



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

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





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	T.PIT4
	Trial Pit Photographs
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	T.PIT4
	Trial Pit Photographs
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## **Appendix E**

## **Indirect CBR Test Data**



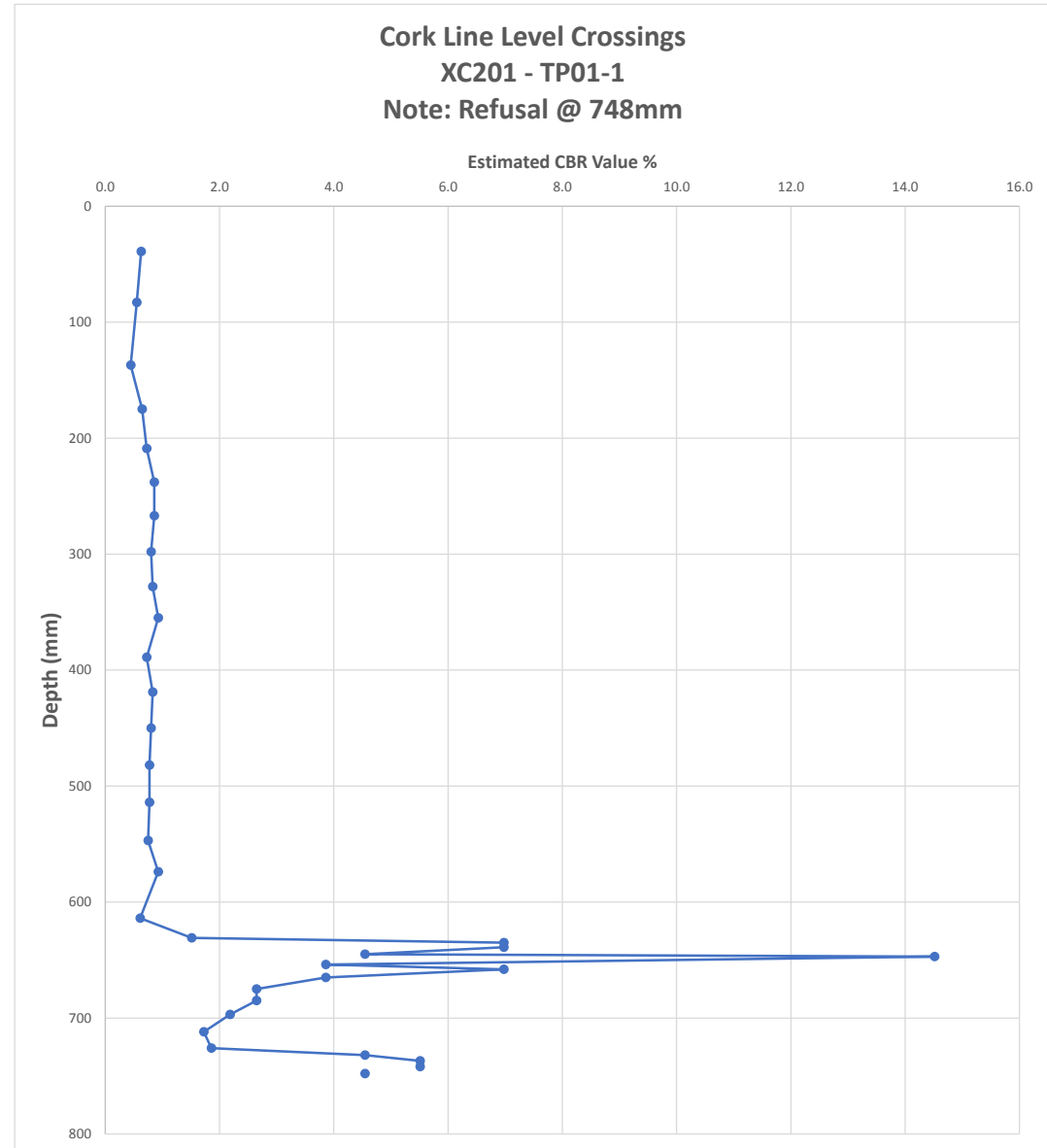
Cork Line Level Crossings - Irish Rail  
 Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	XC201 - TP01-1	Job No	19-135
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Easting	Northing	Elevation

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

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



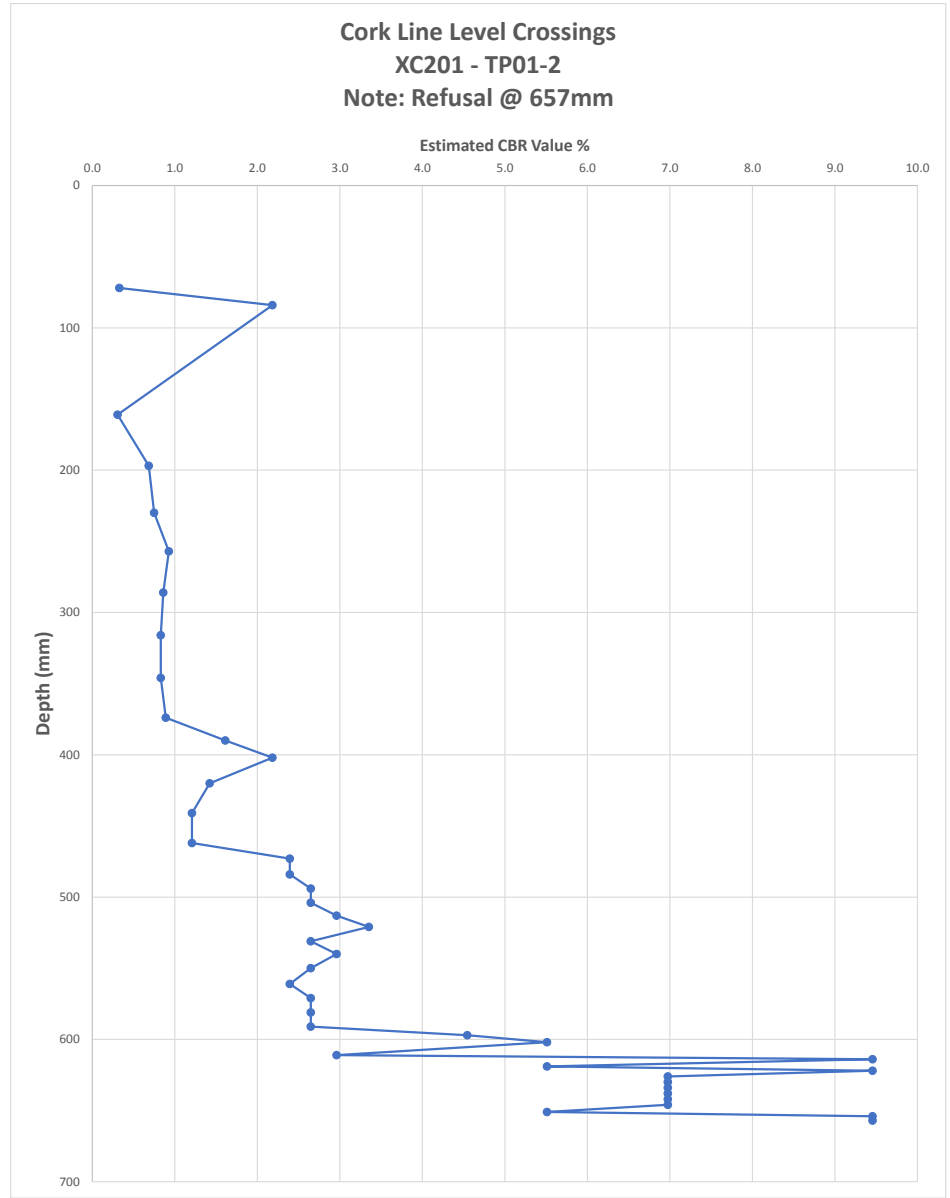
Cork Line Level Crossings - Irish Rail  
 Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	XC201 - TP01-2	Job No	19-135
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Easting	Northing	Elevation
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Test Start Depth	0	mm/bgl	DATE
Start Reading:	1140	mm	14/07/2020

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





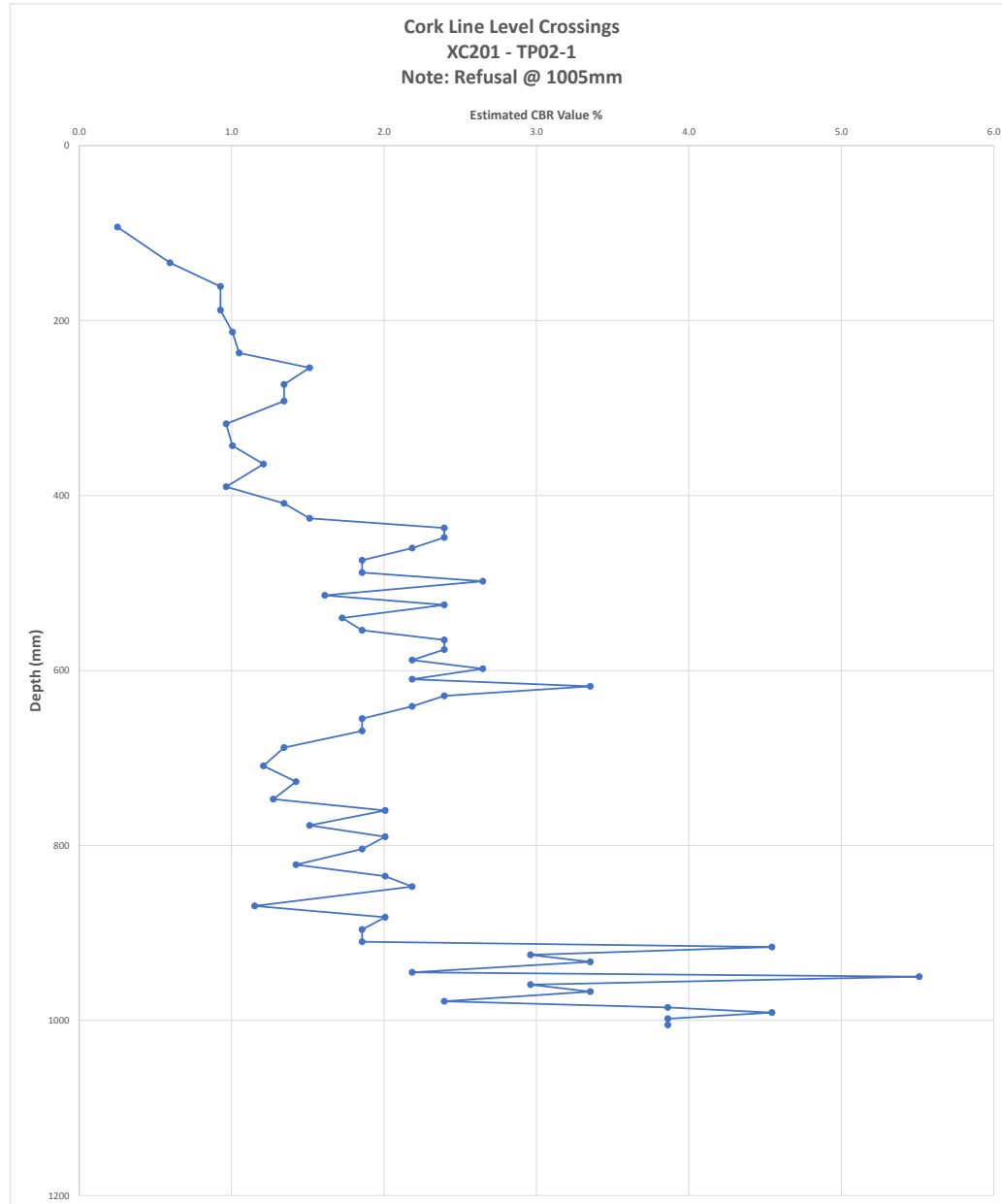
Cork Line Level Crossings - Irish Rail  
 Transport Research Laboratory - Dynamic Cone Penetrometer Data

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

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

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



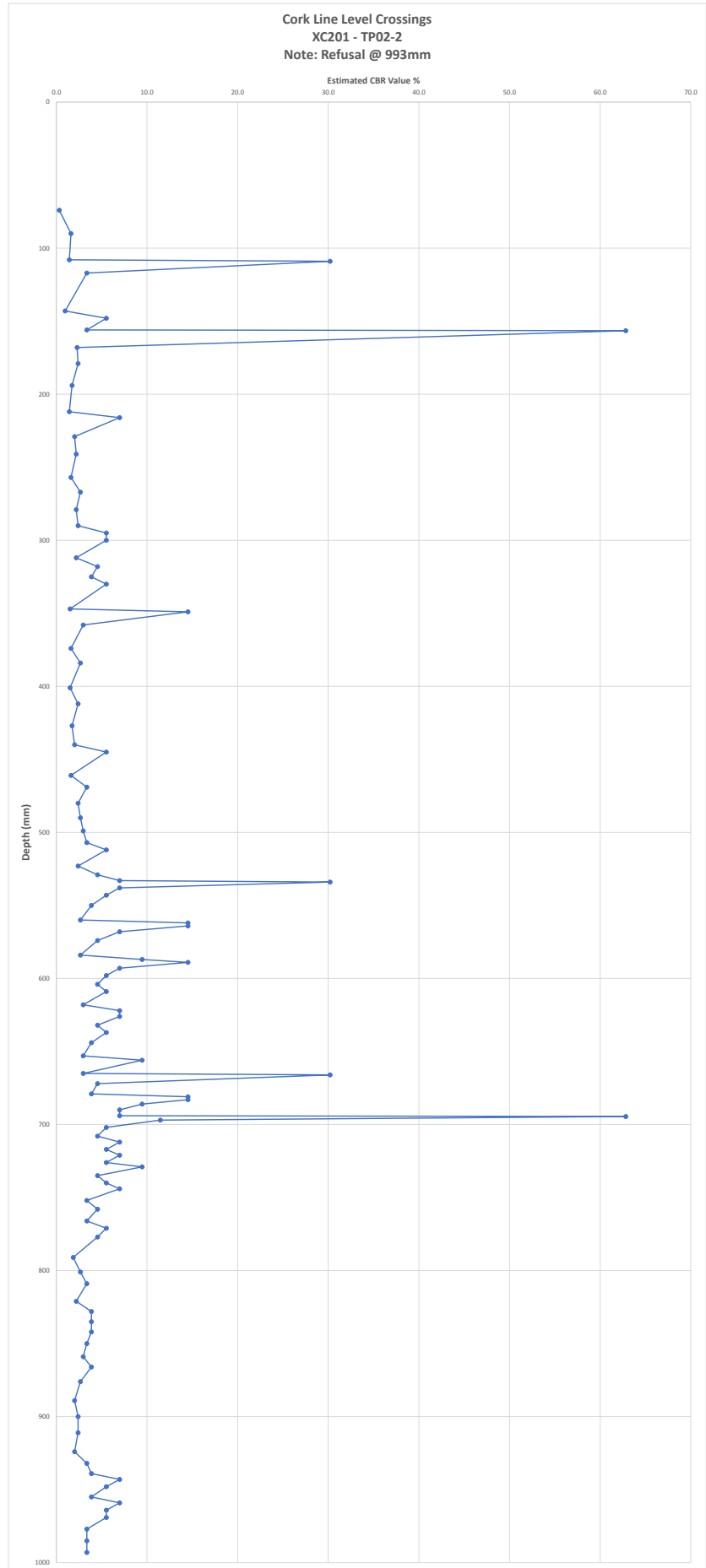
Cork Line Level Crossings - Irish Rail  
Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	XC201 - TP02-2	Job No	19-135
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Easting	Northing	Elevation

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

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





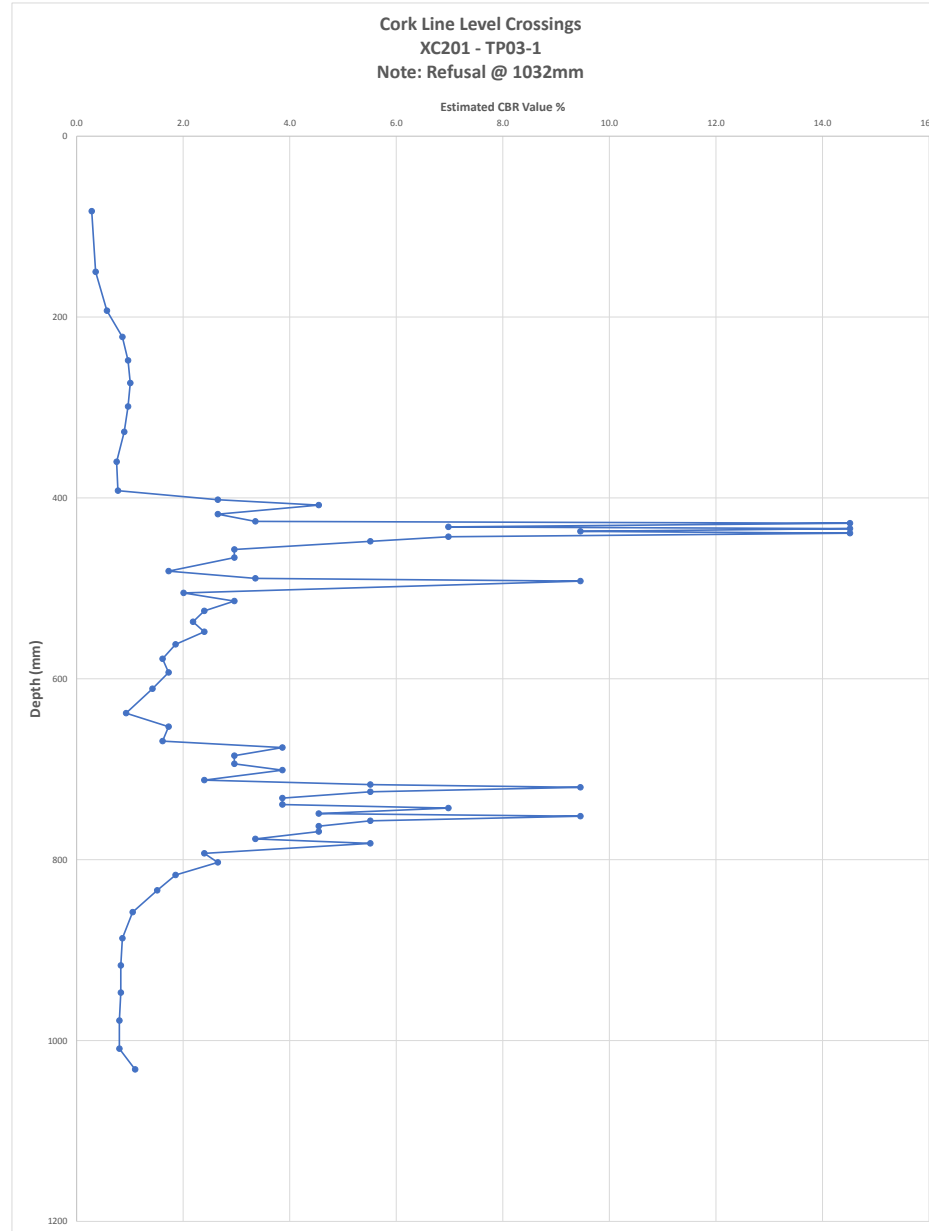
Cork Line Level Crossings - Irish Rail  
 Transport Research Laboratory - Dynamic Cone Penetrometer Data

Location	XC201 - TP03-1	Job No	19-135
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Easting	Northing	Elevation

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

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



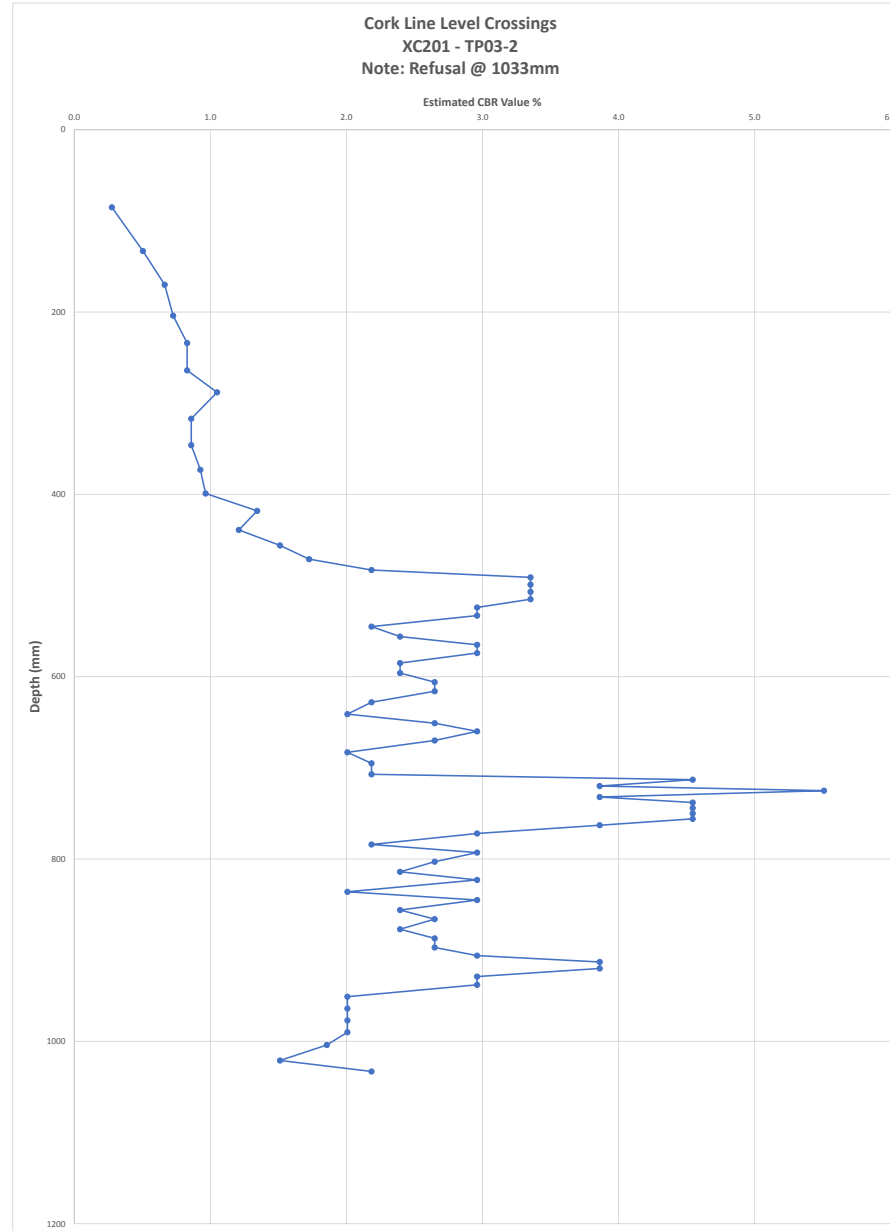
Cork Line Level Crossings - Irish Rail  
 Transport Research Laboratory - Dynamic Cone Penetrometer Data

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

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

No. of Blows	READING (mm)	Penetration/blow (mm)	DEPTH	CBR %
1	1054	85	85	0.3
2	1006	48	133	0.5
3	969	37	170	0.7
4	935	34	204	0.7
5	905	30	234	0.8
6	875	30	264	0.8
7	851	24	288	1.0
8	822	29	317	0.9
9	793	29	346	0.9
10	766	27	373	0.9
11	740	26	399	1.0
12	721	19	418	1.3
13	700	21	439	1.2
14	683	17	456	1.5
15	668	15	471	1.7
16	656	12	483	2.2
17	648	8	491	3.4
18	640	8	499	3.4
19	634	8	507	3.4
20	624	8	515	3.4
21	615	9	524	3.0
22	606	9	533	3.0
23	594	12	545	2.2
24	583	11	556	2.4
25	574	9	565	3.0
26	565	9	574	3.0
27	554	11	585	2.4
28	543	11	596	2.4
29	533	10	606	2.6
30	523	10	616	2.6
31	511	12	628	2.2
32	498	13	641	2.0
33	488	10	651	2.6
34	479	9	660	3.0
35	469	10	670	2.6
36	456	13	683	2.0
37	444	12	695	2.2
38	432	12	707	2.2
39	426	6	713	4.5
40	419	7	720	3.9
41	414	5	725	5.5
42	407	7	732	3.9
43	401	6	738	4.5
44	395	6	744	4.5
45	389	6	750	4.5
46	383	6	756	4.5
47	376	7	763	3.9
48	367	9	772	3.0
49	355	12	784	2.2
50	346	9	793	3.0
51	336	10	803	2.6
52	325	11	814	2.4
53	316	9	823	3.0
54	303	13	836	2.0
55	294	9	845	3.0
56	283	11	856	2.4
57	273	10	866	2.6
58	262	11	877	2.4
59	252	10	887	2.6
60	242	10	897	2.6
61	233	9	906	3.0
62	226	7	913	3.9
63	219	7	920	3.9
64	210	9	929	3.0
65	201	9	938	3.0
66	188	13	951	2.0
67	175	13	964	2.0
68	162	13	977	2.0
69	149	13	990	2.0
70	135	14	1004	1.9
71	118	17	1021	1.5
72	106	12	1033	2.2





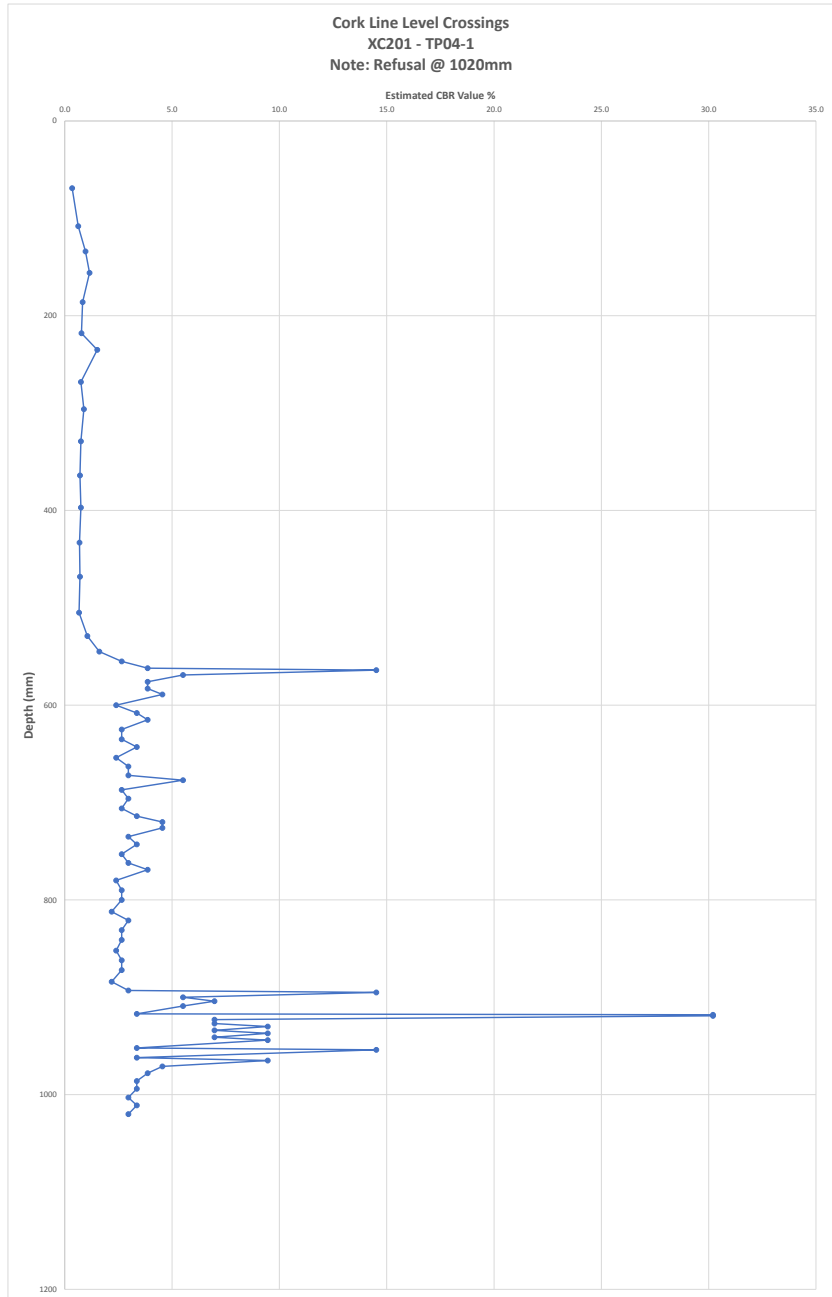
Cork Line Level Crossings - Irish Rail  
 Transport Research Laboratory - Dynamic Cone Penetrometer Data

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

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

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



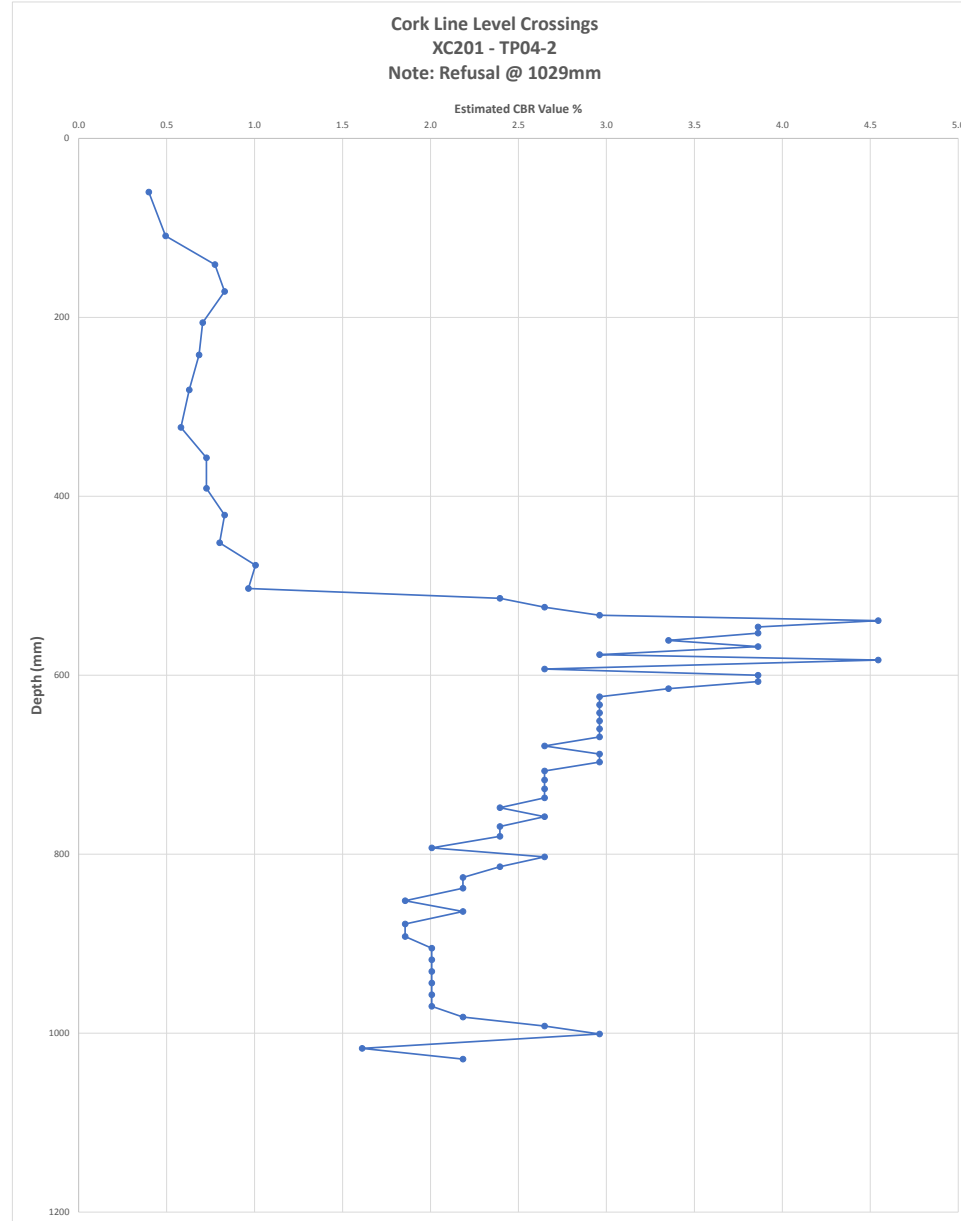
Cork Line Level Crossings - Irish Rail  
 Transport Research Laboratory - Dynamic Cone Penetrometer Data

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

Easting	Northing	Elevation

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

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





**Appendix F**

**Water Purging Data & Logs**

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

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

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

	Time Taken to fill 25ltr container(mins)	Flow Rate l/min	
Reading 1:	4	5	<i>Date</i> <u>06/08/2020</u>
Reading 2:	4	5	
Reading 3:	4	5	

Nr of Containers filled:           

Total Volume Purged:            litres

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

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

<b>BH ID:</b> <u>XC201-CPRC02</u>	<b>Theoretical Well Volume</b>	16.02 <i>ltrs</i>
<b>Depth to Response Zone:</b>	<b>TWV x3</b>	48.07 <i>ltrs</i>
<i>Top (mbgl)</i>		
<i>Bottom (mbgl)</i>		
2	4	

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

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

Nr of Containers filled:

**Total Volume Purged:**  *litres*

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



**Appendix G      Geotechnical Soil Laboratory Test Results**

# INDEX PROPERTIES - SUMMARY OF RESULTS

Hole No.	Sample			Soil Description	$\rho$	$\rho_d$	W	< 425 $\mu$ m sieve	W <sub>L</sub>	W <sub>P</sub>	I <sub>P</sub>	$\rho_s$	Remarks	
	No.	Depth (m)												type
		from	to											
					Mg/m <sup>3</sup>	%	%	%	%		Mg/m <sup>3</sup>			
XC201-CP01	3	0.20	1.20	D	Brown slightly gravelly sandy silty CLAY.			80 s	33 a	21	12			
XC201-CP01A	5	1.20	2.00	D	Brown slightly sandy gravelly CLAY.			74 s	23 a	15	8			
XC201-CP02	3	0.20	1.20	D	Brown mottled grey slightly gravelly sandy silty CLAY.			66 s	23 a	12	11			
XC201-CP02	6	1.20	2.00	D	Brown slightly sandy gravelly CLAY.			68 s	21 a	15	6			
XC201-CPRC01	6	0.50	1.20	D	Brown mottled grey slightly gravelly sandy silty CLAY.			70 s	24 a	16	8			
XC201-CPRC01	8	1.20	2.00	D	Brown mottled grey sandy gravelly CLAY.		8.6							
XC201-CPRC01	11	2.00	3.00	D	Brown slightly sandy gravelly CLAY.			59 s	22 a	13	9			
XC201-CPRC01A	7	1.20	2.00	D	Brown slightly sandy gravelly silty CLAY.			51 s	23 b	14	9			
XC201-CPRC01A	12	2.20	2.40	D	Brown slightly sandy gravelly CLAY.		12							
XC201-CPRC01A	14	2.40	3.40	D	Greyish brown slightly sandy slightly clayey GRAVEL.					NP				
XC201-CPRC02	6	1.20	2.00	D	Brown slightly sandy gravelly silty CLAY.		9.2							
XC201-CPRC02	11	2.50	2.80	D	Brown slightly sandy slightly gravelly silty CLAY.		8.5							

General notes:

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

Key :  $\rho$  bulk density, linear

WL Liquid limit

WP Plastic limit

<425 $\mu$ m preparation

$\rho_s$  particle density

$\rho_d$  dry density

a 4 point cone test

NP non - plastic

n from natural soil

-g = gas jar

w moisture content

b 1 point cone test

IP Plasticity Index

s sieved specimen

-p = small pycnometer

\* test carried out to BS EN ISO 17892

h removed by hand

QA Ref  
SLR 1  
Rev 2.95  
Mar 17



Project No N9387-20  
Project Name Cork Line Level Crossings

Figure  
**INDX**

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# INDEX PROPERTIES - SUMMARY OF RESULTS

Hole No.	Sample			Soil Description	$\rho$	$\rho_d$	W	< 425 $\mu\text{m}$ sieve	$W_L$	$W_P$	$I_P$	$\rho_s$	Remarks	
	No.	Depth (m)												type
		from	to											
					Mg/m <sup>3</sup>	%	%	%	%	%	Mg/m <sup>3</sup>			
XC201-TP01	1	0.50	1.00	D	Brown slightly sandy gravelly CLAY.		15	61 s	25 a	15	10			
XC201-TP01	9	2.20	2.50	D	Brown slightly sandy slightly gravelly CLAY		7.2	67 s	22 a	12	10			
XC201-TP02	7	1.50	2.00	D	Brown slightly sandy slightly gravelly CLAY.		6	62 s	22 a	13	9			
XC201-TP02	9	2.60	3.10	D	Brown slightly sandy gravelly silty CLAY with one cobble		5.3	52 s	22 a	12	10			
XC201-TP03	7	1.40	1.90	D	Brown slightly sandy gravelly CLAY with one cobble		6.2	35 s	23 b	13	10			
XC201-TP03	12	3.00	3.50	D	Brown slightly sandy gravelly silty CLAY with one cobble		4.7	42 s	22 b	13	9			
XC201-TP04	4	0.60	1.10	D	Brown slightly sandy gravelly silty CLAY with one cobble		7.2	61 s	20 b	12	8			
XC201-TP04	9	2.00	2.50	D	Brown slightly sandy slightly gravelly CLAY.		9.2	63 s	23 a	14	9			

General notes:

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

Key :  $\rho$  bulk density, linear

WL Liquid limit

WP Plastic limit

<425 $\mu\text{m}$  preparation

$\rho_s$  particle density

$\rho_d$  dry density

a 4 point cone test

NP non - plastic

n from natural soil

-g = gas jar

w moisture content

b 1 point cone test

IP Plasticity Index

s sieved specimen

-p = small pycnometer

\* test carried out to BS EN ISO 17892

h removed by hand

QA Ref  
SLR 1  
Rev 2.95  
Mar 17



Project No N9425-20  
Project Name Cork Line Level Crossings

Figure  
**INDX**

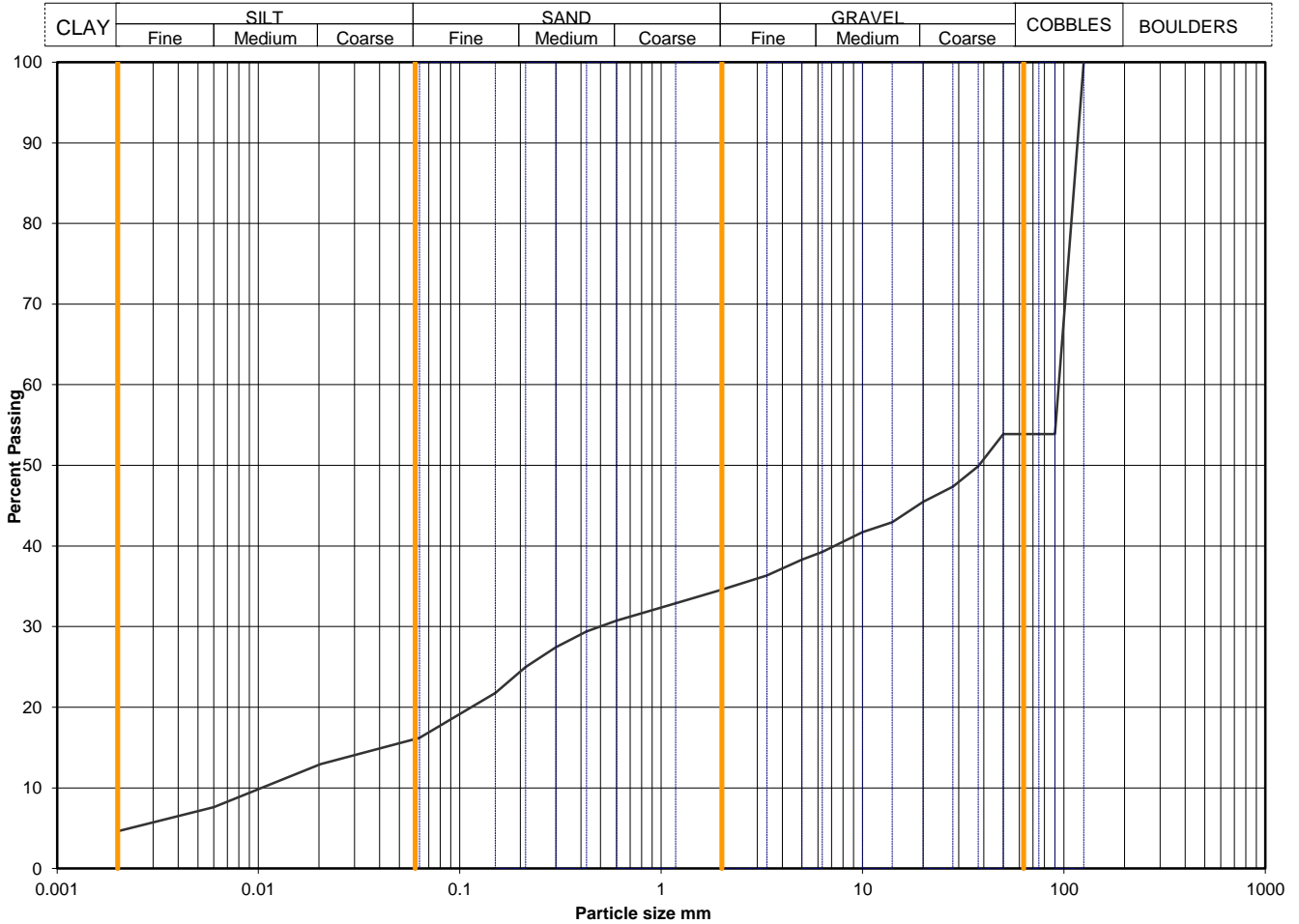
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# Particle Size Distribution Analysis

<b>Sample Details:</b>	SAMPLE ID:	Hole No	XC201-CP01
	SOCO202008042	Sample Depth (m BGL)	1.20 - 2.00
		Sample Type and No	B5
		Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0203	13
90	54	0.0060	8
75	54	0.0020	5
63	54		
50	54		
37.5	50		
28	47		
20	45		
14	43		
10	42		
6.3	39		
5.0	38		
3.35	36		
2.00	35		
1.18	33		
0.600	31	Particle density, Mg/m <sup>3</sup>	
0.425	29	2.65	assumed
0.300	27	Dry mass of sample, kg	
0.212	25	7.1	
0.150	22		
0.063	16		

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

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

\*<60mm values to aid description only

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

QA Ref  
SLR 2,9  
Rev 2.22  
Jul 17



0001



Project No N9387-20  
Project Name Cork Line Level Crossings

Figure

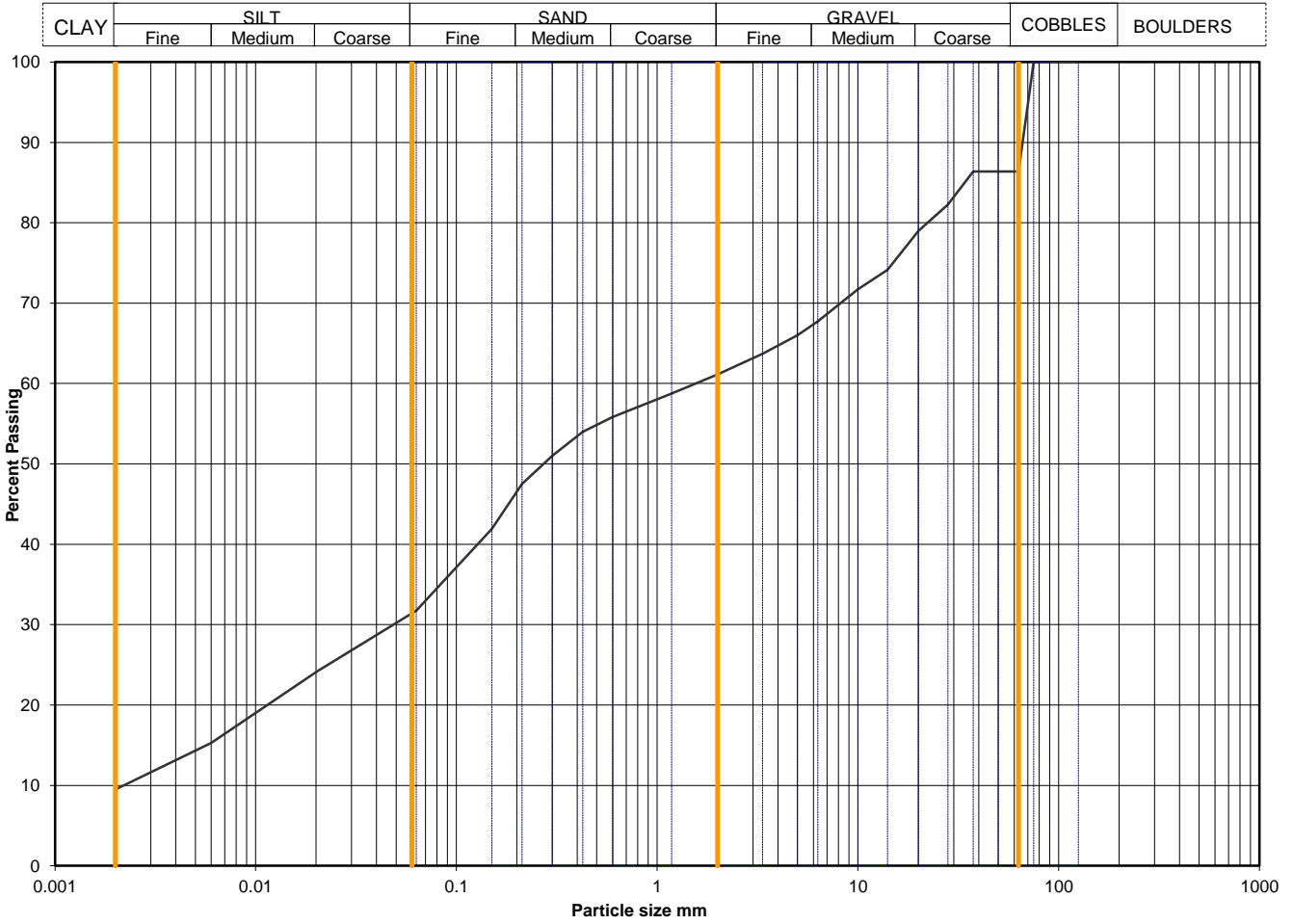
**PSD**

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# Particle Size Distribution Analysis

<b>Sample Details:</b>	SAMPLE ID:	Hole No	XC201-CP01A
	SOCO202008044	Sample Depth (m BGL)	2.00 - 3.00
		Sample Type and No	B7
		Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0203	24
90	100	0.0060	15
75	100	0.0020	9
63	86		
50	86		
37.5	86		
28	82		
20	79		
14	74		
10	72		
6.3	68		
5.0	66		
3.35	64		
2.00	61		
1.18	59		
0.600	56	Particle density, Mg/m <sup>3</sup>	
0.425	54	2.65	assumed
0.300	51	Dry mass of sample, kg	
0.212	48	3.0	
0.150	42		
0.063	32		

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

Sample Proportions	Cobbles / boulders	Whole	*<60mm
		Gravel	13.6
Sand	25.3	29.3	
Silt	29.4	34.0	
Clay	22.2	25.7	
	9.5	11.0	

\*<60mm values to aid description only

<b>Uniformity Coefficient</b>	<b>D60 / D10</b>	725
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<b>Test Method</b>	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

QA Ref  
SLR 2,9  
Rev 2.22  
Jul 17



Project No N9387-20  
Project Name Cork Line Level Crossings

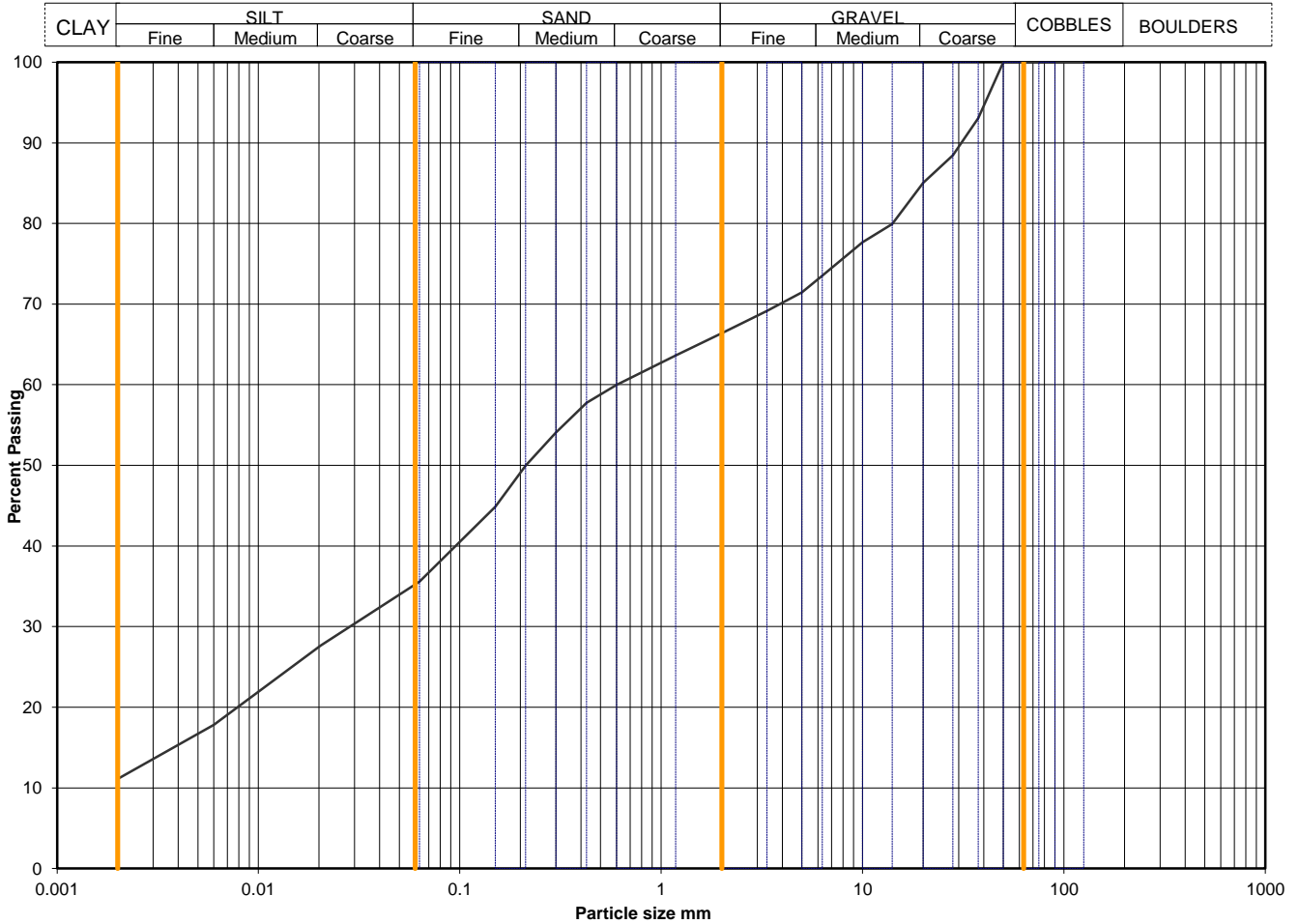
Figure  
**PSD**

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# Particle Size Distribution Analysis

<b>Sample Details:</b>	SAMPLE ID:	Hole No	XC201-CP02
	SOCO202008046	Sample Depth (m BGL)	1.20 - 2.00
		Sample Type and No	B5
		Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0203	28
90	100	0.0060	18
75	100	0.0020	11
63	100		
50	100		
37.5	93		
28	88		
20	85		
14	80		
10	78		
6.3	74		
5.0	71		
3.35	69		
2.00	66		
1.18	64		
0.600	60		
0.425	58		
0.300	54		
0.212	50		
0.150	45		
0.063	36		
		Particle density, Mg/m <sup>3</sup>	
		2.65	assumed
		Dry mass of sample, kg	
		2.9	

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

Sample Proportions	Cobbles / boulders	Whole	*<60mm
		Gravel	0.0
	Sand	33.6	33.6
	Silt	30.8	30.8
	Clay	24.5	24.5
		11.1	11.1

\*<60mm values to aid description only

<b>Uniformity Coefficient</b>	<b>D60 / D10</b>	Not applicable
-------------------------------	------------------	----------------

<b>Test Method</b>	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

QA Ref  
SLR 2,9  
Rev 2.22  
Jul 17



Project No N9387-20  
Project Name Cork Line Level Crossings

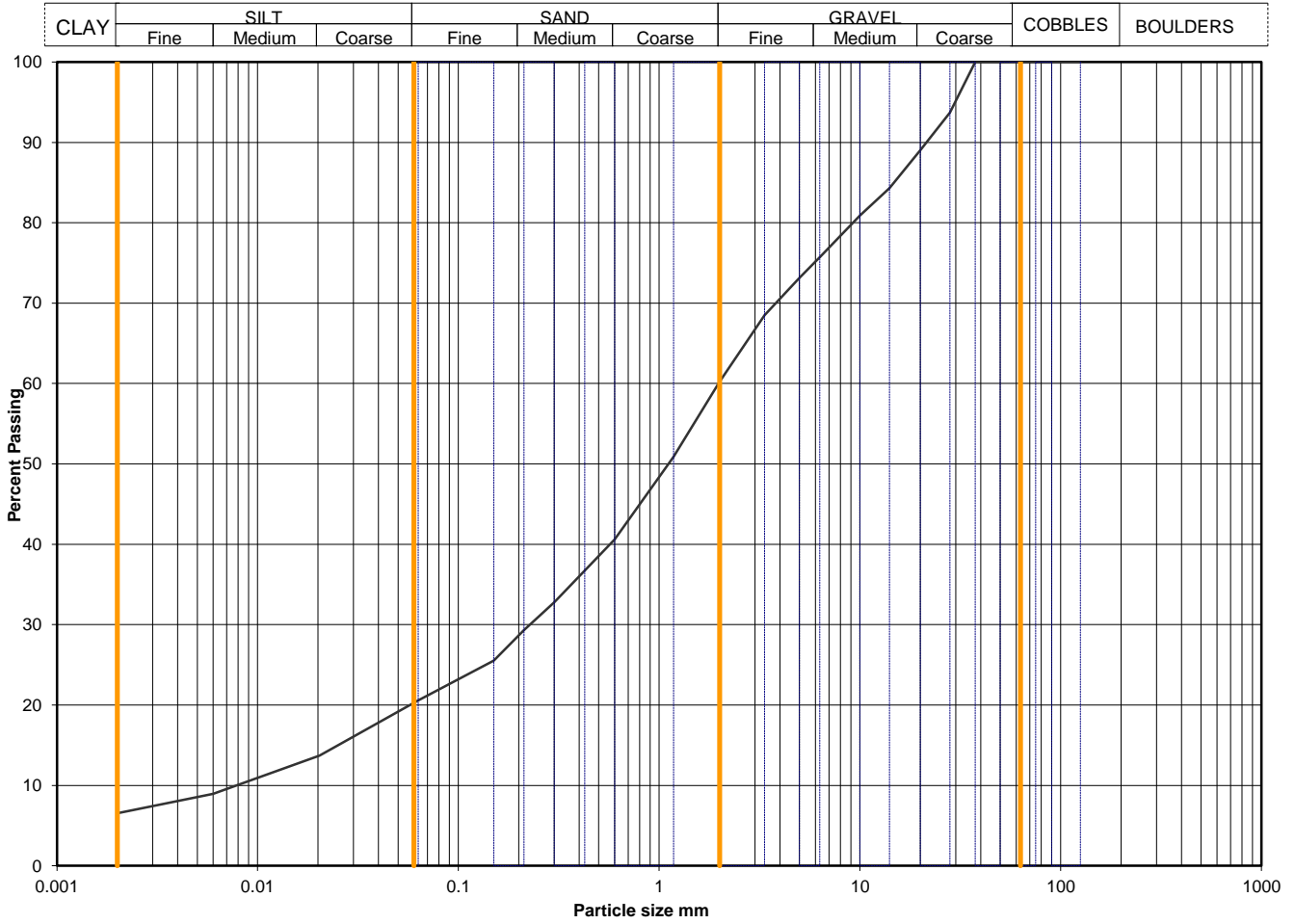
Figure  
**PSD**

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# Particle Size Distribution Analysis

<b>Sample Details:</b>	SAMPLE ID:	Hole No	XC201-CPRC01
	SOCO2020080416	Sample Depth (m BGL)	3.20 - 3.70
		Sample Type and No	B15
		Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0203	14
90	100	0.0060	9
75	100	0.0020	7
63	100		
50	100		
37.5	100		
28	94		
20	89		
14	84		
10	81		
6.3	76		
5.0	73		
3.35	69		
2.00	60		
1.18	51		
0.600	41	Particle density, Mg/m <sup>3</sup>	
0.425	37	2.65 assumed	
0.300	33	Dry mass of sample, kg	
0.212	29	2.7	
0.150	26		
0.063	21		

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

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

\*<60mm values to aid description only

<b>Uniformity Coefficient</b>	<b>D60 / D10</b>	253
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<b>Test Method</b>	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

QA Ref  
SLR 2,9  
Rev 2.22  
Jul 17



Project No N9387-20  
Project Name Cork Line Level Crossings

Figure  
**PSD**

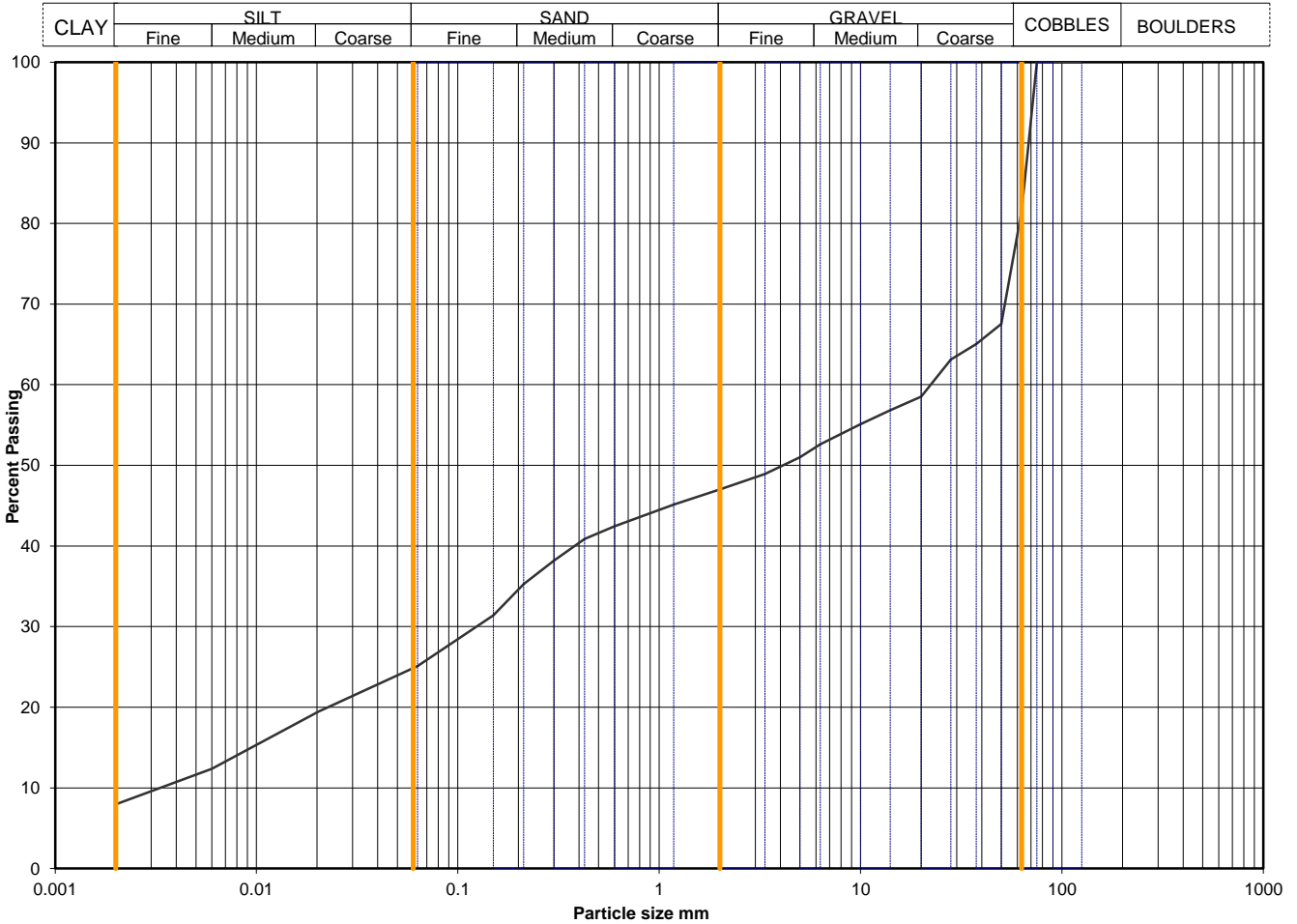
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# Particle Size Distribution Analysis

<b>Sample Details:</b>	SAMPLE ID:	Hole No	XC201-CPRC01A
	SOCO2020080417	Sample Depth (m BGL)	1.20 - 2.00
		Sample Type and No	B6
		Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0203	19
90	100	0.0060	12
75	100	0.0020	8
63	82		
50	68		
37.5	65		
28	63		
20	59		
14	57		
10	55		
6.3	53		
5.0	51		
3.35	49		
2.00	47		
1.18	45		
0.600	42	Particle density, Mg/m <sup>3</sup>	
0.425	41	2.65	assumed
0.300	38	Dry mass of sample, kg	
0.212	35	10.7	
0.150	31		
0.063	25		

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

Sample Proportions	Cobbles / boulders	Whole	*<60mm
		Gravel	18.3
	Sand	34.6	42.4
	Silt	21.9	26.8
	Clay	17.2	21.1
		8.0	9.8

\*<60mm values to aid description only

<b>Uniformity Coefficient</b>	<b>D60 / D10</b>	6681
-------------------------------	------------------	------

<b>Test Method</b>	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

QA Ref  
SLR 2,9  
Rev 2.22  
Jul 17



Project No N9387-20  
Project Name Cork Line Level Crossings

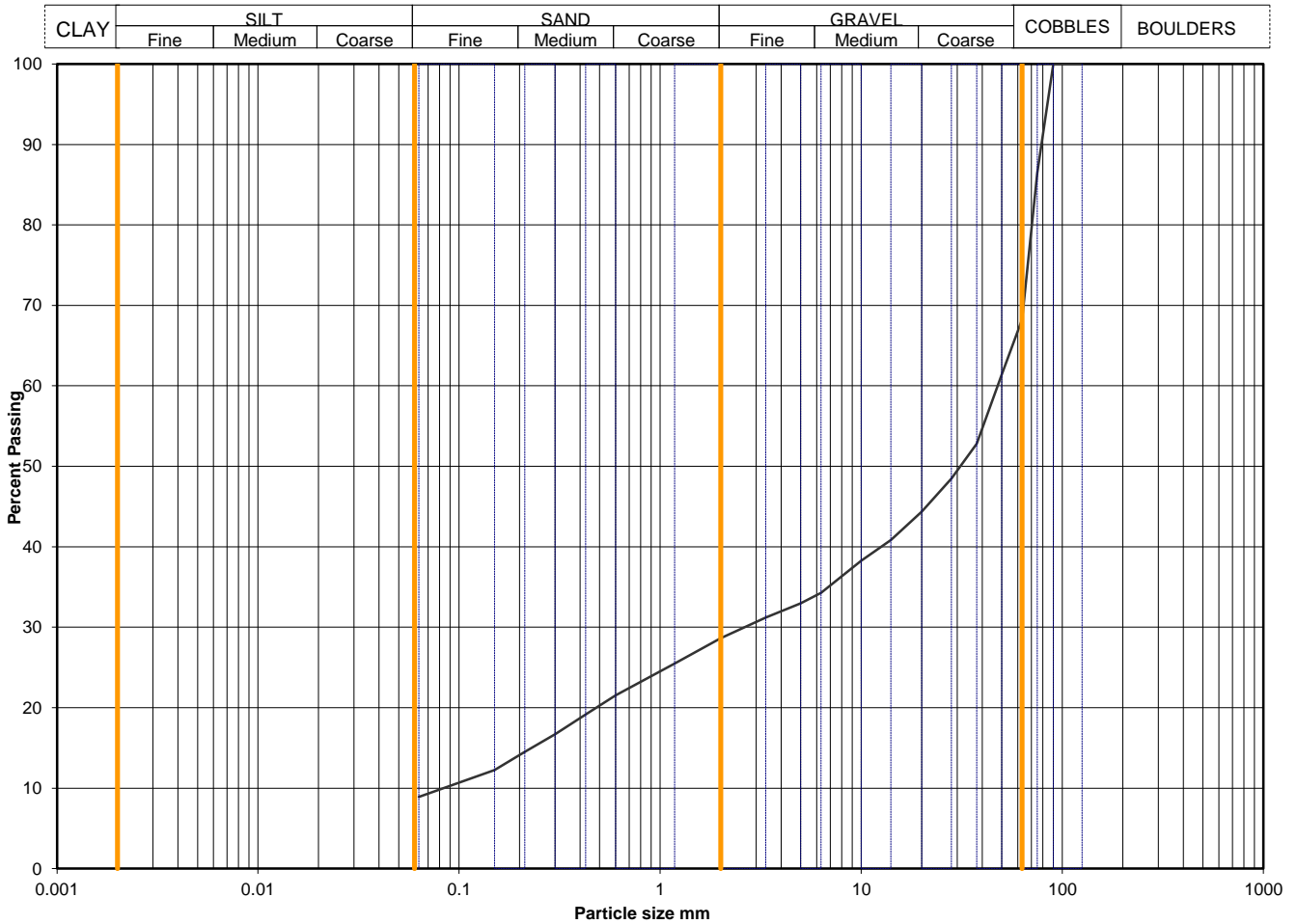
Figure  
**PSD**

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# Particle Size Distribution Analysis

<b>Sample Details:</b>	SAMPLE ID:	Hole No	XC201-CPRC01A
	SOCO2020080420	Sample Depth (m BGL)	2.40 - 3.40
		Sample Type and No	B13
		Specimen Ref	



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

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

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

\*<60mm values to aid description only

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

QA Ref  
SLR 2,9  
Rev 2.22  
Jul 17



Project No N9387-20  
Project Name Cork Line Level Crossings

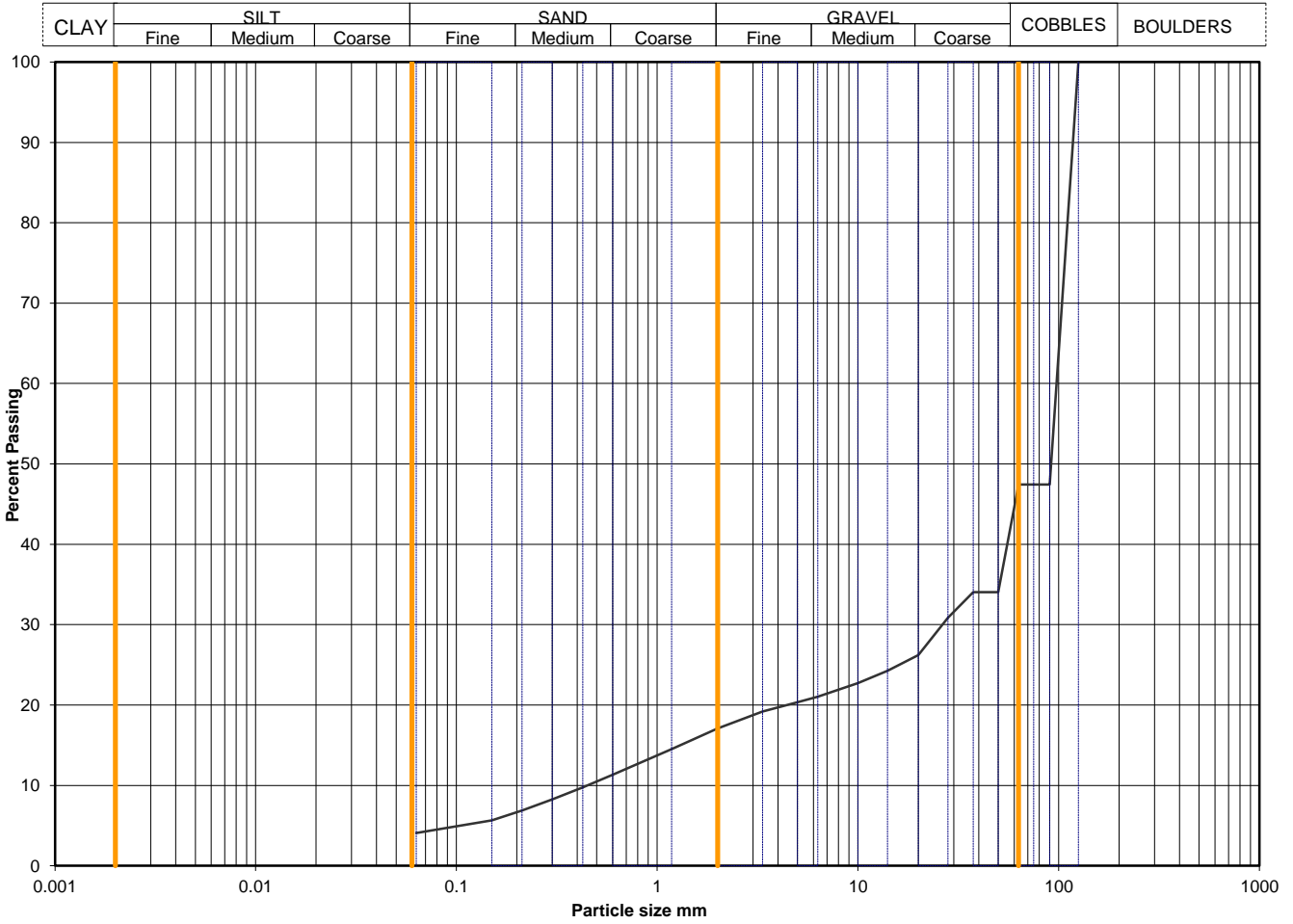
Figure  
**PSD**

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# Particle Size Distribution Analysis

<b>Sample Details:</b>	SAMPLE ID:	Hole No	XC201-CPRC01A
	SOCO2020080422	Sample Depth (m BGL)	3.40 - 3.60
		Sample Type and No	B16
		Specimen Ref	



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

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

Sample Proportions	Cobbles / boulders	Whole	*<60mm
		Gravel	52.6
	Sand	30.3	63.9
	Silt	13.0	27.4
	Clay	4.1	8.6

\*<60mm values to aid description only

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

QA Ref  
SLR 2,9  
Rev 2.22  
Jul 17



Project No N9387-20  
Project Name Cork Line Level Crossings

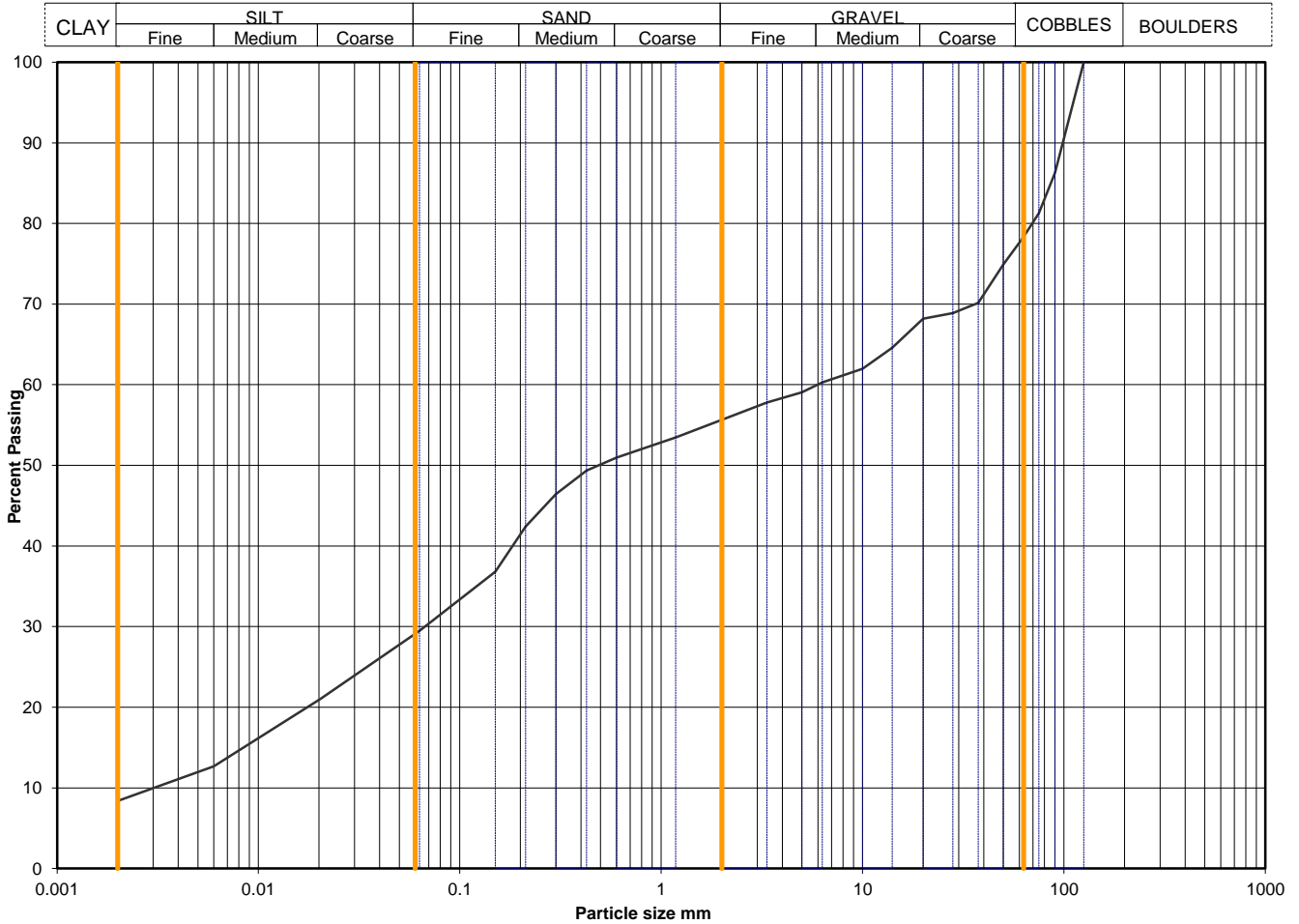
Figure  
**PSD**

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# Particle Size Distribution Analysis

<b>Sample Details:</b>	SAMPLE ID:	Hole No	XC201-CPRC02
	SOCO2020080424	Sample Depth (m BGL)	0.20 - 1.20
		Sample Type and No	B2
		Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0203	21
90	86	0.0060	13
75	81	0.0020	8
63	78		
50	75		
37.5	70		
28	69		
20	68		
14	65		
10	62		
6.3	60		
5.0	59		
3.35	58		
2.00	56		
1.18	53		
0.600	51	Particle density, Mg/m <sup>3</sup>	
0.425	49	2.65 assumed	
0.300	46	Dry mass of sample, kg	
0.212	42	15.4	
0.150	37		
0.063	29		

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

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

\* <60mm values to aid description only

<b>Uniformity Coefficient</b>	<b>D60 / D10</b>	2563
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<b>Test Method</b>	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

QA Ref  
SLR 2,9  
Rev 2.22  
Jul 17



Project No N9387-20  
Project Name Cork Line Level Crossings

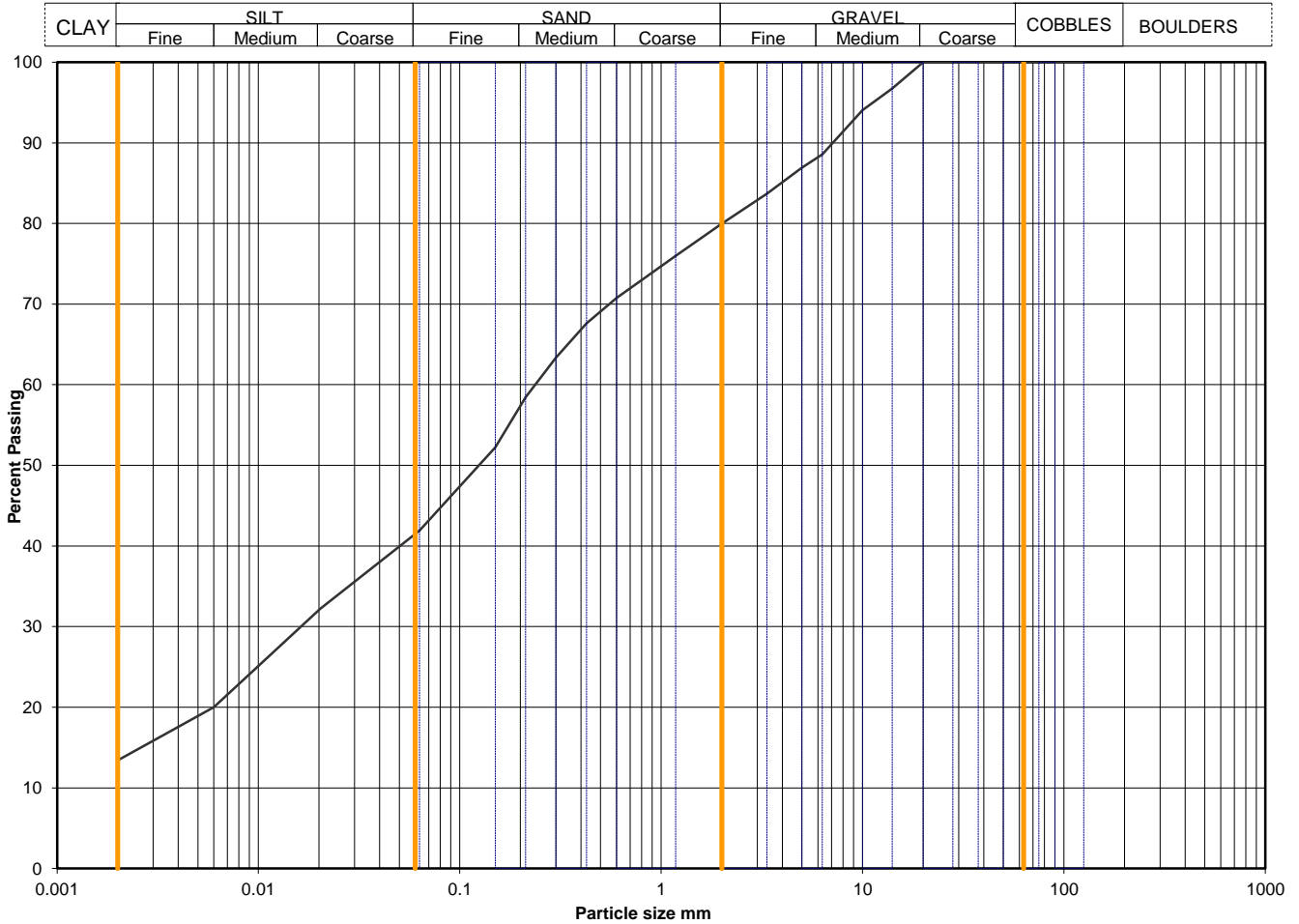
Figure  
**PSD**

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# Particle Size Distribution Analysis

<b>Sample Details:</b>	SAMPLE ID:	Hole No	XC201-CPRC02
	SOCO2020080428	Sample Depth (m BGL)	2.50 - 2.80
		Sample Type and No	B10
		Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0203	32
90	100	0.0060	20
75	100	0.0020	13
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	97		
10	94		
6.3	89		
5.0	87		
3.35	84		
2.00	80		
1.18	76		
0.600	71	Particle density, Mg/m <sup>3</sup>	
0.425	68	2.65	assumed
0.300	63	Dry mass of sample, kg	
0.212	58	1.9	
0.150	52		
0.063	42		

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

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

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

QA Ref  
SLR 2,9  
Rev 2.22  
Jul 17



0001



Project No N9387-20  
Project Name Cork Line Level Crossings

Figure  
**PSD**

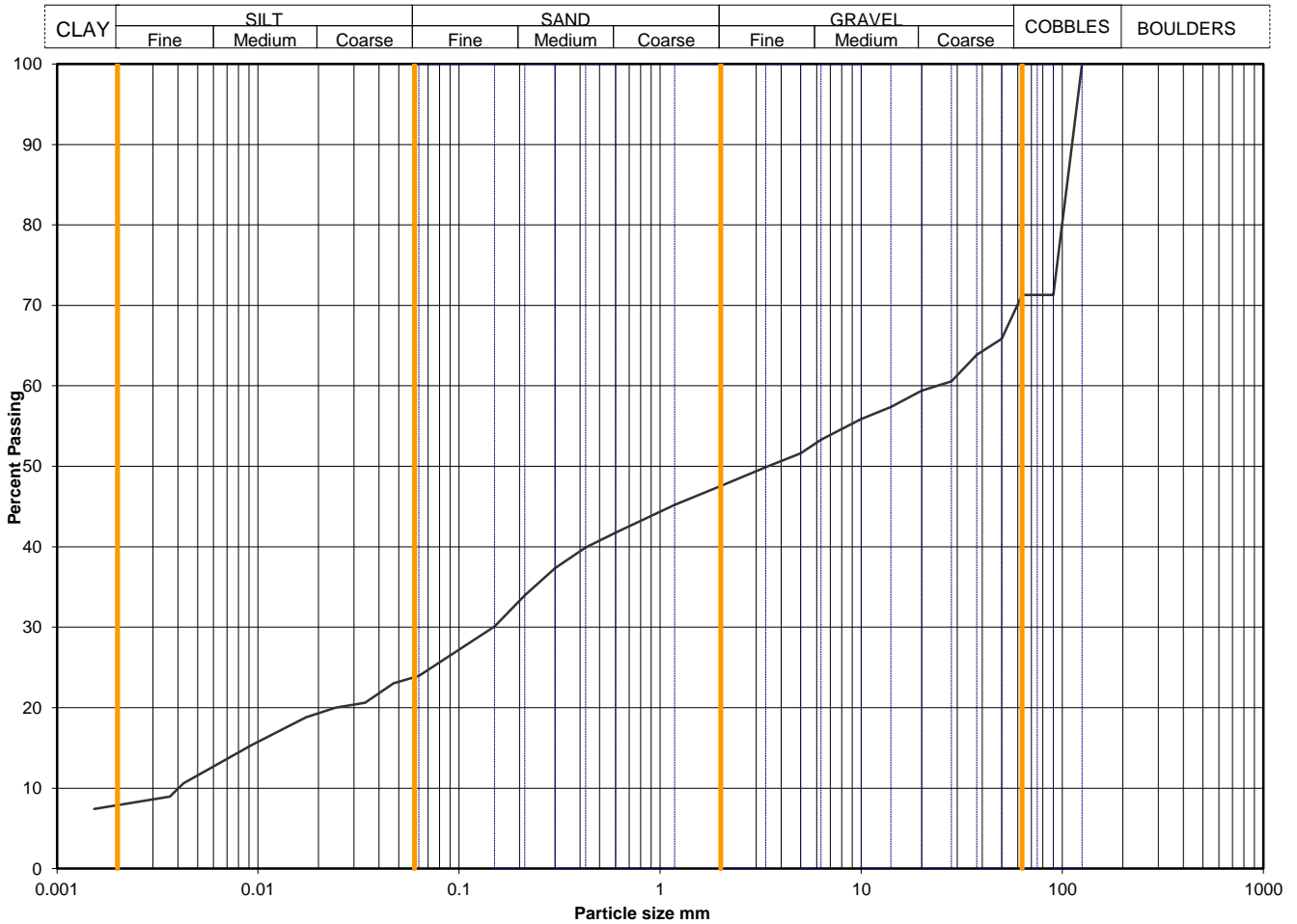
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# Particle Size Distribution Analysis

<b>Sample Details:</b>	SAMPLE ID:	Hole No	XC201-TP01
	SOCO202010025	Sample Depth (m BGL)	1.70 - 2.20
		Sample Type and No	B6
		Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	24
90	71	0.0472	23
75	71	0.0341	21
63	71	0.0242	20
50	66	0.0173	19
37.5	64	0.0092	15
28	61	0.0043	11
20	59	0.0036	9
14	57	0.0015	7
10	56		
6.3	53		
5.0	52		
3.35	50		
2.00	48		
1.18	45		
0.600	42	Particle density, Mg/m <sup>3</sup>	
0.425	40	2.65	assumed
0.300	37	Dry mass of sample, kg	
0.212	34	6.6	
0.150	30		
0.063	24		

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

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

\*<60mm values to aid description only

<b>Uniformity Coefficient</b>	<b>D60 / D10</b>	6639
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<b>Test Method</b>	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref  
SLR 2,9  
Rev 2.22  
Jul 17



Project No N9425-20  
Project Name Cork Line Level Crossings

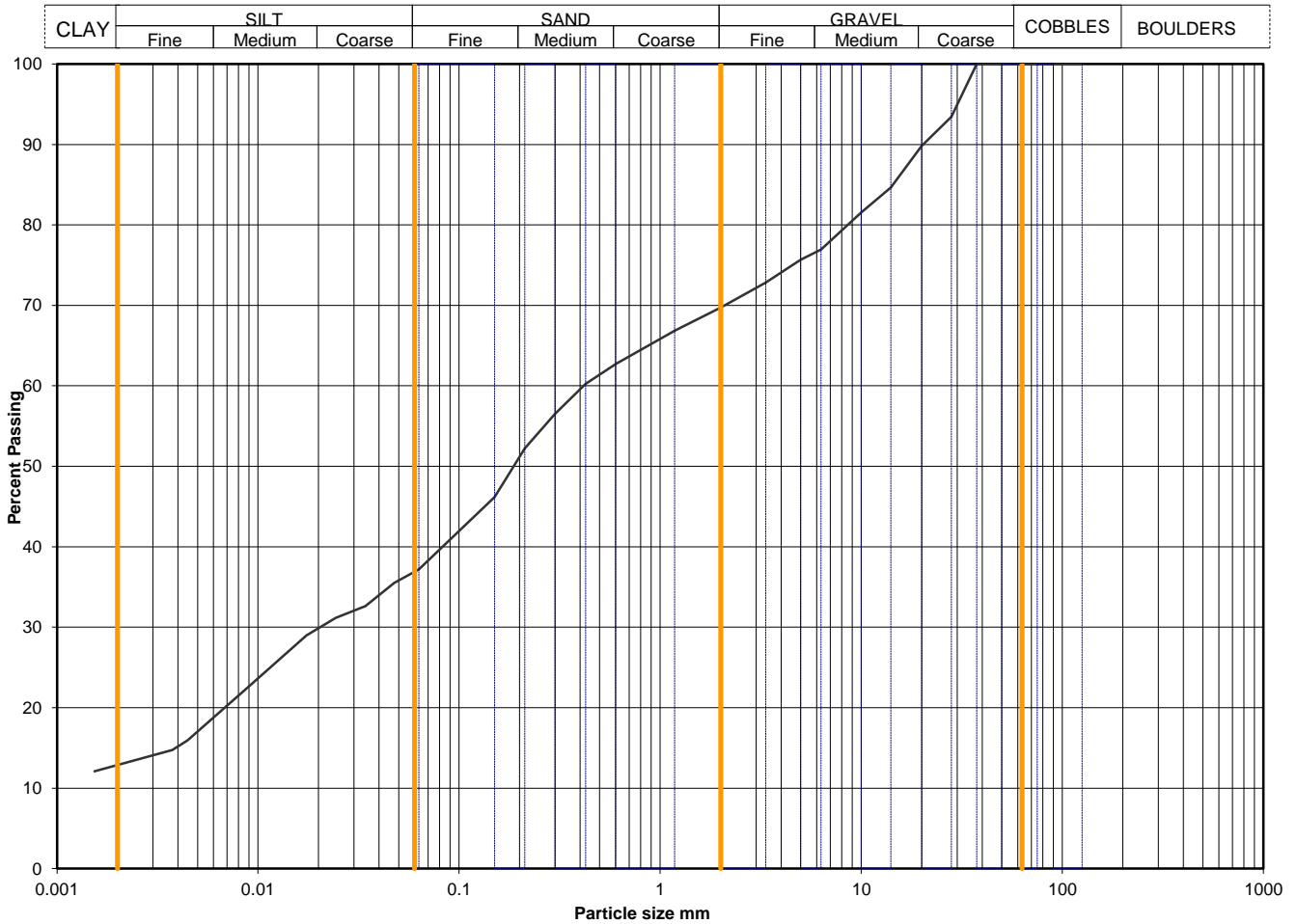
Figure  
**PSD**

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# Particle Size Distribution Analysis

<b>Sample Details:</b>	SAMPLE ID:	Hole No	XC201-TP01
	SOCO2020100213	Sample Depth (m BGL)	2.70 - 3.20
		Sample Type and No	B10
		Specimen Ref	



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

Particle density, Mg/m <sup>3</sup>	2.65 assumed
Dry mass of sample, kg	3.2

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

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

\*<60mm values to aid description only

<b>Uniformity Coefficient</b>	<b>D60 / D10</b>	Not applicable
-------------------------------	------------------	----------------

<b>Test Method</b>	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref  
SLR 2,9  
Rev 2.22  
Jul 17



Project No N9425-20  
Project Name Cork Line Level Crossings

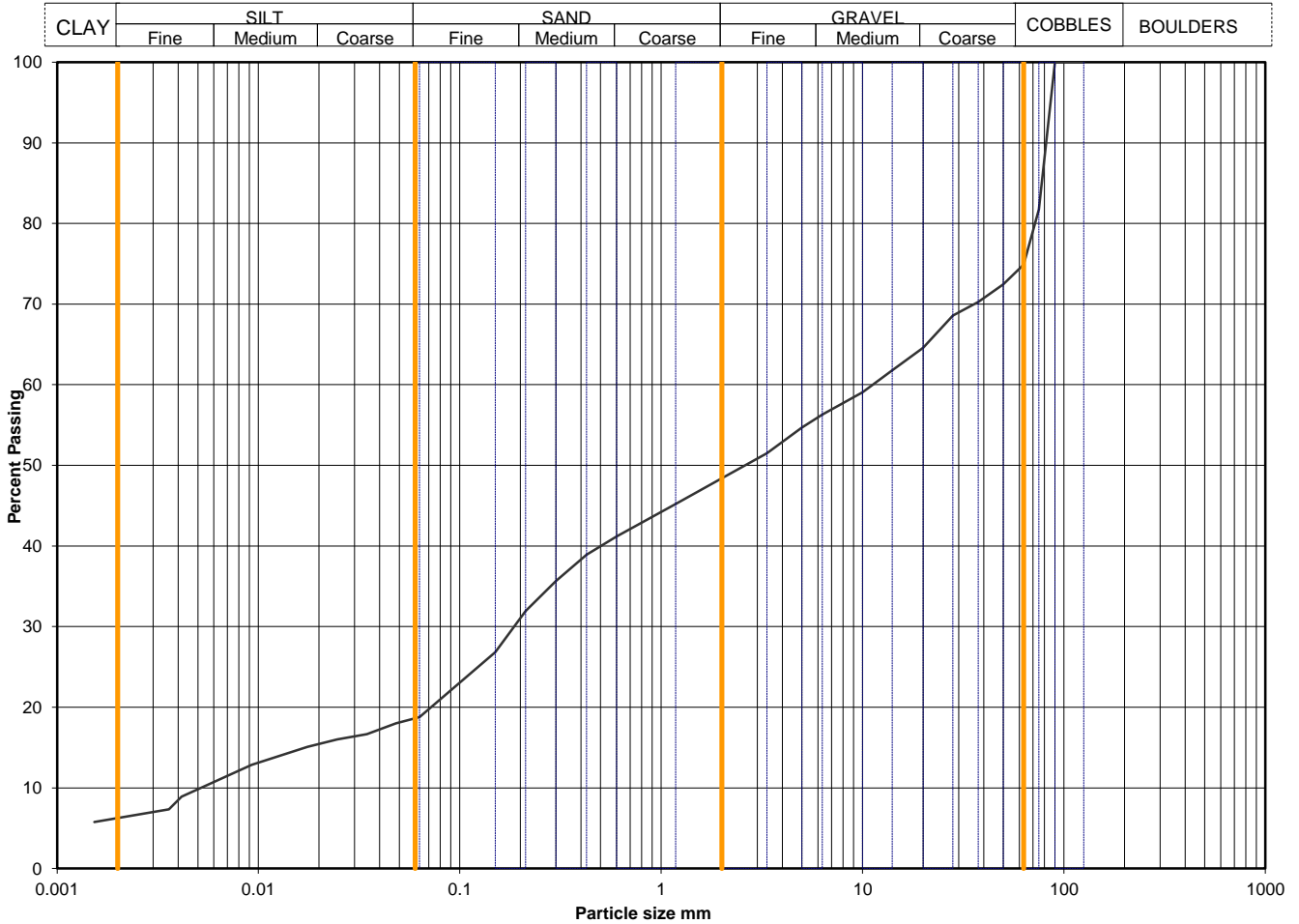
Figure  
**PSD**

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# Particle Size Distribution Analysis

<b>Sample Details:</b>	SAMPLE ID:	Hole No	XC201-TP02
	SOCO2020100217	Sample Depth (m BGL)	1.50 - 2.00
		Sample Type and No	B6
		Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	19
90	100	0.0482	18
75	82	0.0345	17
63	75	0.0246	16
50	72	0.0175	15
37.5	70	0.0093	13
28	69	0.0042	9
20	65	0.0036	7
14	62	0.0015	6
10	59		
6.3	56		
5.0	55		
3.35	52		
2.00	48		
1.18	45		
0.600	41		
0.425	39		
0.300	36		
0.212	32		
0.150	27		
0.063	19		
		Particle density, Mg/m <sup>3</sup>	
		2.65 assumed	
		Dry mass of sample, kg	
		13.7	

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

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

\*<60mm values to aid description only

<b>Uniformity Coefficient</b>	<b>D60 / D10</b>	2164
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<b>Test Method</b>	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref  
SLR 2,9  
Rev 2.22  
Jul 17



Project No N9425-20  
Project Name Cork Line Level Crossings

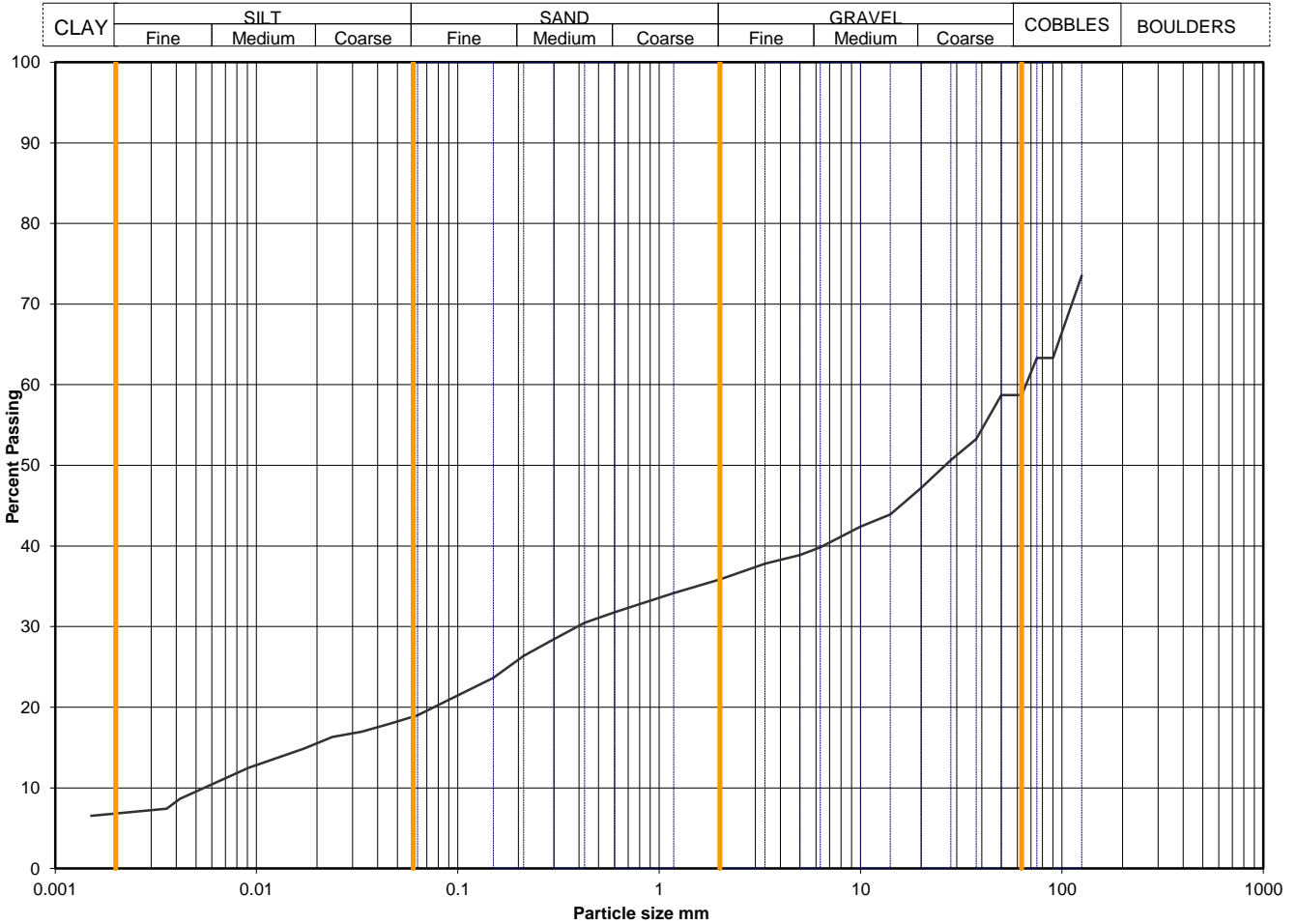
Figure  
**PSD**

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# Particle Size Distribution Analysis

<b>Sample Details:</b>	SAMPLE ID:	Hole No	XC201-TP03
	SOCO2020100225	Sample Depth (m BGL)	2.20 - 2.70
		Sample Type and No	B8
		Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	74	0.0630	19
90	63	0.0466	18
75	63	0.0334	17
63	59	0.0238	16
50	59	0.0171	15
37.5	53	0.0091	12
28	51	0.0042	9
20	47	0.0036	7
14	44	0.0015	7
10	42		
6.3	40		
5.0	39		
3.35	38		
2.00	36		
1.18	34		
0.600	32	Particle density, Mg/m <sup>3</sup>	
0.425	30	2.65 assumed	
0.300	28	Dry mass of sample, kg	
0.212	26	13.2	
0.150	24		
0.063	19		

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

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

\*<60mm values to aid description only

<b>Uniformity Coefficient</b>	<b>D60 / D10</b>	12079
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<b>Test Method</b>	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref  
SLR 2,9  
Rev 2.22  
Jul 17



Project No N9425-20  
Project Name Cork Line Level Crossings

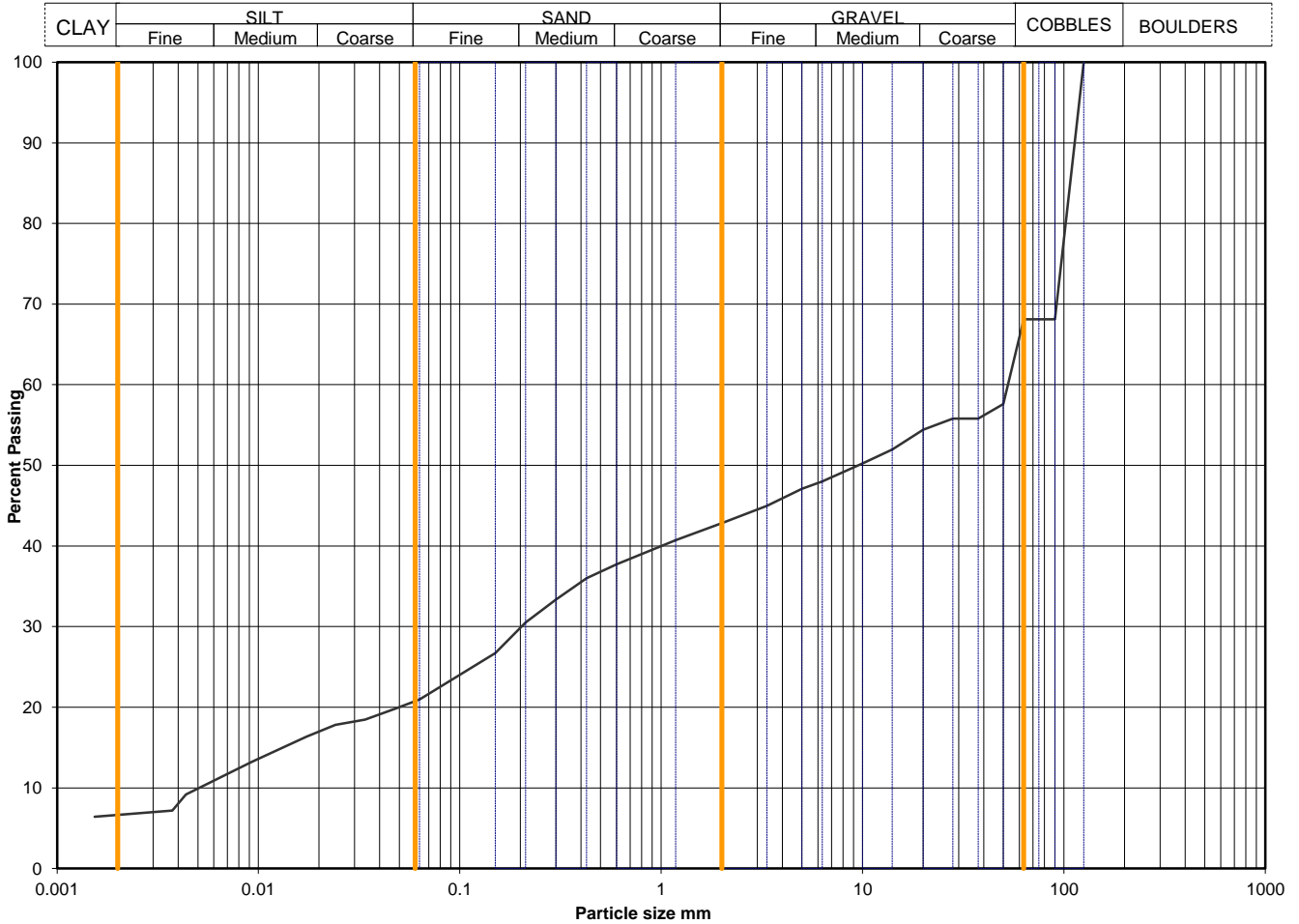
Figure  
**PSD**

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# Particle Size Distribution Analysis

<b>Sample Details:</b>	SAMPLE ID:	Hole No	XC201-TP04
	SOCO2020100231	Sample Depth (m BGL)	1.30 - 1.80
		Sample Type and No	B6
		Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	21
90	68	0.0472	20
75	68	0.0339	18
63	68	0.0241	18
50	58	0.0173	16
37.5	56	0.0092	13
28	56	0.0044	9
20	54	0.0037	7
14	52	0.0015	6
10	50		
6.3	48		
5.0	47		
3.35	45		
2.00	43		
1.18	41		
0.600	38	Particle density, Mg/m <sup>3</sup>	
0.425	36	2.65 assumed	
0.300	33	Dry mass of sample, kg	
0.212	30	6.1	
0.150	27		
0.063	21		

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

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

\*<60mm values to aid description only

<b>Uniformity Coefficient</b>	<b>D60 / D10</b>	10348
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<b>Test Method</b>	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref  
SLR 2,9  
Rev 2.22  
Jul 17



Project No N9425-20  
Project Name Cork Line Level Crossings

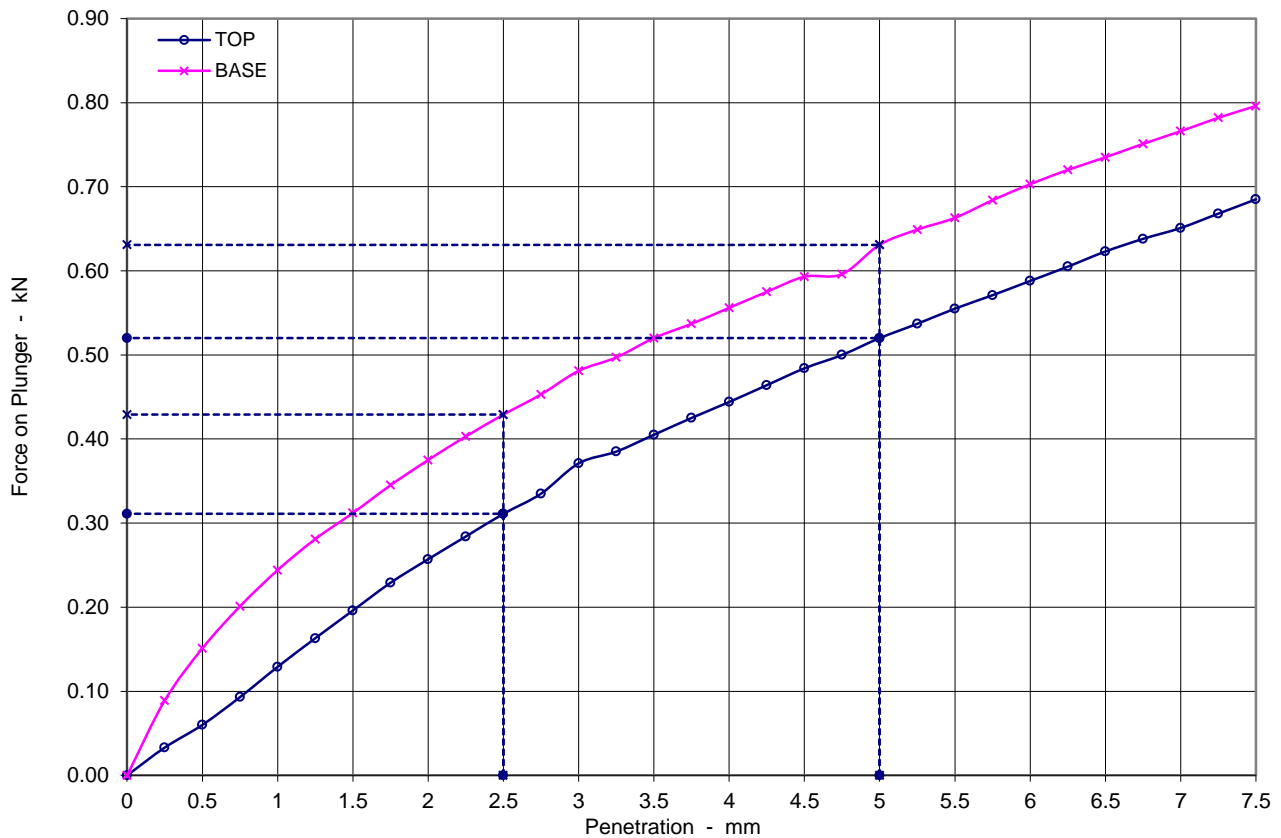
Figure  
**PSD**

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

Sample Details:	SAMPLE ID:	Hole No	XC201-TP01
	SOCO202010024	Sample Depth (m)	0.50 - 1.00
		Sample Type and No	D1
		Specimen Ref	1



Soil description	Brown slightly sandy gravelly CLAY.
------------------	-------------------------------------

Test Conditions	
Sample Retained on 20 mm sieve	% 17

Sample Conditions	
Initial Moisture Content	% 12.0
Bulk Density	Mg/m <sup>3</sup> 1.97
Dry Density	Mg/m <sup>3</sup> 1.77
Moisture Content - TOP	% 11.0
Moisture Content - BASE	% 12.0

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

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

Surcharge applied	kg	0
	kPa	0

Notes : @-2 OF NMC

<b>Accepted CBR %</b>	<b>2.6</b>	<b>3.3</b>
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QA Ref  
SLR 4.7  
Rev 2.8  
Mar 17



Project No N9425-20  
Project Name Cork Line Level Crossings

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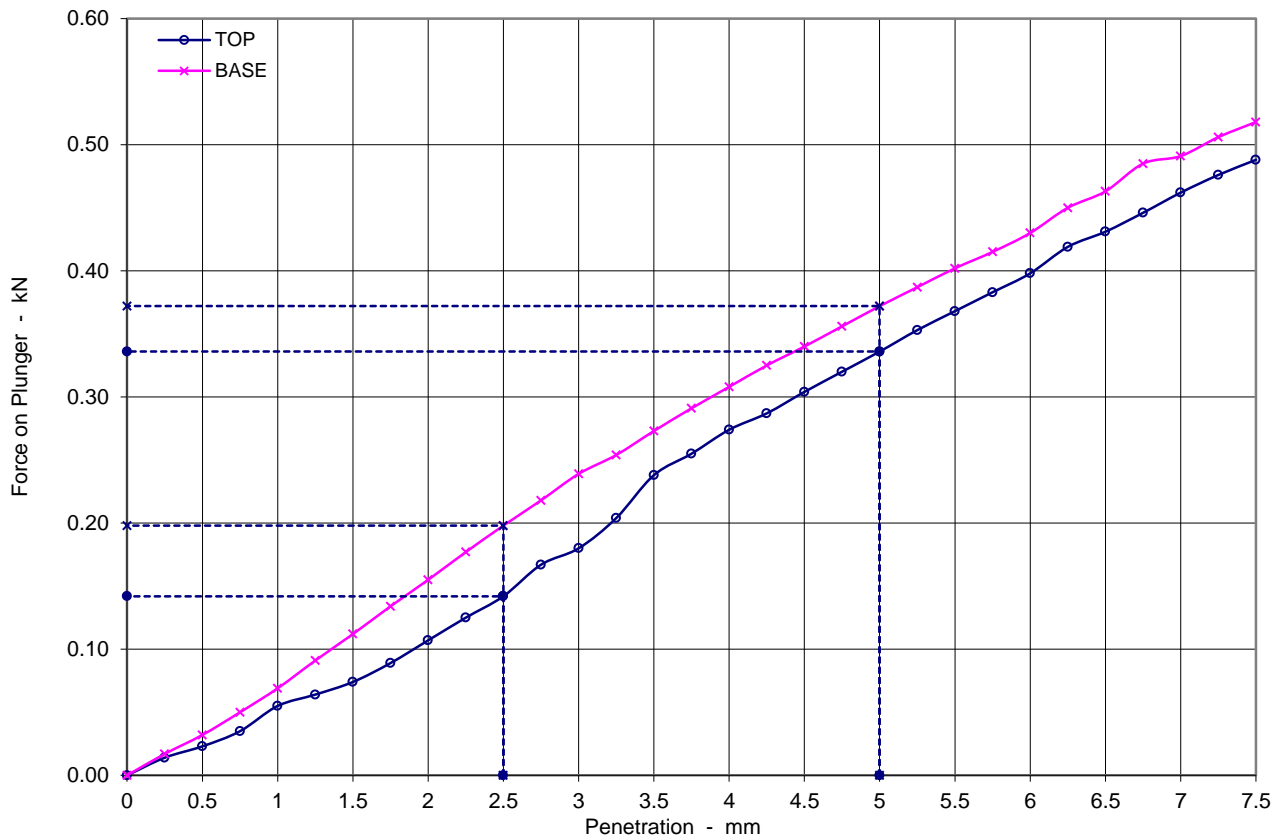
Figure  
**CBR**

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

Sample Details:	SAMPLE ID:	Hole No	XC201-TP04
	SOCO2020100233	Sample Depth (m)	2.00 - 2.50
		Sample Type and No	B8
		Specimen Ref	1



Soil description | Brown slightly sandy slightly gravelly CLAY.

Test Conditions		
Sample Retained on 20 mm sieve	%	0

Sample Conditions		
Initial Moisture Content	%	10.0
Bulk Density	Mg/m <sup>3</sup>	2.12
Dry Density	Mg/m <sup>3</sup>	1.92
Moisture Content - TOP	%	10.0
Moisture Content - BASE	%	10.0

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

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

Surcharge applied	kg	0
	kPa	0

Notes :

<b>Accepted CBR %</b>	<b>1.7</b>	<b>1.9</b>
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QA Ref  
SLR 4.7  
Rev 2.8  
Mar 17



Project No N9425-20  
Project Name Cork Line Level Crossings

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Figure  
**CBR**

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## Certificate of Analysis

*Certificate Number* 20-14518

12-Aug-20

*Client* Socotec - Geotechnical Lab  
Askern Road  
Doncaster  
DN6 8DG

*Our Reference* 20-14518

*Client Reference* N9387-20

*Order No* (not supplied)

*Contract Title* Cork Line Level Crossing

*Description* 3 Soil samples.

*Date Received* 06-Aug-20

*Date Started* 06-Aug-20

*Date Completed* 12-Aug-20

*Test Procedures* Identified by prefix DETSn (details on request).

*Notes* Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

*Approved By*

A handwritten signature in black ink, appearing to read 'A Fenwick'.

Adam Fenwick  
Contracts Manager



2139

## Summary of Chemical Analysis Soil Samples

Our Ref 20-14518

Client Ref N9387-20

Contract Title Cork Line Level Crossing

<b>Lab No</b>	1708692	1708693	1708694
<b>Sample ID</b>	CPRC01A	CP01	CPRC02
<b>Depth</b>	3.40-3.60	0.20-1.20	2.80-3.30
<b>Other ID</b>	D17	B2	D13
<b>Sample Type</b>	SOIL	SOIL	SOIL
<b>Sampling Date</b>	05/08/2020	05/08/2020	05/08/2020
<b>Sampling Time</b>	n/s	n/s	n/s

Test	Method	LOD	Units			
<b>Metals</b>						
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l	19	< 10	< 10
<b>Inorganics</b>						
pH	DETSC 2008#		pH	7.9	7.7	8.4
Ammonia Aqueous Extract as N	DETSC 2119	10	mg/l	< 10	< 10	< 10
Chloride Aqueous Extract	DETSC 2055	1	mg/l	14	11	14
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l	< 1.0	6.4	< 1.0
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	970	280	32
Sulphur as S, Total	DETSC 2320	0.01	%	0.12	0.04	0.02
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.22	0.10	0.04

## Information in Support of the Analytical Results

Our Ref 20-14518  
 Client Ref N9387-20  
 Contract Cork Line Level Crossing

### Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Hold time exceeded for tests	Inappropriate container for tests
1708692	XC201-CPRC01A 3.40-3.60 SOIL	05/08/20	PT 1L		
1708693	XC201-CP01 0.20-1.20 SOIL	05/08/20	PT 1L		
1708694	XC201-CPRC02 2.80-3.30 SOIL	05/08/20	PT 1L		

Key: P-Plastic T-Tub

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

### Soil Analysis Notes

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

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

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

### Disposal

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

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

End of Report



# DETS

## Certificate of Analysis

*Certificate Number* 20-17748

21-Sep-20

*Client* Socotec  
INFRASTRUCTURE SERVICES  
Unit 15  
Crosby Yard  
Wildmill  
Bridgend  
CF31 1JZ

*Our Reference* 20-17748

*Client Reference* N9387

*Order No* N20-O-2186

*Contract Title* Corkline Level Crossing

*Description* One Soil sample.

*Date Received* 15-Sep-20

*Date Started* 15-Sep-20

*Date Completed* 21-Sep-20

*Test Procedures* Identified by prefix DETSn (details on request).

*Notes* Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

*Approved By*



Adam Fenwick  
Contracts Manager



2139

## Summary of Chemical Analysis

### Soil Samples

*Our Ref* 20-17748

*Client Ref* N9387

*Contract Title* Corkline Level Crossing

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

Test	Method	LOD	Units	
<b>Inorganics</b>				
pH	DETSC 2008#		pH	8.3
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	19
Sulphur as S, Total	DETSC 2320	0.01	%	0.02
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.05



## Information in Support of the Analytical Results

Our Ref 20-17748

Client Ref N9387

Contract Corkline Level Crossing

### Containers Received & Deviating Samples

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

Key: P-Plastic T-Tub

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

### Soil Analysis Notes

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

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

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

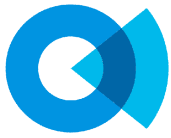
### Disposal

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

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

End of Report

## **Appendix H      Environmental Laboratory Test Results**



**SOCOTEC**

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

# Certificate of Analysis

Project No: 20071478

Client: OCB Geotechnical Limited

Quote Number: BEC200710078

Project Reference: Irish Rail - Cork Line

Site Name: 19-135

Contact: Ian Holley

Address: Unit 1  
Carrigogna  
Midleton  
County Cork

Post Code: Ireland

E-Mail: [iholley@ocbgeotechnical.com](mailto:iholley@ocbgeotechnical.com)

Phone No: 021 4638474

Number of Samples Received: 3

Date Received: 30/07/2020

Analysis Date: 11/08/2020

Date Issued: 11/08/2020

Job Status: Complete

Report Type: Final Version 01

This report supersedes any versions previously issued by the laboratory

Account Manager  
Martin Elliott-Palmer

Authorised by the Operations Manager  
Becky Batham



Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

**Samples Analysed**

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

.....



Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

**Analysis Results**

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



1252



Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

**Analysis Results**

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



1252





Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

**Analysis Results**

Project ID	<b>20071478</b>				
Sample ID	001		003		005
Customer ID	XC201-TP04-1-ES-0.05-0.05		XC201-TP04-2-ES-0.50-0.50		XC201-TP04-5-ES-1.00
Sample Type	LPL	SOLID	LPL	SOLID	LPL
Sampling Date	03/07/2020	03/07/2020	03/07/2020	03/07/2020	03/07/2020

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





Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

**Analysis Results**

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





Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

**Analysis Results**

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





Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

**Analysis Results**

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



# Additional Report Notes

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



Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

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

**Analysis Method**

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



Client: OCB Geotechnical Limited

Project Name: 19-135

Project No: 20071478

Date Issued: 11/08/2020

### Additional Information

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

Results within this report relate only to the samples tested.

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

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

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

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

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

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

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

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

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

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

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

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

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

## **End of Certificate of Analysis**





# Final Report

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**Report No.:** 20-15813-1

**Initial Date of Issue:** 29-Jun-2020

**Client:** Environmental Laboratory Services Ltd

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

**Contact(s):** Emer Kearney  
Results

**Project:** Soil Samples

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

**Date Approved:** 29-Jun-2020

**Approved By:**

**Details:** Glynn Harvey, Technical Manager

---

**Project: Soil Samples**

Client: Environmental Laboratory Services Ltd		Chemtest Job No.:		20-15813	20-15813		
Quotation No.: Q20-19728		Chemtest Sample ID.:		1020856	1020857		
Order No.: 7362		Client Sample Ref.:		182328/001	182328/002		
		Client Sample ID.:		1	2		
		Sample Type:		SOIL	SOIL		
Determinand	Accred.	SOP	Type	Units	LOD		
pH	U	1010	10:1		N/A	8.8	8.7
Cyanide (Free)	U	1300	10:1	mg/l	0.050	< 0.050	< 0.050
Arsenic (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0
Boron (Dissolved)	U	1450	10:1	µg/l	20	< 20	< 20
Barium (Dissolved)	U	1450	10:1	µg/l	5.0	< 5.0	7.3
Beryllium (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0
Cadmium (Dissolved)	U	1450	10:1	µg/l	0.080	< 0.080	< 0.080
Chromium (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0
Copper (Dissolved)	U	1450	10:1	µg/l	1.0	1.9	< 1.0
Mercury (Dissolved)	U	1450	10:1	µg/l	0.50	< 0.50	< 0.50
Nickel (Dissolved)	U	1450	10:1	µg/l	1.0	2.3	1.9
Lead (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0
Selenium (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0
Vanadium (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0
Zinc (Dissolved)	U	1450	10:1	µg/l	1.0	< 1.0	< 1.0
Aliphatic TPH >C5-C6	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aliphatic TPH >C6-C8	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aliphatic TPH >C8-C10	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aliphatic TPH >C10-C12	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aliphatic TPH >C12-C16	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aliphatic TPH >C16-C21	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aliphatic TPH >C21-C35	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aliphatic TPH >C35-C44	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Total Aliphatic Hydrocarbons	N	1675	10:1	µg/l	5.0	[A] < 5.0	[A] < 5.0
Aromatic TPH >C5-C7	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aromatic TPH >C7-C8	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aromatic TPH >C8-C10	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aromatic TPH >C10-C12	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aromatic TPH >C12-C16	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aromatic TPH >C16-C21	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aromatic TPH >C21-C35	N	1675	10:1	µg/l	0.10	[A] < 0.10	[A] < 0.10
Aromatic TPH >C35-C44	N	1680	10:1	µg/l	50.00	[A] < 50	[A] < 50
Total Aromatic Hydrocarbons	N	1675	10:1	µg/l	5.0	[A] < 5.0	[A] < 5.0
Total Petroleum Hydrocarbons	N	1675	10:1	µg/l	10	[A] < 10	[A] < 10
Benzene	U	1760	10:1	µg/l	1.0	[A] < 1.0	[A] < 1.0
Toluene	U	1760	10:1	µg/l	1.0	[A] < 1.0	[A] < 1.0
Ethylbenzene	U	1760	10:1	µg/l	1.0	[A] < 1.0	[A] < 1.0
m & p-Xylene	U	1760	10:1	µg/l	1.0	[A] < 1.0	[A] < 1.0
o-Xylene	U	1760	10:1	µg/l	1.0	[A] < 1.0	[A] < 1.0
Methyl Tert-Butyl Ether	N	1760	10:1	µg/l	1.0	[A] < 1.0	[A] < 1.0

**Project: Soil Samples**

<b>Client: Environmental Laboratory Services Ltd</b>	<b>Chemtest Job No.:</b>		20-15813	20-15813			
Quotation No.: Q20-19728	<b>Chemtest Sample ID.:</b>		1020856	1020857			
Order No.: 7362	Client Sample Ref.:		182328/001	182328/002			
	Client Sample ID.:		1	2			
	Sample Type:		SOIL	SOIL			
<b>Determinand</b>	<b>Accred.</b>	<b>SOP</b>	<b>Type</b>	<b>Units</b>	<b>LOD</b>		
Naphthalene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Acenaphthylene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Acenaphthene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Fluorene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Phenanthrene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Anthracene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Fluoranthene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Pyrene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Chrysene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	1800	10:1	µg/l	2.0	< 2.0	< 2.0

### Deviations

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

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
1020856	182328/001	1			A	Amber Glass 250ml
1020856	182328/001	1			A	Plastic Tub 500g
1020857	182328/002	2			A	Amber Glass 250ml
1020857	182328/002	2			A	Plastic Tub 500g

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5-C6, >C6-C8, >C8-C10, >C10-C12, >C12-C16, >C16-C21, >C21-C35, >C35-C44 Aromatics: >C5-C7, >C7-C8, >C8-C10, >C10-C12, >C12-C16, >C16-C21, >C21-C35, >C35-C44	Pentane extraction / GCxGC FID detection
1680	Extractable Petroleum Hydrocarbons	Aliphatics: >C5-C6, >C6-C8, >C8-C10*, >C10-C12*, >C12-C16*, >C16-C21*, >C21-C35*, >C35-C44 Aromatics: >C5-C7, >C7-C8, >C8-C10*, >C10-C12*, >C12-C16*, >C16-C21*, >C21-C35*, >C35-C44	Dichloromethane extraction / GCxGC FID detection
1760	Volatile Organic Compounds (VOCs) in Waters by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics. (cf. USEPA Method 8260)	Automated headspace gas chromatographic (GC) analysis of water samples with mass spectrometric (MS) detection of volatile organic compounds.
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	Compliance Test for Leaching of Granular Waste Material and Sludge

## **Report Information**

### **Key**

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- 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**

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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](mailto:customerservices@chemtest.com)

## **Appendix I      Pre & Post Site Condition Photographs**





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

	XC201 - Southside
	Pre Works Site Photographs
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	2020





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

	XC201 - Southside
	Pre Works Site Photographs
Client:	Iarnród Éireann
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Date:	2020





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

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

XC201 - Southside	
Pre Works Site Photographs	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	2020





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

	XC201 - Northside
	Pre Works Site Photographs
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	2020





Iarnród Éireann  
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XC201 (19-135-1)

	XC201 - Northside
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Iarnród Éireann  
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 XC201 (19-135-1)

XC201 - Northside	
Pre Works Site Photographs	
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Iarnród Éireann  
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 XC201 (19-135-1)

XC201 - Northside	
Pre Works Site Photographs	
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Date:	2020





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

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





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

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





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	XC201
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XC201 (19-135-1)

	XC201
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 XC201 (19-135-1)

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

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

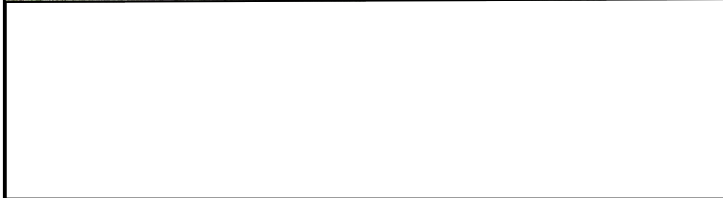




Iarnród Éireann  
Cork Line Level Crossings  
XC201 (19-135-1)

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





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

	XC201
	Post Works Site Photographs
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Date:	2020





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XC201 (19-135-1)

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

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



## Cork Line Level Crossings – XC211 Ground Investigation

Primary Author: Ian Holley

Client: Irish Rail

Client's Representative: JACOBS

Report Date: 25<sup>th</sup> November 2020

Report No.: OCB19-135-2

File Location: OCB19-135-2/Reporting/XC211



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## APPENDICES

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## Document Control Sheet

Report No.: OCB19-135-2  
Project title: Cork Line Level Crossings – XC211  
Client: Irish Rail  
Client's Representative: JACOBS

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

The works were conducted in accordance with:

*Specification And Related Documents For Ground Investigation In Ireland.* (2016) 2<sup>nd</sup> ed. Engineers Ireland.

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

UK Specification for Ground Investigation 2<sup>nd</sup> 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).

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



## **Cork Line Level Crossings – XC211**

### **1 AUTHORITY**

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

This report details the work carried out both on site at XC211 and in the geotechnical and chemical testing laboratories; it contains a description of the site and the works undertaken, the exploratory hole logs and the laboratory test results.

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

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

### **2 SCOPE**

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

### **3 DESCRIPTION OF SITE**

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





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

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

## 4 SITE OPERATIONS

Site operations, which were conducted between 20<sup>th</sup> February 2020 and 6<sup>th</sup> August 2020, included:

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

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

### 4.1 Cable Percussion Boreholes

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

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

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

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

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



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

Appendix B presents the borehole logs.

## **4.2 Standpipe Installations**

A groundwater monitoring standpipe was installed in borehole CP02.

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

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

## **4.3 Trial Pits**

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

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

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

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

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

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

## **4.4 Indirect CBR Tests**

An indirect CBR test was conducted at six locations (TRL01 – TRL06) using a Dynamic Cone Penetrometer (DCP). The equipment was developed in conjunction with the UK Transport Research Laboratory, is used widely throughout the world, and is referred to in the UK Highway Agency Interim Advice Note 73/06.

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



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

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

#### **4.5 Water Purging**

Prior to sampling from the standpipe (in CP02) water purging was carried out.

Appendix F presents the water purging data logs.

#### **4.6 Surveying**

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

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

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

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



## 5 LABORATORY WORK

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

### 5.1 Geotechnical Laboratory Testing of Soils

Laboratory testing of soils comprised:

- **soil classification:** moisture content measurement, Atterberg Limit tests and particle size distribution analysis.
- **compaction:** dry density/moisture content relationship.
- **soil chemistry:** pH, Sulphur content, Organic Matter content and water-soluble and total sulphate content.

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

The test results are presented in Appendix G.

### 5.2 Environmental Laboratory Testing of Soils

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



## **6 GROUND CONDITIONS**

### **6.1 General Geology of the Area**

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

The Geological Survey of Ireland (GSI) bedrock mapping database indicates that soils in the site area are underlain at depth by the Lower Carboniferous-age strata of the Ballysteen Formation, which consists of dark grey irregularly bedded and nodular bedded argillaceous (muddy) bioclastic limestones (wackestones and packstones) interbedded with fossiliferous calcareous shales.

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

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

### **6.2 Ground Types Encountered During Investigation of the Site**

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

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

### **6.3 Groundwater**

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



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

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

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

## 7 DISCUSSION

### 7.1 Proposed Construction

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

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

## 8 REFERENCES

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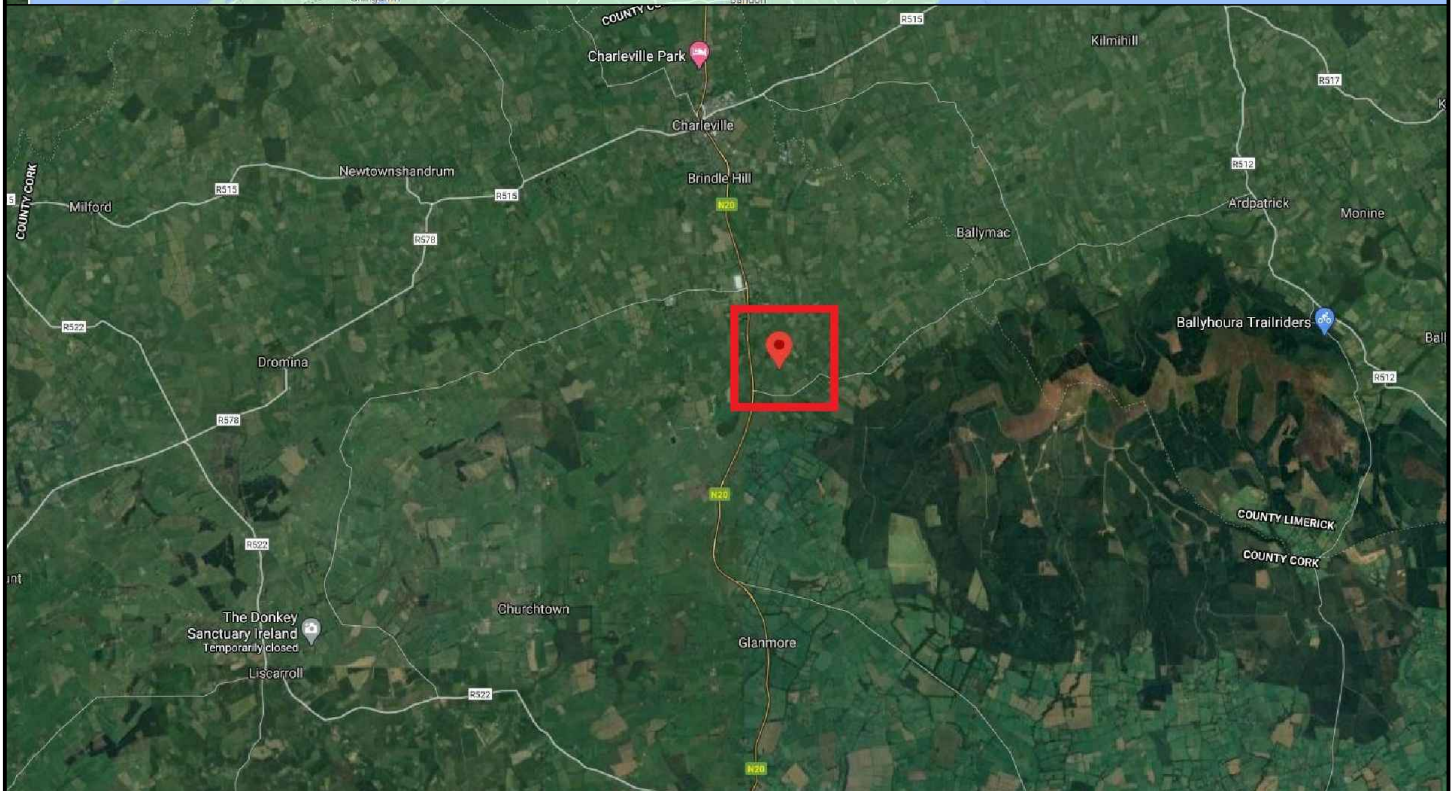
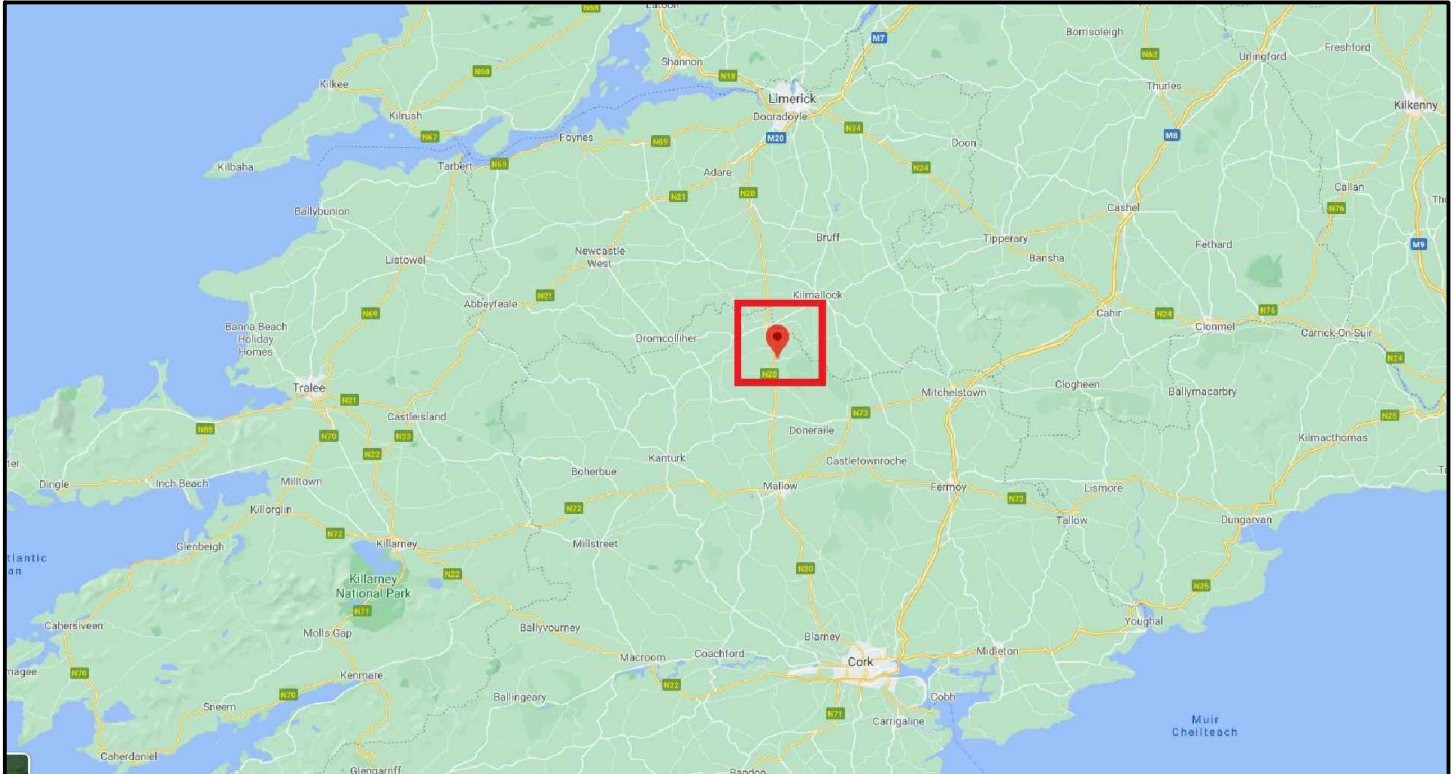
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## **Appendix A      Site and Exploratory Hole Location Plans**

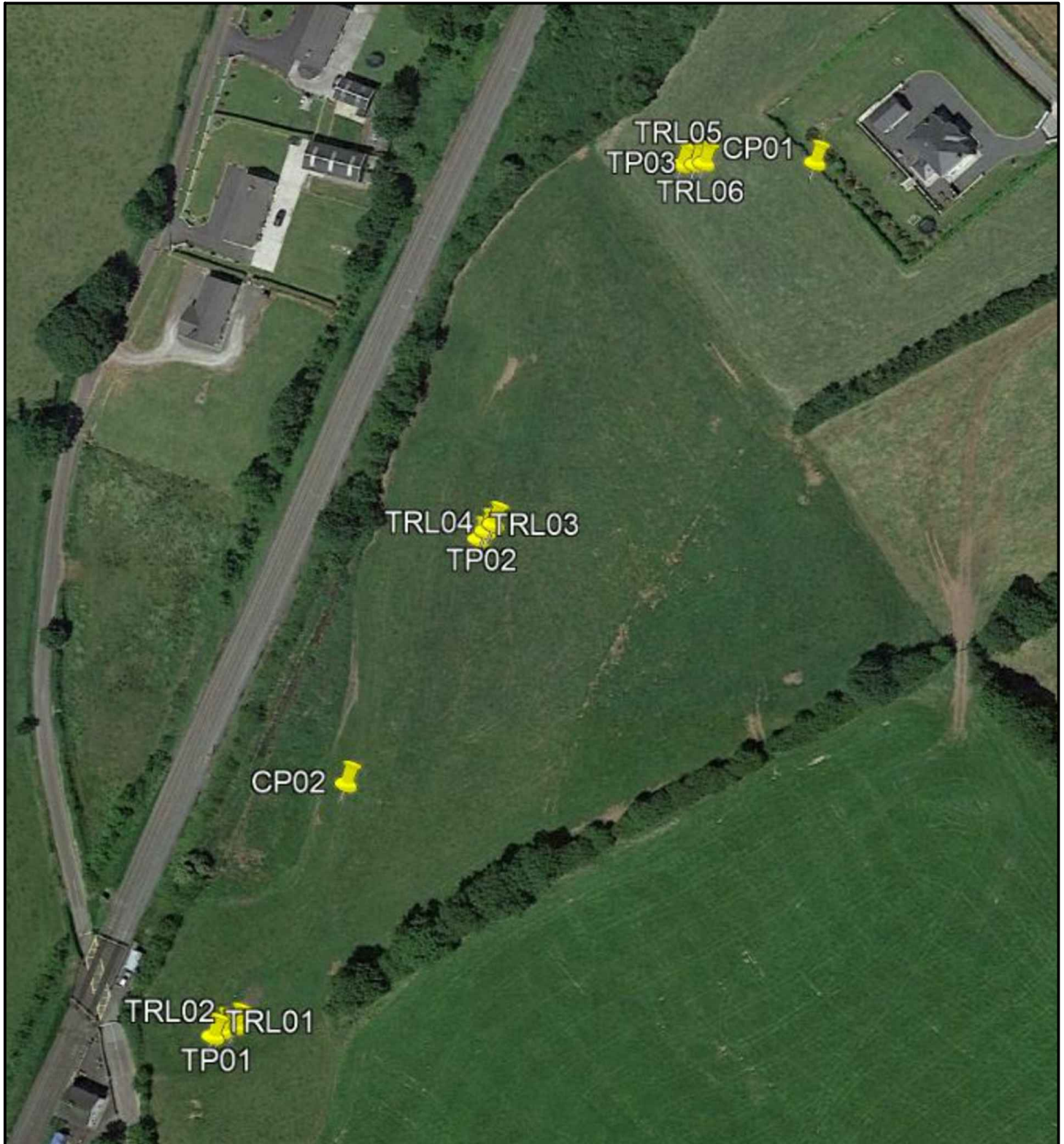




Iarnród Éireann  
 Cork Line Level Crossings  
 XC211 (19-135-2)

SITE LOCATION MAPS	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February/June 2020





Iarnród Éireann  
 Cork Line Level Crossings  
 XC211 (19-135-2)

Exploratory Hole Locations	
Client:	Iarnród Éireann
Engineer:	Jacob's
Date:	February/June 2020

## **Appendix B    Borehole Logs**



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

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0.05	ES1					(0.30)		TOPSOIL		
0.30 - 0.70	B2				111.8	0.30		Brown slightly gravelly slightly sandy clayey SILT with many rootlets. Gravel is fine to coarse, subangular to subrounded. Sand is fine to coarse.		0.5
0.30 - 0.70	D3			4	(0.40)					
0.50	ES4				111.4	0.70		Soft brown slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded.		1.0
0.70 - 1.90	B5				4					
0.70 - 1.90	D6					(1.20)				1.5
1.20 - 1.65	SPT (C) N=5			N=5 (1,1/1,1,2,1)						
1.50	ES7					1.90		Brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subrounded.		2.0
1.90 - 2.50	B8				110.2	0.60				
1.90 - 2.50	D9			50 (50 for 60mm/50 for 0mm)	4	(2.50)				2.5
2.00 - 2.06	SPT (C)									
2.50 - 3.50	B10				109.6	2.50		Stiff light brown slightly silty slightly gravelly sandy CLAY with medium cobble content. Gravel is fine to coarse, subangular to subrounded. Sand is fine to coarse. Cobbles are subrounded.		3.0
2.50 - 3.50	D11				4	(1.50)				
3.00	ES12					4.00		Firm light brown slightly silty slightly gravelly sandy CLAY with medium cobble content. Gravel is fine to coarse, subangular to subrounded. Sand is fine to coarse. Cobbles are subrounded.		4.0
3.00 - 3.45	SPT (C) N=25			N=25 (2,6/5,7,8,5)		4.50				
3.50 - 4.50	B13					5.50		Soft light brown slightly gravelly slightly sandy CLAY with medium cobble and low small boulder content. Gravel is fine to coarse, subangular to subrounded. Sand is fine to coarse. Cobbles and boulders are subrounded.		5.0
3.50 - 4.50	D14					5.50				
4.00 - 4.45	SPT (C) N=8			N=8 (0,0/1,2,1,4)	108.1	4.00				5.5
4.50 - 5.50	B15				107.6	4.50				6.0
4.50 - 5.50	D16				4	(1.00)				6.5
5.00 - 5.45	SPT (C) N=6			N=6 (0,1/1,2,1,2)		5.50				7.0
5.50 - 6.50	B17				106.6	5.50		Firm to Stiff light brownish grey slightly silty slightly sandy very gravelly CLAY with low to medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles are subangular to subrounded.		7.5
5.50 - 6.50	D18				4	(1.70)				
6.00 - 6.45	SPT (C) N=14			N=14 (2,2/3,5,3,3)		7.20				8.0
6.50 - 7.20	B19					8.00		Stiff light brownish grey slightly silty gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded.		8.5
6.50 - 7.20	D20					8.00				
7.00 - 7.45	SPT (C) N=17			N=17 (3,2/4,5,4,4)	104.9	7.20				9.0
7.20 - 8.00	B21				4	(0.80)				9.5
7.20 - 8.00	D22					8.00				10.0
8.00 - 9.00	B23									
8.00 - 9.00	D24									
8.00 - 8.45	SPT (C) N=22			N=22 (4,4/6,5,6,5)		(2.00)		Stiff dark grey slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles are subangular to subrounded.		9.5
8.50 - 9.50	U25									
9.00 - 10.00	B26									
9.00 - 10.00	D27									
9.00 - 9.45	SPT (C) N=20			N=20 (5,5/6,5,4,5)						

Continued on Next Page

<b>Remarks</b>	<b>Water Added</b>		<b>Water Strike - General</b>			
	From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
	5.60	7.20	5.60		20	5.30
	<b>Casing Details</b>		<b>Chiselling Details</b>			
To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)		
10.00	200	1.90	2.20	00:30		

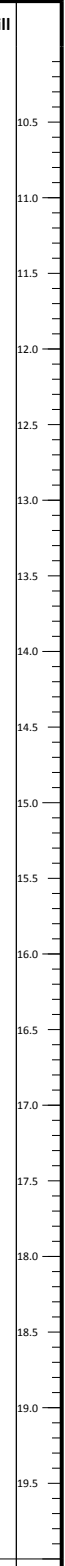


<b>Project No.:</b> 19-135	<b>Project Name:</b> Cork Line Level Crossings	<b>Borehole No.:</b> XC211-CP01
<b>Coordinates:</b> 554970.41 E	<b>Client:</b> Iarnród Éireann / Irish Rail	Sheet 2 of 2
<b>Method:</b> Cable Percussion	<b>Client's Representative:</b> JACOBS	<b>Scale:</b> 1:50
<b>Plant:</b> Pilcon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

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
10.00 - 10.45	SPT (C) N=23			N=23 (7,6/5,6,6,6)	102.1 4			End of borehole at 10.000m		

**Remarks**

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
5.60	7.20	5.60		20	5.30
Casing Details		Chiselling Details			
To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)	
10.00	200	1.90	2.20	00:30	





<b>Project No.:</b> 19-135	<b>Project Name:</b> Cork Line Level Crossings	<b>Borehole No.:</b> XC211-CP02
<b>Coordinates:</b> 554848.35 E	<b>Client:</b> Iarnród Éireann / Irish Rail	Sheet 1 of 2
<b>Method:</b> Cable Percussion	<b>Client's Representative:</b> JACOBS	<b>Scale:</b> 1:50
<b>Plant:</b> Pilcon	<b>Ground Level:</b> 98.28 mOD	<b>Dates:</b> 12/06/2020 - 17/06/2020
		<b>Driller:</b> AA
		<b>Logger:</b> IH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0.05	ES1					(0.30)		TOPSOIL		
0.30 - 1.20	B2				97.98	0.30		Reddish brown slightly gravelly slightly sandy CLAY with medium cobble content and occasional rootlets. Gravel is fine to coarse, subangular to subrounded. Sand is fine to coarse. Cobbles are subrounded.		
0.30 - 1.20	D3					(0.90)				
0.50	ES4									
1.20 - 2.00	B5			N=15 (2,2/5,3,4,3)	97.08	1.20		Firm reddish brown slightly sandy slightly gravelly CLAY with medium cobble content and low small boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles and boulders are subangular to subrounded.		
1.20 - 2.00	D6									
1.20 - 1.65	SPT (C)					(0.80)				
1.50	ES7									
2.00 - 3.00	B8			N=8 (1,2/1,3,2,2)	96.28	2.00		Firm light brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles are subrounded.		
2.00 - 3.00	D9									
2.00 - 2.45	SPT (C)									
	N=8									
3.00	ES10					(2.00)				
3.00 - 4.00	B11			N=14 (2,4/4,3,4,3)						
3.00 - 4.00	D12									
3.00 - 3.45	SPT (C)									
	N=14									
4.00 - 5.00	B13			N=17 (4,5/4,4,4,5)	94.28	4.00		Stiff brown slightly silty slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles are subangular to subrounded.		
4.00 - 5.00	D14									
4.00 - 4.45	SPT (C)					(1.00)				
	N=17									
5.00 - 6.00	B15			N=30 (5,7/7,9,7,7)	93.28	5.00		Very Stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded.		
5.00 - 6.00	D16									
5.00 - 5.45	SPT (C)									
	N=30									
6.00 - 7.00	B17			N=32 (7,7/8,9,8,7)		(2.00)				
6.00 - 7.00	D18									
6.00 - 6.45	SPT (C)									
	N=32									
7.00 - 8.00	B20			N=11 (3,3/2,3,3,3)	91.28	7.00		Firm to Stiff light brown slightly silty sandy gravelly to very gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles are subangular to subrounded.		
7.00 - 8.00	D21									
7.00 - 7.45	SPT (C)									
	N=11									
7.50	U19									
8.00 - 9.00	B22			N=16 (3,4/3,5,4,4)		(2.00)				
8.00 - 9.00	D23									
8.00 - 8.45	SPT (C)									
	N=16									
9.00 - 10.00	B24			N=9 (2,3/2,2,2,3)	89.28	9.00		Firm light brown slightly silty slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded.		
9.00 - 10.00	D25									
9.00 - 9.45	SPT (C)					(1.00)				
	N=9									
10.00 - 11.00	B26				88.28	10.00				

Continued on Next Page

<b>Remarks</b>	<b>Water Added</b>		<b>Water Strike - General</b>			
	From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
	<b>Casing Details</b>		<b>Chiselling Details</b>			
To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)		
12.00	200					



<b>Project No.:</b> 19-135	<b>Project Name:</b> Cork Line Level Crossings	<b>Borehole No.:</b> XC211-CP02
<b>Coordinates:</b> 554848.35 E	<b>Client:</b> Iarnród Éireann / Irish Rail	Sheet 2 of 2
<b>Method:</b> Cable Percussion	<b>Client's Representative:</b> JACOBS	<b>Scale:</b> 1:50
<b>Plant:</b> Pilcon	<b>Ground Level:</b> 98.28 mOD	<b>Dates:</b> 12/06/2020 - 17/06/2020
		<b>Driller:</b> AA
		<b>Logger:</b> IH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
10.00 - 11.00	D27			N=13 (3,2/4,3,3,3)		(1.00)		Firm light brown slightly gravelly slightly sandy CLAY with many fibrous rootlets and an organic odour. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded.		
10.00 - 10.45	SPT (C)									
10.50	N=13 U30									
11.00 - 12.00	B28			N=18 (4,6/4,4,5,5)	87.28	11.00		Stiff brown slightly silty slightly sandy very gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular.		
11.00 - 12.00	D29									
11.00 - 11.45	SPT (C)									
11.50	N=18 U31					(1.00)				
12.00 - 12.45	SPT (C)			N=19 (5,6/7,4,4,4)	86.28	12.00		End of borehole at 12.000m		
	N=19									

<b>Remarks</b>	<b>Water Added</b>		<b>Water Strike - General</b>			
	From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
	<b>Casing Details</b>		<b>Chiselling Details</b>			
To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)		
12.00	200					

**Appendix C**

**Trial Pit Logs**





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

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1			(0.30)		TOPSOIL: Soft dark brown slightly sandy silty CLAY with a trace of gravel and frequent rootlets, moist.	
0.40 - 0.90	B2	HVP=45, HVR=17	97.68	0.30		Soft light brown becoming beige, slightly sandy slightly gravelly silty CLAY with low cobble content and occasional rootlets, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles are angular to subangular, sandstone and siltstone. <i>Strata becomes firm by 0.5m and is more orange in colour.</i>	0.5
0.40 - 0.90	D3			(0.70)			
0.50	ES4						
0.55							
1.00	ES5	HVP=63, HVR=22	96.98	1.00		Firm dark brown organic silty CLAY with partially decayed vegetation, moist.	1.0
1.00 - 1.50	B6		96.93	1.05		Firm light grey slightly gravelly slightly sandy, locally sandy, silty CLAY with occasional dark brown partially decayed vegetation fragments, moist.	
1.00 - 1.50	D7			(1.45)			1.5
1.10							
2.50 - 3.00	B8		95.48	2.50		Soft to firm grey slightly gravelly sandy silty CLAY with occasional brown mottling, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular.	2.5
2.50 - 3.00	D9			(0.50)			
3.00	ES12	Rapid inflow - No rise	94.98	3.00		Light grey becoming yellowish brown gravelly SAND, wet.	3.0
3.00 - 3.40	B10			(0.40)			
3.00 - 3.40	D11						
			94.58	3.40		End of trial pit at 3.400m	3.5

<b>Remarks</b>  Trial Pit terminated at 3.40m due to pit walls collapsing.	<b>Water Strikes:</b>		<b>Stability:</b> Sides collapsing
	Struck at (m):	Remarks:	
	3.00	Rapid inflow - No rise	<b>Width:</b> 2.00 <b>Length:</b> 4.60



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

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1			(0.25)		TOPSOIL: Soft dark brown slightly sandy silty CLAY with frequent rootlets, moist. One red brick fragment.	
0.30 - 0.80 0.30 - 0.80	B2 D3		101.2 3	0.25		Firm light brown slightly sandy silty CLAY with occasional gravel and cobbles, occasional rootlets, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles are angular to subangular, sandstone and limestone.	
0.50 0.50	ES4	HVP=47, HVR=20		(0.85)			0.5
1.00	ES5		100.3 8	1.10		Firm becoming stiff brown slightly sandy slightly gravelly silty CLAY with low cobble and boulder content, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles and boulders are angular to subangular predominantly limestone with occasional sandstone.	1.0
1.60 - 2.10 1.60 - 2.10	B6 D7			(1.60)			1.5
2.70 - 3.20 2.70 - 3.20	B8 D9		98.78	2.70		Very stiff light brown to brown slightly sandy gravelly silty CLAY with medium cobble and boulder content, slightly moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular. Cobbles and boulders are angular to subangular, predominantly limestone.	2.0
3.00	ES10			(0.60)			3.0
			98.18 98.18	(0.90)		Refusal on limestone BOULDERS. End of trial pit at 3.300m	3.5

<b>Remarks</b>  Trial Pit terminated at 3.30m due to Limestone Boulder obstructions.	<b>Water Strikes:</b>		<b>Stability:</b> Slight spalling
	Struck at (m):	Remarks:	
		None Encountered	<b>Width:</b> 1.80 <b>Length:</b> 3.50



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

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.05	ES1			(0.25)		TOPSOIL: Soft dark brown slightly sandy slightly gravelly silty CLAY wit frequent rootlets, moist.	
0.30 - 0.80 0.30 - 0.80	B2 D3		111.7 4	0.25		Firm light brown slightly sandy slightly gravelly silty CLAY with low cobble and boulder content and occasional rootlets, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles and boulders are angular to subrounded, limestone.	
0.50 0.50	ES4	HVP=44, HVR=21		(0.55)			0.5
1.00	ES5		111.1 9	0.80 (0.30)		Stiff light brown slightly sandy gravelly silty CLAY with low cobble and boulder content and occasional rootlets, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles and boulders are angular to subrounded, limestone.	
1.30 - 1.80 1.30 - 1.80	B6 D7	Trickling flow from gravel strata - No rise.	110.8 9	1.10 (0.20)		Light brown slightly clayey slightly silty very sandy GRAVEL with low cobble content, wet.	▼
2.50 - 3.00 2.50 - 3.00	B8 D9		110.6 9	1.30		Stiff becoming very stiff light brown slightly sandy gravelly silty CLAY with low to medium cobble content, moist. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles and boulders are subangular to subrounded, limestone.	
3.00	ES10			(3.20)			1.5 2.0 2.5 3.0 3.5
3.70 - 4.20 3.70 - 4.20	B11 D12						

Continued on Next Page

<b>Remarks</b>  Trial Pit terminated at 4.50m due to pit walls spalling inwards.	<b>Water Strikes:</b>		<b>Stability:</b> Sides spalling
	Struck at (m):	Remarks:	
	1.10	Trickling flow from gravel strata - No rise.	<b>Width:</b> 4.40 <b>Length:</b> 2.00



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

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
			107.4 9	4.50		End of trial pit at 4.500m	

Remarks  Trial Pit terminated at 4.50m due to pit walls spalling inwards.	<b>Water Strikes:</b>		<b>Stability:</b> Sides spalling
	Struck at (m):	Remarks:	
	1.10	Trickling flow from gravel strata - No rise.	<b>Width:</b> 4.40 <b>Length:</b> 2.00



**Appendix D**

**Trial Pit Photographs**



Iarnród Éireann  
Cork Line Level Crossings  
XC211 (19-135-2)

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





Iarnród Éireann  
Cork Line Level Crossings  
XC211 (19-135-2)

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



Iarnród Éireann  
Cork Line Level Crossings  
XC211 (19-135-2)

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





Iarnród Éireann  
 Cork Line Level Crossings  
 XC211 (19-135-2)

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





Iarnród Éireann  
 Cork Line Level Crossings  
 XC211 (19-135-2)

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





Iarnród Éireann  
Cork Line Level Crossings  
XC211 (19-135-2)

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





Iarnród Éireann  
Cork Line Level Crossings  
XC211 (19-135-2)

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