

Persimmon Homes Essex

Northwest Haverhill Relief Road and Bridge

Geotechnical Assessment



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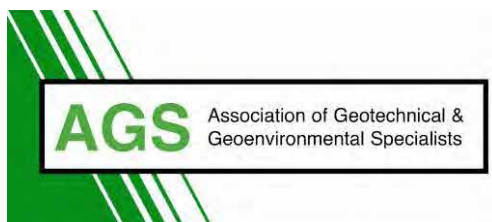
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Contents

1	Executive Summary	1
2	Limitations and Exceptions	2
3	Introduction	3
3.1	General	3
3.2	Terms of Reference	3
3.3	Technical Approach	3
3.4	Proposed Development	3
4	The Site	4
4.1	Location and Description	4
4.2	Geology	4
4.3	Hydrogeology	4
4.4	Hydrology	5
5	Ground Investigation	6
5.1	Site Work	6
5.2	Investigation Rationale	6
5.3	Installations	7
5.4	In Situ Testing	7
5.5	Sampling	7
5.6	Post-Fieldwork Monitoring	7
5.7	Laboratory Analysis	7
6	Ground and Groundwater Conditions	8
6.1	General	8
6.2	Topsoil	8
6.3	Head Deposits	8
6.4	Lowestoft Formation (Diamicton)	8
6.5	Groundwater Conditions	8
7	Material Properties	10
7.1	General	10
7.2	Head Deposits	10
7.3	Lowestoft Formation	11
7.4	Summary	12
8	Geotechnical Assessment	15
8.1	General	15
8.2	Excavations	15

8.3	Bridge Foundations	15
8.4	Road Construction	16
8.5	Below Ground Concrete Design	16
9	Summary and Recommendations	18
9.1	Geotechnical	18
10	References	19

Figures

Figure 1: Site Location Plan

Figure 2: SPT N Values vs Depth

Figure 3: Shear Strength vs Depth

Drawings

775823-MLM-ZZ-XX-DR-J-0005 Exploratory Hole Location Plan

 Exploratory Hole Logs

 In-situ CBR Results

 Geotechnical Test Results

1 Executive Summary

Details	Summary of Main Text
Introduction	This report has been prepared on the instructions of Persimmon Homes Essex which proposes to construct a new relief road to the northwest of Haverhill, including a bridge across an existing ditch in the west of the site. It presents the results of a ground investigation and geotechnical assessment.
Site description	The site currently comprises undeveloped agricultural land, crossed by a number of field boundaries and drainage ditches. There are a number of mature high water demand trees across the larger site area.
Environmental Setting	<p>Geological maps show the site to be underlain by Lowestoft Formation deposits, over Lewes Nodular and Seaford Chalk Formation deposits. The Lowestoft Formation is classified as unproductive strata, while the underlying chalk is a principal aquifer deposit. The northwest of the site is within a zone II (outer) groundwater protection zone.</p> <p>There are a number of water bearing ditches crossing the site.</p> <p>The site is bordered to the south by a new residential development, and to the north by agricultural land.</p>
Ground Investigation	
Ground Conditions Encountered	<p>Topsoil (maximum proven depth 0.47m bgl)</p> <p>Head Deposits (maximum proven depth 2.40m bgl)</p> <p>Lowestoft Formation (Diamicton) (maximum proven depth 20.0m bgl)</p>
Groundwater	<p>Groundwater was encountered across the larger site area at between 1.00m bgl and 4.50m bgl during a previous site investigation, and in the MLM supplementary investigation at 18.50m bgl.</p> <p>During subsequent monitoring visits, groundwater was recorded at depths between 2.70m and 3.40m bgl.</p>
Geotechnical Assessment	
Excavations	Heavy duty excavation plant may be required to excavate to proposed construction depths.
Bridge Foundations	The proposed bridge foundations should be suitable for the proposed development, as settlement is shown to be less than 25mm, and the proposed foundation depth is shown to be out of the zone of influence of trees at the site.
Pavements	Design CBR of 4% on natural fine soils.
Buried Concrete	<p>Head Deposits: Design Sulphate Class – DS1 and ACEC Class – AC1</p> <p>Lowestoft Formation: Design Sulphate Class – DS2 and ACEC Class – AC2</p>

2 Limitations and Exceptions

- 1 This report and its findings should be considered in relation to the terms and conditions proposed and scope of works agreed between MLM Consulting Engineers Ltd (MLM) and the client.
- 2 The Executive Summary, Conclusions and Recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon until considered in the context of the whole report and the development, if any, proposed.
- 3 The assessment and interpretation of contamination and associated risks are based on the scope of work agreed with the client and the report may not be sufficient to fully address contaminations or to allow detailed remediation design to proceed without further investigation and analysis.
- 4 Any assessments made in this report are based on the ground conditions as revealed by the exploratory holes and pits, together with the results of any field or laboratory testing undertaken and, where appropriate, other relevant data which may have been obtained for the sites including previous site investigation reports. There may be special conditions appertaining to the site, however, which have not been revealed by the investigation and which have not, therefore, been taken into account in the report. The assessment may be subject to amendment in the light of additional information becoming available.
- 5 Interpretations and recommendations contained in the report represent our professional opinions, which were arrived at in accordance with currently accepted industry practices at the time of reporting and based on current legislation in force at that time.
- 6 Where the data available from previous site investigation reports, supplied by the Client, have been used, it has been assumed that the information is correct. No responsibility can be accepted by MLM for inaccuracies within the data supplied.
- 7 Whilst the report may express an opinion of possible configuration of strata between or beyond exploratory hole or pit locations, or on the possible presence of features based on visual, verbal or published evidence, this is for guidance only and no liability can be accepted for the accuracy.
- 8 Comments on groundwater conditions are based on observations made at the time of the investigation unless otherwise stated. It should be noted that groundwater levels can vary due to seasonal or other effects.
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- 10 This report is prepared and written in the context of the proposals stated in the introduction to this report and should not be used in a differing context. Furthermore, new information, improved practices and legislation may necessitate an alteration to the report in whole or in part after its submission. Therefore, with any change in circumstances or after the expiry of one year from the date of the report, the report should be referred to us for re-assessment and, if necessary, re-appraisal.

3 Introduction

3.1 General

This report has been prepared by MLM Consulting Engineers Ltd (MLM) on the instructions of Persimmon Homes Essex (Client), which is proposing to construct a new relief road to the northwest of Haverhill, which will include the construction of a bridge over an existing water-bearing ditch in the west of the site.

The objective of this report is to provide an assessment of ground conditions, and to provide recommendations and parameters for geotechnical design of the proposed bridge at the western end of the site and assessment of strength of the sub grade to the proposed road construction.

3.2 Terms of Reference

The terms of reference for the work were set out in two MLM proposals, in reference to parameters for the bridge design in ref. 619132-MLM-ZZ-XX-CP-J-0001 dated 20 March 2018, and in reference to additional investigation to confirm the findings of the slope stability assessment, in the fee proposal ref. 619132-MLM-ZZ-XX-CP-J-0002, dated 21 March 2018.

3.3 Technical Approach

The geoenvironmental and geotechnical work undertaken by MLM follows the Association of Geotechnical and Geoenvironmental Specialists (AGS) *Good Practice Guidelines for Site Investigations*.

The process of contamination assessment adopted in this report generally follows the model procedures for the management of contaminated land described in the Environment Agency Contaminated Land Report 11. It also takes into account the guidance issued in the National Planning Policy Framework (NPPF).

The format of the report is in general accordance with the reporting requirements of BS5930:2015.

3.4 Proposed Development

It is understood that the proposed development will comprise a relief road running along the northern boundary of a new development in northwest Haverhill. The design of the road is set out in MLM drawing ref. 612263/71 Rev 1.

For the proposed bridge, it is understood that a pad solution is being considered for the foundations.

4 The Site

4.1 Location and Description

The site is located to the north of a proposed residential development, located approximately 1.4km to the north of Haverhill town centre.

The new relief road is orientated in a roughly east west direction, the eastern end of the road is at approximate National Grid Reference 567831, 246772 and joins the A143 (Haverhill Road); the western end is at grid reference 566157, 246910 and joins a roundabout on Hales Barn Road. The overall length of the proposed road is approximately 1.8km.

The relief road crosses over undeveloped agricultural land, divided up by a number of field boundaries, formed by hedgerows and drainage ditches. The biggest water-bearing ditch is adjacent to the existing roundabout to the west of the proposed road development.

Mature high and moderate water demand trees have been noted within the larger site area, including an ash and hawthorn tree in the area of the proposed new bridge.

The topography across the site varies from approximately 77m OD from the western end of the site, varying along the road alignment with approximate levels of 86m OD, 97m OD, 92m OD, 108m OD; and 102m OD at the eastern end of the site. Due to the variations in levels along the road, it will be formed at grade, in cut and on an embankment.

A location plan showing the road alignment is presented as Figure 1.

4.2 Geology

The geological map of the area shows the site to be underlain by the Lowestoft Formation (Diamicton), over Lewes Nodular and Seaford Chalk Formation deposits.

4.3 Hydrogeology

The Environment Agency website provides the following hydrogeological information:

Table 4.1 Aquifer Properties

Aspect	Designation	Description
Groundwater Source Protection Zone Eastern third of road	SPZ2	Outer protection zone. Defined by a 400 day travel time from a point below the water table. This zone has a minimum radius of 250 or 500m around the source, depending on the size of the abstraction.
Groundwater Source Protection Zone Central and western site areas	No SPZ	The site is not within a catchment area where groundwater is discharged to a source.

Aspect	Designation	Description
<p>Aquifer Designation – Superficial Deposit</p> <p>Lowestoft Formation</p>	<p>Secondary Aquifer (undifferentiated)</p>	<p>Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.</p> <p>Assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.</p>
<p>Aquifer Designation – Bedrock Deposit</p> <p>Lewes Nodular and Seaford Chalk Formation</p>	<p>Principal Aquifer</p>	<p>These are deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.</p>

4.4 Hydrology

There are four drainage ditches crossing the path of the proposed relief road.

5 Ground Investigation

5.1 Site Work

Site work combines information from a ground investigation undertaken by GEL (ref. 995,SI/SG,PD/09.12.14/V1, dated 9 December 2014) as well as information from a supplementary investigation undertaken by MLM in June 2018.

Table 5.1 Summary of Exploratory Holes (all phases)

Type	Ref.	Depth Range (m bgl)
Cable percussion boreholes	BH5* CP101 to CP102	10.00 –20.00
Windowless sampler boreholes	WS1, WS4, WS6, WS7, WS18, WSF* WS101 to WS107	1.89 –5.00
Trial pits	TP5, TP7, TP17, TP17, TP24, TP31, TP32, TP33* TP101 to TP109	1.20 –3.00
In-situ CBR tests	CBR101 to CBR116	0.40m

* Relevant holes from previous GEL investigation

The exploratory holes undertaken by MLM were set out by an MLM engineer targeting areas not previously investigated and at locations to maximise the available data, whilst operating within the constraints of the site.

All exploratory holes were logged by a geoenvironmental engineer in general accordance with BS5930:2015.

The exploratory hole logs are presented in Appendix A.

5.2 Investigation Rationale

The rationale for the MLM investigation is presented in Tables 6.2:

Table 5.2 MLM Rationale for Geotechnical Sampling and Testing

Target/Area	Potential Geotechnical Feature	Exploratory Hole(s)
Areas of proposed cut	Ground conditions under proposed roadway	TP101 to TP109
Proposed bridge construction	Bridge foundation design	CP101, CP102, WS106 and WS107
Road sections to be constructed at existing site level	Strength of road formation	CBR101 – CBR116

Proposed cable percussive boreholes to the east of the existing ditch were replaced with windowless sampler boreholes due to access issues.

The locations of all the exploratory holes are presented on Drawing, 775823-MLM-ZZ-XX-DR-J-0005-S2-CO1.

5.3 Installations

Groundwater monitoring standpipes were installed in CP102, WS7 and WS102.

Details of the installations are provided on the relevant borehole logs.

5.4 In Situ Testing

Standard penetration tests (SPTs) were undertaken at regular intervals in the cable percussion and windowless sampler boreholes.

In situ CBR testing was undertaken in locations where the current elevations are approximately at formation.

SPT types and depths are recorded on the relevant exploratory hole records, with in-situ CBR testing results saved in Appendix B.

5.5 Sampling

Geotechnical undisturbed samples were recovered from the cable percussion borehole in U100 tubes.

Continuous soil cores were recovered from the windowless sampler boreholes in clear PVC liners to prevent cross contamination and aid sample recovery.

Disturbed samples were recovered from all exploratory holes, in bulk bags and/or tubs depending on the soil types and proposed laboratory testing. In locations where cut is proposed, samples for lab-based CBRs were taken.

Sample types and depths are recorded on the relevant exploratory hole records.

5.6 Post-Fieldwork Monitoring

Post-fieldwork monitoring of groundwater levels has been undertaken on one occasion following the site investigation.

5.7 Laboratory Analysis

The following laboratory tests were scheduled on samples recovered by MLM from the exploratory holes.

Table 5.3 Summary of Geotechnical Testing

Test	No.
Natural moisture content	46
Atterberg limits	37
Bulk density	9
Undrained triaxial shear strength	7
One dimensional oedometer consolidation	4
pH and sulphate	31

Geotechnical testing was undertaken by a UKAS-accredited laboratory to BS1377 and the results are presented in Appendix B.

6 Ground and Groundwater Conditions

6.1 General

The following sections include data from the previous investigation by GEL dated 2014.

The following general strata sequence was encountered across the site. Interpolation between exploratory hole positions has been undertaken based on visual observations and laboratory testing.

Table 6.1 Generalised Strata Sequence

Stratum	Depth range (m bgl)		Proven Thickness range (m)
	Top	Base	
Topsoil	GL	0.10 – 0.60	0.10 – 0.60
Head Deposits	0.25 – 0.60	1.30 – 2.40	1.10 – 2.15
Lowestoft Formation*	0.10 – 2.40	1.20 – 20.00	0.10 – 17.60

* Base of stratum not proven in all holes

The findings of the ground investigations generally do not match the published geology for the area, with Head deposits encountered above the Lowestoft Formation across part of the site.

6.2 Topsoil

For the purposes of this report topsoil is defined as a near surface soil which appears from visual inspection alone to be capable of supporting plant growth. The description of topsoil within this report does not imply compliance with BS3882.

Topsoil was recorded in all exploratory hole locations across the site, to depths of between 0.10m and 0.60m bgl. It generally comprised a clay soil, with varying amounts of silt, sand and gravel comprising flint, brick, charcoal, clinker and chalk.

6.3 Head Deposits

Firm sandy gravelly clay deposits were encountered in two northwest-southeast bands across the site, and in the far west of the site, where deposits in part comprised silty gravelly sands. Significantly lower SPTs were encountered in the west of the site, in the location of the proposed road bridge. These have been recorded as being Head deposits. The gravel component comprised chalk, flint and occasional sandstone and mudstone, with occasional bands of sand. No exploratory holes were terminated in this strata.

6.4 Lowestoft Formation (Diamicton)

Underlying the topsoil and/or Head deposits, a firm to stiff gravelly clay was recorded across the site, with the gravel component comprising flint, chalk and occasional limestone and fossils, which were considered to be representative of the Lowestoft Formation deposits. In CP01, in the west of the site, a silty gravelly sand with bands of sandy silty clay was encountered at depth. All exploratory holes were terminated within this strata.

6.5 Groundwater Conditions

Groundwater was encountered during the initial ground investigation within TP7, WS18 and WSF at depths ranging from 1.0m to 1.8m bgl, within the granular Head deposits, and in the supplementary investigation in CP01, in the west of the site, at 18.50m bgl in the granular Lowestoft Formation deposits. It is considered to be perched groundwater, rather than being representative of the groundwater in the area.

There was only one well along the length of the roadway in the initial investigation, in WS7, where groundwater was encountered between 2.70m and 3.40m bgl during monitoring visits. In the wells installed during the supplementary investigation (CP102 and WS102), groundwater was encountered at 2.87m and 2.98m bgl during the one monitoring visit undertaken.

7 Material Properties

7.1 General

The following sections include data from the previous investigation by GEL dated December 2014 (Ref: 995,SI/SG,PD/09.12.14/V1).

The following presents a summary of the properties of the soils encountered, based on field observations, in situ field testing and laboratory test results.

For the purposes of property designation, soils are divided into fine soils (clays and silts) and coarse soils (sands and gravels).

Soil plasticity class for fine soils is based on the classification system of BS5930, adopting modified plasticity index values (based on percentage passing 425 μ m sieve).

Volume change potential of fine soils on change of moisture content has been assessed using guidance provided in BRE Digest 240 - Part 1.

Equivalent approximate undrained shear strengths (c_u) and equivalent approximate coefficients of volume compressibility (m_v) have been calculated from recorded SPT N values, adopting f_1 and f_2 values respectively (based on CIRIA 143) appropriate to the recorded plasticity.

7.2 Head Deposits

Relief Road Construction

Natural moisture contents in the fine fraction of these materials range from 19% to 24% in the three samples tested, with modified plasticity indices ranging from 21% and 31%. On this basis these soils are classified as of intermediate and high plasticity (CI/CH soils) and of medium swelling/shrinkage potential on change of moisture content.

In situ SPT N values within the fine fraction of these materials range from 6 to 14. Approximate undrained shear strengths based on these results range from 27kN/m² to 64kN/m², adopting an f_1 value of 4.6 (based on an 'average' plasticity of 27%). As shown on Figure 2 these values compare fairly well with the results of hand shear vane tests, which recorded undrained shear strengths of 36kN/m² to 70kN/m² on samples from 0.7m bgl to 1.5m bgl.

Proposed Bridge Location

A band of silty sandy gravel was encountered in one location in the area of the proposed bridge footings. A single in situ SPT N value of 10 was recorded in this stratum, showing the deposit to be between a loose and medium dense relative density. The angle of shearing resistance based on this is 30°.

Natural moisture contents in the fine fraction of these materials range from 17% to 21% in the three samples tested from this area of the site, with modified plasticity indices ranging from 10% and 23%. On this basis these soils are classified as of low to medium plasticity (CL/CI soils) and of low to medium swelling/shrinkage potential on change of moisture content.

In situ SPT N values within the fine fraction of these materials range from 3 to 8. Approximate undrained shear strengths based on these results range from 17kN/m² to 44kN/m², adopting an f_1 value of 5.5 (based on an 'average' plasticity of 19%).

Approximate coefficients of volume compressibility (m_v) have been derived solely from the in situ SPTs in CP101, CP102 and WS106, where Head Deposits were encountered in the vicinity of the proposed bridge. Values in the fine fraction of these materials range from 0.227m²/MN to 0.606m²/MN adopting an f_2 value of 0.55 (based on the 'average' plasticity).

7.3 Lowestoft Formation

Relief Road Construction

Recorded natural moisture contents in the fine fraction of these materials range from 15% to 29%, and plasticity indices from 14% to 32%. On this basis these soils are classified predominantly as of low to intermediate plasticity (CL/CI soils) and occasionally high plasticity (CH soils). The soils are classified as low to medium swelling/shrinkage potential on change of moisture content.

In situ SPT N values within the fine fraction of these materials range from 8 to 74, with SPT N values generally increasing with depth. Approximate undrained shear strengths based on these results range from 41kN/m² to 377kN/m², adopting an f_1 value of 0.48 (based on an 'average' plasticity of 25%). Hand shear vane results from depths of 0.5m to 4.0m bgl generally recorded undrained shear strengths of 48kN/m² to 140kN/m².

Proposed Bridge Location

Recorded natural moisture contents in the fine fraction of these materials range from 17% to 25%, and modified plasticity indices from 7% to 30%. On this basis these soils are classified as of low to intermediate plasticity (CL/CI) soils. The soils are classified as low to medium swelling/shrinkage potential on change of moisture content.

In situ SPT N values within the fine fraction of these materials range from 8 to 38, with SPT N values generally increasing with depth. As the proposed bridge footings will be at approximately 77.1m AOD, only SPT N values below this depth have been used in this assessment, and therefore values range from 13 to 38 have been adopted for this part of the site. Approximate undrained shear strengths based on these results range from 77kN/m² to 220kN/m², adopting an f_1 value of 5.8 (based on an 'average' plasticity of 18%). As shown on Figure 2 these values are shown to be fairly conservative when compared with the results of the laboratory triaxial tests, where undrained shear strengths of 80kN/m² to 350kN/m² are recorded on samples from 1.2m bgl to 9.5m bgl.

Approximate coefficients of volume compressibility (m_v), again only from CP101, CP102, WS106 and WS107 in close proximity to the proposed bridge have been calculated from the SPTs. Values in the fine fraction of these materials range from 0.045m²/MN to 0.13m²/MN adopting an f_2 value of 0.59 (based on the 'average' plasticity).

7.4 Summary

Based on the results of the in-situ testing and lab results, the following design parameters have been established:

Table 7.1 Relief Road Construction

Stratum	Parameter	Result range		Design Parameter/ Range	Justification
		Minimum	Maximum		
Head Deposits – Relief Road Construction	In situ SPT value (N) (fine soils)	6	14	78.0m = 6 plus 2 per metre	Increasing with depth
	Natural moisture content (%)	19	24	21	Average value
	Plasticity Index* (%)	23	31	27	Average value
	Undrained cohesion (c_u) (kN/m ²) (based on SPT N values and hand shear vane results)	27	64	40	Adopted value
	Weight density (kN/m ³) (fine soils)	-	-	20	Assumed value
	Water soluble sulphate content (mg/l)	20	40	40	Assumed based on maximum value recorded in Head Deposits on site
	pH value	7.3	7.8	7.3	Assumed based on maximum value recorded in Head Deposits on site
	Lab based CBRs	4.2	7.5	4.2	Minimum value

Stratum	Parameter	Result range		Design Parameter/ Range	Justification
		Minimum	Maximum		
Lowestoft Formation (Diamicton) – Proposed roadway	In situ SPT value (N) (fine soils)	8	74	79.0m = 8 plus 1.5 per metre	Increasing with depth
	Natural moisture content (%)	15	29	19	Average value
	Plasticity Index* (%)	7	30	19	Average value
	Undrained cohesion (c_u) (kN/m ²) (based on SPT N values and hand shear vane results)	23	377	50	Adopted value for deposit
	Weight density (kN/m ³) (fine soils)	-	-	20	Assumed value
	Water soluble sulphate content (mg/l)	<10	1420	1420	Maximum value
	pH value	6.9	7.8	6.9	Minimum value
	In-situ and lab based CBRs	2.1	14	2.1	Minimum value

* modified

Table 7.2 Bridge Foundations

Stratum	Parameter	Result range		Design Parameter/ Range	Justification
		Minimum	Maximum		
Head Deposits – Bridge structure	In situ SPT value (N) (fine soils)	3	8	3	Minimum value
	In site SPT value (N) (coarse soil)	10	10	10	Single recorded value
	Natural moisture content (%)	17	21	18	Average value
	Plasticity Index* (%)	10	23	19	Average value
	Undrained cohesion (c_u) (kN/m ²) (based on SPT N values, lab triaxial and hand shear vane results)	17	44	20	Conservative value adopted for deposit

Stratum	Parameter	Result range		Design Parameter/	Justification
		Minimum	Maximum	Range	
	Co-efficient of volume compressibility (mv) (m ² /MN) (based on SPT N values)	0.227	0.606	0.455	Conservative value adopted for deposit
	Young's modulus (E') (kPa) (based on c _u)	3570	9240	4200	Conservative value adopted for deposit
	Weight density (kN/m ³) (fine soils)	-	-	20	Assumed value
	Water soluble sulphate content (mg/l)	20	40	40	Maximum value
	pH value	7.3	7.8	7.3	Maximum value
Lowestoft Formation (Diamicton) – Bridge structure	In situ SPT value (N) (fine soils)	13	35	13	Minimum value
	Natural moisture content (%)	15	29	19	Average value
	Plasticity Index* (%)	7	30	18	Average value
	Undrained cohesion (c _u) (kN/m ²) (based on SPT N values and triaxial results)	75	224	85	Conservative value taken for whole deposit
	Co-efficient of volume compressibility (mv) (m ² /MN) (based on SPT N values)	0.034	0.212	0.1	Conservative value taken for whole deposit
	Young's modulus (E') (kPa) (based on c _u)	15750	47040	17850	Conservative value taken for whole deposit
	Weight density (kN/m ³) (fine soils)	-	-	20	Assumed value
	Water soluble sulphate content (mg/l)	<10	1420	1420	Maximum value
	pH value	6.9	7.8	6.9	Minimum value

* modified

8 Geotechnical Assessment

8.1 General

This geotechnical assessment is based on the parameters determined from the field work and laboratory analysis as described in section 8. It presents a geotechnical assessment of possible foundation solutions for the proposed bridge, and infrastructure design for the new relief road.

The road construction will include extensive earthworks activity, with cut and fill sections proposed along the length of the roadway. A separate slope stability assessment has been undertaken for the slopes forming the cut/fill road alignment (ref. 619132-MLM-ZZ-XX-RP-J-0001-S2-C02, October 2018).

8.2 Excavations

Future road levels are proposed to be up to 4.2m below existing levels, and may require heavy-duty excavation plant to extend through the stiff clays at depth.

Instability of excavation faces was not noted during excavation of the trial pits, however random and sudden falls should be expected from the faces of near vertically sided excavations put down at the site. This situation is likely to be prevalent in the natural coarse soils and low strength natural fine soils.

Temporary trench support, or battering of excavation sides, is likely to be required for all excavations that are to be left open for any length of time, and will definitely be required where man entry is required.

Particular attention should be paid to excavation at, or close to, site boundaries, where collapse of excavation faces could have a disproportionate effect.

A risk assessment of the stability of any open excavation should be undertaken by a competent person and appropriate measures adopted to ensure safe working practise in and around open excavations. Further guidance on responsibilities and requirements for working near, and in, excavations can be obtained from the Construction Design and Management Regulations (2015).

During the investigations along the roadway, groundwater was generally not encountered within likely excavation depths, other than where seepages were encountered in the Head deposits in TP7, WS18 and WSF, at depths between 1.0m and 1.8m bgl. These locations are not located in areas where excavations are proposed, and therefore based on site observations, it is considered that sump pumping is likely to be sufficient to deal with anticipated flows.

Groundwater was not encountered in the boreholes in the area of the proposed bridge development, however groundwater was present during monitoring at 2.87m bgl in the borehole adjacent to the bridge, during a subsequent monitoring visit. Construction activities will need to account for water in the existing channel, as well as groundwater, with higher levels likely during wetter months. Dewatering requirements will be subject to actual groundwater and ditch water levels at the time of construction. Temporary works may require some form of dewatering scheme (eg cut off walls) to control groundwater ingress into open excavations.

Any water pumped from excavations is likely to need to be passed via settlement tanks before being discharged to the sewer; discharge consents will also be required.

8.3 Bridge Foundations

The appropriate foundation solution adopted for the site will depend not only on ground conditions, but also on structural loading, load distribution and the limiting criteria for movement or settlement of the structure, which may have high specification finishes and unevenly distributed loadings so that settlement, and particularly differential settlement, will need to be maintained within tight tolerances.

The Head Deposits in the area of the proposed bridge are considered unsuitable in their present condition for use as founding soils, on the basis of their relatively low strength and high compressibility. These deposits should be fully penetrated by all new foundations.

The soils in this area of the site are of low to medium swelling/shrinkage potential on change of moisture content, and the moisture content testing does not show any evidence in of desiccation in these soils.

Trees are noted in the adjacent to the proposed bridge, with a 15m moderate water demand tree and a 7m high water demand tree located in the existing ditch. As bridge foundations are currently proposed at depths of approximately 2.80m below existing ground level, it is considered that, in accordance with NHBC standards, the foundations are outside the zone of influence of the trees to be removed.

Where trees are to be removed, the roots should be grubbed out and foundations extended to below the zone of disturbance created by this activity.

It is understood that the proposed bridge will be founded on two large strip foundations, 2m wide and 19.8m long; the long axis of the foundations running parallel to the ditch. The foundations will be founded at a depth of 2.8m bgl, into the Lowestoft Formation (Diamicton) deposits. The foundation excavations will be battered back, and once the foundations are constructed, the excavations will be backfilled with a 6N fill.

Settlement analysis has been carried out for the proposed foundations using the Oasys software PDISP, version 19.2. For the settlement analysis, an initial worst case load scenario of 120kN/m² was used in the assessment. Based on the geotechnical testing undertaken, assuming a Young's Modulus (E') of 17850kN/m² for the underlying clay soils, settlement of 24.6mm is calculated using the Boussinesq method of calculating settlement. It is understood that this settlement is within the acceptability envelop of the proposed structure and no further refinement of the loadings is warranted.

The Lowestoft Formation is an over consolidated clay and can swell and soften readily when allowed access to free water. Groundwater monitoring indicates the presence of groundwater at the site, as well as the stream being present through the centre of the existing ditch. Therefore, care will be required to ensure that foundation excavations are kept as free of water as practicable and that concrete is poured as soon as practicable after excavation.

8.4 Road Construction

Following site preparation/regrading the sub-grade will comprise Lowestoft Formation deposits across the majority of the site, with Head Deposits present in two bands across the site. In-situ CBRs were undertaken along the length of the proposed roadway, in locations where fill is not proposed. CBR values of between 3.5% and 14% were recorded, with natural moisture contents of between 9% and 25%. Typically, the higher the moisture content, the lower the CBR value and in the most part the majority of the CBR values ranged between 3.5% and 5.8%, with moisture contents in the range of 18% and 25%.

In comparison, assuming an average plasticity of 25%, in accordance with Table 5.1 of Interim Advice Note 73/06 Revision 1 (2009) an equilibrium subgrade CBR value of 3-4% is estimated assuming a thin construction.

Whilst higher CBR values have been recorded, these higher values are due to the lower moisture contents, and following wetting of these soils CBR values will significantly decrease. Based on the testing undertaken, and in line with published guidance, a design value of 4% is considered appropriate at the site.

8.5 Below Ground Concrete Design

Based on the results of the pH and water soluble sulphate determinations on soil samples and in accordance with the categorisation system of BRE Special Digest 1, the soils below the site fall within the classes presented in Table 8.1 below.

Table 8.1 Summary of Concrete Design Class

Soil Type	Design Sulphate Class (DS)	Aggressive Chemical Environment for Concrete (ACEC)
Head Deposits	DS - 1	AC - 1
Lowestoft Formation	DS - 2	AC - 2

9 Summary and Recommendations

The site is underlain by Head Deposits, in three areas of the site, over Lowestoft Formation deposits, which are present from the surface across the majority of the site area.

9.1 Geotechnical

The proposed bridge will be founded on concrete strip foundations, 2.0m by 19.8m in size.

The foundations will be founded into the underlying Lowestoft Clays, from depths of 2.8m bgl.

Settlement analysis, assuming a worst-case load of 120kN/m², has calculated less than 25mm settlement, which is understood to be in acceptable limits of the proposed structure.

The trees present in the area of the proposed bridge should not impact on the foundations, as at approximately 2.8m bgl the foundations are outside the zone of influence based on tree height and type.

Water was present in the well adjacent to the proposed bridge structure, and construction activities will need to take into account surface water, in the existing channel, and groundwater during the build phase. Some form of groundwater control may be required, eg cut off walls.

Based on the classification of the formation soils and in situ CBR testing an overall design CBR of 4% should be available, following proof rolling of the formation. Drainage control will be required on site.

The Head Deposits at the site fall within Design Sulphate Class DS-1 with a corresponding ACEC Class of AC-1, whereas the Lowestoft Formation deposits are classified as DS-2 and AC-2.

10 References

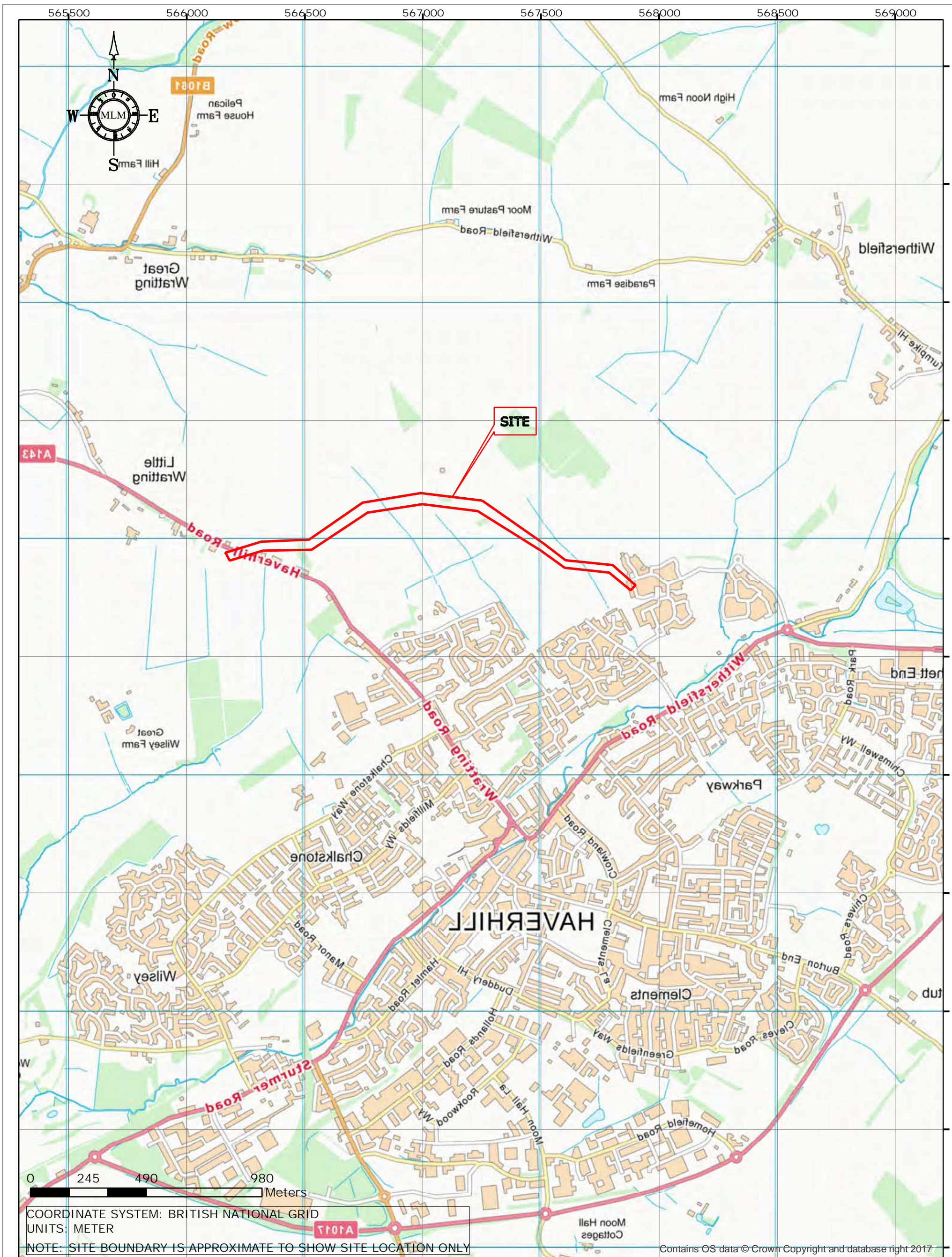
- 1 Association of Geotechnical and Geoenvironmental Specialists (2004) A clients guide to site investigations.
- 2 Association of Geotechnical and Geoenvironmental Specialists (2006) AGS guidelines for good practise in site investigations.
- 3 Association of Geotechnical and Geoenvironmental Specialists (1999) Code of conduct for site investigations.
- 4 Association of Geotechnical and Geoenvironmental Specialists (2005) Management of risk associated with the preparation of ground reports.
- 5 Association of Geotechnical and Geoenvironmental Specialists (2005) Guidelines for the preparation of the ground report.
- 6 Association of Geotechnical and Geoenvironmental Specialists (2000) Guidelines for combined geoenvironmental and geotechnical investigations.
- 7 British Standards Institution (2011) Investigation of potentially contaminated sites - code of practice. BS10175:2011.
- 8 British Standards Institution (2010) Code of practice for site investigation. BS5930:2015.
- 9 British Standards Institution (1990) Methods of test for civil engineering purposes. BS1377:1990.
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- 12 British Geological Survey (2002) Sheet 205 Saffron Walden. 1:50,000 scale Geology Map, Solid and Drift Edition.
- 13 Building Research Establishment (1993) Building on shrinkable clay. BRE Digest 240 - Part 1.
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- 16 CIRIA (1995) The standard penetration test (SPT). Methods and use. CIRIA Report C143.
- 17 Hatanaka M and Uchida A (1996) Empirical correlation between penetration resistance and effective friction of sandy soil. Soils and Foundations, Vol 36 (4), 1-9.
- 18 Hansen J and Brinch A (1961) General formula for bearing capacity. Danish Geotechnical Institute Bulletin No. 11.
- 19 Hansen J and Brinch A (1968) A revised extended formula for bearing capacity. Danish Geotechnical Institute Bulletin No. 28.
- 20 Hansen J and Brinch A (1978) A code of practise for foundation engineering. Danish Geotechnical Institute Bulletin No. 32.
- 21 Highways Agency (2009) Interim Advice Note 73/06 - Revision 1 - Design guidance for road pavement foundations.

Figures

Figure 1: Site Location Plan

Figure 2: SPT N Values vs Depth

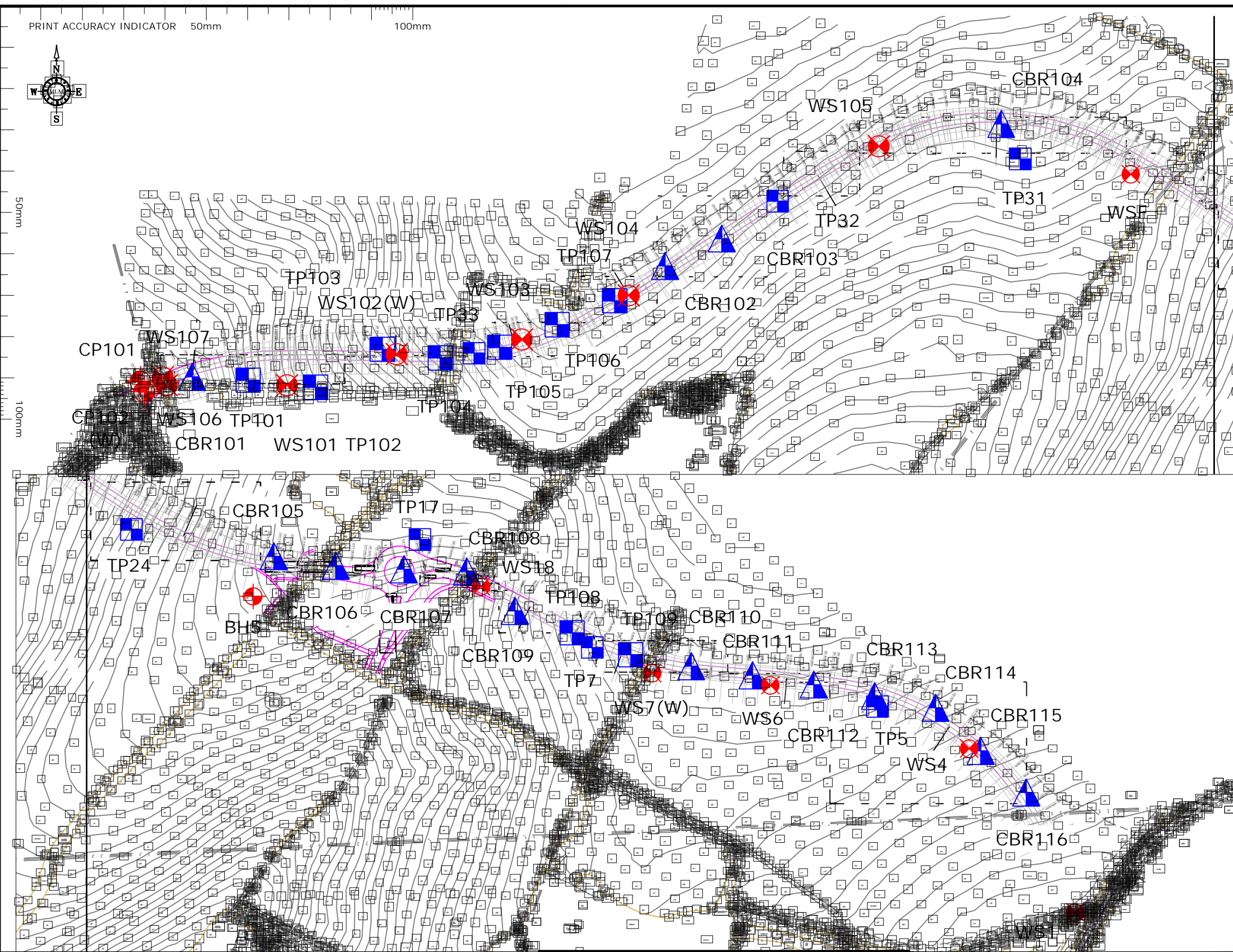
Figure 3: Shear Strength vs Depth



PROJECT		NORTHWEST HAVERHILL RELIEF ROAD		MADE	AC	CHECKED	HC
SITE LOCATION PLAN		MLM REF.		SUITABILITY	S2	REVISION	C01
PROJECT	ORIGINATOR	VOLUME/SYSTEM	LEVELS/LOCATIONS	TYPE	ROLE	NUMBER	
775823	MLM	ZZ	XX	DR	J	FIG 1	

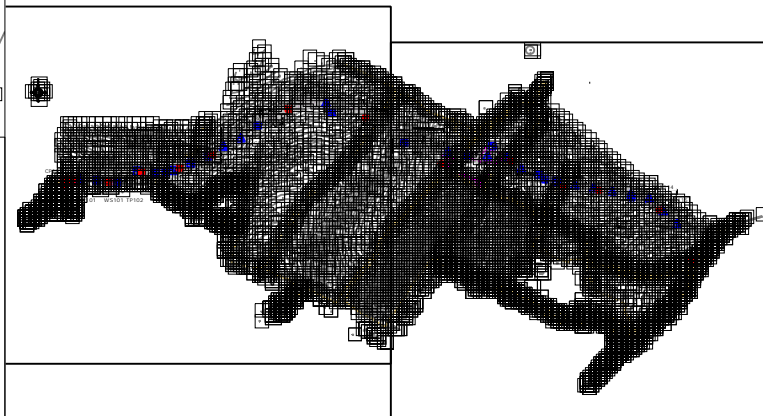
Drawings

775823-MLM-ZZ-XX-DR-J-0005 Exploratory Hole Location Plan



NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERS, ARCHITECTS AND SPECIALISTS DRAWINGS AND THE SPECIFICATION.
2. DO NOT SCALE FROM THIS DRAWING MANUALLY OR ELECTRONICALLY. WRITTEN PERMISSION MUST BE OBTAINED FROM MLM PRIOR TO SCALING ELECTRONICALLY OR USING THIS ELECTRONIC FILE.
3. BASE PLAN TAKEN FROM TOPOGRAPHICAL SURVEY REF. 20774se-01 BY SURVEY SOLUTIONS DATED 17.11.2017 AS PROVIDED BY THE CLIENT.
4. LAYOUT PLAN PROVIDED BY THE CLIENT.
5. ROAD ALIGNMENT TAKEN FROM MLM CIVIL ENGINEERS DRAWING REF. 619132-MLM-ZZ-XX-DR-C-0034-S2-P01 DATED 09.02.2018.



LEGEND

	CP1	CABLE PERCUSSION BOREHOLE LOCATION
	WS1	WINDOWLESS SAMPLER BOREHOLE LOCATION
	WS1	CBR TEST LOCATION
	TP1	TRIAL PIT LOCATION

C01	13.09.2018		AC	HC	JM
REV	DATE	REVISION	MADE	CHK	APP
FINAL ISSUE					
SUITABLE FOR INFORMATION					

Building 7200,
Cambridge Research Park,
Cambridge, CB25 9TL
Tel: 01223 632800
Website: www.mlmgroupp.com

CLIENT

PROJECT
NORTHWEST HAVERHILL RELIEF ROAD

DRAWING TITLE
EXPLORATORY HOLE LOCATION PLAN - RELIEF ROAD & BRIDGE









DRAWN/DESIGN	AC	STATUS	MLM REF	REVISION		
SCALE	NTS @A3	S2	775823	C01		
PROJECT	ORIGINATOR	VOLUME/ SYSTEM	LEVELS & LOCATIONS	TYPE	ROLE	NUMBER
619132-MLM-ZZ-XX-DR-J-0005						

Annex Exploratory Hole Logs



KEY TO BOREHOLE, TRIAL PIT AND WINDOW SAMPLE LOGS

SOIL STRATA

STRATA





	MADE GROUND / FILL
	TOPSOIL
	COBBLES AND BOULDERS
	GRAVEL
	SAND
	SILT
	CLAY
	PEAT

WATER

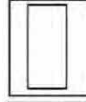
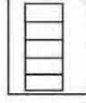

	WATER STRIKE
	WATER STANDING

BACKFILL / INSTALLATIONS

Backfill Details

	CONCRETE
	BENTONITE
	FILTER/GRAVEL
	ARISINGS BACKFILL

Pipe Details

	PLAIN PIPE
	SLOTTED PIPE
	PIEZOMETER TIP

SAMPLES

U100	OPEN DRIVE TUBE SAMPLE (100 mm NOMINAL DIAMETER)
UT100	OPEN DRIVE THIN WALL TUBE SAMPLE (100 mm NOMINAL DIAMETER)
U38	OPEN DRIVE TUBE SAMPLE (38 mm NOMINAL DIAMETER)
P	PISTON SAMPLE (100 mm NOMINAL DIAMETER UNLESS NOTED OTHERWISE)
D	SMALL DISTURBED SAMPLE
B	BULK DISTURBED SAMPLE
BLK	BLOCK SAMPLE
C	ROTARY CORE SAMPLE
G	GAS SAMPLE
U	UNDISTURBED SAMPLE
UT	TUBE SAMPLE
ES	ENVIRONMENTAL SAMPLE
W	WATER SAMPLE
SPTLS	STANDARD PENETRATION TEST LINER SAMPLE

IN SITU TESTING

S	STANDARD PENETRATION TEST USING THE SPLIT SPOON SAMPLER
C	STANDARD PENETRATION TEST USING A SOLID CONE

WHERE A TEST HAS BEEN COMPLETED THE TYPE OF TEST AND THE N-VALUE WILL BE REPORTED.

WHERE THE FULL 300 mm PENETRATION OF THE MAIN DRIVE HAS NOT BEEN COMPLETED, THE NUMBER OF BLOWS (NOT AN N-VALUE) WILL BE REPORTED.

THE FIELD RECORDS COLUMN ON THE LOG WILL SHOW EACH SET OF BLOW COUNTS PER 75 mm OF PENETRATION INCLUDING SEATING BLOWS AND WILL ALSO INDICATE THE PARTIAL PENETRATION ACHIEVED (mm) FOR INCOMPLETE TESTS.



Project: Northwest Haverhill Relief Road
 Project ID: 775823
 Location: Haverhill
 Client: Persimmon Homes Essex
 Project Engineer: Hester Carter

Method: CP
 Start: 07/06/2018
 Finish: 07/06/2018

CP101

Level (mOD): 80.16
 Co-ordinates: 566175.56E -
 246941.32N

1:50
 Sheet 1 of 3
 Logged by:
 LE

Depth (m)	SPT Results (Type)	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend
D1 : 0.30m			79.66	0.50	
D2 : 0.70m				1	
1.20	N=3 (1,0/1,0,1,1) (S)		78.46	1.70	
D3 : 1.80m				2	
2.00	N=10 (1,1/2,2,3,3) (C)		77.76	2.40	
B1 : 2.00m				3	
D4 : 2.70m					
U1 : 3.00m					
D5 : 3.50m					
4.00	N=17 (2,2/3,4,4,6) (C)		75.96	4.20	
D6 : 4.50m				5	
U2 : 5.00m					
D7 : 5.50m				6	
7.10	N=19 (2,2/4,4,5,6) (S)			7	
				8	
D8 : 8.10m					
				9	
U3 : 9.10m					
D9 : 9.60m					



Project: Northwest Haverhill Relief Road
 Project ID: 775823
 Location: Haverhill
 Client: Persimmon Homes Essex
 Project Engineer: Hester Carter

Method: CP
 Start: 07/06/2018
 Finish: 07/06/2018

CP101

Level (mOD): 80.16
 Co-ordinates: 566175.56E -
 246941.32N

1:50
 Sheet 2 of 3
 Logged by:
 LE

Depth (m)	SPT Results (Type)	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend
11.10	N=20 (2,3/4,4,6,6) (S)			10	
D10 : 12.20m B2 : 12.40m				11	
U4 : 13.10m				12	
D11 : 13.60m				13	
				14	
15.00	N=22 (3,3/4,4,6,8) (S)			15	
D12 : 16.20m			64.16	16 16.00	
17.10 B3 : 17.20m	N=38 (4,4/7,8,9,14) (C)			17	
D13 : 18.30m				18	
19.00 B4 : 19.20m	50 (6,7/50 for 87mm) (S)		61.66	18.50	
19.80				19	



Project: Northwest Haverhill Relief Road
 Project ID: 775823
 Location: Haverhill
 Client: Persimmon Homes Essex
 Project Engineer: Hester Carter

Method: CP
 Start: 07/06/2018
 Finish: 07/06/2018

CP101

Level (mOD): 80.16
 Co-ordinates: 566175.56E - 246941.32N

1:50
 Sheet 3 of 3
 Logged by: LE

Depth (m)	SPT Results (Type)	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Inst/ Backfill	Water (m)
	50 (6,6/50 for 90mm) (S)		60.16	20 20.00		End of borehole at 20.00 m			
				21					
				22					
				23					
				24					
				25					
				26					
				27					
				28					
				29					

General Notes
 1. Shear Strengths determined by hand shear vane.
 2. See key sheet for explanation of symbols

Remarks
 1. Borehole backfilled with arisings upon completion.

Water Strike Details. Recorded in metres below ground level (m bgl)				
Date	Depth Encountered	Casing Depth	Inflow Remarks	Depth to water after 20 mins (m)
	18.50			



Project: Northwest Haverhill Relief Road
 Project ID: 775823
 Location: Haverhill
 Client: Persimmon Homes Essex
 Project Engineer: Hester Carter

Method: CP
 Start: 08/06/2018
 Finish: 08/06/2018

CP102

Level (mOD): 80.02
 Co-ordinates: 566178.73E -
 246933.39N

1:50
 Sheet 1 of 2
 Logged by:
 LE

Depth (m)	SPT Results (Type)	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend
D1 : 0.50m			79.77	0.25	
1.20 B1 : 1.20m	N=4 (1,1/1,1,1,1) (S)			1	
D2 : 1.90m 2.00 B2 : 2.20m	N=8 (1,1/2,2,2,2) (C)		78.22	1.80	
D3 : 2.60m				2	
U1 : 2.90m				3	
D4 : 3.30m				4	
4.10	N=13 (1,2/2,3,4,4) (S)			4	
D5 : 4.60m				5	
U2 : 5.00m			75.22	4.80	
D6 : 5.50m				6	
7.00	N=15 (1,2/3,3,4,5) (S)			7	
B3 : 7.20m				8	
D7 : 7.90m			72.52	7.50	
U3 : 9.10m				9	
D8 : 9.60m					



Project: Northwest Haverhill Relief Road
 Project ID: 775823
 Location: Haverhill
 Client: Persimmon Homes Essex
 Project Engineer: Hester Carter

Method: CP
 Start: 08/06/2018
 Finish: 08/06/2018

CP102

Level (mOD): 80.02
 Co-ordinates: 566178.73E -
 246933.39N

1:50
 Sheet 2 of 2
 Logged by:
 LE

Depth (m)	SPT Results (Type)	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend
D9 : 10.50m				10	
11.10 B4 : 11.30m	N=23 (3,3/5,5,6,7) (S)			11	
D10 : 12.30m 12.50	N=22 (2,3/4,5,6,7) (S)		67.52	12	
				12.50	
				13	
				14	
				15	
				16	
				17	
				18	
				19	



Project: Northwest Haverhill Relief Road
 Project ID: 775823
 Location: Haverhill
 Client: Persimmon Homes Essex
 Project Engineer: Hester Carter

Method: TP
 Start: 07/06/2018
 Finish: 07/06/2018

TP101

Level (mOD): 83.07
 Co-ordinates: 566262.48E -
 246942.50N

1:25
 Sheet 1 of 1
 Logged by:
 LE

INSITU TEST/SAMPLING

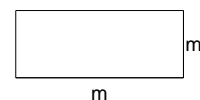
STRATA

Depth (m)	Sample Ref.	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend
			82.57	0.50	
			81.27	1.80	

Notes:
Shear strengths recorded using Pilicon Hand Shear Vane

Remarks
1. Trial pit backfilled with arisings upon completion.

Dimensions:



Stability:
 Plant Used:
 Mechanical Excavator



Project: Northwest Haverhill Relief Road
 Project ID: 775823
 Location: Haverhill
 Client: Persimmon Homes Essex
 Project Engineer: Hester Carter

Method: TP
 Start: 07/06/2018
 Finish: 07/06/2018

TP102

Level (mOD): 86.85
 Co-ordinates: 566316.69E - 246936.82N

1:25
 Sheet 1 of 1
 Logged by: LE

INSITU TEST/SAMPLING

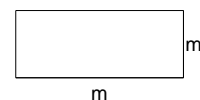
STRATA

Depth (m)	Sample Ref.	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend
			86.45	0.40	
				1	
				2	
			83.85	33.00	
				4	

Notes:
Shear strengths recorded using Pilicon Hand Shear Vane

Remarks
1. Trial pit backfilled with arisings upon completion.

Dimensions:



Stability:
 Plant Used:
 Mechanical Excavator



Project: Northwest Haverhill Relief Road
 Project ID: 775823
 Location: Haverhill
 Client: Persimmon Homes Essex
 Project Engineer: Hester Carter

Method: TP
 Start: 07/06/2018
 Finish: 07/06/2018

TP103

Level (mOD): 90.82
 Co-ordinates: 566370.50E -
 246967.34N

1:25
 Sheet 1 of 1
 Logged by:
 LE

INSITU TEST/SAMPLING

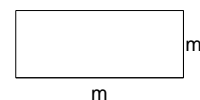
STRATA

Depth (m)	Sample Ref.	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend
			90.22	0.60	
			88.72	2.10	
			87.82	33.00	

Notes:
Shear strengths recorded using Pilicon Hand Shear Vane

Remarks
1. Trial pit backfilled with arisings upon completion.

Dimensions:



Stability:
 Plant Used:
 Mechanical Excavator



Project: Northwest Haverhill Relief Road
 Project ID: 775823
 Location: Haverhill
 Client: Persimmon Homes Essex
 Project Engineer: Hester Carter

Method: TP
 Start: 07/06/2018
 Finish: 07/06/2018

TP104

Level (mOD): 93.11
 Co-ordinates: 566417.18E - 246960.47N

1:25
 Sheet 1 of 1
 Logged by: LE

INSITU TEST/SAMPLING

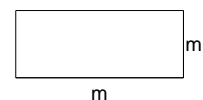
STRATA

Depth (m)	Sample Ref.	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend
			92.61	0.50	
				1	
				2	
			90.11	33.00	
				4	

Notes:
 Shear strengths recorded using Pilicon Hand Shear Vane

Remarks
 1. Trial pit backfilled with arisings upon completion.

Dimensions:



Stability:
 Plant Used:
 Mechanical Excavator



Project: Northwest Haverhill Relief Road
 Project ID: 775823
 Location: Haverhill
 Client: Persimmon Homes Essex
 Project Engineer: Hester Carter

Method: TP
 Start: 07/06/2018
 Finish: 07/06/2018

TP105

Level (mOD): 95.94
 Co-ordinates: 566465.30E -
 246969.11N

1:25
 Sheet 1 of 1
 Logged by:
 LE

INSITU TEST/SAMPLING

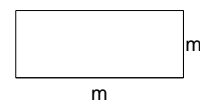
STRATA

Depth (m)	Sample Ref.	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend
			95.34	0.60	
				1	
				2	
			92.94	33.00	
				4	

Notes:
Shear strengths recorded using Pilicon Hand Shear Vane

Remarks
1. Trial pit backfilled with arisings upon completion.

Dimensions:



Stability:
 Plant Used:
 Mechanical Excavator



Project: Northwest Haverhill Relief Road
 Project ID: 775823
 Location: Haverhill
 Client: Persimmon Homes Essex
 Project Engineer: Hester Carter

Method: TP
 Start: 08/06/2018
 Finish: 08/06/2018

TP106

Level (mOD): 97.31
 Co-ordinates: 566511.60E -
 246987.38N

1:25
 Sheet 1 of 1
 Logged by:
 LE

INSITU TEST/SAMPLING

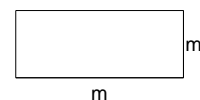
STRATA

Depth (m)	Sample Ref.	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend
			96.81	0.50	
			95.51	1.80	
			94.31	33.00	

Notes:
Shear strengths recorded using Pilicon Hand Shear Vane

Remarks
1. Trial pit backfilled with arisings upon completion.

Dimensions:



Stability:
 Plant Used:
 Mechanical Excavator



Project: Northwest Haverhill Relief Road
 Project ID: 775823
 Location: Haverhill
 Client: Persimmon Homes Essex
 Project Engineer: Hester Carter

Method: TP
 Start: 08/06/2018
 Finish: 08/06/2018

TP107

Level (mOD): 97.57
 Co-ordinates: 566558.01E -
 247006.54N

1:25
 Sheet 1 of 1
 Logged by:
 LE

INSITU TEST/SAMPLING

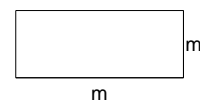
STRATA

Depth (m)	Sample Ref.	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend
			97.17	0.40	
			95.87	1.70	

Notes:
Shear strengths recorded using Pilicon Hand Shear Vane

Remarks
1. Trial pit backfilled with arisings upon completion.

Dimensions:



Stability:
 Plant Used:
 Mechanical Excavator



Project: Northwest Haverhill Relief Road
 Project ID: 775823
 Location: Haverhill
 Client: Persimmon Homes Essex
 Project Engineer: Hester Carter

Method: TP
 Start: 08/06/2018
 Finish: 08/06/2018

TP108

Level (mOD): 106.64
 Co-ordinates: 567433.08E -
 246957.83N

1:25
 Sheet 1 of 1
 Logged by:
 LE

INSITU TEST/SAMPLING

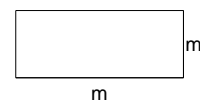
STRATA

Depth (m)	Sample Ref.	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend
			106.14	0.50	
			104.94	1.70	

Notes:
Shear strengths recorded using Pilicon Hand Shear Vane

Remarks
1. Trial pit backfilled with arisings upon completion.

Dimensions:



Stability:
 Plant Used:
 Mechanical Excavator



Project: Northwest Haverhill Relief Road
 Project ID: 775823
 Location: Haverhill
 Client: Persimmon Homes Essex
 Project Engineer: Hester Carter

Method: TP
 Start: 08/06/2018
 Finish: 08/06/2018

TP109

Level (mOD): 108.00
 Co-ordinates: 567480.17E -
 246940.13N

1:25
 Sheet 1 of 1
 Logged by:
 LE

INSITU TEST/SAMPLING

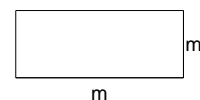
STRATA

Depth (m)	Sample Ref.	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend
			107.50	0.50	
			106.30	1.70	

Notes:
Shear strengths recorded using Pilicon Hand Shear Vane

Remarks
1. Trial pit backfilled with arisings upon completion.

Dimensions:



Stability:
 Plant Used:
 Mechanical Excavator



Project: Northwest Haverhill Relief Road
 Project ID: 775823
 Location: Haverhill
 Client: Persimmon Homes Essex
 Project Engineer: Hester Carter

Method: WS
 Start: 07/06/2018
 Finish: 07/06/2018

WS101

Level (mOD): 85.60
 Co-ordinates: 566293.82E -
 246938.54N

1:50
 Sheet 1 of 1
 Logged by:
 LE

Depth (m)	SPT Results (Type)	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend
D1 : 0.20m			85.45	0.15	
1.00 1.00 D2 : 1.00m D3 : 1.40m	N=13 (2,2/2,3,4,4) (C)	120	84.40	1 1.20	
2.00 2.00 D4 : 2.00m D5 : 2.40m	N=18 (3,4/4,4,5,5) (C)	103		2	
3.00 3.00 D6 : 3.00m D7 : 3.40m	N=22 (5,5/5,5,5,7) (C)	95		3	
4.00 4.00 D8 : 4.00m D9 : 4.50m	N=24 (5,5/5,5,7,7) (C)	93		4	
5.00 5.00 D10 : 5.00m	N=49 (7,7/11,12,12,14) (C)	92	80.60	5 5.00	
				6	
				7	
				8	
				9	



Project: Northwest Haverhill Relief Road
 Project ID: 775823
 Location: Haverhill
 Client: Persimmon Homes Essex
 Project Engineer: Hester Carter

Method: WS
 Start: 07/06/2018
 Finish: 07/06/2018

WS102

Level (mOD): 91.23
 Co-ordinates: 566382.01E -
 246963.64N

1:50
 Sheet 1 of 1
 Logged by:
 LE

Depth (m)	SPT Results (Type)	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend
D1 : 0.30m			91.13	0.10	
1.00 1.00 D2 : 1.00m D3 : 1.10m	N=14 (2,3/3,4,3,4) (C)	125	90.33	1 0.90	
2.00 2.00 D4 : 2.00m D5 : 2.20m	N=18 (3,3/4,3,5,6) (C)	107		2	
3.00 3.00 D6 : 3.00m D7 : 3.20m	N=38 (6,7/10,9,8,11) (C)	93		3	
4.00 4.00 D8 : 4.00m	N=50 (9,13/14,13,13,10) (C)	91	87.23	4 4.00	
				5	
				6	
				7	
				8	
				9	



Project: Northwest Haverhill Relief Road
 Project ID: 775823
 Location: Haverhill
 Client: Persimmon Homes Essex
 Project Engineer: Hester Carter

Method: WS
 Start: 07/06/2018
 Finish: 07/06/2018

WS103

Level (mOD): 96.54
 Co-ordinates: 566483.15E -
 246975.46N

1:50
 Sheet 1 of 1
 Logged by:
 LE

Depth (m)	SPT Results (Type)	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend
D1 : 0.30m			96.44	0.10	
1.00 1.00 D2 : 1.00m D3 : 1.40m	N=37 (2,2/18,7,6,6) (C)	128	95.24	1.30	
2.00 2.00 D4 : 2.00m D5 : 2.20m	N=18 (4,4/5,4,5,4) (C)	105		2	
3.00 3.00 D6 : 3.00m D7 : 3.20m	N=49 (8,12/12,12,13, 12) (C)	96	93.54	3.00	
4.00		94		4	
				5	
				6	
				7	
				8	
				9	



Project: Northwest Haverhill Relief Road
 Project ID: 775823
 Location: Haverhill
 Client: Persimmon Homes Essex
 Project Engineer: Hester Carter

Method: WS
 Start: 08/06/2018
 Finish: 08/06/2018

WS104

Level (mOD): 97.52
 Co-ordinates: 566569.38E -
 247011.03N

1:50
 Sheet 1 of 1
 Logged by:
 LE

Depth (m)	SPT Results (Type)	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend
D1 : 0.10m			97.42	0.10	
D3 : 0.40m			97.12	0.40	
1.00 1.00 D2 : 1.00m	N=14 (3,3/3,3,4,4) (C)	128		1	
2.00 2.00 D5 : 2.00m D4 : 2.10m	N=20 (3,3/5,4,5,6) (C)	106		2	
3.00 3.00 D7 : 3.00m D6 : 3.10m	N=29 (6,6/6,6,8,9) (C)	95	94.52	3 3.00	
4.00 4.00 D8 : 4.00m	N=50 (9,10/11,12,13,14) (C)	93	93.52	4 4.00	
5.00		90		5	
				6	
				7	
				8	
				9	



Project: Northwest Haverhill Relief Road
 Project ID: 775823
 Location: Haverhill
 Client: Persimmon Homes Essex
 Project Engineer: Hester Carter

Method: WS
 Start: 08/06/2018
 Finish: 08/06/2018

WS105

Level (mOD): 96.14
 Co-ordinates: 566770.99E -
 247131.17N

1:50
 Sheet 1 of 1
 Logged by:
 LE

Depth (m)	SPT Results (Type)	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend
D1 : 0.10m			96.04	0.10	
			95.64	0.50	
1.00 1.00 D3 : 1.00m D2 : 1.40m	N=14 (1,3/4,3,3,4) (C)	125		1	
2.00 2.00 D4 : 2.00m	N=19 (3,3/5,4,5,5) (C)	95		2	
D5 : 2.60m					
3.00 3.00 D6 : 3.00m D7 : 3.50m	N=30 (4,6/7,7,8,8) (C)	92		3	
4.00 4.00 D8 : 4.00m	N=50 (11,12/12,12,13, .13) (C)	90	92.14	4 4.00	
				5	
				6	
				7	
				8	
				9	



Project: Northwest Haverhill Relief Road
 Project ID: 775823
 Location: Haverhill
 Client: Persimmon Homes Essex
 Project Engineer: Hester Carter

Method: WS
 Start: 08/06/2018
 Finish: 08/06/2018

WS106 (CP103)

Level (mOD): 79.79
 Co-ordinates: 566196.71E -
 246938.55N

1:50
 Sheet 1 of 1
 Logged by:
 LE

Depth (m)	SPT Results (Type)	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend
D1 : 0.20m			79.69	0.10	
1.00 1.00 D2 : 1.20m	N=7 (1,1/1,2,2,2) (C)	124	78.49	1.30	
2.00 2.00 D3 : 2.00m	N=13 (2,3/3,3,3,4) (C)	97	77.29	2.50	
D4 : 2.50m					
3.00 3.00 D5 : 3.00m D6 : 3.20m	N=17 (3,4/4,4,4,5) (C)	93	76.59	3.20	
4.00 4.00 D7 : 4.00m D8 : 4.20m	N=21 (4,4/5,5,6,5) (C)	91		4	
5.00 5.00	N=32 (8,8/8,8,8,8) (C)	90	74.79	5.00	
				6	
				7	
				8	
				9	



Project: Northwest Haverhill Relief Road
 Project ID: 775823
 Location: Haverhill
 Client: Persimmon Homes Essex
 Project Engineer: Hester Carter

Method: WS
 Start: 08/06/2018
 Finish: 08/06/2018

WS107 (CP104)

Level (mOD): 79.87
 Co-ordinates: 566193.54E -
 246944.89N

1:50
 Sheet 1 of 1
 Logged by:
 LE

Depth (m)	SPT Results (Type)	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend
D1 : 0.20m			79.77	0.10	
1.00 1.00 D2 : 1.00m D3 : 1.30m	N=8 (2,2/2,2,2,2) (C)	125	78.77	1 1.10	
2.00 2.00 D4 : 2.00m D5 : 2.50m	N=10 (1,2/2,2,3,3) (C)	96	77.57	2 2.30	
3.00 3.00 D6 : 3.00m D7 : 3.20m	N=17 (3,3/4,3,5,5) (C)	92		3	
4.00 4.00 D8 : 4.00m D9 : 4.70m	N=20 (4,4/4,5,6,5) (C)	93		4	
5.00 5.00 D10 : 5.00m	N=35 (8,8/8,9,9,9) (C)	91	74.87	5 5.00	
				6	
				7	
				8	
				9	

Appendix B - In-situ CBR Results



In Situ California Bearing Ratio (CBR)

Job Ref 24664

CBR No. CBR 101

Site Name Northwest Haverhill Relief Road, CB9 9NJ

Depth m 0.40

Project No. 775823

Client MLM

Date of Test 07/06/2018

Soil Description Brown slightly gravelly slightly sandy silty CLAY (gravel is fm and angular to sub-rounded)

Test Method BS1377 : Part 9 : 1990, clause 4.3

CBR Test Number 1

Note: Test only applicable when maximum particle size beneath the plunger does not exceed 20mm

Rate of Strain 1.00 mm/min

Mass of Surcharge 4.6 kg

Proving Ring Factor 7.13 N/div

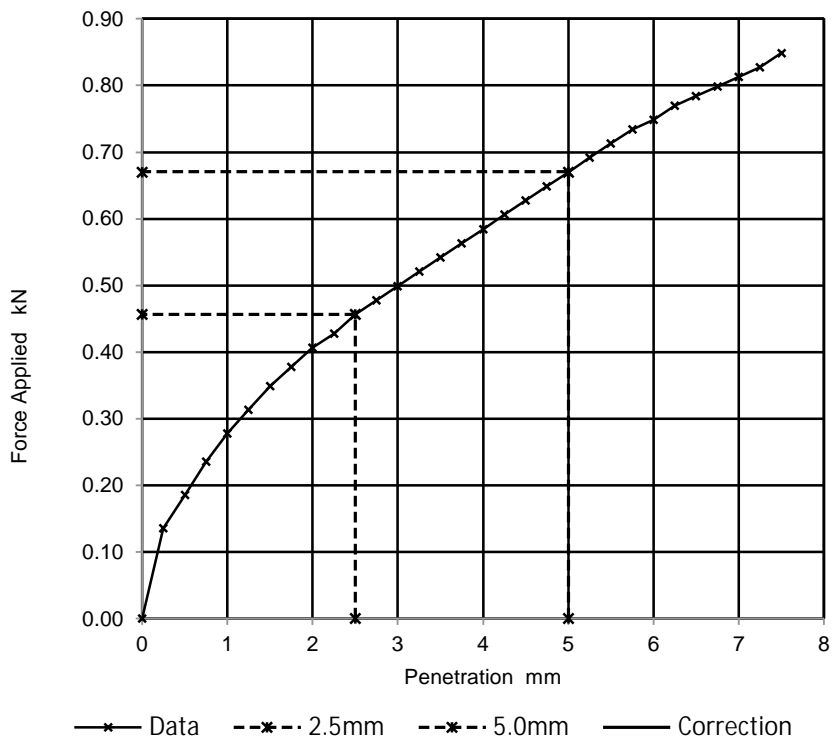
Temperature 20 °C

Environmental Conditions Cloudy

Readings

Penetration of Plunger mm	Force on Plunger	
	Dial Reading	Load kN
0.00	0	0.00
0.25	19	0.14
0.50	26	0.19
0.75	33	0.24
1.00	39	0.28
1.25	44	0.31
1.50	49	0.35
1.75	53	0.38
2.00	57	0.41
2.25	60	0.43
2.50	64	0.46
2.75	67	0.48
3.00	70	0.50
3.25	73	0.52
3.50	76	0.54
3.75	79	0.56
4.00	82	0.58
4.25	85	0.61
4.50	88	0.63
4.75	91	0.65
5.00	94	0.67
5.25	97	0.69
5.50	100	0.71
5.75	103	0.73
6.00	105	0.75
6.25	108	0.77
6.50	110	0.78
6.75	112	0.80
7.00	114	0.81
7.25	116	0.83
7.50	119	0.85

Force versus Penetration Plot



Remarks

Results

Curve correction applied	CBR Values, %			Moisture Content %
	Penetration		CBR Value	
	2.5mm	5mm		
No	3.5	3.4	3.5	18

Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU

Tel: 01923 711 288
Email: James@k4soils.com

Checked and Approved

Initials: J.P

Date: 12/06/2018



2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

MSF-5-R16



In Situ California Bearing Ratio (CBR)

Job Ref 24664

CBR No. CBR 102

Site Name Northwest Haverhill Relief Road, CB9 9NJ

Depth m 0.40

Project No. 775823

Client MLM

Date of Test 07/06/2018

Soil Description Brown slightly sandy silty CLAY with occasional rootlets and fmc chalk fragments

Test Method BS1377 : Part 9 : 1990, clause 4.3

CBR Test Number 2

Note: Test only applicable when maximum particle size beneath the plunger does not exceed 20mm

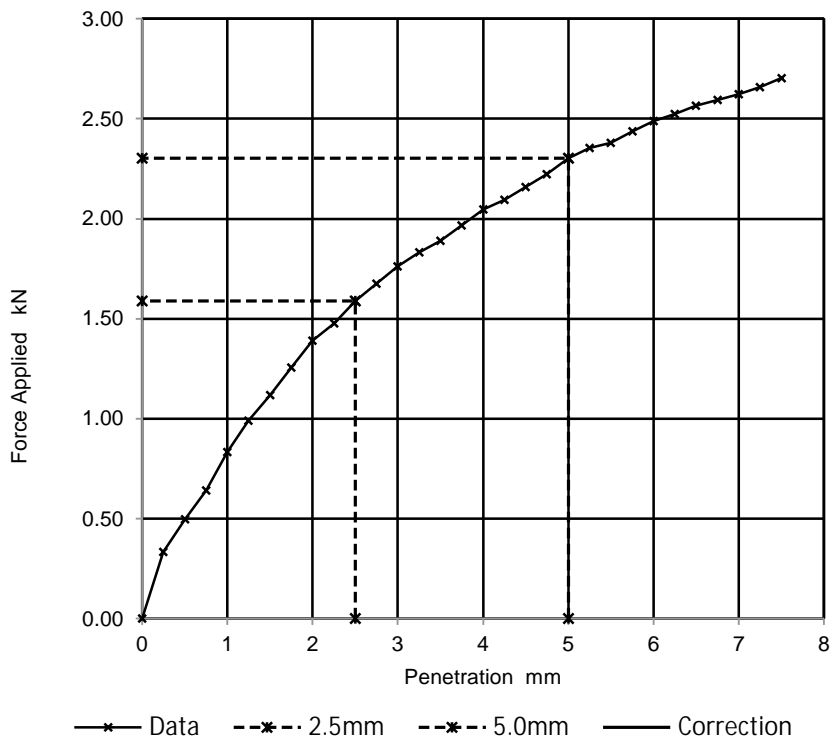
Rate of Strain 1.00 mm/min
 Mass of Surcharge 4.6 kg
 Proving Ring Factor 7.13 N/div

Temperature 20 °C
 Environmental Conditions Cloudy

Readings

Penetration of Plunger mm	Force on Plunger	
	Dial Reading	Load kN
0.00	0	0.00
0.25	47	0.34
0.50	70	0.50
0.75	90	0.64
1.00	117	0.83
1.25	139	0.99
1.50	157	1.12
1.75	176	1.25
2.00	195	1.39
2.25	207	1.48
2.50	223	1.59
2.75	235	1.68
3.00	247	1.76
3.25	257	1.83
3.50	265	1.89
3.75	276	1.97
4.00	287	2.05
4.25	294	2.10
4.50	303	2.16
4.75	312	2.22
5.00	323	2.30
5.25	330	2.35
5.50	334	2.38
5.75	342	2.44
6.00	349	2.49
6.25	354	2.52
6.50	360	2.57
6.75	364	2.60
7.00	368	2.62
7.25	373	2.66
7.50	379	2.70

Force versus Penetration Plot



Remarks

Results

Curve correction applied	CBR Values, %			Moisture Content %
	Penetration		CBR Value	
	2.5mm	5mm		
No	12	12	12	18



Test Report by K4 SOILS LABORATORY
 Unit 8 Olds Close Olds Approach
 Watford Herts WD18 9RU

Tel: 01923 711 288
 Email: James@k4soils.com

Checked and Approved

Initials: J.P

Date: 12/06/2018



In Situ California Bearing Ratio (CBR)

Job Ref 24664

CBR No. CBR 103

Site Name Northwest Haverhill Relief Road, CB9 9NJ

Depth m 0.40

Project No. 775823

Client MLM

Date of Test 07/06/2018

Soil Description Brown slightly gravelly slightly sandy silty CLAY with occasional rootlets and fmc chalk fragments (gravel is fmc and sub-angular to sub-rounded)

Test Method BS1377 : Part 9 : 1990, clause 4.3

CBR Test Number 3

Note: Test only applicable when maximum particle size beneath the plunger does not exceed 20mm

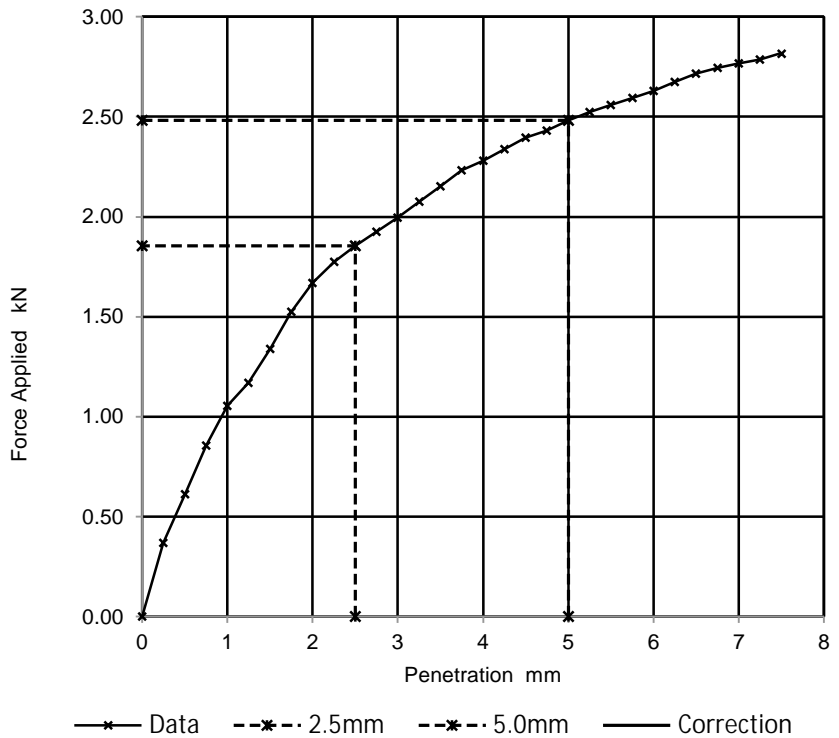
Rate of Strain 1.00 mm/min
 Mass of Surcharge 4.6 kg
 Proving Ring Factor 7.13 N/div

Temperature 20 °C
 Environmental Conditions Cloudy

Readings

Penetration of Plunger mm	Force on Plunger	
	Dial Reading	Load kN
0.00	0	0.00
0.25	52	0.37
0.50	86	0.61
0.75	120	0.86
1.00	148	1.06
1.25	164	1.17
1.50	188	1.34
1.75	214	1.53
2.00	234	1.67
2.25	249	1.78
2.50	260	1.85
2.75	270	1.93
3.00	280	2.00
3.25	291	2.07
3.50	302	2.15
3.75	313	2.23
4.00	320	2.28
4.25	328	2.34
4.50	336	2.40
4.75	341	2.43
5.00	348	2.48
5.25	354	2.52
5.50	359	2.56
5.75	364	2.60
6.00	369	2.63
6.25	375	2.67
6.50	381	2.72
6.75	385	2.75
7.00	388	2.77
7.25	391	2.79
7.50	395	2.82

Force versus Penetration Plot



Remarks

Results

Curve correction applied	CBR Values, %			Moisture Content %
	Penetration		CBR Value	
	2.5mm	5mm		
No	14	12	14	18



Test Report by K4 SOILS LABORATORY
 Unit 8 Olds Close Olds Approach
 Watford Herts WD18 9RU

Tel: 01923 711 288
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Checked and Approved

Initials: J.P

Date: 12/06/2018



In Situ California Bearing Ratio (CBR)

Job Ref 24664

CBR No. CBR 104

Site Name Northwest Haverhill Relief Road, CB9 9NJ

Depth m 0.40

Project No. 775823

Client MLM

Date of Test 07/06/2018

Soil Description Brown slightly gravelly slightly sandy silty CLAY with occasional rootlets and fmc chalk fragments (gravel is fmc and sub-angular to sub-rounded)

Test Method BS1377 : Part 9 : 1990, clause 4.3

CBR Test Number 4

Note: Test only applicable when maximum particle size beneath the plunger does not exceed 20mm

Rate of Strain 1.00 mm/min

Mass of Surcharge 4.6 kg

Proving Ring Factor 7.13 N/div

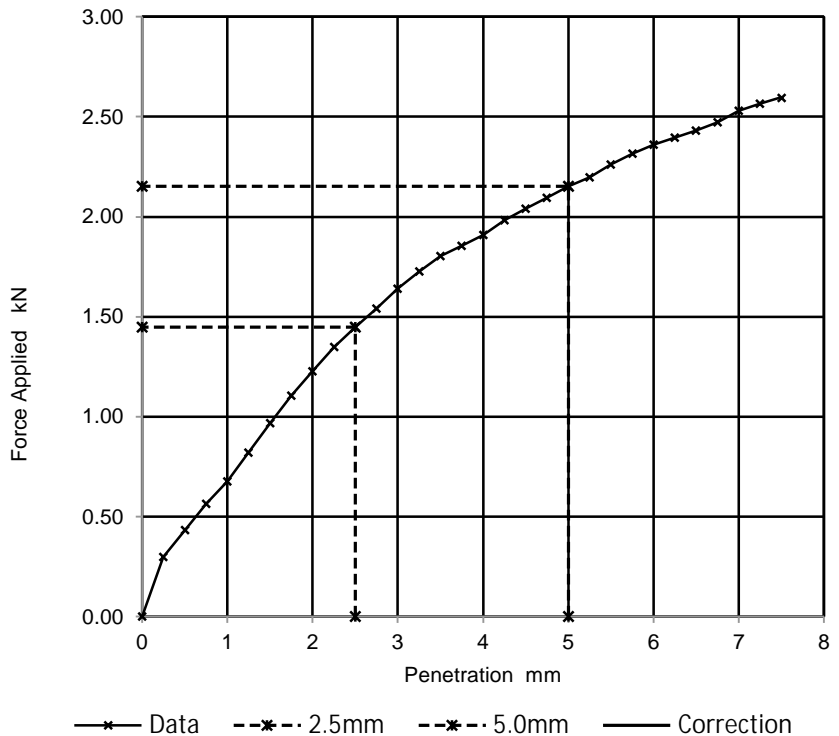
Temperature 20 0C

Environmental Conditions Cloudy

Readings

Penetration of Plunger mm	Force on Plunger	
	Dial Reading	Load kN
0.00	0	0.00
0.25	42	0.30
0.50	61	0.43
0.75	79	0.56
1.00	95	0.68
1.25	115	0.82
1.50	136	0.97
1.75	155	1.11
2.00	172	1.23
2.25	189	1.35
2.50	203	1.45
2.75	216	1.54
3.00	230	1.64
3.25	242	1.73
3.50	253	1.80
3.75	260	1.85
4.00	268	1.91
4.25	278	1.98
4.50	286	2.04
4.75	294	2.10
5.00	302	2.15
5.25	308	2.20
5.50	317	2.26
5.75	325	2.32
6.00	331	2.36
6.25	336	2.40
6.50	341	2.43
6.75	347	2.47
7.00	355	2.53
7.25	360	2.57
7.50	364	2.60

Force versus Penetration Plot



Remarks

Results

Curve correction applied	CBR Values, %			Moisture Content %
	Penetration		CBR Value	
	2.5mm	5mm		
No	11	11	11	19



Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU

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Checked and Approved

Initials: J.P

Date: 12/06/2018



In Situ California Bearing Ratio (CBR)

Job Ref 24664

CBR No. CBR 105

Site Name Northwest Haverhill Relief Road, CB9 9NJ

Depth m 0.40

Project No. 775823

Client MLM

Date of Test 07/06/2018

Soil Description Brown slightly gravelly slightly sandy silty CLAY with occasional rootlets and fmc chalk fragments (gravel is fmc and sub-angular to sub-rounded)

Test Method BS1377 : Part 9 : 1990, clause 4.3

CBR Test Number 5

Note: Test only applicable when maximum particle size beneath the plunger does not exceed 20mm

Rate of Strain 1.00 mm/min

Mass of Surcharge 4.6 kg

Proving Ring Factor 7.13 N/div

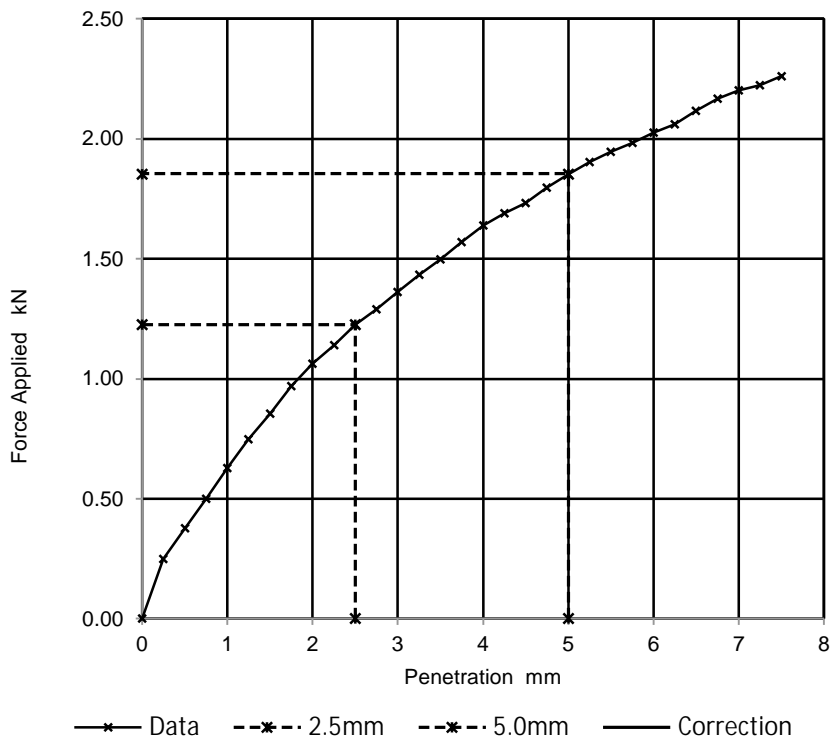
Temperature 20 0C

Environmental Conditions Cloudy

Readings

Penetration of Plunger mm	Force on Plunger	
	Dial Reading	Load kN
0.00	0	0.00
0.25	35	0.25
0.50	53	0.38
0.75	70	0.50
1.00	88	0.63
1.25	105	0.75
1.50	120	0.86
1.75	136	0.97
2.00	149	1.06
2.25	160	1.14
2.50	172	1.23
2.75	181	1.29
3.00	191	1.36
3.25	201	1.43
3.50	210	1.50
3.75	220	1.57
4.00	230	1.64
4.25	237	1.69
4.50	243	1.73
4.75	252	1.80
5.00	260	1.85
5.25	267	1.90
5.50	273	1.95
5.75	278	1.98
6.00	284	2.02
6.25	289	2.06
6.50	297	2.12
6.75	304	2.17
7.00	309	2.20
7.25	312	2.22
7.50	317	2.26

Force versus Penetration Plot



Remarks

Results

Curve correction applied	CBR Values, %			Moisture Content %
	Penetration		CBR Value	
	2.5mm	5mm		
No	9.3	9.3	9.3	20



Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU

Tel: 01923 711 288
Email: James@k4soils.com

Checked and Approved

Initials: J.P

Date: 12/06/2018



In Situ California Bearing Ratio (CBR)

Job Ref 24664

CBR No. CBR 106

Site Name Northwest Haverhill Relief Road, CB9 9NJ

Depth m 0.40

Project No. 775823

Client MLM

Date of Test 07/06/2018

Soil Description Brown slightly gravelly slightly sandy silty CLAY with occasional rootlets and fmc chalk fragments (gravel is fmc and sub-angular to sub-rounded)

Test Method BS1377 : Part 9 : 1990, clause 4.3

CBR Test Number 6

Note: Test only applicable when maximum particle size beneath the plunger does not exceed 20mm

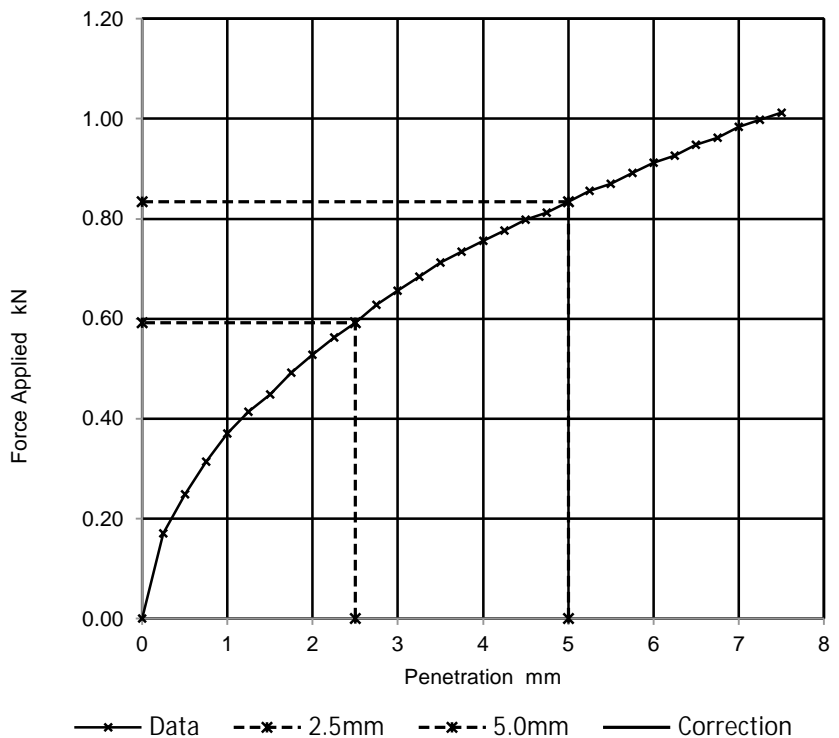
Rate of Strain 1.00 mm/min
 Mass of Surcharge 4.6 kg
 Proving Ring Factor 7.13 N/div

Temperature 20 °C
 Environmental Conditions Cloudy

Readings

Penetration of Plunger mm	Force on Plunger	
	Dial Reading	Load kN
0.00	0	0.00
0.25	24	0.17
0.50	35	0.25
0.75	44	0.31
1.00	52	0.37
1.25	58	0.41
1.50	63	0.45
1.75	69	0.49
2.00	74	0.53
2.25	79	0.56
2.50	83	0.59
2.75	88	0.63
3.00	92	0.66
3.25	96	0.68
3.50	100	0.71
3.75	103	0.73
4.00	106	0.76
4.25	109	0.78
4.50	112	0.80
4.75	114	0.81
5.00	117	0.83
5.25	120	0.86
5.50	122	0.87
5.75	125	0.89
6.00	128	0.91
6.25	130	0.93
6.50	133	0.95
6.75	135	0.96
7.00	138	0.98
7.25	140	1.00
7.50	142	1.01

Force versus Penetration Plot



Remarks

Results

Curve correction applied	CBR Values, %			Moisture Content %
	Penetration		CBR Value	
	2.5mm	5mm		
No	4.5	4.2	4.5	24



Test Report by K4 SOILS LABORATORY
 Unit 8 Olds Close Olds Approach
 Watford Herts WD18 9RU

Tel: 01923 711 288
 Email: James@k4soils.com

Checked and Approved

Initials: J.P

Date: 12/06/2018



In Situ California Bearing Ratio (CBR)

Job Ref 24664

CBR No. CBR 107

Site Name Northwest Haverhill Relief Road, CB9 9NJ

Depth m 0.40

Project No. 775823

Client MLM

Date of Test 07/06/2018

Soil Description Brown slightly gravelly slightly sandy silty CLAY with occasional rootlets and fmc chalk fragments (gravel is fmc and sub-angular to sub-rounded)

Test Method BS1377 : Part 9 : 1990, clause 4.3

CBR Test Number 7

Note: Test only applicable when maximum particle size beneath the plunger does not exceed 20mm

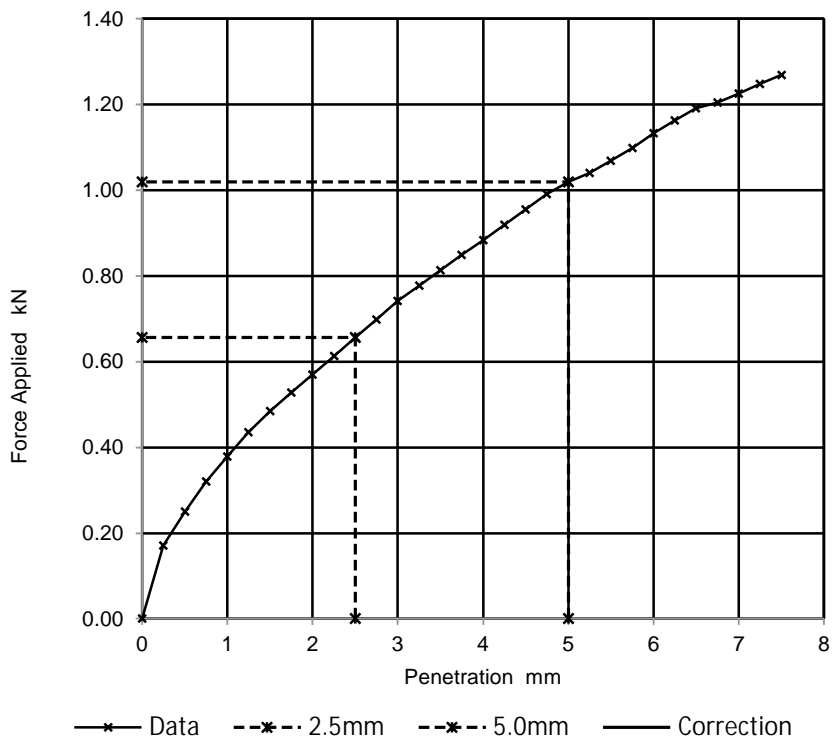
Rate of Strain 1.00 mm/min
 Mass of Surcharge 4.6 kg
 Proving Ring Factor 7.13 N/div

Temperature 20 °C
 Environmental Conditions Cloudy

Readings

Penetration of Plunger mm	Force on Plunger	
	Dial Reading	Load kN
0.00	0	0.00
0.25	24	0.17
0.50	35	0.25
0.75	45	0.32
1.00	53	0.38
1.25	61	0.43
1.50	68	0.48
1.75	74	0.53
2.00	80	0.57
2.25	86	0.61
2.50	92	0.66
2.75	98	0.70
3.00	104	0.74
3.25	109	0.78
3.50	114	0.81
3.75	119	0.85
4.00	124	0.88
4.25	129	0.92
4.50	134	0.96
4.75	139	0.99
5.00	143	1.02
5.25	146	1.04
5.50	150	1.07
5.75	154	1.10
6.00	159	1.13
6.25	163	1.16
6.50	167	1.19
6.75	169	1.20
7.00	172	1.23
7.25	175	1.25
7.50	178	1.27

Force versus Penetration Plot



Remarks

Results

Curve correction applied	CBR Values, %			Moisture Content %
	Penetration		CBR Value	
	2.5mm	5mm		
No	5.0	5.1	5.1	21



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In Situ California Bearing Ratio (CBR)

Job Ref 24664

CBR No. CBR 108

Site Name Northwest Haverhill Relief Road, CB9 9NJ

Depth m 0.40

Project No. 775823

Client MLM

Date of Test 07/06/2018

Soil Description Brown slightly gravelly slightly sandy silty CLAY with occasional rootlets and fmc chalk fragments (gravel is fmc and sub-angular to sub-rounded)

Test Method BS1377 : Part 9 : 1990, clause 4.3

CBR Test Number 8

Note: Test only applicable when maximum particle size beneath the plunger does not exceed 20mm

Rate of Strain 1.00 mm/min

Mass of Surcharge 4.6 kg

Proving Ring Factor 7.13 N/div

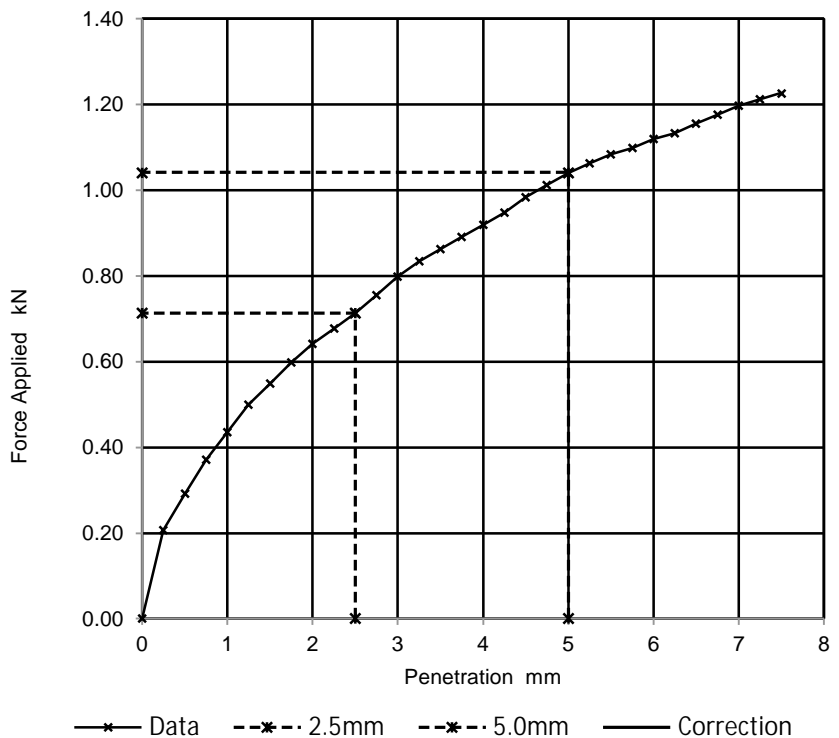
Temperature 20 0C

Environmental Conditions Cloudy

Readings

Penetration of Plunger mm	Force on Plunger	
	Dial Reading	Load kN
0.00	0	0.00
0.25	29	0.21
0.50	41	0.29
0.75	52	0.37
1.00	61	0.43
1.25	70	0.50
1.50	77	0.55
1.75	84	0.60
2.00	90	0.64
2.25	95	0.68
2.50	100	0.71
2.75	106	0.76
3.00	112	0.80
3.25	117	0.83
3.50	121	0.86
3.75	125	0.89
4.00	129	0.92
4.25	133	0.95
4.50	138	0.98
4.75	142	1.01
5.00	146	1.04
5.25	149	1.06
5.50	152	1.08
5.75	154	1.10
6.00	157	1.12
6.25	159	1.13
6.50	162	1.16
6.75	165	1.18
7.00	168	1.20
7.25	170	1.21
7.50	172	1.23

Force versus Penetration Plot



Remarks

Results

Curve correction applied	CBR Values, %			Moisture Content %
	Penetration		CBR Value	
	2.5mm	5mm		
No	5.4	5.2	5.4	21

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Date: 12/06/2018



2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

MSF-5-R16



In Situ California Bearing Ratio (CBR)

Job Ref 24664

CBR No. CBR 109

Site Name Northwest Haverhill Relief Road, CB9 9NJ

Depth m 0.40

Project No. 775823

Client MLM

Date of Test 08/06/2018

Soil Description Brown slightly gravelly slightly sandy silty CLAY with occasional rootlets and fmc chalk fragments (gravel is fmc and sub-angular to sub-rounded)

Test Method BS1377 : Part 9 : 1990, clause 4.3

CBR Test Number 9

Note: Test only applicable when maximum particle size beneath the plunger does not exceed 20mm

Rate of Strain 1.00 mm/min

Mass of Surcharge 4.6 kg

Proving Ring Factor 7.13 N/div

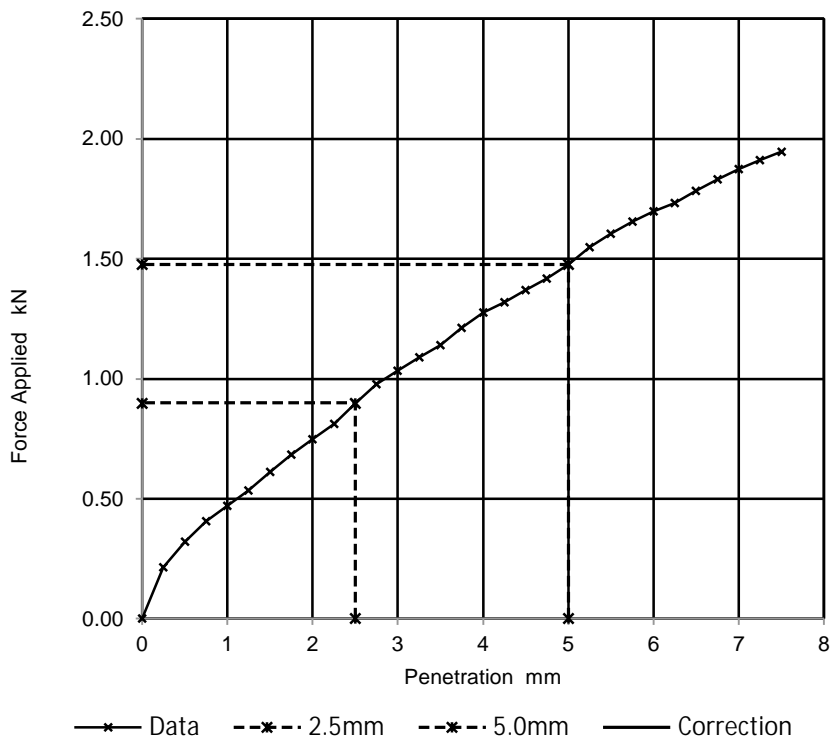
Temperature 21 0C

Environmental Conditions Cloudy

Readings

Penetration of Plunger mm	Force on Plunger	
	Dial Reading	Load kN
0.00	0	0.00
0.25	30	0.21
0.50	45	0.32
0.75	57	0.41
1.00	66	0.47
1.25	75	0.53
1.50	86	0.61
1.75	96	0.68
2.00	105	0.75
2.25	114	0.81
2.50	126	0.90
2.75	137	0.98
3.00	145	1.03
3.25	153	1.09
3.50	160	1.14
3.75	170	1.21
4.00	179	1.28
4.25	185	1.32
4.50	192	1.37
4.75	199	1.42
5.00	207	1.48
5.25	217	1.55
5.50	225	1.60
5.75	232	1.65
6.00	238	1.70
6.25	243	1.73
6.50	250	1.78
6.75	257	1.83
7.00	263	1.88
7.25	268	1.91
7.50	273	1.95

Force versus Penetration Plot



Remarks

Results

Curve correction applied	CBR Values, %			Moisture Content %
	Penetration		CBR Value	
	2.5mm	5mm		
No	6.8	7.4	7.4	18

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Checked and Approved

Initials: J.P

Date: 12/06/2018



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Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

MSF-5-R16



In Situ California Bearing Ratio (CBR)

Job Ref 24664

CBR No. CBR 110

Site Name Northwest Haverhill Relief Road, CB9 9NJ

Depth m 0.40

Project No. 775823

Client MLM

Date of Test 08/06/2018

Soil Description Brown slightly gravelly slightly sandy silty CLAY with occasional rootlets and fmc chalk fragments (gravel is fmc and sub-angular to sub-rounded)

Test Method BS1377 : Part 9 : 1990, clause 4.3

CBR Test Number 10

Note: Test only applicable when maximum particle size beneath the plunger does not exceed 20mm

Rate of Strain 1.00 mm/min

Mass of Surcharge 4.6 kg

Proving Ring Factor 7.13 N/div

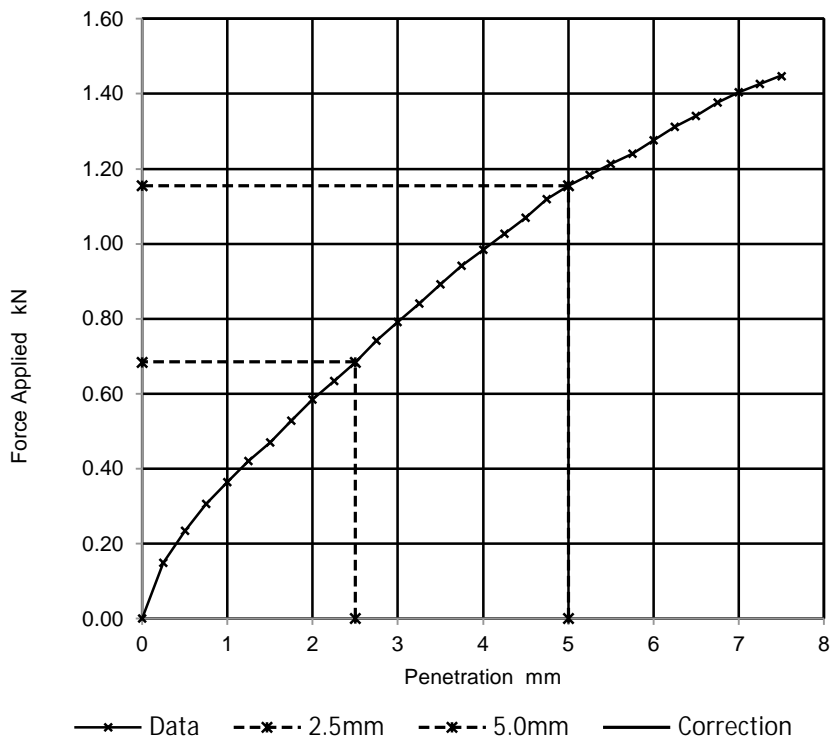
Temperature 21 0C

Environmental Conditions Cloudy

Readings

Penetration of Plunger mm	Force on Plunger	
	Dial Reading	Load kN
0.00	0	0.00
0.25	21	0.15
0.50	33	0.24
0.75	43	0.31
1.00	51	0.36
1.25	59	0.42
1.50	66	0.47
1.75	74	0.53
2.00	82	0.58
2.25	89	0.63
2.50	96	0.68
2.75	104	0.74
3.00	111	0.79
3.25	118	0.84
3.50	125	0.89
3.75	132	0.94
4.00	138	0.98
4.25	144	1.03
4.50	150	1.07
4.75	157	1.12
5.00	162	1.16
5.25	166	1.18
5.50	170	1.21
5.75	174	1.24
6.00	179	1.28
6.25	184	1.31
6.50	188	1.34
6.75	193	1.38
7.00	197	1.40
7.25	200	1.43
7.50	203	1.45

Force versus Penetration Plot



Remarks

Results

Curve correction applied	CBR Values, %			Moisture Content %
	Penetration		CBR Value	
	2.5mm	5mm		
No	5.2	5.8	5.8	20



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Checked and Approved

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Date: 12/06/2018



In Situ California Bearing Ratio (CBR)

Job Ref 24664

CBR No. CBR 111

Site Name Northwest Haverhill Relief Road, CB9 9NJ

Depth m 0.40

Project No. 775823

Client MLM

Date of Test 08/06/2018

Soil Description Brown slightly gravelly slightly sandy silty CLAY with occasional rootlets and fmc chalk fragments (gravel is fmc and sub-angular to sub-rounded)

Test Method BS1377 : Part 9 : 1990, clause 4.3

CBR Test Number 11

Note: Test only applicable when maximum particle size beneath the plunger does not exceed 20mm

Rate of Strain 1.00 mm/min

Mass of Surcharge 4.6 kg

Proving Ring Factor 7.13 N/div

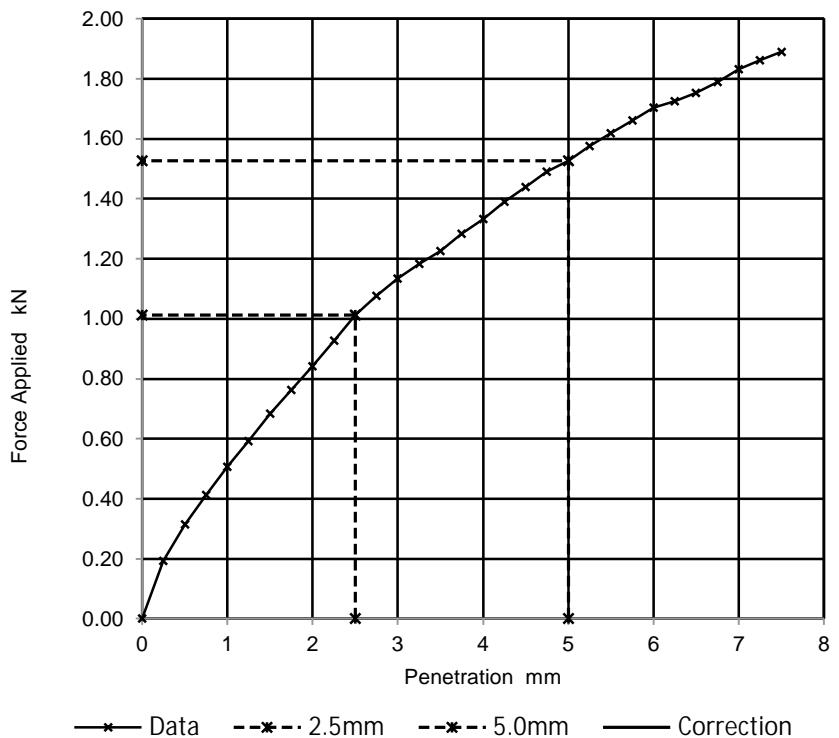
Temperature 21 0C

Environmental Conditions Cloudy

Readings

Penetration of Plunger mm	Force on Plunger	
	Dial Reading	Load kN
0.00	0	0.00
0.25	27	0.19
0.50	44	0.31
0.75	58	0.41
1.00	71	0.51
1.25	83	0.59
1.50	96	0.68
1.75	107	0.76
2.00	118	0.84
2.25	130	0.93
2.50	142	1.01
2.75	151	1.08
3.00	159	1.13
3.25	166	1.18
3.50	172	1.23
3.75	180	1.28
4.00	187	1.33
4.25	195	1.39
4.50	202	1.44
4.75	209	1.49
5.00	214	1.53
5.25	221	1.58
5.50	227	1.62
5.75	233	1.66
6.00	239	1.70
6.25	242	1.73
6.50	246	1.75
6.75	251	1.79
7.00	257	1.83
7.25	261	1.86
7.50	265	1.89

Force versus Penetration Plot



Remarks

Results

Curve correction applied	CBR Values, %			Moisture Content %
	Penetration		CBR Value	
	2.5mm	5mm		
No	7.7	7.6	7.7	19

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Checked and Approved

Initials: J.P

Date: 12/06/2018



2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

MSF-5-R16



In Situ California Bearing Ratio (CBR)

Job Ref 24664

CBR No. CBR 112

Site Name Northwest Haverhill Relief Road, CB9 9NJ

Depth m 0.40

Project No. 775823

Client MLM

Date of Test 08/06/2018

Soil Description Brown slightly gravelly slightly sandy silty CLAY with occasional rootlets and fmc chalk fragments (gravel is fmc and sub-angular to sub-rounded)

Test Method BS1377 : Part 9 : 1990, clause 4.3

CBR Test Number 12

Note: Test only applicable when maximum particle size beneath the plunger does not exceed 20mm

Rate of Strain 1.00 mm/min

Mass of Surcharge 4.6 kg

Proving Ring Factor 7.13 N/div

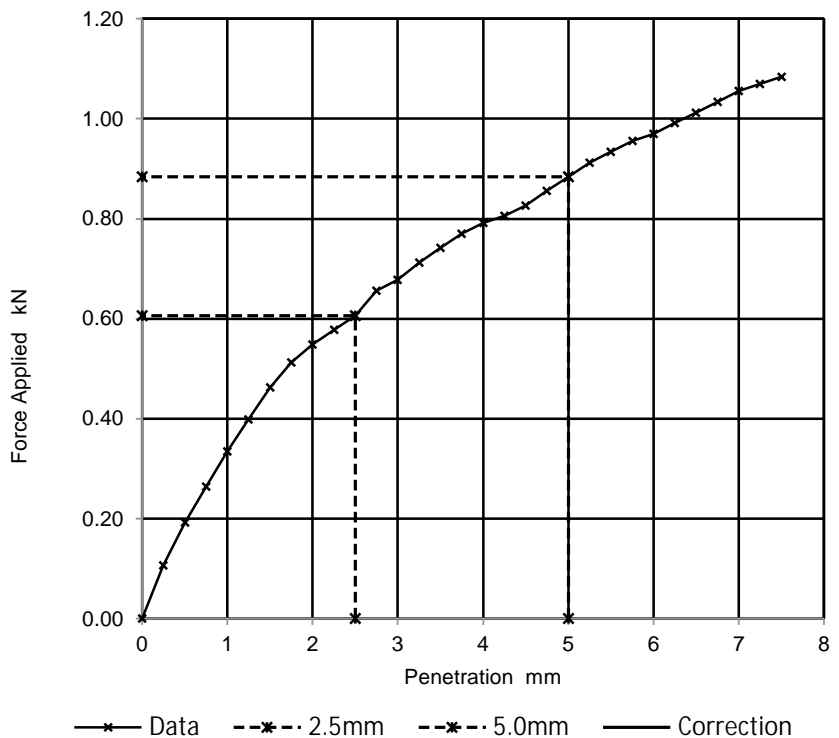
Temperature 21 0C

Environmental Conditions Cloudy

Readings

Penetration of Plunger mm	Force on Plunger	
	Dial Reading	Load kN
0.00	0	0.00
0.25	15	0.11
0.50	27	0.19
0.75	37	0.26
1.00	47	0.34
1.25	56	0.40
1.50	65	0.46
1.75	72	0.51
2.00	77	0.55
2.25	81	0.58
2.50	85	0.61
2.75	92	0.66
3.00	95	0.68
3.25	100	0.71
3.50	104	0.74
3.75	108	0.77
4.00	111	0.79
4.25	113	0.81
4.50	116	0.83
4.75	120	0.86
5.00	124	0.88
5.25	128	0.91
5.50	131	0.93
5.75	134	0.96
6.00	136	0.97
6.25	139	0.99
6.50	142	1.01
6.75	145	1.03
7.00	148	1.06
7.25	150	1.07
7.50	152	1.08

Force versus Penetration Plot



Remarks

Results

Curve correction applied	CBR Values, %			Moisture Content %
	Penetration		CBR Value	
	2.5mm	5mm		
No	4.6	4.4	4.6	21

Test Report by K4 SOILS LABORATORY
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MSF-5-R16



In Situ California Bearing Ratio (CBR)

Job Ref 24664

CBR No. CBR 113

Site Name Northwest Haverhill Relief Road, CB9 9NJ

Depth m 0.40

Project No. 775823

Client MLM

Date of Test 08/06/2018

Soil Description Brown slightly gravelly slightly sandy silty CLAY with occasional rootlets and fmc chalk fragments (gravel is fmc and sub-angular to sub-rounded)

Test Method BS1377 : Part 9 : 1990, clause 4.3

CBR Test Number 13

Note: Test only applicable when maximum particle size beneath the plunger does not exceed 20mm

Rate of Strain 1.00 mm/min

Mass of Surcharge 4.6 kg

Proving Ring Factor 0.43 N/div

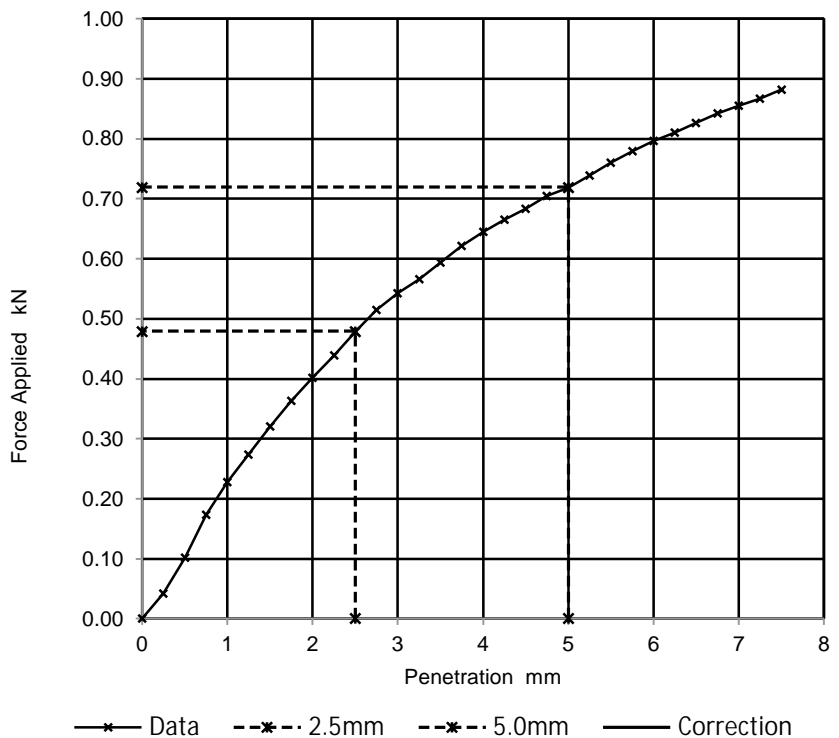
Temperature 21 0C

Environmental Conditions Cloudy

Readings

Penetration of Plunger mm	Force on Plunger	
	Dial Reading	Load kN
0.00	0	0.00
0.25	98	0.04
0.50	237	0.10
0.75	403	0.17
1.00	530	0.23
1.25	637	0.27
1.50	745	0.32
1.75	845	0.36
2.00	934	0.40
2.25	1022	0.44
2.50	1114	0.48
2.75	1196	0.51
3.00	1262	0.54
3.25	1317	0.57
3.50	1380	0.59
3.75	1446	0.62
4.00	1501	0.65
4.25	1548	0.67
4.50	1589	0.68
4.75	1639	0.70 </td
5.00	1672	0.72
5.25	1718	0.74
5.50	1769	0.76
5.75	1812	0.78
6.00	1852	0.80
6.25	1884	0.81
6.50	1921	0.83
6.75	1958	0.84
7.00	1988	0.85
7.25	2017	0.87
7.50	2050	0.88

Force versus Penetration Plot



Remarks

Results

Curve correction applied	CBR Values, %			Moisture Content %
	Penetration		CBR Value	
	2.5mm	5mm		
No	3.6	3.6	3.6	24



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Checked and Approved

Initials: J.P

Date: 12/06/2018



In Situ California Bearing Ratio (CBR)

Job Ref 24664

CBR No. CBR 114

Site Name Northwest Haverhill Relief Road, CB9 9NJ

Depth m 0.40

Project No. 775823

Client MLM

Date of Test 08/06/2018

Soil Description Brown slightly gravelly slightly sandy silty CLAY with occasional rootlets and fmc chalk fragments (gravel is fmc and sub-angular to sub-rounded)

Test Method BS1377 : Part 9 : 1990, clause 4.3

CBR Test Number 14

Note: Test only applicable when maximum particle size beneath the plunger does not exceed 20mm

Rate of Strain 1.00 mm/min

Mass of Surcharge 4.6 kg

Proving Ring Factor 7.13 N/div

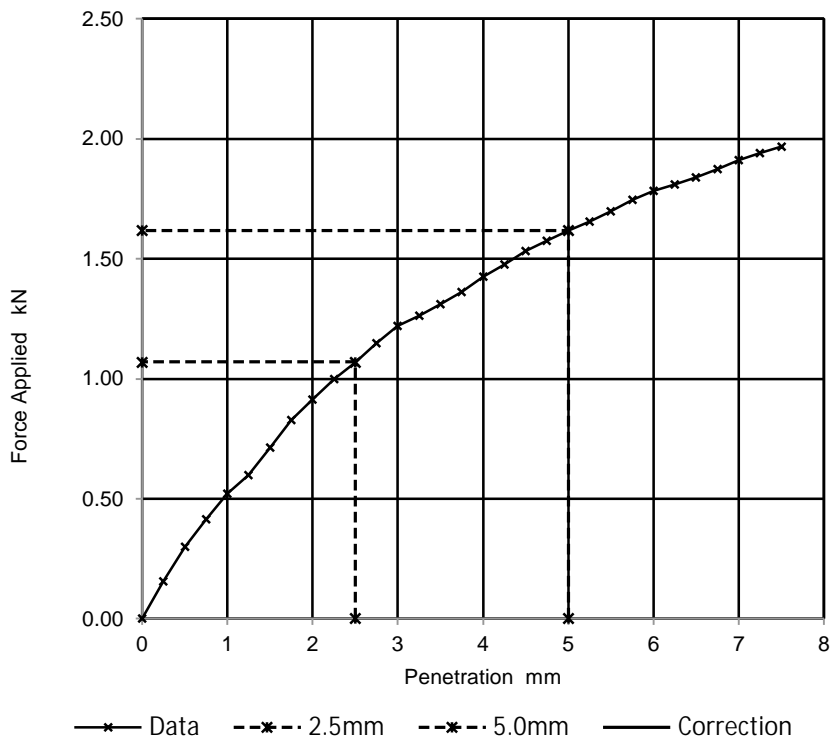
Temperature 21 0C

Environmental Conditions Cloudy

Readings

Penetration of Plunger mm	Force on Plunger	
	Dial Reading	Load kN
0.00	0	0.00
0.25	22	0.16
0.50	42	0.30
0.75	58	0.41
1.00	73	0.52
1.25	84	0.60
1.50	100	0.71
1.75	116	0.83
2.00	128	0.91
2.25	140	1.00
2.50	150	1.07
2.75	161	1.15
3.00	171	1.22
3.25	177	1.26
3.50	184	1.31
3.75	191	1.36
4.00	200	1.43
4.25	207	1.48
4.50	215	1.53
4.75	221	1.58
5.00	227	1.62
5.25	232	1.65
5.50	238	1.70
5.75	245	1.75
6.00	250	1.78
6.25	254	1.81
6.50	258	1.84
6.75	263	1.88
7.00	268	1.91
7.25	272	1.94
7.50	276	1.97

Force versus Penetration Plot



Remarks

Results

Curve correction applied	CBR Values, %			Moisture Content %
	Penetration		CBR Value	
	2.5mm	5mm		
No	8.1	8.1	8.1	18

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Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

MSF-5-R16



In Situ California Bearing Ratio (CBR)

Job Ref 24664

CBR No. CBR 115

Site Name Northwest Haverhill Relief Road, CB9 9NJ

Depth m 0.40

Project No. 775823

Client MLM

Date of Test 08/06/2018

Soil Description Brown slightly gravelly slightly sandy silty CLAY with occasional rootlets and fmc chalk fragments (gravel is fmc and sub-angular to sub-rounded)

Test Method BS1377 : Part 9 : 1990, clause 4.3

CBR Test Number 15

Note: Test only applicable when maximum particle size beneath the plunger does not exceed 20mm

Rate of Strain 1.00 mm/min

Mass of Surcharge 4.6 kg

Proving Ring Factor 7.13 N/div

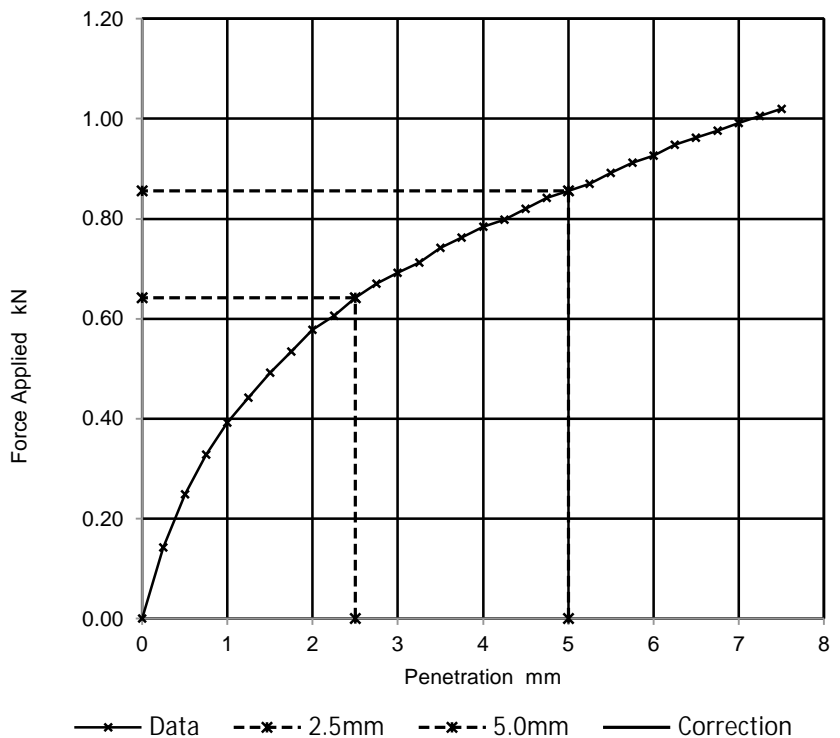
Temperature 21 0C

Environmental Conditions Cloudy

Readings

Penetration of Plunger mm	Force on Plunger	
	Dial Reading	Load kN
0.00	0	0.00
0.25	20	0.14
0.50	35	0.25
0.75	46	0.33
1.00	55	0.39
1.25	62	0.44
1.50	69	0.49
1.75	75	0.53
2.00	81	0.58
2.25	85	0.61
2.50	90	0.64
2.75	94	0.67
3.00	97	0.69
3.25	100	0.71
3.50	104	0.74
3.75	107	0.76
4.00	110	0.78
4.25	112	0.80
4.50	115	0.82
4.75	118	0.84
5.00	120	0.86
5.25	122	0.87
5.50	125	0.89
5.75	128	0.91
6.00	130	0.93
6.25	133	0.95
6.50	135	0.96
6.75	137	0.98
7.00	139	0.99
7.25	141	1.01
7.50	143	1.02

Force versus Penetration Plot



Remarks

Results

Curve correction applied	CBR Values, %			Moisture Content %
	Penetration		CBR Value	
	2.5mm	5mm		
No	4.9	4.3	4.9	25



Test Report by K4 SOILS LABORATORY
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Watford Herts WD18 9RU

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Checked and Approved

Initials: J.P

Date: 12/06/2018



In Situ California Bearing Ratio (CBR)

Job Ref 24664

CBR No. CBR 116

Site Name Northwest Haverhill Relief Road, CB9 9NJ

Depth m 0.40

Project No. 775823

Client MLM

Date of Test 08/06/2018

Soil Description Brown slightly gravelly slightly sandy silty CLAY with occasional rootlets and fmc chalk fragments (gravel is fmc and sub-angular to sub-rounded)

Test Method BS1377 : Part 9 : 1990, clause 4.3

CBR Test Number 16

Note: Test only applicable when maximum particle size beneath the plunger does not exceed 20mm

Rate of Strain 1.00 mm/min

Mass of Surcharge 4.6 kg

Proving Ring Factor 7.13 N/div

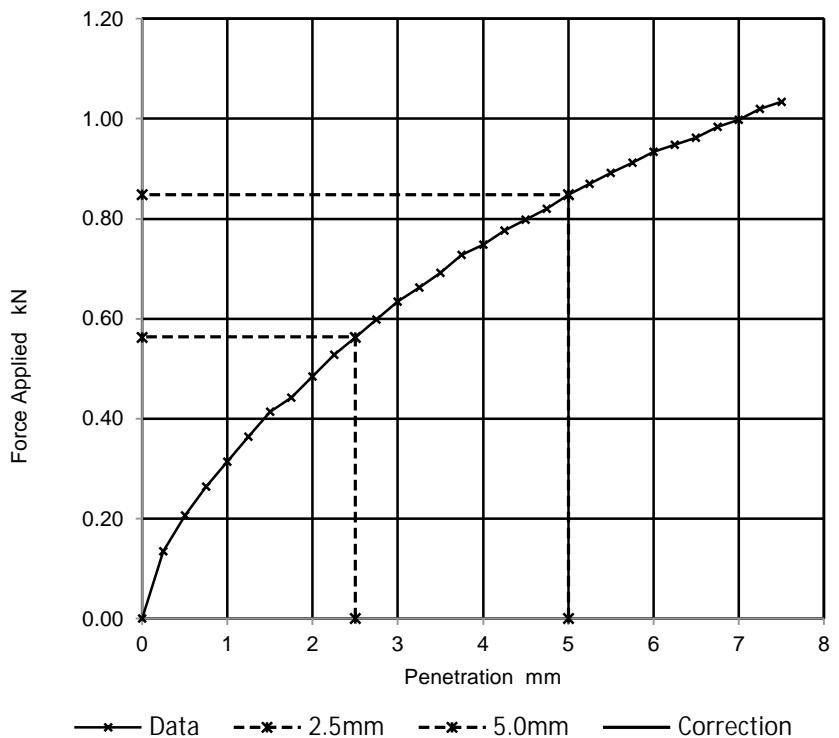
Temperature 21 0C

Environmental Conditions Cloudy

Readings

Penetration of Plunger mm	Force on Plunger	
	Dial Reading	Load kN
0.00	0	0.00
0.25	19	0.14
0.50	29	0.21
0.75	37	0.26
1.00	44	0.31
1.25	51	0.36
1.50	58	0.41
1.75	62	0.44
2.00	68	0.48
2.25	74	0.53
2.50	79	0.56
2.75	84	0.60
3.00	89	0.63
3.25	93	0.66
3.50	97	0.69
3.75	102	0.73
4.00	105	0.75
4.25	109	0.78
4.50	112	0.80
4.75	115	0.82
5.00	119	0.85
5.25	122	0.87
5.50	125	0.89
5.75	128	0.91
6.00	131	0.93
6.25	133	0.95
6.50	135	0.96
6.75	138	0.98
7.00	140	1.00
7.25	143	1.02
7.50	145	1.03

Force versus Penetration Plot



Remarks

Results

Curve correction applied	CBR Values, %			Moisture Content %
	Penetration		CBR Value	
	2.5mm	5mm		
No	4.3	4.2	4.3	22

Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU

Tel: 01923 711 288

Email: James@k4soils.com

Checked and Approved

Initials: J.P

Date: 12/06/2018



2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

MSF-5-R16

Appendix C - Geotechnical Test Results



TEST REPORT
ISSUED BY SOIL PROPERTY TESTING LTD
DATE ISSUED: 10/07/2018



Contract	Northwest Haverhill Relief Road		
Serial No.	S33252		
Client:	<i>Soil Property Testing Ltd</i>		
MLM Consulting Engineers Ltd 7200 Cambridge Research Park Cambridge CB5 9TL	15, 16, 18 Halcyon Court, St Margaret's Way, Stukeley Meadows, Huntingdon, Cambridgeshire, PE29 6DG		
Samples Submitted By:	Approved Signatories:		
MLM Consulting Engineers Ltd	<input checked="" type="checkbox"/> J.C. Garner B.Eng (Hons) FGS Technical Director		
Samples Labelled:	<input type="checkbox"/> S.P. Townend FGS Quality Manager		
Northwest Haverhill Relief Road	<input type="checkbox"/> W. Johnstone Materials Lab Manager		
	<input type="checkbox"/> D. Sabnis Operations Manager		
Date Received: 15/06/2018	Samples Tested Between: 15/06/2018 and 10/07/2018		
Remarks: For the attention of Hester Carter Your Reference No: 775951			
Notes:			
1	All remaining samples or remnants from this contract will be disposed of after 21 days from today, unless we are notified to the contrary.		
2	(a) UKAS - United Kingdom Accreditation Service (b) Opinions and interpretations expressed herein are outside the scope of UKAS accreditation		
3	Tests marked "NOT UKAS ACCREDITED" in this test report are not included in the UKAS Accreditation Schedule for this testing laboratory.		
4	This test report may not be reproduced other than in full except with the prior written approval of the issuing laboratory.		



TEST REPORT

ISSUED BY SOIL PROPERTY TESTING LTD
DATE ISSUED: 10/07/2018



Contract		Northwest Haverhill Relief Road																			
Serial No.		S33252												Target Date		10/07/2018					
Scheduled By		MLM Consulting Engineers Ltd																			
SCHEDULE OF LABORATORY TESTS																					
Schedule Remarks																					
Bore Hole No.	Type	Sample Ref.	Top Depth	<div style="display: flex; justify-content: space-between;"> Sulphate Content/∅H Value Water Content BS EN Liquid Plastic Limits Wet Sieve Preparation Triaxial Test Multi-stage Consolidation Density Determination BS EN </div>															Sample Remarks		
WS101	D	9	4.50		1	1	1														
WS102	D	5	2.20	1	1	1	1														
WS102	D	7	3.20		1	1	1														
WS103	D	4	2.00		1	1	1														
WS103	D	7	3.20	1	1	1	1														
WS104	D	5	2.00		1	1	1														
WS105	D	3	1.00	1																	
WS105	D	2	1.40		1	1	1														
WS106	D	2	1.20		1	1	1														
WS106	D	4	2.50		1	1	1														
WS106	D	5	3.00	1																	
WS107	D	3	1.30	1	1	1															
WS107	D	9	4.70		1	1	1														
Totals				15	34	25	24	7	4	9											End of Schedule



TEST REPORT

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Contract	Northwest Haverhill Relief Road
Serial No.	S33252

DETERMINATION OF DENSITY AND WATER CONTENT

Borehole /Pit No.	Depth (m)	Sample		Water Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Description	Remarks
		Type	Reference					
TP101	1.8	B	1	16.1	1.94	1.67	Very stiff light olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional light bluish grey mottling. Gravel is fine to coarse chalk and rare flint.	
TP102	3	B	1	18.5	2.06	1.74	Very stiff olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional bluish grey mottling. Gravel is fine to coarse chalk and rare flint.	
TP103	3	B	1	17.2	2.10	1.79	Very stiff olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional grey and orange mottling. Gravel is fine to coarse chalk and rare flint.	
TP104	3	B	1	19.9	2.04	1.70	Very stiff dark olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional bluish grey mottling. Gravel is fine to coarse chalk and rare flint.	
TP105	3	B	1	18.3	2.06	1.74	Very stiff dark olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional bluish grey mottling. Gravel is fine to coarse chalk and rare flint.	
TP106	3	B	1	18.9	2.09	1.76	Very stiff dark olive slightly gravelly slightly sandy silty calcareous CLAY with occasional bluish grey mottling. Gravel is fine to coarse chalk and rare flint.	
TP107	1.7	B	1	17.9	2.07	1.76	Very stiff olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional bluish grey mottling and rare orange staining. Gravel is fine to coarse chalk and rare flint.	
TP108	1.7	B	1	16.9	2.08	1.78	Very stiff olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional bluish grey mottling and rare orange staining. Gravel is fine to coarse chalk and rare flint.	

Method of Preparation:

Method of Test: BS EN ISO 17892-1: 2014 & BS EN ISO 17892-2: 2014

Type of Sample Key: U = Undisturbed, B = Bulk, D = Disturbed, J - Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter

Comments:

Remarks to Include: Sample disturbance, loss of moisture, variation from test procedure, location and origin of test specimen within original sample. Oven drying temperature if not 105-110°C.



TEST REPORT

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Contract	Northwest Haverhill Relief Road
Serial No.	S33252

SUMMARY OF WATER CONTENT, LIQUID LIMIT, PLASTIC LIMIT, PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole /Pit No.	Depth (m)	Type	Ref.	Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquid-ity Index (%)	SAMPLE PREPARATION				Description	CLASS
									Method	Ret'd 0.425mm (%)	Corr'd W/C <0.425mm	Curing Time (hrs)		
CP01	0.70	D	2	16.6	28	14	14	0.18	Wet Sieved	19 (M)	N/R*	24	Firm yellowish brown slightly gravelly slightly sandy silty CLAY with occasional recently active roots. Gravel is fine to coarse angular to subangular flint.	CL
CP01	2.70	D	4	19.1	34	16	18	0.17	Wet Sieved	13 (M)	N/R*	24	Stiff light olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional light bluish grey mottling. Gravel is fine to medium chalk.	CL
CP01	4.50	D	6	18.9	31	15	16	0.25	Wet Sieved	15 (M)	N/R*	24	Stiff grey slightly gravelly slightly sandy silty calcareous CLAY with occasional orange staining. Gravel is fine to coarse chalk.	CL
CP01	5.50	D	7	19.0	33	16	17	0.17	Wet Sieved	12 (M)	N/R*	25	Stiff dark grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to medium chalk.	CL
CP01	9.60	D	9	20.0	33	16	17	0.23	Wet Sieved	17 (M)	N/R*	24	Stiff dark grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to medium chalk.	CL
CP01	13.60	D	11	17.0	34	16	18	0.05	Wet Sieved	8 (M)	N/R*	24	Very stiff dark grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to medium chalk.	CL
CP01	19.20	B	4	21.9	20	13	7	1.27	Wet Sieved	2 (M)	N/R*	24	Dark brownish grey sandy silty calcareous CLAY/very clayey fine and medium SAND with rare fine and medium chalk gravel	CL
CP02	1.90	D	2	16.9	33	16	17	0.05	Wet Sieved	43 (M)	N/R*	24	Firm brownish yellow slightly gravelly slightly sandy silty calcareous CLAY with rare recently active roots. Gravel is fine to medium chalk and rare flint.	CL

Method Of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2:1990:4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2:1990:3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter
 Comments: *Corrected water content assume material greater than 0.425mm is non-porous. See BS1377: Part 2: 1990 Clause 3 Note 1. Where N/R, corrected water content is not reported due to material type.
 Remarks to Include: Sample disturbance, loss of water, variation from test procedure, location and origin of test specimen within original sample, oven drying temperature if not 105-110C



TEST REPORT

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DATE ISSUED: 10/07/2018



0998

Contract	Northwest Haverhill Relief Road
Serial No.	S33252

SUMMARY OF WATER CONTENT, LIQUID LIMIT, PLASTIC LIMIT, PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole /Pit No.	Depth (m)	Type	Ref.	Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)	SAMPLE PREPARATION				Description	CLASS
									Method	Ret'd 0.425mm (%)	Corr'd W/C <0.425mm	Curing Time (hrs)		
CP02	2.60	D	3	17.9	34	16	18	0.11	Wet Sieved	9 (M)	N/R*	24	Stiff brownish yellow slightly gravelly slightly sandy silty calcareous CLAY with occasional light grey mottling. Gravel is fine to medium chalk.	CL
CP02	3.30	D	4	19.6	33	15	18	0.26	Wet Sieved	15 (M)	N/R*	77	Stiff olive yellow slightly gravelly slightly sandy silty calcareous CLAY with occasional light grey mottling, and rare decayed roots. Gravel is fine to coarse chalk.	CL
CP02	5.50	D	6	20.8	32	15	17	0.34	Wet Sieved	44 (M)	N/R*	77	Stiff light olive brown slightly gravelly sandy silty calcareous CLAY. Gravel is fine to coarse chalk.	CL
CP02	7.90	D	7	19.3	31	15	16	0.27	Wet Sieved	14 (M)	N/R*	76	Stiff dark olive grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to medium chalk.	CL
CP02	12.30	D	10	16.8	33	15	18	0.10	Wet Sieved	11 (M)	N/R*	28	Very stiff dark grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to medium chalk.	CL
WS101	1.40	D	3	17.3	51	19	32	-0.05	Wet Sieved	6 (M)	N/R*	28	Very stiff olive brown slightly gravelly slightly sandy calcareous CLAY with occasional dark grey mottling. Gravel is fine to medium chalk and rare flint.	CH
WS101	4.50	D	9	17.4	40	18	22	-0.03	Wet Sieved	10 (M)	N/R*	72	Very stiff greyish brown slightly gravelly slightly sandy silty calcareous CLAY with occasional orangish brown mottling. Gravel is fine to medium chalk and rare flint.	CI
WS102	2.20	D	5	16.1	47	19	28	-0.10	Wet Sieved	33 (M)	N/R*	28	Very stiff dark olive slightly gravelly slightly sandy silty CLAY with occasional dark grey mottling. Gravel is fine to coarse chalk.	CI

Method Of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2:1990:4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2:1990:3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter
 Comments: *Corrected water content assume material greater than 0.425mm is non-porous. See BS1377: Part 2: 1990 Clause 3 Note 1. Where N/R, corrected water content is not reported due to material type.
 Remarks to Include: Sample disturbance, loss of water, variation from test procedure, location and origin of test specimen within original sample, oven drying temperature if not 105-110C



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Contract	Northwest Haverhill Relief Road
Serial No.	S33252

SUMMARY OF WATER CONTENT, LIQUID LIMIT, PLASTIC LIMIT, PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole /Pit No.	Depth (m)	Type	Ref.	Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)	SAMPLE PREPARATION				Description	CLASS
									Method	Ret'd 0.425mm (%)	Corr'd W/C <0.425mm	Curing Time (hrs)		
WS102	3.20	D	7	14.9	46	16	30	-0.04	Wet Sieved	38 (M)	N/R*	72	Very stiff dark olive slightly gravelly sandy silty calcareous CLAY with occasional dark grey mottling, and rare selenite crystals. Gravel is fine to coarse chalk.	CI
WS103	2.00	D	4	18.8	43	15	28	0.14	Wet Sieved	22 (M)	N/R*	71	Very stiff light olive brown slightly gravelly slightly sandy silty calcareous CLAY with rare bluish grey veins, and decayed roots. Gravel is fine to medium chalk.	CI
WS103	3.20	D	7	18.4	44	18	26	0.01	Wet Sieved	8 (M)	N/R*	145	Very stiff dark olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional bluish grey mottling, and rare decayed roots. Gravel is fine to medium chalk.	CI
WS104	2.00	D	5	18.4	47	16	31	0.08	Wet Sieved	33 (M)	N/R*	71	Very stiff dark olive slightly gravelly sandy silty calcareous CLAY with occasional bluish grey mottling. Gravel is fine to medium chalk.	CI
WS105	1.40	D	2	17.6	48	19	29	-0.05	Wet Sieved	8 (M)	N/R*	72	Very stiff olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional bluish grey mottling, and rare recently active and decayed roots. Gravel is fine to medium chalk.	CI
WS106	1.20	D	2	21.4	43	18	25	0.14	Wet Sieved	10 (M)	N/R*	144	Very stiff olive yellow slightly gravelly slightly sandy silty calcareous CLAY with rare recently active and decayed roots. Gravel is fine to medium chalk.	CI
WS106	2.50	D	4	20.5	41	16	25	0.18	Wet Sieved	14 (M)	N/R*	71	Very stiff light olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional light bluish grey mottling, and rare recently active roots. Gravel is fine to medium chalk.	CI
WS107	1.30	D	3	24.9	49	19	30	0.20	From Natural	<1% (A)	N/R*	71	Firm brown slightly gravelly slightly sandy silty calcareous CLAY with rare recently active roots. Gravel is fine to medium and flint.	CI

Method Of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2:1990:4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2:1990:3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter
 Comments: *Corrected water content assume material greater than 0.425mm is non-porous. See BS1377: Part 2: 1990 Clause 3 Note 1. Where N/R, corrected water content is not reported due to material type.
 Remarks to Include: Sample disturbance, loss of water, variation from test procedure, location and origin of test specimen within original sample, oven drying temperature if not 105-110C



TEST REPORT

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0998

Contract	Northwest Haverhill Relief Road
Serial No.	S33252

SUMMARY OF WATER CONTENT, LIQUID LIMIT, PLASTIC LIMIT, PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole /Pit No.	Depth (m)	Type	Ref.	Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquid-ity Index (%)	SAMPLE PREPARATION				Description	CLASS
									Method	Ret'd 0.425mm (%)	Corr'd W/C <0.425mm	Curing Time (hrs)		
WS107	4.70	D	9	17.7	32	16	16	0.11	Wet Sieved	13 (M)	N/R*	72	Very stiff dark grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to medium chalk.	CL

Method Of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2:1990:4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2:1990:3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter
 Comments: *Corrected water content assume material greater than 0.425mm is non-porous. See BS1377: Part 2: 1990 Clause 3 Note 1. Where N/R, corrected water content is not reported due to material type.
 Remarks to Include: Sample disturbance, loss of water, variation from test procedure, location and origin of test specimen within original sample, oven drying temperature if not 105-110C



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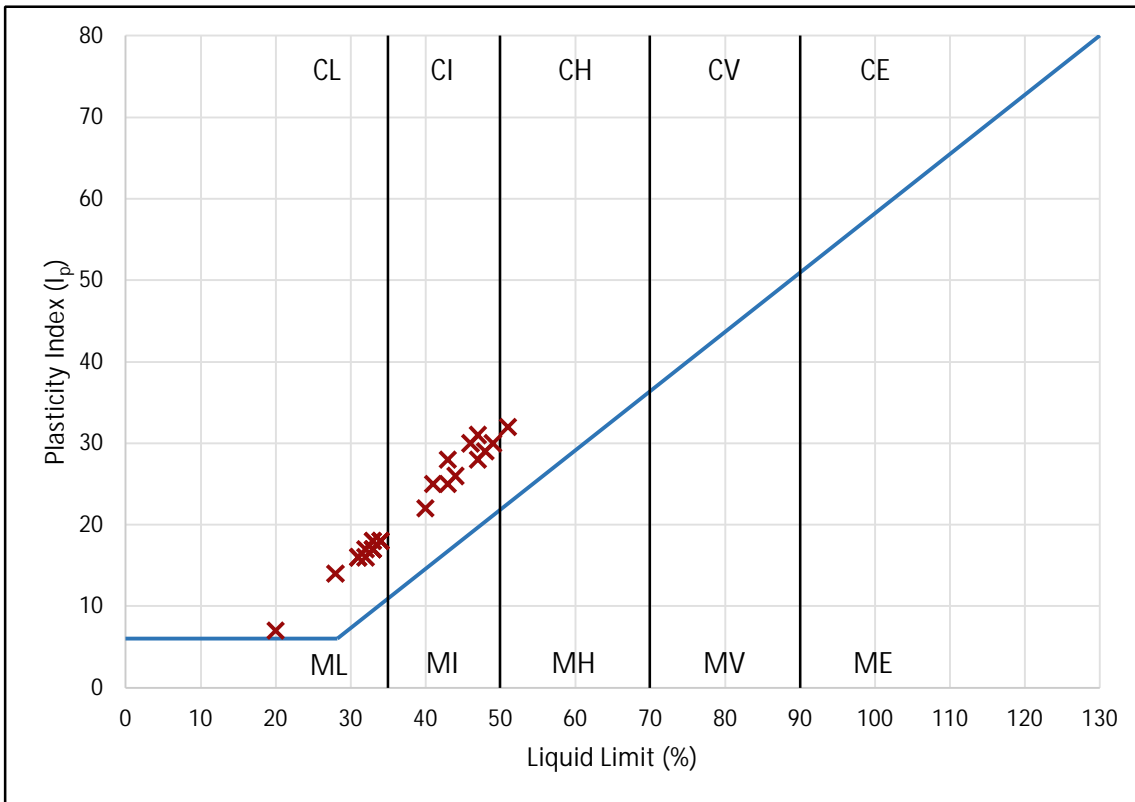


0998

Contract	Northwest Haverhill Relief Road
Serial No.	S33252

PLOT OF PLASTICITY INDEX AGAINST LIQUID LIMIT USING CASAGRANDE CLASSIFICATION CHART

Plasticity				
Low	Medium	High	Very High	Extremely High



Plasticity Chart BS5930: 2015: Figure 8

High	NHBC Volume Change Potential
Medium	
Low	

Method of Preparation:	BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
Method of Test:	BS EN ISO: 17892-1: 2014 & BS1377: Part 2: 3.2, 4.4, 5.3, 5.4
Type of Sample Key:	U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter
Comments:	Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index



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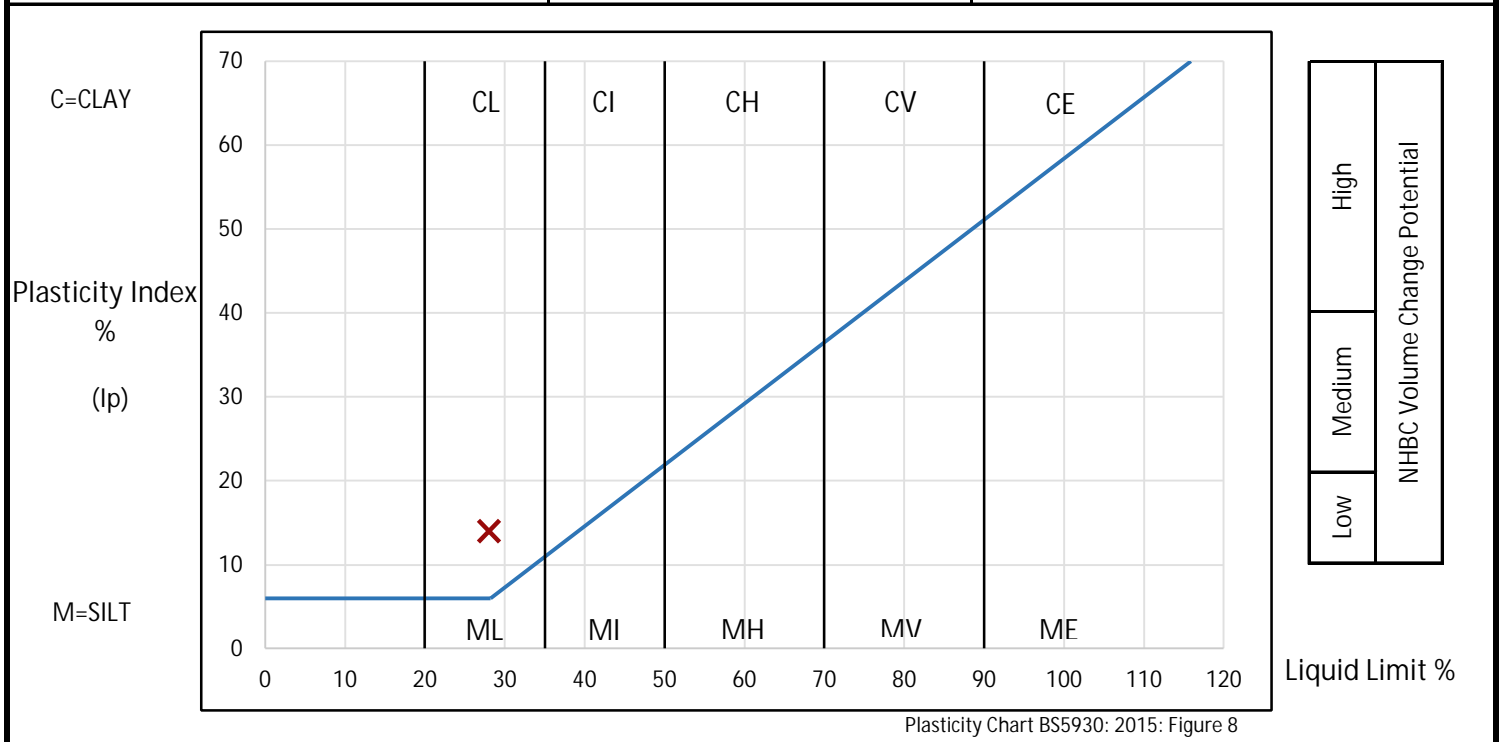


Contract	Northwest Haverhill Relief Road
Serial No.	S33252

DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
CP01	0.70	D	2	16.6	Firm yellowish brown slightly gravelly slightly sandy silty CLAY with occasional recently active roots. Gravel is fine to coarse angular to subangular flint.	

PREPARATION			Liquid Limit	28 %	
Method of preparation		Wet sieved over 0.425mm sieve	Plastic Limit	14 %	
Sample retained 0.425mm sieve	(Measured)	19 %	Plasticity Index	14 %	
Corrected water content for material passing 0.425mm			Not reported	Liquidity Index	0.18
Sample retained 2mm sieve	(Measured)	2 %	NHBC Modified (I'p)	11 %	
Curing time	24 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content not reported due to material type.
 Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



TEST REPORT

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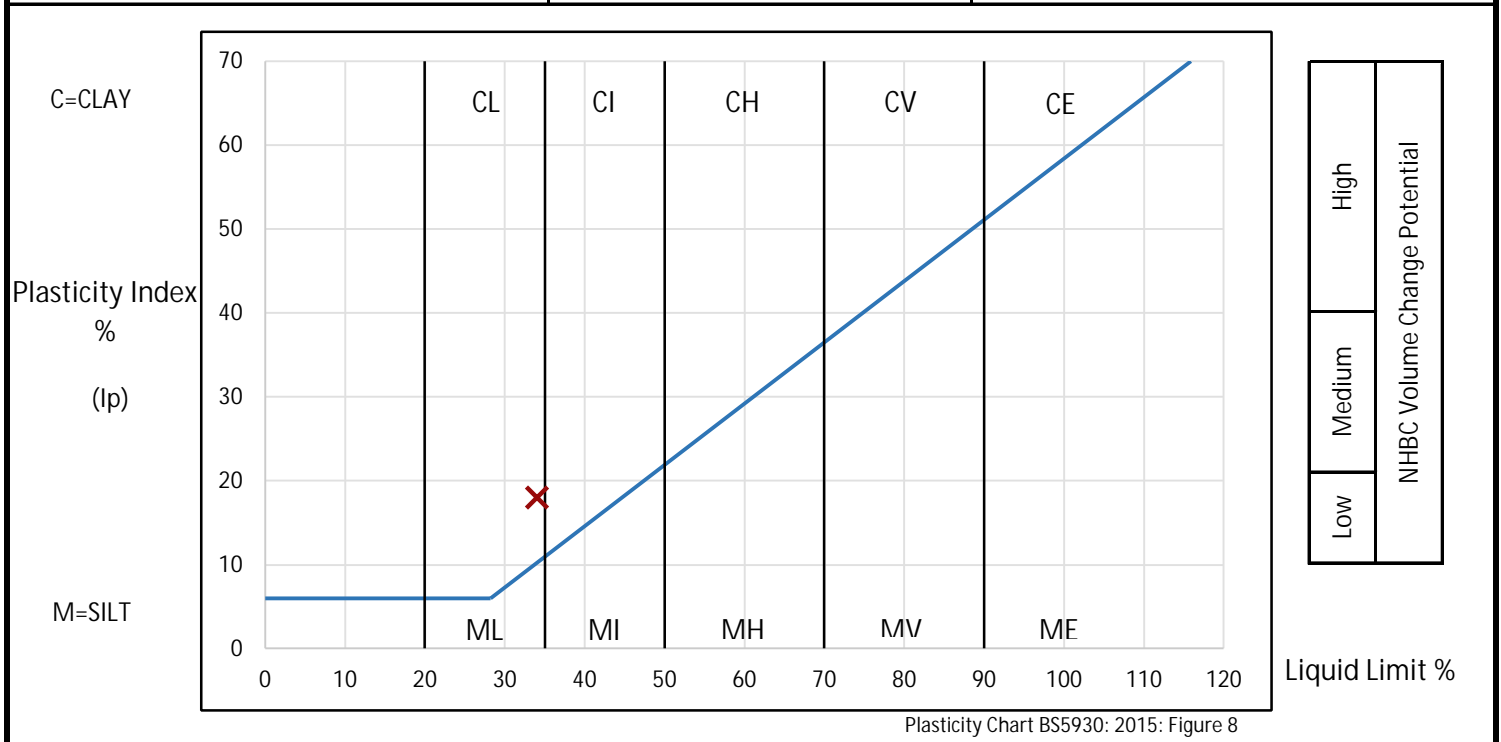
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Contract	Northwest Haverhill Relief Road
Serial No.	S33252

**DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND
DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX**

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
CP01	2.70	D	4	19.1	Stiff light olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional light bluish grey mottling. Gravel is fine to medium chalk.	

PREPARATION			Liquid Limit	34 %	
Method of preparation		Wet sieved over 0.425mm sieve	Plastic Limit	16 %	
Sample retained 0.425mm sieve	(Measured)	13 %	Plasticity Index	18 %	
Corrected water content for material passing 0.425mm			Not reported	Liquidity Index	0.17
Sample retained 2mm sieve	(Measured)	11 %	NHBC Modified (I'p)	16 %	
Curing time	24 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content not reported due to material type.
 Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



TEST REPORT

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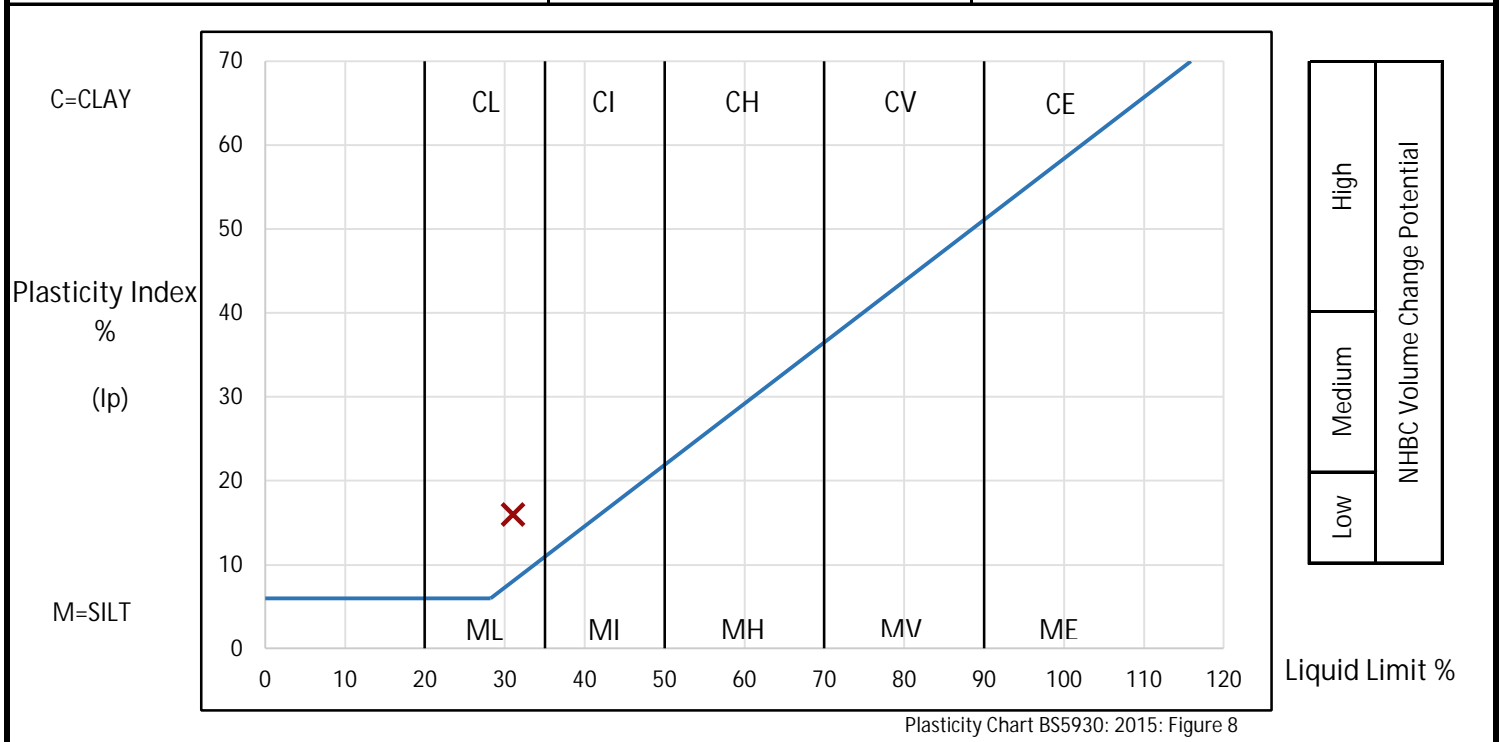
0998

Contract	Northwest Haverhill Relief Road
Serial No.	S33252

**DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND
DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX**

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
CP01	4.50	D	6	18.9	Stiff grey slightly gravelly slightly sandy silty calcareous CLAY with occasional orange staining. Gravel is fine to coarse chalk.	

PREPARATION			Liquid Limit	31 %	
Method of preparation	Wet sieved over 0.425mm sieve		Plastic Limit	15 %	
Sample retained 0.425mm sieve	(Measured)	15 %	Plasticity Index	16 %	
Corrected water content for material passing 0.425mm	Not reported		Liquidity Index	0.25	
Sample retained 2mm sieve	(Measured)	13 %	NHBC Modified (I'p)	14 %	
Curing time	24 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content not reported due to material type.
 Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



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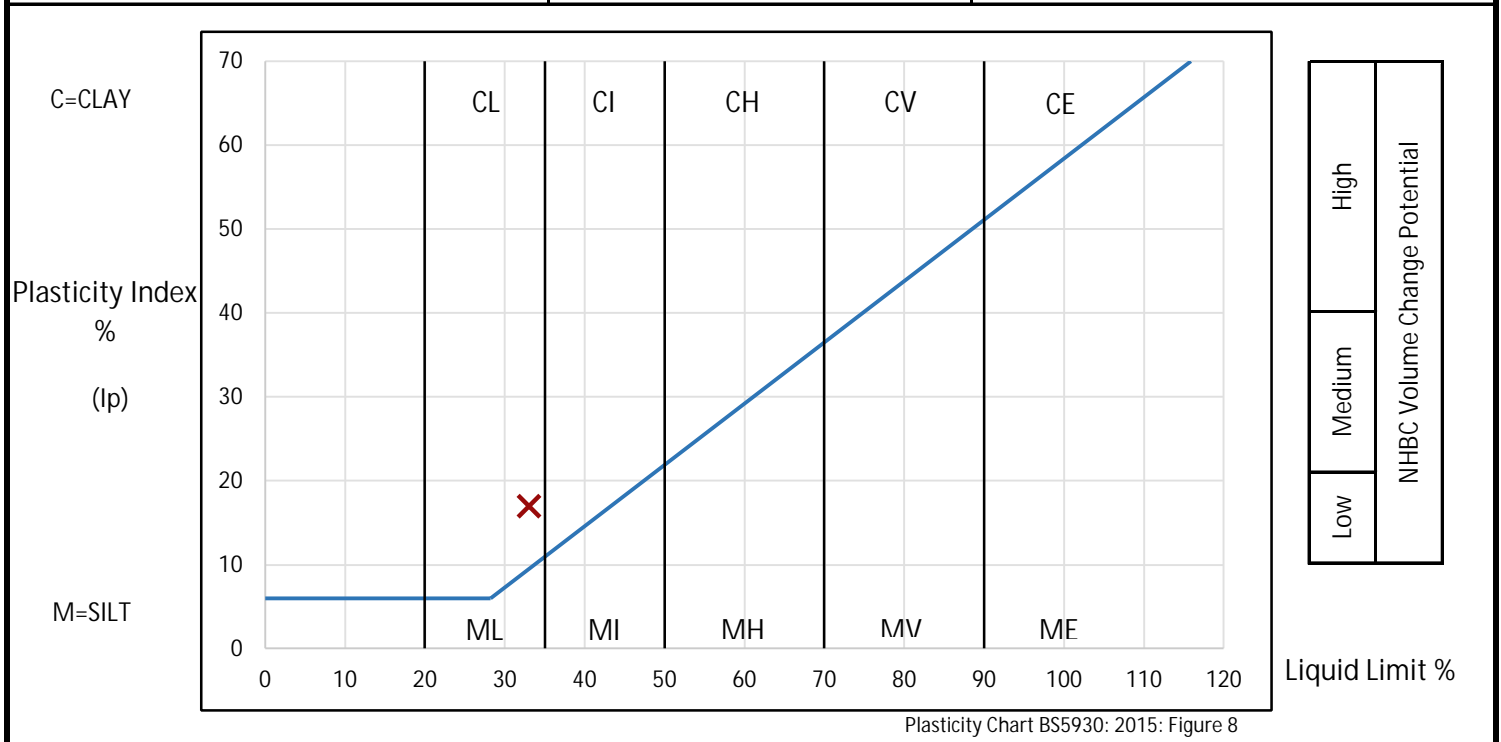
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Contract	Northwest Haverhill Relief Road
Serial No.	S33252

**DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND
DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX**

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
CP01	5.50	D	7	19.0	Stiff dark grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to medium chalk.	

PREPARATION			Liquid Limit	33 %	
Method of preparation	Wet sieved over 0.425mm sieve		Plastic Limit	16 %	
Sample retained 0.425mm sieve	(Measured)	12 %	Plasticity Index	17 %	
Corrected water content for material passing 0.425mm	Not reported		Liquidity Index	0.17	
Sample retained 2mm sieve	(Measured)	10 %	NHBC Modified (I'p)	15 %	
Curing time	25 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content not reported due to material type.
 Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



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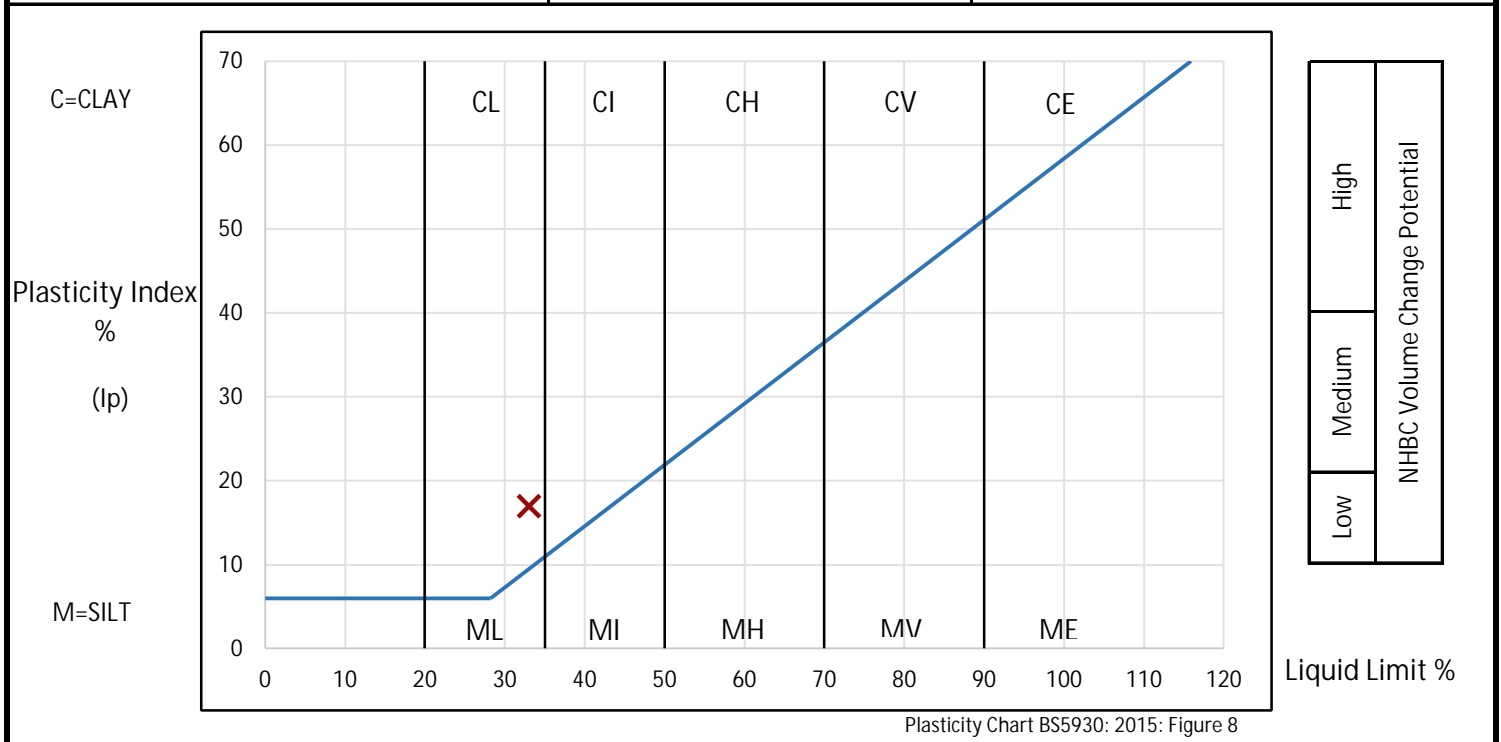
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Contract	Northwest Haverhill Relief Road
Serial No.	S33252

**DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND
DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX**

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
CP01	9.60	D	9	20.0	Stiff dark grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to medium chalk.	

PREPARATION			Liquid Limit	33 %	
Method of preparation			Wet sieved over 0.425mm sieve	Plastic Limit	16 %
Sample retained 0.425mm sieve	(Measured)	17 %	Plasticity Index	17 %	
Corrected water content for material passing 0.425mm			Not reported	Liquidity Index	0.23
Sample retained 2mm sieve	(Measured)	14 %	NHBC Modified (I'p)	14 %	
Curing time	24 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content not reported due to material type.
 Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



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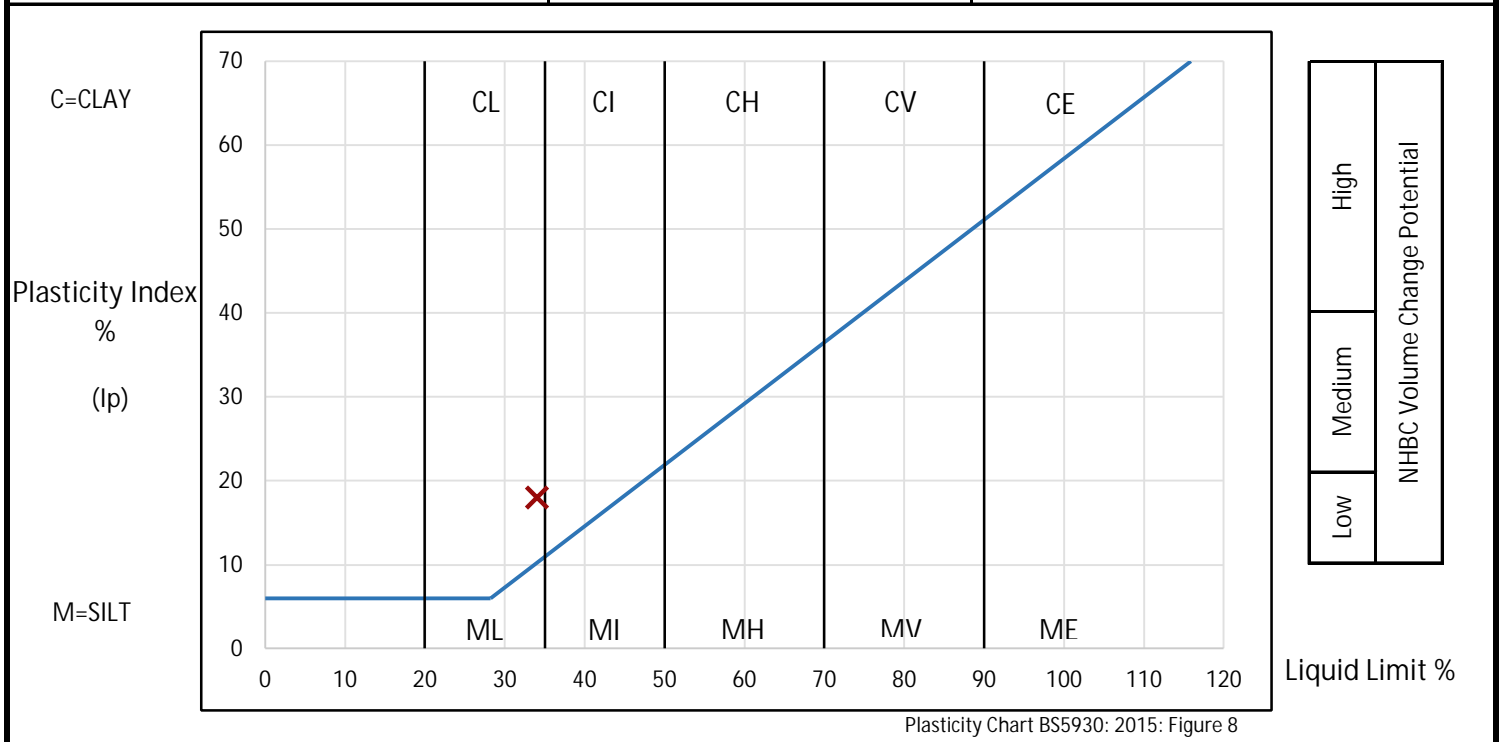
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Contract	Northwest Haverhill Relief Road
Serial No.	S33252

**DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND
DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX**

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
CP01	13.60	D	11	17.0	Very stiff dark grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to medium chalk.	

PREPARATION			Liquid Limit	34 %	
Method of preparation	Wet sieved over 0.425mm sieve		Plastic Limit	16 %	
Sample retained 0.425mm sieve	(Measured)	8 %	Plasticity Index	18 %	
Corrected water content for material passing 0.425mm	Not reported		Liquidity Index	0.05	
Sample retained 2mm sieve	(Measured)	6 %	NHBC Modified (I'p)	17 %	
Curing time	24 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content not reported due to material type.
 Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



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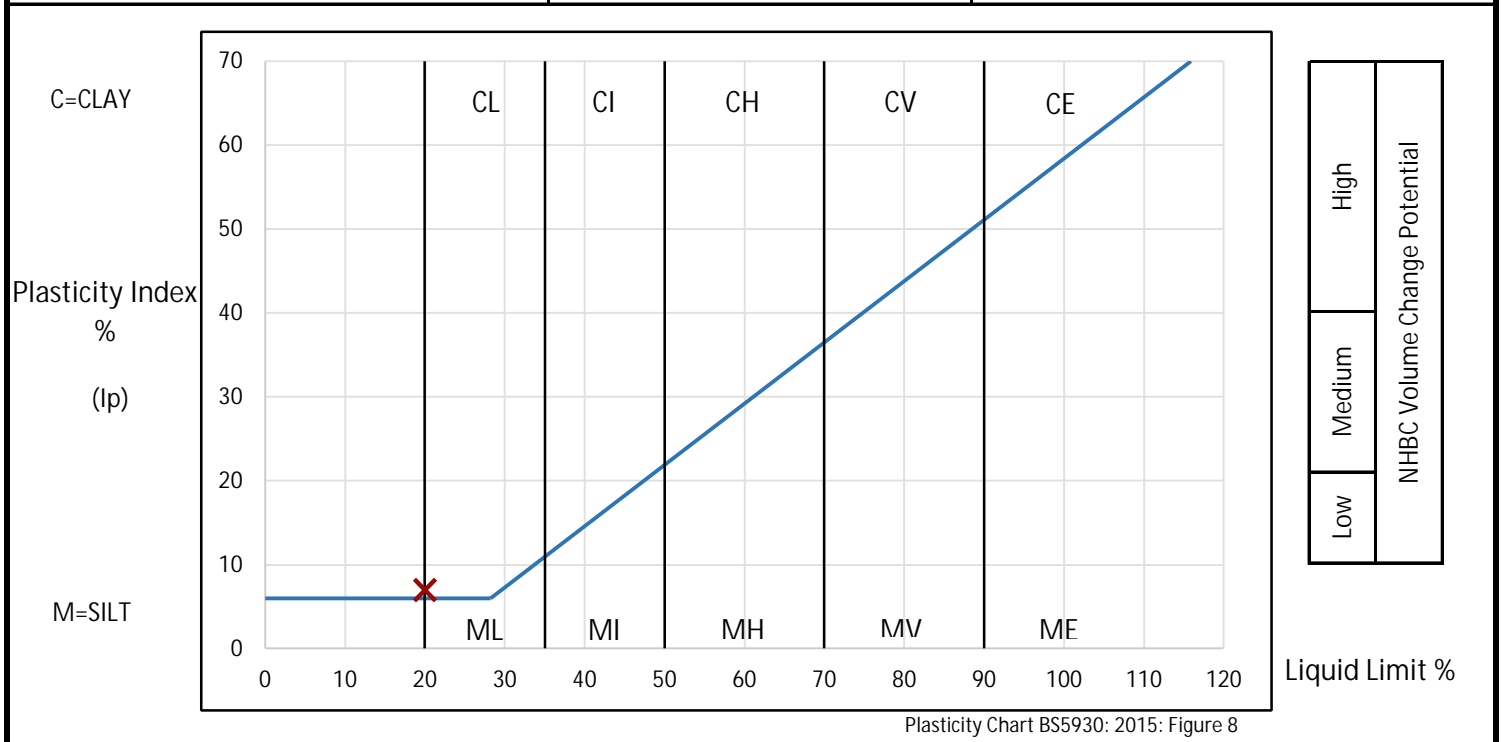
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Contract	Northwest Haverhill Relief Road
Serial No.	S33252

**DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND
DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX**

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
CP01	19.20	B	4	21.9	Dark brownish grey sandy silty calcareous CLAY/very clayey fine and medium SAND with rare fine and medium chalk gravel	

PREPARATION			Liquid Limit	20 %	
Method of preparation			Wet sieved over 0.425mm sieve	Plastic Limit	13 %
Sample retained 0.425mm sieve	(Measured)	2 %	Plasticity Index	7 %	
Corrected water content for material passing 0.425mm			Not reported	Liquidity Index	1.27
Sample retained 2mm sieve	(Measured)	<1 %	NHBC Modified (I'p)	7 %	
Curing time	24 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content not reported due to material type.
 Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



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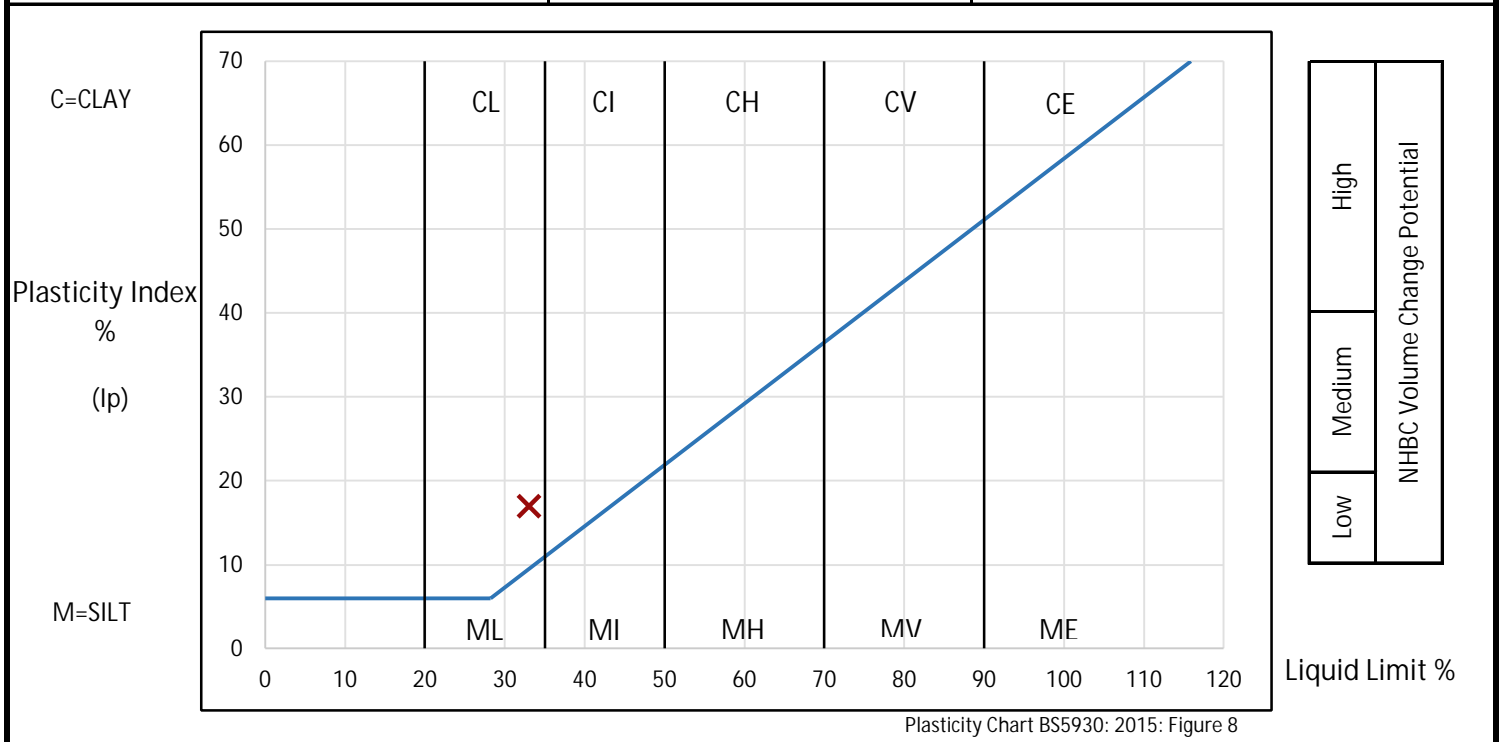


Contract	Northwest Haverhill Relief Road
Serial No.	S33252

**DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND
DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX**

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
CP02	1.90	D	2	16.9	Firm brownish yellow slightly gravelly slightly sandy silty calcareous CLAY with rare recently active roots. Gravel is fine to medium chalk and rare flint.	

PREPARATION			Liquid Limit	33 %	
Method of preparation	Wet sieved over 0.425mm sieve		Plastic Limit	16 %	
Sample retained 0.425mm sieve	(Measured)	43 %	Plasticity Index	17 %	
Corrected water content for material passing 0.425mm	Not reported		Liquidity Index	0.05	
Sample retained 2mm sieve	(Measured)	34 %	NHBC Modified (I'p)	10 %	
Curing time	24 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content not reported due to material type.
 Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



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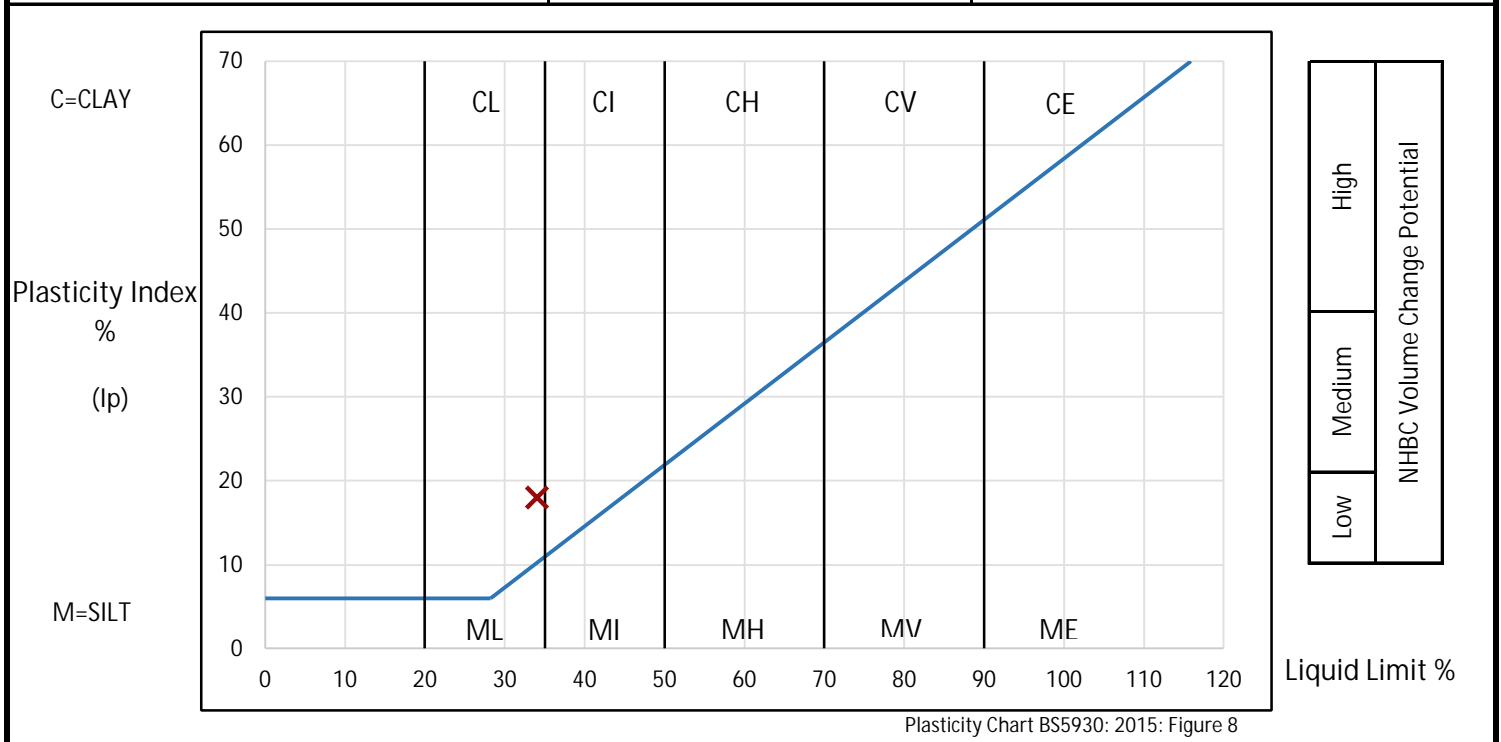
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Contract	Northwest Haverhill Relief Road
Serial No.	S33252

**DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND
DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX**

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
CP02	2.60	D	3	17.9	Stiff brownish yellow slightly gravelly slightly sandy silty calcareous CLAY with occasional light grey mottling. Gravel is fine to medium chalk.	

PREPARATION			Liquid Limit	34 %	
Method of preparation	Wet sieved over 0.425mm sieve		Plastic Limit	16 %	
Sample retained 0.425mm sieve	(Measured)	9 %	Plasticity Index	18 %	
Corrected water content for material passing 0.425mm	Not reported		Liquidity Index	0.11	
Sample retained 2mm sieve	(Measured)	8 %	NHBC Modified (I'p)	16 %	
Curing time	24 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content not reported due to material type.
 Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



TEST REPORT

ISSUED BY SOIL PROPERTY TESTING LTD
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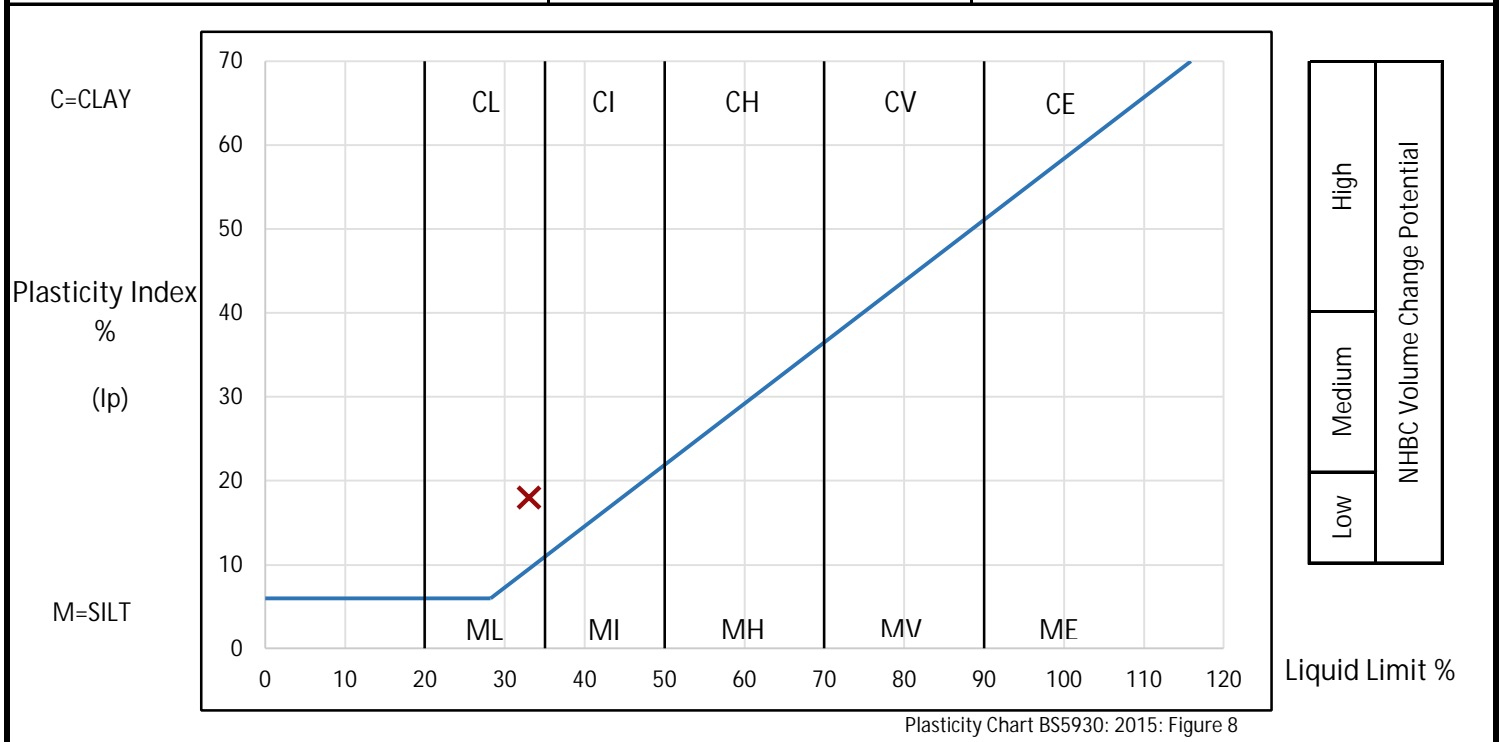
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Contract	Northwest Haverhill Relief Road
Serial No.	S33252

**DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND
DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX**

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
CP02	3.30	D	4	19.6	Stiff olive yellow slightly gravelly slightly sandy silty calcareous CLAY with occasional light grey mottling, and rare decayed roots. Gravel is fine to coarse chalk.	

PREPARATION			Liquid Limit	33 %	
Method of preparation			Wet sieved over 0.425mm sieve	Plastic Limit	15 %
Sample retained 0.425mm sieve	(Measured)	15 %	Plasticity Index	18 %	
Corrected water content for material passing 0.425mm			Not reported	Liquidity Index	0.26
Sample retained 2mm sieve	(Measured)	13 %	NHBC Modified (I'p)	15 %	
Curing time	77 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content not reported due to material type.
 Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



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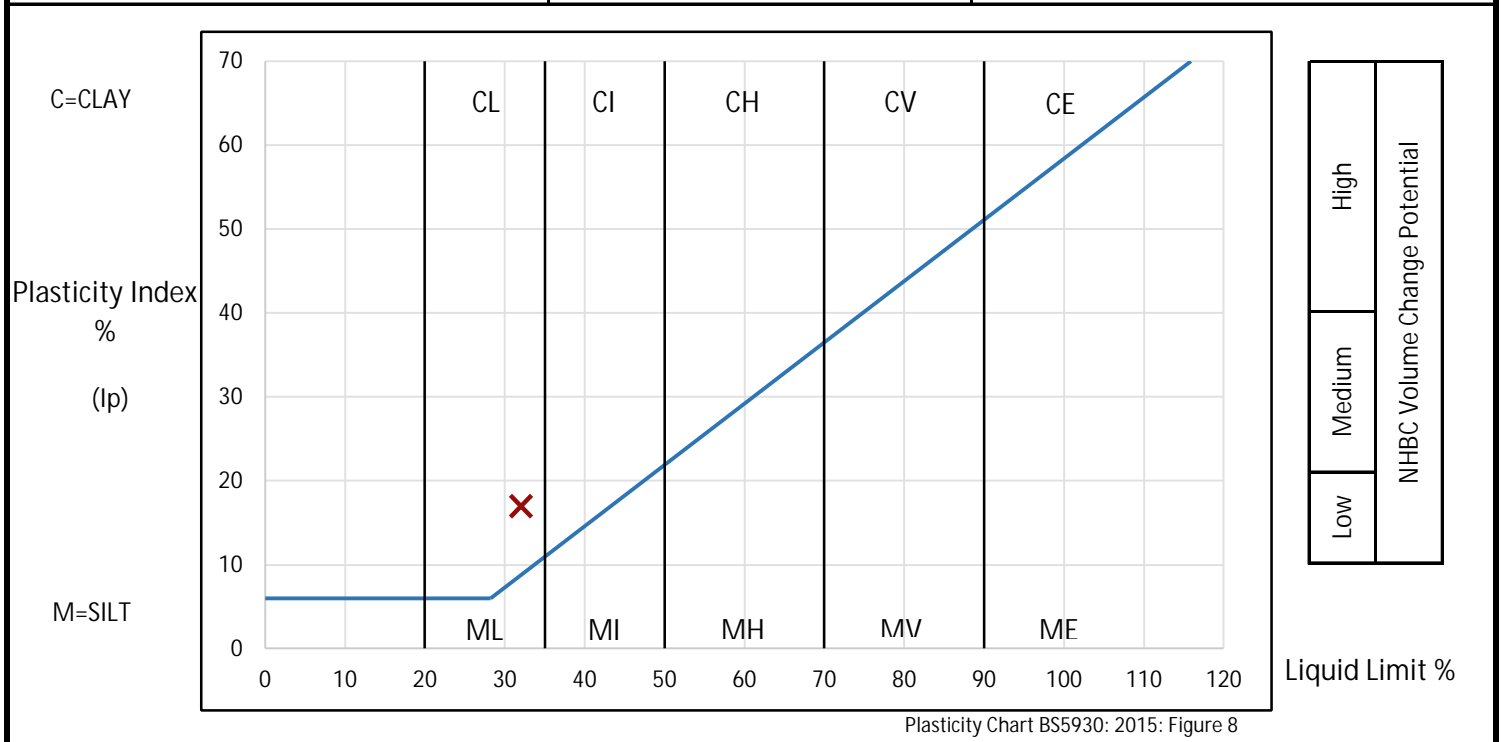
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Contract	Northwest Haverhill Relief Road
Serial No.	S33252

DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
CP02	5.50	D	6	20.8	Stiff light olive brown slightly gravelly sandy silty calcareous CLAY. Gravel is fine to coarse chalk.	

PREPARATION			Liquid Limit	32 %	
Method of preparation	Wet sieved over 0.425mm sieve		Plastic Limit	15 %	
Sample retained 0.425mm sieve	(Measured)	44 %	Plasticity Index	17 %	
Corrected water content for material passing 0.425mm	Not reported		Liquidity Index	0.34	
Sample retained 2mm sieve	(Measured)	10 %	NHBC Modified (I'p)	10 %	
Curing time	77 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content not reported due to material type.
 Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



TEST REPORT

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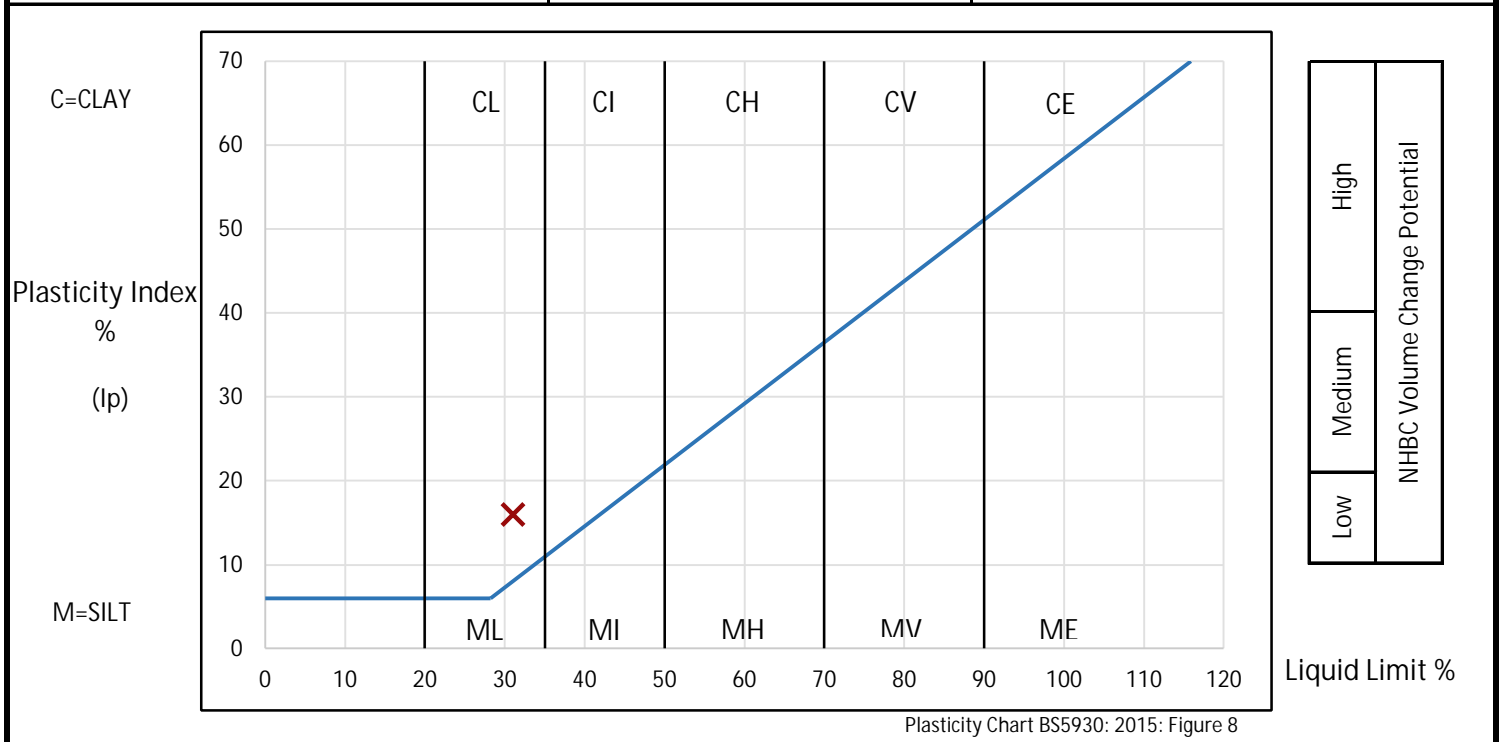
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Contract	Northwest Haverhill Relief Road
Serial No.	S33252

**DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND
DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX**

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
CP02	7.90	D	7	19.3	Stiff dark olive grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to medium chalk.	

PREPARATION			Liquid Limit	31 %	
Method of preparation			Wet sieved over 0.425mm sieve	Plastic Limit	15 %
Sample retained 0.425mm sieve	(Measured)	14 %	Plasticity Index	16 %	
Corrected water content for material passing 0.425mm			Not reported	Liquidity Index	0.27
Sample retained 2mm sieve	(Measured)	13 %	NHBC Modified (I'p)	14 %	
Curing time	76 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content not reported due to material type.
 Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



TEST REPORT

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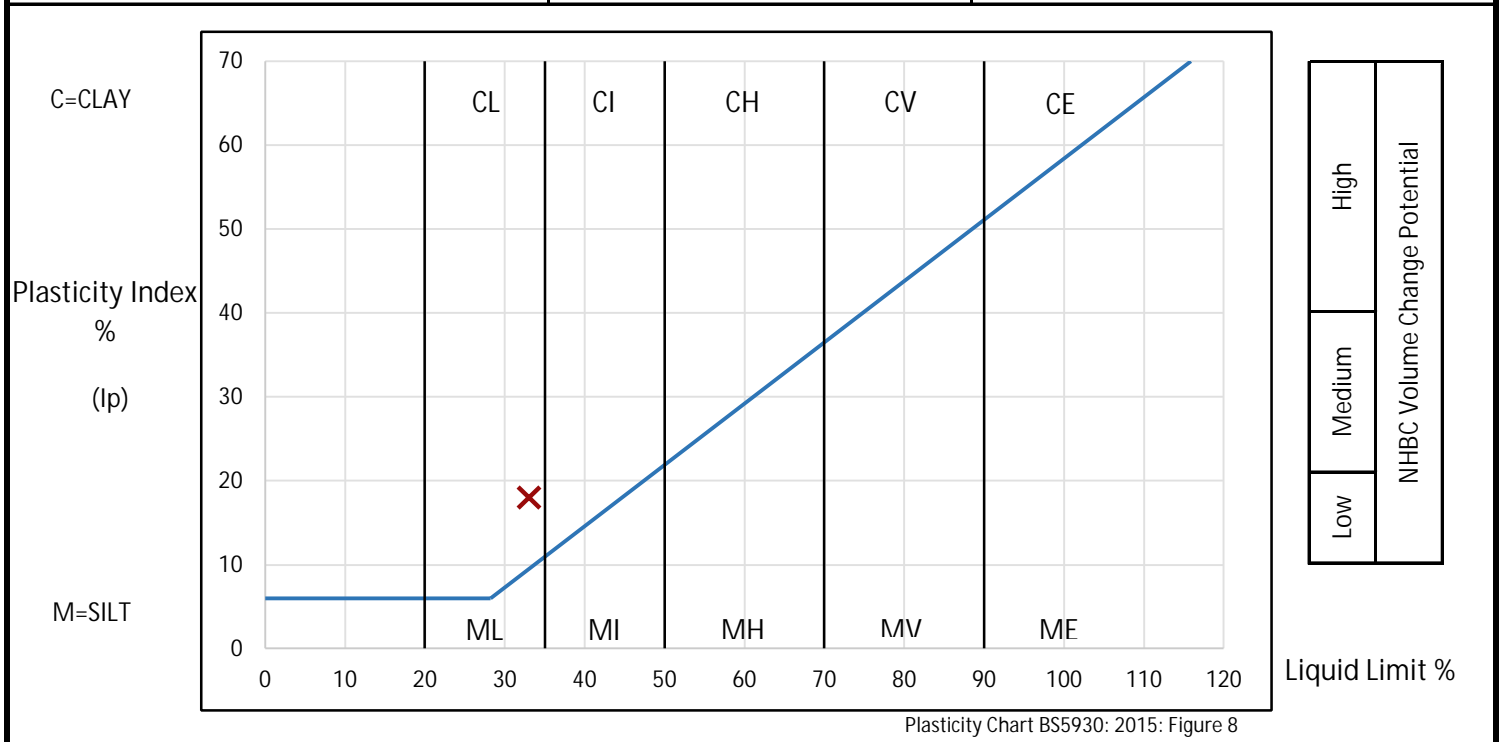
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Contract	Northwest Haverhill Relief Road
Serial No.	S33252

**DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND
DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX**

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
CP02	12.30	D	10	16.8	Very stiff dark grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to medium chalk.	

PREPARATION			Liquid Limit	33 %	
Method of preparation			Wet sieved over 0.425mm sieve	Plastic Limit	15 %
Sample retained 0.425mm sieve	(Measured)	11 %	Plasticity Index	18 %	
Corrected water content for material passing 0.425mm			Not reported	Liquidity Index	0.10
Sample retained 2mm sieve	(Measured)	9 %	NHBC Modified (I'p)	16 %	
Curing time	28 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content not reported due to material type.
 Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



TEST REPORT

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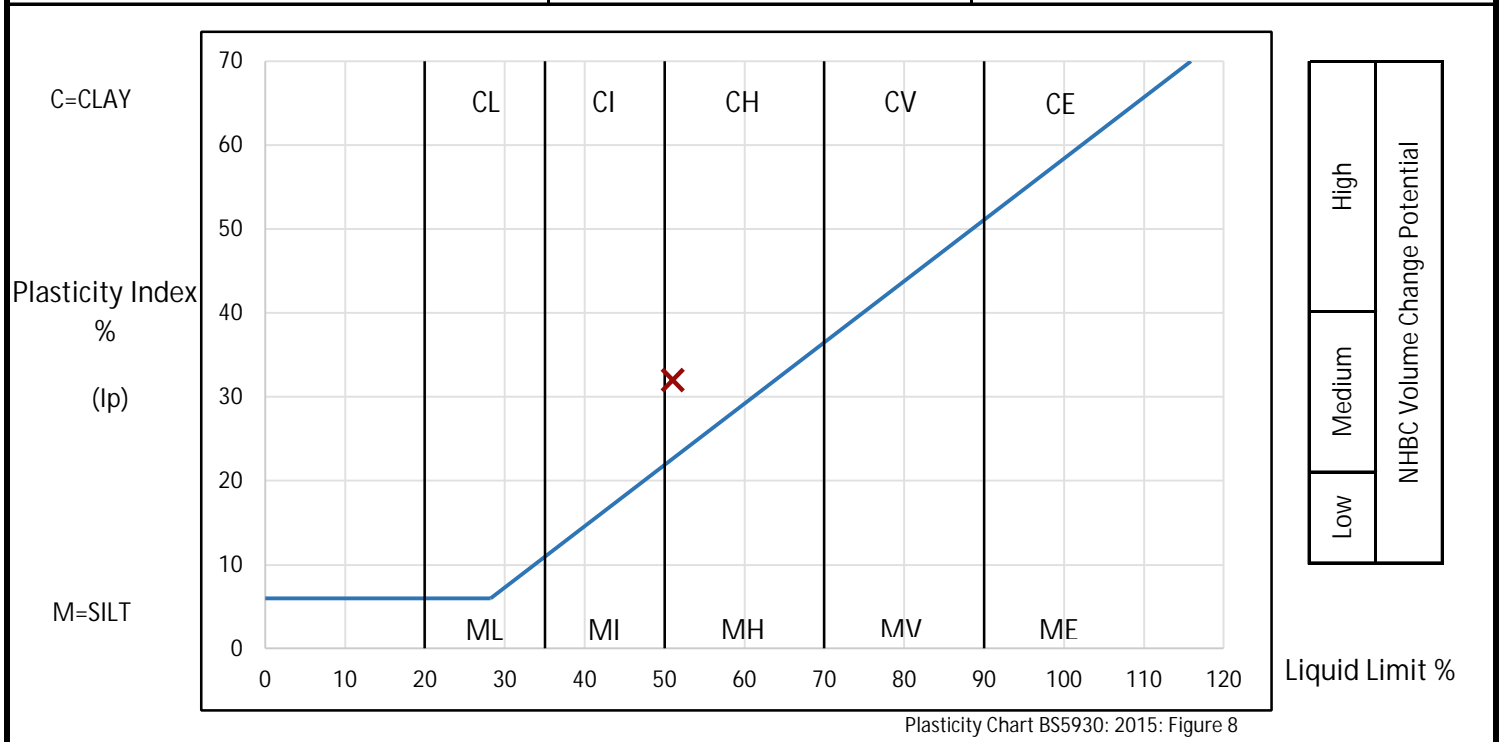
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Contract	Northwest Haverhill Relief Road
Serial No.	S33252

**DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND
DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX**

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
WS101	1.40	D	3	17.3	Very stiff olive brown slightly gravelly slightly sandy calcareous CLAY with occasional dark grey mottling. Gravel is fine to medium chalk and rare flint.	

PREPARATION			Liquid Limit	51 %	
Method of preparation			Wet sieved over 0.425mm sieve	Plastic Limit	19 %
Sample retained 0.425mm sieve	(Measured)	6 %	Plasticity Index	32 %	
Corrected water content for material passing 0.425mm			Not reported	Liquidity Index	-0.05
Sample retained 2mm sieve	(Measured)	4 %	NHBC Modified (I'p)	30 %	
Curing time	28 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content not reported due to material type.
 Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



TEST REPORT

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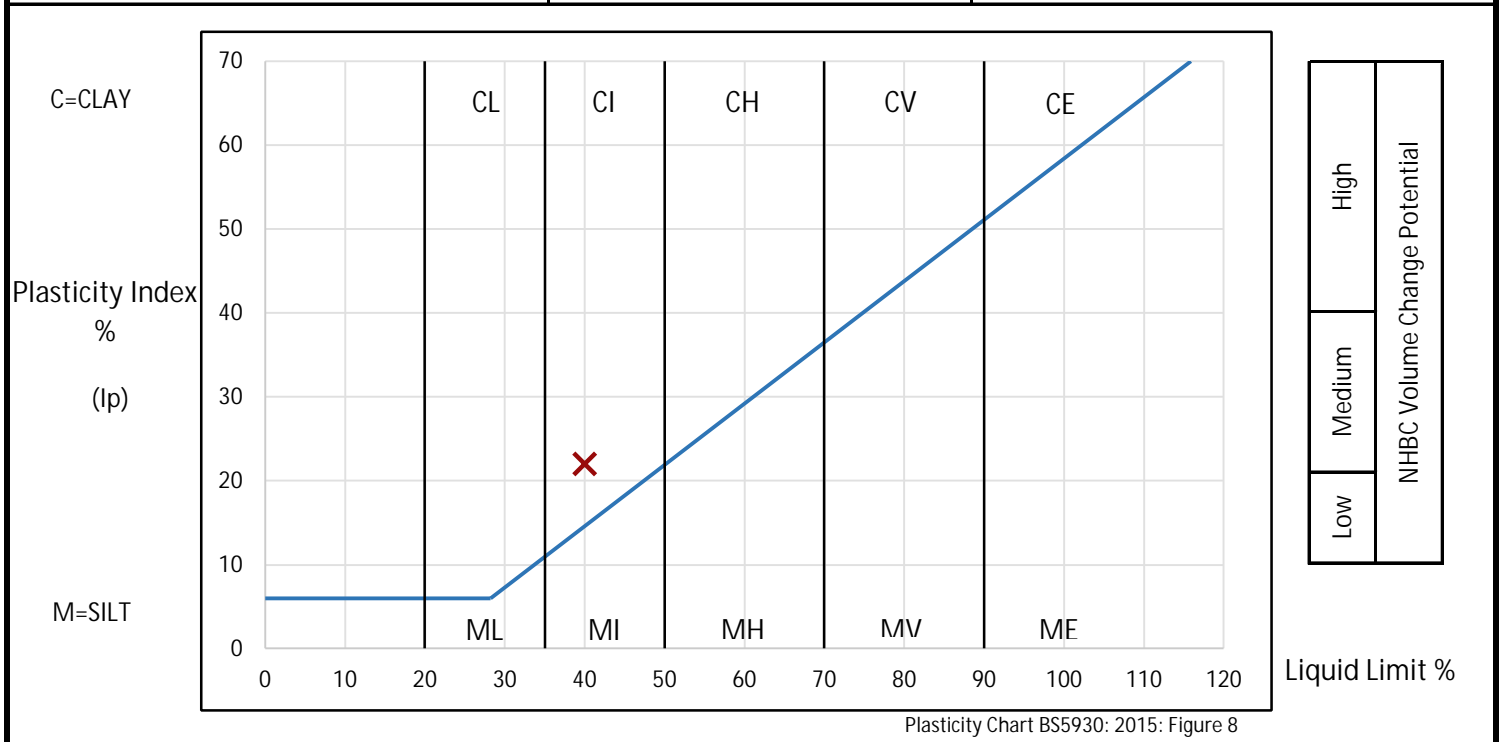
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Contract	Northwest Haverhill Relief Road
Serial No.	S33252

**DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND
DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX**

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
WS101	4.50	D	9	17.4	Very stiff greyish brown slightly gravelly slightly sandy silty calcareous CLAY with occasional orangish brown mottling. Gravel is fine to medium chalk and rare flint.	

PREPARATION			Liquid Limit	40 %	
Method of preparation	Wet sieved over 0.425mm sieve		Plastic Limit	18 %	
Sample retained 0.425mm sieve	(Measured)	10 %	Plasticity Index	22 %	
Corrected water content for material passing 0.425mm	Not reported		Liquidity Index	-0.03	
Sample retained 2mm sieve	(Measured)	8 %	NHBC Modified (I'p)	20 %	
Curing time	72 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content not reported due to material type.
 Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



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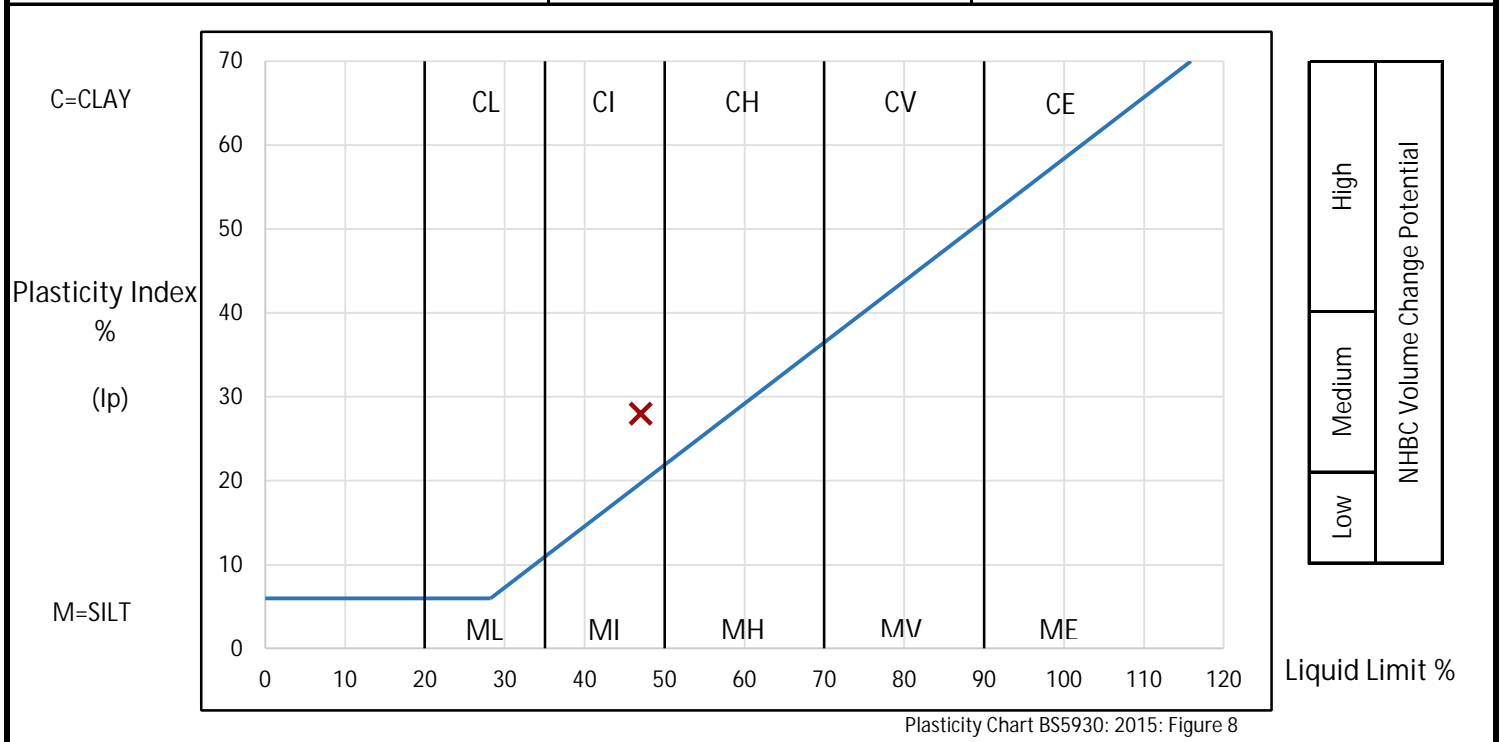
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Contract	Northwest Haverhill Relief Road
Serial No.	S33252

**DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND
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Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
WS102	2.20	D	5	16.1	Very stiff dark olive slightly gravelly slightly sandy silty CLAY with occasional dark grey mottling. Gravel is fine to coarse chalk.	1nr chalk cobble not included in test as unrepresentative.

PREPARATION			Liquid Limit	47 %	
Method of preparation	Wet sieved over 0.425mm sieve		Plastic Limit	19 %	
Sample retained 0.425mm sieve	(Measured)	33 %	Plasticity Index	28 %	
Corrected water content for material passing 0.425mm	Not reported		Liquidity Index	-0.10	
Sample retained 2mm sieve	(Measured)	15 %	NHBC Modified (I'p)	19 %	
Curing time	28 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content not reported due to material type.
 Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



TEST REPORT

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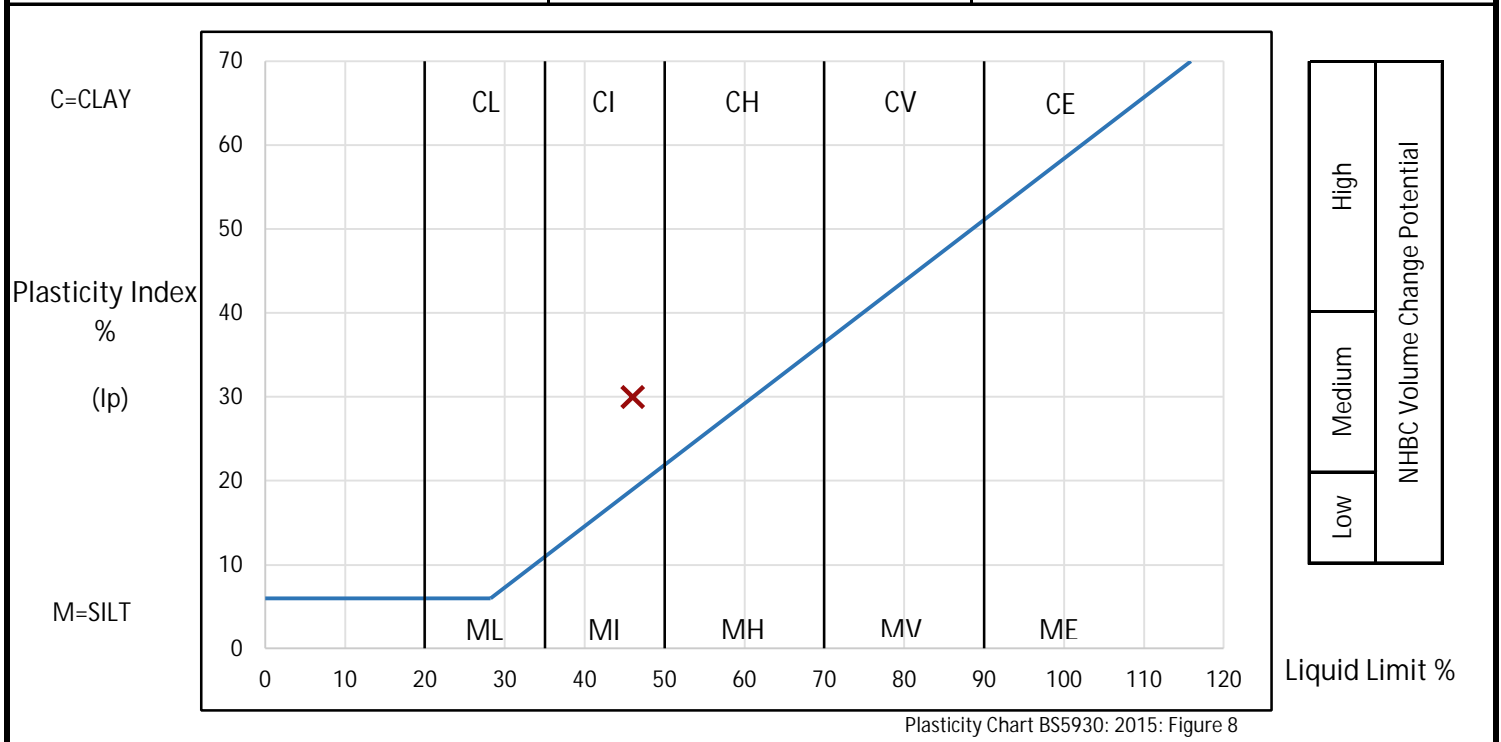


Contract	Northwest Haverhill Relief Road
Serial No.	S33252

**DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND
DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX**

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
WS102	3.20	D	7	14.9	Very stiff dark olive slightly gravelly sandy silty calcareous CLAY with occasional dark grey mottling, and rare selenite crystals. Gravel is fine to coarse chalk.	Specimen dried at 80°C due to the presence of selenite.

PREPARATION			Liquid Limit	46 %	
Method of preparation	Wet sieved over 0.425mm sieve		Plastic Limit	16 %	
Sample retained 0.425mm sieve	(Measured)	38 %	Plasticity Index	30 %	
Corrected water content for material passing 0.425mm	Not reported		Liquidity Index	-0.04	
Sample retained 2mm sieve	(Measured)	5 %	NHBC Modified (I'p)	19 %	
Curing time	72 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content not reported due to material type.
 Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



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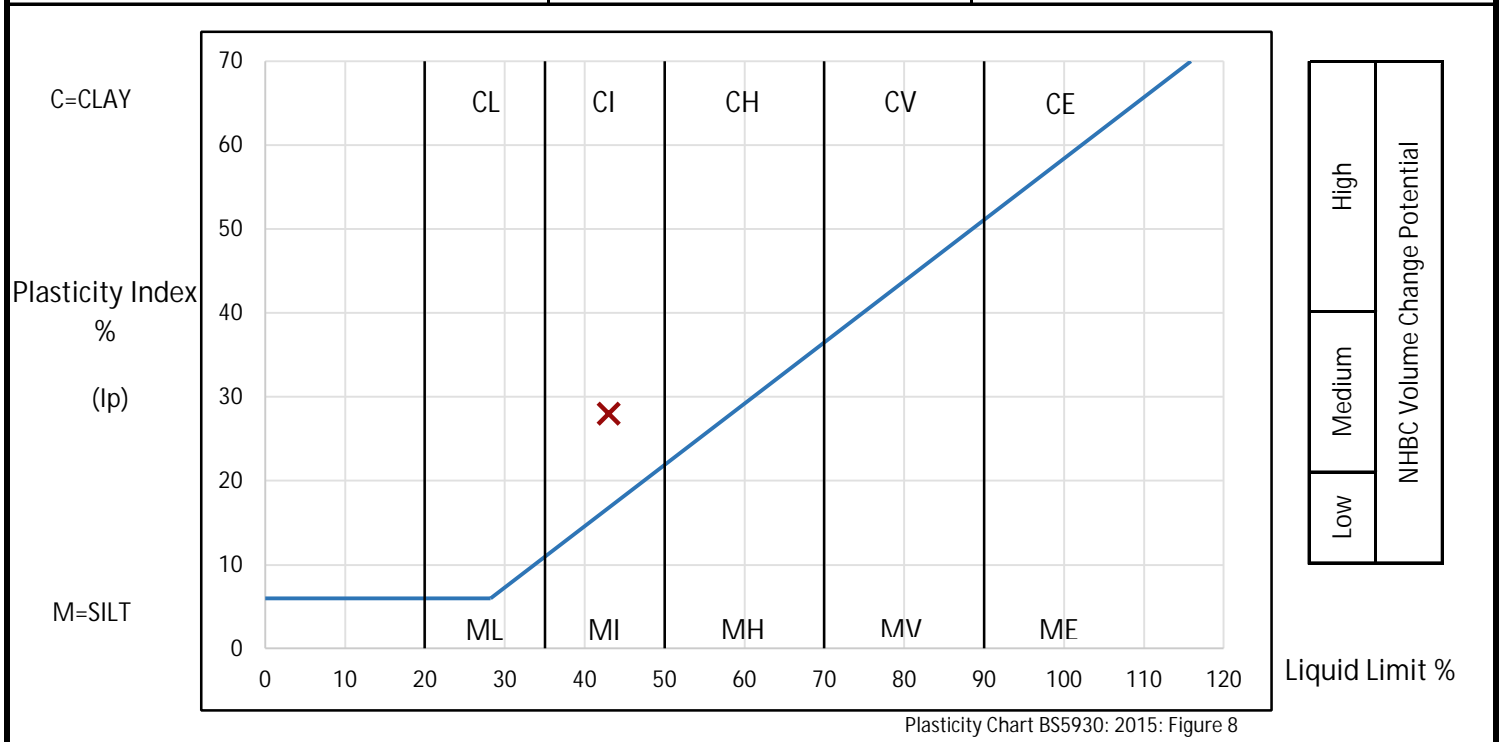


Contract	Northwest Haverhill Relief Road
Serial No.	S33252

DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
WS103	2.00	D	4	18.8	Very stiff light olive brown slightly gravelly slightly sandy silty calcareous CLAY with rare bluish grey veins, and decayed roots. Gravel is fine to medium chalk.	

PREPARATION			Liquid Limit	43 %	
Method of preparation	Wet sieved over 0.425mm sieve		Plastic Limit	15 %	
Sample retained 0.425mm sieve	(Measured)	22 %	Plasticity Index	28 %	
Corrected water content for material passing 0.425mm	Not reported		Liquidity Index	0.14	
Sample retained 2mm sieve	(Measured)	1 %	NHBC Modified (I'p)	22 %	
Curing time	71 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content not reported due to material type.
 Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



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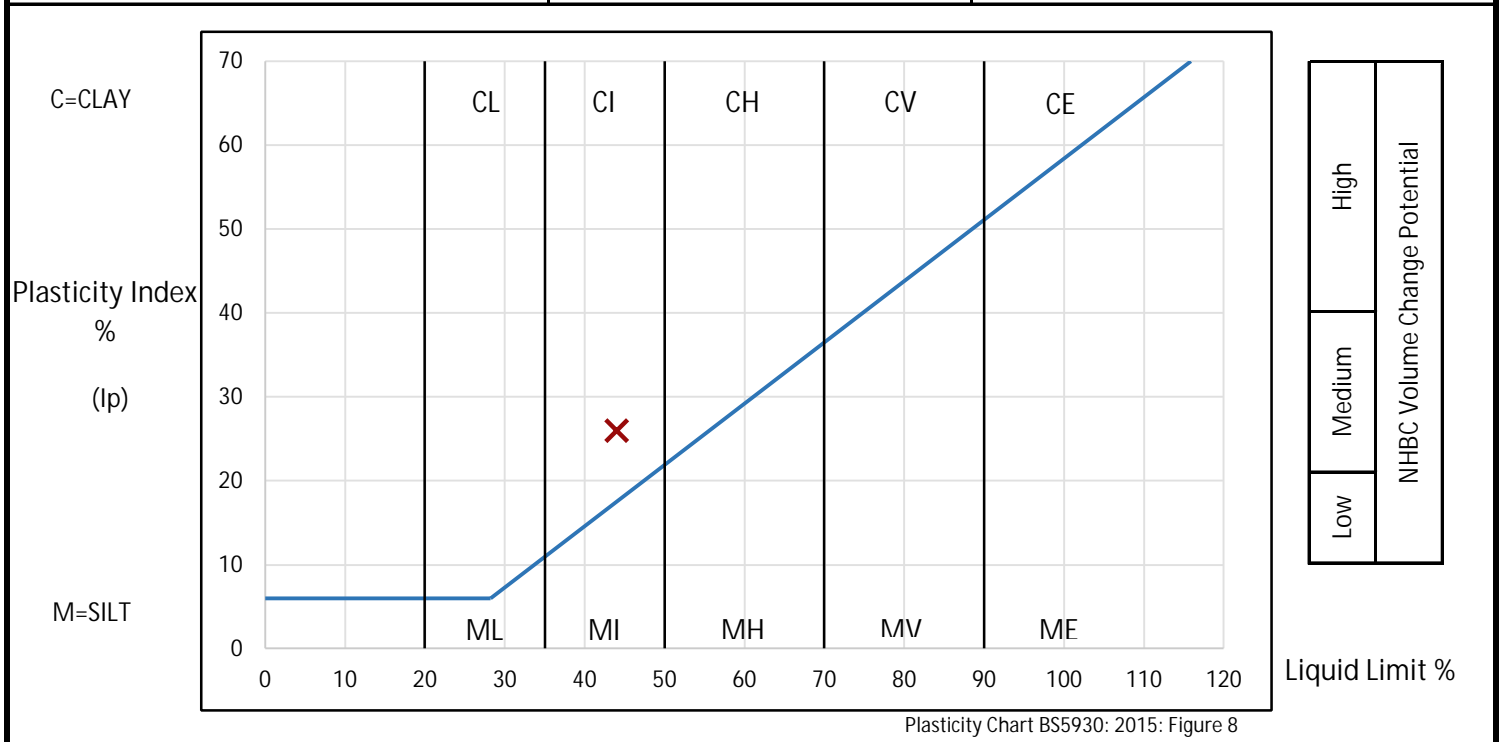


Contract	Northwest Haverhill Relief Road
Serial No.	S33252

DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
WS103	3.20	D	7	18.4	Very stiff dark olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional bluish grey mottling, and rare decayed roots. Gravel is fine to medium chalk.	

PREPARATION			Liquid Limit	44 %	
Method of preparation		Wet sieved over 0.425mm sieve	Plastic Limit	18 %	
Sample retained 0.425mm sieve	(Measured)	8 %	Plasticity Index	26 %	
Corrected water content for material passing 0.425mm			Not reported	Liquidity Index	0.01
Sample retained 2mm sieve	(Measured)	6 %	NHBC Modified (I'p)	24 %	
Curing time	145 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content not reported due to material type.
 Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



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DATE ISSUED: 10/07/2018



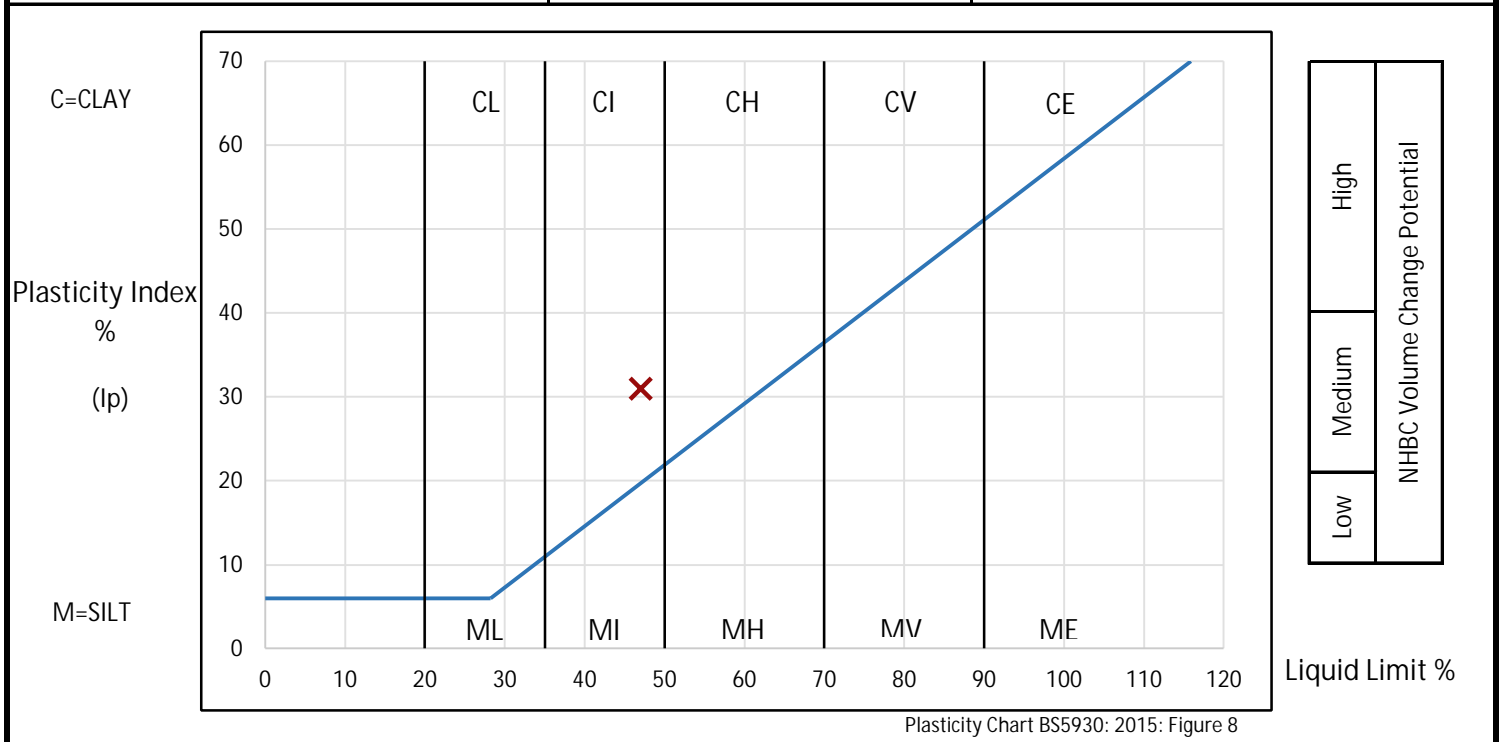
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Contract	Northwest Haverhill Relief Road
Serial No.	S33252

**DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND
DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX**

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
WS104	2.00	D	5	18.4	Very stiff dark olive slightly gravelly sandy silty calcareous CLAY with occasional bluish grey mottling. Gravel is fine to medium chalk.	

PREPARATION			Liquid Limit	47 %	
Method of preparation			Wet sieved over 0.425mm sieve	Plastic Limit	16 %
Sample retained 0.425mm sieve	(Measured)	33 %	Plasticity Index	31 %	
Corrected water content for material passing 0.425mm			Not reported	Liquidity Index	0.08
Sample retained 2mm sieve	(Measured)	2 %	NHBC Modified (I'p)	21 %	
Curing time	71 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content not reported due to material type.
 Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



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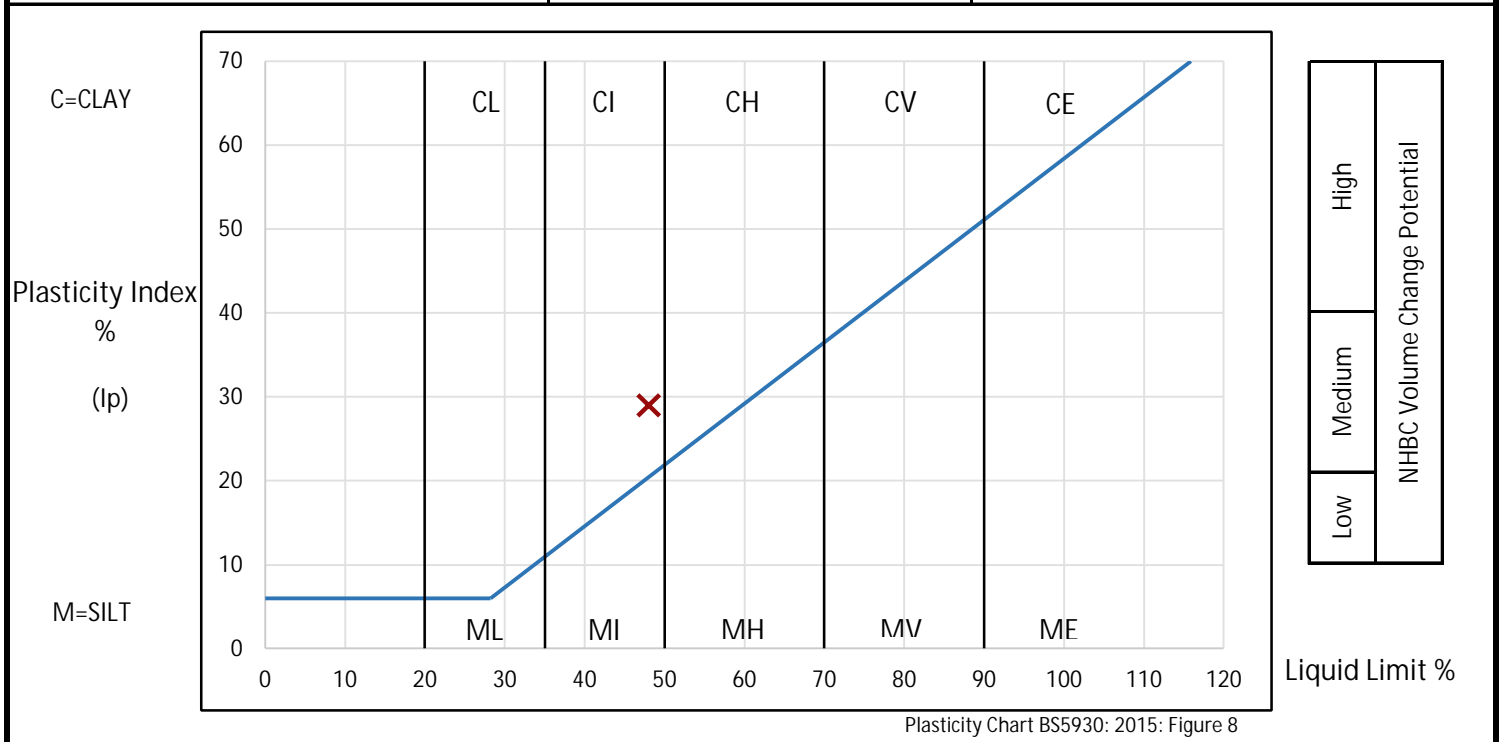
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Contract	Northwest Haverhill Relief Road
Serial No.	S33252

**DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND
DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX**

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
WS105	1.40	D	2	17.6	Very stiff olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional bluish grey mottling, and rare recently active and decayed roots. Gravel is fine to medium chalk.	

PREPARATION			Liquid Limit	48 %	
Method of preparation	Wet sieved over 0.425mm sieve		Plastic Limit	19 %	
Sample retained 0.425mm sieve	(Measured)	8 %	Plasticity Index	29 %	
Corrected water content for material passing 0.425mm	Not reported		Liquidity Index	-0.05	
Sample retained 2mm sieve	(Measured)	6 %	NHBC Modified (I'p)	27 %	
Curing time	72 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content not reported due to material type.
 Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



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DATE ISSUED: 10/07/2018



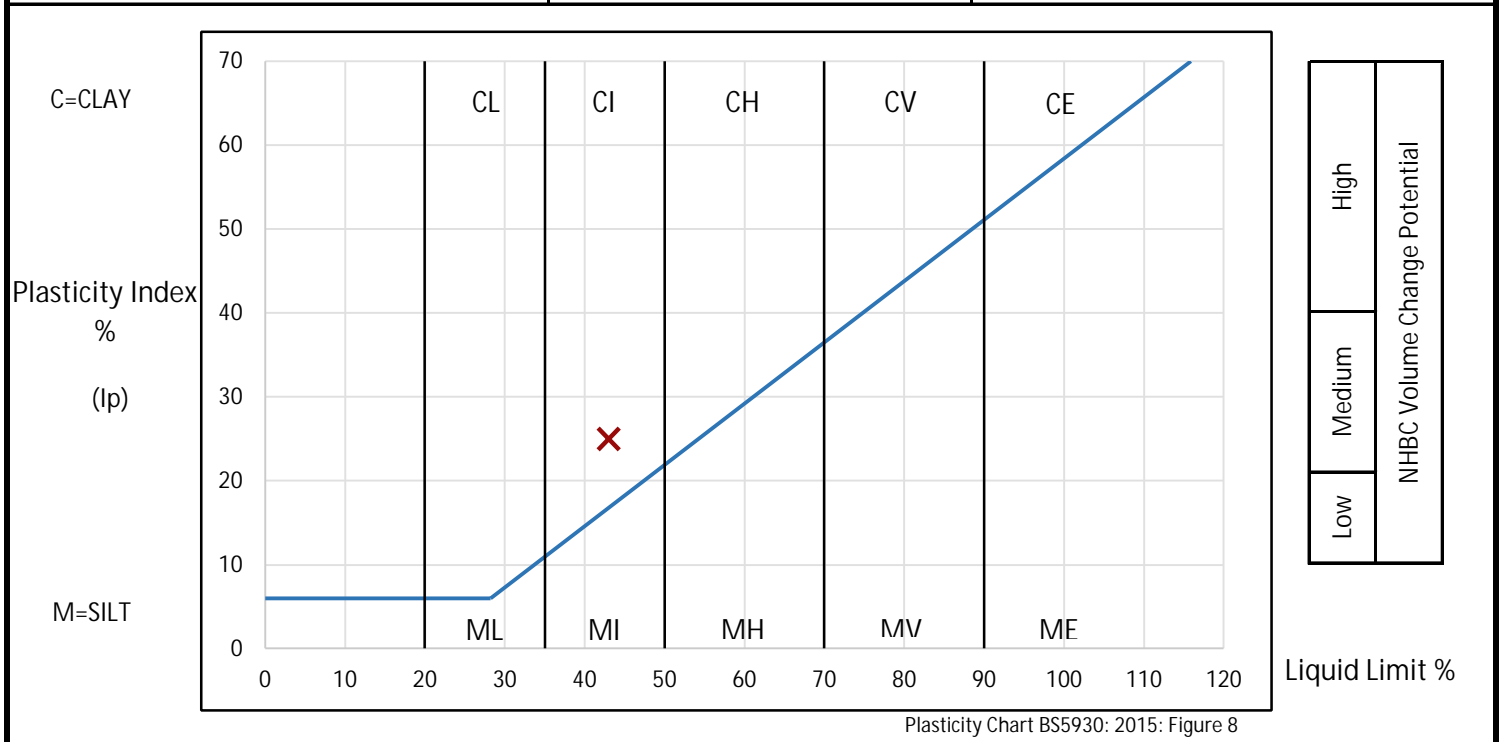
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Contract	Northwest Haverhill Relief Road
Serial No.	S33252

DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
WS106	1.20	D	2	21.4	Very stiff olive yellow slightly gravelly slightly sandy silty calcareous CLAY with rare recently active and decayed roots. Gravel is fine to medium chalk.	

PREPARATION			Liquid Limit	43 %	
Method of preparation			Wet sieved over 0.425mm sieve	Plastic Limit	18 %
Sample retained 0.425mm sieve	(Measured)	10 %	Plasticity Index	25 %	
Corrected water content for material passing 0.425mm			Not reported	Liquidity Index	0.14
Sample retained 2mm sieve	(Measured)	8 %	NHBC Modified (I'p)	23 %	
Curing time	144 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content not reported due to material type.
 Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



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DATE ISSUED: 10/07/2018

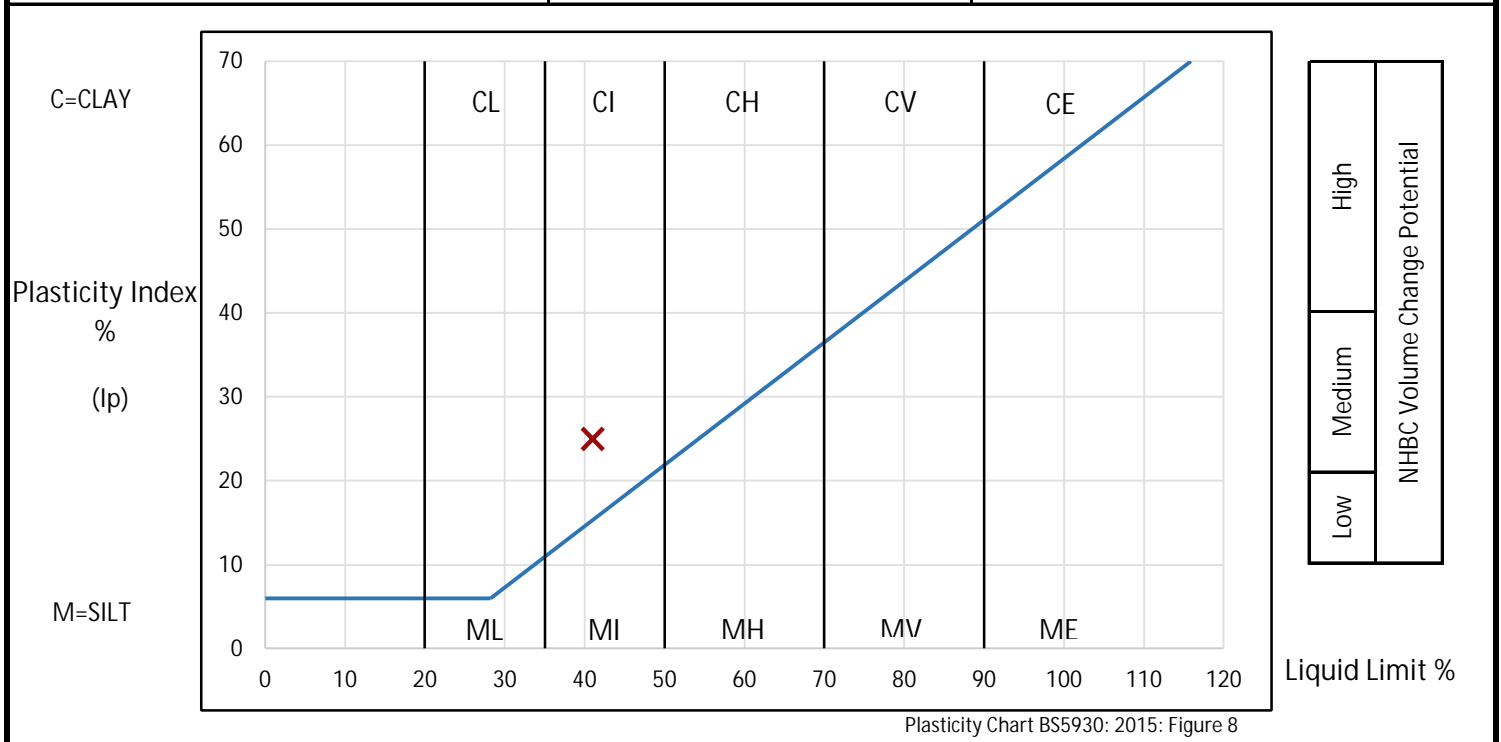


Contract	Northwest Haverhill Relief Road
Serial No.	S33252

**DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND
DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX**

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
WS106	2.50	D	4	20.5	Very stiff light olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional light bluish grey mottling, and rare recently active roots. Gravel is fine to medium chalk.	

PREPARATION			Liquid Limit	41 %	
Method of preparation		Wet sieved over 0.425mm sieve	Plastic Limit	16 %	
Sample retained 0.425mm sieve	(Measured)	14 %	Plasticity Index	25 %	
Corrected water content for material passing 0.425mm			Not reported	Liquidity Index	0.18
Sample retained 2mm sieve	(Measured)	12 %	NHBC Modified (I'p)	22 %	
Curing time	71 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content not reported due to material type.
 Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



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DATE ISSUED: 10/07/2018

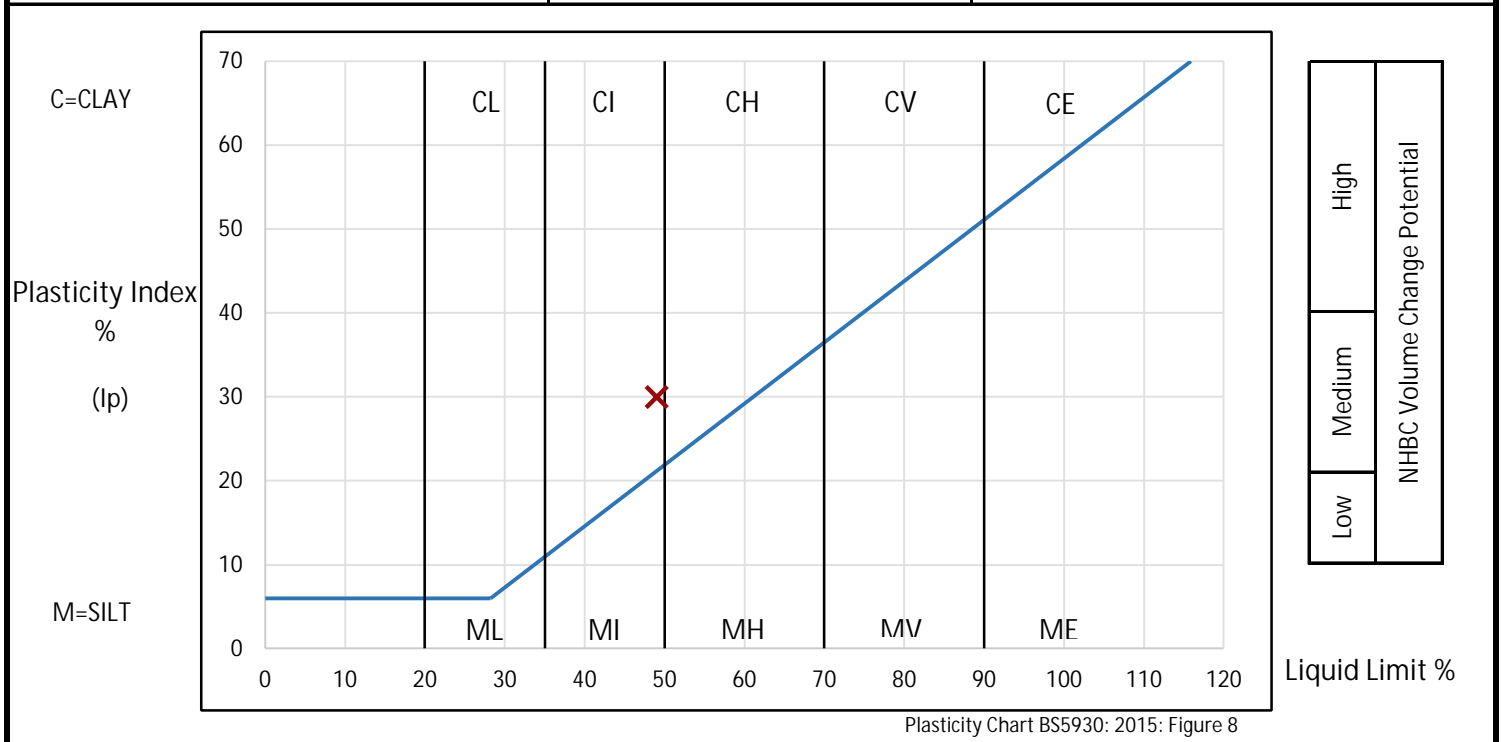


Contract	Northwest Haverhill Relief Road
Serial No.	S33252

DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
WS107	1.30	D	3	24.9	Firm brown slightly gravelly slightly sandy silty calcareous CLAY with rare recently active roots. Gravel is fine to medium and flint.	

PREPARATION			Liquid Limit	49 %	
Method of preparation	From natural/gravel picked out by hand		Plastic Limit	19 %	
Sample retained 0.425mm sieve	(Assumed)	%	Plasticity Index	30 %	
Corrected water content for material passing 0.425mm	Not reported		Liquidity Index	0.20	
Sample retained 2mm sieve	(Approximate)	<1 %	NHBC Modified (I'p)	n/a	
Curing time	71 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content not reported due to material type.



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DATE ISSUED: 10/07/2018



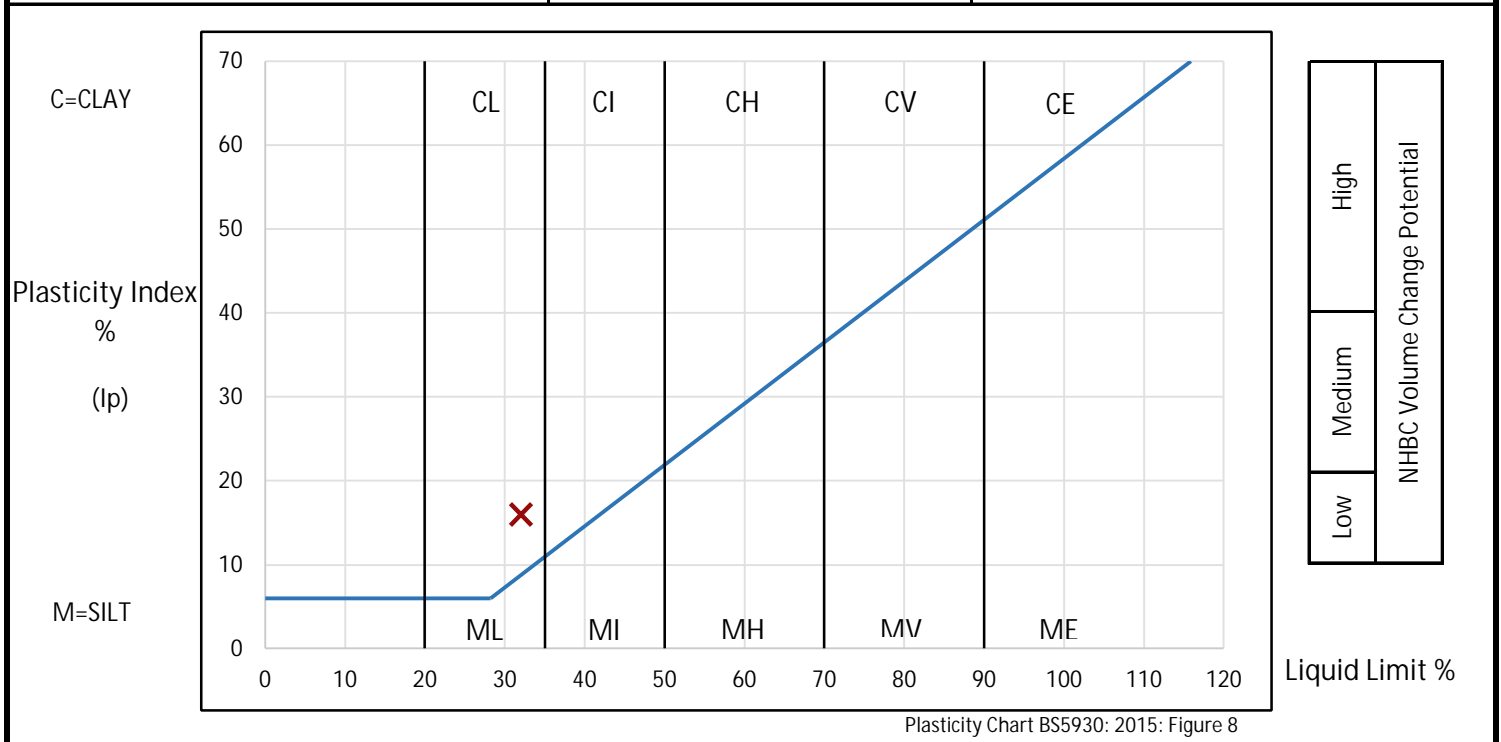
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Contract	Northwest Haverhill Relief Road
Serial No.	S33252

**DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND
DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX**

Borehole / Pit No.	Depth m	Sample		Water Content (W) %	Description	Remarks
		Type	Reference			
WS107	4.70	D	9	17.7	Very stiff dark grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to medium chalk.	

PREPARATION			Liquid Limit	32 %	
Method of preparation	Wet sieved over 0.425mm sieve		Plastic Limit	16 %	
Sample retained 0.425mm sieve	(Measured)	13 %	Plasticity Index	16 %	
Corrected water content for material passing 0.425mm	Not reported		Liquidity Index	0.11	
Sample retained 2mm sieve	(Measured)	10 %	NHBC Modified (I'p)	14 %	
Curing time	72 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content not reported due to material type.
 Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



TEST REPORT

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DATE ISSUED: 10/07/2018



Contract	Northwest Haverhill Relief Road
Serial No.	S33252

DETERMINATION OF DENSITY, WATER CONTENT AND UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT MEASUREMENT OF PORE PRESSURE

Borehole /Pit No.	Depth (m)	Type	Reference	Water Content (%)	Bulk Density (Mg/m³)	Dry Density (Mg/m³)	Lateral Pressure (kPa)	Deviator Stress (kPa)	Shear Stress (kPa)	Mohrs Circle Analysis		Description
										Cu (kPa)	Ø degrees	
CP01	3.00	U	1	18.9	2.08	1.75	60	306	153	140	3.8	Very stiff (Very high strength) light yellowish brown slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to coarse white subangular to rounded chalk.
							123	321	161			
							181	322	161			
CP01	5.00	U	2	18.1	2.15	1.82	99	359	180	163	3.5	Very stiff (Very high strength) grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to coarse white subangular to rounded chalk.
							203	375	188			
							301	386	193			
CP01	9.10	U	3	17.2	2.15	1.83	185	448	224	202	3.4	Very stiff (Very high strength) mottled grey and dark grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to coarse white subangular to rounded chalk.
							370	474	237			
							553	496	248			
CP01	13.10	U	4	17.6	2.13	1.81	265	424	212	180	4.0	Very stiff (Very high strength) mottled grey and dark grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to coarse white subangular to rounded chalk.
							533	470	235			
							796	506	253			
CP02	2.90	U	1	17.7	2.12	1.80	60	425	213	176	8.5	Very stiff (Very high strength) brownish yellow slightly gravelly slightly sandy silty calcareous CLAY with frequent grey mottling. Gravel is fine to coarse white subangular to rounded chalk.
							124	451	226			
							178	468	234			
CP02	5.00	U	2	19.4	2.09	1.75	102	348	174	153	4.4	Very stiff (Very high strength) mottled light olive brown and grey slightly gravelly slightly sandy silty calcareous CLAY with rare orange staining. Gravel is fine to coarse white subangular to rounded chalk.
							205	368	184			
							306	381	191			
CP02	9.10	U	3	16.9	2.14	1.83	187	532	266	234	4.2	Very stiff (Very high strength) grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to coarse white subangular to rounded chalk.
							373	568	284			
							555	589	295			

Method of Preparation: BS 1377: Part 1: 1990: 7.4.2 & 8, Part 2: 1990: 7.2, Part 7: 1990: 8.3
 Method of Test: BS 1377: Part 2: 1990:3 Determination of Moisture Content, Part2: 1990:7 Determination of Density, Part 7: 1990: 8 Undrained Shear Strength
 Type of Sample Key: U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter
 Comments:
 Remarks to Include: Sample disturbance, loss of moisture, variation from test procedure, location and origin of test specimen within original sample, oven drying temperature if not 105-110°C



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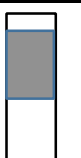


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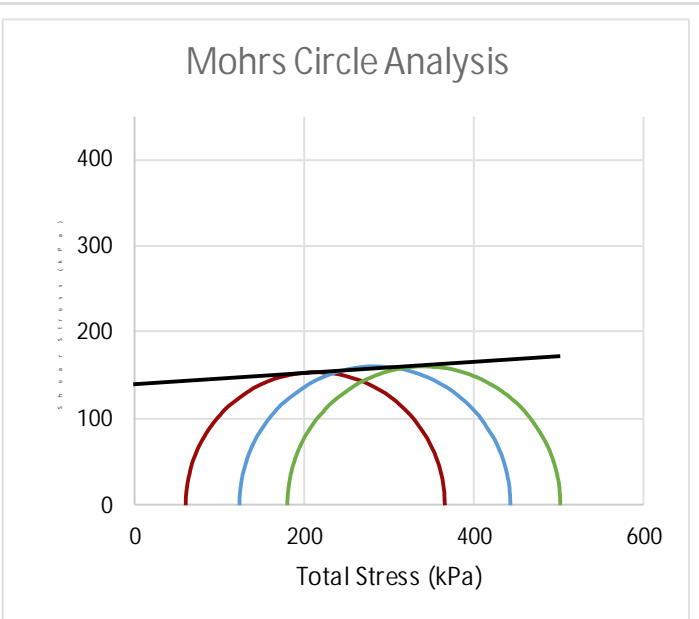
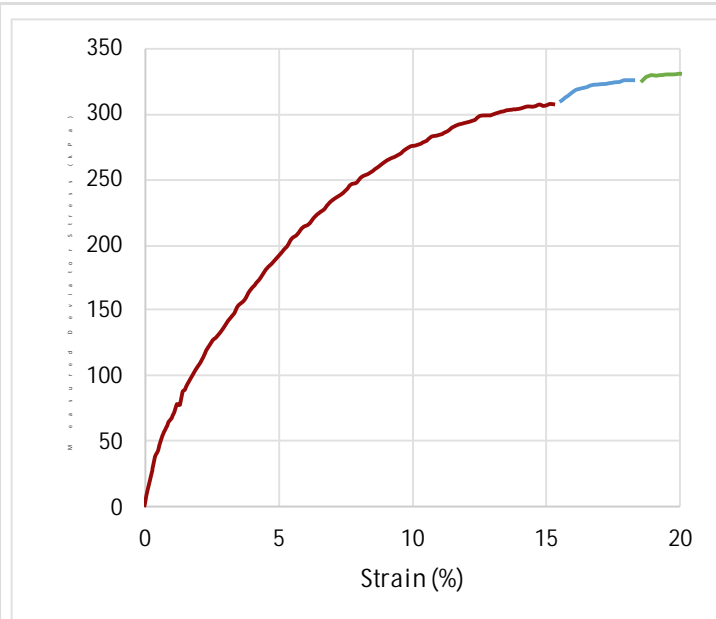
Contract	Northwest Haverhill Relief Road
Serial No.	S33252

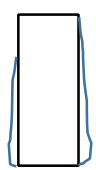
DETERMINATION OF UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT MEASUREMENT OF PORE PRESSURE

Borehole /Pit No.	Depth (m)	Type	Reference	Description	Remarks
CP01	3.00	U	1	Very stiff (Very high strength) light yellowish brown slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to coarse white subangular to rounded chalk.	Coarse gravel noted within specimen after test.

Initial Specimen		Height (mm)	Diameter (mm)	Weight (g)	Water Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)
	Depth of Top of Specimen (m) 3.07	168.9	103.1	2928	18.9	2.08	1.75

TEST INFORMATION	Rate of Strain	2.0	% per Min	Rubber Membrane Thickness	0.6	mm
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Specimen at failure	Measured Cell Pressure, σ_3 (kPa)	Strain at Failure (%)	Stress Corrections (kPa)		Corrected Max. Deviator Stress, $(\sigma_1 - \sigma_3)_f$ (kPa)	Shear Stress C_u , $\frac{1}{2}(\sigma_1 - \sigma_3)_f$ (kPa)	Mohr's Circle Analysis	
			Rubber Membrane	Piston Friction			C_u (kPa)	PHI (degrees)
	60	15.1	1.8	/	306	153	140	3.8
	123	18.0	2.1	2.3	321	161		
	181	20.1	2.3	6.5	322	161		

Method of Preparation: BS 1377: Part 1: 1990
 Method of Test: BS 1377: Part 7: 1990: 8 Definitive Method, 1990: 9 Multi-stage loading
 Type of Sample Key: U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter
 Comments: Tested in Vertical Condition
 UKAS Calibration - loads from 0.2 to 10kN
 Remarks to Include: Sample disturbance, loss of moisture, variation from test procedure, location and origin of test specimen within original sample, oven drying temperature if not 105-110°C



TEST REPORT


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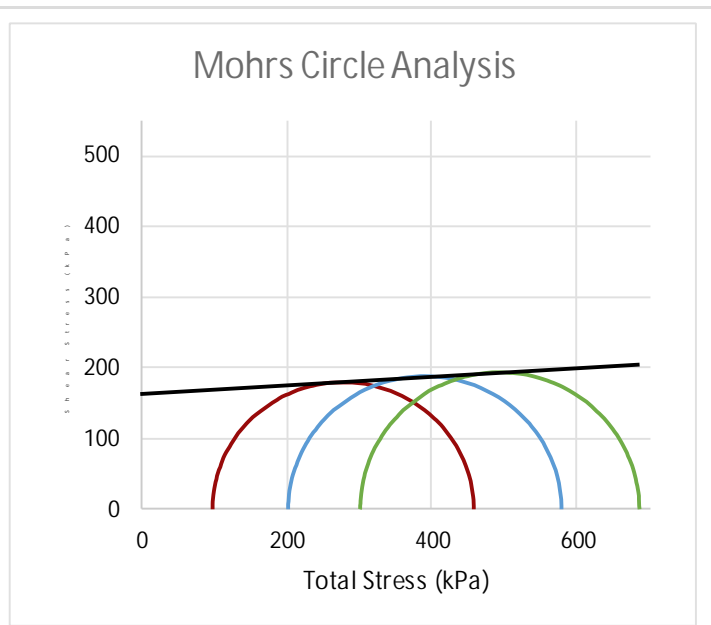
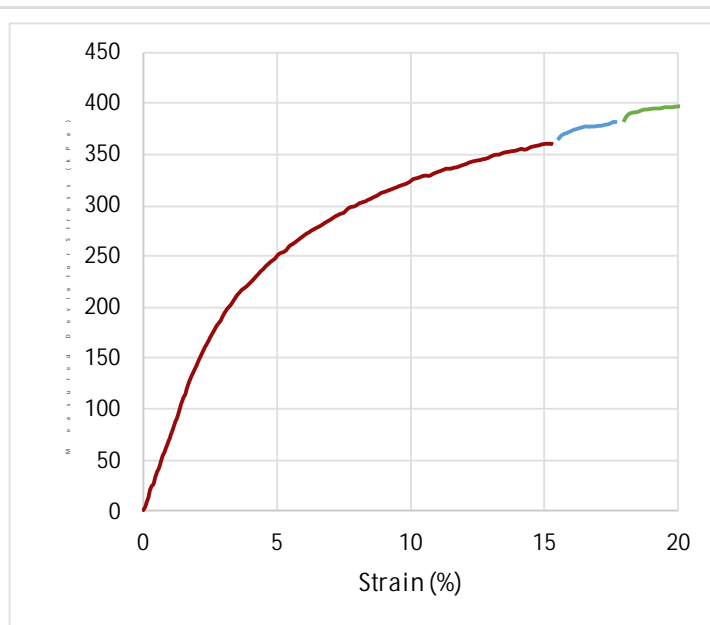
Contract	Northwest Haverhill Relief Road
Serial No.	S33252


DETERMINATION OF UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT MEASUREMENT OF PORE PRESSURE

Borehole /Pit No.	Depth (m)	Type	Reference	Description	Remarks
CP01	5.00	U	2	Very stiff (Very high strength) grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to coarse white subangular to rounded chalk.	Coarse gravel noted within specimen after test.

Initial Specimen		Height (mm)	Diameter (mm)	Weight (g)	Water Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)
	Depth of Top of Specimen (m) 5.09	199.6	102.3	3537	18.1	2.15	1.82

TEST INFORMATION	Rate of Strain	2.0	% per Min	Rubber Membrane Thickness	0.6	mm
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Specimen at failure	Measured Cell Pressure, σ_3 (kPa)	Strain at Failure (%)	Stress Corrections (kPa)		Corrected Max. Deviator Stress, $(\sigma_1 - \sigma_3)_f$ (kPa)	Shear Stress C_u , $\frac{1}{2}(\sigma_1 - \sigma_3)_f$ (kPa)	Mohr's Circle Analysis	
			Rubber Membrane	Piston Friction			C_u (kPa)	ϕ (degrees)
	99	15.1	1.8	/	359	180	163	3.5
	203	17.7	2.0	4.5	375	188		
	301	20.2	2.3	8.6	386	193		

Method of Preparation: BS 1377: Part 1: 1990
 Method of Test: BS 1377: Part 7: 1990: 8 Definitive Method, 1990: 9 Multi-stage loading
 Type of Sample Key: U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter
 Comments: Tested in Vertical Condition
 UKAS Calibration - loads from 0.2 to 10kN
 Remarks to Include: Sample disturbance, loss of moisture, variation from test procedure, location and origin of test specimen within original sample, oven drying temperature if not 105-110°C



TEST REPORT

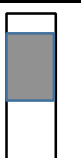
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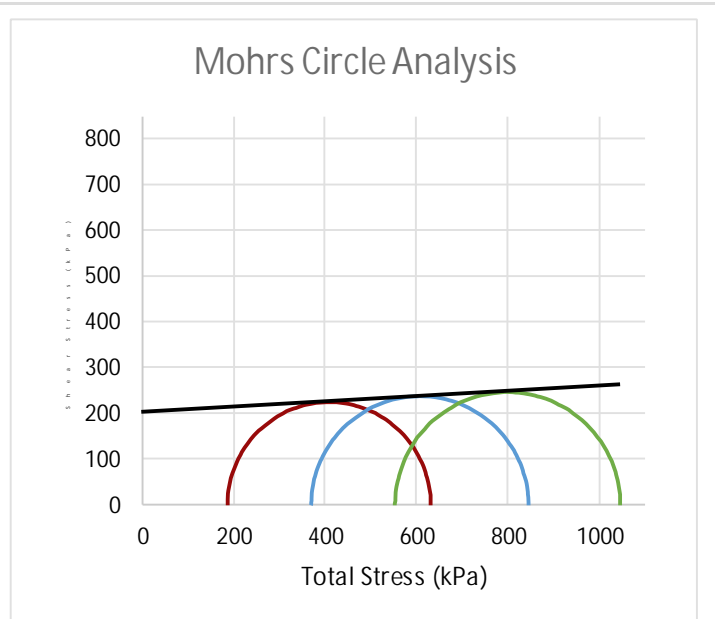
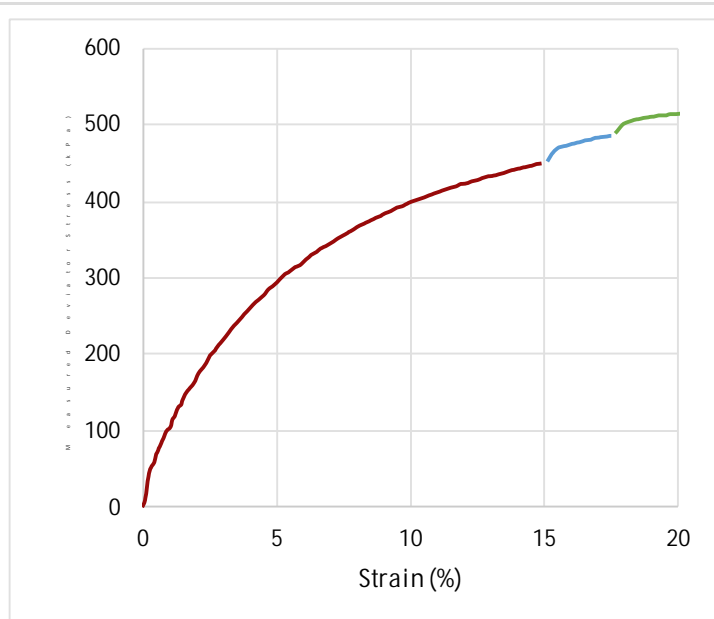
Contract	Northwest Haverhill Relief Road
Serial No.	S33252


DETERMINATION OF UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT MEASUREMENT OF PORE PRESSURE

Borehole /Pit No.	Depth (m)	Type	Reference	Description	Remarks
CP01	9.10	U	3	Very stiff (Very high strength) mottled grey and dark grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to coarse white subangular to rounded chalk.	Coarse gravel noted within specimen after test.

Initial Specimen	Height (mm)	Diameter (mm)	Weight (g)	Water Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)
 Depth of Top of Specimen (m) 9.20	199.5	102.3	3524	17.2	2.15	1.83

TEST INFORMATION	Rate of Strain	2.0	% per Min	Rubber Membrane Thickness	0.6	mm
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Specimen at failure	Measured Cell Pressure, σ_3 (kPa)	Strain at Failure (%)	Stress Corrections (kPa)		Corrected Max. Deviator Stress, $(\sigma_1 - \sigma_3)_f$ (kPa)	Shear Stress C_u , $\frac{1}{2}(\sigma_1 - \sigma_3)_f$ (kPa)	Mohr's Circle Analysis	
			Rubber Membrane	Piston Friction			Cu (kPa)	PHI (degrees)
	185	14.9	1.8	/	448	224	202	3.4
	370	17.5	2.0	10.7	474	237		
	553	20.1	2.3	17.6	496	248		

Method of Preparation: BS 1377: Part 1: 1990
 Method of Test: BS 1377: Part 7: 1990: 8 Definitive Method, 1990: 9 Multi-stage loading
 Type of Sample Key: U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter
 Comments: Tested in Vertical Condition
 UKAS Calibration - loads from 0.2 to 10kN
 Remarks to Include: Sample disturbance, loss of moisture, variation from test procedure, location and origin of test specimen within original sample, oven drying temperature if not 105-110°C



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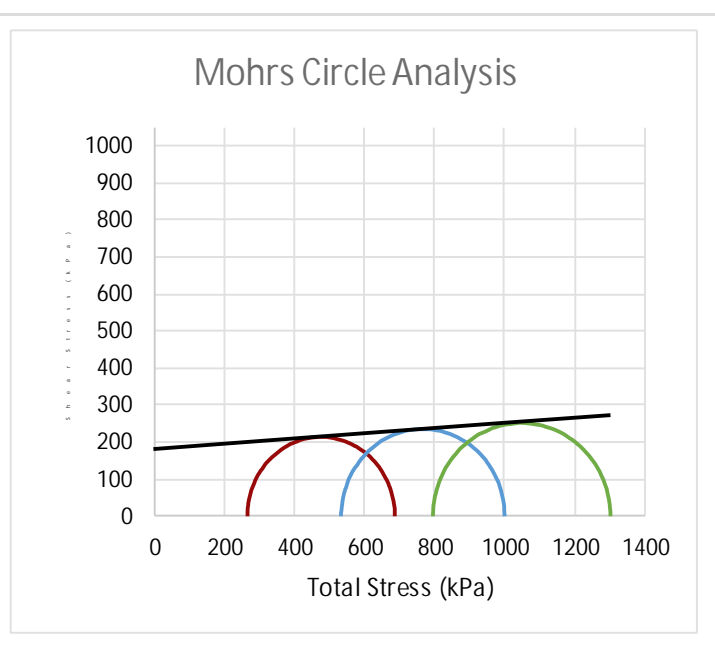
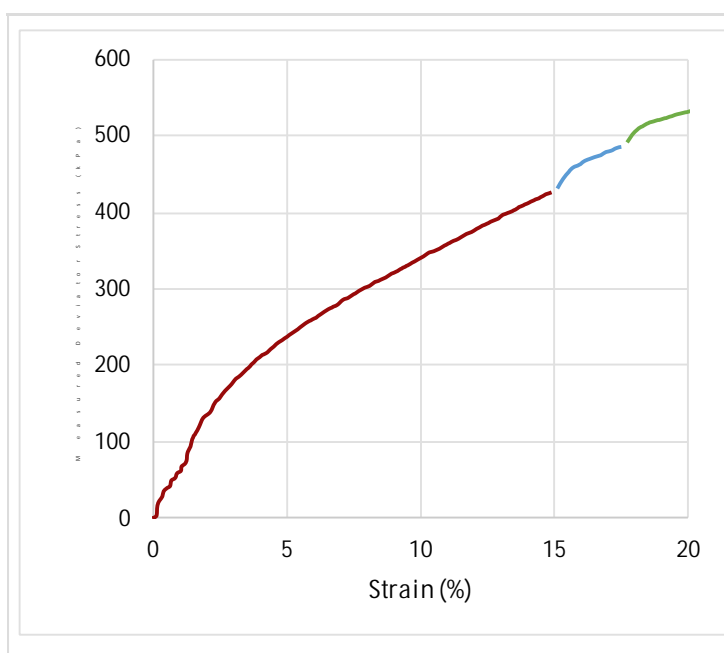
Contract	Northwest Haverhill Relief Road
Serial No.	S33252

DETERMINATION OF UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT MEASUREMENT OF PORE PRESSURE

Borehole /Pit No.	Depth (m)	Type	Reference	Description	Remarks
CP01	13.10	U	4	Very stiff (Very high strength) mottled grey and dark grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to coarse white subangular to rounded chalk.	Coarse gravel noted within specimen after test.

Initial Specimen	Height (mm)	Diameter (mm)	Weight (g)	Water Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)
Depth of Top of Specimen (m) 13.19	199.5	102.7	3526	17.6	2.13	1.81

TEST INFORMATION	Rate of Strain	2.0	% per Min	Rubber Membrane Thickness	0.6	mm
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Specimen at failure	Measured Cell Pressure, σ_3 (kPa)	Strain at Failure (%)	Stress Corrections (kPa)		Corrected Max. Deviator Stress, $(\sigma_1 - \sigma_3)_f$ (kPa)	Shear Stress C_u , $\frac{1}{2}(\sigma_1 - \sigma_3)_f$ (kPa)	Mohr's Circle Analysis	
			Rubber Membrane	Piston Friction			Cu (kPa)	PHI (degrees)
	265	14.9	1.8	/	424	212	180	4.0
	533	17.5	2.0	12.7	470	235		
	796	20.1	2.3	25.2	506	253		

Method of Preparation: BS 1377: Part 1: 1990
 Method of Test: BS 1377: Part 7: 1990: 8 Definitive Method, 1990: 9 Multi-stage loading
 Type of Sample Key: U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter
 Comments: Tested in Vertical Condition
 UKAS Calibration - loads from 0.2 to 10kN
 Remarks to Include: Sample disturbance, loss of moisture, variation from test procedure, location and origin of test specimen within original sample, oven drying temperature if not 105-110°C



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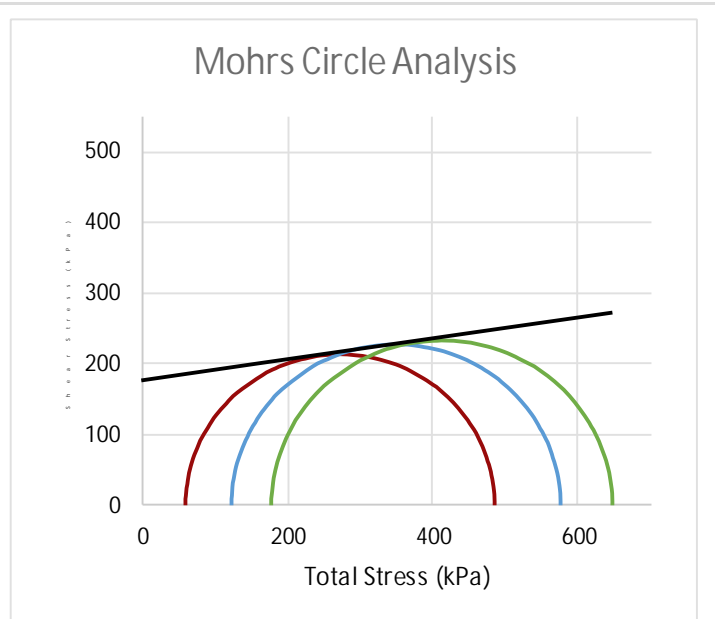
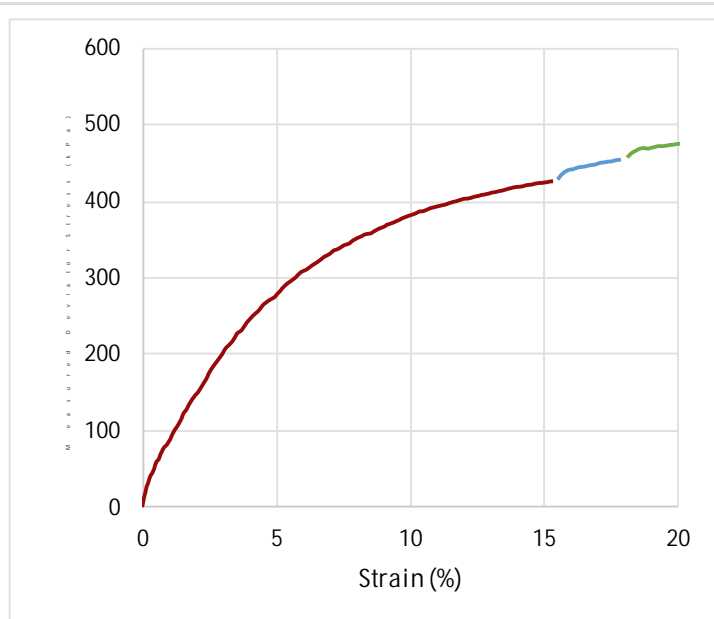
Contract	Northwest Haverhill Relief Road
Serial No.	S33252

DETERMINATION OF UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT MEASUREMENT OF PORE PRESSURE

Borehole /Pit No.	Depth (m)	Type	Reference	Description	Remarks
CP02	2.90	U	1	Very stiff (Very high strength) brownish yellow slightly gravelly slightly sandy silty calcareous CLAY with frequent grey mottling. Gravel is fine to coarse white subangular to rounded chalk.	Coarse gravel noted within specimen after test.

Initial Specimen	Height (mm)	Diameter (mm)	Weight (g)	Water Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)
Depth of Top of Specimen (m) 2.96	153.2	102.5	2685	17.7	2.12	1.80

TEST INFORMATION	Rate of Strain	2.0	% per Min	Rubber Membrane Thickness	0.6	mm
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Specimen at failure	Measured Cell Pressure, σ_3 (kPa)	Strain at Failure (%)	Stress Corrections (kPa)		Corrected Max. Deviator Stress, $(\sigma_1 - \sigma_3)_f$ (kPa)	Shear Stress C_u , $\frac{1}{2}(\sigma_1 - \sigma_3)_f$ (kPa)	Mohr's Circle Analysis	
			Rubber Membrane	Piston Friction			Cu (kPa)	PHI (degrees)
	60	15.3	1.8	/	425	213	176	8.5
	124	17.9	2.1	2.1	451	226		
	178	20.1	2.3	6.3	468	234		

Method of Preparation: BS 1377: Part 1: 1990
 Method of Test: BS 1377: Part 7: 1990: 8 Definitive Method, 1990: 9 Multi-stage loading
 Type of Sample Key: U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter
 Comments: Tested in Vertical Condition
 UKAS Calibration - loads from 0.2 to 10kN
 Remarks to Include: Sample disturbance, loss of moisture, variation from test procedure, location and origin of test specimen within original sample, oven drying temperature if not 105-110°C



TEST REPORT


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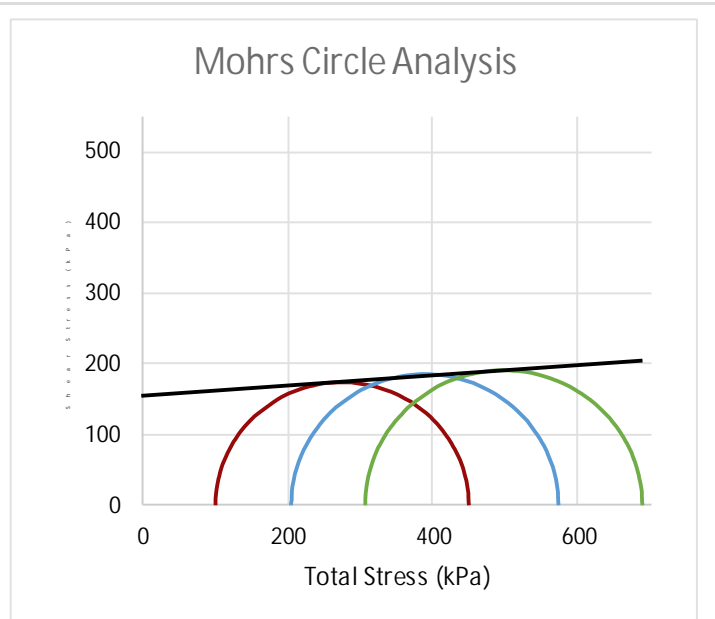
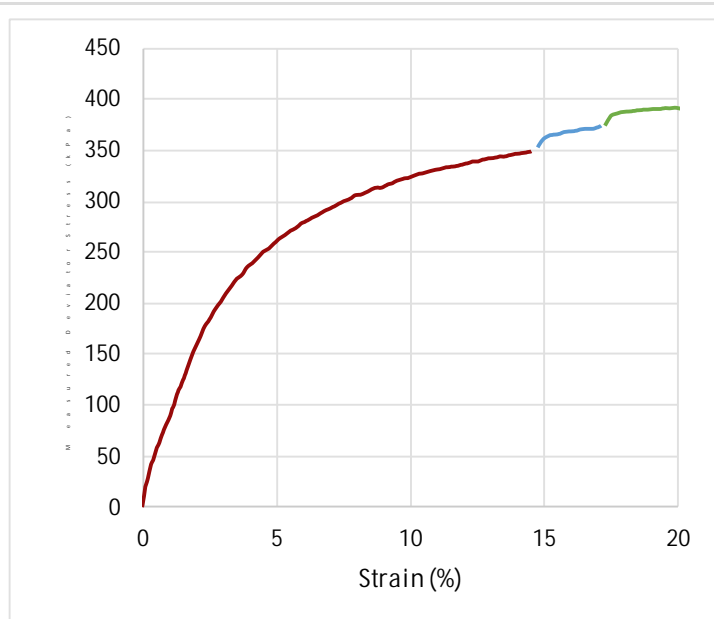
Contract	Northwest Haverhill Relief Road
Serial No.	S33252


DETERMINATION OF UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT MEASUREMENT OF PORE PRESSURE

Borehole /Pit No.	Depth (m)	Type	Reference	Description	Remarks
CP02	5.00	U	2	Very stiff (Very high strength) mottled light olive brown and grey slightly gravelly slightly sandy silty calcareous CLAY with rare orange staining. Gravel is fine to coarse white subangular to rounded chalk.	Coarse gravel noted within specimen after test.

Initial Specimen		Height (mm)	Diameter (mm)	Weight (g)	Water Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)
	Depth of Top of Specimen (m) 5.09	199.3	104.1	3553	19.4	2.09	1.75

TEST INFORMATION	Rate of Strain	2.0	% per Min	Rubber Membrane Thickness	0.6	mm
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Specimen at failure	Measured Cell Pressure, σ_3 (kPa)	Strain at Failure (%)	Stress Corrections (kPa)		Corrected Max. Deviator Stress, $(\sigma_1 - \sigma_3)_f$ (kPa)	Shear Stress C_u , $\frac{1}{2}(\sigma_1 - \sigma_3)_f$ (kPa)	Mohr's Circle Analysis	
			Rubber Membrane	Piston Friction			C_u (kPa)	ϕ (degrees)
	102	14.5	1.7	/	348	174	153	4.4
	205	17.1	2.0	3.8	368	184		
	306	19.9	2.2	8.6	381	191		

Method of Preparation: BS 1377: Part 1: 1990
 Method of Test: BS 1377: Part 7: 1990: 8 Definitive Method, 1990: 9 Multi-stage loading
 Type of Sample Key: U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter
 Comments: Tested in Vertical Condition
 UKAS Calibration - loads from 0.2 to 10kN
 Remarks to Include: Sample disturbance, loss of moisture, variation from test procedure, location and origin of test specimen within original sample, oven drying temperature if not 105-110°C



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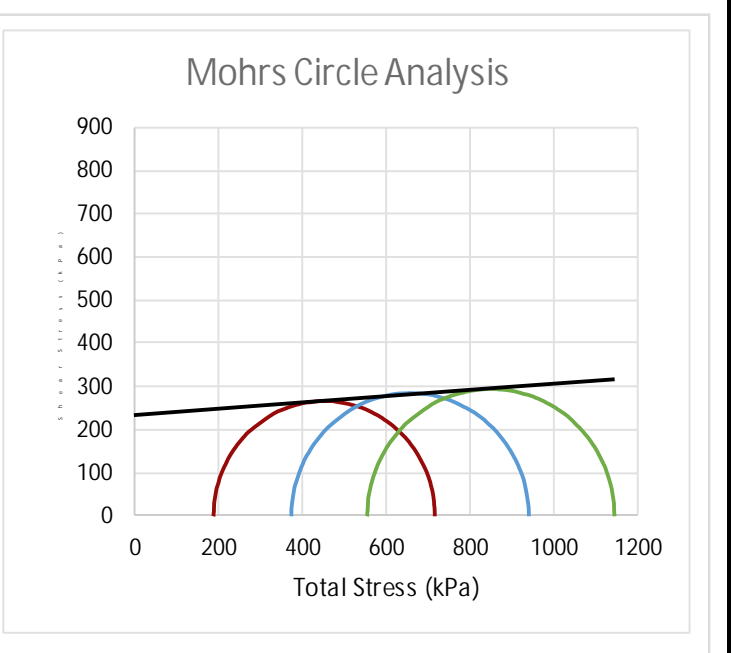
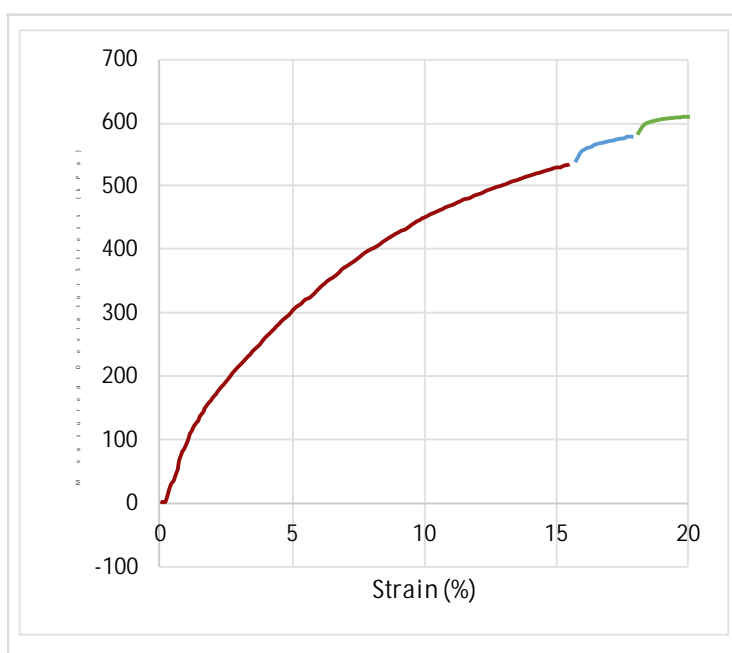
Contract	Northwest Haverhill Relief Road
Serial No.	S33252

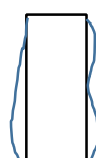
DETERMINATION OF UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT MEASUREMENT OF PORE PRESSURE

Borehole /Pit No.	Depth (m)	Type	Reference	Description	Remarks
CP02	9.10	U	3	Very stiff (Very high strength) grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to coarse white subangular to rounded chalk.	Coarse gravel noted within specimen after test.

Initial Specimen		Height (mm)	Diameter (mm)	Weight (g)	Water Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)
	Depth of Top of Specimen (m) 9.20	199.3	103.0	3544	16.9	2.14	1.83

TEST INFORMATION	Rate of Strain	2.0	% per Min	Rubber Membrane Thickness	0.6 mm
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Specimen at failure	Measured Cell Pressure, σ_3 (kPa)	Strain at Failure (%)	Stress Corrections (kPa)		Corrected Max. Deviator Stress, $(\sigma_1 - \sigma_3)_f$ (kPa)	Shear Stress C_u , $\frac{1}{2}(\sigma_1 - \sigma_3)_f$ (kPa)	Mohr's Circle Analysis	
			Rubber Membrane	Piston Friction			C_u (kPa)	PHI (degrees)
	187	15.5	1.8	/	532	266	234	4.2
	373	17.9	2.0	9.7	568	284		
	555	19.9	2.2	18.5	589	295		

Method of Preparation: BS 1377: Part 1: 1990
 Method of Test: BS 1377: Part 7: 1990: 8 Definitive Method, 1990: 9 Multi-stage loading
 Type of Sample Key: U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter
 Comments: Tested in Vertical Condition
 UKAS Calibration - loads from 0.2 to 10kN
 Remarks to Include: Sample disturbance, loss of moisture, variation from test procedure, location and origin of test specimen within original sample, oven drying temperature if not 105-110°C



TEST REPORT

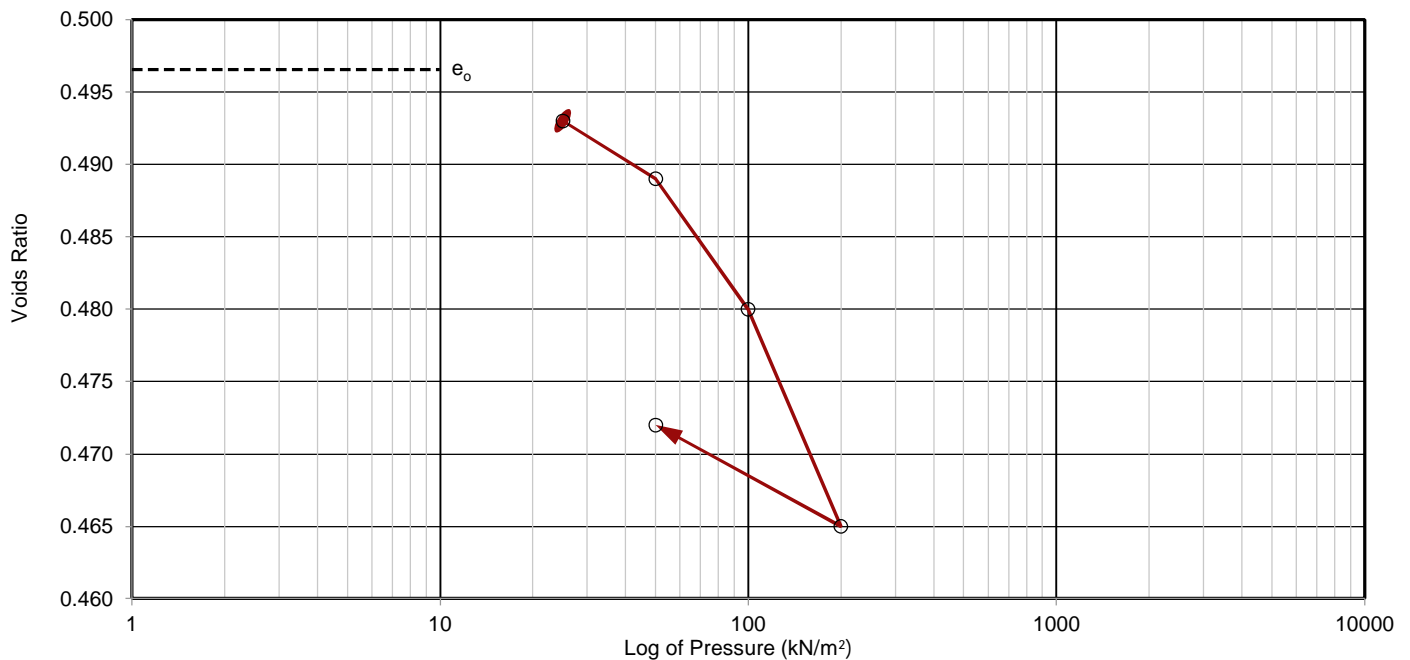
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Contract	Northwest Haverhill Relief Road
Serial No.	S33252

DETERMINATION OF THE ONE-DIMENSIONAL CONSOLIDATION PROPERTIES

Borehole/ Pit No.	Depth (m)	Type	Ref.	Specimen Depth (m) and Orientation	Water Content (%)	Description					Remarks	
CP01	3.00	U	1	3.02 Horizontal	19.2	Very stiff (Very high strength) light yellowish brown slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to coarse white subangular to rounded chalk.					Visible gravel picked out and backfilled.	
Initial Conditions					Increment No.	Load (kN/m ²)	Change in Height (mm)	Void Ratio	Cv (m ² /yr)	Mv (m ² /MN)	Temp (°C)	Corrected Cv
Height	mm			18.84	1	25	0.046	0.493	1.58	0.10	22	1.50
Diameter	mm			50.00	2	50	0.096	0.489	0.37	0.11	22	0.35
Wet Weight	g			76.28	3	100	0.209	0.480	2.11	0.12	22	2.00
Water Content	%			19.2	4	200	0.398	0.465	2.11	0.10	22	2.00
Bulk Density	Mg/m ³			2.06	5	50	0.312	0.472		0.03	22	
Particle Density		Assumed		2.59								
Voids Ratio				0.497								
Degree of Saturation	%			100								
Swelling Pressure	kN/m ²			<25								
Dry Density	Mg/m ³			1.73								



Method of Preparation:	BS 1377: Part 5: 1990: 3.3 & 3.4
Method of Test:	BS 1377: Part 5: 1990: 3.5
Method of Time Fitting Used:	Square root
Type of Sample Key:	U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter
Comments:	
Remarks to Include:	Sample disturbance, loss of water, variation from test procedure, location and origin of test specimen within original sample, oven drying temperature if not 105-110 °C.



TEST REPORT

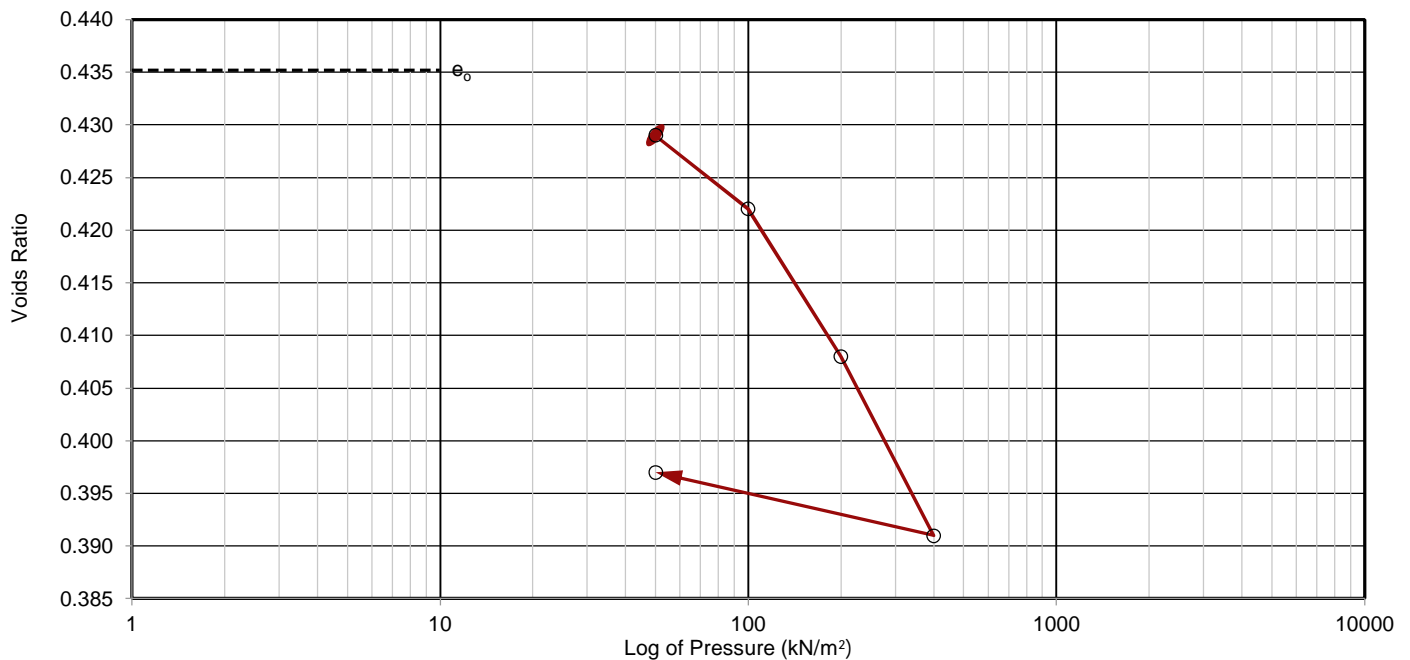
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DATE ISSUED: 10/07/2018



Contract	Northwest Haverhill Relief Road
Serial No.	S33252

DETERMINATION OF THE ONE-DIMENSIONAL CONSOLIDATION PROPERTIES

Borehole/ Pit No.	Depth (m)	Type	Ref.	Specimen Depth (m) and Orientation	Water Content (%)	Description					Remarks	
CP01	13.10	U	4	13.12 Horizontal	17.1	Very stiff (Very high strength) mottled grey and dark grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to coarse white subangular to rounded chalk.					Visible gravel picked out and backfilled.	
Initial Conditions					Increment No.	Load (kN/m ²)	Change in Height (mm)	Void Ratio	Cv (m ² /yr)	Mv (m ² /MN)	Temp (°C)	Corrected Cv
Height	mm			18.63	1	50	0.079	0.429	2.32	0.09	22	2.20
Diameter	mm			50.01	2	100	0.177	0.422	1.79	0.11	22	1.70
Wet Weight	g			75.82	3	200	0.353	0.408	2.53	0.10	22	2.40
Water Content	%			17.1	4	400	0.578	0.391	2.22	0.06	27	1.90
Bulk Density	Mg/m ³			2.07	5	50	0.497	0.397		0.01	22	
Particle Density		Assumed		2.54								
Voids Ratio				0.435								
Degree of Saturation	%			100								
Swelling Pressure	kN/m ²			<50								
Dry Density	Mg/m ³			1.77								



Method of Preparation:	BS 1377: Part 5: 1990: 3.3 & 3.4
Method of Test:	BS 1377: Part 5: 1990: 3.5
Method of Time Fitting Used:	Square root
Type of Sample Key:	U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter
Comments:	
Remarks to Include:	Sample disturbance, loss of water, variation from test procedure, location and origin of test specimen within original sample, oven drying temperature if not 105-110 °C.



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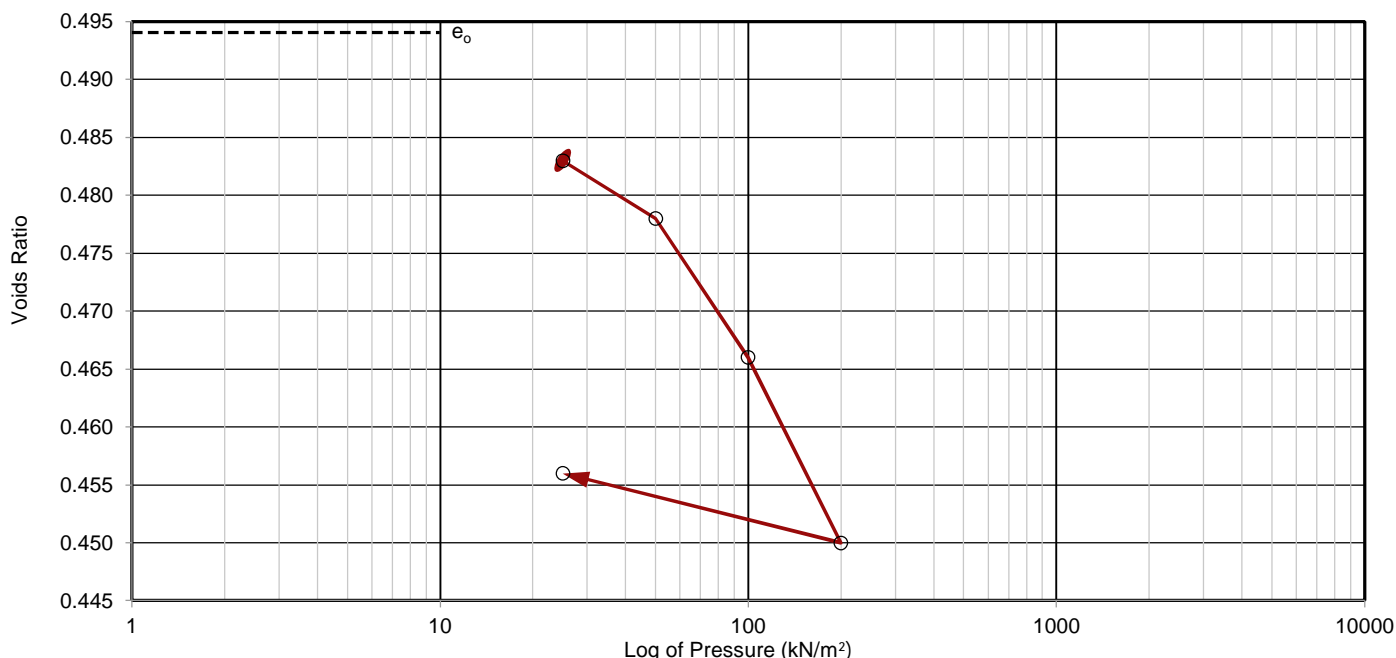


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Contract	Northwest Haverhill Relief Road
Serial No.	S33252

DETERMINATION OF THE ONE-DIMENSIONAL CONSOLIDATION PROPERTIES

Borehole/ Pit No.	Depth (m)	Type	Ref.	Specimen Depth (m) and Orientation	Water Content (%)	Description					Remarks
CP02	2.90	U	1	2.91 Horizontal	18.7	Very stiff (Very high strength) brownish yellow slightly gravelly slightly sandy silty calcareous CLAY with frequent grey mottling. Gravel is fine to coarse white subangular to rounded chalk.					Visible gravel picked out and backfilled.
Initial Conditions				Increment No.	Load (kN/m ²)	Change in Height (mm)	Void Ratio	Cv (m ² /yr)	Mv (m ² /MN)	Temp (°C)	Corrected Cv
Height	mm	18.81		1	25	0.135	0.483	1.16	0.29	22	1.10
Diameter	mm	50.00		2	50	0.202	0.478	0.40	0.14	22	0.38
Wet Weight	g	77.14		3	100	0.357	0.466	0.99	0.17	22	0.94
Water Content	%	18.7		4	200	0.553	0.450	1.27	0.11	22	1.20
Bulk Density	Mg/m ³	2.09		5	25	0.479	0.456		0.02	22	
Particle Density		Assumed 2.63									
Voids Ratio		0.494									
Degree of Saturation	%	99									
Swelling Pressure	kN/m ²	<25									
Dry Density	Mg/m ³	1.76									



Method of Preparation: BS 1377: Part 5: 1990: 3.3 & 3.4
 Method of Test: BS 1377: Part 5: 1990: 3.5
 Method of Time Fitting Used: Square root
 Type of Sample Key: U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter
 Comments:

Remarks to Include: Sample disturbance, loss of water, variation from test procedure, location and origin of test specimen within original sample, oven drying temperature if not 105-110 °C.



TEST REPORT

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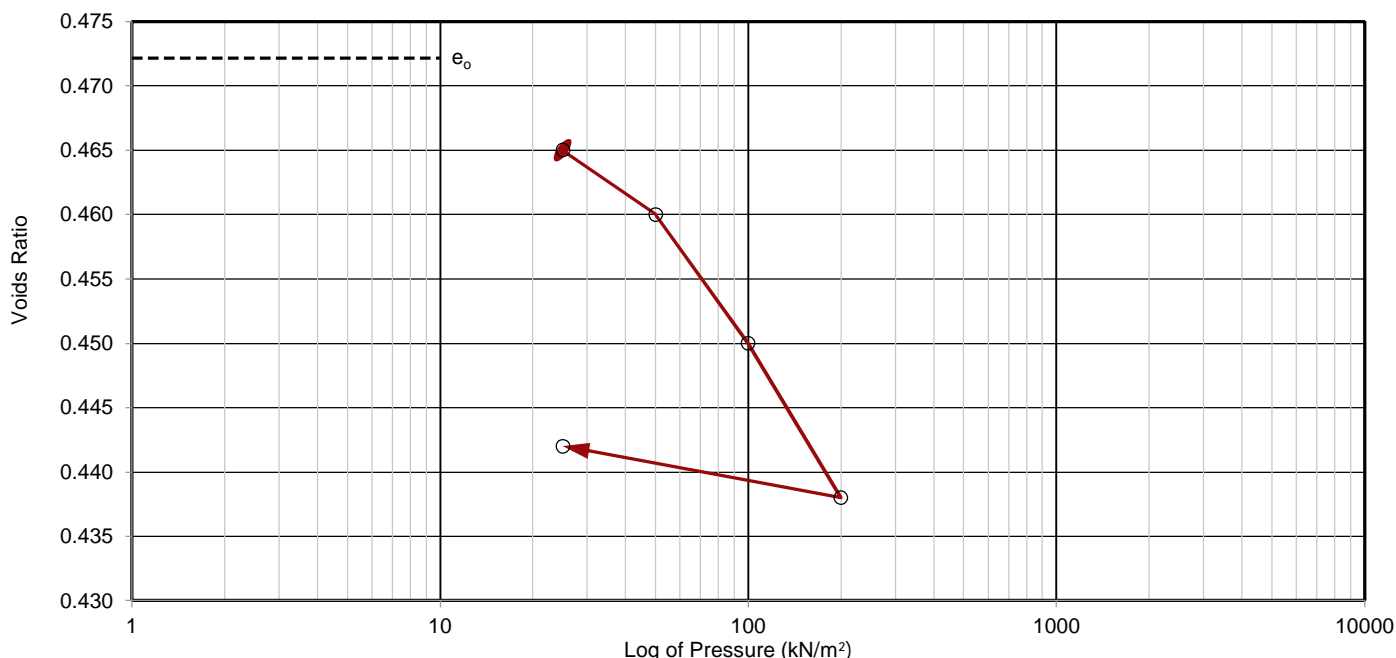


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Contract	Northwest Haverhill Relief Road
Serial No.	S33252

DETERMINATION OF THE ONE-DIMENSIONAL CONSOLIDATION PROPERTIES

Borehole/ Pit No.	Depth (m)	Type	Ref.	Specimen Depth (m) and Orientation	Water Content (%)	Description					Remarks	
CP02	5.00	U	2	5.04 Horizontal	18.4	Very stiff (Very high strength) mottled light olive brown and grey slightly gravelly slightly sandy silty calcareous CLAY with rare orange staining. Gravel is fine to coarse white subangular to rounded chalk.					Visible gravel picked out and backfilled.	
Initial Conditions					Increment No.	Load (kN/m ²)	Change in Height (mm)	Void Ratio	Cv (m ² /yr)	Mv (m ² /MN)	Temp (°C)	Corrected Cv
Height	mm			18.81	1	25	0.094	0.465	1.48	0.20	22	1.40
Diameter	mm			50.00	2	50	0.155	0.460	0.47	0.13	22	0.45
Wet Weight	g			76.01	3	100	0.284	0.450	1.37	0.14	22	1.30
Water Content	%			18.4	4	200	0.434	0.438	1.48	0.08	22	1.40
Bulk Density	Mg/m ³			2.06	5	25	0.387	0.442		0.02	22	
Particle Density				Assumed 2.56								
Voids Ratio				0.472								
Degree of Saturation	%			100								
Swelling Pressure	kN/m ²			<25								
Dry Density	Mg/m ³			1.74								



Method of Preparation:	BS 1377: Part 5: 1990: 3.3 & 3.4
Method of Test:	BS 1377: Part 5: 1990: 3.5
Method of Time Fitting Used:	Square root
Type of Sample Key:	U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter
Comments:	
Remarks to Include:	Sample disturbance, loss of water, variation from test procedure, location and origin of test specimen within original sample, oven drying temperature if not 105-110 °C.



TEST REPORT

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DATE ISSUED: 10/07/2018

Contract:	Northwest Haverhill Relief Road
Serial No:	S33252

DETERMINATION OF THE SULPHATE CONTENT AND pH OF SOIL AND GROUNDWATER

Borehole / Pit No.	Depth (m)	Sample		Conc. of Soluble SO ₃		Calc'd Conc. Of SO ₄ (g/L)	pH Value	% Sample Passing 2mm Sieve	Description	Remarks
		Type	Ref.	Water Soluble 2:1 (g/L)	Ground Water (g/L)					
CP01	0.30	D	1	0.04		0.05	7.2	95	Very stiff brown slightly gravelly slightly sandy silty calcareous CLAY with occasional recently active roots. Gravel is fine to medium chalk and flint.	
CP01	2.70	D	4	0.02		0.03	7.7	89	Stiff light olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional light bluish grey mottling. Gravel is fine to medium chalk.	
CP01	3.50	D	5	0.03		0.04	7.8	79	Very stiff light brownish grey slightly gravelly slightly sandy silty calcareous CLAY with occasional orange staining. Gravel is fine to medium chalk.	
CP01	12.20	D	10	0.25		0.30	7.4	95	Very stiff dark grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to medium chalk.	
CP02	1.90	D	2	0.02		0.03	7.8	66	Firm brownish yellow slightly gravelly slightly sandy silty calcareous CLAY with rare recently active roots. Gravel is fine to medium chalk and rare flint.	
CP02	3.30	D	4	<0.01		<0.01	7.8	87	Stiff olive yellow slightly gravelly slightly sandy silty calcareous CLAY with occasional light grey mottling, and rare decayed roots. Gravel is fine to coarse chalk.	
CP02	5.50	D	6	0.03		0.03	7.6	90	Stiff light olive brown slightly gravelly sandy silty calcareous CLAY. Gravel is fine to coarse chalk.	
CP02	12.30	D	10	0.50		0.60	7.3	91	Very stiff dark grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to medium chalk.	

Method of Preparation: BS1377: Part 1: 2016: 8.5, BS1377: Part 3: 1990: 5.3 Soil/Water Extract, 5.4 Groundwater
 Method of Test: BS1377: Part 3: 1990: 5.5
 Type of Sample Key: U= Undisturbed, B= Bulk, D= Disturbed, J= Jar, W= Water, SPT= Split Spoon Sample, C= Core Cutter
 Comments: Test not UKAS accredited
 Remarks to Include: Sample disturbance, loss of moisture, variation from test procedure, location, and origin of test specimen within original sample. Oven drying temperature if not 105-110C.



TEST REPORT

ISSUED BY SOIL PROPERTY TESTING LTD
DATE ISSUED: 10/07/2018

Contract:	Northwest Haverhill Relief Road
Serial No:	S33252

DETERMINATION OF THE SULPHATE CONTENT AND pH OF SOIL AND GROUNDWATER

Borehole / Pit No.	Depth (m)	Sample		Conc. of Soluble SO ₃		Calc'd Conc. Of SO ₄ (g/L)	pH Value	% Sample Passing 2mm Sieve	Description	Remarks
		Type	Ref.	Water Soluble 2:1 (g/L)	Ground Water (g/L)					
WS101	1.00	D	2	0.06		0.07	7.7	88	Very stiff dark olive slightly gravelly slightly sandy silty calcareous CLAY with occasional dark bluish grey mottling, and rare recently active roots. Gravel is fine to medium chalk.	
WS101	4.00	D	8	0.06		0.08	7.8	97	Very stiff olive grey slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to medium chalk.	
WS102	2.20	D	5	1.38		1.65	7.3	85	Very stiff dark olive slightly gravelly slightly sandy silty CLAY with occasional dark grey mottling. Gravel is fine to coarse chalk.	
WS103	3.20	D	7	1.42		1.70	7.4	94	Very stiff dark olive brown slightly gravelly slightly sandy silty calcareous CLAY with occasional bluish grey mottling, and rare decayed roots. Gravel is fine to medium chalk.	
WS105	1.00	D	3	0.77		0.93	7.5	97	Very stiff olive brown slightly gravelly slightly sandy silty calcareous CLAY. Gravel is fine to medium chalk.	
WS106	3.00	D	5	0.05		0.06	7.8	97	Very stiff olive yellow slightly gravelly slightly sandy silty calcareous CLAY with occasional bluish grey mottling. Gravel is fine to medium chalk.	
WS107	1.30	D	3	0.01		0.02	7.5	96	Firm brown slightly gravelly slightly sandy silty calcareous CLAY with rare recently active roots. Gravel is fine to medium and flint.	

Method of Preparation: BS1377: Part 1: 2016: 8.5, BS1377: Part 3: 1990: 5.3 Soil/Water Extract, 5.4 Groundwater
 Method of Test: BS1377: Part 3: 1990: 5.5
 Type of Sample Key: U= Undisturbed, B= Bulk, D= Disturbed, J= Jar, W= Water, SPT= Split Spoon Sample, C= Core Cutter
 Comments: Test not UKAS accredited
 Remarks to Include: Sample disturbance, loss of moisture, variation from test procedure, location, and origin of test specimen within original sample. Oven drying temperature if not 105-110C.



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