Appendix A14.2

IGSL Factual Report

IGSL Ltd

Galway BusConnects Dublin Road Site Investigation

Site Investigation Report

Project No. 24984

March 2024

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TABLE OF CONTENTS

FIGURES & TABLES

APPENDICES

FOREWORD
The following conditions and notes on the geotechnical site investigation procedures should be read in conjunction with this report.

Standards
The ground investigation works for this project (**Galway Bus Connects Dublin Road Site Investigation**) have been carried out by IGSL Limited in accordance with Eurocode 7 - Part 2: Ground Investigation & Testing (EN 1997-2:2007). This has been used together with complementary documents such as BS 5930 (2015) and BS 1377 (Parts 1 to 9) and the following European Norms:

- EN 1997-2 Eurocode 7: 2007 – Geotechnical Design – Part 2: Ground Investigation & Testing
- EN ISO 22475-1:2006 Geotechnical Investigation and Sampling – Sampling Methods & Groundwater Measurements
- EN ISO 14688-1:2017 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 1: Identification and Description
- EN ISO 14688-2:2017 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 2: Principles for a classification
- EN ISO 14689-1:2017 Geotechnical Investigation and Testing – Identification, description & classification of rock

Barry Transportation have specified the project specification shall be Specification and Related Documents for Ground Investigation in Ireland, 2nd Edition, published by Engineers Ireland (2016) (EI SGI, 2016 including Errata Sheet Revision No.1 January 2019).

Reporting
No responsibility can be held by IGSL Ltd for ground conditions between exploratory hole locations. The engineering logs provide ground profiles and configuration of strata relevant to the investigation depths achieved and caution should be taken when extrapolating between exploratory points. No liability is accepted for ground conditions extraneous to the investigation points. Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction, mining works or karstification below or close to the site.

This report has been prepared for Galway City Council and Barry Transportation and the information should not be used without their prior written permission. IGSL Ltd accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.

Boring Procedures
Unless otherwise stated, 'shell and auger' or cable percussive boring technique has been employed as defined by Section 6.3 of IS EN ISO 22475-1:2006. The boring operations, sampling and in-situ testing complies with the recommendations of IS EN 1997-2:2007 and BS 1377:1990 and EN ISO 22476-3:2005. The shell and auger boring technique allows for continuous sampling in clay and silt above the water table and sand and gravel below the water table (Table 2 of IS EN ISO 22475-1:2006).

It is highlighted that some disturbance and variation is unavoidable in particular ground (e.g. blowing sands, gravel / cobble dominant glacial deposits etc). Attention is drawn to this condition, whenever it is suspected. Where cobbles and boulders are recorded, no conclusion should be drawn concerning the size, presence, lithological nature, or numbers per unit volume of ground.

In-Situ Testing
Standard penetration tests were conducted strictly in accordance with Section 4.6 of IS EN 1997-2:2007. The SPT equipment (hammer energy test) has been calibrated in accordance with EN ISO 22476-3:2005 and the Energy Ratio (E_r). A calibration certificate is available upon request. The E_r is

defined as the ratio of the actual energy E_{meas} (measured energy during calibration) delivered to the drive weight assembly into the drive rod below the anvil, to the theoretical energy (E_{theor}) as calculated from the drive weight assembly. The measured number of blows (N) reported on the engineering logs are uncorrected. In sands, the energy losses due to rod length and the effect of the overburden pressure should be taken into account (see IS EN ISO 22476-3:2005).

Soil Sampling
Three categories of sampling methods are outlined in EN ISO 22475-1:2006. The categories are referenced A, B and C for any given ground conditions and are shown in Tables 1 and 2 of EN ISO 22475-1:2006. Reference should be made to EN 1997-2:2002 for guidelines on sample class and quality for strength and compressibility testing. Samples of quality classes 1 or 2 can only be obtained by using Category A sampling methods.

Class 1 thin wall undisturbed tube samples (UT100) were obtained in fine grained soils and strictly meet the requirements of EN 1997-2:2002 and EN ISO 22475-1:2006. Soil samples for laboratory tests are divided into five classes with respect to the soil properties that are assumed to remain unchanged during sampling, handling transport and storage. The minimum sample quality required for testing purposes to Eurocode 7 compatibility (EN 1997-2:2002) is shown in Table A.

Table A – Details of Sample Quality Requirements

EN 1997 Clause	Test	Minimum Sample Quality Class
5.5.3	Water Content	3
5.5.4	Bulk Density	2
5.5.5	Particle Density	N/S
5.5.6	Particle Size Analysis	N/S
5.5.7	Consistency Limits	4
5.5.8	Density Index	N/S
5.5.9	Soil Dispersivity	N/S
5.5.10	Frost Susceptibility	N/S
5.6.2	Organic Content	4
5.6.3	Carbonate Content	3
5.6.4	Sulphate Content	3
5.6.5	pH	3
5.6.6	Chloride Content	3
5.7	Strength Index	1
5.8	Strength Tests	1
5.9	Compressibility Tests	1
5.10	Compaction Tests	N/S
5.11	Permeability	2

N/S – not stated. Presume a representative sample of appropriate size.

Samples recovered from trial pits or trenches meet the requirements of IS EN ISO 22475-1. It is highlighted that unforeseen circumstances such as variations in geological strata may lead to lower quality sample classes being obtained.

Groundwater
The depth of entry of any influx of groundwater is recorded during the course of boring operations. However, the normal rate of boring does not usually permit the recording of an equilibrium level for any one water strike. Where possible, drilling is suspended for a period of twenty minutes to monitor the subsequent rise in water level. Groundwater conditions observed in the borings or pits are those appertaining to the period of investigation. It should be noted however, that groundwater levels are

subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions, tidal variations etc.

Engineering Logging

Soil and rock identification has been based on the examination of the samples recovered and conforms with IS EN ISO 14688-1:2002 and IS EN ISO 14689-1:2004. Rock weathering classification conforms to IS EN ISO 14689-1:2003 while discontinuities (bedding planes, joints, cleavages, faults etc) are classified in accordance with 4.3.3 of IS EN ISO 14689-1:2003. Rock mechanical indices (TCR, SCR, RQD) are defined in accordance with IS EN ISO 22475-1:2006.

Where peat has been encountered, samples have been logged in accordance with the Von Post Classification (ref. Von Post, L. 1992. Sveriges Gologiska Undersoknings torvinventering och nogra av dess hittils vunna resultat (SGU peat inventory and some preliminary results) Svenska Mosskulturforeningens Tidskrift, Jonkoping, Swedden, 36, 1-37 and Hobbs N. B. Mire morphology and the properties of some British and foreign peats. QJEG, Vol. 19, 1986.

Retention of Samples

After satisfactory completion of all the scheduled laboratory tests on any sample, the remaining material will be discarded. Unless a period of retention of samples is agreed, it is our normal practice to discard all soil samples one month after submission of our final report.

1. INTRODUCTION

IGSL has undertaken a programme of ground investigation works relating to the Bus Connects Galway Project on the Dublin Road, Galway, specifically to assist in the delivery of enhanced walking, cycling and bus infrastructure. The site is located on the carriageway, footpaths and open grass spaces along the Dublin Road(R338) in Galway. The site starts approximately 350m to the southeast of the Dublin Road and Well park Junction and ends 170m before Martin Roundabout.

Figure 1 – Site Location Plan

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The investigation comprised cable percussion boring, rotary drilling, machine-dug trial pits, dynamic probing, and in-situ testing. Window sampling was also utilized on site. The investigations were executed in accordance with BS 5930, Code of Practice for Site Investigations (2015) and EN 1997-2 Eurocode 7 Part 2 Ground Investigation & Testing and supervised by an IGSL geotechnical engineer.

Standpipe installations were constructed in selected drillholes to allow for groundwater.

Geotechnical, chemical and environmental laboratory testing was scheduled on a range of soil and rock samples. The geotechnical soil testing included moisture contents, Atterberg Limits and particle size distribution [PSD] testing. Chemical testing for pH, Sulphate and organic matter testing was completed on selected soil samples.

Rock testing on recovered cores comprised point load strength index testing [PLSI] and uniaxial compressive strength tests [UCS]. This report presents the factual geotechnical data acquired from the 2023 investigation.

Table No: 1 – Exploratory Locations Details

Location	Final Depths(m bgl)	Easting(ITM)	Northing(ITM)	Elevation(Malin)
2023-BH-001	8.2	531363.7	726104.8	9.29
2023-BH-001A	1.4	531363.7	726104.8	9.29

2023-BH-002	12.7	531604.5	726020.8	11.04
2023-BH-003	3	532067.5	725843.5	22.00
2023-BH-004	0.5	532397.3	725749.6	22.45
2023-BH-004A	3.7	532397.3	725749.6	22.45
2023-BH-005	0.6	532741.0	725667.9	22.52
2023-BH-005A	0.5	532744.6	725671.7	22.76
2023-BH-005B	8	532710.6	725708.0	25.08
2023-BH-006	8	532958.4	725626.9	16.59
2023-BH-007	14.2	533754.8	725316.2	20.48
2023-BH-008	8	534317.5	725442.4	20.99
2023-BH-009	8	534538.8	725514.4	17.42
2023-BH-010	8	534889.2	725732.2	23.41
2023-DP-001	1.33	531501.2	726031.1	10.41
2023-DP-002	2.05	531755.3	725965.9	17.23
2023-DP-003	3.25	532248.9	725781.4	20.16
2023-DP-004	2.97	532502.5	725715.4	22.97
2023-DP-005	3.265	532569.5	725701.5	23.43
2023-DP-006	2.74	532569.5	725701.6	23.44
2023-DP-007	3.055	533580.4	725313.6	20.94
2023-RC-007	8	533756.5	725316.6	20.49
2023-SA-001	1.5	533752.8	725316.0	20.60
2023-SA-002	0.7	533896.1	725345.4	18.84
2023-SA-003	1.4	534651.6	725559.4	16.84
2023-SA-004	0.8	534810.7	725674.5	19.54
2023-TP-001	2.5	531419.8	726085.2	10.82
2023-TP-002	2	531691.0	725994.2	14.50
2023-TP-003	3.1	531939.7	725884.5	23.45
2023-TP-004	2.6	532157.2	725816.2	20.98
2023-TP-005	2.4	532690.1	725681.1	23.83
2023-TP-006	2.8	532734.5	725732.6	25.65
2023-TP-007	2.8	532773.7	725621.0	18.73
2023-TP-008	2.3	532831.2	725659.1	19.53
2023-TP-009	1.6	533177.0	725486.6	14.93
2023-TP-010	1.7	533298.4	725431.1	17.61
2023-TP-011	2.4	534678.3	725523.1	18.64
2023-TP-012	1.1	534792.6	725642.8	19.25
2023-TP-013	2	534950.8	725778.9	26.53
2023-WS-001	1.3	531501.2	726031.1	10.41
2023-WS-002	2	531755.3	725965.9	17.23
2023-WS-003	3	532248.9	725781.4	20.16
2023-WS-004	2.7	532502.5	725715.4	22.97
2023-WS-005	1.3	532569.5	725701.5	23.43
2023-WS-006	2.7	532569.5	725701.6	23.44
2023-WS-007	3	533580.4	725313.6	20.94

2. FIELDWORK

2.1 General

The IGSL Limited fieldworks were undertaken in the months of September 2023 through to December 2023. The works which form this report comprise the following:

- Trial Pits (13 No)
- Cable Percussion Boreholes (14 No)
- Rotary Core Drillholes (9 No.)
- Window Sampling (7 No.)
- Dynamic Probe holes (7 No)
- Infiltration Testing (3 No)
- Soil Infiltration Test (BRE Digest 365) (4No)
- Plate Bearing Tests (13 No)
- Geophysical Survey
- Surveying of Exploratory Hole Locations

2.2 Trial Pits

Trial pitting was undertaken at thirteen locations across the scheme. The locations were set out as per the Ground Investigation Schedule issued by Barry Transportation. The trial pits were excavated, logged and sampled under the direction of an IGSL geotechnical engineer in accordance with BS 5930 (1999+A2:2010). Bulk disturbed samples (typically 20 to 30kg) were taken as the pits progressed. Environmental samples were also acquired where Made Ground was encountered. These are denoted ‘Env’ on the logs.

In situ hand vanes were attempted where favourable ground conditions existed. These were generally conducted in the pit to depths of 1.20m where sidewall stability allowed. In some cases, the vanes were undertaken in soil arisings where the SILT/CLAY remained intact. The Shear vane utilized a 20x40 Palette- medium size vane. The results feature in the ‘Vane Test’ column on the respective trial pit logs.

The bulk samples were placed in heavy-duty polyethylene bags and sealed before being transported to Naas for laboratory testing. Environmental glass jars and tubs, where sampled, were placed in cooler boxes before being dispatched to the relevant laboratory where they awaited scheduling. The trial pits were backfilled with the as-dug arisings and reinstated to the satisfaction of IGSL’s site geotechnical engineer. The trial pit logs are presented in Appendix 1 and include descriptions of the soils encountered, groundwater conditions and stability of the pit sidewalls. Note that the pitside photographs are provided separately in .jpeg format.

2.3 Cable Percussion Boreholes

Cable percussive boring (200mm diameter) was used initially at each of the borehole locations [2023-BH-0xx]. It was undertaken at fourteen locations using a Dando 2000 rig. The fourteen locations included a number of Employer Representatives (ER)-instructed re-setups where shallow refusal was observed. Several of the re-setups did not achieve significant greater depth than the initial bore. In any case, the original setup location was used when following on with rotary drilling. The boreholes extended to depths of between 0.50m and 14.20m. At all locations, boring commenced through hand-dug service inspection pits. Disturbed bulk samples were recovered at 1m intervals or change of strata during boring and these are denoted ‘B’ on the engineering logs. Disturbed tub samples were also collected and these are denoted ‘D’.

Standard Penetration Tests (SPT's) were performed in the boreholes and given the nature of the soils; a solid cone was used. It is noted that the SPT N-Values reported are the number of blows for

300mm increment penetration (e.g. 2023-BH-001 at 3.00m where N=52). These exclude the seating blow values, which represent the initial 150mm depth of penetration. Where partial penetration was achieved during testing, the number of blows is shown for the actual penetration depth achieved (e.g. 2023-BH-001 at 1.50m where N=25/10mm). In accordance with Eurocode 7, the SPT hammer has been calibrated and the energy ratio (Er) value is incorporated on the engineering logs. Calibration certificates for SPT hammers (presented in Appendix 2) can be cross-referenced using the assigned hammer code noted on the individual driller logs. It is highlighted that the SPT N-Values reported on the engineering logs are uncorrected for energy ratio.

Descriptions of the soils encountered, in-situ tests undertaken and samples recovered are presented on the borehole records in Appendix 2. Details of groundwater strikes and hard strata boring (i.e. chiselling) are also presented on the aforementioned records. Note that where the cable percussion borehole was followed on by rotary drilling, a combined cable percussion + rotary log is produced. Where, in the case of re-setups, no follow-on rotary drilling was conducted, only the soil bore record features.

2.4 Rotary Core Drillholes

Rotary core drilling was carried out at nine locations using a tracked Comacchio GEO 405. Symmetrix drilling was utilised within the overlying superficial deposits with coring techniques used in the underlying bedrock once encountered. As with cable percussion boreholes, Standard Penetration Tests (SPT's) were performed in the overburden strata with the resulting blowcounts presented on the logs. Where bedrock was encountered, subsequent rotary drilling produced 79mm diameter cores.

The cores were placed in 3m capacity timber boxes and logged by an IGSL engineering geologist. This included photography of the cores with a digital camera. Where rock core was recovered, a graphic fracture log is also presented alongside the mechanical indices. This illustrates the fracture state of the rock cores and allows easy identification of highly fractured / non-intact zones and discontinuity spacings. It should be noted that no correction for dip of the joints has been made and that the spacings shown are successive joint / core intersections within the core.

Groundwater monitoring standpipes were installed in selected drillholes on site. The standpipes consisted of 50mm diameter HDPE pipework with proprietary 1mm slots and incorporated a pea gravel filter pack and cement / bentonite grout seal. Headwork covers were concreted in place.

Rock logging records are presented on the borehole logs in Appendix 2. The combined logs include engineering geological descriptions and details of the bedding / discontinuities and mechanical indices (TCR, SCR and RQD's) for each core run. Core photographs are also presented in Appendix 4 and these illustrate the structure and fracture state of the bedrock. Relevant SPT calibration certificates are also presented in Appendix 2.

In the case of 2023-BH-RC007, the rotary drilling phase was not extended through the original cable percussion borehole. Therefore, the rotary logs, are presented separately in Appendix 2 since they were constructed at locations other than the cable percussion “pre-bore”. The reason for the distancing was due to potential live services in the location presented at tender stage.

2.5 Window Sampling / Driven Sampling

Window sampling was carried out at seven locations using a Dando Terrier rig. The Terrier rig uses a 63.5kg weight to drive the window sampler and the material is retrieved in a semi-rigid plastic core liner. The window sample records are presented in Appendix 3 and include descriptions of the soils encountered and the total recovery per run. Sampling depths ranged from 1.30m to 2.70m below ground level.

2.6 Dynamic Probing
In-situ “Heavy” dynamic probing (DPH) was performed at seven locations using a compact crawler rig. The tracked dando terrier probing unit meets the requirements of BS 1377, Part 9 (1990) and IS EN 1997-2:2007.

The probing rig utilized a 50kg drop weight and 500mm drop height with a 60° cone. In accordance with the standards, the number of blows required to drive the cone each 100mm increment into the sub-soil was recorded. Probing is generally terminated when blow counts, N_{100} values, exceed 25, in order to avoid damage to equipment. The probe records are presented in Appendix 4 and include blow-counts in both numerical and graphical format.

2.7 Borehole Infiltration Testing
In-situ infiltration tests were undertaken in three exploratory holes during their construction in accordance with BS 5930. The tests were undertaken in the 115mm diameter boreholes. The records for the tests are presented in Appendix 5.

2.8 Soil Infiltration Testing (Bre Digest 365)
Soil Infiltration tests were performed in four locations to assess the suitability of the sub-soils for the dispersion of run-off water through a soakaway system. Testing was performed in accordance with BRE Digest 365 ‘Soakaway Design’. The infiltration test records are included in Appendix 6.

2.9 Plate Bearing Testing
Thirteen plate bearing tests were conducted in selected Trial Pits across the site. Plate testing was undertaken to evaluate the modulus of sub-grade reaction (Ks) and equivalent CBR value. A 450mm diameter plate was used for the tests with kentledge provided by a 8t tracked excavator. Two load cycle tests, in accordance with BS 1377, were performed and the load / settlement plots, Ks and equivalent CBR values are presented in Appendix 7 of the report.

2.10 Geophysical Survey
Geophysical Surveying was performed by Minerex Geophysical Limited on behalf of IGSL. A Survey comprising of Electrical Resistivity Tomography (ERT) and seismic refraction(p-wave) were used to evaluate the ground conditions. Details of the methodologies employed, cross- sections and data interpretation are presented in the geophysical report (Appendix 8).

2.11 Surveying of Exploratory Hole Locations
Following completion of the exploratory works, surveying was carried out using GPS techniques. Co-ordinates (x, y) were measured to Irish Transverse Mercator and ground levels (z) established to Malin Head. The co-ordinates and ground levels are shown on the exploratory hole logs with locations shown on the exploratory hole plan in Appendix 12.

3. LABORATORY TESTING

Geotechnical laboratory testing was performed at IGSL’s INAB-accredited laboratory in accordance with the methods set out in BS1377; British Standard Methods of Test for Soils for Civil Engineering Purposes; British Standards Institute:1990. The geotechnical testing included moisture contents, Atterberg Limits and particle size distribution [PSD] testing. The results from geotechnical testing on selected trial pit and borehole soils are presented in Appendix 9.

Chemical analysis incorporating pH levels, Sulphate and organic matter contents were also undertaken on recovered soils. The chemical results are presented in Appendix 10.

Geotechnical laboratory testing was carried out on selected rock cores. Point load strength index (PLSI) and uniaxial compressive strength (UCS) tests were conducted with the results presented in Appendix 11.

KEY TO EXPLORATORY RECORDS

Cable Percussion Boreholes

D	Small Disturbed Sample (Tub)
B	Large Disturbed Sample
UT100	Undisturbed Sample (driven tube sample)
AB 360	Sample Reference No
W	Groundwater Sample
Env	Environmental Tub, Jar & Vial
C	SPT N-Value (Solid Cone)
S	SPT N-Value (Split Spoon / Open Shoe)

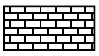
Rotary Core Drillholes

TCR	Total Core Recovery (%)
SCR	Solid Core Recovery (%)
RQD	Rock Quality Designation Value (%)
FSI	Fracture Spacing Index (minimum, maximum, average per lithology grouping)
NI	Non-Intact (where rock core is highly fractured)

Trial Pits

B	Large Disturbed Bulk Sample
D	Small Disturbed Tub Sample
VT	Vane Test (KPa) Using Genor H-70 Hand Vane
HP	Hand Penetrometer Test (KPa)
W	Groundwater Sample
AB 361	Sample Reference No
Env	Environmental Tub, Jar & Vial

Strata Legends / Symbolic Logs



Strata legends / symbolic logs reflect main stratum in accordance with BS 5930 (1999). Legend codes are selected from GINT software to reflect stratum. Note, due to limited codes, legends may not represent exact constituent proportions (e.g. slightly or very sandy, slightly or very gravelly etc)

REFERENCES

1.0 BS 5930 (1999 + A2:2010) Code of Practice for Site Investigation, British Standards Institution (BSI).

2.0 BS 1377 (1990) Methods of Testing of Soils for Civil Engineering Purposes, BSI.

3.0 Eurocode 7, Part 2: Ground Investigation & Testing (EN 1997-2:2007)

4.0 Site Investigation Practice: Assessing BS 5930 (1986), Geological Society Special Publication, No. 2.

Appendix 1 - Trial Pit Records & Photographs

TRIAL PIT RECORD

REPORT NUMBER	24984		
CONTRACT	Galway Bus Connect	**TRIAL PIT NO.**	2023-TP-001
		SHEET	Sheet 1 of 1
LOGGED BY	BC	**CO-ORDINATES**	531,419.84 E 726,085.22 N
		GROUND LEVEL (m)	10.82
DATE STARTED	21/09/2023	**DATE COMPLETED**	21/09/2023
CLIENT	GCC	**EXCAVATION METHOD**	8.5T Z-Axis
ENGINEER	JB Barry		

Scale (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	Topsoil		0.30	10.52						
1.0, 2.0	Grey slightly silty very gravelly SAND with high cobble content & boulders up to 60cm. sand is coarse. Gravel is subrounded to subangular, fine to coarse.		2.50	8.32						
3.0, 4.0	Obstruction - Possible Bedrock End of Trial Pit at 2.50m									

Groundwater Conditions
None encountered

Stability
Poor Stability

General Remarks

TRIAL PIT RECORD

REPORT NUMBER	24984
CONTRACT	Galway Bus Connect
TRIAL PIT NO.	2023-TP-002
SHEET	Sheet 1 of 1
LOGGED BY	BC
CO-ORDINATES	531,691.02 E 725,994.16 N
GROUND LEVEL (m)	14.50
DATE STARTED	27/09/2023
DATE COMPLETED	27/09/2023
CLIENT	GCC
ENGINEER	JB Barry
EXCAVATION METHOD	8.5T Z-Axis

Scale (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	Topsoil		0.20	14.30						
	MADE GROUND soft grey sandy gravelly CLAY with high cobble content. sand is coarse. Gravel is subrounded to subangular, fine to coarse.		0.60	13.90					22	
1.0	Firm grey brown slightly sandy slightly gravelly CLAY with low cobble content. sand is medium. Gravel is subrounded to subangular, fine to coarse.		1.80	12.70						
2.0	Firm to stiff grey slightly sandy slightly gravelly CLAY with moderate cobble content. sand is coarse. Gravel is subrounded to subangular, fine to coarse.		2.00	12.50						
	Obstruction - Possible Bedrock End of Trial Pit at 2.00m									
3.0										
4.0										

Groundwater Conditions
None encountered

Stability
Good Stability

General Remarks

TRIAL PIT RECORD

REPORT NUMBER	24984
CONTRACT	Galway Bus Connect
TRIAL PIT NO.	2023-TP-003
SHEET	Sheet 1 of 1
LOGGED BY	BC
CO-ORDINATES	531,939.72 E 725,884.53 N
GROUND LEVEL (m)	23.45
DATE STARTED	27/09/2023
DATE COMPLETED	27/09/2023
CLIENT	GCC
ENGINEER	JB Barry
EXCAVATION METHOD	8.5T Z-Axis

Scale (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	Topsoil		0.20	23.25						
	MADE GROUND firm brown sandy gravelly CLAY with medium cobble content and brick fragments. sand is medium. Gravel is subrounded to subangular, fine to coarse.		0.90	22.55						
1.0, 2.0	Firm to stiff brown grey sandy gravelly CLAY with high cobble content and boulders up to 30cm. sand is medium. Gravel is subrounded to subangular, fine to coarse.		3.10	20.35						
3.0, 4.0	Obstruction - Possible Bedrock End of Trial Pit at 3.10m									

Groundwater Conditions
None encountered

Stability
Good Stability

General Remarks

TRIAL PIT RECORD

REPORT NUMBER	24984
CONTRACT	Galway Bus Connect
TRIAL PIT NO.	2023-TP-004
SHEET	Sheet 1 of 1
LOGGED BY	BC
CO-ORDINATES	532,157.18 E 725,816.18 N
GROUND LEVEL (m)	20.98
DATE STARTED	27/09/2023
DATE COMPLETED	27/09/2023
CLIENT	GCC
ENGINEER	JB Barry
EXCAVATION METHOD	8.5T Z-Axis

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
Topsoil		0.20	20.78						
MADE GROUND firm brown sandy gravelly CLAY with high cobble content, boulders up to 70cm, metal wires, concrete and building materials. sand is medium. Gravel is subangular to subrounded, fine to coarse.		0.70	20.28					22	
Firm orange brown sandy gravelly CLAY with medium cobble content. sand is medium. Gravel is subrounded to subangular, fine to coarse.		0.90	20.08						
Soft becoming firm grey slightly sandy slightly gravelly CLAY with high cobble content. sand is coarse. Gravel is subrounded to subangular, fine to coarse.		2.60	18.38						
Obstruction - Possible Bedrock End of Trial Pit at 2.60m									

Depth scale: 0.0, 1.0, 2.0, 3.0, 4.0

Groundwater Conditions
None encountered

Stability
Poor Stability

General Remarks

TRIAL PIT RECORD

REPORT NUMBER	24984
CONTRACT	Galway Bus Connect
TRIAL PIT NO.	2023-TP-005
SHEET	Sheet 1 of 1
LOGGED BY	BC
CO-ORDINATES	532,690.11 E 725,681.12 N
GROUND LEVEL (m)	23.83
DATE STARTED	28/09/2023
DATE COMPLETED	28/09/2023
CLIENT	GCC
ENGINEER	JB Barry
EXCAVATION METHOD	8.5T Z-Axis

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
Topsoil		0.20	23.63						
MADE GROUND brown grey sandy gravelly CLAY with high cobble content, plastics, and boulders up to 50cm. sand is coarse. Gravel is subangular to subrounded, fine to coarse.		0.50	23.33						
Firm mottled soft brown sandy slightly gravelly CLAY. Sand is medium. Gravel is subangular to subrounded, fine to coarse.		1.20	22.63						
Soft becoming firm grey slightly sandy gravelly CLAY with high cobble content. sand is coarse. Gravel is subrounded to subangular, fine to coarse.		2.40	21.43						
Obstruction - Possible Bedrock End of Trial Pit at 2.40m									

Depth scale: 0.0, 1.0, 2.0, 3.0, 4.0

Groundwater Conditions
None encountered

Stability
Poor Stability

General Remarks

TRIAL PIT RECORD

REPORT NUMBER	24984
CONTRACT	Galway Bus Connect
TRIAL PIT NO.	2023-TP-006
SHEET	Sheet 1 of 1
LOGGED BY	BC
CO-ORDINATES	532,734.51 E 725,732.57 N
GROUND LEVEL (m)	25.65
DATE STARTED	28/09/2023
DATE COMPLETED	28/09/2023
CLIENT	GCC
ENGINEER	JB Barry
EXCAVATION METHOD	8.5T Z-Axis

Scale (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	Topsoil		0.20	25.45						
	MADE GROUND firm brown sandy gravelly CLAY with high cobble content and plastics. sand is medium. Gravel is subangular to subrounded, fine to coarse.		0.50	25.15						
1.0 2.0	Soft becoming firm grey slightly sandy slightly gravelly CLAY with high cobble content. sand is coarse. Gravel is subrounded to subangular, fine to coarse.		2.80	22.85						
3.0 4.0	Obstruction - Possible Bedrock End of Trial Pit at 2.80m									

Groundwater Conditions
None encountered

Stability
Poor Stability

General Remarks

TRIAL PIT RECORD

REPORT NUMBER	24984		
CONTRACT	Galway Bus Connect	TRIAL PIT NO.	2023-TP-007
		SHEET	Sheet 1 of 1
LOGGED BY	BC	DATE STARTED	20/09/2023
CO-ORDINATES	532,773.71 E 725,620.99 N	DATE COMPLETED	20/09/2023
GROUND LEVEL (m)	18.73	EXCAVATION METHOD	8.5T Z-Axis
CLIENT	GCC		
ENGINEER	JB Barry		

Scale	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	Topsoil		0.30	18.43						
	MADE GROUND firm grey brown sandy slightly gravelly CLAY with low cobble content. sand is medium. Gravel is subangular to subrounded, fine to coarse.		0.60	18.13						
1.0 2.0	Soft becoming firm grey slightly sandy slightly gravelly CLAY with high cobble content. sand is coarse. Gravel is subrounded to subangular, fine to coarse.		2.80	15.93						
3.0 4.0	Obstruction - Possible Bedrock End of Trial Pit at 2.80m									

Groundwater Conditions
None encountered

Stability
Poor Stability

General Remarks

TRIAL PIT RECORD

REPORT NUMBER	24984
CONTRACT	Galway Bus Connect
TRIAL PIT NO.	2023-TP-008
SHEET	Sheet 1 of 1
LOGGED BY	BC
CO-ORDINATES	532,831.22 E 725,659.10 N
GROUND LEVEL (m)	19.53
DATE STARTED	21/09/2023
DATE COMPLETED	21/09/2023
CLIENT	GCC
ENGINEER	JB Barry
EXCAVATION METHOD	8.5T Z-Axis

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
Topsoil		0.30	19.23						
MADE GROUND firm brown sandy gravelly CLAY with medium cobble content and boulders up to 50cm. sand is medium. Gravel is subrounded to subangular, fine to coarse.		0.60	18.93						
Firm to soft grey sandy gravelly SILT with high cobble content and boulders up to 60cm. sand is coarse. Gravel is subrounded to subangular, fine to coarse.		1.80	17.73						
Grey brown clayey slightly gravelly SAND. sand is fine. Gravel is subangular to subrounded, fine to coarse.		2.10	17.43						
Firm to stiff grey slightly sandy gravelly CLAY with high cobble content & boulders up to 50cm. sand is medium. Gravel is subrounded to subangular, fine to coarse.		2.30	17.23						
Obstruction - Possible Bedrock End of Trial Pit at 2.30m									

Depth scale: 0.0, 1.0, 2.0, 3.0, 4.0

Groundwater Conditions
None encountered

Stability
Poor Stability

General Remarks

TRIAL PIT RECORD

REPORT NUMBER	24984
CONTRACT	Galway Bus Connect
TRIAL PIT NO.	2023-TP-009
SHEET	Sheet 1 of 1
LOGGED BY	BC
CO-ORDINATES	533,177.04 E 725,486.60 N
GROUND LEVEL (m)	14.93
DATE STARTED	26/09/2023
DATE COMPLETED	26/09/2023
CLIENT	GCC
ENGINEER	JB Barry
EXCAVATION METHOD	8.5T Z-Axis

Scale	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	Topsoil									
	Firm brown sandy gravelly CLAY with low cobble content. Sand is medium. Gravel is subangular to subrounded, fine to coarse.		0.30	14.63						
	Brown grey clayey sandy GRAVEL with high cobble content and boulders up to 80cm. sand is coarse. Gravel is subrounded to subangular, fine to coarse.		0.80	14.13						
1.0										
	Obstruction - Possible Bedrock End of Trial Pit at 1.60m		1.60	13.33						
2.0										
3.0										
4.0										

Groundwater Conditions
None encountered

Stability
Poor Stability

General Remarks

TRIAL PIT RECORD

REPORT NUMBER	24984
CONTRACT	Galway Bus Connect
TRIAL PIT NO.	2023-TP-010
SHEET	Sheet 1 of 1
LOGGED BY	BC
CO-ORDINATES	533,298.38 E 725,431.13 N
GROUND LEVEL (m)	17.61
DATE STARTED	01/12/2023
DATE COMPLETED	01/12/2023
CLIENT	GCC
ENGINEER	JB Barry
EXCAVATION METHOD	8.5T Z-Axis

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
Topsoil									
Firm to stiff light grey mottled brown sandy gravelly SILT/CLAY with high cobble and boulder content. sand is coarse. Gravel is subrounded to subangular, fine to coarse.		0.30	17.31					62	
Obstruction - Possible Bedrock End of Trial Pit at 1.70m		1.70	15.91						

Depth scale: 0.0, 1.0, 2.0, 3.0, 4.0

Groundwater Conditions
None encountered

Stability
Good Stability

General Remarks

TRIAL PIT RECORD

REPORT NUMBER	24984
CONTRACT	Galway Bus Connect
TRIAL PIT NO.	2023-TP-011
SHEET	Sheet 1 of 1
LOGGED BY	BC
CO-ORDINATES	534,678.26 E 725,523.10 N
GROUND LEVEL (m)	18.64
DATE STARTED	26/09/2023
DATE COMPLETED	26/09/2023
CLIENT	GCC
ENGINEER	JB Barry
EXCAVATION METHOD	8.5T Z-Axis

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
Topsoil									
Firm brown slightly sandy slightly gravelly CLAY with medium cobble content. sand is medium. Gravel is subangular to subrounded, fine to coarse.		0.30	18.34						
Soft becoming firm grey slightly sandy slightly gravelly CLAY with high cobble content and boulders up to 50cm. sand is coarse. Gravel is subrounded to subangular, fine to coarse.		0.80	17.84						
Obstruction - Possible Bedrock End of Trial Pit at 2.40m		2.40	16.24						

Depth scale: 0.0, 1.0, 2.0, 3.0, 4.0

Groundwater Conditions
None encountered

Stability
Poor Stability

General Remarks

TRIAL PIT RECORD

REPORT NUMBER	24984		
CONTRACT	Galway Bus Connect	**TRIAL PIT NO.**	2023-TP-012
		SHEET	Sheet 1 of 1
LOGGED BY	BC	**CO-ORDINATES**	534,792.58 E 725,642.85 N
		GROUND LEVEL (m)	19.25
CLIENT	GCC	**DATE STARTED**	18/09/2023
ENGINEER	JB Barry	**DATE COMPLETED**	18/09/2023
		EXCAVATION METHOD	8.5T Z-Axis

Scale	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	Topsoil		0.30	18.95						
	Soft to firm grey brown sandy gravelly CLAY. sand is medium. Gravel is subangular to subrounded, fine to coarse.		0.60	18.65					26	
	Brownish yellow fine gravelly SAND. Gravel is subangular to subrounded, fine to coarse.		1.10	18.15						
1.0	Obstruction - Possible Bedrock End of Trial Pit at 1.10m									
2.0										
3.0										
4.0										

Groundwater Conditions
None encountered

Stability
Good Stability

General Remarks

TRIAL PIT RECORD

REPORT NUMBER	24984
CONTRACT	Galway Bus Connect
TRIAL PIT NO.	2023-TP-013
SHEET	Sheet 1 of 1
LOGGED BY	BC
CO-ORDINATES	534,950.79 E 725,778.88 N
GROUND LEVEL (m)	26.53
DATE STARTED	22/09/2023
DATE COMPLETED	22/09/2023
CLIENT	GCC
ENGINEER	JB Barry
EXCAVATION METHOD	8.5T Z-Axis

Scale	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	Topsoil									
	Grey brown slightly clayey gravelly SAND with high cobble content. sand is coarse. Gravel is subrounded to subangular, fine to coarse.		0.30	26.23						
1.0	Brown grey slightly clayey gravelly SAND with high cobble content. sand is coarse. Gravel is subangular to subrounded, fine to coarse.		1.20	25.33						
2.0	Obstruction - Possible Bedrock End of Trial Pit at 2.00m		2.00	24.53						
3.0										
4.0										

Groundwater Conditions
None encountered

Stability
Poor stability

General Remarks

2023-TP-01 – 1 of 2

2023-TP-01 – 2 of 2

2023-TP-02 – 1 of 2

2023-TP-02 – 2 of 2

2023-TP-03 – 1 of 1

<u>2023-TP-04 – 1 of 2</u>

<u>2023-TP-04 – 2 of 2</u>

2023-TP-05 – 1 of 2

2023-TP-05 – 2 of 2

2023-TP-06 – 1 of 2

2023-TP-06 – 2 of 2

2023-TP-07 – 1 of 2

2023-TP-07 – 2 of 2

<u>2023-TP-08 – 1 of 2</u>

<u>2023-TP-08 – 2 of 2</u>

2023-TP-09 – 1 of 2

2023-TP-09 – 2 of 2

2023-TP-10 – 1 of 2

2023-TP-10 – 2 of 2

2023-TP-11 – 1 of 2

2023-TP-11 – 2 of 2

2023-TP-12 – 1 of 2

2023-TP-12 – 2 of 2

2023-TP-13 – 1 of 2

2023-TP-13 – 2 of 2

Appendix 2 - Borehole Records & Photographs

SPT Calibration Report

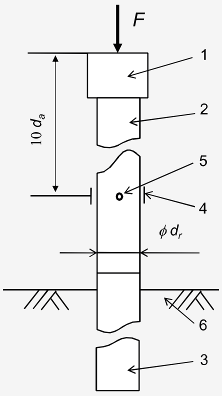
Driller (Rig)	**SPT Calibration Report No. (Hammer ID)**
PA (Cable Percussion)	**S+A 2 Energy Ratio 71.35%**
AK (Rotary – Comacchio 405)	**AR2640 Energy Ratio 61.38%**

SPT Calibration Report

Hammer Energy Measurement Report

Type of Hammer		SPT Hammer
Test No		EQU2023_55
Client		IGSL
Test Depth (m)		9.70
Mass of hammer	m =	63.5kg
Falling height	h =	0.76m
E_{theor} =	$m \times g \times h$ =	473J

Characteristics of the instrumented rod



Key

1 Anvil
2 Part of instrumented rod
3 Drive Rod
4 Strain Gauge
5 Accelerometer
6 Ground

F Force
d_r Diameter of rod

Fig. B.1 and B.2
BS EN ISO 22476-3 : 2005 + A1 : 2011

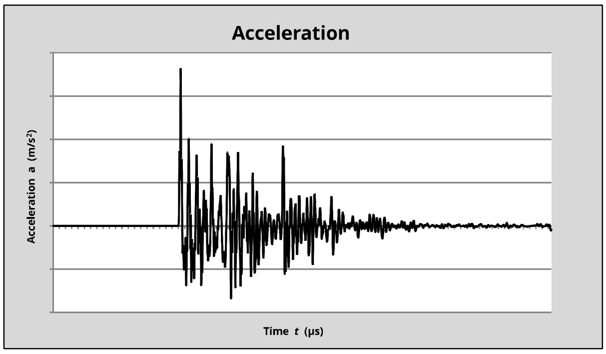
Diameter	d_r =	0.052 m
Length of instrumented rod		0.558 m
Area	A =	11.61 cm²
Modulus	E_a =	206843 MPa

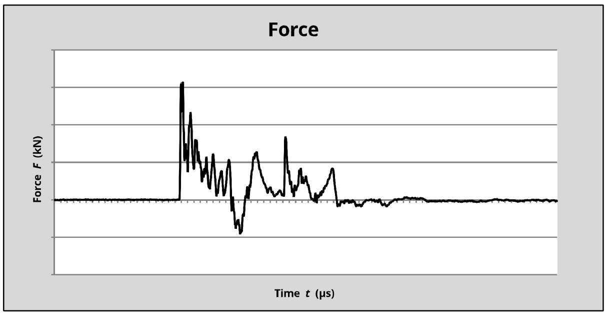
DATE OF TEST	VALID UNTIL	HAMMER ID
06/03/2023	05/03/2024	S+A 2

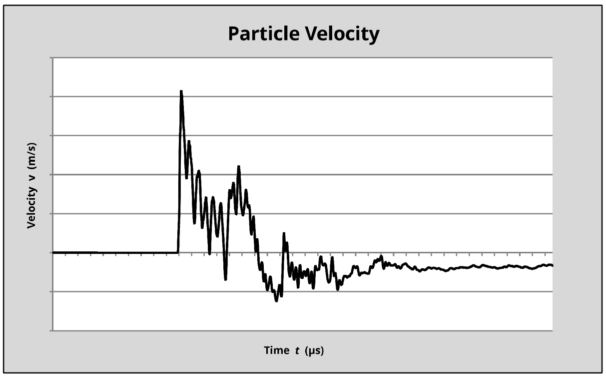
E_{meas} = **0.338** kN-m

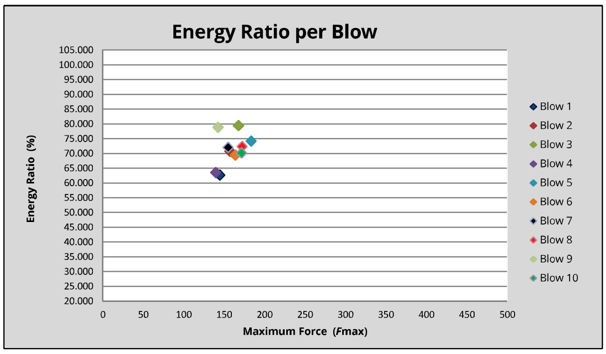
E_{theor} = **0.473** kN-m

Comments









Energy Ratio (Er) = $\frac{E_{meas}}{E_{theor}}$ **71.45%**

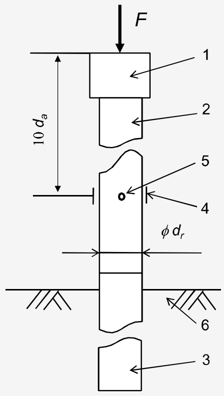
Equipe SPT Analyzer Operator	Certificate prepared by	Certificate checked by	Certificate date
JL	10/03/2023	10/03/2023	10/03/2023

SPT Calibration Report

Hammer Energy Measurement Report

Type of Hammer		SPT Hammer
Test No		EQU2023_53
Client		IGSL
Test Depth (m)		9.70
Mass of hammer	m =	63.5kg
Falling height	h =	0.76m
E_{theor} =	$m \times g \times h$ =	473J

Characteristics of the instrumented rod



Key

1 Anvil
2 Part of instrumented rod
3 Drive Rod
4 Strain Gauge
5 Accelerometer
6 Ground

F Force
d_r Diameter of rod

Fig. B.1 and B.2
BS EN ISO 22476-3 : 2005 + A1 : 2011

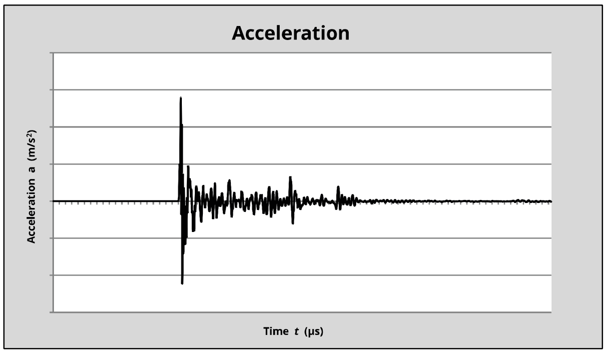
Diameter	d_r =	0.052 m
Length of instrumented rod		0.558 m
Area	A =	11.61 cm²
Modulus	E_a =	206843 MPa

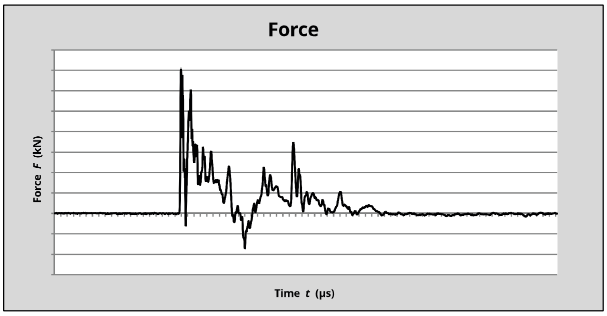
DATE OF TEST	VALID UNTIL	HAMMER ID
06/03/2023	05/03/2024	AR2640

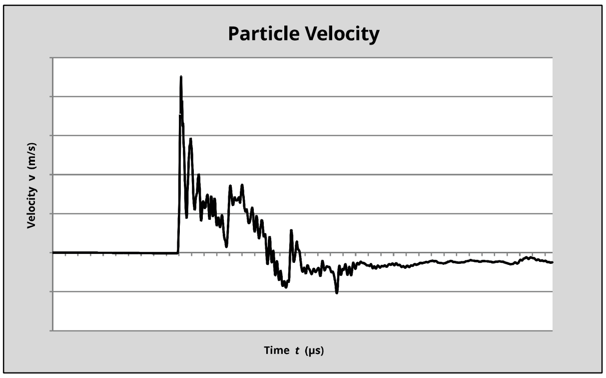
E_{meas} = **0.290** kN-m

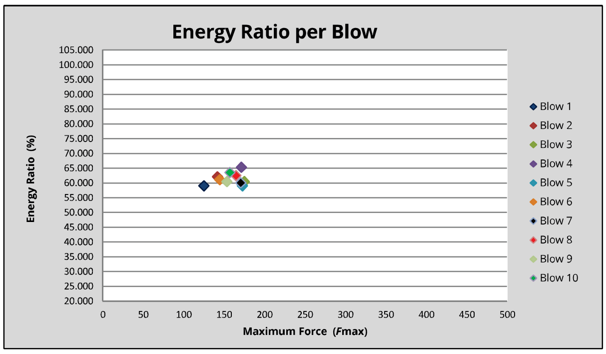
E_{theor} = **0.473** kN-m

Comments









Energy Ratio (Er) = $\frac{E_{meas}}{E_{theor}}$ 61.3[illegible]%

Equipe SPT Analyzer Operator	Certificate prepared by	Certificate checked by	Certificate date
JL	10/03/2023	10/03/2023	10/03/2023

BOREHOLE RECORD

REPORT NUMBER 24984

CONTRACT	Galway BusConnects - Dublin Road Site Investigation	**HOLE NO.**	**2023-BH-001**
		SHEET	Sheet 1 of 1
CO-ORDINATES(_)	531,364 E 726,105 N	**RIG TYPE**	Dando 2000/Commachio 405
GROUND LEVEL (mOD)	9.29	**RC FLUSH MEDIUM**	Air/Mist
CLIENT	galway City Council	**CASING DIAMETER (mm)**	200
ENGINEER	Barry Transportation	**CORE DIAMETER (mm)**	78
		BOREHOLE DEPTH (m)	8.20
DATE COMMENCED	14/09/2023	**DATE COMPLETED**	08/11/2023
BORED BY	P.Allen / Arak	**PROCESSED BY**	IGSL

Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Non-intact Zone	SPT "N" Value	Elevation	Depth (m)	Description
						9.19	0.10	Topsoil
						8.09	1.20	Grey/brown slightly gravelly sandy CLAY with medium cobble content. Gravel is fine to coarse subrounded to angular. Cobbles are subangular to angular
1.50	30	0	0		25/10mm	7.79	1.50	SYMMETRIX DRILLING: No recovery, observed by driller as returns of grey/brown gravelly sandy CLAY with medium cobble content. Obstruction Returns of COBBLE of limestone.
3.00	0	0	0		52/300mm	6.29	3.00	SYMMETRIX DRILLING: No recovery, observed by driller as returns of brown clayey gravelly COBBLES
					68/125mm			
4.80	100	47	19			4.49	4.80	Strong to very strong, thickly to thinly bedded, pale to dark blueish grey/black, fine-grained, LIMESTONE (locally fossiliferous, chert throughout), fresh to locally slightly weathered. Discontinuities are widely to closely spaced, smooth to locally rough, fractures are planar to locally undulose. Apertures are tight to locally moderately open, locally orange/brown clay-filled (at 4.93-4.95m & 8.17-8.20m), locally calcite veined (1-10mm thick). Dips are subhorizontal & 70°.
6.30	100	100	100	949.999999999999				
7.20	100	97	92					
8.20						1.09	8.20	End of Borehole at 8.2 (m)

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (hhmm)	Comments
1.2	1.2	1	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
08-11-23	8.20	4.80	5.40	Water levels recorded 5 mins after end of drilling.

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
08/11/2023	7.50	1.00	7.80	50mm SP

REMARKS

BOREHOLE RECORD

REPORT NUMBER 24984

CONTRACT	Galway BusConnects - Dublin Road Site Investigation	**HOLE NO.**	**2023-BH-001A**
		SHEET	Sheet 1 of 1
CO-ORDINATES(_)	531,364 E 726,105 N	**RIG TYPE**	Dando 2000
GROUND LEVEL (mOD)	9.29	**RC FLUSH MEDIUM**	N/A
		CASING DIAMETER (mm)	200
CLIENT	galway City Council	**CORE DIAMETER (mm)**	N/A
ENGINEER	Barry Transportation	**BOREHOLE DEPTH (m)**	1.40
DATE COMMENCED	21/09/2023	**DATE COMPLETED**	21/09/2023
BORED BY	P.Allen	**PROCESSED BY**	IGSL

Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Sample Ref. Number	Sample Type	Sample Depth (m)	SPT "N" Value	Legend	Elevation	Water	Depth (m)	Description	Standpipe Details
0												9.19		0.10	Topsoil	
								B D	0.50						Grey/brown slightly gravelly sandy CLAY with medium cobble content. Gravel is fine to coarse subrounded to angular. Cobbles are subangular to angular	
1										50/75mm 50/75mm		7.89		1.40	Obstruction End of Borehole at 1.4 (m)	
2																
3																
4																
5																
6																
7																
8																
9																
10																

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (hhmm)	Comments
1.3	1.4	1	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS

IGSL COMBINED BH/RC DUB PORT 24984 FINAL LOGS AGS 3.GPJ IGSL.GDT 2/4/24

BOREHOLE RECORD

REPORT NUMBER 24984

CONTRACT	Galway BusConnects - Dublin Road Site Investigation	**HOLE NO.**	**2023-BH-002**
		SHEET	Sheet 1 of 2
CO-ORDINATES(_)	531,605 E 726,021 N	**RIG TYPE**	Dando 2000/Commachio 405
GROUND LEVEL (mOD)	11.04	**RC FLUSH MEDIUM**	Air/Mist
		CASING DIAMETER (mm)	200
CLIENT	galway City Council	**CORE DIAMETER (mm)**	78
ENGINEER	Barry Transportation	**BOREHOLE DEPTH (m)**	12.70
DATE COMMENCED	22/09/2023	**DATE COMPLETED**	09/11/2023
BORED BY	P.Allen / Arak	**PROCESSED BY**	IGSL

Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Sample Ref. Number	Sample Type	Sample Depth (m)	SPT "N" Value	Legend	Elevation	Water	Depth (m)	Description	Standpipe Details
0												10.94		0.10	MADE GROUND comprised of Tarmacadam	
							209301	D B	0.50			10.54		0.50	MADE GROUND comprised of grey brown clayey sandy GRAVEL	
1							209302	D B	1.20	8/300mm		10.04		1.00	Brown gravelly slightly sandy CLAY	
2							209303	D B	2.00	22/300mm					Stiff grey slightly gravelly slightly sandy CLAY with medium cobble content. Gravel is fine to coarse subrounded to angular. Cobbles are subangular to angular	
3										50/150mm						
										50/75mm		7.64		3.40	SYMMETRIX DRILLING: No recovery, observed by driller as returns of grey gravelly sandy COBBLES Obstruction	
4										56/300mm						
5																
6	6.00									80/95mm		5.04		6.00	Stiff brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of limestone.	
7		100	0	0						67/300mm						
8	7.50	67	0	0												
9	9.00	71	0	0						41/300mm						
10	9.70	100	73	61								1.09		9.95		
	10.70															

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (hhmm)	Comments
3.2	3.4	1	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS 1 hr breaking out Surface and 1 hr reinstating

BOREHOLE RECORD

REPORT NUMBER	24984
CONTRACT	Galway BusConnects - Dublin Road Site Investigation
HOLE NO.	2023-BH-002
SHEET	Sheet 2 of 2
CO-ORDINATES(_)	531,605 E 726,021 N
GROUND LEVEL (mOD)	11.04
RIG TYPE	Dando 2000/Commachio 405
RC FLUSH MEDIUM	Air/Mist
CASING DIAMETER (mm)	200
CORE DIAMETER (mm)	78
BOREHOLE DEPTH (m)	12.70
DATE COMMENCED	22/09/2023
DATE COMPLETED	09/11/2023
CLIENT	galway City Council
ENGINEER	Barry Transportation
BORED BY	P.Allen / Arak
PROCESSED BY	IGSL

Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Sample Ref. Number	Sample Type	Sample Depth (m)	SPT "N" Value	Legend	Elevation	Water	Depth (m)	Description	Standpipe Details
11		100	82	73											Strong to very strong, thickly to thinly bedded, pale to dark blueish grey/black, fine-grained, LIMESTONE (locally fossiliferous, chert throughout), fresh to locally slightly weathered.	
12	11.70	50	95	83												
	12.70											-1.66		12.70	Discontinuities are widely to closely spaced, smooth to locally rough, fractures are planar to locally undulose. Apertures are tight to locally moderately open, locally clay-smeared, locally calcite veined (1-5mm thick). Dips are subhorizontal & 70°. *(continued)*	
13															End of Borehole at 12.7 (m)	
14																
15																
16																
17																
18																
19																
20																
21																

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (hhmm)	Comments

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
09-11-23	12.70	9.70	7.40	Water levels recorded 5 mins after end of drilling.

REMARKS 1 hr breaking out Surface and 1 hr reinstating

BOREHOLE RECORD

REPORT NUMBER: 24984

CONTRACT	Galway BusConnects - Dublin Road Site Investigation	**HOLE NO.**	2023-BH-003
		SHEET	Sheet 1 of 1
CO-ORDINATES(_)	532,067 E 725,844 N	**RIG TYPE**	Dando 2000
GROUND LEVEL (mOD)	22.00	**RC FLUSH MEDIUM**	N/A
		CASING DIAMETER (mm)	200
CLIENT	galway City Council	**CORE DIAMETER (mm)**	N/A
ENGINEER	Barry Transportation	**BOREHOLE DEPTH (m)**	3.00
DATE COMMENCED	14/09/2023	**BORED BY**	P.Allen
DATE COMPLETED	14/09/2023	**PROCESSED BY**	IGSL

Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Sample Ref. Number	Sample Type	Sample Depth (m)	SPT "N" Value	Legend	Elevation	Water	Depth (m)	Description	Standpipe Details
0														0.30	Topsoil	
							204330	D B	0.50			21.70			Very soft/soft brown slightly gravelly sandy CLAY	
1							204331	D B	1.20	5/300mm				1.80		
2							204332	D B	2.00	19/300mm		20.20		3.00	Stiff grey slightly gravelly slightly sandy CLAY with medium cobble content. Gravel is fine to coarse subrounded to angular. Cobbles are subangular to angular	
3										50/75mm		19.00			Obstruction End of Borehole at 3 (m)	
4																
5																
6																
7																
8																
9																
10																

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (hhmm)	Comments
2.9	3	1	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS

BOREHOLE RECORD

REPORT NUMBER: 24984

CONTRACT	Galway BusConnects - Dublin Road Site Investigation	HOLE NO.	2023-BH-004
		SHEET	Sheet 1 of 1
CO-ORDINATES(_)	532,397 E 725,750 N	RIG TYPE	Dando 2000
GROUND LEVEL (mOD)	22.45	RC FLUSH MEDIUM	N/A
		CASING DIAMETER (mm)	200
CLIENT	galway City Council	CORE DIAMETER (mm)	N/A
ENGINEER	Barry Transportation	BOREHOLE DEPTH (m)	0.50
DATE COMMENCED	15/09/2023	DATE COMPLETED	15/09/2023
BORED BY	P.Allen	PROCESSED BY	IGSL

Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Sample Ref. Number	Sample Type	Sample Depth (m)	SPT "N" Value	Legend	Elevation	Water	Depth (m)	Description	Standpipe Details
0												22.05		0.40	Topsoil	
												21.95		0.50	MADE GROUND comprised of concrete	
															Obstruction End of Borehole at 0.5 (m)	

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (hhmm)	Comments
0.5	0.5	1	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS

BOREHOLE RECORD

REPORT NUMBER 24984

CONTRACT	Galway BusConnects - Dublin Road Site Investigation	**HOLE NO.**	**2023-BH-004A**
		SHEET	Sheet 1 of 1
CO-ORDINATES(_)	532,397 E 725,750 N	**RIG TYPE**	Dando 2000
GROUND LEVEL (mOD)	22.45	**RC FLUSH MEDIUM**	N/A
		CASING DIAMETER (mm)	200
CLIENT	galway City Council	**CORE DIAMETER (mm)**	N/A
ENGINEER	Barry Transportation	**BOREHOLE DEPTH (m)**	3.70
DATE COMMENCED	15/09/2023	**DATE COMPLETED**	15/09/2023
BORED BY	P.Allen	**PROCESSED BY**	IGSL

Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Sample Ref. Number	Sample Type	Sample Depth (m)	SPT "N" Value	Legend	Elevation	Water	Depth (m)	Description	Standpipe Details
0														0.30	Topsoil	
												22.15			Firm brown gravelly slightly sandy SILT with low cobble content. Gravel is fine to coarse subrounded to angular. Cobbles are subangular to angular	
							204333	D B	0.50							
1							204334	D B	1.20	8/300mm						
2							204335	D B	2.00	11/300mm		20.45		2.00	Stiff grey gravelly slightly sandy CLAY with medium cobble content. Gravel is fine to coarse subrounded to angular. Cobbles are subangular to angular	
3							204336	D B	3.00	50/300mm						
										50/75mm		18.75		3.70	Obstruction End of Borehole at 3.7 (m)	
4																
5																
6																
7																
8																
9																
10																

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (hhmm)	Comments
1.8	1.9	1	
3.6	3.7	1	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS

BOREHOLE RECORD

REPORT NUMBER	24984		
CONTRACT	Galway BusConnects - Dublin Road Site Investigation	HOLE NO.	2023-BH-005
		SHEET	Sheet 1 of 1
CO-ORDINATES(_)	532,741 E 725,668 N	RIG TYPE	Dando 2000
GROUND LEVEL (mOD)	22.52	RC FLUSH MEDIUM	N/A
		CASING DIAMETER (mm)	200
CLIENT	galway City Council	CORE DIAMETER (mm)	N/A
ENGINEER	Barry Transportation	BOREHOLE DEPTH (m)	0.60
DATE COMMENCED	21/09/2023	DATE COMPLETED	02/11/2023
BORED BY	P.Allen	PROCESSED BY	IGSL

Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Sample Ref. Number	Sample Type	Sample Depth (m)	SPT "N" Value	Legend	Elevation	Water	Depth (m)	Description	Standpipe Details
0															Topsoil	
												21.92		0.60	Obstruction - Concrete End of Borehole at 0.6 (m)	
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (hhmm)	Comments
0.6	0.6	1	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS Obstruction encountered . Moved to 2023-BH-005A and attempted rebore .

BOREHOLE RECORD

REPORT NUMBER 24984

CONTRACT	Galway BusConnects - Dublin Road Site Investigation	**HOLE NO.**	**2023-BH-005A**
		SHEET	Sheet 1 of 1
CO-ORDINATES(_)	532,745 E 725,672 N	**RIG TYPE**	Dando 2000
GROUND LEVEL (mOD)	22.76	**RC FLUSH MEDIUM**	N/A
		CASING DIAMETER (mm)	200
CLIENT	galway City Council	**CORE DIAMETER (mm)**	N/A
ENGINEER	Barry Transportation	**BOREHOLE DEPTH (m)**	0.50
DATE COMMENCED	21/09/2023	**DATE COMPLETED**	21/09/2023
BORED BY	P.Allen	**PROCESSED BY**	IGSL

Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Sample Ref. Number	Sample Type	Sample Depth (m)	SPT "N" Value	Legend	Elevation	Water	Depth (m)	Description	Standpipe Details
0														0.50	Topsoil	
												22.26			Obstruction - Concrete End of Borehole at 0.5 (m)	

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (hhmm)	Comments
0.5	0.5	1	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS Obstruction encountered . Moved to 2023-BH-005B and attempted rebore .

BOREHOLE RECORD

REPORT NUMBER: 24984

CONTRACT	Galway BusConnects - Dublin Road Site Investigation	HOLE NO.	2023-BH-005B
		SHEET	Sheet 1 of 1
CO-ORDINATES(_)	532,711 E 725,708 N	RIG TYPE	Dando 2000/Commachio 405
GROUND LEVEL (mOD)	25.08	RC FLUSH MEDIUM	Air/Mist
		CASING DIAMETER (mm)	200
CLIENT	galway City Council	CORE DIAMETER (mm)	78
ENGINEER	Barry Transportation	BOREHOLE DEPTH (m)	8.00
DATE COMMENCED	08/12/2023	DATE COMPLETED	09/12/2023
BORED BY	P.Allen / Arak	PROCESSED BY	IGSL

Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Sample Ref. Number	Sample Type	Sample Depth (m)	SPT "N" Value	Elevation	Depth (m)	Description
									0.30	TOPSOIL
				AA209880	B	0.50		24.78		Grey sandy gravelly CLAY with low cobble content. Gravel is fine to coarse subrounded to angular. Cobbles are subangular to angular
				AA209881	B	1.20	6/300mm 10/300mm			
				AA209882	B	2.00	18/300mm			
				AA209883	B	3.00	60/115mm			
3.30	50	0	0	AA209884	B	4.00	44/300mm			
4.50	27	0	0				50/30mm			
				AA209885	B	5.00	40/225mm		6.00	
6.00	80	0	0				25/10mm	19.08	6.50	Returns of brown grey clayey sandy GRAVEL, probable sandy gravelly CLAY - Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of limestone. Obstruction
6.50	100	93	75					18.58	8.00	Strong to very strong, medium to thinly bedded, pale to dark blueish grey/black, fine-grained, LIMESTONE (locally fossiliferous, chert throughout), fresh to locally slightly weathered. Discontinuities are medium to closely spaced, smooth to locally rough, fractures are planar to locally undulose. Apertures are tight to locally moderately open, locally orange/brown clay-filled (at 6.73-6.75m), locally calcite veined (1-5mm thick). Dips are subhorizontal & 15°.
8.00								17.08		End of Borehole at 8 (m)

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (hhmm)	Comments
5.7	6	1	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
02-11-23	8.00	6.50	7.60	Water levels recorded 5 mins after end of drilling.

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS

BOREHOLE RECORD

REPORT NUMBER 24984

CONTRACT	Galway BusConnects - Dublin Road Site Investigation
HOLE NO.	**2023-BH-006**
SHEET	Sheet 1 of 1
CO-ORDINATES(_)	532,958 E 725,627 N
GROUND LEVEL (mOD)	16.59
RIG TYPE	Dando 2000/Commachio 405
RC FLUSH MEDIUM	Air/Mist
CASING DIAMETER (mm)	200
CORE DIAMETER (mm)	78
BOREHOLE DEPTH (m)	8.00
DATE COMMENCED	20/09/2023
DATE COMPLETED	07/11/2023
CLIENT	galway City Council
ENGINEER	Barry Transportation
BORED BY	P.Allen / Arak
PROCESSED BY	IGSL

Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Sample Ref. Number	Sample Type	Sample Depth (m)	SPT "N" Value	Elevation	Depth (m)	Description
									0.30	Topsoil
				204345	D B	0.50		16.29	1.00	Brown slightly gravelly slightly sandy CLAY
				204346	D B	1.20	6/300mm	15.59		Dense grey clayey sandy GRAVEL with medium cobble content. Gravel is fine to coarse subrounded to angular. Cobbles are subangular to angular
				204347	D B	2.00	24/300mm			
				204348	D B	3.00	50/150mm		3.50	
							50/75mm	13.09	3.80	SYMMETRIX DRILLING: No recovery, observed by driller as returns of grey gravelly sandy CLAY with medium cobble content. Obstruction
3.80	100	87	75					12.79		Strong to very strong, thickly to thinly bedded, pale to dark blueish grey/black, fine-grained, LIMESTONE (locally fossiliferous, chert throughout), fresh to locally slightly weathered.
5.30	100	96	85							Discontinuities are widely to closely spaced, smooth to locally rough, fractures are planar to locally undulose. Apertures are tight to locally moderately open, locally clay-smeared, locally calcite veined (1-10mm thick). Dips are subhorizontal & 70°.
6.80	100	100	93					8.59	8.00	
8.00										End of Borehole at 8 (m)

Fracture Spacing Log (mm)

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (hhmm)	Comments
3.3	3.5	1	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
07-11-23	8.00	3.80	5.10	Water levels recorded 5 mins after end of drilling.

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
07/11/2023	7.50	1.00	7.70	50mm SP

REMARKS

BOREHOLE RECORD

REPORT NUMBER: 24984

CONTRACT	Galway BusConnects - Dublin Road Site Investigation	HOLE NO.	2023-BH-007
		SHEET	Sheet 1 of 2
CO-ORDINATES(_)	533,755 E 725,316 N	RIG TYPE	Dando 2000/Commachio 405
GROUND LEVEL (mOD)	20.48	RC FLUSH MEDIUM	Air/Mist
		CASING DIAMETER (mm)	200
CLIENT	galway City Council	CORE DIAMETER (mm)	78
ENGINEER	Barry Transportation	BOREHOLE DEPTH (m)	14.20
DATE COMMENCED	09/12/2023	DATE COMPLETED	06/11/2023
BORED BY	P.Allen / Arak	PROCESSED BY	IGSL

Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%
0 – 1.50	0	0	0
1.50 – 3.00	0	0	0
3.00 – 4.50	0	0	0
4.50 – 6.00	0	0	0
6.00 – 7.50	0	0	0
7.50 – 8.00	0	0	0

Sample Ref. Number	Sample Type	Sample Depth (m)	SPT "N" Value
AA209386	B	0.50	
AA209387	B	1.00	4/300mm
AA209388	B	2.00	7/300mm
AA209389	B	3.00	27/225mm
AA209390	B	4.00	23/300mm
AA209391	B	5.00	22/300mm
AA209392	B	6.00	24/300mm
AA209393	B	7.00	50/150mm
			66/300mm

Elevation	Depth (m)	Description
		TOPSOIL
20.08	0.40	Grey sandy gravelly CLAY with low cobble content. Gravel is fine to coarse subrounded to angular. Cobbles are subangular to angular
12.48	8.00	SYMMETRIX DRILLING - No recovery, observed by driller as returns of cobbly CLAY Obstruction

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (hhmm)	Comments
3.9	4	1	
7.6	7.8	1	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS

BOREHOLE RECORD

REPORT NUMBER	24984

CONTRACT	Galway BusConnects - Dublin Road Site Investigation	**HOLE NO.**	**2023-BH-007**
		SHEET	Sheet 2 of 2
CO-ORDINATES(_)	533,755 E 725,316 N	**RIG TYPE**	Dando 2000/Commachio 405
GROUND LEVEL (mOD)	20.48	**RC FLUSH MEDIUM**	Air/Mist
		CASING DIAMETER (mm)	200
CLIENT	galway City Council	**CORE DIAMETER (mm)**	78
ENGINEER	Barry Transportation	**BOREHOLE DEPTH (m)**	14.20
DATE COMMENCED	09/12/2023	**BORED BY**	P.Allen / Arak
DATE COMPLETED	06/11/2023	**PROCESSED BY**	IGSL

Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Sample Ref. Number	Sample Type	Sample Depth (m)	SPT "N" Value	Legend	Elevation	Water	Depth (m)	Description	Standpipe Details
11	11.20	100	90	84	580							9.28		11.20	Strong to very strong, thickly to thinly bedded, pale to dark blueish grey/black, fine-grained, LIMESTONE (locally fossiliferous, chert throughout), fresh to locally slightly weathered. Large, orange/brown clay-filled fracture at 13.38-13.76m - possible infilled Karst feature/cavity Discontinuities are widely to closely spaced, smooth to locally rough, fractures are planar to locally undulose. Apertures are tight to locally moderately open, locally orange/brown clay-filled (at 13.38-13.76m), locally calcite veined (1-5mm thick). Dips are subhorizontal & 30°.	
12																
13	12.70	100	71	61												
14	14.20											6.28		14.20	End of Borehole at 14.2 (m)	
15																
16																
17																
18																
19																
20																
21																

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (hhmm)	Comments

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
06-11-23	14.20	11.20	12.40	Water levels recorded 5 mins after end of drilling.

REMARKS

BOREHOLE RECORD

REPORT NUMBER 24984

CONTRACT	Galway BusConnects - Dublin Road Site Investigation	HOLE NO.	2023-BH-008
		SHEET	Sheet 1 of 1
CO-ORDINATES(_)	534,318 E 725,442 N	RIG TYPE	Commachio 405
GROUND LEVEL (mOD)	20.99	RC FLUSH MEDIUM	Air/Mist
		CASING DIAMETER (mm)	200
CLIENT	galway City Council	CORE DIAMETER (mm)	78
ENGINEER	Barry Transportation	BOREHOLE DEPTH (m)	8.00
DATE COMMENCED	01/11/2023	DATE COMPLETED	01/11/2023
BORED BY	Arak	PROCESSED BY	IGSL

Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	SPT "N" Value	Elevation	Depth (m)	Description
								SYMMETRIX DRILLING: No recovery, observed by driller as returns of brown clayey gravelly COBBLES
					20/300mm	19.49	1.50	SYMMETRIX DRILLING: No recovery, observed by driller as returns of brown clayey GRAVEL
2.00	100	85	77	550		18.99	2.00	Strong to very strong, thickly to thinly bedded, pale to dark blueish grey/black, fine-grained, LIMESTONE (locally fossiliferous, chert throughout), fresh to locally slightly weathered. Discontinuities are widely to closely spaced, smooth to locally rough, fractures are planar to locally undulose. Apertures are tight to locally moderately open, locally clay/gravel-filled (at 2.16-2.18m, 3.23-3.39m & 6.4-6.48m), locally calcite veined (1-10mm thick). Dips are subhorizontal & 70°.
3.50	100	69	43					
5.00	100	55	46					
6.50	100	91	81	1120				
8.00						12.99	8.00	End of Borehole at 8 (m)

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (hhmm)	Comments

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
01-11-23	8.00	2.00	7.40	Water levels recorded 5 mins after end of drilling.

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS

BOREHOLE RECORD

REPORT NUMBER 24984

CONTRACT	Galway BusConnects - Dublin Road Site Investigation	**HOLE NO.**	**2023-BH-009**
		SHEET	Sheet 1 of 1
CO-ORDINATES(_)	534,539 E 725,514 N	**RIG TYPE**	Dando 2000/Commachio 405
GROUND LEVEL (mOD)	17.42	**RC FLUSH MEDIUM**	Air/Mist
		CASING DIAMETER (mm)	200
CLIENT	galway City Council	**CORE DIAMETER (mm)**	78
ENGINEER	Barry Transportation	**BOREHOLE DEPTH (m)**	8.00
DATE COMMENCED	18/09/2023	**DATE COMPLETED**	26/10/2023
BORED BY	P.Allen / Arak	**PROCESSED BY**	IGSL

Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Sample Ref. Number	Sample Type	Sample Depth (m)	SPT "N" Value	Elevation	Depth (m)	Description
0					204338	D B	0.20			0.20	Topsoil
									17.22	0.70	Brown sandy CLAY with medium cobble content. Cobbles are subangular to angular
								50/75mm	16.72	1.40	SYMMETRIX DRILLING: No recovery, observed by driller as returns of brown sandy CLAY with medium cobble content
	1.40							25/10mm	16.02		Obstruction
2		67	31	21							Weak to very strong where competent, structureless to locally thinly bedded , pale to dark blueish grey/black, fine-grained, LIMESTONE (locally fossiliferous, chert throughout), moderately to locally slightly weathered. Core predominately non-intact Discontinuities are closely spaced, smooth to rough, fractures are planar to irregular. Apertures are moderately open to open, locally clay/gravel-filled (at 6.96-7.09m, 7.63-7.71m & 7.76-8.00mm), locally calcite veined (1-10mm thick). Dips are irregular.
3	2.90							25/20mm			
4		67	11	0							
	4.40							25/30mm			
5		67	7	7							
6	5.90							25/20mm			
7		100	31	14							
	7.40	100	35	0				25/20mm			
8	8.00								9.42	8.00	End of Borehole at 8 (m)

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (hhmm)	Comments
0.7	0.7	1	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS

BOREHOLE RECORD

REPORT NUMBER: 24984

CONTRACT	Galway BusConnects - Dublin Road Site Investigation	HOLE NO.	2023-BH-010
		SHEET	Sheet 1 of 1
CO-ORDINATES(_)	534,889 E 725,732 N	RIG TYPE	Dando 2000/Commachio 405
GROUND LEVEL (mOD)	23.41	RC FLUSH MEDIUM	Air/Mist
		CASING DIAMETER (mm)	200
CLIENT	galway City Council	CORE DIAMETER (mm)	78
ENGINEER	Barry Transportation	BOREHOLE DEPTH (m)	8.00
DATE COMMENCED	19/09/2023	DATE COMPLETED	31/10/2023
BORED BY	P.Allen / Arak	PROCESSED BY	IGSL

Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Sample Ref. Number	Sample Type	Sample Depth (m)	SPT "N" Value	Legend	Elevation	Water	Depth (m)	Description	Standpipe Details
0												23.21		0.20	Topsoil	
							204339	D B	0.50						Dense brown silty sandy GRAVEL with occasional cobbles. Gravel is fine to coarse subrounded to angular. Cobbles are subangular	
1							204440	D B	1.20	26/300mm						
2							204541	D B	2.00	50/150mm						
3							204642	D B	3.00	25/75mm		19.71		3.70		
4							204743	D B	4.00	12/300mm					Firm grey slightly gravelly slightly sandy SILT with medium cobble content. Gravel is fine to coarse subrounded to angular. Cobbles are subangular to angular	
5							204844	D B	5.00	11/300mm		17.41		6.00		
6	6.00	75	12	0						50/75mm					Weak, structureless to very locally thinly bedded , pale to dark blueish grey/black, fine-grained, LIMESTONE (locally fossiliferous, chert throughout), moderately weathered. Core predominately non-intact Discontinuities are closely spaced, rough, fractures are irregular. Apertures are open, commonly clay/gravel-filled. Dips are irregular.	
7	7.00	70	16	0								15.41		8.00		
8	8.00														Obstruction End of Borehole at 8 (m)	
9																
10																

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (hhmm)	Comments
2.1	2.3	1	
5.8	6	1	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
31/10/2023	7.00	1.50	7.30	50mm SP

REMARKS Soft Ground, Excvataor requried to aid access to site - E/O 4hrs Set Up

BOREHOLE RECORD

REPORT NUMBER: 24984

CONTRACT	Galway BusConnects - Dublin Road Site Investigation	**HOLE NO.**	2023-RC-007
		SHEET	Sheet 1 of 1
CO-ORDINATES(_)	533,756 E 725,317 N	**RIG TYPE**	Commachio 405
GROUND LEVEL (mOD)	20.49	**RC FLUSH MEDIUM**	Air
		CASING DIAMETER (mm)	200
CLIENT	galway City Council	**CORE DIAMETER (mm)**	N/A
ENGINEER	Barry Transportation	**BOREHOLE DEPTH (m)**	8.00
DATE COMMENCED	03/11/2023	**BORED BY**	Arak
DATE COMPLETED	03/11/2023	**PROCESSED BY**	IGSL

Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Sample Ref. Number	Sample Type	Sample Depth (m)	SPT "N" Value	Legend	Elevation	Water	Depth (m)	Description	Standpipe Details
0															SYMMETRIX DRILLING: No recovery, observed by driller as returns of brown clayey gravelly COBBLES	
1.5										33/300mm		18.99		1.50	SYMMETRIX DRILLING: No recovery, observed by driller as returns of brown gravelly cobbly CLAY	
3.0										53/300mm		17.49		3.00	SYMMETRIX DRILLING: No recovery, observed by driller as returns of brown clayey gravelly COBBLES	
4.5										36/300mm		15.99		4.50	SYMMETRIX DRILLING: No recovery, observed by driller as returns of sandy GRAVEL	
6.0										19/300mm		14.49		6.00	SYMMETRIX DRILLING: No recovery, observed by driller as returns of sandy cobbly GRAVEL	
7.5										28/300mm						
8.0										24/300mm		12.49		8.00	End of Borehole at 8 (m)	

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (hhmm)	Comments

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

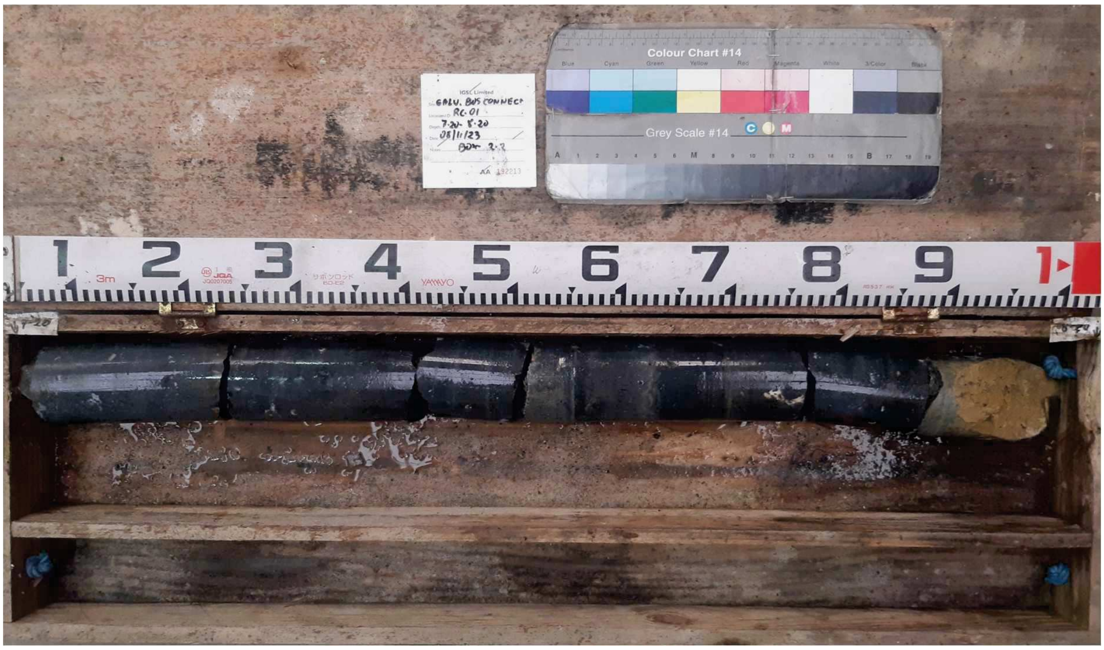
INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS

2023-BH-001 Box 1 of 2 – 1.50-7.20m

2023-BH-001 Box 2 of 2 – 7.20-8.20m



2023-BH-002 Box 1 of 2 – 6.00-9.70m

2023-BH-002 Box 2 of 2 – 9.70-12.70m

2023-BH-005B Box 1 of 1 – 3.00-8.00m

2023-BH-006 Box 1 of 2 – 3.80-6.80m

2023-BH-006 Box 2 of 2 – 6.80-8.00m

2023-BH-007A Box 1 of 1 – 11.20-14.20m

2023-BH-008 Box 1 of 2 – 2.00-5.00m

2023-BH-008 Box 2 of 2 – 5.00-8.00m

2023-BH-009 Box 1 of 2 – 1.40-5.90m

2023-BH-009 Box 2 of 2 – 5.90-8.00m

2023-BH-010 Box 1 of 1 – 6.00-8.00m

Appendix 3 - Window Sample Logs

WINDOW SAMPLE RECORD

REPORT NUMBER	24984
CONTRACT	Galway Bus Connect
PROBE NO.	2023-WS-001
SHEET	Sheet 1 of 1
CO-ORDINATES	531,501.20 E 726,031.12 N
GROUND LEVEL (mOD)	10.41
DATE COMMENCED	31/10/2023
DATE COMPLETED	31/10/2023
CLIENT	JB Barry
ENGINEER	GCC
SAMPLED BY	IGSL
LOGGED BY	BC

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	Topsoil		0.30	10.11						
	Loose brown clayey very gravelly SAND with cobbles. Sand is medium to coarse. Gravel is subrounded to subangular, fine to coarse.		0.70	9.71						
	Firm grey brown sandy gravelly CLAY with cobbles. Sand is medium to coarse. Gravel is subrounded to subangular, fine to coarse.		1.00	9.41		0.00-1.00	50			
1.0	Stiff to very stiff grey brown sandy gravelly CLAY with cobbles. Sand is medium to coarse. Gravel is subrounded to subangular, fine to coarse.		1.30	9.11		1.00-1.30	66			
	Final Depth 1.30m									
2.0										
3.0										
4.0										
5.0										

General Remarks

Installations

WINDOW SAMPLE RECORD

REPORT NUMBER	24984
CONTRACT	Galway Bus Connect
PROBE NO.	2023-WS-002
SHEET	Sheet 1 of 1
CO-ORDINATES	531,755.28 E 725,965.92 N
GROUND LEVEL (mOD)	17.23
DATE COMMENCED	31/10/2023
DATE COMPLETED	31/10/2023
CLIENT	JB Barry
ENGINEER	GCC
SAMPLED BY	IGSL
LOGGED BY	BC

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	MADE GROUND Hardcore									
	Soft grey brown slightly sandy occasionally gravelly CLAY with cobbles. Sand is medium to coarse. Gravel is subrounded to subangular, fine to coarse.		0.25	16.98		0.00-1.00	70			
1.0	Firm grey brown slightly sandy gravelly CLAY with cobbles. Sand is medium to coarse. Gravel is subrounded to subangular, fine to coarse.		1.20	16.03						
	Very stiff grey brown progressing to brown grey slightly sandy gravelly CLAY with cobbles. Sand is medium to coarse. Gravel is subrounded to subangular, fine to coarse.		1.50	15.73		1.00-2.00	80			
2.0	Final Depth 2.00m		2.00	15.23						
3.0										
4.0										
5.0										

General Remarks
Standpipe installed at 2023-WS-002 with gravels, bentonite and manhole cover concreted in.

Installations

WINDOW SAMPLE RECORD

REPORT NUMBER 24984

CONTRACT	Galway Bus Connect	**PROBE NO.**	**2023-WS-003**
		SHEET	Sheet 1 of 1
CO-ORDINATES	532,248.94 E 725,781.40 N	**DATE COMMENCED**	31/10/2023
GROUND LEVEL (mOD)	20.16	**DATE COMPLETED**	31/10/2023
CLIENT	JB Barry	**SAMPLED BY**	IGSL
ENGINEER	GCC	**LOGGED BY**	BC

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	MADE GROUND Firm black brown sandy gravelly CLAY Sand is coarse. Gravel is subrounded to subangular, fine to coarse.		0.55	19.61						
	Very soft grey brown slightly sandy occasionally gravelly CLAY. Sand is medium. Gravel is subrounded to subangular, fine to coarse.		1.40	18.76		0.00-1.00	90			
1.0	Soft brown grey slightly sandy occasionally gravelly CLAY. Sand is medium to coarse. Gravel is subrounded to subangular, fine to coarse.		1.90	18.26						
2.0	Firm brown grey slightly sandy moderately gravelly CLAY. Sand is medium to coarse. Gravel is subrounded to subangular, fine to coarse.		2.40	17.76		1.00-2.00	60			
	Stiff brown grey slightly sandy moderately gravelly CLAY. Sand is medium to coarse. Gravel is subrounded to subangular, fine to coarse.		2.90	17.26						
3.0	Very stiff brown grey slightly sandy moderately gravelly CLAY. Sand is medium to coarse. Gravel is subrounded to subangular, fine to coarse.		3.00	17.16		2.00-3.00	100			
	Final Depth 3.00m									
4.0										
5.0										

General Remarks

Installations

	WINDOW SAMPLE RECORD	REPORT NUMBER 24984

CONTRACT	Galway Bus Connect	**PROBE NO.**	**2023-WS-004**
		SHEET	Sheet 1 of 1
CO-ORDINATES	532,502.50 E 725,715.38 N	**DATE COMMENCED**	01/11/2023
GROUND LEVEL (mOD)	22.97	**DATE COMPLETED**	01/11/2023
CLIENT	JB Barry	**SAMPLED BY**	IGSL
ENGINEER	GCC	**LOGGED BY**	BC

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	Topsoil		0.30	22.67						
	MADE GROUND Stiff grey brown slightly sandy gravelly CLAY with cobbles. Sand is medium. Gravel is subrounded to subangular, fine to coarse.		0.70	22.27						
1.0	MADE GROUND Very stiff grey brown slightly sandy gravelly SILT with cobbles. Sand is medium. Gravel is subrounded to subangular, fine to coarse.		1.30	21.67		0.00-1.00	95			
	Soft brown grey slightly sandy moderately gravelly SILT. Sand is medium to coarse. Gravel is subrounded to subangular, fine to coarse.		1.80	21.17						
2.0	Firm brown grey slightly sandy moderately gravelly SILT. Sand is medium to coarse. Gravel is subrounded to subangular, fine to coarse.		2.40	20.57		1.00-2.00	90			
	Stiff to very stiff brown grey slightly sandy moderately gravelly CLAY. Sand is medium to coarse. Gravel is subrounded to subangular, fine to coarse.		2.70	20.27		2.00-2.70	45			
	Final Depth 2.70m									
3.0										
4.0										
5.0										

General Remarks

Installations

WINDOW SAMPLE RECORD

IGSL

REPORT NUMBER	24984
CONTRACT	Galway Bus Connect
PROBE NO.	2023-WS-005
SHEET	Sheet 1 of 1
CO-ORDINATES	532,569.52 E 725,701.54 N
GROUND LEVEL (mOD)	23.43
DATE COMMENCED	01/11/2023
DATE COMPLETED	01/11/2023
CLIENT	JB Barry
ENGINEER	GCC
SAMPLED BY	IGSL
LOGGED BY	BC

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	Topsoil		0.20	23.23						
	MADE GROUND Brown grey sandy clayey GRAVEL with cobble. Sand is medium to coarse. Gravel is subrounded to subangular, fine to coarse.					0.00-1.00	65			
1.0			1.30	22.13		1.00-1.30	100			
	Final Depth 1.30m									
2.0										
3.0										
4.0										
5.0										

General Remarks
2023-WS-005 Refused at 1.3 possibly due to tree roots. Unable to redrill due to services in area.

Installations

IGSL WS LOG 24984 FINAL LOGS AGS 3.GPJ IGSL.GDT 2/4/24

WINDOW SAMPLE RECORD

REPORT NUMBER 24984

CONTRACT	Galway Bus Connect	**PROBE NO.**	**2023-WS-006**
		SHEET	Sheet 1 of 1
CO-ORDINATES	532,569.52 E 725,701.57 N	**DATE COMMENCED**	01/11/2023
GROUND LEVEL (mOD)	23.44	**DATE COMPLETED**	01/11/2023
CLIENT	JB Barry	**SAMPLED BY**	IGSL
ENGINEER	GCC	**LOGGED BY**	BC

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
Topsoil		0.30	23.14						
Very soft brown grey slightly sandy occasionally gravelly SILT. Sand is medium. Gravel is subrounded to subangular, fine to coarse.		1.50	21.94		0.00-1.00	70			
Soft light brown grey slightly sandy occasionally gravelly silty CLAY. Sand is medium. Gravel is subrounded to subangular, fine to coarse.		2.10	21.34		1.00-2.00	100			
Firm light brown grey slightly sandy gravelly CLAY. Sand is medium. Gravel is subrounded to subangular, fine to coarse.		2.40	21.04						
Very stiff light brown grey slightly sandy gravelly CLAY. Sand is medium. Gravel is subrounded to subangular, fine to coarse.		2.70	20.74		2.00-2.70	90			
Final Depth 2.70m									

Depth scale (m): 0.0, 1.0, 2.0, 3.0, 4.0, 5.0

General Remarks

Installations

WINDOW SAMPLE RECORD

REPORT NUMBER	24984
CONTRACT	Galway Bus Connect
PROBE NO.	2023-WS-007
SHEET	Sheet 1 of 1
CO-ORDINATES	533,580.37 E 725,313.62 N
GROUND LEVEL (mOD)	20.94
DATE COMMENCED	01/11/2023
DATE COMPLETED	01/11/2023
CLIENT	JB Barry
ENGINEER	GCC
SAMPLED BY	IGSL
LOGGED BY	BC

Geotechnical Description	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
MADE GROUND Hardcore	0.50	20.44						
Very soft grey brown sandy occasionally gravelly SILT. Sand is medium to coarse. Gravel is subrounded to subangular, fine to coarse.	1.80	19.14		0.00-1.00	50			
Firm brown grey sandy gravelly SILT. Sand is coarse. Gravel is subrounded to subangular, fine to coarse.	1.90	19.04		1.00-2.00	65			
Very soft brown grey sandy occasionally gravelly SILT. Sand is coarse. Gravel is subrounded to subangular, fine to coarse.	2.10	18.84						
Stiff brown grey sandy gravelly CLAY. Sand is coarse. Gravel is subrounded to subangular, fine to coarse.	2.20	18.74						
Firm brown grey sandy gravelly silty CLAY. Sand is coarse. Gravel is subrounded to subangular, fine to coarse.	2.70	18.24						
Very stiff brown grey sandy gravelly CLAY. Sand is coarse. Gravel is subrounded to subangular, fine to coarse.	3.00	17.94		2.00-3.00	30			
Final Depth 3.00m								

Depth scale (m): 0.0, 1.0, 2.0, 3.0, 4.0, 5.0

General Remarks

Installations

2023-WS-001 – 1 of 1

2023-WS-002 – 1 of 1

2023-WS-003 – 1 of 1

2023-WS-004 – 1 of 1

2023-WS-005 – 1 of 1

2023-WS-006 – 1 of 1

2023-WS-007 – 1 of 1

Appendix 4 - Dynamic Probe Records

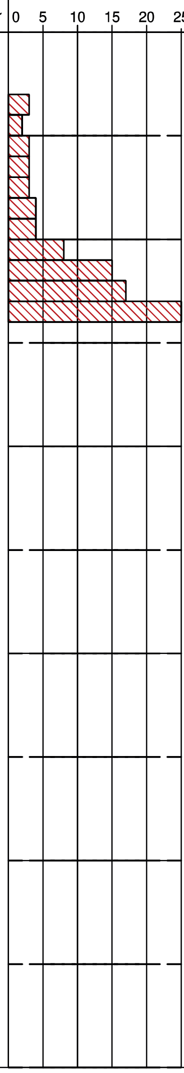
DYNAMIC PROBE RECORD

REPORT NUMBER	24984
CONTRACT	Galway BusConnects - Dublin Road Site Investigation
PROBE NO.	2023-DP-001
SHEET	Sheet 1 of 1
CO-ORDINATES	531,501.20 E 726,031.12 N
GROUND LEVEL (mOD)	10.41
HAMMER MASS (kg)	50
INCREMENT SIZE (mm)	100
FALL HEIGHT (mm)	500
DATE COMMENCED	31/10/2023
DATE COMPLETED	31/10/2023
CLIENT	galway City Council
ENGINEER	Barry Transportation
PROBE TYPE	DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
1.0					
	End of Probe at 1.33 m			9.08	
2.0					
3.0					
4.0					

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	0
0.20	0
0.30	3
0.40	2
0.50	3
0.60	3
0.70	3
0.80	4
0.90	4
1.00	8
1.10	15
1.20	17
1.30	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 24984 FINAL LOGS AGS 3.GPJ IGSL.GDT 2/4/24

DYNAMIC PROBE RECORD

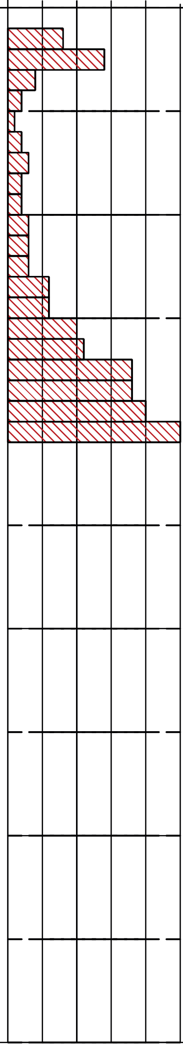
REPORT NUMBER 24984

CONTRACT	Galway BusConnects - Dublin Road Site Investigation	**PROBE NO.**	**2023-DP-002**
		SHEET	Sheet 1 of 1
CO-ORDINATES	531,755.28 E 725,965.92 N	**DATE COMMENCED**	31/10/2023
GROUND LEVEL (mOD)	17.23	**DATE COMPLETED**	31/10/2023
CLIENT	galway City Council	**PROBE TYPE**	DPH
ENGINEER	Barry Transportation		

HAMMER MASS (kg)	50
INCREMENT SIZE (mm)	100
FALL HEIGHT (mm)	500

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	8
						0.20	14
						0.30	4
						0.40	2
						0.50	1
						0.60	2
						0.70	3
						0.80	2
						0.90	2
1.0						1.00	3
						1.10	3
						1.20	3
						1.30	6
						1.40	6
						1.50	10
						1.60	11
						1.70	18
						1.80	18
						1.90	20
2.0	End of Probe at 2.05 m			15.18		2.00	25
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

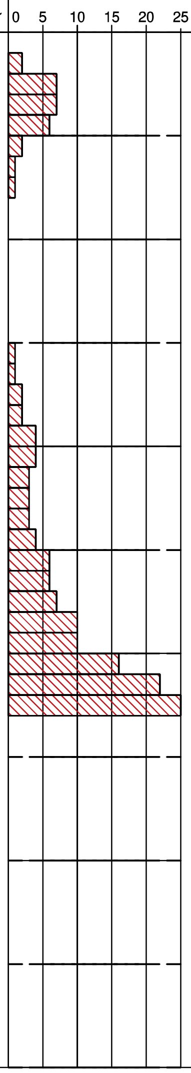
DYNAMIC PROBE RECORD

REPORT NUMBER	24984
CONTRACT	Galway BusConnects - Dublin Road Site Investigation
PROBE NO.	2023-DP-003
SHEET	Sheet 1 of 1
CO-ORDINATES	532,248.94 E 725,781.40 N
GROUND LEVEL (mOD)	20.16
HAMMER MASS (kg)	50
INCREMENT SIZE (mm)	100
FALL HEIGHT (mm)	500
DATE COMMENCED	31/10/2023
DATE COMPLETED	31/10/2023
CLIENT	galway City Council
ENGINEER	Barry Transportation
PROBE TYPE	DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
	End of Probe at 3.25 m			16.91	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	2
0.20	7
0.30	7
0.40	6
0.50	2
0.60	1
0.70	1
0.80	0
0.90	0
1.00	0
1.10	0
1.20	0
1.30	0
1.40	0
1.50	1
1.60	1
1.70	2
1.80	2
1.90	4
2.00	4
2.10	3
2.20	3
2.30	3
2.40	4
2.50	6
2.60	6
2.70	7
2.80	10
2.90	10
3.00	16
3.10	22
3.20	25

Graphic Probe Record



Depth scale: 0.0, 1.0, 2.0, 3.0, 4.0

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 24984 FINAL LOGS AGS 3.GPJ IGSL.GDT 2/4/24

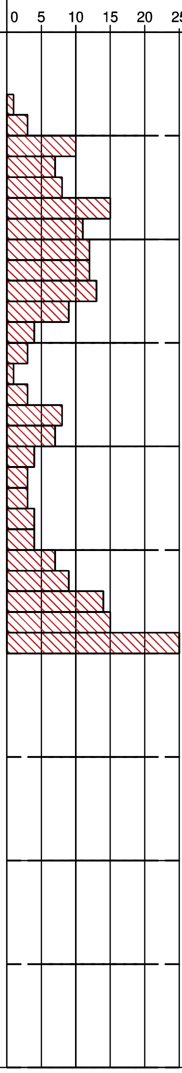
DYNAMIC PROBE RECORD

REPORT NUMBER	24984
CONTRACT	Galway BusConnects - Dublin Road Site Investigation
PROBE NO.	2023-DP-004
SHEET	Sheet 1 of 1
CO-ORDINATES	532,502.50 E 725,715.38 N
GROUND LEVEL (mOD)	22.97
CLIENT	galway City Council
ENGINEER	Barry Transportation
HAMMER MASS (kg)	50
INCREMENT SIZE (mm)	100
FALL HEIGHT (mm)	500
DATE COMMENCED	01/11/2023
DATE COMPLETED	01/11/2023
PROBE TYPE	DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
3.0	End of Probe at 2.97 m			20.00	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	0
0.20	0
0.30	1
0.40	3
0.50	10
0.60	7
0.70	8
0.80	15
0.90	11
1.00	12
1.10	12
1.20	13
1.30	9
1.40	4
1.50	3
1.60	1
1.70	3
1.80	8
1.90	7
2.00	4
2.10	3
2.20	3
2.30	4
2.40	4
2.50	7
2.60	9
2.70	14
2.80	15
2.90	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24984

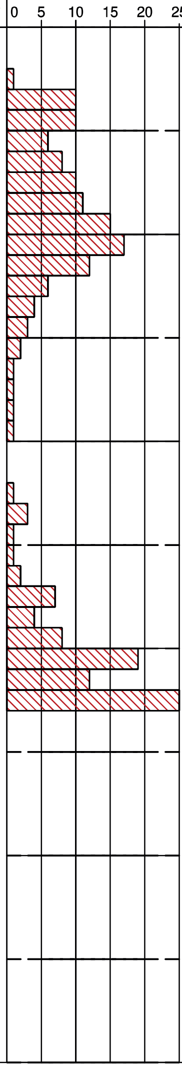
CONTRACT	Galway BusConnects - Dublin Road Site Investigation	**PROBE NO.**	**2023-DP-005**
		SHEET	Sheet 1 of 1
CO-ORDINATES	532,569.52 E 725,701.54 N	**DATE COMMENCED**	01/11/2023
GROUND LEVEL (mOD)	23.43	**DATE COMPLETED**	01/11/2023
CLIENT	galway City Council	**PROBE TYPE**	DPH
ENGINEER	Barry Transportation		

HAMMER MASS (kg)	50
INCREMENT SIZE (mm)	100
FALL HEIGHT (mm)	500

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
	End of Probe at 3.27 m			20.16	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	0
0.20	1
0.30	10
0.40	10
0.50	6
0.60	8
0.70	10
0.80	11
0.90	15
1.00	17
1.10	12
1.20	6
1.30	4
1.40	3
1.50	2
1.60	1
1.70	1
1.80	1
1.90	1
2.00	0
2.10	0
2.20	1
2.30	3
2.40	1
2.50	1
2.60	2
2.70	7
2.80	4
2.90	8
3.00	19
3.10	12
3.20	25

Graphic Probe Record



Depth scale: 0.0, 1.0, 2.0, 3.0, 4.0

GROUNDWATER OBSERVATIONS

REMARKS

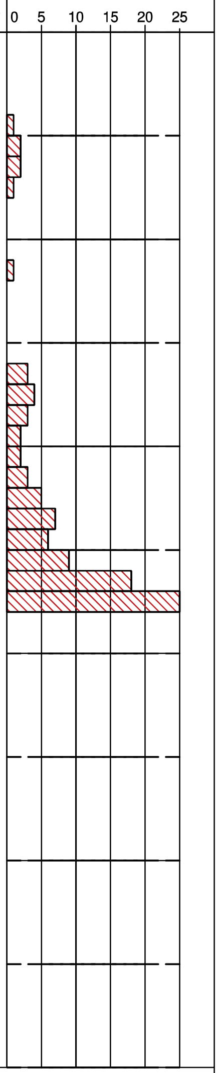
DYNAMIC PROBE RECORD

REPORT NUMBER 24984

CONTRACT	Galway BusConnects - Dublin Road Site Investigation	**PROBE NO.**	2023-DP-006
		SHEET	Sheet 1 of 1
CO-ORDINATES	532,569.52 E 725,701.57 N	**DATE COMMENCED**	01/11/2023
GROUND LEVEL (mOD)	23.44	**DATE COMPLETED**	01/11/2023
CLIENT	galway City Council	**HAMMER MASS (kg)**	50
ENGINEER	Barry Transportation	**INCREMENT SIZE (mm)**	100
		FALL HEIGHT (mm)	500
PROBE TYPE	DPH		

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	0
						0.30	0
						0.40	1
						0.50	2
						0.60	2
						0.70	1
						0.80	0
						0.90	0
1.0						1.00	0
						1.10	1
						1.20	0
						1.30	0
						1.40	0
						1.50	0
						1.60	3
						1.70	4
						1.80	3
						1.90	2
2.0						2.00	2
						2.10	3
						2.20	5
						2.30	7
						2.40	6
						2.50	9
						2.60	18
	End of Probe at 2.74 m			20.70		2.70	25
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

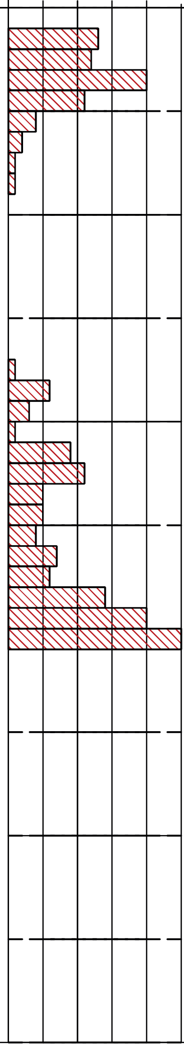
IGSL

REPORT NUMBER	24984
CONTRACT	Galway BusConnects - Dublin Road Site Investigation
PROBE NO.	2023-DP-007
SHEET	Sheet 1 of 1
CO-ORDINATES	533,578.37 E 725,303.62 N
GROUND LEVEL (mOD)	20.94
HAMMER MASS (kg)	50
INCREMENT SIZE (mm)	100
FALL HEIGHT (mm)	500
DATE COMMENCED	01/11/2023
DATE COMPLETED	01/11/2023
CLIENT	galway City Council
ENGINEER	Barry Transportation
PROBE TYPE	DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
3.0	End of Probe at 3.06 m			17.88	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	13
0.20	12
0.30	20
0.40	11
0.50	4
0.60	2
0.70	1
0.80	1
0.90	0
1.00	0
1.10	0
1.20	0
1.30	0
1.40	0
1.50	0
1.60	0
1.70	1
1.80	6
1.90	3
2.00	1
2.10	9
2.20	11
2.30	5
2.40	5
2.50	4
2.60	7
2.70	6
2.80	14
2.90	20
3.00	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 24984 FINAL LOGS AGS 3.GPJ IGSL.GDT 2/4/24

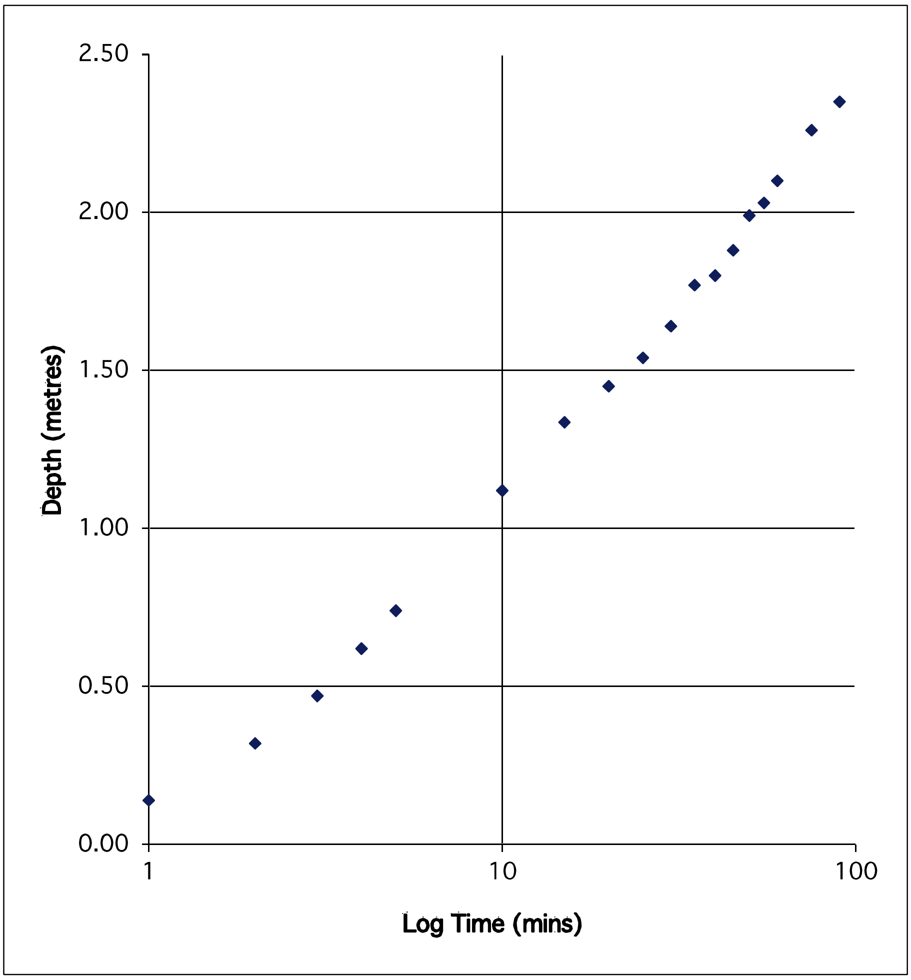
Appendix 5 - Infiltration Testing Records

Borehole Infiltration Test

IGSL

CONTRACT:	Galway Bus Connect	**TEST RESPONSE ZONE DETAILS:**	
NUMBER	24984		
CLIENT:	GCC	**Top (mbgl):**	3.00
ENGINEER:	JB Barry	**Bottom (mbgl):**	3.70
LOCATION:	Old Dublin rd, Galway	**Length (m):**	3.70
BOREHOLE No.	4	**Diameter (m):**	0.200
TEST No.	4	**Initial Standing Water Level (m below top of casing)**	None
		Height of casing or standpipe : above ground level (m)	0.00
		Falling or Rising Head Test?	Falling

Elapsed Time (mins)	Depth to Water* (m)
0.00	0.00
1	0.14
2	0.32
3	0.47
4	0.62
5	0.74
10	1.12
15	1.34
20	1.45
25	1.54
30	1.64
35	1.77
40	1.80
45	1.88
50	1.99
55	2.03
60	2.10
75	2.26
90	2.35



Calculation of steady flow Rate

T1 (mins)	0.00
T2 (mins)	90.00
Flow period (mins)	90.00
Initial depth (m)	0.14
Final depth (m)	2.35
Fall in level (m)	2.21
Vol. Dispersed (m3)	0.0694

Respone Zone

Length (m)	0.700
Diameter (m)	0.200
Exposed Area (m2)	0.471

f-value = Volume dispersed / unit exposed area / unit time

f-value (m/min) = 1.64E-03

* Below Ground level

Borehole Infiltration Test

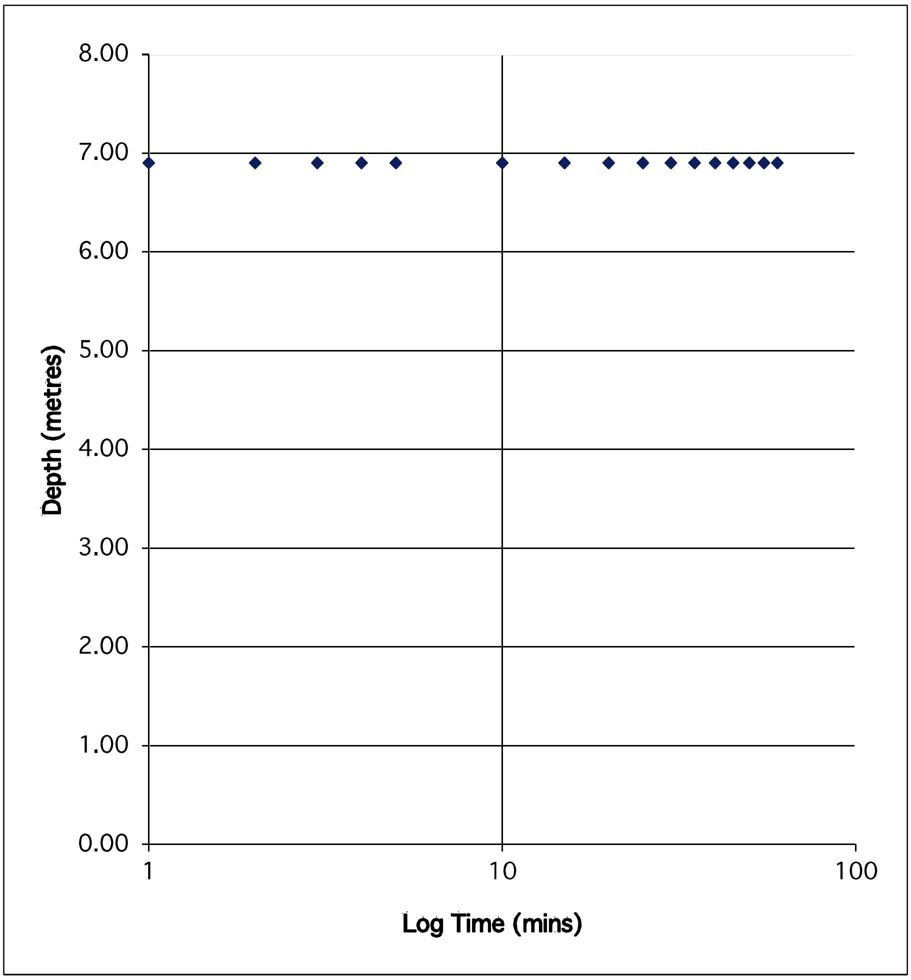
IGSL

CONTRACT:	Galway Bus Connect
NUMBER	24984
CLIENT:	GCC
ENGINEER:	JB Barry
LOCATION:	Old Dublin rd, Galway
BOREHOLE No.	RC08
TEST No.	1

TEST RESPONSE ZONE DETAILS:

Top (mbgl):	2.00
Bottom (mbgl):	8.00
Length (m):	6.00
Diameter (m):	0.115
Initial Standing Water Level (m below top of casing)	7.60
Height of casing or standpipe : above ground level (m)	0.25
Falling or Rising Head Test?	Falling

Elapsed Time (mins)	Depth to Water* (m)
0.00	6.90
1	6.90
2	6.90
3	6.90
4	6.90
5	6.90
10	6.90
15	6.90
20	6.90
25	6.90
30	6.90
35	6.90
40	6.90
45	6.90
50	6.90
55	6.90
60	6.90



Calculation of steady flow Rate

T1 (mins)	0.00
T2 (mins)	60.00
Flow period (mins)	60.00
Initial depth (m)	6.90
Final depth (m)	6.90
Fall in level (m)	0.00
Vol. Dispersed (m3)	0.0000

Respone Zone

Length (m)	6.000
Diameter (m)	0.115
Exposed Area (m2)	2.178

f-value = Volume dispersed / unit exposed area / unit time

f-value (m/min) = 0.00E+00

* Below Ground level

Borehole Infiltration Test

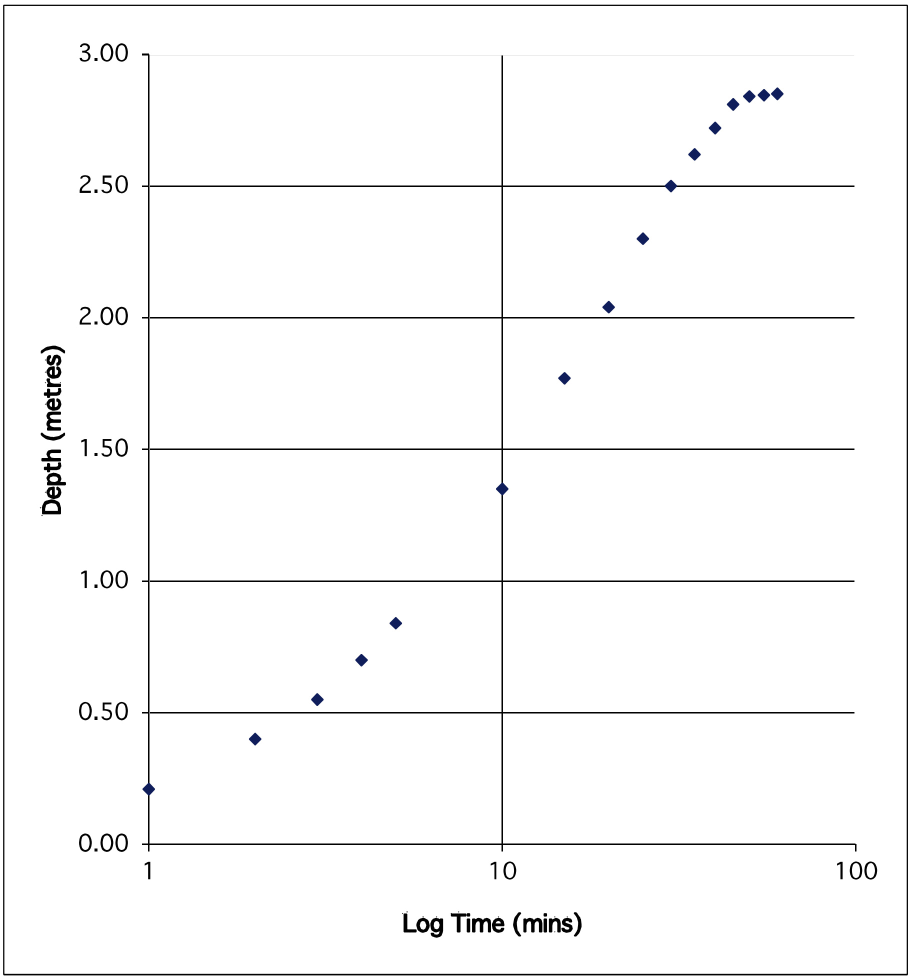
IGSL

CONTRACT:	Galway Bus Connect
NUMBER	24984
CLIENT:	GCC
ENGINEER:	JB Barry
LOCATION:	Old Dublin rd, Galway
BOREHOLE No.	10
TEST No.	10

TEST RESPONSE ZONE DETAILS:

Top (mbgl):	4.50
Bottom (mbgl):	6.00
Length (m):	1.50
Diameter (m):	0.200
Initial Standing Water Level (m below top of casing)	4.00
Height of casing or standpipe : above ground level (m)	0.00
Falling or Rising Head Test?	Falling

Elapsed Time (mins)	Depth to Water* (m)
0.00	0.00
1	0.21
2	0.40
3	0.55
4	0.70
5	0.84
10	1.35
15	1.77
20	2.04
25	2.30
30	2.50
35	2.62
40	2.72
45	2.81
50	2.84
55	2.85
60	2.85



Calculation of steady flow Rate

T1 (mins)	0.00
T2 (mins)	60.00
Flow period (mins)	60.00
Initial depth (m)	0.21
Final depth (m)	2.85
Fall in level (m)	2.64
Vol. Dispersed (m3)	0.0829

Respone Zone

Length (m)	1.500
Diameter (m)	0.200
Exposed Area (m2)	0.974

f-value = Volume dispersed / unit exposed area / unit time

f-value (m/min) = 1.42E-03

* Below Ground level

Appendix 6 - Soil Infiltration Tests (BRE Digest 365)

Soakaway Design f -value from field tests (F2C) IGSL

Contract:	Galway Bus Connect	Contract No.	24984
Test No.	2023-SA-001		
Client	GCC		
Date:	30/11/2023		

Summary of ground conditions

from	to	Description	Ground water
0.00	0.10	Topsoil	None encountered
0.10	0.60	Firm brown slightly sandy gravelly SILT/CLAY with cobble & boulders	
0.60	1.50	Firm to stiff grey sandy gravelly SILT/CLAY with cobble & boulders	

Notes: Samples:

Field Data

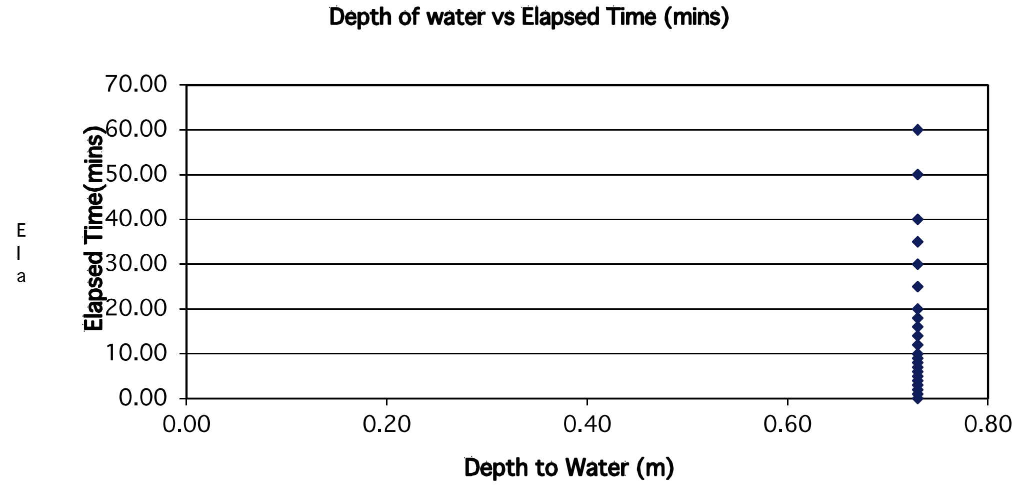
Depth to Water (m)	Elapsed Time (min)
0.73	0.00
0.73	1.00
0.73	2.00
0.73	3.00
0.73	4.00
0.73	5.00
0.73	6.00
0.73	7.00
0.73	8.00
0.73	9.00
0.73	10.00
0.73	12.00
0.73	14.00
0.73	16.00
0.73	18.00
0.73	20.00
0.73	25.00
0.73	30.00
0.73	35.00
0.73	40.00
0.73	50.00
0.73	60.00

Field Test

Depth of Pit (D)	1.50	m
Width of Pit (B)	0.90	m
Length of Pit (L)	1.70	m
Initial depth to Water =	0.73	m
Final depth to water =	0.73	m
Elapsed time (mins)=	60.00	
Top of permeable soil	0.73	m
Base of permeable soil	1.50	m
Base area=	1.53	m2
*Av. side area of permeable stratum over test perioc	4.004	m2
Total Exposed area =	5.534	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0 m/min or 0 m/sec



Soakaway Design f -value from field tests (F2C) IGSL

Contract:	Galway Bus Connect	Contract No.	24984
Test No.	2023-SA-002(1)		
Client	GCC		
Date:	30/11/2023		

Summary of ground conditions

from	to	Description	Ground water
0.00	0.10	Topsoil	None encountered
0.10	0.70	Firm brown slightly sandy gravelly SILT/CLAY with cobble & boulders	

Notes: Samples:

Field Data

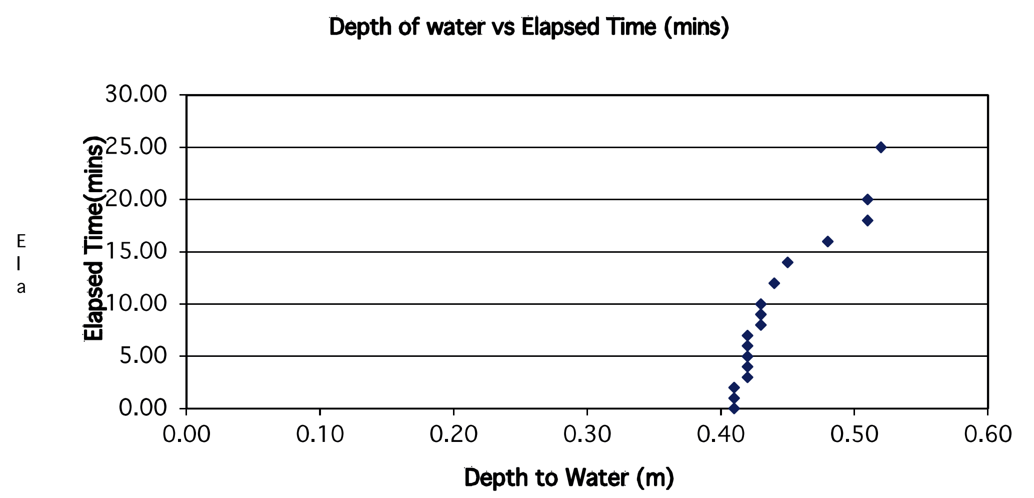
Depth to Water (m)	Elapsed Time (min)
0.41	0.00
0.41	1.00
0.41	2.00
0.42	3.00
0.42	4.00
0.42	5.00
0.42	6.00
0.42	7.00
0.43	8.00
0.43	9.00
0.43	10.00
0.44	12.00
0.45	14.00
0.48	16.00
0.51	18.00
0.51	20.00
0.52	25.00

Field Test

Depth of Pit (D)	0.70	m
Width of Pit (B)	0.90	m
Length of Pit (L)	1.70	m
Initial depth to Water =	0.41	m
Final depth to water =	0.52	m
Elapsed time (mins)=	25.00	
Top of permeable soil	0.41	m
Base of permeable soil	0.70	m
Base area=	1.53	m2
*Av. side area of permeable stratum over test perioc	1.222	m2
Total Exposed area =	2.752	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0.00245 m/min or 4.077E-05 m/sec



Soakaway Design f -value from field tests (F2C) IGSL

Contract:	Galway Bus Connect	Contract No.	24984
Test No.	2023-SA002(2)		
Client	GCC		
Date:	30/11/2023		

Summary of ground conditions

from	to	Description	Ground water
0.00	0.10	Topsoil	None encountered
0.10	0.70	Firm brown slightly sandy gravelly SILT/CLAY with cobble & boulders	

Notes: Samples:

Field Data

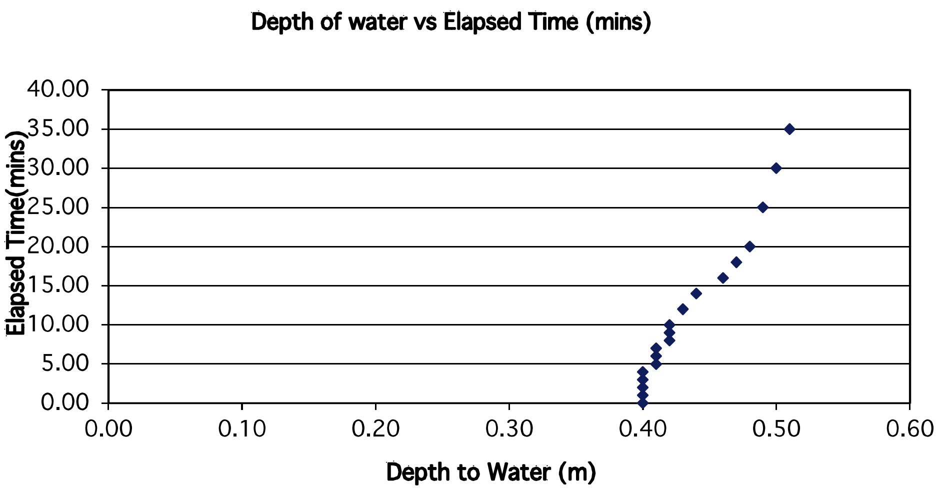
Depth to Water (m)	Elapsed Time (min)
0.40	0.00
0.40	1.00
0.40	2.00
0.40	3.00
0.40	4.00
0.41	5.00
0.41	6.00
0.41	7.00
0.42	8.00
0.42	9.00
0.42	10.00
0.43	12.00
0.44	14.00
0.46	16.00
0.47	18.00
0.48	20.00
0.49	25.00
0.50	30.00
0.51	35.00

Field Test

Depth of Pit (D)	0.70	m
Width of Pit (B)	0.90	m
Length of Pit (L)	1.70	m
Initial depth to Water =	0.40	m
Final depth to water =	0.51	m
Elapsed time (mins)=	35.00	
Top of permeable soil	0.40	m
Base of permeable soil	0.70	m
Base area=	1.53	m2
*Av. side area of permeable stratum over test perioc	1.274	m2
Total Exposed area =	2.804	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0.00171 m/min or 2.858E-05 m/sec



Soakaway Design f -value from field tests (F2C) IGSL

Contract:	Galway Bus Connect	Contract No.	24984
Test No.	2023-SA-003		
Client	GCC		
Date:	29/09/2023		

Summary of ground conditions

from	to	Description	Ground water
0.00	0.30	Topsoil	None encountered
0.30	0.60	Firm brown sandy slightly gravelly CLAY	
0.60	1.40	Soft progressing to firm grey sandy very gravelly CLAY with cobbles.	

Notes: Samples: Bagged sample 0.40 - 0.60m depth AA 208181
Bagged sample 0.80 - 1.0m depth AA 208182

Field Data

Depth to Water (m)	Elapsed Time (min)
0.85	0.00
0.86	1.00
0.86	2.00
0.86	3.00
0.86	4.00
0.86	5.00
0.86	6.00
0.86	7.00
0.86	8.00
0.86	9.00
0.86	10.00
0.86	12.00
0.86	14.00
0.86	16.00
0.86	18.00
0.86	20.00
0.86	25.00
0.86	30.00
0.86	35.00
0.86	40.00
0.86	50.00
0.86	60.00

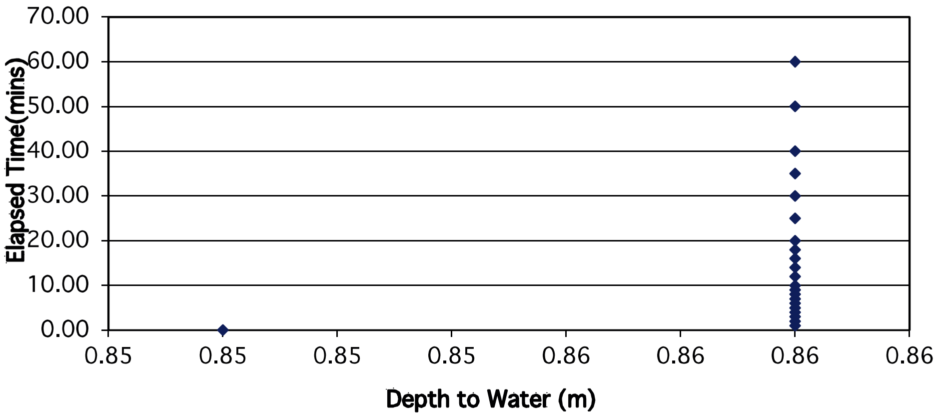
Field Test

Depth of Pit (D)	1.40	m
Width of Pit (B)	1.50	m
Length of Pit (L)	1.50	m
Initial depth to Water =	0.85	m
Final depth to water =	0.86	m
Elapsed time (mins)=	60.00	
Top of permeable soil	0.85	m
Base of permeable soil	1.40	m
Base area=	2.25	m2
*Av. side area of permeable stratum over test perioc	3.27	m2
Total Exposed area =	5.52	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 6.8E-05 m/min or 1.132E-06 m/sec

Depth of water vs Elapsed Time (mins)



Soakaway Design f -value from field tests (F2C) IGSL

Contract:	Galway Bus Connect	Contract No.	24984
Test No.	2023-SA-004		
Client	GCC		
Date:	29/09/2023		

Summary of ground conditions

from	to	Description	Ground water
0.00	0.30	Topsoil	None encountered
0.30	0.50	Firm to soft greybrown sandy moderately gravelly CLAY.	
0.50	0.80	Firm to soft browngrey sandy gravelly CLAY.	

Notes: Samples: Bagged sample 0.60 - 0.80m depth AA 208178

Field Data

Depth to Water (m)	Elapsed Time (min)
0.17	0.00
0.19	1.00
0.19	2.00
0.19	3.00
0.20	4.00
0.20	5.00
0.21	6.00
0.21	7.00
0.22	8.00
0.23	9.00
0.24	10.00
0.25	12.00
0.26	14.00
0.27	16.00
0.28	18.00
0.29	20.00
0.32	25.00
0.38	30.00
0.45	35.00
0.49	40.00
0.51	50.00
	60.00

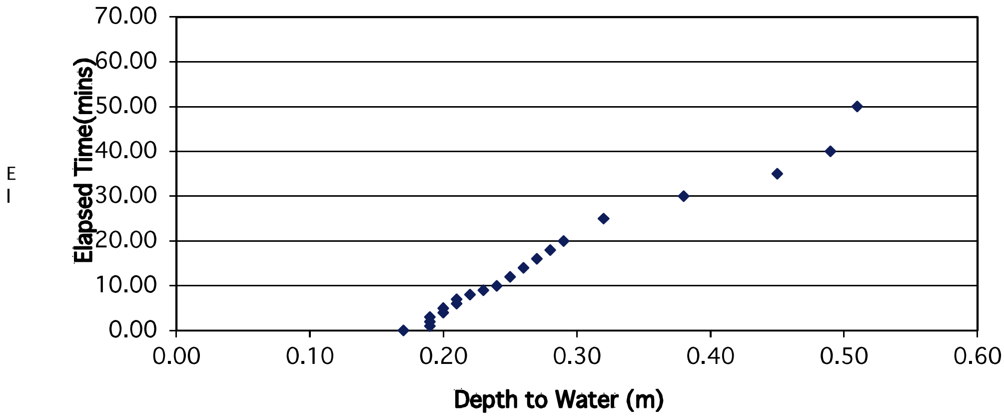
Field Test

Depth of Pit (D)	0.80	m
Width of Pit (B)	0.90	m
Length of Pit (L)	2.10	m
Initial depth to Water =	0.17	m
Final depth to water =	0.51	m
Elapsed time (mins)=	50.00	
Top of permeable soil	0.17	m
Base of permeable soil	0.80	m
Base area=	1.89	m2
*Av. side area of permeable stratum over test perioc	2.76	m2
Total Exposed area =	4.65	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0.00276 m/min or 4.606E-05 m/sec

Depth of water vs Elapsed Time (mins)



2023-SA-001 – 1 of 1

2023-SA-002 – 1 of 1

2023-SA-003 – 1 of 1

2023-SA-004 – 1 of 1

Appendix 7 - Plate Bearing tests

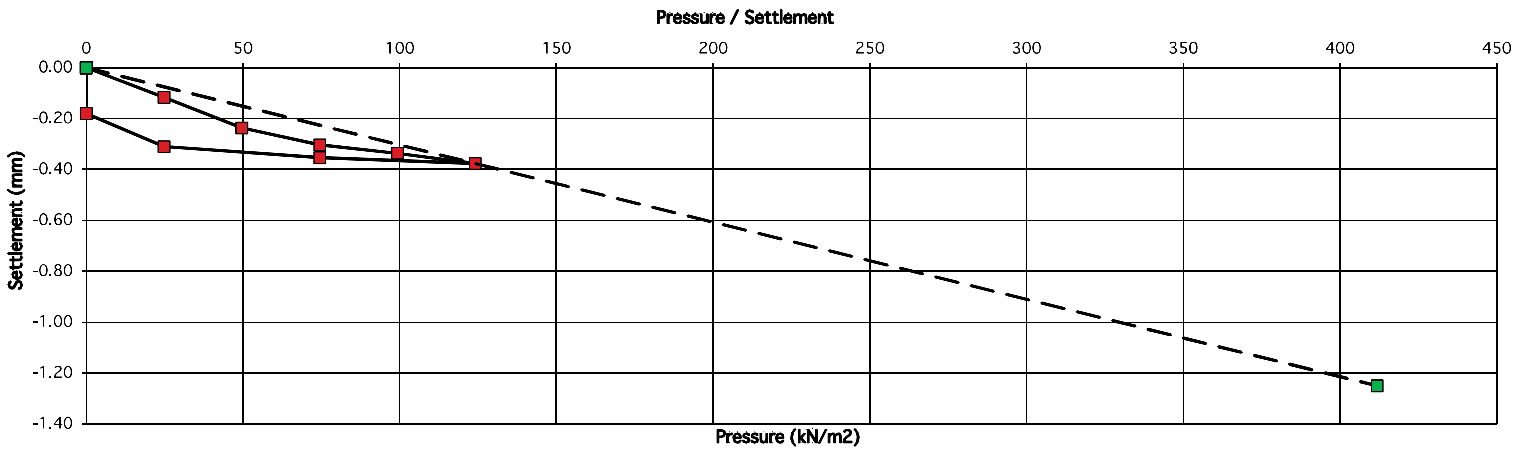
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R150464
Contract	24984 Galway Bus Connect
Test No.	CBR1 Load
Location	2023-TP-001
Depth	0.50m
Client	Galway Co.Co.
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	B. Campbell
Authorised by	
Date	29/09/2023

Description of soil under test
(natural soil, placed fill, sub-base)
Grey slightly clayey very gravelly SAND

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 329
Modulus of subgrade reaction = 212 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 103.6 %

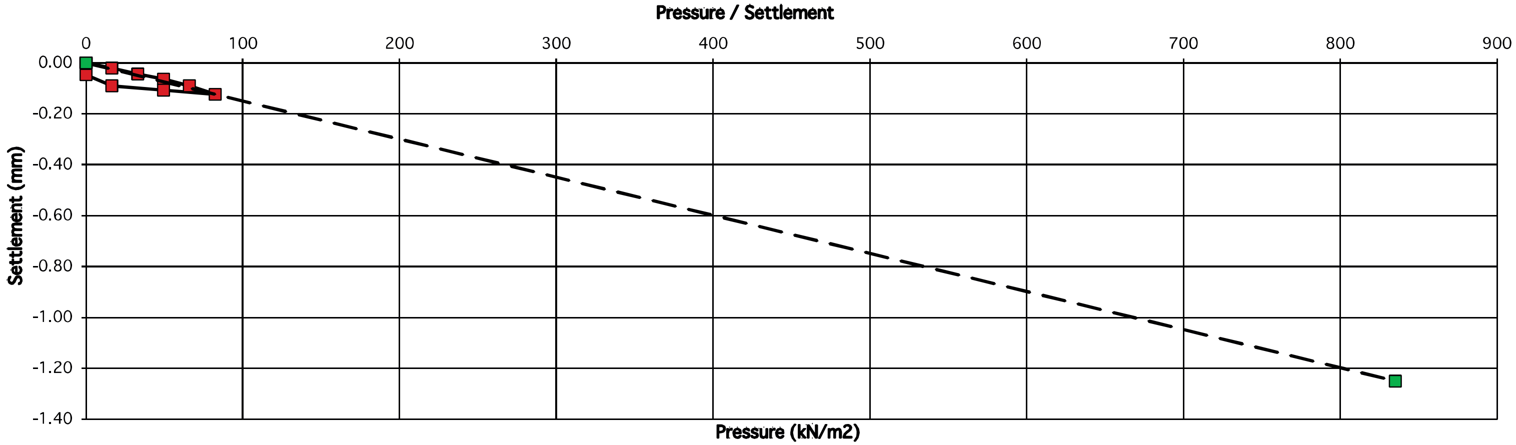
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R150464
Contract	24984 Galway Bus Connect
Test No.	CBR1 Reload
Location	2023-TP-001
Depth	0.50m
Client	Galway Co.Co.
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	B. Campbell
Authorised by	
Date	29/09/2023

Description of soil under test
(natural soil, placed fill, sub-base)
Grey slightly clayey very gravelly SAND

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 668
Modulus of subgrade reaction = 429 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 352.5 %

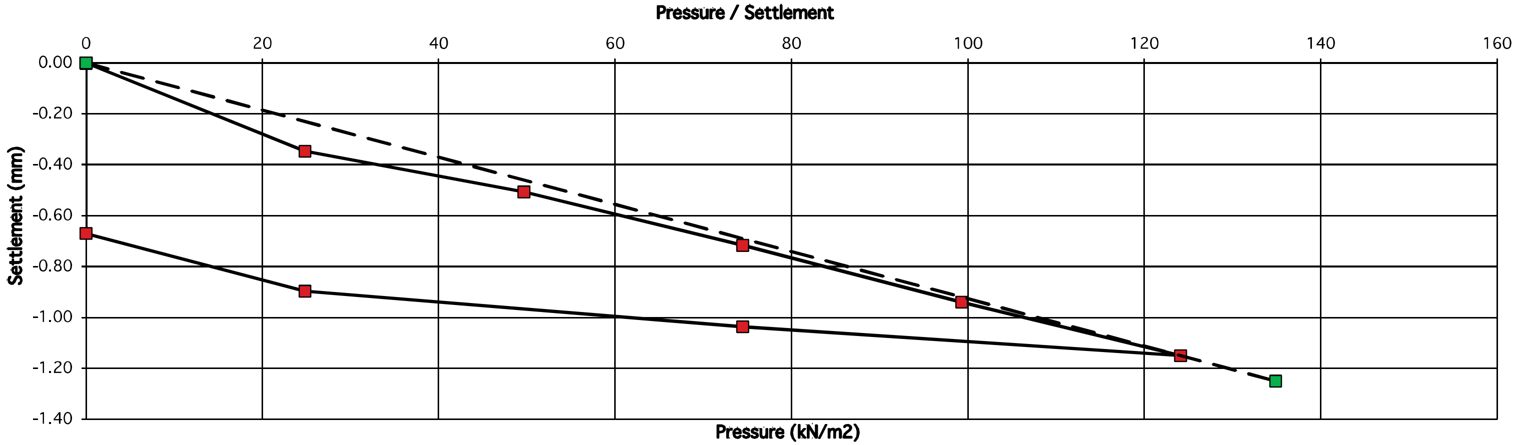
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R150465
Contract	24984 Galway Bus Connect
Test No.	CBR2 Load
Location	2023-TP-002
Depth	0.50m
Client	Galway Co.Co.
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	B. Campbell
Authorised by	
Date	29/09/2023

Description of soil under test
(natural soil, placed fill, sub-base)
grey sandy gravelly CLAY with high cobble content

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 108
Modulus of subgrade reaction = 69 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 15.0 %

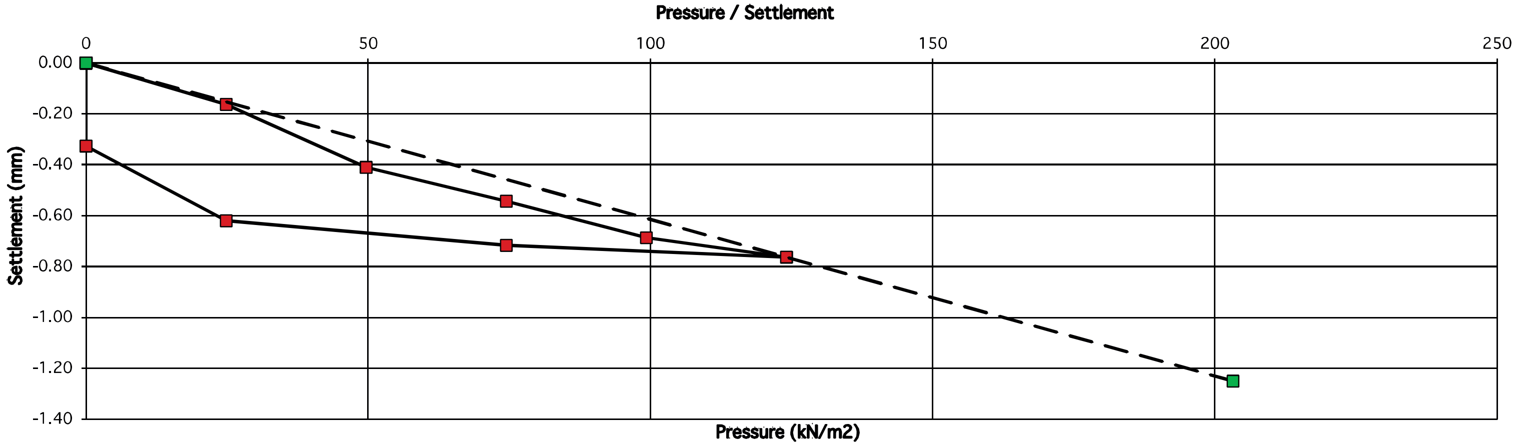
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R150465
Contract	24984 Galway Bus Connect
Test No.	CBR2 Reload
Location	2023-TP-002
Depth	0.50m
Client	Galway Co.Co.
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	B. Campbell
Authorised by	
Date	29/09/2023

Description of soil under test
(natural soil, placed fill, sub-base)
grey sandy gravelly CLAY with high cobble content

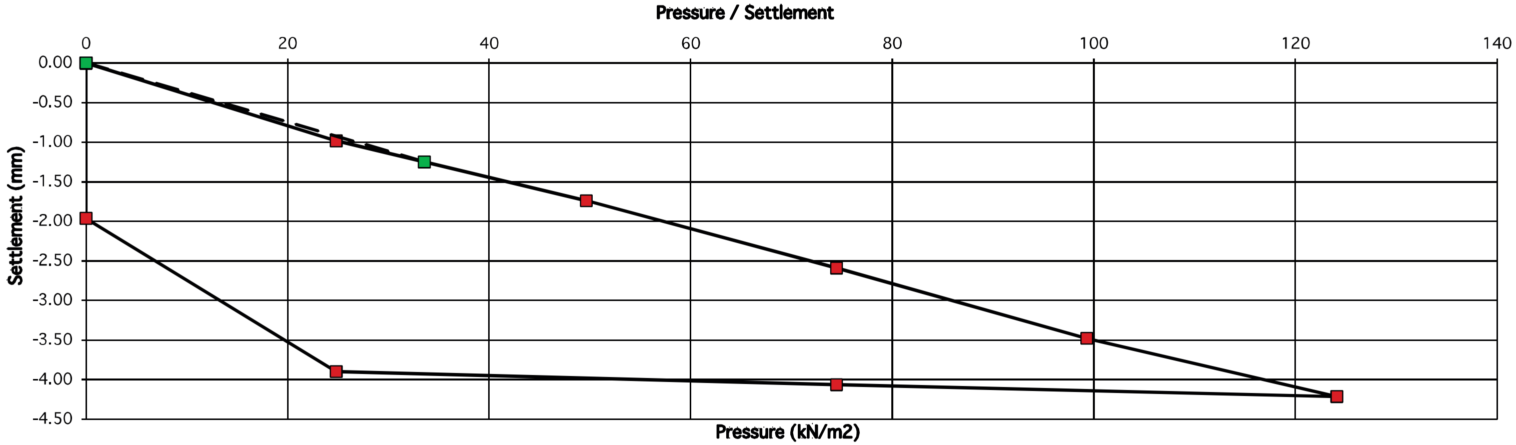
Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 163
Modulus of subgrade reaction = 105 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 30.4 %

PLATE TEST REPORT SHEET (F3.1)		Applied Pressure/Settlement Curve
Reference No.	R150466	
Contract	24984 Galway Bus Connect	Description of soil under test (natural soil, placed fill, sub-base)
Test No.	CBR3 Load	brown sandy moderately gravelly CLAY with cobbles
Location	2023-TP-003	
Depth	0.50m	
Client	Galway Co.Co.	
Plate Diameter:	450 mm	
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test	
Technician	B. Campbell	Sample Ref No.
Authorised by		Depth m bgl
Date	29/09/2023	



Gradient at 1.25 mm settlement intersection = 27
Modulus of subgrade reaction = 17 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 1.3 %

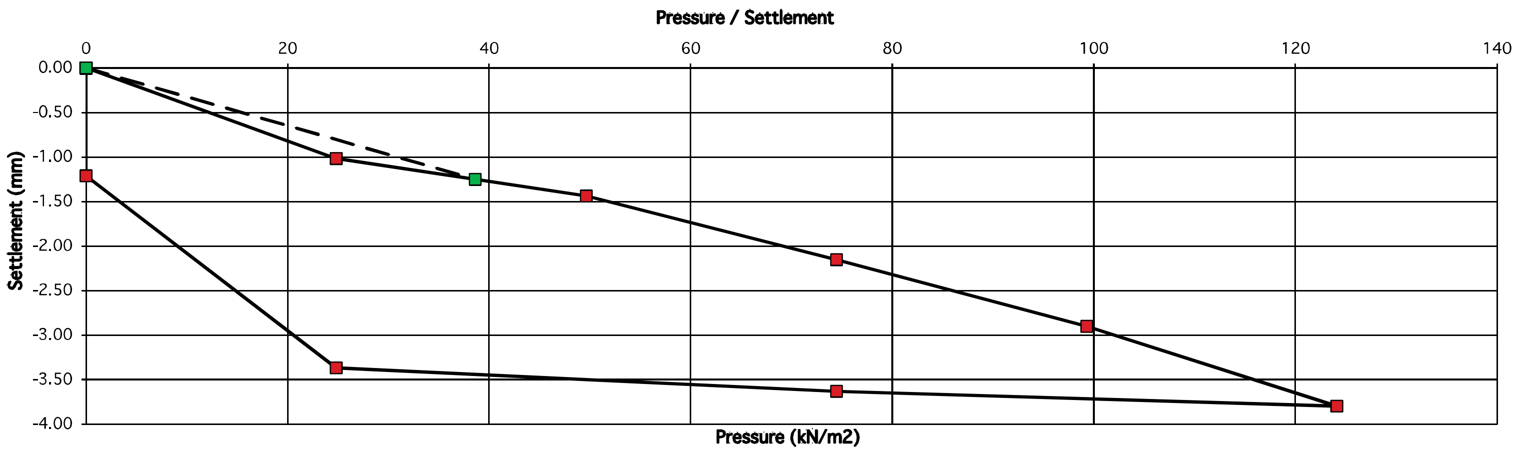
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R150466
Contract	24984 Galway Bus Connect
Test No.	CBR3 Reload
Location	2023-TP-003
Depth	0.50m
Client	Galway Co.Co.
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	B. Campbell
Authorised by	
Date	29/09/2023

Description of soil under test
(natural soil, placed fill, sub-base)
brown sandy moderately gravelly CLAY with cobbles

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 31
Modulus of subgrade reaction = 20 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 1.7 %

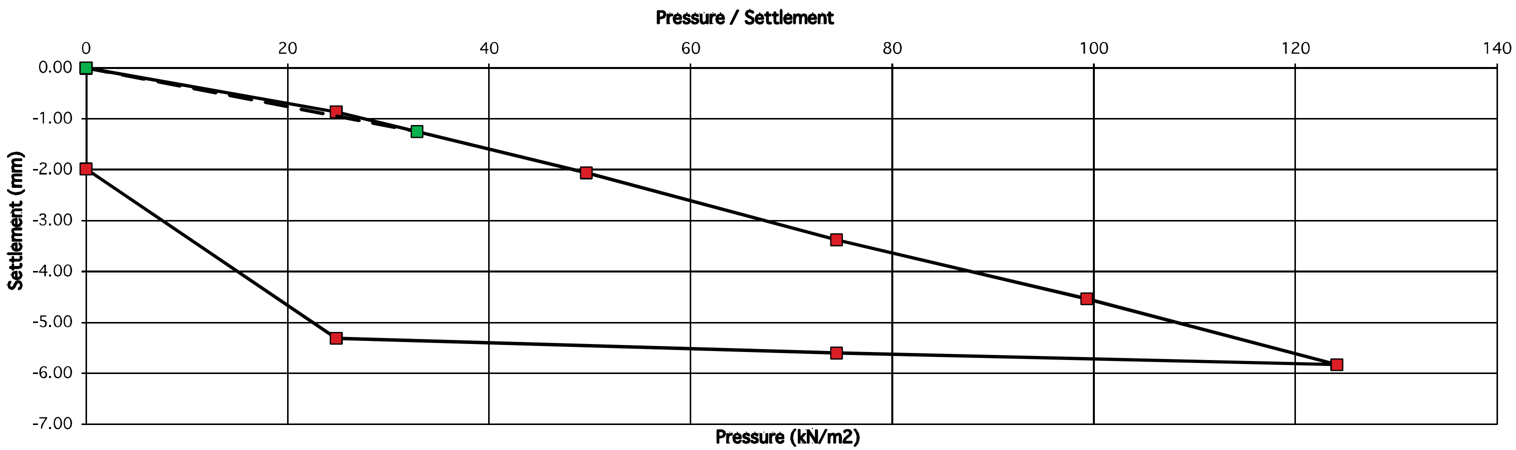
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R150467
Contract	24984 Galway Bus Connect
Test No.	CBR4 Load
Location	2023-TP-004
Depth	0.50m
Client	Galway Co.Co.
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	B. Campbell
Authorised by	
Date	29/09/2023

Description of soil under test
(natural soil, placed fill, sub-base)
brown sandy gravelly CLAY with cobbles

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 26
Modulus of subgrade reaction = 17 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 1.3 %

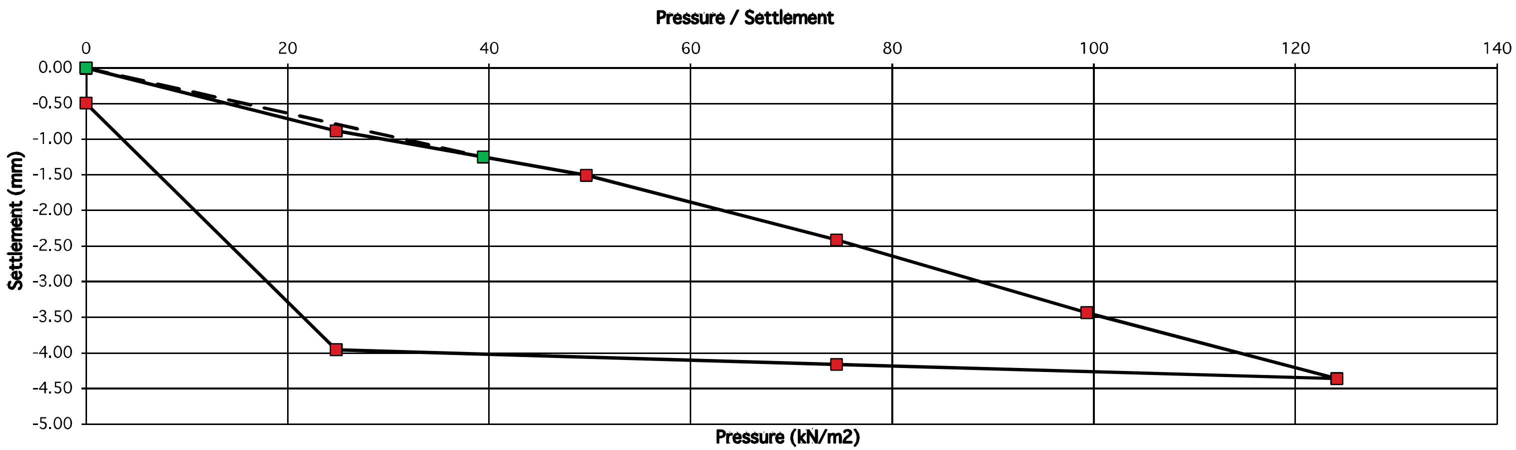
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R150467
Contract	24984 Galway Bus Connect
Test No.	CBR4 Reload
Location	2023-TP-004
Depth	0.50m
Client	Galway Co.Co.
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	B. Campbell
Authorised by	
Date	29/09/2023

Description of soil under test
(natural soil, placed fill, sub-base)
brown sandy gravelly CLAY with cobbles

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 32
Modulus of subgrade reaction = 20 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 1.8 %

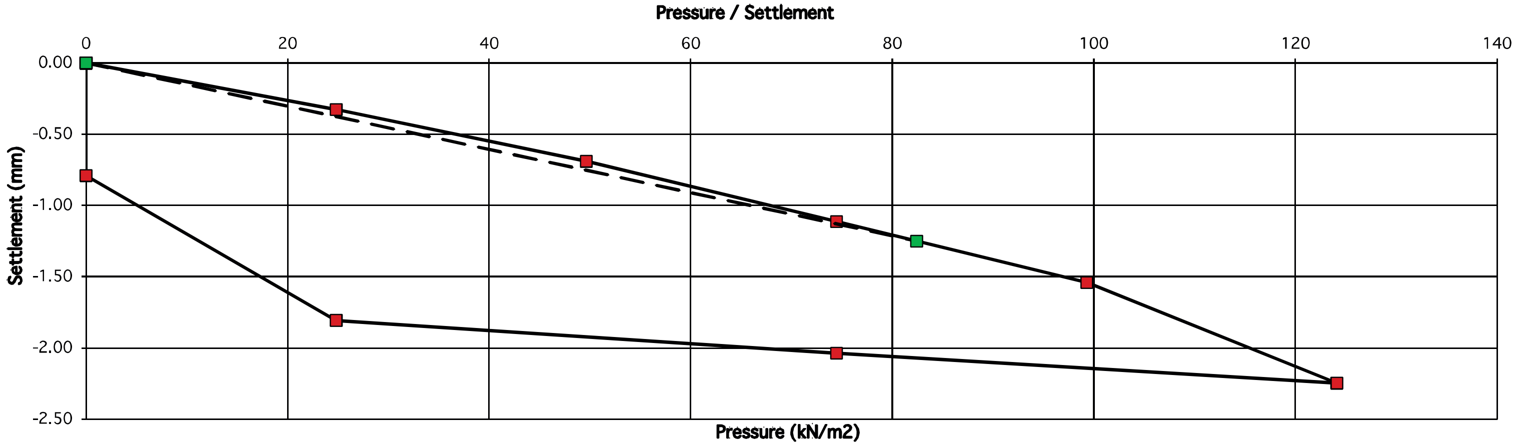
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R150468
Contract	24984 Galway Bus Connect
Test No.	CBR5 Load
Location	2023-TP-005
Depth	0.50m
Client	Galway Co.Co.
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	B. Campbell
Authorised by	
Date	29/09/2023

Description of soil under test
(natural soil, placed fill, sub-base)
brown grey sandy very gravelly CLAY with cobbles

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 66
Modulus of subgrade reaction = 42 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 6.4 %

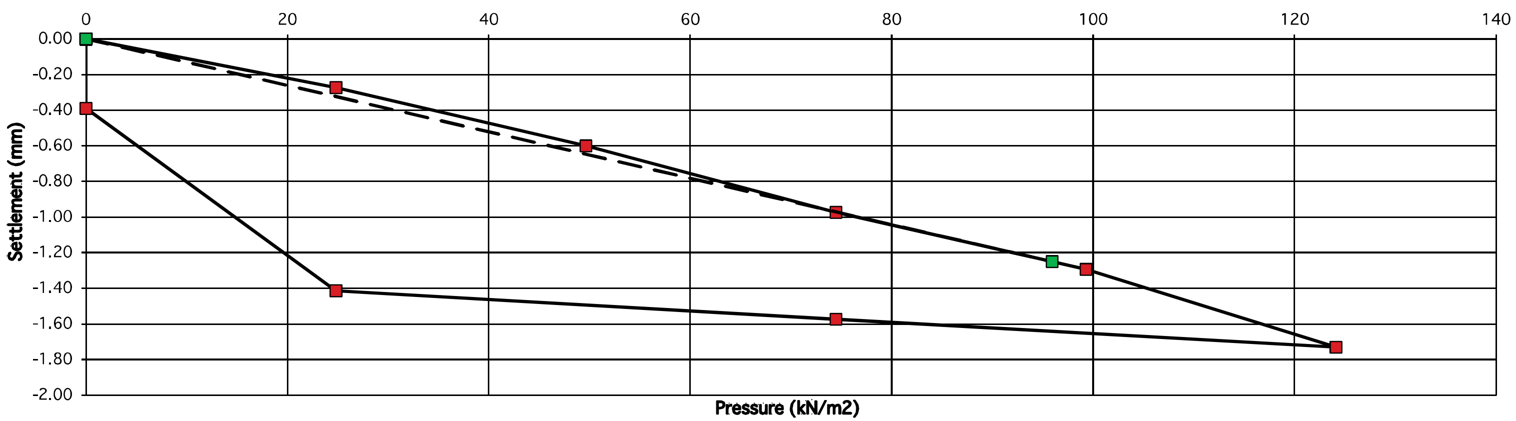
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R150468
Contract	24984 Galway Bus Connect
Test No.	CBR5 Reload
Location	2023-TP-005
Depth	0.50m
Client	Galway Co.Co.
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	B. Campbell
Authorised by	
Date	29/09/2023

Description of soil under test
(natural soil, placed fill, sub-base)
brown grey sandy very gravelly CLAY with cobbles

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 77
Modulus of subgrade reaction = 49 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 8.3 %

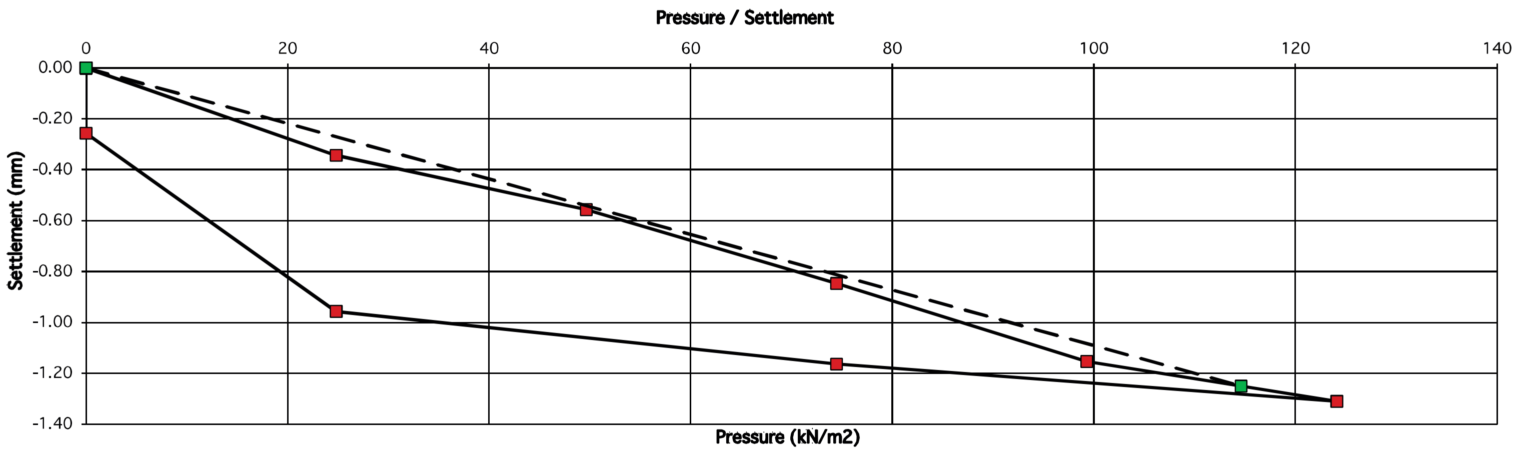
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R150469
Contract	24984 Galway Bus Connect
Test No.	CBR 6 Load
Location	2023-TP -006
Depth	0.50m
Client	Galway Co.Co.
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	B. Campbell
Authorised by	
Date	29/09/2023

Description of soil under test
(natural soil, placed fill, sub-base)
greybrown sandy slightly gravelly CLAY

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 92
Modulus of subgrade reaction = 59 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 11.3 %

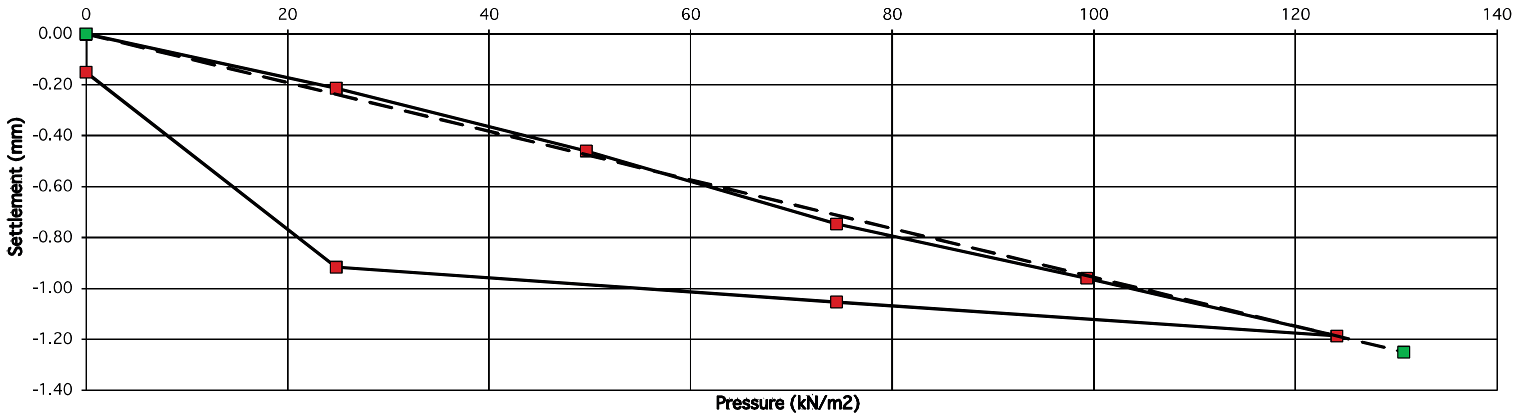
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R150469
Contract	24984 Galway Bus Connect
Test No.	CBR 6 Reload
Location	2023-TP-006
Depth	0.50m
Client	Galway Co.Co.
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	B. Campbell
Authorised by	
Date	29/09/2023

Description of soil under test
(natural soil, placed fill, sub-base)
greybrown sandy slightly gravelly CLAY

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 105
Modulus of subgrade reaction = 67 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

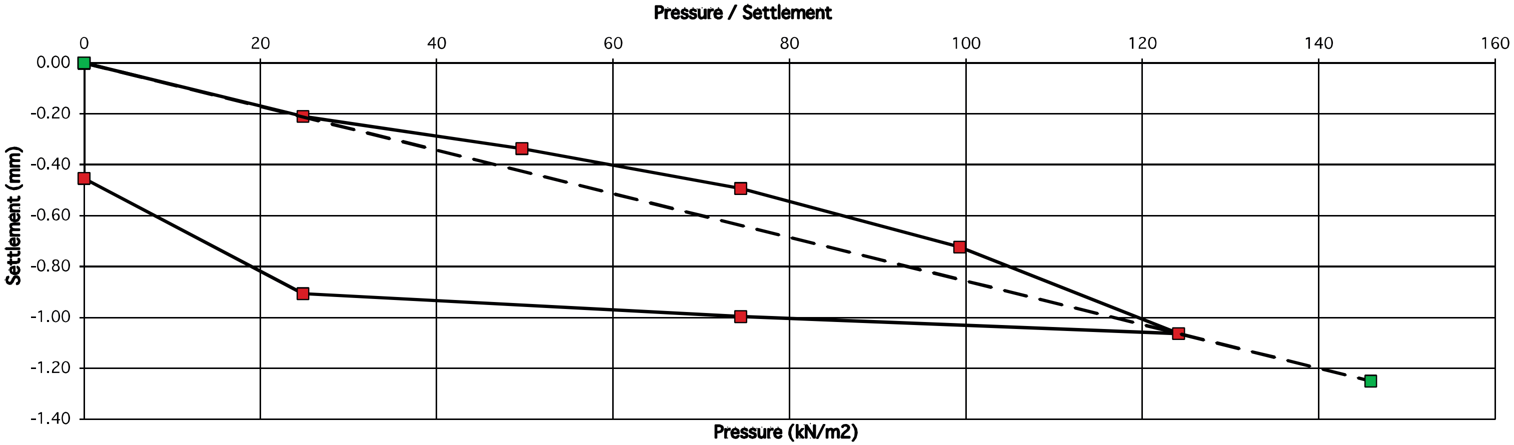
Equivalent CBR value in accordance with NRA HD25-26/10 14.2 %

PLATE TEST REPORT SHEET (F3.1)	
Reference No.	R150470
Contract	24984 Galway Bus Connect
Test No.	CBR7 Load
Location	2023-TP-007
Depth	0.50m
Client	Galway Co.Co.
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	B. Campbell
Authorised by	
Date	29/09/2023

Applied Pressure/Settlement Curve

Description of soil under test
(natural soil, placed fill, sub-base)
greybrown sandy slightly gravelly CLAY

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 117
Modulus of subgrade reaction = 75 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 17.1 %

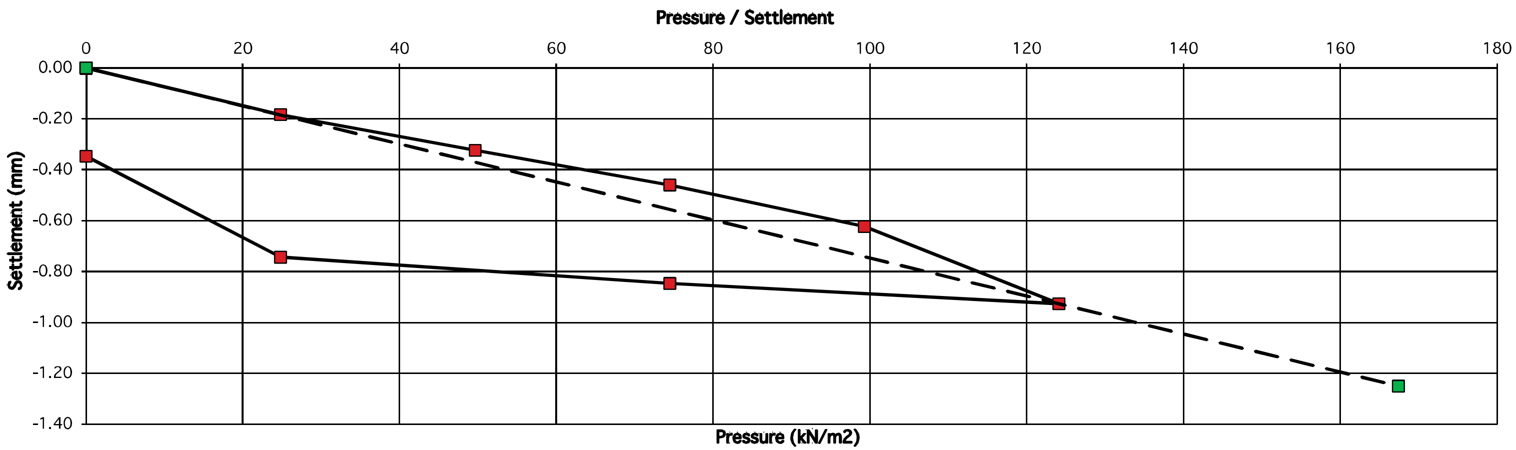
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R150470
Contract	24984 Galway Bus Connect
Test No.	CBR7 Reload
Location	2023-TP-007
Depth	0.50m
Client	Galway Co.Co.
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	B. Campbell
Authorised by	
Date	29/09/2023

Description of soil under test
(natural soil, placed fill, sub-base)
greybrown sandy slightly gravelly CLAY

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 134
Modulus of subgrade reaction = 86 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 21.8 %

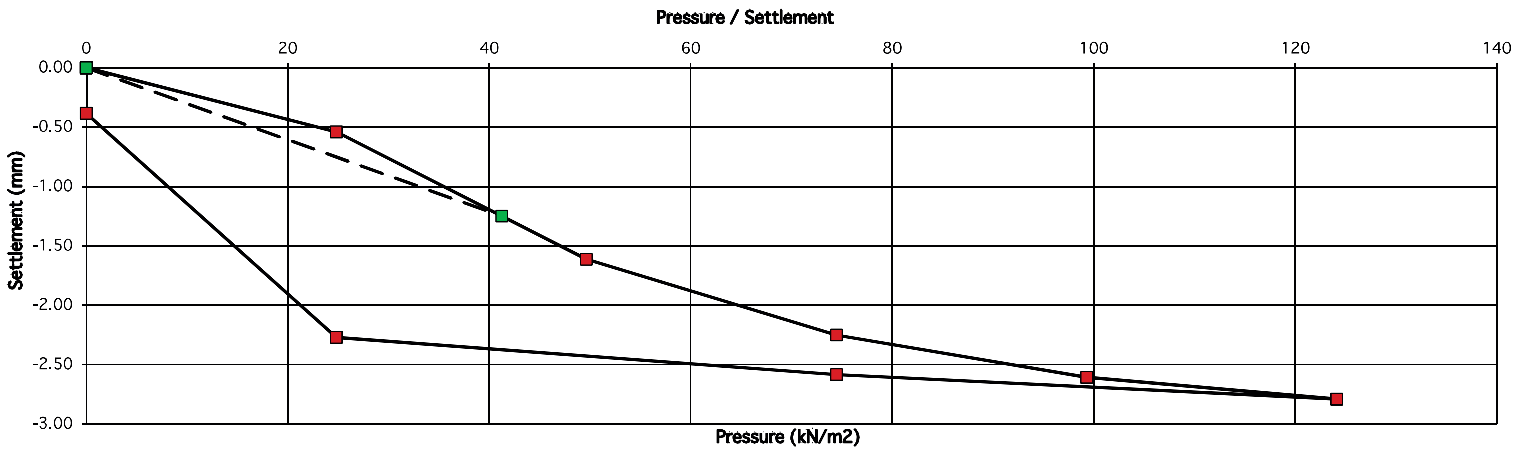
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R150471
Contract	24984 Galway Bus Connect
Test No.	CBR8 Load
Location	2023-TP-008
Depth	0.50m
Client	Galway Co.Co.
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	B. Campbell
Authorised by	
Date	29/09/2023

Description of soil under test
(natural soil, placed fill, sub-base)
brown sandy moderately gravelly CLAY with cobbles

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 33
Modulus of subgrade reaction = 21 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 1.9 %

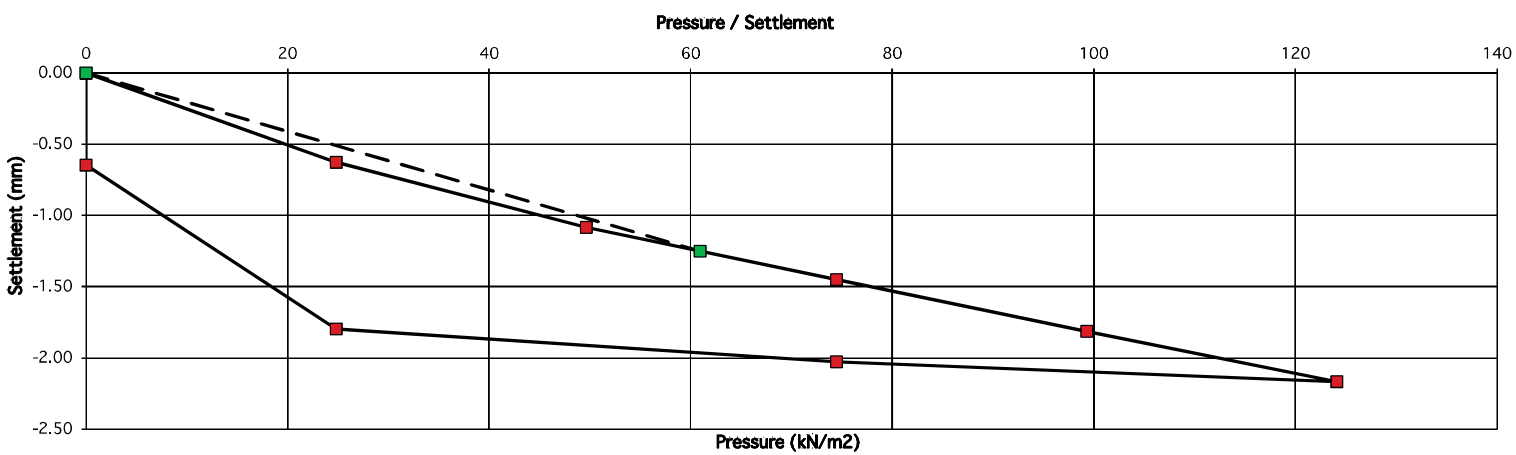
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R150471
Contract	24984 Galway Bus Connect
Test No.	CBR8 Reload
Location	2023-TP-008
Depth	0.50m
Client	Galway Co.Co.
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	B. Campbell
Authorised by	
Date	29/09/2023

Description of soil under test
(natural soil, placed fill, sub-base)
brown sandy moderately gravelly CLAY with cobbles

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 49
Modulus of subgrade reaction = 31 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 3.8 %

PLATE TEST REPORT SHEET (F3.1)

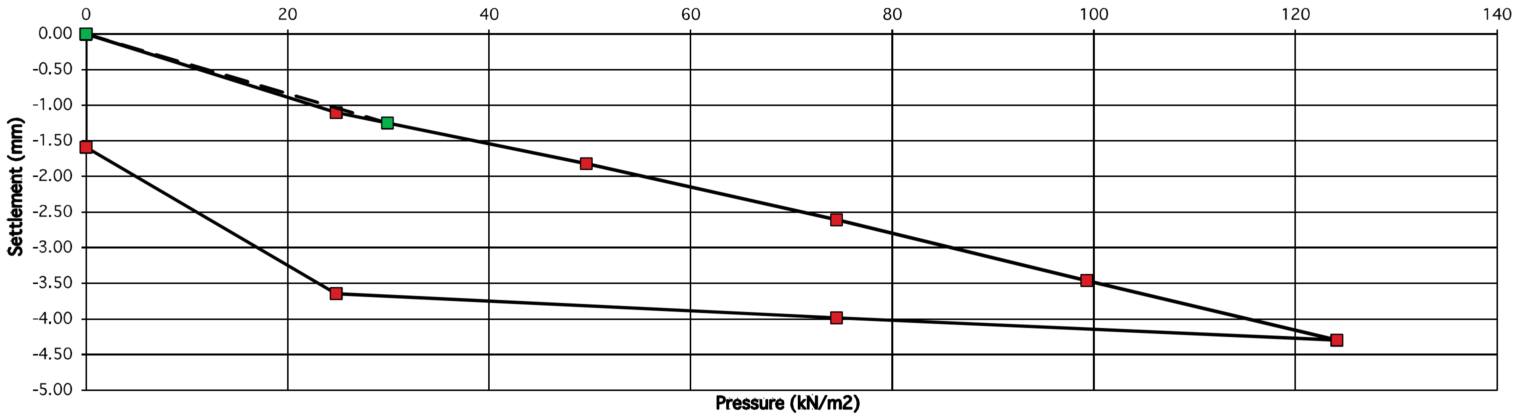
Applied Pressure/Settlement Curve

Reference No.	R150472
Contract	24984 Galway Bus Connect
Test No.	CBR9 Load
Location	2023-TP-009
Depth	0.50m
Client	Galway Co.Co.
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	B. Campbell
Authorised by	
Date	29/09/2023

Description of soil under test
(natural soil, placed fill, sub-base)
brown sandy moderately gravelly CLAY

Sample Ref No.
Depth m bgl

Pressure / Settlement



Gradient at 1.25 mm settlement intersection = 24
Modulus of subgrade reaction = 15 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 1.1 %

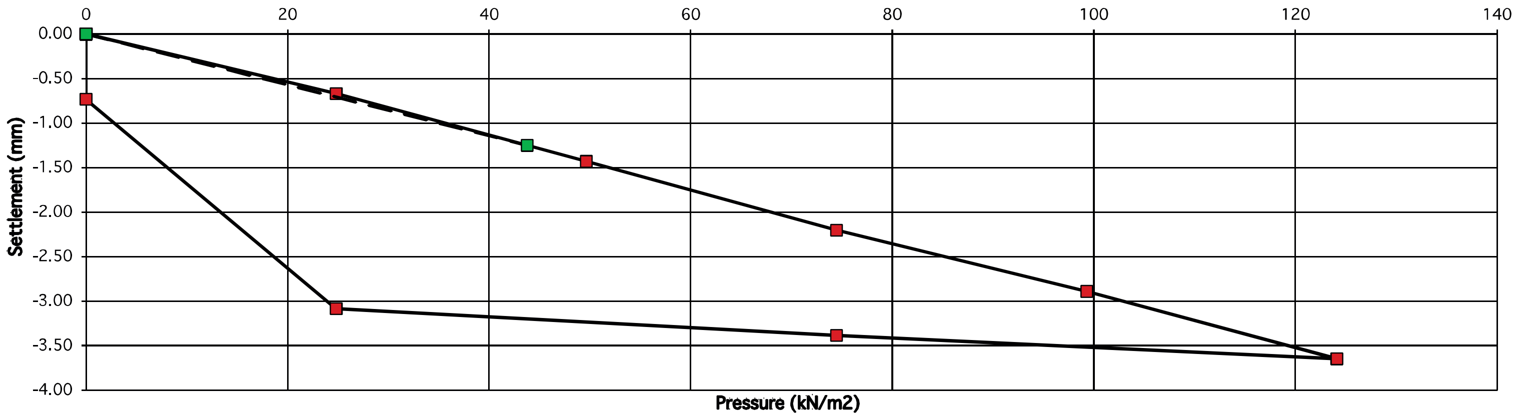
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R150472
Contract	24984 Galway Bus Connect
Test No.	9 Reload
Location	2023-TP-009
Depth	0.50m
Client	Galway Co.Co.
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	B. Campbell
Authorised by	
Date	29/09/2023

Description of soil under test
(natural soil, placed fill, sub-base)
brown sandy moderately gravelly CLAY

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 35
Modulus of subgrade reaction = 23 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 2.1 %

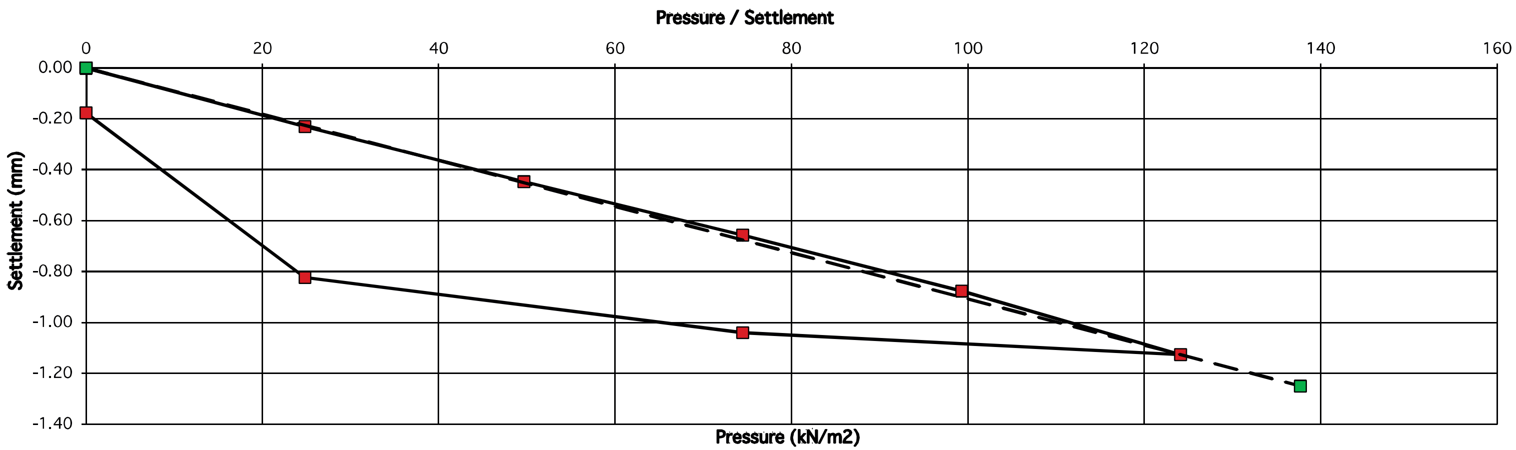
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R151898
Contract	24984 Galway Bus Connect
Test No.	CBR010 Load
Location	2023-TP-010
Depth	0.5m
Client	Galway Co.Co.
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	B. Campbell
Authorised by	
Date	04/12/2023

Description of soil under test
(natural soil, placed fill, sub-base)
light grey sandy gravelly SILT / CLAY

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 110
Modulus of subgrade reaction = 71 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 15.5 %

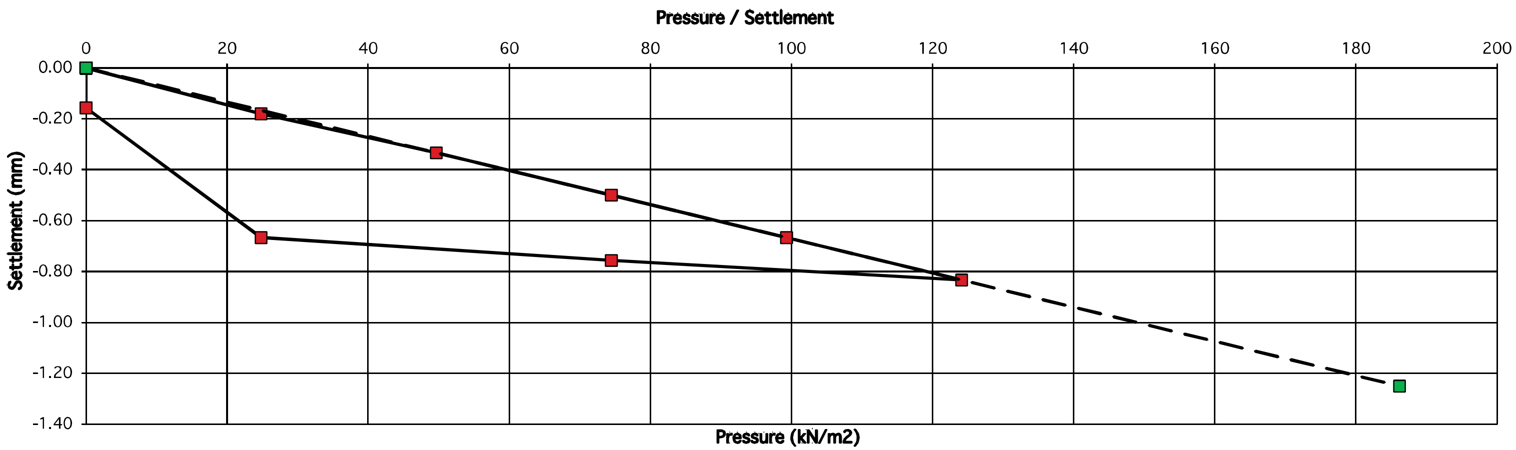
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R151898
Contract	24984 Galway Bus Connect
Test No.	CBR010 Reload
Location	2023-TP-010
Depth	0.5m
Client	Galway Co.Co.
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	B. Campbell
Authorised by	
Date	04/12/2023

Description of soil under test
(natural soil, placed fill, sub-base)
light grey sandy gravelly SILT / CLAY

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 149
Modulus of subgrade reaction = 96 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 26.2 %

PLATE TEST REPORT SHEET (F3.1)

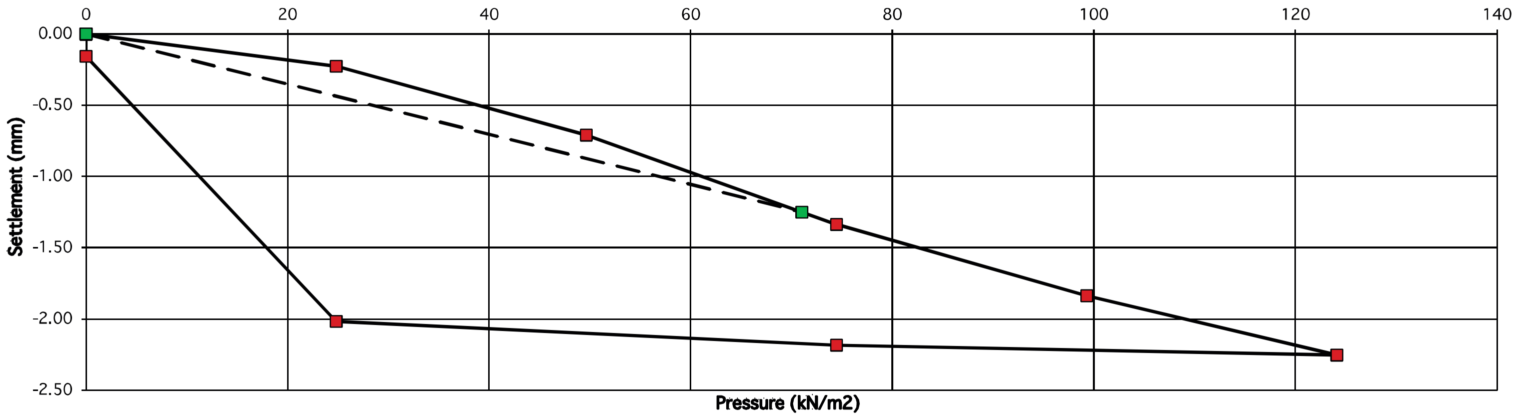
Applied Pressure/Settlement Curve

Reference No.	R150473
Contract	24984 Galway Bus Connect
Test No.	CBR11 Load
Location	2023-TP-011
Depth	0.50m
Client	Galway Co.Co.
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	B. Campbell
Authorised by	
Date	29/09/2023

Description of soil under test
(natural soil, placed fill, sub-base)
brown sandy moderately gravelly CLAY

Sample Ref No.
Depth m bgl

Pressure / Settlement



Gradient at 1.25 mm settlement intersection = 57
Modulus of subgrade reaction = 37 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 4.9 %

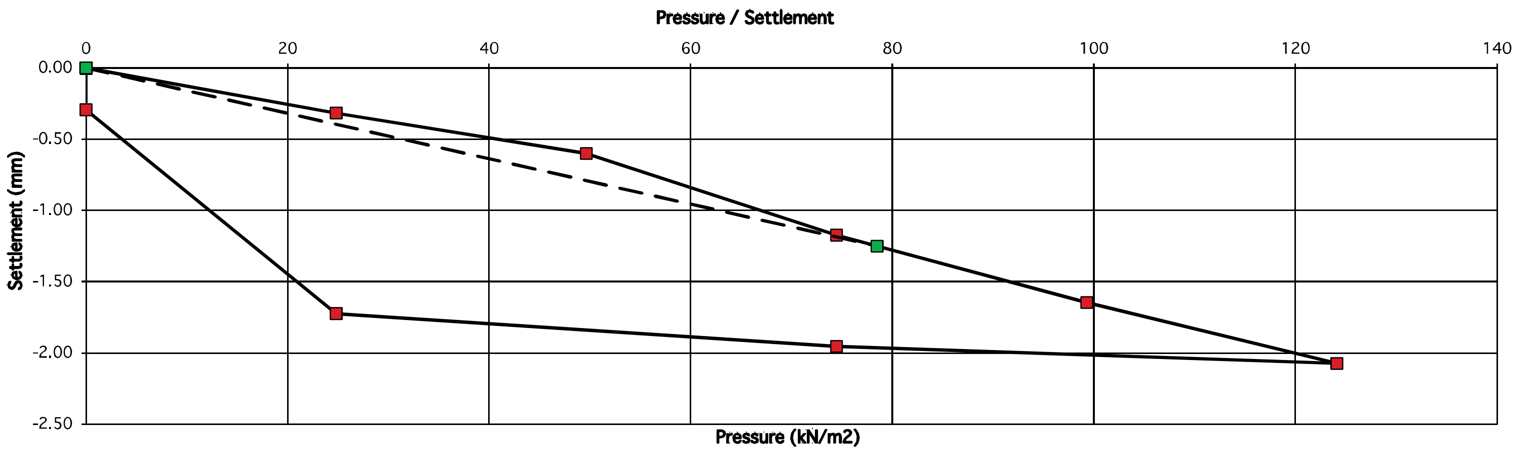
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R150473
Contract	24984 Galway Bus Connect
Test No.	CBR11 Reload
Location	2023-TP-011
Depth	0.50m
Client	Galway Co.Co.
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	B. Campbell
Authorised by	
Date	29/09/2023

Description of soil under test
(natural soil, placed fill, sub-base)
brown sandy moderately gravelly CLAY

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 63
Modulus of subgrade reaction = 40 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 5.9 %

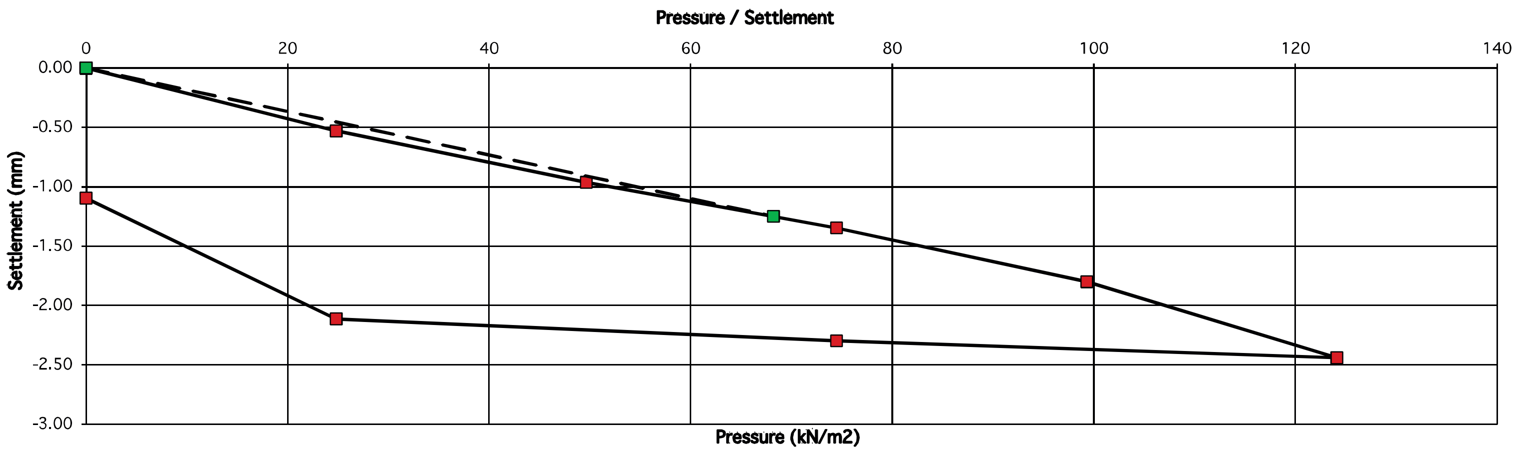
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R150474
Contract	24984 Galway Bus Connect
Test No.	CBR12 Load
Location	2023-TP-012
Depth	0.50m
Client	Galway Co.Co.
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	B. Campbell
Authorised by	
Date	29/09/2023

Description of soil under test
(natural soil, placed fill, sub-base)
greybrown sandy moderately gravelly CLAY

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 55
Modulus of subgrade reaction = 35 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 4.6 %

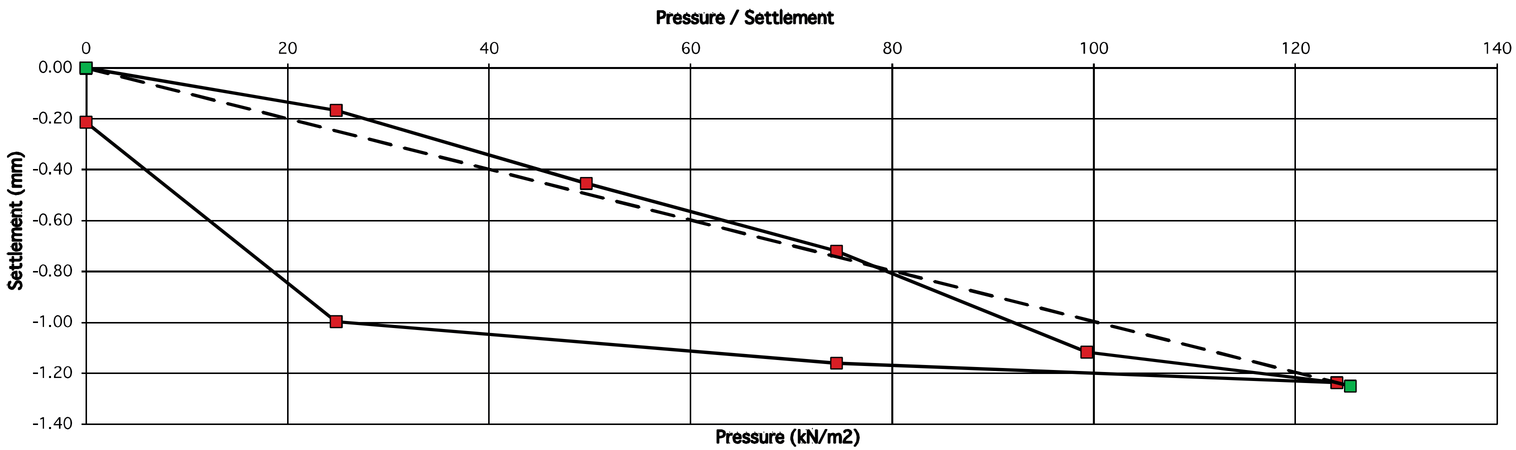
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R150474
Contract	24984 Galway Bus Connect
Test No.	CBR12 Reload
Location	2023-TP-012
Depth	0.50m
Client	Galway Co.Co.
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	B. Campbell
Authorised by	
Date	29/09/2023

Description of soil under test
(natural soil, placed fill, sub-base)
greybrown sandy moderately gravelly CLAY

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 100
Modulus of subgrade reaction = 65 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 13.2 %

PLATE TEST REPORT SHEET (F3.1)

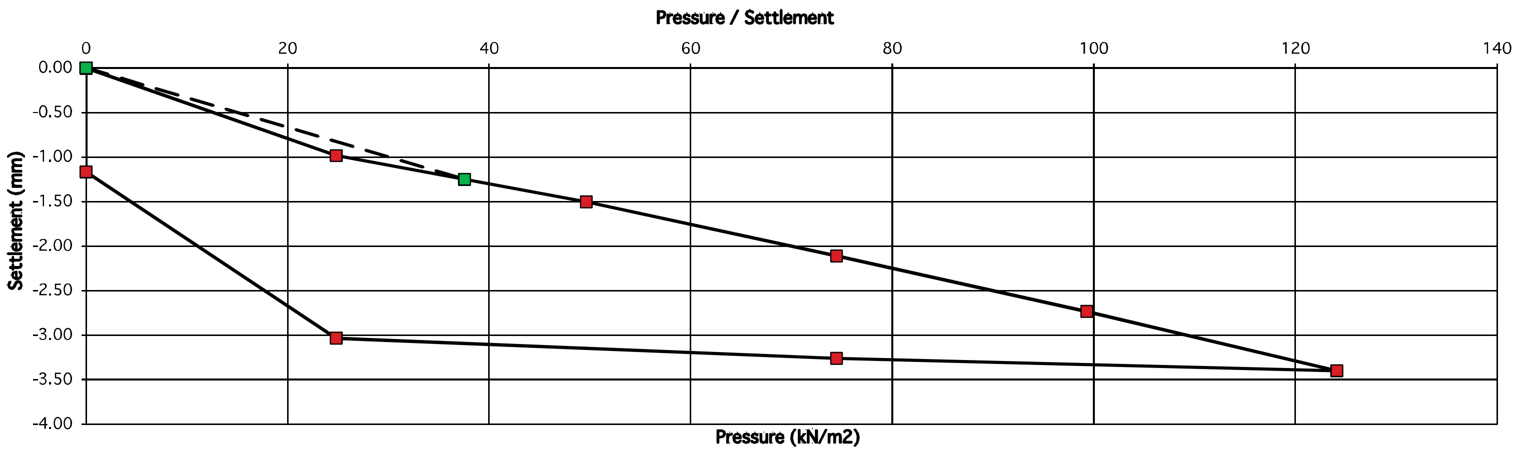
Applied Pressure/Settlement Curve

Reference No.	R150475
Contract	24984 Galway Bus Connect
Test No.	CBR13 Load
Location	2023-TP-013
Depth	0.50m
Client	Galway Co.Co.
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	B. Campbell
Authorised by	
Date	29/09/2023

Description of soil under test
(natural soil, placed fill, sub-base)

Greybrown slightly clayey moderately gravelly coarse grain SAND

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 30
Modulus of subgrade reaction = 19 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 1.6 %

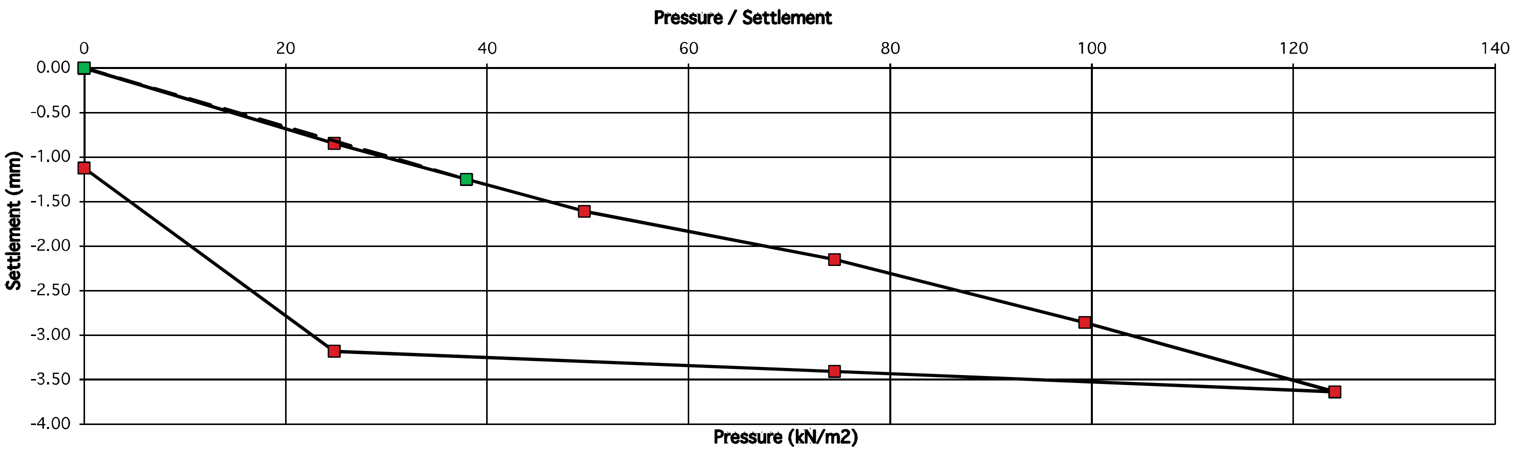
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R150475
Contract	24984 Galway Bus Connect
Test No.	CBR13 Reload
Location	2023-TP-013
Depth	0.50m
Client	Galway Co.Co.
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	B. Campbell
Authorised by	
Date	29/09/2023

Description of soil under test
(natural soil, placed fill, sub-base)
Greybrown slightly clayey moderately gravelly coarse grain SAND

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 30
Modulus of subgrade reaction = 20 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 1.7 %

Appendix 8 - Geophysical Survey

BusConnects

Dublin Road, Galway

Geophysical Survey

Report Status: Final

MGX Project Number: 6730

MGX File Reference: 6730f-005.doc

15th April 2024

Confidential Report To:

IGSL
Unit F
M7 Business Park
Naas
Co. Kildare

Report submitted by:
Minerex Geophysics Limited

Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare, W23X7Y5
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Tel.: 01-6510030
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Issued by:

Author: John Connaughton (Geophysicist)

Reviewer: Hartmut Krahn (Senior Geophysicist)

Minerex Geophysics Limited

Subsurface Geophysical Investigations

EXECUTIVE SUMMARY

1. Minerex Geophysics Ltd. (MGX) carried out a geophysical survey consisting of 2D-Resistivity (ERT) and seismic refraction (p-wave) surveying for the ground investigation for the BusConnects Galway project along the Dublin Road.
2. The main objectives of the survey were to determine the ground conditions under the site, to determine the depth to rock and the overburden thickness, to estimate the strength or stiffness or compaction of overburden and the rock quality, and to detect possible karstified rock.
3. The interpretation consists of 5 layers ranging from soil and road material to clean limestone.
4. The resistivity data from Ch0 – 1900 is disturbed and the interpretation is based on the seismic refraction.
5. Layer 1 is described as road material, fill or soft or loose soil and has a general thickness of around 2m.
6. Layer 2 is interpreted as stiff or dense overburden and is present in three locations after Ch3340 to a depth of up to 12m below ground level (bgl)
7. Layer 3 is described as very stiff or very dense overburden or poor very weathered limestone. Table 3 shows the locations where the top of this layer is shallower than 1m for a combined length of approx. 1.6km along the route.
8. Layer 4 is interpreted as karstified limestone and is present in two locations from Ch2560 – 2860 and 3320 – 3670. These are the main karst zones.
9. There may be other karstified limestone areas including from Ch1960 – 2010, Ch3170 – 3240 and Ch3780 – 3883.
10. Layer 5 is described as good to very good clean limestone. This layer is shallower than 3m for a length of 200m along the route.
11. Borehole logs were provided after the survey and tie in well with the geophysical interpretation.

CONTENTS

List of Tables, Maps and Figures:

1. INTRODUCTION

1.1 Background

Minerex Geophysics Ltd. (MGX) carried out a geophysical survey for the BusConnects Project in Galway City. The survey consisted of 2D-Resistivity (ERT) and seismic refraction (p-wave) along the corridor where a proposed bus lane is to be built. The survey was commissioned by IGSL.

This survey utilized two complementary geophysical methods to improve final interpretations. The role of geophysics as a non-destructive fast method is to provide a geological interpretation over a wide area to complement direct ground investigations at specific locations. The direct ground investigation results can be used to improve the initial geophysical results and interpretation.

The survey was aimed at investigating the ground conditions under the site such as depth to rock head, possible karstification, overburden type as well as rock strength and excavatability.

1.2 Objectives

The main objectives of the geophysical survey were:

- To determine the ground conditions under the site
- To determine the depth to rock and the overburden thickness
- To estimate the strength or stiffness or compaction of overburden materials and the rock quality
- To determine the type of overburden and rock
- To detect lateral changes within the geological layers
- To detect possible karstified zones within the rock or karst features

1.3 Site Description

The site is located along the Dublin Road in the east of Galway City. The site runs from Sailin in the west to the Doughiska Road in the east and is approx. 3.9km long. The survey was carried out along the footpath, grass verge of the road or along the side of the road. Elevation rise gradually along the route from 6 to 27mOD from west to east.

1.4 Geology

Borehole and Rotary Core logs were provided after the survey.

The logs describe the overburden as primarily clay with silt, cobbles and gravels in places. The rock is described as limestone and ranging from 1.4 – 11.2m below ground level (bgl). The rock ranges from weak to very strong. The rotary core hole locations are indicated on Map 1 and the abbreviated borehole logs are shown on the figures.

Online geological maps of Ireland (GSI, 2023) give the following information:

The overburden geology consists of till derived from limestones.

In terms of rock the survey area is underlain by Visean Limestones, described as undifferentiated limestone.

Visean Limestones are karstifiable. There is a swallow hole noted to the north of the road at Ch2000 and an enclosed depression at Ch3650. There are no faults or karst features recorded near the site.

1.5 Report

This report includes the results and interpretation of the geophysical survey. Maps, figures and tables are included to illustrate the results of the survey. More detailed descriptions of geophysical methods and measurements can be found in GSEG (2002), Milsom (1989) and Reynolds (1997).

The description of soil, rock and the use of geotechnical terms (soft, stiff, dense etc) follows Eurocode (2007) and BSI (2015) standards. The terms are defined in the standards and the physical parameters are related from experience. This geophysical survey has been acquired, processed, interpreted and reported in accordance with these guidelines.

The client provided maps of the site and the digital version was used as the background map in this report. Elevations were surveyed on site and are used in the vertical sections. A chainage was added for ease of reference.

The interpretative nature and the non-invasive survey methods must be taken into account when considering the results of this survey and Minerex Geophysics Limited, while using appropriate practice to execute, interpret and present the data, give no guarantees in relation to the existing subsurface.

2. GEOPHYSICAL SURVEY

2.1 Methodology

The methodology consisted of using 2D-Resistivity and seismic refraction along the entire route as well as at the Skerritt Roundabout.

The survey locations are indicated on Map 1. The lines, chainages and parameters are tabulated in Table 1 attached at the end of this report.

Care was taken to avoid or mitigate the presence of metal underground services and the hardstanding surface of the road and footpaths. The existing underground services drawings were examined in order to avoid a negative influence on the resistivity survey where possible. Hardstanding surface have a detrimental effect on the seismic data as a low-velocity-layer is present below the hardstanding surface. Traffic noise that is bad for the seismic survey was avoided by working at night when traffic volumes were low. These topics were also discussed in a start-up meeting with the client and engineers for the project.

2.2 2D-Resistivity (ERT)

2D-Resistivity lines were surveyed with electrode spacing of 5m, up to 64 electrodes per set-up and a maximum length of 315m per set-up. The readings were taken with a Tigre Resistivity Meter, Imager Cables, stainless steel electrodes and a laptop with ImagerPro acquisition software.

The 2D-Resistivity lines were as continuous as possible along the chainage. The data was acquired in the roll-along mode to achieve continuous coverage to a depth of 25m between the ends of the lines.

On solid sealed tarmac, concrete and hard standing areas, the electrodes were placed inside small drilled holes (12mm), and saline water was added to make a good electrical connection. The holes were backfilled with sealant.

During 2D-Resistivity surveying, data is acquired in the form of linear arrays using a suite of metal electrodes. A current is induced into the ground via a pair of electrodes whilst a potential difference is measured across a second pair of electrodes. This allows for the recording of the apparent resistivity in a two-dimensional arrangement below the line. The data is inverted after the survey to obtain a model of subsurface resistivities. The generated model resistivity values and their spatial distribution can then be related to typical values for different geological materials.

The presence of metal underground services like water or gas pipes may influence the results of the survey. A metal water main was indicated on the utility drawings from Ch0 to 650 and offset to the south. This disturbed the survey along this line location. There is also a gas main from Ch0 – 1500, whose construction material is not stated.

2D-Resistivity has previously proven zones of anomalous or karstified rock with lateral extents of 5m and more.

2.3 Seismic Refraction

Seismic refraction lines were surveyed with geophone spacing of 2m and 24 geophones per set-up resulting in a 46m length per set-up. The recording equipment consisted of a 24 Channel GEOMETRICS ES-3000 engineering seismograph with 4.5Hz vertical geophones. The seismic energy source consisted of a hammer and. A zero-delay trigger was used to start the recording.

Set-ups were acquired in longer continuous lines using common shot points between set-ups and concatenating into longer lines at the processing stage.

The seismic refraction survey method focuses on propagating p-waves travelling through the subsurface, which are generated by a seismic source. As the wave propagates through the subsurface, its velocity varies as it travels through overburden, rock with different elastic properties, and along geological boundaries. Velocity data is recorded via the surveying equipment, which is then processed, allowing geological layer thicknesses and boundaries to be established.

Seismic Refraction generally determines the depth to horizontal or near horizontal layers where the compaction or strength or rock quality changes with an accuracy of around 20% of the depth to that layer. Where the layers are shallower than the geophone spacing depth deviations of +- 1m to top of layers can occur. Where low velocity layers or shadow zones are present (e.g., below solid ground surface) or where layers dip with more than 20 degree angle the accuracy becomes much less.

In areas with thick concrete or tarmac a low velocity layer exists for the seismic waves below the solid surface layer. This makes it less certain or impossible to pick first breaks from geophones near the source and therefore no velocity determination for the shallow subsurface is possible. This results in larger deviations in the depth modelling and borehole results are preferred for a final calibration of the results.

The seismic refraction set-ups with 46m individual length have a reasonable penetration depth of around 10m. An internationally accepted maximum depth estimate for a seismic refraction set-up is 1/6 of the set-up length including offshots. The depth penetration varies according to the velocity structure of the subsurface. In this report we used a depth of 10m bgl. where the seismic modelling was ended as deeper modelling becomes less meaningful.

2.4 Site Work

The data acquisition was carried out between the 18th and 21st of September 2023. The weather conditions were fair throughout the acquisition period. Health and safety standards were adhered to at all times. Whilst working on roadways and verges, a traffic management system was in place, clearly highlighted by the use of warning signs and cones. Surveying was carried out at night to minimise disruption to traffic and to reduce the amount of noise on the data.

The locations and elevations were surveyed with a Carlson NR3 RTK-GPS to accuracy < 0.05m.

3. RESULTS AND INTERPRETATION

The interpretation of geophysical data was executed utilizing the known response of geophysical measurements, typical physical parameters for subsurface features that may underlay the site, and the experience of the authors.

Ground investigation results were provided after the survey and the abbreviated borehole logs are indicated on the sections. The overburden was abbreviated as clay, silt, cobbles and gravel. The rock was generally divided into weathered limestone (based on RQD value < 50%) and limestone (> 50%). This can be done only to a certain extend as the rock can be very variable. RQD values, fracture indices and non-intact zones often change rapidly with depth. The small size of a borehole only represents a very small volume of ground while the geophysical survey on the other end of the scale averages over a large volume of ground.

3.1 2D-Resistivity (ERT)

The 2D-Resistivity data was positioned and inverted with the RES2DINV inversion package. Lines using the roll-along method were concatenated for a joint inversion. The programme uses a smoothness constrained least-squares inversion method to produce a 2D model of the subsurface resistivities from the recorded apparent resistivity values. Three variations of the least squares method are available and for this project the Jacobian Matrix was recalculated for the first three iterations, then a Quasi-Newton approximation was used for subsequent iterations. Each dataset was inverted using seven iterations resulting in a typical RMS error of <3.0%. The resulting models were colour contoured with the same resistivity scale for all lines and they are displayed as cross sections (Plans 1a – 1k).

Resistivities are characteristic for certain overburden and rock types. If there is a high content of clay minerals (which are electrically conductive) then the overburden resistivity will be lower than as if there is a high content of clastic grains like sand or gravel. The purer the clay and the lower the sand and gravel content, the lower the resistivity. Water content in overburden layers can influence the resistivities, but generally clay content has a more dominating effect.

In limestone areas, karstified rock is defined in this report as a formerly intact clean limestone rock, liable to karstification, that has been partially dissolved by water over long geological time scales and where the cavities and voids have either remained empty (filled by air) or became filled by overburden sediment (clay, silt, sand), weathering product of the broken rock itself or water. This process would lead to a reduction of the resistivity of the overall rock and therefore karstified rock has a lower resistivity than intact clean limestone rock. This is generally indicated by lower resistivities embedded within high resistivity at depth.

The 2D-Resistivity data from Ch0 – 1900 has been disturbed by underground services such as metal pipes and other metal above or below ground in this area. Items like large manhole chambers and earthing equipment can also disturb the resistivity survey. No interpretation for the resistivity data can be made in this area.

For Ch1900 – 3883, the resistivities cover a range typical for materials from clay rich overburden (low resistivities) to fresh strong unweathered bedrock (high resistivities). The ranges have been taken into the consideration for the interpretation. Within the rock, high resistivities (>500Ohmm) across much of this area indicate a clean limestone which would be karstifiable. Lower resistivities (<500Ohmm) primarily indicate karstified limestone or in some areas indicate deeper overburden such as from Ch3800 – 3900.

3.2 Seismic Refraction

The seismic refraction data was positioned and processed with the SEISIMAGER software package to give a layered model of the subsurface. The number of layers has been determined by analysing the seismic traces and a total of 5 layers were used in the models. All seismic lines were subject to a standardised processing sequence which consisted of a topographic correction which was based on integrated elevation data, first break picking, tomographic inversion, travel-time computation via ray-tracing and velocity modelling. Residual deviations of typically 0.4 to 1.8 msec RMS have been obtained for each line. Following each processing stage QC procedures were adhered to. The resulting layer boundaries are shown as thick lines overlaid on the 2D-Resistivity cross sections (Plans 1a – 1k). The average seismic velocities obtained within the layers are annotated on the sections as bold black numbers.

The p-wave seismic velocity is closely linked to the density of subsurface materials and to parameters like compaction, stiffness, strength and rock quality. The higher the density of the subsurface materials the higher the seismic velocity. More compacted, stiffer, denser and stronger material will have a higher seismic velocity. For rock, the seismic velocity is higher when the rock is stronger, less weathered and has a higher quality. If the rock is more weathered, broken, fractured, fissured or karstified then the seismic velocity will be reduced compared to that of intact fresh rock.

Because of the above relationship, the seismic refraction method and seismic velocities are suitable to investigate ground where the layers get denser, more compacted and stronger with depth. A disadvantage is that some materials may have the same seismic velocity: Very stiff or very dense highly consolidated overburden and a weathered rock can have the same seismic velocity range (as is the case in the layer 3 below).

The modelled seismic data has created the following layered ground model:

Layer 1a has a thickness of 0.5 – 2m and has seismic velocities of 200 - 350m/s. This layer was present where surveying was carried out along grass verges and would be made ground and soil with a soft or loose stiffness or compaction.

Layer 1b has a thickness of up to 4m but is generally around 2m thick and has seismic velocities of 400 - 1000m/s. This layer is present where surveying occurred on the road or footpath. This layer would consist of the road material and fill under the road.

Layer 2 was modelled with a velocity of 1100m/s and is present in the east of the survey area in a few places. The velocity indicates overburden material with a stiff or dense strength or compaction.

Layer 3 velocities of 1800 - 2000m/s indicate overburden with a very stiff or very dense strength or compaction or a very weathered rock with poor rock quality. The thickness of this layer generally varies between 2 and 10m. This layer is thinner in some locations. Table 3 in Chapter 4 shows areas where the top of this layer is less than 1m bgl.

Layer 4 velocities of 2800m/s indicate a karstified rock. This layer is present in two locations to the east of the site between Ch2560 – 5860 and Ch3320 – 3670 which indicate significant karstified limestone areas.

Layer 5 is interpreted as good to very good clean limestone indicated by seismic velocities of 3500 - 5000m/s. To the west of the Skerritt roundabout, the top of this layer is generally between 3.5 – 9m bgl. From Ch600 – 630, the top of this layer drops to 15m bgl and from Ch720 – 740 to 12m bgl. To the east of the roundabout, the depth to the top of this layer is generally between 3 – 9.5m bgl. The top of this layer is deeper close to the karstified rock areas as well as from Ch3770 to Ch3883. The top of this layer is shallower in a number of locations as well. Table 4 in Chapter 4 shows areas where the top of this layer is less than 3m bgl.

3.3 Interpretation of Resistivity and Seismic Refraction

Table 2 summarises the interpretation for the seismic refraction survey. The urban nature of the site means that an interpretation for the 2D-Resistivity is not possible from Ch0 – 1900. To the east of Ch1900, there are two sections where the seismic refraction layer 4 ties in with areas of deep resistivities of >500Ohmm. The results from both methods gives a strong indication that there is karstified limestone in these areas. There are other areas where seismic refraction Layer 4 is not present but there are lower resistivities at depth such as Ch1960 – 2010, Ch3170 – 3240 and Ch3780 – 3883. This may be due to the karstified limestone being underneath unweathered limestone rather than at the top of the rock layer.

Interpreted cross sections are shown in Figure 2a – 2k. The interpretation has been made from all available information. For overburden layers and the top of the rock the seismic refraction data has been used as seismic refraction is the best method to delineate layer boundaries. The resistivity model values have been used primarily to identify weathering or karst features within the rock layer.

Table 2: Summary of Interpretation

Layer	General Seismic Velocity Range (m/sec)	General Resistivity Range (Ohmm)	Stiffness or Compaction or Rock Quality	Interpretation	Estimated Excavation Method
1a	200 - 350	Any	Soft or loose	Soil	Diggable
1b	400 - 1000	Any		Road Material or Fill	Diggable
2	1100	Any	Stiff or Dense Overburden	Overburden	Diggable
3	1800 - 2000	Any	Very stiff or Very Dense Overburden or poor Rock	Overburden or very weathered Limestone	Diggable or rippable to marginal rippable
4	2800	<500		Karstified Limestone	Breaking & Blasting
5	3500 - 5000	>500	Good to very good rock	Clean Limestone	Breaking & Blasting

4. CONCLUSIONS

The following conclusions are made:

- The geophysical surveys carried out for the BusConnects Project along the Dublin Road in Galway City consisted of 2D-Resistivity and seismic refraction along the route.
- The seismic refraction data was modelled with 5 layers. Near the surface where the survey was carried out along the roadway, the accuracy is reduced by the hardstanding materials.
- Layer 1a was interpreted as soft or loose soil where the survey was carried out along grass, and road material or fill where the survey was carried out along the roadway.
- Layer 2 is described as stiff or dense overburden. This layer is present between Ch3340 – 3440 to a depth of 4m, Ch3655 – 3740 to a depth of 12m and Ch3760 – 3883 to a depth of 6m.
- Layer 3 is interpreted as very stiff or very dense overburden or poor very weathered limestone. The top of this layer is shallower than 1m at the following locations:

Table 3: Top of Layer 3 shallower than 1m

Distance (m)	Start Chainage	End Chainage
20	440	460
30	560	590
95	855	950
30	1070	1100
20	1230	1250
10	1450	1460
990	1660	2650
20	2920	2940
105	3015	3120
50	3290	3340
210	3445	3655
20	3740	3760

- The resistivities from Ch0 – 1900 are disturbed due to interference from metal and other man-made items and cannot be interpreted.
- Layer 4 is interpreted as karstified limestone. This layer is present in two areas where resistivities are lower than 500Ohmm to depths of over 15m between Ch2560 – 2860 and 3320 – 3670. These two areas are quite large and they are identified as the main karst zones along the chainage.

- Low resistivities in other areas and at depth may also indicate karstified limestone below clean limestone. The most notable areas include Ch1960 – 2010, Ch3170 – 3240 and Ch3780 – 3883.
- While the seismic refraction data does not indicate any significant karst features from Ch0 – 1900, there may be some karstified limestone in these areas.
- Layer 5 is interpreted as good to very good clean limestone. The top of this layer is shallower than 3m at the following locations:

Table 4: Top of Layer 5 shallower than 3m

Distance (m)	Start Chainage	End Chainage
40	1840	1880
140	2130	2270
20	3310	3330

- Abbreviated borehole logs were included in the final report. The logs show the rock ranging from 1.4 – 11.2m bgl.
- RC08 and RC10 described weathered limestone within interpreted layer 3 while other boreholes describe overburden within this layer which matches with the interpretation.
- RC07 indicates gravel and clay within the interpreted karstified rock layer and these may be infill within the rock at the surface.
- RC09 was carried out within one of the interpreted areas of karstified limestone and shows 6.6m of weathered rock with very low associated RQD values. This borehole identified rock shallower than the geophysical interpretation but this may be due to the highly weathered nature of the rock in this area.

5. REFERENCES

1. **BSI, 2015.** BS5930, Code of Practice for Ground Investigations, British Standards Institute 2015

2. **Eurocode, 2007.** EN 1997-2:2007. Eurocode 7. Part 2 Ground Investigation and Testing 2007

3. **GSEG, 2002.** Geophysics in Engineering Investigations. Geological Society Engineering Geology Special Publication 19, London, 2002

4. **GSI, 2023.** Online Geological Map of Ireland. Geological Survey of Ireland 2023

5. **Milsom, 1989.** Field Geophysics. John Wiley and Sons, 1989

6. **Reynolds, 1997.** An Introduction to Applied and Environmental Geophysics. John Wiley and Son, 1997

7. **Weaver, 1975.** Geological Factors significant in the Assessment of Rippability, 1975

Table 1: Geophysical Survey Locations and Acquisition Parameters

Line	Electrode Spacing (m)	Length (m)	Chainage	Display direction	Survey Type/Mode
R1	5	315	1568	W-E	Traverse
R2	5	1115	1898	NW-SE	Roll Along
R3	5	315	2986	W-E	Traverse
R4	5	585	3286	SW-NE	Roll Along
R5	5	635	874	W-E	Roll Along
R6	5	635	227	W-E	Roll Along
R7	5	220	37	W-E	Traverse
R8	5	70	1515	S-N	Traverse
R9	5	70	1548	S-N	Traverse
	SUM	**3960**			

Line	Geophone Spacing (m)	Length (m)	Chainage	Display direction	Survey Type/Mode
S1	2	94	1564	W-E	Concatenated
S2	2	238	1657	W-E	Concatenated
S3 - S11	2	1974	1898	W-E	Concatenated
S12 - S18	2	1498	0	W-E	Concatenated
S19	2	70	1515	S-N	Single Setup
S20	2	70	1548	S-N	Single Setup
	SUM	**3944**			

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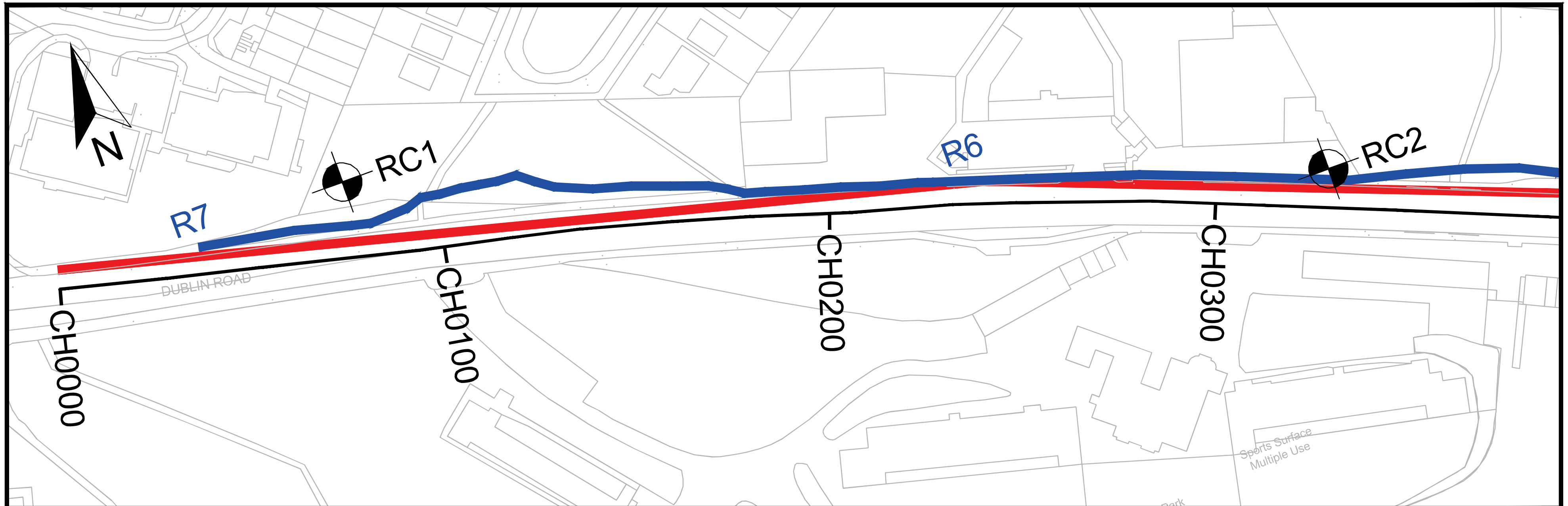
CLIENT	IGSL
PROJECT	Bus Connect, Dublin Road, Galway Geophysical Survey
TITLE	Map 1: Geophysical Survey Location Map

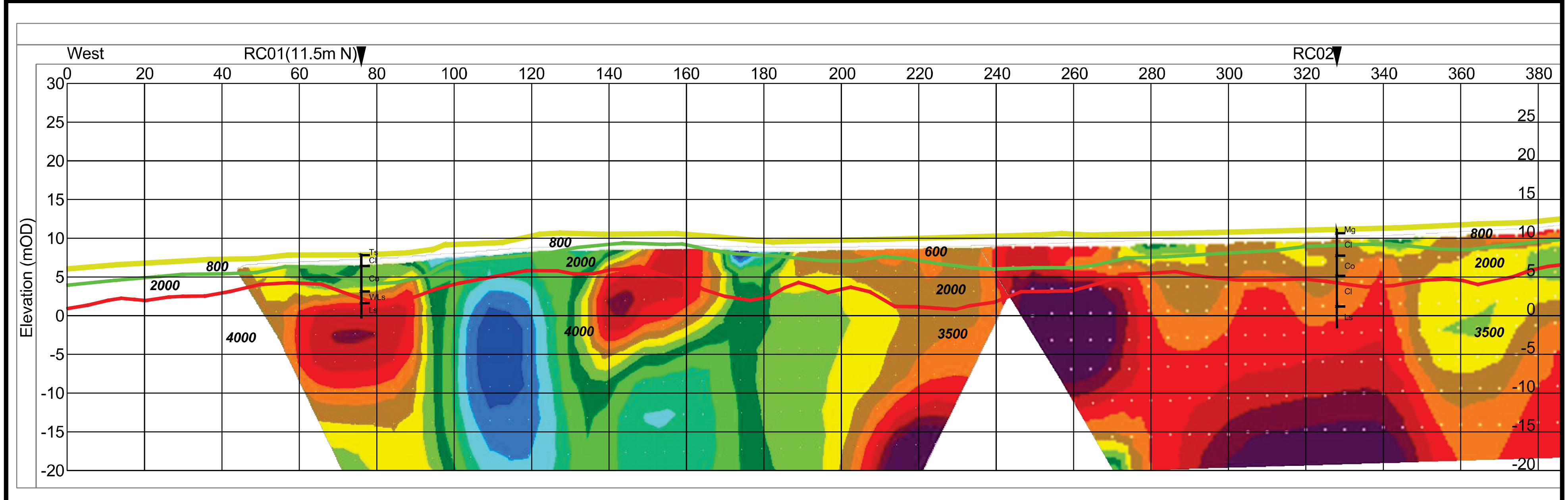
SCALE:	1:5000 @ A3
PROJECT:	6730
DRAWN:	JC
DATE:	12/04/2024
MGX FILE:	6730f_Drawings.dwg
STATUS:	Final

Geophysical Survey Locations:

R2	2D-Resistivity Line
S1	Seismic Refraction Line
RC1	Rotary Core Hole
CH0100	Centreline with Chainage

Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)





Minerex Geophysics Limited Unit F4, Maynooth Business Campus Maynooth, Co. Kildare Tel. (01) 6510030 Email: info@mgx.ie Web: www.mgx.ie	CLIENT	IGSL	
	PROJECT	Bus Connect, Dublin Road, Galway Geophysical Survey	
	TITLE	Plan 1a: Survey Locations and Models	

SCALE:	Hor 1:500 @ A1, Ver 1:250 @ A1, VE x 2
PROJECT:	6730
DRAWN:	JC
DATE:	12/04/2024
MGX FILE:	6730f_Drawings.dwg
STATUS:	Final

Geophysical Survey Locations:

R2	2D-Resistivity Line
S1	Seismic Refraction Line
RC1	Rotary Core Hole
CH0100	Centreline with Chainage

Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)

2D-Resistivity Model Values:

Resistivities (Ohm)

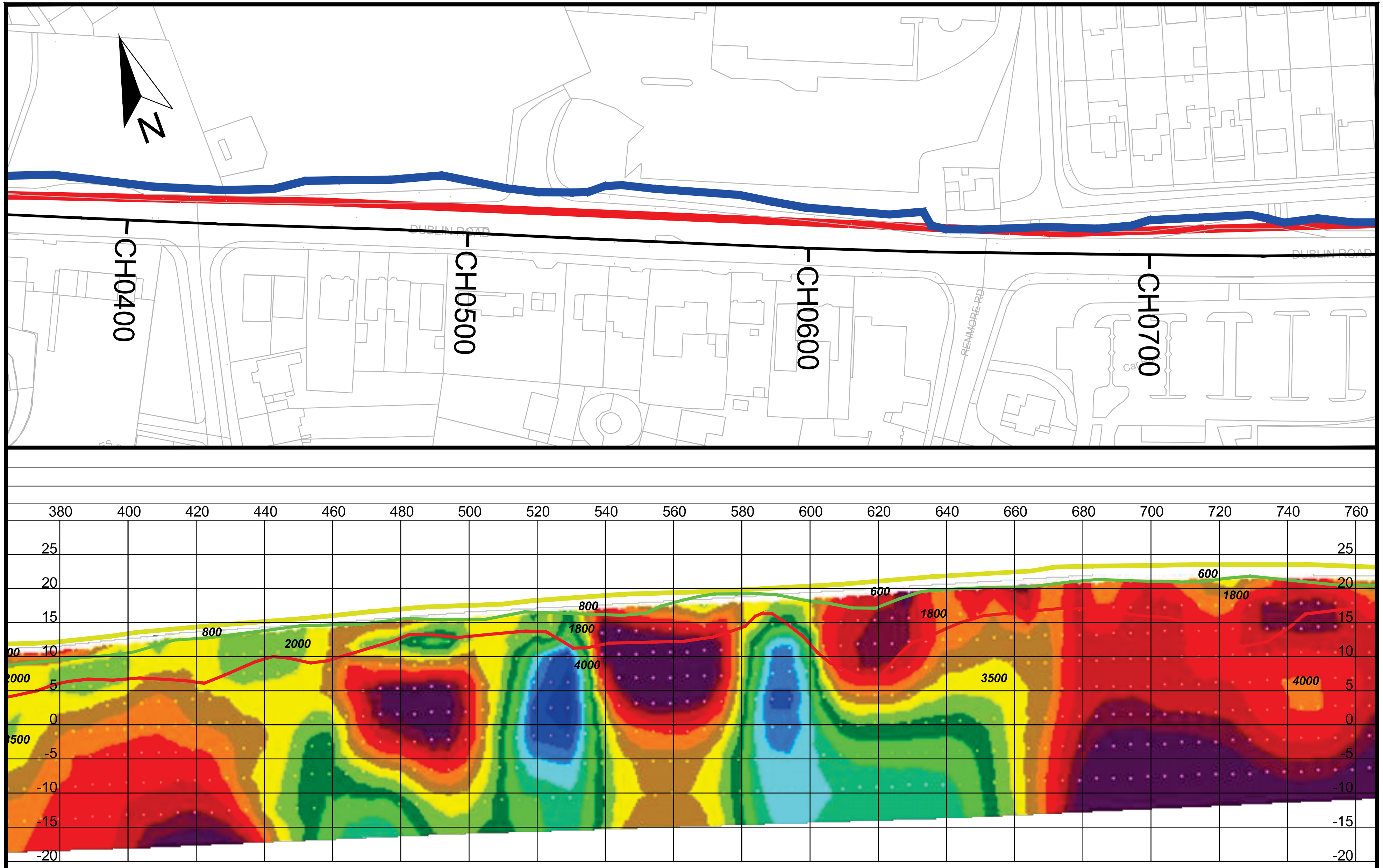
31.2 62.5 125 250 500 1000 2000 4000

Layers from Seismic Refraction Model:

- Grass Surface/Top of Layer 1a (200-350 m/s)
- Hard Surface/Top of Layer 1b (400-1000 m/s)
- Top of Layer 2 (1100 m/s)
- Top of Layer 3 (1800-2000 m/s)
- Top of Layer 4 (2800 m/s)
- Top of Layer 5 (3500-5000 m/s)
- *1800* Seismic Velocity in m/s

Abbreviated GI Logs:

RC01	Borehole Name and Location		
Cl	Clay	Mg	Made Ground
Grv	Gravel	Co	Cobbles
Slt	Silt	Ls	Limestone
Ts	Topsoil	WLs	Weathered Limestone



Minerex Geophysics Limited Unit F4, Maynooth Business Campus Maynooth, Co. Kildare Tel. (01) 6510030 Email: info@mgx.ie Web: www.mgx.ie	
CLIENT	IGSL
PROJECT	Bus Connect, Dublin Road, Galway Geophysical Survey
TITLE	Plan 1b: Survey Locations and Models
SCALE:	Hor 1:500 @ A1, Ver 1:250 @ A1, VE x 2
PROJECT:	6730
DRAWN:	JC
DATE:	12/04/2024
MGX FILE:	6730f_Drawings.dwg
STATUS:	Final

Geophysical Survey Locations:

- R2 — 2D-Resistivity Line
- S1 — Seismic Refraction Line
- RC1 — Rotary Core Hole
- CH0100 — Centreline with Chainage

Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)

2D-Resistivity Model Values:

Resistivities (Ohmm)

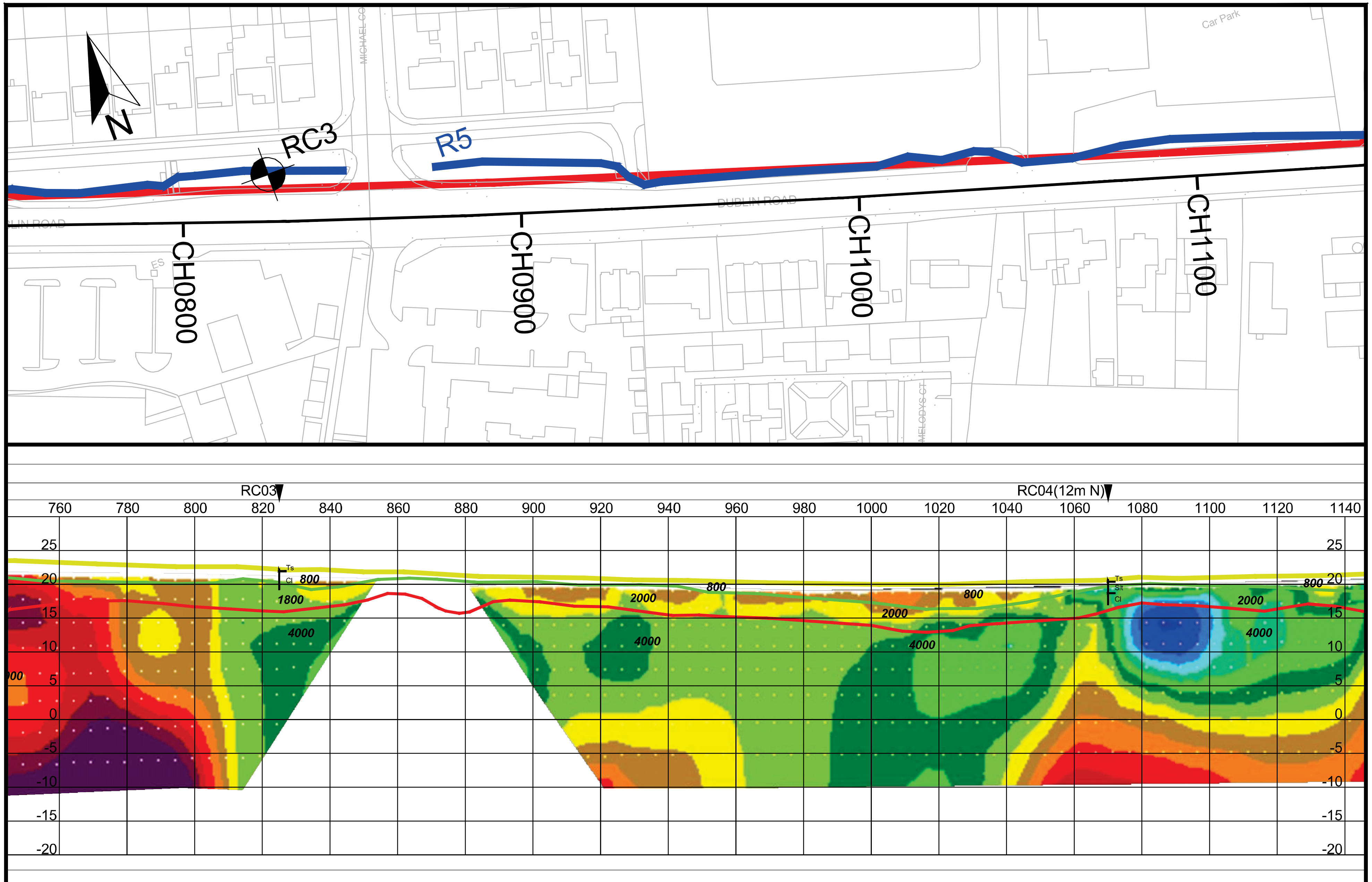
31.2 62.5 125 250 500 1000 2000 4000

Layers from Seismic Refraction Model:

- Grass Surface/Top of Layer 1a (200-350 m/s)
- Hard Surface/Top of Layer 1b (400-1000 m/s)
- Top of Layer 2 (1100 m/s)
- Top of Layer 3 (1800-2000 m/s)
- Top of Layer 4 (2800 m/s)
- Top of Layer 5 (3500-5000 m/s)
- ***1800*** Seismic Velocity in m/s

Abbreviated GI Logs:

RC01	Borehole Name and Location		
Cl	Clay	Mg	Made Ground
Grv	Gravel	Co	Cobbles
Slt	Silt	Ls	Limestone
Ts	Topsoil	WLs	Weathered Limestone



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CLIENT	IGSL
PROJECT	Bus Connect, Dublin Road, Galway Geophysical Survey
TITLE	Plan 1c: Survey Locations and Models

SCALE:	Hor 1:500 @ A1, Ver 1:250 @ A1, VE x 2
PROJECT:	6730
DRAWN:	JC
DATE:	12/04/2024
MGX FILE:	6730f_Drawings.dwg
STATUS:	Final

Geophysical Survey Locations:

- R2 — 2D-Resistivity Line
- S1 — Seismic Refraction Line
- RC1 — Rotary Core Hole
- CH0100 — Centreline with Chainage

Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)

2D-Resistivity Model Values:

Resistivities (Ohmm)

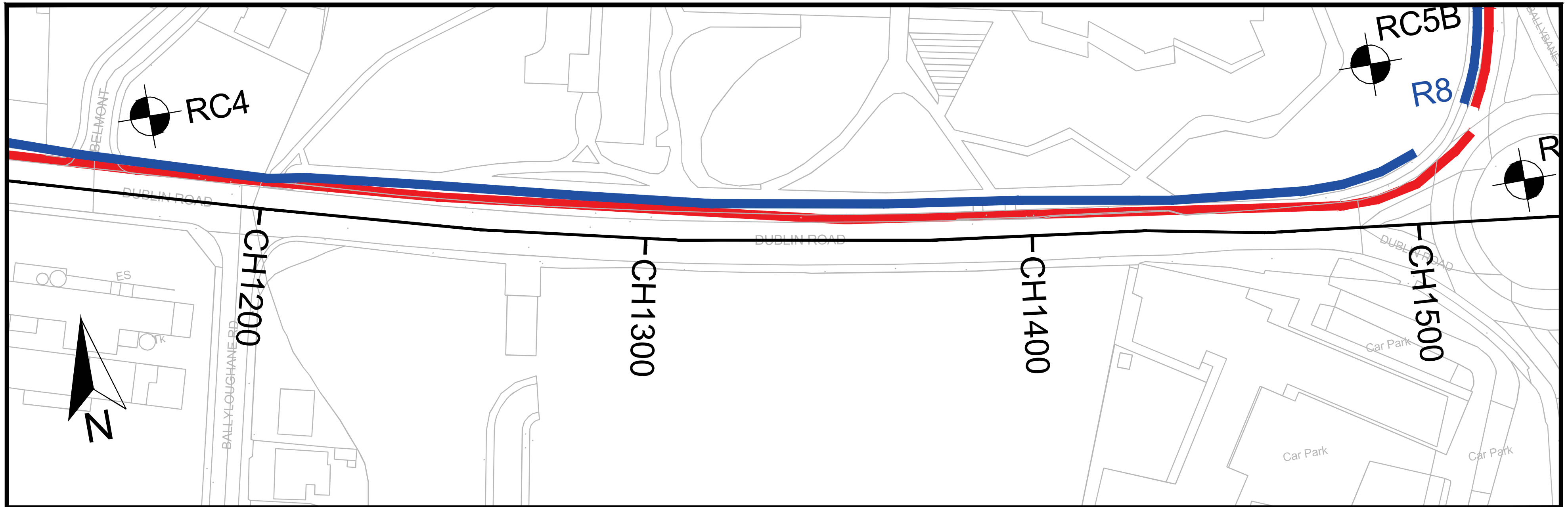
31.2 62.5 125 250 500 1000 2000 4000

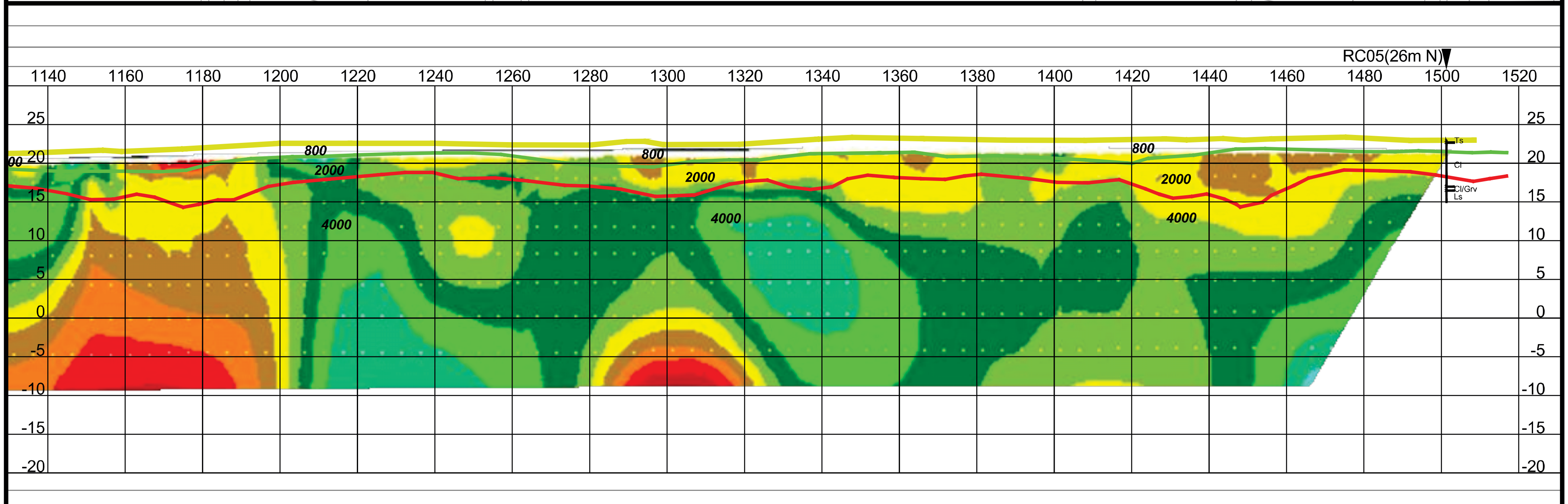
Layers from Seismic Refraction Model:

- Grass Surface/Top of Layer 1a (200-350 m/s)
- Hard Surface/Top of Layer 1b (400-1000 m/s)
- Top of Layer 2 (1100 m/s)
- Top of Layer 3 (1800-2000 m/s)
- Top of Layer 4 (2800 m/s)
- Top of Layer 5 (3500-5000 m/s)
- *1800* Seismic Velocity in m/s

Abbreviated GI Logs:

RC01	Borehole Name and Location		
Cl	Clay	Mg	Made Ground
Grv	Gravel	Co	Cobbles
Slt	Silt	Ls	Limestone
Ts	Topsoil	WLs	Weathered Limestone





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CLIENT	IGSL
PROJECT	Bus Connect, Dublin Road, Galway Geophysical Survey
TITLE	Plan 1d: Survey Locations and Models
SCALE:	Hor 1:500 @ A1, Ver 1:250 @ A1, VE x 2
PROJECT:	6730
DRAWN:	JC
DATE:	12/04/2024
MGX FILE:	6730f_Drawings.dwg
STATUS:	Final

Geophysical Survey Locations:

R2	2D-Resistivity Line
S1	Seismic Refraction Line
RC1	Rotary Core Hole
CH0100	Centreline with Chainage

Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)

2D-Resistivity Model Values:

Resistivities (Ohmm)

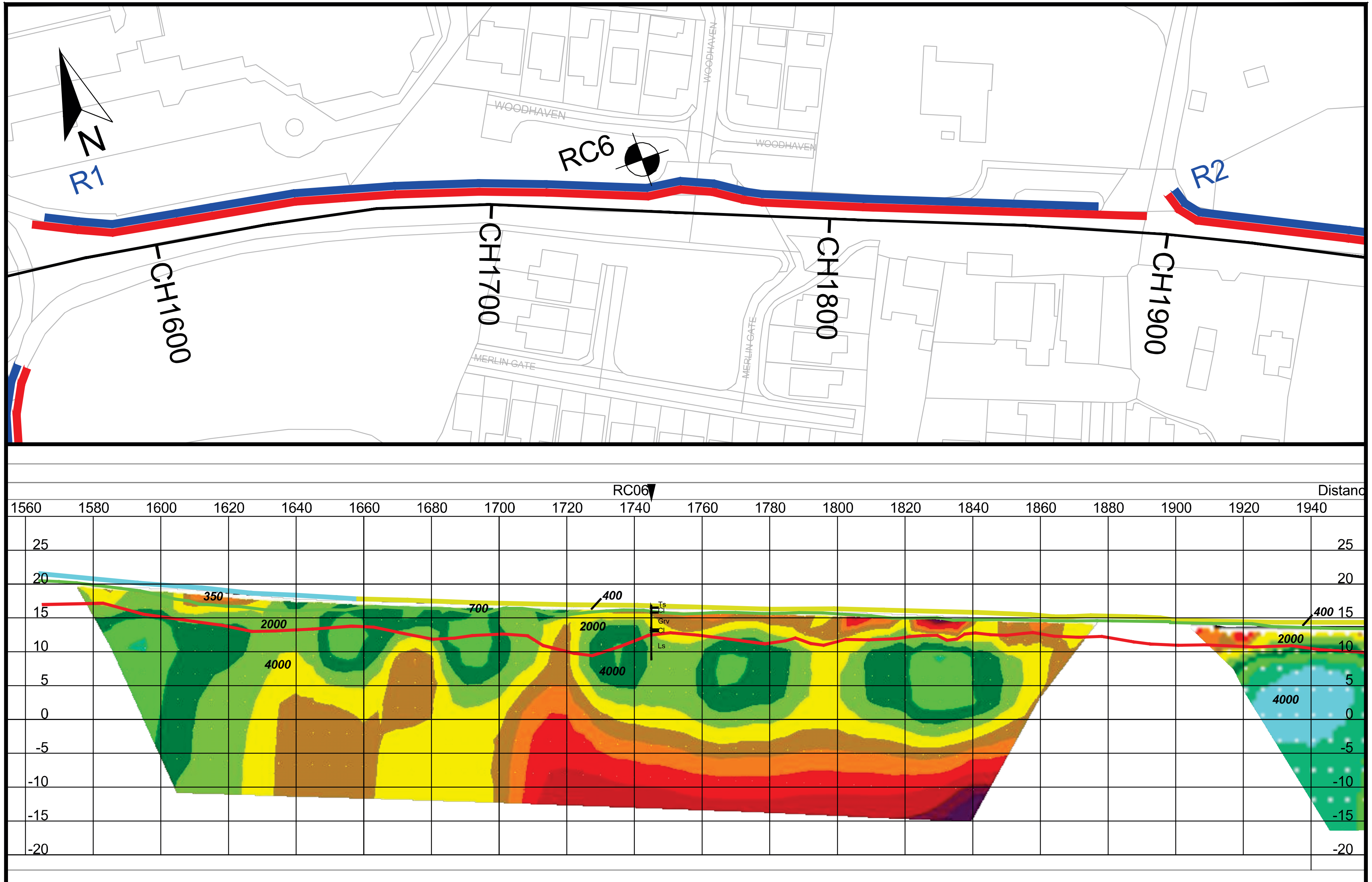
31.2 62.5 125 250 500 1000 2000 4000

Layers from Seismic Refraction Model:

- Grass Surface/Top of Layer 1a (200-350 m/s)
- Hard Surface/Top of Layer 1b (400-1000 m/s)
- Top of Layer 2 (1100 m/s)
- Top of Layer 3 (1800-2000 m/s)
- Top of Layer 4 (2800 m/s)
- Top of Layer 5 (3500-5000 m/s)
- *1800* Seismic Velocity in m/s

Abbreviated GI Logs:

RC01	Borehole Name and Location		
Cl	Clay	Mg	Made Ground
Grv	Gravel	Co	Cobbles
Slt	Silt	Ls	Limestone
Ts	Topsoil	WLs	Weathered Limestone



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	PROJECT	Bus Connect, Dublin Road, Galway Geophysical Survey	
	TITLE	Plan 1e: Survey Locations and Models	

SCALE:	Hor 1:500 @ A1, Ver 1:250 @ A1, VE x 2
PROJECT:	6730
DRAWN:	JC
DATE:	12/04/2024
MGX FILE:	6730f_Drawings.dwg
STATUS:	Final

Geophysical Survey Locations:

R2	2D-Resistivity Line
S1	Seismic Refraction Line
RC1	Rotary Core Hole
CH0100	Centreline with Chainage

Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)

2D-Resistivity Model Values:

Resistivities (Ohmm)

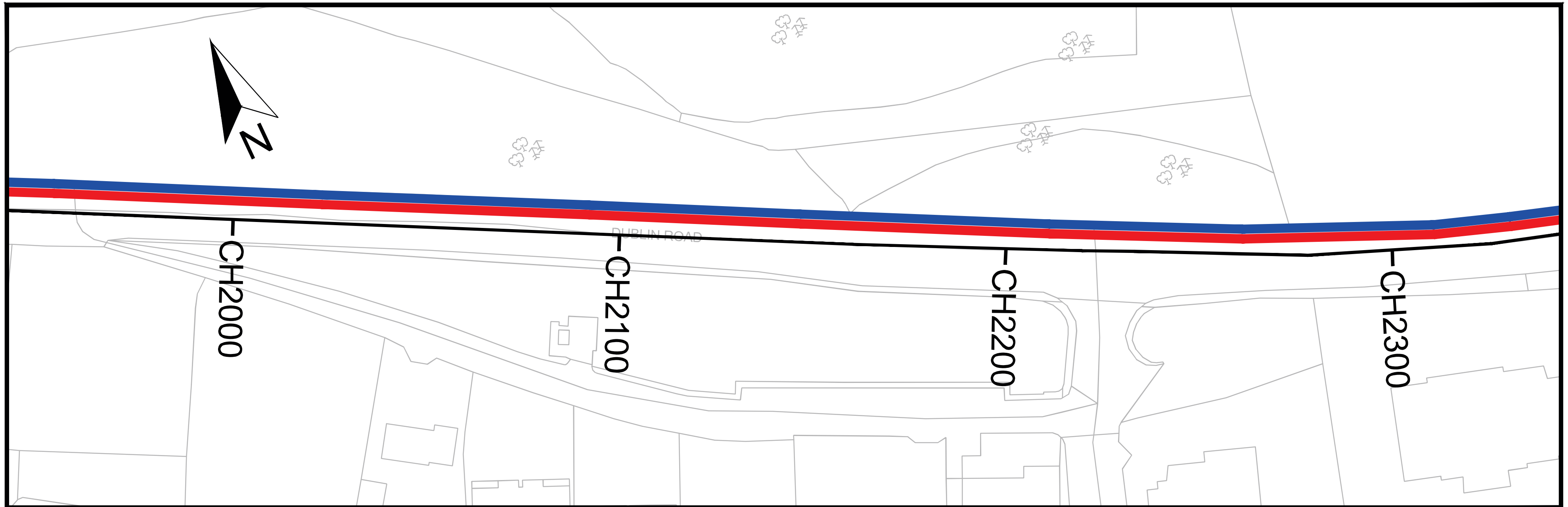
31.2 62.5 125 250 500 1000 2000 4000

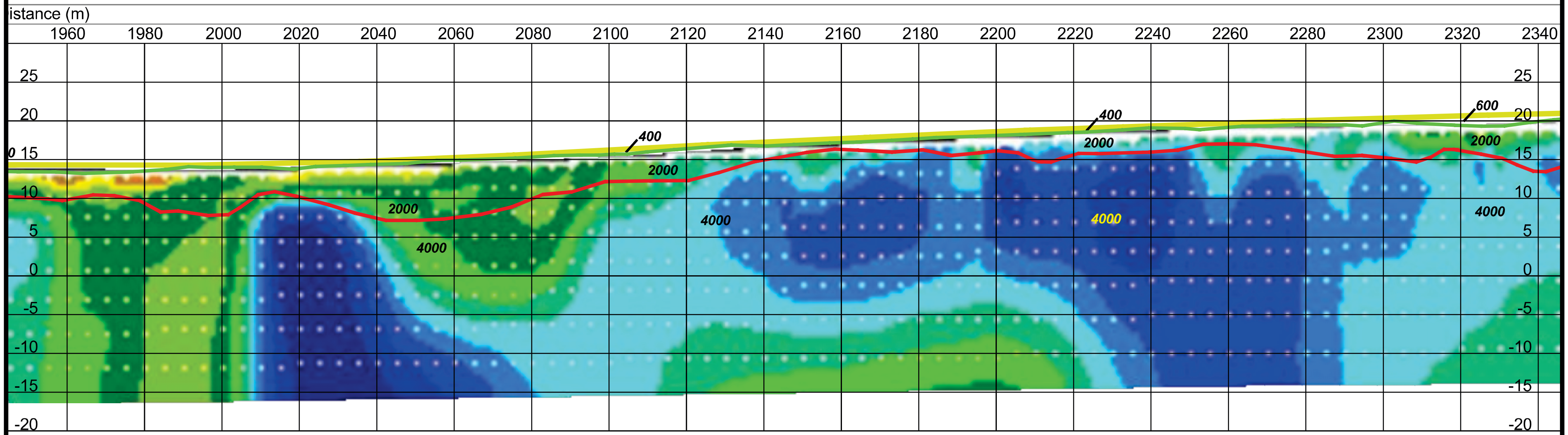
Layers from Seismic Refraction Model:

- Grass Surface/Top of Layer 1a (200-350 m/s)
- Hard Surface/Top of Layer 1b (400-1000 m/s)
- Top of Layer 2 (1100 m/s)
- Top of Layer 3 (1800-2000 m/s)
- Top of Layer 4 (2800 m/s)
- Top of Layer 5 (3500-5000 m/s)
- *1800* Seismic Velocity in m/s

Abbreviated GI Logs:

RC01	Borehole Name and Location		
Cl	Clay	Mg	Made Ground
Grv	Gravel	Co	Cobbles
Slt	Silt	Ls	Limestone
Ts	Topsoil	WLs	Weathered Limestone





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CLIENT	IGSL
PROJECT	Bus Connect, Dublin Road, Galway Geophysical Survey
TITLE	Plan 1f: Survey Locations and Models

SCALE:	Hor 1:500 @ A1, Ver 1:250 @ A1, VE x 2
PROJECT:	6730
DRAWN:	JC
DATE:	12/04/2024
MGX FILE:	6730f_Drawings.dwg
STATUS:	Final

Geophysical Survey Locations:

R2	2D-Resistivity Line
S1	Seismic Refraction Line
RC1	Rotary Core Hole
CH0100	Centreline with Chainage

Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)

2D-Resistivity Model Values:

Resistivities (Ohmm)

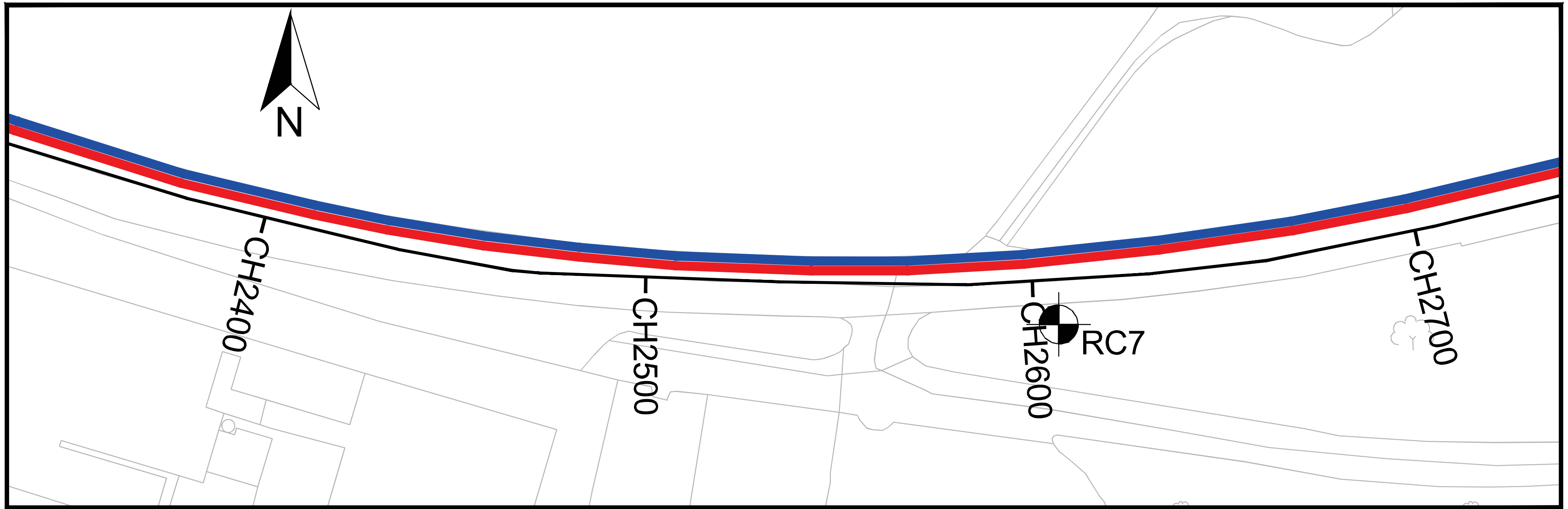
31.2 62.5 125 250 500 1000 2000 4000

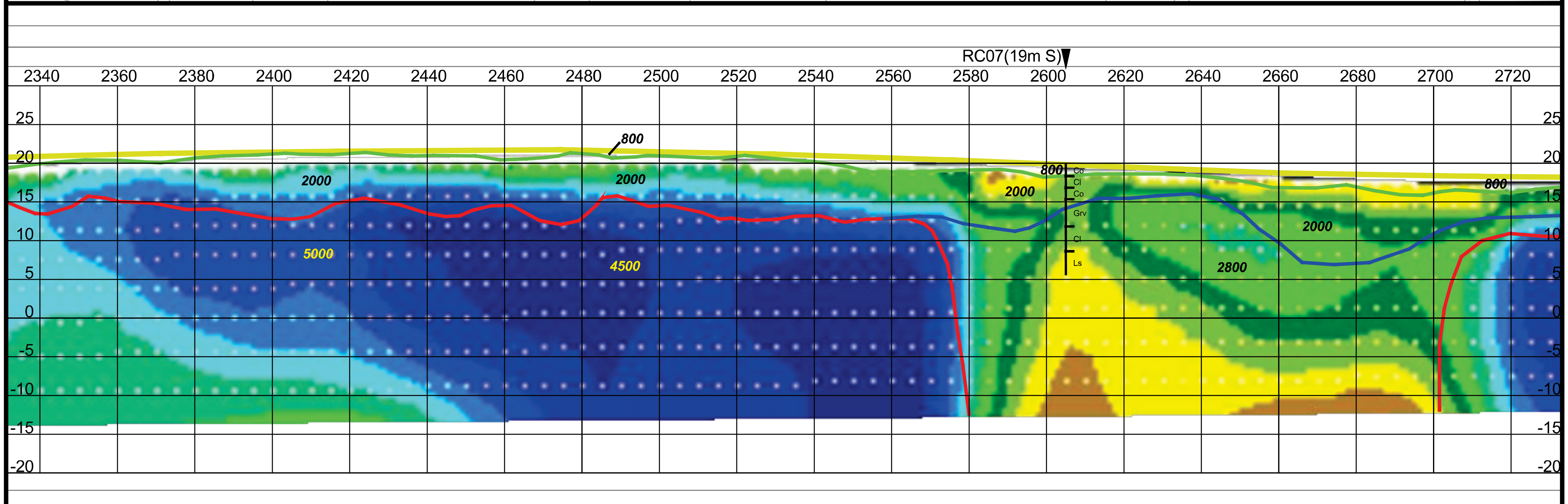
Layers from Seismic Refraction Model:

- Grass Surface/Top of Layer 1a (200-350 m/s)
- Hard Surface/Top of Layer 1b (400-1000 m/s)
- Top of Layer 2 (1100 m/s)
- Top of Layer 3 (1800-2000 m/s)
- Top of Layer 4 (2800 m/s)
- Top of Layer 5 (3500-5000 m/s)
- 1800 Seismic Velocity in m/s

Abbreviated GI Logs:

RC01	Borehole Name and Location		
Cl	Clay	Mg	Made Ground
Grv	Gravel	Co	Cobbles
Slt	Silt	Ls	Limestone
Ts	Topsoil	WLs	Weathered Limestone





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CLIENT	IGSL
PROJECT	Bus Connect, Dublin Road, Galway Geophysical Survey
TITLE	Plan 1g: Survey Locations and Models

SCALE:	Hor 1:500 @ A1, Ver 1:250 @ A1, VE x 2
PROJECT:	6730
DRAWN:	JC
DATE:	12/04/2024
MGX FILE:	6730f_Drawings.dwg
STATUS:	Final

Geophysical Survey Locations:

- R2 — 2D-Resistivity Line
- S1 — Seismic Refraction Line
- RC1 — Rotary Core Hole
- CH0100 — Centreline with Chainage

Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)

2D-Resistivity Model Values:

Resistivities (Ohmm)

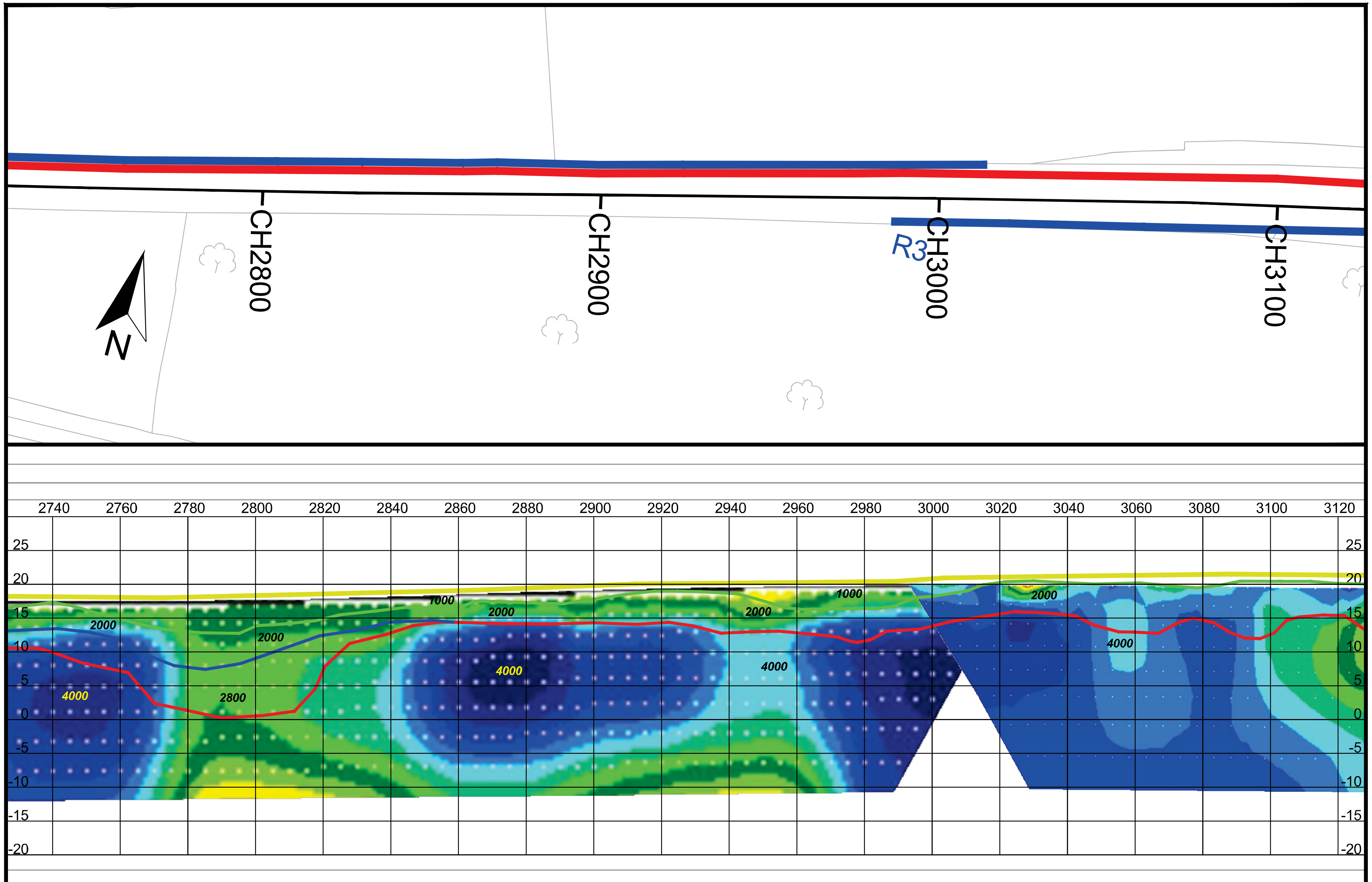
31.2 62.5 125 250 500 1000 2000 4000

Layers from Seismic Refraction Model:

- Grass Surface/Top of Layer 1a (200-350 m/s)
- Hard Surface/Top of Layer 1b (400-1000 m/s)
- Top of Layer 2 (1100 m/s)
- Top of Layer 3 (1800-2000 m/s)
- Top of Layer 4 (2800 m/s)
- Top of Layer 5 (3500-5000 m/s)
- *1800* Seismic Velocity in m/s

Abbreviated GI Logs:

RC01	Borehole Name and Location		
Cl	Clay	Mg	Made Ground
Grv	Gravel	Co	Cobbles
Slt	Silt	Ls	Limestone
Ts	Topsoil	WLs	Weathered Limestone



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CLIENT	IGSL
PROJECT	Bus Connect, Dublin Road, Galway Geophysical Survey
TITLE	Plan 1h: Survey Locations and Models

SCALE:	Hor 1:500 @ A1, Ver 1:250 @ A1, VE x 2
PROJECT:	6730
DRAWN:	JC
DATE:	12/04/2024
MGX FILE:	6730f_Drawings.dwg
STATUS:	Final

Geophysical Survey Locations:
- R2 — 2D-Resistivity Line
- S1 — Seismic Refraction Line
- RC1 — Rotary Core Hole
- CH0100 — Centreline with Chainage

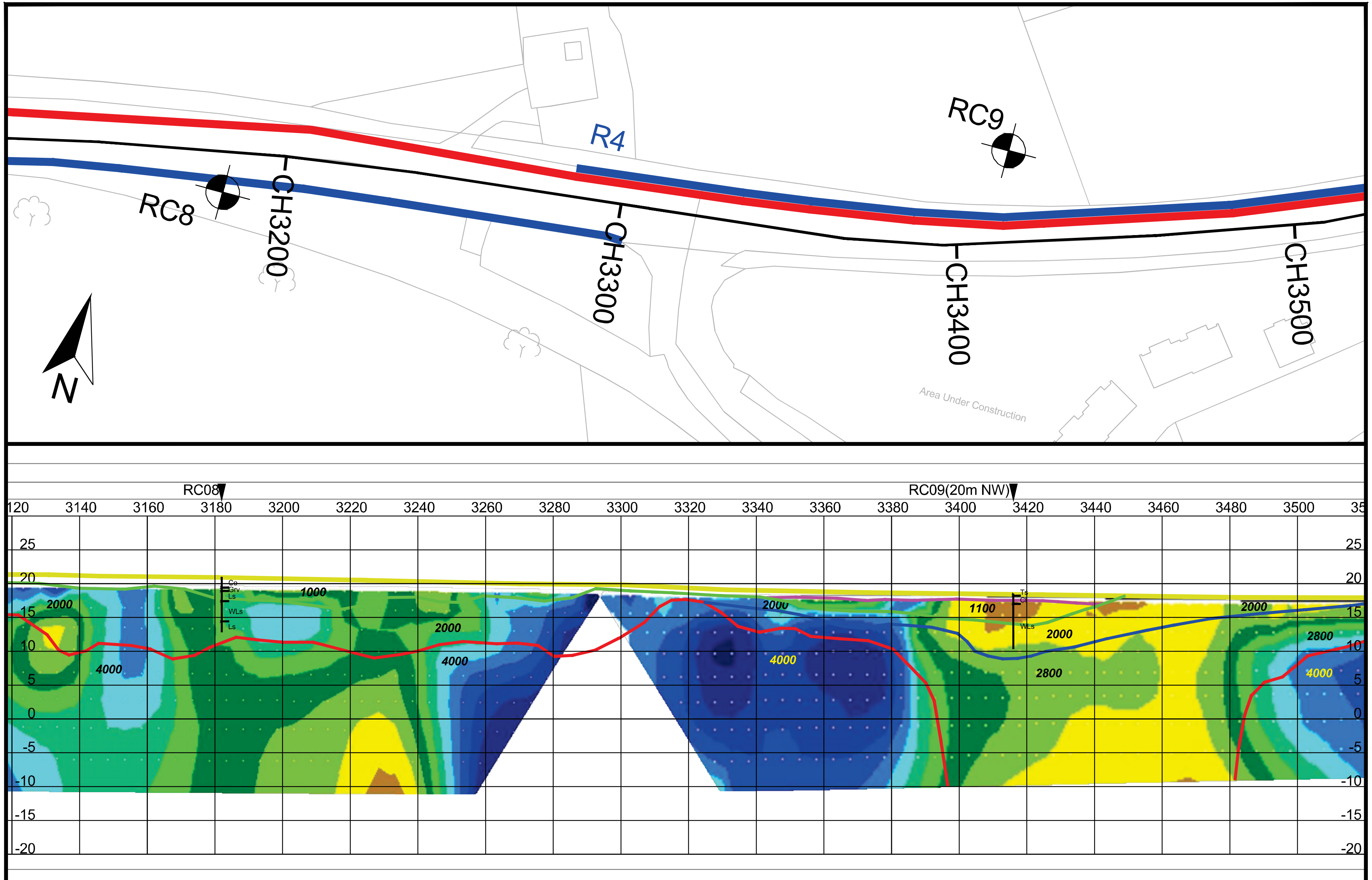
Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)

2D-Resistivity Model Values:
Resistivities (Ohmm)
31.2 62.5 125 250 500 1000 2000 4000

Layers from Seismic Refraction Model:
- Grass Surface/Top of Layer 1a (200-350 m/s)
- Hard Surface/Top of Layer 1b (400-1000 m/s)
- Top of Layer 2 (1100 m/s)
- Top of Layer 3 (1800-2000 m/s)
- Top of Layer 4 (2800 m/s)
- Top of Layer 5 (3500-5000 m/s)
- *1800* Seismic Velocity in m/s

Abbreviated GI Logs:

RC01	Borehole Name and Location		
Cl	Clay	Mg	Made Ground
Grv	Gravel	Co	Cobbles
Slt	Silt	Ls	Limestone
Ts	Topsoil	WLs	Weathered Limestone



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CLIENT	IGSL
PROJECT	Bus Connect, Dublin Road, Galway Geophysical Survey
TITLE	Plan 1i: Survey Locations and Models
SCALE:	Hor 1:500 @ A1, Ver 1:250 @ A1, VE x 2
PROJECT:	6730
DRAWN:	JC
DATE:	12/04/2024
MGX FILE:	6730f_Drawings.dwg
STATUS:	Final

Geophysical Survey Locations:

R2	2D-Resistivity Line
S1	Seismic Refraction Line
RC1	Rotary Core Hole
CH0100	Centreline with Chainage

Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)

2D-Resistivity Model Values:

Resistivities (Ohmm)

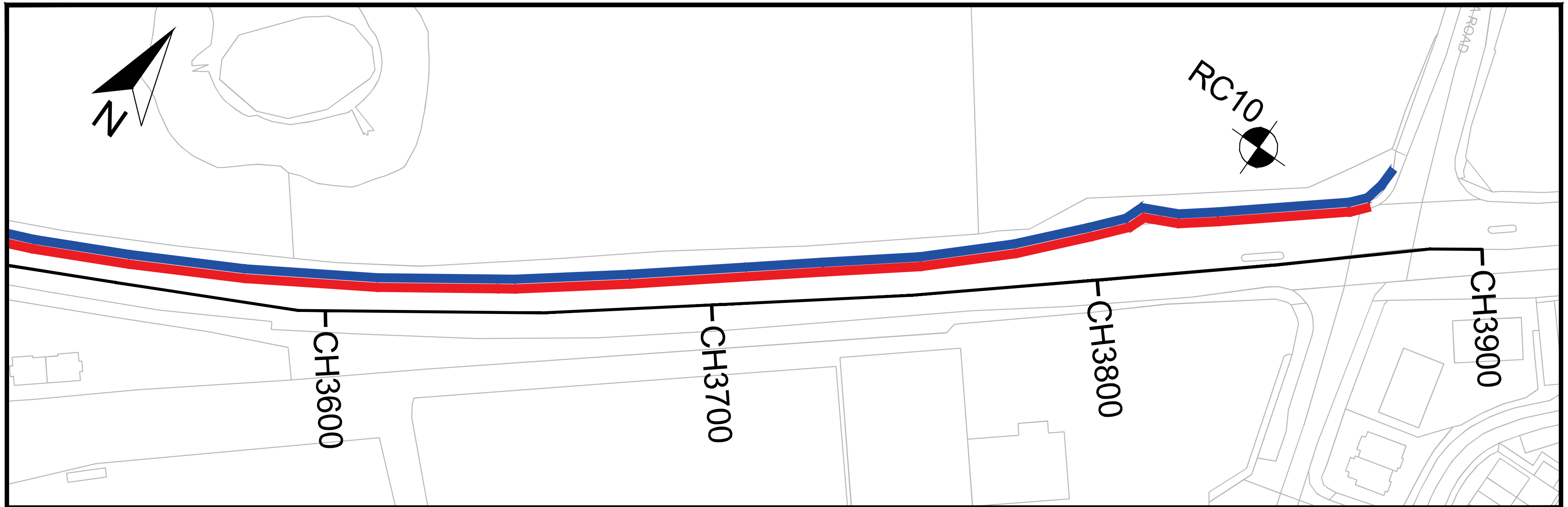
31.2 62.5 125 250 500 1000 2000 4000

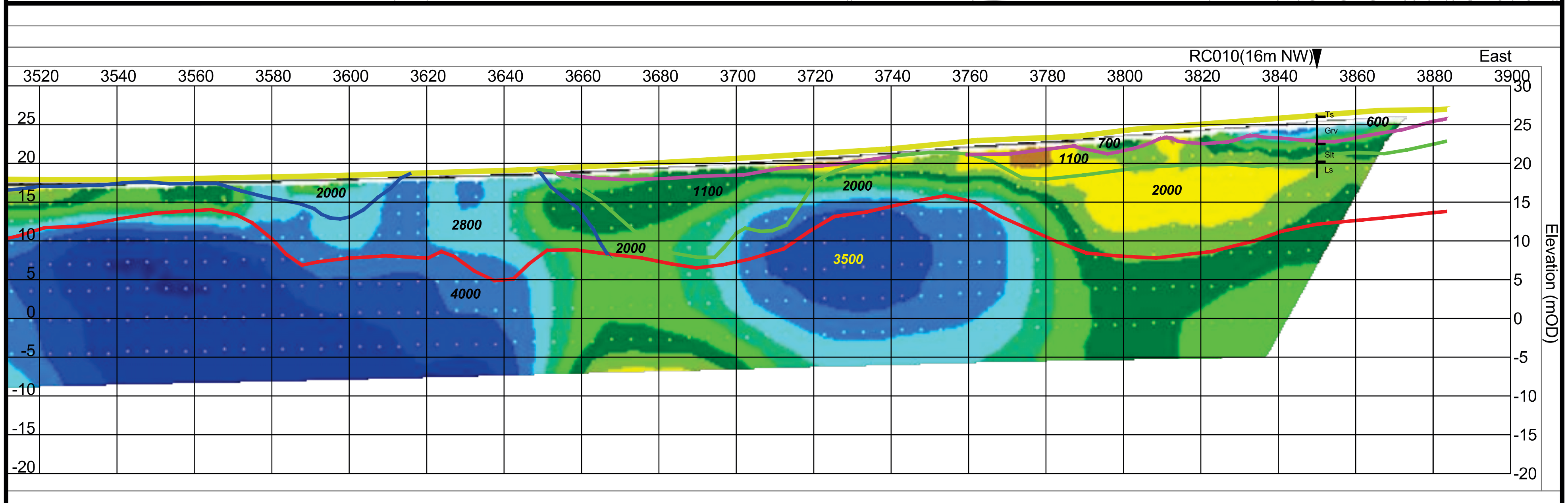
Layers from Seismic Refraction Model:

- Grass Surface/Top of Layer 1a (200-350 m/s)
- Hard Surface/Top of Layer 1b (400-1000 m/s)
- Top of Layer 2 (1100 m/s)
- Top of Layer 3 (1800-2000 m/s)
- Top of Layer 4 (2800 m/s)
- Top of Layer 5 (3500-5000 m/s)
- *1800* Seismic Velocity in m/s

Abbreviated GI Logs:

RC01	Borehole Name and Location		
Cl	Clay	Mg	Made Ground
Grv	Gravel	Co	Cobbles
Slt	Silt	Ls	Limestone
Ts	Topsoil	WLs	Weathered Limestone





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CLIENT	IGSL
PROJECT	Bus Connect, Dublin Road, Galway Geophysical Survey
TITLE	Plan 1j: Survey Locations and Models

SCALE:	Hor 1:500 @ A1, Ver 1:250 @ A1, VE x 2
PROJECT:	6730
DRAWN:	JC
DATE:	12/04/2024
MGX FILE:	6730f_Drawings.dwg
STATUS:	Final

Geophysical Survey Locations:

- R2 — 2D-Resistivity Line
- S1 — Seismic Refraction Line
- RC1 — Rotary Core Hole
- CH0100 — Centreline with Chainage

Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)

2D-Resistivity Model Values:

Resistivities (Ohmm)

31.2 62.5 125 250 500 1000 2000 4000

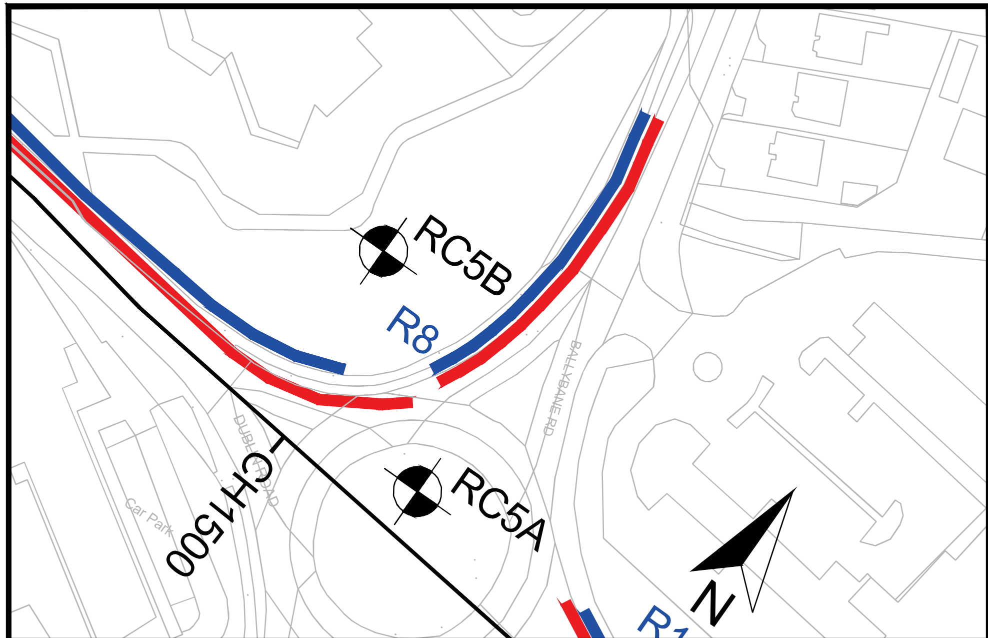
Layers from Seismic Refraction Model:

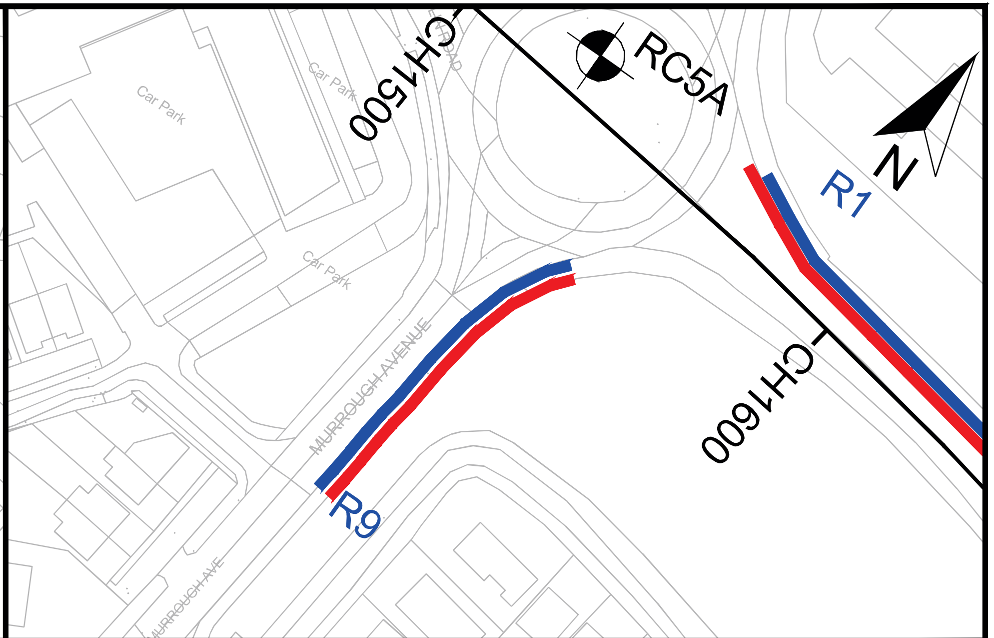
- Grass Surface/Top of Layer 1a (200-350 m/s)
- Hard Surface/Top of Layer 1b (400-1000 m/s)
- Top of Layer 2 (1100 m/s)
- Top of Layer 3 (1800-2000 m/s)
- Top of Layer 4 (2800 m/s)
- Top of Layer 5 (3500-5000 m/s)
- 1800 — Seismic Velocity in m/s

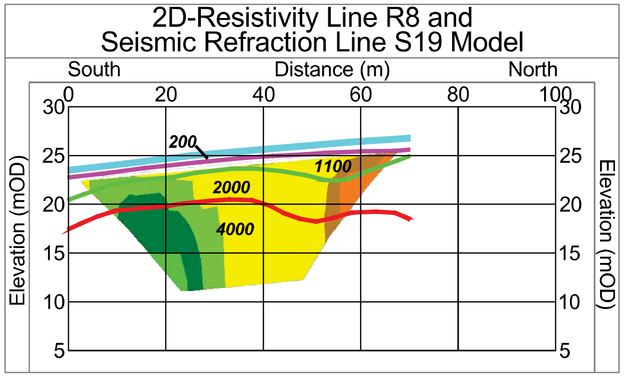
Abbreviated GI Logs:

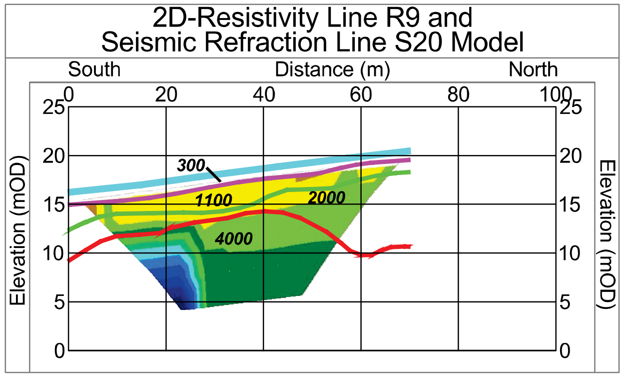
RC01 — Borehole Name and Location

Cl	Clay	Mg	Made Ground
Grv	Gravel	Co	Cobbles
Slt	Silt	Ls	Limestone
Ts	Topsoil	WLs	Weathered Limestone









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CLIENT	IGSL
PROJECT	Bus Connect, Dublin Road, Galway Geophysical Survey
TITLE	Plan 1k: Survey Locations and Models

SCALE:	Hor 1:500 @ A1, Ver 1:250 @ A1, VE x 2
PROJECT:	6730
DRAWN:	JC
DATE:	12/04/2024
MGX FILE:	6730f_Drawings.dwg
STATUS:	Final

Geophysical Survey Locations:

R2	2D-Resistivity Line
S1	Seismic Refraction Line
RC1	Rotary Core Hole
CH0100	Centreline with Chainage

Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)

2D-Resistivity Model Values:

Resistivities (Ohmm)

31.2 62.5 125 250 500 1000 2000 4000

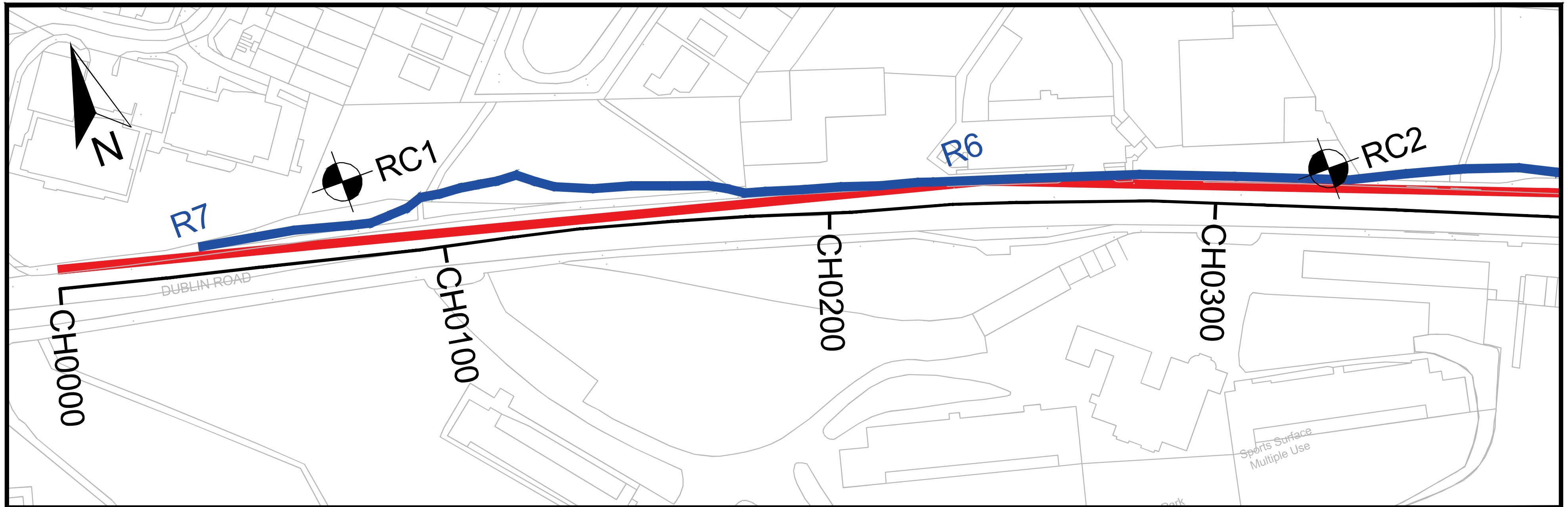
Layers from Seismic Refraction Model:

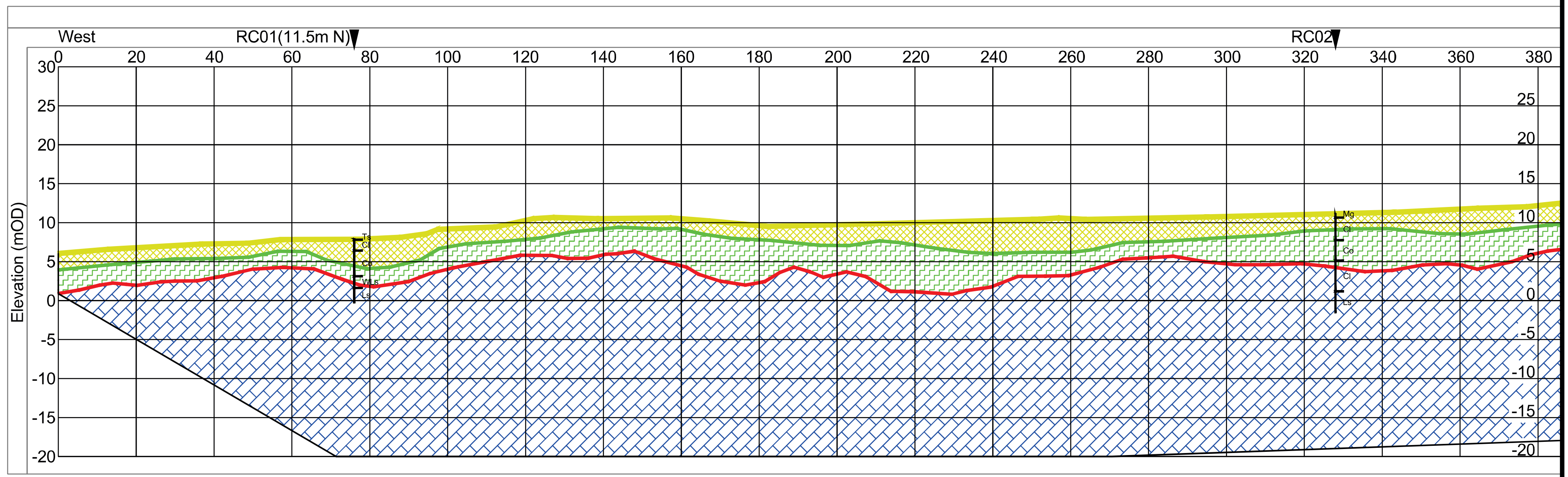
- Grass Surface/Top of Layer 1a (200-350 m/s)
- Hard Surface/Top of Layer 1b (400-1000 m/s)
- Top of Layer 2 (1100 m/s)
- Top of Layer 3 (1800-2000 m/s)
- Top of Layer 4 (2800 m/s)
- Top of Layer 5 (3500-5000 m/s)
- *1800* Seismic Velocity in m/s

Abbreviated GI Logs:

RC01 Borehole Name and Location

Cl	Clay	Mg	Made Ground
Grv	Gravel	Co	Cobbles
Slt	Silt	Ls	Limestone
Ts	Topsoil	WLs	Weathered Limestone





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CLIENT	IGSL
PROJECT	Bus Connect, Dublin Road, Galway Geophysical Survey
TITLE	Plan 2a: Survey Locations and Interpretation

SCALE:	Hor 1:500 @ A1, Ver 1:250 @ A1, VE x 2
PROJECT:	6730
DRAWN:	JC
DATE:	12/04/2024
MGX FILE:	6730f_Drawings.dwg
STATUS:	Final

Geophysical Survey Locations:

R2	2D-Resistivity Line
S1	Seismic Refraction Line
RC1	Rotary Core Hole
CH0100	Centreline with Chainage

Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)

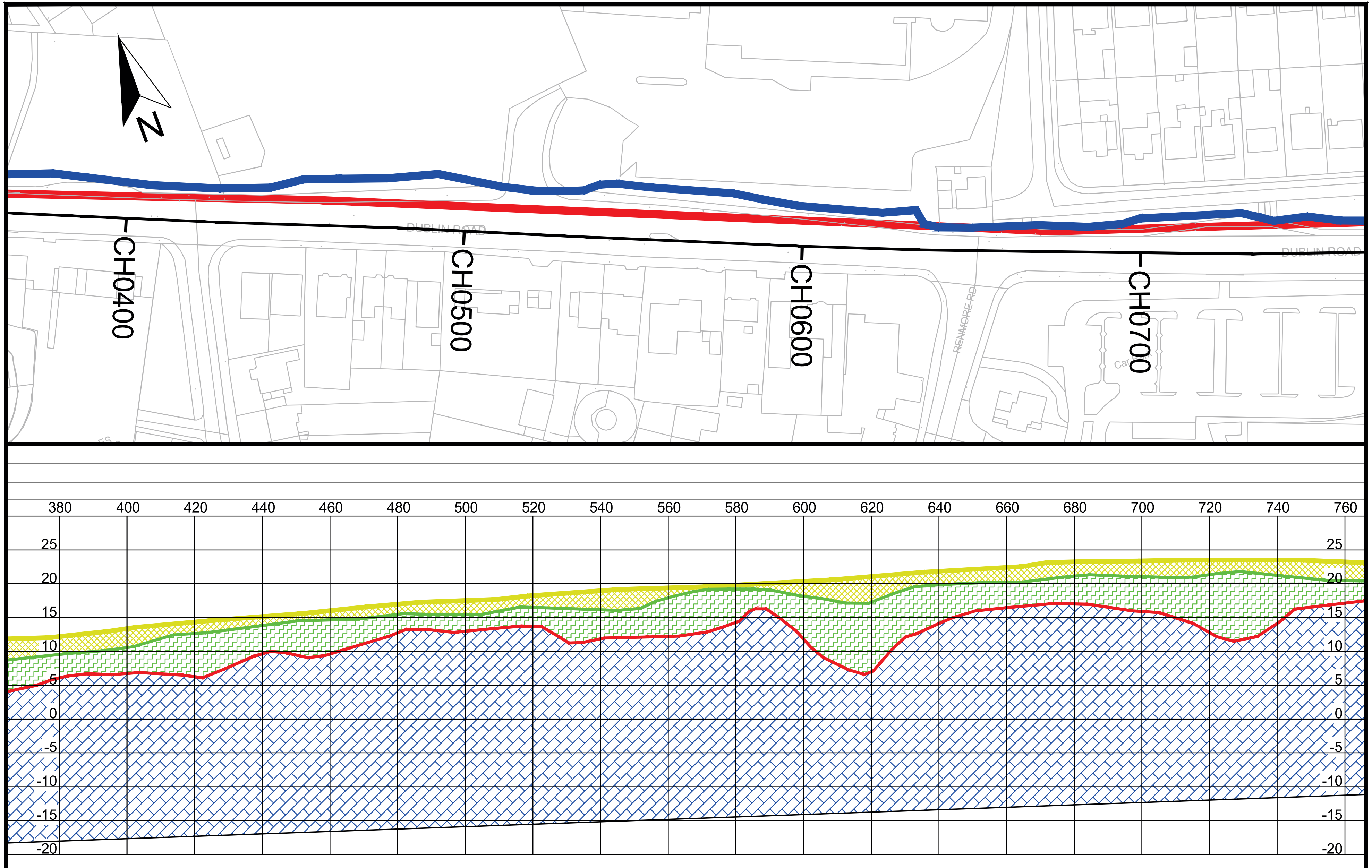
Interpretation:

- 1a Soft or loose Soil
- 1b Road Material and Fill
- 2 Stiff or Dense Overburden
- 3 Very Stiff or Very Dense Overburden or poor very weathered Limestone
- 4 Karstified Limestone
- 5 Good to very good Clean Limestone

Abbreviated GI Logs:

RC01 Borehole Name and Location

Cl	Clay	Mg	Made Ground
Grv	Gravel	Co	Cobbles
Slt	Silt	Ls	Limestone
Ts	Topsoil	WLs	Weathered Limestone



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CLIENT	IGSL
PROJECT	Bus Connect, Dublin Road, Galway Geophysical Survey
TITLE	Plan 2b: Survey Locations and Interpretation

SCALE:	Hor 1:500 @ A1, Ver 1:250 @ A1, VE x 2
PROJECT:	6730
DRAWN:	JC
DATE:	12/04/2024
MGX FILE:	6730f_Drawings.dwg
STATUS:	Final

Geophysical Survey Locations:

R2	2D-Resistivity Line
S1	Seismic Refraction Line
RC1	Rotary Core Hole
CH0100	Centreline with Chainage

Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)

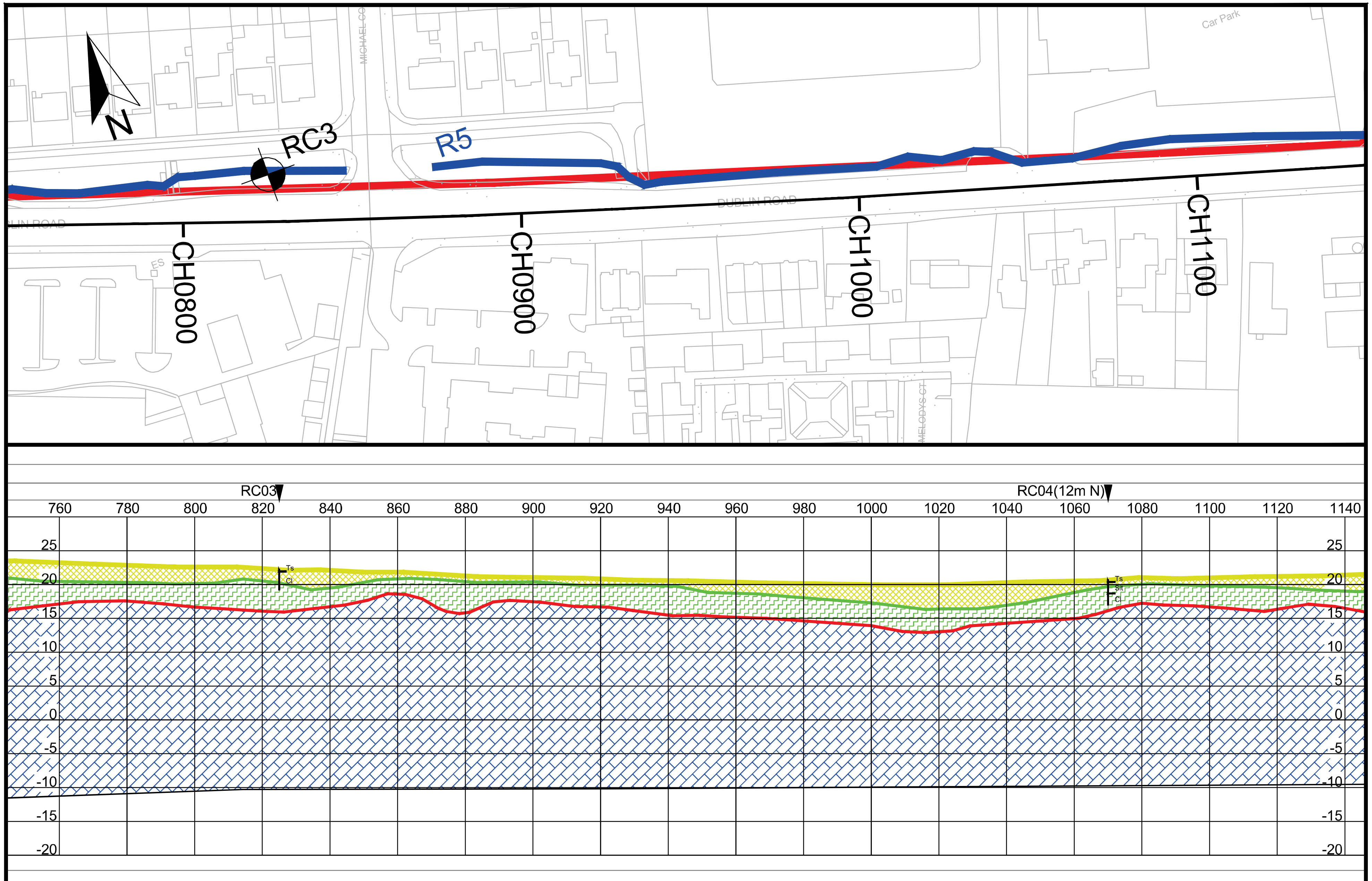
Interpretation:

- 1a Soft or loose Soil
- 1b Road Material and Fill
- 2 Stiff or Dense Overburden
- 3 Very Stiff or Very Dense Overburden or poor very weathered Limestone
- 4 Karstified Limestone
- 5 Good to very good Clean Limestone

Abbreviated GI Logs:

RC01 Borehole Name and Location

Cl	Clay	Mg	Made Ground
Grv	Gravel	Co	Cobbles
Slt	Silt	Ls	Limestone
Ts	Topsoil	WLs	Weathered Limestone



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CLIENT	IGSL
PROJECT	Bus Connect, Dublin Road, Galway Geophysical Survey
TITLE	Plan 2c: Survey Locations and Interpretation

SCALE:	Hor 1:500 @ A1, Ver 1:250 @ A1, VE x 2
PROJECT:	6730
DRAWN:	JC
DATE:	12/04/2024
MGX FILE:	6730f_Drawings.dwg
STATUS:	Final

Geophysical Survey Locations:

- R2 — 2D-Resistivity Line
- S1 — Seismic Refraction Line
- RC1 — Rotary Core Hole
- CH0100 — Centreline with Chainage

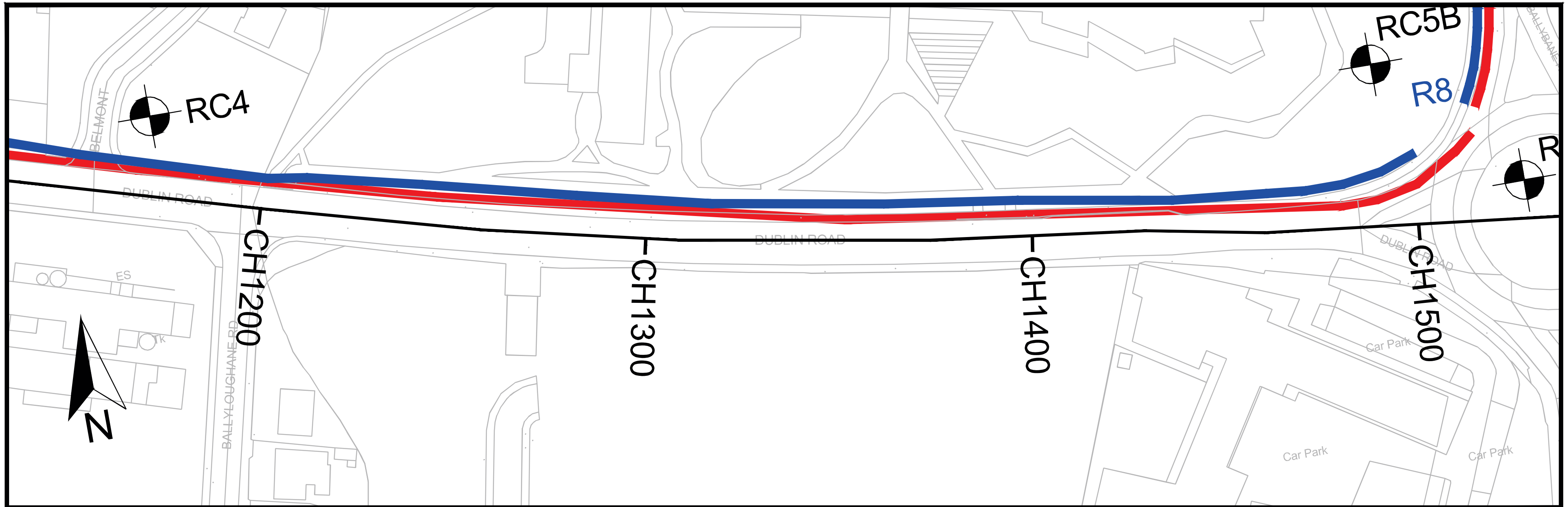
Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)

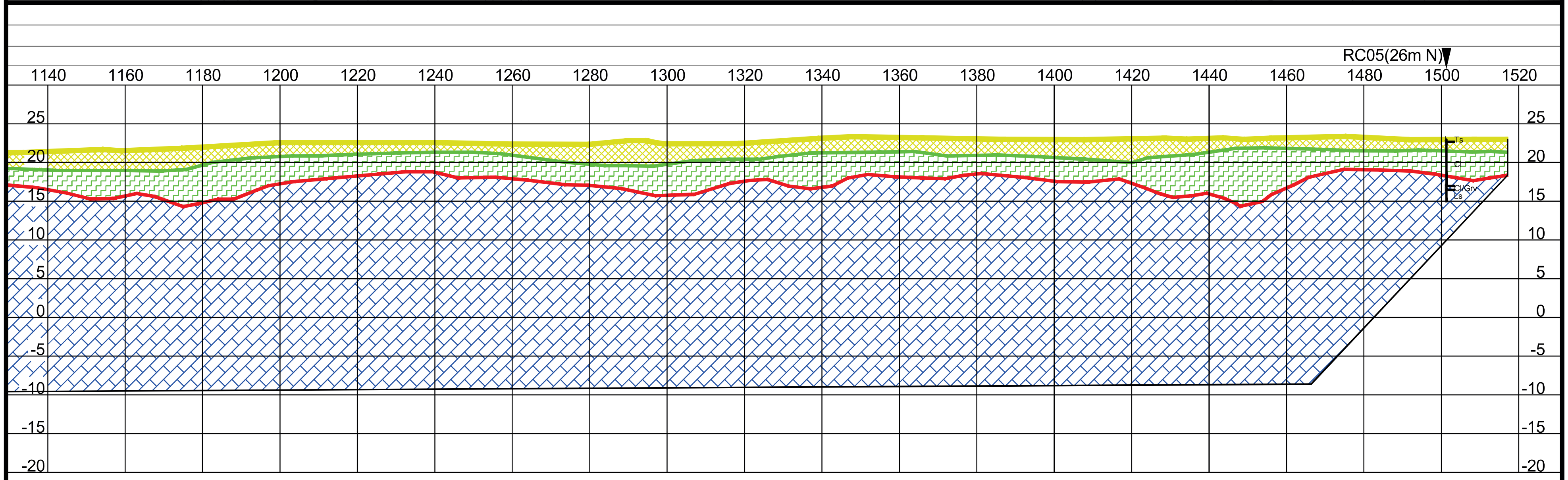
Interpretation:

- 1a Soft or loose Soil
- 1b Road Material and Fill
- 2 Stiff or Dense Overburden
- 3 Very Stiff or Very Dense Overburden or poor very weathered Limestone
- 4 Karstified Limestone
- 5 Good to very good Clean Limestone

Abbreviated GI Logs:

RC01	Borehole Name and Location		
Cl	Clay	Mg	Made Ground
Grv	Gravel	Co	Cobbles
Slt	Silt	Ls	Limestone
Ts	Topsoil	WLs	Weathered Limestone





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CLIENT	IGSL
PROJECT	Bus Connect, Dublin Road, Galway Geophysical Survey
TITLE	Plan 2d: Survey Locations and Interpretation

SCALE:	Hor 1:500 @ A1, Ver 1:250 @ A1, VE x 2
PROJECT:	6730
DRAWN:	JC
DATE:	12/04/2024
MGX FILE:	6730f_Drawings.dwg
STATUS:	Final

Geophysical Survey Locations:

- R2 — 2D-Resistivity Line
- S1 — Seismic Refraction Line
- RC1 — Rotary Core Hole
- CH0100 — Centreline with Chainage

Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)

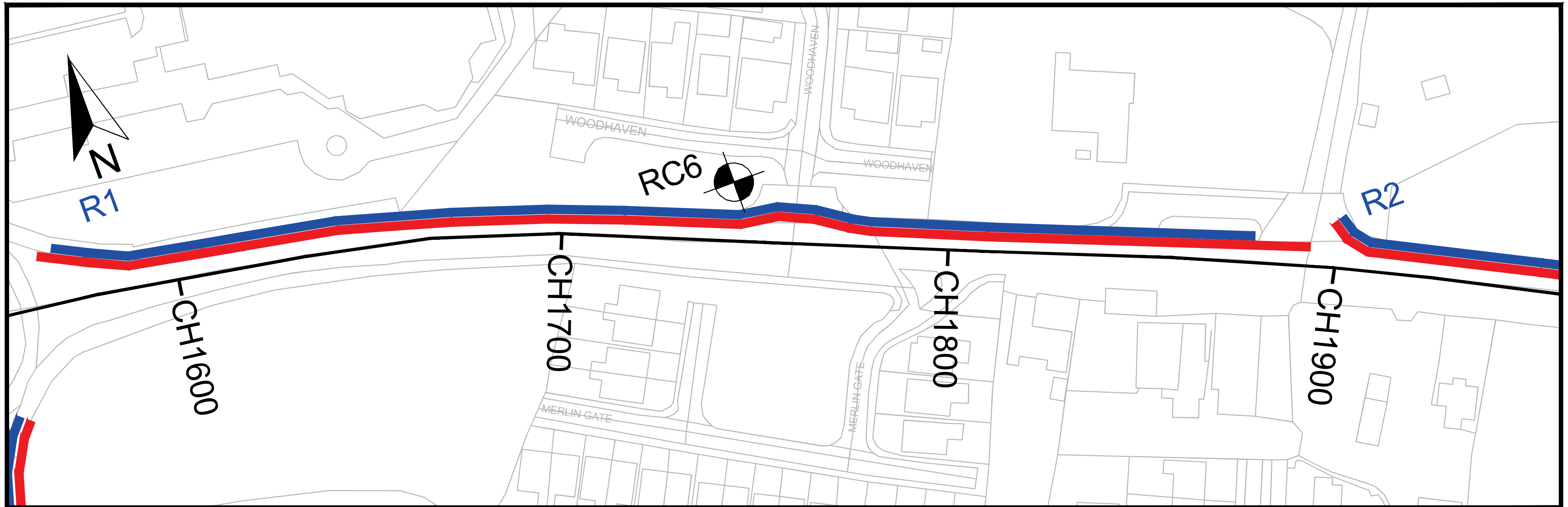
Interpretation:

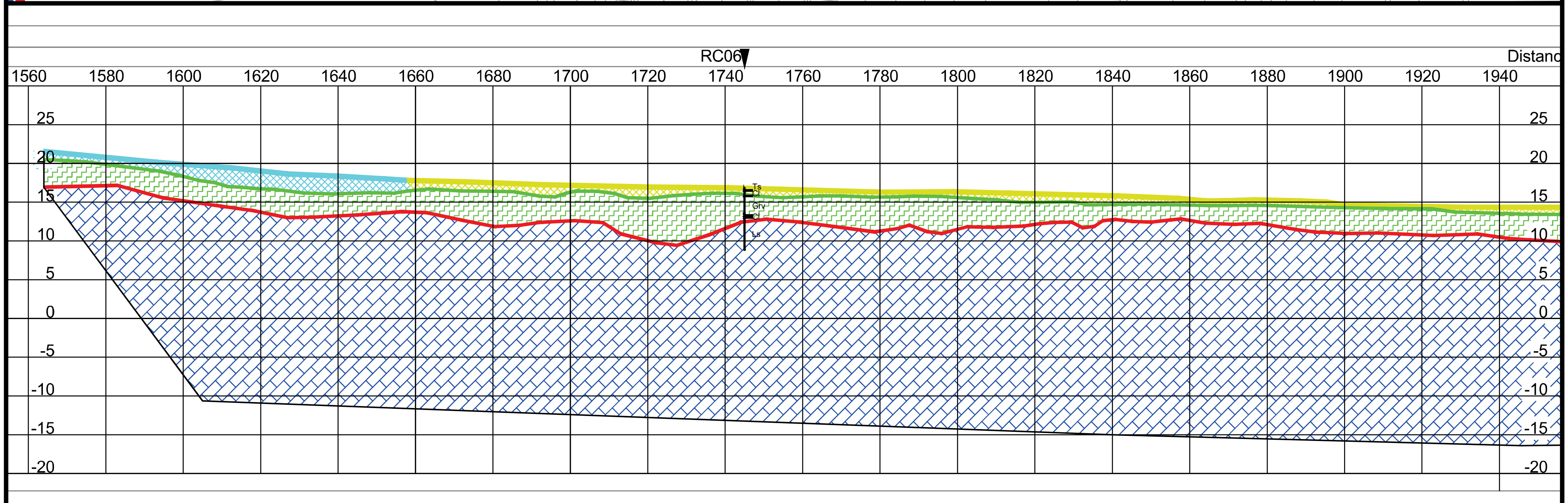
- 1a Soft or loose Soil
- 1b Road Material and Fill
- 2 Stiff or Dense Overburden
- 3 Very Stiff or Very Dense Overburden or poor very weathered Limestone
- 4 Karstified Limestone
- 5 Good to very good Clean Limestone

Abbreviated GI Logs:

RC01 Borehole Name and Location

Cl	Clay	Mg	Made Ground
Grv	Gravel	Co	Cobbles
Slt	Silt	Ls	Limestone
Ts	Topsoil	WLs	Weathered Limestone





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PROJECT	Bus Connect, Dublin Road, Galway Geophysical Survey
TITLE	Plan 2e: Survey Locations and Interpretation

SCALE:	Hor 1:500 @ A1, Ver 1:250 @ A1, VE x 2
PROJECT:	6730
DRAWN:	JC
DATE:	12/04/2024
MGX FILE:	6730f_Drawings.dwg
STATUS:	Final

Geophysical Survey Locations:

- R2 — 2D-Resistivity Line
- S1 — Seismic Refraction Line
- RC1 — Rotary Core Hole
- CH0100 — Centreline with Chainage

Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)

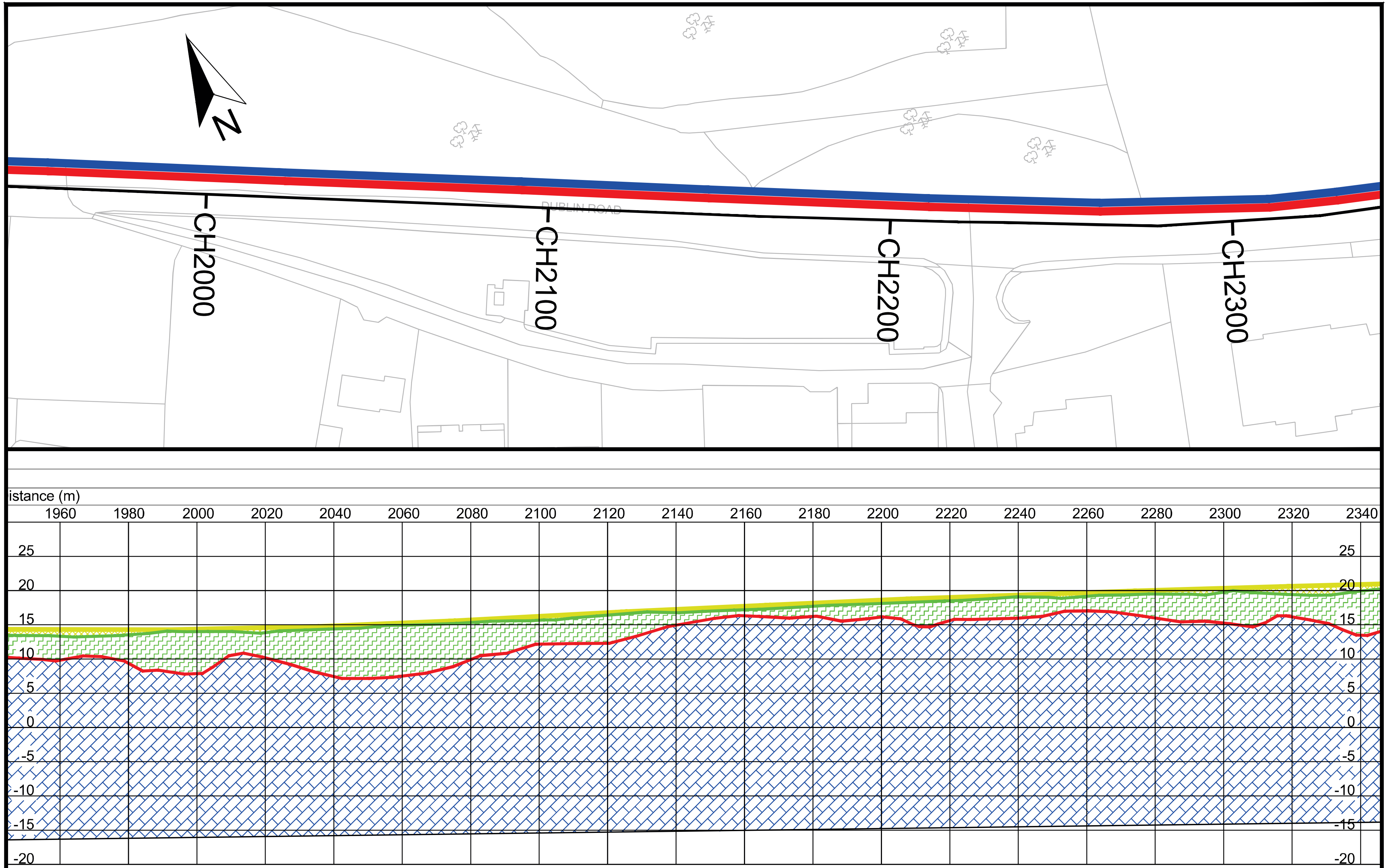
Interpretation:

- 1a Soft or loose Soil
- 1b Road Material and Fill
- 2 Stiff or Dense Overburden
- 3 Very Stiff or Very Dense Overburden or poor very weathered Limestone
- 4 Karstified Limestone
- 5 Good to very good Clean Limestone

Abbreviated GI Logs:

RC01 Borehole Name and Location

Cl	Clay	Mg	Made Ground
Grv	Gravel	Co	Cobbles
Slt	Silt	Ls	Limestone
Ts	Topsoil	WLs	Weathered Limestone



Minerex Geophysics Limited Unit F4, Maynooth Business Campus Maynooth, Co. Kildare Tel. (01) 6510030 Email: info@mgx.ie Web: www.mgx.ie	CLIENT: IGSL PROJECT: Bus Connect, Dublin Road, Galway Geophysical Survey TITLE: Plan 2f: Survey Locations and Interpretation	SCALE: Hor 1:500 @ A1, Ver 1:250 @ A1, VE x 2 PROJECT: 6730 DRAWN: JC DATE: 12/04/2024 MGX FILE: 6730f_Drawings.dwg STATUS: Final	

Geophysical Survey Locations:

- R2 — 2D-Resistivity Line
- S1 — Seismic Refraction Line
- RC1 — Rotary Core Hole
- CH0100 — Centreline with Chainage

Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)

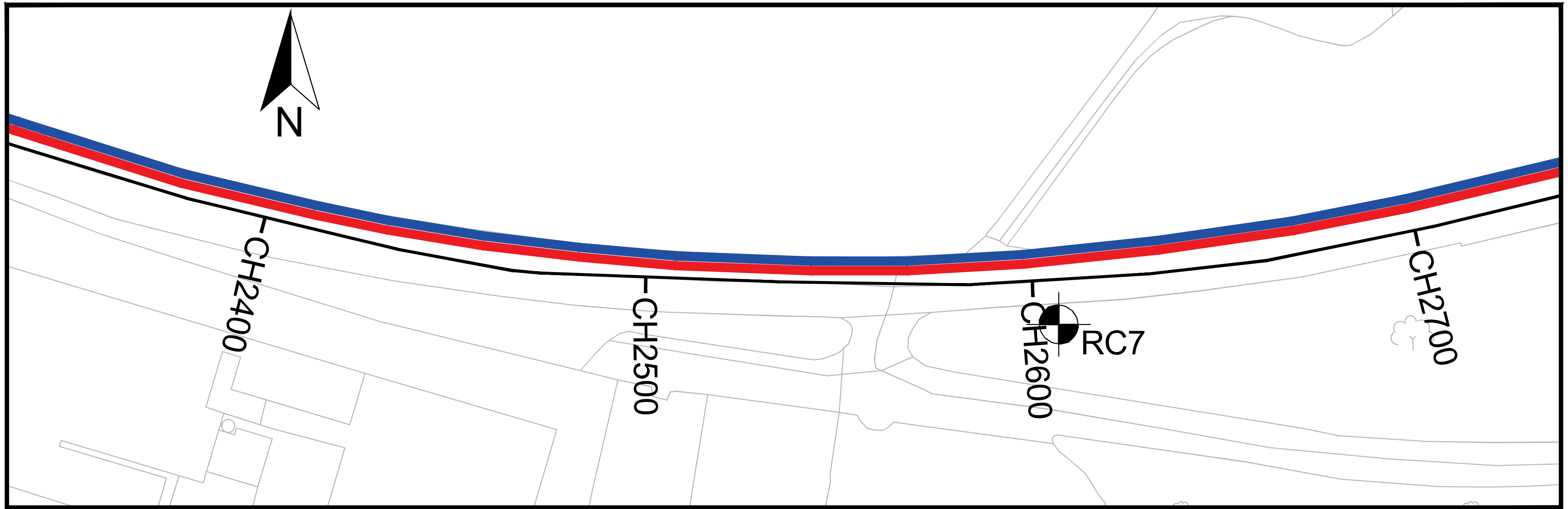
Interpretation:

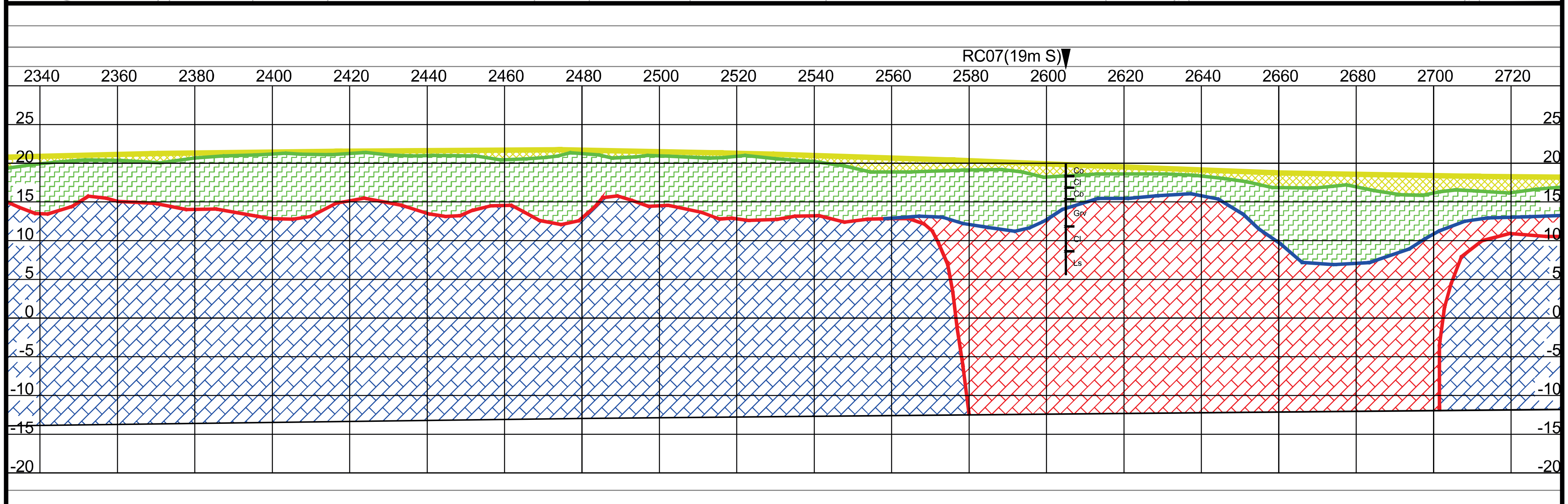
- 1a Soft or loose Soil
- 1b Road Material and Fill
- 2 Stiff or Dense Overburden
- 3 Very Stiff or Very Dense Overburden or poor very weathered Limestone
- 4 Karstified Limestone
- 5 Good to very good Clean Limestone

Abbreviated GI Logs:

RC01 Borehole Name and Location

Cl	Clay	Mg	Made Ground
Grv	Gravel	Co	Cobbles
Slt	Silt	Ls	Limestone
Ts	Topsoil	WLs	Weathered Limestone





Minerex Geophysics Limited

Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare
Tel. (01) 6510030
Email: info@mgx.ie
Web: www.mgx.ie

CLIENT	IGSL
PROJECT	Bus Connect, Dublin Road, Galway Geophysical Survey
TITLE	Plan 2g: Survey Locations and Interpretation

SCALE:	Hor 1:500 @ A1, Ver 1:250 @ A1, VE x 2
PROJECT:	6730
DRAWN:	JC
DATE:	12/04/2024
MGX FILE:	6730f_Drawings.dwg
STATUS:	Final

Geophysical Survey Locations:

R2	2D-Resistivity Line
S1	Seismic Refraction Line
RC1	Rotary Core Hole
CH0100	Centreline with Chainage

Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)

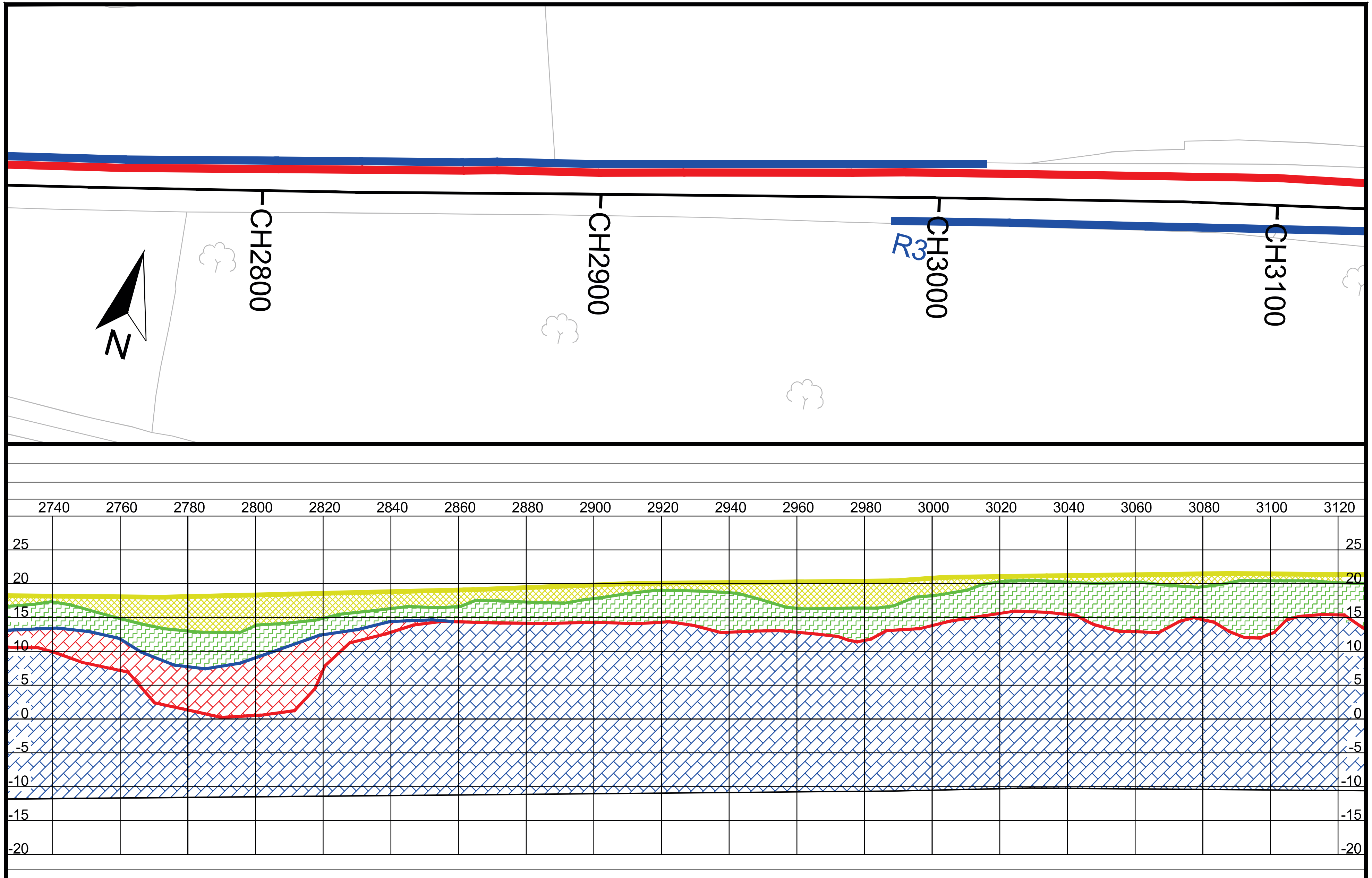
Interpretation:

- 1a Soft or loose Soil
- 1b Road Material and Fill
- 2 Stiff or Dense Overburden
- 3 Very Stiff or Very Dense Overburden or poor very weathered Limestone
- 4 Karstified Limestone
- 5 Good to very good Clean Limestone

Abbreviated GI Logs:

RC01 Borehole Name and Location

Cl	Clay	Mg	Made Ground
Grv	Gravel	Co	Cobbles
Slt	Silt	Ls	Limestone
Ts	Topsoil	WLs	Weathered Limestone



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CLIENT	IGSL
PROJECT	Bus Connect, Dublin Road, Galway Geophysical Survey
TITLE	Plan 2h: Survey Locations and Interpretation

SCALE:	Hor 1:500 @ A1, Ver 1:250 @ A1, VE x 2
PROJECT:	6730
DRAWN:	JC
DATE:	12/04/2024
MGX FILE:	6730f_Drawings.dwg
STATUS:	Final

Geophysical Survey Locations:

- R2 — 2D-Resistivity Line
- S1 — Seismic Refraction Line
- RC1 — Rotary Core Hole
- CH0100 — Centreline with Chainage

Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)

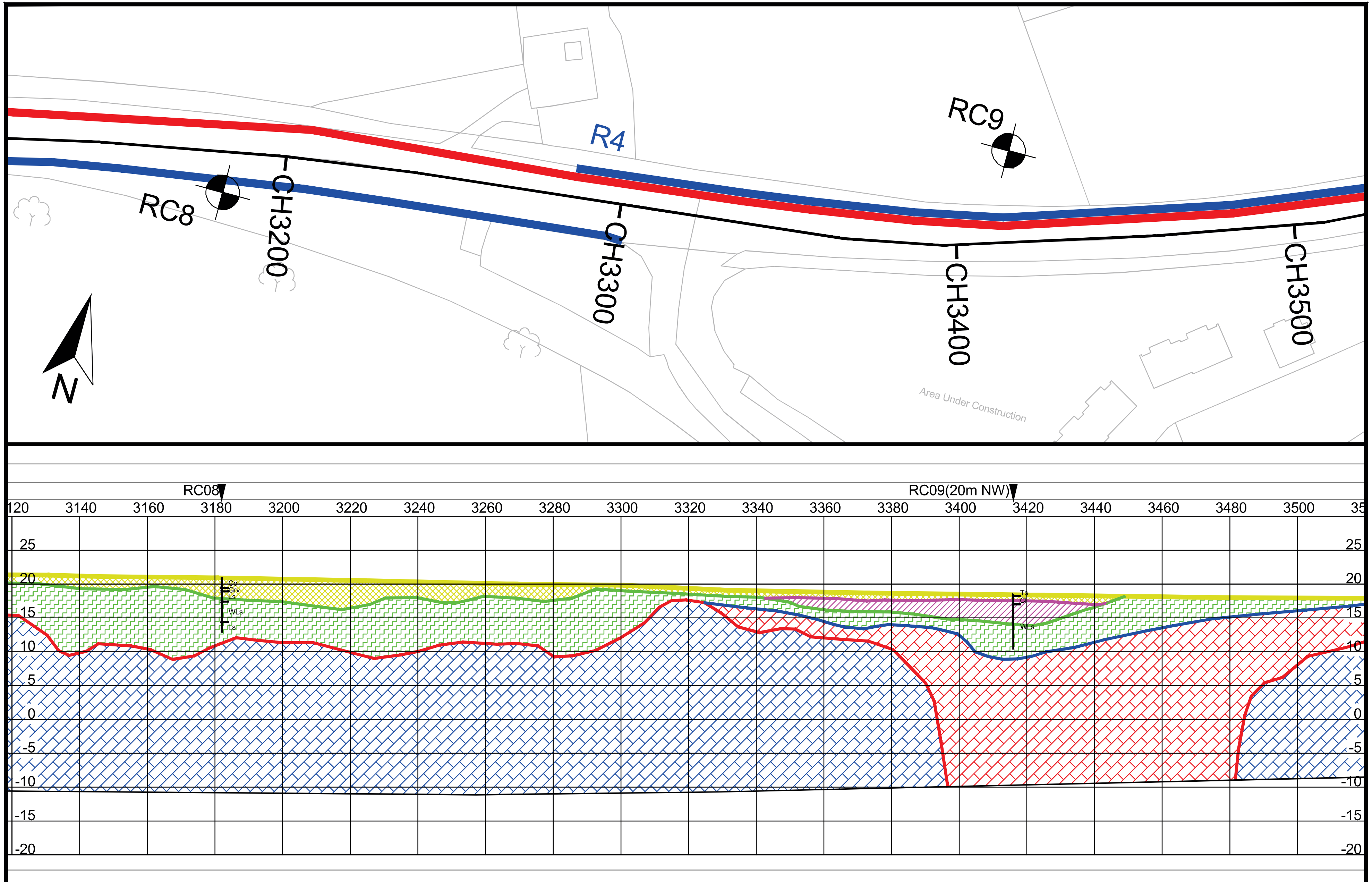
Interpretation:

- 1a Soft or loose Soil
- 1b Road Material and Fill
- 2 Stiff or Dense Overburden
- 3 Very Stiff or Very Dense Overburden or poor very weathered Limestone
- 4 Karstified Limestone
- 5 Good to very good Clean Limestone

Abbreviated GI Logs:

RC01 Borehole Name and Location

Cl	Clay	Mg	Made Ground
Grv	Gravel	Co	Cobbles
Slt	Silt	Ls	Limestone
Ts	Topsoil	WLs	Weathered Limestone



Minerex Geophysics Limited Unit F4, Maynooth Business Campus Maynooth, Co. Kildare Tel. (01) 6510030 Email: info@mgx.ie Web: www.mgx.ie	CLIENT	IGSL	
	PROJECT	Bus Connect, Dublin Road, Galway Geophysical Survey	
	TITLE	Plan 2i: Survey Locations and Interpretation	

SCALE:	Hor 1:500 @ A1, Ver 1:250 @ A1, VE x 2
PROJECT:	6730
DRAWN:	JC
DATE:	12/04/2024
MGX FILE:	6730f_Drawings.dwg
STATUS:	Final

Geophysical Survey Locations:

R2	2D-Resistivity Line
S1	Seismic Refraction Line
RC1	Rotary Core Hole
CH0100	Centreline with Chainage

Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)

Interpretation:

- 1a Soft or loose Soil
- 1b Road Material and Fill
- 2 Stiff or Dense Overburden
- 3 Very Stiff or Very Dense Overburden or poor very weathered Limestone
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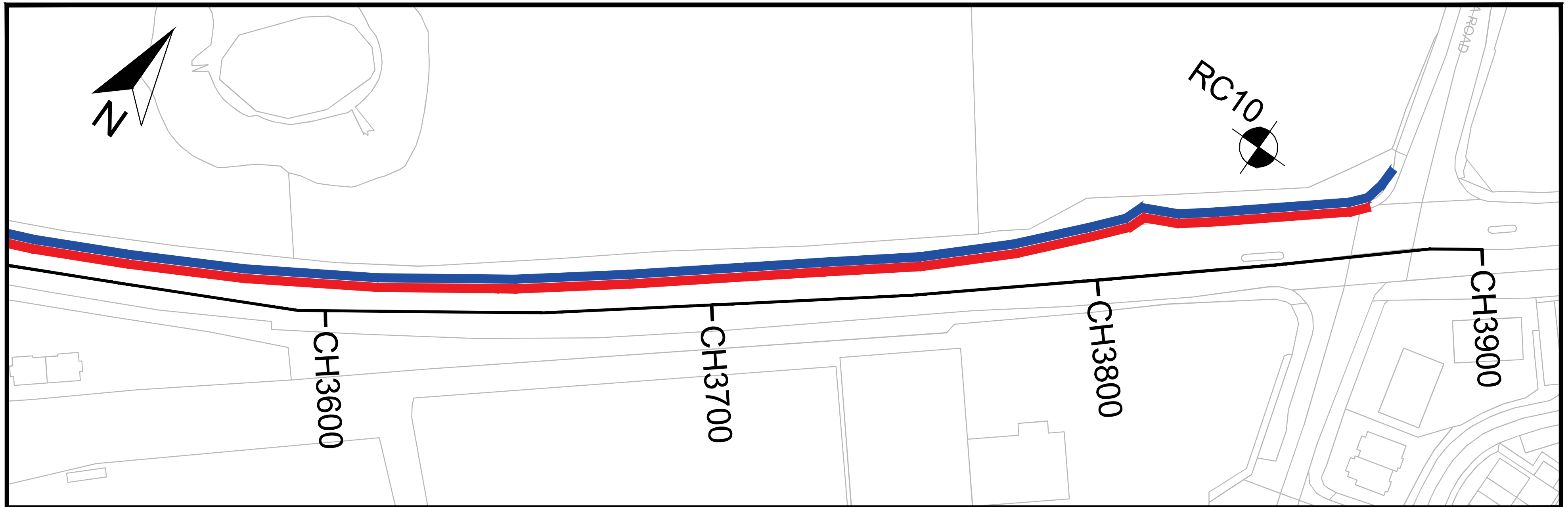
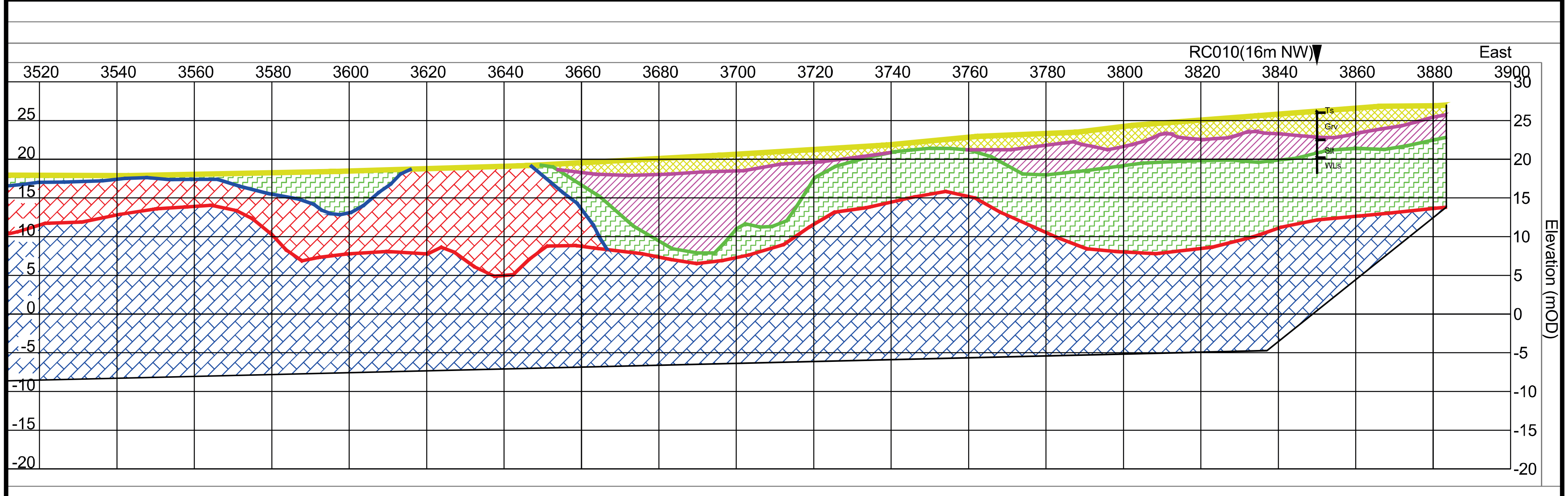
- 5 Good to very good Clean Limestone

Abbreviated GI Logs:

RC01 Borehole Name and Location

Cl	Clay	Mg	Made Ground
Grv	Gravel	Co	Cobbles
Slt	Silt	Ls	Limestone
Ts	Topsoil	WLs	Weathered Limestone





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	PROJECT: Bus Connect, Dublin Road, Galway Geophysical Survey	PROJECT:	6730
		DRAWN:	JC
	TITLE: Plan 2j: Survey Locations and Interpretation	DATE:	12/04/2024
		MGX FILE:	6730f_Drawings.dwg
		STATUS:	Final

Geophysical Survey Locations:

- R2 — 2D-Resistivity Line
- S1 — Seismic Refraction Line
- RC1 — Rotary Core Hole
- CH0100 — Centreline with Chainage

Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)

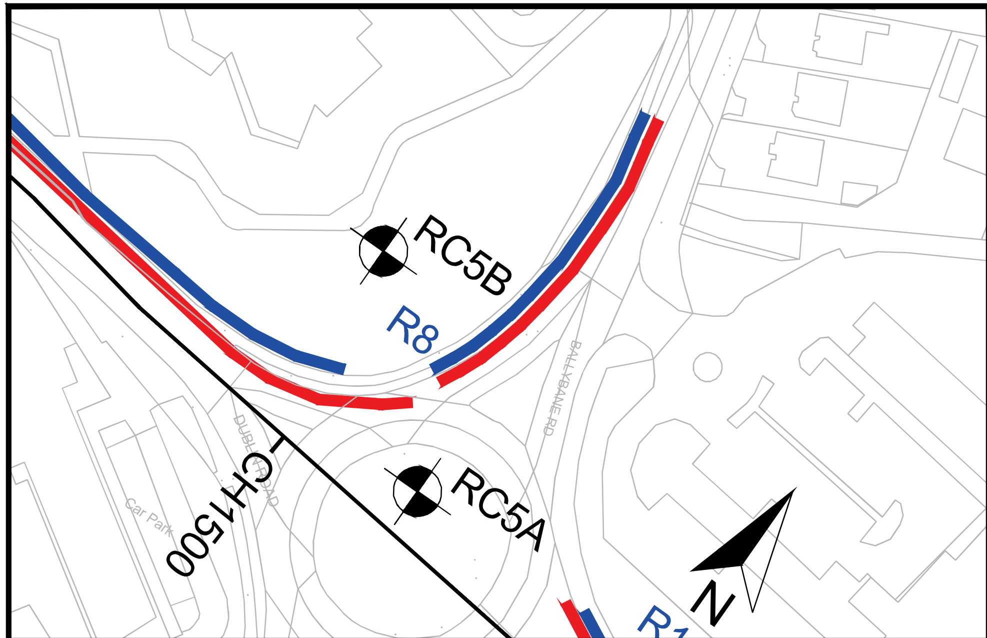
Interpretation:

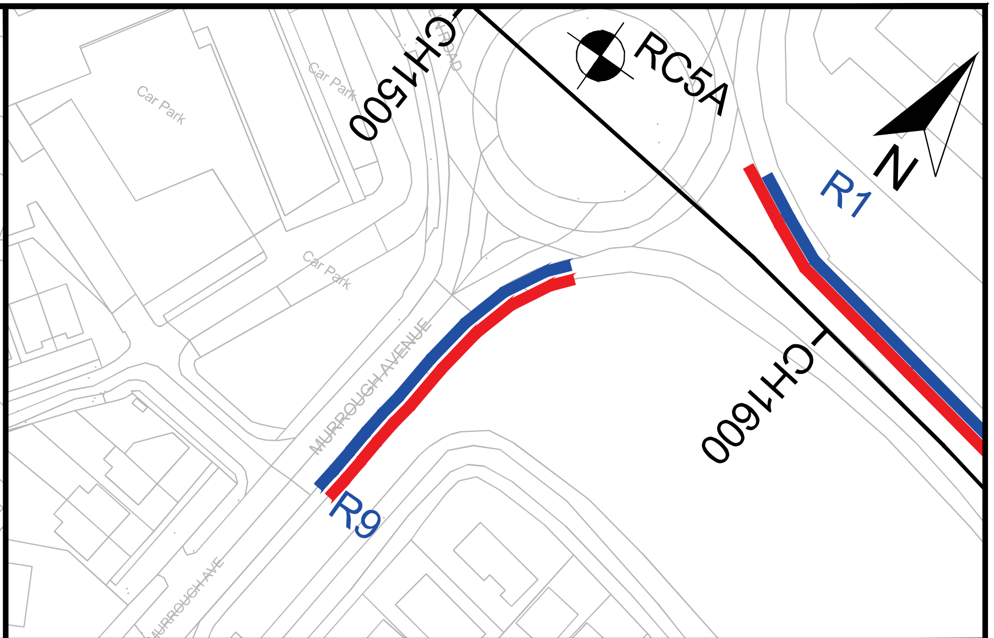
- 1a Soft or loose Soil
- 1b Road Material and Fill
- 2 Stiff or Dense Overburden
- 3 Very Stiff or Very Dense Overburden or poor very weathered Limestone
- 4 Karstified Limestone
- 5 Good to very good Clean Limestone

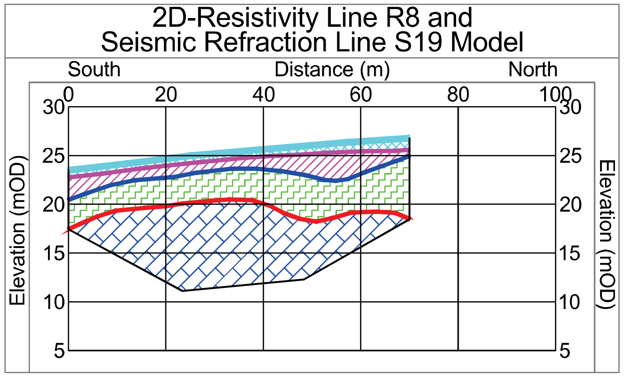
Abbreviated GI Logs:

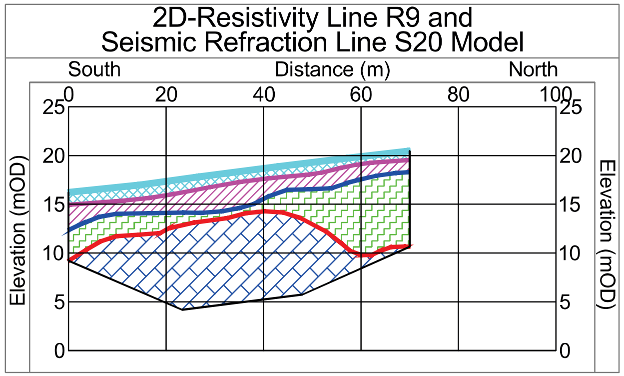
RC01 Borehole Name and Location

Cl	Clay	Mg	Made Ground
Grv	Gravel	Co	Cobbles
Slt	Silt	Ls	Limestone
Ts	Topsoil	WLs	Weathered Limestone









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	PROJECT	Bus Connect, Dublin Road, Galway Geophysical Survey	
	TITLE	Plan 2k: Survey Locations and Interpretation	

SCALE:	Hor 1:500 @ A1, Ver 1:250 @ A1, VE x 2
PROJECT:	6730
DRAWN:	JC
DATE:	12/04/2024
MGX FILE:	6730f_Drawings.dwg
STATUS:	Final

Geophysical Survey Locations:

- R2 — 2D-Resistivity Line
- S1 — Seismic Refraction Line
- RC1 — Rotary Core Hole
- CH0100 — Centreline with Chainage

Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)

Interpretation:

- 1a Soft or loose Soil
- 1b Road Material and Fill
- 2 Stiff or Dense Overburden
- 3 Very Stiff or Very Dense Overburden or poor very weathered Limestone
- 4 Karstified Limestone
- 5 Good to very good Clean Limestone

Abbreviated GI Logs:

RC01 Borehole Name and Location

Cl	Clay	Mg	Made Ground
Grv	Gravel	Co	Cobbles
Slt	Silt	Ls	Limestone
Ts	Topsoil	WLs	Weathered Limestone

Appendix 9 - Geotechnical Laboratory Test Results – Soil

IGSL Ltd
Materials Laboratory
Unit J5, M7 Business Park
Newhall, Naas
Co. Kildare
045 846176

Test Report

Determination of Moisture Content, Liquid & Plastic Limits

Tested in accordance with BS1377:Part 2:1990, clauses 3.2, 4.3, 4.4 & 5.3**

Report No. **R152602** Contract No. 24984 Contract Name: Galway Bus Connects - Dublin Road , Galway

Customer Barry Transportation

Samples Received: Various Date Tested: Various

BH/TP*	Sample No.	Depth* (m)	Lab. Ref	Sample Type*	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425µm	Preparation	Liquid Limit Clause	Classification (BS5930)	Description
2023-BH-001A	0	0.5	A23/4708	B	8.1	24	13	11	50	WS	4.4	C L	Grey slightly sandy, slightly gravelly, CLAY
2023-BH-001A	0	0.5	A23/4708A	D	8.2								Grey slightly sandy, slightly gravelly, SILT
2023-BH-002	209301	0.5	A23/4709	B	7.5	22	12	10	47	WS	4.4	C L	Brown slightly sandy, gravelly, CLAY
2023-BH-002	209303	2.0	A23/4710	B	7.3	20	11	9	52	WS	4.4	C L	Grey slightly sandy, slightly gravelly, CLAY with some cobbles
2023-BH-002	0	0.5	A23/4709A	D	7.6								Brown slightly sandy, gravelly, CLAY
2023-BH-002		2.0	A23/4710A	D	7.0								Grey slightly sandy, slightly gravelly, CLAY with some cobbles
2023-BH-003	204330	0.5	A23/4711A	B	20								Brown sandy, slightly gravelly, CLAY
2023-BH-003	204332	2.0	A23/4712A	B	14								Brown sandy gravelly SILT/CLAY
2023-BH-003	0	0.5	A23/4711	D	20	32	18	14	70	WS	4.4	C L	Brown sandy, slightly gravelly, CLAY
2023-BH-003	0	2.0	A23/4712	D	14	29	16	13	71	WS	4.4	C L	Brown slightly sandy, slightly gravelly, CLAY
2023-BH-004A	204333	0.5	A23/4713B	B	21								Brown sandy gravelly SILT/CLAY with occ.cobbles
2023-BH-004A	204335	2.0	A23/4714B	B	20								Brown slightly sandy, gravelly, CLAY with some cobbles
2023-BH-004A	0	0.5	A23/4713A	D	21	39	NP	NP	47	WS	4.4		Brown slightly sandy, gravelly, SILT
2023-BH-004A	0	2.0	A23/4714A	D	20	36	18	18	42	WS	4.4	C I	Brown slightly sandy, gravelly, CLAY with some cobbles
2023-BH-004A	204336	3.0	A23/4715	B	11								Brown sandy gravelly SILT/CLAY

Preparation: WS - Wet sieved
AR - As received
NP - Non plastic

Liquid Limit Clause: 4.3 Cone Penetrometer definitive method
4.4 Cone Penetrometer one point method

Sample Type: B - Bulk Disturbed
U - Undisturbed

Remarks:
Results relate only to the specimen tested,in as received condition unless otherwise noted.
NOTE: **These clauses have been superceded by EN 17892-1 and EN17892-12.
Opinions and interpretations are outside the scope of accreditation. * denotes Customer supplied information.
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IGSL Ltd
Materials Laboratory
Unit J5, M7 Business Park
Newhall, Naas
Co. Kildare
045 846176

Test Report

Determination of Moisture Content, Liquid & Plastic Limits

Tested in accordance with BS1377:Part 2:1990, clauses 3.2, 4.3, 4.4 & 5.3**

Report No. **R152603** Contract No. 24984 Contract Name: Galway Bus Connects - Dublin Road , Galway

Customer Barry Transportation

Samples Received: 17/11/23 Date Tested: 17/11/23

BH/TP*	Sample No.	Depth* (m)	Lab. Ref	Sample Type*	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425µm	Preparation	Liquid Limit Clause	Classification (BS5930)	Description
2023-BH-006	204346	1.2	A23/4716A	B	11	22	12	10	59	WS	4.4	C L	Brown slightly sandy, slightly gravelly, CLAY
2023-BH-006	204348	3.0	A23/4717A	B	4.1	19	10	9	62	WS	4.4	C L	Brown sandy gravelly CLAY
2023-BH-006	0	0.5	A23/4718	D	28								Brown sandy gravelly SILT/CLAY
2023-BH-006	0	1.2	A23/4716B	D	11								Brown slightly sandy, slightly gravelly, CLAY
2023-BH-006	204348	3.0	A23/4717B	B	4.1								Brown sandy gravelly SILT/CLAY
2023-BH-009	0	0.2	A23/4719	D	31								Brown sandy gravelly SILT/CLAY
2023-BH-010	204440	1.2	A23/4720A	B	11	42	NP	NP	28	WS	4.4		Brown silty, sandy, GRAVEL
2023-BH-010	204743	4.0	A23/4721A	B	6.2	16	NP	NP	57	WS	4.4		Brown slightly sandy, slightly gravelly, SILT with many cobbles
2023-BH-010	0	1.2	A23/4720A	D	11								Brown silty, sandy, GRAVEL
2023-BH-010	0	2.0	A23/4722	D	9.0								Brown sandy gravelly SILT/CLAY
2023-BH-010		4.0	A23/4721B	D	6.2								Brown slightly sandy, slightly gravelly, SILT with many cobbles

Preparation: WS - Wet sieved
AR - As received
NP - Non plastic

Liquid Limit Clause: 4.3 Cone Penetrometer definitive method
4.4 Cone Penetrometer one point method

Sample Type: B - Bulk Disturbed
U - Undisturbed

Remarks:
Results relate only to the specimen tested,in as received condition unless otherwise noted.
NOTE: **These clauses have been superceded by EN 17892-1 and EN17892-12.
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IGSL Ltd
Materials Laboratory
Unit J5, M7 Business Park
Newhall, Naas
Co. Kildare
045 846176

Test Report

Determination of Moisture Content, Liquid & Plastic Limits

Tested in accordance with BS1377:Part 2:1990, clauses 3.2, 4.3, 4.4 & 5.3**

Report No. **R152604** Contract No. 24984 Contract Name: Galway Bus Connects - Dublin Road , Galway

Customer Barry Transportation

Samples Received: 17/11/23 Date Tested: 17/11/23

BH/TP*	Sample No.	Depth* (m)	Lab. Ref	Sample Type*	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425µm	Preparation	Liquid Limit Clause	Classification (BS5930)	Description
2023-TP-001	AA 208190	1.0	A23/4723A	B	15	29	NP	NP	50	WS	4.4		Grey silty, very gravelly, SAND
2023-TP-001	0	1.0	A23/4723	D	15								Grey silty, very gravelly, SAND
2023-TP-001	0	2.0	A23/4724	D	8								Grey slightly clayey gravelly SAND
2023-TP-002	AA 208758	1.0	A23/4725	B	16	22	12	10	70	WS	4.4	C L	Grey/brown slightly sandy, slightly gravelly, CLAY
2023-TP-002	0	0.3	A23/4726	D	15								Brown sandy gravelly CLAY
2023-TP-002	0	1.0	A23/4725A	D	16								Grey/brown slightly sandy, slightly gravelly, CLAY
2023-TP-003	0	0.6	A23/4727	D	14								Grey/brown sandy gravely SILT/CLAY
2023-TP-003	AA 208199	2.0	A23/4728	B	14	28	14	14	59	WS	4.4	C L	Grey/brown slightly sandy, slightly gravelly, CLAY
2023-TP-003	0	2.0	A23/4728A	D	14								Grey/rown sandy gravelly SILT
2023-TP-004	AA 208751	1.5	A23/4730	B	12	28	16	12	63	WS	4.4	C L	Grey/brown slightly sandy, slightly gravelly, CLAY
2023-TP-004	0	0.4	A23/4729	D	16								Grey sandy gravelly SILT/CLAY
2023-TP-004	0	1.5	A23/4730A	D	12								Grey/brown slightly sandy, slightly gravelly, CLAY
2023-TP-004	0	2.0	A23/4731	D	12								Grey/brown sandy gravelly SILT/CLAY
2023-TP-005	AA 208756	1.3	A23/4732	B	8.1	26	14	12	61	WS	4.4	C L	Grey/brown slightly sandy, gravelly, CLAY
2023-TP-005	0	0.3	A23/4733	D	7.6								Brown sandy gravelly SILT/CLAY

Preparation: WS - Wet sieved
AR - As received
NP - Non plastic

Liquid Limit Clause: 4.3 Cone Penetrometer definitive method
4.4 Cone Penetrometer one point method

Sample Type: B - Bulk Disturbed
U - Undisturbed

Remarks:
Results relate only to the specimen tested,in as received condition unless otherwise noted.
NOTE: **These clauses have been superceded by EN 17892-1 and EN17892-12.
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Unit J5, M7 Business Park
Newhall, Naas
Co. Kildare
045 846176

Test Report

Determination of Moisture Content, Liquid & Plastic Limits

Tested in accordance with BS1377:Part 2:1990, clauses 3.2, 4.3, 4.4 & 5.3**

Report No. **R152605** Contract No. 24984 Contract Name: Galway Bus Connects - Dublin Road , Galway

Customer Barry Transportation

Samples Received: 16/11/23 Date Tested: 16/11/23

BH/TP*	Sample No.	Depth* (m)	Lab. Ref	Sample Type*	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425µm	Preparation	Liquid Limit Clause	Classification (BS5930)	Description
2023-TP-005	0	1.3	A23/4732	D	12								Grey/brown slightly sandy, gravelly, CLAY
2023-TP-006	0	0.3	A23/4735	D	9.1								Brown sandy gravelly SILT/CLAY
2023-TP-006	0	1.4	A23/4734	D	9	24	14	10	50	WS	4.4	C L	Grey slightly sandy, slightly gravelly, CLAY
2023-TP-006	0	2.0	A23/4736	D	8.8								Brown sandy gravelly SILT/CLAY
2023-TP-007	0	0.4	A23/4738	D	17								Brown sandy gravelly SILT/CLAY
2023-TP-007	AA208185	2.0	A23/4737	B	8.1	29	15	14	61	WS	4.4	C L	Brown sandy gravelly SILT/CLAY
2023-TP-007	0	2.0	A23/4737B	D	9								Brown slightly sandy, slightly gravelly, CLAY
2023-TP-008	AA 208187	1.0	A23/4739	B	11	20	NP	NP	68	WS	4.4		Brown slightly sandy, gravelly, SILT
2023-TP-008	0	0.4	A23/4740	D	17								Brown sandy gravelly SILT/CLAY
2023-TP-008	0	1.9	A23/4741	D	20								Brown sandy gravelly SILT/CLAY
2023-TP-009	AA 208195	0.5	A23/4742	B	24	30	NP	NP	82	WS	4.4		Brown sandy gravelly SILT
2023-TP-009	0	0.5	A23/4742	D	24								Brown sandy gravelly SILT/CLAY
2023-TP-009	0	1.0	A23/4743	D	10								Grey/brown silty/clayey GRAVEL
2023-TP-011	AA 208194	1.6	A23/4744	B	8.3	26	13	13	63	WS	4.4	C L	Brown slightly sandy, slightly gravelly, CLAY
2023-TP-011	0	0.6	A23/4745	D	5.8								Brown sandy gravelly SILT/CLAY

Preparation: WS - Wet sieved
AR - As received
NP - Non plastic

Liquid Limit Clause: 4.3 Cone Penetrometer definitive method
4.4 Cone Penetrometer one point method

Sample Type: B - Bulk Disturbed
U - Undisturbed

Remarks:
Results relate only to the specimen tested,in as received condition unless otherwise noted.
NOTE: **These clauses have been superceded by EN 17892-1 and EN17892-12.
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Materials Laboratory
Unit J5, M7 Business Park
Newhall, Naas
Co. Kildare
045 846176

Test Report

Determination of Moisture Content, Liquid & Plastic Limits

Tested in accordance with BS1377:Part 2:1990, clauses 3.2, 4.3, 4.4 & 5.3**

Report No. **R152606** Contract No. 24984 Contract Name: Galway Bus Connects - Dublin Road , Galway

Customer Barry Transportation

Samples Received: 17/11/23 Date Tested: 17/11/23

BH/TP*	Sample No.	Depth* (m)	Lab. Ref	Sample Type*	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425µm	Preparation	Liquid Limit Clause	Classification (BS5930)	Description
2023-TP-011	0	1.6	A23/4744	D	8.3	29	15	14	70	WS	4.4	C L	Brown sandy gravelly CLAY
2023-TP-012	0	0.4	A23/4746B	B	22								Brown silty, very gravelly, SAND
2023-TP-012	AA208179	0.4	A23/4746A	D	22	34	NP	NP	67	WS	4.4		Brown silty, very gravelly, SAND
2023-TP-013	AA208192	1.4	A23/4747	B	9.8								Brown clayey/silty, very gravelly, SAND
2023-TP-013	0	0.6	A23/4748	D	19								Brown sandy gravelly silt/CLAY

Preparation: WS - Wet sieved
AR - As received
NP - Non plastic

Sample Type: B - Bulk Disturbed
U - Undisturbed

Liquid Limit Clause: 4.3 Cone Penetrometer definitive method
4.4 Cone Penetrometer one point method

Remarks:
Results relate only to the specimen tested,in as received condition unless otherwise noted.
NOTE: **These clauses have been superceded by EN 17892-1 and EN17892-12.
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IGSL Ltd Materials Laboratory	Persons authorized to approve reports H Byrne (Laboratory Manager)	Approved by	Date	Page
			15/01/24	1 of 1

IGSL Ltd
Materials Laboratory
Unit J5, M7 Business Park
Newhall, Naas
Co. Kildare
045 846176

Test Report

Determination of Moisture Content, Liquid & Plastic Limits

Tested in accordance with BS1377:Part 2:1990, clauses 3.2, 4.3, 4.4 & 5.3**

Report No. **R152665** Contract No. 24984 Contract Name: Galway Bus Connects - Dublin Road , Galway

Customer Barry Transportation

Samples Received: 04/12/23 Date Tested: 04/12/23

BH/TP*	Sample No.	Depth* (m)	Lab. Ref	Sample Type*	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425µm	Preparation	Liquid Limit Clause	Classification (BS5930)	Description
2023-WS-001		0.0	A23/4940	0	16	53	NP	NP	38	023-WS-0	4.4		Brown clayey, very gravelly, SAND with many cobbles
2023-WS-004		1.0	A23/4941	0	9.6	20	NP	NP	92	023-WS-0	4.4		Brown sandy, slightly gravelly, SILT
2023-WS-006		1.0	A23/4942	0	12	25	14	11	64	023-WS-0	4.4	C L	Brown slightly sandy, slightly gravelly, CLAY
2023-WS-007		1.0	A23/4943	0	14	23	NP	NP	51	023-WS-0	4.4		Brown sandy, gravelly, SILT

Preparation: WS - Wet sieved
AR - As received
NP - Non plastic

Liquid Limit Clause: 4.3 Cone Penetrometer definitive method
4.4 Cone Penetrometer one point method

Sample Type: B - Bulk Disturbed
U - Undisturbed

Remarks:
Results relate only to the specimen tested,in as received condition unless otherwise noted.
NOTE: **These clauses have been superceded by EN 17892-1 and EN17892-12.
Opinions and interpretations are outside the scope of accreditation. * denotes Customer supplied information.

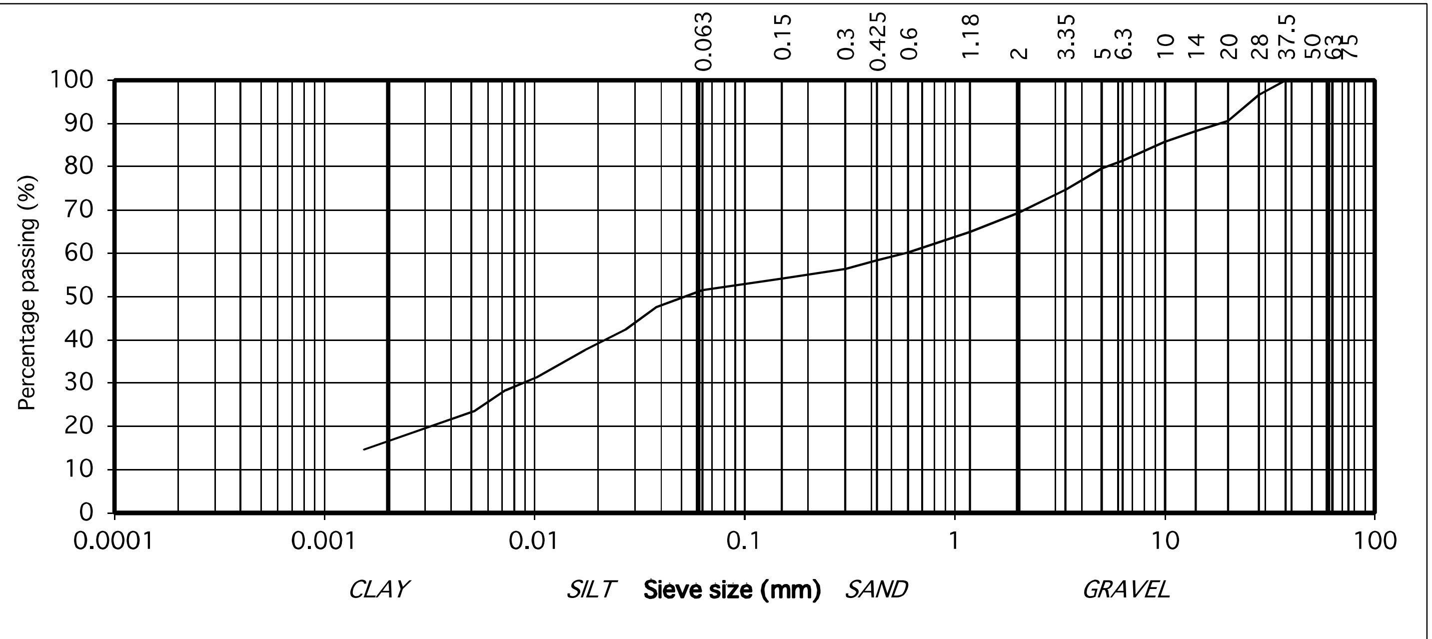
IGSL Ltd Materials Laboratory	Persons authorized to approve reports	Approved by	Date	Page
	H Byrne (Laboratory Manager)		15/01/24	1 of 1

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

Contract No.	24984	Report No.	R152678
Contract Name :	Galway Bus Connects - Dublin Road , Galway		
BH/TP No.	BH01A		
Sample No.*		Lab. Sample No.	A23/4708
Sample Type:	B		
Depth* (m)	0.50-1.00	Customer:	Barrys Transportation
Date Received	08/12/2023	Date Testing started	08/12/2023
Description:	Grey slightly sandy, slightly gravelly, CLAY		
Remarks	Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .		

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory.

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	100	
28	97	
20	91	
14	88	
10	86	
6.3	81	
5	80	
3.35	75	
2	69	
1.18	65	SAND
0.6	60	
0.425	58	
0.3	56	
0.15	54	
0.063	52	SILT/CLAY
0.038	48	
0.027	42	
0.017	38	
0.010	31	
0.007	28	
0.005	24	
0.002	15	



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Approved by:	Date:	Page no:
H Byrne	16/01/24	1 of 1

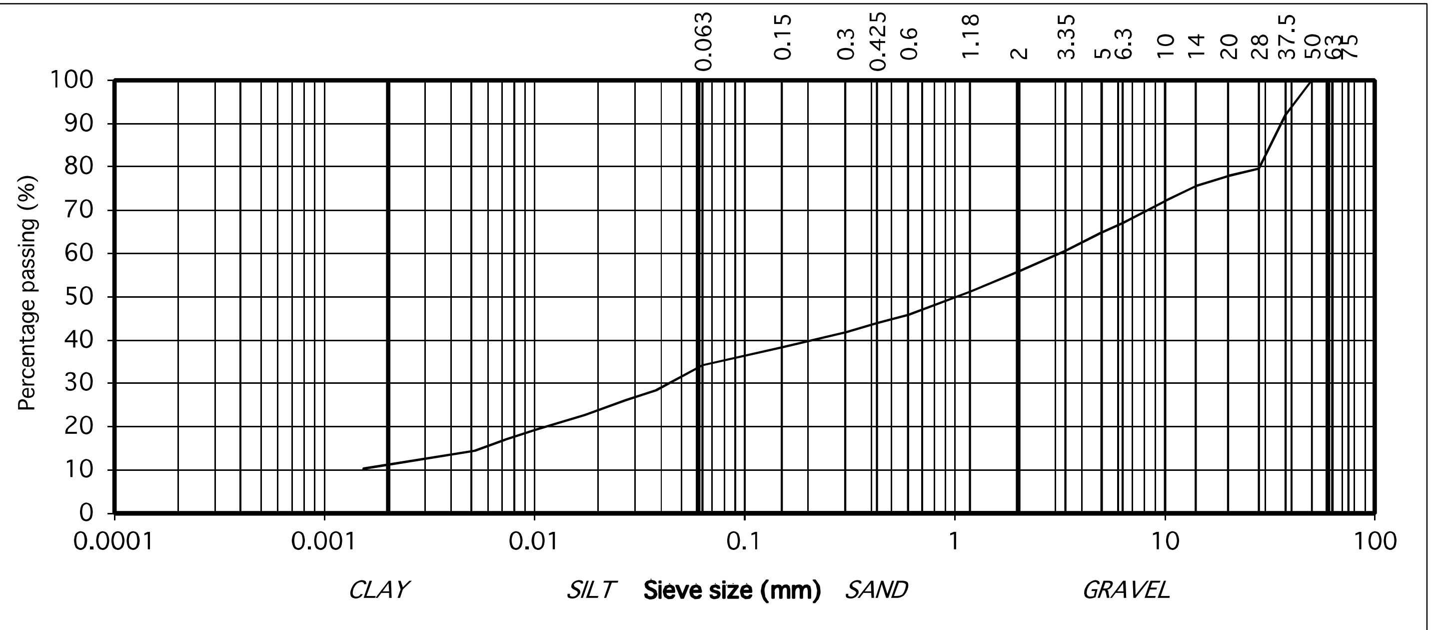
Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

Contract No.	24984 Report No. R152679
Contract Name :	Galway Bus Connects - Dublin Road , Galway
BH/TP No.	BH02
Sample No.*	AA209301 Lab. Sample No. A23/4709
Sample Type:	B
Depth* (m)	0.50-1.00 Customer: Barrys Transportation
Date Received	17/11/2023 Date Testing started 08/12/2023
Description:	Brown slightly sandy, gravelly, CLAY
Remarks	Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
This report shall not be reproduced except in full without the written approval of the Laboratory.

particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	100	GRAVEL
37.5	92	GRAVEL
28	80	GRAVEL
20	78	GRAVEL
14	76	GRAVEL
10	72	GRAVEL
6.3	67	GRAVEL
5	65	GRAVEL
3.35	61	GRAVEL
2	56	GRAVEL
1.18	51	SAND
0.6	46	SAND
0.425	44	SAND
0.3	42	SAND
0.15	38	SAND
0.063	34	SAND
0.038	28	SILT/CLAY
0.027	26	SILT/CLAY
0.017	23	SILT/CLAY
0.010	19	SILT/CLAY
0.007	17	SILT/CLAY
0.005	14	SILT/CLAY
0.002	10	SILT/CLAY



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Approved by:	Date:	Page no:
[signature]	16/01/24	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

Contract No.	24984 Report No. R152680
Contract Name :	Galway Bus Connects - Dublin Road , Galway
BH/TP No.	BH02
Sample No.*	AA209303 Lab. Sample No. A23/4970
Sample Type:	B
Depth* (m)	2.00-2.50 Customer: Barrys Transportation
Date Received	17/11/2023 Date Testing started 08/12/2023
Description:	Grey slightly sandy, slightly gravelly, CLAY with some cobbles
Remarks	Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2 Sample size did not meet the requirements of BS1377

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
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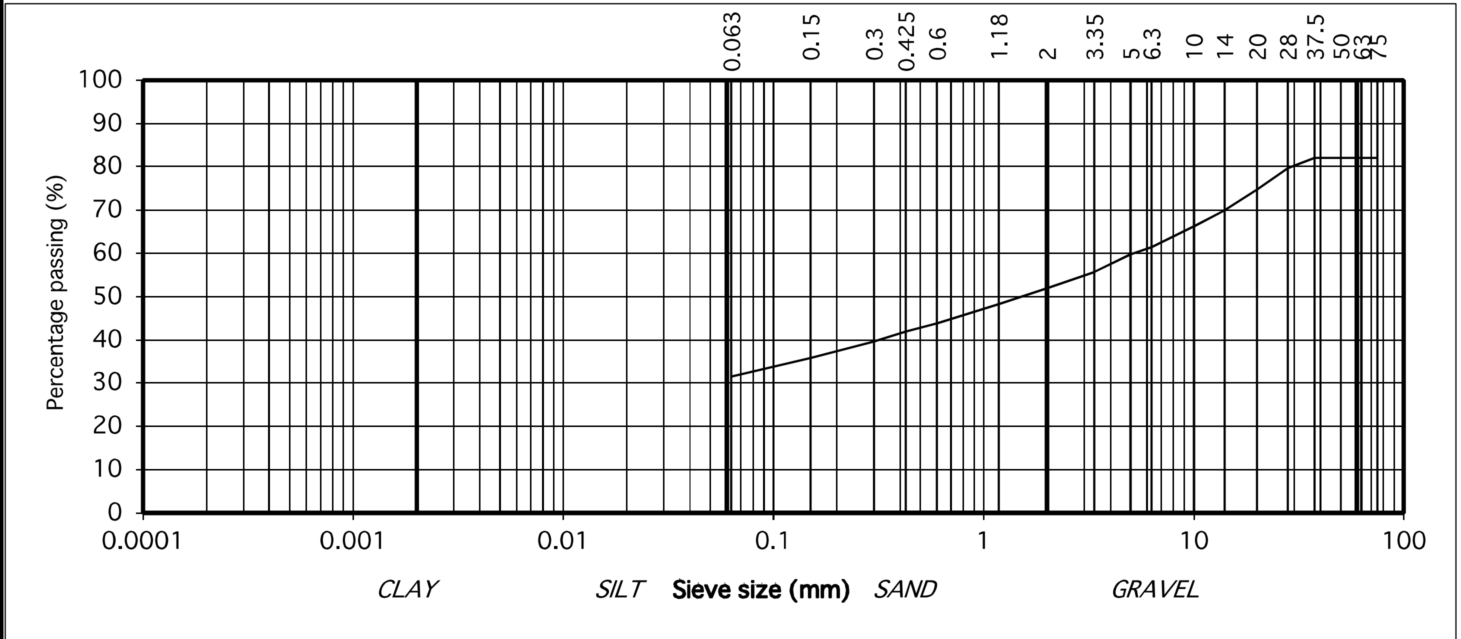
particle size	% passing	
75	82	COBBLES
63	82	
50	82	GRAVEL
37.5	82	
28	80	
20	75	
14	70	
10	66	
6.3	61	
5	60	
3.35	56	
2	52	
1.18	48	SAND
0.6	44	
0.425	42	
0.3	40	
0.15	36	
0.063	31	SILT/CLAY



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Approved by:	Date:	Page no:
	16/01/24	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

Contract No.	24984 Report No. R152006
Contract Name :	Galway Bus Connects - Dublin Road , Galway
BH/TP No.	BH03
Sample No.*	AA204330 Lab. Sample No. A23/4711A
Sample Type:	B
Depth* (m)	0.50 Customer: Barrys Transportation
Date Received	16/11/2023 Date Testing started 16/11/2023
Description:	Brown sandy, slightly gravelly, CLAY
Remarks	Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2 Sample size did not meet the requirements of BS1377

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
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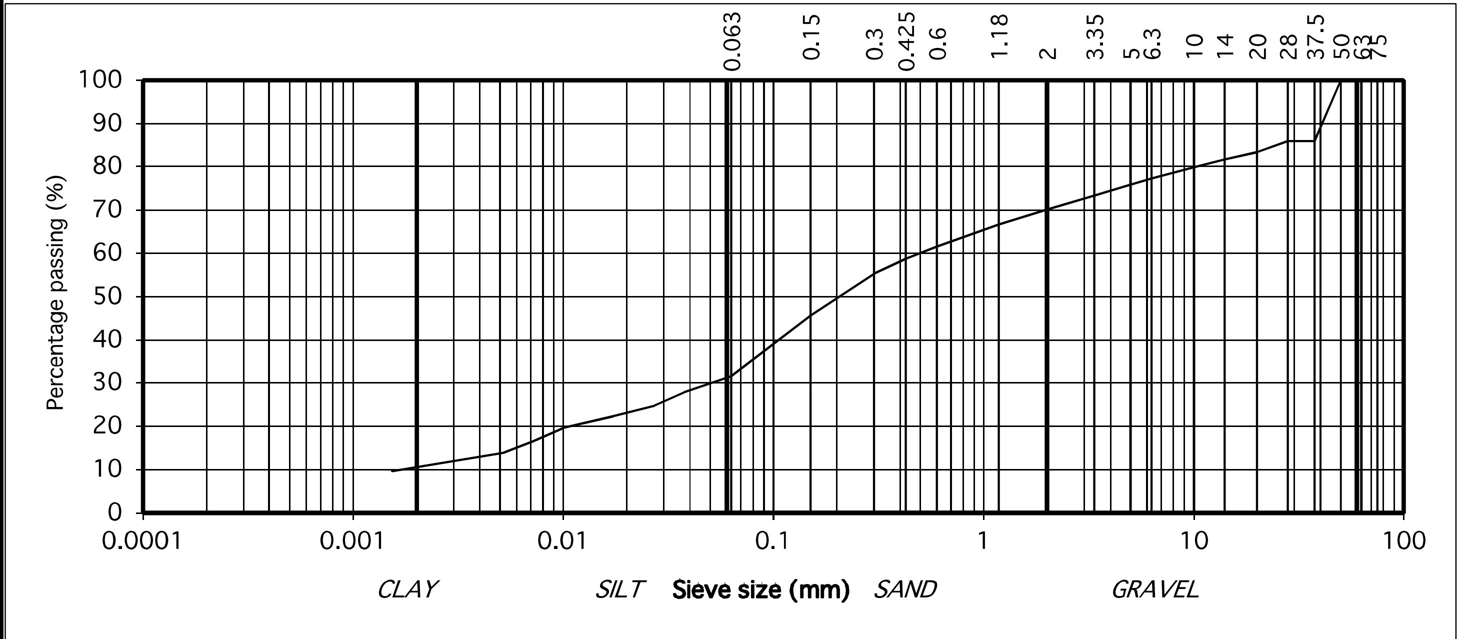
particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	100	
37.5	86	
28	86	
20	83	
14	82	
10	80	
6.3	77	
5	76	
3.35	73	
2	70	
1.18	67	SAND
0.6	62	
0.425	59	
0.3	55	
0.15	46	
0.063	32	SILT/CLAY
0.037	28	
0.027	25	
0.017	22	
0.010	20	
0.007	17	
0.005	14	
0.002	10	



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Approved by:	Date:	Page no:
	18/12/23	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

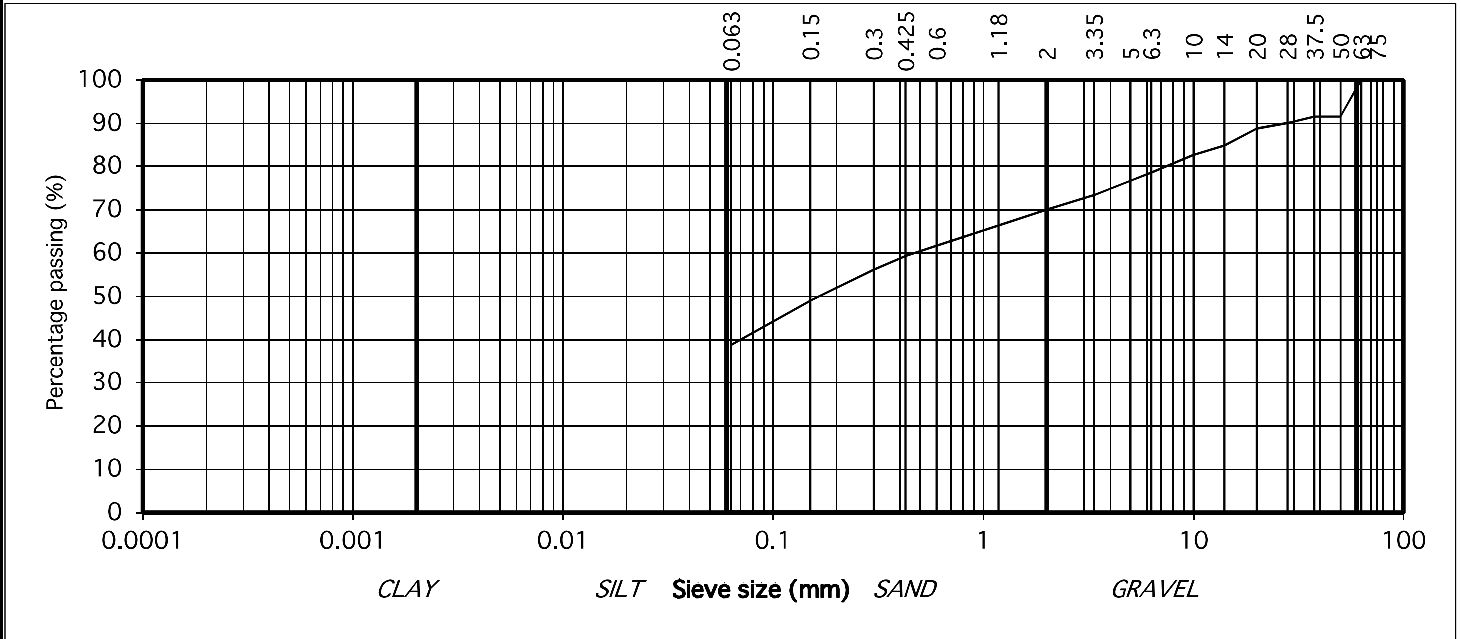
Contract No.	24984	Report No.	R152007
Contract Name :	Galway Bus Connects - Dublin Road , Galway		
BH/TP No.	BH03		
Sample No.*	AA204332	Lab. Sample No.	A23/4712A
Sample Type:	B		
Depth* (m)	2.00	Customer:	Barrys Transportation
Date Received	16/11/2023	Date Testing started	16/11/2023
Description:	Brown slightly sandy, slightly gravelly, CLAY		

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory.

Remarks

Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

particle size	% passing	
75	100	COBBLES
63	100	
50	92	GRAVEL
37.5	92	
28	90	
20	89	
14	85	
10	83	
6.3	79	
5	77	
3.35	73	
2	70	
1.18	66	SAND
0.6	62	
0.425	59	
0.3	56	
0.15	49	
0.063	39	SILT/CLAY



IGSL Ltd Materials Laboratory	Approved by:	Date:	Page no:
	H Byrne	18/12/23	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

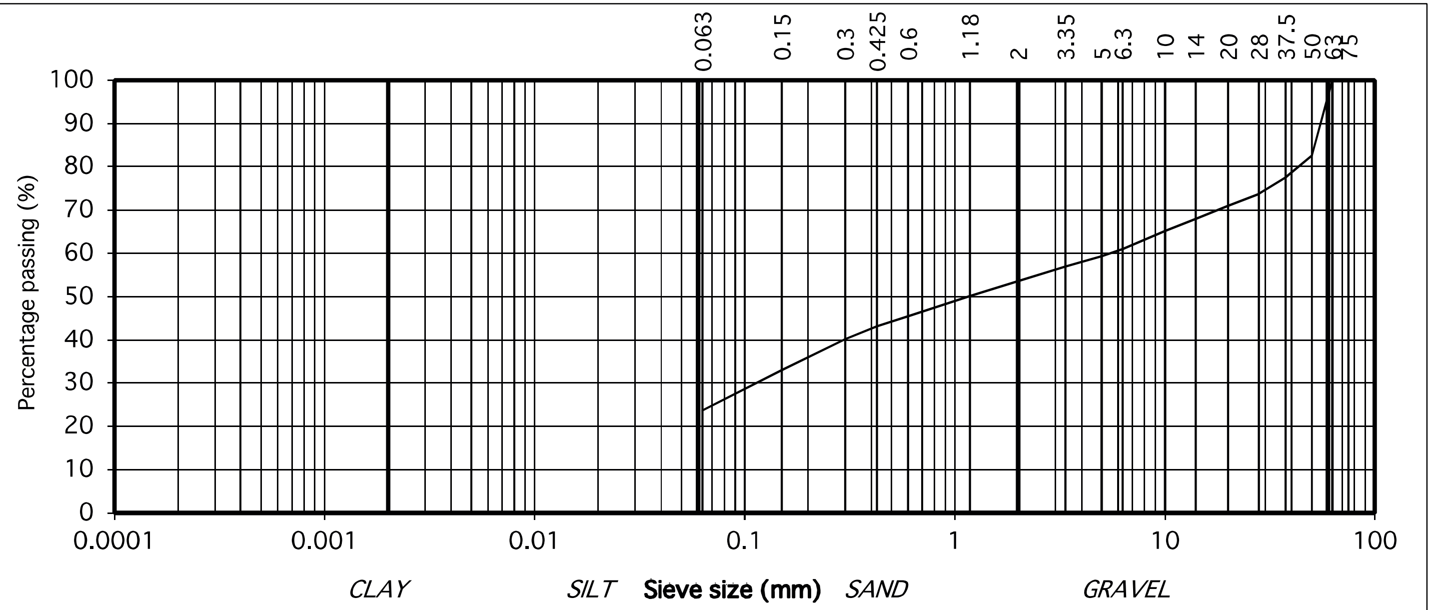
TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

INAB ISO 17025 ACCREDITED TESTING DETAILED IN SCOPE REG NO.133T

Contract No.	24984	Report No.	R152008
Contract Name :	Galway Bus Connects - Dublin Road , Galway		
BH/TP No.	BH04A		
Sample No.*	AA204333	Lab. Sample No.	A23/4713A
Sample Type:	B		
Depth* (m)	0.50	Customer:	Barrys Transportation
Date Received	17/11/2023	Date Testing started	17/11/2023
Description:	Brown slightly sandy, gravelly, SILT		
Remarks	Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2 Sample size did not meet the requirements of BS1377		

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory.

particle size	% passing	
75	100	COBBLES
63	100	
50	82	GRAVEL
37.5	77	
28	74	
20	71	
14	68	
10	65	
6.3	61	
5	59	
3.35	57	
2	54	SAND
1.18	50	
0.6	45	
0.425	43	
0.3	40	
0.15	33	
0.063	24	SILT/CLAY



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Approved by:	Date:	Page no:
	18/12/23	1 of 1

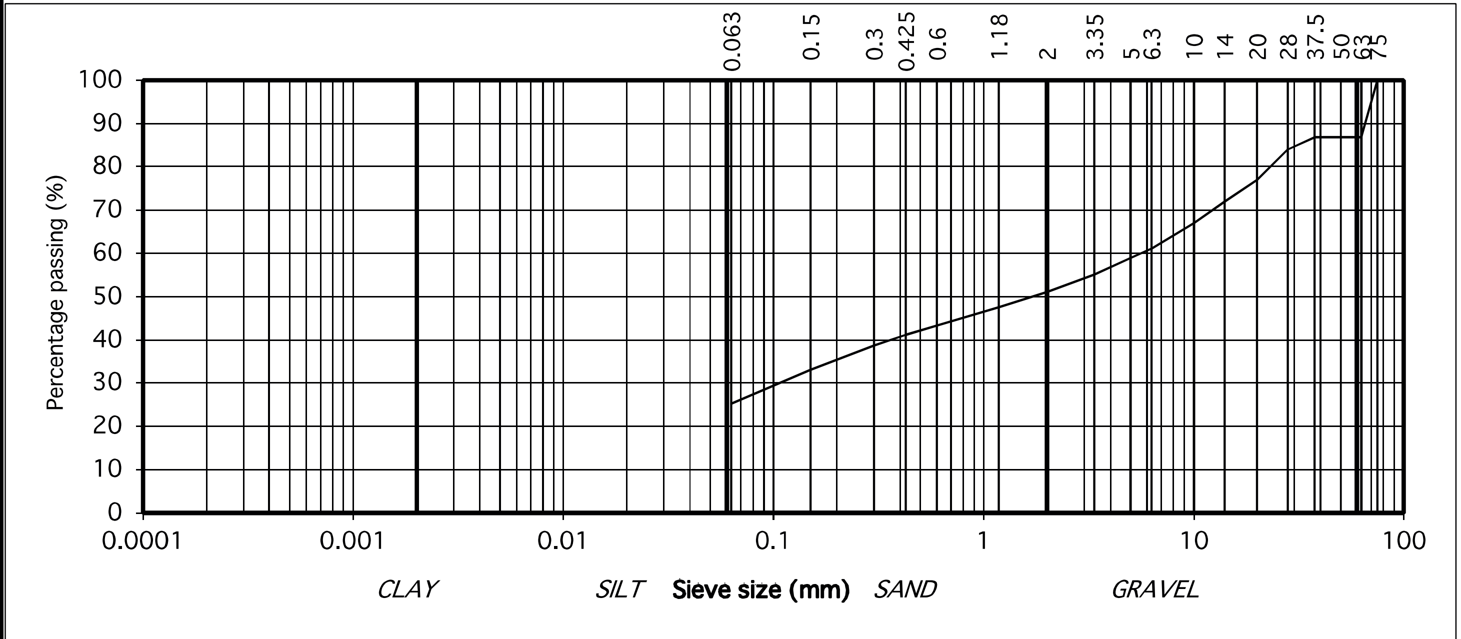
Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

Contract No.	24984	Report No.	R152009
Contract Name :	Galway Bus Connects - Dublin Road , Galway		
BH/TP No.	BH04A		
Sample No.*	AA204335	Lab. Sample No.	A23/4714A
Sample Type:	B		
Depth* (m)	2.00	Customer:	Barrys Transportation
Date Received	17/11/2023	Date Testing started	17/11/2023
Description:	Brown slightly sandy, gravelly, CLAY with some cobbles		
Remarks	Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2 Sample size did not meet the requirements of BS1377		

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory.

particle size	% passing	
75	100	COBBLES
63	87	GRAVEL
50	87	
37.5	87	
28	84	
20	77	
14	72	
10	67	
6.3	61	
5	59	
3.35	55	
2	51	
1.18	48	SAND
0.6	43	
0.425	41	
0.3	39	
0.15	33	
0.063	25	SILT/CLAY



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Approved by:	Date:	Page no:
	18/12/23	1 of 1

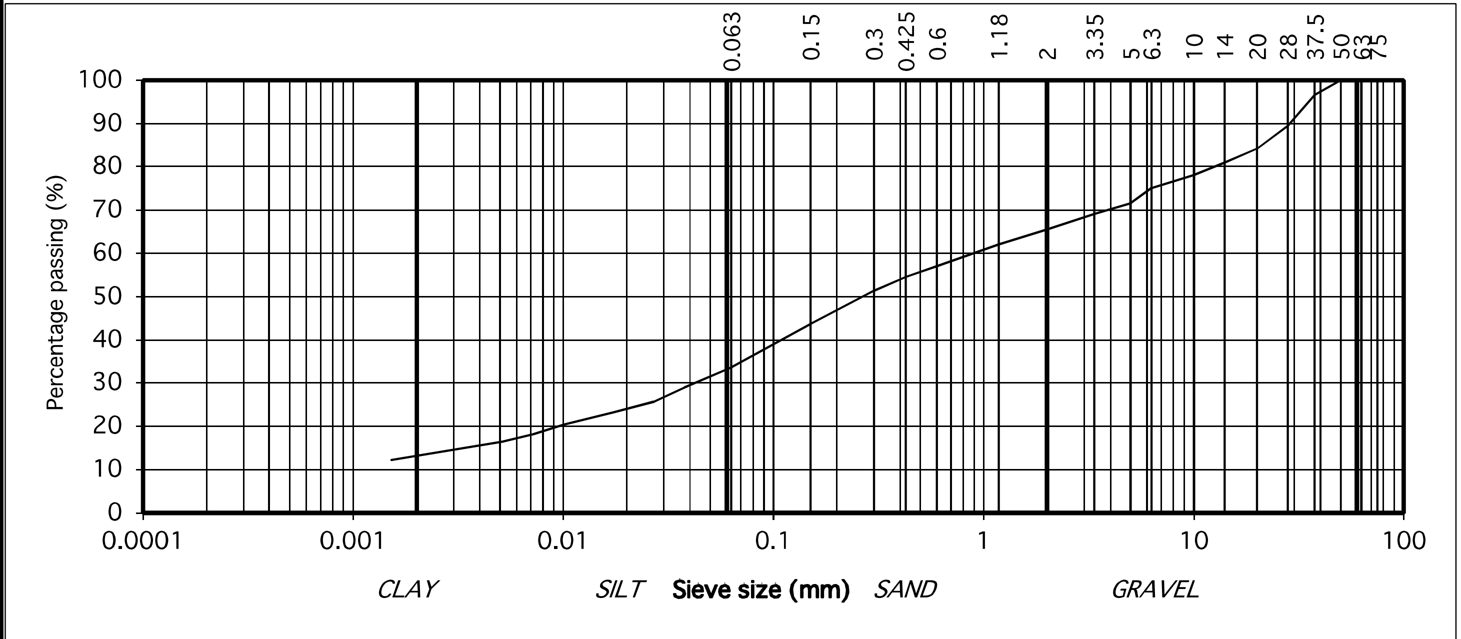
Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

Contract No.	24984 Report No. R152010
Contract Name :	Galway Bus Connects - Dublin Road , Galway
BH/TP No.	BH06
Sample No.*	AA204346 Lab. Sample No. A23/4716A
Sample Type:	B
Depth* (m)	1.20 Customer: Barrys Transportation
Date Received	17/11/2023 Date Testing started 17/11/2023
Description:	Brown slightly sandy, slightly gravelly, CLAY
Remarks	Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory.

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	97	
28	89	
20	84	
14	81	
10	78	
6.3	75	
5	72	
3.35	69	
2	65	
1.18	62	SAND
0.6	57	
0.425	55	
0.3	51	
0.15	44	
0.063	34	SILT/CLAY
0.037	29	
0.027	26	
0.017	23	
0.010	20	
0.007	18	
0.005	16	
0.002	12	



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Approved by:	Date:	Page no:
H Byrne	19/12/23	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

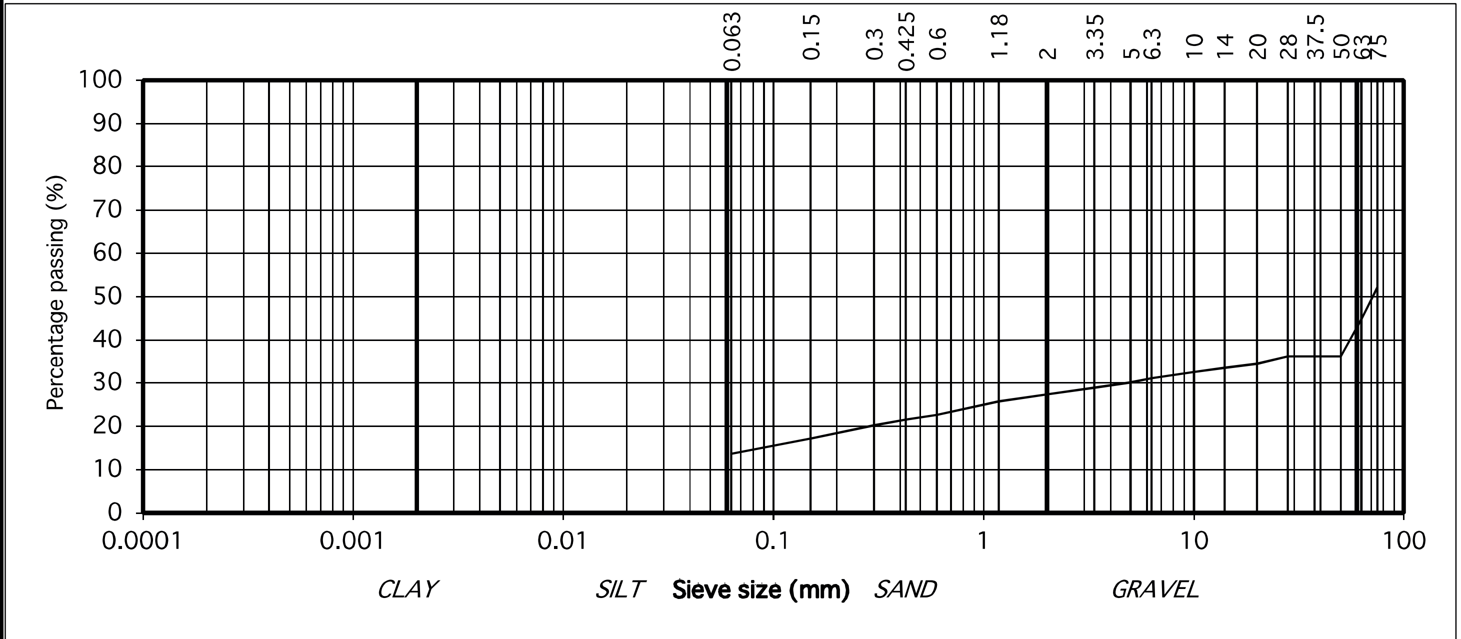
TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

Contract No. 24984 Report No. R152011
Contract Name : Galway Bus Connects - Dublin Road , Galway
BH/TP No. BH06
Sample No.* AA204348 Lab. Sample No. A23/4717A
Sample Type: B
Depth* (m) 3.00-3.50 Customer: Barrys Transportation
Date Received 17/11/2023 Date Testing started 17/11/2023
Description: COBBLES with brown clayey, sandy, gravel

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
This report shall not be reproduced except in full without the written approval of the Laboratory.

Remarks Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2 Sample size di dnot meet the requirements of BS1377

particle size	% passing	
75	52	COBBLES
63	45	GRAVEL
50	36	
37.5	36	
28	36	
20	35	
14	34	
10	33	
6.3	31	
5	30	
3.35	29	
2	27	SAND
1.18	26	
0.6	23	
0.425	22	
0.3	20	
0.15	17	
0.063	14	SILT/CLAY



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Approved by:	Date:	Page no:
	19/12/23	1 of 1

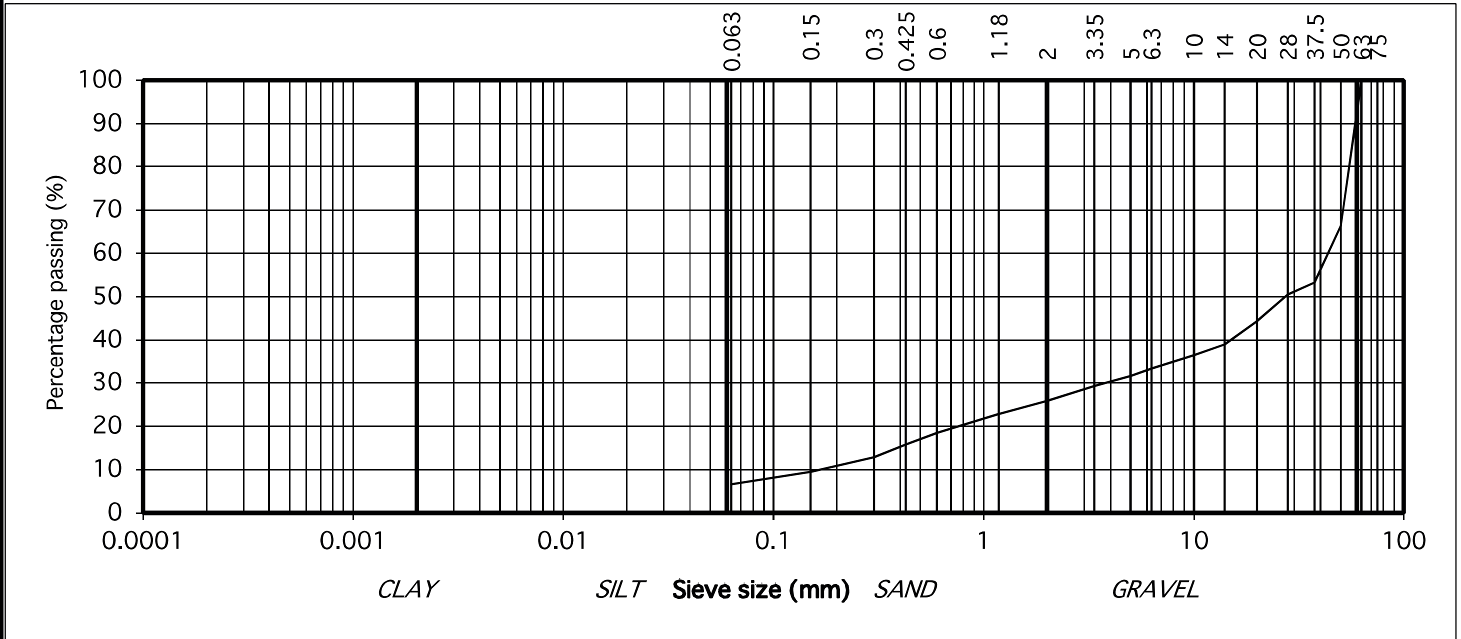
Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

Contract No.	24984 Report No. R152012
Contract Name :	Galway Bus Connects - Dublin Road , Galway
BH/TP No.	BH10
Sample No.*	AA204440 Lab. Sample No. A23/4750A
Sample Type:	B
Depth* (m)	1.20-1.70 Customer: Barrys Transportation
Date Received	17/11/2023 Date Testing started 17/11/2023
Description:	Brown silty, sandy, GRAVEL
Remarks	Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2 Sample size did not meet the requirements of BS1377

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory.

particle size	% passing	
75	100	COBBLES
63	100	
50	66	GRAVEL
37.5	53	
28	50	
20	44	
14	39	
10	36	
6.3	33	
5	32	
3.35	29	
2	26	
1.18	23	SAND
0.6	18	
0.425	16	
0.3	13	
0.15	9	
0.063	7	SILT/CLAY



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Approved by:	Date:	Page no:
H Byrne	19/12/23	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT

Determination of Particle Size Distribution

Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**

(note: Sedimentation stage not accredited)

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.133T

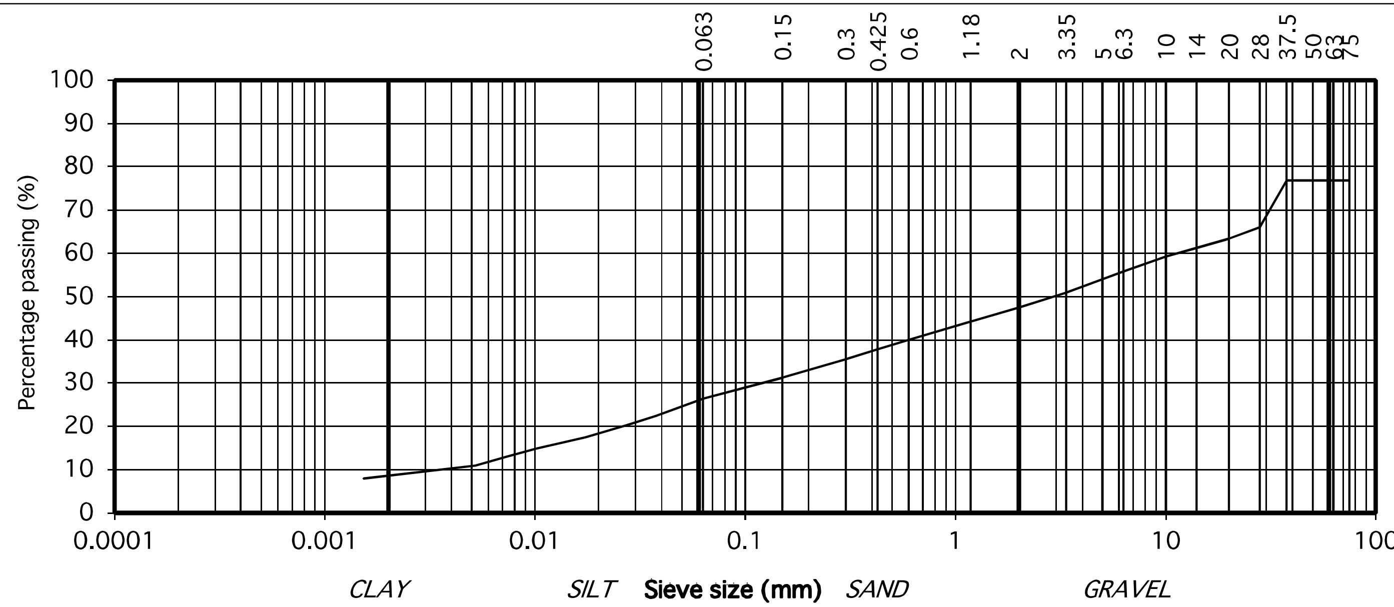
Contract No.	24984	Report No.	R152013
Contract Name :	Galway Bus Connects - Dublin Road , Galway		
BH/TP No.	BH10		
Sample No.*	AA204743	Lab. Sample No.	A23/4721A
Sample Type:	B		
Depth* (m)	4.00-4.50	Customer:	Barrys Transportation
Date Received	17/11/2023	Date Testing started	17/11/2023
Description:	Brown slightly sandy, slightly gravelly, SILT with many cobbles		

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory.

Remarks

Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2 Sample size did not meet the requirements of BS1377

particle size	% passing	
75	77	COBBLES
63	77	
50	77	GRAVEL
37.5	77	
28	66	
20	63	
14	61	
10	59	
6.3	56	
5	54	
3.35	51	
2	48	
1.18	44	SAND
0.6	40	
0.425	38	
0.3	36	
0.15	31	
0.063	26	SILT/CLAY
0.038	22	
0.027	20	
0.017	17	
0.010	15	
0.007	13	
0.005	11	
0.002	8	



IGSL Ltd Materials Laboratory	Approved by:	Date:	Page no:
	[signature]	19/12/23	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

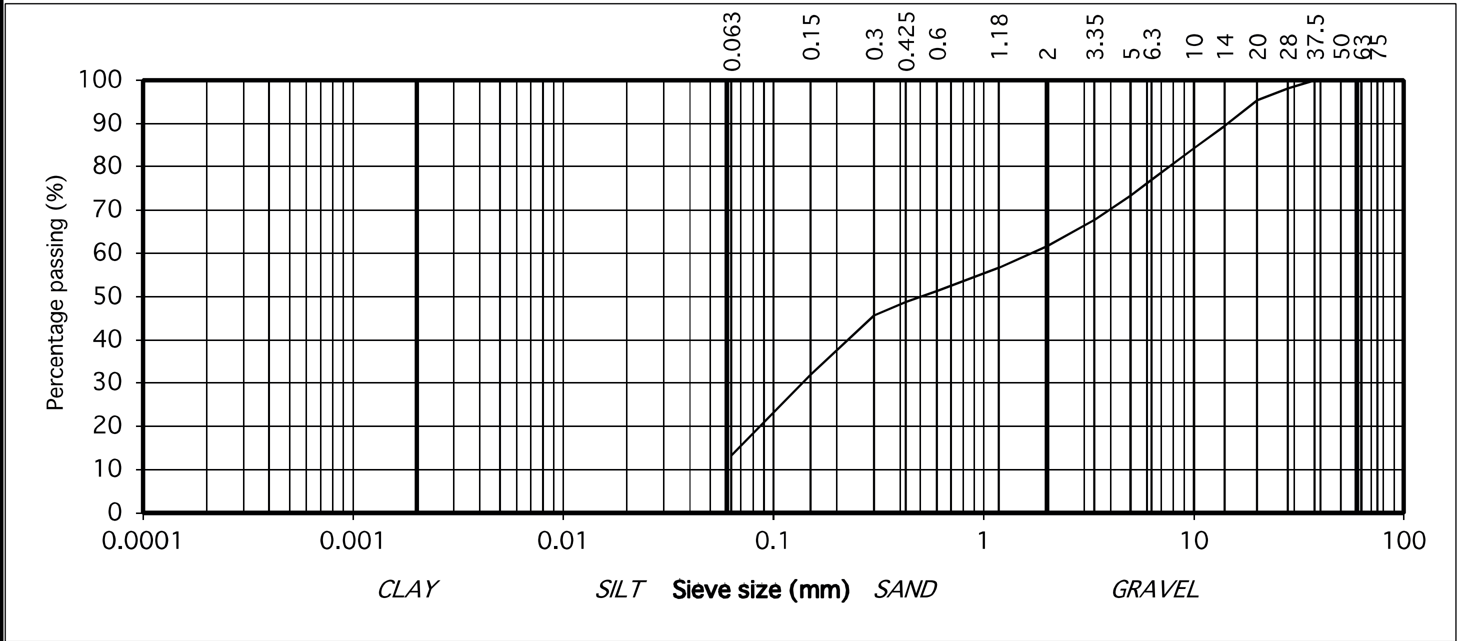
TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

Contract No. 24984 Report No. R152681
Contract Name : Galway Bus Connects - Dublin Road , Galway
BH/TP No. TP01
Sample No.* AA208190 Lab. Sample No. A23/4723
Sample Type: B
Depth* (m) 1.00-1.20 Customer: Barrys Transportation
Date Received 11/12/2023 Date Testing started 11/12/2023
Description: Grey silty, very gravelly, SAND

Remarks Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
This report shall not be reproduced except in full without the written approval of the Laboratory.

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	100	
28	98	
20	95	
14	89	
10	84	
6.3	77	
5	73	
3.35	68	
2	62	
1.18	57	SAND
0.6	51	
0.425	49	
0.3	46	
0.15	32	
0.063	13	SILT/CLAY



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Approved by:	Date:	Page no:
	16/01/24	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

INAB ISO 17025 ACCREDITED TESTING DETAILED IN SCOPE REG NO.133T

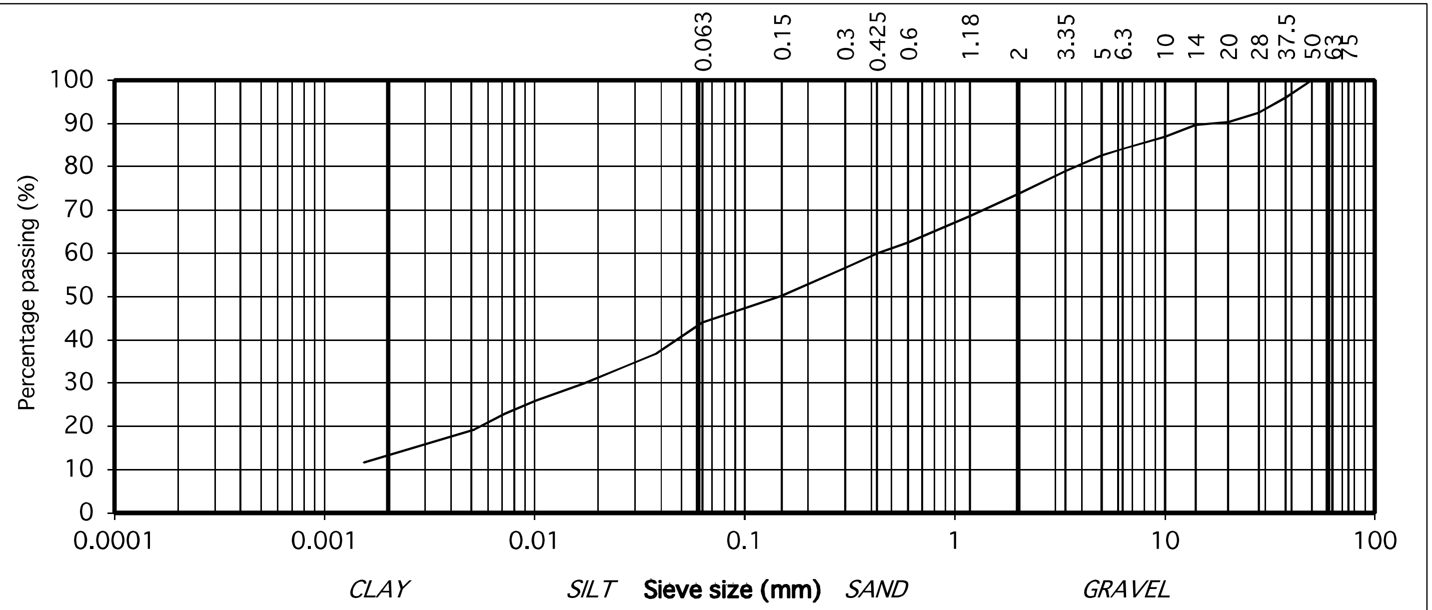
Contract No.	24984	Report No.	R152682
Contract Name :	Galway Bus Connects - Dublin Road , Galway		
BH/TP No.	TP02		
Sample No.*	AA208758	Lab. Sample No.	A23/4725
Sample Type:	B		
Depth* (m)	1.00-1.20	Customer:	Barrys Transportation
Date Received	11/12/2023	Date Testing started	11/12/2023
Description:	Grey/brown slightly sandy, slightly gravelly, CLAY		

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
This report shall not be reproduced except in full without the written approval of the Laboratory.

Remarks

Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	96	
28	93	
20	90	
14	90	
10	87	
6.3	84	
5	83	
3.35	79	
2	74	
1.18	69	SAND
0.6	62	
0.425	60	
0.3	57	
0.15	50	
0.063	44	SILT/CLAY
0.038	37	
0.027	34	
0.017	30	
0.010	26	
0.007	23	
0.005	19	
0.002	12	



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Approved by:	Date:	Page no:
H Byrne	16/01/24	1 of 1

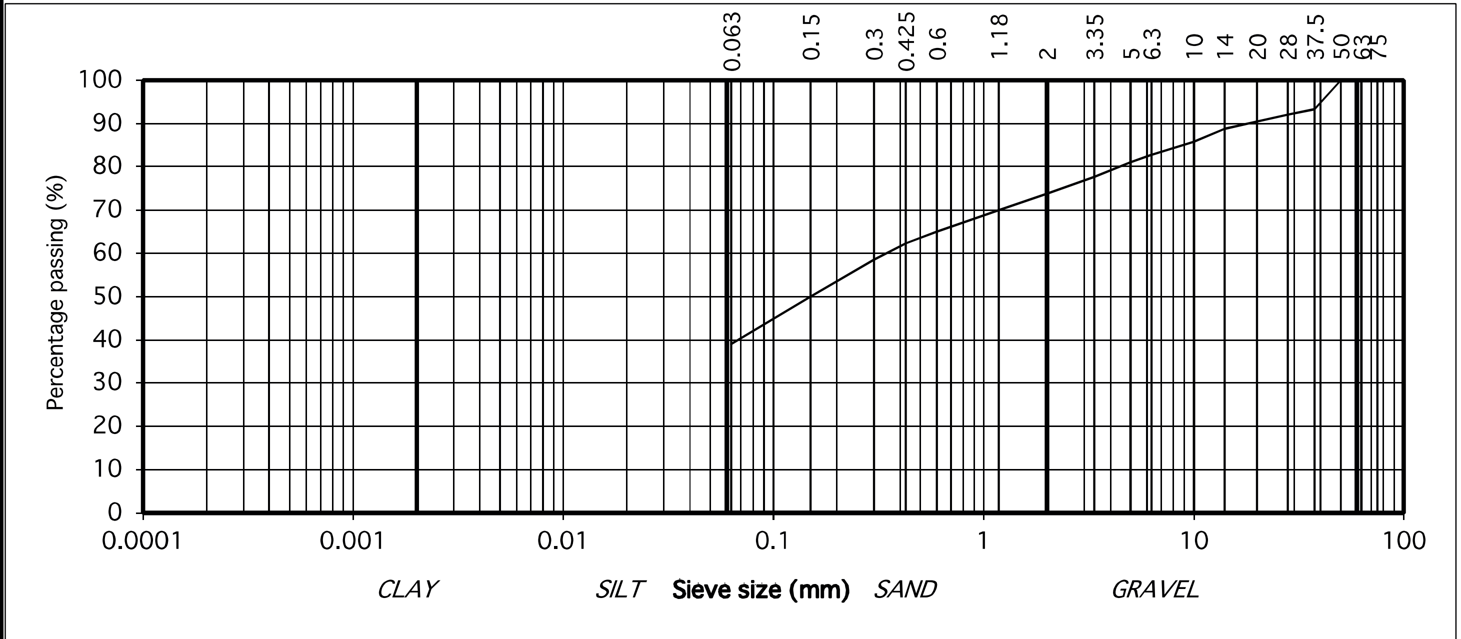
Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

Contract No.	24984 Report No. R152683
Contract Name :	Galway Bus Connects - Dublin Road , Galway
BH/TP No.	TP03
Sample No.*	AA208199 Lab. Sample No. A23/4728
Sample Type:	B
Depth* (m)	2.00-2.50 Customer: Barrys Transportation
Date Received	11/12/2023 Date Testing started 11/12/2023
Description:	Grey/brown slightly sandy, slightly gravelly, CLAY
Remarks	Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
This report shall not be reproduced except in full without the written approval of the Laboratory.

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	93	
28	92	
20	91	
14	89	
10	86	
6.3	83	
5	81	
3.35	78	
2	74	
1.18	70	SAND
0.6	65	
0.425	62	
0.3	59	
0.15	50	
0.063	39	SILT/CLAY



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Approved by:	Date:	Page no:
	16/01/24	1 of 1

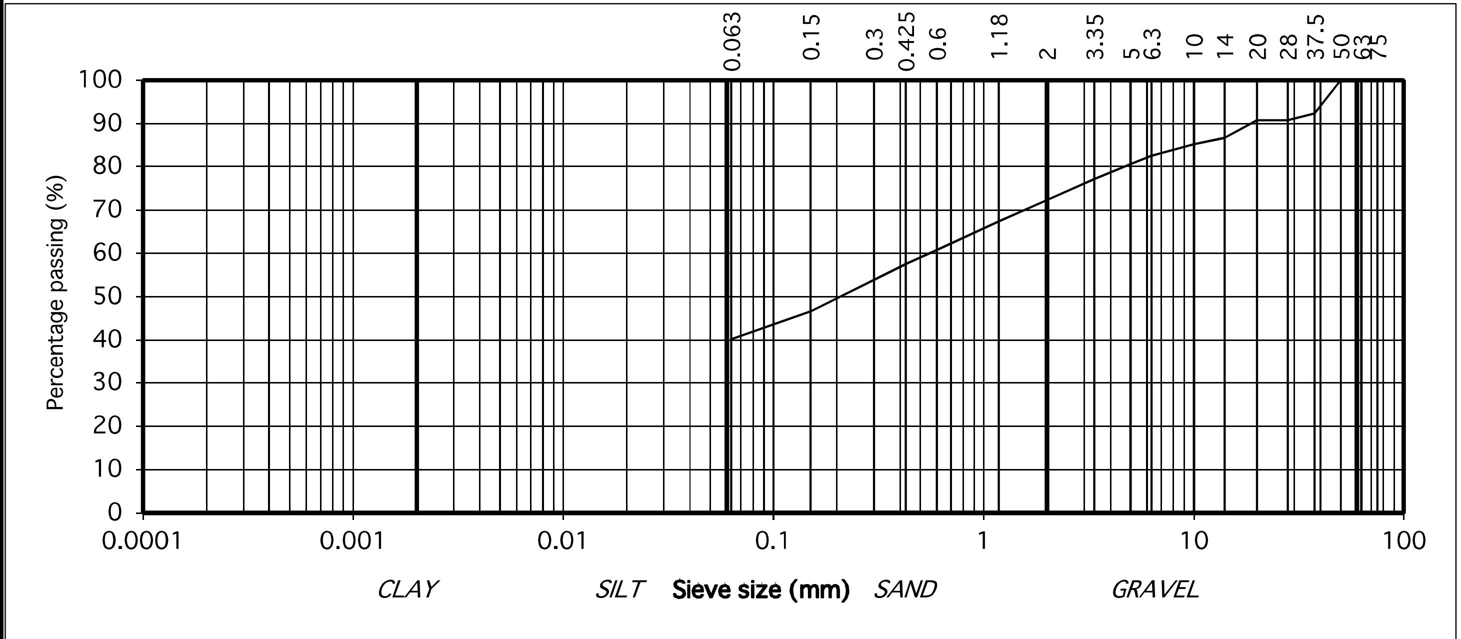
Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

Contract No.	24984 Report No. R152684
Contract Name :	Galway Bus Connects - Dublin Road , Galway
BH/TP No.	TP04
Sample No.*	AA208751 Lab. Sample No. A23/4372
Sample Type:	B
Depth* (m)	1.30-1.50 Customer: Barrys Transportation
Date Received	11/12/2023 Date Testing started 11/12/2023
Description:	Grey/brown slightly sandy, slightly gravelly, CLAY
Remarks	Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory.

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	92	
28	91	
20	91	
14	87	
10	85	
6.3	83	
5	81	
3.35	77	
2	72	
1.18	67	SAND
0.6	61	
0.425	57	
0.3	54	
0.15	47	
0.063	40	SILT/CLAY



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Approved by:	Date:	Page no:
[signature]	16/01/24	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

Contract No. 24984 Report No. R152685
Contract Name : Galway Bus Connects - Dublin Road , Galway
BH/TP No. TP05
Sample No.* AA208756 Lab. Sample No. A23/4372
Sample Type: B
Depth* (m) 1.30-1.50 Customer: Barrys Transportation
Date Received 11/12/2023 Date Testing started 11/12/2023
Description: Grey/brown slightly sandy, gravelly, CLAY

Remarks Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2 Sample size did not meet the requirements of BS1377

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
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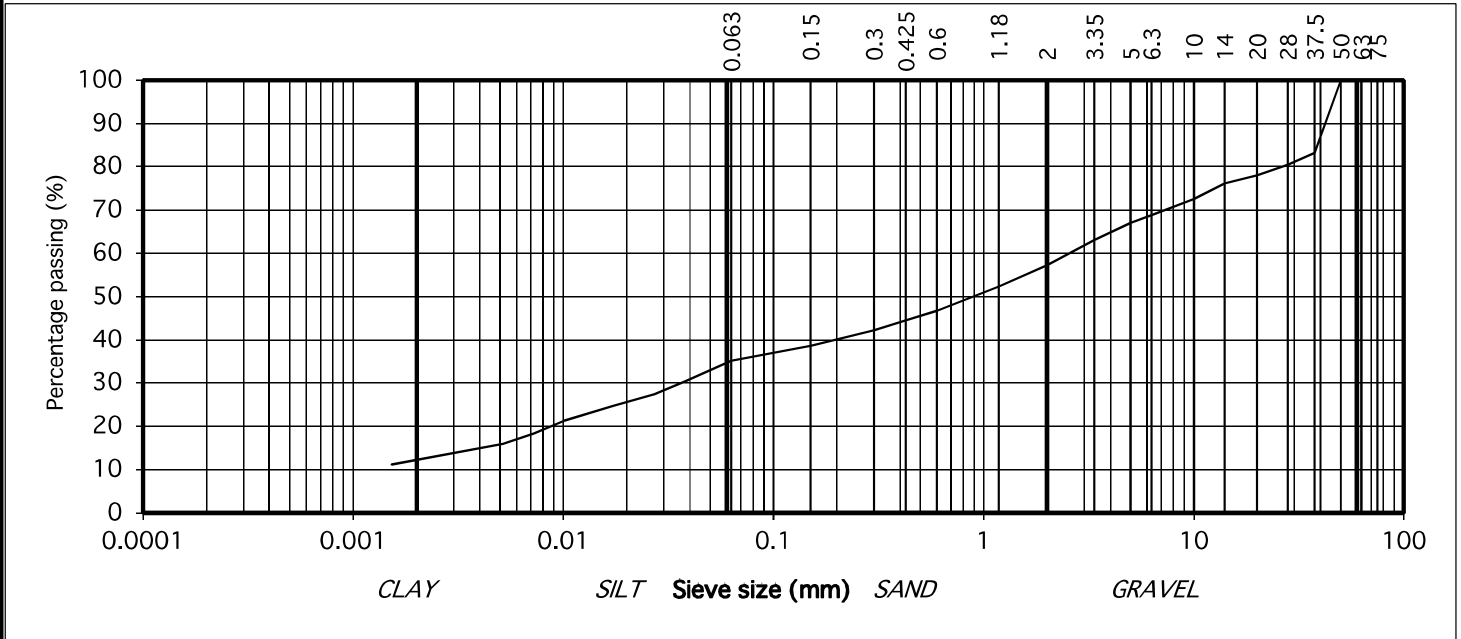
particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	83	
28	80	
20	78	
14	76	
10	73	
6.3	69	
5	67	
3.35	63	
2	57	
1.18	52	SAND
0.6	47	
0.425	45	
0.3	42	
0.15	39	
0.063	35	SILT/CLAY
0.037	30	
0.027	27	
0.017	25	
0.010	21	
0.007	18	
0.005	16	
0.002	11	



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Approved by:	Date:	Page no:
	16/01/24	1 of 1

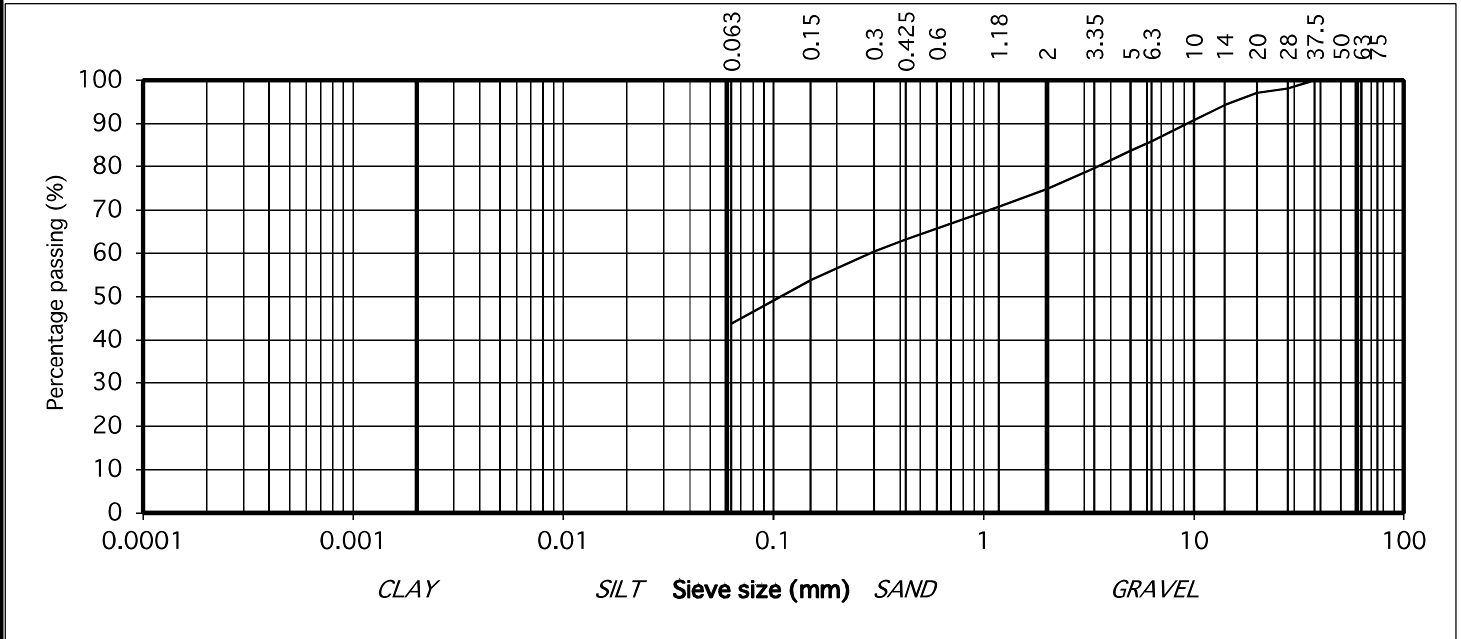
Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

Contract No.	24984 Report No. R152686
Contract Name :	Galway Bus Connects - Dublin Road , Galway
BH/TP No.	TP06
Sample No.*	AA208753 Lab. Sample No. A23/4734
Sample Type:	B
Depth* (m)	1.40-1.60 Customer: Barrys Transportation
Date Received	17/11/2023 Date Testing started 11/12/2023
Description:	Grey slightly sandy, slightly gravelly, CLAY
Remarks	Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
This report shall not be reproduced except in full without the written approval of the Laboratory.

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	100	
28	98	
20	97	
14	94	
10	91	
6.3	86	
5	84	
3.35	80	
2	75	
1.18	71	SAND
0.6	66	
0.425	63	
0.3	60	
0.15	54	
0.063	44	SILT/CLAY



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Approved by:	Date:	Page no:
	16/01/24	1 of 1

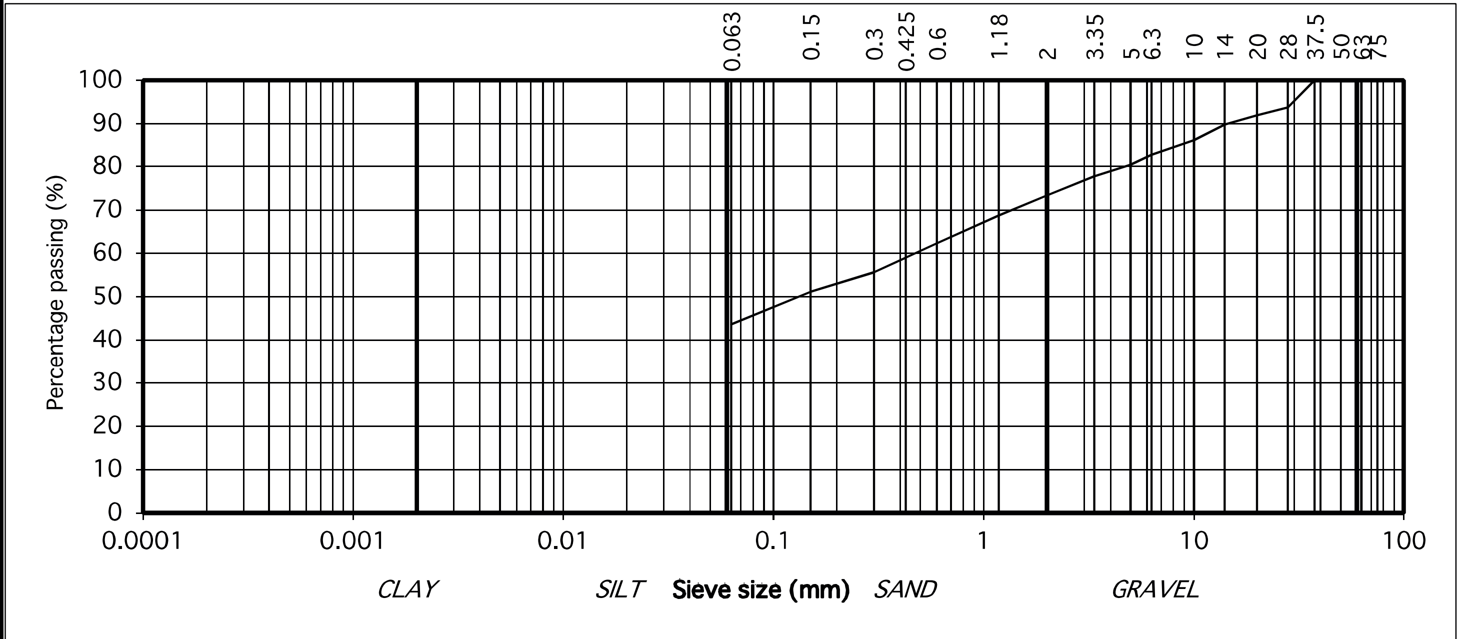
Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

Contract No.	24984	Report No.	R152014
Contract Name :	Galway Bus Connects - Dublin Road , Galway		
BH/TP No.	TP07		
Sample No.*	AA208185	Lab. Sample No.	A23/4737
Sample Type:	B		
Depth* (m)	2.00-2.40	Customer:	Barrys Transportation
Date Received	17/11/2023	Date Testing started	07/12/2023
Description:	Brown slightly sandy, slightly gravelly, CLAY		
Remarks	Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .		

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory.

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	100	
28	94	
20	92	
14	90	
10	86	
6.3	83	
5	80	
3.35	78	
2	73	
1.18	69	SAND
0.6	62	
0.425	59	
0.3	56	
0.15	51	
0.063	44	SILT/CLAY



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Approved by:	Date:	Page no:
	19/12/23	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT

Determination of Particle Size Distribution

Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**

(note: Sedimentation stage not accredited)

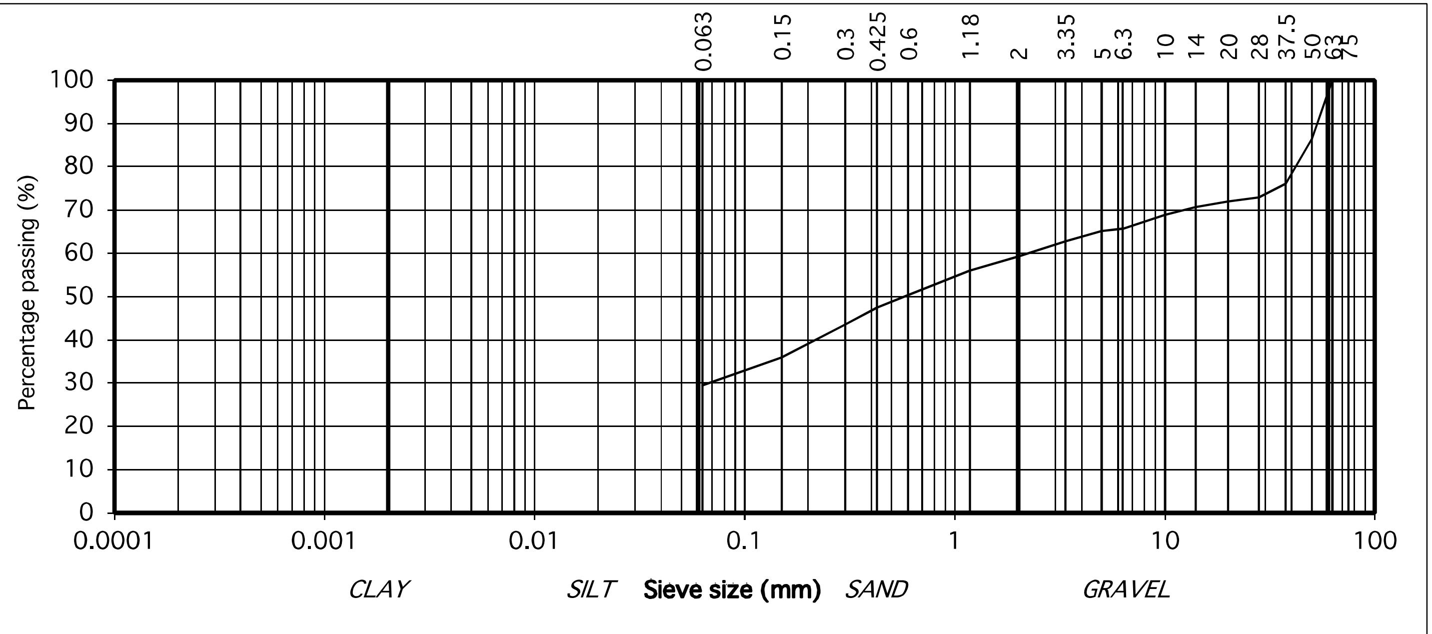
Contract No.	24984	Report No.	R152015
Contract Name :	Galway Bus Connects - Dublin Road , Galway		
BH/TP No.	TP08		
Sample No.*	AA208187	Lab. Sample No.	A23/4739
Sample Type:	B		
Depth* (m)	1.00-1.20	Customer:	Barrys Transportation
Date Received	17/11/2023	Date Testing started	17/11/2023
Description:	Brown slightly sandy, gravelly, SILT		

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory.

Remarks

Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2 Sample size did not meet the requirements of BS1377

particle size	% passing	
75	100	COBBLES
63	100	
50	86	GRAVEL
37.5	76	
28	73	
20	72	
14	71	
10	69	
6.3	66	
5	65	
3.35	63	
2	59	
1.18	56	SAND
0.6	50	
0.425	47	
0.3	44	
0.15	36	
0.063	29	SILT/CLAY



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Approved by:	Date:	Page no:
	19/12/23	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

particle size	% passing
75	100
63	100
50	93
37.5	86
28	81
20	76
14	72
10	64
6.3	54
5	48
3.35	39
2	27
1.18	18
0.6	11
0.425	8
0.3	6
0.15	5
0.063	4

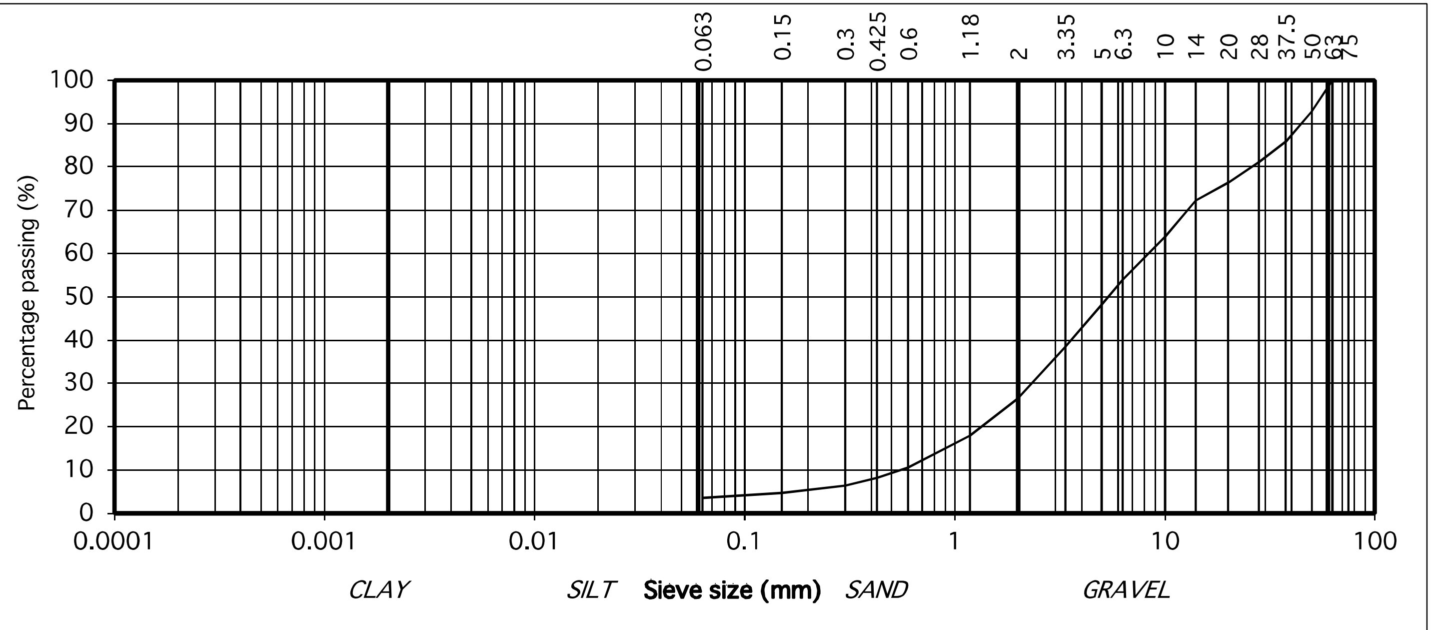
COBBLES
GRAVEL
SAND
SILT/CLAY

Contract No.	24984	Report No.	R152016
Contract Name :	Galway Bus Connects - Dublin Road , Galway		
BH/TP No.	TP09		
Sample No.*	AA108196	Lab. Sample No.	A23/4747
Sample Type:	B		
Depth* (m)	1.00- 1.20	Customer:	Barrys Transportation
Date Received	07/12/2023	Date Testing started	07/12/2023
Description:	Brown slightly clayey/silty, very sandy, GRAVEL		

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
This report shall not be reproduced except in full without the written approval of the Laboratory.

Remarks

Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .



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Approved by:	Date:	Page no:
	19/12/23	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**

(note: Sedimentation stage not accredited)

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	100	
28	96	
20	89	
14	87	
10	83	
6.3	78	
5	76	
3.35	72	
2	67	
1.18	63	SAND
0.6	58	
0.425	55	
0.3	52	
0.15	46	
0.063	39	SILT/CLAY
0.037	33	
0.027	30	
0.017	27	
0.010	23	
0.007	21	
0.005	18	
0.002	13	

Contract No. 24984 Report No. R152017

Contract Name : Galway Bus Connects - Dublin Road , Galway

BH/TP No. TP11

Sample No.* AA208194 Lab. Sample No. A23/4744

Sample Type: B

Depth* (m) 1.60-1.80 Customer: Barrys Transportation

Date Received 07/12/2023 Date Testing started 07/12/2023

Description: Brown slightly sandy, slightly gravelly, CLAY

Remarks

Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.

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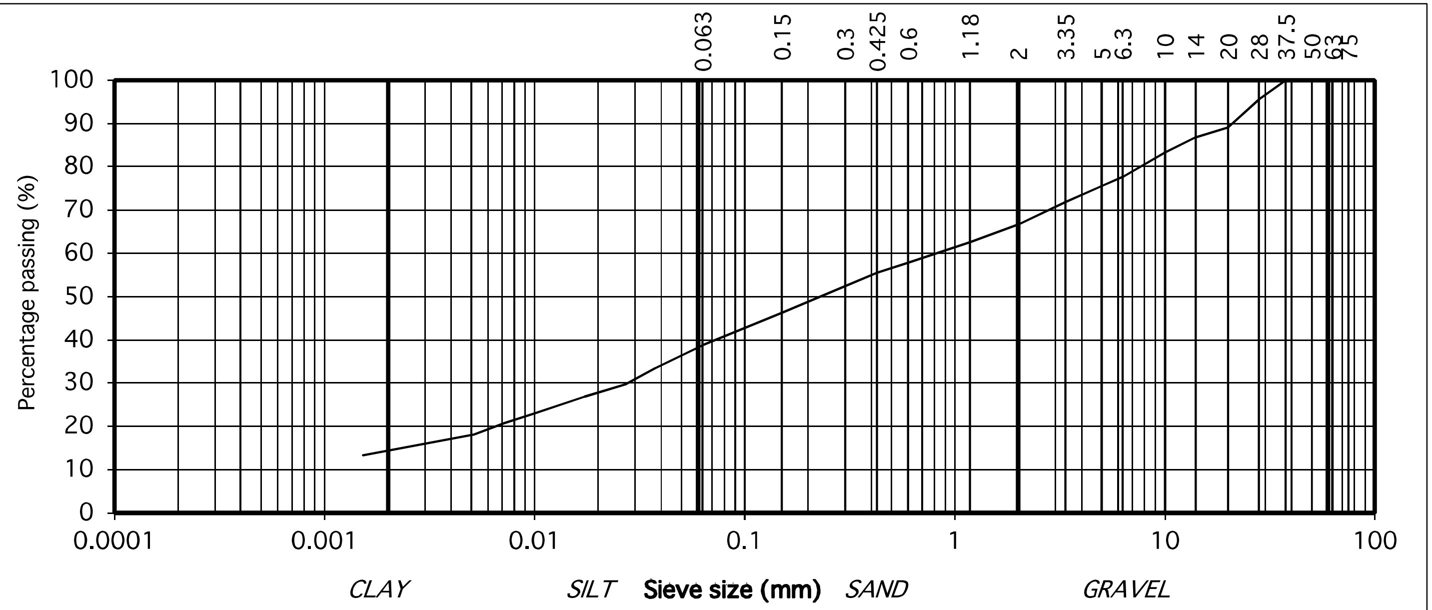


IGSL Ltd Materials Laboratory	Approved by:	Date:	Page no:
		19/12/23	1 of 1

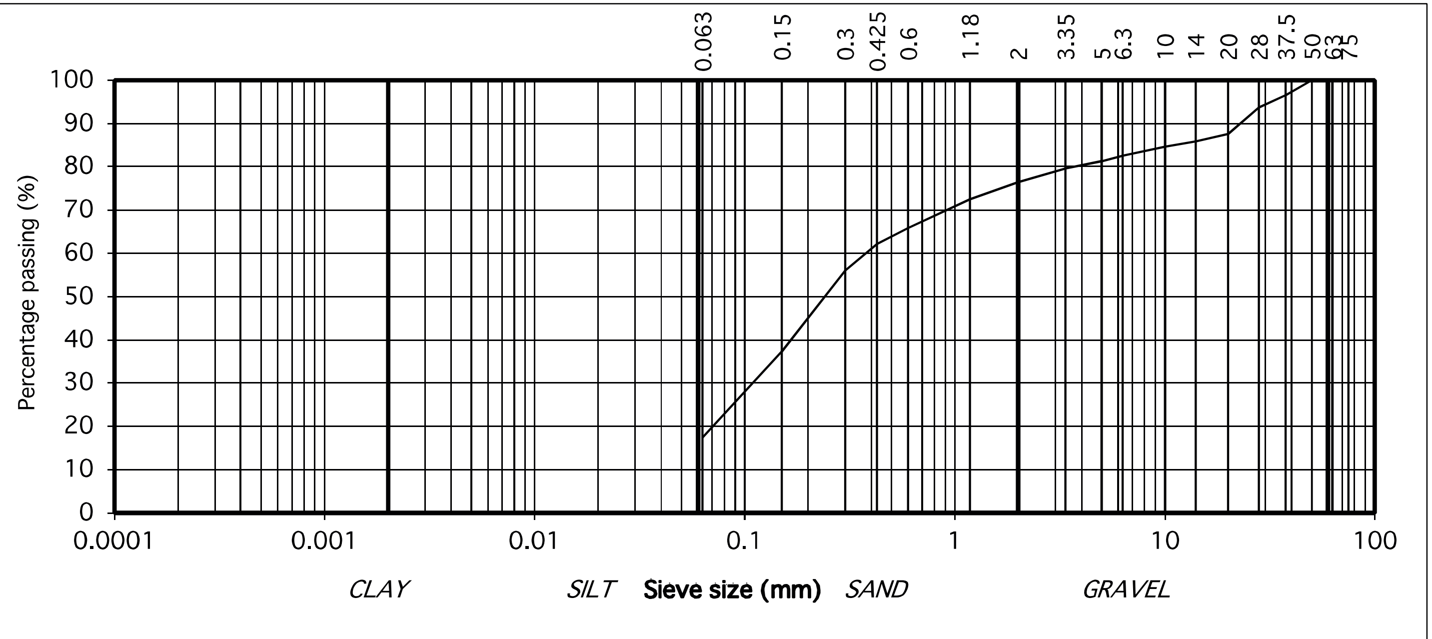
Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

Contract No.	24984	Report No.	R152600	
Contract Name :	Galway Bus Connects - Dublin Road , Galway			
BH/TP No.	TP12			
Sample No.*	AA208179	Lab. Sample No.		A23/4746A
Sample Type:	B			
Depth* (m)	0.40-0.60	Customer:	Barrys Transportation	
Date Received	16/11/2023	Date Testing started		16/11/2023
Description:	Brown silty, very gravelly, SAND			
Remarks	Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .			

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
This report shall not be reproduced except in full without the written approval of the Laboratory.

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	97	
28	94	
20	88	
14	86	
10	85	
6.3	83	
5	81	
3.35	80	
2	76	
1.18	72	SAND
0.6	66	
0.425	62	
0.3	56	
0.15	37	
0.063	17	SILT/CLAY



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Approved by:	Date:	Page no:
H Byrne	21/12/23	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

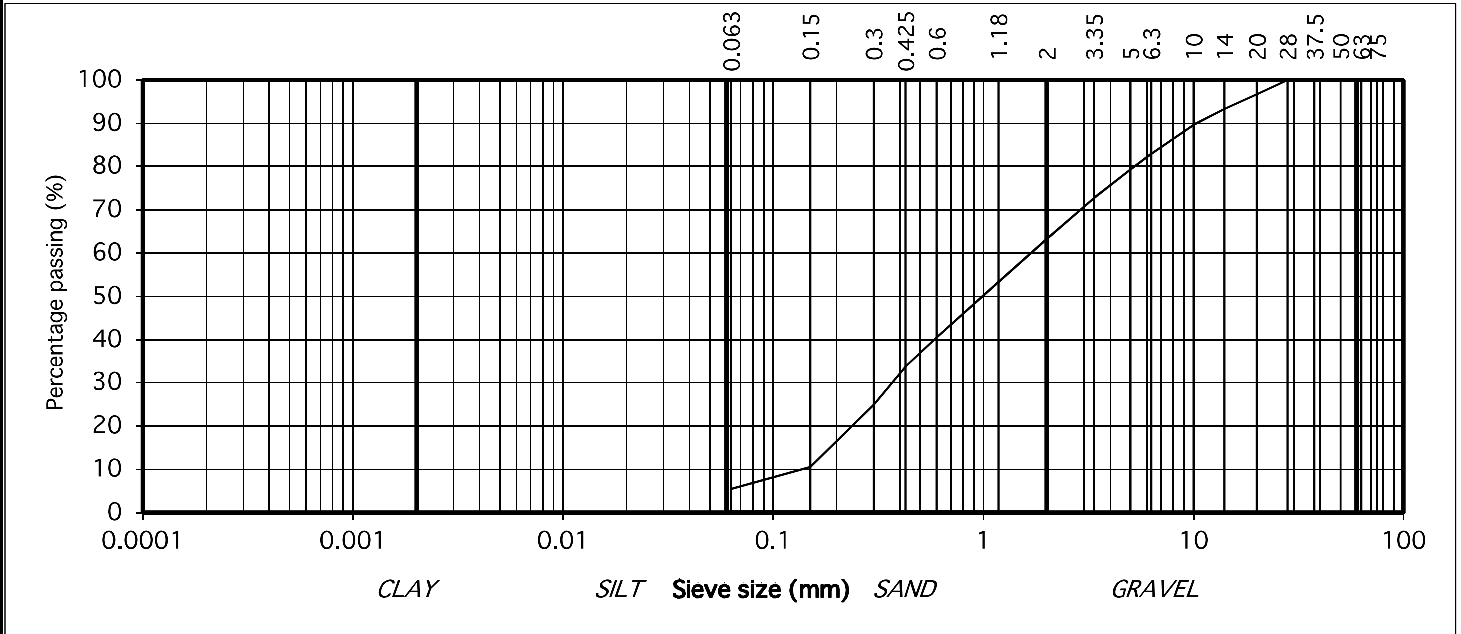
Contract No. 24984 Report No. R152601
Contract Name : Galway Bus Connects - Dublin Road , Galway
BH/TP No. TP13
Sample No.* AA208192 Lab. Sample No. A23/4747A
Sample Type: B
Depth* (m) 1.40-1.60 Customer: Barrys Transportation
Date Received 17/11/2023 Date Testing started 17/11/2023
Description: Brown clayey/silty, very gravelly, SAND

Remarks

Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
This report shall not be reproduced except in full without the written approval of the Laboratory.

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	100	
28	100	
20	97	
14	93	
10	90	
6.3	83	
5	79	
3.35	73	
2	63	
1.18	53	SAND
0.6	41	
0.425	34	
0.3	25	
0.15	11	SILT/CLAY
0.063	5	



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Approved by:	Date:	Page no:
	21/12/23	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

particle size	% passing
75	55
63	55
50	55
37.5	55
28	49
20	48
14	46
10	44
6.3	41
5	40
3.35	38
2	35
1.18	32
0.6	28
0.425	25
0.3	21
0.15	15
0.063	9

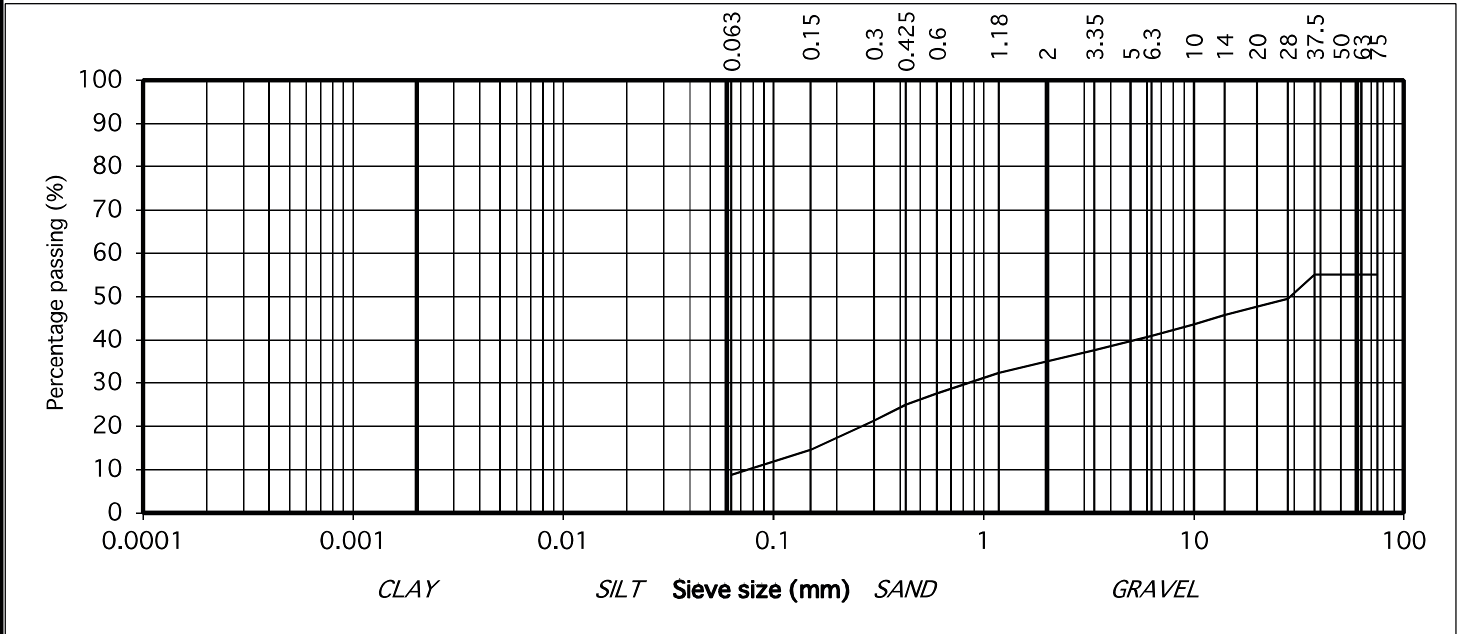
COBBLES
GRAVEL
SAND
SILT/CLAY

Contract No.	24984	Report No.	R152661
Contract Name :	Galway Bus Connects - Dublin Road , Galway		
BH/TP No.	WS001		
Sample No.*		Lab. Sample No.	A23/4940
Sample Type:	B		
Depth* (m)	0.00-1.00	Customer:	Barrys Transportation
Date Received	04/12/2023	Date Testing started	04/12/2023
Description:	Brown clayey, very gravelly, SAND with many cobbles		

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory.

Remarks

Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2 Sample size did not meet the requirements of BS1377



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Approved by:	Date:	Page no:
	16/01/24	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

Contract No. 24984 Report No. R152662
Contract Name : Galway Bus Connects - Dublin Road , Galway
BH/TP No. WS04
Sample No.* Lab. Sample No. A23/4941
Sample Type: B
Depth* (m) 1.00-2.00 Customer: Barrys Transportation
Date Received 04/12/2023 Date Testing started 04/12/2023
Description: Brown sandy, slightly gravelly, SILT

Remarks
Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
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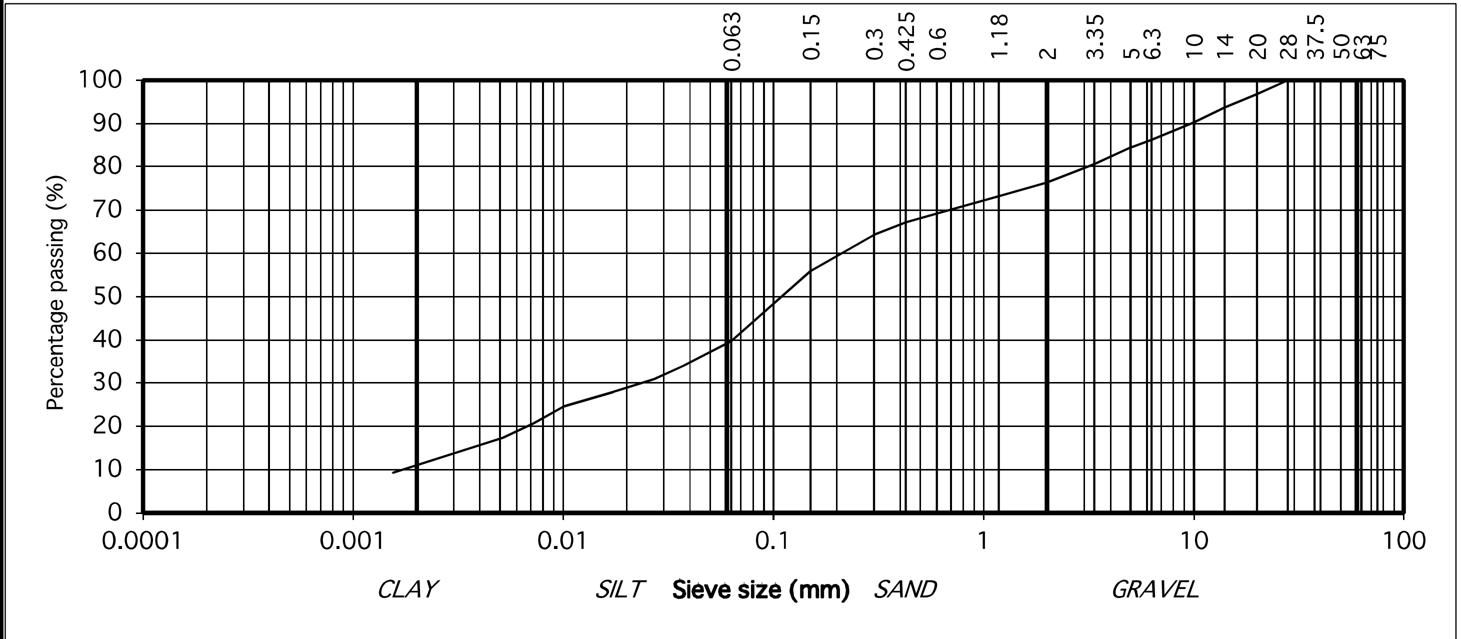
particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	100	
28	100	
20	97	
14	94	
10	90	
6.3	86	
5	85	
3.35	81	
2	76	
1.18	73	SAND
0.6	69	
0.425	67	
0.3	64	
0.15	56	
0.063	40	SILT/CLAY
0.037	34	
0.027	31	
0.017	28	
0.010	25	
0.007	21	
0.005	17	
0.002	9	



IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
[signature]	17/01/24	1 of 1

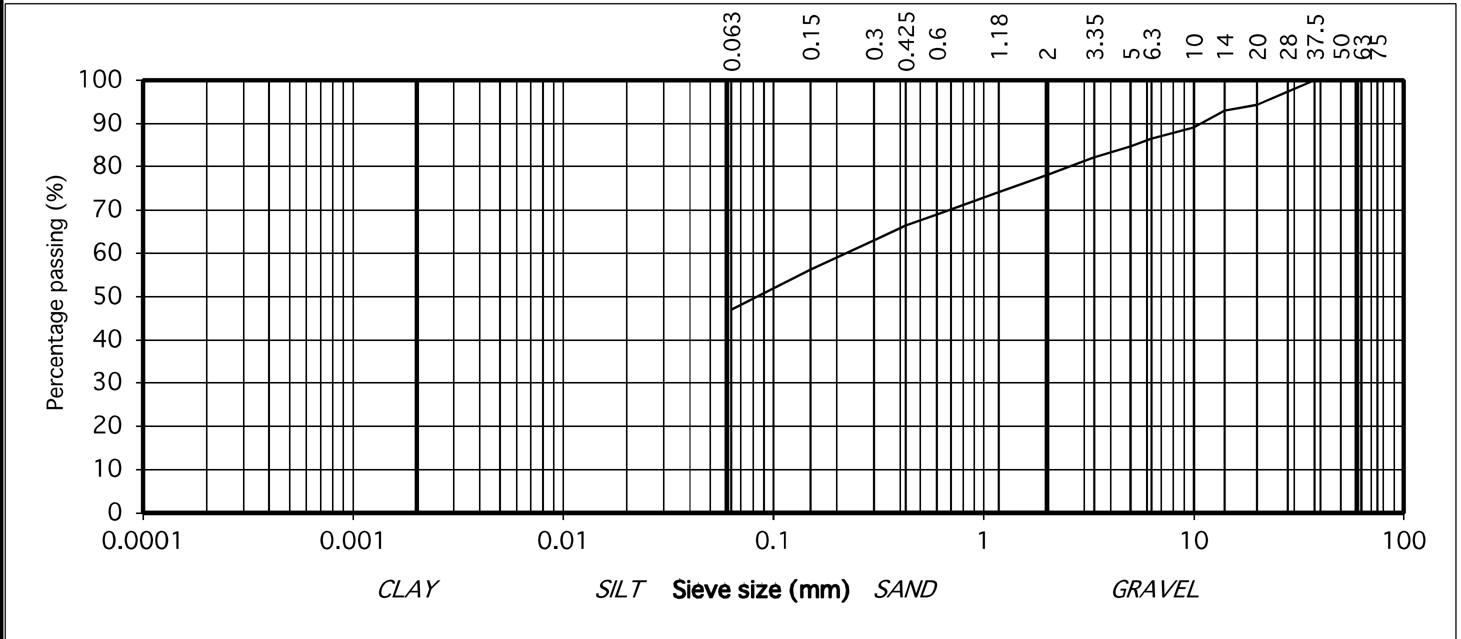
Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

Contract No.	24984 Report No. R152663
Contract Name :	Galway Bus Connects - Dublin Road , Galway
BH/TP No.	WS06
Sample No.*	Lab. Sample No. A23/4942
Sample Type:	B
Depth* (m)	1.00-2.00 Customer: Barrys Transportation
Date Received	04/12/2023 Date Testing started 04/12/2023
Description:	Brown slightly sandy, slightly gravelly, CLAY
Remarks	Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory.

particle size	% passing	
75	100	COBBLES
63	100	GRAVEL
50	100	
37.5	100	
28	97	
20	94	
14	93	
10	89	
6.3	87	
5	85	
3.35	82	
2	78	
1.18	74	SAND
0.6	69	
0.425	66	
0.3	63	
0.15	56	
0.063	47	SILT/CLAY



IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
	17/01/24	1 of 1

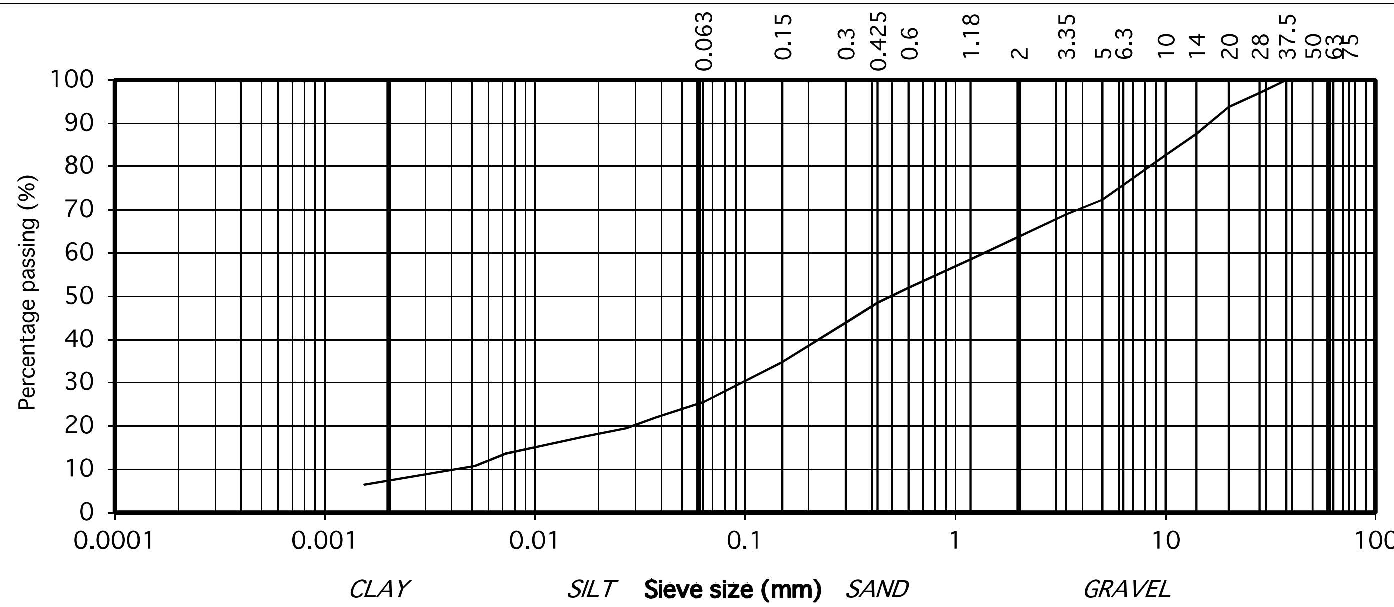
Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

Contract No.	24984 Report No. R152666
Contract Name :	Galway Bus Connects - Dublin Road , Galway
BH/TP No.	WS07
Sample No.*	Lab. Sample No. A23/4943
Sample Type:	B
Depth* (m)	1.00-2.00 Customer: Barrys Transportation
Date Received	04/12/2023 Date Testing started 04/12/2023
Description:	Brown sandy, gravelly, SILT
Remarks	Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
This report shall not be reproduced except in full without the written approval of the Laboratory.

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	100	
28	97	
20	94	
14	88	
10	83	
6.3	76	
5	72	
3.35	69	
2	64	
1.18	59	SAND
0.6	52	
0.425	49	
0.3	44	
0.15	35	
0.063	25	SILT/CLAY
0.037	22	
0.027	19	
0.017	18	
0.010	15	
0.007	14	
0.005	11	
0.002	6	



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Approved by:	Date:	Page no:
	17/01/24	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

Appendix 10 - Chemical Testing – Soil

UKAS TESTING 2183

mCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

eurofins Chemtest

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

Final Report

Report No.:	23-41846-1
Initial Date of Issue:	02-Jan-2024
Re-Issue Details:	
Client	IGSL
Client Address:	M7 Business Park Naas County Kildare Ireland
Contact(s):	Darren Keogh
Project	Galway Bus Barry Transportation

Quotation No.:		**Date Received:**	18-Dec-2023
Order No.:		**Date Instructed:**	18-Dec-2023
No. of Samples:	11		
Turnaround (Wkdays):	7	**Results Due:**	03-Jan-2024
Date Approved:	02-Jan-2024		

Approved By:

Details: Stuart Henderson, Technical Manager

Results - Soil

Project: Galway Bus Barry Transportation

Client: IGSL		**Chemtest Job No.:**				23-41846	23-41846	23-41846	23-41846	23-41846	23-41846	23-41846	23-41846	23-41846	23-41846	23-41846
Quotation No.:		**Chemtest Sample ID.:**				1747419	1747420	1747421	1747422	1747423	1747424	1747425	1747426	1747427	1747428	1747429
		Sample Location:				2023-BH001A	2023-BH002	2023-BH003	2023-BH006	2023-BH010	2023-TP-002	2023-TP-004	2023-TP-006	2023-TP-008	2023-TP-009	2023-TP-012
		Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):				0.5	0.5	0.5	2.0	2.0	1.0	0.7	1.4	1.0	0.5	0.8
		Bottom Depth (m):				1.0	1.0	1.0	2.5	2.5	1.2	0.9	1.6	1.2	0.7	1.0
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**											
Moisture		N	2030	%	0.020	9.6	9.0	9.2	8.7	8.9	8.4	10.1	9.4	11.2	8.8	9.6
Soil Colour		N	2040		N/A	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
Other Material		N	2040		N/A	Stones	Stones	Stones and Roots	Stones	Stones	Stones and Roots	Stones and Roots	Stones	Stones	Stones and Roots	Stones
Soil Texture		N	2040		N/A	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay
pH at 20C		M	2010		4.0	[A] 8.9	[A] 8.7	[A] 8.8	[A] 9.1	[A] 7.9	[A] 8.5	[A] 8.1	[A] 9.0	[A] 8.3	[A] 8.8	[A] 8.5
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010	[A] 0.040	[A] 0.010	[A] 0.013	[A] 0.013	[A] < 0.010	[A] 0.021	[A] < 0.010	[A] 0.018	[A] 0.054	[A] < 0.010	[A] < 0.010
Organic Matter		M	2625	%	0.40	[A] 4.3	[A] 9.3	[A] 3.6	[A] 5.2	[A] 0.7	[A] 1.5	[A] 3.6	[A] < 0.40	[A] 5.2	[A] 4.1	[A] 2.4

Deviations

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

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
1747419			2023-BH001A		A	Amber Glass 250ml
1747419			2023-BH001A		A	Plastic Tub 500g
1747420			2023-BH002		A	Amber Glass 250ml
1747420			2023-BH002		A	Plastic Tub 500g
1747421			2023-BH003		A	Amber Glass 250ml
1747421			2023-BH003		A	Plastic Tub 500g
1747422			2023-BH006		A	Amber Glass 250ml
1747422			2023-BH006		A	Plastic Tub 500g
1747423			2023-BH010		A	Amber Glass 250ml
1747423			2023-BH010		A	Plastic Tub 500g
1747424			2023-TP-002		A	Amber Glass 250ml
1747424			2023-TP-002		A	Plastic Tub 500g
1747425			2023-TP-004		A	Amber Glass 250ml
1747425			2023-TP-004		A	Plastic Tub 500g
1747426			2023-TP-006		A	Amber Glass 250ml
1747426			2023-TP-006		A	Plastic Tub 500g
1747427			2023-TP-008		A	Amber Glass 250ml
1747427			2023-TP-008		A	Plastic Tub 500g
1747428			2023-TP-009		A	Amber Glass 250ml

Deviations

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

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
1747428			2023-TP-009		A	Plastic Tub 500g
1747429			2023-TP-012		A	Amber Glass 250ml
1747429			2023-TP-012		A	Plastic Tub 500g

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH at 20°C	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.

Report Information

Key

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

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

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

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

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

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

UKAS TESTING 2183

Final Report

Report No.:	23-41835-1
Initial Date of Issue:	02-Jan-2024
Re-Issue Details:	
Client	IGSL
Client Address:	M7 Business Park Naas County Kildare Ireland
Contact(s):	Darren Keogh
Project	Galway Bus Barry Transportation

Quotation No.:	Q21-25399	**Date Received:**	18-Dec-2023
Order No.:		**Date Instructed:**	18-Dec-2023
No. of Samples:	2		
Turnaround (Wkdays):	7	**Results Due:**	03-Jan-2024
Date Approved:	02-Jan-2024		

Approved By:

Details: Stuart Henderson, Technical Manager

Results - Soil

Project: Galway Bus Barry Transportation

Client: IGSL					**Chemtest Job No.:**	23-41835	23-41835
Quotation No.: Q21-25399					**Chemtest Sample ID.:**	1747404	1747405
					Sample Location:	2023-WS-004	2023-WS-007
					Sample Type:	SOIL	SOIL
					Top Depth (m):	0.00	0.00
					Bottom Depth (m):	1.0	1.0
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**		
Moisture		N	2030	%	0.020	12	7.0
Soil Colour		N	2040		N/A	Brown	Brown
Other Material		N	2040		N/A	Stones and Roots	Stones
Soil Texture		N	2040		N/A	Clay	Clay
pH at 20C		M	2010		4.0	[A] 8.8	[A] 8.8
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010	[A] 0.075	[A] 0.034
Organic Matter		M	2625	%	0.40	[A] 4.5	[A] 7.2

Deviations

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

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
1747404			2023-WS-004		A	Amber Glass 250ml
1747404			2023-WS-004		A	Plastic Tub 500g
1747405			2023-WS-007		A	Amber Glass 250ml
1747405			2023-WS-007		A	Plastic Tub 500g

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH at 20°C	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.

Report Information

Key

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

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

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

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

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

Appendix 11 - Geotechnical Laboratory Test Results – Rock

(Diametrial) POINT LOAD STRENGTH INDEX TEST DATA

Contract: Galway Bus Connect

Contract no. 24984

Sample Type: Core

Date of test: 14/02/2023

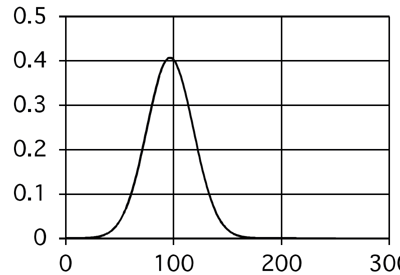
Bh No:	Depth m	D (Diameter) mm	P (failure load) kN	F	Is (index strength) Mpa	Is(50) (index strength) Mpa	*UCS MPa	Type	Orienation
2023-BH-001	4.5	78	27.0	1.222	4.44	5.42	108	d	//
	6.4	78	30.0	1.222	4.93	6.02	120	d	//
	7.5	78	21.0	1.222	3.45	4.22	84	d	//
2023-BH-002	10.6	78	19.0	1.222	3.12	3.81	76	d	//
	12.5	78	28.0	1.222	4.60	5.62	112	d	//
2023-BH-005	6.8	78	34.0	1.222	5.59	6.83	137	d	//
	6.9	78	29.0	1.222	4.77	5.82	116	d	//
	7.7	78	30.0	1.222	4.93	6.02	120	d	//
2023-BH-006	4.2	78	31.0	1.222	5.10	6.22	124	d	//
	6.4	78	28.0	1.222	4.60	5.62	112	d	//
	6.5	78	13.0	1.222	2.14	2.61	52	d	//
2023-BH-007A	12.1	78	21.0	1.222	3.45	4.22	84	d	//
	14.1	78	26.0	1.222	4.27	5.22	104	d	//
2023-BH-008	2.1	78	18.0	1.222	2.96	3.61	72	d	//
	3.0	78	22.0	1.222	3.62	4.42	88	d	//
	3.6	78	28.0	1.222	4.60	5.62	112	d	//
	5.0	78	21.0	1.222	3.45	4.22	84	d	//
2023-BH-009	7.0	78	19.0	1.222	3.12	3.81	76	d	//
	7.5	78	22.0	1.222	3.62	4.42	88	d	//
2023-BH-010	6.1	78	18.0	1.222	2.96	3.61	72	d	//
	6.9	78	20.0	1.222	3.29	4.02	80	d	//
	7.3	78	26.0	1.222	4.27	5.22	104	d	//

Statistical Summary Data	Is(50)	UCS*
Number of Samples Tested	22	22
Minimum	2.61	52
Average	4.85	97
Maximum	6.83	137
Standard Dev.	1.08	22
Upper 95% Confidence Limit	6.96	139.15
Lower 95% Confidence Limit	2.73	54.69

Comments:

*UCS taken as k x Point Load Is(50): k= 20

*UCS Normal Distribution Curve



Abbreviations	
i	irregular
a	axial
b	block
d	diametral

approx. orientation to planes of weakness/bedding

U	unknown
P	perpendicular
//	parallel

Uniaxial Compression Test Report Sheet

I.G.S.L.

Sample Identification

Contract Name:	Galway Bus Connect
Job Number:	24984
Hole No:	2023-BH-001
Depth (m):	7.10m

Sample Description

Colour:	Blueish grey
Grain size:	Fine-grained
Weathering Grade:	Fresh
Rock Type:	LIMESTONE

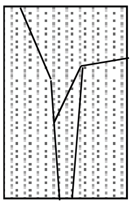
Weathering Grade Criteria

I. Fresh:	Unchanged from original state
II. Slightly weathered:	Slight discolouration, slight weakening
III. Moderately weathered:	Considerable weakening, penetrative discolouration
IV. Highly weathered:	Considerable weakening, penetrative discolouration, breaks in hand

Sample Measurements

Length	201	
Diameter (Ø)	78.1	mm

Sketch of Failure Surfaces



Testing

Load Rate	4.3	kN/min
Load at Failure (P)	451	kN

Strength Calculations

Uniaxial Compressive Strength = $\dfrac{451000}{4788.19385}$

$= \dfrac{1000 \times P}{\pi \times (Ø/2)^2}$

= 94.14 (Mpa)

Bulk Density = 2.67 (Mg/m^3)

Notes:

Uniaxial Compression Test Report Sheet

I.G.S.L.

Sample Identification

Contract Name:	Galway Bus Connect
Job Number:	24984
Hole No:	2023-BH-002
Depth (m):	10.80m

Sample Description

Colour:	Blueish grey
Grain size:	Fine-grained
Weathering Grade:	Fresh
Rock Type:	LIMESTONE

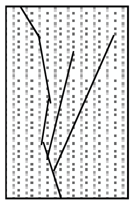
Weathering Grade Criteria

I. Fresh: Unchanged from original state
II. Slightly weathered: Slight discolouration, slight weakening
III. Moderately weathered: Considerable weakening, penetrative discolouration
IV. Highly weathered: Considerable weakening, penetrative discolouration, breaks in hand

Sample Measurements

Length	199	
Diameter (Ø)	78	mm

Sketch of Failure Surfaces



Testing

Load Rate	4.3	kN/min
Load at Failure (P)	506	kN

Strength Calculations

Uniaxial Compressive Strength $= \dfrac{506000}{4775.94}$

$= \dfrac{1000 \times P}{\pi \times (Ø/2)^2}$

= 105.89 (Mpa)

Bulk Density = 2.66 (Mg/m^3)

Notes:

Uniaxial Compression Test Report Sheet | *I.G.S.L.*

Sample Identification

Contract Name:	Galway Bus Connect
Job Number:	24984
Hole No:	2023-BH-005
Depth (m):	7.80m

Sample Description

Colour:	Blueish grey
Grain size:	Fine-grained
Weathering Grade:	Fresh
Rock Type:	LIMESTONE

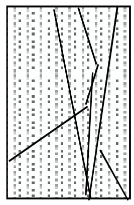
Weathering Grade Criteria

I. Fresh:	Unchanged from original state
II. Slightly weathered:	Slight discolouration, slight weakening
III. Moderately weathered:	Considerable weakening, penetrative discolouration
IV. Highly weathered:	Considerable weakening, penetrative discolouration, breaks in hand

Sample Measurements

Length	202	
Diameter (Ø)	78	mm

Sketch of Failure Surfaces



Testing

Load Rate	4.3	kN/min
Load at Failure (P)	328	kN

Strength Calculations

Uniaxial Compressive Strength = $\frac{328000}{4775.94}$

= $\frac{1000 \times P}{\pi \times (Ø/2)^2}$

= 68.64 (Mpa)

Bulk Density = 2.64 (Mg/m^3)

Notes:

Uniaxial Compression Test Report Sheet | *I.G.S.L.*

Sample Identification

Contract Name:	Galway Bus Connect
Job Number:	24984
Hole No:	2023-BH-006
Depth (m):	4.00m

Sample Description

Colour:	Blueish grey
Grain size:	Fine-grained
Weathering Grade:	Fresh
Rock Type:	LIMESTONE

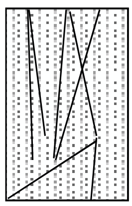
Weathering Grade Criteria

I. Fresh:	Unchanged from original state
II. Slightly weathered:	Slight discolouration, slight weakening
III. Moderately weathered:	Considerable weakening, penetrative discolouration
IV. Highly weathered:	Considerable weakening, penetrative discolouration, breaks in hand

Sample Measurements

Length	200	
Diameter (Ø)	78.1	mm

Sketch of Failure Surfaces



Testing

Load Rate	4.3	kN/min
Load at Failure (P)	492	kN

Strength Calculations

Uniaxial Compressive Strength = $\frac{492000}{4788.19385}$

= $\frac{1000 \times P}{\pi \times (Ø/2)^2}$

= 102.70 (Mpa)

Bulk Density = 2.66 (Mg/m^3)

Notes:

Uniaxial Compression Test Report Sheet | *I.G.S.L.*

Sample Identification

Contract Name:	Galway Bus Connect
Job Number:	24984
Hole No:	2023-BH-007A
Depth (m):	11.50m

Sample Description

Colour:	Blueish grey
Grain size:	Fine-grained
Weathering Grade:	Fresh
Rock Type:	LIMESTONE

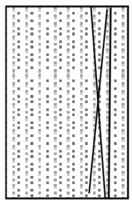
Weathering Grade Criteria

I. Fresh:	Unchanged from original state
II. Slightly weathered:	Slight discolouration, slight weakening
III. Moderately weathered:	Considerable weakening, penetrative discolouration
IV. Highly weathered:	Considerable weakening, penetrative discolouration, breaks in hand

Sample Measurements

Length	200	
Diameter (Ø)	78	mm

Sketch of Failure Surfaces



Testing

Load Rate	4.3	kN/min
Load at Failure (P)	328	kN

Strength Calculations

Uniaxial Compressive Strength $= \dfrac{328000}{4775.94}$

$= \dfrac{1000 \times P}{\pi \times (Ø/2)^2}$

$=$ 68.64 (Mpa)

Bulk Density $=$ 2.65 (Mg/m^3)

Notes:

Uniaxial Compression Test Report Sheet

I.G.S.L.

Sample Identification

Contract Name:	Galway Bus Connect
Job Number:	24984
Hole No:	2023-BH-008
Depth (m):	2.90m

Sample Description

Colour:	Blueish grey
Grain size:	Fine-grained
Weathering Grade:	Fresh
Rock Type:	LIMESTONE

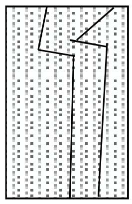
Weathering Grade Criteria

I. Fresh:	Unchanged from original state
II. Slightly weathered:	Slight discolouration, slight weakening
III. Moderately weathered:	Considerable weakening, penetrative discolouration
IV. Highly weathered:	Considerable weakening, penetrative discolouration, breaks in hand

Sample Measurements

Length	194	
Diameter (Ø)	78.1	mm

Sketch of Failure Surfaces



Testing

Load Rate	4.3	kN/min
Load at Failure (P)	178	kN

Strength Calculations

Uniaxial Compressive Strength = $\frac{178000}{4788.19385}$

$= \frac{1000 \times P}{\pi \times (Ø/2)^2}$

= 37.16 (Mpa)

Bulk Density = 2.66 (Mg/m^3)

Notes:

Uniaxial Compression Test Report Sheet | *I.G.S.L.*

Sample Identification

Contract Name:	Galway Bus Connect
Job Number:	24984
Hole No:	2023-BH-009
Depth (m):	1.50m

Sample Description

Colour:	Blueish grey
Grain size:	Fine-grained
Weathering Grade:	Fresh
Rock Type:	LIMESTONE

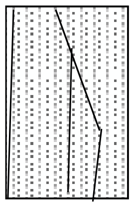
Weathering Grade Criteria

I. Fresh:	Unchanged from original state
II. Slightly weathered:	Slight discolouration, slight weakening
III. Moderately weathered:	Considerable weakening, penetrative discolouration
IV. Highly weathered:	Considerable weakening, penetrative discolouration, breaks in hand

Sample Measurements

Length	199	
Diameter (Ø)	78	mm

Sketch of Failure Surfaces



Testing

Load Rate	4.3	kN/min
Load at Failure (P)	342	kN

Strength Calculations

Uniaxial Compressive Strength $= \dfrac{342000}{4775.94}$

$= \dfrac{1000 \times P}{\pi \times (Ø/2)^2}$

$=$ 71.57 (Mpa)

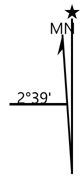
Bulk Density $=$ 2.65 (Mg/m^3)

Notes:

Appendix 12 - Exploratory Hole Location Plan

Galway BusConnects Dublin Road - Site Investigation Map 1

Scale: 1 : 1500.



Galway BusConnects Dublin Road - Site Investigation Map 2

50 0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 ft

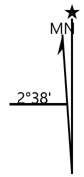
Scale: 1 : 1500.

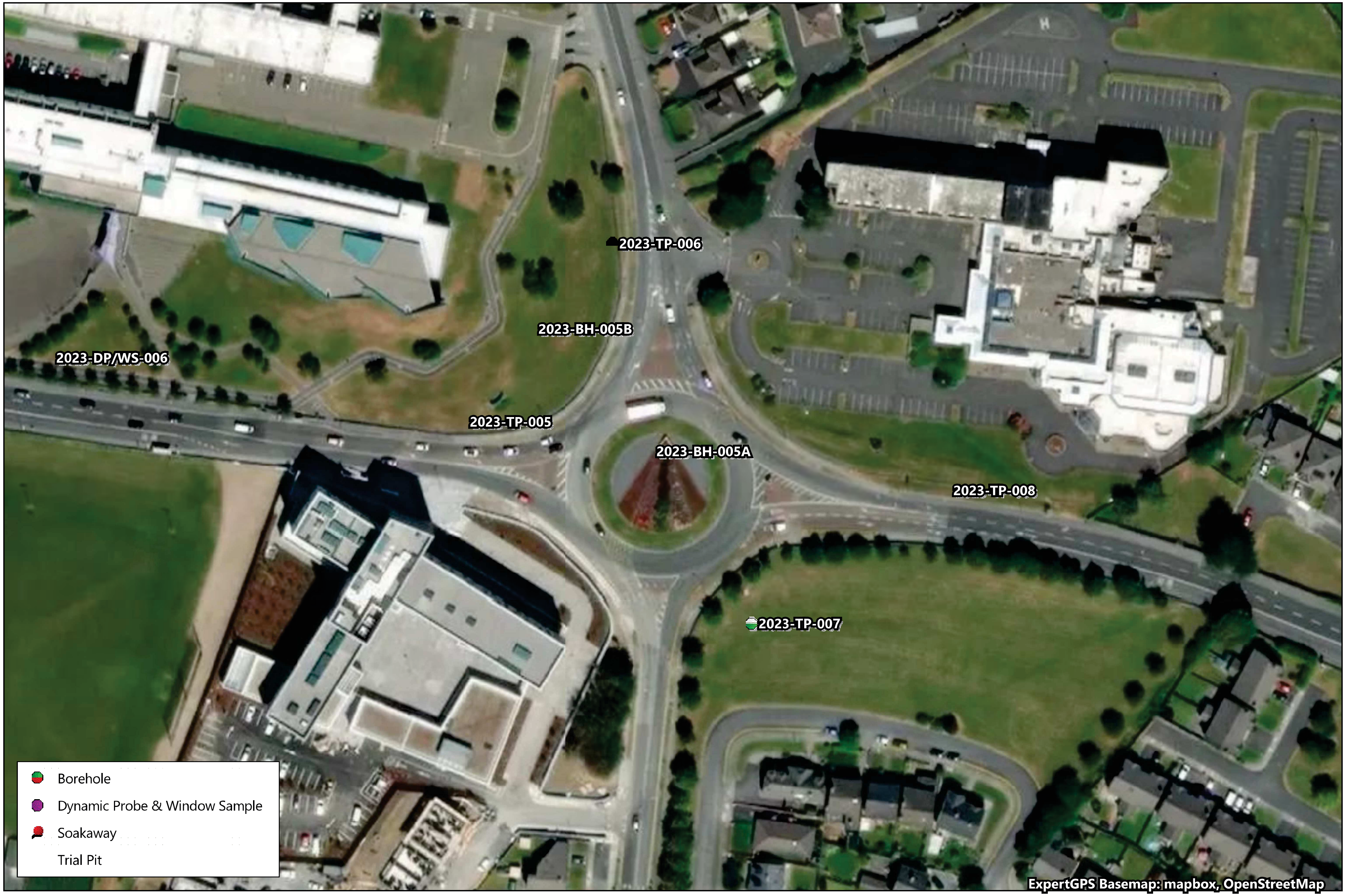
MN

2°38'

Galway BusConnects Dublin Road - Site Investigation Map 3

Scale: 1 : 1500.

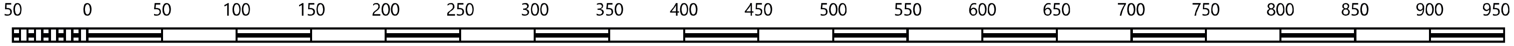


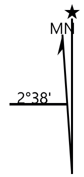


Galway BusConnects Dublin Road - Site Investigation Map 4

Scale: 1 : 1500.

Galway BusConnects Dublin Road - Site Investigation Map 5





Galway BusConnects Dublin Road - Site Investigation Map 6

Scale: 1 : 1500.

Galway BusConnects Dublin Road - Site Investigation Map 7

Scale: 1 : 1500.

Galway BusConnects Dublin Road - Site Investigation Map 8

50 0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 ft

Scale: 1 : 1500.

MN

2°37'