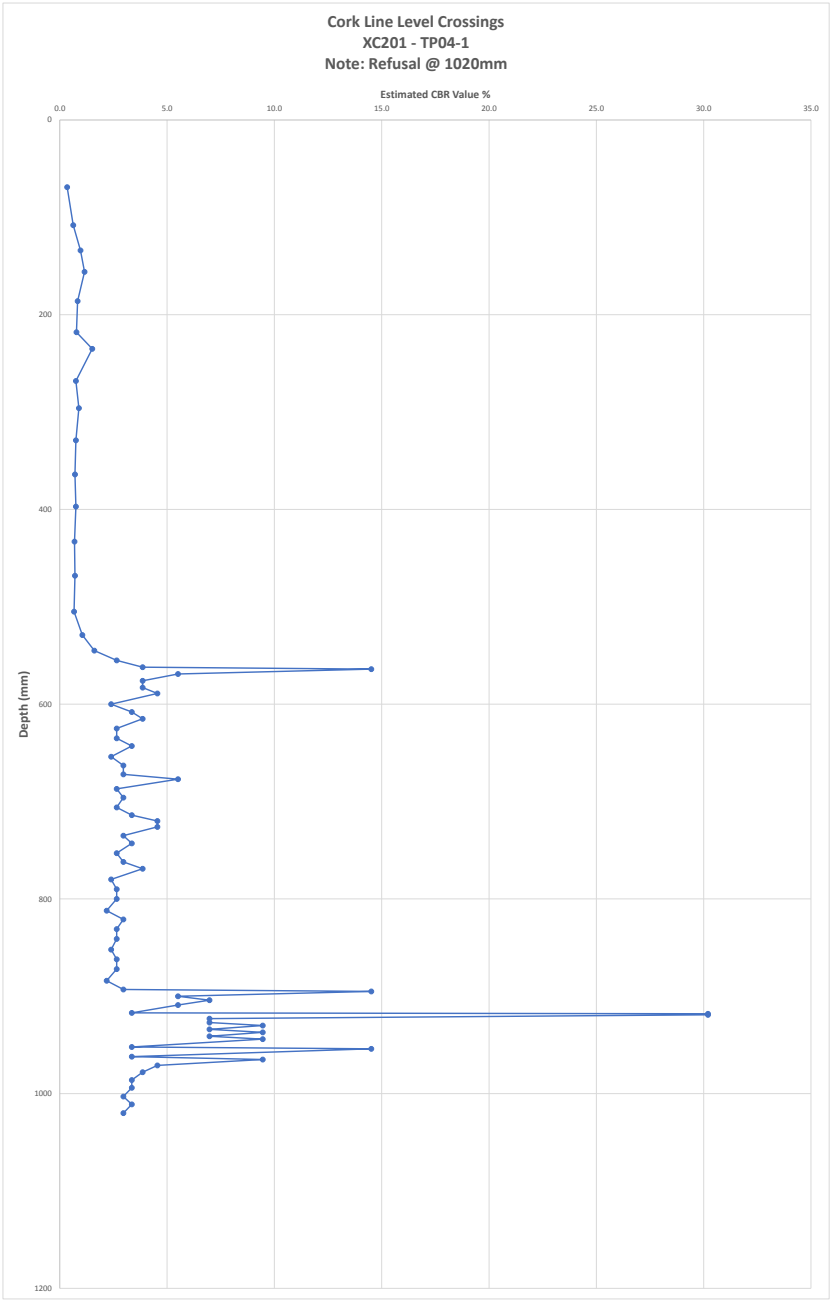
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	XC201 - TP04-1	Job No	19-135

Easting	Northing	Elevation

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1139	mm	14/07/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1070	69	69	0.3
2	1031	39	108	0.6
3	1005	26	134	1.0
4	983	22	156	1.2
5	953	30	186	0.8
6	921	32	218	0.8
7	904	17	235	1.5
8	871	33	268	0.7
9	843	28	296	0.9
10	810	33	329	0.7
11	775	35	364	0.7
12	742	33	397	0.7
13	706	36	433	0.7
14	671	35	468	0.7
15	634	37	505	0.7
16	610	24	529	1.0
17	594	16	545	1.6
18	584	10	555	2.6
19	577	7	562	3.9
20	575	2	564	14.5
21	570	5	569	5.5
22	563	7	576	3.9
23	556	7	583	3.9
24	550	6	589	4.5
25	539	11	600	2.4
26	531	8	608	3.4
27	524	7	615	3.9
28	514	10	625	2.6
29	504	10	635	2.6
30	496	8	643	3.4
31	485	11	654	2.4
32	476	9	663	3.0
33	467	9	672	3.0
34	462	5	677	5.5
35	452	10	687	2.6
36	443	9	696	3.0
37	433	10	706	2.6
38	425	8	714	3.4
39	419	6	720	4.5
40	413	6	726	4.5
41	404	9	735	3.0
42	396	8	743	3.4
43	386	10	753	2.6
44	377	9	762	3.0
45	370	7	769	3.9
46	359	11	780	2.4
47	349	10	790	2.6
48	339	10	800	2.6
49	327	12	812	2.2
50	318	9	821	3.0
51	308	10	831	2.6
52	298	10	841	2.6
53	287	11	852	2.4
54	277	10	862	2.6
55	267	10	872	2.6
56	255	12	884	2.2
57	246	9	893	3.0
58	244	2	895	14.5
59	239	5	900	5.5
60	235	4	904	7.0
61	230	5	909	5.5
62	222	8	917	3.4
63	221	1	918	30.2
64	220	1	919	30.2
65	216	4	923	7.0
66	212	4	927	7.0
67	209	3	930	9.5
68	205	4	934	7.0
69	202	3	937	9.5
70	198	4	941	7.0
71	195	3	944	9.5
72	187	8	952	3.4
73	185	2	954	14.5
74	177	8	962	3.4
75	174	3	965	9.5
76	168	6	971	4.5
77	161	7	978	3.9
78	153	8	986	3.4
79	145	8	994	3.4
80	136	9	1003	3.0
81	128	8	1011	3.4
82	119	9	1020	3.0



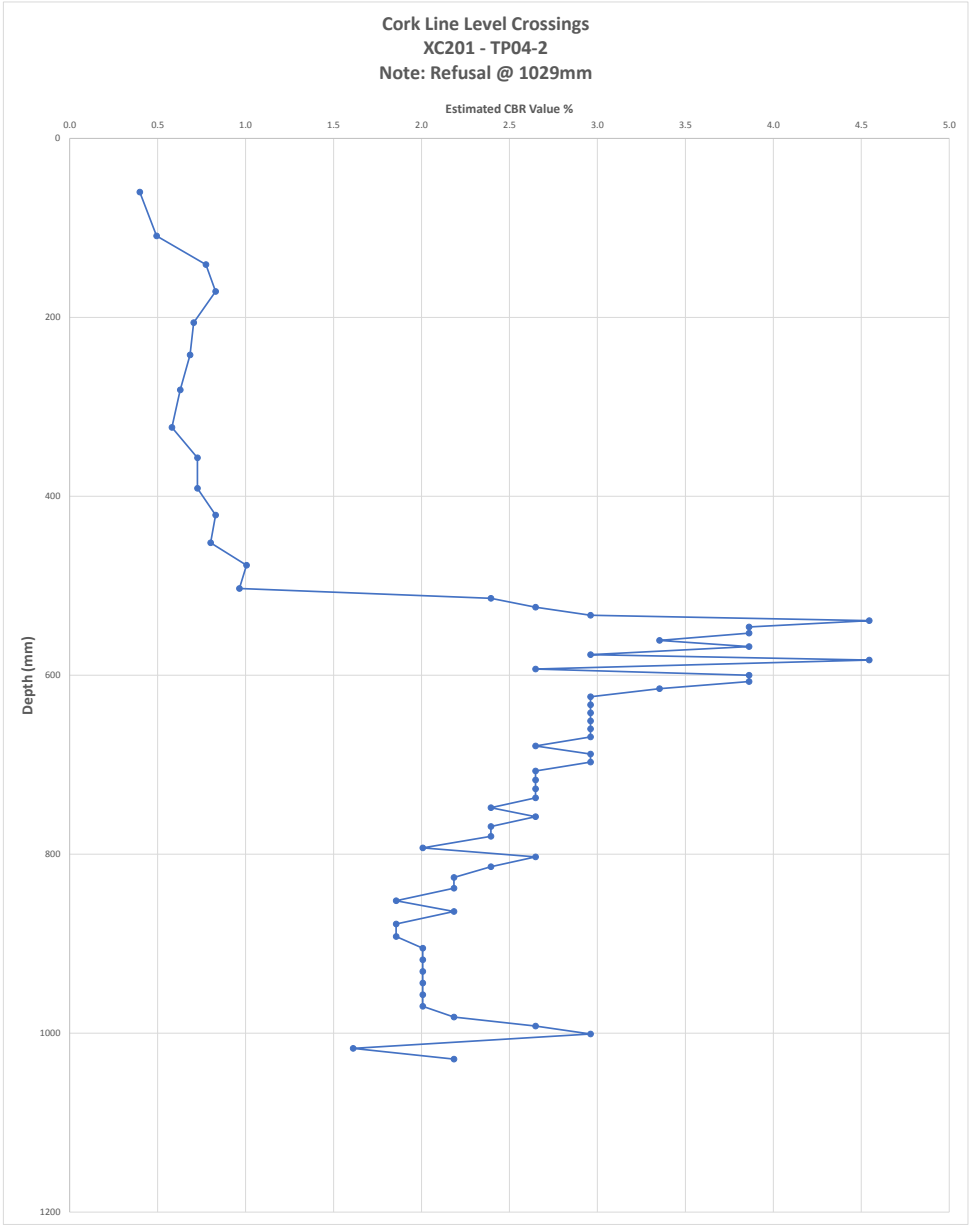
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC201 - TP04-2**	Job No	19-135

Easting	Northing	Elevation

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1138	mm	14/07/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1078	60	60	0.4
2	1029	49	109	0.5
3	997	32	141	0.8
4	967	30	171	0.8
5	932	35	206	0.7
6	896	36	242	0.7
7	857	39	281	0.6
8	815	42	323	0.6
9	781	34	357	0.7
10	747	34	391	0.7
11	717	30	421	0.8
12	686	31	452	0.8
13	661	25	477	1.0
14	635	26	503	1.0
15	624	11	514	2.4
16	614	10	524	2.6
17	605	9	533	3.0
18	599	6	539	4.5
19	592	7	546	3.9
20	585	7	553	3.9
21	577	8	561	3.4
22	570	7	568	3.9
23	561	9	577	3.0
24	555	6	583	4.5
25	545	10	593	2.6
26	538	7	600	3.9
27	531	7	607	3.9
28	523	8	615	3.4
29	514	9	624	3.0
30	505	9	633	3.0
31	496	9	642	3.0
32	487	9	651	3.0
33	478	9	660	3.0
34	469	9	669	3.0
35	459	10	679	2.6
36	450	9	688	3.0
37	441	9	697	3.0
38	431	10	707	2.6
39	421	10	717	2.6
40	411	10	727	2.6
41	401	10	737	2.6
42	390	11	748	2.4
43	380	10	758	2.6
44	369	11	769	2.4
45	358	11	780	2.4
46	345	13	793	2.0
47	335	10	803	2.6
48	324	11	814	2.4
49	312	12	826	2.2
50	300	12	838	2.2
51	286	14	852	1.9
52	274	12	864	2.2
53	260	14	878	1.9
54	246	14	892	1.9
55	233	13	905	2.0
56	220	13	918	2.0
57	207	13	931	2.0
58	194	13	944	2.0
59	181	13	957	2.0
60	168	13	970	2.0
61	156	12	982	2.2
62	146	10	992	2.6
63	137	9	1001	3.0
64	121	16	1017	1.6
65	109	12	1029	2.2



Appendix F Water Purging Data & Logs

Job Name: **I.E - Cork Line**		h (m)	6
		r (m)	0.0505
		r2	0.00255025
Job Nr: **19-135**		TWV (m3)	0.048071192

BH ID: XC201-CPRC01A			**Theoretical Well Volume**	48.07 *ltrs*
Depth to Response Zone:	***Top (mbgl)***	***Bottom (mbgl)***	**TWV x3**	144.21 *ltrs*
	4	10		

Purge Start Time:	15:38		**(mbgl)**
Purge Finish Time:	16:30	**Depth to Water**	1.06
		Total Depth	7.23
Depth to water after purging:	mbgl		

	Time Taken to fill 25ltr container(mins)	Flow Rate l/min
Reading 1:	4	5
Reading 2:	4	5
Reading 3:	4	5

Date 06/08/2020

Nr of Containers filled:	9	
Total Volume Purged:	180	***litres***

	Temperature	**$_{p}$H**	**Electrical Conductivity**	**Dissolved Oxygen**	**Redox Potential**
Reading 1	18.23	5.93	17.79	0.53	23.9
Reading 2	16.4	6.02	14.34	0.55	20.8
Reading 3	14.76	6.12	12.09	0.57	18.6
Reading 4	14.4	6.46	15.63	0.51	17.4
Reading 5	14.04	6.36	14.22	0.56	20.6
Reading 6	13.57	6.39	14.86	0.56	21.2
Reading 7	13.15	6.54	18.63	0.57	21.6
Reading 8	13.11	6.55	13.87	0.57	21.7
Reading 9	12.84	6.52	15.45	0.57	22
Reading 10	12.58	6.48	13.24	0.58	22.2
Reading 11	12.63	6.46	16.48	0.57	22.4
Reading 12	12.41	6.5	16.11	0.57	23.1

		h (m)	2
Job Name:	**I.E - Cork Line**	r (m)	0.0505
		r2	0.00255025
Job Nr:	**19-135**	TWV (m3)	0.016023731

BH ID:	XC201-CPRC02		**Theoretical Well Volume**	16.02	*ltrs*
Depth to Response Zone:	***Top (mbgl)***	***Bottom (mbgl)***	**TWV x3**	48.07	*ltrs*
	2	4			

Purge Start Time:	11:18		**(mbgl)**
Purge Finish Time:	12:55	**Depth to Water**	1.1
		Total Depth	3.87
Depth to water after purging:	3.53 mbgl		

	Time Taken to fill 25ltr container(mins)	Flow Rate l/min	
			Date 07/08/2020
Reading 1:	3.5+	~5.5	(Pumping from water column)
Reading 2:	4	~5	(Pumping from water column)
Reading 3:	2.2	0.9	(Flow slows after pumping c.50L)

Nr of Containers filled:	5.75	
Total Volume Purged:	115	***litres***

	Temperature	**pH**	**Electrical Conductivity**	**Dissolved Oxygen**	**Redox Potential**
Reading 1	19.36 to 17.43	6.57	21.11	0.39	9.8
Reading 2	15.36	6.69	22.57	0.42	7.1
Reading 3	13.79	6.81	21.64	0.42	5.3
Reading 4	13.67	6.83	21.28	0.42	4.9
Reading 5	15.34	6.48	25.4	0.41	7.6
Reading 6	13.48	6.55	24.31	0.41	8
Reading 7	13.76	6.62	20.23	0.41	8.4
Reading 8	13.55	6.34	21.47	0.41	7.8

Appendix G Geotechnical Soil Laboratory Test Results

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
XC201-CP01	3	0.20	1.20	D	Brown slightly gravelly sandy silty CLAY.				80 s	33 a	21	12		
XC201-CP01A	5	1.20	2.00	D	Brown slightly sandy gravelly CLAY.				74 s	23 a	15	8		
XC201-CP02	3	0.20	1.20	D	Brown mottled grey slightly gravelly sandy silty CLAY.				66 s	23 a	12	11		
XC201-CP02	6	1.20	2.00	D	Brown slightly sandy gravelly CLAY.				68 s	21 a	15	6		
XC201-CPRC01	6	0.50	1.20	D	Brown mottled grey slightly gravelly sandy silty CLAY.				70 s	24 a	16	8		
XC201-CPRC01	8	1.20	2.00	D	Brown mottled grey sandy gravelly CLAY.			8.6						
XC201-CPRC01	11	2.00	3.00	D	Brown slightly sandy gravelly CLAY.				59 s	22 a	13	9		
XC201-CPRC01A	7	1.20	2.00	D	Brown slightly sandy gravelly silty CLAY.				51 s	23 b	14	9		
XC201-CPRC01A	12	2.20	2.40	D	Brown slightly sandy gravelly CLAY.			12						
XC201-CPRC01A	14	2.40	3.40	D	Greyish brown slightly sandy slightly clayey GRAVEL.						NP			
XC201-CPRC02	6	1.20	2.00	D	Brown slightly sandy gravelly silty CLAY.			9.2						
XC201-CPRC02	11	2.50	2.80	D	Brown slightly sandy slightly gravelly silty CLAY.			8.5						

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

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

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

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

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

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

QA Ref
SLR 1
Rev 2.95
Mar 17

SOCOTEC

Project No N9387-20

Project Name Cork Line Level Crossings

Figure

INDX

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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
XC201-TP01	1	0.50	1.00	D	Brown slightly sandy gravelly CLAY.			15	61 s	25 a	15	10		
XC201-TP01	9	2.20	2.50	D	Brown slightly sandy slightly gravelly CLAY			7.2	67 s	22 a	12	10		
XC201-TP02	7	1.50	2.00	D	Brown slightly sandy slightly gravelly CLAY.			6	62 s	22 a	13	9		
XC201-TP02	9	2.60	3.10	D	Brown slightly sandy gravelly silty CLAY with one cobble			5.3	52 s	22 a	12	10		
XC201-TP03	7	1.40	1.90	D	Brown slightly sandy gravelly CLAY with one cobble			6.2	35 s	23 b	13	10		
XC201-TP03	12	3.00	3.50	D	Brown slightly sandy gravelly silty CLAY with one cobble			4.7	42 s	22 b	13	9		
XC201-TP04	4	0.60	1.10	D	Brown slightly sandy gravelly silty CLAY with one cobble			7.2	61 s	20 b	12	8		
XC201-TP04	9	2.00	2.50	D	Brown slightly sandy slightly gravelly CLAY.			9.2	63 s	23 a	14	9		

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

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

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

WP Plastic limit
NP non - plastic
IP Plasticity Index

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

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

QA Ref
SLR 1
Rev 2.95
Mar 17

SOCOTEC

Project No N9425-20
Project Name Cork Line Level Crossings

Figure
INDX

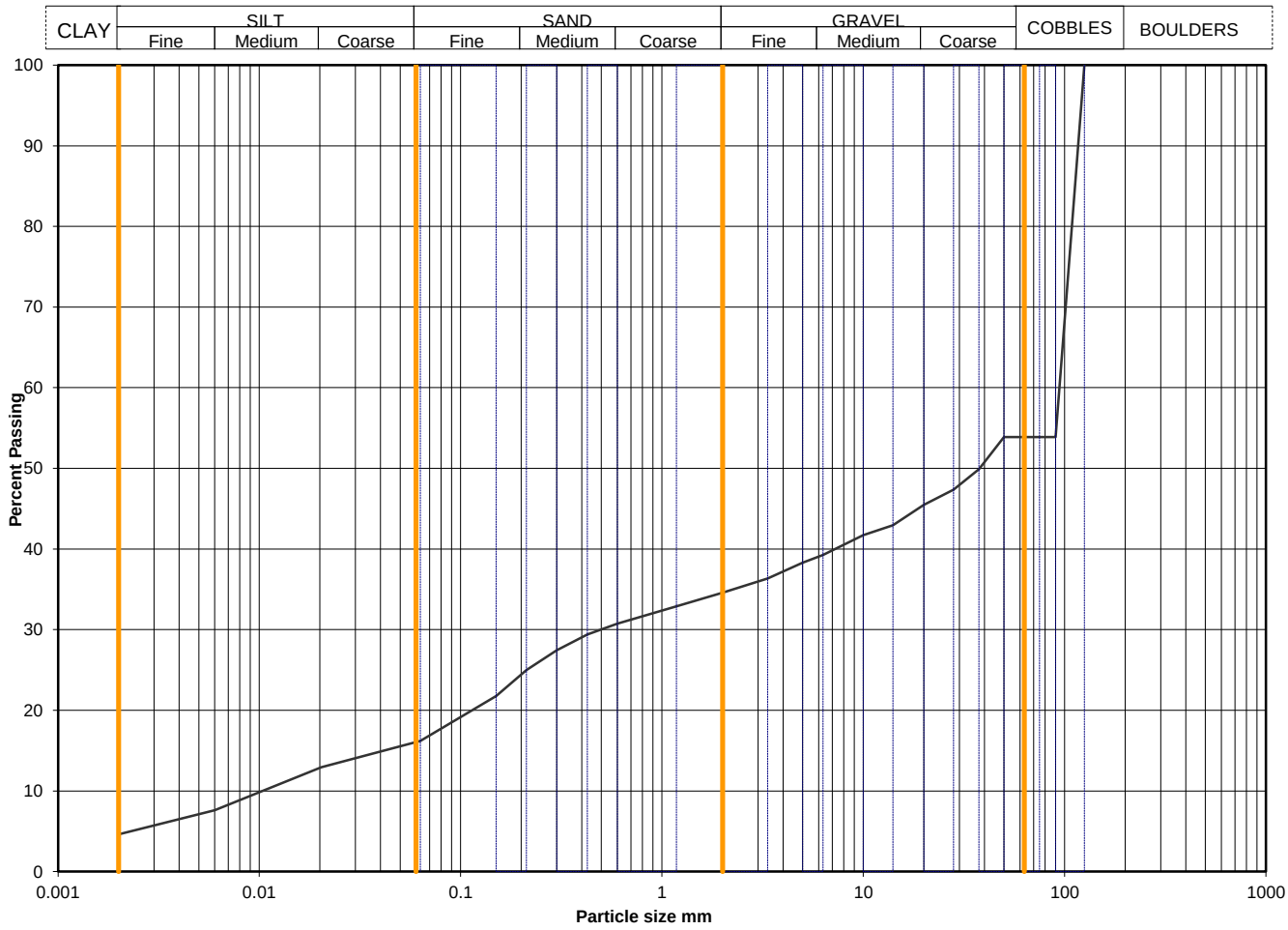
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO202008042

Hole No	XC201-CP01
Sample Depth (m BGL)	1.20 - 2.00
Sample Type and No	B5
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0203	13
90	54	0.0060	8
75	54	0.0020	5
63	54		
50	54		
37.5	50		
28	47		
20	45		
14	43		
10	42		
6.3	39		
5.0	38		
3.35	36		
2.00	35		
1.18	33	Particle density, Mg/m3	
0.600	31		
0.425	29	2.65 assumed	
0.300	27	Dry mass of sample, kg	
0.212	25		
0.150	22	7.1	
0.063	16		

Soil description	Brown mottled grey slightly sandy gravelly SILT with one cobble.
Preparation / Pretreatment	Sieve: pre dried, Pipette: as BS1377
Remarks	

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	46.2	0.0
	Gravel	19.3	35.9
	Sand	18.3	34.0
*<60mm values to aid description only	Silt	11.6	21.6
	Clay	4.6	8.6

Uniformity Coefficient	D60 / D10	9100

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

QA Ref
SLR 2,9
Rev 2.22
Jul 17

UKAS TESTING
0001

SOCOTEC

Project No N9387-20

Project Name Cork Line Level Crossings

Figure
PSD

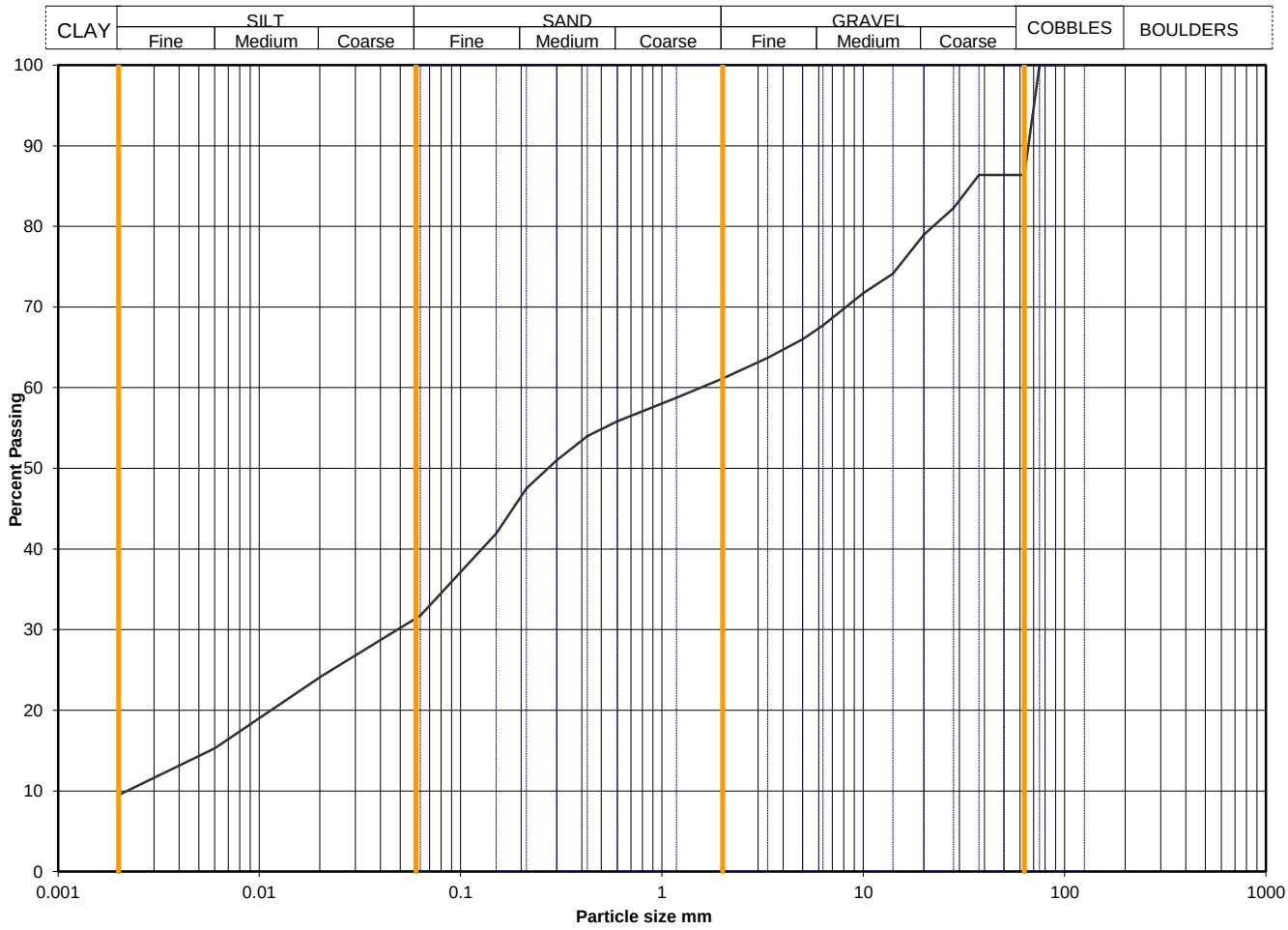
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO202008044

Hole No	XC201-CP01A
Sample Depth (m BGL)	2.00 - 3.00
Sample Type and No	B7
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0203	24
90	100	0.0060	15
75	100	0.0020	9
63	86		
50	86		
37.5	86		
28	82		
20	79		
14	74		
10	72		
6.3	68		
5.0	66		
3.35	64		
2.00	61		
1.18	59	Particle density, Mg/m3	
0.600	56		
0.425	54	2.65 assumed	
0.300	51	Dry mass of sample, kg	
0.212	48		
0.150	42	3.0	
0.063	32		

Soil description	Brown mottled grey slightly sandy slightly gravelly silty CLAY with one cobble.
Preparation / Pretreatment	Sieve: pre dried, Pipette: as BS1377
Remarks	

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	13.6	0.0
	Gravel	25.3	29.3
	Sand	29.4	34.0
*<60mm values to aid description only	Silt	22.2	25.7
	Clay	9.5	11.0

Uniformity Coefficient	D60 / D10	725

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

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Project No N9387-20

Project Name Cork Line Level Crossings

Figure
PSD

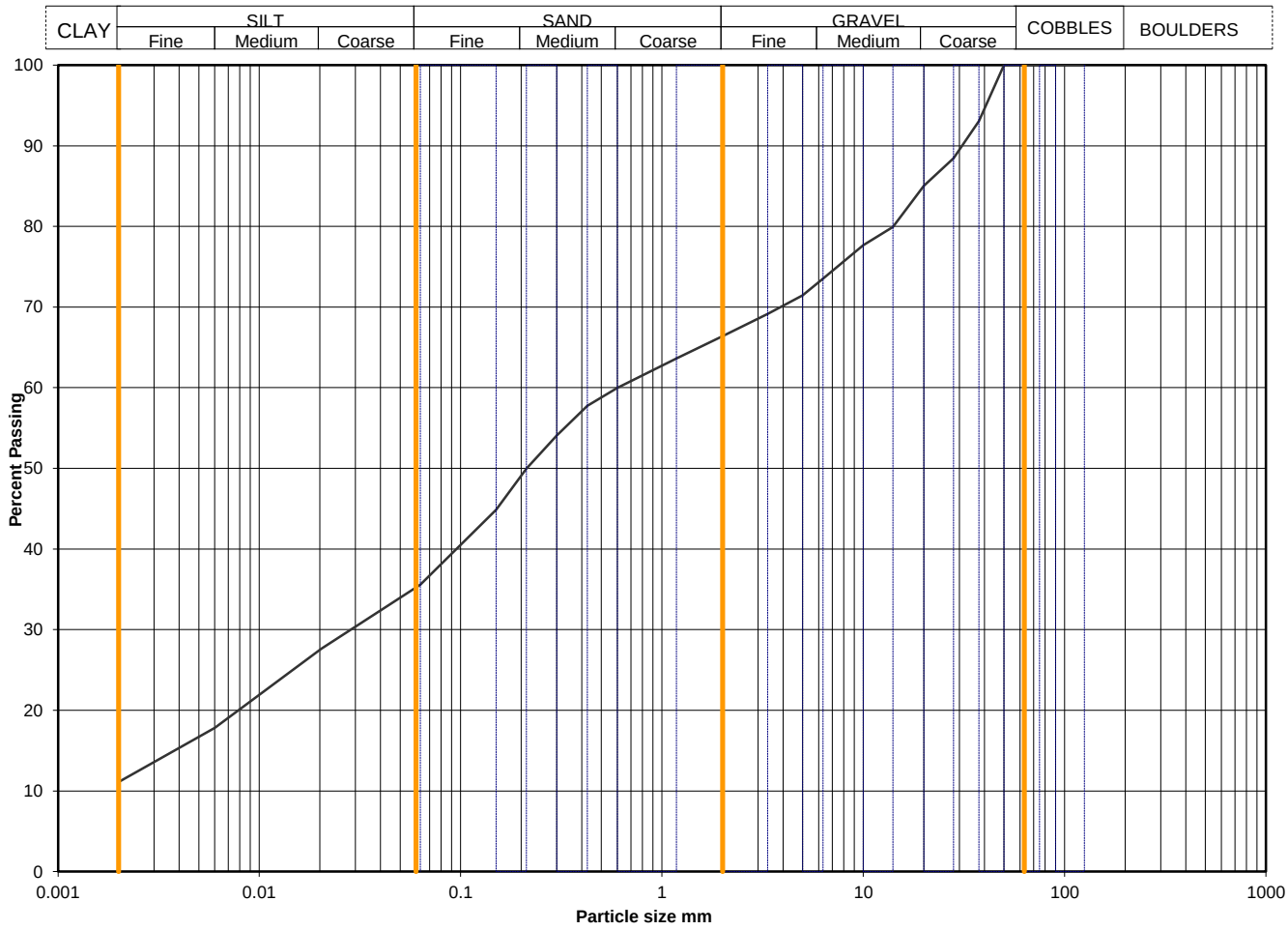
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO202008046

Hole No	XC201-CP02
Sample Depth (m BGL)	1.20 - 2.00
Sample Type and No	B5
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0203	28
90	100	0.0060	18
75	100	0.0020	11
63	100		
50	100		
37.5	93		
28	88		
20	85		
14	80		
10	78		
6.3	74		
5.0	71		
3.35	69		
2.00	66		
1.18	64	Particle density, Mg/m3	
0.600	60		
0.425	58	2.65 assumed	
0.300	54	Dry mass of sample, kg	
0.212	50		
0.150	45	2.9	
0.063	36		

Soil description	Brown mottled grey slightly sandy slightly gravelly silty CLAY
Preparation / Pretreatment	Sieve: pre dried, Pipette: as BS1377
Remarks	

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	0.0	0.0
	Gravel	33.6	33.6
	Sand	30.8	30.8
*<60mm values to aid description only	Silt	24.5	24.5
	Clay	11.1	11.1

Uniformity Coefficient	D60 / D10	Not applicable

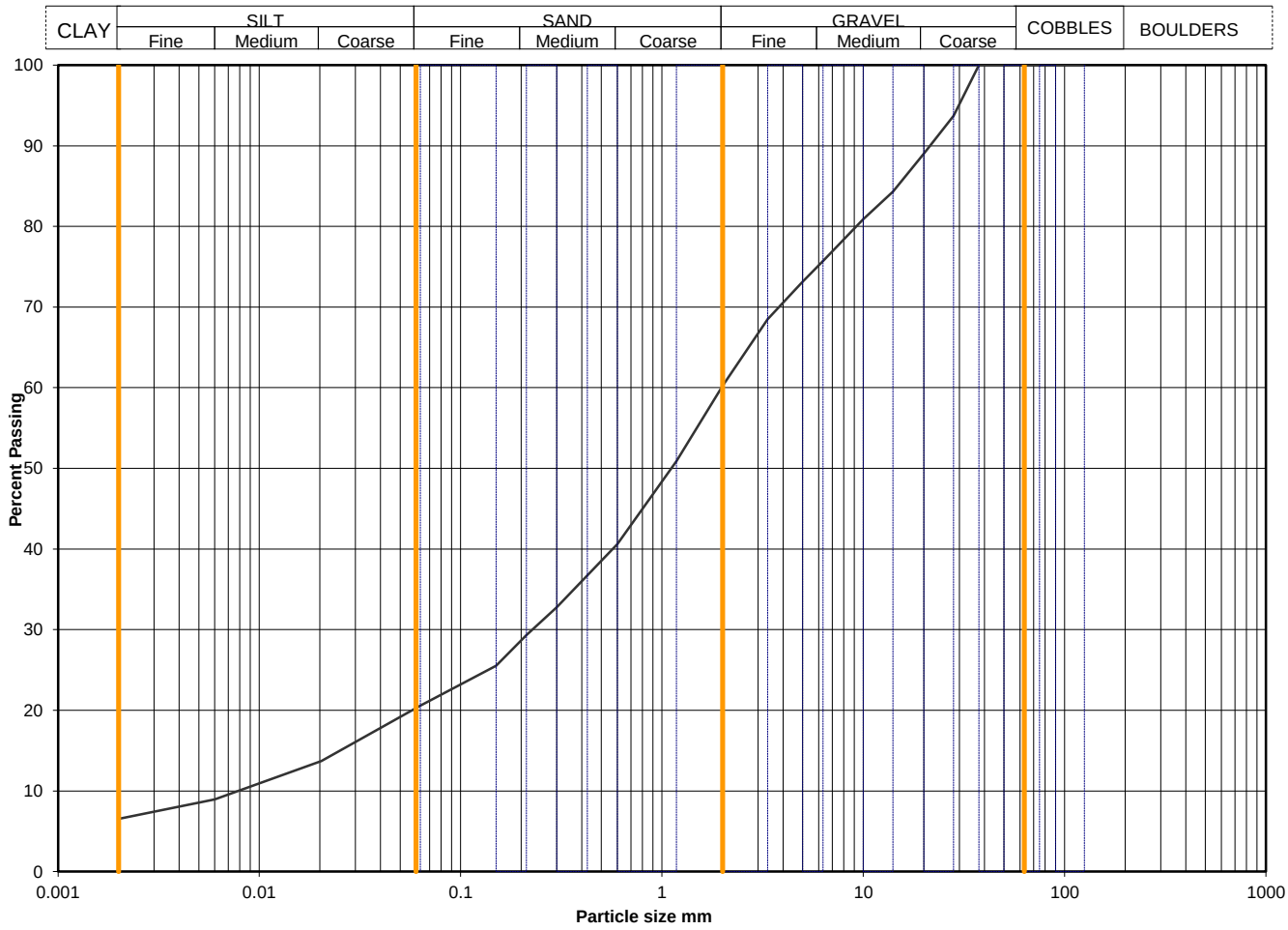
Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020080416

Hole No	XC201-CPRC01
Sample Depth (m BGL)	3.20 - 3.70
Sample Type and No	B15
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0203	14
90	100	0.0060	9
75	100	0.0020	7
63	100		
50	100		
37.5	100		
28	94		
20	89		
14	84		
10	81		
6.3	76		
5.0	73		
3.35	69		
2.00	60		
1.18	51	Particle density, Mg/m3	
0.600	41		
0.425	37	2.65 assumed	
0.300	33	Dry mass of sample, kg	
0.212	29		
0.150	26	2.7	
0.063	21		

Soil description	Dark 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	39.9	39.9
	Sand	39.6	39.6
*<60mm values to aid description only	Silt	14.0	14.0
	Clay	6.5	6.5

Uniformity Coefficient	D60 / D10	253

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

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Figure
PSD

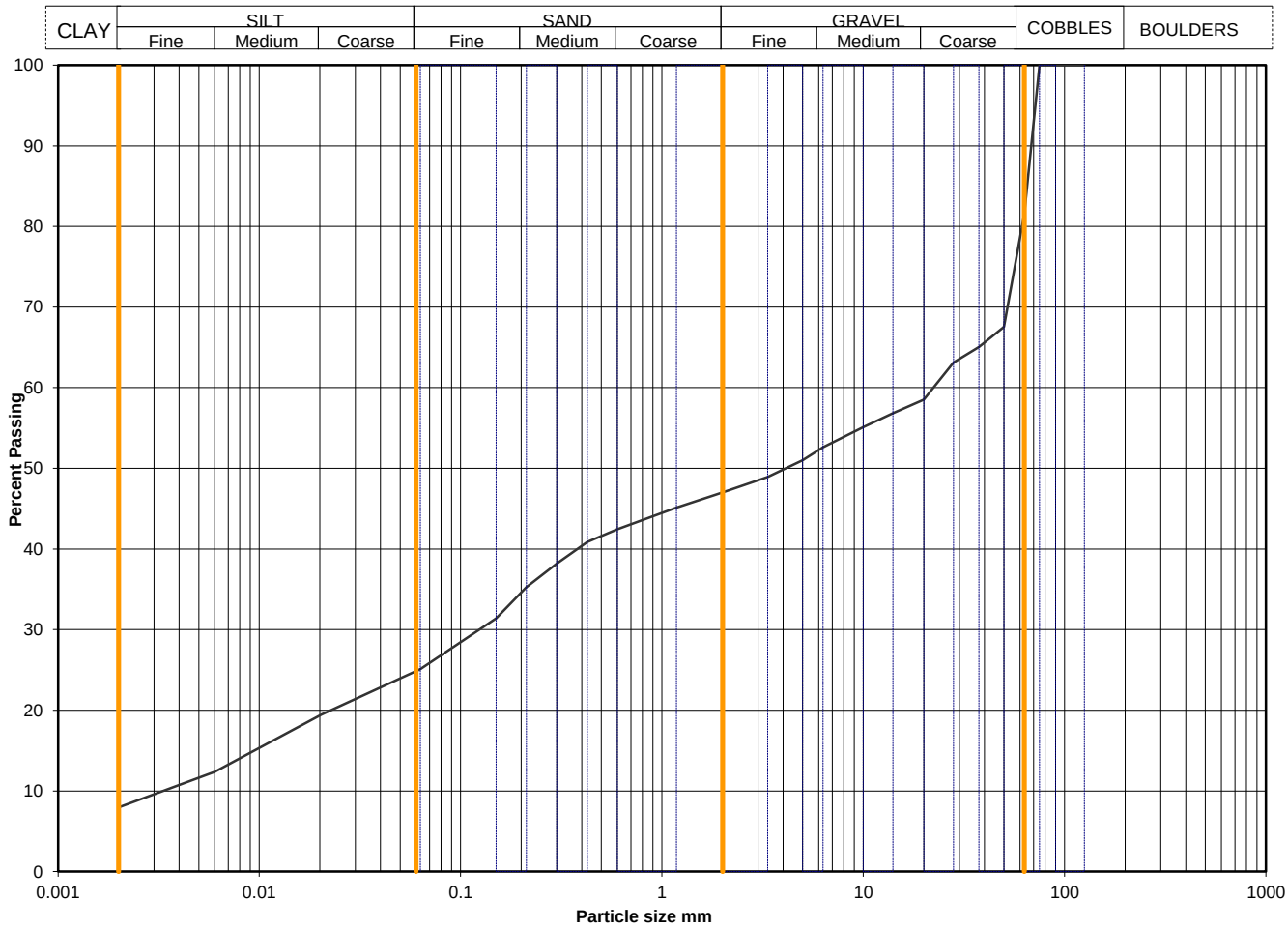
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020080417

Hole No	XC201-CPRC01A
Sample Depth (m BGL)	1.20 - 2.00
Sample Type and No	B6
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0203	19
90	100	0.0060	12
75	100	0.0020	8
63	82		
50	68		
37.5	65		
28	63		
20	59		
14	57		
10	55		
6.3	53		
5.0	51		
3.35	49		
2.00	47		
1.18	45	Particle density, Mg/m3	
0.600	42		
0.425	41	2.65 assumed	
0.300	38	Dry mass of sample, kg	
0.212	35		
0.150	31	10.7	
0.063	25		

Soil description	Brown mottled grey slightly sandy gravelly CLAY with two cobbles.
Preparation / Pretreatment	Sieve: pre dried, Pipette: as BS1377
Remarks	

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	18.3	0.0
	Gravel	34.6	42.4
	Sand	21.9	26.8
*<60mm values to aid description only	Silt	17.2	21.1
	Clay	8.0	9.8

Uniformity Coefficient	D60 / D10	6681

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
PSD

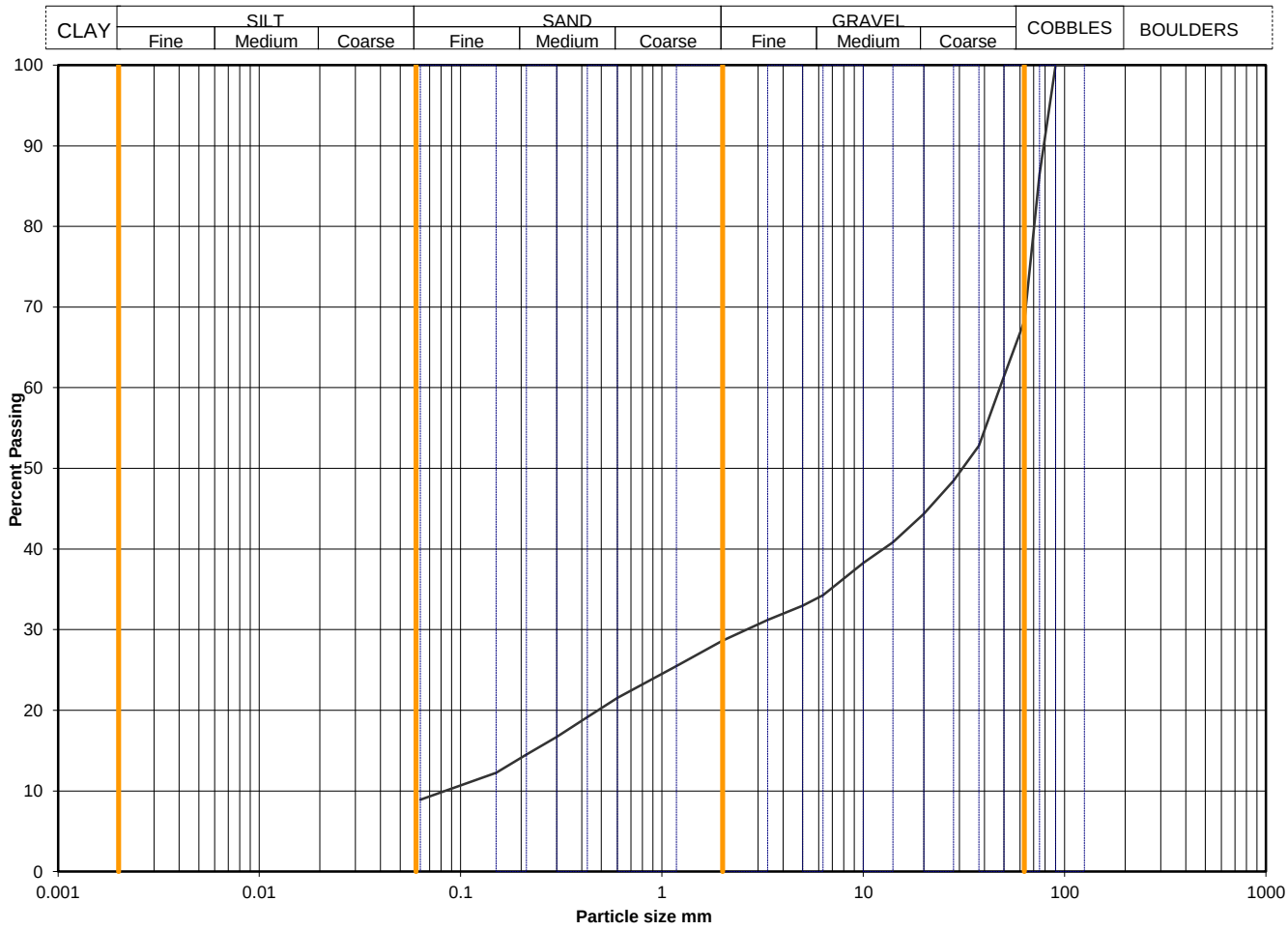
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020080420

Hole No	XC201-CPRC01A
Sample Depth (m BGL)	2.40 - 3.40
Sample Type and No	B13
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	86		
63	68		
50	61		
37.5	53		
28	48		
20	44		
14	41		
10	38		
6.3	34		
5.0	33		
3.35	31		
2.00	29		
1.18	26		
0.600	22		
0.425	19		
0.300	17	Dry mass of sample, kg	
0.212	14		
0.150	12	10.0	
0.063	9		

Soil description	Brown mottled grey slightly sandy gravelly CLAY with five cobbles.
Preparation / Pretreatment	Sieve: pre dried,
Remarks	Sieve:

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	31.7	0.0
	Gravel	39.7	58.1
	Sand	19.7	28.8
*<60mm values to aid description only	Silt	silt+clay =	
	Clay	8.9	13.0

Uniformity Coefficient	D60 / D10	572

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

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Figure
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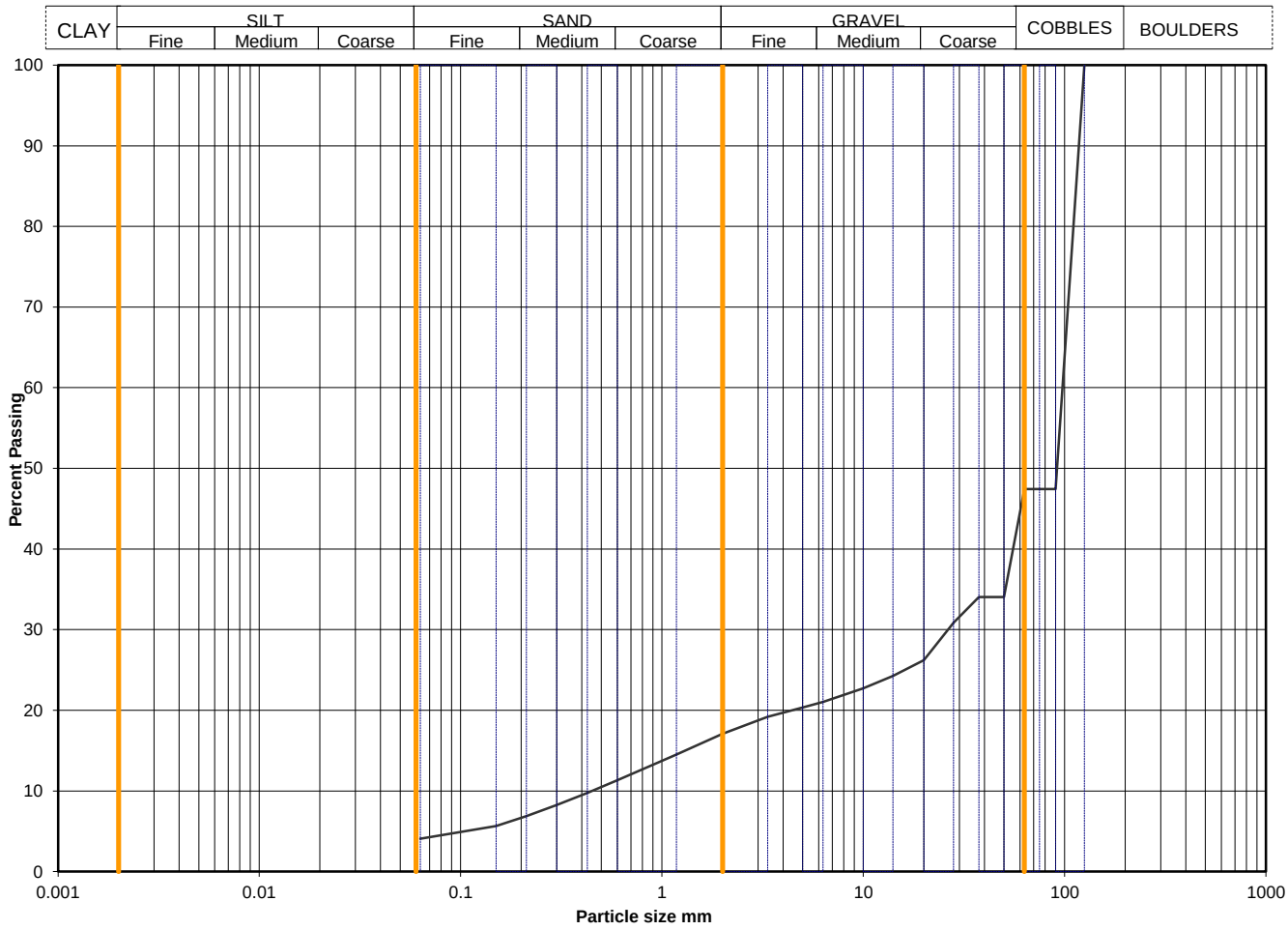
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020080422

Hole No	XC201-CPRC01A
Sample Depth (m BGL)	3.40 - 3.60
Sample Type and No	B16
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	47		
75	47		
63	47		
50	34		
37.5	34		
28	31		
20	26		
14	24		
10	23		
6.3	21		
5.0	20		
3.35	19		
2.00	17		
1.18	15		
0.600	11		
0.425	10		
0.300	8	Dry mass of sample, kg	
0.212	7	5.4	
0.150	6		
0.063	4		

Soil description	Dark grey sandy very gravelly clightly clayey COBBLES.
Preparation / Pretreatment	Sieve: pre dried,
Remarks	

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	52.6	0.0
	Gravel	30.3	63.9
	Sand	13.0	27.4
*<60mm values to aid description only	Silt	silt+clay =	
	Clay	4.1	8.6

Uniformity Coefficient	D60 / D10	217

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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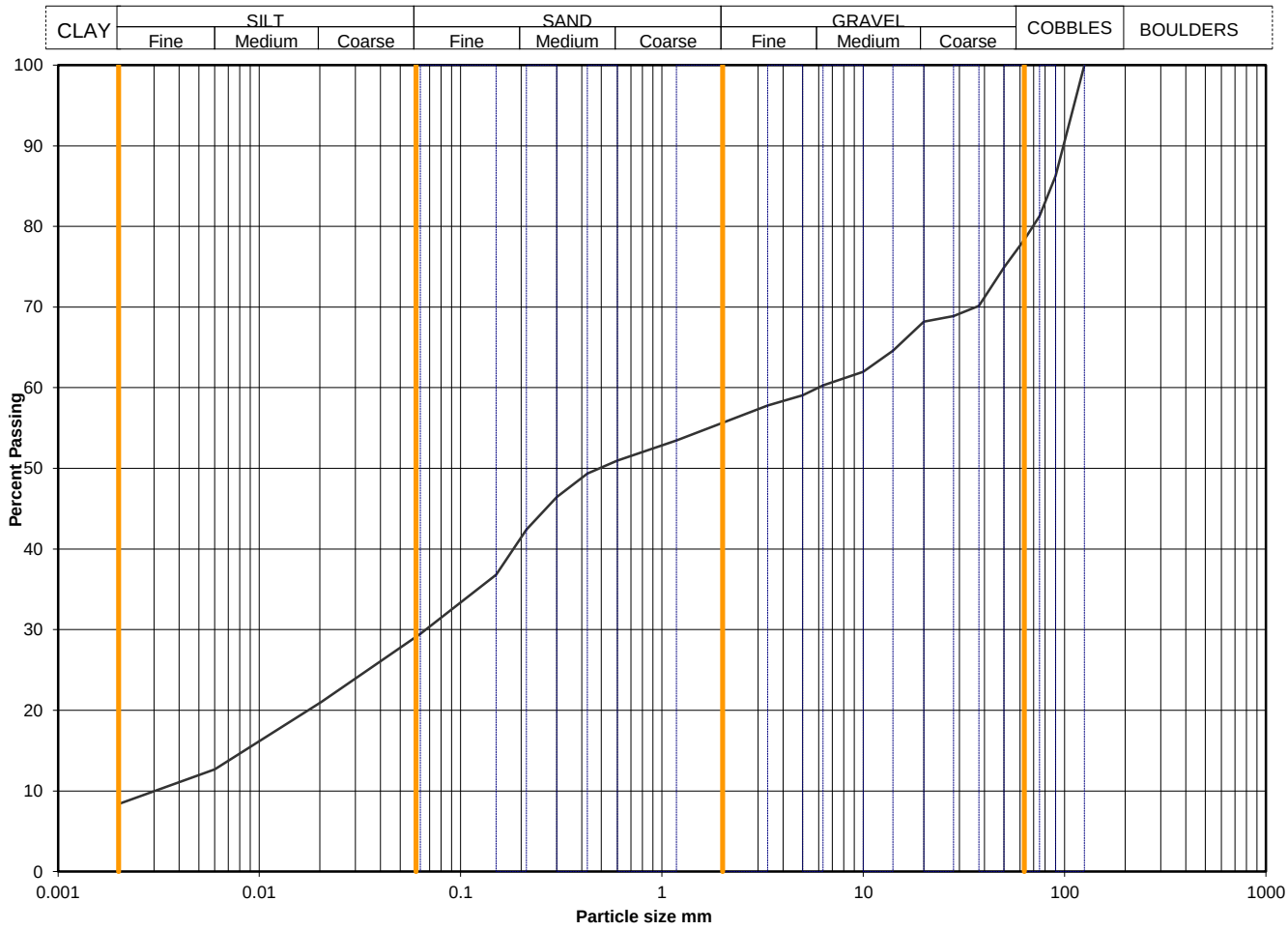
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020080424

Hole No	XC201-CPRC02
Sample Depth (m BGL)	0.20 - 1.20
Sample Type and No	B2
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0203	21
90	86	0.0060	13
75	81	0.0020	8
63	78		
50	75		
37.5	70		
28	69		
20	68		
14	65		
10	62		
6.3	60		
5.0	59		
3.35	58		
2.00	56		
1.18	53	Particle density, Mg/m3	
0.600	51		
0.425	49	2.65 assumed	
0.300	46	Dry mass of sample, kg	
0.212	42		
0.150	37	15.4	
0.063	29		

Soil description	Brown slightly sandy gravelly CLAY with three cobbles
Preparation / Pretreatment	Sieve: pre dried, Pipette: as BS1377
Remarks	

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	21.6	0.0
	Gravel	22.7	29.0
	Sand	26.2	33.4
*<60mm values to aid description only	Silt	21.1	26.9
	Clay	8.4	10.7

Uniformity Coefficient	D60 / D10	2563

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
PSD

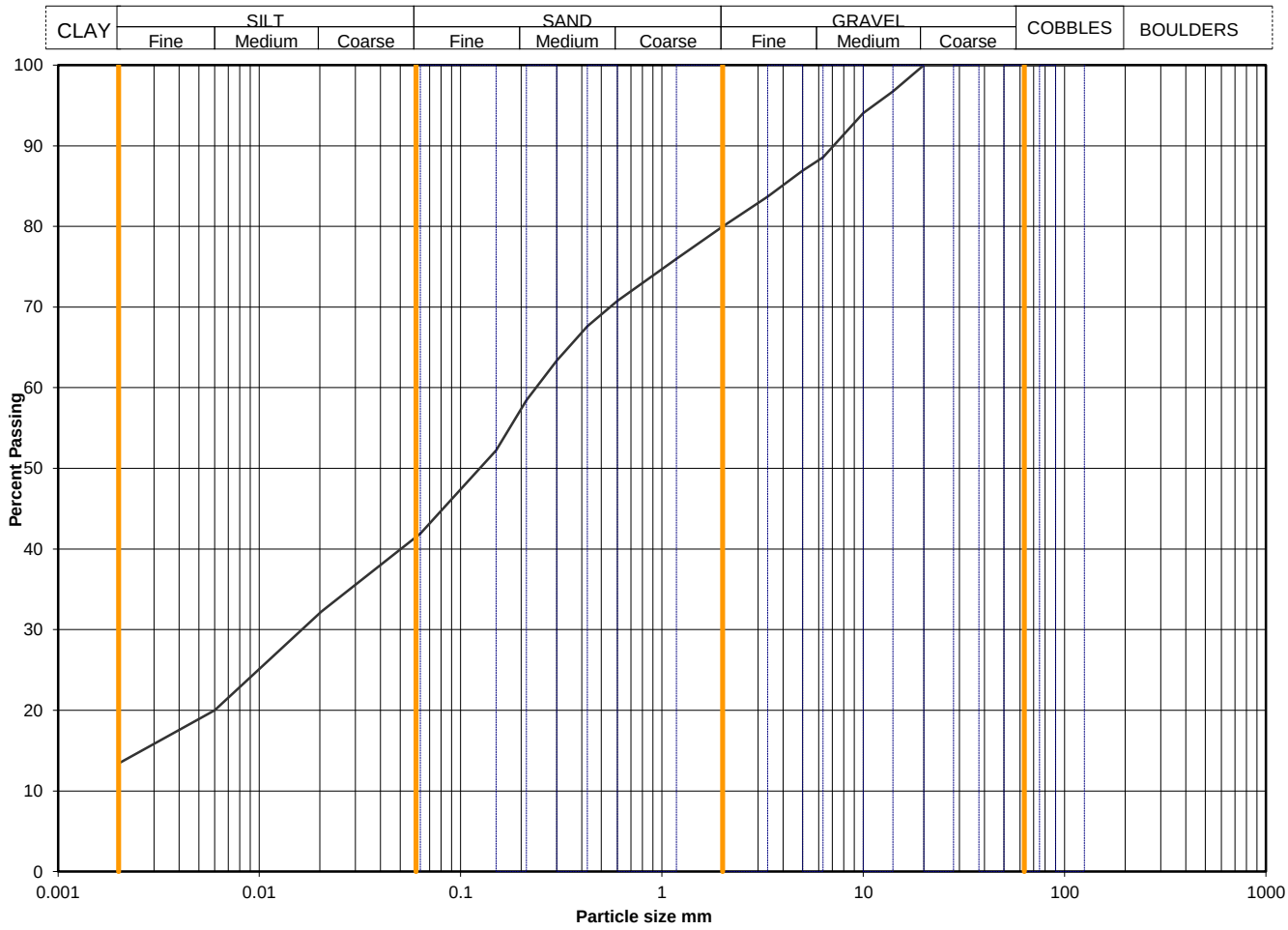
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020080428

Hole No	XC201-CPRC02
Sample Depth (m BGL)	2.50 - 2.80
Sample Type and No	B10
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0203	32
90	100	0.0060	20
75	100	0.0020	13
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	97		
10	94		
6.3	89		
5.0	87		
3.35	84		
2.00	80		
1.18	76	Particle density, Mg/m3	
0.600	71		
0.425	68	2.65 assumed	
0.300	63	Dry mass of sample, kg	
0.212	58		
0.150	52	1.9	
0.063	42		

Soil description	Brown slightly gravelly sandy CLAY
Preparation / Pretreatment	Sieve: pre dried, Pipette: as BS1377
Remarks	

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	0.0	0.0
	Gravel	20.1	20.1
	Sand	38.0	38.0
*<60mm values to aid description only	Silt	28.5	28.5
	Clay	13.4	13.4

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
PSD

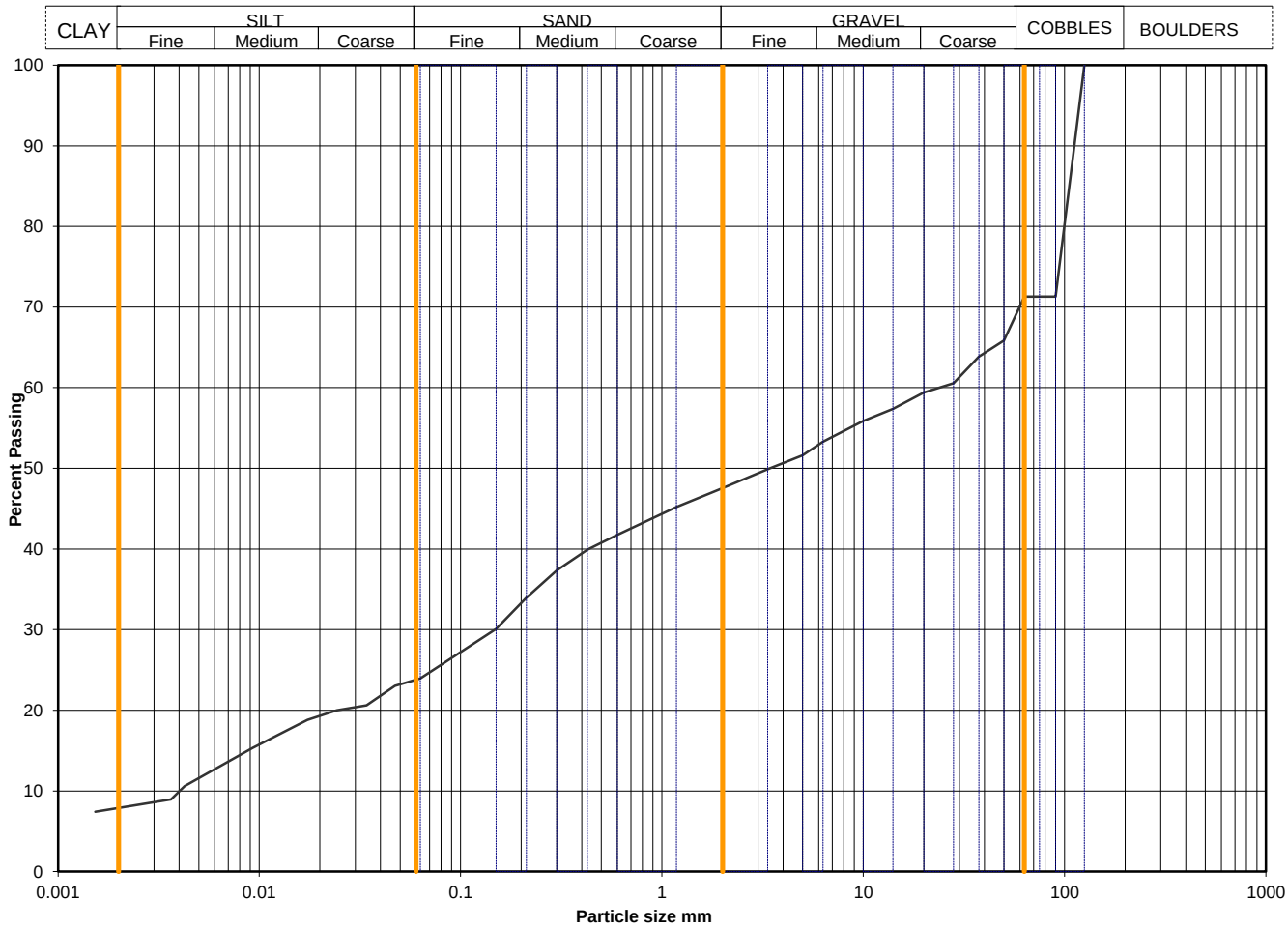
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO202010025

Hole No	XC201-TP01
Sample Depth (m BGL)	1.70 - 2.20
Sample Type and No	B6
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	24
90	71	0.0472	23
75	71	0.0341	21
63	71	0.0242	20
50	66	0.0173	19
37.5	64	0.0092	15
28	61	0.0043	11
20	59	0.0036	9
14	57	0.0015	7
10	56		
6.3	53		
5.0	52		
3.35	50		
2.00	48		
1.18	45	Particle density, Mg/m3	
0.600	42		
0.425	40	2.65 assumed	
0.300	37	Dry mass of sample, kg	
0.212	34		
0.150	30	6.6	
0.063	24		

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

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	28.6	0.0
	Gravel	23.8	33.3
	Sand	23.6	33.1
*<60mm values to aid description only	Silt	16.1	22.5
	Clay	7.9	11.1

Uniformity Coefficient	D60 / D10	6639

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

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Project Name Cork Line Level Crossings

Figure
PSD

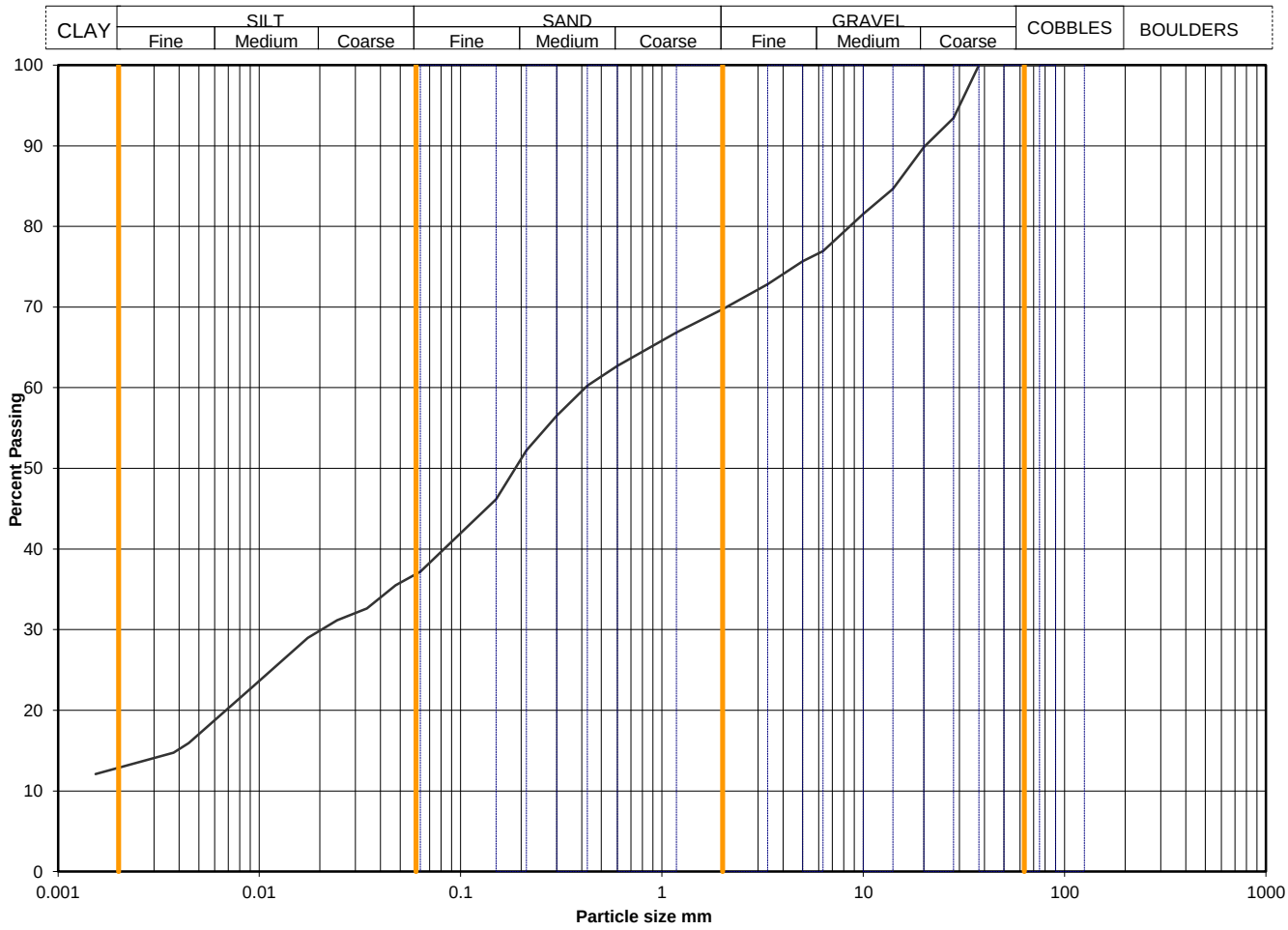
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020100213

Hole No	XC201-TP01
Sample Depth (m BGL)	2.70 - 3.20
Sample Type and No	B10
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	37
90	100	0.0475	36
75	100	0.0342	33
63	100	0.0243	31
50	100	0.0174	29
37.5	100	0.0093	23
28	93	0.0045	16
20	90	0.0037	15
14	85	0.0015	12
10	82		
6.3	77		
5.0	76		
3.35	73		
2.00	70		
1.18	67	Particle density, Mg/m3	
0.600	63		
0.425	60	2.65 assumed	
0.300	57	Dry mass of sample, kg	
0.212	52		
0.150	46	3.2	
0.063	37		

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

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	0.0	0.0
	Gravel	30.3	30.3
	Sand	32.5	32.5
*<60mm values to aid description only	Silt	24.3	24.3
	Clay	12.9	12.9

Uniformity Coefficient	D60 / D10	Not applicable

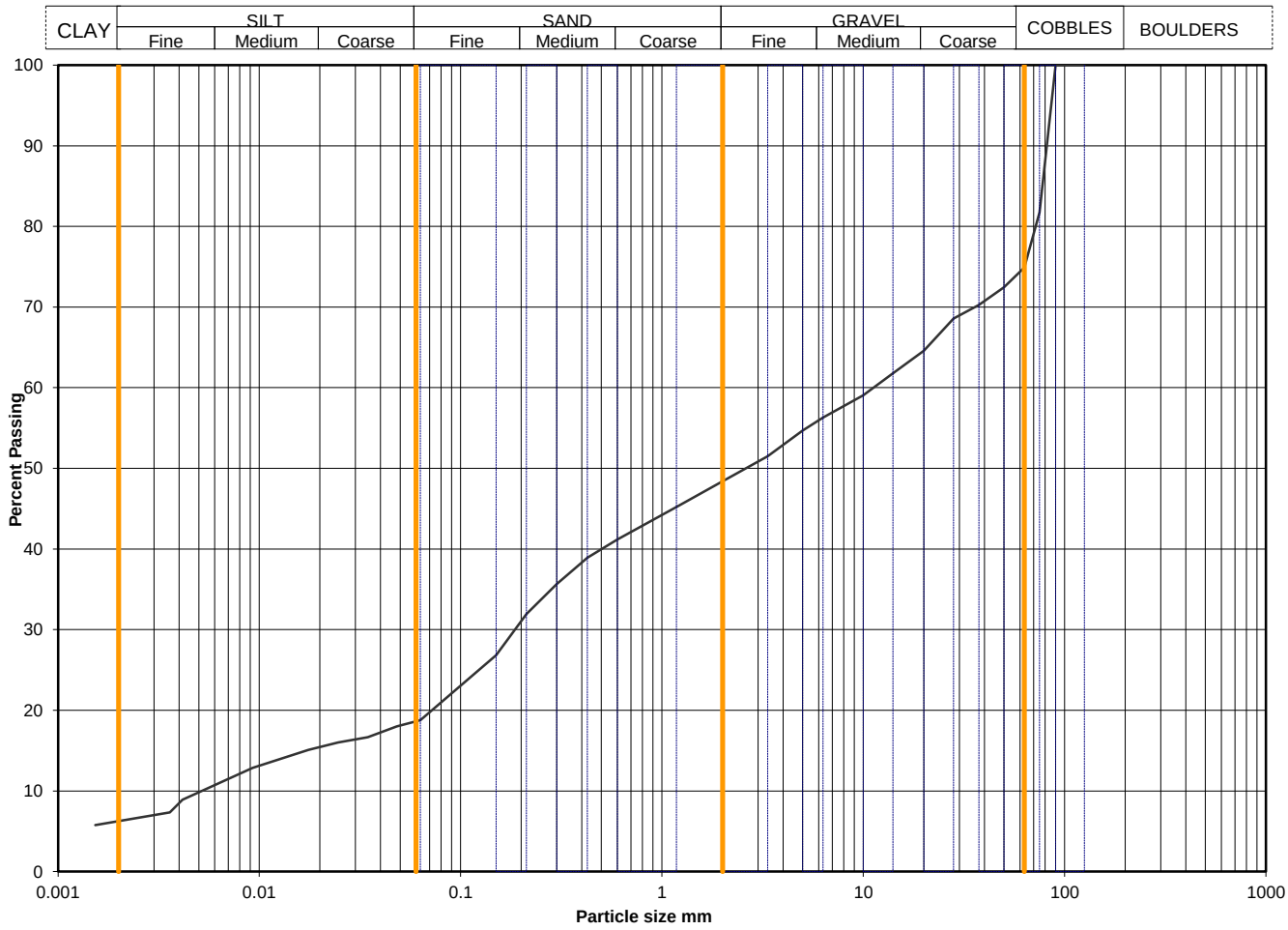
Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020100217

Hole No	XC201-TP02
Sample Depth (m BGL)	1.50 - 2.00
Sample Type and No	B6
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	19
90	100	0.0482	18
75	82	0.0345	17
63	75	0.0246	16
50	72	0.0175	15
37.5	70	0.0093	13
28	69	0.0042	9
20	65	0.0036	7
14	62	0.0015	6
10	59		
6.3	56		
5.0	55		
3.35	52		
2.00	48		
1.18	45	Particle density, Mg/m3	
0.600	41		
0.425	39	2.65 assumed	
0.300	36	Dry mass of sample, kg	
0.212	32		
0.150	27	13.7	
0.063	19		

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

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	25.1	0.0
	Gravel	26.5	35.4
	Sand	29.6	39.5
*<60mm values to aid description only	Silt	12.5	16.7
	Clay	6.3	8.4

Uniformity Coefficient	D60 / D10	2164

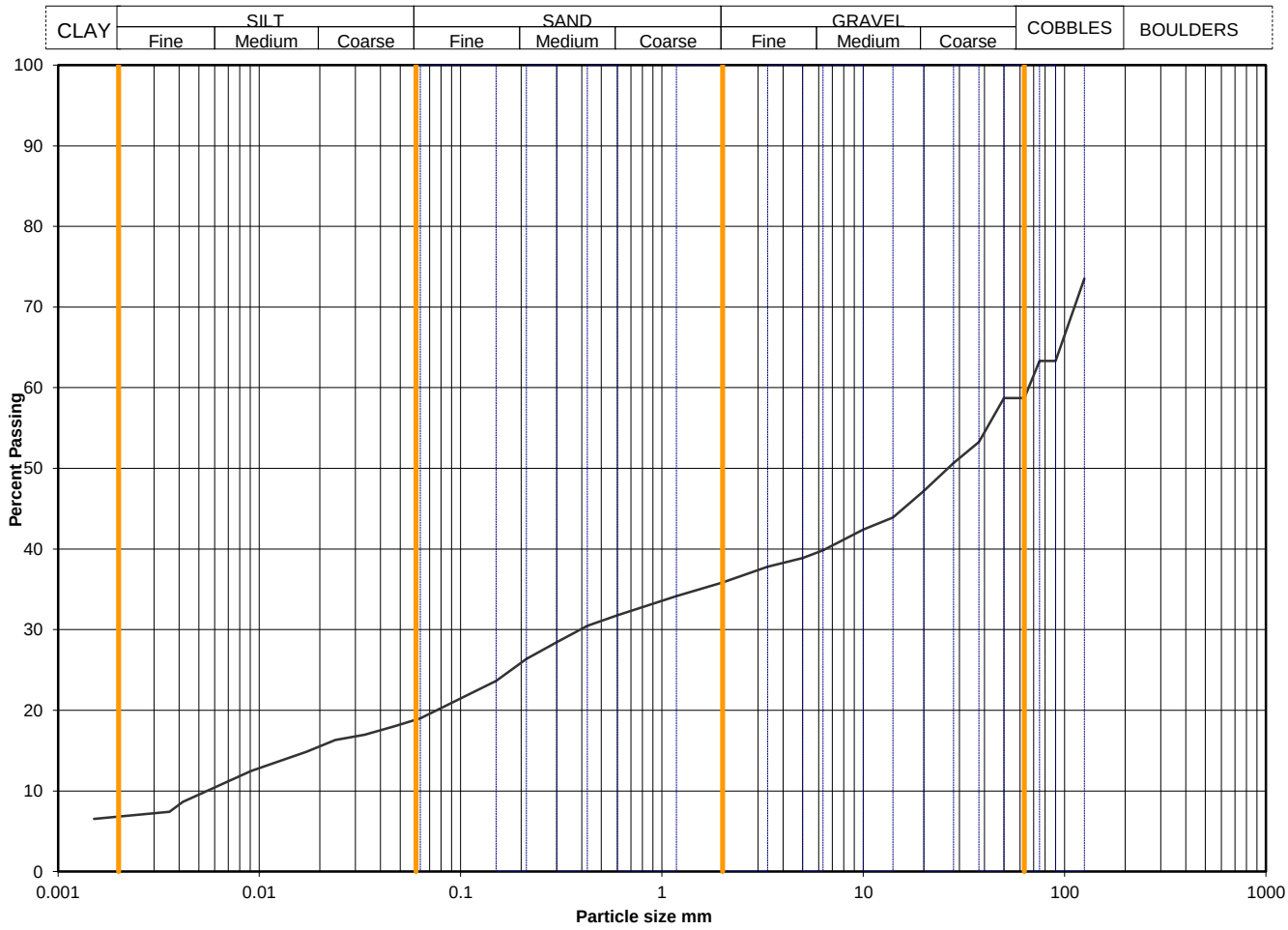
Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020100225

Hole No	XC201-TP03
Sample Depth (m BGL)	2.20 - 2.70
Sample Type and No	B8
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	74	0.0630	19
90	63	0.0466	18
75	63	0.0334	17
63	59	0.0238	16
50	59	0.0171	15
37.5	53	0.0091	12
28	51	0.0042	9
20	47	0.0036	7
14	44	0.0015	7
10	42		
6.3	40		
5.0	39		
3.35	38		
2.00	36		
1.18	34	Particle density, Mg/m3	
0.600	32		
0.425	30	2.65 assumed	
0.300	28	Dry mass of sample, kg	
0.212	26		
0.150	24	13.2	
0.063	19		

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

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	41.3	0.0
	Gravel	22.8	38.8
	Sand	16.9	28.8
*<60mm values to aid description only	Silt	12.2	20.8
	Clay	6.8	11.6

Uniformity Coefficient	D60 / D10	12079

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

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Figure
PSD

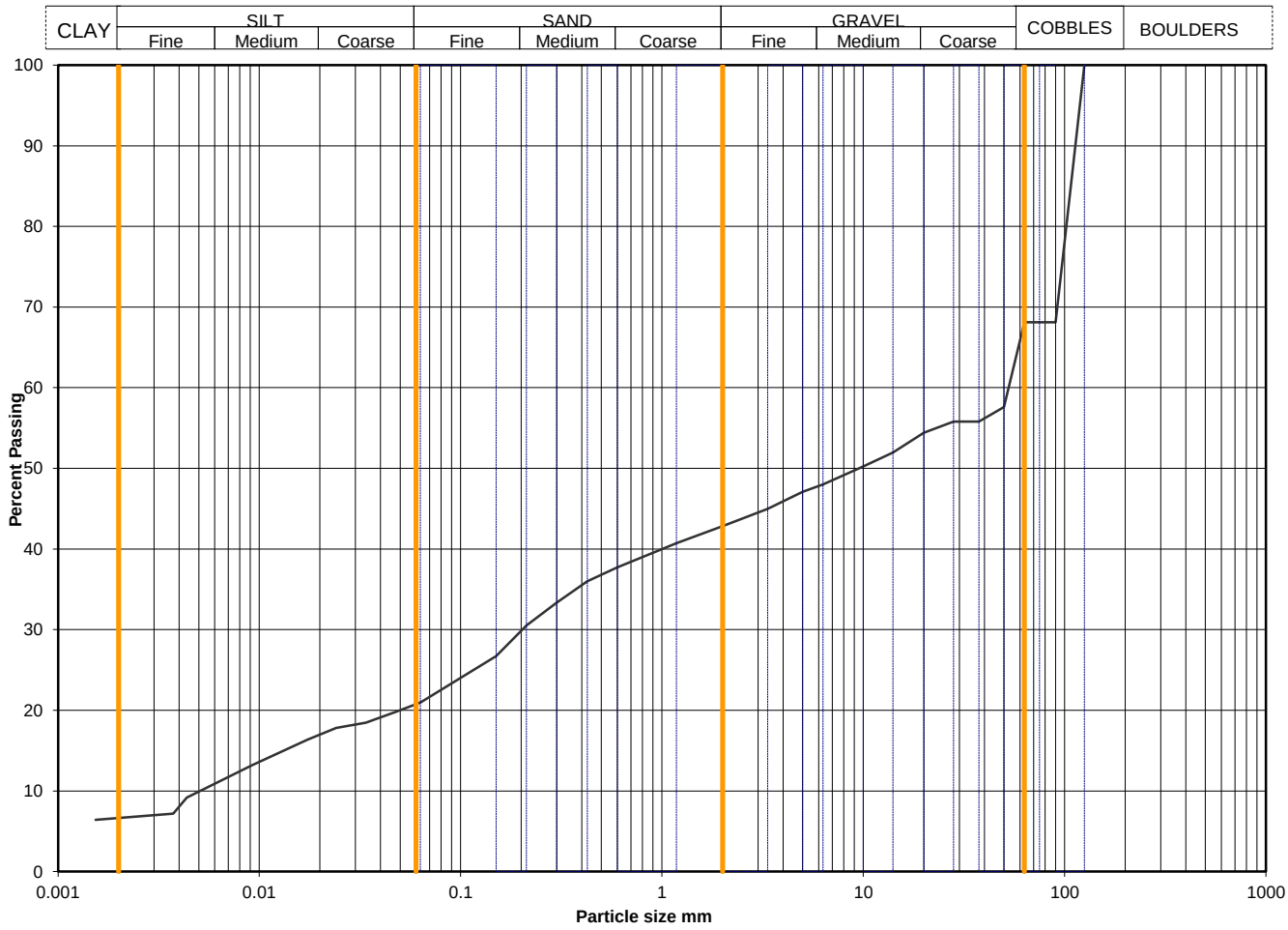
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020100231

Hole No	XC201-TP04
Sample Depth (m BGL)	1.30 - 1.80
Sample Type and No	B6
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	21
90	68	0.0472	20
75	68	0.0339	18
63	68	0.0241	18
50	58	0.0173	16
37.5	56	0.0092	13
28	56	0.0044	9
20	54	0.0037	7
14	52	0.0015	6
10	50		
6.3	48		
5.0	47		
3.35	45		
2.00	43		
1.18	41	Particle density, Mg/m3	
0.600	38		
0.425	36	2.65 assumed	
0.300	33	Dry mass of sample, kg	
0.212	30		
0.150	27	6.1	
0.063	21		

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

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	31.9	0.0
	Gravel	25.3	37.2
	Sand	21.9	32.2
*<60mm values to aid description only	Silt	14.3	21.0
	Clay	6.6	9.7

Uniformity Coefficient	D60 / D10	10348

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

QA Ref
SLR 2,9
Rev 2.22
Jul 17

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SOCOTEC

Project No N9425-20

Project Name Cork Line Level Crossings

Figure
PSD

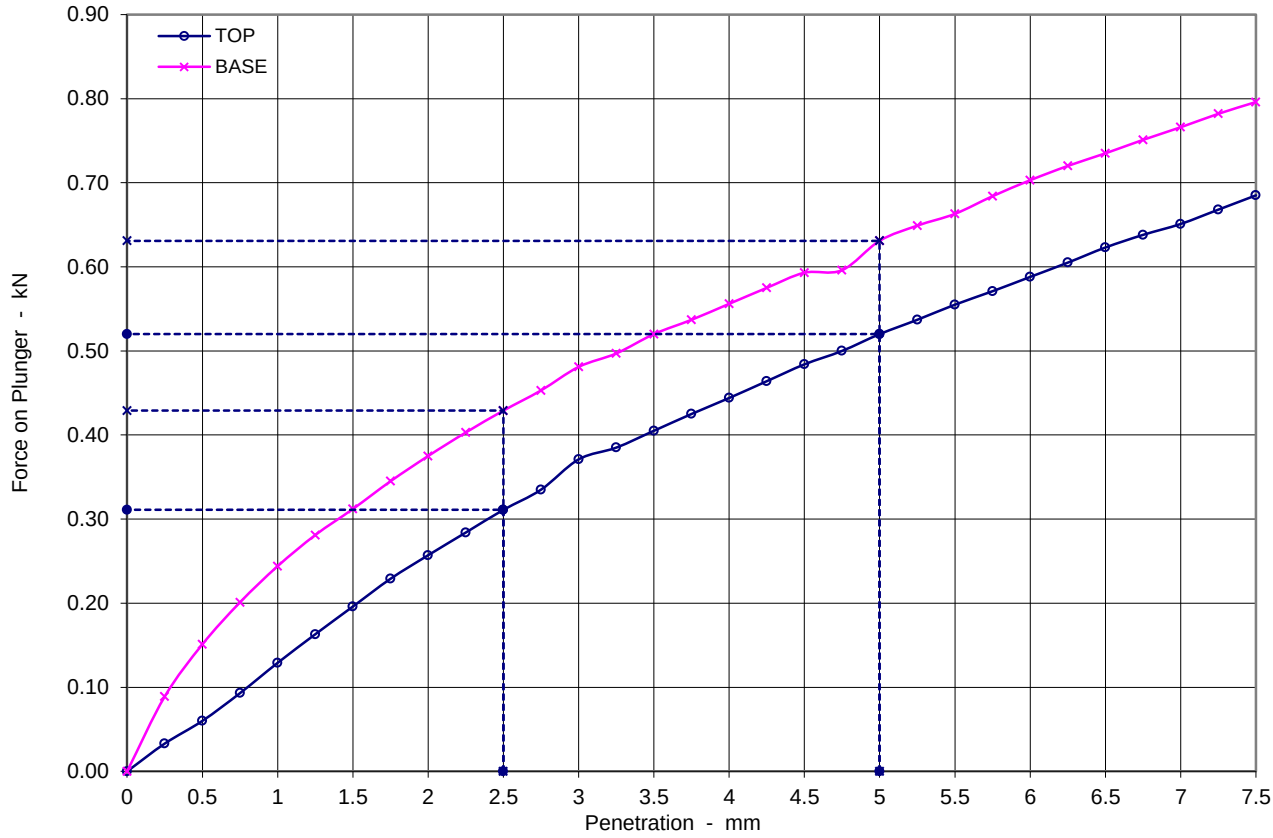
The results reported relate only to the samples tested; opinions and interpretations expressed herein are outside the scope of UKAS accreditation. © Copyright 2016 SOCOTEC UK Limited

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

Sample Details:	SAMPLE ID:
	SOCO202010024

Hole No	XC201-TP01
Sample Depth (m)	0.50 - 1.00
Sample Type and No	D1
Specimen Ref	1



Soil description	Brown slightly sandy gravelly CLAY.

Test Conditions		
Sample Retained on 20 mm sieve	%	17

Preparation	Method of Compaction		
	Remoulded - Rammer compaction to specified density (2.5kg)		
	Soaked test		NO
	Soaking Period	days	N/A
	Amount of Swell	mm	N/A

Surcharge applied		
	kg	0
	kPa	0

Notes : @-2 OF NMC

Sample Conditions		
Initial Moisture Content	%	12.0
Bulk Density	Mg/m³	1.97
Dry Density	Mg/m³	1.77
Moisture Content - TOP	%	11.0
Moisture Content - BASE	%	12.0

Penetration mm	CBR Values %	
	TOP	BASE
2.5	2.4	3.3
5	2.6	3.2

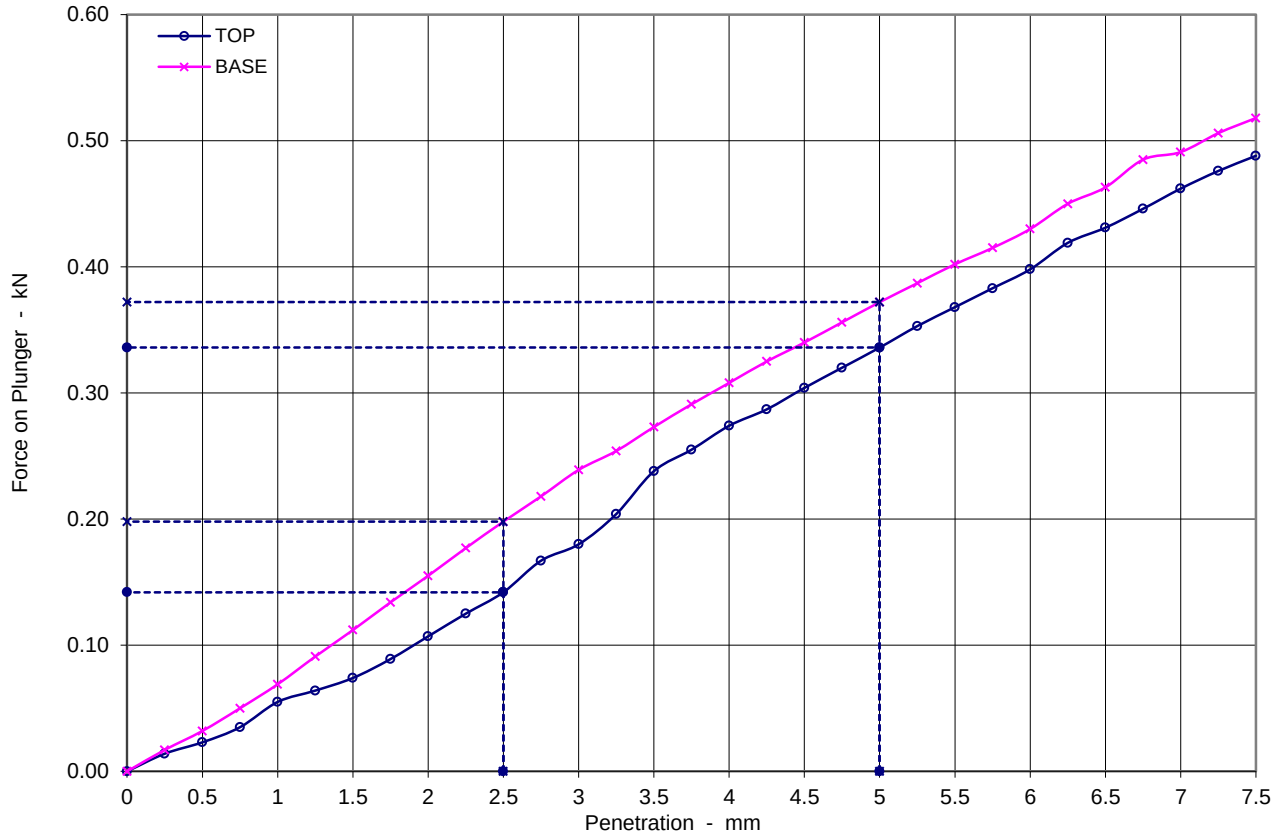
Accepted CBR %	**2.6**	**3.3**

The results reported relate only to the samples tested; opinions and interpretations expressed herein are outside the scope of UKAS accreditation. © Copyright 2017 SOCOTEC UK Limited

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

Sample Details:	SAMPLE ID:
	SOCO2020100233

Hole No	XC201-TP04
Sample Depth (m)	2.00 - 2.50
Sample Type and No	B8
Specimen Ref	1



Soil description	Brown slightly sandy slightly gravelly CLAY.

Test Conditions		
Sample Retained on 20 mm sieve	%	0

Preparation	Method of Compaction		
	Remoulded - Rammer compaction to specified density (2.5kg)		
	Soaked test		NO
	Soaking Period	days	N/A
	Amount of Swell	mm	N/A

Surcharge applied		
	kg	0
	kPa	0

Sample Conditions		
Initial Moisture Content	%	10.0
Bulk Density	Mg/m³	2.12
Dry Density	Mg/m³	1.92
Moisture Content - TOP	%	10.0
Moisture Content - BASE	%	10.0

Penetration mm	CBR Values %	
	TOP	BASE
2.5	1.1	1.5
5	1.7	1.9

Accepted CBR %	**1.7**	**1.9**

Notes :

QA Ref
SLR 4.7
Rev 2.8
Mar 17

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SOCOTEC

Project No N9425-20

Project Name Cork Line Level Crossings

Figure
CBR

The results reported relate only to the samples tested; opinions and interpretations expressed herein are outside the scope of UKAS accreditation. © Copyright 2017 SOCOTEC UK Limited

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Certificate of Analysis

Certificate Number	20-14518
	12-Aug-20
Client	Socotec - Geotechnical Lab Askern Road Doncaster DN6 8DG
Our Reference	20-14518
Client Reference	N9387-20
Order No	(not supplied)
Contract Title	Cork Line Level Crossing
Description	3 Soil samples.
Date Received	06-Aug-20
Date Started	06-Aug-20
Date Completed	12-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 20-14518
Client Ref N9387-20
Contract Title Cork Line Level Crossing

			Lab No	1708692	1708693	1708694
			Sample ID	CPRC01A	CP01	CPRC02
			Depth	3.40-3.60	0.20-1.20	2.80-3.30
			Other ID	D17	B2	D13
			Sample Type	SOIL	SOIL	SOIL
			Sampling Date	05/08/2020	05/08/2020	05/08/2020
			Sampling Time	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**			
Metals						
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l	19	< 10	< 10
Inorganics						
pH	DETSC 2008#		pH	7.9	7.7	8.4
Ammonia Aqueous Extract as N	DETSC 2119	10	mg/l	< 10	< 10	< 10
Chloride Aqueous Extract	DETSC 2055	1	mg/l	14	11	14
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l	< 1.0	6.4	< 1.0
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	970	280	32
Sulphur as S, Total	DETSC 2320	0.01	%	0.12	0.04	0.02
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.22	0.10	0.04

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

Information in Support of the Analytical Results

Our Ref 20-14518
Client Ref N9387-20
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
1708692	XC201-CPRC01A 3.40-3.60 SOIL	05/08/20	PT 1L		
1708693	XC201-CP01 0.20-1.20 SOIL	05/08/20	PT 1L		
1708694	XC201-CPRC02 2.80-3.30 SOIL	05/08/20	PT 1L		

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

Certificate of Analysis

Certificate Number	20-17748
	21-Sep-20
Client	Socotec INFRASTRUCTURE SERVICES Unit 15 Crosby Yard Wildmill Bridgend CF31 1JZ
Our Reference	20-17748
Client Reference	N9387
Order No	N20-O-2186
Contract Title	Corkline Level Crossing
Description	One Soil sample.
Date Received	15-Sep-20
Date Started	15-Sep-20
Date Completed	21-Sep-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

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2139

Summary of Chemical Analysis

Soil Samples

Our Ref 20-17748
Client Ref N9387
Contract Title Corkline Level Crossing

Lab No	1726717
Sample ID	CX201-CPRC02
Depth	1.20-2.00
Other ID	D6
Sample Type	SOIL
Sampling Date	14/09/2020
Sampling Time	n/s

Test	Method	LOD	Units	
Inorganics				
pH	DETSC 2008#		pH	8.3
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	19
Sulphur as S, Total	DETSC 2320	0.01	%	0.02
Sulphate as SO4, Total	DETSC 2321#	0.01	%	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 20-17748
Client Ref N9387
Contract Corkline Level Crossing

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1726717	CX201-CPRC02 1.20-2.00 SOIL	14/09/20	PT 1L		

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 H Environmental Laboratory Test Results

SOCOTEC

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

Certificate of Analysis

Project No: 20071478

Client: OCB Geotechnical Limited

Quote Number: BEC200710078

Project Reference: Irish Rail - Cork Line

Site Name: 19-135

Contact: Ian Holley

Address: Unit 1
Carrigogna
Midleton
County Cork

Post Code: Ireland

E-Mail: iholley@ocbgeotechnical.com

Phone No: 021 4638474

Number of Samples Received: 3

Date Received: 30/07/2020

Analysis Date: 11/08/2020

Date Issued: 11/08/2020

Job Status: Complete

Report Type: Final Version 01

This report supersedes any versions previously issued by the laboratory

Account Manager

Martin Elliott-Palmer

Authorised by the Operations Manager
Becky Batham

Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

Samples Analysed

Sample Reference	Text ID	Sample Date	Sample Type
XC201-TP04-1-ES-0.05-0.05	20071478-001	03/07/2020 17:00:00	SOLID
XC201-TP04-2-ES-0.50-0.50	20071478-003	03/07/2020 18:00:00	SOLID
XC201-TP04-5-ES-1.00-1.00	20071478-005	03/07/2020 19:00:00	SOLID

SOCOTEC

Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

Analysis Results

				Project ID	20071478					
				Sample ID	001		003		005	
				Customer ID	XC201-TP04-1-ES-0.05-0.05		XC201-TP04-2-ES-0.50-0.50		XC201-TP04-5-ES-1.00	
				Sample Type	LPL	SOLID	LPL	SOLID	LPL	
				Sampling Date	03/07/2020	03/07/2020	03/07/2020	03/07/2020	03/07/2020	
Analysis	Method Code	MDL	Units	Accred						
>C6-C8 Aliphatic	GROHSA/BTEXHSA	0.1	mg/l	N	<0.100		<0.100		<0.100	
>C7-C8 Aromatic	GROHSA/BTEXHSA	0.005	mg/l	N	<0.005		<0.005		<0.005	
>C8-C10 Aliphatic	GROHSA/BTEXHSA	0.1	mg/l	N	<0.100		<0.100		<0.100	
>C8-C10 Aromatic	GROHSA/BTEXHSA	0.02	mg/l	N	<0.020		<0.020		<0.020	
C5-C6 Aliphatic	GROHSA/BTEXHSA	0.1	mg/l	N	<0.100		<0.100		<0.100	
C5-C7 Aromatic	GROHSA/BTEXHSA	0.005	mg/l	N	<0.005		<0.005		<0.005	
Total GRO	GROHSA/BTEXHSA	0.1	mg/l	U	<0.100		<0.100		<0.100	
Free Cyanide	SFAPI	0.02	mg/l	U	<0.02		<0.02		<0.02	
Arsenic as As	ICPMSW (Dissolved)	0.001	mg/l	U	<0.001		<0.001		<0.001	
Cadmium as Cd	ICPMSW (Dissolved)	0.00002	mg/l	U	<0.00002		<0.00002		<0.00002	
Total Chromium as Cr	ICPMSW (Dissolved)	0.001	mg/l	U	<0.001		<0.001		<0.001	
Copper as Cu	ICPMSW (Dissolved)	0.001	mg/l	U	0.001		<0.001		<0.001	
Lead as Pb	ICPMSW (Dissolved)	0.001	mg/l	U	<0.001		<0.001		<0.001	
Mercury as Hg	ICPMSW (Dissolved)	0.00003	mg/l	U	<0.00003		<0.00003		<0.00003	
Nickel as Ni	ICPMSW (Dissolved)	0.001	mg/l	U	<0.001		<0.001		<0.001	
Selenium as Se	ICPMSW (Dissolved)	0.001	mg/l	U	<0.001		<0.001		<0.001	
Vanadium as V	ICPMSW (Dissolved)	0.001	mg/l	U	<0.001		0.002		<0.001	
Zinc as Zn	ICPMSW (Dissolved)	0.002	mg/l	U	<0.002		0.004		<0.002	
Barium as Ba	ICPWATVAR (Dissolved)	0.01	mg/l	U	<0.01		<0.01		<0.01	
Beryllium as Be	ICPWATVAR (Dissolved)	0.01	mg/l	N	<0.01		<0.01		<0.01	
Boron as B	ICPWATVAR (Dissolved)	0.01	mg/l	U	<0.01		<0.01		<0.01	
Benzene	BTEXHSA	5	µg/l	N	<5		<5		<5	
Ethylbenzene	BTEXHSA	5	µg/l	N	<5		<5		<5	
m/p-Xylene	BTEXHSA	10	µg/l	N	<10		<10		<10	
o-Xylene	BTEXHSA	5	µg/l	N	<5		<5		<5	

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Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

Analysis Results

				Project ID	20071478	
				Sample ID	005	
				Customer ID	XC201-TP04-5-ES-1.00	
				Sample Type	SOLID	
				Sampling Date	03/07/2020	
Analysis	Method Code	MDL	Units	Accred		
>C6-C8 Aliphatic	GROHSA/BTEXHSA	0.1	mg/l	N		
>C7-C8 Aromatic	GROHSA/BTEXHSA	0.005	mg/l	N		
>C8-C10 Aliphatic	GROHSA/BTEXHSA	0.1	mg/l	N		
>C8-C10 Aromatic	GROHSA/BTEXHSA	0.02	mg/l	N		
C5-C6 Aliphatic	GROHSA/BTEXHSA	0.1	mg/l	N		
C5-C7 Aromatic	GROHSA/BTEXHSA	0.005	mg/l	N		
Total GRO	GROHSA/BTEXHSA	0.1	mg/l	U		
Free Cyanide	SFAPI	0.02	mg/l	U		
Arsenic as As	ICPMSW (Dissolved)	0.001	mg/l	U		
Cadmium as Cd	ICPMSW (Dissolved)	0.00002	mg/l	U		
Total Chromium as Cr	ICPMSW (Dissolved)	0.001	mg/l	U		
Copper as Cu	ICPMSW (Dissolved)	0.001	mg/l	U		
Lead as Pb	ICPMSW (Dissolved)	0.001	mg/l	U		
Mercury as Hg	ICPMSW (Dissolved)	0.00003	mg/l	U		
Nickel as Ni	ICPMSW (Dissolved)	0.001	mg/l	U		
Selenium as Se	ICPMSW (Dissolved)	0.001	mg/l	U		
Vanadium as V	ICPMSW (Dissolved)	0.001	mg/l	U		
Zinc as Zn	ICPMSW (Dissolved)	0.002	mg/l	U		
Barium as Ba	ICPWATVAR (Dissolved)	0.01	mg/l	U		
Beryllium as Be	ICPWATVAR (Dissolved)	0.01	mg/l	N		
Boron as B	ICPWATVAR (Dissolved)	0.01	mg/l	U		
Benzene	BTEXHSA	5	µg/l	N		
Ethylbenzene	BTEXHSA	5	µg/l	N		
m/p-Xylene	BTEXHSA	10	µg/l	N		
o-Xylene	BTEXHSA	5	µg/l	N		

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SOCOTEC

Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

Analysis Results

					Project ID	20071478				
					Sample ID	001		003		005
					Customer ID	XC201-TP04-1-ES-0.05-0.05		XC201-TP04-2-ES-0.50-0.50		XC201-TP04-5-ES-1.00
					Sample Type	LPL	SOLID	LPL	SOLID	LPL
					Sampling Date	03/07/2020	03/07/2020	03/07/2020	03/07/2020	03/07/2020
Analysis	Method Code	MDL	Units	Accred						
Toluene	BTEXHSA	5	µg/l	N		<5		<5		<5
Acenaphthene	PAHMSW	0.01	µg/l	U		0.06		0.12		<0.02
Acenaphthylene	PAHMSW	0.01	µg/l	U		<0.02		<0.02		<0.02
Anthracene	PAHMSW	0.01	µg/l	U		<0.02		<0.02		<0.02
Benzo[a]anthracene	PAHMSW	0.01	µg/l	U		0.08		<0.02		<0.02
Benzo[a]pyrene	PAHMSW	0.01	µg/l	U		<0.02		<0.02		<0.02
Benzo[b]fluoranthene	PAHMSW	0.01	µg/l	U		<0.02		<0.02		<0.02
Benzo[g,h,i]perylene	PAHMSW	0.01	µg/l	U		<0.02		<0.02		<0.02
Benzo[k]fluoranthene	PAHMSW	0.01	µg/l	U		<0.02		<0.02		<0.02
Chrysene	PAHMSW	0.01	µg/l	U		<0.02		<0.02		<0.02
Dibenzo[a,h]anthracene	PAHMSW	0.01	µg/l	U		<0.02		<0.02		<0.02
Fluoranthene	PAHMSW	0.01	µg/l	U		0.19		<0.02		<0.02
Fluorene	PAHMSW	0.01	µg/l	U		0.04		0.06		<0.02
Indeno[1,2,3-cd]pyrene	PAHMSW	0.01	µg/l	U		<0.02*		<0.02*		<0.02*
Naphthalene	PAHMSW	0.01	µg/l	U		0.28		0.21		0.17
Phenanthrene	PAHMSW	0.01	µg/l	U		0.18		0.04		<0.02
Pyrene	PAHMSW	0.01	µg/l	U		0.29		0.02		<0.02
Total PAH 16	PAHMSW	0.16	µg/l	U		<1.25		<0.62		<0.42
>C10-C12 (Aliphatic)	TPHFID (Aliphatic)	0.01	mg/l	U		16.5		2.06		0.44
>C12-C16 (Aliphatic)	TPHFID (Aliphatic)	0.01	mg/l	U		<0.01		<0.02		<0.02
>C16-C21 (Aliphatic)	TPHFID (Aliphatic)	0.01	mg/l	U		5.21		0.64		0.14
>C21-C35 (Aliphatic)	TPHFID (Aliphatic)	0.01	mg/l	U		4.31		0.62		0.14
>C35-C44 (Aliphatic)	TPHFID (Aliphatic)	0.01	mg/l	N		0.04		0.11		<0.02
Total TPH (Aliphatic)	TPHFID (Aliphatic)	0.01	mg/l	U		<0.01		0.11		<0.02
>C10-C12 (Aromatic)	TPHFID (Aromatic)	0.01	mg/l	U		0.02		<0.02		<0.02

UKAS TESTING
1252

Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

Analysis Results

					Project ID	20071478
					Sample ID	005
					Customer ID	XC201-TP04-5-ES-1.00
					Sample Type	SOLID
					Sampling Date	03/07/2020
Analysis	Method Code	MDL	Units	Accred		
Toluene	BTEXHSA	5	µg/l	N		
Acenaphthene	PAHMSW	0.01	µg/l	U		
Acenaphthylene	PAHMSW	0.01	µg/l	U		
Anthracene	PAHMSW	0.01	µg/l	U		
Benzo[a]anthracene	PAHMSW	0.01	µg/l	U		
Benzo[a]pyrene	PAHMSW	0.01	µg/l	U		
Benzo[b]fluoranthene	PAHMSW	0.01	µg/l	U		
Benzo[g,h,i]perylene	PAHMSW	0.01	µg/l	U		
Benzo[k]fluoranthene	PAHMSW	0.01	µg/l	U		
Chrysene	PAHMSW	0.01	µg/l	U		
Dibenzo[a,h]anthracene	PAHMSW	0.01	µg/l	U		
Fluoranthene	PAHMSW	0.01	µg/l	U		
Fluorene	PAHMSW	0.01	µg/l	U		
Indeno[1,2,3-cd]pyrene	PAHMSW	0.01	µg/l	U		
Naphthalene	PAHMSW	0.01	µg/l	U		
Phenanthrene	PAHMSW	0.01	µg/l	U		
Pyrene	PAHMSW	0.01	µg/l	U		
Total PAH 16	PAHMSW	0.16	µg/l	U		
>C10-C12 (Aliphatic)	TPHFID (Aliphatic)	0.01	mg/l	U		
>C12-C16 (Aliphatic)	TPHFID (Aliphatic)	0.01	mg/l	U		
>C16-C21 (Aliphatic)	TPHFID (Aliphatic)	0.01	mg/l	U		
>C21-C35 (Aliphatic)	TPHFID (Aliphatic)	0.01	mg/l	U		
>C35-C44 (Aliphatic)	TPHFID (Aliphatic)	0.01	mg/l	N		
Total TPH (Aliphatic)	TPHFID (Aliphatic)	0.01	mg/l	U		
>C10-C12 (Aromatic)	TPHFID (Aromatic)	0.01	mg/l	U		

UKAS TESTING
1252

SOCOTEC

Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

Analysis Results

				Project ID	20071478					
				Sample ID	001		003		005	
				Customer ID	XC201-TP04-1-ES-0.05-0.05		XC201-TP04-2-ES-0.50-0.50		XC201-TP04-5-ES-1.00	
				Sample Type	LPL	SOLID	LPL	SOLID	LPL	
				Sampling Date	03/07/2020	03/07/2020	03/07/2020	03/07/2020	03/07/2020	
Analysis	Method Code	MDL	Units	Accred						
>C12-C16 (Aromatic)	TPHFID (Aromatic)	0.01	mg/l	U	<0.01		<0.02		<0.02	
>C16-C21 (Aromatic)	TPHFID (Aromatic)	0.01	mg/l	U	0.03		<0.02		<0.02	
>C21-C35 (Aromatic)	TPHFID (Aromatic)	0.01	mg/l	U	4.20		0.55		0.14	
>C35-C44 (Aromatic)	TPHFID (Aromatic)	0.01	mg/l	N	0.18		<0.02		<0.02	
Total TPH (Aromatic)	TPHFID (Aromatic)	0.01	mg/l	U	4.29		0.56		0.16	
Benzene	VOCHSAW	1	µg/l	N	<1		<1		<1	
Ethylbenzene	VOCHSAW	1	µg/l	N	<1		<1		<1	
m and p-Xylene	VOCHSAW	1	µg/l	N	<1		<1		<1	
MTBE	VOCHSAW	1	µg/l	N	<1		<1		<1	
o-Xylene	VOCHSAW	1	µg/l	N	<1		<1		<1	
Toluene	VOCHSAW	1	µg/l	N	<1		<1		<1	
Equivalent Weight of Dry Material (kg)	Leachate Preparation CEN 10:1		kg	N		0.090		0.090		
Fraction above 4mm (%)	Leachate Preparation CEN 10:1		%	N		0		0		
Fraction of non-crushable material (%)	Leachate Preparation CEN 10:1		%	N		0		0		
Volume of Water for 10:1 Leach (ltr)	Leachate Preparation CEN 10:1		l	N		0.865		0.893		
Weight of Sample Leached (kg)	Leachate Preparation CEN 10:1		kg	N		0.125		0.097		

UKAS TESTING 1252

Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

Analysis Results

					Project ID	20071478
					Sample ID	005
					Customer ID	XC201-TP04-5-ES-1.00
					Sample Type	SOLID
					Sampling Date	03/07/2020
Analysis	Method Code	MDL	Units	Accred		
>C12-C16 (Aromatic)	TPHFID (Aromatic)	0.01	mg/l	U		
>C16-C21 (Aromatic)	TPHFID (Aromatic)	0.01	mg/l	U		
>C21-C35 (Aromatic)	TPHFID (Aromatic)	0.01	mg/l	U		
>C35-C44 (Aromatic)	TPHFID (Aromatic)	0.01	mg/l	N		
Total TPH (Aromatic)	TPHFID (Aromatic)	0.01	mg/l	U		
Benzene	VOCHSAW	1	µg/l	N		
Ethylbenzene	VOCHSAW	1	µg/l	N		
m and p-Xylene	VOCHSAW	1	µg/l	N		
MTBE	VOCHSAW	1	µg/l	N		
o-Xylene	VOCHSAW	1	µg/l	N		
Toluene	VOCHSAW	1	µg/l	N		
Equivalent Weight of Dry Material (kg)	Leachate Preparation CEN 10:1		kg	N	0.090	
Fraction above 4mm (%)	Leachate Preparation CEN 10:1		%	N	30.2	
Fraction of non-crushable material (%)	Leachate Preparation CEN 10:1		%	N	0	
Volume of Water for 10:1 Leach (ltr)	Leachate Preparation CEN 10:1		l	N	0.891	
Weight of Sample Leached (kg)	Leachate Preparation CEN 10:1		kg	N	0.099	

UKAS TESTING
1252

Report Number :

Additional Report Notes

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

LIMS-F002 - Report Notes

Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

Deviating Sample Report

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

Analysis Method

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

Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

Additional Information

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

Results within this report relate only to the samples tested.

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

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

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

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

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

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

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

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

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

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

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

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

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

End of Certificate of Analysis

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

Final Report

Report No.:	20-15813-1
Initial Date of Issue:	29-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 Samples

Quotation No.:	Q20-19728	**Date Received:**	23-Jun-2020
Order No.:	7362	**Date Instructed:**	23-Jun-2020
No. of Samples:	2		
Turnaround (Wkdays):	5	**Results Due:**	29-Jun-2020
Date Approved:	29-Jun-2020		

Approved By:



Details: Glynn Harvey, Technical Manager

Chemtest
The right chemistry to deliver results

Results - Leachate

Project: Soil Samples

Client: Environmental Laboratory Services Ltd				**Chemtest Job No.:**		20-15813	20-15813
Quotation No.: Q20-19728				**Chemtest Sample ID.:**		1020856	1020857
Order No.: 7362				Client Sample Ref.:		182328/001	182328/002
				Client Sample ID.:		1	2
				Sample Type:		SOIL	SOIL
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**		
pH	U	1010	10:1		N/A	8.8	8.7
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	7.3
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	1.9	< 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	2.3	1.9
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	< 1.0	< 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

Results - Leachate

Project: Soil Samples

Client: Environmental Laboratory Services Ltd				**Chemtest Job No.:**		20-15813	20-15813
Quotation No.: Q20-19728				**Chemtest Sample ID.:**		1020856	1020857
Order No.: 7362				Client Sample Ref.:		182328/001	182328/002
				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:
1020856	182328/001	1			A	Amber Glass 250ml
1020856	182328/001	1			A	Plastic Tub 500g
1020857	182328/002	2			A	Amber Glass 250ml
1020857	182328/002	2			A	Plastic Tub 500g

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

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 I Pre & Post Site Condition Photographs









obgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	XC201 - Southside Pre Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020









Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	XC201 - Southside
	Pre Works Site Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: 2020









ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	XC201 - Southside Pre Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020









ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	XC201 - Southside Pre Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020









ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	XC201 - Northside Pre Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020









oc bgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	XC201 - Northside Pre Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020









ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	XC201 - Northside Pre Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020







ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	XC201 - Northside Pre Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020









Iarnród Éireann

Cork Line Level Crossings

XC201 (19-135-1)

XC201

Post Works Site Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: 2020









Iarnród Éireann

Cork Line Level Crossings

XC201 (19-135-1)

XC201

Post Works Site Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: 2020









Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	XC201 Post Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020









Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	XC201
	Post Works Site Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: 2020









	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	XC201 Post Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020









ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	XC201 Post Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020









	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	XC201 Post Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020









oc bgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	XC201 Post Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020









ocbgeo	Iarnród Éireann Cork Line Level Crossings XC201 (19-135-1)	XC201 Post Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020



Iarnród Éireann

Cork Line Level Crossings

XC201 (19-135-1)

XC201

Post Works Site Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: 2020

Cork Line Level Crossings – XC211
Ground Investigation

Primary Author:	Ian Holley
Client:	Irish Rail
Client's Representative:	JACOBS
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Document Control Sheet

Report No.:	OCB19-135-2
Project title:	Cork Line Level Crossings – XC211
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 – XC211

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 XC211 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 sampling, in-situ and laboratory testing, 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 XC211 is located in the Farran townland, 4.9km southeast of Charleville, Co. Cork. An unnamed road crosses the Dublin-Cork railway line approximately 200m east of the N20. The level crossing is currently manned with a house and cabin located adjacent to the east of the railway line. The site is surrounded by agricultural land with a number of residential homes and farms in the area.

The site is relatively flat throughout. The main works areas are within agricultural fields, some may be marshy depending on weather conditions.

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 20th February 2020 and 6th August 2020, included:

- Two (2) Cable Percussion Boreholes
- A Standpipe Installation in one (1) Borehole
- Three (3) Trial Pits
- Indirect CBR tests at six (6) locations
- Water Purging in one (1) location1

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 Cable Percussion Boreholes

Two boreholes (CP01 & CP02) were put down to completion in minimum 200mm diameter using a Pilcon cable percussion soil boring rig. All boreholes were terminated either at their scheduled completion depths, on instruction from a Jacobs engineer or else 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.

4.2 Standpipe Installations

A groundwater monitoring standpipe was installed in borehole CP02.

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

Three trial pits (TP01–TP03) were excavated using a 15t tracked excavator fitted with a 600mm wide bucket, to depths between 3.40m and 4.50m. The trial pits were all terminated upon encountering obstructions or upon the pit walls collapsing.

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

4.4 Indirect CBR Tests

An indirect CBR test was conducted at six locations (TRL01 – TRL06) 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 E 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):

Log CBR = 2.48-1.057 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 the standpipe (in CP02) water purging was carried out.

Appendix F 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 I.

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.
- **compaction:** dry density/moisture content relationship.
- **soil chemistry:** pH, Sulphur content, Organic Matter 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 G.

5.2 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 H.

6 GROUND CONDITIONS

6.1 General Geology of the Area

Teagasc soil mapping indicates that the site area is underlain by Glaciofluvial Sands and Gravels, but Glacial Till derived chiefly from Devonian sandstones also occurs in the surrounding area.

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 strata of the Ballysteen Formation, which consists of dark grey irregularly bedded and nodular bedded argillaceous (muddy) bioclastic limestones (wackestones and packstones) interbedded with fossiliferous calcareous shales.

The Lower Carboniferous strata were subjected to compressional deformation (tectonic shortening) during the Variscan Orogeny in Late Carboniferous and Early Permian times, resulting in the formation of an east-northeast west-southwest trending fold-thrust belt. The site is located on the northwest side of the Ballyhoura Mountains between a west-southwest to east-northeast orientated anticline (upfold) axis to the south and a similarly orientated major thrust fault zone to the north. Bedrock in the site vicinity likely dips at variable angles to the north and south, having undergone asymmetric buckle folding and contractional thrust faulting.

According to GSI groundwater database, the Ballysteen Formation is a locally important bedrock aquifer, which is moderately productive only in local zones. The site vicinity has a high groundwater vulnerability index. Karst features such as enlarged fissures, cavities and depressions occur locally in areas of northern County Cork underlain by the Ballysteen Formation.

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 200mm to 250mm thickness.
- Glacial Till: Sandy gravelly silty clay, frequently low cobble content, typically soft to firm in upper horizons, becoming stiff with increasing depth.
- Bedrock: No evidence of bedrock encountered to a maximum depth of 12.00m bgl in CP02.

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.

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

Date	Depth to standing water level (m)
	CP02
13/08/20	4.15
17/08/20	3.84
21/08/20	0.01
29/09/20	2.19

Continued monitoring of the installed standpipe 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.

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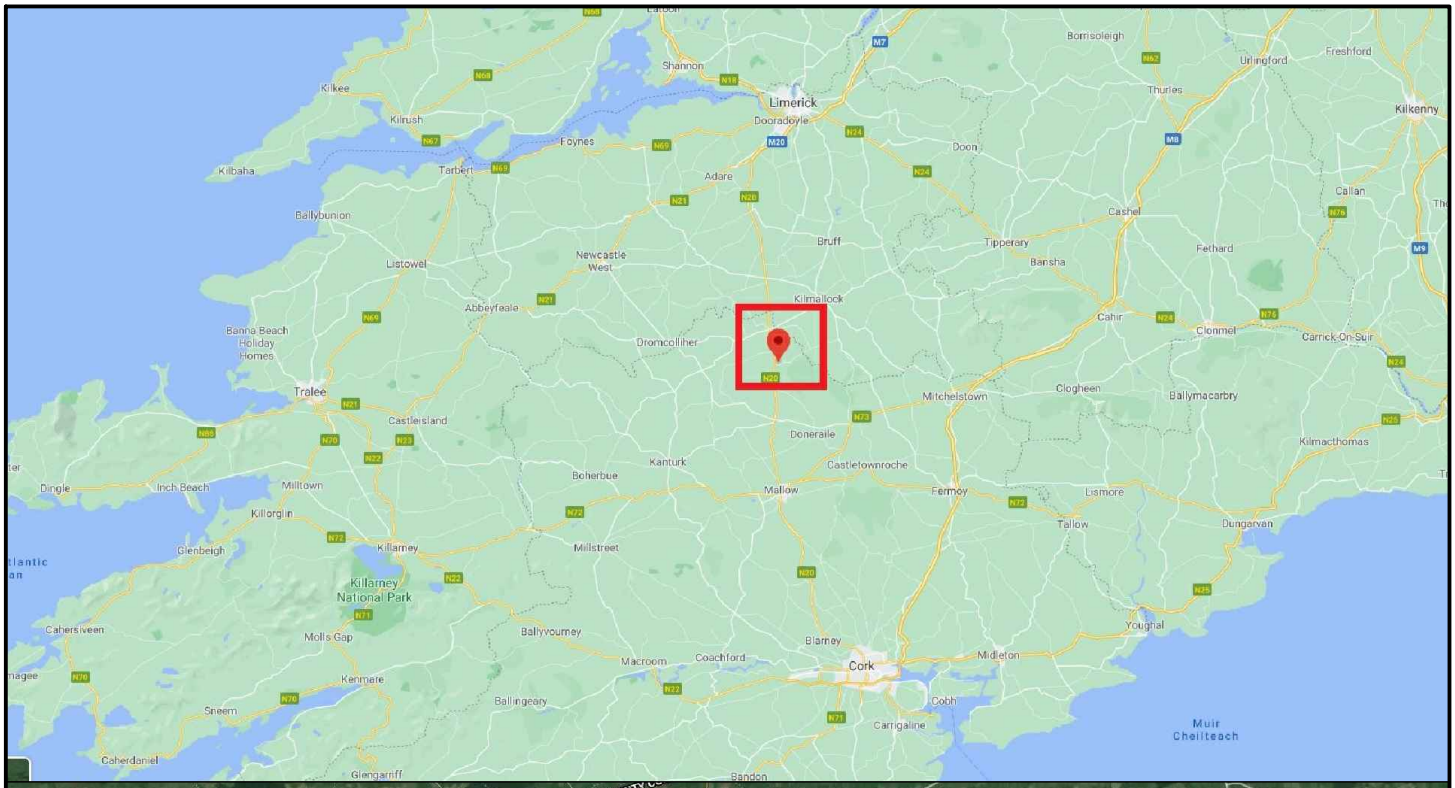
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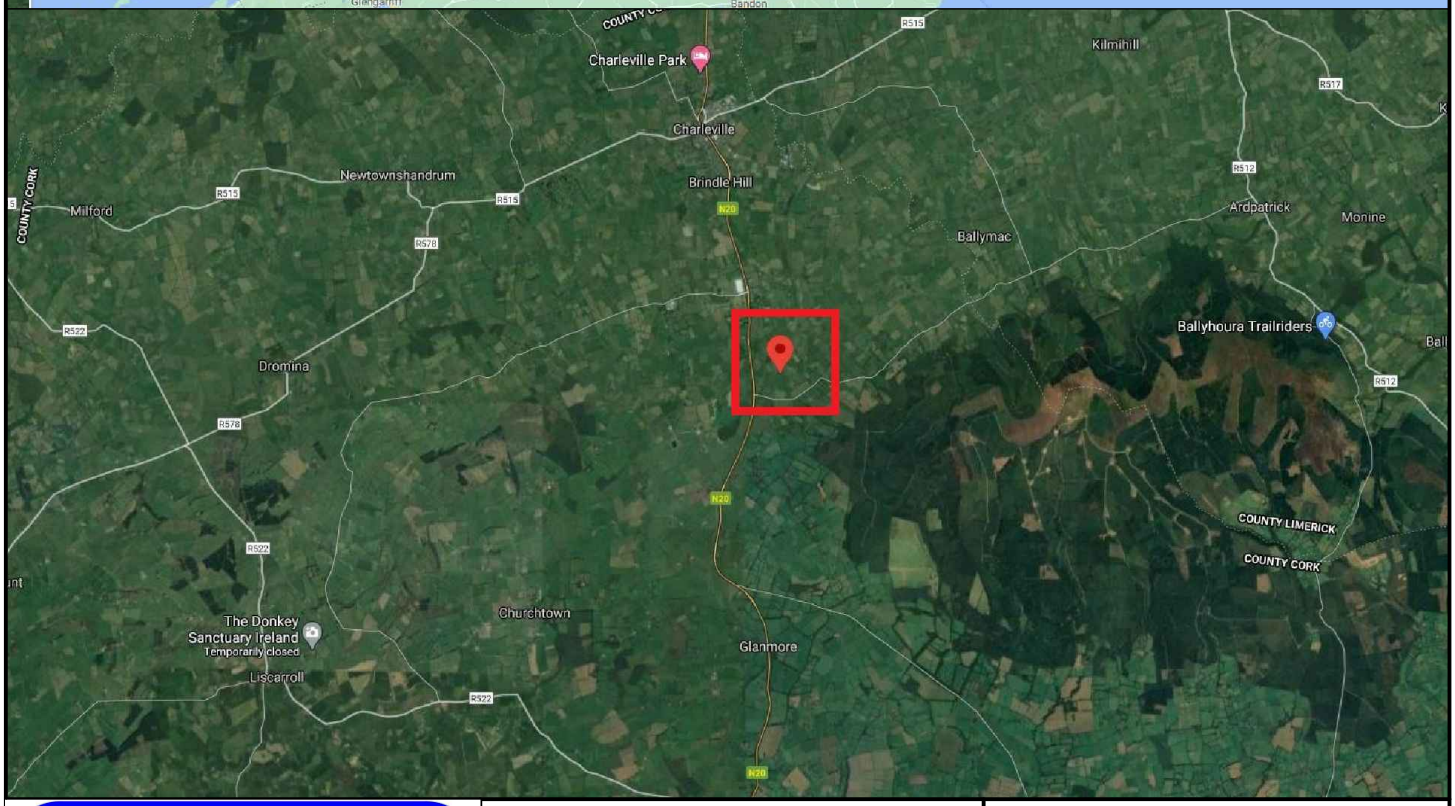
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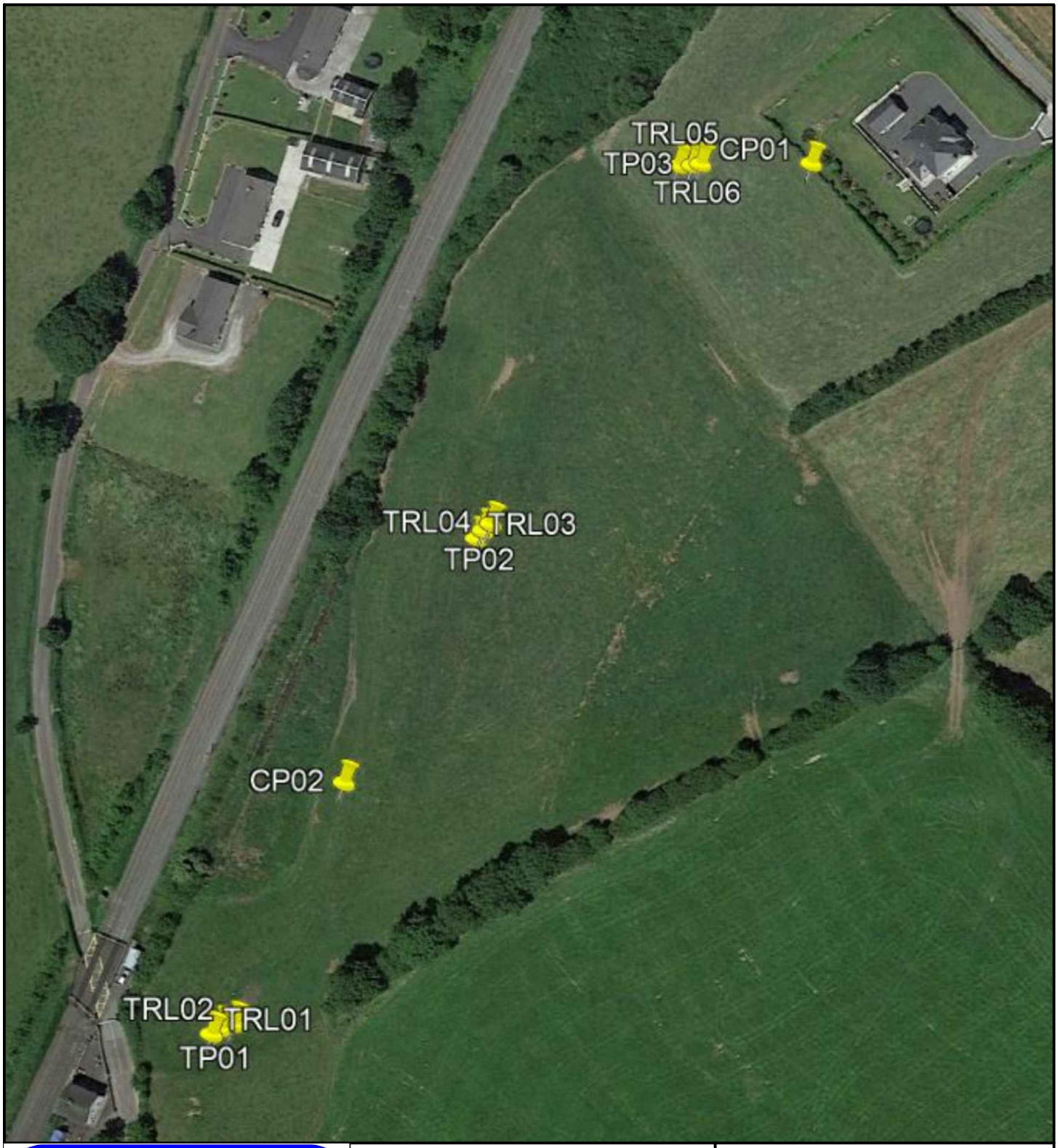
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Appendix A Site and Exploratory Hole Location Plans





oc bgeo	Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	SITE LOCATION MAPS Client: Iarnród Éireann Engineer: Jacob's Date: February/June 2020



Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	Exploratory Hole Locations
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February/June 2020

Appendix B Borehole Logs

Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC211-CP01
Coordinates: 554970.41 E 618184.23 N	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 2
Method: Cable Percussion	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon	**Ground Level:** 112.14 mOD	**Dates:** 18/06/2020 - 22/06/2020	**Driller:** IOD / **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					(0.30)		TOPSOIL		
0.30 - 0.70	B2				111.84	0.30		Brown slightly gravelly slightly sandy clayey SILT with many rootlets. Gravel is fine to coarse, subangular to subrounded. Sand is fine to coarse.		
0.30 - 0.70	D3					(0.40)				
0.50	ES4									
0.70 - 1.90	B5				111.44	0.70		Soft brown slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded.		
0.70 - 1.90	D6									
1.20 - 1.65	SPT (C) N=5			N=5 (1,1/1,1,2,1)		(1.20)				
1.50	ES7									
1.90 - 2.50	B8				110.24	1.90		Brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subrounded.		
1.90 - 2.50	D9									
2.00 - 2.06	SPT (C)			50 (50 for 60mm/50 for 0mm)		(0.60)				
2.50 - 3.50	B10				109.64	2.50		Stiff light brown slightly silty slightly gravelly sandy CLAY with medium cobble content. Gravel is fine to coarse, subangular to subrounded. Sand is fine to coarse. Cobbles are subrounded.		
2.50 - 3.50	D11									
3.00	ES12									
3.00 - 3.45	SPT (C) N=25			N=25 (2,6/5,7,8,5)		(1.50)				
3.50 - 4.50	B13									
3.50 - 4.50	D14									
4.00 - 4.45	SPT (C) N=8			N=8 (0,0/1,2,1,4)	108.14	4.00		Firm light brown slightly silty slightly gravelly sandy CLAY with medium cobble content. Gravel is fine to coarse, subangular to subrounded. Sand is fine to coarse. Cobbles are subrounded.		
						(0.50)				
4.50 - 5.50	B15				107.64	4.50		Soft light brown slightly gravelly slightly sandy CLAY with medium cobble and low small boulder content. Gravel is fine to coarse, subangular to subrounded. Sand is fine to coarse. Cobbles and boulders are subrounded.		
4.50 - 5.50	D16									
5.00 - 5.45	SPT (C) N=6			N=6 (0,1/1,2,1,2)		(1.00)				
5.50 - 6.50	B17				106.64	5.50		Firm to Stiff light brownish grey slightly silty slightly sandy very gravelly CLAY with low to medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles are subangular to subrounded.		
5.50 - 6.50	D18									
6.00 - 6.45	SPT (C) N=14			N=14 (2,2/3,5,3,3)		(1.70)				
6.50 - 7.20	B19									
6.50 - 7.20	D20									
7.00 - 7.45	SPT (C) N=17			N=17 (3,2/4,5,4,4)						
7.20 - 8.00	B21				104.94	7.20		Stiff light brownish grey slightly silty gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded.		
7.20 - 8.00	D22					(0.80)				
8.00 - 9.00	B23				104.14	8.00		Stiff dark grey slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles are subangular to subrounded.		
8.00 - 9.00	D24									
8.00 - 8.45	SPT (C) N=22			N=22 (4,4/6,5,6,5)						
8.50 - 9.50	U25									
9.00 - 10.00	B26					(2.00)				
9.00 - 10.00	D27									
9.00 - 9.45	SPT (C) N=20			N=20 (5,5/6,5,4,5)						
						10.00				

Continued on Next Page

Remarks

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
5.60	7.20	5.60		20	5.30

Casing Details		Chiselling Details		
To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)
10.00	200	1.90	2.20	00:30

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC211-CP01
	Coordinates: 554970.41 E 618184.23 N	**Client:** Iarnród Éireann / Irish Rail	Sheet 2 of 2
Method: Cable Percussion		**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon	**Ground Level:** 112.14 mOD	**Dates:** 18/06/2020 - 22/06/2020	**Driller:** IOD
			Logger: IH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
10.00 - 10.45	SPT (C) N=23			N=23 (7,6/5,6,6,6)	102.14			End of borehole at 10.000m		

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)
5.60	7.20

Water Strike - General			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
5.60		20	5.30

Casing Details	
To (m)	Diam (mm)
10.00	200

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
1.90	2.20	00:30

Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC211-CP02
Coordinates: 554848.35 E 618025.20 N	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 2
Method: Cable Percussion	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon	**Ground Level:** 98.28 mOD	**Dates:** 12/06/2020 - 17/06/2020	**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					(0.30)		TOPSOIL		
0.30 - 1.20	B2				97.98	0.30				
0.30 - 1.20	D3							Reddish brown slightly gravelly slightly sandy CLAY with medium cobble content and occasional rootlets. Gravel is fine to coarse, subangular to subrounded. Sand is fine to coarse. Cobbles are subrounded.		
0.50	ES4					(0.90)				
1.20 - 2.00	B5				97.08	1.20				
1.20 - 2.00	D6							Firm reddish brown slightly sandy slightly gravelly CLAY with medium cobble content and low small boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles and boulders are subangular to subrounded.		
1.20 - 1.65	SPT (C) N=15			N=15 (2,2/5,3,4,3)		(0.80)				
1.50	ES7									
2.00 - 3.00	B8				96.28	2.00				
2.00 - 3.00	D9							Firm light brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles are subrounded.		
2.00 - 2.45	SPT (C) N=8			N=8 (1,2/1,3,2,2)						
3.00	ES10					(2.00)				
3.00 - 4.00	B11									
3.00 - 4.00	D12									
3.00 - 3.45	SPT (C) N=14			N=14 (2,4/4,3,4,3)						
4.00 - 5.00	B13				94.28	4.00				
4.00 - 5.00	D14							Stiff brown slightly silty slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles are subangular to subrounded.		
4.00 - 4.45	SPT (C) N=17			N=17 (4,5/4,4,4,5)		(1.00)				
5.00 - 6.00	B15				93.28	5.00				
5.00 - 6.00	D16							Very Stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded.		
5.00 - 5.45	SPT (C) N=30			N=30 (5,7/7,9,7,7)						
6.00 - 7.00	B17					(2.00)				
6.00 - 7.00	D18									
6.00 - 6.45	SPT (C) N=32			N=32 (7,7/8,9,8,7)						
7.00 - 8.00	B20				91.28	7.00				
7.00 - 8.00	D21							Firm to Stiff light brown slightly silty sandy gravelly to very gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles are subangular to subrounded.		
7.00 - 7.45	SPT (C) N=11			N=11 (3,3/2,3,3,3)						
7.50	U19									
8.00 - 9.00	B22					(2.00)				
8.00 - 9.00	D23									
8.00 - 8.45	SPT (C) N=16			N=16 (3,4/3,5,4,4)						
9.00 - 10.00	B24				89.28	9.00				
9.00 - 10.00	D25							Firm light brown slightly silty slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded.		
9.00 - 9.45	SPT (C) N=9			N=9 (2,3/2,2,2,3)		(1.00)				
~~10.00 - 11.00~~	~~B26~~				~~88.28~~	~~10.00~~				

Continued on Next Page

Remarks

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)
12.00	200			

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC211-CP02
	Coordinates: 554848.35 E 618025.20 N	**Client:** Iarnród Éireann / Irish Rail	Sheet 2 of 2
Method: Cable Percussion		**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon	**Ground Level:** 98.28 mOD	**Dates:** 12/06/2020 - 17/06/2020	**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
10.00 - 11.00	D27							Firm light brown slightly gravelly slightly sandy CLAY with many fibrous rootlets and an organic odour. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded.		
10.00 - 10.45	SPT (C) N=13			N=13 (3,2/4,3,3,3)						
10.50	U30					(1.00)				
11.00 - 12.00	B28				87.28	11.00		Stiff brown slightly silty slightly sandy very gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular.		
11.00 - 12.00	D29									
11.00 - 11.45	SPT (C) N=18			N=18 (4,6/4,4,5,5)						
11.50	U31					(1.00)				
12.00 - 12.45	SPT (C) N=19			N=19 (5,6/7,4,4,4)	86.28	12.00		End of borehole at 12.000m		

Remarks

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)
12.00	200			

Appendix C Trial Pit Logs

Project No.: 19-135	**Project Name:** Cork Line Level Crossings		**Trial Pit No.:** XC211-TP01
Co-ordinates: 554816.90 E 617963.85 N	**Client:** Iarnród Éireann / Irish Rail		Sheet 1 of 1
Method: Excavation	**Client's Representative:** JACOBS		**Scale:** 1:20
Plant: Kobelco SK140SRu	**Ground Level:** 97.98 mOD	**Date:** 20/02/2020	**Driver:** TS / **Logger:** MN

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1			(0.30)		TOPSOIL: Soft dark brown slightly sandy silty CLAY with a trace of gravel and frequent rootlets, moist.	
			97.68	0.30			
0.40 - 0.90	B2					Soft light brown becoming beige, slightly sandy slightly gravelly silty CLAY with low cobble content and occasional rootlets, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles are angular to subangular, sandstone and siltstone.	
0.40 - 0.90	D3						
0.50	ES4						
0.55		HVP=45, HVR=17		(0.70)		*Strata becomes firm by 0.5m and is more orange in colour.*	
1.00	ES5		96.98	1.00			
1.00 - 1.50	B6		96.93	1.05		Firm dark brown organic silty CLAY with partially decayed vegetation, moist.	
1.00 - 1.50	D7					Firm light grey slightly gravelly slightly sandy, locally sandy, silty CLAY with occasional dark brown partially decayed vegetation fragments, moist.	
1.10		HVP=63, HVR=22		(1.45)			
2.50 - 3.00	B8		95.48	2.50		Soft to firm grey slightly gravelly sandy silty CLAY with occasional brown mottling, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular.	
2.50 - 3.00	D9			(0.50)			
3.00	ES12		94.98	3.00		Light grey becoming yellowish brown gravelly SAND, wet.	▼
3.00 - 3.40	B10						
3.00 - 3.40	D11						
		Rapid inflow - No rise		(0.40)			
			94.58	3.40		End of trial pit at 3.400m	

Remarks

Trial Pit terminated at 3.40m due to pit walls collapsing.

Water Strikes:

Struck at (m):	Remarks:
3.00	Rapid inflow - No rise

Stability: Sides collapsing

Width: 2.00

Length: 4.60

Project No.: 19-135	**Project Name:** Cork Line Level Crossings		**Trial Pit No.:** XC211-TP02
Co-ordinates: 554884.22 E 618089.43 N	**Client:** Iarnród Éireann / Irish Rail		Sheet 1 of 1
Method: Excavation	**Client's Representative:** JACOBS		**Scale:** 1:20
Plant: Kobelco SK140SRu	**Ground Level:** 101.48 mOD	**Date:** 20/02/2020	**Driver:** TS **Logger:** MN

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1			(0.25)		TOPSOIL: Soft dark brown slightly sandy silty CLAY with frequent rootlets, moist. One red brick fragment.	
0.30 - 0.80	B2		101.23	0.25		Firm light brown slightly sandy silty CLAY with occasional gravel and cobbles, occasional rootlets, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles are angular to subangular, sandstone and limestone.	
0.30 - 0.80	D3						
0.50	ES4						
0.50		HVP=47, HVR=20		(0.85)			
1.00	ES5						
			100.38	1.10		Firm becoming stiff brown slightly sandy slightly gravelly silty CLAY with low cobble and boulder content, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles and boulders are angular to subangular predominantly limestone with occasional sandstone.	
1.60 - 2.10	B6						
1.60 - 2.10	D7			(1.60)			
2.70 - 3.20	B8		98.78	2.70		Very stiff light brown to brown slightly sandy gravelly silty CLAY with medium cobble and boulder content, slightly moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles and boulders are angular to subangular, predominantly limestone.	
2.70 - 3.20	D9						
3.00	ES10			(0.60)			
			98.18	(0.80)		Refusal on limestone BOULDERS.	
			98.18			End of trial pit at 3.300m	

Remarks

Trial Pit terminated at 3.30m due to Limestone Boulder obstructions.

Water Strikes:

Struck at (m):	Remarks:
	None Encountered

Stability: Slight spalling

Width: 1.80

Length: 3.50

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Trial Pit No.:** XC211-TP03
	Co-ordinates: 554939.53 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 2
Method: Excavation	618184.48 N	**Client's Representative:** JACOBS	**Scale:** 1:20
			Driver: TS
Plant: Kobelco SK140SRu	**Ground Level:** 111.99 mOD	**Date:** 20/02/2020	**Logger:** MN

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1			(0.25)		TOPSOIL: Soft dark brown slightly sandy slightly gravelly silty CLAY wit frequent rootlets, moist.	
			111.74	0.25			
0.30 - 0.80	B2					Firm light brown slightly sandy slightly gravelly silty CLAY with low cobble and boulder content and occasional rootlets, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles and boulders are angular to subrounded, limestone.	
0.30 - 0.80	D3						
0.50	ES4			(0.55)			
0.50		HVP=44, HVR=21					
			111.19	0.80		Stiff light brown slightly sandy gravelly silty CLAY with low cobble and boulder content and occasional rootlets, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles and boulders are angular to subrounded, limestone.	
1.00	ES5			(0.30)			
		Trickling flow from gravel strata - No rise.	110.89	1.10		Light brown slightly clayey slightly silty very sandy GRAVEL with low cobble content, wet.	
				(0.20)			
1.30 - 1.80	B6		110.69	1.30		Stiff becoming very stiff light brown slightly sandy gravelly silty CLAY with low to medium cobble content, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles and boulders are subangular to subrounded, limestone.	
1.30 - 1.80	D7						
2.50 - 3.00	B8						
2.50 - 3.00	D9						
				(3.20)			
3.00	ES10						
3.70 - 4.20	B11						
3.70 - 4.20	D12						

Continued on Next Page

Remarks

Trial Pit terminated at 4.50m due to pit walls spalling inwards.

Water Strikes:

Struck at (m):	Remarks:
1.10	Trickling flow from gravel strata - No rise.

Stability: Sides spalling

Width: 4.40

Length: 2.00

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Trial Pit No.:** XC211-TP03
	Co-ordinates: 554939.53 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 2 of 2
Method: Excavation	618184.48 N	**Client's Representative:** JACOBS	**Scale:** 1:20
Plant: Kobelco SK140SRu	**Ground Level:** 111.99 mOD	**Date:** 20/02/2020	**Driver:** TS
			Logger: MN

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
			107.49	4.50		End of trial pit at 4.500m	

4.5
5.0
5.5
6.0
6.5
7.0
7.5

Remarks

Trial Pit terminated at 4.50m due to pit walls spalling inwards.

Water Strikes:

Struck at (m):	Remarks:
1.10	Trickling flow from gravel strata - No rise.

Stability: Sides spalling

Width: 4.40

Length: 2.00

Appendix D Trial Pit Photographs



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	T.PIT1 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	T.PIT1 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC211 (19-135-2)

T.PIT1

Trial Pit Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	T.PIT1 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	T.PIT1
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	T.PIT1 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	T.PIT1
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	T.PIT1 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	T.PIT1 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC211 (19-135-2)

T.PIT1

Trial Pit Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	T.PIT1 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	T.PIT2
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February 2020



Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	T.PIT2
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	T.PIT2 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC211 (19-135-2)

T.PIT2	
Trial Pit Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	T.PIT2 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC211 (19-135-2)

T.PIT2	
Trial Pit Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	T.PIT2 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	T.PIT2
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February 2020



Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	T.PIT3
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February 2020



Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	T.PIT3
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	T.PIT3 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	T.PIT3
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February 2020



Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	T.PIT3
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC211 (19-135-2)

T.PIT3

Trial Pit Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	T.PIT3 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	T.PIT3 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020

Appendix E Indirect CBR Test Results

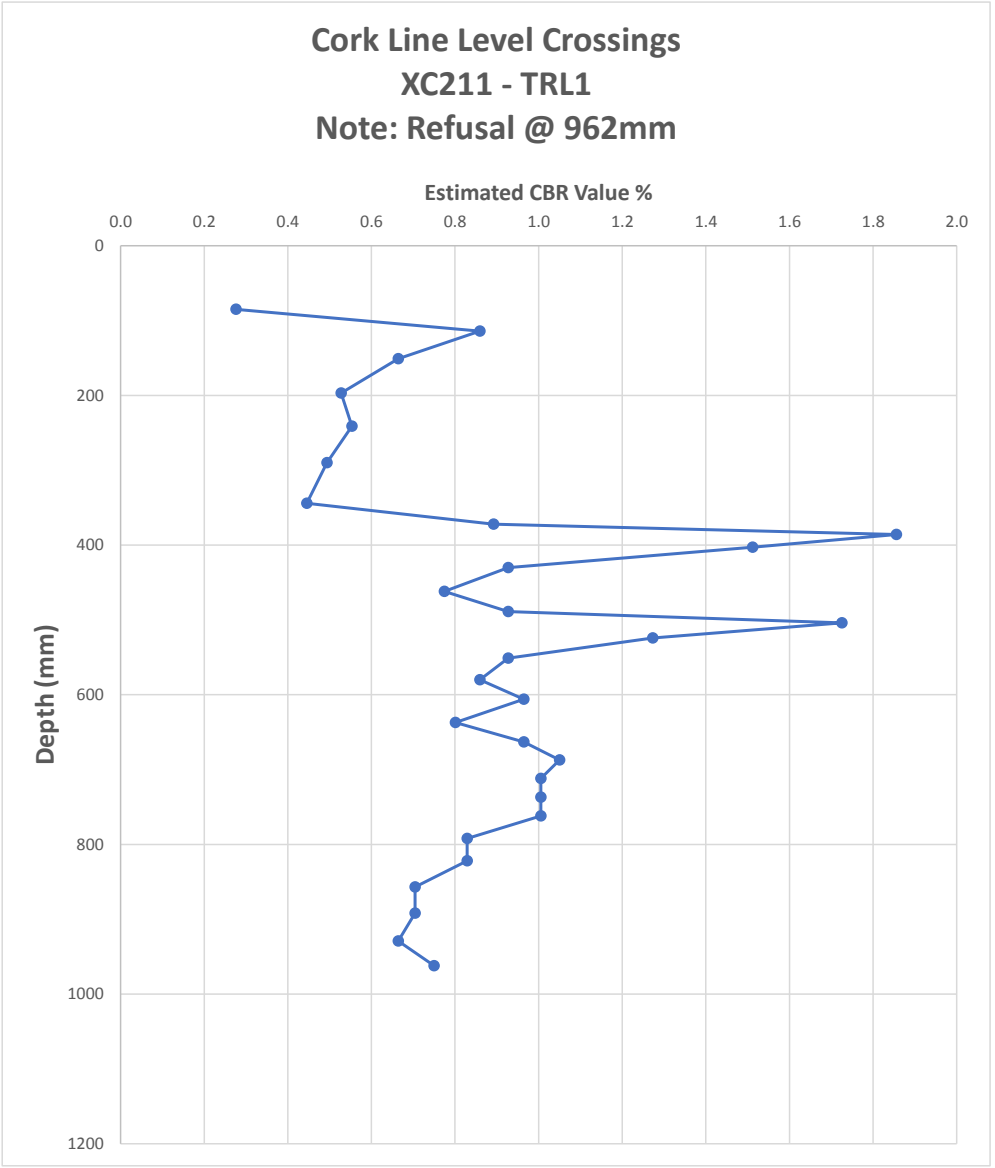
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC211 - TRL1**	Job No	19-135

Easting	Northing	Elevation
554814.846	617962.459	98.149

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1007	mm	09/03/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	922	85	85	0.3
2	893	29	114	0.9
3	856	37	151	0.7
4	810	46	197	0.5
5	766	44	241	0.6
6	717	49	290	0.5
7	663	54	344	0.4
8	635	28	372	0.9
9	621	14	386	1.9
10	604	17	403	1.5
11	577	27	430	0.9
12	545	32	462	0.8
13	518	27	489	0.9
14	503	15	504	1.7
15	483	20	524	1.3
16	456	27	551	0.9
17	427	29	580	0.9
18	401	26	606	1.0
19	370	31	637	0.8
20	344	26	663	1.0
21	320	24	687	1.0
22	295	25	712	1.0
23	270	25	737	1.0
24	245	25	762	1.0
25	215	30	792	0.8
26	185	30	822	0.8
27	150	35	857	0.7
28	115	35	892	0.7
29	78	37	929	0.7
30	45	33	962	0.7
31				



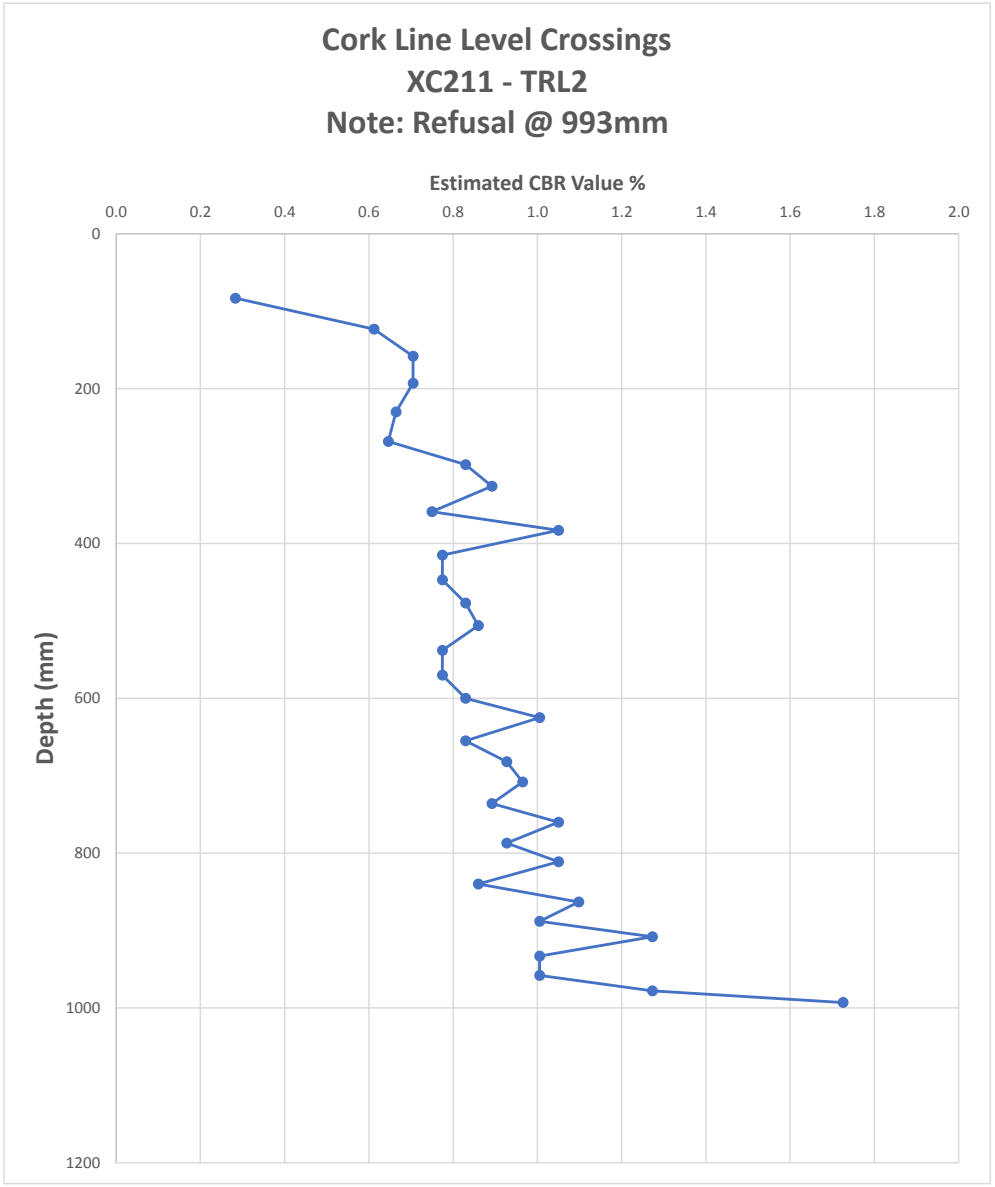
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC211 - TRL2**	Job No	19-135

Easting	Northing	Elevation
554820.522	617964.969	97.873

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1053	mm	09/03/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	970	83	83	0.3
2	930	40	123	0.6
3	895	35	158	0.7
4	860	35	193	0.7
5	823	37	230	0.7
6	785	38	268	0.6
7	755	30	298	0.8
8	727	28	326	0.9
9	694	33	359	0.7
10	670	24	383	1.0
11	638	32	415	0.8
12	606	32	447	0.8
13	576	30	477	0.8
14	547	29	506	0.9
15	515	32	538	0.8
16	483	32	570	0.8
17	453	30	600	0.8
18	428	25	625	1.0
19	398	30	655	0.8
20	371	27	682	0.9
21	345	26	708	1.0
22	317	28	736	0.9
23	293	24	760	1.0
24	266	27	787	0.9
25	242	24	811	1.0
26	213	29	840	0.9
27	190	23	863	1.1
28	165	25	888	1.0
29	145	20	908	1.3
30	120	25	933	1.0
31	95	25	958	1.0
32	75	20	978	1.3
33	60	15	993	1.7
34				



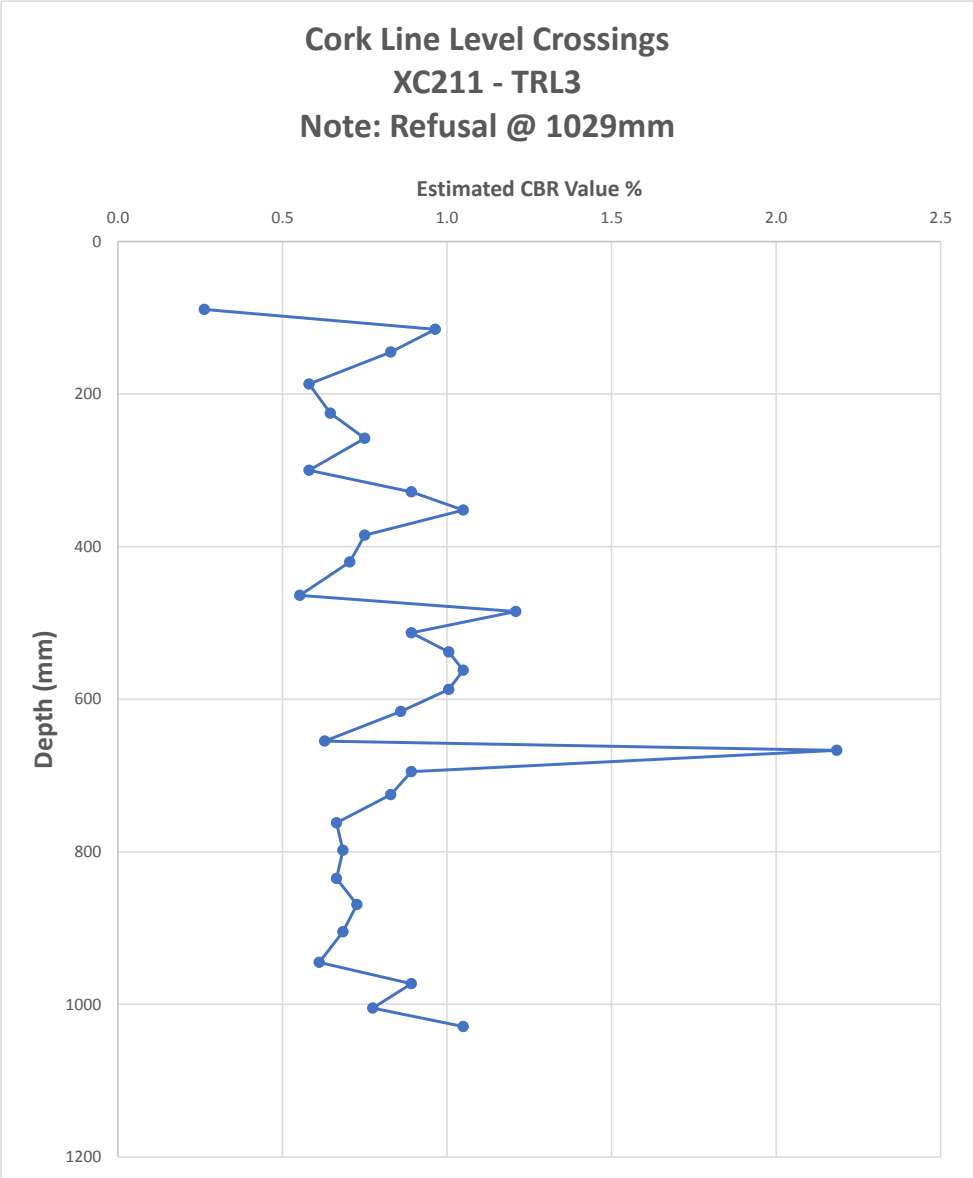
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC211 - TRL3**	Job No	19-135

Easting	Northing	Elevation
554882.414	618087.375	101.182

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1090	mm	09/03/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1001	89	89	0.3
2	975	26	115	1.0
3	945	30	145	0.8
4	903	42	187	0.6
5	865	38	225	0.6
6	832	33	258	0.7
7	790	42	300	0.6
8	762	28	328	0.9
9	738	24	352	1.0
10	705	33	385	0.7
11	670	35	420	0.7
12	626	44	464	0.6
13	605	21	485	1.2
14	577	28	513	0.9
15	552	25	538	1.0
16	528	24	562	1.0
17	503	25	587	1.0
18	474	29	616	0.9
19	435	39	655	0.6
20	423	12	667	2.2
21	395	28	695	0.9
22	365	30	725	0.8
23	328	37	762	0.7
24	292	36	798	0.7
25	255	37	835	0.7
26	221	34	869	0.7
27	185	36	905	0.7
28	145	40	945	0.6
29	117	28	973	0.9
30	85	32	1005	0.8
31	61	24	1029	1.0
32				



Cork Line Level Crossings - Irish Rail

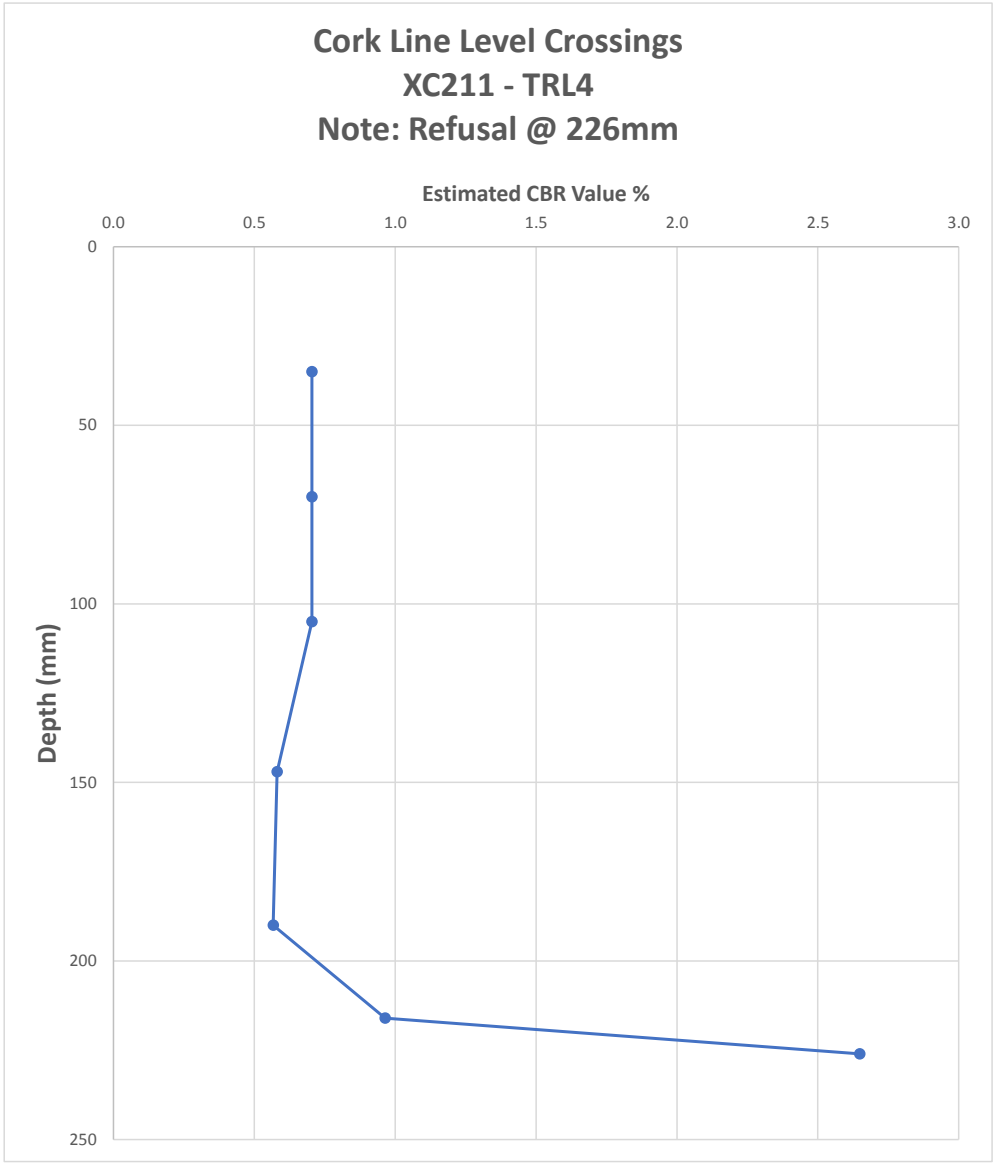
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC211 - TRL4**	Job No	19-135

Easting	Northing	Elevation
554886.268	618091.178	101.803

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1045	mm	09/03/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1010	35	35	0.7
2	975	35	70	0.7
3	940	35	105	0.7
4	898	42	147	0.6
5	855	43	190	0.6
6	829	26	216	1.0
7	819	10	226	2.6
8	819	0	226	
9	819	0	226	
10				



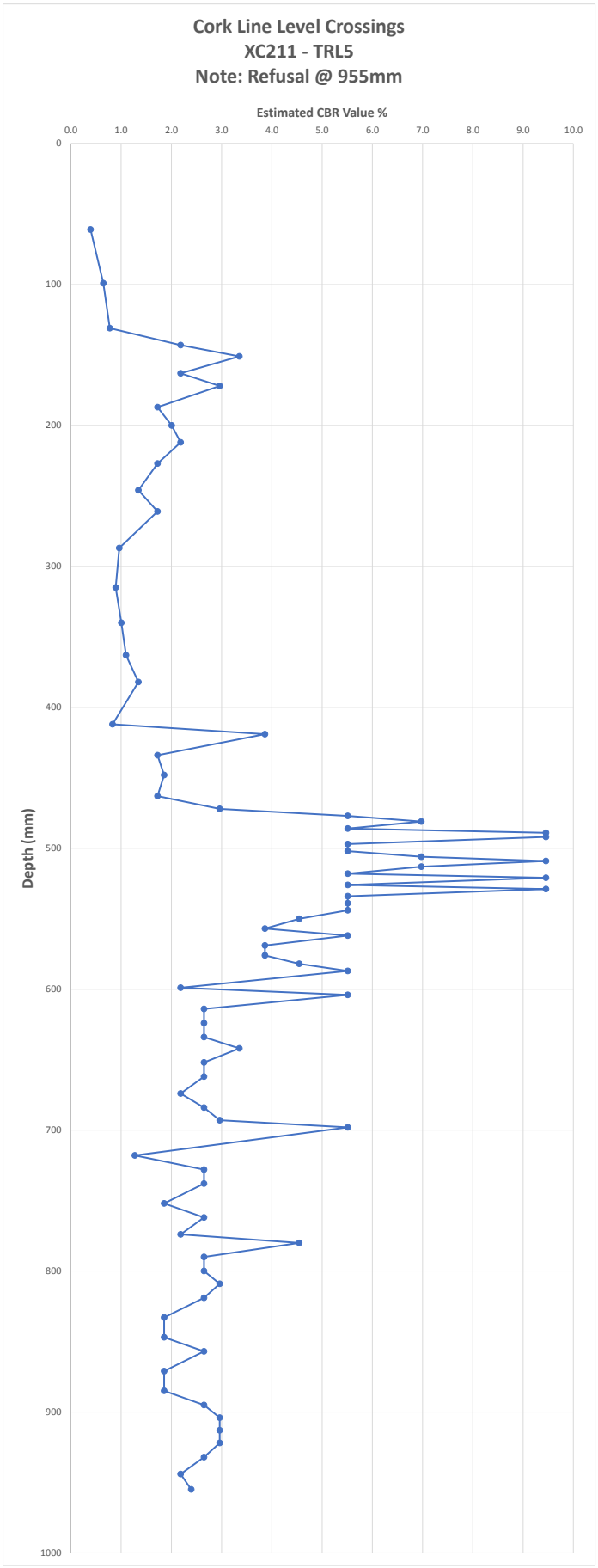
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	XC211 - TRL5	Job No	19-135

Easting	Northing	Elevation
554936.035	618184.51	111.629

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1042	mm	09/03/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	981	61	61	0.4
2	943	38	99	0.6
3	911	32	131	0.8
4	899	12	143	2.2
5	891	8	151	3.4
6	879	12	163	2.2
7	870	9	172	3.0
8	855	15	187	1.7
9	842	13	200	2.0
10	830	12	212	2.2
11	815	15	227	1.7
12	796	19	246	1.3
13	781	15	261	1.7
14	755	26	287	1.0
15	727	28	315	0.9
16	702	25	340	1.0
17	679	23	363	1.1
18	660	19	382	1.3
19	630	30	412	0.8
20	623	7	419	3.9
21	608	15	434	1.7
22	594	14	448	1.9
23	579	15	463	1.7
24	570	9	472	3.0
25	565	5	477	5.5
26	561	4	481	7.0
27	556	5	486	5.5
28	553	3	489	9.5
29	550	3	492	9.5
30	545	5	497	5.5
31	540	5	502	5.5
32	536	4	506	7.0
33	533	3	509	9.5
34	529	4	513	7.0
35	524	5	518	5.5
36	521	3	521	9.5
37	516	5	526	5.5
38	513	3	529	9.5
39	508	5	534	5.5
40	503	5	539	5.5
41	498	5	544	5.5
42	492	6	550	4.5
43	485	7	557	3.9
44	480	5	562	5.5
45	473	7	569	3.9
46	466	7	576	3.9
47	460	6	582	4.5
48	455	5	587	5.5
49	443	12	599	2.2
50	438	5	604	5.5
51	428	10	614	2.6
52	418	10	624	2.6
53	408	10	634	2.6
54	400	8	642	3.4
55	390	10	652	2.6
56	380	10	662	2.6
57	368	12	674	2.2
58	358	10	684	2.6
59	349	9	693	3.0
60	344	5	698	5.5
61	324	20	718	1.3
62	314	10	728	2.6
63	304	10	738	2.6
64	290	14	752	1.9
65	280	10	762	2.6
66	268	12	774	2.2
67	262	6	780	4.5
68	252	10	790	2.6
69	242	10	800	2.6
70	233	9	809	3.0
71	223	10	819	2.6
72	209	14	833	1.9
73	195	14	847	1.9
74	185	10	857	2.6
75	171	14	871	1.9
76	157	14	885	1.9
77	147	10	895	2.6
78	138	9	904	3.0
79	129	9	913	3.0
80	120	9	922	3.0
81	110	10	932	2.6
82	98	12	944	2.2
83	87	11	955	2.4
84				



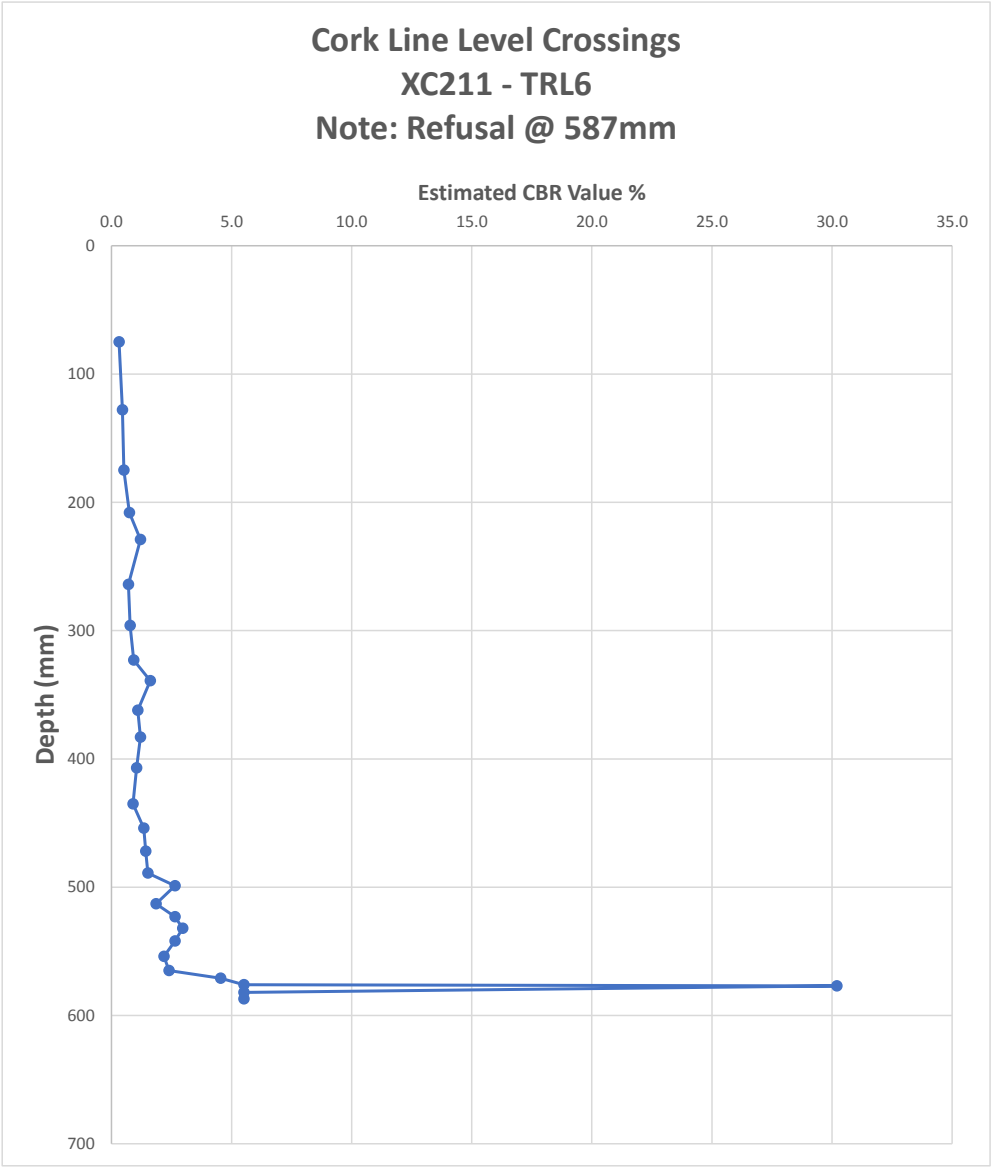
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC211 - TRL6**	Job No	19-135

Easting	Northing	Elevation
554941.786	618184.849	112.108

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1092	mm	09/03/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1017	75	75	0.3
2	964	53	128	0.5
3	917	47	175	0.5
4	884	33	208	0.7
5	863	21	229	1.2
6	828	35	264	0.7
7	796	32	296	0.8
8	769	27	323	0.9
9	753	16	339	1.6
10	730	23	362	1.1
11	709	21	383	1.2
12	685	24	407	1.0
13	657	28	435	0.9
14	638	19	454	1.3
15	620	18	472	1.4
16	603	17	489	1.5
17	593	10	499	2.6
18	579	14	513	1.9
19	569	10	523	2.6
20	560	9	532	3.0
21	550	10	542	2.6
22	538	12	554	2.2
23	527	11	565	2.4
24	521	6	571	4.5
25	516	5	576	5.5
26	515	1	577	30.2
27	510	5	582	5.5
28	505	5	587	5.5
29	505	0	587	
30	505	0	587	
31				



Appendix F Water Purging Data & Logs

Job Name: **I.E - Cork Line**		h (m)	3
		r (m)	0.0505
		r2	0.00255025
Job Nr: **19-135**		TWV (m3)	0.024035596

BH ID: XC211-CP02			**Theoretical Well Volume**	24.04 *ltrs*
Depth to Response Zone:	***Top (mbgl)***	***Bottom (mbgl)***	**TWV x3**	72.11 *ltrs*
	2	5		

Purge Start Time:	13:45		**(mbgl)**
Purge Finish Time:	14:40	**Depth to Water**	4.36
		Total Depth	5.4
Depth to water after purging:	4.75 mbgl		

	Time Taken to fill 25ltr container(mins)	Flow Rate l/min
Reading 1:		
Reading 2:		
Reading 3:		

Date 06/08/2020

(NO RECHARGE - POSSIBLE PERCHED WATER)

Nr of Containers filled:	<1
Total Volume Purged:	14 ***litres***

	Temperature	**$_{P}$H**	**Electrical Conductivity**	**Dissolved Oxygen**	**Redox Potential**
Reading 1	16.23	6.57	78.01	0.52	25

Appendix G Geotechnical Soil Laboratory Test Results

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

James Fisher Testing Services

LABORATORY TEST REPORT

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

Site:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93346
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	31/03/2020
Order No:	2003-104	**Date Reported:**	03/04/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC211-TP01 Type D Sample 3

Sample Type:	Bulk	***Location:***	XC211-TP01 Type D Sample 3
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	0.4-0.9m	***Material Type:***	Soil

Moisture Content (%): 11

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

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

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

UKAS TESTING
0955

James Fisher Testing Services Limited
Ruby House, 40A Hardwick Grange
Warrington,WA1 4RF
Tel: 01925 286 880

James Fisher Testing Services

LABORATORY TEST REPORT

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP - BS 1377: Part 4: 1990

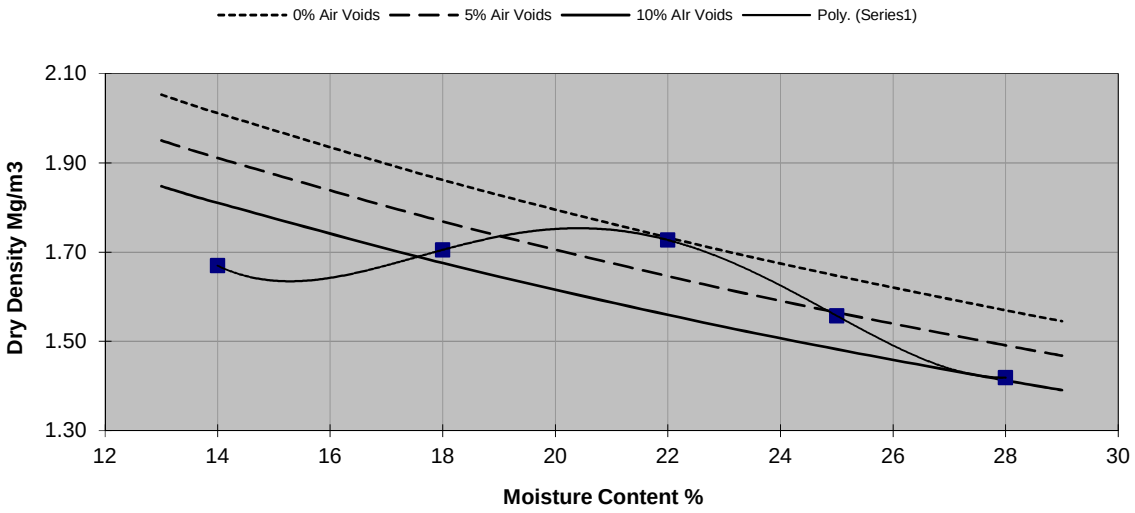
Project:	Cork Line Level Crossings	**Job No:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93345
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	06/04/2020
	Co Cork	**Date Reported:**	07/04/2020
Order No:	2003-104	**Material:**	Soil
Originator:	**Ian Holley**	**Specification:**	Client

Client Sample Ref :	**XC211-TP01 Type B Sample 2**	***Sample Type :***	Bulk
Supplier:	Client Info	***Description :***	Soil
Location:	0.4-0.9m		

Date sampled : Client Info ***Comments : None***
Sampling Cert : No

Rammer used :	4.5	**No of layers:**	3
No of sub samples :	5	**% retained on 37.5mm sieve**	0.6
Mould Size:	CBR	**% retained on 20mm sieve**	4.4

Bulk Density: Mg/m³	1.90	2.01	2.11	1.95	1.82
Moisture Content: %	14	18	22	25	28
Dry Density: Mg/m³	1.67	1.71	1.73	1.56	1.42



Maximum Dry Density (Mg/m³)	**1.75**
Optimum Moisture Content (%)	**20**

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

Tested in accordance with BS 1377: Part 4:1990
Particle Density (Mg/m³) - 2.8 (Assumed)

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

James Fisher Testing Services Limited, a company registered in England and Wales with registration number: 01182561
Registered office: Fisher House, PO Box 4, Barrow-in-Furness, Cumbria, LA14 1HR

UKAS TESTING 0955

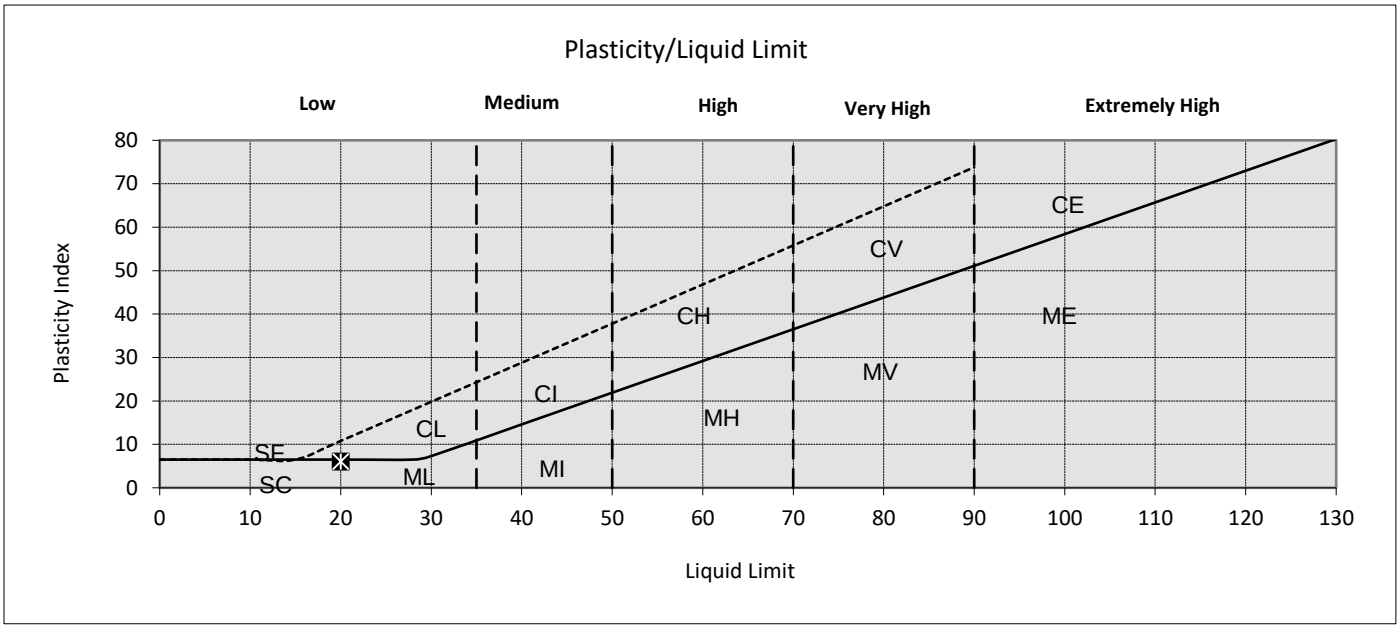
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

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

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93347
	Unit 1 Carrigogna	**Sample Ref.:**	XC211-TP01 0.4-0.9m Type D Samp 3
	Midleton	**Date Sampled:**	Client Info
	Co Cork	**Date Received:**	09/03/2020
Order No:	2003-104	**Date Tested:**	03/04/2020
Originator:	**Ian Holley**	**Date Reported:**	03/04/2020

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Bulk**
Sample Preparation Method	**Washed**
MATERIAL	**Soil**
Retained 425 micron (%)	**24**
Natural Moisture Content (%)	**13**
Liquid Limit (single point)(%)	**20**
Plastic Limit (%)	**14**
Plasticity Index	**6**



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

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

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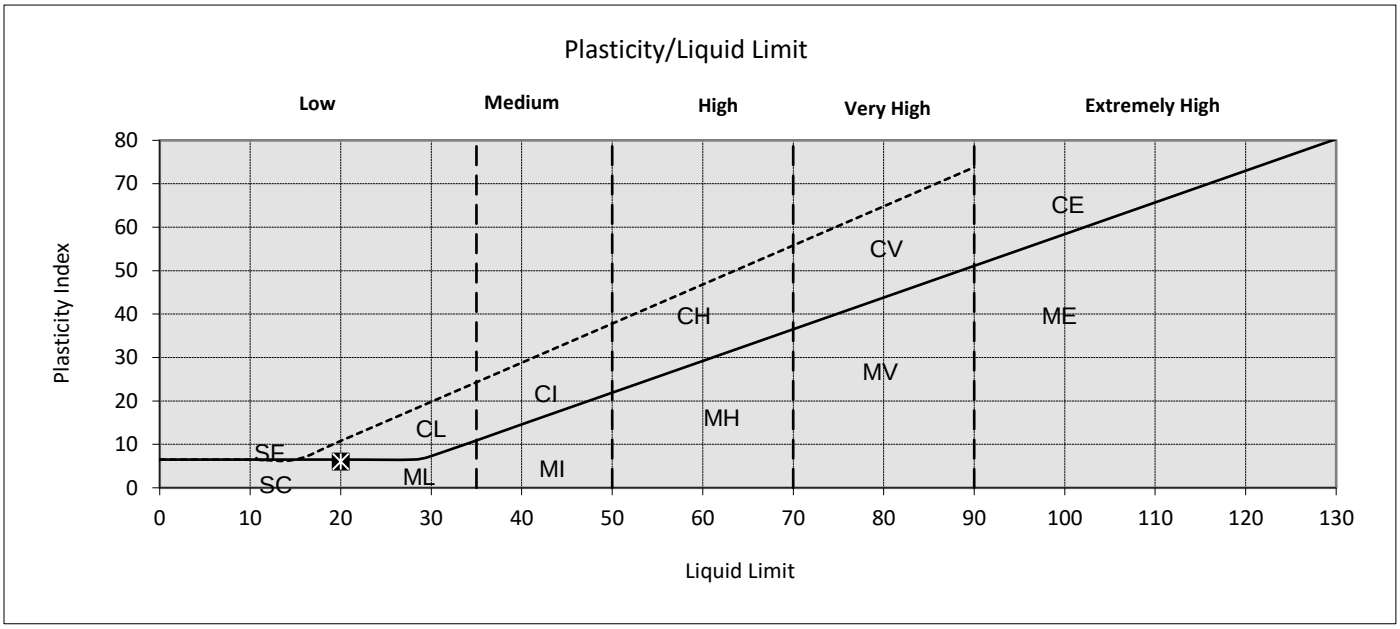
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

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

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93347
	Unit 1 Carrigogna	**Sample Ref.:**	XC211-TP01 0.4-0.9m Type D Samp 3
	Midleton	**Date Sampled:**	Client Info
	Co Cork	**Date Received:**	09/03/2020
Order No:	2003-104	**Date Tested:**	03/04/2020
Originator:	**Ian Holley**	**Date Reported:**	03/04/2020

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Bulk**
Sample Preparation Method	**Washed**
MATERIAL	**Soil**
Retained 425 micron (%)	**24**
Natural Moisture Content (%)	**13**
Liquid Limit (single point)(%)	**20**
Plastic Limit (%)	**14**
Plasticity Index	**6**



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

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

UKAS TESTING 0955

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

James Fisher Testing Services

LABORATORY TEST REPORT

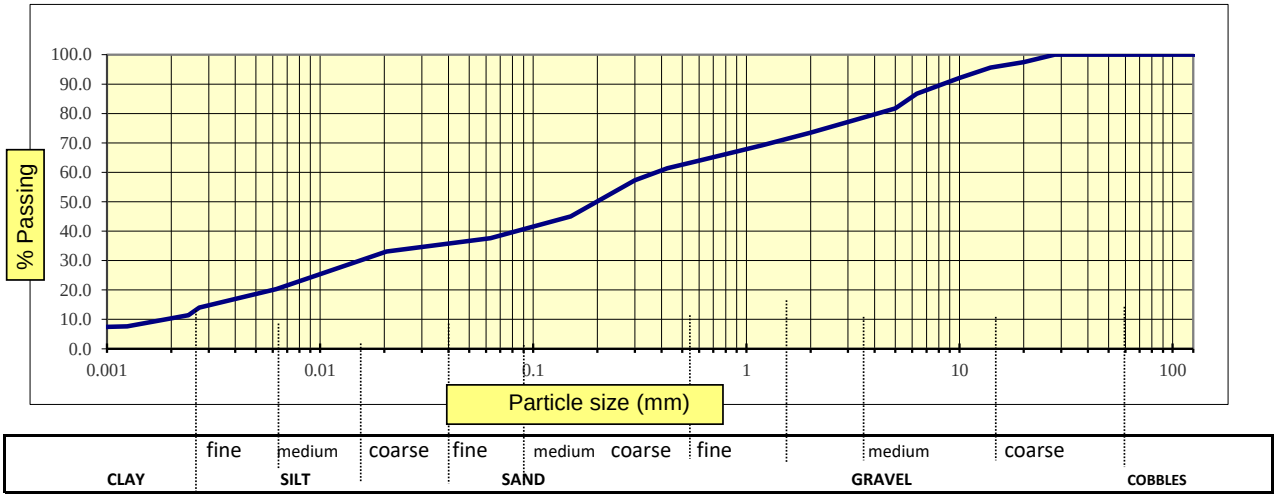
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 93344
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	02/04/2020
		Date Tested:	01/04/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Light Gravel, Sandy

Client Ref.	**XC211-TP01 Type B Sample 2**
Location:	XC211-TP01 Type B Sample 2
Supplier:	Bulk
Source:	Client Info.
Depth (m):	0.4-0.9m
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	96	
10 mm	92	
6.3 mm	87	
5 mm	82	
3.35 mm	78	
2 mm	74	
1.18 mm	69	
0.6 mm	64	
0.425 mm	61	
0.3 mm	57	
0.15 mm	45	
0.063 mm	38	
0.020 mm	33	
0.006 mm	20	
0.003 mm	14	
0.002 mm	11	
0.001 mm	8	



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

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

Sedimentation by Hydrometer - Not UKAS

UKAS TESTING 0955

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

James Fisher Testing Services Limited
Unit D Zone 5
Clonminam Business Park
Tel: 057 86 64885

James Fisher Testing Services

Laboratory Test Report
Determination of shear Strength by Direct Shear (Small Shearbox)
in accordance with BS :1377: Part 7 : 1990 Clause 4

Project:	Cork Line Level Crossing	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref. No.:**	ST 93350
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	05/05/2020
		Material:	Earthworks
Order No.:	2003-104	**Visual Description:**	Brown SAND
Originator:	Ian Holley	**Specification:**	TII Series 600

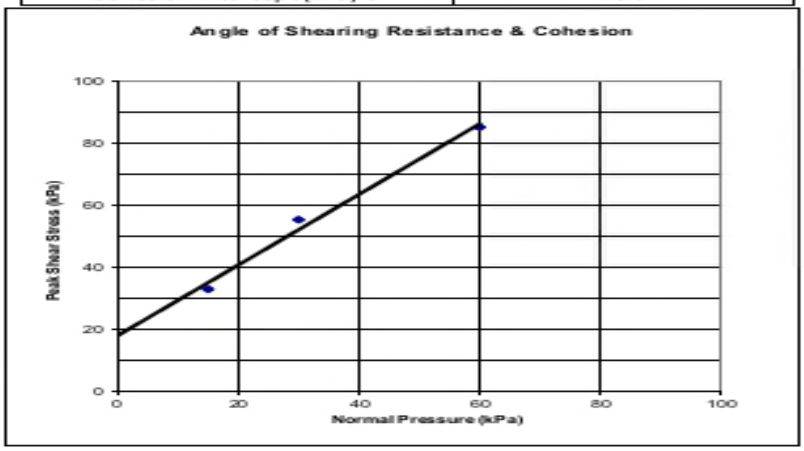
Client Ref:	**ST 93350**		
Certificate of sampling	Yes	**Date Of Sampling:**	Client info
Lab Reference No.	XC211-TP01 1.0-1.5m Sample 6	**Sampled By:**	OCB
Sample Source & Ticket No.	Site Won	**Sample Preparation:**	Bulk sample sieved through 20mm sieve
Sample Location / Orientation :	Cork Line Level Crossings	**Tested Dry or Submerged:**	Dry

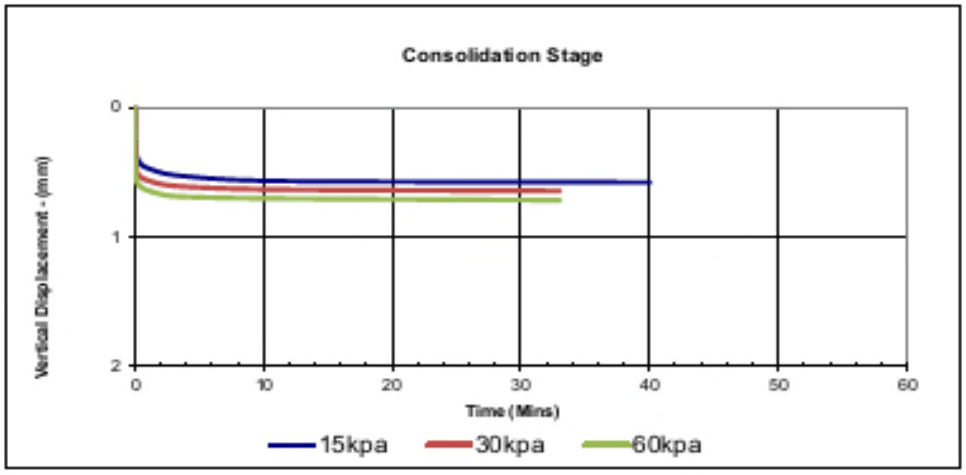
Results

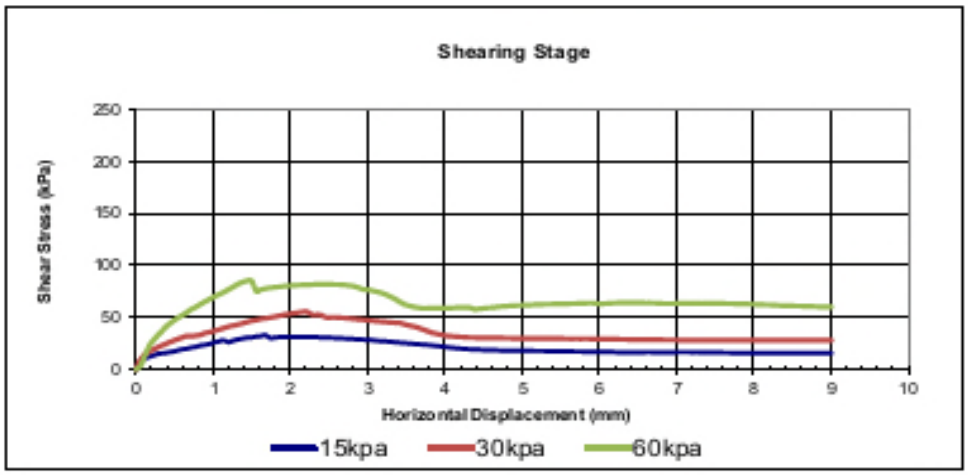
SUMMARY OF TEST RESULTS:	
Angle of Shearing Resistance (°) φ'	48.5
Cohesion Intercept (kPa) c'	18.0

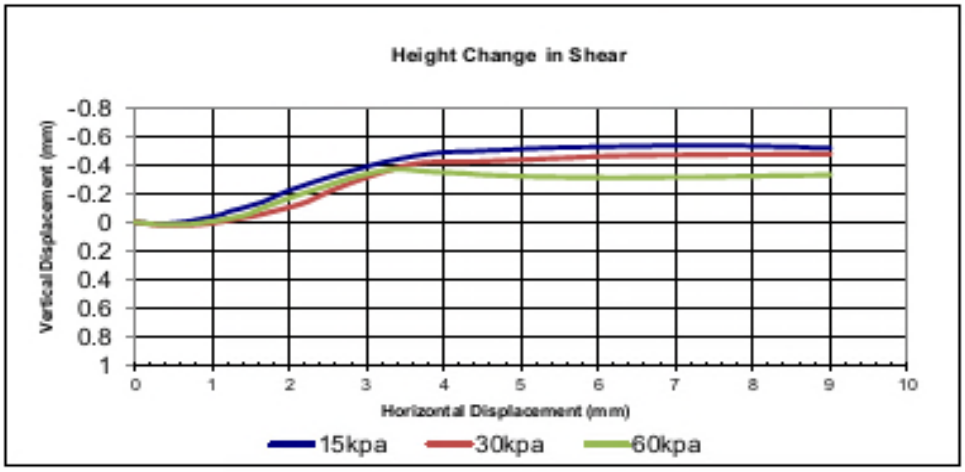
Sample Condition: Submerged
Particle Density: 2.65(Mg/m3) Assumed
Sample Preparation: Remoulded (Hand Tamped)
Material tested passing 2mm sieve

Initial Condition			
	Stage		
	1	2	3
Normal Pressure (kPa)	15	30	60
Height (mm)	19.47	19.23	19.41
Width (mm)	59.9	59.9	59.9
Bulk Density (Mg/m^3)	2.08	2.10	2.08
Dry Density (Mg/m^3)	1.84	1.86	1.84
Moisture Content (%)	13	13	13
Voids Ratio	0.443	0.425	0.438
Degree of Saturation	77.8	81.1	78.6
Shearing Stage			
Rate of Displacement (mm/min)	0.8	0.8	0.8
Peak Shear Stress (kPa)	32.9	55.4	85.2
Displacement at Peak Stress (mm)	1.7	2.2	1.5
Final Condition			
Bulk Density (Mg/m^3)	2.10	2.12	2.14
Dry Density (Mg/m^3)	1.84	1.88	1.88
Moisture Content (%)	14	13	14
Angle of Shearing Resistance (°) φ'	48.5		
Cohesion Intercept (kPa) c'	18.0		









Subcontracted to a Laboratory Accredited in this Testing

Approved Signature
James Fisher Testing Services Limited
James Ward, Operations Manager

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

LABORATORY TEST REPORT

BRE Test Suite B - Greenfield Site

Project:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref. No.:**	ST 93349
	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 **XC211-TP01 Type B Sample 6**

Supplier:	Client Info	**Date of Sampling:**	Client Info.
Source:	Client Info	**Sampled By:**	Client
Sample Location:	1.0-1.5m	**Sampling Reason:**	Request

Parameter	RESULT
pH	7.3
Sulphate Aqueous Extract (SO4) (mg/l)	<10
Sulphur as S, Total (%)	<0.01
Sulphate as SO4, Total (%)	<0.01

Comments:
None

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

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

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.

☐ **James Ward, Operations Manager**

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

James Fisher Testing Services

LABORATORY TEST REPORT

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 93349
	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 **XC211-TP01 Type B Sample 6**

Supplier:	Client Info	**Date of Sampling:**	Client Info
Source:	Client Info	**Sampled By:**	Client
Sample Location:	1.0-1.5m	**Sampling Reason:**	Request

Result:

Organic Matter (%)	**0.3**

Comments:
None

Tested in accordance with the above specifications
Subcontracted to a laboratory UKAS accredited for this testing
The stated result only relates to the item/location tested, this report shall not be reproduced except in full.

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

James Fisher Testing Services

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

James Fisher Testing Services

LABORATORY TEST REPORT

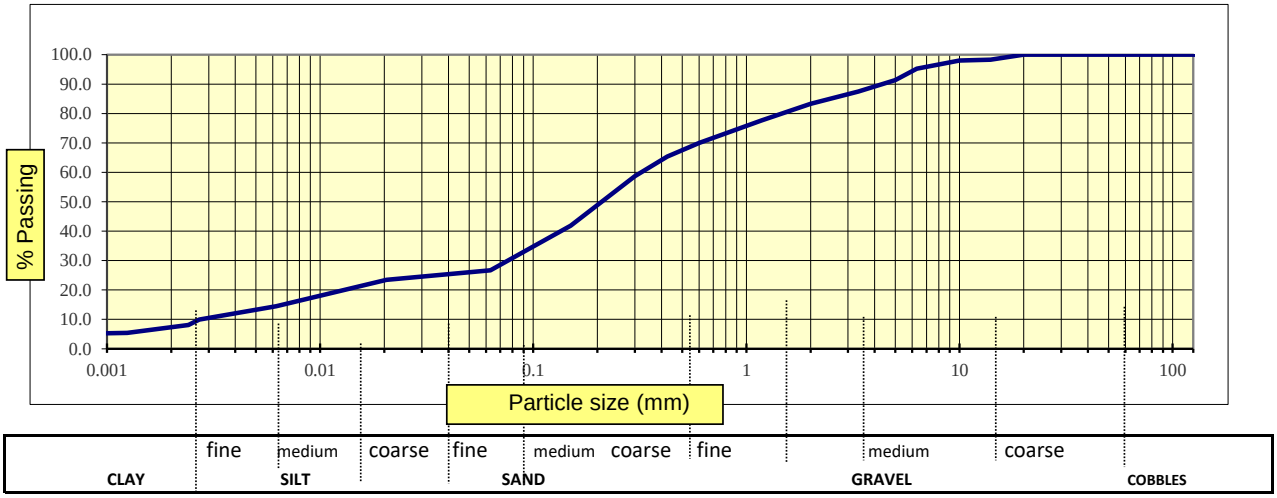
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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

Project:	Cork Line Level Crossings	**Job No:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93348
	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**	Grey Clay, Sandy

Client Ref.	**XC211-TP01 Type B Sample 6**
Location:	XC211-TP01 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	100	
63 mm	100	
50 mm	100	
37.5 mm	100	
28 mm	100	
20 mm	100	
14 mm	98	
10 mm	98	
6.3 mm	95	
5 mm	91	
3.35 mm	87	
2 mm	83	
1.18 mm	78	
0.6 mm	70	
0.425 mm	65	
0.3 mm	59	
0.15 mm	42	
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

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

Sedimentation by Hydrometer - Not UKAS

UKAS TESTING 0955

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

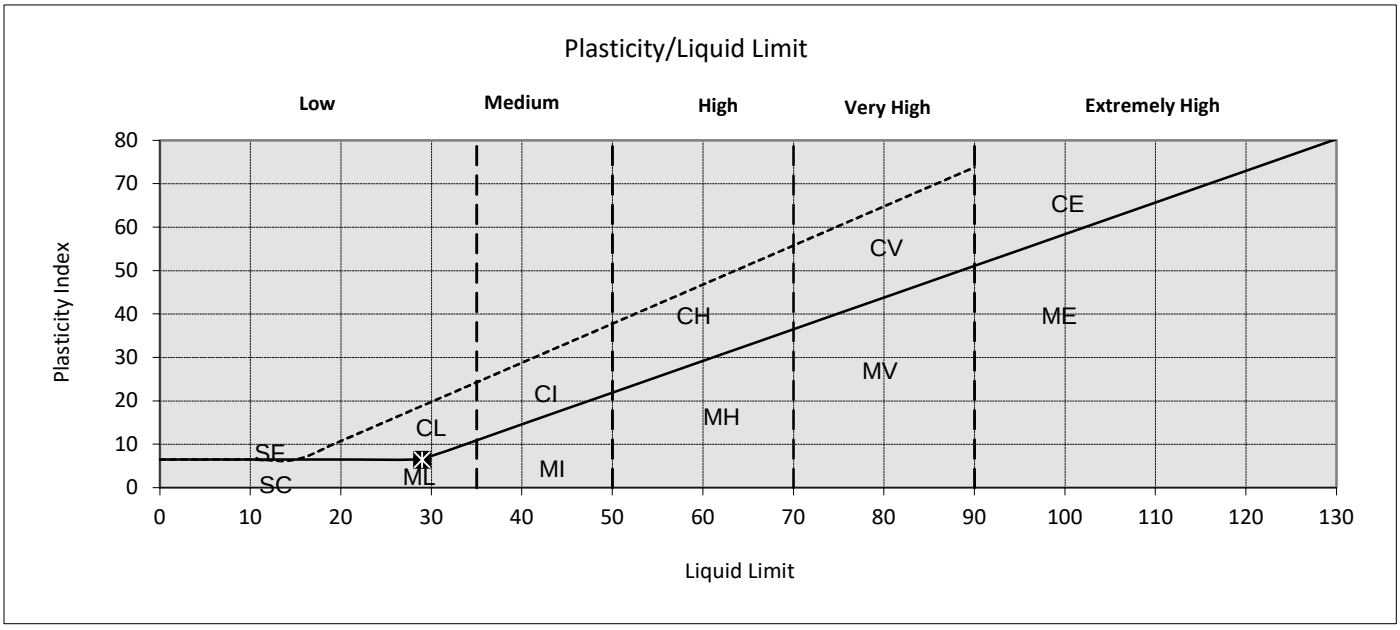
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

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

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93352
	Unit 1 Carrigogna	**Sample Ref.:**	XC211-TP01 2.3-3.0m
	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 (%)	**25**
Natural Moisture Content (%)	**24**
Liquid Limit (single point)(%)	**29**
Plastic Limit (%)	**22**
Plasticity Index	**6**



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

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

UKAS TESTING 0955

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

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 93351
	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: XC211-TP01 Type D Sample 9

Sample Type:	Bulk	***Location:***	XC211-TP01 Type D Sample 9
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	2.5-3.0m	***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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James Ward, Operations Manager

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James Fisher Testing Services

Laboratory Test Report
Determination of shear Strength by Direct Shear (Small Shearbox)
in accordance with BS :1377: Part 7 : 1990 Clause 4

Project:	Cork Line Level Crossing	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref. No.:**	ST 93354
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	22/05/2020
		Material:	Earthworks
Order No.:	2003-104	**Visual Description:**	Brown siltySAND
Originator:	Ian Holley	**Specification:**	TII Series 600

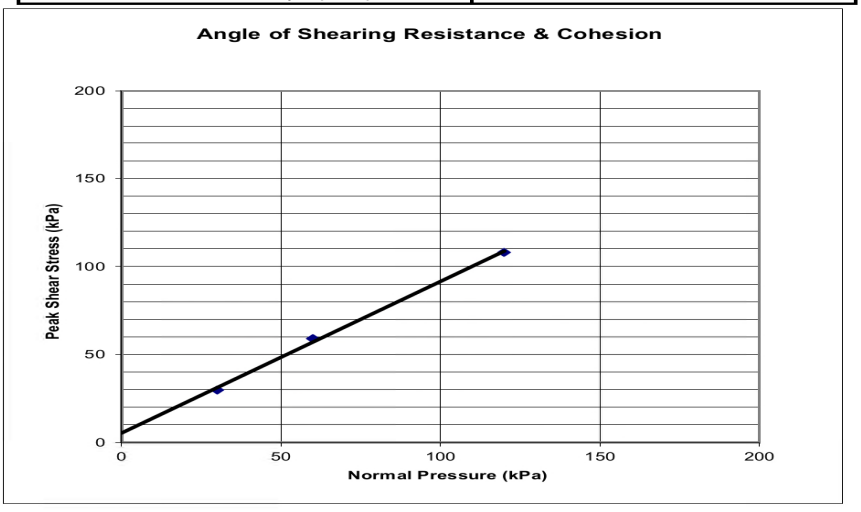
Client Ref:	**ST 93354**		
Certificate of sampling	Yes	**Date Of Sampling:**	Client info
Lab Reference No.	XC211-TP01 3.0-3.4m Sample 10	**Sampled By:**	OCB
Sample Source & Ticket No.	Site Won	**Sample Preparation:**	Bulk sample sieved through 20mm sieve
Sample Location / Orientation :	Cork Line Level Crossings	**Tested Dry or Submerged:**	Dry

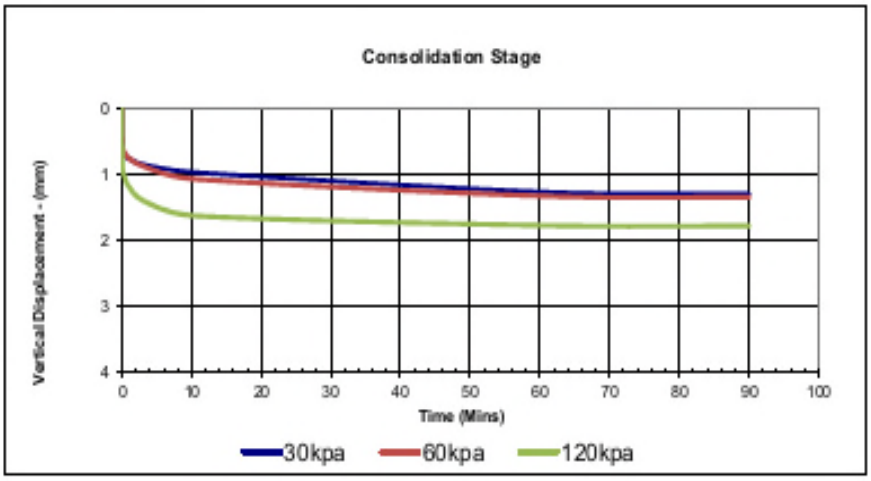
Results

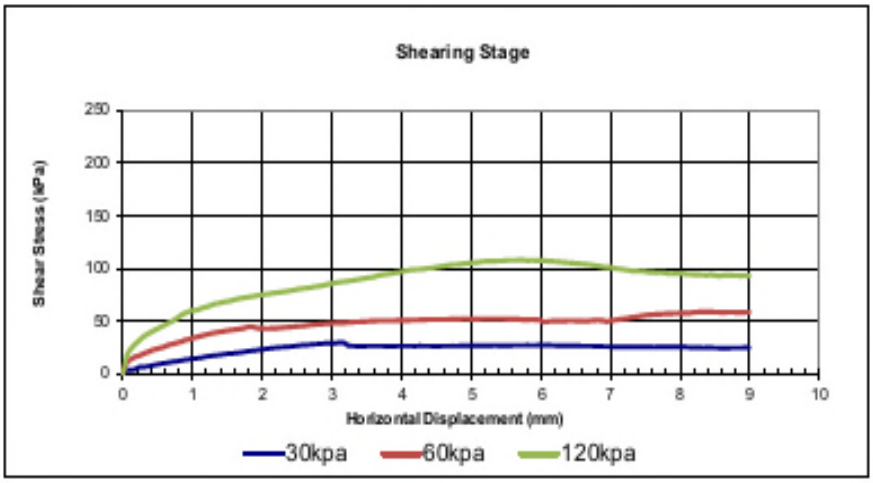
SUMMARY OF TEST RESULTS:	
Angle of Shearing Resistance (°) φ'	40.5
Cohesion Intercept (kPa) c'	5.3

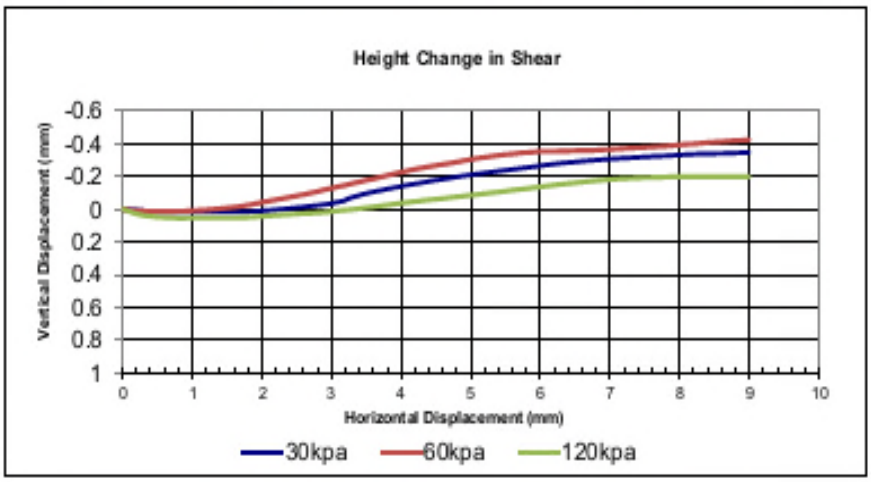
Sample Condition: Submerged
Particle Density: 2.70(Mg/m3) Assumed
Sample Preparation: Remoulded (Hand Tamped)
Material tested passing 2mm sieve

Initial Condition			
	Stage		
	1	2	3
Normal Pressure (kPa)	30	60	120
Height (mm)	18.80	18.81	18.48
Width (mm)	59.9	59.9	59.9
Bulk Density (Mg/m^3)	2.08	2.07	2.11
Dry Density (Mg/m^3)	1.72	1.71	1.74
Moisture Content (%)	21	21	21
Voids Ratio	0.574	0.575	0.547
Degree of Saturation	98.8	98.6	103.6
Shearing Stage			
Rate of Displacement (mm/min)	0.8	0.8	0.8
Peak Shear Stress (kPa)	29.8	59.1	108.0
Displacement at Peak Stress (mm)	3.1	8.3	5.7
Final Condition			
Bulk Density (Mg/m^3)	2.20	2.16	2.27
Dry Density (Mg/m^3)	1.81	1.80	1.91
Moisture Content (%)	22	20	19
Angle of Shearing Resistance (°) φ'	40.5		
Cohesion Intercept (kPa) c'	5.3		









Subcontracted to a Laboratory Accredited in this Testing

Approved Signature
James Fisher Testing Services Limited
James Ward, Operations Manager

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James Fisher Testing Services

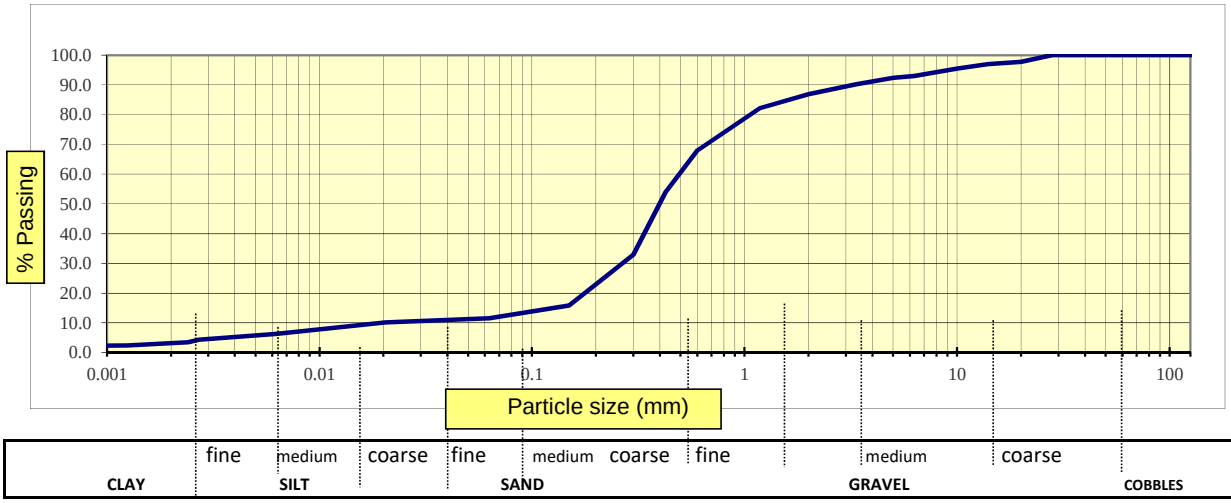
LABORATORY TEST REPORT

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

Project:	Cork Line Level Crossings	**Job No:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93353
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	25/03/2020
		Date Tested:	23/03/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Sandy Clay

Client Ref.	**XC211-TP01 Type B Sample 10**
Location:	XC211-TP01 Type B Sample 10
Supplier:	Bulk
Source:	Client Info.
Depth (m):	3.0-3.4m
Sampling Reason:	Client Request
Sampled By:	Client
Specification:	Client
Preparation Method:	Without Organics Preparation
Notes:	Disturbed sample from cleanout

BS Sieve Size	% Passing	Specification
300 mm	100	
125 mm	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	97	
10 mm	96	
6.3 mm	93	
5 mm	92	
3.35 mm	90	
2 mm	87	
1.18 mm	82	
0.6 mm	68	
0.425 mm	54	
0.3 mm	33	
0.15 mm	16	
0.063 mm	12	
0.020 mm	10	
0.006 mm	6	
0.003 mm	4	
0.002 mm	4	
0.001 mm	2	



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

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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 93357
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	13/03/2020
Order No:	2003-104	**Date Reported:**	25/03/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC211-TP02 Type D Sample 3

Sample Type:	Bulk	***Location:***	XC211-TP02 Type D Sample 3
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	0.3-0.8m	***Material Type:***	Soil

Moisture Content (%): 21

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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LABORATORY TEST REPORT

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP - BS 1377: Part 4: 1990

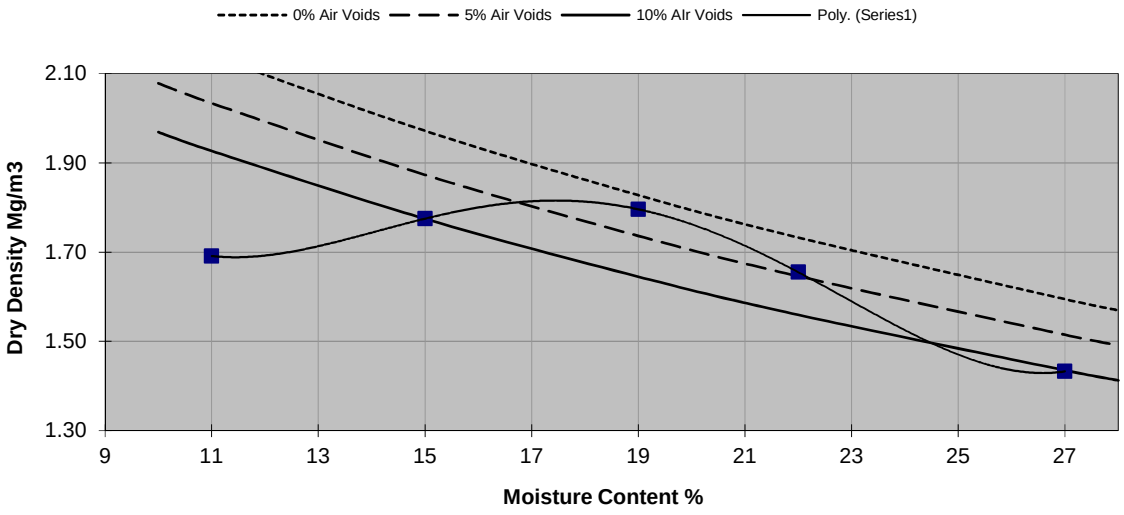
Project:	Cork Line Level Crossings	**Job No:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93356
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	03/04/2020
	Co Cork	**Date Reported:**	06/04/2020
Order No:	2003-104	**Material:**	Soil
Originator:	**Ian Holley**	**Specification:**	Client

Client Sample Ref :	**XC211-TP02 Type B Sample 2**	***Sample Type :***	Bulk
Supplier:	Client Info	***Description :***	Soil
Location:	0.3-0.8m		

Date sampled :	Client Info	***Comments : None***	
Sampling Cert :	No		

Rammer used :	4.5	**No of layers:**	3
No of sub samples :	5	**% retained on 37.5mm sieve**	0.3
Mould Size:	CBR	**% retained on 20mm sieve**	4.6

Bulk Density: Mg/m³	1.88	2.04	2.13	2.03	1.81
Moisture Content: %	11	15	19	22	27
Dry Density: Mg/m³	1.69	1.77	1.80	1.65	1.43



Maximum Dry Density (Mg/m³)	**1.82**
Optimum Moisture Content (%)	**18**

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

Tested in accordance with BS 1377: Part 4:1990

Particle Density (Mg/m³) - 2.8 (Assumed)

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

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Registered office: Fisher House, PO Box 4, Barrow-in-Furness, Cumbria, LA14 1HR

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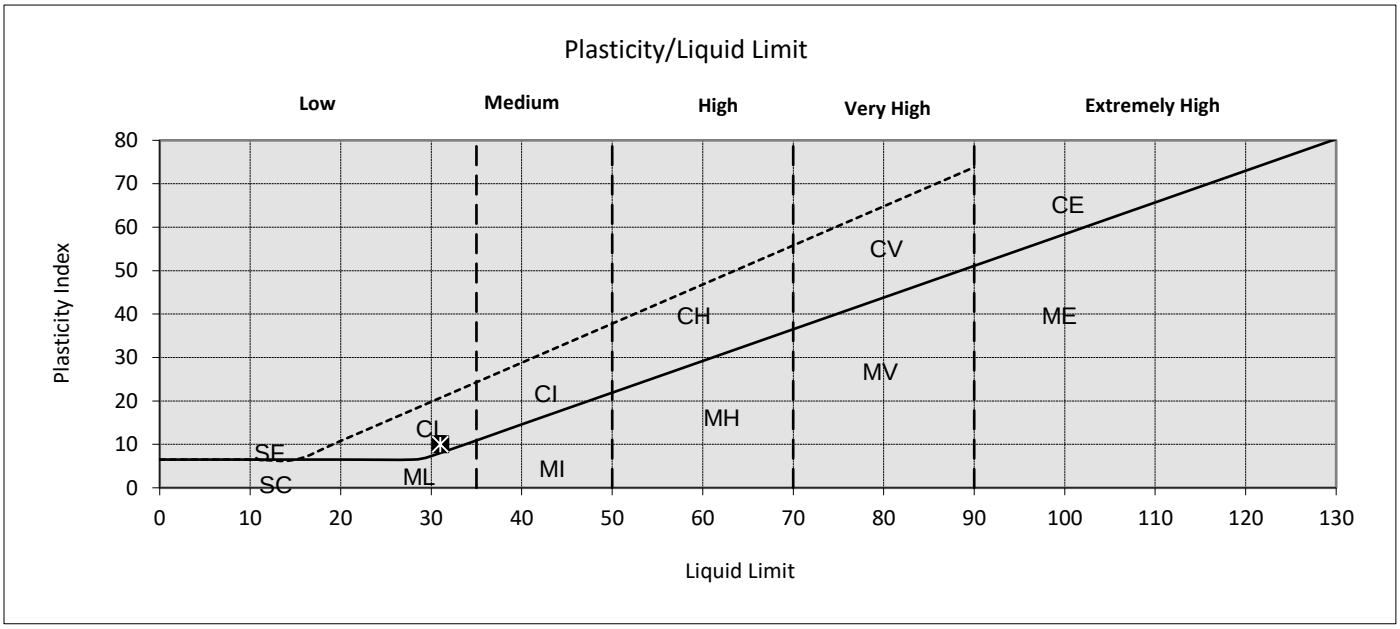
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Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

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

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93358
	Unit 1 Carrigogna	**Sample Ref.:**	XC211-TP02 0.3-0.8m Type D Sample 3
	Midleton	**Date Sampled:**	Client Info
	Co Cork	**Date Received:**	09/03/2020
Order No:	2003-104	**Date Tested:**	20/03/2020
Originator:	**Ian Holley**	**Date Reported:**	31/03/2020

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Bulk**
Sample Preparation Method	**Washed**
MATERIAL	**Soil**
Retained 425 micron (%)	**26**
Natural Moisture Content (%)	**25**
Liquid Limit (single point)(%)	**31**
Plastic Limit (%)	**21**
Plasticity Index	**10**



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Phil Thorp, Laboratory Manager

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Tel: 057 8664885

James Fisher Testing Services

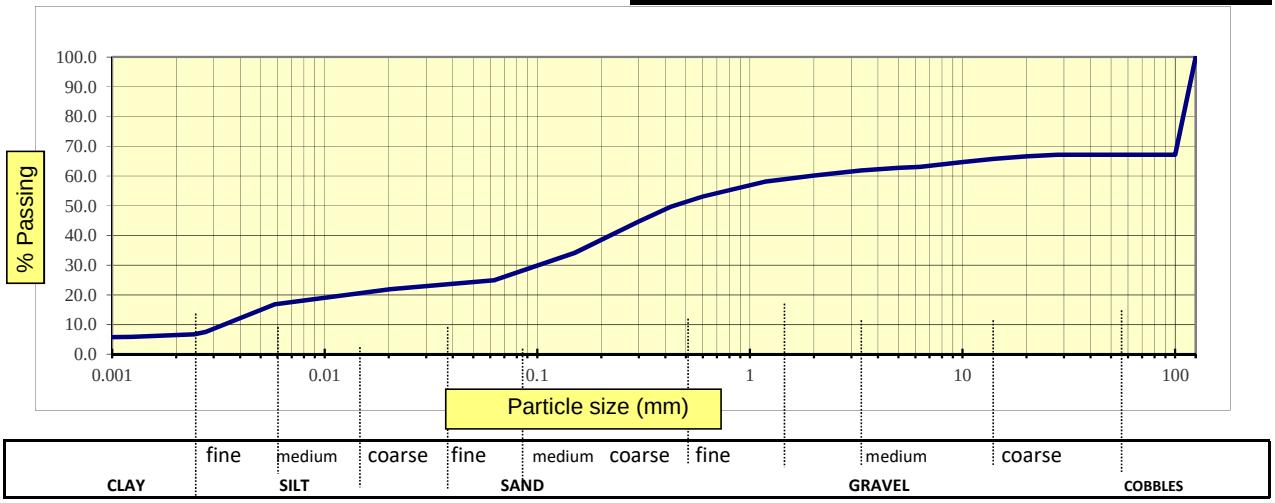
LABORATORY TEST REPORT

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

Project:	Cork Line Level Crossings	**Job No:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93355
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	25/03/2020
		Date Tested:	23/03/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Large Cobble, Dark Sandy Clay

Client Ref.	**XC211-TP02 Type B Sample 2**
Location:	XC211-TP02 Type B Sample 2
Supplier:	Bulk
Source:	Client Info.
Depth (m):	0.3-0.8m
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	67	
75 mm	67	
63 mm	67	
50 mm	67	
37.5 mm	67	
28 mm	67	
20 mm	67	
14 mm	66	
10 mm	65	
6.3 mm	63	
5 mm	63	
3.35 mm	62	
2 mm	60	
1.18 mm	58	
0.6 mm	53	
0.425 mm	50	
0.3 mm	45	
0.15 mm	34	
0.063 mm	25	
0.0205 mm	22	
0.0059 mm	17	
0.0028 mm	7.6	
0.0024 mm	6.7	
0.0012 mm	5.9	



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

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Sedimentation by Hydrometer - Not UKAS

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☐ **James Ward, Operations Manager**

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Warrington,WA1 4RF
Tel: 01925 286 880

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LABORATORY TEST REPORT

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP - BS 1377: Part 4: 1990

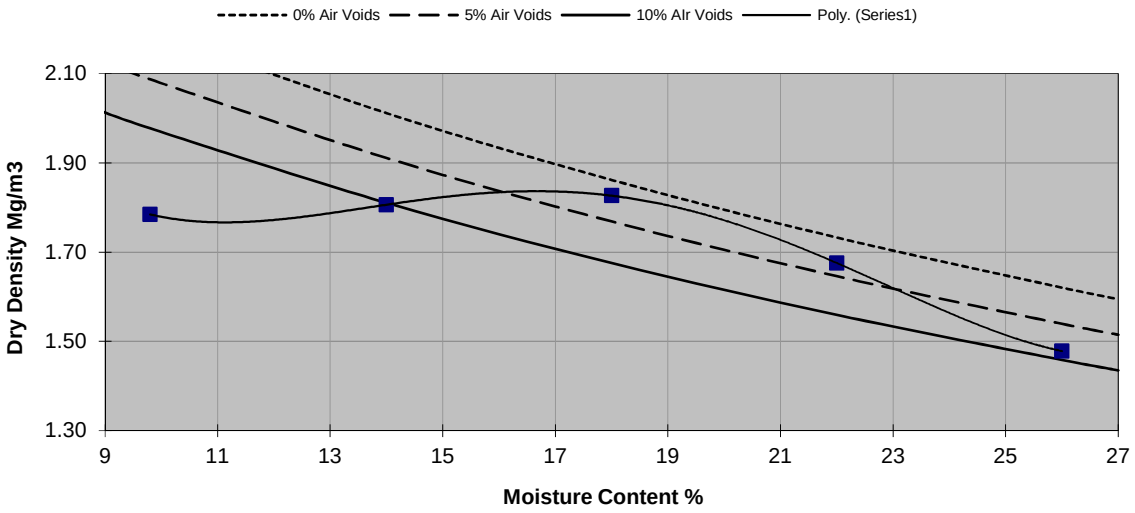
Project:	Cork Line Level Crossings	**Job No:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93360
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	03/04/2020
	Co Cork	**Date Reported:**	06/04/2020
Order No:	2003-104	**Material:**	Soil
Originator:	**Ian Holley**	**Specification:**	Client

Client Sample Ref :	**XC211-TP02 Type B Sample 6**	***Sample Type :***	Bulk
Supplier:	Client Info	***Description :***	Soil
Location:	1.6-2.1m		

Date sampled :	Client Info	***Comments : None***	
Sampling Cert :	No		

Rammer used :	4.5	**No of layers:**	3
No of sub samples :	5	**% retained on 37.5mm sieve**	0.5
Mould Size:	CBR	**% retained on 20mm sieve**	5.5

Bulk Density: Mg/m³	1.96	2.07	2.16	2.04	1.86
Moisture Content: %	9.8	14	18	22	26
Dry Density: Mg/m³	1.78	1.81	1.83	1.68	1.48



Maximum Dry Density (Mg/m³)	**1.84**
Optimum Moisture Content (%)	**17**

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

Tested in accordance with BS 1377: Part 4:1990

Particle Density (Mg/m³) - 2.8 (Assumed)

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

James Fisher Testing Services Limited, a company registered in England and Wales with registration number: 01182561

Registered office: Fisher House, PO Box 4, Barrow-in-Furness, Cumbria, LA14 1HR

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LABORATORY TEST REPORT

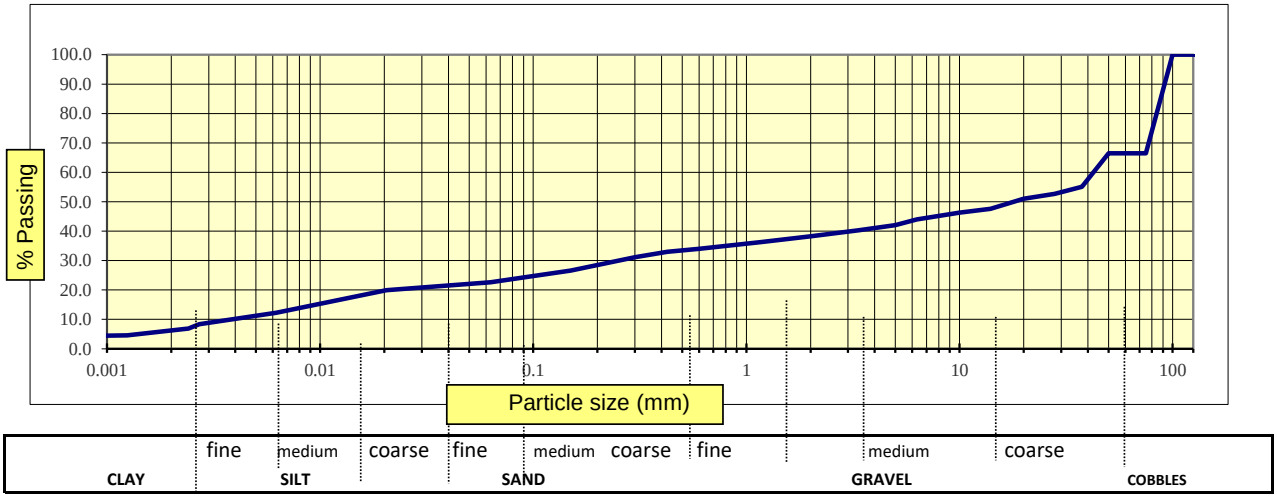
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 93359
	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 Light Clay, Sandy

Client Ref.	**XC211-TP02 Type B Sample 6**
Location:	XC211-TP02 Type B Sample 6
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	66	
63 mm	66	
50 mm	66	
37.5 mm	55	
28 mm	53	
20 mm	51	
14 mm	48	
10 mm	46	
6.3 mm	44	
5 mm	42	
3.35 mm	40	
2 mm	38	
1.18 mm	36	
0.6 mm	34	
0.425 mm	33	
0.3 mm	31	
0.15 mm	27	
0.063 mm	23	
0.020 mm	20	
0.006 mm	12	
0.003 mm	8	
0.002 mm	7	
0.001 mm	5	



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

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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 93363
	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 **XC211-TP02 Type D Sample 9**

Supplier:	Client Info	**Date of Sampling:**	Client Info.
Source:	Client Info	**Sampled By:**	Client
Sample Location:	2.7-3.2m	**Sampling Reason:**	Request

Parameter	RESULT
pH	8.4
Sulphate Aqueous Extract (SO4) (mg/l)	<10
Sulphur as S, Total (%)	0.01
Sulphate as SO4, Total (%)	0.02

Comments:
None

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

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.

☐ **James Ward, Operations Manager**

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Portlaoise, Co.Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

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

Site:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93361
	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: XC211-TP02 Type D Sample 9

Sample Type:	Bulk	***Location:***	XC211-TP02 Type D Sample 9
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	2.7-3.2m	***Material Type:***	Soil

Moisture Content (%): 12

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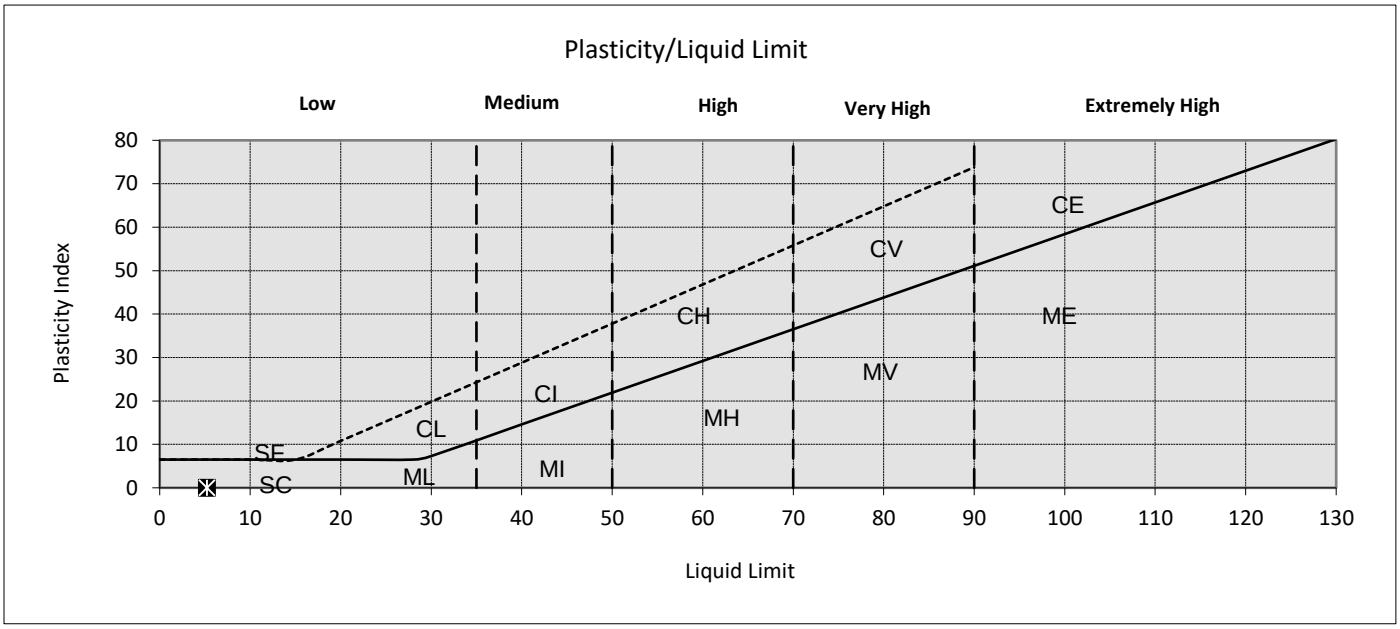
James Fisher Testing Services Ltd
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Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

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

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93362
	Unit 1 Carrigogna	**Sample Ref.:**	XC211-TP02 2.7-3.2m Type D Sample 9
	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 (%)	**70**
Natural Moisture Content (%)	**11**
Liquid Limit (single point)(%)	**5**
Plastic Limit (%)	**Non-Plastic**
Plasticity Index	**N/A**



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

UKAS TESTING 0955

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

James Fisher Testing Services

LABORATORY TEST REPORT

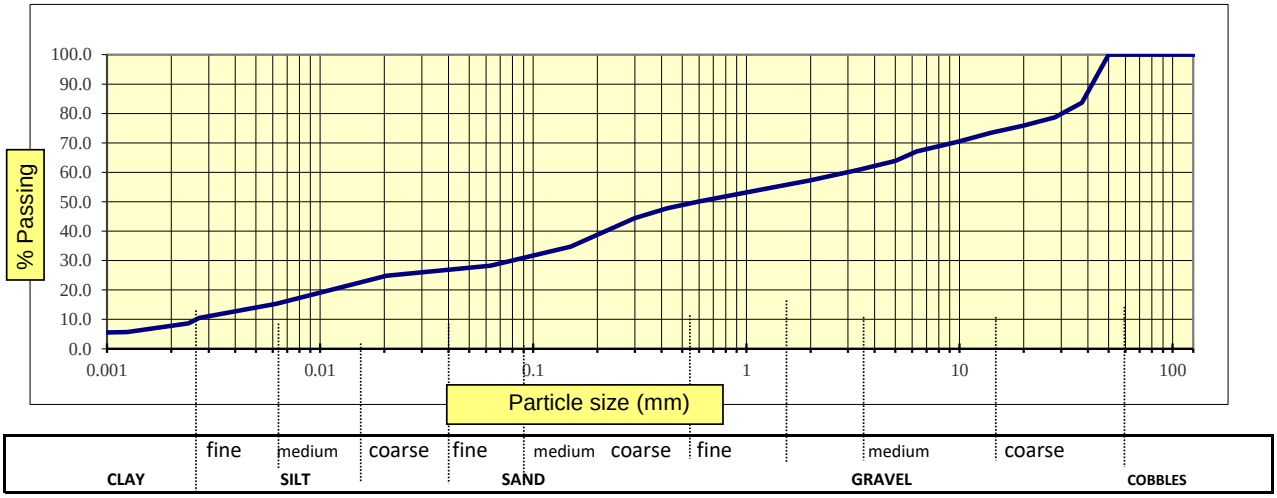
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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

Project:	Cork Line Level Crossings	**Job No:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93364
	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, Sandy

Client Ref.	**XC211-TP03 Type B Sample 2**
Location:	XC211-TP03 Type B Sample 2
Supplier:	Bulk
Source:	Client Info.
Depth (m):	0.3-0.8m
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	100	
63 mm	100	
50 mm	100	
37.5 mm	84	
28 mm	79	
20 mm	76	
14 mm	73	
10 mm	71	
6.3 mm	67	
5 mm	64	
3.35 mm	61	
2 mm	57	
1.18 mm	54	
0.6 mm	50	
0.425 mm	48	
0.3 mm	44	
0.15 mm	35	
0.063 mm	28	
0.020 mm	25	
0.006 mm	15	
0.003 mm	11	
0.002 mm	9	
0.001 mm	6	



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

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Sedimentation by Hydrometer - Not UKAS

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☐ **James Ward, Operations 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 93367
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	06/04/2020
	Co. Cork	**Material:**	Soil
Order No.:	2003-104	**Date Tested:**	31/03/2020
Originator:	Ian Holley	**Specification:**	Client

Sample Details **XC211-TP03 Type D Sample 7**

Supplier:	Client Info	**Date of Sampling:**	Client Info.
Source:	Client Info	**Sampled By:**	Client
Sample Location:	1.3-1.8m	**Sampling Reason:**	Request

Parameter	RESULT
pH	7.8
Sulphate Aqueous Extract as (SO4) (mg/l)	11
Sulphur as S, Total (%)	0.01
Sulphate as SO4, Total (%)	0.02

Comments:
None

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

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.

☐ **James Ward, Operations Manager**

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Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

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

Site:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93465
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	13/03/2020
Order No:	2003-104	**Date Reported:**	25/03/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC211-TP03 Type D Sample 7

Sample Type:	Bulk	***Location:***	XC211-TP03 Type D Sample 7
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	1.3-1.8m	***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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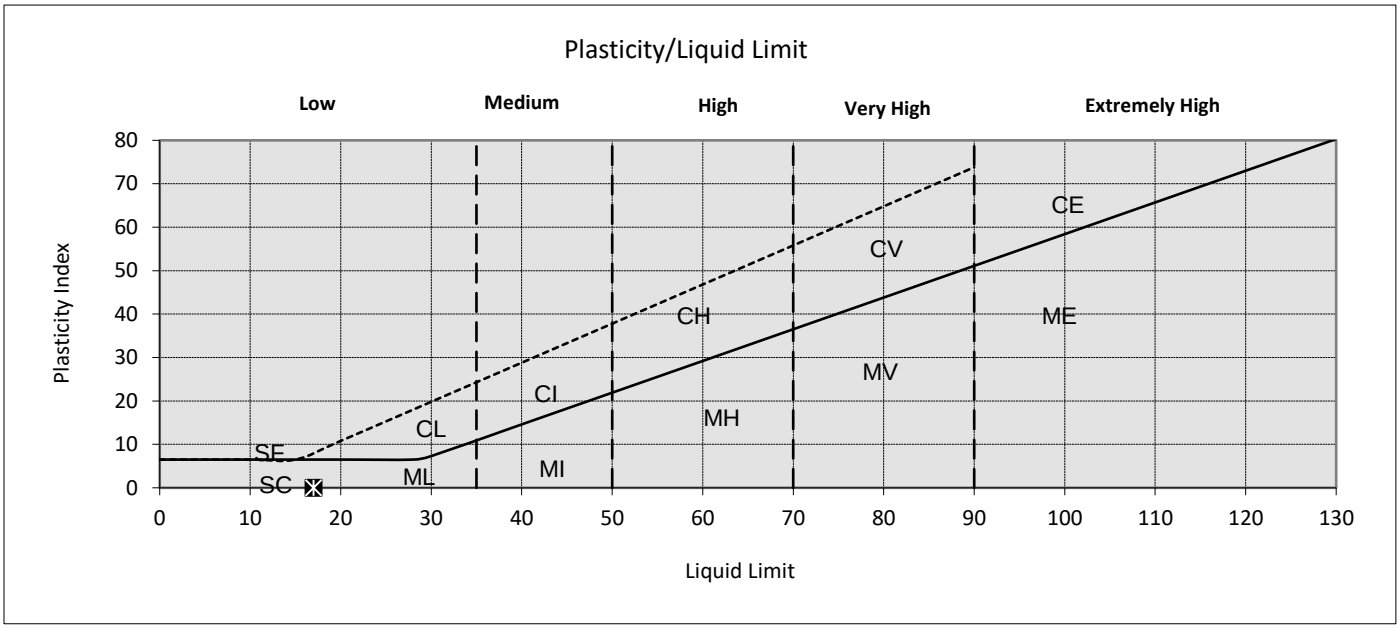
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

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

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93366
	Unit 1 Carrigogna	**Sample Ref.:**	XC211-TP03 1.3-1.8m Type D Sample 7
	Midleton	**Date Sampled:**	Client Info
	Co Cork	**Date Received:**	09/03/2020
Order No:	2003-104	**Date Tested:**	18/03/2020
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 (%)	**56**
Natural Moisture Content (%)	**12**
Liquid Limit (single point)(%)	**17**
Plastic Limit (%)	**Non-Plastic**
Plasticity Index	**N/A**



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James Fisher Testing Services Ltd
Phil Thorp, Laboratory Manager

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Portlaoise, Co.Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

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

Site:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93368
	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: XC211-TP03 Type D Sample 9

Sample Type:	Bulk	***Location:***	XC211-TP03 Type D Sample 9
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	2.5-3.0m	***Material Type:***	Soil

Moisture Content (%): 11

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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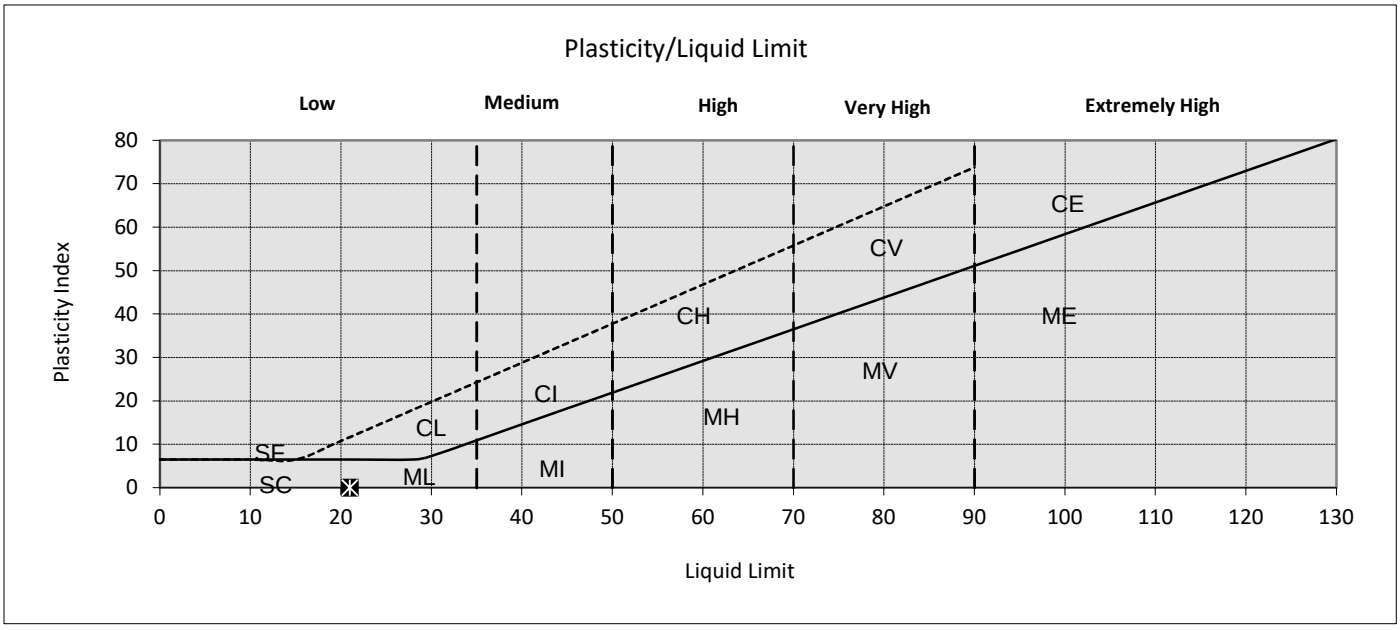
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Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

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

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93369
	Unit 1 Carrigogna	**Sample Ref.:**	XC211-TP03 2.5-3.0m Type D S.9
	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 (%)	**25**
Natural Moisture Content (%)	**10**
Liquid Limit (single point)(%)	**21**
Plastic Limit (%)	**Non-Plastic**
Plasticity Index	**N/A**



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Phil Thorp, Laboratory Manager

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

James Fisher Testing Services

LABORATORY TEST REPORT

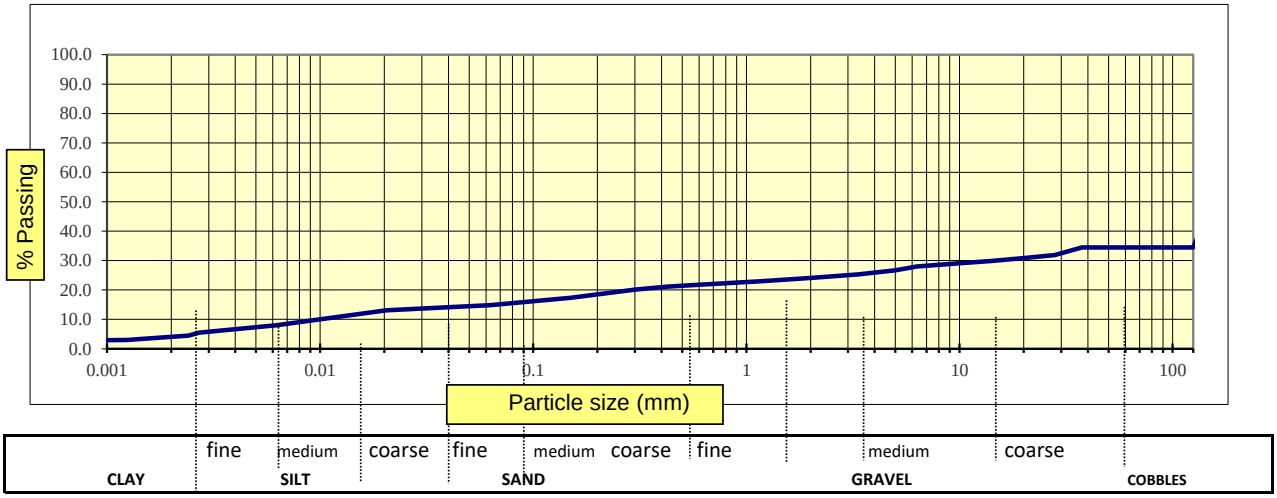
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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

Project:	Cork Line Level Crossings	**Job No:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93370
	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**	Large Cobble, Light Clay, Sandy

Client Ref.	**XC211-TP03 Type B Sample 11**
Location:	XC211-TP03 Type B Sample 11
Supplier:	Bulk
Source:	Client Info.
Depth (m):	3.7-4.2m
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	34	
100 mm	34	
75 mm	34	
63 mm	34	
50 mm	34	
37.5 mm	34	
28 mm	32	
20 mm	31	
14 mm	30	
10 mm	29	
6.3 mm	28	
5 mm	27	
3.35 mm	25	
2 mm	24	
1.18 mm	23	
0.6 mm	22	
0.425 mm	21	
0.3 mm	20	
0.15 mm	17	
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

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Sedimentation by Hydrometer - Not UKAS

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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
XC211-CP01	6	0.70	1.90	D	Brown slightly gravelly sandy CLAY			9.6	49 s	19 b	14	5		
XC211-CP01	9	1.90	2.50	D	Brown slightly sandy slightly gravelly CLAY			4.1	58 s	27 b	15	12		
XC211-CP01	14	3.50	4.50	D	Brown sandy slightly gravelly silty CLAY			9.7	61 s	20 a	13	7		
XC211-CP01	18	5.50	6.50	D	Brown slightly sandy gravelly CLAY.			2.1	41 s	23 b	13	10		
XC211-CP01	22	7.20	8.00	D	Brown slightly sandy slightly gravelly CLAY			12	57 s	27 b	15	12		
XC211-CP01	27	9.00	10.00	D	Brown slightly sandy slightly gravelly CLAY			14	62 s	30 a	15	15		
XC211-CP02	6	1.20	2.00	D	Brown slightly sandy slightly gravelly CLAY.			12	60 s	26 b	14	12		
XC211-CP02	12	3.00	4.00	D	Brown slightly sandy slightly gravelly CLAY			9.8	62 s	31 b	17	14		
XC211-CP02	16	5.00	6.00	D	Brown slightly sandy slightly gravelly CLAY			9.8	62 s	29 b	16	13		
XC211-CP02	21	7.00	8.00	D	Brown slightly sandy slightly gravelly CLAY.			12	74 s	30 a	16	14		
XC211-CP02	25	9.00	10.00	D	Brown sandy slightly gravelly CLAY			15	61 s	26 a	14	12		
XC211-CP02	29	11.00	12.00	D	Brown slightly sandy slightly gravelly CLAY			36	58 s	30 a	16	14		

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

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

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

WP Plastic limit
NP non - plastic
IP Plasticity Index

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

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

QA Ref
SLR 1
Rev 2.95
Mar 17

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Project No N9426-20
Project Name Cork Line Level Crossings

Figure
INDX

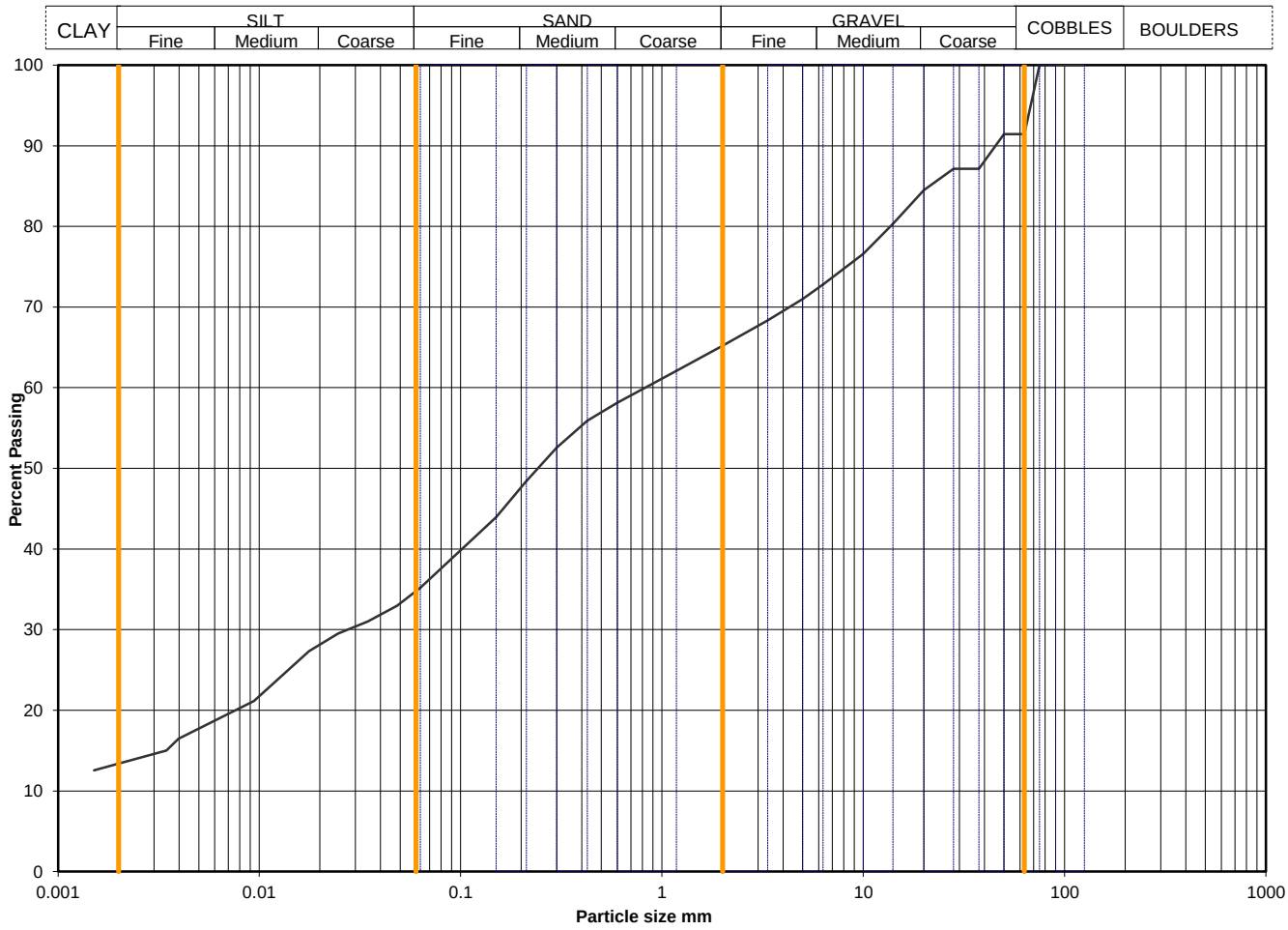
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020100629

Hole No	XC211-CP01
Sample Depth (m BGL)	1.90 - 2.50
Sample Type and No	B8
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	35
90	100	0.0484	33
75	100	0.0346	31
63	91	0.0246	30
50	91	0.0176	27
37.5	87	0.0094	21
28	87	0.0040	16
20	84	0.0034	15
14	80	0.0015	13
10	77		
6.3	73		
5.0	71		
3.35	68		
2.00	65		
1.18	62	Particle density, Mg/m3	
0.600	58		
0.425	56	2.65 assumed	
0.300	53	Dry mass of sample, kg	
0.212	48		
0.150	44	4.5	
0.063	35		

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

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	8.6	0.0
	Gravel	26.2	28.7
	Sand	30.0	32.8
*<60mm values to aid description only	Silt	21.8	23.9
	Clay	13.4	14.7

Uniformity Coefficient	D60 / D10	Not applicable

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

QA Ref
SLR 2,9
Rev 2.22
Jul 17

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Project No N9426-20

Project Name Cork Line Level Crossings

Figure
PSD

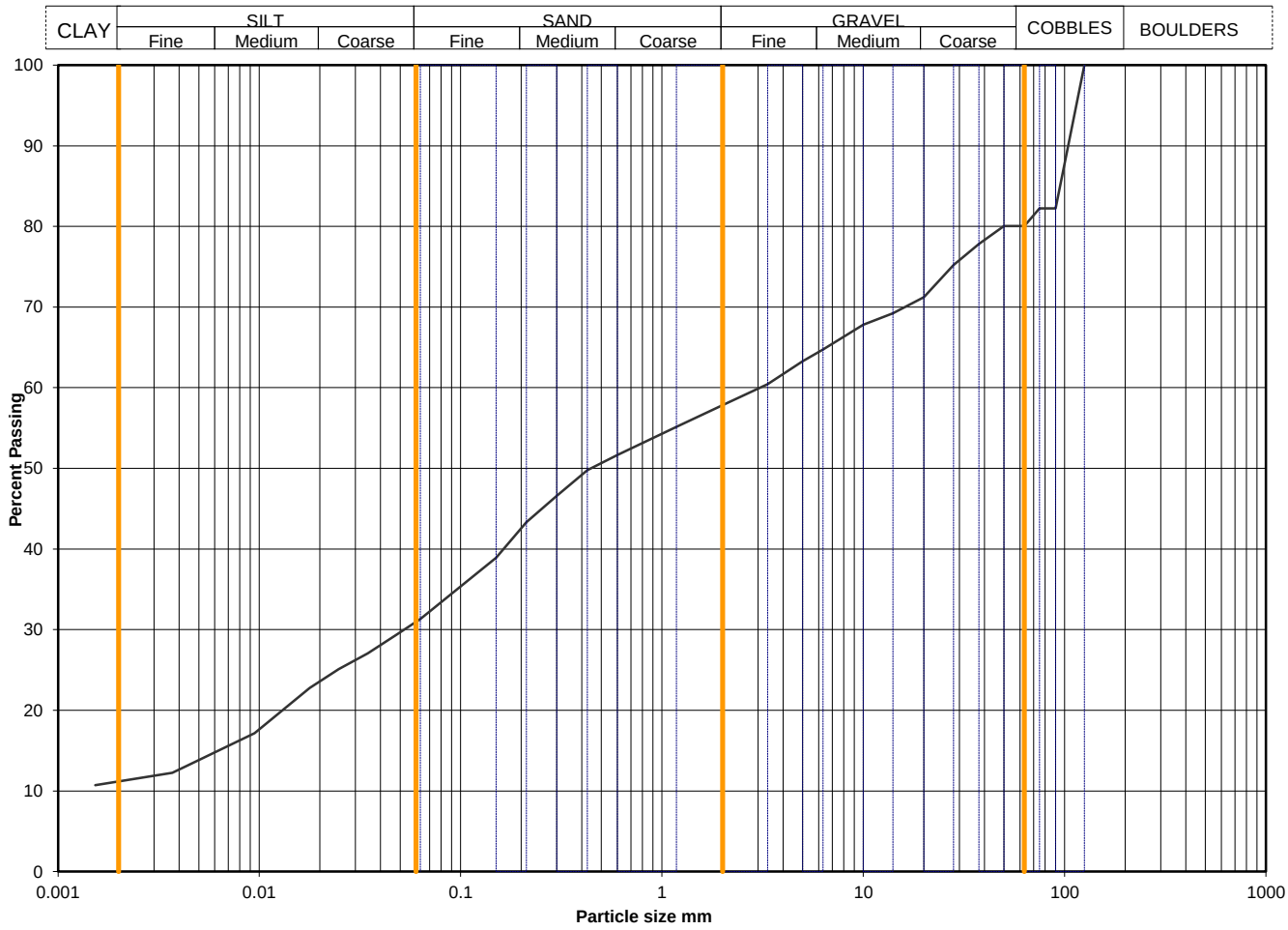
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020100635

Hole No	XC211-CP01
Sample Depth (m BGL)	4.50 - 5.50
Sample Type and No	B15
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	31
90	82	0.0482	29
75	82	0.0346	27
63	80	0.0247	25
50	80	0.0177	23
37.5	78	0.0095	17
28	75	0.0044	13
20	71	0.0037	12
14	69	0.0015	11
10	68		
6.3	65		
5.0	63		
3.35	60		
2.00	58		
1.18	55	Particle density, Mg/m3	
0.600	52		
0.425	50	2.65 assumed	
0.300	47	Dry mass of sample, kg	
0.212	43		
0.150	39	20.0	
0.063	31		

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

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	20.0	0.0
	Gravel	22.2	27.8
	Sand	26.5	33.1
*<60mm values to aid description only	Silt	20.1	25.1
	Clay	11.2	14.0

Uniformity Coefficient	D60 / D10	Not applicable

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

QA Ref
SLR 2,9
Rev 2.22
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Project No N9426-20

Project Name Cork Line Level Crossings

Figure
PSD

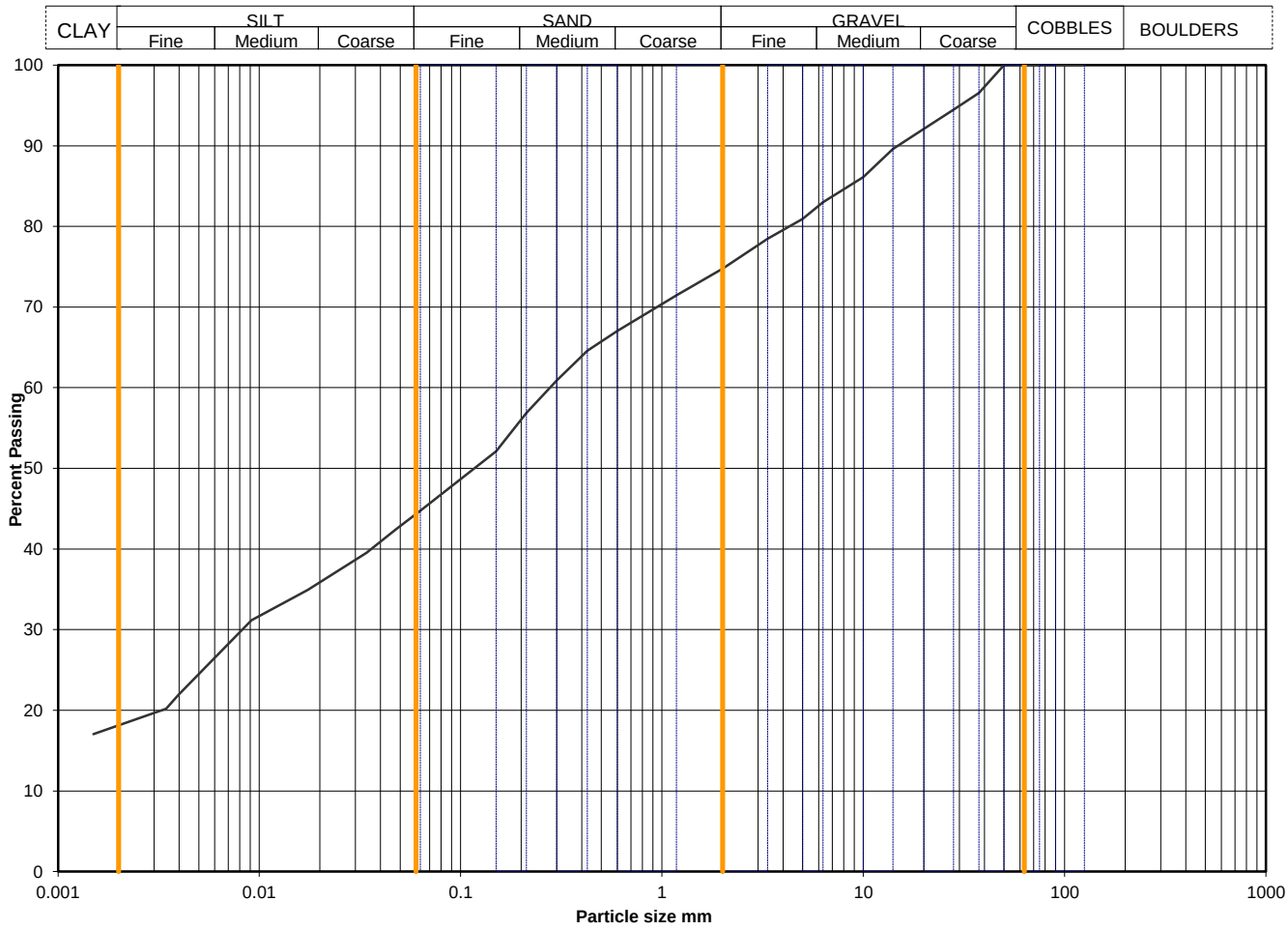
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020100646

Hole No	XC211-CP01
Sample Depth (m BGL)	9.00 - 10.00
Sample Type and No	B26
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	45
90	100	0.0475	42
75	100	0.0341	40
63	100	0.0243	37
50	100	0.0174	35
37.5	97	0.0091	31
28	94	0.0040	22
20	92	0.0034	20
14	90	0.0015	17
10	86		
6.3	83		
5.0	81		
3.35	78		
2.00	75		
1.18	71	Particle density, Mg/m3	
0.600	67		
0.425	65	2.65 assumed	
0.300	61	Dry mass of sample, kg	
0.212	57		
0.150	52	2.8	
0.063	45		

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

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	0.0	0.0
	Gravel	25.3	25.3
	Sand	30.0	30.0
*<60mm values to aid description only	Silt	26.6	26.6
	Clay	18.1	18.1

Uniformity Coefficient	D60 / D10	Not applicable

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

QA Ref
SLR 2,9
Rev 2.22
Jul 17

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Project No N9426-20

Project Name Cork Line Level Crossings

Figure
PSD

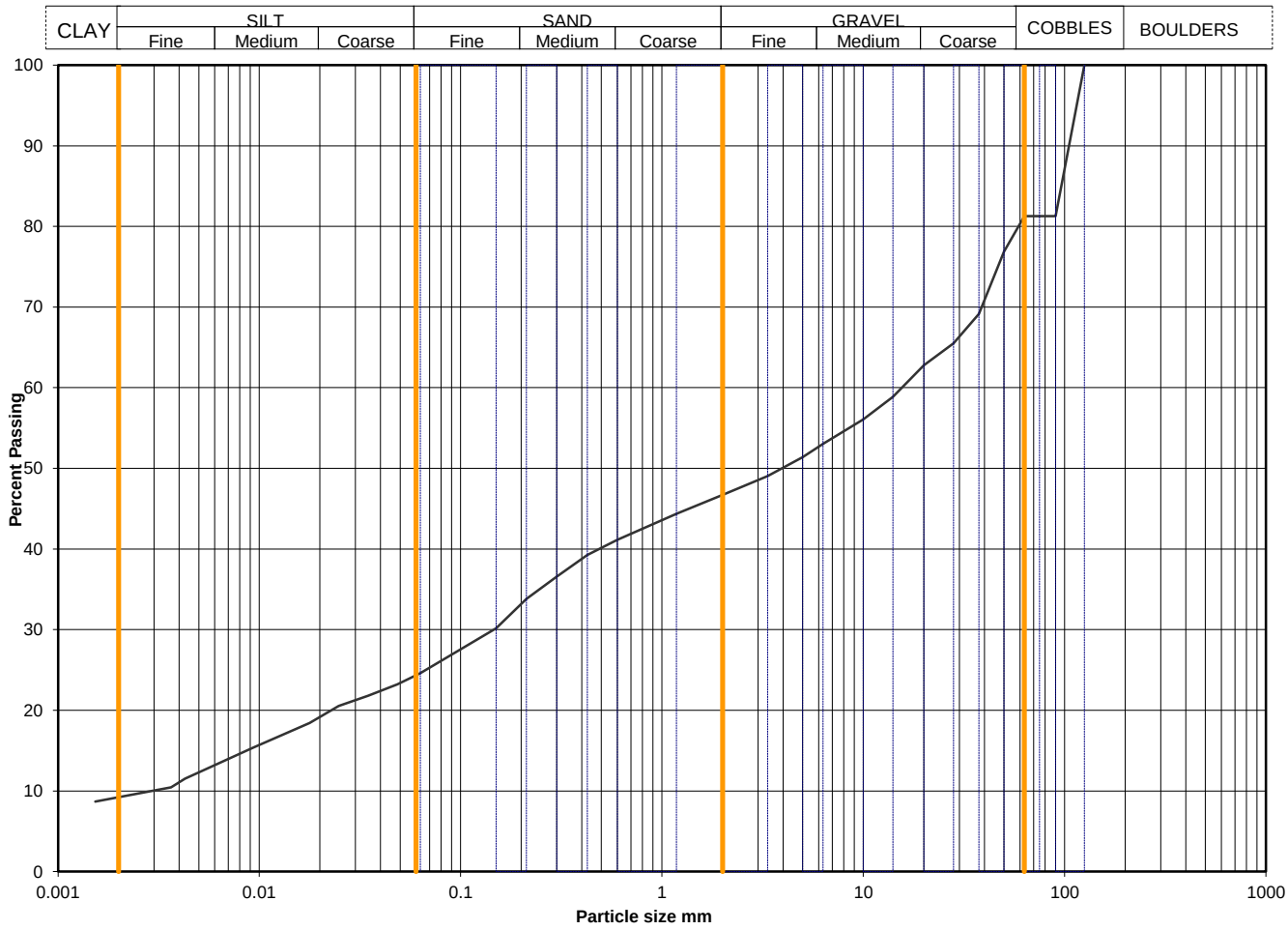
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020100650

Hole No	XC211-CP02
Sample Depth (m BGL)	1.20 - 2.00
Sample Type and No	B5
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	25
90	81	0.0486	23
75	81	0.0347	22
63	81	0.0248	21
50	77	0.0178	18
37.5	69	0.0094	15
28	66	0.0043	12
20	63	0.0036	10
14	59	0.0015	9
10	56		
6.3	53		
5.0	51		
3.35	49		
2.00	47		
1.18	44	Particle density, Mg/m3	
0.600	41		
0.425	39	2.65 assumed	
0.300	37	Dry mass of sample, kg	
0.212	34		
0.150	30	8.4	
0.063	25		

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

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	18.7	0.0
	Gravel	34.6	42.6
	Sand	22.1	27.2
*<60mm values to aid description only	Silt	15.4	18.9
	Clay	9.2	11.3

Uniformity Coefficient	D60 / D10	4858

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

QA Ref
SLR 2,9
Rev 2.22
Jul 17

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Project No N9426-20

Project Name Cork Line Level Crossings

Figure

PSD

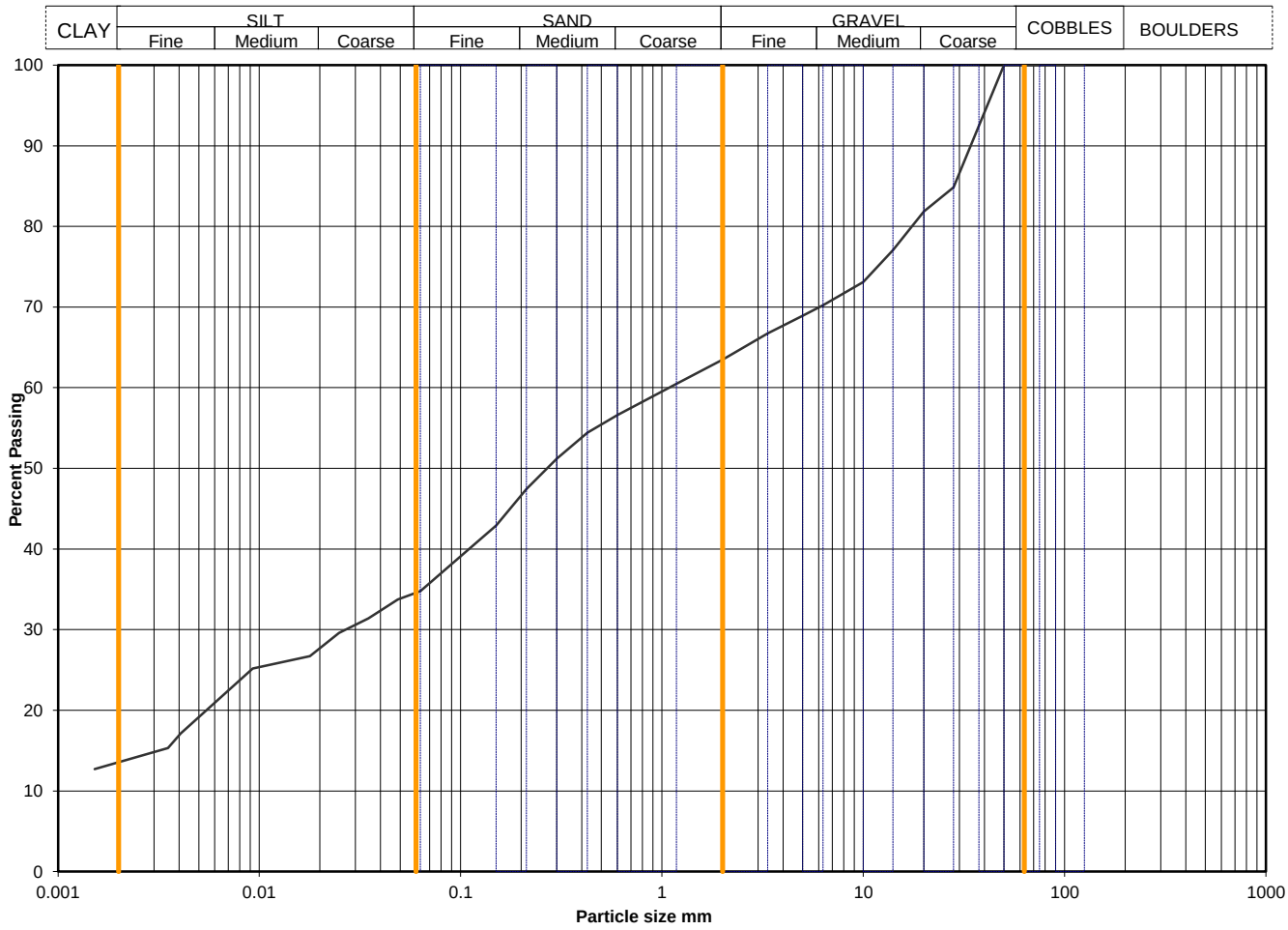
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Printed: 20/11/2020 10:00

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020100652

Hole No	XC211-CP02
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	0.0630	35
90	100	0.0486	34
75	100	0.0348	31
63	100	0.0248	30
50	100	0.0178	27
37.5	92	0.0093	25
28	85	0.0041	17
20	82	0.0035	15
14	77	0.0015	13
10	73		
6.3	70		
5.0	69		
3.35	67		
2.00	63		
1.18	60	Particle density, Mg/m3	
0.600	57		
0.425	54	2.65 assumed	
0.300	51	Dry mass of sample, kg	
0.212	47		
0.150	43	2.3	
0.063	35		

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

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	0.0	0.0
	Gravel	36.5	36.5
	Sand	28.7	28.7
*<60mm values to aid description only	Silt	21.2	21.2
	Clay	13.6	13.6

Uniformity Coefficient	D60 / D10	Not applicable

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

QA Ref
SLR 2,9
Rev 2.22
Jul 17

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Project No N9426-20

Project Name Cork Line Level Crossings

Figure
PSD

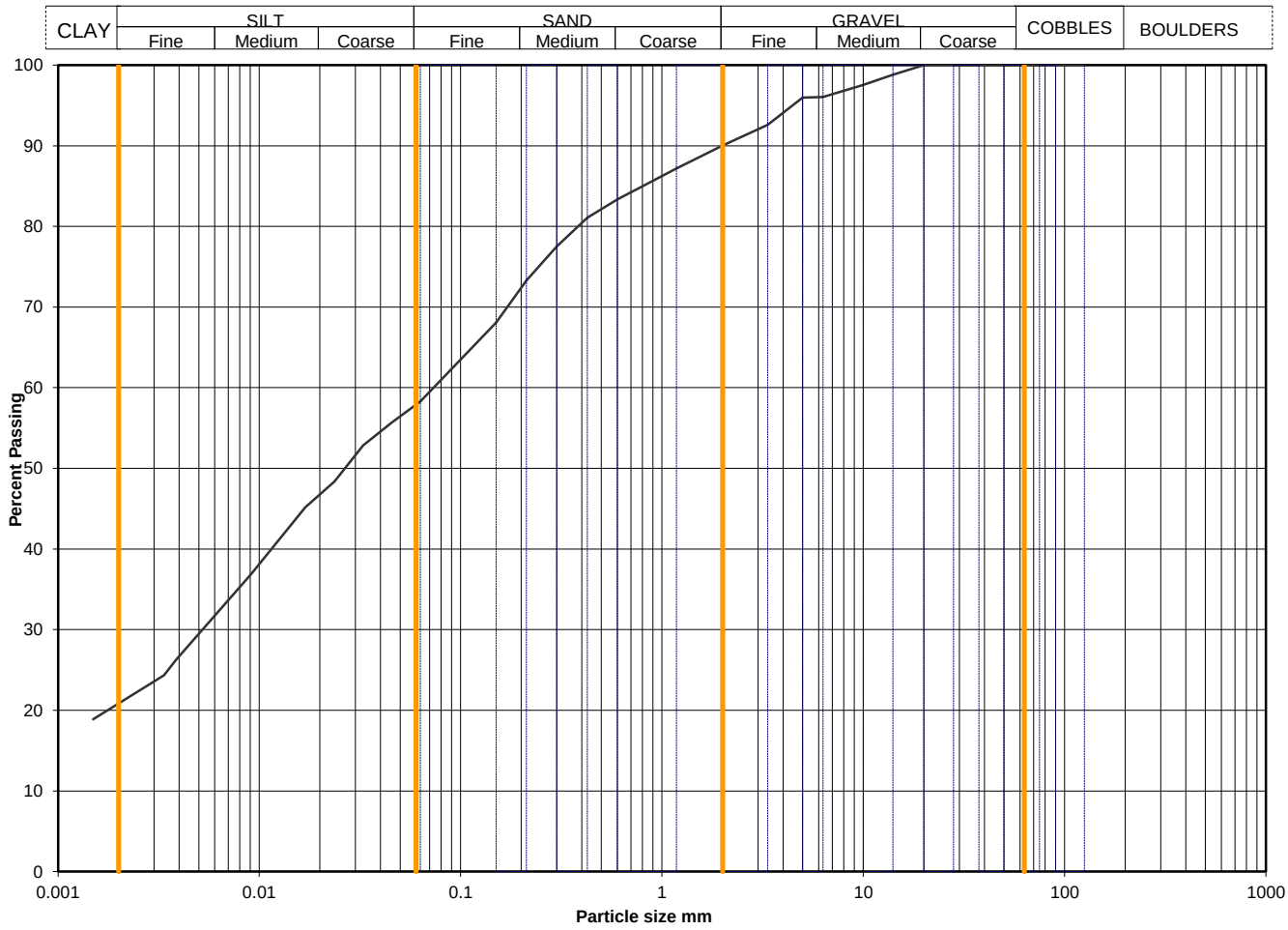
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020100661

Hole No	XC211-CP02
Sample Depth (m BGL)	6.00 - 7.00
Sample Type and No	D18
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	58
90	100	0.0456	56
75	100	0.0327	53
63	100	0.0236	48
50	100	0.0169	45
37.5	100	0.0091	37
28	100	0.0039	26
20	100	0.0034	24
14	99	0.0015	19
10	98		
6.3	96		
5.0	96		
3.35	93		
2.00	90		
1.18	87	Particle density, Mg/m3	
0.600	83		
0.425	81	2.65 assumed	
0.300	78	Dry mass of sample, kg	
0.212	73		
0.150	68	1.0	
0.063	58		

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

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	0.0	0.0
	Gravel	10.0	10.0
	Sand	31.7	31.7
*<60mm values to aid description only	Silt	37.4	37.4
	Clay	20.9	20.9

Uniformity Coefficient	D60 / D10	Not applicable

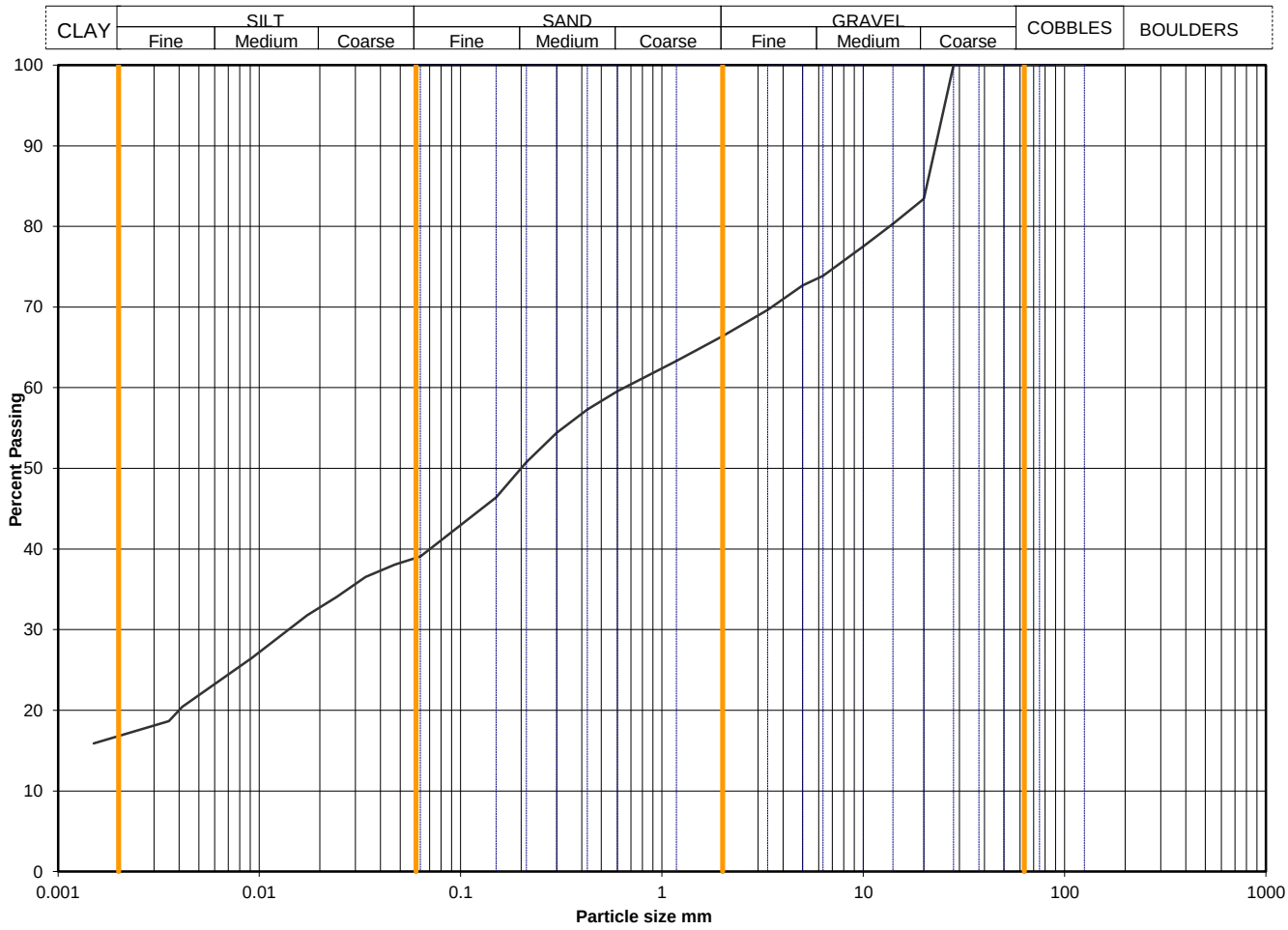
Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020100669

Hole No	XC211-CP02
Sample Depth (m BGL)	10.00 - 11.00
Sample Type and No	B26
Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	39
90	100	0.0472	38
75	100	0.0337	37
63	100	0.0242	34
50	100	0.0173	32
37.5	100	0.0092	26
28	100	0.0041	20
20	83	0.0036	19
14	80	0.0015	16
10	78		
6.3	74		
5.0	73		
3.35	70		
2.00	66		
1.18	63	Particle density, Mg/m3	
0.600	60		
0.425	57	2.65 assumed	
0.300	54	Dry mass of sample, kg	
0.212	51		
0.150	46	3.5	
0.063	39		

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

Sample Proportions		Whole	*<60mm
	Cobbles / boulders	0.0	0.0
	Gravel	33.6	33.6
	Sand	27.3	27.3
*<60mm values to aid description only	Silt	22.3	22.3
	Clay	16.8	16.8

Uniformity Coefficient	D60 / D10	Not applicable

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

QA Ref
SLR 2,9
Rev 2.22
Jul 17

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Project No N9426-20

Project Name Cork Line Level Crossings

Figure
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UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TESTS WITHOUT MEASUREMENT OF PORE PRESSURE - SUMMARY OF RESULTS

Hole No.	Sample No.	Depth (m) from	Depth (m) to	type	Soil Description	Density bulk Mg/m3	Density dry Mg/m3	*w* %	Test type	Dia. mm	ó3 kPa	At failure / end of stage: Axial strain %	ó1 - ó3 kPa	*CU* kPa	MODE	Membrane Thickness mm	Remarks
XC211-CP02	19	7.50		U	Firm light brown slightly sandy slightly gravelly CLAY.	2.27	2.02	12	UUM	103.7 103.7 103.7	75 150 300	3.0 4.9 19.7	34 44 75	17 22 37	P	0.3	

General notes: Tests carried out in accordance with BS1377: Part 7: 1990, clause 8 for single stage, clause 9 for multistage tests. Specimens nominally 2:1 height diameter ratio and tested at a rate of strain of 2%/minute, unless annotated otherwise. Latex rubber membrane used and membrane correction applied in accordance with BS1377-7 8.5.1.4 unless stated. Tested from base depth and in a vertical orientation unless stated otherwise.

Legend						
	UU - single stage test (may be in sets of specimens)	ó3	cell pressure	Mode of failure	P	plastic
	UUM - multistage test on a single specimen	ó1 - ó3	deviator stress		B	brittle
	suffix R - remoulded or recompacted	*CU*	undrained shear strength		C	compound

QA Ref
SLR 2
Rev 2.8
Apr 19

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Project No N9426-20

Project Name Cork Line Level Crossings

Figure

UUSUM

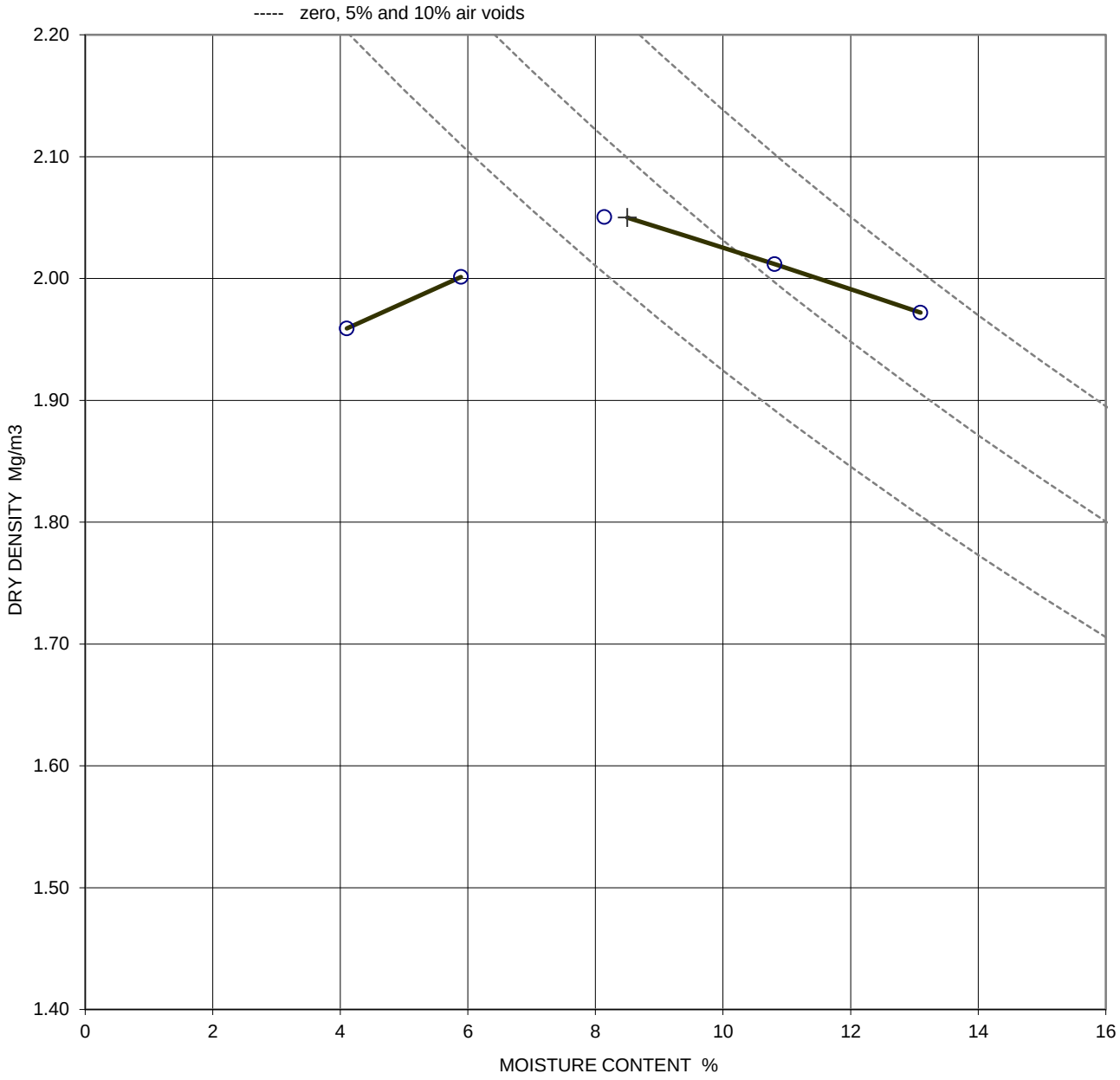
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DRY DENSITY / MOISTURE CONTENT RELATIONSHIP
BS1377 : PART 4 : 1990 : HEAVY COMPACTION, 4.5 kg rammer

Sample Details:	SAMPLE ID:
	SOCO2020100654

Hole No	XC211-CP02
Sample Depth (m BGL)	3.00 - 4.00
Sample Type and No	B11
Specimen Ref	



Soil description	Brown slightly sandy slightly gravelly CLAY.		
Test method	BS 1377:part 4:1990: clause 3.5, 4.5 kg rammer in a 1 litre mould		
Preparation	Original material was natural, single sample tested		
Material > 37.5mm	0	%	
Material < 37.5mm > 20mm	3	%	
Particle density	2.72	assumed	
Remarks			

Derived Parameters +

Maximum dry density, Mg/m3 **2.05**

Optimum moisture content, % **8.5**

QA Ref
SLD 4, 3.5/6
Rev 2.8
Sep 17

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Project No	N9426-20
Project Name	Cork Line Level Crossings

Figure
COMPH

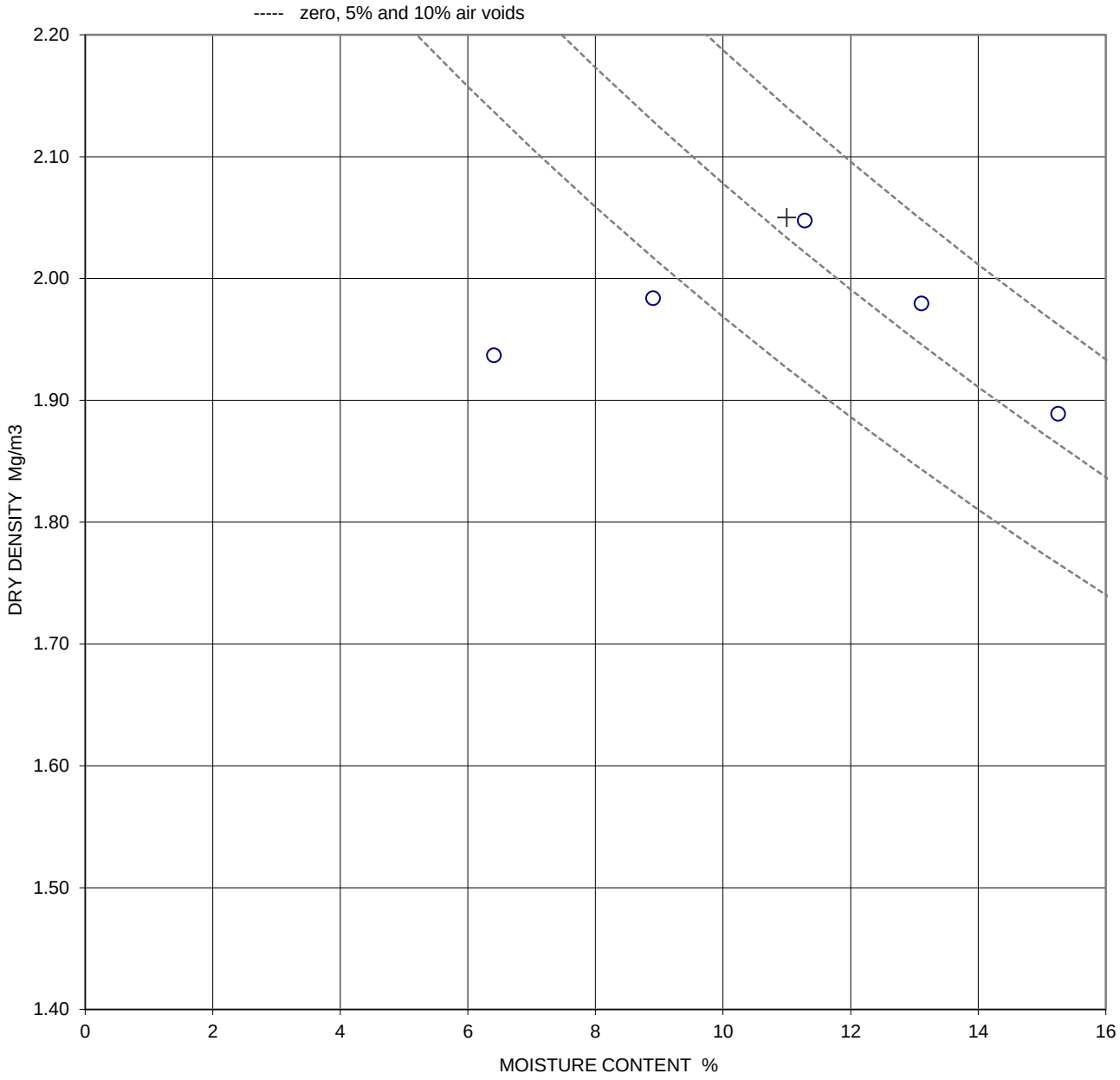
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DRY DENSITY / MOISTURE CONTENT RELATIONSHIP
BS1377 : PART 4 : 1990 : HEAVY COMPACTION, 4.5 kg rammer

Sample Details:	SAMPLE ID:
	SOCO2020100656

Hole No	XC211-CP02
Sample Depth (m BGL)	4.00 - 5.00
Sample Type and No	B13
Specimen Ref	



Soil description	Brown slightly sandy slightly gravelly CLAY.		
Test method	BS 1377:part 4:1990: clause 3.5, 4.5 kg rammer in a 1 litre mould		
Preparation	Original material was natural, single sample tested		
Material > 37.5mm	0	%	
Material < 37.5mm > 20mm	4	%	
Particle density	2.80	assumed	
Remarks			

Derived Parameters +

Maximum dry density, Mg/m3 **2.05**

Optimum moisture content, % **11**

QA Ref
SLD 4, 3.5/6
Rev 2.8
Sep 17

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Project No N9426-20

Project Name Cork Line Level Crossings

Figure
COMPH

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20/11/2020
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Appendix H Environmental Laboratory Test Results

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

Final Report

Report No.:	20-07165-1		
Initial Date of Issue:	12-Mar-2020		
Client	Environmental Laboratory Services Ltd		
Client Address:	Acorn Business Campus Mahon Industrial Park Blackrock Cork Ireland		
Contact(s):	Emer Kearney Results		
Project	Soil Samples		
Quotation No.:	Q20-19728	**Date Received:**	05-Mar-2020
Order No.:	6897	**Date Instructed:**	05-Mar-2020
No. of Samples:	2		
Turnaround (Wkdays):	5	**Results Due:**	11-Mar-2020
Date Approved:	12-Mar-2020		
Approved By:			
Details:	Darrell Hall, Director		

Chemtest
The right chemistry to deliver results

Results - Leachate

Project: Soil Samples

Client: Environmental Laboratory Services Ltd				**Chemtest Job No.:**			20-07165	20-07165		
Quotation No.: Q20-19728				**Chemtest Sample ID.:**			981122	981123		
Order No.: 6897				Client Sample Ref.:			176540/003	176540/004		
				Client Sample ID.:			3	4		
				Sample Location:			XC211-TP01	XC211-TP01		
				Sample Type:			SOIL	SOIL		
				Top Depth (m):			0.05	3.00		
				Date Sampled:			20-Feb-2020	20-Feb-2020		
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**					
pH	U	1010	10:1		N/A			10.0	8.6		
Cyanide (Free)	U	1300	10:1	mg/l	0.050			< 0.050	< 0.050		
Arsenic (Dissolved)	U	1450	10:1	µg/l	1.0			1.2	2.2		
Boron (Dissolved)	U	1450	10:1	µg/l	20			< 20	< 20		
Barium (Dissolved)	U	1450	10:1	µg/l	5.0			< 5.0	7.4		
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			1.8	5.1		
Copper (Dissolved)	U	1450	10:1	µg/l	1.0			1.8	2.4		
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			2.3	6.4		
Selenium (Dissolved)	U	1450	10:1	µg/l	1.0			< 1.0	< 1.0		
Vanadium (Dissolved)	U	1450	10:1	µg/l	1.0			1.9	8.6		
Zinc (Dissolved)	U	1450	10:1	µg/l	1.0			3.5	16		
Aliphatic TPH >C5-C6	N	1675	10:1	µg/l	0.10			< 0.10	< 0.10		
Aliphatic TPH >C6-C8	N	1675	10:1	µg/l	0.10			< 0.10	< 0.10		
Aliphatic TPH >C8-C10	N	1675	10:1	µg/l	0.10			< 0.10	< 0.10		
Aliphatic TPH >C10-C12	N	1675	10:1	µg/l	0.10			< 0.10	< 0.10		
Aliphatic TPH >C12-C16	N	1675	10:1	µg/l	0.10			< 0.10	< 0.10		
Aliphatic TPH >C16-C21	N	1675	10:1	µg/l	0.10			< 0.10	< 0.10		
Aliphatic TPH >C21-C35	N	1675	10:1	µg/l	0.10			< 0.10	< 0.10		
Aliphatic TPH >C35-C44	N	1675	10:1	µg/l	0.10			< 0.10	< 0.10		
Total Aliphatic Hydrocarbons	N	1675	10:1	µg/l	5.0			< 5.0	< 5.0		
Aromatic TPH >C5-C7	N	1675	10:1	µg/l	0.10			< 0.10	< 0.10		
Aromatic TPH >C7-C8	N	1675	10:1	µg/l	0.10			< 0.10	< 0.10		
Aromatic TPH >C8-C10	N	1675	10:1	µg/l	0.10			< 0.10	< 0.10		
Aromatic TPH >C10-C12	N	1675	10:1	µg/l	0.10			36	< 0.10		
Aromatic TPH >C12-C16	N	1675	10:1	µg/l	0.10			< 0.10	< 0.10		
Aromatic TPH >C16-C21	N	1675	10:1	µg/l	0.10			< 0.10	< 0.10		
Aromatic TPH >C21-C35	N	1675	10:1	µg/l	0.10			< 0.10	< 0.10		
Aromatic TPH >C35-C44	N	1680	10:1	µg/l	50.00			< 50	< 50		
Total Aromatic Hydrocarbons	N	1675	10:1	µg/l	5.0			36	< 5.0		
Total Petroleum Hydrocarbons	N	1675	10:1	µg/l	10			36	< 10		
Benzene	U	1760	10:1	µg/l	1.0			< 1.0	< 1.0		
Toluene	U	1760	10:1	µg/l	1.0			< 1.0	< 1.0		
Ethylbenzene	U	1760	10:1	µg/l	1.0			< 1.0	< 1.0		

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Results - Leachate

Project: Soil Samples

Client: Environmental Laboratory Services Ltd						**Chemtest Job No.:**	20-07165	20-07165	
Quotation No.: Q20-19728						**Chemtest Sample ID.:**	981122	981123	
Order No.: 6897						Client Sample Ref.:	176540/003	176540/004	
						Client Sample ID.:	3	4	
							XC211-TP01	XC211-TP01	
						Sample Type:	SOIL	SOIL	
						Top Depth (m):	0.05	3.00	
						Date Sampled:	20-Feb-2020	20-Feb-2020	
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**				
m & p-Xylene	U	1760	10:1	µg/l	1.0		< 1.0	< 1.0	
o-Xylene	U	1760	10:1	µg/l	1.0		< 1.0	< 1.0	
Methyl Tert-Butyl Ether	N	1760	10:1	µg/l	1.0		< 1.0	< 1.0	
Naphthalene	U	1800	10:1	µg/l	0.10		32	< 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		32	< 2.0	

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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.
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

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

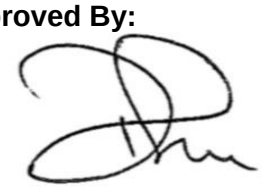
UKAS TESTING
2183

Final Report

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

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

Approved By:



Details: Darrell Hall, Director

Chemtest
The right chemistry to deliver results

Results - Leachate

Project: Soil Testing

Client: Environmental Laboratory Services Ltd								**Chemtest Job No.:**	20-07190	20-07190
Quotation No.: Q20-19728								**Chemtest Sample ID.:**	981249	981250
Order No.: 6881								Client Sample Ref.:	176306/003	176306/004
								Client Sample ID.:	3.0m	0.05m
								Sample Location:	TP02	TP02
								Sample Type:	SOIL	SOIL
								Date Sampled:	20-Feb-2020	20-Feb-2020
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**					
pH	U	1010	10:1		N/A				8.6	7.9
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				< 1.0	< 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				56	< 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				< 1.0	1.9
Aliphatic TPH >C5-C6	N	1675	10:1	µg/l	0.10				< 0.10	< 0.10
Aliphatic TPH >C6-C8	N	1675	10:1	µg/l	0.10				< 0.10	< 0.10
Aliphatic TPH >C8-C10	N	1675	10:1	µg/l	0.10				< 0.10	< 0.10
Aliphatic TPH >C10-C12	N	1675	10:1	µg/l	0.10				< 0.10	< 0.10
Aliphatic TPH >C12-C16	N	1675	10:1	µg/l	0.10				< 0.10	< 0.10
Aliphatic TPH >C16-C21	N	1675	10:1	µg/l	0.10				< 0.10	< 0.10
Aliphatic TPH >C21-C35	N	1675	10:1	µg/l	0.10				< 0.10	< 0.10
Aliphatic TPH >C35-C44	N	1675	10:1	µg/l	0.10				< 0.10	< 0.10
Total Aliphatic Hydrocarbons	N	1675	10:1	µg/l	5.0				< 5.0	< 5.0
Aromatic TPH >C5-C7	N	1675	10:1	µg/l	0.10				< 0.10	< 0.10
Aromatic TPH >C7-C8	N	1675	10:1	µg/l	0.10				< 0.10	< 0.10
Aromatic TPH >C8-C10	N	1675	10:1	µg/l	0.10				< 0.10	< 0.10
Aromatic TPH >C10-C12	N	1675	10:1	µg/l	0.10				240	< 0.10
Aromatic TPH >C12-C16	N	1675	10:1	µg/l	0.10				220	30
Aromatic TPH >C16-C21	N	1675	10:1	µg/l	0.10				72	< 0.10
Aromatic TPH >C21-C35	N	1675	10:1	µg/l	0.10				< 0.10	< 0.10
Aromatic TPH >C35-C44	N	1680	10:1	µg/l	50.00				< 50	< 50
Total Aromatic Hydrocarbons	N	1675	10:1	µg/l	5.0				540	31
Total Petroleum Hydrocarbons	N	1675	10:1	µg/l	10				540	30
Benzene	U	1760	10:1	µg/l	1.0				< 1.0	< 1.0
Toluene	U	1760	10:1	µg/l	1.0				< 1.0	< 1.0
Ethylbenzene	U	1760	10:1	µg/l	1.0				< 1.0	< 1.0
m & p-Xylene	U	1760	10:1	µg/l	1.0				< 1.0	< 1.0

Chemtest
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Results - Leachate

Project: Soil Testing

Client: Environmental Laboratory Services Ltd								20-07190	20-07190
Quotation No.: Q20-19728					**Chemtest Sample ID.:**			981249	981250
Order No.: 6881					Client Sample Ref.:			176306/003	176306/004
					Client Sample ID.:			3.0m	0.05m
					Sample Location:			TP02	TP02
					Sample Type:			SOIL	SOIL
					Date Sampled:			20-Feb-2020	20-Feb-2020
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**				
o-Xylene	U	1760	10:1	µg/l	1.0			< 1.0	< 1.0
Methyl Tert-Butyl Ether	N	1760	10:1	µg/l	1.0			< 1.0	< 1.0
Naphthalene	U	1800	10:1	µg/l	0.10			180	< 0.10
Acenaphthylene	U	1800	10:1	µg/l	0.10			3.7	< 0.10
Acenaphthene	U	1800	10:1	µg/l	0.10			28	< 0.10
Fluorene	U	1800	10:1	µg/l	0.10			16	< 0.10
Phenanthrene	U	1800	10:1	µg/l	0.10			22	< 0.10
Anthracene	U	1800	10:1	µg/l	0.10			3.2	< 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			250	< 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:
981248	176306/002	2	TP02	17-Feb-2020	B	Amber Glass 250ml
981248	176306/002	2	TP02	17-Feb-2020	B	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.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

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

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

Sample Deviation Codes

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

Sample Retention and Disposal

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

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

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

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Final Report

Report No.:	20-16827-1		
Initial Date of Issue:	08-Jul-2020		
Client	Environmental Laboratory Services Ltd		
Client Address:	Acorn Business Campus Mahon Industrial Park Blackrock Cork Ireland		
Contact(s):	Emer Kearney Results		
Project	Soil Samples		
Quotation No.:	Q20-19728	**Date Received:**	02-Jul-2020
Order No.:	7423	**Date Instructed:**	02-Jul-2020
No. of Samples:	2		
Turnaround (Wkdays):	5	**Results Due:**	08-Jul-2020
Date Approved:	08-Jul-2020		
Approved By:			
Details:	Glynn Harvey, Technical Manager		

Results - Leachate

Project: Soil Samples

Client: Environmental Laboratory Services Ltd				**Chemtest Job No.:**		20-16827	20-16827
Quotation No.: Q20-19728				**Chemtest Sample ID.:**		1025420	1025421
Order No.: 7423				Client Sample Ref.:		183057/001	183057/002
				Client Sample ID.:		1	2
				Sample Type:		SOIL	SOIL
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**		
pH	U	1010	10:1		N/A	10.3	9.2
Cyanide (Free)	U	1300	10:1	mg/l	0.050	< 0.050	< 0.050
Arsenic (Dissolved)	U	1450	10:1	µg/l	1.0	3.2	< 1.0
Boron (Dissolved)	U	1450	10:1	µg/l	20	45	33
Barium (Dissolved)	U	1450	10:1	µg/l	5.0	6.0	5.4
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	4.7	2.1
Copper (Dissolved)	U	1450	10:1	µg/l	1.0	2.4	1.4
Mercury (Dissolved)	U	1450	10:1	µg/l	0.50	< 0.50	< 0.50
Nickel (Dissolved)	U	1450	10:1	µg/l	1.0	4.3	< 1.0
Lead (Dissolved)	U	1450	10:1	µg/l	1.0	3.0	< 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	5.7	< 1.0
Zinc (Dissolved)	U	1450	10:1	µg/l	1.0	10	2.9
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

Results - Leachate

Project: Soil Samples

Client: Environmental Laboratory Services Ltd				**Chemtest Job No.:**		20-16827	20-16827
Quotation No.: Q20-19728				**Chemtest Sample ID.:**		1025420	1025421
Order No.: 7423				Client Sample Ref.:		183057/001	183057/002
				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. Eurofins 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:
1025420	183057/001	1			A	Amber Glass 250ml
1025420	183057/001	1			A	Plastic Tub 500g
1025421	183057/002	2			A	Amber Glass 250ml
1025421	183057/002	2			A	Plastic Tub 500g

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

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 I Pre & Post Site Condition Photographs









ocbgeo	Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	XC211 Pre Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020









	Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	XC211 Pre Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020









Iarnród Éireann

Cork Line Level Crossings

XC211 (19-135-2)

XC211

Pre Works Site Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: 2020









	Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	XC211 Post Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020









Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	XC211 Post Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020









Iarnród Éireann Cork Line Level Crossings XC211 (19-135-2)	XC211
	Post Works Site Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: 2020

Cork Line Level Crossings – XC212
Ground Investigation

Primary Author:	Ian Holley
Client:	Irish Rail
Client's Representative:	JACOBS
Report Date:	25th November 2020
Report No.:	OCB19-135-3
File Location:	OCB19-135-3/Reporting/XC212

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Document Control Sheet

Report No.:	OCB19-135-3
Project title:	Cork Line Level Crossings – XC212
Client:	Irish Rail
Client's Representative:	JACOBS

Revision	Status	Report prepared by:	Report reviewed by:	Report approved by:	Issue date
001	Draft Factual	Ian Holley	Glen Byrne	Michael O'Connell	18th November 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 – XC212

1 AUTHORITY

On the instructions of JACOBS on behalf 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 XC212 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 in-situ and 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 and JACOBS 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 a borehole, installation of a standpipe, water purging, soil sampling, in-situ and laboratory testing, 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 XC212 is located in Ballycoskery townland, Ballyhea, 0.25km east of the N20 road along L1533 local road, at grid reference ITM 554645.45, 617660.28. The level crossing is currently manned with a cabin located on the east side of the crossing and north of the L1533 road. An abandoned two-storey house, with an associated concrete-surfaced parking area and shed to the east, is located on the east side of the crossing along the south side of the L1533 road. Beechwood housing estate and Ballyhea Primary School are located north of the L1533 road on the west and east of the railway crossing, respectively.

The location of the proposed over-bridge is immediately to the south of the existing road, L1533, crossing agricultural fields. Access to the location of the proposed overbridge to the east of the railway is through a field gate opposite Ballyhea Primary School and the rear garden of the derelict house. Dense vegetation surrounds this marshy area. To the west of the railway, access is gained through a gate off the N20 road and crossing a number of fields and a stream to access the area south of the L1533 road. Dense hedgerows surround the fields in the vicinity of the proposed overbridge. A watercourse to the west of the rail line contains plant assemblage of conservation interest.

Ground surface in the site vicinity has an overall slope to the west from the lower slopes of the Ballyhoura Mountains towards a lake at Ballynadrideen townland to the west. However, the railroad runs along an embankment in this area and the L1533 local road rises from the west and east towards the railway crossing. Borehole XC212-CPRC01 was located on the south side of the derelict house, east of the railway crossing and south of L1533 road, where ground surface elevation is approximately 2m above that at the marshy agricultural land immediately to the south.

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 2nd February 2020 and 28th June 2020, included:

- One (1) Cable Percussion with Rotary follow-on Borehole
- A Standpipe Installation in one (1) Borehole
- Water Purging in one (1) location

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 Borehole by Combined Cable Percussion and Rotary Follow-On Drilling

One borehole (CPRC01) was put down on the south side of the derelict house to the east of the railway crossing by a combination of cable percussion boring and rotary follow-on open hole drilling techniques. Where the cable percussion borehole had not been advanced onto bedrock, rotary percussive methods were employed to advance the borehole to completion upon reaching scheduled depth of 20.0m bgl.

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.

No rock core recovered.

Appendix B presents the borehole logs.

4.2 Standpipe Installations

A groundwater monitoring standpipe was installed in CPRC01 borehole.

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

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

4.3 Water Purging

Prior to sampling from the standpipe water purging was carried out.

Appendix C presents the water purging data log.

4.4 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 F.

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, particle size distribution analysis and a 300m large shear box test.

- **soil chemistry:** pH, organic matter, Chloride content, 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 D.

5.2 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 E.

6 GROUND CONDITIONS

6.1 General Geology of the Area

Teagasc soil mapping indicates that the site area is underlain by Glacial Till derived chiefly from Devonian sandstones.

The Geological Survey of Ireland (GSI) bedrock mapping database indicates that soils in the site area are underlain at depth by the Carboniferous-age Ballysteen Formation, composed of Dark muddy Limestone and shale.

The site is underlain by a locally important aquifer, consisting of bedrock which is moderately productive only in local zones, and has a moderate groundwater vulnerability. No known karst features identified in the immediate site area but within the Ballysteen formation in the region a couple of karst features are noted. The closest of these is a spring approximately 1.75km to the North of the site.

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:

- Made Ground (fill / reworked material): Generally sandy gravelly Silt/Clay with angular cobbles and traces of inorganic material such as cloth, glass, stoneware and bricks. Extends to 3.50m bgl in CPRC01.
- Glacial Till: Sandy gravelly silty clay, frequently with cobble and boulder content, very soft to firm in upper horizons, becoming stiff with increasing depth.
- Fluvioglacial deposits: Typically medium dense to dense silty sandy Gravel with cobble content.
- Bedrock: Rockhead was not encountered to a maximum depth of 20.00m in CPRC01.

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 log.

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

Date	Depth to standing water level (m)
	CPRC01
13/08/20	3.65
17/08/20	3.70
21/08/20	3.13
29/09/20	3.67
07/10/20	3.40
22/10/20	3.76

Continued monitoring of the installed standpipe 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.

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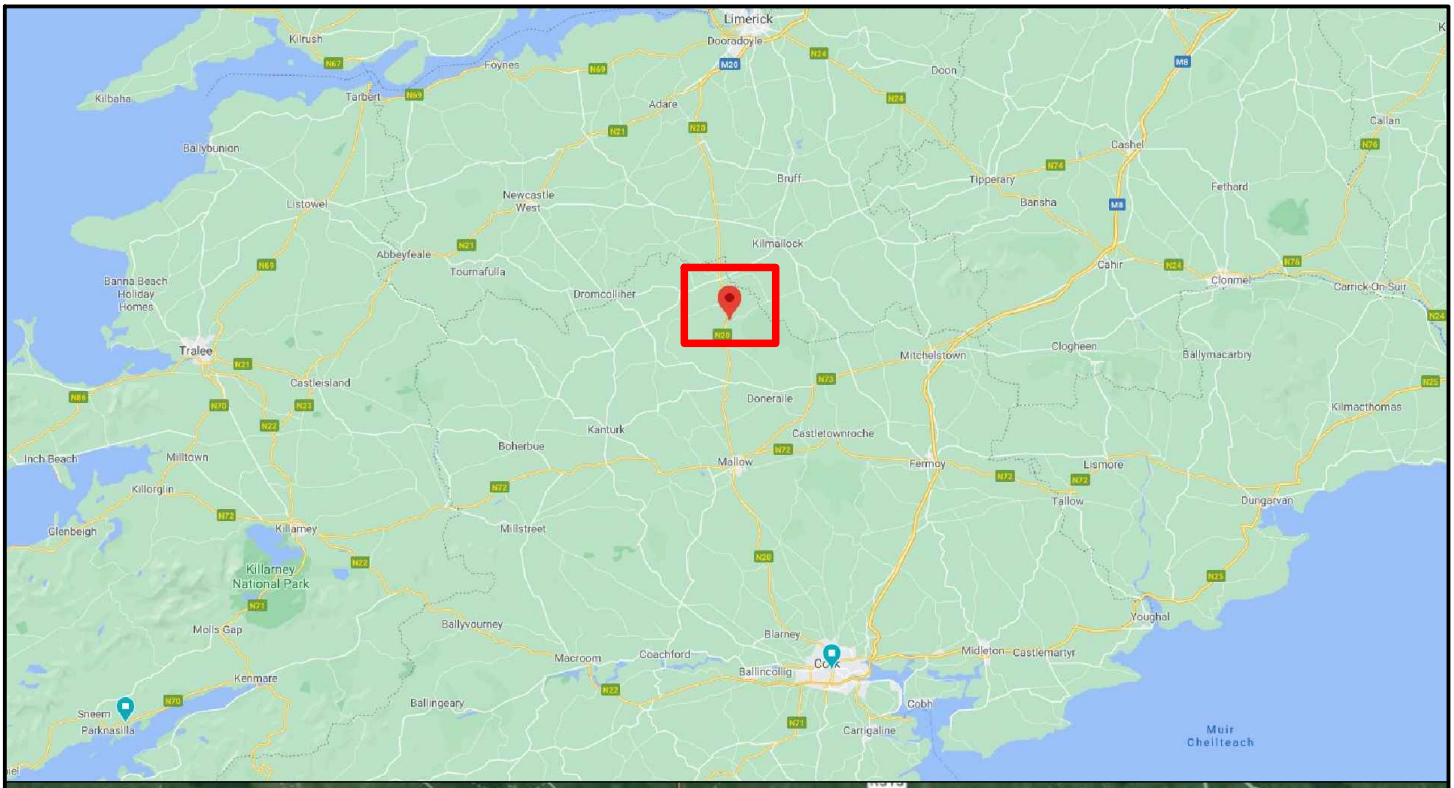
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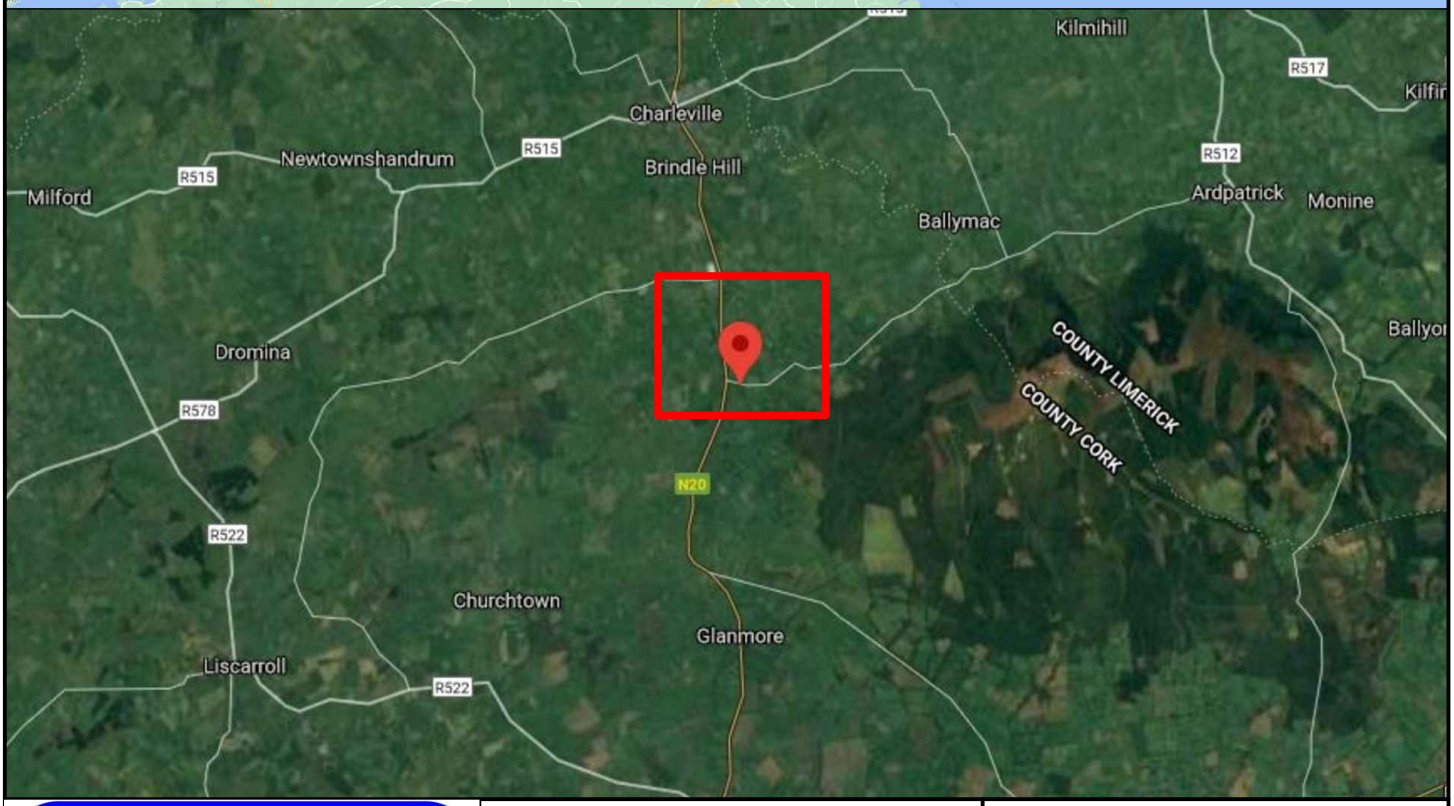
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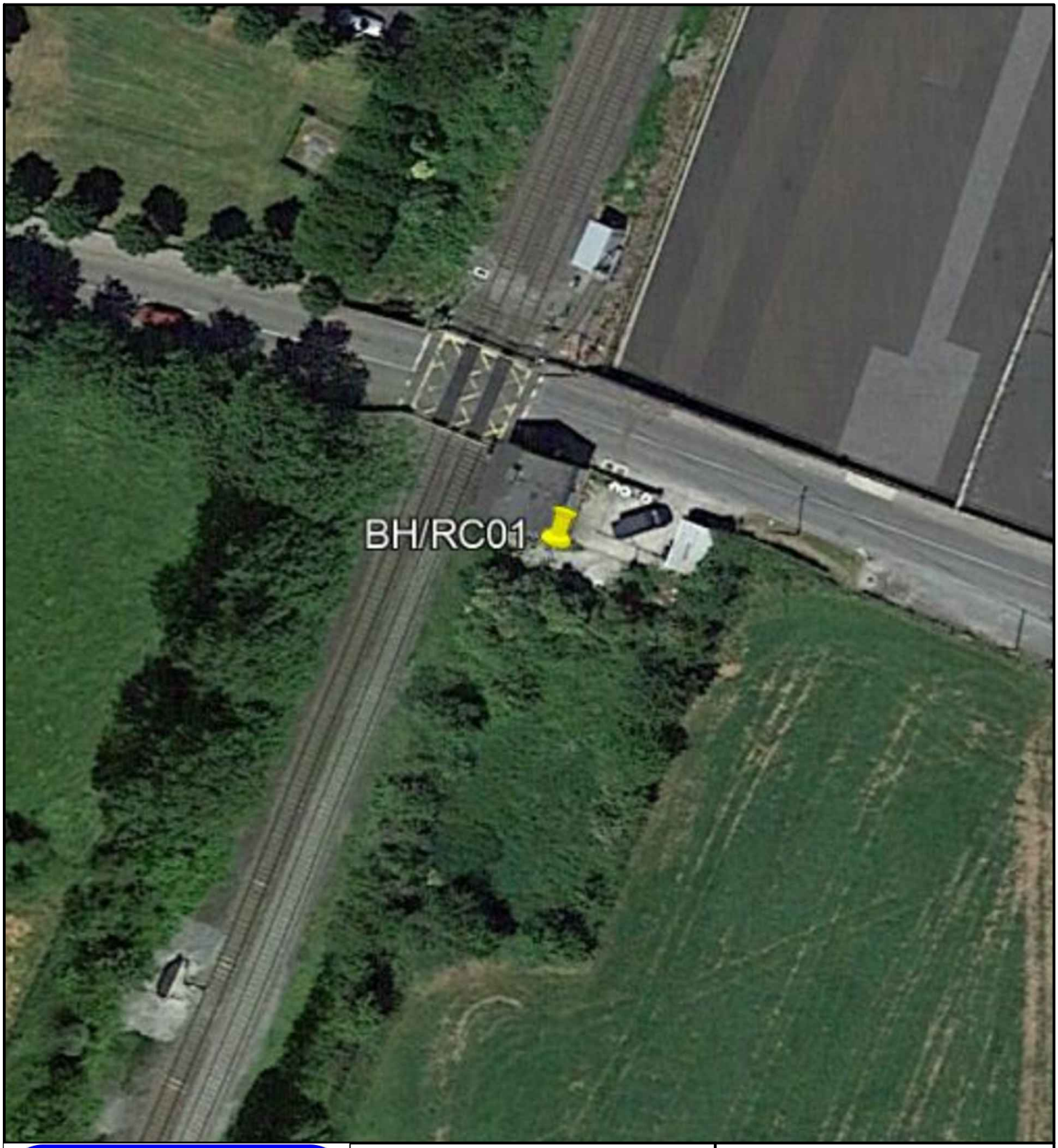
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Appendix A Site and Exploratory Hole Location Plans





	Iarnród Éireann Cork Line Level Crossings XC212 (19-135-3)	SITE LOCATION MAPS
		Client: Iarnród Éireann
		Engineer: Jacob's
		Date: June/July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC212 (19-135-3)	Exploratory Hole Locations
		Client: Iarnród Éireann
		Engineer: Jacob's
		Date: June/July 2020

Appendix B Borehole Logs

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC212-CPRC01
	Coordinates: 554653.01 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 2
Method: Cable Percussion+Rotary Open	617642.69 N	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon+T44	**Ground Level:** 97.81 mOD	**Dates:** 02/03/2020 - 28/06/2020	**Driller:** DS+AA +NOB
			Logger: MN

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
0.05	ES1					(0.50)		MADE GROUND: Dark brown fill material.
0.50	ES4				97.31	0.50		
0.50 - 1.50	B2							MADE GROUND: Brown, light brown and occasional grey slightly sandy to sandy gravelly silty CLAY with low to medium cobble content and occasional vegetation fragments, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular.
0.50 - 1.50	D3							
1.00	ES5					(1.00)		
1.20 - 1.65	SPT (C) N=7			N=7 (1,1/1,2,2,2)				
1.50 - 2.50	B6				96.31	1.50		
1.50 - 2.50	D7							MADE GROUND: Soft to firm light brown sandy gravelly silty CLAY with medium cobble content, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles are predominantly subangular limestone.
2.00 - 2.45	SPT (C) N=12			N=12 (1,2/2,3,4,3)		(1.00)		
2.50 - 3.00	B8				95.31	2.50		
2.50 - 3.00	D9					(0.30)		MADE GROUND / DISTURBED NATIVE MATERIAL: Soft olive grey to brownish grey slightly sandy slightly gravelly silty CLAY with low cobble content including one concrete block and occasional black organic material, moist. One cloth fragment. Organic odour. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded.
					95.01	2.80		
						(0.20)		
3.00	ES12				94.81	3.00		
3.00 - 3.30	B10							
3.00 - 3.30	D11					(0.50)		As above, Dark olive grey with a trace of glass, slate and glazed stoneware fragments.
3.30 - 3.50	B13				94.31	3.50		
3.30 - 3.50	D14	3.50	3.30	02-03-2020		(0.50)		Possible MADE GROUND / DISTURBED NATIVE MATERIAL: Soft olive grey to brownish grey slightly sandy slightly gravelly silty CLAY, moist. Organic odour. Trace of possible red brick fragment, one possible mortar fragment. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular.
3.60 - 4.00	B15							
3.60 - 4.00	D16				93.81	4.00		
3.60 - 4.05	SPT (C)			0 (0 for 450mm/0 for 0mm)				*U4 sample attempted at 3.0 to 3.5m. 0% recovery.*
		3.50	2.60	03-03-2020		(1.00)		Very soft yellowish brown slightly sandy gravelly silty CLAY with low cobble content, wet. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles are angular to subangular including much limestone.
4.00 - 5.00	B17							
4.00 - 5.00	D18							Firm yellowish brown slightly sandy gravelly silty CLAY with medium cobble content, wet. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles are mostly subangular, predominantly limestone.
4.00 - 4.45	SPT (C) N=14			N=14 (3,2/2,4,4,4)	92.81	5.00		
5.00 - 6.00	B19							Stiff yellowish brown slightly sandy gravelly silty CLAY with medium cobble content, wet. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles are mostly subangular, predominantly limestone.
5.00 - 6.00	D20							
5.00 - 5.45	SPT (C) N=25			N=25 (1,2/3,6,8,8)		(1.00)		
6.00 - 7.00	B21				91.81	6.00		
6.00 - 7.00	D22							Stiff greyish brown slightly sandy gravelly silty CLAY with medium cobble content, wet. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles are mostly subangular, predominantly limestone.
6.00 - 6.45	SPT (C) N=26			N=26 (1,1/5,6,7,8)				
						(1.00)		
7.00 - 7.15	B23				90.81	7.00		
7.00 - 7.15	D24					(0.30)		Firm greyish brown slightly sandy gravelly silty CLAY with medium cobble content, wet. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles are mostly subangular, predominantly limestone.
7.00 - 7.45	SPT (C) N=12			N=12 (0,1/2,2,4,4)	90.51	7.30		
7.30 - 8.00	B25							Greyish brown slightly silty very sandy GRAVEL with low cobble content, wet. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles are angular to subrounded, sandstone, siltstone, limestone, conglomerate and occasional quartz.
7.30 - 8.00	D26					(0.70)		
				(Water strike at 7.3m. Water rose to 3.5m in 2 mins. Gravel blowback to 6.4m.)	89.81	8.00		
8.00 - 8.80	B27							Medium Dense greyish brown slightly silty very sandy GRAVEL with medium cobble content, wet. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles are mostly sandstone and limestone.
8.00 - 8.80	D28					(0.80)		
8.00 - 8.45	SPT (C) N=12			N=12 (0,1/2,2,4,4)	89.01	8.80		
		8.00	3.10	04-03-2020				Dense greyish brown slightly silty very sandy GRAVEL with medium cobble content, wet. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles are mostly sandstone and limestone.
		8.20	3.50	03-03-2020		(0.70)		
8.80 - 9.00	B29							
8.80 - 9.00	D30				88.31	9.50		
9.00 - 9.40	B31							Open Hole Boring - Driller Described: Sandy GRAVEL with boulders.
9.00 - 9.40	D32							
9.00 - 9.45	SPT (C) N=47			N=47 (15,18/9,14,12,12)				

Continued on Next Page

Remarks

Cable Percussion terminated at 9.437m due to probable boulder obstruction. Rotary Open Hole techniques employed to 20.00m.

Water Added	
From (m)	To (m)

Water Strike - General			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
7.30	7.10	2	3.50
2.50	2.50	20	2.30
8.00	8.00	20	6.60

Casing Details	
To (m)	Diam (mm)
9.40	200
20.00	151

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
7.10	7.30	00:30
8.80	9.00	00:30
9.40	9.44	01:00

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC212-CPRC01
	Coordinates: 554653.01 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 2 of 2
Method: Cable Percussion+Rotary Open	617642.69 N	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon+T44	**Ground Level:** 97.81 mOD	**Dates:** 02/03/2020 - 28/06/2020	**Driller:** DS+AA +NOB **Logger:** MN

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
9.40 - 9.52	SPT (C)	9.40	2.90	50 (50 for 125mm/50 for 0mm) 04-03-2020				
10.00 - 10.45	SPT (C) N=41			N=41 (3,7/12,12,8,9)		(3.00)		
					85.31	12.50		Open Hole Boring - Driller Described: Boulder CLAY
13.00 - 13.45	SPT (C) N=47			N=47 (3,7/13,14,9,11)		(1.50)		
					83.81	14.00		Open Hole Boring - Driller Described: Sandy BOULDERS
						(1.50)		
					82.31	15.50		Open Hole Boring - Driller Described: Clayey SAND with boulders
16.00 - 16.45	SPT (C) N=49			N=49 (2,5/8,12,13,16)		(3.00)		
					79.31	18.50		Open Hole Boring - Driller Described: Clayey SAND
19.00 - 19.45	SPT (C) N=56			N=56 (3,4/9,13,15,19)		(1.50)		
20.00 - 20.45	SPT (C) N=52			N=52 (6,8/9,10,15,18)	77.81	20.00		End of borehole at 20.000m

Water | Backfill

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 20.0 20.5

Remarks

Cable Percussion terminated at 9.437m due to probable boulder obstruction. Rotary Open Hole techniques employed to 20.00m.

Water Added	
From (m)	To (m)

Water Strike - General			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
7.30	7.10	2	3.50
2.50	2.50	20	2.30
8.00	8.00	20	6.60

Casing Details	
To (m)	Diam (mm)
9.40	200
20.00	151

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
7.10	7.30	00:30
8.80	9.00	00:30
9.40	9.44	01:00

Appendix C Water Purging Data & Log

Job Name: **I.E - Cork Line**		h (m)	5
		r (m)	0.0505
		r2	0.00255025
Job Nr: **19-135**		TWV (m3)	0.040059327

BH ID: XC212-CPRC01			**Theoretical Well Volume**	40.06 *ltrs*
Depth to Response Zone:	***Top (mbgl)***	***Bottom (mbgl)***	**TWV x3**	120.18 *ltrs*
	7.5	12.5		

Purge Start Time:	09:30		**(mbgl)**
Purge Finish Time:	12:01	**Depth to Water**	4.05
		Total Depth	6.85
Depth to water after purging:	mbgl		

	Time Taken to fill 20ltr container(mins)	Flow Rate l/min	
Reading 1:	11		(Pumping in well column)
Reading 2:	20	~0.7	
Reading 3:	23	~0.9	

Date 06/08/2020

Nr of Containers filled:	5.5	
Total Volume Purged:	110	***litres***

	Temperature	**pH**	**Electrical Conductivity**	**Dissolved Oxygen**	**Redox Potential**
Reading 1	16.37	6.28	12	0.6	28.6
Reading 2	15.77	6.28	12	0.62	28
Reading 3	15.75	6.63	10.71	0.62	26.5
Reading 4	14.62	6.43	9.06	0.63	25.8
Reading 5	13.93	6.55	11.53	0.64	24.5
Reading 6	13.23	6.58	11.39	0.64	24.4
Reading 7	13.41	6.65	10.13	0.63	24.7
Reading 8	13.26	6.57	10.18	0.63	25.1
Reading 9	13.3	6.54	11.16	0.63	26.1
Reading 10	13.1	6.55	10.92	0.64	26.1

Appendix D Geotechnical Soil Laboratory Test Results

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

LABORATORY TEST REPORT

BRE Test Suite B - Greenfield Site

Project:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref. No.:**	ST 93839
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	09/04/2020
	Co. Cork	**Material:**	Soil
Order No.:	2003-104	**Date Tested:**	07/04/2020
Originator:	Ian Holley	**Specification:**	Client

Sample Details **XC212-CPRC01 Type D Sample 7**

Supplier:	Client Info	**Date of Sampling:**	Client Info.
Source:	Client Info	**Sampled By:**	Client
Sample Location:	1.5-2.5m	**Sampling Reason:**	Request

Parameter	RESULT
pH	8.4
Sulphate Aqueous Extract (SO4) (mg/l)	2.9
Sulphur as S, Total (%)	0.03
Sulphate as SO4, Total (%)	0.03

Comments:
None

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

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

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.

☐ **James Ward, Operations Manager**

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

James Fisher Testing Services

LABORATORY TEST REPORT

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

Site:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93841
	Unit 1 Carrigogna	**Date Received:**	26/03/2020
	Midleton	**Date Tested:**	31/03/2020
Order No:	2003-104	**Date Reported:**	03/04/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC212-CPRC01 Type D Sample 9

Sample Type:	Bulk	***Location:***	XC212-CPRC01 Type D Sample 9
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	2.5-3.0m	***Material Type:***	Soil

Moisture Content (%): 19

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

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

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

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

James Fisher Testing Services

LABORATORY TEST REPORT

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 93843
	Unit 1 Carrigogna	**Date Received:**	26/03/2020
	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 **XC212-CPRC01 Type D Sample 9**

Supplier:	Client Info	**Date of Sampling:**	Client Info
Source:	Client Info	**Sampled By:**	Client
Sample Location:	2.5-3.0m	**Sampling Reason:**	Request

Result:

Organic Matter (%)	**5.4**

Comments:
None

Tested in accordance with the above specifications
Subcontracted to a laboratory UKAS accredited for this testing
The stated result only relates to the item/location tested, this report shall not be reproduced except in full.

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

James Fisher Testing Services

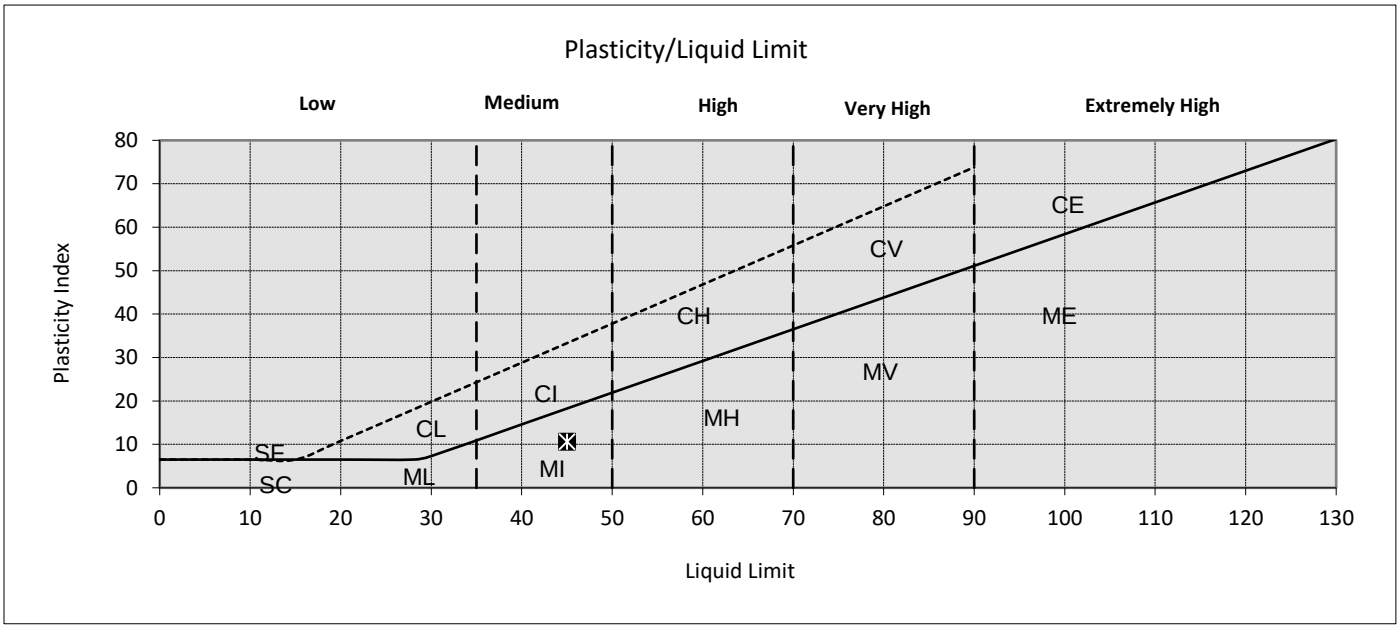
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

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

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93842
	Unit 1 Carrigogna	**Sample Ref.:**	XC212-CPRC01 2.5-3.0m Type D S.9
	Midleton	**Date Sampled:**	Client Info
	Co Cork	**Date Received:**	26/03/2020
Order No:	2003-104	**Date Tested:**	03/04/2020
Originator:	**Ian Holley**	**Date Reported:**	03/04/2020

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Bulk**
Sample Preparation Method	**Washed**
MATERIAL	**Soil**
Retained 425 micron (%)	**23**
Natural Moisture Content (%)	**38**
Liquid Limit (single point)(%)	**45**
Plastic Limit (%)	**34**
Plasticity Index	**11**



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

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James Fisher Testing Services Ltd
Phil Thorp, Laboratory Manager

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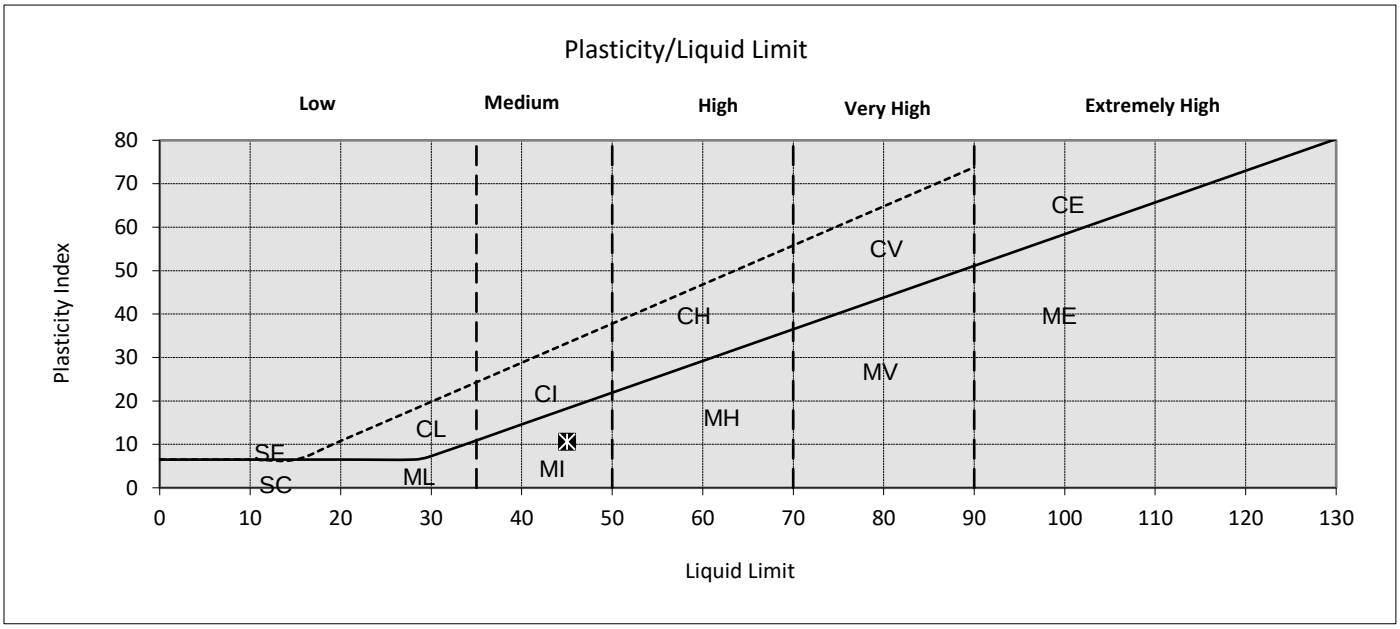
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Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

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

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93842
	Unit 1 Carrigogna	**Sample Ref.:**	XC212-CPRC01 2.5-3.0m Type D S.9
	Midleton	**Date Sampled:**	Client Info
	Co Cork	**Date Received:**	26/03/2020
Order No:	2003-104	**Date Tested:**	03/04/2020
Originator:	**Ian Holley**	**Date Reported:**	03/04/2020

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Bulk**
Sample Preparation Method	**Washed**
MATERIAL	**Soil**
Retained 425 micron (%)	**23**
Natural Moisture Content (%)	**38**
Liquid Limit (single point)(%)	**45**
Plastic Limit (%)	**34**
Plasticity Index	**11**



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

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

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Portlaoise, Co. Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

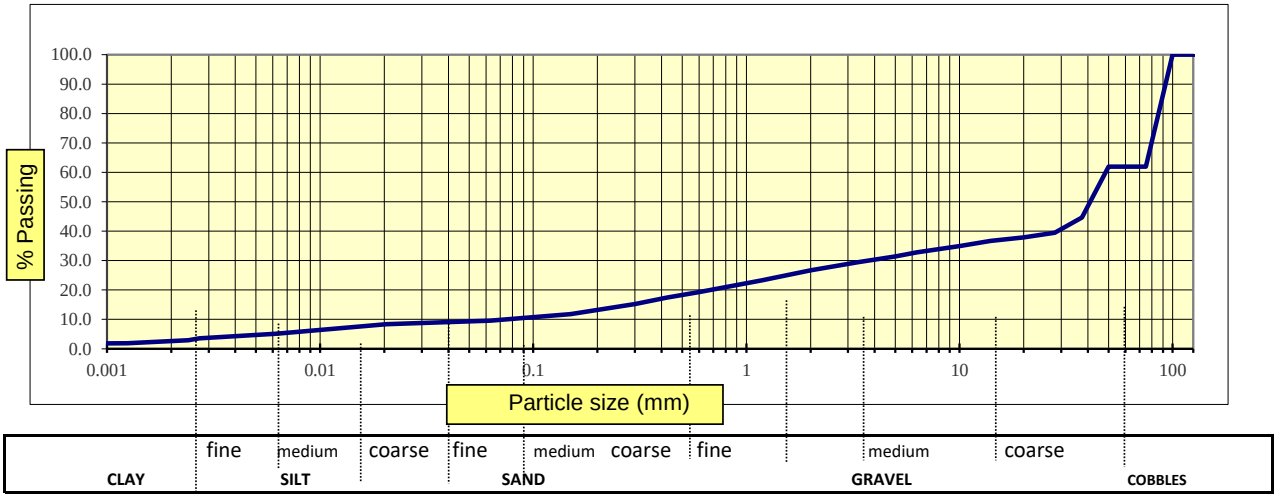
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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

Project:	Cork Line Level Crossings	**Job No:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93840
	Unit 1 Carrigogna	**Date Received:**	11/03/2020
	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.	**XC212-CPRC01 Type B Sample 8**
Location:	XC212-CPRC01 Type B Sample 8
Supplier:	Bulk
Source:	Client Info.
Depth (m):	2.5-3.0m
Sampling Reason:	Client Request
Sampled By:	Client
Specification:	Client
Preparation Method:	Without Organics Preparation
Notes:	Disturbed sample from cleanout

BS Sieve Size	% Passing	Specification
300 mm	100	
125 mm	100	
100 mm	100	
75 mm	62	
63 mm	62	
50 mm	62	
37.5 mm	45	
28 mm	39	
20 mm	38	
14 mm	37	
10 mm	35	
6.3 mm	33	
5 mm	31	
3.35 mm	29	
2 mm	27	
1.18 mm	23	
0.6 mm	19	
0.425 mm	17	
0.3 mm	15	
0.15 mm	12	
0.063 mm	10	
0.020 mm	8	
0.006 mm	5	
0.003 mm	4	
0.002 mm	3	
0.001 mm	2	



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

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

Sedimentation by Hydrometer - Not UKAS

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☐ **James Ward, Operations Manager**

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Tel: 057 8664885

James Fisher Testing Services

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 93844
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	09/04/2020
	Co. Cork	**Material:**	Soil
Order No.:	2003-104	**Date Tested:**	07/04/2020
Originator:	Ian Holley	**Specification:**	Client

Sample Details **XC212-CPRC01 Type D Sample 14**

Supplier:	Client Info	**Date of Sampling:**	Client Info.
Source:	Client Info	**Sampled By:**	Client
Sample Location:	3.3-3.5m	**Sampling Reason:**	Request

Parameter	RESULT
pH	8
Sulphate Aqueous Extract (SO4) (mg/l)	46
Sulphur as S, Total (%)	0.03
Sulphate as SO4, Total (%)	0.03

Comments:
None

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

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.

☐ **James Ward, Operations Manager**

James Fisher Testing Services

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Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

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

Site:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93845
	Unit 1 Carrigogna	**Date Received:**	26/03/2020
	Midleton	**Date Tested:**	31/03/2020
Order No:	2003-104	**Date Reported:**	03/04/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC212-CPRC01 Type D Sample 15

Sample Type:	Bulk	***Location:***	XC212-CPRC01 Type D Sample 15
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	3.6-4.0m	***Material Type:***	Soil

Moisture Content (%): 7.4

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

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

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James Ward, Operations Manager

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Tel: 057 8664885

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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 93847
	Unit 1 Carrigogna	**Date Received:**	26/03/2020
	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 **XC212-CPRC01 Type D Sample 16**

Supplier:	Client Info	**Date of Sampling:**	Client Info
Source:	Client Info	**Sampled By:**	Client
Sample Location:	3.6-4.0m	**Sampling Reason:**	Request

Result:

Organic Matter (%)	**0.9**

Comments:
None

Tested in accordance with the above specifications
Subcontracted to a laboratory UKAS accredited for this testing
The stated result only relates to the item/location tested, this report shall not be reproduced except in full.

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James Ward, Operations Manager

James Fisher Testing Services

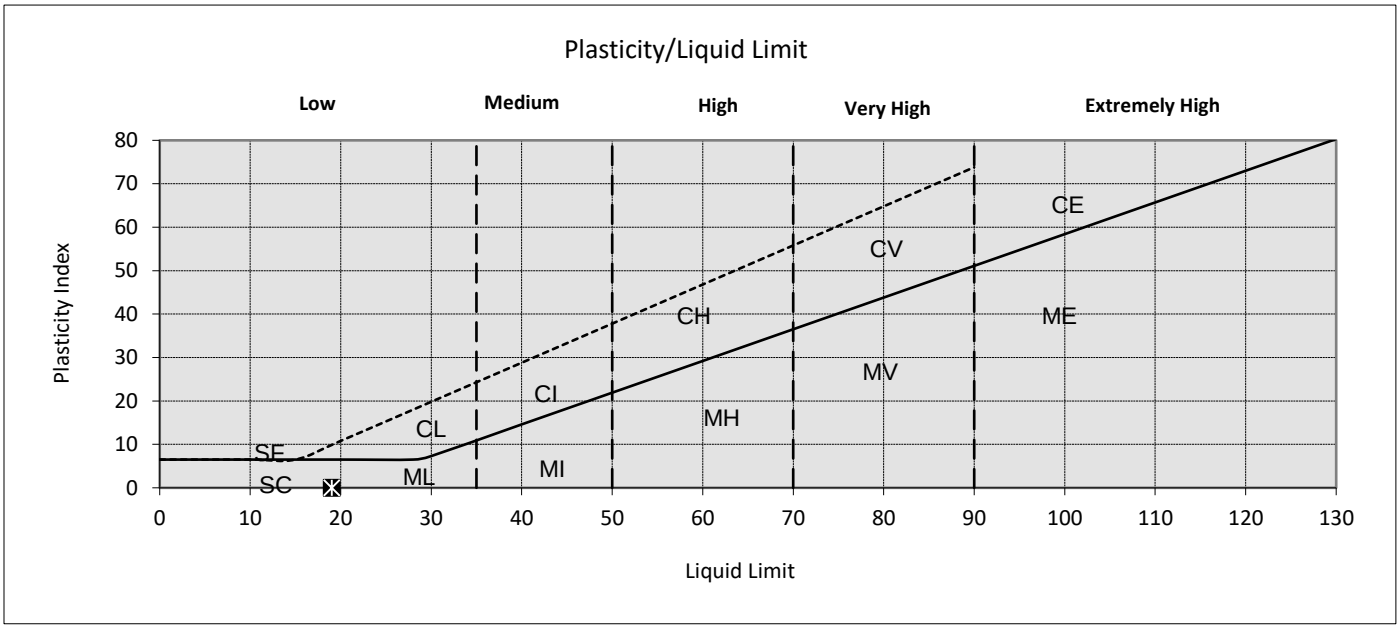
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

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

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93846
	Unit 1 Carrigogna	**Sample Ref.:**	XC212-CPRC01 3.6-4.0m Type B S.15
	Midleton	**Date Sampled:**	Client Info
	Co Cork	**Date Received:**	26/03/2020
Order No:	2003-104	**Date Tested:**	02/04/2020
Originator:	**Ian Holley**	**Date Reported:**	03/04/2020

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Bulk**
Sample Preparation Method	**Washed**
MATERIAL	**Soil**
Retained 425 micron (%)	**66**
Natural Moisture Content (%)	**13**
Liquid Limit (single point)(%)	**19**
Plastic Limit (%)	**Non-Plastic**
Plasticity Index	**N/A**



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

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Tel: 057 8664885

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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 93849
	Unit 1 Carrigogna	**Date Received:**	26/03/2020
	Midleton	**Date Tested:**	31/03/2020
Order No:	2003-104	**Date Reported:**	03/04/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC212-CPRC01 Type D Sample 18

Sample Type:	Bulk	***Location:***	XC212-CPRC01 Type D Sample 18
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	4-5m	***Material Type:***	Soil

Moisture Content (%): 8

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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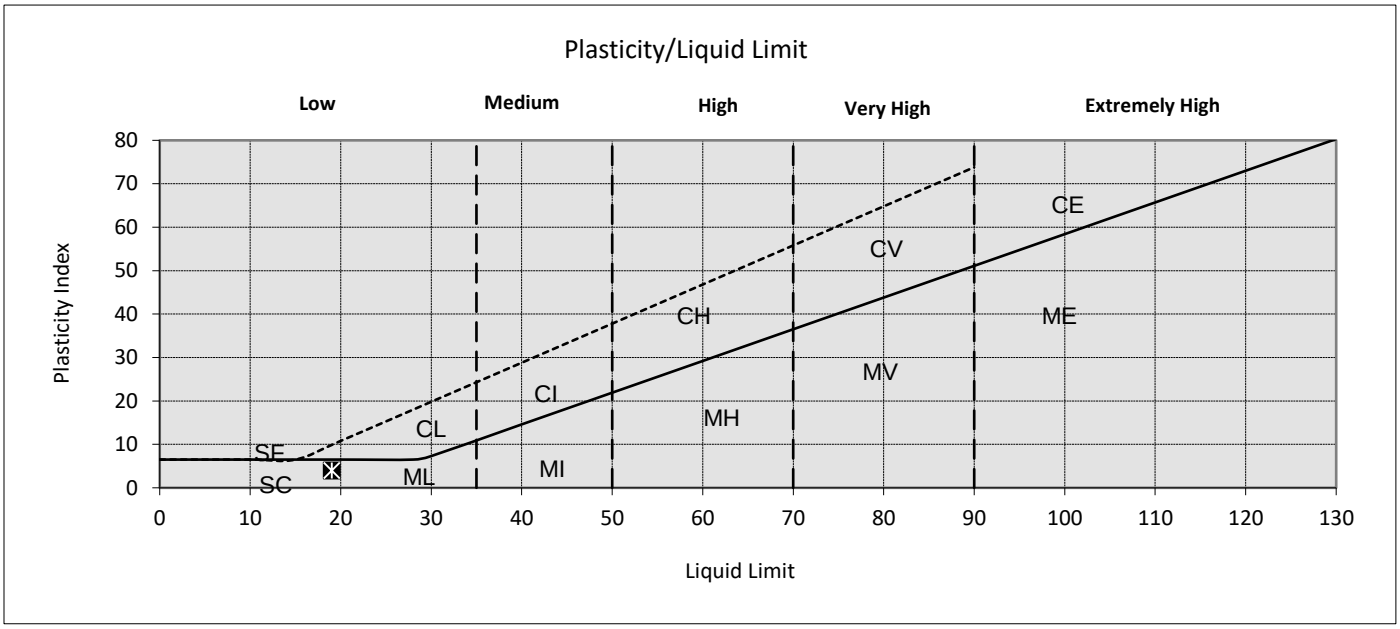
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Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

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

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93850
	Unit 1 Carrigogna	**Sample Ref.:**	XC212-CPRC01 4-5m Type D Sample 18
	Midleton	**Date Sampled:**	Client Info
	Co Cork	**Date Received:**	26/03/2020
Order No:	2003-104	**Date Tested:**	02/04/2020
Originator:	**Ian Holley**	**Date Reported:**	03/04/2020

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Bulk**
Sample Preparation Method	**Washed**
MATERIAL	**Soil**
Retained 425 micron (%)	**19**
Natural Moisture Content (%)	**13**
Liquid Limit (single point)(%)	**19**
Plastic Limit (%)	**15**
Plasticity Index	**4**



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

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James Fisher Testing Services

LABORATORY TEST REPORT

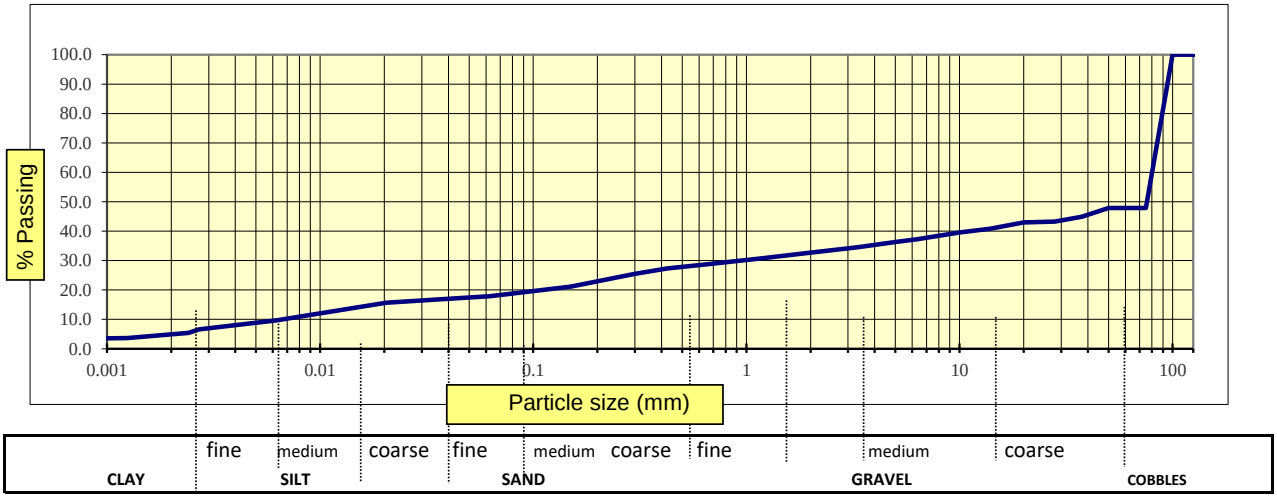
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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

Project:	Cork Line Level Crossings	**Job No:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93848
	Unit 1 Carrigogna	**Date Received:**	11/03/2020
	Midleton	**Date Reported:**	02/04/2020
		Date Tested:	01/04/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Large Cobble, Light Clay, Sandy

Client Ref.	**XC212-CPRC01 Type B Sample 17**
Location:	XC212-CPRC01 Type B Sample 17
Supplier:	Bulk
Source:	Client Info.
Depth (m):	4.0-5.0m
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	48	
63 mm	48	
50 mm	48	
37.5 mm	45	
28 mm	43	
20 mm	43	
14 mm	41	
10 mm	40	
6.3 mm	37	
5 mm	36	
3.35 mm	35	
2 mm	33	
1.18 mm	31	
0.6 mm	28	
0.425 mm	27	
0.3 mm	26	
0.15 mm	21	
0.063 mm	18	
0.020 mm	16	
0.006 mm	10	
0.003 mm	7	
0.002 mm	5	
0.001 mm	4	



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

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

Sedimentation by Hydrometer - Not UKAS

Approved Signature
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☐ **James Ward, Operations Manager**

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James Fisher Testing Services Limited
Unit D Zone 5
Clonminam Business Park
Tel: 057 86 64885

James Fisher Testing Services

Laboratory Test Report
Determination of shear Strength by Direct Shear (Small Shearbox)
in accordance with BS :1377: Part 7 : 1990 Clause 4

Project:	Cork Line Level Crossing	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref. No.:**	ST 93851
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	05/05/2020
		Material:	Earthworks
Order No.:	2003-104	**Visual Description:**	Brown very Gravelly Clay
Originator:	Ian Holley	**Specification:**	TII Series 600

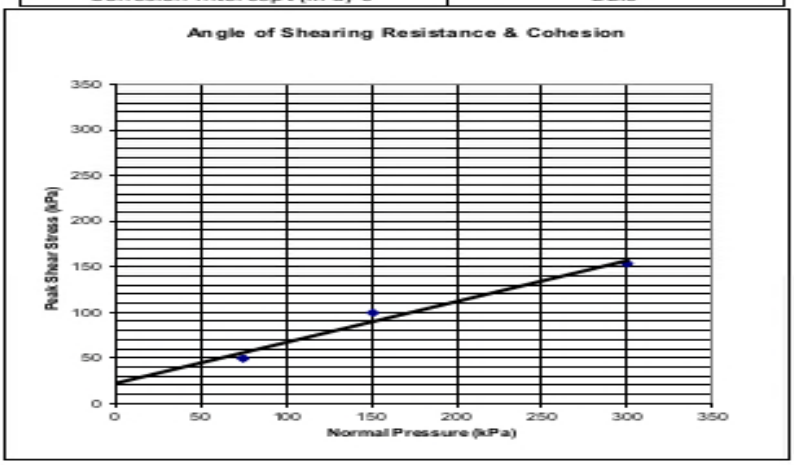
Client Ref:	**ST 93851**		
Certificate of sampling	Yes	**Date Of Sampling:**	Client info
Lab Reference No.	XC212-CPRC01	**Sampled By:**	OCB
Sample Source & Ticket No.	Site Won	**Sample Preparation:**	Bulk sample sieved through 20mm sieve
Sample Location / Orientation :	Cork Line Level Crossings	**Tested Dry or Submerged:**	Dry

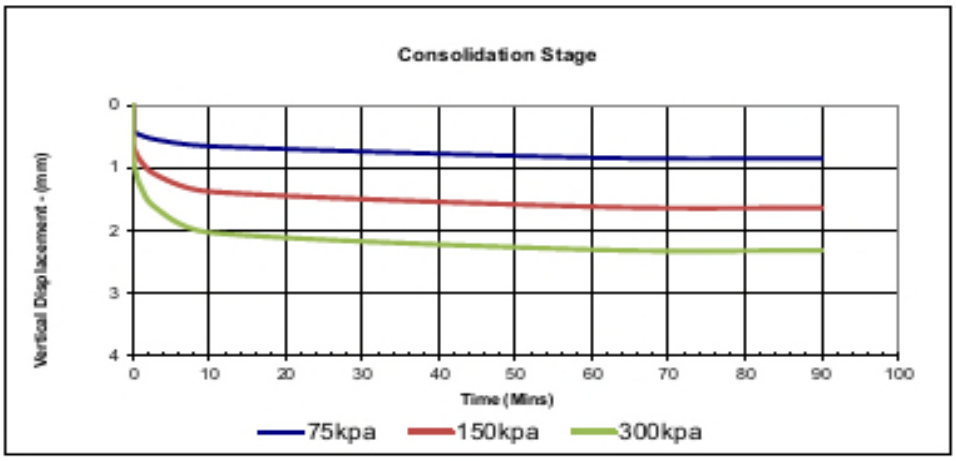
Results

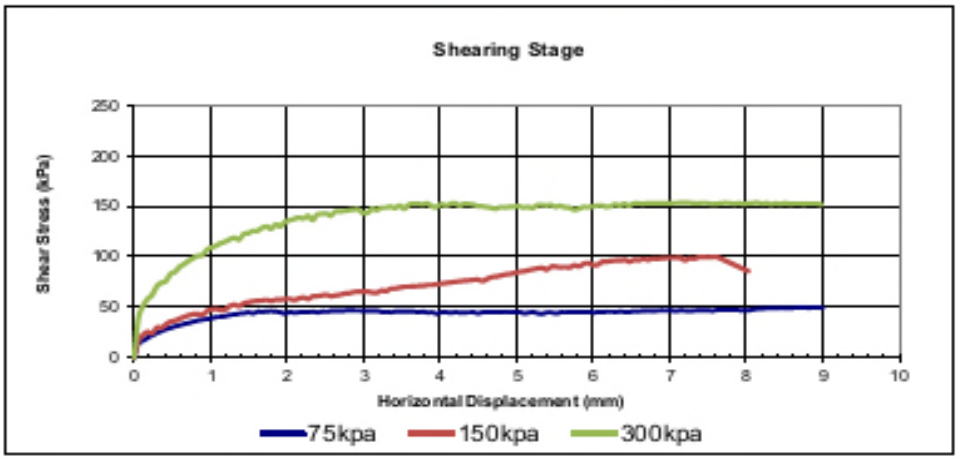
SUMMARY OF TEST RESULTS:	
Angle of Shearing Resistance (°) φ'	24.0
Cohesion Intercept (kPa) c'	22.0

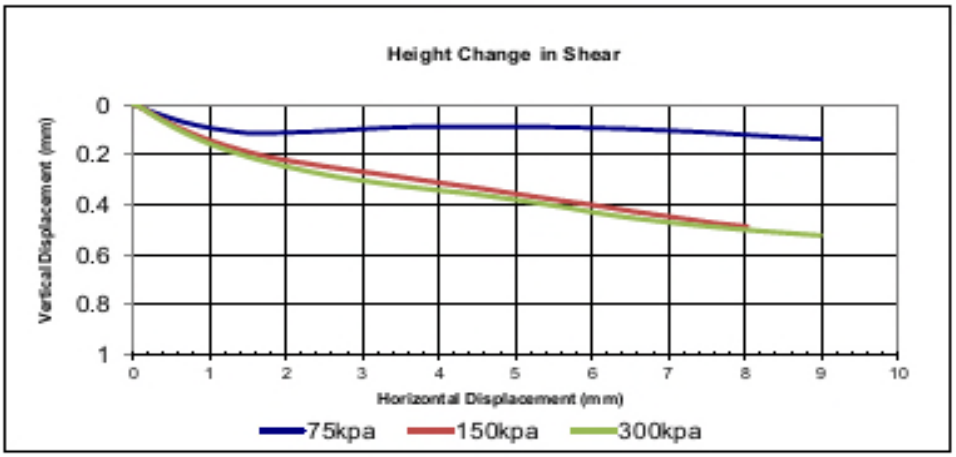
Sample Condition: Submerged
Particle Density: 2.65(Mg/m3) Assumed
Sample Preparation: Remoulded (Hand Tamped)
Material tested passing 2mm sieve

Initial Condition			
	Stage		
	1	2	3
Normal Pressure (kPa)	75	150	300
Height (mm)	20.39	20.20	20.37
Width (mm)	59.9	59.9	59.9
Bulk Density (Mg/m^3)	2.07	2.09	2.07
Dry Density (Mg/m^3)	1.80	1.82	1.80
Moisture Content (%)	15	15	15
Voids Ratio	0.469	0.457	0.475
Degree of Saturation	84.8	87.0	83.7
Shearing Stage			
Rate of Displacement (mm/min)	0.03	0.03	0.03
Peak Shear Stress (kPa)	49.4	99.6	153.5
Displacement at Peak Stress (mm)	8.9	7.6	8.1
Final Condition			
Bulk Density (Mg/m^3)	2.28	2.40	2.42
Dry Density (Mg/m^3)	1.90	2.03	2.09
Moisture Content (%)	20	18	16
Angle of Shearing Resistance (°) φ'	24.0		
Cohesion Intercept (kPa) c'	22.0		









Subcontracted to a Laboratory Accredited in this Testing

Approved Signature
James Fisher Testing Services Limited
James Ward, Operations Manager

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

James Fisher Testing Services

LABORATORY TEST REPORT

BRE Test Suite B - Greenfield Site

Project:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref. No.:**	ST 93852
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	09/04/2020
	Co. Cork	**Material:**	Soil
Order No.:	2003-104	**Date Tested:**	07/04/2020
Originator:	Ian Holley	**Specification:**	Client

Sample Details **XC212-CPRC01 Type D Sample 20**

Supplier:	Client Info	**Date of Sampling:**	Client Info.
Source:	Client Info	**Sampled By:**	Client
Sample Location:	5-6m	**Sampling Reason:**	Request

Parameter	RESULT
pH	8.3
Sulphate Aqueous Extract (SO4) (mg/l)	15
Sulphur as S, Total (%)	0.01
Sulphate as SO4, Total (%)	0.01

Comments:
None

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

James Fisher Testing Services

James Fisher Testing Services Limited
Unit D Zone 5
Clonminam Business Park
Tel: 057 86 64885

James Fisher Testing Services

Laboratory Test Report
Determination of shear Strength by Direct Shear (Small Shearbox)
in accordance with BS :1377: Part 7 : 1990 Clause 4

Project:	Cork Line Level Crossing	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref. No.:**	ST 93853
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	05/05/2020
		Material:	Earthworks
Order No.:	2003-104	**Visual Description:**	Brown very Gravelly, very Clayey SAND
Originator:	Ian Holley	**Specification:**	TII Series 600

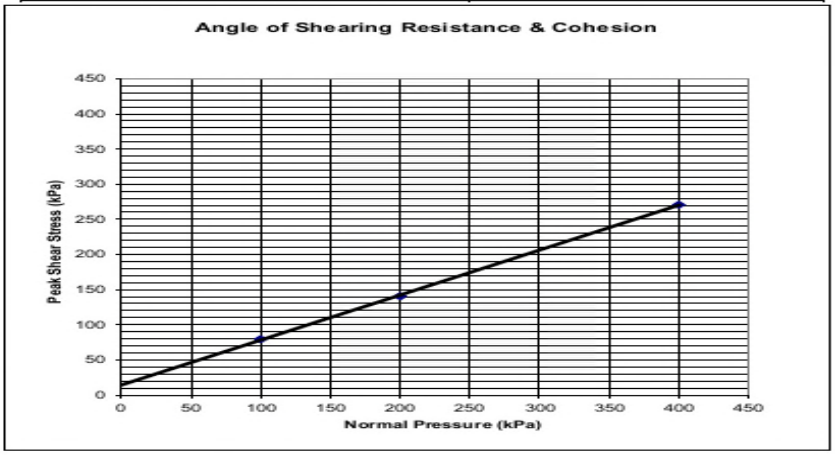
Client Ref:	**ST 93853**		
Certificate of sampling	Yes	**Date Of Sampling:**	Client info
Lab Reference No.	XC212-CPRC01 6-7m Type B Ref 21	**Sampled By:**	OCB
Sample Source & Ticket No.	Site Won	**Sample Preparation:**	Bulk sample sieved through 20mm sieve
Sample Location / Orientation :	Cork Line Level Crossings	**Tested Dry or Submerged:**	Dry

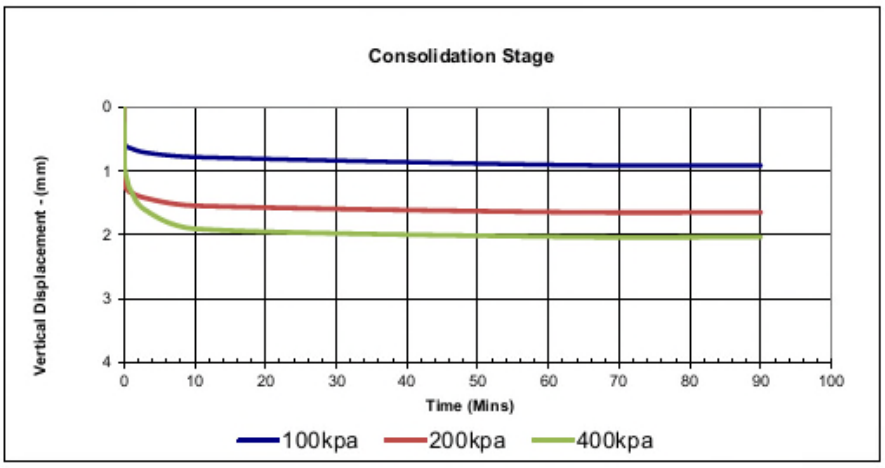
Results

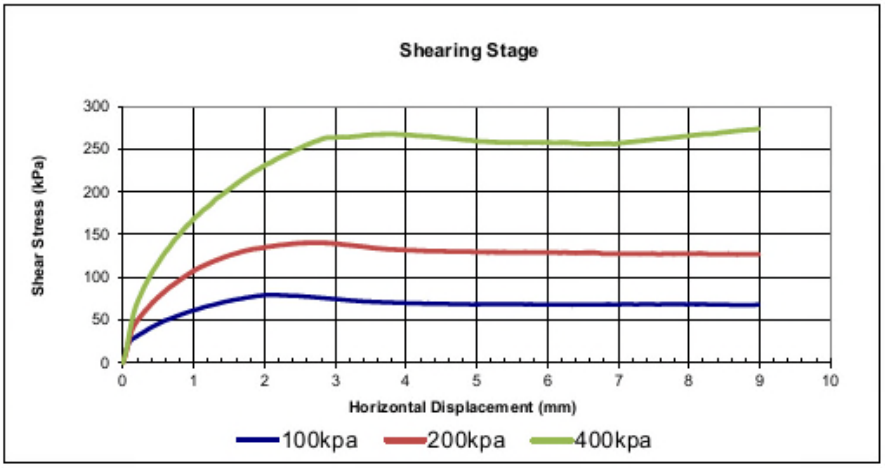
SUMMARY OF TEST RESULTS:	
Angle of Shearing Resistance (°) φ'	32.5
Cohesion Intercept (kPa) c'	14.0

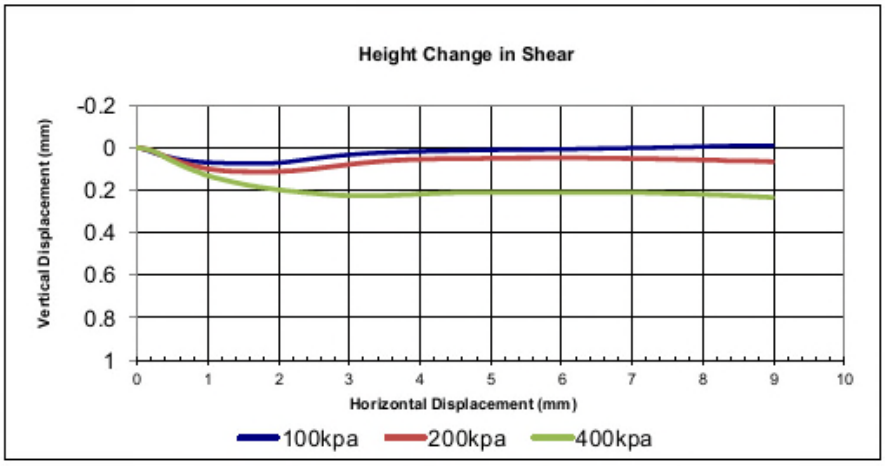
Sample Condition: Submerged
Particle Density: 2.65(Mg/m3) Assumed
Sample Preparation: Remoulded (Hand Tamped)
Material tested passing 2mm sieve

Initial Condition			
	Stage		
	1	2	3
Normal Pressure (kPa)	100	200	400
Height (mm)	20.60	20.23	20.77
Width (mm)	59.9	59.9	59.9
Bulk Density (Mg/m^3)	2.24	2.26	2.21
Dry Density (Mg/m^3)	2.03	2.04	1.99
Moisture Content (%)	10	11	11
Voids Ratio	0.303	0.301	0.329
Degree of Saturation	87.3	96.8	88.5
Shearing Stage			
Rate of Displacement (mm/min)	0.03	0.03	0.03
Peak Shear Stress (kPa)	79.4	140.4	270.7
Displacement at Peak Stress (mm)	2.0	2.7	9.0
Final Condition			
Bulk Density (Mg/m^3)	2.40	2.49	2.44
Dry Density (Mg/m^3)	2.13	2.23	2.24
Moisture Content (%)	13	12	9
Angle of Shearing Resistance (°) φ'	32.5		
Cohesion Intercept (kPa) c'	14.0		









Subcontracted to a Laboratory Accredited in this Testing

Approved Signature
James Fisher Testing Services Limited
James Ward, Operations Manager

James Fisher Testing Services (Ireland) Ltd
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Portlaoise, Co.Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

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

Site:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93854
	Unit 1 Carrigogna	**Date Received:**	26/03/2020
	Midleton	**Date Tested:**	31/03/2020
Order No:	2003-104	**Date Reported:**	03/04/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC212-CPRC01 Type D Sample 22

Sample Type:	Bulk	***Location:***	XC212-CPRC01 Type D Sample 22
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	6-7m	***Material Type:***	Soil

Moisture Content (%): 6.2

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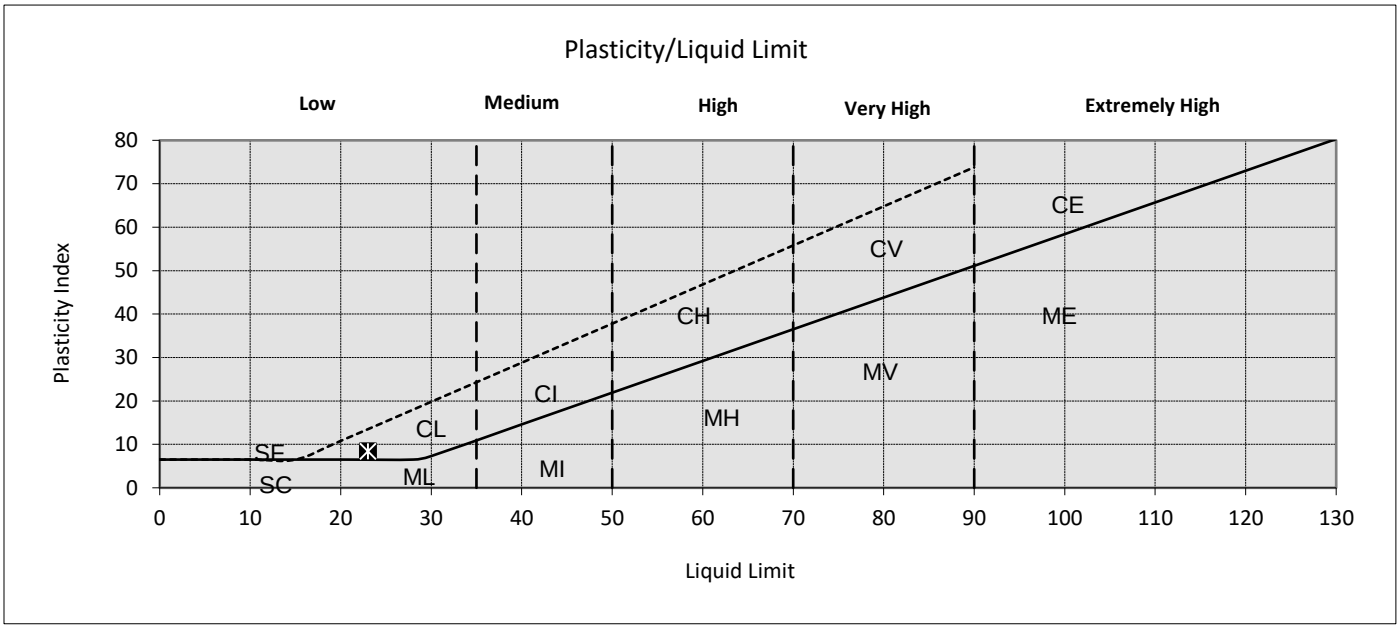
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

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

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93855
	Unit 1 Carrigogna	**Sample Ref.:**	XC212-CPRC01 6-7m Type D Sample 22
	Midleton	**Date Sampled:**	Client Info
	Co Cork	**Date Received:**	26/03/2020
Order No:	2003-104	**Date Tested:**	02/04/2020
Originator:	**Ian Holley**	**Date Reported:**	03/04/2020

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Bulk**
Sample Preparation Method	**Washed**
MATERIAL	**Soil**
Retained 425 micron (%)	**20**
Natural Moisture Content (%)	**13**
Liquid Limit (single point)(%)	**23**
Plastic Limit (%)	**14**
Plasticity Index	**8**



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Phil Thorp, Laboratory Manager

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LABORATORY TEST REPORT

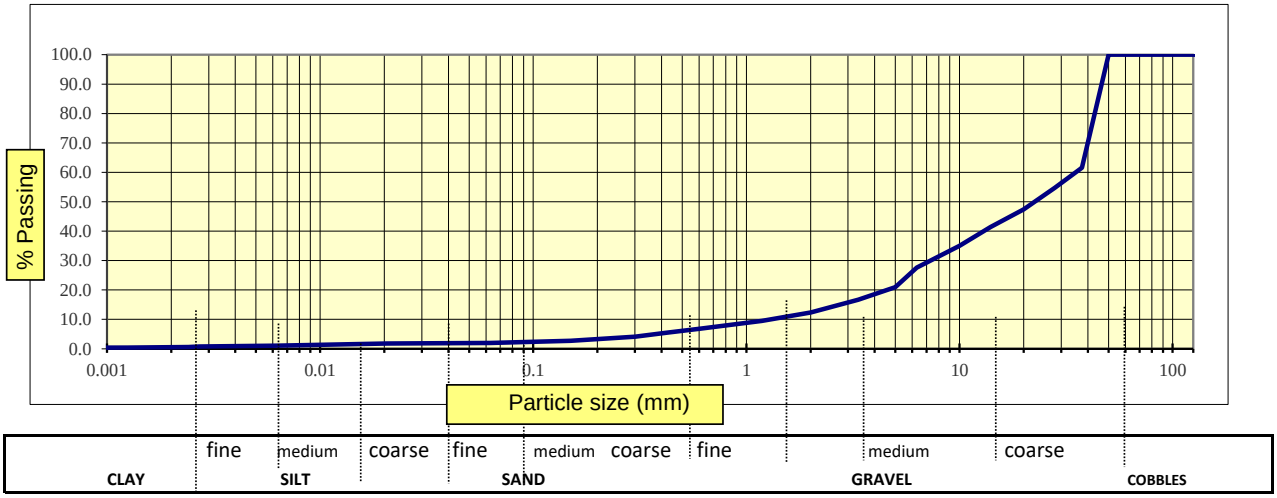
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 93857
	Unit 1 Carrigogna	**Date Received:**	11/03/2020
	Midleton	**Date Reported:**	02/04/2020
		Date Tested:	01/04/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Cobble, Sandy

Client Ref.	**XC212-CPRC01 Type B Sample 25**
Location:	XC212-CPRC01 Type B Sample 25
Supplier:	Bulk
Source:	Client Info.
Depth (m):	7.3-8.0m
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	100	
63 mm	100	
50 mm	100	
37.5 mm	62	
28 mm	55	
20 mm	47	
14 mm	41	
10 mm	35	
6.3 mm	28	
5 mm	21	
3.35 mm	17	
2 mm	12	
1.18 mm	9	
0.6 mm	7	
0.425 mm	5	
0.3 mm	4	
0.15 mm	3	
0.063 mm	2	
0.020 mm	2	
0.006 mm	1	
0.003 mm	1	
0.002 mm	1	
0.001 mm	0	



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

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Sedimentation by Hydrometer - Not UKAS

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☐ **James Ward, Operations Manager**

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Tel: 057 8664885

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LABORATORY TEST REPORT

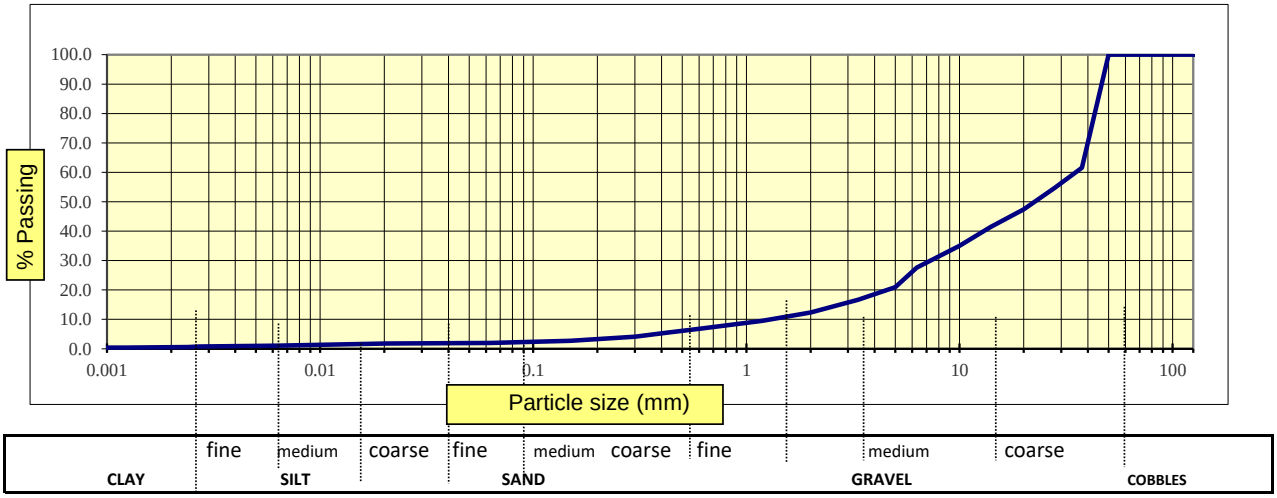
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 93857
	Unit 1 Carrigogna	**Date Received:**	11/03/2020
	Midleton	**Date Reported:**	02/04/2020
		Date Tested:	01/04/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Cobble, Sandy

Client Ref.	**XC212-CPRC01 Type B Sample 25**
Location:	XC212-CPRC01 Type B Sample 25
Supplier:	Bulk
Source:	Client Info.
Depth (m):	7.3-8.0m
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	100	
63 mm	100	
50 mm	100	
37.5 mm	62	
28 mm	55	
20 mm	47	
14 mm	41	
10 mm	35	
6.3 mm	28	
5 mm	21	
3.35 mm	17	
2 mm	12	
1.18 mm	9	
0.6 mm	7	
0.425 mm	5	
0.3 mm	4	
0.15 mm	3	
0.063 mm	2	
0.020 mm	2	
0.006 mm	1	
0.003 mm	1	
0.002 mm	1	
0.001 mm	0	



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

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Sedimentation by Hydrometer - Not UKAS

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☐ **James Ward, Operations Manager**

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Tel: 057 8664885

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LABORATORY TEST REPORT

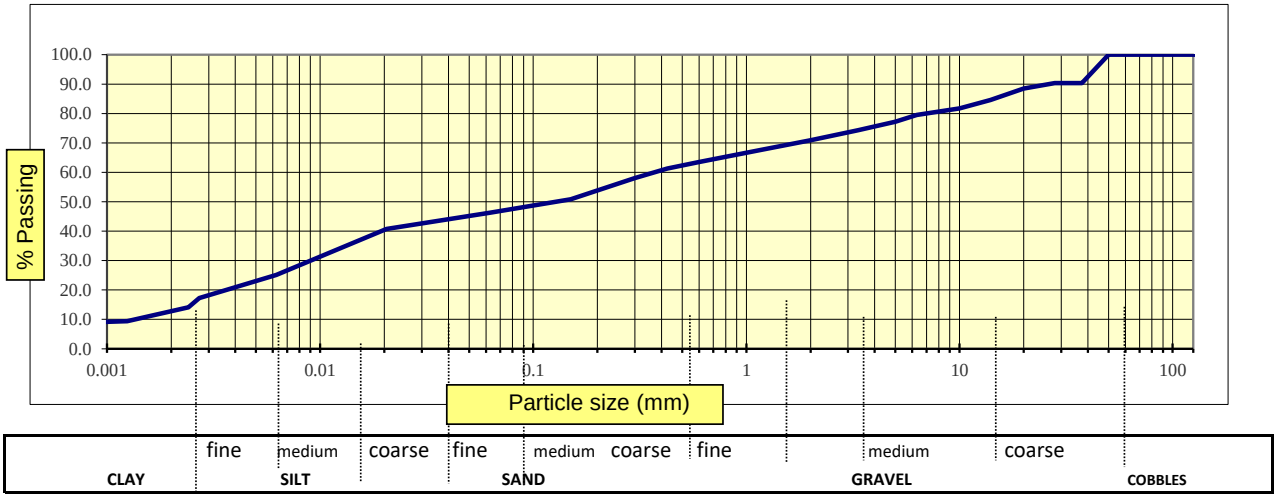
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 93856
	Unit 1 Carrigogna	**Date Received:**	11/03/2020
	Midleton	**Date Reported:**	02/04/2020
		Date Tested:	01/04/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Light Clay, Sandy

Client Ref.	**XC212-CPRC01 Type B Sample 23**
Location:	XC212-CPRC01 Type B Sample 23
Supplier:	Bulk
Source:	Client Info.
Depth (m):	7.0-7.15m
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	90	
28 mm	90	
20 mm	89	
14 mm	85	
10 mm	82	
6.3 mm	79	
5 mm	77	
3.35 mm	74	
2 mm	71	
1.18 mm	68	
0.6 mm	64	
0.425 mm	61	
0.3 mm	58	
0.15 mm	51	
0.063 mm	46	
0.020 mm	41	
0.006 mm	25	
0.003 mm	17	
0.002 mm	14	
0.001 mm	9	



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

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Sedimentation by Hydrometer - Not UKAS

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☐ **James Ward, Operations Manager**

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Portlaoise, Co. Laois
Tel: 057 8664885

James Fisher Testing Services

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 93860
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	09/04/2020
	Co. Cork	**Material:**	Soil
Order No.:	2003-104	**Date Tested:**	07/04/2020
Originator:	Ian Holley	**Specification:**	Client

Sample Details **XC212-CPRC01 Type D Sample 30**

Supplier:	Client Info	**Date of Sampling:**	Client Info.
Source:	Client Info	**Sampled By:**	Client
Sample Location:	8.8-9.0m	**Sampling Reason:**	Request

Parameter	RESULT
pH	8.3
Sulphate Aqueous Extract (SO4) (mg/l)	20
Sulphur as S, Total (%)	0.02
Sulphate as SO4, Total (%)	0.03

Comments:
None

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

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.

☐ **James Ward, Operations Manager**

James Fisher Testing Services

James Fisher Testing Services Limited
Ruby House, 40A Hardwick Grange
Warrington,WA1 4RF
Tel: 01925 286 880

James Fisher Testing Services

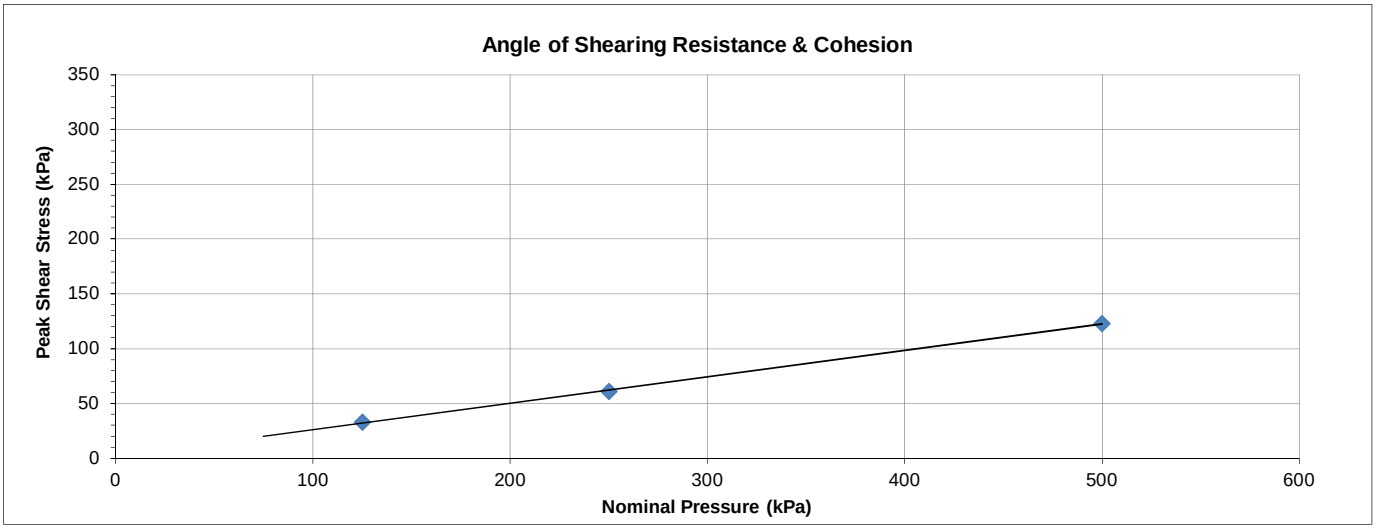
Laboratory Test Report

To determine the Effective Angle of Internal Friction & Effective Cohesion by Dry Direct Shear of a sample, according to SHW Clause 636 March 2000 & BS :1377: Part 7 : 1990 Clause 5

Project:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref. No.:**	ST 93859
	Unit 1 Carrigogna	**Date Received:**	26/03/2020
	Midleton	**Date Reported:**	09/04/2020
	Co Cork	**Material:**	Earthworks
Order No.:	2003-104	**Visual Description:**	Sand & Coarse Gravel
Originator:	Ian Holley	**Specification:**	TII Series 600

Client Ref:	**ST 93859**		
Certificate of sampling	No	**Date Of Sampling:**	Client Info
Lab Reference No.	XC212-CRPC01 8-8.8m Type D Sample 28	**Sampled By:**	Client
Sample Source & Ticket No.	Client Info	**Sample Preparation:**	Bulk sample sieved through 20mm sieve
Sample Location / Orientation :	Cork Line Level Crossings	**Tested Dry or Submerged:**	Dry

Results



Test Specimen Size (mm)	305x305x150		
Maximum Dry Density (Mg/m^3)	1.990		
Optimum Moisture Content (%)	11.0		
Particle Density Used (Mg/m^3)	2.60		
PD indicating measured or assumed	Assumed		
Initial Bulk Density (Mg/m^3)	2.142	2.143	2.146
Moisture Content (%)	14.0	14.2	14.2
Initial Dry Density (Mg/m$^{3)}$	1.879	1.877	1.879
Indicating which direct shear procedure was used, 5.5.4 single stage or 5.5.5 multi-reversal test	Single Stage Test		
Normal Pressure (kPa)	125	250	500
Peak Shear Strength (kPa)	33	61	123
Cohesion (kPa) to 0.1	**2.0**		
Angle of friction (^{0}) to nearest (0.5^0)	**13.5**		
Rate of Displacement (mm/min)	2.5	2.5	2.5

Comments/Departure from specified procedure: None

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

James Fisher Testing Services Limited, a company registered in England and Wales with registration number: 01182561
Registered office: Fisher House, PO Box 4, Barrow-in-Furness, Cumbria, LA14 1HR

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Portlaoise, Co. Laois
Tel: 057 8664885

James Fisher Testing Services

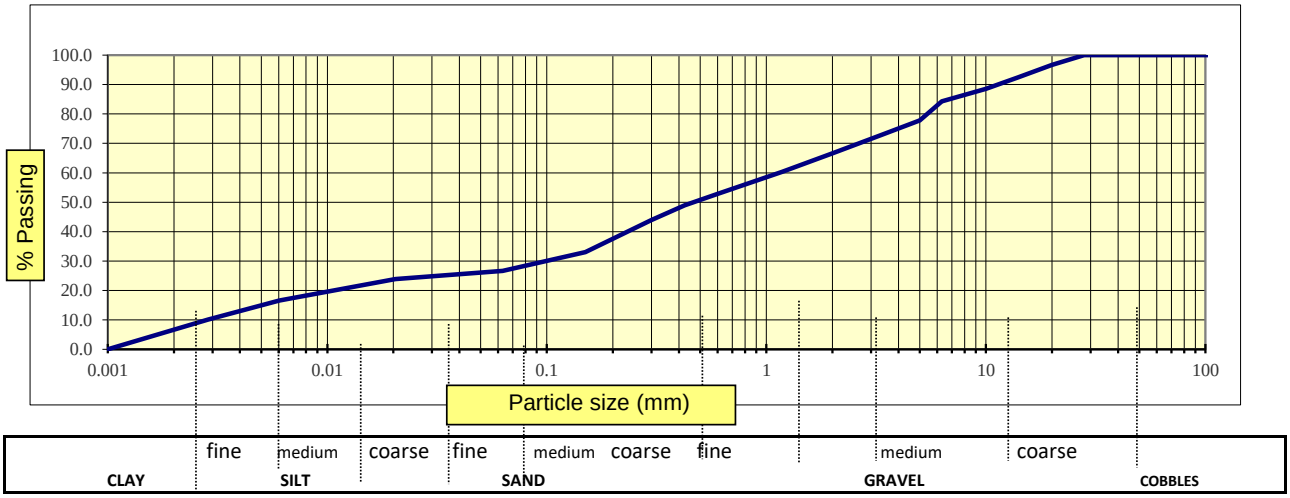
LABORATORY TEST REPORT

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

Project:	Cork Line Level Crossings	**Job No:**	19-135
Client:	OCB Geotechnical Unit 1 Carrigogna Midleton Co Cork	**Lab Ref No.:** **Date Received:** **Date Reported:** **Date Tested:**	ST 93858 11/03/2020 02/04/2020 01/04/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Dark Clay, Sandy

Client Ref.	**XC212-CRPC01 Type B Sample 27**
Location:	XC212-CRPC01 Type B Sample 27
Supplier:	Client Info.
Source:	Client Info.
Depth (m):	8.0-8.8m
Sampling Reason:	Client Request
Sampled By:	Client
Specification:	Client
Preparation Method:	Without Organics Preparation
Notes:	Disturbed sample from cleanout
Moisture Content%:	27

BS Sieve Size	% Passing	Specification
125 mm	100	
100 mm	100	
90 mm	100	
75 mm	100	
63 mm	100	
50 mm	100	
37.5 mm	100	
28 mm	100	
20 mm	97	
14 mm	92	
10 mm	89	
6.3 mm	84	
5 mm	78	
3.35 mm	73	
2 mm	67	
1.18 mm	60	
0.6 mm	53	
0.425 mm	49	
0.3 mm	44	
0.15 mm	33	
0.063 mm	27	
0.0205 mm	24	
0.0060 mm	17	
0.0029 mm	10	



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

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

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

UKAS TESTING 0955

Appendix E 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.:	20-08714-1
Initial Date of Issue:	25-Mar-2020
Client	Environmental Laboratory Services Ltd
Client Address:	Acorn Business Campus Mahon Industrial Park Blackrock Cork Ireland
Contact(s):	Emer Kearney Results
Project	Water Analysis

Quotation No.:	Q20-19728	**Date Received:**	19-Mar-2020
Order No.:	6997	**Date Instructed:**	19-Mar-2020
No. of Samples:	2		
Turnaround (Wkdays):	5	**Results Due:**	25-Mar-2020
Date Approved:	25-Mar-2020		

Approved By:



Details: Glynn Harvey, Technical Manager

Chemtest
The right chemistry to deliver results

Results - Leachate

Project: Water Analysis

Client: Environmental Laboratory Services Ltd				**Chemtest Job No.:**		20-08714	20-08714
Quotation No.: Q20-19728				**Chemtest Sample ID.:**		988286	988287
Order No.: 6997				Client Sample Ref.:		177724/001	177724/002
				Client Sample ID.:		1	2
				Sample Type:		SOIL	SOIL
				Top Depth (m):		1.00	3.00
				Date Sampled:		02-Mar-2020	04-Mar-2020
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**		
pH	U	1010	10:1		N/A	8.9	8.1
Cyanide (Free)	U	1300	10:1	mg/l	0.050	< 0.050	< 0.050
Arsenic (Dissolved)	U	1450	10:1	µg/l	1.0	13	1.5
Boron (Dissolved)	U	1450	10:1	µg/l	20	< 20	62
Barium (Dissolved)	U	1450	10:1	µg/l	5.0	6.2	35
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	3.4	2.4
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	1.4	< 1.0
Selenium (Dissolved)	U	1450	10:1	µg/l	1.0	1.1	< 1.0
Vanadium (Dissolved)	U	1450	10:1	µg/l	1.0	3.4	< 1.0
Zinc (Dissolved)	U	1450	10:1	µg/l	1.0	1.8	3.0
Aliphatic TPH >C5-C6	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10
Aliphatic TPH >C6-C8	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10
Aliphatic TPH >C8-C10	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10
Aliphatic TPH >C10-C12	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10
Aliphatic TPH >C12-C16	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10
Aliphatic TPH >C16-C21	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10
Aliphatic TPH >C21-C35	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10
Aliphatic TPH >C35-C44	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10
Total Aliphatic Hydrocarbons	N	1675	10:1	µg/l	5.0	[B] < 5.0	[B] < 5.0
Aromatic TPH >C5-C7	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10
Aromatic TPH >C7-C8	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10
Aromatic TPH >C8-C10	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10
Aromatic TPH >C10-C12	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10
Aromatic TPH >C12-C16	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10
Aromatic TPH >C16-C21	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10
Aromatic TPH >C21-C35	N	1675	10:1	µg/l	0.10	[B] < 0.10	[B] < 0.10
Aromatic TPH >C35-C44	N	1680	10:1	µg/l	50.00	[B] < 50	[B] < 50
Total Aromatic Hydrocarbons	N	1675	10:1	µg/l	5.0	[B] < 5.0	[B] < 5.0
Total Petroleum Hydrocarbons	N	1675	10:1	µg/l	10	[B] < 10	[B] < 10
Benzene	U	1760	10:1	µg/l	1.0	[B] < 1.0	[B] < 1.0
Toluene	U	1760	10:1	µg/l	1.0	[B] < 1.0	[B] < 1.0
Ethylbenzene	U	1760	10:1	µg/l	1.0	[B] < 1.0	[B] < 1.0
m & p-Xylene	U	1760	10:1	µg/l	1.0	[B] < 1.0	[B] < 1.0

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Results - Leachate

Project: Water Analysis

Client: Environmental Laboratory Services Ltd				**Chemtest Job No.:**		20-08714	20-08714
Quotation No.: Q20-19728				**Chemtest Sample ID.:**		988286	988287
Order No.: 6997				Client Sample Ref.:		177724/001	177724/002
				Client Sample ID.:		1	2
				Sample Type:		SOIL	SOIL
				Top Depth (m):		1.00	3.00
				Date Sampled:		02-Mar-2020	04-Mar-2020
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**		
o-Xylene	U	1760	10:1	µg/l	1.0	[B] 2.0	[B] < 1.0
Methyl Tert-Butyl Ether	N	1760	10:1	µg/l	1.0	[B] < 1.0	[B] < 1.0
Naphthalene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Acenaphthylene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Acenaphthene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Fluorene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Phenanthrene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Anthracene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Fluoranthene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Pyrene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Chrysene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	1800	10:1	µg/l	2.0	< 2.0	< 2.0

Results - Soil

Project: Water Analysis

Client: Environmental Laboratory Services Ltd			**Chemtest Job No.:**		20-08714	20-08714
Quotation No.: Q20-19728			**Chemtest Sample ID.:**		988286	988287
Order No.: 6997			Client Sample Ref.:		177724/001	177724/002
			Client Sample ID.:		1	2
			Sample Type:		SOIL	SOIL
			Top Depth (m):		1.00	3.00
			Date Sampled:		02-Mar-2020	04-Mar-2020
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Moisture	N	2030	%	0.020	13	26
pH	U	2010		4.0	9.4	7.8

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:
988286	177724/001	1		02-Mar-2020	B	Amber Glass 250ml
988286	177724/001	1		02-Mar-2020	B	Plastic Tub 500g
988287	177724/002	2		04-Mar-2020	B	Amber Glass 250ml
988287	177724/002	2		04-Mar-2020	B	Plastic Tub 500g

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
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

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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 F Pre & Post Site Condition Photographs







Iarnród Éireann Cork Line Level Crossings XC212 (19-135-3)	XC212
	Pre Works Site Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: 2020









ocbgeo	Iarnród Éireann Cork Line Level Crossings XC212 (19-135-3)	XC212 Post Works Site Photographs Client: Iarnród Éireann Engineer: Jacob's Date: 2020







Iarnród Éireann Cork Line Level Crossings XC212 (19-135-3)	XC212
	Post Works Site Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: 2020

Cork Line Level Crossings – XC215
Ground Investigation

Primary Author:	Ian Holley
Client:	Irish Rail
Client's Representative:	JACOBS
Report Date:	25th November 2020
Report No.:	OCB19-135-4
File Location:	OCB19-135-4/Reporting/XC215

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APPENDICES

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Appendix J	**Environmental Laboratory Test Results**
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Document Control Sheet

Report No.:	OCB19-135-4
Project title:	Cork Line Level Crossings – XC215
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

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 – XC215

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 XC215 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, 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 XC215 is located in the Imphrick townland approximately 4.5km south of Charleville and immediately west of the N20. The crossing is currently manned with a house and small cabin to the west. The site is surrounded by agricultural land with a number of houses and farms in the wider area.

The site is generally flat within the site 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 18th February 2020 and 14th August 2020, included:

- One (1) Cable Percussion Borehole
- Two (2) Cable Percussion with Rotary follow-on Boreholes
- A Standpipe Installation in two (2) Boreholes
- Nine (9) Trial Pits
- Indirect CBR tests at eighteen (18) locations
- Water Purging in two (2) locations

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 three 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 upon 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

Two boreholes (CPRC01 & CPRC02) 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.

4.2 Standpipe Installations

A groundwater monitoring standpipe was installed in boreholes CP01 and CPRC01.

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

Nine trial pits (TP01–TP09) were excavated using a 15t tracked excavator fitted with a 600mm wide bucket, to depths between 0.80m and 2.40m. Most trial pits were terminated due to the pit walls collapsing while TP02 was terminated at 0.80m due to a possible archaeological feature and TP08 and TP09 were terminated early to prevent damage to the property owners' field.

Environmental samples were taken at depths of 0.05m, 0.50m and 1.0m 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 eighteen locations (TRL01 to TRL18) 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):

Log CBR = 2.48-1.057 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 CP01 and CPRC01) 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 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.
- **shear strength**: 60mm Shear Box test
- **soil chemistry:** pH, Sulphur content, Organic Matter 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

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

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 Devonian sandstones.

The Geological Survey of Ireland (GSI) bedrock mapping database indicates that soils in the site area are underlain at depth by the Upper Devonian-age Kiltorcan Formation, which consists of thick coarse-grained white-yellow sandstone (commonly in channel form), intraformational mudflake conglomerate, red-yellow flaggy sandstone, and red and green silty mudstone and mudstone.

The Upper Devonian strata were subjected to compressional deformation (tectonic shortening) during the Variscan Orogeny in Late Carboniferous and Early Permian times, resulting in the formation of an east-northeast west-southwest trending fold-thrust belt. The site is located on the west side of the Ballyhoura Mountains on either side of a west-southwest to east-northeast orientated anticline (upfold). Bedrock in the site vicinity dips at variable angles to the north, west and south, having undergone buckle folding and contractional thrust faulting.

The site is underlain by a regionally important fissured bedrock aquifer and has a moderate to high groundwater vulnerability.

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 between 200mm and 350mm thickness.
- Glacial Till: Sandy gravelly clay/silt, frequently with low cobble content. Observed directly below the topsoil and at greater depths below the range of 3.60m and 4.70m bgl.
- Fluvioglacial deposits: Observed predominantly between the upper strata and lower strata (glacial till). Typically loose to medium dense sands and gravels.
- Bedrock (Sandstone, Mudstone and Siltstone): Rockhead was encountered at 6.60m in CPRC02 and 9.60m in CPRC01. Predominantly Medium Strong Sandstone with some weaker layers of Mudstone and Siltstone interbedded.

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	CPRC01
13/08/20	Dry	9.51
17/08/20	Dry	9.57
21/08/20	Dry	4.64
29/09/20	Dry	7.16

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

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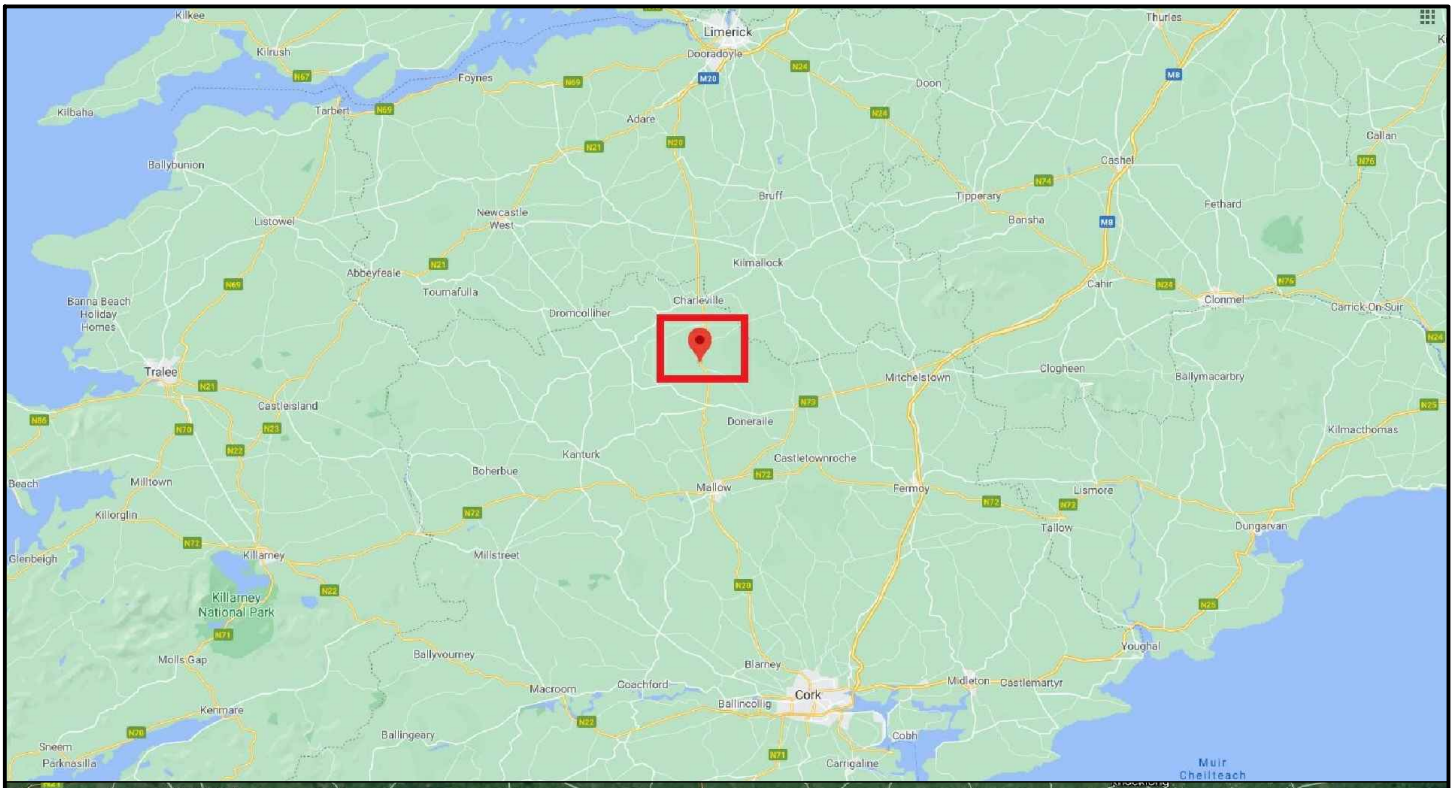
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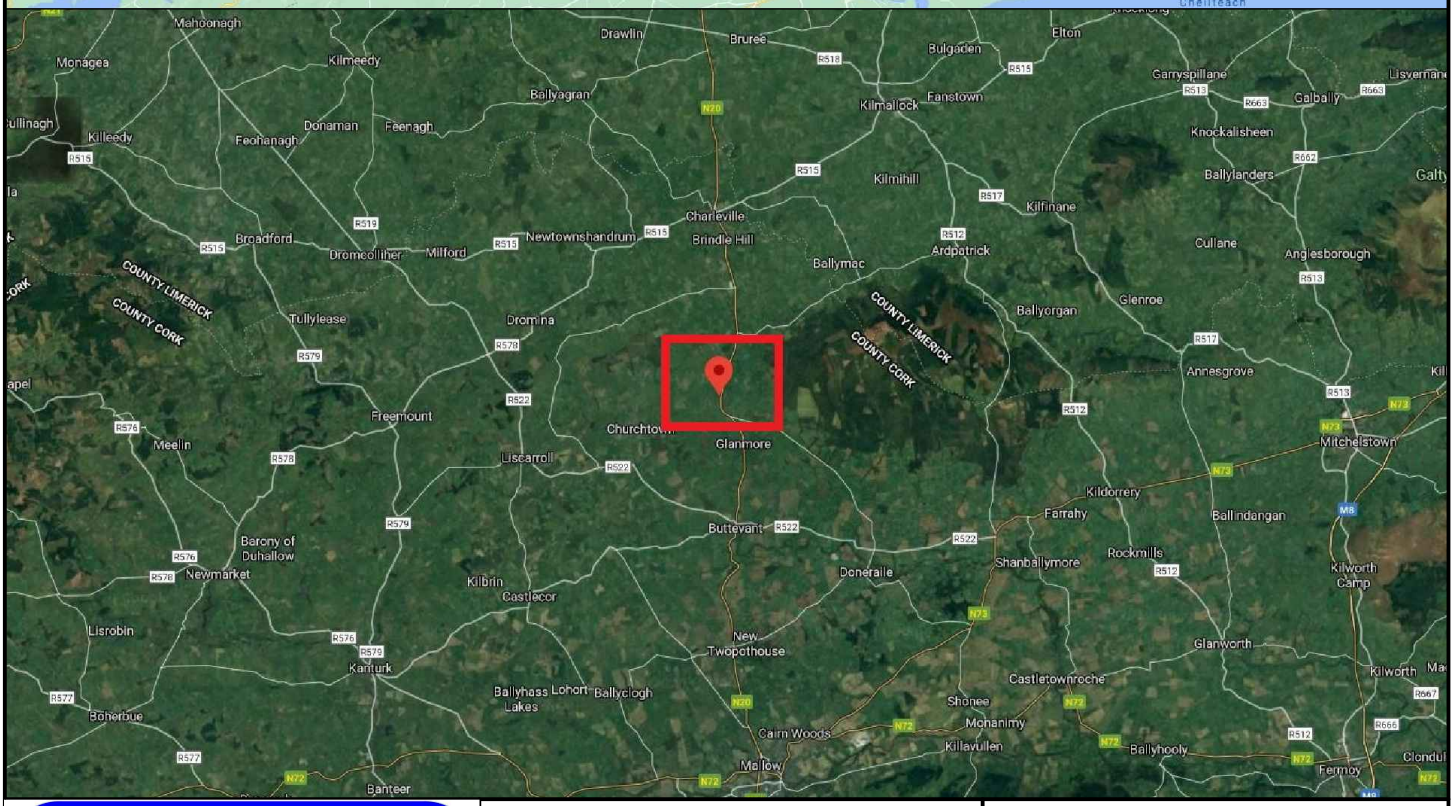
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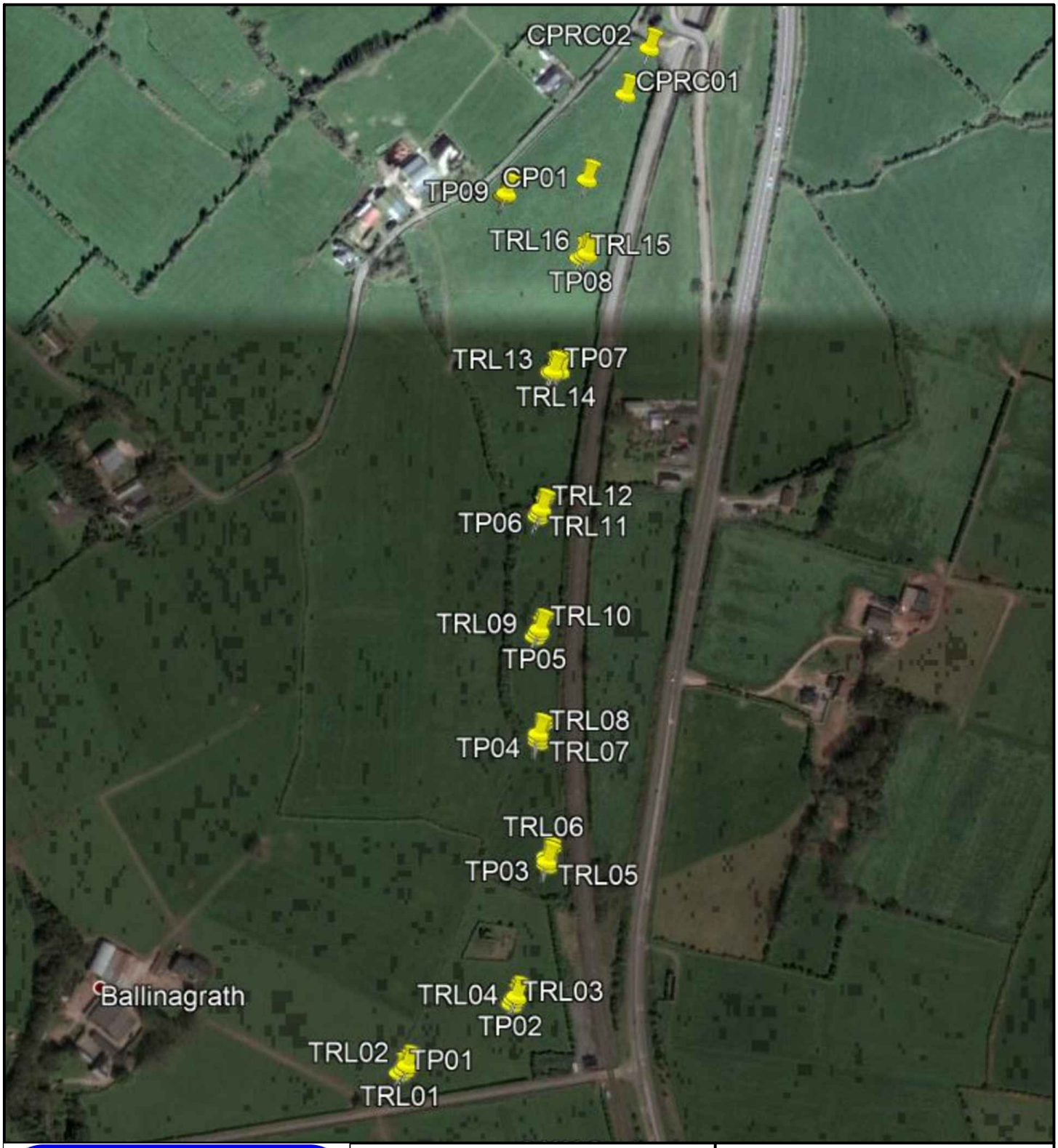
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Appendix A Site and Exploratory Hole Location Plans





obgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	SITE LOCATION MAPS Client: Iarnród Éireann Engineer: Jacob's Date: February/May-July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	Exploratory Hole Locations Client: Iarnród Éireann Engineer: Jacob's Date: February/May-July 2020

Appendix B Borehole Logs

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC215-CP01
	Coordinates: 553546.75 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 1
Method: Cable Percussion	615237.48 N	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon	**Ground Level:** 98.42 mOD	**Dates:** 29/05/2020 - 03/06/2020	**Driller:** AA
			Logger: IH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
0.05	ES1				98.22	(0.20) 0.20		TOPSOIL
0.20 - 1.20	B2							Reddish brown slightly silty slightly gravelly very sandy CLAY. Gravel is fine to medium, subrounded. Sand is fine to coarse.
0.20 - 1.20	D3							
0.50	ES4					(1.00)		
1.20 - 2.00	B5				97.22	1.20		Loose reddish brown slightly silty gravelly clayey SAND with low cobble content. Gravel is fine to coarse, angular to subrounded. Sand is fine to coarse. Cobbles are subrounded.
1.20 - 2.00	D6							
1.20 - 1.65	SPT (C) N=6			N=6 (1,1/2,1,2,1)		(0.80)		
1.50	ES7							
2.00 - 3.00	B8				96.42	2.00		Medium Dense reddish brown slightly silty sandy GRAVEL with medium cobble content. Gravel is fine to coarse, subangular to subrounded. Sand is fine to coarse. Cobbles are subangular to subrounded.
2.00 - 3.00	D9							
2.00 - 2.45	SPT (C) N=17			N=17 (3,6/4,5,4,4)		(1.00)		
3.00	ES10				95.42	3.00		Medium Dense reddish brown slightly silty clayey very sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded.
3.00 - 3.60	B11							
3.00 - 3.60	D12					(0.60)		
3.00 - 3.45	SPT (C) N=20			N=20 (2,4/4,6,5,5)	94.82	3.60		Stiff brown mottled grey slightly gravelly slightly sandy silty 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 subrounded.
3.60 - 4.50	B13							
3.60 - 4.50	D14							
4.00 - 4.45	SPT (C) N=17			N=17 (3,3/2,4,4,7)		(0.90)		
4.50 - 5.50	B15				93.92	4.50		Soft to Firm brown slightly silty slightly sandy slightly gravelly CLAY with low to medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subrounded.
4.50 - 5.50	D16							
5.00 - 5.45	SPT (C) N=8			N=8 (1,1/1,3,2,2)		(1.50)		
5.50 - 6.00	B17							
5.50 - 6.50	D18							
6.00 - 6.80	B19				92.42	6.00		Loose to Medium Dense reddish brown sandy clayey GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded.
6.00 - 6.80	D20							
6.00 - 6.45	SPT (C) N=12			N=12 (1,1/2,3,3,4)		(1.60)		
6.80 - 7.60	B21							
6.80 - 7.60	D22							
6.80 - 6.80	SPT (C)			50 (25 for 0mm/50 for 0mm)				
7.00 - 7.45	SPT (C) N=22			N=22 (2,4/3,5,7,7)				
7.60 - 7.60	SPT (C)			50 (25 for 0mm/50 for 0mm)	90.82	7.60		End of borehole at 7.600m

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)
1.20	3.00	3.70	3.70	20	3.50
3.00	3.60				

Casing Details		Chiselling Details		
To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)
7.60	200	6.80	7.00	00:30
		7.60	7.60	01:00

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC215-CPRC01
	Coordinates: 553581.51 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 2
Method: Cable Percussion+Rotary Open+Rotary Coring	615311.63 N	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon+T44	**Ground Level:** 99.59 mOD	**Dates:** 28/05/2020 - 31/07/2020	**Driller:** AA +NOB
			Logger: IH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0.05	ES1					(0.30)		TOPSOIL		
0.30 - 1.20	B2				99.28	0.30		Dark brown sandy gravelly SILT. Gravel is fine to medium, subangular to subrounded. sand is fine to coarse.		
0.30 - 1.20	D3									
0.50	ES4					(0.90)				
1.20 - 2.00	B5				98.38	1.20		Loose dark grey / brown slightly silty clayey very sandy GRAVEL with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subangular to subrounded.		
1.20 - 2.00	D6									
1.20 - 1.65	SPT (C) N=8			N=8 (2,1/2,3,1,2)		(0.80)				
1.50	ES7									
2.00 - 3.00	B8				97.58	2.00		Medium Dense dark grey / brown slightly silty clayey very sandy GRAVEL with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are angular to subangular		
2.00 - 3.00	D9									
2.00 - 2.45	SPT (C) N=11			N=11 (3,2/2,3,4,2)		(1.00)				
3.00	ES10				96.58	3.00		Medium Dense reddish brown clayey very sandy GRAVEL with medium cobble content. Gravel is fine to coarse, subangular to subrounded. Cobbles are angular to subangular.		
3.00 - 4.00	B11									
3.00 - 4.00	D12									
3.00 - 3.45	SPT (C) N=16			N=16 (1,1/4,4,4,4)		(1.00)				
4.00 - 4.70	B13				95.58	4.00		Medium Dense grey angular to subrounded COBBLES with a matrix of reddish brown slightly silty slightly clayey gravelly SAND.		
4.00 - 4.70	D14									
4.00 - 4.45	SPT (C) N=14			N=14 (1,2/2,3,3,6)		(0.70)				
4.70 - 6.00	B15				94.88	4.70		Firm brown slightly gravelly slightly sandy silty CLAY with low cobble content. Gravel is fine to coarse, subangular to subrounded. Sand is fine to coarse. Cobbles are subangular to subrounded.		
4.70 - 6.00	D16									
5.00 - 5.45	SPT (C) N=9			N=9 (4,1/1,2,3,3)		(1.30)				
6.00 - 6.50	B17				93.58	6.00		Firm brown slightly gravelly slightly sandy silty CLAY. Gravel is fine to coarse, subangular to subrounded. Sand is fine to coarse.		
6.00 - 6.50	D18									
6.00 - 6.45	SPT (C) N=13			N=13 (2,2/3,3,2,5)		(0.50)				
6.50 - 6.50	SPT (C)			50 (25 for 0mm/50 for 0mm)	93.08	6.50		Rotary Open Hole Drilling. Drillers Description: Boulders with sand		
7.50 - 7.95	SPT (C) N=38			N=38 (6,6/8,8,8,14)		(3.10)				
8.50 - 8.95	SPT (C) N=49			N=49 (9,9/9,12,12,16)						
9.60 - 9.60	SPT (C)			50 (25 for 0mm/50 for 0mm)	89.98	9.60		Medium Strong light greyish brown fine to medium grained SANDSTONE.		
9.60 - 9.60				50 (25 for 0mm/50 for 0mm)		(1.08)		Distinctly weathered with brown, black and orange brown discolouration (iron oxide staining) penetrating up to 5mmfrom discontinuities and		
	TCR	SCR	RQD	FI				Continued on Next Page		

Remarks

Cable percussion terminated at 6.50m due to probable boulder obstruction. Rotary techniques employed thereafter.

Water Added	
From (m)	To (m)
1.20	4.70

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

Casing Details	
To (m)	Diam (mm)
6.50	200
9.60	151

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
6.50	6.50	01:00

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC215-CPRC01
	Coordinates: 553581.51 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 2 of 2
Method: Cable Percussion+Rotary Open+Rotary Coring	615311.63 N	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon+T44	**Ground Level:** 99.59 mOD	**Dates:** 28/05/2020 - 31/07/2020	**Driller:** AA +NOB
			Logger: IH

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
									occasional orange brown speckling.		
	100	55	8			88.90	(0.98)		Discontinuities: Very closely to closely spaced. 1.) Subhorizontal, planar, rough. 2.) Step to subvertical, planar, rough		
11.10				NI		88.88	(1.06)		Very weak light olive green MUDSTONE with black and orange iron oxide staining on extremely closely spaced fractures.		
									Very weak to weak maroon MUDSTONE / SILTSTONE, distinctly weathered to destructured locally broken dow to purple gravelly silty Clay.		
	84	38	8			87.82	11.77		Discontinuities: Extremely closely to very closely spaced, undulating and planar, slightly rough with some black and orange brown iron oxide staining on surfaces. 1.) Shallow to subhorizontal planar to slightly undulating slightly rough. 2.) Steep to subvertical, planar to slightly undulating, slightly rough.		
12.60									Weak to medium strong maroon fine sandy SILTSTONE, locally thinly laminated with occasional thin laminae of pale red (pink) fine grained SANDSTONE. Occasional grey (locally weathered to yellowish brown) possible calcrete nodules, locally weathered out to voids.		
	54	42	17	15			(2.33)		Distinctly weathered with a little reddish brown slightly sandy slightly gravelly silty Clay infilling of discontinuities.		
									Discontinuities: Very closely to closely spaced with black iron oxide staining on surfaces.		
14.10						85.48	14.10		End of borehole at 14.100m		
	TCR	SCR	RQD	FI							

Remarks

Cable percussion terminated at 6.50m due to probable boulder obstruction. Rotary techniques employed thereafter.

Water Added	
From (m)	To (m)
1.20	4.70

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

Casing Details	
To (m)	Diam (mm)
6.50	200
9.60	151

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
6.50	6.50	01:00

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Borehole No.:** XC215-CPRC02
	Coordinates: 553601.76 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 1
Method: Cable Percussion+Rotary Open+Rotary Coring	615349.74 N	**Client's Representative:** JACOBS	**Scale:** 1:50
Plant: Pilcon+T44	**Ground Level:** 100.21 mOD	**Dates:** 27/05/2020 - 30/07/2020	**Driller:** AA +NOB **Logger:** IH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0.05	ES17					(0.30)		TOPSOIL		
0.30 - 1.20	B1				99.91	0.30		Dark brown slightly clayey slightly sandy slightly gravelly SILT with low cobble content and frequent rootlets. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subrounded.		
0.30 - 1.20	D2									
0.50	ES18					(0.90)				
1.20 - 2.00	B3				99.01	1.20		Loose dark grey / brown slightly sandy slightly silty GRAVEL with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subangular to subrounded		
1.20 - 2.00	D4									
1.20 - 1.65	SPT (C) N=7			N=7 (2,1/2,1,2,2)		(0.80)				
1.50	ES19									
2.00 - 3.00	B5				98.21	2.00		Dense reddish brown clayey very sandy GRAVEL with low cobble content. Gravel is fine to coarse, subangular to subrounded. Sand is fine to coarse. Cobbles are subangular to subrounded.		
2.00 - 3.00	D6									
2.00 - 2.45	SPT (C) N=46			N=46 (10,13/11,11,13,11)		(1.00)				
3.00	ES20				97.21	3.00		Medium Dense subrounded grey COBBLES with a matrix of grey slightly silty very gravelly SAND.		
3.00 - 3.50	B7									
3.00 - 3.50	D8					(0.50)				
3.00 - 3.45	SPT (C) N=16			N=16 (4,7/6,4,3,3)	96.71	3.50		Firm to stiff reddish brown slightly silty sandy slightly gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subrounded.		
3.50 - 4.20	B9									
3.50 - 4.20	D10					(0.70)				
4.00 - 4.45	SPT (C) N=15			N=15 (1,1/2,1,3,9)						
4.20 - 5.00	B11				96.01	4.20		Stiff reddish brown slightly sandy gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subrounded.		
4.20 - 5.00	D12									
5.00 - 6.00	B13									
5.00 - 6.00	D14									
5.00 - 5.45	SPT (C) N=19			N=19 (3,4/4,4,6,5)		(2.40)				
6.00 - 6.20	B15									
6.00 - 6.20	D16									
6.00 - 6.20	SPT (C)			75 (5,8/75 for 50mm)						
~~6.20 - 6.20~~	~~SPT (C)~~			~~50 (25 for 0mm/50 for 0mm)~~	93.61	6.60		Medium Strong to Strong, pale yellow / grey, medium grained SANDSTONE.		
	60 30	17	NI			(1.50)		Distinctly weathered with pervasive light brown clay staining and infill of discontinuities. Much black and orange / brown oxide staining on discontinuity surfaces.		
								Discontinuities: Subhorizontal to 20°. Planar, rough, very closely spaced.		
8.10					92.11	8.10		Borehole collapsed. Likely entered a void or soft clay band at this depth.		
						(1.50)				
					90.61	9.60		End of borehole at 9.600m		
	TCR SCR	RQD	FI							

Remarks

Borehole collapsed from 8.10m with 0% core recovery. Had to move off location due to safety concerns.

Cable Percussion terminated at 6.20m due to probable boulder obstruction. Rotary Techniques employed thereafter.

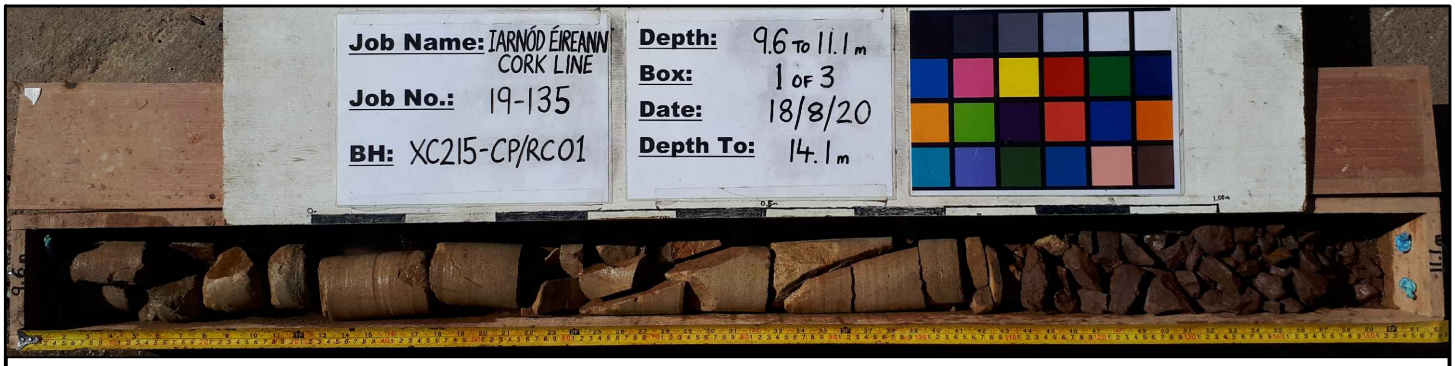
Water Added	
From (m)	To (m)
1.20	4.20

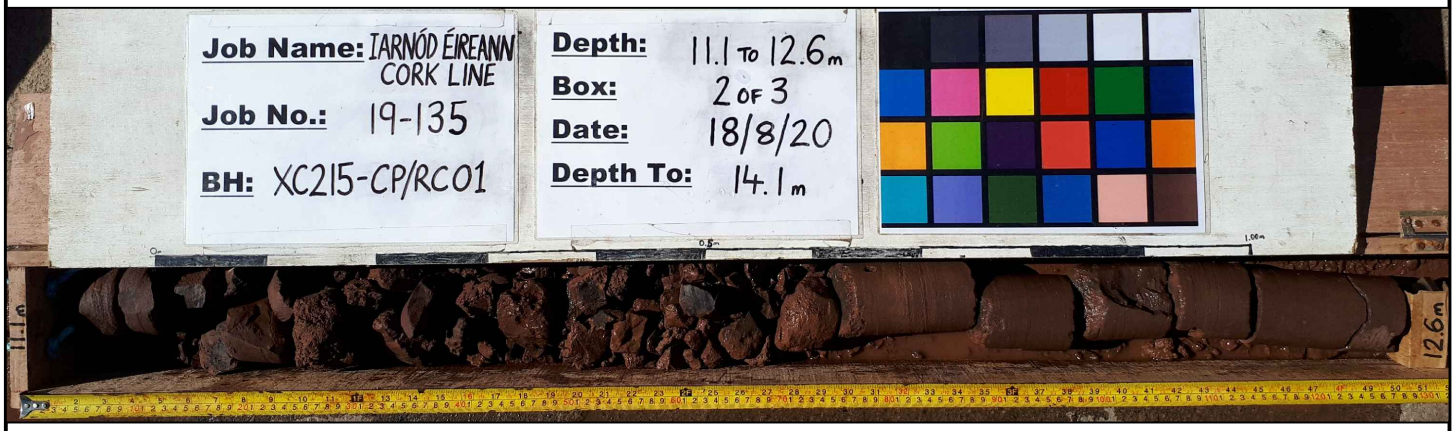
Water Strike - General			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

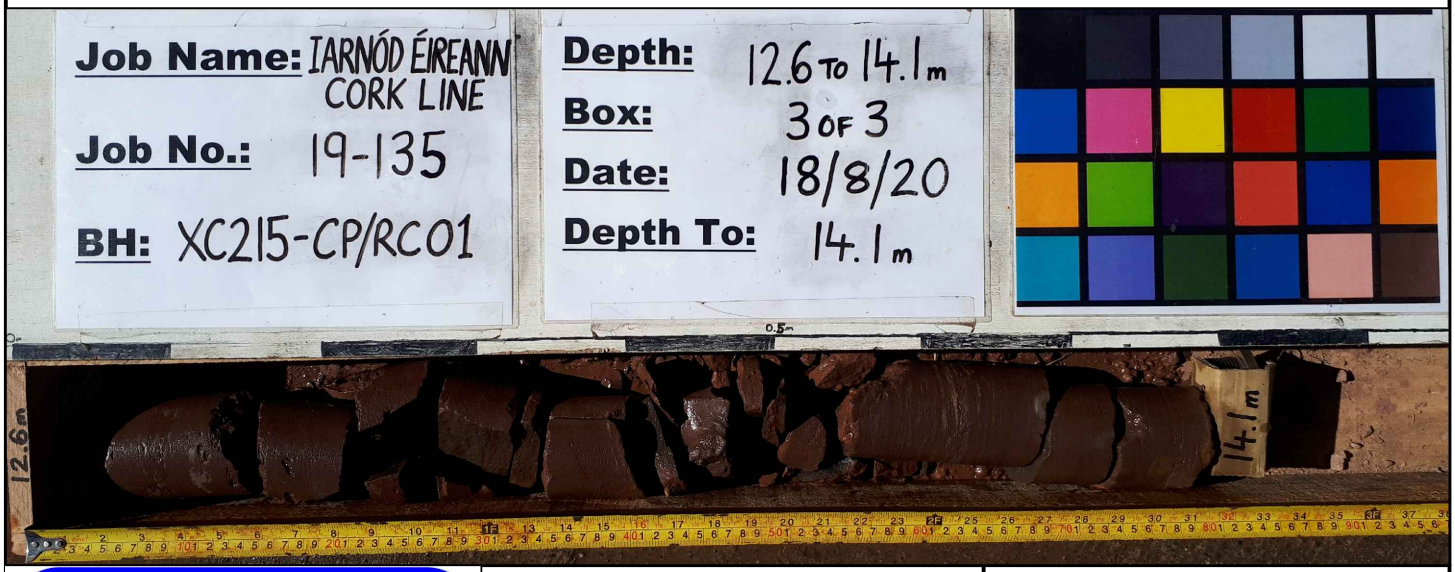
Casing Details	
To (m)	Diam (mm)
6.20	200
6.60	151

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
6.20	6.20	01:30

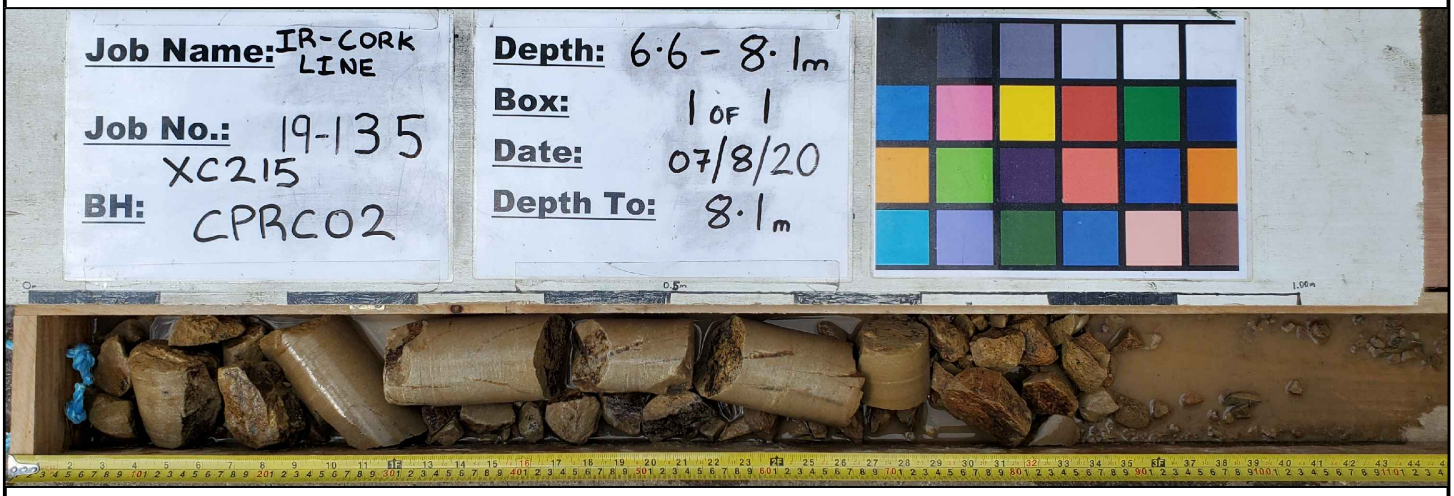
Appendix C Rock Core Photographs







Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	C.P/R.C01 Rock Core Photographs Client: Iarnród Éireann Engineer: Jacob's Date: May - July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	C.P/R.C02 Rock Core Photographs Client: Iarnród Éireann Engineer: Jacob's Date: May - July 2020

Appendix D Trial Pit Logs

Project No.: 19-135	**Project Name:** Cork Line Level Crossings		**Trial Pit No.:** XC215-TP01
Co-ordinates: 553382.20 E	**Client:** Iarnród Éireann / Irish Rail		Sheet 1 of 1
Method: Excavation	614488.00 N	**Client's Representative:** JACOBS	**Scale:** 1:20
Plant: Kobelco SK140SRu	**Ground Level:** 90.51 mOD	**Date:** 18/02/2020	**Driver:** TS **Logger:** MN

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1			(0.35)		TOPSOIL: Soft greyish brown slightly gravelly sandy silty CLAY with frequent rootlets, moist.	
0.35 - 0.80	B2		90.16	0.35		Soft to firm light brown slightly gravelly becoming gravelly sandy silty CLAY with low cobble content and occasional rootlets, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles are angular to subrounded, sandstone and siltstone.	
0.35 - 0.80	B3						
0.35 - 0.80	D4						
0.50	ES5						
0.50		HVP=38, HVR=16		(0.45)			
			89.71	0.80		Light brown mottled orange and reddish brown slightly clayey slightly silty very sandy GRAVEL with medium cobble and low small boulder content, moist becoming wet by 1.55m. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles and boulders are angular to subangular, sandstone and siltstone.	
1.00	ES6						
1.10 - 1.60	B7						
1.10 - 1.60	D8						
		Rapid Inflow - Rose to 1.35m		(1.40)			
			88.31	2.20		End of trial pit at 2.200m	

Remarks

Trial Pit terminated at 2.20m due to pit walls collapsing.

Water Strikes:

Struck at (m):	Remarks:
1.55	Rapid Inflow - Rose to 1.35m

Stability: Sides collapsing

Width: 1.90

Length: 4.80

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Trial Pit No.:** XC215-TP02
	Co-ordinates: 554817.30 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 1
Method: Excavation	617963.85 N	**Client's Representative:** JACOBS	**Scale:** 1:20
Plant: Kobelco SK140SRu	**Ground Level:** 97.95 mOD	**Date:** 18/02/2020	**Driver:** TS **Logger:** MN

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.00	ES1			(0.25)		TOPSOIL: Soft greyish brown slightly gravelly sandy silty CLAY with frequent rootlets, moist.	
			97.70	0.25			
0.30 - 0.80	B3					Firm (locally soft) light brown with a little orange brown mottling slightly gravelly sandy silty CLAY with low cobble content, and occasional rootlets, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles are angular to subangular, sandstone and siltstone.	
0.30 - 0.80	D4					*From 0.25m - 0.80m: WNW - ESE orientated, approx 2m wide with linear boundary. Firm grey slightly gravelly sandy silty CLAY with low cobble content and occasional rootlets, moist.*	
0.50	ES2			(0.55)			
0.50		HVP=48, HVR=65					
			97.15	0.80		End of trial pit at 0.800m	

Remarks
Permission to excavate further / alternate trial pit in the area was refused.

Terminated due to possible archaeological feature.

Water Strikes:

Struck at (m):	Remarks:
	None Encountered

Stability: Good

Width: 3.60

Length: 7.40

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Trial Pit No.:** XC215-TP03
	Co-ordinates: 553507.73 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 1
Method: Excavation	614663.96 N	**Client's Representative:** JACOBS	**Scale:** 1:20
Plant: Kobelco SK140SRu	**Ground Level:** 92.40 mOD	**Date:** 19/02/2020	**Driver:** TS
			Logger: MN

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1			(0.25)		TOPSOIL: Soft dark brown slightly sandy silty CLAY with occasional gravel and frequent rootlets, moist.	
0.25 - 0.50	B2		92.14	0.25			
0.25 - 0.50	D3			(0.25)		Soft orange and black slightly sandy SILT / CLAY with high content of gravel to boulder sized cemented vesicular iron pan (composed of silty sand and gravel) and occasional rootlets. *STONE FIELD DRAIN (0.3 - 0.6m): N - S orientation, 0.20m wide.* *STONE FIELD DRAIN (0.3 - 0.9m): NE - SW orientation, 0.30m wide.*	
0.50	ES4		91.90	0.50		Soft to firm becoming stiff light brown and orange mottled slightly sandy slightly gravelly silty CLAY with low cobble and boulder content and occasional rootlets, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles and boulders are angular to subangular, sandstone and siltstone.	
0.50 - 1.00	B5						
0.50 - 1.00	D6	Water inflow from field drain. - No rise					
0.70		HVP=57, HVR=20		(0.60)			
1.00	ES7						
			91.30	1.10		Soft reddish brown sandy gravelly silty CLAY with medium cobble and low boulder content, wet.	
				(0.20)			
1.30 - 1.80	B8		91.10	1.30		Brown slightly silty very sandy GRAVEL with medium cobble content and low boulder content, wet. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles and boulders are subangular, sandstone, siltstone and quartz.	
1.30 - 1.80	D9	Rapid Inflow - No rise					
				(0.70)			
			90.40	2.00		End of trial pit at 2.000m	

Remarks

Trial Pit terminated at 2.00m due to pit walls collapsing.

Water Strikes:

Struck at (m):	Remarks:
0.60	Water inflow from field drain. - No rise
1.30	Rapid Inflow - No rise

Stability: Sides collapsing

Width: 1.80

Length: 3.70

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Trial Pit No.:** XC215-TP04
	Co-ordinates: 553501.42 E 614767.21 N	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 1
Method: Excavation		**Client's Representative:** JACOBS	**Scale:** 1:20
			Driver: TS
Plant: Kobelco SK140SRu	**Ground Level:** 93.90 mOD	**Date:** 19/02/2020	**Logger:** MN

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1			(0.30)		TOPSOIL: Soft greyish brown slightly sandy to sandy silty CLAY with frequent rootlets, moist.	
0.30 - 0.70	B2		93.60	0.30			
0.30 - 0.70	D3					Firm light brown and orange brown mottled slightly sandy slightly gravelly silty CLAY with low cobble content and occasional rootlets, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles are angular to subangular, sandstone and siltstone.	
0.50	ES4			(0.40)			
0.50		HVP=68, HVR=24					
0.70 - 1.00	B5		93.20	0.70			
0.70 - 1.00	D6					Firm becoming soft reddish brown slightly gravelly slightly sandy becoming sandy silty CLAY with low cobble content and occasional rootlets, moist becoming wet. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles are angular to subangular, sandstone and siltstone.	
				(0.30)			
1.00	ES7		92.90	1.00			
1.00 - 1.50	B8					Greyish brown silty SAND and GRAVEL with medium cobble content and occasional rootlets, wet with thin bed of slightly silty very gravelly sand with occasional blackened partially decayed wood fragments. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles are angular to subrounded, sandstone and siltstone.	
1.00 - 1.50	D9						
		Rapid inflow - Rose to 0.90m.					
				(1.00)			
			91.90	2.00		End of trial pit at 2.000m	

Remarks

Trial Pit terminated at 2.00m due to pit walls collapsing.

Water Strikes:

Struck at (m):	Remarks:
1.00	Rapid inflow - Rose to 0.90m.

Stability: Sides collapsing

Width: 1.70

Length: 3.90

Project No.: 19-135	**Project Name:** Cork Line Level Crossings		**Trial Pit No.:** XC215-TP05
Co-ordinates: 553501.82 E 614855.46 N	**Client:** Iarnród Éireann / Irish Rail		Sheet 1 of 1
Method: Excavation	**Client's Representative:** JACOBS		**Scale:** 1:20
Plant: Kobelco SK140SRu	**Ground Level:** 95.04 mOD	**Date:** 19/02/2020	**Driver:** TS **Logger:** MN

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1			(0.30)		TOPSOIL: Soft greyish brown slightly sandy silty CLAY with frequent rootlets, moist.	
			94.74	0.30			
0.40		HVP=73, HVR=25				Firm light brown and orange brown slightly sandy slightly gravelly silty CLAY with low cobble content, and occasional rootlets, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to rounded. Cobbles are angular to rounded.	
0.50	ES2						
0.50 - 1.00	B3						
0.50 - 1.00	D4			(0.80)			
1.00	ES5						
1.10 - 1.60	B6		93.94	1.10			
1.10 - 1.60	D7					Soft reddish brown sandy gravelly silty CLAY with low cobble content, moist becoming wet by 1.3m. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles are angular to subangular, sandstone and siltstone.	
1.10		HVP=25, HVR=12		(0.60)			
1.70 - 2.20	B8		93.34	1.70			▼
1.70 - 2.20	D9	Rapid inflow - Rose to 1.7m.		(0.50)		Brown clayey silty becoming slightly silty very sandy GRAVEL with low to medium cobble content and low boulder content, wet. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles and boulders are mostly subangular, sandstone and siltstone.	▽
			92.84	2.20		End of trial pit at 2.200m	

Remarks

Trial Pit terminated at 2.20m due to pit walls collapsing.

Water Strikes:

Struck at (m):	Remarks:
1.80	Rapid inflow - Rose to 1.7m.

Stability: Sides collapsing below 1.7m

Width: 0.80

Length: 3.60

Project No.: 19-135	**Project Name:** Cork Line Level Crossings		**Trial Pit No.:** XC215-TP06
Co-ordinates: 553504.67 E 614955.90 N	**Client:** Iarnród Éireann / Irish Rail		Sheet 1 of 1
Method: Excavation	**Client's Representative:** JACOBS		**Scale:** 1:20
Plant: Kobelco SK140SRu	**Ground Level:** 95.74 mOD	**Date:** 19/02/2020	**Driver:** TS **Logger:** MN

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1			(0.30)		TOPSOIL: Soft greyish brown slightly sandy silty CLAY with frequent rootlets, moist.	
0.40		HVP=60, HVR=24	95.44	0.30		Firm light brown and orange brown slightly sandy slightly gravelly silty CLAY with low cobble content and occasional rootlets, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles are angular to subangular, sandstone and siltstone.	
0.50 0.50 - 1.00 0.50 - 1.00	ES2 B3 D4						
1.00	ES5			(1.10)			
1.50 - 2.00 1.50 - 2.00	B6 D7		94.34	1.40		Brown clayey silty very sandy GRAVEL with medium cobble content and low boulder content, wet. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles are angular to subrounded.	
		Rapid inflow - Rose to 1.4m	94.04	(0.30) 1.70		Brown slightly silty very sandy GRAVEL with medium cobble content and low boulder content, wet. Sand is fine to coarse. Gravel is angular to subrounded. Cobbles and boulders are angular to subangular, sandstone and siltstone.	
				(0.40)			
			93.64	2.10		End of trial pit at 2.100m	

Remarks

Trial Pit terminated at 2.10m due to pit walls collapsing.

Water Strikes:

Struck at (m):	Remarks:
1.70	Rapid inflow - Rose to 1.4m

Stability: Sides collapsing below 1.4m

Width: 0.90

Length: 3.30

Project No.: 19-135	**Project Name:** Cork Line Level Crossings		**Trial Pit No.:** XC215-TP07
Co-ordinates: 553516.77 E 615075.58 N	**Client:** Iarnród Éireann / Irish Rail		Sheet 1 of 1
Method: Excavation	**Client's Representative:** JACOBS		**Scale:** 1:20
Plant: Kobelco SK140SRu	**Ground Level:** 96.29 mOD	**Date:** 19/02/2020	**Driver:** TS / **Logger:** MN

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1			(0.25)		TOPSOIL: Soft greyish brown slightly sandy silty CLAY with frequent rootlets, moist.	
			96.04	0.25			
				(0.15)		Firm light brown mottled orange brown slightly sandy silty CLAY with occasional rootlets, moist.	
0.40 - 0.80	B2		95.89	0.40			
0.40 - 0.80	D3						
0.50	ES4						
0.50		HVP=53, HVR=21		(0.40)		Stiff light grey with a little orange brown mottling slightly gravelly slightly sandy silty CLAY with low cobble content, occasional rootlets, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles are angular to subangular, sandstone and siltstone.	
			95.49	0.80			
0.90 - 1.40	B5					Stiff orange brown slightly sandy becoming sandy gravelly silty CLAY with low cobble content, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles are angular to subangular, sandstone and siltstone.	
0.90 - 1.40	D6						
1.00	ES7						
				(0.80)			
		Rapid inflow - No rise					▼
1.60 - 2.10	B8		94.69	1.60			
1.60 - 2.10	D9					Soft greyish brown and orange brown mottled clayey silty very sandy GRAVEL with medium cobble and low boulder content, wet. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles and boulders are angular to subangular, sandstone and siltstone.	
				(0.50)			
2.10 - 2.40	B10		94.19	2.10			
2.10 - 2.40	D11					Brown slightly silty very sandy GRAVEL with medium cobble and low boulder content, wet. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles and boulders are angular to subangular, sandstone and siltstone.	
				(0.30)			
			93.89	2.40		End of trial pit at 2.400m	

0.5 1.0 1.5 2.0 2.5 3.0 3.5

Remarks

Trial Pit terminated at 2.40m due to pit walls collapsing.

Water Strikes:

Struck at (m):	Remarks:
1.30	Rapid inflow - No rise

Stability: Sides collapsing

Width: 1.10

Length: 2.80

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Trial Pit No.:** XC215-TP08
	Co-ordinates: 553543.87 E 615173.05 N	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 1
Method: Excavation		**Client's Representative:** JACOBS	**Scale:** 1:20
			Driver: TS
Plant: Kobelco SK140SRu	**Ground Level:** 97.83 mOD	**Date:** 18/02/2020	**Logger:** MN

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1			(0.35)		TOPSOIL: Soft dark brown sandy silty CLAY with frequent rootlets, moist.	
			97.48	0.35		Firm light brown with a little orange brown mottling slightly gravelly sandy silty CLAY with low cobble content and occasional rootlets, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles are angular to subangular.	
0.50	ES2						
0.50 - 1.00	B3						
0.50 - 1.00	D4						
0.60		HVP=41, HVR=18					
0.75				(1.00)			
1.00	ES5						
		Rapid inflow - No rise	96.48	1.35		Brown slightly silty very sandy GRAVEL with medium cobble and low boulder content, wet. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles and boulders are subangular, sandstone and siltstone.	▼
1.40 - 1.80	B6						
1.40 - 1.80	D7			(0.45)			
			96.03	1.80		End of trial pit at 1.800m	

Remarks
Instructed by clients engineer to terminate TP at 1.80m to minimise impact to farmer.

Water Strikes:

Struck at (m):	Remarks:
1.35	Rapid inflow - No rise

Stability: Sides collapsing

Width: 1.90

Length: 4.90

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Trial Pit No.:** XC215-TP09
	Co-ordinates: 553478.44 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 1
Method: Excavation	615226.62 N	**Client's Representative:** JACOBS	**Scale:** 1:20
Plant: Kobelco SK140SRu	**Ground Level:** 96.75 mOD	**Date:** 18/02/2020	**Driver:** TS **Logger:** MN

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1			(0.35)		TOPSOIL: Soft dark brown slightly gravelly sandy silty CLAY with frequent rootlets, moist.	
0.35 - 0.60	B2		96.40	0.35			
0.35 - 0.60	D3					Soft dark brown sandy gravelly silty CLAY with low cobble content and occasional rootlets. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded.	
0.50	ES4			(0.25)			
0.60 - 1.10	B5		96.15	0.60			
0.60 - 1.10	D6	Rapid inflow - Rose to 0.5m				Brown slightly clayey silty very sandy GRAVEL with medium cobble content and low boulder content, wet. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles and boulders are subangular, sandstone and siltstone.	
				(0.50)			
1.00	ES7						
			95.65	1.10		End of trial pit at 1.100m	

0.5
1.0
1.5
2.0
2.5
3.0
3.5

Remarks
Instructed by clients engineer to terminate TP at 1.10m to minimise impact to farmer.

Water Strikes:

Struck at (m):	Remarks:
0.75	Rapid inflow - Rose to 0.5m

Stability: Sides collapsing

Width: 1.80

Length: 4.60

Appendix E Trial Pit Photographs



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT1 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

T.PIT1

Trial Pit Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: February 2020



Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT1
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

	T.PIT1
	Trial Pit Photographs
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February 2020



	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT1 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT1 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT1 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT2 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT2 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

	T.PIT2
	Trial Pit Photographs
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February 2020



Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT2
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

T.PIT2

Trial Pit Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT2 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT2
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

T.PIT2

Trial Pit Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: February 2020



Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT2
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT3 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

T.PIT3	
Trial Pit Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February 2020



	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT3 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

T.PIT3

Trial Pit Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

T.PIT3	
Trial Pit Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT3 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

T.PIT3	
Trial Pit Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

T.PIT3

Trial Pit Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

T.PIT3	
Trial Pit Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT3 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT4
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

T.PIT4

Trial Pit Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

T.PIT4	
Trial Pit Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT4 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

T.PIT4	
Trial Pit Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT4 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT4
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT4 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT4 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT5
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT5 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

T.PIT5

Trial Pit Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

	T.PIT5
	Trial Pit Photographs
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February 2020



Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT5
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February 2020



Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT5
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

T.PIT5	
Trial Pit Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT6 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT6
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT6 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

T.PIT6

Trial Pit Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT6 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

T.PIT6

Trial Pit Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

T.PIT6	
Trial Pit Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT6 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT7 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT7
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

T.PIT7

Trial Pit Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

	T.PIT7
	Trial Pit Photographs
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

	T.PIT7
	Trial Pit Photographs
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

T.PIT7

Trial Pit Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT7 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT8
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February 2020



Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT8
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT8 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

T.PIT8	
Trial Pit Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT8 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



	T.PIT8
Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February 2020



	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT9 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT9
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT9 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)	T.PIT9 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

T.PIT9

Trial Pit Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

T.PIT9

Trial Pit Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: February 2020



Iarnród Éireann

Cork Line Level Crossings

XC215 (19-135-4)

T.PIT9

Trial Pit Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: February 2020

Appendix F Indirect CBR Test Results

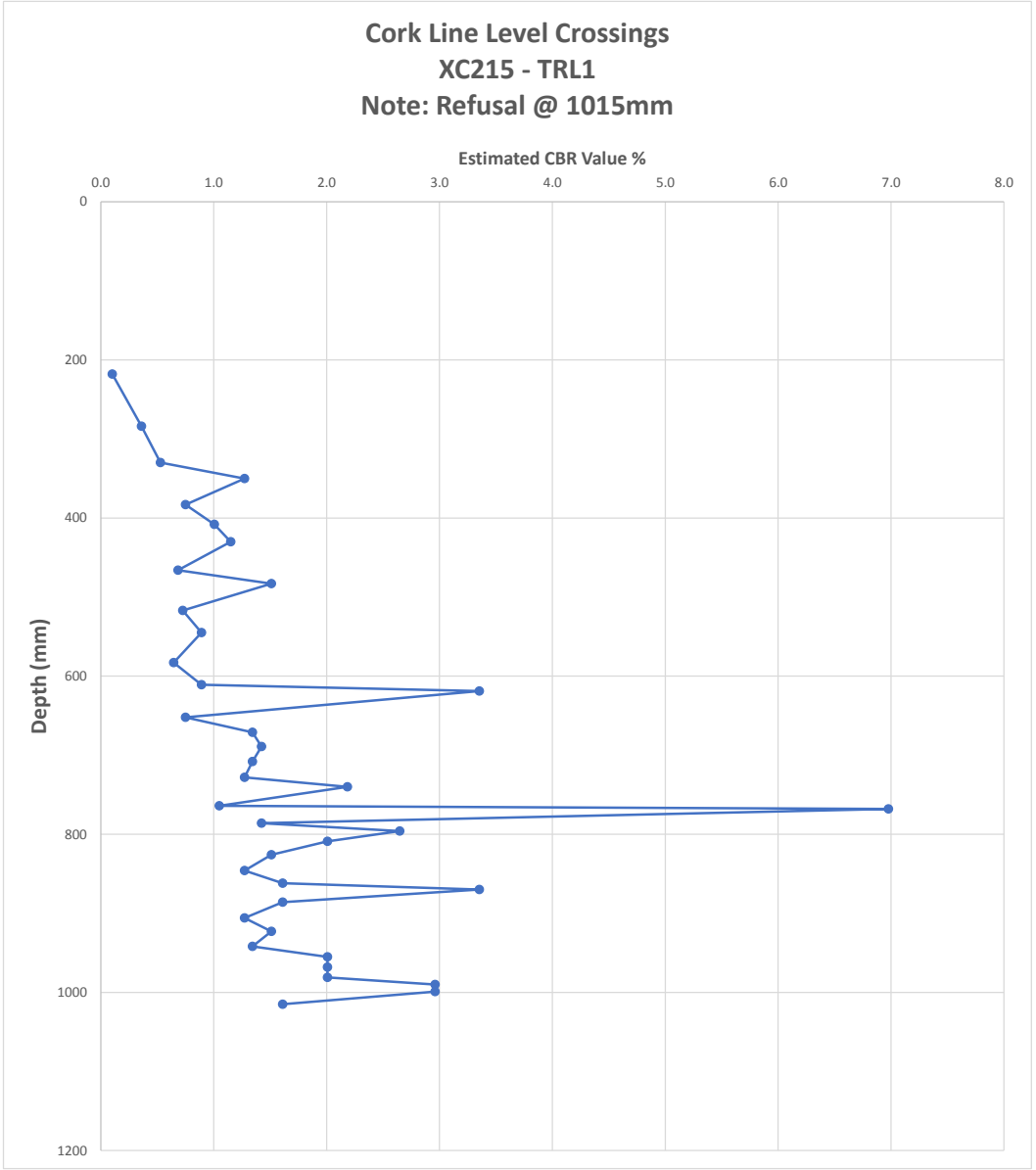
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC215 - TRL1**	Job No	19-135

Easting	Northing	Elevation
553386.111	614490.802	90.542

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1150	mm	25/02/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	932	218	218	0.1
2	866	66	284	0.4
3	820	46	330	0.5
4	800	20	350	1.3
5	767	33	383	0.7
6	742	25	408	1.0
7	720	22	430	1.2
8	684	36	466	0.7
9	667	17	483	1.5
10	633	34	517	0.7
11	605	28	545	0.9
12	567	38	583	0.6
13	539	28	611	0.9
14	531	8	619	3.4
15	498	33	652	0.7
16	479	19	671	1.3
17	461	18	689	1.4
18	442	19	708	1.3
19	422	20	728	1.3
20	410	12	740	2.2
21	386	24	764	1.0
22	382	4	768	7.0
23	364	18	786	1.4
24	354	10	796	2.6
25	341	13	809	2.0
26	324	17	826	1.5
27	304	20	846	1.3
28	288	16	862	1.6
29	280	8	870	3.4
30	264	16	886	1.6
31	244	20	906	1.3
32	227	17	923	1.5
33	208	19	942	1.3
34	195	13	955	2.0
35	182	13	968	2.0
36	169	13	981	2.0
37	160	9	990	3.0
38	151	9	999	3.0
39	135	16	1015	1.6
40				



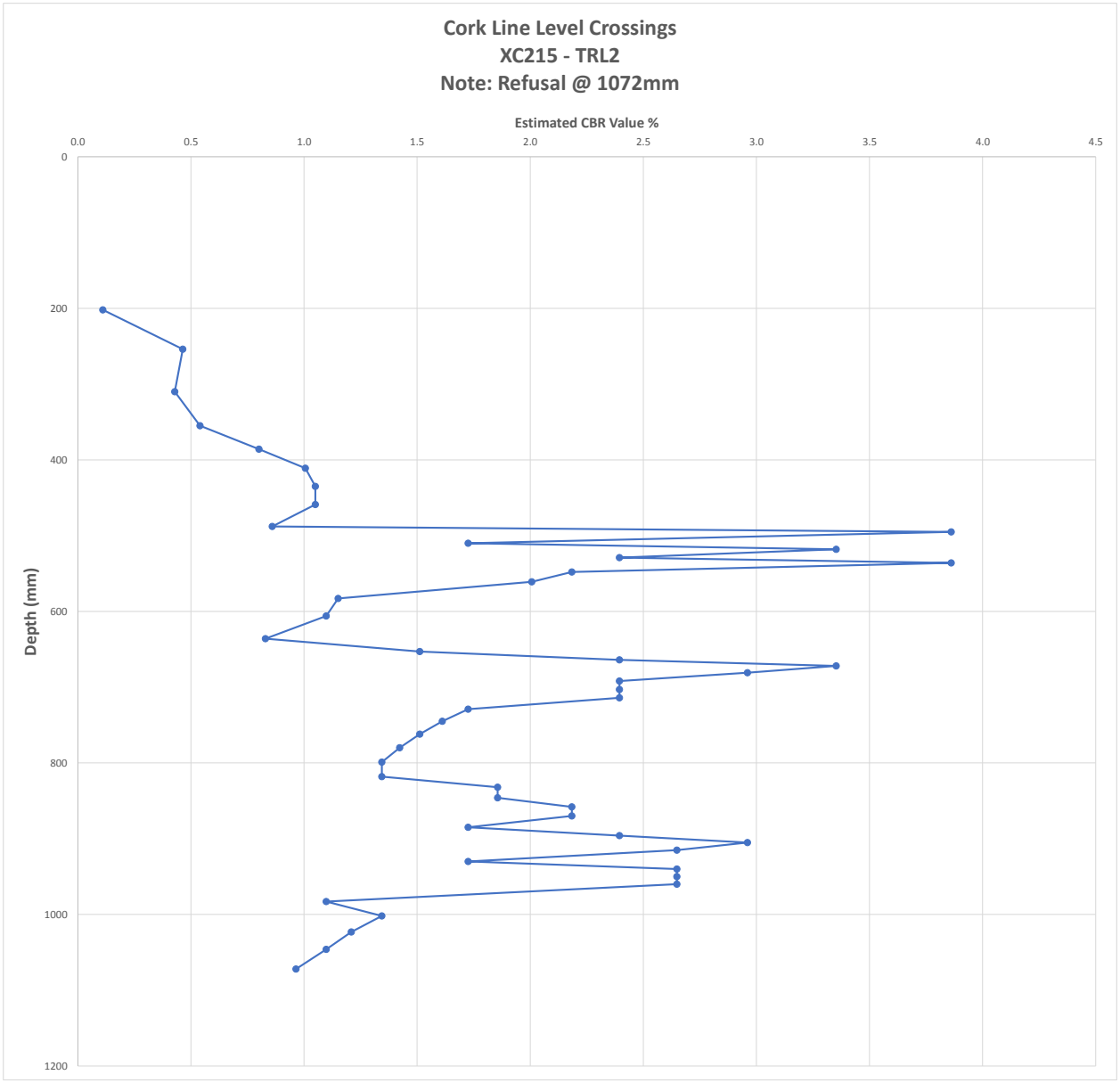
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC215 - TRL2**	Job No	19-135

Easting	Northing	Elevation
553388.56	614494.392	90.591

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1150	mm	25/02/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	948	202	202	0.1
2	896	52	254	0.5
3	840	56	310	0.4
4	795	45	355	0.5
5	764	31	386	0.8
6	739	25	411	1.0
7	715	24	435	1.0
8	691	24	459	1.0
9	662	29	488	0.9
10	655	7	495	3.9
11	640	15	510	1.7
12	632	8	518	3.4
13	621	11	529	2.4
14	614	7	536	3.9
15	602	12	548	2.2
16	589	13	561	2.0
17	567	22	583	1.2
18	544	23	606	1.1
19	514	30	636	0.8
20	497	17	653	1.5
21	486	11	664	2.4
22	478	8	672	3.4
23	469	9	681	3.0
24	458	11	692	2.4
25	447	11	703	2.4
26	436	11	714	2.4
27	421	15	729	1.7
28	405	16	745	1.6
29	388	17	762	1.5
30	370	18	780	1.4
31	351	19	799	1.3
32	332	19	818	1.3
33	318	14	832	1.9
34	304	14	846	1.9
35	292	12	858	2.2
36	280	12	870	2.2
37	265	15	885	1.7
38	254	11	896	2.4
39	245	9	905	3.0
40	235	10	915	2.6
41	220	15	930	1.7
42	210	10	940	2.6
43	200	10	950	2.6
44	190	10	960	2.6
45	167	23	983	1.1
46	148	19	1002	1.3
47	127	21	1023	1.2
48	104	23	1046	1.1
49	78	26	1072	1.0
50				



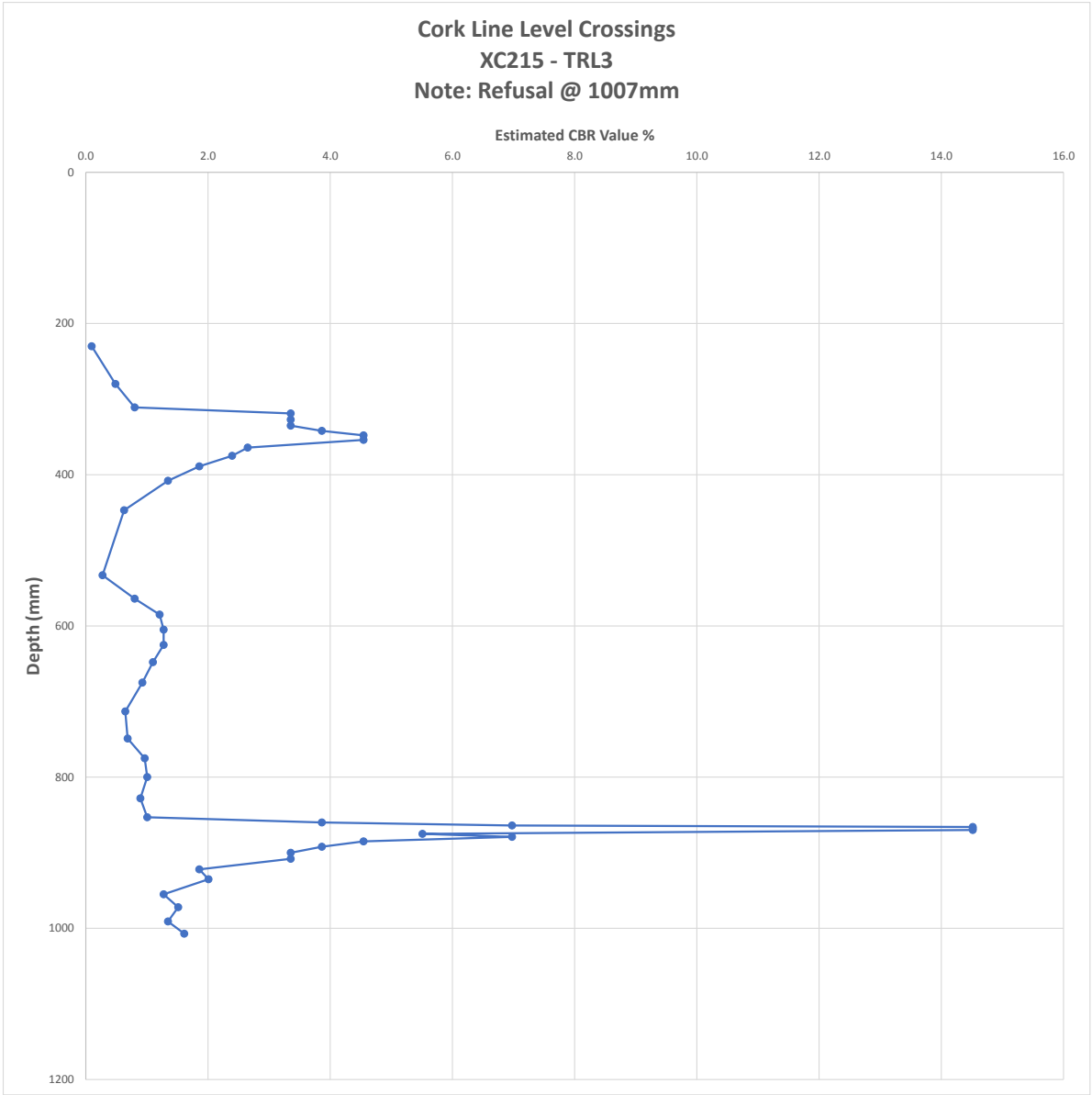
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC215 - TRL3**	Job No	19-135

Easting	Northing	Elevation
553477.004	614544.776	90.917

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1150	mm	25/02/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	920	230	230	0.1
2	870	50	280	0.5
3	839	31	311	0.8
4	831	8	319	3.4
5	823	8	327	3.4
6	815	8	335	3.4
7	808	7	342	3.9
8	802	6	348	4.5
9	796	6	354	4.5
10	786	10	364	2.6
11	775	11	375	2.4
12	761	14	389	1.9
13	742	19	408	1.3
14	703	39	447	0.6
15	617	86	533	0.3
16	586	31	564	0.8
17	565	21	585	1.2
18	545	20	605	1.3
19	525	20	625	1.3
20	502	23	648	1.1
21	475	27	675	0.9
22	437	38	713	0.6
23	401	36	749	0.7
24	375	26	775	1.0
25	350	25	800	1.0
26	322	28	828	0.9
27	297	25	853	1.0
28	290	7	860	3.9
29	286	4	864	7.0
30	284	2	866	14.5
31	282	2	868	14.5
32	280	2	870	14.5
33	275	5	875	5.5
34	271	4	879	7.0
35	265	6	885	4.5
36	258	7	892	3.9
37	250	8	900	3.4
38	242	8	908	3.4
39	228	14	922	1.9
40	215	13	935	2.0
41	195	20	955	1.3
42	178	17	972	1.5
43	159	19	991	1.3
44	143	16	1007	1.6
45				



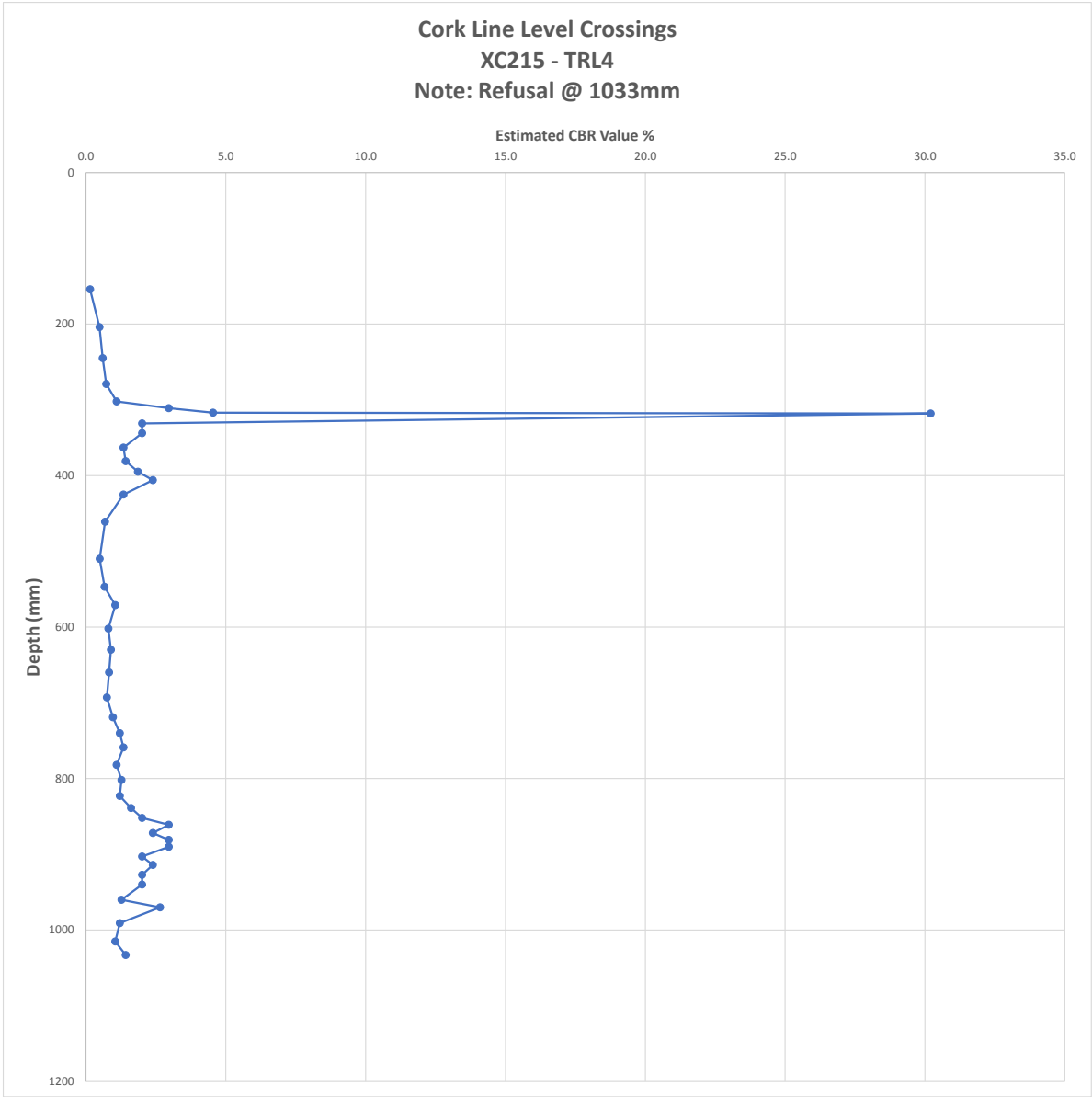
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC215 - TRL4**	Job No	19-135

Easting	Northing	Elevation
553480.886	614551.358	91.2

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1150	mm	25/02/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	996	154	154	0.1
2	946	50	204	0.5
3	905	41	245	0.6
4	871	34	279	0.7
5	848	23	302	1.1
6	839	9	311	3.0
7	833	6	317	4.5
8	832	1	318	30.2
9	819	13	331	2.0
10	806	13	344	2.0
11	787	19	363	1.3
12	769	18	381	1.4
13	755	14	395	1.9
14	744	11	406	2.4
15	725	19	425	1.3
16	689	36	461	0.7
17	640	49	510	0.5
18	603	37	547	0.7
19	579	24	571	1.0
20	548	31	602	0.8
21	520	28	630	0.9
22	490	30	660	0.8
23	457	33	693	0.7
24	431	26	719	1.0
25	410	21	740	1.2
26	391	19	759	1.3
27	368	23	782	1.1
28	348	20	802	1.3
29	327	21	823	1.2
30	311	16	839	1.6
31	298	13	852	2.0
32	289	9	861	3.0
33	278	11	872	2.4
34	269	9	881	3.0
35	260	9	890	3.0
36	247	13	903	2.0
37	236	11	914	2.4
38	223	13	927	2.0
39	210	13	940	2.0
40	190	20	960	1.3
41	180	10	970	2.6
42	159	21	991	1.2
43	135	24	1015	1.0
44	117	18	1033	1.4
45				



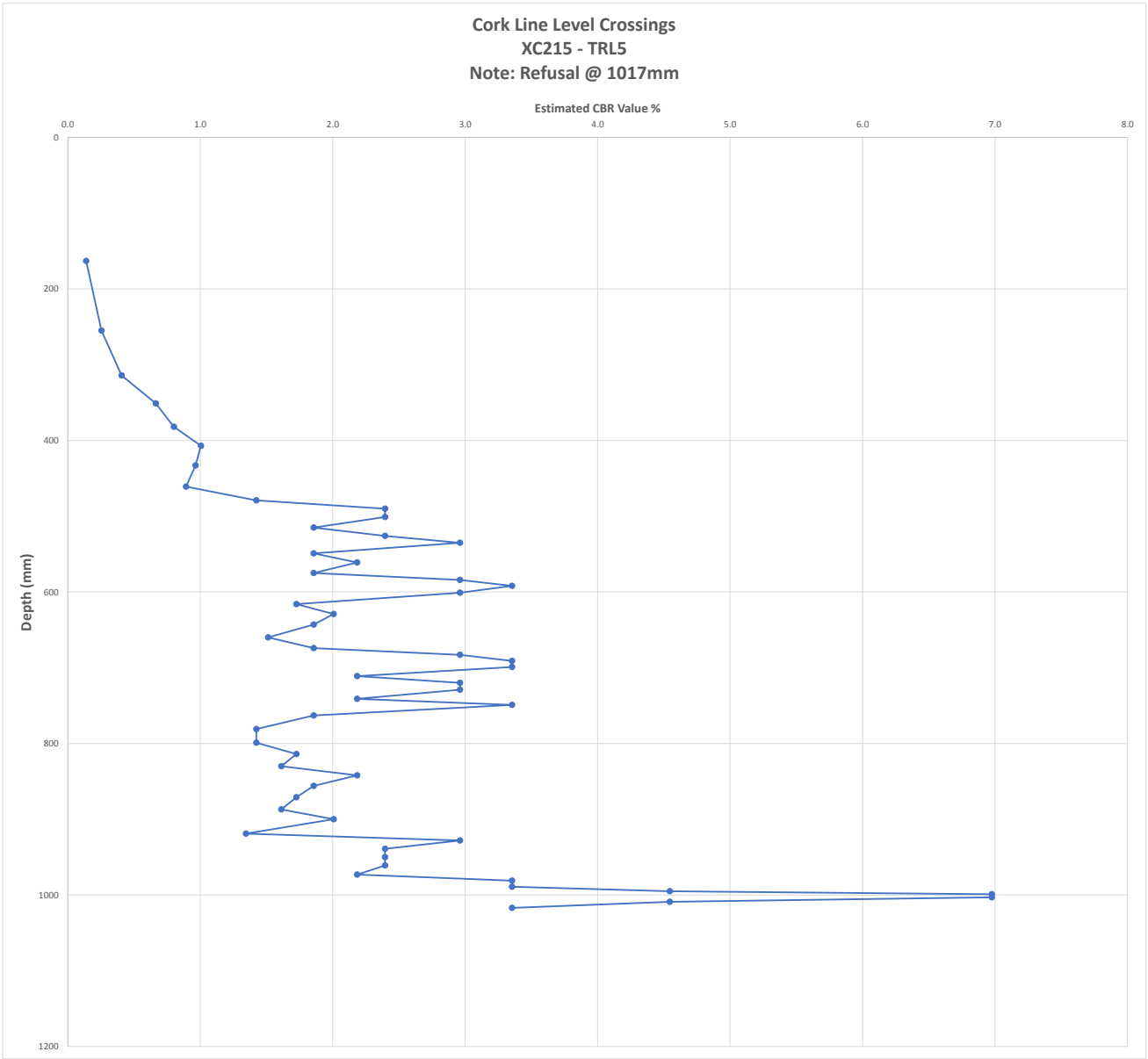
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC215 - TRL5**	Job No	19-135

Easting	Northing	Elevation
553507.653	614660.645	92.217

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1150	mm	25/02/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	987	163	163	0.1
2	895	92	255	0.3
3	836	59	314	0.4
4	799	37	351	0.7
5	768	31	382	0.8
6	743	25	407	1.0
7	717	26	433	1.0
8	689	28	461	0.9
9	671	18	479	1.4
10	660	11	490	2.4
11	649	11	501	2.4
12	635	14	515	1.9
13	624	11	526	2.4
14	615	9	535	3.0
15	601	14	549	1.9
16	589	12	561	2.2
17	575	14	575	1.9
18	566	9	584	3.0
19	558	8	592	3.4
20	549	9	601	3.0
21	534	15	616	1.7
22	521	13	629	2.0
23	507	14	643	1.9
24	490	17	660	1.5
25	476	14	674	1.9
26	467	9	683	3.0
27	459	8	691	3.4
28	451	8	699	3.4
29	439	12	711	2.2
30	430	9	720	3.0
31	421	9	729	3.0
32	409	12	741	2.2
33	401	8	749	3.4
34	387	14	763	1.9
35	369	18	781	1.4
36	351	18	799	1.4
37	336	15	814	1.7
38	320	16	830	1.6
39	308	12	842	2.2
40	294	14	856	1.9
41	279	15	871	1.7
42	263	16	887	1.6
43	250	13	900	2.0
44	231	19	919	1.3
45	222	9	928	3.0
46	211	11	939	2.4
47	200	11	950	2.4
48	189	11	961	2.4
49	177	12	973	2.2
50	169	8	981	3.4
51	161	8	989	3.4
52	155	6	995	4.5
53	151	4	999	7.0
54	147	4	1003	7.0
55	141	6	1009	4.5
56	133	8	1017	3.4
57				



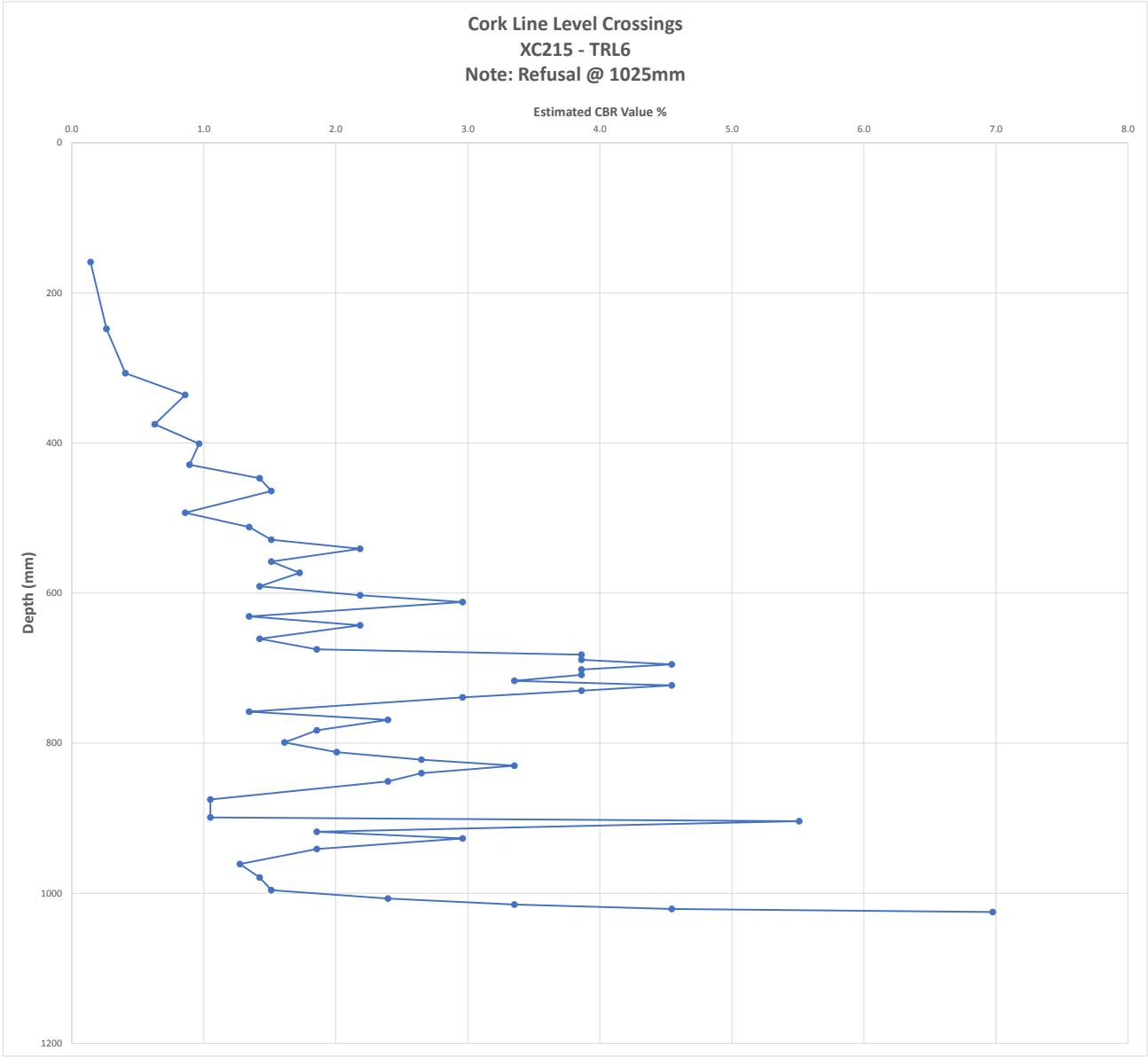
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC215 - TRL6**	Job No	19-135

Easting	Northing	Elevation
553507.708	614667.947	92.671

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1150	mm	25/02/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	991	159	159	0.1
2	902	89	248	0.3
3	843	59	307	0.4
4	814	29	336	0.9
5	775	39	375	0.6
6	749	26	401	1.0
7	721	28	429	0.9
8	703	18	447	1.4
9	686	17	464	1.5
10	657	29	493	0.9
11	638	19	512	1.3
12	621	17	529	1.5
13	609	12	541	2.2
14	592	17	558	1.5
15	577	15	573	1.7
16	559	18	591	1.4
17	547	12	603	2.2
18	538	9	612	3.0
19	519	19	631	1.3
20	507	12	643	2.2
21	489	18	661	1.4
22	475	14	675	1.9
23	468	7	682	3.9
24	461	7	689	3.9
25	455	6	695	4.5
26	448	7	702	3.9
27	441	7	709	3.9
28	433	8	717	3.4
29	427	6	723	4.5
30	420	7	730	3.9
31	411	9	739	3.0
32	392	19	758	1.3
33	381	11	769	2.4
34	367	14	783	1.9
35	351	16	799	1.6
36	338	13	812	2.0
37	328	10	822	2.6
38	320	8	830	3.4
39	310	10	840	2.6
40	299	11	851	2.4
41	275	24	875	1.0
42	251	24	899	1.0
43	246	5	904	5.5
44	232	14	918	1.9
45	223	9	927	3.0
46	209	14	941	1.9
47	189	20	961	1.3
48	171	18	979	1.4
49	154	17	996	1.5
50	143	11	1007	2.4
51	135	8	1015	3.4
52	129	6	1021	4.5
53	125	4	1025	7.0
54				



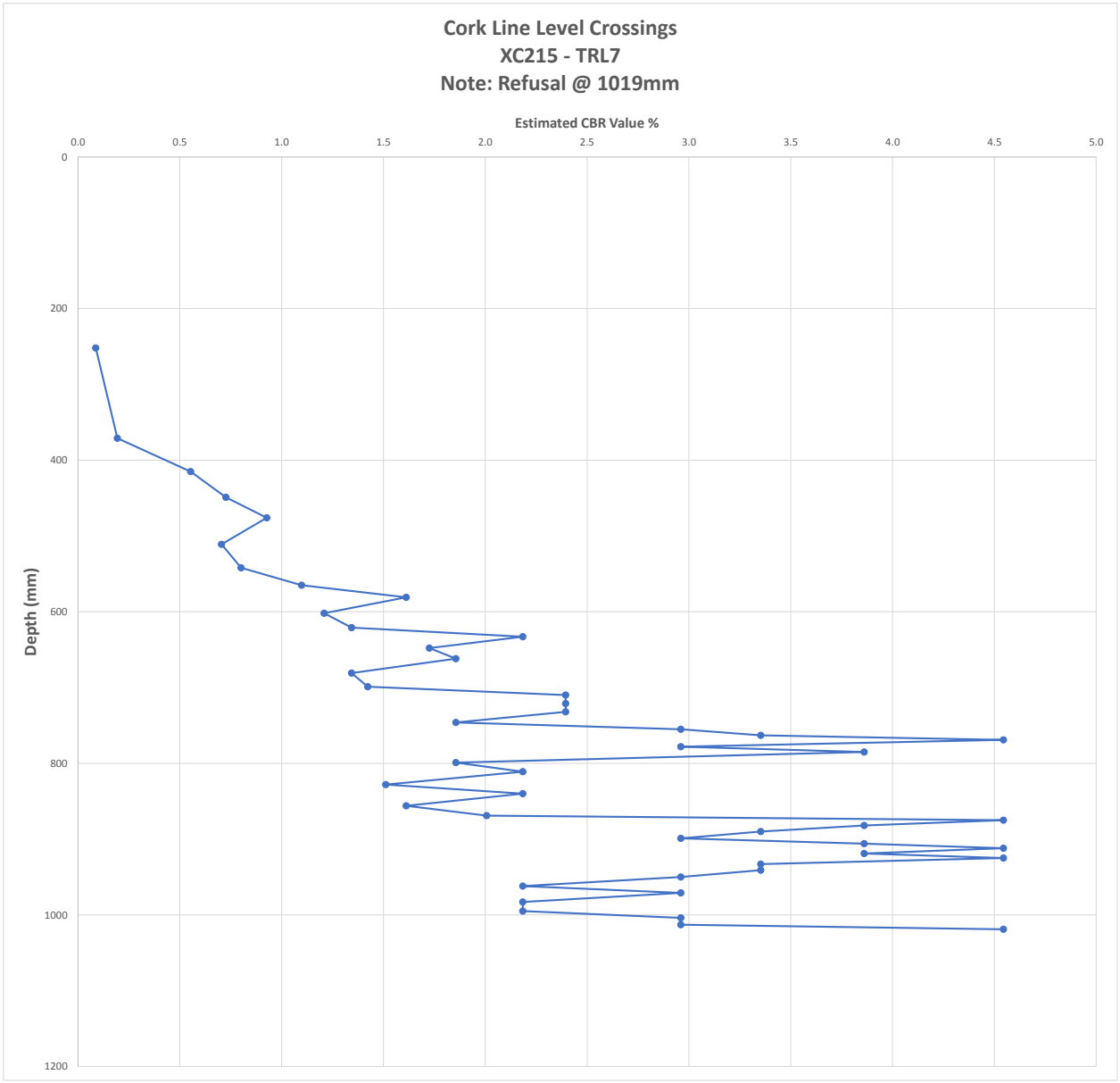
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC215 - TRL7**	Job No	19-135

Easting	Northing	Elevation
553501.29	614764.114	93.922

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1150	mm	25/02/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	898	252	252	0.1
2	779	119	371	0.2
3	735	44	415	0.6
4	701	34	449	0.7
5	674	27	476	0.9
6	639	35	511	0.7
7	608	31	542	0.8
8	585	23	565	1.1
9	569	16	581	1.6
10	548	21	602	1.2
11	529	19	621	1.3
12	517	12	633	2.2
13	502	15	648	1.7
14	488	14	662	1.9
15	469	19	681	1.3
16	451	18	699	1.4
17	440	11	710	2.4
18	429	11	721	2.4
19	418	11	732	2.4
20	404	14	746	1.9
21	395	9	755	3.0
22	387	8	763	3.4
23	381	6	769	4.5
24	372	9	778	3.0
25	365	7	785	3.9
26	351	14	799	1.9
27	339	12	811	2.2
28	322	17	828	1.5
29	310	12	840	2.2
30	294	16	856	1.6
31	281	13	869	2.0
32	275	6	875	4.5
33	268	7	882	3.9
34	260	8	890	3.4
35	251	9	899	3.0
36	244	7	906	3.9
37	238	6	912	4.5
38	231	7	919	3.9
39	225	6	925	4.5
40	217	8	933	3.4
41	209	8	941	3.4
42	200	9	950	3.0
43	188	12	962	2.2
44	179	9	971	3.0
45	167	12	983	2.2
46	155	12	995	2.2
47	146	9	1004	3.0
48	137	9	1013	3.0
49	131	6	1019	4.5
50				



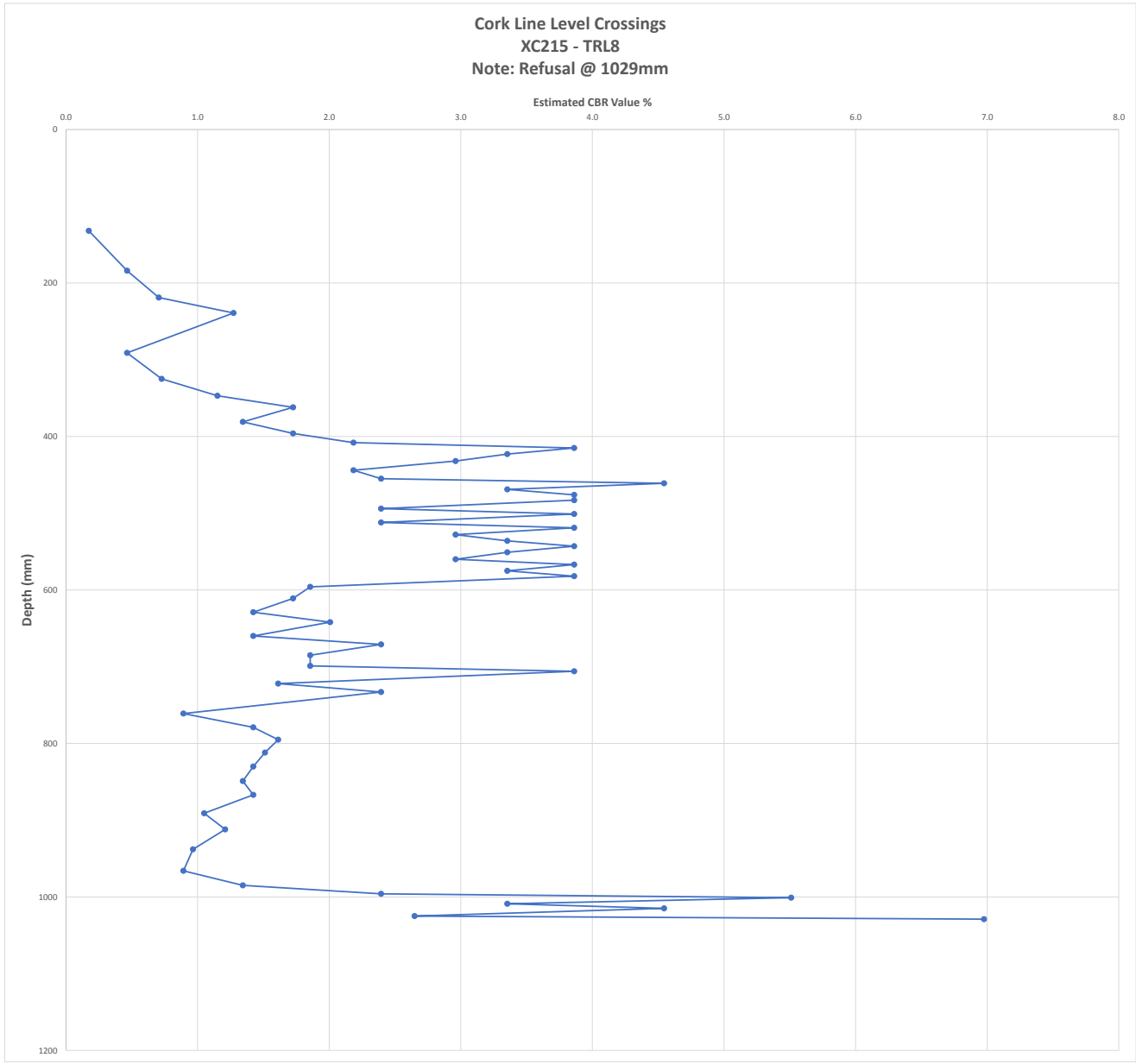
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC215 - TRL8**	Job No	19-135

Easting	Northing	Elevation
553501.532	614771.003	93.891

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1150	mm	25/02/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1018	132	132	0.2
2	966	52	184	0.5
3	931	35	219	0.7
4	911	20	239	1.3
5	859	52	291	0.5
6	825	34	325	0.7
7	803	22	347	1.2
8	788	15	362	1.7
9	769	19	381	1.3
10	754	15	396	1.7
11	742	12	408	2.2
12	735	7	415	3.9
13	727	8	423	3.4
14	718	9	432	3.0
15	706	12	444	2.2
16	695	11	455	2.4
17	689	6	461	4.5
18	681	8	469	3.4
19	674	7	476	3.9
20	667	7	483	3.9
21	656	11	494	2.4
22	649	7	501	3.9
23	638	11	512	2.4
24	631	7	519	3.9
25	622	9	528	3.0
26	614	8	536	3.4
27	607	7	543	3.9
28	599	8	551	3.4
29	590	9	560	3.0
30	583	7	567	3.9
31	575	8	575	3.4
32	568	7	582	3.9
33	554	14	596	1.9
34	539	15	611	1.7
35	521	18	629	1.4
36	508	13	642	2.0
37	490	18	660	1.4
38	479	11	671	2.4
39	465	14	685	1.9
40	451	14	699	1.9
41	444	7	706	3.9
42	428	16	722	1.6
43	417	11	733	2.4
44	389	28	761	0.9
45	371	18	779	1.4
46	355	16	795	1.6
47	338	17	812	1.5
48	320	18	830	1.4
49	301	19	849	1.3
50	283	18	867	1.4
51	259	24	891	1.0
52	238	21	912	1.2
53	212	26	938	1.0
54	184	28	966	0.9
55	165	19	985	1.3
56	154	11	996	2.4
57	149	5	1001	5.5
58	141	8	1009	3.4
59	135	6	1015	4.5
60	125	10	1025	2.6
61	121	4	1029	7.0



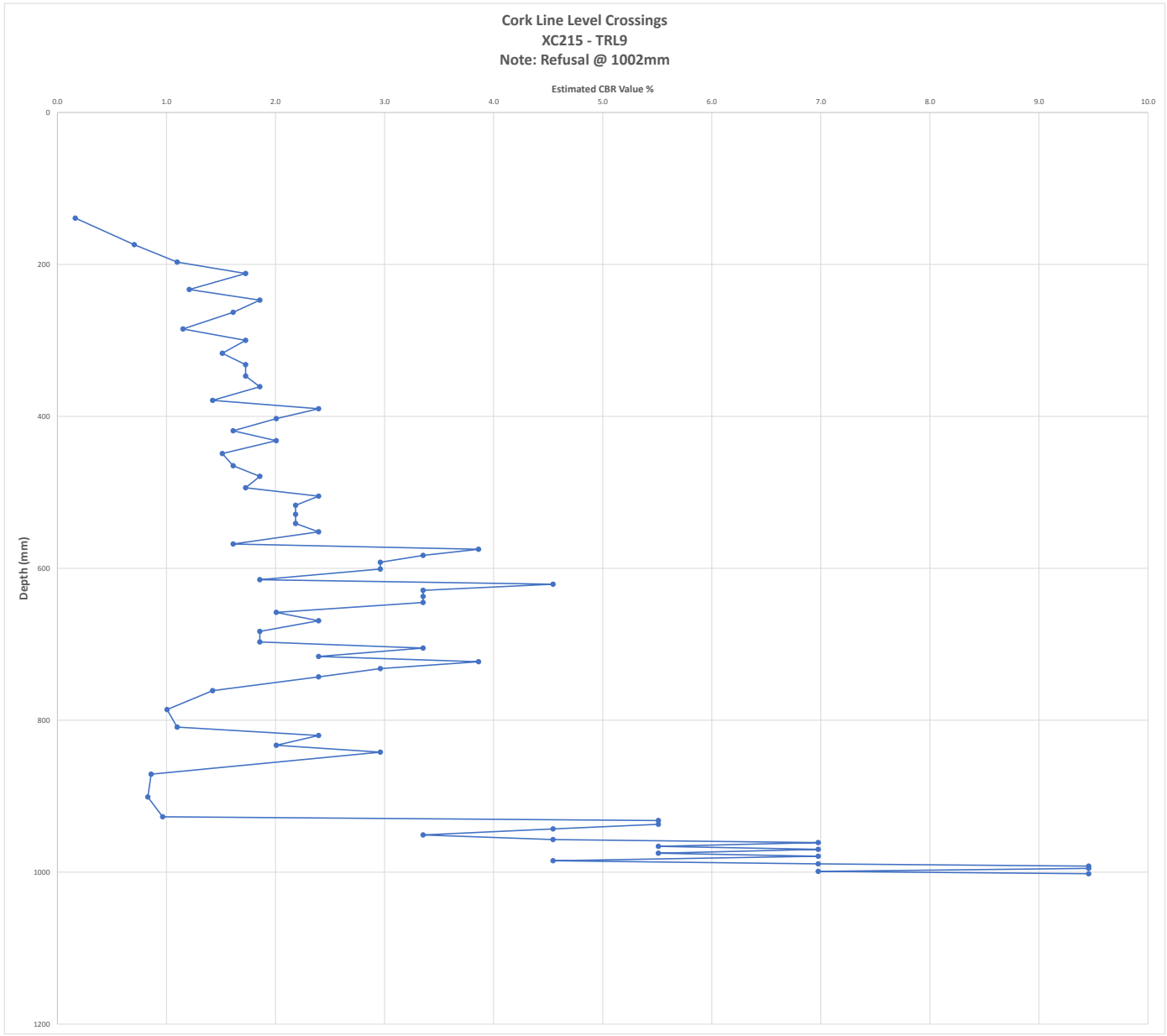
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC215 - TRL9**	Job No	19-135

Easting	Northing	Elevation
553499.313	614852.182	94.915

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1150	mm	25/02/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1011	139	139	0.2
2	976	35	174	0.7
3	953	23	197	1.1
4	938	15	212	1.7
5	917	21	233	1.2
6	903	14	247	1.9
7	887	16	263	1.6
8	865	22	285	1.2
9	850	15	300	1.7
10	833	17	317	1.5
11	818	15	332	1.7
12	803	15	347	1.7
13	789	14	361	1.9
14	771	18	379	1.4
15	760	11	390	2.4
16	747	13	403	2.0
17	731	16	419	1.6
18	718	13	432	2.0
19	701	17	449	1.5
20	685	16	465	1.6
21	671	14	479	1.9
22	656	15	494	1.7
23	645	11	505	2.4
24	633	12	517	2.2
25	621	12	529	2.2
26	609	12	541	2.2
27	598	11	552	2.4
28	582	16	568	1.6
29	575	7	575	3.9
30	567	8	583	3.4
31	558	9	592	3.0
32	549	9	601	3.0
33	535	14	615	1.9
34	529	6	621	4.5
35	521	8	629	3.4
36	513	8	637	3.4
37	505	8	645	3.4
38	492	13	658	2.0
39	481	11	669	2.4
40	467	14	683	1.9
41	453	14	697	1.9
42	445	8	705	3.4
43	434	11	716	2.4
44	427	7	723	3.9
45	418	9	732	3.0
46	407	11	743	2.4
47	389	18	761	1.4
48	364	25	786	1.0
49	341	23	809	1.1
50	330	11	820	2.4
51	317	13	833	2.0
52	308	9	842	3.0
53	279	29	871	0.9
54	249	30	901	0.8
55	223	26	927	1.0
56	218	5	932	5.5
57	213	5	937	5.5
58	207	6	943	4.5
59	199	8	951	3.4
60	193	6	957	4.5
61	189	4	961	7.0
62	184	5	966	5.5
63	180	4	970	7.0
64	175	5	975	5.5
65	171	4	979	7.0
66	165	6	985	4.5
67	161	4	989	7.0
68	158	3	992	9.5
69	155	3	995	9.5
70	151	4	999	7.0
71	148	3	1002	9.5



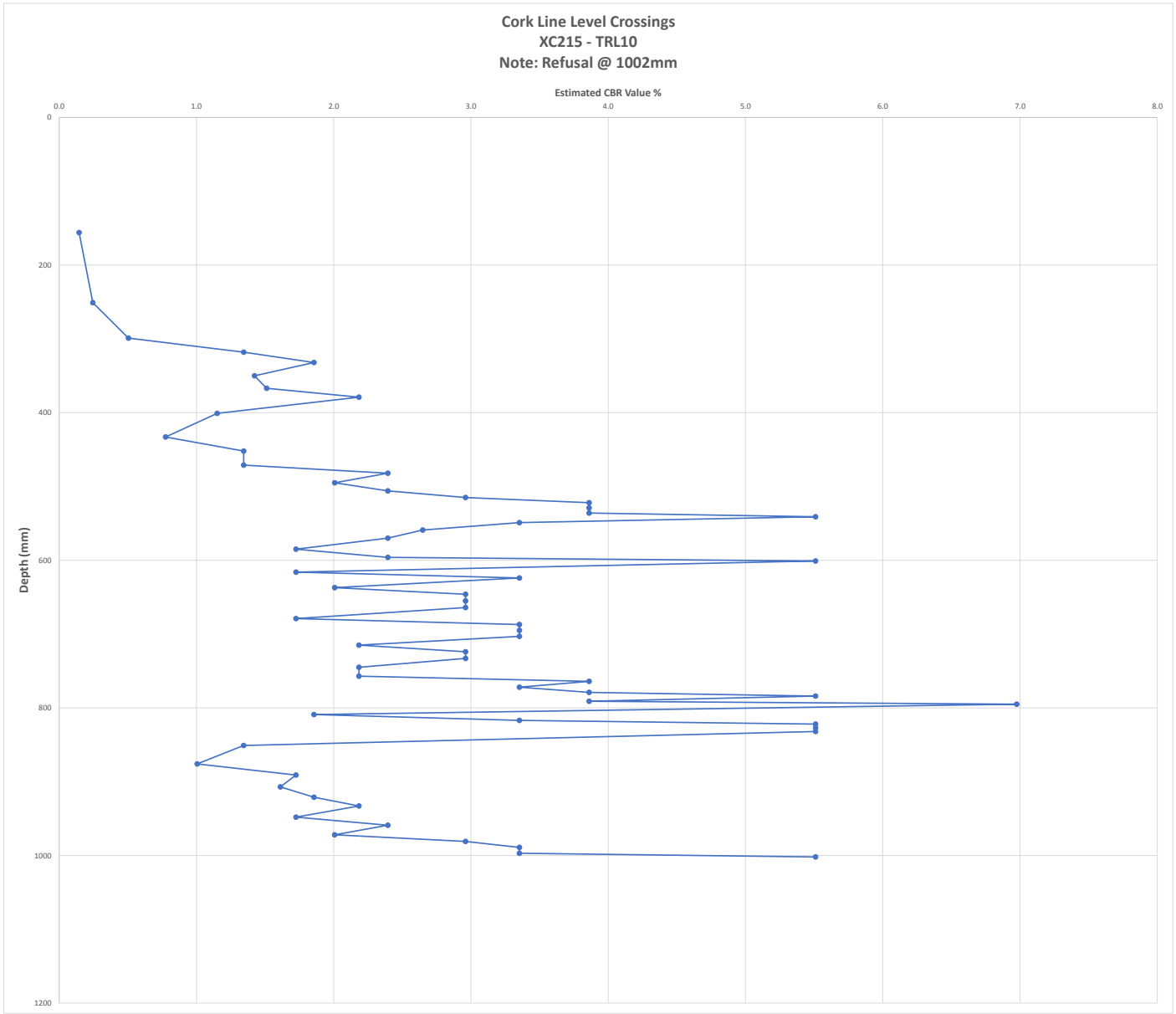
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC215 - TRL10**	Job No	19-135

Easting	Northing	Elevation
553503.342	614858.482	95.172

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1150	mm	25/02/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	994	156	156	0.1
2	899	95	251	0.2
3	851	48	299	0.5
4	832	19	318	1.3
5	818	14	332	1.9
6	800	18	350	1.4
7	783	17	367	1.5
8	771	12	379	2.2
9	749	22	401	1.2
10	717	32	433	0.8
11	698	19	452	1.3
12	679	19	471	1.3
13	668	11	482	2.4
14	655	13	495	2.0
15	644	11	506	2.4
16	635	9	515	3.0
17	628	7	522	3.9
18	621	7	529	3.9
19	614	7	536	3.9
20	609	5	541	5.5
21	601	8	549	3.4
22	591	10	559	2.6
23	580	11	570	2.4
24	565	15	585	1.7
25	554	11	596	2.4
26	549	5	601	5.5
27	534	15	616	1.7
28	526	8	624	3.4
29	513	13	637	2.0
30	504	9	646	3.0
31	495	9	655	3.0
32	486	9	664	3.0
33	471	15	679	1.7
34	463	8	687	3.4
35	455	8	695	3.4
36	447	8	703	3.4
37	435	12	715	2.2
38	426	9	724	3.0
39	417	9	733	3.0
40	405	12	745	2.2
41	393	12	757	2.2
42	386	7	764	3.9
43	378	8	772	3.4
44	371	7	779	3.9
45	366	5	784	5.5
46	359	7	791	3.9
47	355	4	795	7.0
48	341	14	809	1.9
49	333	8	817	3.4
50	328	5	822	5.5
51	323	5	827	5.5
52	318	5	832	5.5
53	299	19	851	1.3
54	274	25	876	1.0
55	259	15	891	1.7
56	243	16	907	1.6
57	229	14	921	1.9
58	217	12	933	2.2
59	202	15	948	1.7
60	191	11	959	2.4
61	178	13	972	2.0
62	169	9	981	3.0
63	161	8	989	3.4
64	153	8	997	3.4
65	148	5	1002	5.5



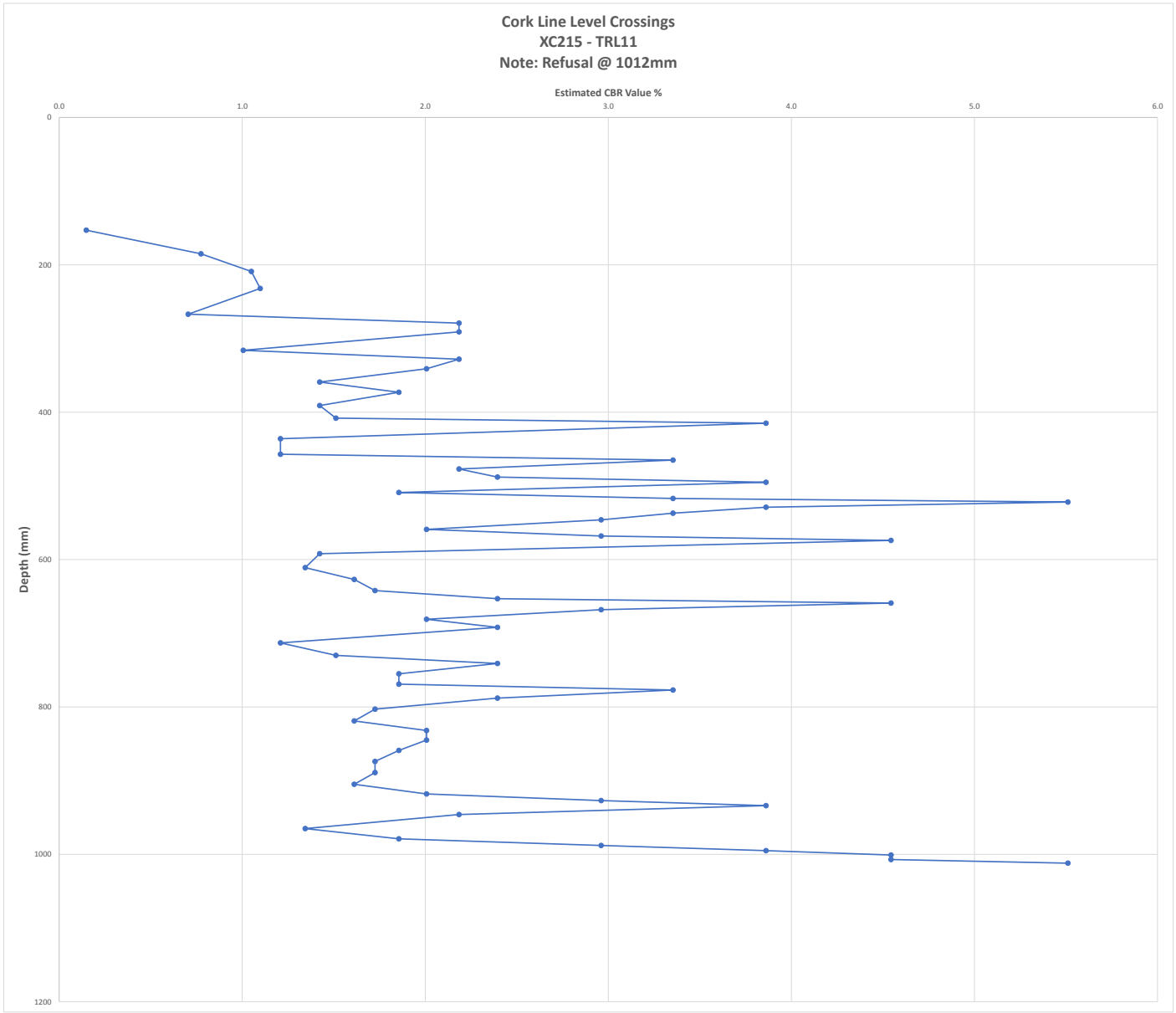
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC215 - TRL11**	Job No	19-135

Easting	Northing	Elevation
553502.583	614953.133	95.679

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1150	mm	25/02/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	997	153	153	0.1
2	965	32	185	0.8
3	941	24	209	1.0
4	918	23	232	1.1
5	883	35	267	0.7
6	871	12	279	2.2
7	859	12	291	2.2
8	834	25	316	1.0
9	822	12	328	2.2
10	809	13	341	2.0
11	791	18	359	1.4
12	777	14	373	1.9
13	759	18	391	1.4
14	742	17	408	1.5
15	735	7	415	3.9
16	714	21	436	1.2
17	693	21	457	1.2
18	685	8	465	3.4
19	673	12	477	2.2
20	662	11	488	2.4
21	655	7	495	3.9
22	641	14	509	1.9
23	633	8	517	3.4
24	628	5	522	5.5
25	621	7	529	3.9
26	613	8	537	3.4
27	604	9	546	3.0
28	591	13	559	2.0
29	582	9	568	3.0
30	576	6	574	4.5
31	558	18	592	1.4
32	539	19	611	1.3
33	523	16	627	1.6
34	508	15	642	1.7
35	497	11	653	2.4
36	491	6	659	4.5
37	482	9	668	3.0
38	469	13	681	2.0
39	458	11	692	2.4
40	437	21	713	1.2
41	420	17	730	1.5
42	409	11	741	2.4
43	395	14	755	1.9
44	381	14	769	1.9
45	373	8	777	3.4
46	362	11	788	2.4
47	347	15	803	1.7
48	331	16	819	1.6
49	318	13	832	2.0
50	305	13	845	2.0
51	291	14	859	1.9
52	276	15	874	1.7
53	261	15	889	1.7
54	245	16	905	1.6
55	232	13	918	2.0
56	223	9	927	3.0
57	216	7	934	3.9
58	204	12	946	2.2
59	185	19	965	1.3
60	171	14	979	1.9
61	162	9	988	3.0
62	155	7	995	3.9
63	149	6	1001	4.5
64	143	6	1007	4.5
65	138	5	1012	5.5



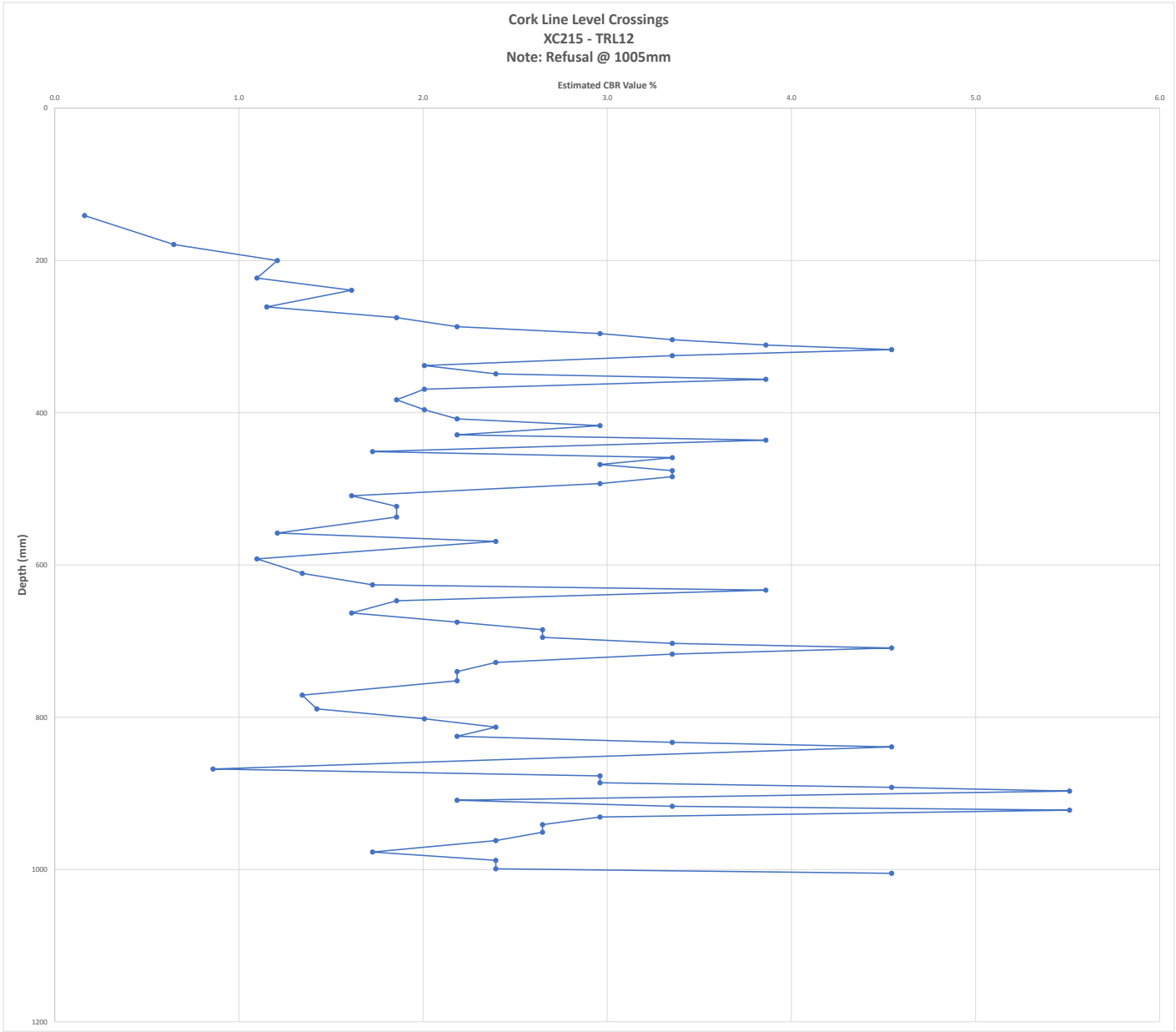
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC215 - TRL12**	Job No	19-135

Easting	Northing	Elevation
553505.713	614959.532	95.749

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1150	mm	25/02/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1009	141	141	0.2
2	971	38	179	0.6
3	950	21	200	1.2
4	927	23	223	1.1
5	911	16	239	1.6
6	889	22	261	1.2
7	875	14	275	1.9
8	863	12	287	2.2
9	854	9	296	3.0
10	846	8	304	3.4
11	839	7	311	3.9
12	833	6	317	4.5
13	825	8	325	3.4
14	812	13	338	2.0
15	801	11	349	2.4
16	794	7	356	3.9
17	781	13	369	2.0
18	767	14	383	1.9
19	754	13	396	2.0
20	742	12	408	2.2
21	733	9	417	3.0
22	721	12	429	2.2
23	714	7	436	3.9
24	699	15	451	1.7
25	691	8	459	3.4
26	682	9	468	3.0
27	674	8	476	3.4
28	666	8	484	3.4
29	657	9	493	3.0
30	641	16	509	1.6
31	627	14	523	1.9
32	613	14	537	1.9
33	592	21	558	1.2
34	581	11	569	2.4
35	558	23	592	1.1
36	539	19	611	1.3
37	524	15	626	1.7
38	517	7	633	3.9
39	503	14	647	1.9
40	487	16	663	1.6
41	475	12	675	2.2
42	465	10	685	2.6
43	455	10	695	2.6
44	447	8	703	3.4
45	441	6	709	4.5
46	433	8	717	3.4
47	422	11	728	2.4
48	410	12	740	2.2
49	398	12	752	2.2
50	379	19	771	1.3
51	361	18	789	1.4
52	348	13	802	2.0
53	337	11	813	2.4
54	325	12	825	2.2
55	317	8	833	3.4
56	311	6	839	4.5
57	282	29	868	0.9
58	273	9	877	3.0
59	264	9	886	3.0
60	258	6	892	4.5
61	253	5	897	5.5
62	241	12	909	2.2
63	233	8	917	3.4
64	228	5	922	5.5
65	219	9	931	3.0
66	209	10	941	2.6
67	199	10	951	2.6
68	188	11	962	2.4
69	173	15	977	1.7
70	162	11	988	2.4
71	151	11	999	2.4
72	145	6	1005	4.5
73				



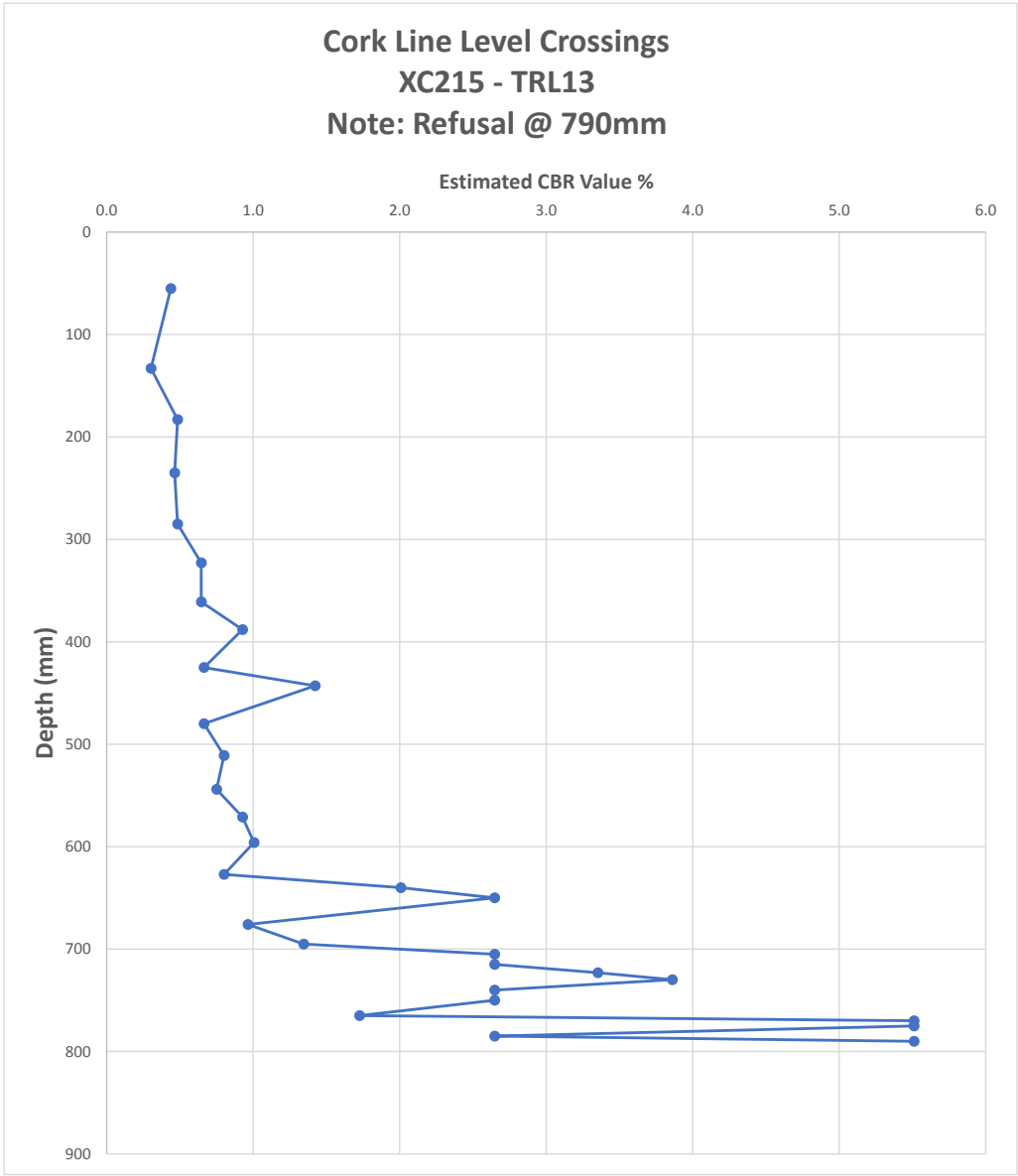
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC215 - TRL13**	Job No	19-135

Easting	Northing	Elevation
553514.535	615074.448	96.219

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1050	mm	09/03/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	995	55	55	0.4
2	917	78	133	0.3
3	867	50	183	0.5
4	815	52	235	0.5
5	765	50	285	0.5
6	727	38	323	0.6
7	689	38	361	0.6
8	662	27	388	0.9
9	625	37	425	0.7
10	607	18	443	1.4
11	570	37	480	0.7
12	539	31	511	0.8
13	506	33	544	0.7
14	479	27	571	0.9
15	454	25	596	1.0
16	423	31	627	0.8
17	410	13	640	2.0
18	400	10	650	2.6
19	374	26	676	1.0
20	355	19	695	1.3
21	345	10	705	2.6
22	335	10	715	2.6
23	327	8	723	3.4
24	320	7	730	3.9
25	310	10	740	2.6
26	300	10	750	2.6
27	285	15	765	1.7
28	280	5	770	5.5
29	275	5	775	5.5
30	265	10	785	2.6
31	260	5	790	5.5
32	260	0	790	
33	260	0	790	
34				



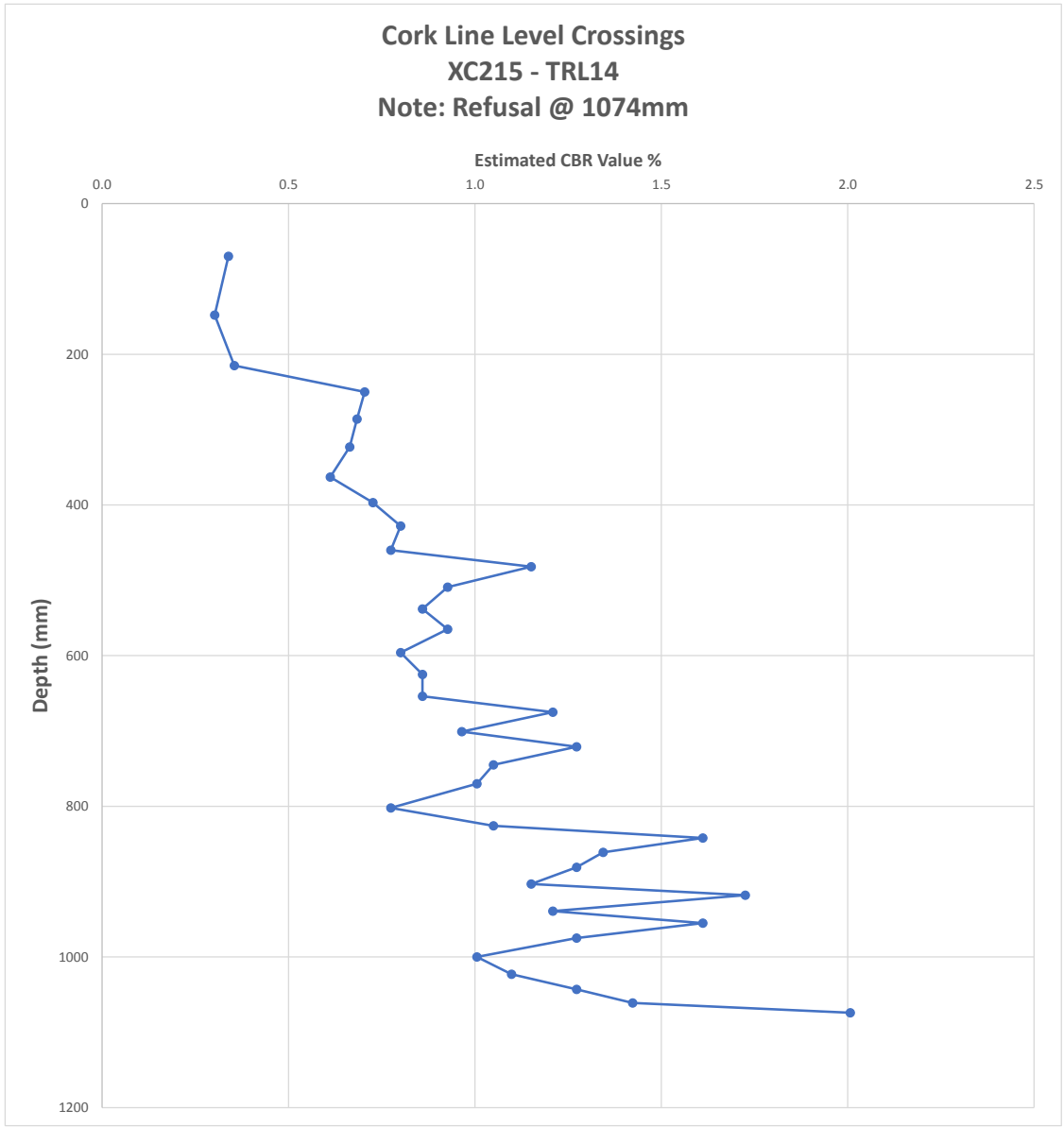
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC215 - TRL14**	Job No	19-135

Easting	Northing	Elevation
553522.173	615075.924	96.272

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1110	mm	09/03/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1040	70	70	0.3
2	962	78	148	0.3
3	895	67	215	0.4
4	860	35	250	0.7
5	824	36	286	0.7
6	787	37	323	0.7
7	747	40	363	0.6
8	713	34	397	0.7
9	682	31	428	0.8
10	650	32	460	0.8
11	628	22	482	1.2
12	601	27	509	0.9
13	572	29	538	0.9
14	545	27	565	0.9
15	514	31	596	0.8
16	485	29	625	0.9
17	456	29	654	0.9
18	435	21	675	1.2
19	409	26	701	1.0
20	389	20	721	1.3
21	365	24	745	1.0
22	340	25	770	1.0
23	308	32	802	0.8
24	284	24	826	1.0
25	268	16	842	1.6
26	249	19	861	1.3
27	229	20	881	1.3
28	207	22	903	1.2
29	192	15	918	1.7
30	171	21	939	1.2
31	155	16	955	1.6
32	135	20	975	1.3
33	110	25	1000	1.0
34	87	23	1023	1.1
35	67	20	1043	1.3
36	49	18	1061	1.4
37	36	13	1074	2.0
38				



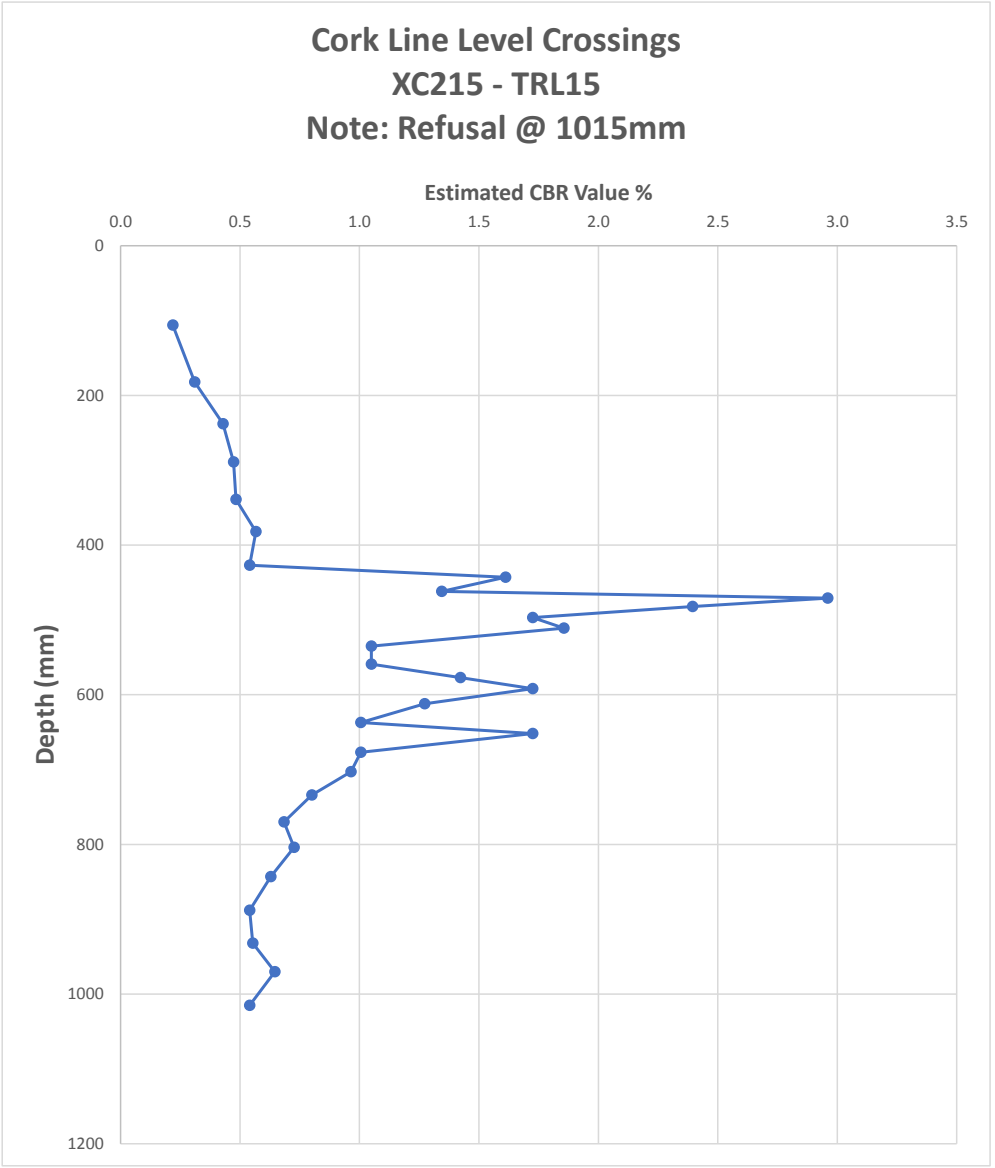
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC215 - TRL15**	Job No	19-135

Easting	Northing	Elevation
553539.79	615171.124	97.785

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1037	mm	09/03/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	931	106	106	0.2
2	855	76	182	0.3
3	799	56	238	0.4
4	748	51	289	0.5
5	698	50	339	0.5
6	655	43	382	0.6
7	610	45	427	0.5
8	594	16	443	1.6
9	575	19	462	1.3
10	566	9	471	3.0
11	555	11	482	2.4
12	540	15	497	1.7
13	526	14	511	1.9
14	502	24	535	1.0
15	478	24	559	1.0
16	460	18	577	1.4
17	445	15	592	1.7
18	425	20	612	1.3
19	400	25	637	1.0
20	385	15	652	1.7
21	360	25	677	1.0
22	334	26	703	1.0
23	303	31	734	0.8
24	267	36	770	0.7
25	233	34	804	0.7
26	194	39	843	0.6
27	149	45	888	0.5
28	105	44	932	0.6
29	67	38	970	0.6
30	22	45	1015	0.5
31				



Cork Line Level Crossings - Irish Rail

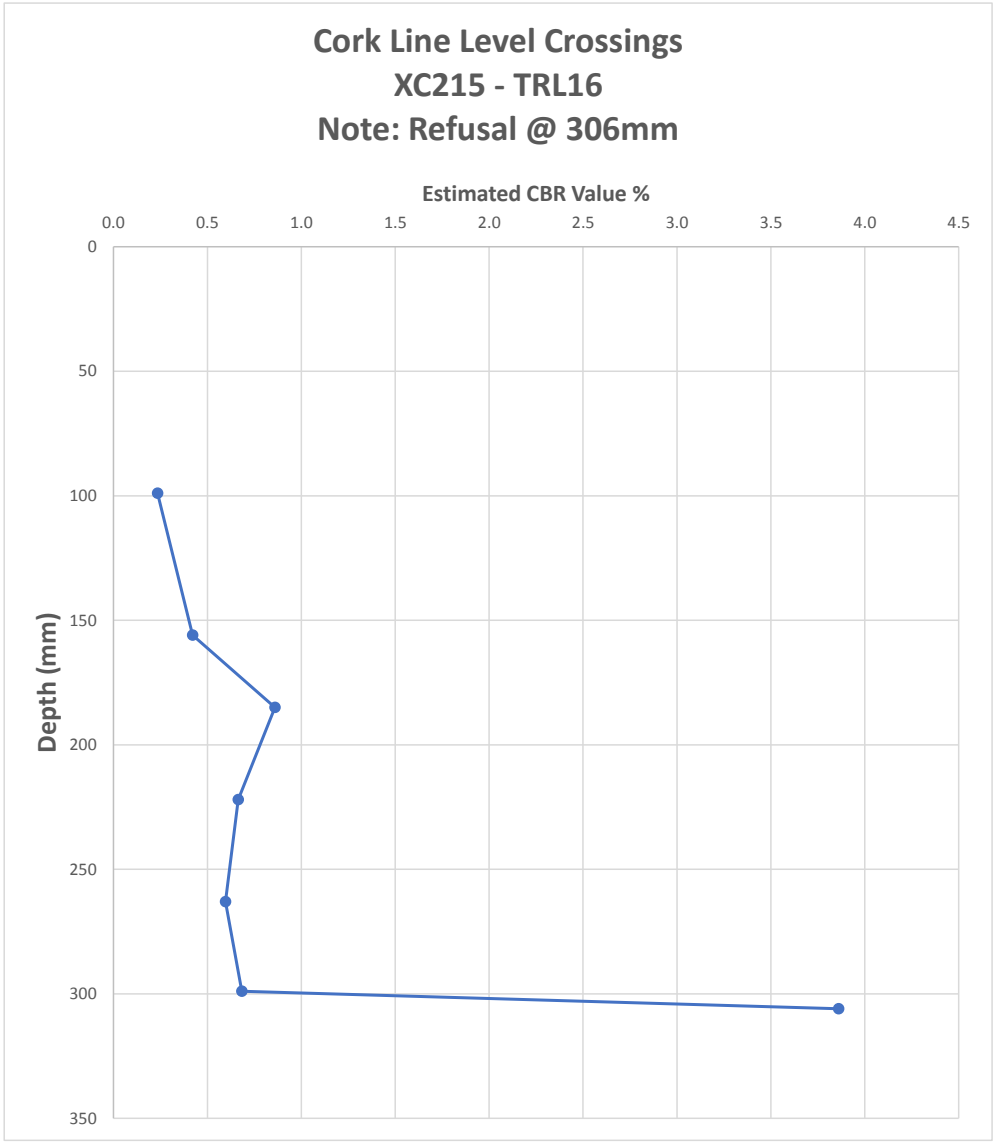
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC215 - TRL16**	Job No	19-135

Easting	Northing	Elevation
553546.563	615174.868	97.845

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1056	mm	09/03/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	957	99	99	0.2
2	900	57	156	0.4
3	871	29	185	0.9
4	834	37	222	0.7
5	793	41	263	0.6
6	757	36	299	0.7
7	750	7	306	3.9
8	750	0	306	
9	750	0	306	
10				



Cork Line Level Crossings - Irish Rail

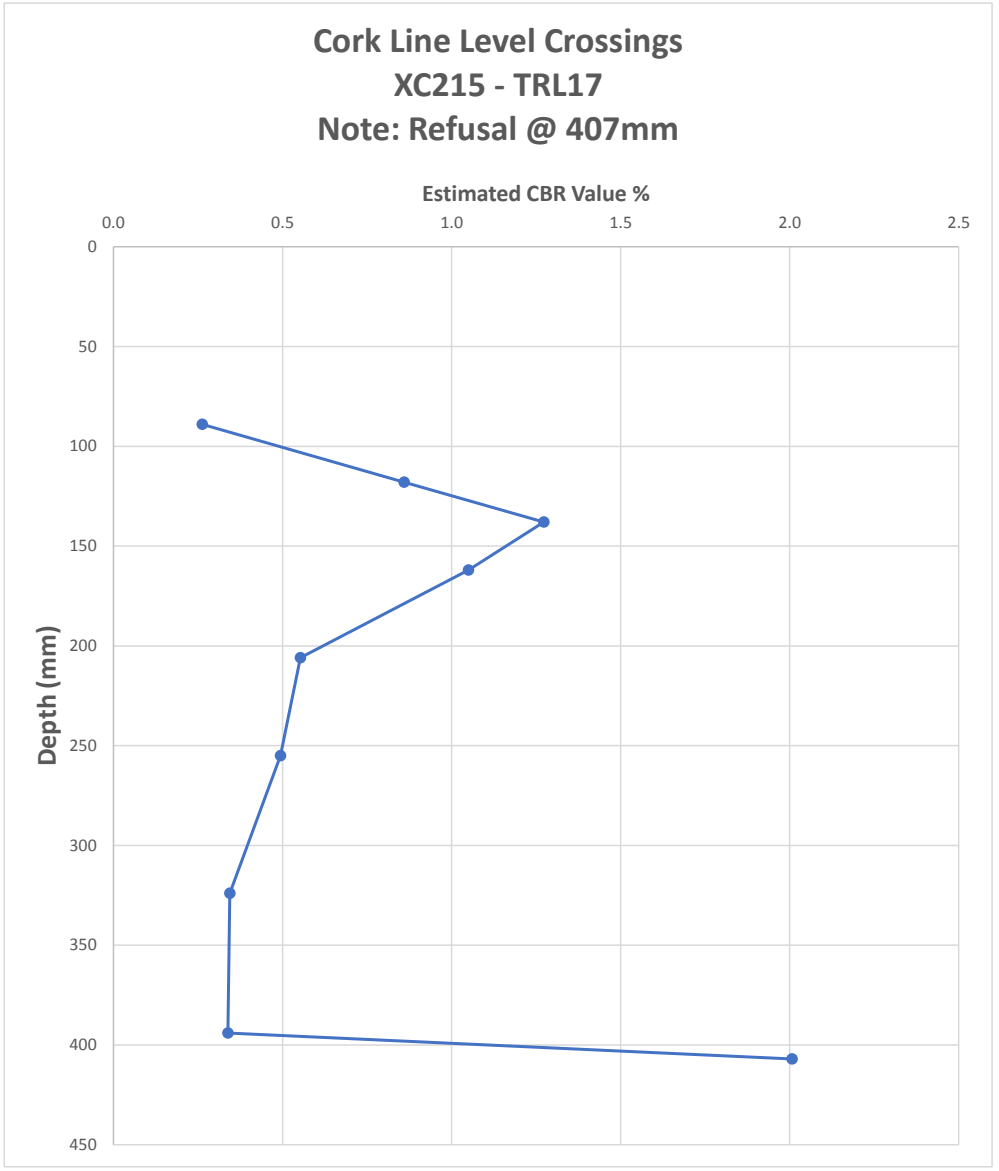
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC215 - TRL17**	Job No	19-135

Easting	Northing	Elevation
553475.81	615224.461	96.724

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1083	mm	09/03/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	994	89	89	0.3
2	965	29	118	0.9
3	945	20	138	1.3
4	921	24	162	1.0
5	877	44	206	0.6
6	828	49	255	0.5
7	759	69	324	0.3
8	689	70	394	0.3
9	676	13	407	2.0
10	676	0	407	
11	676	0	407	
12				



Cork Line Level Crossings - Irish Rail

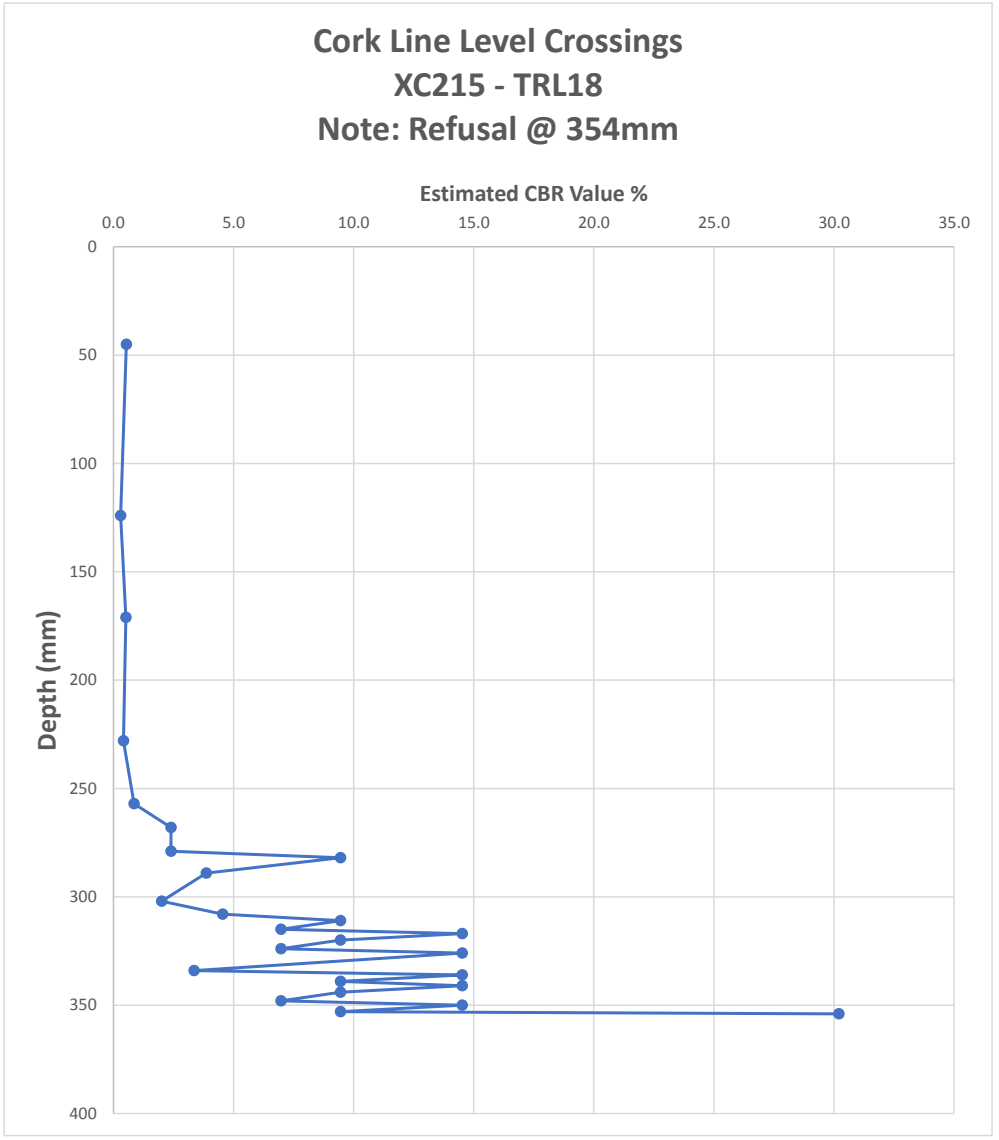
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC215 - TRL18**	Job No	19-135

Easting	Northing	Elevation
553481.288	615229.003	96.98

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1105	mm	09/03/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1060	45	45	0.5
2	981	79	124	0.3
3	934	47	171	0.5
4	877	57	228	0.4
5	848	29	257	0.9
6	837	11	268	2.4
7	826	11	279	2.4
8	823	3	282	9.5
9	816	7	289	3.9
10	803	13	302	2.0
11	797	6	308	4.5
12	794	3	311	9.5
13	790	4	315	7.0
14	788	2	317	14.5
15	785	3	320	9.5
16	781	4	324	7.0
17	779	2	326	14.5
18	771	8	334	3.4
19	769	2	336	14.5
20	766	3	339	9.5
21	764	2	341	14.5
22	761	3	344	9.5
23	757	4	348	7.0
24	755	2	350	14.5
25	752	3	353	9.5
26	751	1	354	30.2
27	751	0	354	
28	751	0	354	
29				



Appendix G Water Purging Data & Logs

Job Name: **I.E - Cork Line**		h (m)	3
		r (m)	0.0505
		r2	0.00255025
Job Nr: **19-135**		TWV (m3)	0.024035596

BH ID: XC215-CP01			**Theoretical Well Volume**	24.04 *ltrs*
Depth to Response Zone:	***Top (mbgl)***	***Bottom (mbgl)***	**TWV x3**	72.11 *ltrs*
	1.5	4.5		

Purge Start Time:			**(mbgl)**
Purge Finish Time:		**Depth to Water**	Dry
		Total Depth	3.32
Depth to water after purging:	mbgl		

	Time Taken to fill 25ltr container(mins)	Flow Rate l/min
Reading 1:		
Reading 2:		
Reading 3:		

Well was dry. Returned 3 days later, well was still dry

Date 04/08/20 - 07/08/20

Nr of Containers filled:

Total Volume Purged: ***litres***

	Temperature	**pH**	**Electrical Conductivity**	**Dissolved Oxygen**	**Redox Potential**
Reading 1					
Reading 2					
Reading 3					
Reading 4					
Reading 5					
Reading 6					
Reading 7					
Reading 8					
Reading 9					
Reading 10					
Reading 11					
Reading 12					

Job Name: **I.E - Cork Line**			h (m)	6	
			r (m)	0.0505	
			r2	0.00255025	
Job Nr: **19-135**			TWV (m3)	0.048071192	
BH ID: XC215-CPRC01			**Theoretical Well Volume**	48.071192 *ltrs*	
Depth to Response Zone:	***Top (mbgl)***	***Bottom (mbgl)***	**TWV x3**	144.213576 *ltrs*	
	9.6	12.2			
	13/08/2020	14/08/2020			
Purge Start Time:	10:45	10:00		**(mbgl)**	
Purge Finish Time:	14:30	14:45	**Depth to Water**	9.81	
			Total Depth	14.03	
Depth to water after purging:	9.6 mbgl				

	Time Taken to fill 25ltr container(mins)	Flow Rate l/min
Reading 1:		
Reading 2:		
Reading 3:		

Bailer

Date 13/08/20 & 14/08/20

9.81

14.03

Nr of Containers filled:

Total Volume Purged: 145 ***litres***

	Temperature	**$_{P}$H**	**Electrical Conductivity**	**Dissolved Oxygen**	**Redox Potential**
(13/08/20) Reading 1	20.35	6.54	8.36	0	-23.1
Reading 2	16.19	6.86	4.69	0	-32.3
Reading 3	17.51	6.39	6.35	0	-25.1
Reading 4	17.7	6.43	6.77	0	-24.4
(14/08/20) Reading 5	15.52	6.64	48.54	0	-40.6
Reading 6	13.72	6.61	55.34	0	-41.1
Reading 7	12.42	6.69	23.4	0	-40.6
Reading 8	11.92	6.69	21.43	0	-37.8
Reading 9	11.83	6.82	14.92	0	-38
Reading 10	11.91	6.53	16.13	0	-33.9
Reading 11	11.73	6.57	13.06	0	-35.7
Reading 12	12.39	6.33	21.85	0	-31.5
Reading 13	14.53	6.54	16.86	0	-36.3
Reading 14	15.14	6.36	22.81	0	-38.3
Reading 15	13.38	6.17	19.65	0	-41.5

Appendix H Geotechnical Soil Laboratory Test Results

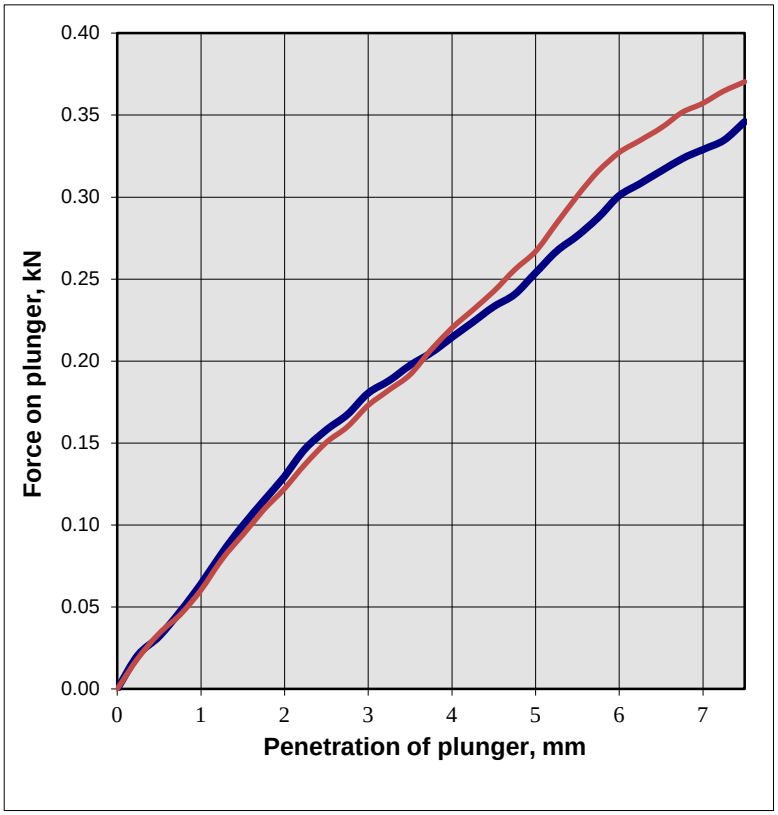
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

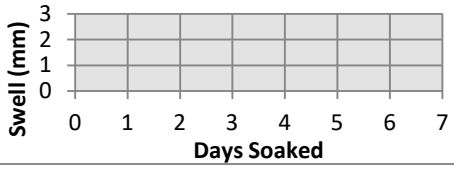
LABORATORY TEST REPORT

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

Project :	Cork Line Level Crossings	**Job No:**	19-135
Client :	OCB Geotechnical	**Lab Ref No:**	ST 93372
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	16/04/2020
	Co Cork	**Date Reported:**	21/04/2020
Order No:	2003-104	**Sample Ref:**	XC215-TP01 Type B Sample 3
Originator :	**Ian Holley**	**Location:**	0.35-0.8m



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)
2.17
Propertion of material removed from initial sample by dry mass (%)
10.9



Final Swell (mm):	N/A

Penetration (mm)	Force (kN)	Standard Force (kN)	Top CBR (%)
2.5	0.16	13.2	1.2
5.0	0.25	20.0	1.3
Moisture content : %	**19.5**	**Mean CBR value : %**	**1.2**

Penetration (mm)	Force (kN)	Standard Force (kN)	Bottom CBR (%)
2.5	0.15	13.2	1.1
5.0	0.27	20.0	1.3
Moisture content : %	**19.5**	**Mean CBR value : %**	**1.2**

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

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James Fisher Testing Services Limited, a company registered in England and Wales with registration number: 01182561
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James Fisher Testing Services (Ireland) Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co.Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

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

Site:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93373
	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-TP01 Type D Sample 4

Sample Type:	Bulk	***Location:***	XC215-TP01 Type D Sample 4
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	0.35-0.80m	***Material Type:***	Soil

Moisture Content (%): 19

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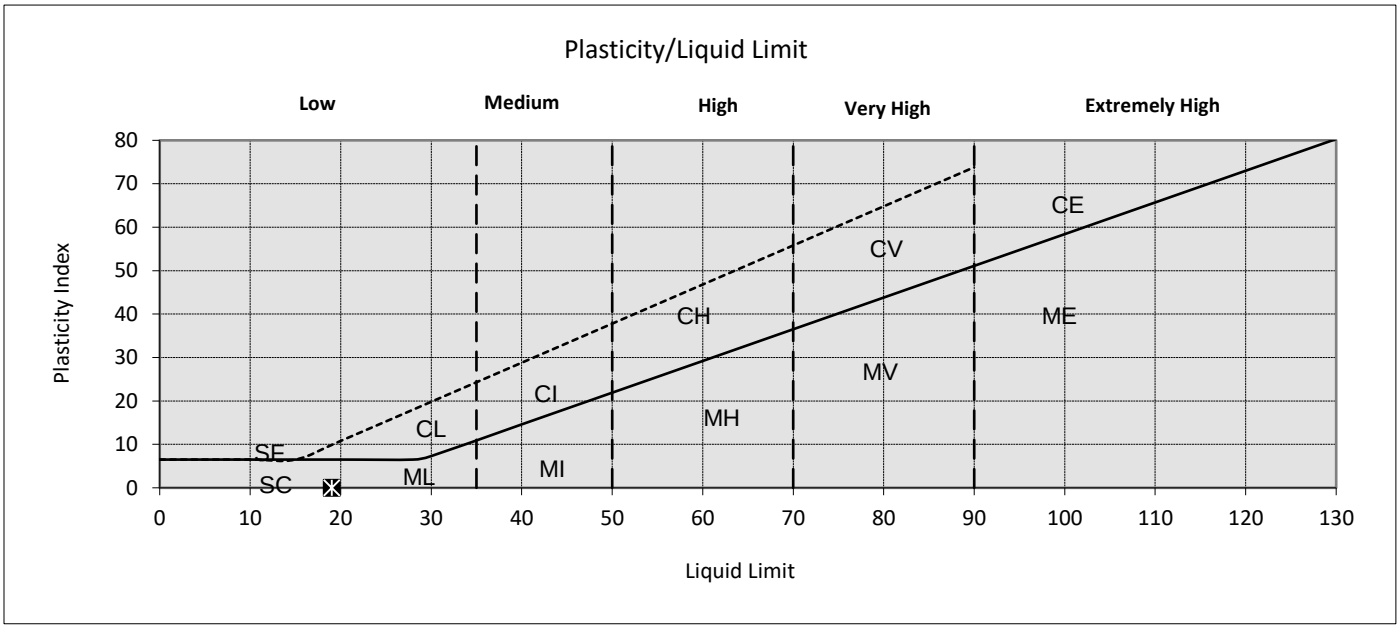
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

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

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93374
	Unit 1 Carrigogna	**Sample Ref.:**	XC215-TP01 0.35-0.8mType D Sample4
	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 (%)	**61**
Natural Moisture Content (%)	**18**
Liquid Limit (single point)(%)	**19**
Plastic Limit (%)	**Non-Plastic**
Plasticity Index	**N/A**



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James Fisher Testing Services Ltd
Phil Thorp, Laboratory Manager

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LABORATORY TEST REPORT

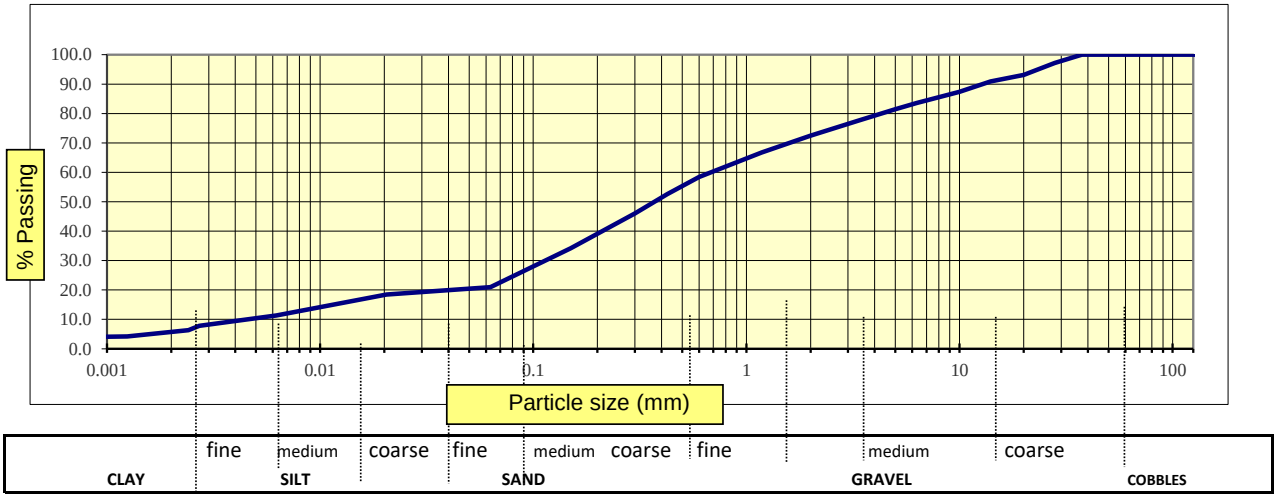
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 93371
	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, Sandy

Client Ref.	**XC215-TP01 Type B Sample 2**
Location:	XC215-TP01 Type B Sample 2
Supplier:	Bulk
Source:	Client Info.
Depth (m):	0.35-0.8m
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	100	
63 mm	100	
50 mm	100	
37.5 mm	100	
28 mm	97	
20 mm	93	
14 mm	91	
10 mm	87	
6.3 mm	84	
5 mm	81	
3.35 mm	78	
2 mm	72	
1.18 mm	67	
0.6 mm	58	
0.425 mm	53	
0.3 mm	46	
0.15 mm	34	
0.063 mm	21	
0.020 mm	18	
0.006 mm	11	
0.003 mm	8	
0.002 mm	6	
0.001 mm	4	



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

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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 93375
	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-TP01 Type D Sample 8**

Supplier:	Client Info	**Date of Sampling:**	Client Info.
Source:	Client Info	**Sampled By:**	Client
Sample Location:	1.1-1.6m	**Sampling Reason:**	Request

Parameter	RESULT
pH	7.8
Sulphate Aqueous Extract (SO4) (mg/l)	<10
Sulphur as S, Total (%)	<0.01
Sulphate as SO4, Total (%)	0.01

Comments:
None

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

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

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.

☐ **James Ward, Operations Manager**

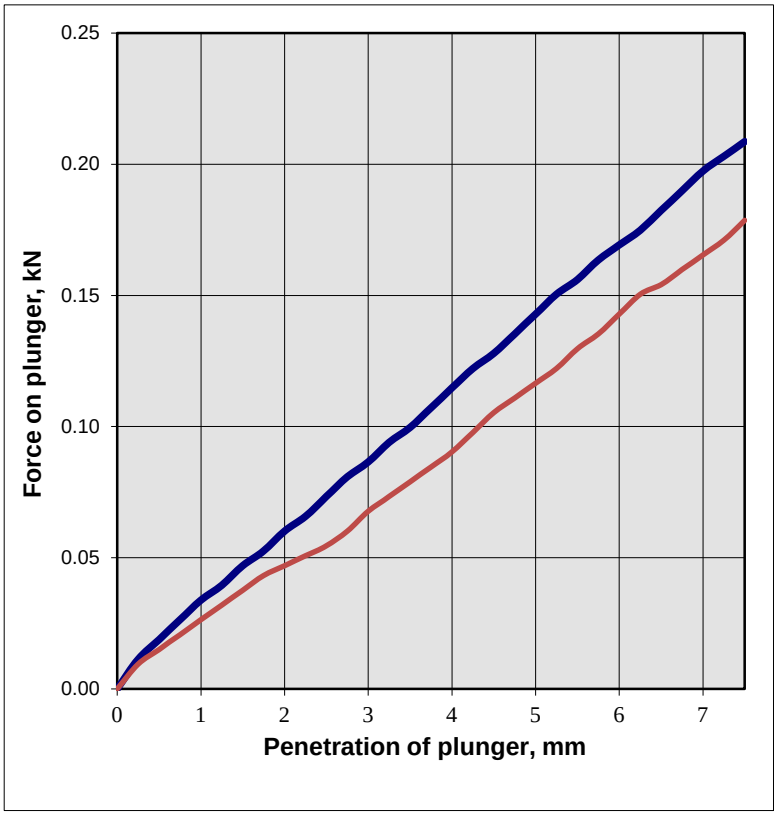
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

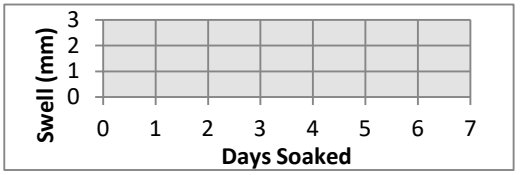
LABORATORY TEST REPORT

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

Project :	Cork Line Level Crossings	**Job No:**	19-135
Client :	OCB Geotechnical	**Lab Ref No:**	ST 93376
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	16/04/2020
	Co Cork	**Date Reported:**	21/04/2020
Order No:	2003-104	**Sample Ref:**	XC215-TP02 Type B Sample 3
Originator :	**Ian Holley**	**Location:**	0.3-0.8m



Type of Reaction Load
Load Frame
Technician(s)
NW
Mass of Surcharge Weights
8.8Kg
Overburden Pressure
3.9kPa
Material Type
Soil
Density (Mg/m³)
2.21
Propertion of material removed from initial sample by dry mass (%)
7.24



Final Swell (mm):	N/A

Penetration (mm)	Force (kN)	Standard Force (kN)	Top CBR (%)
2.5	0.07	13.2	0.6
5.0	0.14	20.0	0.7
Moisture content : %	**26.8**	**Mean CBR value : %**	**0.6**

Penetration (mm)	Force (kN)	Standard Force (kN)	Bottom CBR (%)
2.5	0.05	13.2	0.4
5.0	0.12	20.0	0.6
Moisture content : %	**26.8**	**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

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

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Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co.Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

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

Site:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93377
	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-TP02 Type D Sample 4

Sample Type:	Bulk	***Location:***	XC215-TP02 Type D Sample 4
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	0.3-0.8m	***Material Type:***	Soil

Moisture Content (%): 25

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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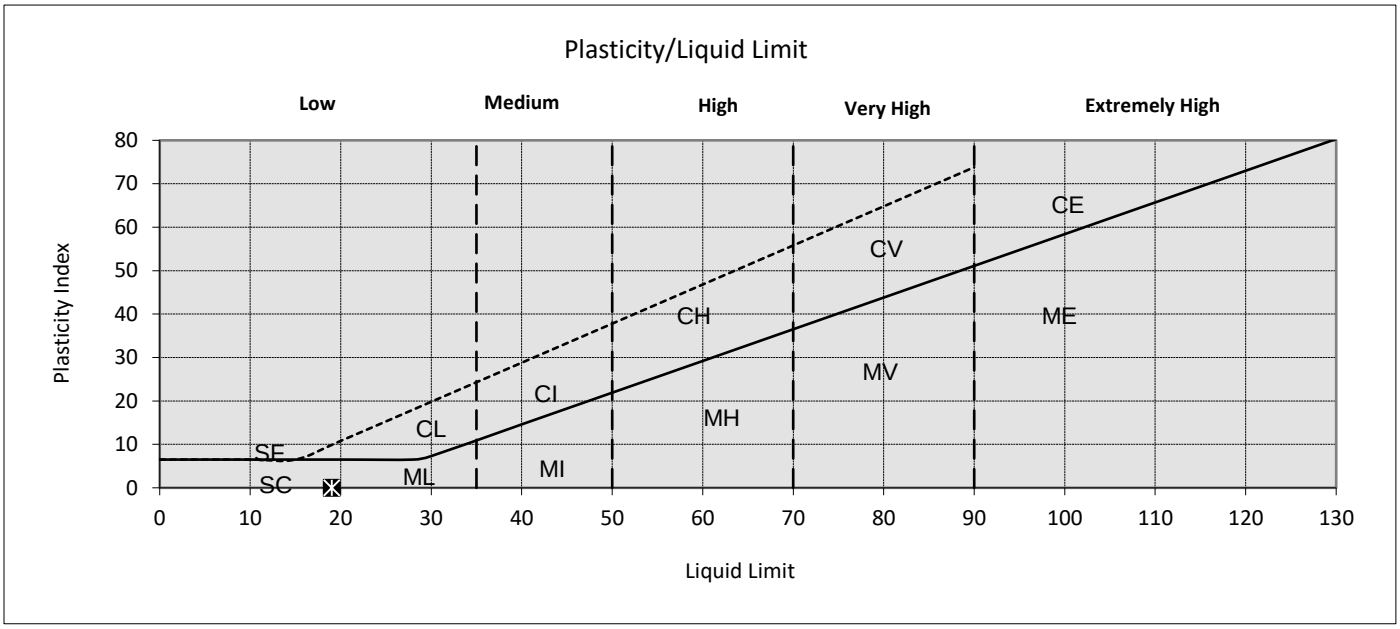
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Warrington, WA1 4RF
Tel: 01925286880

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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 93378
	Unit 1 Carrigogna	**Sample Ref.:**	XC215-TP02 0.3-0.8m Type D Sample 4
	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 (%)	**72**
Natural Moisture Content (%)	**28**
Liquid Limit (single point)(%)	**19**
Plastic Limit (%)	**Non-Plastic**
Plasticity Index	**N/A**



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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 93385
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	31/03/2020
Order No:	2003-104	**Date Reported:**	03/04/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC215-TP03 Type D Sample 6

Sample Type:	Bulk	***Location:***	XC215-TP03 Type D Sample 6
Date Sampled:	Client Info	***Sample by:***	Client
Depth:	0.5-1.0m	***Material Type:***	Soil

Moisture Content (%): 11

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

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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 93386
	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 D Sample 6**

Supplier:	Client Info	**Date of Sampling:**	Client Info
Source:	Client Info	**Sampled By:**	Client
Sample Location:	0.5-1.0m	**Sampling Reason:**	Request

Result:

Organic Matter (%)	**0.4**

Comments:
None

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

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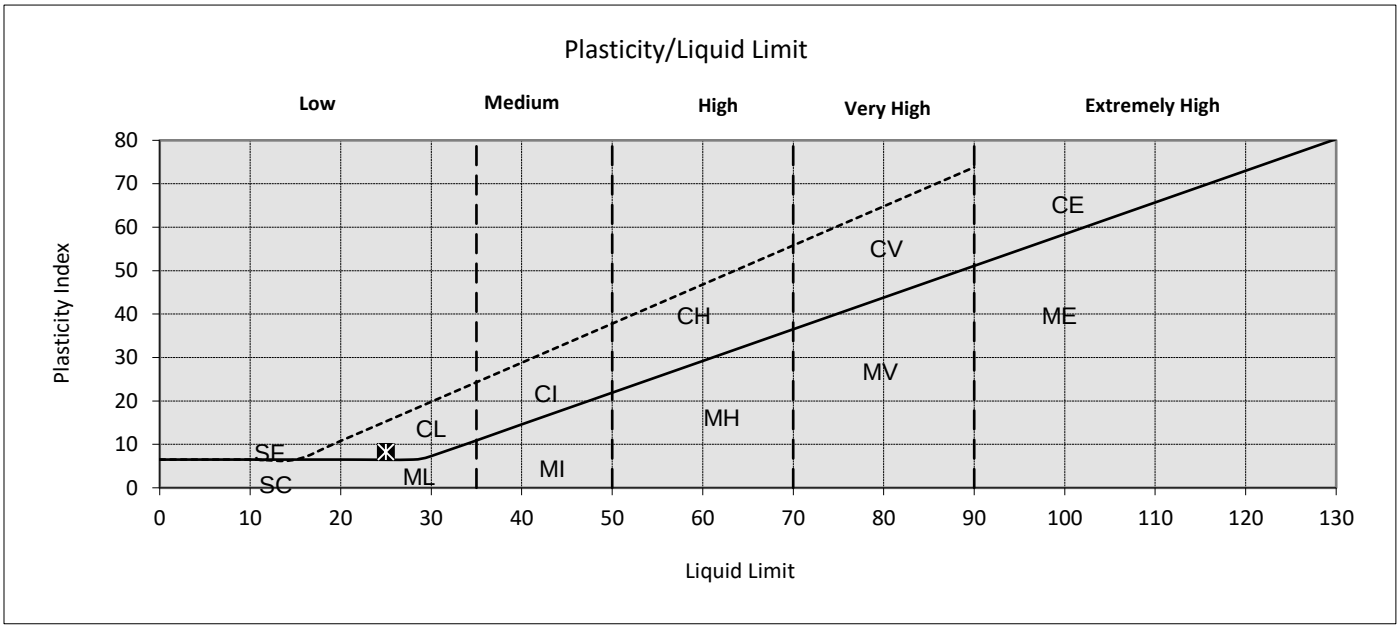
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LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93382
	Unit 1 Carrigogna	**Sample Ref.:**	XC215-TP03 0.5-1.0m Type D Sample 5
	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:**	03/04/2020

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Bulk**
Sample Preparation Method	**Washed**
MATERIAL	**Soil**
Retained 425 micron (%)	**22**
Natural Moisture Content (%)	**10**
Liquid Limit (single point)(%)	**25**
Plastic Limit (%)	**16**
Plasticity Index	**8**



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LABORATORY TEST REPORT

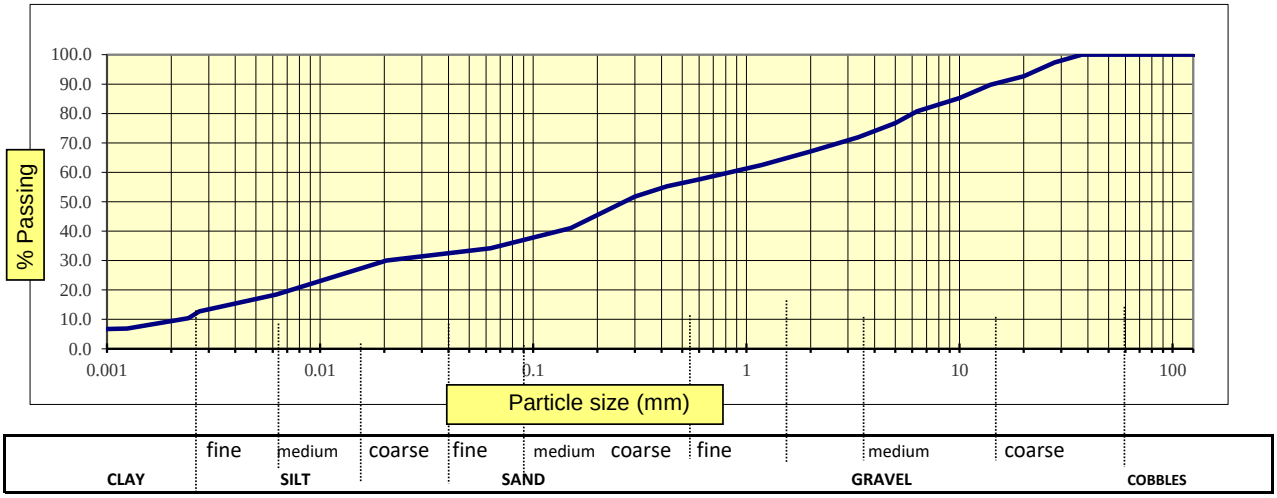
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 93383
	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, Sandy

Client Ref.	**XC215-TP03 Type B Sample 5**
Location:	XC215-TP03 Type B Sample 5
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	100	
63 mm	100	
50 mm	100	
37.5 mm	100	
28 mm	97	
20 mm	93	
14 mm	90	
10 mm	85	
6.3 mm	81	
5 mm	77	
3.35 mm	72	
2 mm	67	
1.18 mm	63	
0.6 mm	58	
0.425 mm	55	
0.3 mm	52	
0.15 mm	41	
0.063 mm	34	
0.020 mm	30	
0.006 mm	19	
0.003 mm	13	
0.002 mm	10	
0.001 mm	7	



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

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Sedimentation by Hydrometer - Not UKAS

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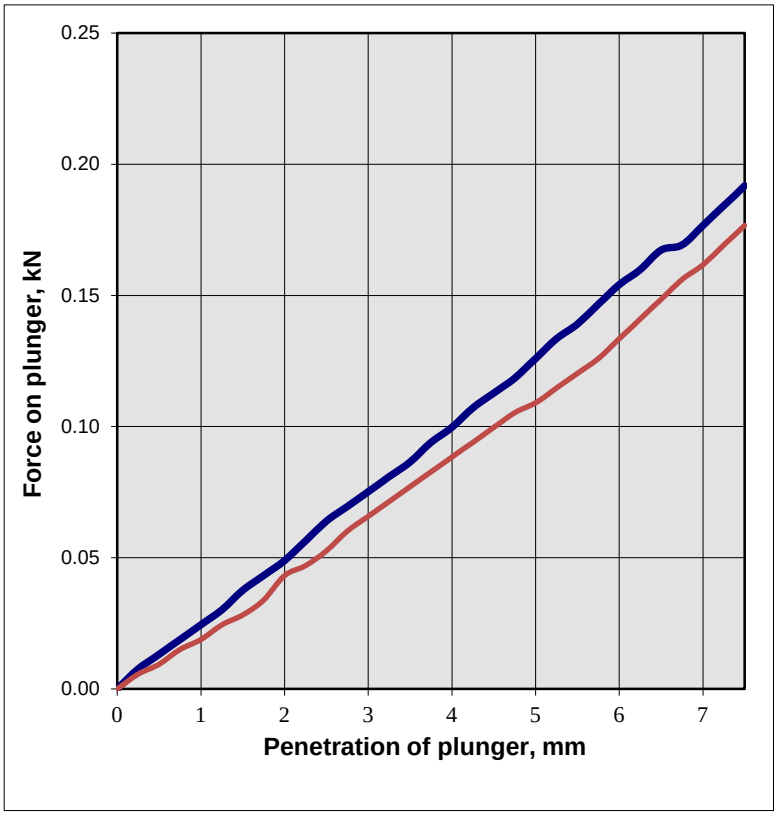
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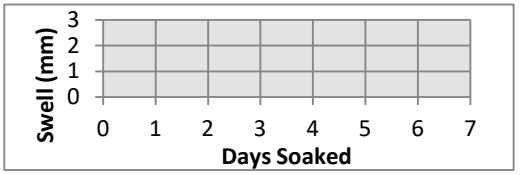
LABORATORY TEST REPORT

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 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

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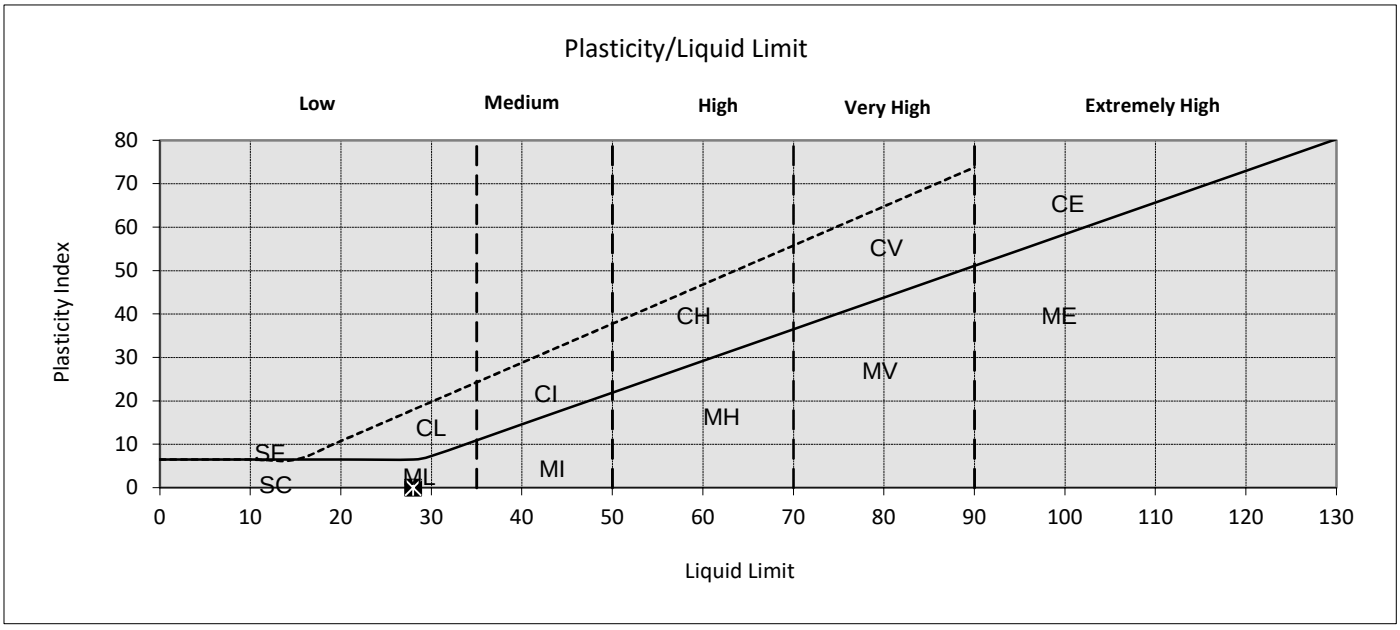
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LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

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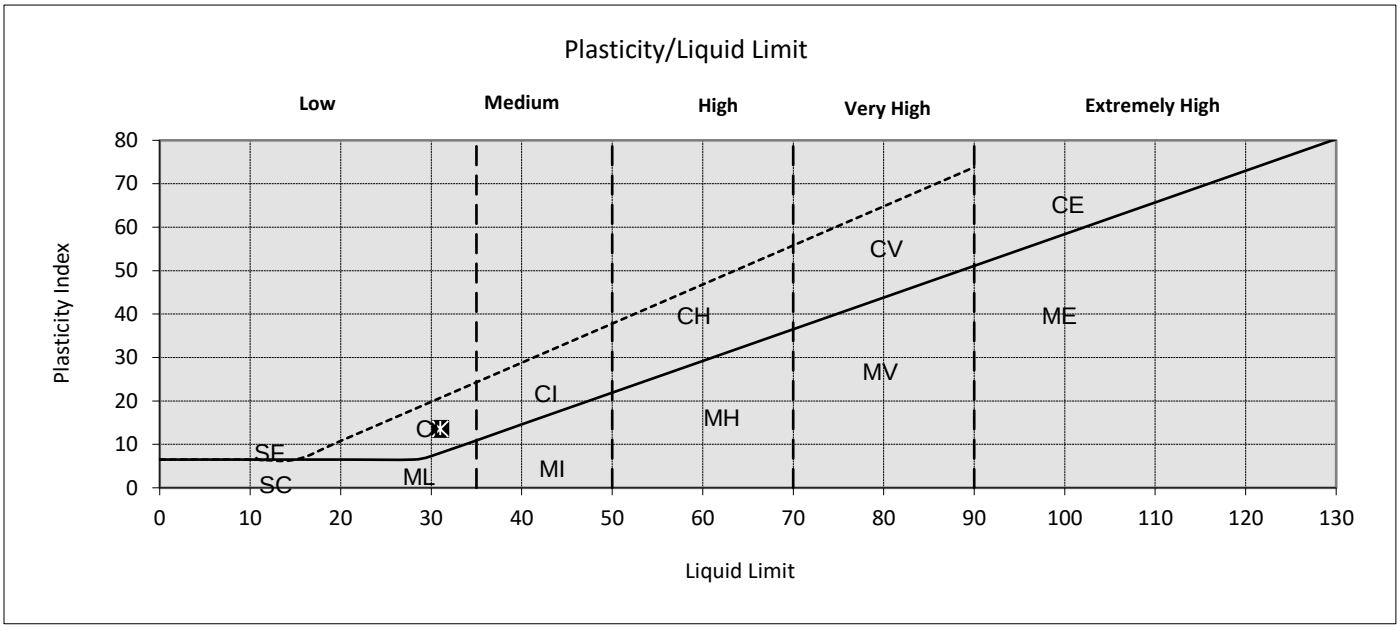
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LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

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

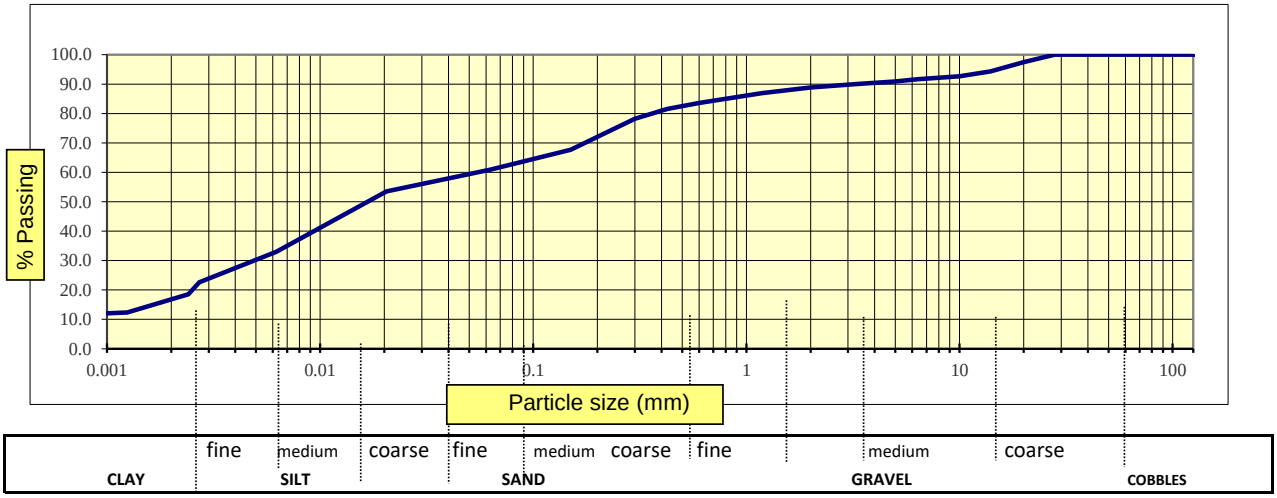
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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

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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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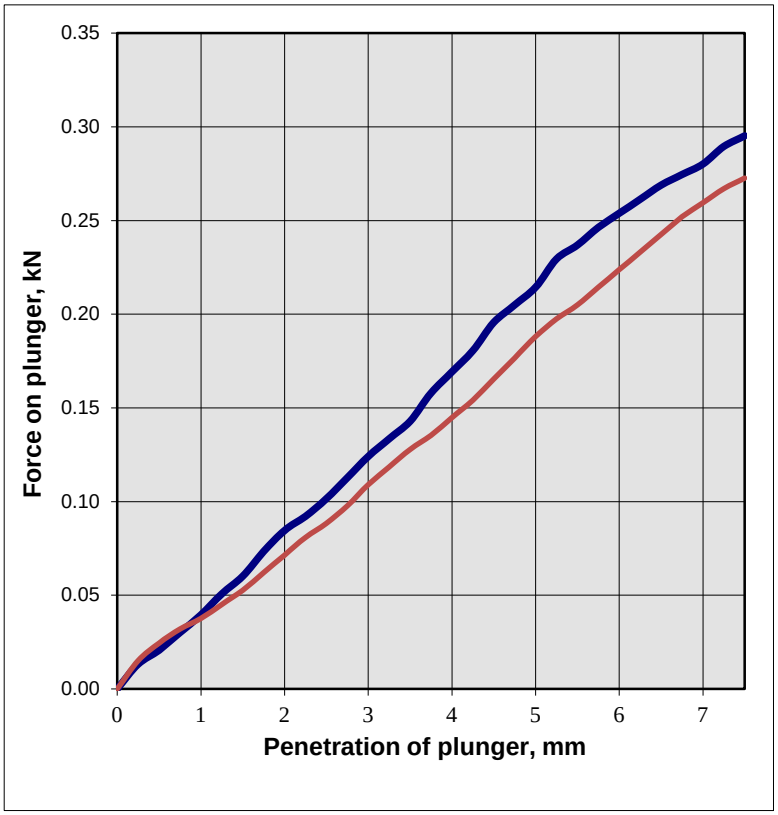
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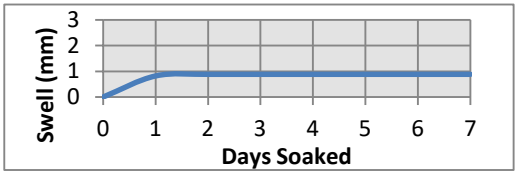
LABORATORY TEST REPORT

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 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

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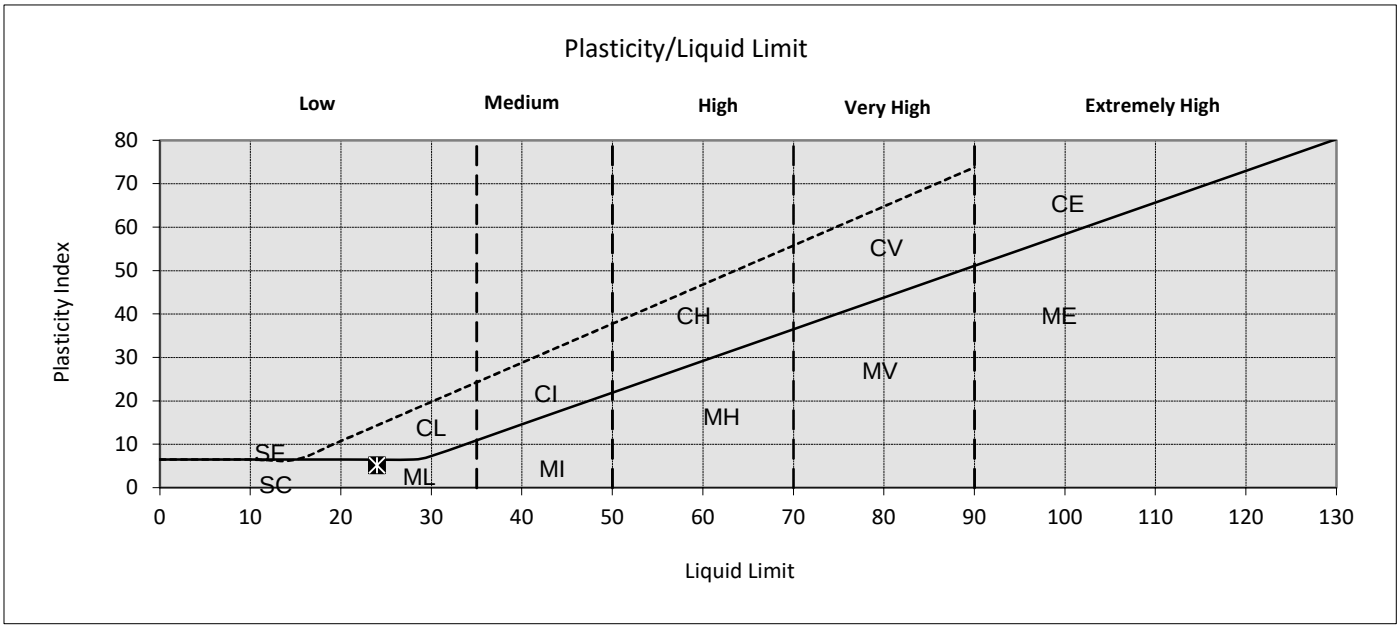
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LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

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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Phil Thorp, Laboratory Manager

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LABORATORY TEST REPORT

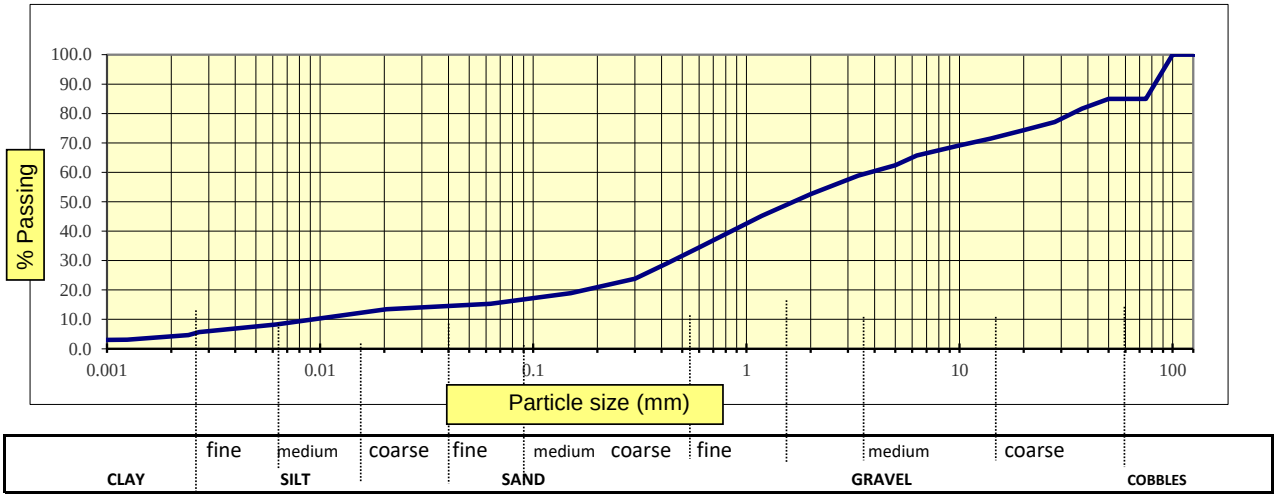
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 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

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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 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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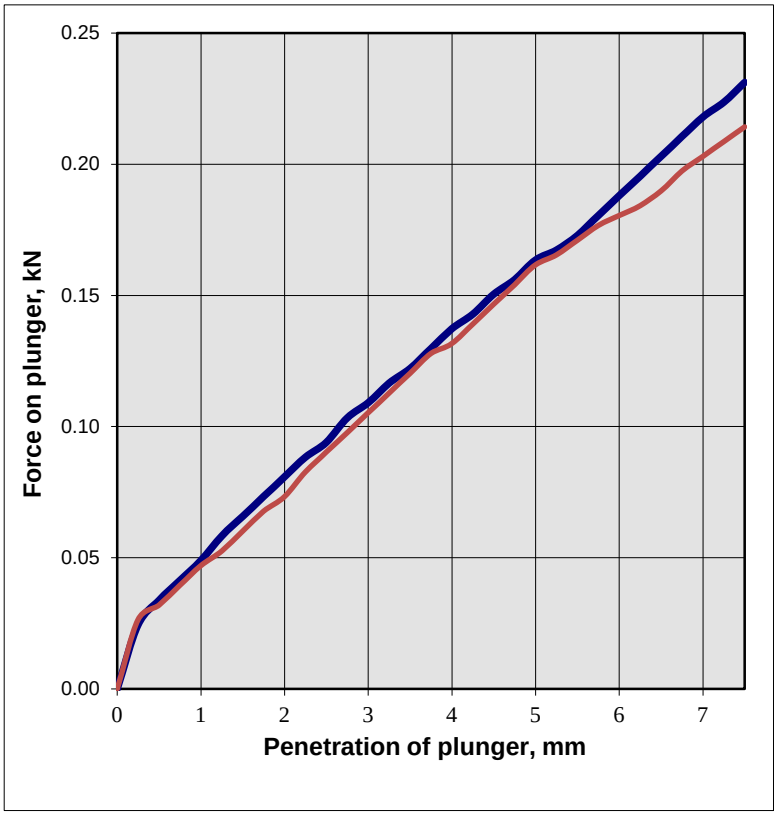
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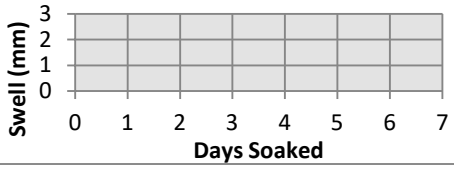
LABORATORY TEST REPORT

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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Registered office: Fisher House, PO Box 4, Barrow-in-Furness, Cumbria, LA14 1HR

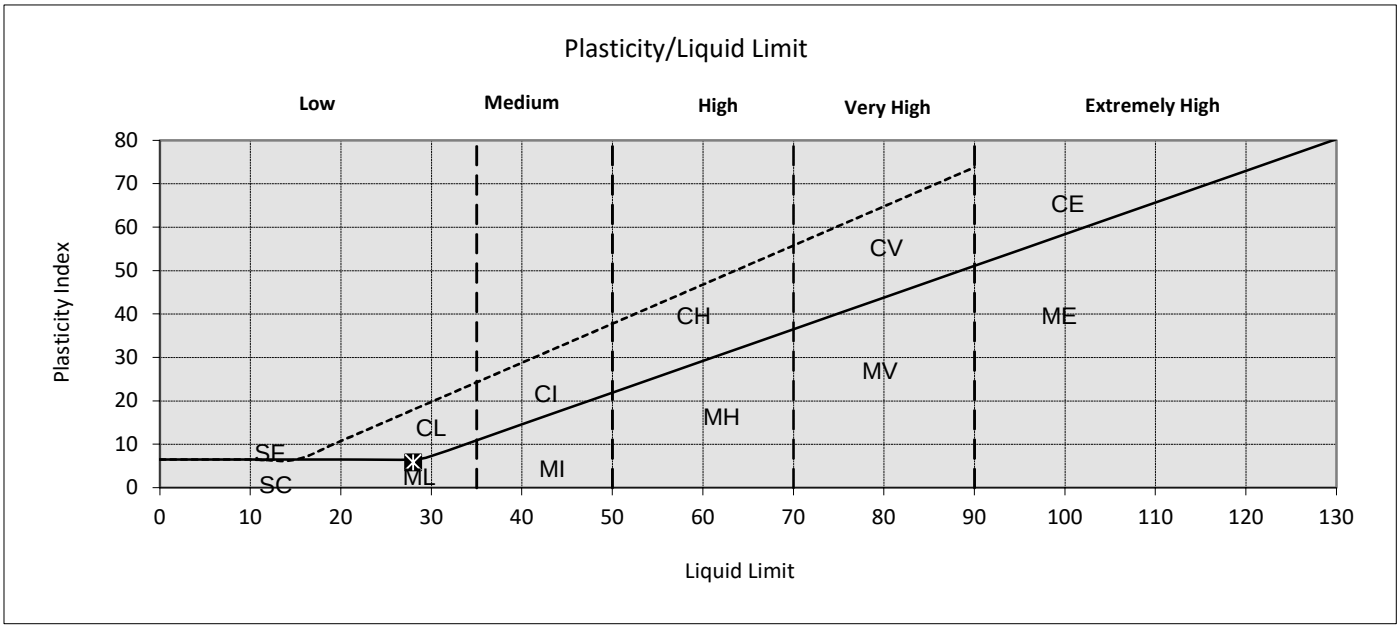
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LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

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

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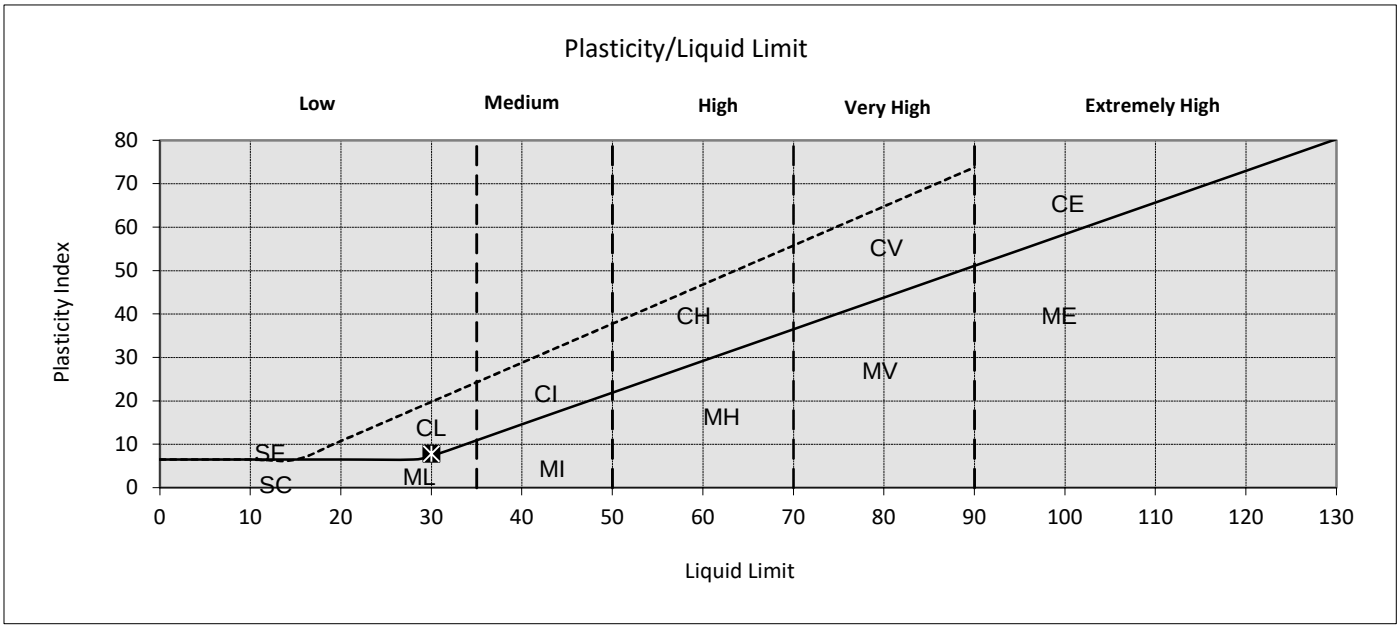
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LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 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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LABORATORY TEST REPORT

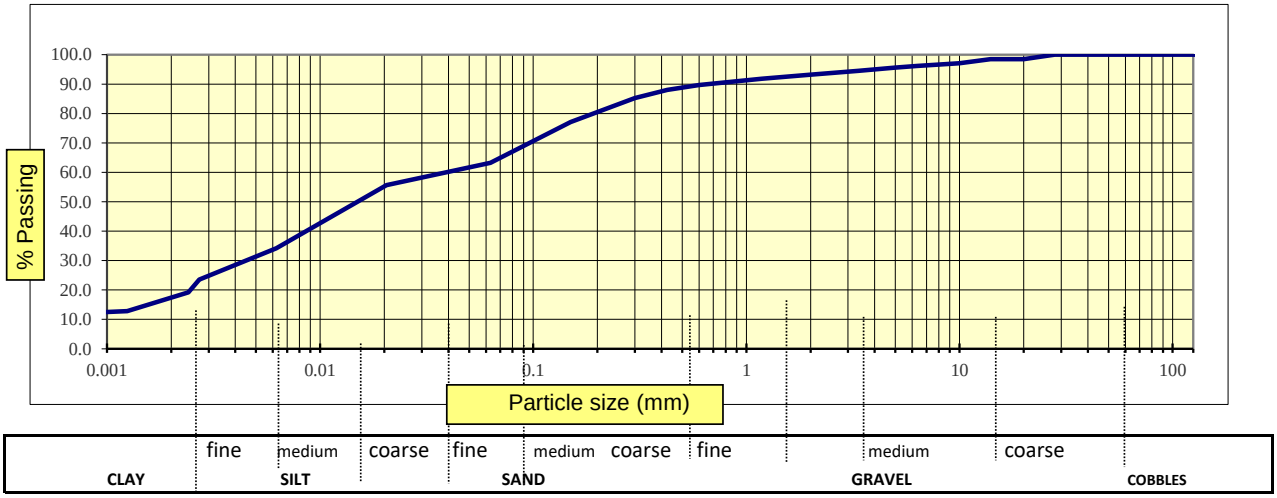
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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

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Sedimentation by Hydrometer - Not UKAS

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LABORATORY TEST REPORT

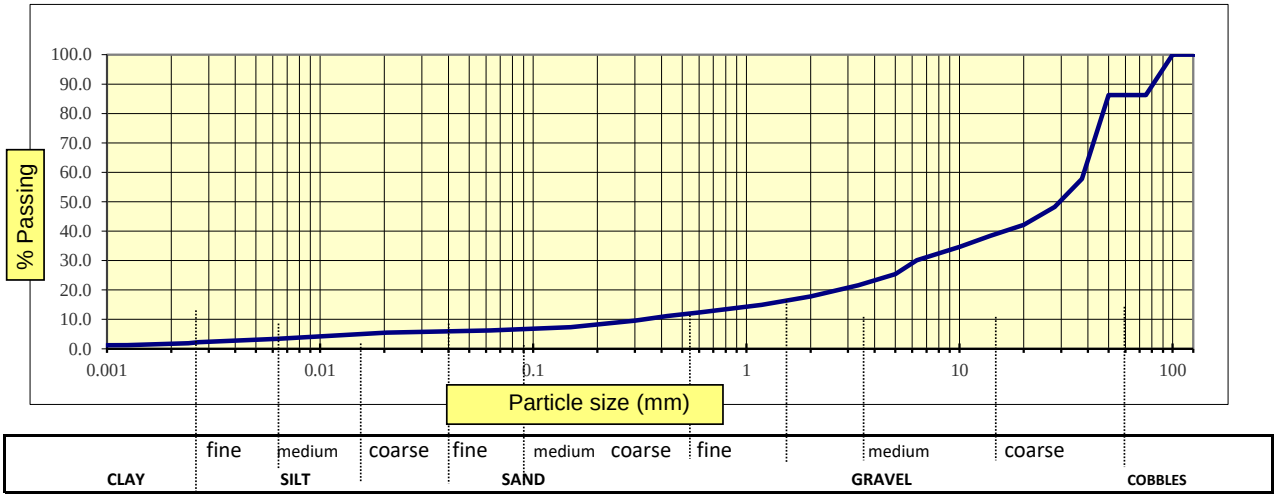
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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

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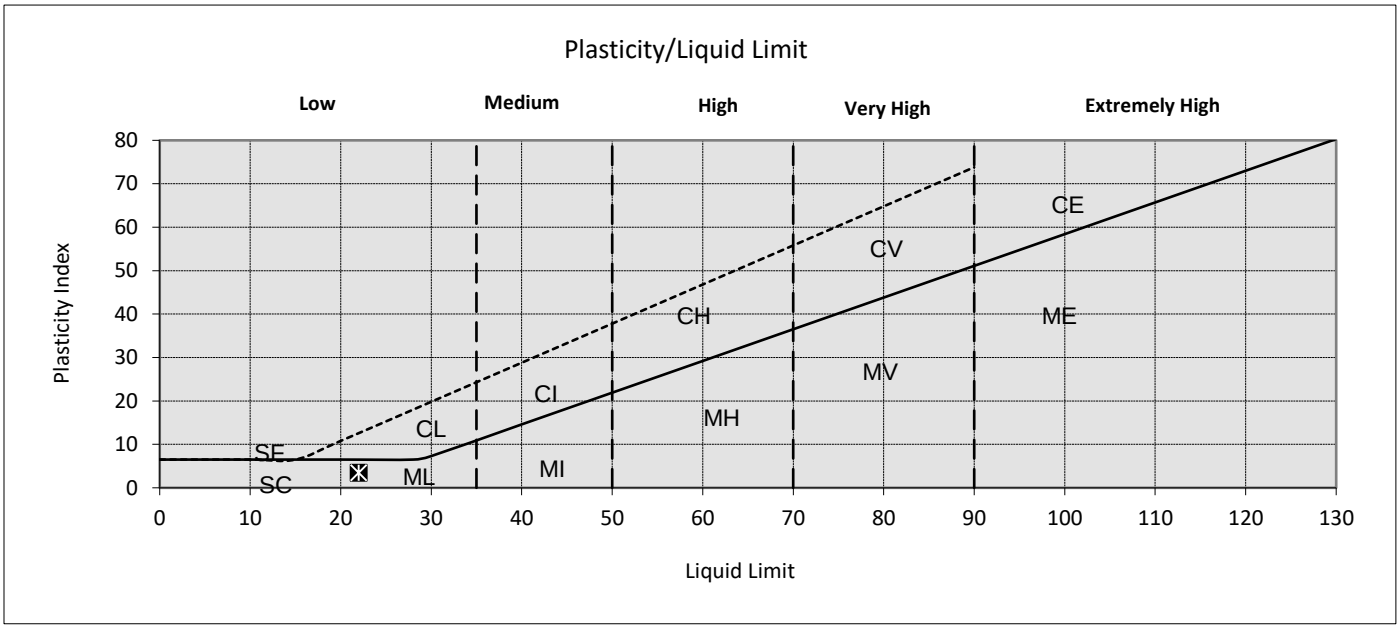
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LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

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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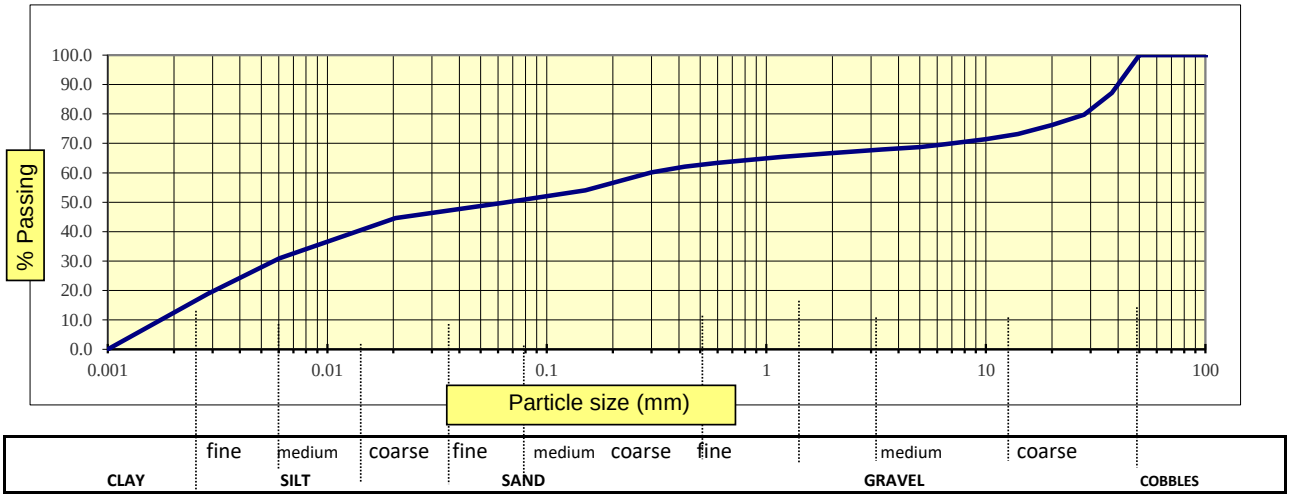
LABORATORY TEST REPORT

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

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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 Ward, Operations Manager**

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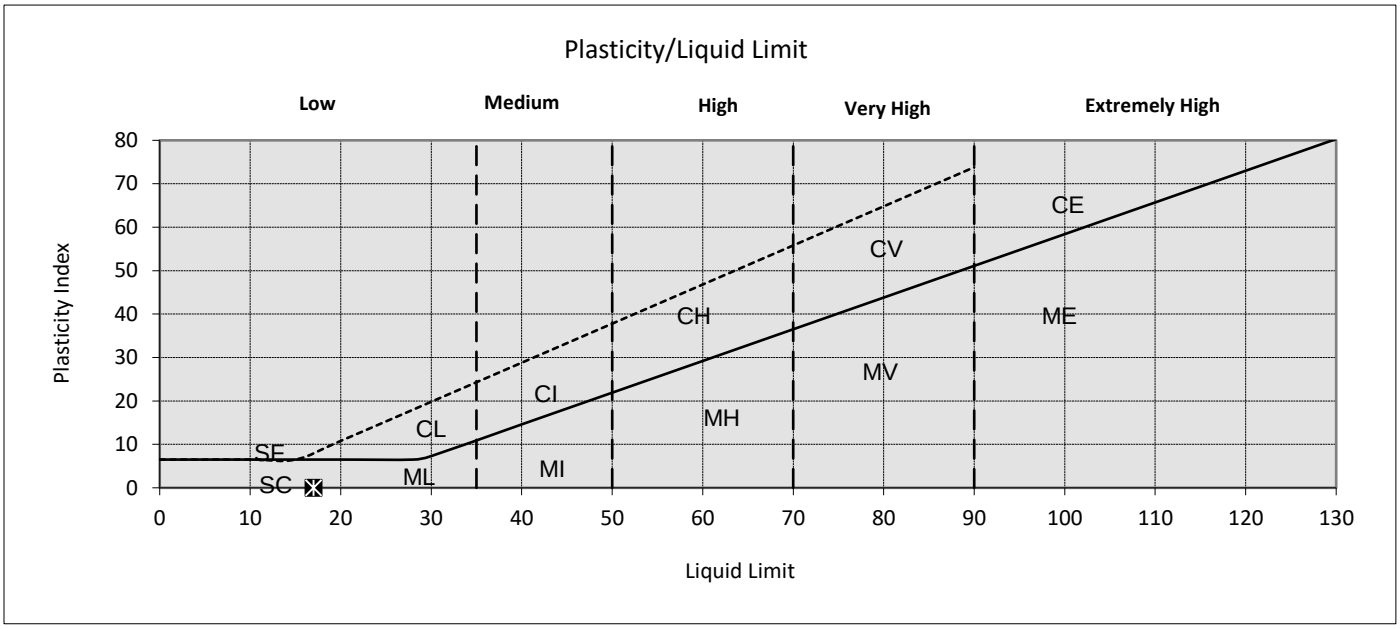
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Warrington, WA1 4RF
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LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 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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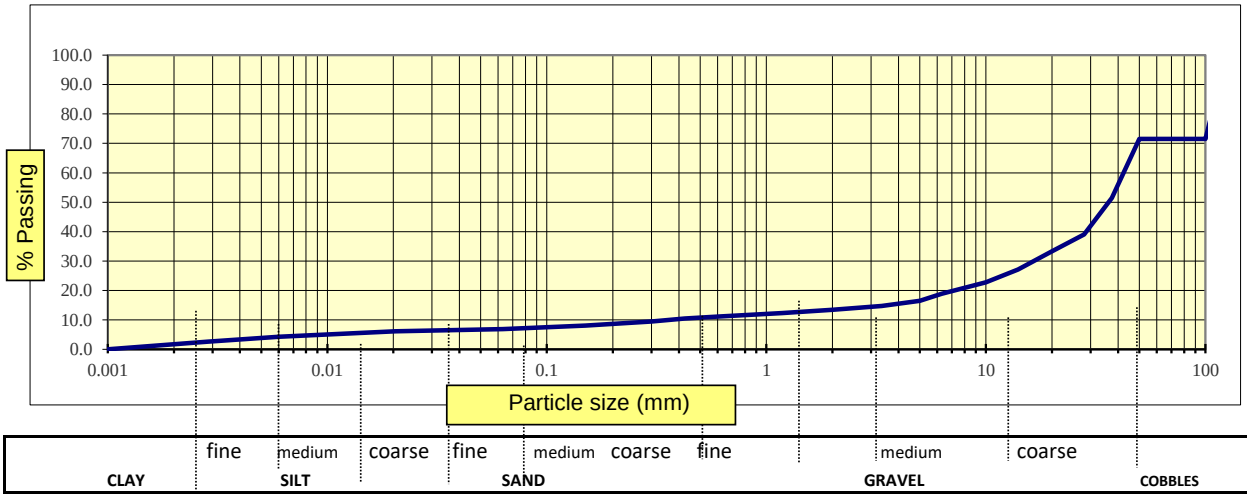
LABORATORY TEST REPORT

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
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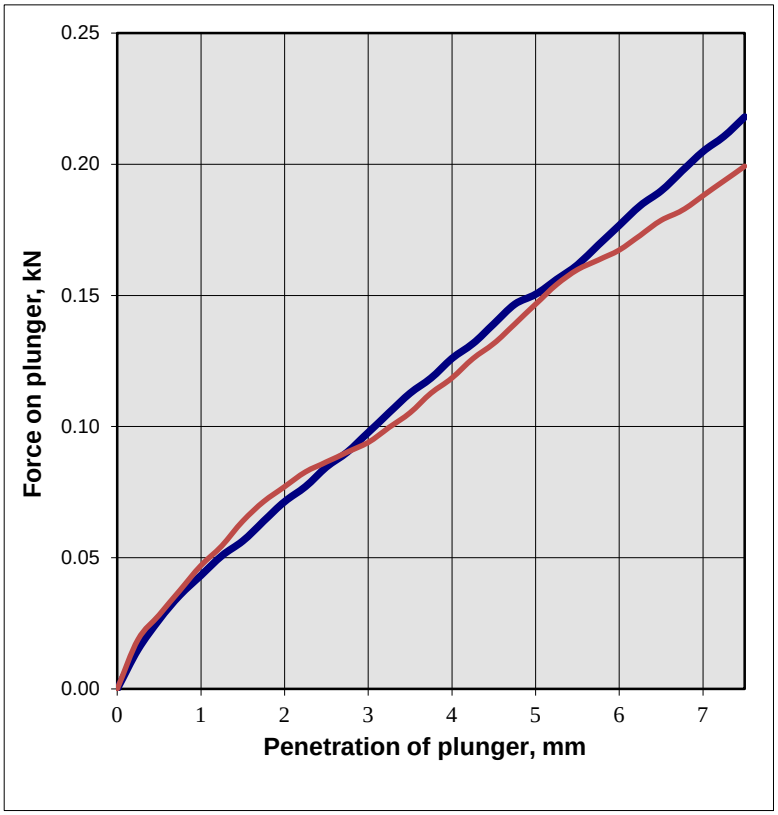
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Tel: 01925286880

James Fisher Testing Services

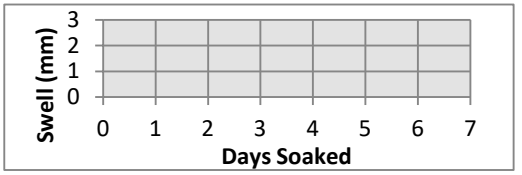
LABORATORY TEST REPORT

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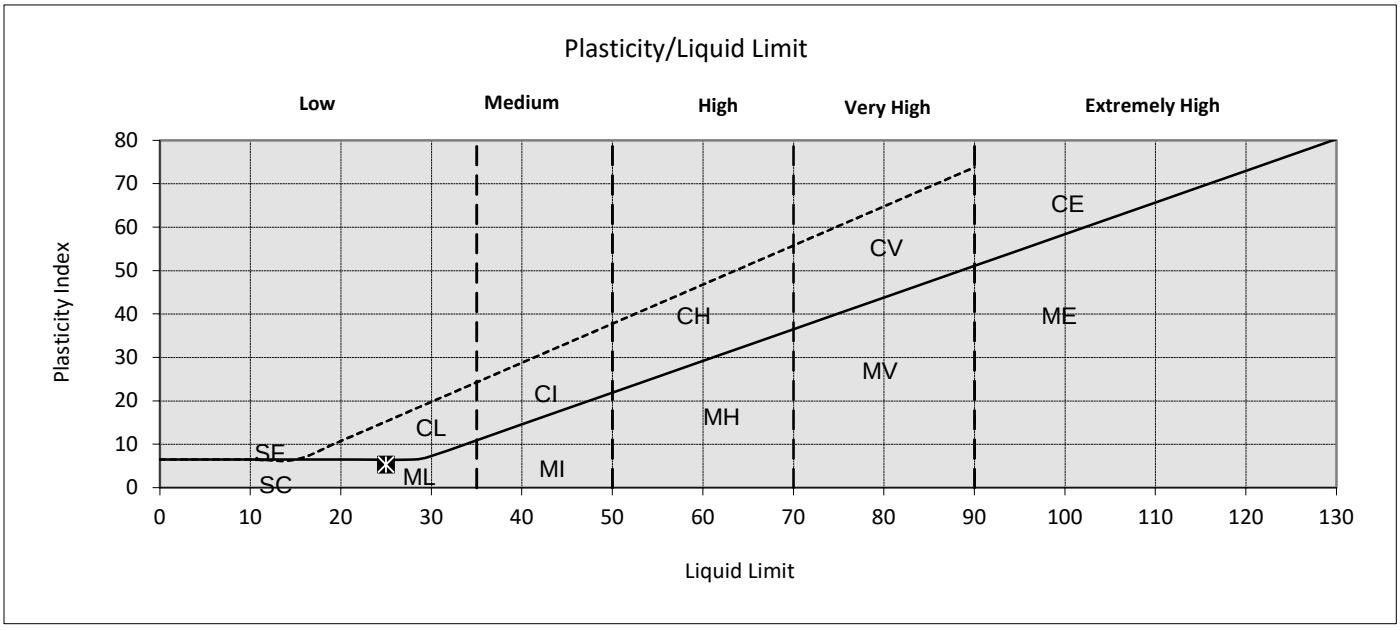
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LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

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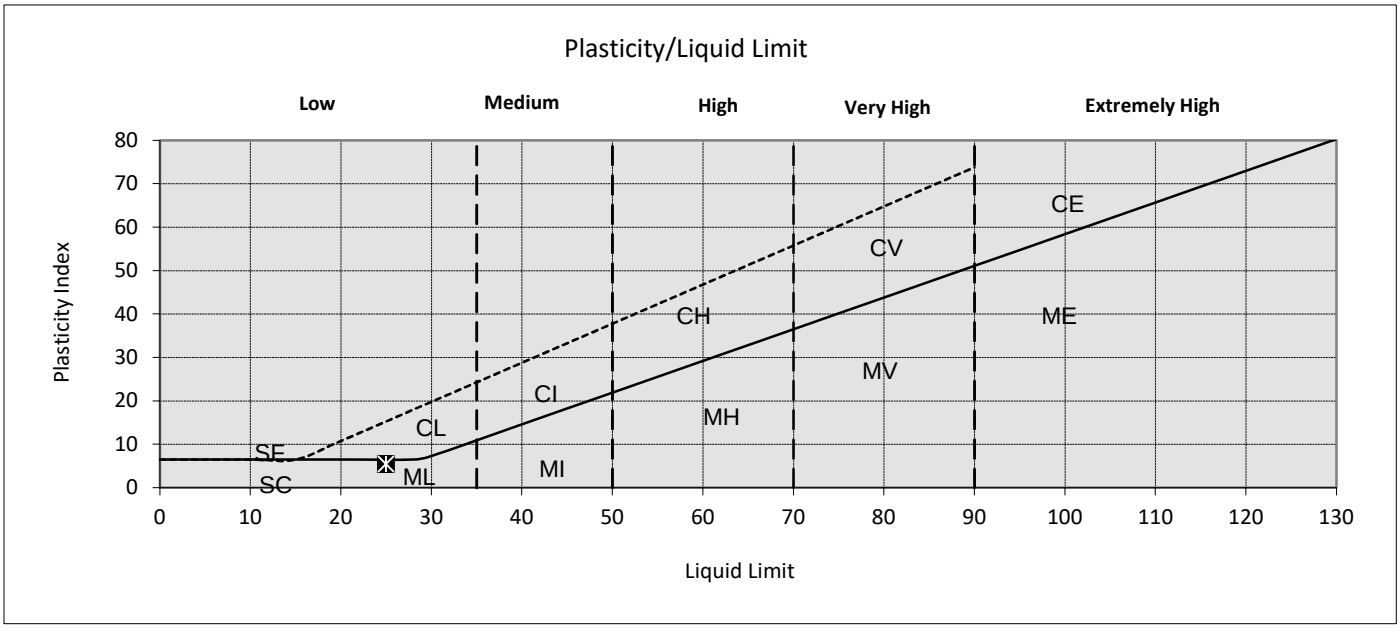
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LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

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

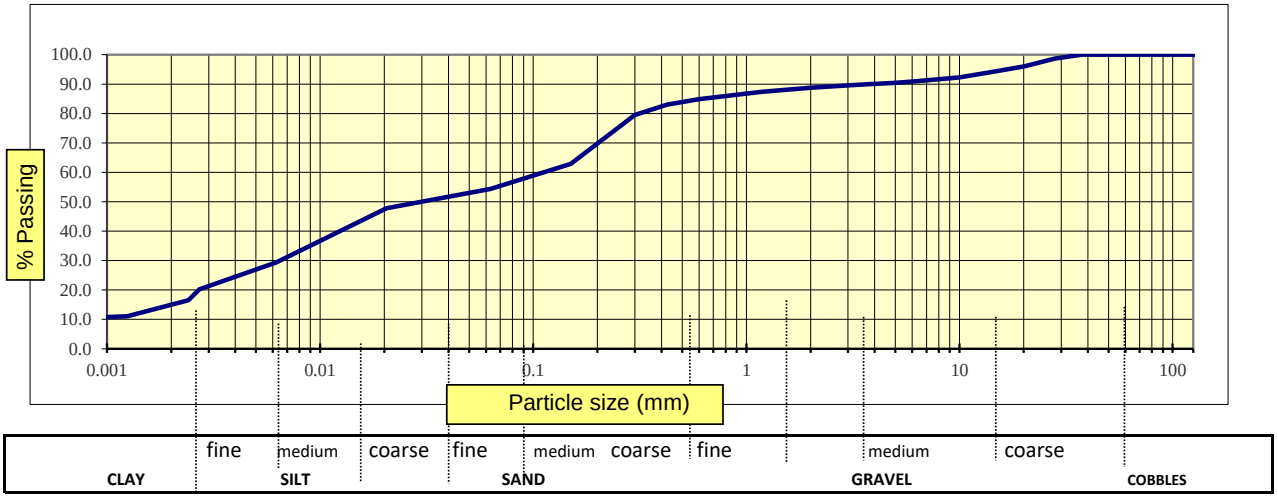
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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

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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 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

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Subcontracted to a laboratory UKAS accredited for this testing

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LABORATORY TEST REPORT

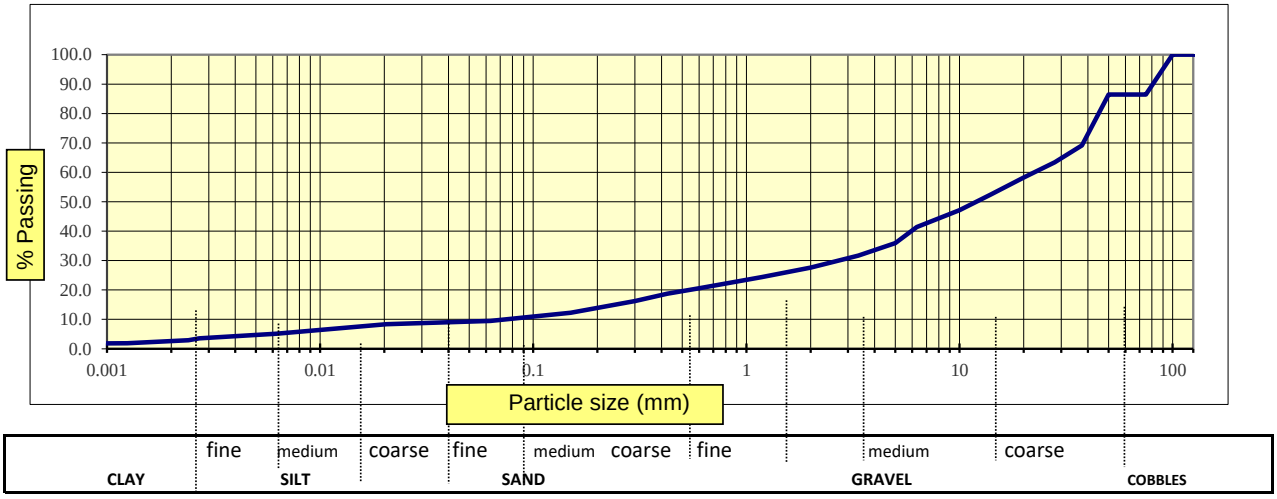
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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	



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 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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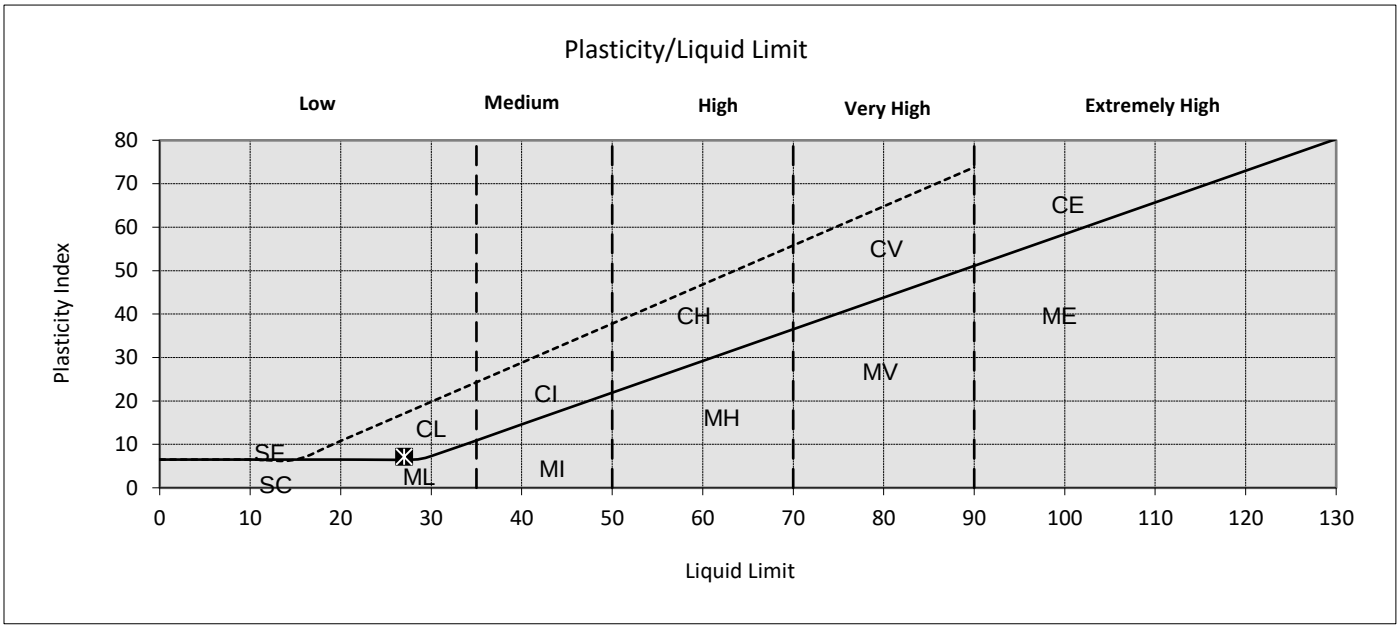
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Warrington, WA1 4RF
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LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 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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Phil Thorp, Laboratory Manager

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LABORATORY TEST REPORT

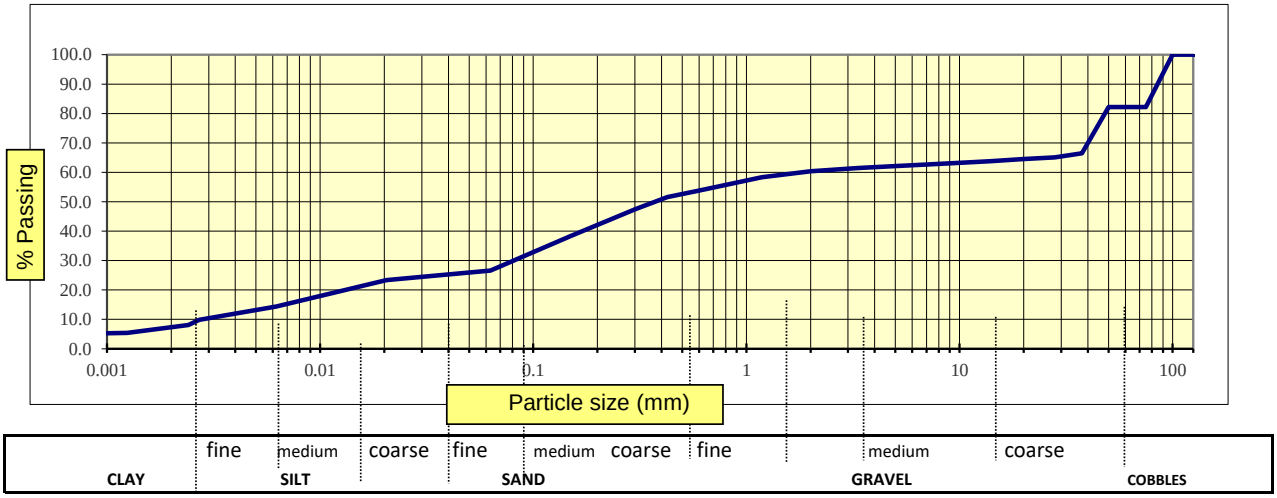
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 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

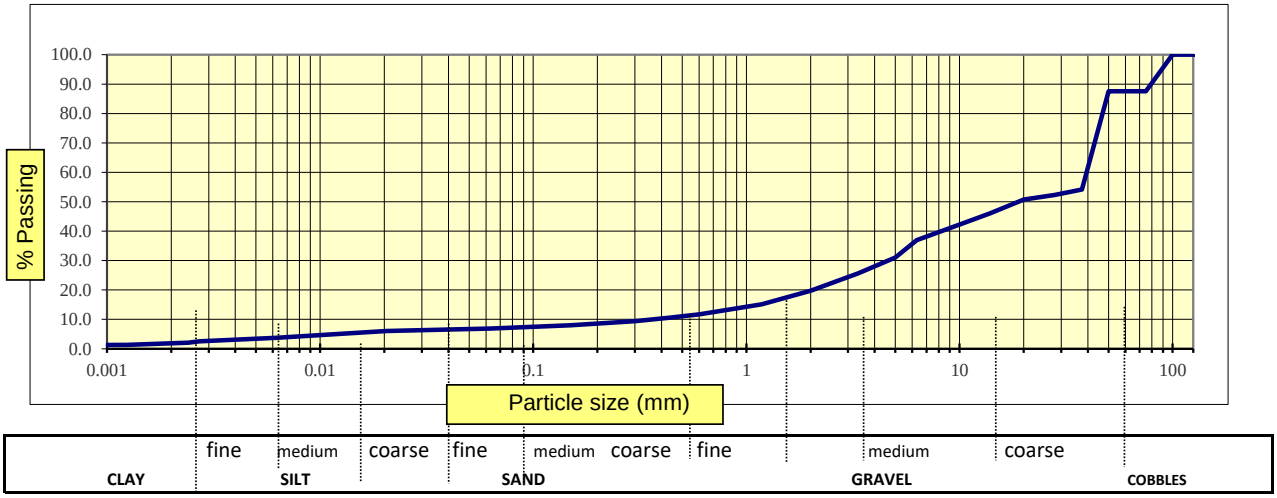
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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	



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

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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

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Subcontracted to a laboratory UKAS accredited for this testing

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LABORATORY TEST REPORT

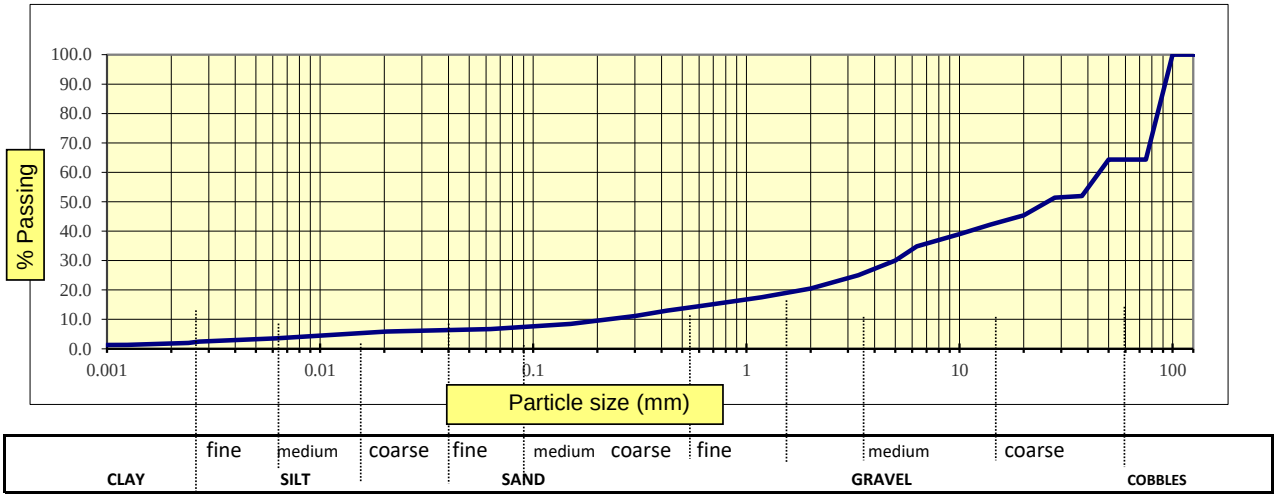
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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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Sedimentation by Hydrometer - Not UKAS

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

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

James Fisher Testing Services

LABORATORY TEST REPORT

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

Site:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 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 Fisher Testing Services (Ireland) Ltd
James Ward, Operations Manager

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

James Fisher Testing Services

LABORATORY TEST REPORT

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 Ward, Operations Manager

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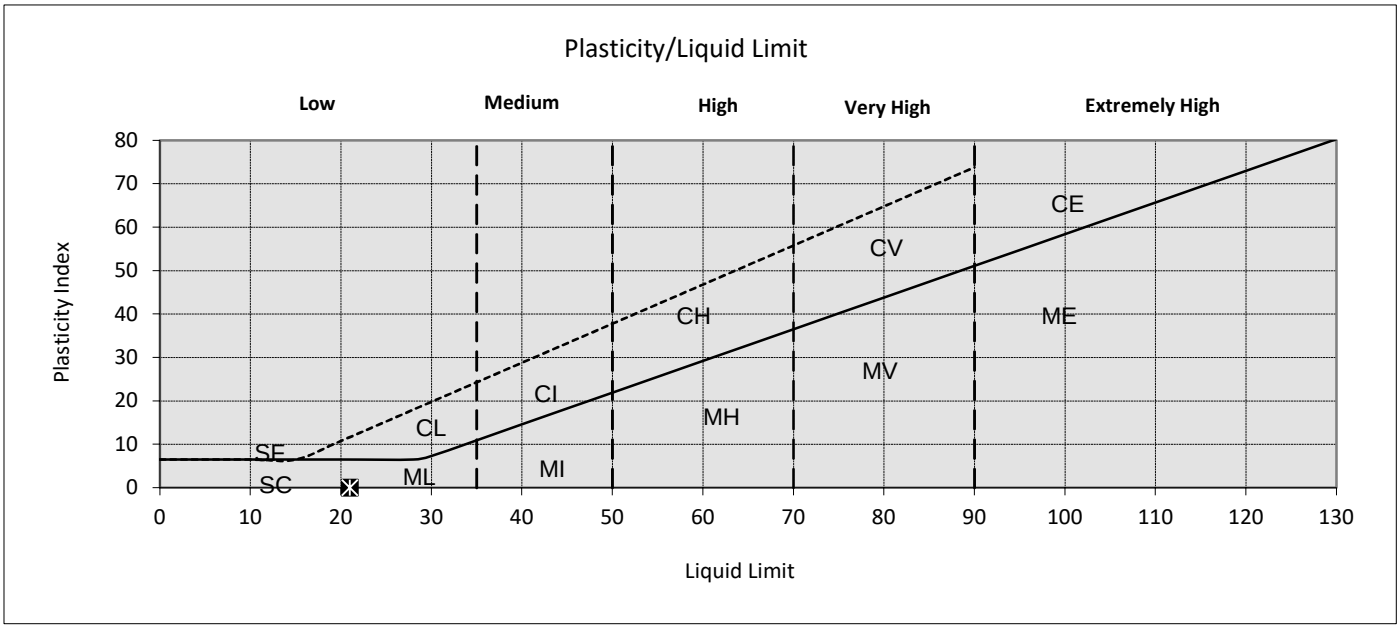
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

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

Site Ref.:	Cork Line Level Crossings	**Job No.:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 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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James Fisher Testing Services Ltd
Phil Thorp, Laboratory Manager

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LABORATORY TEST REPORT

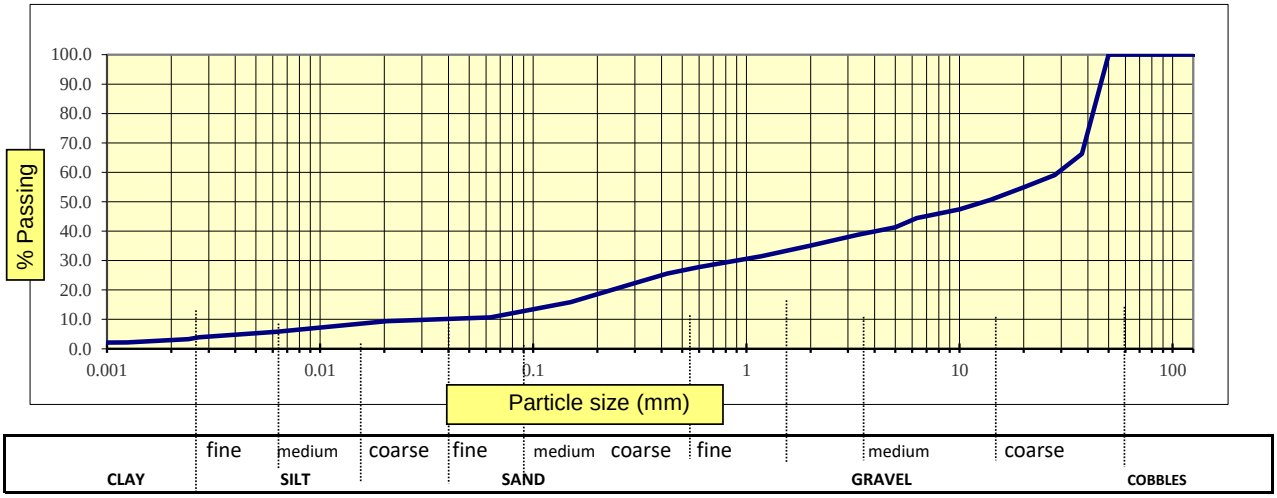
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 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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Sedimentation by Hydrometer - Not UKAS

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

INDEX PROPERTIES - SUMMARY OF RESULTS

Hole No.	Sample No.	Depth (m) from	Depth (m) to	type	Soil Description	ρ Mg/m3	ρ_d Mg/m3	w %	< 425 µm sieve %	W_L %	W_P %	I_P	ρ_s Mg/m3	Remarks
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

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Project No N9390-20

Project Name Cork Line Level Crossings

Figure
INDX

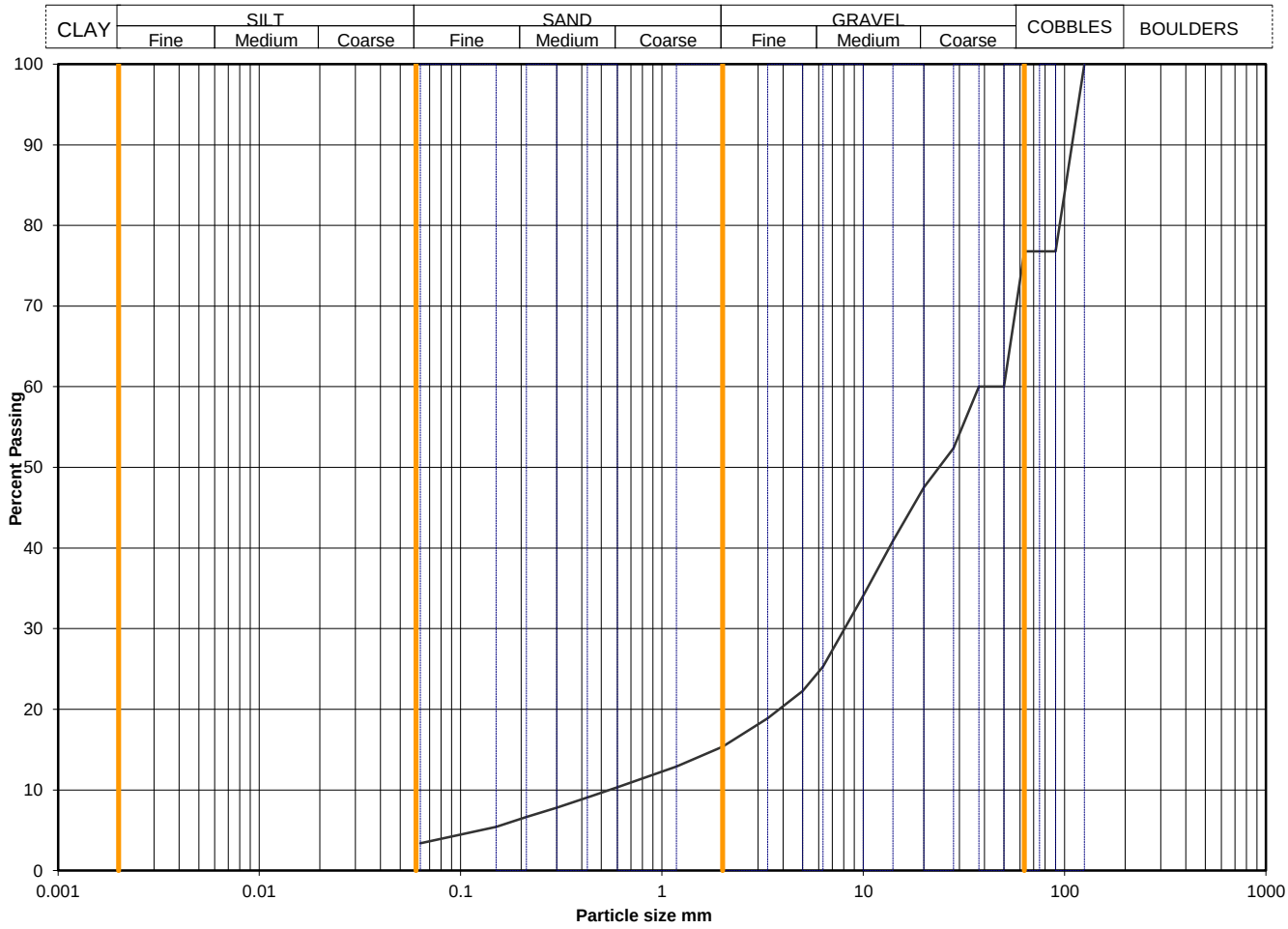
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Particle Size Distribution Analysis

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

QA Ref
SLR 2,9
Rev 2.21
Jul 17

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Project No N9390-20

Project Name Cork Line Level Crossings

Figure

PSD

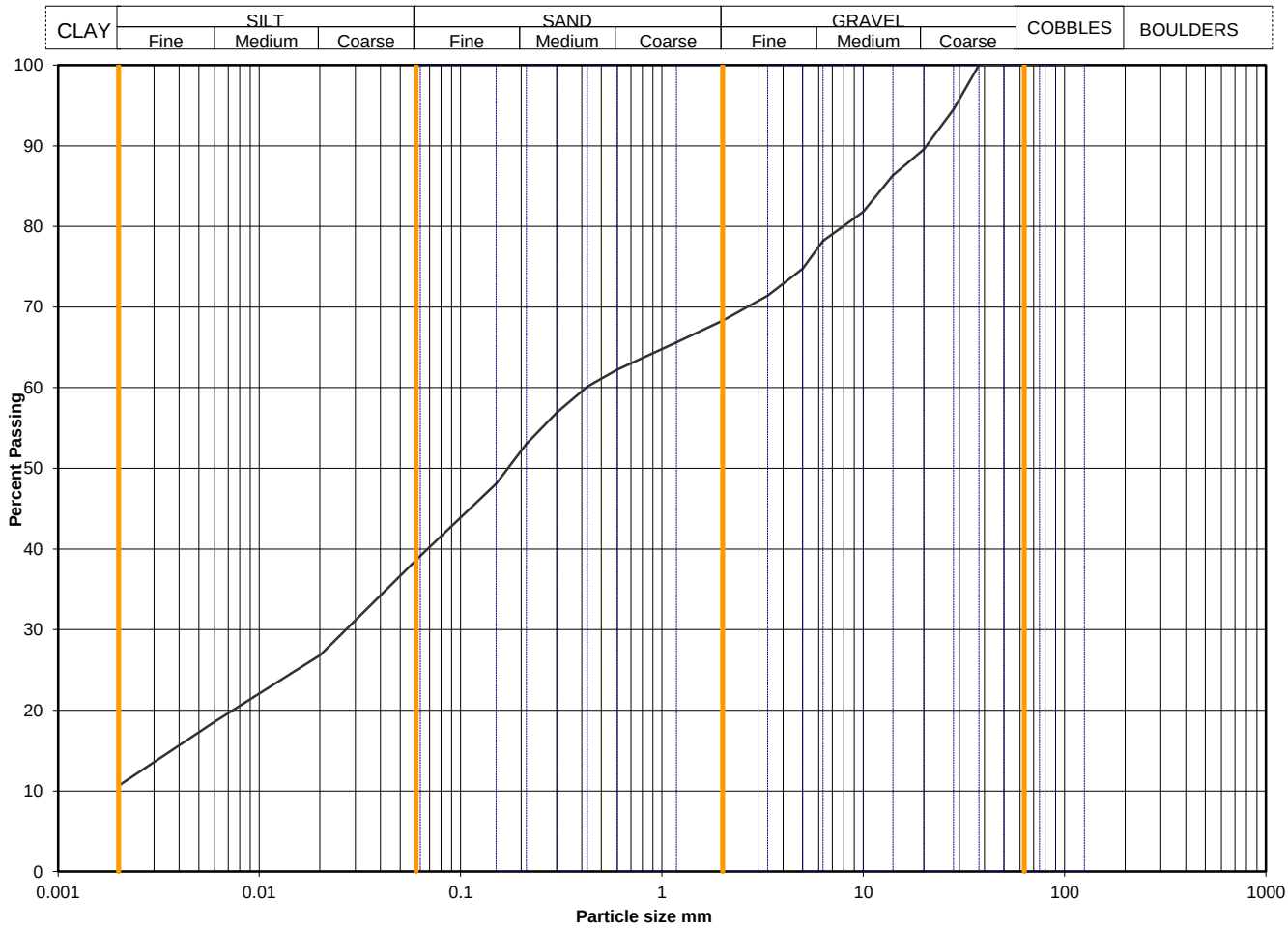
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Particle Size Distribution Analysis

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

QA Ref
SLR 2,9
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Jul 17

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Project No N9390-20

Project Name Cork Line Level Crossings

Figure

PSD

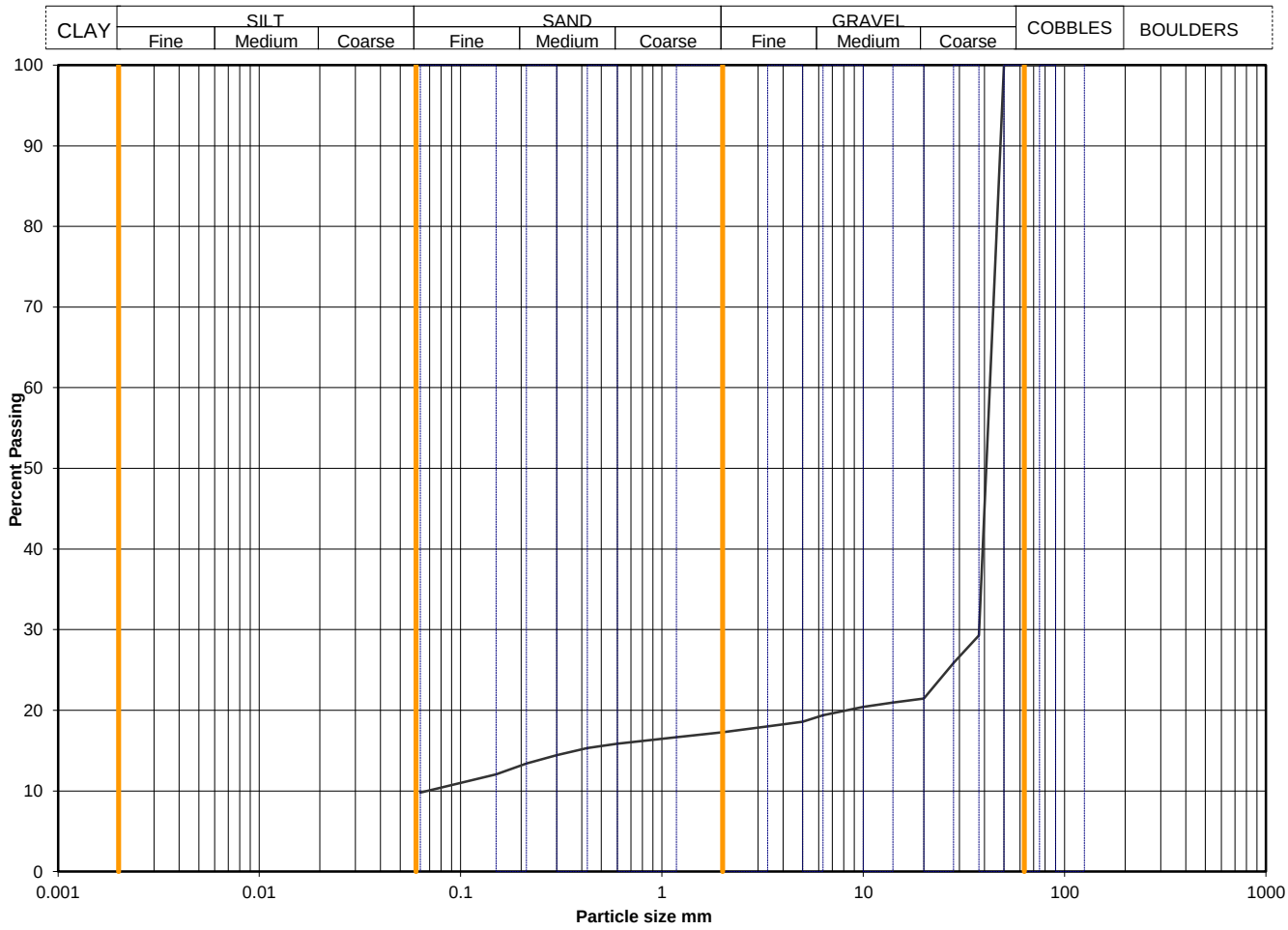
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Particle Size Distribution Analysis

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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Project No N9390-20

Project Name Cork Line Level Crossings

Figure

PSD

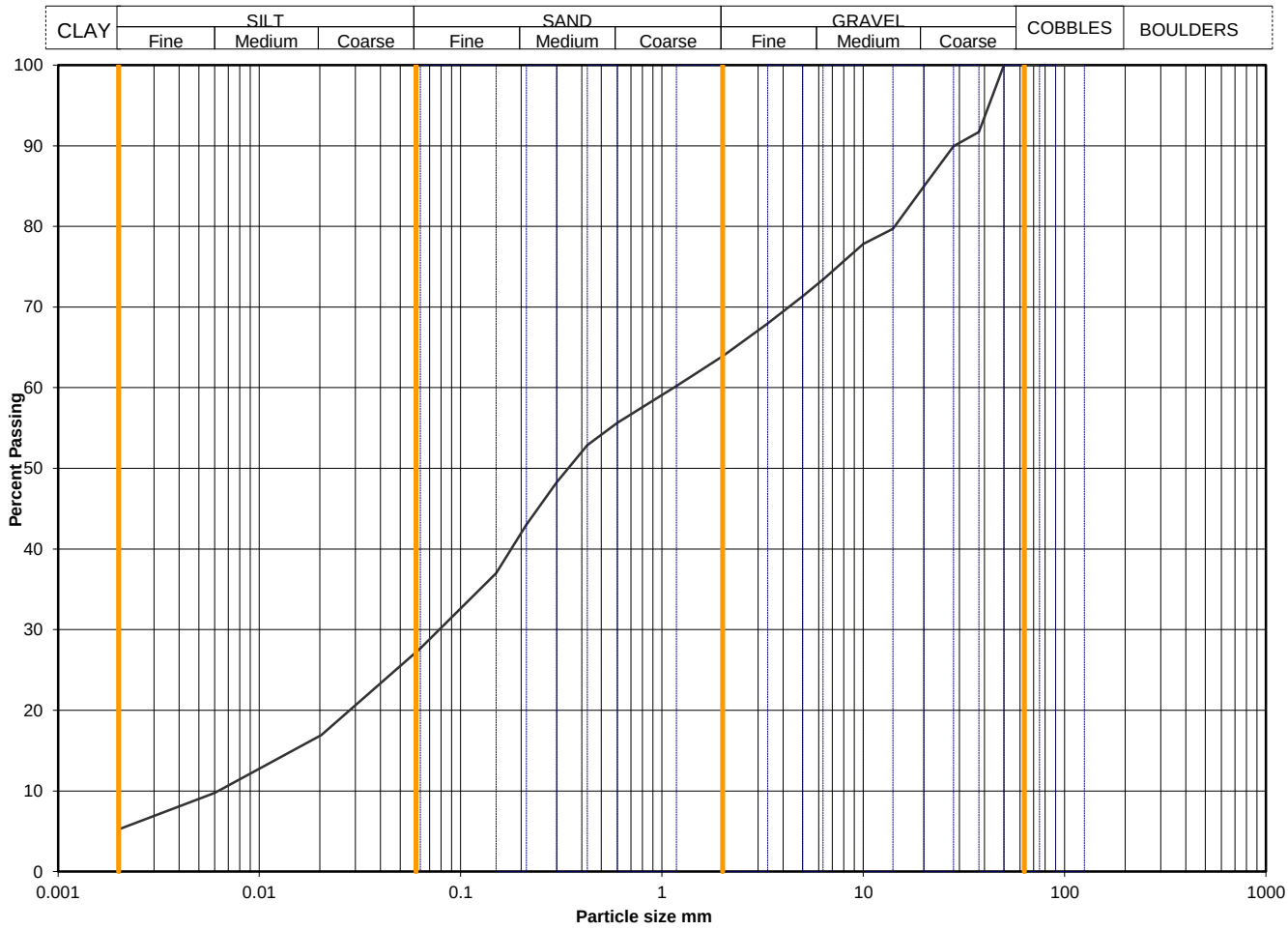
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Particle Size Distribution Analysis

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

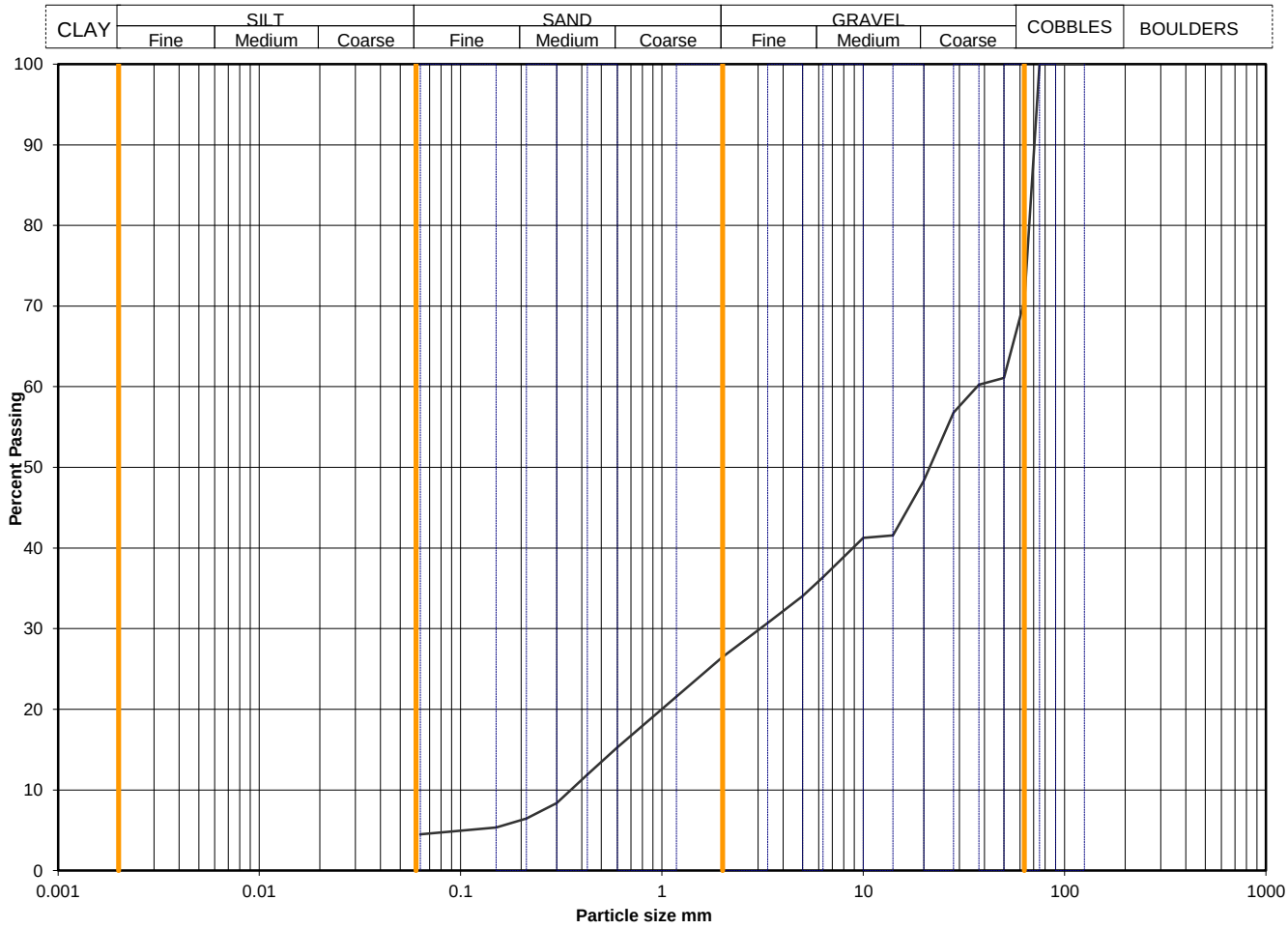
Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

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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

QA Ref
SLR 2,9
Rev 2.21
Jul 17

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Project No N9390-20

Project Name Cork Line Level Crossings

Figure

PSD

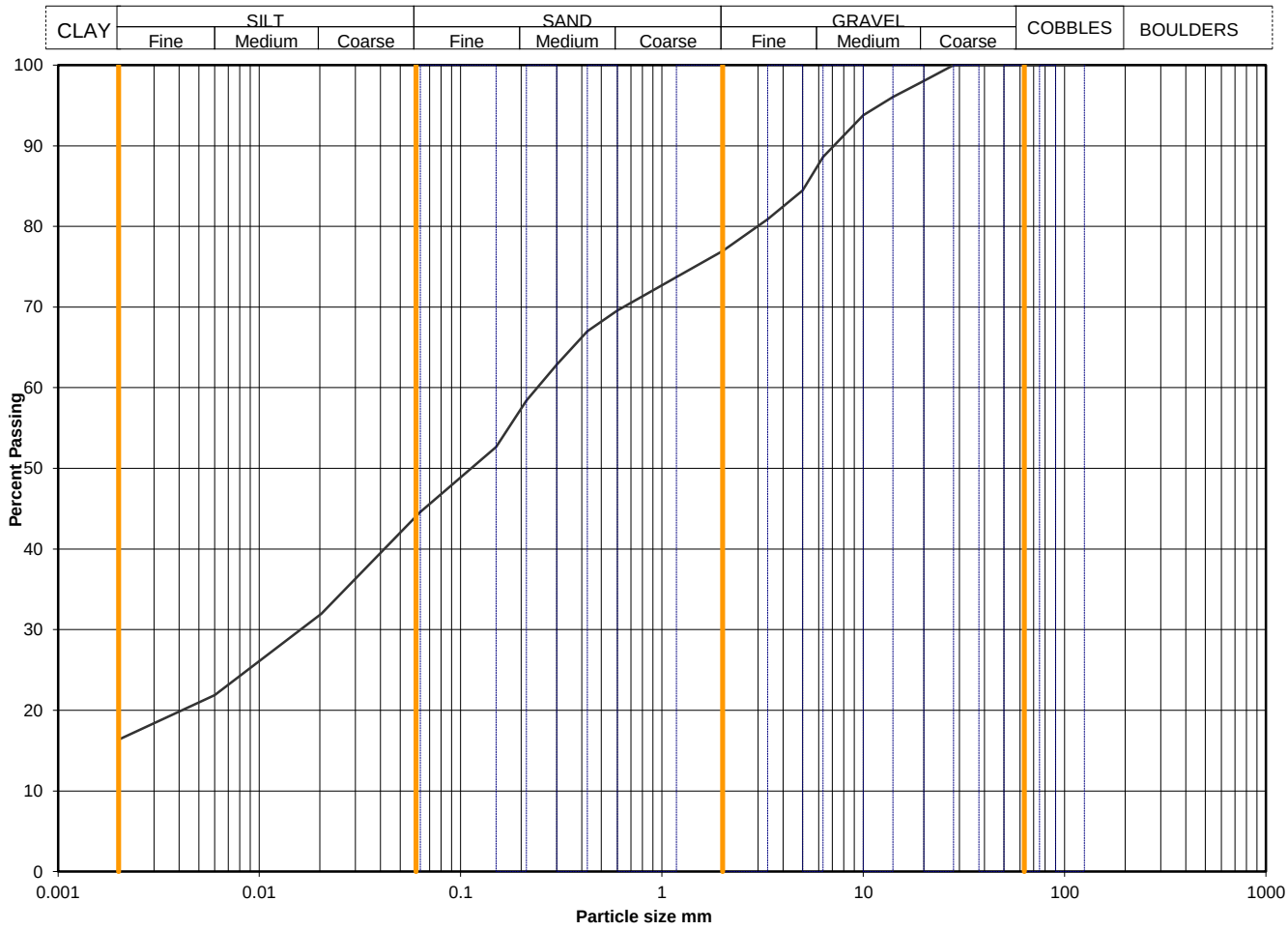
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Particle Size Distribution Analysis

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

QA Ref
SLR 2,9
Rev 2.21
Jul 17

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Project No N9390-20

Project Name Cork Line Level Crossings

Figure

PSD

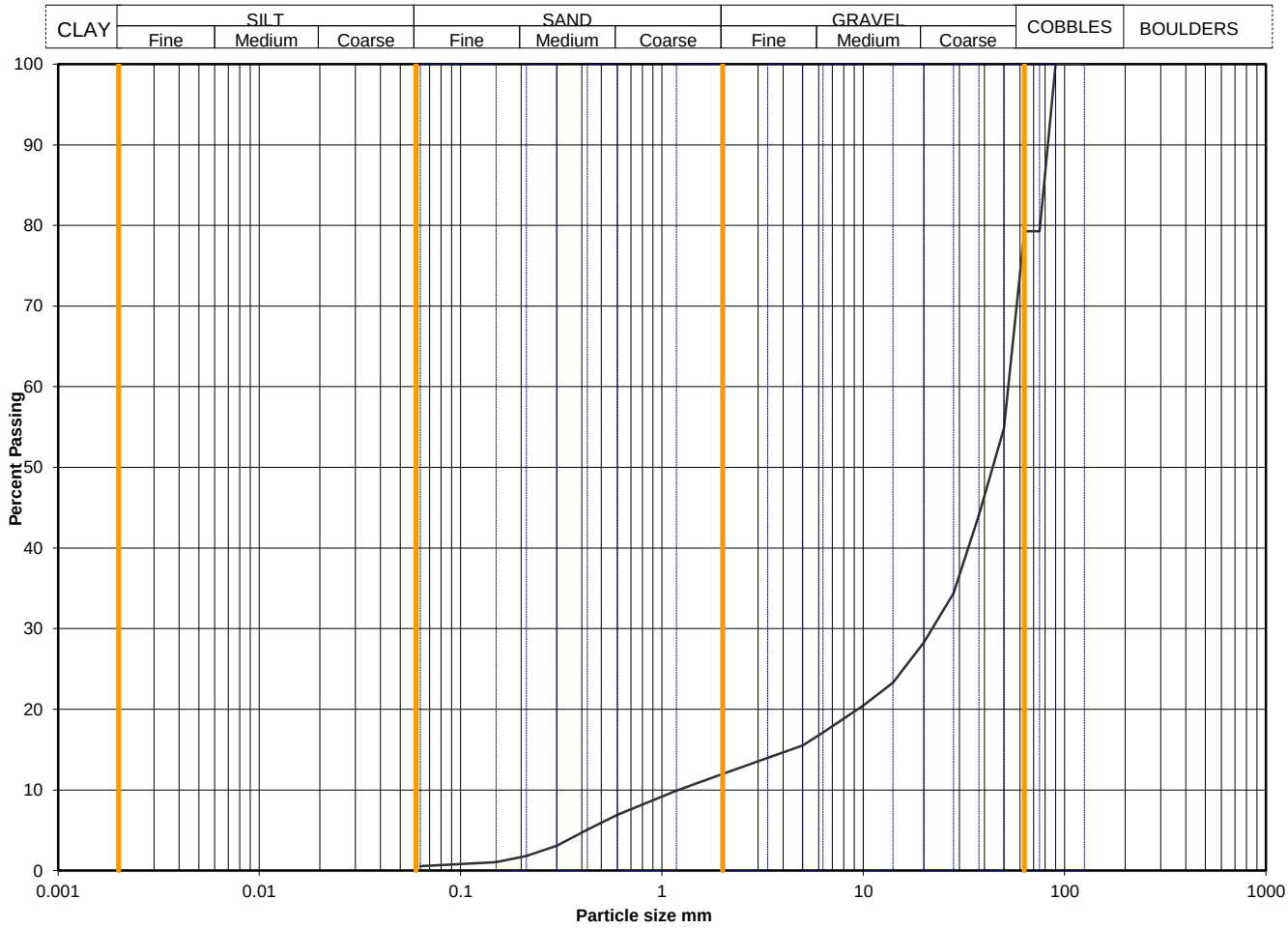
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Particle Size Distribution Analysis

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

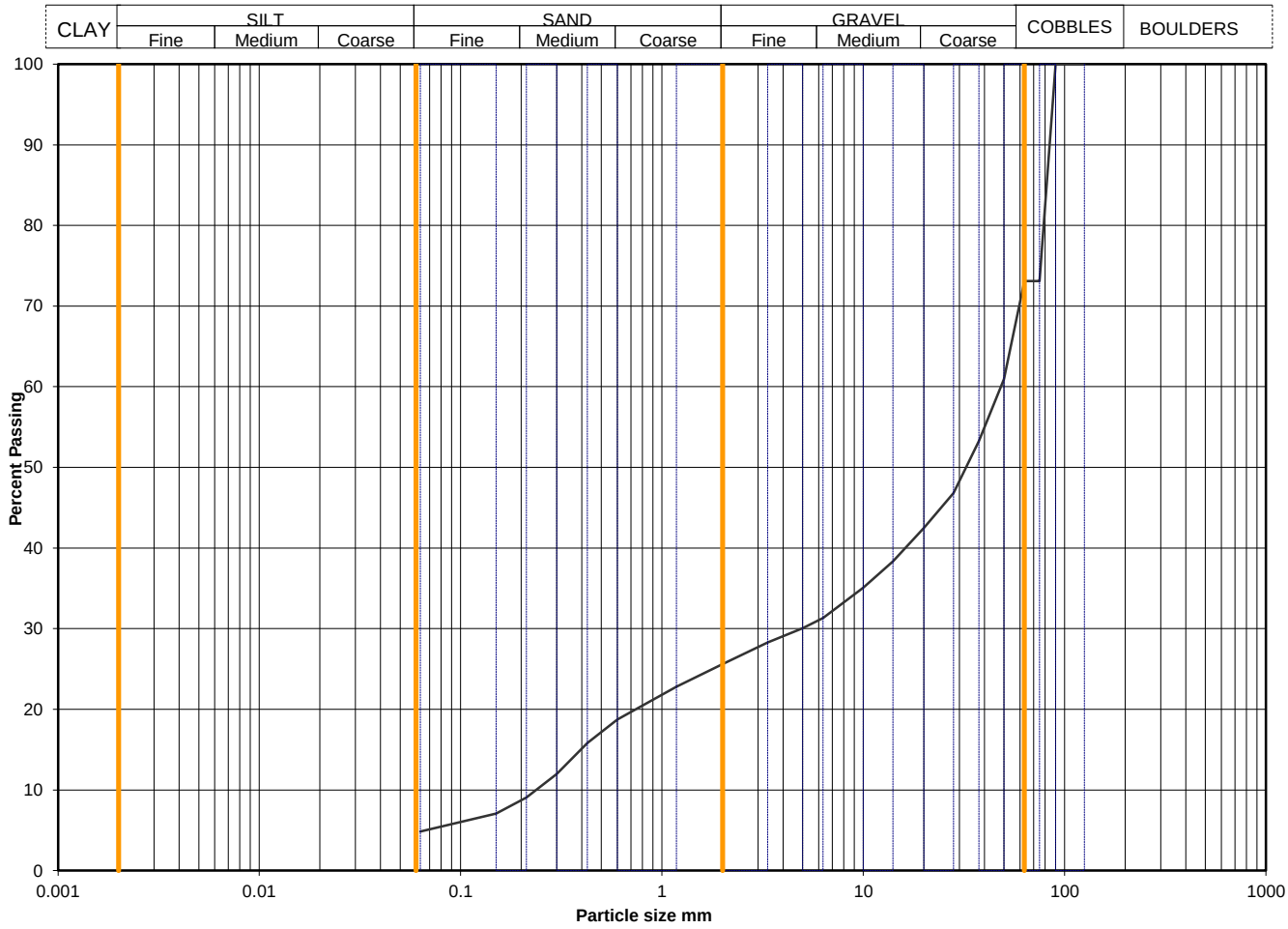
Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

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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

QA Ref
SLR 2,9
Rev 2.21
Jul 17

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Project No N9390-20

Project Name Cork Line Level Crossings

Figure

PSD

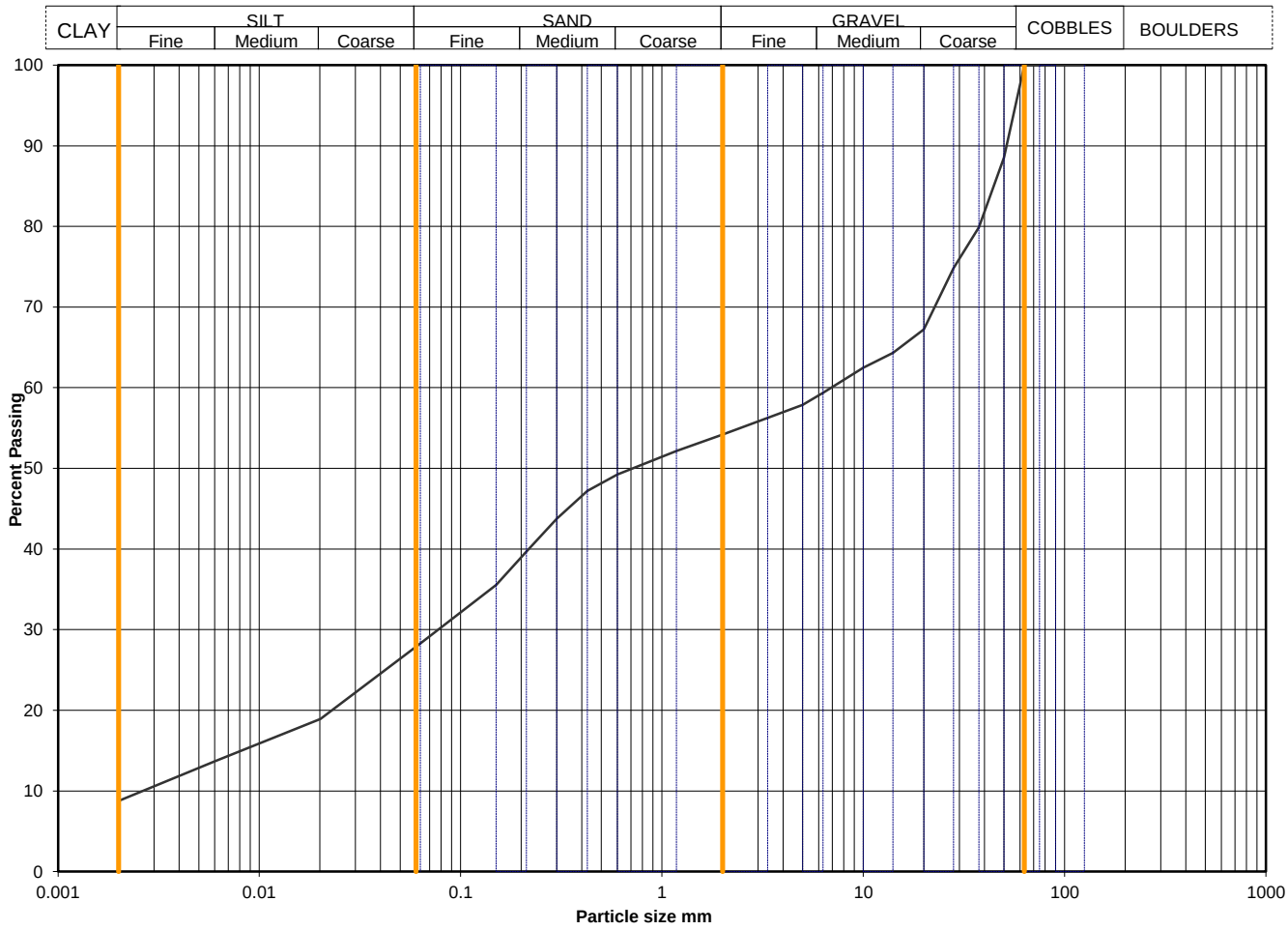
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Particle Size Distribution Analysis

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

QA Ref
SLR 2,9
Rev 2.21
Jul 17

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Project No N9390-20

Project Name Cork Line Level Crossings

Figure

PSD

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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			

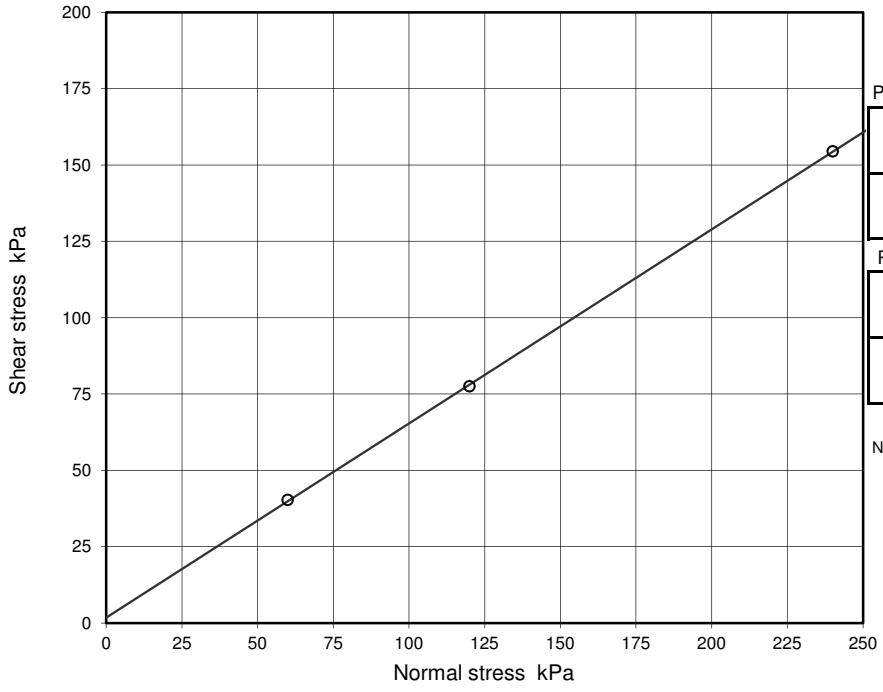
Soil Description	Brown SAND.
Specimen Type /Preparation	-2mm material. Recompacted to 2Mg/m3 at as received moisture content.

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	-	-

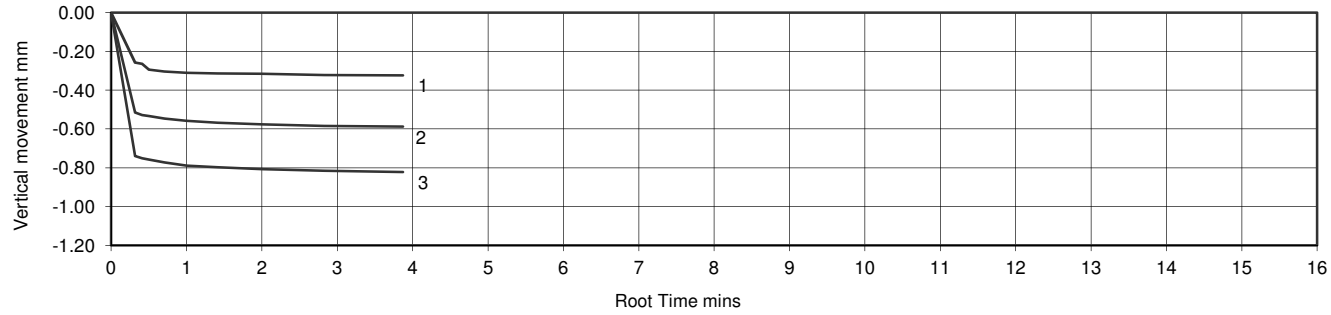
Notes :

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

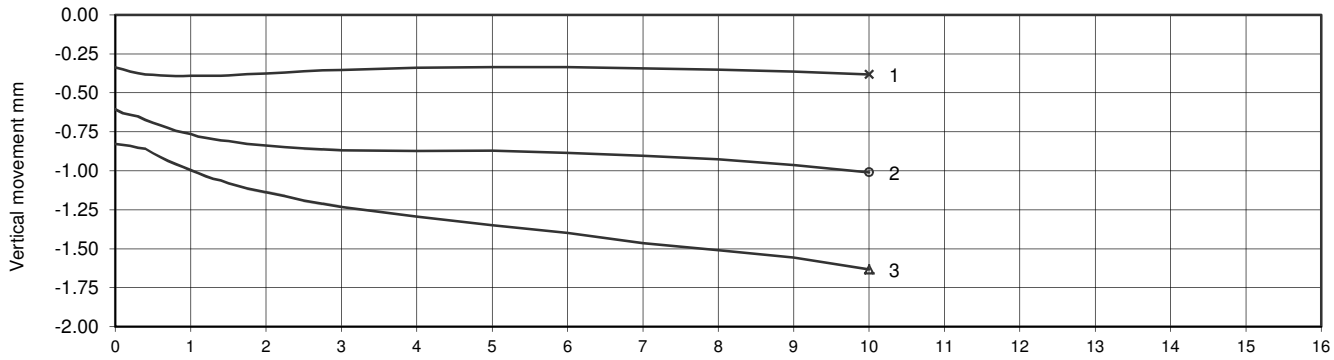
Determination of shear strength by direct shear (Small shearbox apparatus)
(BS1377 : Part 7 : clause 4 : 1990)

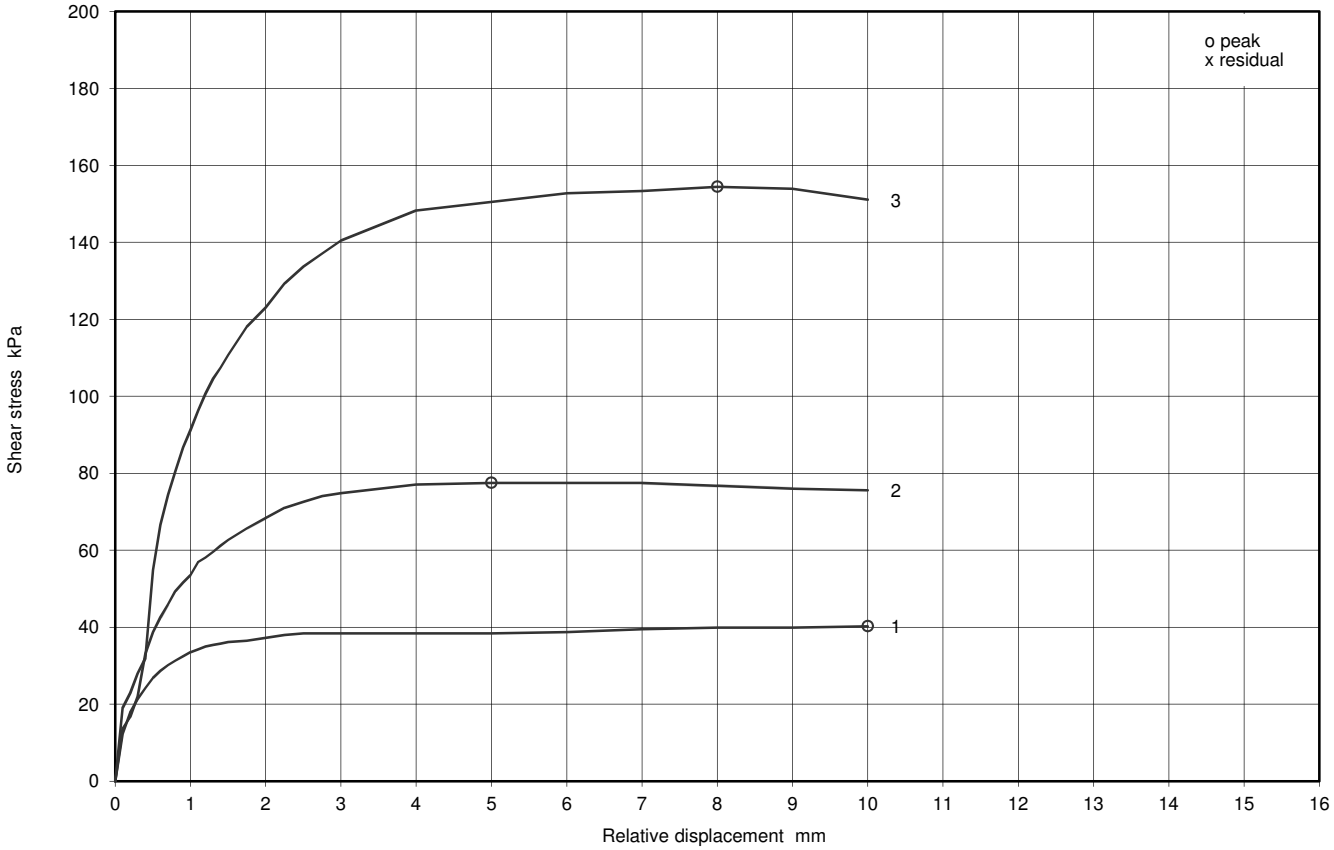
Project No	N9390-20	Sample Details:	Hole No.	XC215-CP01		
Project Name	Cork Line Level Crossings		Depth (m BGL)	1.20 - 2.00		
			Sample No	5	Type	B
			ID			
			Spec Ref			

Consolidation stage(s)



Shearing stage(s)





Ref			Figure
SLR7.4 Rev 86.0 Feb18	SOCOTEC UKAS TESTING 0001	Printed:19/08/2020 14:26	**SSB** sheet 2 of 2

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

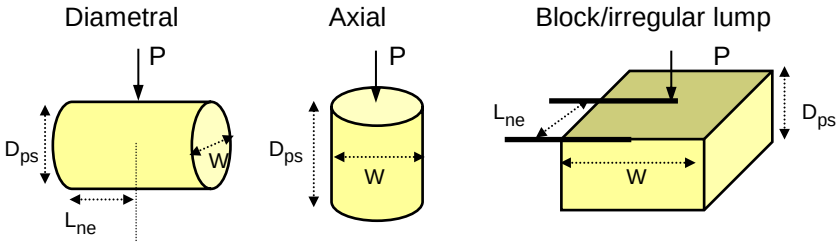
End of Report

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

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Project No N9435-20
Project Name Cork Line Level Crossings

Figure
PLT

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Appendix J Environmental Laboratory Test Results

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

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

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

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

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









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









oc bgeo	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









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









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









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









oc bgeo	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
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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.

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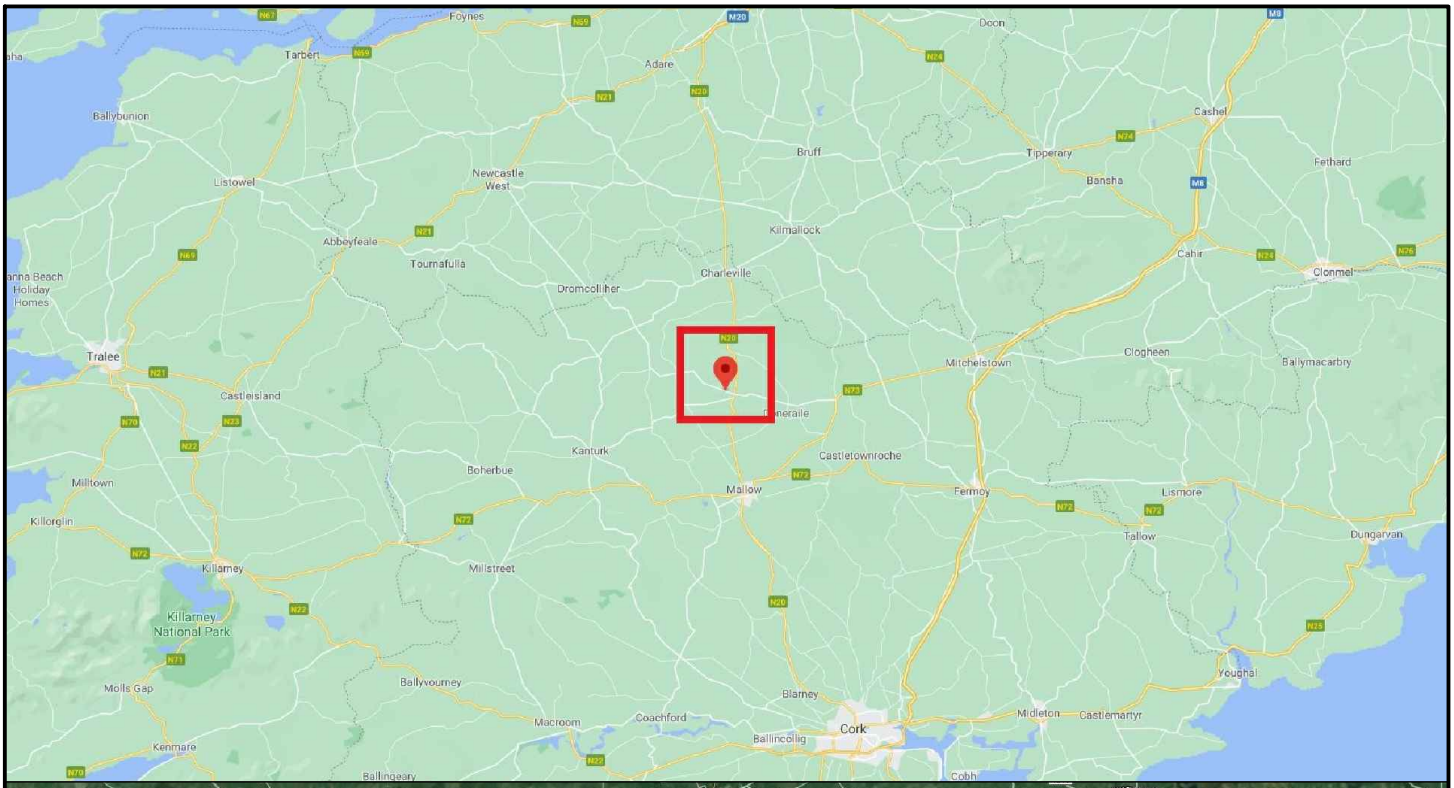
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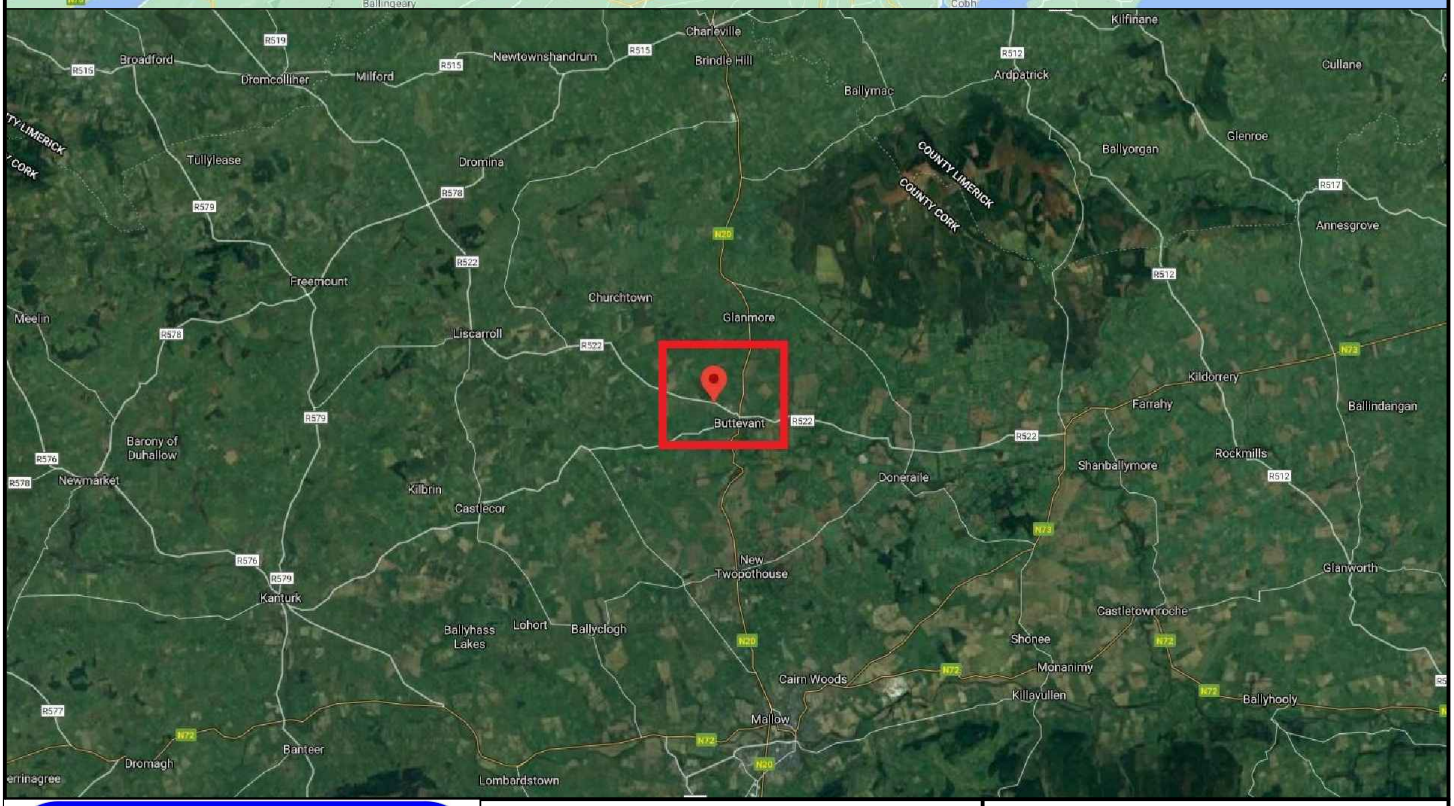
Environmental Protection Agency / Waste Classification List of Waste & Determining if Waste is Hazardous or Non-hazardous. 1st June 2015
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https://rwsenvironment.eu/subjects/soil/legislation-and/soil-remediation/

Appendix A Site and Exploratory Hole Location Plans





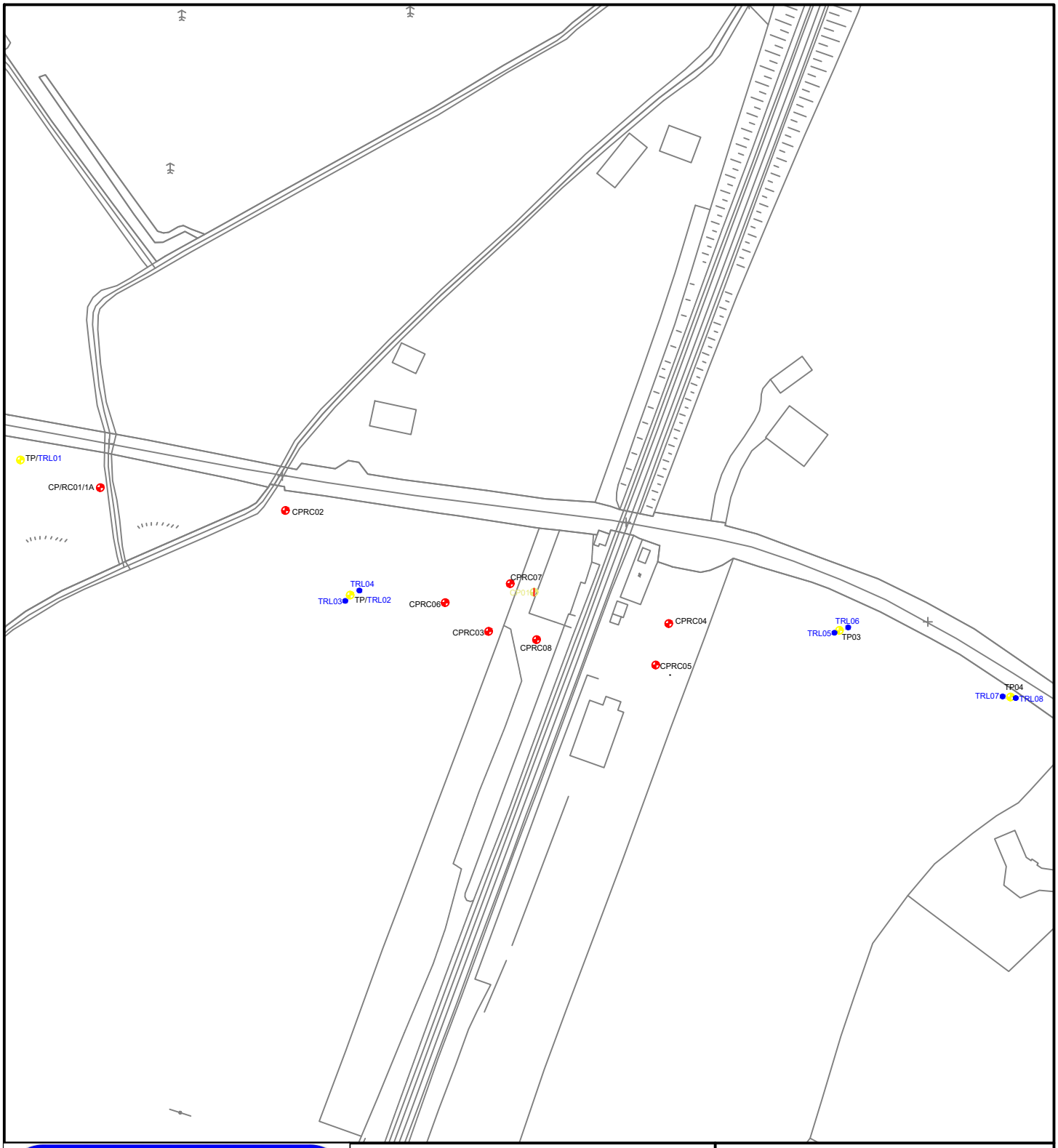
Iarnród Éireann
Cork Line Level Crossings
XC219 (19-135-5)

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	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 1
Method: Cable Percussion	609817.96 N	**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
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		
0.50 - 1.00	B3					(0.70)		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.
1.00	ES4							
1.20 - 1.70	B5				85.54	1.20		
1.20 - 1.70	D6							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 - 1.65	SPT (C) N=29			N=29 (4,5/5,7,8,9)		(0.50)		
1.70 - 2.20	B7				85.04	1.70		
1.70 - 2.20	D8					(0.50)		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.
2.00 - 2.18	SPT (C)			75 (11,25/75 for 30mm)	84.54	2.20		
2.20 - 2.45	D9					(0.38)		Yellowish / light brown slightly gravelly silty very sandy CLAY. Sand is fine to coarse. Gravel is fine to medium, subangular.
					84.16	2.58		End of borehole at 2.580m

Water | Backfill

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	Water	Backfill
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
									Open Hole Boring, See XC219-CPRC01 for overburden details.
							(7.50)		
							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. Discontinuities: -Mostly non-intact -Subhorizontal, undulating, smooth.
	55	44	21	NI			(1.50)		
9.50 - 9.50					50 (25 for 0mm/50 for 0mm)				
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 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:** 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 6.90	1.10	20 20	0.75 5.90

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

Chiselling Details		
From (m)	To (m)	Time (hh:mm)
3.20 3.30	3.30 3.40	01:00 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.		
	80	25	25	NI	79.96	5.76		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) 0.20		MADE GROUND: Granular fill material. Clause 804 angular gravel		
0.00 - 1.20	D5							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							
5.25			2		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.		
	99 97 97					(2.50)				
6.70			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.		
	89 86 86					(1.55)				
8.25					80.20	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	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

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 10.0

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 609791.07 N	**Client:** Iarnród Éireann / Irish Rail	Sheet 2 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)	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	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	Water	Backfill
						84.70	(0.30) 0.30		Hand Dug Inspection Pit to 1.2m. Driller describes: TOPSOIL		
							(0.90)		Hand Dug Inspection Pit to 1.2m. Driller describes: Sand and Gravel		
						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				
6.80							(0.85)				
	100	67	50	8		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.		
8.30							(2.80)				
	70	63	63	3					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.		
9.80						75.20	9.80				
	TCR	SCR	RQD	FI					Continued on Next Page		

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	7	0	0	NI			(3.00)		Discontinuities: Completely non-intact		
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. 2.) 60° - 75°, undulating, smooth, medium spaced.		
8.20						77.76	7.90		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:		
9.70						75.96	(0.50) 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 609800.39 N	**Client:** Iarnród Éireann / Irish Rail		Sheet 1 of 1
Method: Rotary Open+Rotary Coring	**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	NI			(4.50)				
8.40											
	90										
9.90						75.73	9.90		End of borehole at 9.900m		
	TCR	SCR	RQD	FI							

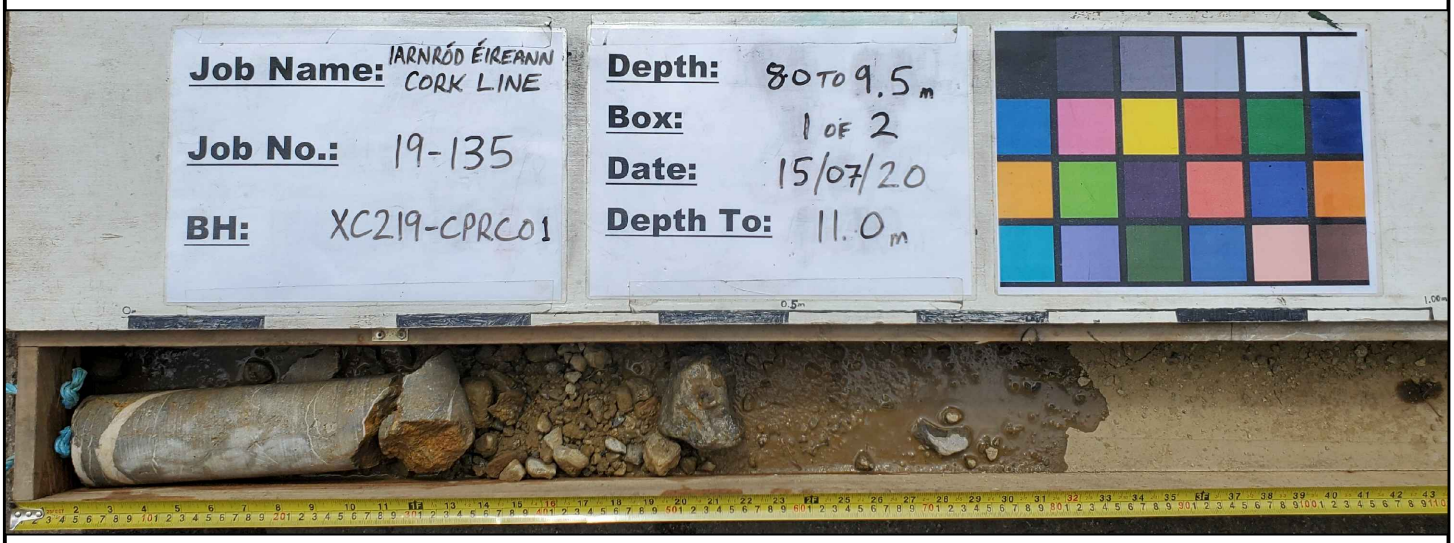
Remarks

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

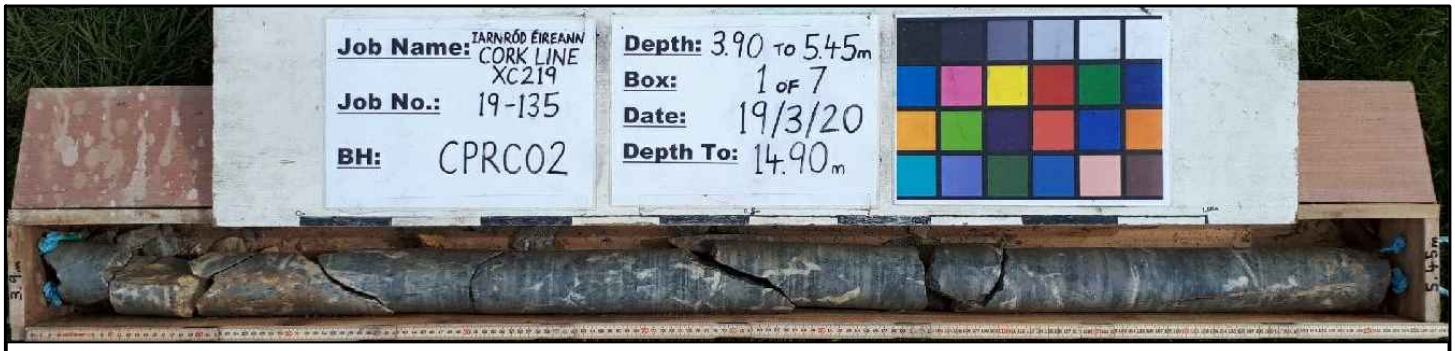




ocbgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	C.P/R.C01 Rock Core Photographs Client: Iarnród Éireann Engineer: Jacob's Date: Feb-March & Jun-Sep 2020



	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

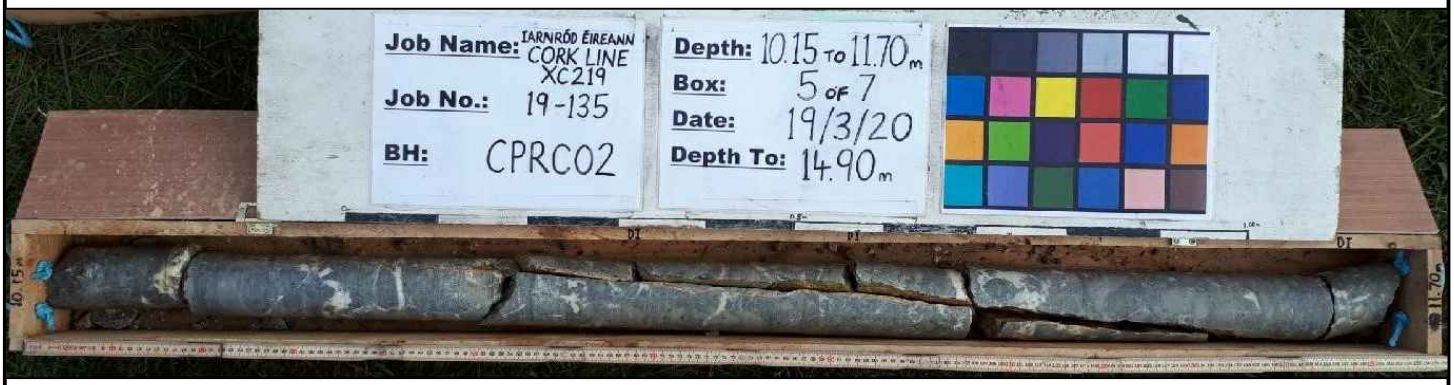


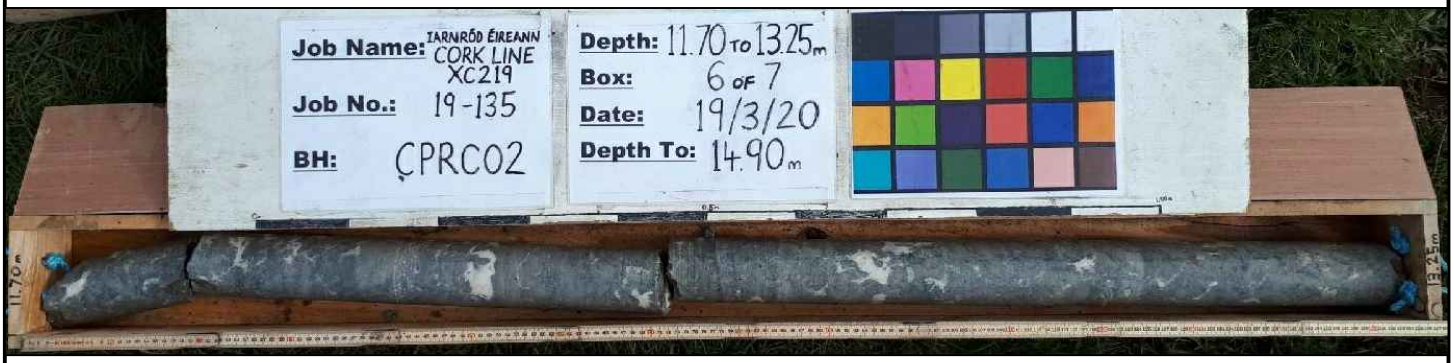






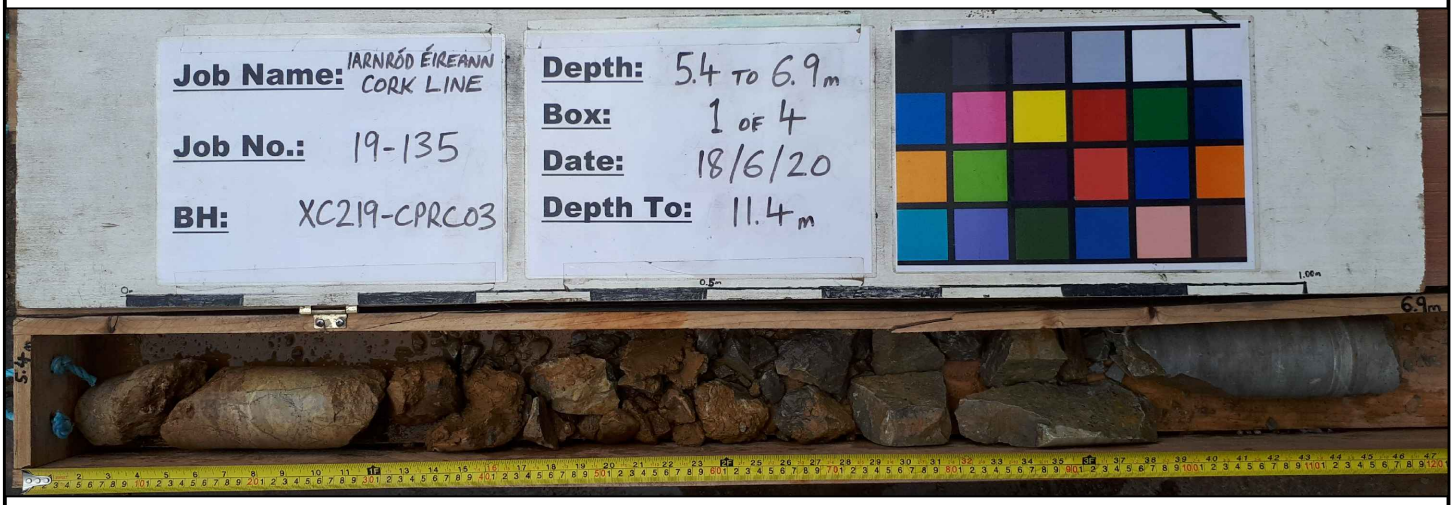
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Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	Rock Core Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: Feb-March & Jun-Sep 2020

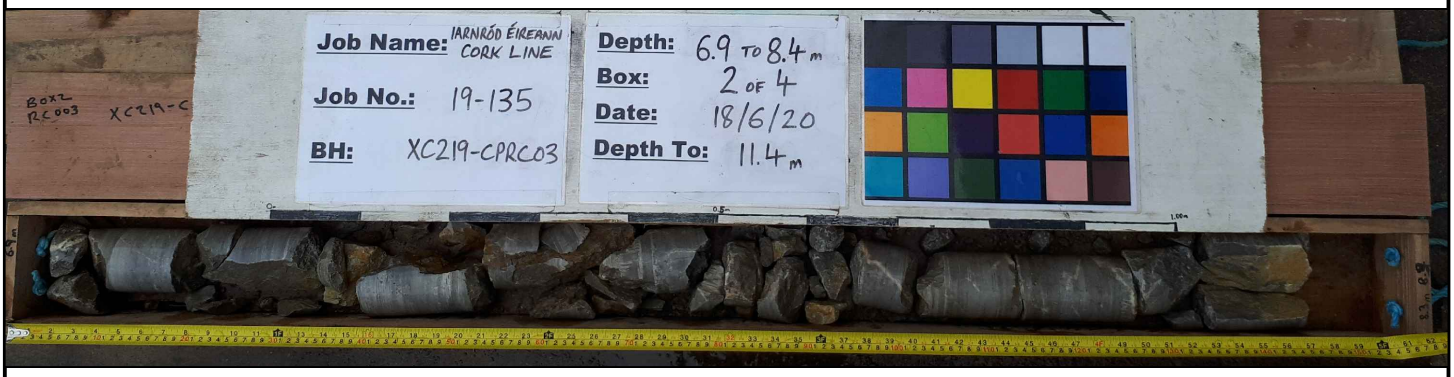




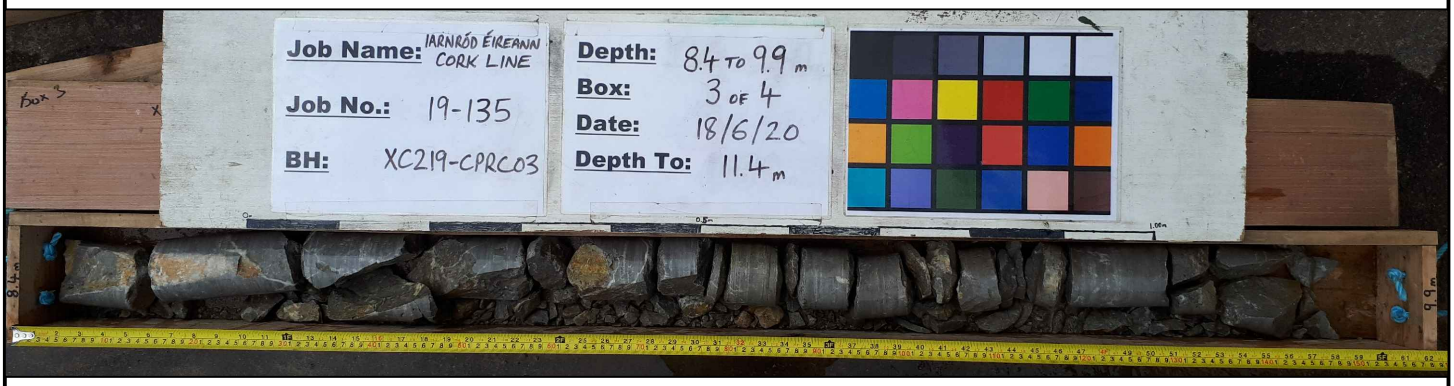


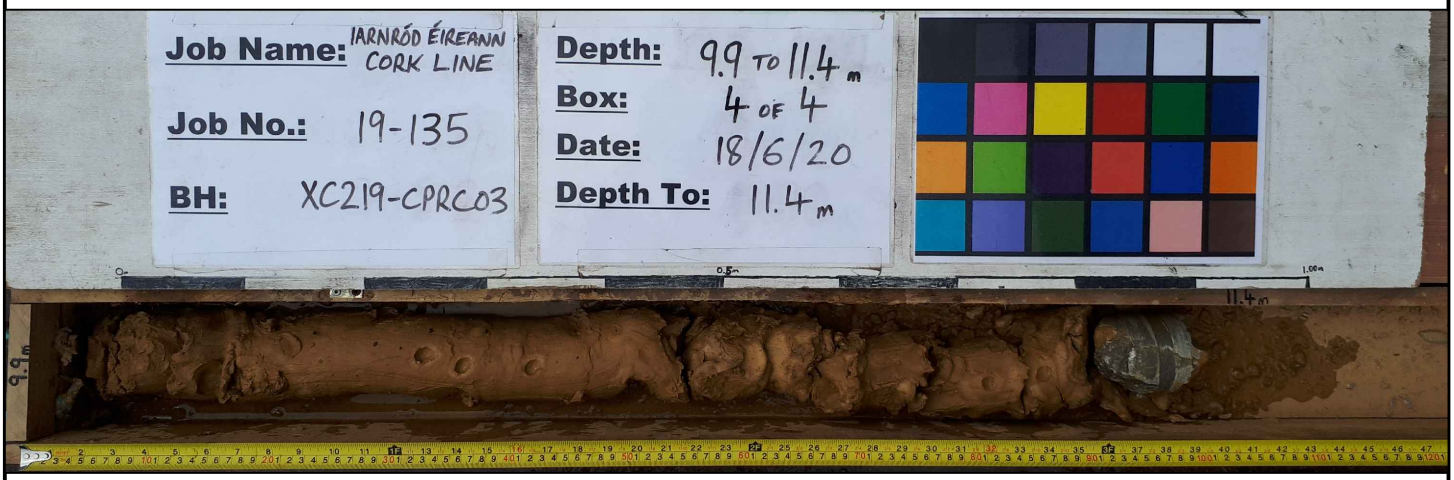
Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	C.P/R.C02 Rock Core Photographs Client: Iarnród Éireann Engineer: Jacob's Date: Feb-March & Jun-Sep 2020



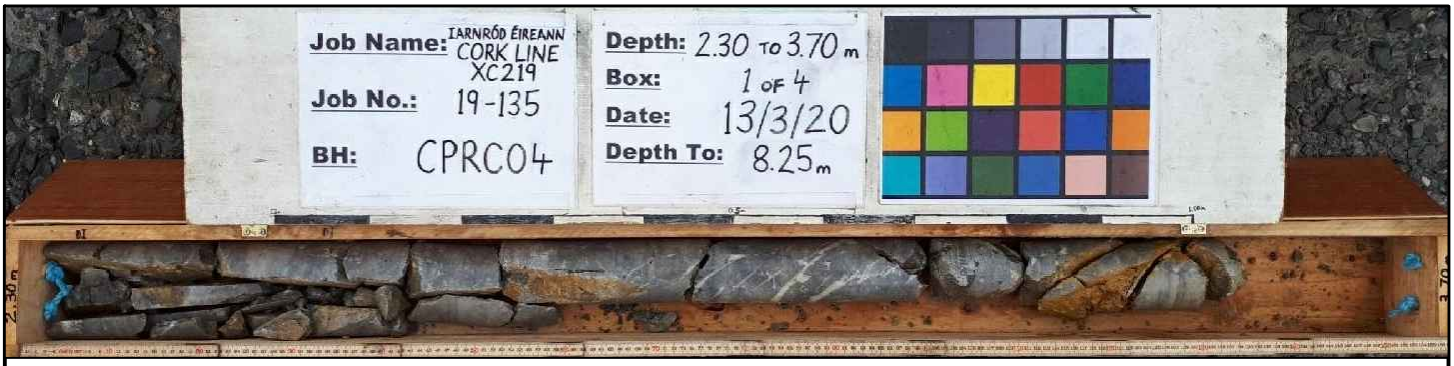


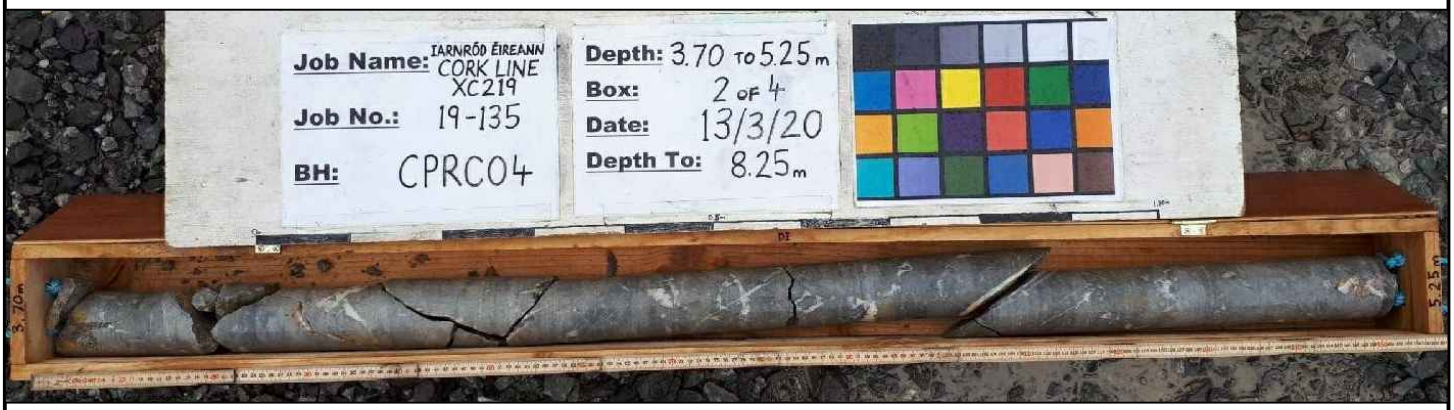
Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	C.P/R.C04 Rock Core Photographs Client: Iarnród Éireann Engineer: Jacob's Date: Feb-March & Jun-Sep 2020

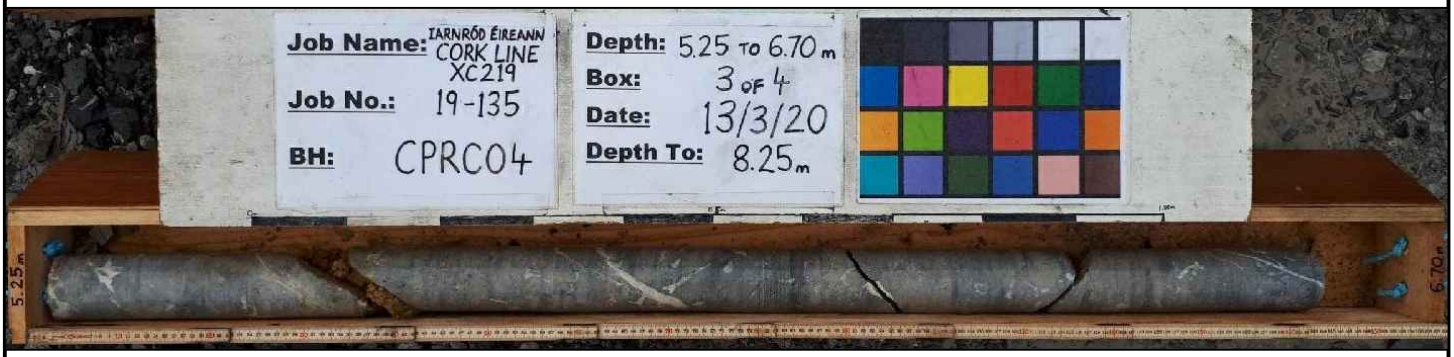


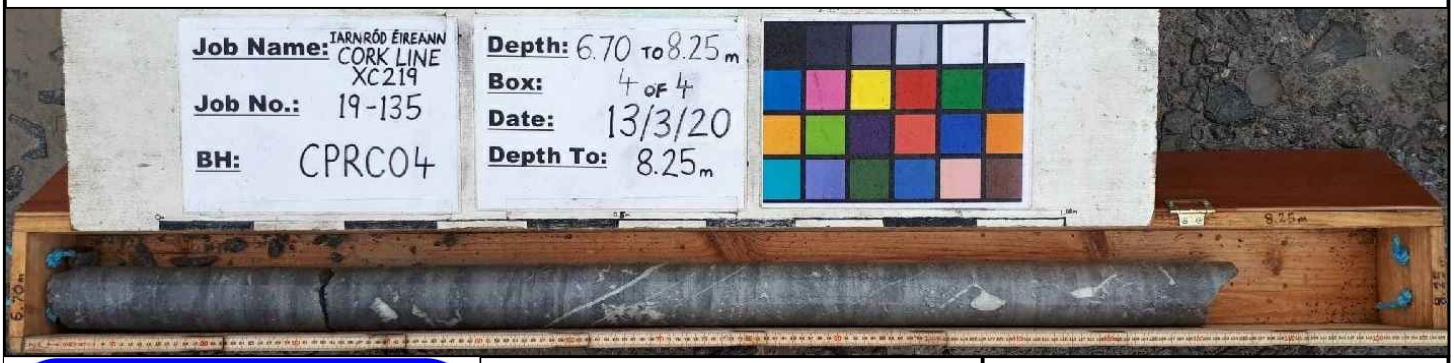


ocbgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	C.P/R.C03 Rock Core Photographs Client: Iarnród Éireann Engineer: Jacob's Date: Feb-March & Jun-Sep 2020



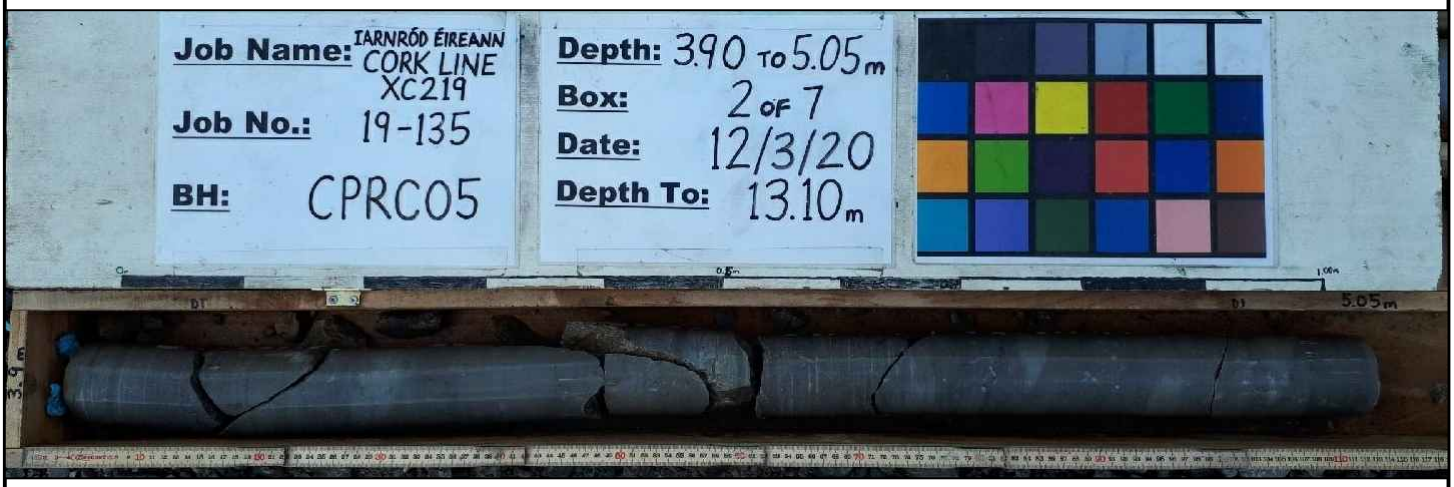


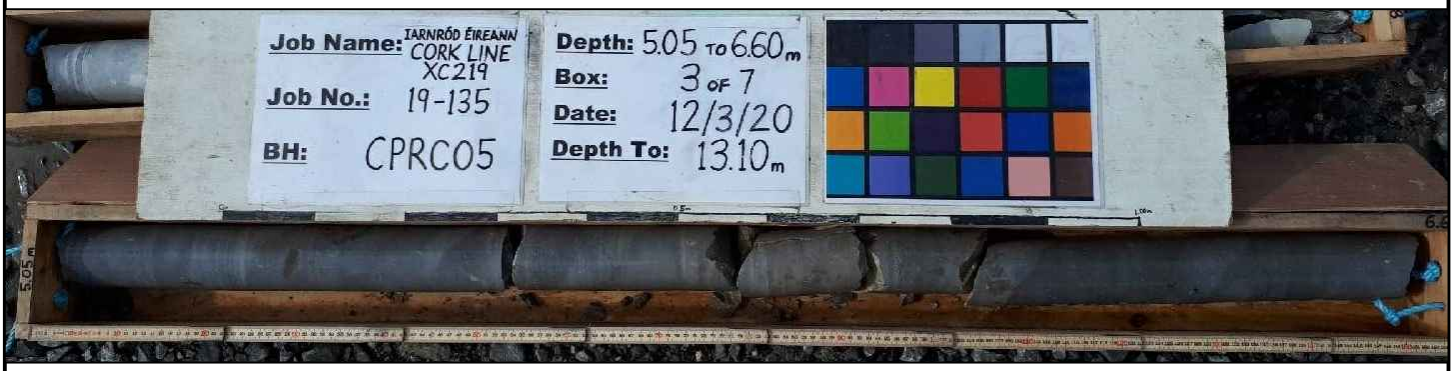




	C.P/R.C04
Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	Rock Core Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: Feb-March & Jun-Sep 2020

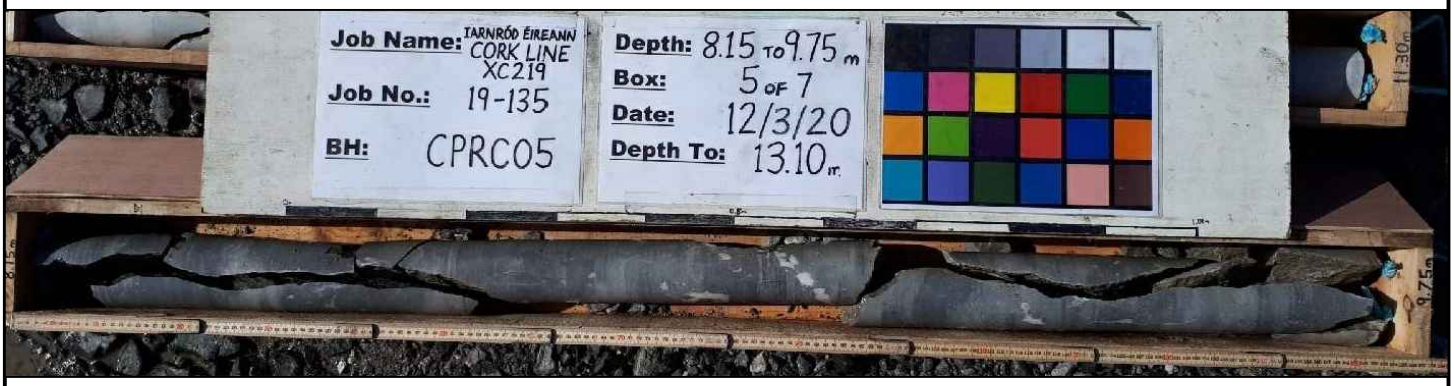


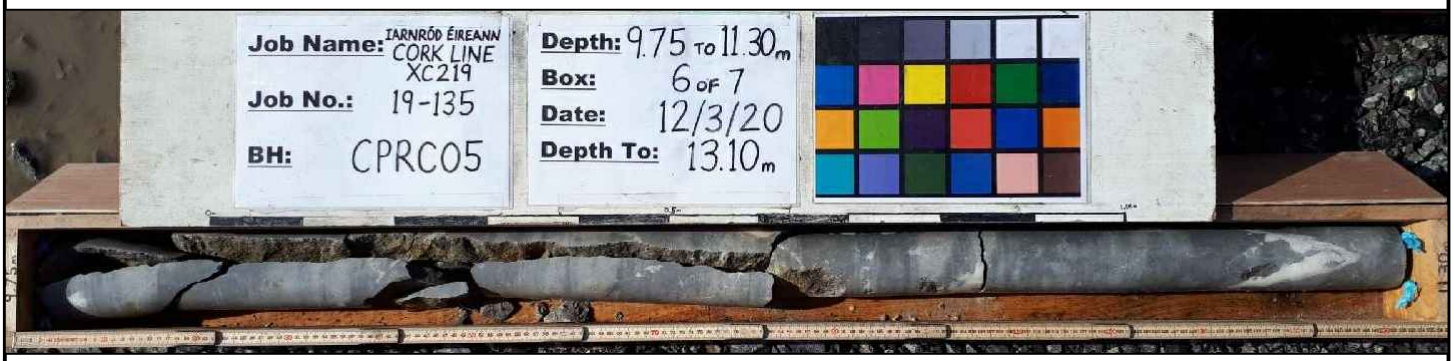


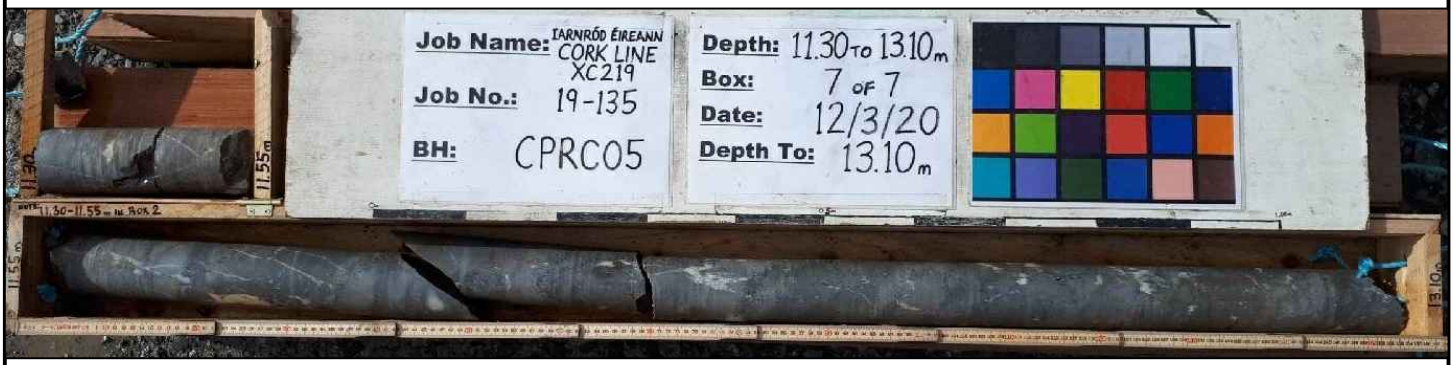




	C.P/R.C05
Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	Rock Core Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: Feb-March & Jun-Sep 2020

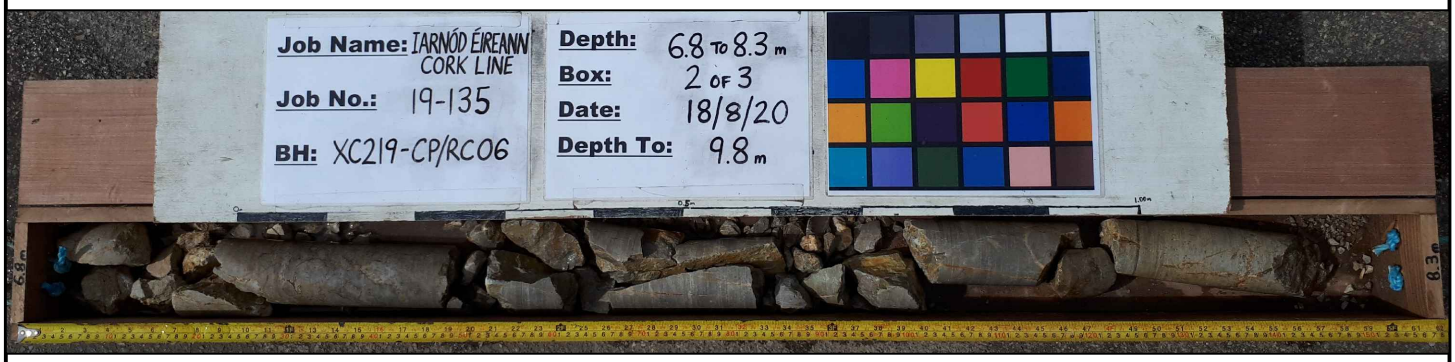


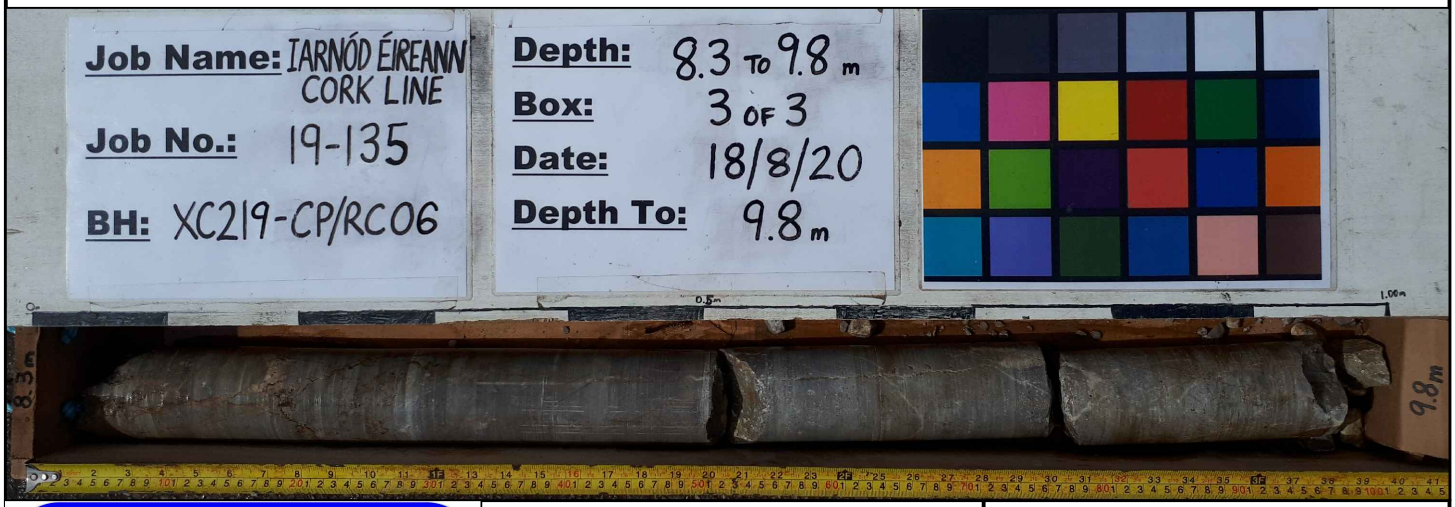




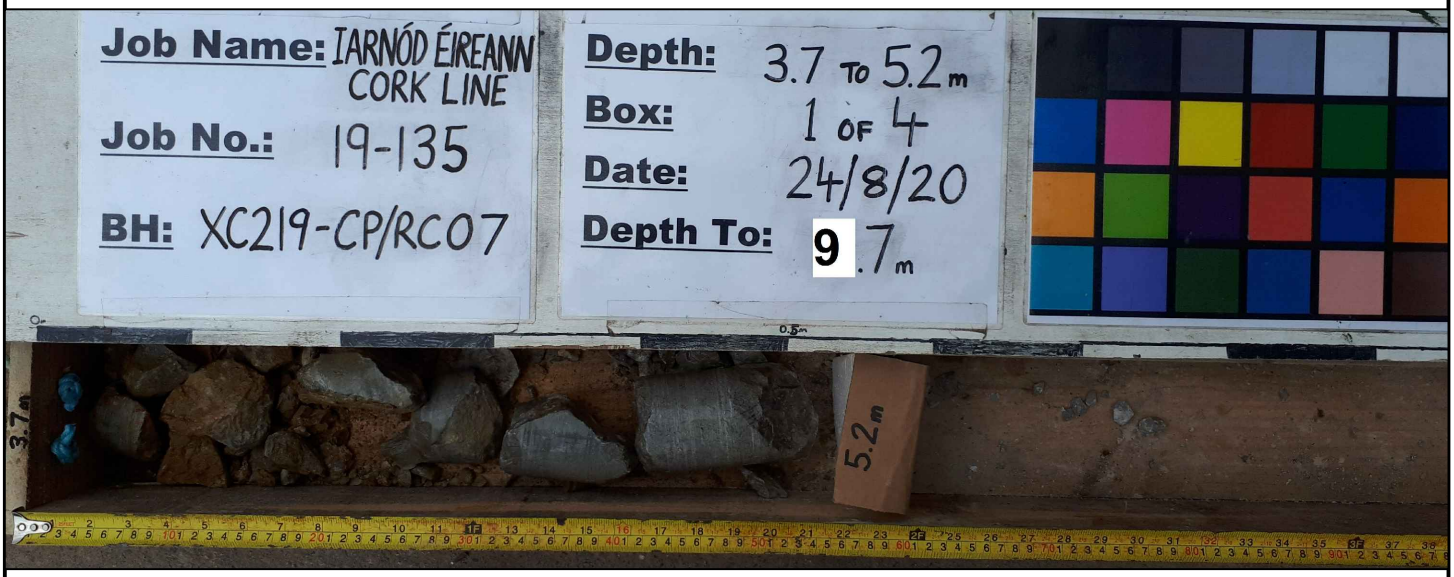
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Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	Rock Core Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: Feb-March & Jun-Sep 2020

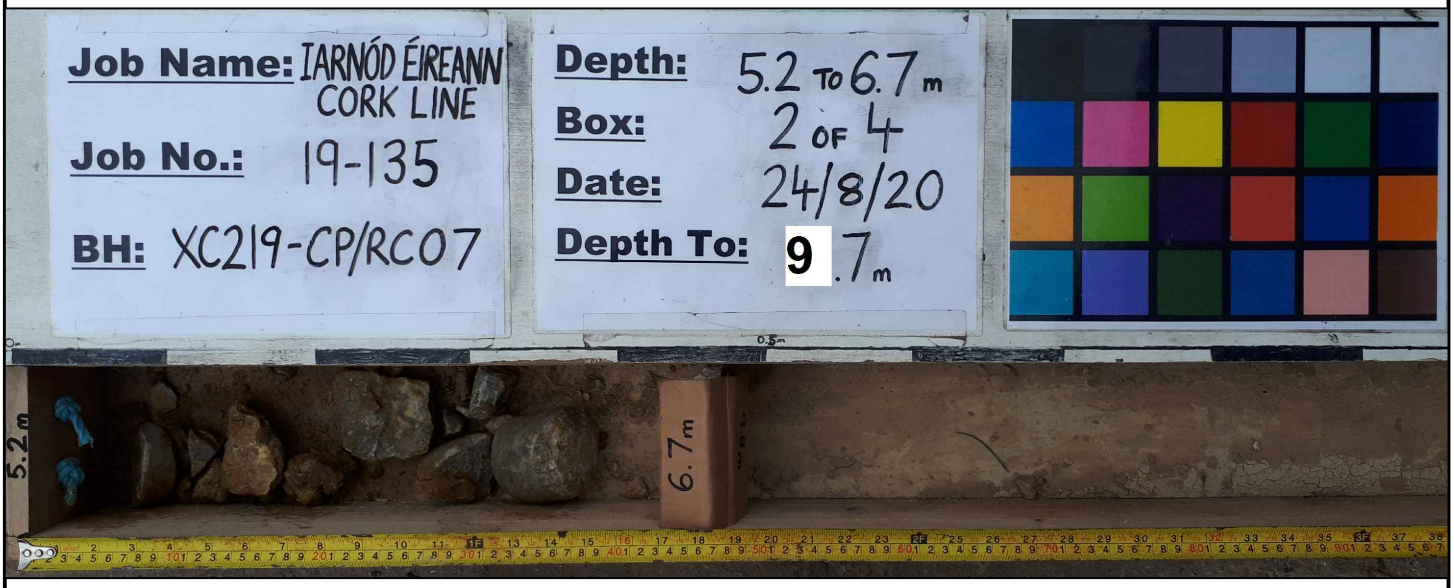




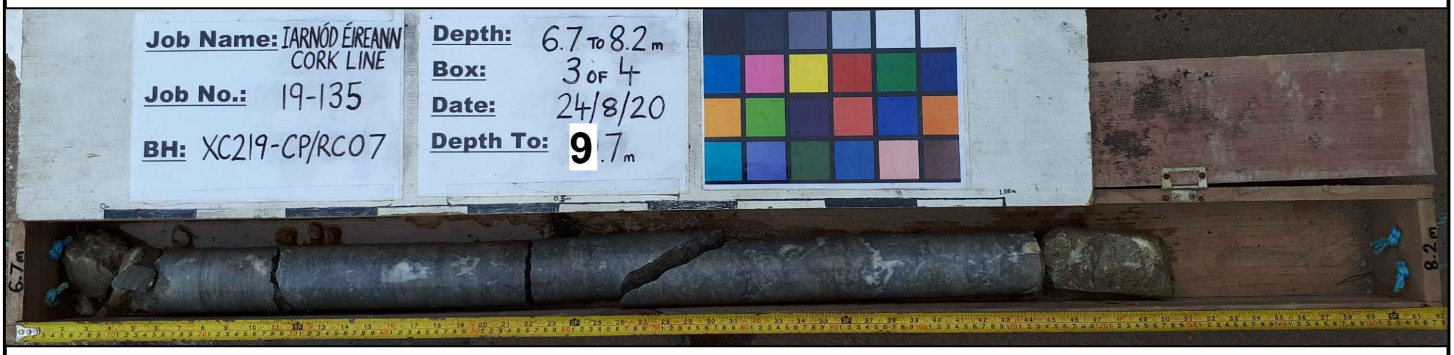


	C.P/R.C06
Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	Rock Core Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: Feb-March & Jun-Sep 2020





	C.P/R.C07
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





ocbgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	C.P/R.C07 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.C08 Rock Core Photographs Client: Iarnród Éireann Engineer: Jacob's Date: Feb-March & Jun-Sep 2020

Appendix D Trial Pit Logs

Project No.: 19-135	**Project Name:** Cork Line Level Crossings		**Trial Pit No.:** XC219-TP01
Co-ordinates: 553103.46 E	**Client:** Iarnród Éireann / Irish Rail		Sheet 1 of 1
Method: Excavation	609866.75 N	**Client's Representative:** JACOBS	**Scale:** 1:20
Plant: Kobelco SK140SRLC	**Ground Level:** 82.78 mOD	**Date:** 03/07/2020	**Driver:** AL / **Logger:** MN

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1			(0.20)		TOPSOIL: Soft dark brown slightly sandy silty CLAY with occasional gravel and frequent rootlets, moist	
0.20 - 0.50	B2		82.58	0.20			
0.20 - 0.50	D3			(0.30)		Firm to stiff light brownish grey and orange brown mottled slightly sandy silty CLAY with occasional gravel and occasional rootlets, moist. Sand fine to coarse. Gravel mostly fine to medium.	
0.40		HVP=56, HVR=20					
0.40		HVP=57, HVR=16					
0.40		HVP=68, HVR=18	82.28	0.50			
0.50	ES4					Stiff orange brown with a little light grey to light brownish grey slightly sandy slightly gravelly silty CLAY with occasional rootlets, moist. Lens of orange brown slightly silty fine to medium sand from 0.8m to 1.0m in southern portion of trial pit.	
0.50 - 1.00	B5						
0.50 - 1.00	D6						
0.70		HVP=74, HVR=21		(0.50)			
0.70		HVP=77, HVR=20					
0.70		HVP=78, HVR=17					
1.00	ES7		81.78	1.00		Stiff orange brown slightly sandy silty CLAY, moist. Sand mostly fine.	
1.20 - 1.70	B8						
1.20 - 1.70	D9			(0.80)			
1.80 - 2.30	B10		80.98	1.80			
1.80 - 2.30	D11					Firm greyish brown to brownish grey silty CLAY locally thinly interlaminated with slightly fine sandy slightly clayey silt, moist. (Potential Alluvium Deposit)	
				(0.50)			
2.30 - 2.50	B12		80.48	2.30			▼
2.30 - 2.50	D13					Brownish grey sandy clayey GRAVEL with low cobble content, wet. Sand fine to coarse. Gravel and cobbles angular to subangular predominantly limestone.	
		Rapid inflow		(0.20)			
			80.28	2.50		End of trial pit at 2.500m	

Remarks

Trial Pit terminated at 2.50m due to rapid water inflow from 2.3m leading to gravel slumping into the pit below this depth.

Water Strikes:

Struck at (m):	Remarks:
2.30	Rapid inflow

Stability: Good to 2.3m; collapsing below 2.3m

Width: 1.10

Length: 3.80

Project No.: 19-135	**Project Name:** Cork Line Level Crossings		**Trial Pit No.:** XC219-TP02
Co-ordinates: 553224.96 E	**Client:** Iarnród Éireann / Irish Rail		Sheet 1 of 2
Method: Excavation	609816.83 N	**Client's Representative:** JACOBS	**Scale:** 1:20
Plant: Kobelco SK140SRu	**Ground Level:** 84.45 mOD	**Date:** 17/02/2020	**Driver:** TS / **Logger:** MN

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1			(0.30)		TOPSOIL: Soft dark brown slightly gravelly slightly silty CLAY with frequent rootlets, moist.	
			84.15	0.30		Soft to firm yellowish brown slightly gravelly sandy silty CLAY with occasional charcoal fragments and rootlets, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular.	
0.50	ES2						
0.50 - 1.00	B3			(0.50)			
0.50 - 1.00	B4						
0.60		HVP=64, HVR=26					
			83.65	0.80		Stiff yellowish brown sandy slightly gravelly silty CLAY with charcoal fragments and rootlets, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular.	
1.00	ES5			(0.50)			
1.10		HVP=86, HVR=37					
1.30 - 1.80	B6		83.15	1.30		Stiff yellowish brown slightly sandy slightly gravelly silty CLAY with low cobble and small boulder content, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles and boulders are angular to subangular limestone.	
				(0.50)			
		Steady inflow - No rise	82.65	1.80		Stiff yellowish brown slightly sandy slightly gravelly silty CLAY with low cobble and boulder content, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles and boulders are angular to subangular limestone. *At 1.80m: Slightly sandy GRAVEL lens.*	▼
		Steady inflow - No rise					▼
2.50 - 3.00	B7						
				(2.50)			
3.00	ES8						
3.50 - 4.00	B9						

Continued on Next Page

Remarks

Trial Pit terminated at 4.30m due to pit walls collapsing.

Water Strikes:

Struck at (m):	Remarks:
1.80	Steady inflow - No rise
2.20	Steady inflow - No rise

Stability: Sides collapsing

Width: 2.00

Length: 4.70

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Trial Pit No.:** XC219-TP02
	Co-ordinates: 553224.96 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 2 of 2
Method: Excavation	609816.83 N	**Client's Representative:** JACOBS	**Scale:** 1:20
Plant: Kobelco SK140SRu	**Ground Level:** 84.45 mOD	**Date:** 17/02/2020	**Driver:** TS
			Logger: MN

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
			80.15	4.30		End of trial pit at 4.300m	

4.5
5.0
5.5
6.0
6.5
7.0
7.5

Remarks

Trial Pit terminated at 4.30m due to pit walls collapsing.

Water Strikes:

Struck at (m):	Remarks:
1.80	Steady inflow - No rise
2.20	Steady inflow - No rise

Stability: Sides collapsing

Width: 2.00

Length: 4.70

Project No.: 19-135	**Project Name:** Cork Line Level Crossings		**Trial Pit No.:** XC219-TP03
Co-ordinates: 553405.28 E	**Client:** Iarnród Éireann / Irish Rail		Sheet 1 of 1
Method: Excavation	609803.84 N	**Client's Representative:** JACOBS	**Scale:** 1:20
Plant: Kobelco SK140SRu	**Ground Level:** 90.02 mOD	**Date:** 17/02/2020	**Driver:** TS / **Logger:** MN

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1			(0.30)		TOPSOIL: Soft dark brown slightly sandy silty CLAY with occasional gravel and frequent rootlets, very moist.	
0.30 - 0.55	B2		89.72	0.30			
0.35		HVP=39, HVR=18		(0.25)		Soft to firm yellowish brown slightly sandy to sandy slightly gravelly silty CLAY with occasional rootlets, moist.	
0.50	ES3		89.47	0.55			
0.70 - 1.20	B4					Soft to firm yellowish brown slightly sandy slightly gravelly silty CLAY with medium to high cobble and boulder content, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles and boulders are subangular, predominately limestone.	
1.00	ES5						
1.00		HVP=34, HVR=16		(1.15)		*At 1.10m on West side of pit: Large 800mm dia subangular limestone boulder.*	
			88.32	1.70		Yellowish brown slightly clayey very silty very gravelly SAND with low to medium cobble content and low boulder content, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles and boulders are angular to subangular, limestone.	
2.00 - 2.50	B6			(1.10)			
2.80 - 3.00	B7		87.22	2.80			
				(0.20)		Firm brown slightly sandy gravelly silty CLAY with high cobble and boulder content, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles and boulders are angular to subangular, limestone.	
			87.02	(0.00)			
			87.02			Strong grey closely fractured slightly weathered fine grained micritic LIMESTONE.	
						End of trial pit at 3.000m	

Remarks

Trial Pit terminated at 3.00m on probable bedrock.

Water Strikes:

Struck at (m):	Remarks:
	None Encountered

Stability: Sides spalling

Width: 1.70

Length: 3.70

	Project No.: 19-135	**Project Name:** Cork Line Level Crossings	**Trial Pit No.:** XC219-TP04
	Co-ordinates: 553468.36 E	**Client:** Iarnród Éireann / Irish Rail	Sheet 1 of 1
Method: Excavation	609779.24 N	**Client's Representative:** JACOBS	**Scale:** 1:20
Plant: Kobelco SK140SRu	**Ground Level:** 87.65 mOD	**Date:** 17/02/2020	**Driver:** TS **Logger:** MN

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1			(0.30)		TOPSOIL: Soft dark brown slightly sandy silty CLAY with occasional gravel and frequent rootlets, moist.	
0.30 - 0.80	B2		87.35	0.30		Soft to firm yellowish brown slightly gravelly sandy silty CLAY with occasional rootlets, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular.	
0.45		HVP=32, HVR=18					
0.50	ES3			(0.60)			
			86.75	0.90		Firm yellowish brown sandy silty gravelly CLAY with high cobble content and low boulder content, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles and boulders are angular to subangular, limestone.	
1.00	ES4						
1.00 - 1.50	B5			(1.00)			
			85.75	(1.90)		Strong light grey closely to medium fractured slightly weathered fine grained micritic LIMESTONE bedrock.	
			85.75			End of trial pit at 1.900m	

Remarks

Trial Pit terminated at 1.90m on probable bedrock.

Water Strikes:

Struck at (m):	Remarks:
	None Encountered

Stability: Sides collapsing

Width: 2.40

Length: 4.60

Appendix E Trial Pit Photographs



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	T.PIT1 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February & July 2020



Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	T.PIT1
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February & July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	T.PIT1 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February & July 2020



Iarnród Éireann

Cork Line Level Crossings

XC219 (19-135-5)

T.PIT1	
Trial Pit Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February & July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	T.PIT1 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February & July 2020



Iarnród Éireann

Cork Line Level Crossings

XC219 (19-135-5)

T.PIT1

Trial Pit Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: February & July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	T.PIT1 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February & July 2020



Iarnród Éireann

Cork Line Level Crossings

XC219 (19-135-5)

T.PIT1

Trial Pit Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: February & July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	T.PIT1 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February & July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	T.PIT1 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February & July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	T.PIT2 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February & July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	T.PIT2 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February & July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	T.PIT2 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February & July 2020



Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	T.PIT2
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February & July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	T.PIT2 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February & July 2020



Iarnród Éireann

Cork Line Level Crossings

XC219 (19-135-5)

	T.PIT2
	Trial Pit Photographs
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February & July 2020



Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	T.PIT2
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February & July 2020



Iarnród Éireann

Cork Line Level Crossings

XC219 (19-135-5)

T.PIT2	
Trial Pit Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February & July 2020



Iarnród Éireann

Cork Line Level Crossings

XC219 (19-135-5)

	T.PIT2
	Trial Pit Photographs
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February & July 2020



Iarnród Éireann

Cork Line Level Crossings

XC219 (19-135-5)

T.PIT2	
Trial Pit Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February & July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	T.PIT2 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February & July 2020



	T.PIT3
Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February & July 2020



Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	T.PIT3
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February & July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	T.PIT3 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February & July 2020



Iarnród Éireann

Cork Line Level Crossings

XC219 (19-135-5)

T.PIT3	
Trial Pit Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February & July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	T.PIT3 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February & July 2020



Iarnród Éireann

Cork Line Level Crossings

XC219 (19-135-5)

	T.PIT3
	Trial Pit Photographs
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February & July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	T.PIT3 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February & July 2020



Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	T.PIT3
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February & July 2020



Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	T.PIT4
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February & July 2020



Iarnród Éireann

Cork Line Level Crossings

XC219 (19-135-5)

T.PIT4

Trial Pit Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: February & July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	T.PIT4 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February & July 2020



Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	T.PIT4
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February & July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	T.PIT4 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February & July 2020



Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	T.PIT4
	Trial Pit Photographs
	Client: Iarnród Éireann
	Engineer: Jacob's
	Date: February & July 2020



ocbgeo	Iarnród Éireann Cork Line Level Crossings XC219 (19-135-5)	T.PIT4 Trial Pit Photographs Client: Iarnród Éireann Engineer: Jacob's Date: February & July 2020



Iarnród Éireann

Cork Line Level Crossings

XC219 (19-135-5)

T.PIT4

Trial Pit Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: February & July 2020

Appendix F Indirect CBR Test Results

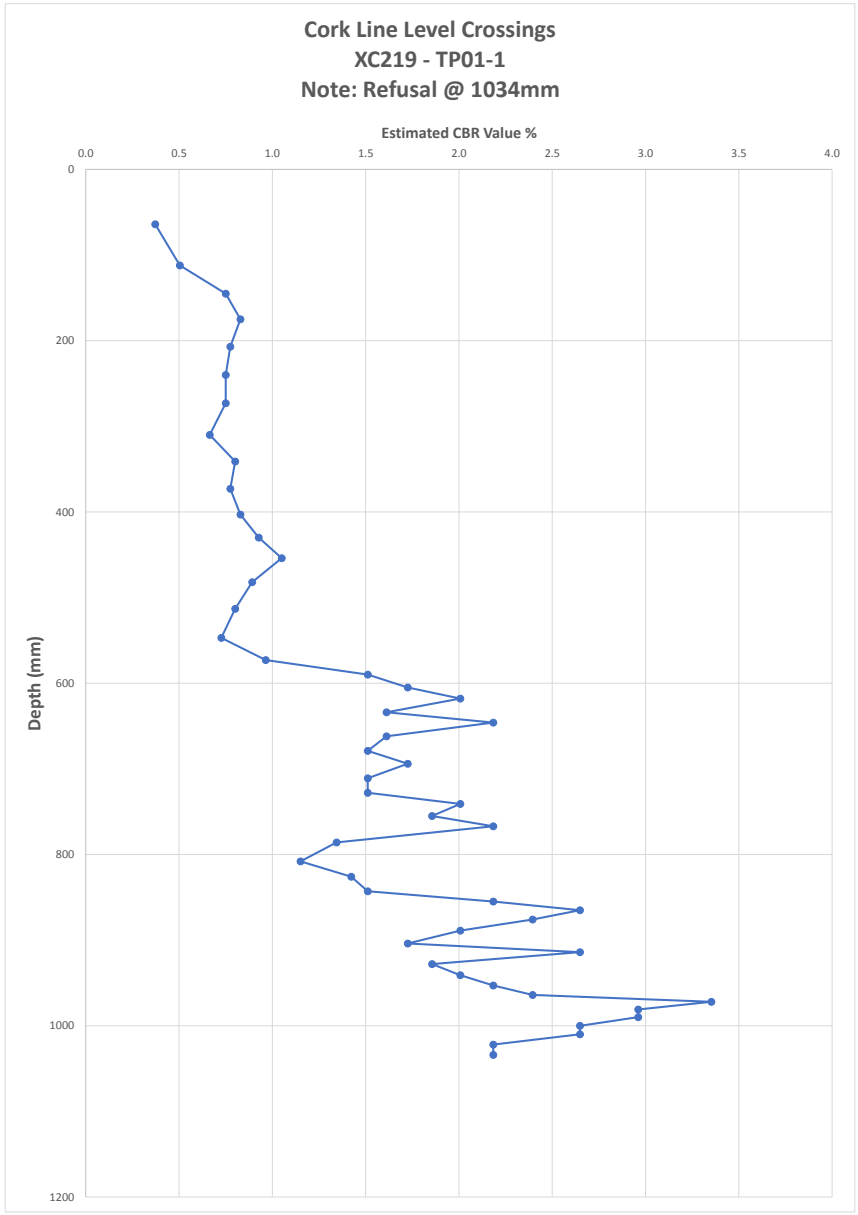
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC219 - TP01-1**	Job No	19-135

Easting	Northing	Elevation

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1132	mm	14/07/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1068	64	64	0.4
2	1020	48	112	0.5
3	987	33	145	0.7
4	957	30	175	0.8
5	925	32	207	0.8
6	892	33	240	0.7
7	859	33	273	0.7
8	822	37	310	0.7
9	791	31	341	0.8
10	759	32	373	0.8
11	729	30	403	0.8
12	702	27	430	0.9
13	678	24	454	1.0
14	650	28	482	0.9
15	619	31	513	0.8
16	585	34	547	0.7
17	559	26	573	1.0
18	542	17	590	1.5
19	527	15	605	1.7
20	514	13	618	2.0
21	498	16	634	1.6
22	486	12	646	2.2
23	470	16	662	1.6
24	453	17	679	1.5
25	438	15	694	1.7
26	421	17	711	1.5
27	404	17	728	1.5
28	391	13	741	2.0
29	377	14	755	1.9
30	365	12	767	2.2
31	346	19	786	1.3
32	324	22	808	1.2
33	306	18	826	1.4
34	289	17	843	1.5
35	277	12	855	2.2
36	267	10	865	2.6
37	256	11	876	2.4
38	243	13	889	2.0
39	228	15	904	1.7
40	218	10	914	2.6
41	204	14	928	1.9
42	191	13	941	2.0
43	179	12	953	2.2
44	168	11	964	2.4
45	160	8	972	3.4
46	151	9	981	3.0
47	142	9	990	3.0
48	132	10	1000	2.6
49	122	10	1010	2.6
50	110	12	1022	2.2
51	98	12	1034	2.2

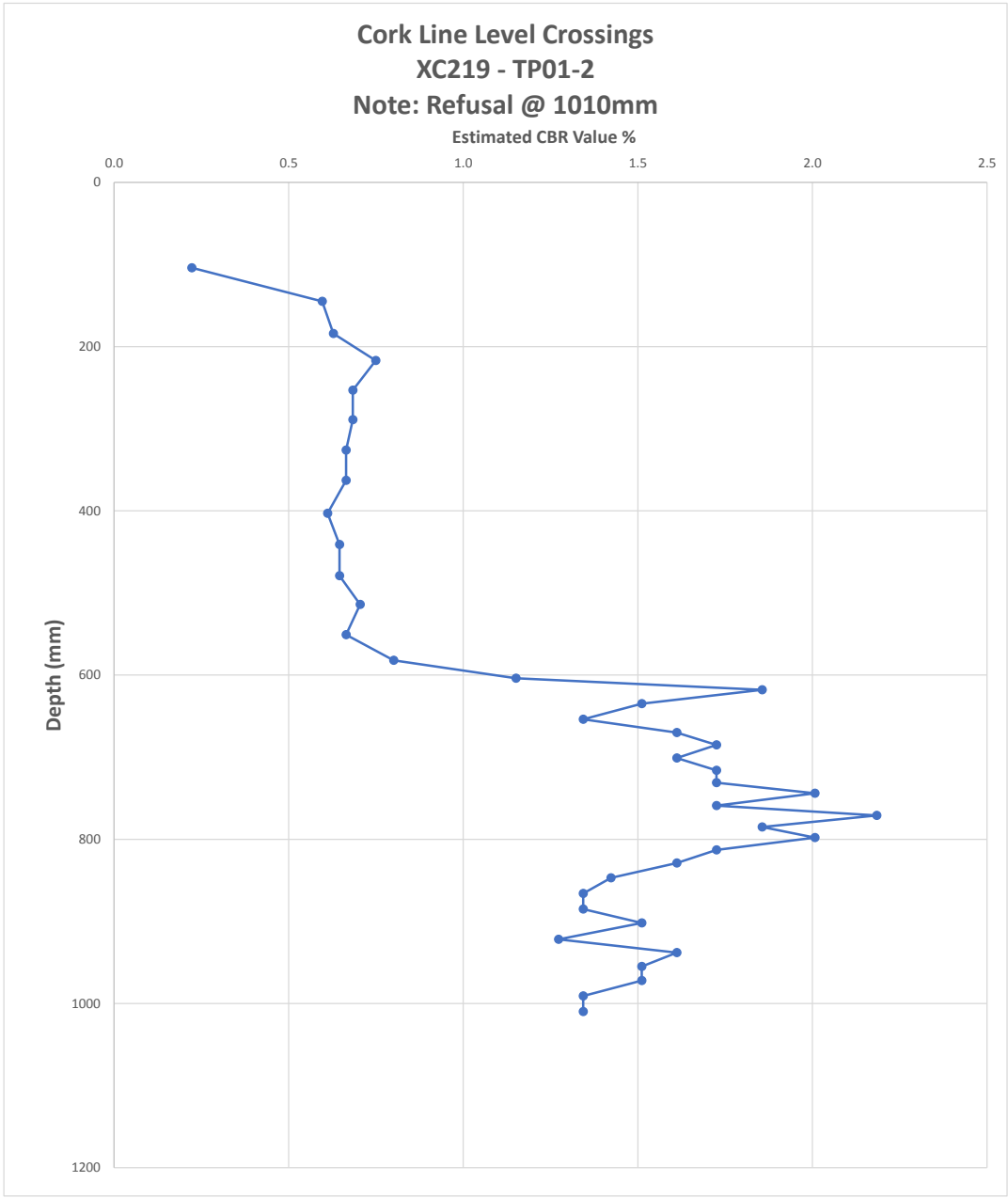


Location	**XC219 - TP01-2**	Job No	19-135

Easting	Northing	Elevation

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1125	mm	14/07/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1021	104	104	0.2
2	980	41	145	0.6
3	941	39	184	0.6
4	908	33	217	0.7
5	872	36	253	0.7
6	836	36	289	0.7
7	799	37	326	0.7
8	762	37	363	0.7
9	722	40	403	0.6
10	684	38	441	0.6
11	646	38	479	0.6
12	611	35	514	0.7
13	574	37	551	0.7
14	543	31	582	0.8
15	521	22	604	1.2
16	507	14	618	1.9
17	490	17	635	1.5
18	471	19	654	1.3
19	455	16	670	1.6
20	440	15	685	1.7
21	424	16	701	1.6
22	409	15	716	1.7
23	394	15	731	1.7
24	381	13	744	2.0
25	366	15	759	1.7
26	354	12	771	2.2
27	340	14	785	1.9
28	327	13	798	2.0
29	312	15	813	1.7
30	296	16	829	1.6
31	278	18	847	1.4
32	259	19	866	1.3
33	240	19	885	1.3
34	223	17	902	1.5
35	203	20	922	1.3
36	187	16	938	1.6
37	170	17	955	1.5
38	153	17	972	1.5
39	134	19	991	1.3
40	115	19	1010	1.3



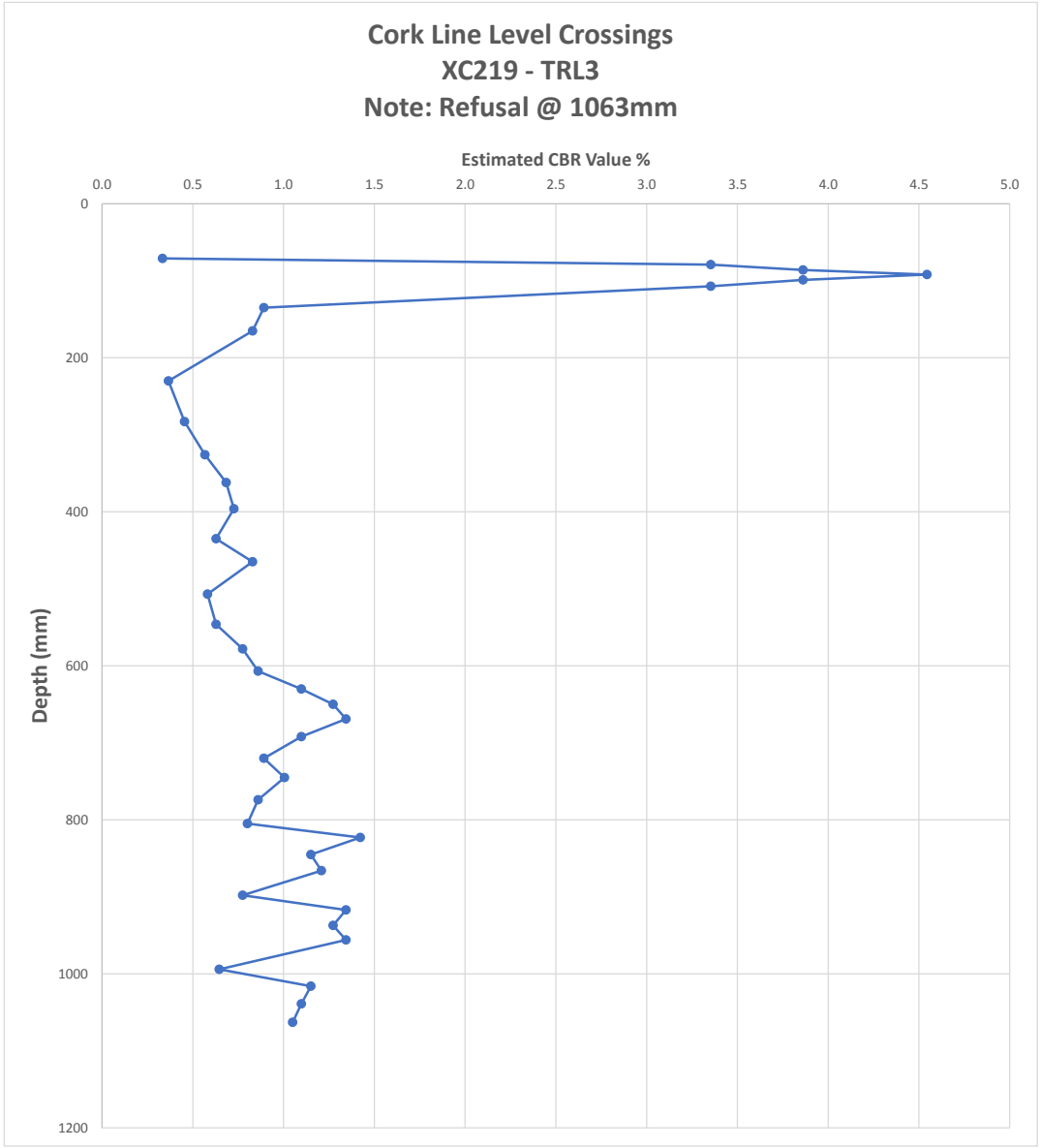
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC219 - TRL3**	Job No	19-135

Easting	Northing	Elevation
553223.16	609814.655	84.527

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1150	mm	25/02/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1079	71	71	0.3
2	1071	8	79	3.4
3	1064	7	86	3.9
4	1058	6	92	4.5
5	1051	7	99	3.9
6	1043	8	107	3.4
7	1015	28	135	0.9
8	985	30	165	0.8
9	920	65	230	0.4
10	867	53	283	0.5
11	824	43	326	0.6
12	788	36	362	0.7
13	754	34	396	0.7
14	715	39	435	0.6
15	685	30	465	0.8
16	643	42	507	0.6
17	604	39	546	0.6
18	572	32	578	0.8
19	543	29	607	0.9
20	520	23	630	1.1
21	500	20	650	1.3
22	481	19	669	1.3
23	458	23	692	1.1
24	430	28	720	0.9
25	405	25	745	1.0
26	376	29	774	0.9
27	345	31	805	0.8
28	327	18	823	1.4
29	305	22	845	1.2
30	284	21	866	1.2
31	252	32	898	0.8
32	233	19	917	1.3
33	213	20	937	1.3
34	194	19	956	1.3
35	156	38	994	0.6
36	134	22	1016	1.2
37	111	23	1039	1.1
38	87	24	1063	1.0
39				



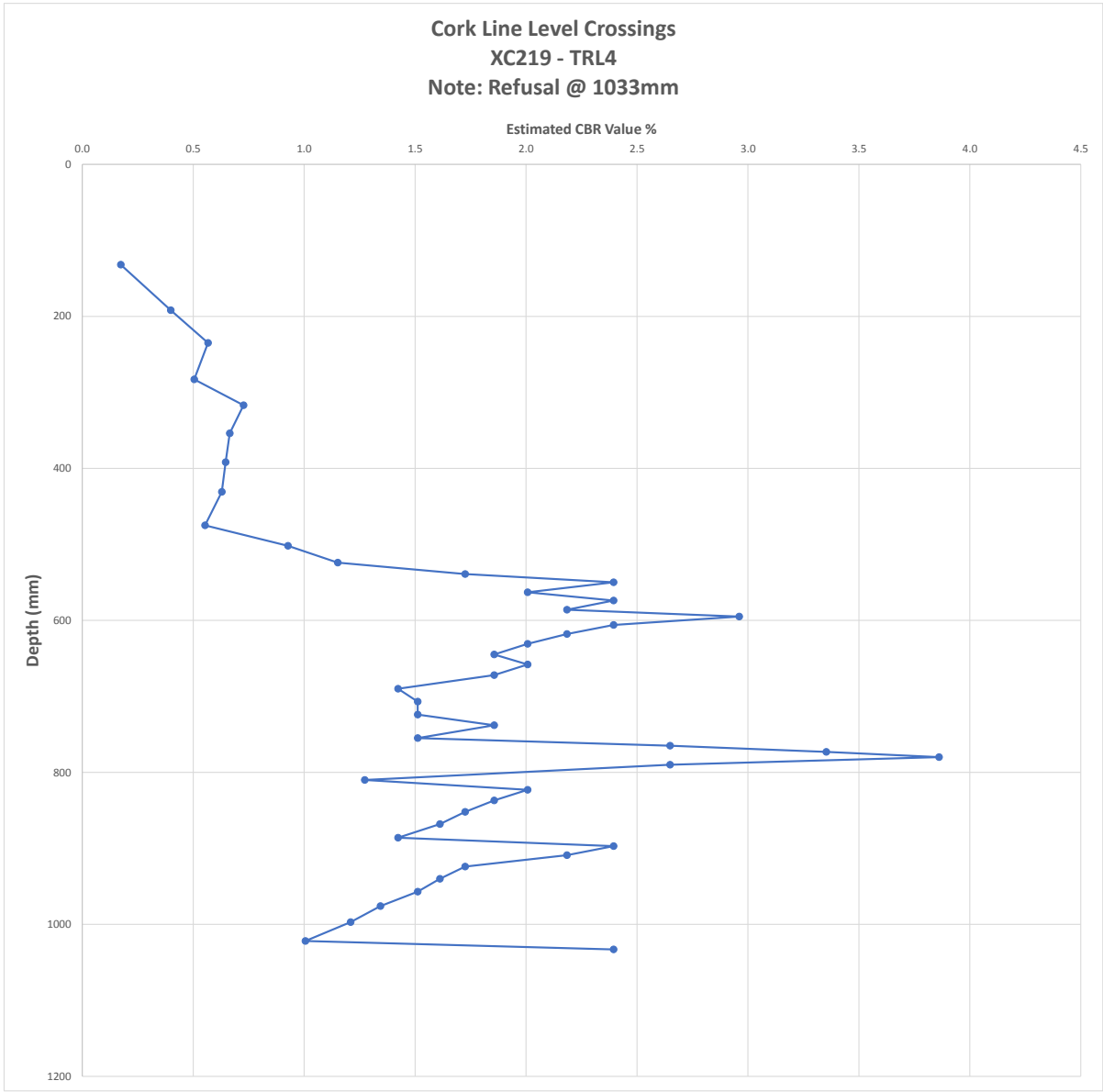
Cork Line Level Crossings - Irish Rail
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Location	**XC219 - TRL4**	Job No	19-135

Easting	Northing	Elevation
553228.376	609818.474	84.536

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1150	mm	25/02/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1018	132	132	0.2
2	958	60	192	0.4
3	915	43	235	0.6
4	867	48	283	0.5
5	833	34	317	0.7
6	796	37	354	0.7
7	758	38	392	0.6
8	719	39	431	0.6
9	675	44	475	0.6
10	648	27	502	0.9
11	626	22	524	1.2
12	611	15	539	1.7
13	600	11	550	2.4
14	587	13	563	2.0
15	576	11	574	2.4
16	564	12	586	2.2
17	555	9	595	3.0
18	544	11	606	2.4
19	532	12	618	2.2
20	519	13	631	2.0
21	505	14	645	1.9
22	492	13	658	2.0
23	478	14	672	1.9
24	460	18	690	1.4
25	443	17	707	1.5
26	426	17	724	1.5
27	412	14	738	1.9
28	395	17	755	1.5
29	385	10	765	2.6
30	377	8	773	3.4
31	370	7	780	3.9
32	360	10	790	2.6
33	340	20	810	1.3
34	327	13	823	2.0
35	313	14	837	1.9
36	298	15	852	1.7
37	282	16	868	1.6
38	264	18	886	1.4
39	253	11	897	2.4
40	241	12	909	2.2
41	226	15	924	1.7
42	210	16	940	1.6
43	193	17	957	1.5
44	174	19	976	1.3
45	153	21	997	1.2
46	128	25	1022	1.0
47	117	11	1033	2.4
48				



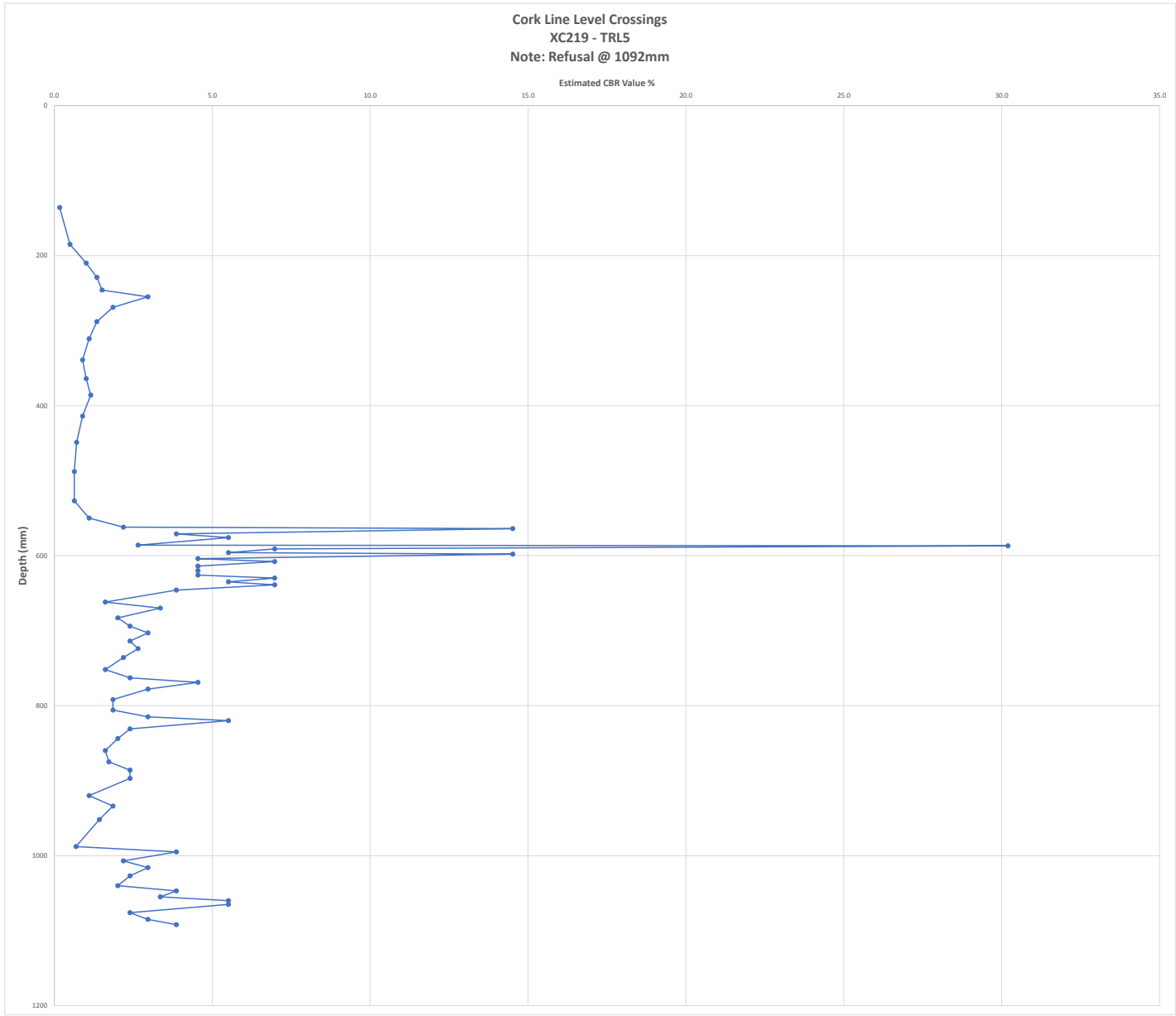
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	XC219 - TRL5	Job No	19-135

Easting	Northing	Elevation
553403.448	609802.921	90.162

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1150	mm	25/02/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1014	136	136	0.2
2	965	49	185	0.5
3	940	25	210	1.0
4	921	19	229	1.3
5	904	17	246	1.5
6	895	9	255	3.0
7	881	14	269	1.9
8	862	19	288	1.3
9	839	23	311	1.1
10	811	28	339	0.9
11	786	25	364	1.0
12	764	22	386	1.2
13	736	28	414	0.9
14	701	35	449	0.7
15	662	39	488	0.6
16	623	39	527	0.6
17	600	23	550	1.1
18	588	12	562	2.2
19	586	2	564	14.5
20	579	7	571	3.9
21	574	5	576	5.5
22	564	10	586	2.6
23	563	1	587	30.2
24	559	4	591	7.0
25	554	5	596	5.5
26	552	2	598	14.5
27	546	6	604	4.5
28	542	4	608	7.0
29	536	6	614	4.5
30	530	6	620	4.5
31	524	6	626	4.5
32	520	4	630	7.0
33	515	5	635	5.5
34	511	4	639	7.0
35	504	7	646	3.9
36	488	16	662	1.6
37	480	8	670	3.4
38	467	13	683	2.0
39	456	11	694	2.4
40	447	9	703	3.0
41	436	11	714	2.4
42	426	10	724	2.6
43	414	12	736	2.2
44	398	16	752	1.6
45	387	11	763	2.4
46	381	6	769	4.5
47	372	9	778	3.0
48	358	14	792	1.9
49	344	14	806	1.9
50	335	9	815	3.0
51	330	5	820	5.5
52	319	11	831	2.4
53	306	13	844	2.0
54	290	16	860	1.6
55	275	15	875	1.7
56	264	11	886	2.4
57	253	11	897	2.4
58	230	23	920	1.1
59	216	14	934	1.9
60	198	18	952	1.4
61	162	36	988	0.7
62	155	7	995	3.9
63	143	12	1007	2.2
64	134	9	1016	3.0
65	123	11	1027	2.4
66	110	13	1040	2.0
67	103	7	1047	3.9
68	95	8	1055	3.4
69	90	5	1060	5.5
70	85	5	1065	5.5
71	74	11	1076	2.4
72	65	9	1085	3.0
73	58	7	1092	3.9
74				



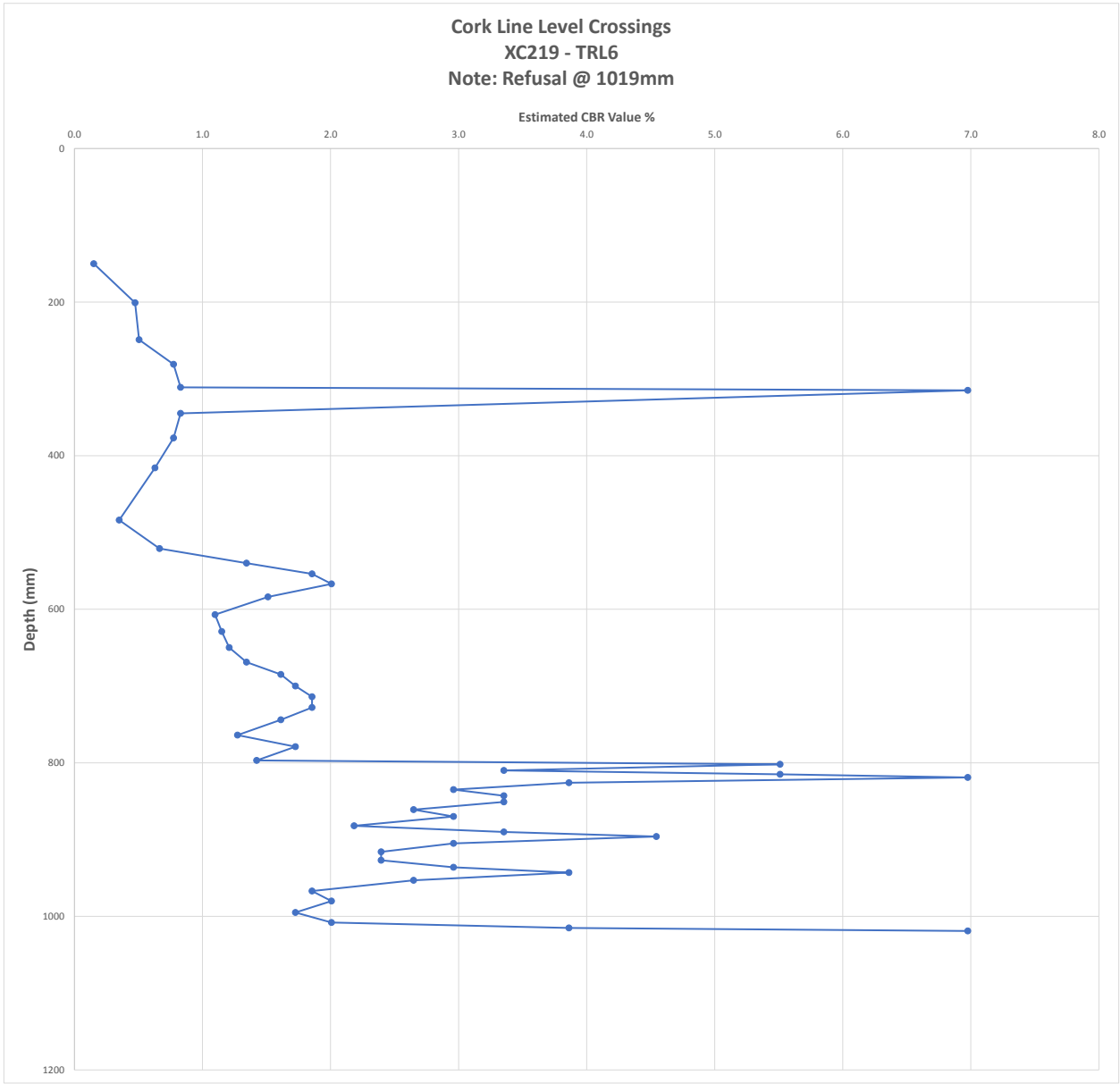
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC219 - TRL6**	Job No	19-135

Easting	Northing	Elevation
553408.518	609804.892	89.805

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1150	mm	25/02/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1000	150	150	0.2
2	949	51	201	0.5
3	901	48	249	0.5
4	869	32	281	0.8
5	839	30	311	0.8
6	835	4	315	7.0
7	805	30	345	0.8
8	773	32	377	0.8
9	734	39	416	0.6
10	666	68	484	0.3
11	629	37	521	0.7
12	610	19	540	1.3
13	596	14	554	1.9
14	583	13	567	2.0
15	566	17	584	1.5
16	543	23	607	1.1
17	521	22	629	1.2
18	500	21	650	1.2
19	481	19	669	1.3
20	465	16	685	1.6
21	450	15	700	1.7
22	436	14	714	1.9
23	422	14	728	1.9
24	406	16	744	1.6
25	386	20	764	1.3
26	371	15	779	1.7
27	353	18	797	1.4
28	348	5	802	5.5
29	340	8	810	3.4
30	335	5	815	5.5
31	331	4	819	7.0
32	324	7	826	3.9
33	315	9	835	3.0
34	307	8	843	3.4
35	299	8	851	3.4
36	289	10	861	2.6
37	280	9	870	3.0
38	268	12	882	2.2
39	260	8	890	3.4
40	254	6	896	4.5
41	245	9	905	3.0
42	234	11	916	2.4
43	223	11	927	2.4
44	214	9	936	3.0
45	207	7	943	3.9
46	197	10	953	2.6
47	183	14	967	1.9
48	170	13	980	2.0
49	155	15	995	1.7
50	142	13	1008	2.0
51	135	7	1015	3.9
52	131	4	1019	7.0



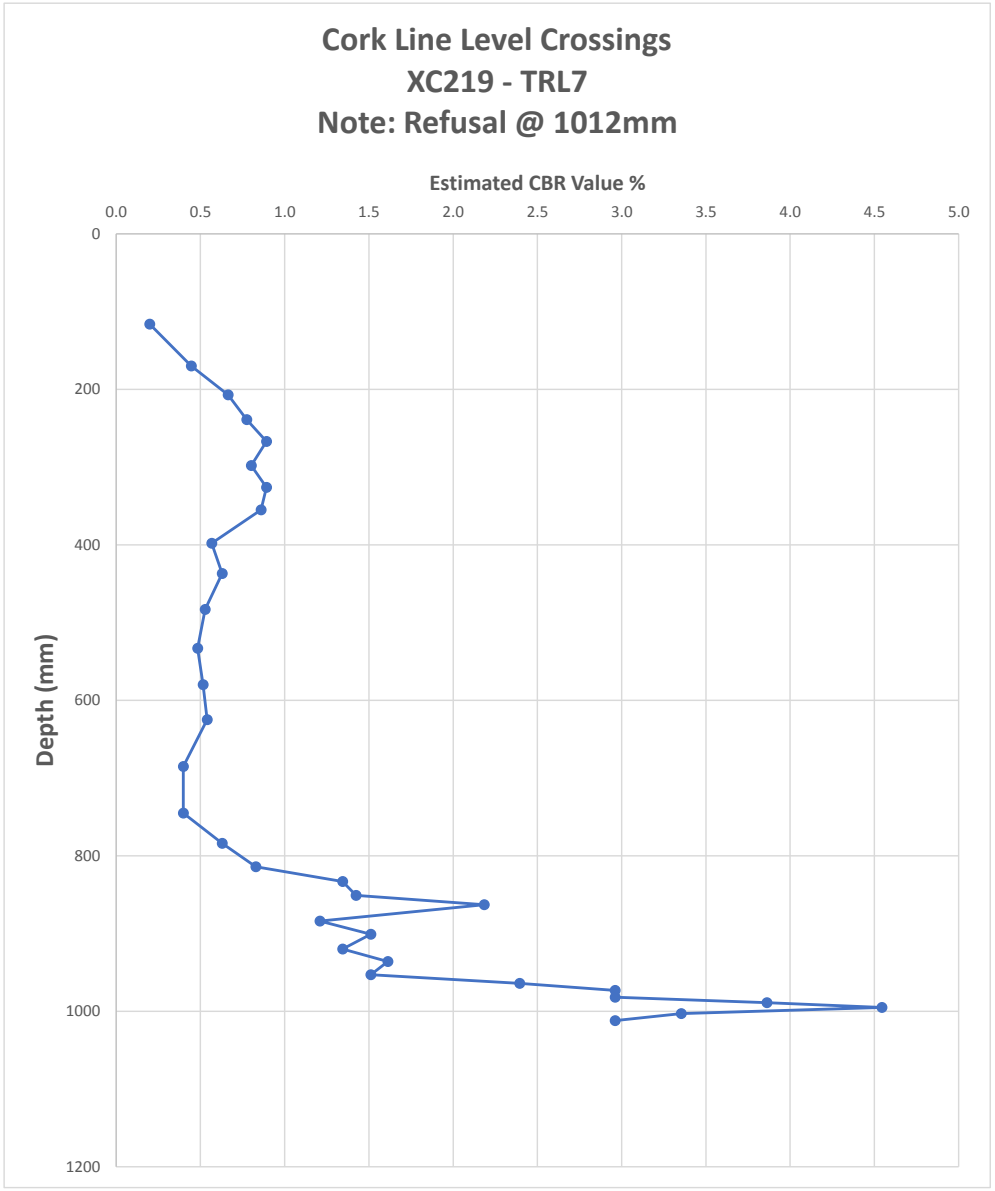
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC219 - TRL7**	Job No	19-135

Easting	Northing	Elevation
553465.441	609779.465	87.717

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1150	mm	25/02/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1034	116	116	0.2
2	980	54	170	0.4
3	943	37	207	0.7
4	911	32	239	0.8
5	883	28	267	0.9
6	852	31	298	0.8
7	824	28	326	0.9
8	795	29	355	0.9
9	752	43	398	0.6
10	713	39	437	0.6
11	667	46	483	0.5
12	617	50	533	0.5
13	570	47	580	0.5
14	525	45	625	0.5
15	465	60	685	0.4
16	405	60	745	0.4
17	366	39	784	0.6
18	336	30	814	0.8
19	317	19	833	1.3
20	299	18	851	1.4
21	287	12	863	2.2
22	266	21	884	1.2
23	249	17	901	1.5
24	230	19	920	1.3
25	214	16	936	1.6
26	197	17	953	1.5
27	186	11	964	2.4
28	177	9	973	3.0
29	168	9	982	3.0
30	161	7	989	3.9
31	155	6	995	4.5
32	147	8	1003	3.4
33	138	9	1012	3.0
34				



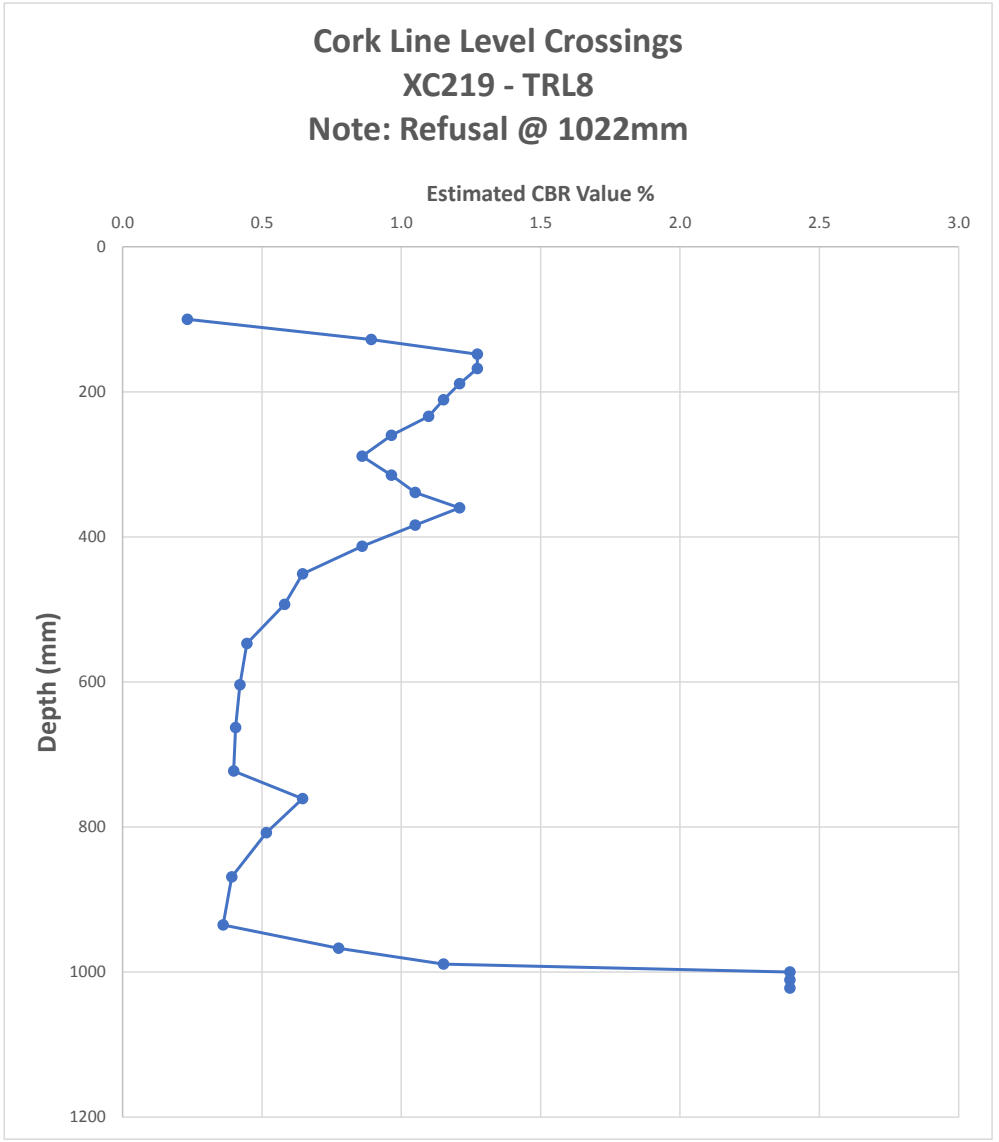
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	**XC219 - TRL8**	Job No	19-135

Easting	Northing	Elevation
553470.268	609778.864	87.71

Test Start Depth	0	mm/bgl	DATE
Start Reading:	1150	mm	25/02/2020

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1050	100	100	0.2
2	1022	28	128	0.9
3	1002	20	148	1.3
4	982	20	168	1.3
5	961	21	189	1.2
6	939	22	211	1.2
7	916	23	234	1.1
8	890	26	260	1.0
9	861	29	289	0.9
10	835	26	315	1.0
11	811	24	339	1.0
12	790	21	360	1.2
13	766	24	384	1.0
14	737	29	413	0.9
15	699	38	451	0.6
16	657	42	493	0.6
17	603	54	547	0.4
18	546	57	604	0.4
19	487	59	663	0.4
20	427	60	723	0.4
21	389	38	761	0.6
22	342	47	808	0.5
23	281	61	869	0.4
24	215	66	935	0.4
25	183	32	967	0.8
26	161	22	989	1.2
27	150	11	1000	2.4
28	139	11	1011	2.4
29	128	11	1022	2.4
30				



Appendix G Water Purging Data and Logs

Job Name: **I.E - Cork Line**		h (m)	3
		r (m)	0.0505
		r2	0.00255025
Job Nr: **19-135**		TWV (m3)	0.024035596

BH ID: XC219-CPRC01A			**Theoretical Well Volume**	24.04 *ltrs*
Depth to Response Zone:	***Top (mbgl)***	***Bottom (mbgl)***	**TWV x3**	72.11 *ltrs*
	3	6		

Purge Start Time:	14:43		**(mbgl)**
Purge Finish Time:	16:00	**Depth to Water**	1.32
		Total Depth	5.1
Depth to water after purging:	1.05 mbgl		

	Time Taken to fill 25ltr container(mins)	Flow Rate l/min
Reading 1:	4	5
Reading 2:	4	5
Reading 3:	4	5

Date 05/08/2020

Nr of Containers filled: 6+

Total Volume Purged: 120+ ***litres***

	Temperature	**pH**	**Electrical Conductivity**	**Dissolved Oxygen**	**Redox Potential**
Reading 1	17.57	6.46	25.55	0.85	22
Reading 2	14.96	6.61	39	0.87	17.5
Reading 3	13.99	6.58	34.93	0.88	21
Reading 4	13.65	6.61	37.7	0.88	25.1
Reading 5	12.95	6.62	28.58	0.88	26.7
Reading 6	12.94	6.63	32.82	0.9	27.9
Reading 7	12.79	6.67	39.97	0.89	29.2
Reading 8	12.93	6.67	40.8	0.88	29.3
Reading 9	13	6.56	29.12	0.86	30.4
Reading 10	12.41	6.59	41.64	0.85	30.7

Job Name: **Iarnród Éireann Cork Line**

Job Nr: **19-135**

h (m)	3
r (m)	0.0505
r2	0.00255025
TWV (m3)	0.024035596

BH ID: X219-CPRC02

Depth to Response Zone:	***Top (mbgl)***	***Bottom m(bgl)***
	0.5	3.5

Theoretical Well Volume	24.04 *ltrs*
TWV x3	72.11 *ltrs*

Purge Start Time:	09:30
Purge Finish Time:	10:30
Depth to water after purging:	1.23 mbgl

	(mbgl)
Depth to Water	
Total Depth	3.04

Date 26/03/2020

	Time Taken to fill 25ltr container(mins)	Flow Rate l/min
Reading 1:	4	6.25
Reading 2:	4	6.25
Reading 3:	4	6.25

Nr of Containers filled: 9

Total Volume Purged: 225 ***litres***

	Temperature	**pH**	**Electrical Conductivity**	**Dissolved Oxygen**	**Redox Potential**
Reading 1 : Bailer	16.22	7.52	14.20	9.77	161.8
Reading 2	16.89	7.58	14.82	9.52	159.3
Reading 3	15.92	7.60	761.10	9.80	179.7
Reading 4: Pumping	14.76	7.35	772.68	9.91	177.2
Reading 5	13.56	7.55	794.01	10.53	138.7
Reading 6	13.66	7.24	739.89	10.78	143.8
Reading 7	14.60	7.59	721.36	9.92	142
Reading 8	16.35	7.58	657.27	9.51	127.3
Bailer 27/3/20	10.72	7.39	28.23	10.73	144.1

Job Name: **Iarnród Éireann Cork Line**		h (m)	5.2
		r (m)	0.0505
		r2	0.00255025
Job Nr: **19-135**		TWV (m3)	0.0416617

BH ID: X219-CPRC04			**Theoretical Well Volume**	41.66	*ltrs*
Depth to Response Zone:	***Top (mbgl)***	***Bottom (mbgl)***	**TWV x3**	124.99	*ltrs*
	3	8.2			

Purge Start Time:	14:30		**(mbgl)**
Purge Finish Time:	15:05	**Depth to Water**	6.98
		Total Depth	8.02
Depth to water after purging:	mbgl		

	Time Taken to fill 25ltr container(mins)	Flow Rate l/min
Reading 1:		
Reading 2:		
Reading 3:		

Date 07/08/2020

Bentonite muddy water. Pump stops working after approx 1 minute. Removed pump and clean off mud by pumping in IBC tank. Reattempt pumping in well again but pump stops wrorking after another minute: Bentonite mud on pump when removed from well, repeat process.

Nr of Containers filled:

Total Volume Purged: ***litres***

	Temperature	**pH**	**Electrical Conductivity**	**Dissolved Oxygen**	**Redox Potential**
Reading 1					
Reading 2					
Reading 3					
Reading 4					
Reading 5					
Reading 6					
Reading 7					
Reading 8					
Reading 9					
Reading 10					

Job Name:	**I.E - Cork Line**	h (m)	10
		r (m)	0.0505
		r2	0.00255025
Job Nr:	**19-135**	TWV (m3)	0.080118654

BH ID:	XC219-CPRC05		**Theoretical Well Volume**	80.12	*ltrs*
Depth to Response Zone:	***Top (mbgl)***	***Bottom (mbgl)***	**TWV x3**	240.36	*ltrs*
	3	13			

Purge Start Time:	15:10		**(mbgl)**
Purge Finish Time:	16:25	**Depth to Water**	6.76
		Total Depth	13.12
Depth to water after purging:	mbgl		

	Time Taken to fill 25ltr container(mins)	Flow Rate l/min
Reading 1:	20	1
Reading 2:	22	0.9
Reading 3:	18	1.1

Date 07/08/2020

Nr of Containers filled:	~3.75	
Total Volume Purged:	75	***litres***

	Temperature	**pH**	**Electrical Conductivity**	**Dissolved Oxygen**	**Redox Potential**
Reading 1	17.58	6.6	27.56	0.33	10.6
Reading 2	16.63	6.65	26.54	0.35	9.9
Reading 3	13.42	6.72	23.2	0.38	8.5
Reading 4	13.27	6.72	24.07	0.4	6.8
Reading 5	12.94	6.61	19.35	0.39	8.4
Reading 6	13.17	6.6	19.95	0.38	9.4
Reading 7	12.97	6.59	19.95	0.38	9.8
Reading 8	13.48	6.71	28.45	0.38	9.9
Reading 9	13.13	6.62	21.89	0.37	10.4
Reading 10	13.39	6.61	18.36	0.37	11.7
Reading 11	13.16	6.47	17.03	0.37	12.8
Reading 12	13.23	6.65	22.25	0.37	13
Reading 13	13.03	6.51	20.17	0.37	13.6

Appendix H Geotechnical Soil Laboratory Test Results

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

James Fisher Testing Services

LABORATORY TEST REPORT

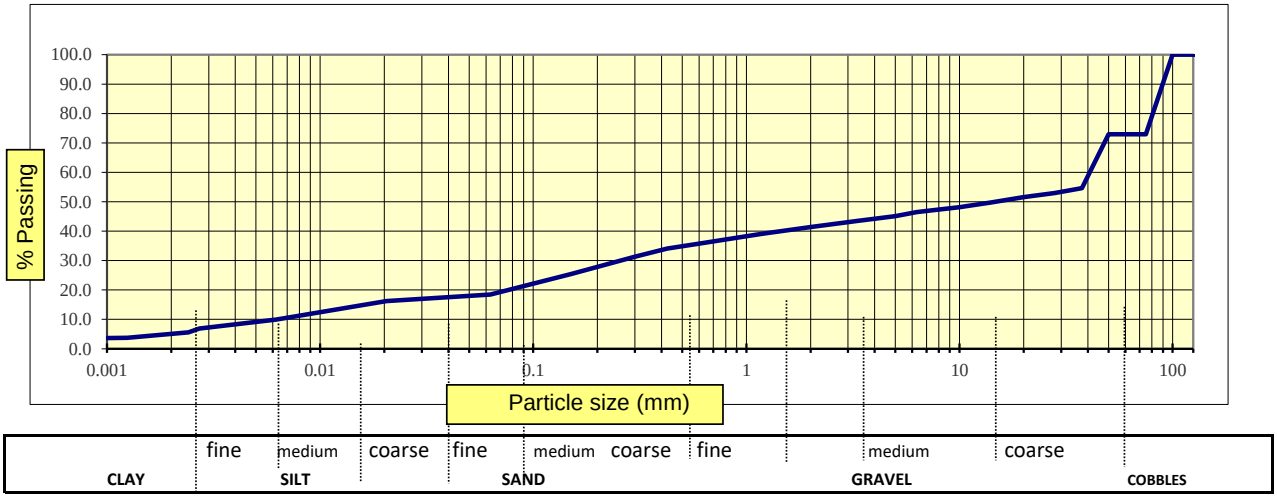
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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

Project:	Cork Line Level Crossings	**Job No:**	19-135
Client:	OCB Geotechnical	**Lab Ref No.:**	ST 93426
	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, Sandy

Client Ref.	**XC219-CPRC02 Type B Sample 3**
Location:	XC219-CPRC02 Type B Sample 3
Supplier:	Bulk
Source:	Client Info.
Depth (m):	1.2-2.0m
Sampling Reason:	Client Request
Sampled By:	Client
Specification:	Client
Preparation Method:	Without Organics Preparation
Notes:	Disturbed sample from cleanout

BS Sieve Size	% Passing	Specification
300 mm	100	
125 mm	100	
100 mm	100	
75 mm	73	
63 mm	73	
50 mm	73	
37.5 mm	55	
28 mm	53	
20 mm	52	
14 mm	50	
10 mm	48	
6.3 mm	46	
5 mm	45	
3.35 mm	44	
2 mm	41	
1.18 mm	39	
0.6 mm	36	
0.425 mm	34	
0.3 mm	31	
0.15 mm	25	
0.063 mm	18	
0.020 mm	16	
0.006 mm	10	
0.003 mm	7	
0.002 mm	6	
0.001 mm	4	



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

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

Sedimentation by Hydrometer - Not UKAS

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

UKAS TESTING 0955

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

LABORATORY TEST REPORT

BRE Test Suite B - Greenfield Site

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

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

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

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

Comments:
None

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

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.

☐ **James Ward, Operations Manager**

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Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co.Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

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

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

Sampled Ref: XC219-CPRC02 Type D Sample 6

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

Moisture Content (%): 5.9

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

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

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James Ward, Operations Manager

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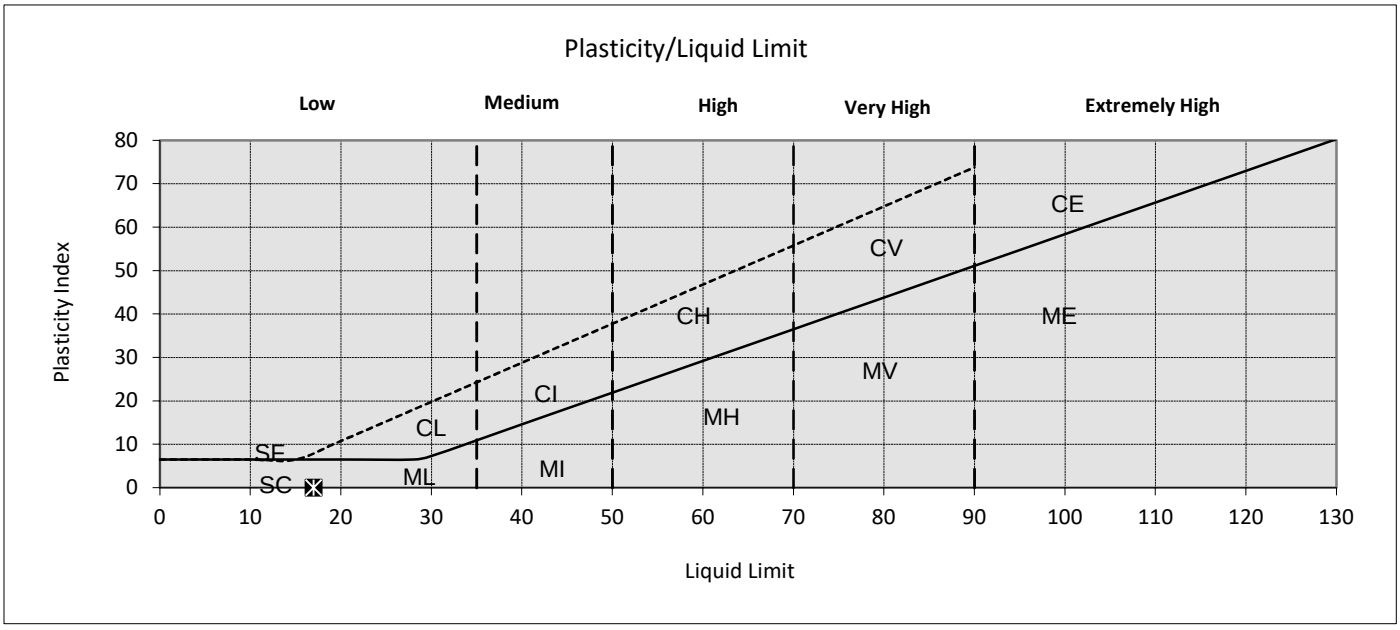
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

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

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

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



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

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

James Fisher Testing Services

LABORATORY TEST REPORT

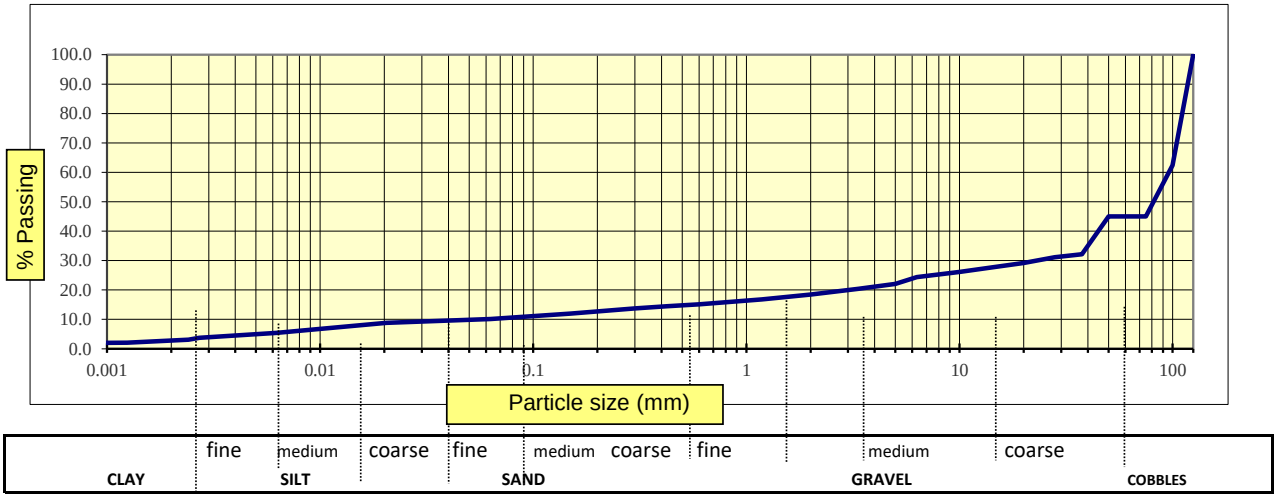
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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

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

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

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



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

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Sedimentation by Hydrometer - Not UKAS

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

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Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

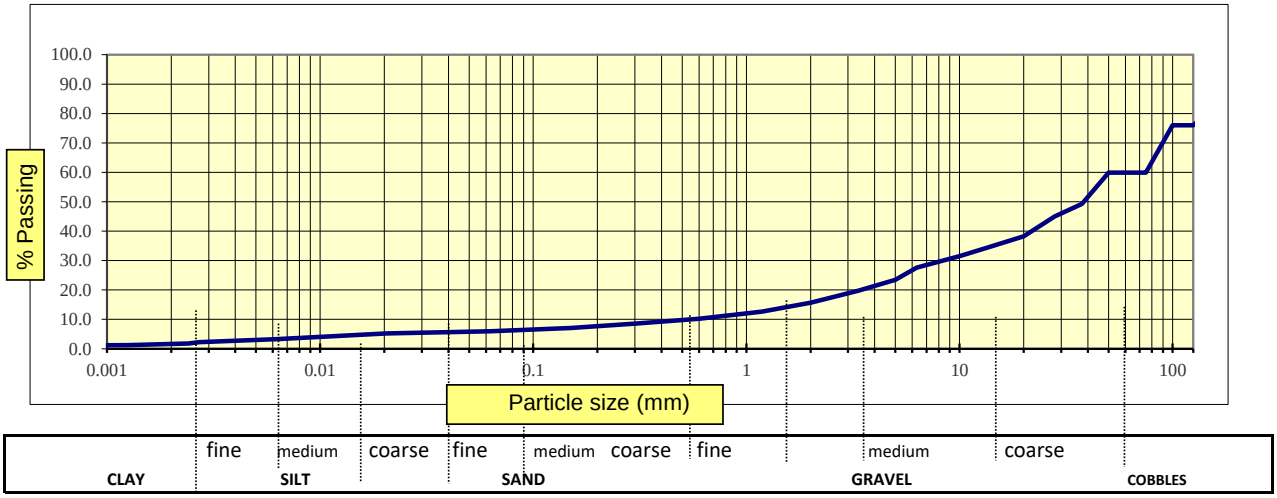
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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

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

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

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



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

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Sedimentation by Hydrometer - Not UKAS

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☐ **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 93432
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	27/03/2020
Order No:	2003-104	**Date Reported:**	02/04/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC219-CPRC03 Type D Sample 3

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

Moisture Content (%): 23

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

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James Ward, Operations Manager

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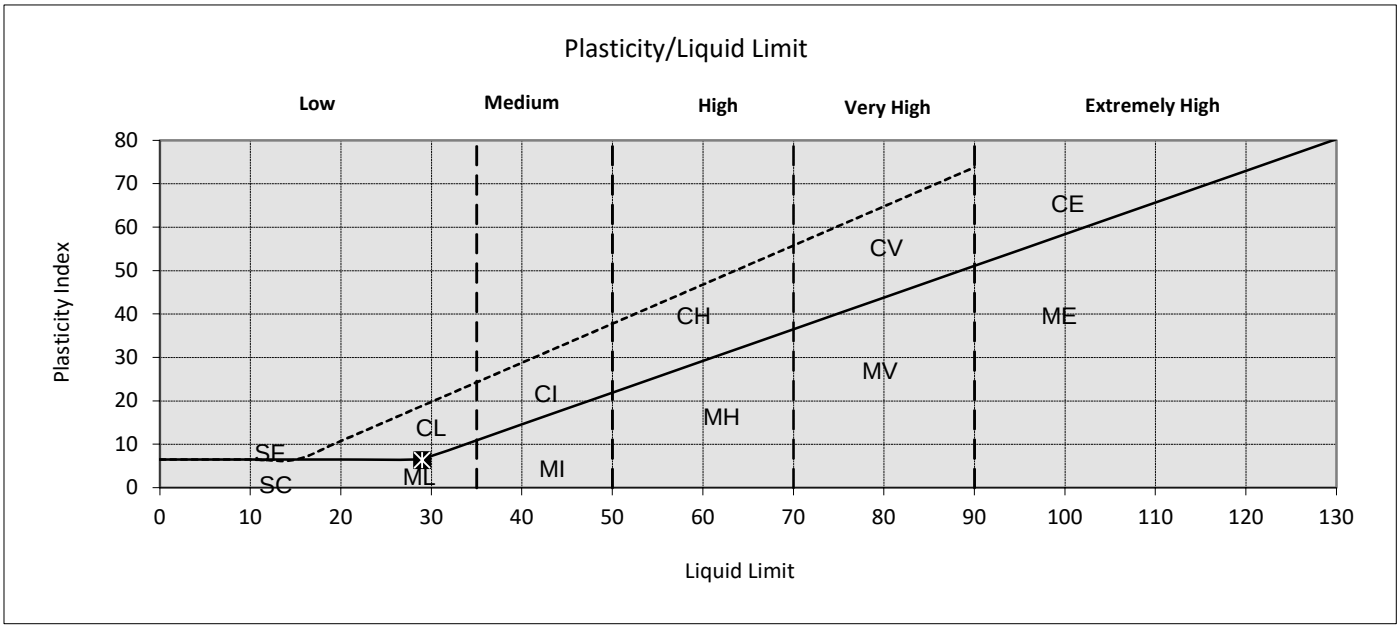
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

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

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

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



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James Fisher Testing Services Ltd
Phil Thorp, Laboratory Manager

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Tel: 057 8664885

LABORATORY TEST REPORT

BRE Test Suite B - Greenfield Site

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

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

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

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

Comments:
None

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

Approved Signature
JAMES FISHER TESTING SERVICES (IRELAND) LTD.

☐ **James Ward, Operations Manager**

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Portlaoise, Co.Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

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

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

Sampled Ref: XC219-CPRC03 Type D Sample 5

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

Moisture Content (%): 5.1

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

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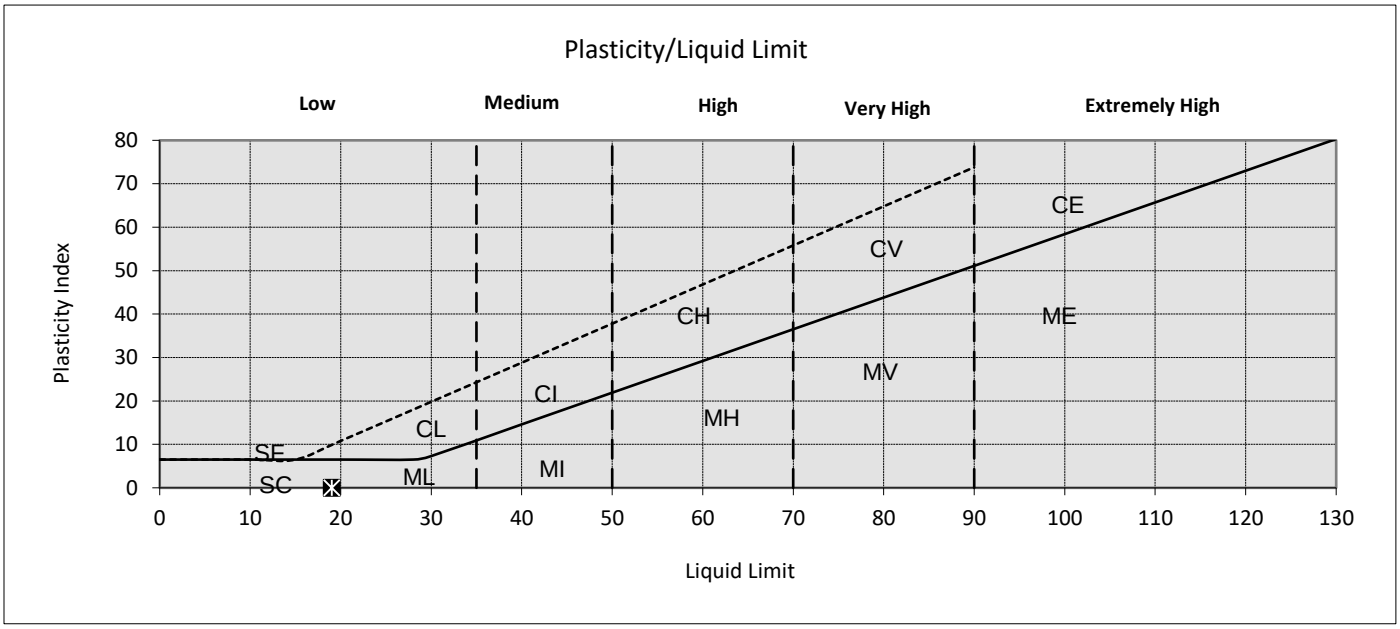
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Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

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

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

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



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

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Portlaoise, Co. Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

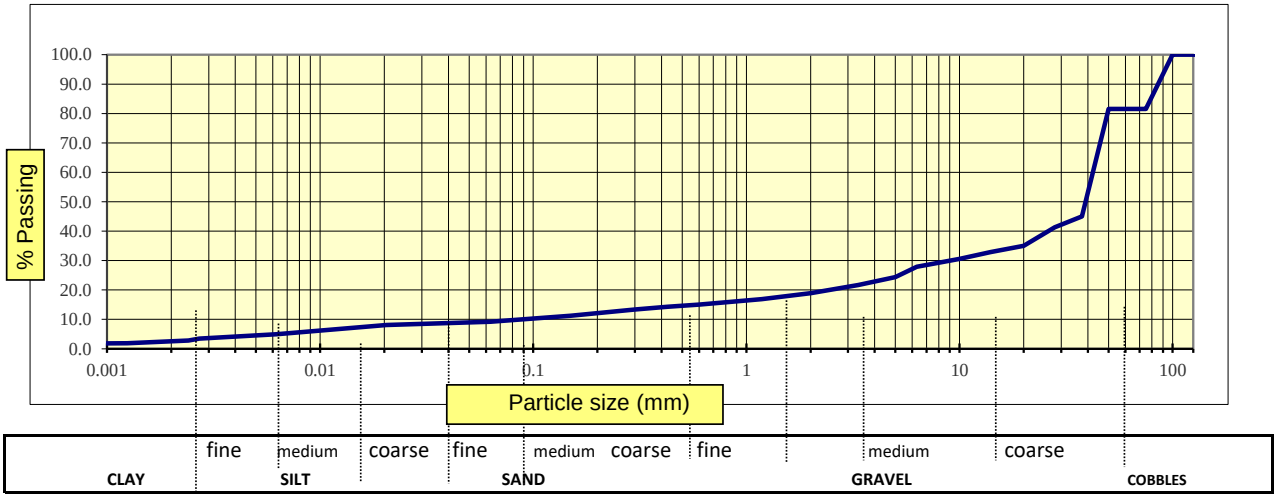
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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

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

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

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



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

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Sedimentation by Hydrometer - Not UKAS

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

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Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

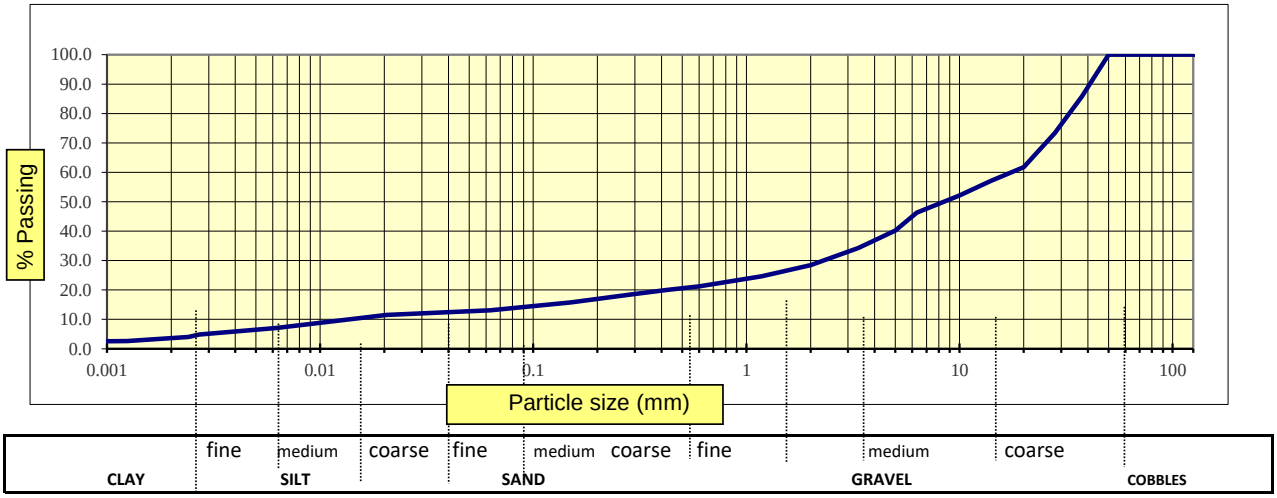
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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

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

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

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



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

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Sedimentation by Hydrometer - Not UKAS

UKAS TESTING 0955

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

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Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois
Tel: 057 8664885

James Fisher Testing Services

LABORATORY TEST REPORT

BRE Test Suite B - Greenfield Site

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

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

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

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

Comments:
None

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Subcontracted to a laboratory UKAS accredited for this testing

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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 93439
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	27/03/2020
Order No:	2003-104	**Date Reported:**	02/04/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC219-CPRC03 Type D Sample 10

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

Moisture Content (%): 2.7

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

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LABORATORY TEST REPORT

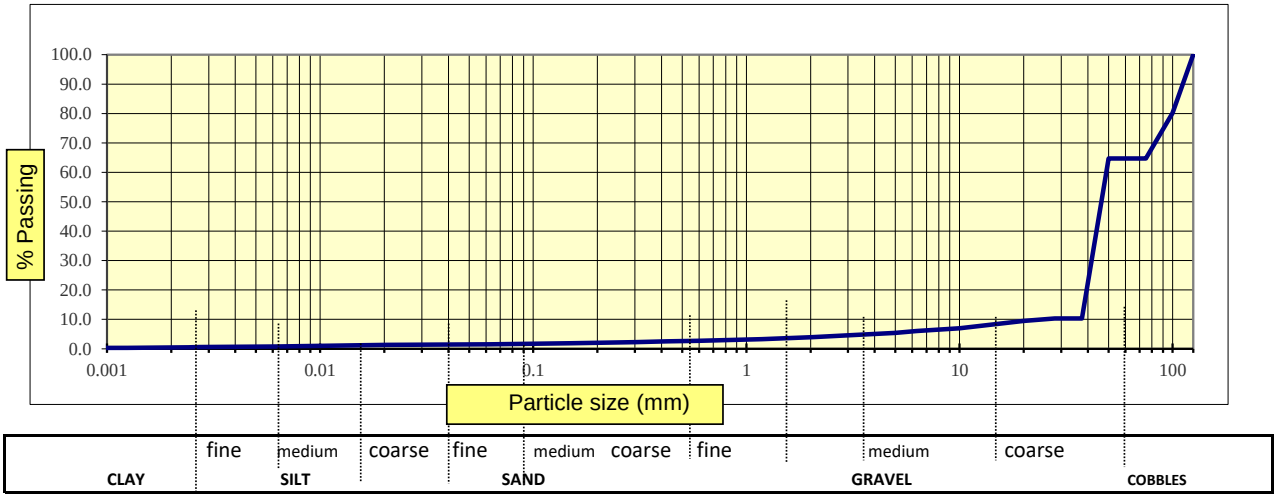
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 93441
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	02/04/2020
		Date Tested:	01/04/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Cobbly Clay, Sandy

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

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



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

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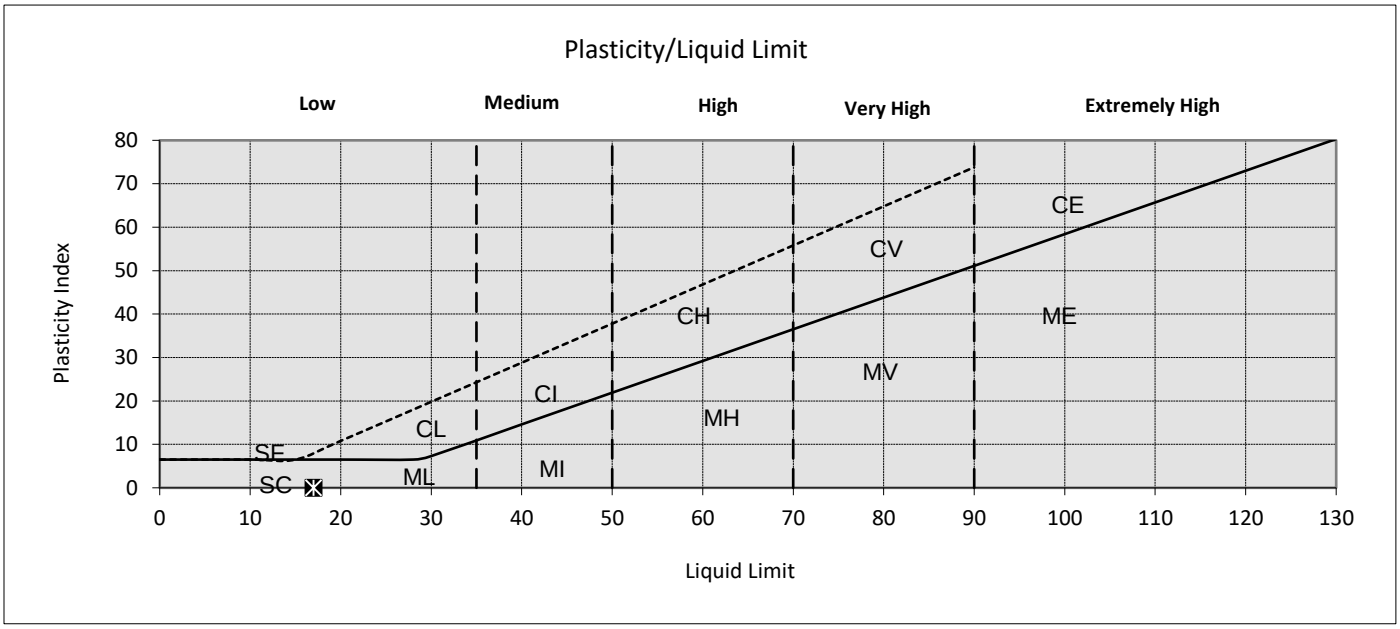
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Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

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

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

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



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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 93446
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	09/04/2020
	Co. Cork	**Material:**	Soil
Order No.:	2003-104	**Date Tested:**	07/04/2020
Originator:	Ian Holley	**Specification:**	Client

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

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

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

Comments:
None

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Subcontracted to a laboratory UKAS accredited for this testing

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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 93444
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	27/03/2020
Order No:	2003-104	**Date Reported:**	02/04/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC219-CPRC04 Type D Sample 4

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

Moisture Content (%): 5.7

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

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LABORATORY TEST REPORT

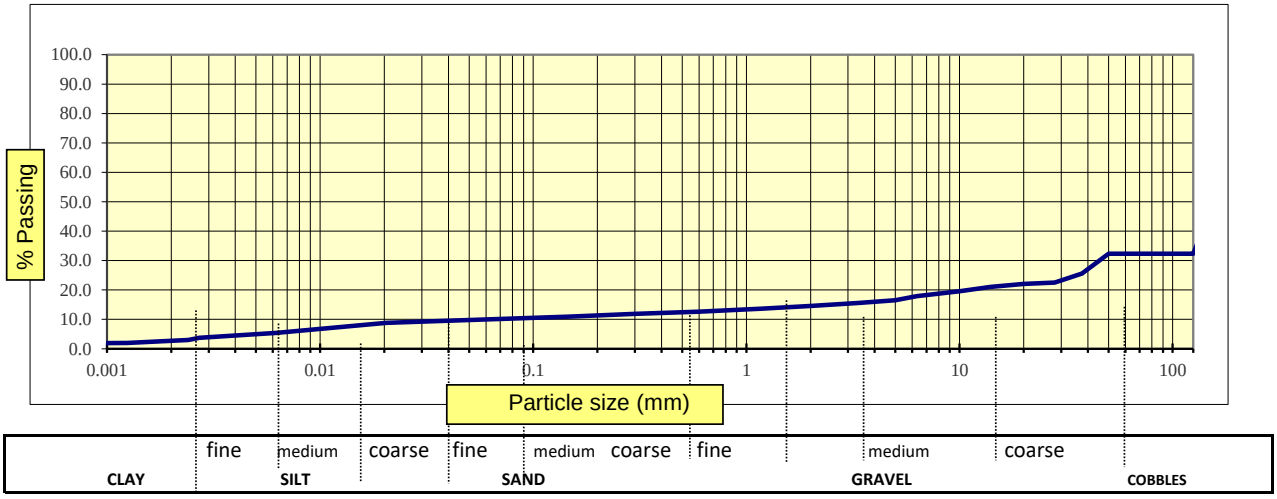
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 93443
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	02/04/2020
		Date Tested:	01/04/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Large Cobble, Light Clay, Sandy

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

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



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

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Sedimentation by Hydrometer - Not UKAS

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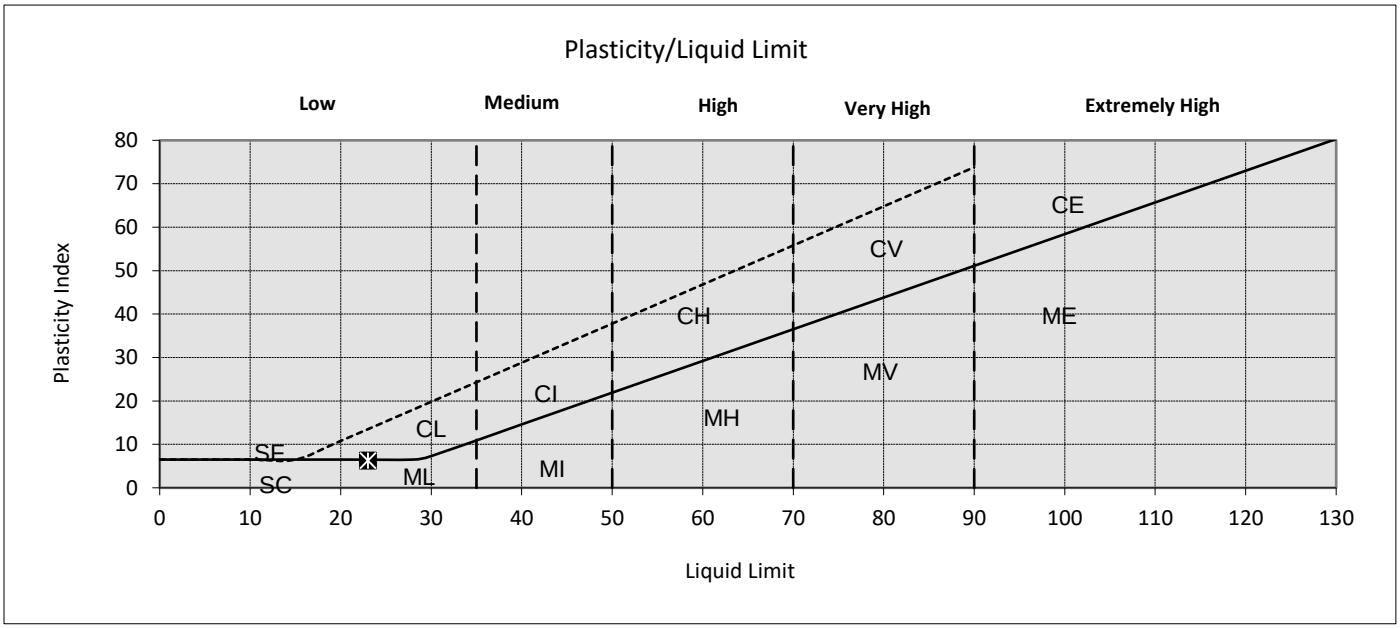
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Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

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

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

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



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Phil Thorp, Laboratory Manager

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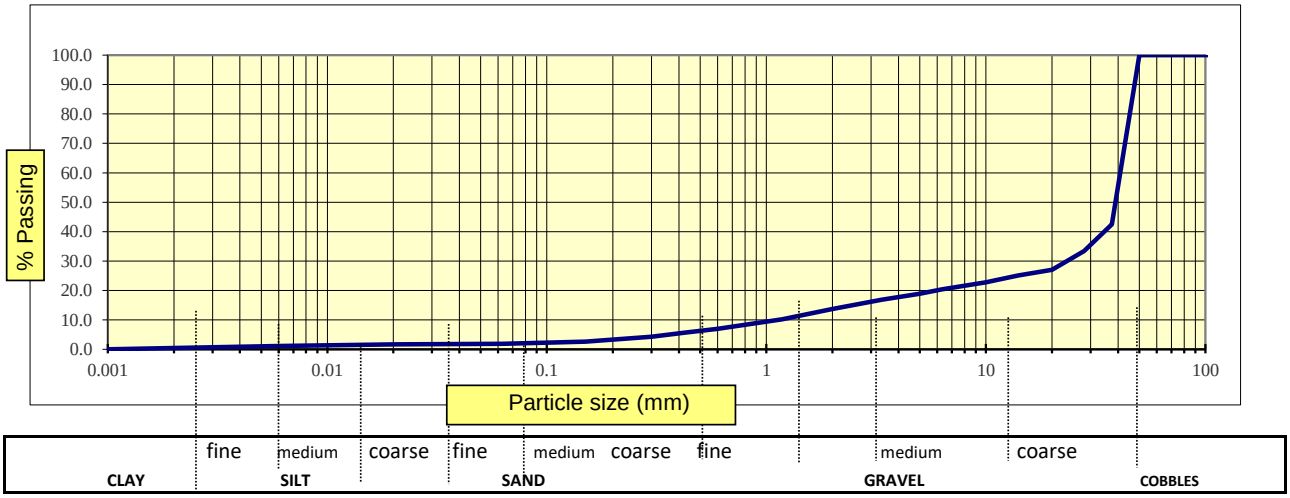
LABORATORY TEST REPORT

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

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

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

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



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

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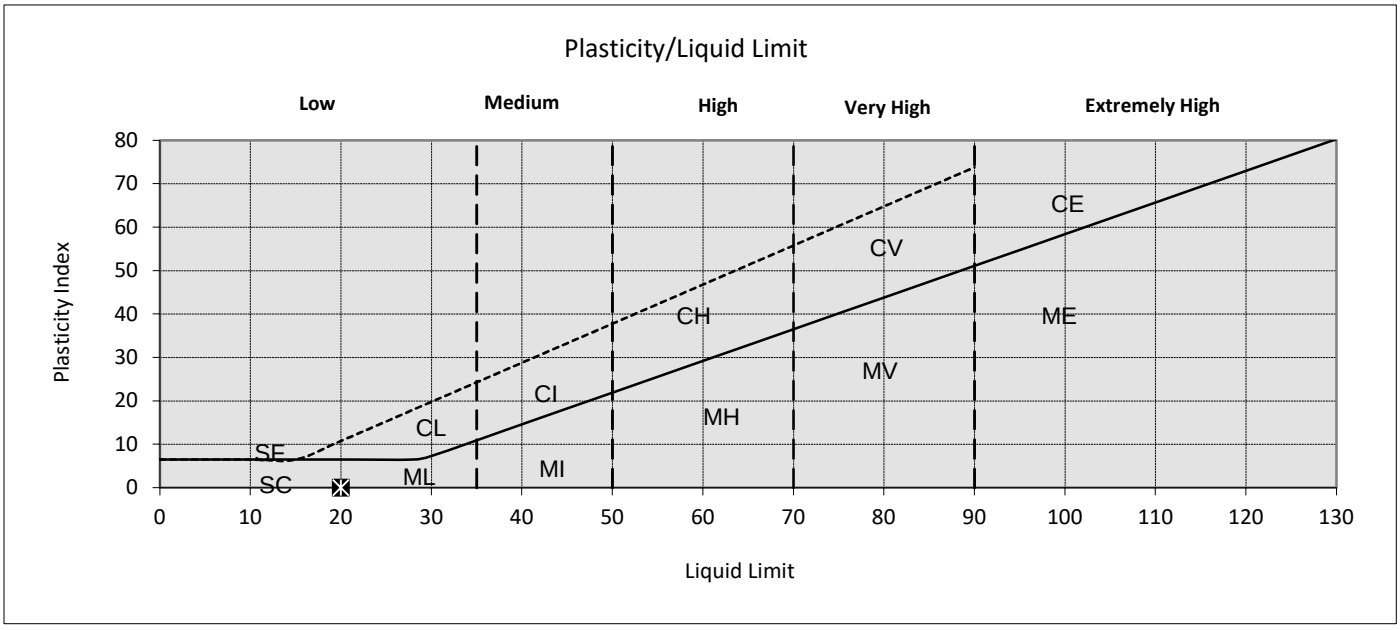
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LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

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

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



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Phil Thorp, Laboratory Manager

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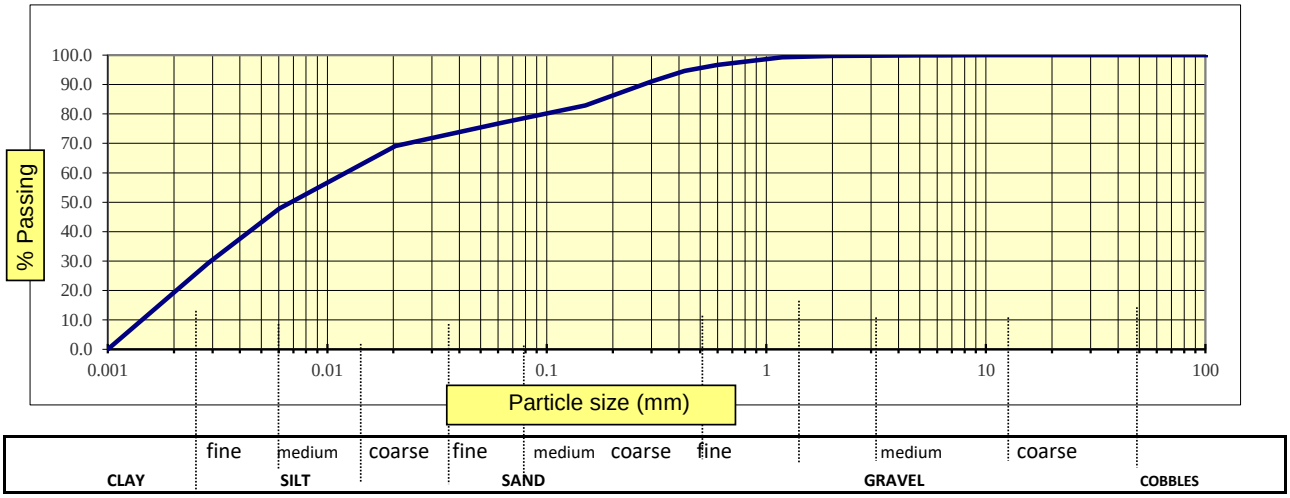
LABORATORY TEST REPORT

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

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

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

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



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

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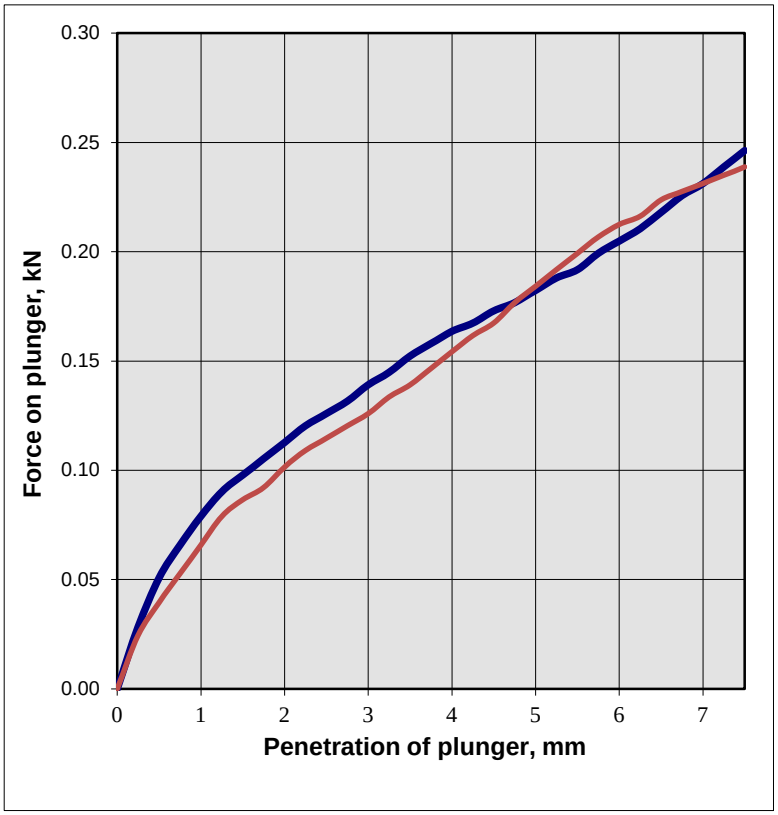
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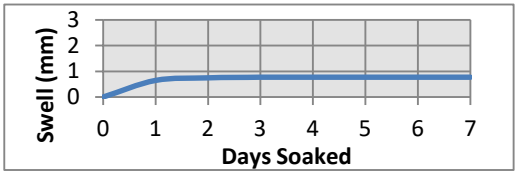
LABORATORY TEST REPORT

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 93453
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	14/04/2020
	Co Cork	**Date Reported:**	22/04/2020
Order No:	2003-104	**Sample Ref:**	XC219-TP02 Type D Sample 4
Originator :	**Ian Holley**	**Location:**	0.5-1.0m



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



Final Swell (mm):	0.77

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

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

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

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Phil Thorp, Laboratory Manager

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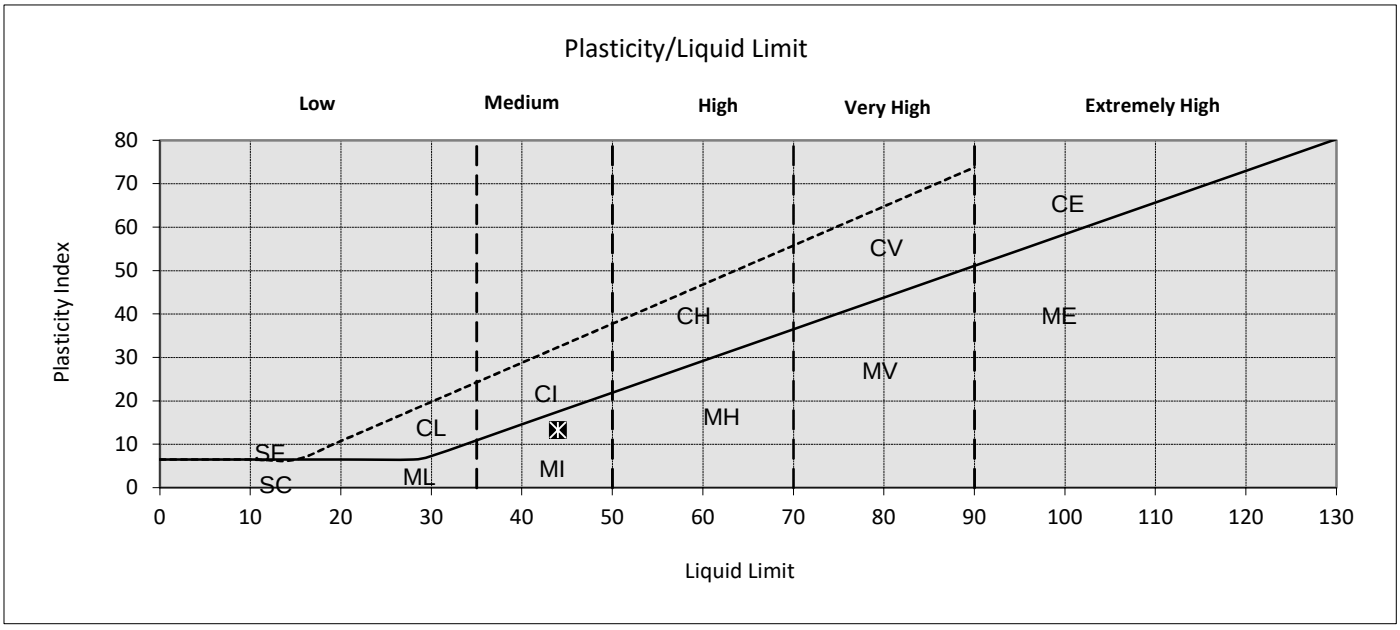
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Tel: 01925286880

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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 93451
	Unit 1 Carrigogna	**Sample Ref.:**	XC219-TP02 0.5-1.0m Type B S.3
	Midleton	**Date Sampled:**	Client Info
	Co Cork	**Date Received:**	09/03/2020
Order No:	2003-104	**Date Tested:**	01/04/2020
Originator:	**Ian Holley**	**Date Reported:**	22/04/2020

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



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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 93454
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	26/03/2020
Order No:	2003-104	**Date Reported:**	06/04/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC219-TP02 Type B Sample 6

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

Moisture Content (%): 32

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

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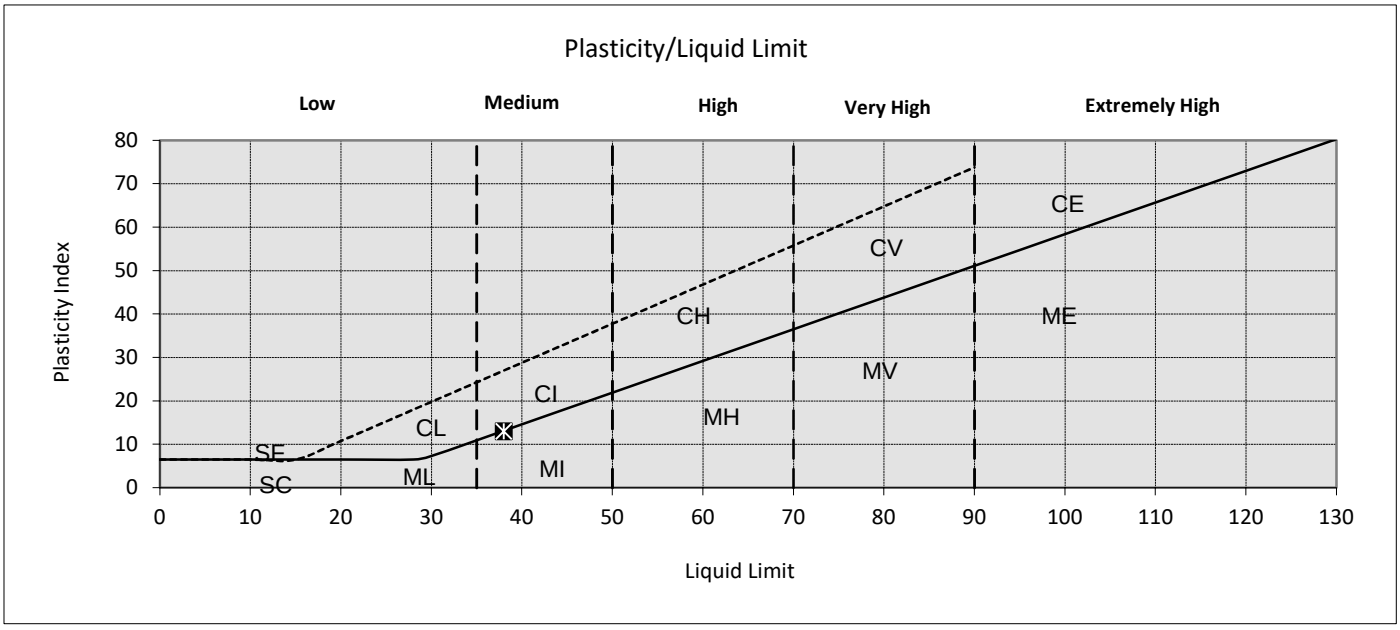
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Warrington, WA1 4RF
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LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

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

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



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LABORATORY TEST REPORT

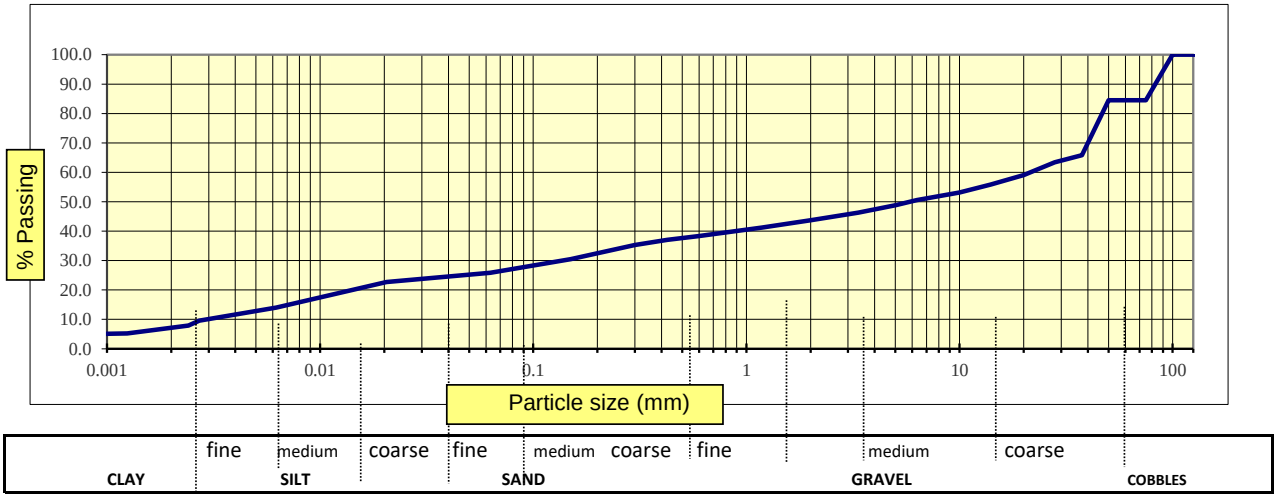
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 93456
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	02/04/2020
		Date Tested:	31/03/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Cobble, Light Clay, Sandy

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

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



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

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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 93457
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	09/04/2020
	Co. Cork	**Material:**	Soil
Order No.:	2003-104	**Date Tested:**	07/04/2020
Originator:	Ian Holley	**Specification:**	Client

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

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

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

Comments:
None

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Subcontracted to a laboratory UKAS accredited for this testing

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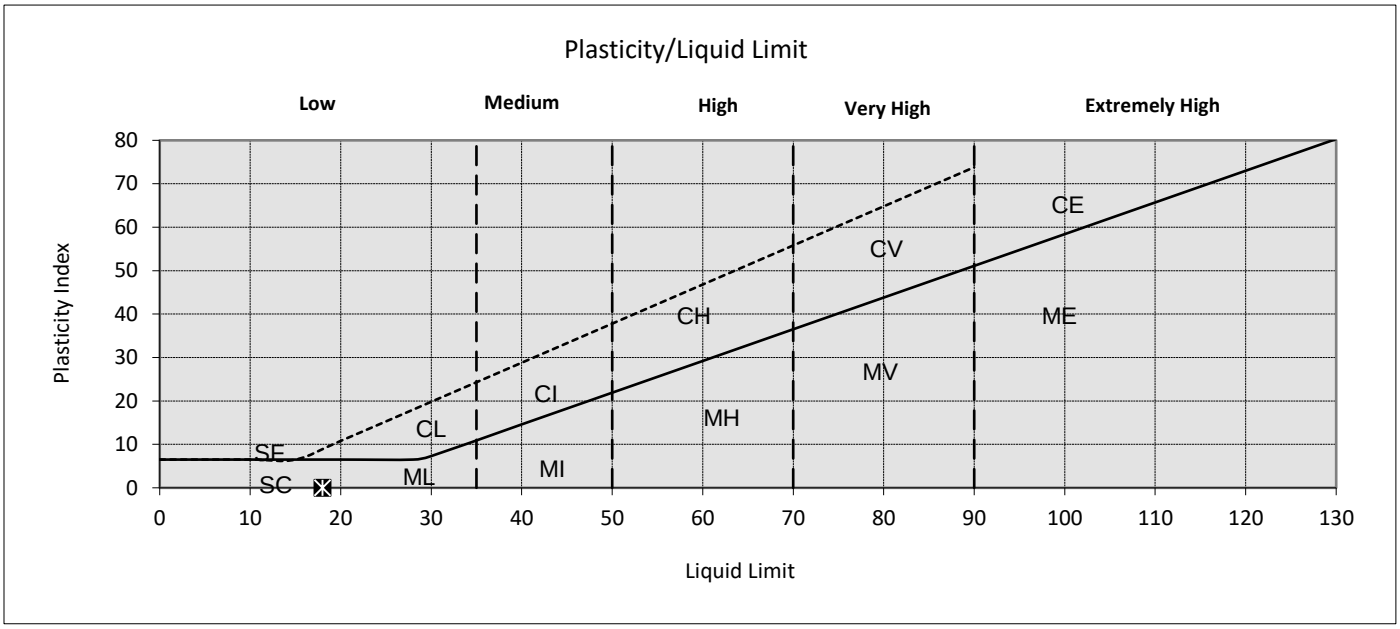
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LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

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

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



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Phil Thorp, Laboratory Manager

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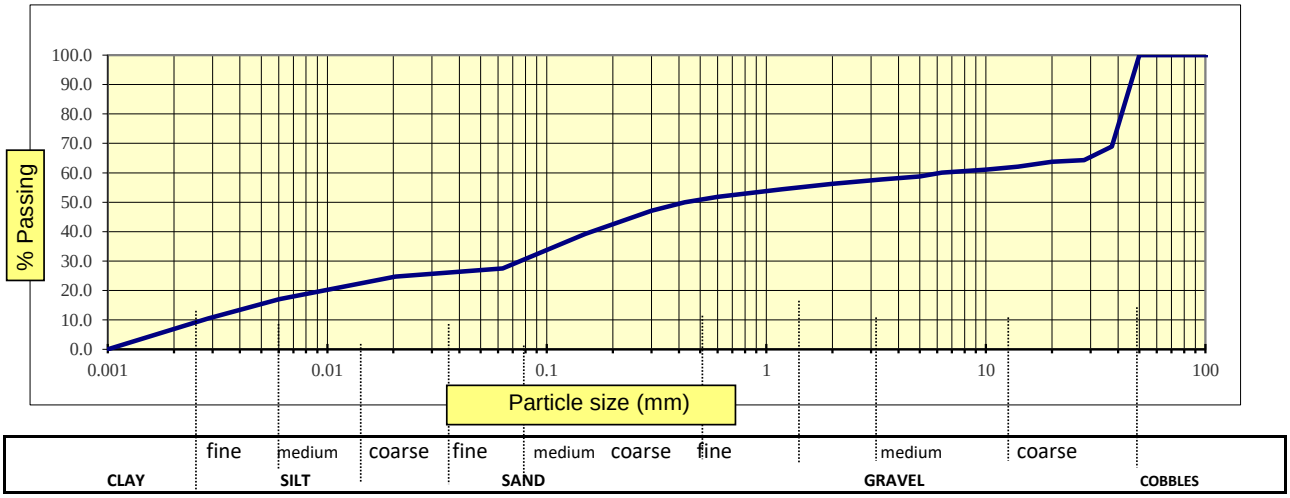
LABORATORY TEST REPORT

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

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

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

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



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

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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 93461
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	13/03/2020
Order No:	2003-104	**Date Reported:**	25/03/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC219-TP03 Type B Sample 4

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

Moisture Content (%): 20

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

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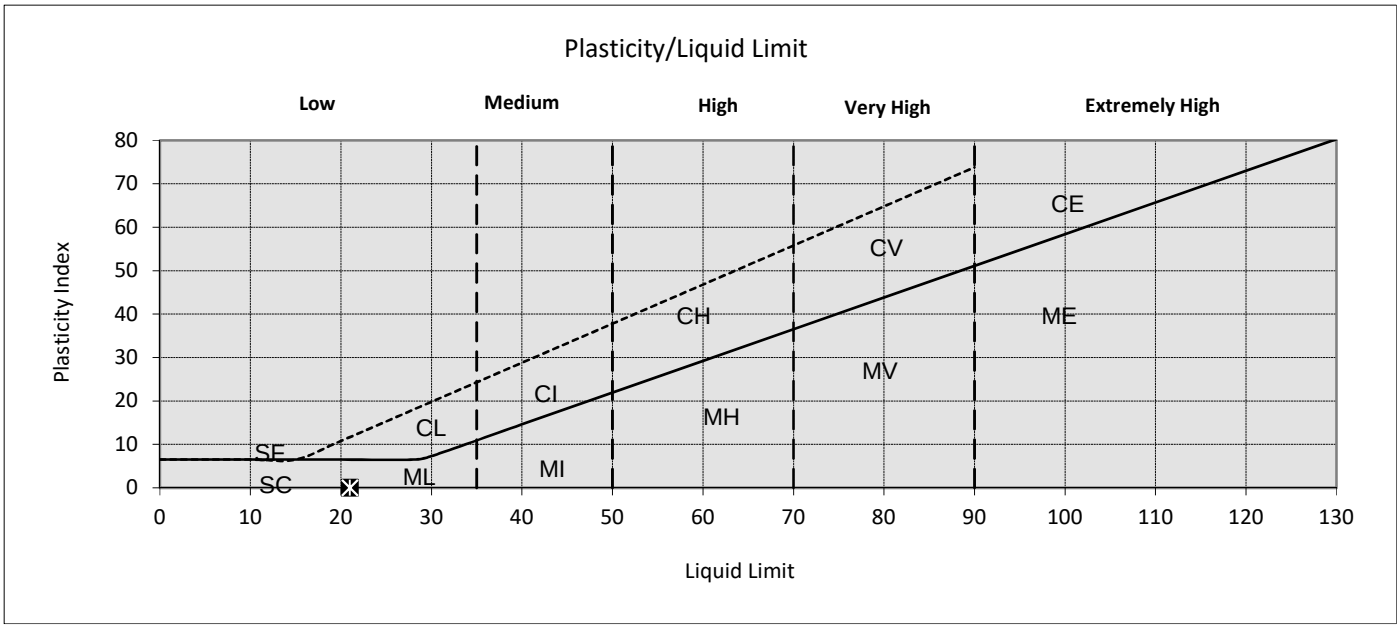
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LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

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

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



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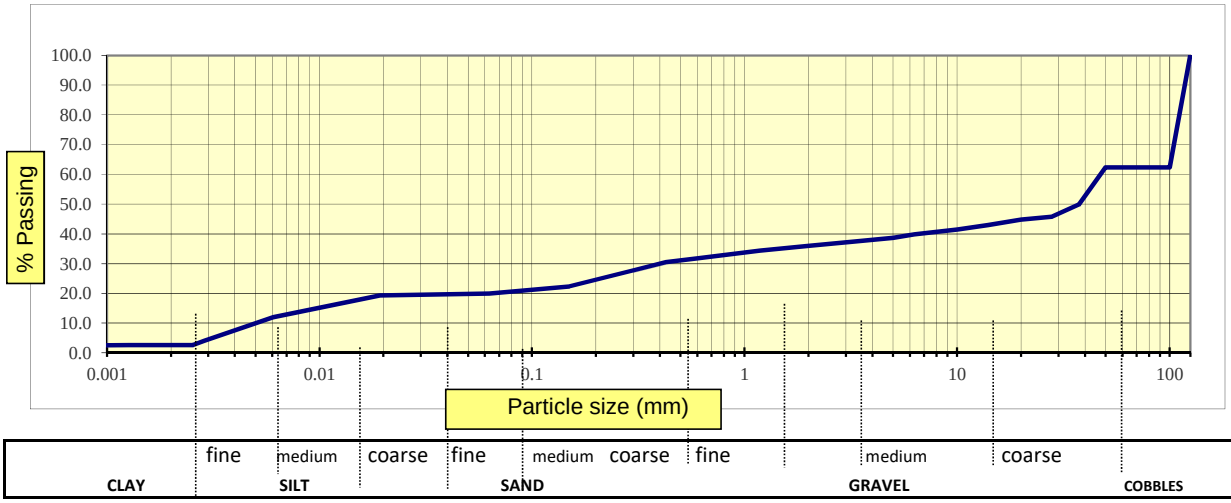
LABORATORY TEST REPORT

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

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

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

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



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

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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 93465
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	09/04/2020
	Co. Cork	**Material:**	Soil
Order No.:	2003-104	**Date Tested:**	07/04/2020
Originator:	Ian Holley	**Specification:**	Client

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

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

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

Comments:
None

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LABORATORY TEST REPORT

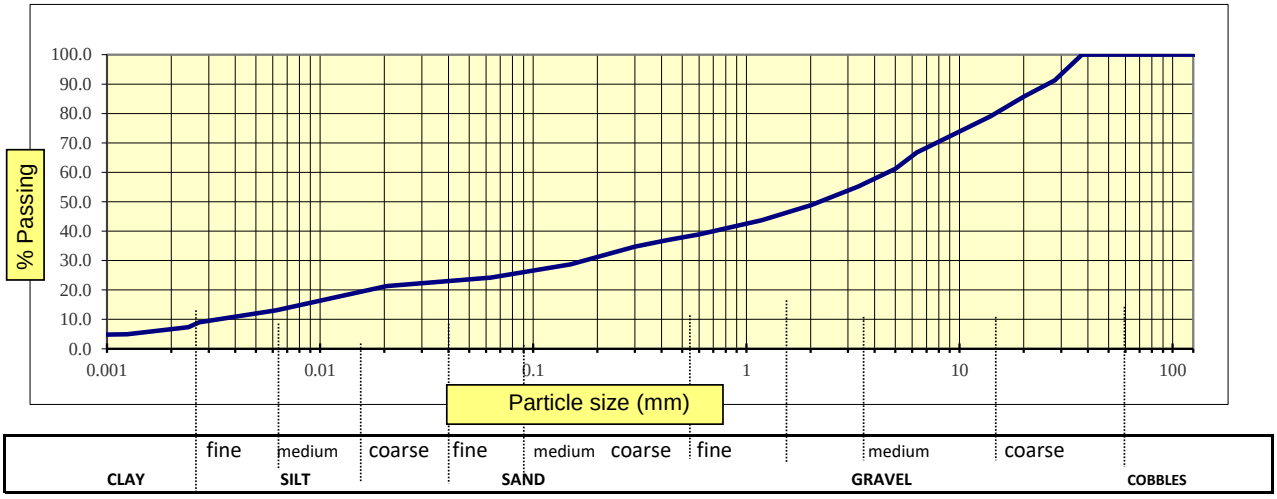
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 93464
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	02/04/2020
		Date Tested:	01/04/2020
Order No:	2003-104	**Material:**	Soil
Originator:	Ian Holley	**Visual Description**	Light Gravel, Sandy

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

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



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

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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 93468
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Reported:**	09/04/2020
	Co. Cork	**Material:**	Soil
Order No.:	2003-104	**Date Tested:**	07/04/2020
Originator:	Ian Holley	**Specification:**	Client

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

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

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

Comments:
None

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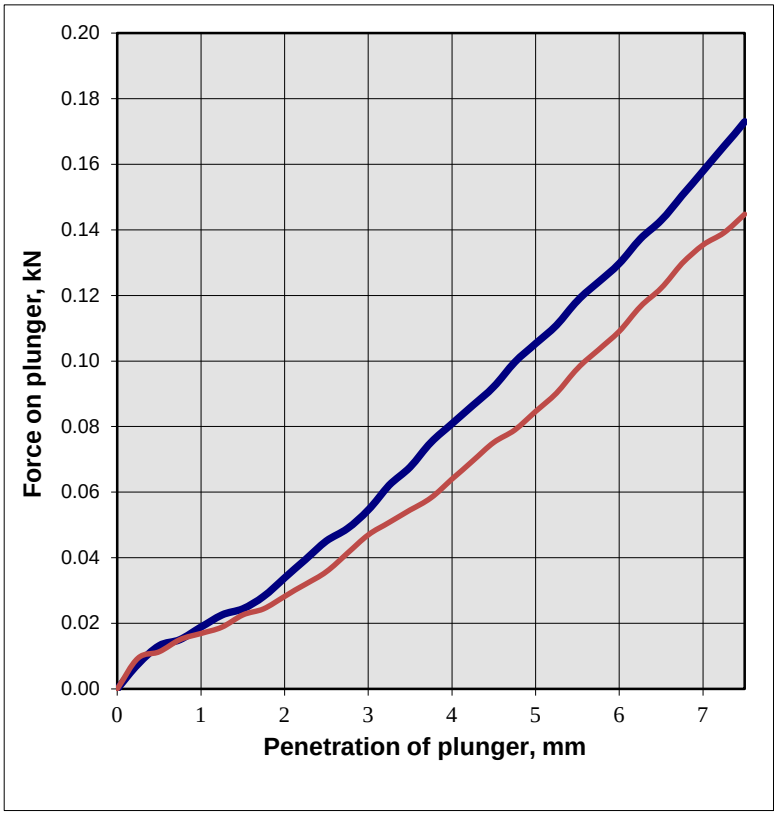
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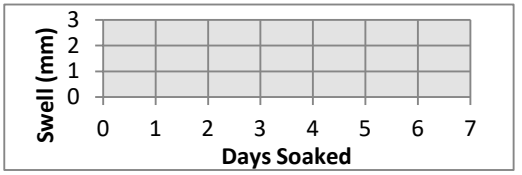
LABORATORY TEST REPORT

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 93469
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	17/04/2020
	Co Cork	**Date Reported:**	21/04/2020
Order No:	2003-104	**Sample Ref:**	XC219-TP04 Type B Sample 2
Originator :	**Ian Holley**	**Location:**	0.3-0.8m



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



Final Swell (mm):	N/A

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

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

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

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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 93466
	Unit 1 Carrigogna	**Date Received:**	09/03/2020
	Midleton	**Date Tested:**	27/03/2020
Order No:	2003-104	**Date Reported:**	02/04/2020
Originator:	**Ian Holley**	**Specification:**	Client

Sampled Ref: XC219-TP04 Type D Sample 2

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

Moisture Content (%): 19

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

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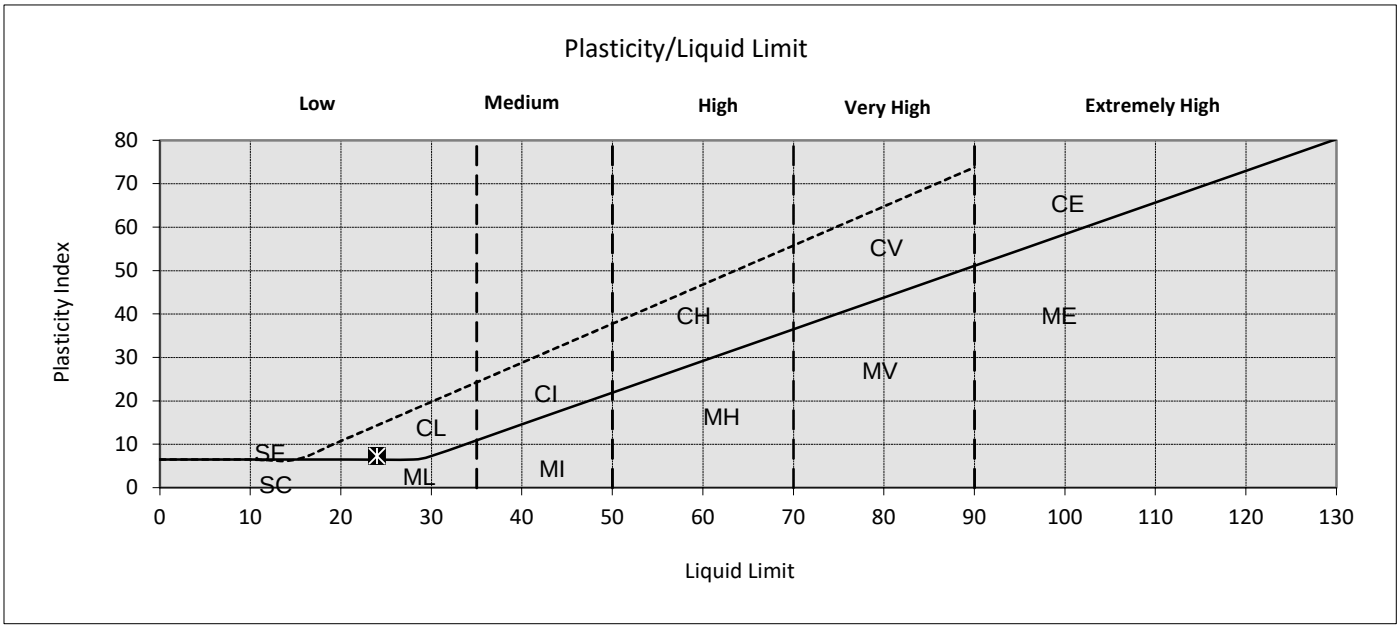
James Fisher Testing Services Ltd
Ruby House, 40A Hardwick Grange
Warrington, WA1 4RF
Tel: 01925286880

James Fisher Testing Services

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

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

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



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

UKAS TESTING 0955

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

James Fisher Testing Services

LABORATORY TEST REPORT

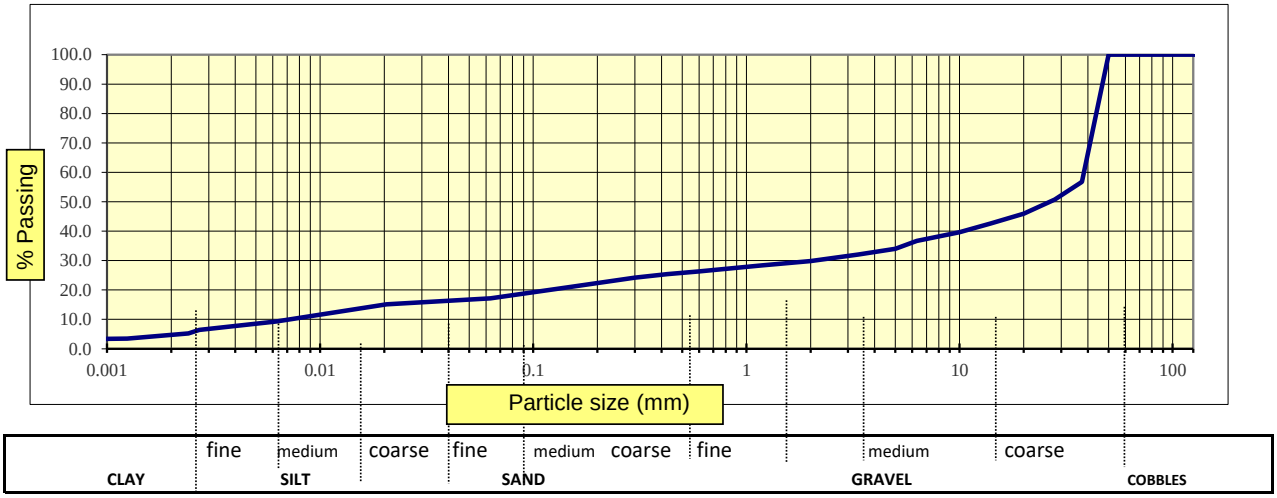
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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

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

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

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



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

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Sedimentation by Hydrometer - Not UKAS

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

UKAS TESTING 0955

INDEX PROPERTIES - SUMMARY OF RESULTS

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

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

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

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

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

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

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

QA Ref
SLR 1
Rev 2.95
Mar 17

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Project No N9426-20

Project Name Cork Line Level Crossings

Figure

INDX

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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
XC219-CPRC01	8	1.20	2.00	D	Brown slightly sandy gravelly CLAY.			7	45 s	23 a	16	7		
XC219-CPRC01	11	2.00	2.40	D	Brown slightly sandy slightly gravelly CLAY.			25	95 h	44 a	23	21		
XC219-CPRC01	13	2.40	3.00	D				5.8						

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

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

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

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

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

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

QA Ref
SLR 1
Rev 2.95
Mar 17

SOCOTEC

Project No N9426-20

Project Name Cork Line Level Crossings

Figure

INDX

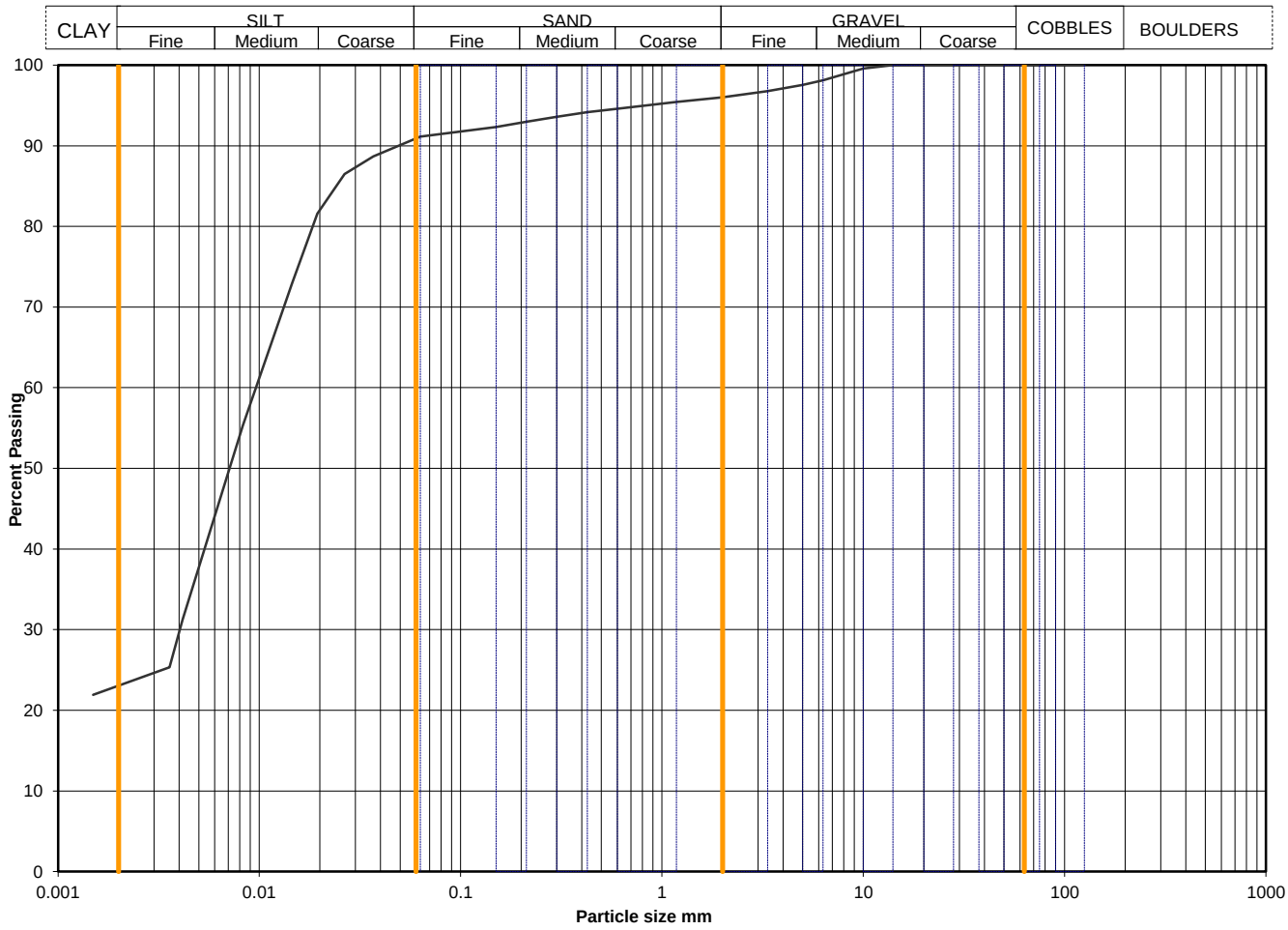
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020100237

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



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

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

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

Uniformity Coefficient	D60 / D10	Not applicable

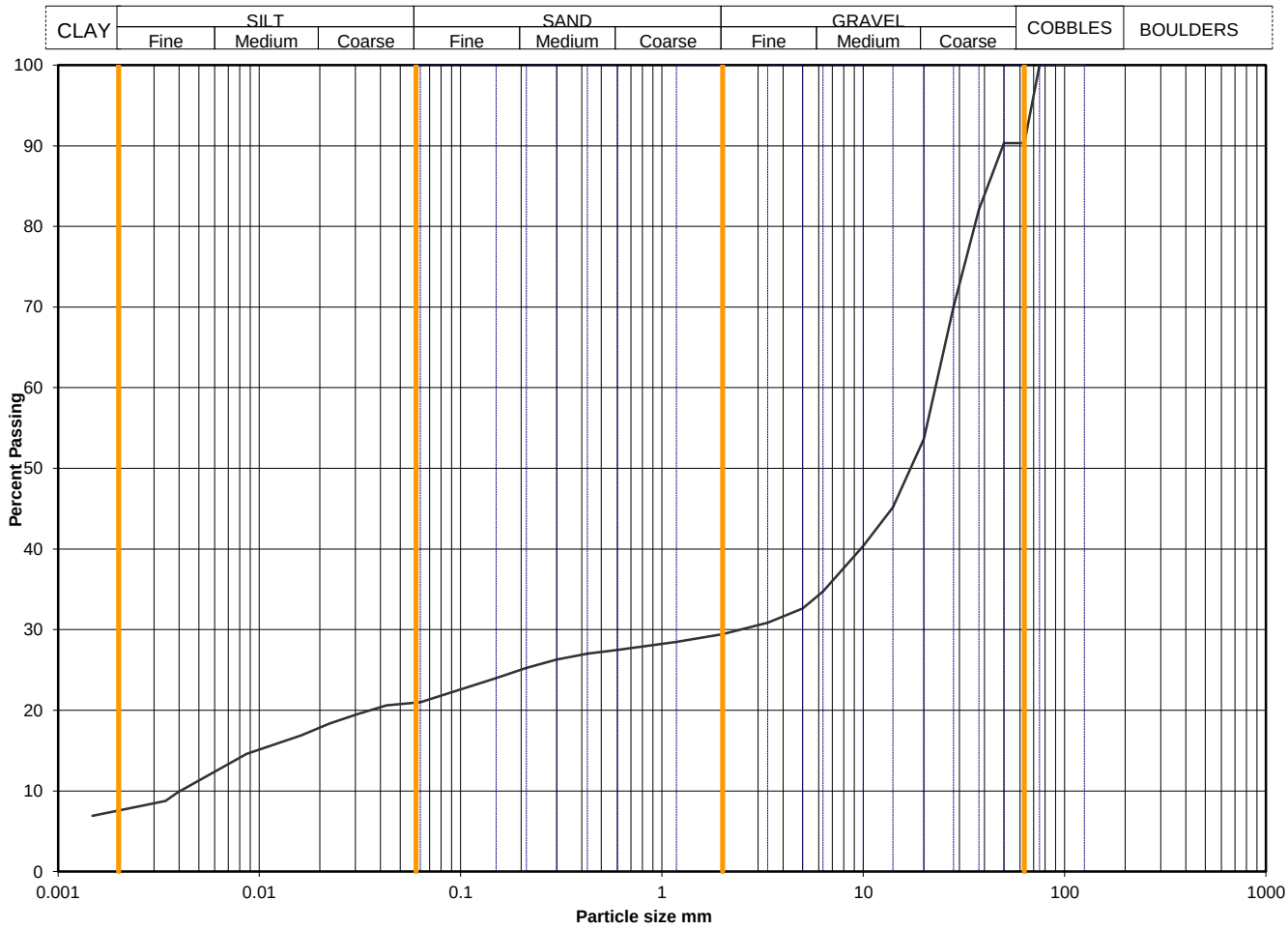
Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020100243

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



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

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

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

Uniformity Coefficient	D60 / D10	5605

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

QA Ref
SLR 2,9
Rev 2.22
Jul 17

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Project No N9425-20

Project Name Cork Line Level Crossings

Figure
PSD

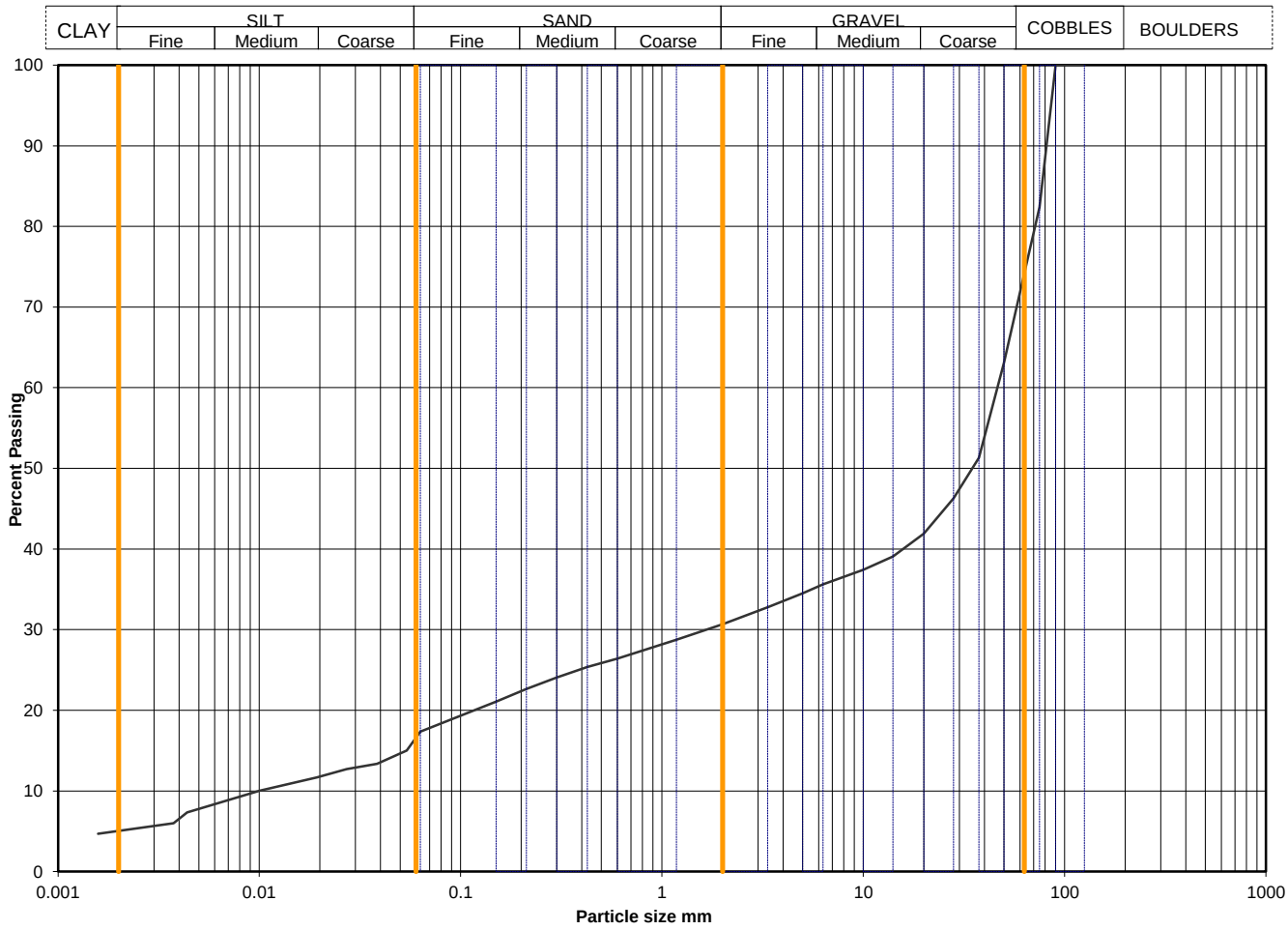
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020100679

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



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

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

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

Uniformity Coefficient	D60 / D10	4661

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

QA Ref
SLR 2,9
Rev 2.22
Jul 17

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Project No N9426-20

Project Name Cork Line Level Crossings

Figure
PSD

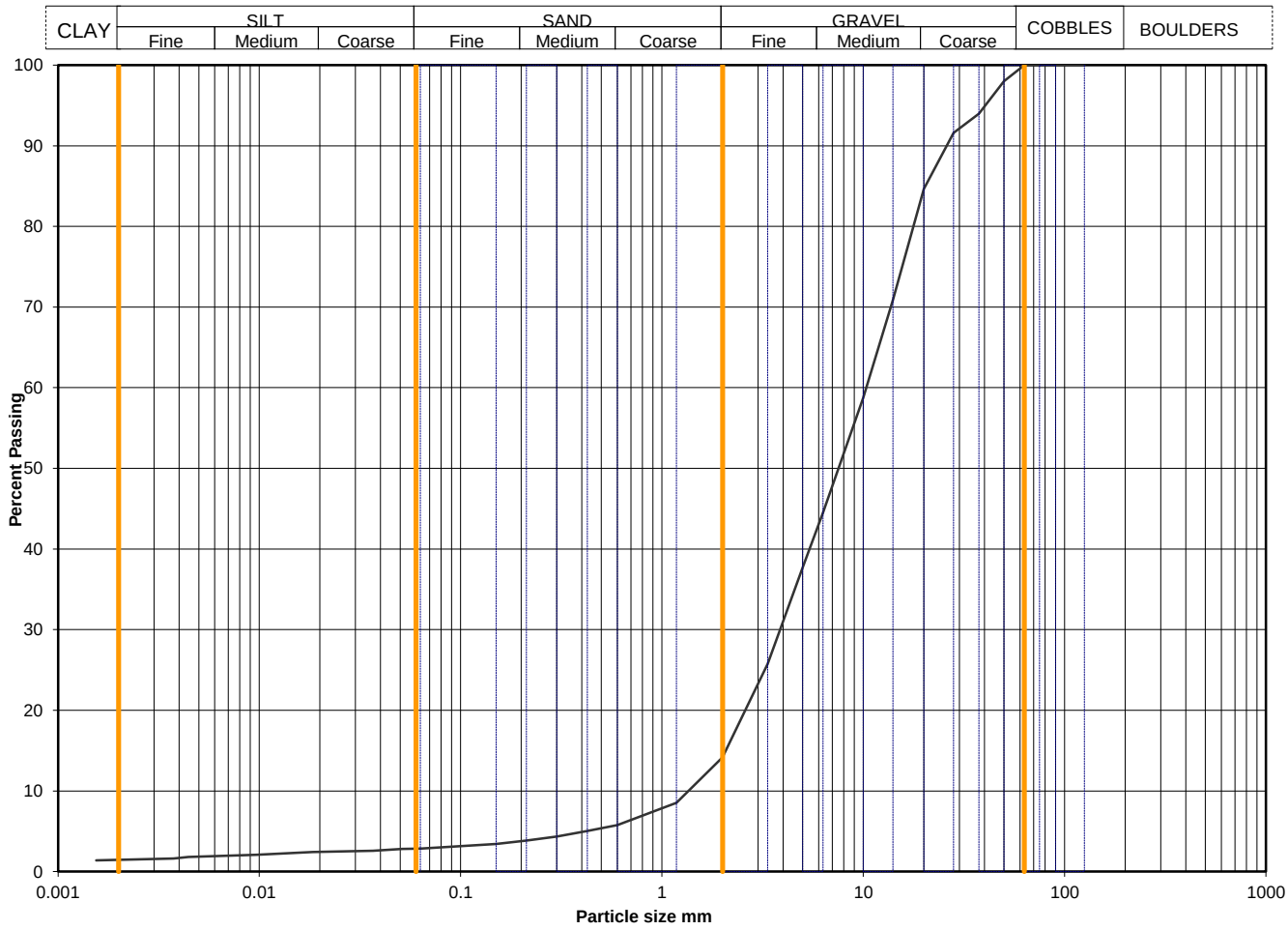
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020100685

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



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

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

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

Uniformity Coefficient	D60 / D10	8

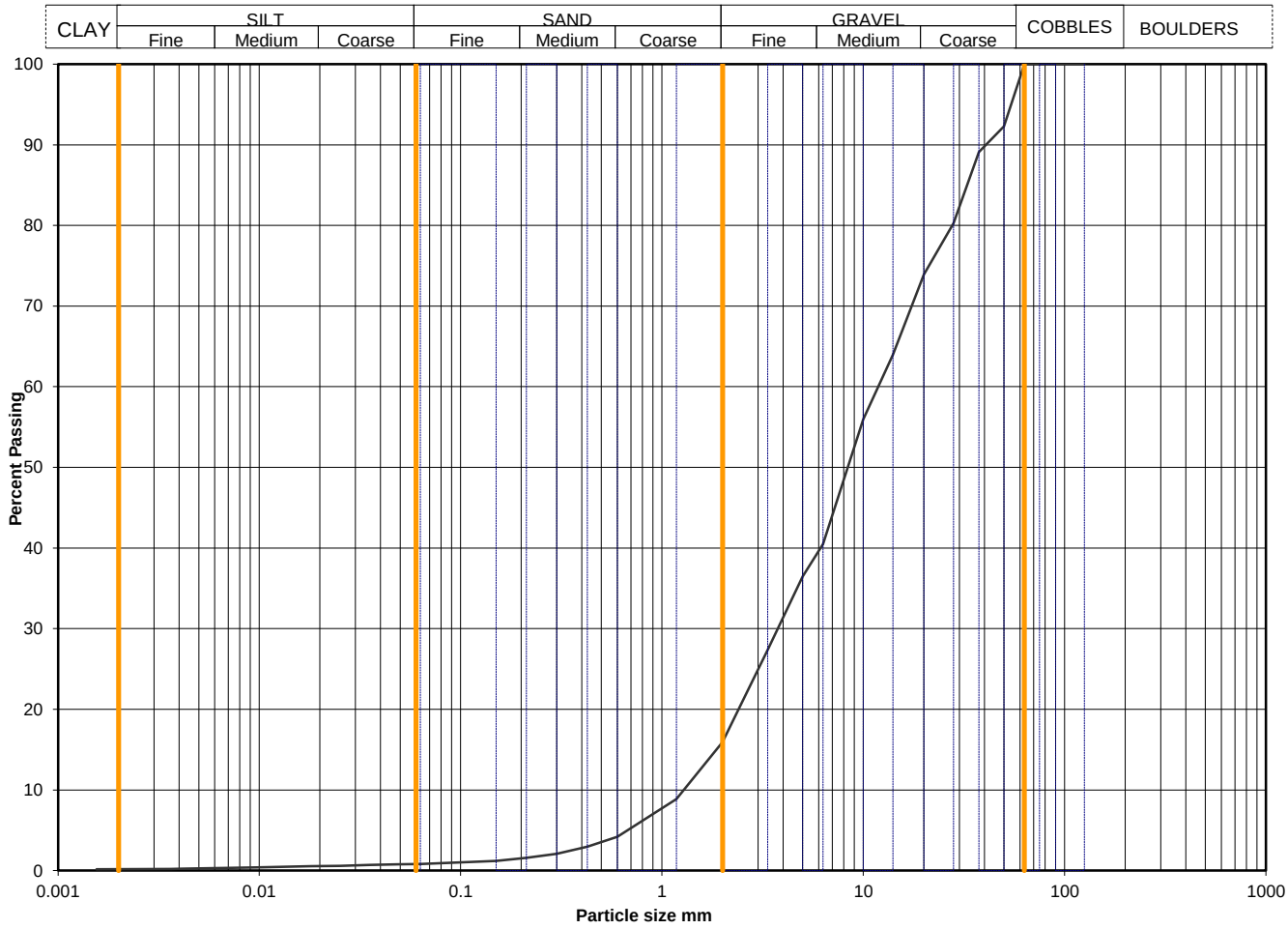
Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:
	SOCO2020100691

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



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

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

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

Uniformity Coefficient	D60 / D10	9

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

QA Ref
SLR 2,9
Rev 2.22
Jul 17

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Project No N9426-20

Project Name Cork Line Level Crossings

Figure
PSD

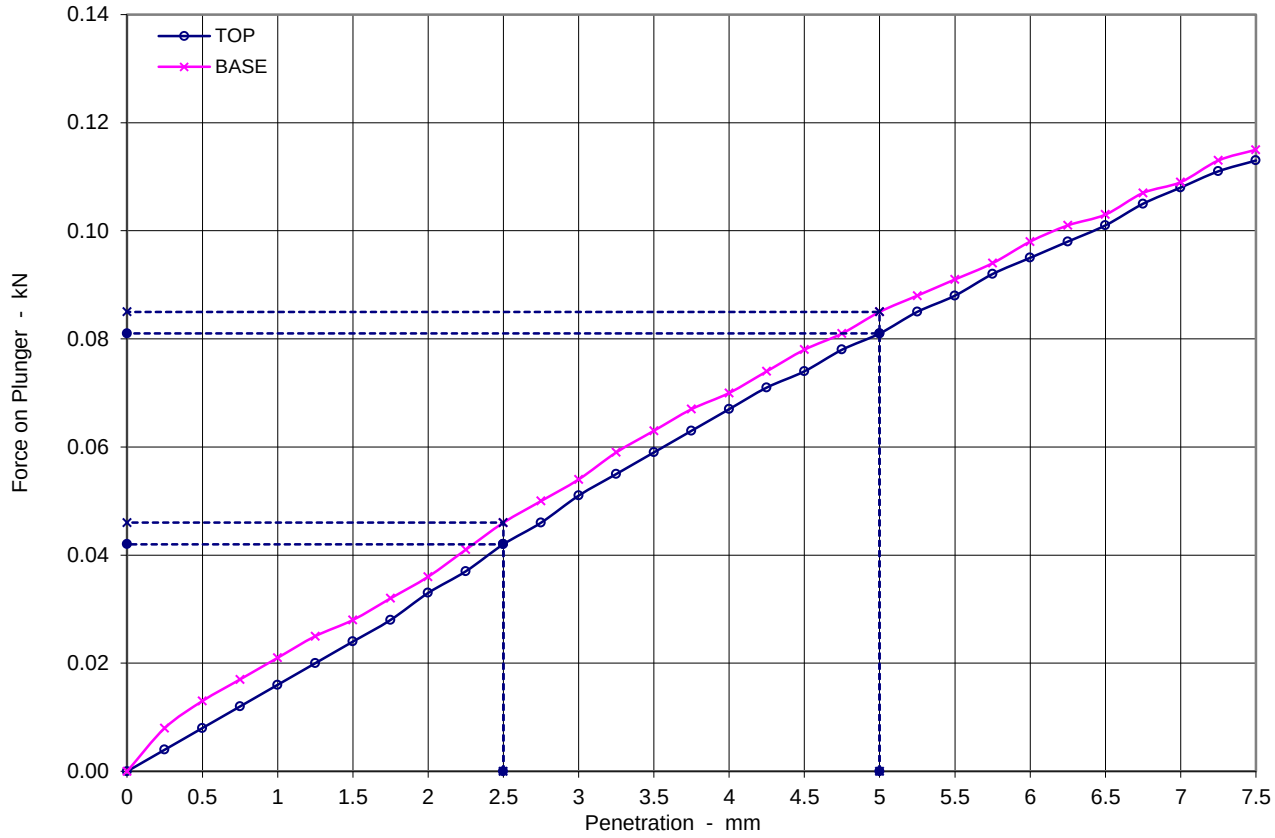
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California Bearing Ratio (BS1377:1990:Part 4 , section 7)

Sample Details:	SAMPLE ID:
	SOCO2020100239

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



Soil description	Brown slightly sandy CLAY.

Test Conditions		
Sample Retained on 20 mm sieve	%	0

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

Surcharge applied		
	kg	0
	kPa	0

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

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

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

Notes :

QA Ref
SLR 4.7
Rev 2.8
Mar 17

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Project No N9425-20

Project Name Cork Line Level Crossings

Figure
CBR

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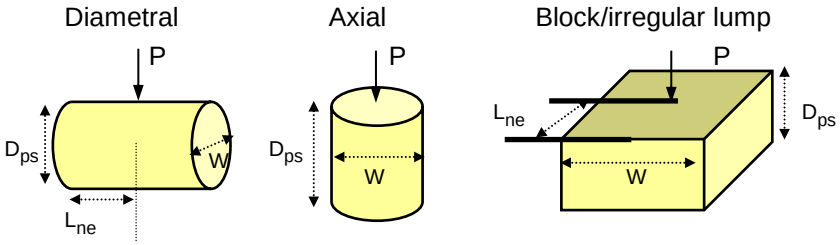
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Appendix I Geotechnical Rock Core Laboratory Test Results

Point Load Index Test

All specimens tested at as received water content unless shown otherwise

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



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

QA Ref
ISRM 85
Rev 2.10
Aug 17

UKAS TESTING
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SOCOTEC

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

Figure
PLT

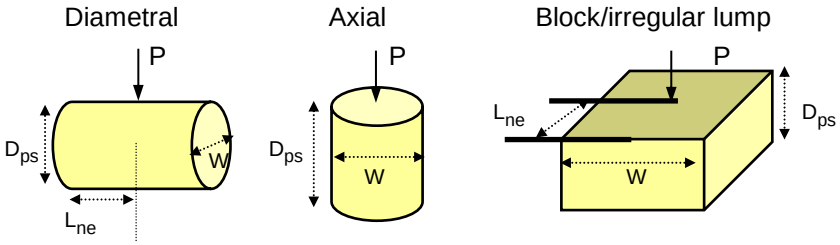
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Point Load Index Test

All specimens tested at as received water content unless shown otherwise

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



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

QA Ref
ISRM 85
Rev 2.10
Aug 17

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Project No N9366-20

Project Name Irish Rail - Cork Line

Figure
PLT

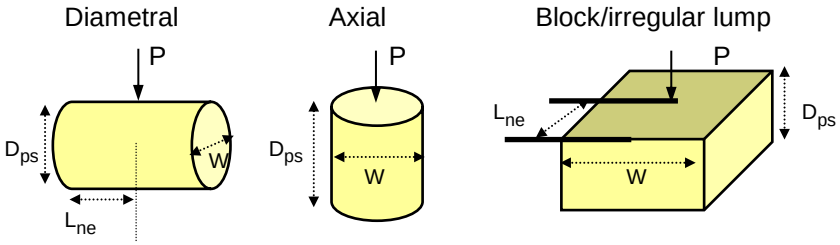
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Point Load Index Test

All specimens tested at as received water content unless shown otherwise

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



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

QA Ref
ISRM 85
Rev 2.10
Aug 17

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Project No N9435-20

Project Name Cork Line Level Crossings

Figure
PLT

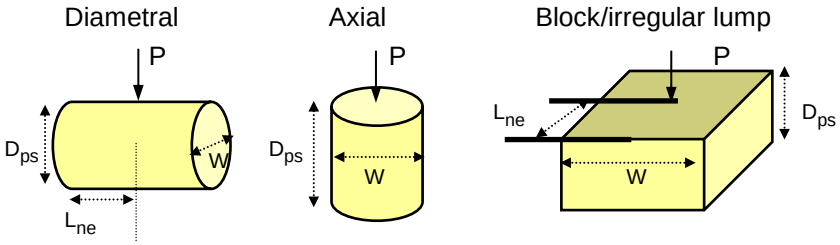
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Point Load Index Test

All specimens tested at as received water content unless shown otherwise

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



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

QA Ref
ISRM 85
Rev 2.10
Aug 17

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Project No N9435-20

Project Name Cork Line Level Crossings

Figure
PLT

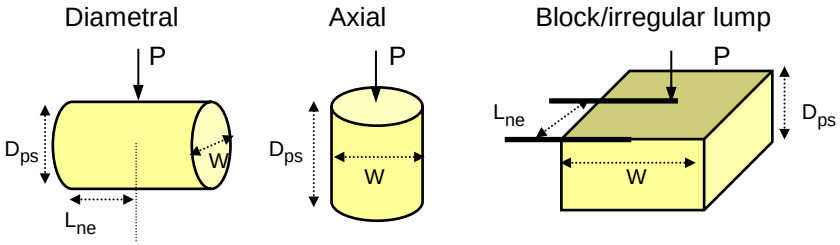
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Point Load Index Test

All specimens tested at as received water content unless shown otherwise

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



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

QA Ref
ISRM 85
Rev 2.10
Aug 17

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Project No N9436-20

Project Name Cork Line Level Crossings

Figure
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Uniaxial Compressive Strength Of Rock - Summary of Results

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

Notes :

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

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

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

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

above notes apply unless annotated otherwise in the remarks

Mode of failure :

S - Single shear MS - multiple shear

AC - Axial cleavage F - Fragmented

QA Ref
RLR 2
Rev 2.19
Apr 19

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Project No N9366-20

Project Name Irish Rail - Cork Line

Figure

RUCS

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Uniaxial Compressive Strength Of Rock - Summary of Results

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

Notes :

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

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

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

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

above notes apply unless annotated otherwise in the remarks

Mode of failure :

S - Single shear MS - multiple shear

AC - Axial cleavage F - Fragmented

QA Ref
RLR 2
Rev 2.19
Apr 19

UKAS TESTING
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SOCOTEC

Project No N9435-20

Project Name Cork Line Level Crossings

Figure

RUCS

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Uniaxial Compressive Strength Of Rock - Summary of Results

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

Notes :

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

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

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

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

above notes apply unless annotated otherwise in the remarks

Mode of failure :

S - Single shear MS - multiple shear

AC - Axial cleavage F - Fragmented

QA Ref
RLR 2
Rev 2.19
Apr 19

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Project No N9436-20

Project Name Cork Line Level Crossings

Figure

RUCS

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Certificate of Analysis

Certificate Number 20-19523

16-Oct-20

Client Socotec - Geotechnical Lab
Askern Road
Doncaster
DN6 8DG

Our Reference 20-19523

Client Reference N9366-20

Order No N20-O-2198

Contract Title Irish Rail- Cork Line

Description 13 Concrete samples.

Date Received 06-Oct-20

Date Started 06-Oct-20

Date Completed 16-Oct-20

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Adam Fenwick
Contracts Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Concrete Samples

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

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

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

Summary of Chemical Analysis
Concrete Samples

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

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

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

Information in Support of the Analytical Results

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

Containers Received & Deviating Samples

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

Key: P-Plastic G-Bag

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

Soil Analysis Notes

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

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

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

Disposal

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

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

End of Report

Appendix J Environmental Laboratory Test Results

SOCOTEC

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

Certificate of Analysis

Project No: 20071478

Client: OCB Geotechnical Limited

Quote Number: BEC200710078

Project Reference: Irish Rail - Cork Line

Site Name: 19-135

Contact: Ian Holley

Address: Unit 1
Carrigogna
Midleton
County Cork

Post Code: Ireland

E-Mail: iholley@ocbgeotechnical.com

Phone No: 021 4638474

Number of Samples Received: 2

Date Received: 30/07/2020

Analysis Date: 11/08/2020

Date Issued: 11/08/2020

Job Status: Complete

Report Type: Final Version 01

This report supersedes any versions previously issued by the laboratory

Account Manager

Martin Elliott-Palmer

Authorised by the Operations Manager
Becky Batham

Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

Samples Analysed

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

SOCOTEC

Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

Analysis Results

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

UKAS TESTING
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Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

Analysis Results

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

UKAS TESTING
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Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

Analysis Results

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

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Report Number :

Additional Report Notes

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

LIMS-F002 - Report Notes

Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

Deviating Sample Report

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

Analysis Method

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

Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

Additional Information

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

Results within this report relate only to the samples tested.

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

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

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

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

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

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

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

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

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

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

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

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

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

End of Certificate of Analysis

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

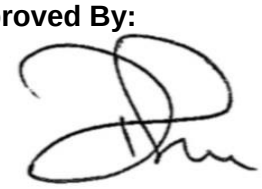
UKAS TESTING
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Final Report

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

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

Approved By:



Details: Darrell Hall, Director

Chemtest
The right chemistry to deliver results

Results - Leachate

Project: Soil Testing

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

Results - Leachate

Project: Soil Testing

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

Deviations

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

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

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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.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

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

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

Sample Deviation Codes

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

Sample Retention and Disposal

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

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

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

Final Report

Report No.:	20-07165-1		
Initial Date of Issue:	12-Mar-2020		
Client	Environmental Laboratory Services Ltd		
Client Address:	Acorn Business Campus Mahon Industrial Park Blackrock Cork Ireland		
Contact(s):	Emer Kearney Results		
Project	Soil Samples		
Quotation No.:	Q20-19728	**Date Received:**	05-Mar-2020
Order No.:	6897	**Date Instructed:**	05-Mar-2020
No. of Samples:	4		
Turnaround (Wkdays):	5	**Results Due:**	11-Mar-2020
Date Approved:	12-Mar-2020		
Approved By:			
Details:	Darrell Hall, Director		

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Results - Leachate

Project: Soil Samples

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

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Project: Soil Samples

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

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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.
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 Geophysical Survey Report

XC219 Buttevant Level Crossing

Co. Cork

Geophysical Survey

Report Status: Final

MGX Project Number: 6508

MGX File Ref: 6508f-005.doc

9th November 2020

Confidential Report To:

OCB Geotechnical
Unit 11
Carrigogna
Midleton
Co. Cork

Report submitted by :
Minerex Geophysics Limited

Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare, W23X7Y5
Ireland
Tel.: 01-6510030
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Issued by:

Author: Hartmut Krahn (Senior Geophysicist)

Reviewer: John Connaughton (Geophysicist)

Minerex
Geophysics Limited

Subsurface Geophysical Investigations

EXECUTIVE SUMMARY

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

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List of Tables, Maps and Figures:

Title	Pages	Document Reference
Table 1: Geophysical Survey Locations and Acquisition Parameters	In text	In text
Table 2: Summary of Interpretation	In text	In text
Map 1: Geophysical Survey Location Map	1 x A3	6508f_MapsFigs.dwg
Figure 1a: Models of Geophysical Survey	1 x A3	6508f_MapsFigs.dwg
Figure 1a: Models of Geophysical Survey	1 x A3	6508f_MapsFigs.dwg
Figure 2a: Interpretation of Geophysical Survey	1 x A3	6508f_MapsFigs.dwg
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1. INTRODUCTION

1.1 Background

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

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

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

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

1.2 Objectives

The main objectives of the geophysical survey were:

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

1.3 Site Description

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

1.4 Geology

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

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

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

1.5 Report

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

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

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

2. GEOPHYSICAL SURVEY

2.1 Methodology

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

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

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

Table 1: Geophysical Survey Locations and Acquisition Parameters

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

2.2 2D-Resistivity

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

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

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

2.3 Site Work

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

3. RESULTS AND INTERPRETATION

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

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

3.1 2D-Resistivity

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

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

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

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

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

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

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

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

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

Table 2: Summary of Interpretation

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

4. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are made:

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

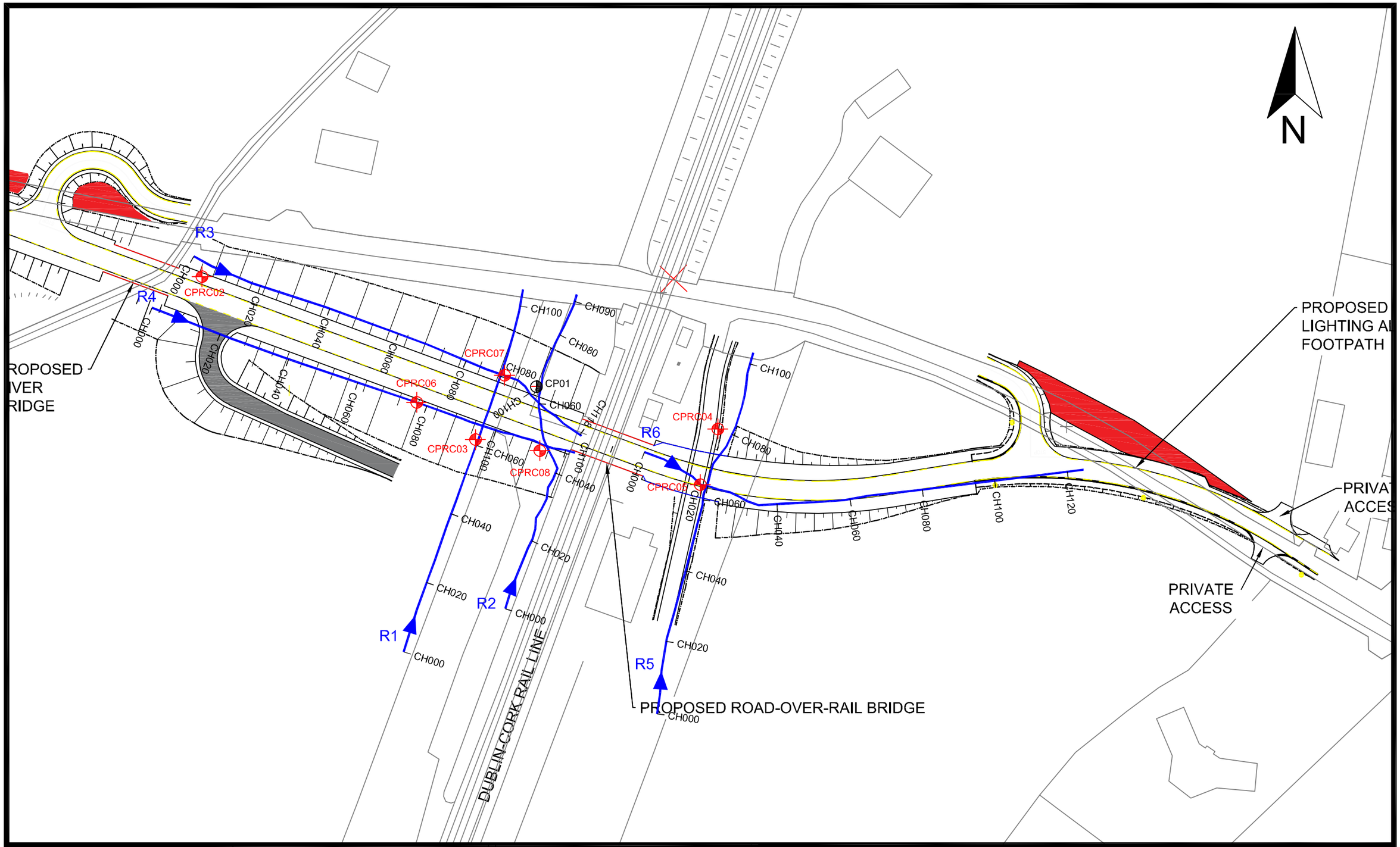
5. REFERENCES

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

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

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

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



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

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

LEGEND:

Geophysical Survey Locations:

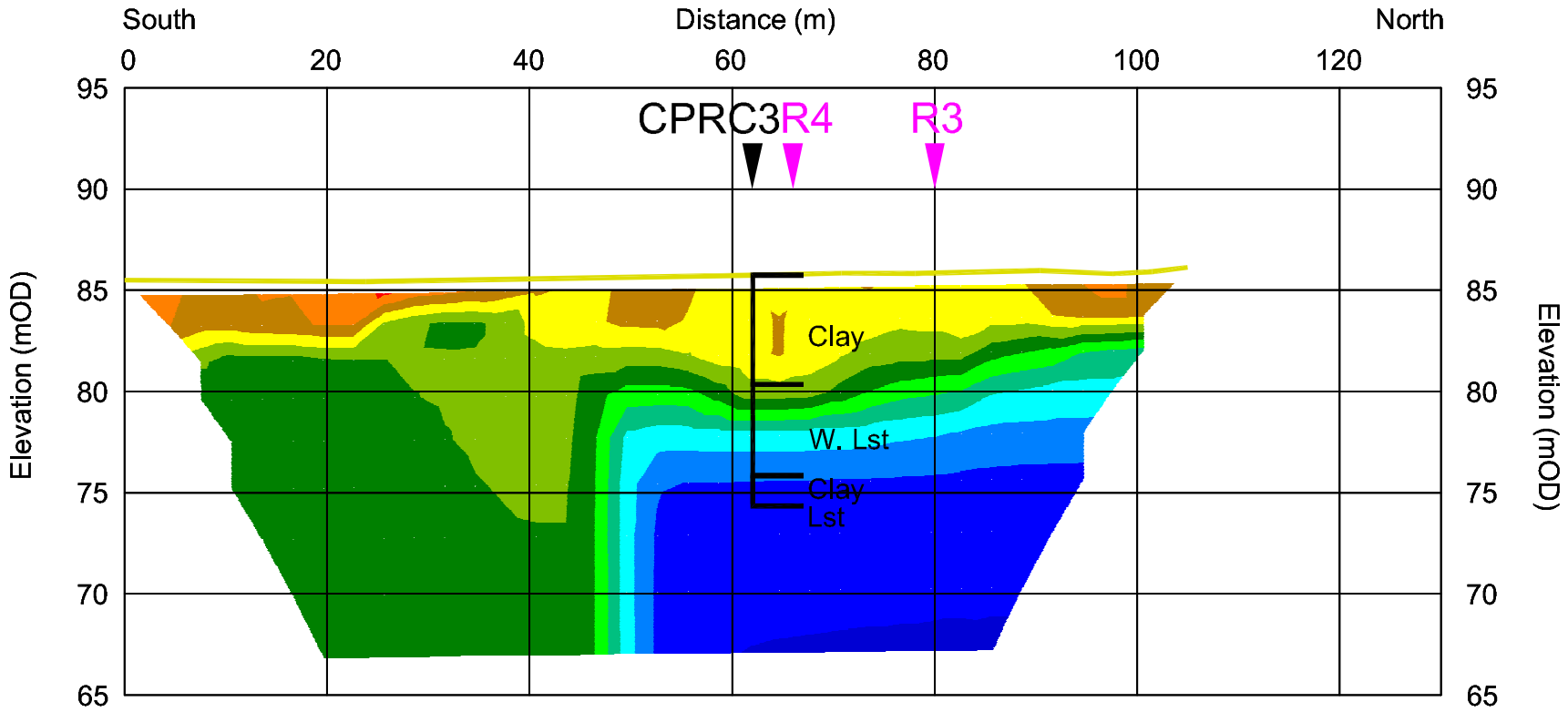
R2 — 2D-Resistivity Profile

CH020 — Distance along Profile

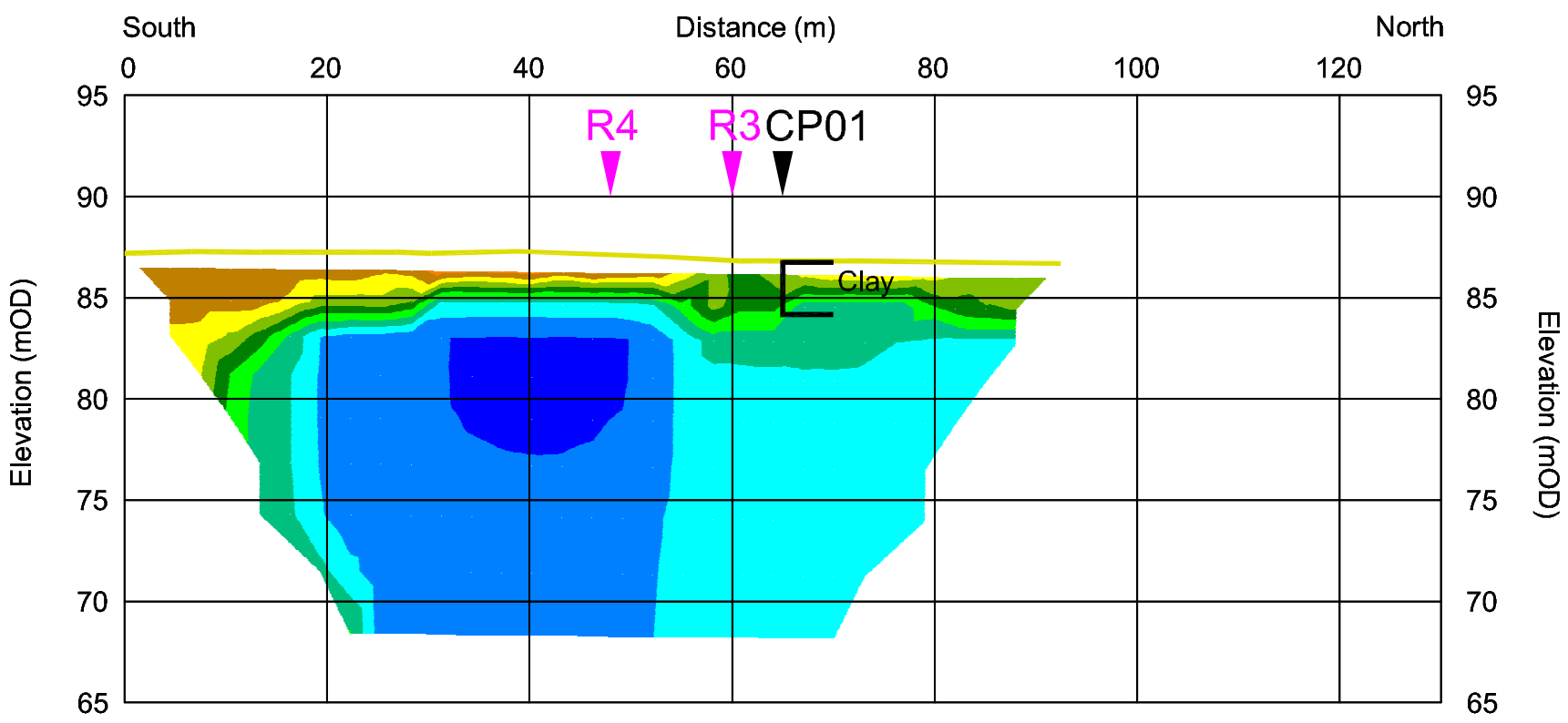
Direct Ground Investigation Locations:

XC219-CPRC03 — Borehole

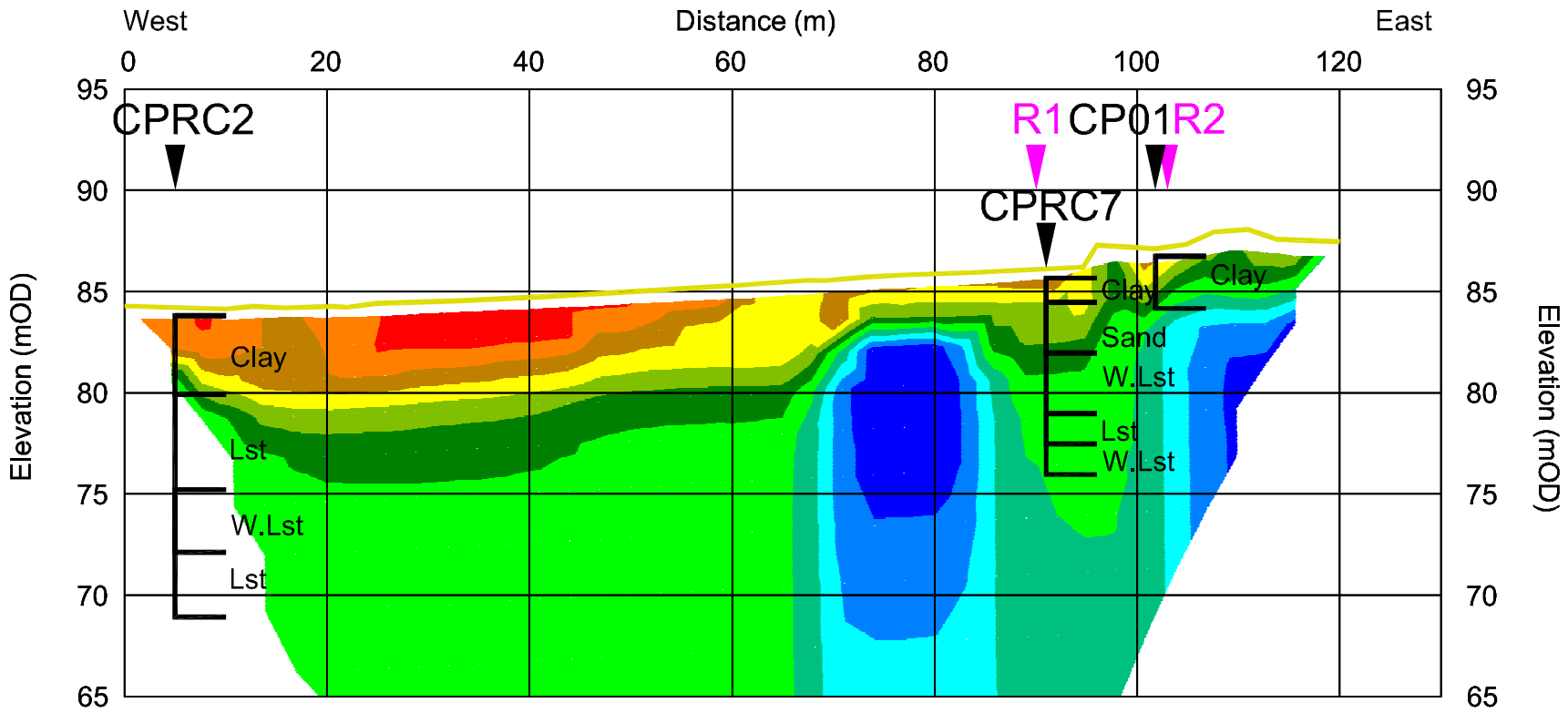
2D-Resistivity Profile R1 Model



2D-Resistivity Profile R2 Model



2D-Resistivity Profile R3 Model



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

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

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

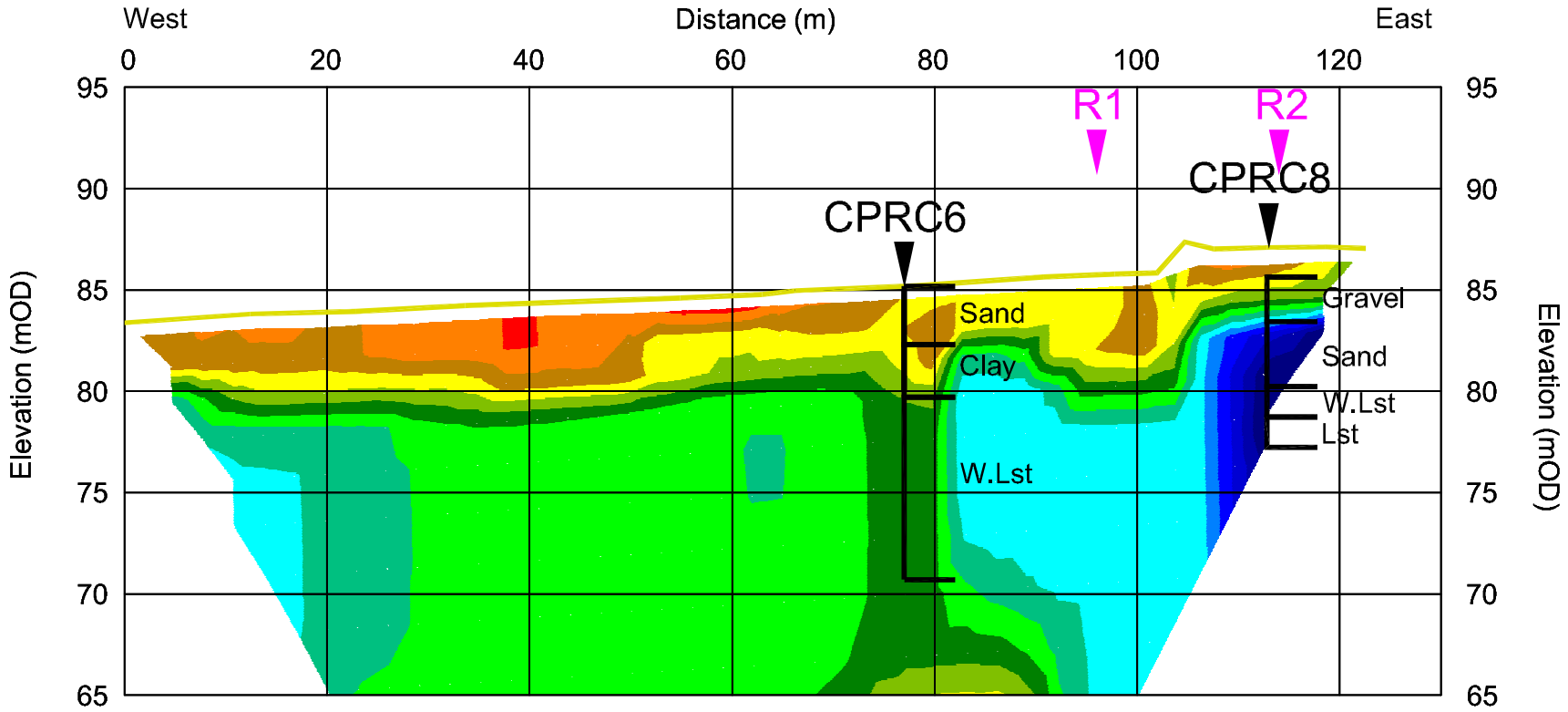
31.3 62.5 125 250 500 1000 2000 4000

R5 Profile Crossing
CPRC5 Borehole

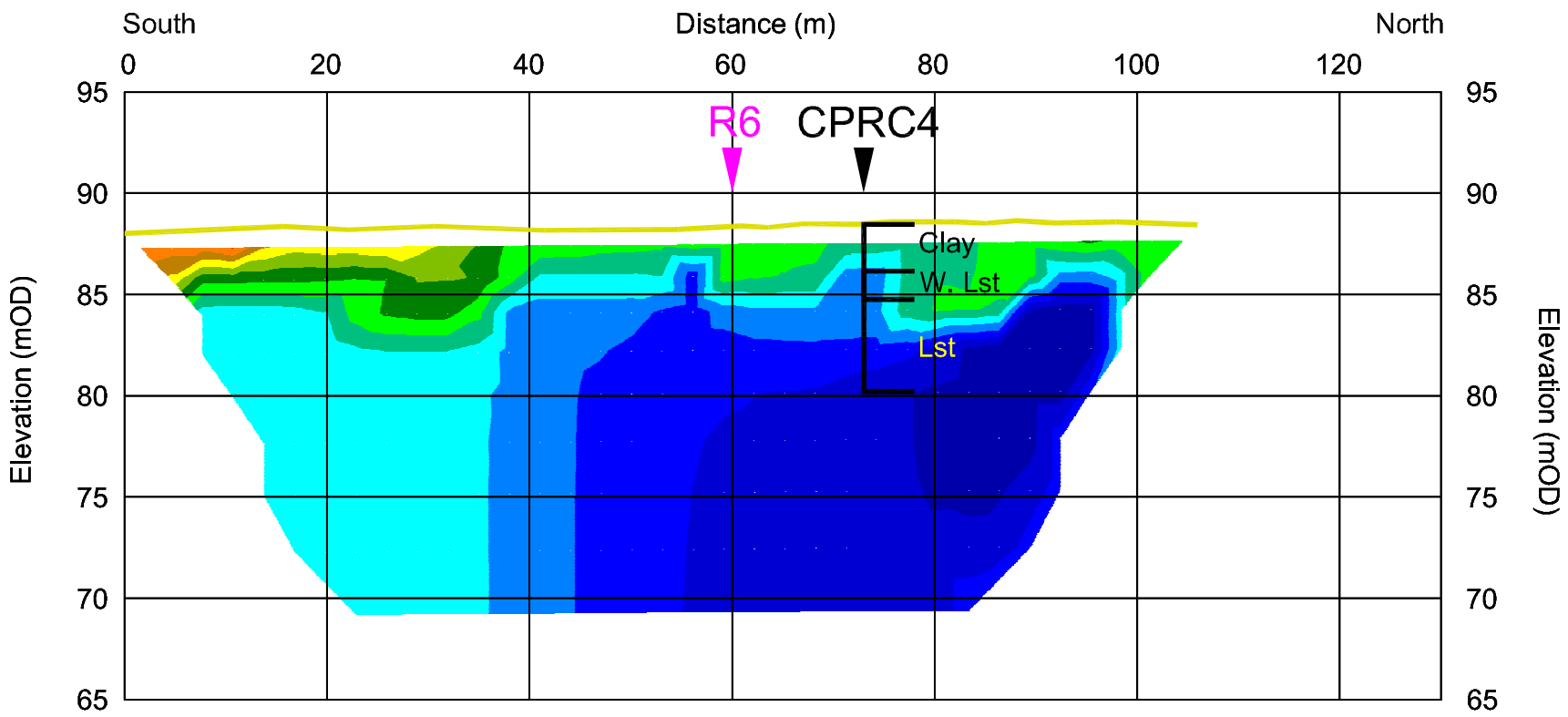
Abbreviated GI Logs:

Cl	Clay
W. Ls	Weathered Ls
Ls	Limestone

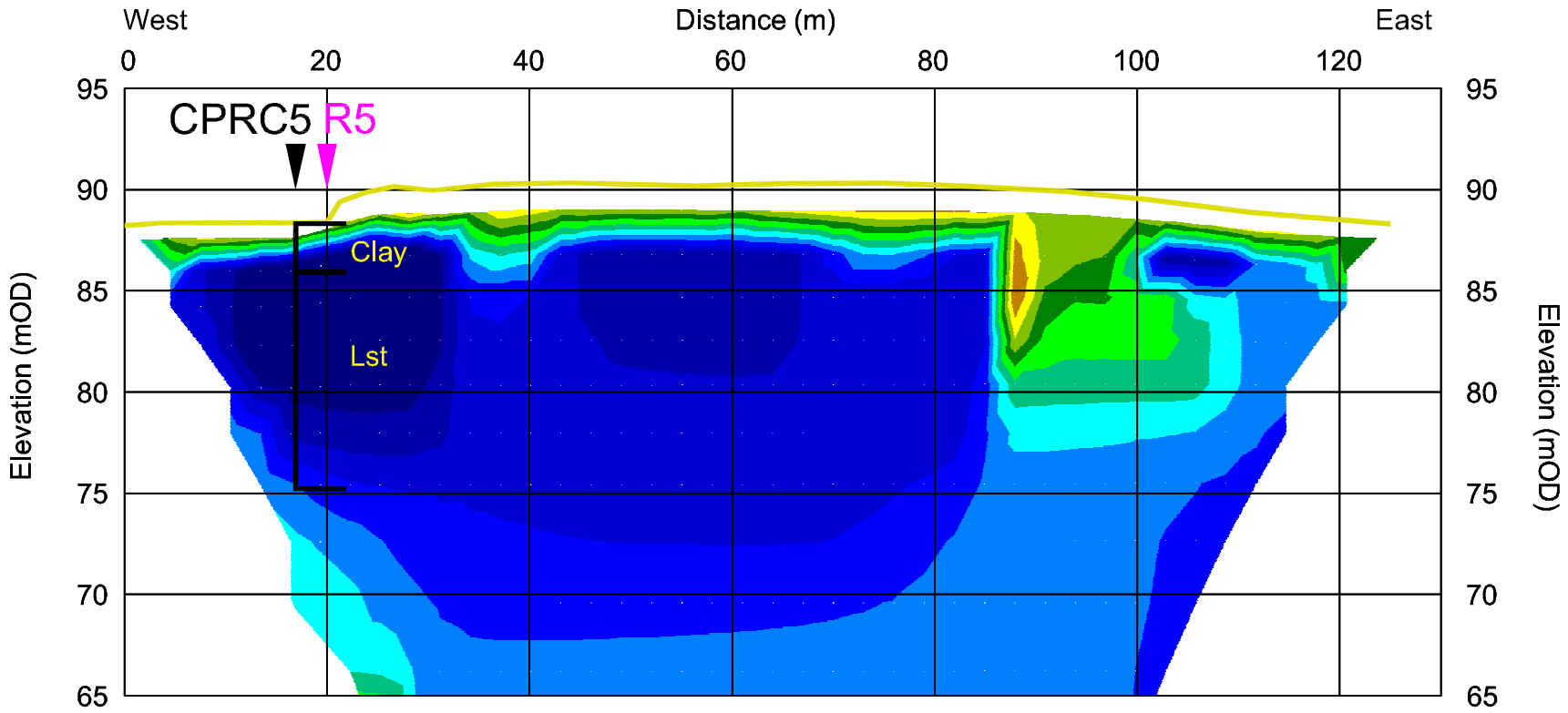
2D-Resistivity Profile R4 Model



2D-Resistivity Profile R5 Model



2D-Resistivity Profile R6 Model



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

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

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

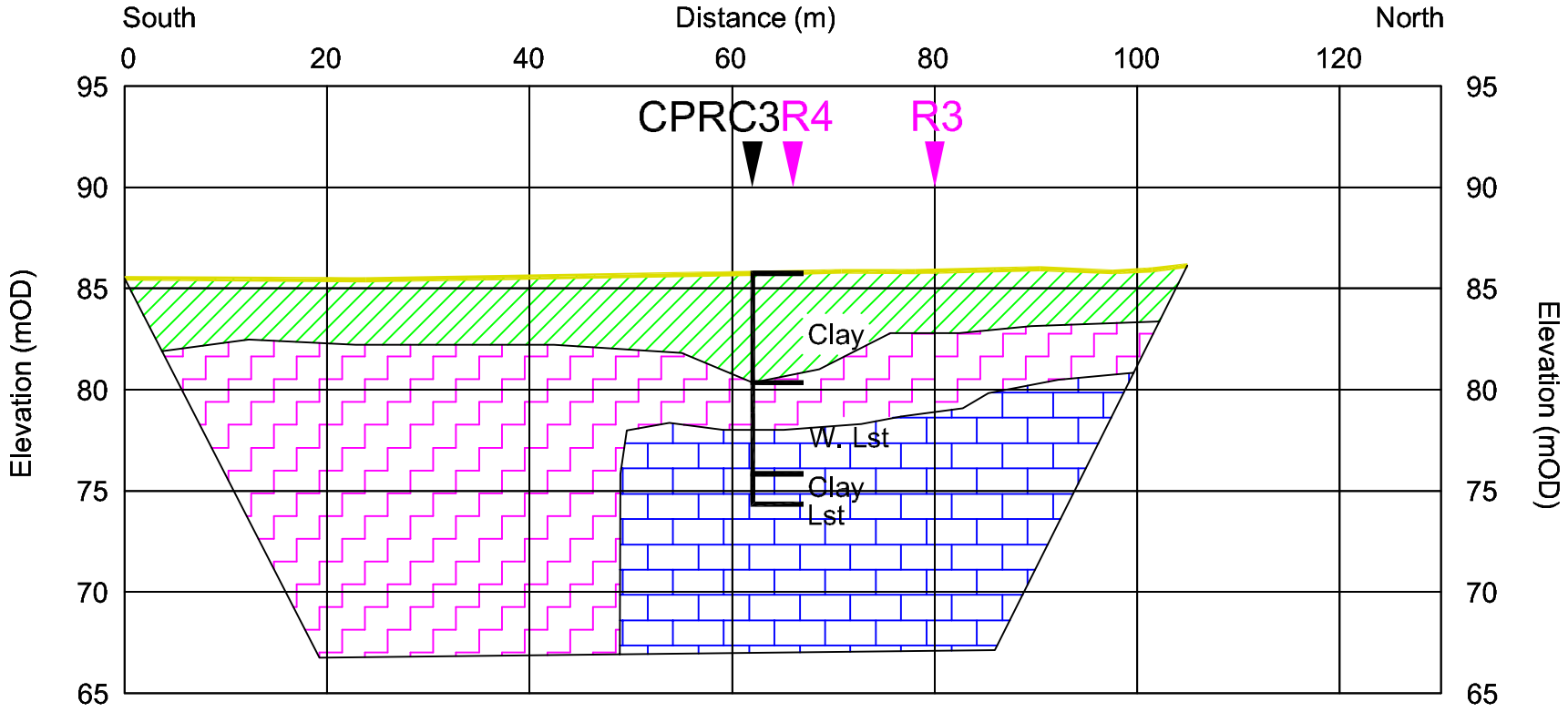
31.3 62.5 125 250 500 1000 2000 4000

R5 Profile Crossing
CPRC5 Borehole

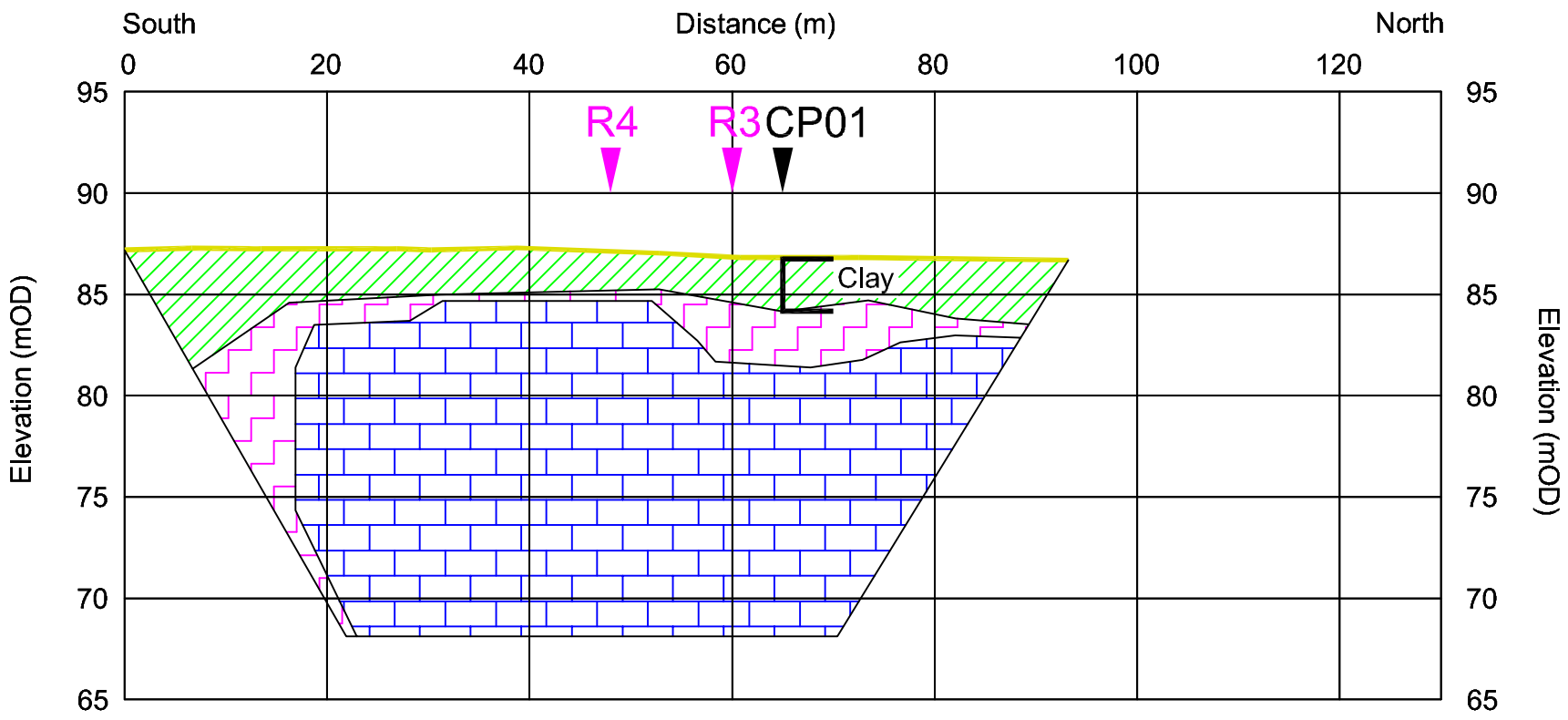
Abbreviated GI Logs:

Cl	Clay
W. Ls	Weathered Ls
Ls	Limestone

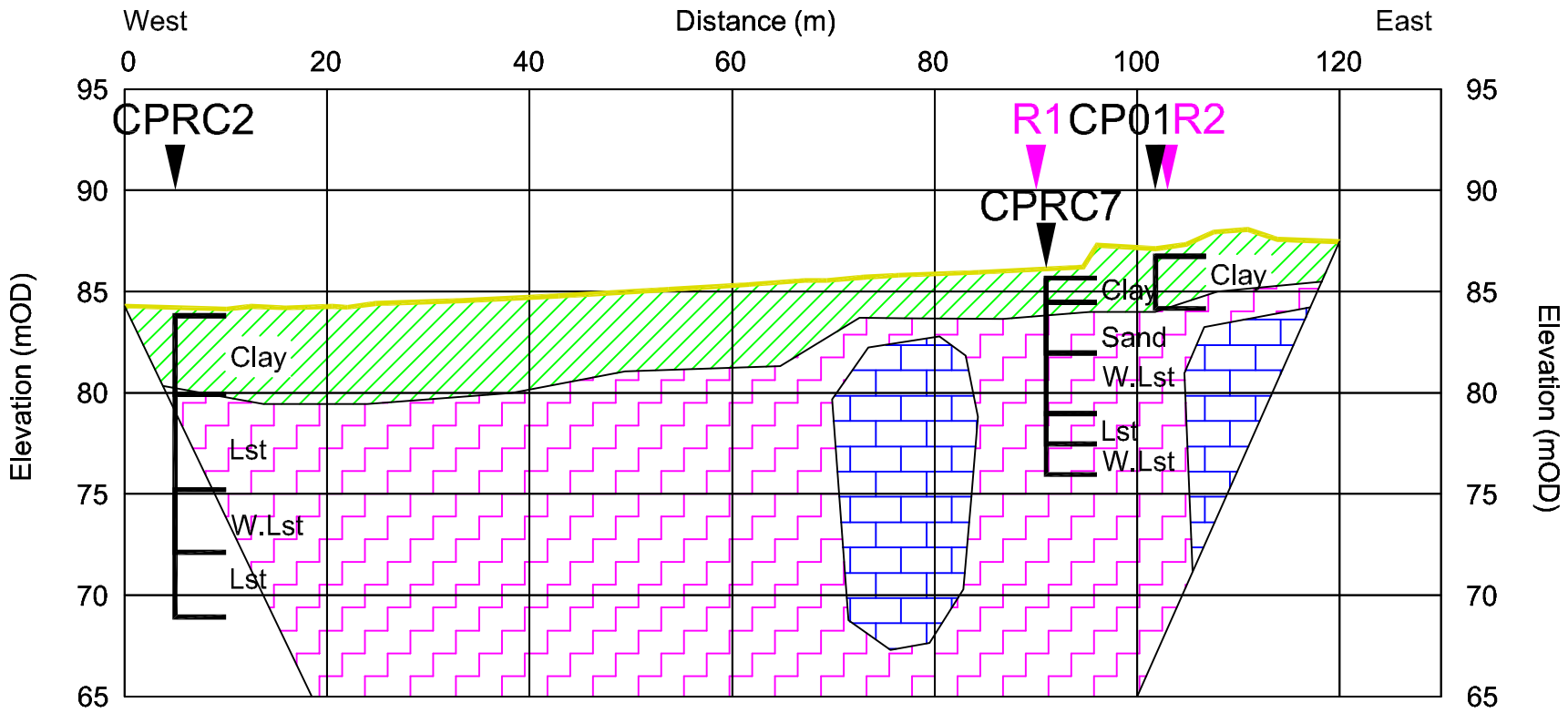
2D-Resistivity Profile R1 Interpretation



2D-Resistivity Profile R2 Interpretation



2D-Resistivity Profile R3 Interpretation



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

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

LEGEND:

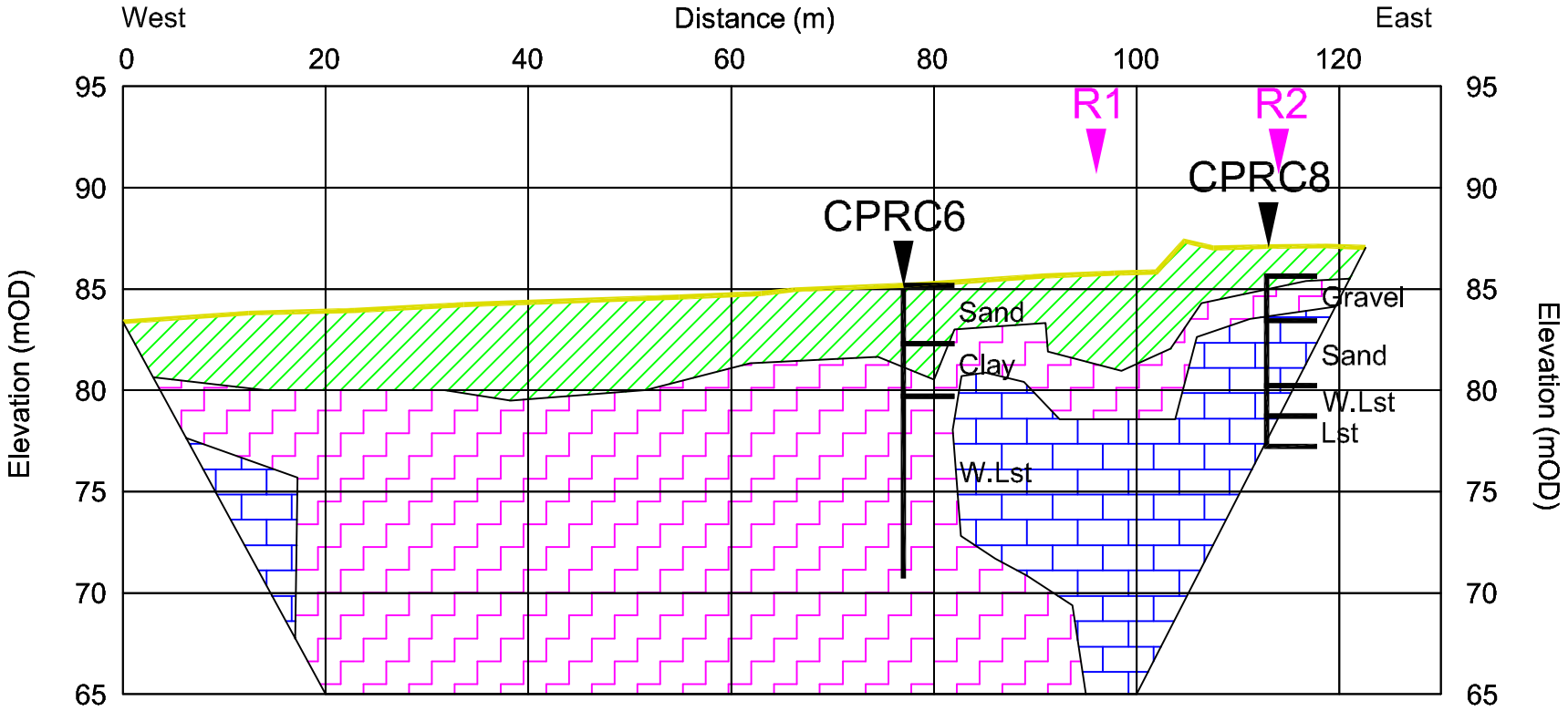
Interpretation of Resistivities:

1 Clay-rich Overburden

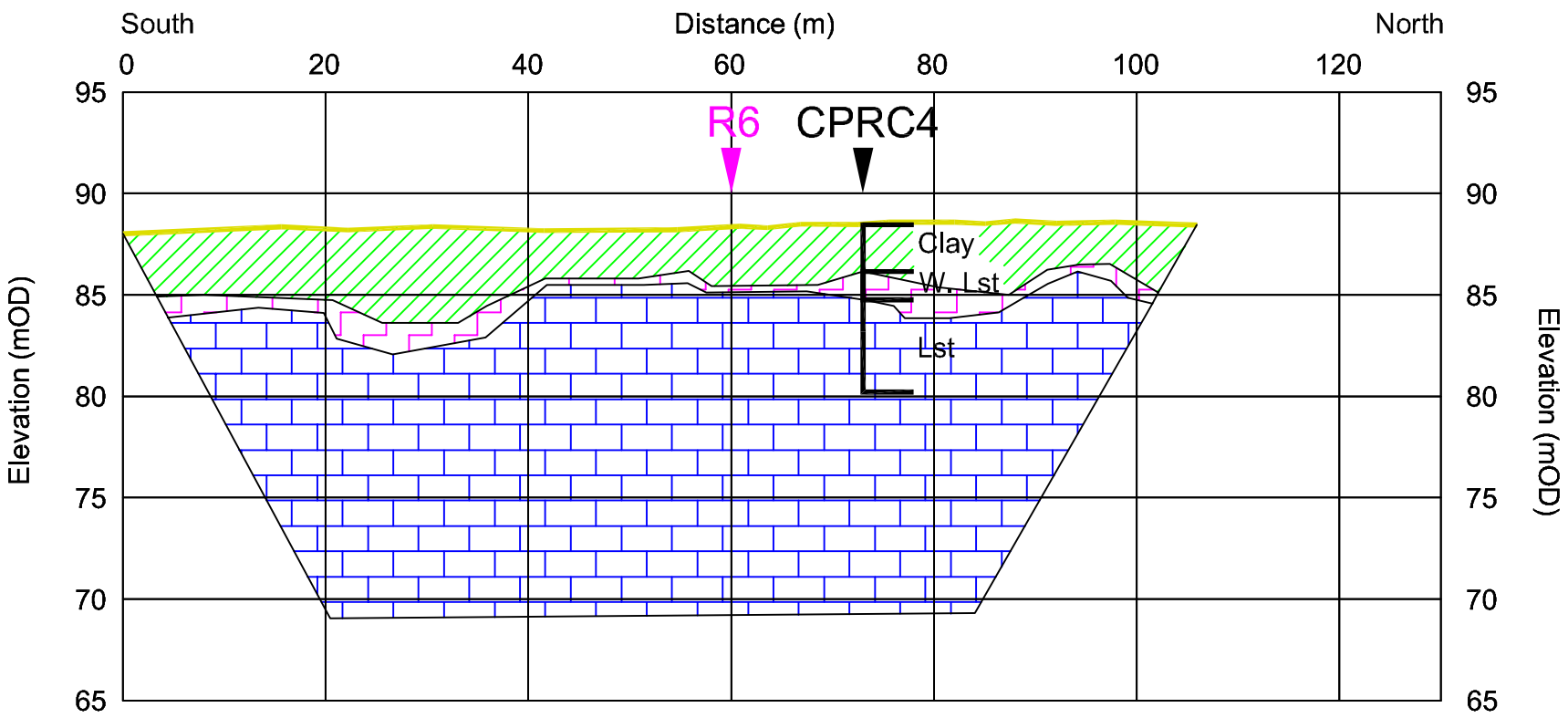
2 Weathered karstified Limestone

3 Fresh compact Limestone

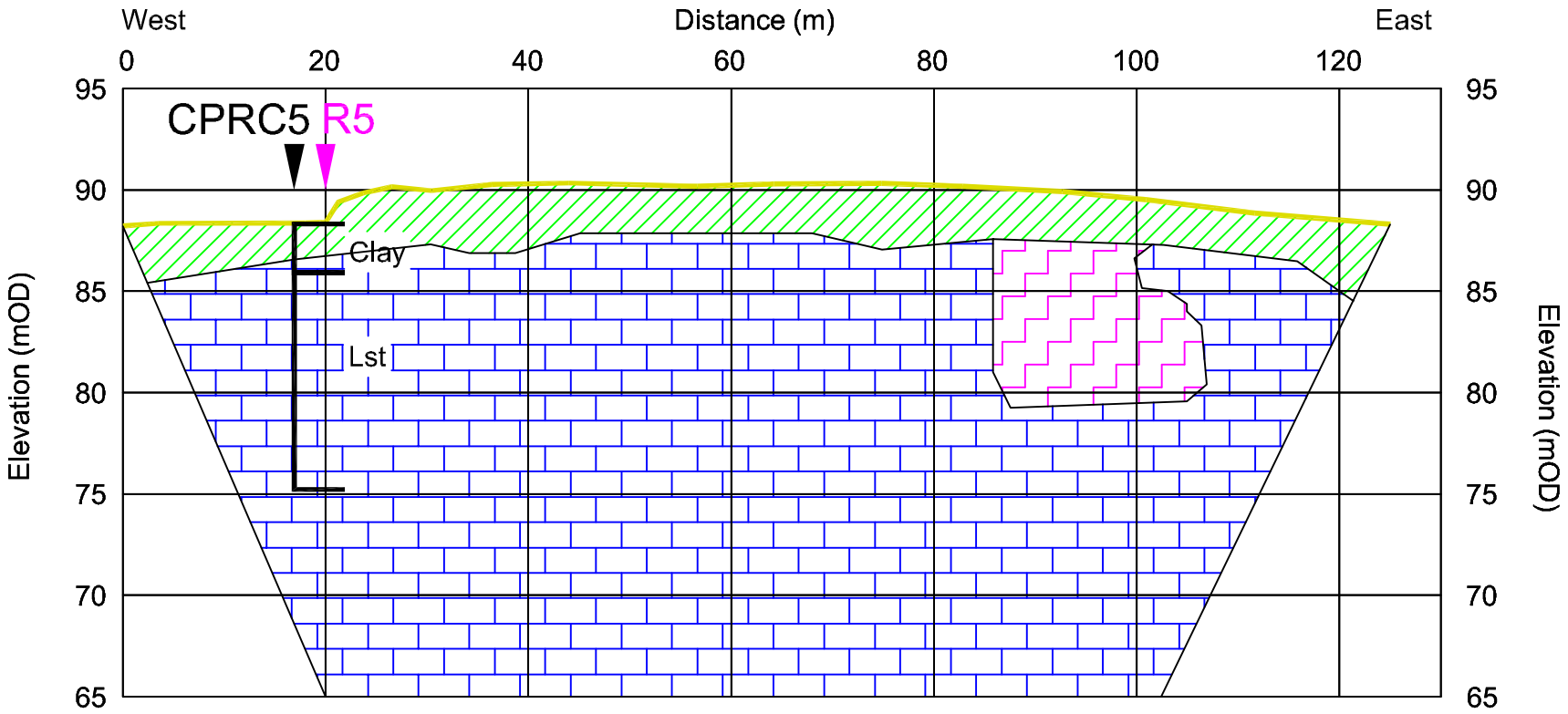
2D-Resistivity Profile R4 Interpretation



2D-Resistivity Profile R5 Interpretation



2D-Resistivity Profile R6 Interpretation



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

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

LEGEND:

Interpretation of Resistivities:

1 Clay-rich Overburden

2 Weathered karstified Limestone

3 Fresh compact Limestone

Appendix L Pre & Post Site Condition Photographs









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









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









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









Iarnród Éireann

Cork Line Level Crossings

XC219 (19-135-5)

XC219

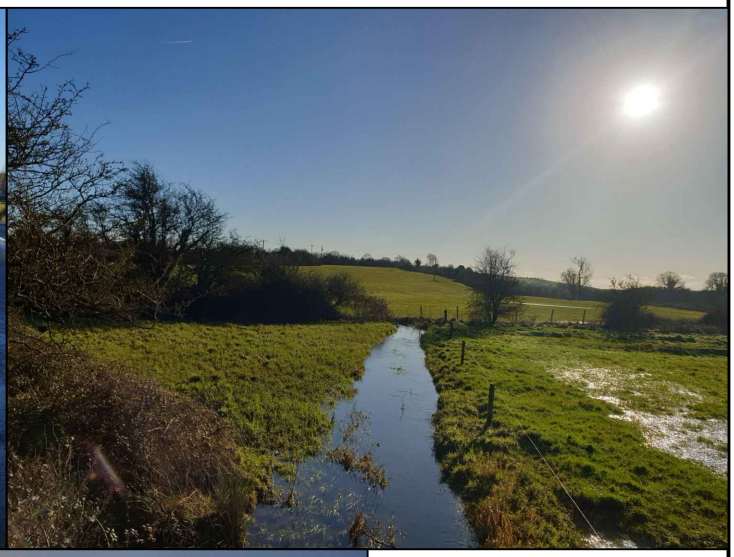
Pre Works Site Photographs

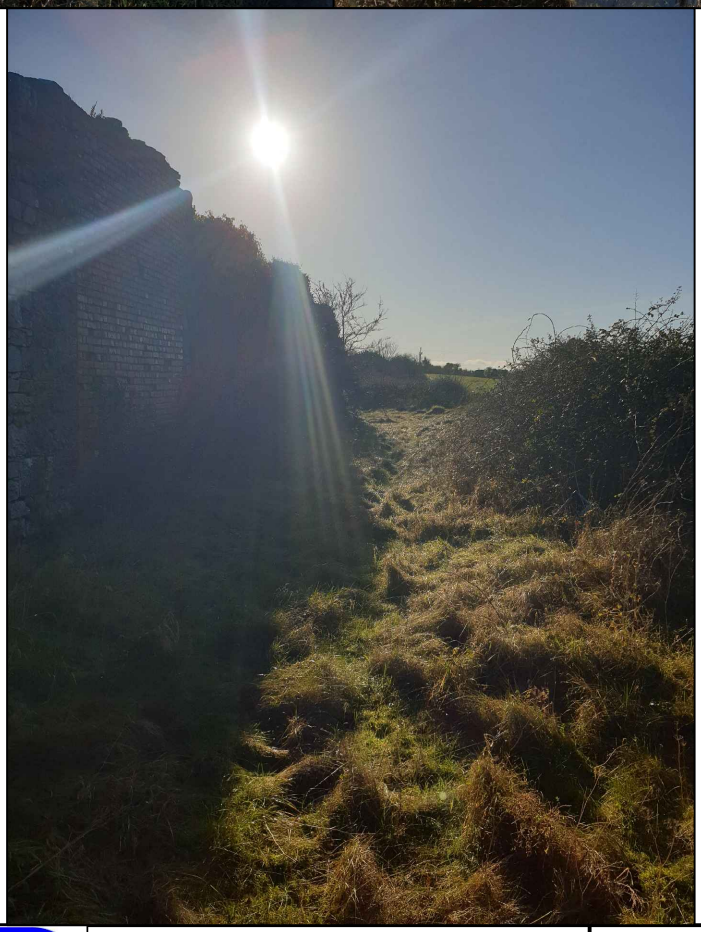
Client: Iarnród Éireann

Engineer: Jacob's

Date: 2020







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









Iarnród Éireann

Cork Line Level Crossings

XC219 (19-135-5)

XC219

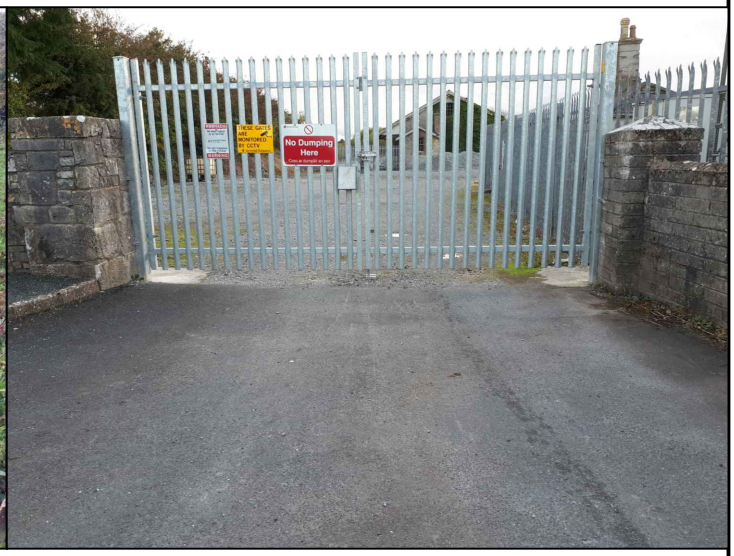
Post Works Site Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: 2020









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









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









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









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









Iarnród Éireann

Cork Line Level Crossings

XC219 (19-135-5)

XC219

Post Works Site Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: 2020









Iarnród Éireann

Cork Line Level Crossings

XC219 (19-135-5)

XC219

Post Works Site Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: 2020









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









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









Iarnród Éireann

Cork Line Level Crossings

XC219 (19-135-5)

XC219

Post Works Site Photographs

Client: Iarnród Éireann

Engineer: Jacob's

Date: 2020