FINAL
FOR ISSUE

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New Port of Galway

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Client:	Galway Harbour Company
Client's Representative:	Patrick J. Tobin & Co. Ltd
Completed:	17 May 2012
Report No.:	12-161
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CAUSEWAY GEOTECH

New Port of Galway

CONTENTS Page No.

Appendices

Document Control Sheet

Report No.: **12-161**

Project title: **New Port of Galway**

Client: **Galway Harbour Company**

Client's Representative: **Patrick J. Tobin & Co. Ltd**

Revision	Status	Report prepared by:	Report reviewed by:	Issue date
A02	Final	Paul Dunlop BEng PhD CEng MIEI	David Cameron BSc CEng MIEI	17 May 2012

The works were conducted in accordance with:

Site Investigation in Construction Part 3: Specification for Ground Investigation, Site Investigation Steering Group, published by Thomas Telford Ltd (1993)

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

- BS EN 1997-2:2007: *Eurocode 7. Geotechnical design. Ground investigation and testing*
- 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: *Geotechnical investigation and testing. Identification and classification of soil. Identification and description*
- BS EN ISO 14688-2:2004: *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: *Geotechnical investigation and testing. Field testing. Dynamic probing*
- BS EN ISO 22476-3:2005: *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, *The Code of Practice for Site Investigation*, Amendment 1. The amendment revised the Standard to remove text superseded by BS EN ISO 14688-1:2002, BS EN ISO 14688-2:2004 and EN ISO 14689-1:2003 and refers to the relevant standard for each affected subclause. However, the following terms are used in the description of fine-grained soils, where applicable:

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

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

New Port of Galway

1 AUTHORITY

On the instructions of Consulting Engineers, Patrick J. Tobin & Co. Ltd ("the Client's Representative"), on behalf of Galway Harbour Company ("the Client"), a marine investigation was undertaken at the above location to provide geotechnical information for input to the design and construction of a proposed new port.

This report details the work carried out both on site and in the geotechnical laboratory; 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 variable conditions between exploratory holes

This report was prepared by Causeway Geotech Ltd for the use of the Client and the Client's Representative 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 Client's Representative, included cable percussion and rotary cored boreholes, dynamic probing, soil sampling, in-situ and laboratory testing, cone penetration tests and the preparation of a factual report on the findings.

3 DESCRIPTION OF SITE

As shown on the site location plan in Appendix A, the site of the proposed new harbour lies to the south of the existing lock gated harbour and would be accessed through the existing harbour estate.

The development will consist of a new quay, large areas of reclaimed land, a marina and a new dredged approach channel.

4 SITE OPERATIONS

The Site Operations, conducted on 10 March – 22 March 2012, comprised:

- eight cable percussion boreholes
- three rotary cored boreholes
- twenty dynamic probe holes
- cone penetration tests

All exploratory work was carried out from a C5 Combi-float jack-up platform supplied and operated by ABCO Marine.

All site works were supervised by a chartered geotechnical engineer from Causeway Geotech.

The jack-up platform was 18m x 18m in plan area with 17m long jack legs. The jack-up was manoeuvred to the locations using a workboat. A safety boat provided a watching brief and also provided access to the platform for the crew and Engineer's representatives.

The locations of the test holes were set out from co-ordinates supplied by the Client's representative and buoys placed to allow accurate navigation to each test location.

The bed levels were recorded by measuring the water level to bed at the test location using tidal prediction software with confirmatory checks of pier to water at the end of the breakwater. On each exploratory hole log the "ground level" is reported – this level is a record of the sea bed level.

All work was undertaken under a watching brief by a Marine Mammal Observer who was approved by the National Parks and Wildlife Service (NPWS) for this project. The Marine Mammal Observer's findings were reported directly to the NPWS.

The exploratory holes and insitu 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

Eight boreholes (BH01 – BH08) were put down in 200mm diameter using a Dando 3000 percussion boring rig. All boreholes meet refusal in either Meta-Gabbro boulders within the glacial till or possible Granite bedrock, at a depths ranging 3.40m – 15.00m.

Disturbed (small bag and bulk bag) samples and undisturbed thin wall piston samples and were taken within the encountered strata.

The piston samples were immediately waxed to prevent moisture loss and packed with bubble wrap to prevent slumping within the tube. The tubes were stored vertically and transported to Queens University in Belfast for subsequent testing.

Standard penetration tests were carried out at 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.

Vane tests were also carried out within the strata using a 150mm x 75mm Farnell Vane Tester and pilcon hand vane tester. The Farnell Vane tester was used to measure both peak vane and remoulded shear strengths.

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

Appendix B presents the borehole logs.

4.2 Rotary cored boreholes

Three rotary cored boreholes (RC01 – RC03) were put down as extensions of shell and auger boreholes taken into bedrock by means of symmetrix rotary cased percussive techniques.

The coring was undertaken using a Comacchio 205 drilling rig using T2-86 core barrels in boreholes RC02 and RC03 and T2-101 in borehole RC01 due to damage to the T2-86 core barrel in the previous boreholes.

The cores were placed in wooden core boxes and logged onsite by the Causeway Geotech Chartered Geotechnical Engineer.

Appendix C present the rotary cored borehole logs.

4.3 Dynamic probing

Twenty dynamic probes (DP01 – DP20) were conducted using the DPSH-B method as described in EN ISO 22476-2. The method entails a 63.5kg hammer falling 0.75m onto a 90° cone of 50.5mm diameter.

Appendix D provides the dynamic probe logs in the form of plots, against depth, of the number of blows per 100mm penetration.

4.4 Cone penetration tests

Seven cone penetration tests (CPTu) were carried out by a specialist sub-contractor, Insitu Site Investigation.

Porewater dissipation tests were scheduled but as the porewater levels did not rise above ambient levels, these tests were not undertaken.

These results are presented in a separate report detailed in Appendix E.

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.

Laboratory testing of soils comprised:

- soil classification tests: moisture content, Atterberg Limit and particle size distribution analysis.
- consolidation tests: one dimension oedometer consolidation test
- strength tests: unconsolidated undrained triaxial test without the measurement of porewater pressure and consolidated undrained triaxial test with the measurement of porewater pressure
- rock classification tests: petrographic analysis
- rock tests: unconfined compressive strength and point load

The test results are presented in Appendix F.

6 GROUND CONDITIONS

6.1 General geology of the site

The 1:100,000 Bedrock Geology Map of the area inshore of the site (Geological Survey of Ireland, 2003) shows the bedrock to be undifferentiated strata of the metagabbro and orthogneiss suite of the Ordovician period, rocks formed approximately 440-490 million years ago.

Metagabbro is metamorphosed coarsely crystalline igneous rock, iron and magnesium-rich with little or no quartz. The rock was originally formed by solidifying from magma (igneous) and was subsequently altered by heat and/or pressure with accompanying deformation (metamorphoric). Similarly, the orthogneiss is a banded rock formed by metamorphosis of an igneous rock.

6.2 Ground types

The boreholes revealed the following ground types, listed in stratigraphical order:

6.2.1 Recent deposits

The Recent marine deposits are generally very soft grey slightly sandy - sandy silts with layers of silty – very silty sand.

The silt contents are typically high with generally no / very low sand or gravel content and very low clay content.

There are variable amounts of shells, mostly oyster shells, within the marine deposits varying from slight to moderate levels. In BHRC01 a layer of oyster shells was encountered from 2.60m – 3.00m below seabed.

The Atterberg Limits indicate soils in the intermediate to very high plasticity ranges, with some concentration in the intermediate range. The measured plasticity values of the silts, and the plotting of several samples above the A-line, are a consequence of the organic content which aids retention of moisture in the test specimens.

6.2.2 Glacial soils

The glacial soils include Glacial Till and Fluvio-Glacial deposits: they were very stiff sandy gravelly CLAY/SILT and silty, sandy GRAVEL.

There are significant levels of cobbles and boulders within the glacial till. These consist generally of subangular to subrounded meta-gabbro derived material.

6.2.3 Bedrock

The bedrock encountered was generally a very strong Granite.

The recovery in the rotary boreholes was generally good with a total core recovery of over 80%.

7 REFERENCES

British Standards Institute (1990) *BS 1377:1990, Methods of test for soils for civil engineering purposes. Parts 1 to 9.*

British Standards Institute (1999) *BS 5930:1999, Code of practice for site investigations. Incorporating Amendment No. 1 of December 2007.*

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

Building Research Establishment (2007), *BRE Digest 365: Soakaways.*

APPENDIX A

Site and exploratory hole location plans

KEY:

N

ENGINEER:

Patrick J Tobin & Co

CLIENT:

Galway Harbour Company

PROJECT NAME:

New Port of Galway

SITE ADDRESS (IF APPLICABLE):

TITLE:

Site location plan

SCALE:		DATE:	
NTS		24/04/12	
DWG NO:	REV:	DRWN:	CHCK:
12-161		MD	PD

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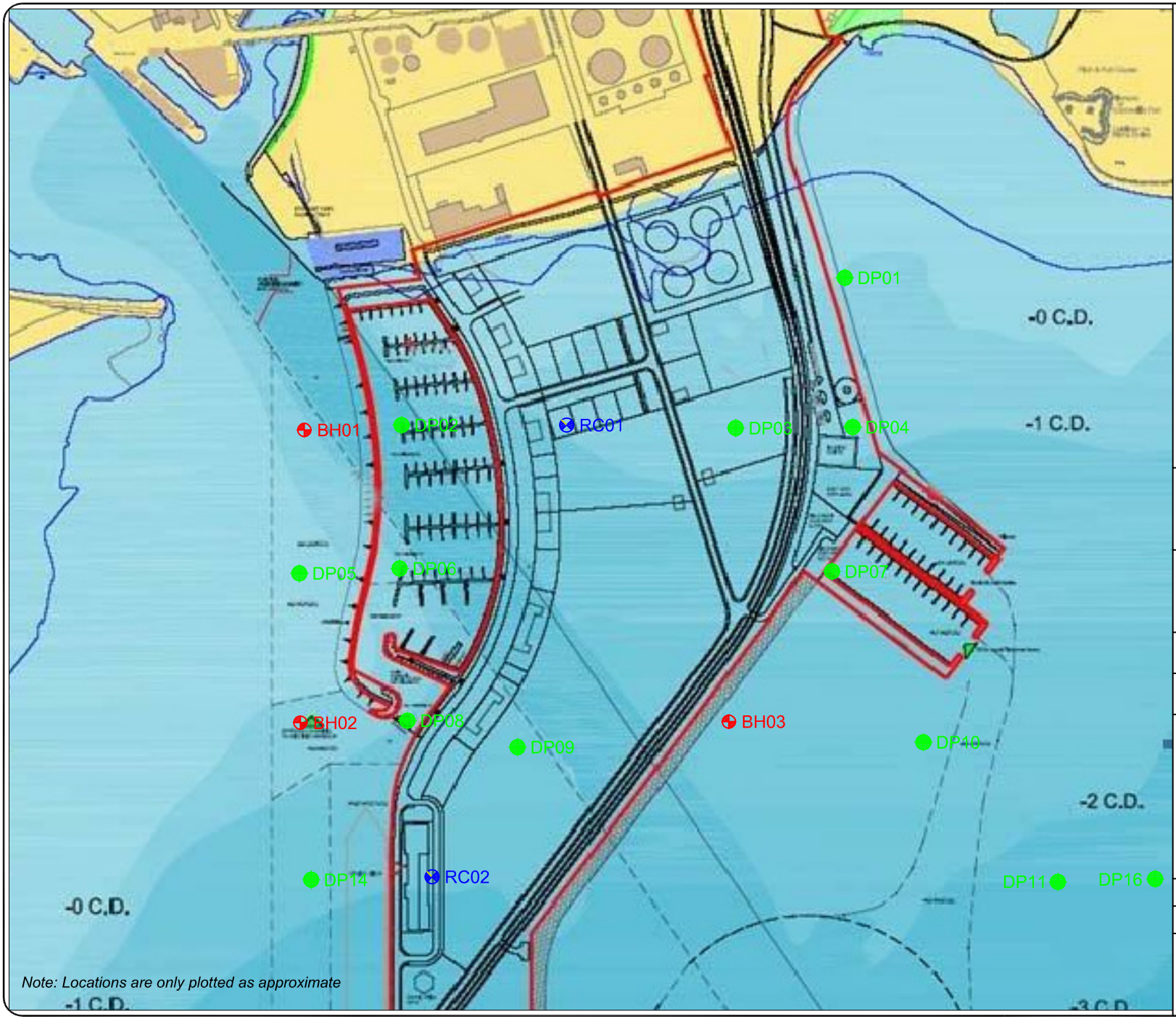

KEY:

BH - Borehole

DP - Dynamic Probe

RC - Rotary Borehole

N

ENGINEER:

Patrick J Tobin & Co

CLIENT:

Galway Harbour Company

PROJECT NAME:

New Port of Galway

SITE ADDRESS (IF APPLICABLE):

TITLE:

Exploratory hole location plan

SCALE:		DATE:	
NTS		24/04/12	
DWG NO:	REV:	DRWN:	CHCK:
12-161/1		MD	PD

CAUSEWAY GEOTECH
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KEY:

BH - Borehole

DP - Dynamic Probe

RC - Rotary Borehole

N

ENGINEER:

Patrick J Tobin & Co

CLIENT:

Galway Harbour Company

PROJECT NAME:

New Port of Galway

SITE ADDRESS (IF APPLICABLE):

TITLE:

Exploratory hole location plan

SCALE:		DATE:	
NTS		24/04/12	
DWG NO:	REV:	DRWN:	CHCK:
12-161/2		MD	PD

CAUSEWAY GEOTECH
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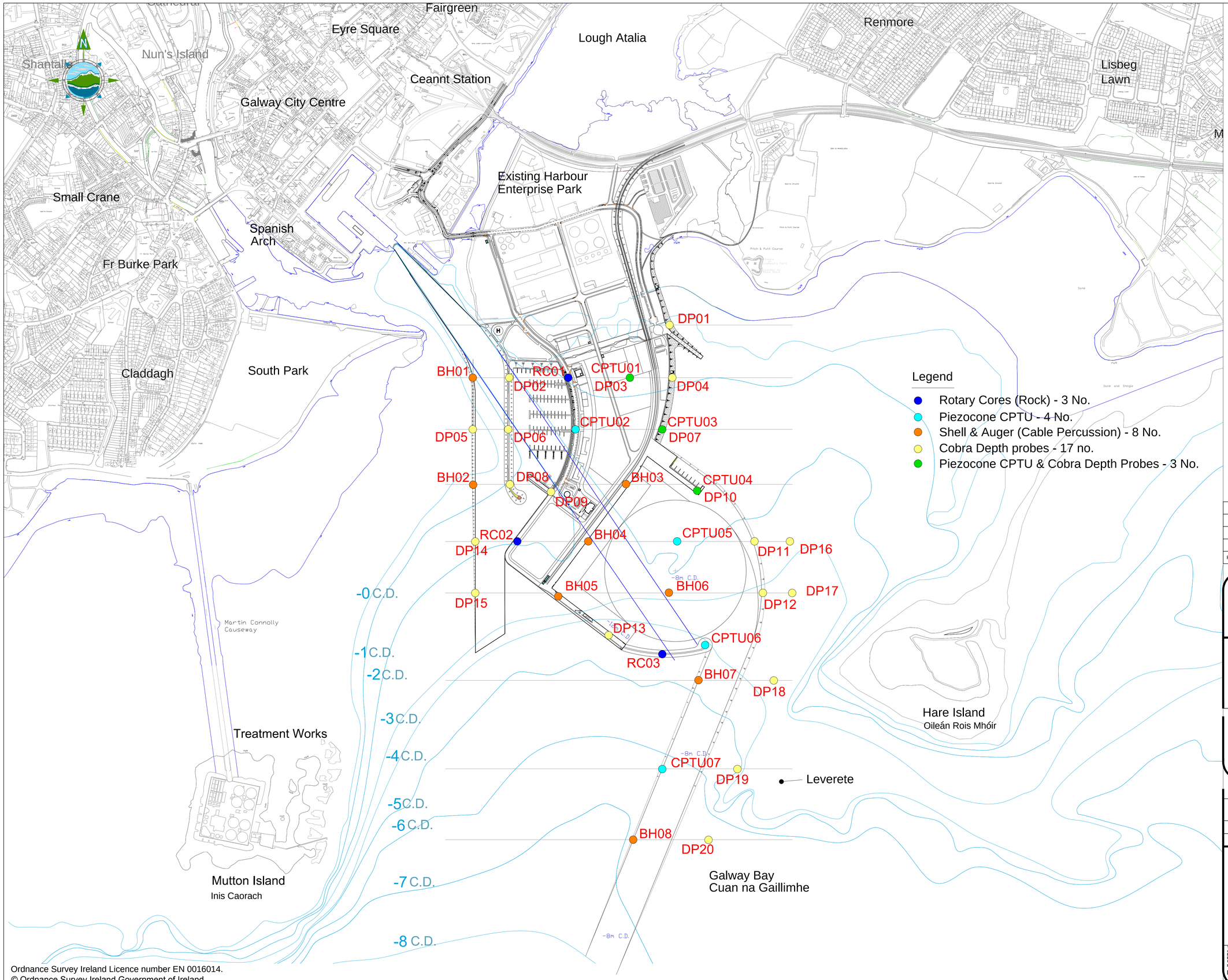

NOTES:

1. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING.
2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE
3. ENGINEER/EMPLOYERS REPRESENTATIVE, AS APPROPRIATE, TO BE INFORMED BY THE CONTRACTOR OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES
4. THE CONTRACTOR SHALL UNDERTAKE A THOROUGH CHECK FOR THE ACTUAL LOCATION OF ALL SERVICES/UTILITIES, ABOVE AND BELOW GROUND, BEFORE ANY WORK COMMENCES
5. ALL LEVELS SHOWN RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD
6. LEVELS SHOWN -4C.D. RELATE TO CHART DATUM

Rev	Date	Description	By	Chkd.
A	JAN 2014	FIRST ISSUE	JOM	JPK

Client:
GALWAY HARBOUR COMPANY

Project:
GALWAY HARBOUR EXTENSION

Title:
SITE INVESTIGATION EXPLORATORY HOLE LAYOUT

Scale @ A1: 1/5000 A3 1/ 10000

Prepared by:	Checked:	Date:
JOM	BR	JAN 2014

Project Director: J.P. KELLY

Drawing Status: PLANNING & EIS

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Drawing No.: 2139-2136

Revision: A

APPENDIX B

Cable percussion borehole logs

Causeway Geotech Ltd

Project No.	Project Name:	Borehole No.
12-161	New Port of Galway	BH01

Method and Equipment: Percussion boring 0.00-7.50m Dando 2000

Co-ords: 130353.0mE 224409.0mN

Client: Galway Harbour Company

Engineer: Patrick J. Tobin & Co. Ltd

Ground Level: -1.20mCD

Dates: 10/03/2012

Sheet 1 of 1 | **Scale:** 1:50 | **Driller:** CC | **Logger:** DC

Depth (m)	Sample / Test	Casing Depth (m)	Water Depth (m)	Field Records	Level (Thickness)	Depth	Stratum Description	Legend & Water Strikes	Backfill/ Installs
0.00	SPT		dry	N=0			Very soft light grey slightly sandy SILT with medium shell content . Sand is fine to coarse (organic odour noted).		
0.00	D			N=0 (0,0,0,0,0,0)					
					(1.60)				
1.00	SPT	1.00	dry	N=0					
1.00	D			N=0 (0,0,0,0,0,0)					
					-2.80	1.60			
2.00	SPT	2.00	dry	N=0			Very soft grey slightly organic slightly sandy SILT with small shell content. Sand is fine to coarse		
2.00	D			N=0 (0,0,0,0,0,0)					
3.00	D		dry	800mm Recovery					
3.00-3.80	P								
4.00	IVN 1			V:7kPa / VR:1kPa					
					(5.10)				
5.00	D		dry	750mm Recovery					
5.00-5.75	P								
5.50	IVN 1			V:8kPa / VR:1kPa					
6.00	SPT	6.00	dry	N=2					
6.00	D			N=2 (1,0,1,0,1,0)					
					-7.90	6.70			
7.00	SPT(c)	7.00	dry	50/181mm	(0.60)		Medium dense grey slightly silty sandy subrounded fine to coarse GRAVEL. Sand is fine to coarse		
7.00	B			181mm (6,7,7,8,35)					
7.30	B				-8.50	7.30			
7.50	SPT	7.50	dry	10/03/2012 dry 50/20mm 20mm (25,50)	-8.70	7.50	Strong grey fine to medium grained META GABBRO		
							End of Borehole at 7.50 m		
	Type								

Remarks:
Hand vane test results:
1.8m = 6.0kPa, 2.3m = 6.5kPa,
3.0m = 7.3kPa, 4.0m = 7.6kPa,
5.0m = 8.1kPa, 6.5m = 10.2kPa
U100 not attempted in Glacial Till due to high cobble and boulder content.

Chiseling:

From (m)	to (m)	time (hh:mm)
7.10	7.50	01:00

Water Strikes:

Struck (m)	rising to (m)	time (min)
No Groundwater Encountered		

Casing:

to (m)	dia. (mm)
7.50	200

Last Revised: 19/04/2012

ISO 9002 AGS

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Causeway Geotech Ltd

Project No.	Project Name:	Borehole No.
12-161	New Port of Galway	BH02

Method and Equipment:
Percussion boring 0.00-3.40m Dando 2000

Co-ords:
130349.0mE
224111.0mN

Ground Level:
-1.00mCD

Client: Galway Harbour Company

Engineer: Patrick
J. Tobin & Co. Ltd

Dates: 11/03/2012

Sheet 1 of 1

Scale: 1:50

Driller: CC

Logger: DC

Depth (m)	Sample / Test	Casing Depth (m)	Water Depth (m)	Field Records	Level (Thickness)	Depth	Stratum Description	Legend & Water Strikes	Backfill/ Installs
0.00	D						Very soft grey slightly sandy SILT with high oyster shell content (organic odour noted)		
1.00	SPT	1.00	dry	N=0					
1.00	D			N=0 (0,0,0,0,0,0)	(2.15)				
2.00	SPT	2.00	dry	N=25					
2.00	D			N=25 (0,0,3,6,8,8)	-3.15	2.15			
2.50	B				(0.95)		Very stiff grey slightly gravelly slightly sandy SILT with low cobble content and low boulder content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are angular		
3.00	D								
3.30	SPT	3.30	dry	50/30mm 11/03/2012	-4.10	3.10	Strong pink, light grey and black speckled GRANITE		
3.30	B			30mm (25,50)	-4.40	3.40	End of Borehole at 3.40 m		
	Type								

Remarks:
U100 not attempted in Glacial Till due to high cobble and boulder content.

Chiseling:

From (m)	to (m)	time (hh:mm)
2.60	3.40	02:00
3.10	3.40	01:00

Water Strikes:

Struck (m)	rising to (m)	time (min)

No Groundwater Encountered

Casing:

to (m)	dia. (mm)
3.40	200

Last Revised:
19/04/2012

ISO 9002 AGS

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Causeway Geotech Ltd

Project No.	Project Name:	Borehole No.
12-161	New Port of Galway	BH03

Method and Equipment: Percussion boring 0.00-9.60m Dando 2000

Co-ords: 130785.0mE 224112.0mN

Client: Galway Harbour Company

Engineer: Patrick J. Tobin & Co. Ltd

Ground Level: -1.60mCD

Dates: 12/03/2012

Sheet 1 of 1 | **Scale:** 1:50 | **Driller:** CC | **Logger:** DC

Depth (m)	Sample / Test	Casing Depth (m)	Water Depth (m)	Field Records	Level	Depth (Thickness)	Stratum Description	Legend & Water Strikes	Backfill/ Installs
0.00	D						Very soft grey very sandy SILT with medium shell content. (organic odour noted)		
1.00 1.00	SPT D	1.00	dry	N=1 N=1 (0,0,1,0,0,0)		(3.30)			
2.00 2.00	SPT D	2.00	dry	N=0 N=0 (0,0,0,0,0,0)					
3.00 3.00	SPT D	3.00	dry	N=0 N=0 (1,0,0,0,0,0)					
					-4.90	3.30	Very soft light grey slightly sandy SILT/CLAY		
4.00 4.00-4.90	D P		dry	600mm Recovery					
5.00 5.00	IVN 1 D			V:7kPa / VR:1kPa		(3.30)			
6.00 6.00-6.60	D P		dry	300mm Recovery					
					-8.20	6.60	Medium dense grey sandy very silty subrounded fine to coarse GRAVEL		
7.00 7.00	SPT(c) B	7.00	dry	N=21 N=21 (3,4,5,5,5,6)		(0.90)			
					-9.10	7.50	Very stiff grey slightly sandy gravelly SILT with medium cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded		
8.00 8.00	SPT B	8.00	dry	N=50 N=50 (7,10,10,11,14,15)		(1.90)			
9.00 9.00	SPT B	9.00	dry	58/110mm 110mm (10,12,15,43)					
				12/03/2012 dry	-11.00	9.40	Large META-GABBRO BOULDER		
					-11.20	9.60	End of Borehole at 9.60 m		
	Type								

Remarks:
U100 not attempted in Glacial Till due to high cobble and boulder content.

Chiseling:

From (m)	to (m)	time (hh:mm)
9.40	9.60	01:00

Water Strikes:

Struck (m)	rising to (m)	time (min)
No Groundwater Encountered		

Casing:

to (m)	dia. (mm)
9.60	200

Last Revised: 19/04/2012

Causeway Geotech Ltd

Project No.	Project Name:	Borehole No.
12-161	New Port of Galway	BH04

Method and Equipment:
Percussion boring 0.00-15.00m Dando 2000

Co-ords:
130594.0mE
223796.0mN

Ground Level:
-2.20mCD

Client: Galway Harbour Company

Engineer: Patrick
J. Tobin & Co. Ltd

Dates: 10/03/2012

Sheet 1 of 2

Scale: 1:50

Driller: CC

Logger: DC

Depth (m)	Sample / Test	Casing Depth (m)	Water Depth (m)	Field Records	Level	Depth (Thickness)	Stratum Description	Legend & Water Strikes	Backfill/ Installs
0.00	D						Very soft light grey slightly sandy SILT with slight shell content (organic odour noted)		
1.00	SPT	1.00	dry	N=2					
1.00	D			N=2 (1,0,1,0,1,0)		(2.70)			
2.00	SPT	2.00	dry	N=1					
2.00	D			N=1 (1,0,0,1,0,0)					
					-4.90	2.70			
3.00-3.70	P		dry	150mm Recovery			Very soft light grey slightly sandy SILT with slight shell content. Sand is fine		
3.00	B					(1.90)			
4.00	IVN 1			V:7kPa / VR:1kPa					
4.00	D								
					-6.80	4.60			
5.00-5.90	P		dry	800mm Recovery			Very soft grey slightly organic slightly sandy SILT with slight shell content		
5.00	D								
6.00	IVN 1			V:8kPa / VR:2kPa					
6.00	D								
						(5.40)			
7.50	SPT	7.50	dry	N=0					
7.50	D			N=0 (0,0,0,0,0,0)					
8.00-8.90	P		dry	800mm Recovery					
9.00	D								
9.50	SPT	9.50	dry	N=0					
9.50	B			N=0 (0,0,0,0,0,0)					
	Type						Continued next sheet		

Remarks:
Hand vane test results:
4.0m = 9kPa, 6.0m = 11.5kPa
7.5m = 9kPa, 9.0m = 10kPa,
0.0m - 8.5kPa, 11.0m = 8.0kPa,
12.0m = 10.5kPa
U100 not attempted in Glacial Till due to high cobble and boulder content.

Chiseling:

From (m)	to (m)	time (hh:mm)

Water Strikes:

Struck (m)	rising to (m)	time (min)

No Groundwater Encountered

Casing:

to (m)	dia. (mm)
15.00	200

Last Revised:
19/04/2012

Causeway Geotech Ltd

Project No.	Project Name:	Borehole No.
12-161	New Port of Galway	BH04

Method and Equipment:
Percussion boring 0.00-15.00m Dando 2000

Co-ords:
130594.0mE
223796.0mN

Ground Level:
-2.20mCD

Client: Galway Harbour Company

Engineer: Patrick
J. Tobin & Co. Ltd

Dates: 10/03/2012

Sheet 2 of 2

Scale: 1:50

Driller: CC

Logger: DC

Depth (m)	Sample / Test	Casing Depth (m)	Water Depth (m)	Field Records	Level Depth (Thickness)	Stratum Description	Legend & Water Strikes	Backfill/ Installs
					-12.20 10.00	Very soft light grey slightly organic silty CLAY with slight shell content		
11.00	D							
11.20-11.70	P		dry	0.00mm Recovery	(2.50)			
					-14.70 12.50	Very stiff grey gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse. Cobbles are subangular of mainly meta-gabbro Fines washing out of recovered gravel from 12.50m		
13.20	SPT	13.20	dry	50/265mm				
13.20	B			265mm (4,7,8,8,10,24)				
13.20	D				(1.90)			
					-16.60 14.40	Strong grey pink and dark grey speckled coarse grained GRANITE		
14.70-15.00	B				(0.60)			
				10/03/2012 dry	-17.20 15.00	End of Borehole at 15.00 m		
	Type							

Remarks:
Hand vane test results:
4.0m = 9kPa, 6.0m = 11.5kPa
7.5m = 9kPa, 9.0m = 10kPa,
0.0m - 8.5kPa, 11.0m = 8.0kPa,
12.0m = 10.5kPa
U100 not attempted in Glacial Till due to high cobble and boulder content.

Chiseling:

From (m)	to (m)	time (hh:mm)
14.70	15.00	01:00

Water Strikes:

Struck (m)	rising to (m)	time (min)
No Groundwater Encountered		

Casing:

to (m)	dia. (mm)
15.00	200

Last Revised:
19/04/2012

ISO 9002 AGS

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Causeway Geotech Ltd

Project No.	Project Name:	Borehole No.
12-161	New Port of Galway	BH05

Method and Equipment: Percussion boring 0.00-9.80m Dando 2000

Co-ords: 130595.0mE 223798.0mN

Ground Level: -2.90mCD

Client: Galway Harbour Company

Engineer: Patrick J. Tobin & Co. Ltd

Dates: 12/03/2012

Sheet 1 of 1 | **Scale:** 1:50 | **Driller:** CC | **Logger:** DC

Depth (m)	Sample / Test	Casing Depth (m)	Water Depth (m)	Field Records	Level	Depth (Thickness)	Stratum Description
0.00	D						Very soft grey slightly sandy SILT. Sand is fine to coarse (organic odour noted)
1.00	SPT	1.00	dry	N=2			
1.00	D			N=2 (0,0,0,1,0,1)			
						(2.80)	
2.00	SPT	2.00	dry	N=1			
2.00	D			N=1 (0,1,0,0,1,0)			
					-5.70	2.80	
3.00	D		dry	800mm Recovery			Very soft grey slightly sandy SILT with slight shell content. Sand is fine
3.00-3.90	P						Casing falling under own weight from 3.00m - 5.00m
4.00	IVN 1			V:5kPa / VR:1kPa			
4.00	D						
5.00	IVN 1			V:6kPa / VR:1kPa			
5.00	D						
						(5.40)	
6.00	D		dry	800mm Recovery			
6.00-6.90	P						
7.00	IVN 1			V:6kPa / VR:1kPa			
7.00	D						Methane pocket encountered at 7.30m - blew plug of clay up the hole and 2.0m into the air
8.00	D		dry	0.00mm Recovery			
8.00-8.10	P				-11.10	8.20	
8.50	SPT	8.50	dry	50/105mm			Very stiff grey slightly sandy gravelly SILT with medium cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded
8.50	B			105mm (10,12,19,31)			
						(1.40)	
9.50	SPT	9.50	dry	50/3mm			
9.50	B			3mm (25,50)	-12.50	9.60	
9.60-9.80	B	9.80	dry	50/2mm			Strong pink, grey and black speckled
9.80	SPT			2mm (25,50)	-12.70	9.80	

12/03/2012 dry

Type

Continued next sheet

Remarks:
U100 not attempted in Glacial Till due to high cobble and boulder content.

Chiseling:

From (m)	to (m)	time (hh:mm)
9.60	9.80	01:00

Water Strikes:

Struck (m)	rising to (m)	time (min)
No Groundwater Encountered		

Casing:

to (m)	dia. (mm)
9.80	200

Last Revised: 19/04/2012

Causeway Geotech Ltd

Project No.	Project Name:	Borehole No.
12-161	New Port of Galway	BH05

Method and Equipment:
Percussion boring 0.00-9.80m Dando 2000

Co-ords:
130595.0mE
223798.0mN

Ground Level:
-2.90mCD

Client: Galway Harbour Company

Engineer: Patrick
J. Tobin & Co. Ltd

Dates: 12/03/2012

Sheet 1+ of 1

Scale: 1:50

Driller: CC

Logger: DC

Depth (m)	Sample / Test	Casing Depth (m)	Water Depth (m)	Field Records	Level	Depth (Thickness)	Stratum Description	Legend & Water Strikes	Backfill/ Installs
							coarse grained GRANITE		
							End of Borehole at 9.80 m		

Type

Remarks:
U100 not attempted in Glacial Till due to high cobble and boulder content.

Chiseling:

From (m)	to (m)	time (hh:mm)

Water Strikes:

Struck (m)	rising to (m)	time (min)

No Groundwater Encountered

Casing:

to (m)	dia. (mm)
9.80	200

Last Revised:
19/04/2012

Causeway Geotech Ltd

Project No.	Project Name:	Borehole No.
12-161	New Port of Galway	BH06

Method and Equipment: Percussion boring 0.00-9.10m Dando 2000

Co-ords: 130907.0mE 223808.0mN

Client: Galway Harbour Company

Engineer: Patrick J. Tobin & Co. Ltd

Ground Level: -2.10mCD

Dates: 12/03/2012

Sheet 1 of 1 | **Scale:** 1:50 | **Driller:** CC | **Logger:** DC

Depth (m)	Sample / Test	Casing Depth (m)	Water Depth (m)	Field Records	Level	Depth (Thickness)	Stratum Description	Legend & Water Strikes	Backfill/ Installs
0.00	D						Very soft grey slightly sandy SILT with medium shell content. Sand is fine to coarse (organic odour noted)		
1.00	SPT	1.00	dry	N=2					
1.00	D			N=2 (1,0,1,0,1,0)		(2.70)			
2.00	SPT	2.00	dry	N=1					
2.00	D			N=1 (1,0,0,1,0,0)					
					-4.80	2.70	Very soft grey slightly organic slightly sandy SILT with low shell content. Sand is fine to medium		
3.00	D		dry	700mm Recovery					
3.00-3.90	P								
4.00	IVN 1			V:5kPa / VR:1kPa					
4.00	D					(4.10)			
5.00	SPT	5.00	dry	N=0					
5.00	D			N=0 (0,0,0,0,0,0)					
6.00-6.90	P		dry						
6.80-7.00	B				-8.90	6.80			
6.90	IVN 1			V:25kPa / VR:3kPa			Firm brown subamorphous PEAT with pieces of decayed wood		
7.00	B				-9.10	7.00			
7.50	SPT	7.50	dry	N=32			Very stiff grey slightly gravelly slightly sandy SILT with medium cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subrounded of mega-gabbro and granite		
8.00	B			N=32 (4,5,7,8,7,10)		(1.90)			
8.50	SPT	8.50	dry	50/105mm					
				105mm (8,10,13,37)					
8.90-9.10	B				-11.00	8.90			
9.10	SPT	9.10	dry	50/3mm	-11.20	9.10	Strong dark grey META-GABBRO (Large Boulder)		
				3mm (25,50)			End of Borehole at 9.10 m		

12/03/2012 dry

Type

Remarks:
Sample of peat in bottom on piston sample from 6.0m - 6.9m
U100 not attempted in Glacial Till due to high cobble and boulder content.

Chiseling:

From (m)	to (m)	time (hh:mm)
8.30	9.10	01:30

Water Strikes:

Struck (m)	rising to (m)	time (min)
No Groundwater Encountered		

Casing:

to (m)	dia. (mm)
9.10	200

Last Revised: 19/04/2012

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Causeway Geotech Ltd

Project No.	Project Name:	Borehole No.
12-161	New Port of Galway	BH07

Method and Equipment: Percussion boring 0.00-8.40m Dando 2000

Co-ords: 130989.0mE 223558.0mN

Client: Galway Harbour Company

Engineer: Patrick J. Tobin & Co. Ltd

Ground Level: -4.70mCD

Dates: 11/03/2012

Sheet 1 of 1 | **Scale:** 1:50 | **Driller:** CC | **Logger:** DC

Depth (m)	Sample / Test	Casing Depth (m)	Water Depth (m)	Field Records	Level	Depth (Thickness)	Stratum Description	Legend & Water Strikes	Backfill/ Installs
0.00	D						Very soft grey slightly sandy SILT with medium shell content. Sand is fine to coarse (organic odour noted)		
1.00	SPT	1.00	dry	N=0					
1.00	D			N=0 (0,0,0,0,0,0)		(2.60)			
2.00	SPT	2.00	dry	N=0					
2.00	D			N=0 (0,0,0,0,0,0)					
					-7.30	2.60			
3.00	D		dry	800mm Recovery			Very soft grey slightly sandy SILT with low to medium shell content. Sand is fine to coarse		
3.00-3.90	P								
4.00	IVN 1			V:10kPa / VR:2kPa					
4.00	D								
						(4.00)			
5.00	D		dry	800mm Recovery					
5.00-5.90	P								
6.00	IVN 1			V:12kPa / VR:2kPa					
6.00	D								
6.60	D				-11.30	6.60			
					-11.35	6.65	Soft brown peaty SILT		
7.00	SPT	7.00	dry	50/105mm			Dense grey subangular to subrounded fine to coarse GRAVEL with medium cobble content. Cobbles are subangular to subrounded		
7.00	D			105mm (10,15,21,29)					
7.00	B					(1.55)			
8.00	SPT	8.00	dry	50/20mm					
8.00	D			20mm (16,18,50)					
				11/03/2012 dry	-12.90	8.20			
					-13.10	8.40	Strong grey medium grained META-GABBRO (Large Boulder)		
							End of Borehole at 8.40 m		
	Type								

Remarks:
Hand vane test results:
2.6m = 7.3kPa, 3.0m = 7.7kPa
U100 not attempted in Glacial Till due to high cobble and boulder content.

Chiseling:

From (m)	to (m)	time (hh:mm)

Water Strikes:

Struck (m)	rising to (m)	time (min)

No Groundwater Encountered

Casing:

to (m)	dia. (mm)
8.40	200

Last Revised: 19/04/2012

ISO 9002 AGS

www.causewaygeotech.com

Causeway Geotech Ltd

Project No.	Project Name:	Borehole No.
12-161	New Port of Galway	BH08

Method and Equipment: Percussion boring 0.00-8.80m Dando 2000

Co-ords: 130808.0mE 223106.0mN

Client: Galway Harbour Company

Engineer: Patrick J. Tobin & Co. Ltd

Ground Level: -7.80mCD

Dates: 11/03/2012

Sheet 1 of 1 | **Scale:** 1:50 | **Driller:** CC | **Logger:** DC

Depth (m)	Sample / Test	Casing Depth (m)	Water Depth (m)	Field Records	Level	Depth (Thickness)	Stratum Description	Legend & Water Strikes	Backfill/ Installs
0.00	D						Very soft grey slightly sandy SILT/CLAY with occasional thin seams of sandy silt with low shell content. Sand is fine (organic odour noted)		
1.00	D								
2.00	SPT	2.00	dry	N=0					
2.00	D			N=0 (0,0,0,0,0,0)					
3.00	D		dry	300mm Recovery					
3.00-3.90	P								
4.00	IVN 1			V:7kPa / VR:1kPa		(8.00)			
4.00	D								
5.00	SPT	5.00	dry	N=0					
5.00	D			N=0 (0,0,0,0,0,0)					
6.00	IVN 1			V:7kPa / VR:1kPa					
6.00	D								
7.00	SPT	7.00	dry	N=0					
7.00	D			N=0 (0,0,0,0,0,0)			becoming highly organic below 7.20m		
7.60	D								
8.00	IVN 1			V:14kPa / VR:2kPa	-15.80	8.00			
8.00	D				-15.95	8.15	Spongy light brown fibrous PEAT		
						(0.45)	Very stiff light grey gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded		
8.60	SPT	8.00	dry	50/2mm	-16.40	8.60			
8.60	D			11/03/2012 dry	-16.60	8.80	Strong grey medium grained META-GABBRO (Large Boulder)		
							End of Borehole at 8.80 m		
	Type								

Remarks:
U100 not attempted in Glacial Till due to high cobble and boulder content.

Chiseling:

From (m)	to (m)	time (hh:mm)
8.60	8.80	01:00

Water Strikes:

Struck (m)	rising to (m)	time (min)
No Groundwater Encountered		

Casing:

to (m)	dia. (mm)
8.80	200

Last Revised: 19/04/2012

APPENDIX C

Rotary cored borehole logs

Causeway Geotech Ltd

Project No.	Project Name:	Borehole No.
12-161	New Port of Galway	RC01

Method and Equipment:
Percussion boring 0.00-3.75m Dando 2000
Rotary drilling 3.75-6.80m Symmetrix Drilling
Rotary coring 6.80-9.80m Comacchio 205

Co-ords: 130620.0mE 224414.0mN

Ground Level: -1.20mCD

Client: Galway Harbour Company

Engineer: Patrick J. Tobin & Co. Ltd

Dates: 13/03/2012

Sheet 1 of 1 | **Scale:** 1:50 | **Driller:** CC | **Logger:** DC

Depth (m)	Sample / Test	Casing Depth (m)	Water Depth (m)	Field Records	Level	Depth (Thickness)	Stratum Description	Legend & Water Strikes	Backfill/ Installs
0.00	D						Very soft grey sandy SILT/silty fine SAND with medium shell content. Sand is fine (Organic odour noted)		
							Shells mainly oyster shells		
1.00	D								
						(2.60)			
2.00	D								
					-3.80	2.60			
						(0.40)	Layer of Oyster Shells in a matrix of grey organic silt		
3.00	B				-4.20	3.00			
							Stiff grey gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is subrounded to subangular fine to coarse. Cobbles are subangular to subrounded		
						(2.30)			
					-6.50	5.30			
							Very strong grey, pink and dark grey speckled coarse grained GRANITE. Fresh		
							near vertical fractures open from 6.0m - 6.3m		
6.80									
	100 93	84	4			(4.50)			
8.30				8.30					
	100 94	86	3						
				9.80 13/03/2012 dry	-11.00	9.80			
							End of Borehole at 9.80 m		
	TCR SCR	RQD	FI						

Remarks:
First attempt abandoned on broken rock at 6.3m due to losing corebit down the hole (sheared off).
Symmetrix cased down the hole rotary from 5.3m - 6.8m due to broken nature of the bedrock causing the borehole to collapse.

Chiseling:
From (m) | to (m) | time (hh:mm)

Water Strikes:
Struck (m) | rising to (m) | time (min)
No Groundwater Encountered

Casing:
to (m) | dia. (mm)
3.75 | 200

Last Revised: 20/03/2012


Job no: 12-161
CAUSEWAY
Job Name: New Port of Galway
BH: RC01
Date: 12-3-2012
Box no: 1
of: 1
Starts: 6.8
Ends: 9.8

RC01

Causeway Geotech Ltd

Project No.	Project Name:	Borehole No.
12-161	New Port of Galway	RC02

Method and Equipment:
Percussion boring 0.00-9.70m Dando 2000
Rotary drilling 9.70-11.10m Symmetrix Drilling
Rotary coring 11.10-14.40m Comacchio 205

Co-ords: 130483.0mE 223954.0mN

Client: Galway Harbour Company

Engineer: Patrick J. Tobin & Co. Ltd

Ground Level: -2.20mCD

Dates: 12/03/2012

Sheet 1 of 2

Scale: 1:50

Driller: CC

Logger: DC

Depth (m)	Sample / Test	Casing Depth (m)	Water Depth (m)	Field Records	Level Depth (Thickness)	Stratum Description	Legend & Water Strikes	Backfill/ Installs
0.00	D					Very soft grey sandy SILT/silty fine SAND with medium shell content. Sand is fine (Organic odour noted)		
1.00	D				(2.80)			
2.00	D							
					-5.00 2.80			
3.00	D					Very soft grey slightly organic sandy CLAY with slight shell content. Sand is fine		
4.00	D							
5.00	D							
6.00	D				(6.20)			
7.00	D							
8.00	D							
					-11.20 9.00			
					(1.40)	Very stiff grey gravelly sandy CLAY with medium cobble content and low boulder content. Sand is fine to coarse. Gravel is subrounded to subangular fine to coarse. Cobbles and boulders are subrounded to subangular of meta-gabbro		
	Type							

Continued next sheet

Remarks:
Could not seal off water with shell and auger or symmetrix casings

Chiseling:

From (m)	to (m)	time (hh:mm)
9.50	9.70	01:00

Water Strikes:

Struck (m)	rising to (m)	time (min)
No Groundwater Encountered		

Casing:

to (m)	dia. (mm)
9.70	200

Last Revised: 20/03/2012

Causeway Geotech Ltd

Project No.	Project Name:	Borehole No.
12-161	New Port of Galway	RC02

Method and Equipment:
Percussion boring 0.00-9.70m Dando 2000
Rotary drilling 9.70-11.10m Symmetrix Drilling
Rotary coring 11.10-14.40m Comacchio 205

Co-ords: 130483.0mE 223954.0mN

Ground Level: -2.20mCD

Client: Galway Harbour Company

Engineer: Patrick J. Tobin & Co. Ltd

Dates: 12/03/2012

Sheet 2 of 2 | **Scale:** 1:50 | **Driller:** CC | **Logger:** DC

Depth (m)	Sample / Test	Casing Depth (m)	Water Depth (m)	Field Records	Level	Depth (Thickness)	Stratum Description	Legend & Water Strikes	Backfill/ Installs
							and granite		
					-12.60	10.40			
11.10							Very strong grey with dark grey and pink speckles coarse grained GRANITE.		
	0 0	0	0				Core badly broken from 11.10m - 12.50m		
11.50				11.50					
	86 0	0	0						
12.10				12.10					
	92 30	30	10			(4.00)			
12.70				12.70					
	100 67	67	5						
13.40				13.40					
	93 81	76	3						
				12/03/2012 dry					
14.40					-16.60	14.40	End of Borehole at 14.40 m		
	TCR SCR	RQD	FI						

Remarks:
Could not seal off water with shell and auger or symmetrix casings

Chiseling:
From (m) | to (m) | time (hh:mm)

Water Strikes:
Struck (m) | rising to (m) | time (min)
No Groundwater Encountered

Casing:
to (m) 9.70 | dia. (mm) 200

Last Revised: 20/03/2012


12-161
CAUSEWAY
New Port of Galway
RC02
12-3-2012
1
1
11.10m
14.40m

RC02

Causeway Geotech Ltd

Project No.	Project Name:	Borehole No.
12-161	New Port of Galway	RC03

Method and Equipment:
Percussion boring 0.00-9.40m Dando 2000
Rotary drilling 9.40-10.70m Symmetrix Drilling
Rotary coring 10.70-13.10m Comacchio 205

Co-ords: 130888.0mE 223630.0mN

Client: Galway Harbour Company

Engineer: Patrick J. Tobin & Co. Ltd

Ground Level: -4.50mCD

Dates: 12/03/2012

Sheet 1 of 2 | **Scale:** 1:50 | **Driller:** CC | **Logger:** DC

Depth (m)	Sample / Test	Casing Depth (m)	Water Depth (m)	Field Records	Level	Depth (Thickness)	Stratum Description	Legend & Water Strikes	Backfill/ Installs
0.00	D						Very soft grey sandy SILT/silty fine SAND with medium shell content. Sand is fine (Organic Odour)		
						(1.10)			
					-5.60	1.10	Very soft grey slightly organic sandy clayey SILT/silty CLAY with low cobble content. Sand is fine. Cobbles are subangular to subrounded		
						(7.50)			
					-13.10	8.60	Firm brown sub-amorphous PEAT		
					-13.25	8.75	Grey silty sandy subangular to subrounded fine to coarse GRAVEL. Sand is fine to coarse		
						(1.35)			
	Type								

Continued next sheet

Remarks:
Could not seal off water with shell and auger or symmetrix casing.

Chiseling:

From (m)	to (m)	time (hh:mm)
8.75	9.40	01:00

Water Strikes:

Struck (m)	rising to (m)	time (min)
No Groundwater Encountered		

Casing:

to (m)	dia. (mm)
9.40	200

Last Revised: 20/03/2012

Causeway Geotech Ltd

Project No.	Project Name:	Borehole No.
12-161	New Port of Galway	RC03

Method and Equipment:
Percussion boring 0.00-9.40m Dando 2000
Rotary drilling 9.40-10.70m Symmetrix Drilling
Rotary coring 10.70-13.10m Comacchio 205

Co-ords: 130888.0mE 223630.0mN

Client: Galway Harbour Company

Engineer: Patrick J. Tobin & Co. Ltd

Ground Level: -4.50mCD

Dates: 12/03/2012

Sheet 2 of 2 | **Scale:** 1:50 | **Driller:** CC | **Logger:** DC

Depth (m)	Sample / Test	Casing Depth (m)	Water Depth (m)	Field Records	Level Depth (Thickness)	Stratum Description	Legend & Water Strikes	Backfill/ Installs
					-14.60 10.10	Grey silty sandy subangular to subrounded fine to coarse GRAVEL. Sand is fine to coarse		
10.70						Strong grey with pink and white speckles coarse grained GRANITE		
	83 64	36	0		(2.90)			
11.90				11.90				
	81 81	62	5					
				12/03/2012 dry 13.10	-17.50 13.00	End of Borehole at 13.10 m		
	TCR SCR	RQD	FI					

Remarks:
Could not seal off water with shell and auger or symmetrix casing.

Chiseling:
From (m) | to (m) | time (hh:mm)

Water Strikes:
Struck (m) | rising to (m) | time (min)
No Groundwater Encountered

Casing:
to (m) 9.40 | dia. (mm) 200

Last Revised: 20/03/2012


Job no: 12-161
CAUSEWAY GEOTECH
Job Name: New Port of Galway
BH: RC03
Date: 12-3-2012
Box no: 1
of: 1
Starts: 10.70m
Ends: 13.10m

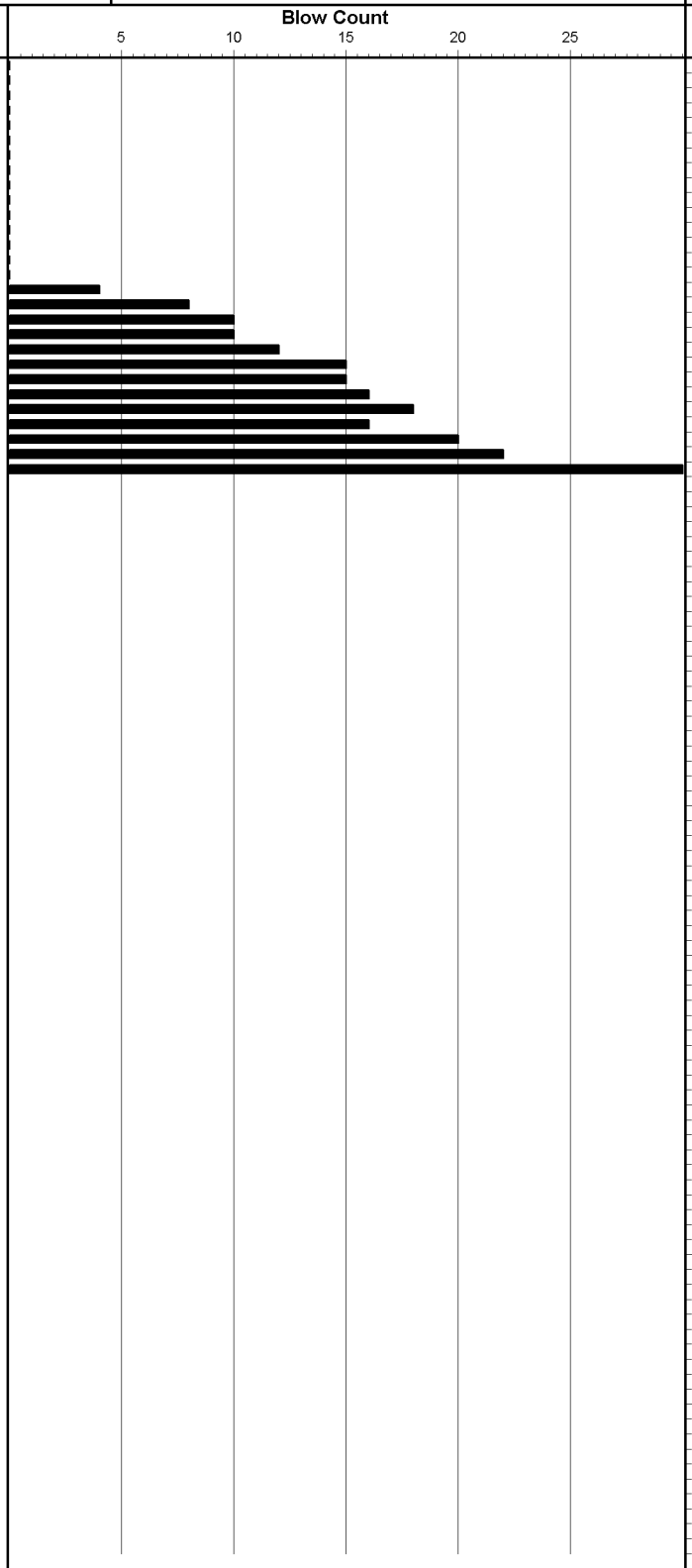
RC03

APPENDIX D

Dynamic probe logs

Causeway Geotech Ltd	Project No. 12-161	Project Name: New Port of Galway	Dynamic Probe No. DP01
Method and Equipment: Dynamic Probing to 2.70m by Dando Terrier	**Co-ords:** 130903.0mE 224564.0mN	**Client:** Galway Harbour Company	Sheet 1 of 1
		Engineer: Patrick J. Tobin & Co. Ltd	**Scale:** 1:50
	Ground Level: -0.30mCD	**Dates:** 13/03/2012	**Operator:**
			Logger: DC

Depth (m)	Level (mCD)	Blows per 100mm	Blow Count	Torque (Nm)
0.00	-0.30	0 0 0 0 0		
0.50	-0.80	0 0 0 0 0		
1.00	-1.30	0 0 0 0 0		
1.50	-1.80	4 8 10 10 12		
2.00	-2.30	15 15 16 18 16		
2.50	-2.80	20 22 30		



Remarks:
Probe fell under its own weight plus hammer to 1.4m.

	Test Method: DPSH-B
Cone Angle 90degree	**Hammer Mass:** 63.50
Cone Diameter: 50mm	**Fall Height:** 750mm

Last Revised: 26/03/2012

ISO 9002 AGS

Causeway Geotech Ltd

Project No.	Project Name:	Dynamic Probe No.
12-161	New Port of Galway	DP02

Method and Equipment:
Dynamic Probing to 2.70m by Dando Terrier

Co-ords:
130452.0mE
224414.0mN

Ground Level:
-3.30mCD

Client: Galway Harbour Company

Engineer: Patrick
J. Tobin & Co. Ltd

Dates: 13/03/2012

Sheet 1 of 1

Scale: 1:50

Operator:

Logger: DC

Depth (m)	Level (mCD)	Blows per 100mm	Blow Count	Torque (Nm)
0.00	-3.30	0 0 0 0 0		
0.50	-3.80	0 0 0 0 0		
1.00	-4.30	0 0 0 0 0		
1.50	-4.80	0 0 0 0 0		
2.00	-5.30	0 0 0 0 0		
2.50	-5.80	10 18 30		

Blow Count: 5 10 15 20 25

Remarks:
Probe fell under its own weight plus hammer to 2.4m.

Test Method: DPSH-B

Cone Angle: 90degree

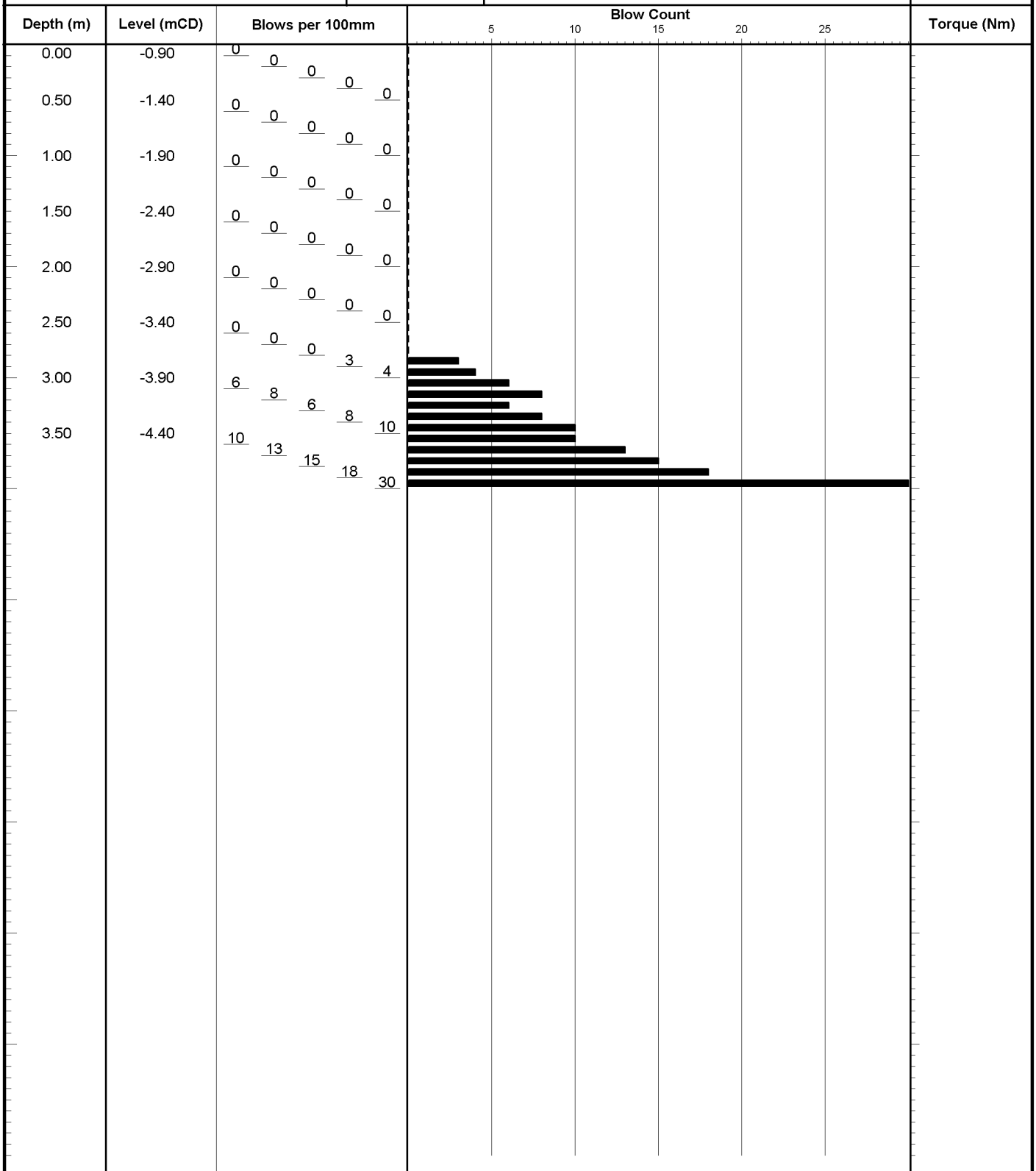
Hammer Mass: 63.50

Cone Diameter: 50mm

Fall Height: 750mm

Last Revised: 26/03/2012

Causeway Geotech Ltd	Project No. 12-161	Project Name: New Port of Galway	Dynamic Probe No. DP03
Method and Equipment: Dynamic Probing to 3.90m by Dando Terrier	**Co-ords:** 130792.0mE 224411.0mN	**Client:** Galway Harbour Company	Sheet 1 of 1
		Engineer: Patrick J. Tobin & Co. Ltd	**Scale:** 1:50
	Ground Level: -0.90mCD	**Dates:** 13/03/2012	**Operator:**
			Logger: DC



Remarks:
Probe fell under its own weight plus hammer to 2.7m.

		Test Method: DPSH-B
Cone Angle 90degree	**Hammer Mass:** 63.50	
Cone Diameter: 50mm	**Fall Height:** 750mm	

Last Revised: 26/03/2012

ISO 9002 AGS

Causeway Geotech Ltd	Project No. 12-161	Project Name: New Port of Galway	Dynamic Probe No. DP04
Method and Equipment: Dynamic Probing to 3.50m by Dando Terrier	**Co-ords:** 130911.0mE 224412.0mN	**Client:** Galway Harbour Company	Sheet 1 of 1
		Engineer: Patrick J. Tobin & Co. Ltd	**Scale:** 1:50
	Ground Level: -0.80mCD	**Dates:** 13/03/2012	**Operator:**
			Logger: DC

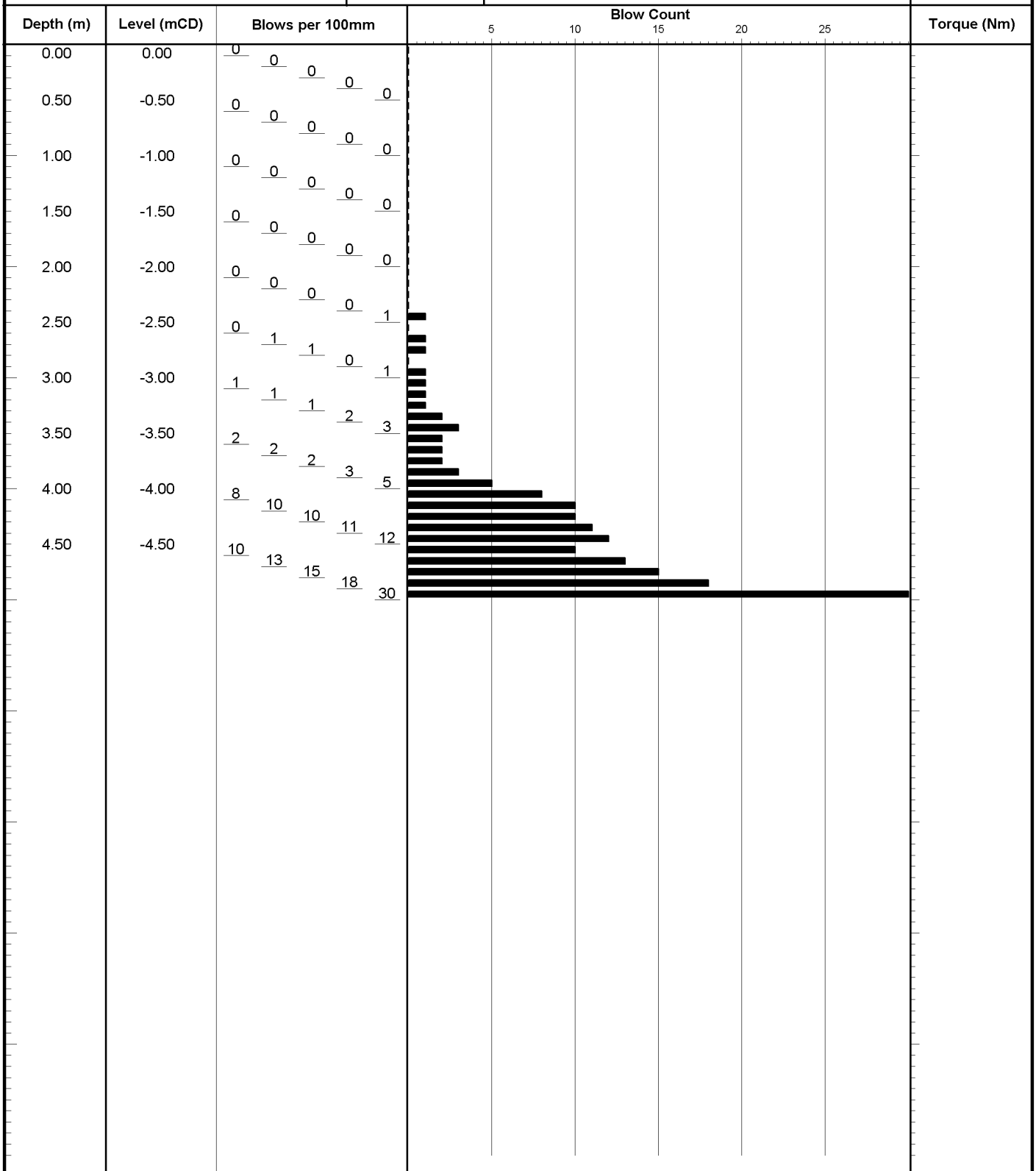
Depth (m)	Level (mCD)	Blows per 100mm	Blow Count	Torque (Nm)
0.00	-0.80	0 0 0 0 0	5 10 15 20 25	
0.50	-1.30	0 0 0 0 0		
1.00	-1.80	0 0 0 0 0		
1.50	-2.30	0 1 1 1 1		
2.00	-2.80	1 1 2 2 2		
2.50	-3.30	3 4 5 6 8		
3.00	-3.80	10 12 14 14 18		
3.50	-4.30	30		

Remarks:
Probe fell under its own weight plus hammer to 1.5m.

	Test Method: DPSH-B
Cone Angle 90degree	**Hammer Mass:** 63.50
Cone Diameter: 50mm	**Fall Height:** 750mm

Last Revised: 26/03/2012

Causeway Geotech Ltd	Project No. 12-161	Project Name: New Port of Galway	Dynamic Probe No. DP05
Method and Equipment: Dynamic Probing to 4.90m by Dando Terrier	**Co-ords:** 130348.0mE 224263.0mN	**Client:** Galway Harbour Company	Sheet 1 of 1
		Engineer: Patrick J. Tobin & Co. Ltd	**Scale:** 1:50
	Ground Level: 0.00mCD	**Dates:** 13/03/2012	**Operator:**
			Logger: DC



Remarks:
Probe fell under its own weight plus hammer to 2.3m.

	Test Method: DPSH-B
Cone Angle 90degree	**Hammer Mass:** 63.50
Cone Diameter: 50mm	**Fall Height:** 750mm

Last Revised: 26/03/2012

Causeway Geotech Ltd

Project No.	Project Name:	Dynamic Probe No.
12-161	New Port of Galway	DP06

Method and Equipment:
Dynamic Probing to 8.40m by Dando Terrier

Co-ords:
130450.0mE
224268.0mN

Ground Level:
-1.10mCD

Client: Galway Harbour Company

Engineer: Patrick
J. Tobin & Co. Ltd

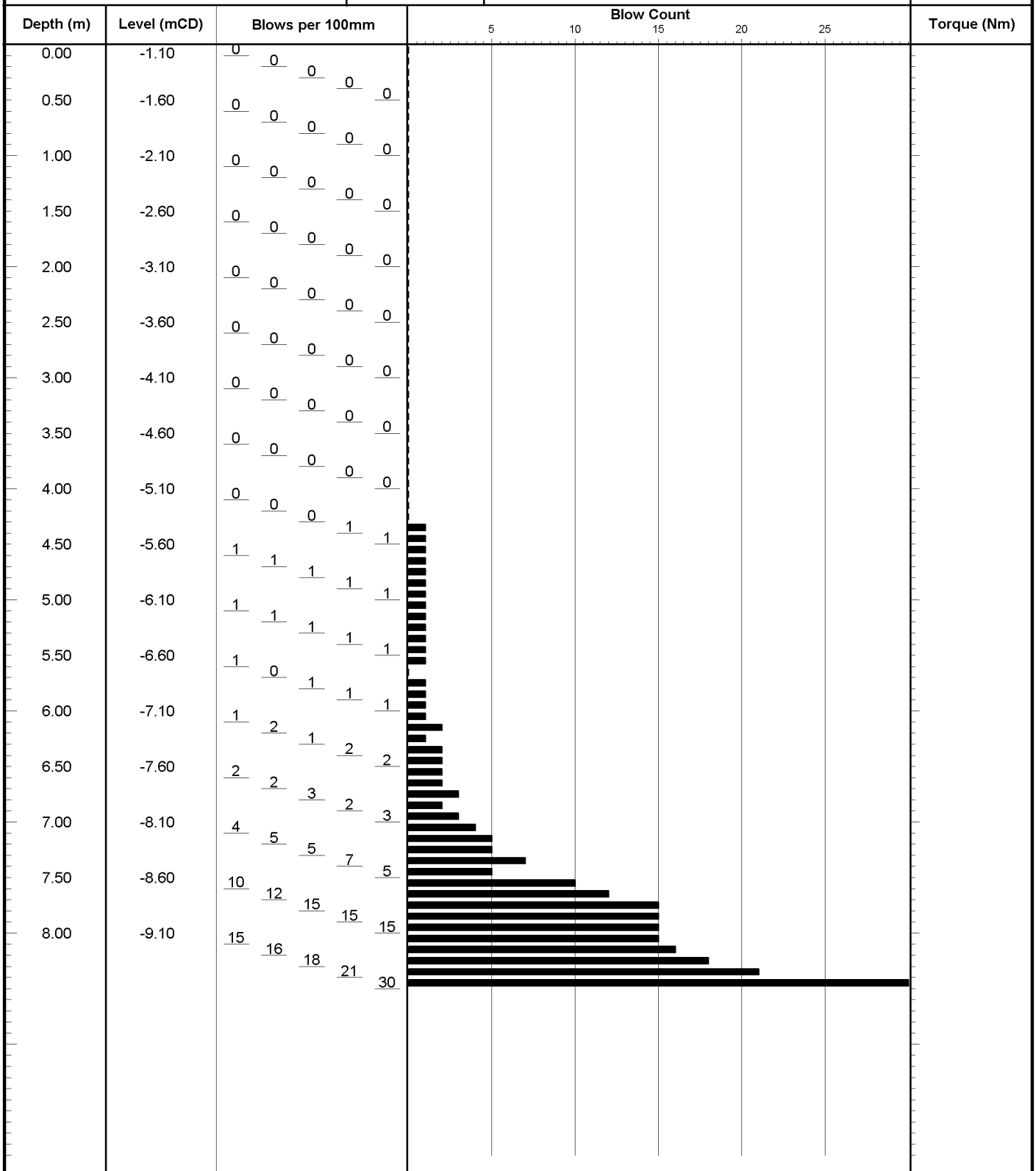
Dates: 13/03/2012

Sheet 1 of 1

Scale: 1:50

Operator:

Logger: DC



Remarks:
Probe fell under its own weight plus hammer to 4.2m.

Test Method: DPSH-B

Cone Angle: 90degree

Hammer Mass: 63.50

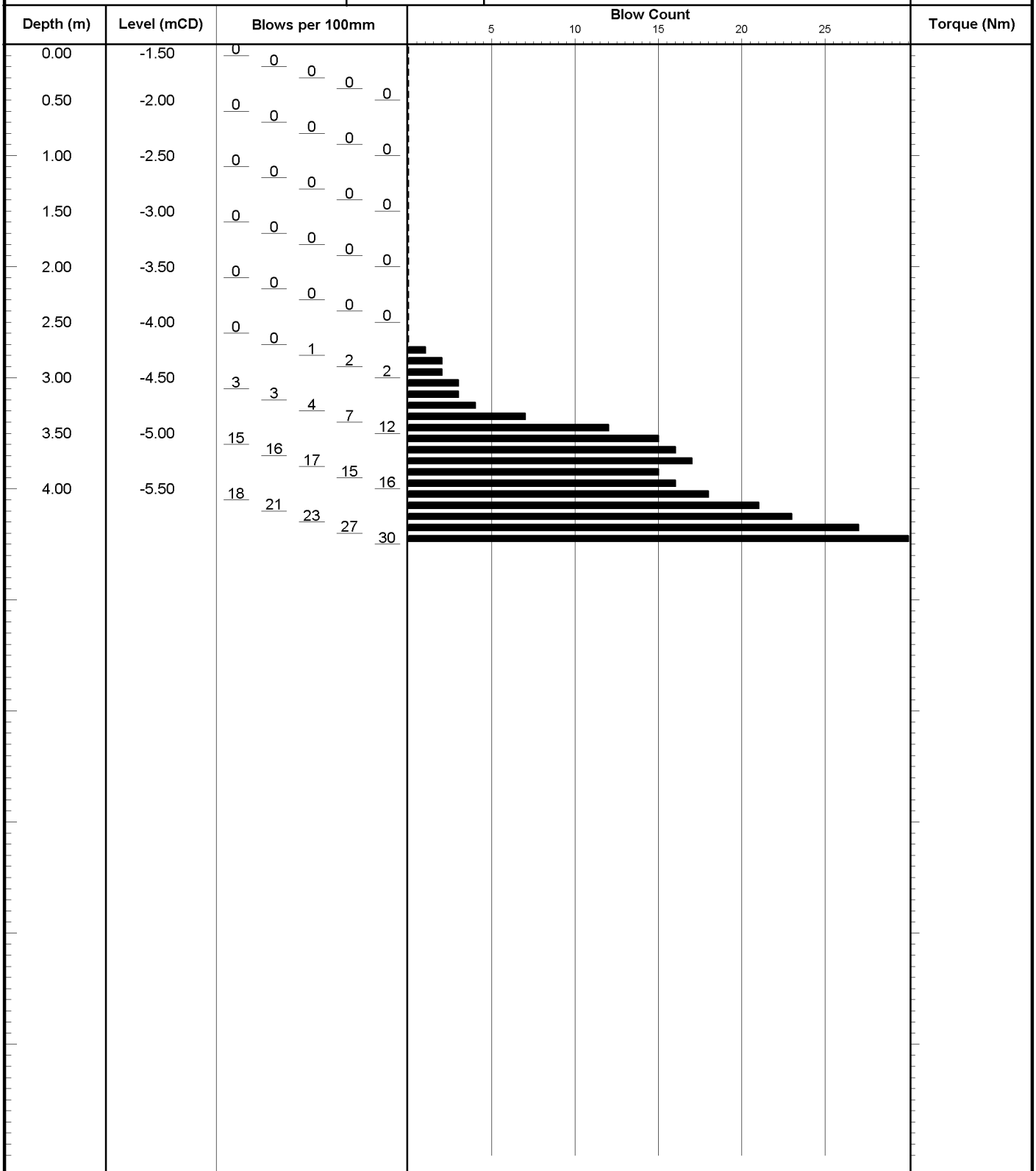
Cone Diameter: 50mm

Fall Height: 750mm

Last Revised: 26/03/2012

Causeway Geotech Ltd

Project No. 12-161	**Project Name:** New Port of Galway		**Dynamic Probe No.** DP07
Method and Equipment: Dynamic Probing to 4.40m by Dando Terrier	**Co-ords:** 130890.0mE 224265.0mN	**Client:** Galway Harbour Company	Sheet 1 of 1
		Engineer: Patrick J. Tobin & Co. Ltd	**Scale:** 1:50
	Ground Level: -1.50mCD	**Dates:** 13/03/2012	**Operator:**
			Logger: DC



Remarks:
Probe fell under its own weight plus hammer to 2.6m.

Test Method: DPSH-B	**Last Revised:** 26/03/2012
Cone Angle 90degree	**Hammer Mass:** 63.50
Cone Diameter: 50mm	**Fall Height:** 750mm

ISO 9002 AGS

Causeway Geotech Ltd

Project No. 12-161	**Project Name:** New Port of Galway		**Dynamic Probe No.** DP08
Method and Equipment: Dynamic Probing to 5.10m by Dando Terrier	**Co-ords:** 130458.0mE 224113.0mN	**Client:** Galway Harbour Company	Sheet 1 of 1
		Engineer: Patrick J. Tobin & Co. Ltd	**Scale:** 1:50
	Ground Level: -1.10mCD	**Dates:** 13/03/2012	**Operator:**
			Logger: DC

Depth (m)	Level (mCD)	Blows per 100mm	Blow Count	Torque (Nm)
0.00	-1.10	0 0 0 0 0	5 10 15 20 25	
0.50	-1.60	0 0 0 0 0		
1.00	-2.10	0 0 0 0 0		
1.50	-2.60	0 0 1 0 1		
2.00	-3.10	1 0 1 1 1		
2.50	-3.60	1 1 0 1 1		
3.00	-4.10	1 1 1 1 2		
3.50	-4.60	1 2 2 2 1		
4.00	-5.10	2 2 2 2 3		
4.50	-5.60	4 5 5 10 15		
5.00	-6.10	18 30		

Remarks:
Probe fell under its own weight plus hammer to 1.6m.

Cone Angle 90degree	**Test Method:** DPSH-B
Cone Diameter: 50mm	**Hammer Mass:** 63.50
	Fall Height: 750mm

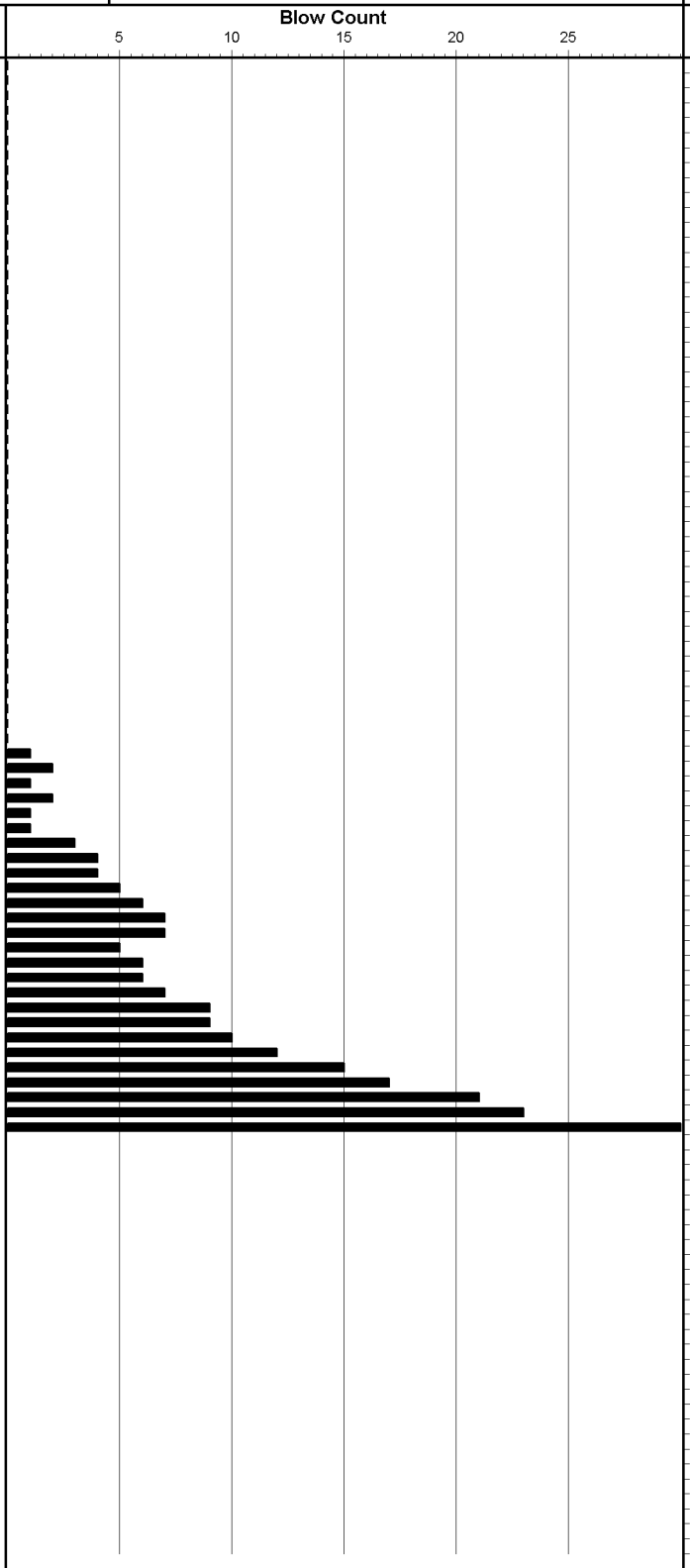
Last Revised: 26/03/2012

ISO 9002 AGS

Causeway Geotech Ltd

Project No. 12-161	**Project Name:** New Port of Galway		**Dynamic Probe No.** DP09
Method and Equipment: Dynamic Probing to 7.10m by Dando Terrier	**Co-ords:** 130570.0mE 224086.0mN	**Client:** Galway Harbour Company	Sheet 1 of 1
		Engineer: Patrick J. Tobin & Co. Ltd	**Scale:** 1:50
	Ground Level: -1.90mCD	**Dates:** 13/03/2012	**Operator:**
			Logger: DC

Depth (m)	Level (mCD)	Blows per 100mm	Blow Count	Torque (Nm)
0.00	-1.90	0 0 0 0 0		
0.50	-2.40	0 0 0 0 0		
1.00	-2.90	0 0 0 0 0		
1.50	-3.40	0 0 0 0 0		
2.00	-3.90	0 0 0 0 0		
2.50	-4.40	0 0 0 0 0		
3.00	-4.90	0 0 0 0 0		
3.50	-5.40	0 0 0 0 0		
4.00	-5.90	0 0 0 0 0		
4.50	-6.40	0 1 2 1 2		
5.00	-6.90	1 1 3 4 4		
5.50	-7.40	5 6 7 7 5		
6.00	-7.90	6 6 7 9 9		
6.50	-8.40	10 12 15 17 21		
7.00	-8.90	23 30		



Remarks:
Probe fell under its own weight plus hammer to 4.5m.

		Test Method: DPSH-B
Cone Angle 90degree	**Hammer Mass:** 63.50	
Cone Diameter: 50mm	**Fall Height:** 750mm	

Last Revised: 26/03/2012

Causeway Geotech Ltd

Project No.	Project Name:	Dynamic Probe No.
12-161	New Port of Galway	DP10

Method and Equipment:
Dynamic Probing to 5.30m by Dando Terrier

Co-ords:
130983.0mE
224091.0mN

Ground Level:
-1.90mCD

Client: Galway Harbour Company

Engineer: Patrick
J. Tobin & Co. Ltd

Dates: 13/03/2012

Sheet 1 of 1

Scale: 1:50

Operator:

Logger: DC

Depth (m)	Level (mCD)	Blows per 100mm	Blow Count	Torque (Nm)
0.00	-1.90	0 0 0 0 0	5 10 15 20 25	
0.50	-2.40	0 0 0 0 0		
1.00	-2.90	0 0 0 0 0		
1.50	-3.40	0 0 0 0 0		
2.00	-3.90	0 0 0 0 0		
2.50	-4.40	0 1 2 2 2		
3.00	-4.90	3 4 3 4 4		
3.50	-5.40	4 4 5 4 5		
4.00	-5.90	5 5 6 6 7		
4.50	-6.40	6 7 6 6 7		
5.00	-6.90	9 10 18 23		

Remarks:
Probe fell under its own weight plus hammer to 2.5m.

Test Method: DPSH-B

Cone Angle: 90degree

Hammer Mass: 63.50

Cone Diameter: 50mm

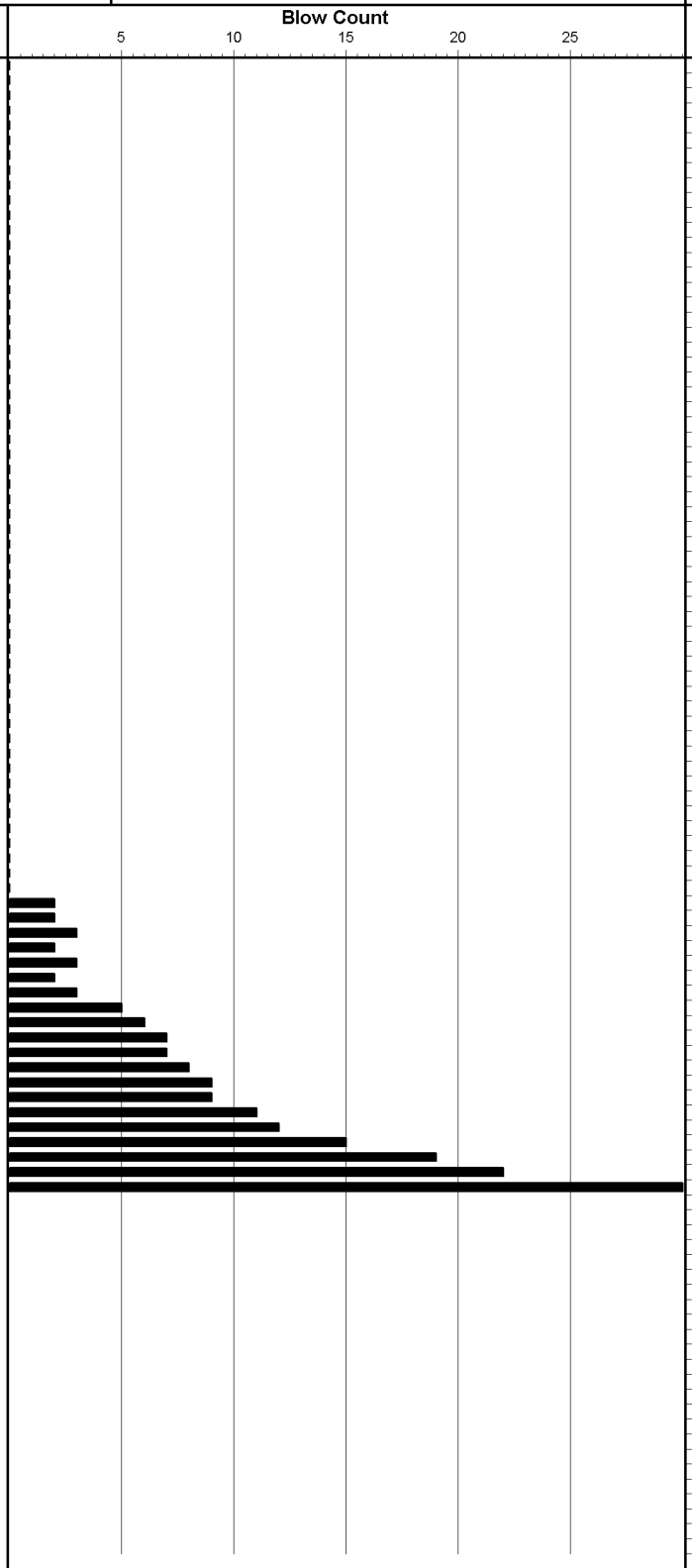
Fall Height: 750mm

Last Revised: 26/03/2012

ISO 9002 AGS

Causeway Geotech Ltd	Project No. 12-161	Project Name: New Port of Galway	Dynamic Probe No. DP11
Method and Equipment: Dynamic Probing to 7.50m by Dando Terrier	**Co-ords:** 131149.0mE 223948.0mN	**Client:** Galway Harbour Company	Sheet 1 of 1
		Engineer: Patrick J. Tobin & Co. Ltd	**Scale:** 1:50
	Ground Level: -2.70mCD	**Dates:** 14/03/2012	**Operator:**
			Logger: DC

Depth (m)	Level (mCD)	Blows per 100mm	Blow Count	Torque (Nm)
0.00	-2.70	0 0 0 0 0		
0.50	-3.20	0 0 0 0 0		
1.00	-3.70	0 0 0 0 0		
1.50	-4.20	0 0 0 0 0		
2.00	-4.70	0 0 0 0 0		
2.50	-5.20	0 0 0 0 0		
3.00	-5.70	0 0 0 0 0		
3.50	-6.20	0 0 0 0 0		
4.00	-6.70	0 0 0 0 0		
4.50	-7.20	0 0 0 0 0		
5.00	-7.70	0 0 0 0 0		
5.50	-8.20	0 2 2 3 2		
6.00	-8.70	3 2 3 5 6		
6.50	-9.20	7 7 8 9 9		
7.00	-9.70	11 12 15 19 22		
7.50	-10.20	30		



Remarks:
Probe fell under its own weight plus hammer to 5.5m.

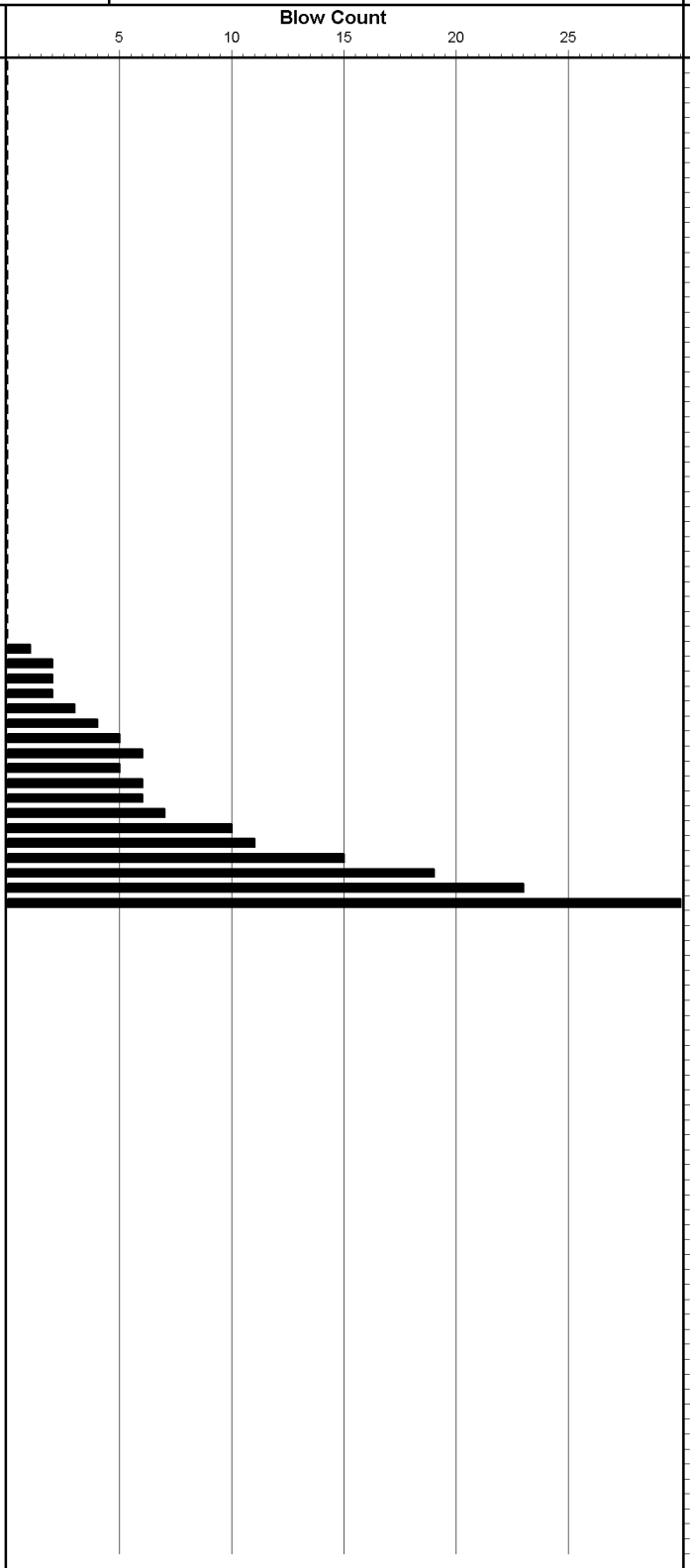
		Test Method: DPSH-B
Cone Angle 90degree	**Hammer Mass:** 63.50	
Cone Diameter: 50mm	**Fall Height:** 750mm	

Last Revised: 05/04/2012

ISO 9002 AGS

Causeway Geotech Ltd	Project No. 12-161	Project Name: New Port of Galway	Dynamic Probe No. DP12
Method and Equipment: Dynamic Probing to 5.60m by Dando Terrier	**Co-ords:** 131168.0mE 223806.0mN	**Client:** Galway Harbour Company	Sheet 1 of 1
		Engineer: Patrick J. Tobin & Co. Ltd	**Scale:** 1:50
	Ground Level: -3.20mCD	**Dates:** 14/03/2012	**Operator:**
			Logger: DC

Depth (m)	Level (mCD)	Blows per 100mm	Blow Count	Torque (Nm)
0.00	-3.20	0 0 0 0 0		
0.50	-3.70	0 0 0 0 0		
1.00	-4.20	0 0 0 0 0		
1.50	-4.70	0 0 0 0 0		
2.00	-5.20	0 0 0 0 0		
2.50	-5.70	0 0 0 0 0		
3.00	-6.20	0 0 0 0 0		
3.50	-6.70	0 0 0 0 0		
4.00	-7.20	2 2 2 3 4		
4.50	-7.70	5 6 5 6 6		
5.00	-8.20	7 10 11 15 19		
5.50	-8.70	23 30		



Remarks:
Probe fell under its own weight plus hammer to 3.8m.

		Test Method: DPSH-B
Cone Angle 90degree	**Hammer Mass:** 63.50	
Cone Diameter: 50mm	**Fall Height:** 750mm	

Last Revised: 05/04/2012

ISO 9002 AGS

Causeway Geotech Ltd

Project No. 12-161	**Project Name:** New Port of Galway		**Dynamic Probe No.** DP13
Method and Equipment: Dynamic Probing to 12.10m by Dando Terrier	**Co-ords:** 130737.0mE 223688.0mN	**Client:** Galway Harbour Company	Sheet 1 of 2
		Engineer: Patrick J. Tobin & Co. Ltd	**Scale:** 1:50
	Ground Level: -3.80mCD	**Dates:** 14/03/2012	**Operator:**
			Logger: DC

Depth (m)	Level (mCD)	Blows per 100mm	Blow Count	Torque (Nm)
0.00	-3.80	0 0 0 0 0	5 10 15 20 25	
0.50	-4.30	0 0 0 0 0		
1.00	-4.80	0 0 0 0 0		
1.50	-5.30	0 0 0 0 0		
2.00	-5.80	0 0 0 0 0		
2.50	-6.30	0 0 0 0 0		
3.00	-6.80	0 0 0 0 0		
3.50	-7.30	0 0 0 0 0		
4.00	-7.80	0 0 0 0 0		
4.50	-8.30	0 0 0 0 0		
5.00	-8.80	0 0 0 0 0		
5.50	-9.30	0 0 0 0 0		
6.00	-9.80	0 0 0 0 0		
6.50	-10.30	0 0 0 0 0		
7.00	-10.80	0 0 0 0 0		
7.50	-11.30	0 0 0 0 0		
8.00	-11.80	0 0 0 0 0		
8.50	-12.30	0 1 1 1 1		
9.00	-12.80	1 1 1 1 1		
9.50	-13.30	1 1 1 1 1		

Remarks:
Probe fell under its own weight plus hammer to 8.5m.

		Test Method: DPSH-B
Cone Angle 90degree	**Hammer Mass:** 63.50	
Cone Diameter: 50mm	**Fall Height:** 750mm	

Last Revised: 05/04/2012

ISO 9002 AGS

Causeway Geotech Ltd	Project No. 12-161	Project Name: New Port of Galway	Dynamic Probe No. DP13
Method and Equipment: Dynamic Probing to 12.10m by Dando Terrier	**Co-ords:** 130737.0mE 223688.0mN	**Client:** Galway Harbour Company	Sheet 2 of 2
		Engineer: Patrick J. Tobin & Co. Ltd	**Scale:** 1:50
	Ground Level: -3.80mCD	**Dates:** 14/03/2012	**Operator:**
			Logger: DC

Depth (m)	Level (mCD)	Blows per 100mm	Blow Count	Torque (Nm)
10.00	-13.80	1 1 2 1 2	5 10 15 20 25	
10.50	-14.30	2 3 2 2 3		
11.00	-14.80	3 3 3 4 3		
11.50	-15.30	4 5 6 12 15		
12.00	-15.80	21 24 30		

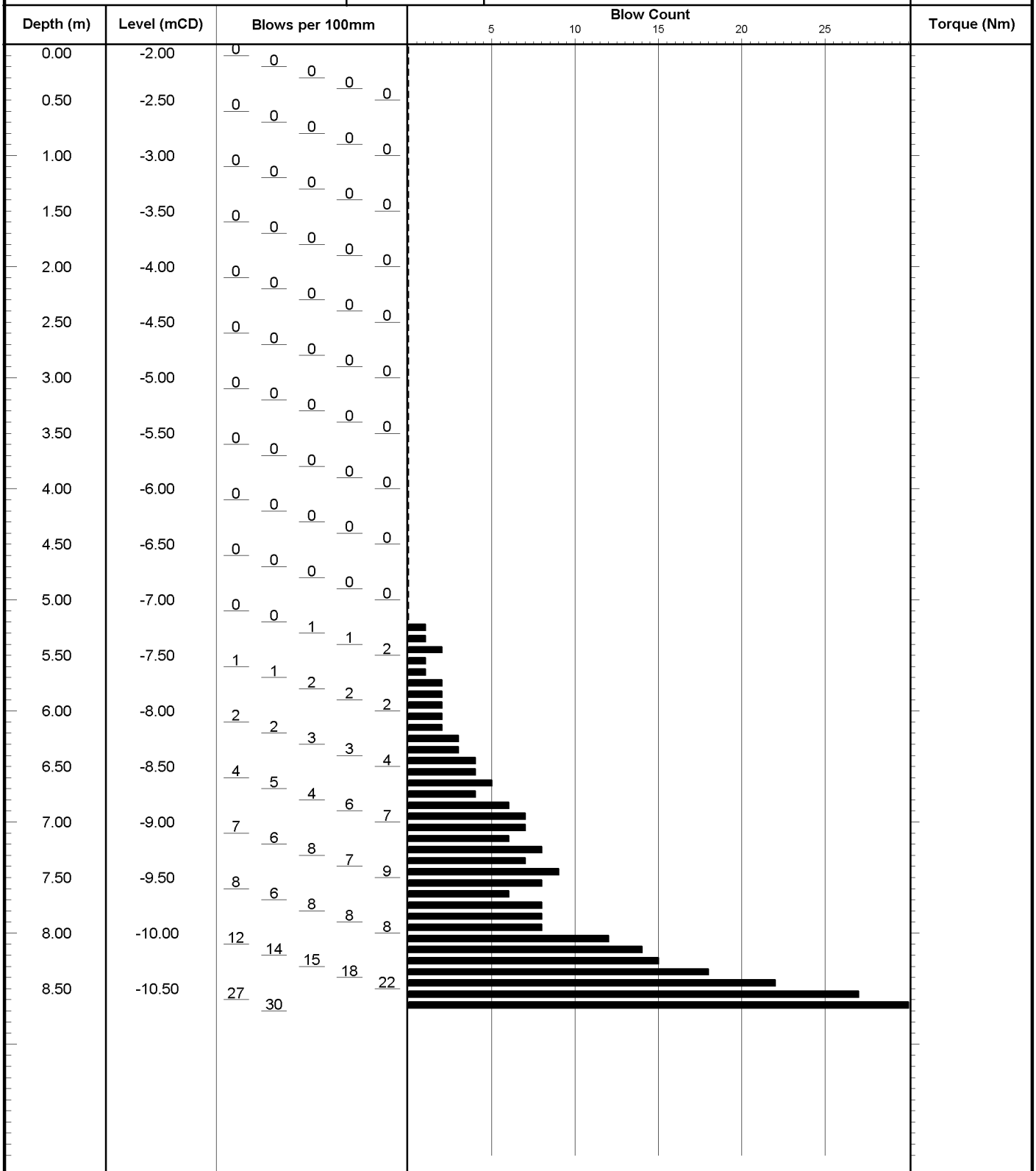
Remarks:
Probe fell under its own weight plus hammer to 8.5m.

	Test Method: DPSH-B
Cone Angle 90degree	**Hammer Mass:** 63.50
Cone Diameter: 50mm	**Fall Height:** 750mm

Last Revised: 05/04/2012

Causeway Geotech Ltd

Project No. 12-161	**Project Name:** New Port of Galway		**Dynamic Probe No.** DP14
Method and Equipment: Dynamic Probing to 8.60m by Dando Terrier	**Co-ords:** 130360.0mE 223951.0mN	**Client:** Galway Harbour Company	Sheet 1 of 1
		Engineer: Patrick J. Tobin & Co. Ltd	**Scale:** 1:50
	Ground Level: -2.00mCD	**Dates:** 14/03/2012	**Operator:**
			Logger: DC



Remarks:
Probe fell under its own weight plus hammer to 5.1m.

		Test Method: DPSH-B
Cone Angle 90degree	**Hammer Mass:** 63.50	
Cone Diameter: 50mm	**Fall Height:** 750mm	

Last Revised: 05/04/2012

Causeway Geotech Ltd

Project No.	Project Name:	Dynamic Probe No.
12-161	New Port of Galway	DP15

Method and Equipment:
Dynamic Probing to 7.30m by Dando Terrier

Co-ords:
130356.0mE
223808.0mN

Ground Level:
-2.30mCD

Client: Galway Harbour Company

Engineer: Patrick
J. Tobin & Co. Ltd

Dates: 14/03/2012

Sheet 1 of 1

Scale: 1:50

Operator:

Logger: DC

Depth (m)	Level (mCD)	Blows per 100mm	Blow Count	Torque (Nm)
0.00	-2.30	0 0 0 0 0		
0.50	-2.80	0 0 0 0 0		
1.00	-3.30	0 0 0 0 0		
1.50	-3.80	0 0 0 0 0		
2.00	-4.30	0 0 0 0 0		
2.50	-4.80	0 0 0 0 0		
3.00	-5.30	0 0 0 0 0		
3.50	-5.80	0 0 0 0 0		
4.00	-6.30	0 0 0 0 0		
4.50	-6.80	0 0 0 0 0		
5.00	-7.30	0 0 0 0 0		
5.50	-7.80	0 1 0 1 1		
6.00	-8.30	1 1 6 6 7		
6.50	-8.80	10 12 15 18 22		
7.00	-9.30	21 23 25 30		

Blow Count: 5 10 15 20 25

Remarks:
Probe fell under its own weight plus hammer to 5.5m.

Cone Angle	Test Method:
90degree	DPSH-B
Cone Diameter: 50mm	**Hammer Mass:** 63.50
	Fall Height: 750mm

Last Revised:
05/04/2012

ISO 9002 AGS

Causeway Geotech Ltd

Project No. 12-161	**Project Name:** New Port of Galway		**Dynamic Probe No.** DP16
Method and Equipment: Dynamic Probing to 2.20m by Dando Terrier	**Co-ords:** 131248.0mE 223951.0mN	**Client:** Galway Harbour Company	Sheet 1 of 1
		Engineer: Patrick J. Tobin & Co. Ltd	**Scale:** 1:50
	Ground Level: -3.00mCD	**Dates:** 14/03/2012	**Operator:**
			Logger: DC

Depth (m)	Level (mCD)	Blows per 100mm	Blow Count	Torque (Nm)
0.00	-3.00	0 0 0 0 0		
0.50	-3.50	0 0 0 0 0		
1.00	-4.00	0 0 0 0 0		
1.50	-4.50	0 0 0 0 0		
2.00	-5.00	3 12 30 0 2		

Blow Count: 5 10 15 20 25

Remarks:
Probe fell under its own weight plus hammer to 1.8m.

Cone Angle 90degree	**Test Method:** DPSH-B
Cone Diameter: 50mm	**Hammer Mass:** 63.50
	Fall Height: 750mm

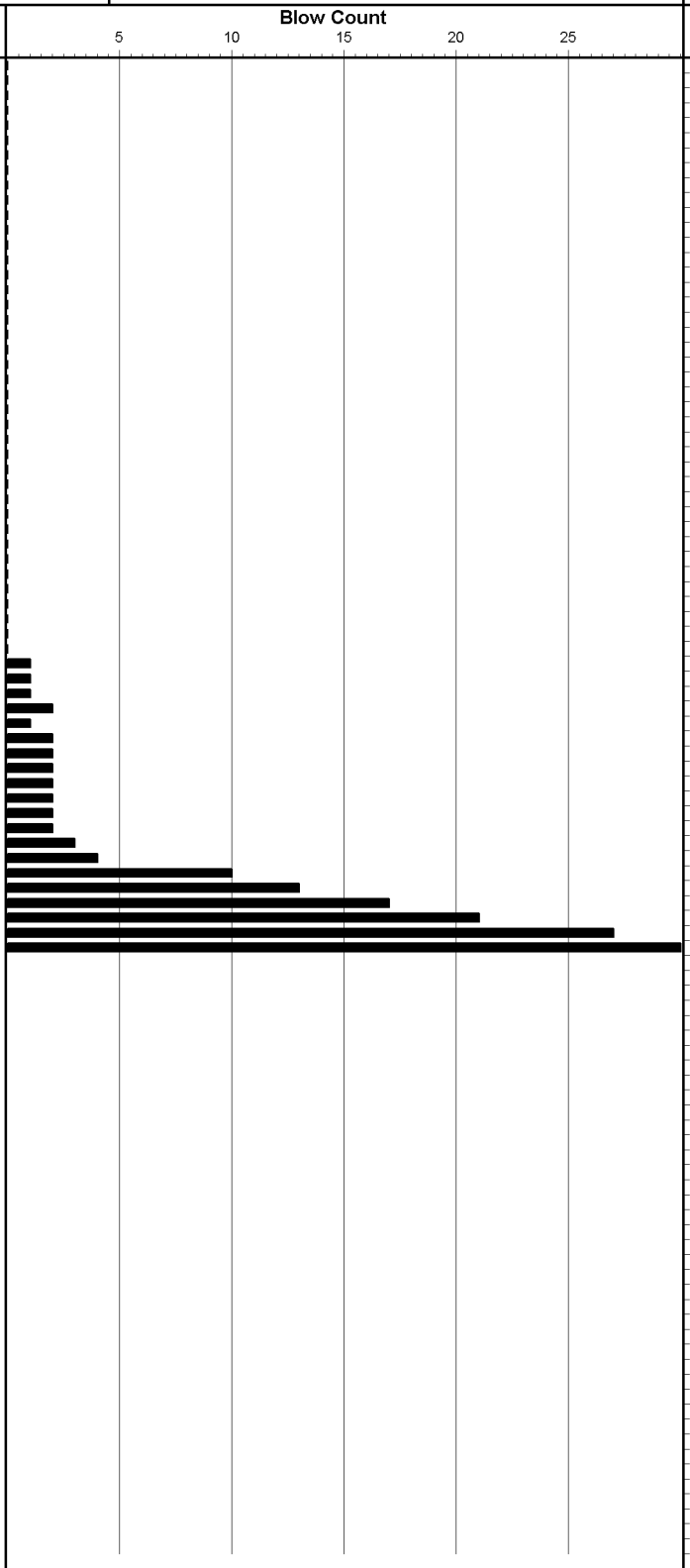
Last Revised: 05/04/2012

ISO 9002 AGS

Causeway Geotech Ltd

Project No. 12-161	**Project Name:** New Port of Galway		**Dynamic Probe No.** DP17
Method and Equipment: Dynamic Probing to 5.90m by Dando Terrier	**Co-ords:** 131256.0mE 223807.0mN	**Client:** Galway Harbour Company	Sheet 1 of 1
		Engineer: Patrick J. Tobin & Co. Ltd	**Scale:** 1:50
	Ground Level: -3.50mCD	**Dates:** 14/03/2012	**Operator:**
			Logger: DC

Depth (m)	Level (mCD)	Blows per 100mm	Blow Count	Torque (Nm)
0.00	-3.50	0 0 0 0 0		
0.50	-4.00	0 0 0 0 0		
1.00	-4.50	0 0 0 0 0		
1.50	-5.00	0 0 0 0 0		
2.00	-5.50	0 0 0 0 0		
2.50	-6.00	0 0 0 0 0		
3.00	-6.50	0 0 0 0 0		
3.50	-7.00	0 0 0 0 0		
4.00	-7.50	1 1 1 2 1		
4.50	-8.00	2 2 2 2 2		
5.00	-8.50	2 2 3 4 10		
5.50	-9.00	13 17 21 27 30		



Remarks:
Probe fell under its own weight plus hammer to 3.9m.

		Test Method: DPSH-B
Cone Angle 90degree	**Hammer Mass:** 63.50	
Cone Diameter: 50mm	**Fall Height:** 750mm	

Last Revised: 05/04/2012

Causeway Geotech Ltd

Project No. 12-161	**Project Name:** New Port of Galway		**Dynamic Probe No.** DP18
Method and Equipment: Dynamic Probing to 6.70m by Dando Terrier	**Co-ords:** 131206.0mE 223561.0mN	**Client:** Galway Harbour Company	Sheet 1 of 1
		Engineer: Patrick J. Tobin & Co. Ltd	**Scale:** 1:50
	Ground Level: -4.10mCD	**Dates:** 14/03/2012	**Operator:**
			Logger: DC

Depth (m)	Level (mCD)	Blows per 100mm	Blow Count	Torque (Nm)
0.00	-4.10	0 0 0 0 0		
0.50	-4.60	0 0 0 0 0		
1.00	-5.10	0 0 0 0 0		
1.50	-5.60	0 0 0 0 0		
2.00	-6.10	0 0 0 0 0		
2.50	-6.60	0 0 0 0 0		
3.00	-7.10	0 0 0 0 0		
3.50	-7.60	0 0 0 0 0		
4.00	-8.10	0 0 0 0 0		
4.50	-8.60	0 0 0 0 0		
5.00	-9.10	2 2 2 3 1		
5.50	-9.60	5 5 5 6 4		
6.00	-10.10	9 10 12 12 7		
6.50	-10.60	17 22 30 15		

Blow Count: 5 10 15 20 25

Remarks:
Probe fell under its own weight plus hammer to 4.8m.

		Test Method: DPSH-B
Cone Angle 90degree	**Hammer Mass:** 63.50	
Cone Diameter: 50mm	**Fall Height:** 750mm	

Last Revised: 05/04/2012

ISO 9002 AGS

Causeway Geotech Ltd

Project No. 12-161	**Project Name:** New Port of Galway		**Dynamic Probe No.** DP19
Method and Equipment: Dynamic Probing to 3.50m by Dando Terrier	**Co-ords:** 131102.0mE 223303.0mN	**Client:** Galway Harbour Company	Sheet 1 of 1
		Engineer: Patrick J. Tobin & Co. Ltd	**Scale:** 1:50
	Ground Level: -5.30mCD	**Dates:** 14/03/2012	**Operator:**
			Logger: DC

Depth (m)	Level (mCD)	Blows per 100mm	Blow Count	Torque (Nm)
0.00	-5.30	0 0 0 0 0	5 10 15 20 25	
0.50	-5.80	0 0 0 0 0		
1.00	-6.30	0 0 0 0 0		
1.50	-6.80	0 0 0 0 0		
2.00	-7.30	0 0 0 0 0		
2.50	-7.80	0 2 4 7 6		
3.00	-8.30	7 8 15 19 21		
3.50	-8.80	30		

Remarks:
Probe fell under its own weight plus hammer to 2.5m.

Cone Angle 90degree	**Test Method:** DPSH-B
Cone Diameter: 50mm	**Hammer Mass:** 63.50
	Fall Height: 750mm

Last Revised: 05/04/2012

ISO 9002 AGS

Causeway Geotech Ltd

Project No.	Project Name:	Dynamic Probe No.
12-161	New Port of Galway	DP20

Method and Equipment:
Dynamic Probing to 5.60m by Dando Terrier

Co-ords:
131015.0mE
223105.0mN

Ground Level:
-6.60mCD

Client: Galway Harbour Company

Engineer: Patrick
J. Tobin & Co. Ltd

Dates: 14/03/2012

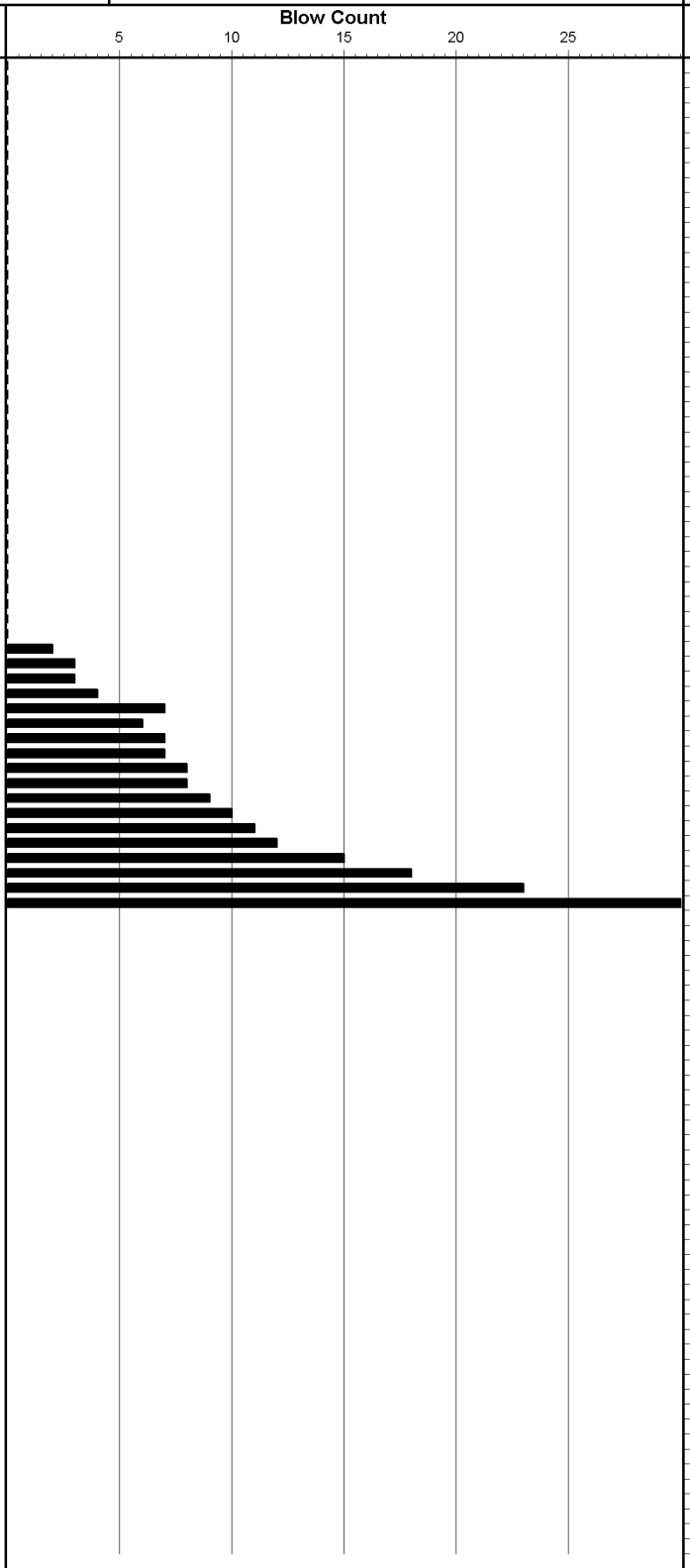
Sheet 1 of 1

Scale: 1:50

Operator:

Logger: DC

Depth (m)	Level (mCD)	Blows per 100mm	Blow Count	Torque (Nm)
0.00	-6.60	0 0 0 0 0		
0.50	-7.10	0 0 0 0 0		
1.00	-7.60	0 0 0 0 0		
1.50	-8.10	0 0 0 0 0		
2.00	-8.60	0 0 0 0 0		
2.50	-9.10	0 0 0 0 0		
3.00	-9.60	0 0 0 0 0		
3.50	-10.10	0 0 0 0 0		
4.00	-10.60	3 3 4 7 6		
4.50	-11.10	7 7 8 8 9		
5.00	-11.60	10 11 12 15 18		
5.50	-12.10	23 30		



Remarks:
Probe fell under its own weight plus hammer to 3.8m.

Cone Angle	Test Method:
90degree	DPSH-B
Cone Diameter: 50mm	**Hammer Mass:** 63.50
	Fall Height: 750mm

Last Revised:
05/04/2012

ISO 9002 AGS

APPENDIX E

CPT report by Insitu Site Investigations Ltd

PROJECT: GALWAY HARBOUR

STATIC CONE PENETRATION TESTING

FACTUAL REPORT

CLIENT: CAUSEWAY GEOTECHNICS LIMITED

CONTRACT No.: 1001PD




Issue	Date	Description	Prepared	Checked	Approved
01	30/03/12	Final	RW	CD	DW

Date: 30 March 2012
Our Ref: 1120134

Causeway Geotechnics Limited
8 Drumahiskey Road
Balnamore
Ballymoney
Co. Antrim
BT53 7QL

Penetration House, 13 Vale Road,
Battle, East Sussex, TN33 0HE.
Tel: 0845 862 0558
Fax: 0845 862 0559
Email: mail@insitusi.com
www.insitusi.com
Company Reg No.: 6339499
VAT No.: 922 3561 41

Attention: Mr David Cameron

Dear Mr Cameron

STATIC CONE PENETRATION TESTING
AT GALWAY HARBOUR

We have pleasure in providing a digital copy of our report and data in AGS format for the above project.

We hope that you are satisfied with the performance of our staff, equipment and reporting on this project. If you should have any queries about any aspect of the works carried out, please do not hesitate to contact us. We look forward to being of service to you in the future.

Yours faithfully,
In Situ Site Investigation Limited

Darren Ward
Director

Contents

1.0 INTRODUCTION

At the request of Causeway Geotechnics Limited (The Client), In Situ Site Investigation Limited (In Situ S.I.) carried out a soils investigation at Galway Harbour.

The investigation consisted of performing Static Cone Penetration Tests (CPTs). All tests were performed at locations set out by the Client.

The fieldwork details are shown below in figure 1.1 and figure 1.2.

Fieldwork Summary	
CPT Rig Used	3.5 tonne Track Mounted Rig (CPT004)
Operators	Ian Musson and Martin Hopwood
Date Started	22/03/12
Date Finished	23/03/12
In Situ S.I. Project Manager	Darren Ward
Main Contractor's Site Manager	David Cameron

Figure 1.1: Table showing the fieldwork summary details.

Completed Fieldwork Summary
7 Static Cone Penetration Tests (CPTs) to a maximum depth of 7.35m or refusal. Each test measured Cone Resistance (q_c), Sleeve fiction (f_s), Measured Pore Pressure in the shoulder position (u_2), inclination in X and Y planes.
Provision of factual report with estimated soil type, geotechnical parameters and AGS data.

Figure 1.2: Table showing the completed fieldwork summary details.

2.0 FIELDWORK

2.1 CPT RIG

All works were performed with a 3.5 tonne CPT Track Mounted Rig (CPT004) equipped with a 20 tonne capacity hydraulic ram set. A full data sheet for this rig is presented in Appendix A.

2.2 CPTU CONE

A single electric CPTU cone was used S10CFIP.742 a type conforming to the requirements of Application Class 1 of Eurocode 7 (2007). The cones measured parameters are shown in figure 1.2. The cone had a cross-sectional area of 10cm^2. The piezo filter was mounted in the shoulder (u_2) position (see figure 3.2). A full datasheet of the cone used is shown in Appendix A.

2.3 TEST PROCEDURE

The tests are carried out in accordance with the International Reference Test Procedure for CPT and CPTU (ISSMGE).

The final depths of the tests were determined by either completion to the specified test depth or when the maximum safe capacity of the equipment was reached. A schedule of the tests performed is shown in Appendix A which has been compiled from the operator's daily progress reports.

The data is transmitted from the digital CPTU through an umbilical cable that runs through the push rods to the data acquisition system.

The rate of penetration is kept constant at 2cm/s ±10% except when penetrating very dense or hard strata. A copy of the depth encoder calibration certificate is shown in Appendix A. Results are displayed instantaneously on the computer logging screen. The results are recorded on the computer hard disc.

Before each test is carried out zero values are taken of the cone to check to see if it is within calibration. At the end of each test, zero values are taken again to see if there has been any drift during the test. These values are inspected during the post processing stage. This is a quality check on the data and the testing procedure. Individual test zero values are shown on their corresponding test results on form CPT0001 in Appendix B.

2.5 POSITIONING

All positions were set out by the Client on site.

3.0 CONE PENETRATION TEST RESULTS

All tests carried with the CPTU cone are shown in Appendix B and displays all results as described in section 3.1 and 3.2. Two graphs are shown for each test. The first graph (form CPT0001 Estimated Soil Behaviour Type Plot) shows the measured readings from the cone and the estimated soil description, these are plotted at a 0-20MPa scale for the cone resistance. The second graph (form CPT0002 Measured Pore Pressure Plot) shows derived and corrected values along with the pore pressure results; these are plotted at a 0-80MPa scale for the cone resistance.

3.1 ESTIMATED SOIL BEHAVIOUR TYPE PLOT (FORM CPT0001)

The estimated soil behaviour type plot presented in Appendix B details the following:

- Measured cone end resistance (q_c) and sleeve friction (f_s);
- Friction ratio (R_f);
- Inclination, X and Y axis;
- Estimated behaviour soil type log (Robertson *et.al* 1986, friction ratio chart)
- Legend indicating soil log (BS5930:1999 legend)

3.1.1 Estimated Soil Behaviour Type

The estimation of soil behaviour type using measurements of cone and friction is based upon the variation of the friction ratio in respect to the cone resistance. The friction ratio varies depending upon whether the soil is cohesive or granular. The cone resistance varies depending on the strength and densities of the soil.

The interpretation is based on Robertson *et. al*. (1986) (Friction ratio chart) which is shown below (figure 3.1).

The density and stiffness values descriptions are based on derived N60 (Robertson *et. al*. (1986)) and S_u (Lunne and Kleven (1981)) values from the cone resistance in accordance to BS5930:1999. A list of these values are presented in Appendix A.

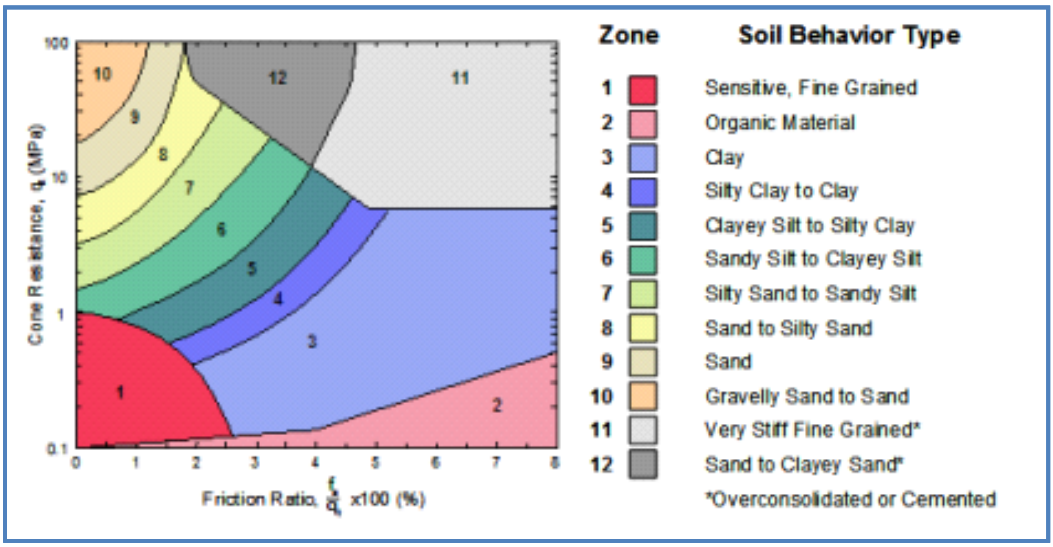


Figure 3.1: Robertson *et al.*, 1986 soil behaviour type chart.

3.1.2 Friction Ratio (R_f)

The friction ratio (R_f) is the ratio between the sleeve friction and the cone resistance. This is a very useful parameter for carrying out soil interpretation

$$\boldsymbol{Fricton\ Ratio\ (R_f)} = \left(\frac{\boldsymbol{Sleeve\ Friction\ (f_s)}}{\boldsymbol{Tip\ Resistance\ (q_c)}}\right) \times \mathbf{100}$$ (Lunne *et al.*, 1997)

3.1.3 Depth Correction

All tests in the report have been corrected for depth difference caused by inclination. This has been calculated using the method described in the International Reference Test Procedure (2001).

To calculate the corrected depth the following formula is used:

$$z = \int_0^l C_h \cdot dl$$

where:

z = penetration depth, in m;
l = penetration length, in m;
C_h = correction factor for the effect of the inclination of the CPTU relative to the vertical axis.

The equation for calculating the correction factor for the influence of the inclination for a bi-axial inclinometer is:

$$C_h = (1 + tan^2 \propto + tan^2 \beta)^{-1/2}$$

3.2 MEASURED PORE PRESSURE PLOT (CPT0002)

Behind each estimated soil type plots in Appendix B is a second plot showing the pore pressure results as well as corrected and derived parameters. These logs detail the following:

- Measured Pore pressure (u_2),
- Corrected cone resistance (q_t);
- Pore pressure ratio (B_q)
- Sleeve friction (f_s)

3.2.1 Pore Pressure Results (u_2)

The CPTU measured the pore pressure during penetration. If the material is free draining and saturation is maintained it will normally measure hydrostatic pore pressure. In material that is not free draining it will record the total pore pressure (hydrostatic plus any excess pore pressures generated) created by the cone penetrating through this material

The filter element can be mounted in one of three positions. For the tests carried out in this report the filter was mounted in the u_2, or shoulder position (see figure 3.2)

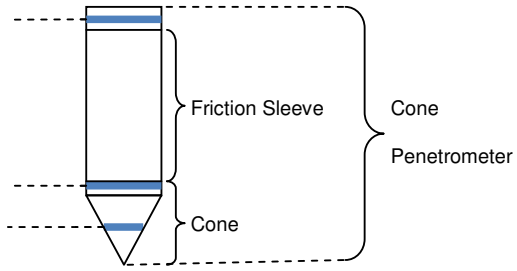


Figure 3.2: Diagram showing pore pressure filter locations (after Lunne *et al.*, 1997)

3.2.2 Corrected Cone Resistance (q_t)

For each penetration test, the measured Cone Resistance, q_c, can be corrected for the 'unequal area effect' due to the influence of the ambient pore water pressure acting on the cone.

The corrections have been applied using the following equation:

$$q_t = q_c + [u_2.(1 - \alpha)]$$ (Lunne *et al.*, 1997)

Where α is the cone area ratio, which is **0.869** for the cone used on this project (This value is geometrically measured).

3.2.3 Pore Pressure Ratio (B_q)

Pore pressure ratio is the ratio between the measured pore pressure generated during penetration and the corrected cone resistance minus the total overburden stress.

Pore pressure ratio as defined by Senneset and Janbu (1985) is defined as:

$$B_q = \frac{u_2 - u_0}{q_t - \sigma_{vo}}$$

where:

u_2 = pore pressure measured between the cone and the friction sleeve
u_0 = equilibrium pore pressure
σ_{vo} = total overburden stress
q_t = cone resistance corrected for unequal end area effects

3.2.4 Soil Unit Weight

For calculations involving the total overburden stress, an estimate of the soil unit weight has to be made. For all calculations in this report, an approximate unit weight is assigned to each soil classification zone from the Robertson *et al.*, 1986 chart.

Figure 3.3 below lists the approximate unit weight for each zone from Lunne *et al.*, 1997.

Zone	Approximate unit weight (kN/m^3)
1	17.5
2	12.5
3	17.5
4	18
5	18
6	18
7	18.5
8	19
9	19.5
10	20
11	20.5
12	19

Figure 3.3: Estimate of unit weights based on the Robertson *et al.*,(1986) friction ratio chart (Lunne *et al.*, 1997).

3.2.5 In Situ Pore Pressure

On the pore pressure plot is a second line (in red) showing the inferred in situ or hydrostatic pore pressure, u_0. This is calculated from a known or estimated water table level.

In the report, the water table has been inferred at 2m below ground level.

4.0 GEOTECHNICAL PARAMETERS

A number of empirical correlations can be carried out to derive geotechnical parameters from CPT data. This report includes a number of these parameters which are described in this section. For the CPT data only soil behaviour type, SPT values, shear strength and relative density are derived and are shown in Appendix C. For the CPTU data all the derived parameters described in the section are derived and displayed in Appendix C.

Please note that a number of the correlations are derived for a certain type of soil, and may not be appropriate for all the soil types encountered on this project.

4.1 SOIL BEHAVIOUR TYPE INDEX

The soil behaviour type index was derived by Jefferies and Davies (1991). It was created to allow a continuous variation of $(q_c/p_a)/N_{60}$ with soil type, which was an improvement on the discontinuous nature of an earlier conversion by Robertson *et al.* (1986).

This approach has been modified for use with the Robertson (1990) normalised CPT soil classification chart. The boundaries between soil behaviour type zones (2 to 7) can be approximated as concentric circles, and the radius of each circle can be used as a soil behaviour type index (Lunne *et al.,* 1997).

The soil behaviour type index, I_c, can then be defined as:

$$\boldsymbol{I_c = ((3.47 - logQ_t)^2 + (logF_r + 1.22)^2)^{0.5}}$$

The boundaries of soil behaviour type are then given in terms of the index, I_c. See figure 4.1 for the table of soil behaviour types.

Soil Behaviour Type Index, I_c	Zone (from Robertson 1990 normalised chart)	Soil Behaviour Type
$I_c < 1.31$	7	Gravelly sand to dense sand
$1.31 < I_c < 2.05$	6	Sands – clean sand to silty sand
$2.05 < I_c < 2.60$	5	Sand mixtures – silty sand to sandy silts
$2.60 < I_c < 2.95$	4	Silt mixtures – clayey silt to silty clay
$2.95 < I_c < 3.60$	3	Clays: silty clay to clay
$I_c > 3.60$	2	Organic soils - peats

Figure 4.1: Boundaries of soil behaviour type index, I_c.

4.2 STANDARD PENETRATION TEST (SPT) N VALUE

The SPT N value can be derived using differing ratios of the relationship between q_c and N_{60}. These ratios were suggested by Robertson *et al.* (1986) and are shown in figure 4.2.

Zone	Soil Behaviour Type	$(q_c/p_a)/N_{60}$
1	Sensitive fine grained	2
2	Organic material	1
3	CLAY	1
4	Silty CLAY to CLAY	1.5
5	Clayey SILT to silty CLAY	2
6	Sandy SILT to clayey SILT	2.5
7	Silty SAND to sandy SILT	3
8	SAND to silty SAND	4
9	SAND	5
10	Gravely SAND to SAND	6
11	Very stiff fine grained	1
12	SAND to clayey SAND	2

Figure 4.2: SPT N value ratios from Robertson *et al.*, 1986.

For the best results for the calculation of N_{60} it is recommended to use the soil behaviour type index, I_c. This is the method used in this report.

The relationship between N_{60} and I_c is defined as:

$$\frac{\left(\frac{q_c}{p_a}\right)}{N_{60}} = 8.5\left(1 - \frac{I_c}{4.6}\right)$$ (Lunne *et al.*, 1997)

It is suggested (Jefferies and Davies, 1991) that this method provides a better estimate of the SPT N values than the actual SPT test due to poor repeatability of the SPT.

4.3 SHEAR STRENGTH

Estimation of s_u from CPTUs using corrected cone resistance is made from the following equation:

$$s_u = \frac{(q_t - \sigma_{vo})}{N_{kt}}$$ (Lunne *et al.*, 1981)

where:

N_{kt} = empirical cone factor
σ_{vo} = total overburden stress.

Research has shown that the cone factor N_{kt} varies between 11 and 30 with an average value of 15. We present an upper bound s_u value with an N_{kt} value of 15 and a lower bound s_u value with an N_{kt} value of 20. This report only presents this data on soils with a soil behaviour type index (I_c) of greater than 2.60.

4.4 RELATIVE DENSITY (D_r)

Relative density has been derived using a method by Jamiolkowski *et al.*, 1985 (see figure 4.3). This correlation was derived from five predominantly silica sands under controlled laboratory conditions. The sands were normally consolidated, un-cemented, un-aged and predominantly quartz. It is noted that field cases are likely to show more variability than that demonstrated in figure 4.3.

The correlation in this report is calculated on soil with a soil behaviour type index (I_r) of less than 2.60. The formula for calculating relative density (D_r) is:

$$D_r = -98 + 66\ log_{10}\frac{q_c}{[\sigma'_{vo}]^{0.5}}$$

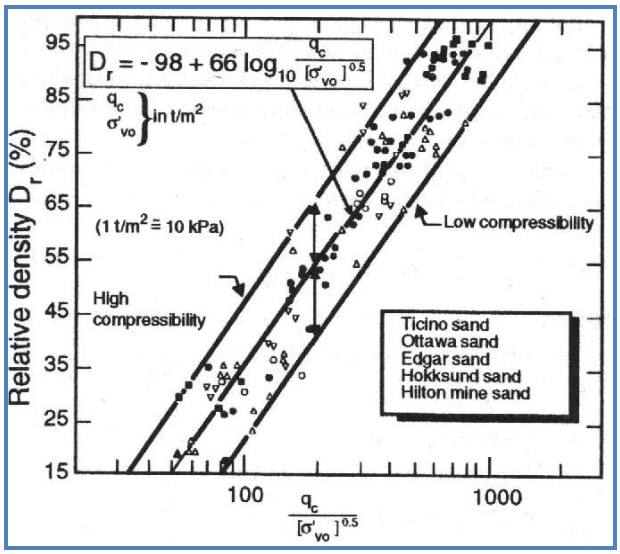


Figure 4.3: Correlation between q_c and relative density (after Jamiolkowski *et al.*, 1985)

4.5 FRICTION ANGLE

Friction angle is derived using the Robertson and Campanella (1983) method from their work looking at calibration test data (see figure 4.6). The correlation is based on un-aged un-cemented quartz sand. The formula for peak Φ' from CPTU is:

$$\Phi' = arctan\left[0.1 + 0.38\log\left(^{q_t}/_{\sigma_{vo}'}\right)\right]$$

The correlation in this report is calculated on soil with a soil behaviour type index (I_c) of less than 2.60.

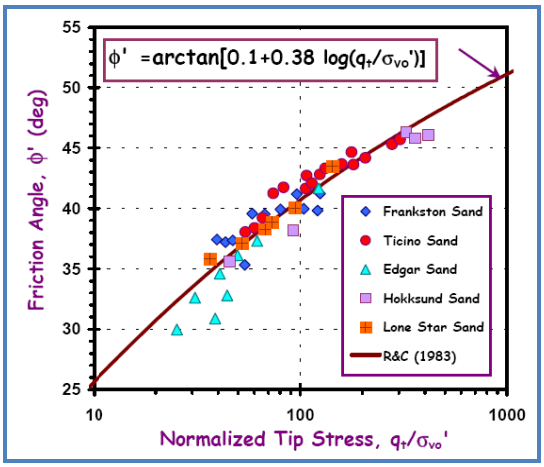


Figure 4.6: Peak friction angle of clean quartz sands from CPTU (after Robertson & Campanella, 1983).

4.6 FINES CONTENT (*FC*)

It is possible to estimate fines content from the friction ratio of sandy soils. Suzuki *et al*., (1995) demonstrated how friction ratio (R_f) varies with fines content (*FC*) (see figure 4.7)

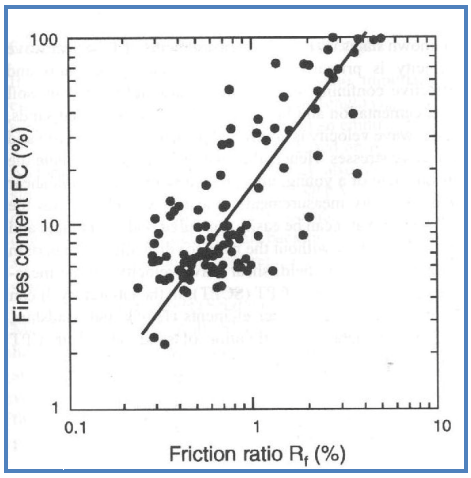


Figure 4.7: Variation of fines content with friction ratio (Suzuki *et al*., 1995)

Robertson and Fear (1995) used this relationship and integrated it with the soil behaviour type index (I_c), this was later updated in 1998. This relationship is shown below:

$$\boldsymbol{if\ I_c} < 1.26\ apparent\ fines\ content\ FC\ (\%) = \mathbf{0}$$

$$\boldsymbol{if\ 1.26 \leq I_c\ \leq 3.5\ apparent\ fines\ content\ FC}\ (\%) = \mathbf{1.75\ I_c^3 - 3.7}$$

$$\boldsymbol{if\ I_c} > 3.5\ apparent\ fines\ content\ FC\ (\%) = \mathbf{100}$$

5.0 REFERENCES

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APPENDIX A

GENERAL INFORMATION

LIST OF FIGURES

Description	Pages Included
Cone Calibration Certificate for Cone S10CFIP.742	1
CPT Project Summary Sheet	1
3.5 Tonne Track Mounted Rig Datasheet	1
CPT Soil Description Table	1
Explanation of Symbols	1

CONE CALIBRATION CERTIFICATE – S10CFIP.742

Sondeerapparatuur Waterspanningsmeters Hellingmeters Veldmeet-apparatuur

GeoPoint Systems bv
Rijksstraatweg 22F
2171 AL Sassenheim
Tel. : +31 71 301 92 51
Fax : +31 71 301 92 52
E-mail : info@geopoint.nl
ING bank : 68.23.01.396
BTW nr. : NL806331677B01

Cone Calibration Certificate

Number	**S10-CFIIP.742**
Type	Subtraction 100 kN, 1000 mm2
Date	04-10-2011
Client	Insitu
Engineer	W.Volgering
Certificate number	GP-742-01
Calibration equipment	HBM
HBM certificate number	**FN 824**

Load qc in [kN]	Output qc [mV]	Load fs [kN]	Output fs [mV]	Load pp [MPa]	Output pp [mV]	Zeroshifts [mV]
10	769	10	768	0,4	1514	qc : **273**
20	1539	20	1538	0,8	3030	fs : **248**
30	2311	30	2306	1,2	4544	pp : **266**
40	3079	40	3074	1,6	6048	XY :
50	**3848**	50	**3843**	2,0	**7548**	

Inclination [°]	X = -20°	X = 0°	X = +20°	Y = -20°	Y = 0°	Y = +20°
	492	2596	4593	265	2476	4469

Range (nominal) :			**Range (maximum) :**	
Tip resistance	**50**	**kN**	100	kN
Tip + Local friction	**50**	**kN**	100	kN
Pore pressure	**2,0**	**MPa (20 Bar)**	3,0	MPa

Max. Inaccuracy : Tip Resistance **1,0%**
Sleeve Friction **2,0%**
Pore Pressure **1,0%**
Total inaccuracy consist of hysteresis, non-linearity, crosstalk and calibration error.

Remarks :

Approved **Date:** 04-10-2011
Technician: R.Mosterd.

CPT PROJECT SUMMARY SHEET

HOLE	Final Depth of Test (m)	Date of Test	Cone Used	Test Remarks
CPT 01	1.26	22.03.12	S10CFIP742	Test Refused on Total Pressure
CPT 02	7.35	22.03.12	S10CFIP742	Test Refused on Total Pressure
CPT 03	1.41	22.03.12	S10CFIP742	Test Refused on Total Pressure
CPT 04	5.72	22.03.12	S10CFIP742	Test Refused on Total Pressure
CPT 05	6.94	22.03.12	S10CFIP742	Test Refused on Total Pressure
CPT 06	4.12	22.03.12	S10CFIP742	Test Refused on Total Pressure
CPT 07	5.46	22.03.12	S10CFIP742	Test Refused on Total Pressure

3.5 TONNE EXCAVATOR MOUNTED RIG

3.5 Tonne CPT Track Mounted Rig (CPT004)
Datasheet

IN SITU SITE INVESTIGATION

3.5 Tonne CPT Track Mounted Rig

CPT Rig Details	
Drive System	Small tracked system
Total Weight	3.5 Tonnes
Addtitonal Reaction Weiight	4 Hydraulicly Driven Screw Anchors
CPT Ram Thrust Capacity	20 Tonnes
Maximum Penetration	10-30m depending on the ground conditions and reaction from screw anchors.
Performance Rates	50-100m of testing in a day depending on access to positons.
Typical Sites for this Rig	Specialises on soft ground sites. Can be mounted on marine jack-ups and rail trailers.

CPT Rig Dimensions	
Width	1.20m
Length	2.90m
Height	2.85m

Datasheet 011v001 insitusi.com 20/07/2009

SOIL DESCRIPTION TABLES

GRANULAR SOILS (Sands and Gravels)

Description	Cone Resistance (*qc*) (MPa)
Very Loose	0 – 2
Loose	2 – 4
Medium Dense	4 – 12
Dense	12 – 20
Very Dense	>20

COHESIVE SOILS (Clays)

Description	Cone Resistance (q_c) (MPa)	Equivalent S_u value from q_c (kPa)
Very Soft	0 – 0.3	0 –20
Soft	0.3 – 0.5	20 – 40
Firm	0.5 – 1.0	40 – 75
Stiff	1.0 – 2.0	75 – 150
Very stiff	2.0-4.0	150-300
Hard	>4.0	>300

(from Waltham, 2002)

EXPLANATION OF SYMBOLS

a (α) = area ratio of the cone ($=A_n/A_c$)

A_c = projected area of the cone

A_n = cross-sectional area of shaft

B_q = pore pressure parameter ($=(u_2-u_0)/(q_t-\sigma_{vo})$)

c_h = horizontal coefficient of consolidation

Dr = relative density $\left(D_r = \frac{e_{max} - e}{e_{max} - e_{min}} \times 100\%\right)$

e = void ratio

e_o = initial void ratio

e_{max} = maximum void ratio

e_{min} = minimum void ratio

f_s = unit sleeve friction

FC = fines content

I_c = soil behaviour type index

I_r = rigidity index = G/s_u

m_v = coefficient of volume change

M = constrained deformation modulus

N = no. Of blows in the SPT

N_k or N_{kt} cone factor

N_{60} = SPT energy ratio

q_c = measured cone resistance

q_e = effective cone resistance = (q_t-u_2)

q_n = net cone resistance = $(q_t-\sigma_{vo})$

q_t = corrected cone resistance = $q_c+(1-a)u_2$

Q_t = normalised cone resistance = $(q_t-\sigma_{vo})/\sigma'_{vo}$

R_f = friction ratio ($=(f_s/q_c)\times 100\%$)

s_u = undrained shear strength

t_{50} = time for 50% dissipation of measured pore pressure

u_0 = in situ pore pressure

u_1 = pore pressure measured on the cone

u_2 = pore pressure measured behind the cone

Δu = measured pore water pressure

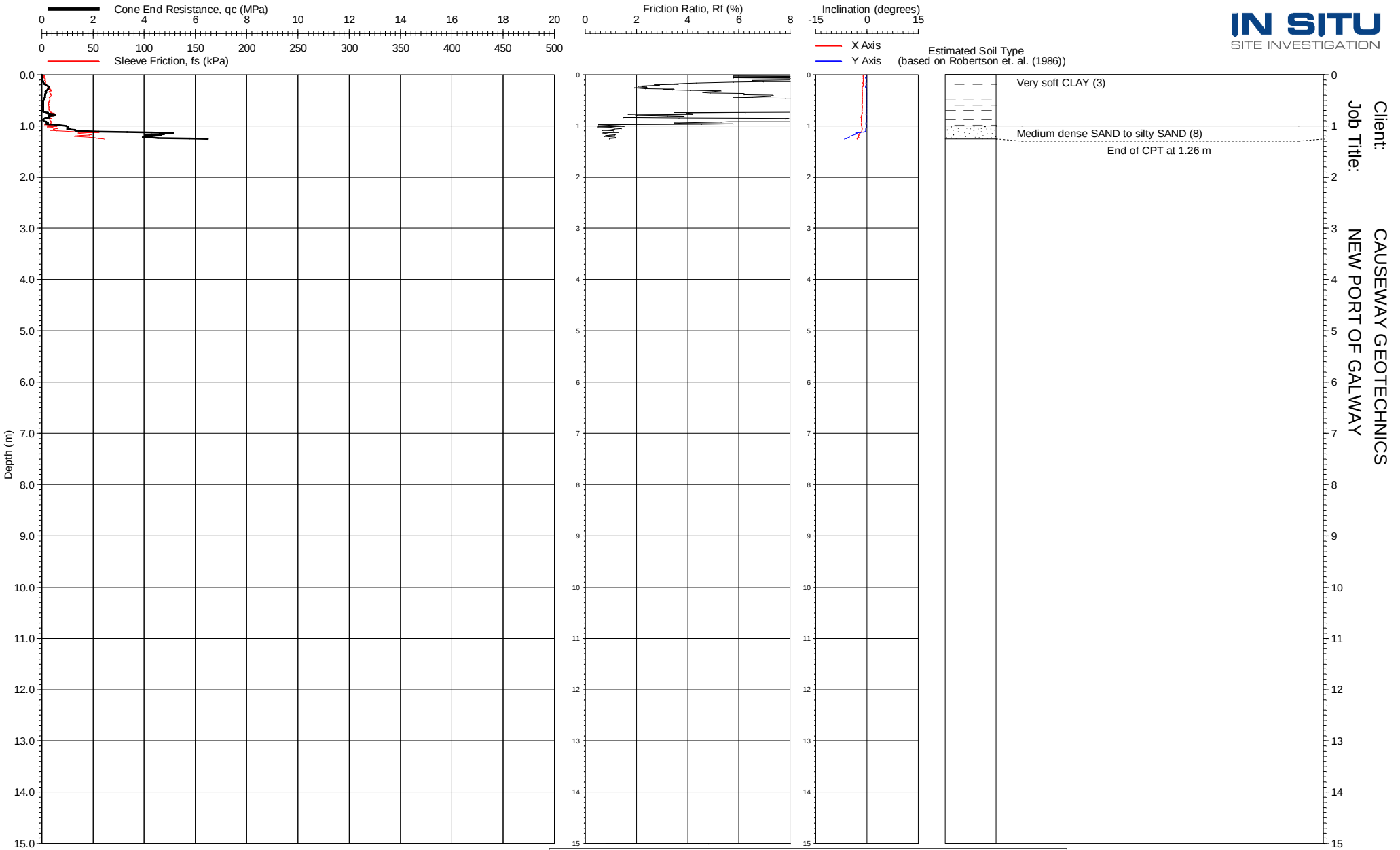
φ = total friction ratio

APPENDIX B

CPT RESULTS

LIST OF FIGURES

Description	Pages Included
CPT 01 – CPT 07 (Printed on Form CPT0001) Estimated Soil Behaviour Type Plot	7
CPT 01 – CPT 07 (Printed on Form CPT0002) Measured Pore Pressure Plot	7



IN SITU
SITE INVESTIGATION

Client:
Job Title: CAUSEWAY GEOTECHNICS
NEW PORT OF GALWAY

Location:	GALWAY	Date of Test:	22/03/2012
Coordinates:	130792.000E - 224414.000N	Date of Plot:	30/03/2012
Ground Level:	-0.70 m CD	File Name:	1120134 - CPTU 01
Cone & Rig Used:	S10-CFIP.742 - CPT 003	Checked By:	
Remarks:	Test refused on total pressure.		

PCPT Zero Values

Tip Zero Pre: -	Tip Zero Post: 270.0000 mV	Tip Zero Difference: -1.8519 %
Sleeve Zero Pre: -	Sleeve Zero Post: 193.0000 mV	Sleeve Zero Difference: 0.0000 %
Pore Pressure Zero Pre: 220.0000 mV	Pore Pressure Zero Post: 218.0000 mV	Pore Pressure Difference: 0.9174 %
X Inclinometer Zero Pre: 2492.0000 mV	X Inclinometer Zero Post: 2536.0000 mV	X Inclinometer Difference: -1.7350 %
Y Inclinometer Zero Pre: 2492.0000 mV	Y Inclinometer Zero Post: 2536.0000 mV	Y Inclinometer Difference: -1.7350 %

PIEZO CONE PENETRATION TEST

CPTU 01

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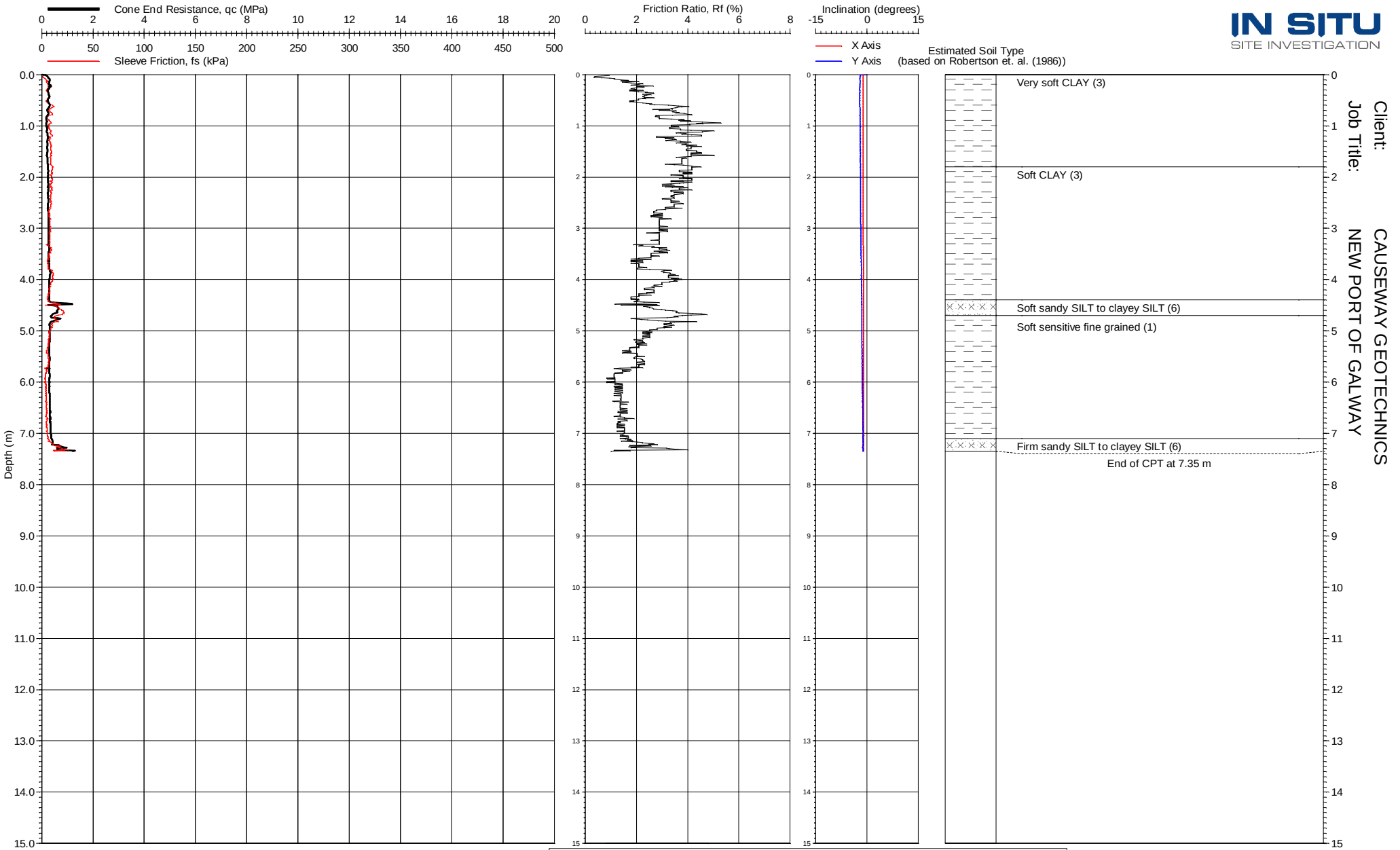
Form: CPT0001



IN SITU
SITE INVESTIGATION

Client:
Job Title: CAUSEWAY GEOTECHNICS
NEW PORT OF GALWAY

Location:	GALWAY	Date of Test:	22/03/2012
Coordinates:	130645.000E - 224268.000N	Date of Plot:	30/03/2012
Ground Level:	-2.00 m CD	File Name:	1120134 - CPTU 02
Cone & Rig Used:	S10-CFIP.742 - CPT 003	Checked By:	
Remarks:	Test refused on total pressure.		

PCPT Zero Values

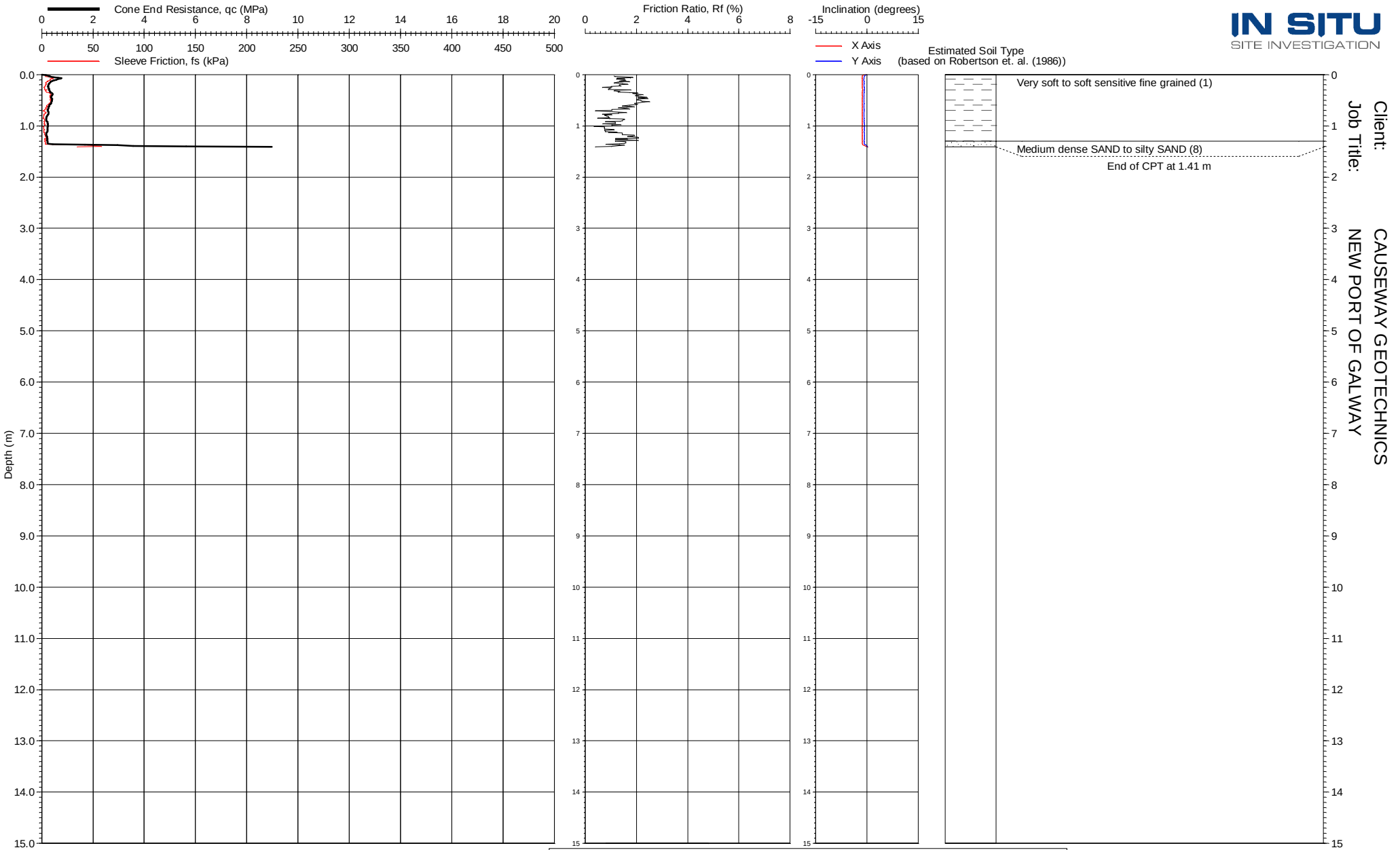
Tip Zero Pre: -	Tip Zero Post: 277.0000 mV	Tip Zero Difference: -0.3610 %
Sleeve Zero Pre: -	Sleeve Zero Post: 193.0000 mV	Sleeve Zero Difference: -0.5181 %
Pore Pressure Zero Pre: 212.0000 mV	Pore Pressure Zero Post: 217.0000 mV	Pore Pressure Difference: -2.3041 %
X Inclinometer Zero Pre: 2475.0000 mV	X Inclinometer Zero Post: 2479.0000 mV	X Inclinometer Difference: -0.1614 %
Y Inclinometer Zero Pre: 2475.0000 mV	Y Inclinometer Zero Post: 2479.0000 mV	Y Inclinometer Difference: -0.1614 %

PIEZO CONE PENETRATION TEST

CPTU 02

insitusi.com

Form: CPT0001



IN SITU
SITE INVESTIGATION

Client:

Job Title: CAUSEWAY GEOTECHNICS
NEW PORT OF GALWAY

Location:	GALWAY	Date of Test:	22/03/2012
Coordinates:	130888.000E - 224264.000N	Date of Plot:	30/03/2012
Ground Level:	-1.30 m CD	File Name:	1120134 - CPTU 03
Cone & Rig Used:	S10-CFIP.742 - CPT 003	Checked By:	
Remarks:	Test refused on total pressure.		

PCPT Zero Values

Tip Zero Pre: -	Tip Zero Post: 275.0000 mV	Tip Zero Difference: 0.0000 %
Sleeve Zero Pre: -	Sleeve Zero Post: 194.0000 mV	Sleeve Zero Difference: 0.0000 %
Pore Pressure Zero Pre: 211.0000 mV	Pore Pressure Zero Post: 410.0000 mV	Pore Pressure Difference: -48.5366 %
X Inclinometer Zero Pre: 2502.0000 mV	X Inclinometer Zero Post: 2452.0000 mV	X Inclinometer Difference: 2.0392 %
Y Inclinometer Zero Pre: 2502.0000 mV	Y Inclinometer Zero Post: 2452.0000 mV	Y Inclinometer Difference: 2.0392 %

PIEZO CONE PENETRATION TEST

CPTU 03

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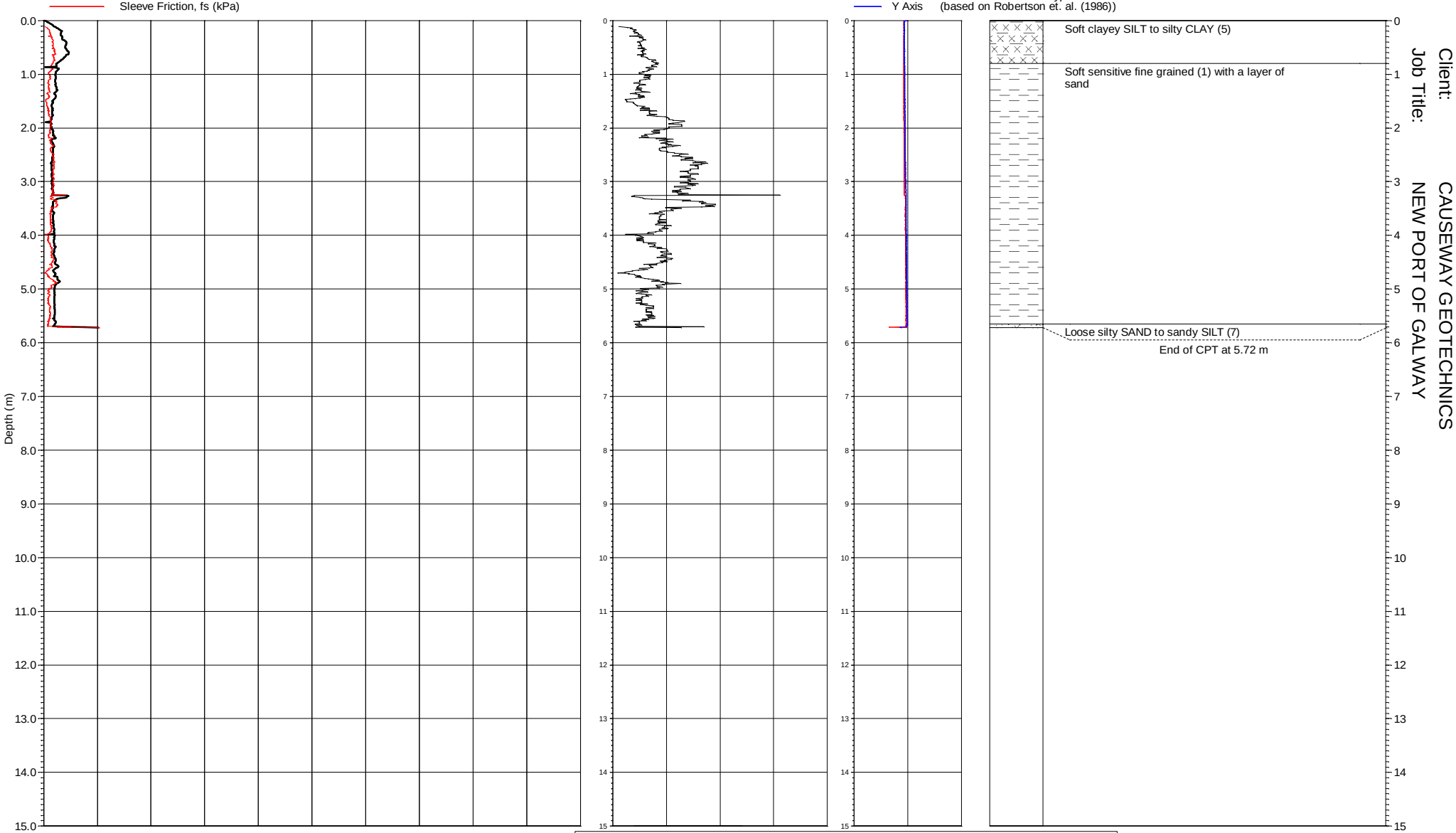
Form: CPT0001



IN SITU
SITE INVESTIGATION

Client:
Job Title: CAUSEWAY GEOTECHNICS
NEW PORT OF GALWAY

Location:	GALWAY	Date of Test:	22/03/2012
Coordinates:	130981.000E - 224090.000N	Date of Plot:	30/03/2012
Ground Level:	-1.90 m CD	File Name:	1120134 - CPTU 04
Cone & Rig Used:	S10-CFIP.742 - CPT 003	Checked By:	
Remarks:	Test refused on total pressure.		

PCPT Zero Values

Tip Zero Pre: -	Tip Zero Post: 273.0000 mV	Tip Zero Difference: -1.4652 %
Sleeve Zero Pre: -	Sleeve Zero Post: 193.0000 mV	Sleeve Zero Difference: -0.5181 %
Pore Pressure Zero Pre: 211.0000 mV	Pore Pressure Zero Post: 218.0000 mV	Pore Pressure Difference: -3.2110 %
X Inclinometer Zero Pre: 2489.0000 mV	X Inclinometer Zero Post: 2628.0000 mV	X Inclinometer Difference: -5.2892 %
Y Inclinometer Zero Pre: 2489.0000 mV	Y Inclinometer Zero Post: 2628.0000 mV	Y Inclinometer Difference: -5.2892 %

PIEZO CONE PENETRATION TEST

CPTU 04

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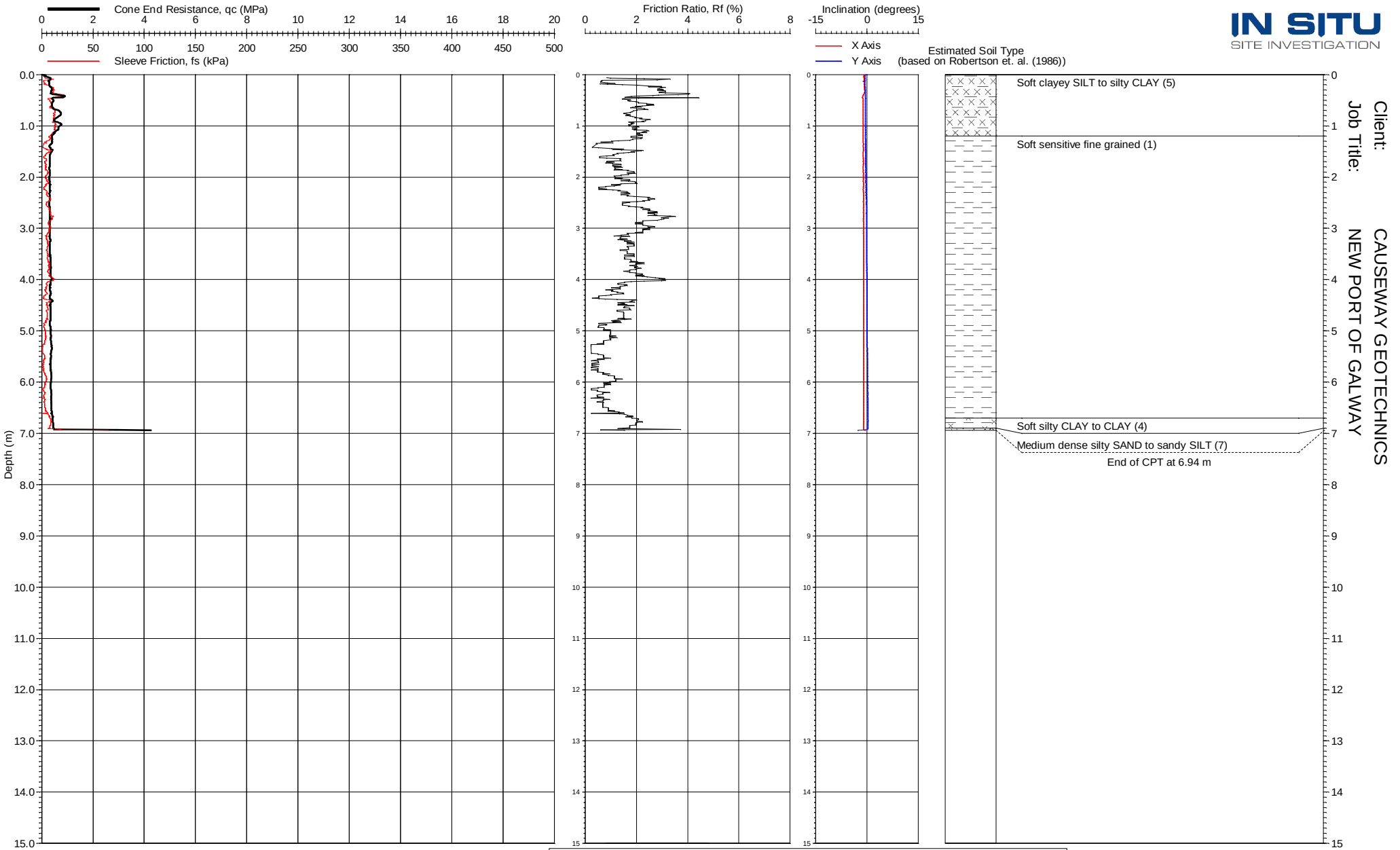
Form: CPT0001



IN SITU
SITE INVESTIGATION

Client:
Job Title: CAUSEWAY GEOTECHNICS
NEW PORT OF GALWAY

Location:	GALWAY	Date of Test:	22/03/2012
Coordinates:	130927.000E - 223950.000N	Date of Plot:	30/03/2012
Ground Level:	-1.80 m CD	File Name:	1120134 - CPTU 05
Cone & Rig Used:	S10-CFIP.742 - CPT 003	Checked By:	
Remarks:	Test refused on total pressure.		

PCPT Zero Values

Tip Zero Pre: -	Tip Zero Post: 279.0000 mV	Tip Zero Difference: -2.5090 %
Sleeve Zero Pre: -	Sleeve Zero Post: 192.0000 mV	Sleeve Zero Difference: 0.0000 %
Pore Pressure Zero Pre: 211.0000 mV	Pore Pressure Zero Post: 218.0000 mV	Pore Pressure Difference: -3.2110 %
X Inclinometer Zero Pre: 2579.0000 mV	X Inclinometer Zero Post: 2531.0000 mV	X Inclinometer Difference: 1.8965 %
Y Inclinometer Zero Pre: 2579.0000 mV	Y Inclinometer Zero Post: 25331.0000 mV	Y Inclinometer Difference: -89.8188 %

PIEZO CONE PENETRATION TEST

CPTU 05

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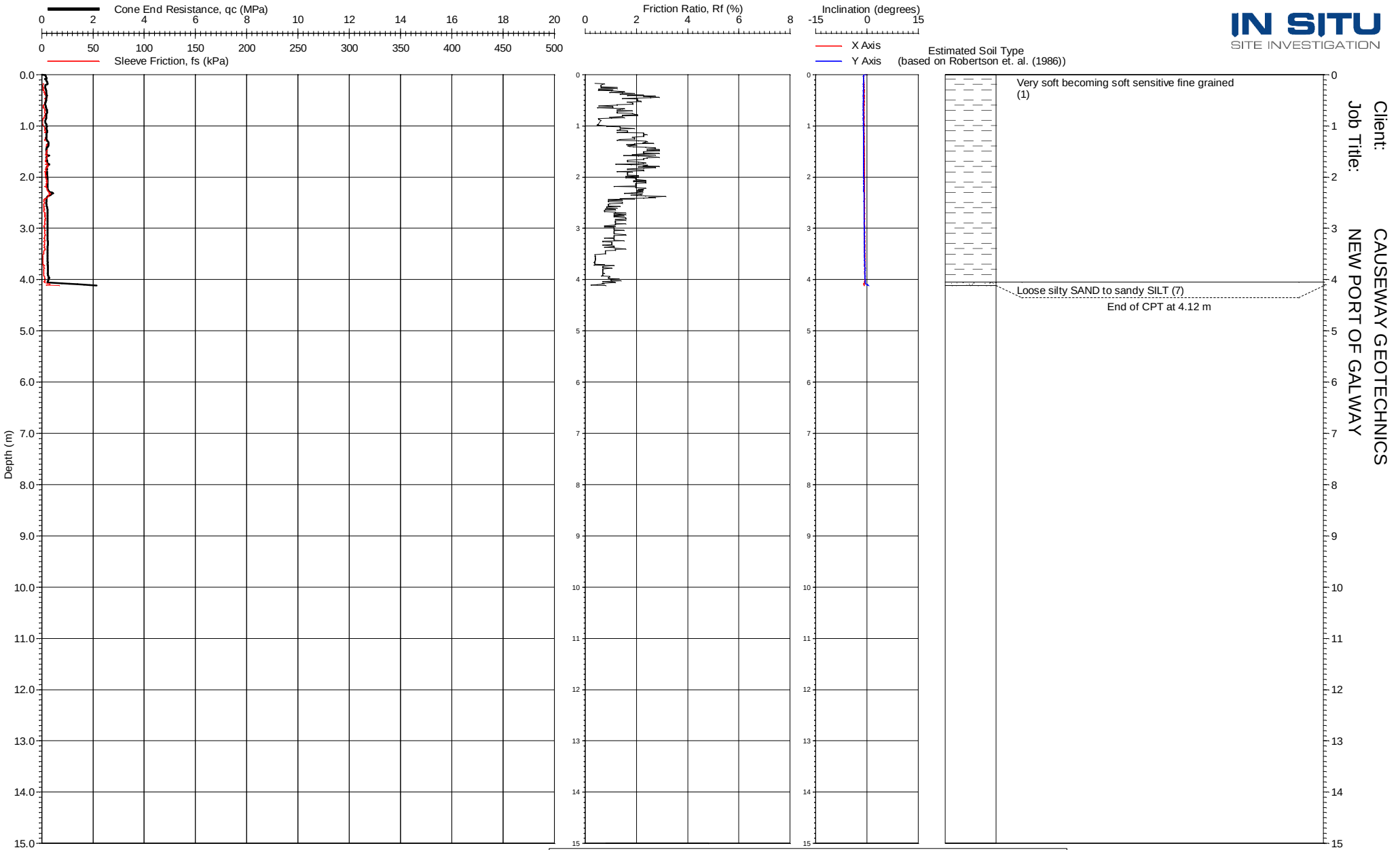
Form: CPT0001



IN SITU
SITE INVESTIGATION

Client:

Job Title: CAUSEWAY GEOTECHNICS
NEW PORT OF GALWAY

Location:	GALWAY	Date of Test:	22/03/2012
Coordinates:	131003.000E - 223660.000N	Date of Plot:	30/03/2012
Ground Level:	-4.20 m CD	File Name:	1120134 - CPTU 06
Cone & Rig Used:	S10-CFIP.742 - CPT 003	Checked By:	
Remarks:	Test refused on total pressure.		

PCPT Zero Values

Tip Zero Pre: -	Tip Zero Post: 281.0000 mV	Tip Zero Difference: -2.4911 %
Sleeve Zero Pre: -	Sleeve Zero Post: 192.0000 mV	Sleeve Zero Difference: 0.0000 %
Pore Pressure Zero Pre: 217.0000 mV	Pore Pressure Zero Post: 218.0000 mV	Pore Pressure Difference: -0.4587 %
X Inclinometer Zero Pre: 2370.0000 mV	X Inclinometer Zero Post: 2498.0000 mV	X Inclinometer Difference: -5.1241 %
Y Inclinometer Zero Pre: 2370.0000 mV	Y Inclinometer Zero Post: 2498.0000 mV	Y Inclinometer Difference: -5.1241 %

PIEZO CONE PENETRATION TEST

CPTU 06

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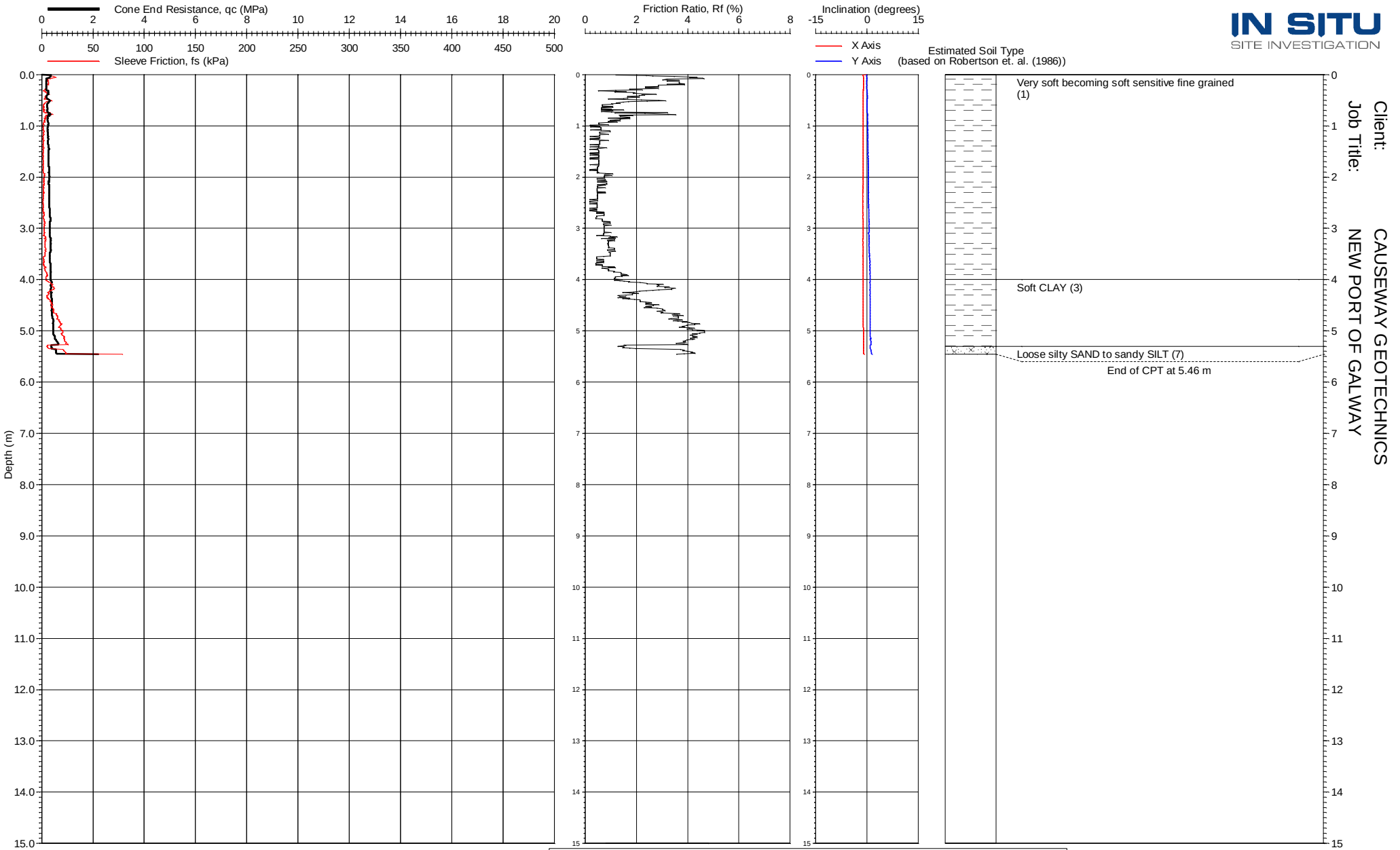
Form: CPT0001



IN SITU
SITE INVESTIGATION

Client:

Job Title: CAUSEWAY GEOTECHNICS
NEW PORT OF GALWAY

Location:	GALWAY	Date of Test:	22/03/2012
Coordinates:	130228.000E - 223305.000N	Date of Plot:	30/03/2012
Ground Level:	-6.40 m CD	File Name:	1120134 - CPTU 07
Cone & Rig Used:	S10-CFIP.742 - CPT 003	Checked By:	
Remarks:	Test refused on total pressure.		

PCPT Zero Values

Tip Zero Pre: -	Tip Zero Post: 281.0000 mV	Tip Zero Difference: -2.4911 %
Sleeve Zero Pre: -	Sleeve Zero Post: 192.0000 mV	Sleeve Zero Difference: 0.0000 %
Pore Pressure Zero Pre: 217.0000 mV	Pore Pressure Zero Post: 218.0000 mV	Pore Pressure Difference: -0.4587 %
X Inclinometer Zero Pre: 2370.0000 mV	X Inclinometer Zero Post: 2498.0000 mV	X Inclinometer Difference: -5.1241 %
Y Inclinometer Zero Pre: 2370.0000 mV	Y Inclinometer Zero Post: 2498.0000 mV	Y Inclinometer Difference: -5.1241 %

PIEZO CONE PENETRATION TEST

CPTU 07

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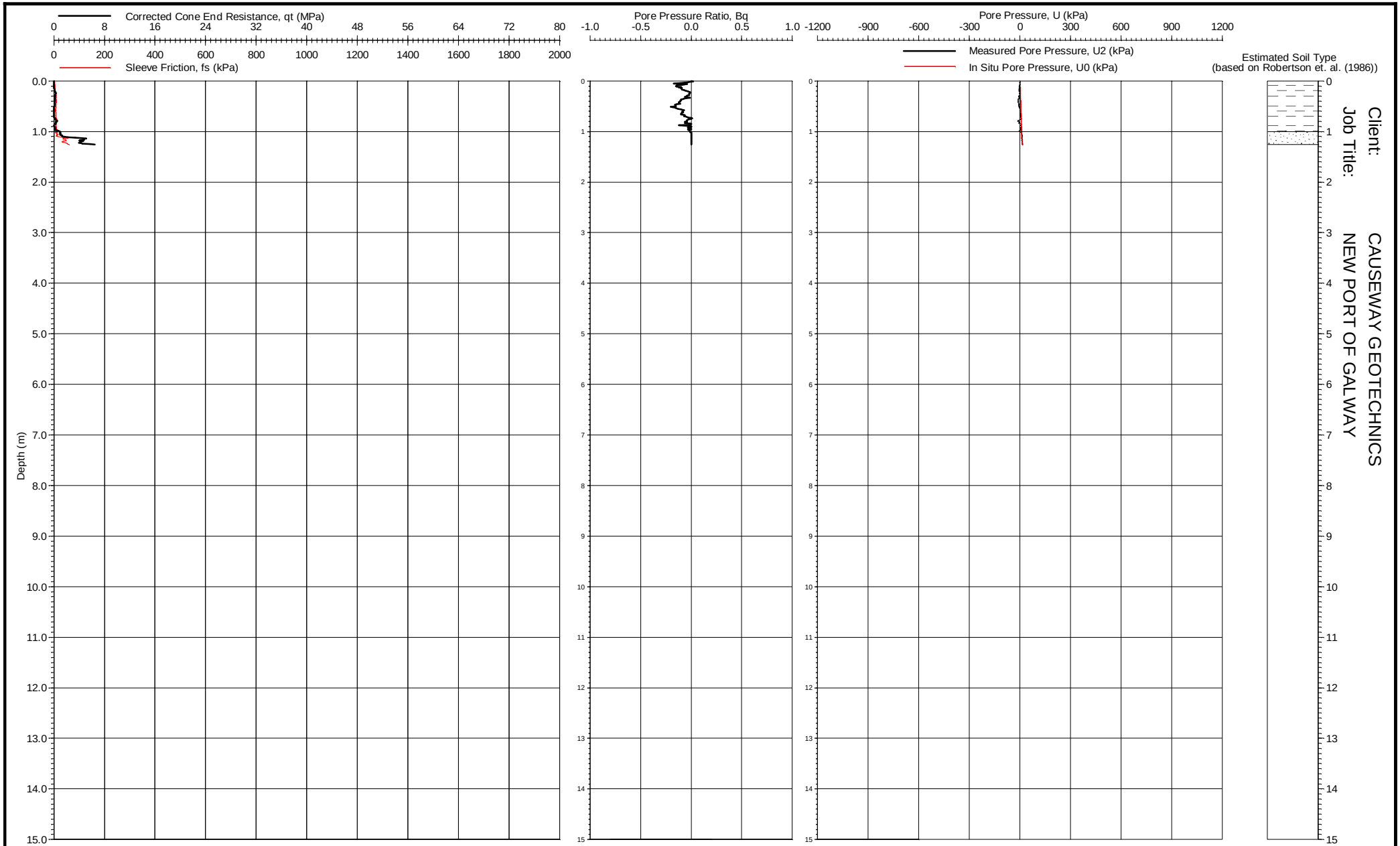
Form: CPT0001



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location: GALWAY

Coordinates: 130792.000E - 224414.000N

Ground Level: -0.70 m CD

Cone & Rig Used: S10-CFIP.742 - CPT 003

Remarks: Test refused on total pressure.

Date of Test: 22/03/2012

Date of Plot: 30/03/2012

File Name: 1120134 - CPTU 01

Checked By:

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SITE INVESTIGATION
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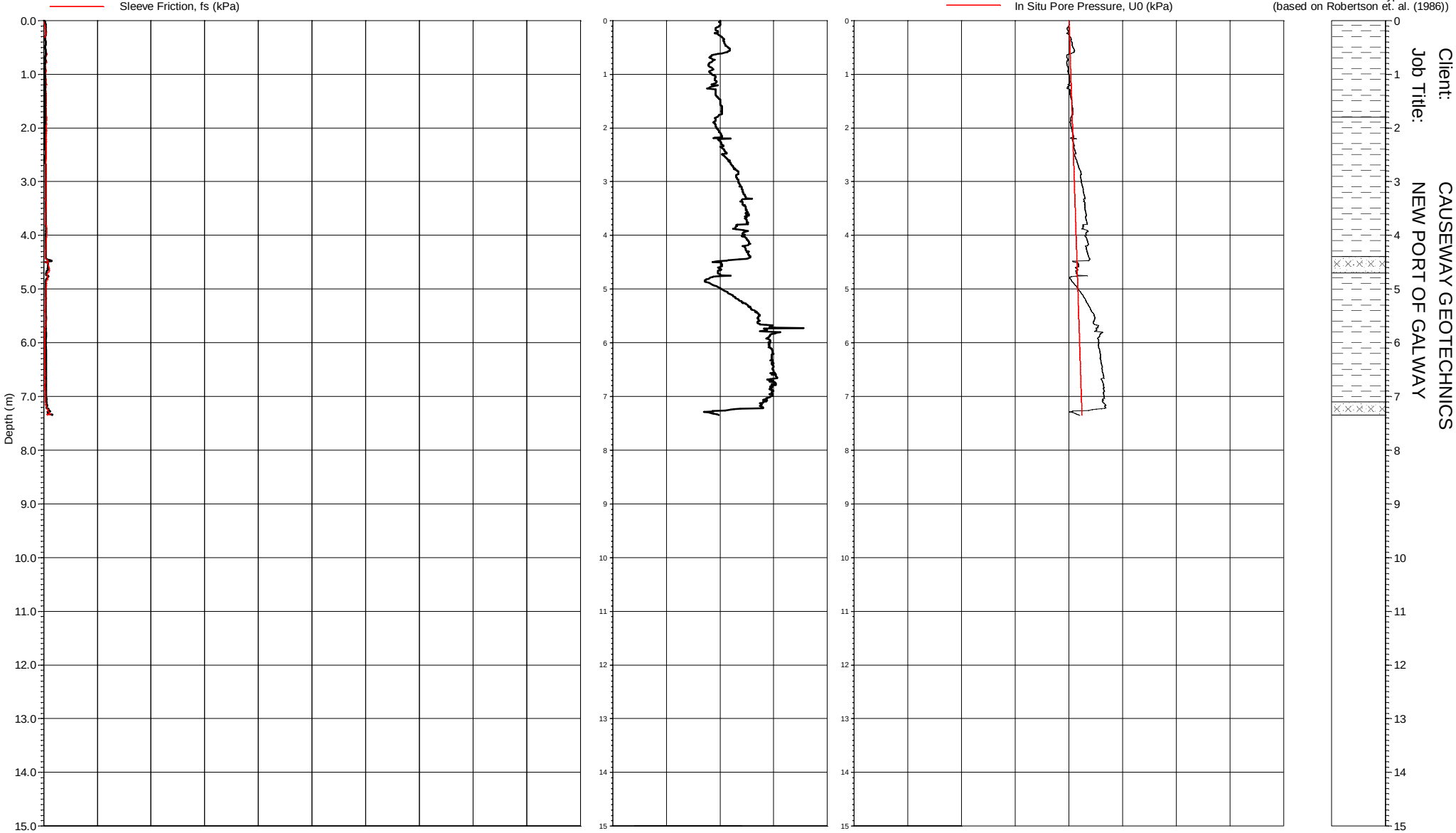
PIEZO CONE PENETRATION TEST

CPTU 01

Form: CPT0002



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location: GALWAY

Coordinates: 130645.000E - 224268.000N

Ground Level: -2.00 m CD

Cone & Rig Used: S10-CFIP.742 - CPT 003

Remarks: Test refused on total pressure.

Date of Test: 22/03/2012

Date of Plot: 30/03/2012

File Name: 1120134 - CPTU 02

Checked By:

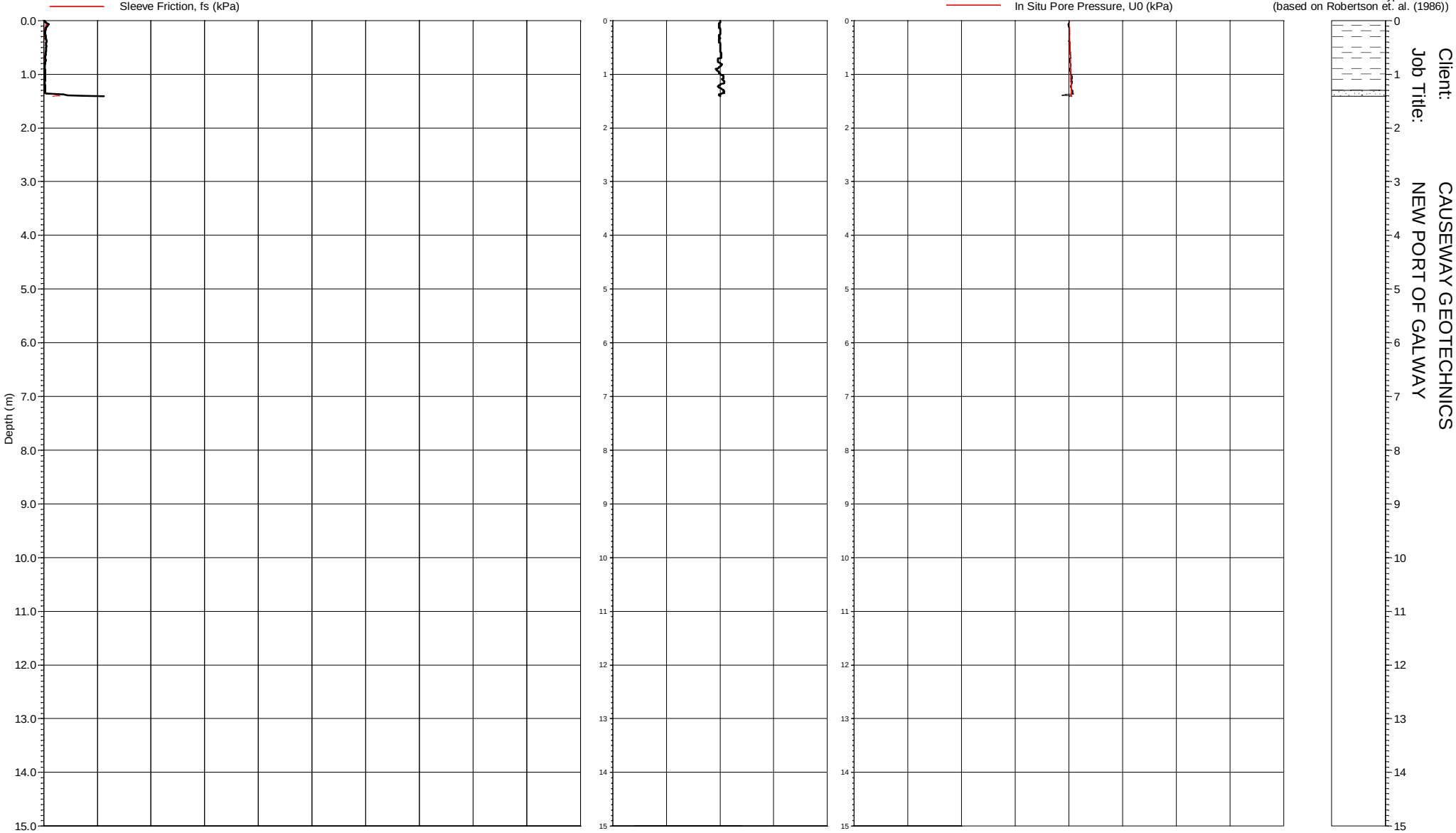
IN SITU SITE INVESTIGATION

INSITUSI.COM

PIEZO CONE PENETRATION TEST

CPTU 02

Form: CPT0002



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location: GALWAY

Coordinates: 130888.000E - 224264.000N

Ground Level: -1.30 m CD

Cone & Rig Used: S10-CFIP.742 - CPT 003

Remarks: Test refused on total pressure.

Date of Test: 22/03/2012

Date of Plot: 30/03/2012

File Name: 1120134 - CPTU 03

Checked By:

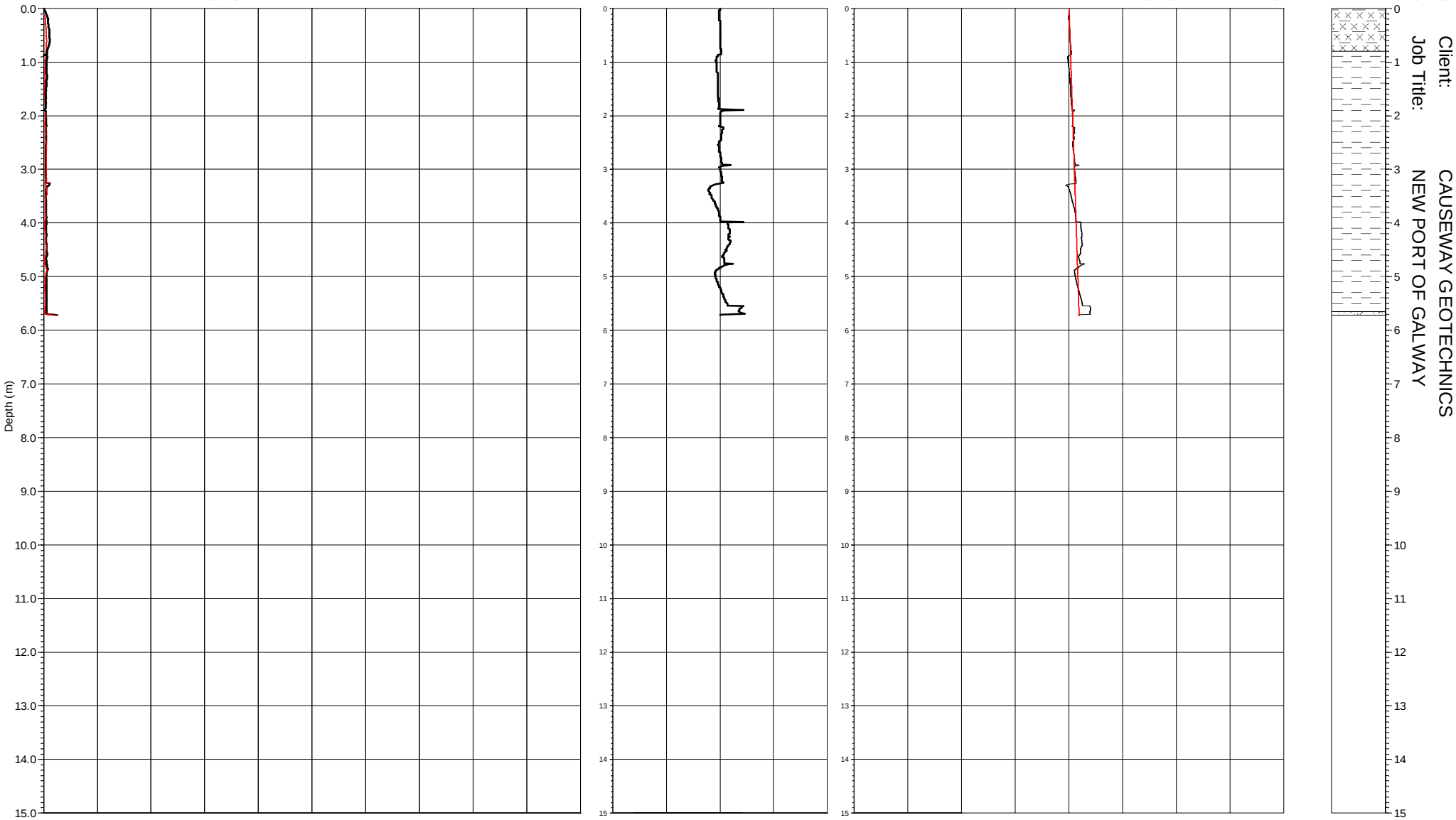
IN SITU SITE INVESTIGATION

INSITUSI.COM

PIEZO CONE PENETRATION TEST

CPTU 03

Form: CPT0002



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location: GALWAY

Coordinates: 130981.000E - 224090.000N

Ground Level: -1.90 m CD

Cone & Rig Used: S10-CFIP.742 - CPT 003

Remarks: Test refused on total pressure.

Date of Test: 22/03/2012

Date of Plot: 30/03/2012

File Name: 1120134 - CPTU 04

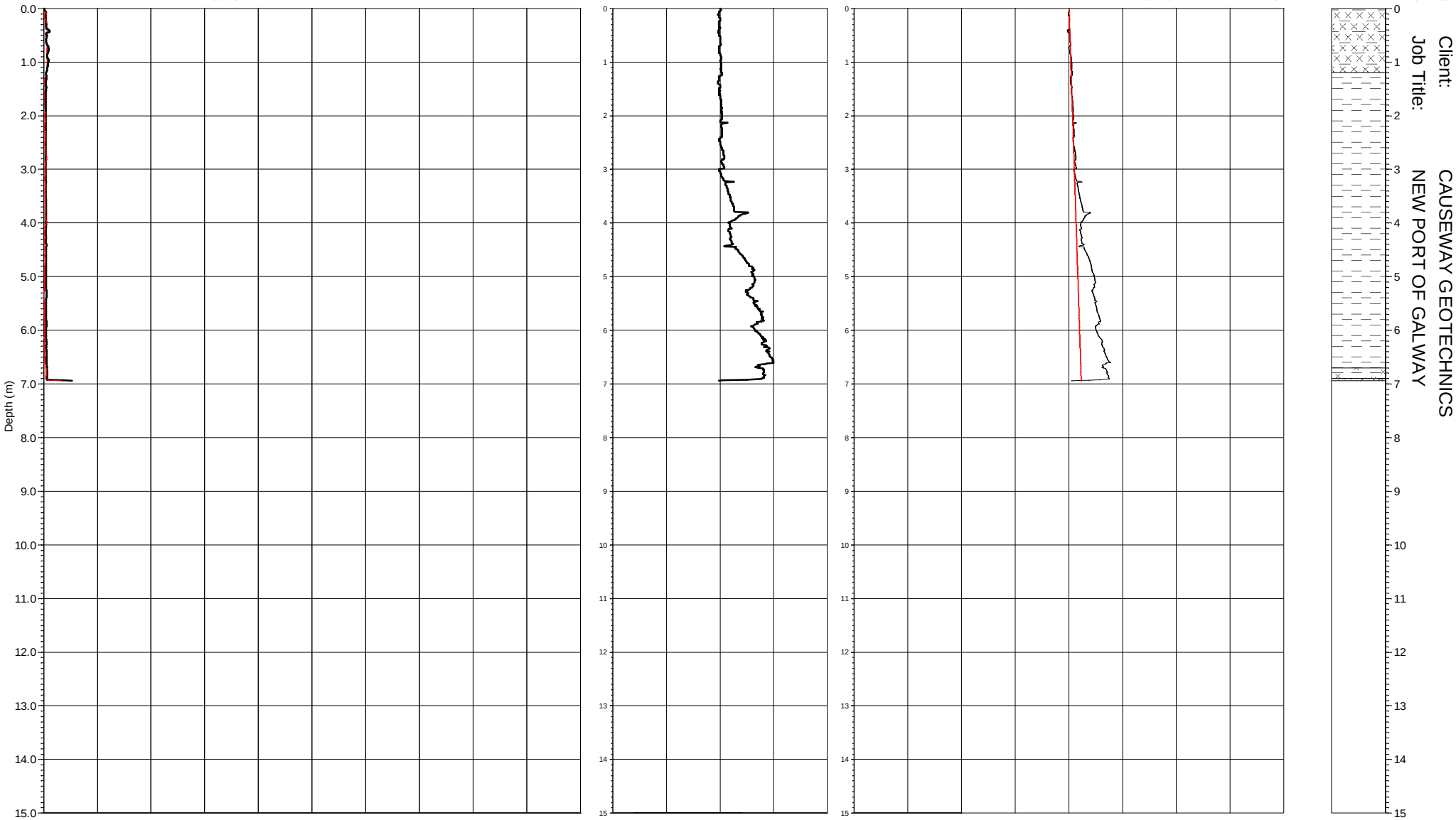
Checked By:

IN SITU
SITE INVESTIGATION
INSITUSI.COM

PIEZO CONE PENETRATION TEST

CPTU 04

Form: CPT0002



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location: GALWAY

Coordinates: 130927.000E - 223950.000N

Ground Level: -1.80 m CD

Cone & Rig Used: S10-CFIP.742 - CPT 003

Remarks: Test refused on total pressure.

Date of Test: 22/03/2012

Date of Plot: 30/03/2012

File Name: 1120134 - CPTU 05

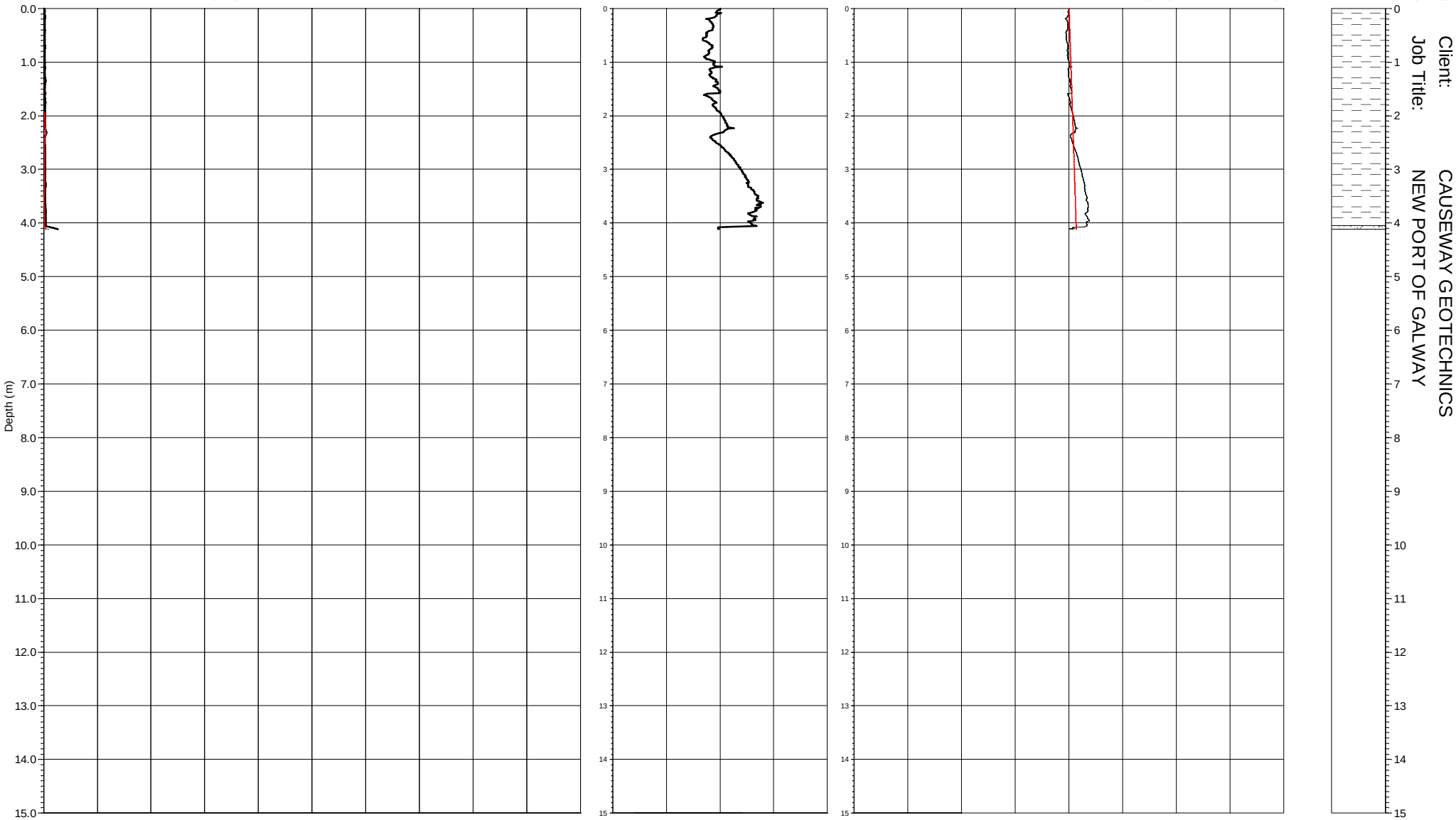
Checked By:

IN SITU
SITE INVESTIGATION
INSITUSI.COM

PIEZO CONE PENETRATION TEST

CPTU 05

Form: CPT0002



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location: GALWAY

Coordinates: 131003.000E - 223660.000N

Ground Level: -4.20 m CD

Cone & Rig Used: S10-CFIP.742 - CPT 003

Remarks: Test refused on total pressure.

Date of Test: 22/03/2012

Date of Plot: 30/03/2012

File Name: 1120134 - CPTU 06

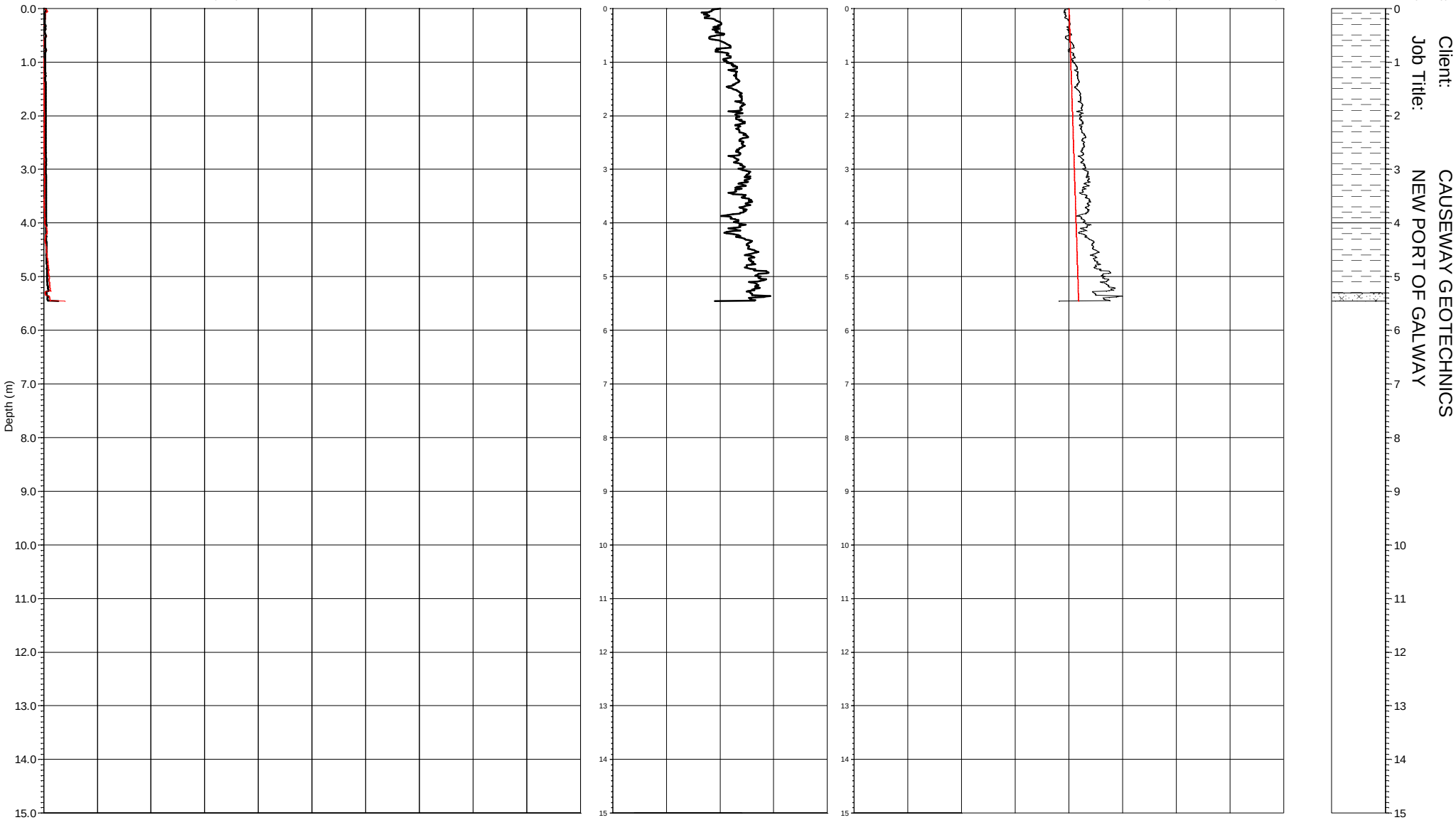
Checked By:

IN SITU SITE INVESTIGATION
INSITUSI.COM

PIEZO CONE PENETRATION TEST

CPTU 06

Form: CPT0002



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location: GALWAY

Coordinates: 130228.000E - 223305.000N

Ground Level: -6.40 m CD

Cone & Rig Used: S10-CFIP.742 - CPT 003

Remarks: Test refused on total pressure.

Date of Test: 22/03/2012

Date of Plot: 30/03/2012

File Name: 1120134 - CPTU 07

Checked By:

IN SITU
SITE INVESTIGATION
INSITUSI.COM

PIEZO CONE PENETRATION TEST

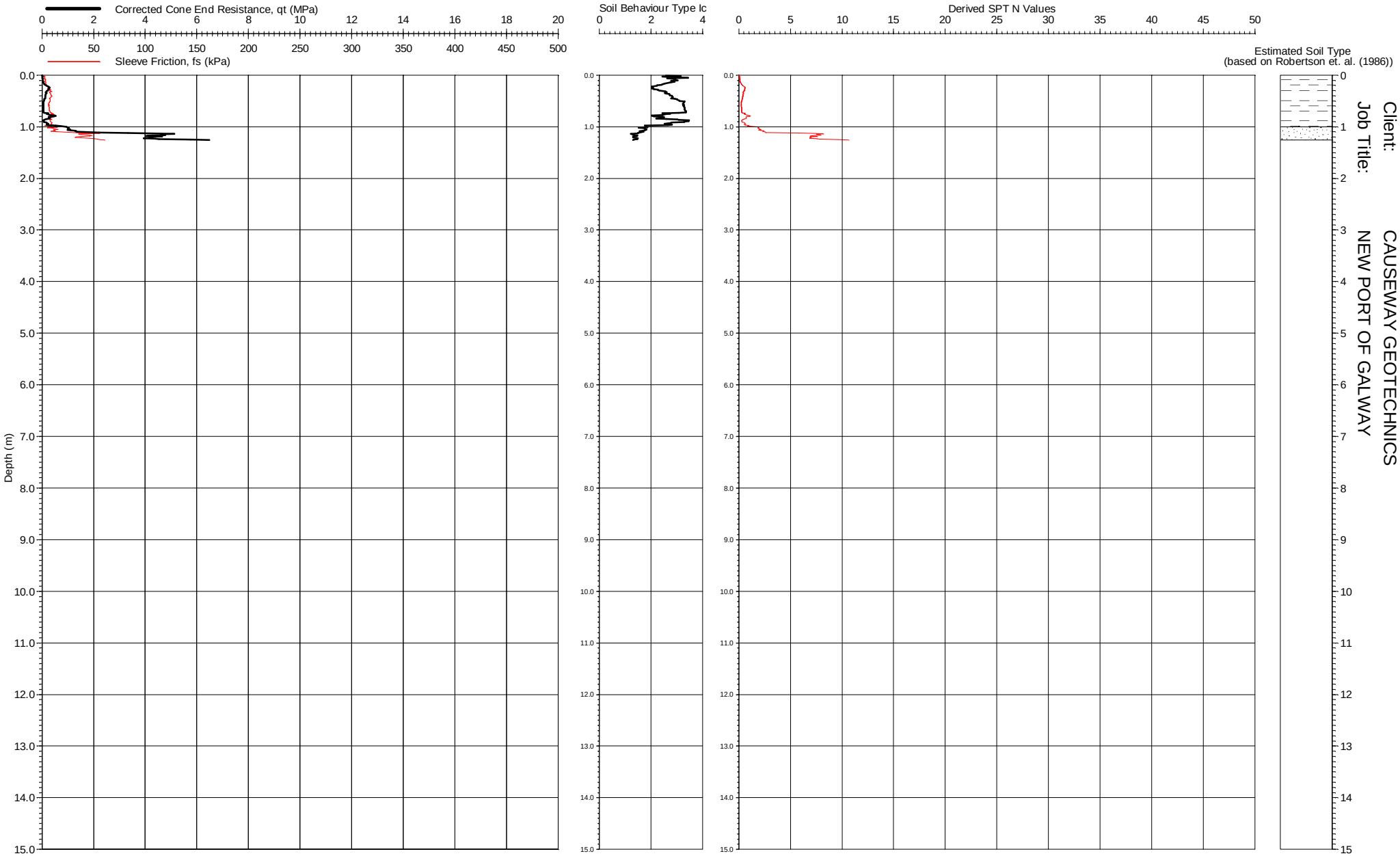
CPTU 07

Form: CPT0002

APPENDIX C

CPT DERIVED GEOTECHNICAL PARAMETERS

LIST OF FIGURES



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location: GALWAY

Coordinates: 130792.000E - 224414.000N

Ground Level: -0.70 m CD

Cone & Rig Used: S10-CFIP.742 - CPT 003

Remarks: Test refused on total pressure.

Date of Test: 22/03/2012

Date of Plot: 30/03/2012

File Name: 1120134 - CPTU 01

Checked By:

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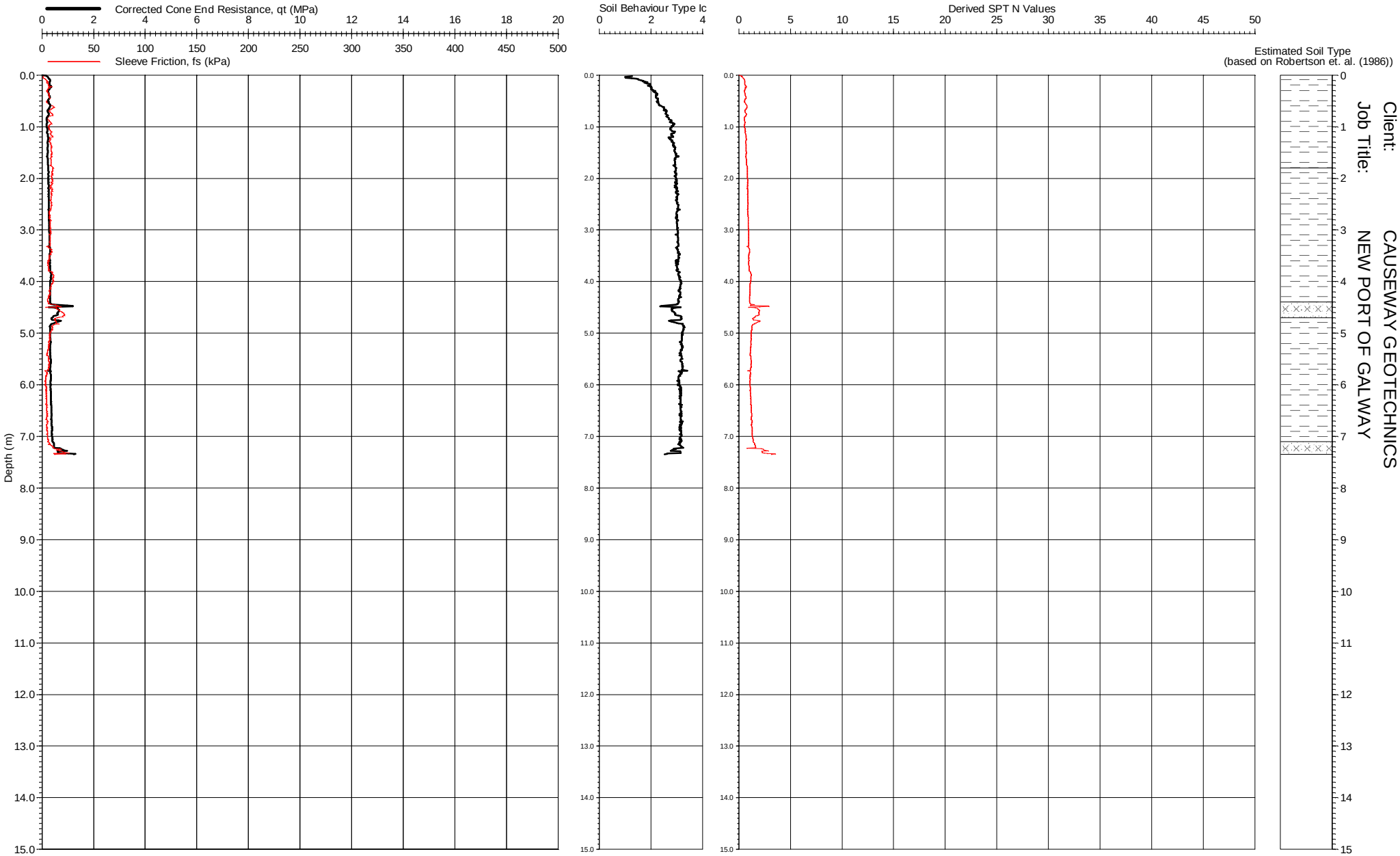
PIEZO CONE PENETRATION TEST

CPTU 01

Form: CPT0003



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location: GALWAY

Coordinates: 130645.000E - 224268.000N

Ground Level: -2.00 m CD

Cone & Rig Used: S10-CFIP.742 - CPT 003

Remarks: Test refused on total pressure.

Date of Test: 22/03/2012

Date of Plot: 30/03/2012

File Name: 1120134 - CPTU 02

Checked By:

IN SITU SITE INVESTIGATION

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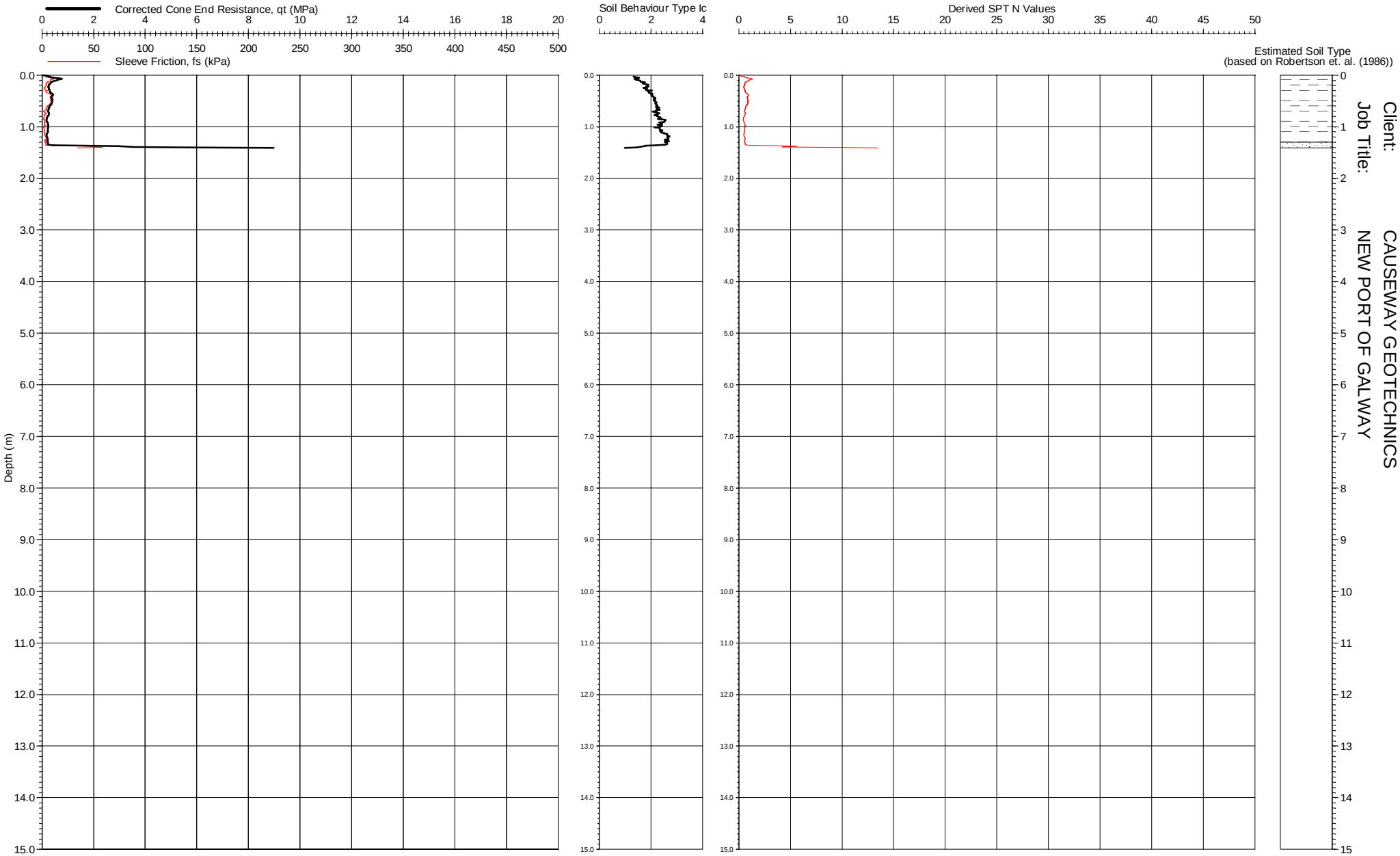
PIEZO CONE PENETRATION TEST

CPTU 02

Form: CPT0003



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location: GALWAY

Coordinates: 130888.000E - 224264.000N

Ground Level: -1.30 m CD

Cone & Rig Used: S10-CFIP.742 - CPT 003

Remarks: Test refused on total pressure.

Date of Test: 22/03/2012

Date of Plot: 30/03/2012

File Name: 1120134 - CPTU 03

Checked By:

IN SITU SITE INVESTIGATION

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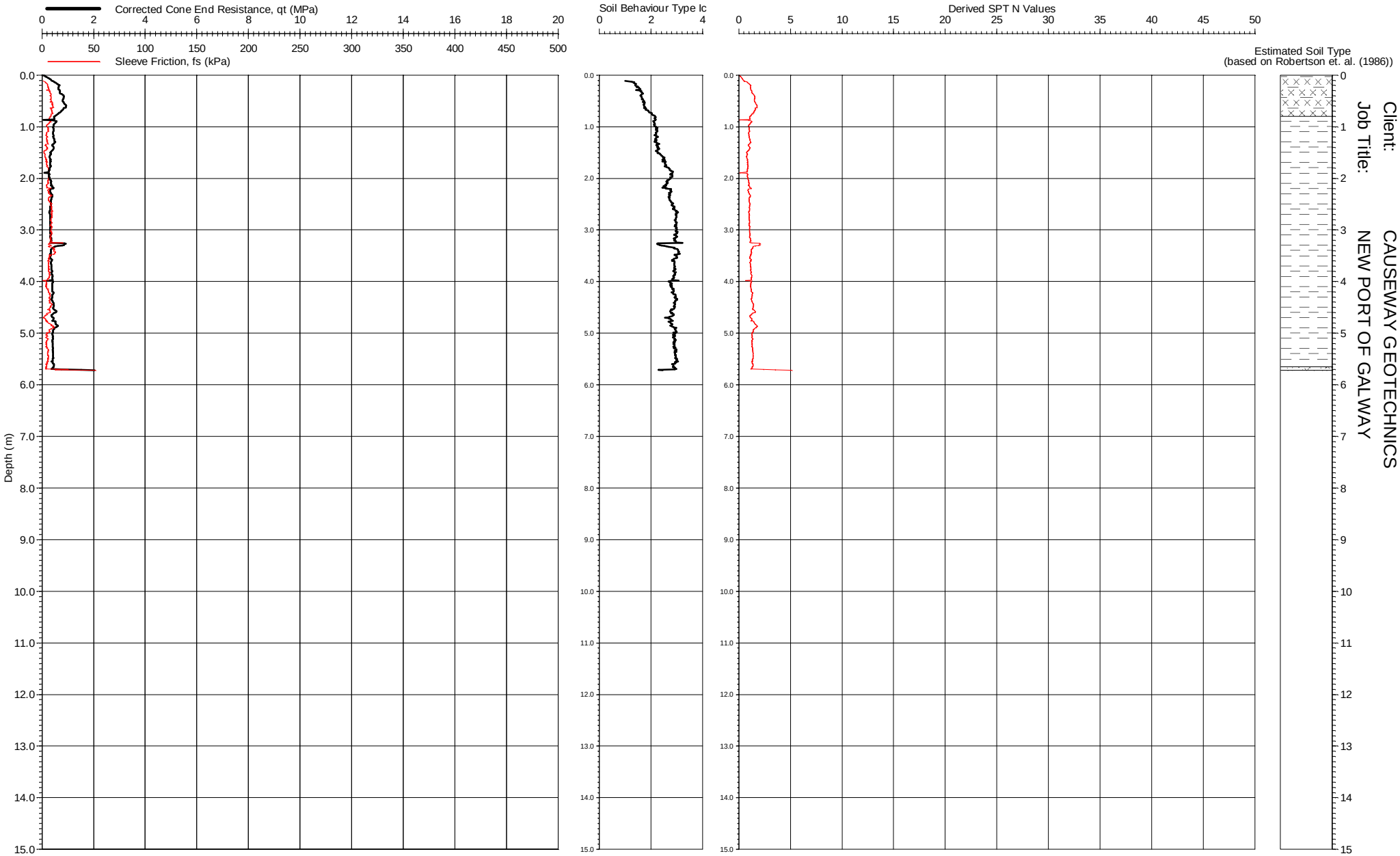
PIEZO CONE PENETRATION TEST

CPTU 03

Form: CPT0003



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location: GALWAY

Coordinates: 130981.000E - 224090.000N

Ground Level: -1.90 m CD

Cone & Rig Used: S10-CFIP.742 - CPT 003

Remarks: Test refused on total pressure.

Date of Test: 22/03/2012

Date of Plot: 30/03/2012

File Name: 1120134 - CPTU 04

Checked By:

IN SITU SITE INVESTIGATION

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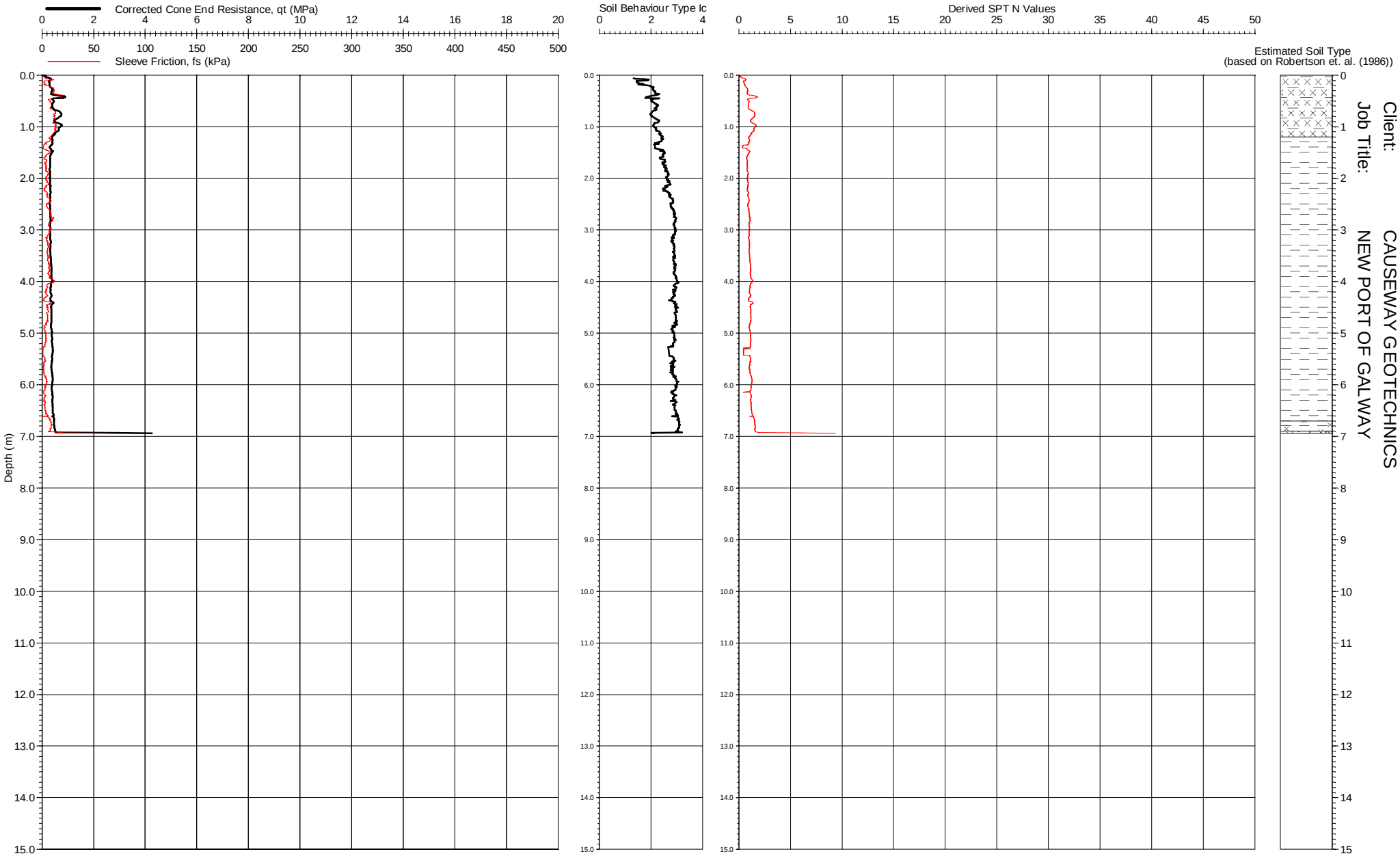
PIEZO CONE PENETRATION TEST

CPTU 04

Form: CPT0003



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location:	GALWAY	Date of Test:	22/03/2012
Coordinates:	130927.000E - 223950.000N	Date of Plot:	30/03/2012
Ground Level:	-1.80 m CD	File Name:	1120134 - CPTU 05
Cone & Rig Used:	S10-CFIP.742 - CPT 003	Checked By:	
Remarks:	Test refused on total pressure.		

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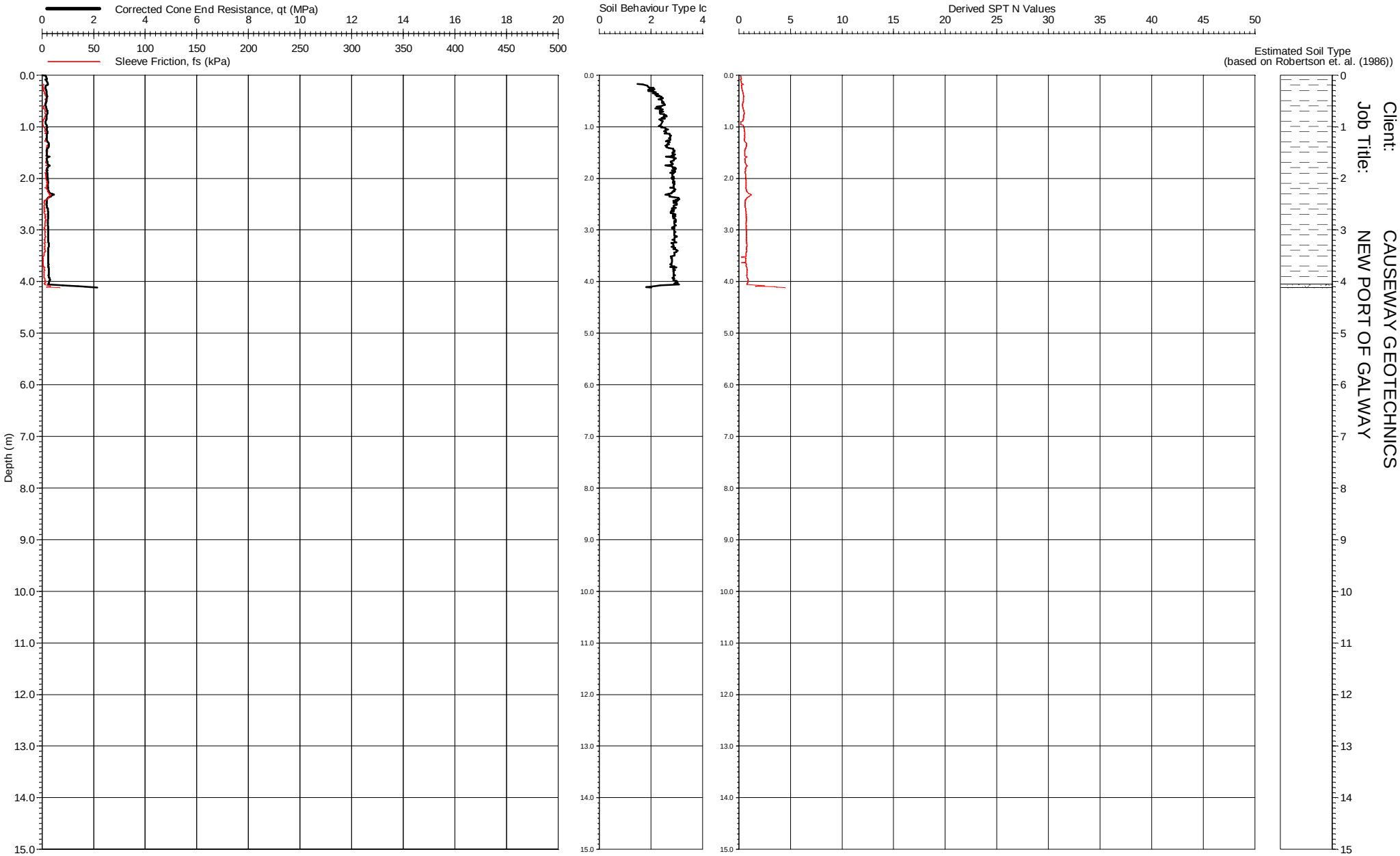
PIEZO CONE PENETRATION TEST
CPTU 05

Form: CPT0003



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location: GALWAY

Coordinates: 131003.000E - 223660.000N

Ground Level: -4.20 m CD

Cone & Rig Used: S10-CFIP.742 - CPT 003

Remarks: Test refused on total pressure.

Date of Test: 22/03/2012

Date of Plot: 30/03/2012

File Name: 1120134 - CPTU 06

Checked By:

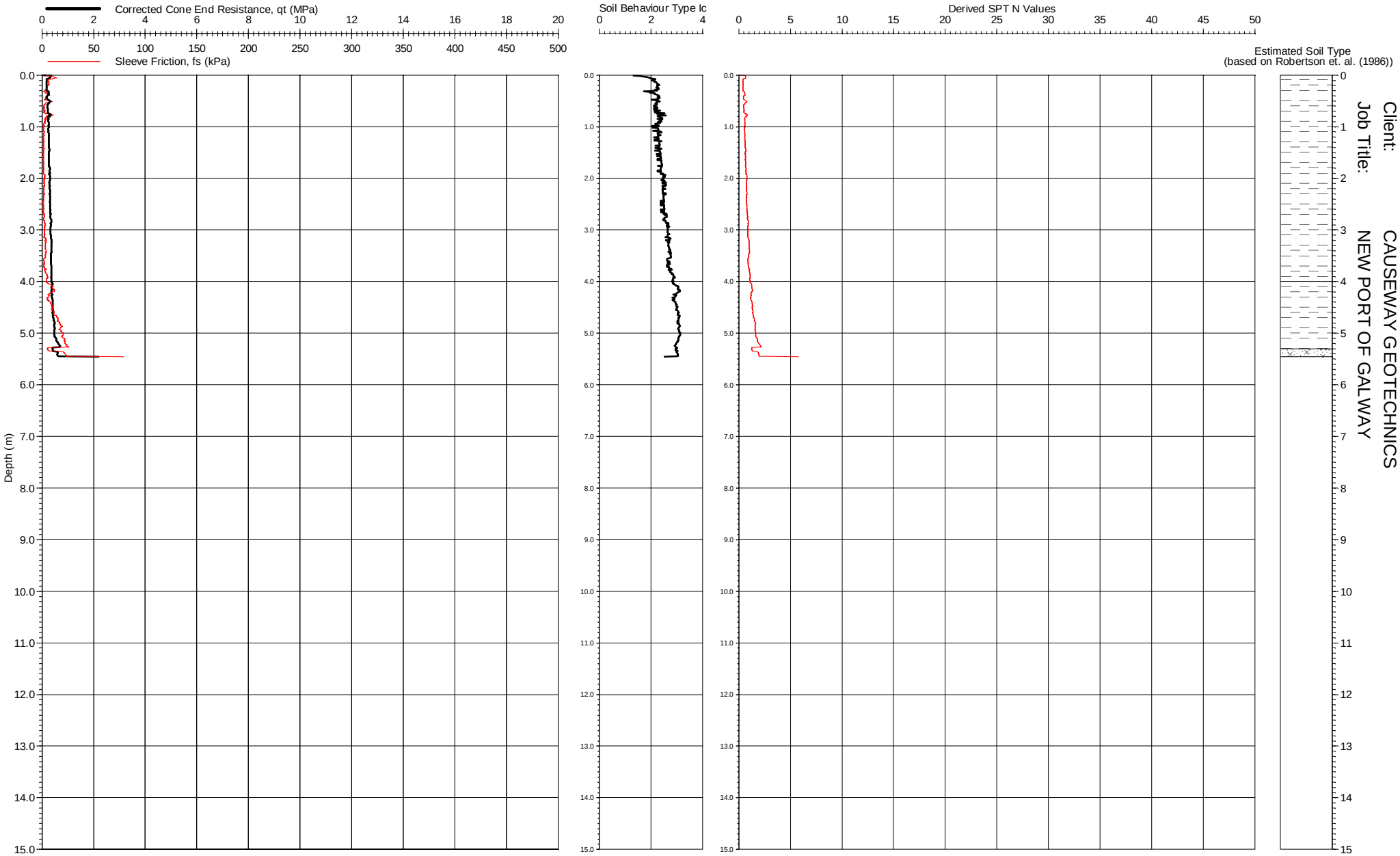
IN SITU SITE INVESTIGATION

insitusi.com

PIEZO CONE PENETRATION TEST

CPTU 06

Form: CPT0003



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location: GALWAY

Coordinates: 130228.000E - 223305.000N

Ground Level: -6.40 m CD

Cone & Rig Used: S10-CFIP.742 - CPT 003

Remarks: Test refused on total pressure.

Date of Test: 22/03/2012

Date of Plot: 30/03/2012

File Name: 1120134 - CPTU 07

Checked By:

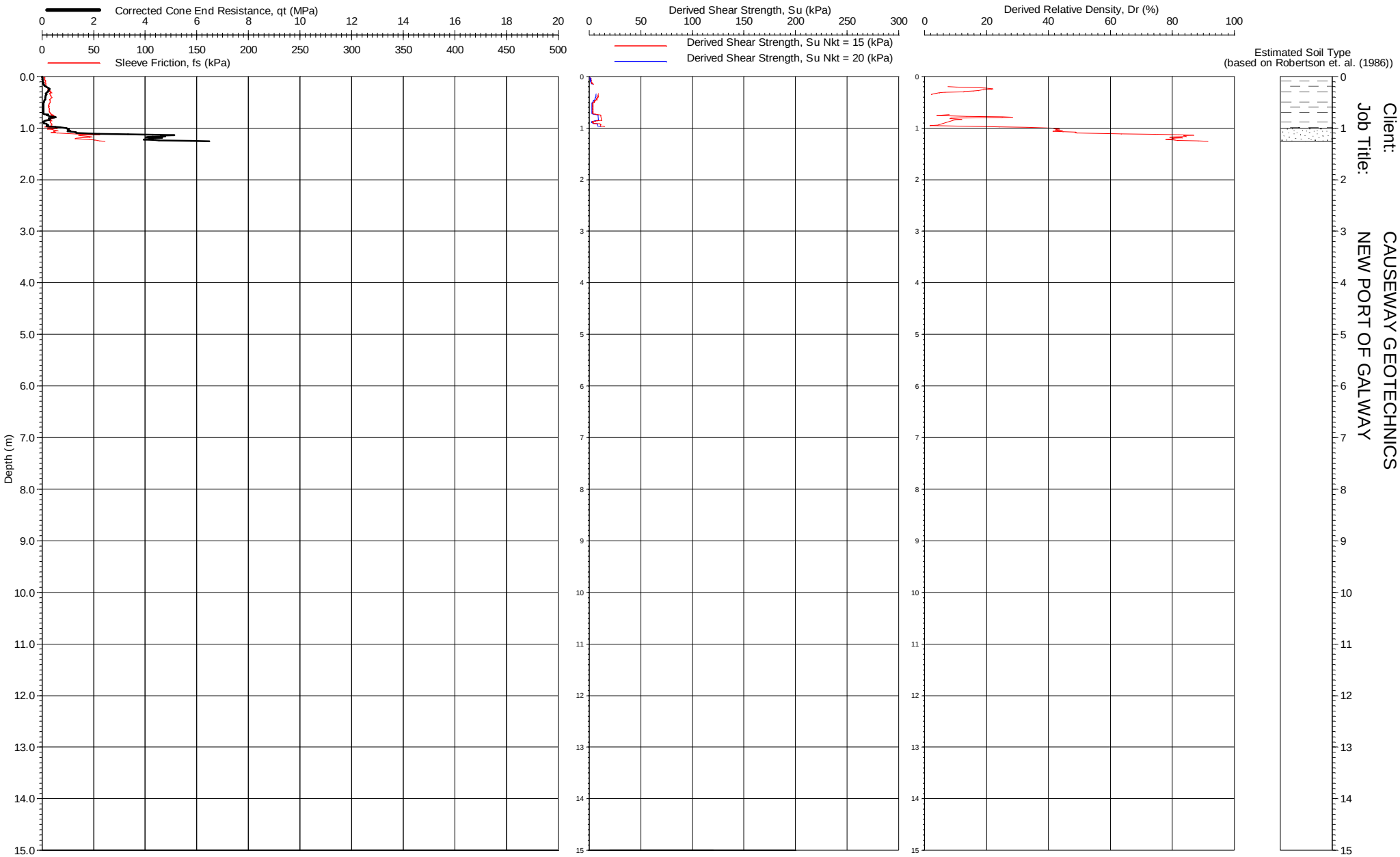
IN SITU SITE INVESTIGATION

insitusi.com

PIEZO CONE PENETRATION TEST

CPTU 07

Form: CPT0003



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location:	GALWAY	Date of Test:	22/03/2012
Coordinates:	130792.000E - 224414.000N	Date of Plot:	30/03/2012
Ground Level:	-0.70 m CD	File Name:	1120134 - CPTU 01
Cone & Rig Used:	S10-CFIP.742 - CPT 003	Checked By:	
Remarks:	Test refused on total pressure.		

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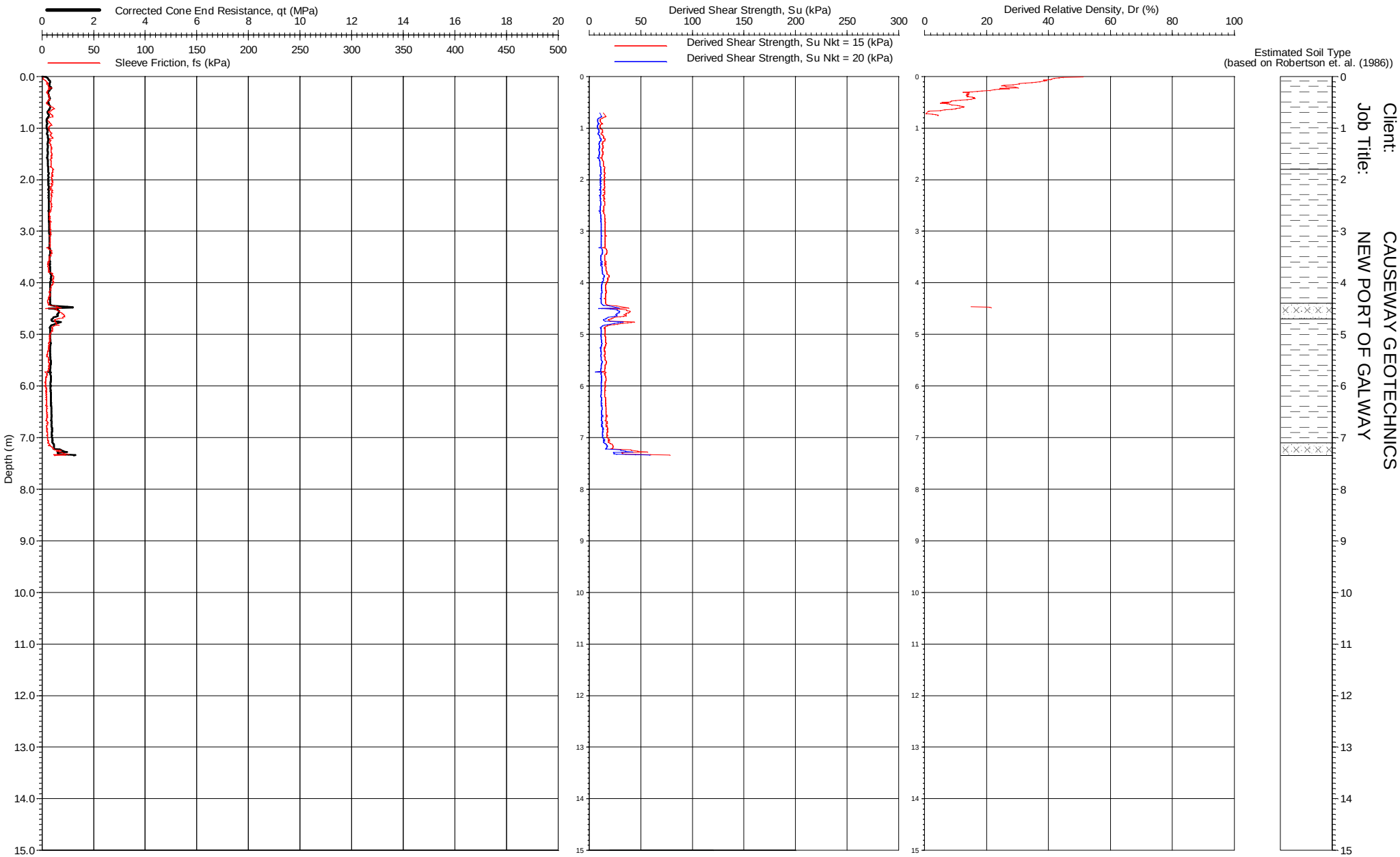
PIEZO CONE PENETRATION TEST
CPTU 01

Form: CPT0004



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location:	GALWAY	Date of Test:	22/03/2012
Coordinates:	130645.000E - 224268.000N	Date of Plot:	30/03/2012
Ground Level:	-2.00 m CD	File Name:	1120134 - CPTU 02
Cone & Rig Used:	S10-CFIP.742 - CPT 003	Checked By:	
Remarks:	Test refused on total pressure.		

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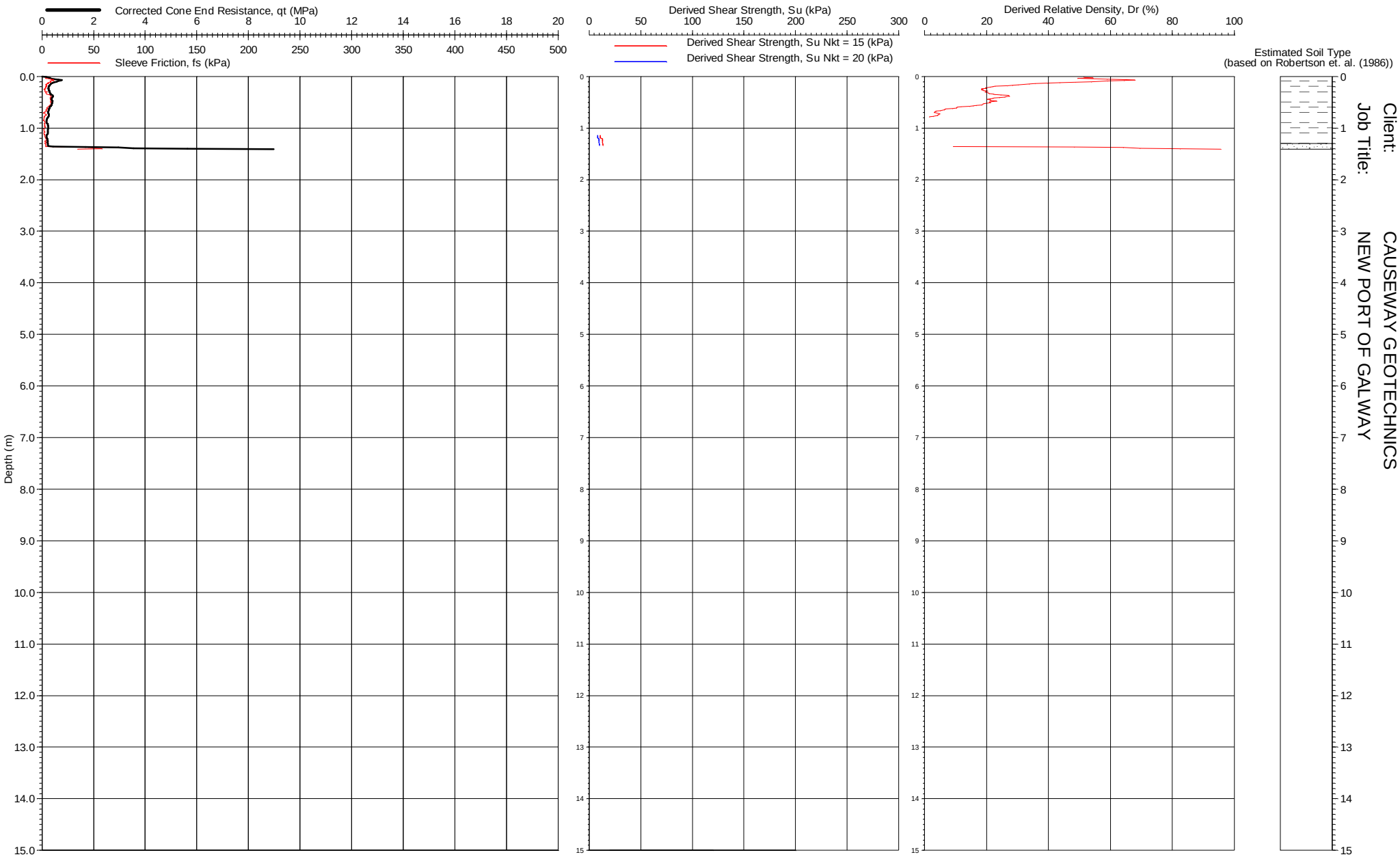
PIEZO CONE PENETRATION TEST
CPTU 02

Form: CPT0004



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location: GALWAY

Coordinates: 130888.000E - 224264.000N

Ground Level: -1.30 m CD

Cone & Rig Used: S10-CFIP.742 - CPT 003

Remarks: Test refused on total pressure.

Date of Test: 22/03/2012

Date of Plot: 30/03/2012

File Name: 1120134 - CPTU 03

Checked By:

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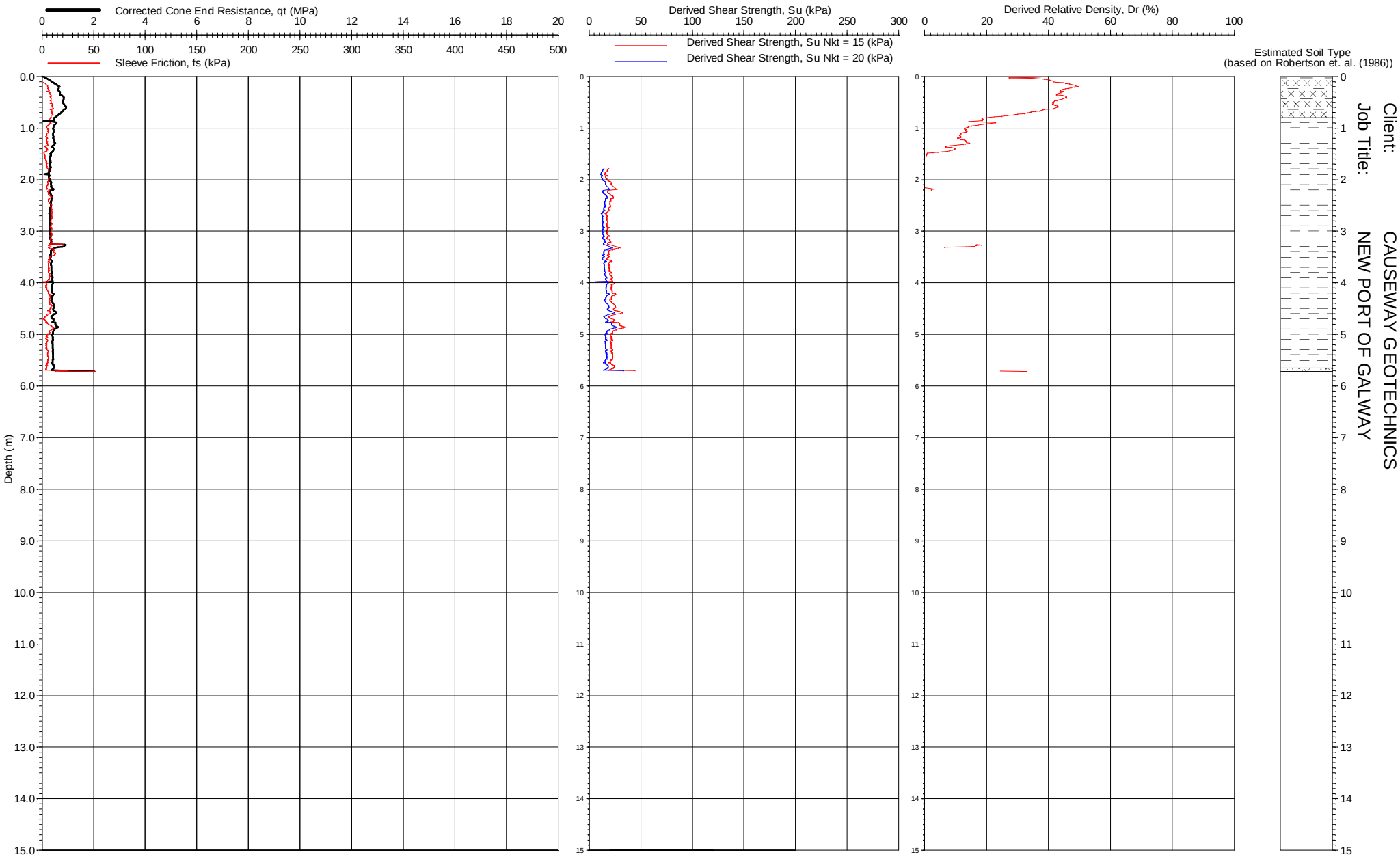
PIEZO CONE PENETRATION TEST

CPTU 03

Form: CPT0004



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location:	GALWAY	Date of Test:	22/03/2012
Coordinates:	130981.000E - 224090.000N	Date of Plot:	30/03/2012
Ground Level:	-1.90 m CD	File Name:	1120134 - CPTU 04
Cone & Rig Used:	S10-CFIP.742 - CPT 003	Checked By:	
Remarks:	Test refused on total pressure.		

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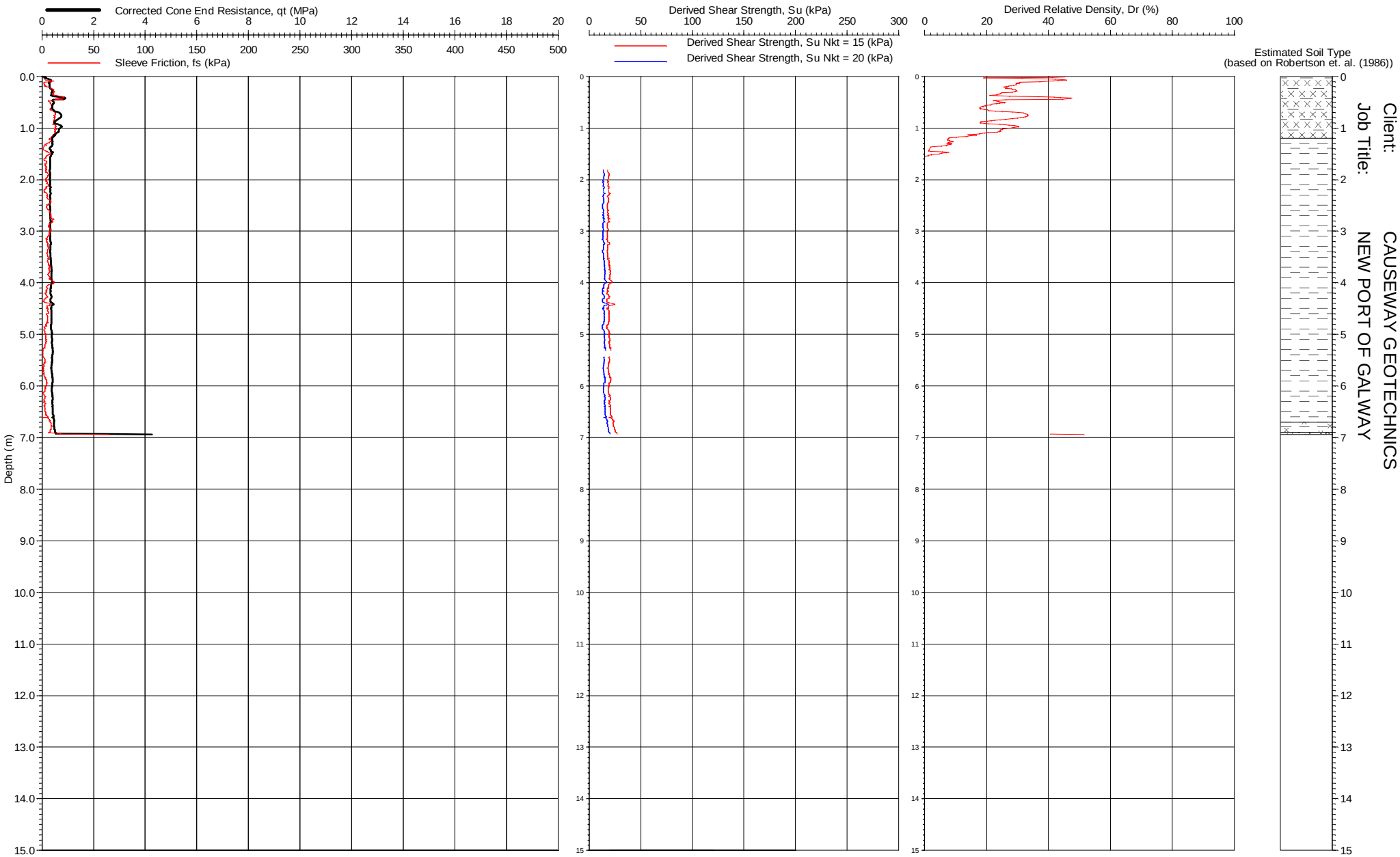
PIEZO CONE PENETRATION TEST
CPTU 04

Form: CPT0004



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location:	GALWAY	Date of Test:	22/03/2012
Coordinates:	130927.000E - 223950.000N	Date of Plot:	30/03/2012
Ground Level:	-1.80 m CD	File Name:	1120134 - CPTU 05
Cone & Rig Used:	S10-CFIP.742 - CPT 003	Checked By:	
Remarks:	Test refused on total pressure.		

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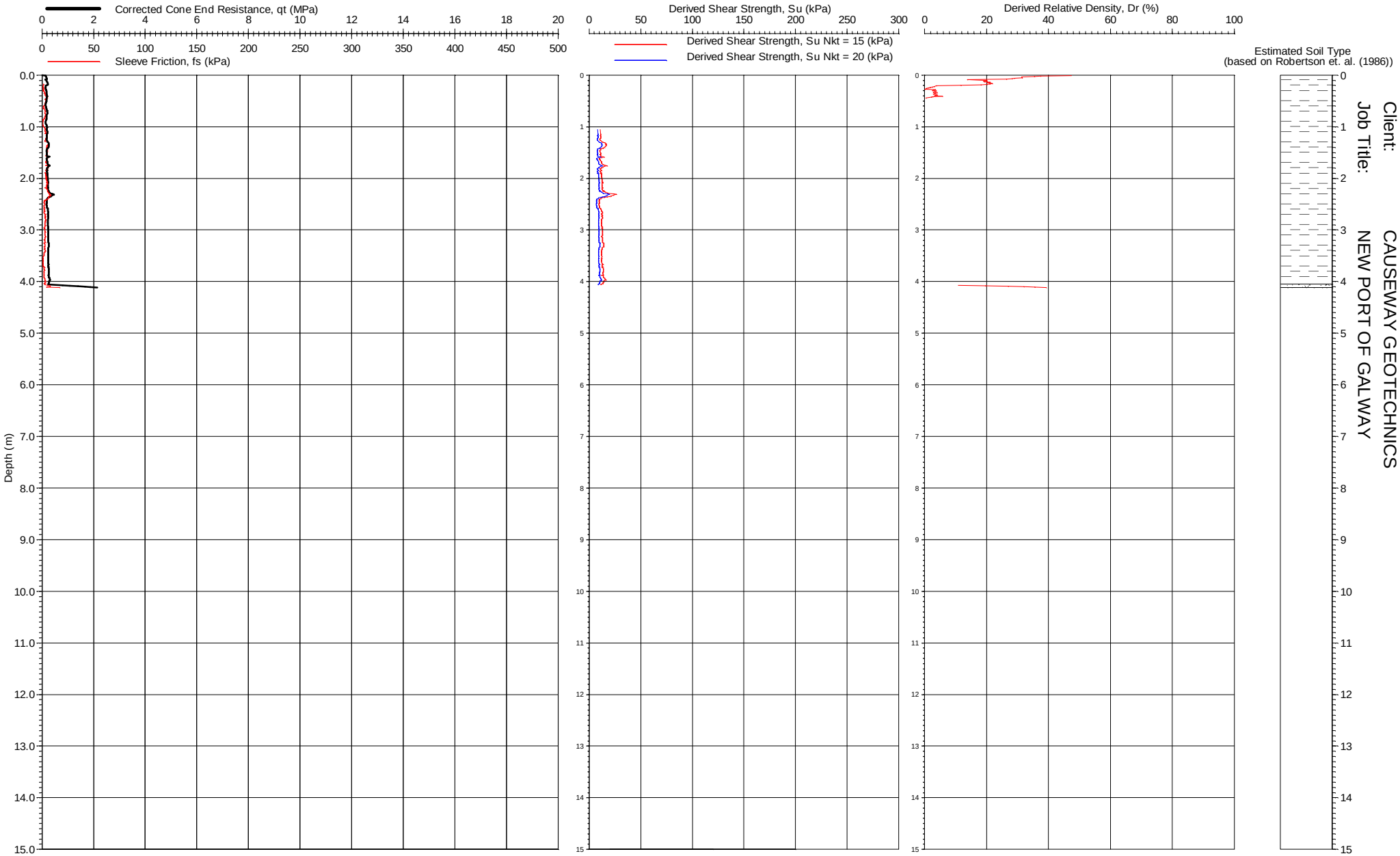
PIEZO CONE PENETRATION TEST
CPTU 05

Form: CPT0004



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location: GALWAY

Coordinates: 131003.000E - 223660.000N

Ground Level: -4.20 m CD

Cone & Rig Used: S10-CFIP.742 - CPT 003

Remarks: Test refused on total pressure.

Date of Test: 22/03/2012

Date of Plot: 30/03/2012

File Name: 1120134 - CPTU 06

Checked By:

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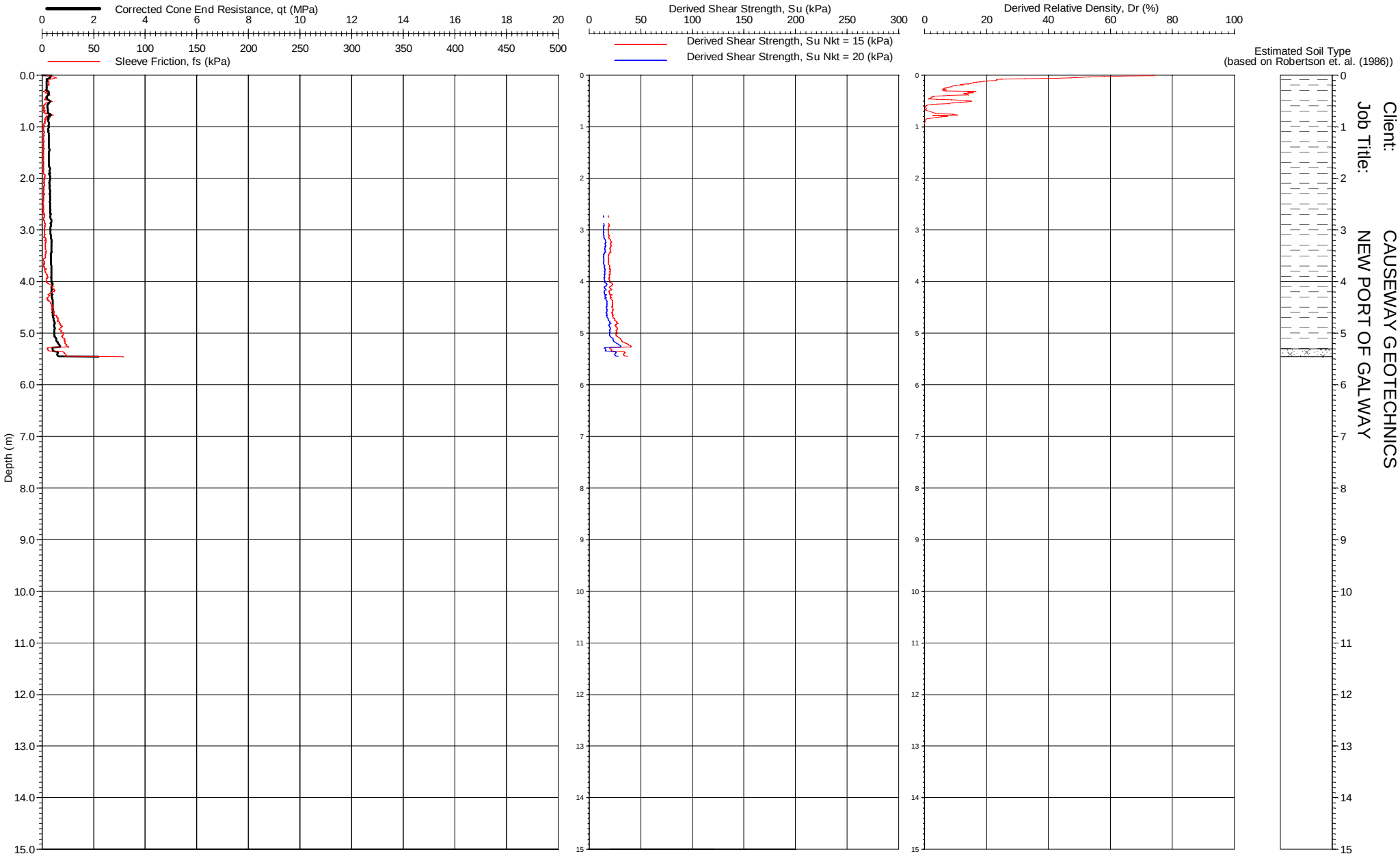
PIEZO CONE PENETRATION TEST

CPTU 06

Form: CPT0004



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location: GALWAY

Coordinates: 130228.000E - 223305.000N

Ground Level: -6.40 m CD

Cone & Rig Used: S10-CFIP.742 - CPT 003

Remarks: Test refused on total pressure.

Date of Test: 22/03/2012

Date of Plot: 30/03/2012

File Name: 1120134 - CPTU 07

Checked By:

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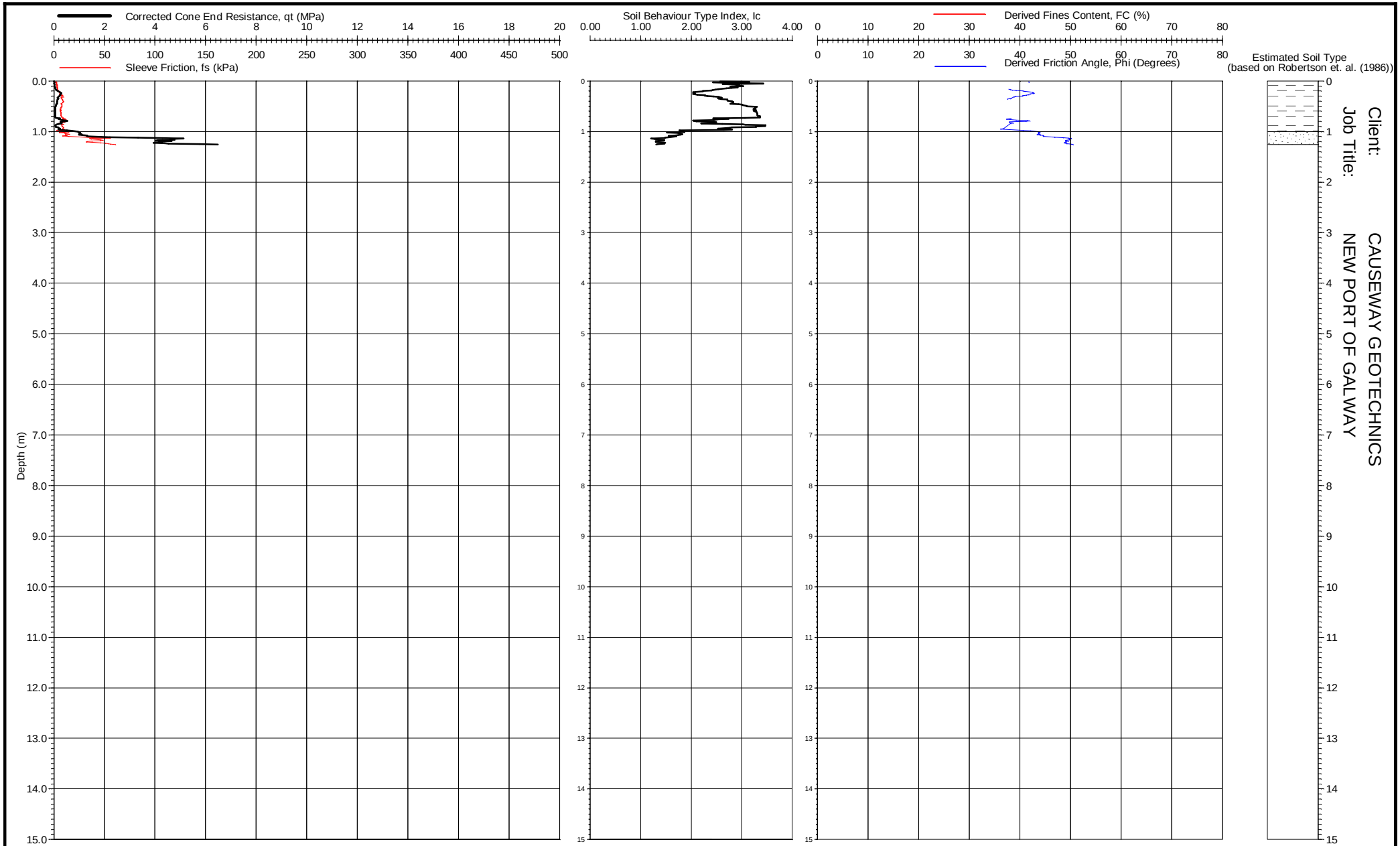
PIEZO CONE PENETRATION TEST

CPTU 07

Form: CPT0004



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location: GALWAY

Coordinates: 130792.000E - 224414.000N

Ground Level: -0.70 m CD

Cone & Rig Used: S10-CFIP.742 - CPT 003

Remarks: Test refused on total pressure.

Date of Test: 22/03/2012

Date of Plot: 30/03/2012

File Name: 1120134 - CPTU 01

Checked By:

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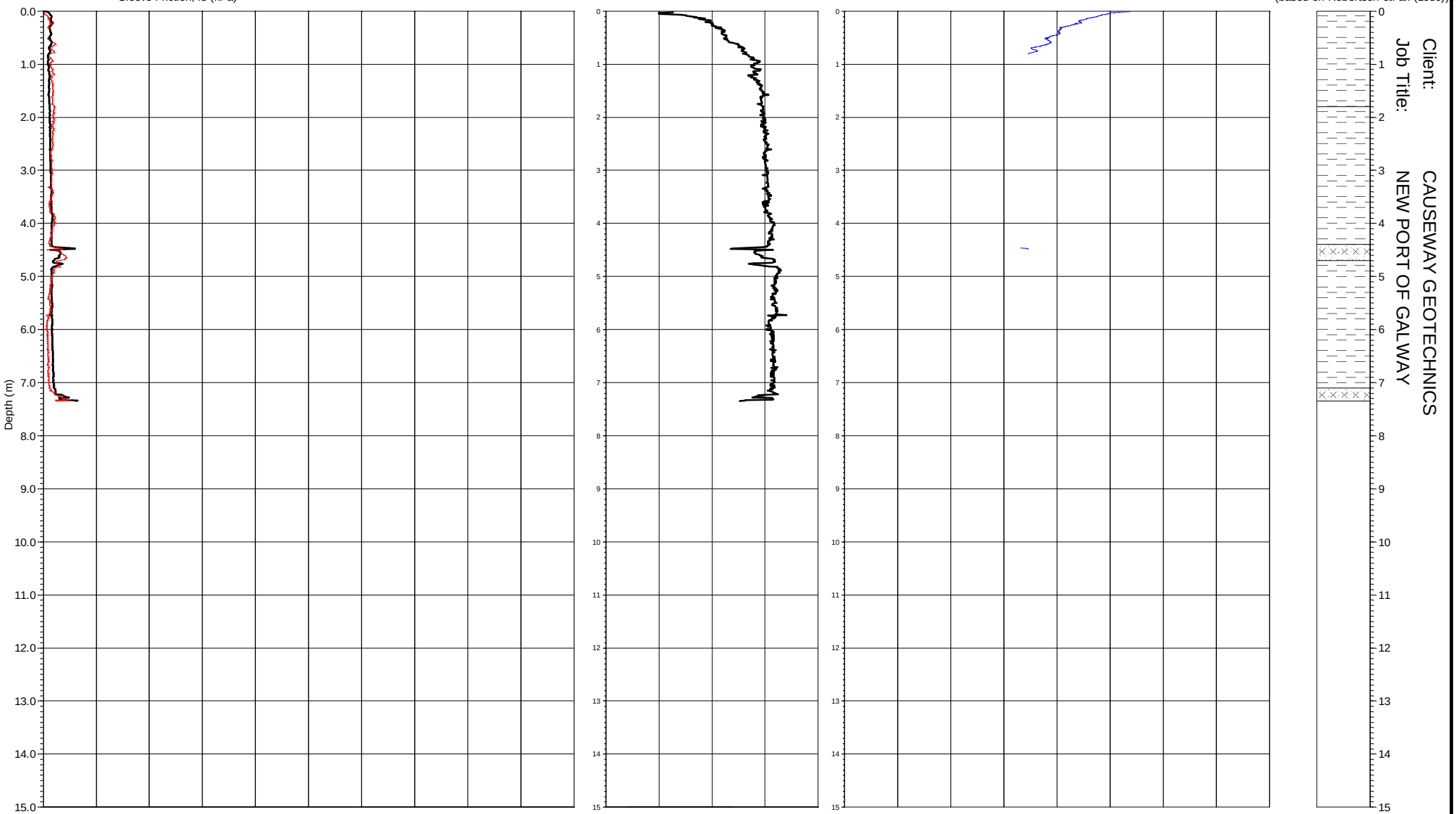
PIEZO CONE PENETRATION TEST

CPTU 01

Form: CPT0005



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location: GALWAY

Coordinates: 130645.000E - 224268.000N

Ground Level: -2.00 m CD

Cone & Rig Used: S10-CFIP.742 - CPT 003

Remarks: Test refused on total pressure.

Date of Test: 22/03/2012

Date of Plot: 30/03/2012

File Name: 1120134 - CPTU 02

Checked By:

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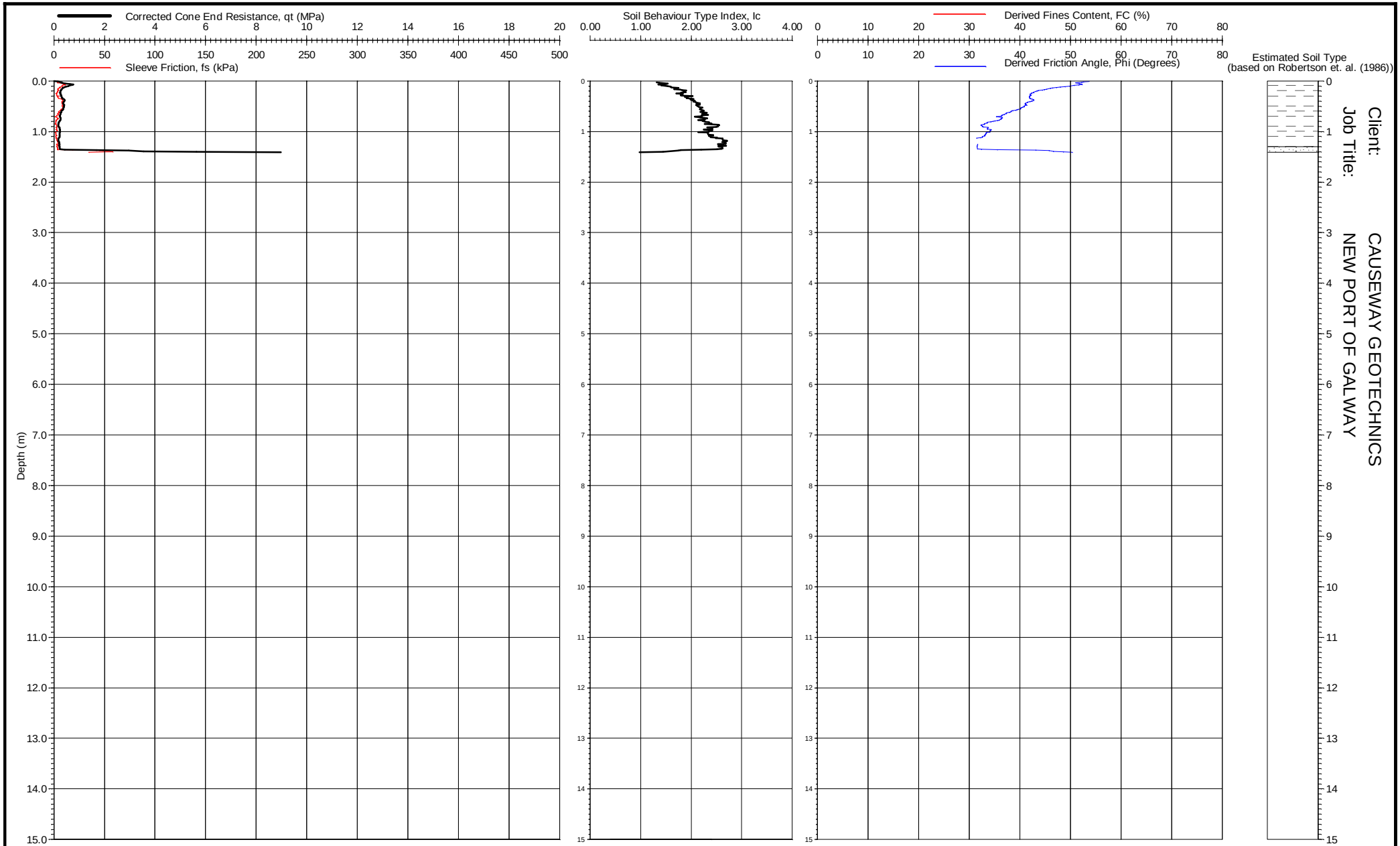
PIEZO CONE PENETRATION TEST

CPTU 02

Form: CPT0005



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location: GALWAY

Coordinates: 130888.000E - 224264.000N

Ground Level: -1.30 m CD

Cone & Rig Used: S10-CFIP.742 - CPT 003

Remarks: Test refused on total pressure.

Date of Test: 22/03/2012

Date of Plot: 30/03/2012

File Name: 1120134 - CPTU 03

Checked By:

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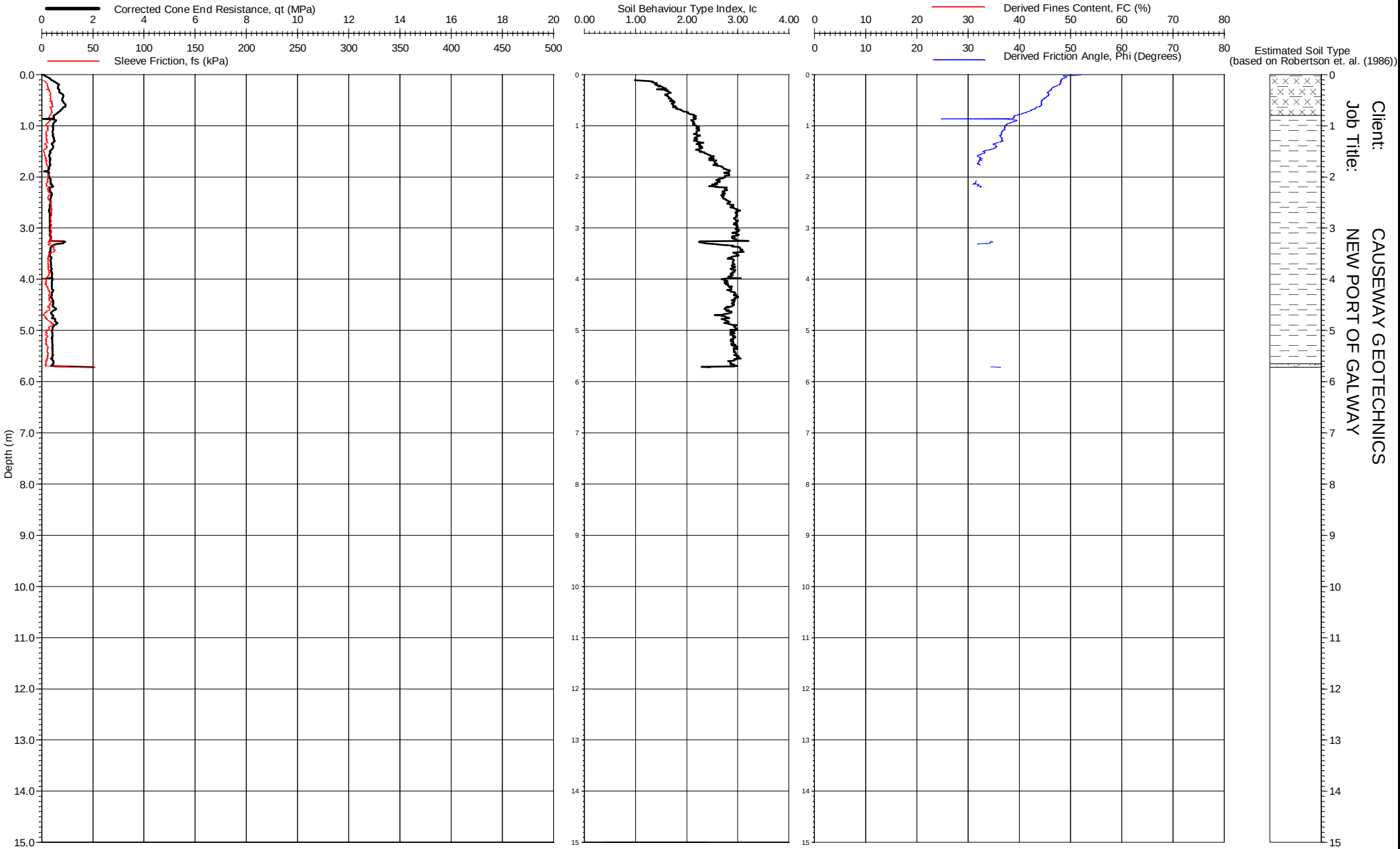
PIEZO CONE PENETRATION TEST

CPTU 03

Form: CPT0005



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location: GALWAY

Coordinates: 130981.000E - 224090.000N

Ground Level: -1.90 m CD

Cone & Rig Used: S10-CFIP.742 - CPT 003

Remarks: Test refused on total pressure.

Date of Test: 22/03/2012

Date of Plot: 30/03/2012

File Name: 1120134 - CPTU 04

Checked By:

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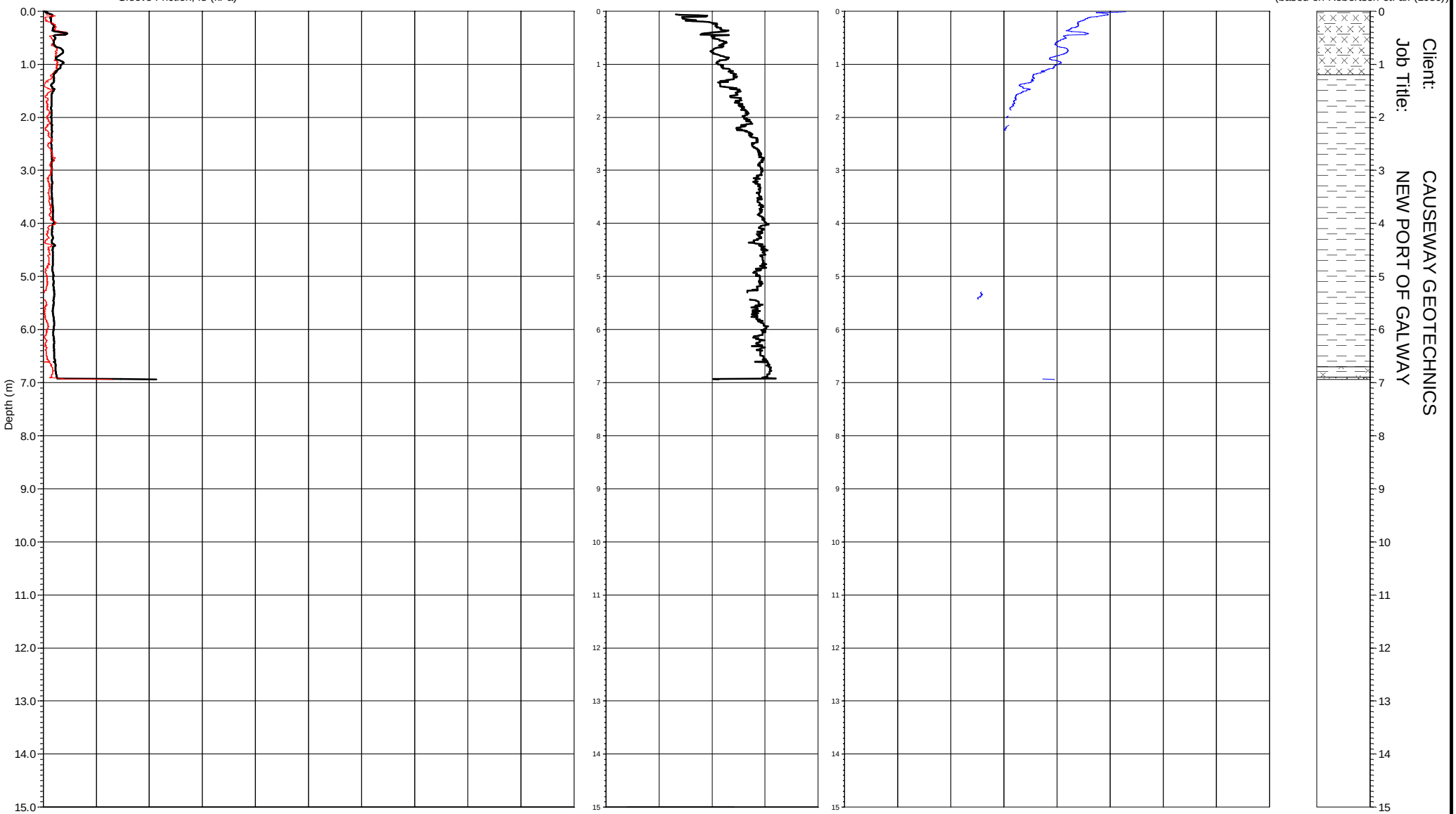
PIEZO CONE PENETRATION TEST

CPTU 04

Form: CPT0005



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location:	GALWAY	Date of Test:	22/03/2012
Coordinates:	130927.000E - 223950.000N	Date of Plot:	30/03/2012
Ground Level:	-1.80 m CD	File Name:	1120134 - CPTU 05
Cone & Rig Used:	S10-CFIP.742 - CPT 003	Checked By:	
Remarks:	Test refused on total pressure.		

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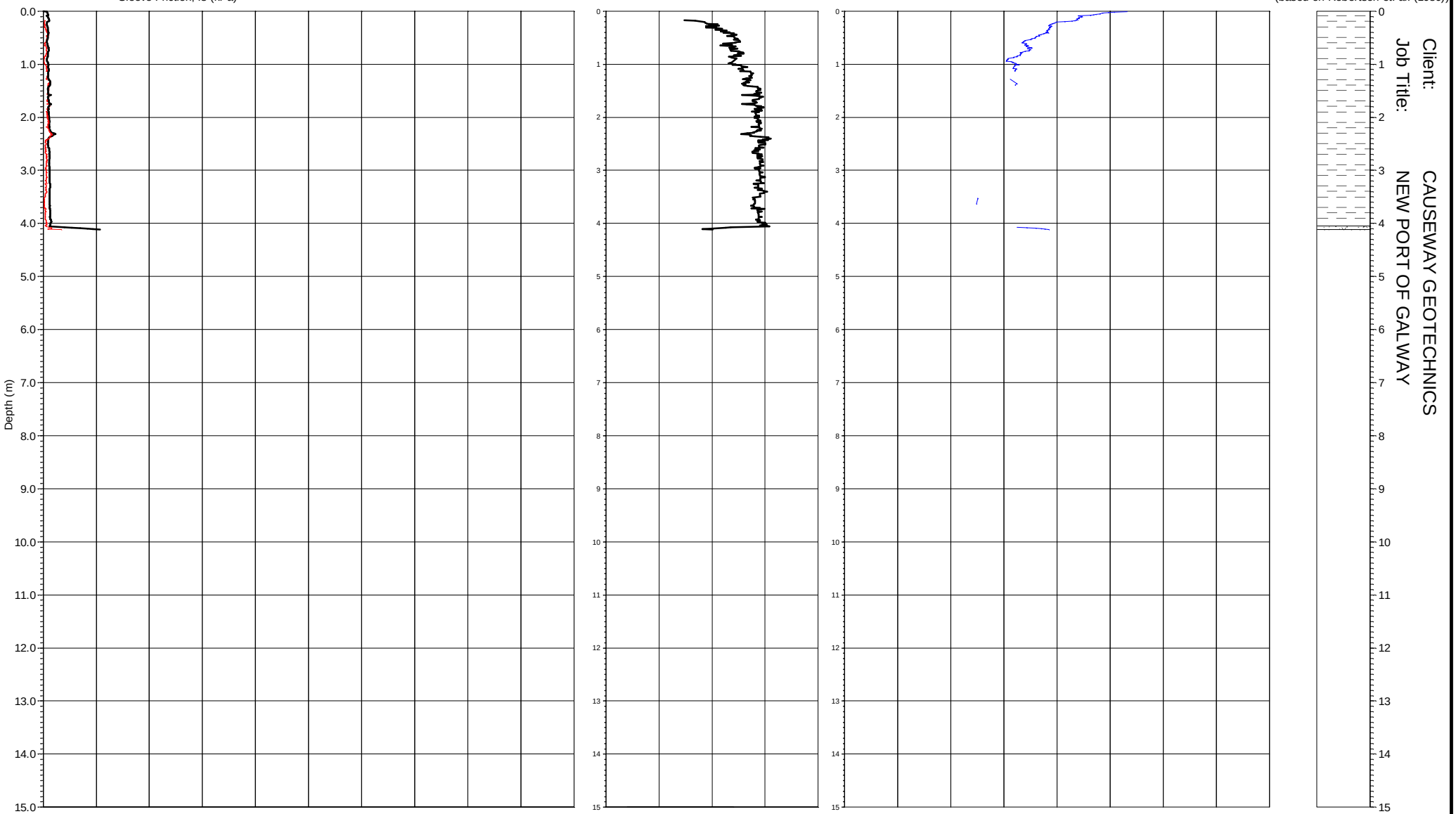
PIEZO CONE PENETRATION TEST

CPTU 05

Form: CPT0005



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location: GALWAY

Coordinates: 131003.000E - 223660.000N

Ground Level: -4.20 m CD

Cone & Rig Used: S10-CFIP.742 - CPT 003

Remarks: Test refused on total pressure.

Date of Test: 22/03/2012

Date of Plot: 30/03/2012

File Name: 1120134 - CPTU 06

Checked By:

IN SITU SITE INVESTIGATION

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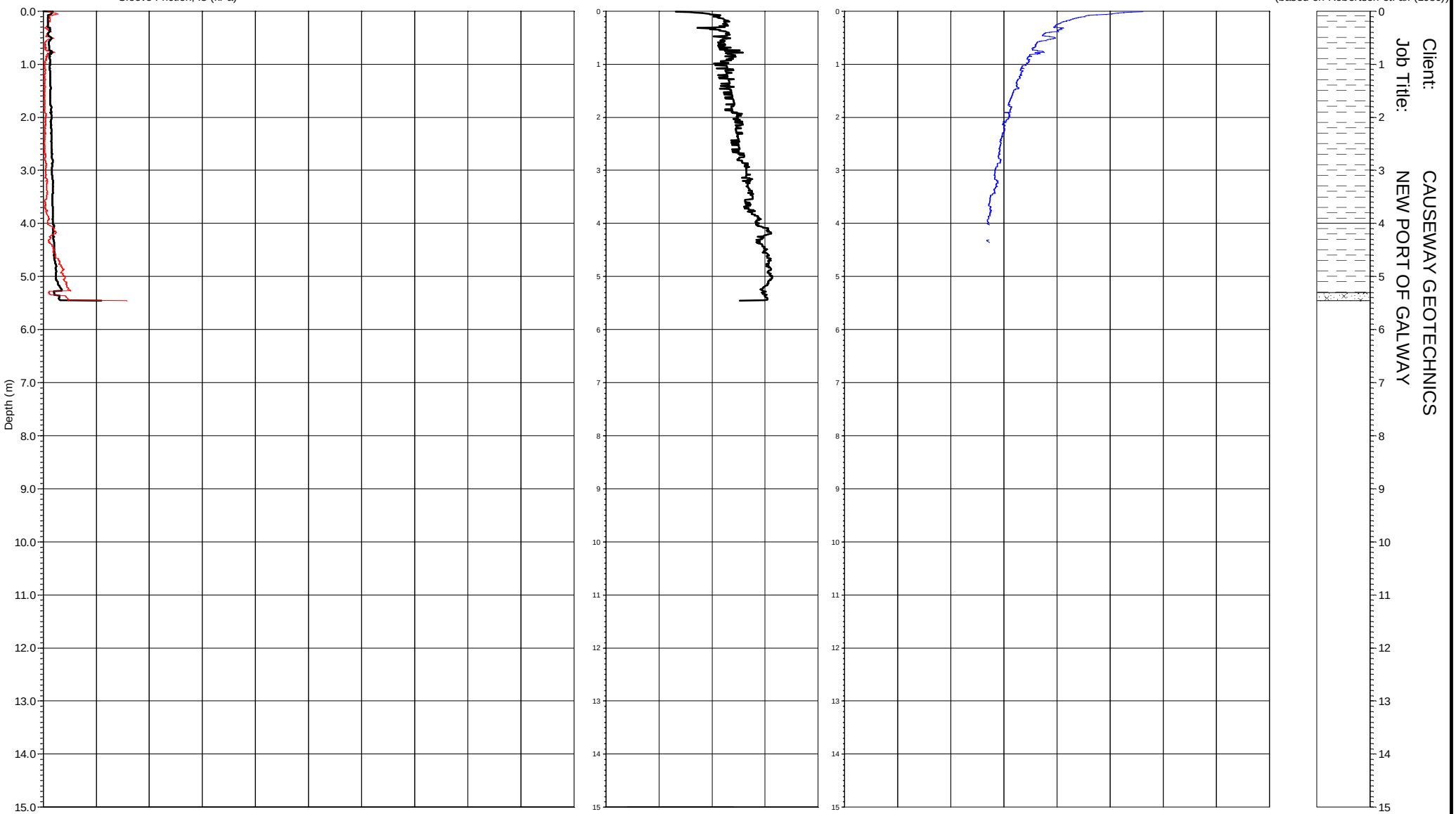
PIEZO CONE PENETRATION TEST

CPTU 06

Form: CPT0005



Client: CAUSEWAY GEOTECHNICS

Job Title: NEW PORT OF GALWAY

Location: GALWAY

Coordinates: 130228.000E - 223305.000N

Ground Level: -6.40 m CD

Cone & Rig Used: S10-CFIP.742 - CPT 003

Remarks: Test refused on total pressure.

Date of Test: 22/03/2012

Date of Plot: 30/03/2012

File Name: 1120134 - CPTU 07

Checked By:

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PIEZO CONE PENETRATION TEST

CPTU 07

Form: CPT0005

APPENDIX F

Laboratory test results

Contract: New Port of Galway
Job No.:12-161

Causeway Geotech Ltd

Moisture content, Atterberg Limits & Particle Density
Tests 3.2, 4.3, 5.3 & 8.3 of BS 1377 : Part 2 : 1990

EH No.	Sample		Sample Depth		Moisture Content	Passing 425µm Sieve	Liquid Limit	Plastic Limit	Plasticity Index	Casagrande Classification	Particle Density
	Type	No.	at (m)	to (m)	(%)	(%)	(%)	(%)	(%)		(Mg/m^3)
BH01	D	1	0.00		48						
BH01	D	2	1.00		50	99	36	NP	NP		
BH01	D	3	2.00		65	98	37	NP	NP		
BH01	P	5	3.00	3.80	82	98	84	43	41	MV	
BH01	D	6	5.00		54						
BH01	P	7	5.00	5.75	38	99	46	30	16	MI	
BH02	D	1	0.00		43						
BH02	D	2	1.00		52	99	42.8	NP	NP		
BH02	B	4	2.50		10	56	17	11	6	NP	
BH02	D	5	3.00		10						
BH03	D	1	0.00		57						
BH03	D	3	2.00		60						
BH03	P	6	4.00	4.90	49	99	42	29	13	MI	
BH03	P	9	6.00	6.60	38	99	34	22	12	CL	
BH03	B	11	8.00		11	50.9	15	12	3	NP	
BH04	D	1	0.00		46						
BH04	B	5	3.00		50	99	44	28	16	MI	
BH04	D	9	6.00		52	99	44	29	15	MI	
BH04	D	10	7.50		52						
BH04	D	14	11.00		25	99	44	27	17	MI/CI	
BH05	D	1	0.00		69						
BH05	D	3	2.00		56						
BH05	P	5	3.00	3.90	62	99	42	28	14	MI	
BH05	D	7	5.00		58	98	43	28	15	MI	
BH05	B	13	8.50		1	46	No test: GRAVEL				
BH06	D	1	0.00		53	100	42	27	15	MI	
BH06	D	4	3.00		47						
BH06	P	5	3.00	3.90	46	99	38	26	12	MI	
BH06	D	7	5.00		44	100	38	23	15	CI	
BH06	B	9	6.80	7.00	113						
BH06	B	11	8.00		21	81.7	31	20	11	CL	
BH07	D	1	0.00		67						
BH07	D	2	1.00		65	99	42	NP	NP		
BH07	D	6	4.00		62	99	37	25	12	MI/CI	
BH07	D	10	6.60		81						

NP non-plastic soil
$ Insufficient material for Limits tests.

Contract: New Port of Galway
Job No.:12-161

Causeway Geotech Ltd

Moisture content, Atterberg Limits & Particle Density
Tests 3.2, 4.3, 5.3 & 8.3 of BS 1377 : Part 2 : 1990

EH No.	Sample		Sample Depth		Moisture Content (%)	Passing 425µm Sieve (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Casagrande Classification	Particle Density (Mg/m^3)
	Type	No.	at (m)	to (m)							
BH07	B	12	7.00		2		No test: GRAVEL				
BH07	D	11	7.00		3						
BH08	D	2	1.00		38	99	44	21	23	CI	
BH08	D	6	4.00		38.7	99	44	20	24	CI	
BH08	D	8	6.00		34	99	41	21	20	CI	
BH08	D	11	8.00		36.3						

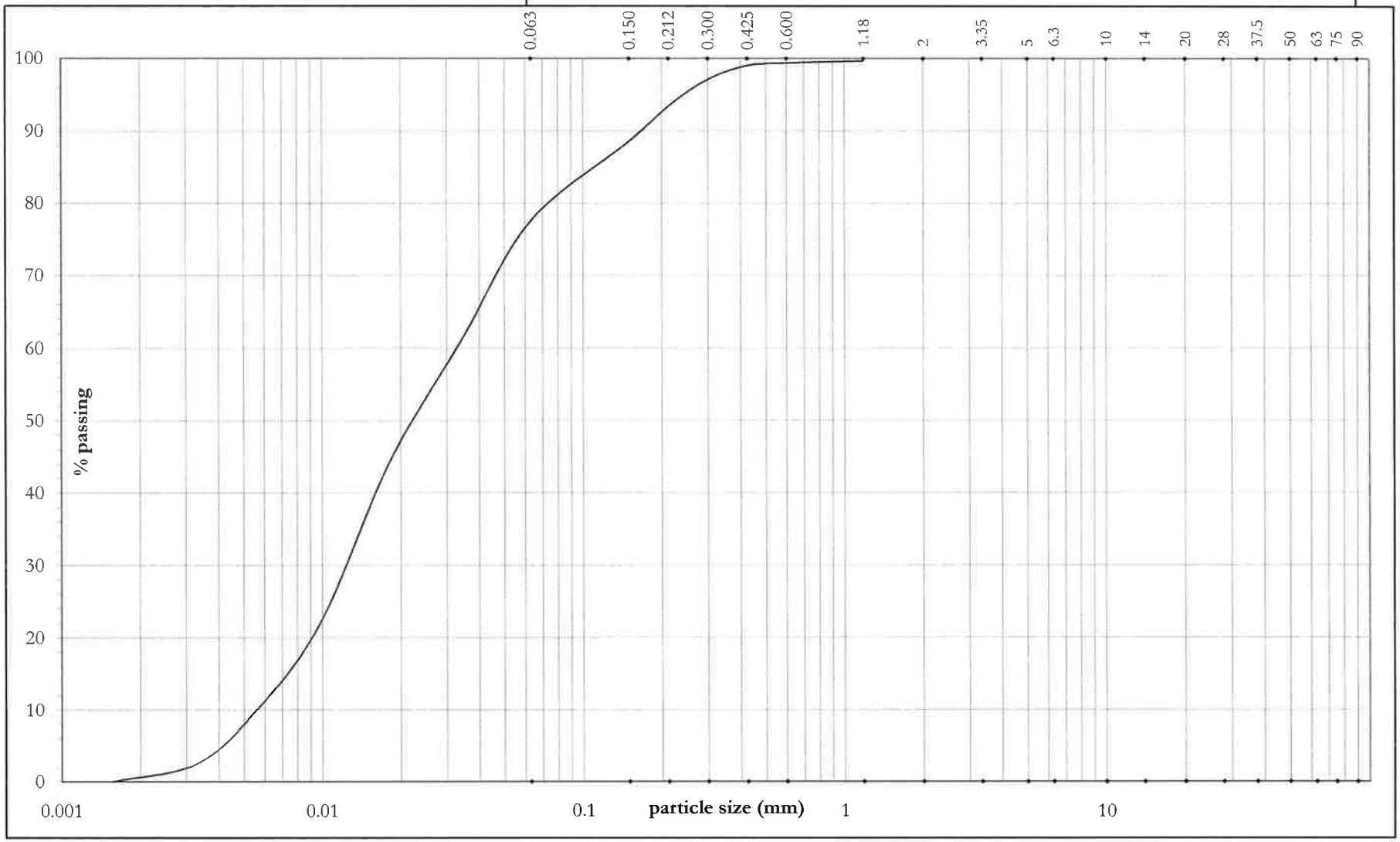
NP non-plastic soil
$ Insufficient material for Limits tests.

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	99
0.425	99
0.3	97
0.212	93
0.15	89
0.063	78
0.0347	61.6
0.0181	44.3
0.0098	22.2
0.0055	9.9
0.0032	2.5
0.0016	0.0



Clay 0%	Silt 78%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 22%			Gravel 0%			

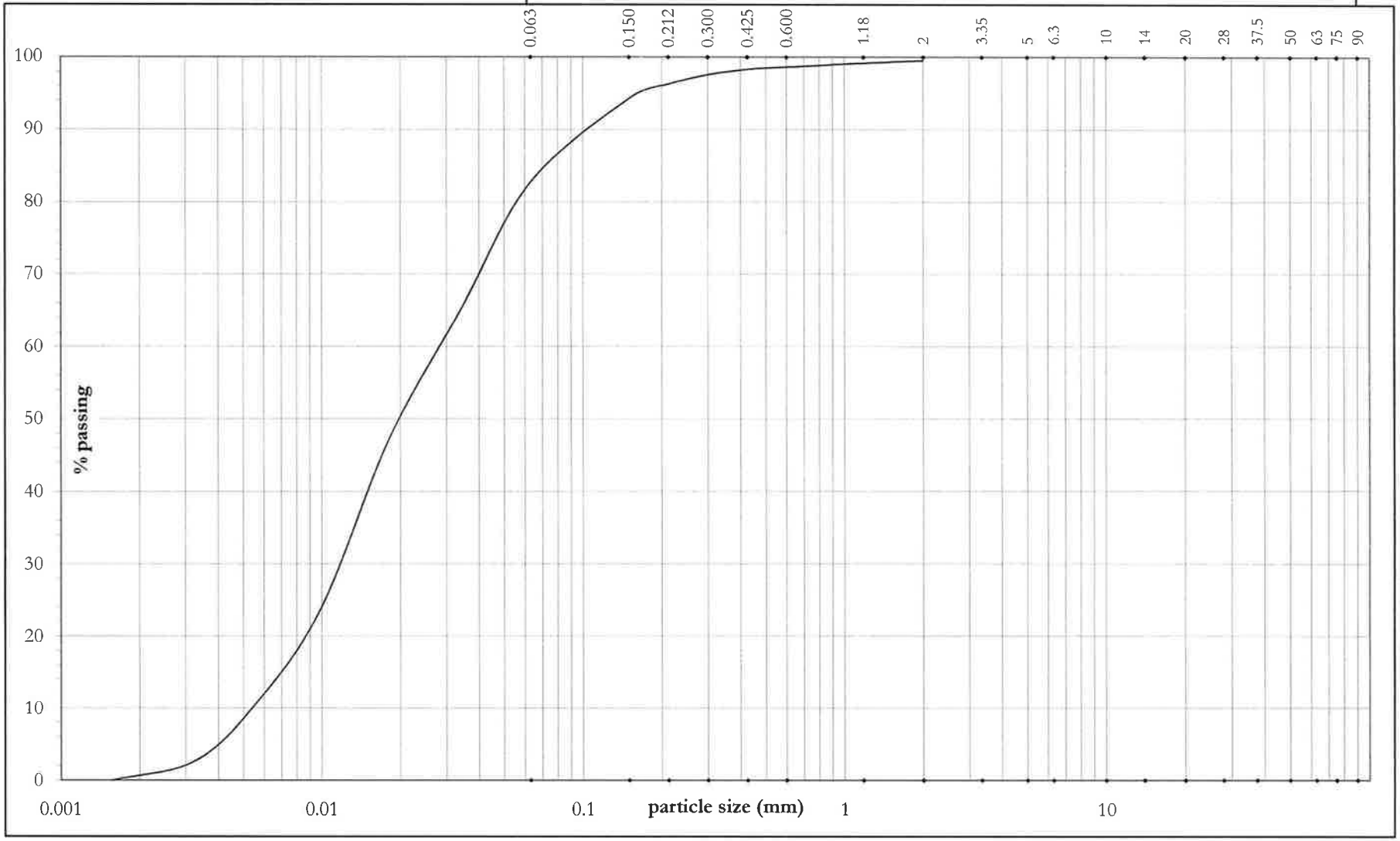
Project:	New Port of Galway	Exploratory Hole No.:	BH01	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			D	1				

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	99
0.6	99
0.425	98
0.3	98
0.212	96
0.15	94
0.063	83
0.0347	65.7
0.0181	47.3
0.0098	23.7
0.0055	10.5
0.0032	2.6
0.0016	0.0



Clay 0%	Silt 83%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 17%			Gravel 0%			

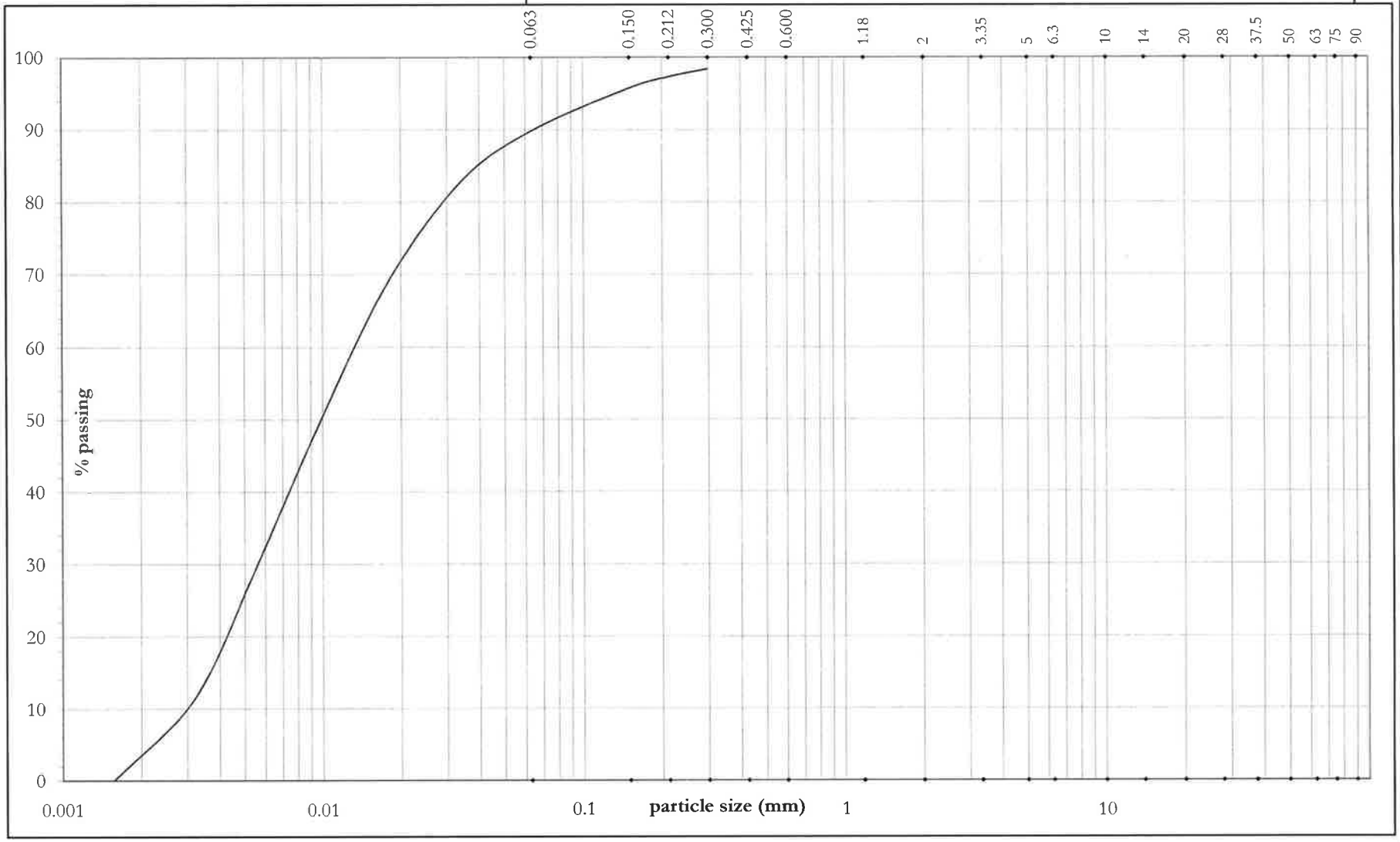
Project:	New Port of Galway	Exploratory Hole No.:	BH01	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			D	3	2.00			

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	99
0.425	99
0.3	98
0.212	97
0.15	96
0.063	90
0.0338	82.7
0.0175	68.5
0.0094	48.5
0.0054	28.5
0.0032	11.4
0.0016	0.0



Clay 2%	Silt 88%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 10%			Gravel 0%			

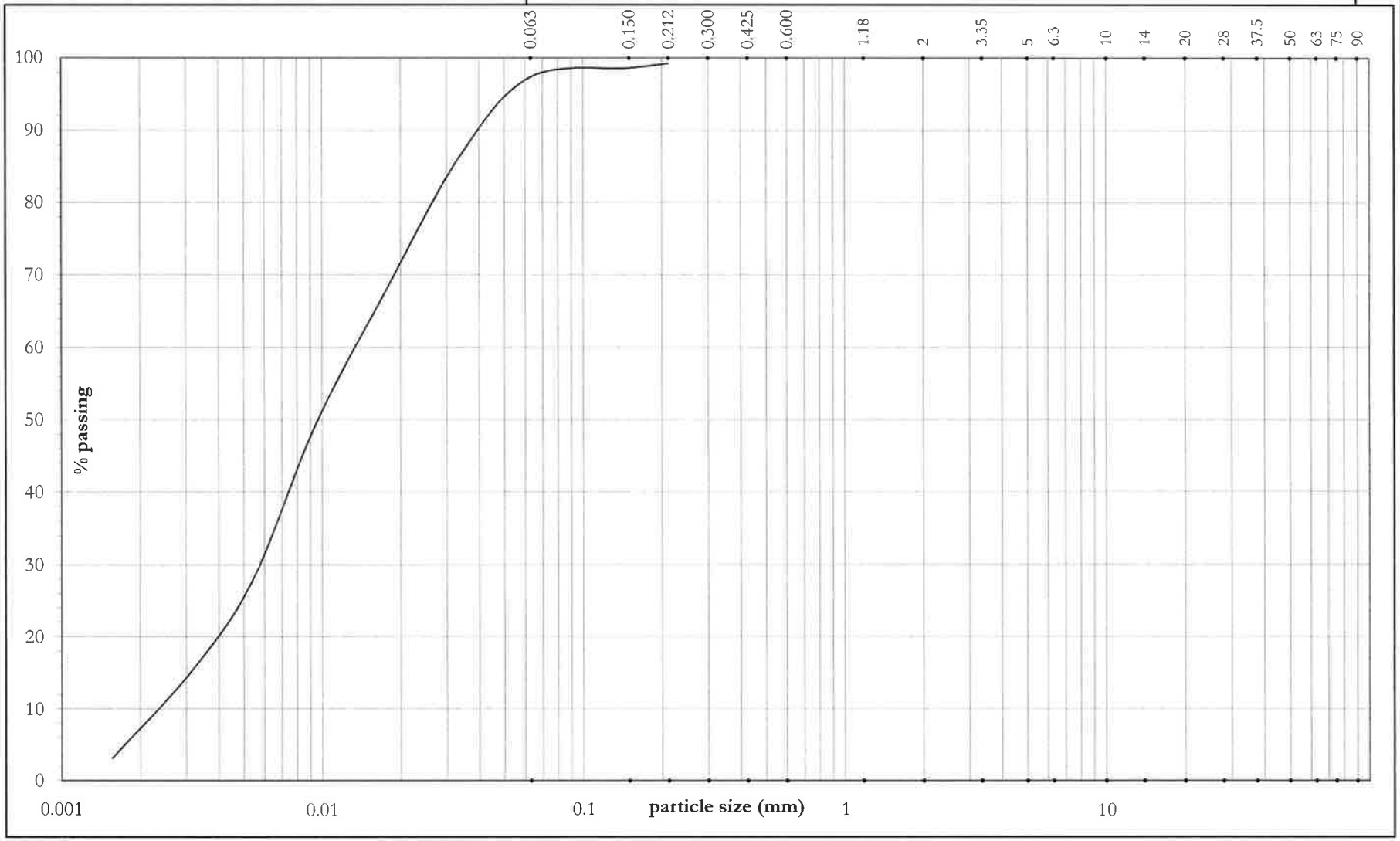
Project:	New Port of Galway	Exploratory Hole No.:	BH01	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			P	5	3.00	3.80		

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	100
0.425	100
0.3	100
0.212	99
0.15	99
0.063	97
0.0341	86.6
0.0177	68.1
0.0095	49.5
0.0054	27.8
0.0032	15.5
0.0016	3.1



Clay 7%	Silt 90%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 3%			Gravel 0%			

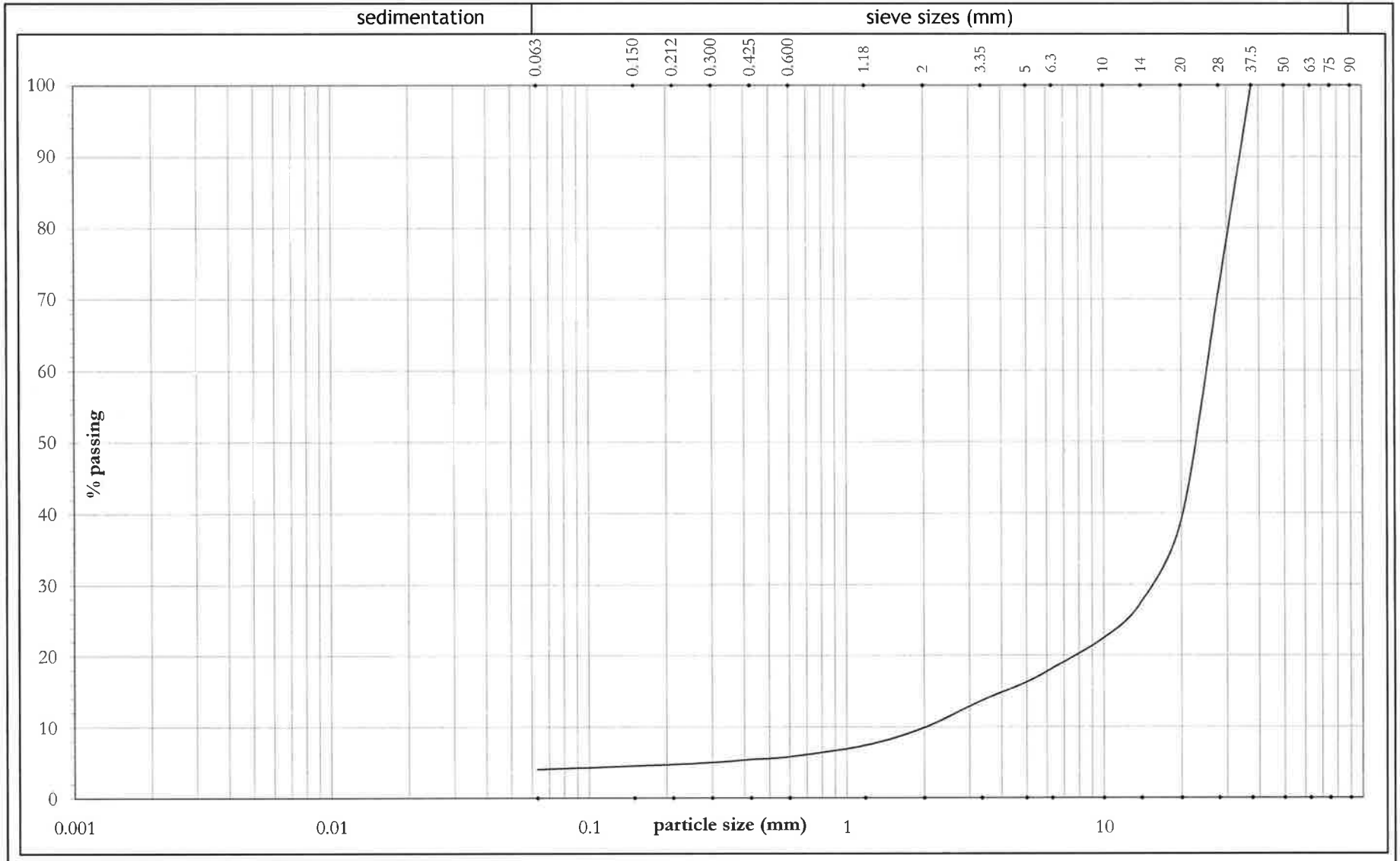
Project:	New Port of Galway	Exploratory Hole No.:	BH01	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			P	7	5.00	5.75		

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	72
20	39
14	28
10	23
6.3	18
5	16
3.35	14
2	10
1.18	7
0.6	6
0.425	5
0.3	5
0.212	5
0.15	5
0.063	4



	Fines 4%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 6%			Gravel 90%			

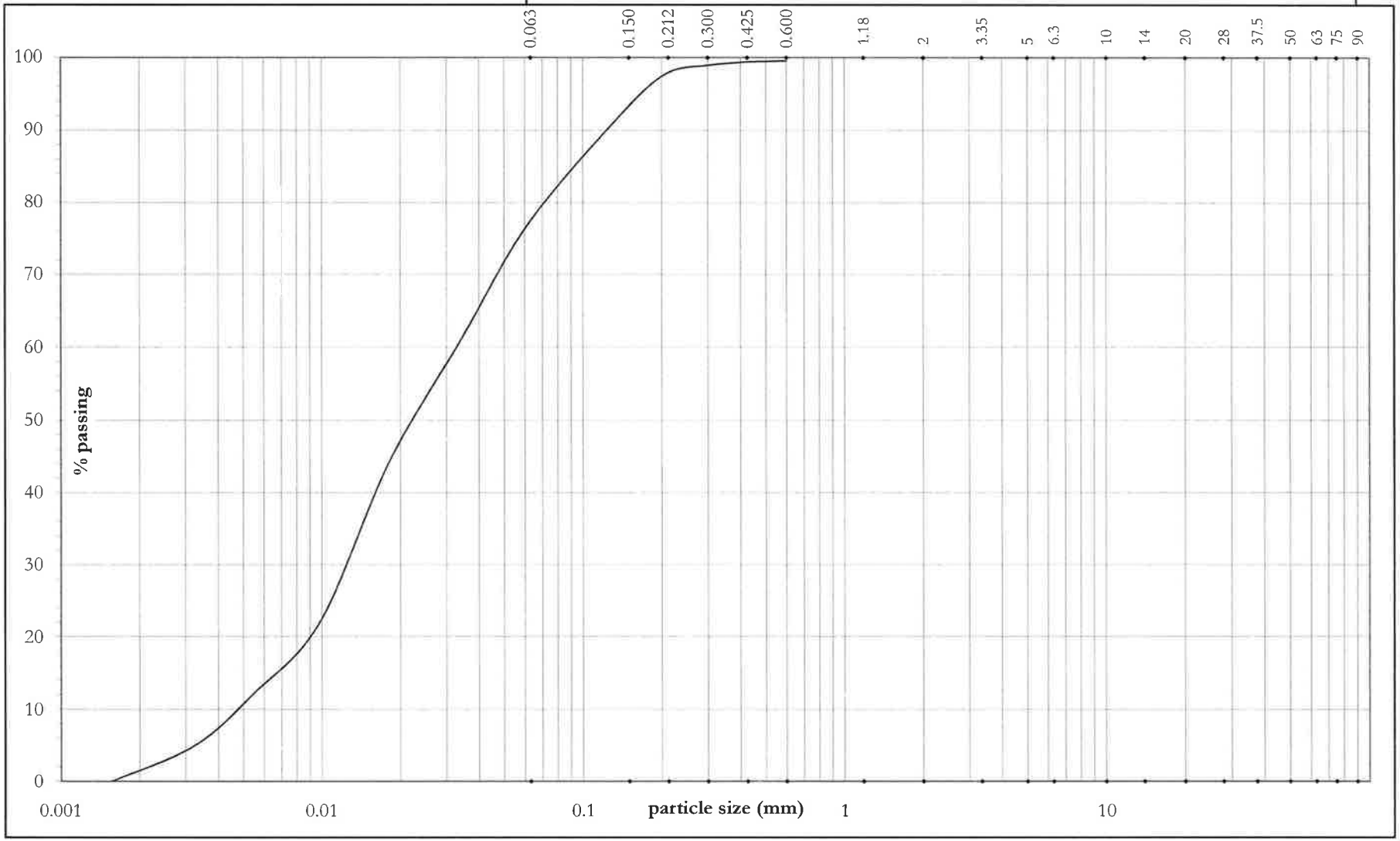
Project:	New Port of Galway	Exploratory Hole No.:	BH01	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			B	9	7.00			

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	100
0.425	99
0.3	99
0.212	98
0.15	93
0.063	77
0.0347	61.5
0.0181	44.3
0.0098	22.2
0.0055	12.3
0.0032	4.9
0.0016	0.0



Clay 1%	Silt 76%	fine	medium	coarse	fine	medium	coarse	Cobbles
		Sand 22%			Gravel 0%			0%

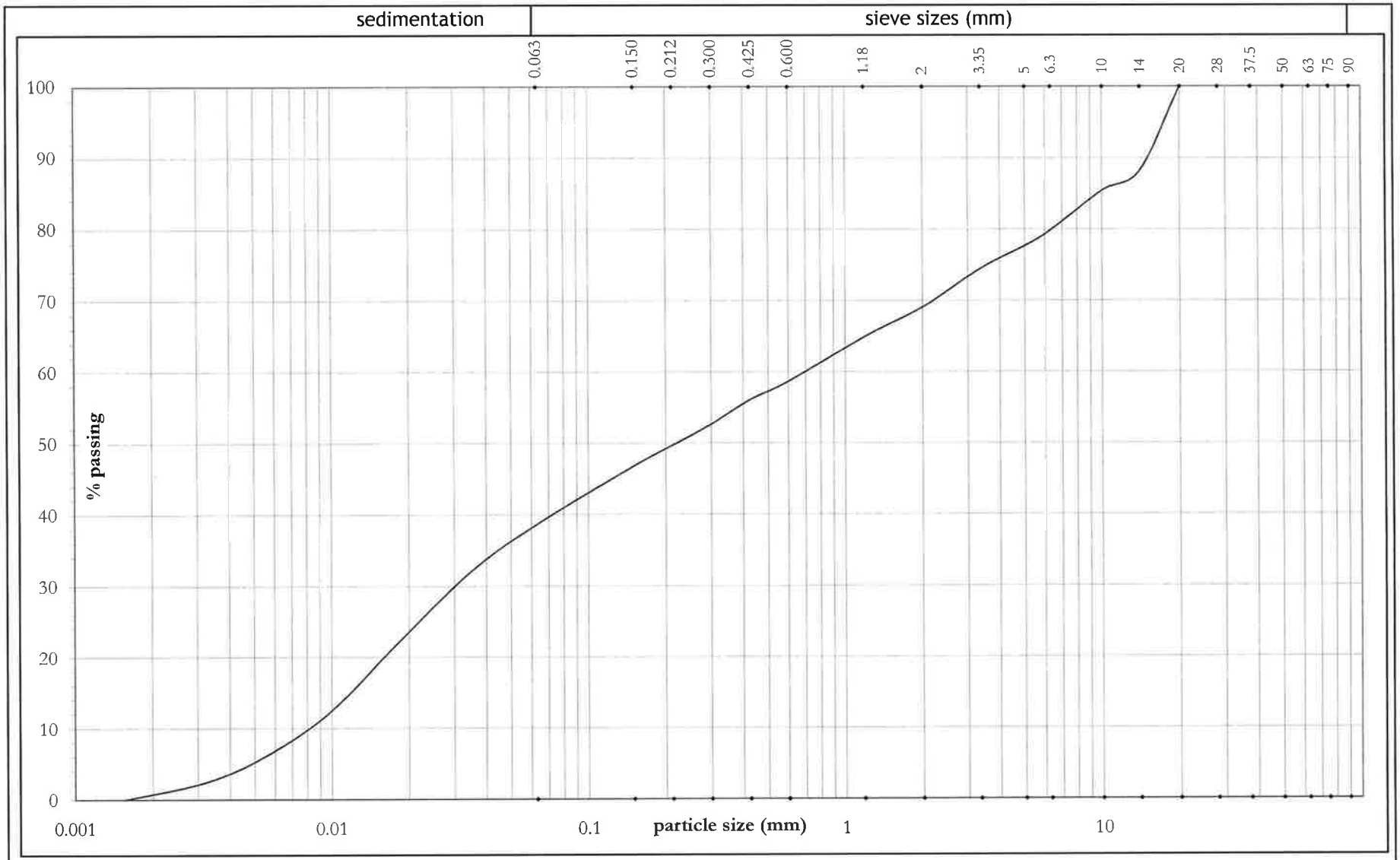
Project:	New Port of Galway	Exploratory Hole No.:	BH02	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			D	2	1.00			

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	88
10	85
6.3	80
5	78
3.35	74
2	69
1.18	65
0.6	59
0.425	56
0.3	53
0.212	50
0.15	47
0.063	39
0.0345	31.9
0.0181	22.1
0.0098	12.3
0.0055	6.1
0.0032	2.5
0.0016	0.0



Clay 1%	Silt 38%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 30%			Gravel 31%			

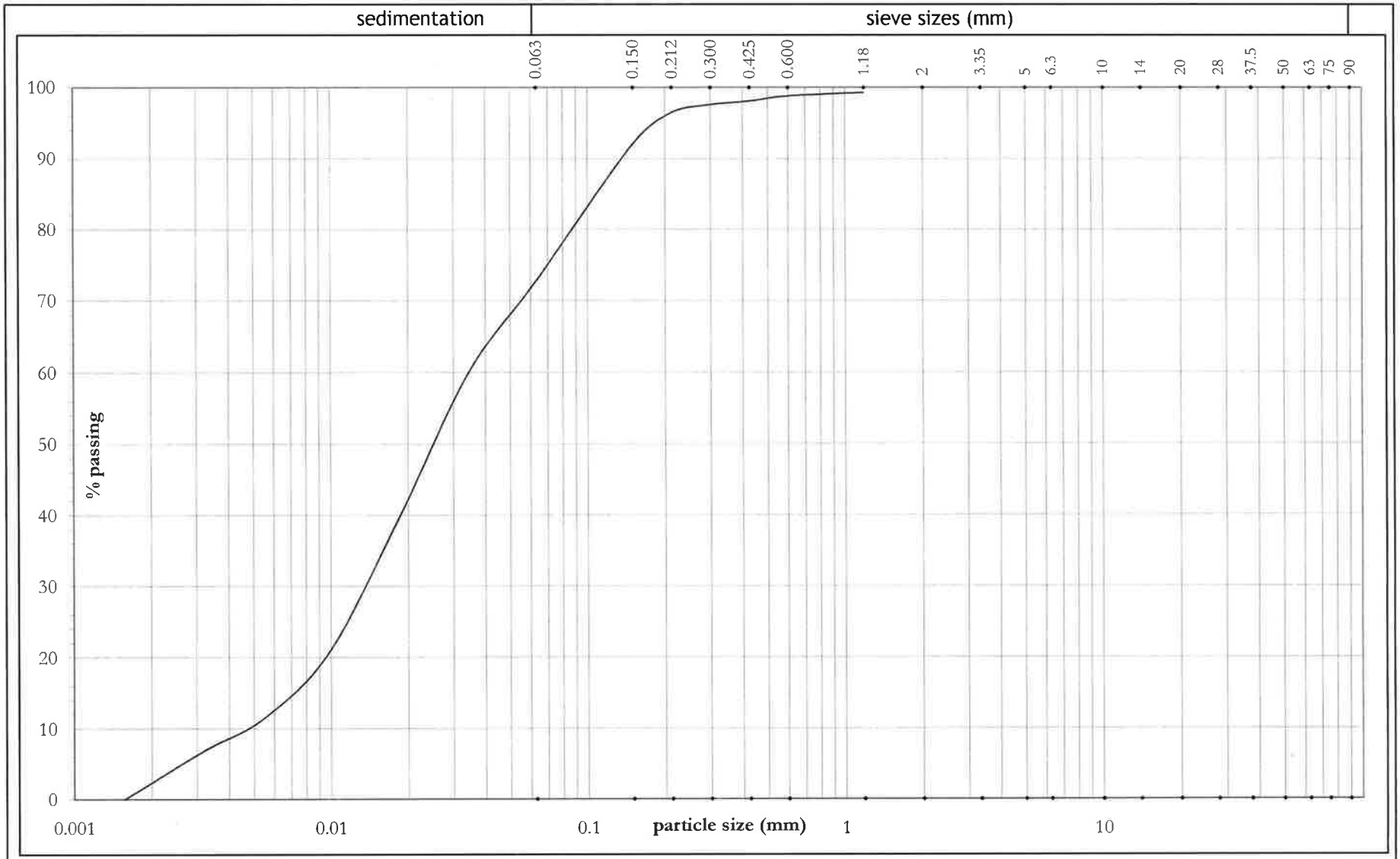
Project:	New Port of Galway	Exploratory Hole No.:	BH02	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			D	2	2.50			

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	99
0.6	99
0.425	98
0.3	98
0.212	96
0.15	92
0.063	73
0.0345	60.1
0.0182	39.3
0.0098	20.8
0.0055	11.6
0.0032	6.9
0.0016	0.0



Clay 2%	Silt 71%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 27%			Gravel 0%			

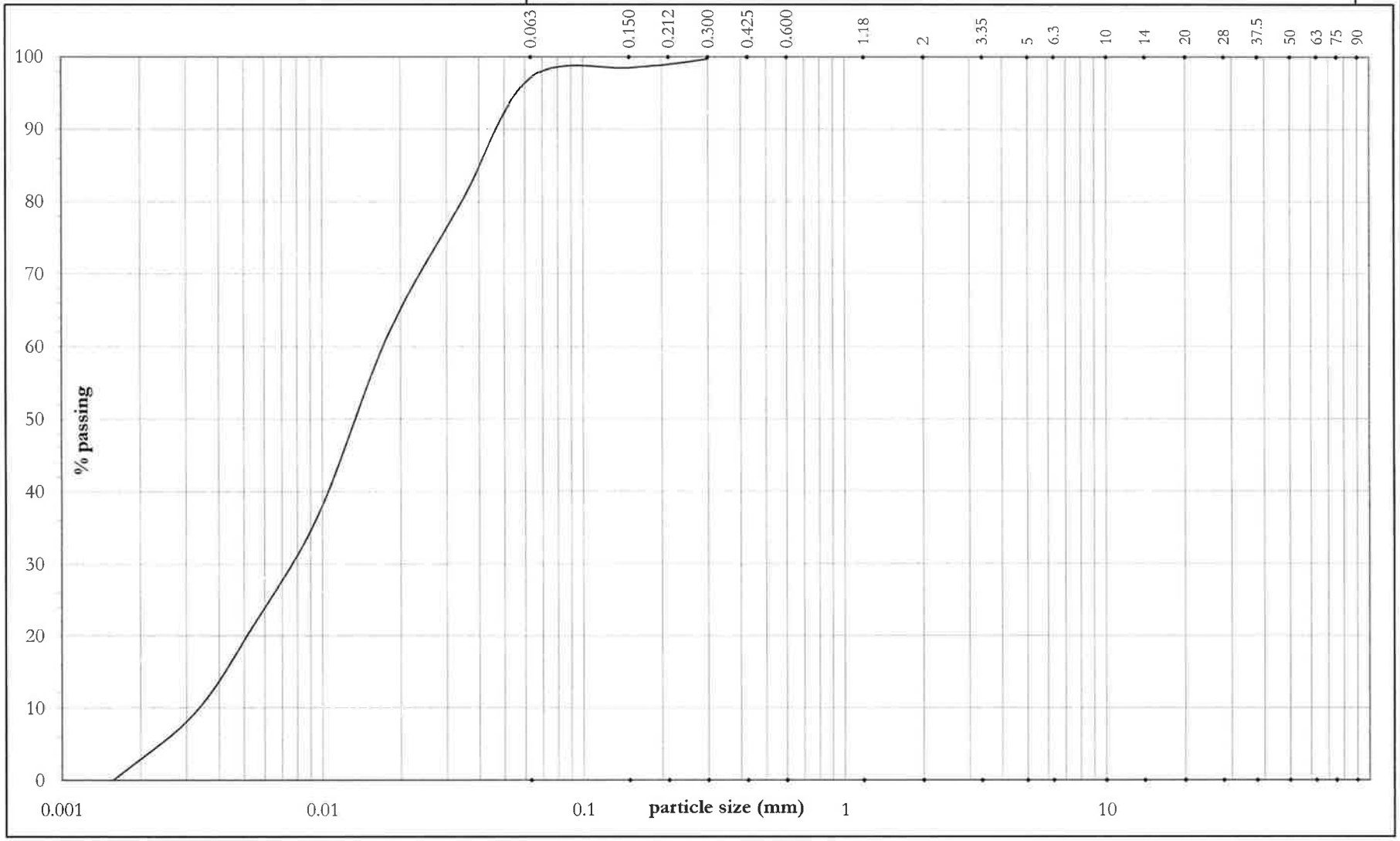
Project:	New Port of Galway	Exploratory Hole No.:	BH03	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			D	3	2.00			

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	100
0.425	100
0.3	100
0.212	99
0.15	98
0.063	97
0.0345	80.2
0.0179	61.7
0.0097	37.0
0.0055	21.6
0.0032	9.2
0.0016	0.0



Clay 3%	Silt 94%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 3%			Gravel 0%			

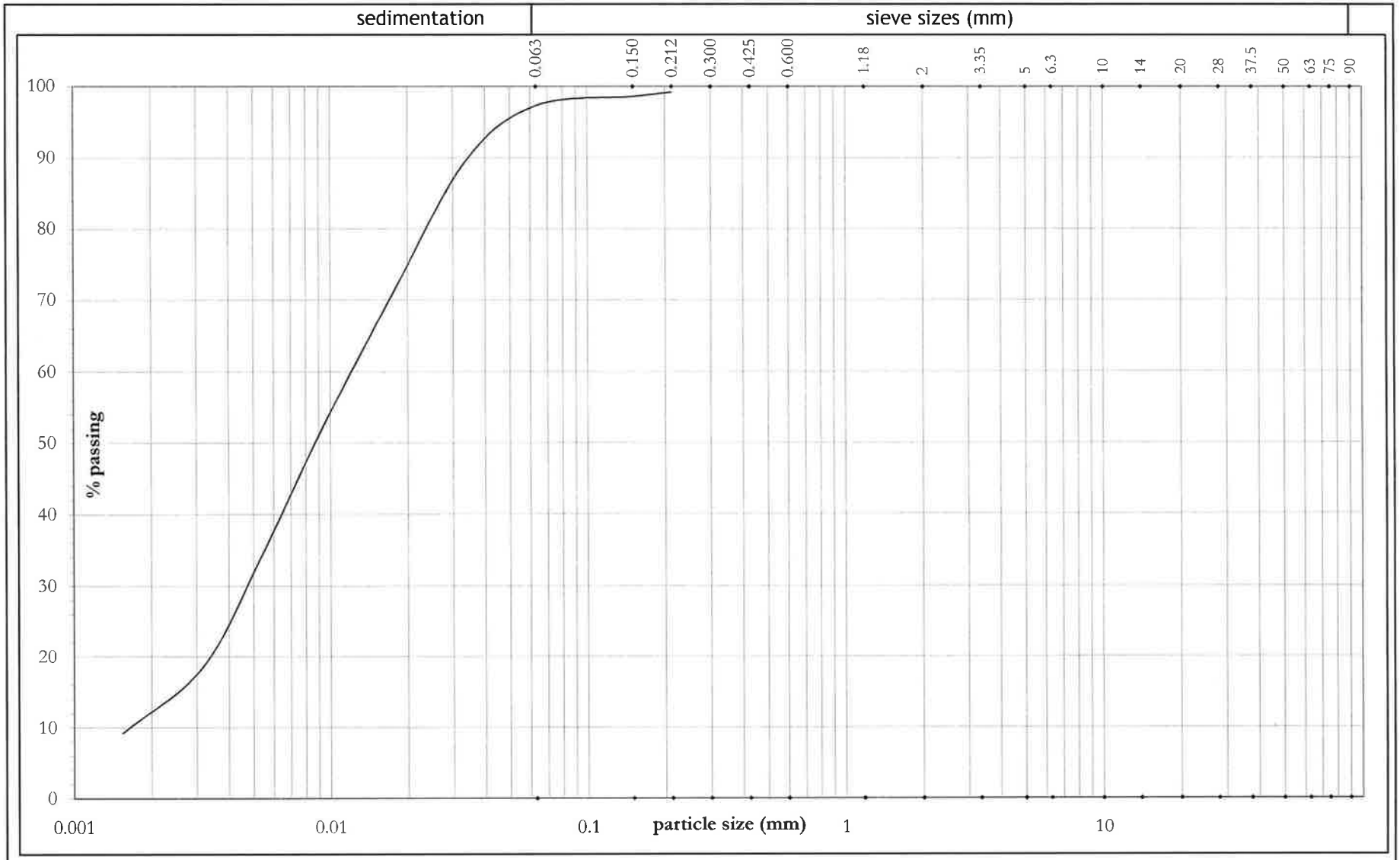
Project:	New Port of Galway	Exploratory Hole No.:	BH03	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			P	6	4.00	4.60		

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	100
0.425	100
0.3	99
0.212	99
0.15	99
0.063	97
0.0338	89.6
0.0176	71.1
0.0094	52.5
0.0053	34.0
0.0032	18.5
0.0015	9.3



Clay 13%	Silt 84%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 3%			Gravel 0%			

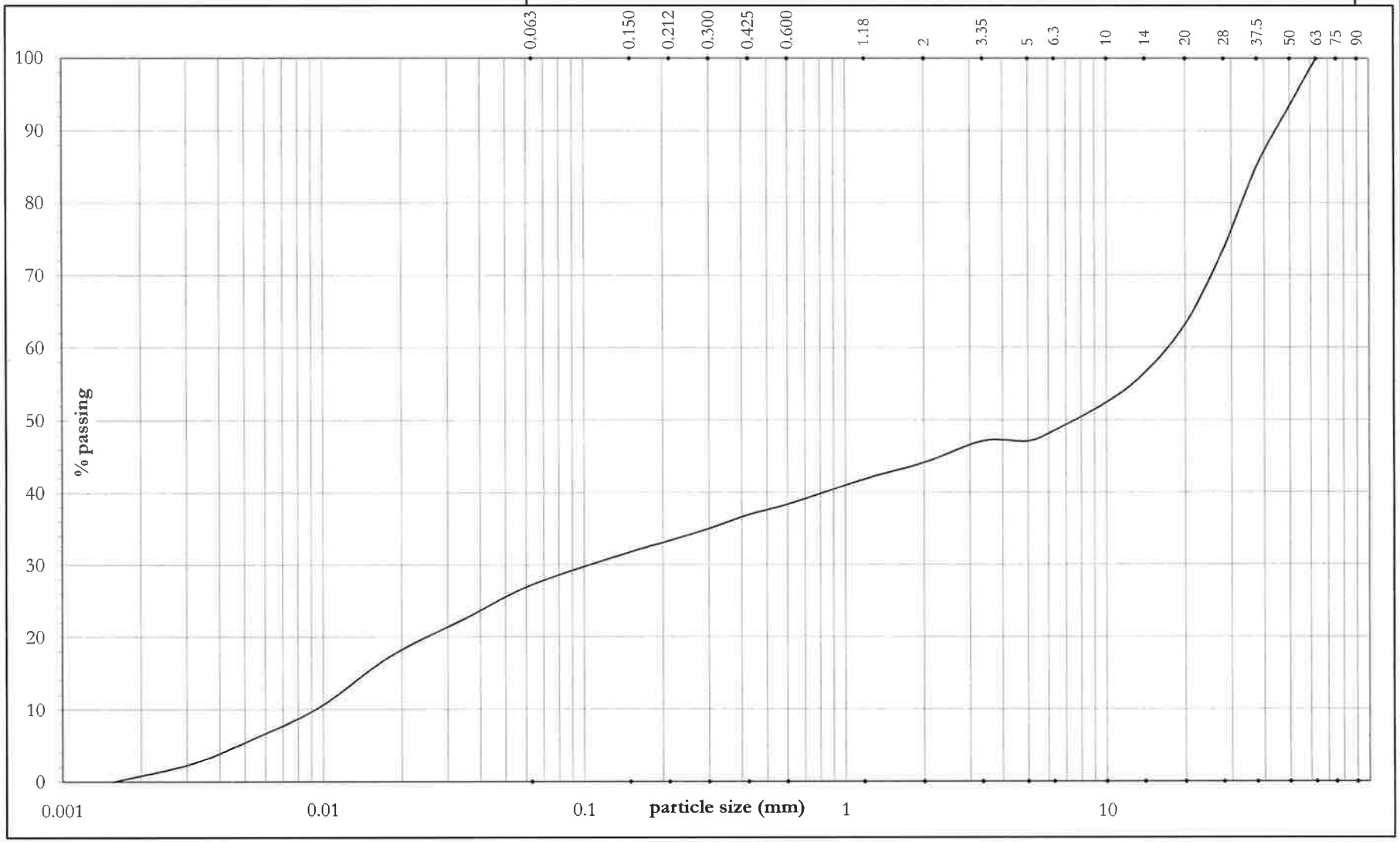
Project:	New Port of Galway	Exploratory Hole No.:	BH03	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			P	9	6.00	6.60		

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	93
37.5	85
28	74
20	63
14	56
10	52
6.3	49
5	47
3.35	47
2	44
1.18	42
0.6	38
0.425	37
0.3	35
0.212	33
0.15	32
0.063	27
0.0345	22.5
0.0179	17.3
0.0097	10.4
0.0055	6.1
0.0032	2.6
0.0016	0.0



Clay 1%	Silt 26%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 17%			Gravel 56%			

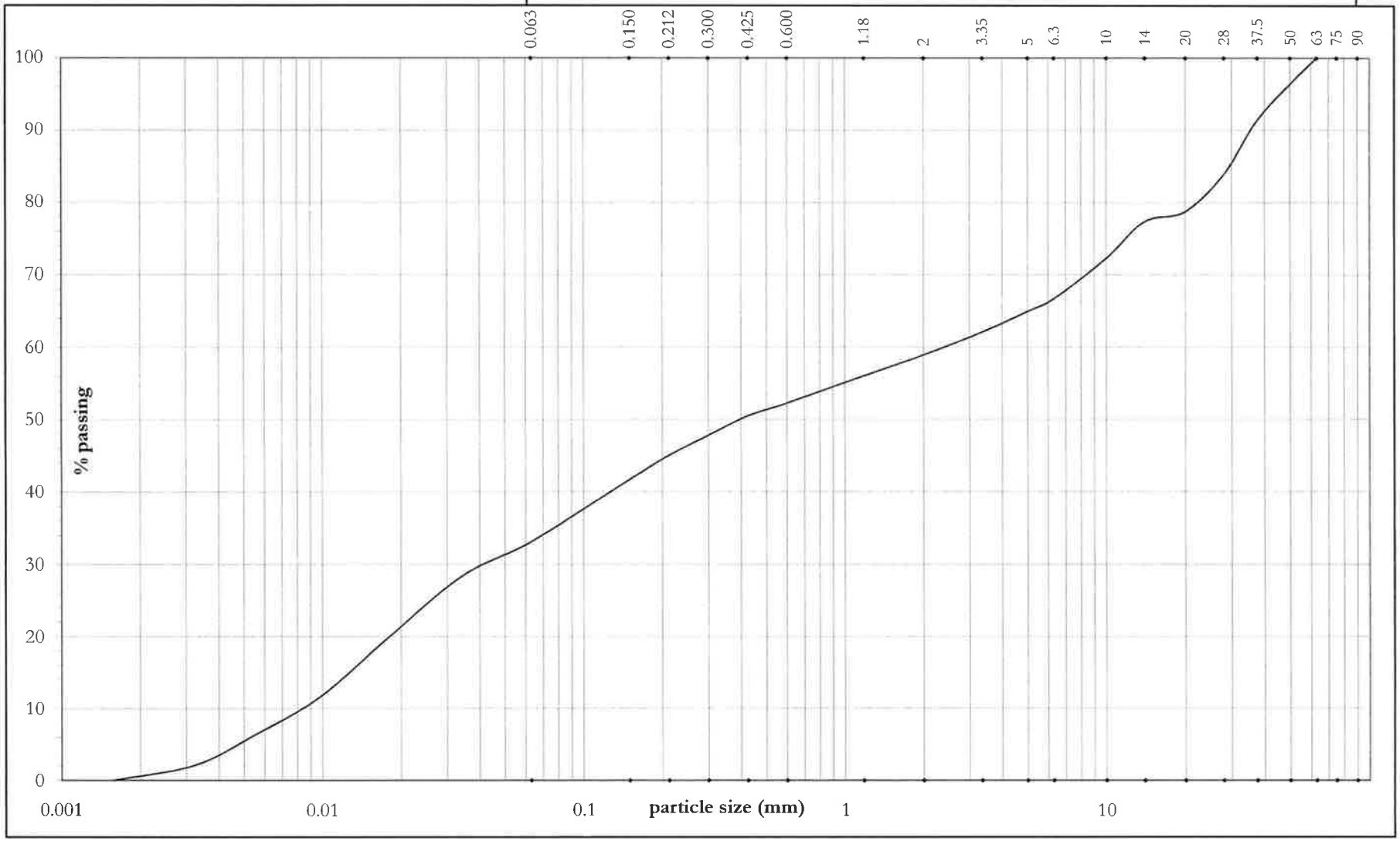
Project:	New Port of Galway	Exploratory Hole No.:	BH03	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			B	10	7.00			

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	96
37.5	91
28	84
20	79
14	77
10	72
6.3	67
5	65
3.35	62
2	59
1.18	56
0.6	52
0.425	50
0.3	48
0.212	45
0.15	42
0.063	33
0.0343	28.4
0.0180	20.0
0.0097	11.6
0.0055	6.3
0.0032	2.1
0.0016	0.0



Clay 1%	Silt 32%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 26%			Gravel 41%			

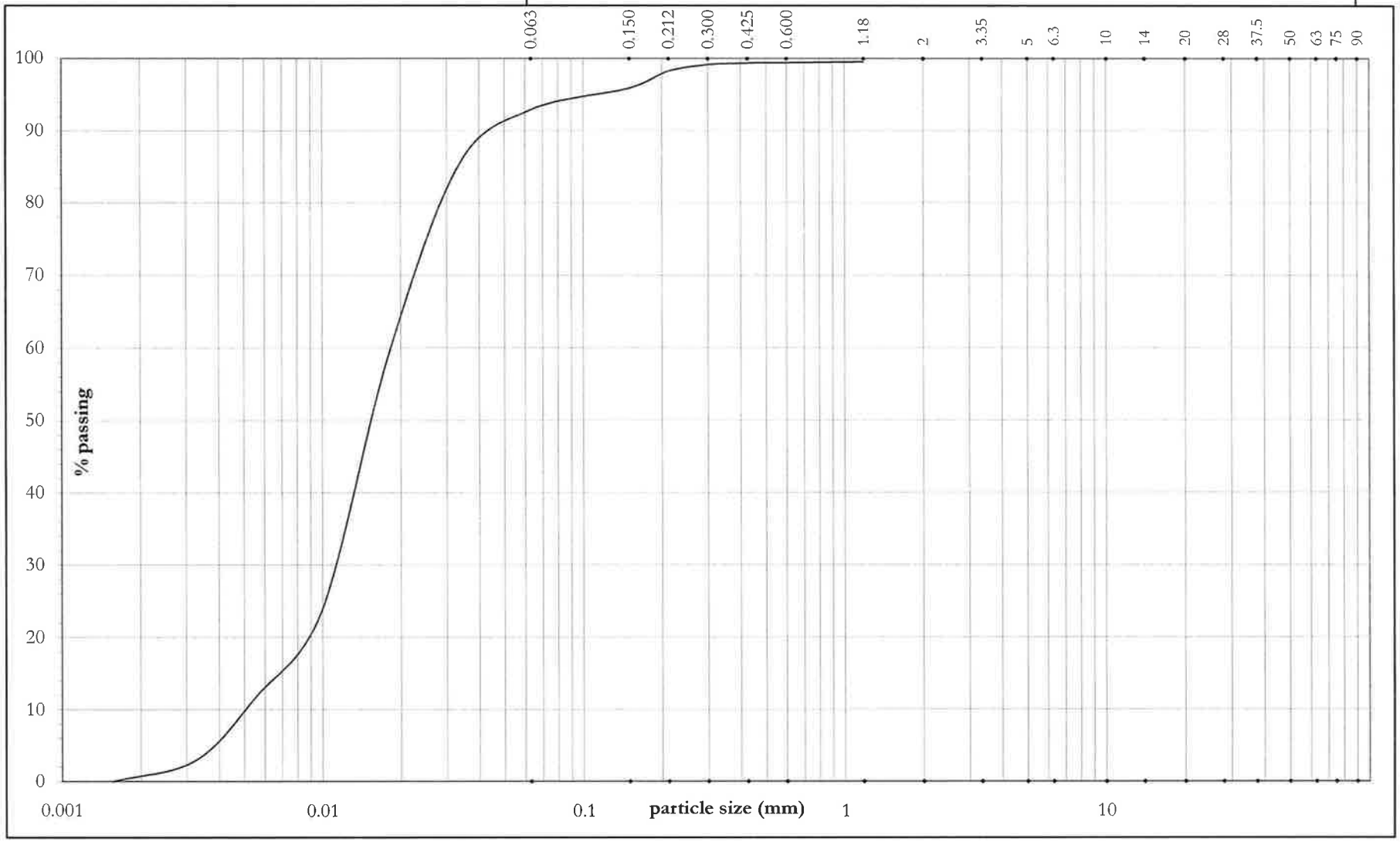
Project:	New Port of Galway	Exploratory Hole No.:	BH03	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			B	11	8.00			

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	99
0.425	99
0.3	99
0.212	98
0.15	96
0.063	93
0.0338	85.6
0.0179	59.0
0.0099	23.6
0.0055	11.8
0.0032	3.0
0.0016	0.0



Clay 1%	Silt 92%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 7%			Gravel 0%			

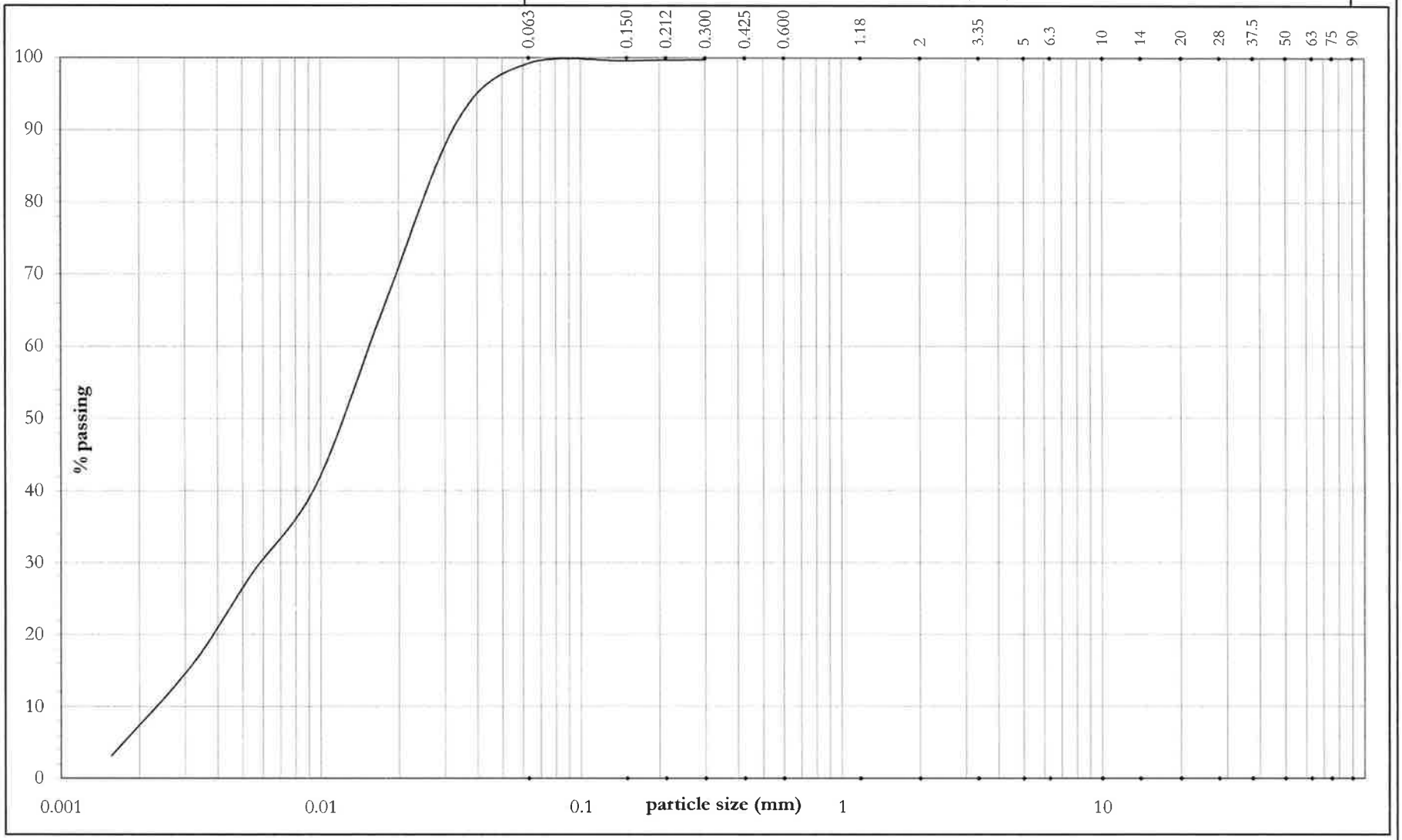
Project:	New Port of Galway	Exploratory Hole No.:	BH04	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			D	1	0.00			

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	100
0.425	100
0.3	100
0.212	100
0.15	100
0.063	99
0.0338	91.4
0.0178	66.2
0.0096	41.0
0.0054	28.4
0.0032	15.8
0.0016	3.2



Clay 6%	Silt 93%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 1%			Gravel 0%			

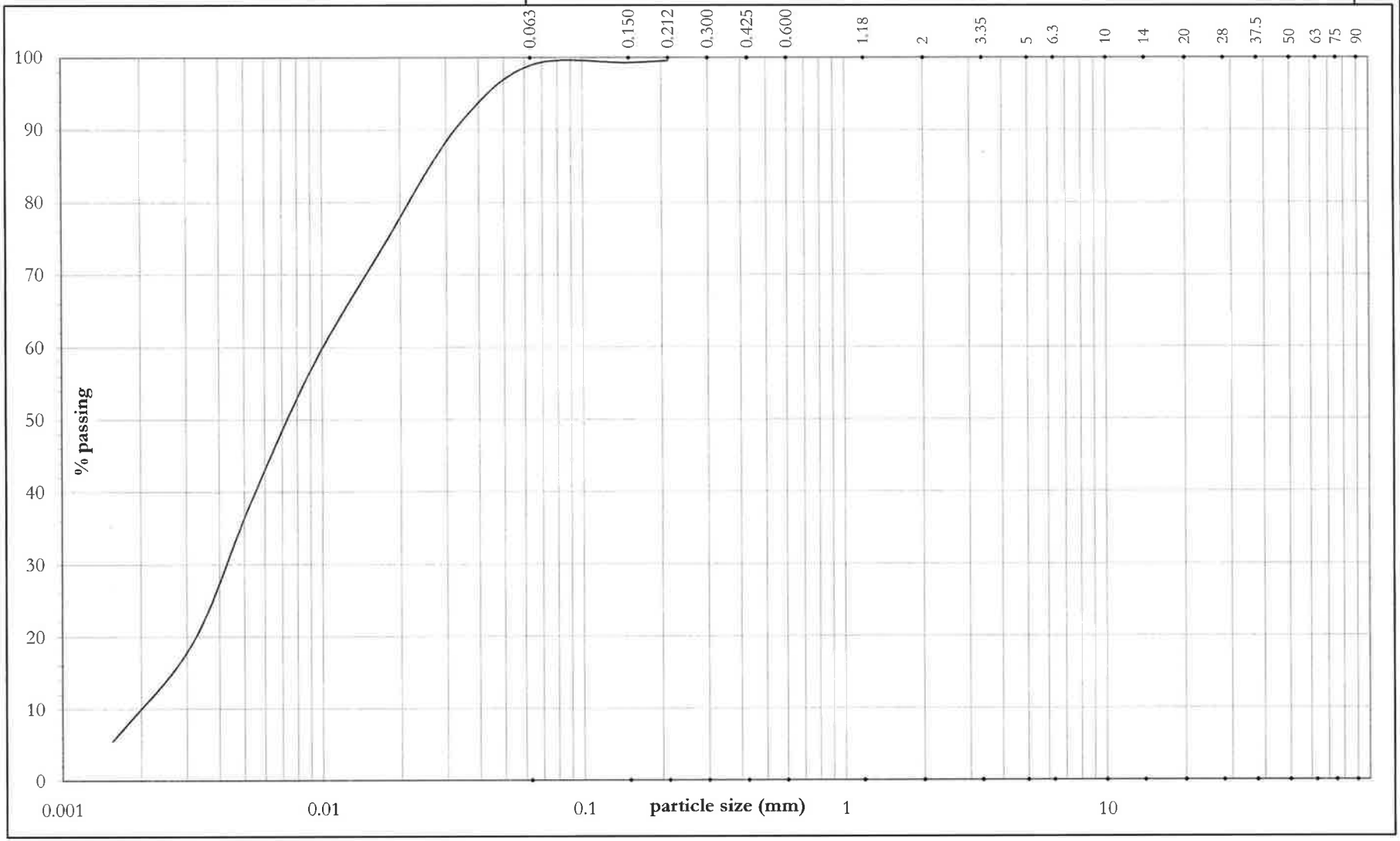
Project:	New Port of Galway	Exploratory Hole No.:	BH04	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			B	5	3.00			

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	100
0.425	100
0.3	100
0.212	100
0.15	99
0.063	99
0.0329	90.3
0.0171	73.9
0.0092	57.5
0.0052	38.3
0.0031	19.2
0.0016	5.5



Clay 10%	Silt 89%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 1%			Gravel 0%			

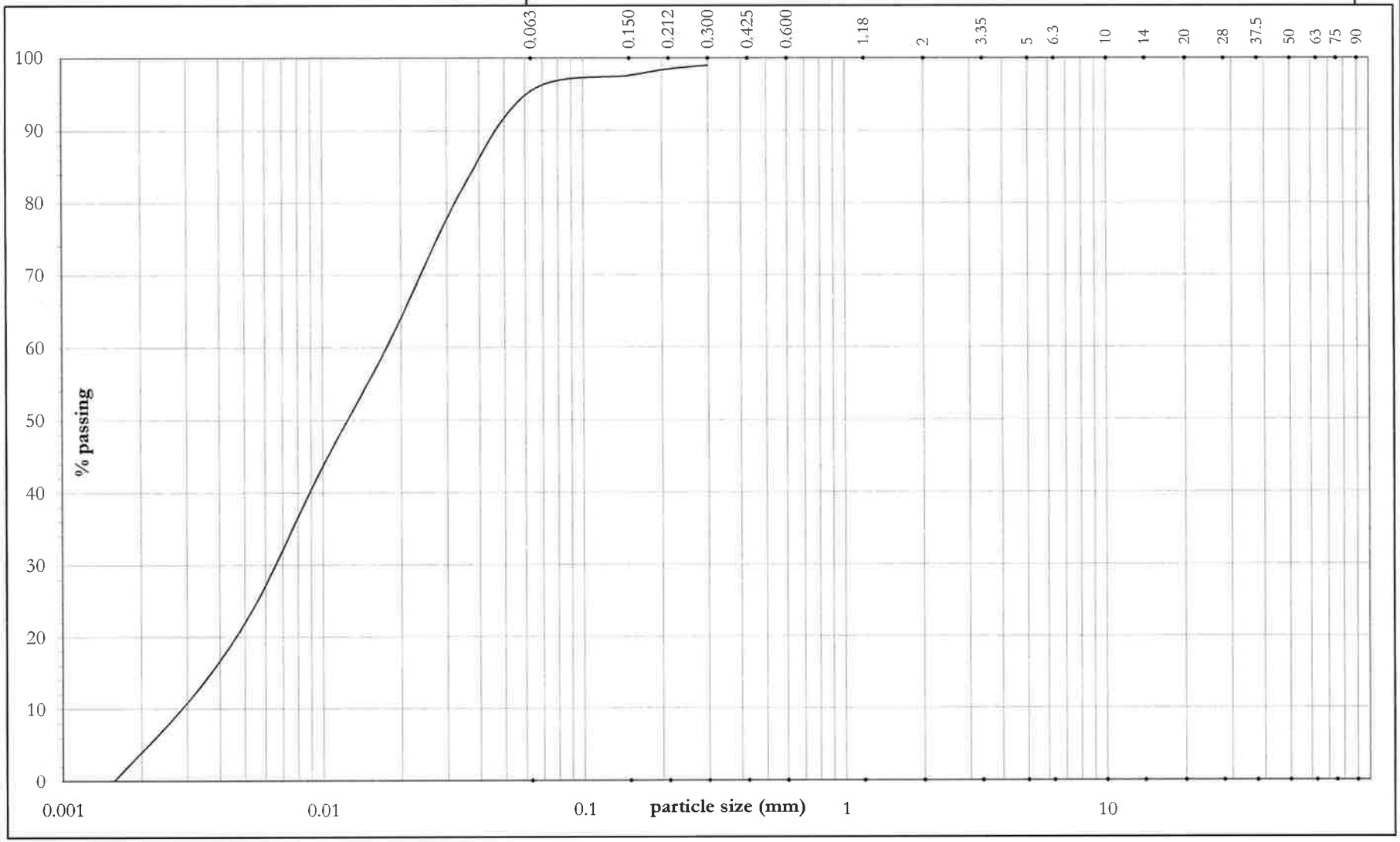
Project:	New Port of Galway	Exploratory Hole No.:	BH04	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			P7	8	5.00	5.90		

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	99
0.425	99
0.3	99
0.212	99
0.15	98
0.063	95
0.0343	81.9
0.0179	60.6
0.0096	42.4
0.0054	24.3
0.0032	12.1
0.0016	0.0



Clay 4%	Silt 91%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 4%			Gravel 0%			

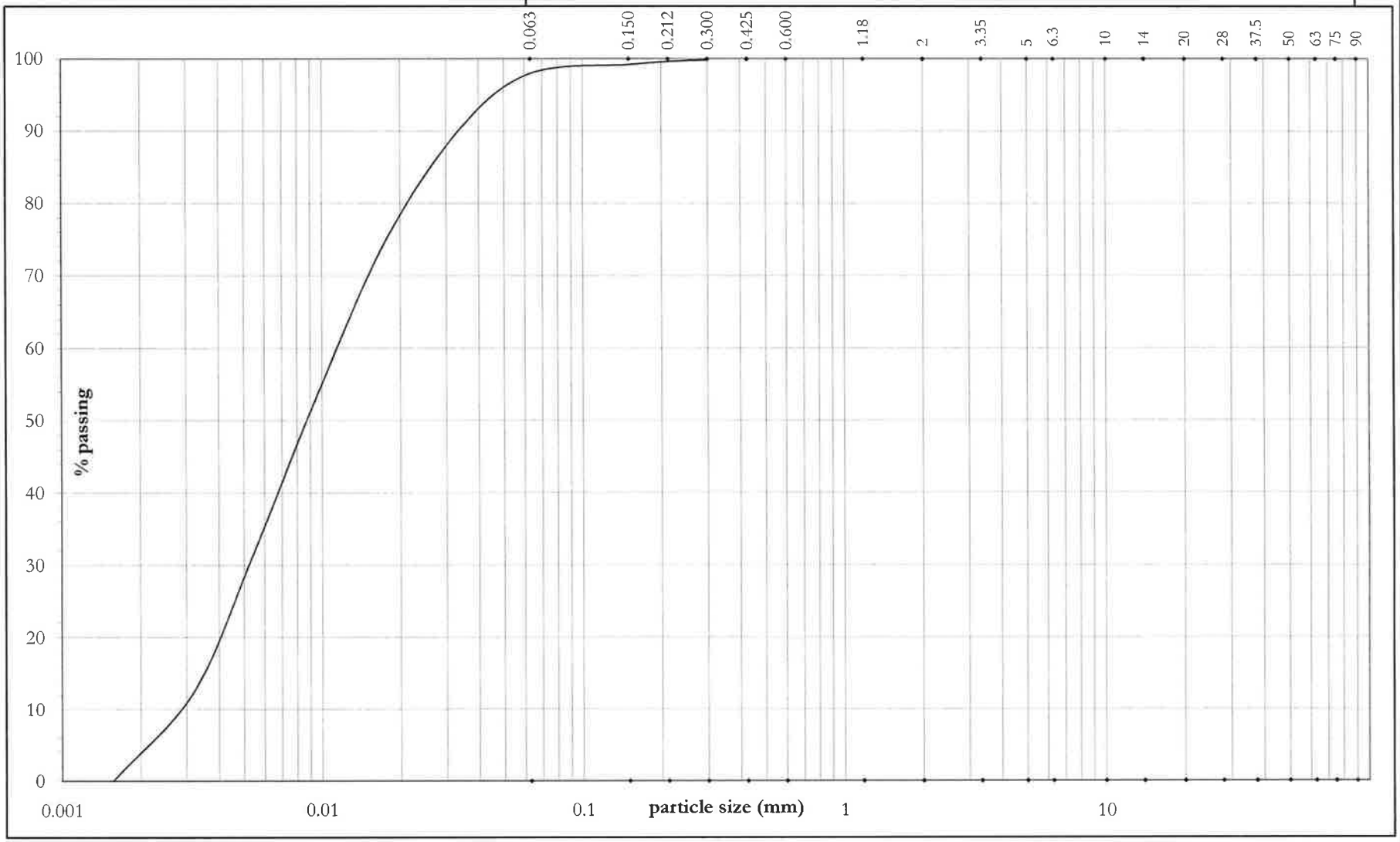
Project:	New Port of Galway	Exploratory Hole No.:	BH04	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			D	9	6.00			

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	100
0.425	100
0.3	100
0.212	100
0.15	99
0.063	98
0.0338	90.2
0.0175	74.7
0.0094	52.9
0.0054	31.1
0.0032	12.4
0.0016	0.0



Clay 4%	Silt 94%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 2%			Gravel 0%			

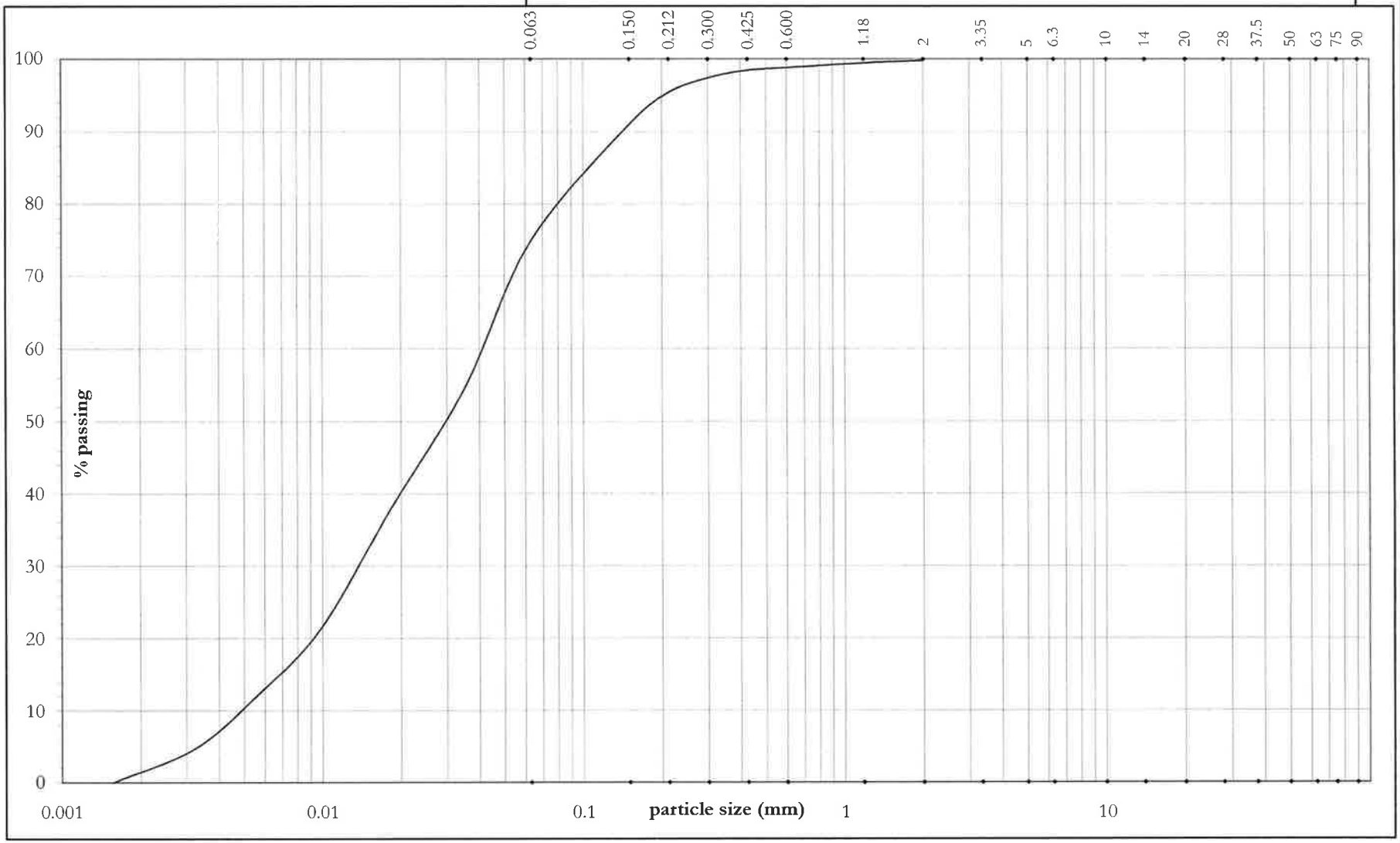
Project:	New Port of Galway	Exploratory Hole No.:	BH04	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			D	14	11.00			

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	99
0.6	99
0.425	98
0.3	97
0.212	95
0.15	91
0.063	75
0.0352	54.7
0.0183	38.1
0.0098	21.4
0.0055	11.9
0.0032	4.8
0.0016	0.0



Clay 2%	Silt 73%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 25%			Gravel 0%			

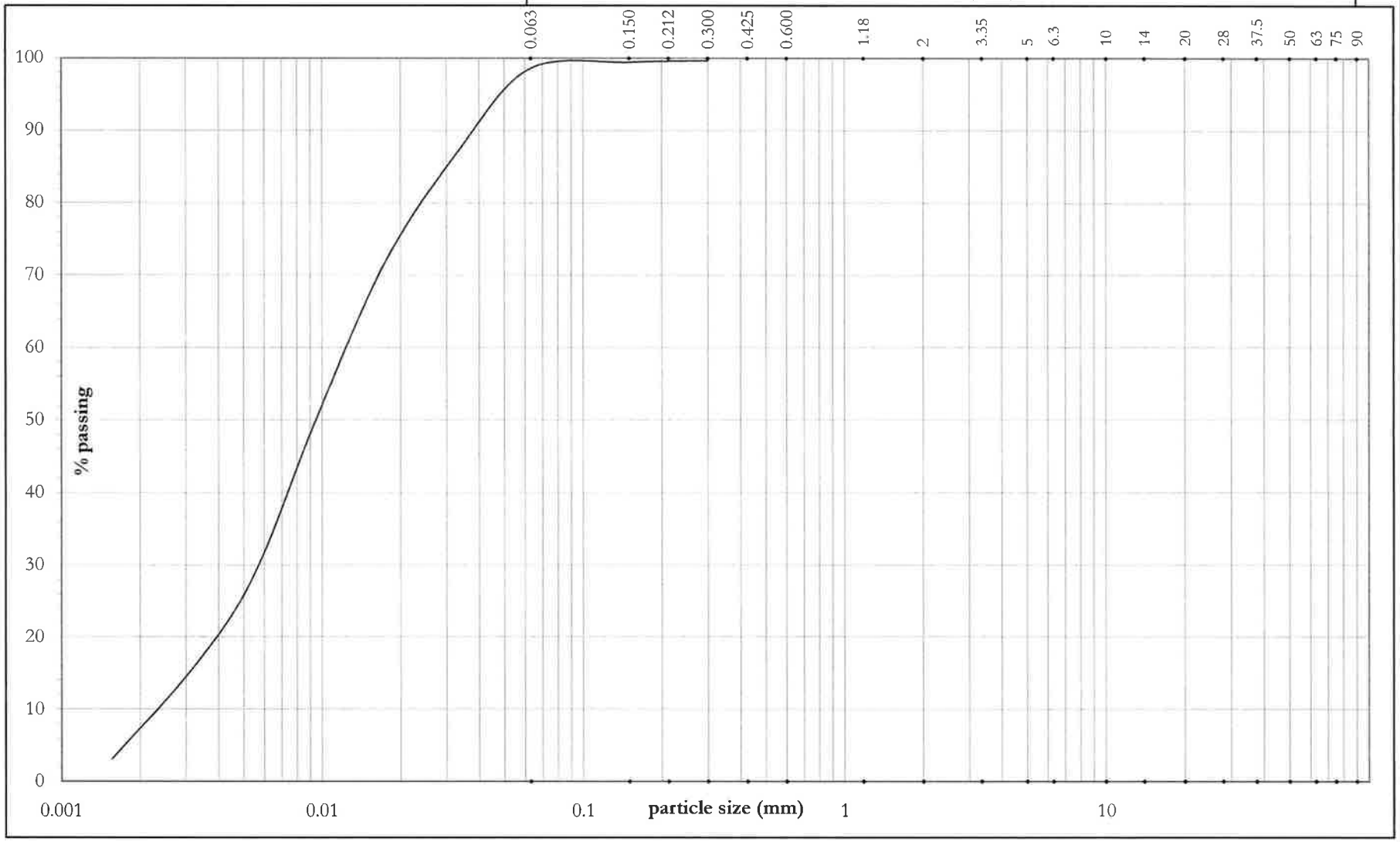
Project:	New Port of Galway	Exploratory Hole No.:	BH05	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			D	3	2.00			

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	100
0.425	100
0.3	100
0.212	100
0.15	99
0.063	99
0.0341	87.7
0.0176	72.0
0.0095	50.1
0.0054	28.2
0.0032	15.7
0.0016	3.1



Clay 7%	Silt 92%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 1%			Gravel 0%			

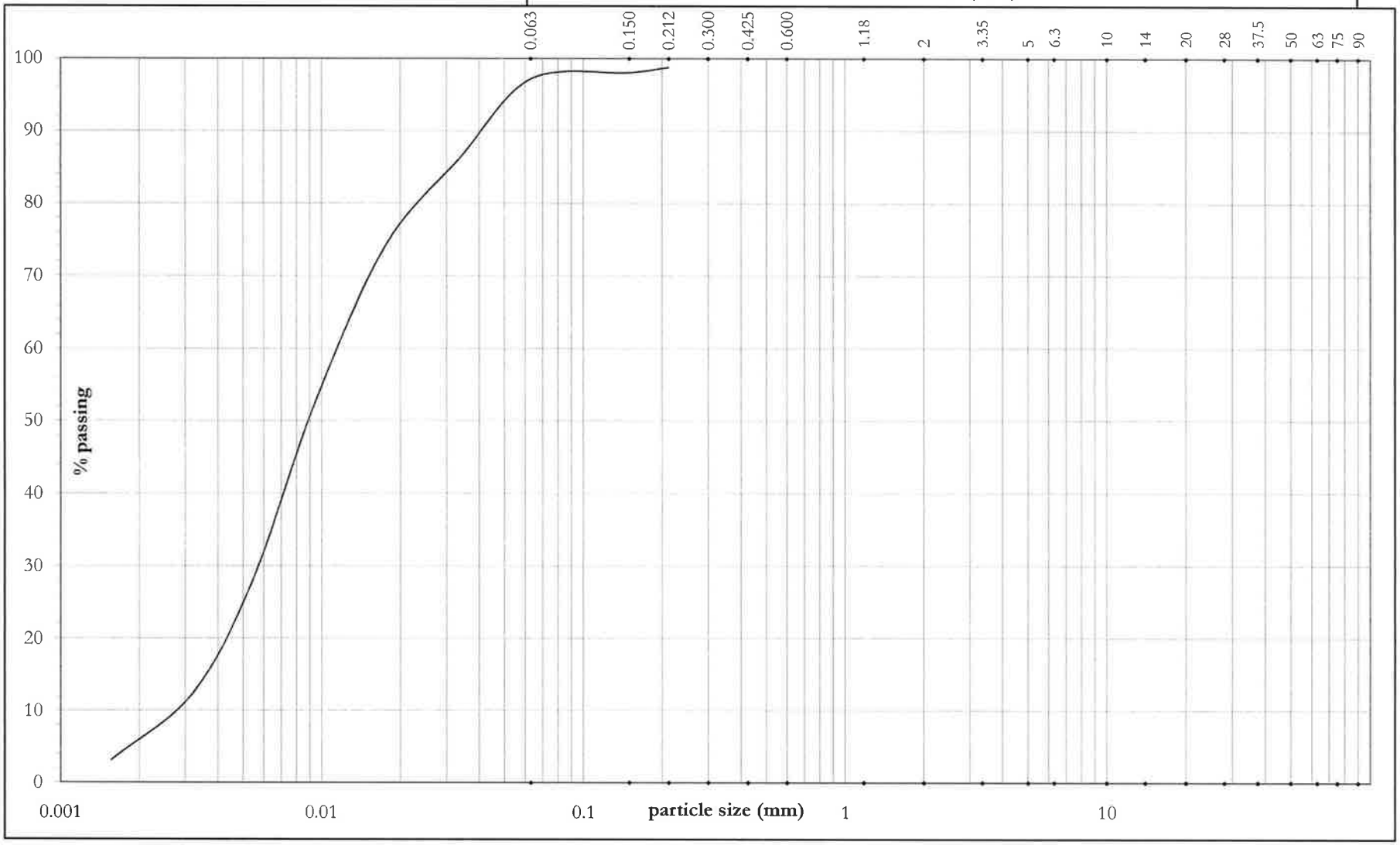
Project:	New Port of Galway	Exploratory Hole No.:	BH05	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			P	5	3.00	3.90		

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	100
0.425	99
0.3	99
0.212	99
0.15	98
0.063	97
0.0341	86.4
0.0175	74.1
0.0094	52.5
0.0054	27.8
0.0032	12.3
0.0016	3.1



Clay 6%	Silt 91%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 3%			Gravel 0%			

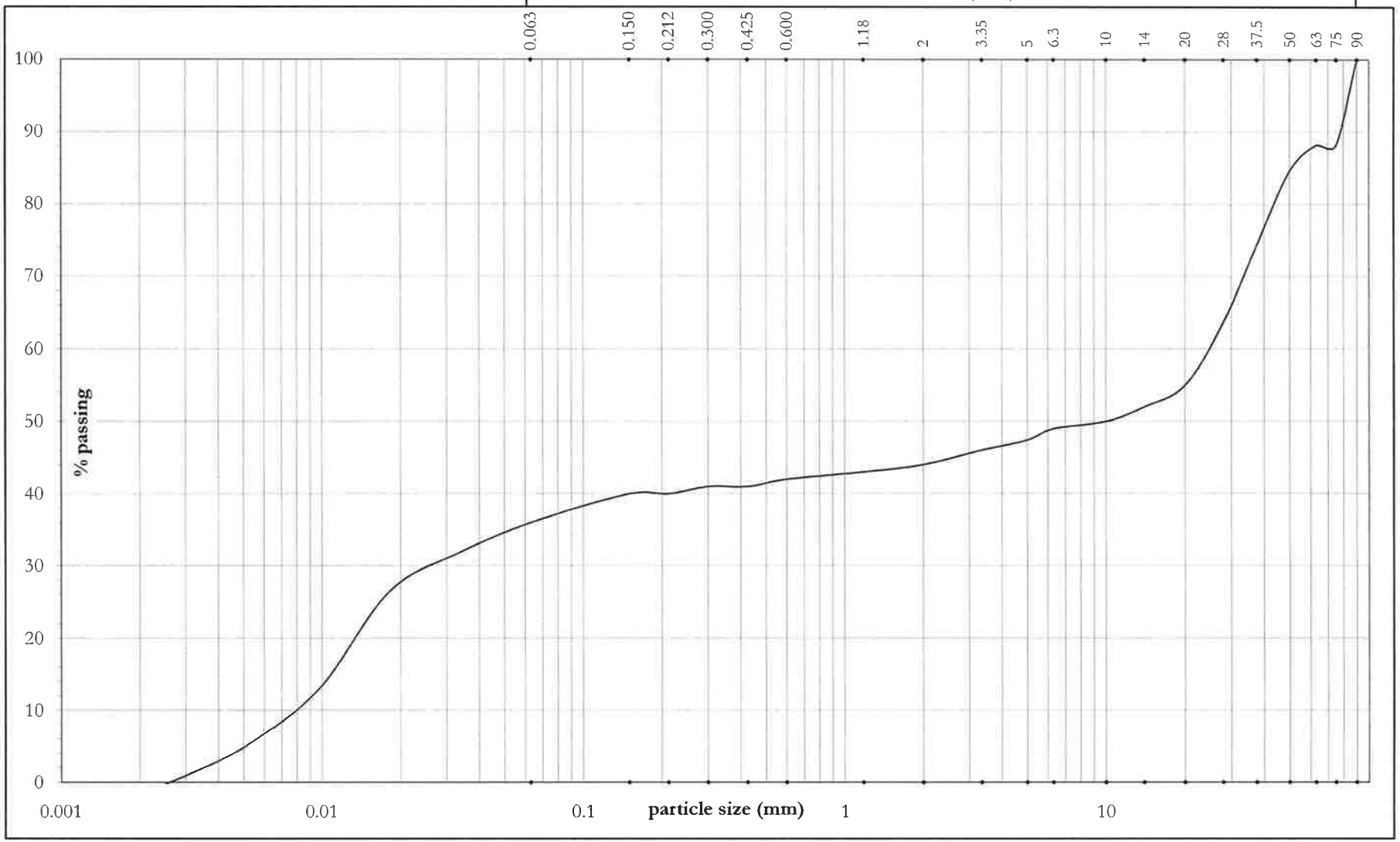
Project:	New Port of Galway	Exploratory Hole No.:	BH05	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			P7	8	6.00	6.90		

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	88
63	88
50	85
37.5	74
28	64
20	55
14	52
10	50
6.3	49
5	47
3.35	46
2	44
1.18	43
0.6	42
0.425	41
0.3	41
0.212	40
0.15	40
0.063	36
0.0343	32.0
0.0181	26.5
0.0098	13.2
0.0055	5.9
0.0032	1.5
0.0016	-2.9



Clay 0%	Silt 36%	fine	medium	coarse	fine	medium	coarse	Cobbles 12%
		Sand 8%			Gravel 44%			

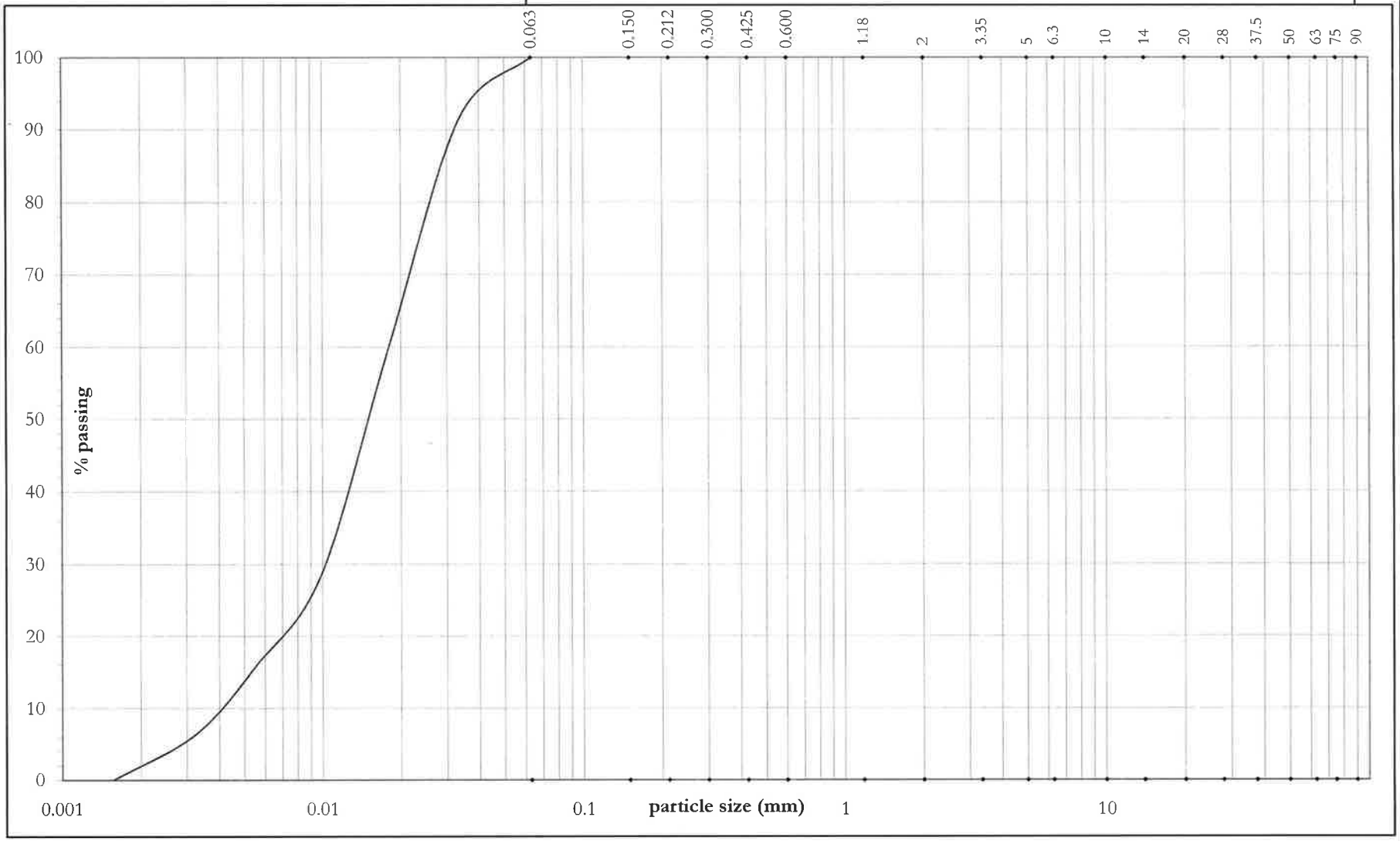
Project:	New Port of Galway	Exploratory Hole No.:	BH05	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			B13		8.50			

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	100
0.425	100
0.3	100
0.212	100
0.15	100
0.063	100
0.0338	91.8
0.0180	60.1
0.0098	28.5
0.0055	15.8
0.0032	6.3
0.0016	0.0



Clay 1%	Silt 99%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 0%			Gravel 0%			

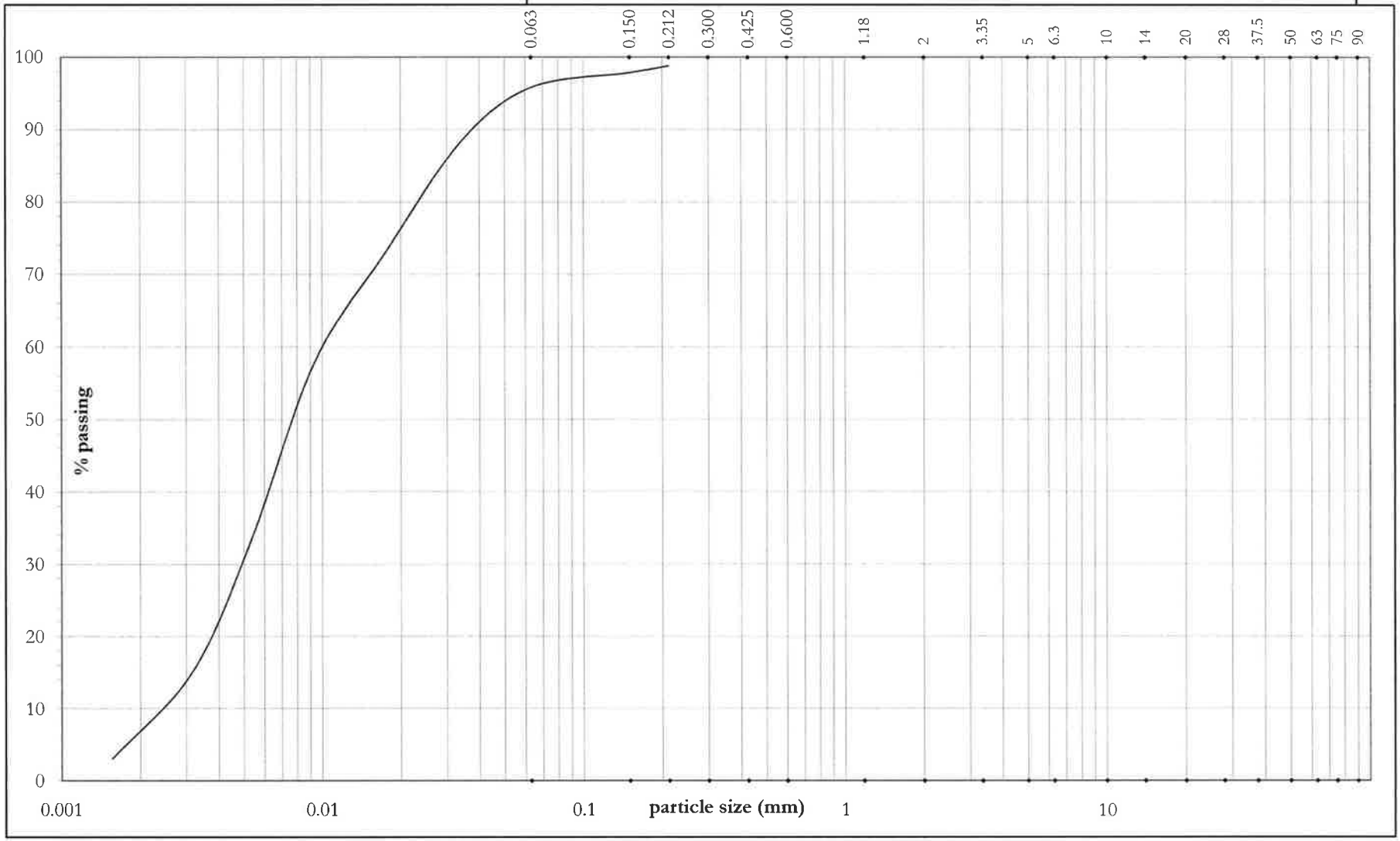
Project:	New Port of Galway	Exploratory Hole No.:	BH06	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			D	1				

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	100
0.425	99
0.3	99
0.212	99
0.15	98
0.063	96
0.0338	88.2
0.0175	73.0
0.0093	57.8
0.0053	33.5
0.0032	15.2
0.0016	3.0



Clay 7%	Silt 89%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 4%			Gravel 0%			

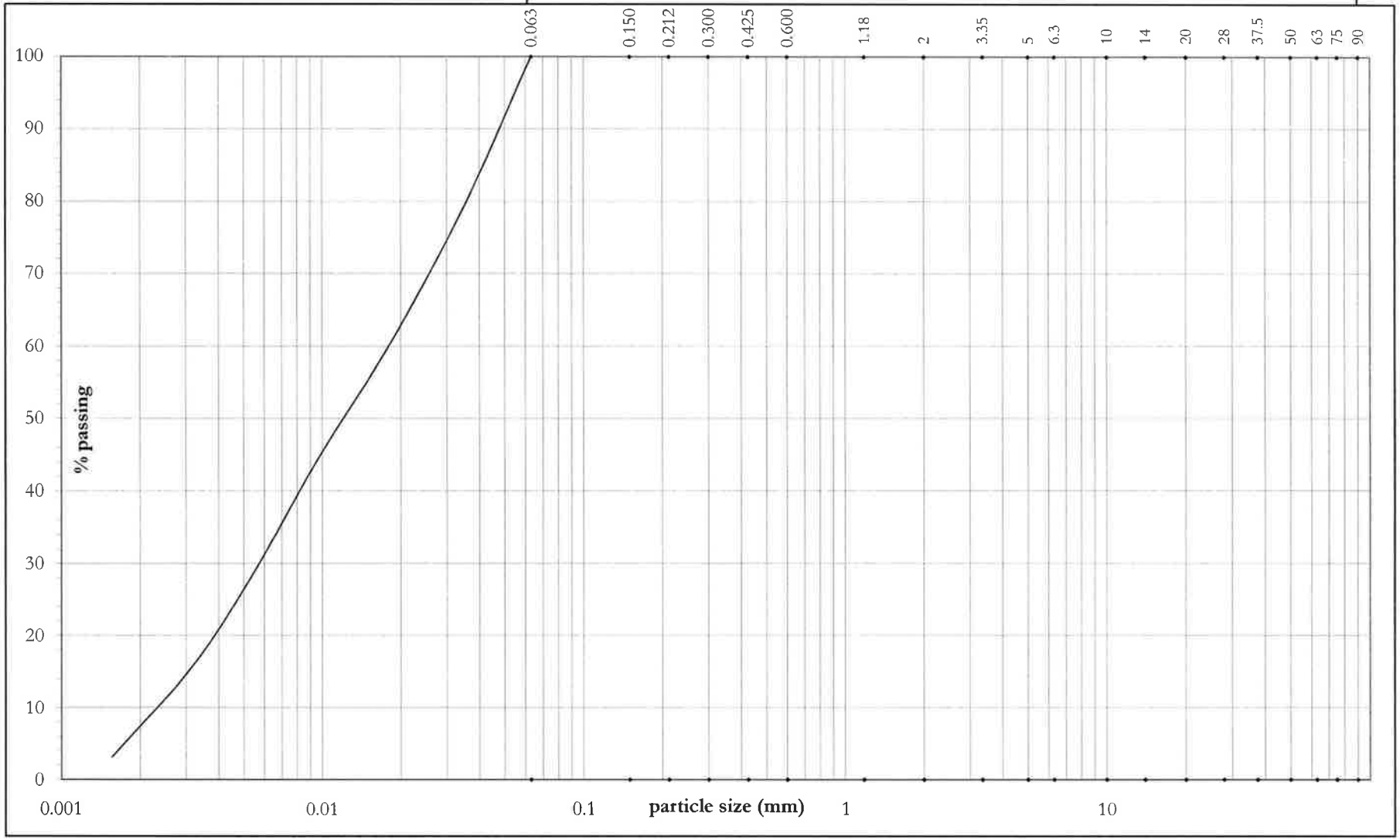
Project:	New Port of Galway	Exploratory Hole No.:	BH06	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			P	5	3.00	3.90		

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	100
0.425	100
0.3	100
0.212	100
0.15	100
0.063	100
0.0347	79.1
0.0180	60.1
0.0096	44.3
0.0054	28.5
0.0032	15.8
0.0016	3.2



Clay 8%	Silt 92%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 0%			Gravel 0%			

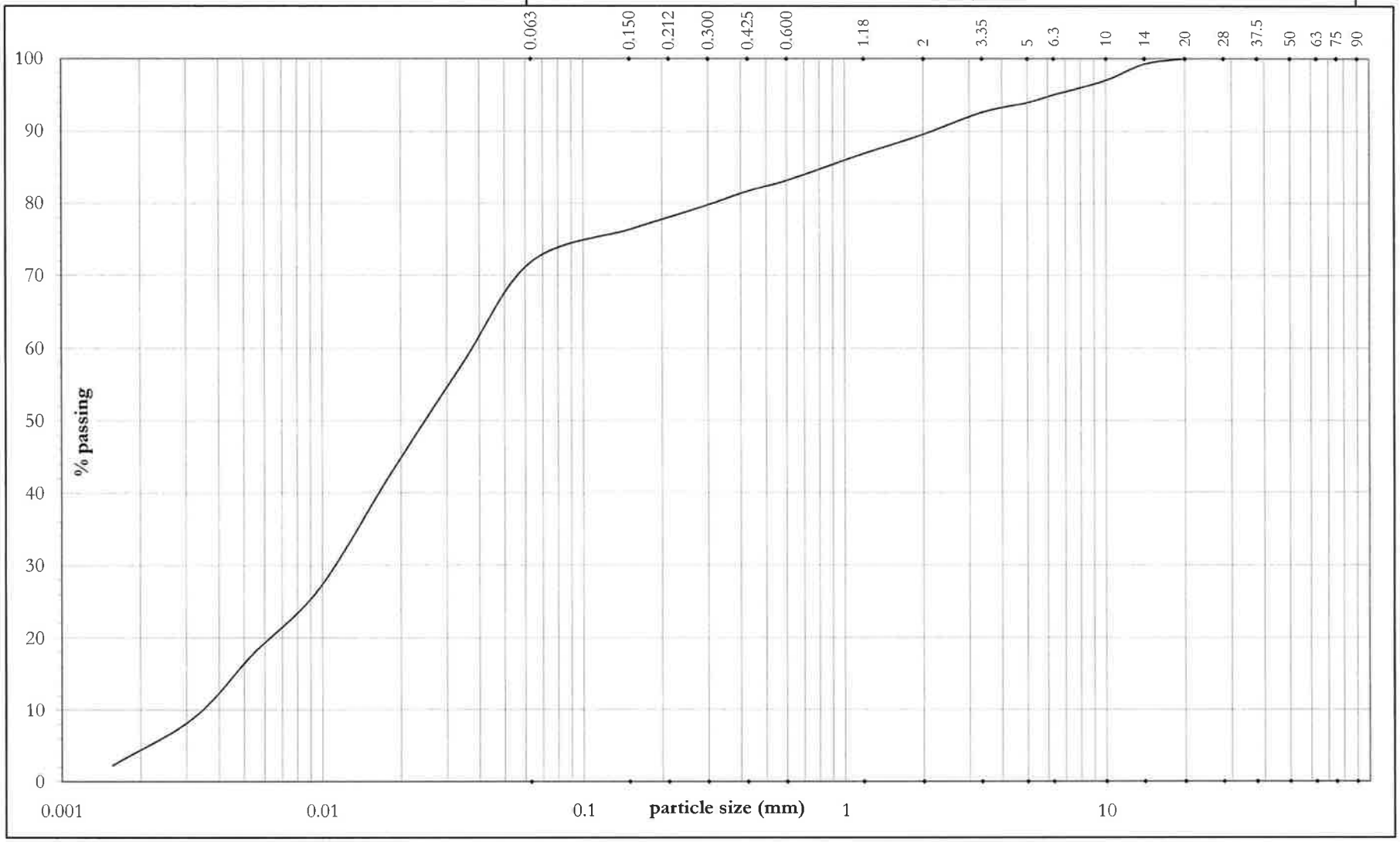
Project:	New Port of Galway	Exploratory Hole No.:	BH06	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			D	7	5.00			

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	99
10	97
6.3	95
5	94
3.35	93
2	90
1.18	87
0.6	83
0.425	82
0.3	80
0.212	78
0.15	76
0.063	72
0.0345	58.0
0.0180	42.3
0.0097	26.7
0.0054	17.8
0.0032	8.9
0.0016	2.2



Clay 4%	Silt 68%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 18%			Gravel 10%			

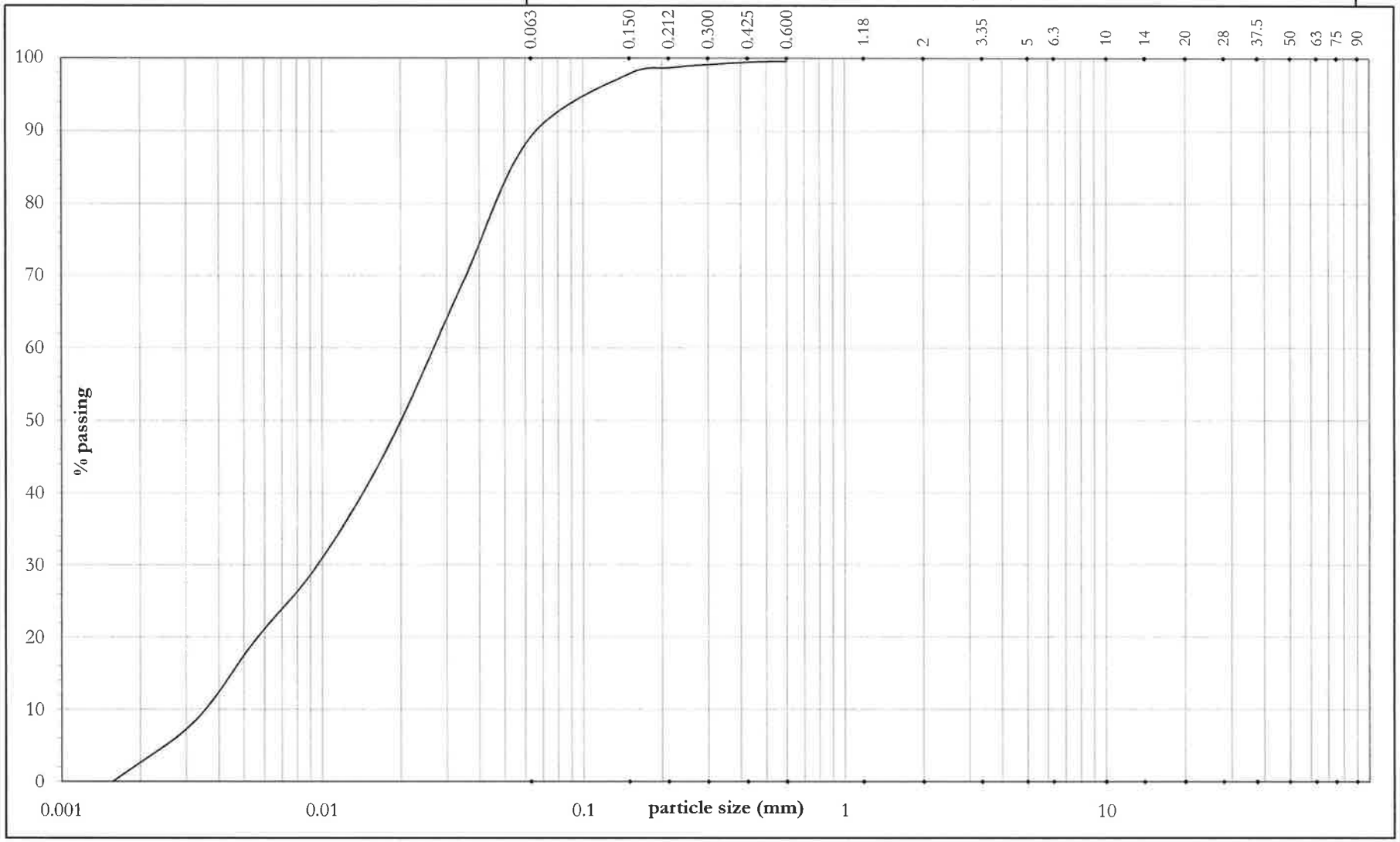
Project:	New Port of Galway	Exploratory Hole No.:	BH06	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			B	11	8.00			

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	100
0.425	99
0.3	99
0.212	99
0.15	98
0.063	89
0.0347	69.2
0.0182	47.0
0.0097	30.4
0.0055	19.4
0.0032	8.3
0.0016	0.0



Clay 3%	Silt 86%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 11%			Gravel 0%			

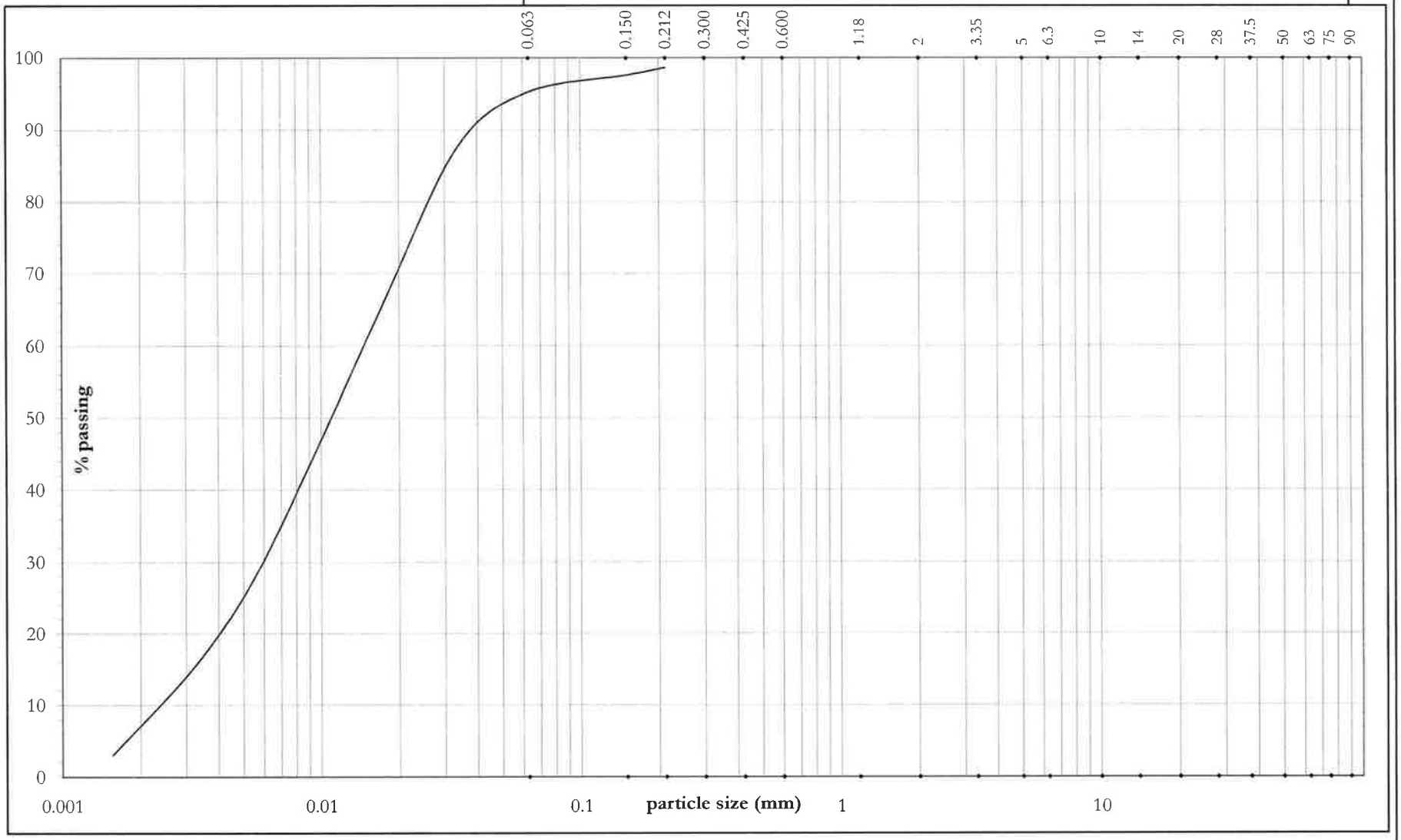
Project:	New Port of Galway	Exploratory Hole No.:	BH07	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			D	2	1.00			

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	100
0.425	99
0.3	99
0.212	99
0.15	98
0.063	95
0.0338	87.7
0.0177	66.6
0.0095	45.4
0.0054	27.2
0.0032	15.1
0.0016	3.0



Clay 8%	Silt 87%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 5%			Gravel 0%			

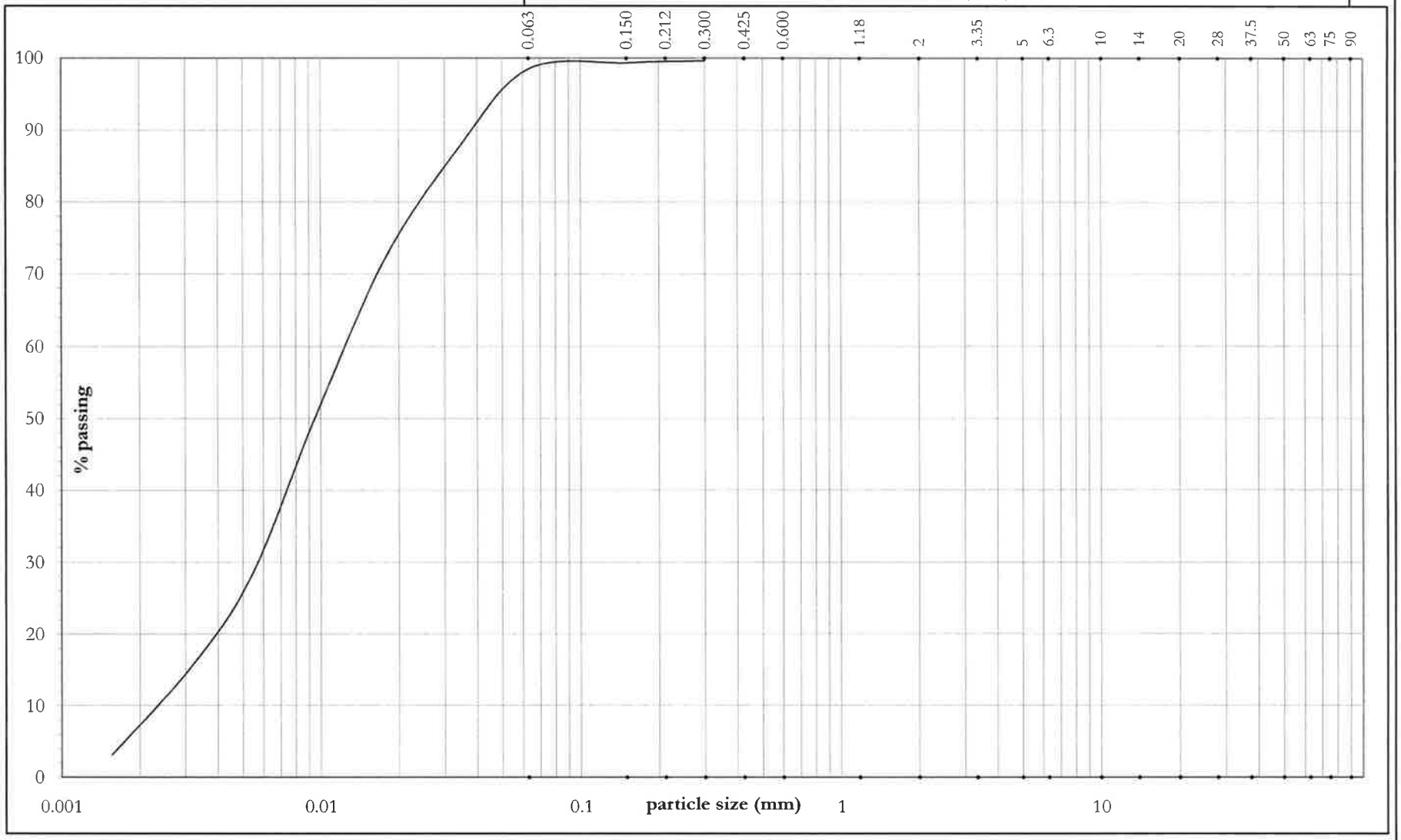
Project:	New Port of Galway	Exploratory Hole No.:	BH07	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			P	5	3.00	3.90		

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	100
0.425	100
0.3	100
0.212	100
0.15	99
0.063	99
0.0341	87.6
0.0176	72.0
0.0095	50.1
0.0054	28.2
0.0032	15.6
0.0016	3.1



Clay 7%	Silt 92%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 1%			Gravel 0%			

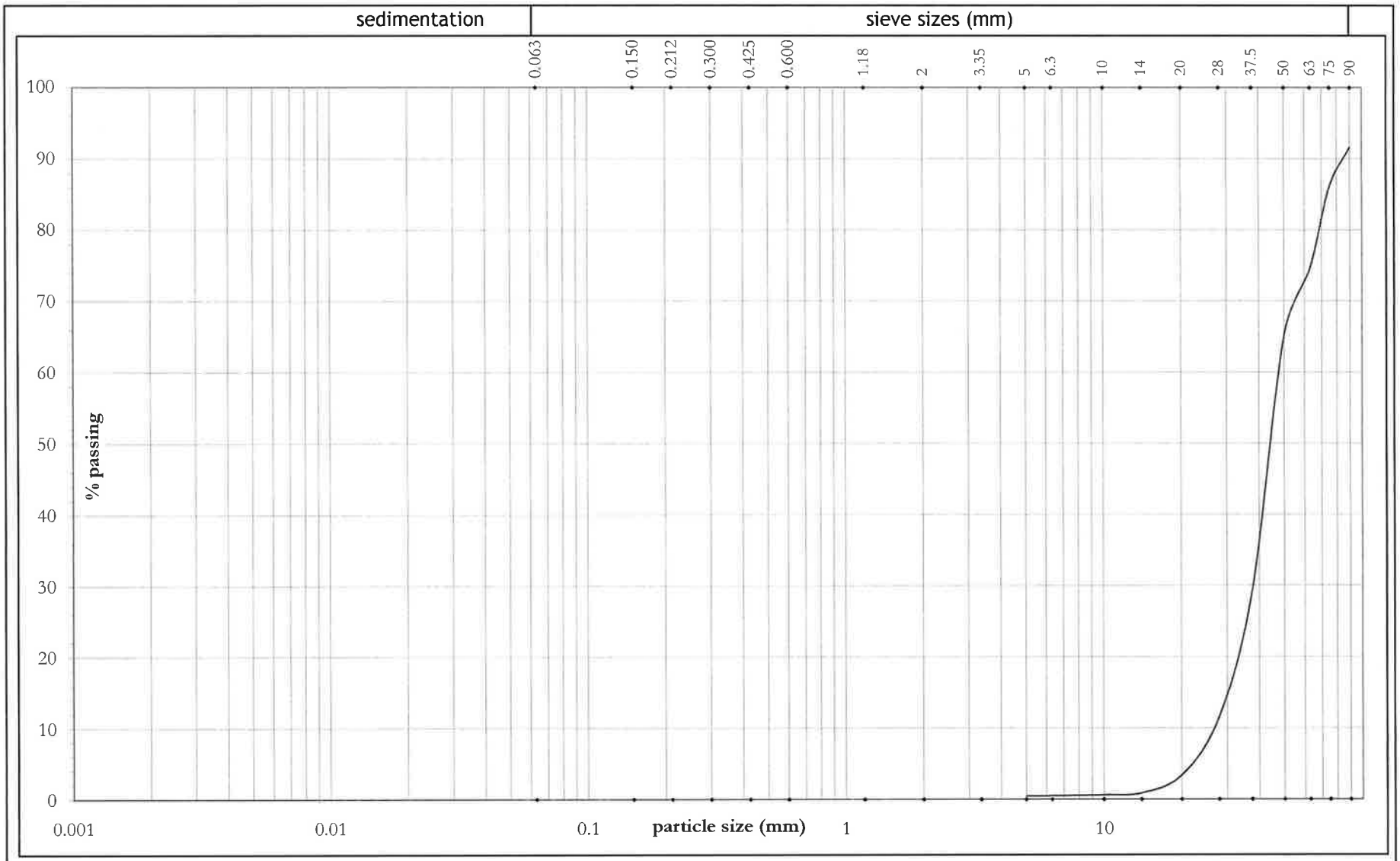
Project:	New Port of Galway	Exploratory Hole No.:	BH07	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			D	6	4.00			

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	92
75	86
63	74
50	65
37.5	29
28	12
20	3
14	1
10	1
6.3	0
5	0
3.35	0
2	0
1.18	0
0.6	0
0.425	0
0.3	0
0.212	0
0.15	0
0.063	0



	Fines 0%	fine	medium	coarse	fine	medium	coarse	Cobbles 26%
		Sand 0%			Gravel 74%			

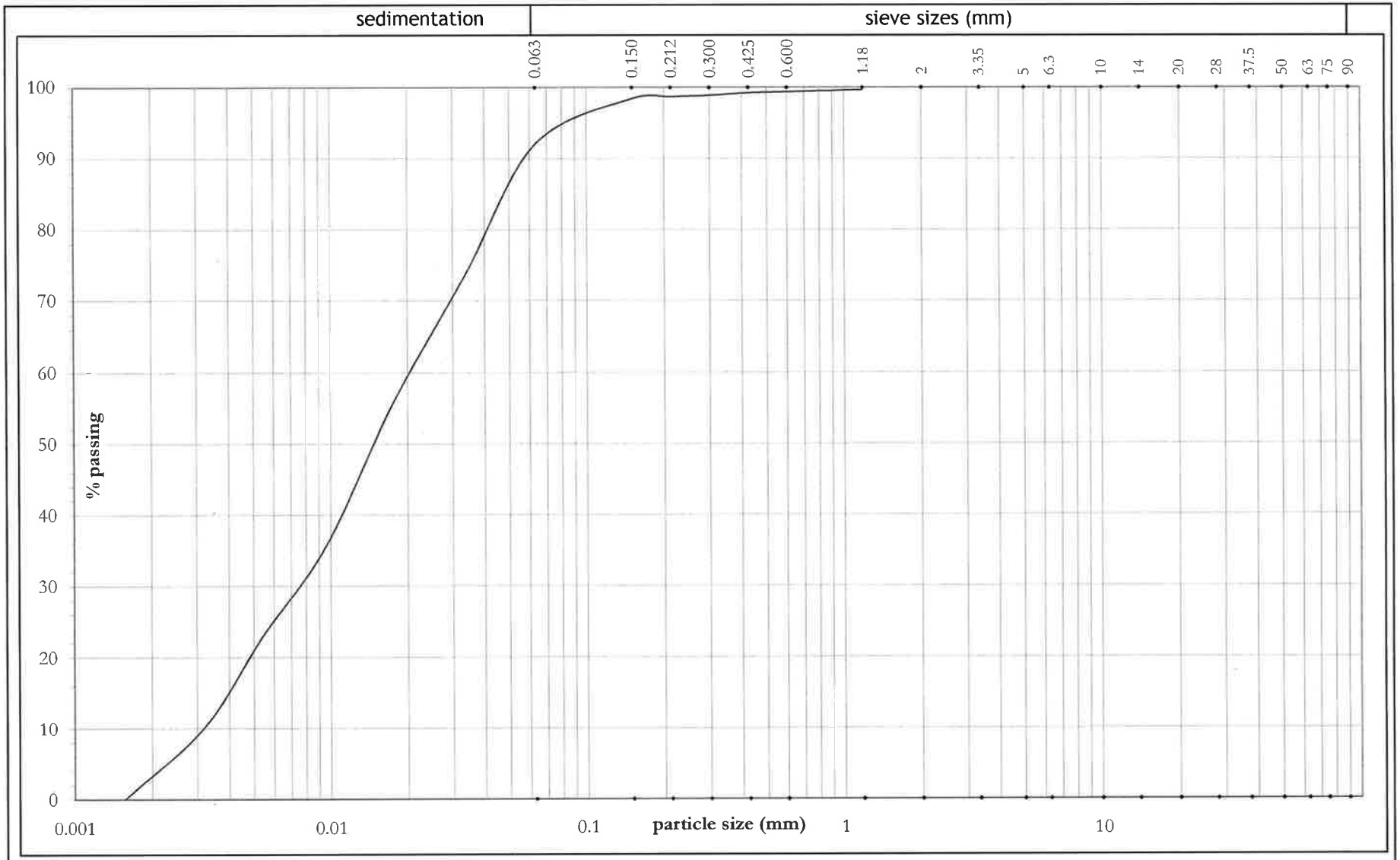
Project:	New Port of Galway	Exploratory Hole No.:	BH07	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			B	12	7.00			

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	99
0.425	99
0.3	99
0.212	99
0.15	98
0.063	92
0.0338	73.8
0.0177	56.0
0.0096	35.6
0.0054	22.9
0.0032	10.2
0.0016	0.0



Clay 4%	Silt 88%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 8%			Gravel 0%			

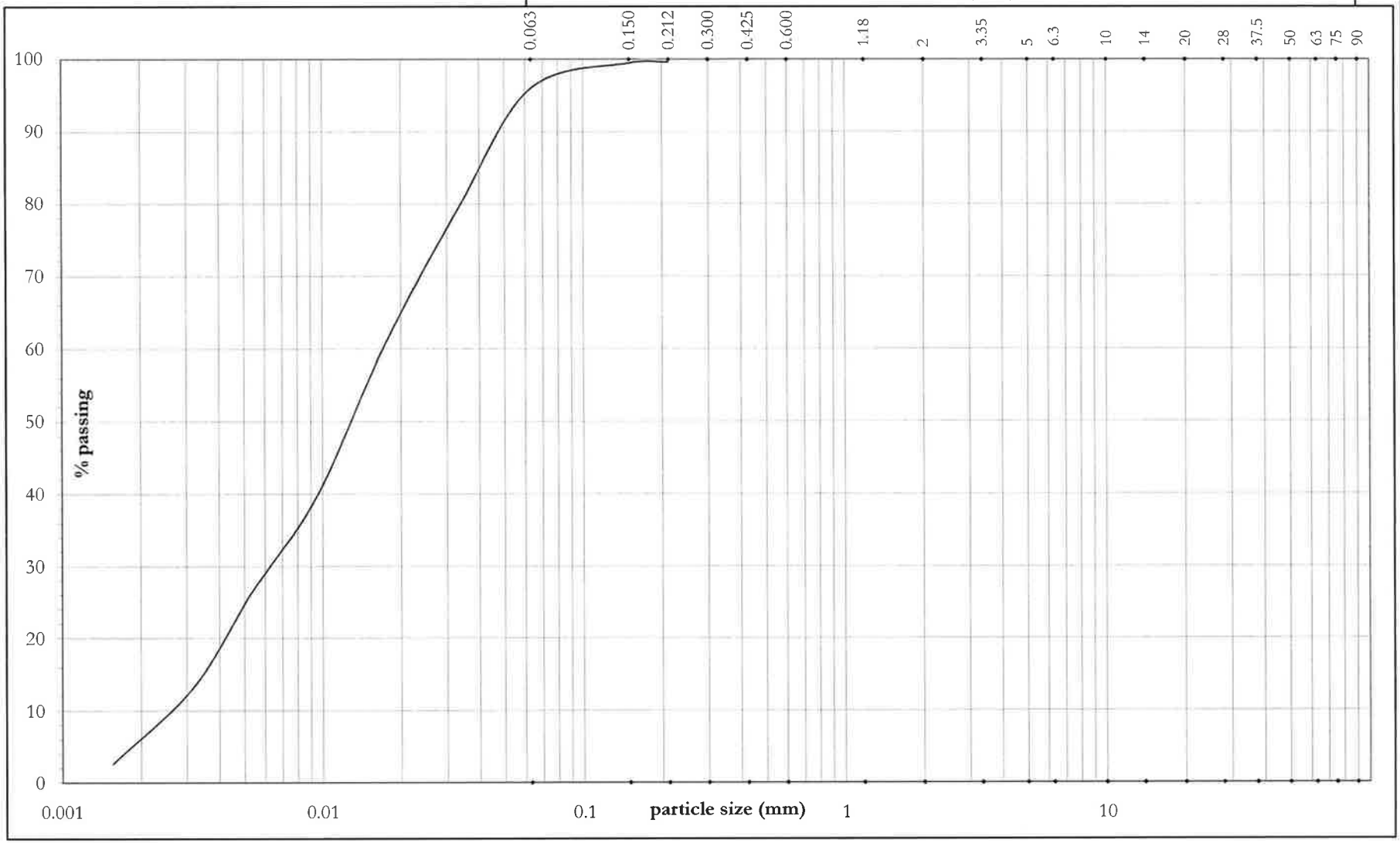
Project:	New Port of Galway	Exploratory Hole No.:	BH08	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			D	2	1.00			

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	100
0.425	100
0.3	100
0.212	100
0.15	99
0.063	96
0.0336	79.6
0.0176	61.1
0.0095	39.8
0.0054	26.5
0.0032	13.3
0.0016	2.7



Clay 5%	Silt 91%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 4%			Gravel 0%			

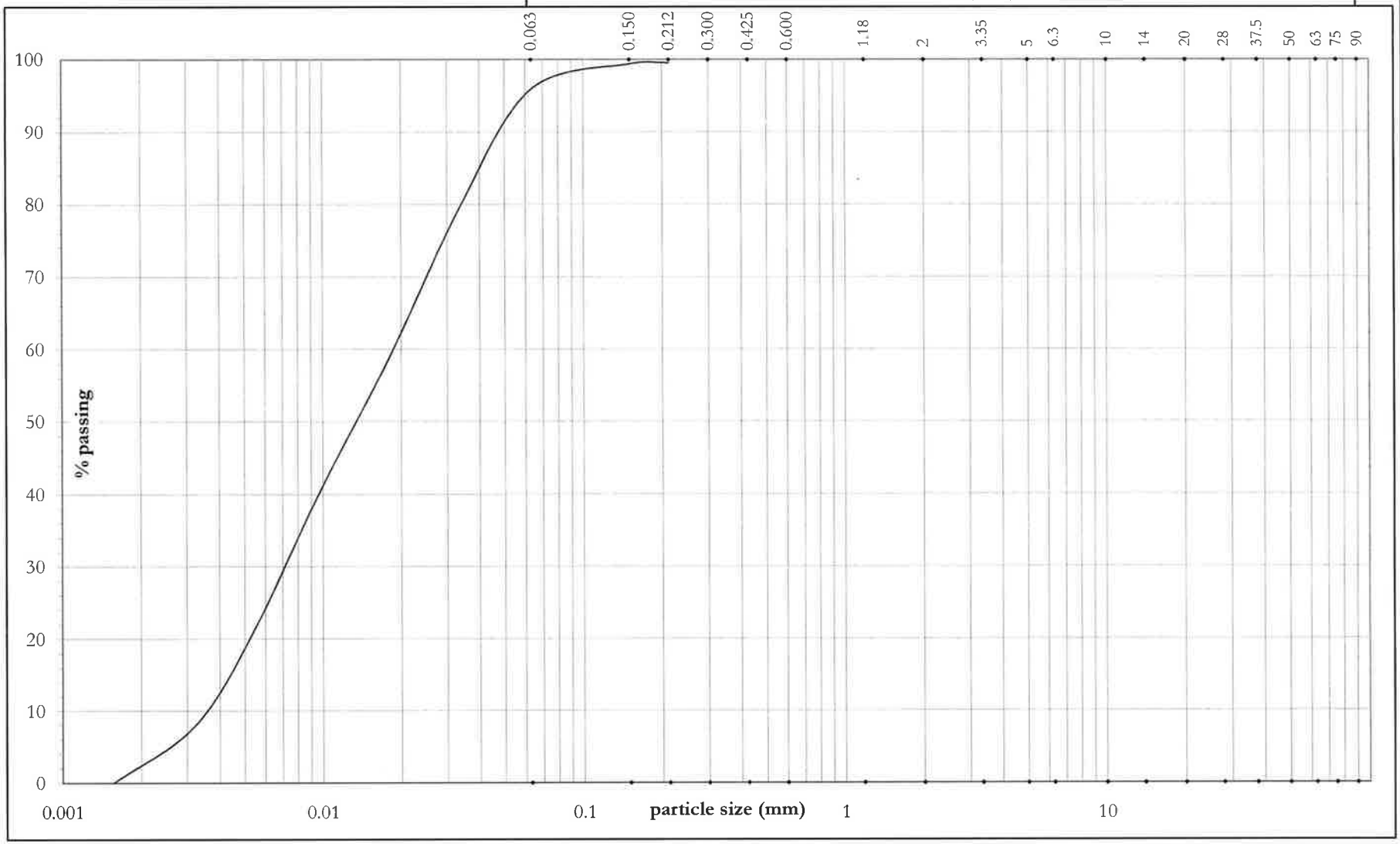
Project:	New Port of Galway	Exploratory Hole No.:	BH08	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			D	6	4.00			

Causeway Geotech Ltd

Particle Size Distribution

BS1377:1990 Part 2 Clause 9.2 and 9.5

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	100
0.425	100
0.3	100
0.212	100
0.15	99
0.063	96
0.0336	79.6
0.0177	58.4
0.0095	39.8
0.0054	21.2
0.0032	8.0
0.0016	0.0



Clay 3%	Silt 93%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
		Sand 4%			Gravel 0%			

Project:	New Port of Galway	Exploratory Hole No.:	BH08	Sample				Sample description:	
				Type	No.	at (m)	to (m)		
Job No.:	12-161			D	8	6.00			

Unconsolidated Undrained test (BS1377:1990 7/8)				
Location&Ref	Galway			
Borehole/sample no.	BH01			
Depth	3m			
Soil type	Grey silty clay			
Sampling	U			
Stage No.		1	2	3
Diameter	mm	100		
Height	mm	180		
Initial moisture content	%	80.2	80.2	80.2
Initial bulk density	kg/m3	1555	1555	1555
Dry density	kg/m3	863	863	863
Cell pressure	kPa	50	100	150
Rate of strain	%/min	1.00	1.00	1.00
CONDITIONS AT FAILURE				
Mem. and side drains corrections	kPa	3		
Maximum deviator stress	kPa	55	52	42
cu			24 kPa	
Mode of failure			Bulging	
Checked and approved by V Sivakumar				

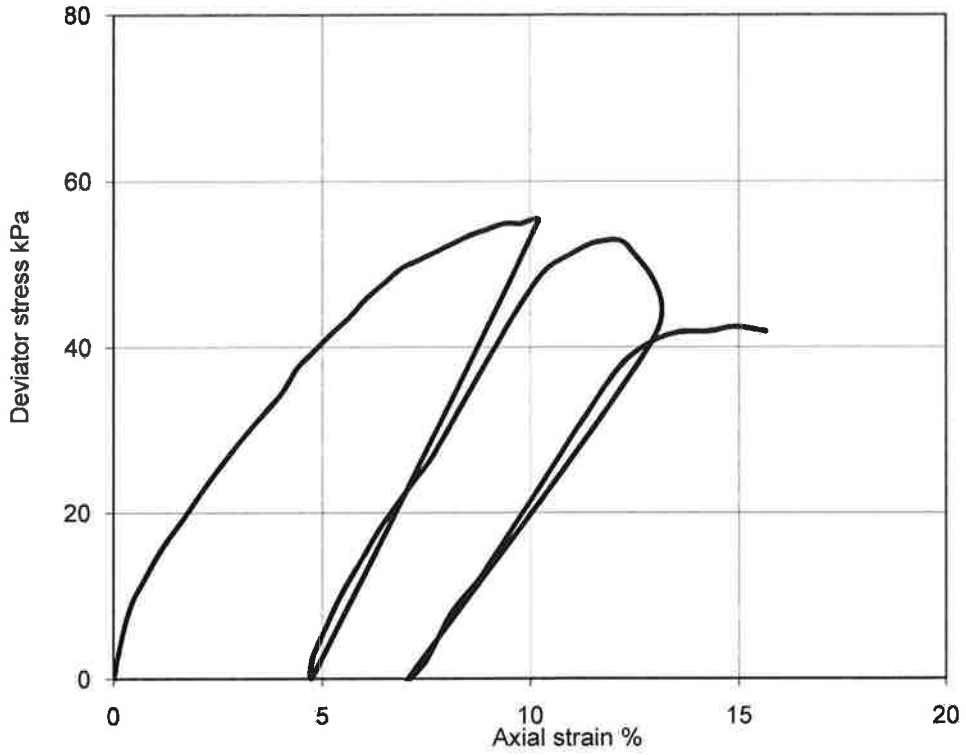


Figure 1 Deviator stress vs axial strain

Ref	Galway
BH	BH01
Depth	3m
Test	Unconsolidated Undrained

Unconsolidated Undrained test (BS1377:1990 7/8)				
Location&Ref	Galway			
Borehole/sample no.	BH01			
Depth	5m			
Soil type	Grey silty clay			
Sampling	U			
Stage No.		1	2	3
Diameter	mm	100		
Height	mm	180		
Initial moisture content	%	59.0	59.0	59.0
Initial bulk density	kg/m3	1497	1497	1497
Dry density	kg/m3	941	941	941
Cell pressure	kPa	50	100	150
Rate of strain	%/min	1.00	1.00	1.00
CONDITIONS AT FAILURE				
Mem. and side drains corrections	kPa	3		
Maximum deviator stress	kPa	19	20	22
cu			9 kPa	
Mode of failure			Bulging	
Checked and approved by V Sivakumar				

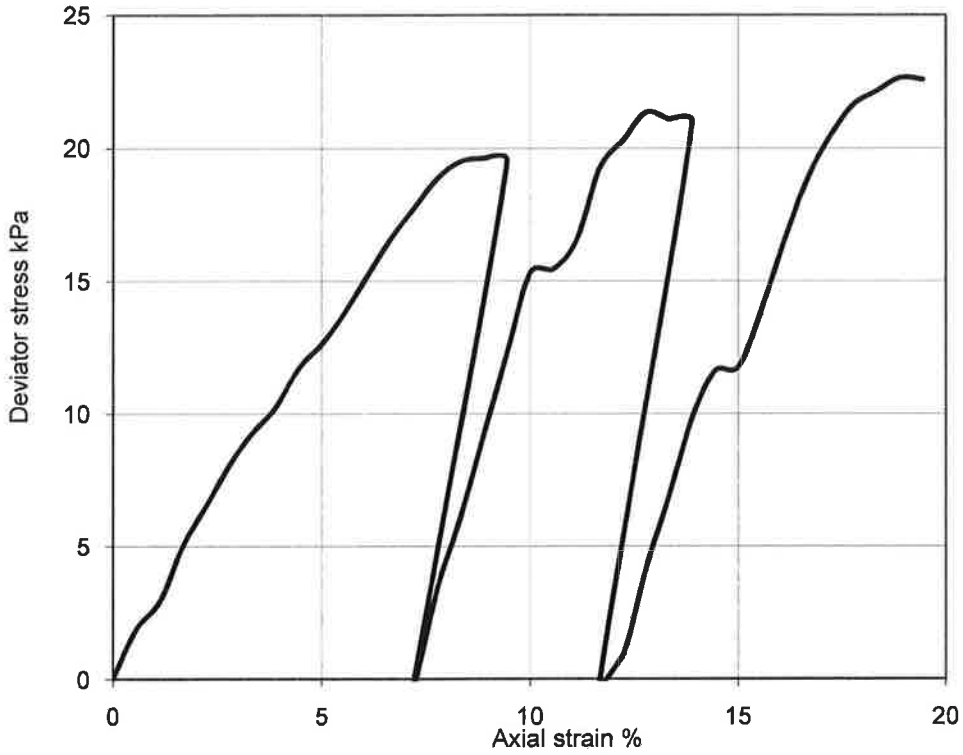


Figure 1 Deviator stress vs axial strain

Ref	Galway
BH	BH01
Depth	5m
Test	Unconsolidated Undrained

Unconsolidated Undrained test (BS1377:1990 7/8)				
Location&Ref	Galway			
Borehole/sample no.	BH03			
Depth	4m			
Soil type	Grey silty clay			
Sampling	U			
Stage No.		1	2	3
Diameter	mm	100		
Height	mm	200		
Initial moisture content	%	67.9	67.9	67.9
Initial bulk density	kg/m3	1578	1578	1578
Dry density	kg/m3	939	939	939
Cell pressure	kPa	50	100	150
Rate of strain	%/min	1.00	1.00	1.00
CONDITIONS AT FAILURE				
Mem. and side drains corrections	kPa	3		
Maximum deviator stress	kPa	41	41	45
cu			20 kPa	
Mode of failure			Bulging	
Checked and approved by V Sivakumar				

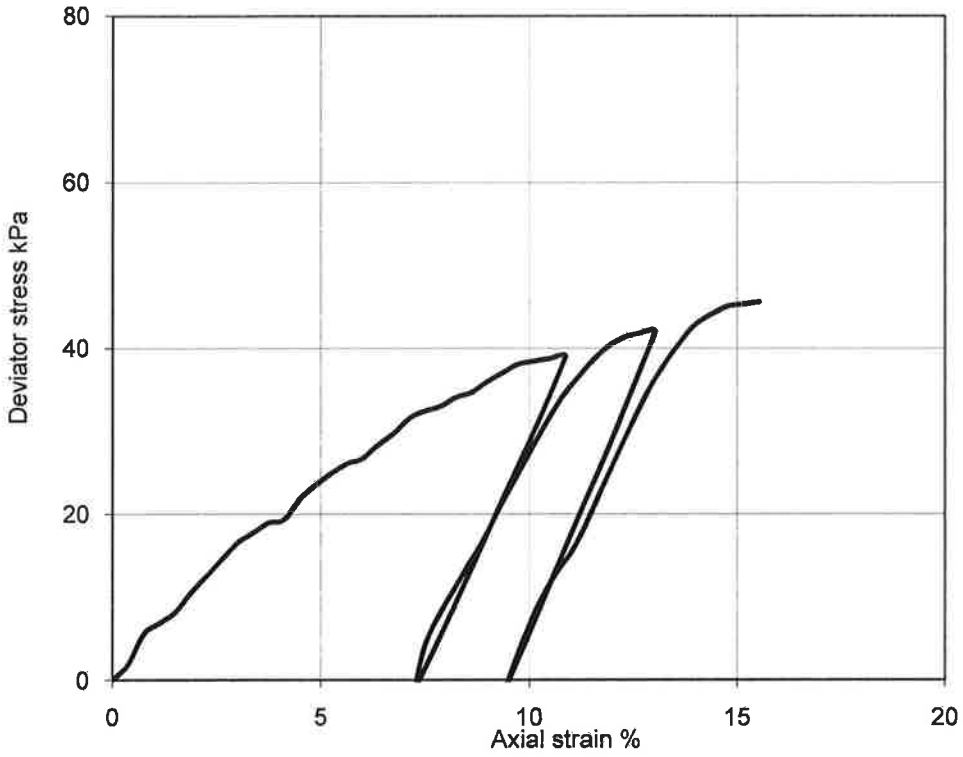


Figure 1 Deviator stress vs axial strain

Ref	Galway
BH	BH03
Depth	4m
Test	Unconsolidated Undrained

Unconsolidated Undrained test (BS1377:1990 7/8)				
Location&Ref	Galway			
Borehole/sample no.	BH04			
Depth	3m			
Soil type	Grey silty clay			
Sampling	U			
Stage No.		1	2	3
Diameter	mm	100		
Height	mm	200		
Initial moisture content	%	48.8	48.8	48.8
Initial bulk density	kg/m3	1790	1790	1790
Dry density	kg/m3	1203	1203	1203
Cell pressure	kPa	50	100	150
Rate of strain	%/min	1.00	1.00	1.00
CONDITIONS AT FAILURE				
Mem. and side drains corrections	kPa	3		
Maximum deviator stress	kPa	17	17	15
cu			7 kPa	
Mode of failure			Bulging	
Checked and approved by V Sivakumar				

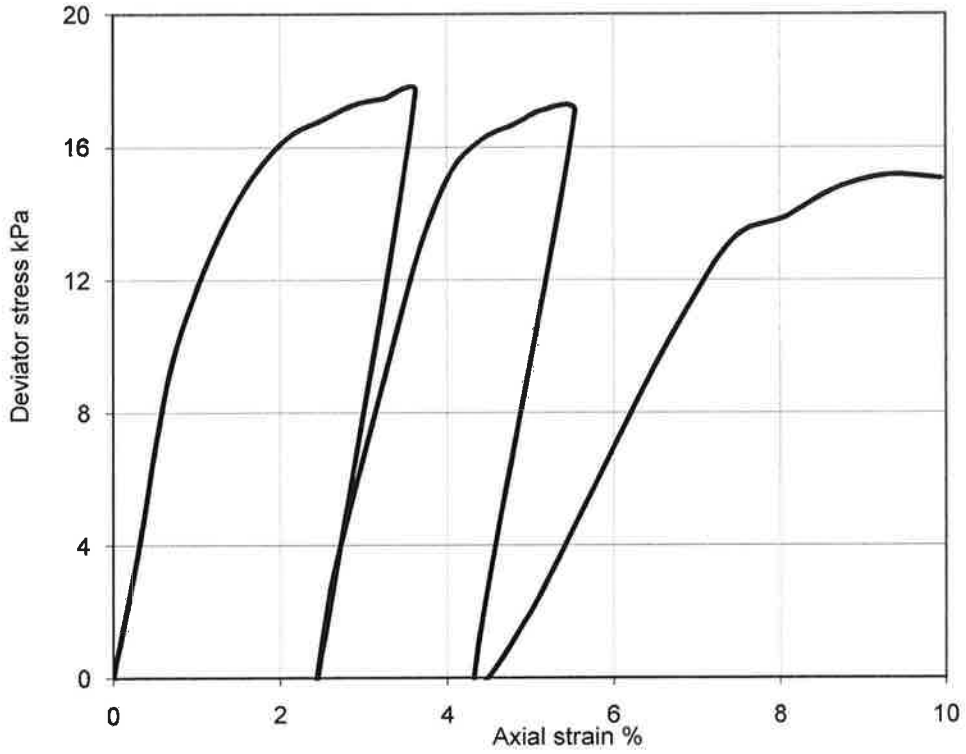


Figure 1 Deviator stress vs axial strain

Ref	Galway
BH	BH04
Depth	3m
Test	Unconsolidated Undrained

Unconsolidated Undrained test (BS1377:1990 7/8)				
Location&Ref	Galway			
Borehole/sample no.	BH04			
Depth	5m			
Soil type	Grey silty clay			
Sampling	U			
Stage No.		1	2	3
Diameter	mm	100		
Height	mm	180		
Initial moisture content	%	50.9	50.9	
Initial bulk density	kg/m3	1753	1753	
Dry density	kg/m3	1162	1162	
Cell pressure	kPa	50	100	
Rate of strain	%/min	1.00	1.00	
CONDITIONS AT FAILURE				
Mem. and side drains corrections	kPa	3		
Maximum deviator stress	kPa	10	12	
cu			9 kPa	
Mode of failure			Bulging	
Checked and approved by V Sivakumar				

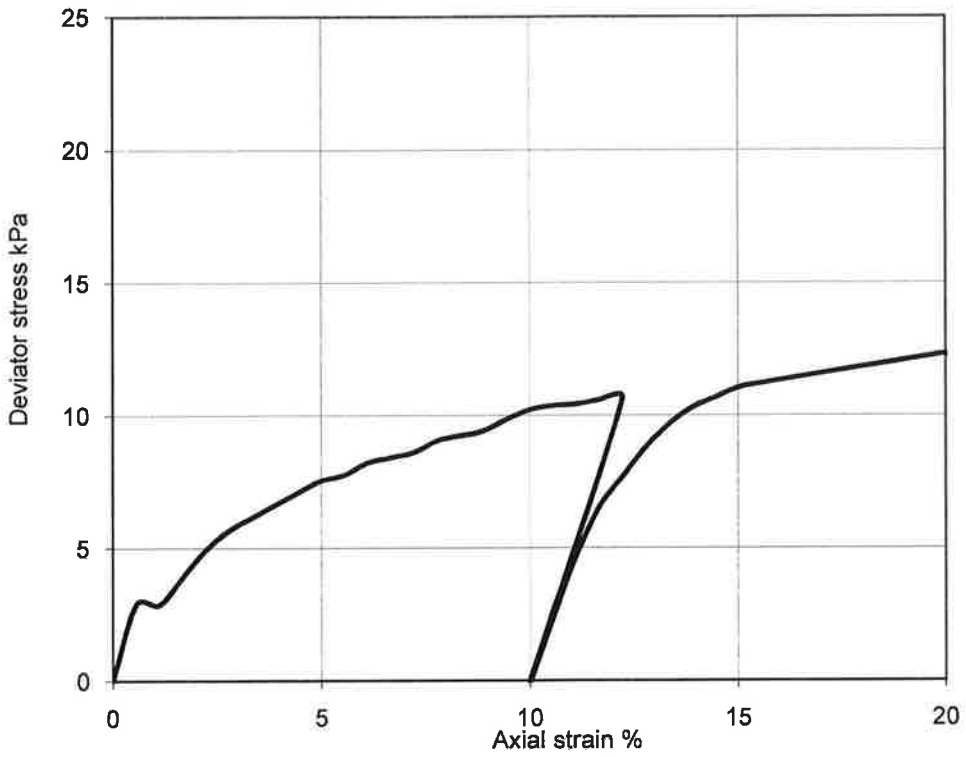


Figure 1 Deviator stress vs axial strain

Ref	Galway
BH	BH04
Depth	5m
Test	Unconsolidated Undrained

Unconsolidated Undrained test (BS1377:1990 7/8)				
Location&Ref	Galway			
Borehole/sample no.	BH06			
Depth	3m			
Soil type	Grey silty clay			
Sampling	U			
Stage No.		1	2	3
Diameter	mm	100		
Height	mm	200		
Initial moisture content	%	40.6	40.6	40.6
Initial bulk density	kg/m3	1778	1778	1778
Dry density	kg/m3	1265	1265	1265
Cell pressure	kPa	50	100	150
Rate of strain	%/min	1.00	1.00	1.00
CONDITIONS AT FAILURE				
Mem. and side drains corrections	kPa	3		
Maximum deviator stress	kPa	18	18	19
cu			8 kPa	
Mode of failure			Bulging	
Checked and approved by V Sivakumar				

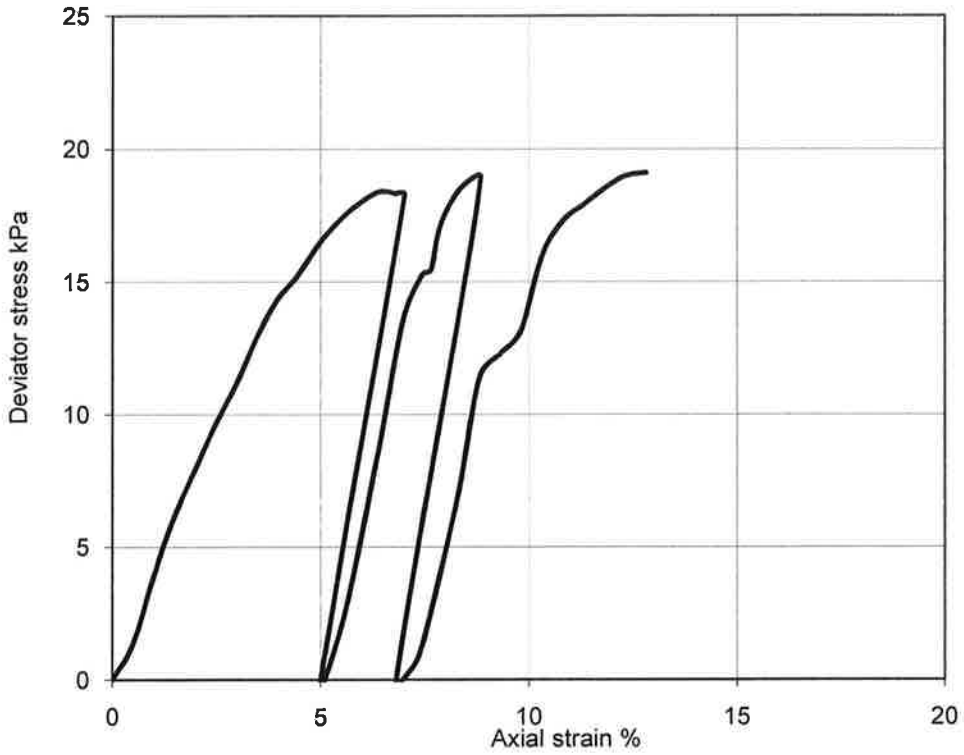


Figure 1 Deviator stress vs axial strain

Ref	Galway
BH	BH06
Depth	3m
Test	Unconsolidated Undrained

Unconsolidated Undrained test (BS1377:1990 7/8)				
Location&Ref	Galway			
Borehole/sample no.	BH07			
Depth	3m			
Soil type	Grey clay			
Sampling	U			
Stage No.		1	2	3
Diameter	mm	100		
Height	mm	200		
Initial moisture content	%	57.2	57.2	57.2
Initial bulk density	kg/m3	1773	1773	1773
Dry density	kg/m3	1127	1127	1127
Cell pressure	kPa	50	100	150
Rate of strain	%/min	1.00	1.00	1.00
CONDITIONS AT FAILURE				
Mem. and side drains corrections	kPa	3		
Maximum deviator stress	kPa	46	45	40
cu			21 kPa	
Mode of failure			Bulging	
Checked and approved by V Sivakumar				

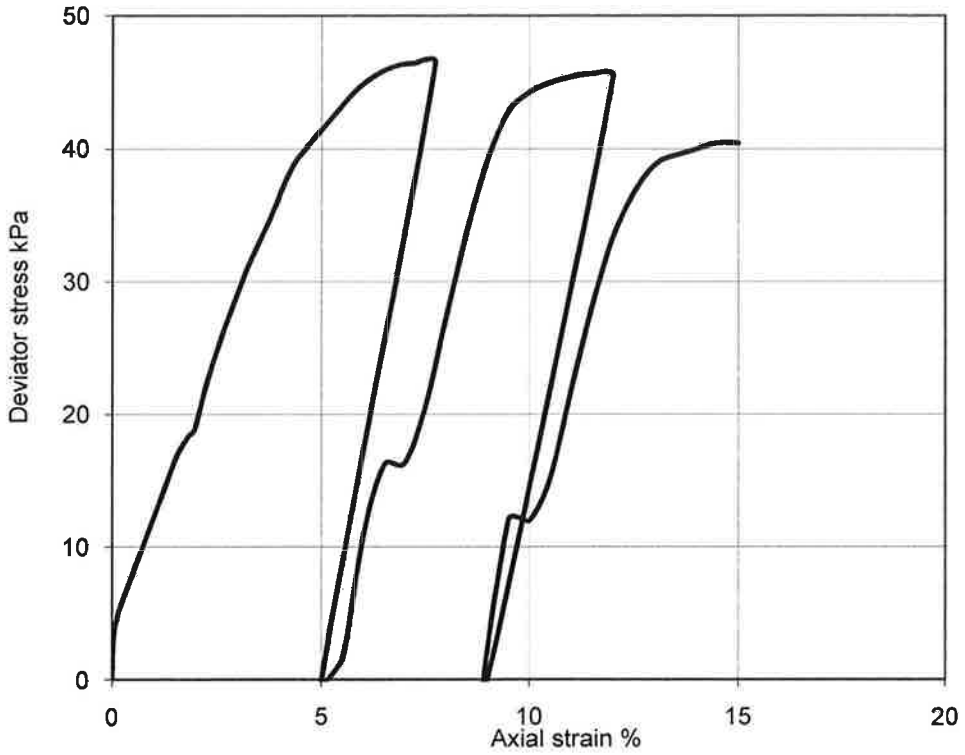


Figure 1 Deviator stress vs axial strain

Ref	Galway
BH	BH07
Depth	3m
Test	Unconsolidated Undrained

Vane stregth

BH No	Depth m	Stregth kPa
BH04	5	10
BH05	6	22
BH06	3	14
BH07	5	32
BH04	3	16
BH05	3	15
BH03	4	26

Consolidated undrained multistage triaxial test with pore water pressure measurements				
Tested in accordance with BS:1377 Part 8				
Location	**Galway**			
Job Ref	**Galway**			
Borehole No	**BH03**			
Depth	**6m**			
Soil type	**Soft grey Clay**			
Sampling	**U100**			
INITIAL CONDITIONS				
Stage No.		**1**	**2**	**3**
Diameter	**mm**	**100**		
Height	**mm**	**200**		
Initial Moisture content	**%**	**52.0**		
Initial Bulk density	**kg/m3**	**1695**		
Initial dry density	**kg/m3**	**1115**		
Specific Gravity		**2.6**		
SATURATION STAGE				
Initial cell pressure	**kPa**	**50**		
Initial B value		**<0.95**		
Back pressure applied	**kPa**	**300**		
Period of saturation	**h**	**24**		
Final B value	**kPa**	**1**		
CONSOLIDATION STAGE				
Cell pressure	**kPa**	**346**	**399**	**500**
Back pressure	**kPa**	**302**	**300**	**205**
Effective consolidation pressure	**kPa**	**44**	**99**	**295**
Drainage conditions	**S/F/T/B**			
Period of consolidation	**h**	**69**	**51**	**71**
Water content after consolidation%		**41.3**	**36.8**	**32.2**
Void ratio		**1.075**	**0.956**	**0.837**
Total cell pressure	**kPa**	**346**	**399**	**500**
Rate of strain	**%/h**	**0.15**	**0.16**	**0.21**
Period of compression	**h**	**47**	**70**	**48**
CONDITIONS AT FAILURE				
Mem. and side drains corrections	**kPa**	**3**	**3**	**3**
Maximum deviator stress	**kPa**	**42**	**100**	**224**
Pore water pressure	**kPa**	**333**	**368**	**424**
Change in pore water pressure	**kPa**	**30.0**	**68.0**	**127.0**
Strain at failure	**%**	**7.1**	**11.5**	**10.2**
Minor principal total stress	**kPa**	**346**	**399**	**500**
Major principal total stress	**kPa**	**388**	**499**	**724**
Minor principal effective stress	**kPa**	**13**	**31**	**76**
Major principal effective stress	**kPa**	**55**	**131**	**300**
A_f		**0.71**	**0.68**	**0.57**
c' (kPa)			**0**	
ϕ' (degrees)				
Critical ϕ' (degrees)			**35**	
Test carried out and checked by VS (QUB)				

Consolidated Undrained Multistage Triaxial Test With Pore Water Pressure Measurements
Ref 12-161, BH03, Depth 6m

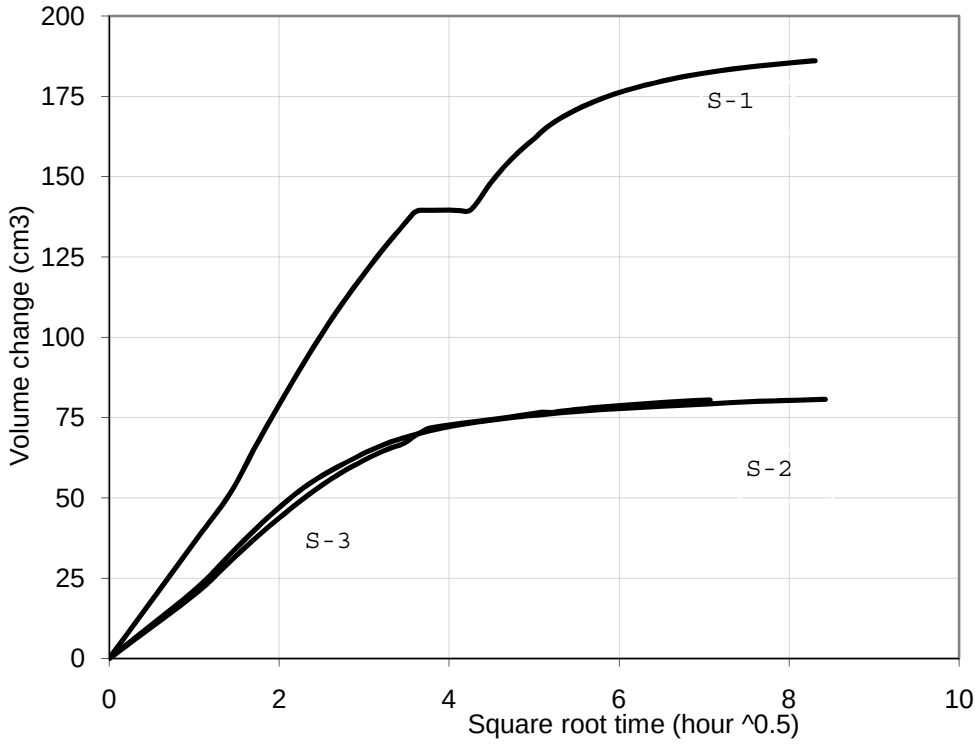


Figure 1 Consolidation: Volume change vs square root time

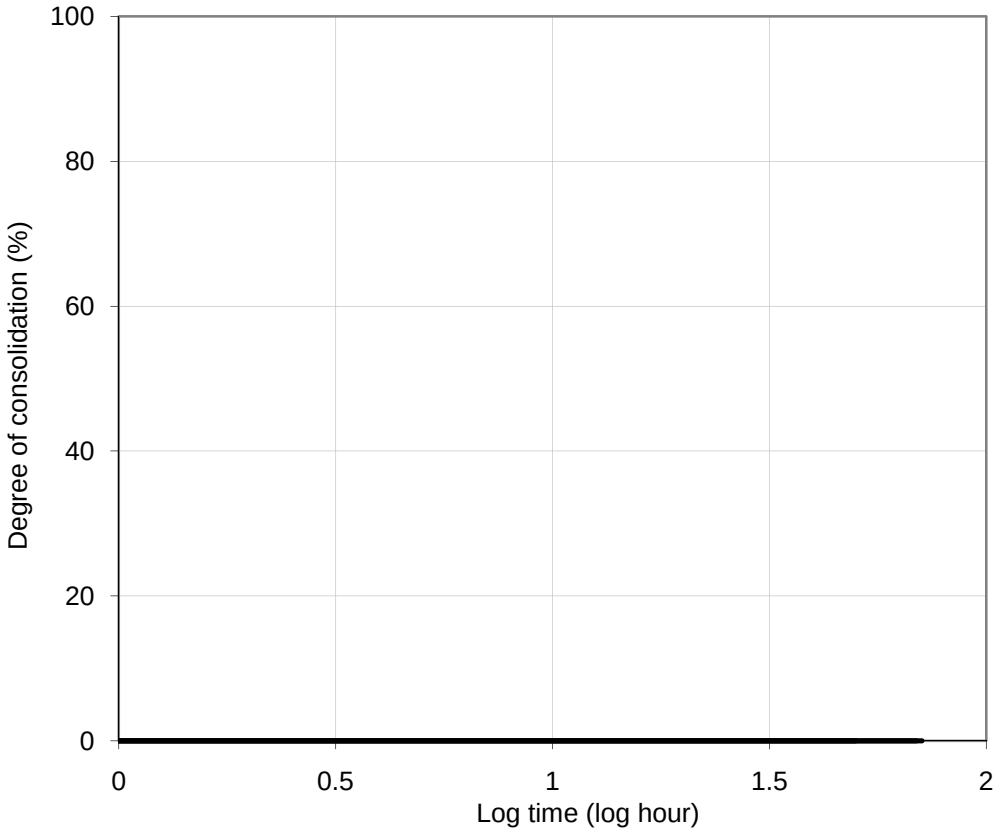


Figure 2 Degree of consolidation vs log time

Consolidated Undrained Multistage Triaxial Test With Pore Water Pressure Measurements
Ref 12-161, BH03, Depth 6m

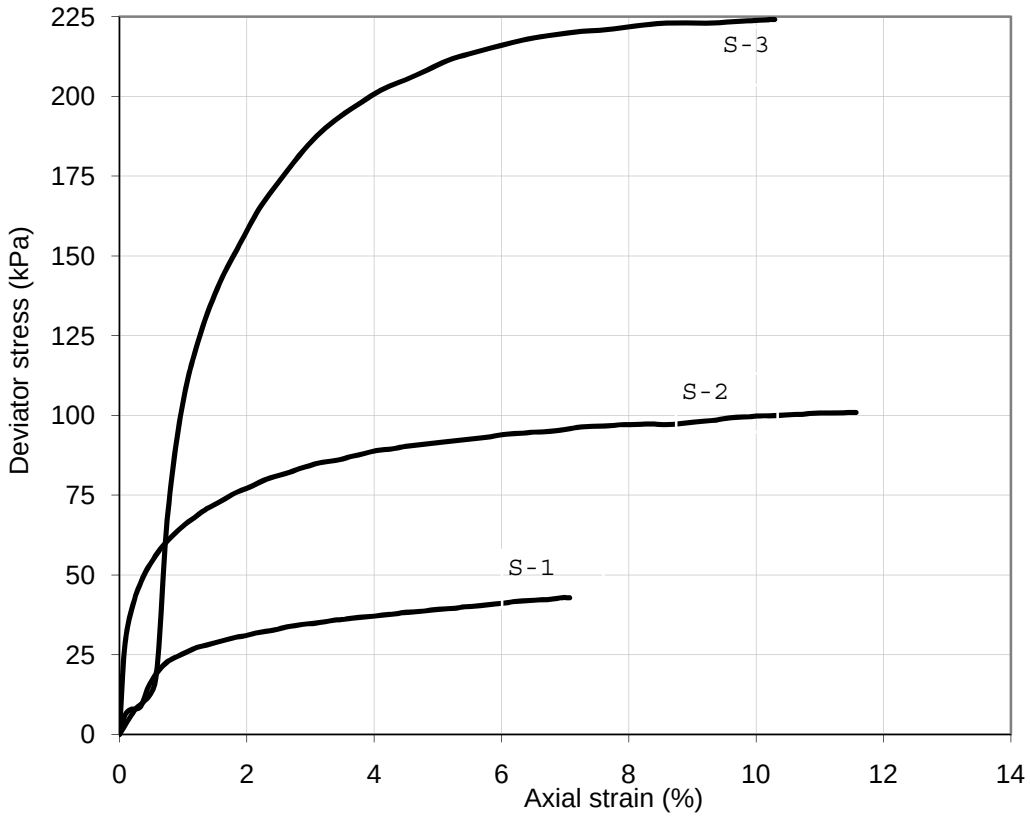


Figure 3 Deviator stress vs axial strain

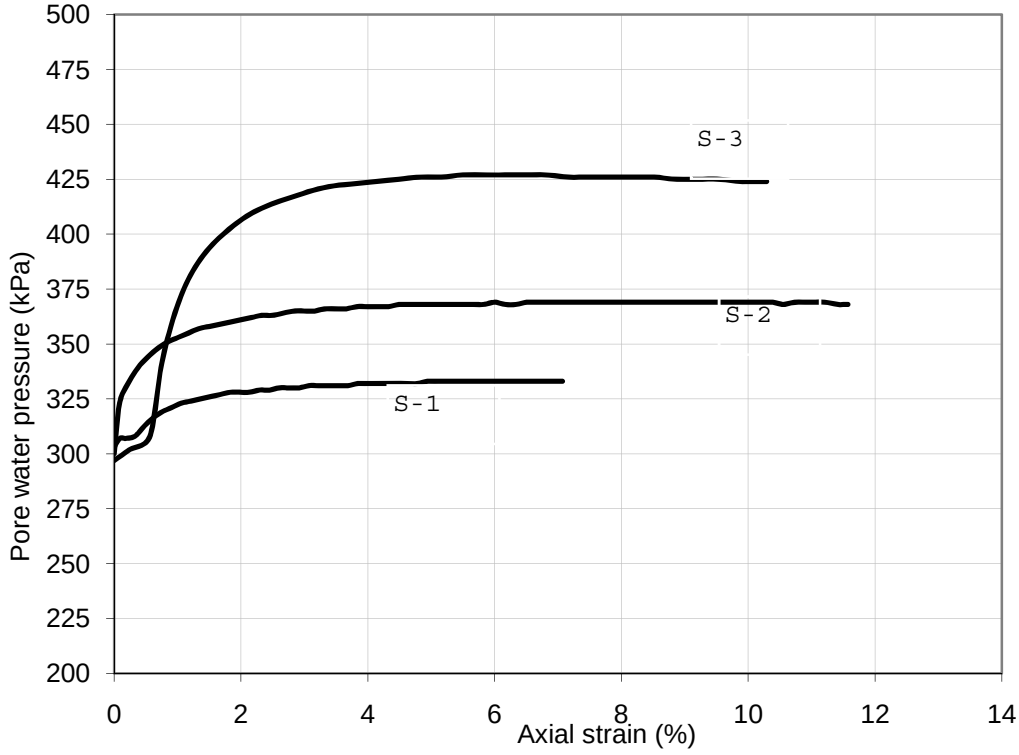


Figure 4 Pore water pressure vs axial strain

Consolidated Undrained Multistage Triaxial Test With Pore Water Pressure Measurements
Ref 12-161, BH03, Depth 6m

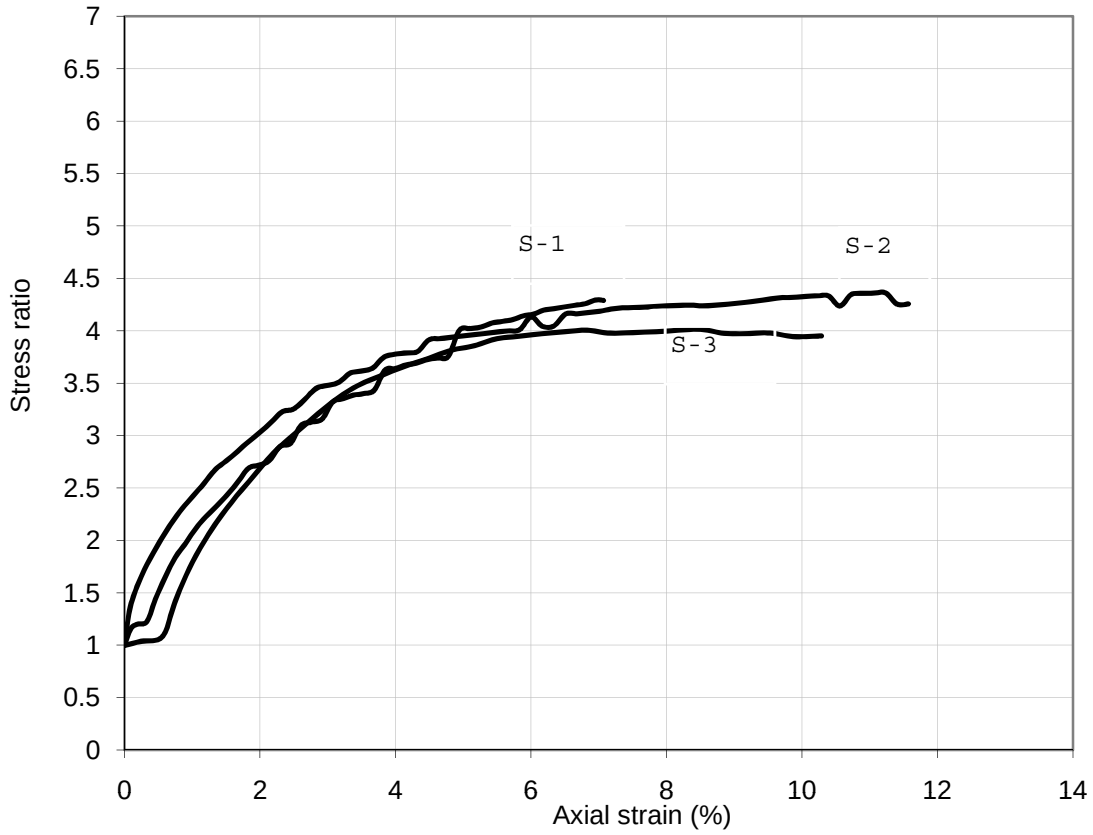


Figure 5 Stress ratio vs axial strain

Consolidated Undrained Multistage Triaxial Test With Pore Water Pressure Measurements
Ref 12-161, BH03, Depth 6m

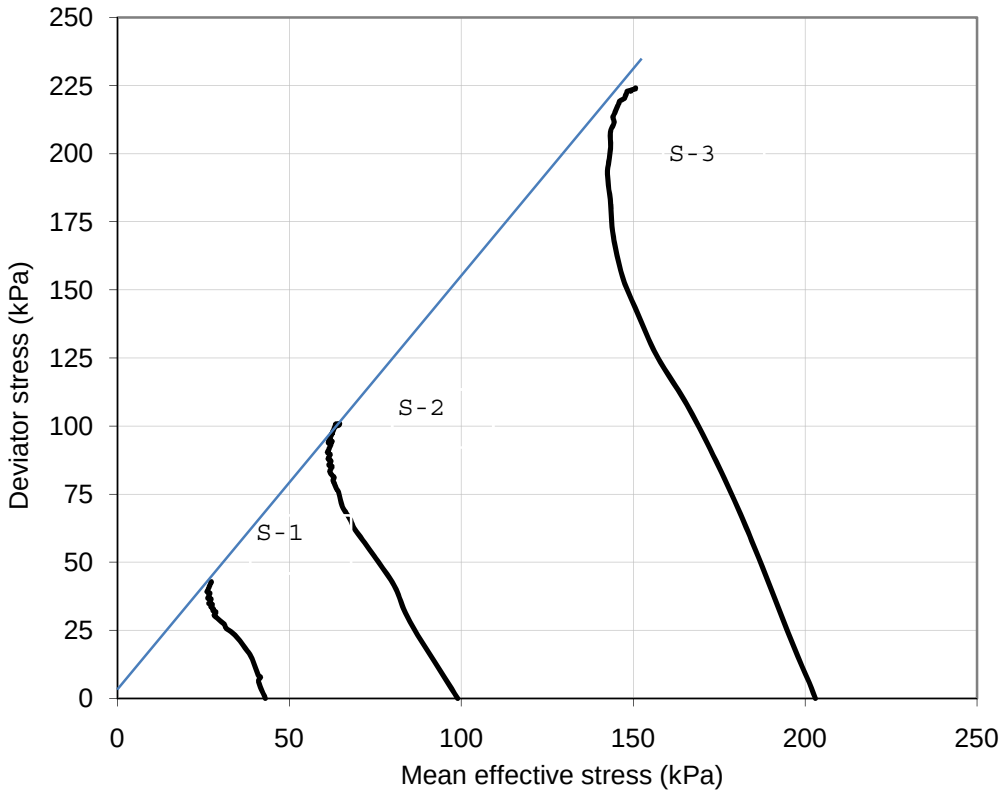


Figure 6 Deviator stress vs mean effective (stress paths)

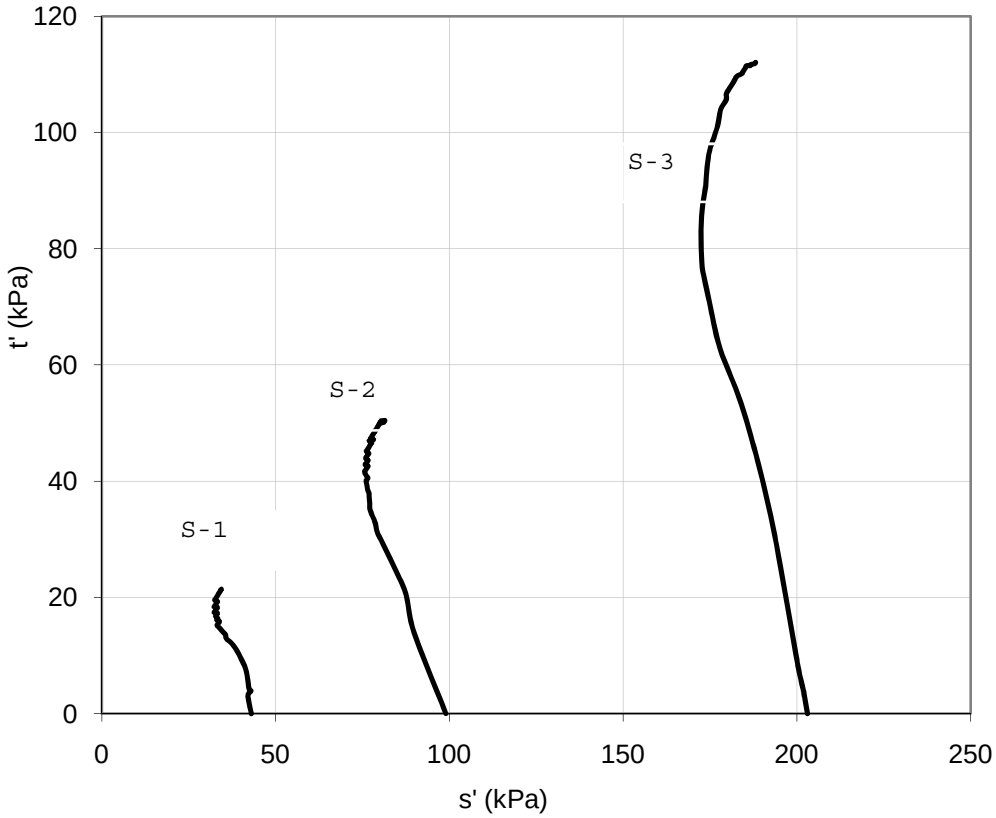


Figure 7 t' vs s' (stress paths)

Consolidated Undrained Multistage Triaxial Test With Pore Water Pressure Measurements
Ref 12-161, BH03, Depth 6m

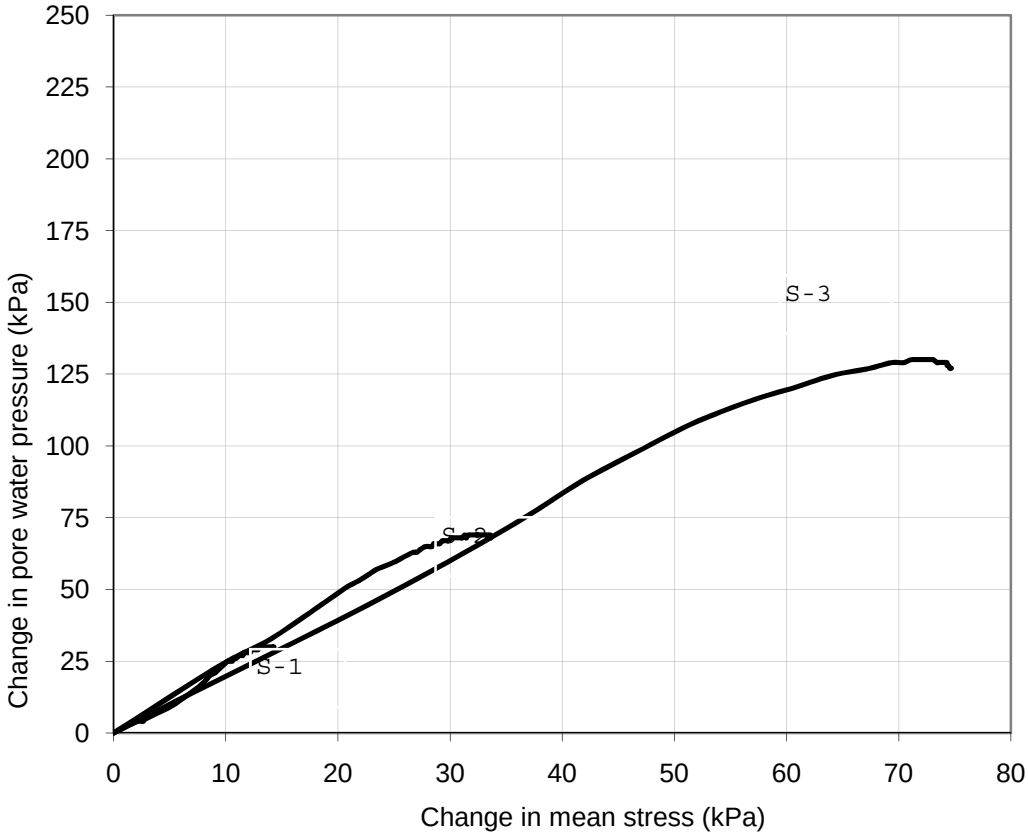


Figure 8 Change in pore water pressure vs change in mean stress

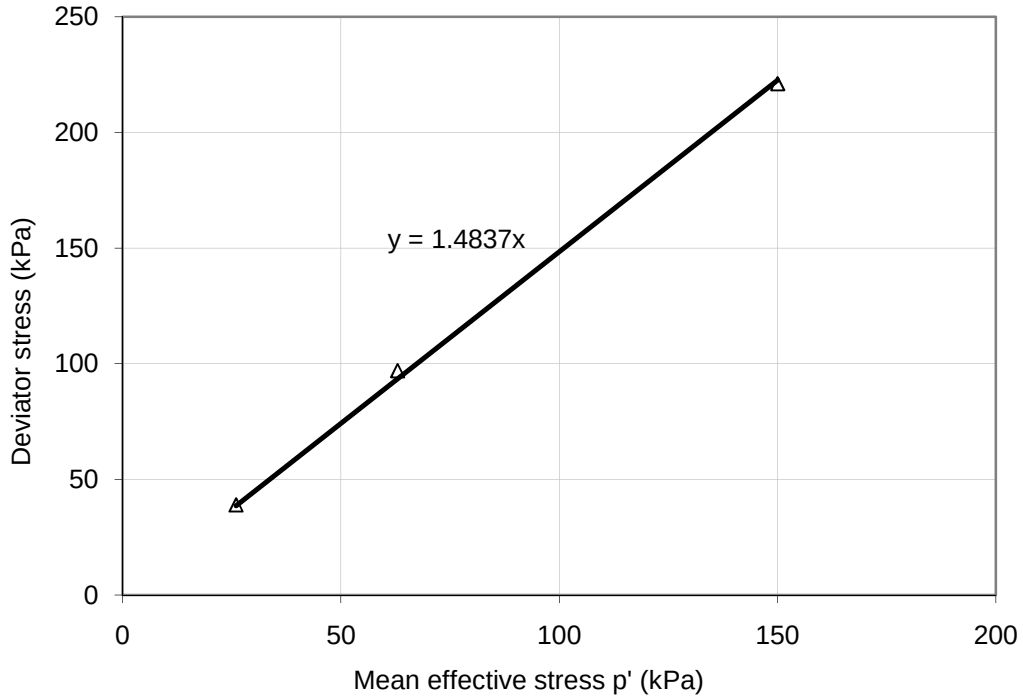


Figure 9 Deviator stress q vs mean effective stress at failure

Consolidated undrained multistage triaxial test with pore water pressure measurements				
Tested in accordance with BS:1377 Part 8				
Location	**Galway**			
Job Ref	**Galway**			
Borehole No	**BH05**			
Depth	**6m**			
Soil type	**Soft grey Clay**			
Sampling	**U100**			
INITIAL CONDITIONS				
Stage No.		**1**	**2**	**3**
Diameter	**mm**	**100**		
Height	**mm**	**200**		
Initial Moisture content	**%**	**56.2**		
Initial Bulk density	**kg/m3**	**1668**		
Initial dry density	**kg/m3**	**1068**		
Specific Gravity		**2.6**		
SATURATION STAGE				
Initial cell pressure	**kPa**	**50**		
Initial B value		**<0.95**		
Back pressure applied	**kPa**	**300**		
Period of saturation	**h**	**24**		
Final B value	**kPa**	**1**		
CONSOLIDATION STAGE				
Cell pressure	**kPa**	**354**	**403**	**503**
Back pressure	**kPa**	**303**	**301**	**205**
Effective consolidation pressure	**kPa**	**51**	**102**	**298**
Drainage conditions	**S/F/T/B**			
Period of consolidation	**h**	**72**	**49**	**70**
Water content after consolidation%		**46.4**	**42.3**	**34.8**
Void ratio		**1.207**	**1.100**	**0.904**
Total cell pressure	**kPa**	**354**	**403**	**503**
Rate of strain	**%/h**	**0.10**	**0.16**	**0.19**
Period of compression	**h**	**54**	**70**	**48**
CONDITIONS AT FAILURE				
Mem. and side drains corrections	**kPa**	**3**	**3**	**3**
Maximum deviator stress	**kPa**	**45**	**85**	**219**
Pore water pressure	**kPa**	**341**	**381**	**434**
Change in pore water pressure	**kPa**	**36.0**	**81.0**	**230.0**
Strain at failure	**%**	**5.6**	**11.5**	**9.1**
Minor principal total stress	**kPa**	**354**	**403**	**503**
Major principal total stress	**kPa**	**399**	**488**	**722**
Minor principal effective stress	**kPa**	**13**	**22**	**69**
Major principal effective stress	**kPa**	**58**	**107**	**288**
A_f		**0.80**	**0.95**	**1.05**
c' (kPa)			**0**	
ϕ' (degrees)				
Critical ϕ' (degrees)			**36**	
Test carried out and checked by VS (QUB)				

Consolidated Undrained Multistage Triaxial Test With Pore Water Pressure Measurements
Ref 12-161, BH05, Depth 6m

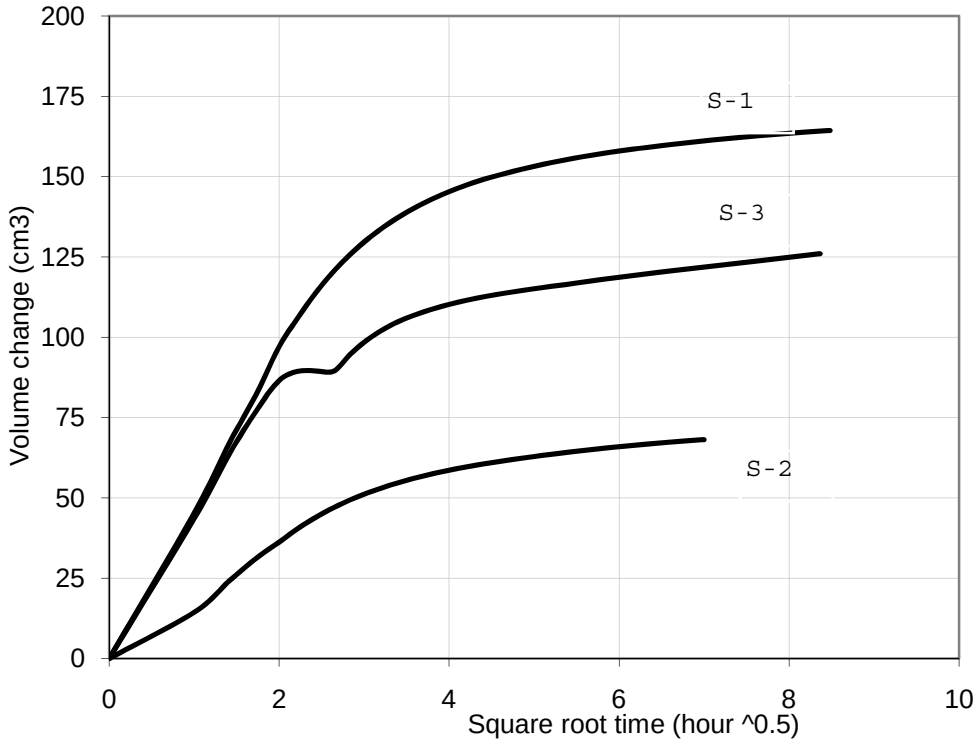


Figure 1 Consolidation: Volume change vs square root time

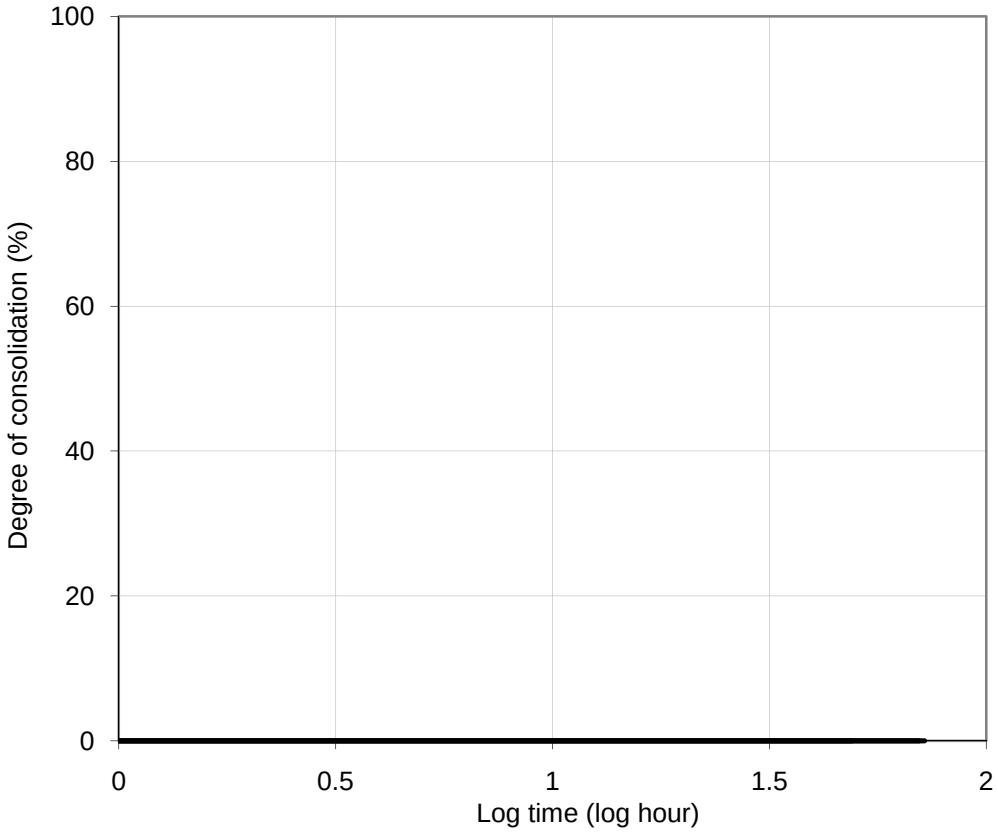


Figure 2 Degree of consolidation vs log time

Consolidated Undrained Multistage Triaxial Test With Pore Water Pressure Measurements
Ref 12-161, BH05, Depth 6m

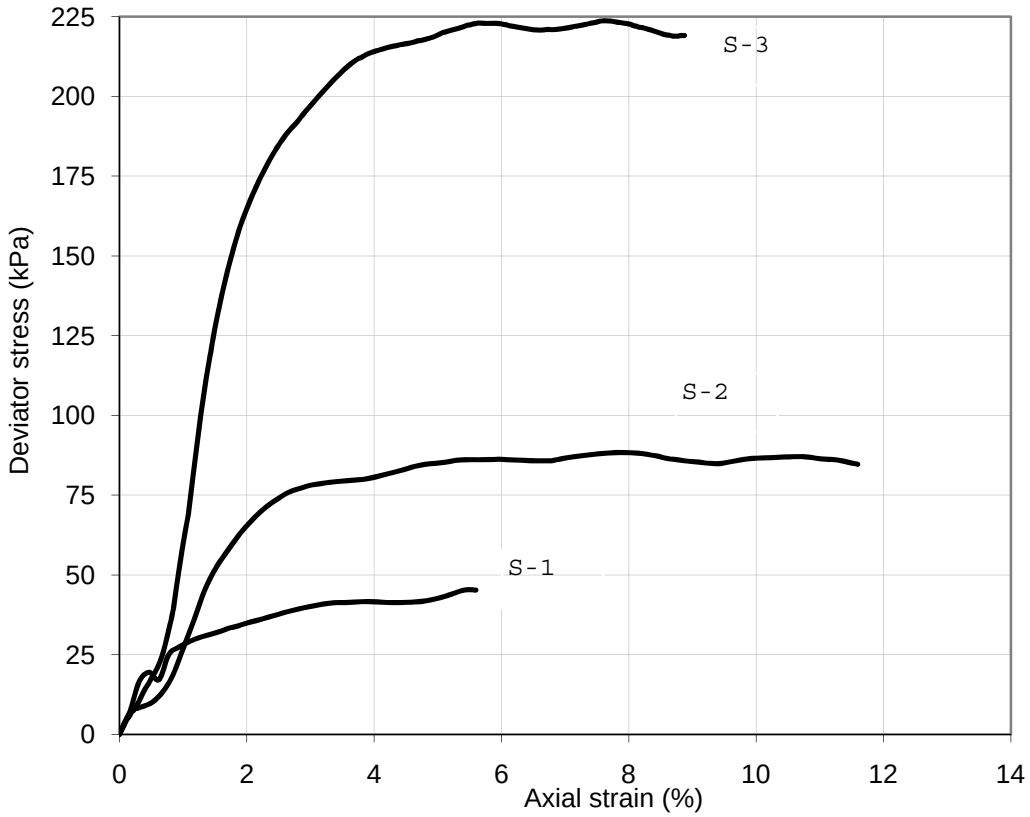


Figure 3 Deviator stress vs axial strain

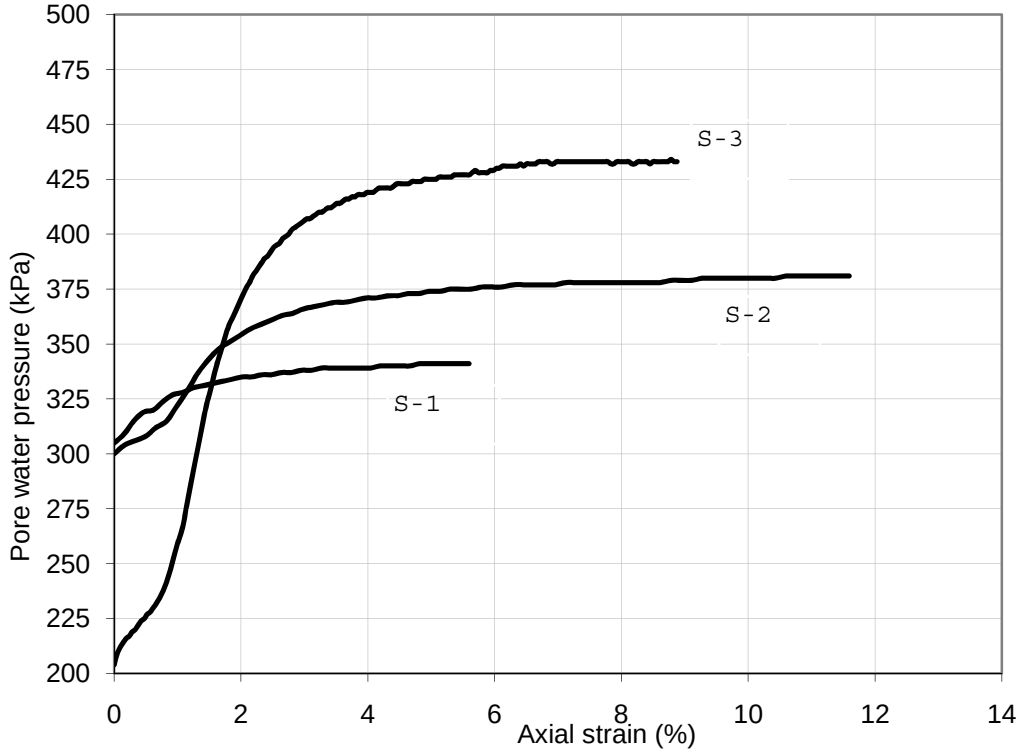


Figure 4 Pore water pressure vs axial strain

Consolidated Undrained Multistage Triaxial Test With Pore Water Pressure Measurements
Ref 12-161, BH05, Depth 6m

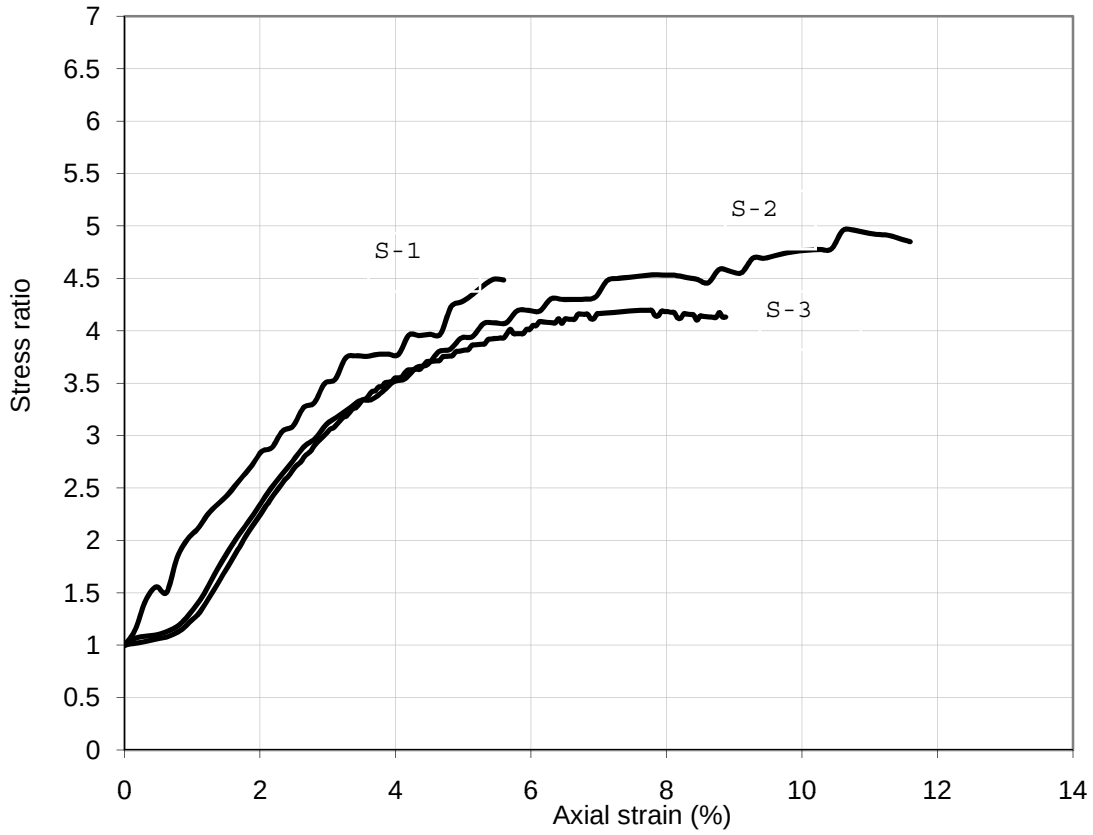


Figure 5 Stress ratio vs axial strain

Consolidated Undrained Multistage Triaxial Test With Pore Water Pressure Measurements
Ref 12-161, BH05, Depth 6m

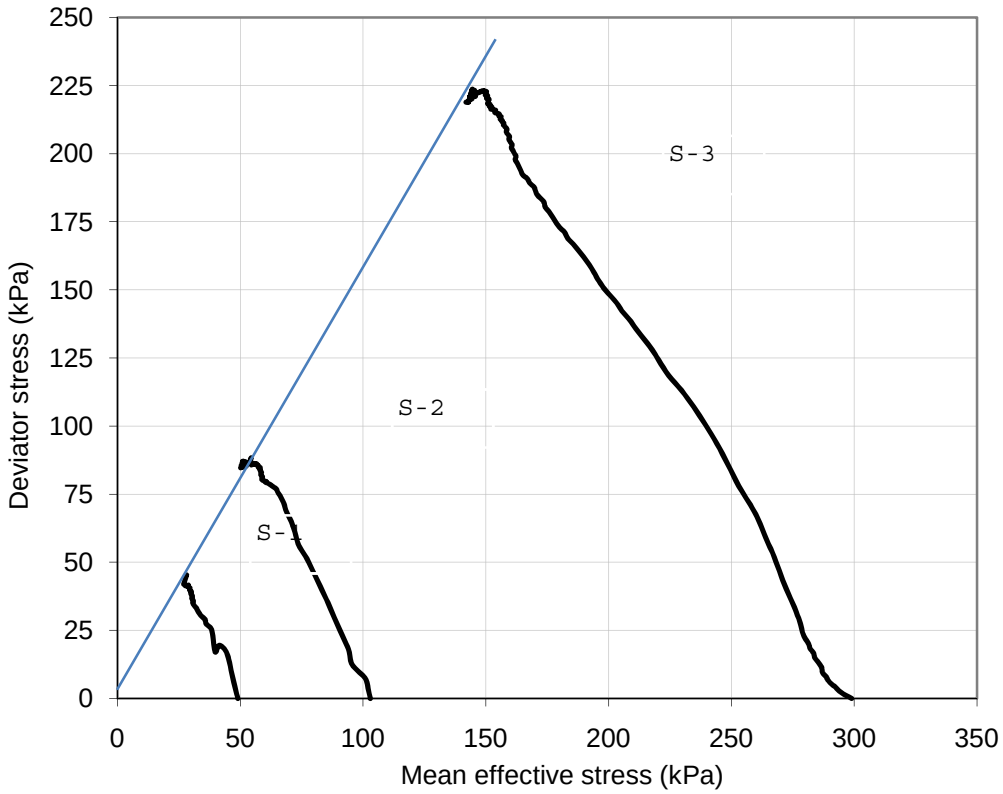


Figure 6 Deviator stress vs mean effective (stress paths)

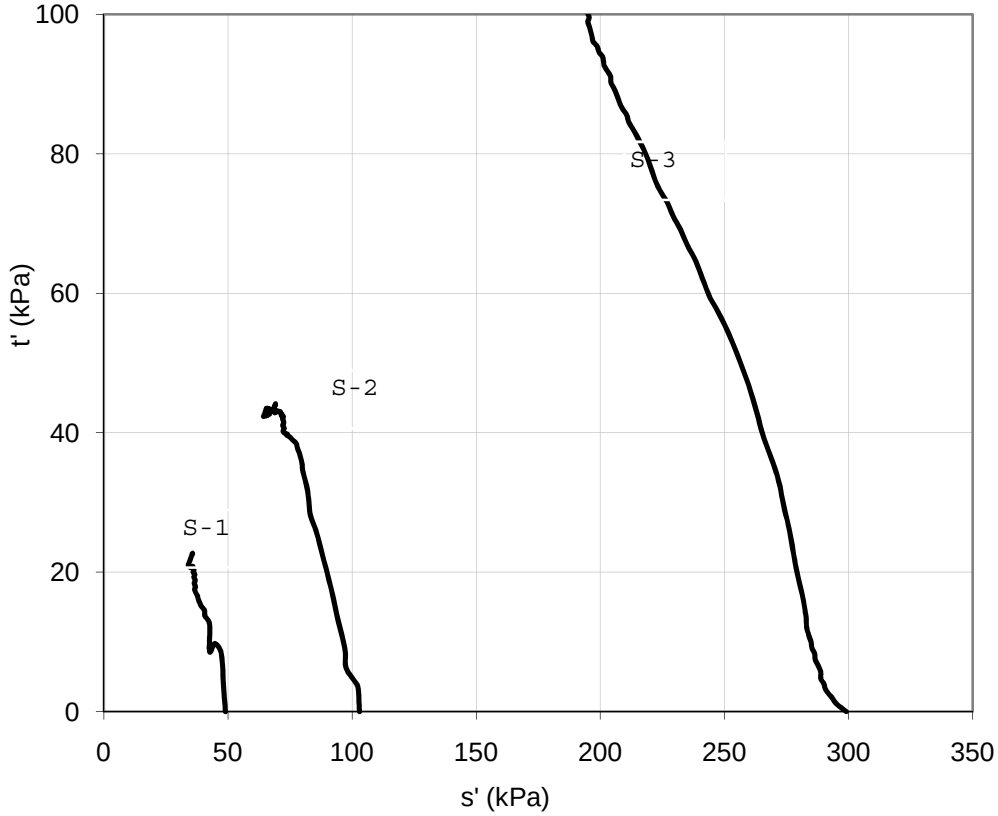


Figure 7 t' vs s' (stress paths)

Consolidated Undrained Multistage Triaxial Test With Pore Water Pressure Measurements
Ref 12-161, BH05, Depth 6m

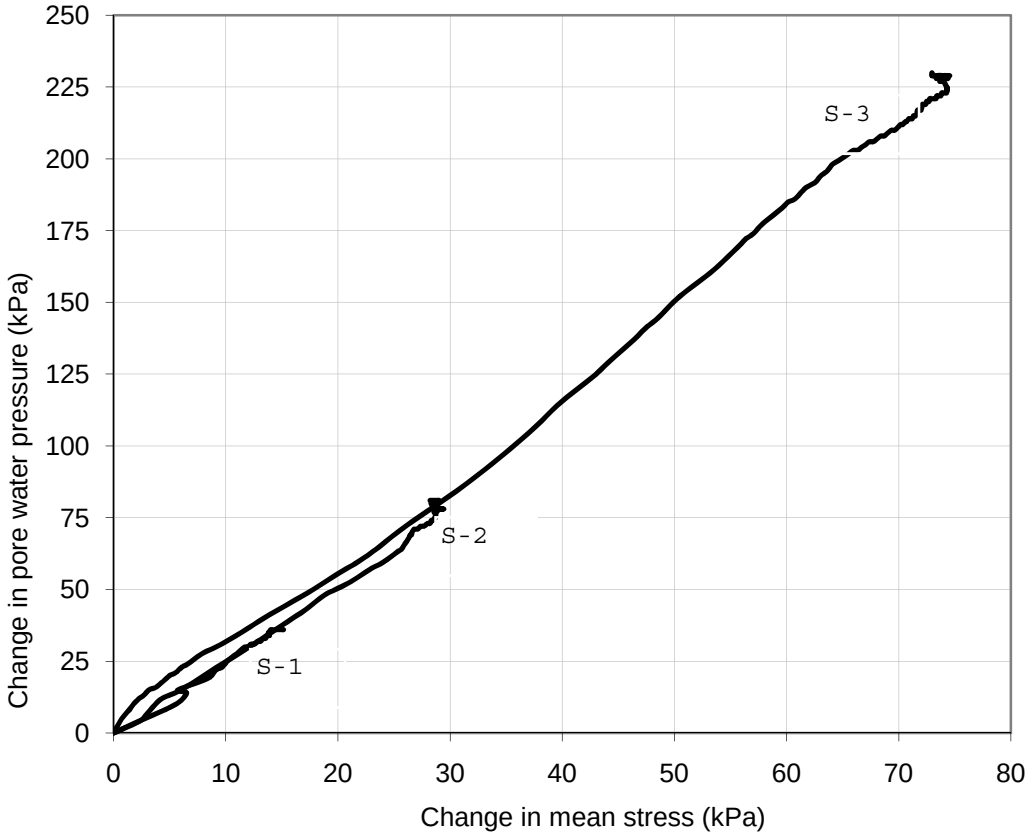


Figure 8 Change in pore water pressure vs change in mean stress

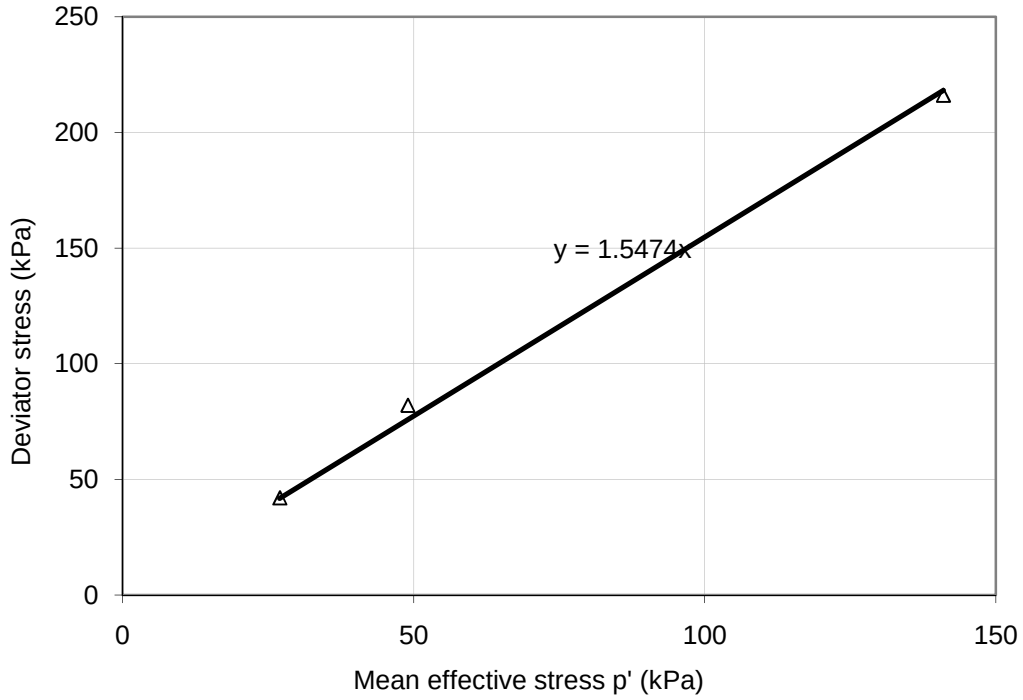


Figure 9 Deviator stress q vs mean effective stress at failure

Consolidated undrained multistage triaxial test with pore water pressure measurements				
Tested in accordance with BS:1377 Part 8				
Location	**Galway**			
Job Ref	**Galway**			
Borehole No	**BH05**			
Depth	**3m**			
Soil type	**Very soft dark grey clayey silt**			
Sampling	**U100**			
INITIAL CONDITIONS				
Stage No.		**1**	**2**	**3**
Diameter	**mm**	**100**		
Height	**mm**	**200**		
Initial Moisture content	**%**	**35.8**		
Initial Bulk density	**kg/m3**	**1806**		
Initial dry density	**kg/m3**	**1330**		
Specific Gravity		**2.6**		
SATURATION STAGE				
Initial cell pressure	**kPa**	**50**		
Initial B value		**<0.95**		
Back pressure applied	**kPa**	**300**		
Period of saturation	**h**	**24**		
Final B value	**kPa**	**1**		
CONSOLIDATION STAGE				
Cell pressure	**kPa**	**348**	**401**	**503**
Back pressure	**kPa**	**300**	**303**	**303**
Effective consolidation pressure	**kPa**	**48**	**98**	**200**
Drainage conditions	**S/F/T/B**			
Period of consolidation	**h**	**57**	**45**	**40**
Water content after consolidation%		**26.6**	**22.3**	**18.5**
Void ratio		**0.691**	**0.579**	**0.482**
Total cell pressure	**kPa**	**348**	**401**	**503**
Rate of strain	**%/h**	**0.12**	**0.12**	**0.13**
Period of compression	**h**	**51**	**68**	**90**
CONDITIONS AT FAILURE				
Mem. and side drains corrections	**kPa**	**3**	**3**	**3**
Maximum deviator stress	**kPa**	**40**	**88**	**180**
Pore water pressure	**kPa**	**334**	**372**	**440**
Change in pore water pressure	**kPa**	**34.0**	**68.0**	**137.0**
Strain at failure	**%**	**6**	**8.2**	**12**
Minor principal total stress	**kPa**	**348**	**401**	**503**
Major principal total stress	**kPa**	**388**	**489**	**683**
Minor principal effective stress	**kPa**	**14**	**29**	**63**
Major principal effective stress	**kPa**	**54**	**117**	**243**
A_f		**0.85**	**0.77**	**0.76**
c' (kPa)			**0**	
ϕ' (degrees)				
Critical ϕ' (degrees)			**34**	
Test carried out and checked by VS (QUB)				

Consolidated Undrained Multistage Triaxial Test With Pore Water Pressure Measurements
Ref 12-161, BH05, Depth 3m

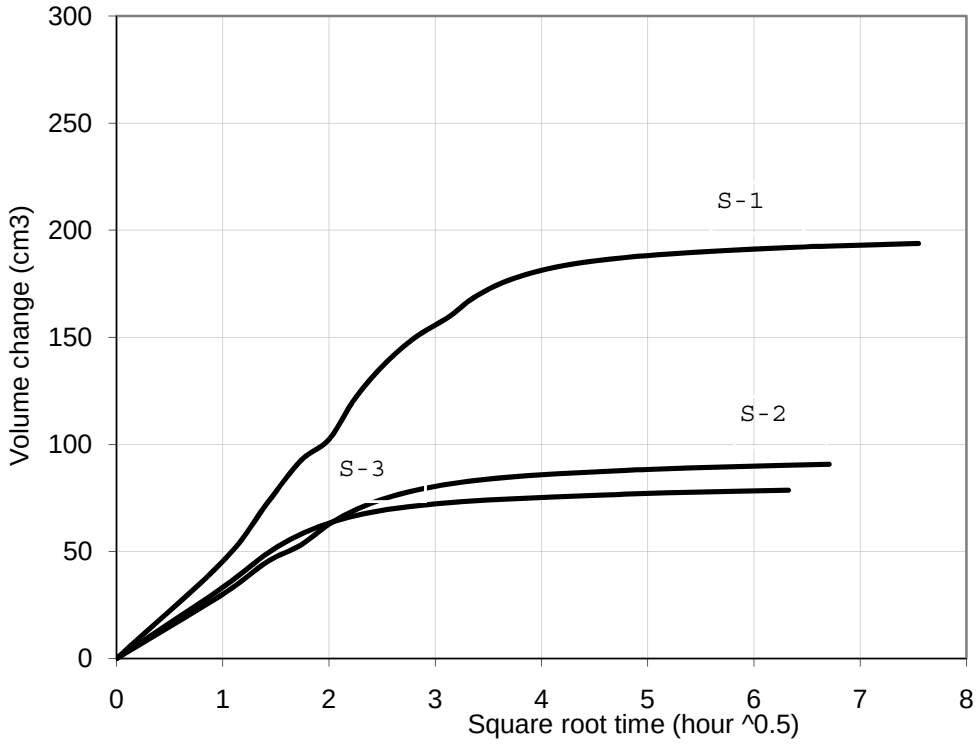


Figure 1 Consolidation: Volume change vs square root time

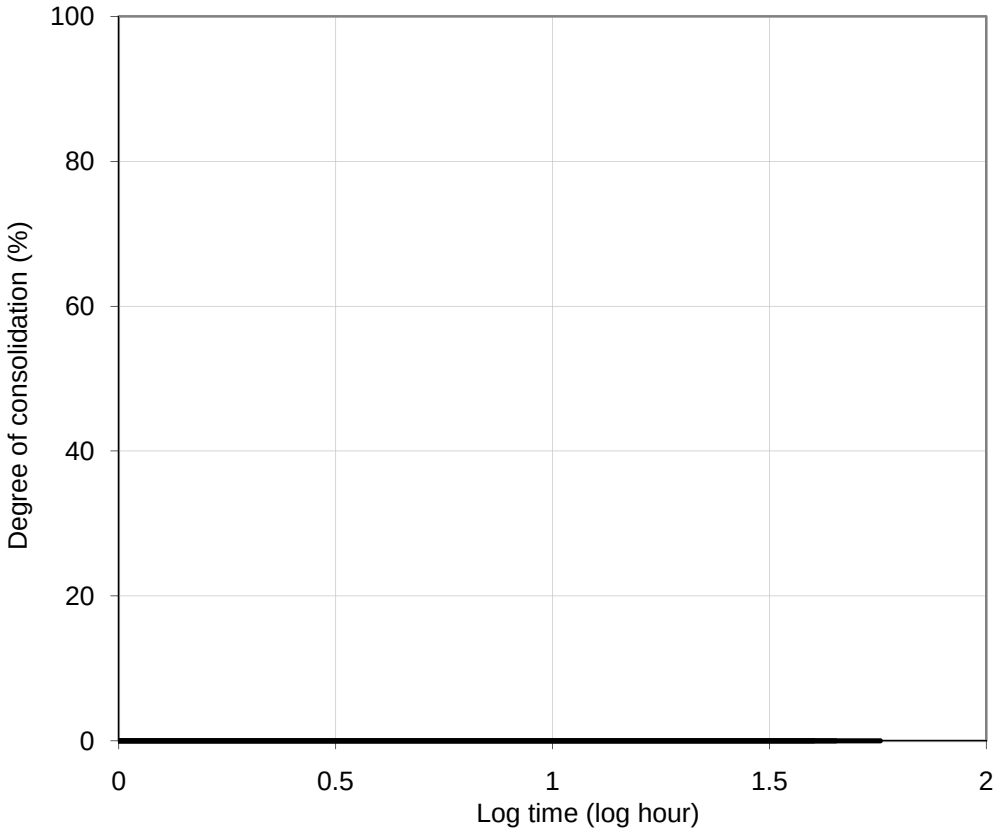


Figure 2 Degree of consolidation vs log time

Consolidated Undrained Multistage Triaxial Test With Pore Water Pressure Measurements
Ref 12-161, BH05, Depth 3m

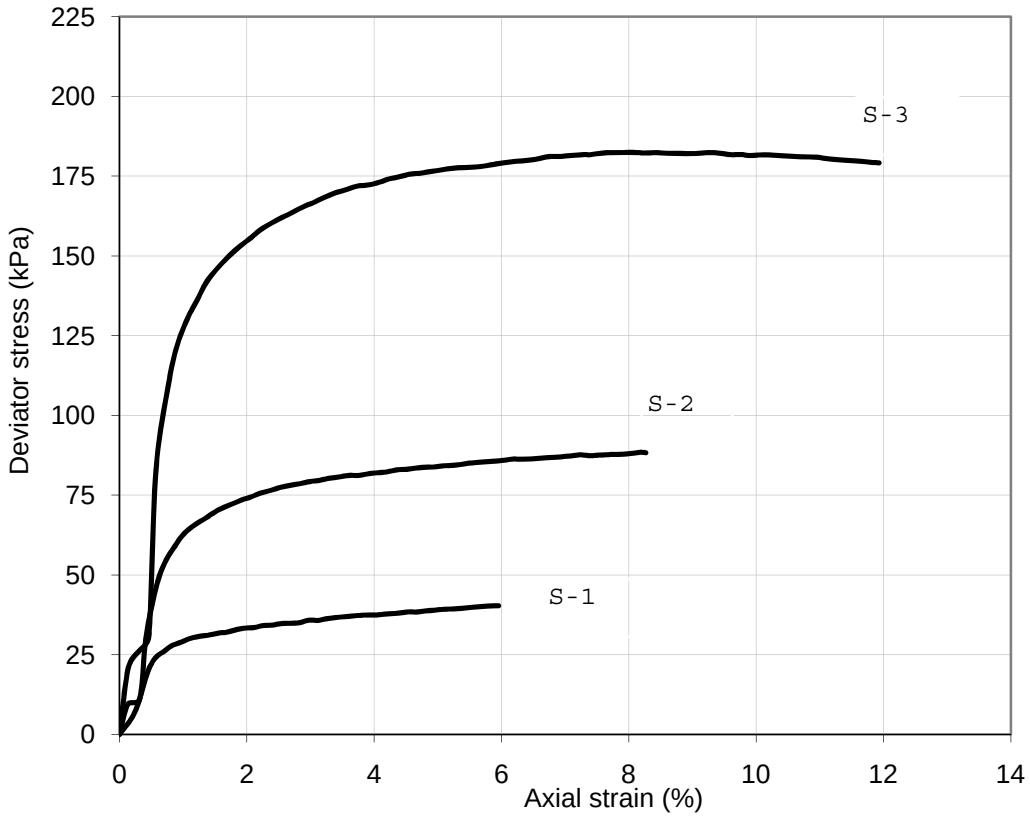


Figure 3 Deviator stress vs axial strain

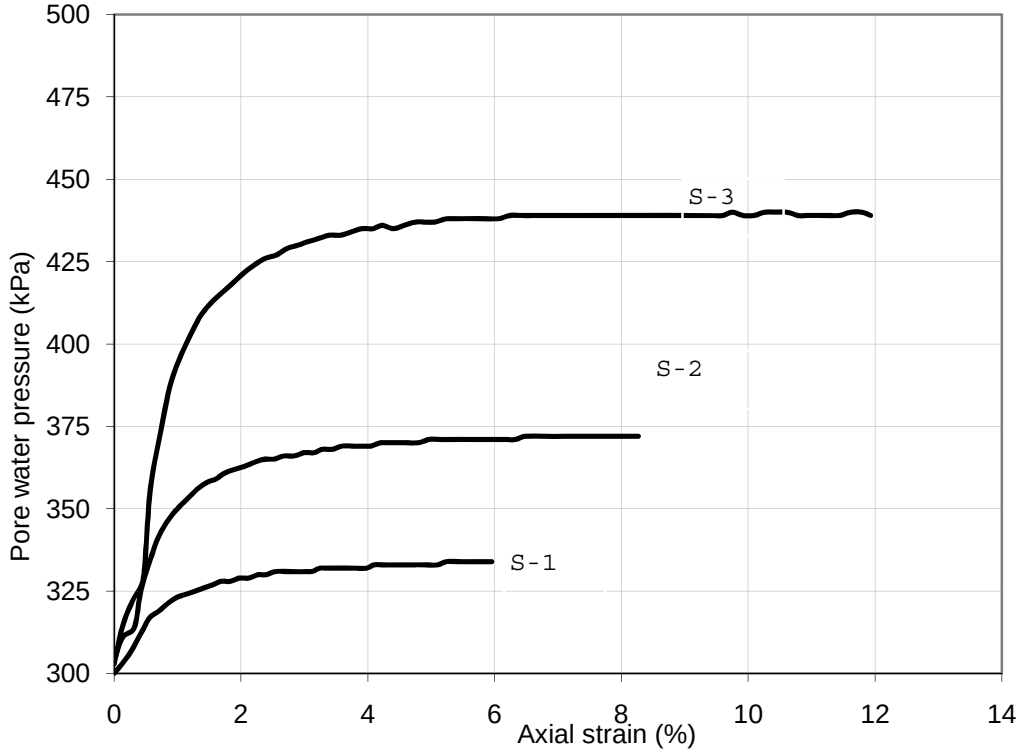


Figure 4 Pore water pressure vs axial strain

Consolidated Undrained Multistage Triaxial Test With Pore Water Pressure Measurements
Ref 12-161, BH05, Depth 3m

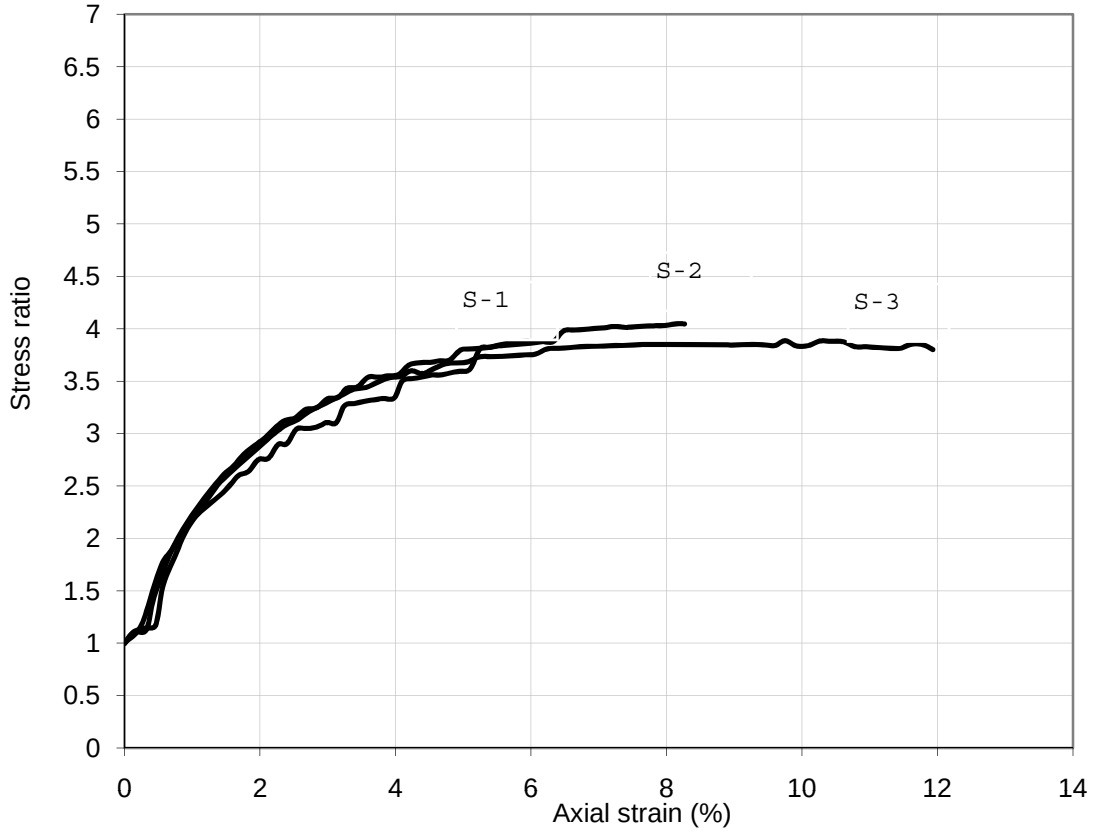


Figure 5 Stress ratio vs axial strain

Consolidated Undrained Multistage Triaxial Test With Pore Water Pressure Measurements
Ref 12-161, BH05, Depth 3m

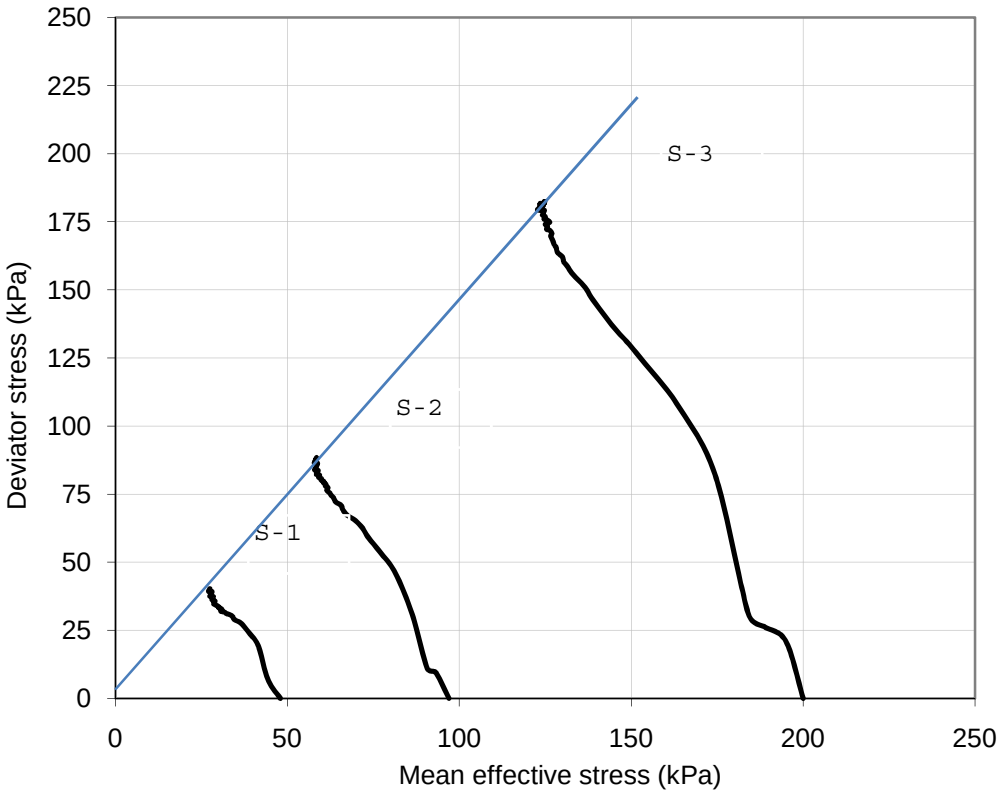


Figure 6 Deviator stress vs mean effective (stress paths)

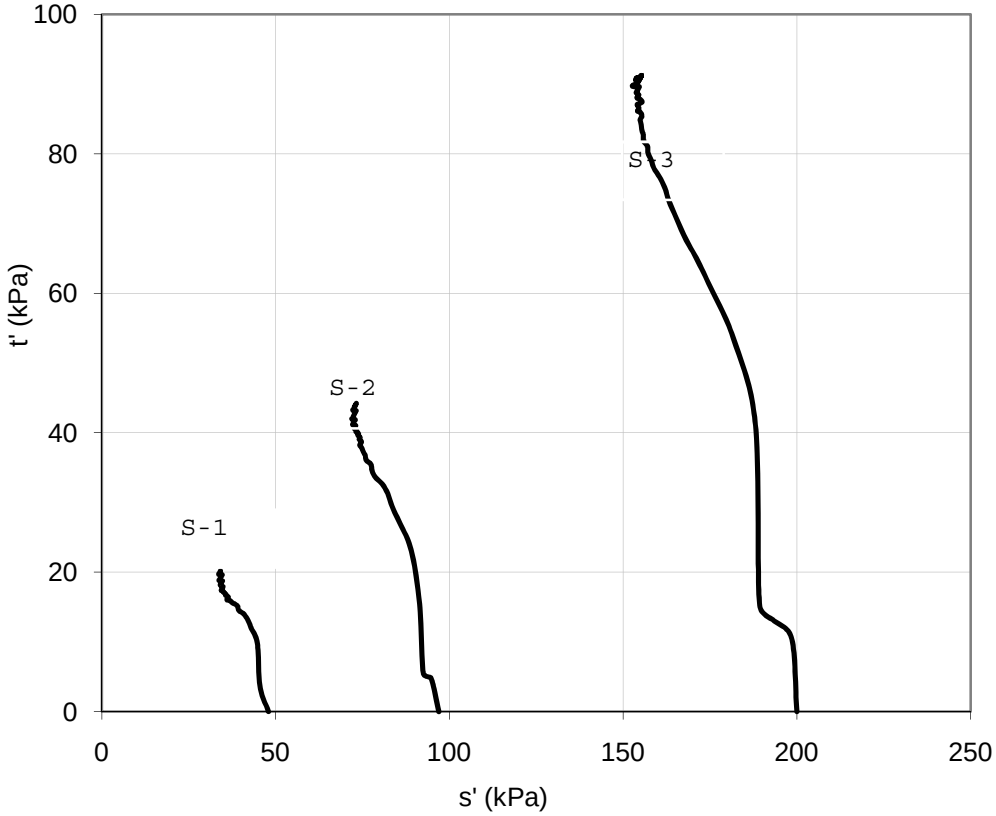


Figure 7 t' vs s' (stress paths)

Consolidated Undrained Multistage Triaxial Test With Pore Water Pressure Measurements
Ref 12-161, BH05, Depth 3m

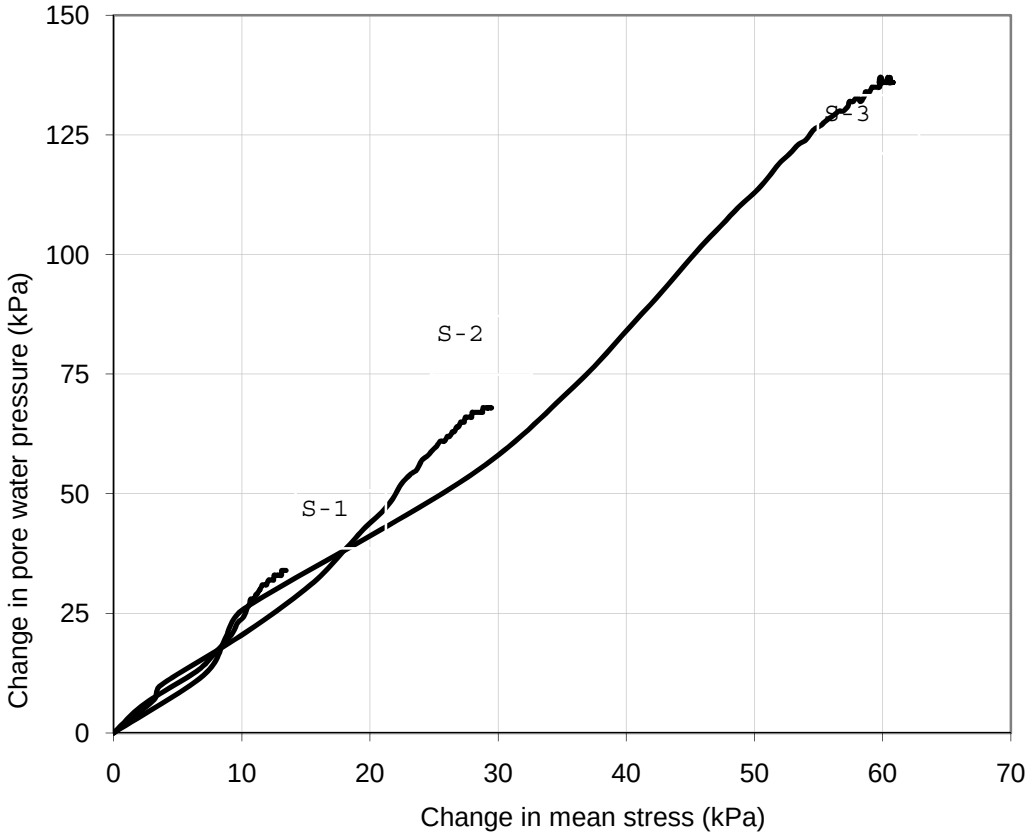


Figure 8 Change in pore water pressure vs change in mean stress

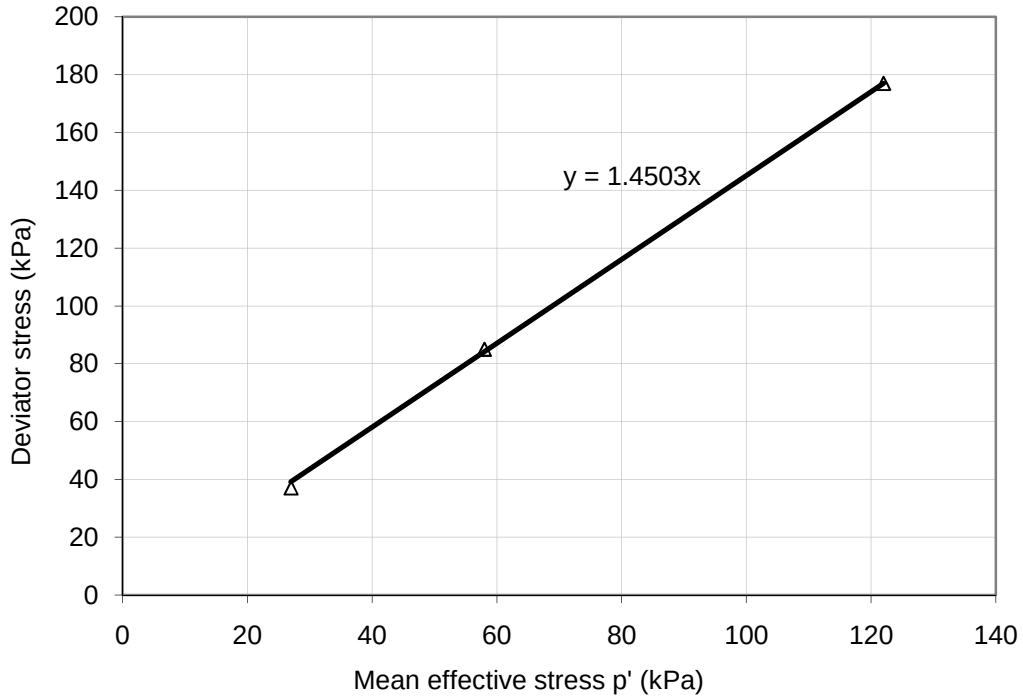


Figure 9 Deviator stress q vs mean effective stress at failure

Consolidated undrained multistage triaxial test with pore water pressure measurements				
Tested in accordance with BS:1377 Part 8				
Location	**Galway**			
Job Ref	**Galway**			
Borehole No	**BH03**			
Depth	**4m**			
Soil type	**Very soft dark grey clayey silt**			
Sampling	**U100**			
INITIAL CONDITIONS				
Stage No.		**1**	**2**	**3**
Diameter	**mm**	**100**		
Height	**mm**	**200**		
Initial Moisture content	**%**	**19.5**		
Initial Bulk density	**kg/m3**	**1590**		
Initial dry density	**kg/m3**	**1330**		
Specific Gravity		**2.6**		
SATURATION STAGE				
Initial cell pressure	**kPa**	**50**		
Initial B value		**<0.95**		
Back pressure applied	**kPa**	**300**		
Period of saturation	**h**	**24**		
Final B value	**kPa**	**1**		
CONSOLIDATION STAGE				
Cell pressure	**kPa**	**349**	**401**	**500**
Back pressure	**kPa**	**298**	**298**	**303**
Effective consolidation pressure	**kPa**	**51**	**103**	**197**
Drainage conditions	**S/F/T/B**			
Period of consolidation	**h**	**53**	**48**	**44**
Water content after consolidation%		**14.7**	**10.9**	**6.9**
Void ratio		**0.382**	**0.284**	**0.179**
Total cell pressure	**kPa**	**349**	**401**	**500**
Rate of strain	**%/h**	**0.10**	**0.10**	**0.08**
Period of compression	**h**	**51**	**66**	**90**
CONDITIONS AT FAILURE				
Mem. and side drains corrections	**kPa**	**3**	**3**	**3**
Maximum deviator stress	**kPa**	**70**	**104**	**168**
Pore water pressure	**kPa**	**336**	**372**	**470**
Change in pore water pressure	**kPa**	**38.0**	**74.0**	**172.0**
Strain at failure	**%**	**5**	**6.4**	**6.8**
Minor principal total stress	**kPa**	**349**	**401**	**500**
Major principal total stress	**kPa**	**419**	**505**	**668**
Minor principal effective stress	**kPa**	**13**	**29**	**30**
Major principal effective stress	**kPa**	**83**	**133**	**198**
A_f		**0.54**	**0.71**	**1.02**
c' (kPa)			**0**	
ϕ' (degrees)				
Critical ϕ' (degrees)			**38**	
Test carried out and checked by VS (QUB)				

Consolidated Undrained Multistage Triaxial Test With Pore Water Pressure Measurements
Ref 12-161, BH03, Depth 4m

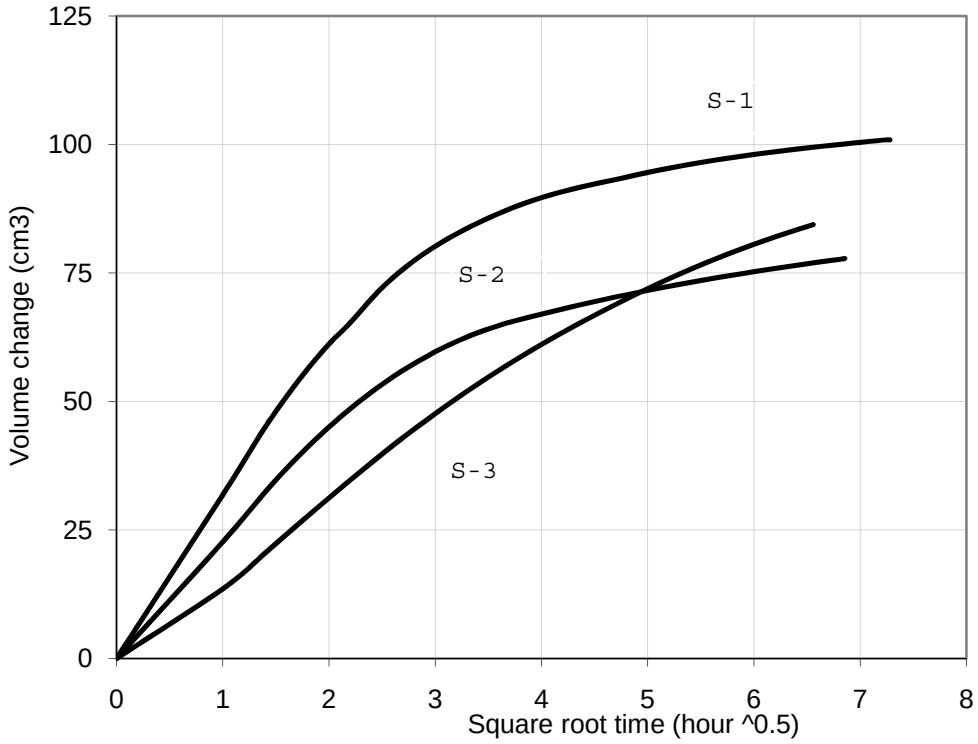


Figure 1 Consolidation: Volume change vs square root time

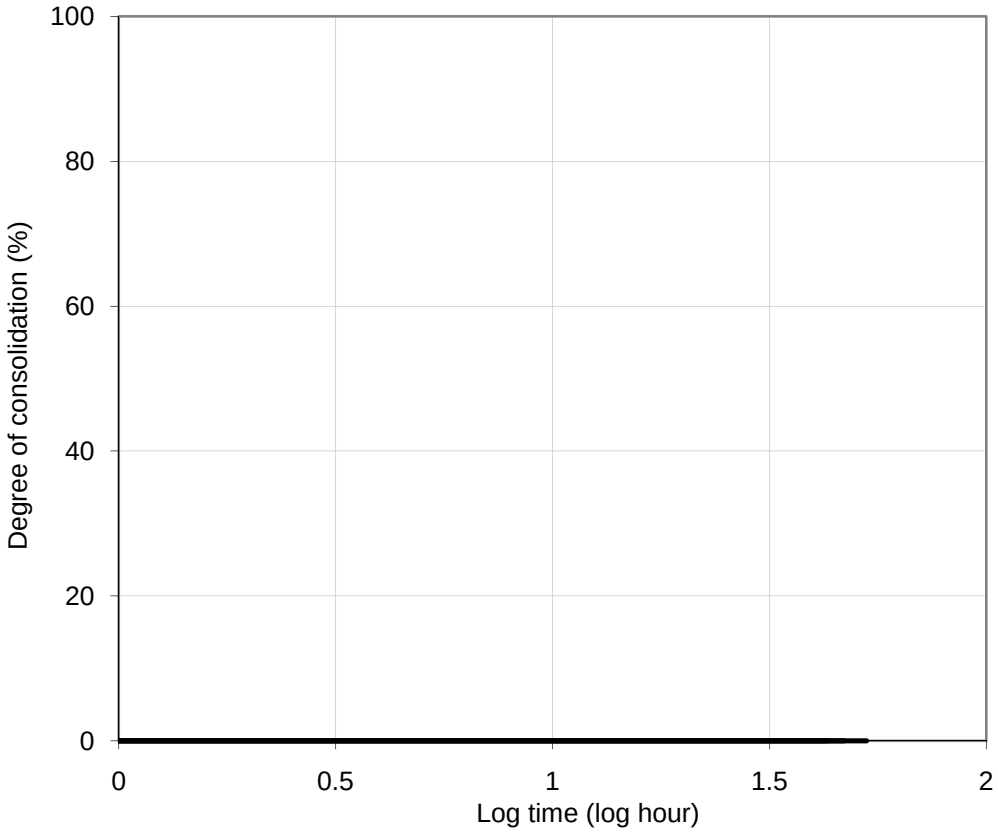


Figure 2 Degree of consolidation vs log time

Consolidated Undrained Multistage Triaxial Test With Pore Water Pressure Measurements
Ref 12-161, BH03, Depth 4m

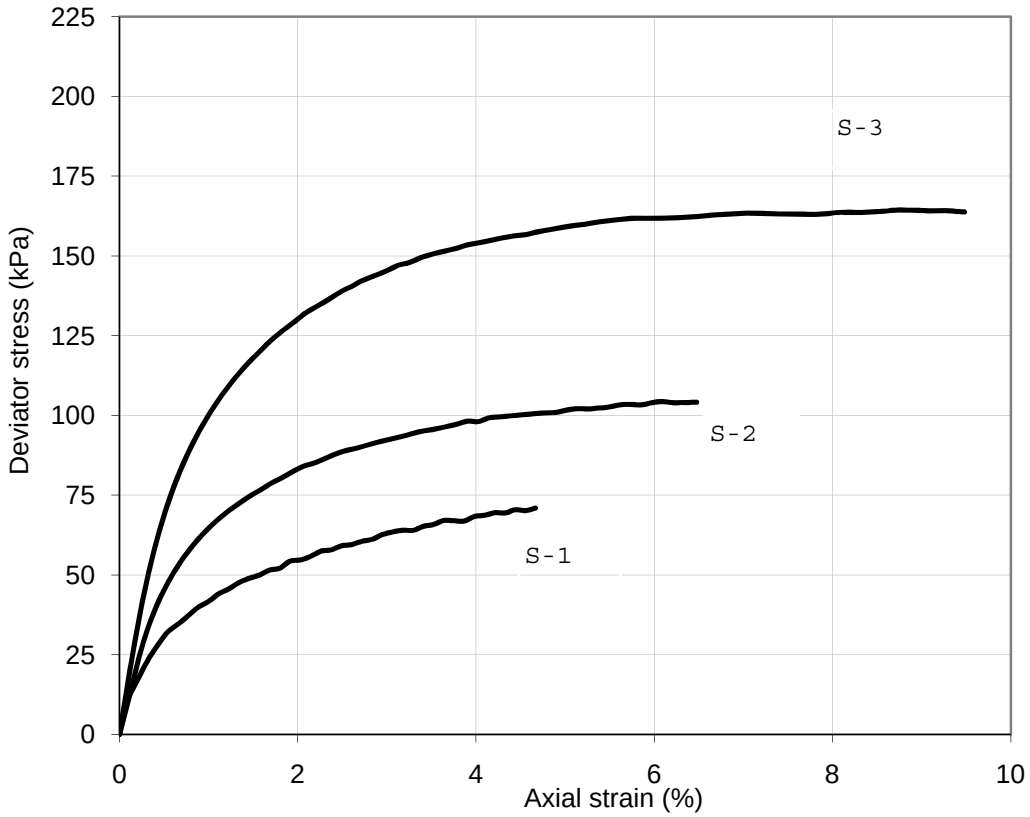


Figure 3 Deviator stress vs axial strain

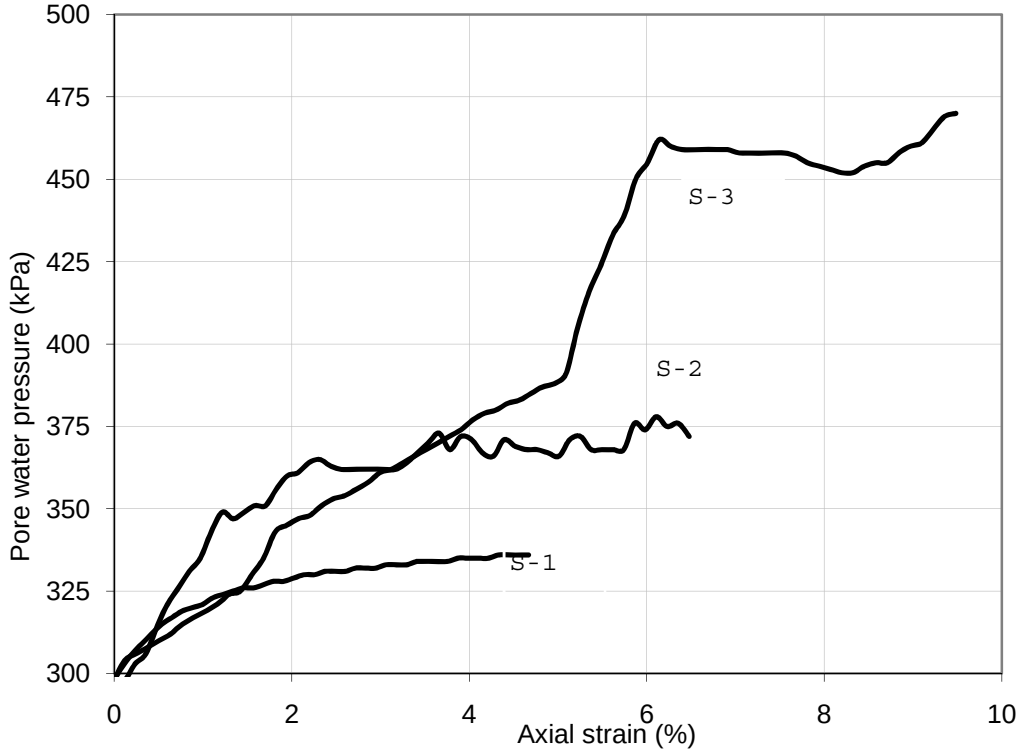


Figure 4 Pore water pressure vs axial strain

Consolidated Undrained Multistage Triaxial Test With Pore Water Pressure Measurements
Ref 12-161, BH03, Depth 4m

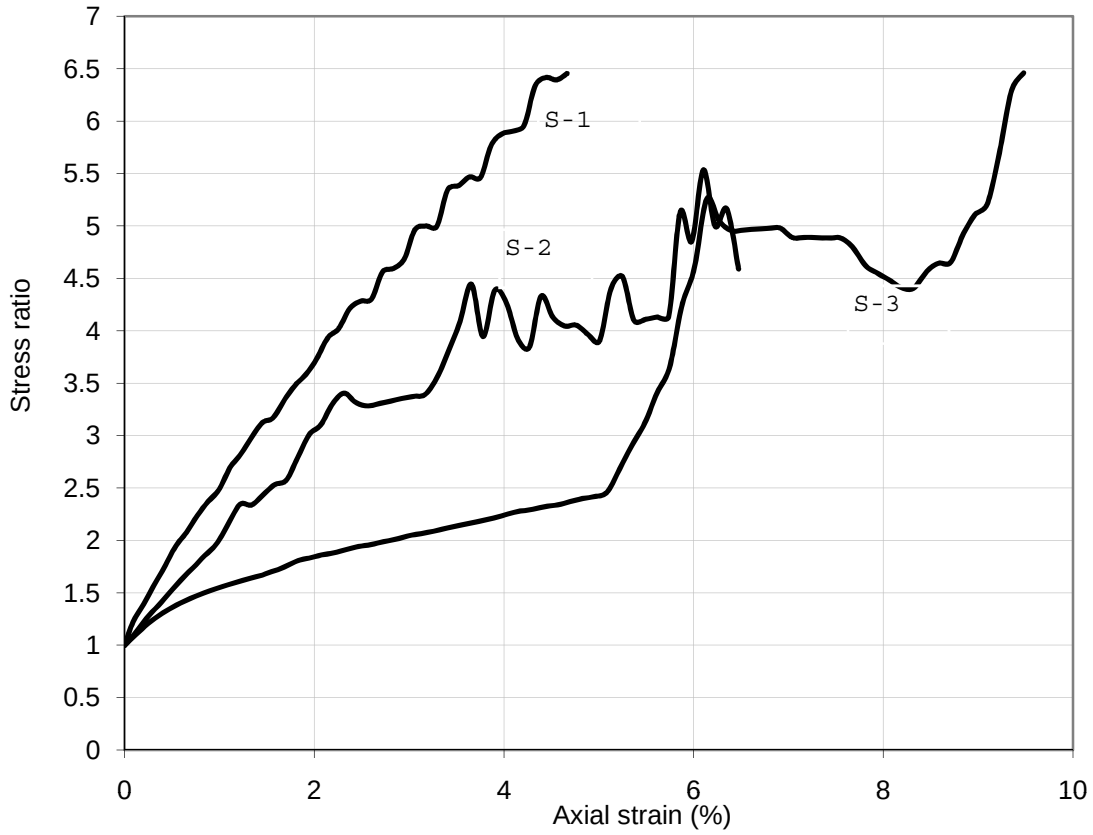


Figure 5 Stress ratio vs axial strain

Consolidated Undrained Multistage Triaxial Test With Pore Water Pressure Measurements
Ref 12-161, BH03, Depth 4m

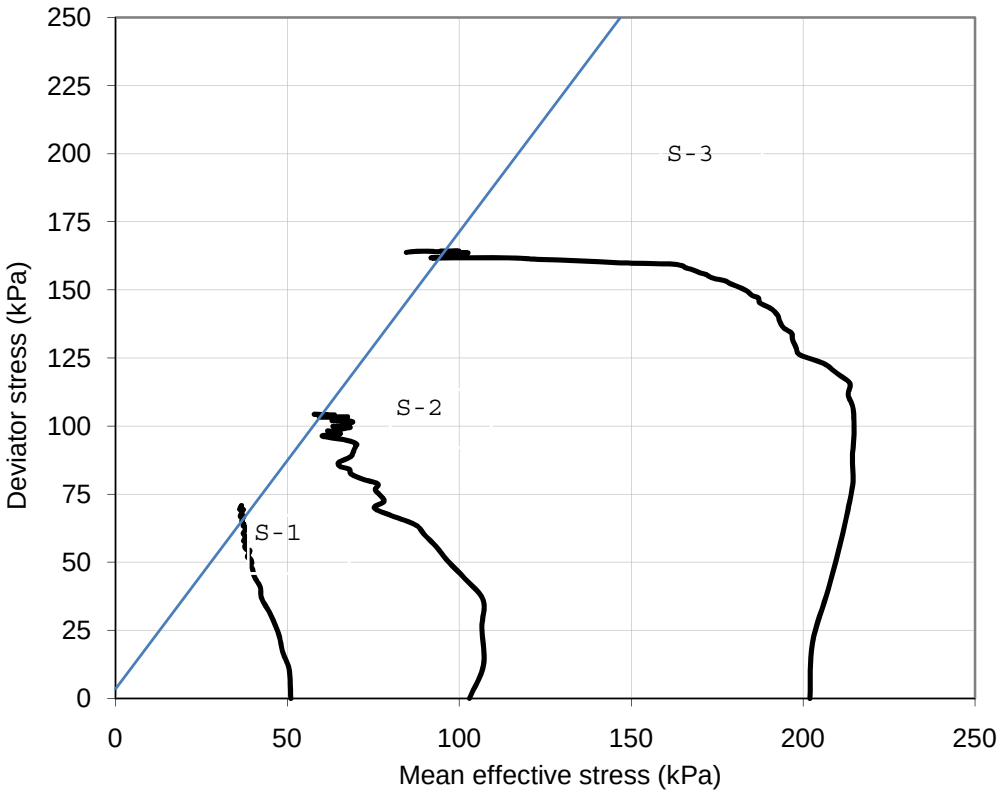


Figure 6 Deviator stress vs mean effective (stress paths)

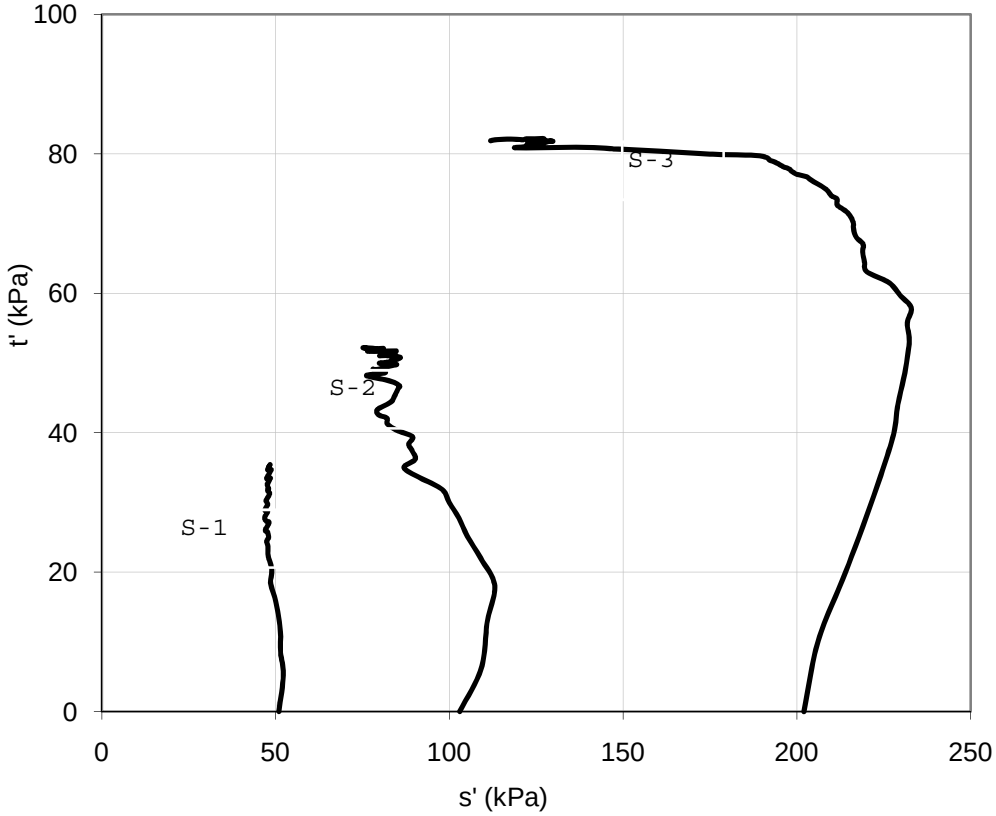


Figure 7 t' vs s' (stress paths)

Consolidated Undrained Multistage Triaxial Test With Pore Water Pressure Measurements
Ref 12-161, BH03, Depth 4m

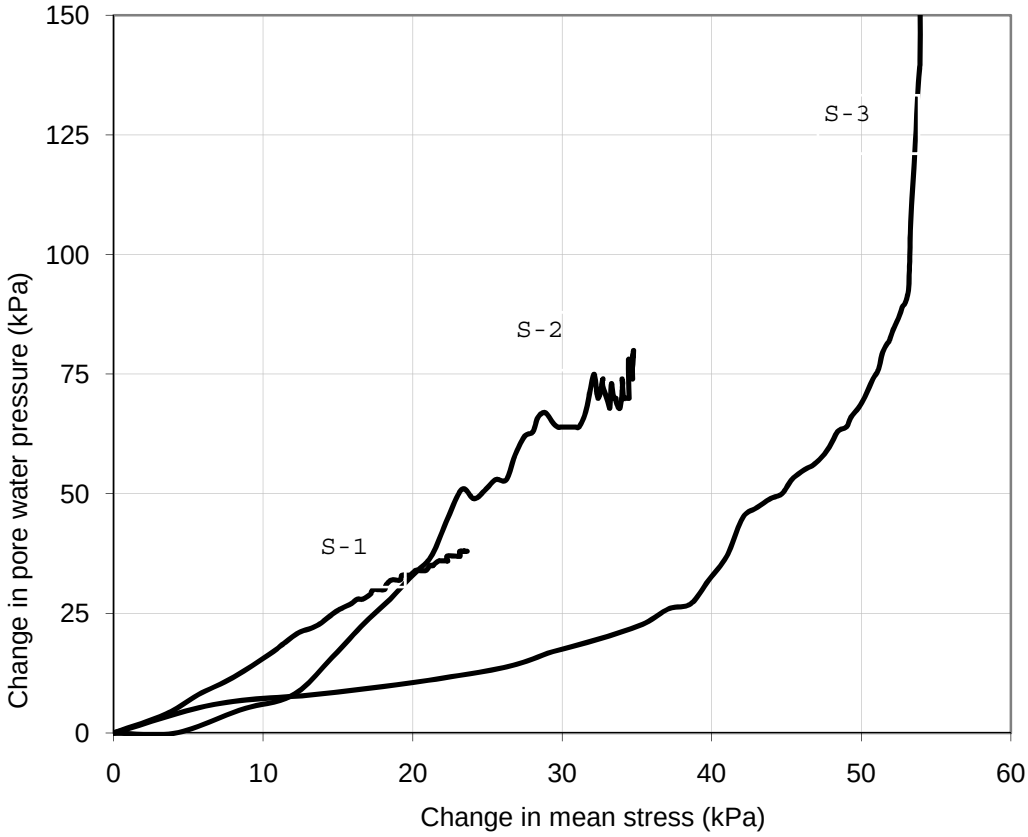


Figure 8 Change in pore water pressure vs change in mean stress

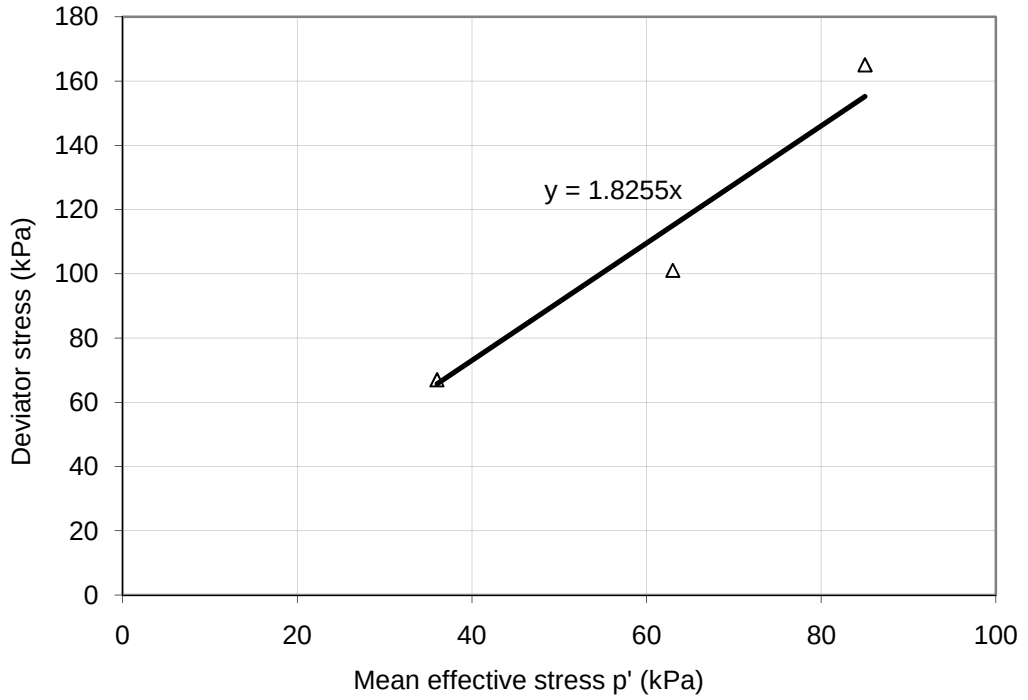


Figure 9 Deviator stress q vs mean effective stress at failure

Consolidated undrained multistage triaxial test with pore water pressure measurements				
Tested in accordance with BS:1377 Part 8				
Location	Galway			
Job Ref	Galway			
Borehole No	BH05			
Depth	6m			
Soil type	Soft grey Clay			
Sampling	U100			
INITIAL CONDITIONS				
Stage No.		1	2	3
Diameter	mm	100		
Height	mm	200		
Initial Moisture content	%	56.2		
Initial Bulk density	kg/m3	1668		
Initial Bulk density	kg/m3	1068		
Specific Gravity		2.6		
SATURATION STAGE				
Initial cell pressure	kPa	50		
Initial B value		<0.95		
Back pressure applied	kPa	300		
Period of saturation	h	24		
Final B value	kPa	1		
CONSOLIDATION STAGE				
Cell pressure	kPa	354	403	503
Back pressure	kPa	303	301	205
Effective consolidation pressure	kPa	51	102	298
Drainage conditions	S/F/T/B			
Period of consolidation	h	72	49	70
Water content after consolidation%		46.4	42.3	34.8
Void ratio		1.207	1.100	0.904
Total cell pressure	kPa	354	403	503
Rate of strain	%/h	0.10	0.16	0.19
Period of compression	h	54	70	48
CONDITIONS AT FAILURE				
Mem. and side drains corrections	kPa	3	3	3
Maximum deviator stress	kPa	45	85	219
Pore water pressure	kPa	341	381	434
Change in pore water pressure	kPa	36.0	81.0	230.0
Strain at failure	%	5.6	11.5	9.1
Minor principal total stress	kPa	354	403	503
Major principal total stress	kPa	399	488	722
Minor principal effective stress	kPa	13	22	69
Major principal effective stress	kPa	58	107	288
A_f		0.80	0.95	1.05
c' (kPa)				
ϕ' (degrees)				
Critical ϕ' (degrees)			36	
Test carried out and checked by VS (QUB)				

Consolidated Undrained Multistage Triaxial Test With Pore Water Pressure Measurements
Ref 12-161, BH05, Depth 6m

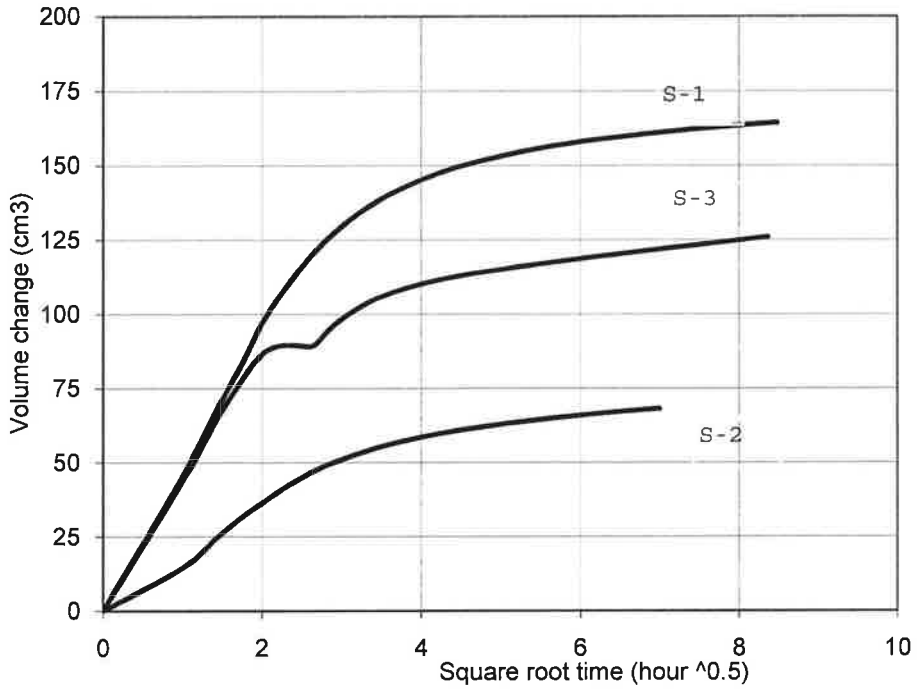


Figure 1 Consolidation: Volume change vs square root time

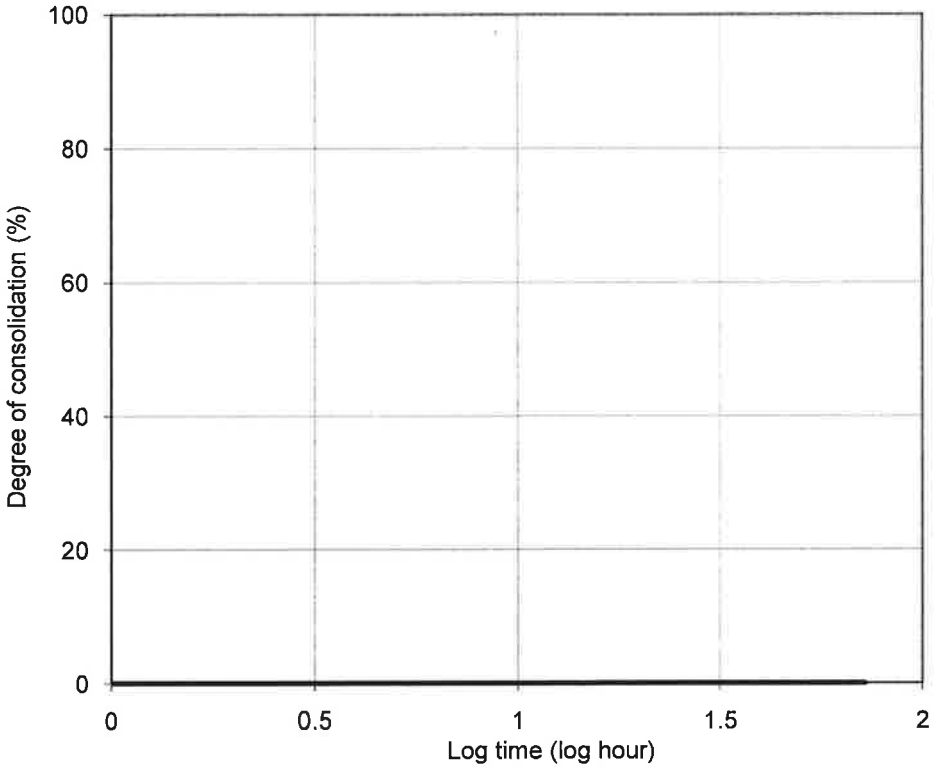


Figure 2 Degree of consolidation vs log time

Consolidated Undrained Multistage Triaxial Test With Pore Water Pressure Measurements
Ref 12-161, BH05, Depth 6m

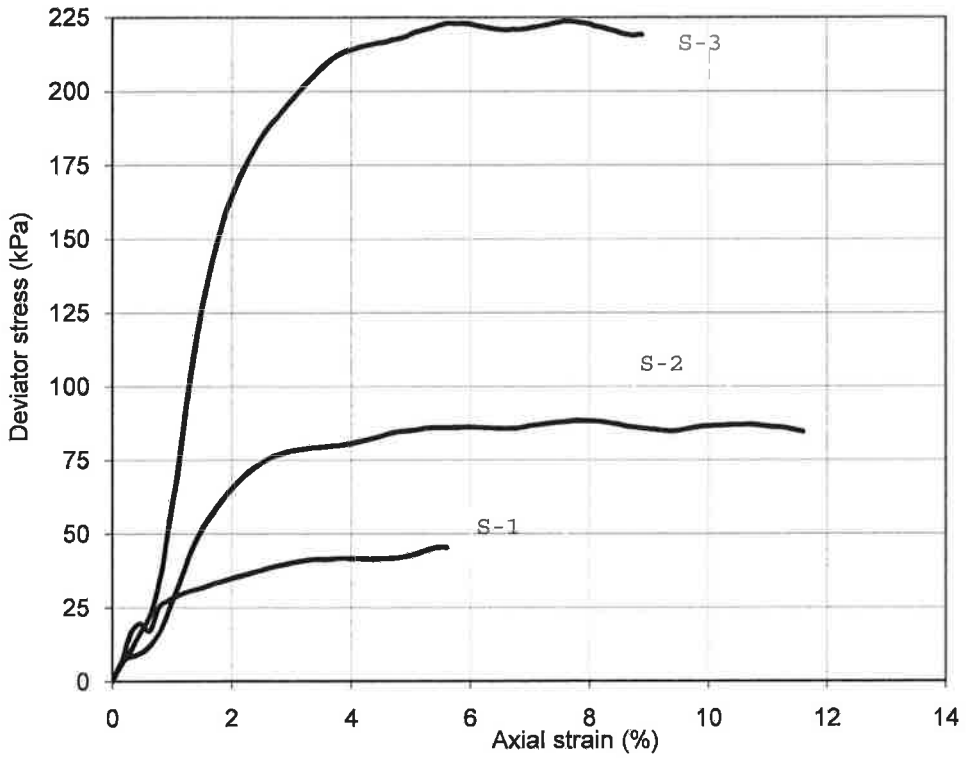


Figure 3 Deviator stress vs axial strain

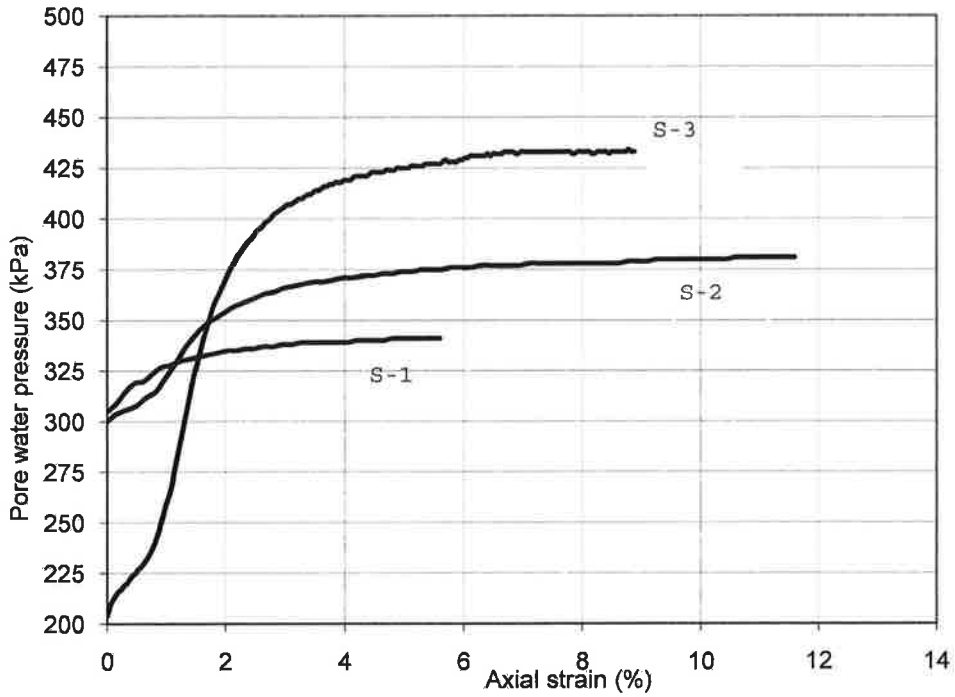


Figure 4 Pore water pressure vs axial strain

Consolidated Undrained Multistage Triaxial Test With Pore Water Pressure Measurements
Ref 12-161, BH05, Depth 6m

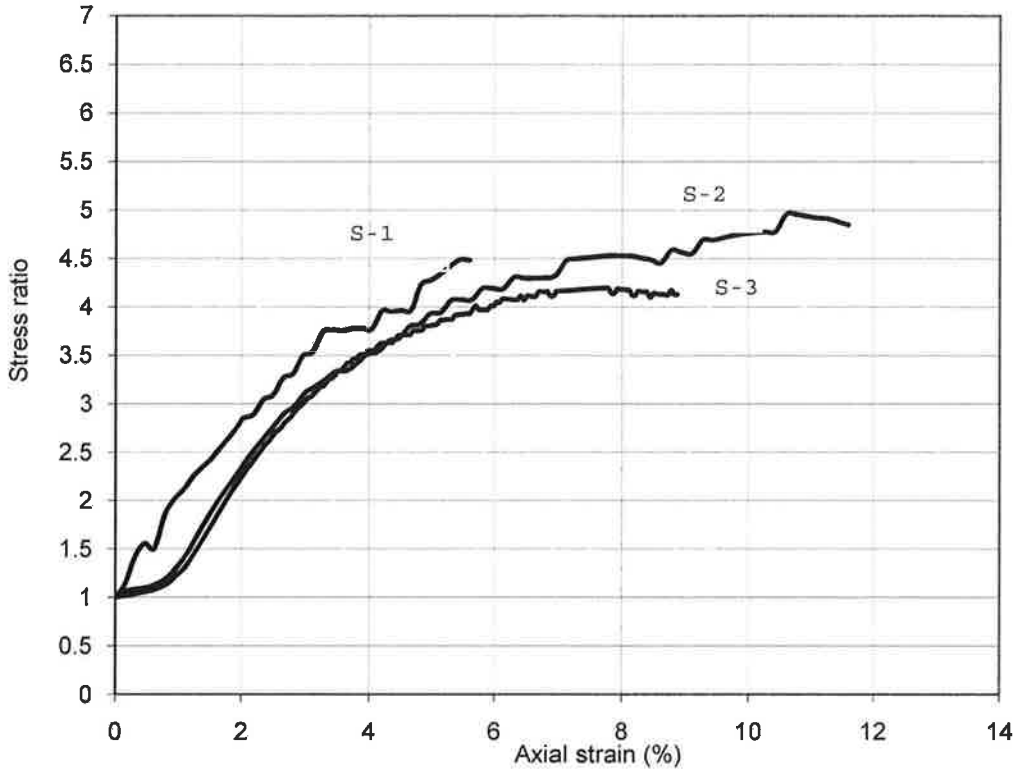


Figure 5 Stress ratio vs axial strain

Consolidated Undrained Multistage Triaxial Test With Pore Water Pressure Measurements
Ref 12-161, BH05, Depth 6m

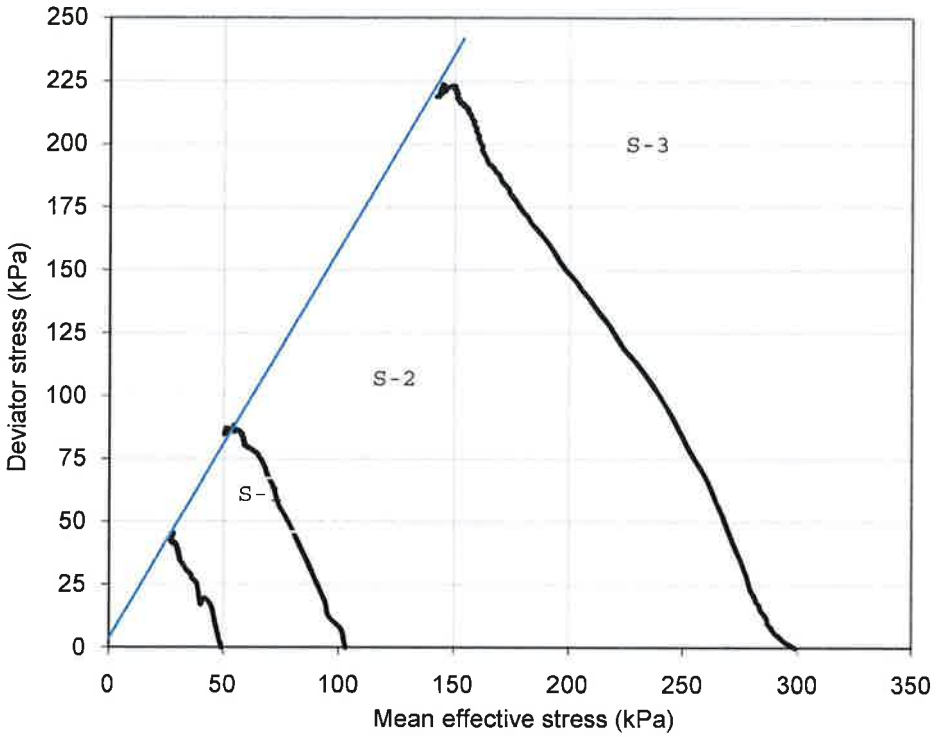


Figure 6 Deviator stress vs mean effective (stress paths)

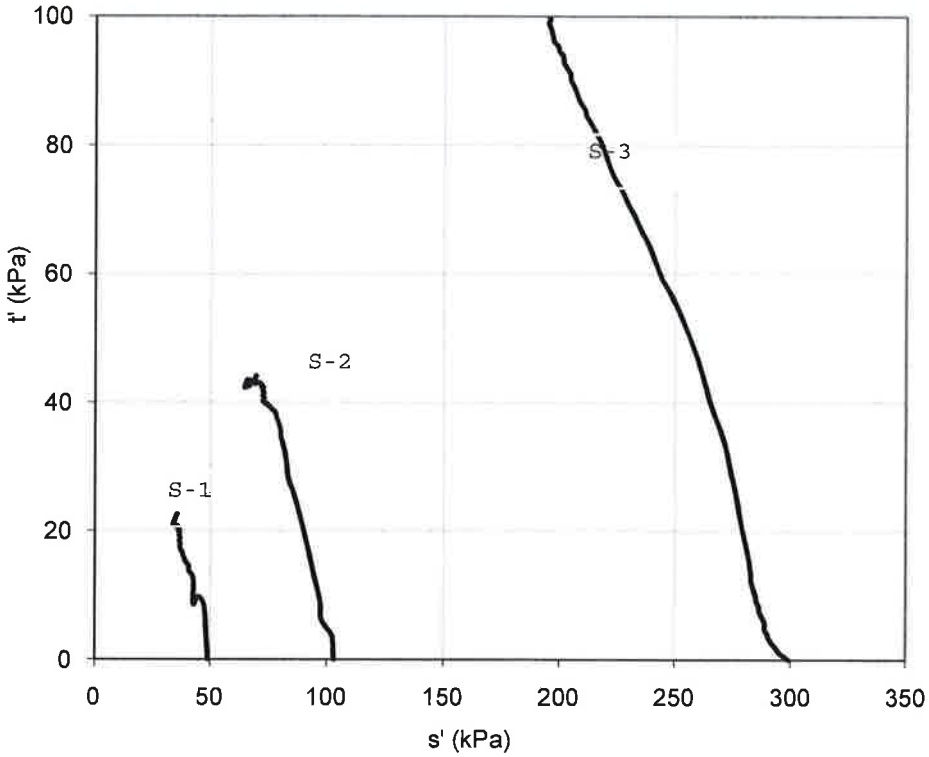


Figure 7 t' vs s' (stress paths)

Consolidated Undrained Multistage Triaxial Test With Pore Water Pressure Measurements
Ref 12-161, BH05, Depth 6m

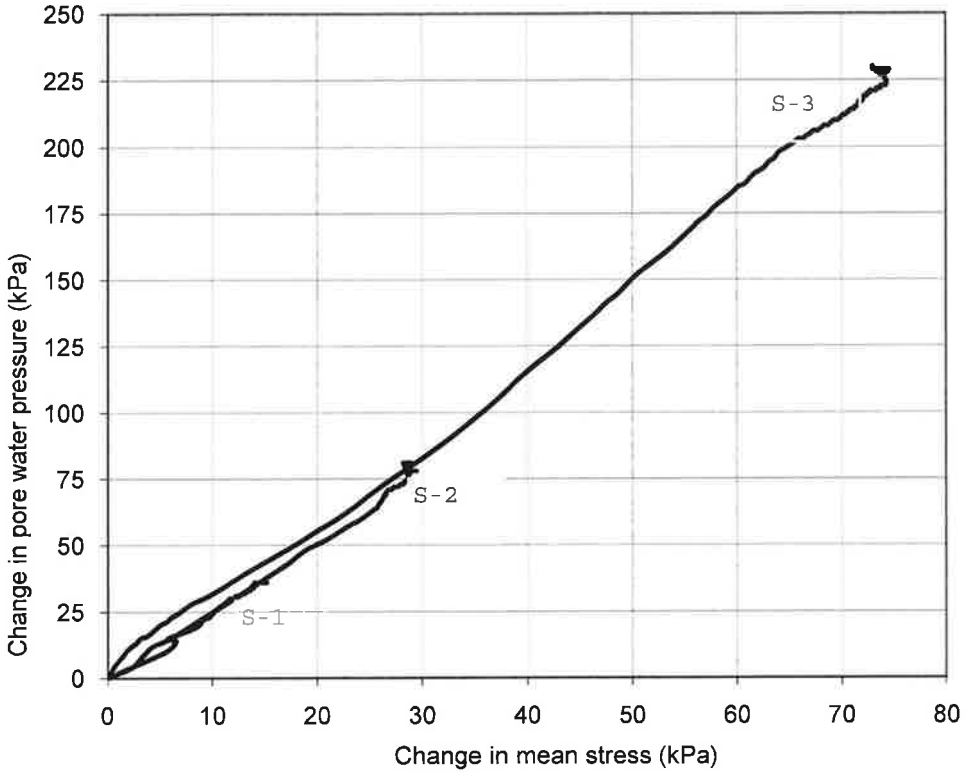


Figure 8 Change in pore water pressure vs change in mean stress

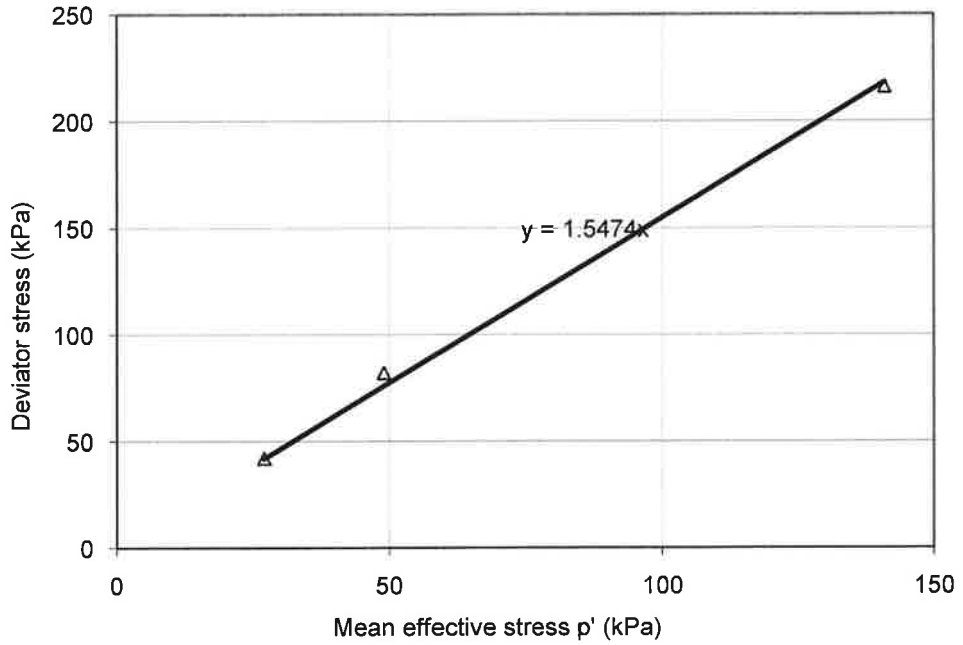


Figure 9 Deviator stress q vs mean effective stress at failure

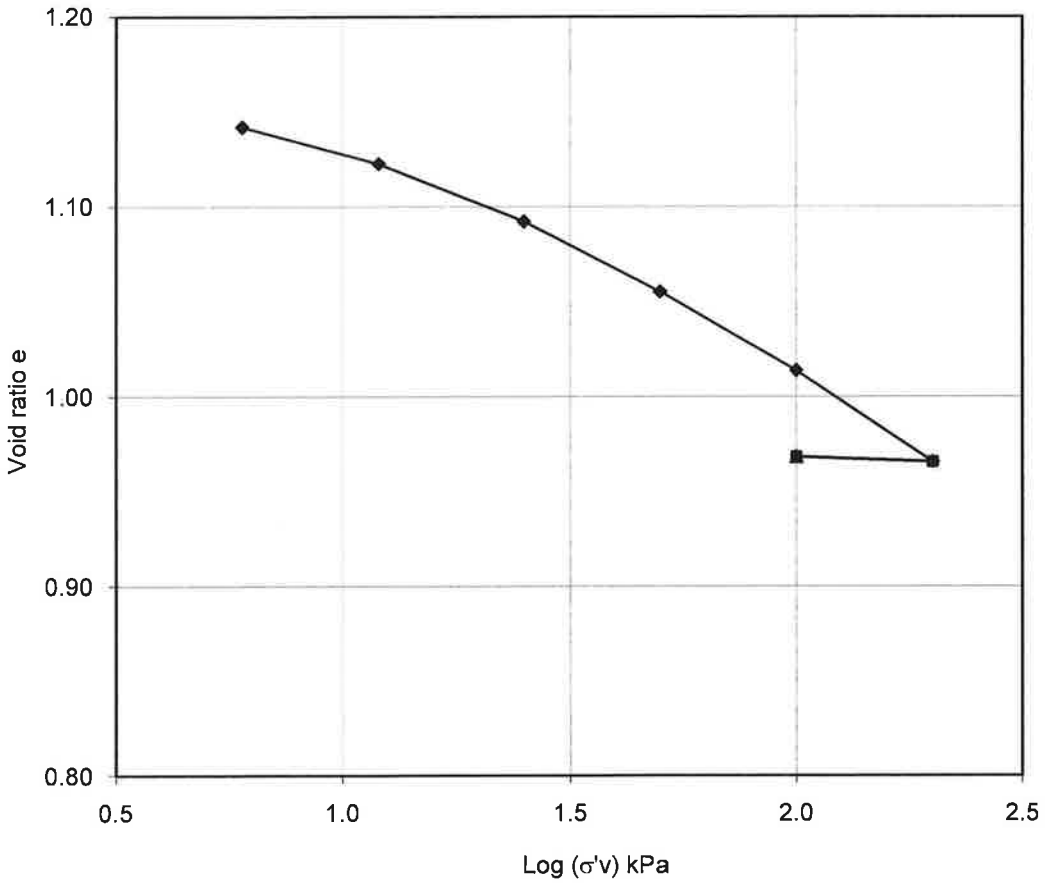
Queen's University Belfast	Geotechnical Testing Station

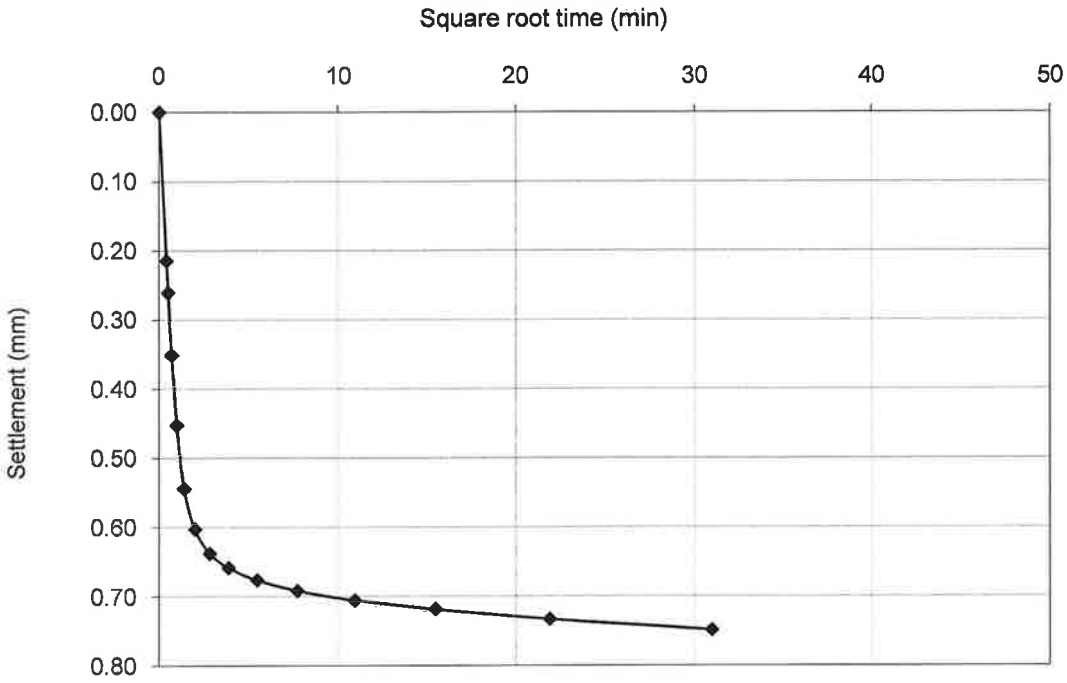
Client	CG
Job Ref	Galway
Date	10/04/2012
Borehole number	BH01
Sample number	
Depth m	1.0
Soil type	Very sofy sandy silty clay (D)
Test	1 D Consolidation

Wet mass (i) g	152
Wet mass (f) g	137.1
Dry mass g	100.8
Water content (i) %	50.8
Water content (f) %	36.0
Bulk density kg/m3	1792.9
Dry density kg/m3	1189.0

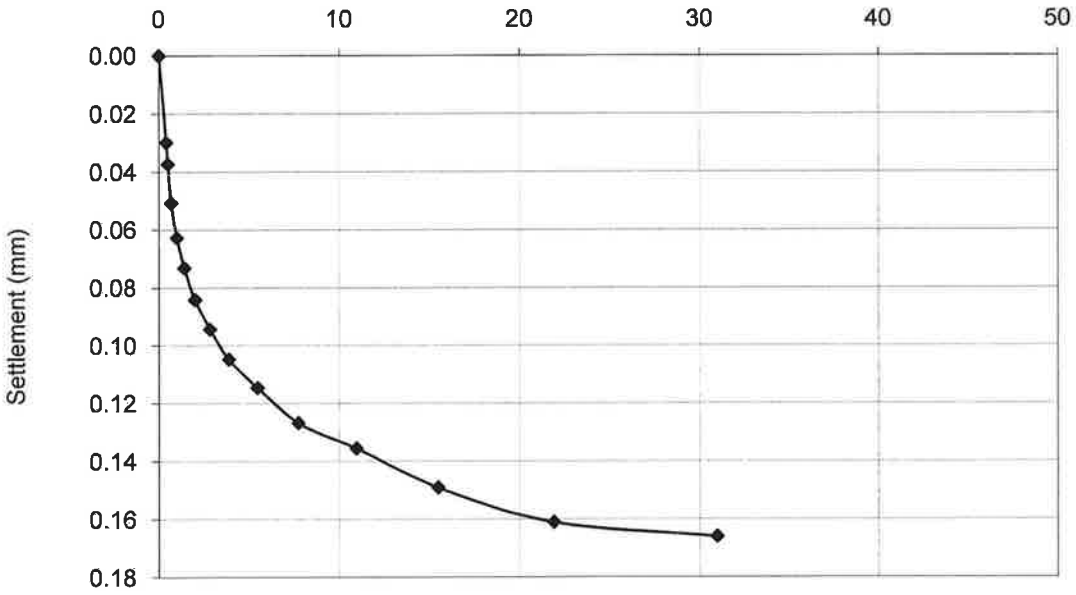
Diameter mm	75		
Initial Height mm	19.2	Specific gravity	2.6

σ'v kPa	ΔH mm	H mm	V cm3	Vv cm3	e	log(σ'v)	Compressibility m2/MN	Cv m2/year
6	0.749	18.451	81.473	43.435	1.142	0.78		2.37
12	0.166	18.285	80.740	42.702	1.123	1.08	1.50	0.37
25	0.262	18.023	79.585	41.547	1.092	1.40	1.10	0.57
50	0.319	17.704	78.174	40.137	1.055	1.70	0.71	0.43
100	0.358	17.346	76.594	38.557	1.014	2.00	0.40	0.52
200	0.414	16.932	74.766	36.729	0.966	2.30	0.24	0.50
100	-0.024	16.956	74.870	36.832	0.968	2.00	0.01	1.28

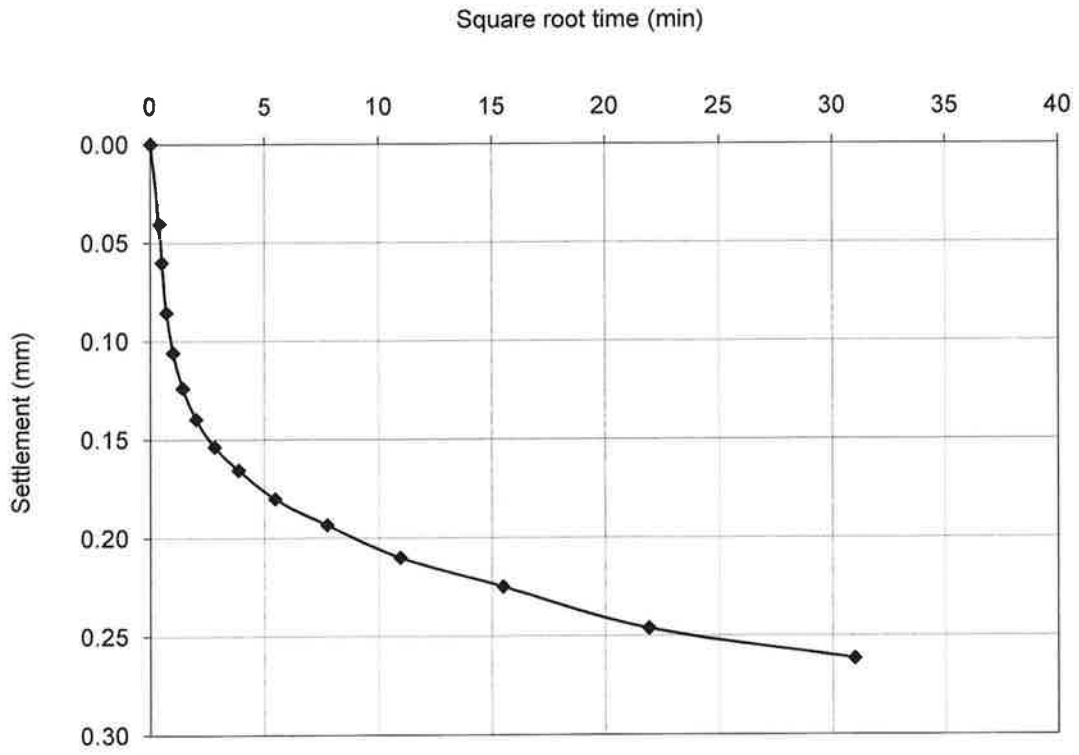




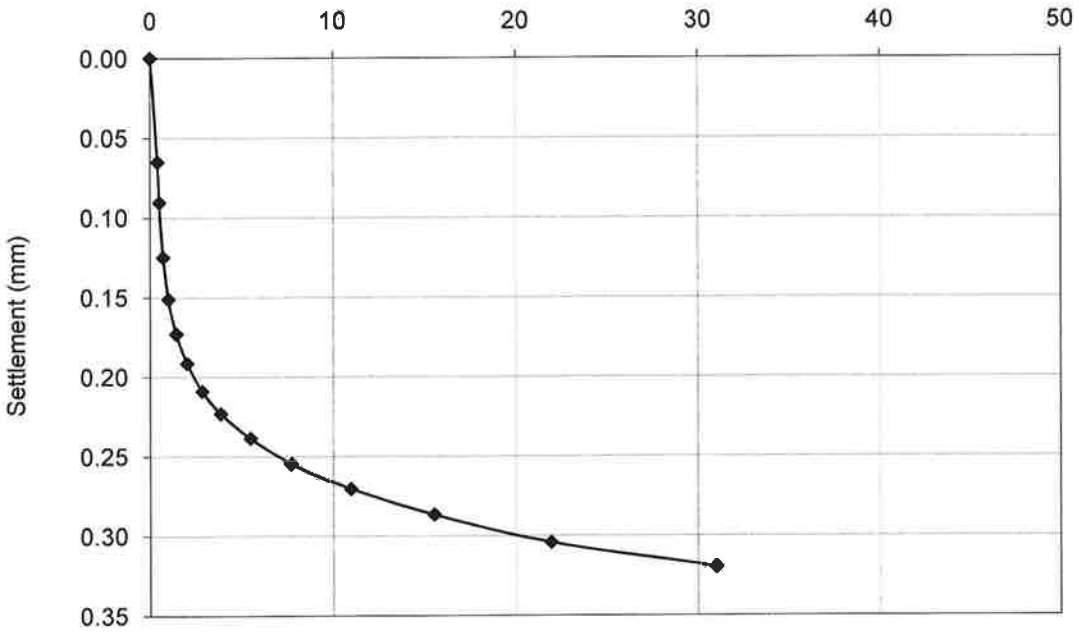
σ'_v = 6 kPa



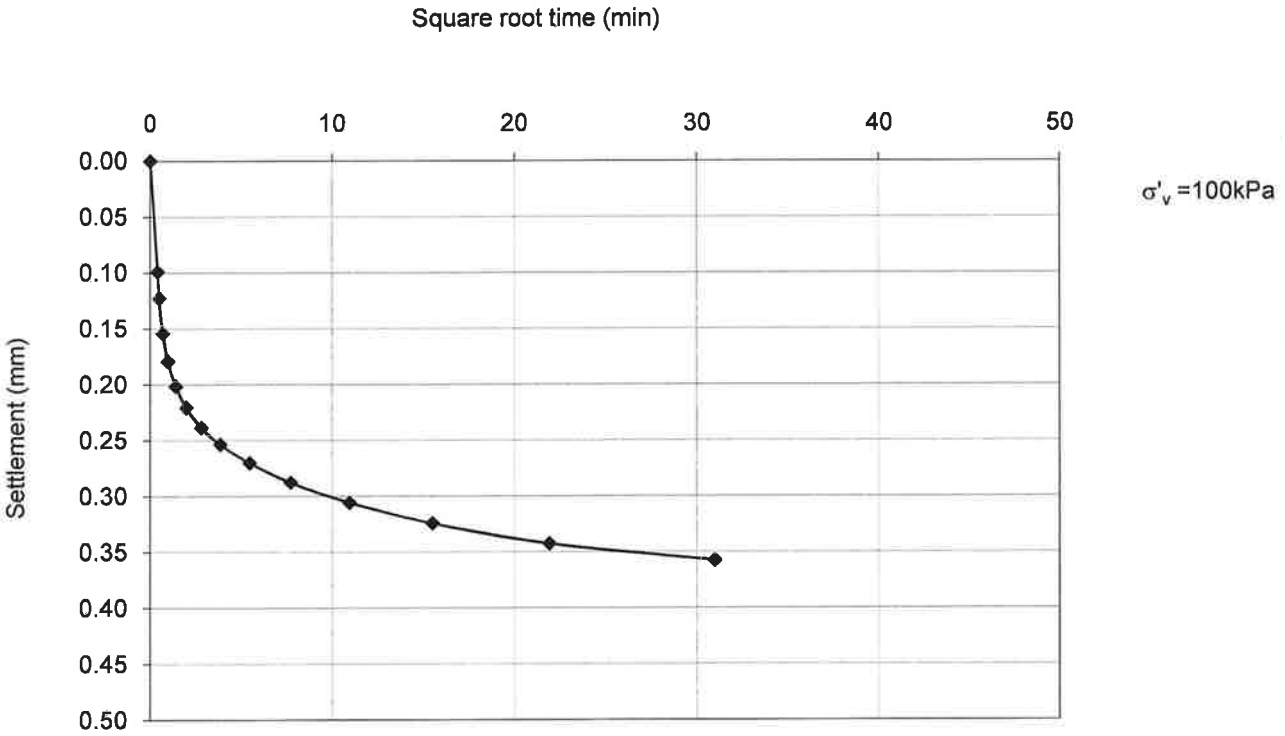
σ'_v = 12.5kPa

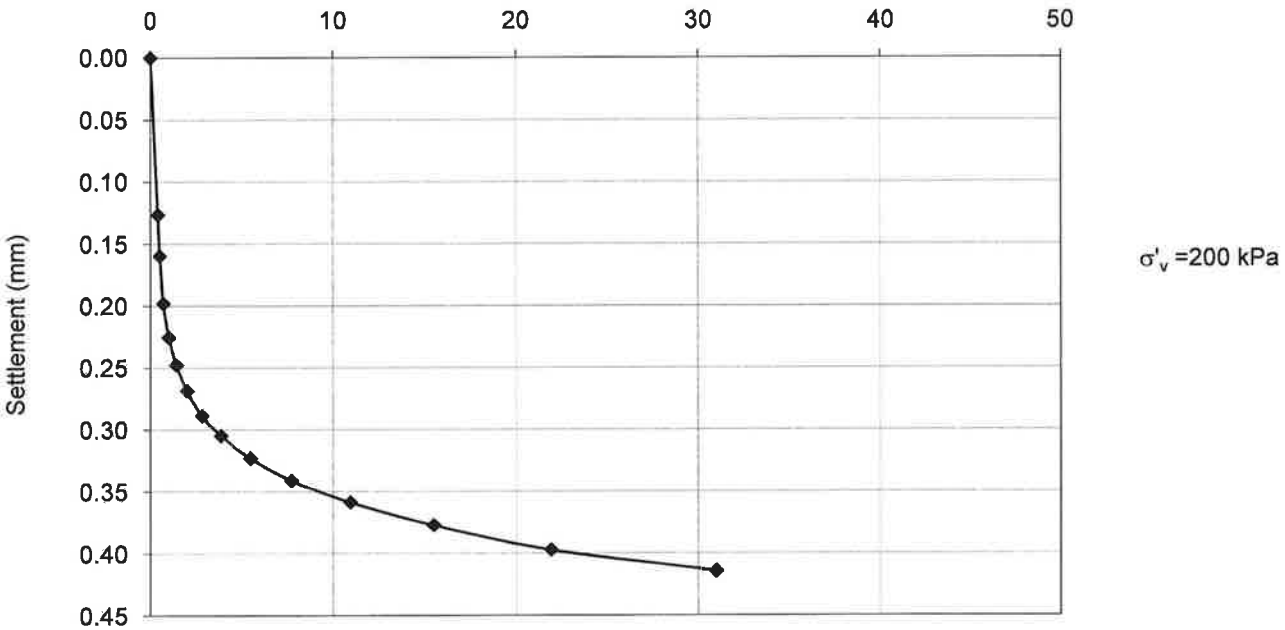


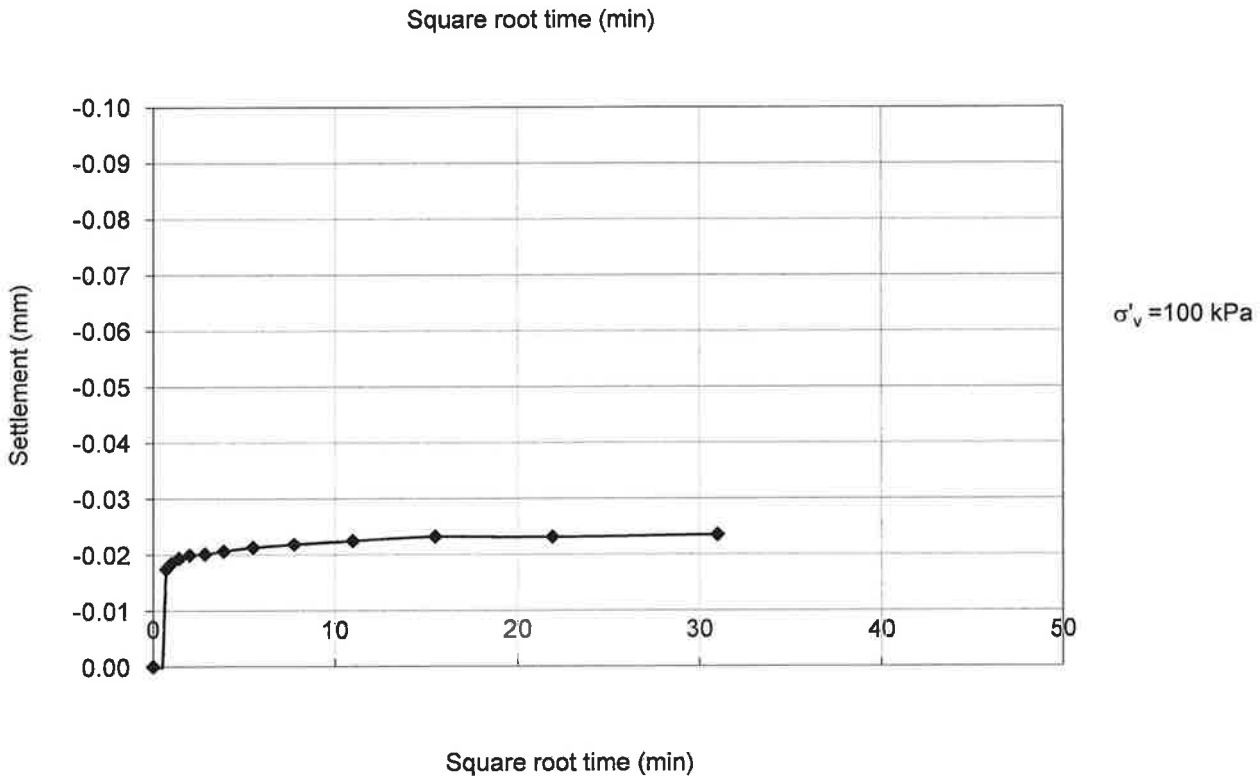
σ'_v =25 kPa



σ'_v =50 kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
Settlement (mm)
σ'v =100kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
Settlement (mm)
σ'v =200 kPa


Square root time (min)
Settlement (mm)
-0.10
-0.09
-0.08
-0.07
-0.06
-0.05
-0.04
-0.03
-0.02
-0.01
0.00
0
10
20
30
40
50
σ'v =100 kPa
Square root time (min)

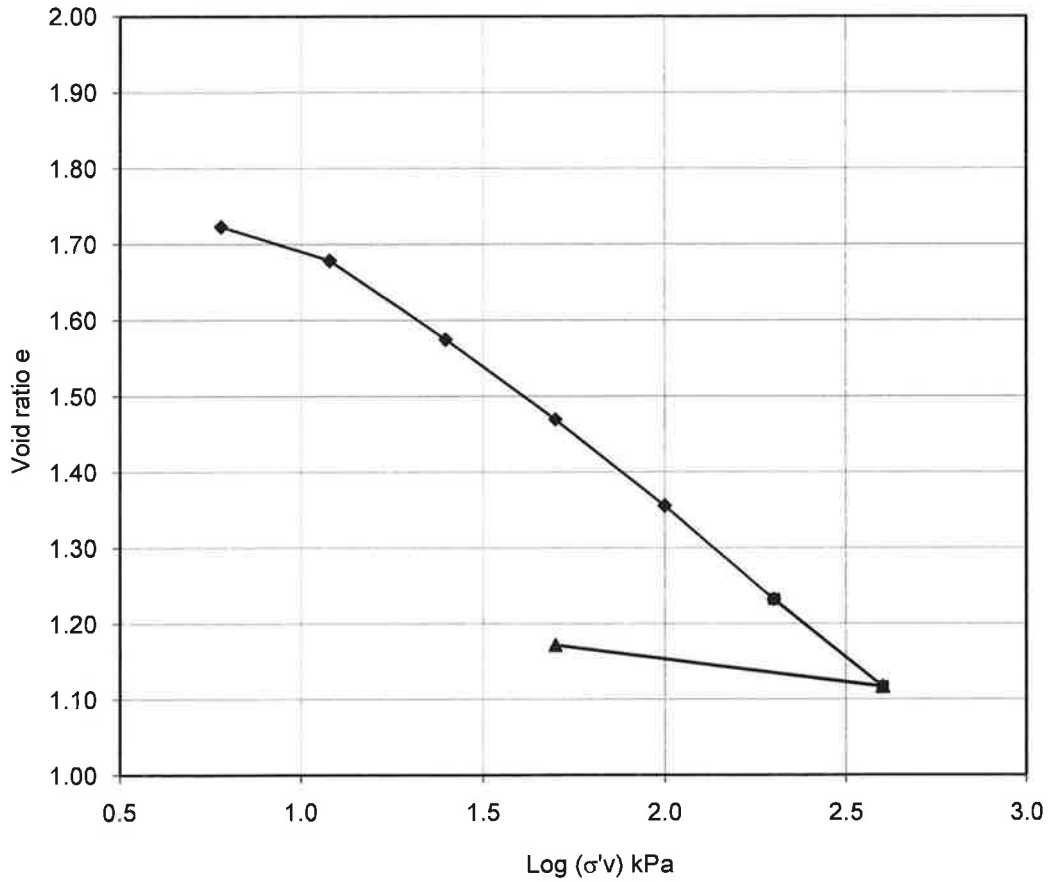
Queen's University Belfast	Geotechnical Testing Station

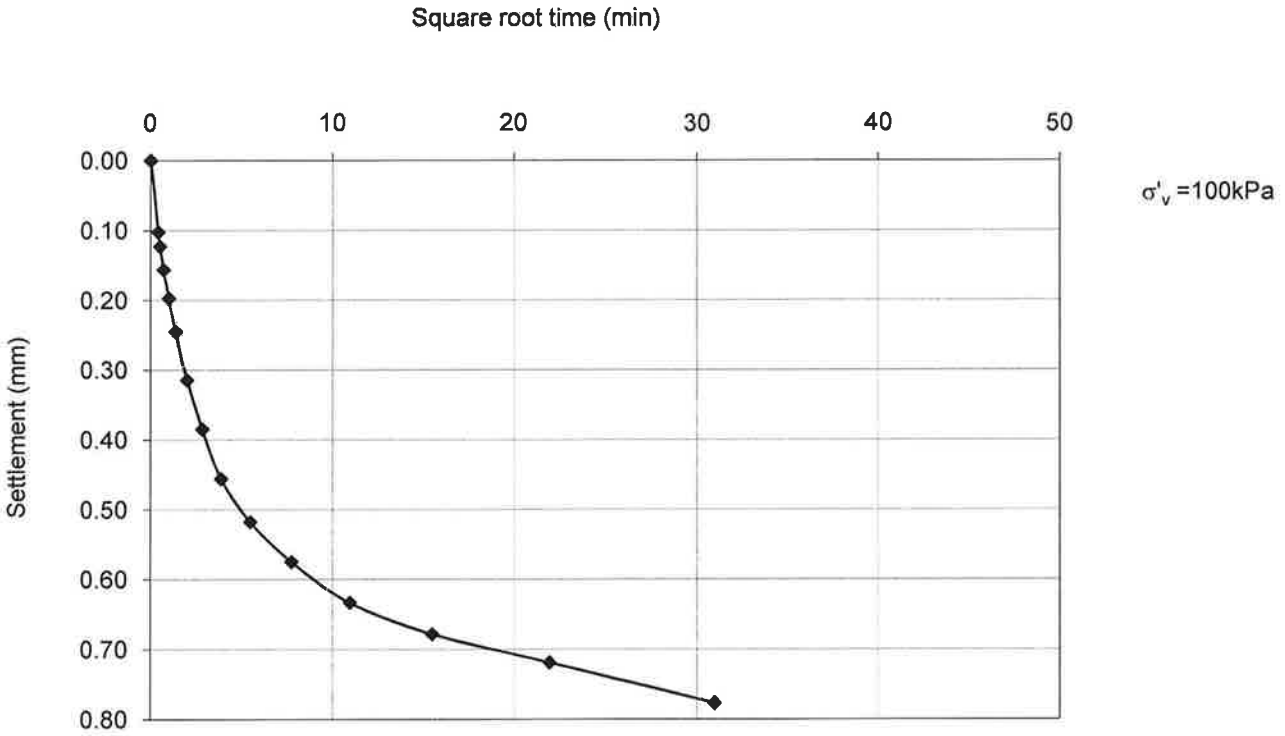
Client	**CG**
Job Ref	Galway
Date	10/04/2012
Borehole number	BH01
Sample number	
Depth m	2.0
Soil type	**Very sofy silty clay (D)**
Test	**1 D Consolidation**

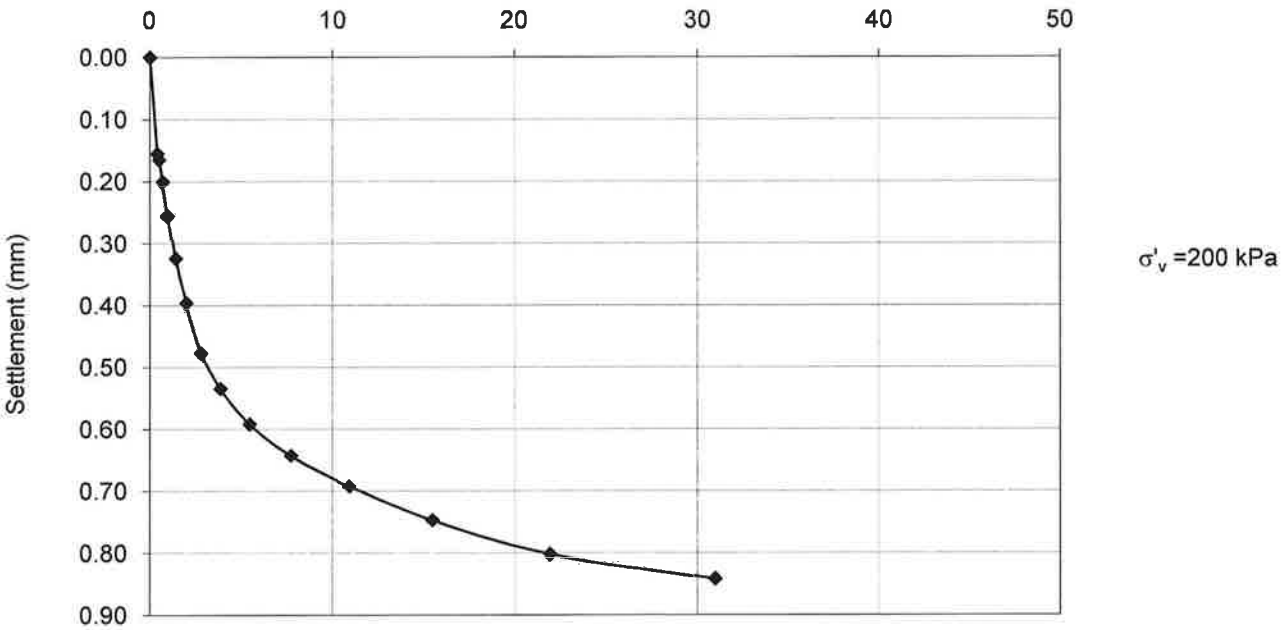
Wet mass (i) g	134.5
Wet mass (f) g	111.4
Dry mass g	78.4
Water content (i) %	71.6
Water content (f) %	42.1
Bulk density kg/m3	1586.5
Dry density kg/m3	924.7

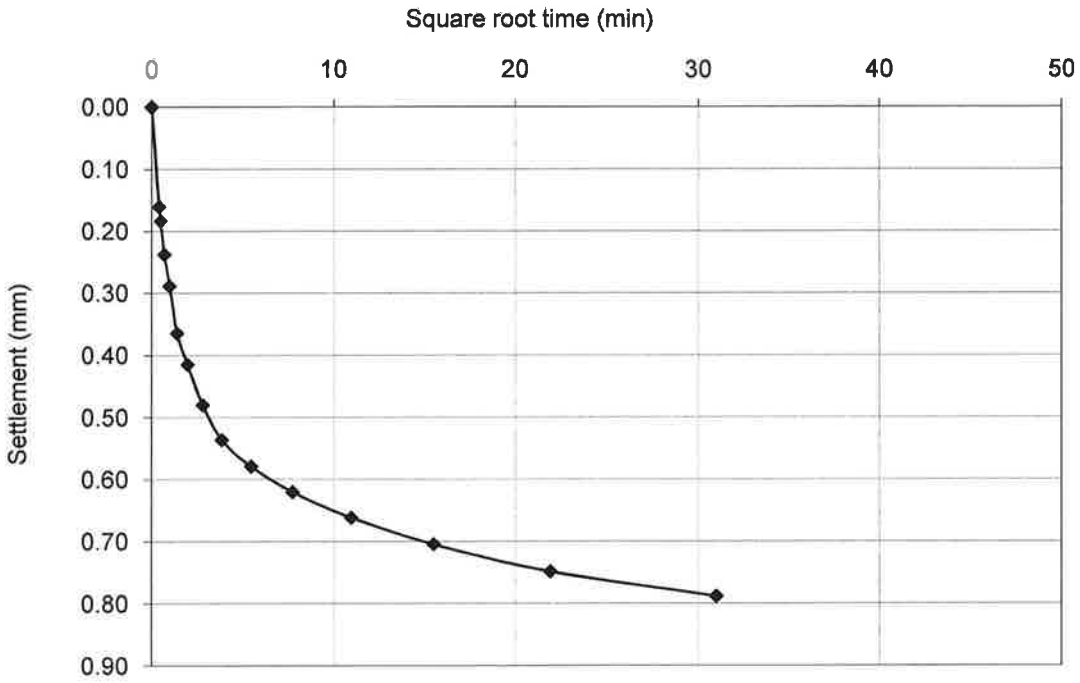
Diameter mm	75		
Initial Height mm	19.2	Specific gravity	2.6

σ'v kPa	ΔH mm	H mm	V cm3	Vv cm3	e	log(σ'v)	Compressibility m2/MN	Cv m2/year
6	0.603	18.597	82.119	51.965	1.723	0.78		
12	0.305	18.292	80.772	50.618	1.679	1.08	2.73	
25	0.709	17.583	77.639	47.486	1.575	1.40	2.98	
50	0.721	16.862	74.458	44.304	1.469	1.70	1.64	
100	0.777	16.085	71.027	40.873	1.355	2.00	0.92	0.29
200	0.842	15.244	67.310	37.156	1.232	2.30	0.52	0.26
400	0.789	14.455	63.828	33.674	1.117	2.60	0.26	0.36
50	-0.375	14.830	65.482	35.328	1.172	1.70	0.07	0.68



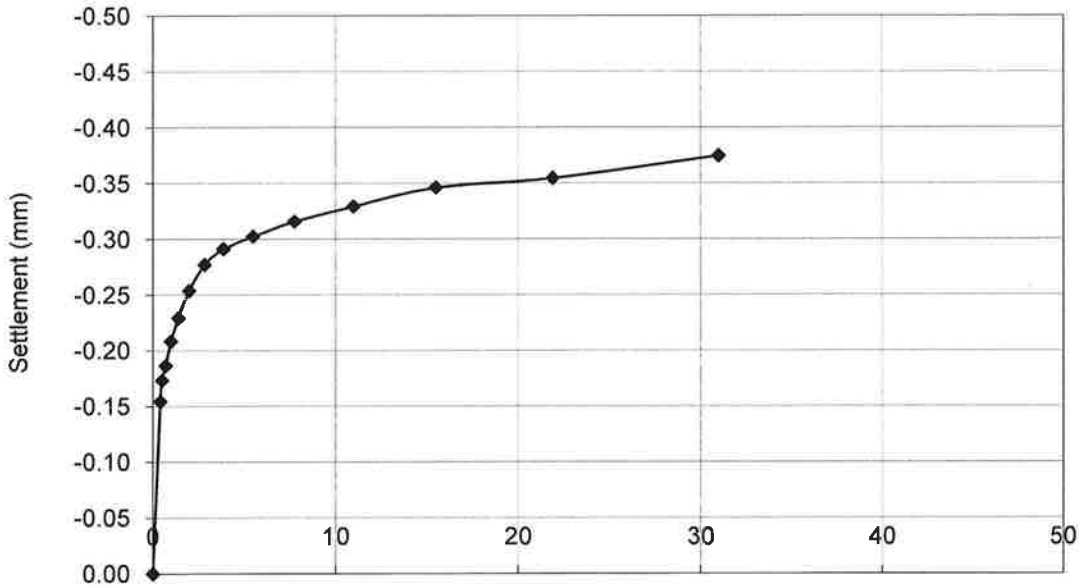

Square root time (min)
0
10
20
30
40
50
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
Settlement (mm)
σ'v =100kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
Settlement (mm)
σ'v =200 kPa



σ'_v =400 kPa

Square root time (min)



σ'_v =50 kPa

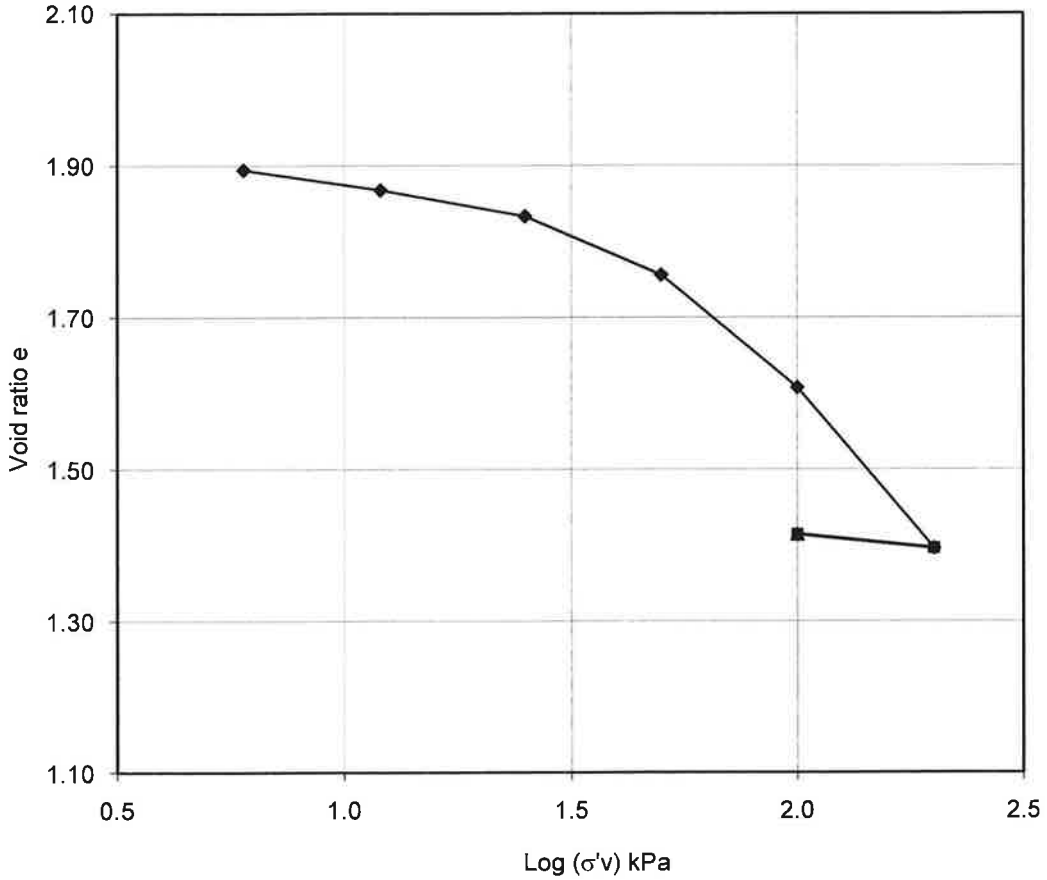
Queen's University Belfast	Geotechnical Testing Station

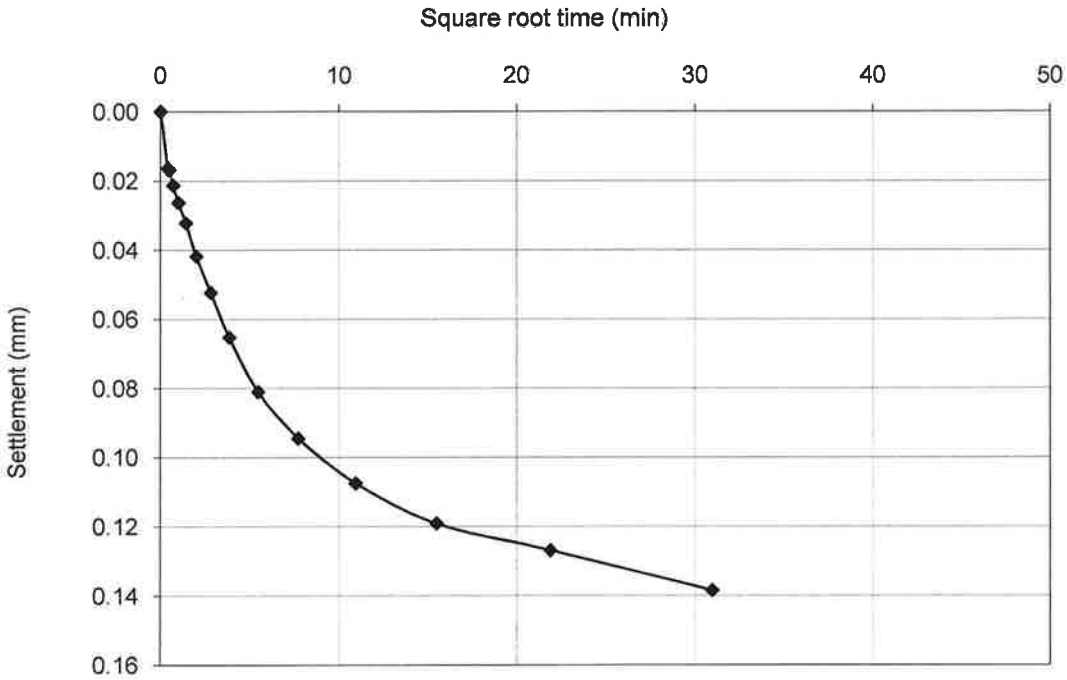
Client	**CG**
Job Ref	Galway
Date	10/04/2012
Borehole number	BH01
Sample number	
Depth m	3.0
Soil type	**Very soft grey caly**
Test	**1 D Consolidation**

Wet mass (i) g	137
Wet mass (f) g	123.9
Dry mass g	80.3
Water content (i) %	70.6
Water content (f) %	54.3
Bulk density kg/m3	1551.3
Dry density kg/m3	909.3

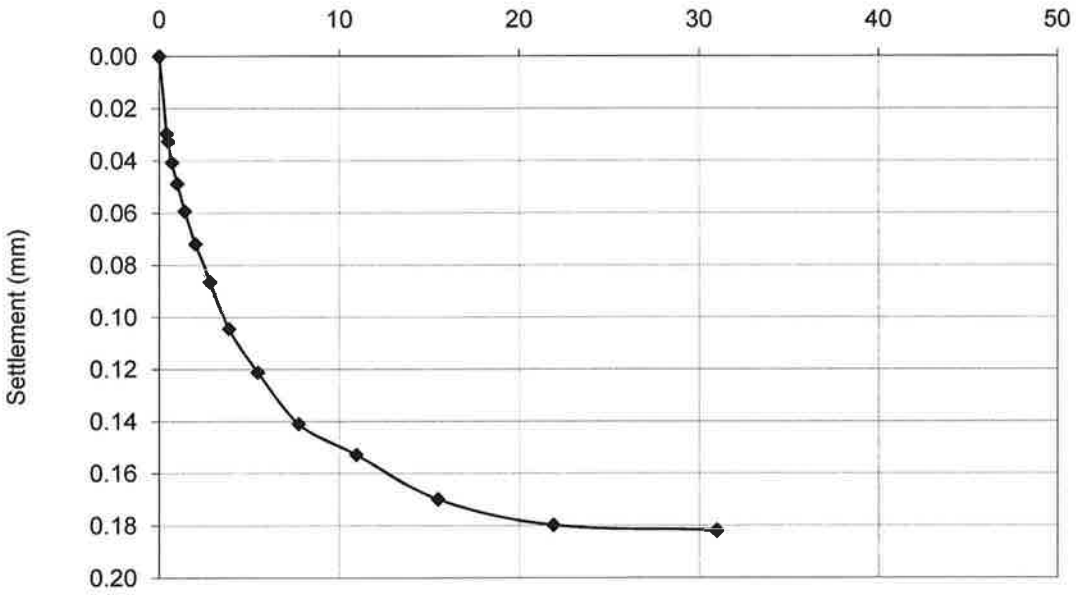
Diameter mm	75		
Initial Height mm	20	Specific gravity	2.6

σ'v kPa	ΔH mm	H mm	V cm3	Vv cm3	e	log(σ'v)	Compressibility m2/MN	Cv m2/year
6	0.139	19.862	87.701	57.399	1.894	0.78		0.36
12	0.182	19.680	86.898	56.596	1.868	1.08	1.53	0.36
25	0.238	19.442	85.849	55.548	1.833	1.40	0.93	0.29
50	0.530	18.912	83.508	53.206	1.756	1.70	1.09	0.33
100	1.019	17.893	79.011	48.709	1.607	2.00	1.08	0.29
200	1.450	16.443	72.606	42.304	1.396	2.30	0.81	0.25
100	-0.125	16.568	73.159	42.857	1.414	2.00	0.08	0.48

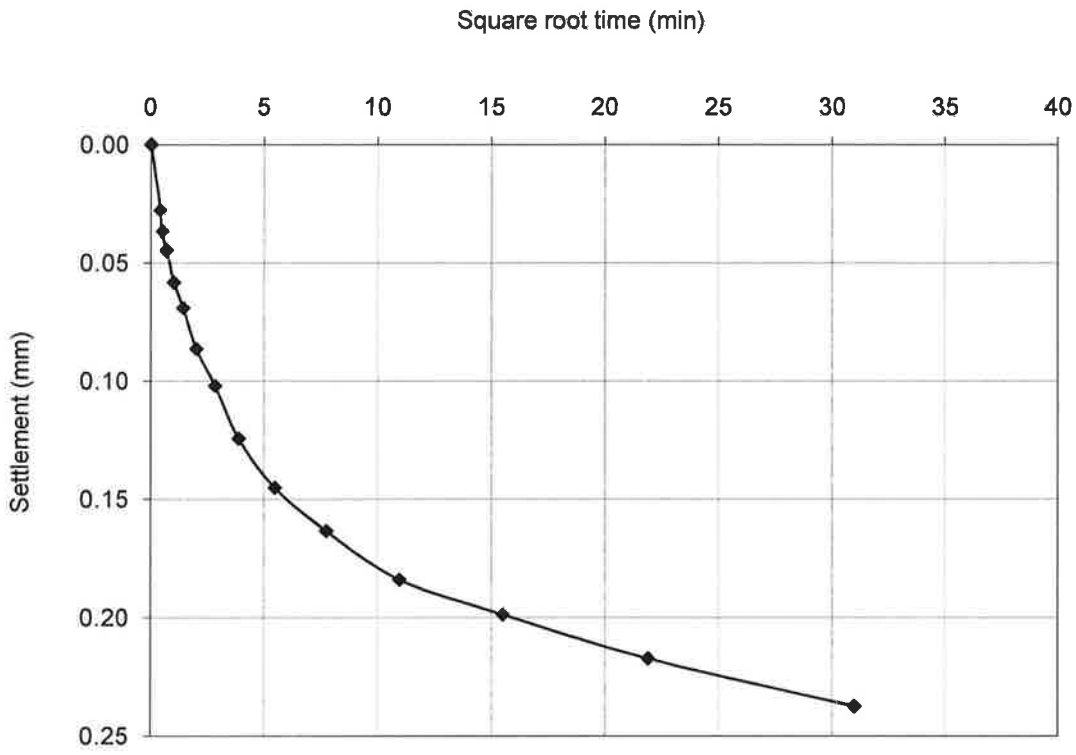




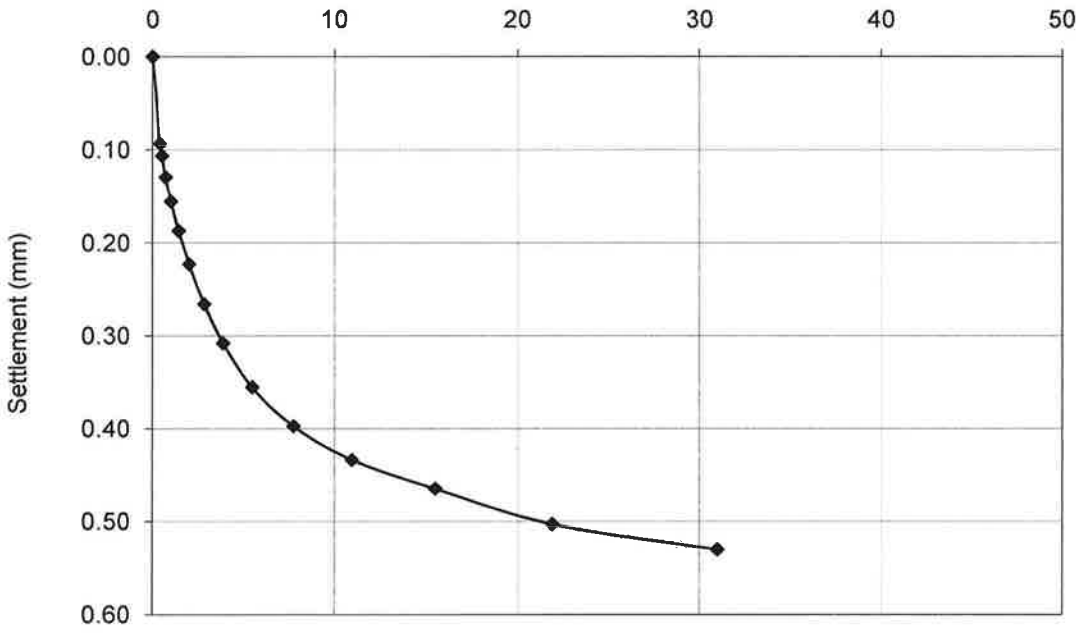
σ'_v = 6 kPa



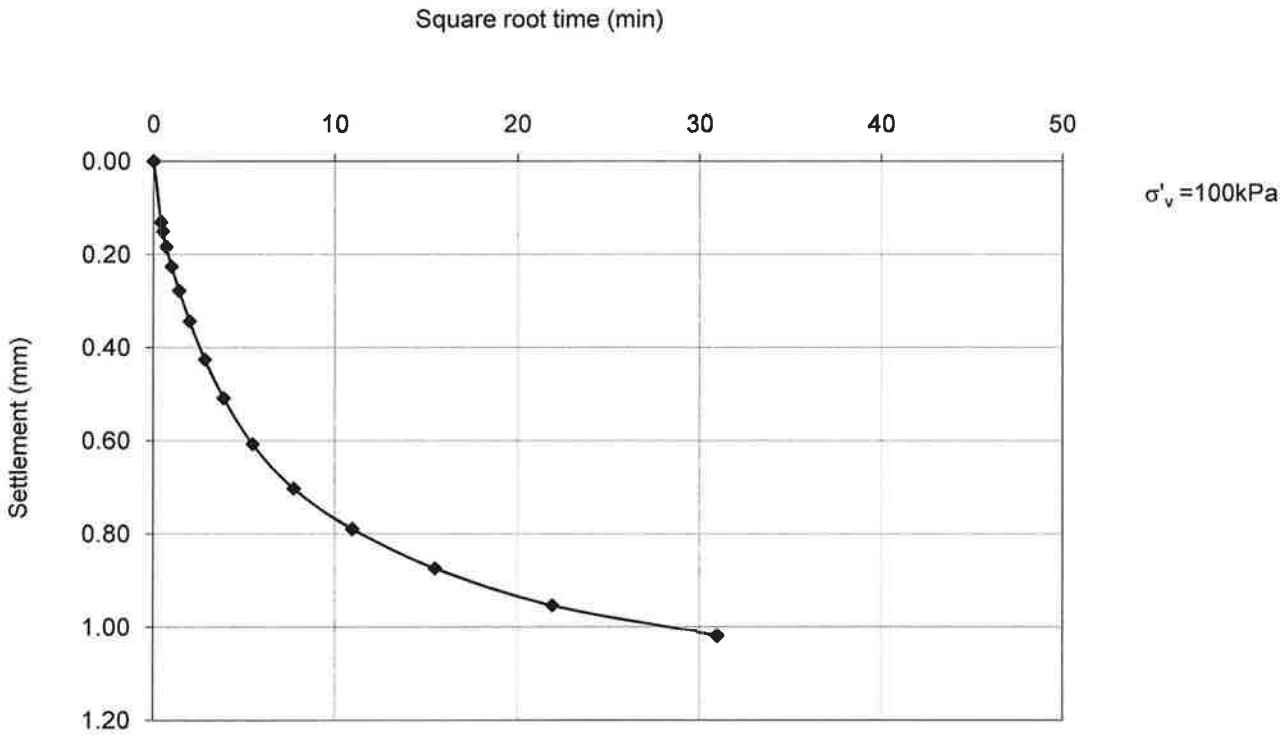
σ'_v = 12.5kPa

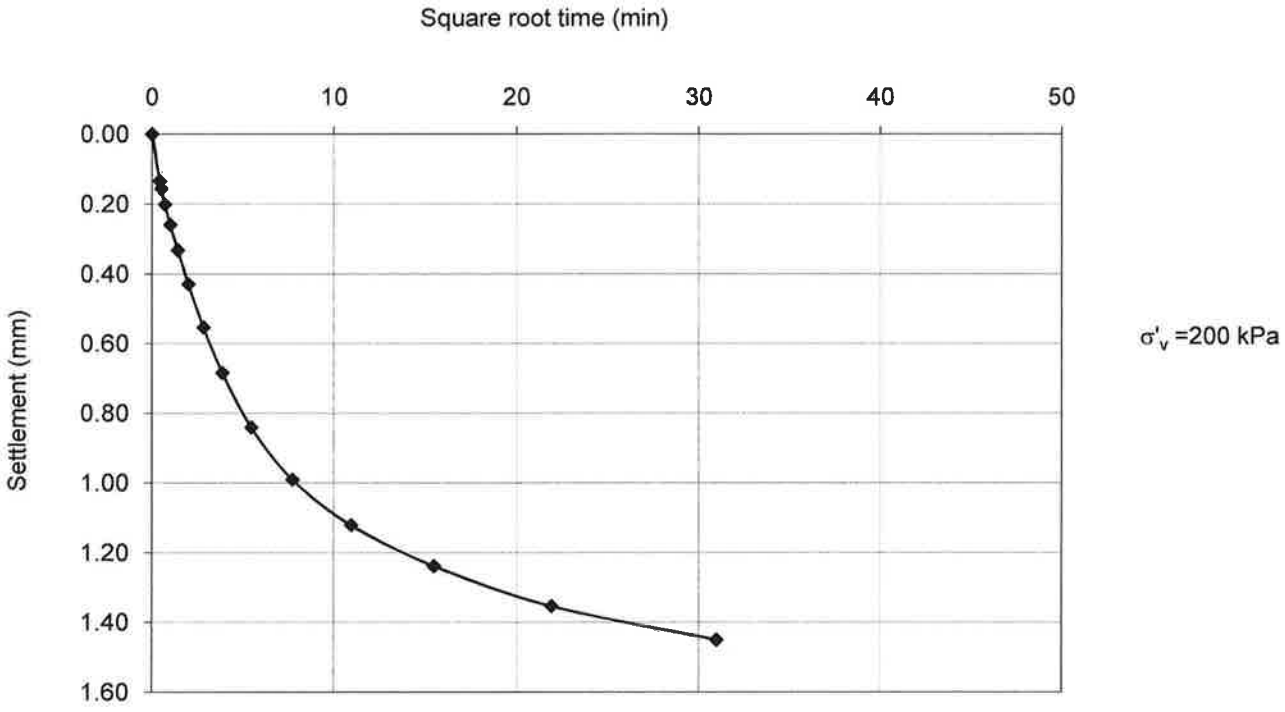


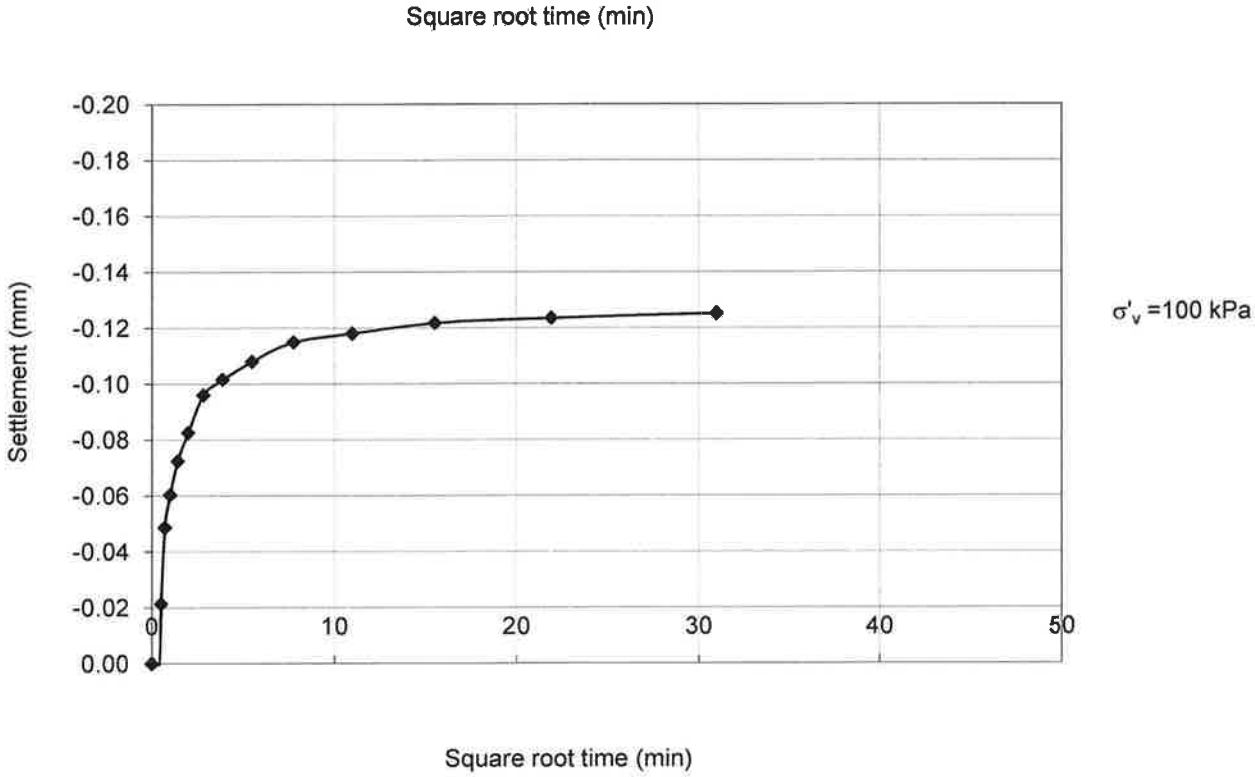
σ'_v =25 kPa



σ'_v =50 kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.20
0.40
0.60
0.80
1.00
1.20
Settlement (mm)
σ'v =100kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
Settlement (mm)
σ'v =200 kPa


Square root time (min)
Settlement (mm)
-0.20
-0.18
-0.16
-0.14
-0.12
-0.10
-0.08
-0.06
-0.04
-0.02
0.00
0
10
20
30
40
50
Square root time (min)
σ'v =100 kPa

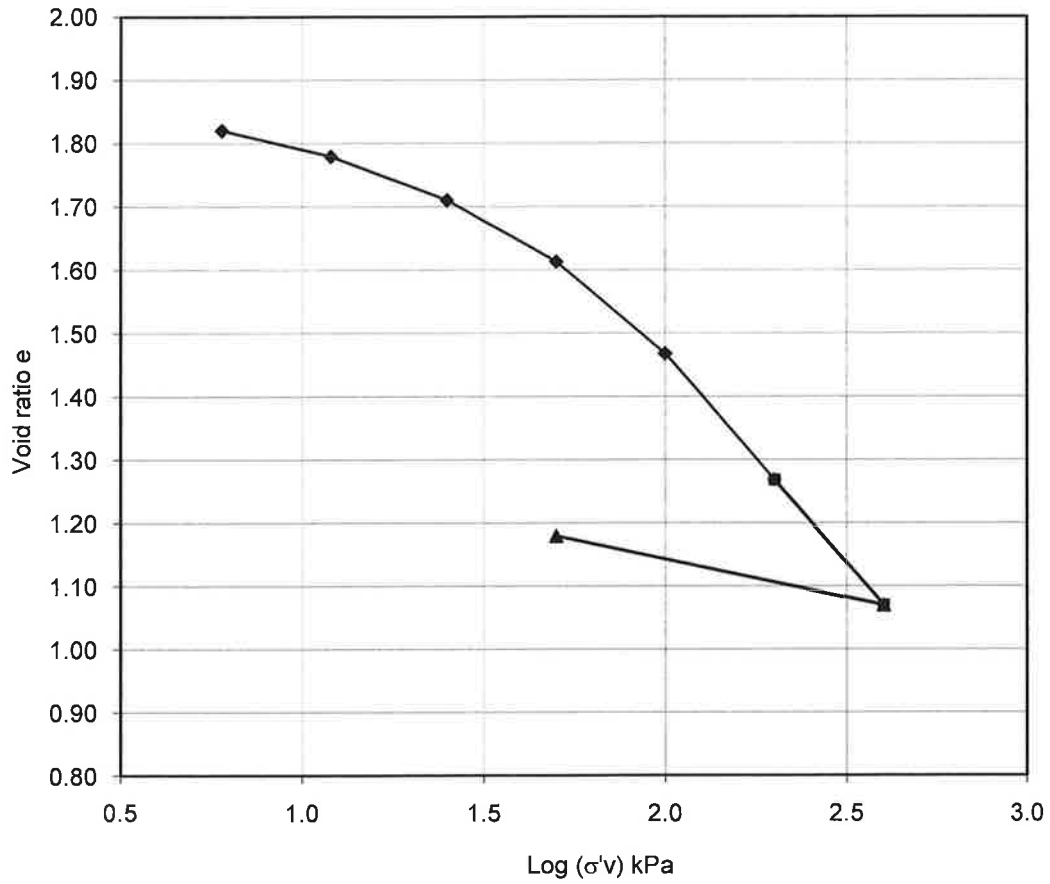
Queen's University Belfast	Geotechnical Testing Station

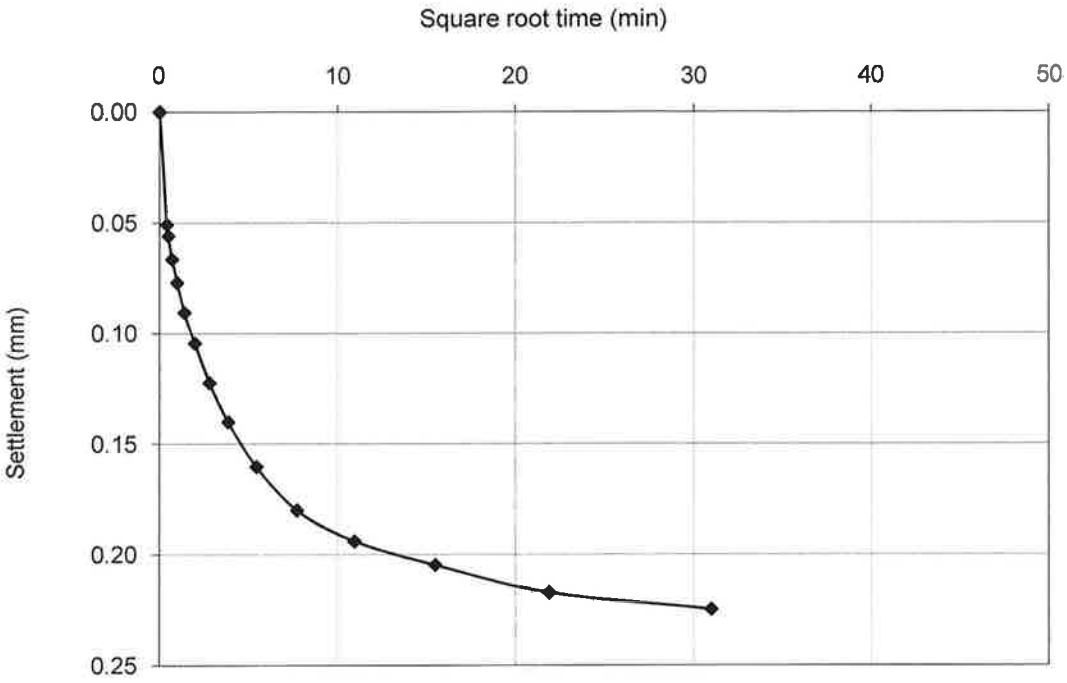
Client	**CG**
Job Ref	Galway
Date	10/04/2012
Borehole number	BH01
Sample number	
Depth m	5.0
Soil type	**Very sofy silty clay**
Test	**1 D Consolidation**

Wet mass (i) g	139.8
Wet mass (f) g	119
Dry mass g	80.5
Water content (i) %	73.7
Water content (f) %	47.8
Bulk density kg/m3	1583.0
Dry density kg/m3	911.5

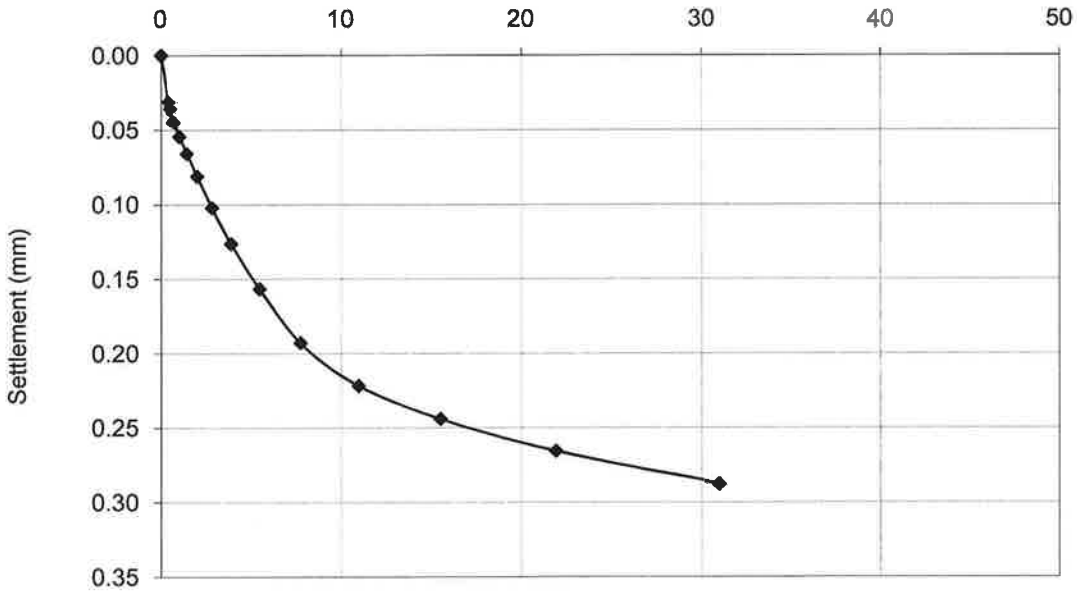
Diameter mm	75		
Initial Height mm	20	Specific gravity	2.6

σ'v kPa	ΔH mm	H mm	V cm3	Vv cm3	e	log(σ'v)	Compressibility m2/MN	Cv m2/year
6	0.225	19.775	87.320	56.358	1.820	0.78		0.68
12	0.287	19.488	86.051	55.089	1.779	1.08	2.42	0.42
25	0.485	19.003	83.911	52.950	1.710	1.40	1.91	0.40
50	0.681	18.322	80.904	49.942	1.613	1.70	1.43	0.31
100	1.019	17.303	76.404	45.442	1.468	2.00	1.11	0.23
200	1.400	15.903	70.223	39.261	1.268	2.30	0.81	0.20
400	1.391	14.513	64.082	33.121	1.070	2.60	0.44	0.19
50	-0.768	15.281	67.474	36.512	1.179	1.70	0.15	0.41

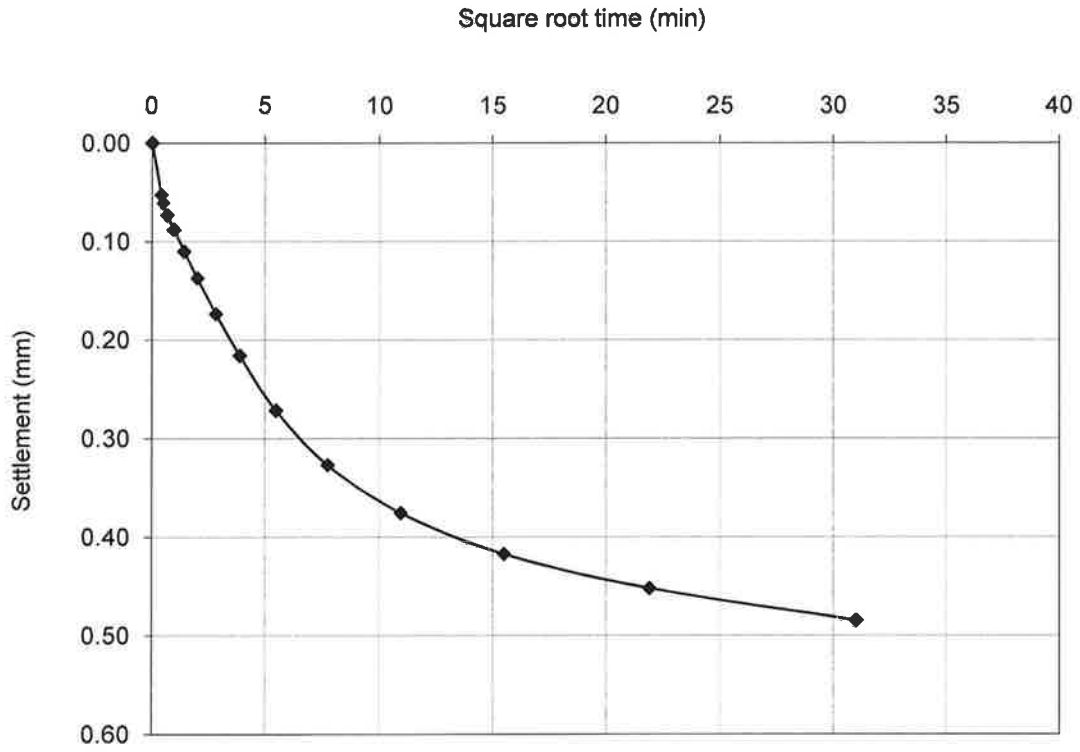




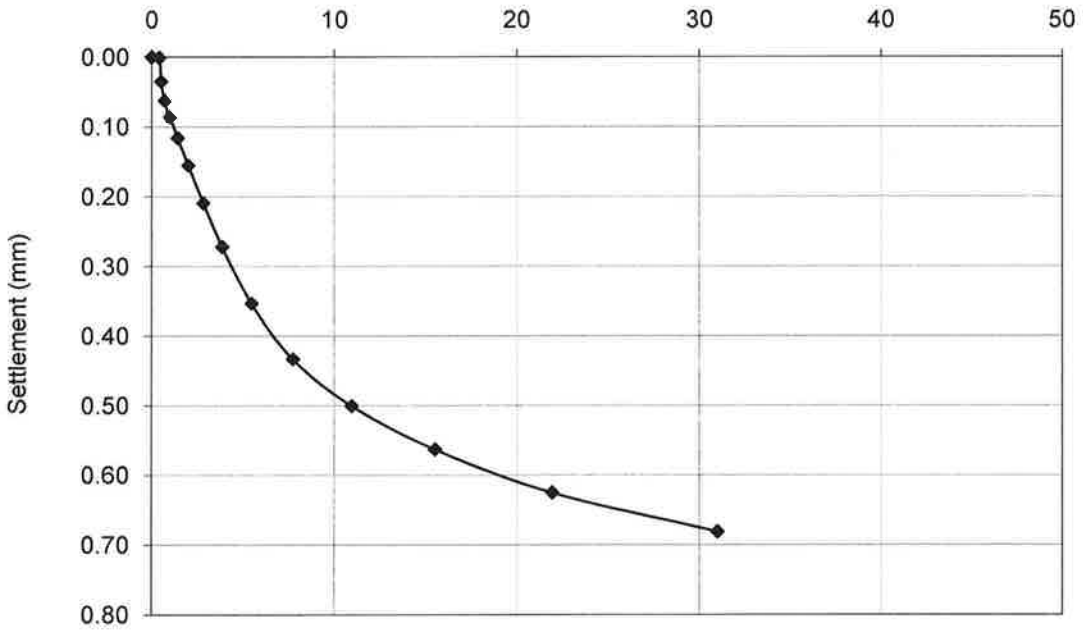
σ'_v = 6 kPa



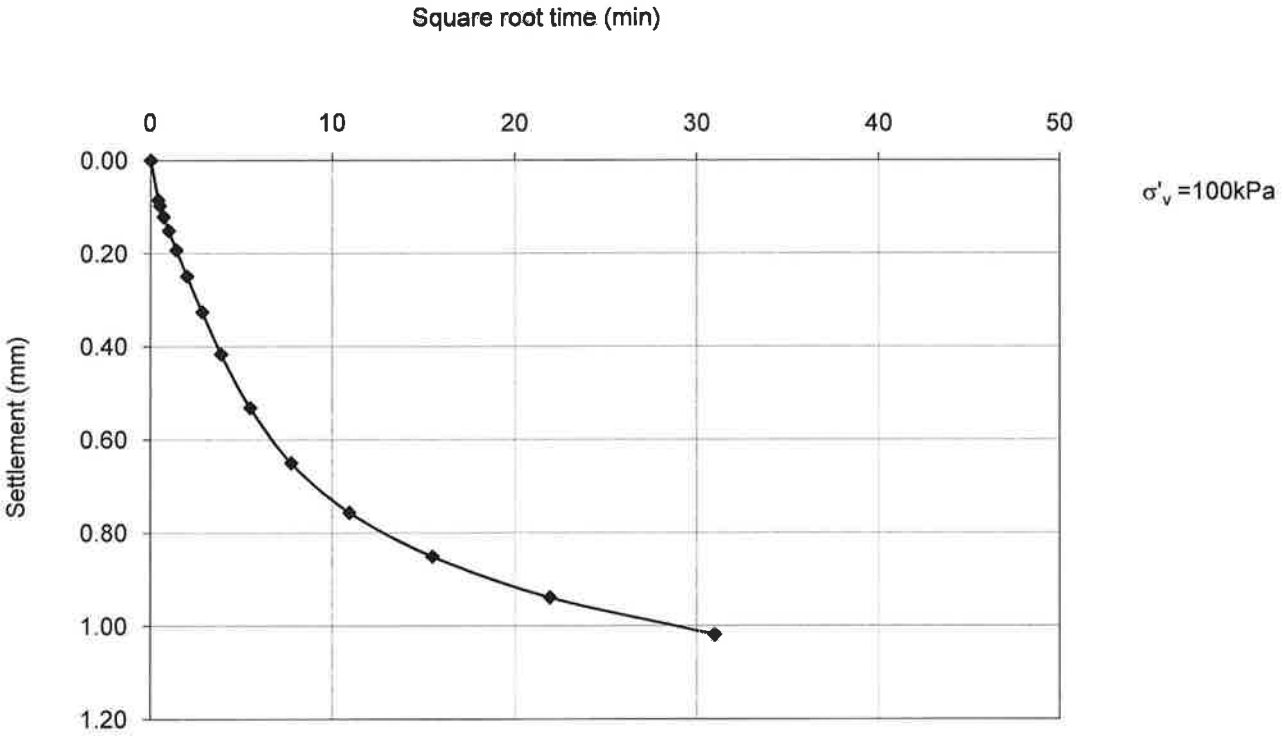
σ'_v = 12.5kPa

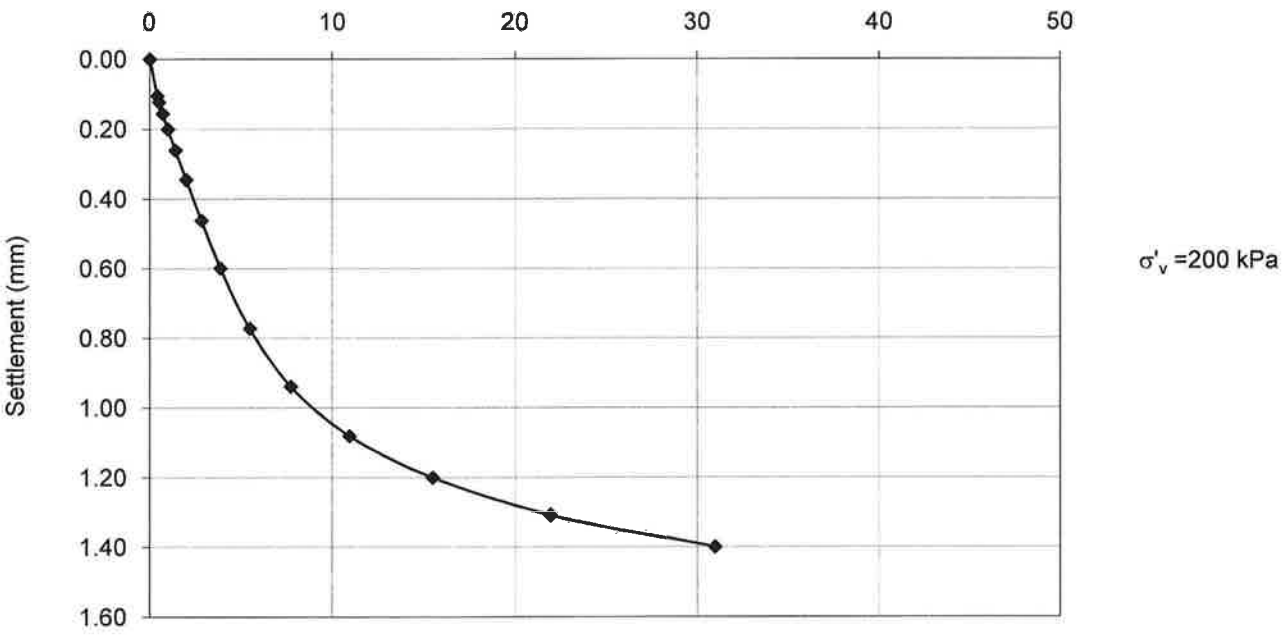


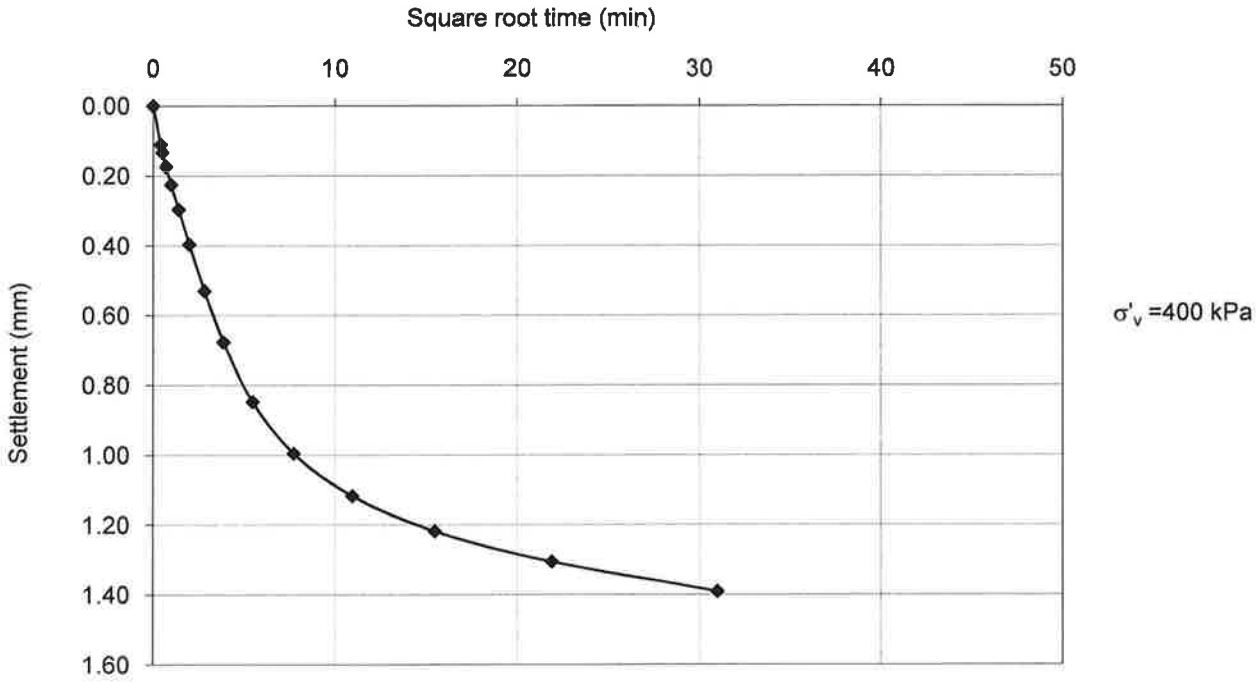
σ'_v =25 kPa

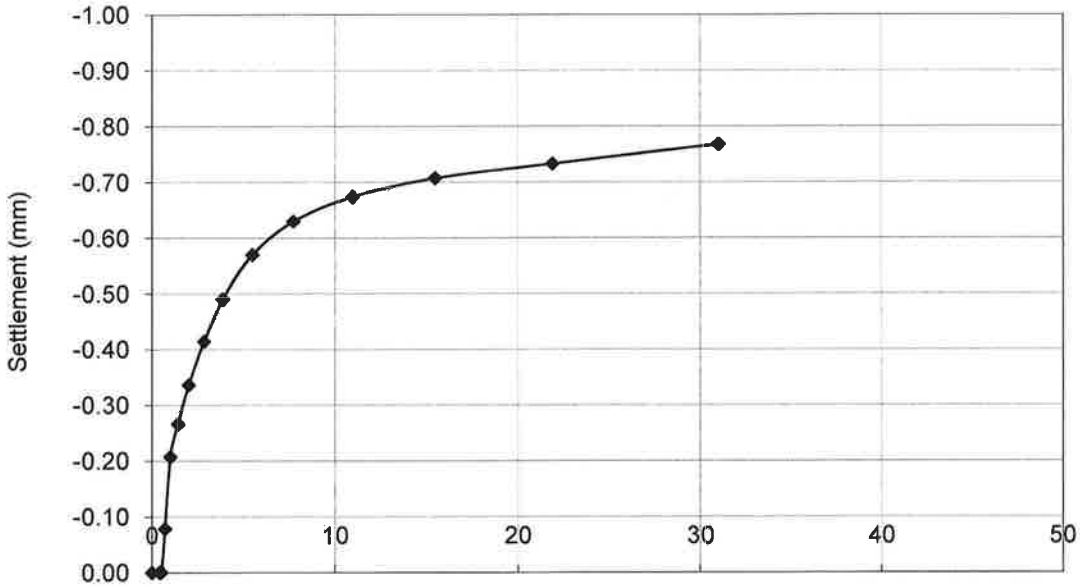


σ'_v =50 kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.20
0.40
0.60
0.80
1.00
1.20
Settlement (mm)
σ'v =100kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
Settlement (mm)
σ'v =200 kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
Settlement (mm)
σ'v =400 kPa


Square root time (min)
-1.00
-0.90
-0.80
-0.70
-0.60
-0.50
-0.40
-0.30
-0.20
-0.10
0.00
0
10
20
30
40
50
Settlement (mm)

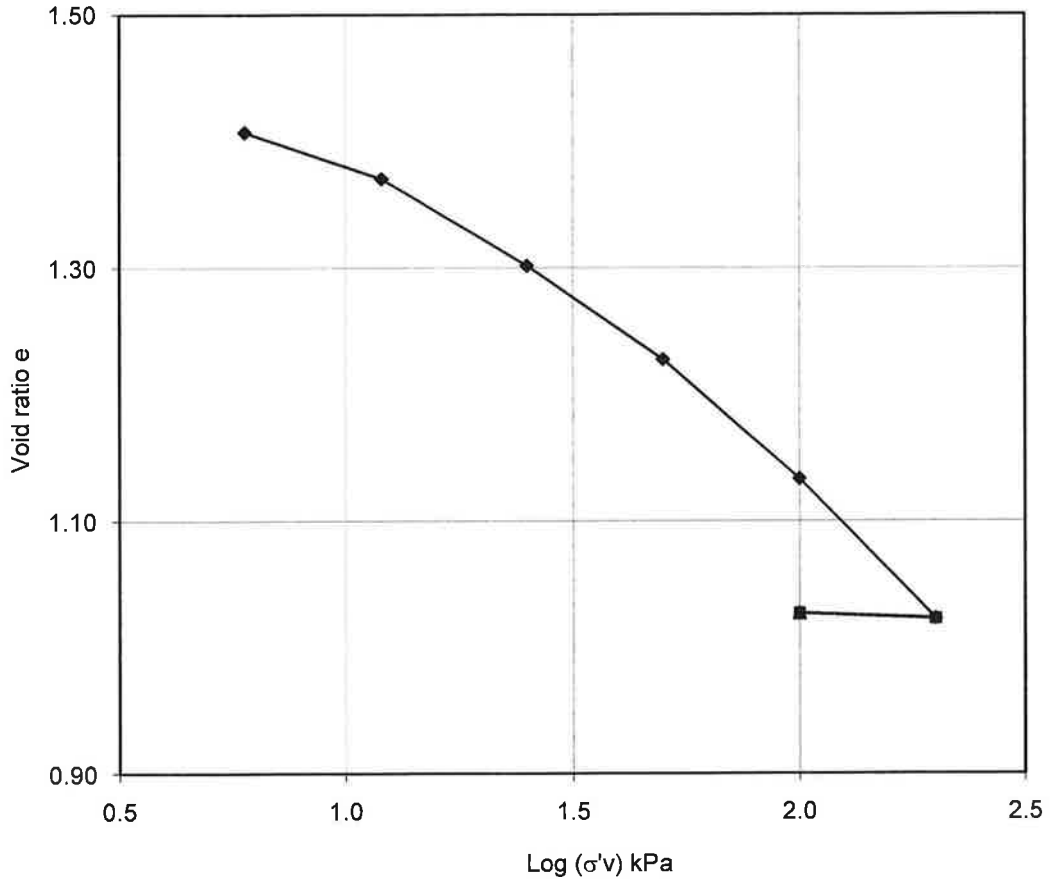
Queen's University Belfast	Geotechnical Testing Station

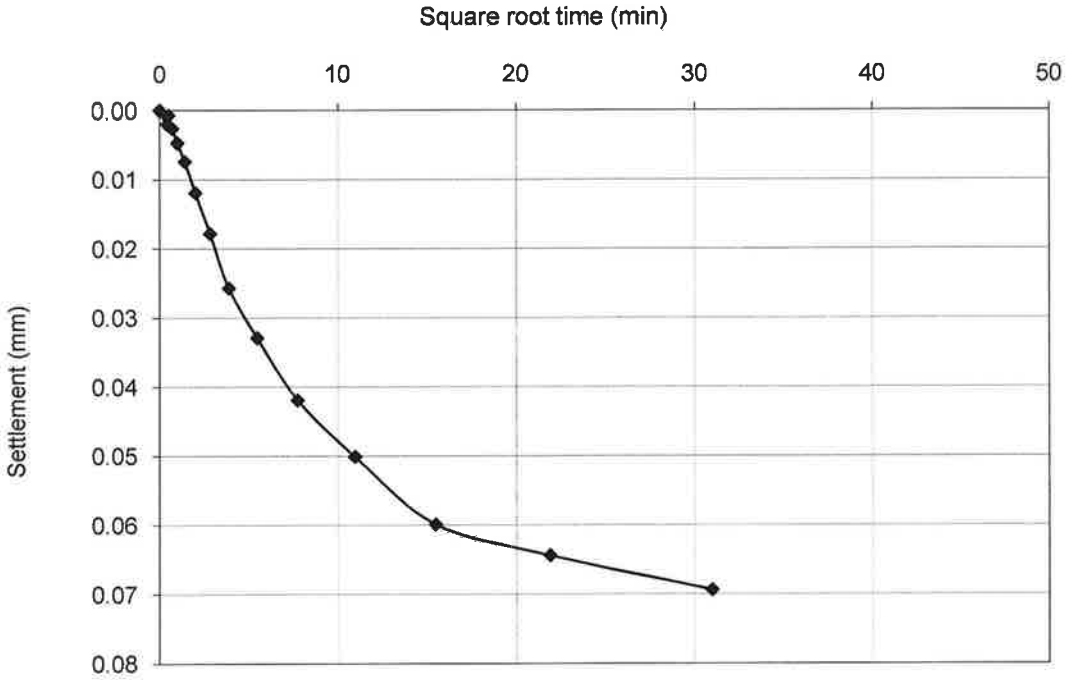
Client	**CG**
Job Ref	Galway
Date	10/04/2012
Borehole number	BH03
Sample number	
Depth m	4.0
Soil type	**Soft grey silty Clay**
Test	**1 D Consolidation**

Wet mass (i) g	141
Wet mass (f) g	129.4
Dry mass g	93
Water content (i) %	51.6
Water content (f) %	39.1
Bulk density kg/m3	1663.1
Dry density kg/m3	1097.0

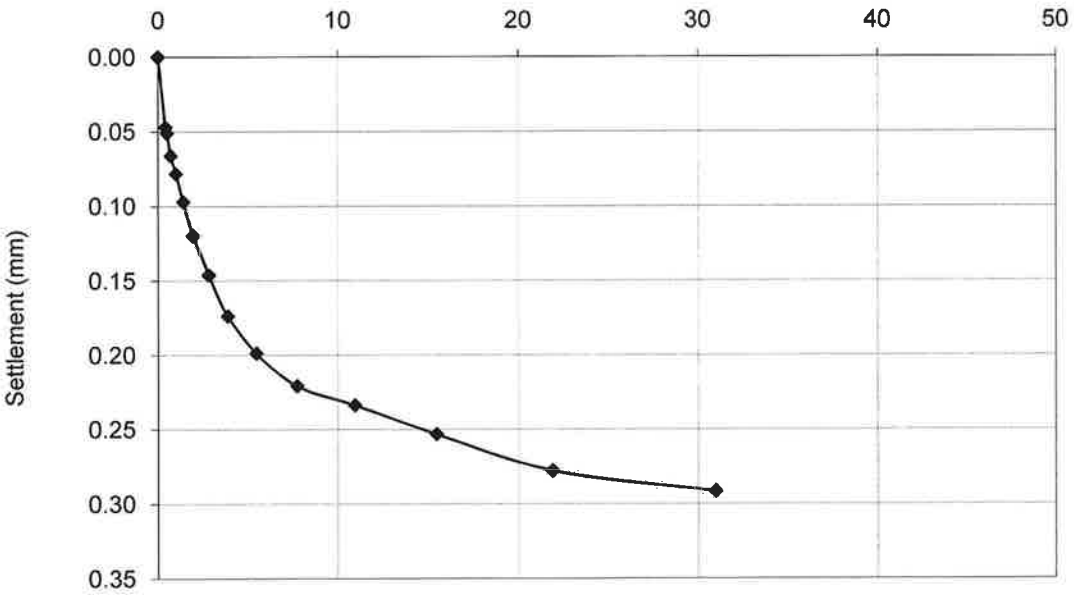
Diameter mm	75		
Initial Height mm	19.2	Specific gravity	2.6

σ'v kPa	ΔH mm	H mm	V cm3	Vv cm3	e	log(σ'v)	Compressibility m2/MN	Cv m2/year
6	0.069	19.131	84.474	49.379	1.407	0.78		0.34
12	0.292	18.839	83.186	48.092	1.370	1.08	2.54	0.33
25	0.546	18.293	80.775	45.681	1.302	1.40	2.23	0.37
50	0.589	17.704	78.172	43.078	1.227	1.70	1.29	0.35
100	0.749	16.955	74.866	39.771	1.133	2.00	0.85	0.32
200	0.879	16.076	70.986	35.892	1.023	2.30	0.52	0.29
100	-0.034	16.110	71.136	36.042	1.027	2.00	0.02	0.59

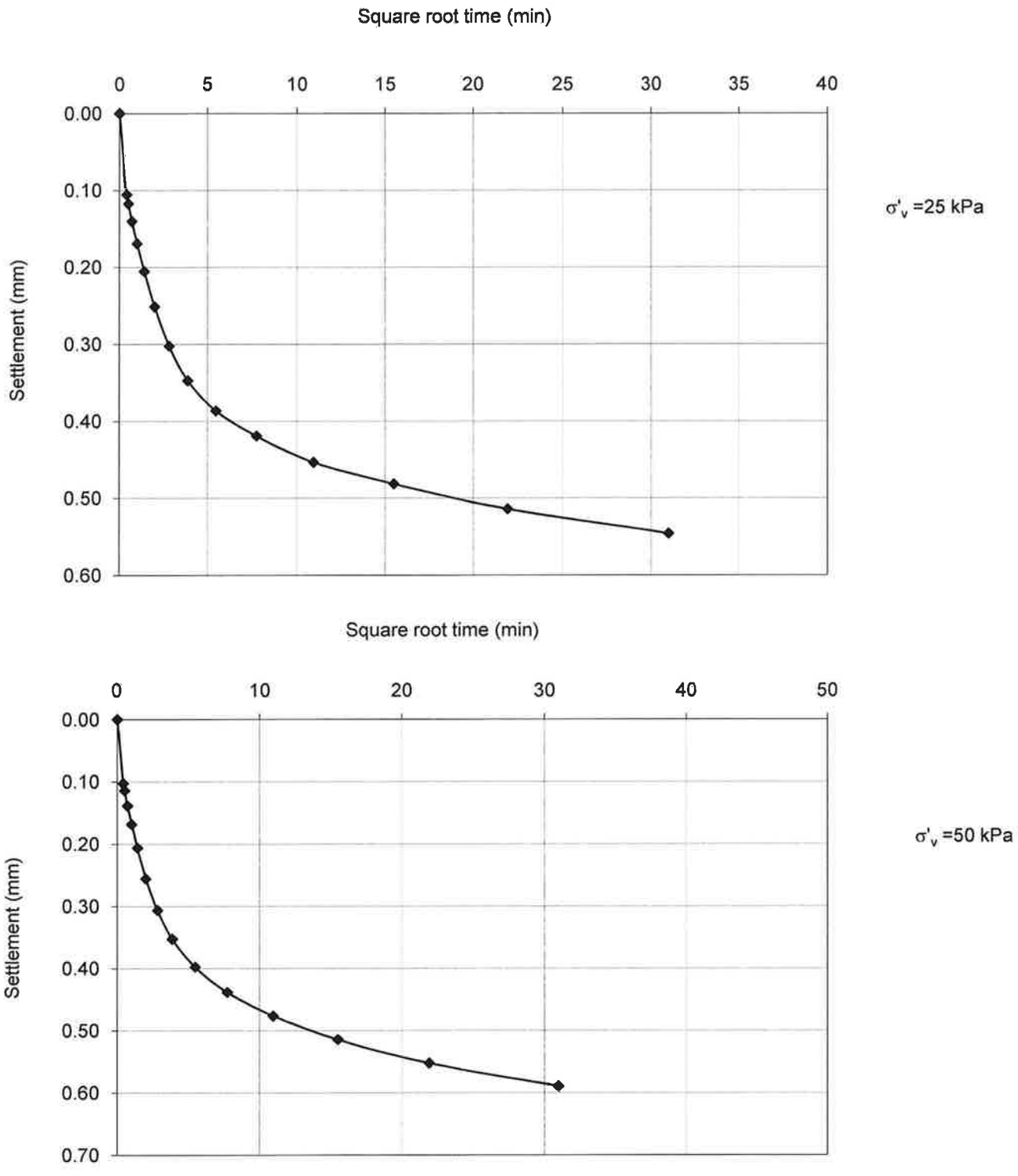


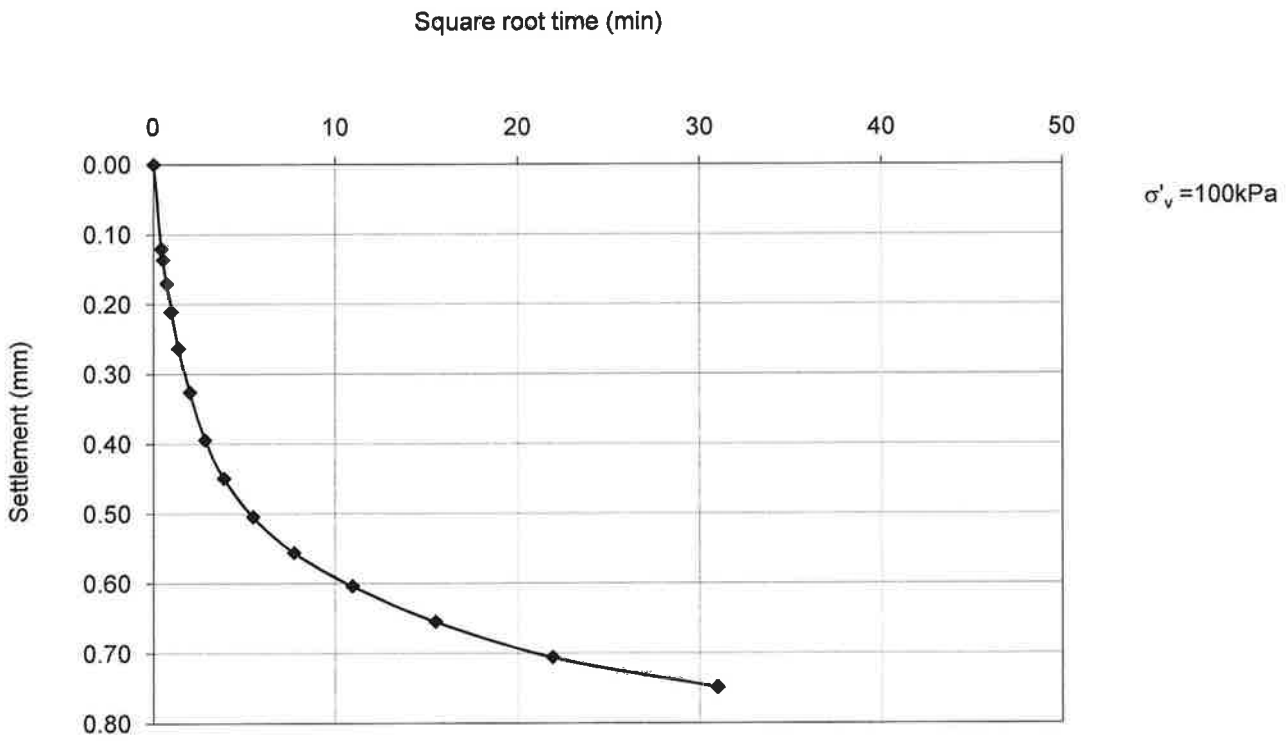


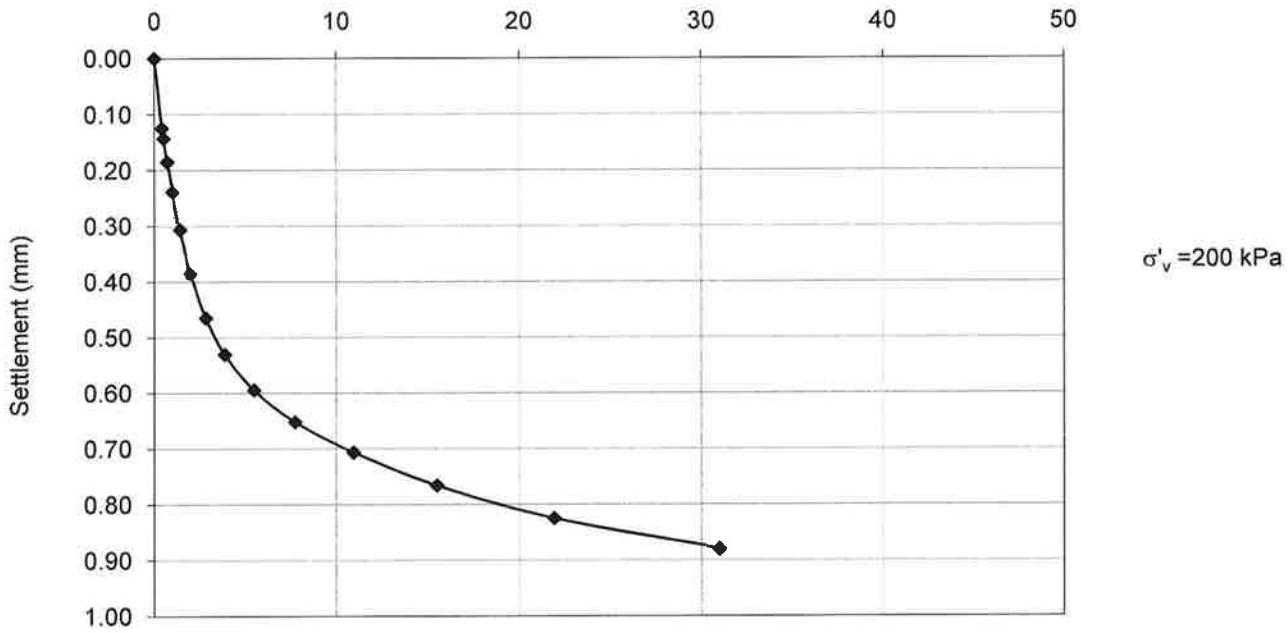
σ'_v = 6 kPa

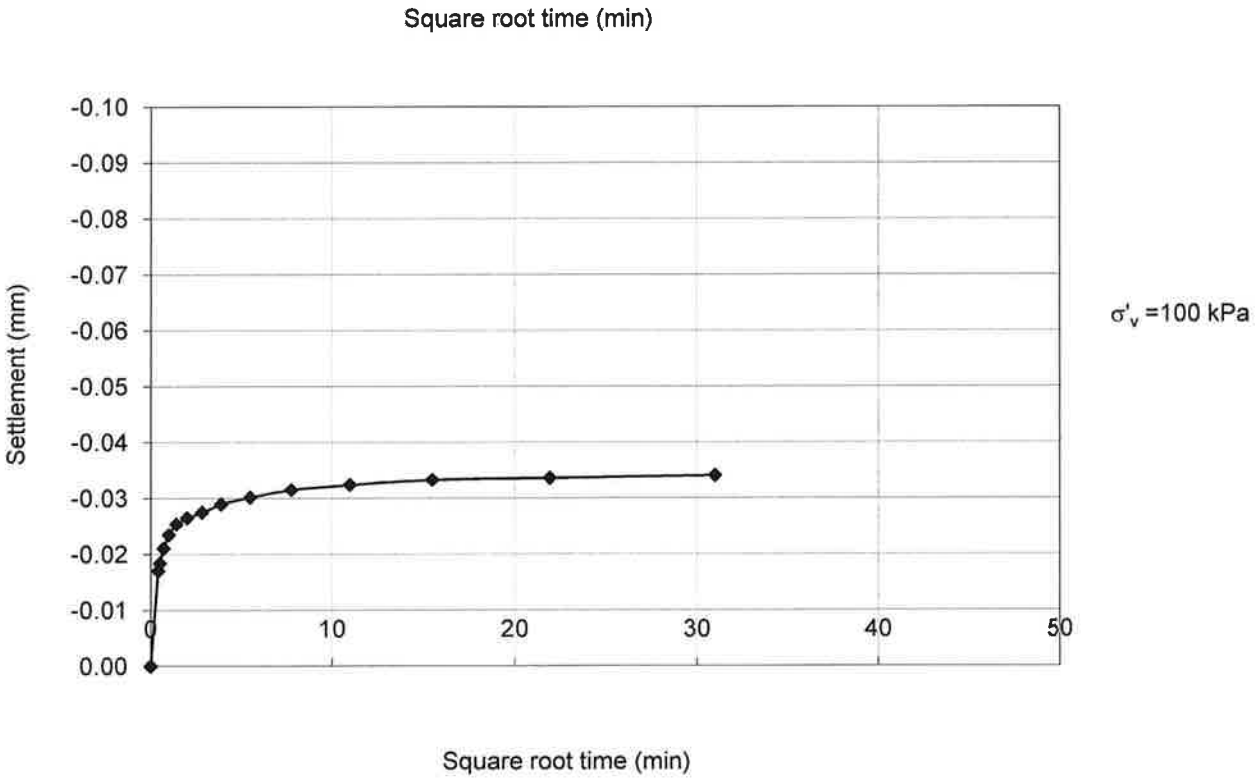


σ'_v = 12.5kPa


Square root time (min)
0
5
10
15
20
25
30
35
40
0.00
0.10
0.20
0.30
0.40
0.50
0.60
Settlement (mm)
σ'v =25 kPa
Square root time (min)
0
10
20
30
40
50
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
Settlement (mm)
σ'v =50 kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
Settlement (mm)
σ'v =100kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
Settlement (mm)
σ'v =200 kPa


Square root time (min)
Settlement (mm)
-0.10
-0.09
-0.08
-0.07
-0.06
-0.05
-0.04
-0.03
-0.02
-0.01
0.00
0
10
20
30
40
50
Square root time (min)
σ'v =100 kPa

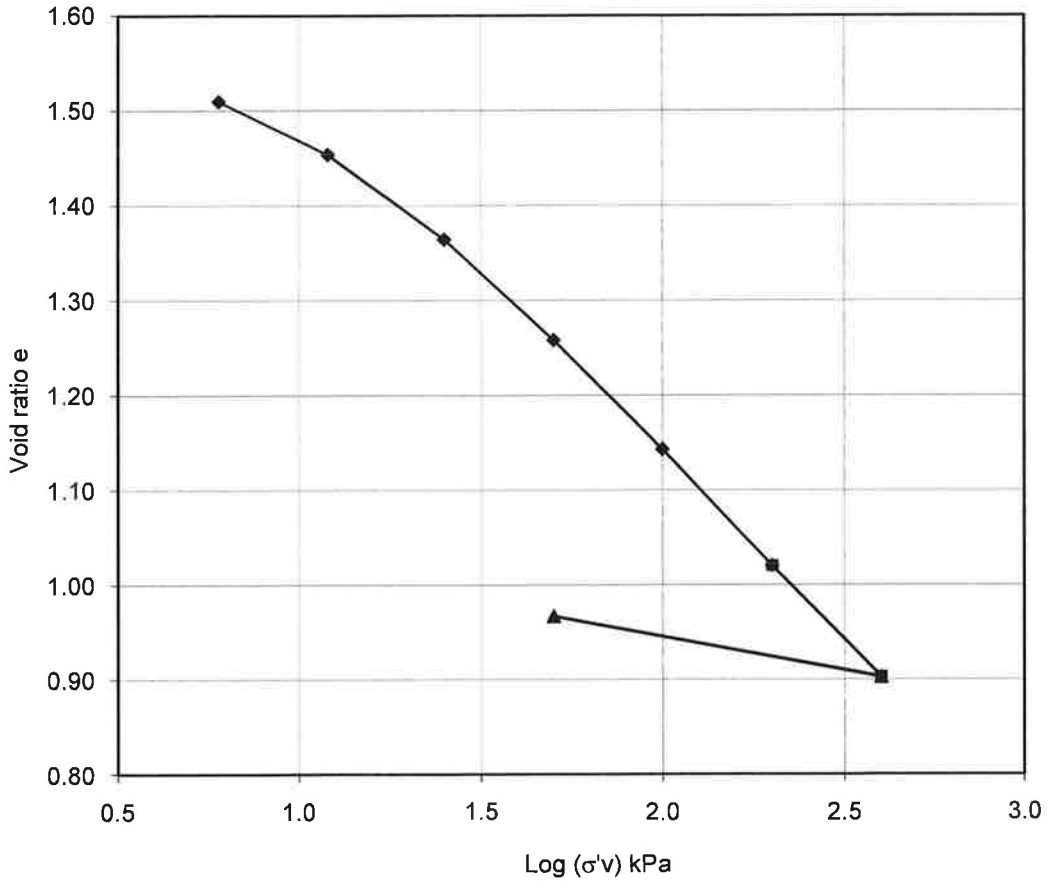
Queen's University Belfast	Geotechnical Testing Station

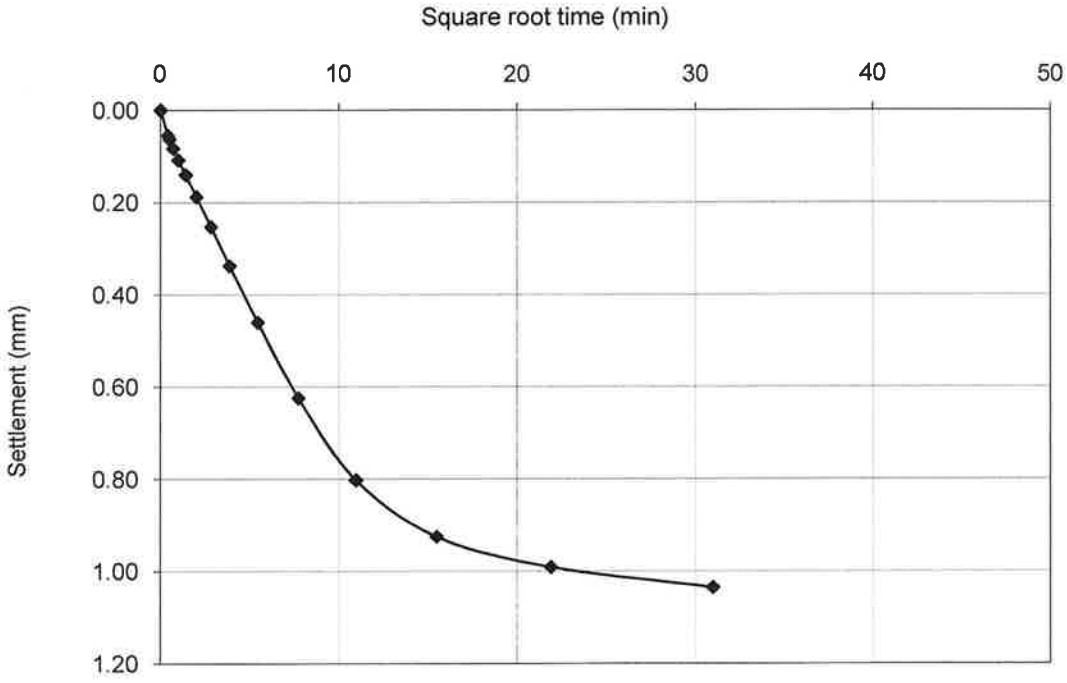
Client	CG
Job Ref	Galway
Date	10/04/2012
Borehole number	BH03
Sample number	
Depth m	6.0
Soil type	Very sofy silty clay
Test	1 D Consolidation

Wet mass (i) g	137.1
Wet mass (f) g	115
Dry mass g	83.1
Water content (i) %	65.0
Water content (f) %	38.4
Bulk density kg/m3	1617.1
Dry density kg/m3	980.2

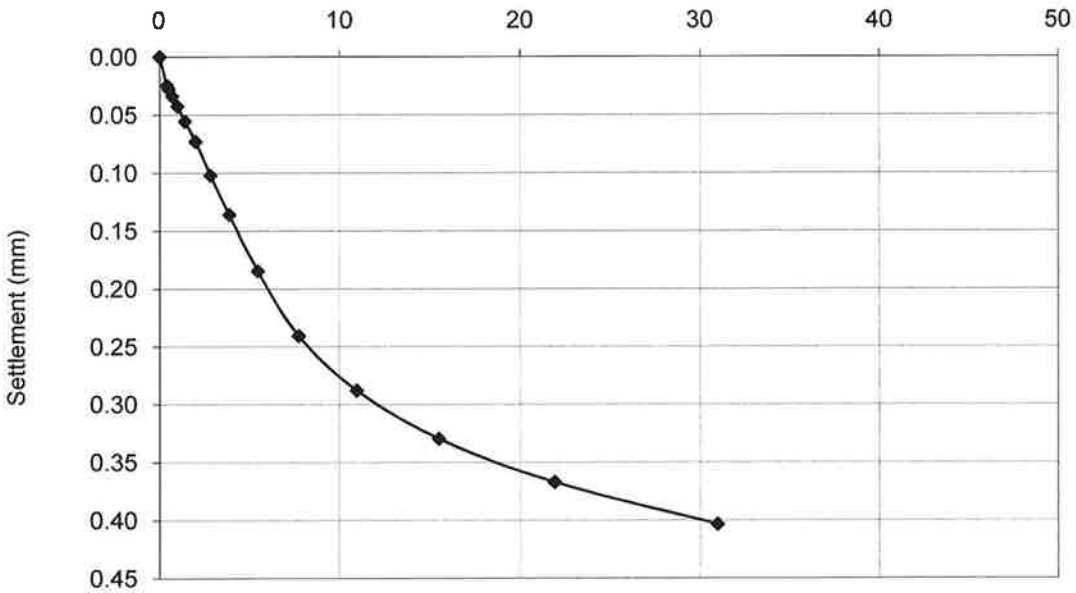
Diameter mm	75		
Initial Height mm	19.2	Specific gravity	2.6

σ'v kPa	ΔH mm	H mm	V cm3	Vv cm3	e	log(σ'v)	Compressibility m2/MN	Cv m2/year
6	1.036	18.165	80.208	48.246	1.510	0.78		0.26
12	0.404	17.761	78.426	46.464	1.454	1.08	3.70	0.24
25	0.648	17.113	75.563	43.602	1.364	1.40	2.81	0.23
50	0.768	16.345	72.173	40.212	1.258	1.70	1.79	0.21
100	0.834	15.511	68.490	36.528	1.143	2.00	1.02	0.22
200	0.887	14.623	64.572	32.610	1.020	2.30	0.57	0.24
400	0.851	13.773	60.816	28.854	0.903	2.60	0.29	0.26
50	-0.466	14.239	62.873	30.912	0.967	1.70	0.10	0.35

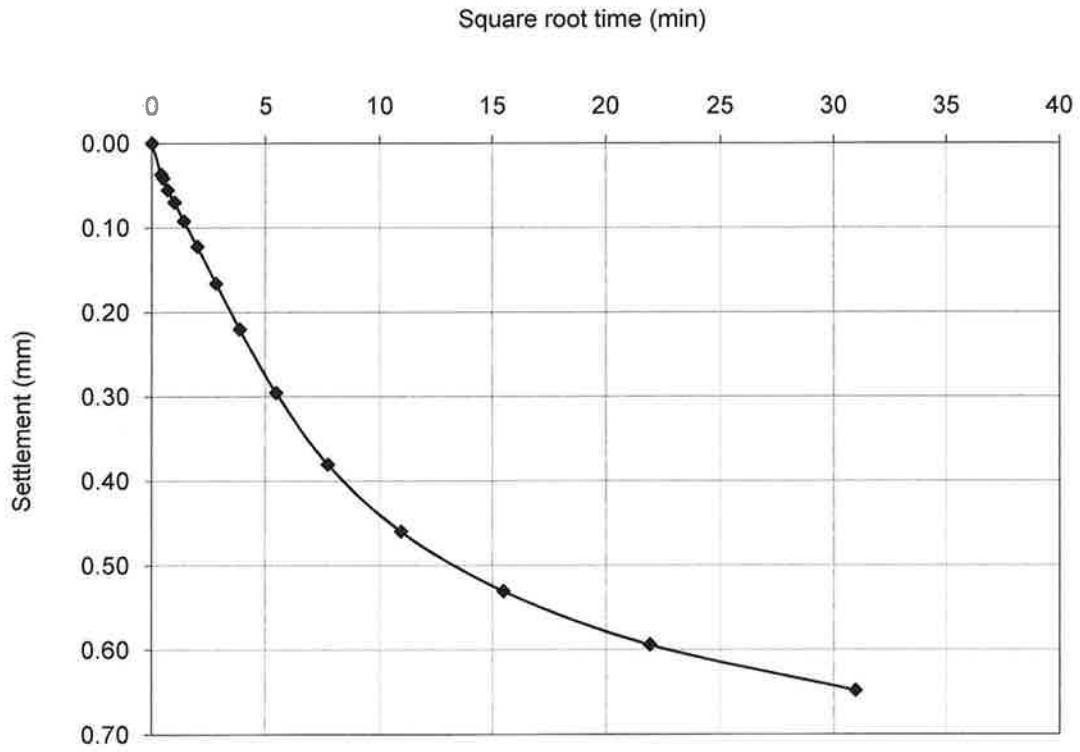




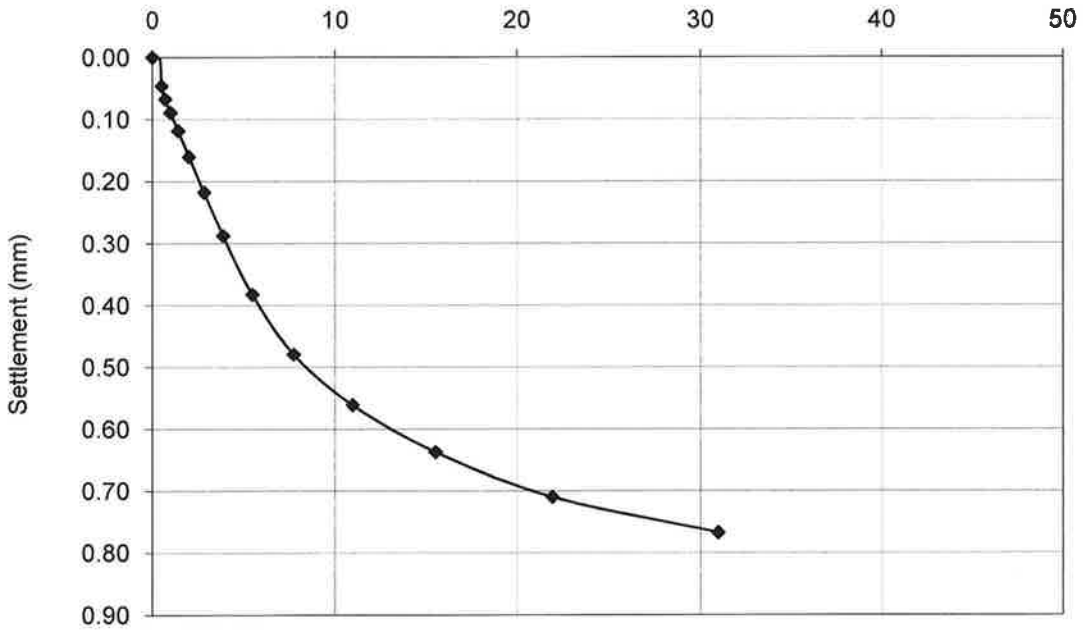
σ'_v = 6 kPa



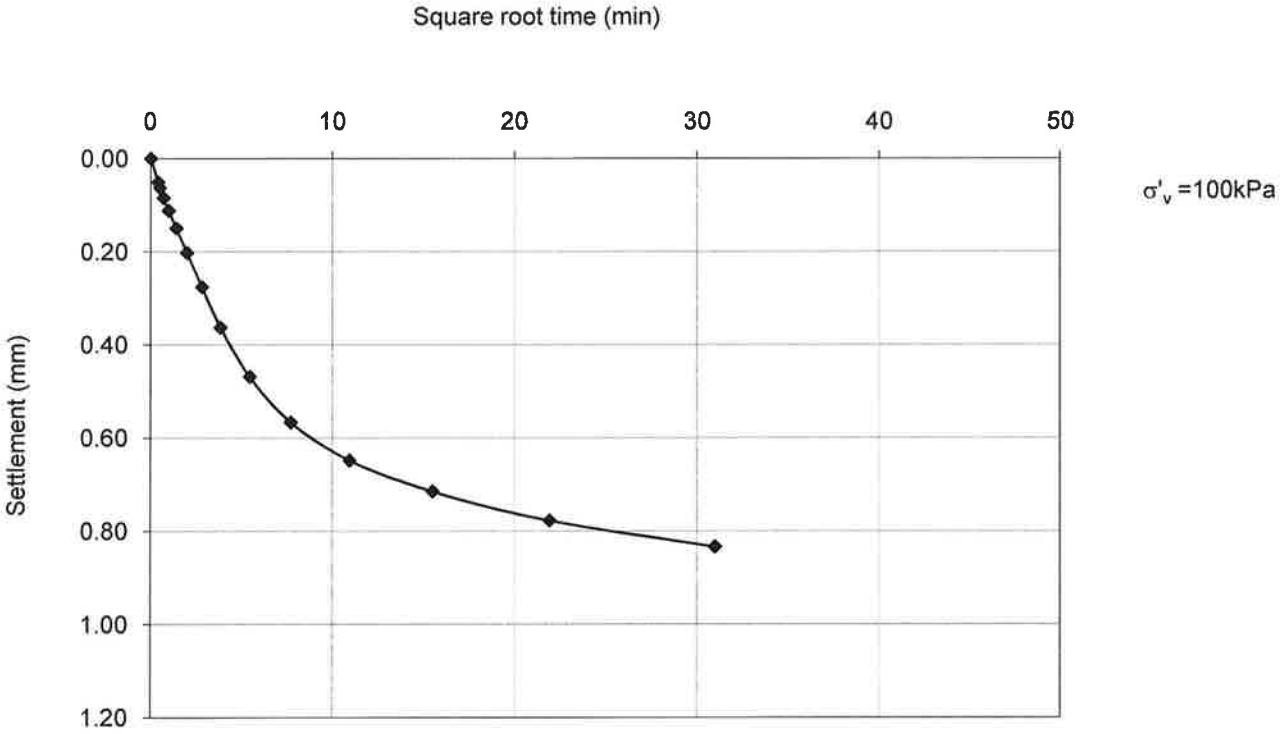
σ'_v = 12.5kPa

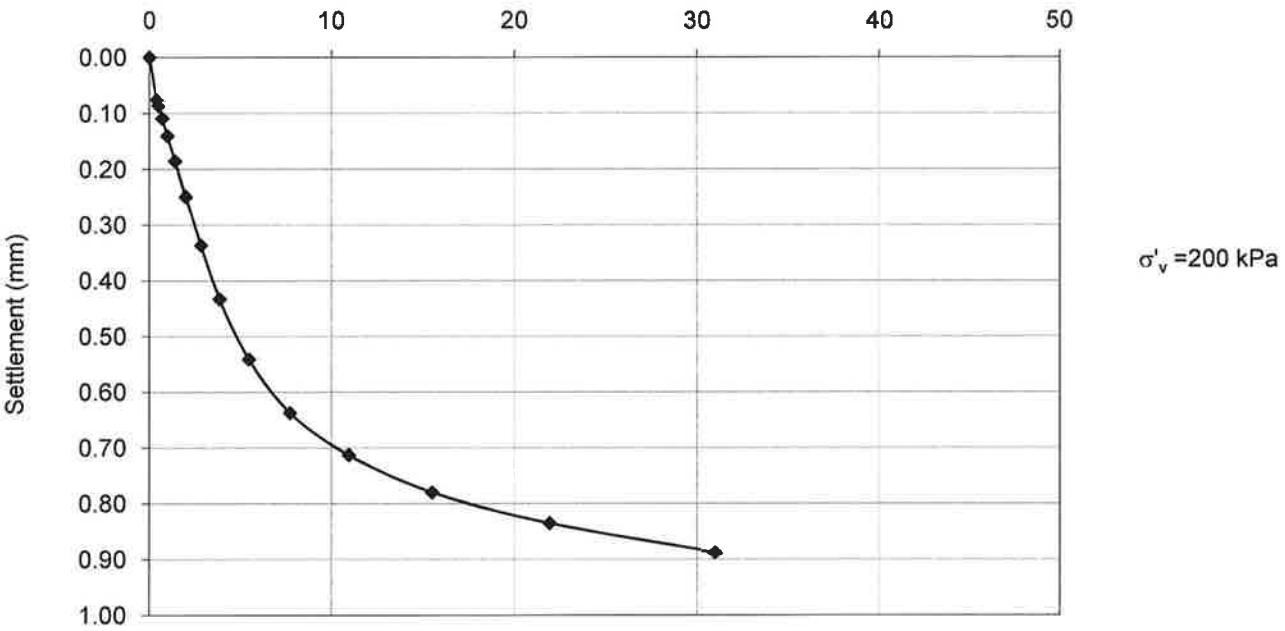


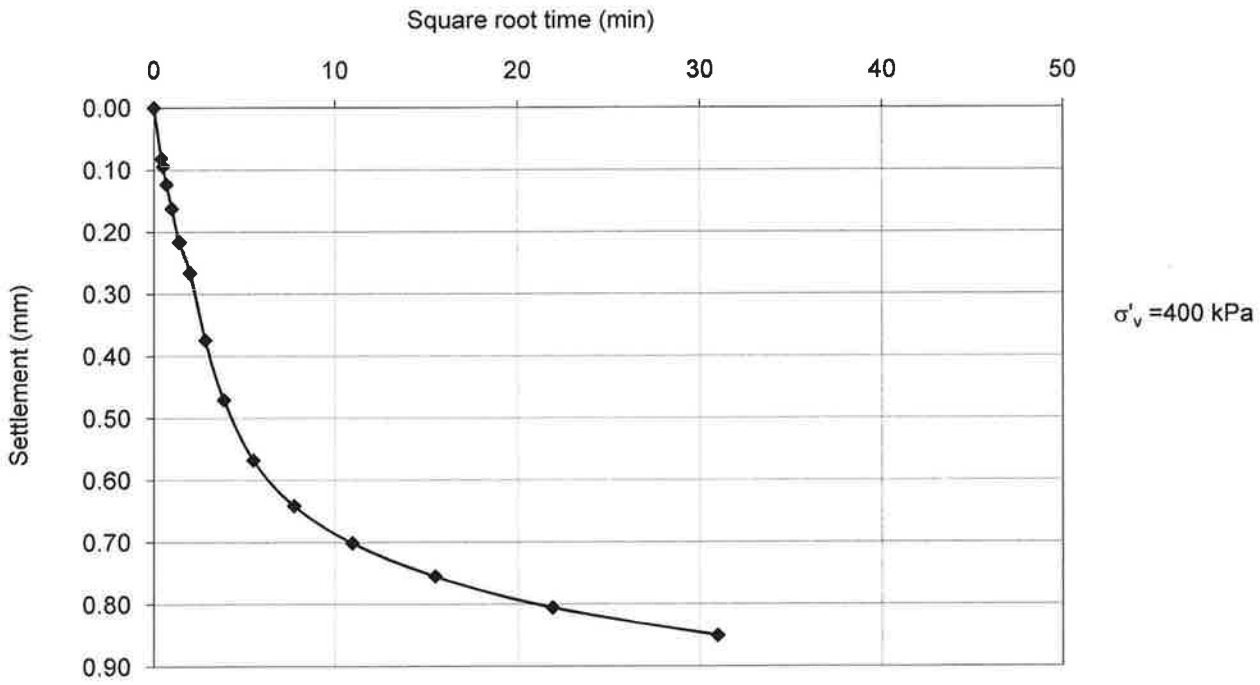
σ'_v =25 kPa



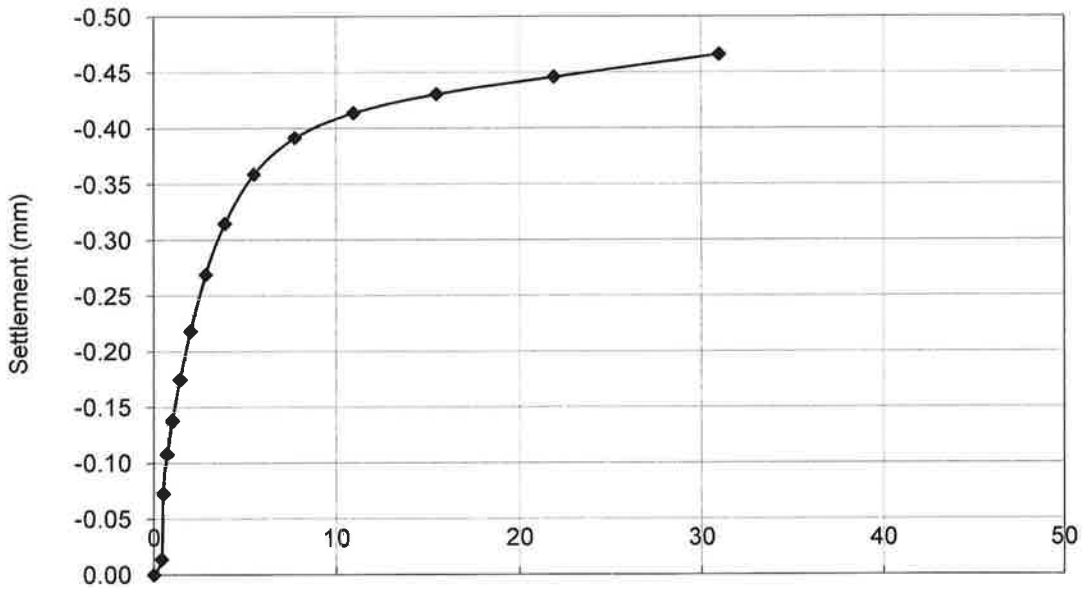
σ'_v =50 kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.20
0.40
0.60
0.80
1.00
1.20
Settlement (mm)
σ'v =100kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
Settlement (mm)
σ'v =200 kPa



Square root time (min)



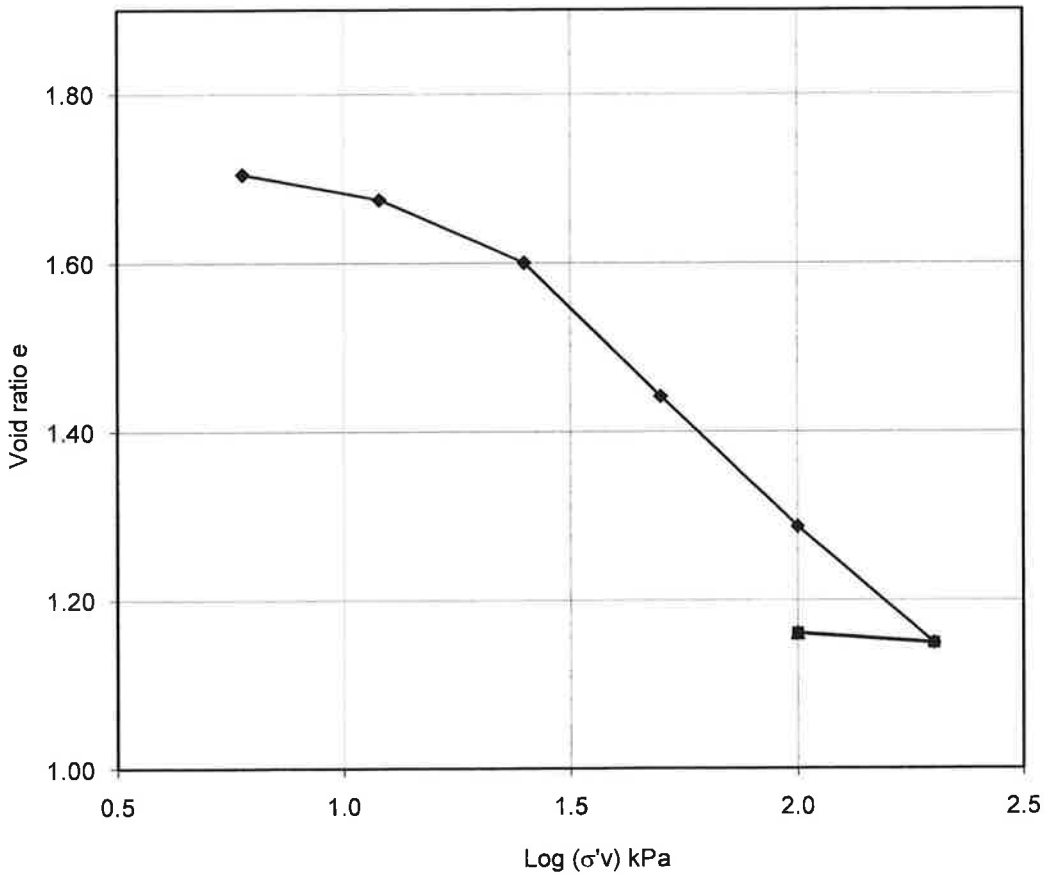
Queen's University Belfast	Geotechnical Testing Station

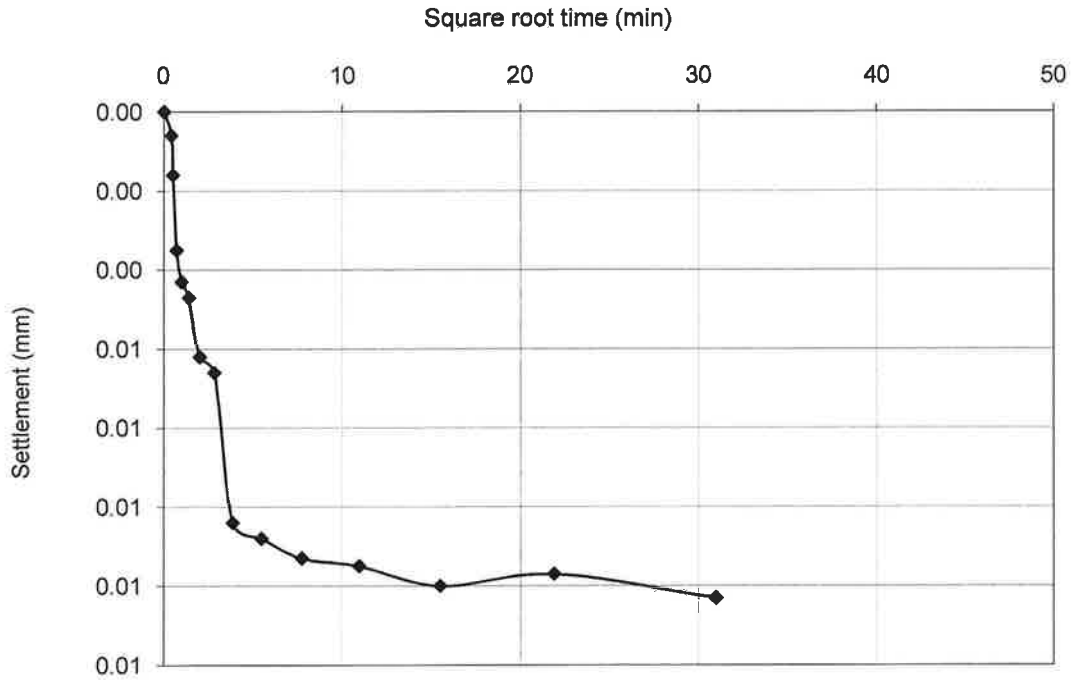
Client	CG
Job Ref	Galway
Date	10/04/2012
Borehole number	BH04
Sample number	
Depth m	3.0
Soil type	Very soft grey caly
Test	1 D Consolidation

Wet mass (i) g	137
Wet mass (f) g	117.3
Dry mass g	83
Water content (i) %	65.1
Water content (f) %	41.3
Bulk density kg/m3	1615.9
Dry density kg/m3	979.0

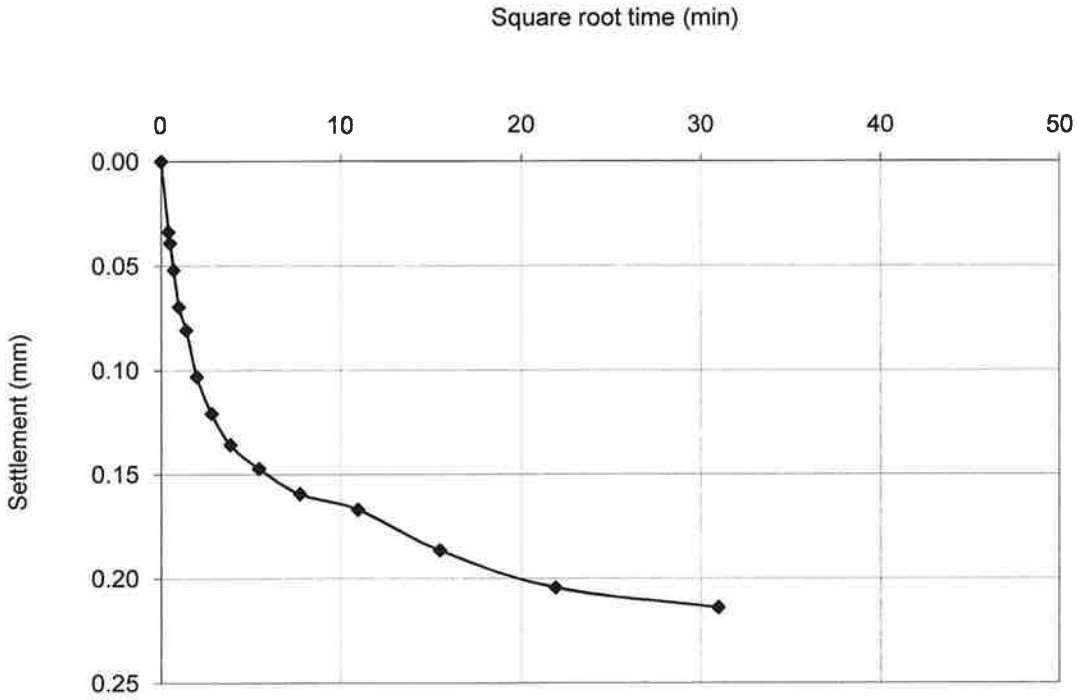
Diameter mm	75		
Initial Height mm	19.2	Specific gravity	2.6

σ'v kPa	ΔH mm	H mm	V cm3	Vv cm3	e	log(σ'v)	Compressibility m2/MN	Cv m2/year
6	0.012	19.188	84.726	53.405	1.705	0.78		
12	0.214	18.974	83.781	52.460	1.675	1.08	1.86	0.50
25	0.530	18.443	81.439	50.118	1.600	1.40	2.15	0.26
50	1.124	17.319	76.474	45.153	1.442	1.70	2.44	0.23
100	1.095	16.224	71.638	40.318	1.287	2.00	1.26	0.29
200	0.981	15.243	67.306	35.986	1.149	2.30	0.60	0.21
100	-0.084	15.327	67.677	36.356	1.161	2.00	0.06	0.41

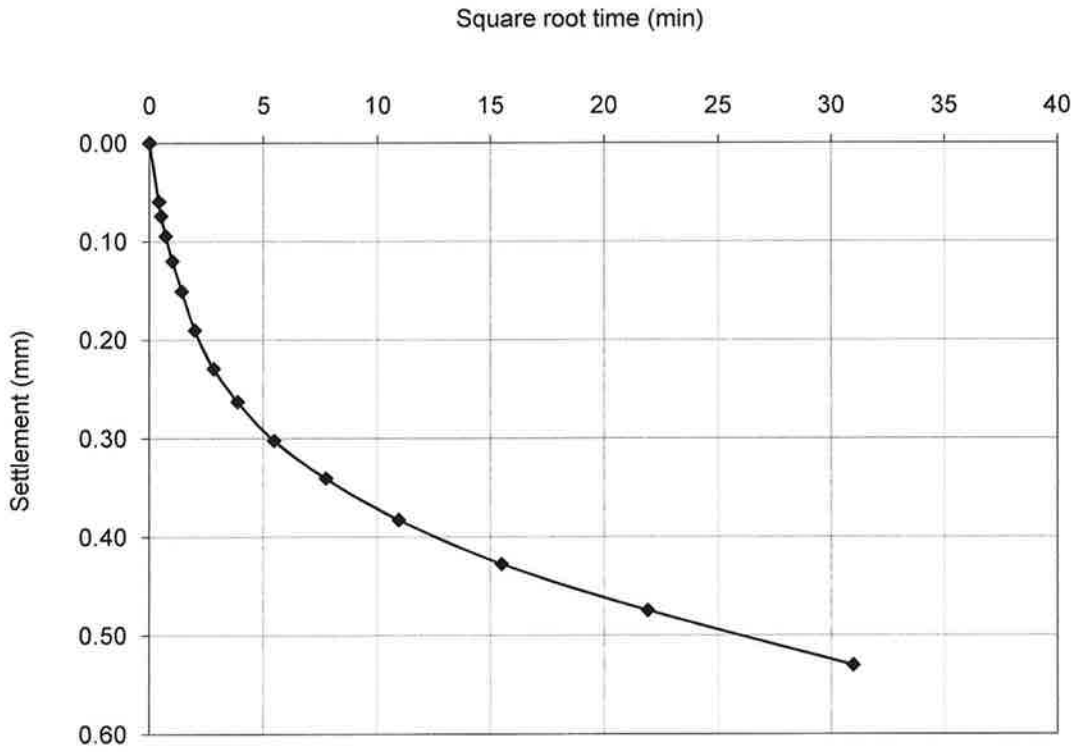




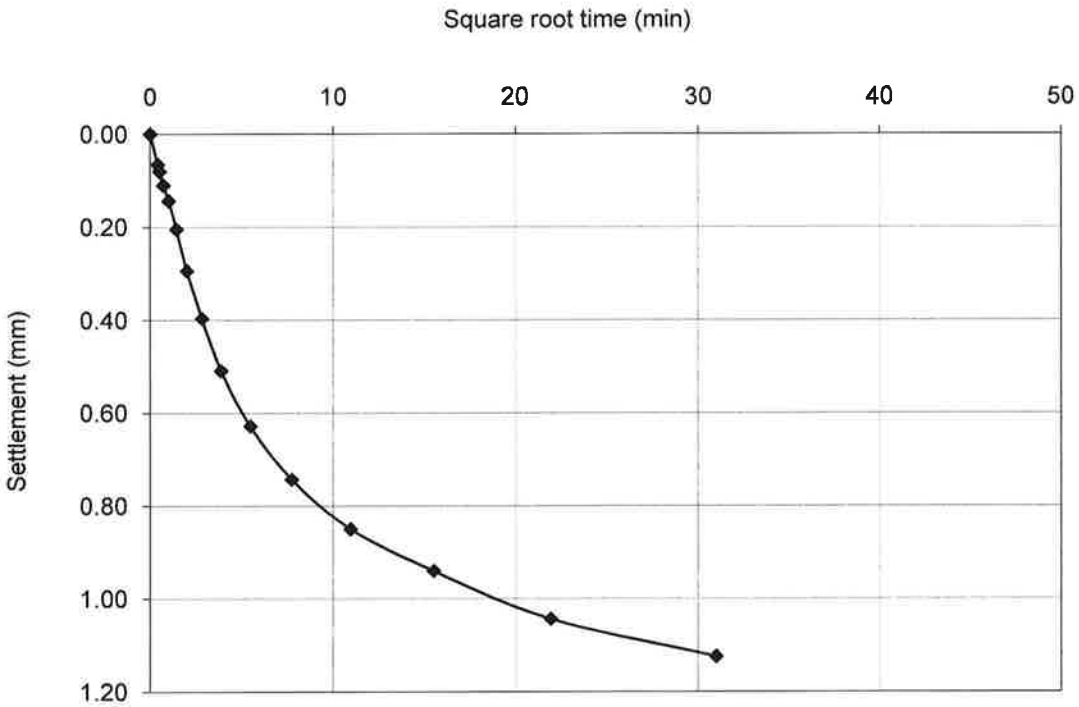
σ'_v = 6 kPa



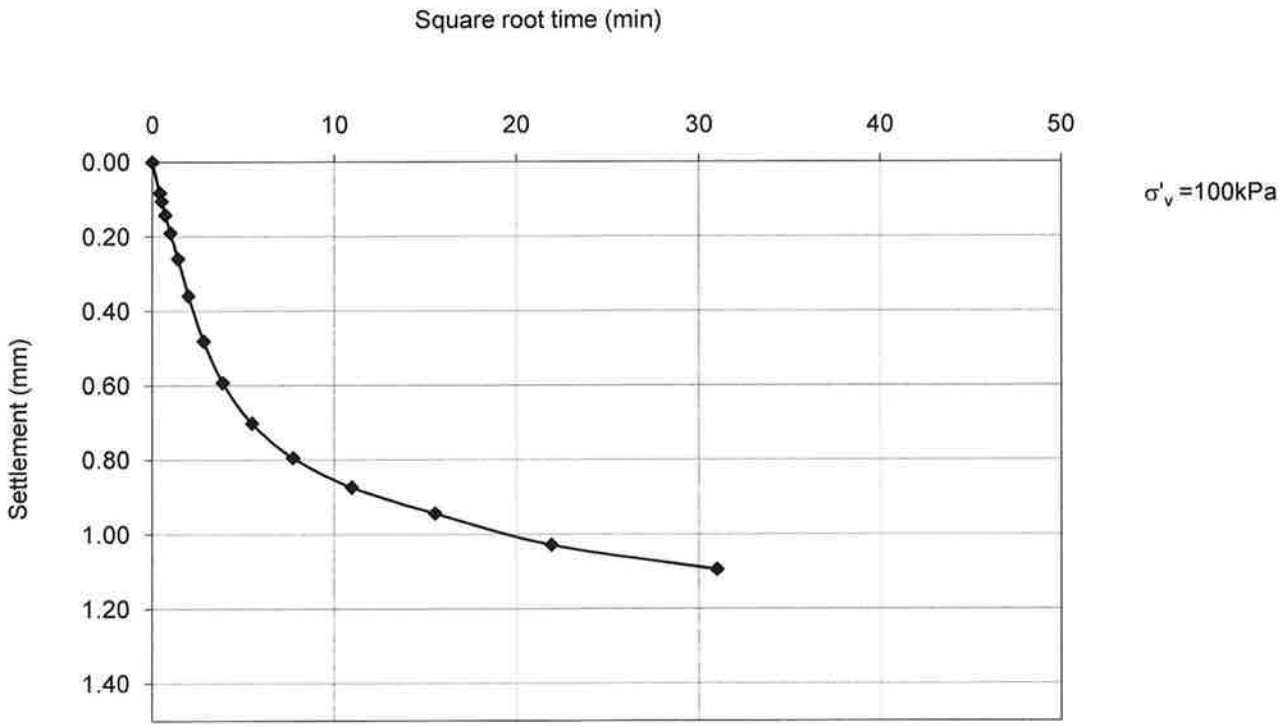
σ'_v = 12.5kPa

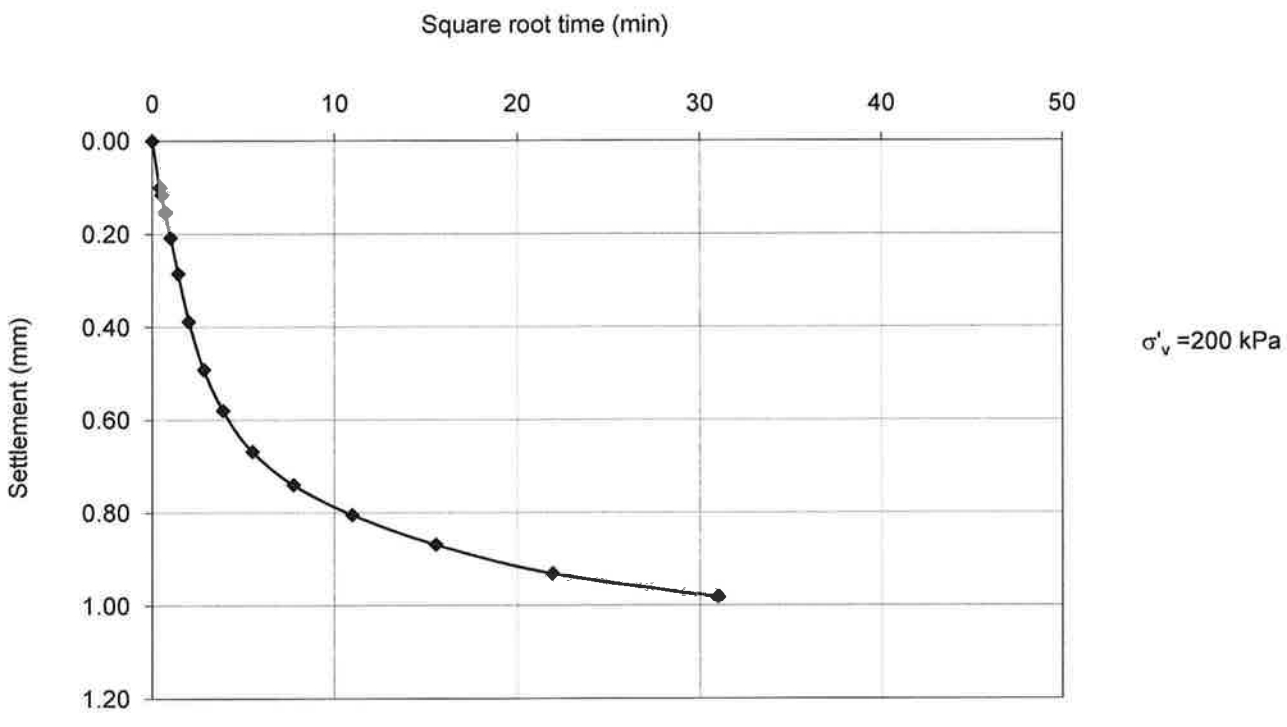


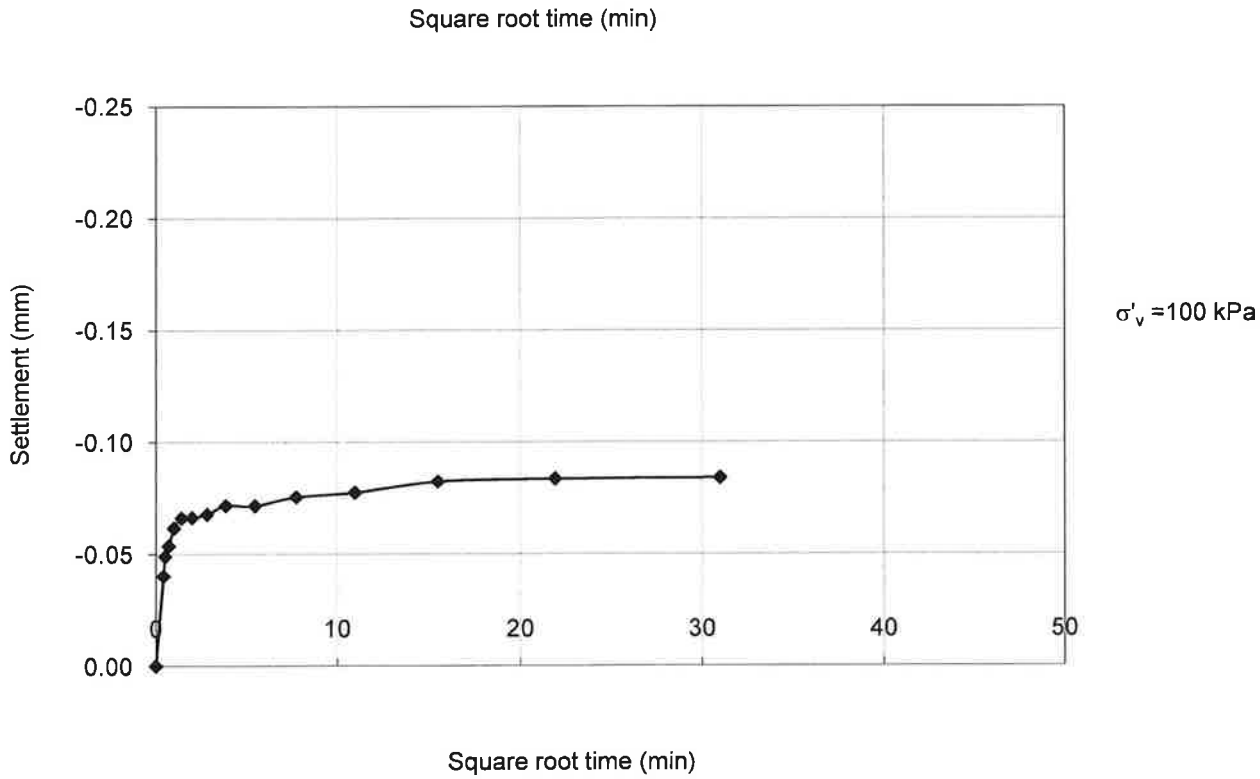
σ'_v =25 kPa



σ'_v =50 kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
Settlement (mm)
σ'v =100kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.20
0.40
0.60
0.80
1.00
1.20
Settlement (mm)
σ'v =200 kPa


Square root time (min)
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Settlement (mm)
0
10
20
30
40
50
σ'v =100 kPa
Square root time (min)

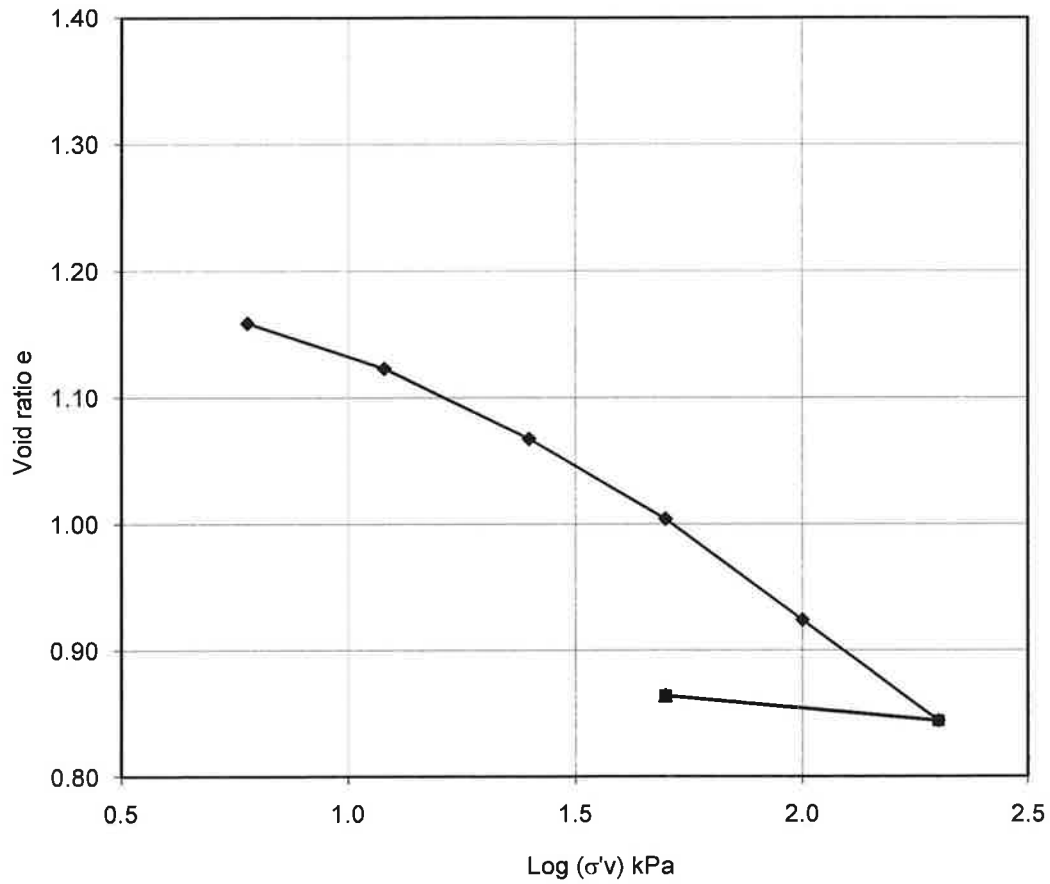
Queen's University Belfast	Geotechnical Testing Station

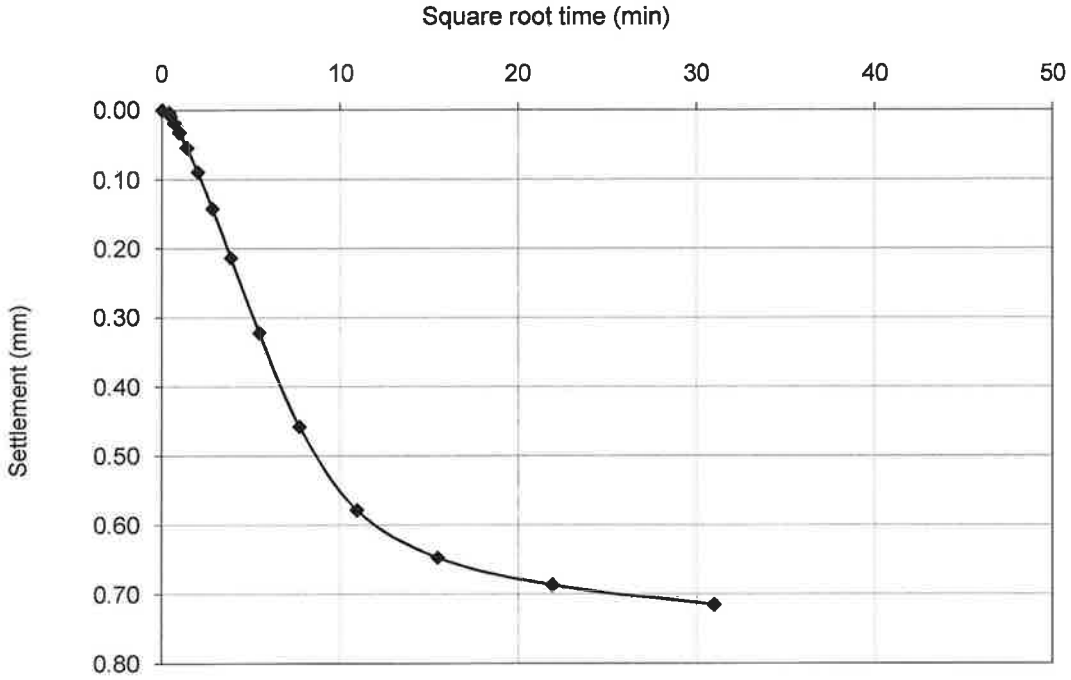
Client	CG
Job Ref	Galway
Date	10/04/2012
Borehole number	BH04
Sample number	
Depth m	5.0
Soil type	Very sofy silty clay
Test	1 D Consolidation

Wet mass (i) g	150.3
Wet mass (f) g	134
Dry mass g	98.3
Water content (i) %	52.9
Water content (f) %	36.3
Bulk density kg/m3	1772.8
Dry density kg/m3	1159.5

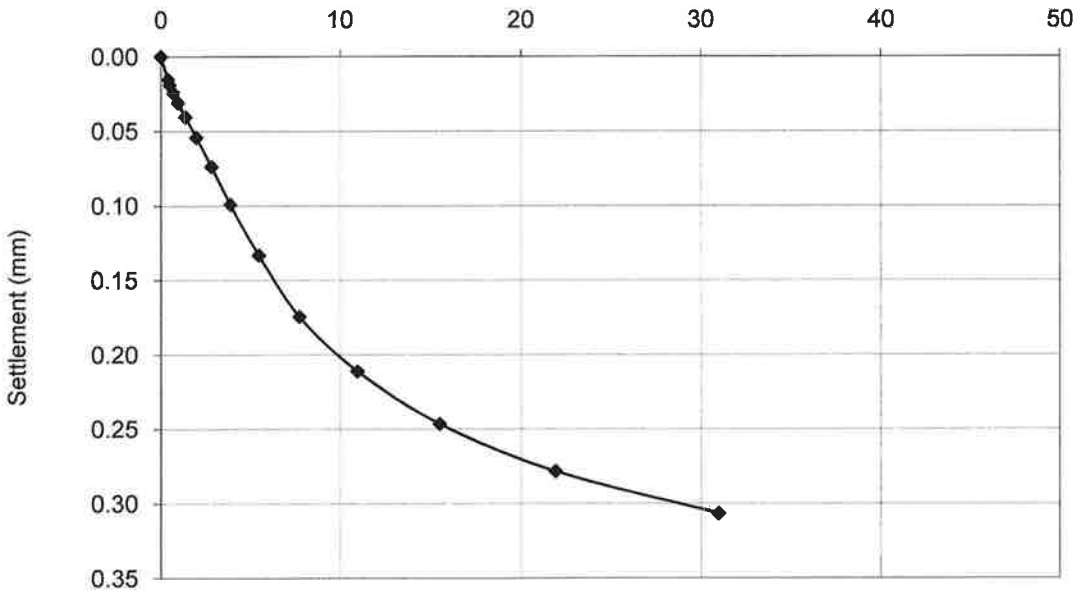
Diameter mm	75		
Initial Height mm	19.2	Specific gravity	2.6

σ'v kPa	ΔH mm	H mm	V cm3	Vv cm3	e	log(σ'v)	Compressibility m2/MN	Cv m2/year
6	0.716	18.484	81.620	43.812	1.159	0.78		0.38
12	0.307	18.178	80.265	42.457	1.123	1.08	2.77	0.26
25	0.476	17.702	78.164	40.356	1.067	1.40	2.01	0.21
50	0.543	17.158	75.764	37.956	1.004	1.70	1.23	0.33
100	0.684	16.474	72.744	34.936	0.924	2.00	0.80	0.37
200	0.685	15.789	69.718	31.910	0.844	2.30	0.42	0.34
50	-0.173	15.962	70.484	32.676	0.864	1.70	0.07	0.58

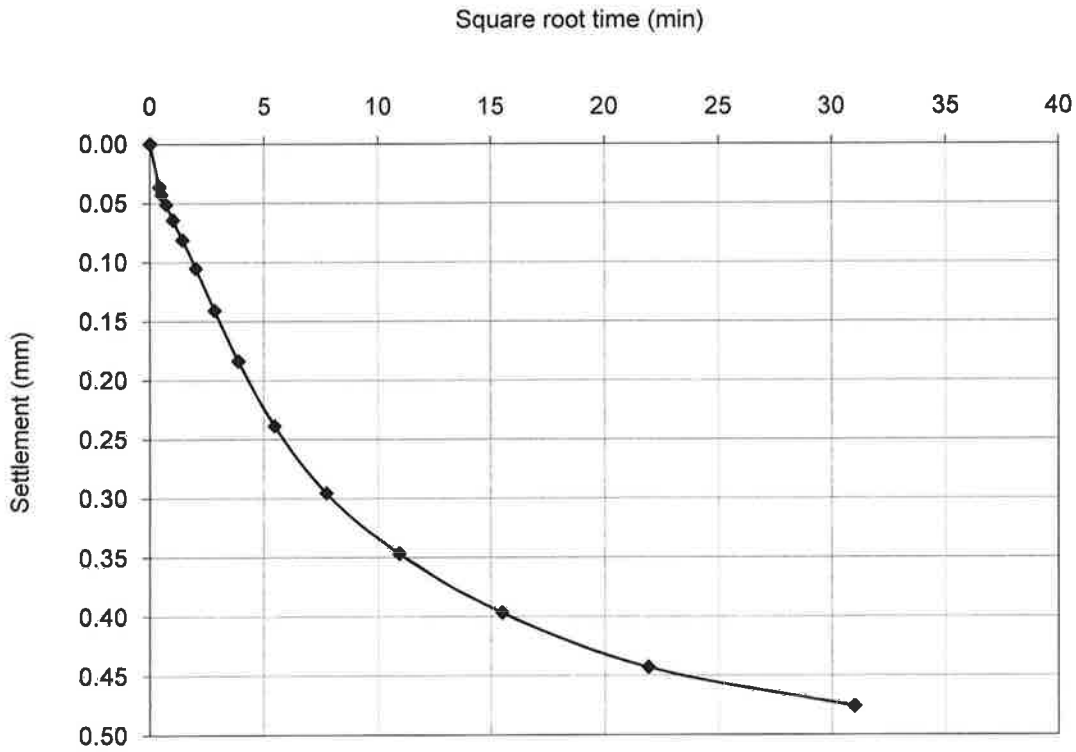




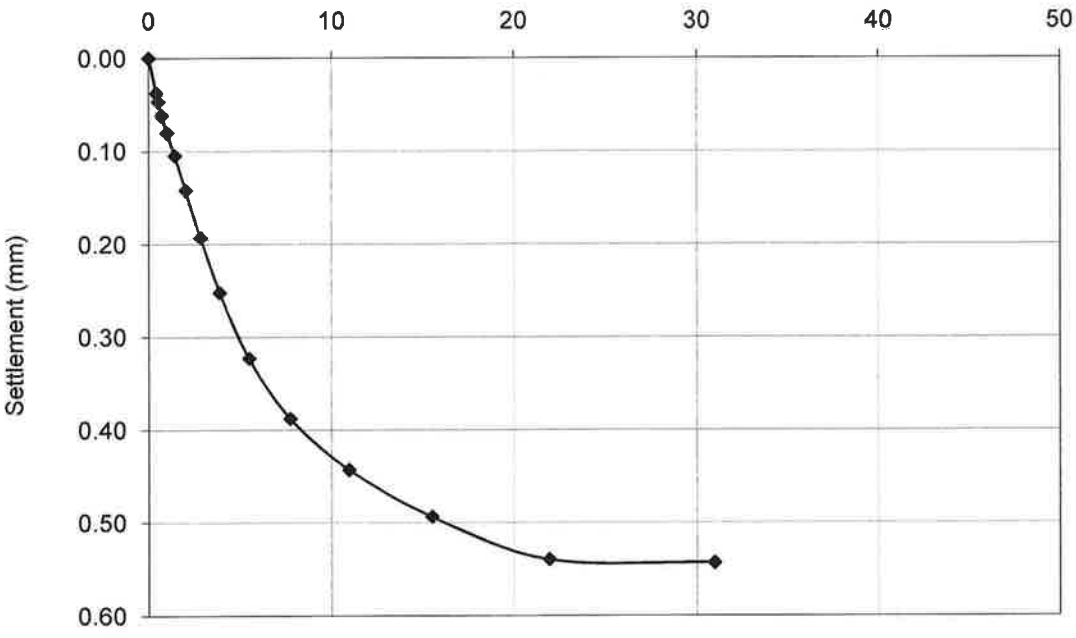
σ'_v = 6 kPa



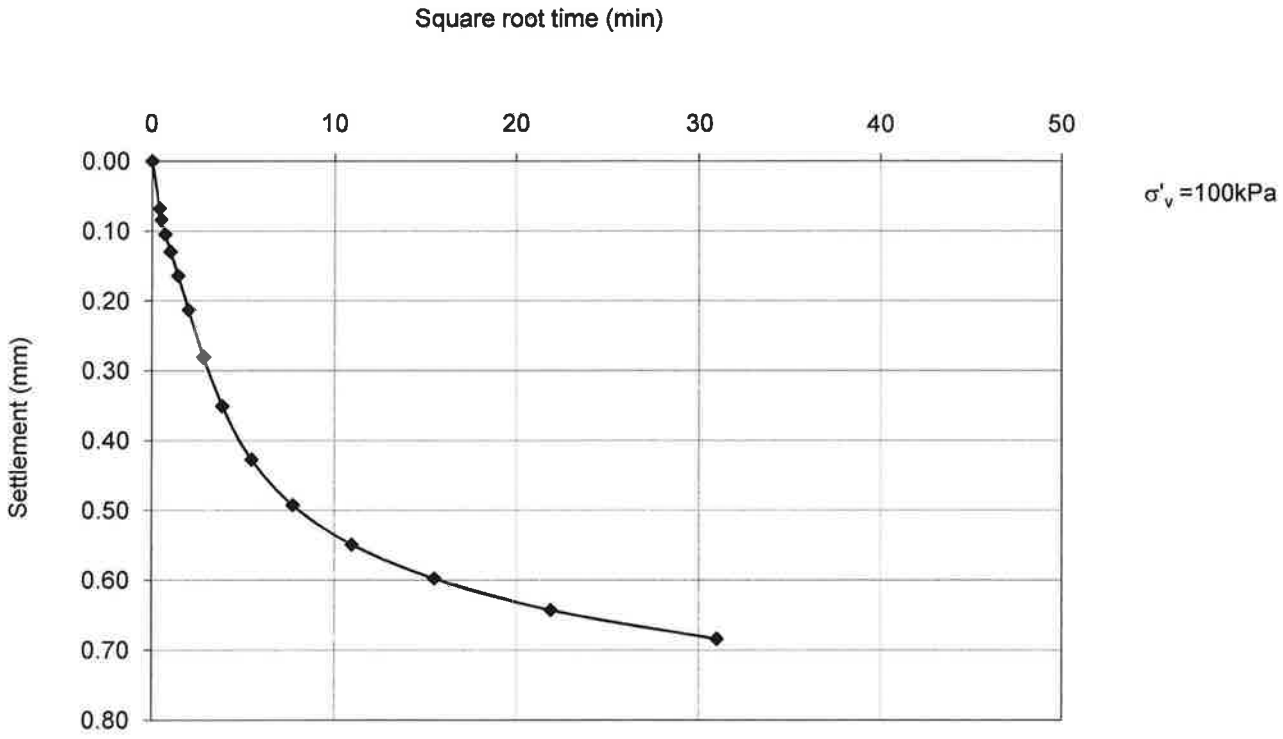
σ'_v = 12.5kPa

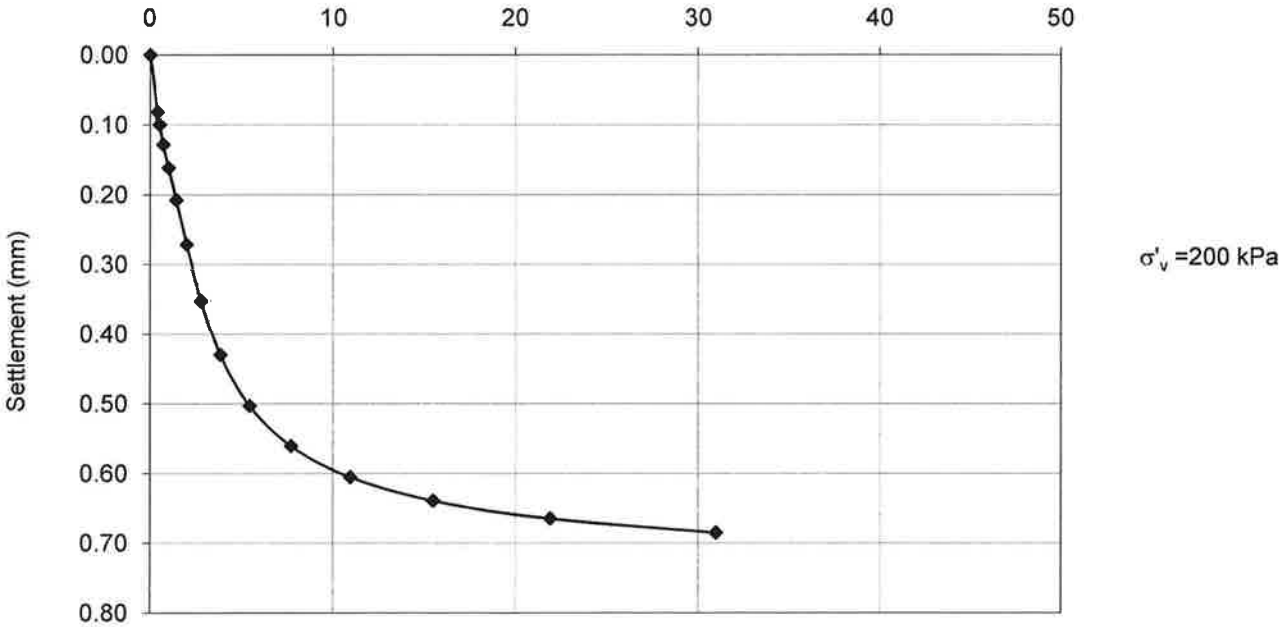


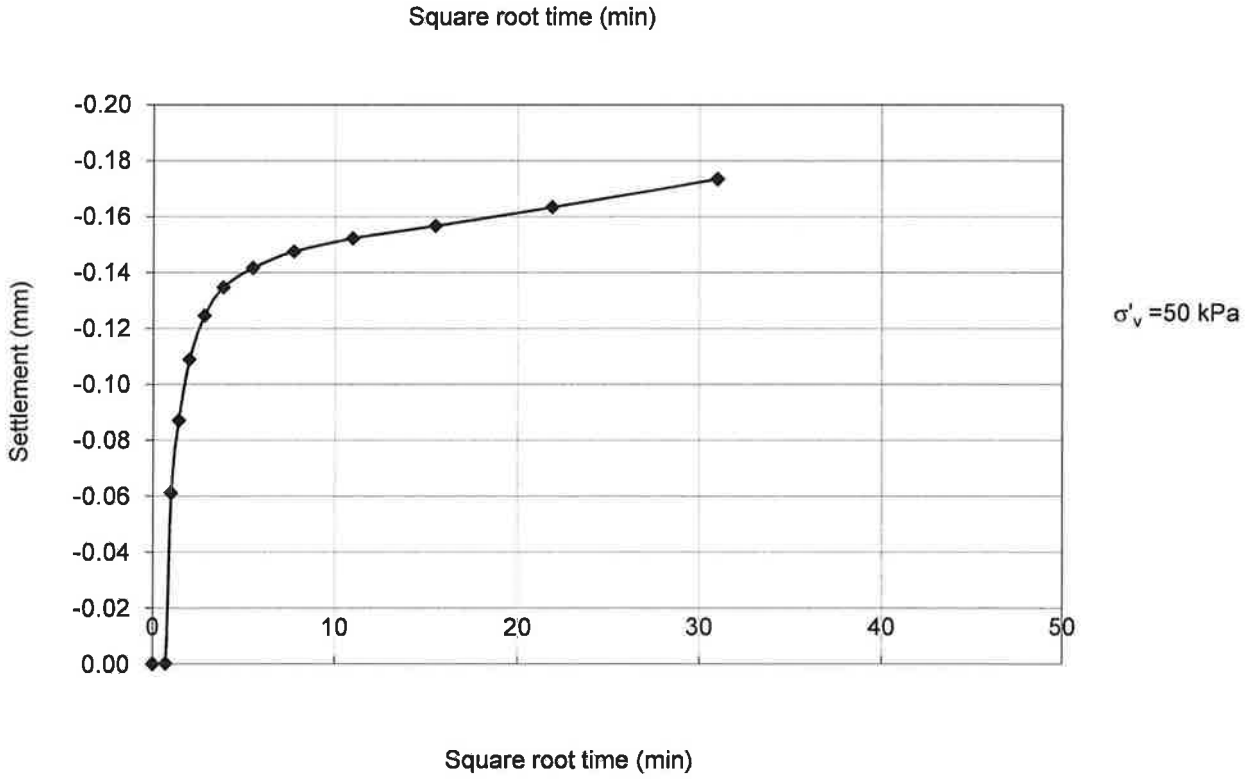
σ'_v =25 kPa



σ'_v =50 kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
Settlement (mm)
σ'v =100kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
Settlement (mm)
σ'v =200 kPa


Square root time (min)
Settlement (mm)
-0.20
-0.18
-0.16
-0.14
-0.12
-0.10
-0.08
-0.06
-0.04
-0.02
0.00
0
10
20
30
40
50
Square root time (min)
σ'v =50 kPa

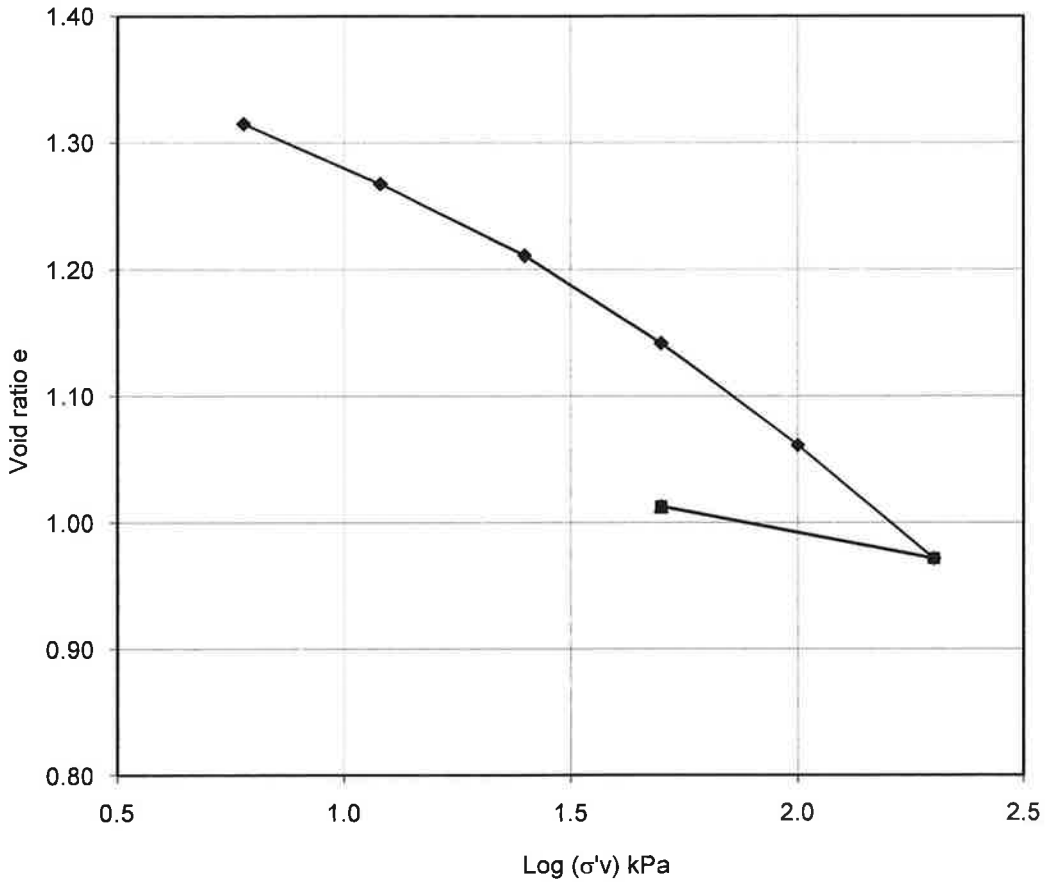
Queen's University Belfast	Geotechnical Testing Station

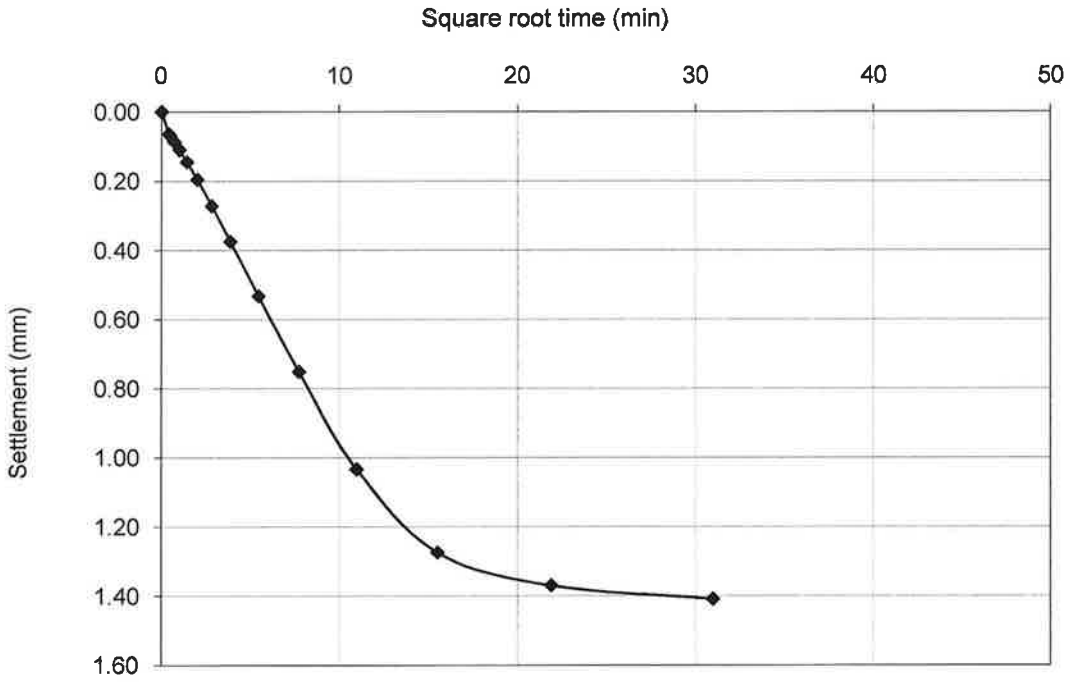
Client	**CG**
Job Ref	Galway
Date	10/04/2012
Borehole number	BH04
Sample number	
Depth m	9.0
Soil type	**Very sofy silty clay (D)**
Test	**1 D Consolidation**

Wet mass (i) g	154
Wet mass (f) g	135
Dry mass g	100
Water content (i) %	54.0
Water content (f) %	35.0
Bulk density kg/m3	1816.5
Dry density kg/m3	1179.5

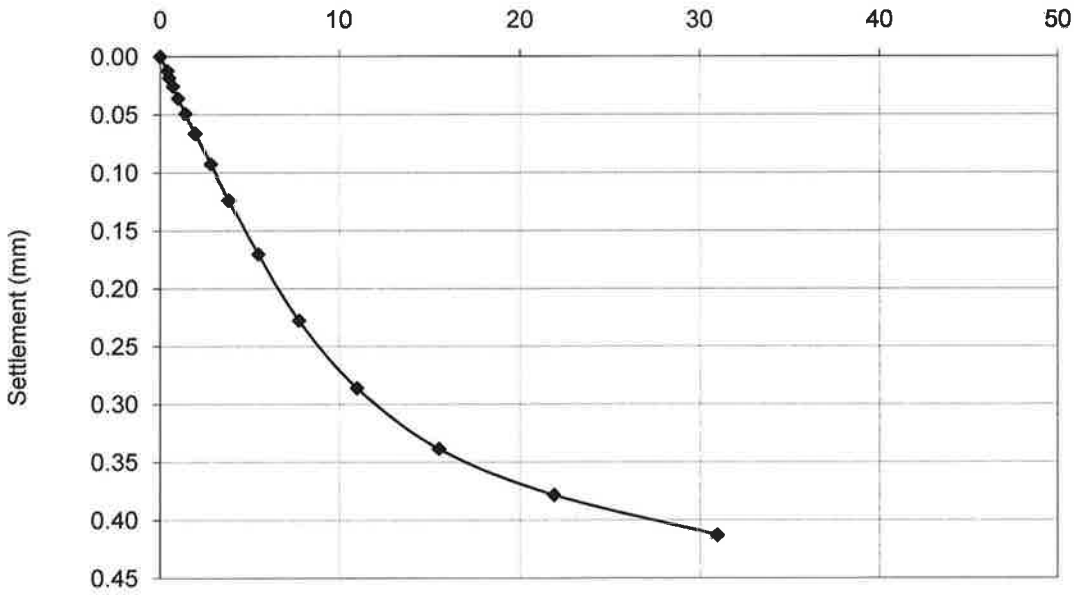
Diameter mm	75		
Initial Height mm	20	Specific gravity	2.6

σ'v kPa	ΔH mm	H mm	V cm3	Vv cm3	e	log(σ'v)	Compressibility m2/MN	Cv m2/year
6	0.000	20.000	88.313	50.577	1.315	0.78		0.20
12	0.413	19.587	86.489	48.753	1.268	1.08	3.41	0.19
25	0.494	19.093	84.308	46.573	1.211	1.40	1.92	0.24
50	0.602	18.491	81.649	43.913	1.142	1.70	1.25	0.38
100	0.702	17.789	78.548	40.812	1.061	2.00	0.75	0.44
200	0.780	17.009	75.104	37.369	0.972	2.30	0.43	0.50
50	-0.358	17.367	76.687	38.951	1.013	1.70	0.14	0.93

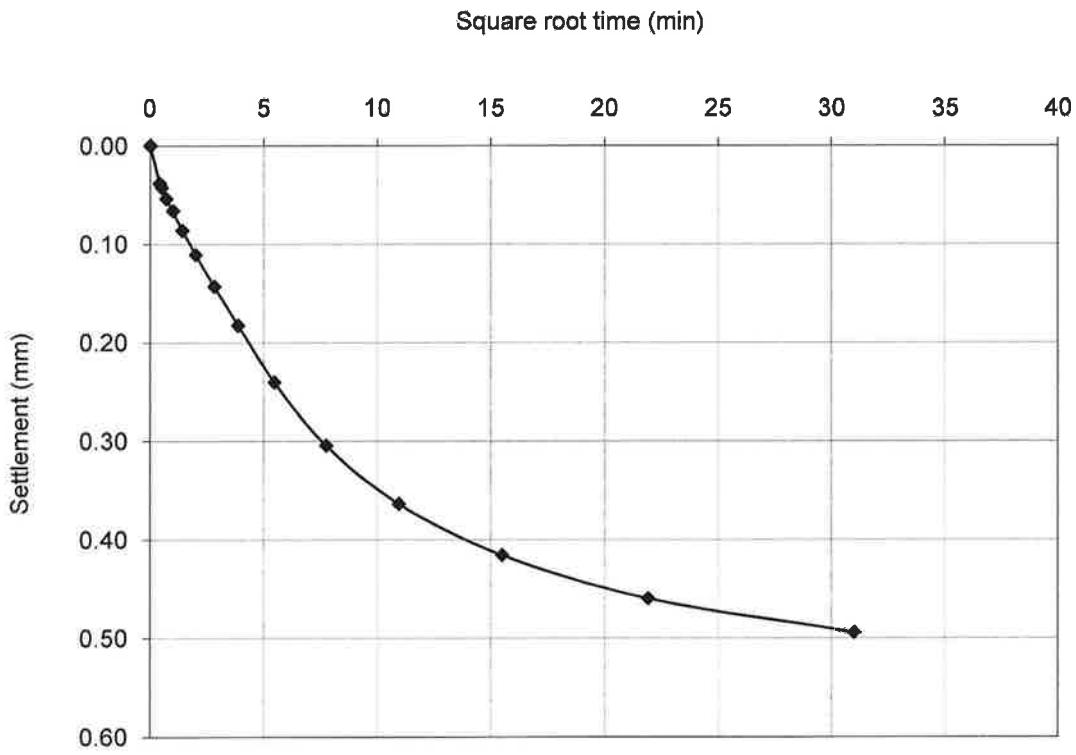




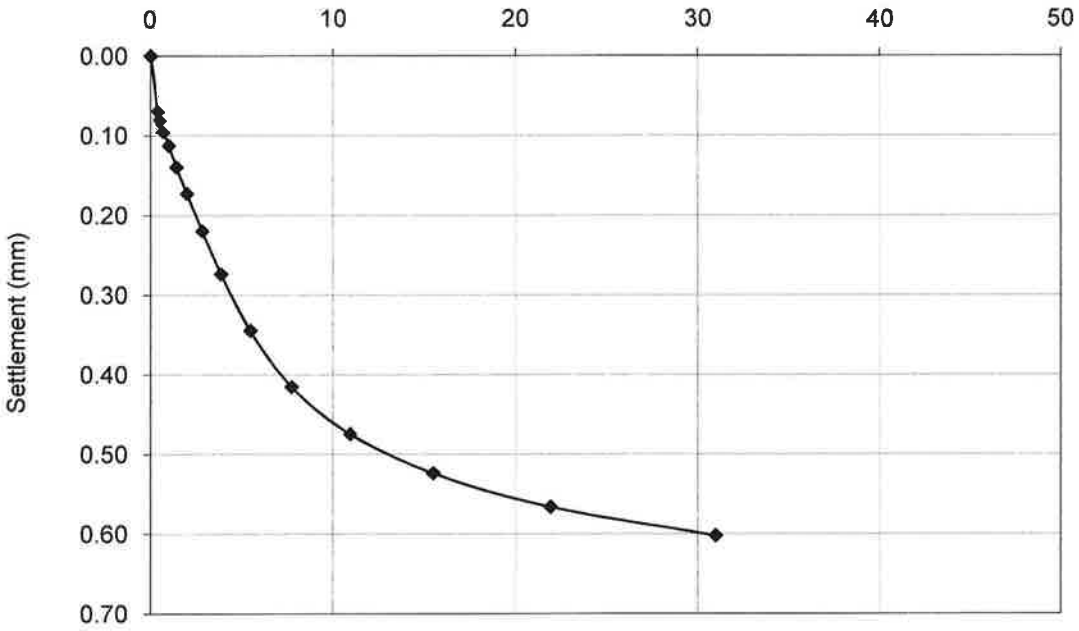
σ'_v = 6 kPa



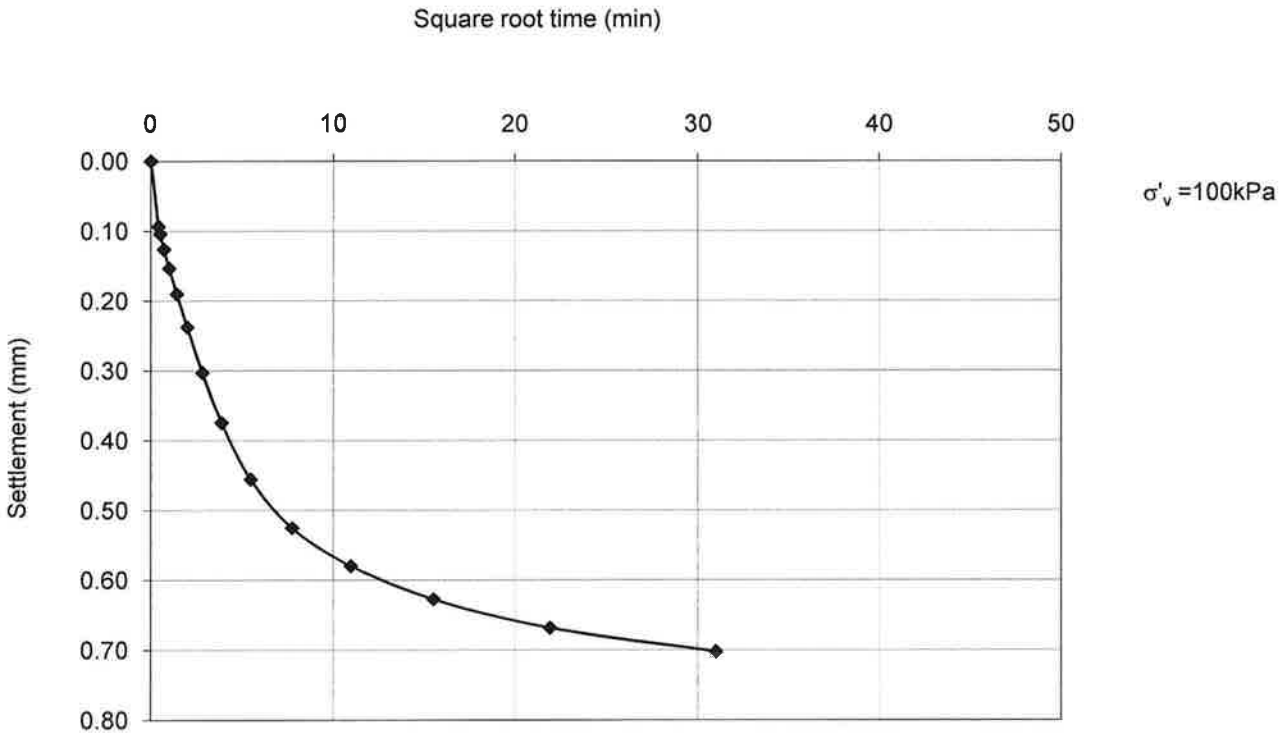
σ'_v = 12.5kPa

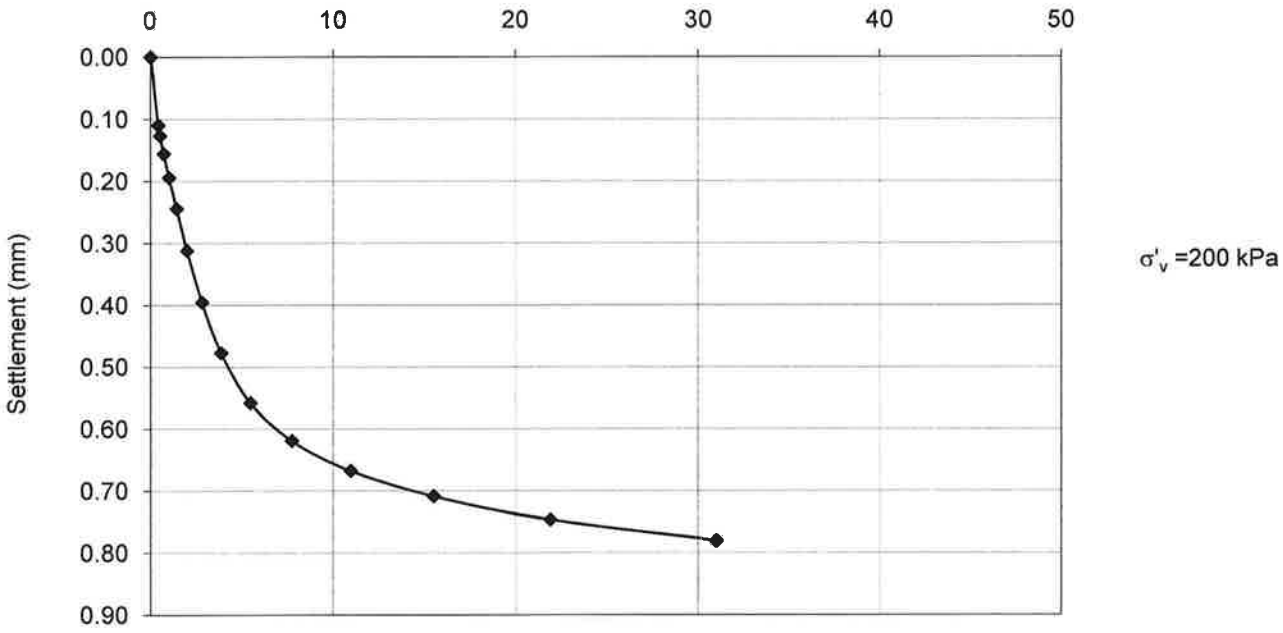


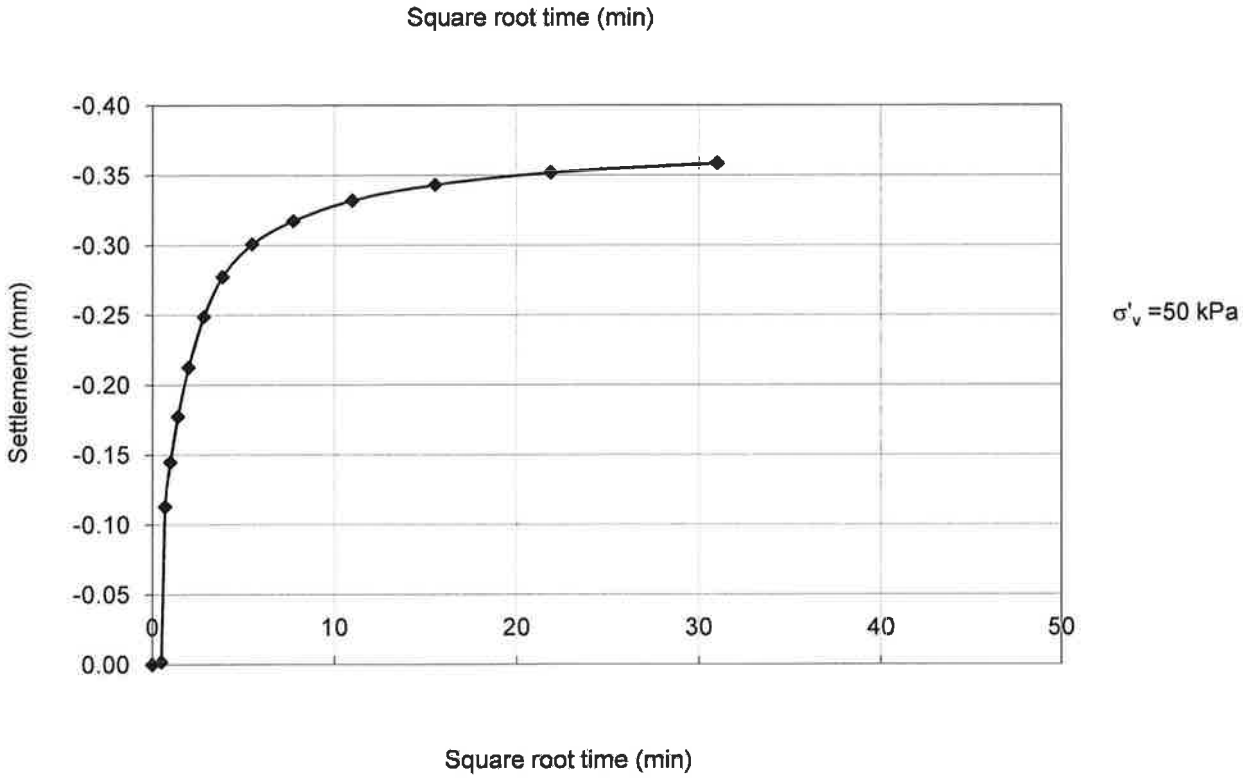
σ'_v =25 kPa



σ'_v =50 kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
Settlement (mm)
σ'v =100kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
Settlement (mm)
σ'v =200 kPa


Square root time (min)
Settlement (mm)
-0.40
-0.35
-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
0
10
20
30
40
50
Square root time (min)
σ'v =50 kPa

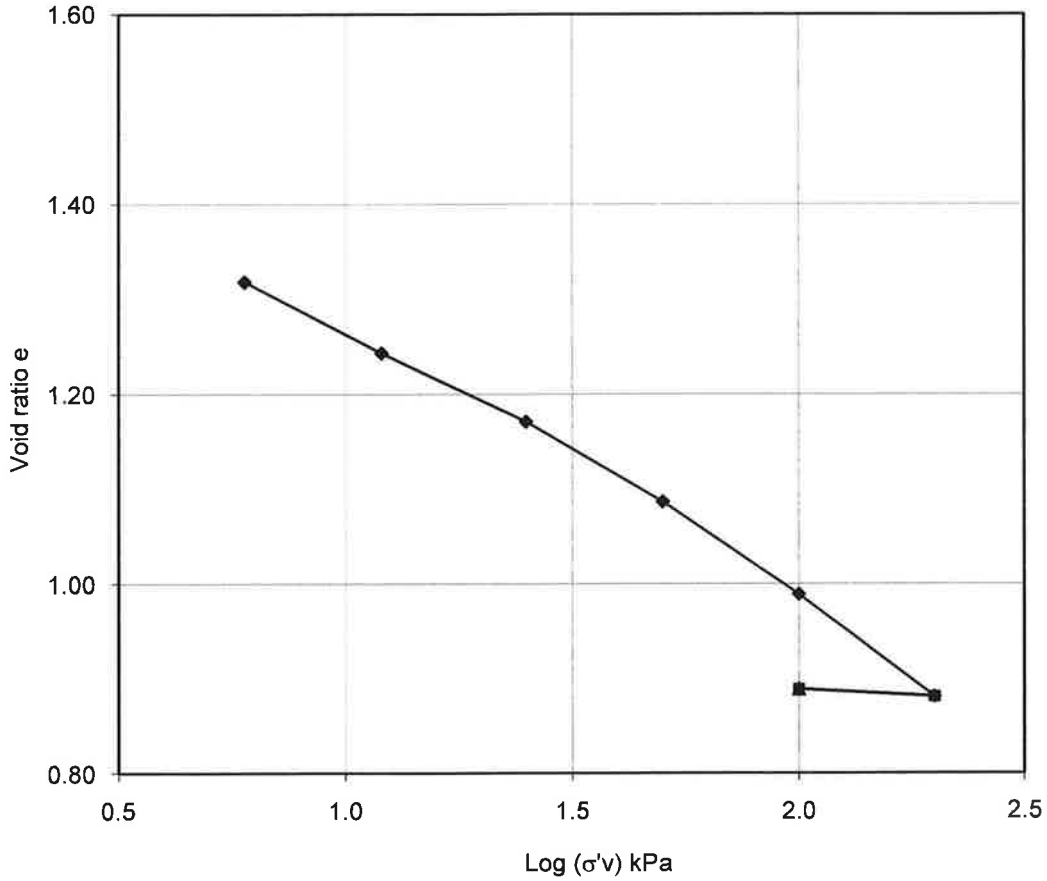
Queen's University Belfast	Geotechnical Testing Station

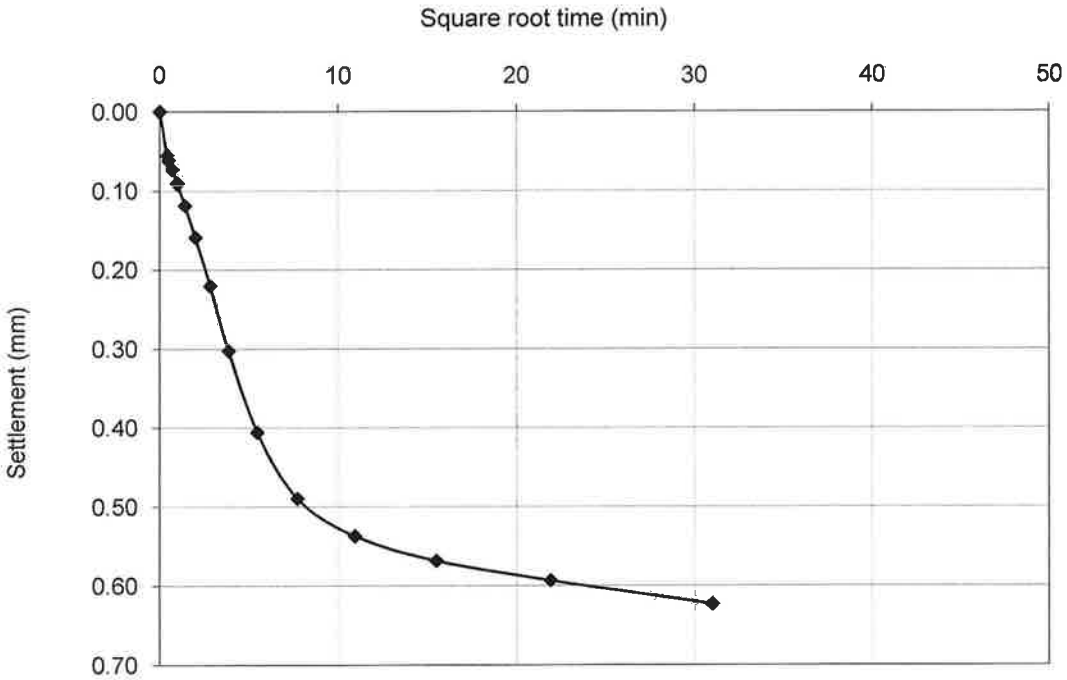
Client	CG
Job Ref	Galway
Date	10/04/2012
Borehole number	BH05
Sample number	
Depth m	3.0
Soil type	Very sofy grey clay
Test	1 D Consolidation

Wet mass (i) g	151
Wet mass (f) g	131.1
Dry mass g	97.8
Water content (i) %	54.4
Water content (f) %	34.0
Bulk density kg/m3	1709.8
Dry density kg/m3	1107.4

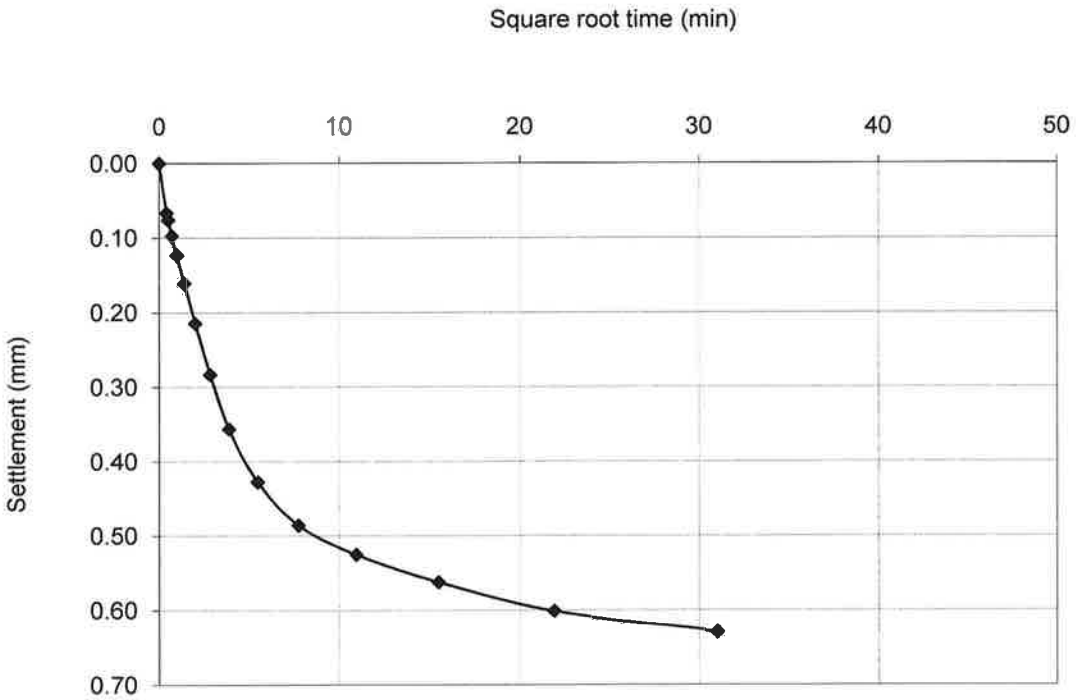
Diameter mm	75		
Initial Height mm	20	Specific gravity	2.6

σ'v kPa	ΔH mm	H mm	V cm3	Vv cm3	e	log(σ'v)	Compressibility m2/MN	Cv m2/year
6	0.623	19.377	85.560	48.655	1.318	0.78		0.42
12	0.628	18.749	82.786	45.881	1.243	1.08	5.40	0.39
25	0.603	18.146	80.124	43.219	1.171	1.40	2.47	0.37
50	0.706	17.439	77.005	40.100	1.087	1.70	1.56	0.34
100	0.816	16.623	73.402	36.496	0.989	2.00	0.94	0.38
200	0.902	15.721	69.419	32.514	0.881	2.30	0.54	0.34
100	-0.065	15.786	69.705	32.800	0.889	2.00	0.04	0.43

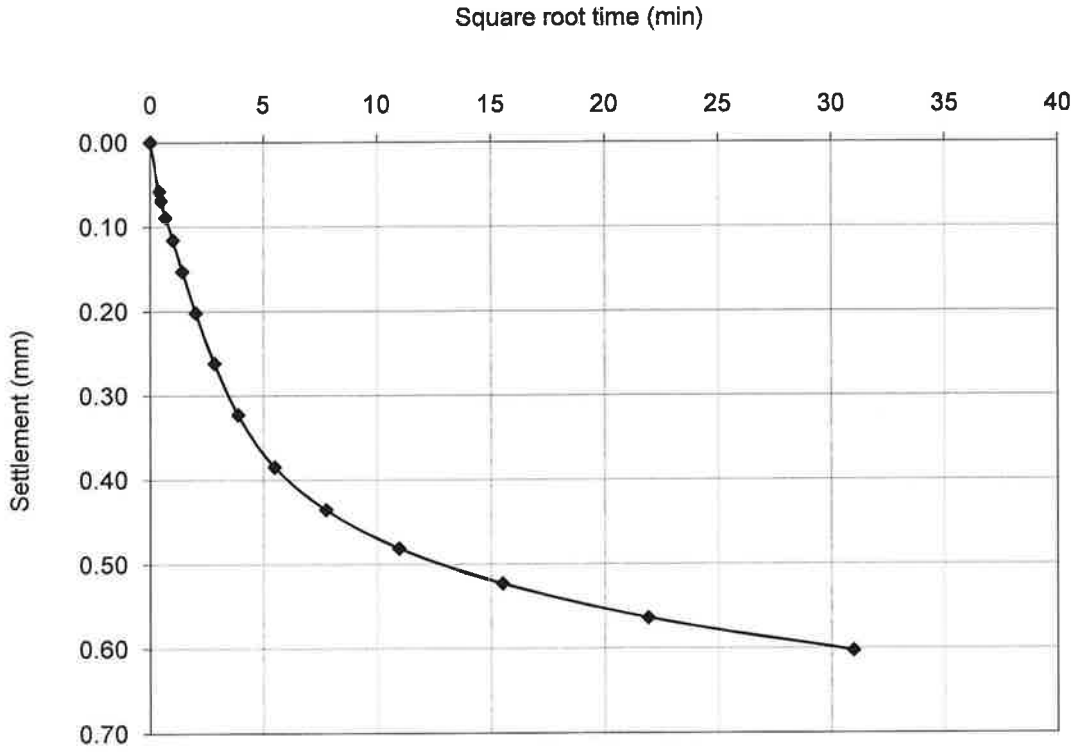




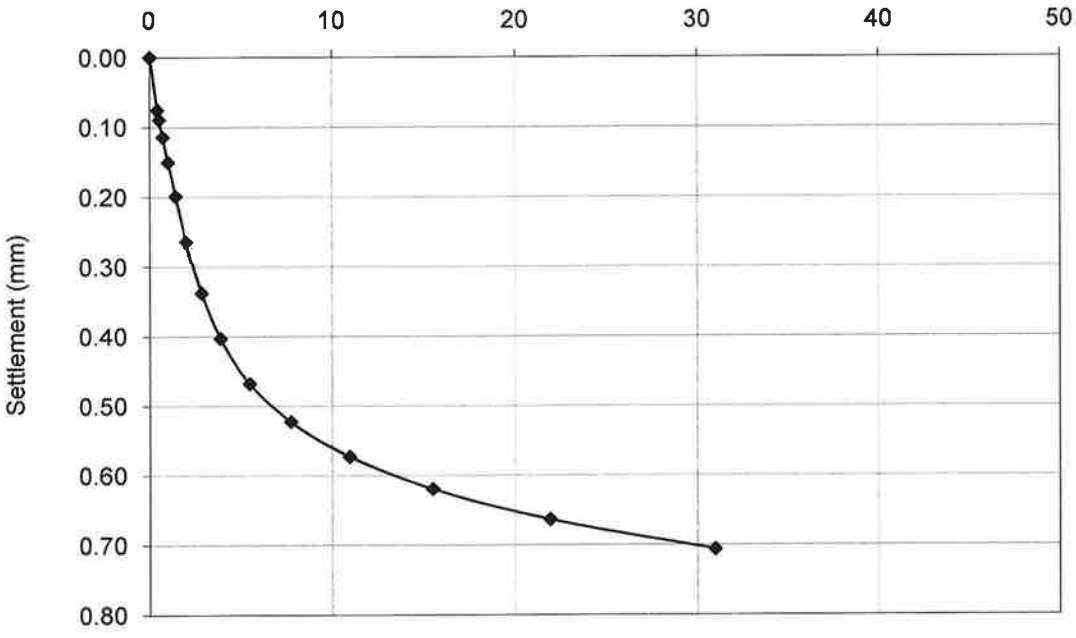
σ'_v = 6 kPa



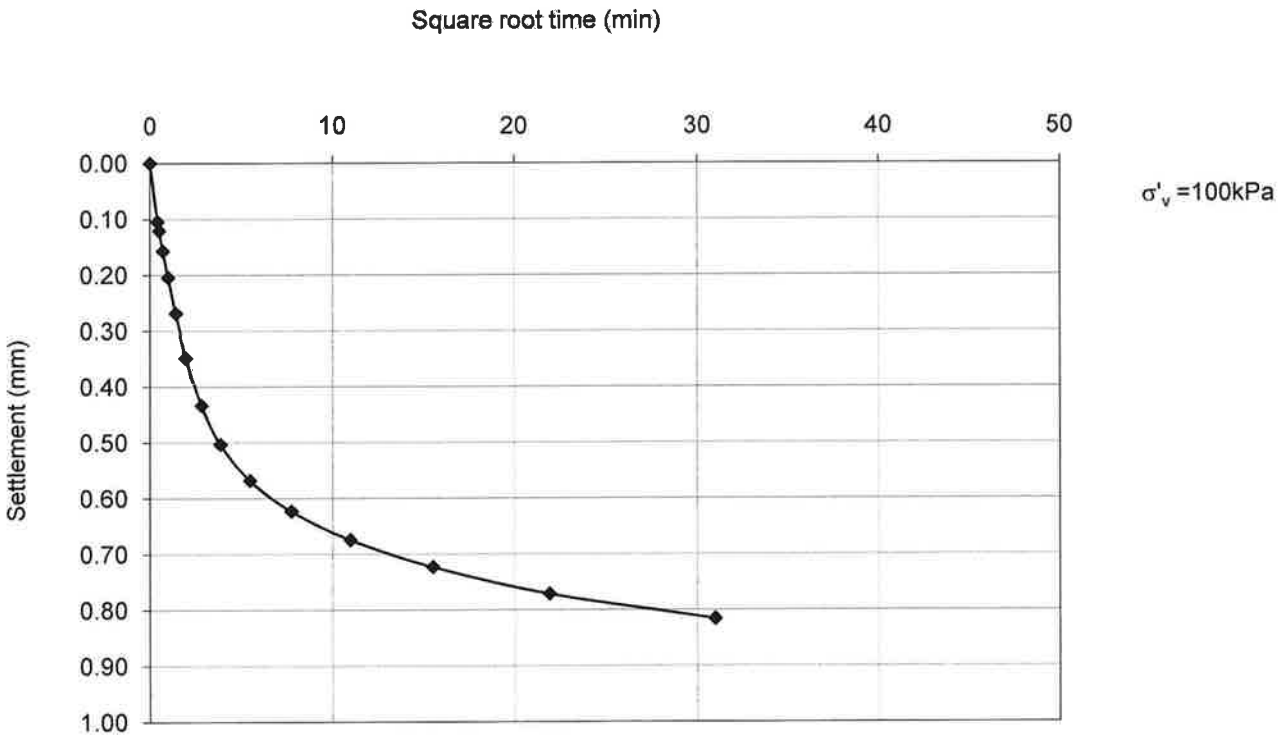
σ'_v = 12.5kPa

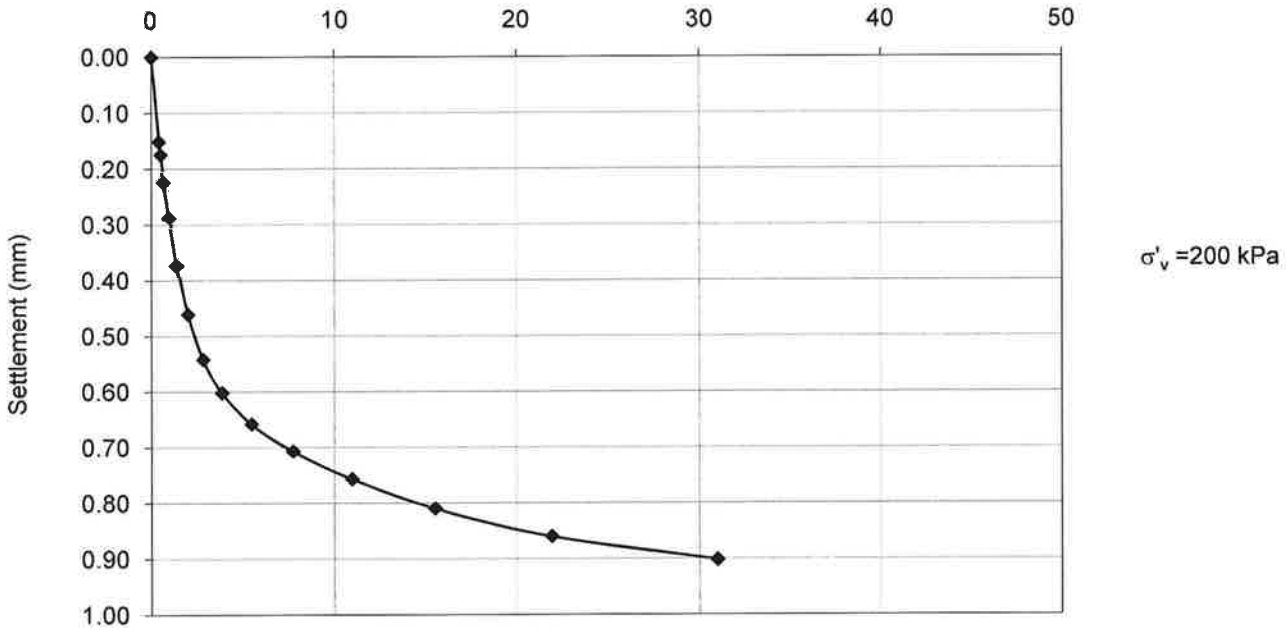


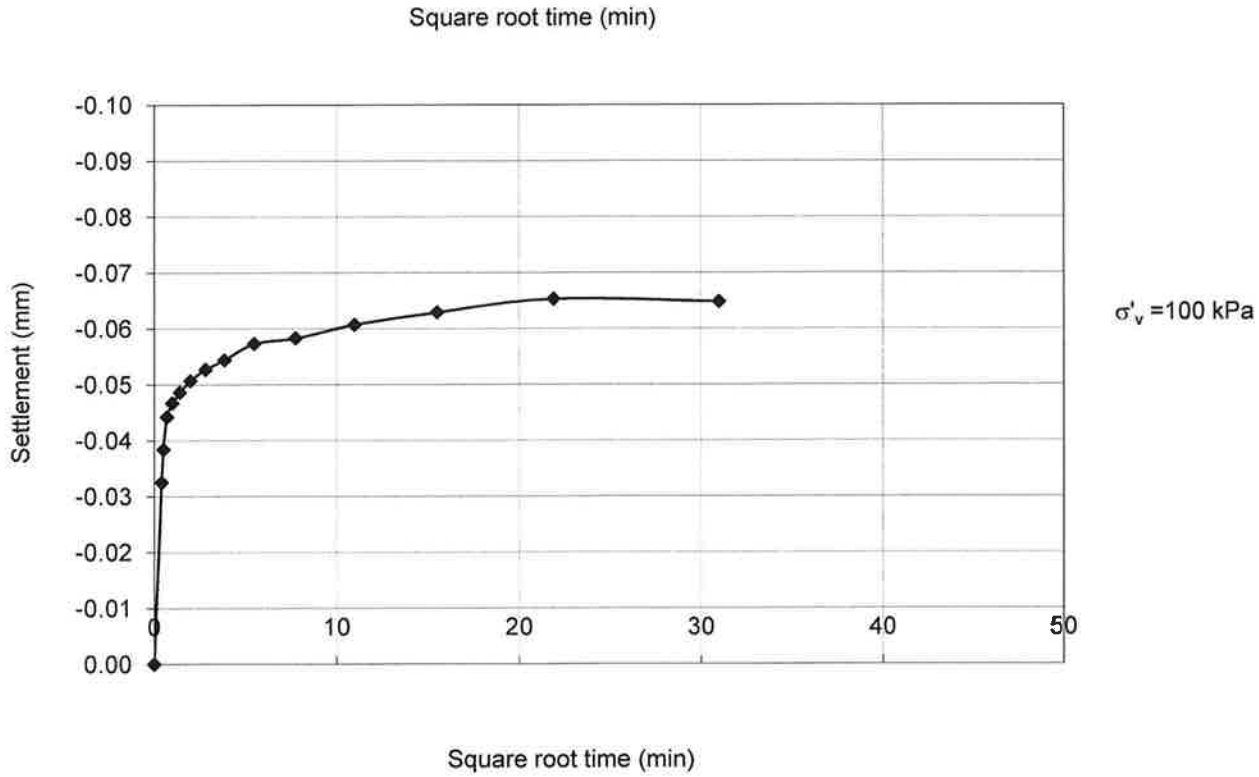
σ'_v =25 kPa



σ'_v =50 kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
Settlement (mm)
σ'v =100kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
Settlement (mm)
σ'v =200 kPa


Square root time (min)
Settlement (mm)
-0.10
-0.09
-0.08
-0.07
-0.06
-0.05
-0.04
-0.03
-0.02
-0.01
0.00
0
10
20
30
40
50
Square root time (min)
σ'v =100 kPa

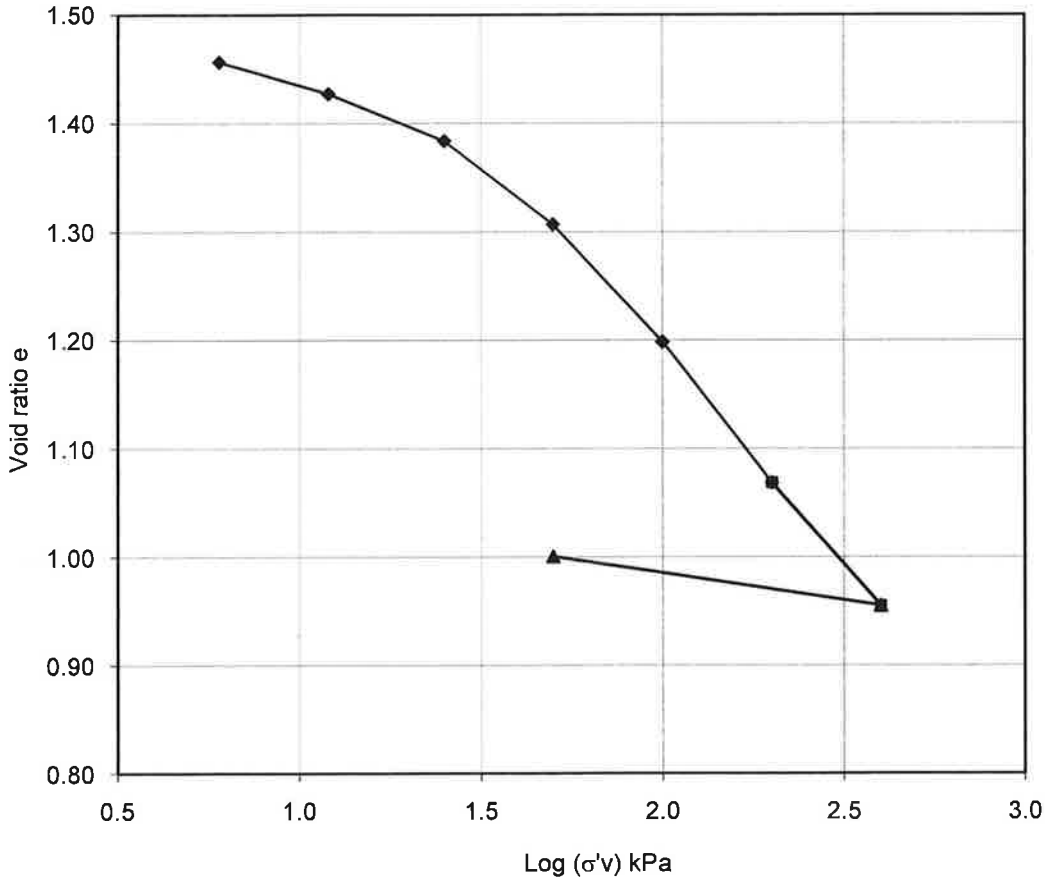
Queen's University Belfast	Geotechnical Testing Station

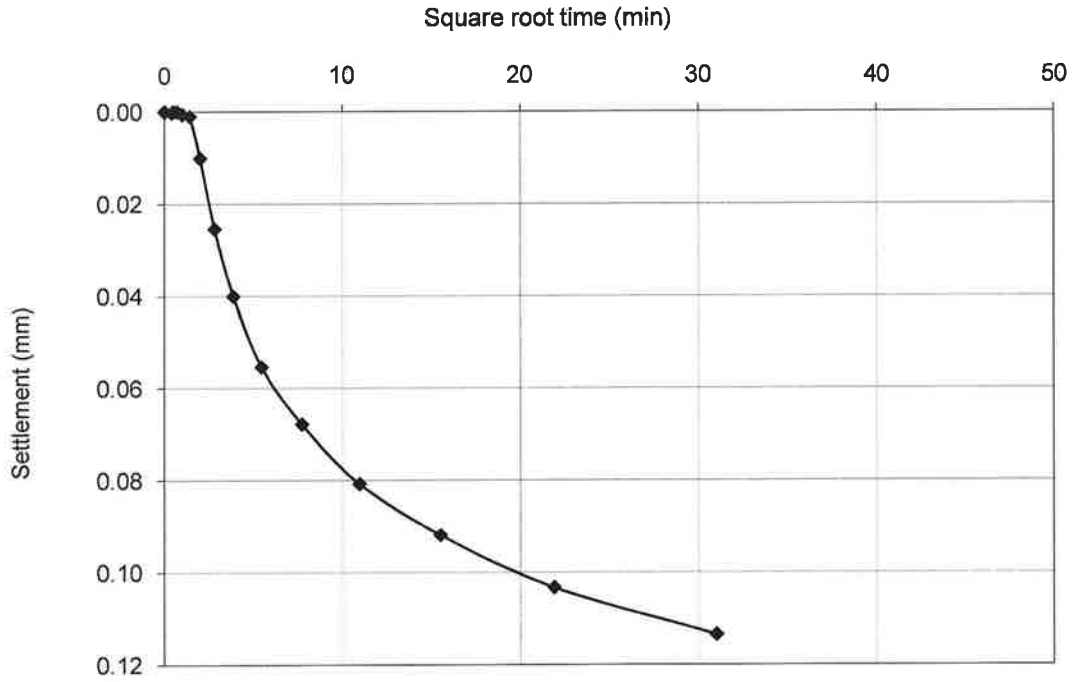
Client	CG
Job Ref	Galway
Date	10/04/2012
Borehole number	BH05
Sample number	
Depth m	6.0
Soil type	Very sofy silty clay
Test	1 D Consolidation

Wet mass (i) g	144
Wet mass (f) g	122.8
Dry mass g	89.2
Water content (i) %	61.4
Water content (f) %	37.7
Bulk density kg/m3	1698.5
Dry density kg/m3	1052.1

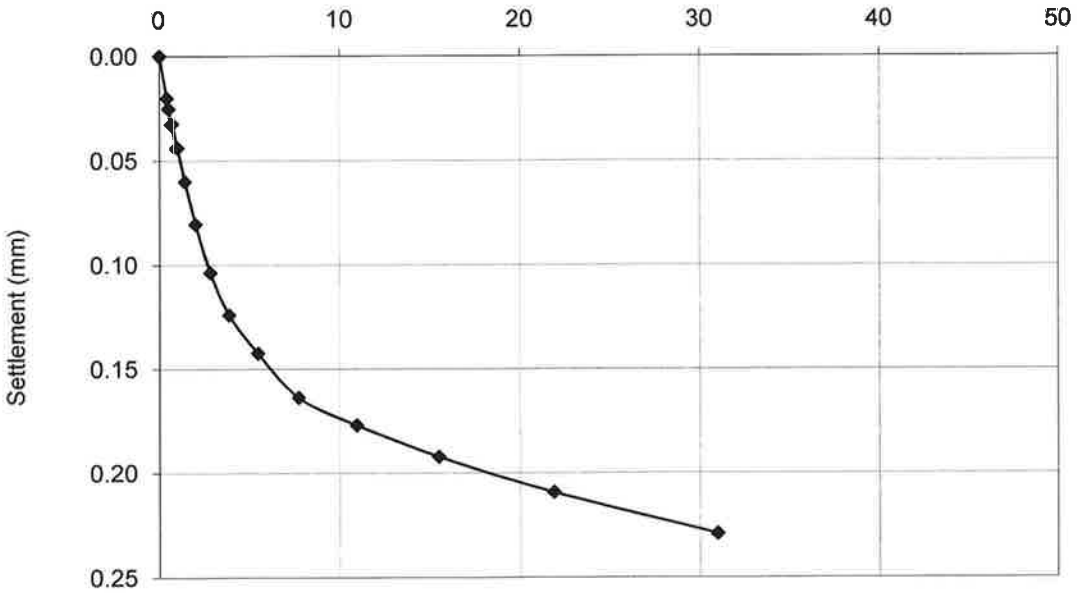
Diameter mm	75		
Initial Height mm	19.2	Specific gravity	2.6

σ'v kPa	ΔH mm	H mm	V cm3	Vv cm3	e	log(σ'v)	Compressibility m2/MN	Cv m2/year
6	0.114	19.087	84.279	49.971	1.457	0.78		0.28
12	0.229	18.857	83.267	48.960	1.427	1.08	2.00	0.40
25	0.337	18.520	81.779	47.471	1.384	1.40	1.38	0.38
50	0.598	17.923	79.139	44.831	1.307	1.70	1.29	0.36
100	0.842	17.081	75.422	41.114	1.198	2.00	0.94	0.33
200	1.009	16.072	70.967	36.659	1.069	2.30	0.59	0.36
400	0.880	15.191	67.080	32.772	0.955	2.60	0.27	0.40
50	-0.353	15.544	68.637	34.329	1.001	1.70	0.07	0.75

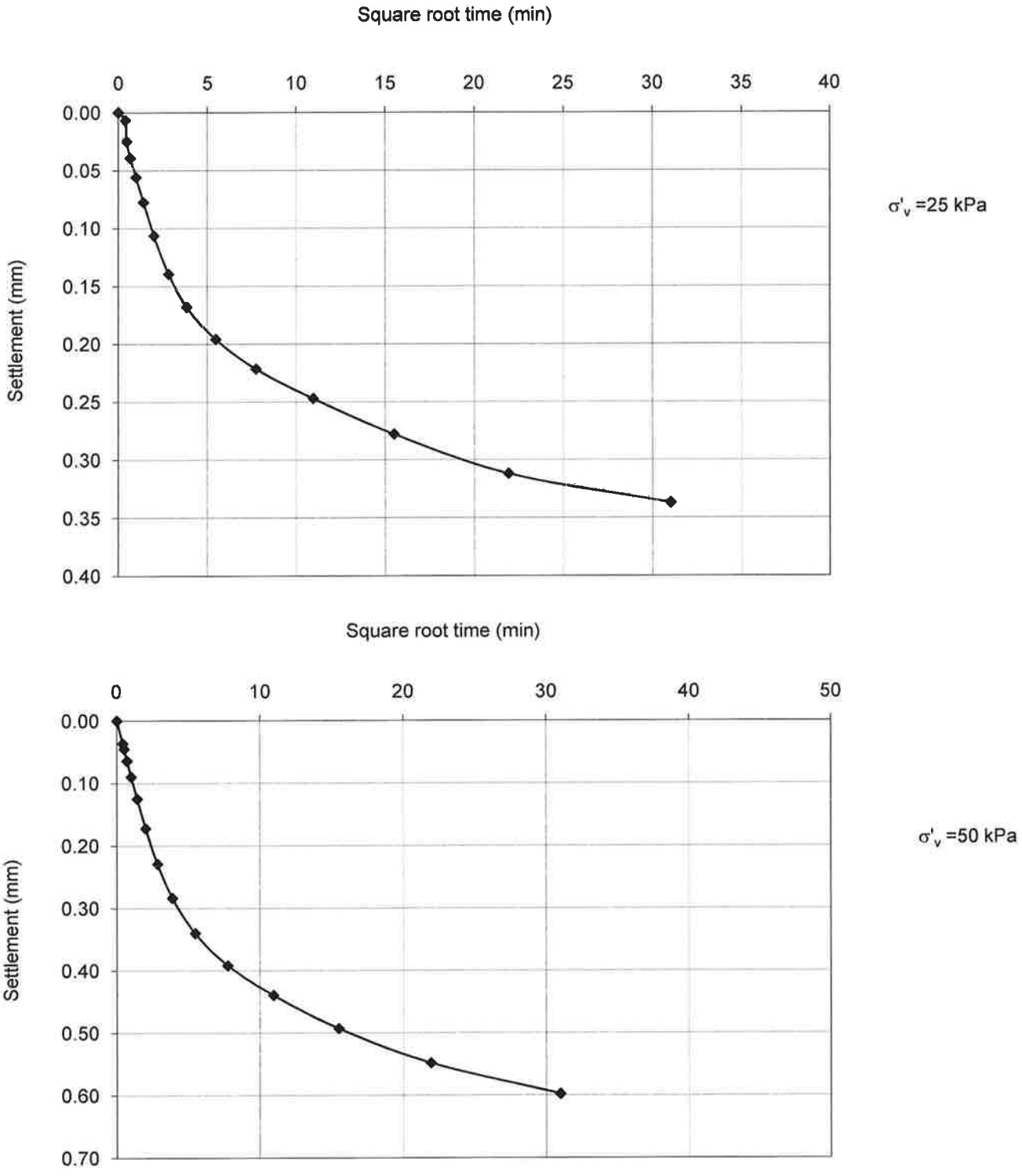


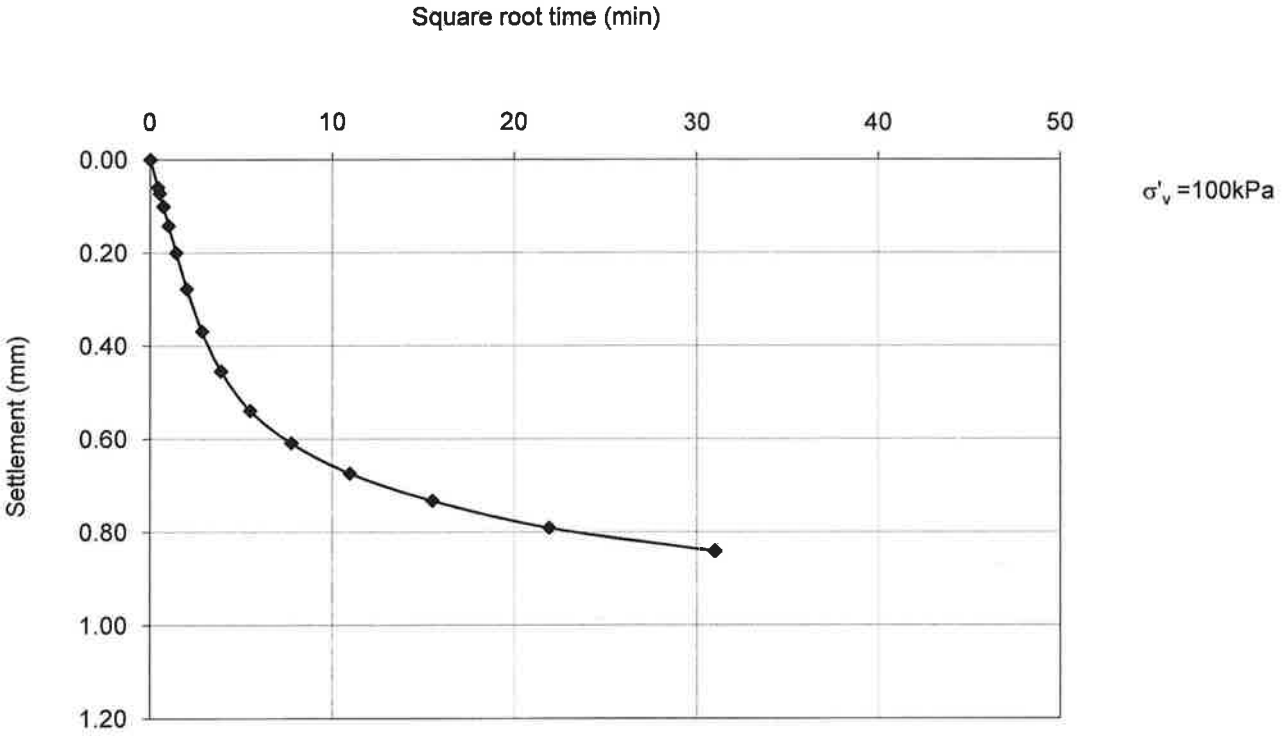


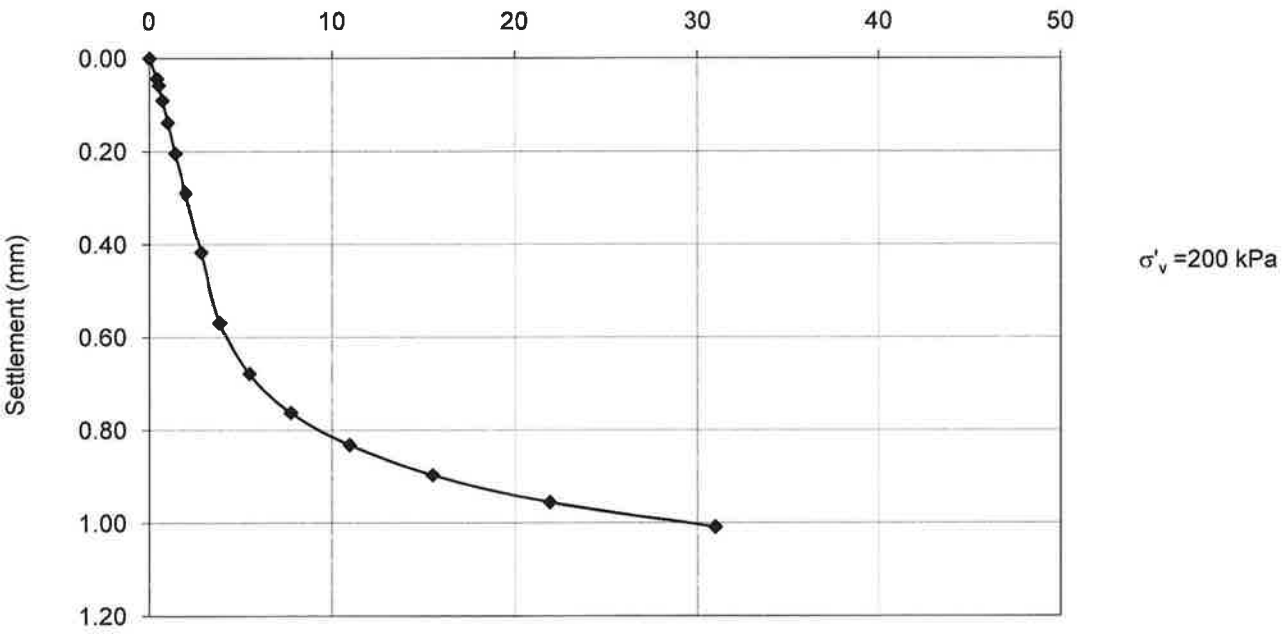
σ'_v = 6 kPa

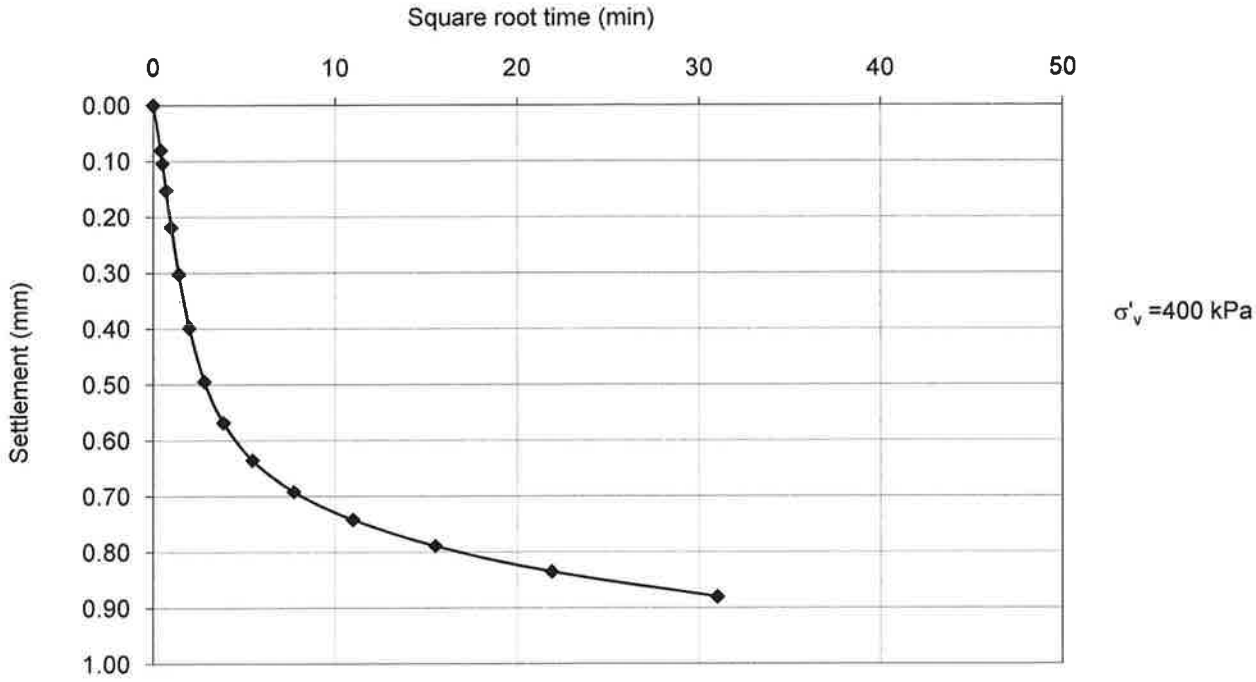


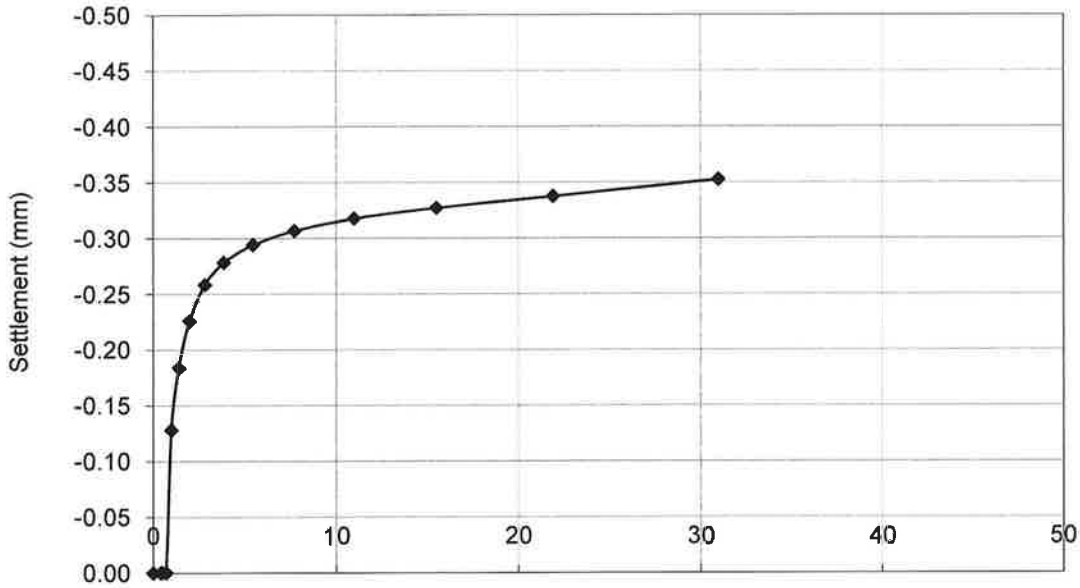
σ'_v = 12.5kPa


Square root time (min)
0
5
10
15
20
25
30
35
40
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
Settlement (mm)
σ'v =25 kPa
Square root time (min)
0
10
20
30
40
50
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
Settlement (mm)
σ'v =50 kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.20
0.40
0.60
0.80
1.00
1.20
Settlement (mm)
σ'v =100kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.20
0.40
0.60
0.80
1.00
1.20
Settlement (mm)
σ'v =200 kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
Settlement (mm)
σ'v =400 kPa


Square root time (min)
-0.50
-0.45
-0.40
-0.35
-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
0
10
20
30
40
50
Settlement (mm)

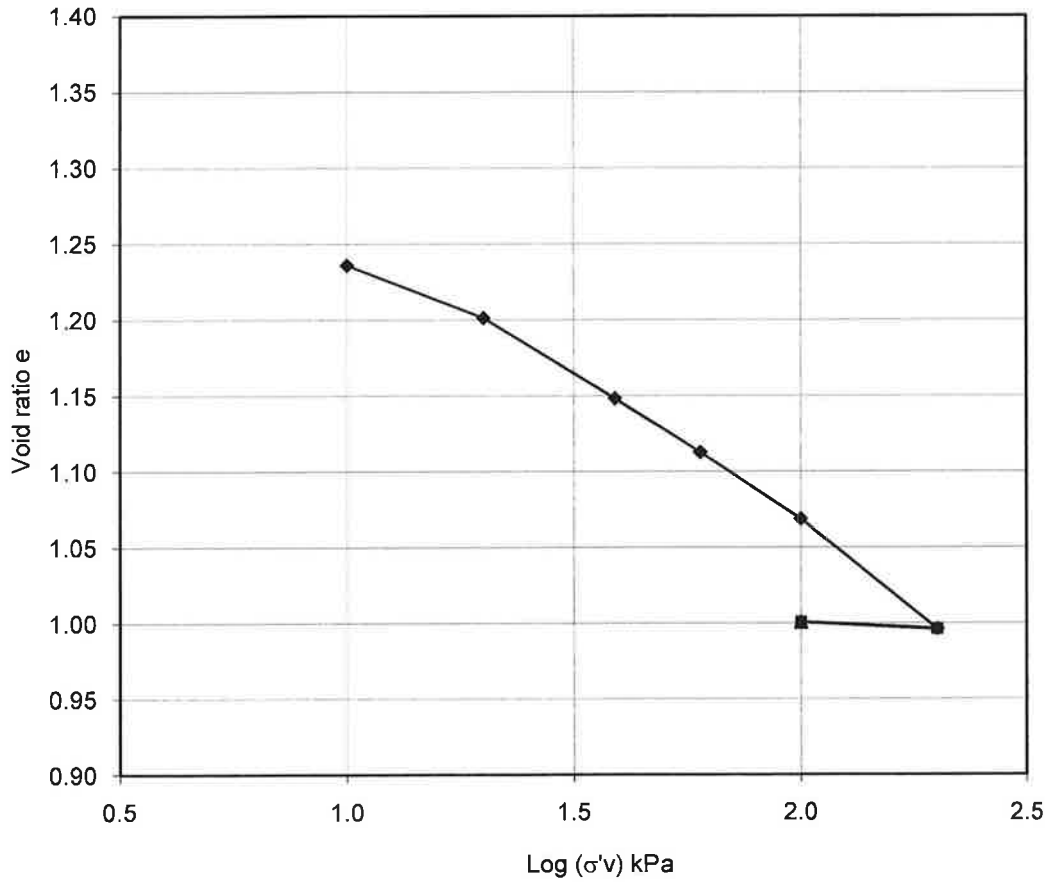
Queen's University Belfast	Geotechnical Testing Station

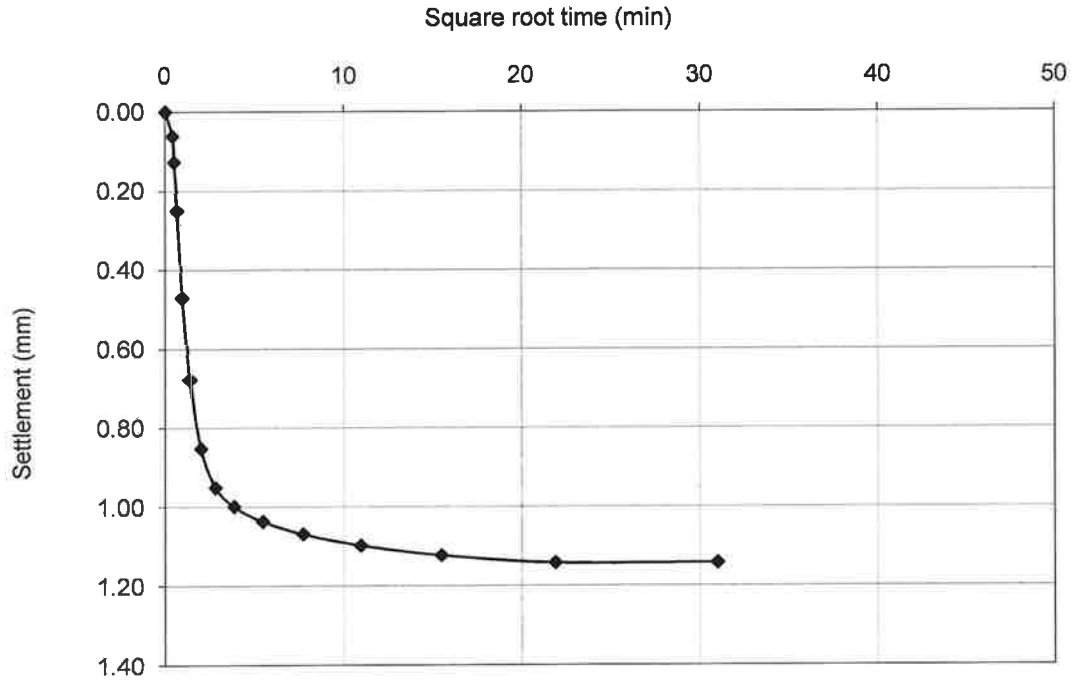
Client	CG
Job Ref	Galway
Date	10/04/2012
Borehole number	BH06
Sample number	
Depth m	1.0
Soil type	Soft Silty clay (D)
Test	1 D Consolidation

Wet mass (i) g	65
Wet mass (f) g	58.3
Dry mass g	42
Water content (i) %	54.8
Water content (f) %	38.8
Bulk density kg/m3	1725.1
Dry density kg/m3	1114.6

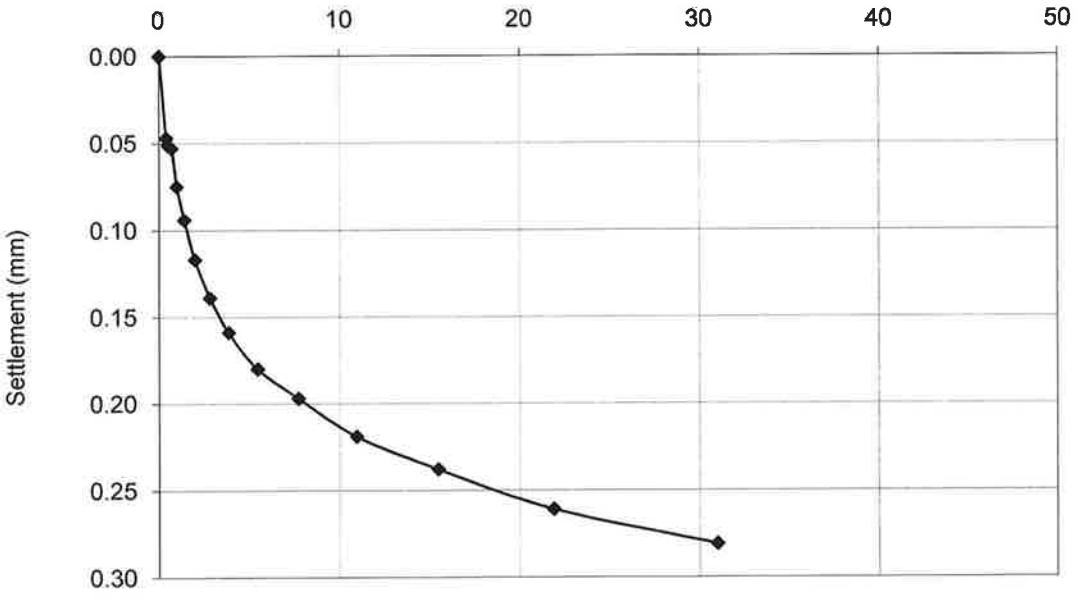
Diameter mm	50		
Initial Height mm	19.2	Specific gravity	2.65

σ'v kPa	ΔH mm	H mm	V cm3	Vv cm3	e	log(σ'v)	Compressibility m2/MN	Cv m2/year
10	1.142	18.058	35.439	19.590	1.236	1.00		1.45
20	0.281	17.777	34.887	19.038	1.201	1.30	1.56	0.35
39	0.428	17.349	34.047	18.198	1.148	1.59	1.27	0.34
60	0.287	17.062	33.484	17.635	1.113	1.78	0.79	0.27
100	0.354	16.708	32.789	16.940	1.069	2.00	0.52	0.31
200	0.587	16.121	31.637	15.788	0.996	2.30	0.35	0.29
100	-0.037	16.158	31.710	15.861	1.001	2.00	0.02	0.81

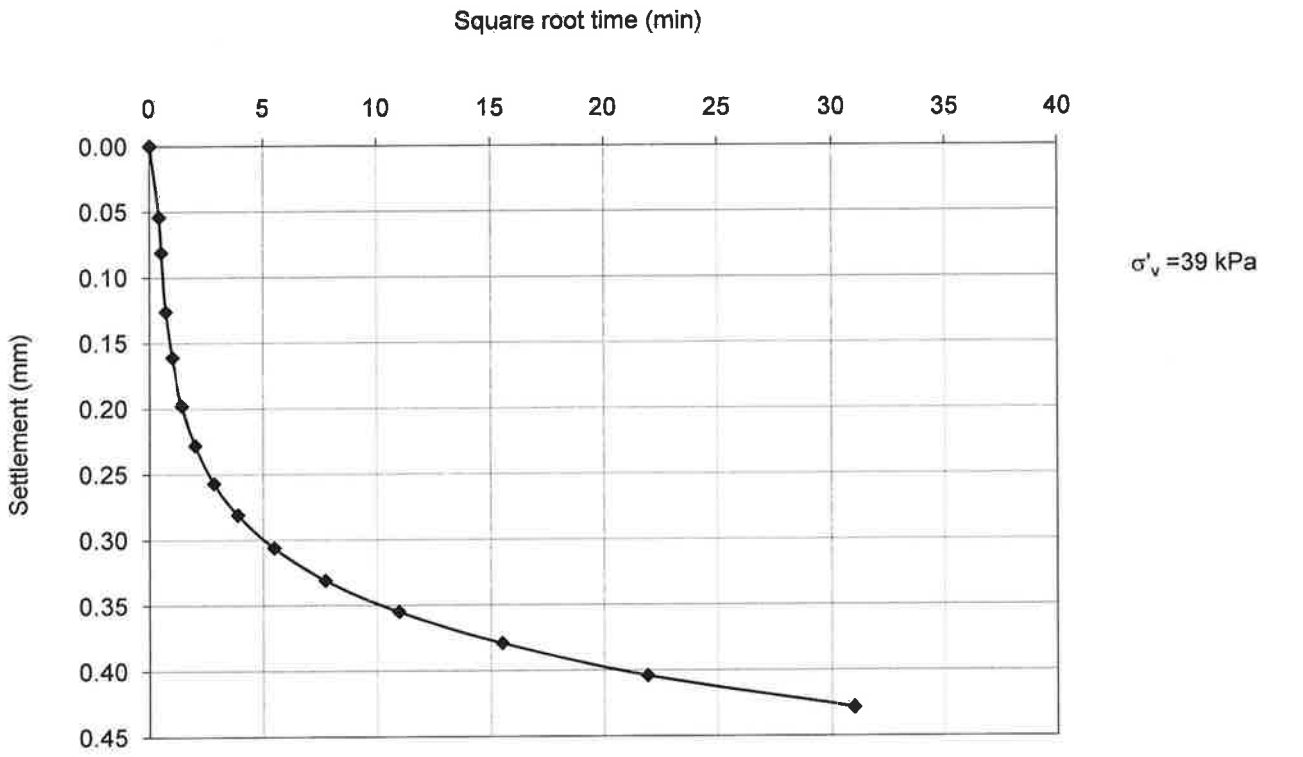




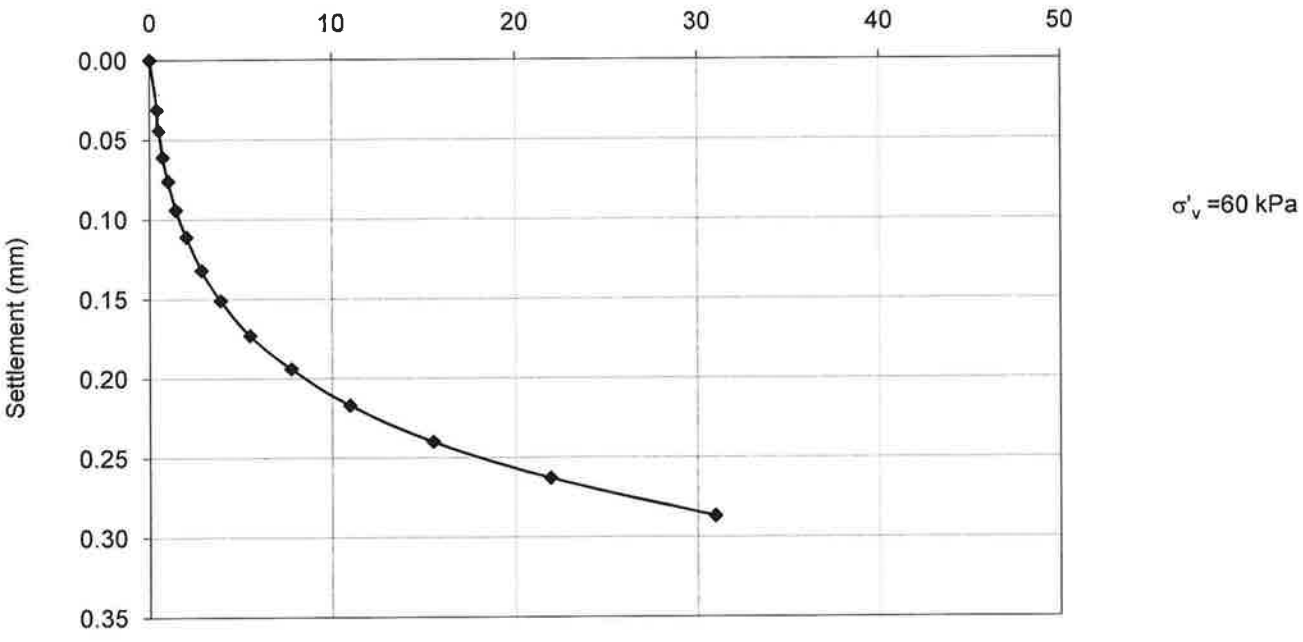
σ'_v = 10 kPa



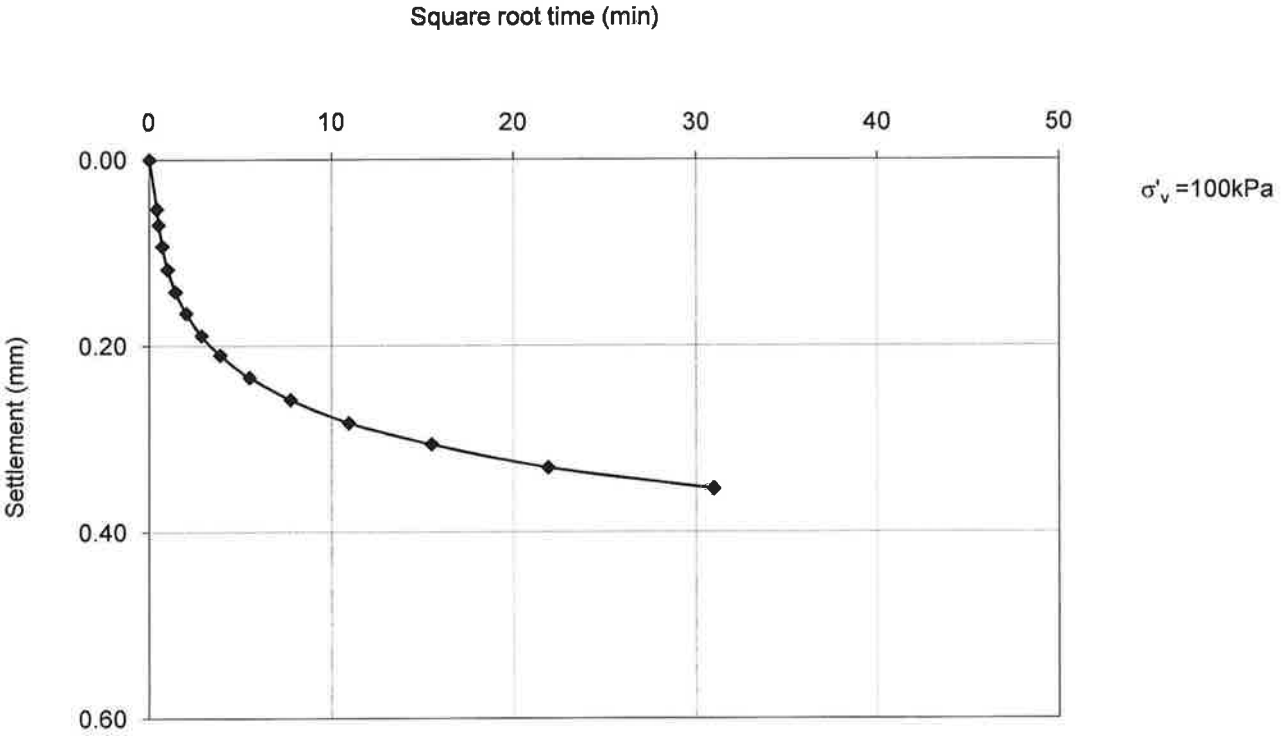
σ'_v = 20kPa

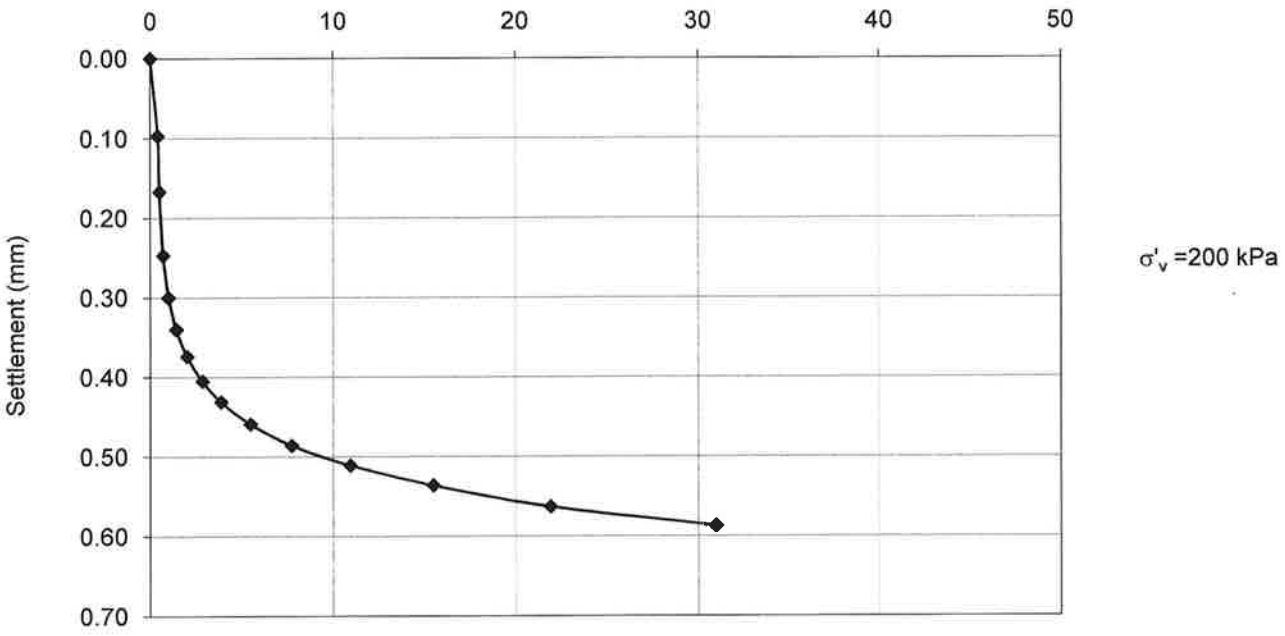


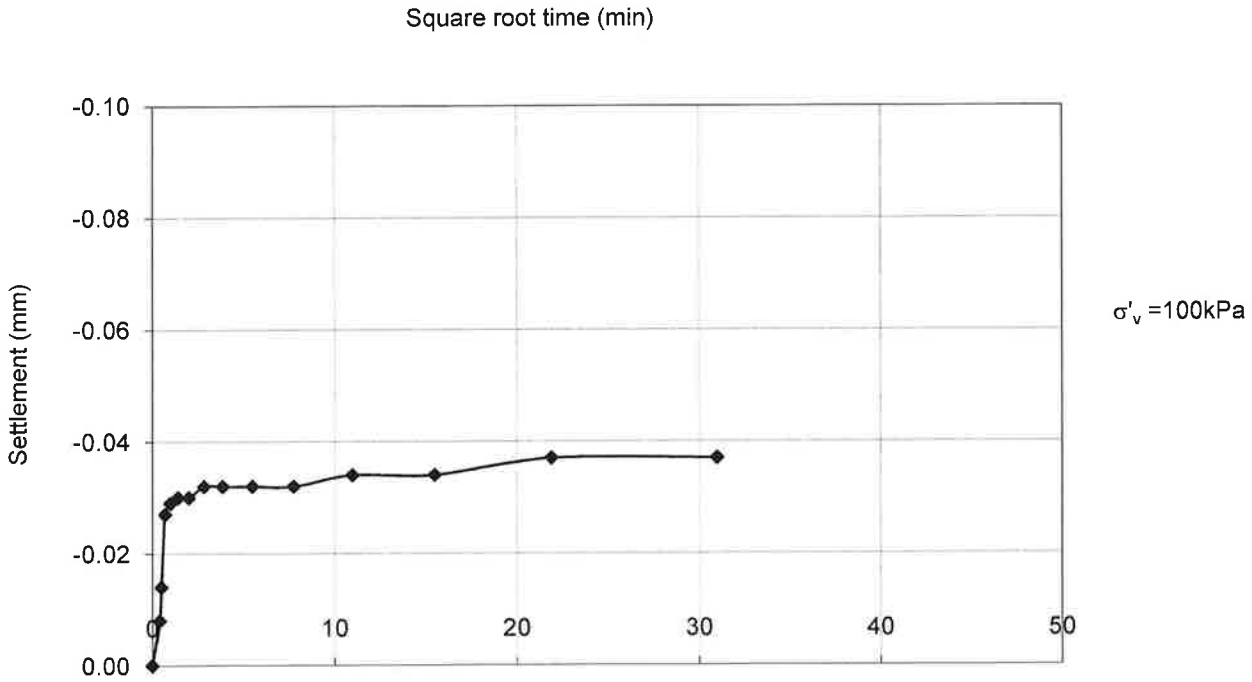
σ'_v =39 kPa



σ'_v =60 kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.20
0.40
0.60
Settlement (mm)
σ'v =100kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
Settlement (mm)
σ'v =200 kPa


Square root time (min)
Settlement (mm)
-0.10
-0.08
-0.06
-0.04
-0.02
0.00
0
10
20
30
40
50
σ'v =100kPa

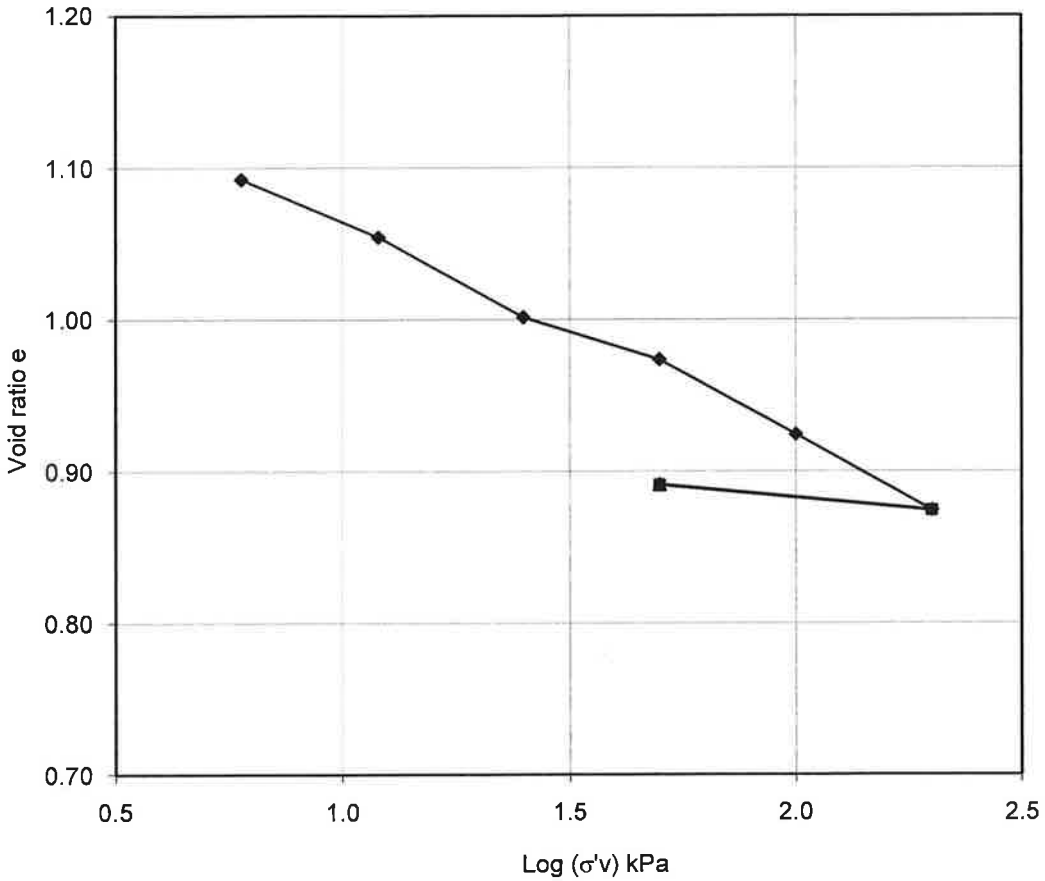
Queen's University Belfast	Geotechnical Testing Station

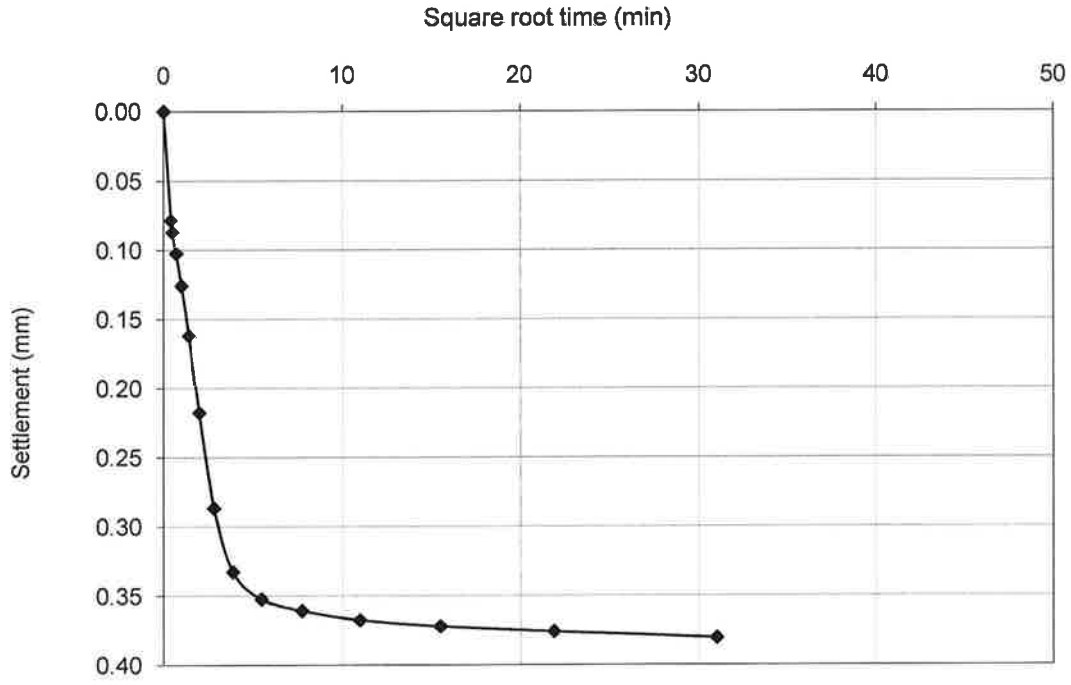
Client	CG
Job Ref	Galway
Date	10/04/2012
Borehole number	BH06
Sample number	
Depth m	3.0
Soil type	Very sofy silty clay (D)
Test	1 D Consolidation

Wet mass (i) g	151.4
Wet mass (f) g	139
Dry mass g	104.2
Water content (i) %	45.3
Water content (f) %	33.4
Bulk density kg/m3	1785.8
Dry density kg/m3	1229.1

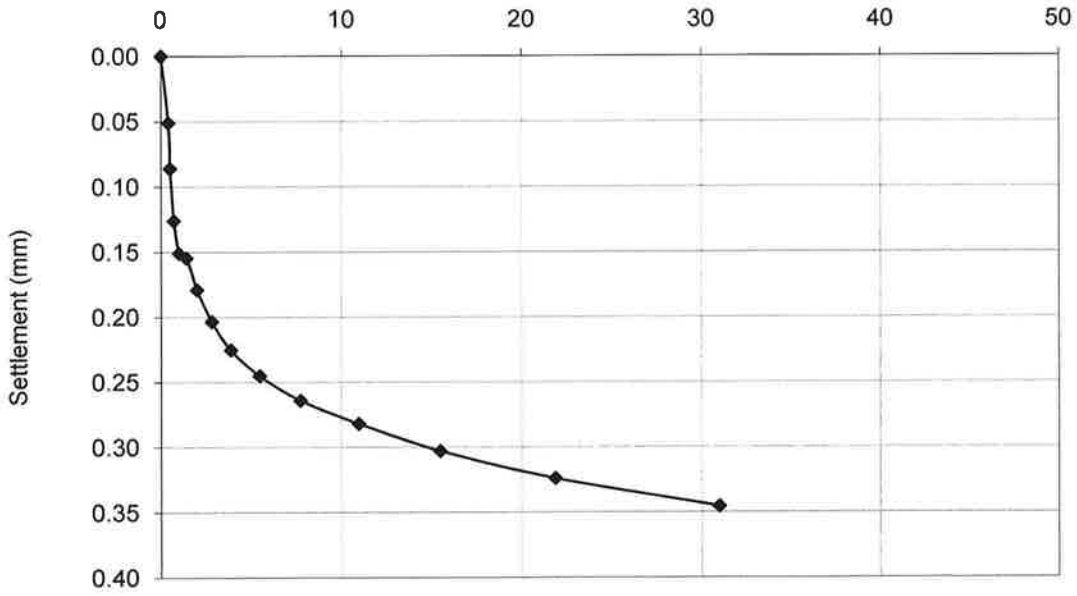
Diameter mm	75		
Initial Height mm	19.2	Specific gravity	2.6

σ'v kPa	ΔH mm	H mm	V cm3	Vv cm3	e	log(σ'v)	Compressibility m2/MN	Cv m2/year
6	0.381	18.820	83.100	43.779	1.092	0.78		1.58
12	0.346	18.474	81.574	42.254	1.054	1.08	3.03	0.59
25	0.478	17.996	79.462	40.141	1.002	1.40	1.97	0.74
50	0.255	17.741	78.338	39.017	0.974	1.70	0.56	0.35
100	0.447	17.294	76.364	37.043	0.924	2.00	0.50	0.52
200	0.453	16.841	74.362	35.041	0.874	2.30	0.26	0.64
50	-0.153	16.994	75.040	35.719	0.891	1.70	0.06	2.01

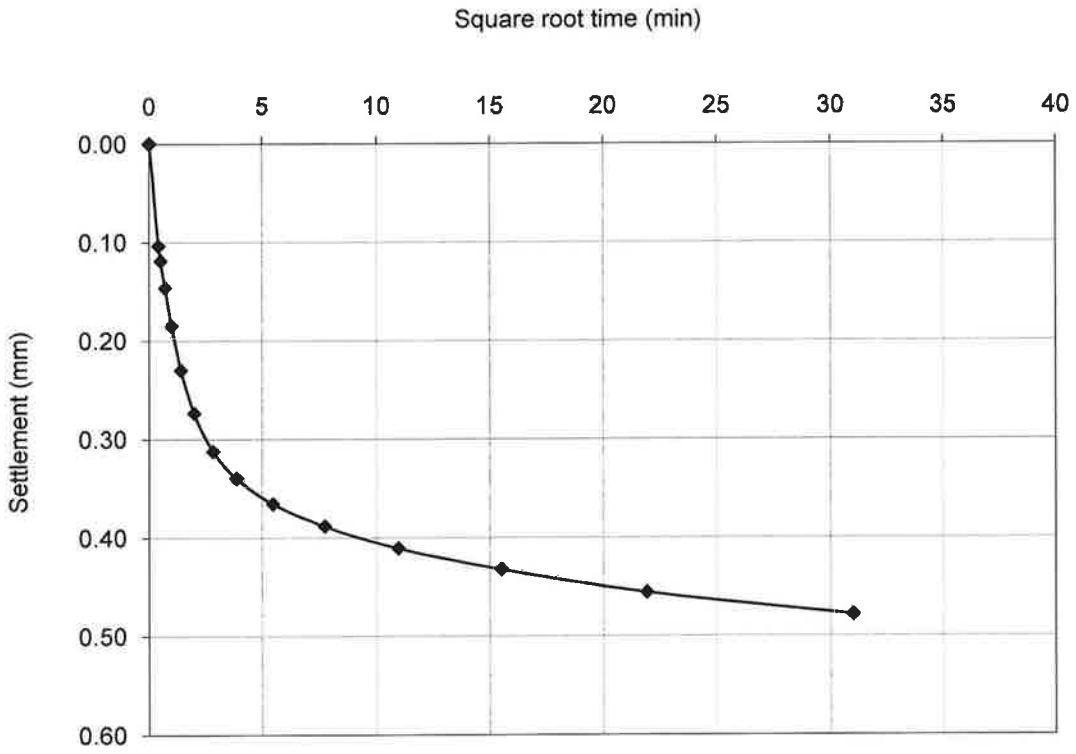




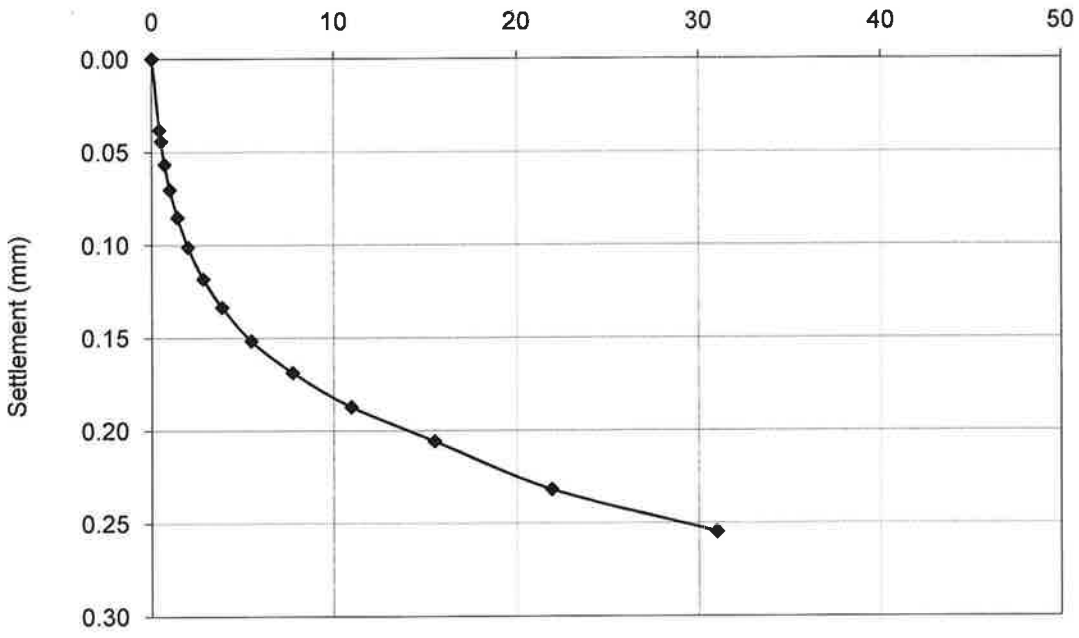
σ'_v = 6 kPa



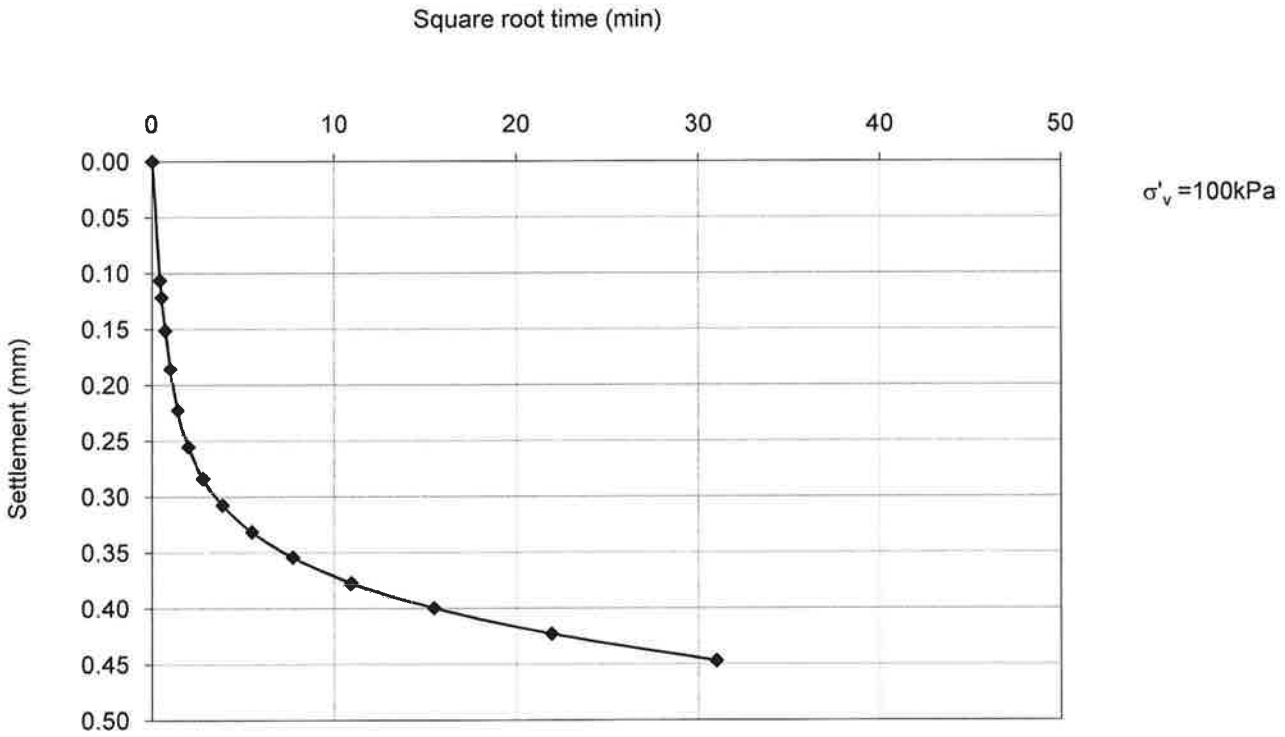
σ'_v = 12.5kPa

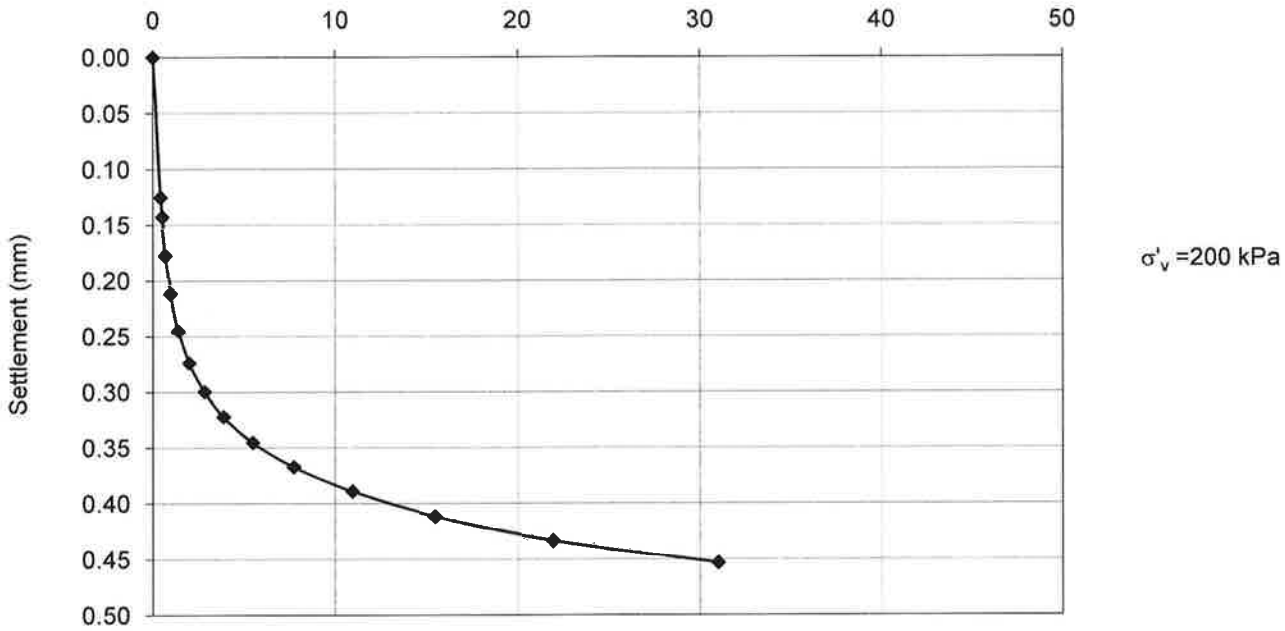


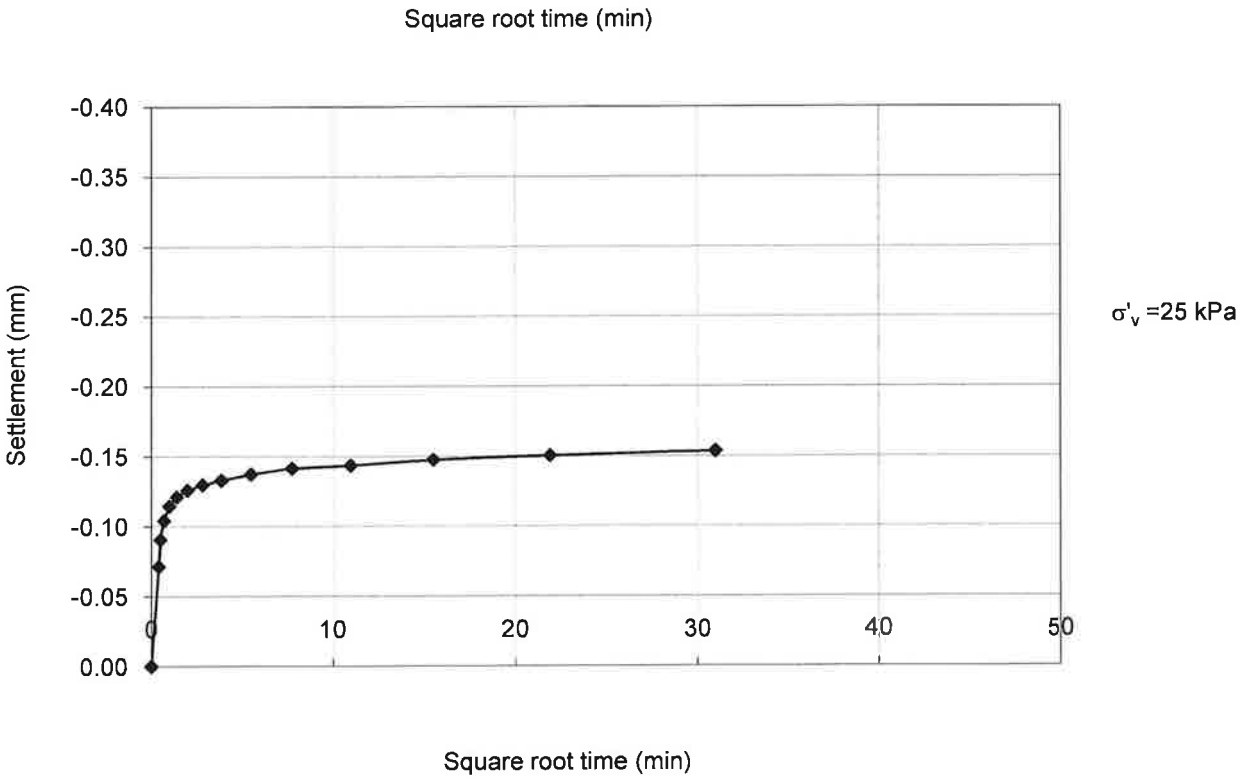
σ'_v =25 kPa



σ'_v =50 kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
Settlement (mm)
σ'v =100kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
Settlement (mm)
σ'v =200 kPa


Square root time (min)
Settlement (mm)
-0.40
-0.35
-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
0
10
20
30
40
50
Square root time (min)
σ'v =25 kPa

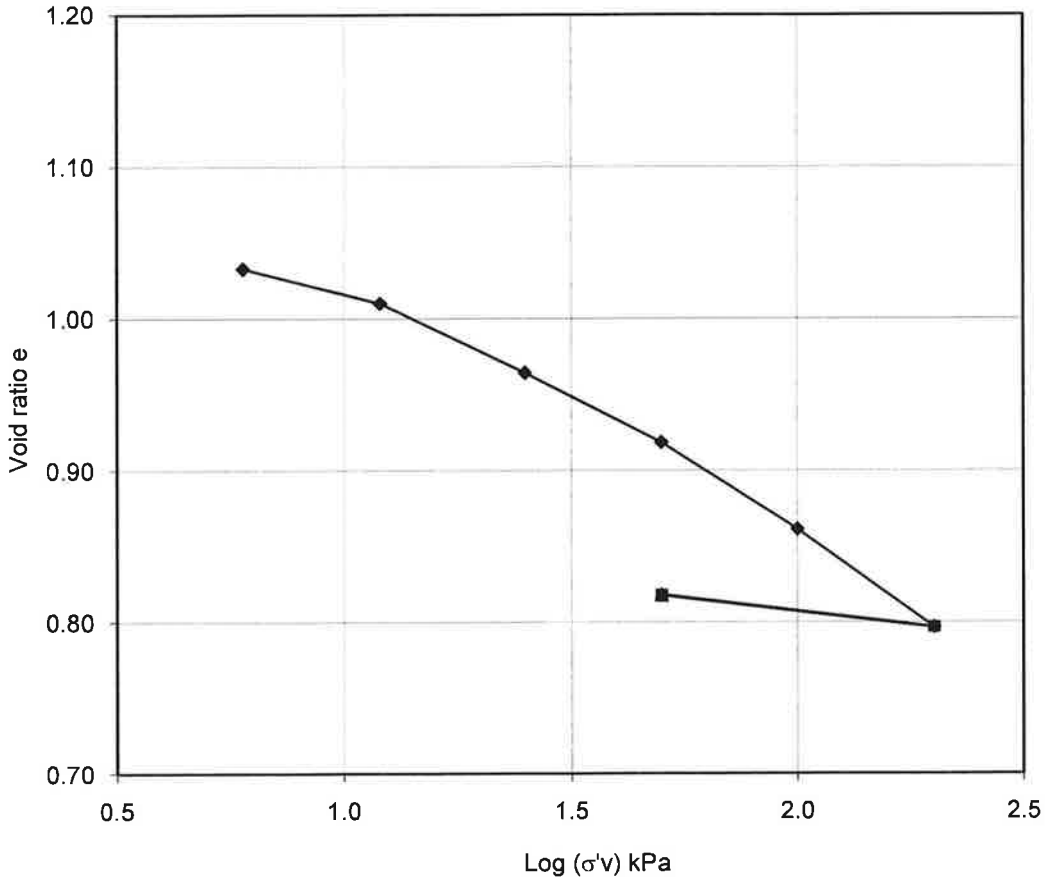
Queen's University Belfast	Geotechnical Testing Station

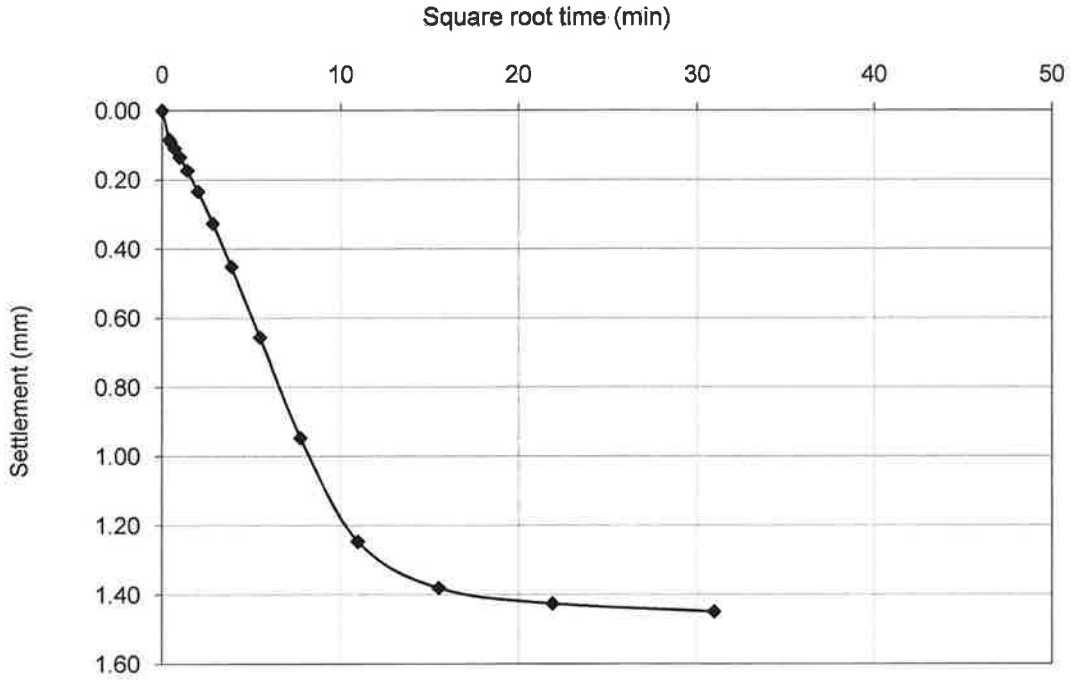
Client	**CG**
Job Ref	Galway
Date	10/04/2012
Borehole number	BH06
Sample number	
Depth m	5.0
Soil type	**Very sofy silty clay (D)**
Test	**1 D Consolidation**

Wet mass (i) g	164.5
Wet mass (f) g	146
Dry mass g	114
Water content (i) %	44.3
Water content (f) %	28.1
Bulk density kg/m3	1940.3
Dry density kg/m3	1344.7

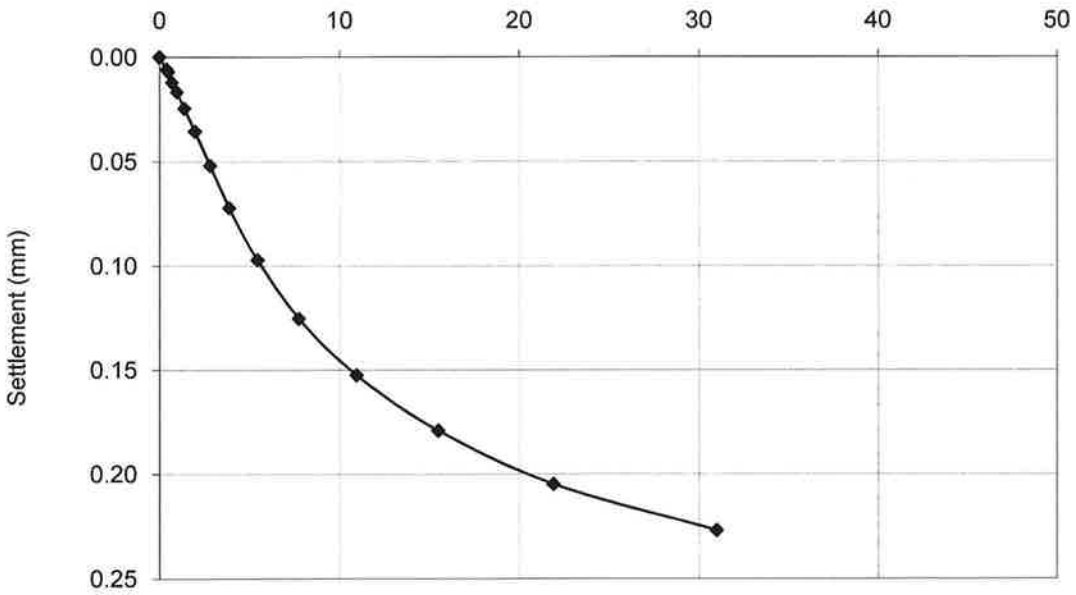
Diameter mm	75		
Initial Height mm	20	Specific gravity	2.6

σ'v kPa	ΔH mm	H mm	V cm3	Vv cm3	e	log(σ'v)	Compressibility m2/MN	Cv m2/year
6	0.000	20.000	88.313	45.294	1.033	0.78		0.45
12	0.227	19.773	87.310	44.291	1.010	1.08	1.87	0.26
25	0.455	19.318	85.303	42.284	0.964	1.40	1.75	0.29
50	0.456	18.862	83.288	40.269	0.918	1.70	0.94	0.40
100	0.568	18.294	80.779	37.760	0.861	2.00	0.60	0.58
200	0.641	17.653	77.947	34.928	0.797	2.30	0.35	0.54
50	-0.211	17.864	78.881	35.862	0.818	1.70	0.08	1.42

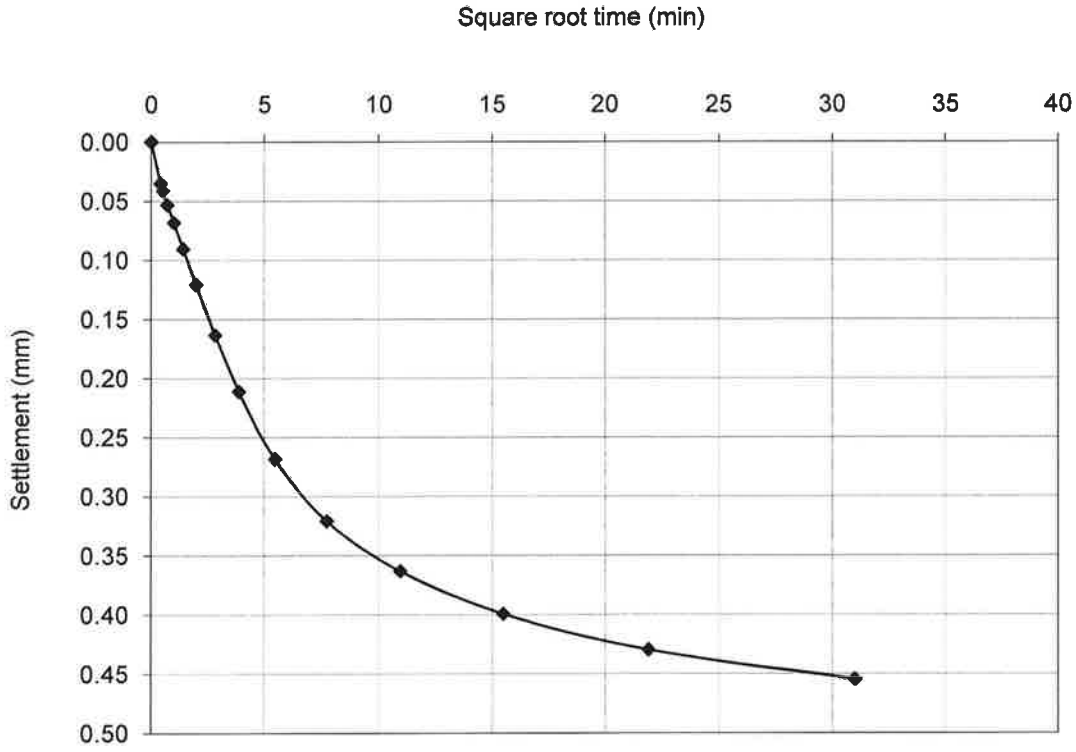




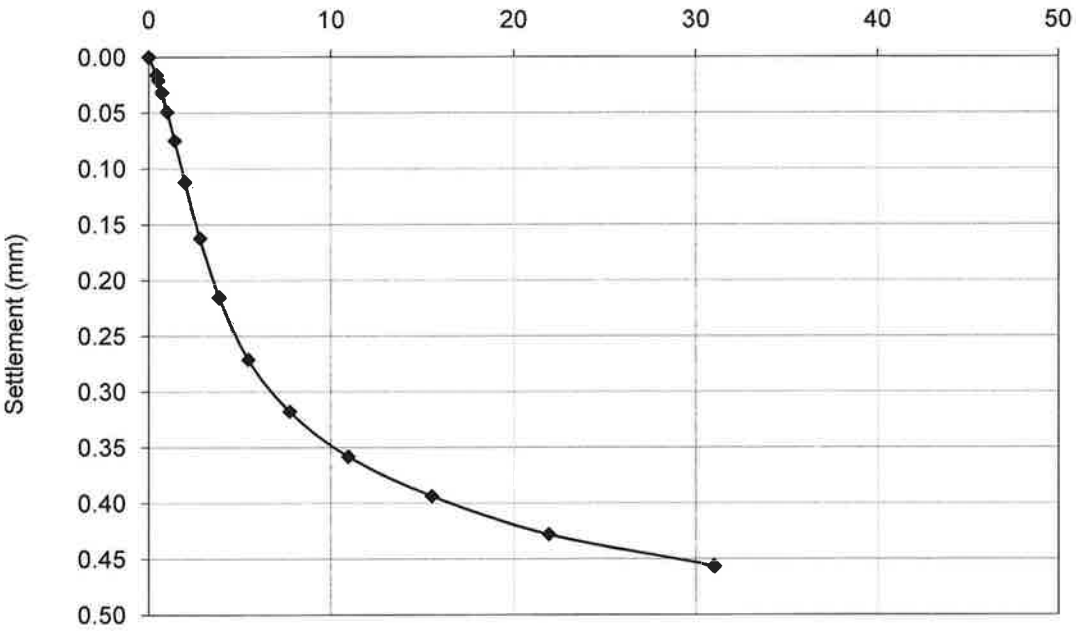
σ'_v = 6 kPa



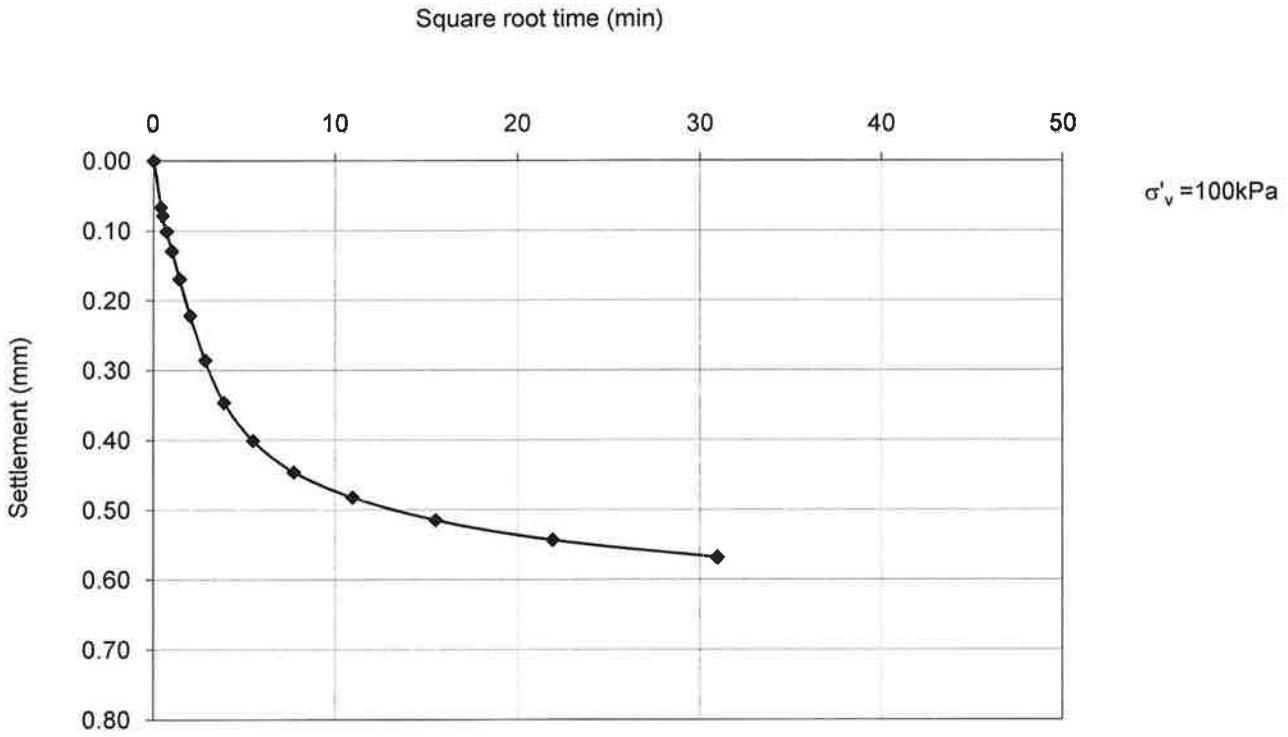
σ'_v = 12.5kPa

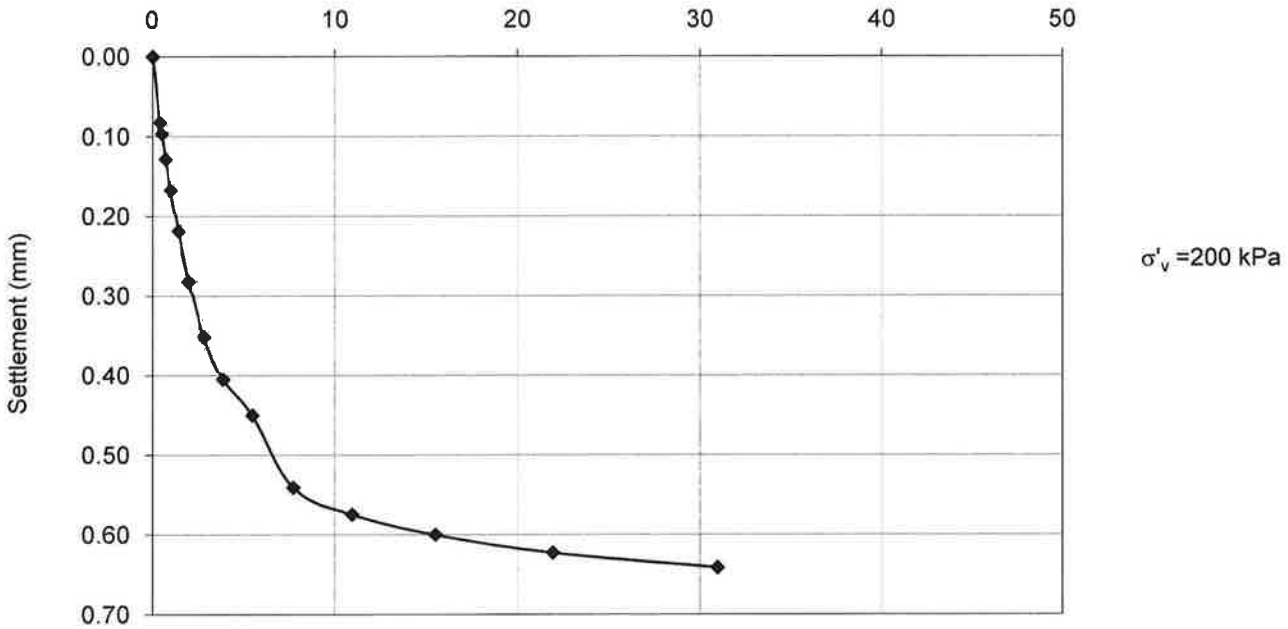


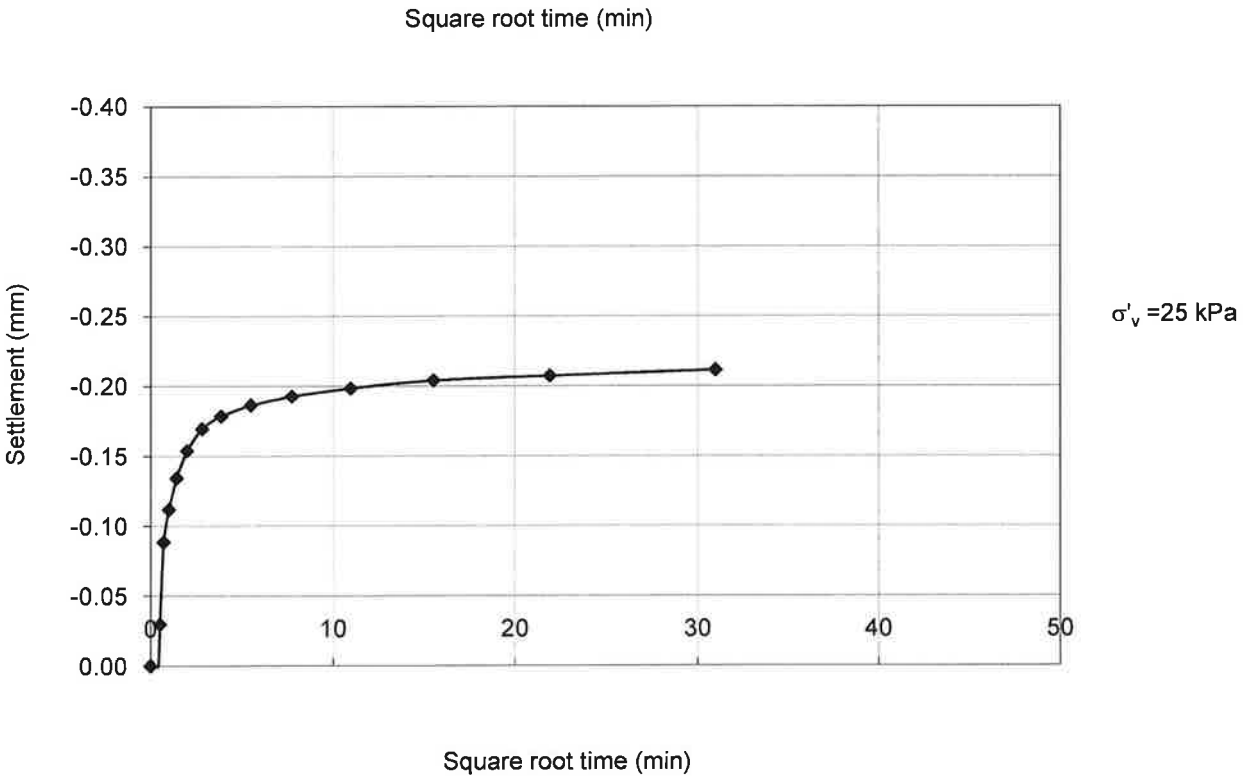
σ'_v =25 kPa



σ'_v =50 kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
Settlement (mm)
σ'v =100kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
Settlement (mm)
σ'v =200 kPa


Square root time (min)
Settlement (mm)
-0.40
-0.35
-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
0
10
20
30
40
50
Square root time (min)
σ'v =25 kPa

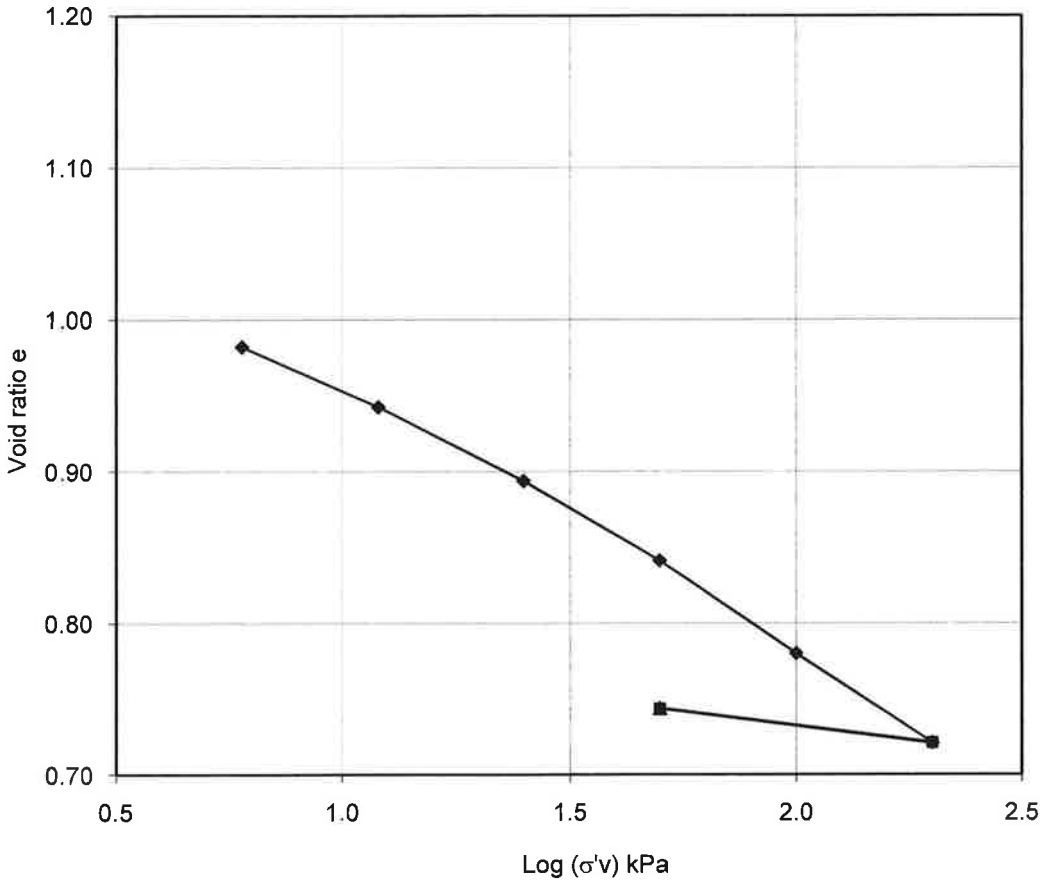
Queen's University Belfast	Geotechnical Testing Station

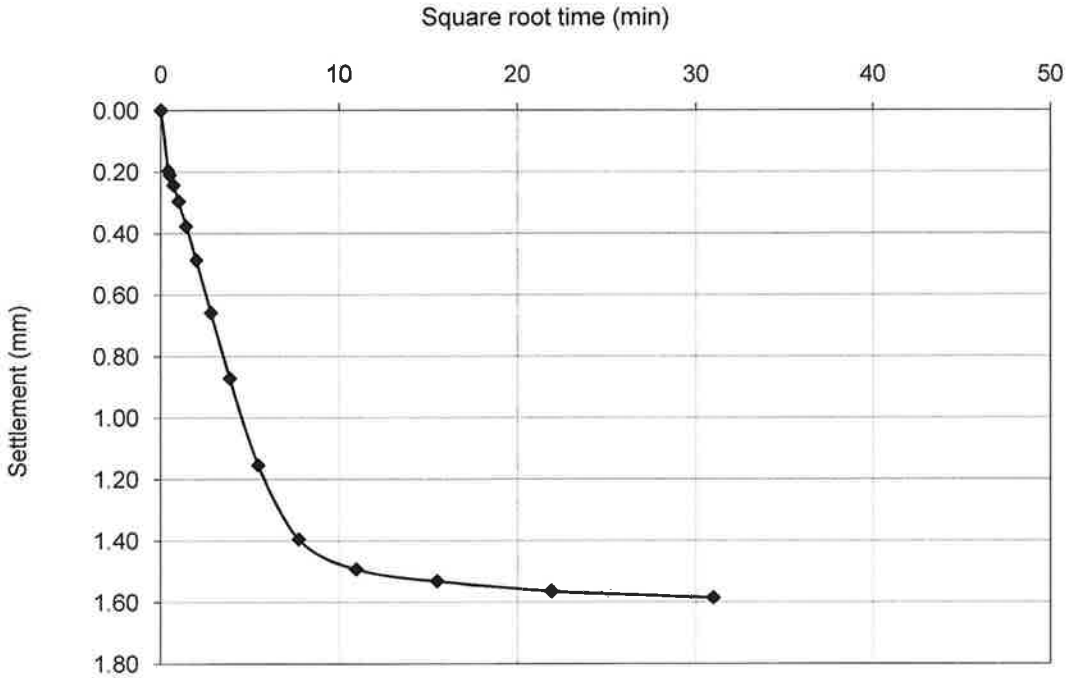
Client	**CG**
Job Ref	Galway
Date	10/04/2012
Borehole number	BH08
Sample number	
Depth m	1.0
Soil type	**Very sofy silty clay (D)**
Test	**1 D Consolidation**

Wet mass (i) g	151.1
Wet mass (f) g	129
Dry mass g	103
Water content (i) %	46.7
Water content (f) %	25.2
Bulk density kg/m3	1782.3
Dry density kg/m3	1214.9

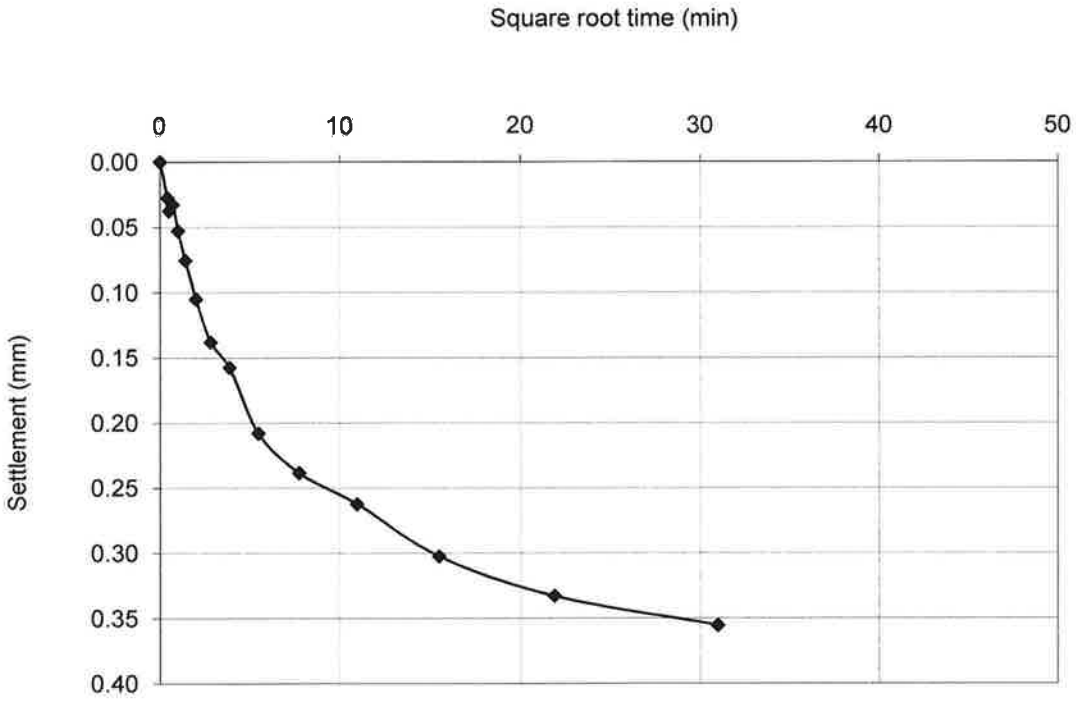
Diameter mm	75		
Initial Height mm	19.2	Specific gravity	2.6

σ'v kPa	ΔH mm	H mm	V cm3	Vv cm3	e	log(σ'v)	Compressibility m2/MN	Cv m2/year
6	1.586	17.614	77.778	38.910	0.982	0.78		0.71
12	0.356	17.259	76.208	37.340	0.943	1.08	3.33	0.27
25	0.438	16.821	74.274	35.406	0.894	1.40	1.93	0.26
50	0.471	16.349	72.193	33.325	0.841	1.70	1.11	0.37
100	0.550	15.800	69.765	30.897	0.780	2.00	0.67	0.43
200	0.529	15.271	67.429	28.561	0.721	2.30	0.33	0.53
50	-0.204	15.475	68.330	29.463	0.744	1.70	0.09	1.07

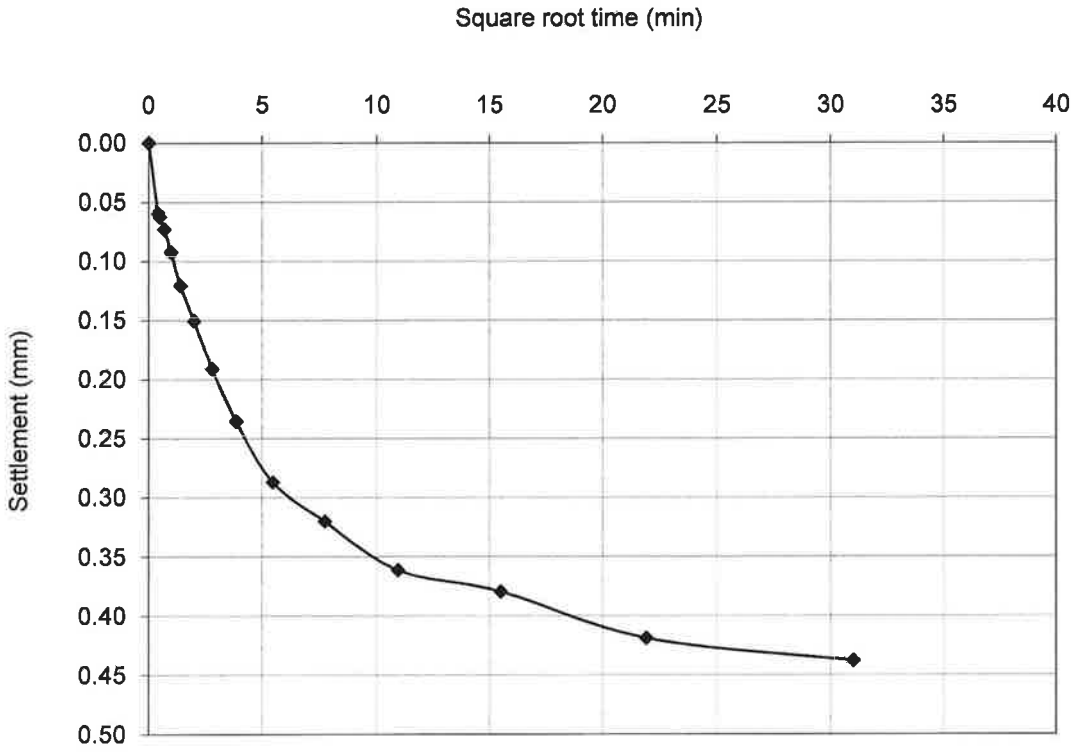




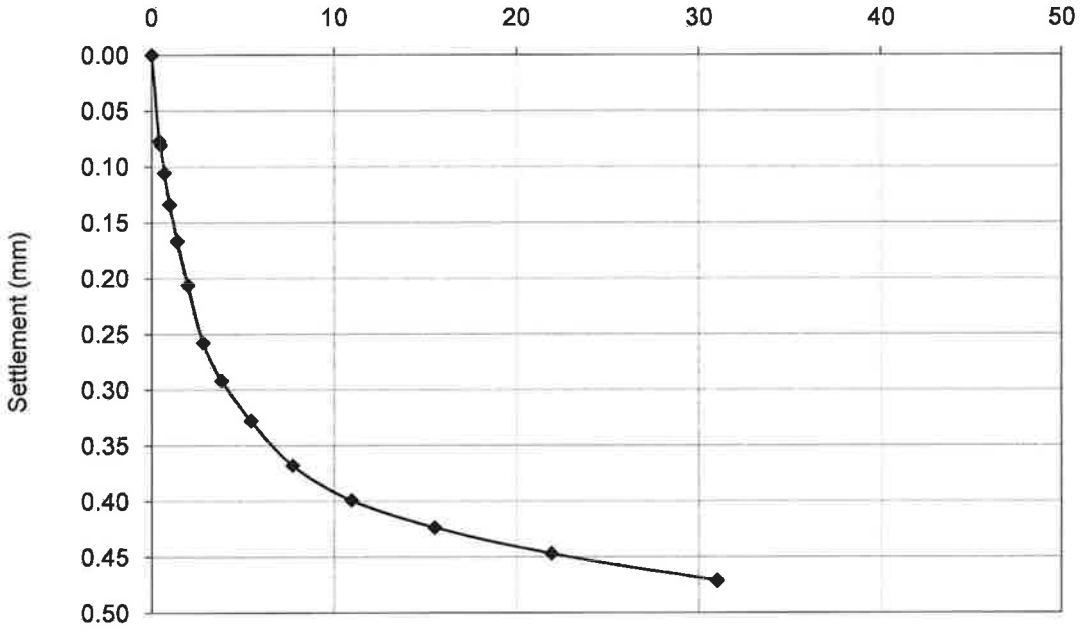
σ'_v = 6 kPa



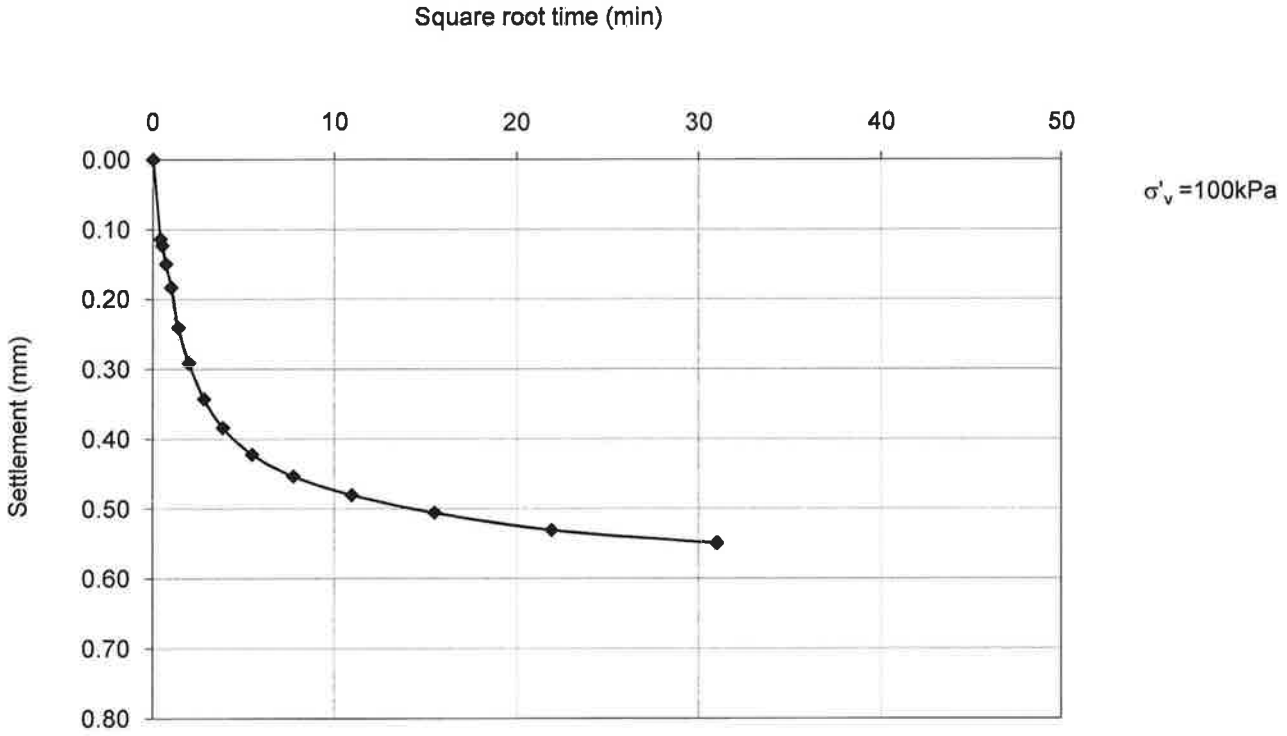
σ'_v = 12.5kPa

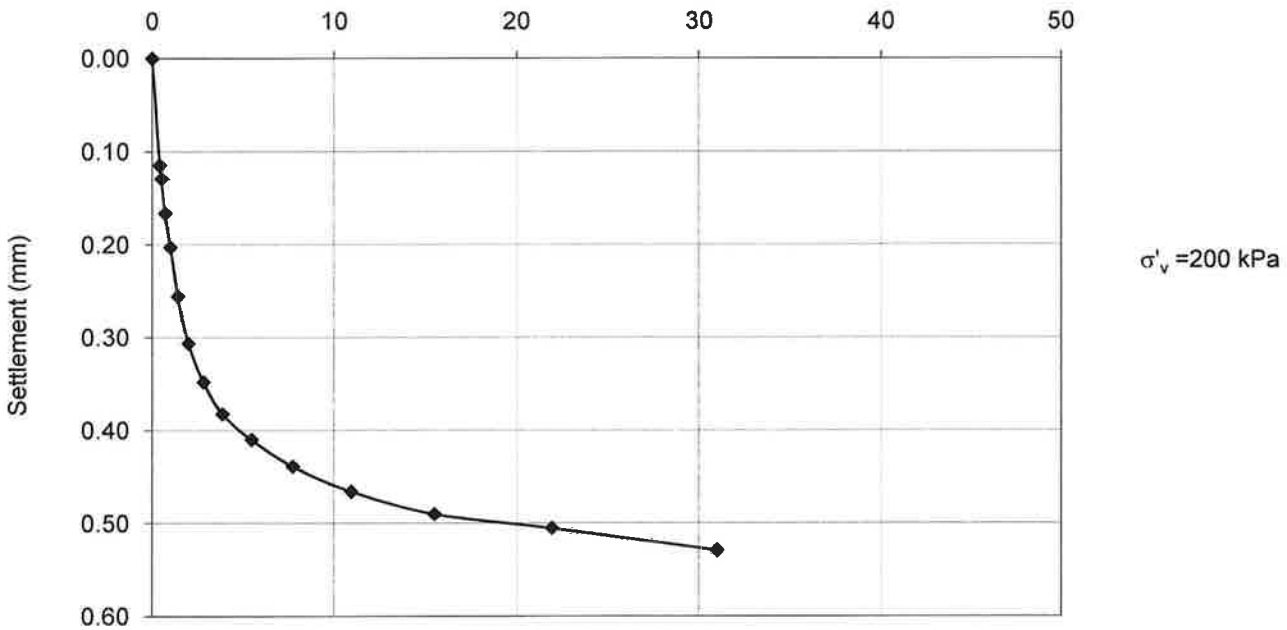


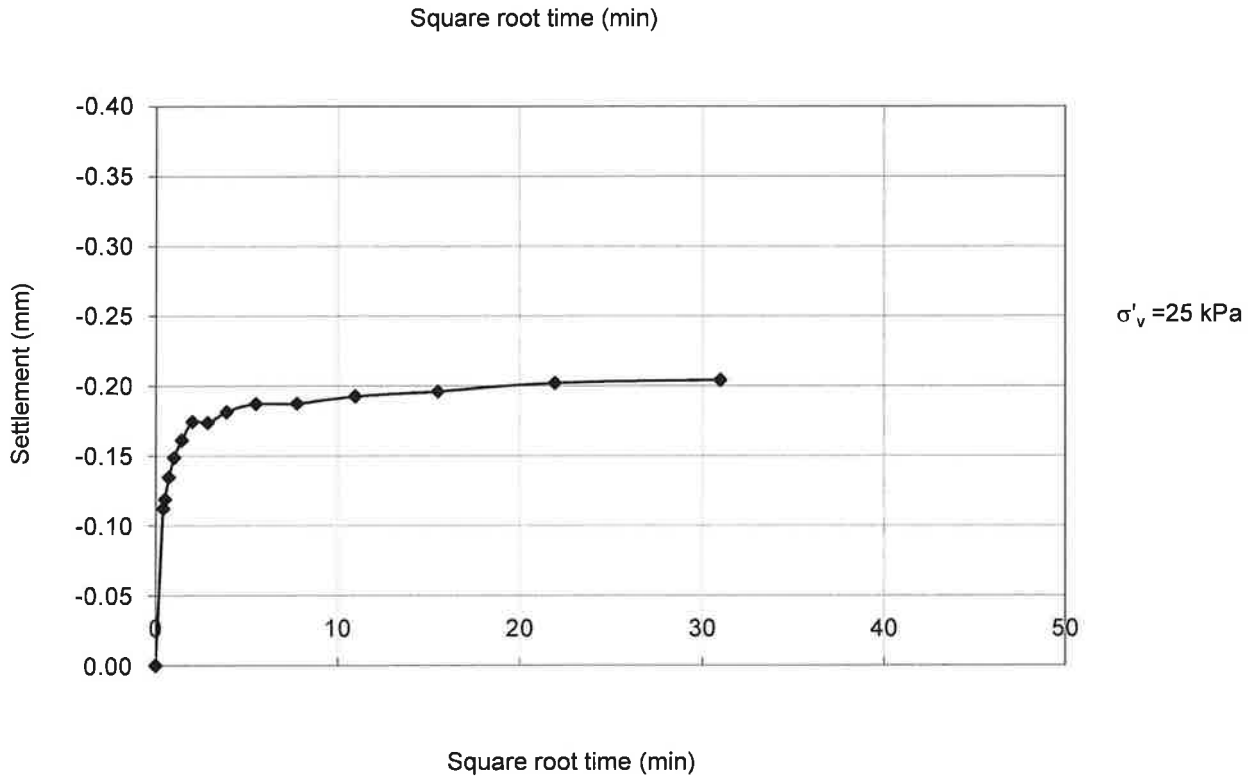
σ'_v =25 kPa



σ'_v =50 kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
Settlement (mm)
σ'v =100kPa


Square root time (min)
0
10
20
30
40
50
0.00
0.10
0.20
0.30
0.40
0.50
0.60
Settlement (mm)
σ'v =200 kPa


Square root time (min)
Settlement (mm)
-0.40
-0.35
-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
0
10
20
30
40
50
Square root time (min)
σ'v =25 kPa

K.A. Jones for Causeway Geotech Ltd

Petrographic Description of Borehole Samples from Galway Harbour

1. RC01 – 7.5 - 7.55mm

i) Hand specimen:

Rock is massive granite, consisting of irregular, interlocking aggregates of orthoclase feldspar (>40%), quartz (>10%), plagioclase feldspar (~20%) and a small amount of ferromagnesium mineral. All the minerals appear to be anhedral. Two very fine (<1 mm) discontinuous fractures are visible. These have been filled by calcite but have not affected the mechanical strength of the rock, which is still classified as very to extremely strong.

ii) Thin section:

Plane-polarized light (Fig. 1a)

Ferromagnesian mineral seen to be magnetite and aggregates of chloritized biotite.

Crossed polars (Fig. 1b)

Feldspar shows small amount of sericilization (hydrothermal alteration) and some very small incipient fracturing, which is very common even in igneous rocks and would not affect the mechanical strength significantly. The plagioclase feldspar is seen to be oligoclase (very low extinction angle).

The crystals are all anhedral and interlocking giving a very strong structure.

2. RC02, 14.2 m

i) Hand specimen:

Rock is granite composed of orthoclase feldspar (~40%), plagioclase feldspar (occurring in elongate, irregular aggregates), quartz (clear, glassy) and very fine grained green material scattered throughout rock but particularly visible along thin, discontinuous, incipient fractures.

The rock (hammer test) is clearly very to extremely strong mechanically.

ii) Thin section:

Plane-polarized light (Fig. 2a)

Feldspar shows slight cloudiness due to hydrothermal alteration. Thin fracture filled with calcite occurs across the field of view. One crystal of hornblende is visible.

Crossed polars (Fig. 2b)

Texture is seen to be interlocking mosaic of anhedral crystals of quartz, orthoclase and plagioclase feldspar, slightly sericitized.

3. RC03 11.9 – 12.0m

i) Hand specimen:

Rock is granite composed of interlocking anhedral crystals of approximately equal amounts of orthoclase and plagioclase feldspar (~80%), quartz (>10%) and a small amount of pale green mineral. The rock shows incipient, very fine and discontinuous rocks, but this would not have weakened it to less than very to extremely strong.

ii) Thin section

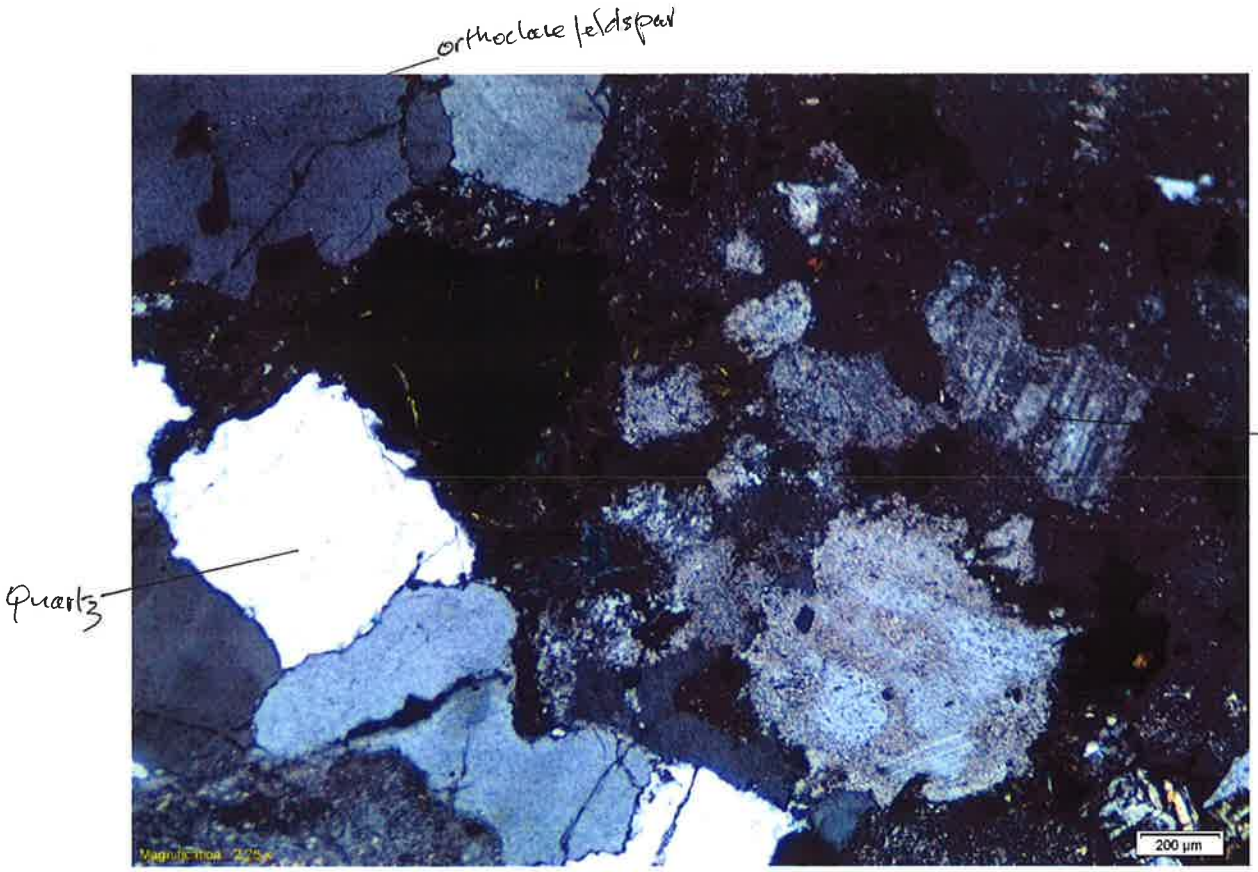
Plane-polarized light (Fig. 3a)

Colourless, cloudy feldspar (hydrothermally altered) is the dominant component of rock, followed by clear, colourless quartz and a few percent of hornblende and fine-grained irregular aggregates of chlorite and magnetite (probably originally biotite (but now hydrothermally altered) associated with magnetite.

Crossed polars (Fig. 3b)

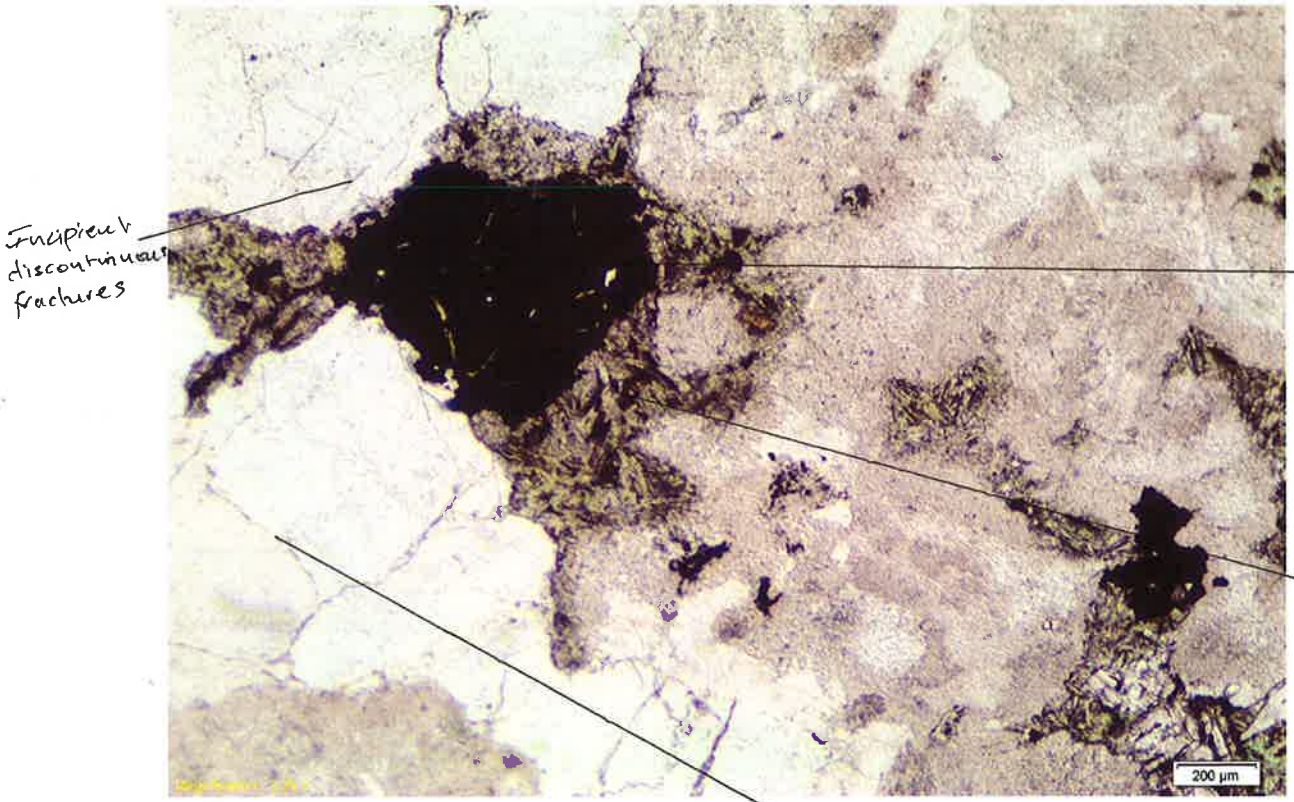
Rock shows granular sutured mosaic of anhydral, orthoclase (dominant) and subsidiary plagioclase (oligoclase) and quartz. The feldspar shows incipient alteration to seriate.

The rock is classed as very to extremely strong with little sign of incipient factures in this thin section.



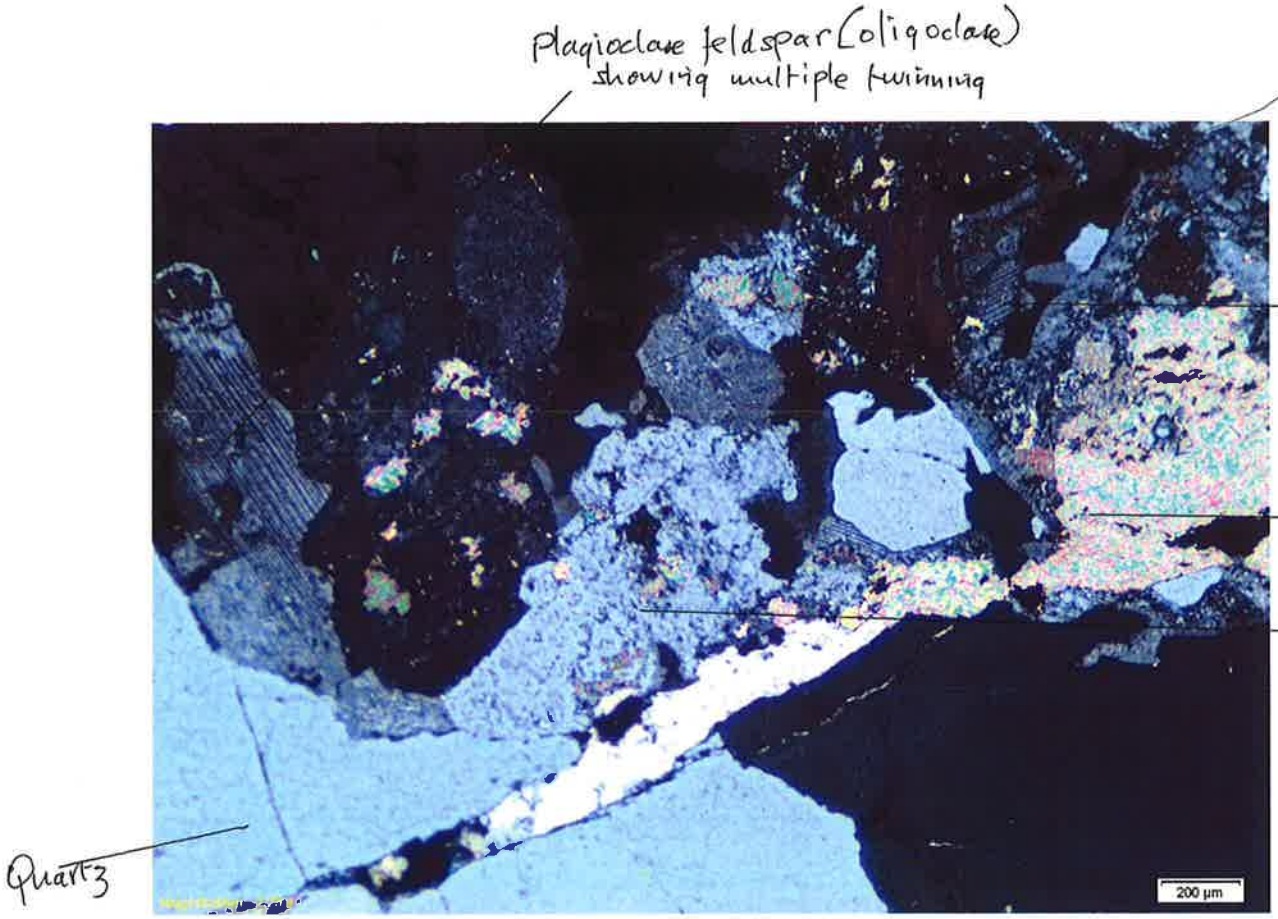
rco1

Fig 1 b



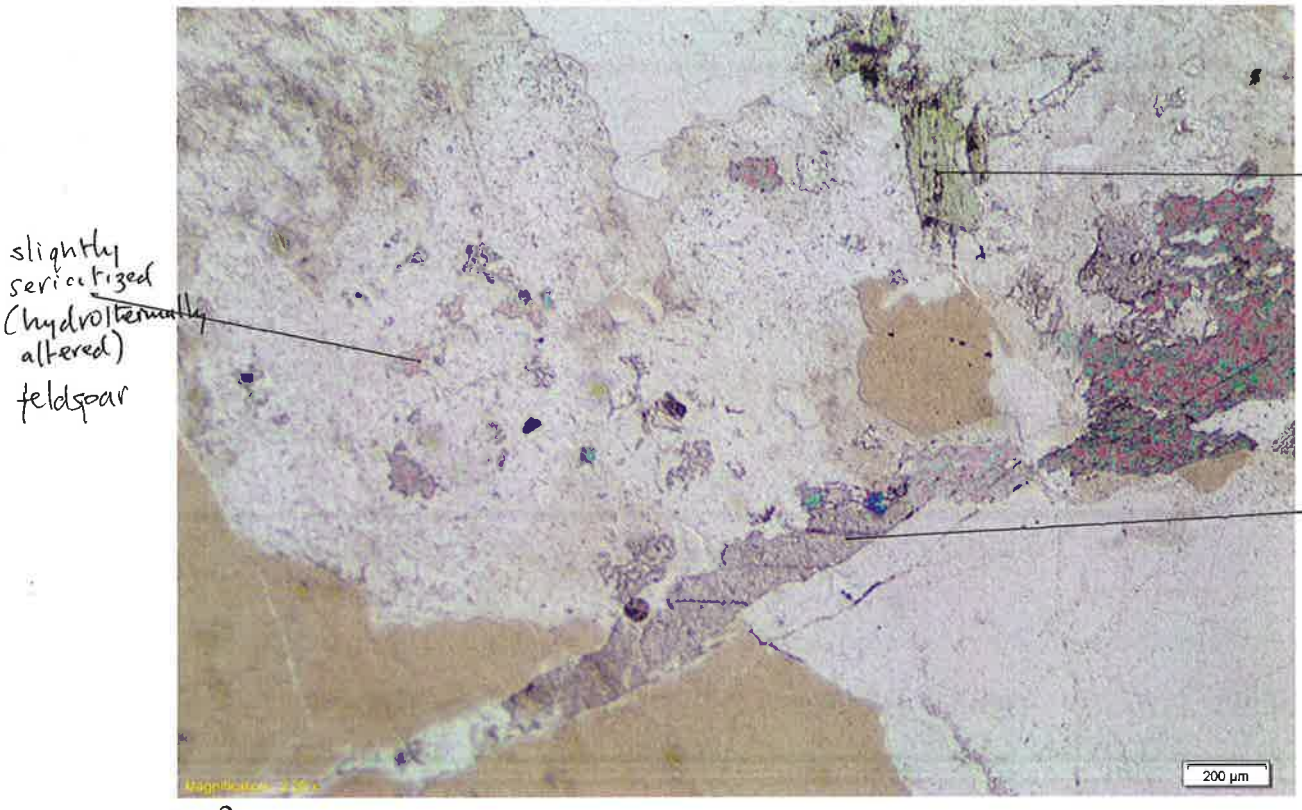
rco1

Fig 1 a.



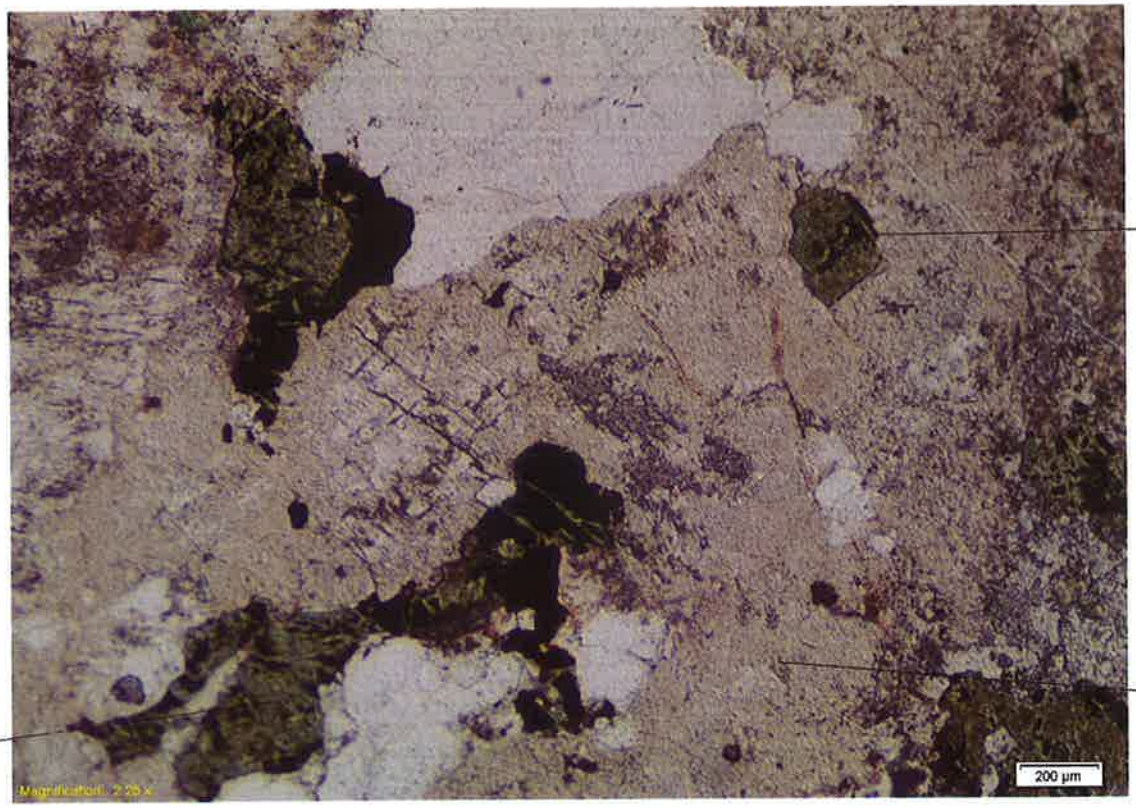
rco2

Fig. 2 b



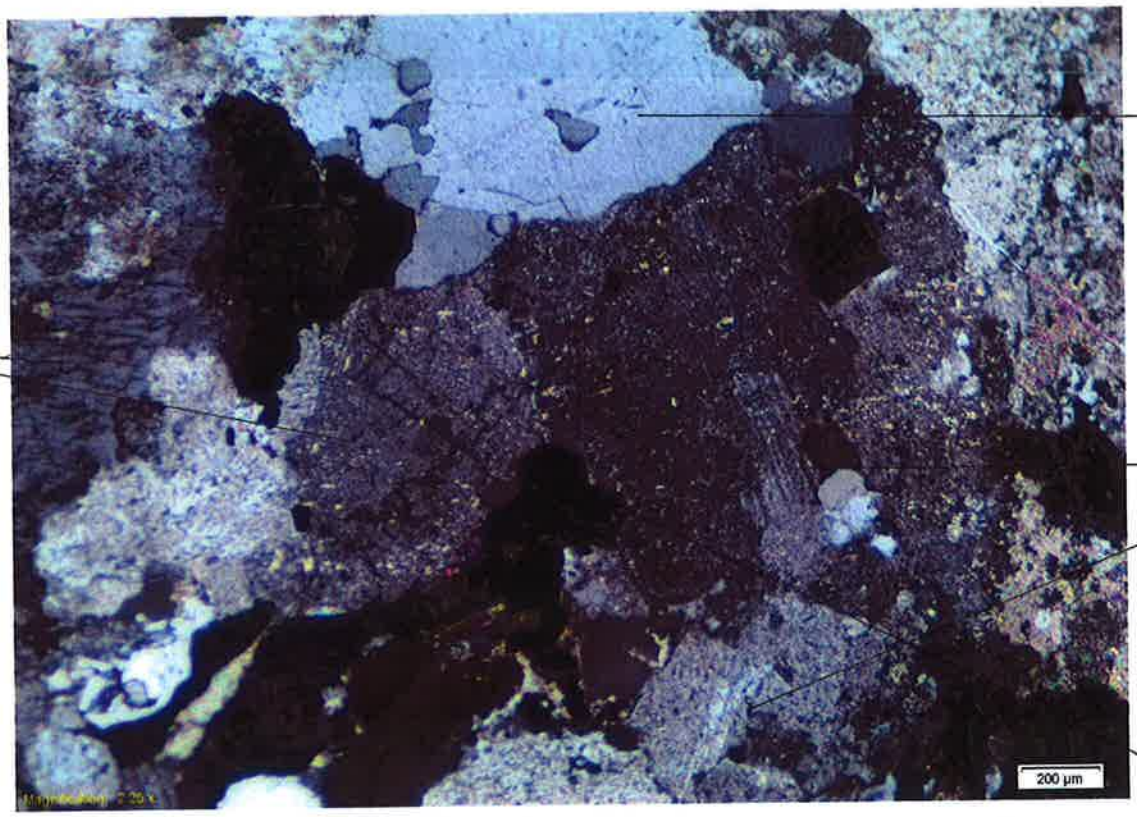
rco2

Fig 2a



rco3

Fig 3 a



rco3

Fig 3 b

Chemtest
The right chemistry to deliver results

Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070

Causeway Geotech Ltd
8 Drumahiskey Road
Balnamore, Ballymoney
Co. Antrim
BT53 7QL

FAO Paul Dunlop
16 April 2012

Dear Paul Dunlop

Test Report Number **203790**
Your Project Reference **12-161 - New Port of Galway**

Please find enclosed the results of analysis for the samples received 4 April 2012.

All soil samples will be retained for a period of one month and all water samples will be retained for 7 days following the date of the test report. Should you require an extended retention period then please detail your requirements in an email to customerservices@chemtest.co.uk. Please be aware that charges may be applicable for extended sample storage.

If you require any further assistance, please do not hesitate to contact the Customer Services team.

Yours sincerely

Keith Jones, Technical Manager

UKAS TESTING
2183

ISO 14001
sira
UKAS ENVIRONMENTAL MANAGEMENT

Notes to accompany report:

- *The sign < means 'less than'*
- *Tests marked 'U' hold UKAS accreditation*
- *Tests marked 'M' hold MCertS (and UKAS) accreditation*
- *Tests marked 'N' do not currently hold UKAS accreditation*
- *Tests marked 'S' were subcontracted to an approved laboratory*
- *n/e means 'not evaluated'*
- *i/s means 'insufficient sample'*
- *u/s means 'unsuitable sample'*
- *Comments or interpretations are beyond the scope of UKAS accreditation*
- *The results relate only to the items tested*
- *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*
- *Uncertainties of measurement for the determinands tested are available upon request*
- *None of the test results included in this report have been recovery corrected*

Newmarket • Tamworth • Glasgow
Registered in England & Wales - Registration Number 6511736 - Registered Office: 11 Depot Road Newmarket Suffolk CB8 0AL

Causeway Geotech Ltd
8 Drumahiskey Road
Balnamore, Ballymoney
Co. Antrim
BT53 7QL

FAO Paul Dunlop

LABORATORY TEST REPORT

Results of analysis of 9 samples
received 29 March 2012

12-161 - New Port of Galway

Chemtest
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Report Date
16 April 2012

Login Batch No				203512							
Chemtest LIMS ID				AH16540	AH16541	AH16542	AH16543	AH16544	AH16545	AH16546	AH16547
Sample ID				BH02	BH04	BH04	BH05	BH06	BH07	BH08	BH08
Sample No				2	9	14	3	9	10	2	11
Sampling Date				Not Provided	Not Provided	Not Provided	Not Provided	Not Provided	Not Provided	Not Provided	Not Provided
Depth				1.00m	6.00m	11.00m	2.00m	6.80m	6.60m	1.00m	8.00m
Matrix				*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*
SOP↓	Determinand↓	CAS No↓	Units↓	*							
2625	Organic matter		%	M	1.3	2.1	1.6	2.1	12	1.2	1.2	5.0

All tests undertaken between 02/04/2012 and 02/04/2012

* Accreditation status

This report should be interpreted in conjunction with the notes on the accompanying cover page.

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BT53 7QL

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LABORATORY TEST REPORT

Results of analysis of 9 samples received 29 March 2012

12-161 - New Port of Galway

Chemtest
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Report Date
16 April 2012

Login Batch No					203512
Chemtest LIMS ID					AH16548
Sample ID					BH01
Sample No					5
Sampling Date					Not Provided
Depth					3.00m - 3.80m
Matrix					*SOIL*
SOP↓	Determinand↓	CAS No↓		Units↓	
2625	Organic matter		%	M	4.8

* Accreditation status

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BT53 7QL

FAO Paul Dunlop
16 April 2012

Dear Paul Dunlop

Test Report Number **203512**
Your Project Reference **12-161 - New Port of Galway**

Please find enclosed the results of analysis for the samples received 29 March 2012.

All soil samples will be retained for a period of one month and all water samples will be retained for 7 days following the date of the test report. Should you require an extended retention period then please detail your requirements in an email to customerservices@chemtest.co.uk. Please be aware that charges may be applicable for extended sample storage.

If you require any further assistance, please do not hesitate to contact the Customer Services team.

Yours sincerely

Keith Jones, Technical Manager

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8 Drumahiskey Road
Balnamore, Ballymoney
Co. Antrim
BT53 7QL

FAO Paul Dunlop

LABORATORY TEST REPORT

Results of analysis of 1 sample
received 4 April 2012

12-161 - New Port of Galway

Chemtest
The right chemistry to deliver results

Report Date
16 April 2012

Login Batch No					**203790**
Chemtest LIMS ID					AH18489
Sample ID					BH07
Sample No					5
Sampling Date					Not Provided
Depth					3.00m - 3.90m
Matrix					*SOIL*
SOP↓	Determinand↓	CAS No↓	Units↓	*	
2625	Organic matter		%	M	2.1

All tests undertaken between 10/04/2012 and 10/04/2012
* Accreditation status
This report should be interpreted in conjunction with the notes on the accompanying cover page.

Contract: New Port of Galway

Job No.: 12-161

W = core diameter (Axial test) or specimen width (Irregular lump test)
D = core diameter (Diametral test) or specimen length (Axial test/Irregular lump test)
L = measured applied load for failure
P = actual applied load for failure (L x calibration factor)
D' = distance between platens at point of failure

D_e^2 = D x D' (Diametral test)
D_e^2 = 4/p (W x D') (Axial test / Irregular lump test)
I_s = Uncorrected point load strength (P/D_e^2)
$I_{s(50)}$ = Size corrected point load strength (I_s x F)
F = $(D_e/50)^{0.45}$ Size correction factor for core other than 50mm diameter

POINT LOAD STRENGTH TEST RESULTS

Borehole	Specimen Depth (m bgl)	Test Type A = Axial D = Diametral I = Irregular	W (mm)	D (mm)	D' (mm)	L (kN)	P (kN)	De^2 (mm^2)	De (mm)	Is (MPa)	F	Is(50) (MPa)	Remarks
RC01	7.50	D		84	81.5	30.9	30.9	6846	82.74	4.51	1.25	5.66	
RC01	9.20	D		84	82	28.8	28.8	6888	82.99	4.18	1.26	5.25	
RC02	12.40	D		72	70	27.5	27.5	5040	70.99	5.45	1.17	6.38	
RC02	12.00	A	72	67	65	32.0	32.0	5959	77.19	5.37	1.22	6.52	
RC02	13.50	D		72	69.5	31.0	31.0	5004	70.74	6.19	1.17	7.24	
RC02	13.55	A	72	108	105	23.0	23.0	9626	98.11	2.39	1.35	3.23	
RC03	10.70	D		72	69	28.5	28.5	4968	70.48	5.73	1.17	6.69	
RC03	10.75	A	72	103.5	101	31.0	31.0	9259	96.22	3.35	1.34	4.49	
RC03	13.00	D		72	69	26.5	26.5	4968	70.48	5.33	1.17	6.22	
RC03	13.10	A	72	76	73.5	26.5	26.5	6738	82.09	3.93	1.25	4.91	

Contract: New Port of Galway

Job No.: 12-161

UNIAXIAL COMPRESSIVE STRENGTH TEST RESULTS

D = core diameter
L = specimen length
M = specimen mass
P = applied load for failure

g_b = Bulk Density ($4M \times 10^6 / p \times D^2 \times L$)
MCS = Uncorrected compressive strength ($4P \times 10^3 / p \times D^2$)
UCS = Size corrected uniaxial compression strength (MCS x F)
F = Size correction factor for core L/D<2 (0.89 + 0.11x(L/D - 1))

Borehole	Specimen Depth (m bgl)	Specimen Diameter D (mm)	Specimen Length L (mm)	Specimen Mass M (kg)	Failure Load P (tonf)	Failure Load P (kN)	Bulk Density γ_b (Mg/m³)	Measured Compressive Strength (MCS) (MPa)	Correction Factor F	Uniaxial Compressive Strength (UCS) (MPa)	Remarks
RC01	7.50	84	126	1.755	18.5	184.3	2.51	33.26	0.95	31.4	-
RC02	13.10	72	181.5	1.908	13.5	134.5	2.58	33.04	1.00	33.0	-
RC03	12.20	72	116	1.217	23.5	234.2	2.58	57.51	0.96	55.1	-
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