











Cork Line Level Crossings – XC212 Ground Investigation

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Document Control Sheet

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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 The amendments revised the Standard to remove text superseded by BS EN ISO 14688-1:2002, BS EN ISO 14688-2:2004 and EN ISO 14689-1:2003 and refers to the relevant standard for each affected subclause.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						
Р	Nominal 100mm diameter undisturbed piston sample						
В	3ulk 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 kPaV: undisturbed vane shear strengthVR: remoulded vane shear strength						
<u>dd/mm/yy: 1.0</u> dd/mm/yy: dry	Date & water level at the borehole depth at the end of shift and the start of the following shift						
Abbreviations relati	ng to rock core – reference Clause 44.4.4 of BS 5930: 1999						
TCR (%)	Total Core Recovery: Ratio of rock/soil core recovered (both solid and non-intact) to the total length of core run.						
SCR (%)	Solid Core Recovery: Ratio of solid core to the total length of core run. Solid core has a full diameter, uninterrupted by natural discontinuities, but not necessarily a full circumference and is measured along the core axis between natural fractures.						
RQD (%)	Rock Quality Designation: Ratio of total length of solid core pieces greater than 100mm to the total length of core run.						
FI	Fracture Index: Number of natural discontinuities per metre over an indicated length of core of similar intensity of fracturing.						
NI	Non-Intact: Used where the rock material was recovered fragmented, for example as fine to coarse gravel size particles.						
AZCL	Assessed zone of core loss: The estimated depth range where core was not recovered.						
DIF	Drilling induced fracture: A fracture of non-geological origin brought about by the rock coring.						



Cork Line Level Crossings – XC212

1 AUTHORITY

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

This report details the work carried out both on site at XC212 and in the geotechnical and chemical testing laboratories; it contains a description of the site and the works undertaken, the exploratory hole logs and the in-situ and laboratory test results.

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

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

2 SCOPE

The extent of the investigation, as instructed by the JACOBS, included a borehole, installation of a standpipe, water purging, soil sampling, in-situ and laboratory testing, and the preparation of a factual report on the findings.



3 DESCRIPTION OF SITE

As shown on the site location plan in Appendix A, level crossing XC212 is located in Ballycoskery townland, Ballyhea, 0.25km east of the N20 road along L1533 local road, at grid reference ITM 554645.45, 617660.28. The level crossing is currently manned with a cabin located on the east side of the crossing and north of the L1533 road. An abandoned two-storey house, with an associated concrete-surfaced parking area and shed to the east, is located on the east side of the crossing along the south side of the L1533 road. Beechwood housing estate and Ballyhea Primary School are located north of the L1533 road on the west and east of the railway crossing, respectively.

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

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

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

4 SITE OPERATIONS

Site operations, which were conducted between 2nd February 2020 and 28th June 2020, included:

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

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



4.1 Borehole by Combined Cable Percussion and Rotary Follow-On Drilling

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

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

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

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

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

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

No rock core recovered.

Appendix B presents the borehole logs.

4.2 Standpipe Installations

A groundwater monitoring standpipe was installed in CPRC01 borehole.

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

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

4.3 Water Purging

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

Appendix C presents the water purging data log.



4.4 Surveying

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

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

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

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

5 LABORATORY WORK

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

5.1 Geotechnical Laboratory Testing of Soils

Laboratory testing of soils comprised:

- **soil classification:** moisture content measurement, Atterberg Limit tests, particle size distribution analysis and a 300m large shear box test.
- **soil chemistry:** pH, organic matter, Chloride content, Sulphur content and water-soluble and total sulphate content

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

The test results are presented in Appendix D.



5.2 Environmental Laboratory Testing of Soils

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

6 **GROUND CONDITIONS**

6.1 General Geology of the Area

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

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

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

6.2 Ground Types Encountered During Investigation of the Site

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

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

6.3 Groundwater

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



Data	Depth to standing water level (m)
Date	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

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

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

7 DISCUSSION

7.1 Proposed Construction

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

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



8 **REFERENCES**

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

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

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

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

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

Appendix A Site and Exploratory Hole Location Plans





Appendix B Borehole Logs

					Project	t No.:	Project Name:		Borehole No.				
		\bigwedge)	19-135		Cork Li	ine Level Crossings	X	C21	2-CF	PRC)1
	ha				Coordi	nates:	Client:						
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Mathadi					55465	3.01 E	Client'		Scale: 1.EO		_		
Cable Porcuss	ion Pota	nv ()	non	61		2.69 N	Client		50	ale	• 1		
	IUIITROLA	Ty O	pen				JACOR	5	D	rille	e r: [])S+A	Aر.
Plant:					Groun	d Level:	Dates:				+		3
Pilcon+144		- 1			97.8	1 mOD		02/03/2020 - 28/06/2020		gge	er: I\	/IN	
Depth (m)	Sample /	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m)	Legend	Description	Nater	Ba	ackfil	1	
0.05	ES1	(,			(-		MADE GROUND: Dark brown fill material.	f	•*.			_
						(0.50)						,* °	-
0.50	ES4				97.31	0.50			_			0.5	_
0.50 - 1.50	B2							and occasional grey slightly sandy to sandy grey slightly sandy to sandy gravelly slightly cLAY with low to medium cobble content and		•		•	
0.50 - 1.50	D3							occasional vegetation fragments, moist. Sand is fine to coarse. Gravel is				, ,*	
1.00	ES5					(1.00)		fine to coarse, angular to subangular.				• 1.0	-
1.20 - 1.65	SPT (C)			N=7 (1,1/1,2,2,2)								•	
1.50 - 2.50	B6				96.31	1.50		MADE COOLIND: Soft to firm light brown conductrough, city CLAV with	-			1.5	_
1.50 - 2.50	D7							made GROUND: soft to firm light brown sandy gravely slity CLAY with medium cobble content, moist. Sand is fine to coarse. Gravel is fine to				•	-
	(-)							coarse, angular to subrounded. Cobbles are predominantly subangular				, .*	
2.00 - 2.45	SPT (C)			N=12 (1,2/2,3,4,3)		(1.00)		limestone.				2.0	-
	12					Ē				<u>-</u>	1	•	-
2.50 - 3.00	B8				95.31	2.50				<u>z</u>		° 2.5	_
2.50 - 3.00	D9				0	(0.30)		brownish grey slightly sandy slightly gravelly silty CLAY with low cobble				*	
2.00	F642				95.01	2.80 (0.20)		content including one concrete block and occasional black organic				•	
3.00	ES12 B10				94.81	- 3.00		material, moist. One cloth fragment. Organic odour. Sand is fine to coarse.	//			3.0	-
3.00 - 3.30	D11					(0.50)		As above. Dark olive grey with a trace of glass, slate and glazed stoneware	/	Ŷ			
3.30 - 3.50	B13				94.31	3.50		fragments.	-	<u>-</u>		3.5	_
3.30 - 3.50	D14	3 50	3 30	02-03-2020		(0.50)	<u>x~_</u>	Possible MADE GROUND / DISTURBED NATIVE MATERIAL: Soft olive grey to				*	-
3.60 - 4.00	B15	5.50	5.50	02 03 2020		(0.50)	<u>~~~~</u> ~~	odour. Trace of possible red brick fragment, one possible mortar fragment.	/			•	
3.60 - 4.00	D16			- /- / /-	93.81	- 4.00	<u>~~~</u> .	Sand is fine to coarse. Gravel is fine to coarse, angular to subangular.	11			. 4.0	-
3.60 - 4.05	SPT (C)			0 (0 for 450mm/0 for 0mm)				Very soft vellowish brown slightly sandy gravely sitty CLAY with low cobble	/			*	
		3.50	2.60	03-03-2020		(1.00)		content, wet. Sand is fine to coarse. Gravel is fine to coarse, angular to	/	Ŷ		° 4.5	_
4.00 - 5.00	B17						<u>x </u>	subangular. Cobbles are angular to subangular including much limestone.		•			
4.00 - 5.00	D18 SPT (C)			N=14 (3 2/2 4 4 4)			<u>x</u>	- Firm yellowish brown slightly sandy gravely slity CLAY with medium cobble				•	-
4.00 4.45	N=14			N-1+ (3,2/2,-,-,-,-)	92.81	5.00	x	subangular. Cobbles are mostly subangular, predominantly limestone.	/			* 5.0	-
5.00 - 6.00	B19						<u>~~~</u> ~	Stiff yellowish brown slightly sandy gravelly silty CLAY with medium cobble				,*	-
5.00 - 6.00	D20			N-25 (1 2/3 6 8 8)		(1.00)	$\frac{1}{2}$ $\frac{1}{2}$	content, wet. Sand is fine to coarse. Gravel is fine to coarse, angular to				\$ 5.5	-
5.00 5.45	N=25			N=23 (1,2/3,0,0,0)				subangular. Coopies are mostly subangular, predominantly intestone.		°			
							×						
6.00 - 7.00	D22				91.81	- 6.00	<u>x</u>	Stiff greyish brown slightly sandy gravelly silty CLAY with medium cobble	1			° 6.0	-
6.00 - 6.45	SPT (C)			N=26 (1,1/5,6,7,8)		-	<u>x ^ 0</u>	content, wet. Sand is fine to coarse. Gravel is fine to coarse, angular to				•	-
	N=26					(1.00)	<u>~~~~</u> ~~					° 6.5	_
							<u>x x o</u>					•	-
7.00 7.15	022				00.81	7.00	$\sim \times$						-
7.00 - 7.15	D24				90.81	(0.30)	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Firm greyish brown slightly sandy gravelly silty CLAY with medium cobble		•		* 7.0	-
7.00 - 7.45	SPT (C)			N=12 (0,1/2,2,4,4)	90.51	7.30	×	content, wet. Sand is fine to coarse. Gravel is fine to coarse, angular to	∦⊭	2		, ,*	-
7 20 . 9 00	N=12					E	م × مح و	Greyish brown slightly silty very sandy GRAVEL with low cobble content,			H	, 7.5	-
7.30 - 8.00	D26					(0.70)	• × • • • × (wet. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded.			H	•	
	-			(Water strike at	00.01		• ×: • • × §	CODDIES are angular to subrounded, sandstone, siltstone, limestone,	<u> </u>	z • • .	H.	,* • • • • •	-
				7.3m. Water rose to	89.81	8.00	• × • • • × •	Medium Dense greyish brown slightly silty very sandy GRAVEL with	1		٦.	*	-
				Gravel blowback to		(0.80)	a X o aX o	medium cobble content, wet. Sand is fine to coarse. Gravel is fine to			Ц.	•	-
				6.4m.)		(0.00)	9 0 0 X 0	coarse, angular to subrounded. Cobbles are mostly sandstone and limestone.			H	8.5	-
8.00 - 8.80	B27				80.01	0 00	** × *				T.		-
8.00 - 8.45	SPT (C)			N=12 (0,1/2,2,4,4)	09.01	0.00	م کی فر م× مح و	Dense greyish brown slightly silty very sandy GRAVEL with medium cobble			T.	· •	_
	N=12	8.00	3.10	04-03-2020		(0.70)	• X • • • × 8	content, wet. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles are mostly sandstone and limestone			H.	* 9.0 ·	-
8 80 . 0.00	820	8.20	3.50	03-03-2020		È, '	• × • • • • •				F.	*	-
8.80 - 9.00	D30				88.31	9.50		Open Hole Boring - Driller Described	-		Ц.	* 9.5	-
9.00 - 9.40	B31						0.0	Sandy GRAVEL with boulders.			H.		-
9.00 - 9.40	D32			N-47		E	0,0				٩.	. 10.0	_
9.00 - 9.45	N=47			(15.18/9.14.12.12)		E	Q O					*	-
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Image Image <th< th=""><th>Depth</th><th>Sample</th><th>/ Casing</th><th>Water</th><th></th><th>97.8</th><th>Depth (m)</th><th></th><th>02/03/2020 - 28/06/2020</th><th>b</th><th>5501</th><th></th></th<>	Depth	Sample	/ Casing	Water		97.8	Depth (m)		02/03/2020 - 28/06/2020	b	5501	
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30.00 - 10.45 PF (C) N-41 N-41 (3.7/2.1.2.8.9) 85.32 12.50 10.00			9.40	2.90	0mm) 04-03-2020			000				
13.00 - 13.45 ST (C) N=47 N=48 N=49	10.00 - 10.45	SPT (C)			N=41 (3,7/12,12,8,9)		-	0.0				11.0 -
13.00 - 13.45 SVT (C) N-47 B5.31 12.50 Deam Hole Boning-Diller Described: Image: Diller Described: Image: Dill		11-41					(3.00)	000				
12.00 - 12.45 ST (C) Ne47 12.50							(5100)	000				* 11.5 -
13.00 - 13.45 SPT [c] N=67 N=67 N=67 N=67 15.01 12.50 Image: Spin [c] N=67								000				,
13.00 - 13.45 SPT (C) N-67 (13,713,14,9,11) 85.31 12.50 Open Hole Boring - Driller Described: Souder CAN Image: Control open Hole Boring - Driller Described: Souder CAN Image: Control open Hole Boring - Driller Described: Souder CAN Image: Control open Hole Boring - Driller Described: Souder CAN Image: Control open Hole Boring - Driller Described: Souder CAN Image: Control open Hole Boring - Driller Described: Souder CAN Image: Control open Hole Boring - Driller Described: Souder CAN Image: Control open Hole Boring - Driller Described: Souder CAN Image: Control open Hole Boring - Driller Described: Souder CAN Image: Control open Hole Boring - Driller Described: Souder CAN Image: Control open Hole Boring - Driller Described: Souder CAN Image: Control open Hole Boring - Driller Described: Souder CAN Image: Control open Hole Boring - Driller Described: Souder CAN Image: Control open Hole Boring - Driller Described: Souder CAN Image: Control open Hole Boring - Driller Described: Souder CAN Image: Control open Hole Boring - Driller Described: Souder CAN Image: Control open Hole Boring - Driller Described: Souder CAN Image: Control open Hole Boring - Driller Described: Souder CAN Image: Control open Hole Boring - Driller Described: Souder CAN Image: Control open Hole Boring - Driller Described: Souder CAN Image: Control open Hole Boring - Driller Described: Souder CAN Image: Control open Hole Boring - Driller Described: Souder CAN Image: Control open Hole Boring - Driller Described: Souder CAN Image: Control open Hole Boring - Driller Described: Souder CAN Ima								000				12.0
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13.00 - 13.45 SPT (C) N=57 (1.50)<						85.31	12.50	-0-0-	Open Hole Boring - Driller Described: Boulder CLAY			12.5
Loor Loo N+47 (57/13.14,9,11) a (1.50) a <	12.00 - 12.45	SPT (C)			N-47							13.0
15.00 - 16.45 SPT (C) N=49 12.00 15.00 16.00 16.00 15.00 16.00	13.00 - 13.43	N=47			(3,7/13,14,9,11)		(1 50)		-			
15.00 - 16.45 SPT (C) N=49 N=49 N=49 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td>(1.50)</td><td></td><td></td><td></td><td></td><td>13.5</td></t<>							(1.50)					13.5
16.00 - 16.45 SPT (C) N=49									-			-
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16.00 - 16.45 SPT (C) N-49 82.31 15.50 <								$\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$	Open Hole Boring - Driller Described: Sandy BOULDERS			-
16 00 - 10.45 SFT (C) N-49 82.31 15.50 <								000				14.5 —
16.00 - 16.45 SPT (C) N=49 N=49 15.50 Open Hole Boring - Driller Described: Copen SAND with boulders Image: Copen Hole Boring - Driller Described: Copen SAND with boulders Image: Copen Hole Boring - Driller Described: Copen SAND with boulders Image: Copen Hole Boring - Driller Described: Copen Hole Boring - Driller Described: Copen SAND with boulders Image: Copen Hole Boring - Driller Described: Copen SAND with boulders Image: Copen Hole Boring - Driller Described: Copen SAND with boulders Image: Copen Hole Boring - Driller Described: Copen Hole Boring - Driller Described: Copen SAND Image: Copen Hole Bo							(1.50)	000				-
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16.00 - 16.45 SPT (C) N -49 (2,5/8,12,13,16) 82.31 15.50 O Open Hole Boring - Driller Described: Clayey SAND with boulders Image: Clayer Sand Sand Sand Sand Sand Sand Sand Sand								၀ွိ၀ွိ	-			
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19.00 - 19.45 SPT (C) N=56 (3.49),13,15,19) 77.81 20.00 Open Hole Boring - Driller Described: 18.50 18.50 20.00 - 20.45 SPT (C) N=52 (5.8),910,15,18) 77.81 20.00 End of borehole at 20.000m 18.50 Water Added Water Strike - General Tom (m) Tom (m) true at at fm Cauge to The tom (m) Tom (m) true at at fm Cauge to The tom (m) Tom (m) true to the tom (m) Tom		N=49			(2,5/8,12,13,16)			000	1			-
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19.00 - 19.45 SPT (C) N=56 N=56 (3,4/9,13,15,19) N=56 (3,4/9,13,15,19) 18.50 (1.50) Open Hole Boring - Driller Described: Cayey SAND Image: Comparison of the com								000				
19.00 - 19.45 SPT (C) N=56 N=56 (3,4/9,13,15,19) N=56 (3,4/9,13,15,19) 79.31 (1.50) 18.50 (1.50) Open Hole Boring - Driller Described: Clayey SAND Image: Clayer SAND 19.00 20.00 - 20.45 SPT (C) N=52 N=52 (6,8/9,10,15,18) N=52 (6,8/9,10,15,18) 77.81 20.00 End of borehole at 20.000m Image: Clayer SAND Water Added To borehole at 20.000m Remarks Cable Percussion terminated at 9.437m due to probable boulder obstruction. Rotary Open Hole techniques employed to 20.000m							-	000				18.0
19.00 - 19.45 SPT (C) N=56 N=56 (3,4/9,13,15,19) N=56 (3,4/9,13,15,19) 77.81 P 20.00 Caller Described: P <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>0,0</td> <td></td> <td></td> <td></td> <td>_</td>								0,0				_
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19.00 - 19.43 SPT (C) N=56 N=50 (3,4/9,13,15,19) N=50 (3,4/9,13,15,19) N=50 (1.50) Image: Constraint of the constraint of	10.00 10	CDT (~)			NEC							-
20.00 - 20.45 SPT (C) N=52 N=52 (6,8/9,10,15,18) 77.81 (6,8/9,10,15,18) 20.00 End of borehole at 20.000m Image: Construction of the construction	19.00 - 19.45	N=56			(3,4/9,13,15,19)			 				- 19.0
20.00 - 20.45 SPT (C) N=52 N=52 (6,8/9,10,15,18) 77.81 20.00 End of borehole at 20.000m Image: Constraint of the constraint o							(1.50)					195 -
20.00 - 20.45 SPT (C) N=52 N=52 (6,8/9,10,15,18) 77.81 20.00 End of borehole at 20.000m Image: Comparison of the comparison o												
20.00 20.00 10.01 10.01 10.00 End of borehole at 20.000m Image: Construction of borehole at 20.000m N=52 (6,8/9,10,15,18) Image: Construction of borehole at 20.000m Remarks Water Added Water Strike - General From (m) To (m) Struke at (m) Cosing to (m) Time (min)kose to (m) Cosing Details Cosing to (m) Time (min)kose to (m) Of (m) Diam (mm) From (m) To (m) Time (min)kose to (m) Of (m) Diam (mm) From (m) To (m) Time (min)kose to (m) Of (m) Diam (mm) From (m) To (m) Time (min)kose to (m) Of (m) Diam (mm) From (m) To (m) Time (min)kose to (m) Of (m) Diam (mm) From (m) To (m) Time (min)kose to (m) Of (m) Diam (mm) From (m) To (m) Time (min)kose to (m) Of (m) Diam (mm) From (m) To (m) Time (min)kose to (m) Of (m) Diam (mm) From (m) To (m) Time (min)kose to (m) Of (m) Diam (mm) From (m) To (m) Time (min)kose to (m) Of (m) Diam (mm) From (m) To (m) Time (min)kose to (m) Of	20 00 - 20 45	SPT (C)			N=52	77 81	20.00					20.0
Remarks	20.00 20.45	N=52			(6,8/9,10,15,18)	77.01	20.00		End of borehole at 20.000m			=
Image: Normal Section Image: Normal Sec												20.5
Remarks Water Aded Water Strike - General From (m) To (m) Struk at (m) Casing to (m) Struk at (m) Casing to (m) Struk at (m) Casing to (m) Struk at (m) Stru				-			-			+	<u> </u>	
From (m) To (m) Struck at (m) Casing to (m) Therm (m) Rose to (m) 2.50 <td< td=""><td>Remarks</td><td></td><td></td><td>1</td><td> </td><td> </td><td>1</td><td></td><td>Water Added Wate</td><td>r Strike</td><td>- Genera</td><td></td></td<>	Remarks			1			1		Water Added Wate	r Strike	- Genera	
Cable Percussion terminated at 9.437m due to probable boulder obstruction. Rotary Open Hole techniques employed to 20.00m. 8.00 8.00 20 6.60 Cable Percussion terminated at 9.437m due to probable boulder obstruction. Rotary Open Hole techniques employed to 20.00m. 0 7.10 7.30 00.30	-								From (m) To (m) Struck at (m) Cas 7.30 2.50	ng to (m) 7.10 2.50	Fime (min) 2 20	Rose to (m) 3.50 2.30
Cashing Section Constraining Decision C									Casing Details Ch	8.00	20 Details	6.60
Cable Percussion terminated at 9.437m due to probable boulder obstruction. Rotary Open Hole techniques employed to 20.00m.									To (m) Diam (mm) From (m) 9.40 200 7.10	To (n 7.30	n) Tim	ie (hh:mm) 00:30
	Cable Percussion	n terminate	ed at 9	.437n	n due to probable boul	der obstr	uction. Rotar	y Open H	ole techniques employed to 20.00m. 20.00 151 8.80 9.40	9.00 9.44	<u></u>	00:30 01:00

Appendix C

Water Purging Data & Log

Job Name: Job Nr:	I.E - Cork Line 19-135			h (m) r (m) r2 TWV (m3)	5 0.0505 0.00255025 0.040059327
BH ID:	XC212-CPRC01		Theoretical Well Volume	40.06	ltrs
Depth to Response Zone:	Top (mbgl)	Bottom (mbgl)	TWV x3	120.18	ltrs
	7.5	12.5			
Purge Start Time:	09:30			(mbgl)	
Purge Finish Time:	12:01		Depth to Water	4.05	
			Total Depth	6.85	
Depth to water after purging:		mbgl			
	Time Taken to fill 20ltr container(mins)	Flow Rate I/min		Date _	06/08/2020
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 Burged:	1	110	litras		
Total volume Purgeu.		110	intes		
	Temperature	₽H	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



BRE Test Suite B - Greenfield Site

Project:	Cork Line Level Crossings	Job No.:	19-135
Client:	OCB Geotechnical	Lab Ref. No.:	ST 93839
	Unit 1 Carrigogna	Date Received:	09/03/2020
	Midleton	Date Reported:	09/04/2020
	Co. Cork	Material:	Soil
Order No.:	2003-104	Date Tested:	07/04/2020
Originator:	Ian Holley	Specification:	Client
Sample Details	XC212-CPRC01 T	ype D Sample 7	
Supplier:	Client Info	Date of Sampling:	Client Info.
Source:	Client Info	Sampled By:	Client
Sample Locatio	n: 1.5-2.5m	Sampling Reason:	Request

Parameter	RESULT
рН	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





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

Site:	Cork Line Leve	el Crossings		Job No.:	19-135
Client:	OCB Geotech	nical		Lab Ref No.:	ST 93841
	Unit 1 Carrigo	gna		Date Receive	d: 26/03/2020
	Midleton			Date Tested:	31/03/2020
Order No:	2003-104			Date Reporte	ed: 03/04/2020
Originator:	lan Holley			Specification	: Client
Sampled Ref:		XC212-CPRC0	1 Type D Samp	ble 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	e:	Soil

Moisture Content (%):

Tested in accordance with BS 1377: Part 2: 1990

19

Sample preperation by cone and quarter

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

Approved Signature

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



Page 1 of 1



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

-	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

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



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



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



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

Site Ref.:	Cork Line Level Crossings	Job No.:	19-135		
Client:	OCB Geotechnical	Lab Ref No.:	ST 93842		
	Unit 1 Carrigogna	Sample Ref.:	XC212-CPRC01 2.5-3.0m Type D S.9		
	Midleton	Date Sampled:	Client Info		
	Co Cork	Date Received:	26/03/2020		
Order No:	2003-104	Date Tested:	03/04/2020		
Originator:	Ian Holley	Date Reported:	03/04/2020		
Sampling Certificat	e	No			
Sampled By		Client			
Sample Type		Bulk			
Sample Preparatio	n Method	Washed			
MATERIAL		Soil			
Retained 425 micro	on (%)	23			
Natural Moisture Content (%)		38			
Liquid Limit (single point)(%)		45	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



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

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



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

Site Ref.:	Cork Line Level Crossings	Job No.:	19-135		
Client:	OCB Geotechnical	Lab Ref No.:	ST 93842		
	Unit 1 Carrigogna	Sample Ref.:	XC212-CPRC01 2.5-3.0m Type D S.9		
	Midleton	Date Sampled:	Client Info		
	Co Cork	Date Received:	26/03/2020		
Order No:	2003-104	Date Tested:	03/04/2020		
Originator:	lan Holley	Date Reported:	03/04/2020		
Sampling Certifica	ate	No			
Sampled By		Client	Client		
Sample Type		Bulk	Bulk		
Sample Preparati	on Method	Washed	Washed		
MATERIAL		Soil	Soil		
Retained 425 mic	ron (%)	23	23		
Natural Moisture Content (%)		38	38		
Liquid Limit (single point)(%)		45	45		
Plastic Limit (%)		34	34		
Plasticity Index		11			



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

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



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RS70 Issue 2

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



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						
Brojost:	Cork Lin			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	10 125	
Project:	Cork Line Level Crossings		JON DO:	JUNO: 10-100		
Client:	OCB Geo	otechnical	Lab Ref No.:	ST 93840		
	Unit 1 Ca	arrigogna	Date Received:	11/03/2020		
	Midleto	1	Date Reported:		02/04/2020	
			Date Tested:		01/04/2020	
Order No:	2003-10	4	Material:		Soil	
Originator:	Ian Holle	2 y	Visual Description	Cobb	ole, Dark Clay, Sandy	
		·	BS Sieve	%	Specification	
Client Ref.		XC212-CPRC01 Type B Sample 8	Size	Passing		
			300 mm	100		
			125 mm	100		
Location		XC212-CPRC01 Type B Sample 8	100 mm	100		
Location:			75 mm	62		
			63 mm	62		
Supplier:		Bulk	50 mm	62		
		baik	37.5 mm	45		
Source:		Client Info.	28 mm	39		
			20 mm	38		
Depth (m):		2.5-3.0m	14 mm	37		
Sampling Reason: Client R			63 mm	33		
		Client Request	5 mm	31		
6			3.35 mm	29		
Sampled By:		Client	2 mm	27		
Specification		Client	1.18 mm	23		
specification.		Client	0.6 mm	19		
Preparation Method:		Without Organics Preparation	0.425 mm	17		
		······································	0.3 mm	15		
Notes:		Disturbed sample from cleanout	0.15 mm	12		
		·	0.003 mm	010		
			0.020 mm	5		
			0.003 mm	4		
			0.002 mm	2		

LABORATORY TEST REPORT



0.001 mm

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BRE Test Suite B - Greenfield Site

Project:	Cork Line Level Crossings	Job No.:	19-135
Client:	OCB Geotechnical	Lab Ref. No.:	ST 93844
	Unit 1 Carrigogna	Date Received:	09/03/2020
	Midleton	Date Reported:	09/04/2020
	Co. Cork	Material:	Soil
Order No.:	2003-104	Date Tested:	07/04/2020
Originator:	Ian Holley	Specification:	Client
Sample Details	XC212-CPRC01 T	ype D Sample 14	
Supplier:	Client Info	Date of Sampling:	Client Info.
Source:	Client Info	Sampled By:	Client
Sample Locatio	n: 3.3-3.5m	Sampling Reason:	Request

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

Comments:

None

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□ James Ward, Operations Manager





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

Site:	Cork Line Leve	el Crossings		Job No.:	19-135
Client:	OCB Geotech	nical		Lab Ref No.:	ST 93845
	Unit 1 Carrigo	gna		Date Receive	d: 26/03/2020
	Midleton			Date Tested:	31/03/2020
Order No:	2003-104			Date Reporte	ed: 03/04/2020
Originator:	Ian Holley			Specification	: Client
Sampled Ref:		XC212-CPRC0	1 Type D Samp	ble 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	e:	Soil

Moisture Content (%):

Tested in accordance with BS 1377: Part 2: 1990

7.4

Sample preperation by cone and quarter

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Page 1 of 1



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

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

Result:

Organic Matter (%)	0.9

Comments:

None



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



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

0": D (1 1 11	40.405		
Site Ref.:	Cork Line Level Crossings	JOD 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:	lan 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	66		
Natural Moisture Content (%)		13	13		
Liquid Limit (single point)(%)		19			
Plastic Limit (%)		Non-Plastic			
Plasticity Index		N/A			



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

RS70 Issue 2



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

Site:	Cork Line Level Crossings		Job No.:	19-135		
Client:	OCB Geotechnical			Lab Ref No.:	ST 93849	
	Unit 1 Carrigogna			Date Receive	d : 26/03/2020	
	Midleton			Date Tested:	31/03/2020	
Order No:	2003-104			Date Reporte	d: 03/04/2020	
Originator:	Ian Holley			Specification	: Client	
Sampled Ref:		XC212-CPRC01 Type D Sample 18				
Sample Type:		Bulk	Location:		XC212-CPRC01 Type D Sample 18	
Date Sampled:		Client Info	Sample by:		Client	
Depth:		4-5m	Material Type	e:	Soil	

Moisture Content (%):

8

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

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Page 1 of 1
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LABORATORY TEST REPORT LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site Pof ·	Cork Line Level Crossings	loh No :	10-125
Sile Rel.	COR Crateshuisel		13-133
Client:	OCB Geotechnical	Lab Ref No.:	51 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:	lan Holley	Date Reported:	03/04/2020
Sampling Certific	cate	No	
Sampled By		Client	
Sample Type		Bulk	
Sample Preparat	tion Method	Washed	
MATERIAL		Soil	
Retained 425 mi	cron (%)	19	
Natural Moisture Content (%)		13	
Liquid Limit (single point)(%)		19	
Plastic Limit (%)		15	
Plasticity Index		4	



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



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 Lin	e Level Crossings	Job No:	19-135		
Client [.]	OCB Geo	otechnical	Lah Ref. No ·	ST 93848		
cheffe.	Unit 1 C	arrigogna	Date Received:		11/03/2020	
			Date Received.		11/03/2020	
	Midleto	1	Date Reported:		02/04/2020	
			Date Tested:		01/04/2020	
Order No:	2003-10	4	Material:		Soil	
Originator:	Ian Holle	ey	Visual Description	Large Co	obble, Light Clay, Sandy	
		VC212 CDDC01 Turne D Commile 17	BS Sieve	%	Specification	
Client Ref.		XC212-CPRC01 Type B Sample 17	Size	Passing		
			300 mm	100		
		XC212-CPRC01 Type B Sample 17	125 mm	100		
Location:			100 mm	100		
			75 mm	48		
			63 mm	48		
Supplier:		Bulk	37.5 mm	45		
_			28 mm	43		
Source:		Client Info.	20 mm	43		
Depth (m):		4.0-5.0m	14 mm	41		
			10 mm	40		
Sampling Reason:		Client Request	6.3 mm	37		
Samping Re		cheft hequest	5 mm	36		
Sampled By:		Client	3.35 mm	35		
			2 mm	33		
Specification	1:	Client	0.6 mm	28		
Duenenation	Mathadi	Without Organics Dranaration	0.425 mm	27		
Preparation	iviethoa:	without Organics Preparation	0.3 mm	26		
Notes:		Disturbed sample from cleanout	0.15 mm	21		
Notes.		Distarbed sample from cleanout	0.063 mm	18		
			0.020 mm	16		
			0.006 mm	10		
			0.003 mm	5		
			0.002 11111	5		

LABORATORY TEST REPORT



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

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Sedimentation by Hydrometer - Not UKAS



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

Project: Cork Line Level Cros	sing	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:	ОСВ
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 RES	ULTS:
Angle of Shearing Resistance (°) φ'	24.0
Cohesion Intercept (kPa) c'	22.0

Sample Condition:	Submerge d				
Particle Density:	2.65(Mg/m3)	Assumed			
Sample Preparation:	Remoulded (H	and Tampe	and Tamped)		
	Material teste	d passing 2	mm sieve		
	Initial Cond	ition			
			Stage		
		1	2	3	
Normal Press	75	150	300		
Height (n	nm)	20.39	20.20	20.37	
Width (n	nm)	59.9	59.9	59.9	
Bulk Density (2.07	2.09	2.07		
Dry Density (1.80	1.82	1.80		
Moisture Con	15	15	15		
Voids Ra	0.469	0.457	0.475		
Degree of Sat	84.8	87.0	83.7		
	Shearing S	tage			
Rate of Displaceme	ent (mm/min)	0.03	0.03	0.03	
Peak Shear Str	ess (kPa)	49.4	99.6	153.5	
Displacement at Pea	ak Stress (mm)	8.9	7.6	8.1	
	Final Cond	tion			
Bulk Density ((Mg/m ³)	2.28	2.40	2.42	
Dry Density (Mg/m³)	1.90	2.03	2.09	
Moisture Con	tent (%)	20	18	16	
Angle of Shearing R	esistance (°) φ'		24.0		
Cohesion Interce		22.0			









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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
	Midleton	Date Reported:	09/04/2020
	Co. Cork	Material:	Soil
Order No.:	2003-104	Date Tested:	07/04/2020
Originator:	Ian Holley	Specification:	Client
Sample Details	XC212-CPRC01	Type D Sample 20	
Supplier:	Client Info	Date of Sampling:	Client Info.
Source:	Client Info	Sampled By:	Client
Sample Locatio	on: 5-6m	Sampling Reason:	Request

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

Comments:

None

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□ 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 Cro	ossing	Job No.:	19-135
Client: OCB Geotechnical	I	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

<u>Results</u>

SUMMARY OF TEST RES	ULTS:
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:	and Tampe	:d)			
	Material tested				
Initial Condition					
			Stage		
		1	2	3	
Normal Press	ure (kPa)	100	200	400	
Height (n	nm)	20.60	20.23	20.77	
Width (m	ım)	59.9	59.9	59.9	
Bulk Density	2.24	2.26	2.21		
Dry Density (Dry Density (Mg/m ³)			1.99	
Moisture Con	10	11	11		
Voids Ra	0.303	0.301	0.329		
Degree of Sat	87.3	96.8	88.5		
Shearing Stage					
Rate of Displaceme	ent (mm/min)	0.03	0.03	0.03	
Peak Shear Str	ess (kPa)	79.4	140.4	270.7	
Displacement at Pea	ak Stress (mm)	2.0	2.7	9.0	
	Final Condi	tion			
Bulk Density	(Mg/m ³)	2.40	2.49	2.44	
Dry Density (Mg/m³)	2.13	2.23	2.24	
Moisture Con	tent (%)	13	12	9	
Angle of Shearing Re	esistance (°) φ'		32.5		
Cohesion Interce	Cohesion Intercept (kPa) c'				

Angle of Shearing Resistance & Cohesion









Subcontracted to a Laboratory Accredited in this Testing

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LABORATORY TEST REPORT

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

Site:	Cork Line Leve	el Crossings		Job No.:	19-135
Client:	OCB Geotechnical		Lab Ref No.:	ST 93854	
	Unit 1 Carrigo	gna		Date Receive	d: 26/03/2020
	Midleton			Date Tested:	31/03/2020
Order No:	2003-104			Date Reporte	ed: 03/04/2020
Originator:	Ian Holley			Specification	: Client
Sampled Ref:		XC212-CPRC0	1 Type D Samp	ble 22	
Sample Type:		Bulk	Location:		XC212-CPRC01 Type D Sample 22
Date Sampled:		Client Info	Sample by:		Client
Depth:		6-7m	Material Type	е:	Soil

Moisture Content (%):

6.2

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

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Page 1 of 1

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

Site Ref ·	Cork Line Level Crossings	lob No :	10-135
Site Kei	COR Costoshrisol		13-133
Client:	OCB Geotechnical	Lab Ker No.:	51 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:	lan Holley	Date Reported:	03/04/2020
Sampling Certific	cate	No	
Sampled By		Client	
Sample Type		Bulk	
Sample Preparat	tion Method	Washed	
MATERIAL		Soil	
Retained 425 mi	cron (%)	20	
Natural Moisture Content (%)		13	
Liquid Limit (single point)(%)		23	
Plastic Limit (%)		14	
Plasticity Index		8	



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



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 Lin		Job No:	,	10-125			
Project: Cork Line Lo		e Lever Crossings		19-122				
Client:	OCB Geo	otechnical	Lab Ref No.:		ST 93857			
	Unit 1 Ca	arrigogna	Date Received:		11/03/2020			
	Midleto	า	Date Reported:		02/04/2020			
			Date Tested:		01/04/2020			
Order No:	2003-10	4	Material:		Soil			
Originator:	Ian Holle	2 y	Visual Description		Cobble, Sandy			
			BS Sieve	%	Specification			
Client Ref.		XC212-CPRC01 Type B Sample 25	Size	Passing				
			300 mm	100				
			125 mm	100				
Location:		XC212-CPRC01 Type B Sample 25	100 mm	100				
Location.			75 mm	100				
			63 mm	100				
Supplier:		Bulk	50 mm	100				
			37.5 mm	55				
Source:		Client Info.	28 mm	47				
			14 mm	41				
Depth (m):		7.3-8.0m	10 mm	35				
Sampling Bo		Client Pequest	6.3 mm	28				
Samping Ke	ason.	Client Request	5 mm	21				
Sampled By:		Client	3.35 mm	17				
oumpieu by:		Cherre	2 mm	12				
Specification	:	Client	1.18 mm	9				
•			0.0 mm	7				
Preparation	Method:	Without Organics Preparation	0.425 mm	4				
Notos		Disturbed severals from all several	0.15 mm	3				
Notes:		Disturbed sample from cleanout	0.063 mm	2				
			0.020 mm	2				
			0.006 mm	1				
			0.003 mm	1				
			0.002 mm	1	1			

LABORATORY TEST REPORT



0.001 mm

0

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

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Sedimentation by Hydrometer - Not UKAS



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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 Lin		Job No:	,	10-125			
Project: Cork Line Lo		e Lever Crossings		19-122				
Client:	OCB Geo	otechnical	Lab Ref No.:		ST 93857			
	Unit 1 Ca	arrigogna	Date Received:		11/03/2020			
	Midleto	า	Date Reported:		02/04/2020			
			Date Tested:		01/04/2020			
Order No:	2003-10	4	Material:		Soil			
Originator:	Ian Holle	2 y	Visual Description		Cobble, Sandy			
			BS Sieve	%	Specification			
Client Ref.		XC212-CPRC01 Type B Sample 25	Size	Passing				
			300 mm	100				
			125 mm	100				
Location:		XC212-CPRC01 Type B Sample 25	100 mm	100				
Location.			75 mm	100				
			63 mm	100				
Supplier:		Bulk	50 mm	100				
			37.5 mm	55				
Source:		Client Info.	28 mm	47				
			14 mm	41				
Depth (m):		7.3-8.0m	10 mm	35				
Sampling Bo		Client Pequest	6.3 mm	28				
Samping Ke	ason.	Client Request	5 mm	21				
Sampled By:		Client	3.35 mm	17				
oumpieu by:		Cherre	2 mm	12				
Specification	:	Client	1.18 mm	9				
•			0.0 mm	7				
Preparation	Method:	Without Organics Preparation	0.425 mm	4				
Notos		Disturbed severals from all several	0.15 mm	3				
Notes:		Disturbed sample from cleanout	0.063 mm	2				
			0.020 mm	2				
			0.006 mm	1				
			0.003 mm	1				
			0.002 mm	1	1			

LABORATORY TEST REPORT



0.001 mm

0

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

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Sedimentation by Hydrometer - Not UKAS



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Determ	nination o	Determination of Particle Size D of Particle Size Distribution (Hydro	istribution - BS 1377 meter Sedimentatio	7 : Part 2 : 19 on) - BS 1377	90 : Part 2 : 1990 Cl. 9.5	
Project:	Cork Line	e Level Crossings	Job No:	19-135		
Client [.]	OCB Geo	otechnical	Lah Ref. No ·		ST 93856	
cheffe.	Unit 1 Ca	arrigogna	Date Received		11/03/2020	
	Midlata		Date Received:		02/04/2020	
	windletor	1	Date Reported:		02/04/2020	
			Date Tested:		01/04/2020	
Order No:	2003-10	4	Material:		Soil	
Originator:	Ian Holle	έγ.	Visual Description	L	ight Clay, Sandy	
Client Def		VC212 CDDC01 Turo B Sample 22	BS Sieve	%	Specification	
Client Ref.		XC212-CPRC01 Type B Sample 23	Size	Passing		
			300 mm	100		
			125 mm	100		
Location:		XC212-CPRC01 Type B Sample 23	100 mm	100		
2000000		Xelli en Keel Type B sample 25	75 mm	100		
			63 mm	100		
Supplier:		Bulk	50 mm	100		
			28 mm	90		
Source:		Client Info.	20 mm	89		
-			14 mm	85		
Depth (m):		7.0-7.15m	10 mm	82		
Compling Do		Client Dequest	6.3 mm	79		
Sampling Rea	ason:	Client Request	5 mm	77		
Sampled By:		Client	3.35 mm	74		
Sampled by.		Client	2 mm	71		
Specification	:	Client	1.18 mm	68		
			0.6 mm	64		
Preparation	Method:	Without Organics Preparation	0.425 mm	61 58		
			0.5 mm	51		
Notes:		Disturbed sample from cleanout	0.063 mm	46		
			0.020 mm	41		
			0.006 mm	25		
			0.003 mm	17		
			0.002 mm	14		
			0.001 mm	9		

LABORATORY TEST REPORT

100.0 90.0 80.0 70.0 Passing 60.0 50.0 40.0 % 30.0 20.0 10.0 0.0 0.001 0.01 0.1 1 10 100 Particle size (mm) medium coarse fine fine fine medium coarse medium coarse CLAY SILT SAND GRAVEL COBBLES

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

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Sedimentation by Hydrometer - Not UKAS



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



LABORATORY TEST REPORT

BRE Test Suite B - Greenfield Site

Project:	Cork Line Level	Crossings	Job No.:	19-135	
Client:	OCB Geotechnie	cal	Lab Ref. No.:	ST 93860	
	Unit 1 Carrigogr	na	Date Received:	09/03/2020	
	Midleton		Date Reported:	09/04/2020	
	Co. Cork		Material:	Soil	
Order No.:	2003-104		Date Tested:	07/04/2020	
Originator:	Ian Holley		Specification:	Client	
Sample Details	C	XC212-CPRC01 Type D Sam	ple 30		
Supplier:	C	lient Info	Date of Sampling:	Client Info.	
Source:	C	lient Info	Sampled By:	Client	
Sample Location	n: 8.	.8-9.0m	Sampling Reason:	Request	

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

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 Cro	ossings	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]		
L 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				
Indicating which direct shear procedure was used, 5.5.4 single stage or 5.5.5 multi-reversal test	Single Stage Test				
Normal Pressure (kPa)	125	250	500		
Peak Shear Strength (kPa)	33 61 123				
Cohesion (kPa) to 0.1	2.0				
Angle of friction (⁰) to nearest (0.5 ⁰)		13.5			
Rate of Displacement (mm/min)	2.5 2.5 2.5				

Comments/Departure from specified procedure: None

 \mathcal{Q}

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



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LABORATORY TEST REPORT

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

Determination of Particle Size Distribution (Hydrometer Sedimentation) - BS 1377 : Part 2 : 1990 Cl. 9.5 Moisture content to BS 1377: Part 2 : 1990 Oven Drving Method Cl 3 2

Moisture content to BS 1377. Part 2 . 1990 Oven Drying Method Cr 3.2								
Project: Cork Line		e Level Crossings	Job No:	19-135				
Client:	OCB Geo	otechnical	Lab Ref No.:		ST 93858			
Unit 1 Ca		arrigogna	Date Received:	11/03/2020				
	NA: IL	-	Date Devented		02/04/2020			
	wildleto	n	Date Reported:		02/04/2020			
Co Cork			Date Tested:		01/04/2020			
Order No:	2003-10	4	Material:		Soil			
Originator:	Ian Holle	29	Visual Description	[Dark Clay, Sandy			
				<u> </u>	o ::: ::			
Client Ref.		XC212-CRPC01 Type B Sample 27	BS Sieve	%	Specification			
			Size	Passing				
			125 mm	100				
		XC212-CRPC01 Type B Sample 27	100 mm	100				
Location:			90 mm	100				
			63 mm	100				
			50 mm	100				
Supplier:		Client Info.	37.5 mm	100				
Courses		Client Info	28 mm	100				
source:		Client Into.	20 mm	97				
Denth (m)·		8 0-8 8m	14 mm	92				
Deptil (ill).		0.0 0.011	10 mm	89				
Sampling Rea	ason:	Client Request	6.3 mm	84				
		·	2 25 mm	78				
Sampled By:		Client	2 mm	67				
o			1.18 mm	60				
Specification	1:	Client	0.6 mm	53				
Prenaration	Method	Without Organics Preparation	0.425 mm	49				
rieparation	wiethou.	without organics rreparation	0.3 mm	44				
Notes:		Disturbed sample from cleanout	0.15 mm	33				
		27	0.005 mm	27				
woisture Co	ntent%:	27	0.0205 mm	17				
			0.0029 mm	10				



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



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

Approved Signature JAMES FISHER TESTING SERVICES (IRELAND) LTD. Appendix E Environmental Laboratory Test Results



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

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:			
Un Mary			
Details:	Glynn Harvey, Technical Manager		



Results - Leachate

Client: Environmental Laboratory	Chemtest Job No.:				20-08714	20-08714	
Quotation No · Q20-19728		_	Chemte	est Sam	nle ID.:	988286	988287
Order No : 6997	_		Clier	nt Same	le Ref.:	177724/001	177724/002
			Clie	ent Sam	iple ID.:	1	2
				Sampl	e Type:	SOIL	SOIL
				Top De	oth (m):	1.00	3.00
				Date Sa	ampled:	02-Mar-2020	04-Mar-2020
Determinand	Accred.	SOP	Type	Units	LOD		
H	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



Results - Leachate

Client: Environmental Laboratory Services Ltd	Chemtest Job No.:				20-08714	20-08714	
Quotation No.: Q20-19728			Chemte	st Sam	ple ID.:	988286	988287
Order No.: 6997			Clier	nt Samp	le Ref.:	177724/001	177724/002
			Clie	ent Sam	ple ID.:	1	2
				Sampl	e Type:	SOIL	SOIL
				Top Dep	oth (m):	1.00	3.00
				Date Sa	ampled:	02-Mar-2020	04-Mar-2020
Determinand	Accred.	SOP	Туре	Units	LOD		
o-Xylene	U	1760	10:1	µg/l	1.0	[B] 2.0	[B] < 1.0
Methyl Tert-Butyl Ether	Ν	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



Client: Environmental Laboratory Services Ltd	Chemtest Job No.:				20-08714	20-08714
Quotation No.: Q20-19728	(Chemte	st Sam	ple 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	В	Amber Glass 250ml
988286	177724/001	1		02-Mar-2020	В	Plastic Tub 500g
988287	177724/002	2		04-Mar-2020	В	Amber Glass 250ml
988287	177724/002	2		04-Mar-2020	В	Plastic Tub 500g



Test Methods

SOP	Title	Parameters included	Method summary	
1010	pH Value of Waters	pН	pH Meter	
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.	
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35–C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection	
1680	Extractable Petroleum Hydrocarbons	Aliphatics: >C5–C6, >C6–C8, >C8– C10*, >C10–C12*, >C12–C16*, >C16–C21*, >C21– C35*, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10*, >C10–C12*, >C12–C16*, >C16– C21*, >C21– C35*, >C35– C44	Dichloromethane extraction / GCxGC FID detection	
1760	Volatile Organic Compounds (VOCs) in Waters by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics. (cf. USEPA Method 8260)	Automated headspace gas chromatographic (GC) analysis of water samples with mass spectrometric (MS) detection of volatile organic compounds.	
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection	
2010	pH Value of Soils	pH	pH Meter	
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.	
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge	

The right chemistry to deliver results

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









Cork Line Level Crossings – XC215 Ground Investigation

Primary Author:	Ian Holley
Client:	Irish Rail
Client's Representative:	JACOBS
Report Date:	25 th November 2020
Report No.:	OCB19-135-4
File Location:	OCB19-135-4/Reporting/XC215



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APPENDICES

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Document Control Sheet

Report No.:	OCB19-135-4
Project title:	Cork Line Level Crossings – XC215
Client:	Irish Rail
Client's Representative:	JACOBS

Revision	Status	Report prepared by:	Report reviewed by:	Report approved by:	Issue date
001	Draft	lan 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	
Р	Nominal 100mm diameter undisturbed piston sample	
В	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 kPaV: undisturbed vane shear strengthVR: remoulded vane shear strength	
<u>dd/mm/yy: 1.0</u> dd/mm/yy: dry	Date & water level at the borehole depth at the end of shift and the start of the following shift	
Abbreviations relating to rock core – reference Clause 44.4.4 of BS 5930: 1999		
TCR (%)	Total Core Recovery: Ratio of rock/soil core recovered (both solid and non-intact) to the total length of core run.	
SCR (%)	Solid Core Recovery: Ratio of solid core to the total length of core run. Solid core has a full diameter, uninterrupted by natural discontinuities, but not necessarily a full circumference and is measured along the core axis between natural fractures.	
RQD (%)	Rock Quality Designation: Ratio of total length of solid core pieces greater than 100mm to the total length of core run.	
FI	Fracture Index: Number of natural discontinuities per metre over an indicated length of core of similar intensity of fracturing.	
NI	Non-Intact: Used where the rock material was recovered fragmented, for example as fine to coarse gravel size particles.	
AZCL	Assessed zone of core loss: The estimated depth range where core was not recovered.	
DIF	Drilling induced fracture: A fracture of non-geological origin brought about by the rock coring.	





Cork Line Level Crossings - XC215

1 AUTHORITY

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

This report details the work carried out both on site at XC215 and in the geotechnical and chemical testing laboratories; it contains a description of the site and the works undertaken, the exploratory hole logs and the laboratory test results.

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

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

2 SCOPE

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

3 DESCRIPTION OF SITE

As shown on the site location plan in Appendix A, level crossing XC215 is located in the Imphrick townland approximately 4.5km south of Charleville and immediately west of the N20. The crossing is currently manned with a house and small cabin to the west. The site is surrounded by agricultural land with a number of houses and farms in the wider area.

The site is generally flat within the site area.



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

4 SITE OPERATIONS

Site operations, which were conducted between 18th February 2020 and 14th August 2020, included:

- One (1) Cable Percussion Borehole
- Two (2) Cable Percussion with Rotary follow-on Boreholes
- A Standpipe Installation in two (2) Boreholes
- Nine (9) Trial Pits
- Indirect CBR tests at eighteen (18) locations
- Water Purging in two (2) locations

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

4.1 Boreholes

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

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

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

Appendix B presents the borehole logs.

4.1.1 Cable Percussion Boreholes

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



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

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

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

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

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

Appendix B presents the borehole logs.

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

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

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

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

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

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

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



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

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

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

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

4.2 Standpipe Installations

A groundwater monitoring standpipe was installed in boreholes CP01 and CPRC01.

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

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

4.3 Trial Pits

Nine trial pits (TP01–TP09) were excavated using a 15t tracked excavator fitted with a 600mm wide bucket, to depths between 0.80m and 2.40m. Most trial pits were terminated due to the pit walls collapsing while TP02 was terminated at 0.80m due to a possible archaeological feature and TP08 and TP09 were terminated early to prevent damage to the property owners' field.

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

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

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

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

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


4.4 Indirect CBR Tests

An indirect CBR test was conducted at eighteen locations (TRL01 to TRL18) using a Dynamic Cone Penetrometer (DCP). The equipment was developed in conjunction with the UK Transport Research Laboratory, is used widely throughout the world, and is referred to in the UK Highway Agency Interim Advice Note 73/06.

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

Log CBR = 2.48-1.057 Log (mm/blow)

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

4.5 Water Purging

Prior to sampling from each standpipe (in CP01 and CPRC01) water purging was carried out.

Appendix G presents the water purging data logs.

4.6 Surveying

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

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

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

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



5 LABORATORY WORK

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

5.1 Geotechnical Laboratory Testing of Soils

Laboratory testing of soils comprised:

- **soil classification:** Moisture Content measurement, Atterberg Limit tests and particle size distribution analysis.
- shear strength: 60mm Shear Box test
- **soil chemistry:** pH, Sulphur content, Organic Matter content and water-soluble and total Sulphate content

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

The test results are presented in Appendix H.

5.2 Geotechnical Laboratory Testing of Rock

Laboratory testing of rock sub-samples comprised:

• Point Load index

Test		Test carried out in accordance with
Point	Load	ISRM Suggested Methods (1985) Suggested method for determining
Index		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.

Data	Depth to standing water level (m)							
Date	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						

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

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

7 DISCUSSION

7.1 Proposed Construction

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

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



8 **REFERENCES**

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Appendix A Site and Exploratory Hole Location Plans



CPRC02 CPRC01 TP09 CP01 🜏 TRL16 TRL15 TP08 TRL13 TP07 TRL14 TP06 TRL12 TRL09 **TP05** TP04 TRL06 TP03 TRL05 TRL04 Ballinagrath **TP02** TRL02 TP01 TRL01 0,0 **Exploratory Hole Locations** larnród Éireann Client: larnród Éireann Cork Line Level Crossings Engineer XC215 (19-135-4) Jacob's Date: February/May-July 2020

Appendix B Borehole Logs

		8			Projec	t No.:	Project	t Name:	Во	rehol	e N	o.:
0	.C				19-135	i	Cork Li	ne Level Crossings	x	C215	-CP(01
	DC	e			Coordi	nates:	Client:		S	heet	1 of	1
	3			/	55354	6.75 E	larnróc	l Éireann / Irish Rail	_			_
Method:					61523	7.48 N	Client's	s Representative:	Sca	ile:	1:50	0
	n				•		JACOBS		Dri	ller:	AA	
Pilcon					Groun	d Level:	Dates:	29/05/2020 - 03/06/2020	LOS	ger:	IH	
Depth	Sample /	Casing	Water	Sield Deserves	Level	Depth (m)		25/05/2020 - 05/00/2020	e	Deels		
(m)	Tests	(m)	(m)	Field Records	(mOD)	(Thickness)	Legend		Wa	Баскі		_
0.20 - 1.20 0.20 - 1.20 0.50 1.20 - 2.00	B2 D3 ES4 B5				98.22 97.22	(1.00)		Reddish brown slightly silty slightly gravelly very sandy CLAY. Gravel is fine to medium, subrounded. Sand is fine to coarse.	-		0).5 1.0
1.20 - 2.00 1.20 - 1.65 1.50	D6 SPT (C) N=6 ES7			N=6 (1,1/2,1,2,1)		- (0.80)		content. Gravel is fine to coarse, angular to subrounded. Sand is fine to coarse. Cobbles are subrounded.			1	L.5 — - -
2.00 - 3.00 2.00 - 3.00 2.00 - 2.45	88 D9 SPT (C) N=17			N=17 (3,6/4,5,4,4)	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 , 2 , 2	1.0
3.00 3.00 - 3.60 3.00 - 3.60 3.00 - 3.45	ES10 B11 D12 SPT (C)			N=20 (2,4/4,6,5,5)	95.42	- 3.00 - (0.60)	× × × × × ×	Medium Dense reddish brown slightly silty clayey very sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded.				1.0
3.60 - 4.50 3.60 - 4.50 4.00 - 4.45	N=20 B13 D14 SPT (C) N=17			N=17 (3,3/2,4,4,7)	94.82	3.60	2000 2000 2000 2000 2000 2000 2000 200	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.			4	1.0 —
4.50 - 5.50 4.50 - 5.50	B15 D16				93.92	- 4.50 -	x 0 x x x x x x x x x x x x x x x x x x	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	1.5 — -
5.00 - 5.45 5.50 - 6.00	SPT (C) N=8 B17			N=8 (1,1/1,3,2,2)		 (1.50) 					5	i.0 — — 5.5 —
6.00 - 6.80 6.00 - 6.80 6.00 - 6.45	B19 D20 SPT (C) N=12			N=12 (1,1/2,3,3,4)	92.42	- 6.00 - 6.00		Loose to Medium Dense reddish brown sandy clayey GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded.	-		6	5.0 — - - 5.5 — -
6.80 - 7.60 6.80 - 7.60 6.80 - 6.80 7.00 - 7.45	B21 D22 SPT (C)			50 (25 for 0mm/50 for 0mm) N=22 (2,4/3,5,7,7)		- (1.60) 					7	7.0
7.60 - 7.60	N=22 SPT (C)			50 (25 for 0mm/50 for 0mm)	90.82	7.60	10-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-	End of borehole at 7.600m			8	3.0
						-					8	
											9	1.0
						-						
Remarks			1					Water Added Water S From (m) To (m) Struck at (m) Casing 1.20 3.00 3.00 3.70 3.10 3.00 3.60 Casing Chice	trike to (m) 70	- Gener Time (min 20 Details	al Rose	to (m)
								To (m) Diam (mm) From (m) 7.60 200 5.80	To (n 7.00 7.60	i) Tir	ne (hh 00:30 01:00	1:mm) 0 0

					Project	t No.:	Project	t Name:	Bore	eho	le N	١ ٥.:
	.C	\mathbb{A})	19-135		Cork Li	ne Level Crossings	XC2	15-0	CPF	۲ C 01
	ba	e(7		Coordi	nates:	Client:		ch		1.0	f 2
	~9			J	55358	1.51 E	larnróc	l Éireann / Irish Rail		eet		л Z
Method:				-			Client's	s Representative:	Scal	e:	1:5	50
Cable Percuss	on+Rota	ry Op	en+	Rotary Coring	61531	1.63 N	JACOBS	5	D		AA	1
Plant:					Ground	d Level:	Dates:			er:	+N	<u>IOB</u>
Pilcon+T44					99.59	9 mOD		28/05/2020 - 31/07/2020	Log	ger:	IH	
Depth	Sample /	Casing Depth	Water Depth	Field Records	Level	Depth (m)	Legend	Description	/ater	Back	fill	
0.05	ES1	(m)	(m)		(mob)	(Thickness)		TOPSOIL	>	.П	• •	
0.30 - 1.20	В2				99.28	0.30		Dark brown candy gravelly SIIT. Gravel is find to modium subangular to	-	•		
0.30 - 1.20	D3					-	(subrounded. sand is fine to coarse.				0.5 —
0.50	E34					(0.90)	(°.		-
						_	(°.		1.0
1.20 - 2.00	В5				98.38	1.20		Lages dark grou / brown slightly sity slavey your condy CDAVEL with high		Ŷ	•	-
1.20 - 2.00	D6			N-8 (2 1 /2 2 1 2)				cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular	•	Ŷ		-
1.20 - 1.05	N=8			N-0 (2,1/2,3,1,2)		(0.80)		to subrounded. Cobbles are subangular to subrounded.	•	°		
1.50	ES7						0 v ×0 ×0			Ŷ		
2.00 - 3.00 2.00 - 3.00	B8 D9				97.58	2.00	0. v.	Medium Dense dark grey / brown slightly silty clayey very sandy GRAVEL	1	°		2.0
2.00 - 2.45	SPT (C)			N=11 (3,2/2,3,4,2)		-	0_x_	with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are angular to subangular		•		-
	N=11					(1.00)	<u>Ô</u> xº					2.5
							<u>Ô</u> xo.					
3.00	ES10				96.58	3.00	<u>o</u> xo	Medium Danse reddich brown clavey very sandy GRAVEL with medium		•		3.0
3.00 - 4.00	B11						<u>O_</u> ×O.	cobble content. Gravel is fine to coarse, subangular to subrounded.	•	•		-
3.00 - 3.45	SPT (C)			N=16 (1,1/4,4,4,4)		(1.00)	<u>0</u> ×0_	Cobbles are angular to subangular.		•		3.5 -
	N=16					(,	$O^{\times 0}$					-
4.00 4.70	D12				05 50	4.00	0 <u>~</u> ~0					-
4.00 - 4.70 4.00 - 4.70	D14				95.58	- 4.00	ו•ו	Medium Dense grey angular to subrounded COBBLES with a matrix of				4.0
4.00 - 4.45	SPT (C)			N=14 (1,2/2,3,3,6)		(0.70)	ו••••	reddish brown slightly slity slightly clayey gravelly SAND.				
	N=14						ו••••••••••••••••••••••••••••••••••••					4.5 —
4.70 - 6.00 4.70 - 6.00	B15 D16				94.88	4.70	0 <u>× 0</u>	Firm brown slightly gravelly slightly sandy silty CLAY with low cobble				_
5.00 - 5.45	SPT (C)			N=9 (4,1/1,2,3,3)		-	<u>x°×</u> o-	content. Gravel is fine to coarse, subangular to subrounded. Sand is fine to coarse. Cobbles are subangular to subrounded.		°,		5.0
	N=9					(1.20)				Ŷ		
						(1.30)	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			, i		5.5 —
						-				Ŷ	•	_
6 00 - 6 50	B17				93 58	6.00				Ŷ		- 6.0
6.00 - 6.50	D18				55.50	(0.50)	×— 	Firm brown slightly gravelly slightly sandy silty CLAY. Gravel is fine to coarse, subangular to subrounded. Sand is fine to coarse.	•	°		
6.00 - 6.45	SPT (C) N=13			N=13 (2,2/3,3,2,5)	00.00	(0.50)	×			°		-
6.50 - 6.50	SPT (C)			50 (25 for 0mm/50	93.08	6.50	0,00	Rotary Open Hole Drilling.	1	°		6.5 -
				for 0mm)			0,00	Drillers Description: Boulders with sand		•		
						-	0,0					7.0
							၀ွိ၀					
7.50 - 7.95	SPT (C)			N=38 (6,6/8,8,8,14)			၀ွိ၀			•		7.5 -
	N=38						ု၀္ဂၴ၀				Ň	
						(3.10)	ု၀္ဂိ၀္					8.0
							ုတို့တို့					-
8.50 - 8.95	SPT (C)			N=49			ုပ္ခ်ဳပ္ခ်					8.5 -
	N=49			(9,9/9,12,12,16)		-	၀ို၀ို					
							00					-
							00					9.0 -
							000					
8.68 - 8.68	SPT (C)	$\left - \right $		58 (35 for 8mm/58	80.00	9.60	0	Medium Strong light gravish brown fing to madium grained SANDSTONS		\square		9.5 —
3.00 - 3.00				for 0mm) for 0mm)	07.78			medium strong light greytsh brown fille to medium graffied SANDSTONE.		E	•	
			14			(1.08)		Distinctly weathered with brown, black and orange brown discolouration		·H		10.0 -
						-					••••	
	TCR SCR	RQD	FI					Continued on Next Page				
Remarks								Water AddedWaterFrom (m)To (m)struck at (m)	to (m) Ti	pener me (mi	dl n) Ros	se to (m
								1.20 4.70				
								Casing Details Chis	elling De	etails		
								To (m) Diam (mm) From (m) 6.50 200 6.50	To (m) 6.50	Ti	ime (h	1h:mm) .:00
Cable percussio	n termina	ited a	t 6.5	0m due to probable	boulder	obstruction	. Rotary	techniques employed thereafter. 9.60 ¹⁵¹				

			8			Projec	t No.:	Project	t Name:	Bore	hole	No.:
) <mark>.C</mark>	; /	\mathbb{A}			19-135		Cork Li	ne Level Crossings	XC2	15-CP	2RC01
	D		e			Coordi	nates:	Client:		Sh	eet 2	of 2
		5)	55358	1.51 E	larnróc	l Éireann / Irish Rail			
Method:					Determ Carrier	61531	1.63 N	Client's	s Representative:	Scal	e: 1	:50
Cable Percuss	ion+i	Kotar	γO	ben+	Rotary Coring	01331	<u></u>	JACOB:	<u>5</u>	Drill	er: A	
Plant: Pilcon+T44						Groun	d Level:	Dates:	28/05/2020 21/07/2020	Log	+	H
Depth						Level	Depth (m)		28/03/2020 - 31/07/2020			
(m)	ICR	SCR	RQD	FI	Field Records	(mOD)	(Thickness)		Description	N N	заскпі	- T
			_			88 00	409/69	· · · · · · ·			H	10.5 -
	100	55	8			88.88	- 4797301 - 1		Discontinuities: Very closely to closely spaced. 1.) Subhorizontal, planar, rough.		<u>ا</u>	
11.10							-		2.) Step to subvertical, planar, rough		H	11.0
				NI			(1.06)		staining on extremely closely spaced fractures.		H	
									to destructured locally broken dow to purple gravely silty Clay.		H	, 11.5 —
	84	38	8			87.82	11.77	× × × × × × × × × × × ×	Discontinuities:			: -
								× × × × × × × × × × × × × × × × × ×	Extremely closely to very closely spaced, undulating and planar, slightly			,* 12.0 —
								* * * * * *	1.) Shallow to subhorizontal planar to slightly undulating slightly rough.			
12.60								* * * * * *	2.) Steep to subvertical, planar to slightly undulating, slightly rough.			12.5
				15			(2 33)		laminated with occasional thin laminae of pale red (pink) fine grained	••		
				15			(2.55)	× × × × × × × × × × × × × × × × × × ×	SANDSTONE. Occasional grey (locally weathered to yellowish brown) possible calcrete nodules, locally weathered out to voids.	••		13.0
	54	42	17					$\begin{array}{c} \times \times \times \times \times \\ \times \times \times \times \times \\ \times \times \times \times \end{array}$	Distinctly weathered with a little reddish brown slightly sandy slightly	•		
								× × × × × × × × × × × ×	gravelly silty Clay infilling of discontinuities.	•		13.5 –
								* * * * * *	Discontinuities:			,
14.10						85.48	14.10	<u> </u>	Very closely to closely spaced with black iron oxide staining on surfaces. End of borehole at 14.100m	-	<u></u>	,° 14.0
												14.5 —
												15.0
												15.5 —
							E E					16.0 -
							-					16.5
												17.0
							Ē					17.5
												18.0 -
							Ē					10.0
							Ē					18.5 -
							Ē					
							Ē					19.0 -
							Ē					
							Ē					19.5 —
							Ē					
							E E					20.0
							Ē					
							Ē					20.5
	TCP	SCB	RUD				-			\vdash		+
Remarks	TCR	30K	κųD	- FI		1	1		Water Added Water	Strike - (General	
									From (m) To (m) Struck at (m) Casing 1.20 4.70	to (m) Tir	ne (min) R	ose to (m)
									Casing Details Chise To (m) Diam (mm) From (m)	Iling De To (m)	tails Time	e (hh:mm)
Cable percussio	n teri	minat	ted a	t 6.50	Om due to probable	boulder	obstruction	. Rotary	techniques employed thereafter. 6.50 200 6.50 9.60 151 6.50	6.50		01:00
•												

			8			Project	: No.:	Projec	t Name:	Boreho	le No.:
	.C					19-135		Cork Li	ne Level Crossings	XC215-	CPRC02
	b		e			Coordi	nates:	Client:		Sheet	1 of 1
		9)	55360	1.76 E	larnróo	d Éireann / Irish Rail	Sheet	1011
Method:					-			Client'	s Representative:	Scale:	1:50
Cable Percuss	ion+R	otar	ry Op	oen+	-Rotary Coring	61534	9.74 N	JACOB	S		AA
Plant:						Ground	d Level:	Dates:		Driller:	+NOB
Pilcon+T44						100.22	1 mOD		27/05/2020 - 30/07/2020	Logger:	IH
Depth	Samp	ole /	Casing Depth	Water Depth	Field Records	Level	Depth (m)	Legend	Description	Jate Back	fill
(m) 0.05	ES17	sts	(m)	(m)		(mob)			TOPSOIL	5	- 18
0.30 - 1.20	B1					99.91	0.30		Doel brown dightly down slightly condy slightly grouply CUT with low		- 🕅
0.30 - 1.20	D2						-	(***.× ****	cobble content and frequent rootlets. Sand is fine to coarse. Gravel is fine		0.5 -
0.50	E210						(0.90)	(× × × × × × ×	to coarse, subangular to subrounded. Cobbles are subrounded.		2
							_	(× × × ×			- 1.0 _
1.20 - 2.00	В3					99.01	1.20		Loose dark grow / brown slightly sandy slightly silty GRAVEL with medium		
1.20 - 2.00	D4 SPT (0			N=7 (2 1/2 1 2 2)		-		cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular		- 1.5
1.20 1.05	N=7	C)			N=, (2,1,2,1,2,2)		(0.80)		to subrounded. Cobbles are subangular to subrounded		
1.50	ES19					00.04	2.00				-
2.00 - 3.00	D6					98.21	2.00		Dense reddish brown clayey very sandy GRAVEL with low cobble content.		2.0
2.00 - 2.45	SPT (C)			N=46		-		Cobbles are subangular to subrounded. Sand is fine to coarse.		-
	11-40	,			(10,13/11,11,13,11)		(1.00)				2.5 -
								$O_{\times O}$			
3.00	ES20					97.21	- 3.00		Medium Dense subrounded grey COBBLES with a matrix of grey slightly		3.0
3.00 - 3.50	D8						(0.50)	ו•ו ו••*	silty very gravelly SAND.		-
3.00 - 3.45	SPT (C)			N=16 (4,7/6,4,3,3)	96.71	3.50	×° •×°	Firm to stiff reddish brown slightly silty sandy slightly gravelly CLAY with	-	3.5 _
3.50 - 4.20	B9	,					(0,70)	<u>x</u>	medium cobble content. Sand is fine to coarse. Gravel is fine to coarse,		-
3.50 - 4.20	D10	C)			N=15 (1 1/2 1 3 9)		(0.70)	<u>x</u>	subangular to subrounded. Cobbles are subrounded.		4.0
	N=15	5				96.01	4.20	<u>x</u>	Stiff reddish brown slightly sandy gravelly silty CLAY with low cobble	-	
4.20 - 5.00 4.20 - 5.00	B11 D12							<u>x</u>	content. Sand is fine to coarse. Gravel is fine to coarse, subangular to		4.5 —
								<u>x</u>	subrounded. Cobbles are subrounded.		-
5.00 - 6.00	B13						_	<u>x o x</u>			5.0
5.00 - 6.00	D14						-	<u>x o x</u>			-
5.00 - 5.45	N=19	C))			N=19 (3,4/4,4,6,5)		(2.40)	<u>x</u>			
								<u>x</u>			-
C 00 C 20	D15						-	<u>x</u>			-
6.00 - 6.20	D16							<u>x</u>			6.0
6.00 - 6.20	SPT (C)			75 (5,8/75 for			<u>x</u>			
6.20 - 6.20	SPT (c)			50 (25 for 0mm/50	93.61	6.60	<u>x</u>	Medium Strong to Strong nale vellow / grey medium grained		6.5
					for 0mm)			· · · · · ·	SANDSTONE.		
							<u>-</u>	· · · · · ·	Distinctly weathered with pervasive light brown clay staining and infill of		7.0
	60	30	17	NI			(1.50)	· · · · · ·	discontinuities. Much black and orange / brown oxide staining on		
								· · · · · ·	discontinuity surfaces.		7.5 —
							-	· · · · · ·	Discontinuities:		
8 10						92 11	- - - 810	· · · · · · · · · · · · · · · · · · ·	Subiolizolital to zo . Fialia, lough, very closely spaced.		8.0
							5.10		Borehole collapsed. Likely entered a void or soft clay band at this depth.		
											8.5 —
							(1 50)				
							(1.50)				9.0
						0.00					9.5 —
						90.61	9.60		End of borehole at 9.600m		
							-				10.0 —
	TCR	SCR	RQD	FI	<u> </u>						
Remarks	د م <i>۲</i> .		0 10.	i	h 0% core re	U a d +	ovo offi-	ation J.	Water Added Water 2 From (m) To (m) Struck at (m)	Strike - Gener g to (m) Time (mi	al n) Rose to (m
BUIENDIE COllap	sea tra	א תוכ	s. tun	n wit	n u% core recovery.	nau to m	IOVE OIT IOC	ation du			
									Casing Details Chis	elling Details	
									To (m) Diam (mm) From (m) 6.20 200 6.20	To (m) T	ime (hh:mm) 01:30
Cable Percussio	n term	ninat	ted a	t 6.2	0m due to probable	boulder	obstruction	i. Rotary	Techniques employed thereafter. 6.60 151		

Appendix C Rock Core Photographs





Appendix D

Trial Pit Logs

				: No.:	Project Name:				Т	Trial Pit No.:		
0			19-135		Cork Li	ne Level Crossings				XC215-TP01		
	bae		Co-ord	inates:	Client:					Shoot 1 of 1		
	-90		55338	2.20 E	larnróo	d Éireann / Irish Rail			_	SHEELIOII		
Method:					Client'	s Representative:			s	cale: 1:20		
Excavation			61448	8.00 N	JACOB	S				rivor: TS		
Plant:			Ground	d Level:	Date:					11001.15		
Kobelco SK140	SRu	1	90.52	1 mOD	18/02/	2020			L	ogger: MN		
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend		Description		Water			
(m) 0.05 0.35 - 0.80 0.35 - 0.80 0.35 - 0.80 0.50 0.50 1.00 1.10 - 1.60 1.10 - 1.60	ES1 B2 B3 D4 ES5 ES6 B7 D8	HVP=38, HVR=16 Rapid Inflow - Rose to 1.35m	90.16 89.71 88.31	(Indexess) (0.35) (0.35) (0.45) (0.45) (0.45) (1.40) (1.40) (1.40)		TOPSOIL: Soft greyish brown slip rootlets, moist. Soft to firm light brown slightly with low cobble content and oc coarse. Gravel is fine to coarse, angular to subrounded, sandsto Light brown mottled orange and very sandy GRAVEL with mediu moist becoming wet by 1.55m. coarse, angular to subrounded. subangular, sandstone and siltst	gravelly gravelly sandy gravelly becoming icasional rootlets, n angular to subrour one and siltstone. d reddish brown sli m cobble and low s Sand is fine to coar Cobbles and bould tone.	y silty CLAY with frequencies of the second	LAY	Z 1.5 — Z 2.0 —		
										2.5 — - - - - - - - - - - - - - - - - - - -		
Remarks							Water	Strikes:	Stabil	ty:		
							Struck at (m):	Remarks:	Sides	collapsing		
							1.55	Rapid Inflow - Rose to 1.35m	Widt	n: 190		
									Lorat	h 400		
Trial Pit terminat	ted at 2.20m d	lue to pit walls collapsing							Lengt	4.80		

		Projec	t No.:	Project	Name:		Tr	ial Pit No.:		
			19-135	5	Cork Li	ne Level Crossings				XC215-TP02
	bae		Co-ord	linates:	Client:					Sheet 1 of 1
	- 3-		55481	.7.30 E	larnród	l Éireann / Irish Rail			ŀ	JIEEL T OF T
Method:			1 61796		Client's	s Representative:			Sc	:ale: 1:20
Excavation			01/30	11 0.0	JACOBS	<u>.</u>			D;	river: TS
Plant:	<u>эсп</u>		Groun	d Level:	Date:	2000				MN
Robeico Skii4u	ЈЅКИ Т	1	97.9	5 MOD	18/02/	2020			ъ	
(m)	Sample / Tests	Field Records	(mOD)	(Thickness)	Legend	The second se	Description	the strate tak for a	. Nat	
0.00	ES1			(0.05)		TOPSOIL: Soft greyisn brown siig rootlets, moist.	ghtly gravelly sandy	silty CLAY with frequ	Jent	
				(0.25)						
0 30 - 0.80	B3		97.70	0.25		Firm (locally soft) light brown w	ith a little orange b	rown mottling slight	ly	
0.30 - 0.80	D4				∞ <u>~</u> ~~	gravelly sandy silty CLAY with lo	w cobble content, a ravel is fine to coars	and occasional rootle	ets,	
0.50	EC2			F	∞ <u>~</u> ~~	subangular. Cobbles are angular	r to subangular, san	dstone and siltstone		0.5
0.50	ESZ	HVP=48, HVR=65		(0.55)	∞ <u>~</u> ~~	boundary. Firm grey slightly grav	velly sandy silty CLA	Y with low cobble		
				F	×		moisi.			
				-	×					-
			97.15	- 0.80	×	End o	f trial pit at 0.800m			-
				-						
				-						1.0
				-						
				-						-
				-						-
				Ļ						
				-						1.5 —
				Ę						-
				F						
				-						
				-						
				-						2.0
				-						-
				-						_
				-						
				-						_
				-						2.5 —
				-						_
				ŀ						
				Ł						
				F						20
				F						5.U —
				-						-
				-						-
				-						-
				-						-
				-						3.5 —
				-						-
				-						
				ŀ						
				L						-
			<u> </u>							
Remarks	vezvato furtho	r / altornato trial nit in th	0.2502.04	as refused			Water	Strikes:	Stabili	ty:
Permission to ex	xcavale fullier	/ alternate that pit in the	e alea wa	is refused.			Struck at (m):	Remarks:	Good	
								None Encountered	Midth	- 2.60
									width	1. 5.00
Terminated due	to possible are	chaeological feature.							Length	1: 7.40

				: No.:	Project Name:					Trial Pit No.:			
C			19-135		Cork Li	ne Level Crossings				XC215-TP03			
	bae		Co-ord	inates:	Client:					Sheet 1 of 1			
	-90		55350	7.73 E	larnróo	d Éireann / Irish Rail				511661 1 01 1			
Method:			61.466	2 0 C N	Client'	s Representative:			9	Scale: 1:20			
Excavation			61466	3.96 N	JACOB	S				Driver: TS			
Plant:			Ground	d Level:	Date:								
Kobelco SK14	OSRu		92.4	0 mOD	19/02/	2020				.ogger: MN			
Depth (m)	Sample / Tests	Field Records	(mOD)	(Thickness)	Legend		Description		-	Wate			
Depth (m) 0.05 0.25 - 0.50 0.50 0.50 - 1.00 0.50 - 1.00 0.70 1.00 1.30 - 1.80 1.30 - 1.80 1.30 - 1.80	Sample / Tests ES1 B2 D3 ES4 B5 D6	Field Records Water inflow from field drain No rise HVP=57, HVR=20 Rapid Inflow - No rise	92.44 Level (mOD) 92.14 91.90 91.30 91.10 90.40	Depth (m) (Thickness) (0.25) (0.25) (0.25) (0.25) (0.25) (0.25) (0.60) (0.60) (0.60) (0.60) (0.70) (0.70) (0.70)		TOPSOIL: Soft dark brown slight and frequent rootlets, moist. Soft orange and black slightly sa to boulder sized cemented vesi gravel) and occasional rootlets. STONE FIELD DRAIN (0.3 - 0.6 STONE FIELD DRAIN (0.3 - 0.5 Soft to firm becoming stiff light occasional rootlets, moist. Sanc angular to subangular. Cobbles sandstone and siltstone. Soft reddish brown sandy grave boulder content, wet. Brown slightly silty very sandy G low boulder content, wet. Sand angular to subrounded. Cobbles siltstone and quartz. End o	Description tly sandy silty CLAY andy SILT / CLAY wit cular iron pan (com <u>Sim: N</u> - S orientation <u>Sim: N</u> - S orientation Jown and orange Jown and orange and boulders are a vily silty CLAY with r SRAVEL with mediu Is fine to coarse. C s and boulders are of trial pit at 2.000m	with occasional grav th high content of gra posed of silty sand a , 0.20m wide. mottled slightly sand ider content and Gravel is fine to coarso ngular to subangular, nedium cobble and le m cobble content an iravel is fine to coarso subangular, sandstor	el avel nd dy e, ,	Jugger: IVIN and and			
				- - - - - - - - - - - -						3.5			
Remarks							Water	Strikes:	Stabi	lity:			
							Struck at (m):	Remarks	Sides	collapsing			
							0.60	Water inflow from					
								field drain No rise	Wid	th: 1.80			
Trial Pit termina	ated at 2 00m o	ue to nit walls collansing					1.30	Rapid Inflow - No rise	Leng	th: 3.70			
	ut 2.00111 U	ac to pit waits collapsillig					I		5				

				No.:	Project Name:					Trial Pit No	».:
C).C /\		19-135		Cork Li	ne Level Crossings				XC215-TP	'04
	bae		Co-ord	inates:	Client:					Sheet 1 o	f 1
	-9-		55350	1.42 E	larnróo	d Éireann / Irish Rail			-	Sheet 10	
Method:			61476	7 21 N	Client'	s Representative:				Scale: 1:2	20
Excavation			01470	7.21 N	JACOB	S				Driver: TS	
Plant:	OCDU		Ground	d Level:	Date:	/2020			ŀ	logger: M	
Depth	USRU .		Level	Depth (m)	19/02/	2020				ь 	
(m)	Sample / Tests	Field Records	(mOD)	(Thickness)	Legend		Description	ika CLAV ikk		Wat	
0.30 - 0.70	B2		93.60	- - (0.30) - - 0.30		frequent rootlets, moist.					_
0.30 - 0.70 0.50	D3 ES4			- - - (0.40)		silty CLAY with low cobble control fine to coarse. Gravel is fine to angular to subangular, sandstor	ent and occasional coarse, angular to s ne and siltstone.	v sandy slightly grave rootlets, moist. Sand ubangular. Cobbles a	l is are	0.	.5 —
0.50 0.70 - 1.00	В5	HVP=68, HVR=24	93.20	- - - 0.70							_
0.70 - 1.00	D6			- - (0.30)		Firm becoming soft reddish bro sandy silty CLAY with low cobbl becoming wet. Sand is fine to c	wn slightly gravelly e content and occas oarse. Gravel is fine r to subangular sar	slightly sandy becom sional rootlets, moist to coarse, angular to dstone and siltstone	ning t o	T	_
1.00	FS7		92 90	- 1.00	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		r to suburigatur) sur			∇ 1	.0
1.00 - 1.50 1.00 - 1.50	B8 D9	Rapid inflow - Rose to 0.90m.		-	k × k × k − k × k × k − k × k − × k − k − × k − × k − × k − k − × k −	Greyish brown silty SAND and C occasional rootlets, wet with th with occasional blackened parti to coarse. Gravel is fine to coars angular to subrounded, sandsto	GRAVEL with mediu nin bed of slightly si ially decayed wood se, angular to subro one and siltstone.	m cobble content an Ity very gravelly sand fragments. Sand is fi unded. Cobbles are	d 1 ine		_
				-							_
				- (1.00) - -						1.	.5 —
				-	4						-
			91.90	- - 2.00 -	× × ·	End o	of trial pit at 2.000m			2	.0
				-							_
				-							-
				-						2	.5 —
				-							_
										3.	.0
											_
				-							-
				-						3.	.5 —
				-							-
Remarks							Water	Strikes:	Stab	ility:	
							Struck at (m):	Remarks:	Sides	conapsing	
							1.00	Rapid inflow - Rose to 0.90m.	Wid	th: 1.7	0
Trial Pit termina	ated at 2.00m d	lue to pit walls collapsing	Į.						Leng	;th: 3.9	0

			Project	t No.:	Projec	t Name:			Tr	ial Pit No.:
			19-135	i	Cork Li	ne Level Crossings			3	C215-TP05
	bae		Co-ord	inates:	Client:					Sheet 1 of 1
	- 3-		55350	1.82 E	larnróc	d Éireann / Irish Rail			_	Sheet I OI I
Method:			61/185	5.46 N	Client'	s Representative:			Sc	ale: 1:20
Excavation			01403	5.40 1	JACOB:	S			Di	river: TS
Plant:			Ground	d Level:	Date:	2020				gger MN
Depth			Level	Depth (m)	19/02/	2020			<u>د</u>	
(m)	Sample / Tests	Field Records	(mOD)	(Thickness)	Legend	TODCOLL. Coft grouish brown ali	Description	AV with frequent	Vat	
0.40	ES2	HVP=73, HVR=25	94.74	- (0.30) - 0.30 		Firm light brown and orange br CLAY with low cobble content, a to coarse. Gravel is fine to coars to rounded.	own slightly sandy and occasional root se, angular to round	slightly gravelly silty lets, moist. Sand is fi led. Cobbles are ang	ne ular	0.5
0.50 - 1.00 0.50 - 1.00	B3 D4			- - - - - - - - -						
1.00 1.10 - 1.60 1.10 - 1.60 1.10	ES5 B6 D7	HVP=25, HVR=12	93.94	- 1.10 - 1.10 		Soft reddish brown sandy grave moist becoming wet by 1.3m. S coarse, angular to subangular. C sandstone and siltstone.	Ily silty CLAY with Id and is fine to coars Cobbles are angular	ow cobble content, e. Gravel is fine to to subangular,		
1.70 - 2.20	88		93.34	- (0.60) - - - - - - - - - - - - - - - - - - -	0 × 0 × 0 × 0 × 0 × 0					1.5
1.70 - 2.20	D9	Rapid inflow - Rose to 1.7m.		- (0.50)		Brown clayey silty becoming slig medium cobble content and lov coarse. Gravel is fine to coarse, boulders are mostly subangular	ghtly silty very sand v boulder content, angular to subroun ; sandstone and silt	ly GRAVEL with low t wet. Sand is fine to ded. Cobbles and istone.	•	2.0
			92.84	- 2.20	0.0	End o	f trial pit at 2.200m			-
				-						2.5 —
				-						-
				-						3.0
				-						-
				- - - - -						3.5 —
				-						_
Remarks	•						Water	Strikes:	Stabilit	y:
							Struck at (m):	Remarks:	Sides c	ollapsing
							1.80	Rapid inflow - Rose	weigw	1./[[]
								to 1.7m.	Width	: 0.80
Trial Pit termina	ted at 2.20m d	lue to pit walls collapsing							Length	1: 3.60

			Project	No.:	Projec	t Name:			Tr	ial Pit No.:
			19-135		Cork Li	ne Level Crossings				XC215-TP06
	bae		Co-ord	inates:	Client:					Sheet 1 of 1
	-90		55350	4.67 E	larnróo	d Éireann / Irish Rail				Sheet I OF I
Method:					Client'	s Representative:			So	ale: 1:20
Excavation			61495	5.90 N	JACOB	S				river. TS
Plant:			Ground	d Level:	Date:				ľ	
Kobelco SK140	SRu		95.74	4 mOD	19/02/	2020			Lo	ogger: MN
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend		Description		Water	
0.05	ES1			-		TOPSOIL: Soft greyish brown slig	ghtly sandy silty CL	AY with frequent		
				- (0.30)		rootiets, moist.				-
				-						-
			95.44	0.30	¢	Firm light brown and orange bro	own slightly sandy	slightly gravelly silty		-
0.40		HVP=60, HVR=24		-	<u>x 0 x</u> 0	CLAY with low cobble content a	nd occasional rootl	ets, moist. Sand is fir	ne	-
0.50	ES2			-	x 0 X 0	angular to subangular, sandston	ie and siltstone.	igular. Cobbles are		0.5
0.50 - 1.00 0 50 - 1 00	B3 D4			-	<u>~~~</u> ~	- - -				_
0.00 1.00				-	<u>× × × × × × × × × × × × × × × × × × × </u>	2 * *				_
				-	<u>× × × × × × × × × × × × × × × × × × × </u>					_
				(1.10)	<u>x°×</u> o					
1.00	565			-						
1.00	E35			-						1.0
				-	<u>~~~</u> ~	*				_
				-	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	2 • •				-
				-	0. <u>0</u> 0. <u>×</u> 0					-
			94.34	1.40	~ XQ	Brown clayey silty very sandy G	RAVEL with mediur	n cobble content and	- T	
1.50 - 2.00	B6			(0.20)		low boulder content, wet. Sand	is fine to coarse. G	ravel is fine to coarse	2,	1.5
1.50 - 2.00	D7			- (0.30)			s are angular to suc	ilounded.		-
		Rapid inflow - Rose to	94.04	1.70		Prown slightly silty yory sandy G	PAVEL with modiu	m cobble content an		z _
		1.4m		-	\hat{O}^{0}	low boulder content, wet. Sand	is fine to coarse. G	ravel is angular to	u	_
				- (0.40)	Qx_	subrounded. Cobbles and bould	lers are angular to	subangular, sandstor	ie	_
					\tilde{O}					2.0
				-	Q_xQ	s 				2.0
			93.64	2.10		End o	f trial pit at 2.100m			
				-						_
				-						_
				-						-
				-						2.5 —
				-						-
				-						-
				-						-
				-						
				-						3.0
				F F						_
				-						
				-						
				L						
				-						
				-						3.5 —
				F -						-
				-						-
				-						-
				_						-
Remarks							Water	Strikes:	Stabili	ty:
							Struck at (m):	Remarks:	Sides o	ollapsing 1.4m
							1.70	Rapid inflow - Rose	WOISG	1.4111
								to 1.4m	Width	: 0.90
Trial Pit terminat	ted at 2.10m d	ue to pit walls collapsing.							Lengt	1: 3.30

		Project No.:		Project Name:			Т	Trial Pit No.:			
			19-135		Cork Line Level Crossings					XC215-TP07	
Daeo		Co-ordinates:		Client:					Shoot 1 of 1		
L'goo			553516.77 E		Iarnród Éireann / Irish Rail					Sheet 1 OF 1	
Method:			-		Client'	s Representative:			s	cale: 1:20	
Excavation			615075.58 N		JACOBS					river: TS	
Plant:			Ground Level:		Date:						
Kobelco SK140SRu			96.29 mOD		19/02/2020				L	Logger: MN	
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend		Description		Water		
0.05	ES1			-		TOPSOIL: Soft greyish brown slig	ghtly sandy silty CL	AY with frequent			
				(0.25)		rootiets, moist.				-	
			96.04	- 0.25						-	
				(0.15)	×	Firm light brown mottled orange occasional rootlets, moist.	e brown slightly sa	ndy silty CLAY with		-	
0.40 - 0.80	B2		95.89	0.40	X	Stiff light grey with a little orang	ge brown mottling s	lightly gravelly sligh	tly	-	
0.40 - 0.80	ES4			-	<u>x ~ ~ ~</u> ~	sandy silty CLAY with low cobble	e content, occasion	al rootlets, moist. Sa	and	0.5	
0.50		HVP=53, HVR=21		(0.40)	x_0_v	are angular to subangular, sand	stone and siltstone		.5	-	
				-		-				_	
			95.49	0.80	<u>~~~</u> ~				44	_	
0.90 - 1.40	B5			-	<u>x x o</u>	low cobble content, moist. Sand	d is fine to coarse. O	Gravel is fine to coars	se,	_	
0.90 - 1.40	D6			-	x 0	angular to subangular. Cobbles	are angular to suba	ngular, sandstone a	nd	1.0	
1.00	ES7			-	<u>x x o</u>						
				(0.80)	<u>x x o</u>						
				(0.80)	<u>x x o</u>					-	
		Rapid Inflow - No rise		-	0 <u>×</u> 0						
				-	<u>x°×</u> o					_	
				-						1.5	
1.60 - 2.10	B8		94.69	1.60		Soft greyish brown and orange I	brown mottled clay	ey silty very sandy		-	
1.00 - 2.10	09					GRAVEL with medium cobble ar	nd low boulder com angular to subrour	tent, wet. Sand is fin ded. Cobbles and	ie to	-	
				(0.50)		boulders are angular to subangu	ular, sandstone and	siltstone.		-	
				- (0.50)		- - -				-	
				-						2.0	
2.10 - 2.40	B10		94.19	2.10						_	
2.10 - 2.40	D11			-	\underline{O}_{\times}	boulder content, wet. Sand is fi	RAVEL with mediu ne to coarse. Grave	h cobble and low lis fine to coarse,		_	
				- (0.30)		angular to subrounded. Cobbles	s and boulders are	angular to subangula	ar,	_	
			03.80	- 2.40	$\underline{O}_{\times 0}$						
			55.05	- 2.40		End of trial pit at 2.400m			25		
				-						2.5	
				-						_	
				-							
				-						-	
				-						-	
				-						3.0	
				-						-	
				Ł						-	
				ŀ							
				F							
				-						3.5 —	
				-						_	
				-							
				-							
				_							
				-							
Remarks									Stahili	ity:	
inclinding							Water	Strikes:	Sides	collapsing	
							Struck at (m):	Remarks:			
							1.30	rise	Widt	h: 1.10	
Trial Pit termina	ted at 2 40m d	lue to nit walls collansing							Lengt	h: 2.80	
mai rit termina	.cu at 2.40111 0	ine to bit mails collabslug.							0.		

			Project	t No.:	Projec	t Name:			Т	rial Pit No.:	
Method:			19-135		Cork Line Level Crossings					XC215-TP08	
			Co-ordinates:		Client:					Sheet 1 of 1	
			553543.87 E		larnród Éireann / Irish Rail						
			615173.05 N		Client's Representative:				S	Scale: 1:20	
Excavation			013173.03 N		JACOBS				D	river: TS	
Plant:			Ground Level:		Date:					Logger: MN	
Denth		97.83 MOD		18/02/2020							
(m)	Sample / Tests	Field Records	(mOD)	(Thickness)	Legend		Description		Mat		
0.05	E21			-		TOPSOIL: Soft dark brown sandy	y slity CLAY with fre	quent rootlets, mois	st.	_	
				(0.35)						_	
				-						_	
			97.48	- 0.35		Firm light brown with a little or	ange brown mottlin	ng slightly gravelly sa	indy	_	
0.50	FS2			-		silty CLAY with low cobble conte fine to coarse. Gravel is fine to c	ent and occasional i coarse, angular to s	rootlets, moist. Sand ubangular. Cobbles ;	d is are	0.5	
0.50 - 1.00	B3			-		angular to subangular.				_	
0.50 - 1.00 0.60	D4	HVP=41, HVR=18		-	0 0 0 0 0 0 0 0 0 0	2 7 -				_	
0.75					0 0 0 0 0 0 0 0 0 0	2 7 -					
				(1.00)		27 • -					
1.00	505			-		27 • -				_	
1.00	ES5			-	<u>~~~</u> ~	20 7 				1.0	
				-	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	2 4 4				-	
				-						_	
		Rapid inflow - No rise	96.48	- 1.35	$\frac{1}{2}$	Prown slightly silty yong sandy (PAVEL with modiu	m cobble and low			
1.40 - 1.80 1.40 - 1.80	B6 D7			-		boulder content, wet. Sand is fi	ne to coarse. Grave	l is fine to coarse,		-	
				(0.45)		angular to subrounded. Cobbles and siltstone.	s and boulders are s	subangular, sandstor	ne	1.5 —	
				(0.45)	$\tilde{\mathbf{n}}_{0}$	-				-	
				-	$\tilde{\alpha}^{0}$	- 9 9				-	
			96.03	- 1.80		End o	f trial pit at 1.800m			-	
				-						-	
				_						2.0	
				-						-	
				-						-	
				-						-	
				-						-	
				-						2.5 —	
				-						-	
				-						-	
				-						_	
				-						_	
				-						3.0	
				-						_	
				-						_	
				-						_	
				-						_	
				-						3.5 —	
				-						_	
				-							
				Ł							
				-							
				-							
Remarks								Chuiltere	Stabili	tv:	
Instructed by cli	ents engineer	to terminate TP at 1.80m	ı to minir	nise impact	to farm	er.	Water	Strikes:	Sides	••• collapsing	
							Struck at (m):	Remarks:			
							1.55	rise	Widt	n: 1.90	
									Lengt	h: 4.90	

		Project No.:		Project Name:				Т	Trial Pit No.:		
		19-135		Cork Line Level Crossings					XC215-TP09		
Method:			Co-ordinates:		Client:					Sheet 1 of 1	
			553478.44 E		Iarnród Éireann / Irish Rail Client's Representative:					Scale: 1:20	
Plant:			Ground Level:		Date:					logger: MN	
Depth	Comula (Tosta	Field Descude	Level Depth (m)		10/02/				2		
(m)	Sample / lests	Field Records	(mOD)	(Thickness)	Legend	TOPSOUL Soft dark brown clight	Description	Ity CLAY with froquer	*		
0.05	231			-		rootlets, moist.	iy gravelly sandy si	ity CLAF with nequen		-	
				(0.35)						_	
				-						_	
0.35 - 0.60 0.35 - 0.60	B2 D3		96.40	- 0.35		Soft dark brown sandy gravelly	silty CLAY with low	cobble content and		_	
0.50	ES4			(0.25)	<u>x x c</u>	to subrounded.	to coarse. Gravel is	s fine to coarse, angu	lar	• 0.5 —	
0.60 - 1.10	B5		96.15	- 0.60				madium ashhla sant	ant	_	
0.60 - 1.10	D6			-	-0- <u>-0</u> -8	Brown slightly clayey slity very sandy GRAVEL with medium cobble content and low boulder content, wet. Sand is fine to coarse. Gravel is fine to			ent		
		Rapid inflow - Rose to 0.5m		-	<u>x 0 4</u>	coarse, angular to subrounded.	Cobbles and bould	ers are subangular,		-	
				- (0.50)	<u>x 0 6</u>					_	
1.00	ES7			-	<u>x 0 6</u>					1.0	
	-		95.65	- 1.10	<u>8.0×</u> 8	End of trial pit at 1,100m				_	
				-		Ella o	End of trial pit at 1.100m			_	
				-						_	
				-						_	
				-						1.5	
				-						_	
				-						_	
				-						_	
				-						_	
				-						2.0	
				-						-	
				-						-	
				-						_	
				-						-	
				-						2.5 —	
				-						-	
				-						-	
				-						-	
				-						-	
				-						3.0	
				-						-	
				-						-	
				-						-	
				-							
				-						3.5 —	
				-						_	
				-						-	
				-						-	
				-						_	
Remarks							Motor	Strikes:	Stabil	ity:	
Instructed by clients engineer to terminate TP at 1.10m to				nise impact	to farm	er.	Struck at (m):	Remarks:	Sides	collapsing	
							0.75	Rapid inflow - Rose			
								to 0.5m	Widt	h: 1.80	
									Lengt	: h: 4.60	

Appendix E

Trial Pit Photographs







