



Cork Line Level Crossings – XC201 Ground Investigation

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Client: Irish Rail

Client's Representative: JACOBS

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CONTENTS

Document Control Sheet

Note on: Methods of describing soils and rocks & abbreviations used on exploratory hole logs

1	AUTHORITY	1
2	SCOPE	1
3	DESCRIPTION OF SITE	1
4	SITE OPERATIONS.....	2
4.1	Boreholes.....	2
4.1.1	Cable Percussion Boreholes	2
4.1.2	Boreholes by Combined Percussion Boring and Rotary Follow-On Drilling.....	3
4.2	Standpipe Installations.....	4
4.3	Trial Pits.....	4
4.4	Indirect CBR Tests	4
4.5	Water Purging	5
4.6	Surveying.....	5
5	LABORATORY WORK.....	6
5.1	Geotechnical Laboratory Testing of Soils.....	6
5.2	Environmental Laboratory Testing of Soils	6
6	GROUND CONDITIONS	7
6.1	General Geology of the Area	7
6.2	Ground Types Encountered During Investigation of the Site	7
6.3	Groundwater.....	7
7	DISCUSSION.....	8
7.1	Proposed Construction.....	8
8	REFERENCES	9

APPENDICES

Appendix A	Site and Exploratory Hole Location Plans
Appendix B	Borehole Logs
Appendix C	Trial Pit Logs
Appendix D	Trial Pit Photographs
Appendix E	Indirect CBR Test Results
Appendix F	Water Purging Data & Logs
Appendix G	Geotechnical Laboratory Test Results
Appendix H	Environmental Laboratory Test Results
Appendix I	Pre & Post Site Condition Photographs



Document Control Sheet

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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	1 st October 2020
002	Final Factual	Ian Holley	Glen Byrne	Michael O'Connell	25 th 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 attempted 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 CBRT04-2) 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):

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

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 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.

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

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

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

Environmental Protection Agency / Draft Guidance Note on Soil Recovery Waste Acceptance Criteria. December 2017.

<http://www.epa.ie/pubs/consultation/soilrecoveryconsultation/>

Environmental Protection Agency / Waste Classification List of Waste & Determining if Waste is Hazardous or Non-hazardous. 1st June 2015

https://www.epa.ie/pubs/reports/waste/stats/wasteclassification/EPA_Waste_Classification_2015_Web.pdf

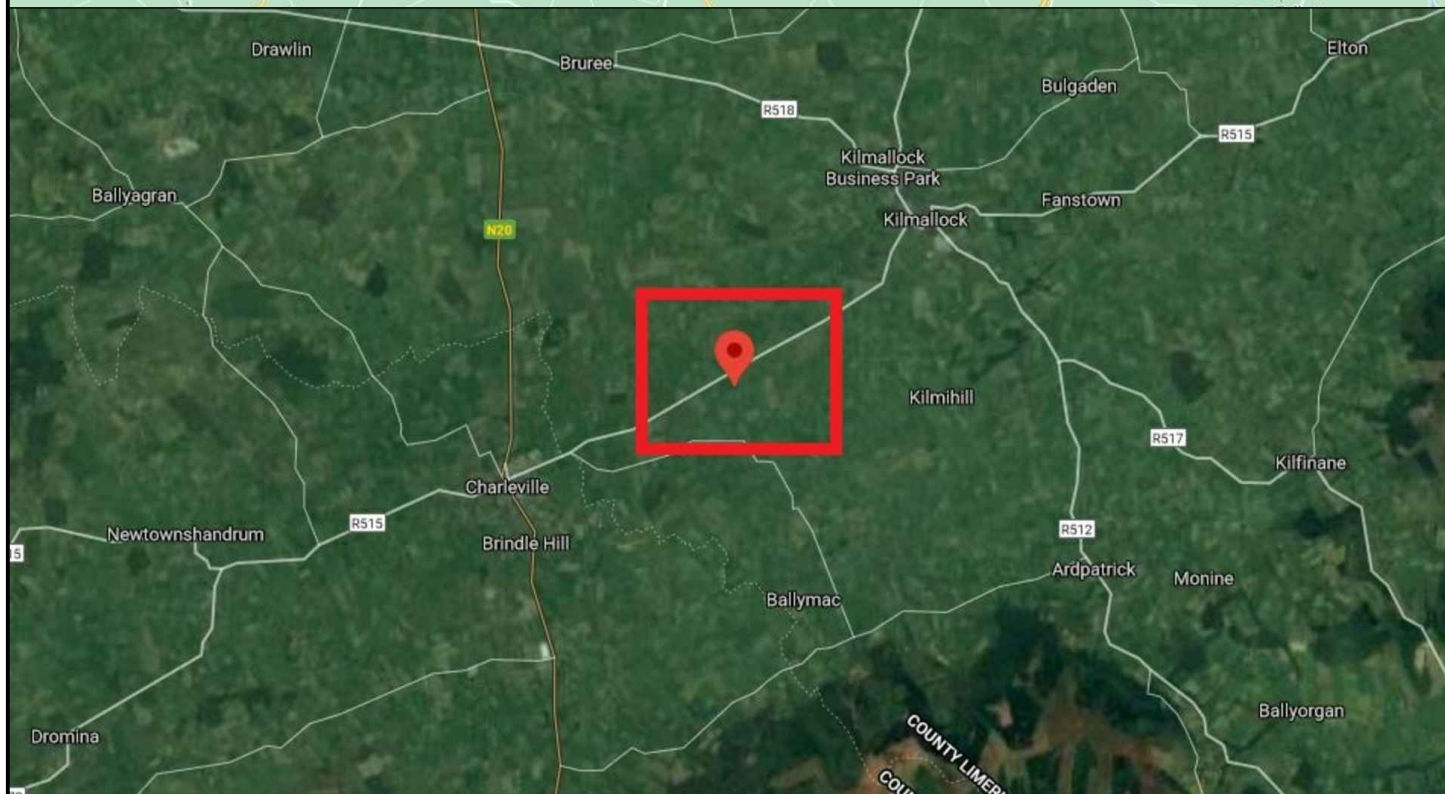
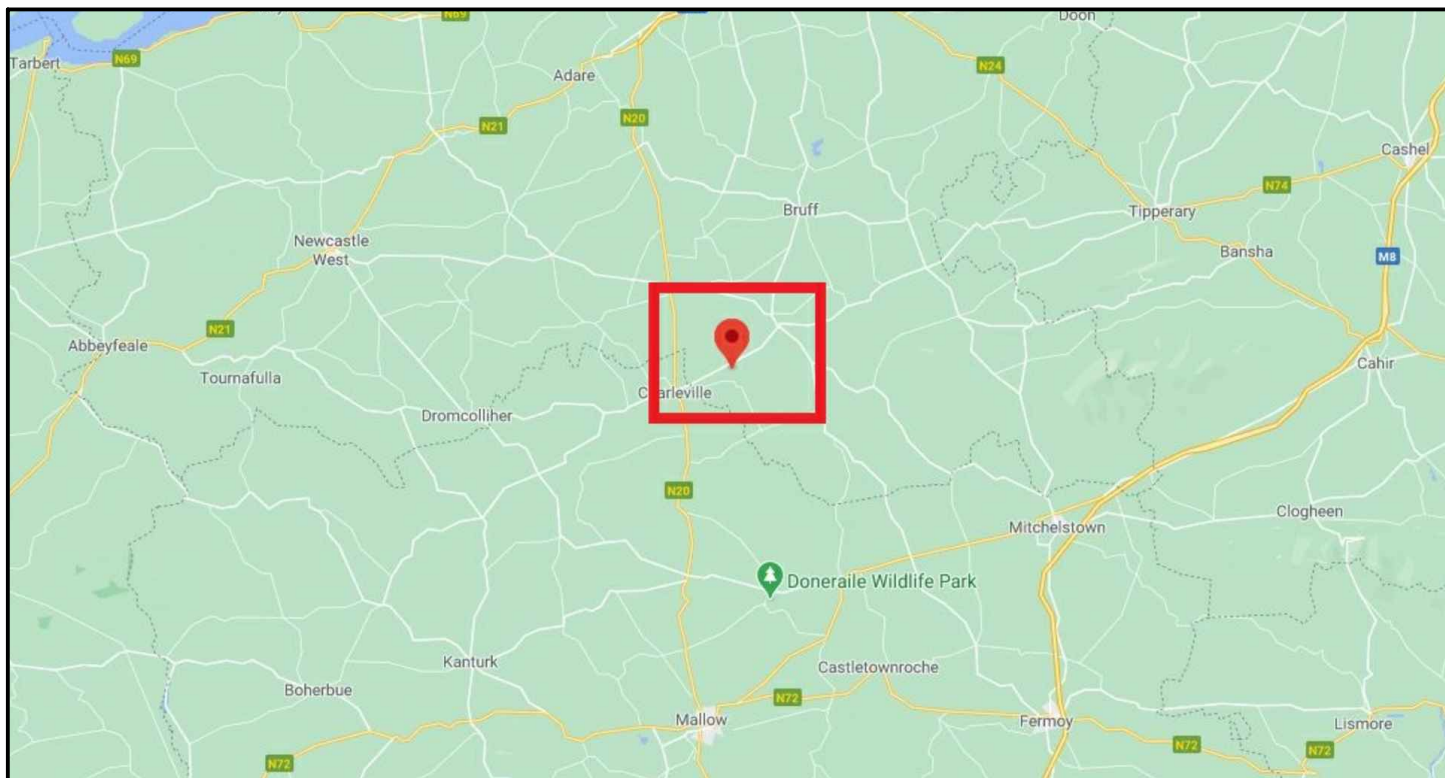
Environment Agency UK (2009). Soil Guideline Values (SGVs).

<https://www.gov.uk/government/collections/land-contamination-technical-guidance>

Soil Remediation Circular 2013, Ministry for Environment and Infrastructure, The Hague, Netherlands.

<https://rwsenvironment.eu/subjects/soil/legislation-and/soil-remediation/>

Appendix A Site and Exploratory Hole Location Plans



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

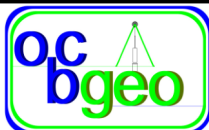
Engineer:

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

Driller: AA

Logger: IH

Plant:

Pilcon

Ground Level:

80.60 mOD

Dates:	
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05/06/2020 - 05/06/2020











[illegible]

Remarks


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



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 Client's Representative: JACOBS		Sheet 1 of 1	
Method: Cable Percussion				Ground Level: mOD		Dates: 08/06/2020 – 08/06/2020		Scale: 1:50	
Plant: Pilcon								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 - 1.20	B1					(0.20)		TOPSOIL		
0.20 - 1.20	D2					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.		
0.50	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			N=7 (1,1/2,1,2,2)		(0.80)				
1.20 - 1.65	SPT (C) N=7					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.		
1.50	ES6					(1.00)				
2.00 - 3.00	B7					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.		
2.00 - 3.00	D8			N=7 (2,2/1,2,2,2)		(0.40)				
2.00 - 2.45	SPT (C) N=7					3.40		End of borehole at 3.400m		
3.00	ES9									
3.00 - 3.40	B10									
3.00 - 3.40	D11									
3.00 - 3.40	SPT (C)			N=48 (1,1/48 for 255mm) 50 (25 for 0mm/50 for 0mm)						
3.40 - 3.40	SPT (C)									






















Remarks	Water Added		Water Strike - General			
	From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
Cable Percussion terminated at 3.40m due to probable boulder obstruction.	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 624458.19 N		Client: Iarnród Éireann / Irish Rail Client's Representative: JACOBS		Sheet 1 of 1	
Method: Cable Percussion				Ground Level: 82.31 mOD		Dates: 10/06/2020 - 10/06/2020		Scale: 1:50	
Plant: Pilcon								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					(1.00)		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.		
0.50	ES4							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.		
1.20 - 2.00	B5			N=26 (1,1/4,11,7,4)	81.11	1.20				
1.20 - 2.00	D6					(0.80)				
1.20 - 1.65	SPT (C) N=26									
1.50	ES7									
2.00 - 2.20	B8			50 (50 for 2mm/50 for 0mm)	80.31	2.00				
2.00 - 2.20	D9				80.11	(0.20)				
2.00 - 2.00	SPT (C)			50 (25 for 0mm/50 for 0mm)		2.20		End of borehole at 2.200m		
2.20 - 2.20	SPT (C)									


Remarks	Water Added		Water Strike - General			
	From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
Cable Percussion terminated at 2.20m due to possible boulder obstruction.	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 624588.30 N		Client: Iarnród Éireann / Irish Rail Client's Representative: JACOBS				Sheet 1 of 1 Scale: 1:50 Driller: AA Logger: MN	
Method: Cable Percussion+Rotary Open				Plant: Pilcon+T44		Ground Level: 80.47 mOD		Dates: 04/06/2020 - 19/06/2020			

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 - 0.50	B2				80.26	0.20		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					(0.30)		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	ES4				79.96	0.50		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, predominantly limestone.		
0.50 - 1.20	B5					(0.70)		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.		
0.50 - 1.20	D6					(1.20)		Yellowish brown sandy gravelly clayey SILT. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular.		
1.20 - 2.00	B7			N=6 (0,1/1,2,2,1)	79.26	1.20		Open Hole Boring, Driller Described: BOULDERS		
1.20 - 2.00	D8					(0.80)		Open Hole Boring, Driller Described: BOULDERS		
1.20 - 1.65	SPT (C) N=6					(0.80)		Open Hole Boring, Driller Described: BOULDERS		
1.50	ES9					(1.20)		Open Hole Boring, Driller Described: BOULDERS		
2.00 - 3.00	B10			N=17 (1,1/2,4,6,5)	78.46	2.00		Open Hole Boring, Driller Described: BOULDERS		
2.00 - 3.00	D11					(1.20)		Open Hole Boring, Driller Described: BOULDERS		
2.00 - 2.45	SPT (C) N=17					(1.20)		Open Hole Boring, Driller Described: BOULDERS		
3.00	ES14					(1.20)		Open Hole Boring, Driller Described: BOULDERS		
3.00 - 3.20	B12					(1.20)		Open Hole Boring, Driller Described: BOULDERS		
3.00 - 3.20	D13					(1.20)		Open Hole Boring, Driller Described: BOULDERS		
3.00 - 3.20	SPT (C)			75 (4,5/75 for 50mm)	77.26	3.20		Open Hole Boring, Driller Described: BOULDERS		
3.20 - 3.70	B15					(0.50)		Open Hole Boring, Driller Described: BOULDERS		
3.20 - 3.70	D16					(0.50)		Open Hole Boring, Driller Described: BOULDERS		
3.70 - 3.70	SPT (C)			50 (25 for 0mm/50 for 0mm)	76.76	3.70		Open Hole Boring, Driller Described: BOULDERS		
5.10 - 5.18	SPT (C)			50 (50 for 75mm/50 for 0mm)	75.36	5.10		Open Hole Boring, Driller Described: BOULDERS		
								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		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
3.20	3.60				
Casing Details		Chiselling Details			
To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)	
3.70	200	3.20	3.40	00:40	
5.10	151	3.60	3.70	00:30	

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

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.		
						(1.50)				
16.60 - 17.05	SPT (C) N=81			N=81 (11,11/16,20,20,25)		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	Water Added		Water Strike - General			
	From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
	2.20	3.40	2.20	5.60	20	2.20
			5.60	7.60	20	4.90
			8.60	8.50	20	7.60
	Casing Details		Chiselling Details			
To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)		
3.60	200	3.40	3.60	01:00		
19.60	151					

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


				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	Water	Backfill
0.05	ES1					(0.20)		TOPSOIL		
0.20 - 1.20	B2				81.78	0.20		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					(1.00)				
0.50	ES4									
1.20 - 2.00	B5			N=13 (2,4/3,3,3,4)	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					(0.80)				
1.20 - 1.65	SPT (C) N=13									
1.50	ES7									
2.00 - 2.50	B8			N=27 (1,1/4,5,8,10)	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									
2.50 - 2.80	B10				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	D11					(0.80)				
2.80 - 3.30	D12									
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

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)		
3.30	200	2.60	2.60	00:15		
19.70	151	3.00	3.00	00:20		
		3.30	3.30	00:15		

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


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

















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.		
					66.28	15.70				
						(3.00)		Open Hole Boring, Driller Described: Gravelly SAND with boulders.		
16.70 - 17.00	SPT (C)			78 (10,16/78 for 150mm)						
					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)		Chiselling Details From (m) To (m) Time (hh:mm)			
	3.30	200	2.60	2.60	00:15	
	19.70	151	3.00	3.30	00:20	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 624706.32 N		Client: Iarnród Éireann / Irish Rail Client's Representative: JACOBS		Sheet 1 of 1	
Method: Excavation		Ground Level: 79.59 mOD		Date: 03/07/2020		Scale: 1:20	
Plant: Kobelco SK140SRLC						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.	
			79.19	0.40			
0.50 0.50 - 1.00 0.50 - 1.00	ES2 B3 D4					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.	0.5
							
1.00	ES5			(1.30)			1.0
							
							1.5
1.70 - 2.20 1.70 - 2.20	B6 D7		77.89	1.70		Firm yellowish brown slightly 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.	2.0
				(0.80)			
2.20 - 2.50 2.20 - 2.50	B8 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.	2.5
				(0.70)			
2.70 - 3.20 2.70 - 3.20	B10 D11						
							3.0
3.00	ES12		76.39	3.20		End of trial pit at 3.200m	3.5









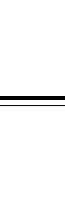
Remarks Hand Vane Tests attempted unsuccessfully due to relatively high granular content. Trial Pit terminated at 3.20m on either a large limestone boulder or possible bedrock.	Water Strikes:		Stability: Sides collapsing Width: 2.00 Length: 4.50
	Struck at (m):	Remarks:	
	2.50		

		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 Client's Representative: JACOBS		Sheet 1 of 1	
Method: Excavation		Ground Level: 80.24 mOD		Date: 03/07/2020		Scale: 1:20	
Plant: Kobelco SK140SRLC						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 0.50 - 1.00 0.50 - 1.00	ES2 B3 D4			(0.70)		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.	0.5
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.	1.0
1.50 - 2.00 1.50 - 2.00	B6 D7			(1.30)			1.5
			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.	2.5
2.60 - 3.10 2.60 - 3.10	B8 D9			(0.90)			3.0
3.00	ES10		76.94	3.30		End of trial pit at 3.300m	3.5










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:		Stability: Sides spalling Width: 1.40 Length: 5.60
	Struck at (m):	Remarks:	
	2.40		

		Project No.: 19-135		Project Name: Cork Line Level Crossings		Trial Pit No.: XC201-TP03	
		Co-ordinates: 557638.45 E 624415.67 N		Client: Iarnród Éireann / Irish Rail Client's Representative: JACOBS		Sheet 1 of 1	
Method: Excavation		Ground Level: 82.90 mOD		Date: 03/07/2020		Scale: 1:20	
Plant: Kobelco SK140SRLC						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			
				(0.20)			
			82.50	0.40			
0.50 0.50 - 1.00 0.50 - 1.00	ES2 B3 D4					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.	0.5
1.00	ES5			(1.50)			1.0
1.40 - 1.90 1.40 - 1.90	B6 D7						1.5
			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.	2.0
2.20 - 2.70 2.20 - 2.70	B8 D9			(1.10)			2.5
3.00 3.00 - 3.50 3.00 - 3.50	ES10 B11 D12		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.	3.0
				(0.60)			3.5
			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:		Stability: Sides collapsing Width: 2.30 Length: 4.80
	Struck at (m):	Remarks:	
	1.90		

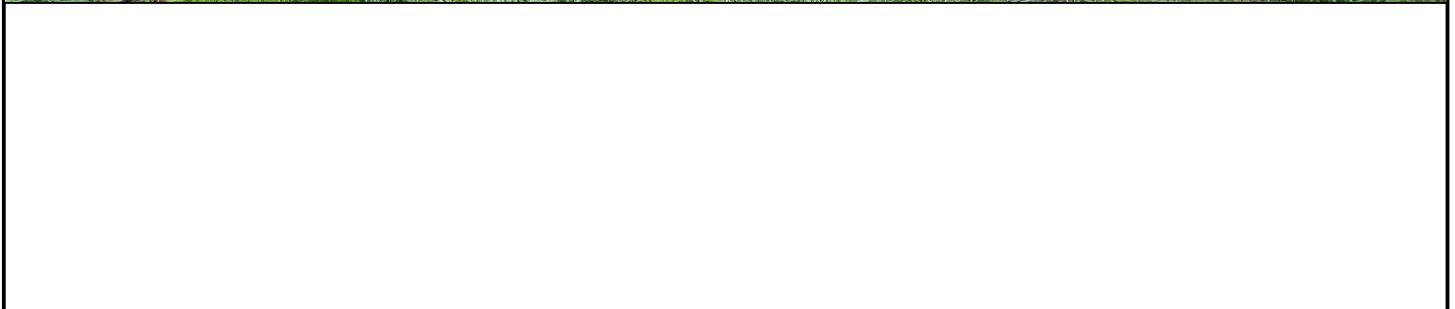
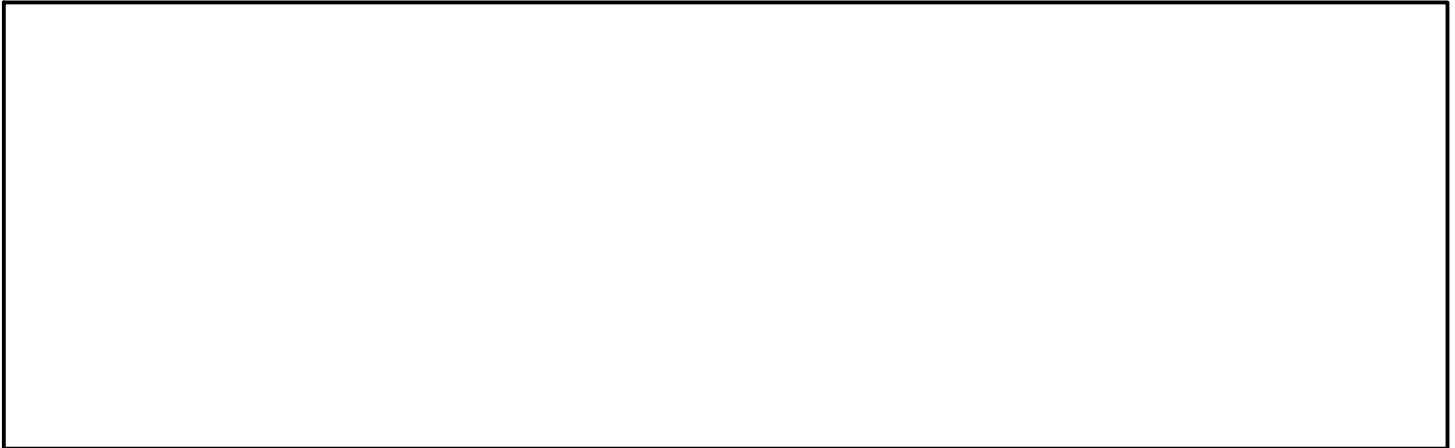
		Project No.: 19-135		Project Name: Cork Line Level Crossings		Trial Pit No.: XC201-TP04	
		Co-ordinates: 557663.87 E 624336.31 N		Client: Iarnród Éireann / Irish Rail Client's Representative: JACOBS		Sheet 1 of 1	
Method: Excavation		Ground Level: 84.20 mOD		Date: 03/07/2020		Scale: 1:20	
Plant: Kobelco SK140SRLC						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		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.	
0.50	ES2		83.80	0.40		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.	0.5
0.60 - 1.10	B3			(0.90)			
0.60 - 1.10	D4						
1.00	ES5						1.0
1.30 - 1.80	B6		82.90	1.30		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.	1.5
1.30 - 1.80	D7			(0.60)			
2.00 - 2.50	B8		82.30	1.90		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	2.0
2.00 - 2.50	D9			(0.80)			
			81.50	2.70		End of trial pit at 2.700m	3.0
							3.5

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:		Stability: Sides collapsing Width: 2.70 Length: 4.60
	Struck at (m):	Remarks:	
	1.20		

Appendix D

Trial Pit Photographs



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

19-135
XC201
TP01



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



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.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.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.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.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



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



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



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



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



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



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



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



Iarnród Éireann
Cork Line Level Crossings
XC201 (19-135-1)

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



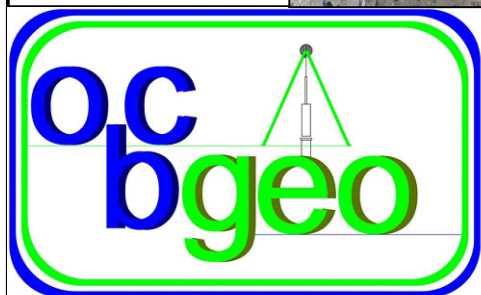
Iarnród Éireann
Cork Line Level Crossings
XC201 (19-135-1)

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



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



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

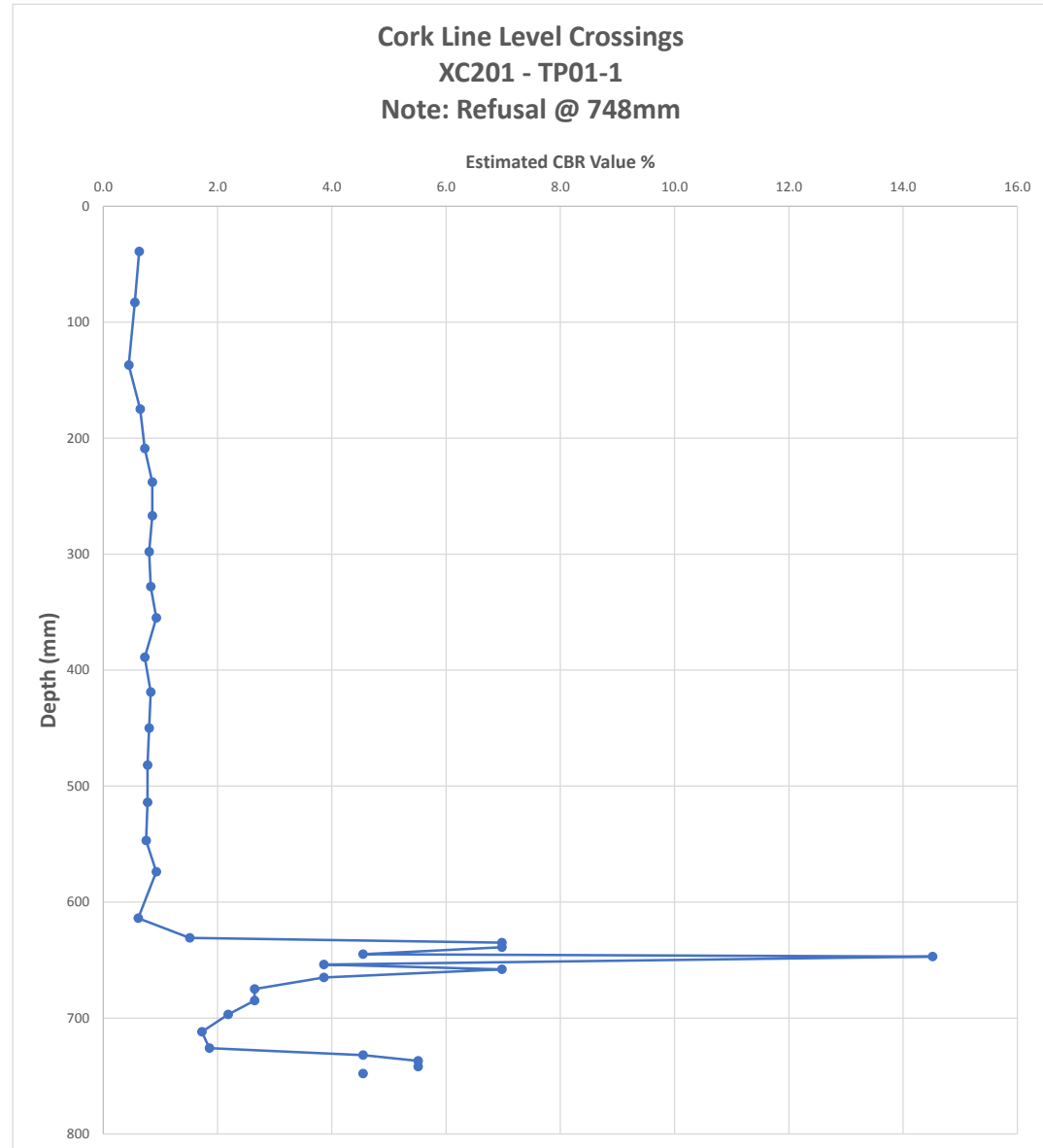
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	XC201 - TP01-1	Job No	19-135
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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	



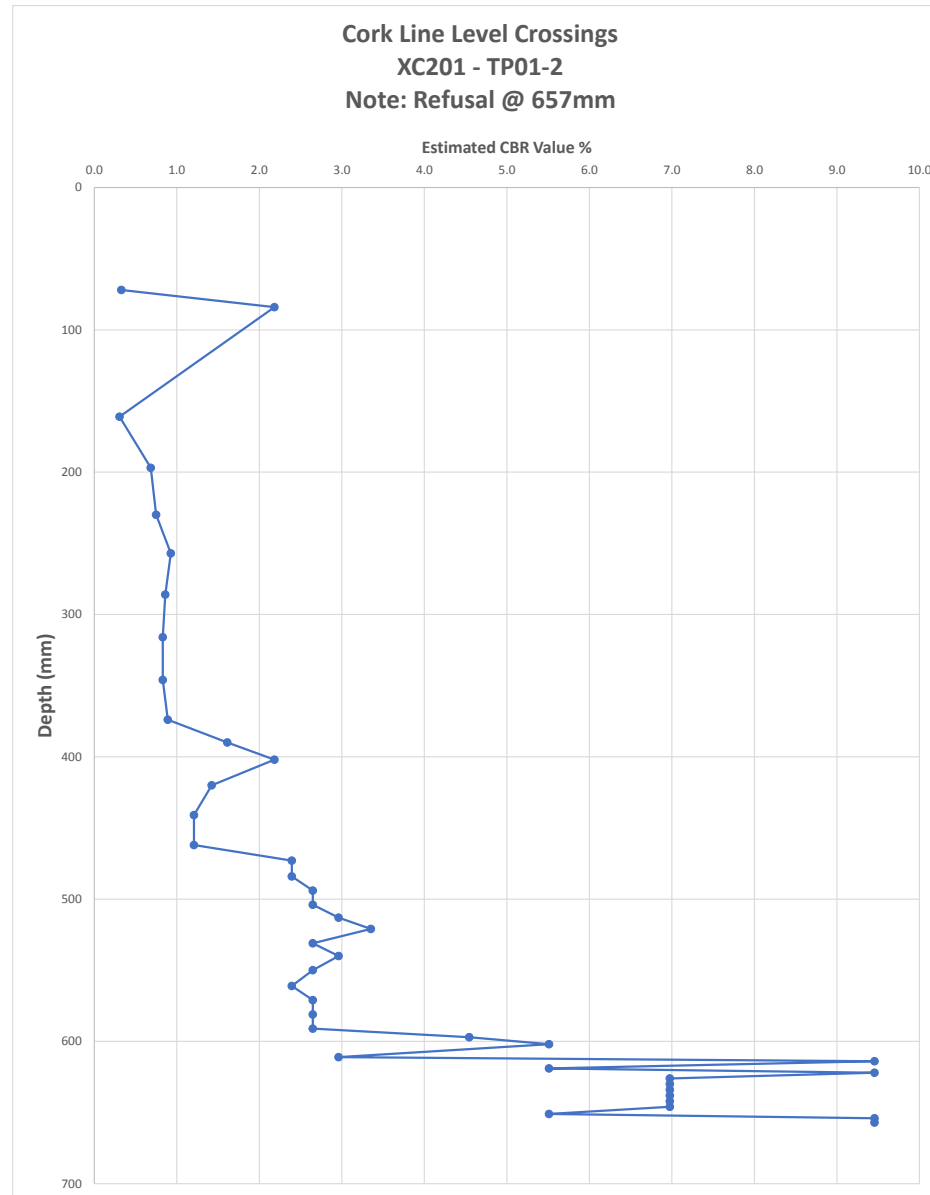
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	XC201 - TP01-2	Job No	19-135
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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	



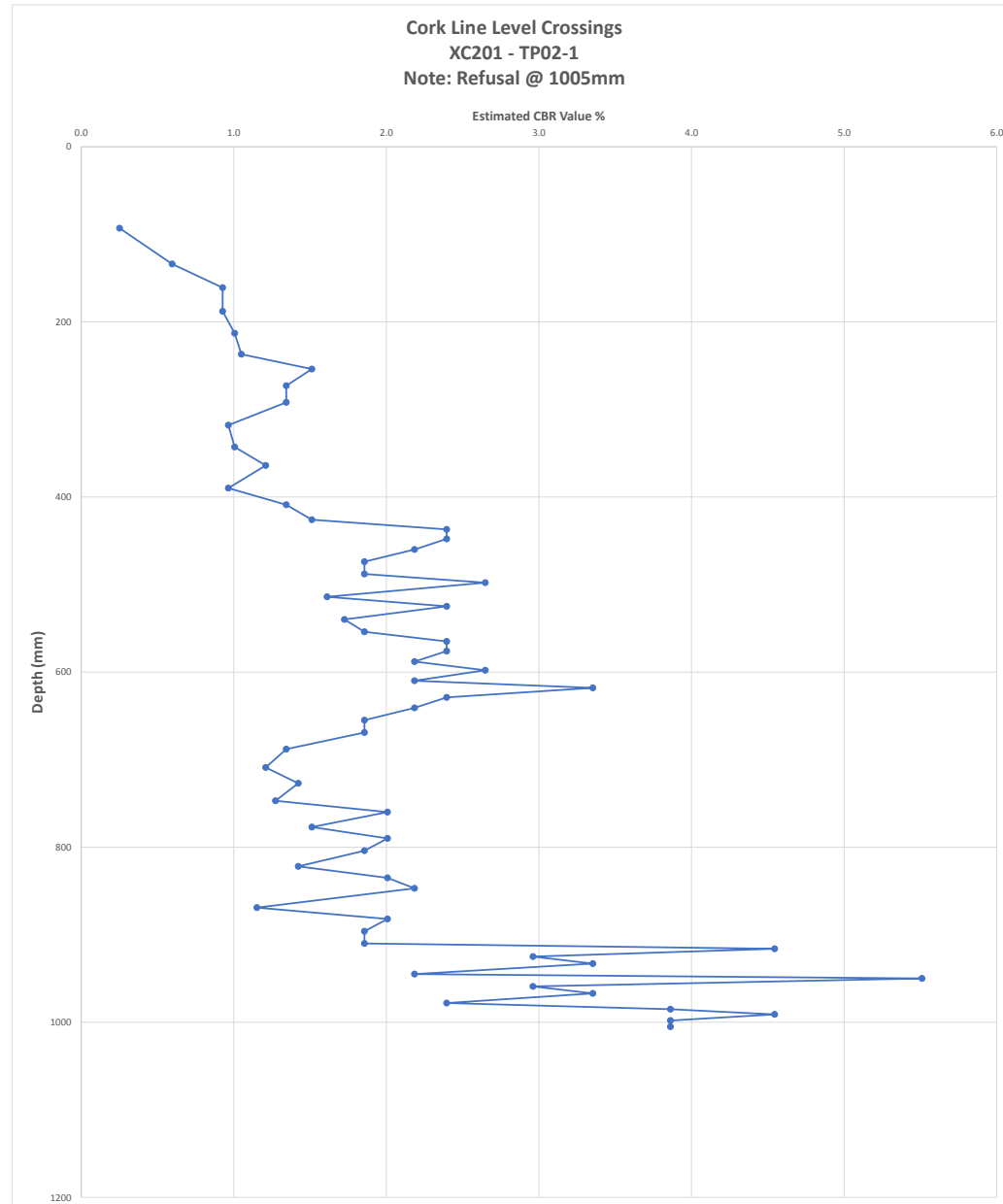
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	XC201 - TP02-1	Job No	19-135
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Easting	Northing	Elevation

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

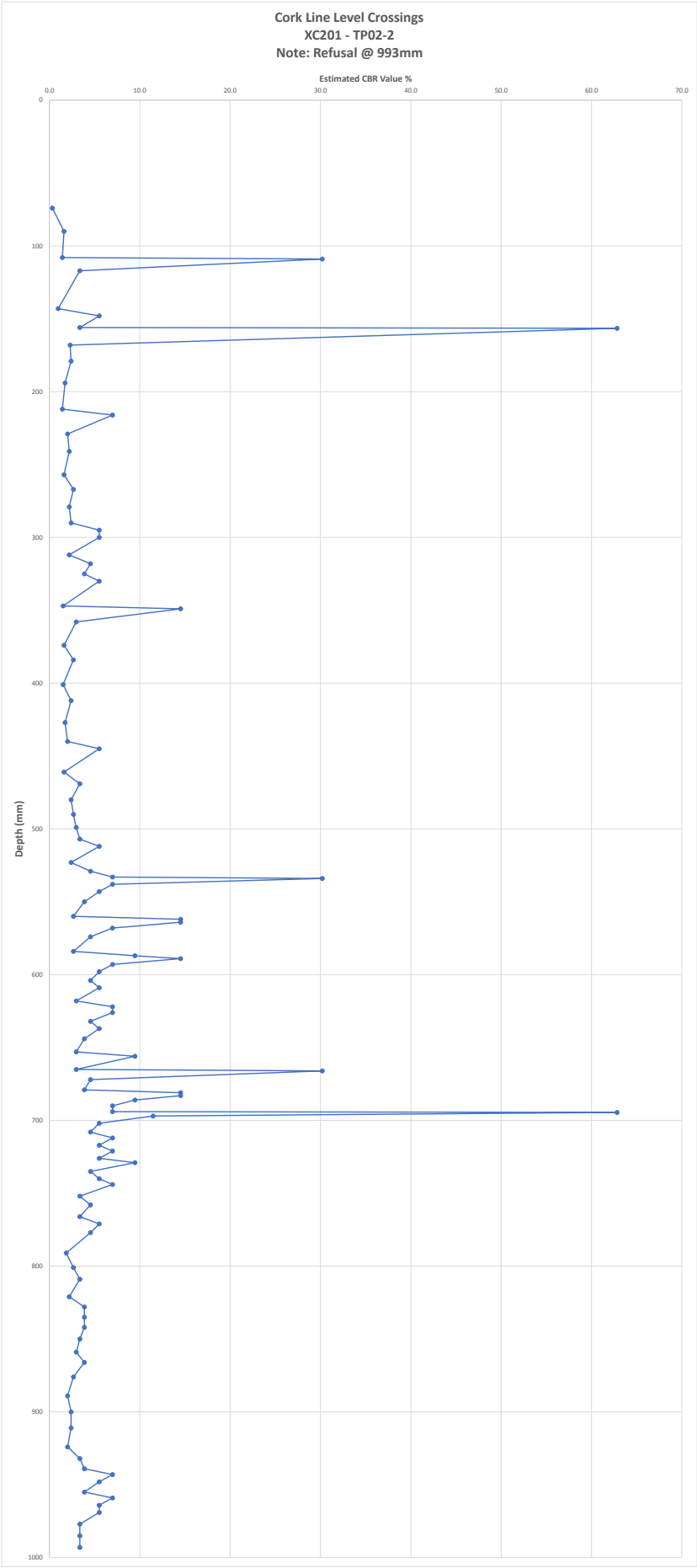
No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1030	93	93	0.3
2	989	41	134	0.6
3	962	27	161	0.9
4	935	27	188	0.9
5	910	25	213	1.0
6	886	24	237	1.0
7	869	17	254	1.5
8	850	19	273	1.3
9	831	19	292	1.3
10	805	26	318	1.0
11	780	25	343	1.0
12	759	21	364	1.2
13	733	26	390	1.0
14	714	19	409	1.3
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	2.2
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



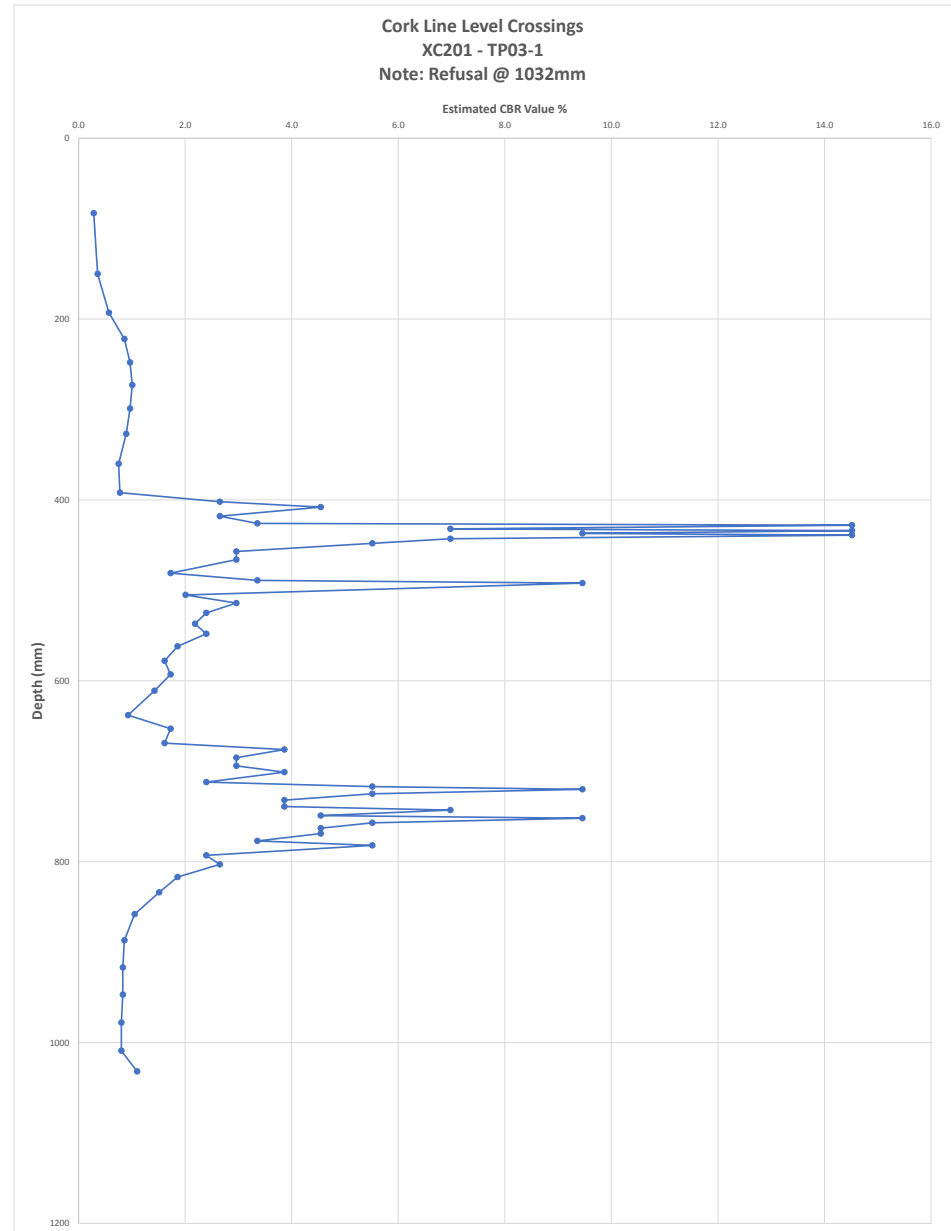
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	XC201 - TP03-1	Job No	19-135
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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 (mm)	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	3	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



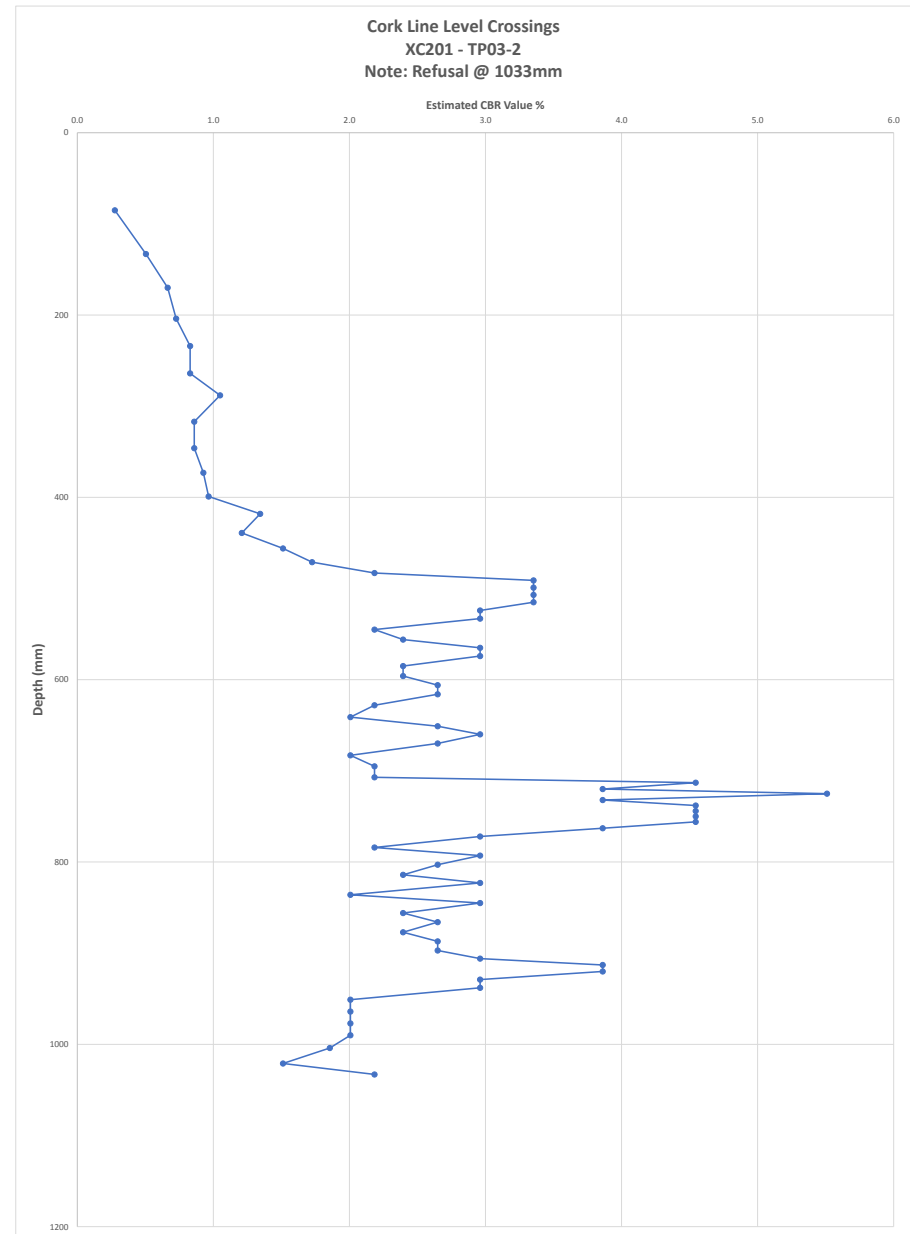
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	XC201 - TP03-2	Job No	19-135
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Easting	Northing	Elevation
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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



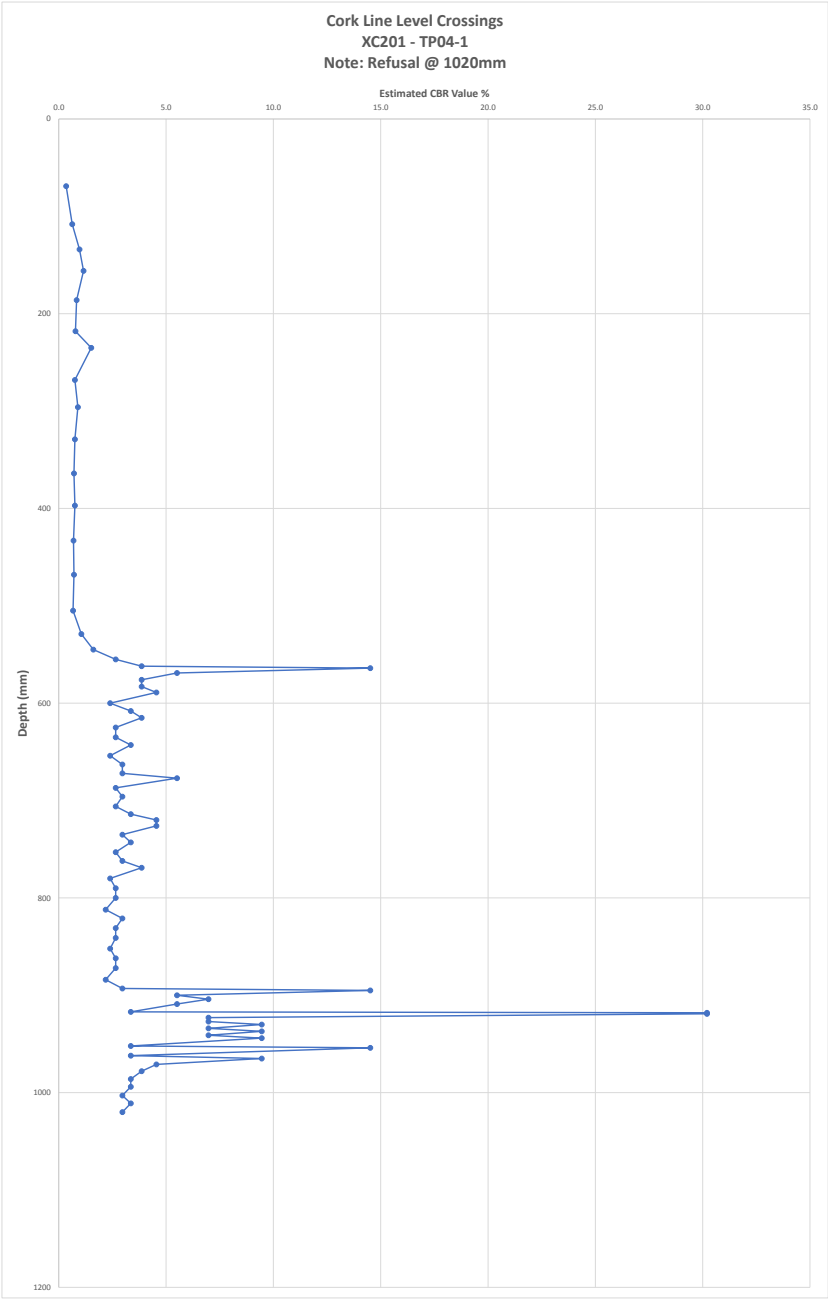
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	XC201 - TP04-1	Job No	19-135
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Easting	Northing	Elevation
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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



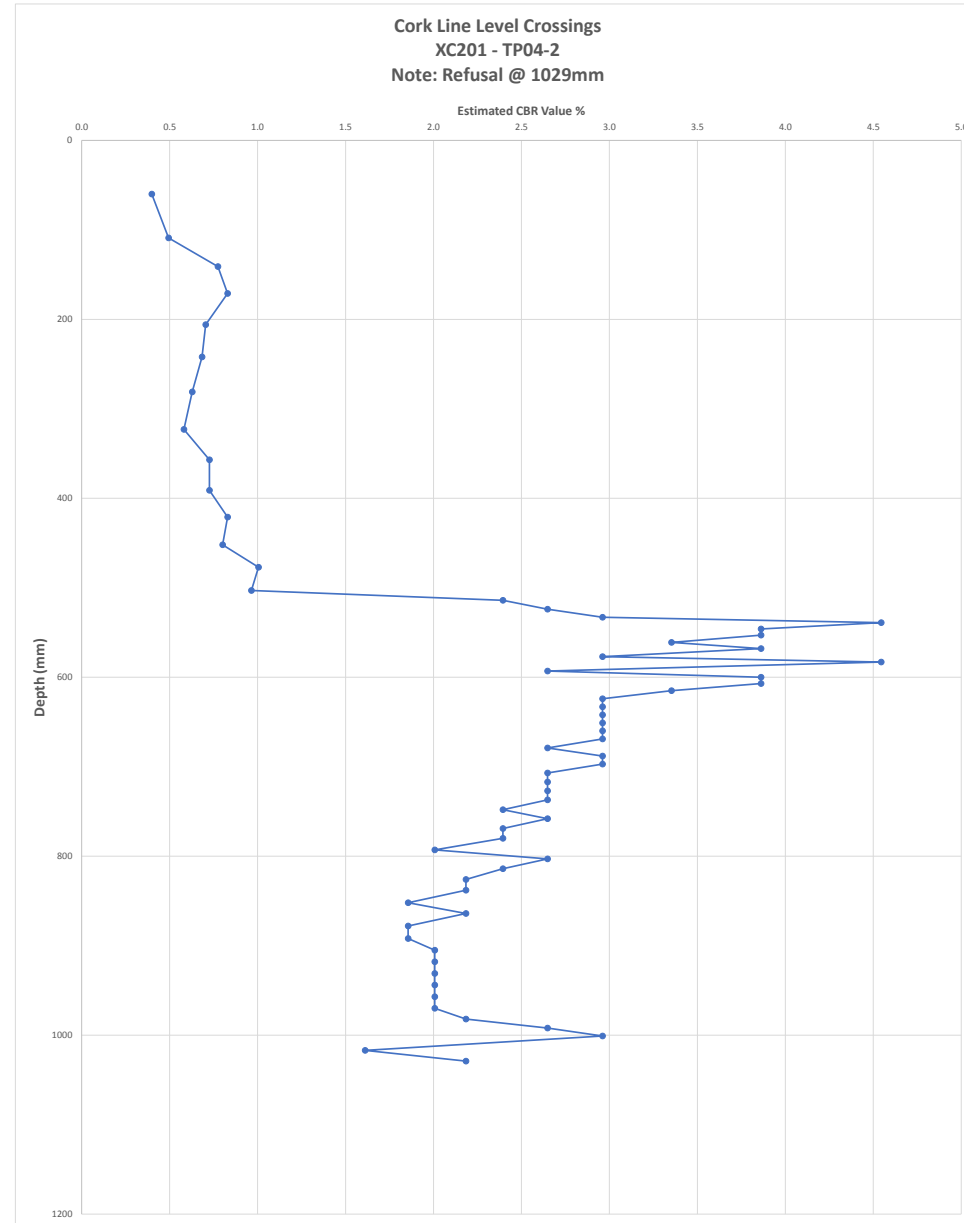
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	XC201 - TP04-2	Job No	19-135
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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 TWV (m3) 0.048071192
Job Nr: 19-135		

BH ID: <u>XC201-CPRC01A</u>	Theoretical Well Volume 48.07 <i>ltrs</i>
Depth to Response Zone: <i>Top (mbgl)</i> <i>Bottom (mbgl)</i> <div style="display: flex; justify-content: space-around; width: 100%;"> 4 10 </div>	TWV x3 144.21 <i>ltrs</i>

Purge Start Time: 15:38 Purge Finish Time: 16:30 Depth to water after purging: mbgl	(mbgl) Depth to Water 1.06 Total Depth 7.23
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	Time Taken to fill 25ltr container(mins)
	Flow Rate l/min
Reading 1:	4
Reading 2:	4
Reading 3:	4

Date 06/08/2020

Nr of Containers filled:

Total Volume Purged: *litres*

	Temperature	pH	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

Job Name: I.E - Cork Line			h (m) 2 r (m) 0.0505 r2 0.00255025 TWV (m3) 0.016023731																				
Job Nr: 19-135																							
BH ID: <u>XC201-CPRC02</u>			Theoretical Well Volume 16.02 <i>ltrs</i>																				
Depth to Response Zone: <i>Top (mbgl)</i> <i>Bottom (mbgl)</i> <div style="text-align: center;">2 4</div>			TWV x3 48.07 <i>ltrs</i>																				
Purge Start Time: 11:18 Purge Finish Time: 12:55 Depth to water after purging: 3.53 mbgl			(mbgl) Depth to Water 1.1 Total Depth 3.87																				
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;"></td> <td style="width: 20%;">Time Taken to fill 25ltr container(mins)</td> <td style="width: 20%;">Flow Rate l/min</td> <td colspan="3" rowspan="4" style="vertical-align: top;"> <i>Date</i> 07/08/2020 </td> </tr> <tr> <td>Reading 1:</td> <td>3.5+</td> <td>~5.5</td> <td>(Pumping from water column)</td> </tr> <tr> <td>Reading 2:</td> <td>4</td> <td>~5</td> <td>(Pumping from water column)</td> </tr> <tr> <td>Reading 3:</td> <td>2.2</td> <td>0.9</td> <td>(Flow slows after pumping c.50L)</td> </tr> </table>							Time Taken to fill 25ltr container(mins)	Flow Rate l/min	<i>Date</i> 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)
	Time Taken to fill 25ltr container(mins)	Flow Rate l/min	<i>Date</i> 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: <div style="border: 1px solid black; padding: 2px 10px;">5.75</div> Total Volume Purged: <div style="border: 1px solid black; padding: 2px 10px;">115</div> <i>litres</i>																							
	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				Soil Description	ρ	ρ_d	W	< 425 μm sieve	W_L	W_P	I_P	ρ_s	Remarks
	No.	Depth (m)		type										
		from	to			Mg/m3		%	%	%	%		Mg/m3	
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 : ρ bulk density, linear

ρ_d 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

<425 μ m preparation

n from natural soil

s sieved specimen

h removed by hand


ρ_s particle density

-g = gas jar

-p = small pycnometer

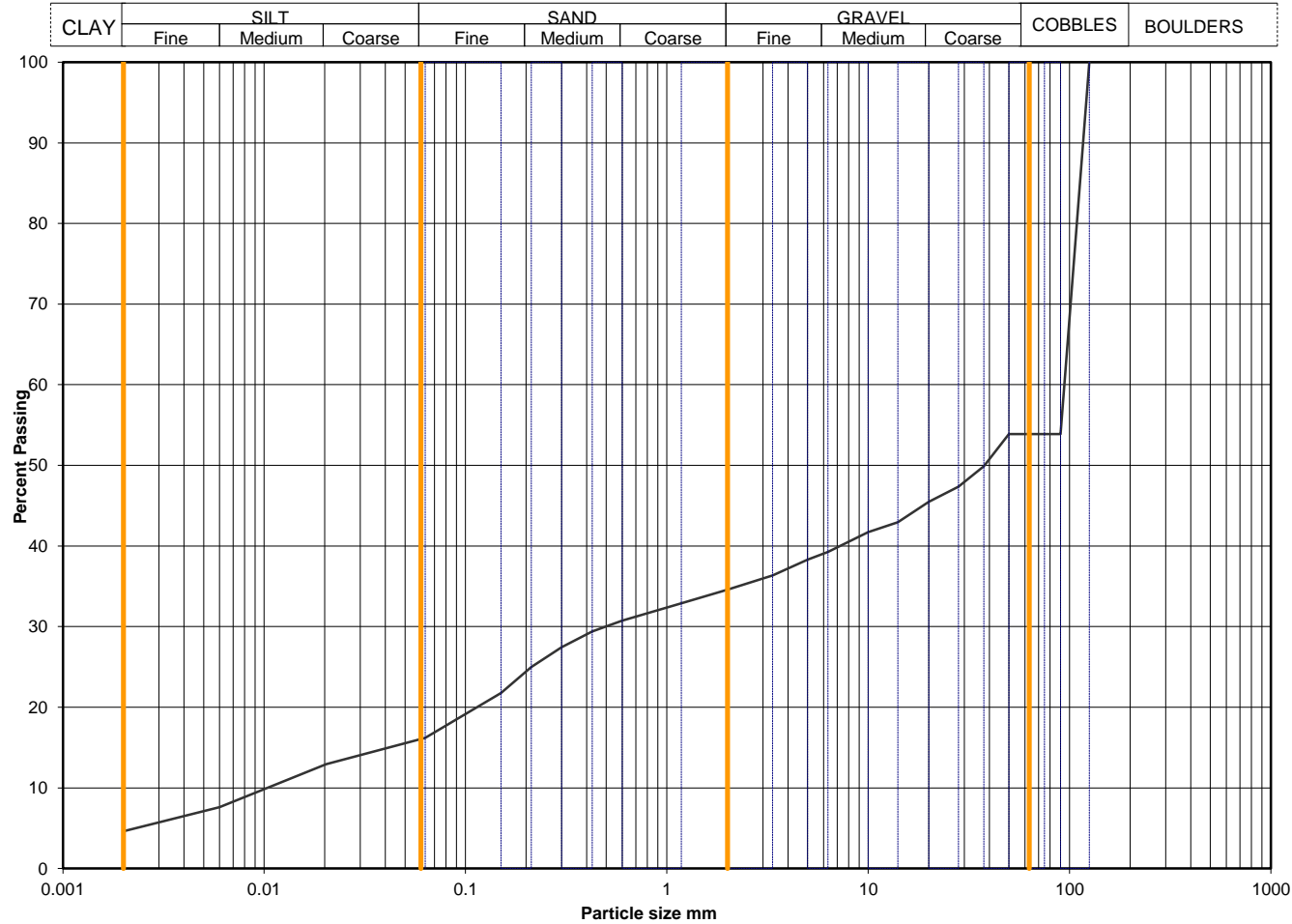
INDEX PROPERTIES - SUMMARY OF RESULTS

Hole No.	Sample				Soil Description	ρ	ρ_d	W	< 425 μm sieve	W_L	W_P	I_P	ρ_s	Remarks
	No.	Depth (m)		type										
		from	to			Mg/m3		%	%	%	%		Mg/m3	
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		

<div>General notes: All above tests carried out to BS1377 : 1990 unless annotated otherwise. See Remarks for further details</div> <div><div>Key : ρ bulk density, linear ρ_d dry density w moisture content * test carried out to BS EN ISO 17892</div><div>W_L Liquid limit a 4 point cone test b 1 point cone test</div><div>W_P Plastic limit NP non - plastic IP Plasticity Index</div><div><425μm preparation n from natural soil s sieved specimen h removed by hand</div><div>ρ_s particle density -g = gas jar -p = small pyknometer</div></div>														
<div>QA Ref SLR 1 Rev 2.95 Mar 17</div>				<div>Project No N9425-20</div> <div>Project Name Cork Line Level Crossings</div>							<div>Figure</div> <div>INDX</div>			
				<div>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</div>							<div>Printed: 20/11/2020 10:50</div>			

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	XC201-CP01
		Sample Depth (m BGL)	1.20 - 2.00
	SOCO202008042	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		
0.600	31	Particle density, Mg/m3	
0.425	29	2.65 assumed	
0.300	27	Dry mass of sample, kg	
0.212	25	7.1	
0.150	22		
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	Cobbles / boulders Gravel Sand Silt Clay	Whole	*<60mm
		46.2	0.0
		19.3	35.9
		18.3	34.0
		11.6	21.6
		4.6	8.6

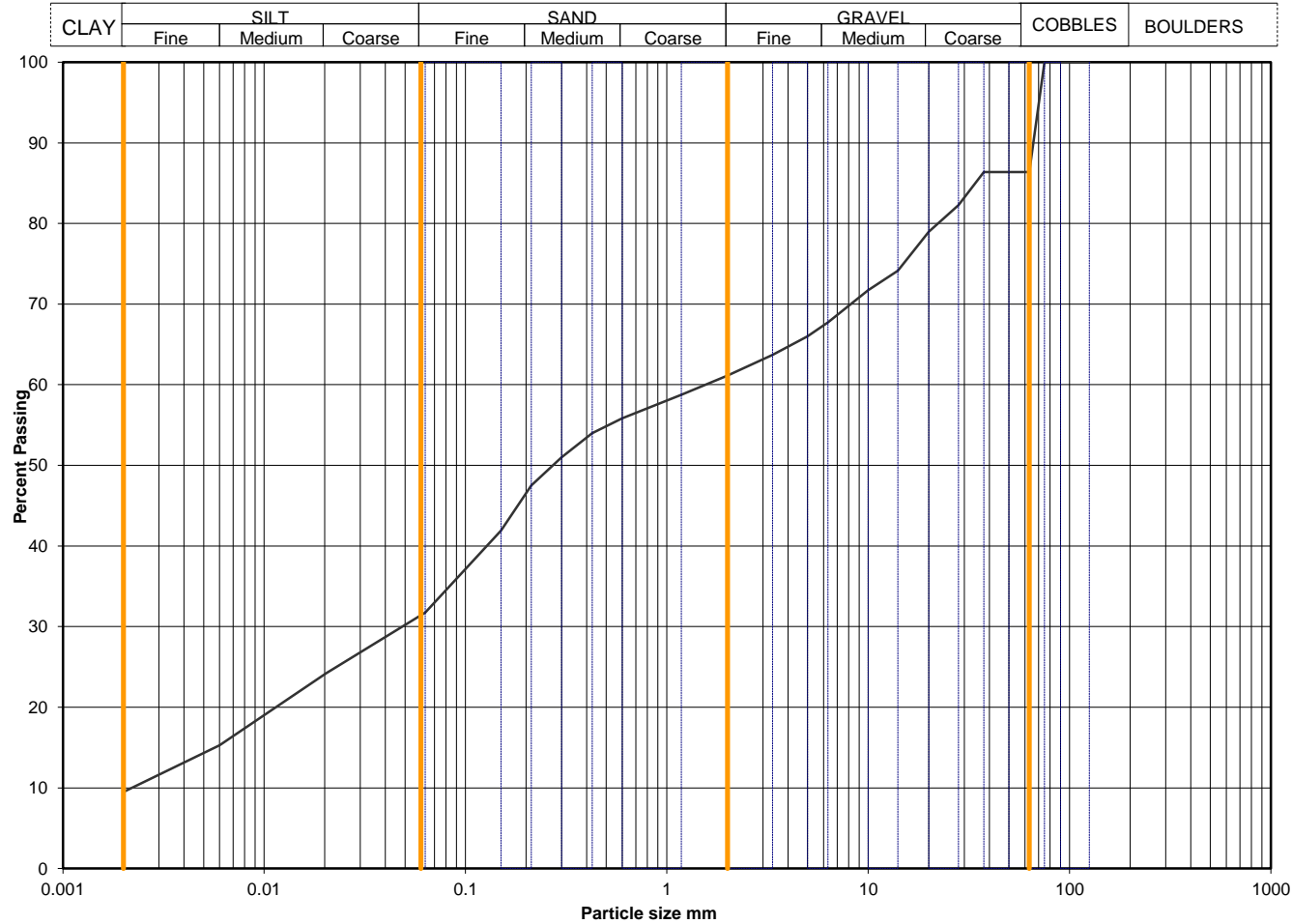
*<60mm values to aid description only

Uniformity Coefficient	D60 / D10	9100
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Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	XC201-CP01A
		Sample Depth (m BGL)	2.00 - 3.00
	SOCO202008044	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		
0.600	56	Particle density, Mg/m3	
0.425	54	2.65 assumed	
0.300	51	Dry mass of sample, kg	
0.212	48	3.0	
0.150	42		
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	Cobbles / boulders Gravel Sand Silt Clay	Whole	*<60mm
		13.6	0.0
		25.3	29.3
		29.4	34.0
		22.2	25.7
		9.5	11.0

*<60mm values to aid description only

Uniformity Coefficient	D60 / D10	725
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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



Project No N9387-20
Project Name Cork Line Level Crossings

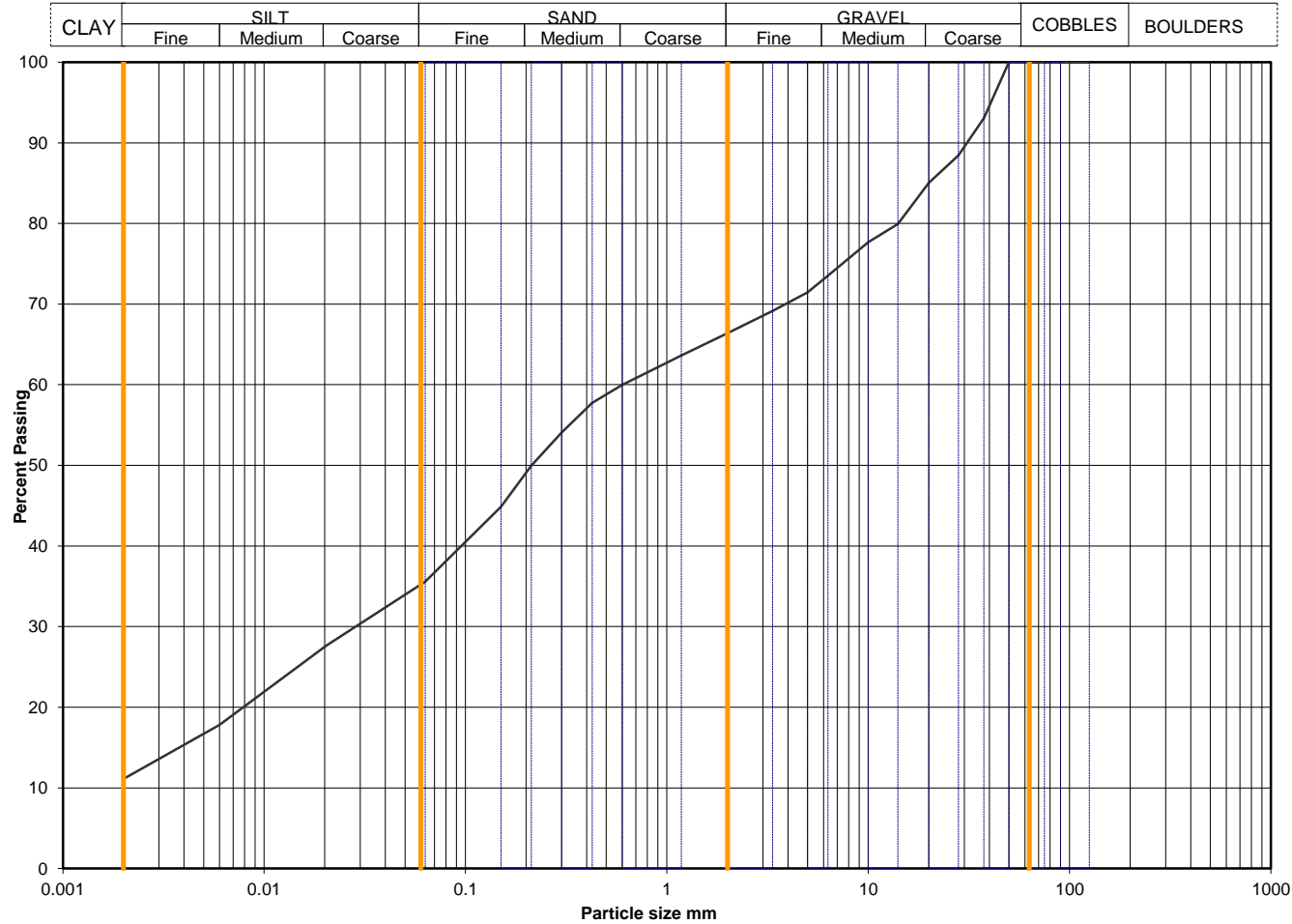
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	XC201-CP02
	SOCO202008046	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		
0.600	60	Particle density, Mg/m3	
0.425	58	2.65 assumed	
0.300	54	Dry mass of sample, kg	
0.212	50	2.9	
0.150	45		
0.063	36		

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

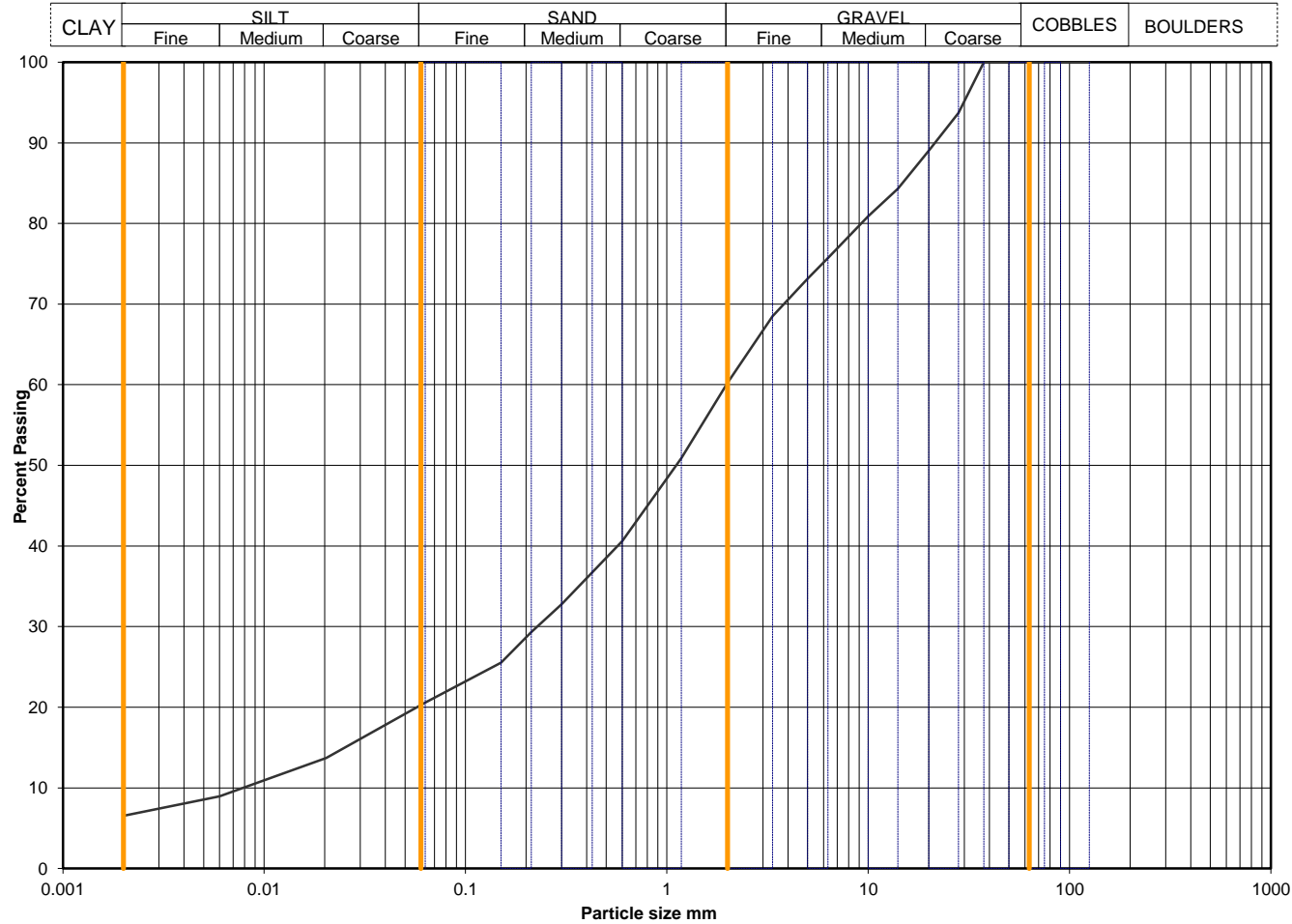
Sample Proportions	Cobbles / boulders Gravel Sand Silt Clay	Whole	*<60mm
		0.0	0.0
		33.6	33.6
		30.8	30.8
		24.5	24.5
		11.1	11.1
*<60mm values to aid description only			

Uniformity Coefficient	D60 / D10	Not applicable
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Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	XC201-CPRC01
		Sample Depth (m BGL)	3.20 - 3.70
	SOCO2020080416	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		
0.600	41	Particle density, Mg/m3	
0.425	37	2.65 assumed	
0.300	33	Dry mass of sample, kg	
0.212	29	2.7	
0.150	26		
0.063	21		

Soil description	Dark brown sandy gravelly clayey SILT.
Preparation / Pretreatment	Sieve: pre dried, Pipette: as BS1377
Remarks	

Sample Proportions	Cobbles / boulders Gravel Sand Silt Clay	Whole	*<60mm
		0.0	0.0
		39.9	39.9
		39.6	39.6
		14.0	14.0
		6.5	6.5

*<60mm values to aid description only

Uniformity Coefficient	D60 / D10	253
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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



Project No N9387-20
Project Name Cork Line Level Crossings

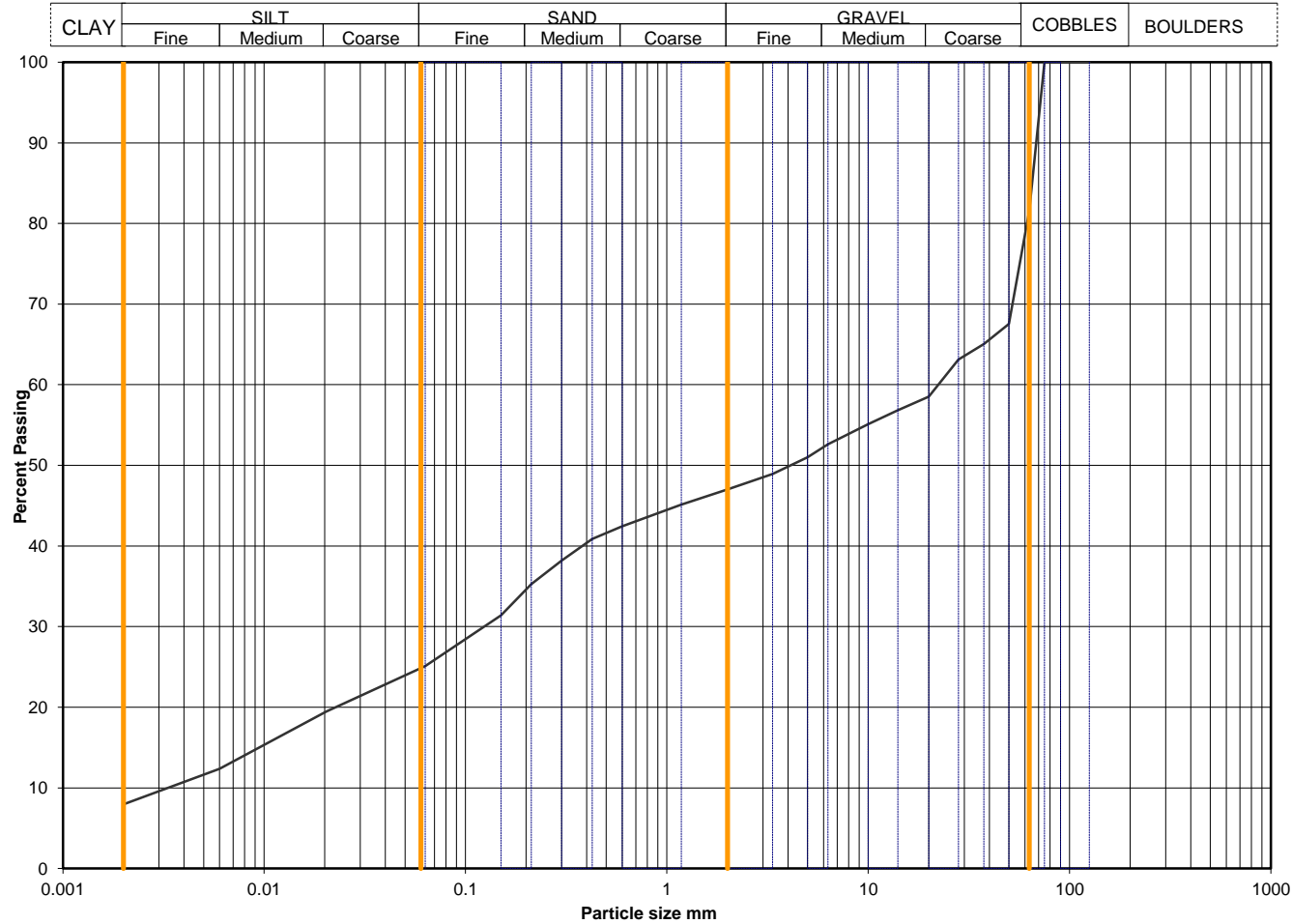
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	XC201-CPRC01A
		Sample Depth (m BGL)	1.20 - 2.00
	SOCO2020080417	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		
0.600	42	Particle density, Mg/m3	
0.425	41	2.65 assumed	
0.300	38	Dry mass of sample, kg	
0.212	35	10.7	
0.150	31		
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	Cobbles / boulders Gravel Sand Silt Clay	Whole	*<60mm
		18.3	0.0
		34.6	42.4
		21.9	26.8
		17.2	21.1
		8.0	9.8
	*<60mm values to aid description only		

Uniformity Coefficient	D60 / D10	6681
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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



Project No N9387-20
Project Name Cork Line Level Crossings

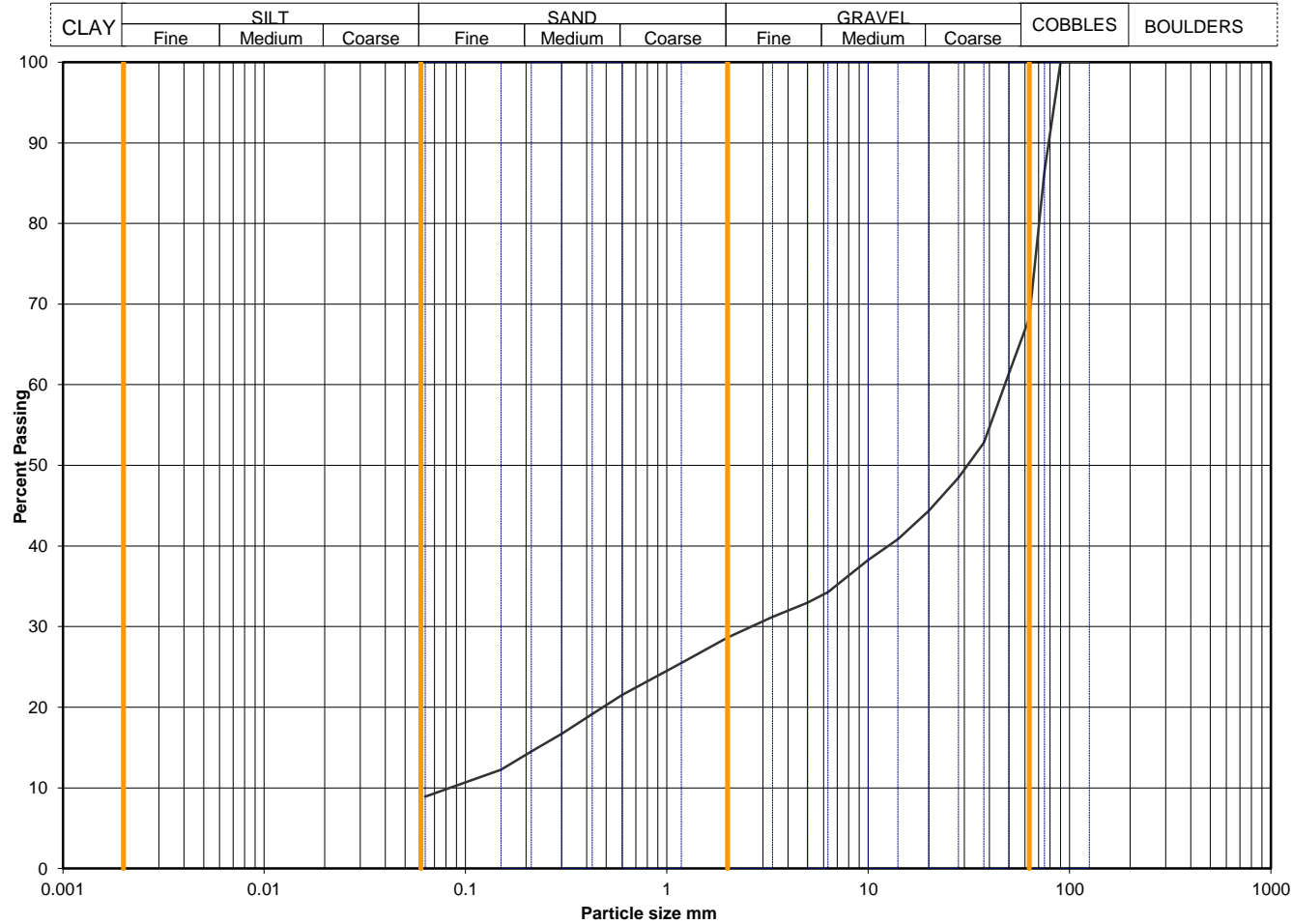
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	XC201-CPRC01A
	SOCO2020080420	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		
0.212	14		
0.150	12		
0.063	9		

Dry mass of sample, kg	
10.0	

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

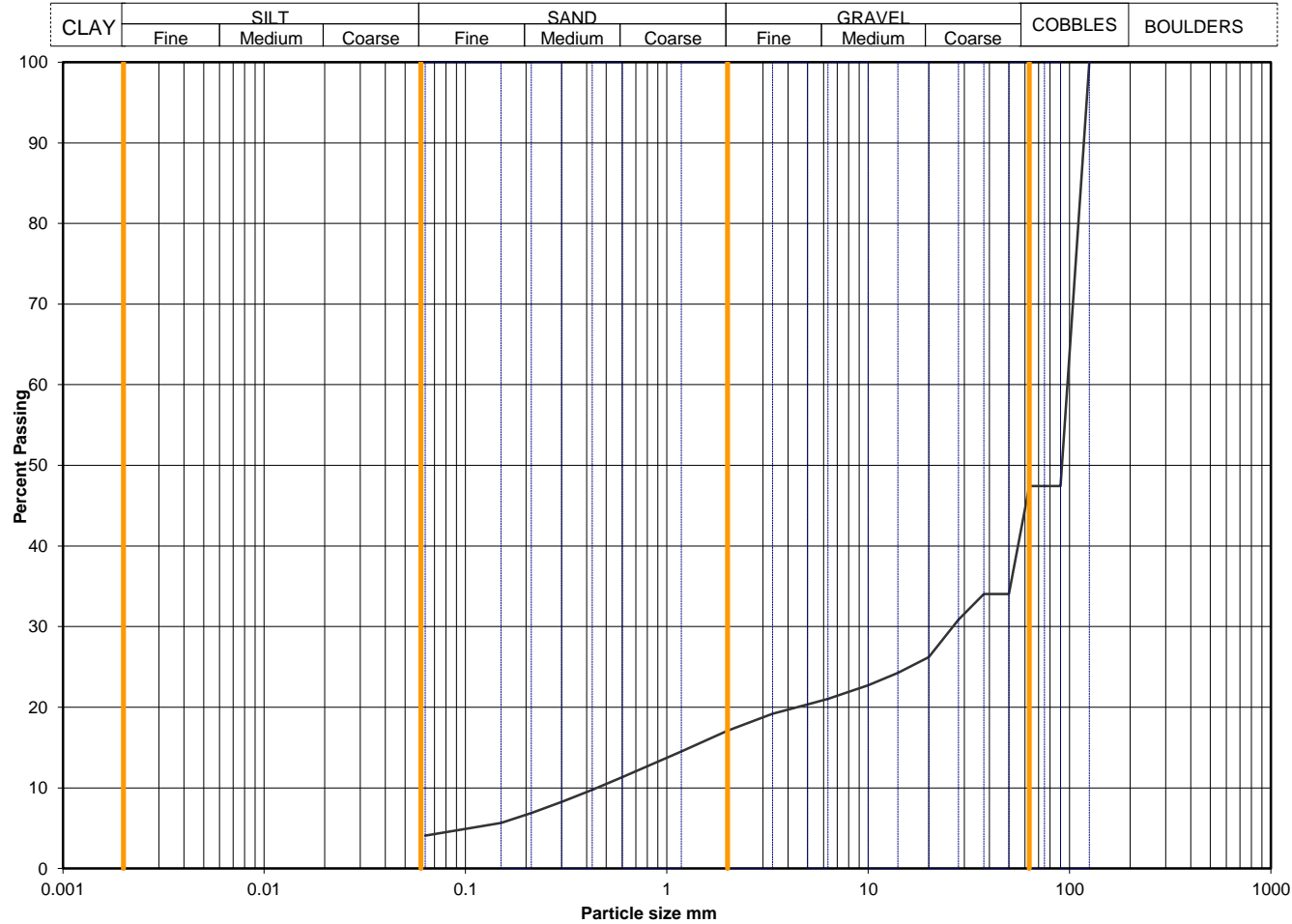
Sample Proportions	Cobbles / boulders Gravel Sand Silt Clay	Whole	*<60mm
		31.7	0.0
		39.7	58.1
		19.7	28.8
		silt+clay =	
		8.9	13.0
*<60mm values to aid description only			

Uniformity Coefficient	D60 / D10	572
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Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	XC201-CPRC01A
	SOCO2020080422	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		
0.212	7		
0.150	6		
0.063	4		

Dry mass of sample, kg	
5.4	

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

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

Uniformity Coefficient	D60 / D10	217
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Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

QA Ref
SLR 2,9
Rev 2.22
Jul 17



Project No N9387-20
Project Name Cork Line Level Crossings

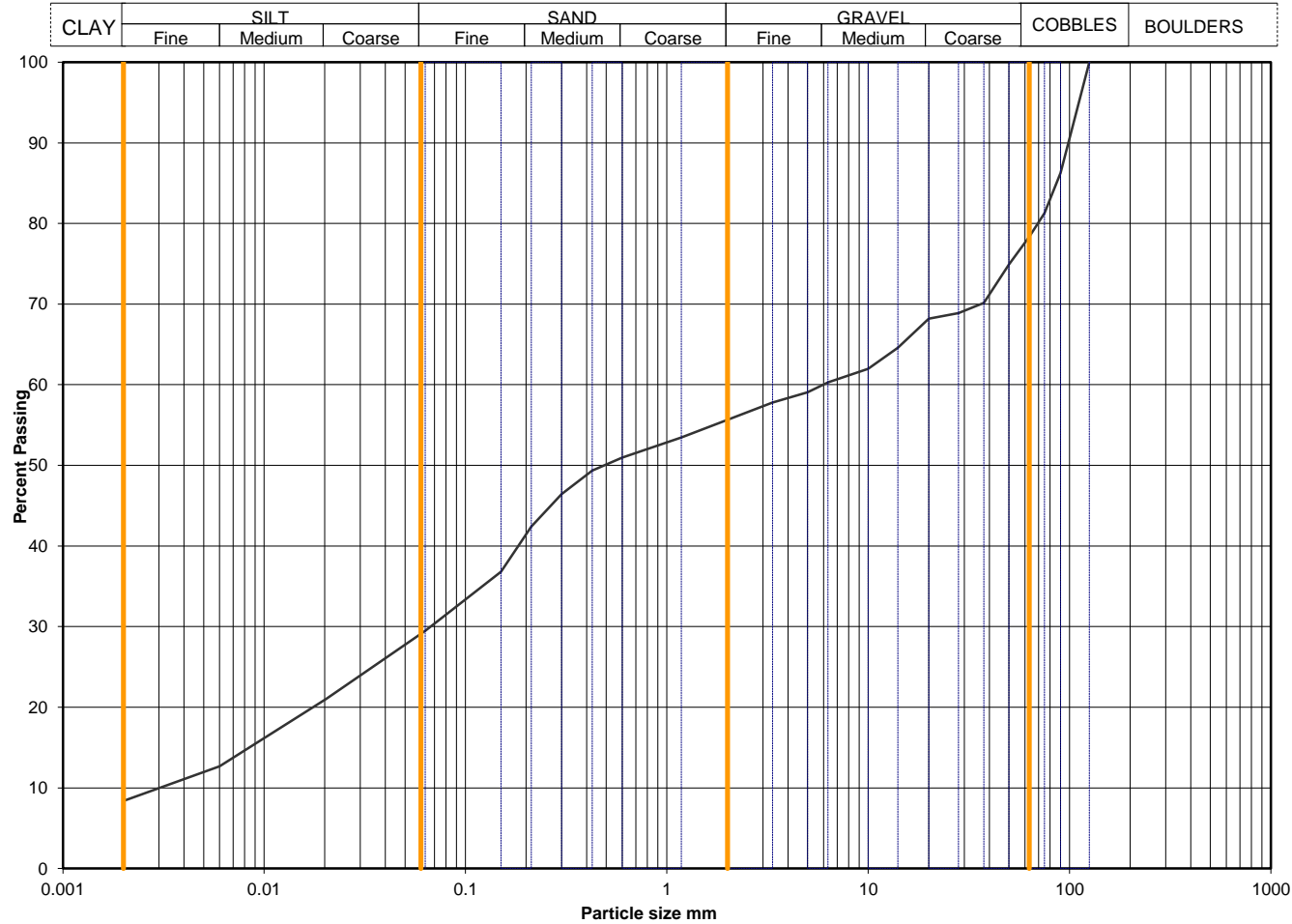
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	XC201-CPRC02
	SOCO2020080424	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		
0.600	51	Particle density, Mg/m3	
0.425	49	2.65 assumed	
0.300	46	Dry mass of sample, kg	
0.212	42	15.4	
0.150	37		
0.063	29		

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

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

Uniformity Coefficient	D60 / D10	2563
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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



Project No N9387-20
Project Name Cork Line Level Crossings

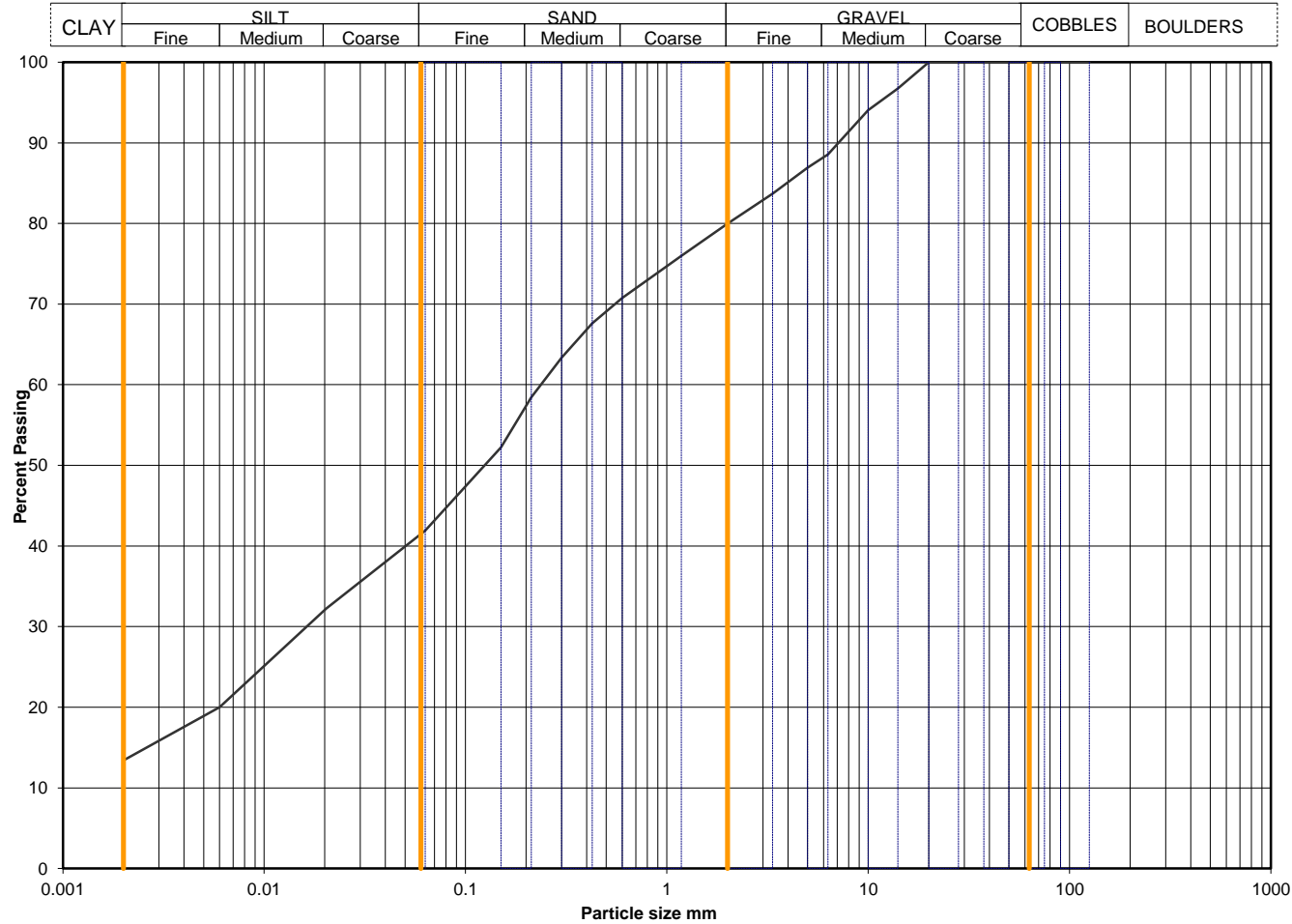
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	XC201-CPRC02
	SOCO2020080428	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		
0.600	71	Particle density, Mg/m3	
0.425	68	2.65 assumed	
0.300	63	Dry mass of sample, kg	
0.212	58	1.9	
0.150	52		
0.063	42		

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

Sample Proportions	Cobbles / boulders Gravel Sand Silt Clay	Whole	*<60mm
		0.0	0.0
		20.1	20.1
		38.0	38.0
		28.5	28.5
		13.4	13.4

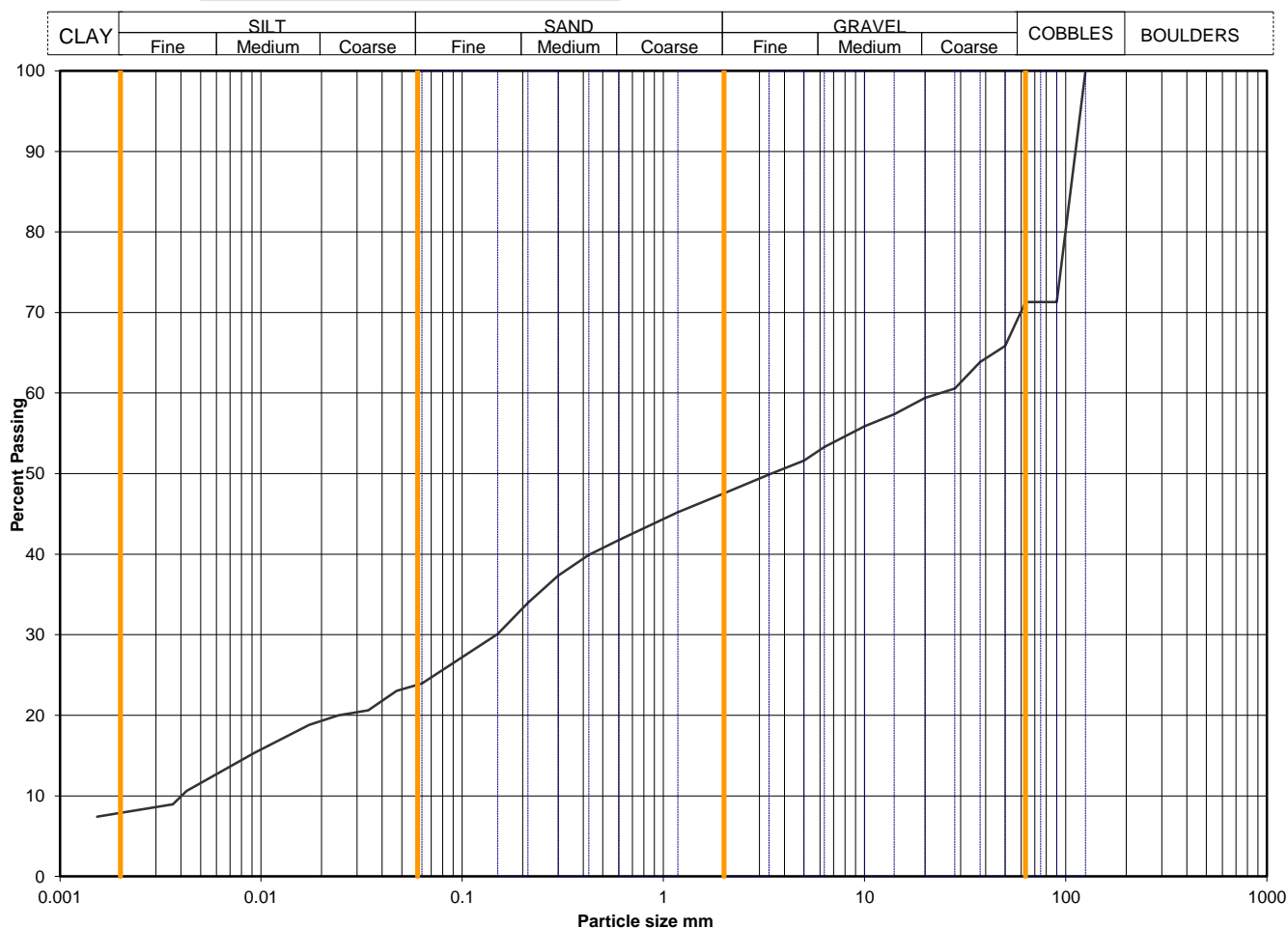
*<60mm values to aid description only

Uniformity Coefficient	D60 / D10	Not applicable
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Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	XC201-TP01
	SOCO202010025	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		
0.600	42	Particle density, Mg/m3	
0.425	40	2.65 assumed	
0.300	37	Dry mass of sample, kg	
0.212	34	6.6	
0.150	30		
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	Cobbles / boulders Gravel Sand Silt Clay	Whole	* <60mm
		28.6	0.0
		23.8	33.3
		23.6	33.1
		16.1	22.5
		7.9	11.1

* <60mm values to aid description only

Uniformity Coefficient	D60 / D10	6639
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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



Project No N9425-20
Project Name Cork Line Level Crossings

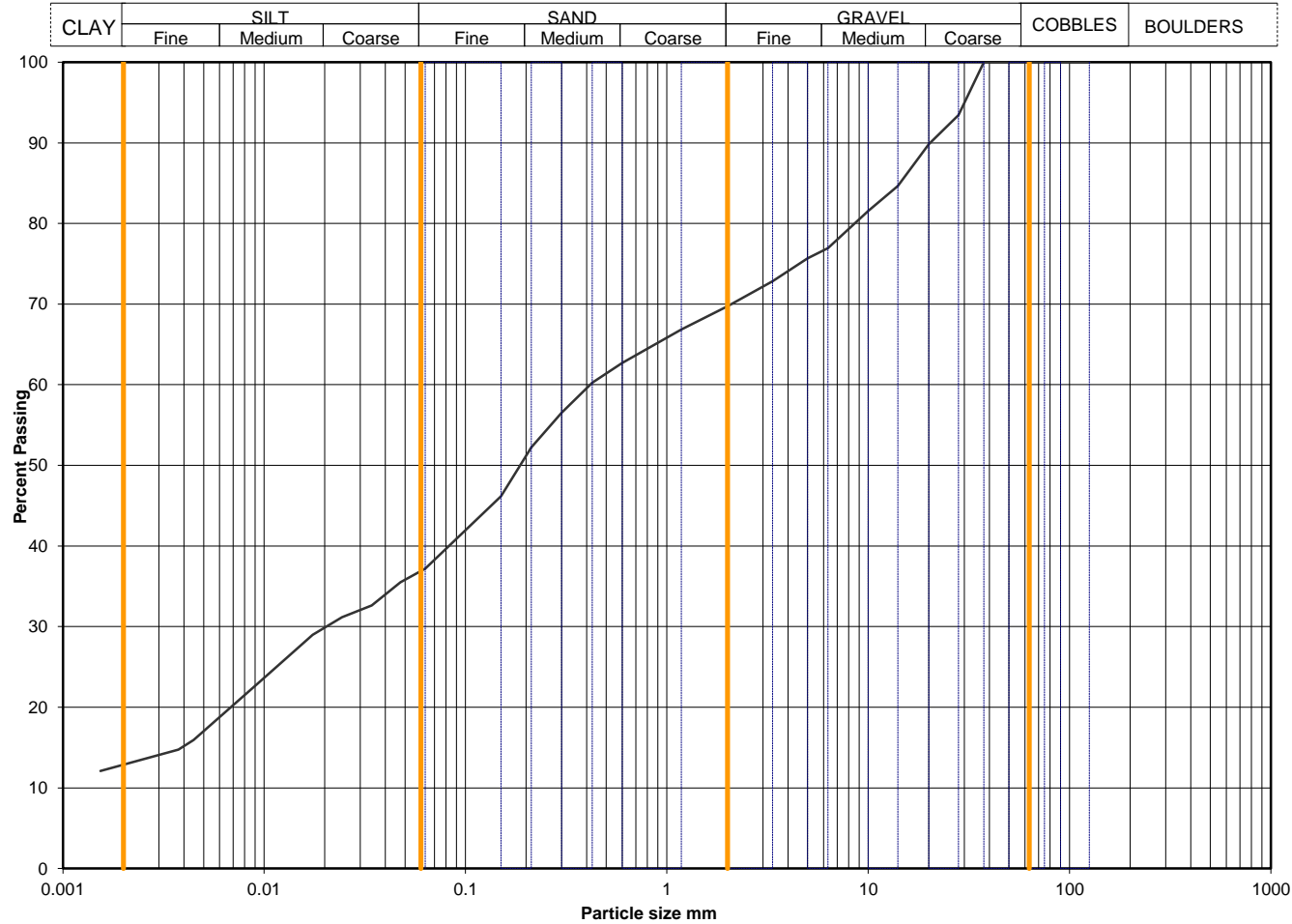
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	XC201-TP01
	SOCO2020100213	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		
0.600	63	Particle density, Mg/m3	
0.425	60	2.65 assumed	
0.300	57	Dry mass of sample, kg	
0.212	52	3.2	
0.150	46		
0.063	37		

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

Sample Proportions	Cobbles / boulders Gravel Sand Silt Clay	Whole	*<60mm
		0.0	0.0
		30.3	30.3
		32.5	32.5
		24.3	24.3
		12.9	12.9

*<60mm values to aid description only

Uniformity Coefficient	D60 / D10	Not applicable
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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



Project No N9425-20
Project Name Cork Line Level Crossings

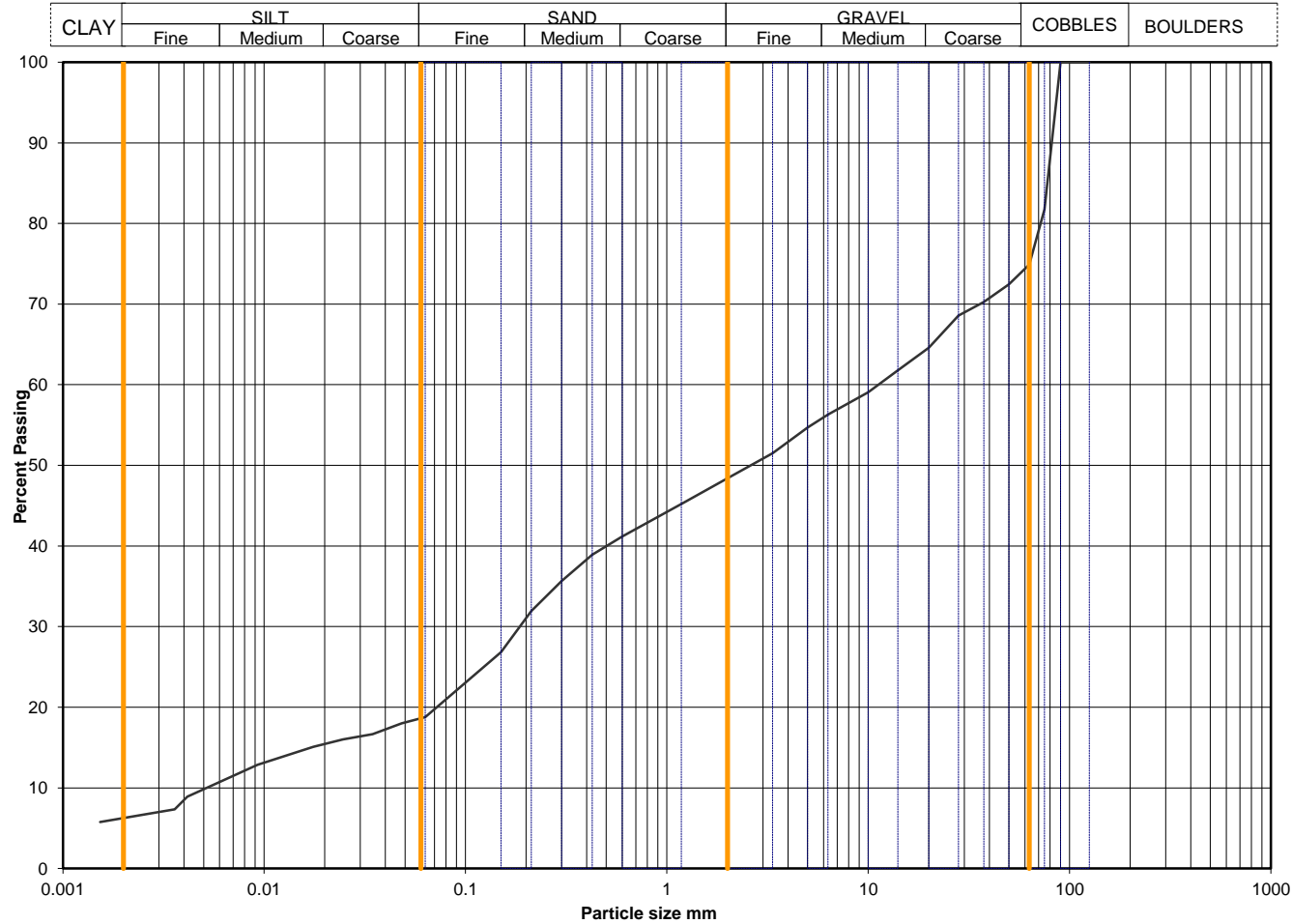
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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	XC201-TP02
	SOCO2020100217	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		
0.600	41	Particle density, Mg/m3	
0.425	39	2.65 assumed	
0.300	36	Dry mass of sample, kg	
0.212	32	13.7	
0.150	27		
0.063	19		

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

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

*<60mm values to aid description only

Uniformity Coefficient	D60 / D10	2164
------------------------	-----------	------

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



Project No N9425-20
Project Name Cork Line Level Crossings

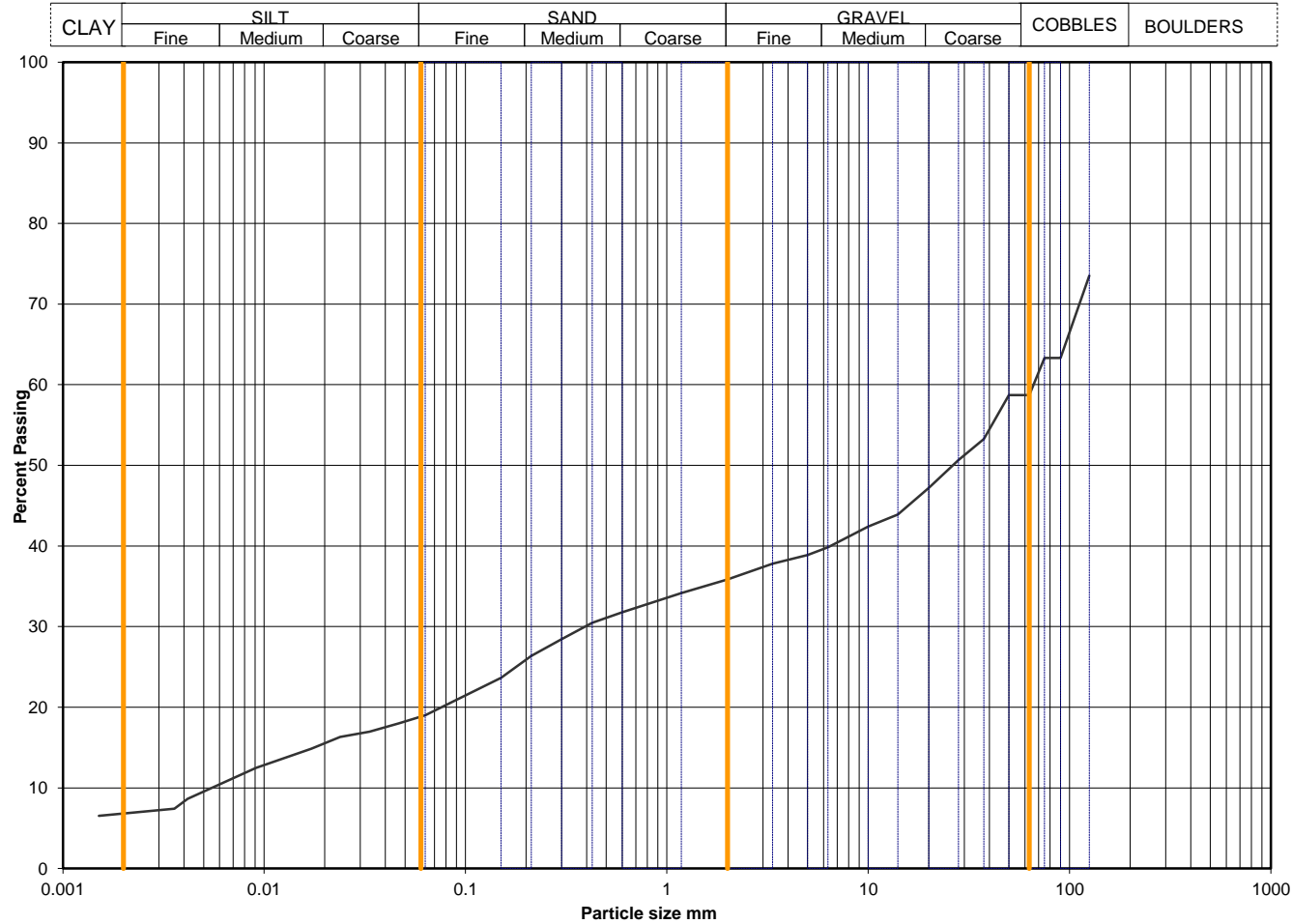
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Figure
PSD

Printed: 20/11/2020 10:52

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	XC201-TP03
	SOCO2020100225	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		
0.600	32	Particle density, Mg/m3	
0.425	30	2.65 assumed	
0.300	28	Dry mass of sample, kg	
0.212	26	13.2	
0.150	24		
0.063	19		

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

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

*<60mm values to aid description only

Uniformity Coefficient	D60 / D10	12079
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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



Project No N9425-20
Project Name Cork Line Level Crossings

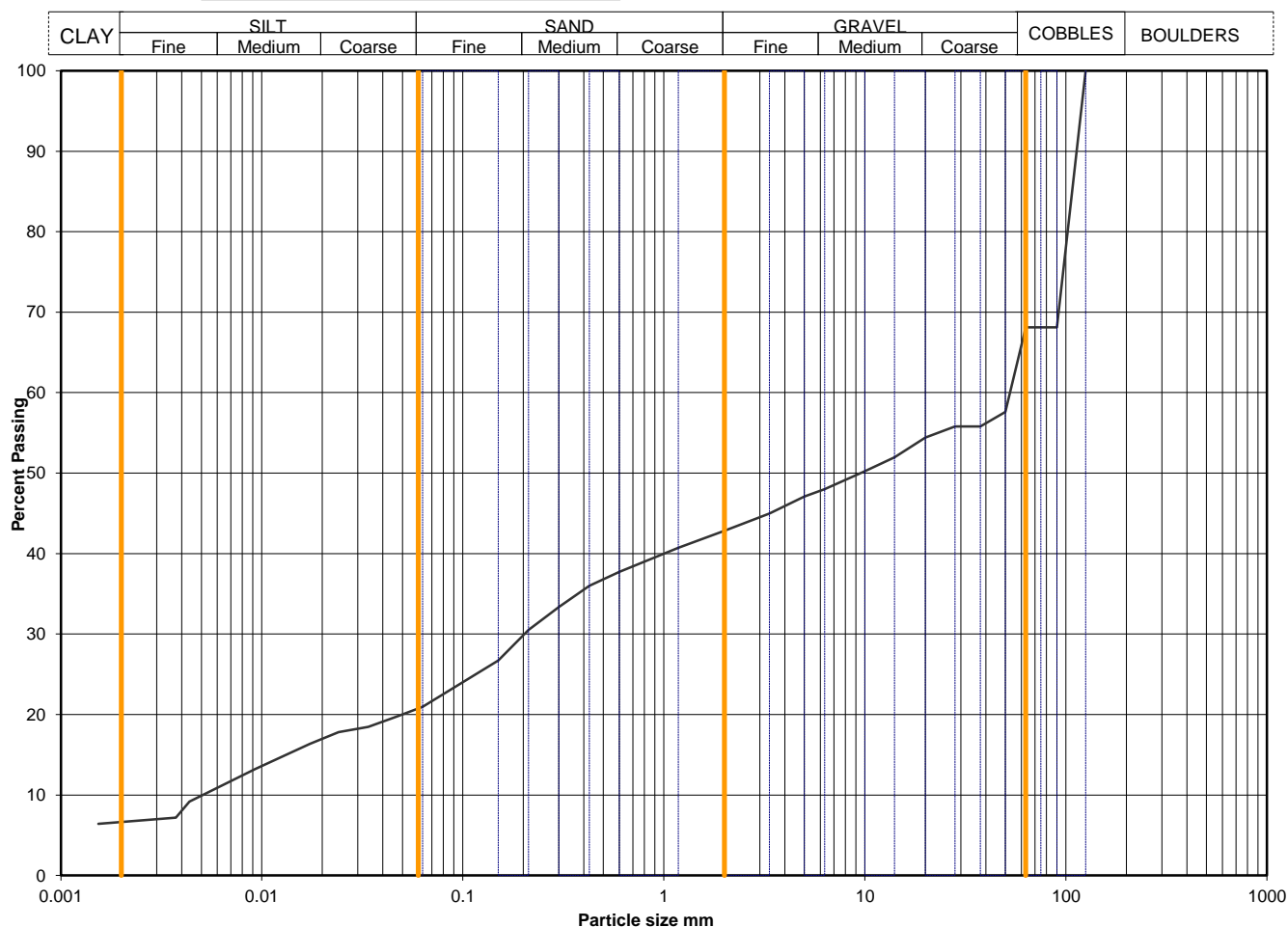
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Figure
PSD

Printed: 20/11/2020 10:52

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	XC201-TP04
	SOCO2020100231	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		
0.600	38	Particle density, Mg/m3	
0.425	36	2.65 assumed	
0.300	33	Dry mass of sample, kg	
0.212	30	6.1	
0.150	27		
0.063	21		

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

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

*<60mm values to aid description only

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



Project No N9425-20
Project Name Cork Line Level Crossings

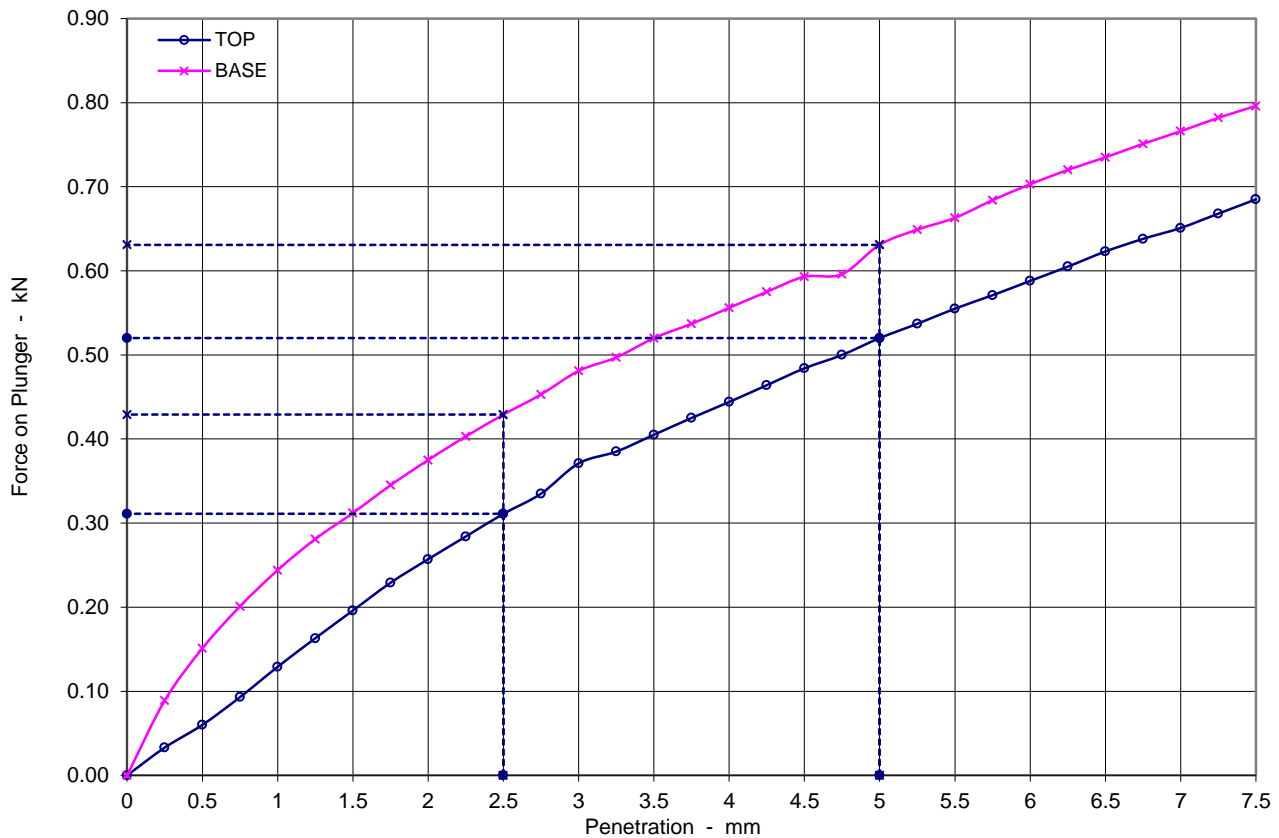
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Figure
PSD

Printed: 20/11/2020 10:52

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

Sample Details:	SAMPLE ID:	Hole No	XC201-TP01
		Sample Depth (m)	0.50 - 1.00
	SOCO202010024	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

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

Notes : @-2 OF NMC

Accepted CBR %	2.6	3.3
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QA Ref
SLR 4.7
Rev 2.8
Mar 17



Project No N9425-20
Project Name Cork Line Level Crossings

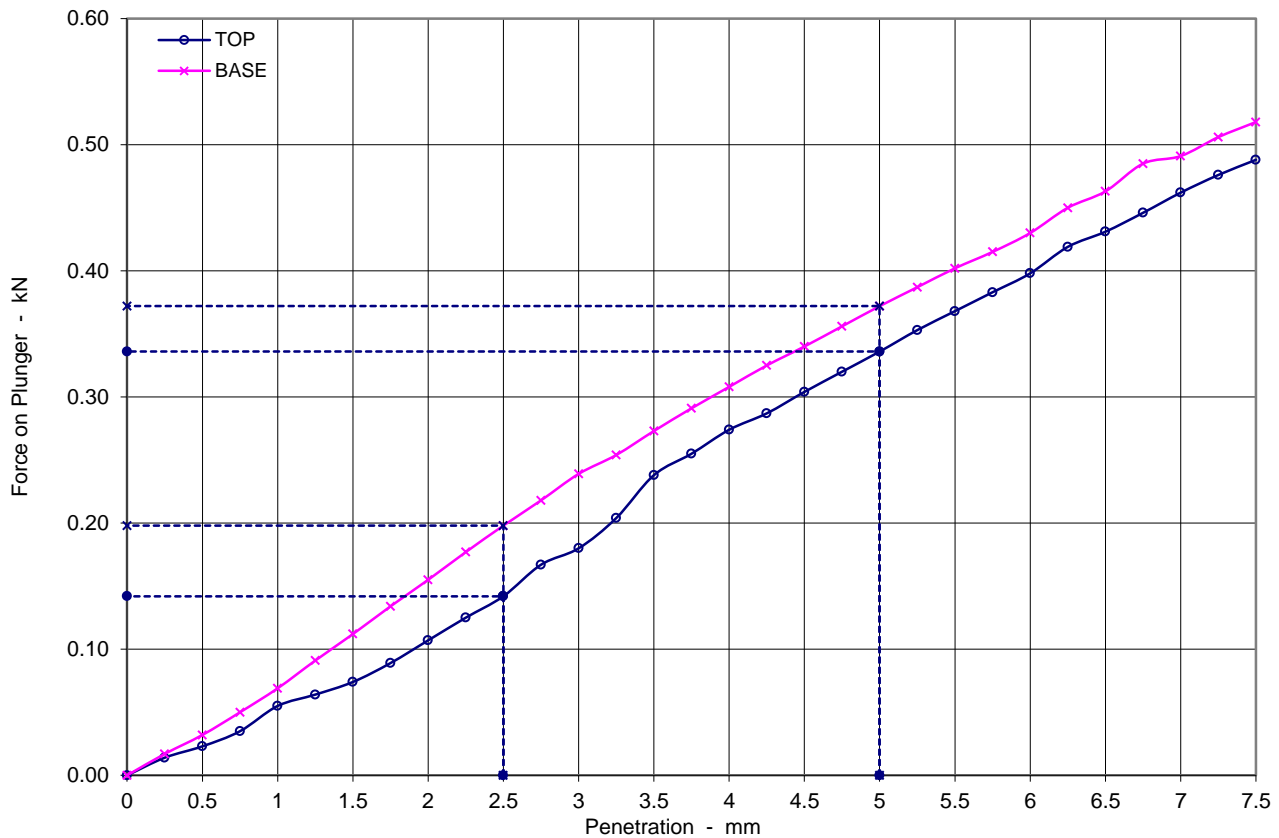
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Figure
CBR

Printed: 20/11/2020 10:49

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

Sample Details:	SAMPLE ID:	Hole No	XC201-TP04
		Sample Depth (m)	2.00 - 2.50
	SOCO2020100233	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

Notes :

Accepted CBR %	1.7	1.9
----------------	-----	-----

QA Ref
SLR 4.7
Rev 2.8
Mar 17



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Project No N9425-20
Project Name Cork Line Level Crossings

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Figure
CBR

Printed: 20/11/2020 10:49



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



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

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



2139

Summary of Chemical Analysis

Soil Samples

Our Ref 20-17748

Client Ref N9387

Contract Title Corkline Level Crossing

Lab No	1726717
	CX201-
Sample ID	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

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

<u>Sample Reference</u>	<u>Text ID</u>	<u>Sample Date</u>	<u>Sample Type</u>
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



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
					Sampling Date 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





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			





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
					Sampling Date 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





Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

Analysis Results

					Project ID	20071478
					Sample ID	
					Customer ID	
					Sample Type	
					Sampling Date	
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		



Analysis Results

					Project ID				
					20071478				
					Sample ID		001		003
					Customer ID		XC201-TP04-1-ES-0.05-0.05		XC201-TP04-2-ES-0.50-0.50
					Sample Type		LPL	SOLID	LPL
					Sampling Date		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					
>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					
Fraction above 4mm (%)	Leachate Preparation CEN 10:1		%	N					
Fraction of non-crushable material (%)	Leachate Preparation CEN 10:1		%	N					
Volume of Water for 10:1 Leach (ltr)	Leachate Preparation CEN 10:1		l	N					
Weight of Sample Leached (kg)	Leachate Preparation CEN 10:1		kg	N					



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	



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.

<u>Deviating Sample Report</u>			Incorrect Container	Incorrect Label	Headspace	Incorrect/No Preservative	No Sampling Date	Holding Time	Handling Time
Sample Reference	Text ID	Reported Name							

Analysis Method

<u>Analysis</u>	<u>Analysis Type</u>	<u>Analysis Method</u>
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



2183

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

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

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

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–C44 Aromatics: >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–C44 Aromatics: >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; Dibenzo[a,h]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	Compliance Test 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



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
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Cork Line Level Crossings
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XC201 - Southside	
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Cork Line Level Crossings
XC201 (19-135-1)

XC201 - Southside	
Pre Works Site Photographs	
Client:	Iarnród Éireann
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Iarnród Éireann
Cork Line Level Crossings
XC201 (19-135-1)

XC201 - Northside	
Pre Works Site Photographs	
Client:	Iarnród Éireann
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Iarnród Éireann
Cork Line Level Crossings
XC201 (19-135-1)

XC201 - Northside	
Pre Works Site Photographs	
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Iarnród Éireann
Cork Line Level Crossings
XC201 (19-135-1)

XC201 - Northside	
Pre Works Site Photographs	
Client:	Iarnród Éireann
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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



Iarnród Éireann
Cork Line Level Crossings
XC201 (19-135-1)

XC201	
Post Works Site Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	2020



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Cork Line Level Crossings – XC211 Ground Investigation

Primary Author: Ian Holley

Client: Irish Rail

Client's Representative: JACOBS

Report Date: 25th November 2020

Report No.: OCB19-135-2

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CONTENTS

Document Control Sheet

Note on: Methods of describing soils and rocks & abbreviations used on exploratory hole logs

1	AUTHORITY	1
2	SCOPE	1
3	DESCRIPTION OF SITE	1
4	SITE OPERATIONS.....	2
4.1	Cable Percussion Boreholes	2
4.2	Standpipe Installations.....	3
4.3	Trial Pits.....	3
4.4	Indirect CBR Tests	3
4.5	Water Purging	4
4.6	Surveying.....	4
5	LABORATORY WORK.....	5
5.1	Geotechnical Laboratory Testing of Soils.....	5
5.2	Environmental Laboratory Testing of Soils	5
6	GROUND CONDITIONS	6
6.1	General Geology of the Area	6
6.2	Ground Types Encountered During Investigation of the Site	6
6.3	Groundwater.....	6
7	DISCUSSION.....	7
7.1	Proposed Construction.....	7
8	REFERENCES	8

APPENDICES

Appendix A	Site and Exploratory Hole Location Plans
Appendix B	Borehole Logs
Appendix C	Trial Pit Logs
Appendix D	Trial Pit Photographs
Appendix E	Indirect CBR Test Results
Appendix F	Water Purging Data & Logs
Appendix G	Geotechnical Laboratory Test Results
Appendix H	Environmental Laboratory Test Results
Appendix I	Pre & Post Site Condition Photographs



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	1 st October 2020
002	Final Factual	Ian Holley	Glen Byrne	Michael O'Connell	25 th 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):

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

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 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.

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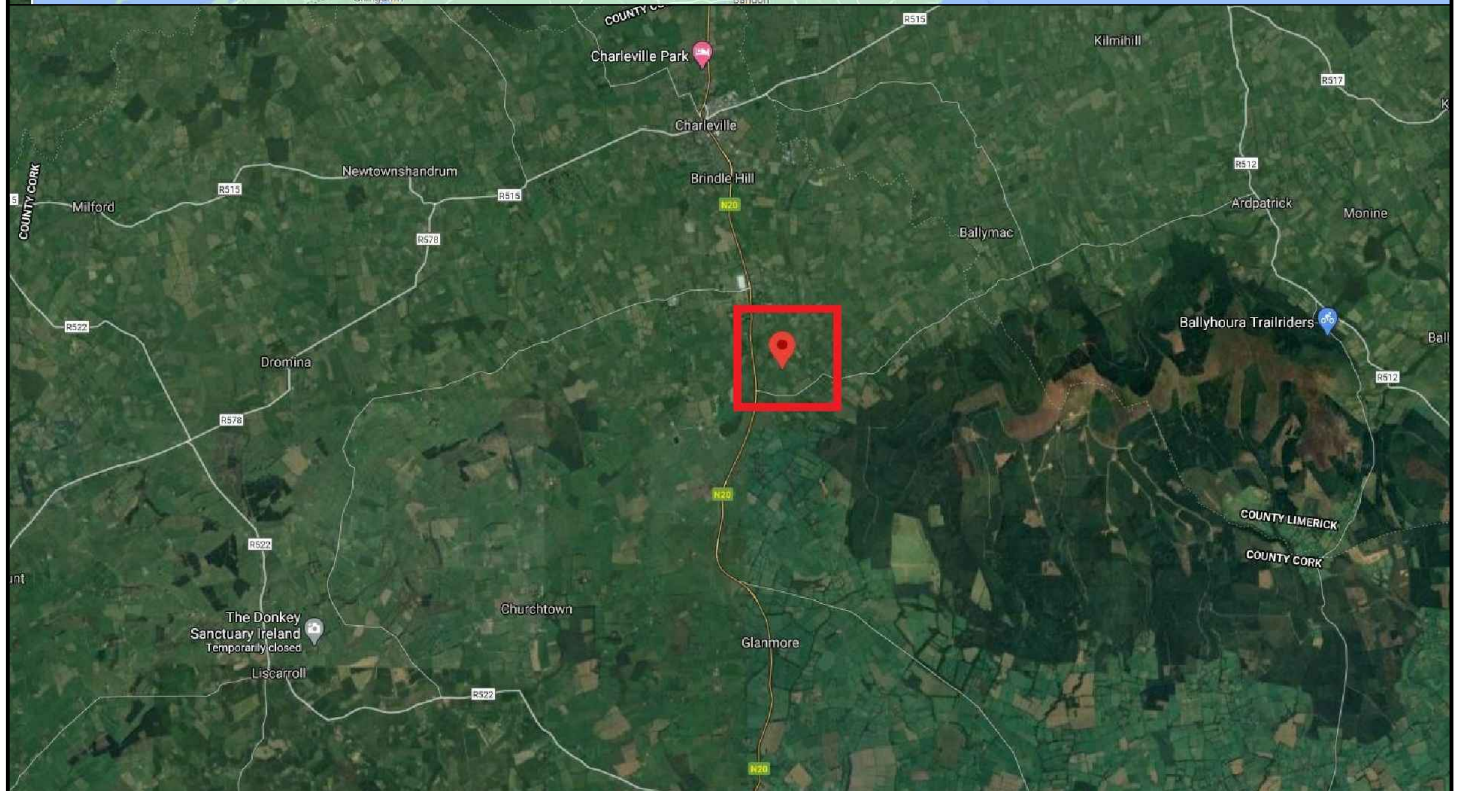
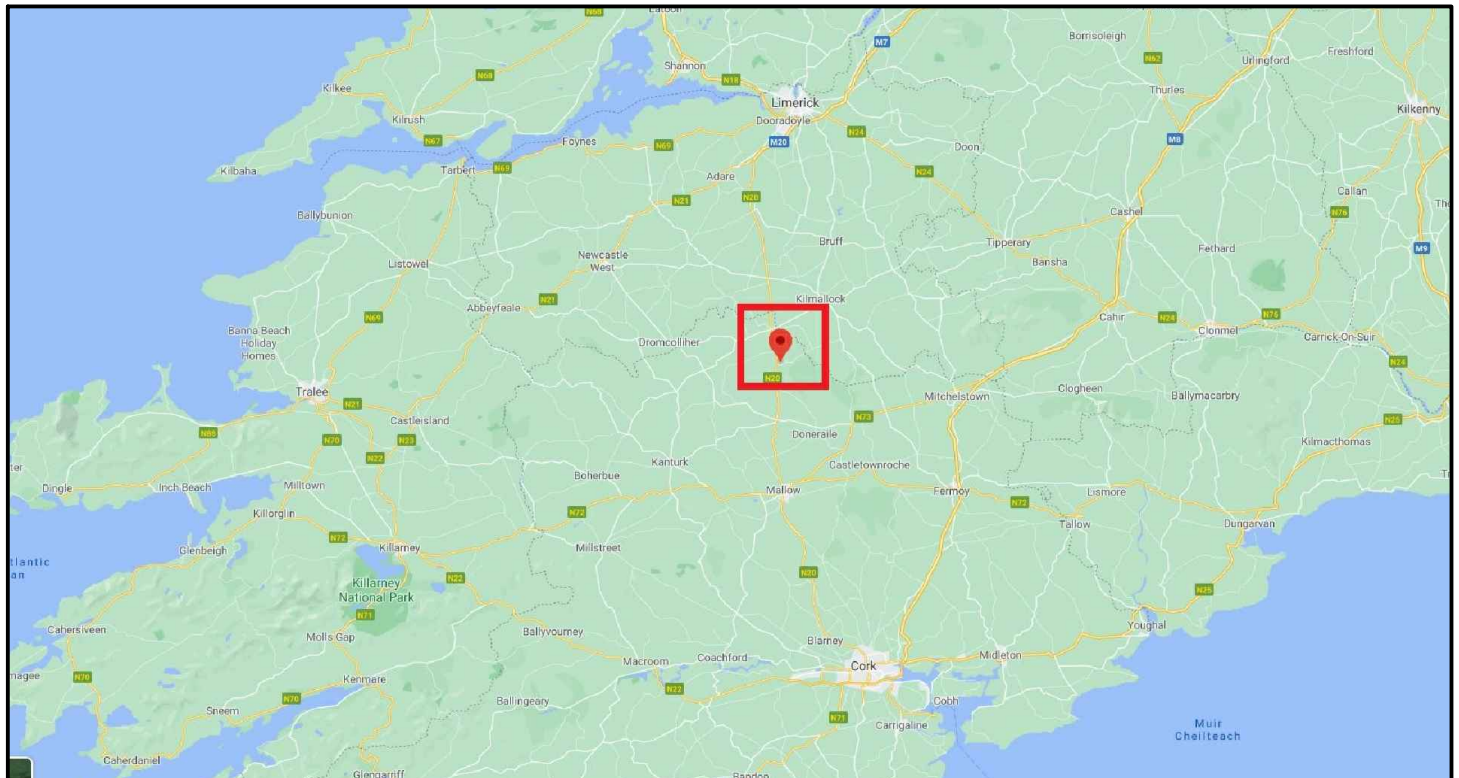
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Appendix A Site and Exploratory Hole Location Plans



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 Client's Representative: JACOBS		Sheet 1 of 2	
Method: Cable Percussion				Ground Level: 112.14 mOD		Dates: 18/06/2020 - 22/06/2020		Scale: 1:50	
Plant: Pilcon								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				111.8	0.30				
0.30 - 0.70	D3				4	(0.40)		Brown slightly gravelly slightly sandy clayey SILT with many rootlets. Gravel is fine to coarse, subangular to subrounded. Sand is fine to coarse.		
0.50	ES4				111.4	0.70				
0.70 - 1.90	B5				4			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				110.2	1.90				
1.90 - 2.50	D9				4	(0.60)		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.		
2.00 - 2.06	SPT (C)			50 (50 for 60mm/50 for 0mm)						
2.50 - 3.50	B10				109.6	2.50				
2.50 - 3.50	D11				4			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.		
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)	108.1	4.00				
					4	(0.50)		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.		
4.50 - 5.50	B15				107.6	4.50				
4.50 - 5.50	D16				4			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.		
5.00 - 5.45	SPT (C) N=6			N=6 (0,1/1,2,1,2)		(1.00)				
5.50 - 6.50	B17				106.6	5.50				
5.50 - 6.50	D18				4			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.		
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				104.9	7.20				
7.20 - 8.00	D22				4	(0.80)		Stiff light brownish grey slightly silty gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded.		
8.00 - 9.00	B23									
8.00 - 9.00	D24				104.1	8.00				
8.00 - 8.45	SPT (C) N=22			N=22 (4,4/6,5,6,5)	4			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.		
8.50 - 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.:	
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XC211-CP01

Coordinates:

554970 41 F

Client:	
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Iarnród Éireann / Irish Rail

Sheet 2 of 2

Method:

Cable Percussion

618184.23 N

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Client's Representative:

JACOBS

Scale: 1:50

Driller: IOD

Logger: IH

Plant:

Pilcon

Ground Level:

112.14 mOD


Dates:




































18/06/2020 - 22/06/2020

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)	102.1 4			End of borehole at 10.000m		

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-CP02	
				Coordinates: 554848.35 E 618025.20 N		Client: Iarnród Éireann / Irish Rail Client's Representative: JACOBS		Sheet 1 of 2	
Method: Cable Percussion				Ground Level: 98.28 mOD		Dates: 12/06/2020 - 17/06/2020		Scale: 1:50	
Plant: Pilcon								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		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.		
0.30 - 1.20	D3					(0.90)				
0.50	ES4									
1.20 - 2.00	B5			N=15 (2,2/5,3,4,3)	97.08	1.20		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 - 2.00	D6					(0.80)				
1.20 - 1.65	SPT (C) N=15									
1.50	ES7									
2.00 - 3.00	B8			N=8 (1,2/1,3,2,2)	96.28	2.00		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 - 3.00	D9									
2.00 - 2.45	SPT (C) N=8									
3.00	ES10					(2.00)				
3.00 - 4.00	B11			N=14 (2,4/4,3,4,3)						
3.00 - 4.00	D12									
3.00 - 3.45	SPT (C) N=14									
4.00 - 5.00	B13			N=17 (4,5/4,4,4,5)	94.28	4.00		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 - 5.00	D14					(1.00)				
4.00 - 4.45	SPT (C) N=17									
5.00 - 6.00	B15			N=30 (5,7/7,9,7,7)	93.28	5.00		Very Stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded.		
5.00 - 6.00	D16									
5.00 - 5.45	SPT (C) N=30									
6.00 - 7.00	B17			N=32 (7,7/8,9,8,7)		(2.00)				
6.00 - 7.00	D18									
6.00 - 6.45	SPT (C) N=32									
7.00 - 8.00	B20			N=11 (3,3/2,3,3,3)	91.28	7.00		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 - 8.00	D21									
7.00 - 7.45	SPT (C) N=11									
7.50	U19									
8.00 - 9.00	B22			N=16 (3,4/3,5,4,4)		(2.00)				
8.00 - 9.00	D23									
8.00 - 8.45	SPT (C) N=16									
9.00 - 10.00	B24			N=9 (2,3/2,2,2,3)	89.28	9.00		Firm light brown slightly silty slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded.		
9.00 - 10.00	D25					(1.00)				
9.00 - 9.45	SPT (C) N=9									
10.00 - 11.00	B26				88.28	10.00				

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

Client:

Iarnród Éireann / Irish Rail

Sheet 2 of 2

Method:

Cable Percussion

618025.20 N

[illegible]

Client's Representative:

JACOBS

Scale: 1:50

Driller: AA

Logger: 1H

Plant:

Pilcon

Ground Level:

98.28 mOD

Dates:

12/06/2020 - 17/06/2020

Logger: IH



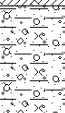
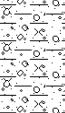
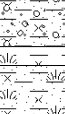
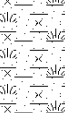
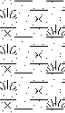
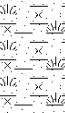
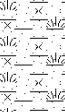
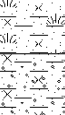
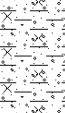

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Remarks










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 Client's Representative: JACOBS		Sheet 1 of 1	
Method: Excavation			Ground Level: 97.98 mOD		Date: 20/02/2020		Scale: 1:20	
Plant: Kobelco SK140SRu							Driver: TS	
							Logger: MN	
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	
0.05	ES1	HVP=45, HVR=17	97.68	(0.30)		TOPSOIL: Soft dark brown slightly sandy silty CLAY with a trace of gravel and frequent rootlets, moist.		0.5
0.40 - 0.90	B2			0.30		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					Strata becomes firm by 0.5m and is more orange in colour.		
0.50	ES4			(0.70)				
0.55		HVP=63, HVR=22	96.98 96.93					1.0
1.00	ES5			1.00		Firm dark brown organic silty CLAY with partially decayed vegetation, moist.		
1.00 - 1.50	B6			1.05		Firm light grey slightly gravelly slightly sandy, locally sandy, silty CLAY with occasional dark brown partially decayed vegetation fragments, moist.		
1.00 - 1.50	D7							
1.10		Rapid inflow - No rise	95.48	(1.45)				1.5
2.50 - 3.00	B8			2.50				
2.50 - 3.00	D9			(0.50)		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.		
3.00	ES12			3.00		Light grey becoming yellowish brown gravelly SAND, wet.		
3.00 - 3.40	B10	Rapid inflow - No rise	94.98	(0.40)				3.0
3.00 - 3.40	D11			3.40				
			94.58	3.40		End of trial pit at 3.400m		3.5
Remarks						Water Strikes:		Stability:
						Struck at (m):	Remarks:	Sides collapsing
						3.00	Rapid inflow - No rise	Width: 2.00
Trial Pit terminated at 3.40m due to pit walls collapsing.							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		Driver: TS	
Plant: Kobelco SK140SRu		Ground Level: 101.48 mOD		Date: 20/02/2020		Logger: MN	

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1	HVP=47, HVR=20	101.23	(0.25)		TOPSOIL: Soft dark brown slightly sandy silty CLAY with frequent rootlets, moist. One red brick fragment.	
0.30 - 0.80 0.30 - 0.80	B2 D3			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.	
0.50 0.50	ES4		(0.85)				
1.00	ES5		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 1.60 - 2.10	B6 D7		(1.60)				
2.70 - 3.20 2.70 - 3.20	B8 D9		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.		
3.00	ES10		(0.60)				
			(0.90)				
			98.18 98.18			Refusal on limestone BOULDERS. End of trial pit at 3.300m	

Remarks	Water Strikes:		Stability: Slight spalling Width: 1.80 Length: 3.50
	Struck at (m):	Remarks:	
		None Encountered	

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


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


Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1	HVP=44, HVR=21	111.7 4	(0.25)		TOPSOIL: Soft dark brown slightly sandy slightly gravelly silty CLAY wit frequent rootlets, moist.	
0.30 - 0.80 0.30 - 0.80	B2 D3			0.25		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.	
0.50 0.50	ES4			(0.55)			
1.00	ES5			0.80 (0.30)		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.	
1.30 - 1.80 1.30 - 1.80	B6 D7	Trickling flow from gravel strata - No rise.	110.8 9	1.10 (0.20)		Light brown slightly clayey slightly silty very sandy GRAVEL with low cobble content, wet.	
2.50 - 3.00 2.50 - 3.00	B8 D9		110.6 9	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.	
3.00	ES10			(3.20)			
3.70 - 4.20 3.70 - 4.20	B11 D12						

Continued on Next Page

Remarks	Water Strikes:		Stability: Sides spalling
	Struck at (m):	Remarks:	
	1.10	Trickling flow from gravel strata - No rise.	Width: 4.40 Length: 2.00

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

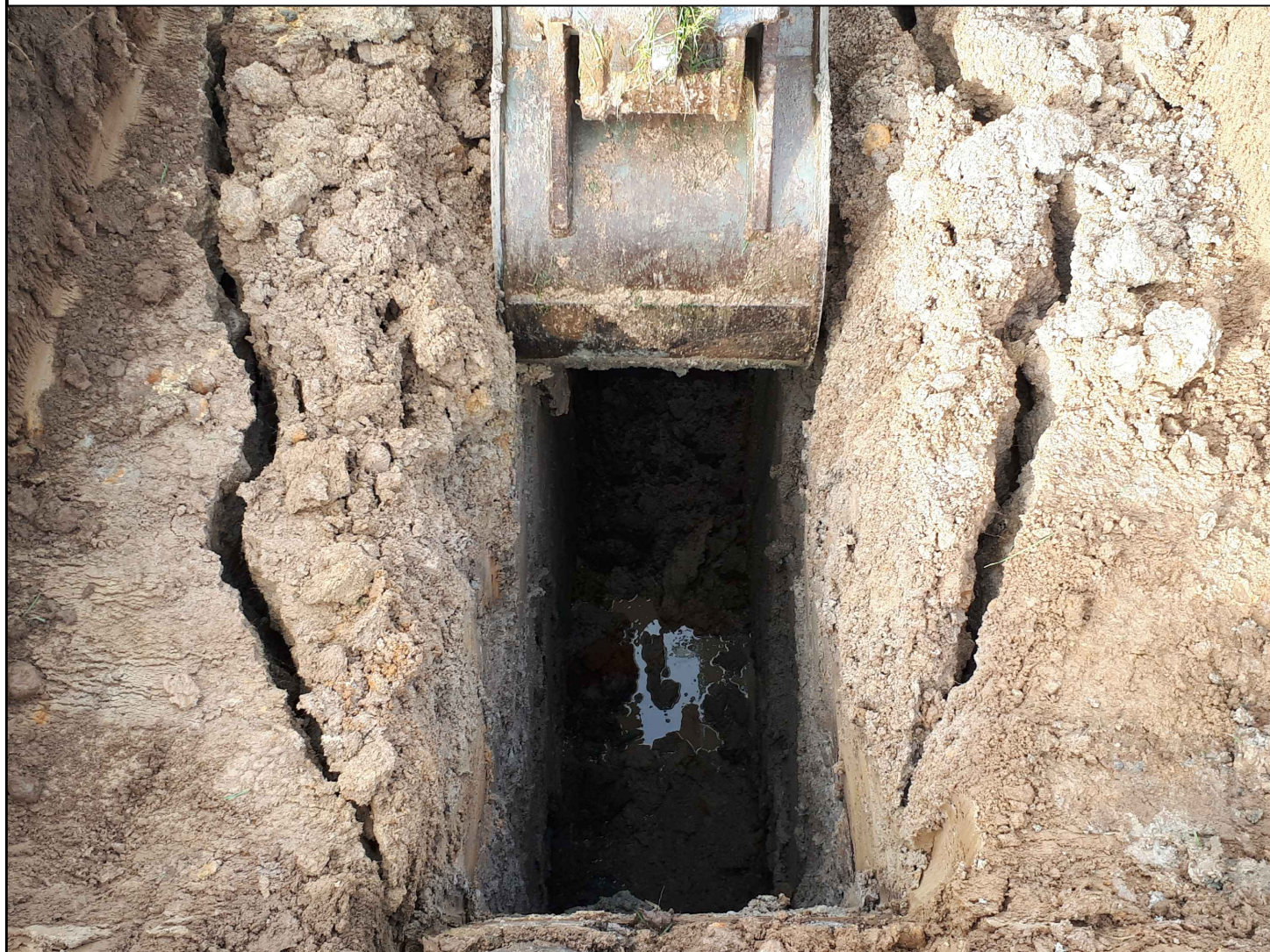
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			Co-ordinates: 554939.53 E 618184.48 N		Client: Iarnród Éireann / Irish Rail Client's Representative: JACOBS		Sheet 2 of 2 Scale: 1:20 Driver: TS Logger: MN	
Method: Excavation			Ground Level: 111.99 mOD		Date: 20/02/2020			
Plant: Kobelco SK140SRu								

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:		Stability: Sides spalling Width: 4.40 Length: 2.00
	Struck at (m):	Remarks:	
	1.10	Trickling flow from gravel strata - No rise.	

Appendix D

Trial Pit Photographs



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



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



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



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



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



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



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.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.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



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



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

Appendix E

Indirect CBR Test Results

Cork Line Level Crossings - Irish Rail

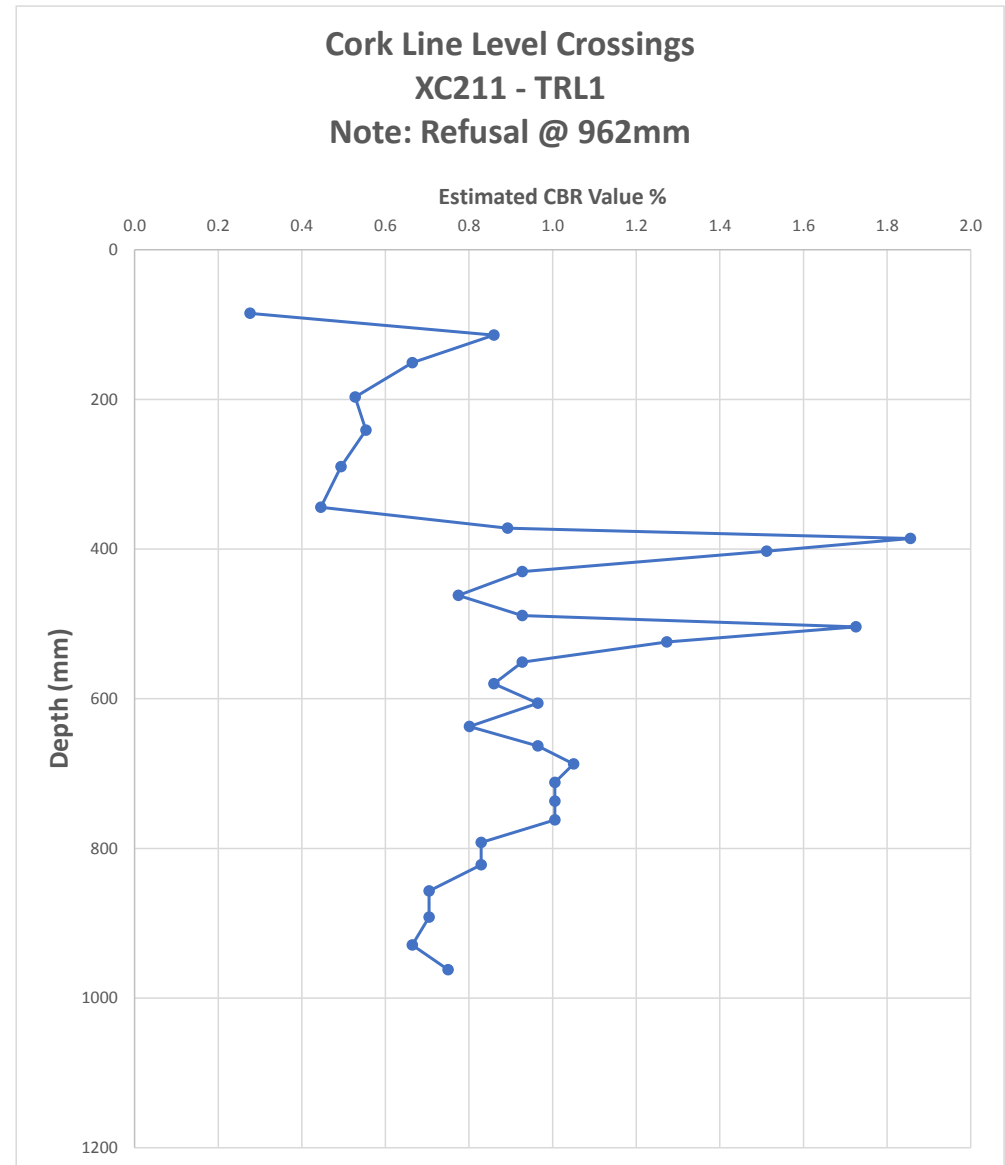
Transport Research Laboratory - Dynamic Cone Penetrometer Data

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				



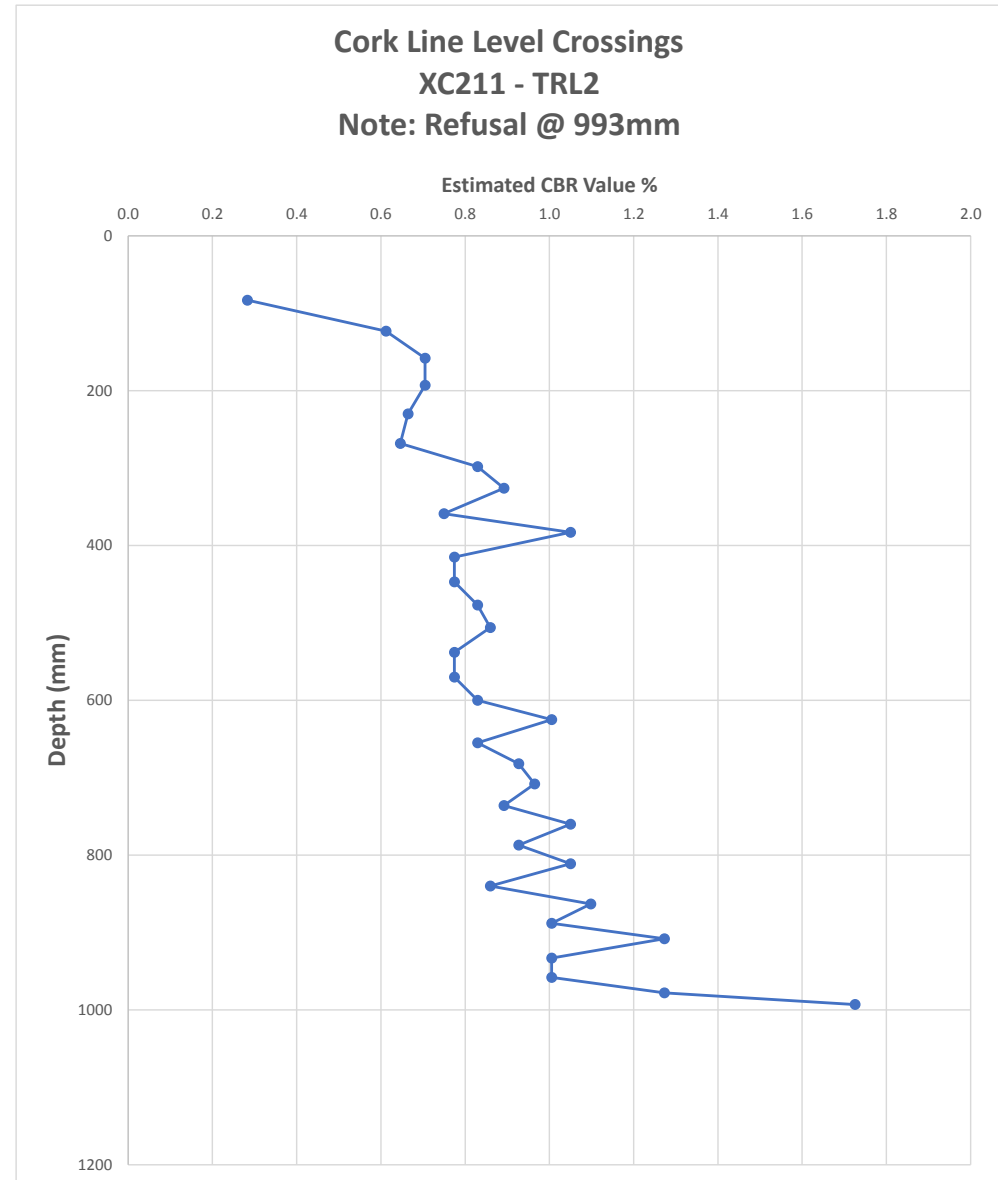
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	XC211 - TRL2	Job No	19-135
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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				



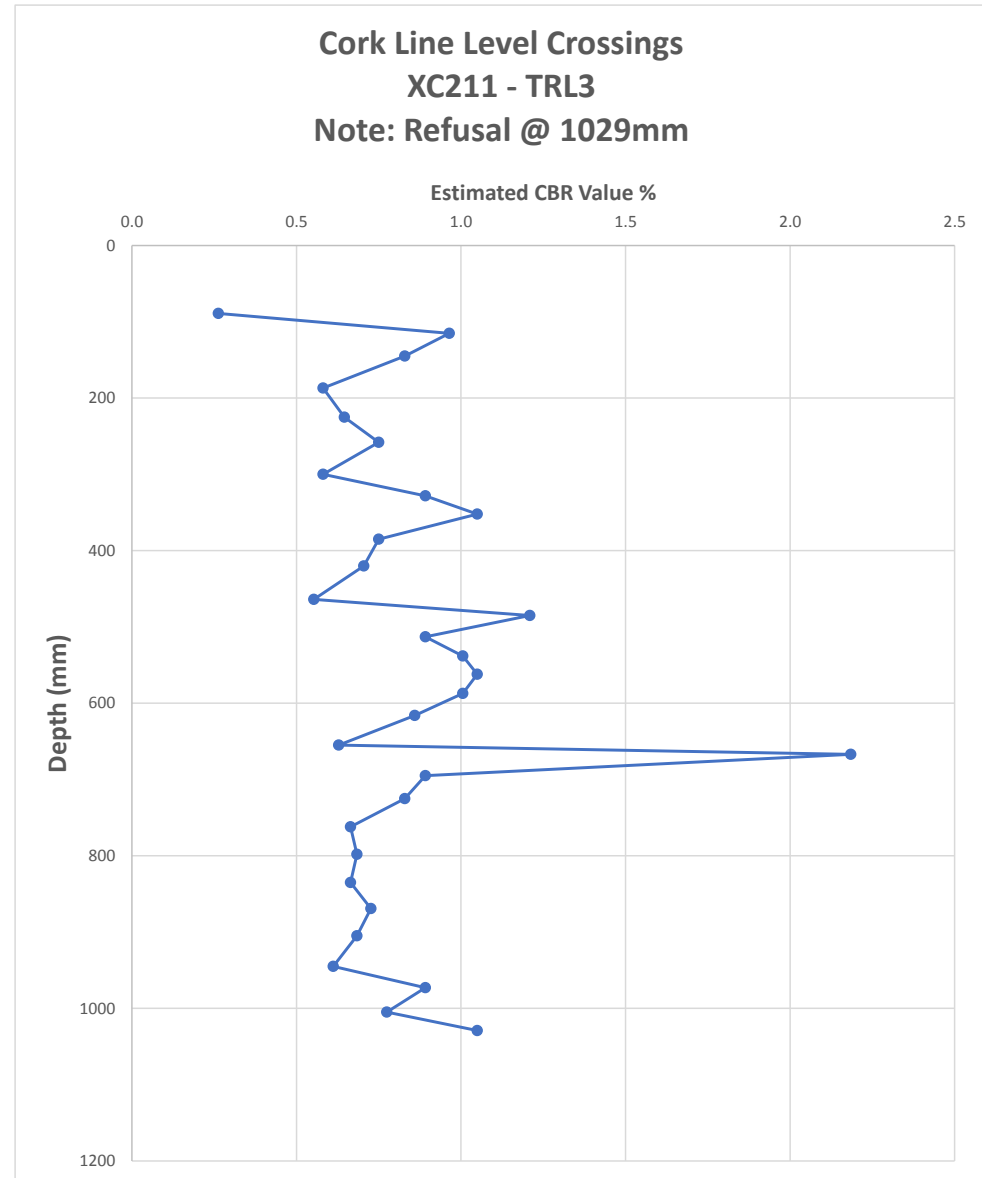
Cork Line Level Crossings - Irish Rail
Transport Research Laboratory - Dynamic Cone Penetrometer Data

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

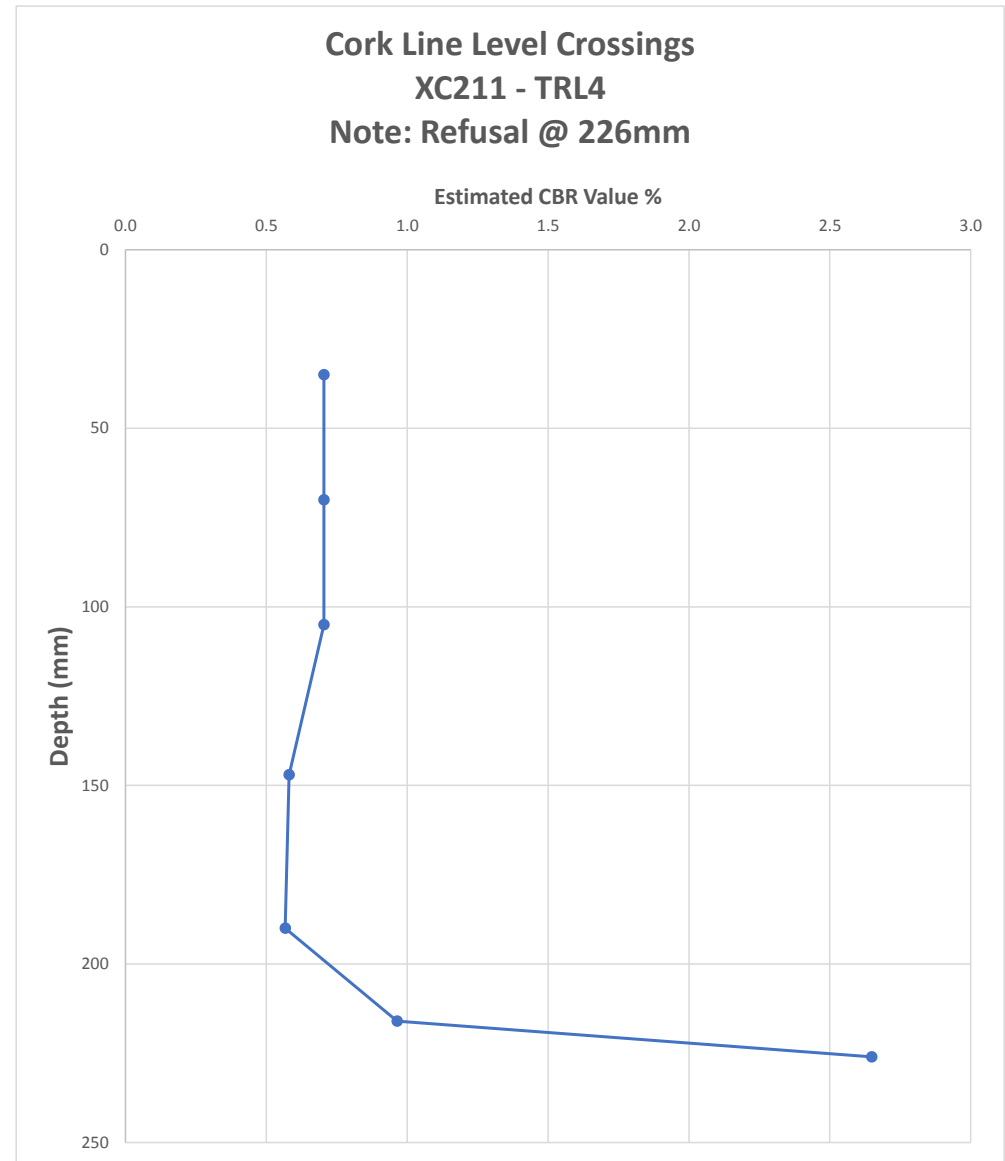
Transport Research Laboratory - Dynamic Cone Penetrometer Data

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

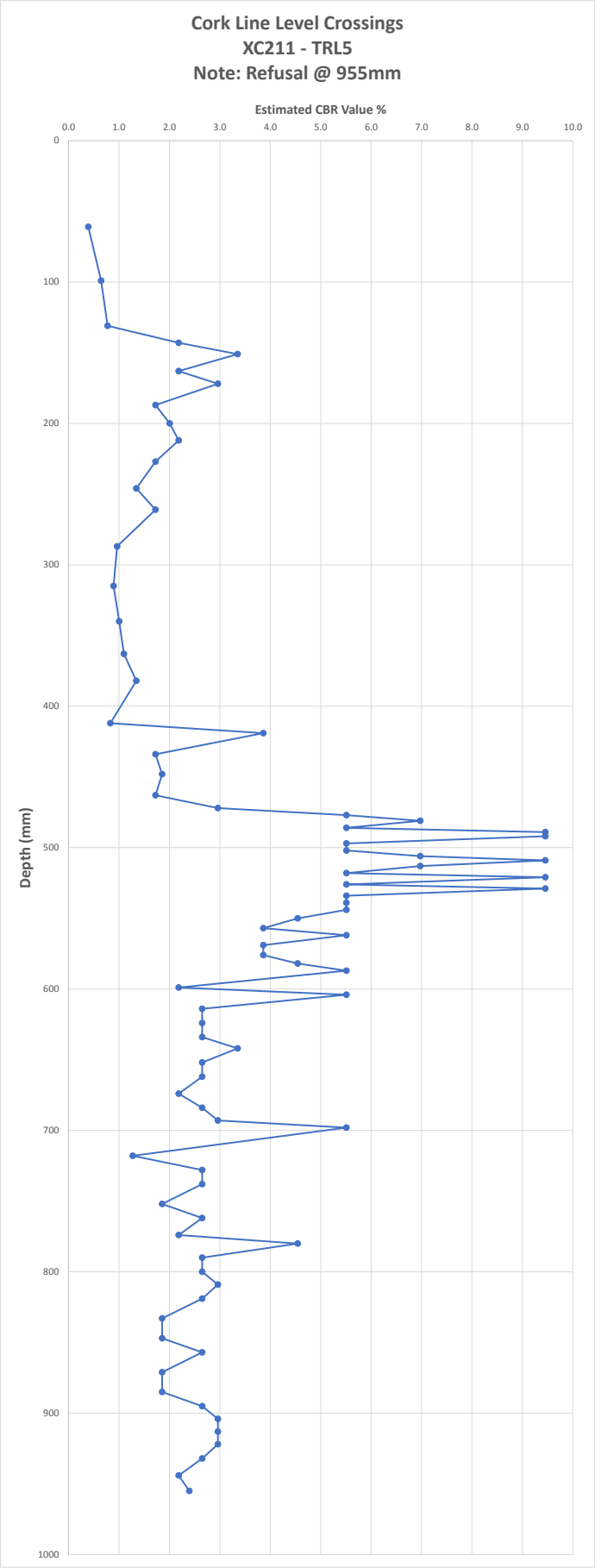
No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1010	35	35	0.7
2	975	35	70	0.7
3	940	35	105	0.7
4	898	42	147	0.6
5	855	43	190	0.6
6	829	26	216	1.0
7	819	10	226	2.6
8	819	0	226	
9	819	0	226	
10				



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

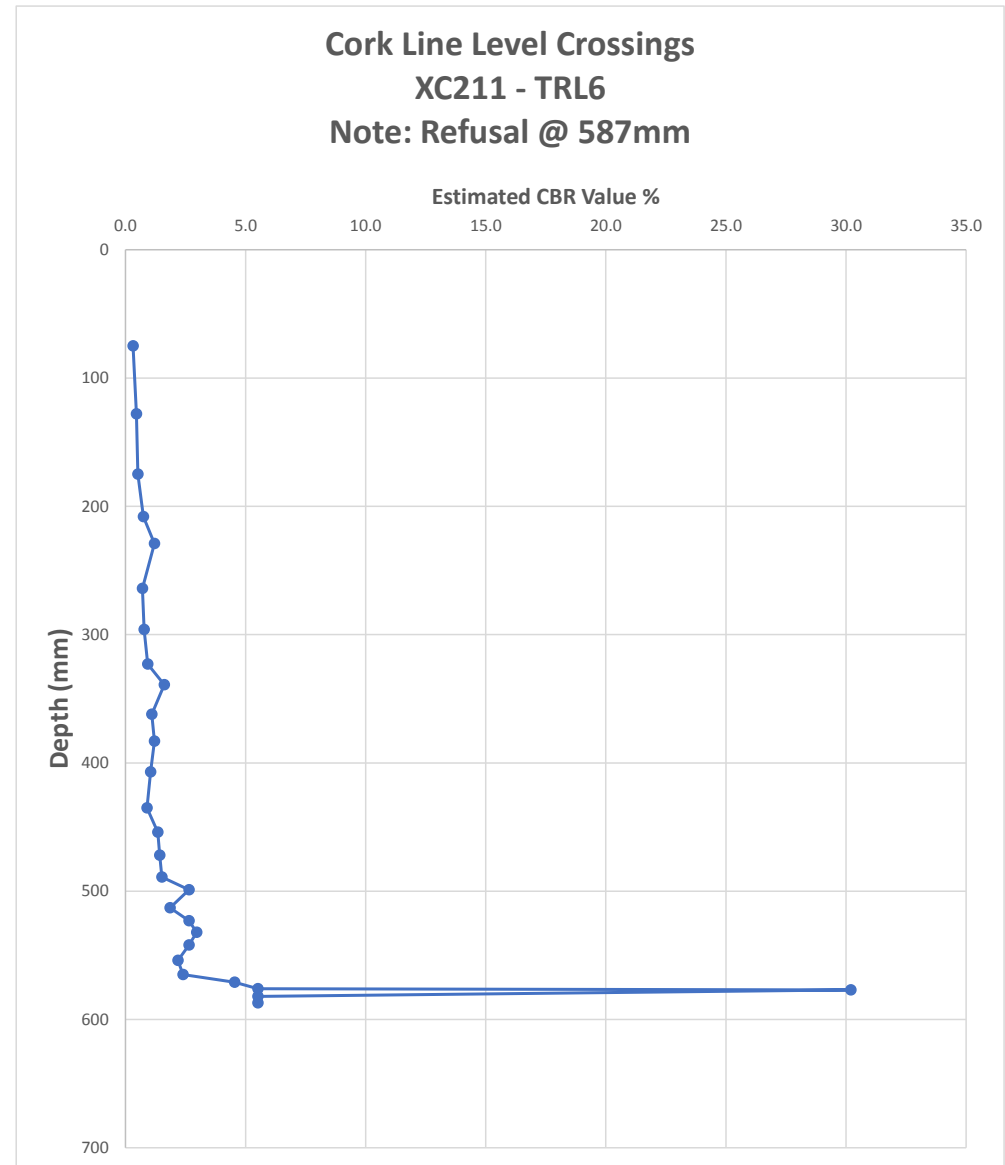
Transport Research Laboratory - Dynamic Cone Penetrometer Data

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

[illegible]

Appendix G Geotechnical Soil Laboratory Test Results



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 Unit 1 Carrigogna Midleton	Lab Ref No.:	ST 93346
Order No:	2003-104	Date Received:	09/03/2020
Originator:	Ian Holley	Date Tested:	31/03/2020
		Date Reported:	03/04/2020
		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 preparation 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





LABORATORY TEST REPORT

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

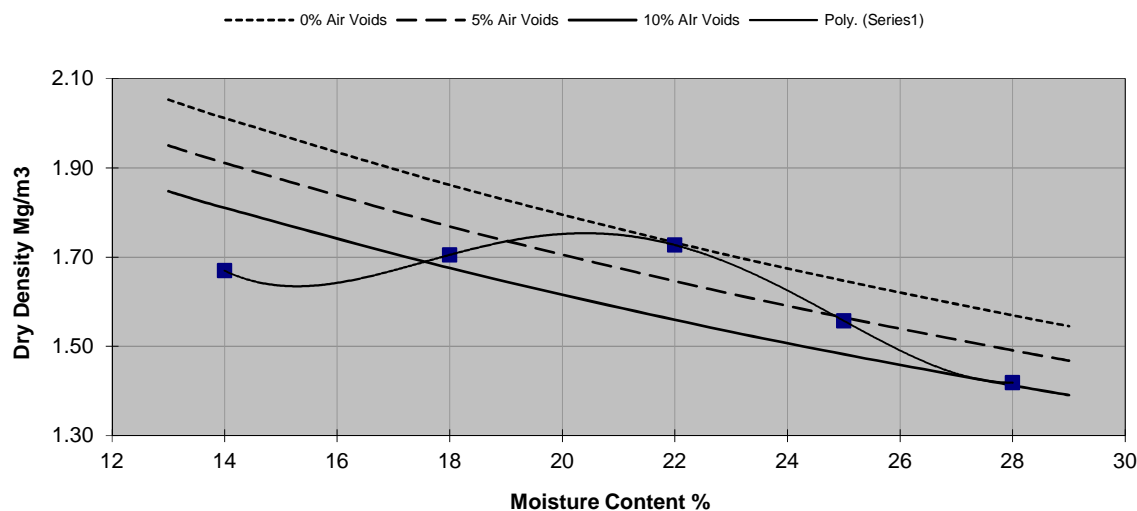
Project:	Cork Line Level Crossings	Job No:	19-135
Client:	OCB Geotechnical	Lab Ref No.:	ST 93345
	Unit 1 Carrigogna	Date Received:	09/03/2020
	Midleton	Date Tested:	06/04/2020
	Co Cork	Date Reported:	07/04/2020
Order No:	2003-104	Material:	Soil
Originator:	Ian Holley	Specification:	Client

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
Sampling Cert : No
Comments : None

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/m ³	1.90	2.01	2.11	1.95	1.82
Moisture Content: %	14	18	22	25	28
Dry Density: Mg/m ³	1.67	1.71	1.73	1.56	1.42



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

1.75
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)

[Signature]

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

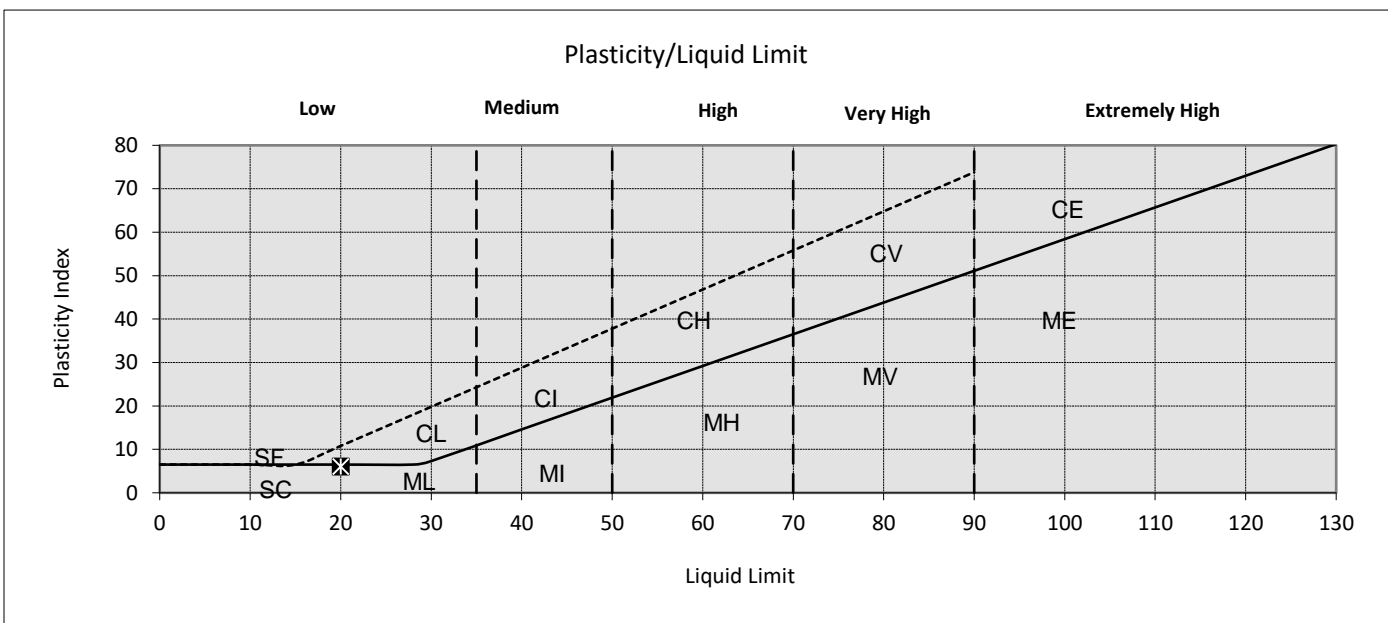




LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 CI 4.4,5.3

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.

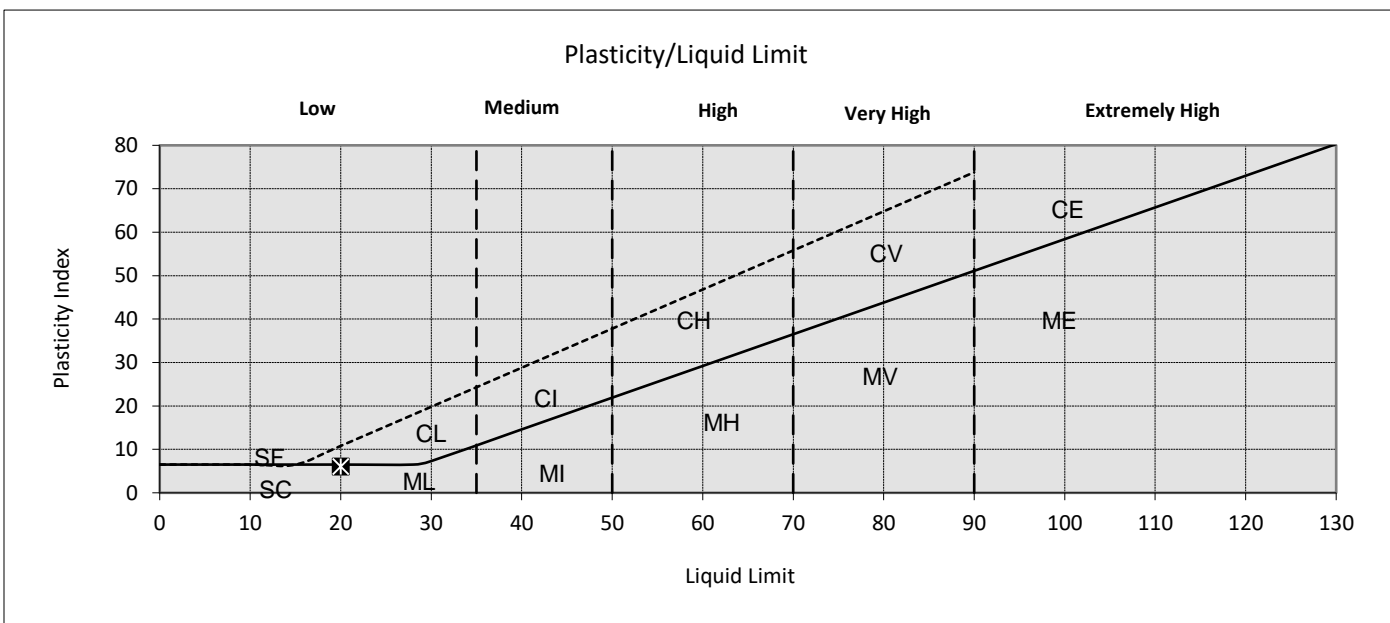
Approved Signature
 James Fisher Testing Services Ltd
 Phil Thorp, Laboratory Manager



LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 CI 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



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 Unit 1 Carrigogna Midleton	Lab Ref No.:	ST 93344
		Date Received:	09/03/2020
		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

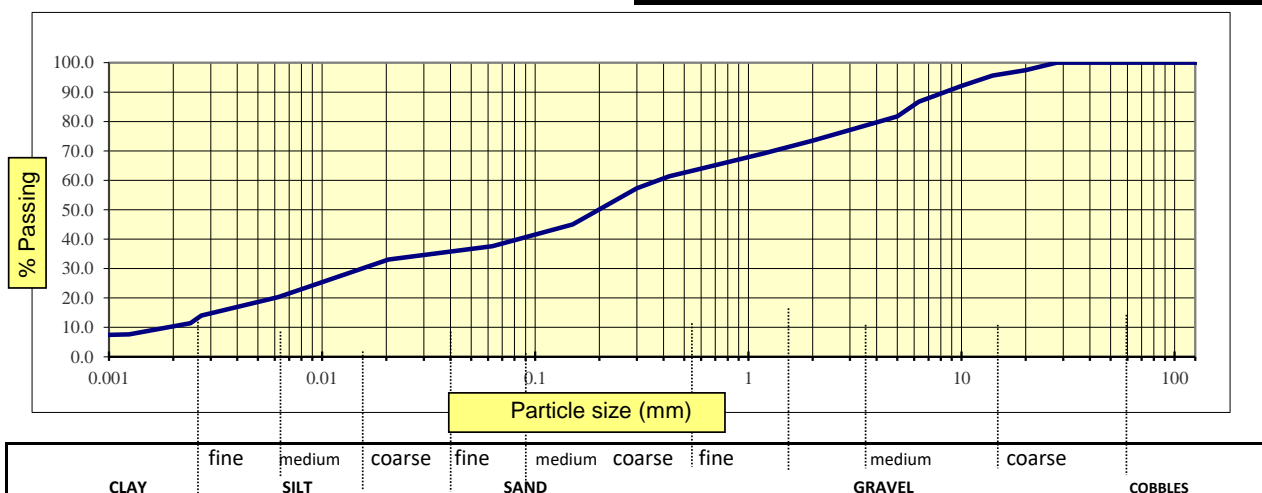
Sampled By: Client

Specification: Client

Preparation Method: Without Organics Preparation

Notes: Disturbed sample from cleanout

BS Sieve	%	Specification
Size	Passing	
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

[Signature]

Approved Signature

JAMES FISHER TESTING SERVICES (IRELAND) LTD.

☐ James Ward, Operations Manager





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

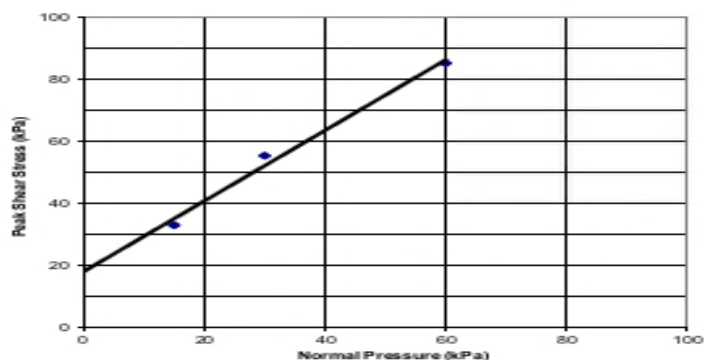
SUMMARY OF TEST RESULTS:

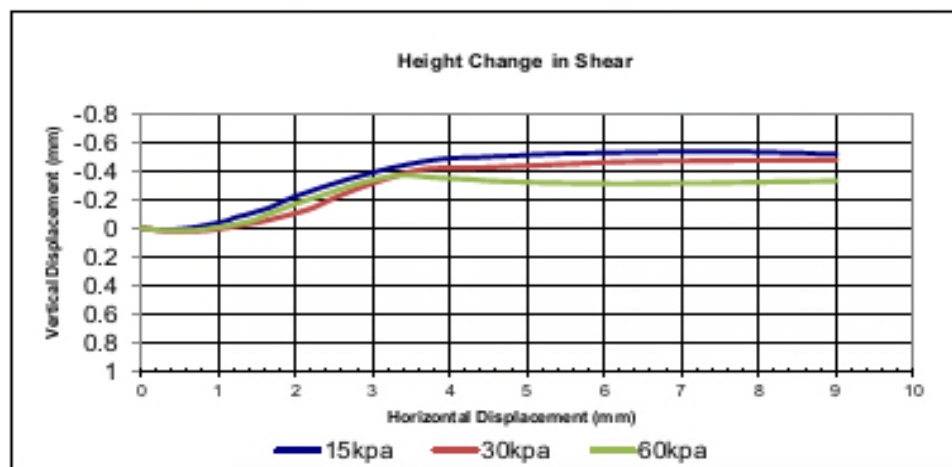
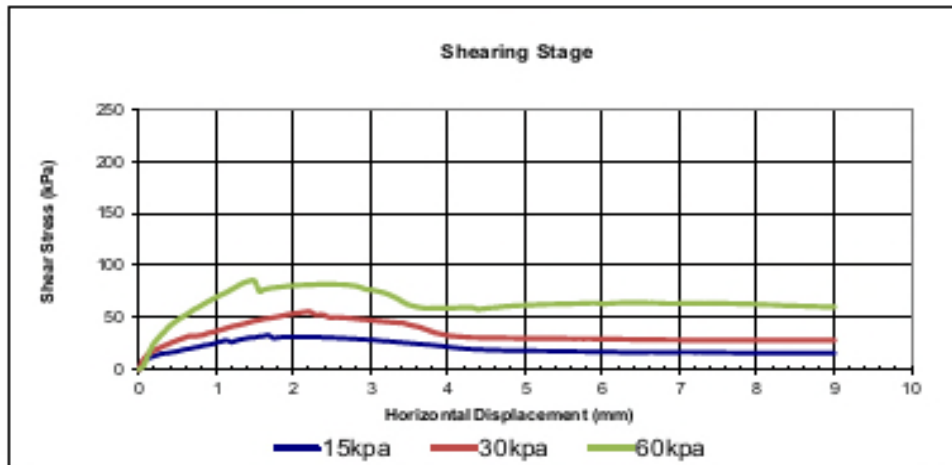
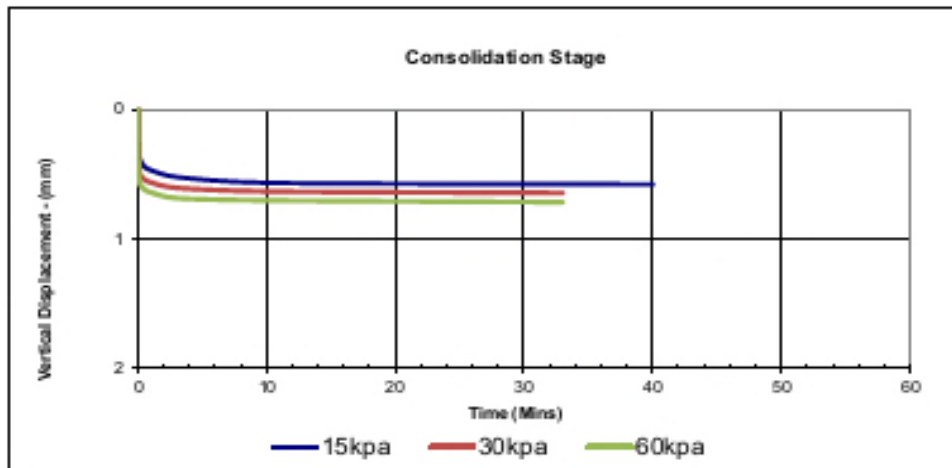
Angle of Shearing Resistance (°) ϕ'	48.5
Cohesion Intercept (kPa) c'	18.0

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

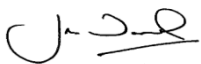
Initial Condition			
	Stage		
	1	2	3
Normal Pressure (kPa)	15	30	60
Height (mm)	19.47	19.23	19.41
Width (mm)	59.9	59.9	59.9
Bulk Density (Mg/m ³)	2.08	2.10	2.08
Dry Density (Mg/m ³)	1.84	1.86	1.84
Moisture Content (%)	13	13	13
Voids Ratio	0.443	0.425	0.438
Degree of Saturation	77.8	81.1	78.6
Shearing 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		

Angle of Shearing Resistance & Cohesion





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James Fisher Testing Services Limited

James Ward, Operations Manager



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
	Middleton	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

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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





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

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James Ward, Operations Manager





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 Unit 1 Carrigogna Midleton	Lab Ref No.:	ST 93348
		Date Received:	09/03/2020
		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

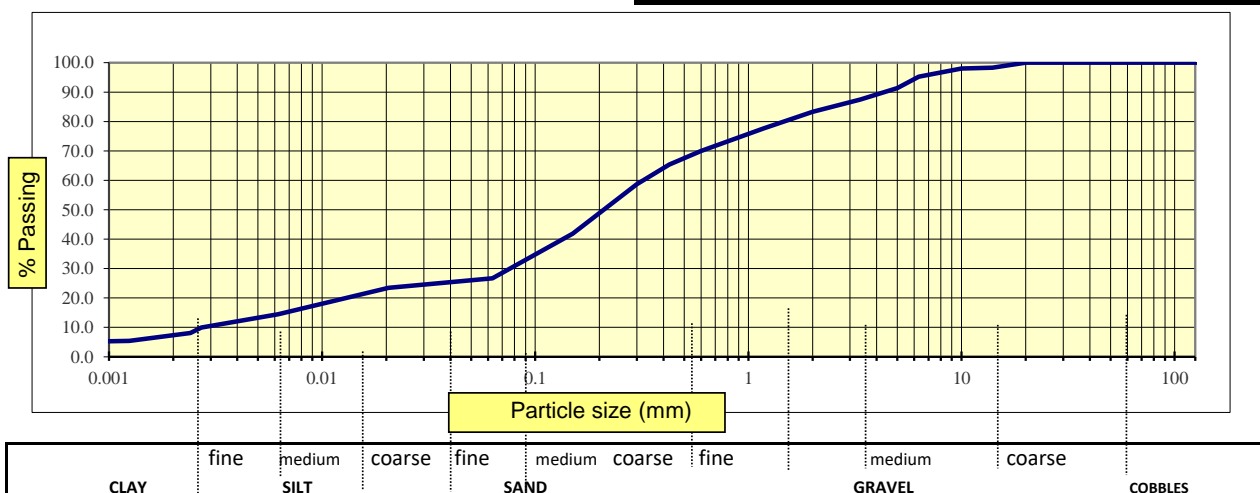
Sampled By: Client

Specification: Client

Preparation Method: Without Organics Preparation

Notes: Disturbed sample from cleanout

BS Sieve	%	Specification
Size	Passing	
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	



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Sedimentation by Hydrometer - Not UKAS

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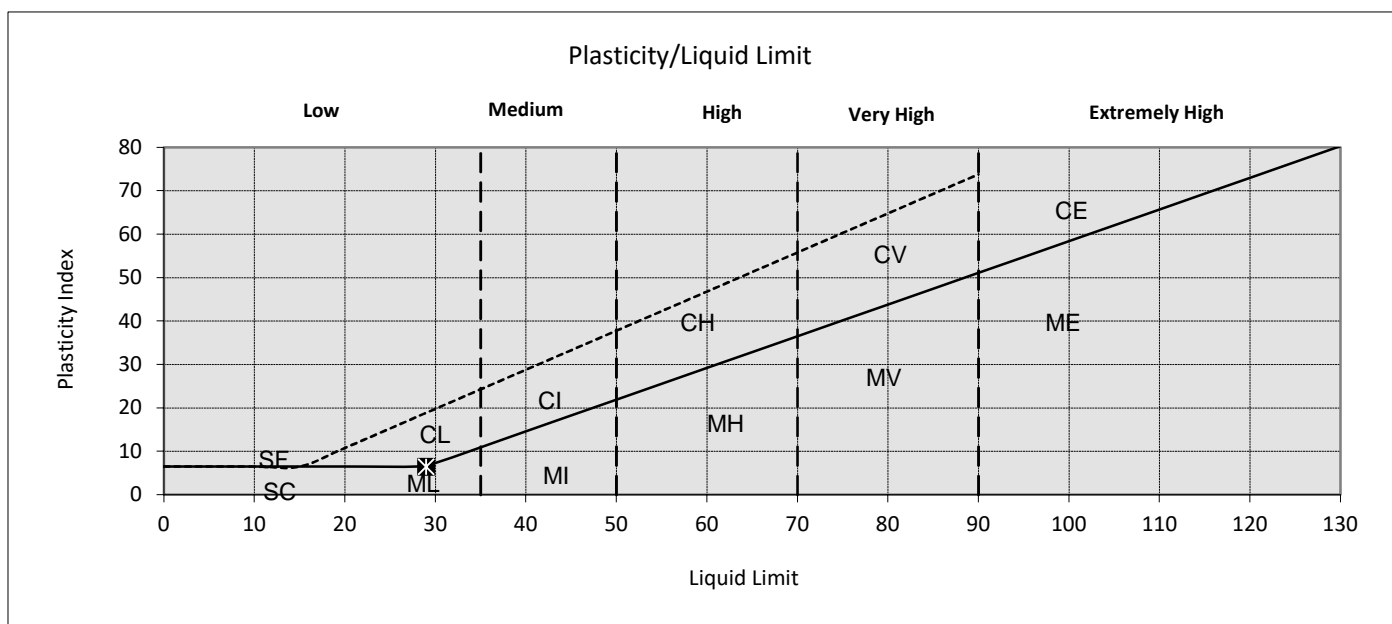




LABORATORY TEST REPORT
 LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 CI 4.4,5.3

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



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Approved Signature
 James Fisher Testing Services Ltd
 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

RS70 Issue 2



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Page 1 of 1



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 Unit 1 Carrigogna Midleton	Lab Ref No.:	ST 93351
Order No:	2003-104	Date Received:	09/03/2020
Originator:	Ian Holley	Date Tested:	26/03/2020
		Date Reported:	03/04/2020
		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 preparation by cone and quarter

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





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

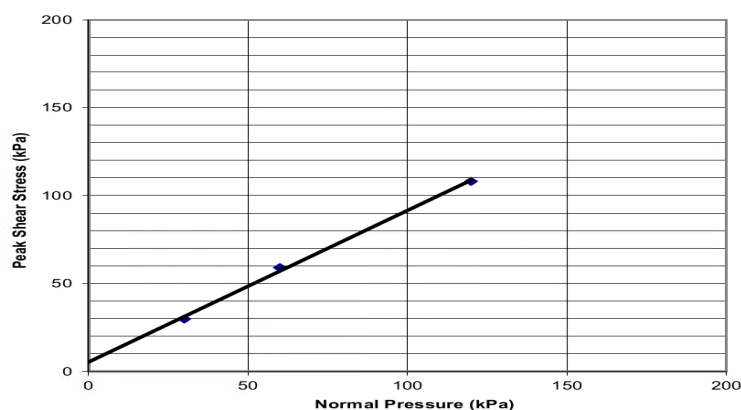
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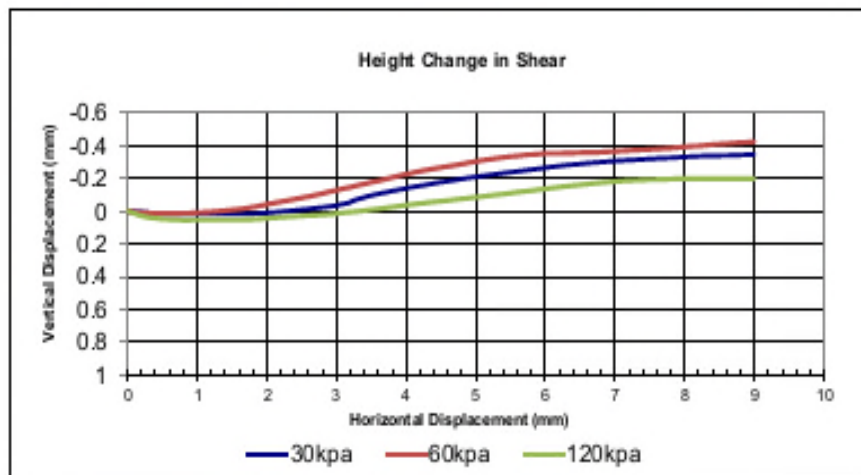
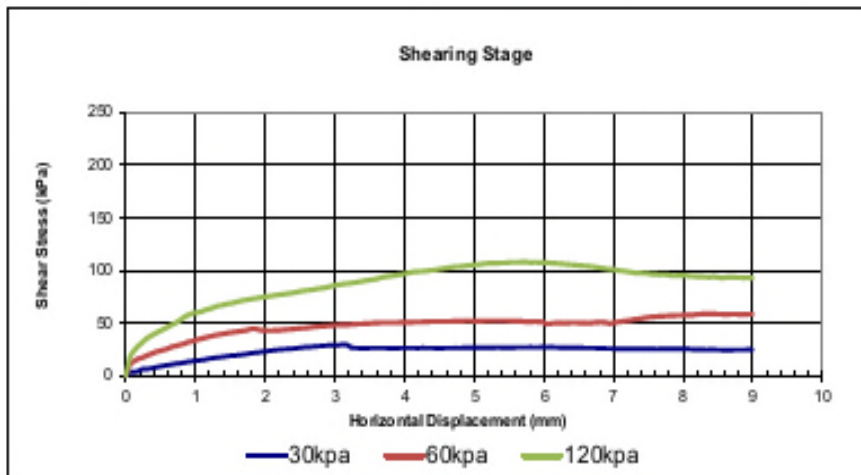
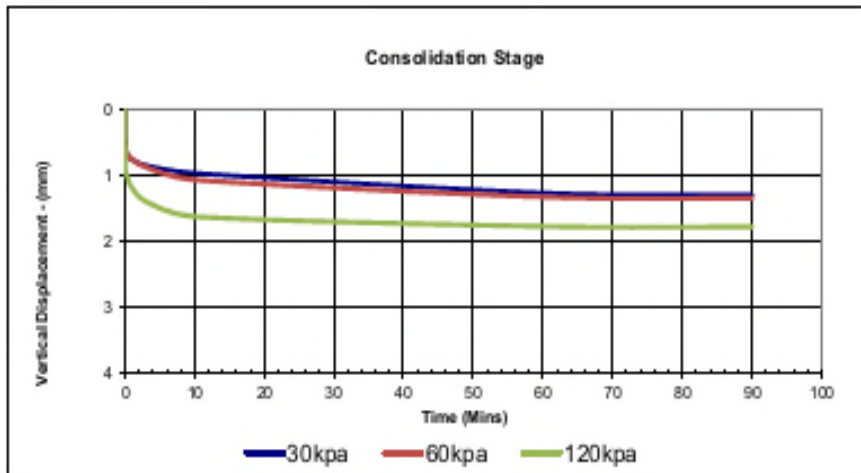
SUMMARY OF TEST RESULTS:	
Angle of Shearing Resistance (°) ϕ'	40.5
Cohesion Intercept (kPa) c'	5.3

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		

Angle of Shearing Resistance & Cohesion





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Approved Signature

James Fisher Testing Services Limited

James Ward, Operations Manager



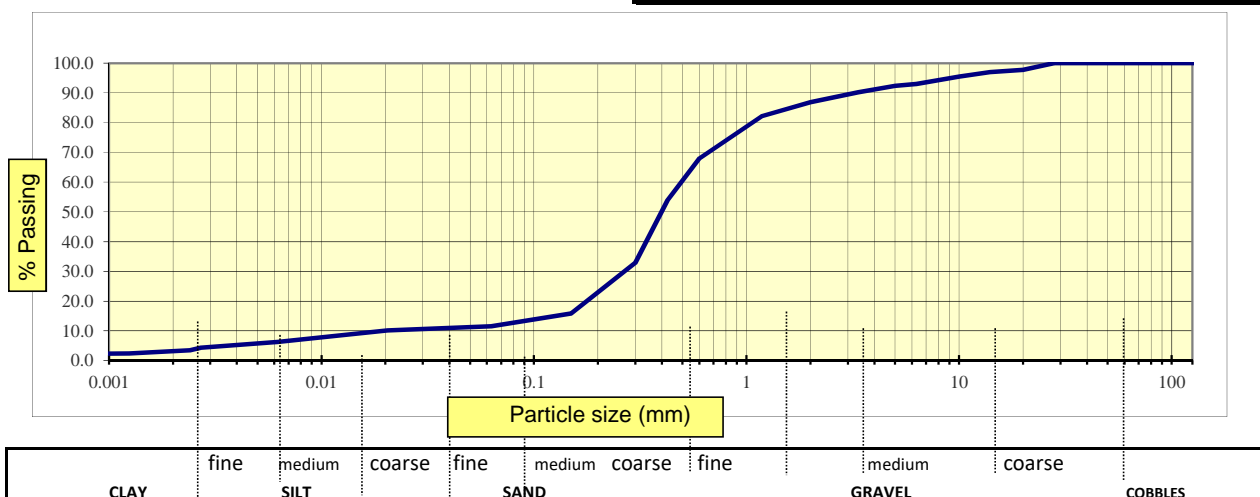
LABORATORY TEST REPORT

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

Project:	Cork Line Level Crossings	Job No:	19-135
Client:	OCB Geotechnical Unit 1 Carrigogna Midleton	Lab Ref No.:	ST 93353
		Date Received:	09/03/2020
		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	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	

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



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JAMES FISHER TESTING SERVICES (IRELAND) LTD.

☐ 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 Unit 1 Carrigogna Midleton	Lab Ref No.:	ST 93357
Order No:	2003-104	Date Received:	09/03/2020
Originator:	Ian Holley	Date Tested:	13/03/2020
		Date Reported:	25/03/2020
		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 preparation by cone and quarter

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James Ward, Operations Manager





LABORATORY TEST REPORT

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

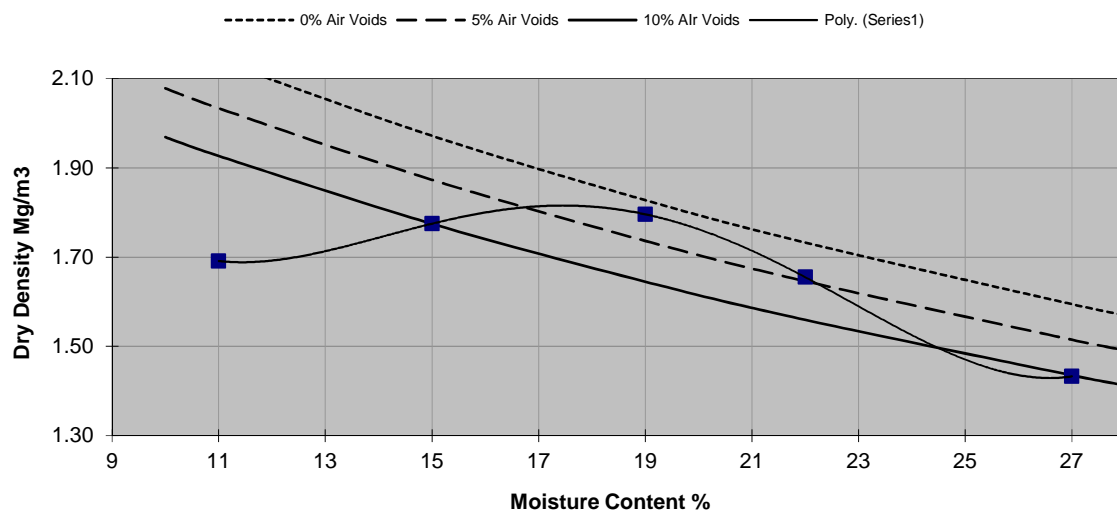
Project:	Cork Line Level Crossings	Job No:	19-135
Client:	OCB Geotechnical	Lab Ref No.:	ST 93356
	Unit 1 Carrigogna	Date Received:	09/03/2020
	Midleton	Date Tested:	03/04/2020
	Co Cork	Date Reported:	06/04/2020
Order No:	2003-104	Material:	Soil
Originator:	Ian Holley	Specification:	Client

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
Sampling Cert : No
Comments : None

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/m ³	1.88	2.04	2.13	2.03	1.81
Moisture Content: %	11	15	19	22	27
Dry Density: Mg/m ³	1.69	1.77	1.80	1.65	1.43



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

1.82
18

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Tested in accordance with BS 1377: Part 4:1990

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

[Signature]

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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

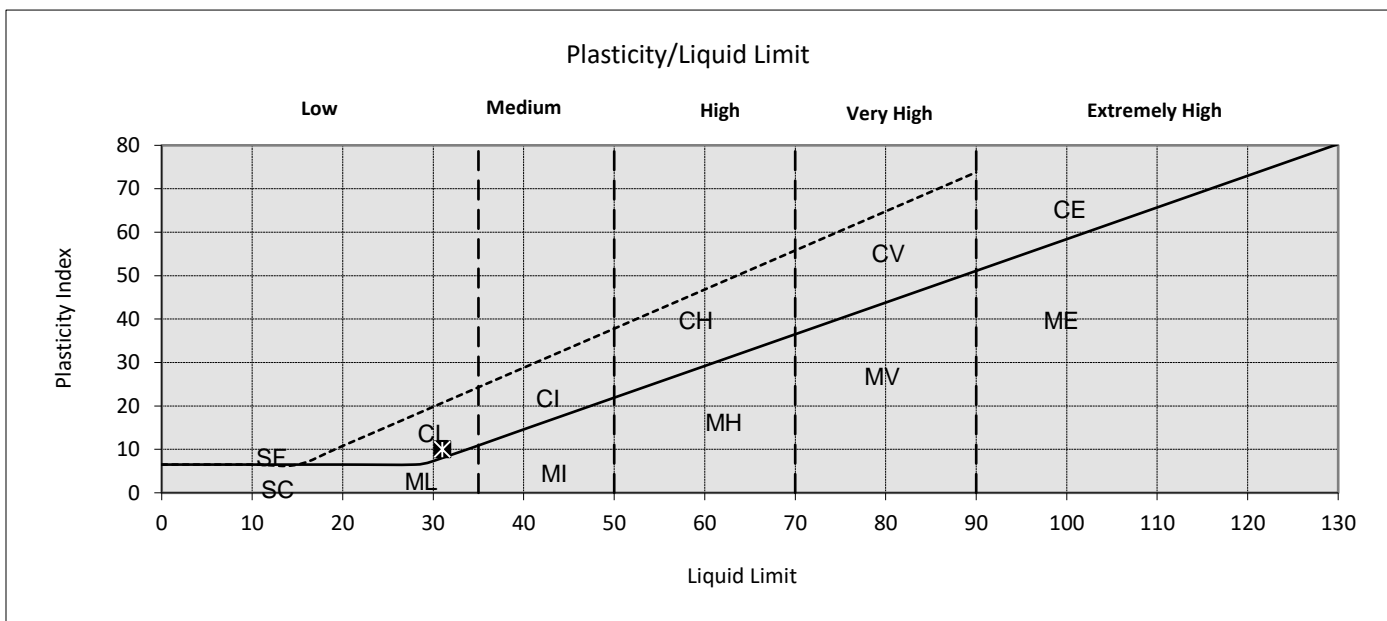




LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 CI 4.4,5.3

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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 James Fisher Testing Services Ltd
 Phil Thorp, Laboratory Manager



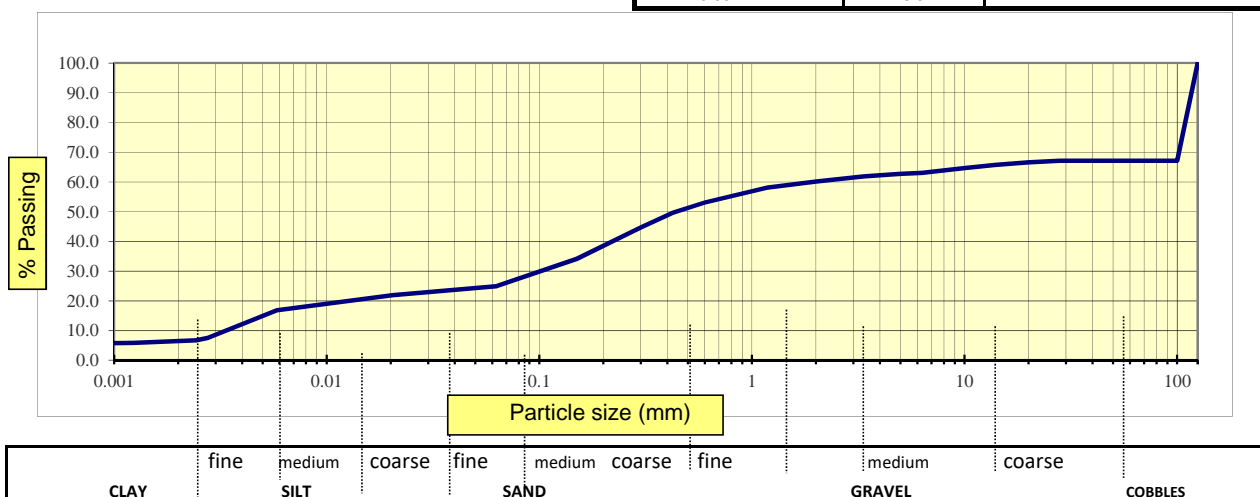
LABORATORY TEST REPORT

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

Project:	Cork Line Level Crossings	Job No:	19-135
Client:	OCB Geotechnical Unit 1 Carrigogna Midleton	Lab Ref No.:	ST 93355
		Date Received:	09/03/2020
		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 FISHER TESTING SERVICES (IRELAND) LTD.
☐ James Ward, Operations Manager





LABORATORY TEST REPORT

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

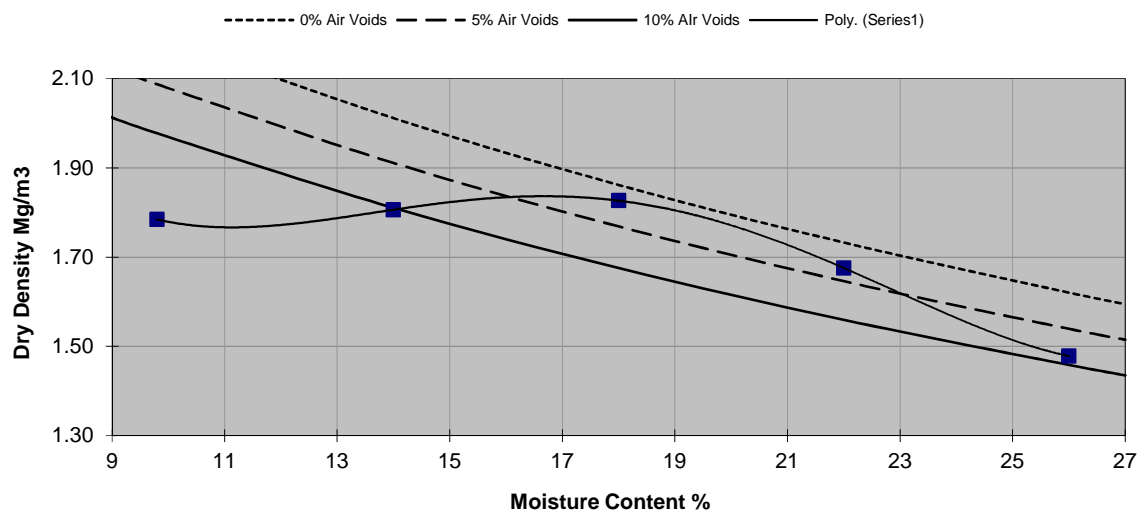
Project:	Cork Line Level Crossings	Job No:	19-135
Client:	OCB Geotechnical	Lab Ref No.:	ST 93360
	Unit 1 Carrigogna	Date Received:	09/03/2020
	Midleton	Date Tested:	03/04/2020
	Co Cork	Date Reported:	06/04/2020
Order No:	2003-104	Material:	Soil
Originator:	Ian Holley	Specification:	Client

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
Sampling Cert : No
Comments : None

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/m ³	1.96	2.07	2.16	2.04	1.86
Moisture Content: %	9.8	14	18	22	26
Dry Density: Mg/m ³	1.78	1.81	1.83	1.68	1.48



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

1.84
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)

[Signature]

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





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 Unit 1 Carrigogna Midleton	Lab Ref No.:	ST 93359
		Date Received:	09/03/2020
		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

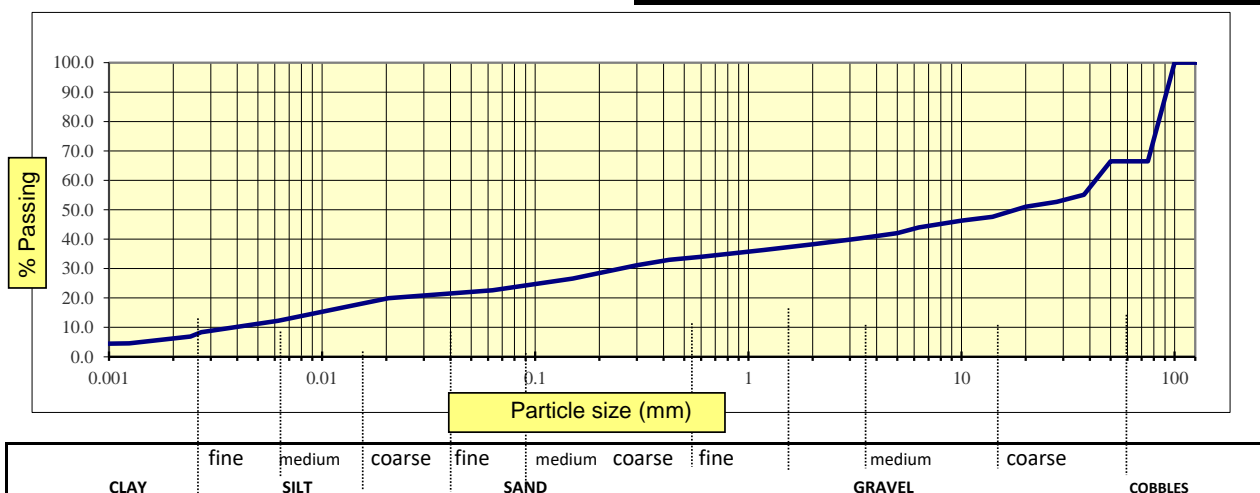
Sampled By: Client

Specification: Client

Preparation Method: Without Organics Preparation

Notes: Disturbed sample from cleanout

BS Sieve	%	Specification
Size	Passing	
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	



[Signature]

Approved Signature

JAMES FISHER TESTING SERVICES (IRELAND) LTD.

☐ James Ward, Operations Manager





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
	Middleton	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

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☐ James Ward, Operations Manager





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 Unit 1 Carrigogna Midleton	Lab Ref No.:	ST 93361
Order No:	2003-104	Date Received:	09/03/2020
Originator:	Ian Holley	Date Tested:	26/03/2020
		Date Reported:	03/04/2020
		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 preparation by cone and quarter

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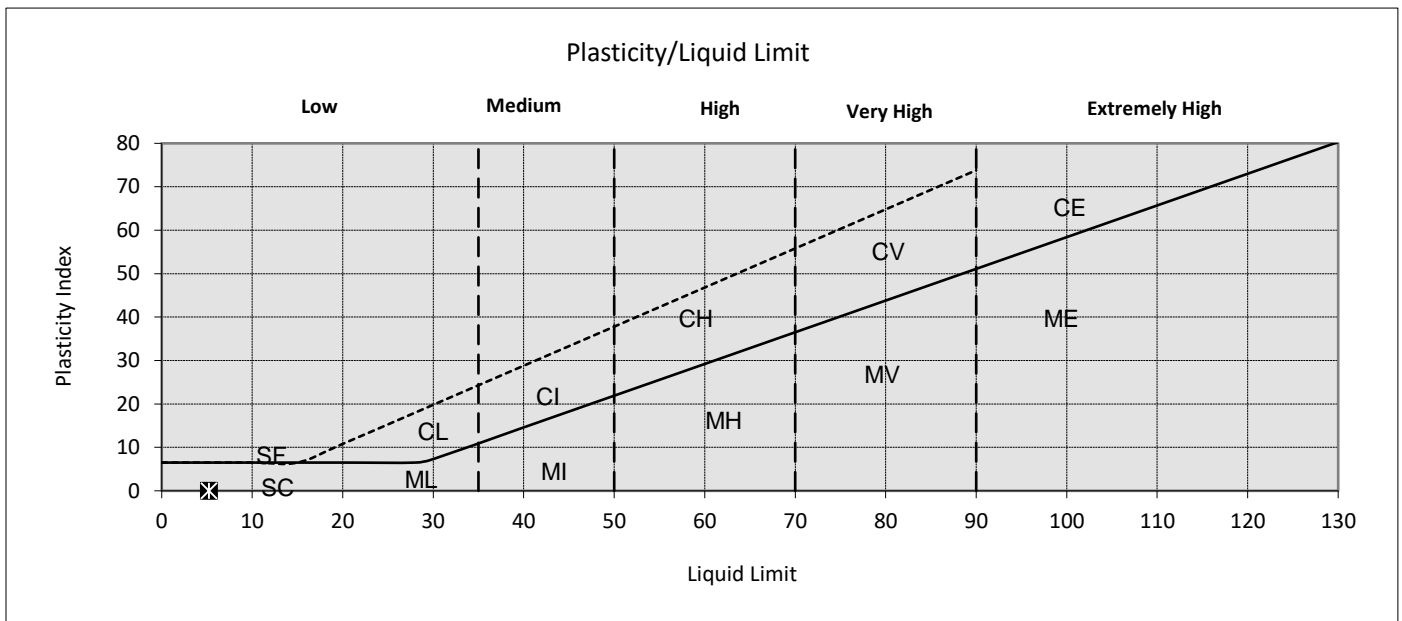




LABORATORY TEST REPORT
 LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 CI 4.4,5.3

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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Phil Thorp

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



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 Unit 1 Carrigogna Midleton	Lab Ref No.:	ST 93364
		Date Received:	09/03/2020
		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

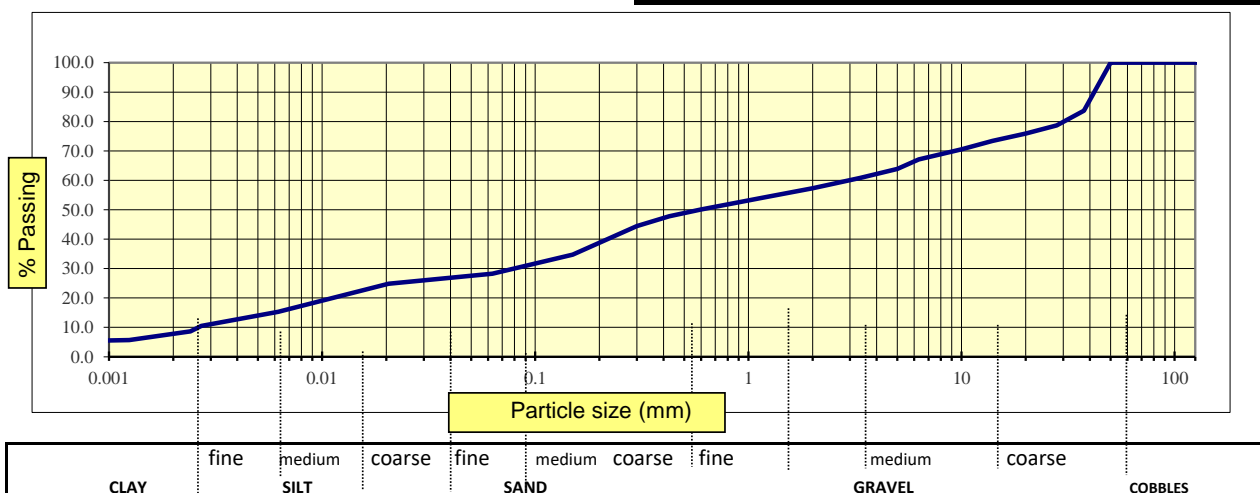
Sampled By: Client

Specification: Client

Preparation Method: Without Organics Preparation

Notes: Disturbed sample from cleanout

BS Sieve	%	Specification
Size	Passing	
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





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
	Middleton	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 (SO ₄) (mg/l)	11
Sulphur as S, Total (%)	0.01
Sulphate as SO ₄ , Total (%)	0.02

Comments:

None

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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 Unit 1 Carrigogna Midleton	Lab Ref No.:	ST 93465
Order No:	2003-104	Date Received:	09/03/2020
Originator:	Ian Holley	Date Tested:	13/03/2020
		Date Reported:	25/03/2020
		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 preparation by cone and quarter

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James Ward, Operations Manager

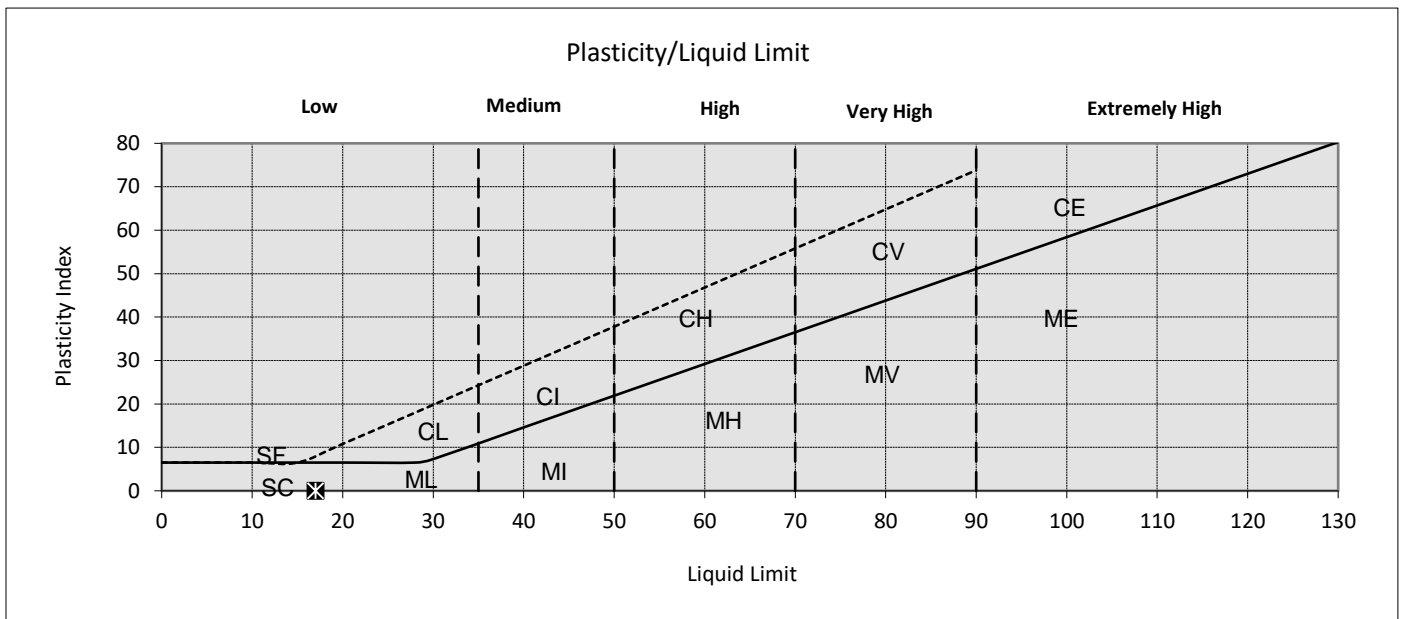




LABORATORY TEST REPORT
 LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 CI 4.4,5.3

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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Phil Thorp

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 James Fisher Testing Services Ltd
 Phil Thorp, Laboratory Manager



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 Unit 1 Carrigogna Midleton	Lab Ref No.:	ST 93368
Order No:	2003-104	Date Received:	09/03/2020
Originator:	Ian Holley	Date Tested:	26/03/2020
		Date Reported:	03/04/2020
		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 preparation by cone and quarter

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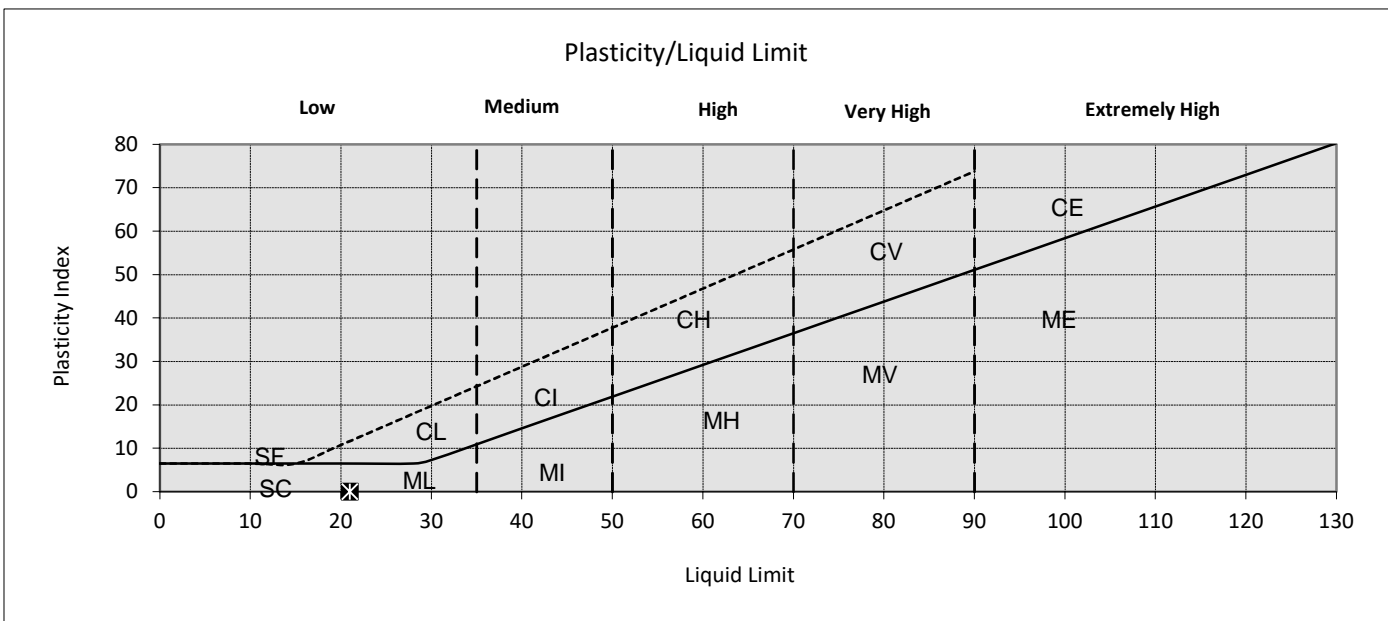




LABORATORY TEST REPORT
 LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 CI 4.4,5.3

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

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

RS70 Issue 2



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Page 1 of 1



LABORATORY TEST REPORT

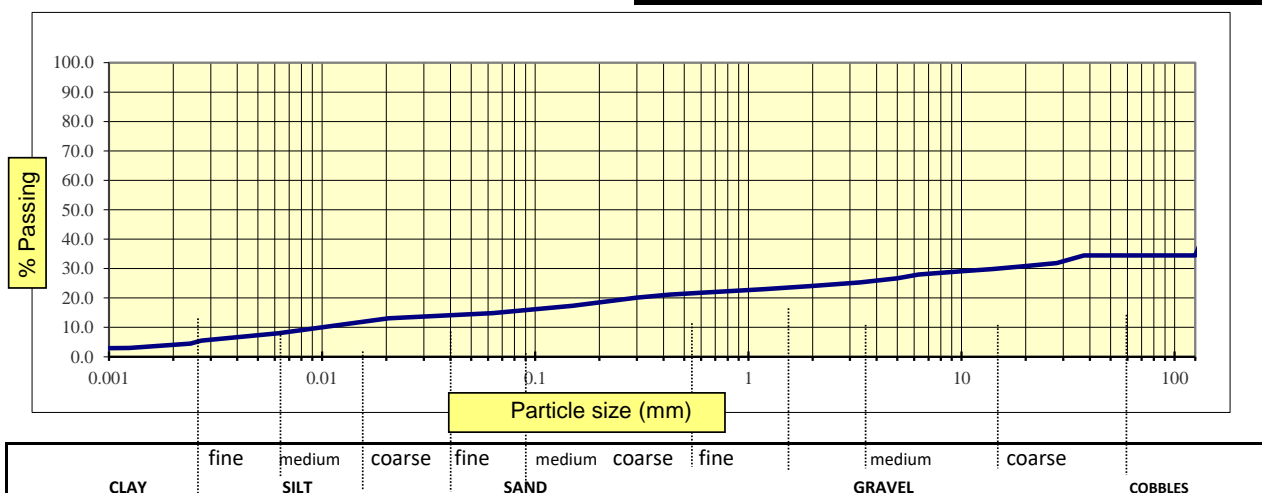
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 Unit 1 Carrigogna Midleton	Lab Ref No.:	ST 93370
		Date Received:	09/03/2020
		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	%	Specification
Size	Passing	
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				Soil Description	ρ	ρ_d	W	< 425 μm sieve	W_L	W_P	I_p	ρ_s	Remarks
	No.	Depth (m)		type										
		from	to			Mg/m3	%	%	%	%	Mg/m3			
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 : ρ bulk density, linear

W_L Liquid limit

W_P Plastic limit

<425 μ m preparation

ρ_s particle density

ρ_d dry density

a 4 point cone test

NP non - plastic

n from natural soil

-g = gas jar

w moisture content

b 1 point cone test

IP Plasticity Index

s sieved specimen

-p = small pycnometer

* test carried out to BS EN ISO 17892

h removed by hand

QA Ref
SLR 1
Rev 2.95
Mar 17



Project No

N9426-20

Project Name

Cork Line Level Crossings

Figure

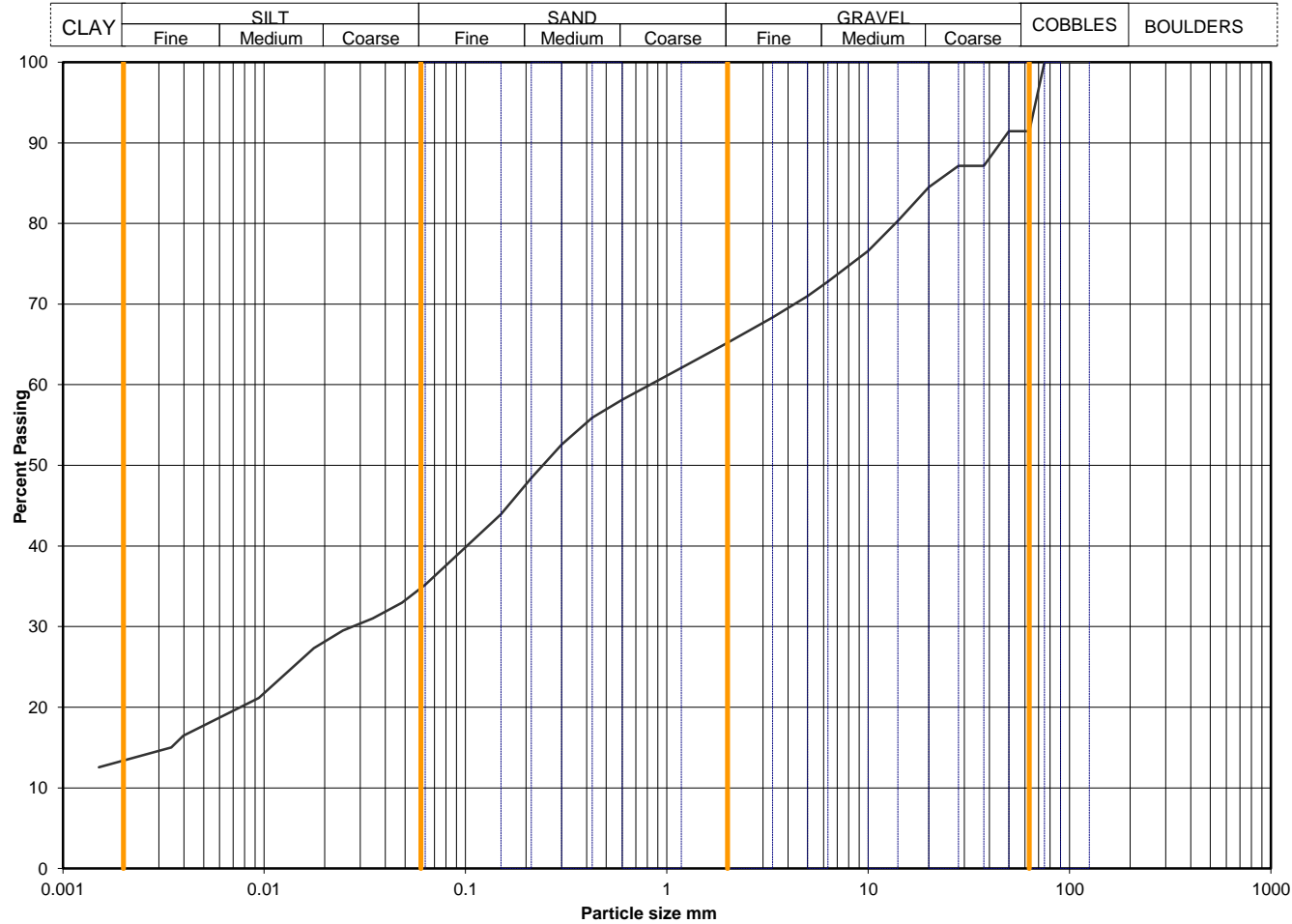
INDX

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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	XC211-CP01
	SOCO2020100629	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		
0.600	58	Particle density, Mg/m3	
0.425	56	2.65 assumed	
0.300	53	Dry mass of sample, kg	
0.212	48	4.5	
0.150	44		
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	Cobbles / boulders Gravel Sand Silt Clay	Whole	*<60mm
		8.6	0.0
		26.2	28.7
		30.0	32.8
		21.8	23.9
		13.4	14.7

*<60mm values to aid description only

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



Project No N9426-20
Project Name Cork Line Level Crossings

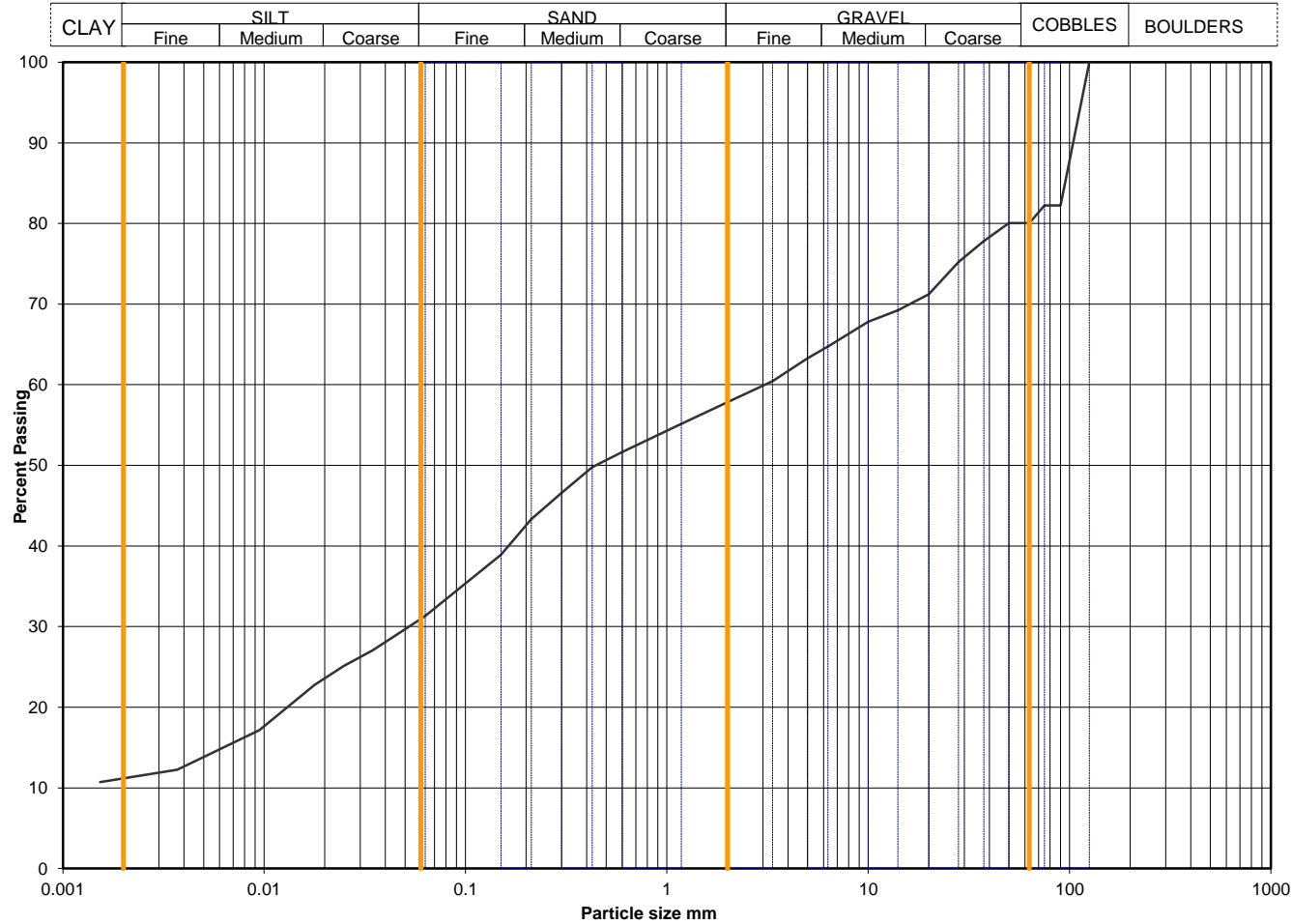
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Figure
PSD

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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	XC211-CP01
	SOCO2020100635	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		
0.600	52	Particle density, Mg/m3	
0.425	50	2.65 assumed	
0.300	47	Dry mass of sample, kg	
0.212	43	20.0	
0.150	39		
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	Cobbles / boulders Gravel Sand Silt Clay	Whole	*<60mm
		20.0	0.0
		22.2	27.8
		26.5	33.1
		20.1	25.1
		11.2	14.0

*<60mm values to aid description only

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



Project No N9426-20
Project Name Cork Line Level Crossings

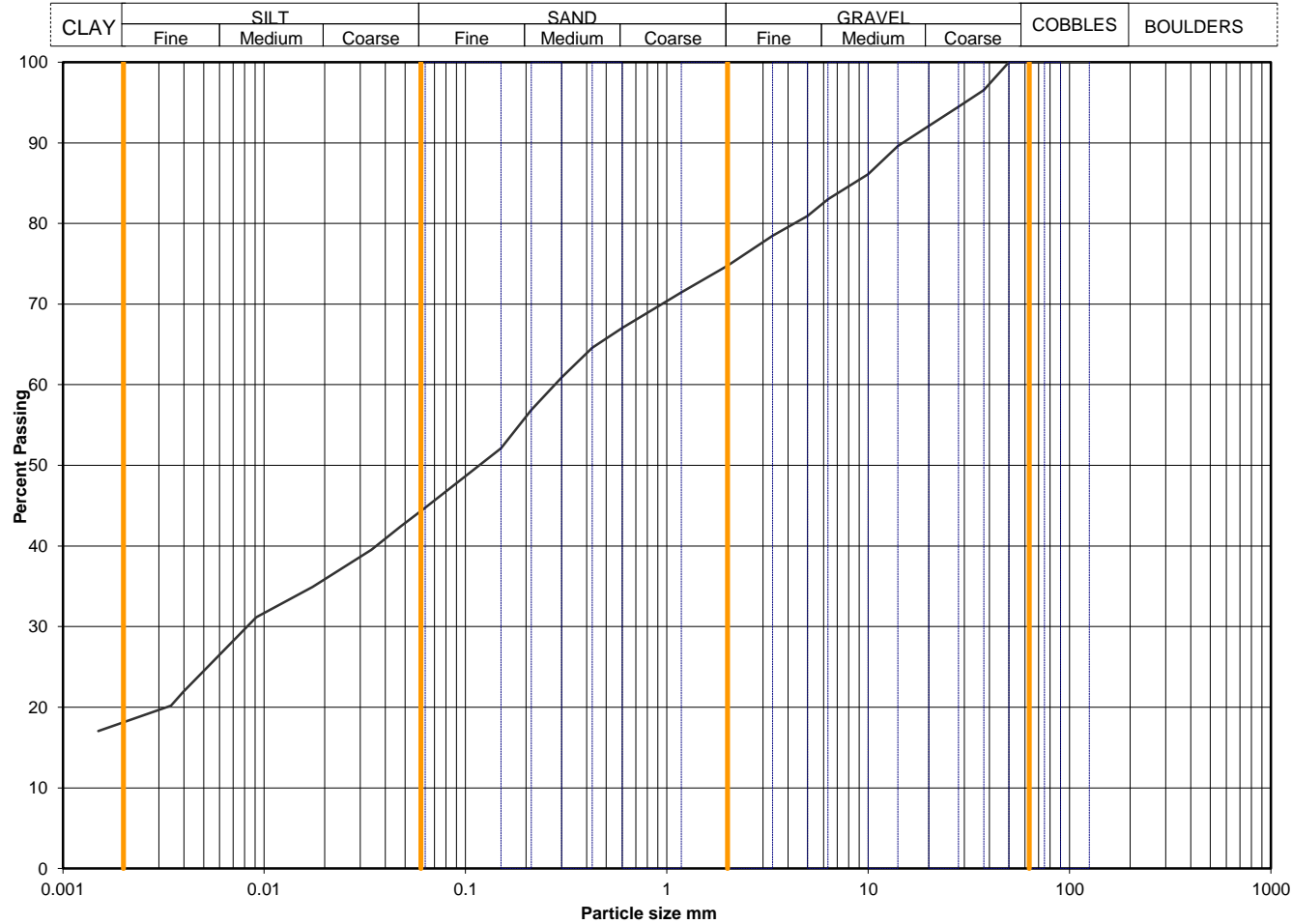
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Figure
PSD

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Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	XC211-CP01
	SOCO2020100646	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		
0.600	67	Particle density, Mg/m3	
0.425	65	2.65 assumed	
0.300	61	Dry mass of sample, kg	
0.212	57	2.8	
0.150	52		
0.063	45		

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

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

Uniformity Coefficient	D60 / D10	Not applicable
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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



Project No N9426-20
Project Name Cork Line Level Crossings

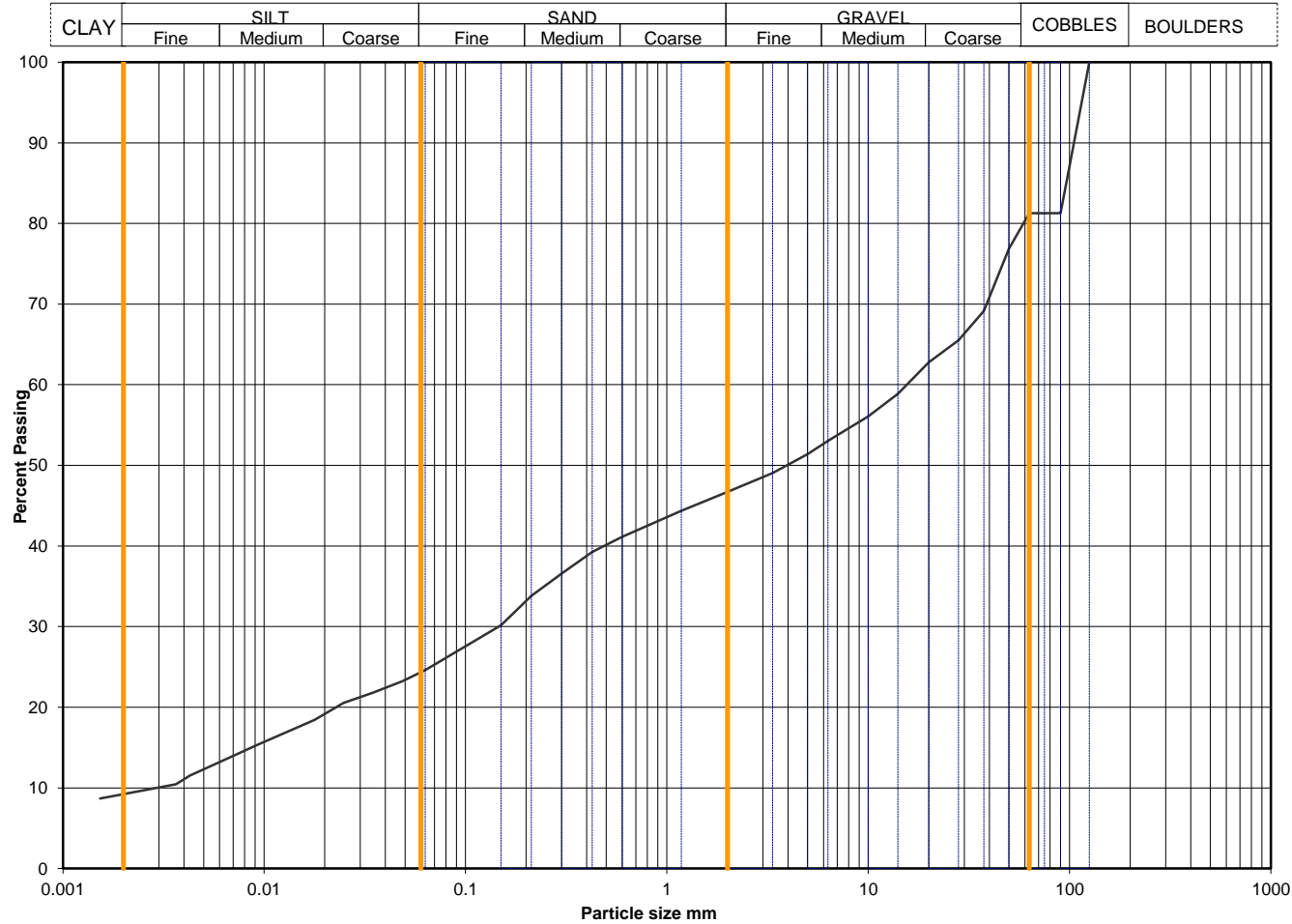
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Figure
PSD

Printed: 20/11/2020 10:00

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	XC211-CP02
	SOCO2020100650	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		
0.600	41	Particle density, Mg/m3	
0.425	39	2.65 assumed	
0.300	37	Dry mass of sample, kg	
0.212	34	8.4	
0.150	30		
0.063	25		

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

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

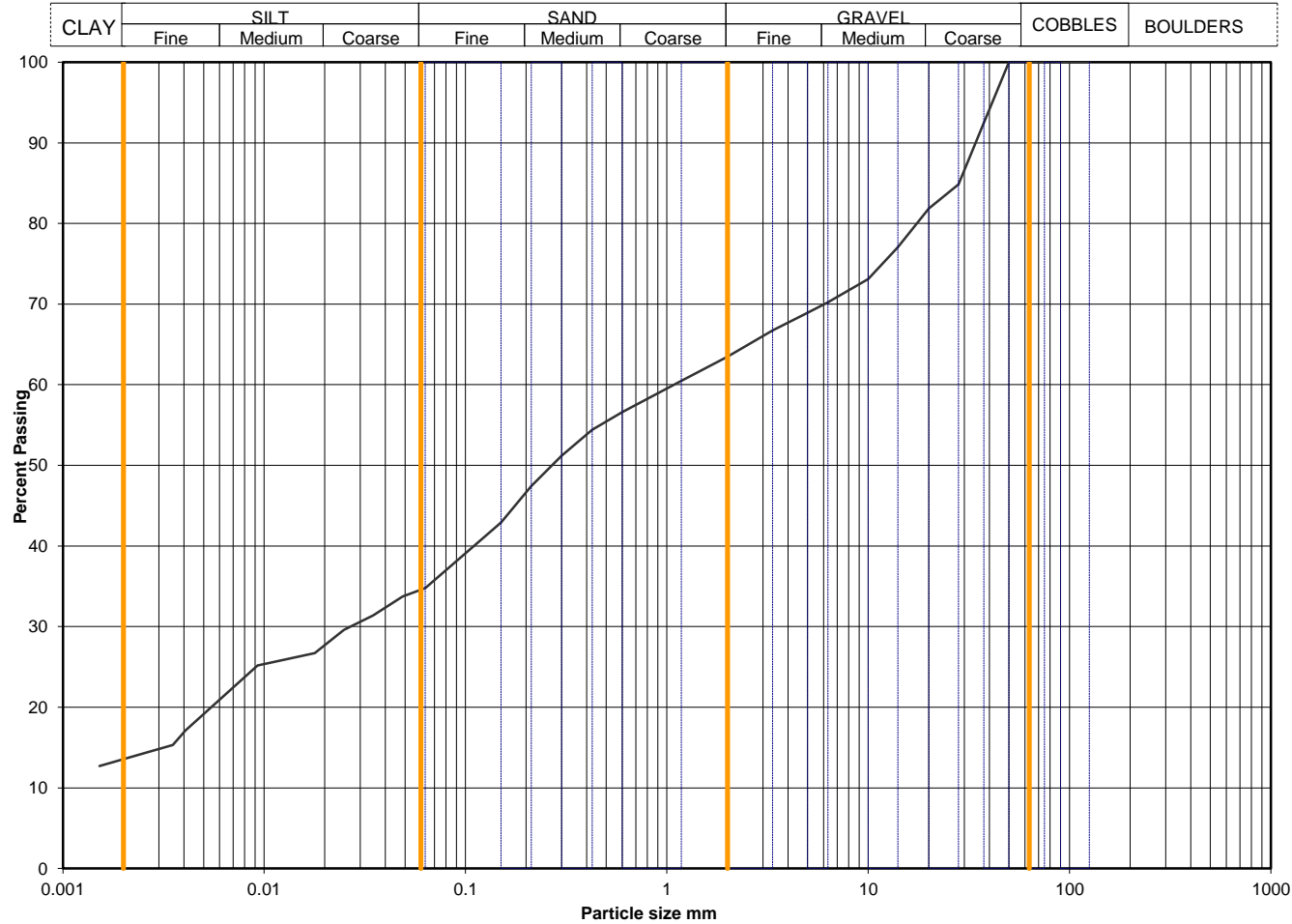
*<60mm values to aid description only

Uniformity Coefficient	D60 / D10	4858
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Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	XC211-CP02
	SOCO2020100652	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		
0.600	57	Particle density, Mg/m3	
0.425	54	2.65 assumed	
0.300	51	Dry mass of sample, kg	
0.212	47	2.3	
0.150	43		
0.063	35		

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

Sample Proportions	Cobbles / boulders Gravel Sand Silt Clay	Whole	*<60mm
		0.0	0.0
		36.5	36.5
		28.7	28.7
		21.2	21.2
		13.6	13.6

*<60mm values to aid description only

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



Project No N9426-20
Project Name Cork Line Level Crossings

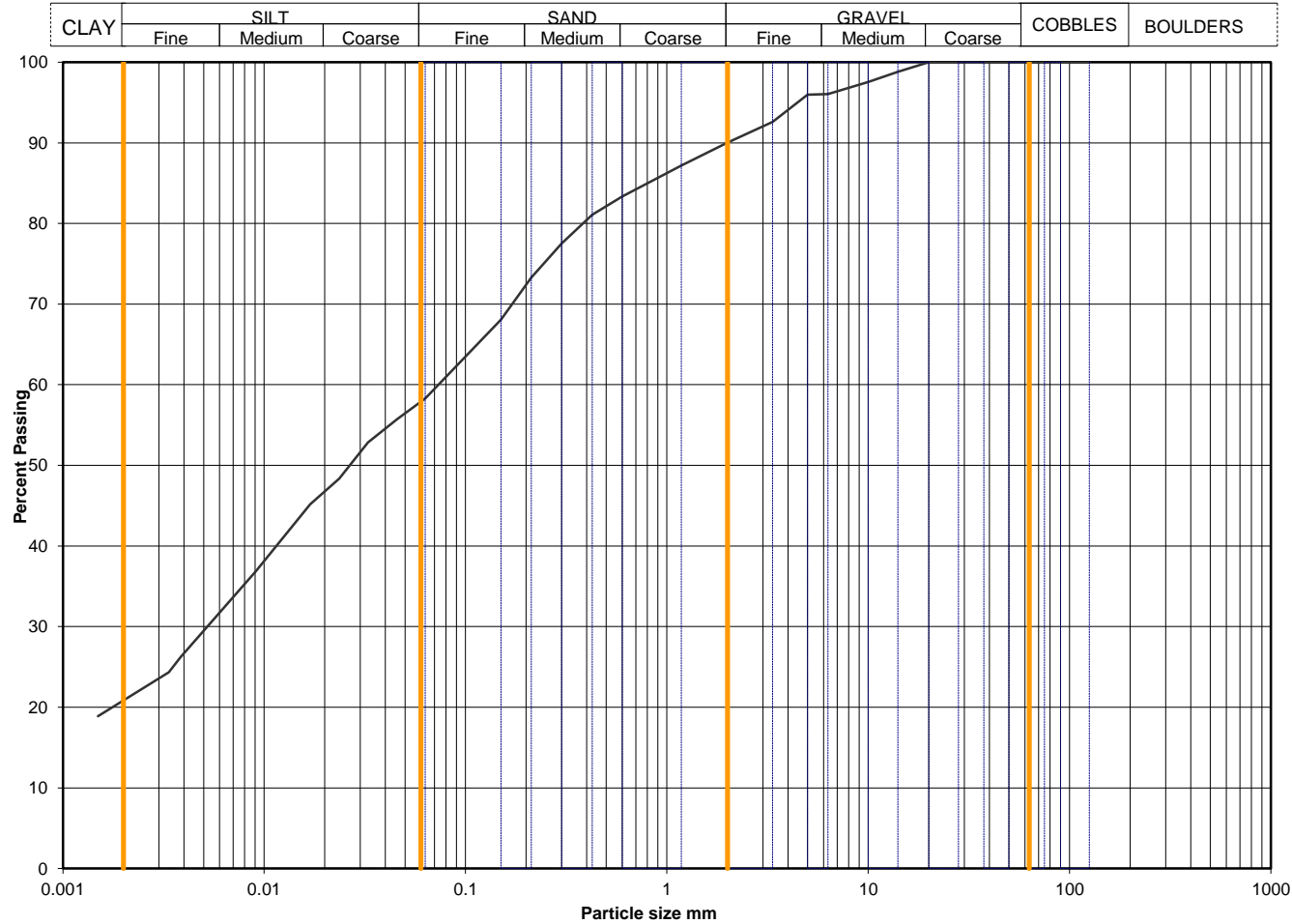
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Figure
PSD

Printed: 20/11/2020 10:00

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	XC211-CP02
	SOCO2020100661	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		
0.600	83	Particle density, Mg/m3	
0.425	81	2.65 assumed	
0.300	78	Dry mass of sample, kg	
0.212	73	1.0	
0.150	68		
0.063	58		

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

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

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



Project No N9426-20
Project Name Cork Line Level Crossings

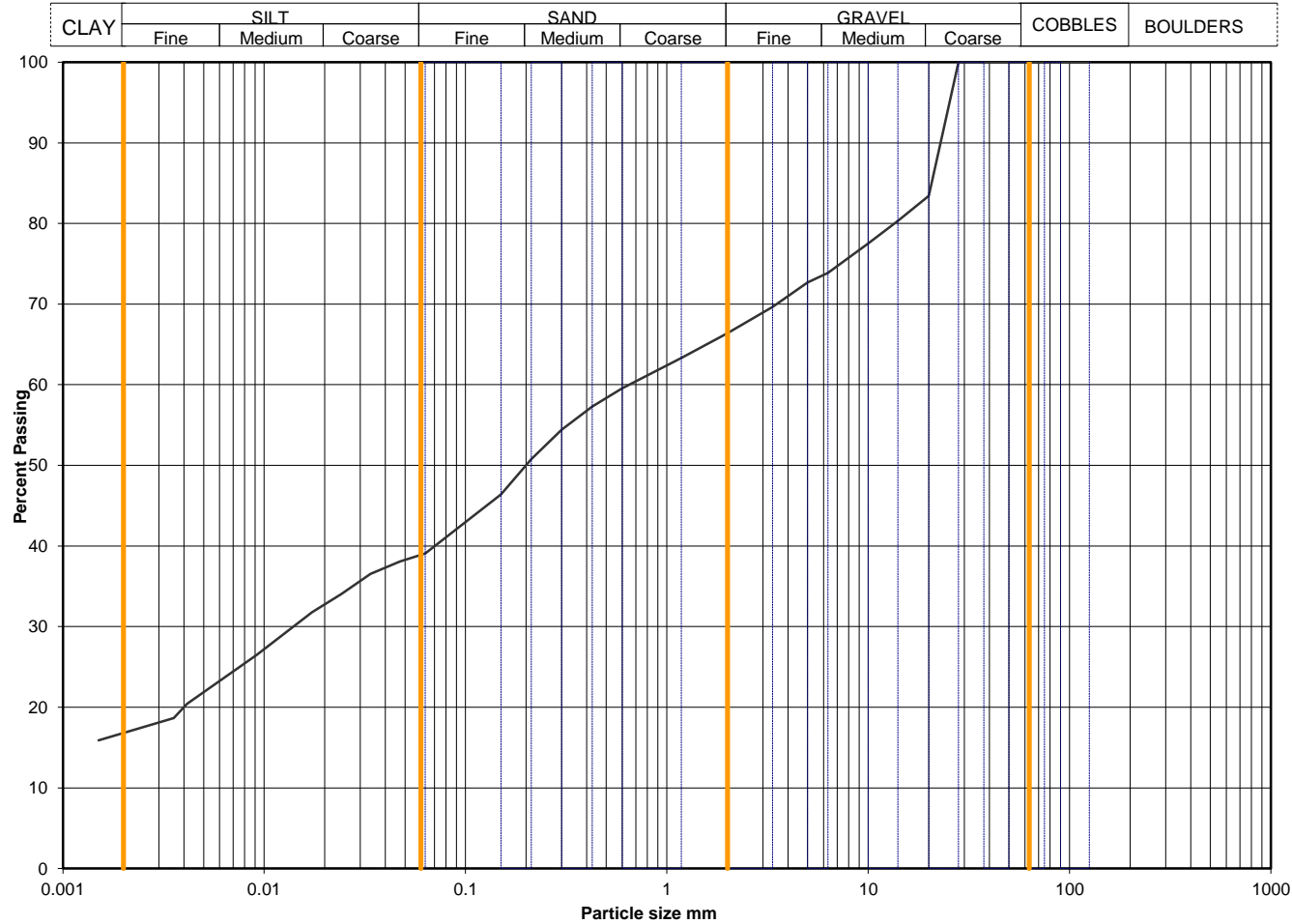
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Figure
PSD

Printed: 20/11/2020 10:00

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	XC211-CP02
	SOCO2020100669	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		
0.600	60	Particle density, Mg/m3	
0.425	57	2.65 assumed	
0.300	54	Dry mass of sample, kg	
0.212	51	3.5	
0.150	46		
0.063	39		

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

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

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



Project No N9426-20
Project Name Cork Line Level Crossings

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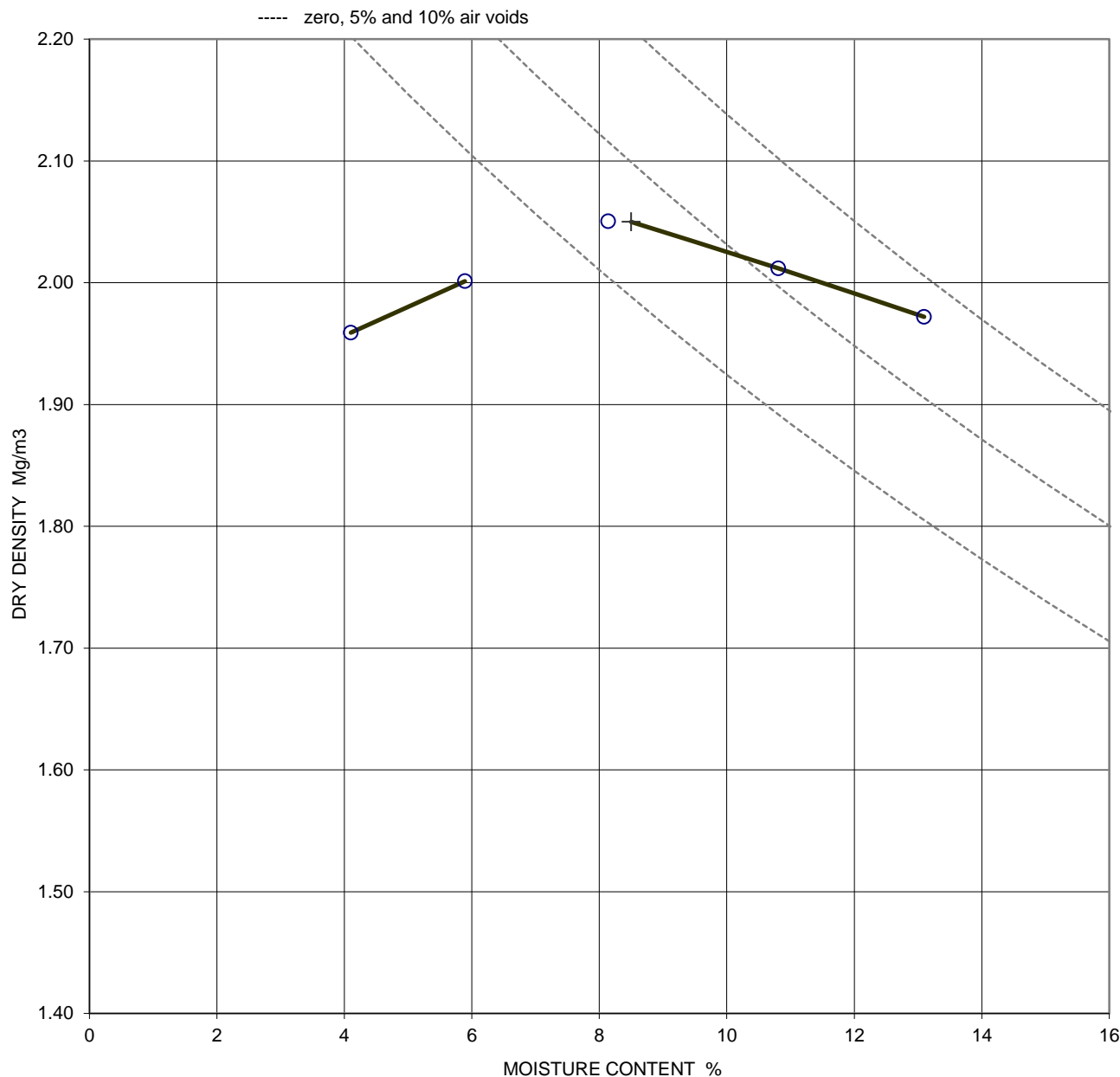
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DRY DENSITY / MOISTURE CONTENT RELATIONSHIP
BS1377 : PART 4 : 1990 : HEAVY COMPACTION, 4.5 kg rammer

Sample Details:	SAMPLE ID:	Hole No	XC211-CP02
		Sample Depth (m BGL)	3.00 - 4.00
	SOCO2020100654	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



Project No N9426-20
Project Name Cork Line Level Crossings

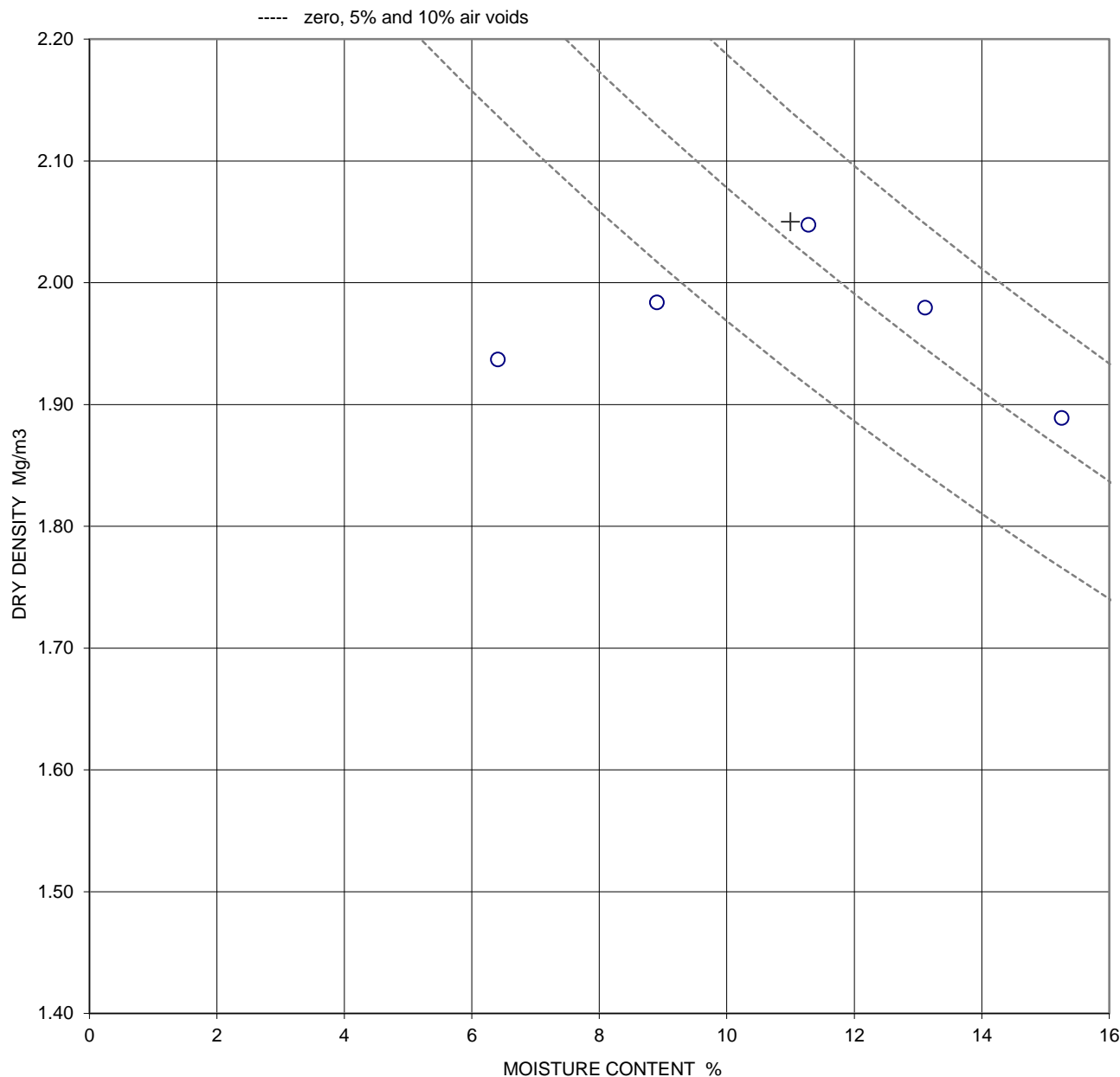
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Figure
COMPH

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

Sample Details:	SAMPLE ID:	Hole No	XC211-CP02
	SOCO2020100656	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



Project No N9426-20

Project Name Cork Line Level Crossings

Figure

COMPH

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Appendix H Environmental Laboratory Test Results



2183

Final Report

Report No.: 20-07165-1

Initial Date of Issue: 12-Mar-2020

Client Environmental Laboratory Services Ltd

Client Address: Acorn Business Campus
Mahon Industrial Park
Blackrock
Cork
Ireland

Contact(s): Emer Kearney
Results

Project Soil Samples

Quotation No.: Q20-19728 **Date Received:** 05-Mar-2020

Order No.: 6897 **Date Instructed:** 05-Mar-2020

No. of Samples: 2

Turnaround (Wkdays): 5 **Results Due:** 11-Mar-2020

Date Approved: 12-Mar-2020

Approved By:


Details: Darrell Hall, Director

Results - Leachate

Project: Soil Samples

Client: Environmental Laboratory Services Ltd	Chemtest Job No.:							20-07165	20-07165		
Quotation No.: Q20-19728 Order No.: 6897	Chemtest Sample ID.:							981122	981123		
	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		

Results - Leachate

Project: Soil Samples

Client: Environmental Laboratory Services Ltd	Chemtest Job No.:					20-07165	20-07165	
Quotation No.: Q20-19728 Order No.: 6897	Chemtest Sample ID.: Client Sample Ref.: Client Sample ID.: Sample Type: Top Depth (m): Date Sampled:					981122 176540/003 3 XC211-TP01 SOIL 0.05 20-Feb-2020	981123 176540/004 4 XC211-TP01 SOIL 3.00 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	

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–C44 Aromatics: >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–C44 Aromatics: >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; Dibenzo[a,h]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



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

Project: Soil Testing

Client: Environmental Laboratory Services Ltd	Chemtest Job No.:							20-07190	20-07190
Quotation No.: Q20-19728 Order No.: 6881	Chemtest Sample ID.:							981249	981250
	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

Results - Leachate

Project: Soil Testing

Client: Environmental Laboratory Services Ltd	Chemtest Job No.:							20-07190	20-07190
Quotation No.: Q20-19728 Order No.: 6881	Chemtest Sample ID.:							981249	981250
	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

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–C44 Aromatics: >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–C44 Aromatics: >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; Dibenzo[a,h]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



2183

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; Dibenzo[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

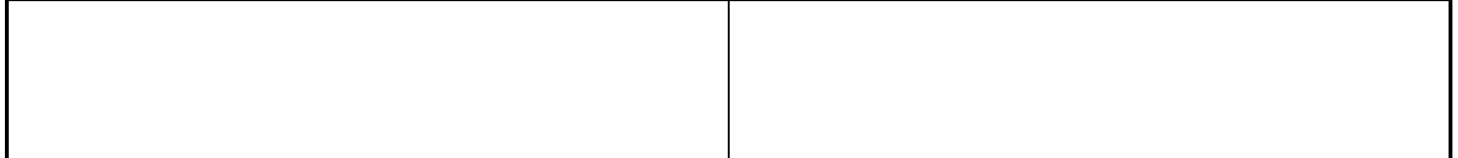
All water samples will be retained for 14 days from the date of receipt

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



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



CONTENTS

Document Control Sheet

Note on: Methods of describing soils and rocks & abbreviations used on exploratory hole logs

1	AUTHORITY	1
2	SCOPE	1
3	DESCRIPTION OF SITE	2
4	SITE OPERATIONS.....	2
4.1	Borehole by Combined Cable Percussion and Rotary Follow-On Drilling.....	3
4.2	Standpipe Installations.....	3
4.3	Water Purging	3
4.4	Surveying.....	4
5	LABORATORY WORK.....	4
5.1	Geotechnical Laboratory Testing of Soils.....	4
5.2	Environmental Laboratory Testing of Soils	5
6	GROUND CONDITIONS	5
6.1	General Geology of the Area	5
6.2	Ground Types Encountered During Investigation of the Site	5
6.3	Groundwater	5
7	DISCUSSION.....	6
7.1	Proposed Construction.....	6
8	REFERENCES	7

APPENDICES

Appendix A	Site and Exploratory Hole Location Plans
Appendix B	Borehole Logs
Appendix C	Water Purging Data & Logs
Appendix D	Geotechnical Laboratory Test Results
Appendix E	Environmental Laboratory Test Results
Appendix F	Pre & Post Site Condition Photographs



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	18 th November 2020
002	Final Factual	Ian Holley	Glen Byrne	Michael O'Connell	25 th 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 300mm 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

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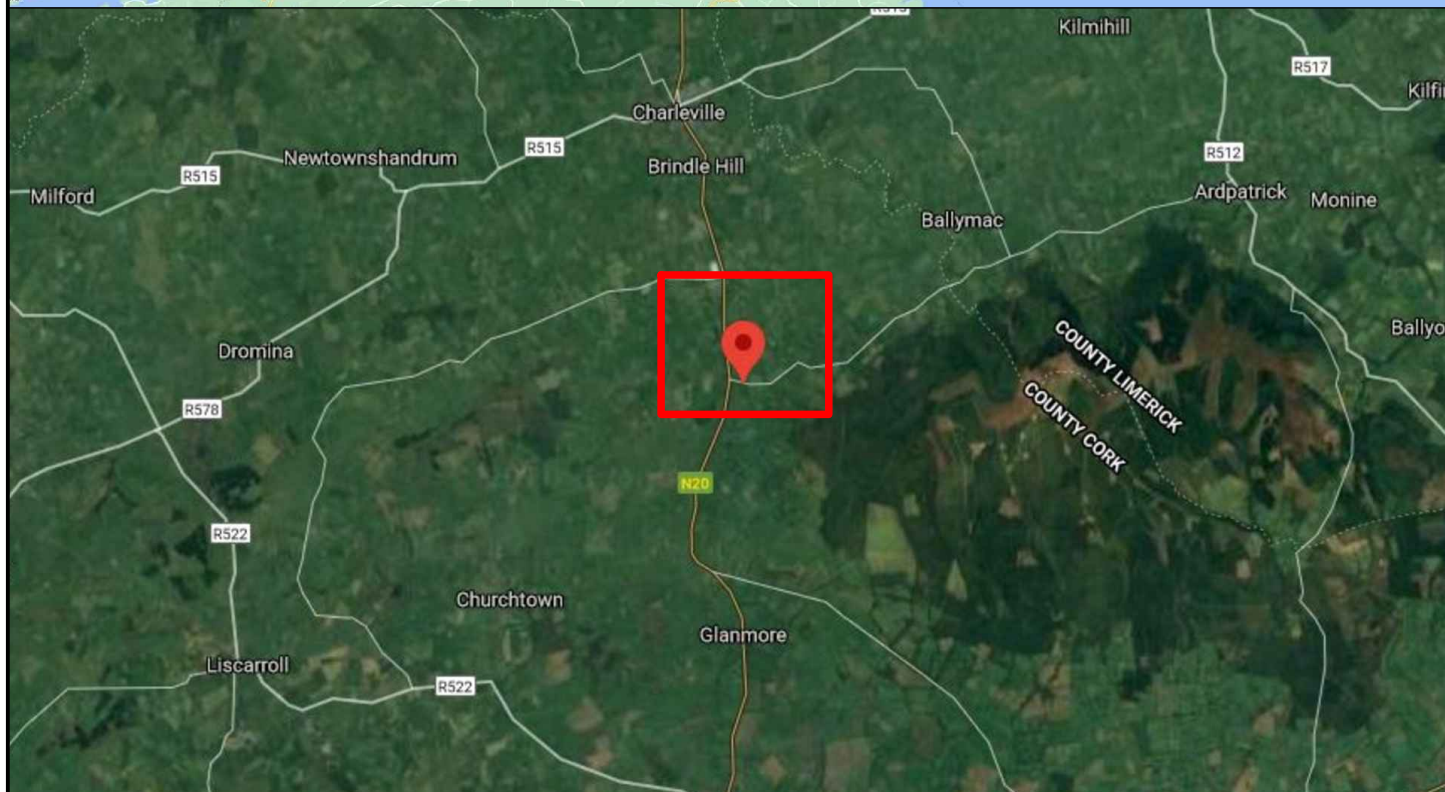
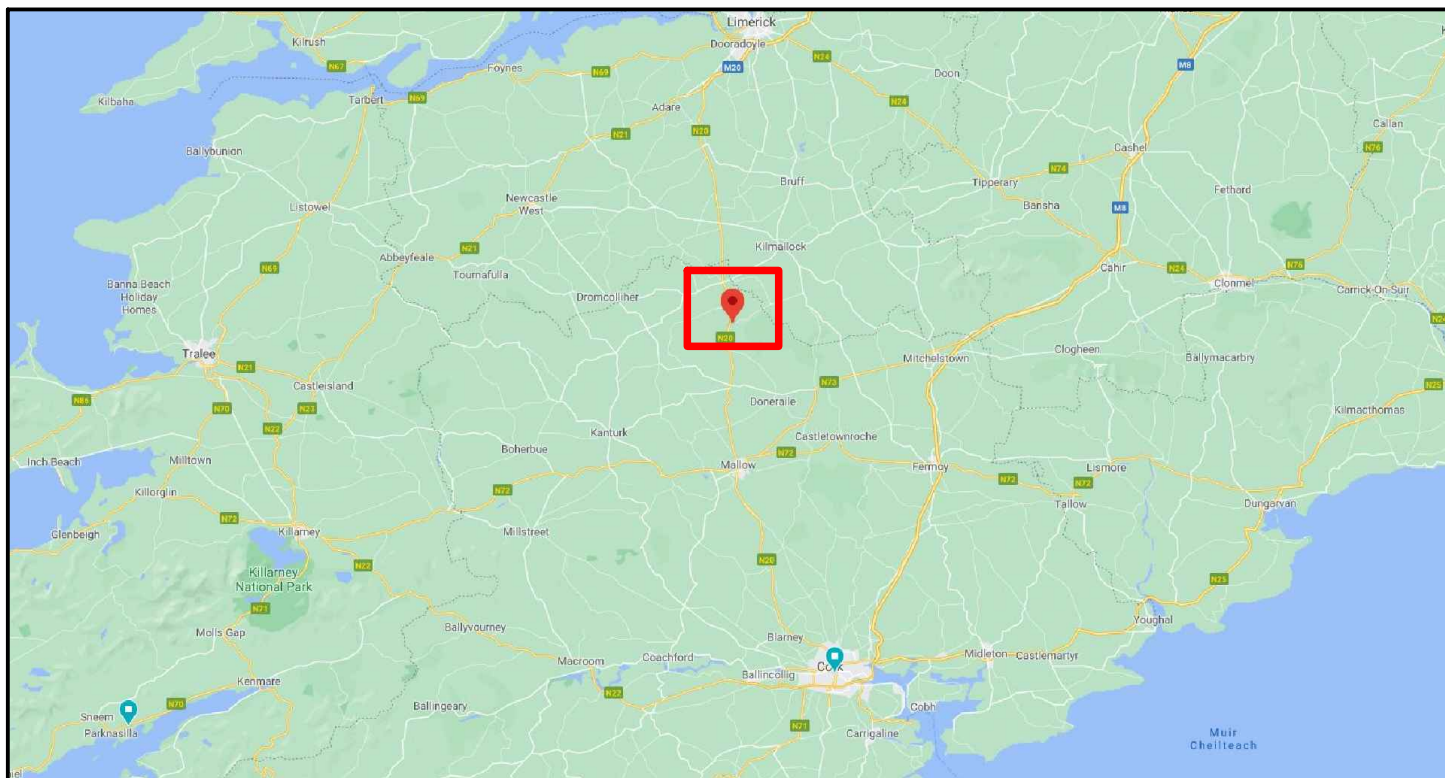
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Appendix A Site and Exploratory Hole Location Plans



Iarnród Éireann
Cork Line Level Crossings
XC212 (19-135-3)

SITE LOCATION MAPS

Client:

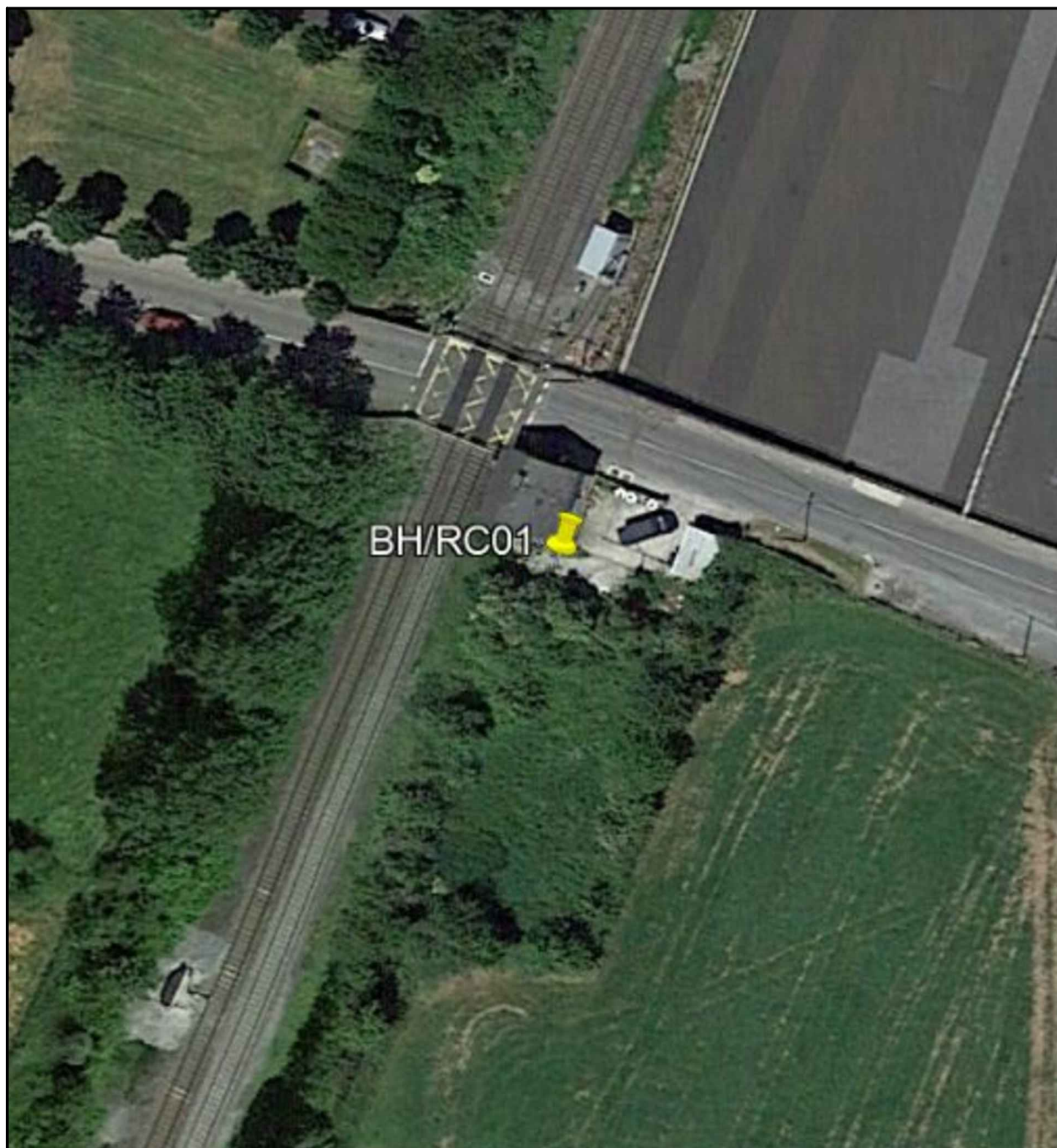
Iarnród Éireann

Engineer:

Jacob's

Date:

June/July 2020



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

Coordinates:

554653.01 F

1

61/642.69 N

Ground Level

97.81 mOD

Project Name:

Cork Line Level Crossings

Client:	
----------------	--

Iarnród Éireann / Irish Rail

Client's Representative:

JACOBS

Dates:

[illegible]

02/03/2020 - 28/06/2020

Borehole No.:	
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XC212-CPRC01

Sheet 1 of 2

Scale: 1:50

Drilldown	DS+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					(0.50)		MADE GROUND: Dark brown fill material.		
0.50	ES4				97.31	0.50		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	B2									
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		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.		
1.50 - 2.50	D7									
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		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.		
2.50 - 3.00	D9				95.01	(0.30)				
3.00	ES12				94.81	3.00		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.		
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		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.		
3.30 - 3.50	D14									
3.60 - 4.00	B15	3.50	3.30	02-03-2020		(0.50)		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.		
3.60 - 4.00	D16				93.81	4.00		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.		
3.60 - 4.05	SPT (C)			0 (0 for 450mm/0 for 0mm)				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.		
4.00 - 5.00	B17	3.50	2.60	03-03-2020		(1.00)				
4.00 - 5.00	D18									
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									
5.00 - 6.00	D20					(1.00)				
5.00 - 5.45	SPT (C) N=25			N=25 (1,2/3,6,8,8)						
6.00 - 7.00	B21				91.81	6.00		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 - 7.00	D22									
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		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 - 7.15	D24					(0.30)				
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					(0.70)		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				89.81	8.00		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	B27			(Water strike at 7.3m. Water rose to 3.5m in 2 mins. Gravel blowback to 6.4m.)		(0.80)				
8.00 - 8.80	D28				89.01	8.80		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 - 8.45	SPT (C) N=12	8.00	3.10	N=12 (0,1/2,2,4,4)		(0.70)				
8.80 - 9.00	B29	8.20	3.50	04-03-2020						
8.80 - 9.00	D30			03-03-2020	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

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

Casing Details		Chiselling Details		
To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)
9.40	200	7.10	7.30	00:30
20.00	151	8.80	9.80	00:30
		8.40	9.40	01:30

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

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

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

Remarks

Water Added		Water Strike - General			
From (m)	To (m)	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		Chiselling Details			
To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)	
9.40	200	7.10	7.30	00:30	
20.00	151	8.80	9.00	00:30	
		9.40	9.44	01:00	

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

Appendix C

Water Purging Data & Log

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

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

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

	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	

Nr of Containers filled:	5.5	
Total Volume Purged:	110	<i>litres</i>

	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



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
	Middleton	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





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 Unit 1 Carrigogna Midleton	Lab Ref No.:	ST 93841
Order No:	2003-104	Date Received:	26/03/2020
Originator:	Ian Holley	Date Tested:	31/03/2020
		Date Reported:	03/04/2020
		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 preparation 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





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

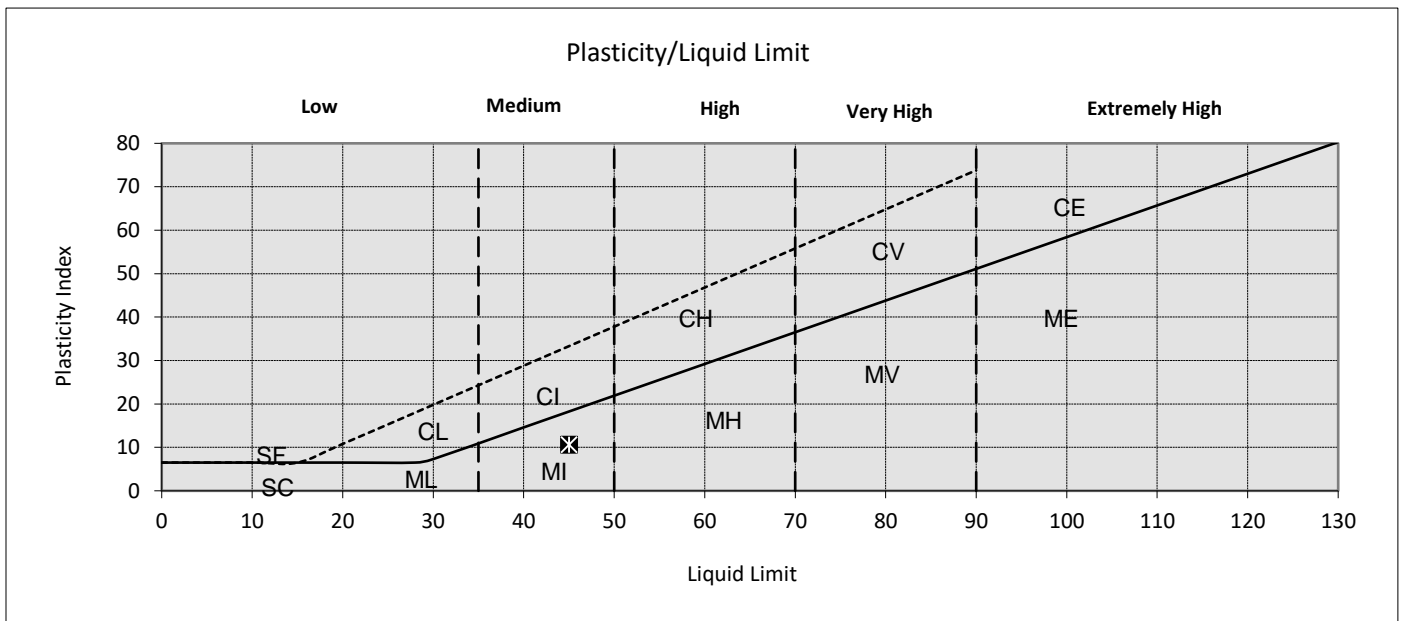




LABORATORY TEST REPORT
 LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 CI 4.4,5.3

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

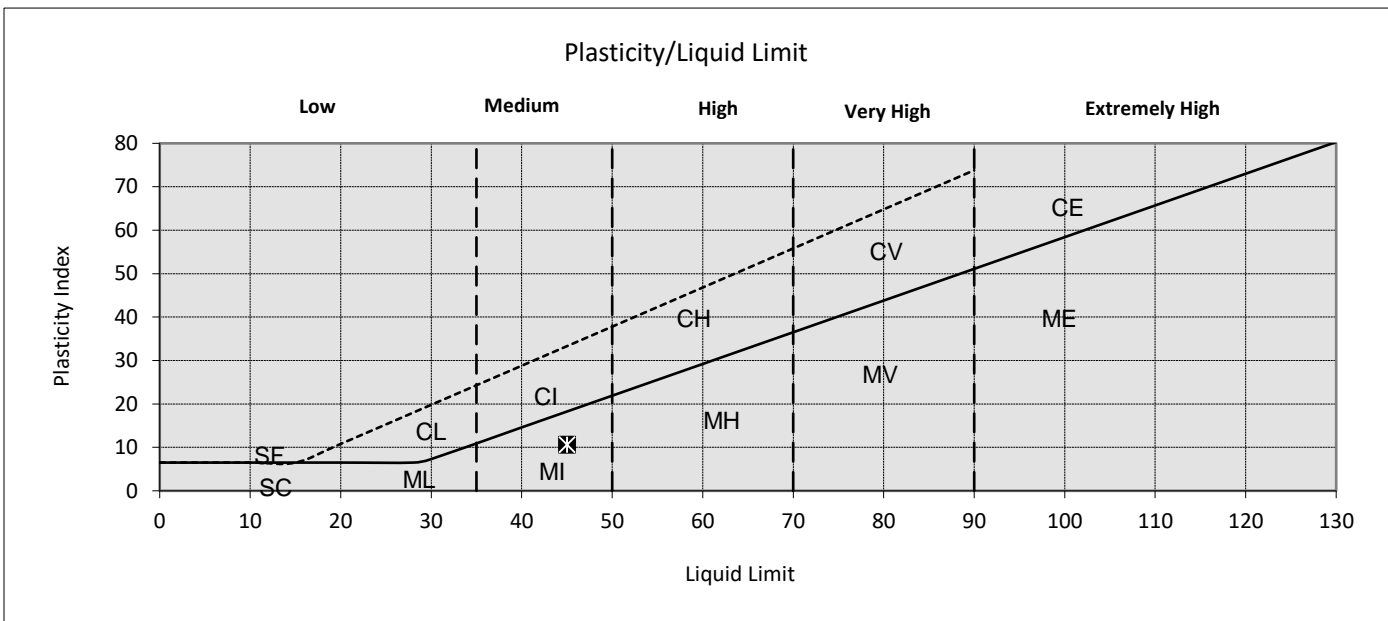
Approved Signature
 James Fisher Testing Services Ltd
 Phil Thorp, Laboratory Manager



LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 CI 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



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 Unit 1 Carrigogna Midleton	Lab Ref No.:	ST 93840
		Date Received:	11/03/2020
		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

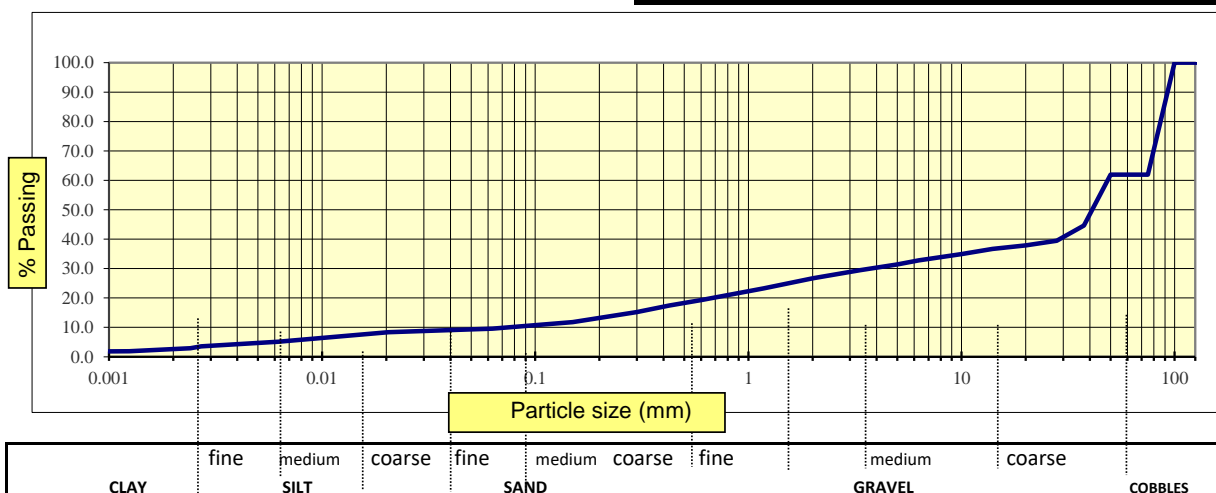
Sampled By: Client

Specification: Client

Preparation Method: Without Organics Preparation

Notes: Disturbed sample from cleanout

BS Sieve	%	Specification
Size	Passing	
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

[Signature]

Approved Signature

JAMES FISHER TESTING SERVICES (IRELAND) LTD.

☐ James Ward, Operations Manager





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
	Middleton	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 (SO ₄) (mg/l)	46
Sulphur as S, Total (%)	0.03
Sulphate as SO ₄ , 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





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 Unit 1 Carrigogna Midleton	Lab Ref No.:	ST 93845
Order No:	2003-104	Date Received:	26/03/2020
Originator:	Ian Holley	Date Tested:	31/03/2020
		Date Reported:	03/04/2020
		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 preparation 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





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
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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

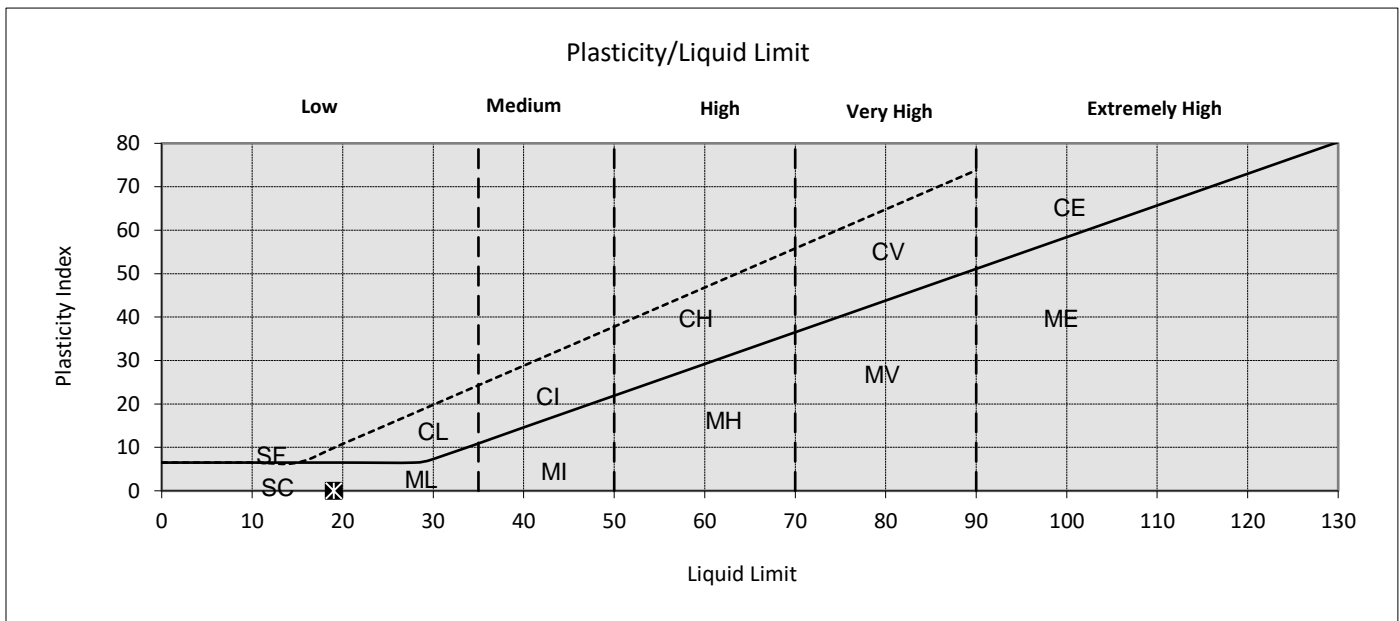




LABORATORY TEST REPORT
 LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 CI 4.4,5.3

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



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

Phil Thorp

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



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 Unit 1 Carrigogna Midleton	Lab Ref No.:	ST 93849
Order No:	2003-104	Date Received:	26/03/2020
Originator:	Ian Holley	Date Tested:	31/03/2020
		Date Reported:	03/04/2020
		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 preparation 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 Fisher Testing Services (Ireland) Ltd
James Ward, Operations Manager

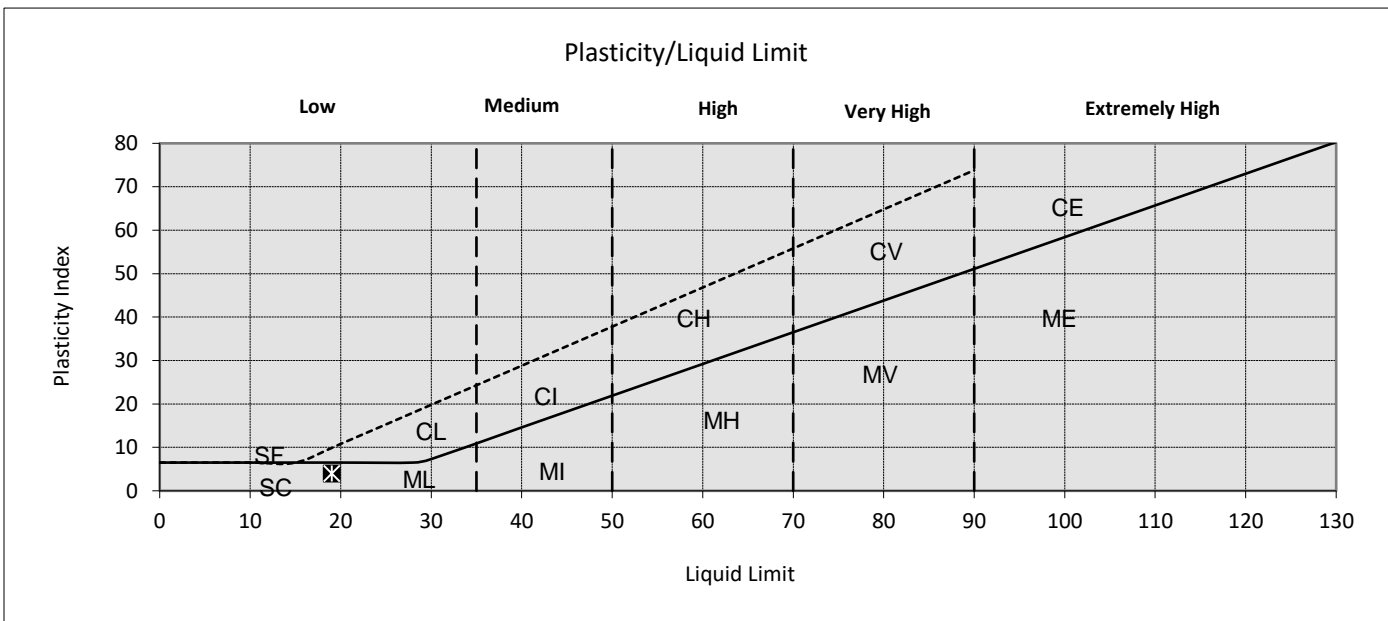




LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 CI 4.4,5.3

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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James Fisher Testing Services Ltd
Phil Thorp, Laboratory Manager



LABORATORY TEST REPORT

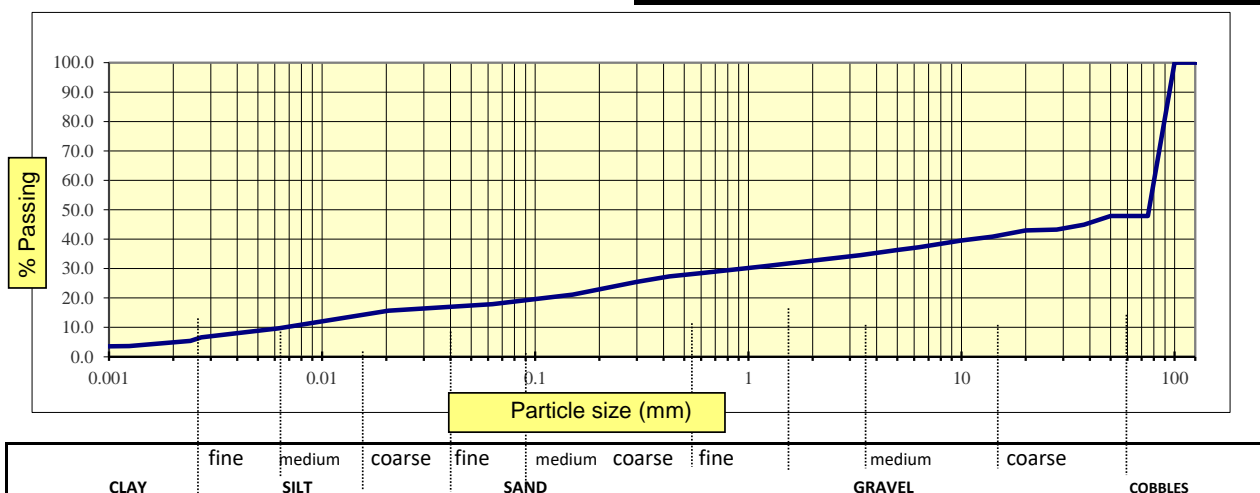
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 Unit 1 Carrigogna Midleton	Lab Ref No.:	ST 93848
		Date Received:	11/03/2020
		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	%	Specification
Size	Passing	
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	



[Signature]

Approved Signature

JAMES FISHER TESTING SERVICES (IRELAND) LTD.

☐ James Ward, Operations Manager





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:

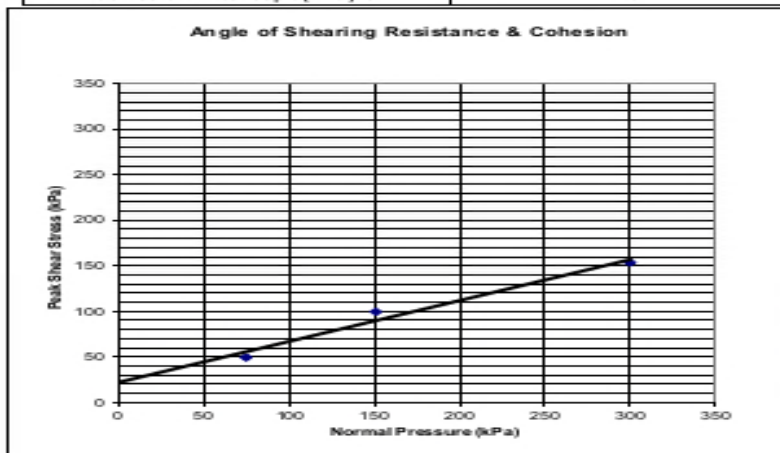
Dry

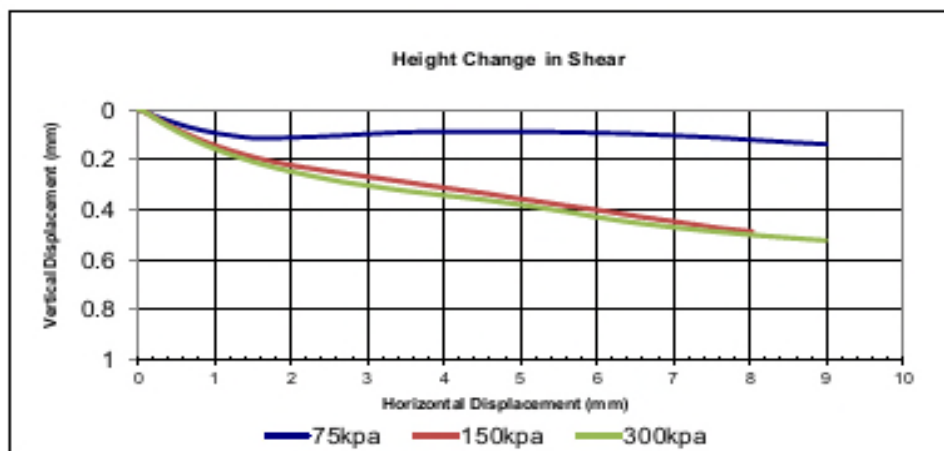
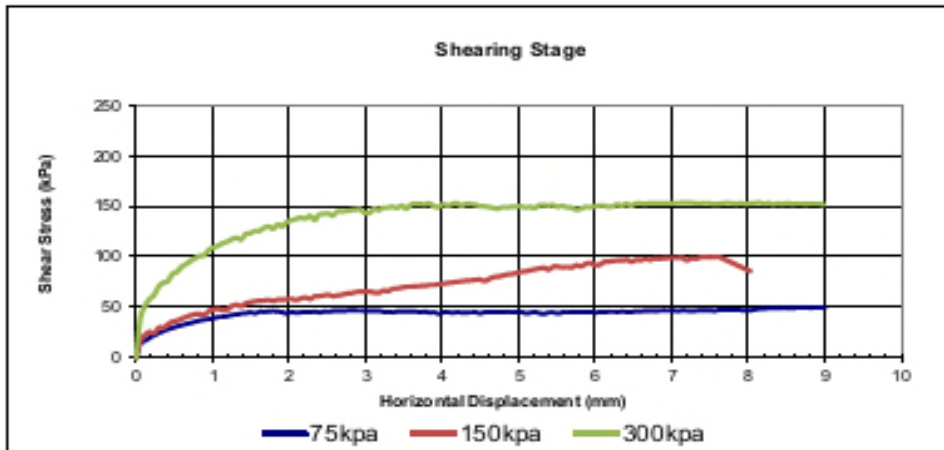
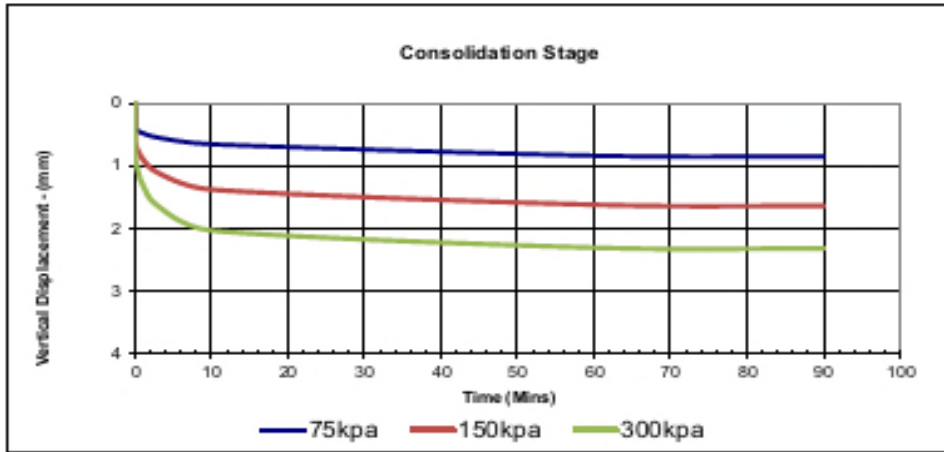
Results

SUMMARY OF TEST RESULTS:	
Angle of Shearing Resistance ($^{\circ}$) 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			
	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 ($^{\circ}$) 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



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
	Middleton	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

Approved Signature

JAMES FISHER TESTING SERVICES (IRELAND) LTD.

☐ James Ward, Operations Manager





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:

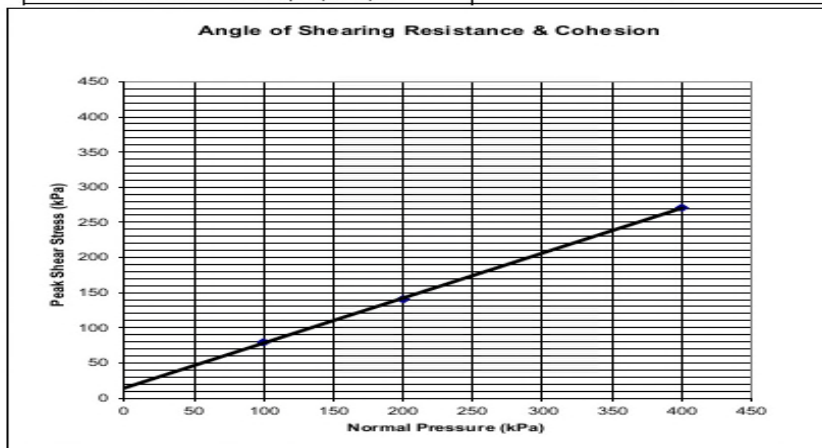
Dry

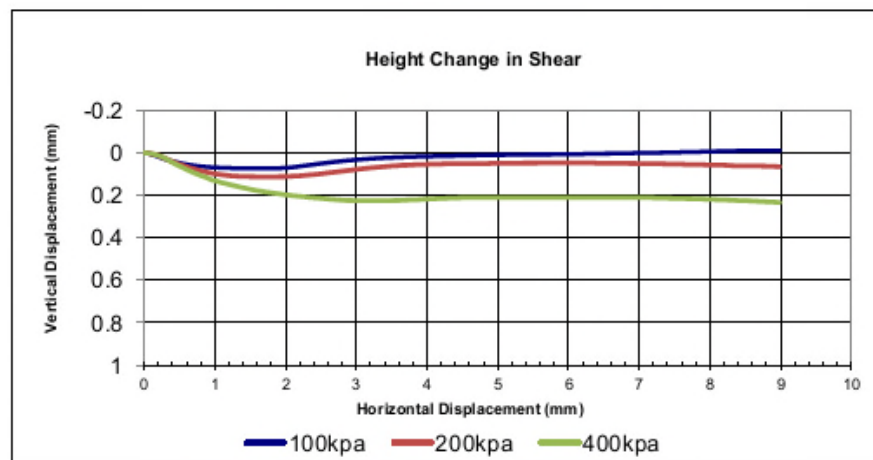
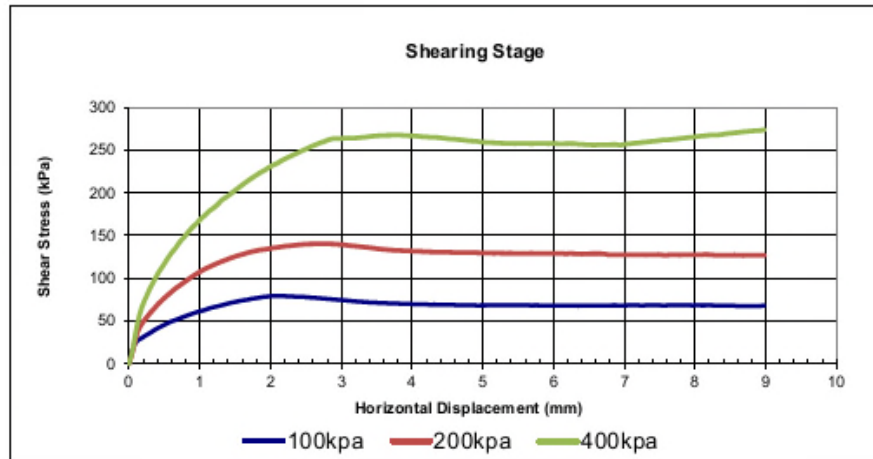
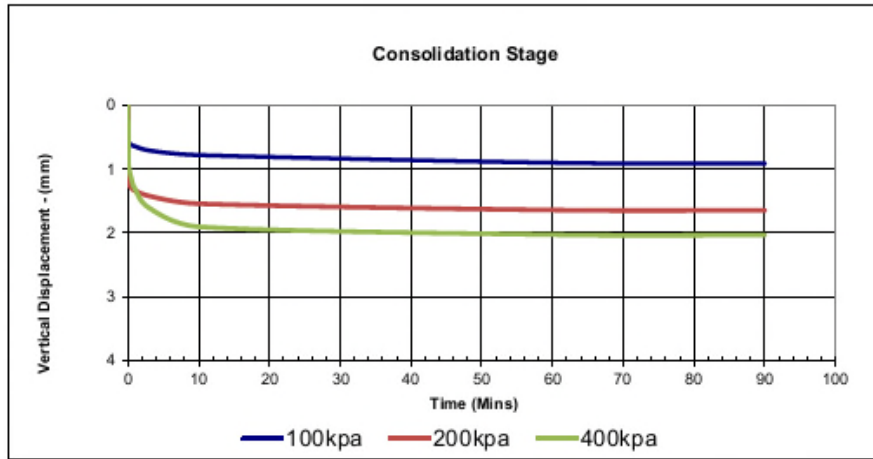
Results

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			
	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



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 Unit 1 Carrigogna Midleton	Lab Ref No.:	ST 93854
Order No:	2003-104	Date Received:	26/03/2020
Originator:	Ian Holley	Date Tested:	31/03/2020
		Date Reported:	03/04/2020
		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 preparation 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 Fisher Testing Services (Ireland) Ltd
James Ward, Operations Manager

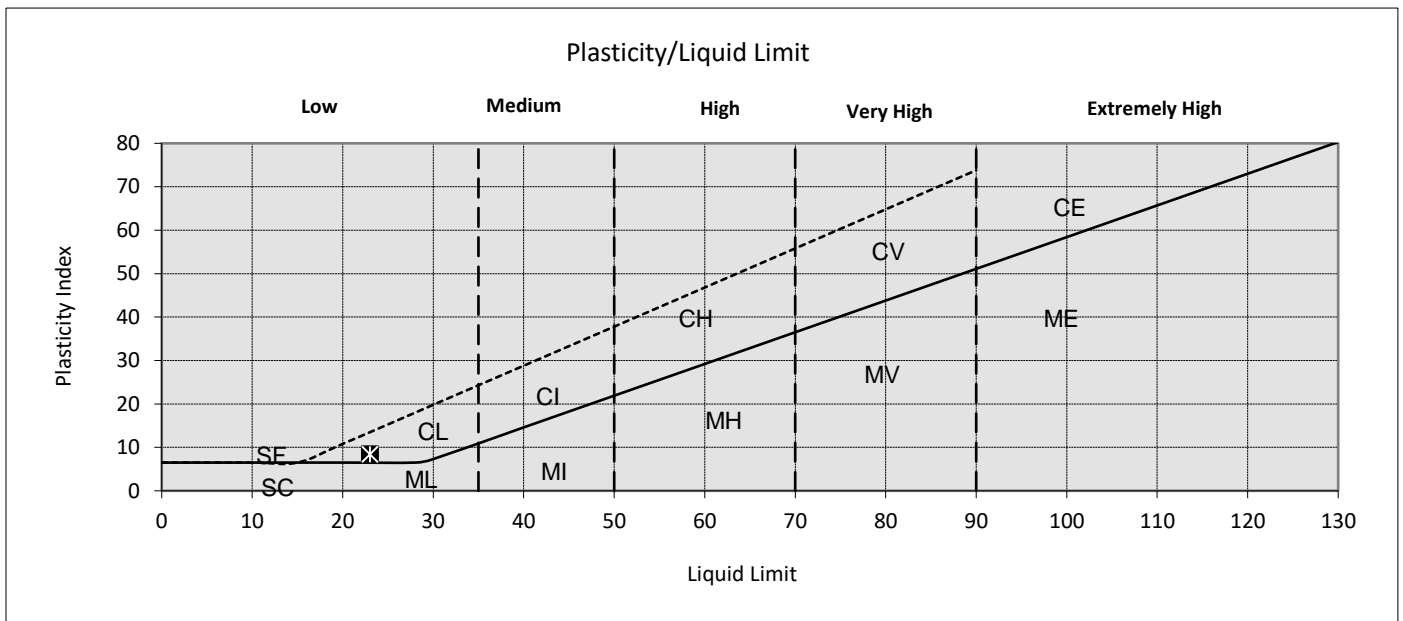




LABORATORY TEST REPORT
 LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 CI 4.4,5.3

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

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



LABORATORY TEST REPORT

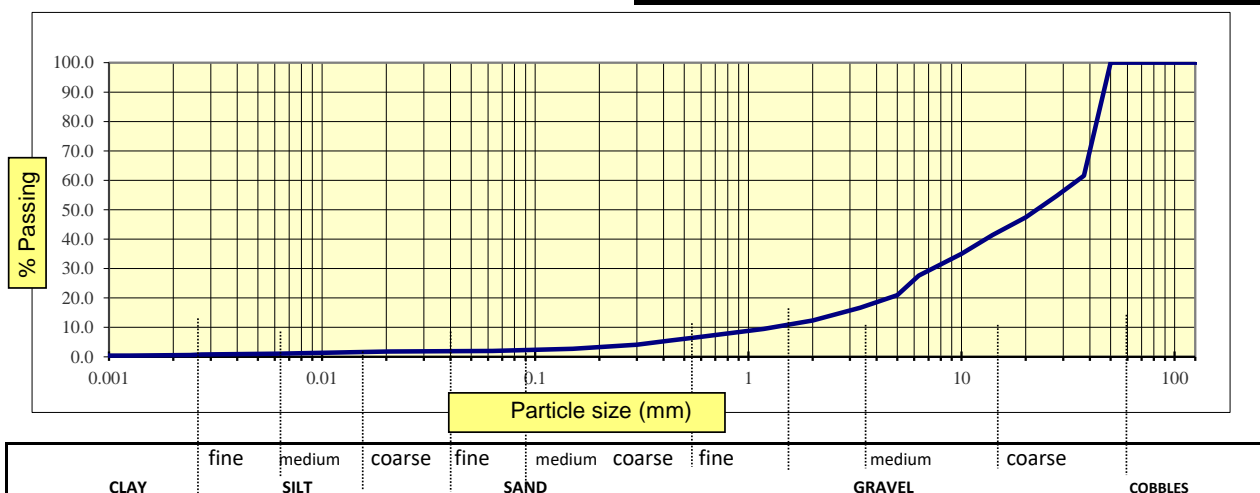
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 Unit 1 Carrigogna Midleton	Lab Ref No.:	ST 93857
		Date Received:	11/03/2020
		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	%	Specification
Size	Passing	
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

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

Sedimentation by Hydrometer - Not UKAS

[Signature]

Approved Signature

JAMES FISHER TESTING SERVICES (IRELAND) LTD.

☐ James Ward, Operations Manager





LABORATORY TEST REPORT

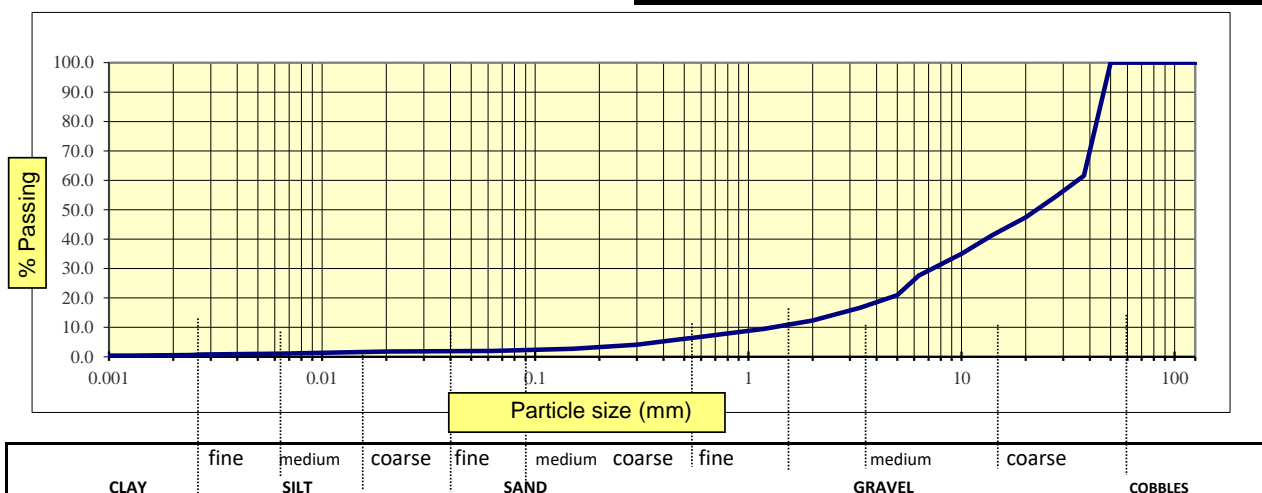
Determination of Particle Size Distribution - BS 1377 : Part 2 : 1990

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 Unit 1 Carrigogna Midleton	Lab Ref No.:	ST 93857
		Date Received:	11/03/2020
		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	%	Specification
Size	Passing	
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

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





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 Unit 1 Carrigogna Midleton	Lab Ref No.:	ST 93856
		Date Received:	11/03/2020
		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

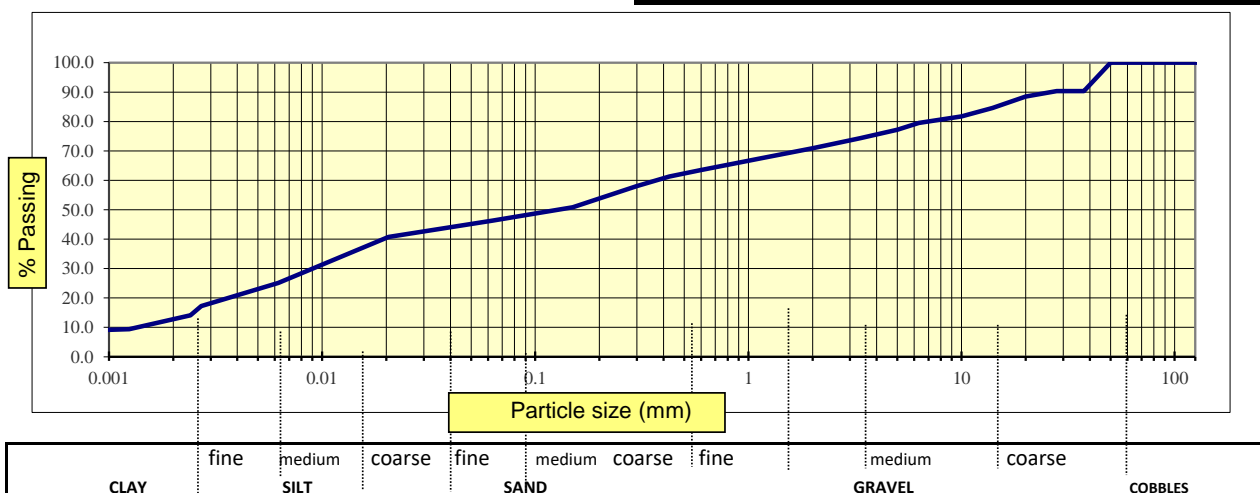
Sampled By: Client

Specification: Client

Preparation Method: Without Organics Preparation

Notes: Disturbed sample from cleanout

BS Sieve	%	Specification
Size	Passing	
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

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 FISHER TESTING SERVICES (IRELAND) LTD.

☐ James Ward, Operations Manager





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
	Middleton	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 (SO ₄) (mg/l)	20
Sulphur as S, Total (%)	0.02
Sulphate as SO ₄ , 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





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

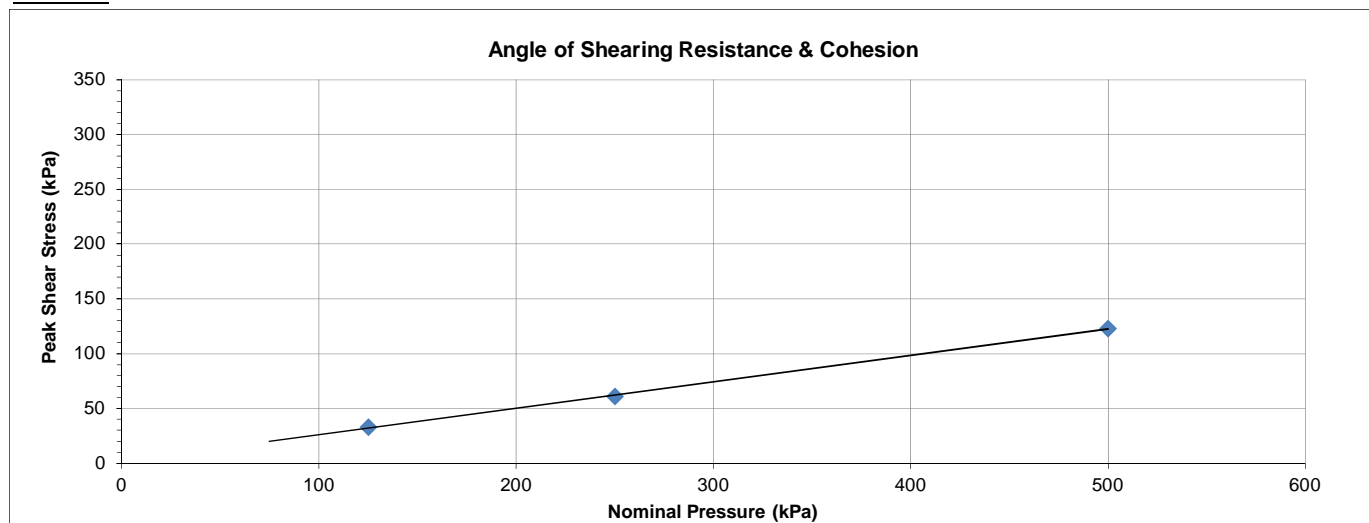
Sample Location / Orientation :

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 (°) to nearest (0.5°)	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

RS80 Issue 1





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.:	ST 93858
Order No:	2003-104	Date Received:	11/03/2020
Originator:	Ian Holley	Date Reported:	02/04/2020
		Date Tested:	01/04/2020
		Material:	Soil
		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

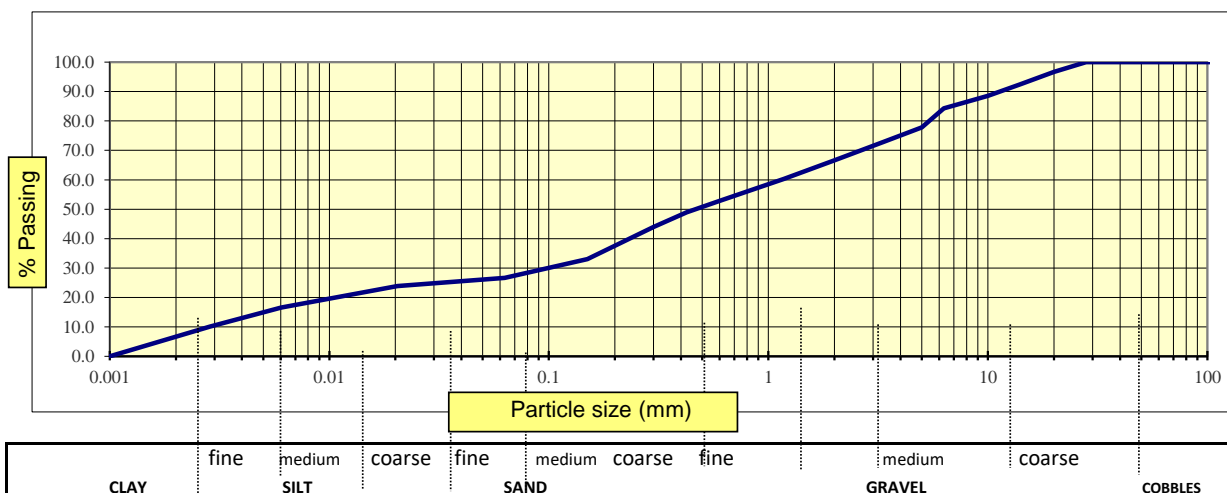
Specification: Client

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.

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JAMES FISHER TESTING SERVICES (IRELAND) LTD.

☐ James Ward, Operations Manager



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Appendix E Environmental Laboratory Test Results



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

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

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

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

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–C44 Aromatics: >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–C44 Aromatics: >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; Dibenzo[a,h]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

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



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

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CONTENTS

Document Control Sheet

Note on: Methods of describing soils and rocks & abbreviations used on exploratory hole logs

1	AUTHORITY	1
2	SCOPE	1
3	DESCRIPTION OF SITE	1
4	SITE OPERATIONS.....	2
4.1	Boreholes.....	2
4.1.1	Cable Percussion Boreholes	2
4.1.2	Boreholes by Combined Percussion Boring and Rotary Follow-On Drilling.....	3
4.2	Standpipe Installations.....	4
4.3	Trial Pits.....	4
4.4	Indirect CBR Tests	5
4.5	Water Purging	5
4.6	Surveying.....	5
5	LABORATORY WORK.....	6
5.1	Geotechnical Laboratory Testing of Soils.....	6
6	GROUND CONDITIONS	7
6.1	General Geology of the Area	7
6.2	Ground Types Encountered During Investigation of the Site	7
6.3	Groundwater.....	7
7	DISCUSSION.....	8
7.1	Proposed Construction.....	8
8	REFERENCES	9



APPENDICES

Appendix A	Site and Exploratory Hole Location Plans
Appendix B	Borehole Logs
Appendix C	Core Photographs
Appendix D	Trial Pit Logs
Appendix E	Trial Pit Photos
Appendix F	Indirect CBR Test Results
Appendix G	Water Purging Data & Logs
Appendix H	Geotechnical Soil Laboratory Test Results
Appendix I	Geotechnical Rock Core Laboratory Test Results
Appendix J	Environmental Laboratory Test Results
Appendix K	Pre & Post Site Condition Photographs



Document Control Sheet

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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	1 st 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):

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

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 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

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.

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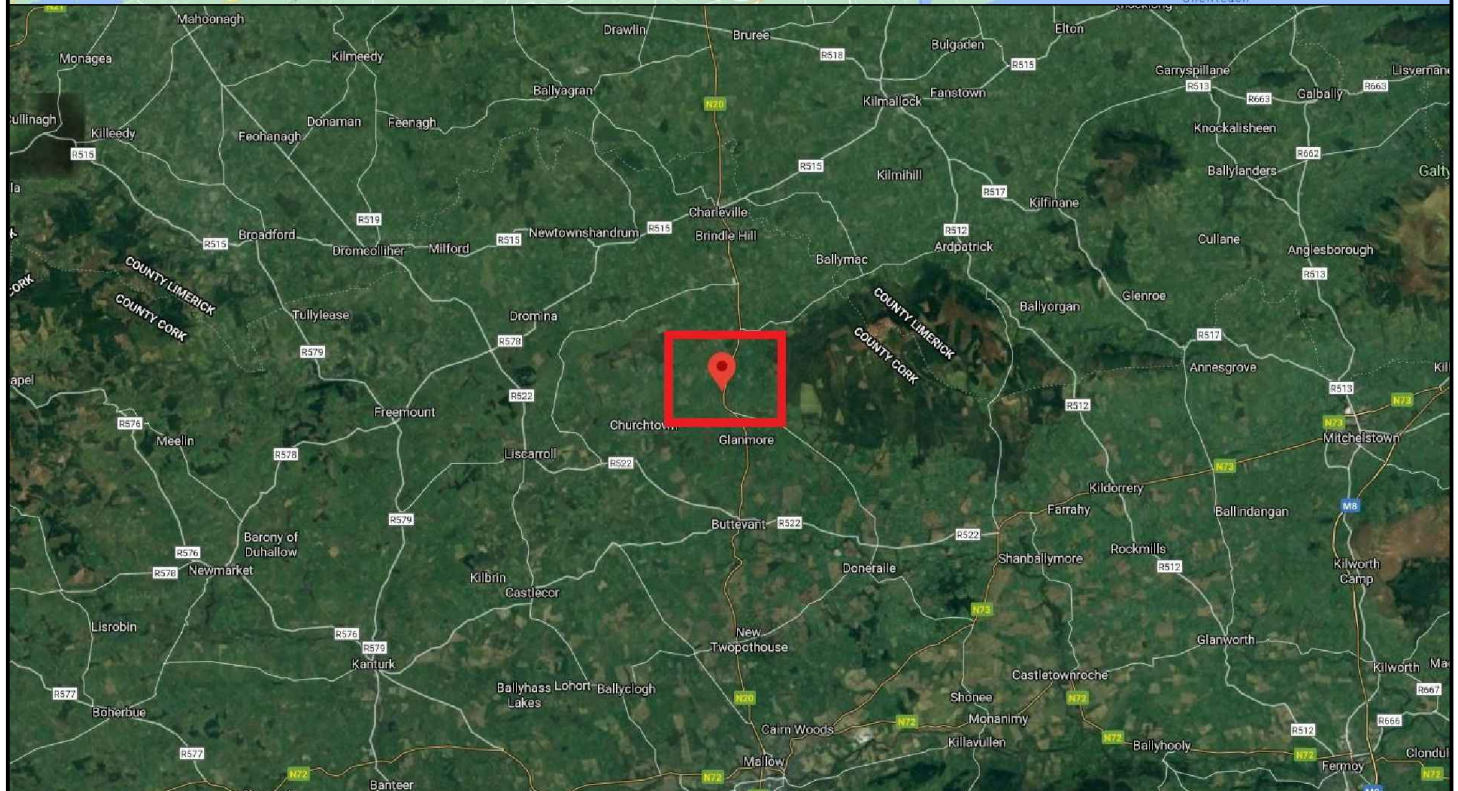
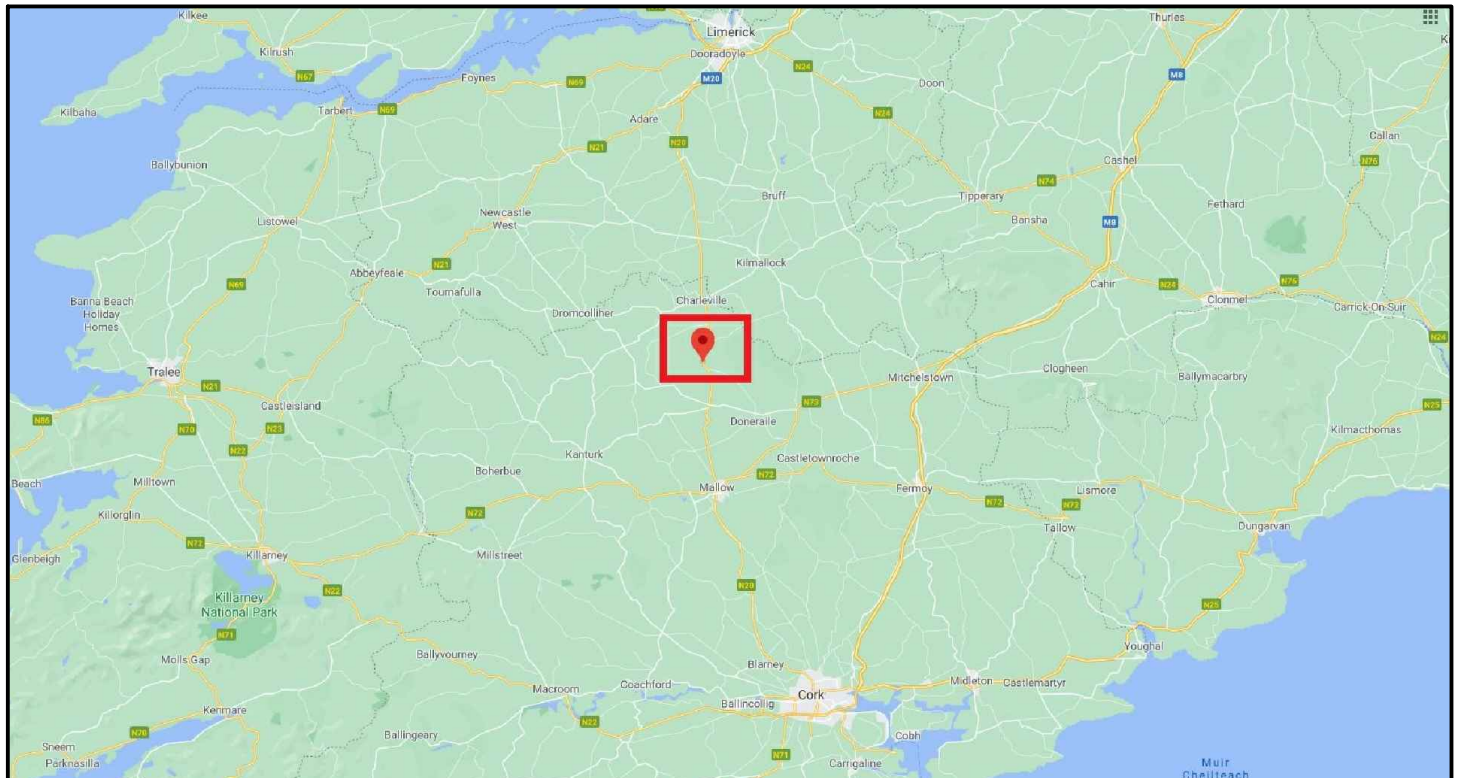
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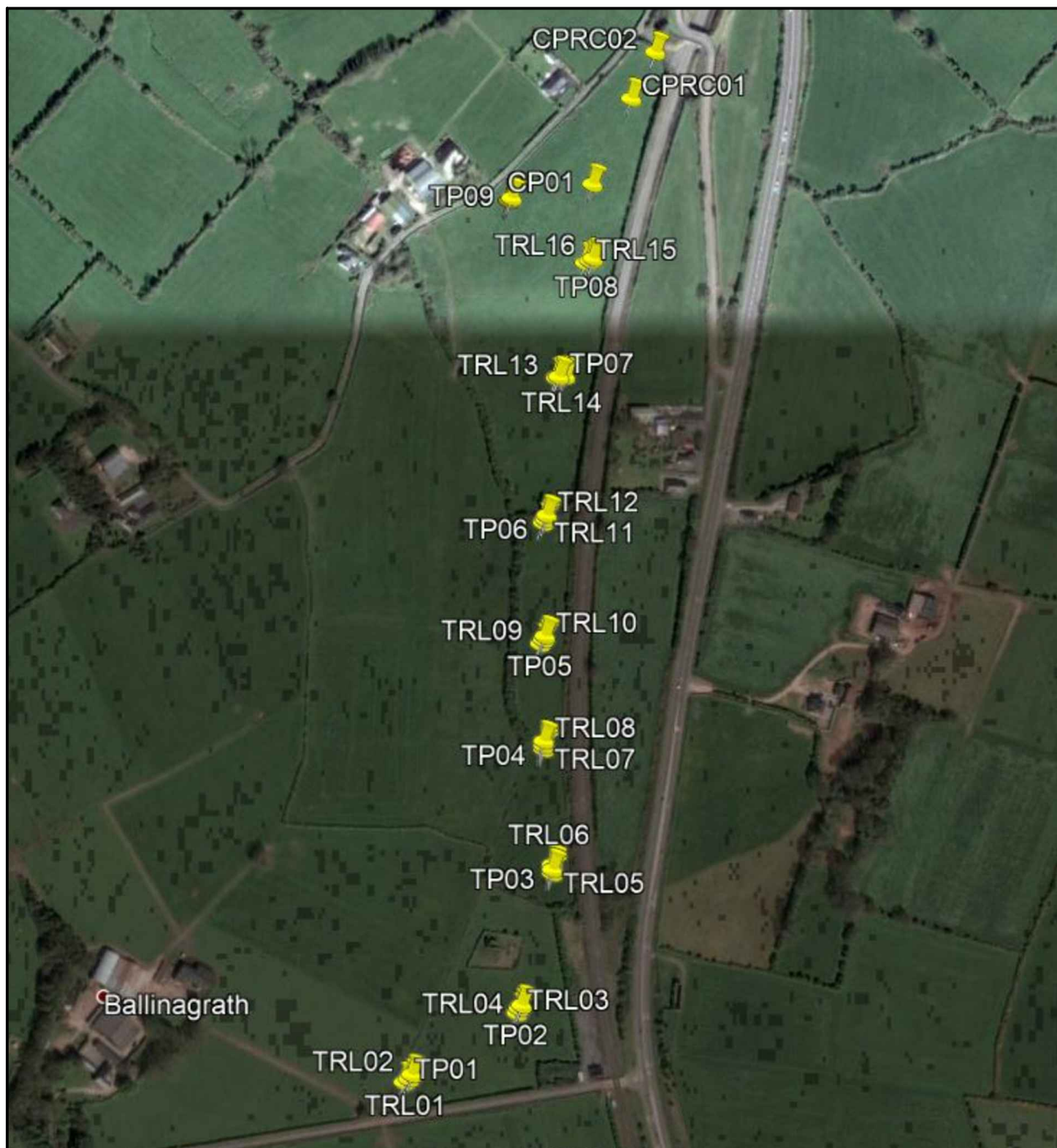
<https://rwsenvironment.eu/subjects/soil/legislation-and/soil-remediation/>

Appendix A Site and Exploratory Hole Location Plans



Iarnród Éireann Cork Line Level Crossings XC215 (19-135-4)

SITE LOCATION MAPS	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February/May-July 2020



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 615237.48 N		Client: Iarnród Éireann / Irish Rail Client's Representative: JACOBS		Sheet 1 of 1	
Method: Cable Percussion				Ground Level: 98.42 mOD		Dates: 29/05/2020 – 03/06/2020		Scale: 1:50	
Plant: Pilcon								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				98.22	0.20		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					(1.00)				
0.50	ES4									
1.20 - 2.00	B5			N=6 (1,1/2,1,2,1)	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					(0.80)				
1.20 - 1.65	SPT (C) N=6									
1.50	ES7				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	B8			N=17 (3,6/4,5,4,4)		(1.00)				
2.00 - 3.00	D9									
2.00 - 2.45	SPT (C) N=17									
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			N=20 (2,4/4,6,5,5)		(0.60)				
3.00 - 3.60	D12									
3.00 - 3.45	SPT (C) N=20				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			N=17 (3,3/2,4,4,7)		(0.90)				
3.60 - 4.50	D14									
4.00 - 4.45	SPT (C) N=17				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	B15			N=8 (1,1/1,3,2,2)		(1.50)				
4.50 - 5.50	D16									
5.00 - 5.45	SPT (C) N=8				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.		
5.50 - 6.00	B17			N=12 (1,1/2,3,3,4)		(1.60)				
5.50 - 6.50	D18									
6.00 - 6.80	B19			50 (25 for 0mm/50 for 0mm)	90.82	7.60		End of borehole at 7.600m		
6.00 - 6.80	D20			N=22 (2,4/3,5,7,7)						
6.00 - 6.45	SPT (C) N=12									
6.80 - 7.60	B21									
6.80 - 7.60	D22									
6.80 - 6.80	SPT (C)									
7.00 - 7.45	SPT (C) N=22									
7.60 - 7.60	SPT (C)									

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 615311.63 N		Client: Iarnród Éireann / Irish Rail Client's Representative: JACOBS		Sheet 1 of 2			
Method: Cable Percussion+Rotary Open+Rotary Coring				Plant: Pilcon+T44		Ground Level: 99.59 mOD		Dates: 28/05/2020 – 31/07/2020		Scale: 1:50 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							TOPSOIL			
0.30 - 1.20	B2				99.28	(0.30)					
0.30 - 1.20	D3					0.30		Dark brown sandy gravelly SILT. Gravel is fine to medium, subangular to subrounded. sand is fine to coarse.			0.5
0.50	ES4					(0.90)					1.0
1.20 - 2.00	B5			N=8 (2,1/2,3,1,2)	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.			1.5
1.20 - 2.00	D6					(0.80)					2.0
1.20 - 1.65	SPT (C)										2.5
1.50	N=8										3.0
2.00 - 3.00	ES7				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			3.5
2.00 - 3.00	D9			N=11 (3,2/2,3,4,2)		(1.00)					4.0
2.00 - 2.45	SPT (C)										4.5
	N=11										5.0
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.			5.5
3.00 - 4.00	B11			N=16 (1,1/4,4,4,4)		(1.00)					6.0
3.00 - 4.00	D12										6.5
3.00 - 3.45	SPT (C)										7.0
	N=16										7.5
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.			8.0
4.00 - 4.70	D14			N=14 (1,2/2,3,3,6)		(0.70)					8.5
4.00 - 4.45	SPT (C)										9.0
	N=14										9.5
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.			10.0
4.70 - 6.00	D16			N=9 (4,1/1,2,3,3)		(1.30)					
5.00 - 5.45	SPT (C)										
	N=9										
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			N=13 (2,2/3,3,2,5)		(0.50)					
6.00 - 6.45	SPT (C)				93.08	6.50		Rotary Open Hole Drilling. Drillers Description: Boulders with sand			
6.50 - 6.50	SPT (C)			50 (25 for 0mm/50 for 0mm)							
	N=38			N=38 (6,6/8,8,8,14)		(3.10)					
7.50 - 7.95	SPT (C)										
	N=38										
8.50 - 8.95	SPT (C)			N=49 (9,9/9,12,12,16)							
	N=49										
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			14	50 (25 for 0mm/50 for 0mm)		(1.08)		Distinctly weathered with brown, black and orange brown discolouration (iron oxide staining) penetrating up to 5mm from discontinuities and			
				TCR	SCR	RQD	FI	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)
						1.20	4.70				
						Casing Details		Chiselling Details			
						To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)	
						6.50	200	6.50	6.50	01:00	
						9.60	151				
Cable percussion terminated at 6.50m due to probable boulder obstruction. Rotary techniques employed thereafter.											



Project No.:

19-135

Coordinates:

553581.51 E

615311.63 N

Ground Level:

99.59 mOD

Project Name:

Cork Line Level Crossings

Client:	
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Iarnród Éireann / Irish Rail

Client's Representative:

JACOBS

Dates:

100

28/05/2020 - 31/07/2020

Borehole No.:	
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XC215-CPRC01

Sheet 2 of 2

Scale: 1:50

	AA
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Driller.	+NOB
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Logger: IH

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill	
11.10	100	55	8	NI		88.90	10.00		occasional orange brown speckling.			10.5 -
						88.88	10.08		Discontinuities: Very closely to closely spaced. 1.) Subhorizontal, planar, rough. 2.) Step to subvertical, planar, rough			11.0 -
	12.60	84	38	8	15			(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.		
							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. 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.	12.0 -		
14.10		54	42	17				(2.33)		Distinctly weathered with a little reddish brown slightly sandy slightly gravelly silty Clay infilling of discontinuities.		
							14.10		Discontinuities: Very closely to closely spaced with black iron oxide staining on surfaces.	13.0 -		
									End of borehole at 14.100m			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 -
	TCR	SCR	RQD	FI								

Remarks

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
1.20	4.70				
Casing Details		Chiselling Details			
To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)	
6.50	200	6.50	6.50	01:00	
9.60	151				

Cable percussion terminated at 6.50m due to probable boulder obstruction. Rotary techniques employed thereafter.



Project No.:

19-135

Coordinates:

553601.76 F

1

615349.74 N

Ground Level

100.21 mOD

Project Name:

Cork Line Level Crossings

Client:	
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Iarnród Éireann / Irish Rail

Client's Representative:

JACOBS

Dates:[illegible]

27/05/2020 - 30/07/2020

Borehole No.:	
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XC215-CPRC02

Sheet 1 of 1

Scale: 1:50

Driller:	AA +NOB
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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					(0.90)				
0.50	ES18									
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					(0.80)				
1.20 - 1.65	SPT (C) N=7			N=7 (2,1/2,1,2,2)						
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					(1.00)				
2.00 - 2.45	SPT (C) N=46			N=46 (10,13/11,11,13,11)						
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					(0.50)				
3.00 - 3.50	D8				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.		
3.00 - 3.45	SPT (C) N=16			N=16 (4,7/6,4,3,3)						
3.50 - 4.20	B9					(0.70)				
3.50 - 4.20	D10				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.		
4.00 - 4.45	SPT (C) N=15			N=15 (1,1/2,1,3,9)						
4.20 - 5.00	B11									
4.20 - 5.00	D12									
5.00 - 6.00	B13					(2.40)		Medium Strong to Strong, pale yellow / grey, medium grained SANDSTONE.		
5.00 - 6.00	D14									
5.00 - 5.45	SPT (C) N=19			N=19 (3,4/4,4,6,5)						
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		Distinctly weathered with pervasive light brown clay staining and infill of discontinuities. Much black and orange / brown oxide staining on discontinuity surfaces.		
	60	30	17	NI		(1.50)		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

Remarks	Borehole collapsed from 8.10m with 0% core recovery. Had to move off location due to safety concerns.
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Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
1.20	4.20				
Casing Details		Chiselling Details			
To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)	
6.20	200	6.20	6.20	01:30	
6.60	151				

Cable Percussion terminated at 6.20m due to probable boulder obstruction. Rotary Techniques employed thereafter.

Appendix C Rock Core Photographs

Job Name: IARNÓD ÉIREANN
CORK LINE
Job No.: 19-135
BH: XC215-CP/RC01

Depth: 9.6 to 11.1 m
Box: 1 of 3
Date: 18/8/20
Depth To: 14.1 m



Job Name: IARNÓD ÉIREANN
CORK LINE
Job No.: 19-135
BH: XC215-CP/RC01

Depth: 11.1 to 12.6 m
Box: 2 of 3
Date: 18/8/20
Depth To: 14.1 m



Job Name: IARNÓD ÉIREANN
CORK LINE
Job No.: 19-135
BH: XC215-CP/RC01

Depth: 12.6 to 14.1 m
Box: 3 of 3
Date: 18/8/20
Depth To: 14.1 m



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

Job Name: IR-CORK
LINE

Job No.: 19-135
XC215

BH: CPRC02

Depth: 6.6 - 8.1m

Box: 1 of 1

Date: 07/8/20

Depth To: 8.1m



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 614488.00 N		Client: Iarnród Éireann / Irish Rail Client's Representative: JACOBS		Sheet 1 of 1	
Method: Excavation		Plant: Kobelco SK140SRu		Ground Level: 90.51 mOD		Date: 18/02/2020	
						Scale: 1:20	
						Driver: TS	
						Logger: MN	

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1	HVP=38, HVR=16	90.16	(0.35)		TOPSOIL: Soft greyish brown slightly gravelly sandy silty CLAY with frequent rootlets, moist.	0.5
0.35 - 0.80	B2			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			(0.45)		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.	
0.35 - 0.80	D4						
0.50	ES5						
0.50							
1.00	ES6	Rapid Inflow - Rose to 1.35m	89.71	0.80			1.0
1.10 - 1.60	B7			(1.40)			
1.10 - 1.60	D8						
			88.31	2.20			1.5
						End of trial pit at 2.200m	2.0
							2.5
							3.0
							3.5


Remarks	Water Strikes:		Stability: Sides collapsing
	Struck at (m):	Remarks:	
	1.55	Rapid Inflow - Rose to 1.35m	Width: 1.90 Length: 4.80










Trial Pit terminated at 2.20m due to pit walls collapsing.

		Project No.: 19-135		Project Name: Cork Line Level Crossings		Trial Pit No.: XC215-TP02	
		Co-ordinates: 554817.30 E 617963.85 N		Client: Iarnród Éireann / Irish Rail Client's Representative: JACOBS		Sheet 1 of 1	
Method: Excavation		Ground Level: 97.95 mOD		Date: 18/02/2020		Scale: 1:20	
Plant: Kobelco SK140SRu						Driver: TS	
						Logger: MN	

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.00	ES1	HVP=48, HVR=65	97.70	(0.25)		TOPSOIL: Soft greyish brown slightly gravelly sandy silty CLAY with frequent rootlets, moist.	0.5
0.30 - 0.80	B3			0.25		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			97.15	0.80		End of trial pit at 0.800m	
							1.0
							1.5
							2.0
							2.5
							3.0
							3.5


Remarks Permission to excavate further / alternate trial pit in the area was refused. Terminated due to possible archaeological feature.	Water Strikes:		Stability: Good
	Struck at (m):	Remarks:	
			None Encountered



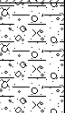

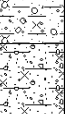
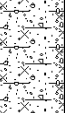
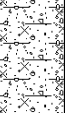
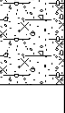
		Project No.: 19-135		Project Name: Cork Line Level Crossings		Trial Pit No.: XC215-TP03	
		Co-ordinates: 553507.73 E 614663.96 N		Client: Iarnród Éireann / Irish Rail Client's Representative: JACOBS		Sheet 1 of 1	
Method: Excavation		Ground Level: 92.40 mOD		Date: 19/02/2020		Scale: 1:20	
Plant: Kobelco SK140SRu						Driver: TS	
						Logger: MN	

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1	Water inflow from field drain. - No rise HVP=57, HVR=20	92.14	(0.25)		TOPSOIL: Soft dark brown slightly sandy silty CLAY with occasional gravel and frequent rootlets, moist.	▼
0.25 - 0.50	B2			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.	
0.25 - 0.50	D3			(0.25)		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			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	Rapid Inflow - No rise	91.90	(0.60)		Soft reddish brown sandy gravelly silty CLAY with medium cobble and low boulder content, wet.	▼
0.50 - 1.00	D6			1.10		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.	
0.70	ES7			(0.20)			
1.00	B8			1.30			
1.30 - 1.80	D9		91.10	(0.70)			
1.30 - 1.80			90.40	2.00		End of trial pit at 2.000m	

Remarks	Water Strikes:		Stability: Sides collapsing
	Struck at (m):	Remarks:	
	0.60	Water inflow from field drain. - No rise	Width: 1.80 Length: 3.70
	1.30	Rapid Inflow - No rise	


Trial Pit terminated at 2.00m due to pit walls collapsing.


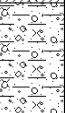

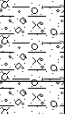

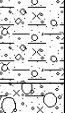

		Project No.: 19-135		Project Name: Cork Line Level Crossings		Trial Pit No.: XC215-TP04	
		Co-ordinates: 553501.42 E 614767.21 N		Client: Iarnród Éireann / Irish Rail Client's Representative: JACOBS		Sheet 1 of 1	
Method: Excavation		Ground Level: 93.90 mOD		Date: 19/02/2020		Scale: 1:20	
Plant: Kobelco SK140SRu						Driver: TS	
						Logger: MN	

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1	HVP=68, HVR=24	93.60	(0.30)		TOPSOIL: Soft greyish brown slightly sandy to sandy silty CLAY with frequent rootlets, moist.	
0.30 - 0.70 0.30 - 0.70	B2 D3			0.30		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 0.50	ES4			(0.40)		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.	
0.70 - 1.00 0.70 - 1.00	B5 D6			0.70			
1.00 1.00 - 1.50 1.00 - 1.50	ES7 B8 D9	Rapid inflow - Rose to 0.90m.	92.90	1.00		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.	1.0
				(1.00)			1.5
			91.90	2.00		End of trial pit at 2.000m	2.0
							2.5
							3.0
							3.5

Remarks	Water Strikes:		Stability: Sides collapsing
	Struck at (m):	Remarks:	
		1.00	Rapid inflow - Rose to 0.90m.


Trial Pit terminated at 2.00m due to pit walls collapsing.


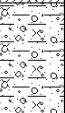

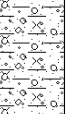






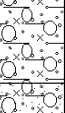

		Project No.: 19-135		Project Name: Cork Line Level Crossings		Trial Pit No.: XC215-TP05	
		Co-ordinates: 553501.82 E 614855.46 N		Client: Iarnród Éireann / Irish Rail Client's Representative: JACOBS		Sheet 1 of 1	
Method: Excavation		Plant: Kobelco SK140SRu		Ground Level: 95.04 mOD		Date: 19/02/2020	
						Scale: 1:20	
						Driver: TS	
						Logger: MN	

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1	HVP=73, HVR=25	94.74	(0.30)		TOPSOIL: Soft greyish brown slightly sandy silty CLAY with frequent rootlets, moist.	
0.40	ES2 B3 D4			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 rounded. Cobbles are angular to rounded.	
0.50 0.50 - 1.00 0.50 - 1.00				(0.80)			
1.00	ES5	HVP=25, HVR=12	93.94	1.10		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 - 1.60 1.10 - 1.60 1.10	B6 D7			(0.60)			
1.70 - 2.20 1.70 - 2.20	B8 D9			1.70		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.	
		Rapid inflow - Rose to 1.7m.	93.34	(0.50)			
			92.84	2.20		End of trial pit at 2.200m	

Remarks	Water Strikes:		Stability: Sides collapsing below 1.7m Width: 0.80 Length: 3.60
	Struck at (m):	Remarks:	
	1.80	Rapid inflow - Rose to 1.7m.	


Trial Pit terminated at 2.20m due to pit walls collapsing.












		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 Client's Representative: JACOBS		Sheet 1 of 1	
Method: Excavation		Ground Level: 95.74 mOD		Date: 19/02/2020		Scale: 1:20	
Plant: Kobelco SK140SRu						Driver: TS	
						Logger: MN	

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1	HVP=60, HVR=24	95.44	(0.30)		TOPSOIL: Soft greyish brown slightly sandy silty CLAY with frequent rootlets, moist.	
0.40	ES2 B3 D4			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				(1.10)			
1.00	ES5	Rapid inflow - Rose to 1.4m	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.	 1.5  2.0  2.5  3.0  3.5
1.50 - 2.00 1.50 - 2.00	B6 D7			(0.30)			
				94.04	1.70		
			93.64	2.10		End of trial pit at 2.100m	

Remarks	Water Strikes:		Stability: Sides collapsing below 1.4m
	Struck at (m):	Remarks:	
	1.70	Rapid inflow - Rose to 1.4m	Width: 0.90 Length: 3.30


Trial Pit terminated at 2.10m due to pit walls collapsing.



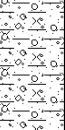
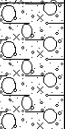
		Project No.: 19-135		Project Name: Cork Line Level Crossings		Trial Pit No.: XC215-TP07	
		Co-ordinates: 553516.77 E 615075.58 N		Client: Iarnród Éireann / Irish Rail Client's Representative: JACOBS		Sheet 1 of 1	
Method: Excavation		Ground Level: 96.29 mOD		Date: 19/02/2020		Scale: 1:20	
Plant: Kobelco SK140SRu						Driver: TS	
						Logger: MN	

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	
0.05	ES1	HVP=53, HVR=21	96.04	(0.25)		TOPSOIL: Soft greyish brown slightly sandy silty CLAY with frequent rootlets, moist.		
0.40 - 0.80	B2			(0.15)		Firm light brown mottled orange brown slightly sandy silty CLAY with occasional rootlets, moist.		
0.40 - 0.80	D3			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.		
0.50	ES4			(0.40)		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	B5	Rapid inflow - No rise	95.49	0.80				
0.90 - 1.40	D6			(0.80)				
1.00	ES7			1.60				
1.60 - 2.10	B8			(0.50)				
1.60 - 2.10	D9		94.69	2.10		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.		
2.10 - 2.40	B10		94.19	(0.30)		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.		
2.10 - 2.40	D11			93.89	2.40			
						End of trial pit at 2.400m		


Remarks	Water Strikes:		Stability: Sides collapsing
	Struck at (m):	Remarks:	
		1.30	Rapid inflow - No rise






Trial Pit terminated at 2.40m due to pit walls collapsing.

			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 Client's Representative: JACOBS		Sheet 1 of 1 Scale: 1:20 Driver: TS Logger: MN	
Method: Excavation			Ground Level: 97.83 mOD		Date: 18/02/2020			
Plant: Kobelco SK140SRu								

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	
0.05	ES1	HVP=41, HVR=18	97.48	(0.35)		TOPSOIL: Soft dark brown sandy silty CLAY with frequent rootlets, moist.		0.5
0.50	ES2 B3 D4			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 - 1.00				(1.00)				
0.50 - 1.00								
0.60	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.		1.5
0.75				(0.45)				
1.00	B6 D7		96.03	1.80		End of trial pit at 1.800m		2.0
1.40 - 1.80								
1.40 - 1.80								2.5
								3.0
								3.5

Remarks Instructed by clients engineer to terminate TP at 1.80m to minimise impact to farmer.	Water Strikes:		Stability: Sides collapsing Width: 1.90 Length: 4.90
	Struck at (m):	Remarks:	
	1.35	Rapid inflow - No rise	

		Project No.: 19-135		Project Name: Cork Line Level Crossings		Trial Pit No.: XC215-TP09	
		Co-ordinates: 553478.44 E 615226.62 N		Client: Iarnród Éireann / Irish Rail Client's Representative: JACOBS		Sheet 1 of 1	
Method: Excavation		Ground Level: 96.75 mOD		Date: 18/02/2020		Scale: 1:20	
Plant: Kobelco SK140SRu						Driver: TS	
						Logger: MN	

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	
0.05	ES1	Rapid inflow - Rose to 0.5m	96.40	(0.35)		TOPSOIL: Soft dark brown slightly gravelly sandy silty CLAY with frequent rootlets, moist.		0.5
0.35 - 0.60	B2			0.35		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.		
0.35 - 0.60	D3			(0.25)		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	ES4			0.60				
0.60 - 1.10	B5			(0.50)				
0.60 - 1.10	D6	96.15	1.10		End of trial pit at 1.100m		1.0	
1.00	ES7		95.65					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:		Stability: Sides collapsing Width: 1.80 Length: 4.60
	Struck at (m):	Remarks:	
	0.75	Rapid inflow - Rose to 0.5m	

Appendix E

Trial Pit Photographs



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



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.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



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



Iarnród Éireann
Cork Line Level Crossings
XC215 (19-135-4)

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