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CHURCH LANE, LINTHWAITE

EARTHWORKS SPECIFICATION FOR CASEY GROUP LTD

Project Ref:
P8985

Date:
May 2020

Prepared for:
Casey Group Ltd
Rydings Road
Rochdale
OL12 9PS

This report has been prepared in accordance with GRM's Accredited Quality Procedures.

If you have any queries regarding this report please contact the project manager in the first instance.

Reviewed by: Andrew Brown BSc CGeol FGS ProfGradIOM3 (Principal Geotechnical Engineer – Project Manager) andrew.brown@grm-uk.com	Approved by: Geoffrey Beckett FGS CGeol (Director) geoff.beckett@grm-uk.com
Description of Revision	Signature



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1 INTRODUCTION

The specification shall be as per the requirements of the Manual Contract Document for Highway Works Series 600, dated February 2016. It is the responsibility of the Contractor to ensure that an acceptable standard of workmanship and earthworks practices are employed during the works.

1.1 PREAMBLE

GRM Development Solutions (GRM) has been appointed by Casey Group Ltd (Client) to produce an earthworks specification for the proposed development located off Church Lane, Linthwaite.

The site is located off Church Lane, approximately 4.5km to the south west of the town of Huddersfield, Kirklees. The National Grid Reference (NGR) for the approximate centre of the site is SK 10517 14646. A site location plan is enclosed within Appendix A.

The Client proposes to develop the site with residential properties with associated gardens, soft landscaping and infrastructure. The outline development proposals provided by the Client are presented in Appendix B.

The existing topography ranges from 212m AOD in the south western corner to 200m AOD in the north western corner, and from 230m AOD in the south eastern corner to 194m AOD in the north eastern corner. It is inferred by cross referencing the proposed development plan with the topographical plan that up to around 3.0m of fill will take place in the south western corner of the site, whilst up to 2.50m of cut will take place around the eastern part of the site. Minor amounts of cut and fill are to take place elsewhere around the site. An earthwork cut and fill drawing inferred from the aforementioned plans is presented in Appendix C. An allowance for an attenuation pond is included within the proposed development plan however levels haven't been provided for this structure. Therefore the earthwork levels advocated in this specification and within the plan presented in Appendix C are likely to change.

This specification is not appropriate for use in construction of the attenuation pond which will likely require a more rigorous earthwork specification to ensure its integrity over the design life of the pond.

This report should be read in conjunction with the existing desk study and site appraisal reports which have been produced for the site, which provide information on the wider site setting:

- GRM Phase 1 Desk Study, report reference GRM/P8985/DS.1 Rev A.
- Pre-purchase Due Diligence Letter Report, reference P8985/DDLR, dated July 2019.
- GRM Phase 2 Site Appraisal, report reference GRM/P8985/F.1, dated April 2020.

2 SUMMARY OF GROUND CONDITIONS

2.1 GEOLOGY

The ground investigation within the site under covered the following ground conditions:

- Topsoil.
- Made Ground.
- Glacial Deposits.
- Weathered and Unweathered Rossendale Formation.
- Weathered and Unweathered Huddersfield White Rock Formation.

An Exploratory Hole Plan is presented in Appendix D.

Topsoil

Topsoil including subsoil was encountered within all exploratory holes advanced, with the exception of TP107 around the stables block, to depths of between 0.2m and 0.4m below existing ground level (begl) and with a general thickness of 0.3m. It was generally encountered as dark brown, slightly sandy, slightly gravelly clay, with gravels of sandstone, mudstone and quartzite. The topsoil was prone to significant saturation and softening during inclement weather and will likely lead to trafficability issues.

Made Ground

Made ground was only encountered within TP107, located in the vicinity of the stables block in the south western part of the site. Made ground was encountered as a dark brown, slightly sandy, gravelly clay with gravels of roadstone, brick, mudstone and sandstone. The Made Ground was recorded to a depth of 0.3m begl.

Glacial Deposits

These deposits generally comprised of soft to firm, orange brown mottled grey, slightly gravelly clay with gravel including mudstone and sandstone. The Glacial Deposits were encountered within all exploratory holes advanced to depths of between 0.2m to 2.4m begl and had a general proven thickness of 1.1m.

Weathered Rossendale Formation

This stratum generally comprised of either firm to stiff, gravelly clay with lithorelicts of laminated mudstone or extremely weak dark grey and brown highly weathered mudstone, which was recovered as a mudstone gravel lithorelicts in a clayey matrix. The mudstone was found to be variably weathered at all depths encountered.

All locations that recorded the Rossendale Formation observed this weathered horizon above the less weathered mudstone from depths of between 0.7m to 3.0m begl; the average thickness of this weathered stratum was approximately 1.0m. The full thickness was proven in TP116 only, where the unweathered/slightly weathered Huddersfield White Rock Formation was encountered directly beneath it.

Unweathered Rossendale Formation

This stratum generally comprised of extremely weak to weak to dark brown and brown laminated mudstone which was recovered as dark grey sandy clayey gravel.

This stratum was encountered from between 1.5m begl and 3.9m begl; its full thickness was not proven.

Coal

A thin band of intact coal was encountered within WS04 (1.4m to 1.7m begl) and TP107 (3.1m to 3.7m begl).

Huddersfield White Rock Formation

The weathered and unweathered Huddersfield White Rock Formation was only encountered in the north and north western area of the site.

Completely Weathered Huddersfield White Rock Formation

This stratum generally comprised of very dense, yellow brown, silty sand with gravels of sandstone. This stratum was encountered at depths ranging from 0.7m and 2.1m begl with an average thickness of 0.7m begl and recorded to depths of between 1.8m and 3.2m begl.

Unweathered / Slightly Weathered Huddersfield White Rock Formation

This strata generally comprised of extremely weak, slightly weathered becoming weak to moderately strong, unweathered yellow brown fine to coarse grained sandstone. The material was encountered within all the exploratory holes within the north and north western areas and beneath the Completely Weathered Huddersfield White Rock Formation at between depths of 1.0m and 3.2m begl.

2.2 GROUNDWATER

Damp strata was encountered during the intrusive investigation at approximately 2.0m (approximately 205.2m AOD) within the Rossendale Formation in WS01 and between 2.1m and 2.2m begl (195.5m to 196.6m AOD) in the Huddersfield White Rock Formation.

Damp natural strata was encountered within the Weathered Rossendale Formation within TP101, TP110 and WS01 at 1.6m begl (210.39m AOD), 2.0m begl (197.63m AOD) and 2.0m begl (207.82m AOD) respectively.

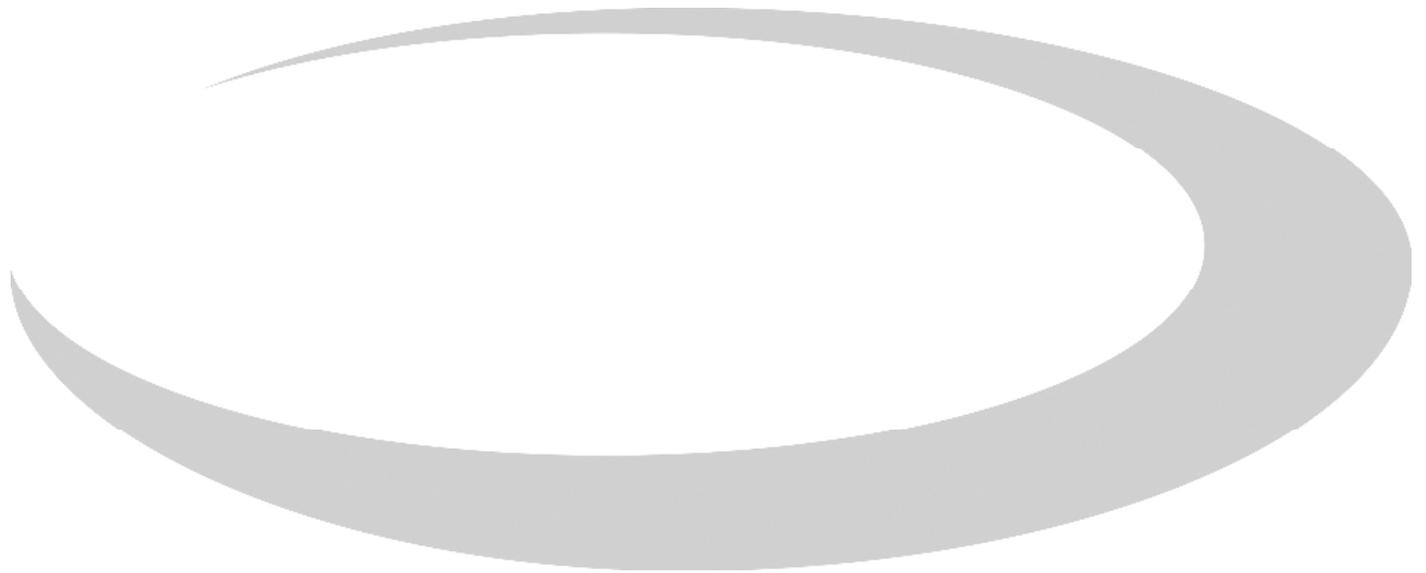
In the Huddersfield White Rock Formation groundwater was encountered within TP02 at 2.2m begl (195.34m AOD) within the completely weathered material and within TP03 at 2.1m begl (199.10M AOD) within the unweathered strata.

Standing water was recorded during monitoring visits at depths ranging between 0.75m begl to 3.28m begl. All response zones were installed within the weathered bedrock at the site, therefore the observations are indicative of the groundwater levels within the bedrock.

The initial groundwater monitoring visits undertook in 2019 recorded groundwater only within WS01 at between 1.3m and 1.32m begl. However, following monitoring visits have shown groundwater within all the installations with the exception of WS06. Groundwater was recorded within the Weathered Rossendale Formation at between 0.75m and 3.28m begl and within the granular Completely Weathered Huddersfield White Rock Formation at 1.18m begl.

It is assumed that the groundwater is from permeable horizons within the Weathered Rossendale Formation (WS01, WS02 and WS03), while WS06 it is considered most

likely to be perched water from within the weathered granular strata above the more competent sandstone.



3 PROPOSED EARTHWORKS

3.1 GENERAL

The proposed earthworks are likely to comprise varying amounts of cut and fill. Generally 'fill' earthworks are expected to take place in the south western corner of the site, up to around 3.0m of fill expected. 'Cut' earthworks are expected to take place in the eastern edge of the site with minor amounts of cut and fill expected to take place elsewhere across the site. An allowance for an attenuation pond is included within the proposed development plan however levels haven't been provided for this structure. Therefore the earthwork levels advocated in this specification are likely to change.

All fill materials should be compacted in line with Series 600 MCDHW Specification, unless specifically stated otherwise. Construction of temporary drainage may be required up slope of the earthworks during construction to manage short term weather events.

3.2 EXCAVATIONS

Excavation of the materials encountered during the ground investigation should be easily achieved using conventional hydraulic excavation techniques. A breaker may be required for deeper excavations in the less weathered shallow sandstone recorded within the north western areas of the site, as the machine used for trial pitting was struggling to excavate past 2m begl.

From the ground investigation undertaken, it is likely that excavations will be generally stable in the short term within cohesive materials, however within granular soils, which have been recorded within the northern and western areas of the site are liable to collapse without warning. This situation is likely to be exacerbated by water ingress. Therefore, instability may be experienced in the medium to long term. Any excavations which are left open for a significant amount of time should ideally be benched. Further advice on this is given in Section 5.2.

It is considered unlikely that dewatering will be required for shallow short-term excavations. The observed groundwater conditions suggest that only simple dewatering techniques (e.g. sump pumping) will be needed to control water ingress following any periods of significant rainfall. Care should be taken to ensure that dewatering does not lead to settlement of soils below existing structures or services on or off-site.

4 SOURCE MATERIALS

The levels of cut across the site suggest that the material which will be generated for use within 'fill' areas is likely to be Glacial Deposits, which was encountered to be predominantly cohesive in nature. Therefore, the fill material will likely meet Class 2 material which needs to meet a minimum shear strength requirement, and the other properties stated in Table 6/1 in Section 6 of this specification.

4.1 CLASSIFICATION OF MATERIALS

Earthworks materials shall be categorised into one of the following classifications:

- i) Acceptable material; material which meets with the requirements of Table 6/1 (Section 6).
- ii) Unacceptable material; material which either does not meet the requirements of Table 6/1 or contains the following materials or constituents:
 - a. Peat, organic soils and organic perishable materials (e.g. wood, straw, sawdust, paper, etc).
 - b. Materials in a frozen condition.
 - c. Clays of liquid limit >90 or plasticity index >65.
 - d. Combustible materials.
 - e. Materials having hazardous chemicals or physical properties requiring special measures for excavation, storage, transportation, deposition and disposal.
 - f. Materials which are visibly rich in sulphur (either by colouration or odour).
 - g. Materials which appear rich in coal fragments or coal fines and have a calorific value of 4MJ/kg or more.
 - h. Cobbles, boulders, rock or waste fragments whose largest dimension is greater than two-thirds of the loose layer thickness shall not be incorporated into the fill.

Particular note is given to the presence of intact coal at the site which maybe at depths which may interact with proposed foundations. If encountered, this material must be segregated as it will likely render any material used for fill as unacceptable material.

4.2 QUALITY TESTING

Quality testing must be conducted by the contractor during the works at a rate of one test every 1000m³ to prove that performance requirements in Table 6/1 (Appendix A) are being met. This will assist in classification of the 'cut' material if it is used on another site. The tests required are detailed in the table overleaf:

Type of Testing Required and Frequency		
Works Goods or Materials	Test	Frequency of Testing
Class 2 cohesive material	Grading	1 test per 1000 m ³
	Moisture Content	
	Atterberg Limits	
	Particle Density	
	OMC/MDD	
Class 2 cohesive material (Insitu testing)	Insitu density measurement (core cutter or sand replacement) Or Nuclear Density Gauge (NDG)	1 per 500m ² in each layer

The GRM ground investigations undertaken to date undertook geotechnical testing on the Glacial Deposits. The laboratory geotechnical testing included: Moisture Content, Atterberg Limits, Moisture Content/Dry Density Relationship (4.5kg rammer), and Particle Density testing. The results of which are included in Appendix E and summarised below.

Cohesive Fill – Glacial Deposits		
Parameter	Minimum	Maximum
Bulk Density (kN/m ³)	17.2	21.5
Particle Density (Mg/m ³)	2.68	2.70
Maximum Dry Density (Mg/m ³)	1.64	1.95
Optimum Moisture Content (%)	12	22
Natural Moisture Content (%)	8.6	39
Plasticity Index (%)	9	31

The results indicate that the Glacial Deposits at the site show a large variability in terms of moisture content, which in turn affect the geotechnical performance. This is observed particularly with the Optimum Moisture Content Results, where all the OMC/MDD tests undertaken had to be dried back significantly, before the test was completed.

The high moisture content is likely to be influenced by the topography at the site since any surface water derived from the south will naturally drain down the slopes at the site towards the north. Generally most soils tested recorded moisture contents in excess of 20%, with only one sample out of fifteen in total recording a moisture content <20% (confined to near the stable block).

Areas which would be subject to cutting recorded an average moisture content of 27%. Areas subject to filling recorded an average moisture content of 25%.

It is therefore likely that any material excavated from the site will need to be conditioned prior to filling and it is recommended that site trials are established to understand the true performance of the fill to be derived from the earthworks exercise. Given the above, the limits stated in Table 6/1 in Appendix A have been altered to reflect the limits which maybe expected for this kind of material.

4.3 MATERIALS QUALITY

In addition to the requirements of Manual Contract Document for Highway Works Series 600, to ensure sufficient quality and performance of fill materials, the following quality control procedures should be followed throughout site works and handling of material:

Cohesive Fill (Class 2)

- Excavated cohesive materials should be covered and protected from weather to ensure they do not become excessively wet of optimum moisture content, thus deeming them unsuitable.
- Any pockets of naturally occurring granular material should be removed during excavation from source, to ensure the permeability of cohesive fill is not compromised.
- Any oversize natural fractions (i.e. cobbles), unsuitable material inclusions (listed In Section 4.1(ii)) or fragments of construction material should be hand-picked from the material during material handling or prior to compaction to ensure the fill can be compacted adequately.

5 EARTHWORKS AND COMPACTION

5.1 PREPARATION OF FORMATION

To limit potential settlements and instability issues, any cohesive soil forming the formation should be proof rolled prior to filling activities.

Due to the likely foundation type being trench fill, it is recommended that a geotextile separation layer (i.e. Terram T1000) should be laid on the formation prior to placement of cohesive fill. This will act as a marker to show the minimum depth at which foundations need to penetrate, since they will need to be founded within natural ground.

5.2 SLOPED GROUND

Any sloping ground surfaces cut within the existing slope should be benched at a suitable angle to ensure any instability in faces is minimised. If excavations are to be formed adjacent to slopes which are greater than 1 in 3 temporary drainage features e.g. French drains, should be placed at the crest of the excavation to ensure instability within excavation faces aren't exacerbated.

5.3 PLACEMENT AND COMPACTION OF FILL

All fill materials and the starter layer should be laid and compacted in accordance with the appropriate method cited in Table 6/4 of the Manual Contract Document for Highway Works: Series 600 Earthworks Volume 1 Specification.

Use of the Highways Specification method should produce an engineered fill that has been compacted to approximately 95% and has approximately 5% air voids. Careful attention will need to be paid on site to ensure that material is not engineered at unacceptable moisture contents.

Compliance testing as per the table in section 3.2 will be required to confirm that the employed fill complies with the above specification. On completion of each layer, any soft spots should be removed; the material replaced with more suitable soils and then re-compacted.

5.4 DESIGNER SUPERVISION OF POND CONSTRUCTION (GRM)

A GRM engineer should be in attendance during various stages of the earthworks to inspect the works for compliance with the specification. In particular the following critical stages should be inspected:

1. Excavation of all cohesive strata to be used as fill. The material should be inspected by an Engineering Geologist or Geotechnical Engineer.
2. Inspection of the formation layer prior to placement of geotextile separation layer.
3. Inspection of any excavation adjacent to the existing slopes at the site.

6 TABLE 6/1 REQUIREMENTS FOR ACCEPTABILITY OF EARTHWORKS MATERIALS

Soil Class	General Material Description	Typical Use	Permitted Constituents (All subject to Requirements of Clause 601 and Appendix 6/1)	Material Properties Requirement for Acceptability (in Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Notes
				Property (see Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits within:		
						Lower	Upper	
2A	Wet Cohesive Material fill	General Fill	Any material, or combination of materials, other than chalk.	Grading	BS 1377 : part 2	Tab 6/2	Tab 6/2	See Table 6/4 Method 1 ¹⁾ for compaction properties.
				MC	BS 1377 : part 2	14%	18%	Values from initial source testing.
				Plasticity Index	BS 1377 : part 2	10	-	Source testing is compliant.
				Particle Density	BS 1377 : part 2	2.68 Mg/m ³	2.75 Mg/m ³	Values from initial source testing.
				Maximum Dry Density	BS 1377 : part 4	1.64 Mg/m ³	1.80 Mg/m ³	
				Compaction		95% and air voids 5% or lower		
				Undrained Shear Strength	BS 1377 : part 9	55kPa	120kPa	Values from initial source testing.



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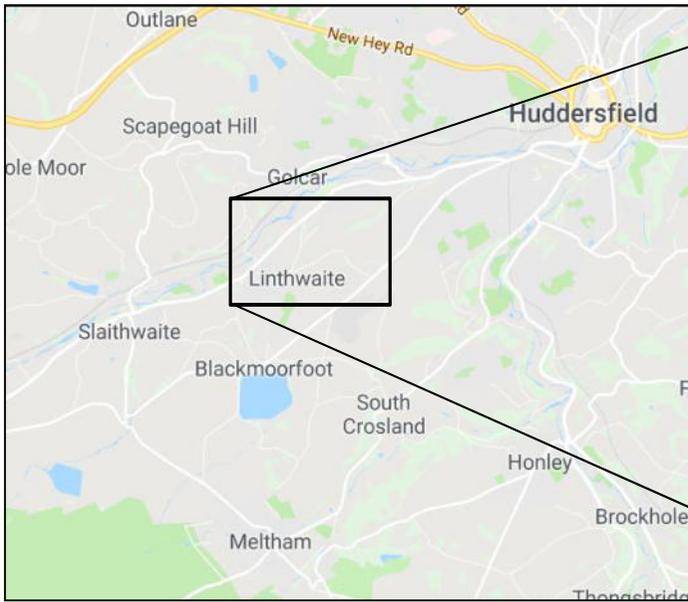
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NOTES:



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CLIENT:

Casey Group Ltd

PROJECT:

**Land Off Church Lane,
 Linthwaite**

TITLE:

**Site Location and Boundary
 Plan**

SCALE@SIZE:

NTS

ISSUE:

Final

DESIGN/DRAWN by :

GS

DATE:

March 2020

PROJECT No:

P8985

DRAWING No:

2

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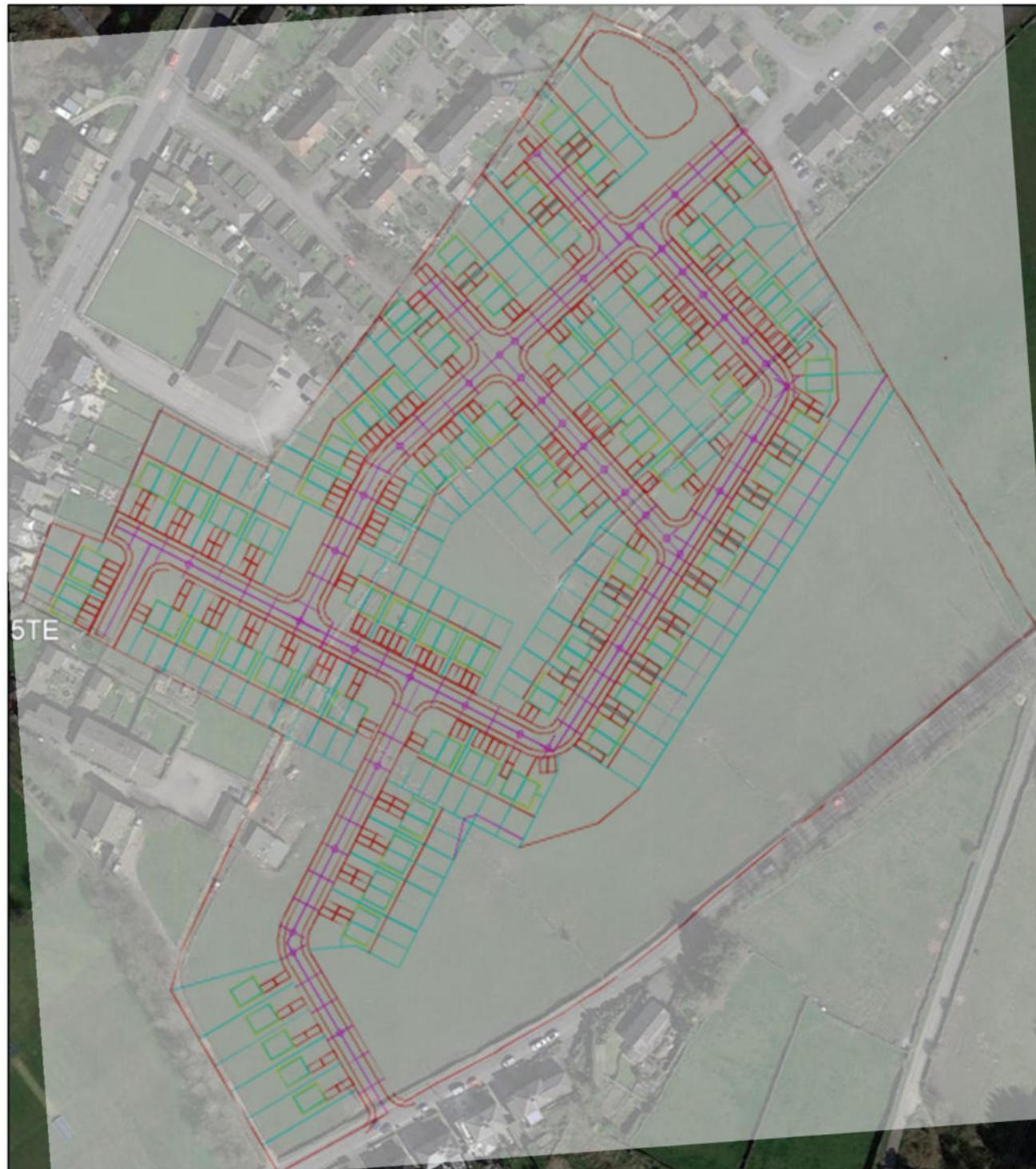
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CLIENT:

Casey Group Ltd

PROJECT:

**Land Off Church Lane,
Linthwaite**

TITLE:

Proposed Development Plan

SCALE@SIZE:

NTS

ISSUE:

Final

DESIGN/DRAWN by :

GS

DATE:

March 2020

PROJECT No:

P8985

DRAWING No:

1

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LEGEND

Earthworks

- -3.00m - cut
- -2.50m - cut
- -2.00m - cut
- -1.50m - cut
- -1.00m - cut
- -0.50m - cut
- 0.00
- 0.50m - fill
- 1.00m - fill
- 1.50m - fill
- 2.00m - fill
- 2.50m - fill
- 3.00m - fill



NOTES:

1. Earthwork levels based upon FFL on Tadw Architects drawing 911277 drwg no. 2, issue P2, dated 25/04/19.
2. Existing ground levels based on Latitude Surveys Topographical Survey drawing, reference TW1026-002, dated 17/06/15.
3. Contour lines are automatically generated. Local earthwork profiles likely to change due to proposed development requirements.

CLIENT: Casey Group Ltd	TITLE: Earthwork Cut and Fill Drawing
PROJECT: Church Lane, Linthwaite	

PROJECT No: P8985	DATE: April 2020
DESIGN/DRAWN: AB	ISSUE: Preliminary
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PROJECT No: P8985	DATE: April 2020
DESIGN/DRAWN: AB	ISSUE: Preliminary
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DO NOT SCALE

NOTES:

-  Trial Pit
-  Window Sampling Borehole
-  Sandstone*
-  Mudstone*

* - As recorded by the BGS.

N.B. All positions approximate only



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CLIENT:
Casey Group Ltd

PROJECT:
**Land Off Church Lane,
 Lintwaite**

TITLE:
**Exploratory Hole Location
 Plan**

SCALE@SIZE: NTS	ISSUE: Final
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DESIGN/DRAWN by : GS	DATE: March 2020
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PROJECT No: P8985	DRAWING No:
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Analytical Test Report: L19/1552/GRM/002

Your Project Reference:	Church Road, Linthwaite	Samples Received on:	24/06/2019
Your Order Number:	P8985	Testing Instruction Received:	24/06/2019
Report Issue Number:	1	Sample Tested:	24/06 to 28/06/2019
Samples Analysed:	6 soil samples	Report issued:	28/06/2019

Signed

Lee Harbottle
GCM Operations Manager
Nicholls Colton Group

Notes:

Samples will be retained for 14 days after issue of this report unless otherwise requested.
The results included within the report are representative of the samples submitted for analysis.
A certificate of sampling was not supplied.
Samples were provided by client

1377 Plasticity Index

Sample preparation was in accordance with BS1377:Part 1:2016.
Testing was in accordance with BS1377:Part 2:1990

1377 Moisture Content

Sample preparation was in accordance with BS1377:Part 1:2016.
Moisture content testing was in accordance with BS1377 : Part 2 :1990

Accreditation Key

UKAS = UKAS Accreditation, u = Unaccredited

Date of Issue 24.01.2017

Owned by Emily Blissett - Customer Services Supervisor

Authorised by James Gane - Commercial Manager

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L19/1552/GRM/001

Project Reference - Church Road, Linthwaite

Analytical Test Results - Soil

NC Reference	41550	41551	41552	41553	41554	41555		
Client Sample Reference	TP04	TP01	TP06	WS02	TP11	TP09		
Client Sample Location	TP04	TP01	TP06	WS02	TP11	TP09		
Depth - Top (m)	1.0	0.7	1.1	0.5	0.5	0.5		
Depth - Bottom (m)	1.1	0.7	1.2	0.5	0.6	0.6		
Date of Sampling	20/06/2019	20/06/2019	20/06/2019	21/06/2019	20/06/2019	20/06/2019		
Sample type	Not provided	Not provided	Not provided	Not provided	Not provided	Not provided		
Sample Description	Brown clayey silt with siltstone	Brown slightly silty clay with occasional siltstone	Brown slightly silty clay with occasional peat	Light brown silty clay with occasional peat	Brown silty clay with siltstone	Brown peaty clay with occasional sandstone		
Determinant	Specification	Units						
Moisture Content		(%)	8.6	23	35	35	27	22
Moisture Content Prep		-	3.2.3.2 (medium)	3.2.3.2 (medium)	3.2.3.1 (fine)	3.2.3.1 (fine)	3.2.3.2 (medium)	3.2.3.2 (medium)
Fines passing 425µm test sieve		(%)	87	87	100	100	36	95
Liquid Limit		(%)	26	49	61	50	56	54
Plastic Limit		(%)	Non Plastic	25	33	28	30	30
Plasticity Index		(%)	Non Plastic	24	28	22	26	24
PI preparation		-	from its natural state	from its natural state	from its natural state	from its natural state	from its natural state	from its natural state
PI Test Method			clause 4.4 (one point)	clause 4.4 (one point)	clause 4.4 (one point)	clause 4.4 (one point)	clause 4.4 (one point)	clause 4.4 (one point)



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Analytical Test Report: L20/0696/GRM/001

Your Project Reference:	Church Lane Linthwaite	Samples Received on:	25/03/2020
Your Order Number:	P8985	Testing Instruction Received:	24/03/2020
Report Issue Number:	1	Sample Tested:	24/03 to 24/04/2020
Samples Analysed:	11 soil samples	Report issued:	24/04/2020

Signed

Lee Harbottle
 GCM Operations Manager
 Nicholls Colton Group

Notes:

Samples will be retained for 14 days after issue of this report unless otherwise requested.
 The results included within the report are representative of the samples submitted for analysis.
 A certificate of sampling was not supplied.
 Samples were supplied by customer, results apply to the samples as received.

1377 Plasticity Index

Sample preparation was in accordance with BS1377:Part 1:2016.
 Testing was in accordance with BS1377:Part 2:1990

1377 Moisture Content

Sample preparation was in accordance with BS1377:Part 1:2016.
 Moisture content testing was in accordance with BS1377 : Part 2 :1990

1377 Particle Density

Sample preparation was in accordance with BS 1377 : Part 1 : 2016.
 Testing was in accordance with BS 1377 : Part 2 : 1990 Clause 8.2 gas jar method.

Accreditation Key

UKAS = UKAS Accreditation, u = Unaccredited

Date of Issue 27/11/2019

Owned by Emily Blissett - Commercial Reporting Supervisor
 Authorised by Lee Harbottle - GCM Operations Manager

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L20/0696/GRM/001

Project Reference - Church Lane Linthwaite

Analytical Test Results - Soil

NC Reference		84680	84681	84682	84683	84684	84685
Client Sample ID		TP101	TP106	TP107	TP108	TP109	TP110
Client Sample Location		TP101	TP106	TP107	TP108	TP109	TP110
Depth - Top (m)		0.50	0.80	0.70	0.60	0.70	0.80
Depth - Bottom (m)		0.60	0.90	0.80	0.70	0.80	0.90
Date of Sampling		11/03/2020	11/03/2020	11/03/2020	11/03/2020	11/03/2020	11/03/2020
Sample type		Disturbed	Disturbed	Disturbed	Disturbed	Disturbed	Disturbed
Sample Description		Brown slightly silty clay	Brown slightly silty slightly gravelly clay	Brown silty clay with occasional sandstone	Brown slightly silty clay	Brown slightly silty clay with mudstone	Light brown sandy silt
Determinant	Units						
Moisture Content	(%)	35	-	17	21	27	29
Moisture Content Prep	-	3.2.3.1 (fine)	-	3.2.3.2 (medium)	3.2.3.2 (medium)	3.2.3.1 (fine)	3.2.3.1 (fine)
Fines passing 425µm test sieve	(%)	100	-	85	92	94	100
Liquid Limit	(%)	63	-	45	45	45	45
Plastic Limit	(%)	32	-	22	25	26	27
Plasticity Index	(%)	31	-	23	20	19	18
PI preparation	-	from its natural state	-	from its natural state	from its natural state	from its natural state	from its natural state
PI Test Method		clause 4.4 (one point)	-	clause 4.4 (one point)	clause 4.4 (one point)	clause 4.4 (one point)	clause 4.4 (one point)
Particle Density	(Mg/m ³)	2.68	2.70	-	-	-	2.70



L20/0696/GRM/001

Project Reference - Church Lane Lint

Analytical Test Results - Soil

NC Reference		84686	84687	84688	84689	84690
Client Sample ID		TP111	TP112	TP113	TP115	TP116
Client Sample Location		TP111	TP112	TP113	TP115	TP116
Depth - Top (m)		0.40	0.40	0.50	0.80	0.80
Depth - Bottom (m)		0.50	0.50	0.60	0.90	0.90
Date of Sampling		11/03/2020	11/03/2020	11/03/2020	11/03/2020	11/03/2020
Sample type		Disturbed	Disturbed	Disturbed	Disturbed	Disturbed
Sample Description		Light brown sandy silt	Brown silty clay with mudstone	Light brown silty clay	Brown silty clay	Brown slightly gravelly silty clay
Determinant	Units					
Moisture Content	(%)	29	22	33	24	39
Moisture Content Prep	-	3.2.3.1 (fine)	3.2.3.2 (medium)	3.2.3.1 (fine)	3.2.3.1 (fine)	3.2.3.2 (medium)
Fines passing 425µm test sieve	(%)	100	94	100	100	100
Liquid Limit	(%)	47	33	48	54	58
Plastic Limit	(%)	26	24	28	26	32
Plasticity Index	(%)	21	9	20	28	26
PI preparation	-	from its natural state	from its natural state	from its natural state	from its natural state	from its natural state
PI Test Method		clause 4.4 (one point)	clause 4.4 (one point)	clause 4.4 (one point)	clause 4.4 (one point)	clause 4.4 (one point)
Particle Density	(Mg/m ³)	-	-	-	-	-

L20/0696/GRM/001

Project Reference - Church Lane Linthwaite

BS 1377 Dry Density / Moisture Content Relationship - 4.5 Kg Rammer

NC Reference	84680		
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Client Sample ID	TP101	Depth (Top) (m)	0.50
Client Sample Location	TP101	Depth - Bottom (m)	0.60

Type of sample and visual description : Brown slightly silty clay

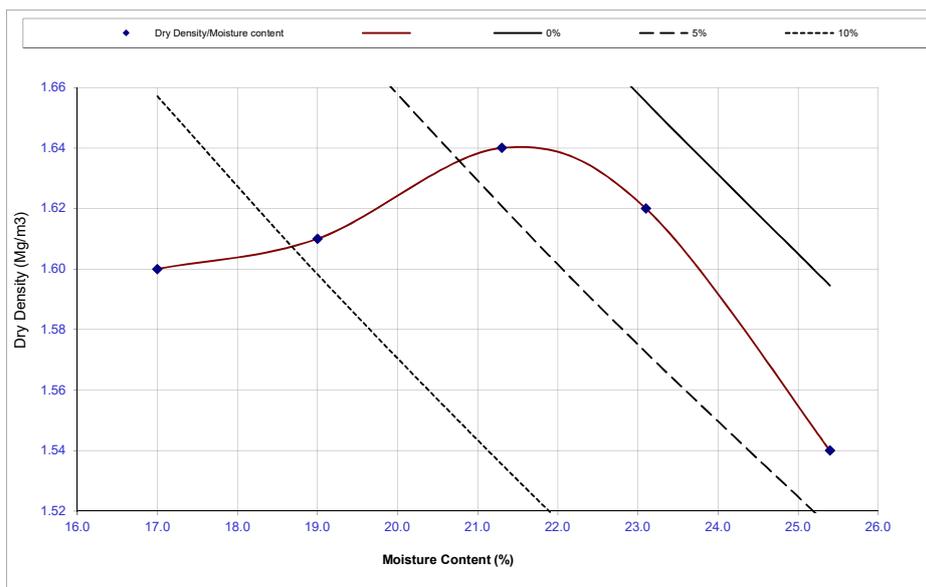
Material retained on 37.5mm BS test sieve (%) : 0

Material retained on 20mm BS test sieve (%) : 0

Particle Density (Measured) (Mg/m³) : 2.68

Maximum Dry Density (Mg/m³) : 1.64

Optimum Moisture Content % : 22



NOTES :

1. Samples were prepared in accordance with BS1377:Part 4:1990 Clause 3.2.6.1 using separate batches
2. Testing was in accordance with BS1377:Part 4:1990 Clause 3.5

L20/0696/GRM/001

Project Reference - Church Lane Linthwaite

BS 1377 Dry Density / Moisture Content Relationship - 4.5 Kg Rammer

NC Reference	84682
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Client Sample ID	TP107	Depth (Top) (m)	0.70
Client Sample Location	TP107	Depth - Bottom (m)	0.80

Type of sample and visual description : Brown silty clay with occasional sandstone

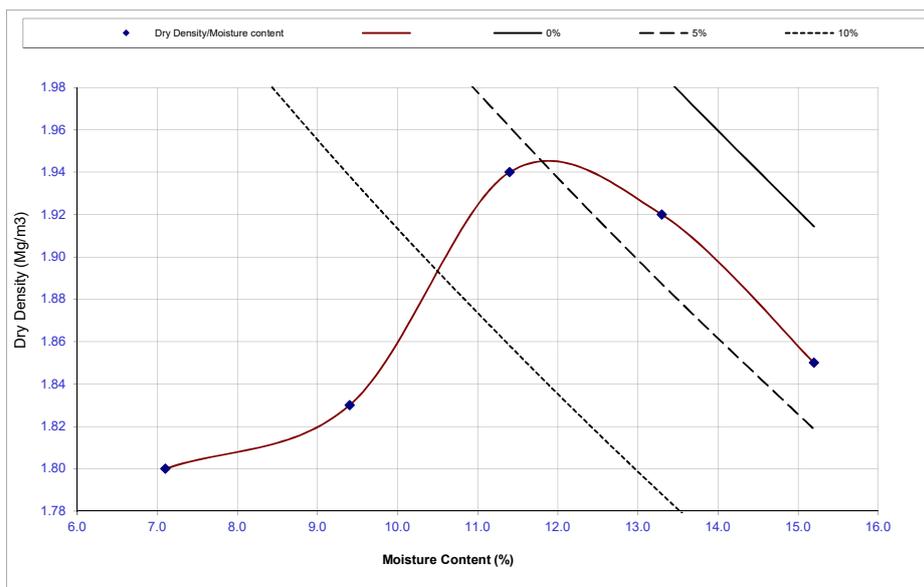
Material retained on 37.5mm BS test sieve (%) : 0

Material retained on 20mm BS test sieve (%) : 3

Particle Density (Assumed) (Mg/m³) : 2.70

Maximum Dry Density (Mg/m³) : 1.95

Optimum Moisture Content % : 12



NOTES :

1. Samples were prepared in accordance with BS1377:Part 4:1990 Clause 3.2.6.2 using separate batches
2. Testing was in accordance with BS1377:Part 4:1990 Clause Clause 3.5

L20/0696/GRM/001

Project Reference - Church Lane Linthwaite

BS 1377 Dry Density / Moisture Content Relationship - 4.5 Kg Rammer

NC Reference	84683		
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Client Sample ID	TP108	Depth (Top) (m)	0.60
Client Sample Location	TP108	Depth - Bottom (m)	0.70

Type of sample and visual description : Brown slightly silty clay

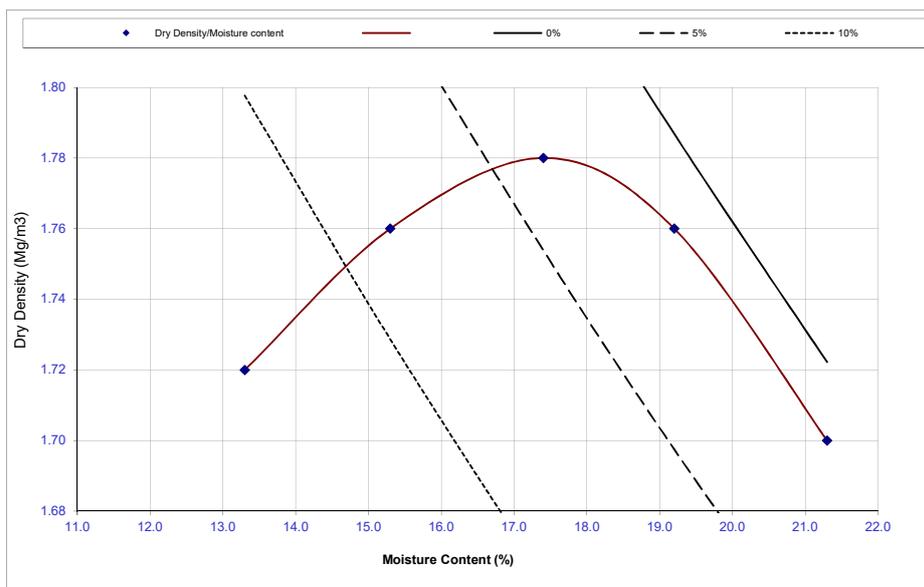
Material retained on 37.5mm BS test sieve (%) : 0

Material retained on 20mm BS test sieve (%) : 2

Particle Density (Assumed) (Mg/m³) : 2.72

Maximum Dry Density (Mg/m³) : 1.78

Optimum Moisture Content % : 17



NOTES :

1. Samples were prepared in accordance with BS1377:Part 4:1990 Clause 3.2.6.2 using separate batches
2. Testing was in accordance with BS1377:Part 4:1990 Clause 3.5

L20/0696/GRM/001

Project Reference - Church Lane Linthwaite

BS 1377 Dry Density / Moisture Content Relationship - 4.5 Kg Rammer

NC Reference	84684
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Client Sample ID	TP109	Depth (Top) (m)	0.70
Client Sample Location	TP109	Depth - Bottom (m)	0.80

Type of sample and visual description : Brown slightly silty clay with mudstone

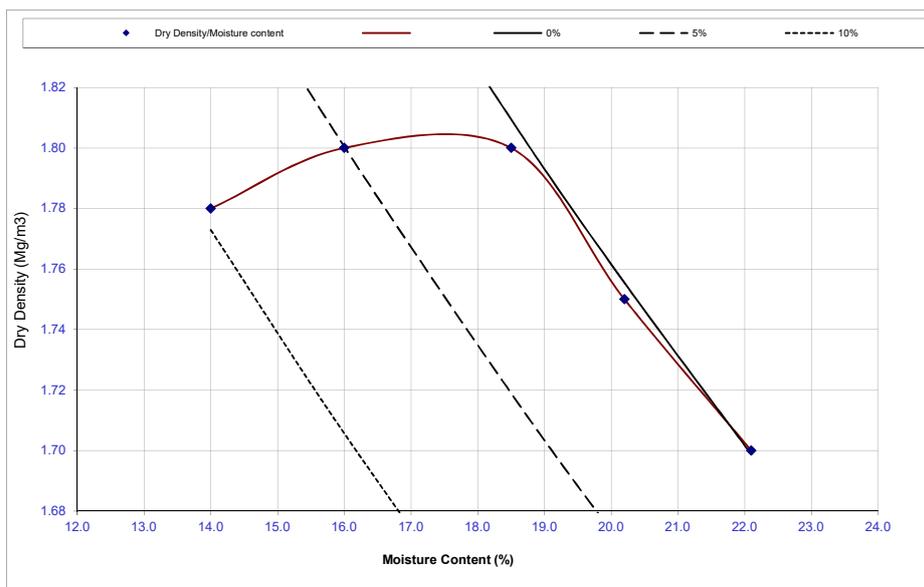
Material retained on 37.5mm BS test sieve (%) : 5

Material retained on 20mm BS test sieve (%) : 8

Particle Density (Assumed) (Mg/m³) : 2.72

Maximum Dry Density (Mg/m³) : 1.80

Optimum Moisture Content % : 18



NOTES :

1. Samples were prepared in accordance with BS1377:Part 4:1990 Clause 3.2.7.1 using separate batches
2. Testing was in accordance with BS1377:Part 4:1990 Clause 3.6

L20/0696/GRM/001

Project Reference - Church Lane Linthwaite

BS 1377 Dry Density / Moisture Content Relationship - 4.5 Kg Rammer

NC Reference	84685		
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Client Sample ID	TP110	Depth (Top) (m)	0.80
Client Sample Location	TP110	Depth - Bottom (m)	0.90

Type of sample and visual description : Light brown sandy silt

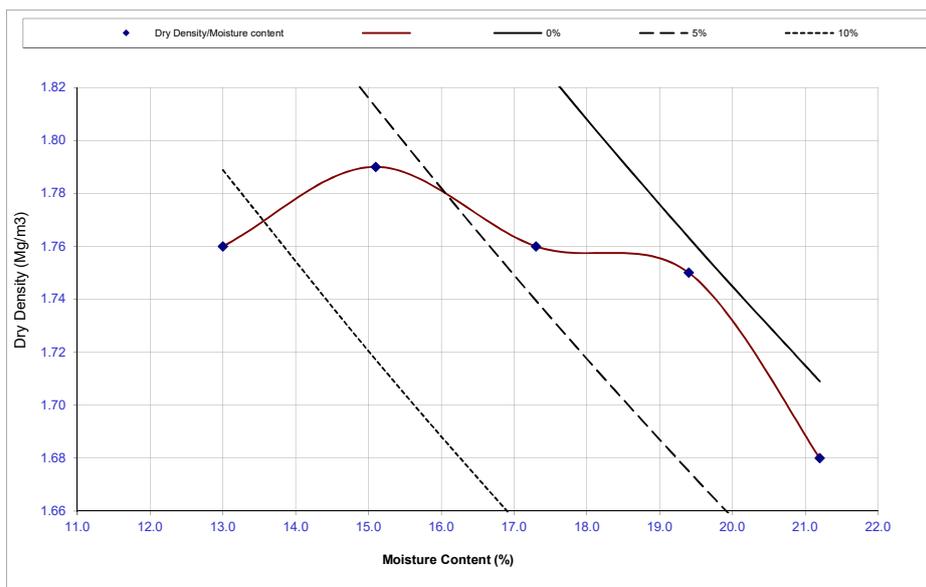
Material retained on 37.5mm BS test sieve (%) : 0

Material retained on 20mm BS test sieve (%) : 0

Particle Density (Assumed) (Mg/m³) : 2.68

Maximum Dry Density (Mg/m³) : 1.79

Optimum Moisture Content % : 15



NOTES :

1. Samples were prepared in accordance with BS1377:Part 4:1990 Clause 3.2.6.1 using separate batches
2. Testing was in accordance with BS1377:Part 4:1990 Clause 3.5

L20/0696/GRM/001

Project Reference - Church Lane Linthwaite

BS 1377 Dry Density / Moisture Content Relationship - 4.5 Kg Rammer

NC Reference	84686
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Client Sample ID	TP111	Depth (Top) (m)	0.40
Client Sample Location	TP111	Depth - Bottom (m)	0.50

Type of sample and visual description : Light brown sandy silt

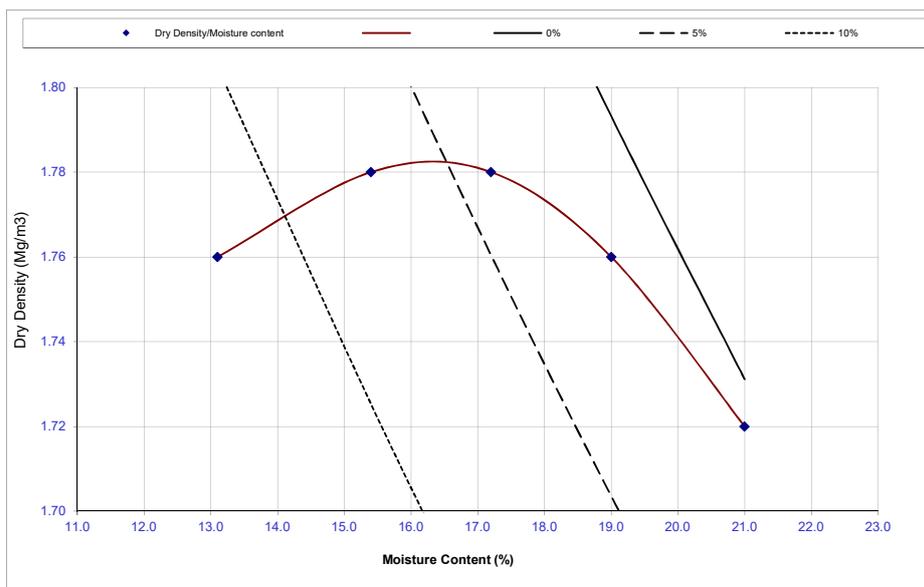
Material retained on 37.5mm BS test sieve (%) : 0

Material retained on 20mm BS test sieve (%) : 0

Particle Density (Assumed) (Mg/m³) : 2.72

Maximum Dry Density (Mg/m³) : 1.78

Optimum Moisture Content % : 16



NOTES :

1. Samples were prepared in accordance with BS1377:Part 4:1990 Clause 3.2.6.1 using separate batches
2. Testing was in accordance with BS1377:Part 4:1990 Clause 3.5

L20/0696/GRM/001

Project Reference - Church Lane Linthwaite

BS 1377 Dry Density / Moisture Content Relationship - 4.5 Kg Rammer

NC Reference	84687
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Client Sample ID	TP112	Depth (Top) (m)	0.40
Client Sample Location	TP112	Depth - Bottom (m)	0.50

Type of sample and visual description : Brown silty clay with mudstone

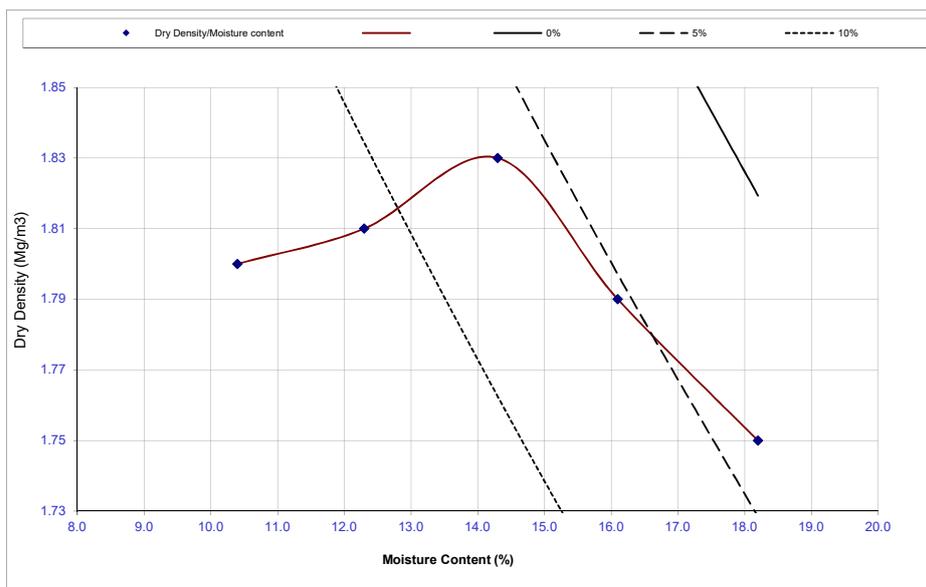
Material retained on 37.5mm BS test sieve (%) : 7

Material retained on 20mm BS test sieve (%) : 13

Particle Density (Assumed) (Mg/m³) : 2.72

Maximum Dry Density (Mg/m³) : 1.83

Optimum Moisture Content % : 14



NOTES :

1. Samples were prepared in accordance with BS1377:Part 4:1990 Clause 3.2.7.2 using separate batches
2. Testing was in accordance with BS1377:Part 4:1990 Clause 3.6

L20/0696/GRM/001

Project Reference - Church Lane Linthwaite

BS 1377 Dry Density / Moisture Content Relationship - 4.5 Kg Rammer

NC Reference	84688		
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Client Sample ID	TP113	Depth (Top) (m)	0.50
Client Sample Location	TP113	Depth - Bottom (m)	0.60

Type of sample and visual description : Light brown silty clay

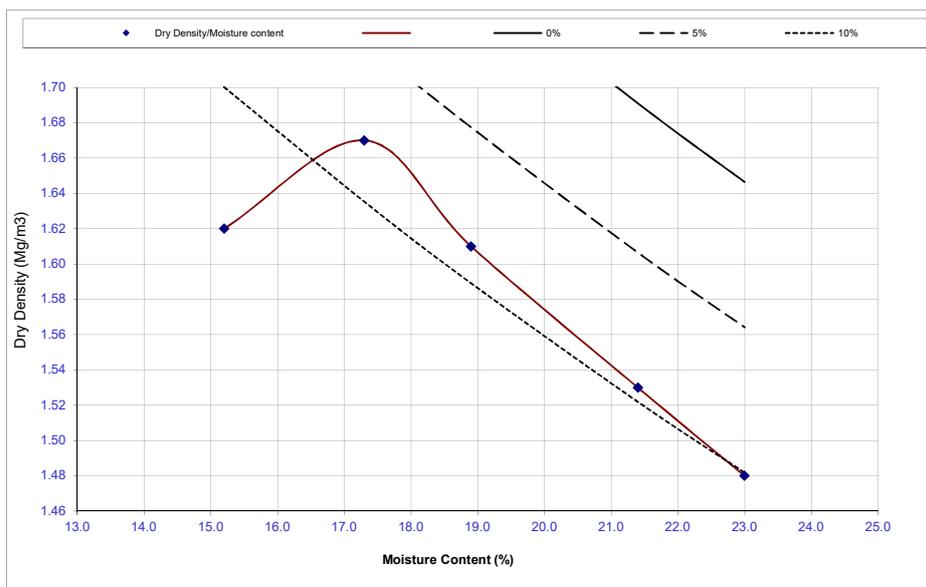
Material retained on 37.5mm BS test sieve (%) : 0

Material retained on 20mm BS test sieve (%) : 0

Particle Density (Assumed) (Mg/m³) : 2.65

Maximum Dry Density (Mg/m³) : 1.67

Optimum Moisture Content % : 17



NOTES :

1. Samples were prepared in accordance with BS1377:Part 4:1990 Clause 3.2.6.1 using separate batches
2. Testing was in accordance with BS1377:Part 4:1990 Clause 3.5

L20/0696/GRM/001

Project Reference - Church Lane Linthwaite

BS 1377 Dry Density / Moisture Content Relationship - 4.5 Kg Rammer

NC Reference	84689
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Client Sample ID	TP115	Depth (Top) (m)	0.80
Client Sample Location	TP115	Depth - Bottom (m)	0.90

Type of sample and visual description : Brown silty clay

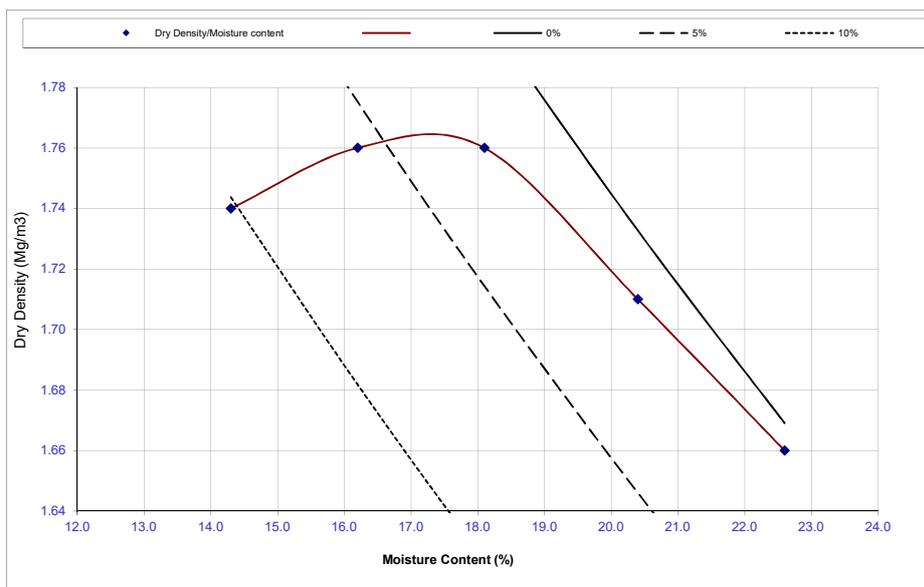
Material retained on 37.5mm BS test sieve (%) : 0

Material retained on 20mm BS test sieve (%) : 0

Particle Density (Assumed) (Mg/m³) : 2.68

Maximum Dry Density (Mg/m³) : 1.76

Optimum Moisture Content % : 17



NOTES :

1. Samples were prepared in accordance with BS1377:Part 4:1990 Clause 3.2.6.1 using separate batches
2. Testing was in accordance with BS1377:Part 4:1990 Clause 3.5

L20/0696/GRM/001

Project Reference - Church Lane Linthwaite

BS 1377 Dry Density / Moisture Content Relationship - 4.5 Kg Rammer

NC Reference	84690
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Client Sample ID	TP116	Depth (Top) (m)	0.80
Client Sample Location	TP116	Depth - Bottom (m)	0.90

Type of sample and visual description : Brown slightly gravelly silty clay

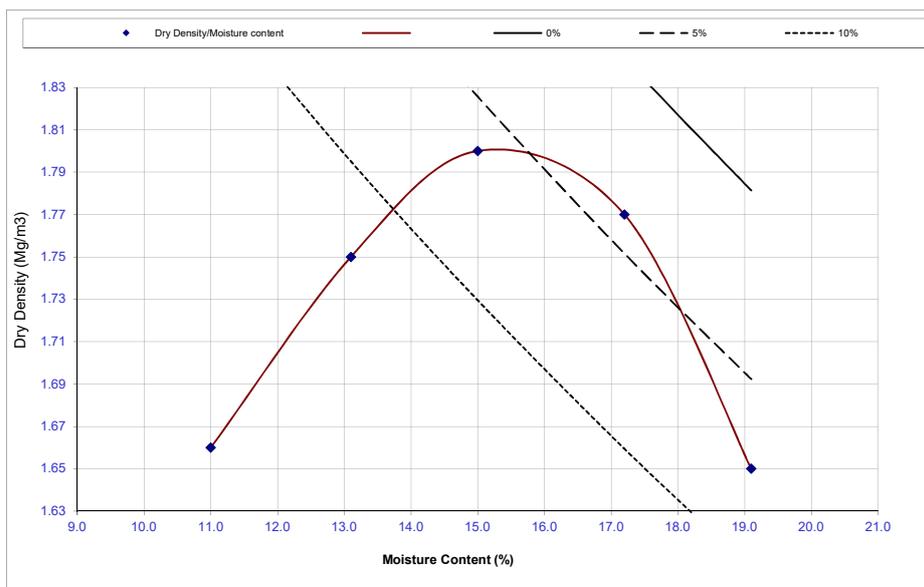
Material retained on 37.5mm BS test sieve (%) : 0

Material retained on 20mm BS test sieve (%) : 0

Particle Density (Assumed) (Mg/m³) : 2.70

Maximum Dry Density (Mg/m³) : 1.80

Optimum Moisture Content % : 15



NOTES :

1. Samples were prepared in accordance with BS1377:Part 4:1990 Clause 3.2.6.1 using separate batches
2. Testing was in accordance with BS1377:Part 4:1990 Clause 3.5



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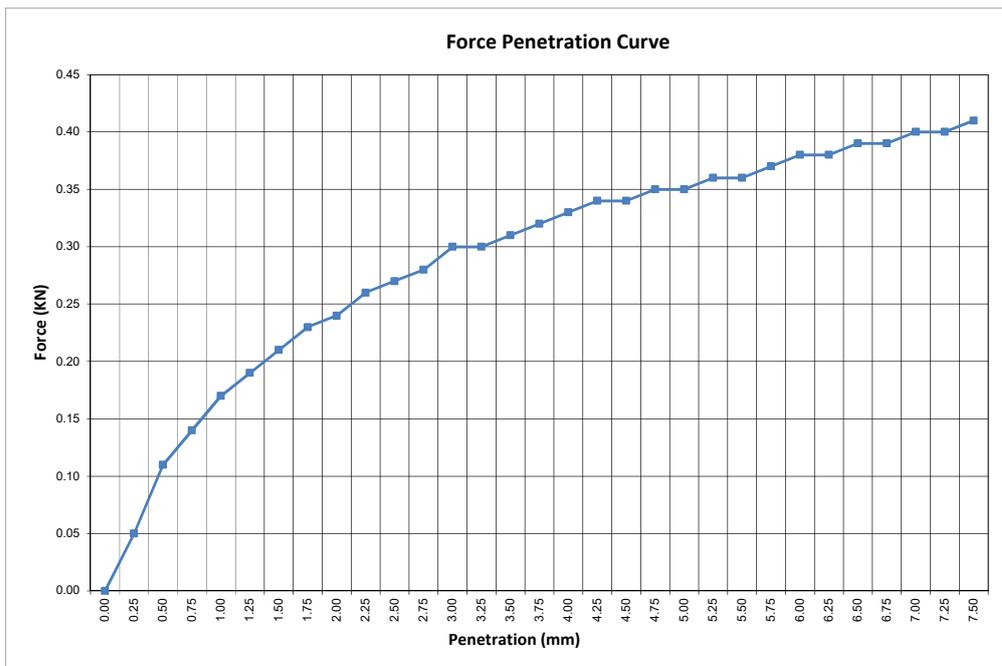
L20/0696/GRM/001

Project Reference - Church Lane Linthwaite

Test Result - BS 1377 Laboratory CBR value - Top only

NC Reference	84680
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Client reference :	TP101	Location:	TP101
Sample Depth - Top (m):	0.5	Sample Depth - Bottom (m):	0.6
Visual description :	Brown slightly silty clay		
Sample type:	Disturbed		
Initial Bulk Density (Mg/m3) :	1.83	Initial Dry Density (Mg/m3) :	1.35
Material retained on 20mm test sieve (%) :	0	Moisture content (%) :	35
California Bearing Ratio (CBR) % :	2.0		



NOTES :

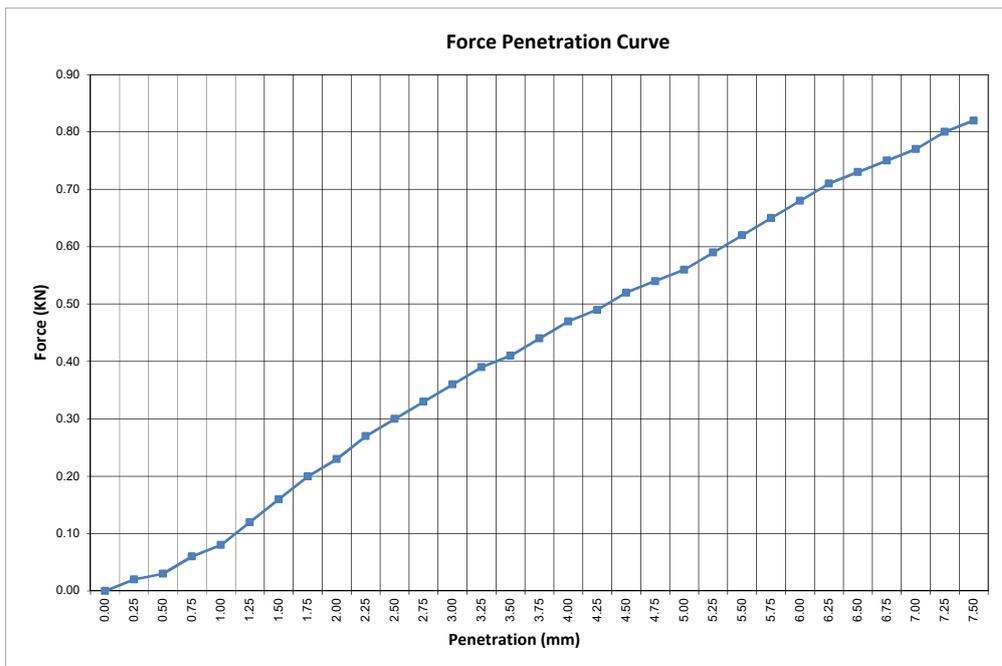
1. Testing was in accordance with BS 1377 : Part 4 : 1990 : Clause 7.
2. Sample preparation was in accordance with cl.7.2.4.4 method 5 4.5kg rammer
3. The test specimen was not soaked prior to testing



L20/0696/GRM/001
Project Reference - Church Lane Linthwaite
Test Result - BS 1377 Laboratory CBR value - Top only

NC Reference	84682
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Client reference :	TP107	Location:	TP107
Sample Depth - Top (m):	0.7	Sample Depth - Bottom (m):	0.8
Visual description :	Brown silty clay with occasional sandstone		
Sample type:	Disturbed		
Initial Bulk Density (Mg/m3) :	2.15	Initial Dry Density (Mg/m3) :	1.84
Material retained on 20mm test sieve (%) :	3	Moisture content (%) :	17
California Bearing Ratio (CBR) % :	2.8		



NOTES :

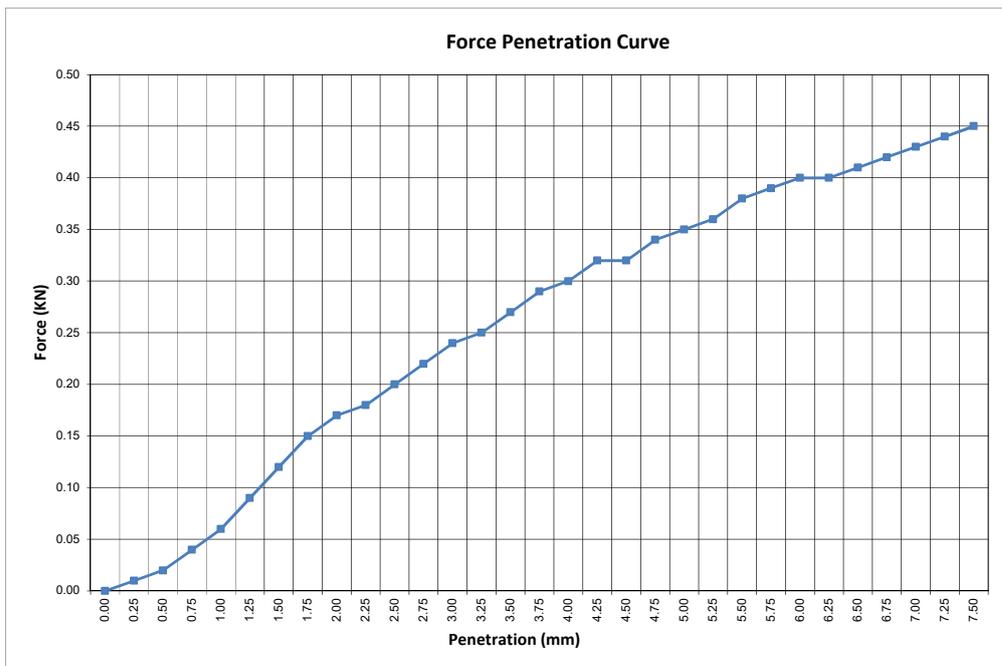
1. Testing was in accordance with BS 1377 : Part 4 : 1990 : Clause 7.
2. Sample preparation was in accordance with cl.7.2.4.4 method 5 4.5kg rammer
3. The test specimen was not soaked prior to testing



L20/0696/GRM/001
Project Reference - Church Lane Linthwaite
Test Result - BS 1377 Laboratory CBR value - Top only

NC Reference **84683**

Client reference :	TP108	Location:	TP108
Sample Depth - Top (m):	0.6	Sample Depth - Bottom (m):	0.7
Visual description :	Brown slightly silty clay		
Sample type:	Disturbed		
Initial Bulk Density (Mg/m3) :	1.98	Initial Dry Density (Mg/m3) :	1.58
Material retained on 20mm test sieve (%) :	2	Moisture content (%) :	25
California Bearing Ratio (CBR) % :	1.8		



NOTES :

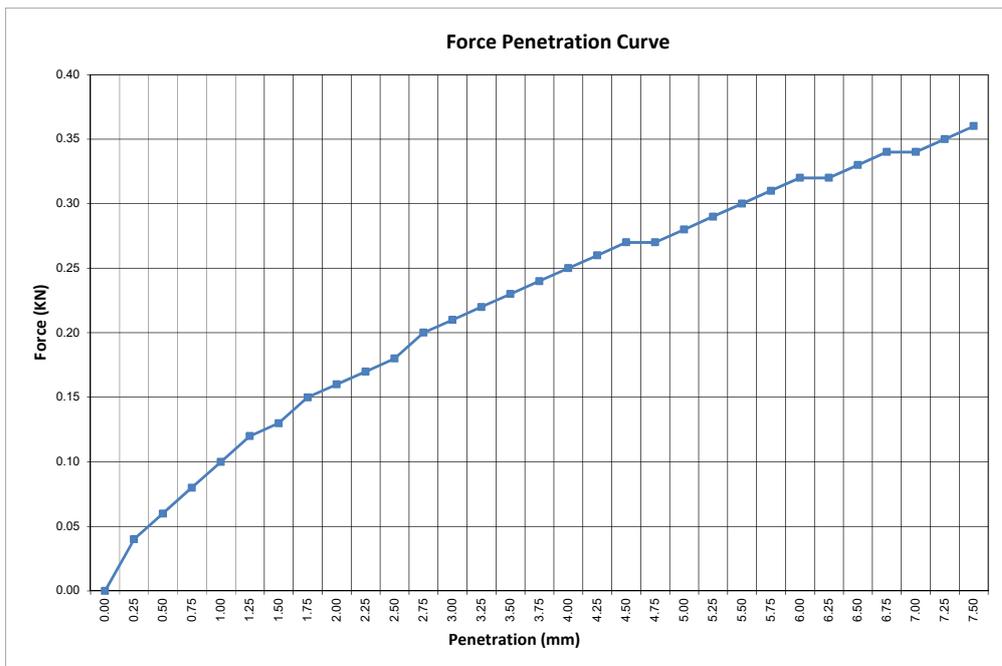
1. Testing was in accordance with BS 1377 : Part 4 : 1990 : Clause 7.
2. Sample preparation was in accordance with cl.7.2.4.4 method 5 4.5kg rammer
3. The test specimen was not soaked prior to testing



L20/0696/GRM/001
Project Reference - Church Lane Linthwaite
Test Result - BS 1377 Laboratory CBR value - Top only

NC Reference **84684**

Client reference :	TTP109	Location:	TP109
Sample Depth - Top (m):	0.7	Sample Depth - Bottom (m):	0.8
Visual description :	Brown slightly silty clay with mudstone		
Sample type:	Disturbed		
Initial Bulk Density (Mg/m3) :	2.04	Initial Dry Density (Mg/m3) :	1.65
Material retained on 20mm test sieve (%) :	8	Moisture content (%) :	24
California Bearing Ratio (CBR) % :	1.4		



NOTES :

1. Testing was in accordance with BS 1377 : Part 4 : 1990 : Clause 7.
2. Sample preparation was in accordance with cl.7.2.4.4 method 5 4.5kg rammer
3. The test specimen was not soaked prior to testing



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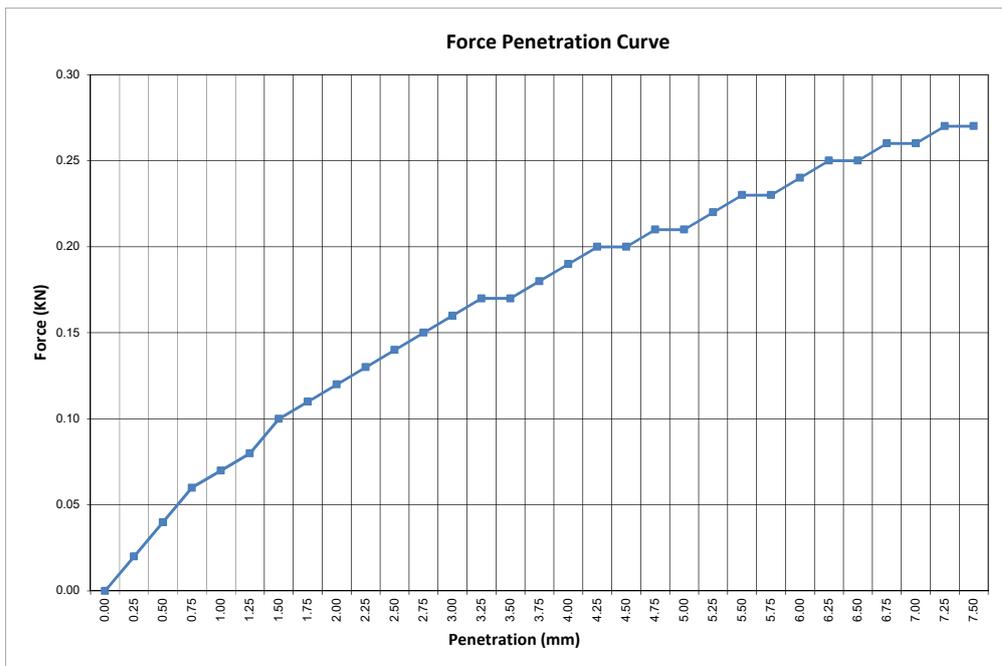
L20/0696/GRM/001

Project Reference - Church Lane Linthwaite

Test Result - BS 1377 Laboratory CBR value - Top only

NC Reference	84685
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Client reference :	TP110	Location:	TP110
Sample Depth - Top (m):	0.8	Sample Depth - Bottom (m):	0.9
Visual description :	Light brown sandy silt		
Sample type:	Disturbed		
Initial Bulk Density (Mg/m3) :	1.93	Initial Dry Density (Mg/m3) :	1.49
Material retained on 20mm test sieve (%) :	0	Moisture content (%) :	29
California Bearing Ratio (CBR) % :	1.1		



NOTES :

1. Testing was in accordance with BS 1377 : Part 4 : 1990 : Clause 7.
2. Sample preparation was in accordance with cl.7.2.4.4 method 5 4.5kg rammer
3. The test specimen was not soaked prior to testing



0320



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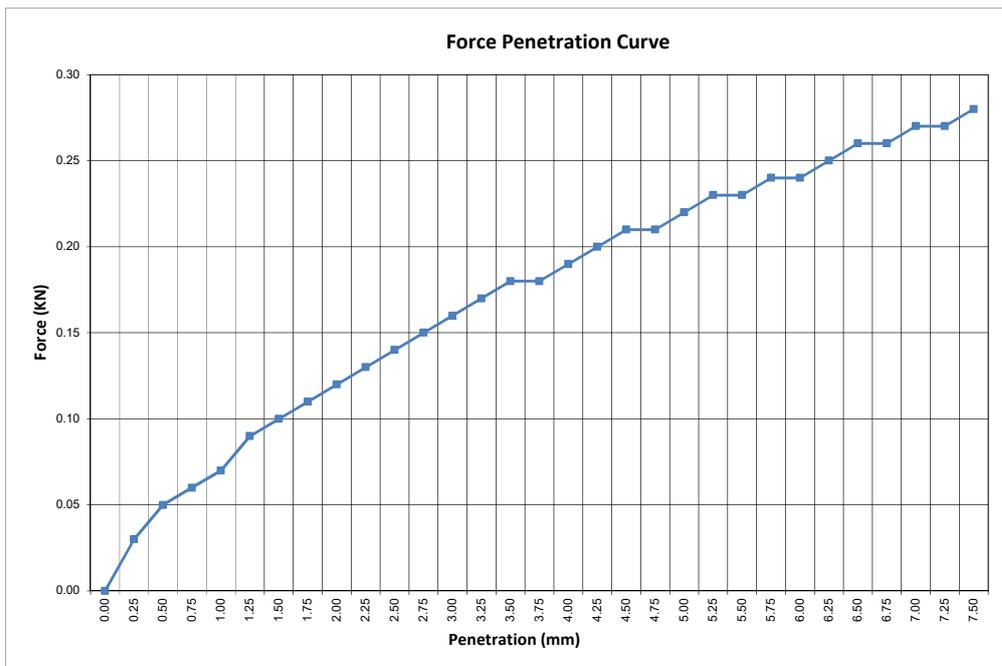
L20/0696/GRM/001

Project Reference - Church Lane Linthwaite

Test Result - BS 1377 Laboratory CBR value - Top only

NC Reference	84686
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Client reference :	TP111	Location:	TP111
Sample Depth - Top (m):	0.4	Sample Depth - Bottom (m):	0.5
Visual description :	Light brown sandy silt		
Sample type:	Disturbed		
Initial Bulk Density (Mg/m3) :	1.95	Initial Dry Density (Mg/m3) :	1.51
Material retained on 20mm test sieve (%) :	0	Moisture content (%) :	29
California Bearing Ratio (CBR) % :	1.1		



NOTES :

1. Testing was in accordance with BS 1377 : Part 4 : 1990 : Clause 7.
2. Sample preparation was in accordance with cl.7.2.4.4 method 5 4.5kg rammer
3. The test specimen was not soaked prior to testing



0320



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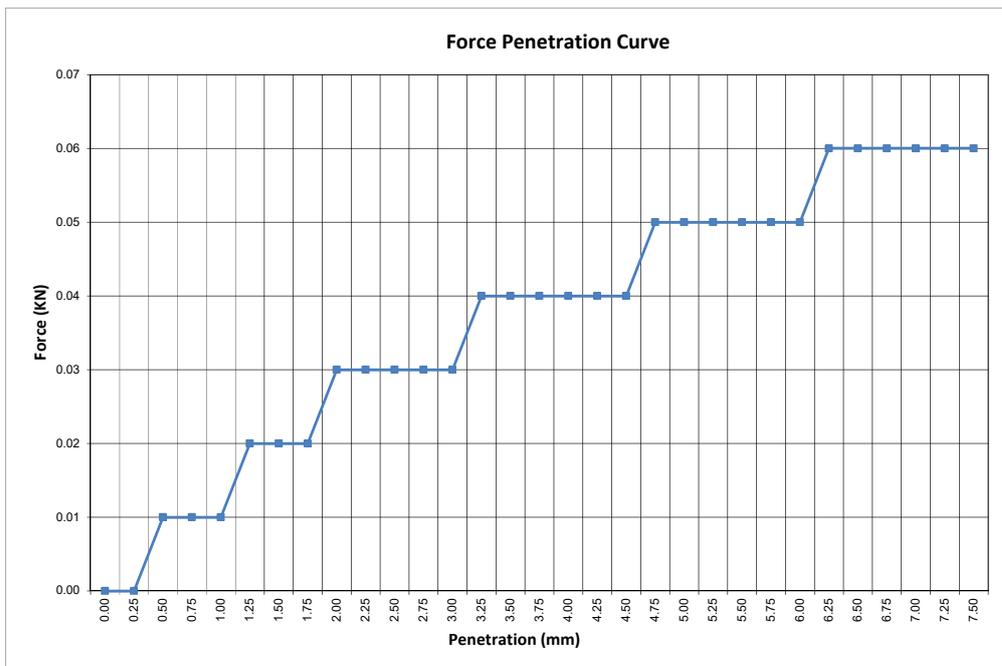
L20/0696/GRM/001

Project Reference - Church Lane Linthwaite

Test Result - BS 1377 Laboratory CBR value - Top only

NC Reference	84687
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Client reference :	TP112	Location:	TP112
Sample Depth - Top (m):	0.4	Sample Depth - Bottom (m):	0.5
Visual description :	Brown silty clay with mudstone		
Sample type:	Disturbed		
Initial Bulk Density (Mg/m3) :	1.93	Initial Dry Density (Mg/m3) :	1.55
Material retained on 20mm test sieve (%) :	13	Moisture content (%) :	25
California Bearing Ratio (CBR) % :	0.3		



NOTES :

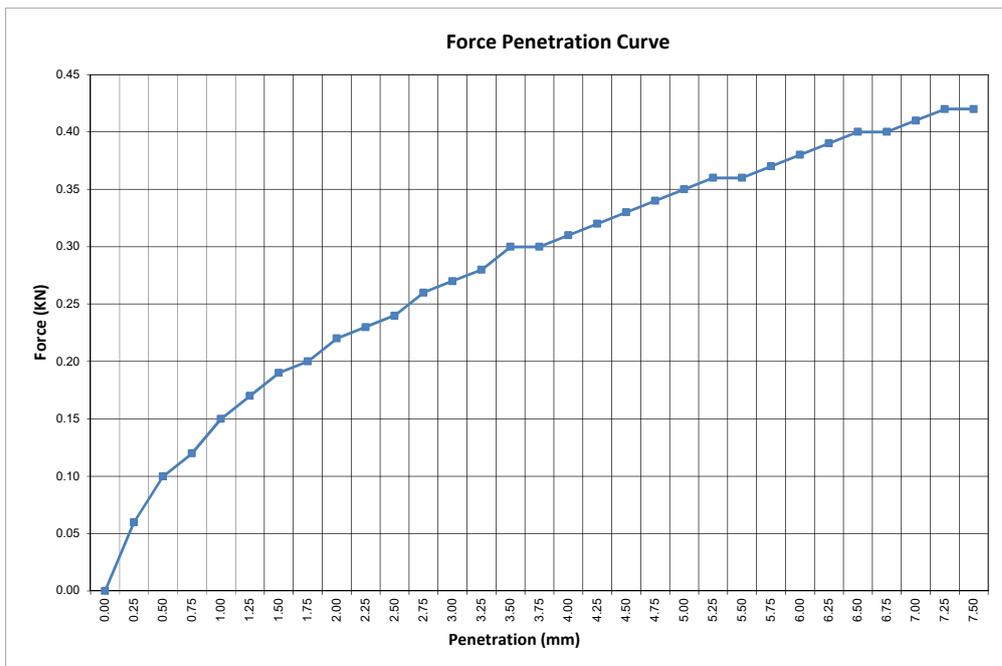
1. Testing was in accordance with BS 1377 : Part 4 : 1990 : Clause 7.
2. Sample preparation was in accordance with cl.7.2.4.4 method 5 4.5kg rammer
3. The test specimen was not soaked prior to testing



L20/0696/GRM/001
Project Reference - Church Lane Linthwaite
Test Result - BS 1377 Laboratory CBR value - Top only

NC Reference	84688
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Client reference :	TP113	Location:	TP113
Sample Depth - Top (m):	0.5	Sample Depth - Bottom (m):	0.6
Visual description :	Light brown silty clay		
Sample type:	Disturbed		
Initial Bulk Density (Mg/m3) :	1.92	Initial Dry Density (Mg/m3) :	1.49
Material retained on 20mm test sieve (%) :	0	Moisture content (%) :	29
California Bearing Ratio (CBR) % :	1.8		



NOTES :

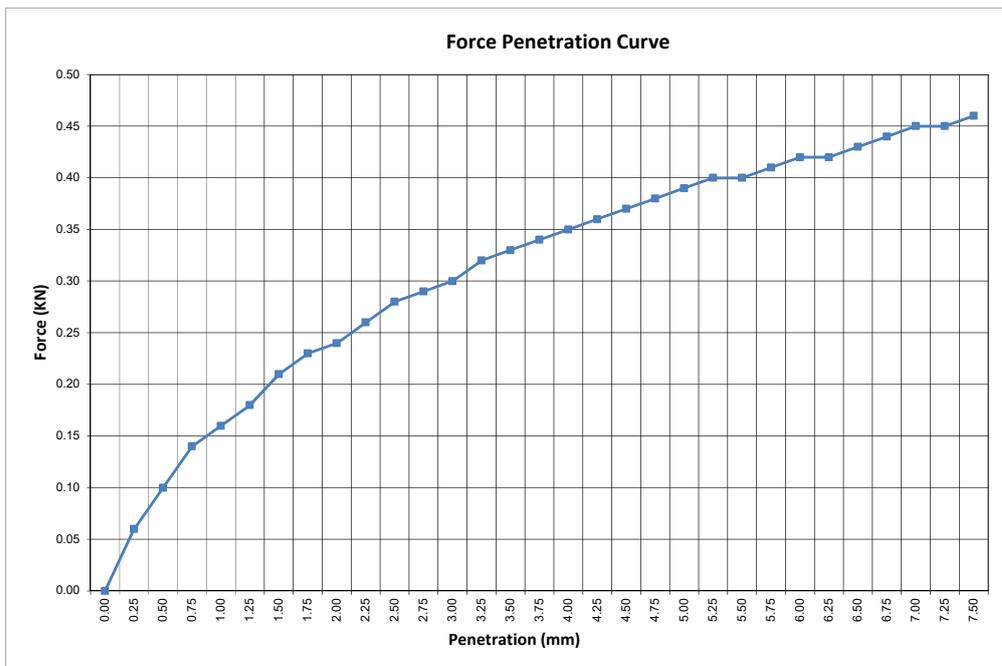
1. Testing was in accordance with BS 1377 : Part 4 : 1990 : Clause 7.
2. Sample preparation was in accordance with cl.7.2.4.4 method 5 4.5kg rammer
3. The test specimen was not soaked prior to testing



L20/0696/GRM/001
Project Reference - Church Lane Linthwaite
Test Result - BS 1377 Laboratory CBR value - Top only

NC Reference	84689
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Client reference :	TP115	Location:	TP115
Sample Depth - Top (m):	0.8	Sample Depth - Bottom (m):	0.9
Visual description :	Brown silty clay		
Sample type:	Disturbed		
Initial Bulk Density (Mg/m3) :	1.92	Initial Dry Density (Mg/m3) :	1.48
Material retained on 20mm test sieve (%) :	0	Moisture content (%) :	30
California Bearing Ratio (CBR) % :	2.1		



NOTES :

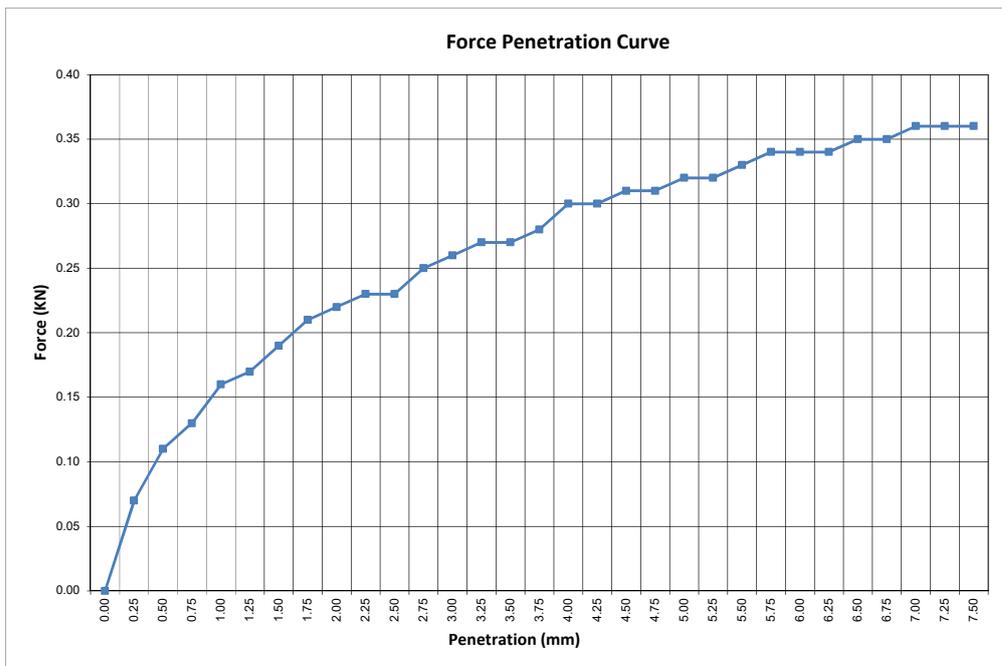
1. Testing was in accordance with BS 1377 : Part 4 : 1990 : Clause 7.
2. Sample preparation was in accordance with cl.7.2.4.4 method 5 4.5kg rammer
3. The test specimen was not soaked prior to testing



L20/0696/GRM/001
Project Reference - Church Lane Linthwaite
Test Result - BS 1377 Laboratory CBR value - Top only

NC Reference	84690
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Client reference :	TP116	Location:	TP116
Sample Depth - Top (m):	0.8	Sample Depth - Bottom (m):	0.9
Visual description :	Brown slightly gravelly silty clay		
Sample type:	Disturbed		
Initial Bulk Density (Mg/m3) :	1.72	Initial Dry Density (Mg/m3) :	1.16
Material retained on 20mm test sieve (%) :	0	Moisture content (%) :	49
California Bearing Ratio (CBR) % :	1.7		



NOTES :

1. Testing was in accordance with BS 1377 : Part 4 : 1990 : Clause 7.
2. Sample preparation was in accordance with cl.7.2.4.4 method 5 4.5kg rammer
3. The test specimen was not soaked prior to testing