Docksway Disposal Site, Newport

Area 2, Cells 3 and 4 Base Stabilisation – CQA Validation Report

On behalf of **Newport City Council**

Project Ref: 14739/3511 | Rev: 01 | Date: March 2016

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Document Control Sheet

Project Name: **Docksway Disposal Site**

Project Ref: **14739/3511**

Report Title: **Area 2, Cells 3 and 4 Base Stabilisation – CQA Validation Report**

Doc Ref: **14739/3511/rev01**

Date: **March 2016**

	Name	Position	Signature	Date
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For and on behalf of Peter Brett Associates LLP				

Revision	Date	Description	Prepared	Reviewed	Approved
Rev01	Mar 16	Issue	VKR	RHT	RHT

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1 Introduction

1.1 Background

1.1.1 Docksway Disposal Site is an active licensed waste disposal site located approximately 3km south of Newport City Centre, Gwent, and is centred on National Grid Reference ST 305 853. The site is operated by Newport City Council, referred to hereafter as NCC. The location of the site is shown on Figure 1.

1.1.2 The site is approximately split into a northern half (Area 1) and a southern half (Area 2). Area 1 is an unlined ('dilute and disperse') landfill that was operated under waste management licence (WML) number EAWML30058 and is now closed and in the aftercare phase, whilst Area 2 is an engineered containment landfill that is active and operated under Pollution Prevention Control (PPC) Permit No. DP3733BK. Variation Notice Number MP3730MJ.

1.1.3 Area 2 comprises five engineered landfill cells (Cells 1-5), as shown on Figure 2. Cells 1 and 2 are built and active, whilst Cells 3-5 are not yet constructed and receiving waste.

1.1.4 The Area 2 Engineering Design Philosophy[1] for the site describes the Area 2 design concept and this includes the construction of an Engineered Barrier System (EBS) above a natural geological barrier. Parts of the cohesive Alluvium that forms the proposed natural geological barrier do not inherently have sufficient strength to support the plant required to construct the engineered barrier, without prior stabilisation. These areas are located within the channels of a former river that historically meandered through the site, but that was previously diverted to facilitate the development of the disposal site.

1.1.5 The objectives of the stabilisation works are to improve the strength of the upper parts (top 2m) of the Alluvium sufficiently to allow construction of the engineered barrier system by the required plant and machinery, whilst retaining a maximum permeability of the Alluvium, of $1x10^{-9}$ m/s. This maximum permeability is based on the conservative value of vertical hydraulic conductivity used for LandSim modelling work, as described in the Conceptual Model and Hydrogeological Risk Assessment for Area 2 – Landfill Extension, PBA 2005[2].

1.1.6 This CQA Validation report describes the works carried out to stabilise the low strength parts of the Alluvium present below the site as described above. The work was carried out in accordance with the CQA Plan that was submitted to Natural Resources Wales (NRW) prior to commencement of the stabilisation works. A copy of the CQA Plan is presented as Appendix 1.

1.2 Parties

The following parties were involved in the undertaking of this project as described below, and with duties as defined in the CQA Plan for the works, presented in Appendix 1.

1.2.1 **Client/Employer**: Newport City Council - responsible for preparing contract documents, drawings and specifications, reviewing Contractors (and Sub-Contractors) information, reviewing and agreeing amendments to contract documents, drawings and specifications, overseeing budgetary and contractual matters, provide day to day management of the works, surveying services, liaise with all parties.

1.2.2 **Contractor including specialist Sub-Contractor**: Jim Davis Civil Engineering Ltd (Contractor) and Deep Soil Mixing Ltd (Sub-Contractor) – responsible for the design of the stabilisation works to achieve the required objectives, and the undertaking of the stabilisation works in accordance with the contract documents, drawings and specifications and to meet the requirements of the Employer and CQA Consultant.

1.2.3 **CQA Field Engineer:** Ian Fisher – Newport City Council – responsible for the day to day management of the works in accordance with the CQA Plan and the contract documents, drawings and specifications, under the direction of the CQA Consultant.

1.2.4 **CQA Consultant:** Peter Brett Associates LLP – responsible for preparing the CQA Plan, reviewing the CQA Field Engineer's site diary, technical queries during the works and preparation of the CQA Validation Report.

1.3 Scope of Works

1.3.1 There are former river channels within both Cells 3 and 4 where the alluvial clays have insufficient strength to support construction plant and machinery, and these areas therefore require stabilisation prior to any landfill cell construction works. These areas were approximately delineated by NCC using shear strength determined by hand shear vane and subsequently agreed with the Sub-Contractor, and are shown on Figure 3.

1.3.2 The stabilisation method proposed by the Sub-Contractor comprised the mass stabilisation of the upper 2m of alluvial clays in the delineated areas. This was achieved by the addition of a cementitious binder to the low strength Alluvium, in the form of a premixed wet grout, and mixing to create a relatively homogenous mass. The binder cures with time, and forms a stiffened upper crust to the soft and very soft alluvial clays, sufficient to support typical construction plant, whilst retaining the required permeability described in Section 1.1.5.

1.3.3 The areas delineated formed the minimum areas for stabilisation and inclusion in this CQA Validation Report. Prior to commencement of the main works, the Sub-Contractor carried out a field trial within the delineated working area to confirm that the Specification requirements could be achieved in the field and to allow the Sub-Contractor to determine the optimal range of mix-ratios of the binder. The field trial is described in Section 3.

1.3.4 On commencement of the works, the Sub-Contractor divided the working area into sub-cells according to a grid system, and worked the sub-cells one by one. Cell 3 was commenced and completed first and then Cell 4 was commenced and completed following Cell 3. The Sub-Contractor carried out sampling and testing in accordance with the CQA Plan and the requirements of the CQA Field Engineer.

1.4 Methodology and Plant

1.4.1 The works were carried out in general accordance with and using the plant described in the Sub-Contractors General Site Proposals and Works Method Statement (revised following completion of the field trial), and presented in Appendices 2 and 3.

2 CQA Requirements

2.1 CQA Plan

A Construction Quality Assurance (CQA) Plan, describing the works to be carried out, defining the roles and responsibilities of the parties involved and the quality procedures to be adopted during the construction works was produced by Peter Brett Associates (PBA) and submitted to Natural Resources Wales for approval prior to commencement of the works. A copy of the CQA Plan is presented as Appendix 1.

2.2 Acceptability

The stabilised material is considered acceptable if samples recovered from the works area achieve a minimum shear strength of 50kPa and a maximum permeability of $1x10^{-9}$ m/s. However, only test results relating to permeability are discussed in this CQA Validation Report because shear strength testing is an operational requirement and not related to the integrity of the EBS. The minimum sampling frequency for permeability testing, in accordance with Table 3.1 in the CQA Plan is 1 per $500m^2$.

2.3 Laboratory Accreditation

The samples for permeability testing were submitted to UKAS accredited laboratory, GEO Site and Testing Services Ltd, for testing in accordance with BS1377 Part 6 : 1990 Clause 6 – Determination of Permeability in a triaxial cell. The laboratory UKAS accreditation number is 2788.

2.4 CQA Records

The CQA records of relevance to this CQA Validation Report are the laboratory certificates for the permeability testing, the drawings showing the cell and sample locations, the CQA Field Engineers site diary records and the Sub-Contractors weekly progress records.

3 Field Trials

3.1 Introduction

3.1.1 At the start of the works, part of the area to be stabilised (in Cell 3) was identified for a field trial. The area was selected to be representative of general conditions within the area to be stabilised, and so that if successful, the area could form part of the main works and resources were not wasted on a redundant area.

3.1.2 The site plan of the area to be stabilised, including the field trial area, was overlaid by a grid system, as shown on Figure 4 for Cell 3 and Figure 5 for Cell 4. The grid system was based on cells 6m by 6m and each cell was provided a unique reference to enable subsequent relocation of any failed areas based on sample test results to be identified and remediated. The grid was set out on site by the Employer.

3.2 Initial Field Trial

3.2.1 The field trial was undertaken between the 27th and 29th January 2015, in accordance with the Sub-Contractors original General Site Proposals, using an Allu mixing arm attached to a long reach excavator to mix the binder materials into the alluvial clays. A photograph showing the Allu mixing arm is presented as Plate 1 in Appendix 3 and a description of the method is provided in Section 6.1.2 of this report. A copy of the Sub-Contractor's original General Site Proposals is presented in Appendix 2. A total of four cells were mixed, using three different binder and binder content ratios, as described in the CQA field engineers site diary dated 26th January to 1st February 2015 (presented in Appendix 5). The material was then allowed to cure for a minimum of 7 days before core samples were obtained and submitted to the laboratory for permeability testing in accordance with the Specification. A total of five cores were obtained on the 5th February 2015 from the initial four sub-cells stabilised, and the samples were submitted for laboratory testing.

3.2.2 The laboratory used for the field trial was UKAS accredited Geolabs Ltd, and the permeability testing was undertaken in accordance with BS1377 Part 6 : 1990 Clause 6 – Determination of Permeability in a triaxial cell. The laboratory UKAS accreditation number is 1982.

3.2.3 The laboratory testing carried out on the initial field trial indicated that four out of the five samples had failed to reach the required permeability, ie the permeability was too great and therefore the trial area was failed and as a result both the mixing and sampling methods were reviewed. The results of the laboratory testing for the preliminary field trial are presented in Section 6.1.4, and further details of the initial field trial and subsequent assessment are provided in Section 6.

3.2.4 A review of the results of the initial field trial concluded that improvements in the mixing, sampling, and sample transportation methods may lead to improved results that were within Specification. See Section 6.

3.2.5 A further field trial was carried out on the 25th February 2015, implementing improvements to the sampling and sample transportation methods, and trialling a reduced binder percentage. Two of the cells mixed (23B, 23C) were subsequently sampled and passed as being within the Specification requirements. However there were still concerns relating to mixing consistency and therefore a new mixing method and methodology was proposed.

3.3 Amended Methodology

3.3.1 On the 16th April 2015, a new trial was undertaken, using a REMU mixing bucket instead of an Allu mixing arm. The sub-contractors modified method statement is presented as Appendix 3, and a photograph of the REMU bucket is presented as Plate 2 in Appendix 4. The REMU mixing method appeared from visual inspection, to provide greater consistency in the mixed material.

3.3.2 Following receipt of Specification compliant results for material mixed using the REMU bucket, this mixing method was adopted into practice at the site in the main stabilisation works, and the trial was deemed to be completed.

4 Works Progress

4.1 General

4.1.1 Sub-Contractor’s Weekly Reports

The Sub-Contractor commenced mobilisation to the site on Monday 5th January 2015 and completed the stabilisation works in Cell 3 on Tuesday 26th May 2015, before commencing in Cell 4 on Wednesday 27th May 2015 and completing the stabilisation works in Cell 4 on 9th July 2015.

The Sub-Contractor has recorded progress in weekly reports that are presented in Appendix 6 for Cell 3 and Appendix 7 for Cell 4. These weekly progress logs have been reviewed by the CQA Field Engineer.

4.1.2 CQA Field Engineer’s Site Diary

The CQA Field Engineer was present on site during the works and recorded the weather, progress, technical issues, sampling and testing for each week and relevant photographs, within a site diary. A copy of the CQA Field Engineer’s site diary is presented in Appendix 5.

4.1.3 Progress

As described in Section 3.2, the initial field trial encountered some early problems and therefore the main stabilisation works commenced in Cell 3 on the 16th April. There were 129 full or part cells to stabilise within Cell 3 and these were completed in 29 days, at an average of 4.5 cells per day. In Cell 4 there were 174 full or part cells to stabilise, and this took 32 days at an average of 5.4 cells per day.

4.1.4 Problems Encountered

The main problem encountered during the stabilisation works was the failure of the initial field trial, and this is described in detail in Section 6.

In addition to the initial field trial, other minor problems encountered during the main works involved plant and machinery breakdowns or the excavator becoming bogged down in soft ground, requiring excavation for retrieval. These minor issues are documented in both the Sub-Contractors weekly reports (Appendices 6 and 7), and the CQA Field Engineers site diary (Appendix 5).

5 Stabilisation Results

5.1 Stabilised Area

5.1.1 In Cell 3, a total of 129 full and part sub-cells were stabilised, representing a maximum possible stabilised area of 4,644m^2. The locations of the stabilised area in Cell 3, and the sub-cells are presented in Figures 3 and 4.

5.1.2 In Cell 4, a total of 174 full and part sub-cells were stabilised, representing a maximum possible stabilised area of 6,264m^2. The locations of the stabilised area in Cell 4, and the sub-cells are presented in Figures 3 and 5.

5.2 Permeability Test Locations

5.2.1 In accordance with the Specification, samples for permeability testing are required at a rate of 1 per 500m^2. In Cell 3, the minimum number of samples required for permeability testing, given the maximum stabilised area identified in 5.1.1 is 9. Excluding the samples obtained during the initial field trial (as this area was subsequently remixed and re-sampled), a total of 19 samples of the stabilised material were submitted to the laboratory for testing.

5.2.2 In Cell 4, the minimum number of samples required for permeability testing given the maximum stabilised area identified in 5.1.2 is 13. A total of 14 samples of the stabilised material were submitted to the laboratory for testing.

5.2.3 The laboratory used for the permeability testing in the main works phase was UKAS accredited GEO Site and Testing Services Ltd, and the permeability testing was undertaken in accordance with BS1377 Part 6 : 1990 Clause 6 – Determination of Permeability in a triaxial cell. The laboratory UKAS accreditation number is 2788.

5.3 Summary of Results – Cell 3

5.3.1 The permeability test results for Cell 3, taken from the main works phase, all achieved the permeability required by the Specification. The results ranged from 1.01×10^{-10} to 9.99×10^{-10}. A summary table, produced by the Sub-Contractor, presenting a summary of the laboratory testing results is presented in Appendix 8. The laboratory testing certificates for the Cell 3 samples tested are also presented in Appendix 9.

5.4 Summary of Results – Cell 4

5.4.1 The permeability test results for Cell 4 all achieved the permeability required by the Specification. The results ranged from 1×10^{-10} to 7.11×10^{-10}. A summary table, produced by the Sub-Contractor, presenting a summary of the laboratory testing results is presented in Appendix 10. The laboratory testing certificates for the Cell 4 samples tested are also presented in Appendix 11.

6 Non-Conformities

6.1 Field Trials

6.1.1 The proposed mass mixing stabilisation method was designed by the Sub-Contractor Deep Soil Mixing Ltd, based on the Specification written and provided to them by the Client, Newport City Council. The initial mass mixing stabilisation method is described in the General Site Proposals document, produced by Deep Soil Mixing and presented in Appendix 2.

6.1.2 The initial mass mixing used in the field trial was undertaken using an Allu mixing head attached to a long reach excavator. The Allu mixing head is a double rotary mixing head that delivers the binder to the soil by compressed air through a delivery hose. The binder is mixed externally in a computer controlled batching plant to a wet mix that is then pumped as slurry to the mixing head. An explanation of the mass mixing method, taken from the Sub-Contractors website, is provided as Appendix 12.

6.1.3 The initial field trial comprised an area of 4 sub-cells within the main stabilisation area. The four sub-cells were mixed with binder ratio's and content by mass as follows;

Cell Ref	Binder ratio (Cement:Bentonite)	Binder content by mass	Date of Mixing
26C	50:50	10%	28th Jan
25C	60:40	10%	28th Jan
24B	40:60	10%	29th Jan
23A	50:50	7.5%	29th Jan

Following mixing using the Allu mixing head, to a depth of 2m, the stabilised material was allowed a minimum of 7 days to cure, prior to sampling and testing, in accordance with the Specification and CQA Plan (Appendix 1).

6.1.4 Following the curing time, 5 samples of the stabilised material were extracted for laboratory permeability testing in a triaxial cell. The results of the laboratory permeability testing indicated that 4 out of the 5 samples had a permeability value higher than the maximum value allowed in the Specification, and therefore the trial was failed. The results of the failed trial are presented below;

Cell Ref	Sample Depth	Binder ratio (Cement:Bentonite)	Binder content by mass	Permeability Result
26C	0 – 1m	50:50	10%	2.1×10^{-8} m/s (fail)
26C	1m – 2m	50:50	10%	3.6×10^{-9} m/s (fail)
25C	0 – 1m	60:40	10%	9.7×10^{-10} m/s (pass)
24B	0 – 1m	40:60	10%	9.8×10^{-9} m/s (fail)
23A	1m – 2m	50:50	7.5%	1.0×10^{-8} m/s (fail)

Copies of the laboratory certificates for these initial field trial samples are presented in Appendix 13.

6.1.5 A review of the trial results by the Sub-Contractors consultant concluded that the higher than anticipated permeability results probably resulted from ongoing curing of the mixed material following sampling, but without the necessary moisture for hydration of the cement. This led to shrinking and cracking in the sample, which was present during the permeability test, leading to the higher permeability results. However this situation is not strictly representative of the mixed material in-situ because there would be additional moisture from groundwater available to the hydrating cement and this would prevent drying out, shrinking and cracking. Therefore the permeability values of the material in-situ should be lower than those demonstrated by the laboratory testing.

6.1.6 Notwithstanding the above, the method of sampling was amended so that an oversize sample was obtained and trimmed to testing size in the laboratory immediately before being tested. This was to remove any unrepresentative cracking on the outside of the sample prior to testing.

6.1.7 A further trial was undertaken using the Allu mixing head and varying binder ratios and contents, as shown in the table below;

Cell Ref	**Binder ratio** **(Cement:Bentonite)**	**Binder content by mass**	**Date of Mixing**
23B	50:50	7.5%	25th Feb
23C	50:50	10%	25th Feb
23D	55:45	7.5%	25th Feb

Samples from sub-cells 23B and 23C were taken on the 7th April, in accordance with the Sub-Contractors amended Sampling Method Statement (presented in Appendix 14), and submitted to GSTL Ltd. The permeability results from both of these sub-cells are in accordance with the Specification requirements.

6.1.8 In addition to the review of sampling methods, the method of mixing was also reviewed. It was observed that material that had been mixed with the Allu head appeared to be stratified in places, indicating that the mixing was not producing a homogeneous material. Therefore an alternative mixing method using a REMU mixing bucket was proposed.

6.1.9 The REMU mixing bucket was trialled on site on the 16th April 2016 and immediately appeared to create a more homogenous material mix than the Allu mixing head. Following confirmation by laboratory testing that the permeability requirements were consistently being achieved by the REMU mixing method, this method was adopted for the main works. All results obtained following commencement of mixing with the REMU bucket are in accordance with the Specification, and as described in Sections 5.3 and 5.4.

6.2 Remediation

6.2.1 The area of the initial field trials was agreed between the Contractor and Client as requiring remediation, based on the variation of the permeability values obtained in this area, and the inconsistencies with the mixing and testing methodologies. All sub-cells in rows 24 to 26 were designated for remediation. A copy of the Sub-Contractor's Remediation Method Statement is presented as Appendix 15.

6.2.2 Sub-cells in rows 24 to 26 were remediated as described in the Remediation Method Statement on the 6th May 2015 and subsequently sampled for laboratory testing. Each full sub-cell within the designated rows was sampled and tested following remediation and all permeability values achieved were in accordance with the Specification. The results are presented in the summary table in Appendix 8 and the laboratory certificates are presented in Appendix 9.

7 Conclusions

The total combined area of Cells 3 and 4 that were mass stabilised is 10,908m^2.

There were initial problems encountered with the mixing method for the stabilisation (described in Section 6) and 6 sub-cells were subsequently remediated as described in Section 6.2.

A total of 33 samples of the stabilised material were submitted for laboratory permeability testing to UKAS accredited laboratories, and all of the permeability values achieved in these samples are in accordance with the Specification ($<1x10^{-9}$).

It is considered that the stabilisation has been undertaken in accordance with the engineering design philosophy, the CQA Plan and the Specification.

REFERENCES

[1] Docksway Landfill Site, Area 2 Engineering Design Philosophy (Rev A) – Peter Brett Associates, 2005.

[2] Docksway Disposal Site, Newport. Conceptual Model and Hydrogeological Risk Assessment for Area 2 – Landfill Extension. Peter Brett Associates, April 2005.

FIGURES

Site Grid Reference: ST 309 852

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Client
NEWPORT CITY COUNCIL

DOCKSWAY DISPOSAL SITE
NEWPORT

SITE LOCATION PLAN

Date	01.04.2015
A4 Scale	1:50 000
Drawn by	davco
Checked by	VKR
Revision	0

FIGURE 1

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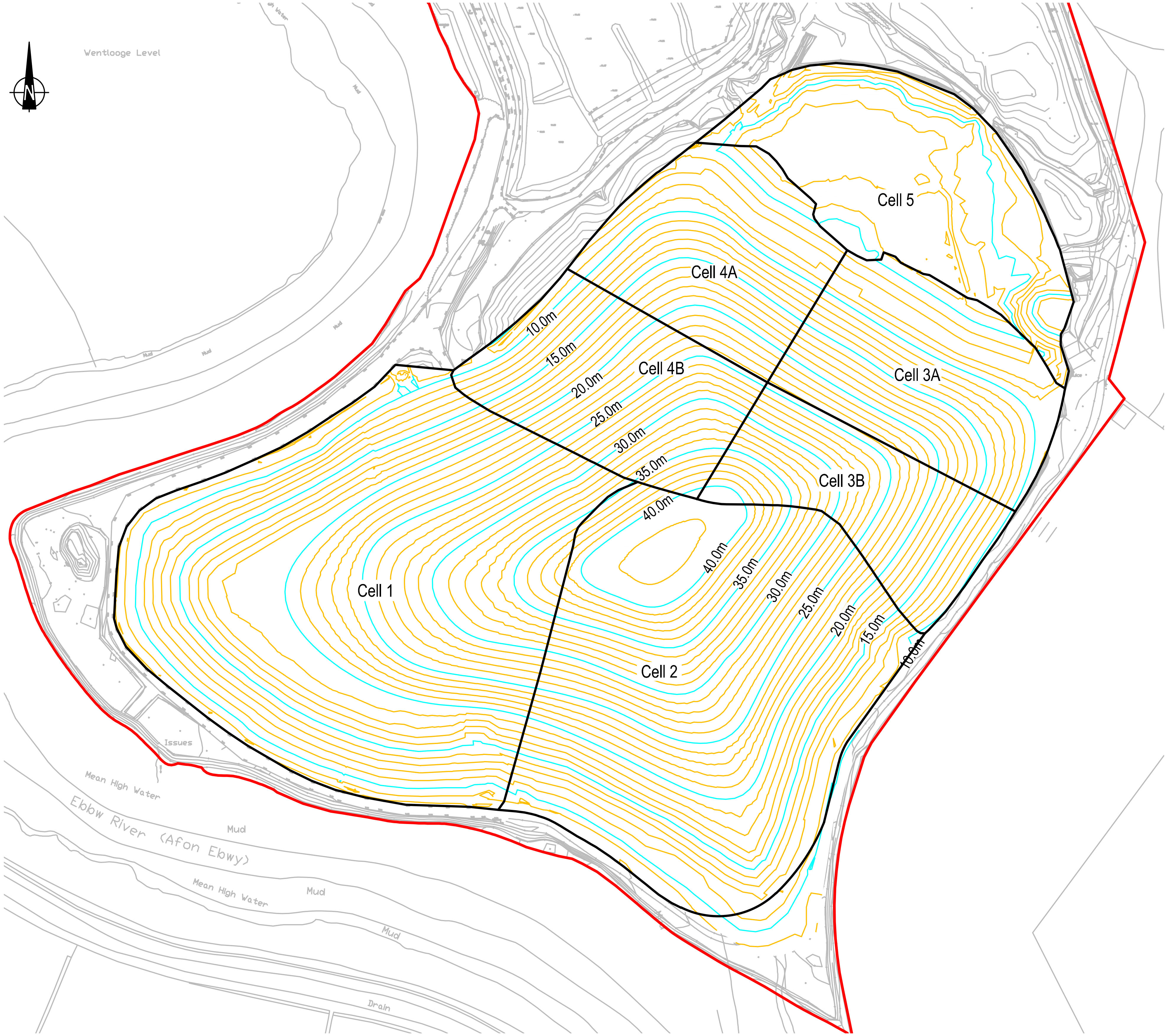

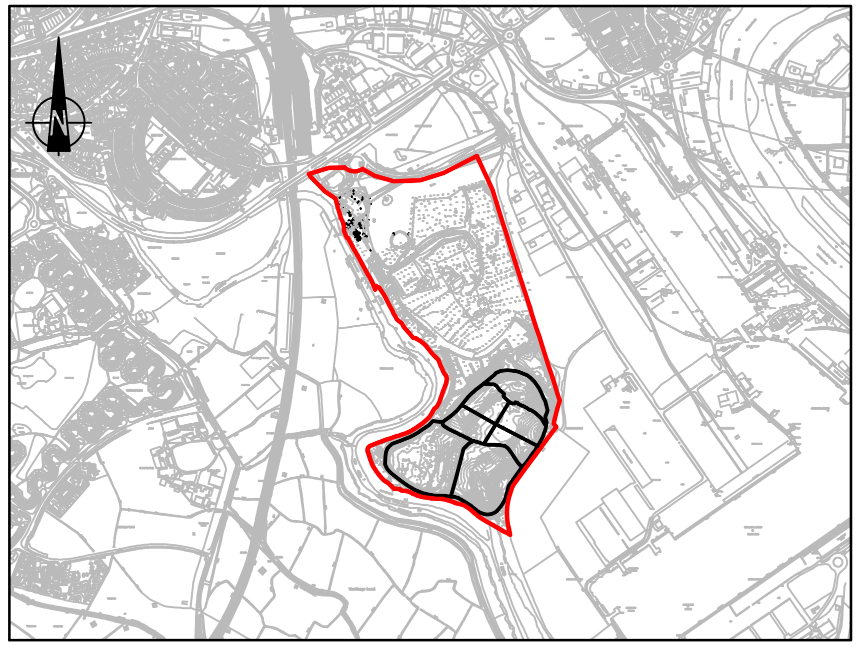

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READING

Tel: 0118 950 0761

Client

NEWPORT CITY COUNCIL

DOCKSWAY DISPOSAL SITE
AREA 2

PRE SETTLEMENT RESTORATION CONTOURS

Date	30.03.2015
A3 Scale	1:5000
Drawn by	davco
Checked by	VKR
Figure Number	2

user name: david cotton

File Location: j:\14739\155 - permit revision 2015\03_ figures & drawings\cad\dwgs\figure 2.dwg

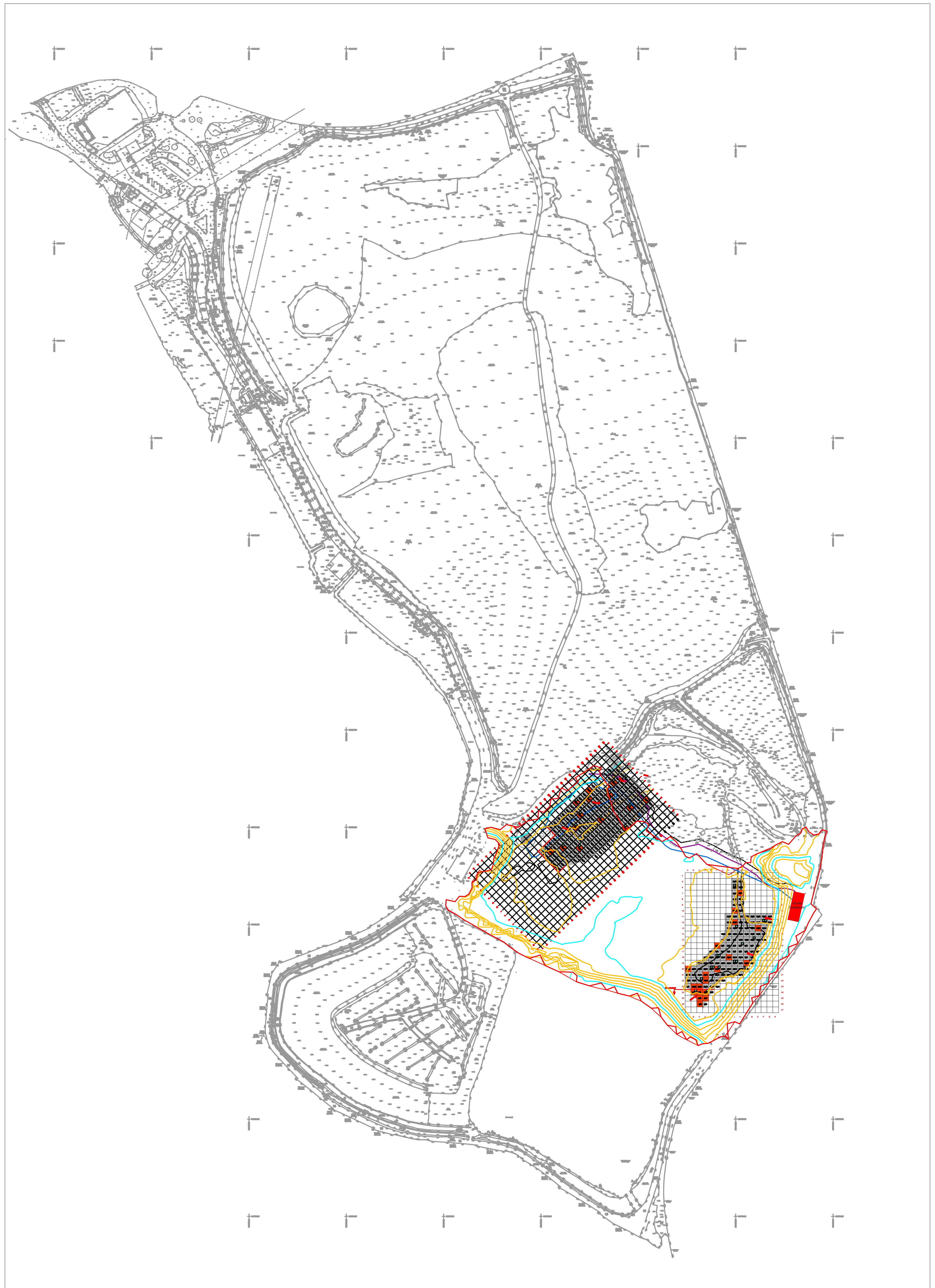

Figure 3

A2

NOTES

(grey box)	Stabilised Area
(red box)	Permeability Test Location
(green box)	Shear Test Location
(red circle)	Dynamic Probe Locations

Rev	Details	Dr	Ch	Ap	Date

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Project

Docksway Waste Disposal Site
Phase 2 Stabilisation

Cell 3 and Cell 4 □Site conte□t

File No.	2505	Status:	C□A		
Drawn By	IF	Checked By		Approved By	
Date	2□/0□/15	Date		Date	
Scales	NTS				
Drawing No.	2505 □AC □03				

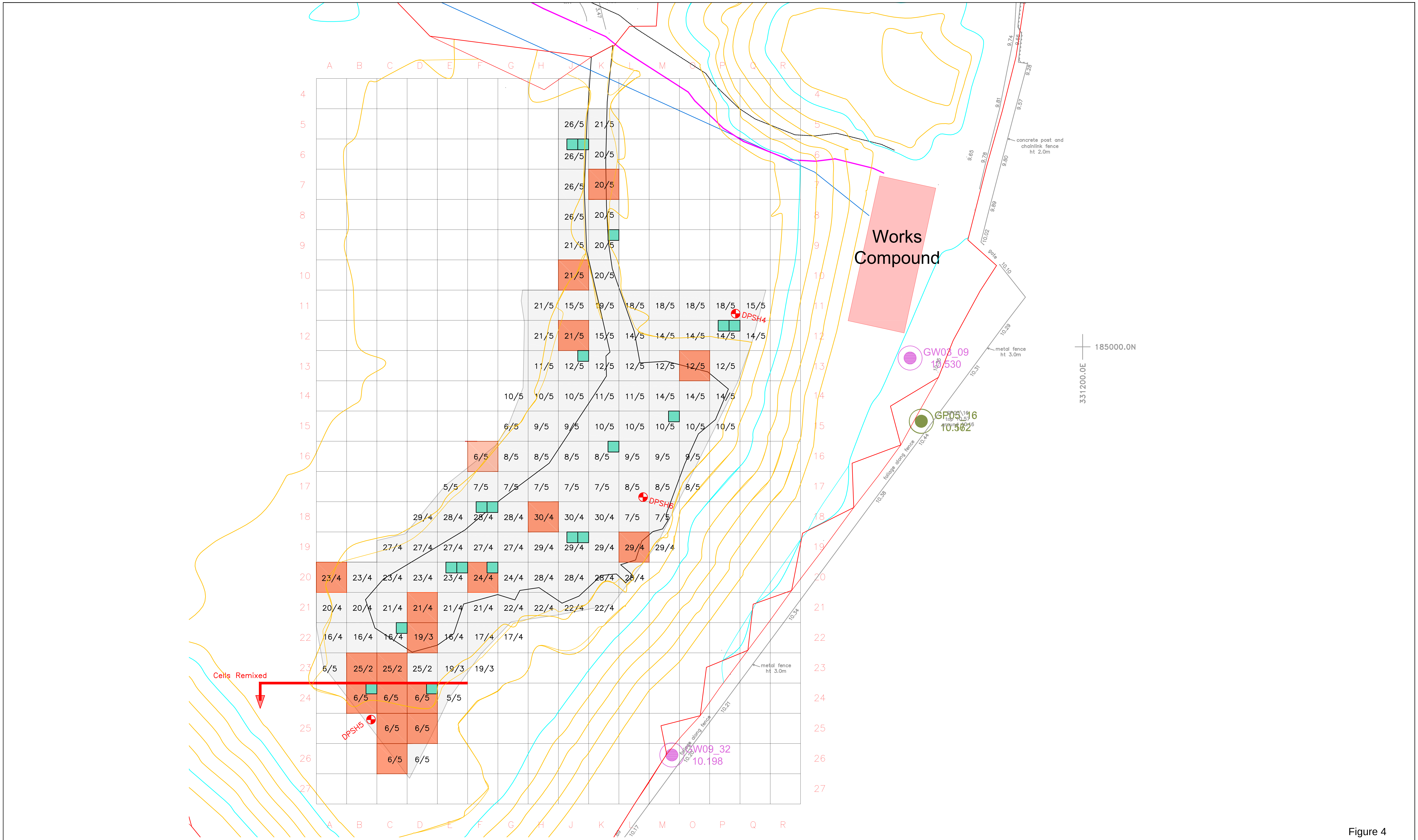

Figure 4

A2

NOTES

Stabilised Area

Permeability Test Location

Shear Test Location

Dynamic Probe Locations

Rev	Details	Dr	Ch	Ap	Date

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Project

Docksway Waste Disposal Site
Phase 2 Stabilisation

Cell 3 Stabilised Areas and Testing Locations

File No.	2505	Status:	CA		
Drawn By	IF	Checked By		Approved By	
Date	2/0/15	Date		Date	
Scales	NTS				
Drawing No.	2505 AC 01				

Figure 5

A2

NOTES

- Stabilised Area
- Permeability Test Location
- Shear Test Location
- Dynamic Probe Locations

Rev	Details	Dr	Ch	Ap	Date

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Project

Docksway Waste Disposal Site
Phase 2 Stabilisation

Cell 4 Stabilised Areas and Testing Locations

File No.	2505	Status:	C□A		
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Date	2□/0□/15	Date		Date	
Scales	NTS				
Drawing No.	2505 □AC □02				

Appendix 1

Appendix 2

Project – Docksway Newport

Deep Soil Mixing General Site Proposals

DEEP SOIL MIXING LTD.

Project No.1134
Date: - 22/1/2015

Understanding of the Project

The works are essentially for design and construction of a working platform for the future construction of the new landfill development that is to be constructed in an area that was formally the course of the River Ebww. Some areas of the site have sufficient strength and low permeability cover to provide the required conditions to place land fill waste on top but the areas marked on the drawing indicate areas of special concern that need preparation treatment to both provide strength and maintain the low level of permeability for the base of the proposed site. Long term the importance of providing a barrier to mitigate leakage from the site is essential to the works.

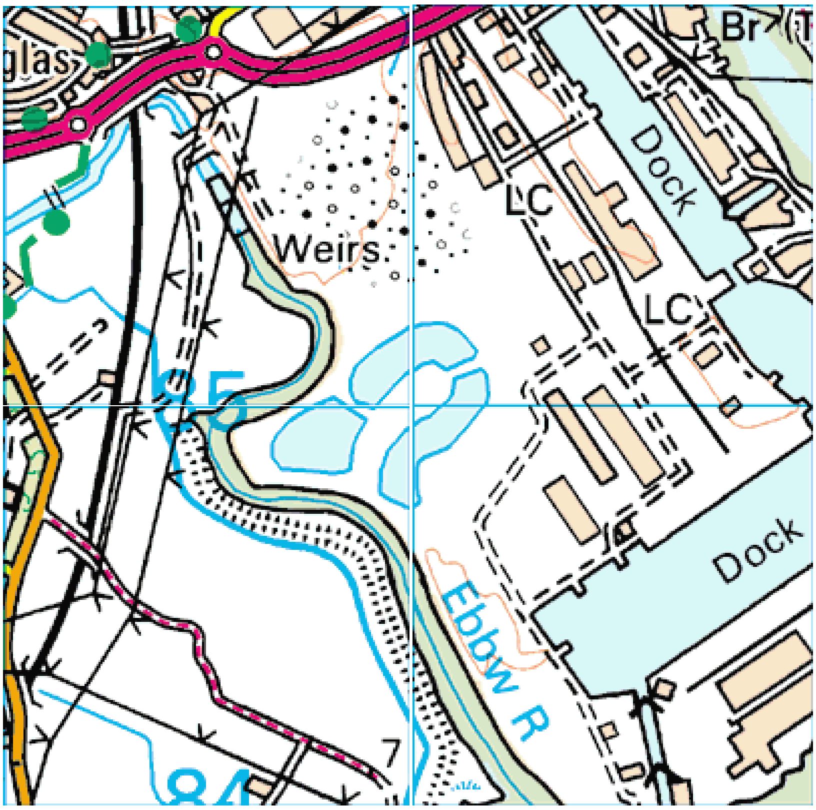
On the site there presently exists a band of very soft alluvium silts with low permeability properties that range in depths that vary between 8.0m in the east of the site and down to 2.0m in the riverbed. While these silts do have a low permeability level there is an importance to treat the top surface to form the working platform but it is considered essential that the bottom 2.0m of the silt must remain intact to provide a constant barrier to the underling terrace gravel.

In order that the site is best understood for the depths of alluvial overlying the gravels there is a need to carry out a grid survey of the site and probe the silts down to establish their depth, sections then need to be plotted and an assessment of treatment established. This will identify areas that do not have sufficient depth of alluvium to carry out the soil mixing treatment and the areas that can have material redistributed from to enable those areas with only the 2.0m of undisturbed alluvium to have newly treated material placed on top to provide the working platform with low permeability properties.

In addition to the survey work and assessment of the above DSML shall also look to utilize the early period of the project to trial some mixing operations with the proposed plant in order to demonstrate the binders and system of mixing is providing the required specification again to the client's engineer, the EA and DEFRA.

Project: **Docksway Newport**

<u>General Site Location</u>



General Working Methodology

The mass mixing would be performed using the Allu mixing head. By treating all of the soft silt material within the top 1.5-2.0m, the ground is transformed into a firm block of suitable strength to carry the proposed loading.

The ALLU PM Power Mix is a hydraulic mixing tool for excavators. The mixing power is based on the inclined locating of the drums and the unique structure of the mixing parts. The drums move simultaneously in three ways at the same time mixing the material in a controlled way. ALLU PMX Power Mix can process different materials all the way up to a depth of five meters depending on the chosen ALLU PMX Power Mix model, the excavator's reach and the quality of the material. The binder is feed by compressed air right inside the ground through a tube to a selected location near the drums. The amount of binder per square can range from only a few percent up to tens of percents. ALLU Power Mix is mounted as an accessory onto a standard excavator by a pin mounting or quick hitch adapter plate.

To maintain control of the mass mixing operation, the work needs to be carried out in cellular blocks ranging from approximately 70m3 to 100m3 at a time. Pre-construction layout of grids, individually identified, will be established on the construction drawings. Grid sizes and depth will be clarified on site prior to the mass mixing taking place and with the known volume to be mixed shall be calculated on a cell-by-cell bases. Monitoring equipment to record the binder volume used in each cell keeps the operator informed of how much is in the cell and how much is still needed to go in. Each cell has its unique number identified on the site plan with a print out of the volume used within that cell.

Treatment of the silts shall be by a wet mix system; dry binders shall be delivered to site in sealed containers and transferred into site-based silos through sealed pipelines. Then utilising the self contained batching plant that draws the powder/binder from the silos, mixing these with predetermined water: binder ratio the resultant grout is held in suspension in an agitating vessel until called off by the mixing rig operator.

Each batch that is mixed in automatic mode is electronically recorded for source of binders, with two binders being mixed on site records are downloaded on a daily bases to show the percentages of each binder being used in a batch, the weight of binder, volume of water, mixing times both period of mixing and time of day.

DSML propose to use Mass Stabilisation as the method for achieving the requirements of the project at Docksway Disposal Site. Mass stabilisation is a method to stabilise soft soils by adding binders to improve the shear strength. It is proposed to use blended bentonite and cement powder as the binder at Docksway this will be batched in ratios determined by the site trials and introduced to the soils requiring stabilisation using a computerised automated batching plant and an Allu mixing head attached to a 35T CAT 330 excavator. (See Below Sketches and Photo.)

It is proposed to use a wet mass mixing solution, in order to produce a consistent grout a specialised batching plant shall be erected with feeds from two silos that contain the dry powders. To produce the wet grout, a predetermined quantity of water is dropped into the mixing tank of the batching plant, followed by the programmed weight of Bentonite and Cement Binders, these shall be blended to the required consistency within the mixing pan before being discharged as a grout to the holding/agitator hopper where the grout is stored before being pumped to the soil mixing head. The speed of the grout being pumped is controlled by the Allu soil mixing operator who is mixing a particular cell. Each cell shall be individually identified and the actual volume of each cell shall be calculated and the required quantity of binder known in advance. The grout shall be continually supplied until the predetermined quantity has been batched for that particular cell size.

DSML consider that the top 1.5 – 2.0m of silt can be mass mixed to meet both the required soil strength and the permeability factors.

Full method statement shall be provided for all these activities prior to the work commencing but it is clear to say that the client’s engineer, Newport CC the EA and DEFRA shall all be satisfied with the survey information and the working proposals prior to commencing any full scale stabilization operations.

As mentioned previously for installation of the actual works we shall be bringing in our own ALLU mixing equipment and our own batching plant for the mixing and pumping of the binders as a grout.

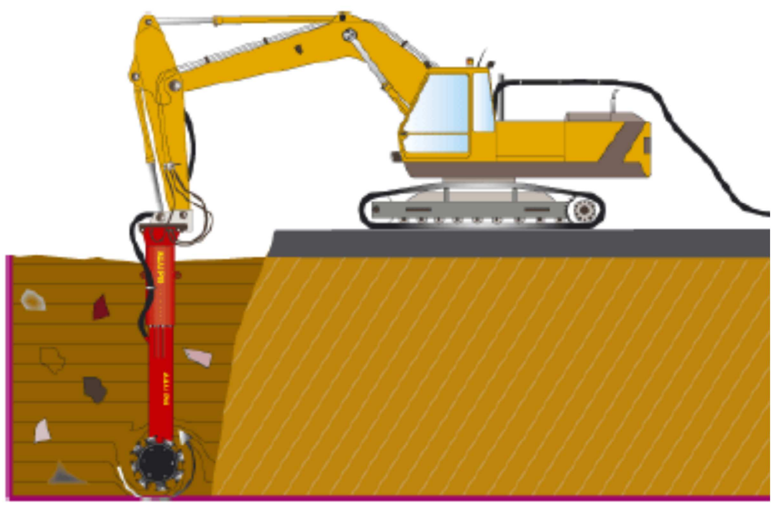
We recognise the importance of probing the alluvium layer to identify the depth to the gravels and this shall be carried out with a small dynamic probe rig that we shall again sub-contract in but this process we consider is not needed for the complete 6m by 6m grid.

We propose initially carrying out cross-sections of the site at about 20 m spacing with the probing being concentrated nearer the old riverbed thus identifying the risk areas for depth of alluvium and potential areas that need material transferred to/built up.

For this work, we envisage placing large timber rafts on top of the softer silts to provide a safe working platform for the probing rig.

For the main work, all men on site shall be directly employed by DSML. With an experience soil mixing foreman working full time on the project the upper tier management shall be either Colin Critchlow or Robert McGall who shall be onsite a minimum of 90% of the working week but who shall always be available on mobile phone. Full time site Engineer/manager shall be George Olney.

Mass Mixi



Mass mixing with the ALLU mixing arm and head can enable the mixing operations to reach depths of 5.0m but as seen in the photograph a simple mark to represent the desired depth keeps the operator aware and the engineer in tune with the correct depth.

<u>Sketch showing typical Mass Mixing Operation using the ALLU Mixing Head</u>

2) Site Programme

Short Programme

	Description	Months								
		Weeks	Jan	Feb	Mar	Apr	May	Jun	July	Aug
	Mobilisation of Plant site compound fencing	**2**								
	Field Trials with ALLU mixing head.	**1**								
	Site Survey - Probing of site and lay out of cells	**3**								
	Testing of site trial samples and assessment of results	**1**								
	Anticipated main works start date Week Commencing 16th Feb 2015									
	Installation of soil mixed blanket over site 15000m2	**15**								
	Testing procedures and validation works									
	Decommission and move off site									
	Design Validation report and Warrantees issued	**4**								

While this is a simple programme, there will be a need to expand this once the site survey and plan of mixing cells has been established with ID's, plan sizes and depths.

With this information recorded, the anticipated progress programme shall be established and used to monitor weekly working progress reports. Testing regime and designer reporting schedule shall also be plotted onto the contract programme with monthly site meetings.

Appendix 3

METHOD STATEMENT

For

SOIL MIXED FOUNDATIONS

INSTALLATION
BY

SOIL MIXING EQUIPMENT(Wet Mix Solution)

Docksway Newport

16th December 2014

Revised 29/4/15

AUTHORISATION

Signed:	Title:
Name: Colin Critchlow	Date: April 29th 2015
To be signed by the author or project team leader.	

I certify that the staff who have prepared the above method statement are competent to carry out their duties and that (so far as I can reasonably ascertain) they have used reasonable professional skill and care.

Signed:	Title:
Name: Robert McGall	Date: April 29th 2015
To be signed by the Director (or equivalent) to whom the author or project team leader is responsible.	

DISTRIBUTION – REVISION 4

POSITION	NAME	DATE	Tel	INITIAL
CLIENT	**Newport CC**	30/4/15	**01622 852000**	
ENGINEER	**Peter Brett Association**			
Contracts Manager	**Colin Critchlow/ Robert McGall**	30/4/15	**07977 117180**	
Engineer	**George Olney**	30/4/15	**0750846 7366**	
Foreman	**Peter Dixon**	30/4/15	**07999 219969**	
Mixing Operative	**Denny Critchlow**	30/4/15	**07415 048 612**	
Mixing Operative	**Matthew Penny**	30/4/15	**0784580 7898**	
H&S Officer	**Colin Critchlow**	30/4/15	**07977 117180**	

Comments; *This document is a live document and revisions are constantly being added, when reading please ensure that you have the latest copy. For changes to be made to this document please write out the relevant changes and submit to author for revision.*
All revisions shall be in Blue Writing

CONTENTS

1.0 SCOPE OF WORKS

1.1 All Principal Items of works to be described

- Soil mixing is to be used to provide solidification of the soft alluvium mud's that has been identified as the bed of the oxbow lake.
- DSML have carried out site sampling and laboratory testing of the various soils found in this location and have proposed to use deep mass mixing of the soils down to an approximate depth of 1.5 to 2.0m in order to establish a suitable working platform.
- Site works takes on four main activities
    1. Trial works, to carry out the proposed system of works in order to identify that the system of working provides the necessary mixing of the silts to achieve the required shear strengths and permeability values.
    2. Testing of these trial cells shall be carried out with plate loading and samples taken for laboratory triaxial permeability analyses.
    3. Following receipt of satisfactory results on the field trials, soil mixing operations shall commence on the overall works.
    4. Continuous testing and validation shall be carried out to ensure high standards are maintained.

1.2 Items of Special Concern.

- Work is being carried out adjacent to a working land fill operation.
- At no time shall the DSML plant or work force enter into the land fill area.

2.0 PLANT & LABOUR – (Detailed list of all plant and labour to be used on site)

Actions to be carried out	Additional Actions Required	Parties Responsible	Sign off by
Plant requirements shall be but not limited to the following,			
30Tonne Excavator with REMU mixing bucket Batching Plant Generator and electrical junction box 2No. Vertical Silo, 40Tonne recommended. Screw feed from silo to batching plant. 2" water feed via Pump Excavator in attendance. 50mm delivery hose 100m from batching plant to soil mixing rig. Power Washer Compressor Paint spray	Location for batching plant set up and suitability for binder deliveries. Concrete slab required for silos	DSML	
Labour			
As detailed in distribution page.			
PPE requirements			
Helmet Hi-Vis Gloves Boots Dust mask for cleaning of batching plant		DSML	

3.0 Mobilising to site – (Describe how the site will be mobilised and set up)

3.1 Set up site compound

Actions to be carried out	Additional Actions Required	Parties Responsible	Sign off by
Mobilisation – Site Establishment			
Induction shall take place before any works are commenced. Induction shall be by DSML	Site induction sign off sheets.	DSML)	
Location for batching plant set up and suitability for binder deliveries has been agreed and this area shall be fenced off.		DSML	
Welfare facilities shall be installed as part of the first days actions		DSML	
Timber formwork shall be used to construct the two silo bases.		DSML	
Silo bases shall be poured using 30N ready mixed concrete delivered to site on the Tuesday 6th January2015.		DSML	
Mobilisation of the batching plant and silos shall be started on Thursday 8thth January 2015		DSML	
Water supply, 50mm shall be provided by electric pump from the storage lake 100m to the north of the site works.		DSML	
The concrete slabs shall have the silos bolted into them.		DSML	
The Silo will be filled with a delivery of binder on Friday 9th January. Silos should not be left empty if strong winds are likely and must be bolted to the ground.		DSML	
Computerised recording devices within the batching plant shall be calibrated before any mixing operations takes place.	Calibration certificates to be received before work commences.	DSML	

4.0 PROCEDURES TO CARRY OUT THE WORK

4.1 Main Contract Works

Actions to be carried out	Additional Actions Required	Parties Responsible	Sign off by
Site Operations			
Induction shall take place before any soil mixing operations are carried out. Induction shall be by RMcG or C C.	Induction sign off sheets	DSML	
Setting out of the mixing cells shall be identified on a drawing and marked out along the length of the works with clearly identifiable posts.	Hazard – RA needed for working close to deep enclosed area.	DSML	
Each cell shall be identified by a number and dimensions, (length & breadth) recorded onto a calculation sheet.	*Note:-This identification of each cell location is very important and locations must be maintained initially for installation and then for testing positions.*	DSML	
Dimensions of each cell's required mixing depth shall be recorded onto the calculation sheet for the purpose of calculating the volume of material to be mixed within each cell.	Cell calculation sheet to be provided.	DSML	
With the volume known the tonnage can be calculated and the % of binder required for that particular cell shall be worked out and logged on the record sheet.		DSML	
Tonnage shall be noted by the batching plant operator and that tonnage shall be weighed through the computerised batching plant.		DSML	
The top layer of roots and hard material (especially on the edge of stabilised area) shall be removed prior to mixing to ensure consistency of mix.		DSML	
This total tonnage shall be pumped through the mixing bucket as it picks up the material and thoroughly mixes it as it moves through the bucket until homogeneously mixed with the site soils.		DSML	
REMU mixing bucket shall break down material prior to and during mixing and be constantly introducing and thoroughly mixing the binder in with the existing site soils.		DSML	
REMU bucket shall continue to mix soil and binder together once it has assumed a more liquid form, ensuring that all parts of each cell are consistently mixed with the required amount of binder.		DSML	
Computer down loads can be taken daily from batching plant.		DSML	
The batching plant shall be primed and set up in auto mode to mix the binder to the required ratios. The initial ratios shall be 1:1 water: binder.	Daily log sheets required	DSML	

Records of each cells construction shall be logged into the operators log sheet.	Cell Log record sheet to be provided.	DSML	
The initial cell shall be mixed to the pre-described ratios of Binder % and the Binder:Water ratio shall be 1:1		DSML	
DSML shall monitor and assess the mixing of this initial cell and make any recommended changes to the mix. Batching ratios may be changed during the operations in order to provide a stiffer grout but this shall only be carried out in agreement with DSML Supervisor. Written notification shall be logged by the DSML representative.		DSML	

4.2 Testing of Mixed Soils

Refer to Testing Method Statement

4.3 Other Areas Requiring Special Attention

Actions to be carried out	Additional Actions Required	Parties Responsible	Sign off by
Dealing with Blockages			
Dealing with blockages is a common problem with pumping of grouts/mortars/ concrete and due to high pressures that can be produced in pipelines the procedure for dealing with these types of problems must be understood by the people in charge of the works and the people using the plant.	Dealing with blockages tool box talk will be presented by DSML at time of induction. Copy attached.	DSML	
Operating procedure for gravity feed silo			
Ensure air supply is connected to air-in line, 100v electrical supply is connected to control box and bottom discharge valve is in the closed position. Open air-in, switch on 110v electrics and switch reverse jet filter on Connect tanker/tanker hose to fill point connection (unicone connection) and Proceed to fill vessel. MAXIMUM DISCHARGE PRESSURE 1 BAR. When red light illuminates and or Klaxon sounds, vessel is full and tanker filling must cease, silence Klaxon by pressing mute button. Blow fill line and tanker line clear Disconnect tanker/fill line from unicone connection and switch off reverse jet filter. Reverse jet filter will continue to operate for approx 6 minutes after switching off to allow dust to settle and reverse jet filter to clear itself of all product. Vessel is ready for discharging of product. When green, low level indicator (amber and/or green, mid/low level indicator on 45 cu m) light illuminates vessel is now capable of receiving full tanker load of product or 1 to 2 loads in the case of the 45 cu m silo depending on which lights are illuminated. Please note the binder product can be discharged from silo even when vessel is being filled from tanker.	Operators on site need to be trained in the use of the equipment.	DSML	
REMU mixing bucket			
During mixing, no personnel shall stand within a 5 metre area around the excavator. Also no personnel shall stand within a 5 metre radius of the mixing bucket due to possible splash-back of silts/binder.	Shall be stressed to all personnel on site and any site visitors shall be warned and provided with PPE	DSML	

4.4 Demobilisation of Equipment.

Actions to be carried out	Additional Actions Required	Parties Responsible	Sign off by
Demobilisation			
When all works have been completed the plant shall be disconnected and washed down, the area shall be cleared from any rubbish and it will be deposited in suitable skips.	Soak a away area shall be made available by PC	DSML	
Plant shall be left with lifting points suitable for loading onto the transport vehicles and transport ordered for collection time suitable for loading. One DSML representative shall stay on site to co-ordinate with the lifting supervisor.		DSML	

5.0 HEALTH & SAFETY

- Regular site audits shall be carried out by in house visits and external auditors visiting site
- All operatives involved in these works must be experienced in the activities they carry out.
- All Operatives shall be fully briefed in the risks associated with the activities they carry out.
- All plant and equipment to be used in these works must hold suitable certification to prove that it is suitable and safe for the way it is to be used.
- All Operatives will wear suitable P.P.E. as identified with in the risk assessment.
- All Operatives of plant will hold CPCS certification relative to the plant that they operate.
- All Operatives will be CSCS trained.
- All Operatives are to wear gloves
- **Other specific requirements**

REPORTING OF NEAR MISSES IS AN ESSENTIAL TOOL IN

THE REDUCTION OF ACCIDENTS AND

ALL INCIDENTS MUST BE REPORTED

Safety is EVERYONE'S Responsibility

YOU share responsible for yourself your work colleagues and the public

Therefore important to have risks Identified.
DSM shall identify the Risks prior to carrying out the work but on site things can change, conditions change, methods may well have to change
Therefore risks can change or may not have been originally identified

Good working practice is to

“Stop and Think”

“Recognise potential risks”

We can all carry out Risk Assessments
Emergency Services, Police, Armed Forces all carry out Risk Assessments as they carry out their duties.
These are known as

Dynamic Risk Assessments (DRA)

Acting responsibly

Everyone is **personally responsible** for following the operations that relate to the jobs they do.

We’re all responsible for acting safely, using any machinery supplied safely and, if necessary, wearing and using the protective equipment supplied safely. However, we recognise that risk circumstances might change ‘on the day’.

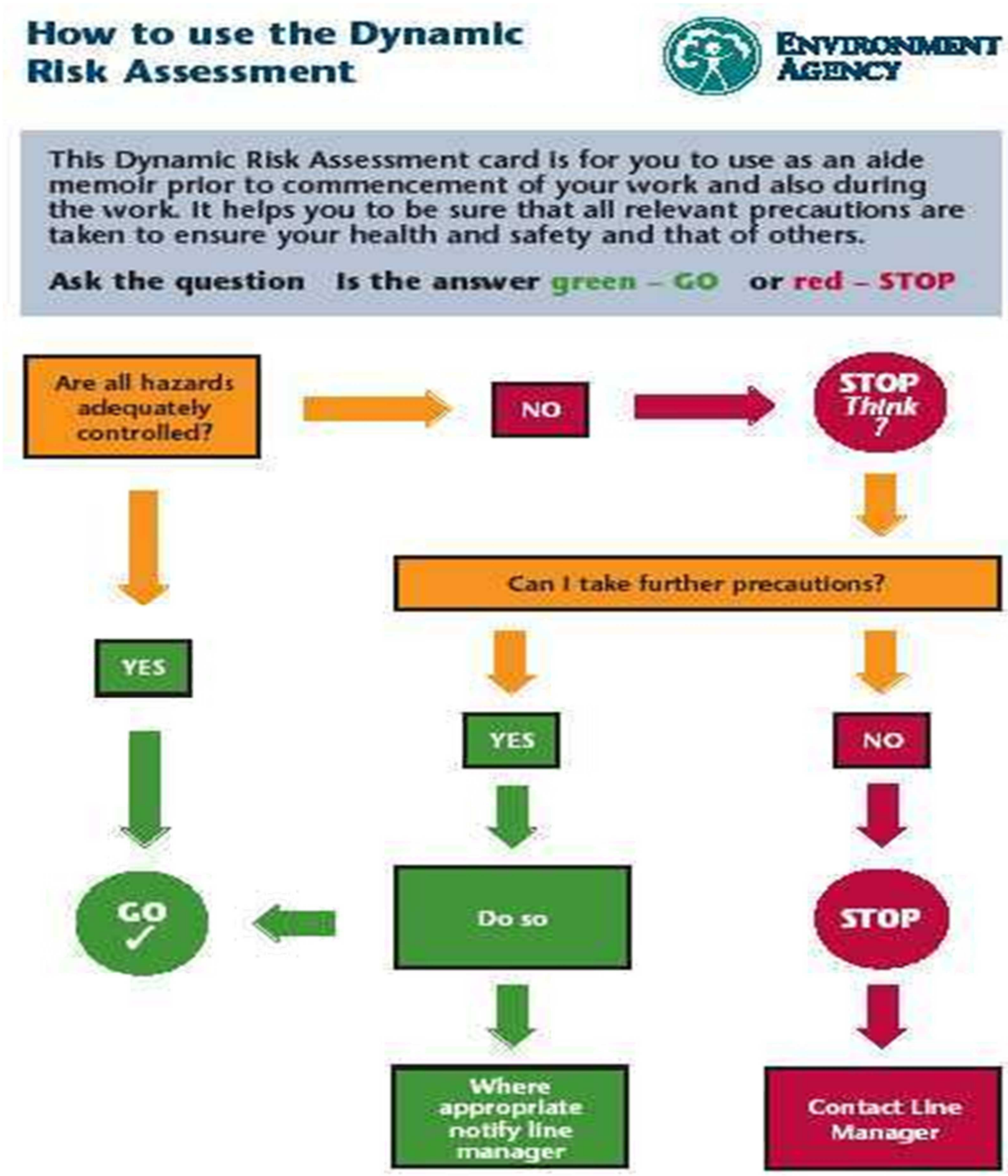
When to carry out a Stop and Think/DRA

We must always STOP and THINK before and during any work we do. If ever in doubt about any given safety procedure or whether the required risk controls will be effective, **stop** and ask for help.

We have a Stop and think - DRA card to provide an aide-mémoire for all fieldworkers which also helps to decide what action to take when out on site.

Note: It’s never acceptable to solely rely upon Stop and think/DRA as the main control measure – it’s **not** a substitute for planning the work thoroughly.

The flow diagram below tells you how to use the Stop and think/DRA.



Learning from Stop & think Dynamic Risk Assessment decisions	Most DRAs occur on the day and result in a decision to continue but some will lead a decision to stop the job or to put new controls in place before continuing. In these cases all team members are strongly encouraged to feedback their decisions. Team leaders are also encouraged to actively seek and share feedback. Someone else might learn from the experience. Maybe an existing risk assessment needs to be updated for everyone, then changes should be noted and GRA's amended.

Example:
If changes are considered necessary then
DRA's must be Recorded
Management Informed about changes.
General Risk Assessments amended to reflect the changes.

REPORTING OF NEAR MISSES IS AN ESSENTIAL TOOL IN THE REDUCTION OF ACCIDENTS AND ALL INCIDENTS MUST BE REPORTED

6.0 RISK ASSESSMENT APPRAISAL

HAZARDS	Who is in Danger	Risks and Potential harm	Action taken and additional action to be taken	Personnel to take appropriative action
Working close to water	All staff and operators	Falling into water; hypothermia,	Keep clear of water or work in pairs if required.	All persons on site
Working with pressure lines	Operators	Blockages, hose rupture, hose flying into the air. Impact injuries, death.	See detailed section 8.2 in MS. Tool box talk for all operatives and management on site.	All operators, management on site.
Working close to tracked plant	All staff and operators	Impact injuries, crushing, death.	Zoned area for plant movements.	All site staff and operators.
Operation of Silo	Operator	Blockages, hose rupture, hose flying into the air. Impact injuries, death.	See detailed section 8.3 in MS. Tool box talk for all operatives and management on site.	All operators, delivery men, management on site.

7.0 COSHH ASSESSMENT FORMS

Substance	Actions to be Taken
CEM II	Wearing of dust masks and gloves during times of deliveries

8.0 ADDITIONAL INFORMATION

8.1 Information on Plant & Equipment

- See Attached

8.2 Cleaning out pipe lines and mixing equipment.

PROCEDURES FOR DEALING WITH BLOCKAGES IN PRESSURISED PIPELINES

Tool Box Talk for Sites using Pressurised Pipelines

Note:- This is to deal with both grout and concrete pipelines.
When a blockage occurs in the pump valve mechanism, boom or pipeline, it immediately creates safety hazards with the Grout or Concrete in the system under pressure. Therefore entry into the valve mechanism or pipeline has to be carried out with extreme caution.

THE MAIN CAUSES OF BLOCKAGES ARE:

1) Mix design faulty/Incorrect.

The grout or concrete may not be a pumpable mix e.g.

- there may not be enough sand/cement in the mix or the concrete may be too stiff
- there may be bleeding or segregation
- some admixtures may adversely affect pumpability (e.g. excess entrainment of air)

If the mix is not pumpable then no amount of operator expertise will eliminate blockages

2) Pipeline and joint faults

These will include:

- dirty pipelines – pipelines which have not been cleaned out adequately previously
- worn and leaking joints with permit the loss of grout and fines and will lead to segregation, which is one cause of blockages
- pipelines which have not been properly grouted up prior to the first load of concrete being pumped, could also cause a blockage
- too many bends in the pipeline or excessive length of flexible hose, both of which increase friction, can also inhibit pumping.

3) Power of the Pump

- The pump chosen may be inadequate for the job or not developing sufficient hydraulic pressure.

4) Concrete/Grout setting in the pipeline

- This may be due to delays on site for a variety of reasons. At the first sign of concrete setting, (e.g. appearing as dry ‘slugs’ at the placing hose end) the whole system should be washed out. Weather conditions may affect the concrete and operators should take note of their company procedures in this respect. If in doubt – wash out!

5) Foreign Bodies

- Pieces of old concrete or large aggregate from the batching plant or truckmixer can cause a blockage. Never allow a truckmixer to washout into the pump hopper.

6) Inexperience

- An inexperienced operator could create a blockage by pumping at too high a pressure
- An inexperienced placing crew who kinks the end hose can cause a blockage or a serious accident from a possible ‘whiplash’ of the flexible hose.

CLEANING OUT THE PUMP, HOPPER AND PIPELINE

This important procedure is carried out normally using high pressure water, but in certain circumstances compressed air may be used.

Both methods present hazards, particularly when compressed air is involved. This later method should only be used when it is not practical to use water, for example with long pipelines and water is not readily available.

Cleaning out must only take place at a point designated by the site management. Concrete must not enter a watercourse drain, or splash adjacent property.

The law places a “duty of care” on all those involved at any stage of the waste disposal chain, including you. If you have not received instructions from the site then you must ask for it to fulfil this duty.

Cleaning out the pipeline using high pressure water

This is DSML preferred system for washing out pipelines and equipment.

- Release pressure from the pump and pipeline by reverse pumping. This may not release all the pressure if the pipeline is sloping downhill.
- Fix a washout adaptor/pipe cleaning head at one end of the pipeline and a catch basket at the discard end. The sponge ball or wad should be inserted in the pipeline immediately in front of the washout adaptor.
- A short double valve and caped “T” piece should be used to insert the Sponge Cleaning Ball
- The pump should be gradually turned on to allow controlled water pressure to move the ball. The position of the ball can be monitored by lightly tapping the pipeline. The ball will accelerate as it nears the end of the pipeline and pressure must be reduced to prevent a violent discharge.

- The concrete and sponge ball/wad may be ejected at considerable force and this could cause serious injury or damage to property. All persons should be warned to stand well clear. Those persons involved in the operation should wear protective clothing, which should include eye protection or face visor and hard hat.

Cleaning out the pipeline using compressed air

Procedures when using high pressure water are the same when using compressed air, but additional precautions are necessary. There are much greater risks involved and this should only be done as a last resort. The use of a trap/catch basket that is securely fixed is absolutely essential.

- You must be thoroughly experienced in the operation and have an assistant who is equally experienced.
- Never use a compressor which has a rating more than that necessary for the operation. Normally an output of seven bar (approx 100psi) is all that is required.
- The washout adaptor/pipe cleaning head must have an air entry cock which can regulate the amount of air being taken in.
- The procedures used for cleaning out using high pressure water should be followed. The position of the sponge ball must be monitored by your assistant. Venting the air will control the speed of the ball. As the ball nears the end of the line, (say 20 to 25 metres from the end) the air should be turned off, otherwise the ball will be ejected at a dangerous speed.
- It is possible that the air can overtake the ball, forming a pocket of compressed air between the ball and concrete. Extreme caution must therefore be taken when uncoupling in the vicinity of the ball and minimum protection must include a face visor and helmet.
- After completion of the initial clean out, it is usual to repeat the operation (again with compressed air) this time using two sponge balls with a water cushion (approximately 50 litres) between them.

Cleaning out the pump valve chamber, pistons, tapered or 'Y' pipes, hopper etc, using high pressure water.

- Before starting this operation, you must ensure that the engine is switched off and all pressure released. Isolate the concrete valve by closing the shut-off valve. Before removing the grill to gain access to the remix hopper, the remix shaft must be isolated by closing the shut-off valve and locking it if a locking device is fitted.
- Always clean out thoroughly and remove any build up of concrete. Build up can be particularly rapid in corners, tapered pipes etc. Incomplete cleaning can cause blockages and wear leading to safety problems.
- Where possible, use mould oil or similar on equipment or parts of the pump where build up is likely to occur. Clean all equipment or individual pipe lengths immediately you have finished using them, or as soon as possible thereafter.
- When hosing down, take care that you avoid electric switch boxes, remote control cables and associated equipment, which are normally only splash proof.

Clearing or dealing with blockages

Initial considerations are
- That clearing blockages must only be attempted by an experienced operator,
- Assume all pipelines to be pressurised.

A small amount of reverse/forward pumping may clear a minor blockage, but continuing this procedure and increasing the pumping pressure will not clear a major blockage and may make matters worse by creating an even more severe blockage.

The next action normally taken before attempting to clear a blockage is to release the pressure by reverse pumping. If the pipeline is inclined downhill then you will not be able to release all the pressure. The gate valve normally positioned at the bottom of an inclined pipeline should be opened.

Before opening up a pipeline or disconnecting any part of the pump, you should wear protective clothing – minimum safety helmet, goggles/face visor, as a safeguard against blowbacks. It is essential that an experienced operator takes control. Warn the crew to stand clear of the delivery hose in case there is a whiplash when the blockage is cleared.

Before entering the concrete valve/piston area, the concrete valve should be rendered inoperative by closing the shut off valve. Before lifting the hopper grill, isolate the remix valve by closing the shut off valve. Engage the locking device if one is fitted. Never attempt any work in the valve mechanism or piston area unless the power has been switched off with either the key removed from the petrol engine or the electric motor isolated.

Blockages mostly occur in the concrete valve or cylinders area. Taper or reducer pipes are other likely areas. In the pipeline or boom, blockages are usually found at bends or in flexible hoses. Cleaning is normally carried out by rodding and flushing through with water.

Dirty pipelines will cause blockages. Even a small amount of concrete build-up left over from the previous job could create a blockage. Pipes and end hoses should be in short enough lengths to afford visual inspection for cleanliness.

Effective Daily cleaning will help to prevent blockages.

8.3 Operating procedure for gravity feed silo

- Ensure air supply is connected to air-in line, 100v electrical supply is connected to control box and bottom discharge valve is in the closed position.
- Open air-in, switch on 110v electrics and switch reverse jet filter on
- Connect tanker/tanker hose to fill point connection (unicone connection) and
- Proceed to fill vessel. MAXIMUM DISCHARGE PRESSURE 1 BAR.
- When red light illuminates and or Klaxon sounds, vessel is full and tanker filling must cease, silence Klaxon by pressing mute button.
- Blow fill line and tanker line clear
- Disconnect tanker/fill line from unicone connection and switch off reverse jet filter. Reverse jet filter will continue to operate for approx 6 minutes after switching off to allow dust to settle and reverse jet filter to clear itself of all product. Vessel is ready for discharging of product.
- When green, low level indicator (amber and/or green, mid/low level indicator on 45 cu m) light illuminates vessel is now capable of receiving full tanker load of product or 1 to 2 loads in the case of the 45 cu m silo depending on which lights are illuminated.
- Please note, product can be discharged from silo even when vessel is being filled from tanker.

9.0 Programme

Detail the programme of works
Main Activities

- Mobilise Silo to site Wednesday 7th January 2015
- Set up batching plant, position silo. Wed - Thursday
- Commence installation Monday 12th January 2015
-

Appendix 4

PLATE 1: ALLU MIXING ARM

PLATE 2: REMU MIXING BUCKET

Appendix 5

STAGE 2 CELL 3 STABILISATION **SITE DIARY**

DATE	05-01-2015 – 11-01-2015
WEATHER	Generally Dry intermittent showers

PROGRESS -

Started site set up, installing compound area and silo slabs. SW pumps still under NCC control.
Set up likely to progress for 10 days.

Batching plant slab installed on the 6th, 2men machine and materials.

Long reach excavator onsite from Wednesday (10:30) for reed strip.
ALLU head and machine forecast arrival on 21st

TECHNICAL ISSUES
None

TESTING UNDERTAKEN / RESULTS RECEIVED
None

STAGE 2 CELL 3 STABILISATION **SITE DIARY**

DATE	12-01-2015 – 18-01-2015
WEATHER	Generally Dry intermittent showers

PROGRESS -

Installation and commissioning of new Silos and telemetry from the 15th.

Pump for mix water installed in the lower lagoons including screen for biomass.

TECHNICAL ISSUES
The silo provider is Danfords and the telemetry / batching systems are being provided installed and commissioned by AMMANN ELBA. This is likely to take a week and can only be finalised once the Rig is deploying.

TESTING UNDERTAKEN / RESULTS RECEIVED
None

DATE	19-01-2015 – 25-01-2015
WEATHER	Generally Dry, Cold frost.

PROGRESS - MIXING TRIALS

ALLU head and machine arrive on 21st. The machine is calibrated and fitted with the ALLU arm on Thursday with the trial scheduled for Friday to Monday.

TECHNICAL ISSUES

Friday saw a limited amount of movement on the base before driver error saw the machine stuck. So the trial was called off.

[redacted]

MACHINE STUCK

[redacted]

MACHINE WORKING

TESTING UNDERTAKEN / RESULTS RECEIVED

None

DATE	26-01-2015 – 01-02-2015
WEATHER	Generally Dry 10°C

PROGRESS - MIXING TRIALS

Machine remained stuck until Tuesday the 27th Trials begin on Wednesday 28th and finished on Thursday 29th.

TECHNICAL ISSUES

No issues all telemetry is reported as working and the binder is flowing adequately.

Trial mixes were undertaken on the 28th and 29th. The exact location, mix ratio, photographs etc are formally recorded on A DSM Pro-forma in summary the locations were as follows:

Cell Ref	**Binder ratio (C:B)**	**Binder content by mass**	**Date of Mixing**
26C	50:50	10%	28th Jan
25C	60:40	10%	28th Jan
24B	40:60	10%	29th Jan
23A	50:50	7.5%	29th Jan

The area will reside undesturbed insitu for 1 week before being sampled using a mackintosh probe.

TESTING UNDERTAKEN / RESULTS RECEIVED

None

DATE	02-02-2015 – 08-02-2015
WEATHER	Generally Dry 10°C

PROGRESS - MIXING TRIALS

None, stand down during curing time.

TECHNICAL ISSUES

None

TESTING UNDERTAKEN / RESULTS RECEIVED

Samples were extracted on the 05-02-15.

Cell Ref	Sample Ref / Depth	Binder ratio (C:B)	Binder content by mass	Date / method of sampling
26C	WS1 1.0 – 2.0m	50:50	10%	05/02/15 Macintosh Probe
26C	WS1 GL – 1.0m	50:50	10%	05/02/15 Macintosh Probe
25C	WS2 GL – 1.0m	60:40	10%	05/02/15 Macintosh Probe
24B	WS3 GL – 1.0m	40:60	10%	05/02/15 Macintosh Probe
23A	WS4 1.0 – 2.0m	50:50	7.5%	05/02/15 Macintosh Probe

The Laboratory used is Geolabs in Watford and the test will be determination of Permeability in a triaxial cell BS1377 : Part 6 : Clause 6 :1990 and determination of Shear strength again via triaxial

STAGE 2 CELL 3 STABILISATION SITE DIARY

DATE	09-02-2015 – 15-02-2015
WEATHER	Wet 10 – 12°C
PROGRESS - MIXING TRIALS None, stand down during lab testing.	
TECHNICAL ISSUES Robert is looking at an alternative mixing head to improve blending. This needs to be discussed as there may be a requirement for a new trial. Await PBA comment.	
TESTING UNDERTAKEN / RESULTS RECEIVED None	

STAGE 2 CELL 3 STABILISATION SITE DIARY

DATE	16-02-2015 – 22-02-2015
WEATHER	Wet 10 – 12°C
PROGRESS - MIXING TRIALS None, stand down during lab testing.	
TECHNICAL ISSUES	
TESTING UNDERTAKEN / RESULTS RECEIVED Shear strength test results in on Monday. All Passed Permeability results in on Friday, all failed except one sample. Refer to Email thread Trial interim Test Results 100kPa confining pressure\Trial Failure communication thread.pdf Robert was happy to proceed with the mix that failed, but from a client perspective the risk to the project would remain as the failed samples were deemed unrepresentative. It could be argued that the passed sample is unrepresentative by the same token. Arranged for a geo meeting next week to discuss the interpretation of the results and a way forward.	

STAGE 2 CELL 3 STABILISATION **SITE DIARY**

DATE	23-02-2015 – 01-03-2015
WEATHER	Dry 12 – 15^{o}C

PROGRESS - MIXING TRIALS

Meeting held between NCC / DSM/ JDC / PBA / BLPGE to discuss the cause of the failures. Of the samples taken the sample which could reasonably be expected to perform worst wrt permeability actually performed the best (The only pass)

Based on the interpretation of the results the following hypothesis can be made.

Given consideration to the B-Values obtained (which is a measure of the degree of Saturation – a value of 1.0 being fully saturated), and specifically the difference between WS2 (0.99) and WS1, WS3 and WS4 samples (0.39 – 0.62), there was a significant difference in the initial state of the specimens. The fact that WS2 was fully saturated in comparison to the relatively dried out samples, highlights a probable reason for the low permeability's obtained. In theory, given the ground water conditions on site, the samples should be near to fully saturated. This highlights a change in condition during sampling or sample transportation. (It transpires the samples were not loaded into the triaxial cell until the Monday)

It can be hypothesised that the higher permeability samples have dried out either by inappropriate sealing while in the sample tubes or due to ongoing hydration in the absence of groundwater when in the sample tube (or both). This drying out has led to internal shrinking and cracking (especially prevalent in highly plastic bentonite enriched soils) and has led to a subsequent increase in macro-voids in the sample, an increased passage for fluid flow and an increased permeability.

These voids are likely to have hardened through cementation and lack of water, meaning that when the sample is subsequently consolidated, these macro voids remain opened and the higher permeability is retained. This is backed up by comparison of the volume change measured during consolidation stage for WS2 (44.5ml) as opposed to WS1, WS3 and WS4 samples (6.2 – 11.4 ml).

We agreed that the likely cause of failure was poor laboratory control, however the method of sample extraction and transportation may have a significant bearing on the results. Consequently the following affirmative changes would be made to mitigate and detrimental effects.

The samples would be taken in an oversized (150mmdia) shell, then cut to size in the lab, hence mitigating and micro fissures that may propagating towards the sample mass.

The sample shell would be a bespoke tube much thinner than a normal CBR mould (5mm) and this would be driven into the ground using a hydraulic jack. The net effect will be to absolutely minimise the mechanical effect of obtaining the cores. The samples would again be extracted after 7 days left insitu and wrapped sealed and transported immediately in an upright position. It is vital to ensure the lab does not leave the samples any length of time before loading into the triaxial cell, due to the aforementioned problems with hydration cracking.

A new sampling method statement would be prepared by the contractor, but alongside the new mixing and trialling we intend to sample again the original mix (14 days old) with better QA on the sample lab work. Furthermore we intend to take some ex situ samples and deliver them straight to the labs for reference.

25/02/15 Re mixing for the second trial. In cells 23B 23C 23D 7.5% 50:50 10% 50:50 7.5% 55:45
TECHNICAL ISSUES Pump failure 25/02 resolved by 10am Telemetry failure between the computer and the delivery mechanism. again resolved by 11:00AM
TESTING UNDERTAKEN / RESULTS RECEIVED 26/02 2nd Samples taken from 23A, 24A, 24B,25B, 25C, 26C 1st Samples taken from 23B, 23C 23D for Perms 27/02 1st Samples taken from 23B, 23C 23D for DSM internal cube crushing and triaxial tests at Coventry Uni

STAGE 2 CELL 3 STABILISATION **SITE DIARY**

DATE	02-03-15 – 08-03-15
WEATHER	Dry with isolated showers 10 – 15^{o}C
PROGRESS – Stand down awaiting Trial results	
TECHNICAL ISSUES	
TESTING UNDERTAKEN / RESULTS RECEIVED	

STAGE 2 CELL 3 STABILISATION **SITE DIARY**

DATE	09-03-15 – 15-03-15
WEATHER	Dry with isolated showers 10 – 15^{o}C
PROGRESS - Stand Down	
TECHNICAL ISSUES None. Contractor has taken receipt of a new Allu bucket. This is deemed a more appropriate technique given the ground conditions. The material can be visually assessed by the operator who can determine the consistency of the mix	
TESTING UNDERTAKEN / RESULTS RECEIVED Results for retested C25 received and passed as $9.7x10^{-10}$	

Stage 2 Cell 3 Stabilisation — Site Diary

Date	16-03-15 – 22-03-15
Weather	Dry
Progress - Awaiting trial results before further mixing can commence. Mixed a further trial area in 23E and 22D with a 7.5% binder and 50:50 cement binder ratio. Mixed are also consolidated with surcharge mats on which the vehicle sits.	
Technical Issues	
Testing Undertaken / Results Received	

Stage 2 Cell 3 Stabilisation — Site Diary

Date	23-03-15 – 29-03-15
Weather	Dry
Progress – Stand down curing time. Meeting with DSM to analyse the results received. Robert Mcgall has tabled a series of trial results that indicate that they have the correct mix and testing regime to continue. Further test results are due in the next 10 days. The results of which will determine if work can begin on the main part of the site. DSM and NCC are in agreement with this, however due to the inconsistencies in testing methodology and the poor communication of results it has been agreed to designate rows 24 – 26 as the trial area. All mixing in this area will be removed and replaced with unstabilised alluvium recovered from the adjacent river loop. This material will then be stabilised and following successful testing will be accepted into the main works. It has been agreed to retest Row 23 following further curing time.	
Technical Issues Calibration of telemetry scheduled for Monday	
Testing Undertaken / Results Received	

STAGE 2 CELL 3 STABILISATION **SITE DIARY**

DATE	30-03-15 – 05-04-15
WEATHER	Dry

PROGRESS -
Stand Down

Bank Holiday Friday

TECHNICAL ISSUES

TESTING UNDERTAKEN / RESULTS RECEIVED

Awaiting outstanding test results to gather further evidence that the mixing ratios and methodology are risk free.
Permeability samples taken for 20F on 04/04

STAGE 2 CELL 3 STABILISATION **SITE DIARY**

DATE	06-04-15 – 12-04-15
WEATHER	Dry with isolated showers

PROGRESS –
Bank Holiday Monday.
Stand down awaiting trial results.

TECHNICAL ISSUES
None

TESTING UNDERTAKEN / RESULTS RECEIVED
Permeability Samples for Cells 23B, 23C, 22D Taken on 7/04

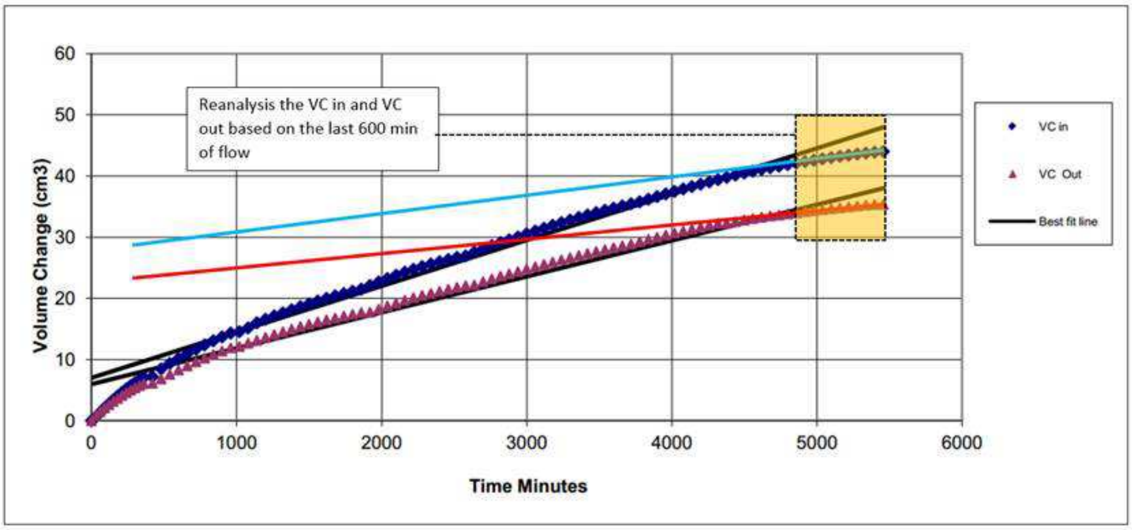
STAGE 2 CELL 3 STABILISATION **SITE DIARY**

DATE	13-04-15 – 19-04-15
Weather	Dry

PROGRESS – TRIAL / MAIN WORKS

Trial results received by DSM (see below), have been analysed by Byrne Looby Associates. The results are generally within the permeability range with two values marginally outside. The designer maintains that the cells will continue to reduce in permeability as the bentonite continues to hydrate over long periods of time.

Over the course of the trials a trend showing the reduction of permeability with time is apparent. This is shown by the decrease in the rate of both inflow and outflow during permeability testing attained in the results



Sample test: 23C (18/04/15)

Permission has subsequently been granted to begin the formal works.

The contractor is using the new REMO bucket as opposed to the mixing head. The consistency of the mix has been observed as significantly improved. Previously there was no way of scrutinising the degree to which the material was mixing with the alluvium, but the surface was observed as having a stratified colouration. The bucket produces a visibly consistent material colour that the operator can see and remix until there is a completely remixed product. Much improved.

Cell 22A mixed at 7.5% binder and 50:50 cement to bentonite ratio
Cell 22B mixed at 7.5% binder with a 50:50 cement to bentonite ratio
Cell 22C mixed at 7.5% binder with a 50:50 cement to bentonite ratio
Cell 22D remixed at 7.5% binder with a 50:50 cement to bentonite ratio
Cell 22E mixed at 7.5% binder and 50:50 cement to bentonite ratio
Cell 22F/G mixed at 7.5% binder and 50:50 cement to bentonite ratio

TECHNICAL ISSUES

Calibration of STS mixing plant ahead of the main works

TESTING UNDERTAKEN / RESULTS RECEIVED

Test Results in on 15/4

Sample tested	**Testing House**	**Permeability (m/s)**
22D*	GSTL	1.15×10^{-9}
23B^	GSTL	7.56×10^{-10}
23C	GSTL	3.18×10^{-10}
22D*	Fugro	8.90×10^{-10}
23B^	Fugro	1.90×10^{-9}
* & ^ highlight repeat test results		

STAGE 2 CELL 3 STABILISATION **SITE DIARY**

DATE	20-04-15 – 26-04-15
WEATHER	DRY WITH SHOWERS

PROGRESS – MAIN WORKS

Mixed at 7.5% binder content and 50:50 cement to bentonite ratio

DATE	**CELLS MIXED**						
20/4	**21A**	**21B**					
21/4	**21C**	**21D**	**21E**	**21F**			
22/4	**21G**	**21H**	**21J**	**21K**			
23/4	**20A**	**20B**	**20C**	**20D**			
24/4	**20F**	**20G**					

TECHNICAL ISSUES

REMU bucket hydraulic oil leak. Pirtek called to resolve

REMU bucket coupling failed on Friday. Welder called to resolve the issue

TESTING UNDERTAKEN / RESULTS RECEIVED

21D sample extracted by Southern Ground testing and sent to GSTL.

STAGE 2 CELL 3 STABILISATION **SITE DIARY**

DATE	27-04-15 – 03-05-15
WEATHER	Dry with Heavy Showers periodically during the week.

PROGRESS – MAIN WORKS

Mixed at 7.5% binder content and 50:50 cement to bentonite ratio

DATE	**CELLS MIXED**						
27/4	**19C**	**19D**	**19E**	**19F**	**19G**		
28/4	**20H**	**20J**	**20K**	**20L**	**18E**	**18F**	**18G**
29/4	**18D**	**19H**	**19J**	**19K**	**19L**	**19M**	
30/4	**18H**	**18J**	**18K**	**-**			
1/5	**-**	**-**	**-**	**-**			

TECHNICAL ISSUES

Track Failure 30/4 – 1/5

TESTING UNDERTAKEN / RESULTS RECEIVED

Permeability samples taken for cell 21D on 27/4

STAGE 2 CELL 3 STABILISATION **SITE DIARY**

DATE	04-05-15 – 10-05-15
WEATHER	Dry Warm

PROGRESS – MAIN WORKS

DATE	CELLS MIXED								
4/5	BANK HOLIDAY								
5/5	17E	24E							
6/5	26C	26D	25D	24B	24C	24D	23A	16F	15G
7/5	17F	17G	17H	17J	17K	18L	18M		
8/5	17L	17M	17O	16G	16H	16J	16K		
9/5	16L	16M	16O	15H	15J				
10/5	15K	15L	15M	15O	15P	14G	14H	14J	

TECHNICAL ISSUES

Excavator track problem resolved on the 5/5.
Pumping problems at the lagoon. Fitters called and resolved same day.

TESTING UNDERTAKEN / RESULTS RECEIVED

Permeability Samples for Cells 20A Taken on 6/05

STAGE 2 CELL 3 STABILISATION **SITE DIARY**

DATE	11-05-15 – 17-05-15
WEATHER	Heavy Showers

PROGRESS – MAIN WORKS

DATE	CELLS MIXED								
11/5	14K	14L	14M	14O	14P	13H			
12/5	13J	13K	13L	13M	13O	13P			
13/5	DIGGER STUCK								
14/5	12Q	12P	12O	12M	12L				
15/5	12K	11J	11Q						

TECHNICAL ISSUES

Driver error saw the mixing rig slip off the mat and get stuck in the recently mixed material located at cell reference 13O. No work on the 13/5 whilst machine was retrieved. Mixed material removed in the retrieval exercise was replaced with onsite material and mixed anew. Instructed a test location for 13O.

Testing Undertaken / Results Received
Permeability Samples for Cells 19L, 18H Taken on 14/05

Stage 2 Cell 3 Stabilisation **Site Diary**

Date	18-05-15 – 24-05-15
Weather	Dry

Progress – Main Works

Mixed at 7.5% binder and 50:50 cement to bentonite ratio.

Date	**Cells Mixed**								
18/5	**11Q**	**11P**	**11O**	**11M**	**11L**	**13H**			
19/5	**11K**	**Plant Breakdown**							
20/5	**11K**	**10K**	**9K**	**8K**	**7K**	**6K**			
21/5	**5K**	**12J**	**12H**	**11H**	**10J**	**9J**			
22/5	**REMO Bucket Failure**								

Technical Issues

CAT track detached on Tuesday, same say repair. Remo bucket repair on Friday. The spindle was becomong loose.

Testing Undertaken / Results Received

Samples from cells 16F, 13O taken for permeability testing on 22/05

DATE	25-05-15 – 31-05-15
WEATHER	Dry

PROGRESS – MAIN WORKS

Mixed at 7.5% binder and 50:50 cement to bentonite ratio.

DATE	**CELLS MIXED**								
25/5	**BANK HOLIDAY**								
26/5	**8J**	**7J**	**6J**	**5J**	**MOVED TO CELL 4**				
27/5	**31M**	**30M**	**29M**	**PROBLEM WITH REMO BUCKET AND CHAINS**					
28/5	**27M**	**26M**	**31L**	**30L**	**29L**				
29/5	**31K**	**DELIVERY HOSE FAILURE**							

TECHNICAL ISSUES

Remu bucket and slinging chains observed as becoming detached fitter called out to assess and repair. Newport Fluid Power called to repair mixing hoses at the head. Failure caused by the afore mentioned REMU head.

TESTING UNDERTAKEN / RESULTS RECEIVED

STAGE 2 CELL 4 STABILISATION — SITE DIARY

DATE	25-05-15 – 31-05-15
WEATHER	Dry

PROGRESS – MAIN WORKS

Mixed at 7.5% binder and 50:50 cement to bentonite ratio.

DATE	CELLS MIXED								
25/5	X								
26/5	X	X	X	X	X				
27/5	31M	30M	29M	PROBLEM WITH REMO BUCKET AND CHAINS					
28/5	27M	26M	31L	30L	29L				
29/5	31K	DELIVERY HOSE FAILURE							

TECHNICAL ISSUES

Remu bucket and slinging chains observed as becoming detached fitter called out to assess and repair. Newport Fluid Power called to repair mixing hoses at the head. Failure caused by the afore mentioned REMU head.

TESTING UNDERTAKEN / RESULTS RECEIVED

STAGE 2 CELL 4 STABILISATION — SITE DIARY

DATE	01-06-15 – 07-06-15
WEATHER	Intermittent showers

PROGRESS – MAIN WORKS

Mixed at 7.5% binder and 50:50 cement to bentonite ratio.

DATE	CELLS MIXED							
01/06	30K	25M	24M	23M	22M	21M	20M		
02/06	28L	27L	28M	26L	25L				
03/06	23L	22L	21L	20L	19L	18L	19M		
04/06	31J	30J	29J	28J	29K	28K			
05/06	27J	26J	25J	27K	26K				

TECHNICAL ISSUES

No Technical issues. Manpower issues on Tuesday and Friday saw a decrease in output.

TESTING UNDERTAKEN / RESULTS RECEIVED

Permeability Samples for Cells 12J, 10J, 7K taken on 04/06

STAGE 2 CELL 4 STABILISATION **SITE DIARY**

DATE	08-06-15 – 14-06-15
WEATHER	Dry

PROGRESS – MAIN WORKS

Mixed at 7.5% binder and 50:50 cement to bentonite ratio.

DATE	**CELLS MIXED**								
08/06	**25K**	**24K**	**23K**	**24J**	**23J**	**24L**			
09/06	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**			
10/06	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**			
11/06	**22K**	**21K**	**20K**	**22J**	**21J**	**20J**			
12/06	**19K**	**19J**	**18K**						

TECHNICAL ISSUES

Track failure on mixing machine. Lost time Tuesday and Wednesday

TESTING UNDERTAKEN / RESULTS RECEIVED

Permeability Samples for Cells 031L Taken on 11/06

STAGE 2 CELL 4 STABILISATION **SITE DIARY**

DATE	15-06-15 – 21-06-15
WEATHER	Dry

PROGRESS – MAIN WORKS

Mixed at 7.5% binder and 50:50 cement to bentonite ratio.

DATE	**CELLS MIXED**								
15/06	**31I**	**17K**	**18J**	**17L**	**18M**				
16/06	**24I**	**25I**	**26I**	**27I**	**28I**	**29I**	**30I**		
17/06	**19I**	**20I**	**21I**	**22I**	**23I**				
18/06	**18I**	**17J**	**31H**	**30H**	**29H**	**28H**			
19/06	**27H**	**26H**	**25H**						

TECHNICAL ISSUES

None

TESTING UNDERTAKEN / RESULTS RECEIVED

Permeability Samples for Cells 025M Taken on 15/06

Permeability Samples for Cells 028K Taken on 18/06

STAGE 2 CELL 4 STABILISATION **SITE DIARY**

DATE	22-06-15 – 28-06-15
WEATHER	Dry / Showers

PROGRESS – MAIN WORKS

Mixed at 7.5% binder and 50:50 cement to bentonite ratio.

DATE	**CELLS MIXED**								
22/06	**24H**	**23H**	**22H**	**21H**	**20H**	**19H**	**18H**		
23/06	**17I**	**31G**	**30G**	**29G**	**28G**	**27G**			
24/06	**26G**	**25G**	**21I**	**24G**	**23G**	**22G**	**21G**	**20G**	
25/06	**19G**	**18G**	**17H**						
26/06	**31F**	**30F**	**31E**						

TECHNICAL ISSUES

Telemetry checks on the silo and distribution kit on the 25th and 26th

TESTING UNDERTAKEN / RESULTS RECEIVED

Permeability Samples for Cells 24B, 24C, 24D, 25D, 26C Taken on 26/06

STAGE 2 CELL 4 STABILISATION **SITE DIARY**

DATE	29-06-15 – 05-07-15
WEATHER	Dry / Showers

PROGRESS – MAIN WORKS

Mixed at 7.5% binder and 50:50 cement to bentonite ratio.

DATE	**CELLS MIXED**								
29/06	**29F**	**29E**	**28F**	**27F**	**29D**	**26D**	**25D**	**30D**	**30E**
30/06	**26F**	**25F**	**24F**	**23F**	**22F**	**21F**	**20F**	**19F**	
01/07	**18F**	**17F**	**17G**	**26E**	**25E**	**24E**	**23E**		
02/07	**22E**	**21E**	**16F**	**16G**	**16H**	**16I**	**16J**	**16K**	
03/07	**20E**	**19E**	**18E**	**17E**	**16E**				

TECHNICAL ISSUES

None

TESTING UNDERTAKEN / RESULTS RECEIVED

Permeability Samples for Cells 023I Taken on 01/07

Permeability Samples for Cells 017J Taken on 02/07

STAGE 2 CELL 4 STABILISATION — SITE DIARY

DATE	06-07-15 – 12-07-15
WEATHER	Dry

PROGRESS – MAIN WORKS

Mixed at 7.5% binder and 50:50 cement to bentonite ratio.

DATE	CELLS MIXED								
06/07	16L	15F	15G	15H	15I	15J	15K	14K	
07/07	14F	14G	14H	14I	14J	13J	12J		
08/07	24D	23D	22D	21D	20D	19D	18D	17D	16D
09/07	13F	13G	13H	13I	12J	12I	12H	12G	12F
10/07	DEMOBILISATION								

TECHNICAL ISSUES

None

TESTING UNDERTAKEN / RESULTS RECEIVED

Permeability Samples for Cells 027G Taken on 07/07

STAGE 2 CELL 4 STABILISATION — SITE DIARY

DATE	13-07-15 – 19-07-15
WEATHER	Dry

PROGRESS – DEMOBILISATION AND TESTING

TECHNICAL ISSUES

None

TESTING UNDERTAKEN / RESULTS RECEIVED

Permeability Samples for Cells 029F taken on 13/07
Permeability Samples for Cells 021F taken on 14/07
Permeability Samples for Cells 024E taken on 15/07

STAGE 2 CELL 4 STABILISATION **SITE DIARY**

DATE	13-07-15 – 19-07-15
WEATHER	Dry
PROGRESS – DEMOBILISATION AND TESTING	
TECHNICAL ISSUES None	
TESTING UNDERTAKEN / RESULTS RECEIVED Permeability Samples for Cells 029F taken on 13/07 Permeability Samples for Cells 021F taken on 14/07 Permeability Samples for Cells 024E taken on 15/07	

STAGE 2 CELL 4 STABILISATION **SITE DIARY**

DATE	20-07-15 – 26-07-15
WEATHER	Dry
PROGRESS – DEMOBILISATION AND TESTING	
TECHNICAL ISSUES None	
TESTING UNDERTAKEN / RESULTS RECEIVED Permeability Samples for Cells 015H taken on 20/07 Permeability Samples for Cells 022D taken on 22/07 Permeability Samples for Cells 013G taken on 23/07	

Appendix 6

Weekly Progress Log – Newport

Week beginning: 05/01/15

Monday 05/1/15

Site Set up and commissioning

Tuesday 04/1/15

Site Set up and commissioning

Wednesday 05/1/15

Site Set up and commissioning

Thursday 06/1/15

Site Set up and commissioning

Cell Ref	Sample Ref / Depth	Binder ratio (C:B)	Binder content by mass	Date / method of sampling
26C	WS1 1.0 – 2.0m	50:50	10%	05/02/15 Macintosh Probe
26C	WS1 GL – 1.0m	50:50	10%	05/02/15 Macintosh Probe
25C	WS2 GL – 1.0m	60:40	10%	05/02/15 Macintosh Probe
24B	WS3 GL – 1.0m	40:60	10%	05/02/15 Macintosh Probe
23A	WS4 1.0 – 2.0m	50:50	7.5%	05/02/15 Macintosh Probe

Friday 07/1/15

Stand Down

Weekly Progress Log – Newport

Week beginning: 12/01/15

Monday 12/1/15

Site Set up and commissioning

Tuesday 13/1/15

Site Set up and commissioning

Wednesday 14/1/15

Site Set up and commissioning. Long Reach excavator onsite

Thursday 15/1/15

Site Set up and commissioning. Commissioning of batching telemetry.

Friday 16/1/15

Site Set up and commissioning. Pumping System and Biomass Screen

Weekly Progress Log – Newport

Week beginning: 19/01/15

Monday 19/1/15

Site Set Up

Tuesday 20/1/15

Site Set up

Wednesday 21/1/15

Site Set up. Allu Head delivered

Thursday 22/1/15

Allu head / arm connected and linked up to delivery hoses

Friday 23/1/15

Proposed mixing trial called off due to vehicle stuck

Weekly Progress Log – Newport

Week beginning: 26/01/15

Monday 26/1/15

Vehicle stuck

Tuesday 27/1/15

Vehicle stuck

Wednesday 28/1/15 - Thursday 29/1/15

Site mixing trials

Cell Ref	Binder ratio (C:B)	Binder content by mass	Date of Mixing
26C	50:50	10%	28th Jan
25C	60:40	10%	28th Jan
24B	40:60	10%	29th Jan
23A	50:50	7.5%	29th Jan

Friday 30/1/15

Stand down, Curing time

Weekly Progress Log – Newport

Week beginning: 02/2/15

Monday 02/2/15

Stand Down

Tuesday 03/2/15

Stand Down

Wednesday 04/2/15

Stand Down

Thursday 05/2/15

Samples extracted

Cell Ref	Sample Ref / Depth	Binder ratio (C:B)	Binder content by mass	Date / method of sampling
26C	WS1 1.0 – 2.0m	50:50	10%	05/02/15 Macintosh Probe
26C	WS1 GL – 1.0m	50:50	10%	05/02/15 Macintosh Probe
25C	WS2 GL – 1.0m	60:40	10%	05/02/15 Macintosh Probe
24B	WS3 GL – 1.0m	40:60	10%	05/02/15 Macintosh Probe
23A	WS4 1.0 – 2.0m	50:50	7.5%	05/02/15 Macintosh Probe

Friday 06/2/15

Stand Down

Weekly Progress Log – Newport

Week beginning: 9/2/15

Monday 9/2/15

Stand Down

Tuesday 10/2/15

Stand Down

Wednesday 11/2/15

Stand Down

Thursday 12/2/15

Stand Down

Friday 13/2/15

Weekly Progress Log – Newport

Week beginning: 16/2/15

Monday 16/2/15

Stand Down.

Shear results received all within Spec.

Tuesday 17/2/15

Stand Down

Wednesday 18/2/15

Stand Down

Thursday 19/2/15

Stand Down

Friday 20/2/15

Stand Down

Permeability results received all out of Spec.

Weekly Progress Log – Newport

Week beginning: 23/2/15

Monday 23/2/15

Awaiting trial results before further mixing can commence

General site cleanliness and repairs taking place

Tuesday 24/2/15

Awaiting trial results before further mixing can commence

General site cleanliness and repairs taking place

Wednesday 25/2/15

Meeting to discuss further trials and sampling methods

Cell 23B mixed at 10% binder content with a 50:50 cement to bentonite ratio

Cell 23C mixed at 7.5% binder content with a 50:50 cement to bentonite ratio

Cell 23D mixed at 7.5% binder content with a 55:45 cement to bentonite ratio

Thursday 26/2/15

Second samples taken from cells 23A, 24A/B, 25B/C, 26C. Taken to Geolabs for permeability testing.

Samples taken from Cells 23B, 23C and 23D for testing. Taken to Geolabs for permeability testing

Awaiting trial results before further mixing can commence

General site cleanliness and repairs taking place

Friday 27/2/15

Samples taken from cells 23B, C and D for triaxial and cube crushing tests at Coventry University labs

Awaiting trial results before further mixing can commence

General site cleanliness and repairs taking place

Weekly Progress Log – Newport

Week beginning: 02/03/15

Monday 02/03/15

Stand down

Tuesday 03/03/15

Stand down

Wednesday 04/03/15

Stand down

Thursday 05/03/15

Stand down

Friday 06/03/15

Stand down

Weekly Progress Log – Newport

Week beginning: 09/03/15

Monday 09/03/15

Stand down

Tuesday 10/03/15

Stand down

Wednesday 11/03/15

Stand down

Thursday 12/03/15

Stand down

Friday 13/03/15

Stand down

Weekly Progress Log – Newport

Week beginning: 16/3/15

Monday 16/3/15

Awaiting trial results before further mixing can commence

General site cleanliness and repairs taking place

Tuesday 17/3/15

Meeting to discuss progress of job using double rotary mixing head. Also discussed sampling and testing methods.

Awaiting trial results before further mixing can commence

General site cleanliness and repairs taking place

Wednesday 18/3/15

Awaiting trial results before further mixing can commence

General site cleanliness and repairs taking place

Thursday 19/3/15

Mixed Cell 23E and 22D with 7.5% binder and 50:50 cement to bentonite ratio. However, mixed at a 3:1 water to binder ratio to make material more liquid-like. Also made sure to compress mixed material with the use of excavator and mats

Friday 20/3/15

Stand Down

Weekly Progress Log – Newport

Week beginning: 23/3/15

Monday 23/3/15

Stand Down

Tuesday 24/3/15

Stand Down

Wednesday 25/3/15

Stand Down

Thursday 26/3/15

Stand Down

Friday 27/3/15

Stand Down

Weekly Progress Log – Newport

Week beginning: 30/3/15

Monday 30/3/15

Awaiting trial results before further mixing can commence

General site cleanliness and repairs taking place

Tuesday 31/3/15

General site cleanliness and repairs taking place

Wednesday 1/4/15

Awaiting trial results before further mixing can commence

General site cleanliness and repairs taking place

Thursday 2/4/15

Awaiting trial results before further mixing can commence

General site cleanliness and repairs taking place

Friday 3/4/15

Bank Holiday

Weekly Progress Log – Newport

Week beginning: 6/4/15

Monday 6/4/15

Bank Holiday

Tuesday 7/4/15

Awaiting trial results before further mixing can commence

General site cleanliness and repairs taking place

Wednesday 8/4/15

Awaiting trial results before further mixing can commence

General site cleanliness and repairs taking place

Thursday 9/4/15

Awaiting trial results before further mixing can commence

General site cleanliness and repairs taking place

Friday 10/4/15

Awaiting trial results before further mixing can commence

General site cleanliness and repairs taking place

Weekly Progress Log – Newport

Week beginning: 13/4/15

Monday 13/4/15

Awaiting trial results before further mixing can commence

General site cleanliness and repairs taking place

Tuesday 14/4/15

Awaiting trial results before further mixing can commence

General site cleanliness and repairs taking place

Wednesday 15/4/15

Trial results came back positive, OK to begin mixing properly.

Had Frank and Oliver (electrician) over from Germany to work on the STS batching plant. Fixing and tweaking taking place all day, no real mixing done. General site cleanliness and repairs taking place

Thursday 16/4/15

Cell 22A mixed at 7.5% binder and 50:50 cement to bentonite ratio

Cell 22B mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 22C mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 22D mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 22E mixed at 7.5% binder and 50:50 cement to bentonite ratio

Friday 17/4/15

Cell 22F/G mixed at 7.5% binder and 50:50 cement to bentonite ratio

Telemetry calibration disrupted mixing today. Fixing and tweaking taking place all day. General site cleanliness and repairs taking place.

Weekly Progress Log – Newport

Week beginning: 20/4/15

Monday 20/4/15

Had problems with pipes and pipe fittings in the morning. Also problems with sinking in cells previously mixed, had to remediate some of these cells.

Cell 21A mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 21B mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Tuesday 21/4/15

Problems with batching plant, held up for a while.

Cell 21C mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 21D mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 21E mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 21F mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Wednesday 22/4/15

Had hydraulic oil leak from REMU bucket, had to get pirtek out and get more hydraulic oil from Finnings.

Cell 21G mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 21H mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 21J mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 21K mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Samples from cell 21D taken to GSTL.

Thursday 23/4/15

Cell 20A mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 20B mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 20C mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 20D mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 20E mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Friday 24/4/15

Had problems with side of the REMU bucket falling off, had to get site welder out to fix it.

Cell 20F mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 20G mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Weekly Progress Log – Newport

Week beginning: 27/4/15

Monday 27/4/15

Cell 19C mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 19D mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 19E mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 19F mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 19G mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Tuesday 28/4/15

Cell 20H mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 20J mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 20K mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 20L mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 18E mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 18F mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 18G mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Wednesday 29/4/15

Cell 18D mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 19H mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 19J mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 19K mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 19L mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 19M mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Thursday 30/4/15

Cell 18H mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 18J mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 18K mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Track broken on machine, waiting for fitter to fix

Friday 1/5/15

Track broken on machine, waiting for fitter to fix

Weekly Progress Log – Newport

Week beginning: 4/5/15

Monday 4/5/15

Bank Holiday

Tuesday 5/5/15

Had digger track fixed, problems with water

Cell 17E mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 24E mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Wednesday 6/5/15

Cell 26C remixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 26D remixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 25C remixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 25D remixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 24B remixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 24C remixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 24D remixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 23A remixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 16F mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 15G mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Thursday 7/5/15

Cell 17F mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 17G mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 17H mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 17J mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 17K mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 18L mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 18M mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Friday 8/5/15

Cell 17L mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 17M mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 17O mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 16G mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 16H mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 16J mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 16K mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Saturday 9/5/15

Cell 16L mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 16M mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 16O mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 15H mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 15J mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Sunday 10/5/15

Cell 15K mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 15L mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 15M mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 15O mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 15P mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 14G mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 14H mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Cell 14J mixed at 7.5% binder with a 50:50 cement to bentonite ratio

Weekly Progress Log – Newport

Week beginning: 11/5/15

Monday 11/5/15

Cell 14K mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 14L mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 14M mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 14O mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 14P mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 13H mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Tuesday 12/5/15

Cell 13J mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 13K mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 13L mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 13M mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 13O mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 13P mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Wednesday 13/5/15

Digger Stuck, retrieved it and the mats

Thursday 14/5/15

Cell 12Q mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 12P mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 12O mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 12M mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 12L mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Friday 15/5/15

Cell 12K mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 11J mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Cell 11Q mixed at 7.5% binder content and 50:50 cement to bentonite ratio

Weekly Progress Log – Newport

Week beginning: 18/5/15

Monday 18/5/15

Problems with REMU bucket

Problems with hydraulic hoses

Cell 11P mixed at 7.5% binder and 50:50 cement to bentonite ratio

Cell 11O mixed at 7.5% binder and 50:50 cement to bentonite ratio

Cell 11M mixed at 7.5% binder and 50:50 cement to bentonite ratio

Cell 11L mixed at 7.5% binder and 50:50 cement to bentonite ratio

Tuesday 19/5/15

Cell 11K mixed at 7.5% binder and 50:50 cement to bentonite ratio (not finished due to break down of machine)

Problems with CAT 330

Wednesday 20/5/15

Cell 11K mixed at 7.5% binder and 50:50 cement to bentonite ratio (finished)

Cell 10K mixed at 7.5% binder and 50:50 cement to bentonite ratio

Cell 9Kmixed at 7.5% binder and 50:50 cement to bentonite ratio

Cell 8K mixed at 7.5% binder and 50:50 cement to bentonite ratio

Cell 7K mixed at 7.5% binder and 50:50 cement to bentonite ratio

Cell 6K mixed at 7.5% binder and 50:50 cement to bentonite ratio

Thursday 21/5/15

Cell 5K mixed at 7.5% binder and 50:50 cement to bentonite ratio

Cell 12J mixed at 7.5% binder and 50:50 cement to bentonite ratio

Cell 12H mixed at 7.5% binder and 50:50 cement to bentonite ratio

Cell 11H mixed at 7.5% binder and 50:50 cement to bentonite ratio

Cell 10J mixed at 7.5% binder and 50:50 cement to bentonite ratio

Cell 9J mixed at 7.5% binder and 50:50 cement to bentonite ratio

Friday 22/5/15

REMU bucket problems, fixed in the afternoon.

Samples from cells 16F, 15K, 13O taken for permeability testing

Weekly Progress Log – Newport

Week beginning: 25/5/15

Monday 25/5/15

Bank Holiday

Tuesday 26/5/15

Cell 8J mixed at 7.5% binder content and a 50:50 cement to bentonite ratio

Cell 7J mixed at 7.5% binder content and a 50:50 cement to bentonite ratio

Cell 6J mixed at 7.5% binder content and a 50:50 cement to bentonite ratio

Cell 5J mixed at 7.5% binder content and a 50:50 cement to bentonite ratio

Moved over to new stabilisation grid area, started grading off first area of stabilisation

Wednesday 27/5/15

Cell 31M mixed at 7.5% binder content and a 50:50 cement to bentonite ratio

Cell 30M mixed at 7.5% binder content and a 50:50 cement to bentonite ratio

Cell 29M mixed at 7.5% binder content and a 50:50 cement to bentonite ratio

Problems with REMU bucket cradle and chains

Thursday 28/5/15

Cell 27M mixed at 7.5% binder content and a 50:50 cement to bentonite ratio

Cell 26M mixed at 7.5% binder content and a 50:50 cement to bentonite ratio

Cell 31L mixed at 7.5% binder content and a 50:50 cement to bentonite ratio

Cell 30L mixed at 7.5% binder content and a 50:50 cement to bentonite ratio

Cell 29L mixed at 7.5% binder content and a 50:50 cement to bentonite ratio

Friday 29/5/15

Cell 31K mixed at 7.5% binder content and a 50:50 cement to bentonite ratio

Pipe problems

Appendix 7

Weekly Progress Log – Newport

Week beginning: 25/5/15

Monday 25/5/15

Bank Holiday

Tuesday 26/5/15

~~Cell 8J mixed at 7.5% binder content and a 50:50 cement to bentonite ratio~~

~~Cell 7J mixed at 7.5% binder content and a 50:50 cement to bentonite ratio~~

~~Cell 6J mixed at 7.5% binder content and a 50:50 cement to bentonite ratio~~

~~Cell 5J mixed at 7.5% binder content and a 50:50 cement to bentonite ratio~~

Moved over to new stabilisation grid area, started grading off first area of stabilisation

Wednesday 27/5/15

Cell 31M mixed at 7.5% binder content and a 50:50 cement to bentonite ratio

Cell 30M mixed at 7.5% binder content and a 50:50 cement to bentonite ratio

Cell 29M mixed at 7.5% binder content and a 50:50 cement to bentonite ratio

Problems with REMU bucket cradle and chains

Thursday 28/5/15

Cell 27M mixed at 7.5% binder content and a 50:50 cement to bentonite ratio

Cell 26M mixed at 7.5% binder content and a 50:50 cement to bentonite ratio

Cell 31L mixed at 7.5% binder content and a 50:50 cement to bentonite ratio

Cell 30L mixed at 7.5% binder content and a 50:50 cement to bentonite ratio

Cell 29L mixed at 7.5% binder content and a 50:50 cement to bentonite ratio

Friday 29/5/15

Cell 31K mixed at 7.5% binder content and a 50:50 cement to bentonite ratio

Pipe problems

Weekly Progress Log – Newport

Week beginning: 1/6/15

Monday 1/6/15

Cell 30K mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 25M mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 24M mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 23M mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 22M mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 21M mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 20M mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Tuesday 2/6/15

Cell 28L mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 27L mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 28M mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 26L mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 25L mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Wednesday 3/6/15

Cell 23L mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 22L mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 21L mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 20L mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 19L mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 18L mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 19M mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Thursday 4/6/15

Cell 31J mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 30J mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 29J mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 28J mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 29K mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 28K mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Friday 5/6/15

Cell 27J mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 26J mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 25J mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 27K mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 26K mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Weekly Progress Log – Newport

Week beginning: 8/6/15

Monday 8/6/15

Cell 25K mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 24K mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 23K mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 24J mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 23J mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 24L mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Tuesday 9/6/15

Machinery problems

Wednesday 10/6/15

Machinery problems

Thursday 11/6/15

Cell 22K mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 21K mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 20K mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 22J mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 21J mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 20J mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Friday 12/6/15

Cell 19K mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 19J mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 18K mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Weekly Progress Log – Newport

Week beginning: 15/6/15

Monday 15/6/15

Cell 31I mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 17K mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 18J mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 17L mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 18M mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Tuesday 16/6/15

Cell 24I mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 25I mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 26I mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 27I mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 28I mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 29I mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 30I mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Wednesday 17/6/15

Cell 19I mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 20I mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 21I mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 22I mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 23I mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Thursday 18/6/15

Cell 18I mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 17J mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 31H mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 30H mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 29H mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 28H mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Friday 19/6/15

Cell 27H mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 26H mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 25H mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Weekly Progress Log – Newport

Week beginning: 22/6/15

Monday 22/6/15

Cell 24H mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 23H mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 22H mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 21H mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 20H mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 19H mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 18H mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Tuesday 23/6/15

Cell 17I mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 31G mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 30G mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 29G mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 28G mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 27G mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Wednesday 24/6/15

Cell 26G mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 25G mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 24G mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 23G mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 22G mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 21G mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 20G mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Thursday 25/6/15

Cell 19G mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 18G mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 17H mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Friday 26/6/15

Cell 31F mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 30F mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 31E mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Weekly Progress Log – Newport

Week beginning: 29/6/15

Monday 29/6/15

Cell 29F mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 29E mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 28F mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 27F mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 29D mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 26D mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 25D mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 30E mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 30D mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Tuesday 30/6/15

Cell 26F mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 25F mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 24F mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 23F mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 22F mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 21F mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 20F mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 19F mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Wednesday 1/7/15

Cell 18F mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 17F mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 17G mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 26E mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 25E mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 24E mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 23E mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Thursday 2/7/15

Cell 22E mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 21E mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 16F mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 16G mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 16H mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 16I mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 16J mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 16K mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Friday 3/7/15

Cell 20E mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 19E mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 18E mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 17E mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 16E mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Weekly Progress Log – Newport

Week beginning: 6/7/15

Monday 6/7/15

Cell 16L mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 15F mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 15G mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 15H mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 15I mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 15J mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 15K mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 14K mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Tuesday 7/7/15

Cell 14F mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 14G mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 14H mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 14I mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 14J mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 13J mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 12J mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Wednesday 8/7/15

Cell 24D mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 23D mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 22D mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 21D mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 20D mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 19D mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 18D mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 17D mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 16D mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Thursday 9/7/15

Cell 13F mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 13G mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 13H mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 13I mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 12J mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 12I mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 12H mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 12G mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Cell 12F mixed at 7.5% binder and a 50:50 cement to bentonite ratio

Friday 10/7/15

Cleaning down and beginning of demobilisation

Appendix 8

Cell No	Binder Percentage	Cement : Bentonite Ratio	Date Mixed	Permeability																
				Date Samples Taken	Method of Sampling	Method of Sealing	Date Delivered to Lab	Lab	Level of Mixed Material	Date Prepared for Testing	Date Test Started	Final Effective Pressure (kPa)	Final Result	Days in Saturation	Days in Consolidation	Initial Moisture Content (%)	Final Moisture Content (%)	Initial 'B' Saturation Value	Volume Change During Consolidation (mL)
23B	7.50%	50 : 50	25/02/2015	07/04/2015	Jack and Bucket	Cling Film	07/04/15	GSTL	Ground level - 1m	09/04/2015	09/04/15	100	8.71×10^{-10}	5	2	113.2	113.98	0.1	30
23C	7.50%	50 : 50	25/02/2015	07/04/2015	Jack and Bucket	Cling Film	07/04/15	GSTL	Ground level - 1m	09/04/2015	09/04/15	100	$9.31 \text{ X } 10^{-10}$	5	2	114.5	115.544	0.08	90
21D	7.50%	50 : 50	21/04/2015	27/04/2015	Jack and Bucket	Cling Film	27/04/15	GSTL	Ground level - 1m	29/04/2014	29/04/15	100	4.51×10^{-10}	3	2	84.8	93.36	0.18	18
				27/04/2015	Jack and Bucket	Cling Film	27/04/15	GSTL	1m-2m	29/04/2015	29/04/15	100	4.18×10^{-10}	3	2	81.5	83.97	0.42	75
20F	7.50%	50 : 50	24/04/2015	04/04/2015	Jack and Bucket	Cling Film	04/04/15	GSTL	Ground level - 1m	05/05/2015	05/05/15	100	$1.93 \text{ X } 10^{-10}$	3	2	180.7	181.15	0.52	25
				04/04/2015	Jack and Bucket	Cling Film	04/04/15	GSTL	1m-2m	05/05/2015	05/05/15	100	2.47×10^{-10}	3	2	108	108.66	0.19	19
22D	7.50%	50 : 50	19/03/2015	07/04/2015	Jack and Bucket	Cling Film	07/04/15	Fugro	1.5m	08/04/2015	08/04/15	100	8.9×10^{-10}	4	2	111	108	0.96	
20A	7.50%	50 : 50	23/04/2015	06/05/2015	Jack and Bucket	Cling Film	06/05/15	GSTL	1.5m	08/05/2015	08/05/15	100	4.17×10^{-10}	4	2	63.6	64.75	0.25	58
19L	7.50%	50 : 50	29/04/2015	14/05/2015	Jack and Bucket	Cling Film	14/05/15	GSTL	0.5m	15/05/2015	15/05/15	100	4.94×10^{-10}	3	3	81.4	82.57	0.21	25
18H	7.50%	50 : 50	30/04/2015	14/05/2015	Jack and Bucket	Cling Film	14/05/15	GSTL	1m	15/05/2015	15/05/15	100	2.9×10^{-10}	4	3	69.1	70.69	0.13	12
16F	7.50%	50:50	06/05/2015	22/05/2015	Jack and Bucket	Cling Film	22/05/15	GSTL	1.5m	25/05/2015	25/05/15	100	9.99×10^{-10}	4	2	93.4	94.56	0.3	52
13O	7.50%	50:50	12/05/2015	22/05/2015	Jack and Bucket	Cling Film	22/05/15	GSTL	0.5m	25/05/2015	25/05/15	100	6.48×10^{-10}	4	2	116.2	117.74	0.22	58
12J	7.50%	50:50	21/05/2015	04/06/2015	Jack and Bucket	Cling Film	04/06/15	GSTL	1m	05/06/2015	05/06/15	100	1.35×10^{-10}	5	3	106.1	105.95	0.19	11
10J	7.50%	50:50	21/05/2015	04/06/2015	Jack and Bucket	Cling Film	04/06/15	GSTL	1.5m	05/06/2015	05/06/15	100	3.69×10^{-10}	5	2	103.6	103.59	0.23	12
7K	7.50%	50:50	20/05/2015	04/06/2015	Jack and Bucket	Cling Film	04/06/15	GSTL	0.5m	05/06/2015	05/06/15	100	5.64×10^{-10}	4	3	108.5	108.51	0.37	13
24B	7.50%	50:50	06/05/2015	26/06/2015	Jack and Bucket	Cling Film	29/06/15	GSTL	0.5m	16/07/15	16/07/15	100	1.3×10^{-10}			105.2	108.91	0.26	11
24C	7.50%	50:50	06/05/2015	26/06/2015	Jack and Bucket	Cling Film	29/06/15	GSTL	1.0m	15/07/15	15/07/15	100	1.53×10^{-10}			103.2	104.63	0.46	4
24D	7.50%	50:50	06/05/2015	26/06/2015	Jack and Bucket	Cling Film	29/06/15	GSTL	1.5m	03/07/15	03/07/15	100	9.36×10^{-10}			98.5	103.21	0.38	3
25D	7.50%	50:50	06/05/2015	26/06/2015	Jack and Bucket	Cling Film	29/06/15	GSTL	0.5m	15/07/15	15/07/15	100	1.01×10^{-10}			96.0	98.6	0.30	4
26C	7.50%	50:50	06/05/2015	26/06/2015	Jack and Bucket	Cling Film	29/06/15	GSTL	1.0m	15/07/15	15/07/15	100	1.33×10^{-10}			103.3	107.03	0.02	4

Deep Soil Mixing. Birchwood, Westoning Road, Greenfield, Beds, MK45 5BH. Made by George Olney

Appendix 9

Laboratory Report

GEO Site & Testing Services Ltd

UKAS TESTING 2788

Contract Number: 27144

Client's Reference:

Report Date: **03-07-2015**

Client **Deep Soil Mixing Ltd**
Deep Soil Mixing Ltd,
Birchwood,
Westoning Road,
Greenfield,
Bedfordshire,
MK45 5BH

Contract Title: **Unknown**
For the attention of: **George Olney**

Date Received: **05-06-2015**
Date Commenced: **05-06-2015**
Date Completed: **03-07-2015**

Test Description	Qty
Moisture Content 1377 : 1990 Part 2 : 3.2 - * UKAS	2
4 Point Liquid & Plastic Limit (LL/PL) 1377 : 1990 Part 2 : 4.3 & 5.3 - * UKAS	2
(GI) BRE Suite Total Sulphate, Aqueous Sulphate, Total Sulphur, Aqueous Nitrate, Aqueous Mag, Chloride, 1377 : 1990 Part 3 & BRE CP2/79 - @ Non Accredited Test	5
Quick Undrained Triaxial Compression test - single specimen at one confining pressure (100mm or 38mm diameter) 1377 : 1990 Part 7 : 8 - * UKAS	3
Determination of Permeability in a triaxial cell BS1377 Part 6 :1990 Clause 6 - * UKAS	3
Extra Over Item (4 Days Over)	12
Disposal of Samples on Project	1

Notes: Observations and Interpretations are outside the UKAS Accreditation
*** - denotes test included in laboratory scope of accreditation**
 # - denotes test carried out by approved contractor
@ - denotes non accredited tests

Approved Signatories:
Alex Wynn (Associate Director) - Benjamin Sharp (Contracts Manager) - D V Edwards (Managing Director)
Emma Sharp (Office Manager) - Paul Evans (Quality/Technical Manager)

GEO Site & Testing Services Ltd
Unit 4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN
Tel: 01554 784040 Fax: 01554 784041 info@geo.uk.com geo.uk.com

Client ref: N/A

Location: Newport Deep Soil

Contract Number: 27144-150615

Hole Number	Sample Number	Type	Depth (m)	Description of Sample*
Ely Silt				Brown gravelly fine sandy clayey SILT.
Ely Peat				Brown fine sandy PEAT.

Note: Results on this table are in summary format and may not meet the requirements of the relevant standards, additional information is held by the laboratory

GSTL
GEO SITE & TESTING SERVICES LTD

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Emma Sharp (Office Manager)
Date: 30.6.15

UKAS TESTING 2788

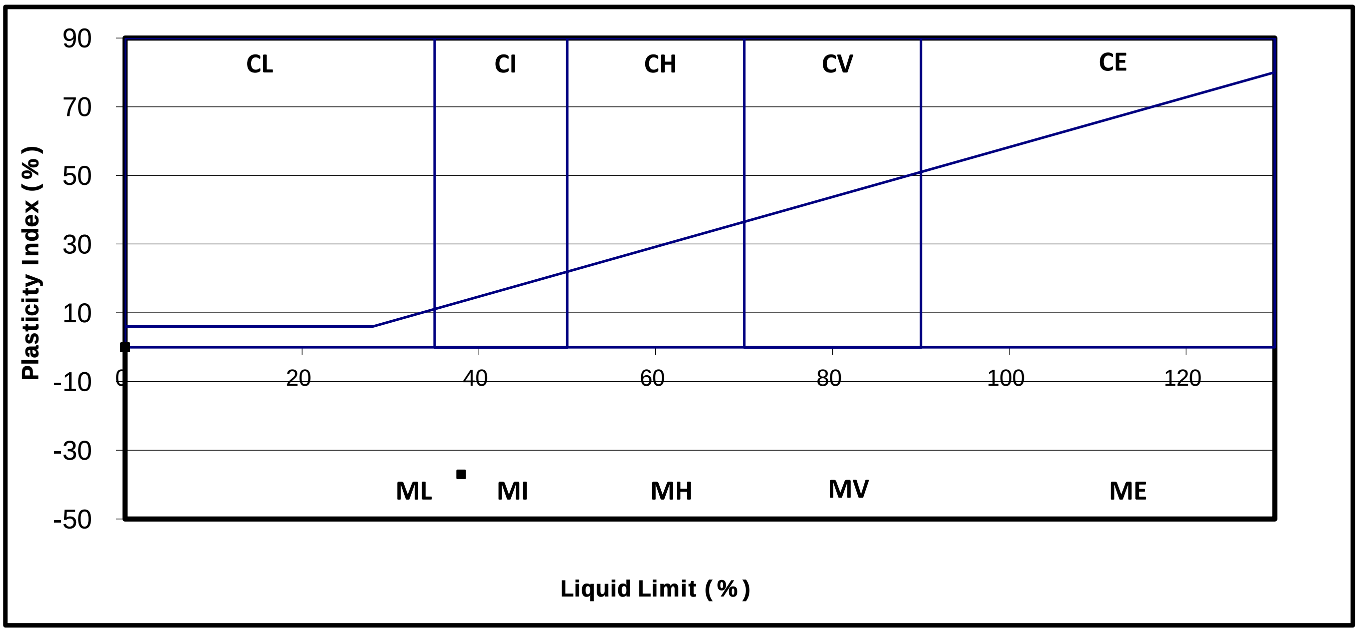
Test Report: **Method of the Determination of the plastic limit and plasticity index**
BS 1377 : Part 2 : 1990 Method 5

Client ref: N/A
Location: Newport Deep Soil
Contract Number: 27144-150615

Hole / Sample Number	Sample Type	Depth m	Moisture Content % Cl. 3.2	Liquid Limit % Cl. 4.3 / 4.4	Plastic Limit % Cl. 5.	Plasticity Index % Cl. 6.	% Passing .425mm	Remarks
Ely Silt			72	38	75	-37	94	MI Intermediate Plasticity
Ely Peat			309		NP		100	

Symbols: **NP : Non Plastic** **# : Liquid Limit and Plastic Limit Wet Sieved**

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.
BS 5930:1999+A2:2010



For and behalf of GEO Site & Testing Services Ltd

GSTL GEO SITE & TESTING SERVICES LTD

Authorised By:
Emma Sharp (Office Manager)

Date: 30.6.15

UKAS TESTING 2788

Unit 4
Heol Aur
Dafen Ind EstateDafen
Carmarthenshire
SA14 8QN
Tel: 01554 784040
01554 750752
Fax: 01554 770529
01554 784041
Web: www.geo.uk.com

Certificate of Analysis

Date:	01/07/2015
Client:	Deep Soil Mixing
Our Reference:	27144-150615
Client Reference:	
Contract Title:	Unknown
Description: (Total Samples)	5
Date Received:	15/06/2015
Date Started:	24/06/2015
Date Completed:	01/07/2015
Test Procedures:	(B.S. 1377 : PART 3 : 1990 AND BRE CP2/79)
Notes:	

Solid samples will be disposed 1 month and liquids 2 weeks after the date of issue of this test certificate

Approved By:

Authorised Signatories:

Emma Williams	Dafydd Simon	Paul Evans
Laboratory Office Manager	Laboratory Team Leader	Quality Manager

Contract No: 27144-150615
Client Ref:
Location: Unknown
Date: 01/07/2015

Summary of Chemical Analysis

(B.S. 1377 : PART 3 : 1990 AND BRE CP2/79)

Hole Number	Sample Number	Depth m	Sulphate Content SO3 (as SO_4) Acid Soluble Sulphate as % SO_4 Clause 5.5.	Aqueous Extract Sulphate as g/l SO_4 Clause 5.5.	Ground-water g/l Clause 5.4.	Chloride Content Soluble Chloride as % equiv. NaCl Clause 7.3	Ground-water g/l Clause 7.2	pH Value @ 25°C Clause 9.	Total Sulphur %	Magnesium g/l	Nitrate mg/l	Organic %
M8			0.22 (0.27)	0.01 (0.02)		NCP		7.81	0.15	<1	<10	
M8			0.09 (0.10)	0.09 (0.11)		NCP		7.31	0.05	<1	<10	
M8			0.03 (0.04)	<.01 (<.01)		NCP		7.80	0.02	<1	<10	
Ely Peat			0.09 (0.10)	0.05 (0.06)		NCP		7.26	0.06	<1	<10	
Ely Silt			0.34 (0.41)	0.12 (0.14)		NCP		7.56	0.25	<1	<10	

NCP - No Chloride present

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		10J
Sample No.		
Depth	m	
Date		26/06/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Greyish brown silty CLAY

Initial Specimen Conditions

Height	mm	103.00
Diameter	mm	99.00
Area	mm^2	7697.69
Volume	cm^3	792.86
Mass	g	1106.40
Dry Mass	g	543.40
Density	Mg/m^3	1.40
Dry Density	Mg/m^3	0.69
Moisture Content	%	103.6
Voids Ratio		2.867
Specific Gravity	kN/m^3	2.65
(assumed/measured)		assumed

Final Specimen Conditions

Moisture Content	%	103.59
Density	Mg/m^3	1.42
Dry Density	Mg/m^3	0.70

Test Setup

Date started	17/06/2015
Date Finished	25/06/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPERM 2
Cell Number	CPERM 2

D P Grant

Checked and Approved By

26/06/15
Date

Client Ref

Contract No

27144

GSTL
GEO Site & Testing Services Limited

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		10J
Sample No.		
Depth	m	
Date		26/06/2015

Saturation

Cell Pressure Incr.	kPa	100.00
Back Pressure Incr.	kPa	97.00
Differential Pressure	kPa	3.00
Final Cell Pressure	kPa	550.00
Final Pore Pressure	kPa	545.00
Final B Value		0.97

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	550.00
Back Pressure	kPa	450.00
Excess Pore Pressure	kPa	95.00
Pore Pressure at End	kPa	450.00
Consolidated Volume	cm^3	780.66
Consolidated Height	mm	102.47
Consolidated Area	mm^2	7618.72
Vol. Compressibility	m^2/MN	1.7920
Consolidation Coef.	$m^2/yr.$	0.1620
Final Voids Ratio		2.807

Permeability

Cell Pressure	kPa	550.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00337
Average Temperature	'C	20

Vertical Permeability I m/s	**3.69 x 10-10**

D P Gians

Checked and Approved By

26/06/15
Date

Client Ref

GSTL
GEO Site & Testing Services Limited

Contract No

27144

UKAS TESTING 2788

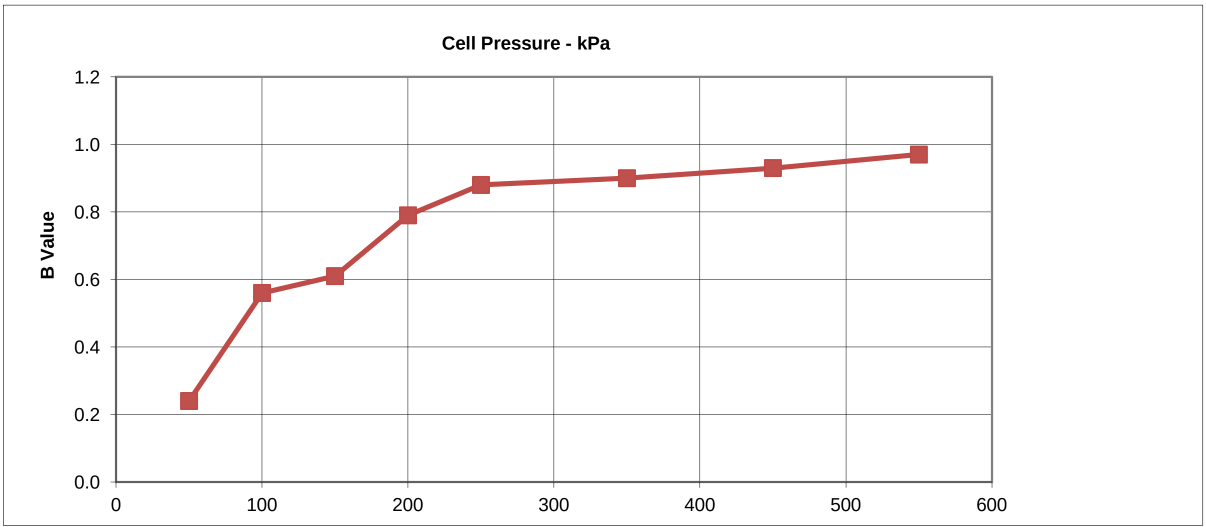
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole	10J
Sample No.	
Depth m	
Date	26/06/2015

Saturation Stage



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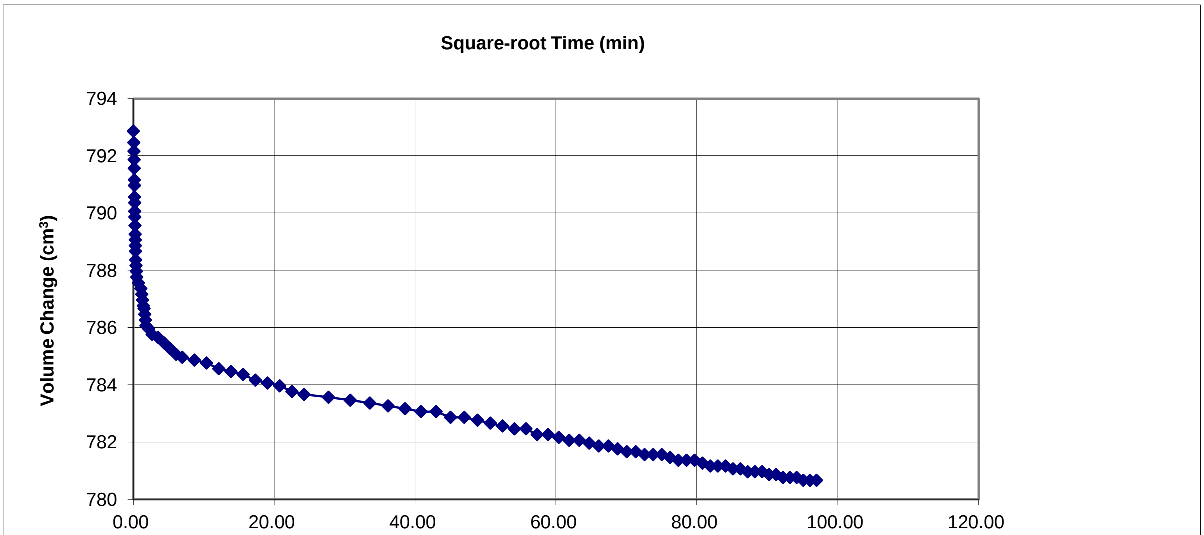


Checked and Approved By

26/06/15
Date

Client Ref

Contract No

27144

GEO Site & Testing Services Limited

UKAS TESTING 2788

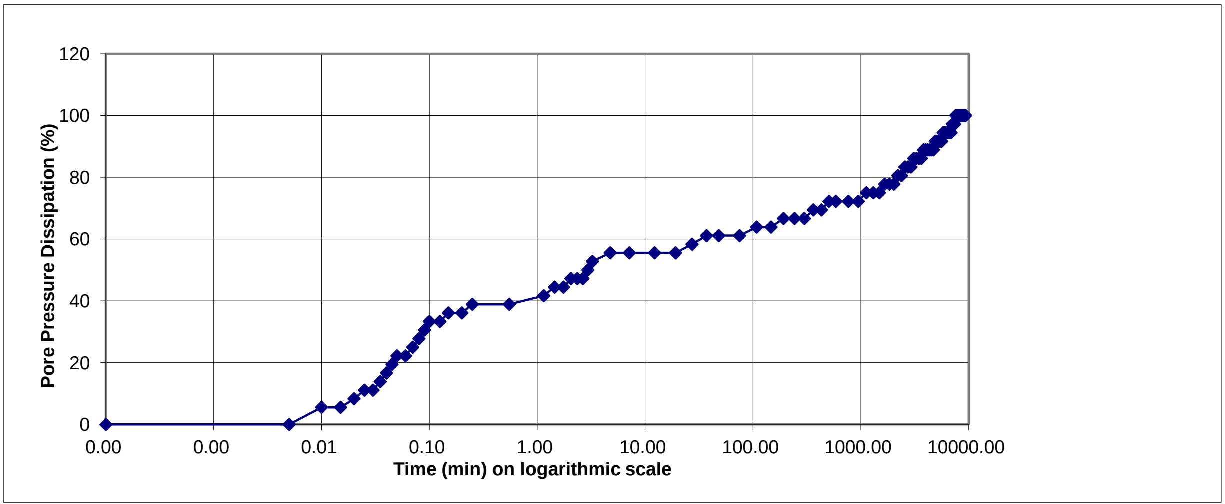
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

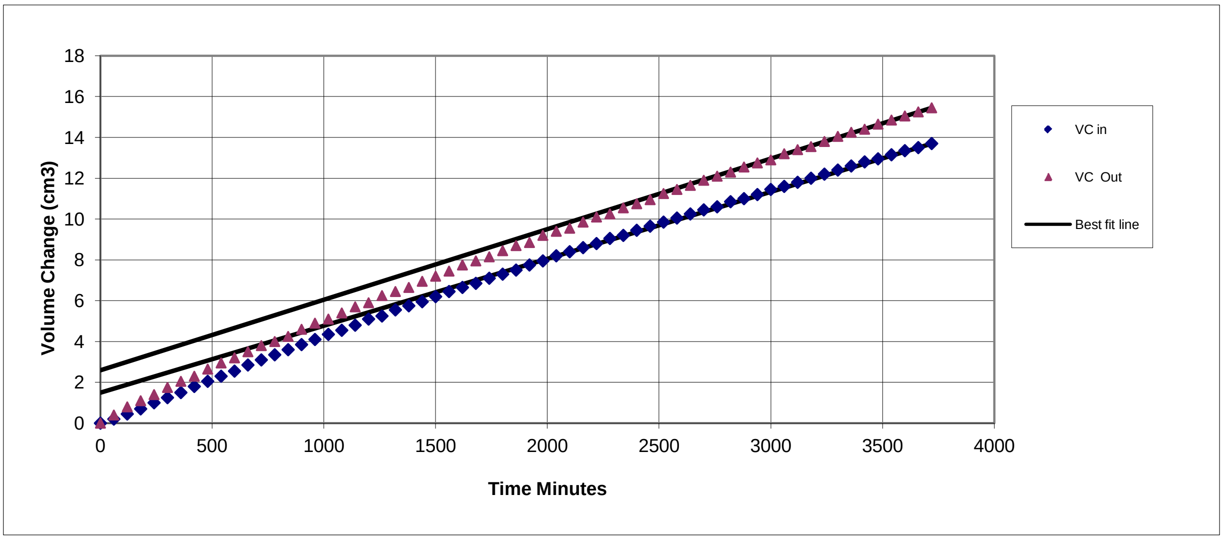
Specimen Details

Borehole	10J
Sample No.	
Depth m	
Date	26/06/2015

Consolidation Stage



Permeability Stage



D P Grans

Checked and Approved By

26/06/15
Date

GSTL
GEO Site & Testing Services Limited

Client Ref

Contract No

27144

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		12J
Sample No.		
Depth	m	
Date		26/06/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Greyish brown silty CLAY

Initial Specimen Conditions

Height	mm	103.00
Diameter	mm	100.00
Area	mm^2	7853.98
Volume	cm^3	808.96
Mass	g	1094.20
Dry Mass	g	531.00
Density	Mg/m^3	1.35
Dry Density	Mg/m^3	0.66
Moisture Content	%	106.1
Voids Ratio		3.037
Specific Gravity	kN/m^3	2.65
(assumed/measured)		assumed

Final Specimen Conditions

Moisture Content	%	105.95
Density	Mg/m^3	1.37
Dry Density	Mg/m^3	0.67

Test Setup

Date started	17/06/2015
Date Finished	25/06/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPERM 5
Cell Number	CPERM 5

D P Evans

Checked and Approved By

26/06/15
Date

Client Ref

GSTL
GEO Site & Testing Services Limited

Contract No

27144

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		12J
Sample No.		
Depth	m	
Date		26/06/2015

Saturation

Cell Pressure Incr.	kPa	100.00
Back Pressure Incr.	kPa	97.00
Differential Pressure	kPa	3.00
Final Cell Pressure	kPa	550.00
Final Pore Pressure	kPa	545.00
Final B Value		0.97

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	550.00
Back Pressure	kPa	450.00
Excess Pore Pressure	kPa	95.00
Pore Pressure at End	kPa	450.00
Consolidated Volume	cm^3	796.76
Consolidated Height	mm	102.48
Consolidated Area	mm^2	7775.02
Vol. Compressibility	m^2/MN	1.7921
Consolidation Coef.	m^2/yr.	0.1587
Final Voids Ratio		2.976

Permeability

Cell Pressure	kPa	550.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00126
Average Temperature	'C	20

Vertical Permeability I m/s	**1.35 x 10-10**

D P Grant

Checked and Approved By

26/06/15
Date

Client Ref

Contract No

27144

GSTL
GEO Site & Testing Services Limited

UKAS TESTING 2788

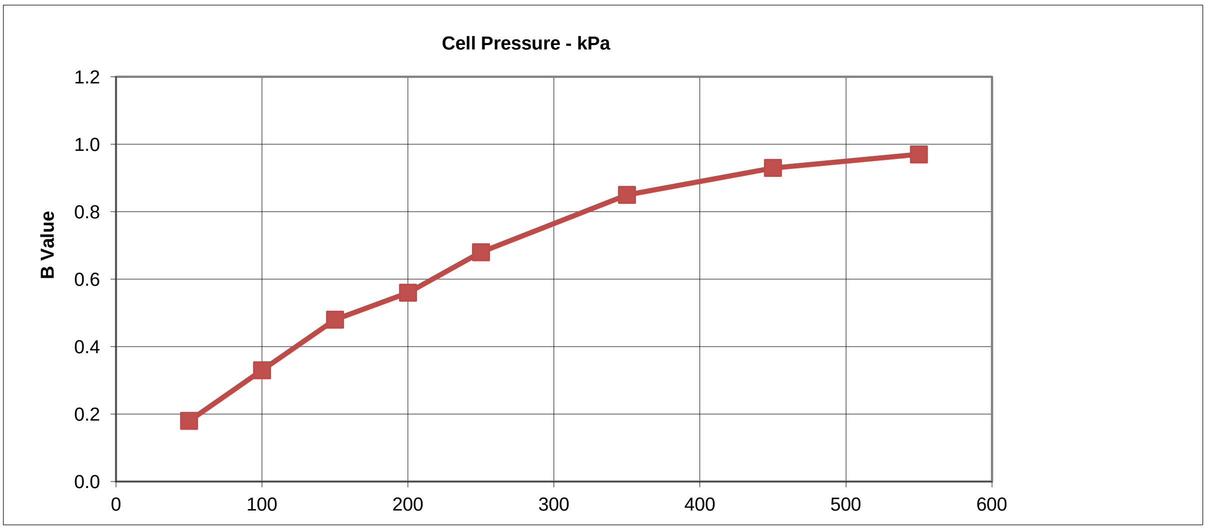
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

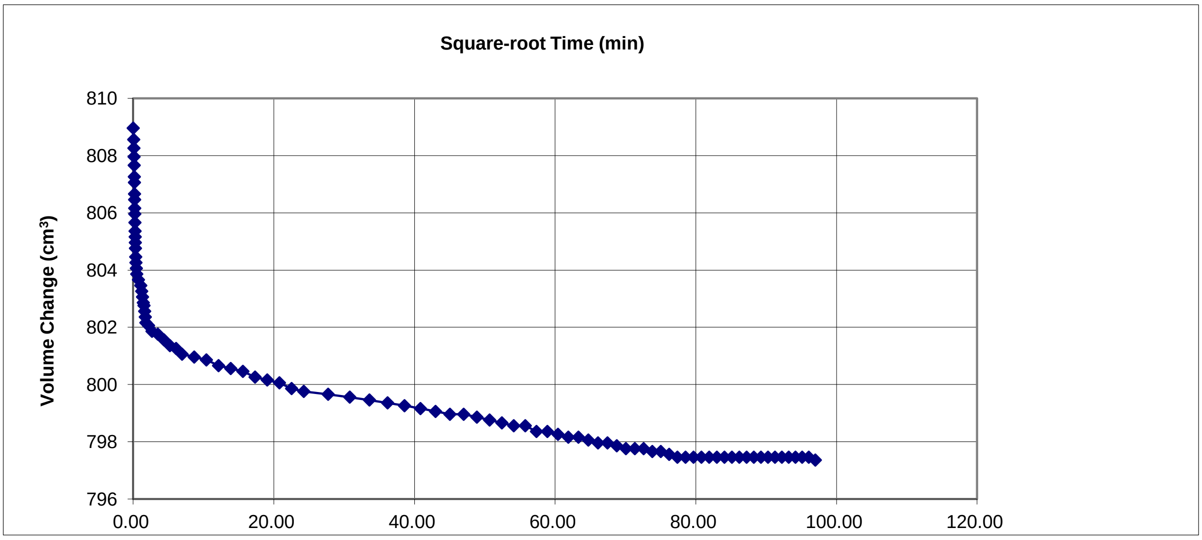
Specimen Details

Borehole	12J
Sample No.	
Depth m	
Date	26/06/2015

Saturation Stage



Consolidation Stage



D P Gong

Checked and Approved By

26/06/15
Date

Client Ref

Contract No

27144

GSTL
GEO Site & Testing Services Limited

UKAS TESTING 2788

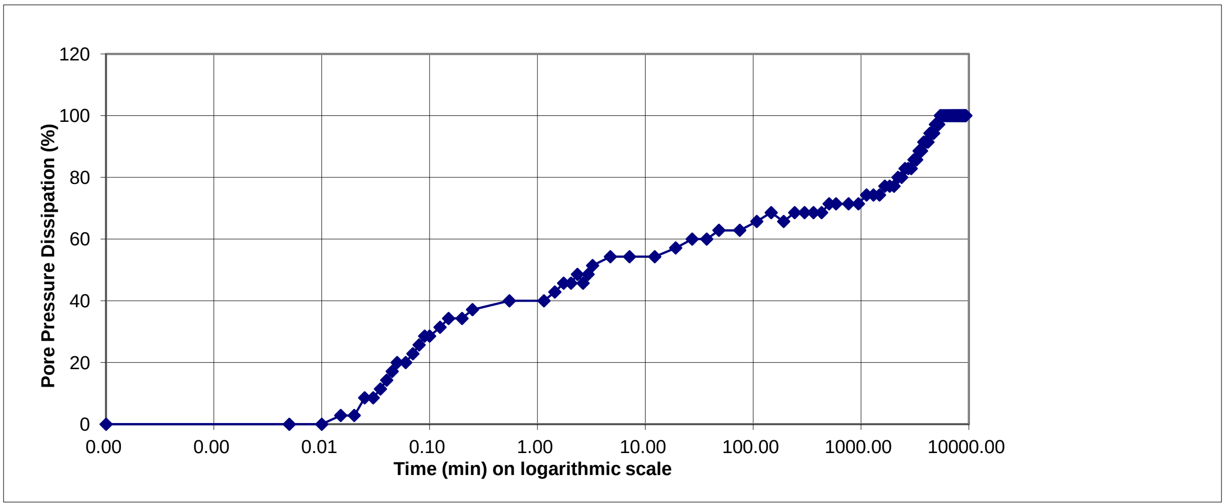
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

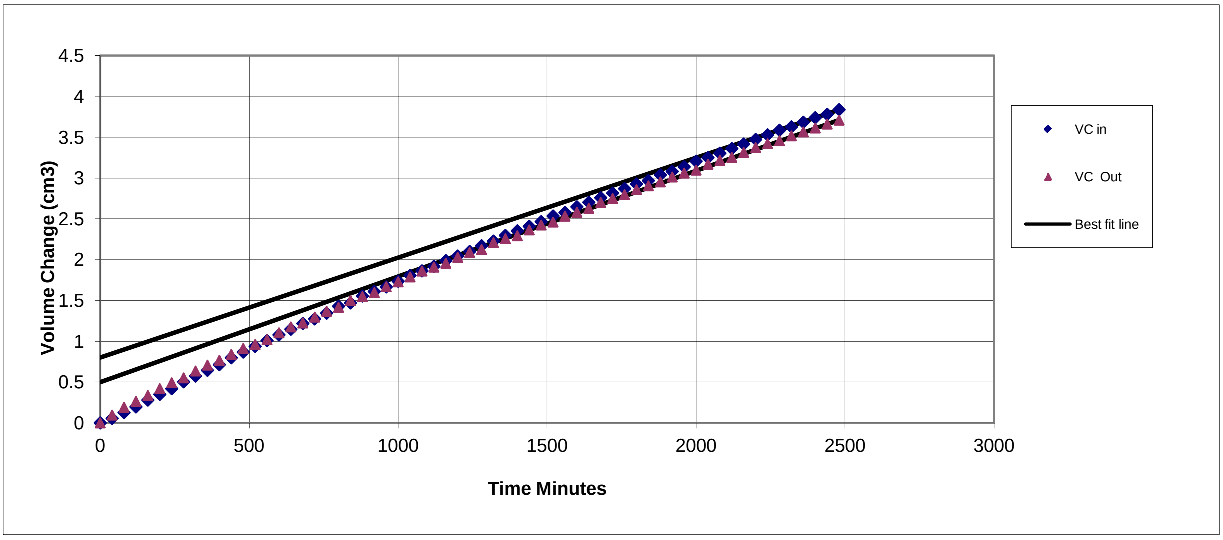
Specimen Details

Borehole		12J
Sample No.		
Depth	m	
Date		26/06/2015

Consolidation Stage



Permeability Stage



D P Grans

Checked and Approved By

26/06/15
Date

Client Ref

GSTL
GEO Site & Testing Services Limited

Contract No

27144

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		7K
Sample No.		
Depth	m	
Date		26/06/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Dark greyish brown silty CLAY

Initial Specimen Conditions

Height	mm	103.00
Diameter	mm	99.00
Area	mm^2	7697.69
Volume	cm^3	792.86
Mass	g	1062.90
Dry Mass	g	509.90
Density	Mg/m^3	1.34
Dry Density	Mg/m^3	0.64
Moisture Content	%	108.5
Voids Ratio		3.121
Specific Gravity	kN/m^3	2.65
(assumed/measured)		assumed

Final Specimen Conditions

Moisture Content	%	108.51
Density	Mg/m^3	1.36
Dry Density	Mg/m^3	0.65

Test Setup

Date started	17/06/2015
Date Finished	25/06/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPERM 4
Cell Number	CPERM 4

D P Grant

Checked and Approved By

26/06/15
Date

Client Ref

Contract No

27144

GSTL
GEO Site & Testing Services Limited

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		7K
Sample No.		
Depth	m	
Date		26/06/2015

Saturation

Cell Pressure Incr.	kPa	100.00
Back Pressure Incr.	kPa	96.00
Differential Pressure	kPa	4.00
Final Cell Pressure	kPa	550.00
Final Pore Pressure	kPa	545.00
Final B Value		0.96

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	550.00
Back Pressure	kPa	450.00
Excess Pore Pressure	kPa	95.00
Pore Pressure at End	kPa	450.00
Consolidated Volume	cm^3	779.36
Consolidated Height	mm	102.42
Consolidated Area	mm^2	7610.31
Vol. Compressibility	m^2/MN	6.3341
Consolidation Coef.	$m^2/yr.$	0.1792
Final Voids Ratio		3.050

Permeability

Cell Pressure	kPa	550.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00515
Average Temperature	'C	20

Vertical Permeability I m/s	**5.64 x 10-10**

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26/06/15
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GEO Site & Testing Services Limited

UKAS TESTING 2788

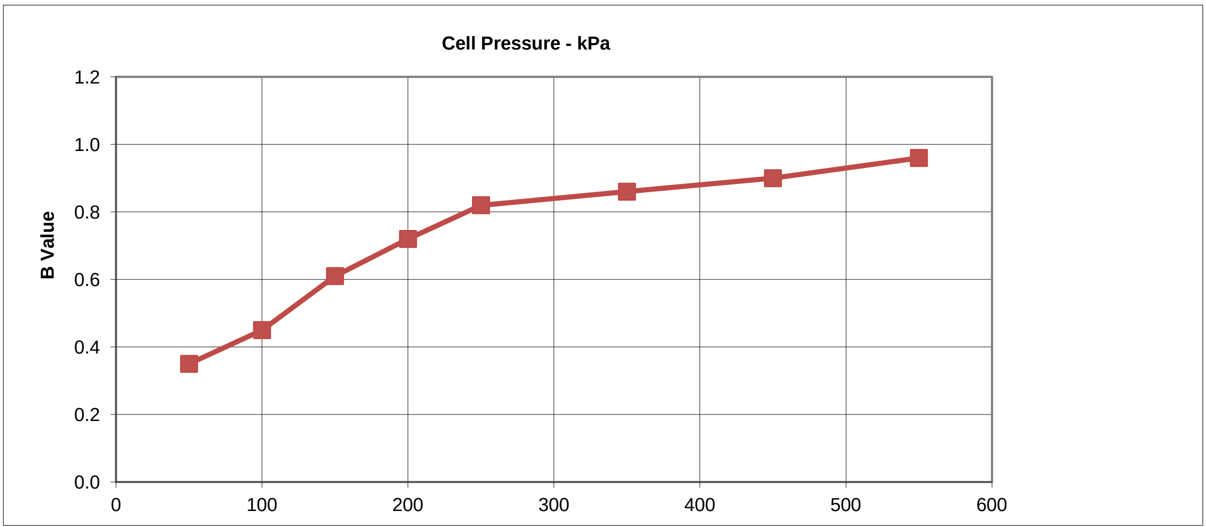
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

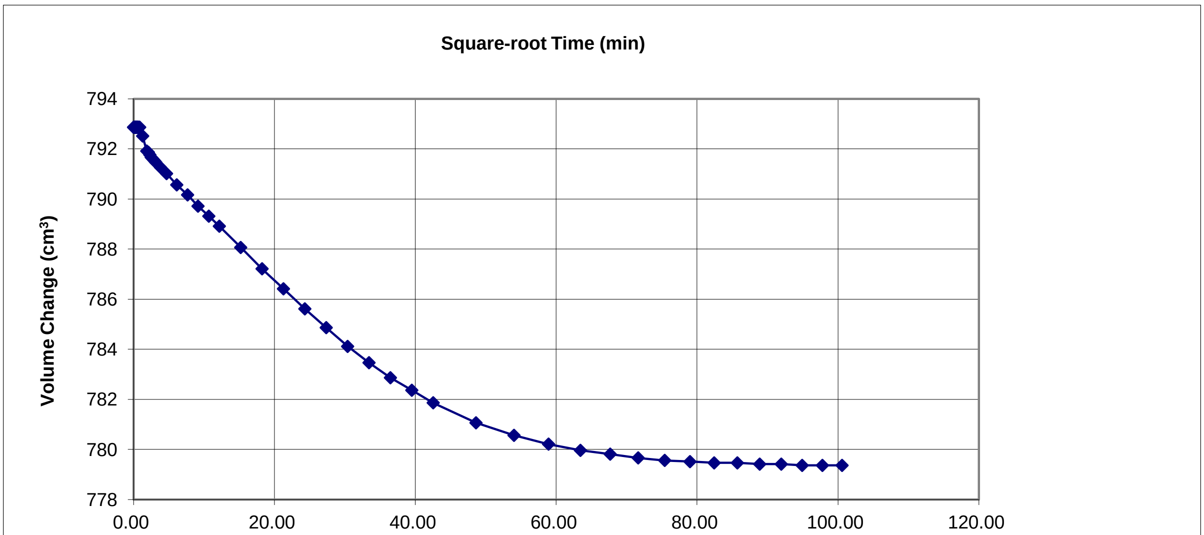
Specimen Details

Borehole	7K
Sample No.	
Depth m	
Date	26/06/2015

Saturation Stage



Consolidation Stage



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26/06/15

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27144

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UKAS TESTING 2788

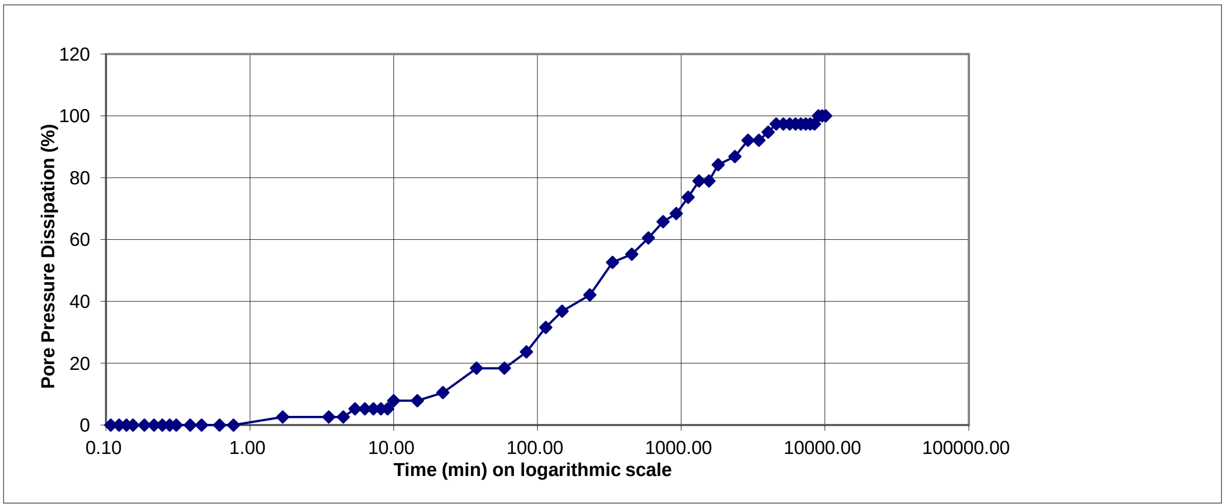
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

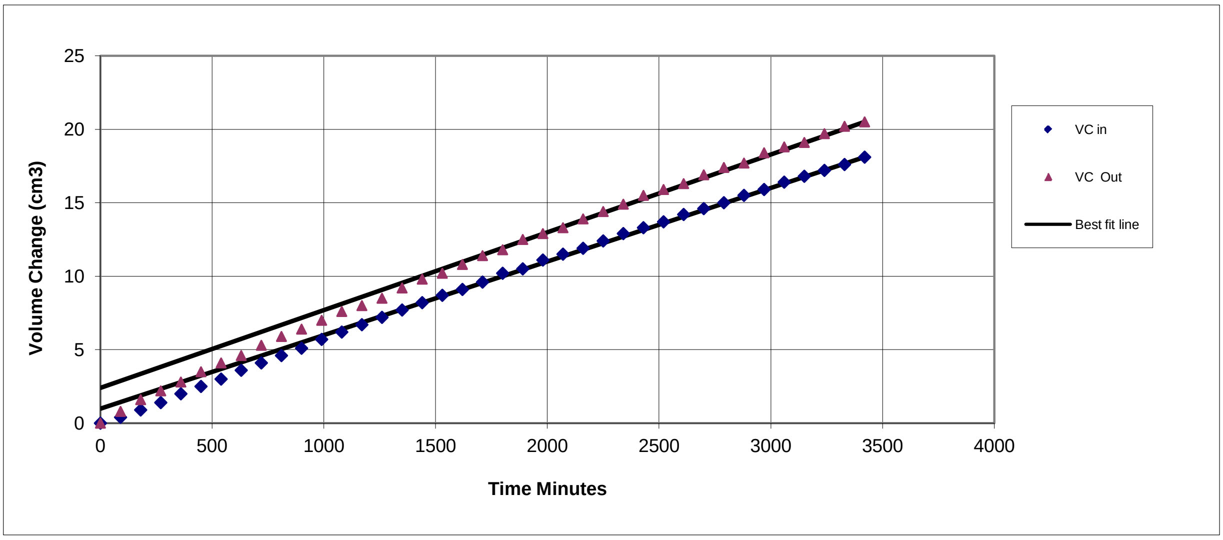
Specimen Details

Borehole	7K
Sample No.	
Depth m	
Date	26/06/2015

Consolidation Stage



Permeability Stage



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26/06/15
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Client Ref

Contract No

27144

GSTL
GEO Site & Testing Services Limited

UKAS TESTING 2788

Laboratory Report

2788

GSTL

GEO Site & Testing Services Ltd

Contract Number: 27031

Client's Reference: **N/A**

Report Date: **09-06-2015**

Client **Deep Soil Mixing Ltd**
Deep Soil Mixing Ltd,
Birchwood,
Westoning Road,
Greenfield,
Bedfordshire,
MK45 5BH

Contract Title: **Unknown**
For the attention of: **George Olney**

Date Received: **22-05-2015**
Date Commenced: **22-05-2015**
Date Completed: **09-06-2015**

Test Description	Qty
Determination of Permeability in a triaxial cell BS1377 Part 6 :1990 Clause 6 - * UKAS	3
Quick Undrained Triaxial Compression test - single specimen at one confining pressure (100mm or 38mm diameter) 1377 : 1990 Part 7 : 8 - * UKAS	1
Extra Over Item (4 Days Over)	3
Disposal of Samples on Project	1

Notes: **Observations and Interpretations are outside the UKAS Accreditation**
*** - denotes test included in laboratory scope of accreditation**
 # - denotes test carried out by approved contractor
@ - denotes non accredited tests

Approved Signatories:
Alex Wynn (Associate Director) - Benjamin Sharp (Contracts Manager) - D V Edwards (Managing Director)
Emma Sharp (Office Manager) - Emma Williams (Office Manager) - Paul Evans (Quality/Technical Manager)

GEO Site & Testing Services Ltd
Unit 4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN
Tel: 01554 784040 Fax: 01554 784041 info@geo.uk.com geo.uk.com

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		130
Sample No.		
Depth	m	
Date		02/06/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Brown/grey silty CLAY

Initial Specimen Conditions

Height	mm	152.00
Diameter	mm	101.00
Area	mm^2	8011.85
Volume	cm^3	1217.80
Mass	g	1841.30
Dry Mass	g	851.70
Density	Mg/m^3	1.51
Dry Density	Mg/m^3	0.70
Moisture Content	%	116.2
Voids Ratio		2.789
Specific Gravity	kN/m^3	2.65
(assumed/measured)		assumed

Final Specimen Conditions

Moisture Content	%	117.74
Density	Mg/m^3	1.55
Dry Density	Mg/m^3	0.71

Test Setup

Date started	27/05/2015
Date Finished	01/06/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPerm 2
Cell Number	CPerm 2

D P Grang

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02/06/15
Date

Client Ref

GSTL
GEO Site & Testing Services Limited

Contract No

27031

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		130
Sample No.		
Depth	m	
Date		02/06/2015

Saturation

Cell Pressure Incr.	kPa	50.00
Back Pressure Incr.	kPa	48.00
Differential Pressure	kPa	2.00
Final Cell Pressure	kPa	250.00
Final Pore Pressure	kPa	246.00
Final B Value		0.96

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	250.00
Back Pressure	kPa	150.00
Excess Pore Pressure	kPa	96.00
Pore Pressure at End	kPa	150.00
Consolidated Volume	cm^3	1196.60
Consolidated Height	mm	151.12
Consolidated Area	mm^2	7918.86
Vol. Compressibility	m^2/MN	0.7138
Consolidation Coef.	m^2/yr.	0.1813
Final Voids Ratio		2.723

Permeability

Cell Pressure	kPa	250.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00417
Average Temperature	'C	20

Vertical Permeability I m/s	**6.48 x 10-10**

Checked and Approved By

02/06/15
Date

Client Ref

Contract No

27031

GSTL
GEO Site & Testing Services Limited

UKAS TESTING 2788

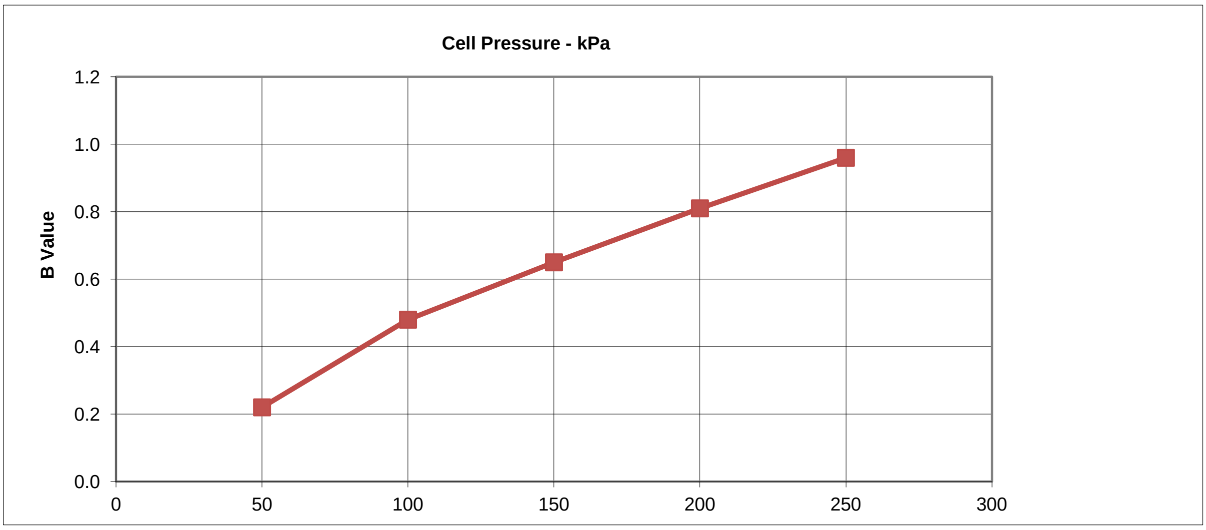
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

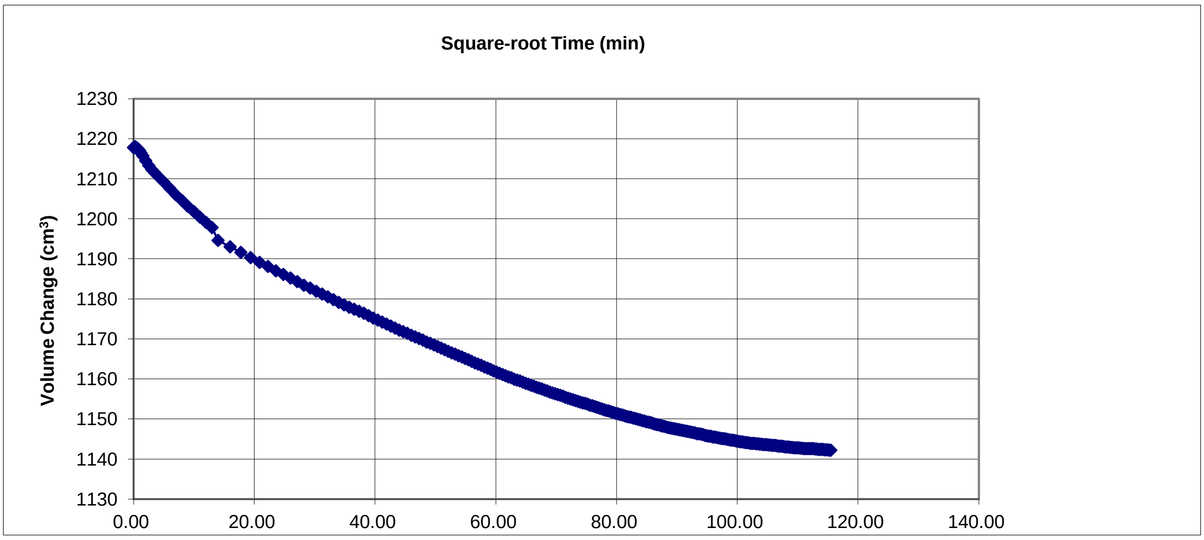
Specimen Details

Borehole	130
Sample No.	
Depth m	
Date	02/06/2015

Saturation Stage



Consolidation Stage



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02/06/15
Date

Client Ref

GSTL
GEO Site & Testing Services Limited

Contract No

27031

UKAS TESTING 2788

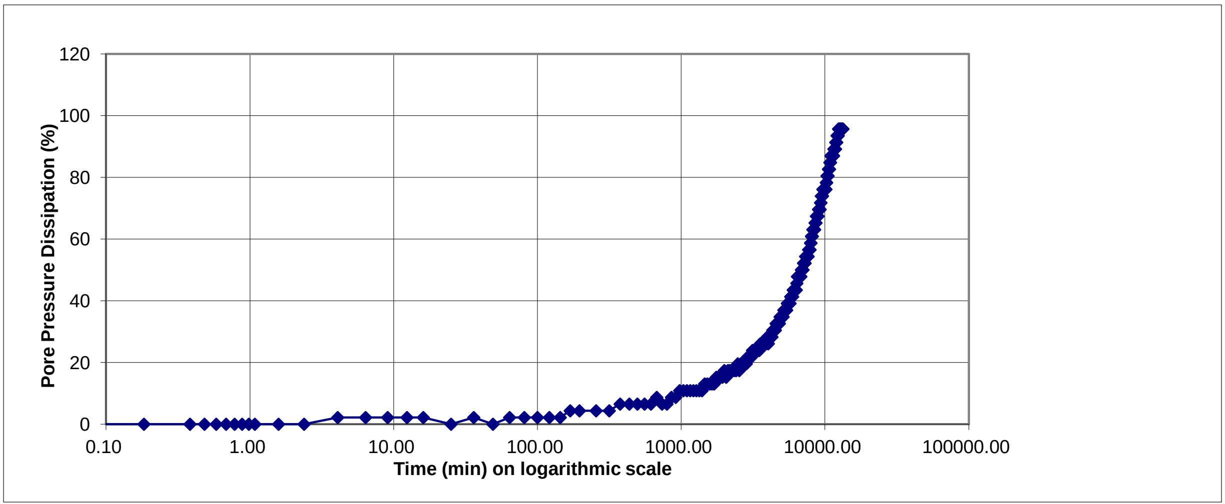
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

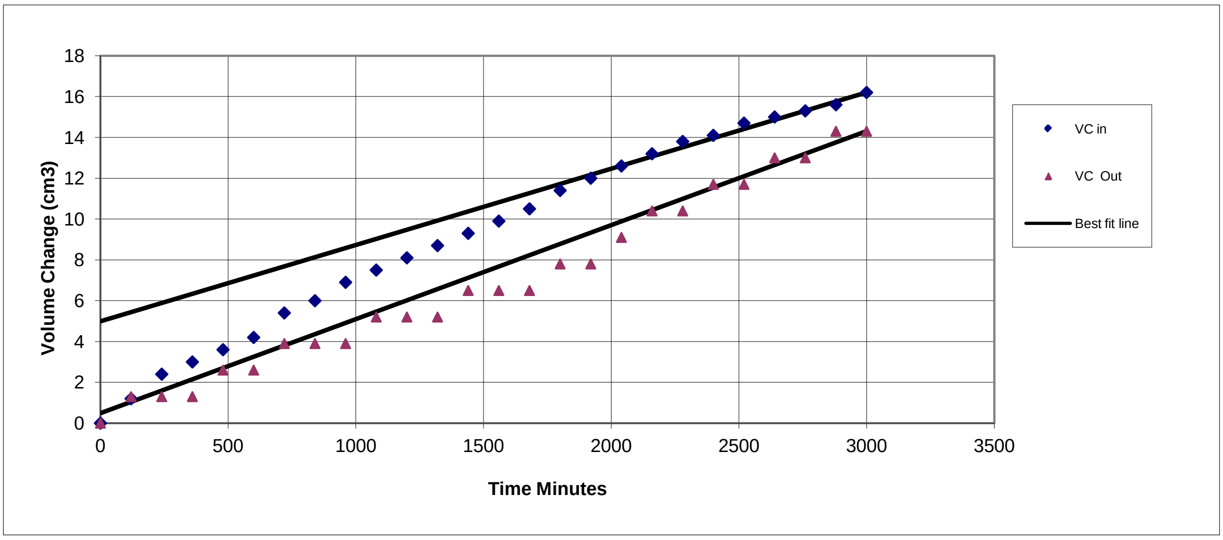
Specimen Details

Borehole	130
Sample No.	
Depth m	
Date	02/06/2015

Consolidation Stage



Permeability Stage



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02/06/15
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Client Ref

Contract No

27031

GSTL GEO Site & Testing Services Limited

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		16F
Sample No.		
Depth	m	
Date		02/06/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Brown/grey silty CLAY

Initial Specimen Conditions

Height	mm	150.00
Diameter	mm	102.00
Area	mm^2	8171.28
Volume	cm^3	1225.69
Mass	g	1768.10
Dry Mass	g	914.10
Density	Mg/m^3	1.44
Dry Density	Mg/m^3	0.75
Moisture Content	%	93.4
Voids Ratio		2.553
Specific Gravity	kN/m^3	2.65
(assumed/measured)		assumed

Final Specimen Conditions

Moisture Content	%	94.56
Density	Mg/m^3	1.52
Dry Density	Mg/m^3	0.78

Test Setup

Date started	27/05/2015
Date Finished	01/06/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPerm 3
Cell Number	CPerm 3

D P Evans

Checked and Approved By

02/06/15
Date

Client Ref

Contract No

27031

GEO Site & Testing Services Limited

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		16F
Sample No.		
Depth	m	
Date		02/06/2015

Saturation

Cell Pressure Incr.	kPa	50.00
Back Pressure Incr.	kPa	50.00
Differential Pressure	kPa	0.00
Final Cell Pressure	kPa	200.00
Final Pore Pressure	kPa	199.40
Final B Value		1.00

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	200.00
Back Pressure	kPa	100.00
Excess Pore Pressure	kPa	99.40
Pore Pressure at End	kPa	100.00
Consolidated Volume	cm^3	1173.39
Consolidated Height	mm	147.87
Consolidated Area	mm^2	7938.84
Vol. Compressibility	m^2/MN	7.2007
Consolidation Coef.	m^2/yr.	0.4293
Final Voids Ratio		2.402

Permeability

Cell Pressure	kPa	200.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00658
Average Temperature	'C	20

Vertical Permeability l m/s	**9.99 x 10-10**

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Checked and Approved By

02/06/15
Date

Client Ref

GSTL
GEO Site & Testing Services Limited

Contract No

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UKAS TESTING 2788

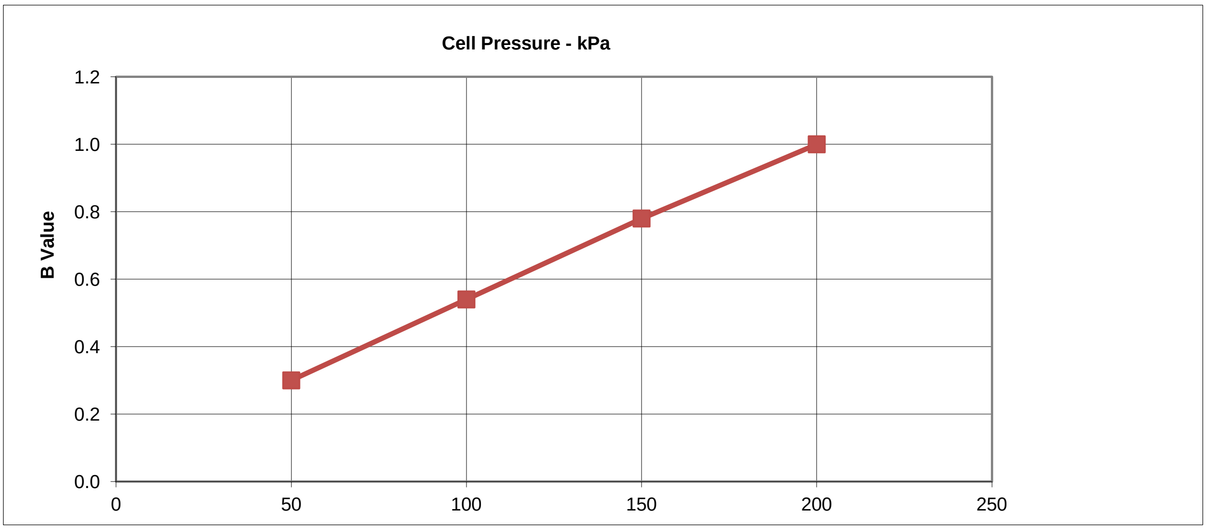
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

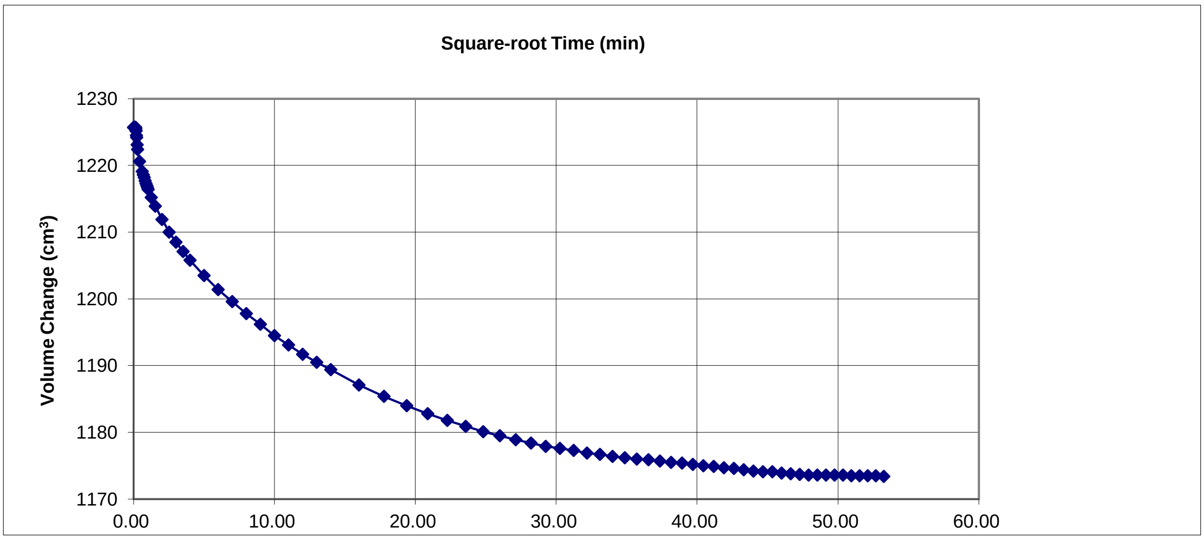
Specimen Details

Borehole	16F
Sample No.	
Depth m	
Date	02/06/2015

Saturation Stage



Consolidation Stage



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GEO Site & Testing Services Limited

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UKAS TESTING 2788

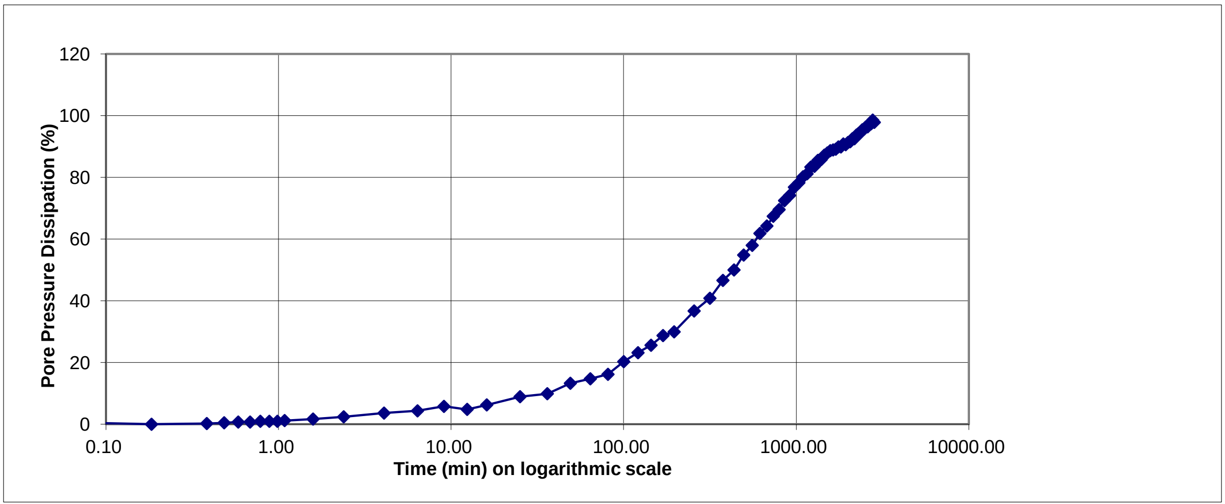
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

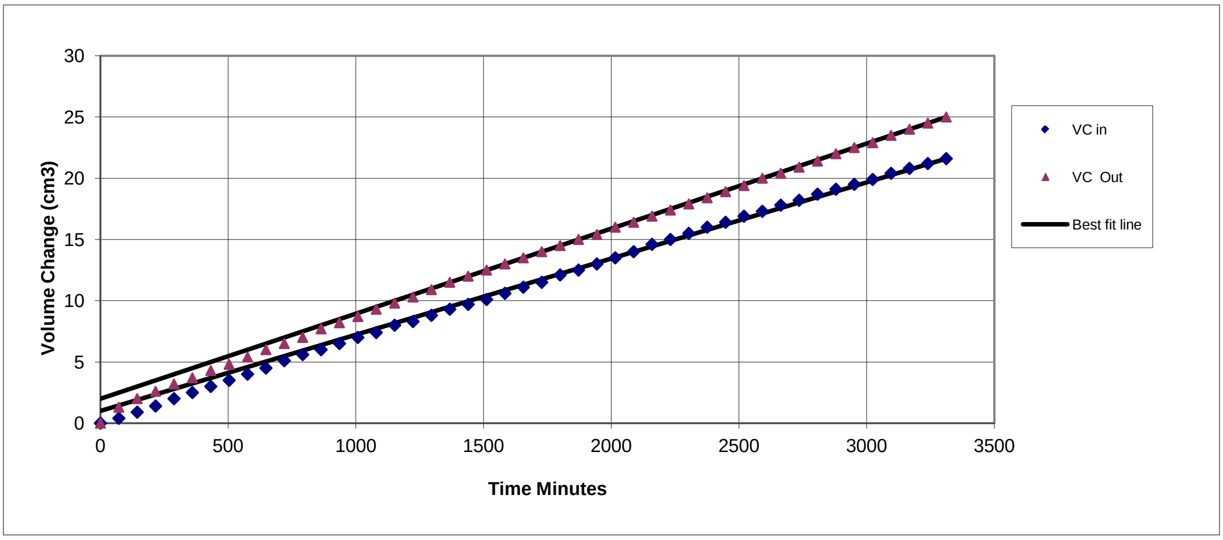
Specimen Details

Borehole	16F
Sample No.	
Depth m	
Date	02/06/2015

Consolidation Stage



Permeability Stage



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02/06/15
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Client Ref

Contract No

27031

GEO Site & Testing Services Limited

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		18H
Sample No.		
Depth	m	
Date		23/05/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Greyish brown sl clayey very firm SILT

Initial Specimen Conditions

Height	mm	138.00
Diameter	mm	102.00
Area	mm^2	8171.28
Volume	cm^3	1127.64
Mass	g	1685.30
Dry Mass	g	996.40
Density	Mg/m^3	1.49
Dry Density	Mg/m^3	0.88
Moisture Content	%	69.1
Voids Ratio		1.999
Specific Gravity	kN/m^3	2.65
(assumed/measured)		assumed

Final Specimen Conditions

Moisture Content	%	70.69
Density	Mg/m^3	1.52
Dry Density	Mg/m^3	0.89

Test Setup

Date started	13/05/2015
Date Finished	22/05/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPerm 6
Cell Number	CPerm 6

D P Grant

Checked and Approved By

23/05/15

Date

Client Ref

Contract No

26884

GSTL GEO Site & Testing Services Limited

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		18H
Sample No.		
Depth	m	
Date		23/05/2015

Saturation

Cell Pressure Incr.	kPa	50.00
Back Pressure Incr.	kPa	50.00
Differential Pressure	kPa	0.00
Final Cell Pressure	kPa	300.00
Final Pore Pressure	kPa	274.00
Final B Value		1.00

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	300.00
Back Pressure	kPa	200.00
Excess Pore Pressure	kPa	74.00
Pore Pressure at End	kPa	200.00
Consolidated Volume	cm^3	1115.64
Consolidated Height	mm	137.51
Consolidated Area	mm^2	8113.31
Vol. Compressibility	m^2/MN	1.3574
Consolidation Coef.	m^2/yr.	0.1438
Final Voids Ratio		1.967

Permeability

Cell Pressure	kPa	300.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00210
Average Temperature	'C	20

Vertical Permeability I m/s	**2.9 x 10-10**

D P Grant

Checked and Approved By

23/05/15
Date

Client Ref

Contract No

26884

GSTL
GEO Site & Testing Services Limited

UKAS TESTING 2788

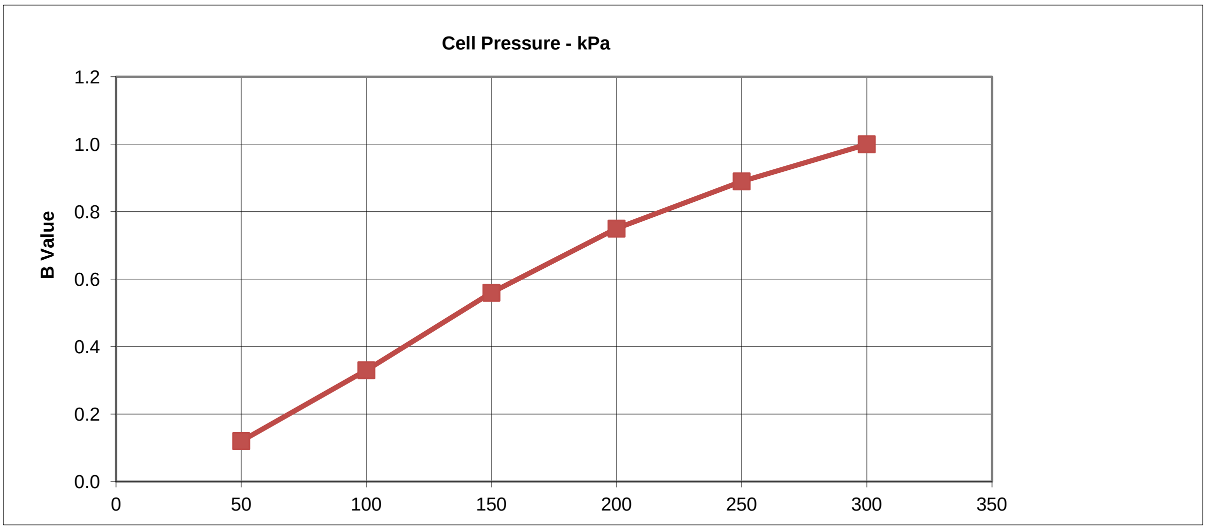
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

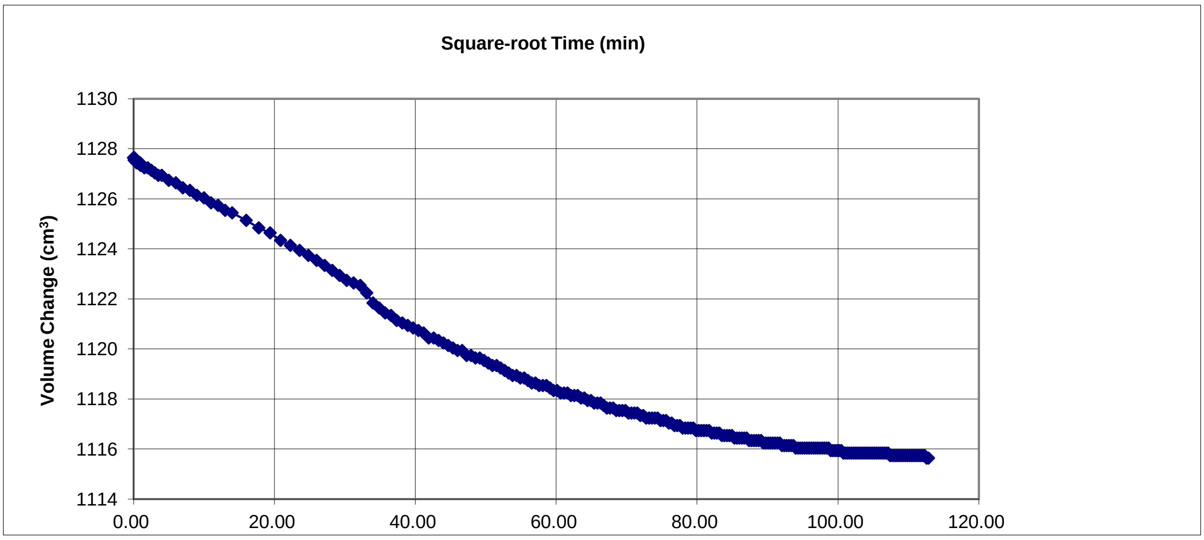
Specimen Details

Borehole		18H
Sample No.		
Depth	m	
Date		23/05/2015

Saturation Stage



Consolidation Stage



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Client Ref

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GEO Site & Testing Services Limited

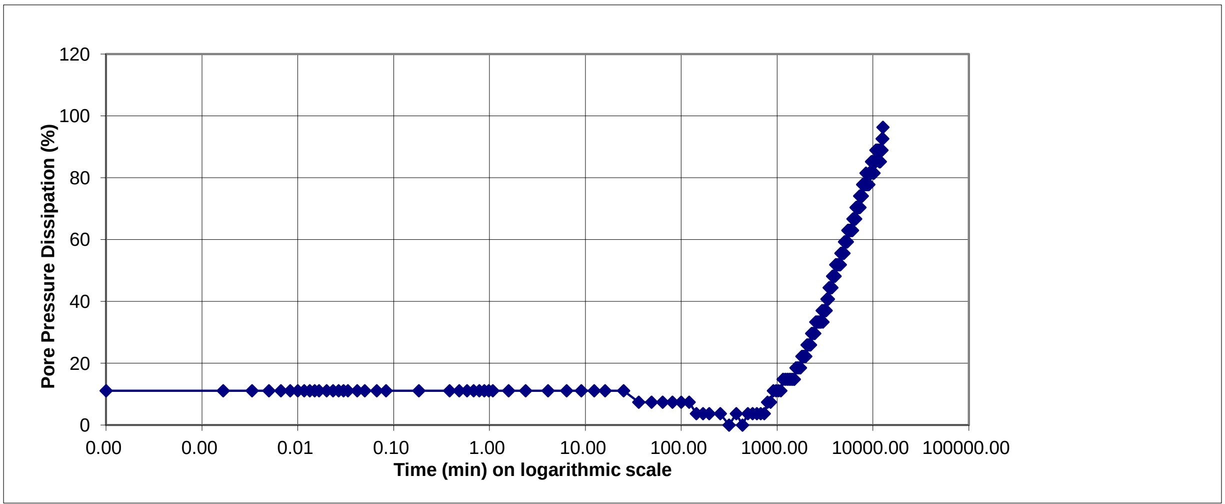
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

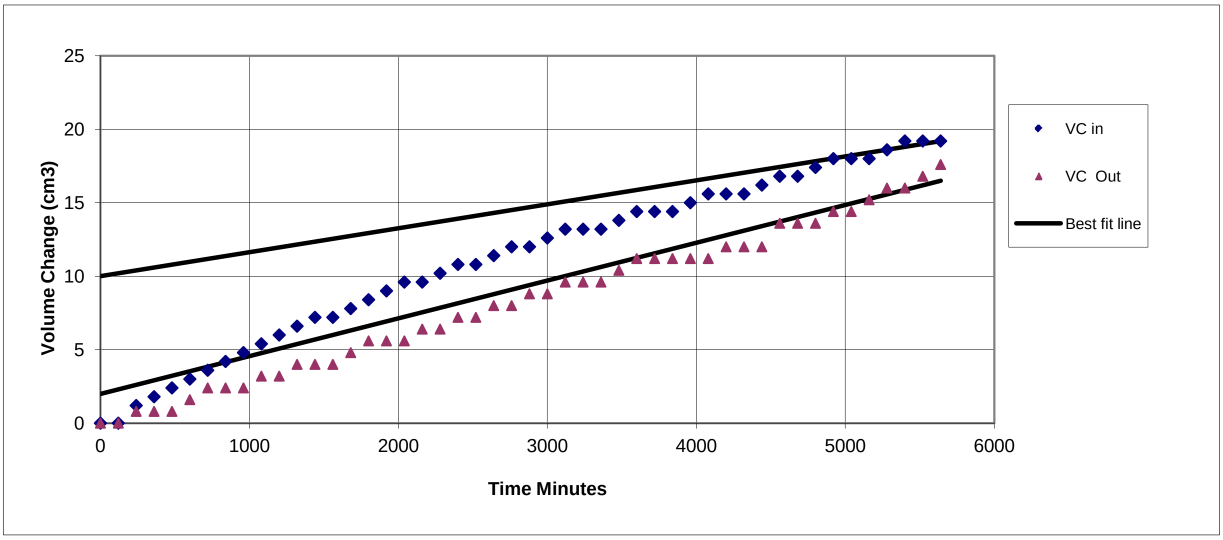
Specimen Details

Borehole	18H
Sample No.	
Depth m	
Date	23/05/2015

Consolidation Stage



Permeability Stage



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23/05/15
Date

Client Ref

Contract No

26884

GSTL
GEO Site & Testing Services Limited

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		19L
Sample No.		
Depth	m	
Date		23/05/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Dark greyish brown sl clayey very firm SILT

Initial Specimen Conditions

Height	mm	142.00
Diameter	mm	101.00
Area	mm^2	8011.85
Volume	cm^3	1137.68
Mass	g	1666.00
Dry Mass	g	918.20
Density	Mg/m^3	1.46
Dry Density	Mg/m^3	0.81
Moisture Content	%	81.4
Voids Ratio		2.283
Specific Gravity	kN/m^3	2.65
(assumed/measured)		assumed

Final Specimen Conditions

Moisture Content	%	82.57
Density	Mg/m^3	1.53
Dry Density	Mg/m^3	0.84

Test Setup

Date started	13/05/2015
Date Finished	22/05/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPerm 12
Cell Number	CPerm 12

D P Evans

Checked and Approved By

23/05/15
Date

Client Ref

Contract No

26884

GSTL
GEO Site & Testing Services Limited

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		19L
Sample No.		
Depth	m	
Date		23/05/2015

Saturation

Cell Pressure Incr.	kPa	100.00
Back Pressure Incr.	kPa	98.00
Differential Pressure	kPa	2.00
Final Cell Pressure	kPa	500.00
Final Pore Pressure	kPa	451.90
Final B Value		0.98

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	500.00
Back Pressure	kPa	400.00
Excess Pore Pressure	kPa	95.00
Pore Pressure at End	kPa	400.00
Consolidated Volume	cm^3	1110.98
Consolidated Height	mm	140.89
Consolidated Area	mm^2	7886.49
Vol. Compressibility	m^2/MN	7.1956
Consolidation Coef.	m^2/yr.	0.2470
Final Voids Ratio		2.206

Permeability

Cell Pressure	kPa	500.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00340
Average Temperature	'C	20

Vertical Permeability I m/s	**4.94 x 10-10**

D P Grant

Checked and Approved By

23/05/15
Date

Client Ref

GSTL
GEO Site & Testing Services Limited

Contract No

26884

UKAS TESTING 2788

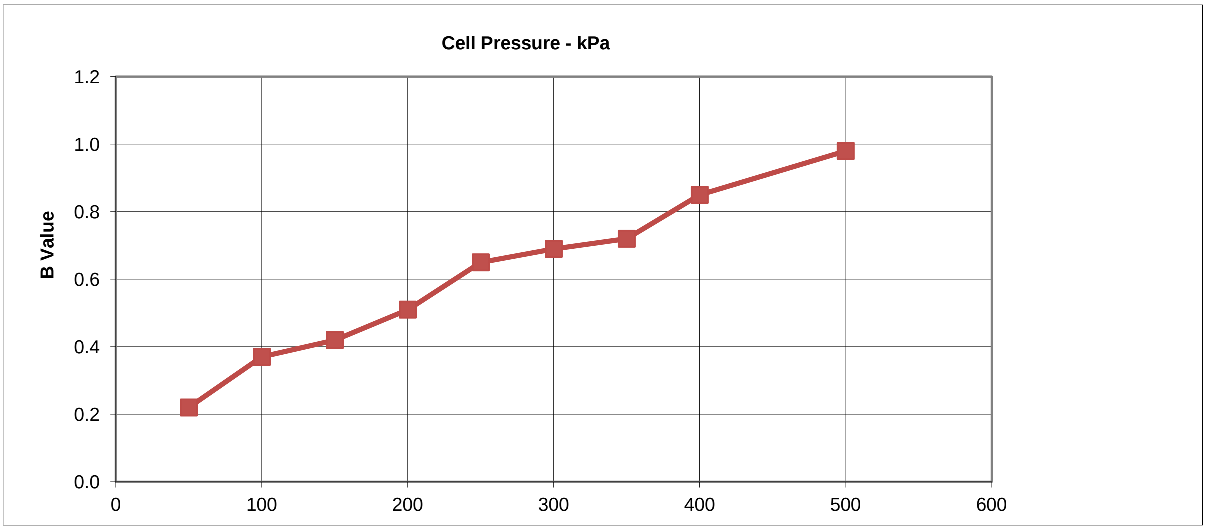
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

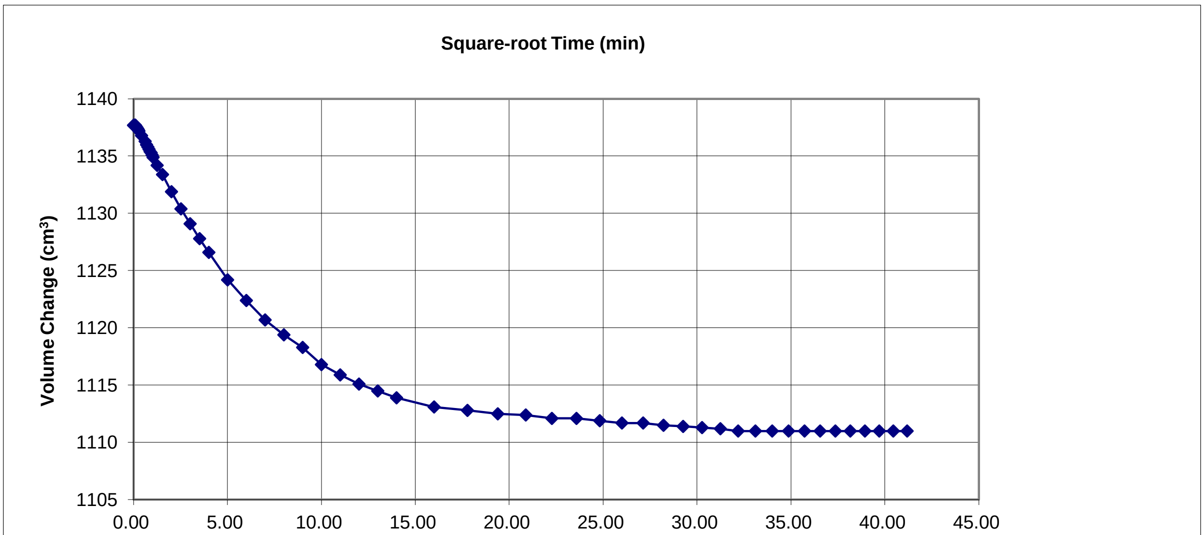
Specimen Details

Borehole	19L
Sample No.	
Depth m	
Date	23/05/2015

Saturation Stage



Consolidation Stage



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23/05/15
Date

Client Ref

GSTL
GEO Site & Testing Services Limited

Contract No

26884

UKAS TESTING 2788

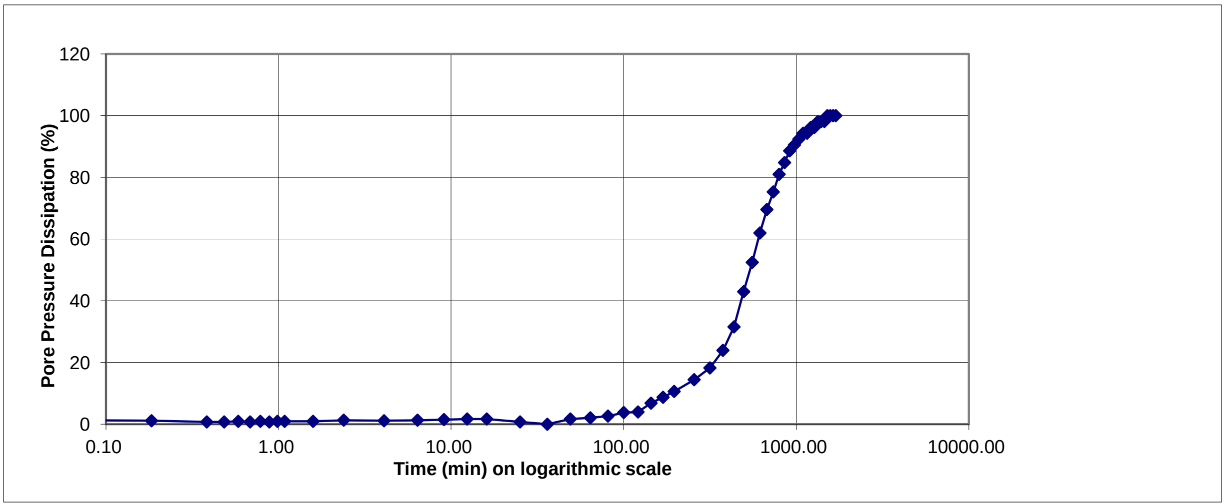
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

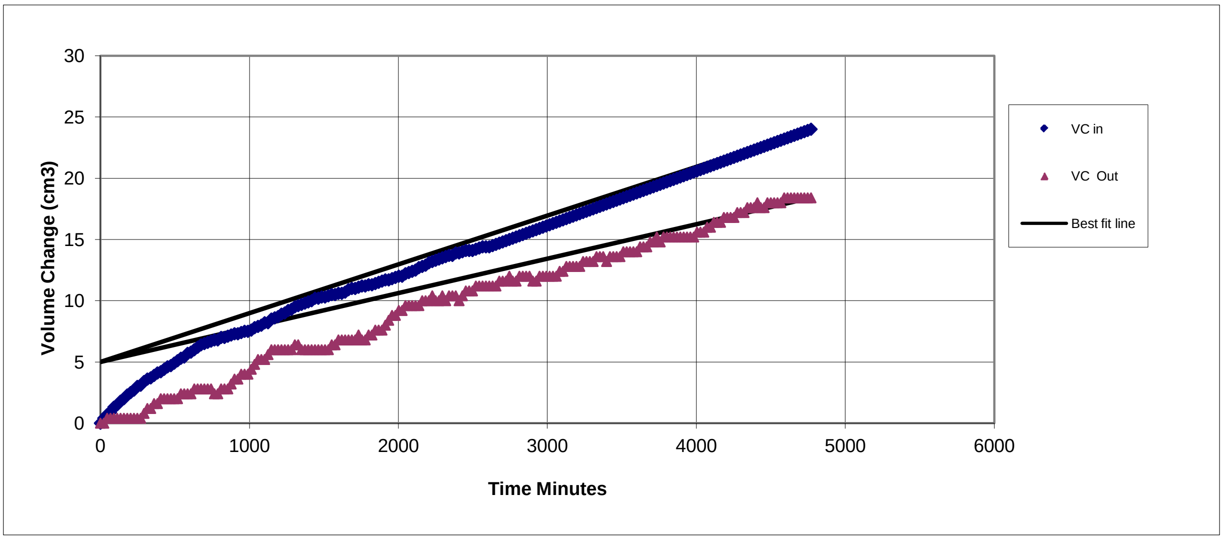
Specimen Details

Borehole	19L
Sample No.	
Depth m	
Date	23/05/2015

Consolidation Stage



Permeability Stage



DP Wang

Checked and Approved By

23/05/15
Date

Client Ref

GSTL
GEO Site & Testing Services Limited

Contract No

26884

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		20A
Sample No.		
Depth	m	
Date		23/05/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Dark greyish brown sl clayey very firm SILT

Initial Specimen Conditions

Height	mm	155.00
Diameter	mm	101.00
Area	mm^2	8011.85
Volume	cm^3	1241.84
Mass	g	1819.40
Dry Mass	g	1111.90
Density	Mg/m^3	1.47
Dry Density	Mg/m^3	0.90
Moisture Content	%	63.6
Voids Ratio		1.960
Specific Gravity	kN/m^3	2.65
(assumed/measured)		assumed

Final Specimen Conditions

Moisture Content	%	64.75
Density	Mg/m^3	1.55
Dry Density	Mg/m^3	0.94

Test Setup

Date started	15/05/2015
Date Finished	22/05/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	P8
Cell Number	C8

D P Evans

Checked and Approved By

23/05/15
Date

Client Ref

Contract No

26884

GSTL
GEO Site & Testing Services Limited

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		20A
Sample No.		
Depth	m	
Date		23/05/2015

Saturation

Cell Pressure Incr.	kPa	50.00
Back Pressure Incr.	kPa	48.00
Differential Pressure	kPa	2.00
Final Cell Pressure	kPa	300.00
Final Pore Pressure	kPa	289.00
Final B Value		0.96

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	300.00
Back Pressure	kPa	200.00
Excess Pore Pressure	kPa	100.00
Pore Pressure at End	kPa	200.00
Consolidated Volume	cm^3	1182.84
Consolidated Height	mm	152.55
Consolidated Area	mm^2	7758.08
Vol. Compressibility	m^2/MN	5.5243
Consolidation Coef.	m^2/yr.	0.4751
Final Voids Ratio		1.819

Permeability

Cell Pressure	kPa	300.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00261
Average Temperature	'C	20

Vertical Permeability I m/s	**4.17 x 10-10**

D P Evans

Checked and Approved By

23/05/15
Date

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UKAS TESTING 2788

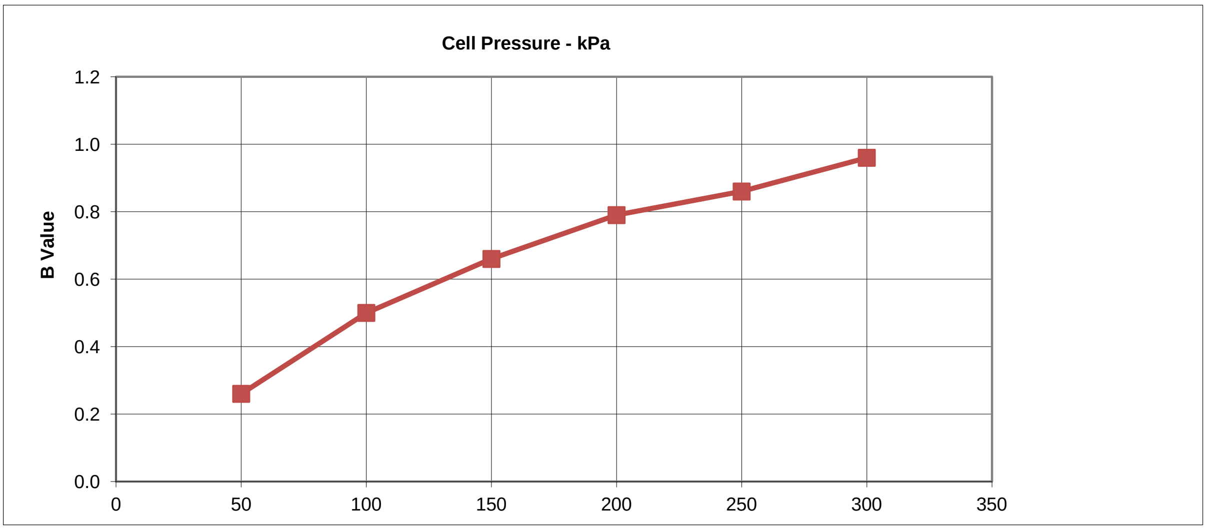
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

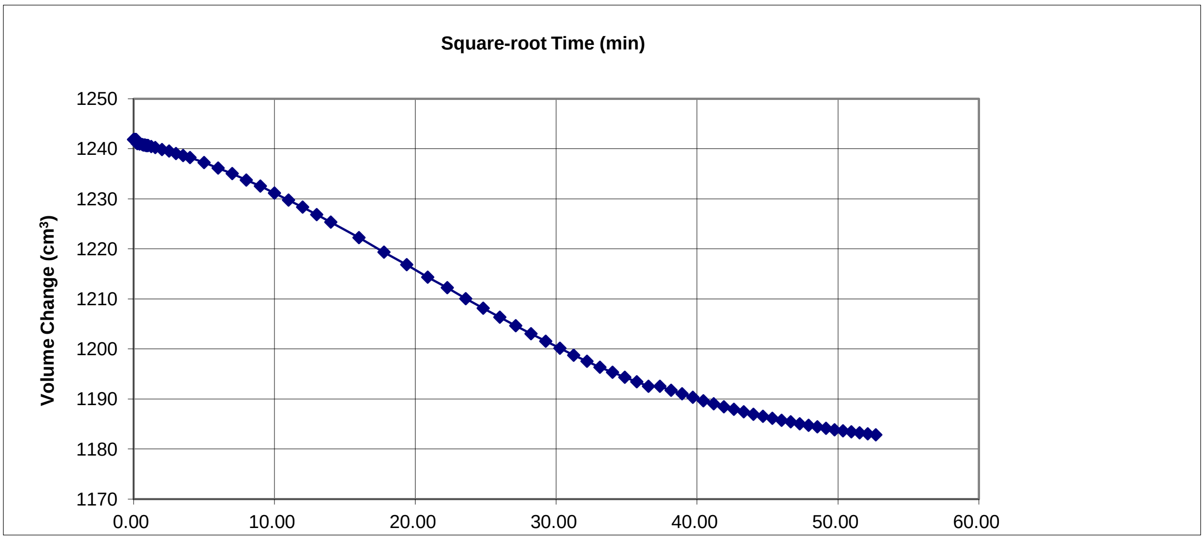
Specimen Details

Borehole	20A
Sample No.	
Depth m	
Date	23/05/2015

Saturation Stage



Consolidation Stage



D P Grant

Checked and Approved By

23/05/15
Date

Client Ref

Contract No

26884

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UKAS TESTING 2788

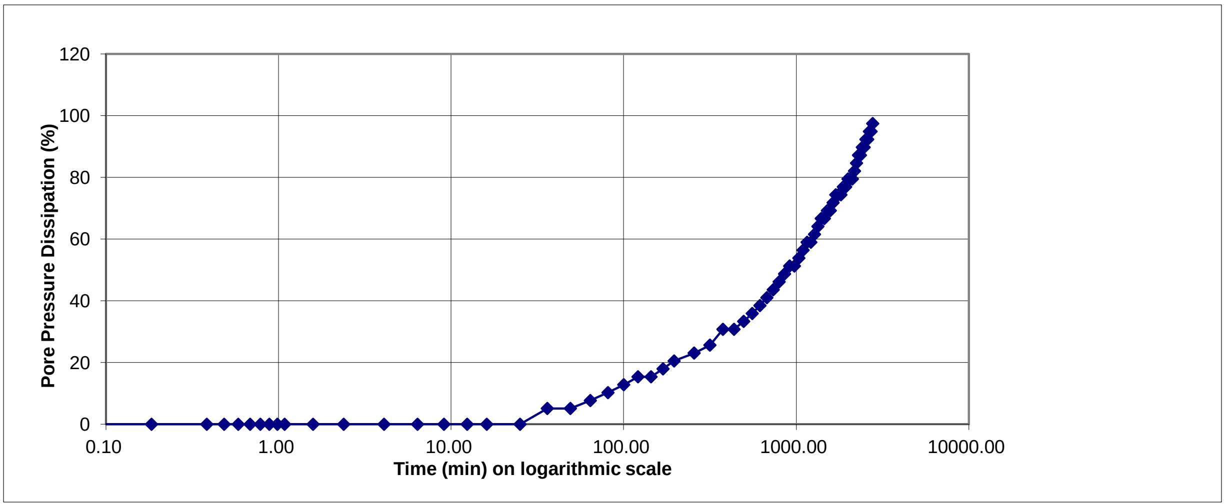
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

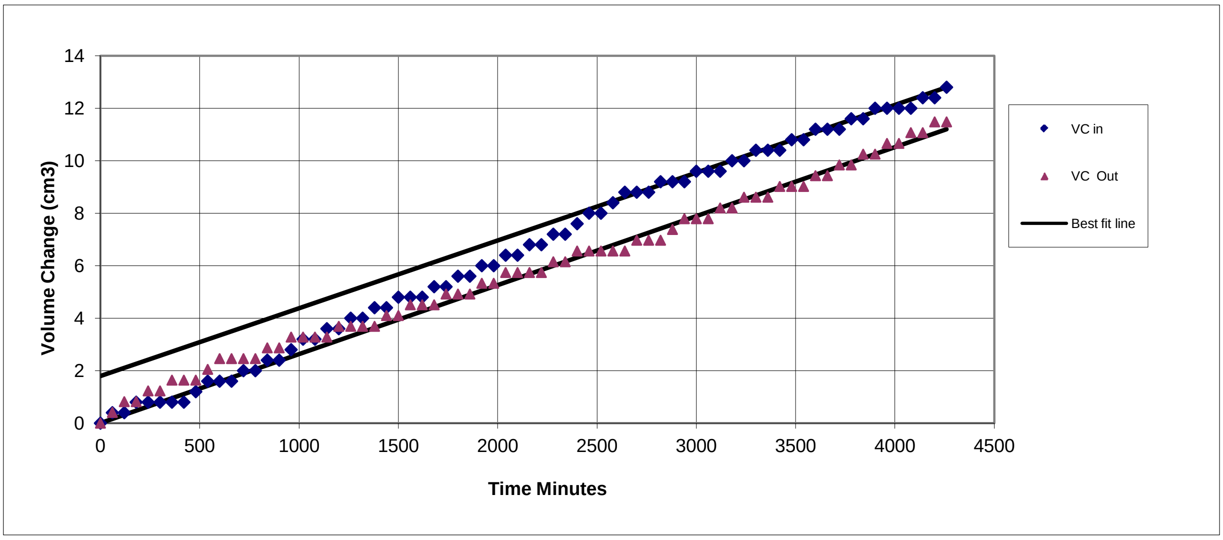
Specimen Details

Borehole	20A
Sample No.	
Depth m	
Date	23/05/2015

Consolidation Stage



Permeability Stage



DP Evans

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23/05/15
Date

Client Ref

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GEO Site & Testing Services Limited

Contract No

26884

UKAS TESTING 2788

Laboratory Report

GEO Site & Testing Services Ltd

2788

Contract Number: 26767

Client's Reference:

Report Date: **13-05-2015**

Client **Deep Soil Mixing Ltd**
Deep Soil Mixing Ltd,
Birchwood,
Westoning Road,
Greenfield,
Bedfordshire,
MK45 5BH

Contract Title: **Unknown**
For the attention of: **Colin Critchlow**

Date Received: **28-04-2015**
Date Commenced: **28-04-2015**
Date Completed: **13-05-2015**

Test Description	Qty
Determination of Permeability in a triaxial cell BS1377 Part 6 :1990 Clause 6 - * UKAS	2
Extra Over Item (4 Days Over)	4
Quick Undrained Triaxial Compression test - single specimen at one confining pressure (100mm or 38mm diameter) 1377 : 1990 Part 7 : 8 - * UKAS	1
Disposal of Samples on Project	1

Notes: **Observations and Interpretations are outside the UKAS Accreditation**
*** - denotes test included in laboratory scope of accreditation**
 # - denotes test carried out by approved contractor
@ - denotes non accredited tests

Approved Signatories:
Alex Wynn (Associate Director) - Benjamin Sharp (Contracts Manager) - D V Edwards (Managing Director)
Emma Williams (Office Manager) - Paul Evans (Quality/Technical Manager)

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		20F
Sample No.		1
Depth	m	0
Date		12/05/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Greyish brown stiff clayey SILT

Initial Specimen Conditions

Height	mm	102.00
Diameter	mm	102.00
Area	mm^2	8171.28
Volume	cm^3	833.47
Mass	g	1161.80
Dry Mass	g	413.90
Density	Mg/m^3	1.39
Dry Density	Mg/m^3	0.50
Moisture Content	%	180.7
Voids Ratio		4.336
Specific Gravity	kN/m^3	2.65
	(assumed/measured)	assumed

Final Specimen Conditions

Moisture Content	%	181.15
Density	Mg/m^3	1.44
Dry Density	Mg/m^3	0.51

Test Setup

Date started	05/05/2015
Date Finished	11/05/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	P12
Cell Number	C12

D P Evans

Checked and Approved By

12/05/15
Date

Client Ref

Contract No

26767

GSTL
GEO Site & Testing Services Limited

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		20F
Sample No.		1
Depth	m	0
Date		12/05/2015

Saturation

Cell Pressure Incr.	kPa	100.00
Back Pressure Incr.	kPa	98.00
Differential Pressure	kPa	2.00
Final Cell Pressure	kPa	300.00
Final Pore Pressure	kPa	291.00
Final B Value		0.98

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	300.00
Back Pressure	kPa	200.00
Excess Pore Pressure	kPa	91.00
Pore Pressure at End	kPa	200.00
Consolidated Volume	cm^3	808.87
Consolidated Height	mm	101.00
Consolidated Area	mm^2	8010.50
Vol. Compressibility	m^2/MN	25.4117
Consolidation Coef.	m^2/yr.	0.3243
Final Voids Ratio		4.179

Permeability

Cell Pressure	kPa	300.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00189
Average Temperature	'C	20

Vertical Permeability Kv	**m/s**	**1.93 x 10-10**

D P Evans

Checked and Approved By

12/05/15
Date

Client Ref

Contract No

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UKAS TESTING
2788

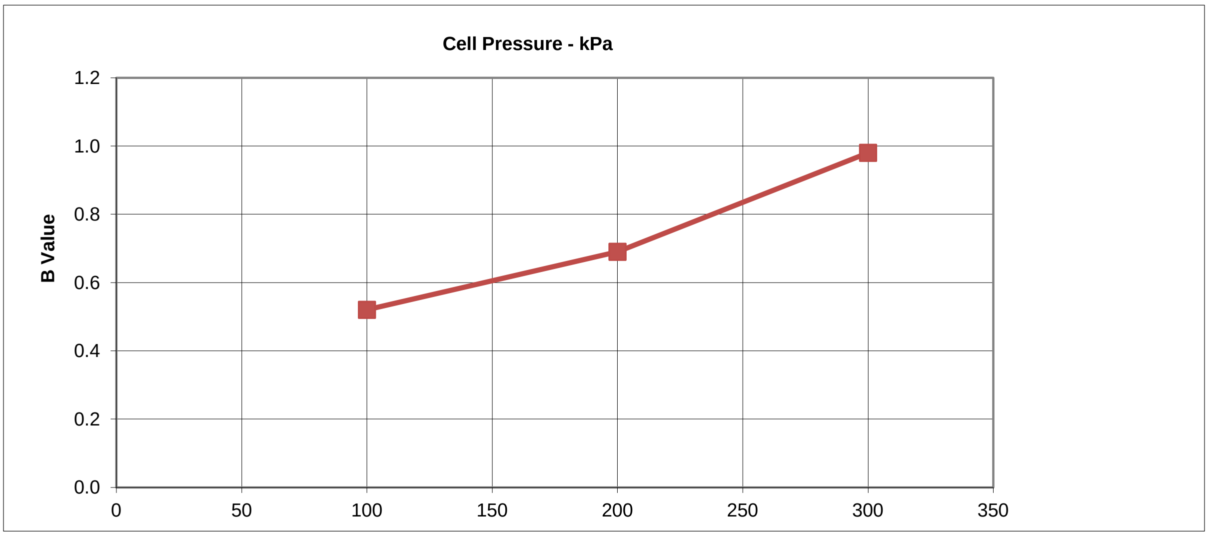
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

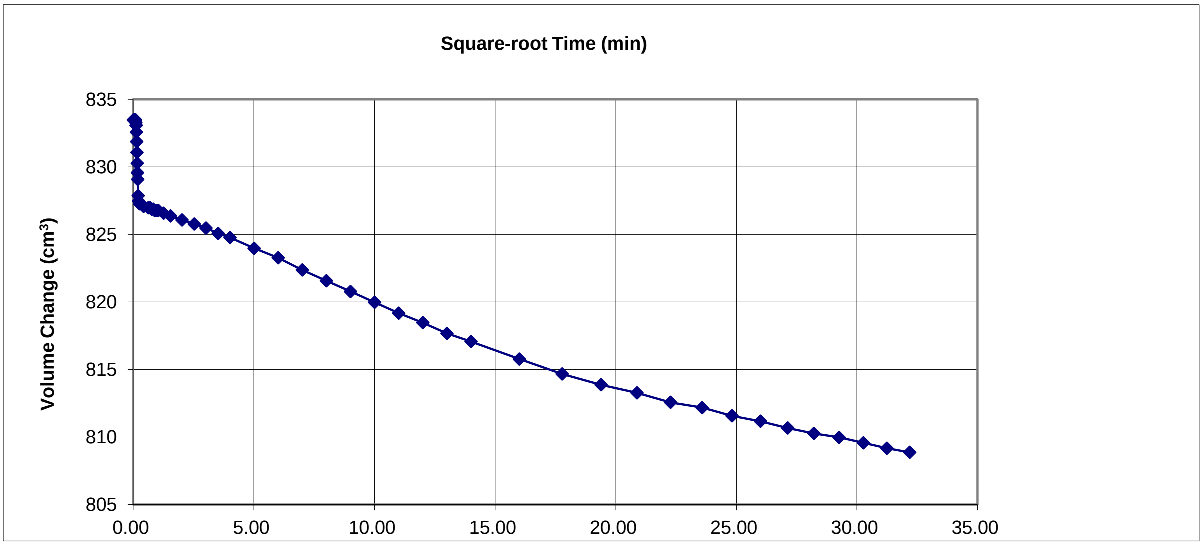
Specimen Details

Borehole		20F
Sample No.		1
Depth	m	0
Date		12/05/2015

Saturation Stage



Consolidation Stage



DP Evans

12/05/15

Checked and Approved By **Date**

Client Ref

Contract No

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GEO Site & Testing Services Limited

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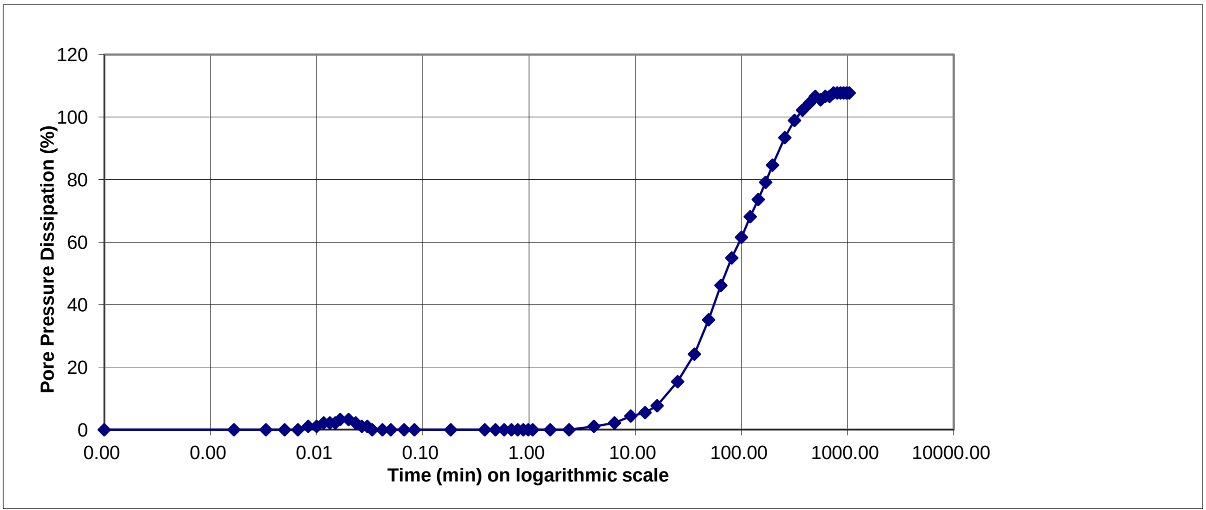
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

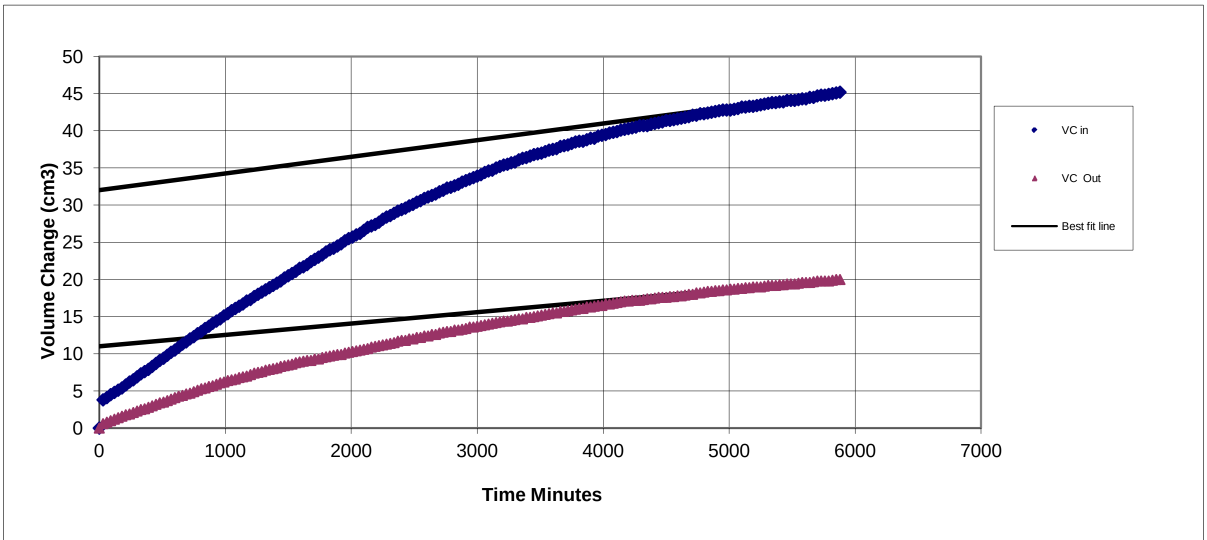
Specimen Details

Borehole		20F
Sample No.		1
Depth	m	0
Date		12/05/2015

Consolidation Stage



Permeability Stage



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12/05/15

Date

Client Ref

Contract No

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UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		20F
Sample No.		2
Depth	m	
Date		12/05/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Greyish brown stiff clayey SILT

Initial Specimen Conditions

Height	mm	188.00
Diameter	mm	99.00
Area	mm^2	7697.69
Volume	cm^3	1447.17
Mass	g	1961.80
Dry Mass	g	943.30
Density	Mg/m^3	1.36
Dry Density	Mg/m^3	0.65
Moisture Content	%	108.0
Voids Ratio		3.066
Specific Gravity	kN/m^3	2.65
	(assumed/measured)	assumed

Final Specimen Conditions

Moisture Content	%	108.66
Density	Mg/m^3	1.38
Dry Density	Mg/m^3	0.66

Test Setup

Date started	05/05/2015
Date Finished	11/05/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	P8
Cell Number	C8

D P Evans

Checked and Approved By

12/05/15
Date

Client Ref

Contract No

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UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		20F
Sample No.		2
Depth	m	
Date		12/05/2015

Saturation

Cell Pressure Incr.	kPa	100.00
Back Pressure Incr.	kPa	101.00
Differential Pressure	kPa	-1.00
Final Cell Pressure	kPa	200.00
Final Pore Pressure	kPa	195.00
Final B Value		1.01

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	200.00
Back Pressure	kPa	100.00
Excess Pore Pressure	kPa	95.00
Pore Pressure at End	kPa	100.00
Consolidated Volume	cm^3	1427.67
Consolidated Height	mm	187.16
Consolidated Area	mm^2	7628.54
Vol. Compressibility	m^2/MN	2.9126
Consolidation Coef.	m^2/yr.	0.1418
Final Voids Ratio		3.011

Permeability

Cell Pressure	kPa	200.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00124
Average Temperature	'C	20

Vertical Permeability Kv	**m/s**	**2.47 x 10-10**

DP Evans

Checked and Approved By

12/05/15
Date

Client Ref

Contract No

26767

GSTL
GEO Site & Testing Services Limited

UKAS TESTING 2788

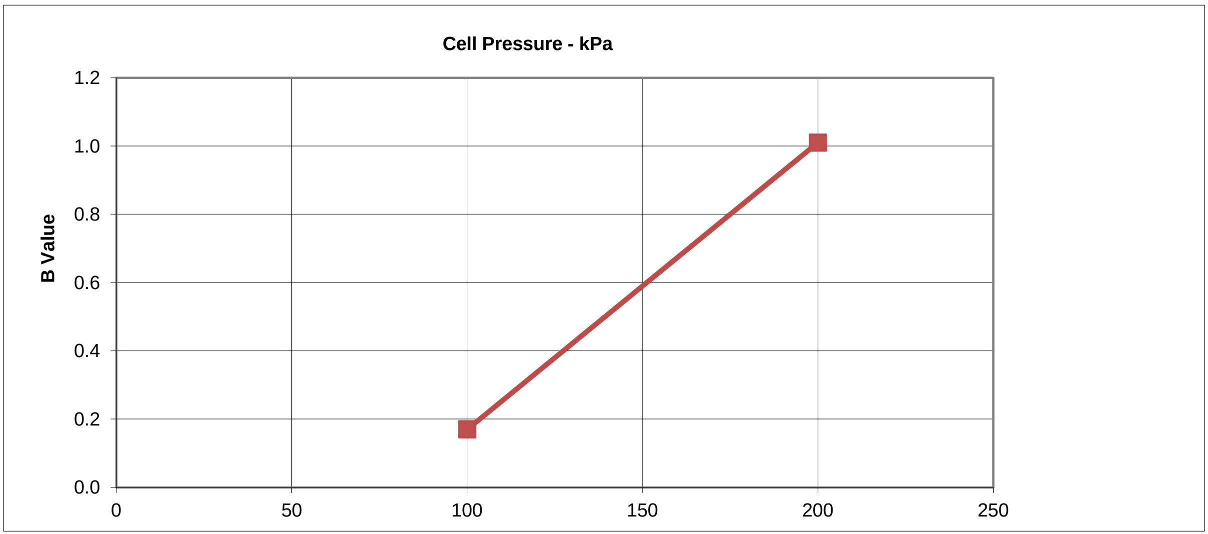
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

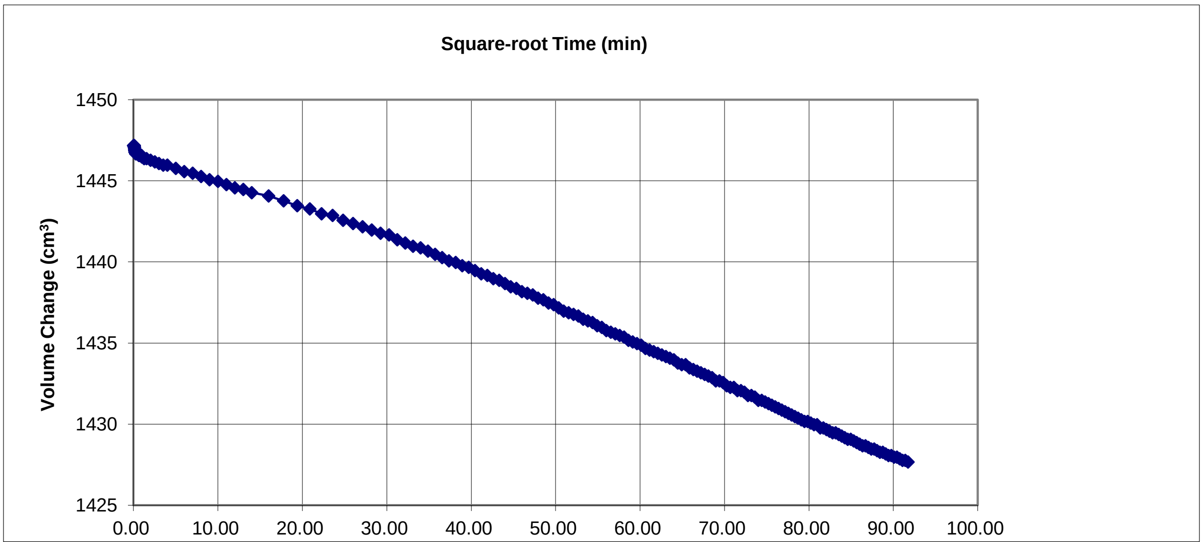
Specimen Details

Borehole		20F
Sample No.		2
Depth	m	
Date		12/05/2015

Saturation Stage



Consolidation Stage



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GEO Site & Testing Services Limited

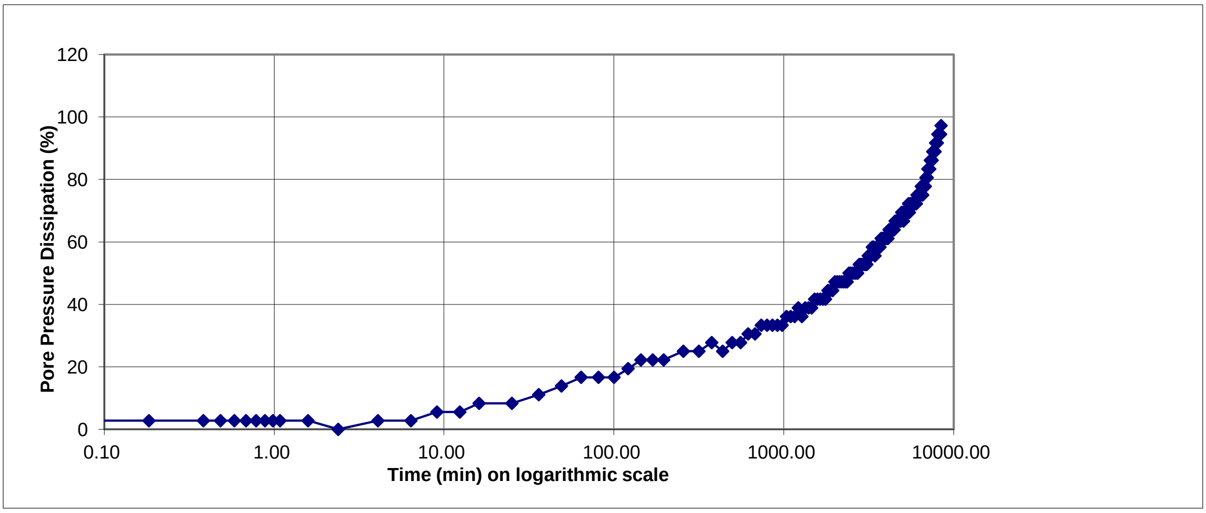
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

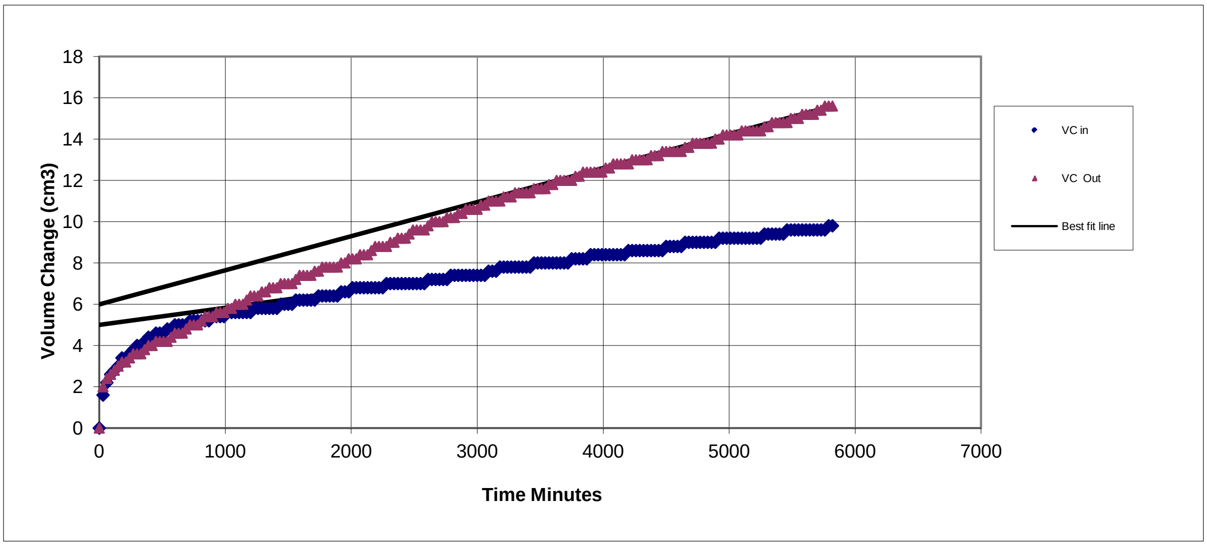
Specimen Details

Borehole		20F
Sample No.		2
Depth	m	
Date		12/05/2015

Consolidation Stage



Permeability Stage



Checked and Approved By DP Gans

12/05/15
Date

Client Ref

Contract No

26767

GEO Site & Testing Services Limited

UKAS TESTING 2788

Laboratory Report

UKAS TESTING 2788

GSTL

GEO Site & Testing Services Ltd

Contract Number: 26678

Client's Reference:

Report Date: **06-05-2015**

Client **Deep Soil Mixing Ltd**
Deep Soil Mixing Ltd,
Birchwood,
Westoning Road,
Greenfield,
Bedfordshire,
MK45 5BH

Contract Title: **Unknown**
For the attention of: **George Olney**

Date Received: **22-04-2015**
Date Commenced: **22-04-2015**
Date Completed: **06-05-2015**

Test Description	Qty
Determination of Permeability in a triaxial cell BS1377 Part 6 :1990 Clause 6 - * UKAS	2
Disposal of Samples on Project	1

Notes: **Observations and Interpretations are outside the UKAS Accreditation**
*** - denotes test included in laboratory scope of accreditation**
 # - denotes test carried out by approved contractor
@ - denotes non accredited tests

Approved Signatories:
Alex Wynn (Associate Director) - Benjamin Sharp (Contracts Manager) - D V Edwards (Managing Director)
Emma Williams (Office Manager) - Paul Evans (Quality/Technical Manager)

GEO Site & Testing Services Ltd
Unit 4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN
Tel: 01554 784040 Fax: 01554 784041 info@geo.uk.com geo.uk.com

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		21D
Sample No.		1
Depth	m	
Date		06/05/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Light greyish brown stiff clayey SILT

Initial Specimen Conditions

Height	mm	131.00
Diameter	mm	101.00
Area	mm^2	8011.85
Volume	cm^3	1049.55
Mass	g	1451.40
Dry Mass	g	785.20
Density	Mg/m^3	1.38
Dry Density	Mg/m^3	0.75
Moisture Content	%	84.8
Voids Ratio		2.542
Specific Gravity	kN/m^3	2.65
(assumed/measured)		assumed

Final Specimen Conditions

Moisture Content	%	93.36
Density	Mg/m^3	1.41
Dry Density	Mg/m^3	0.73

Test Setup

Date started	29/04/2015
Date Finished	05/05/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	P4
Cell Number	C4

D P Evans

Checked and Approved By

06/05/15
Date

Client Ref

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GEO Site & Testing Services Limited

Contract No

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UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		21D
Sample No.		1
Depth	m	
Date		06/05/2015

Saturation

Cell Pressure Incr.	kPa	50.00
Back Pressure Incr.	kPa	48.00
Differential Pressure	kPa	2.00
Final Cell Pressure	kPa	600.00
Final Pore Pressure	kPa	583.40
Final B Value		0.96

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	600.00
Back Pressure	kPa	500.00
Excess Pore Pressure	kPa	100.00
Pore Pressure at End	kPa	500.00
Consolidated Volume	cm^3	1030.95
Consolidated Height	mm	130.23
Consolidated Area	mm^2	7917.19
Vol. Compressibility	m^2/MN	3.4956
Consolidation Coef.	$m^2/yr.$	0.1772
Final Voids Ratio		2.479

Permeability

Cell Pressure	kPa	600.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00337
Average Temperature	'C	20

Vertical Permeability I m/s	**4.51 x 10-10**

D P Evans

Checked and Approved By

06/05/15
Date

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GSTL
GEO Site & Testing Services Limited

UKAS TESTING 2788

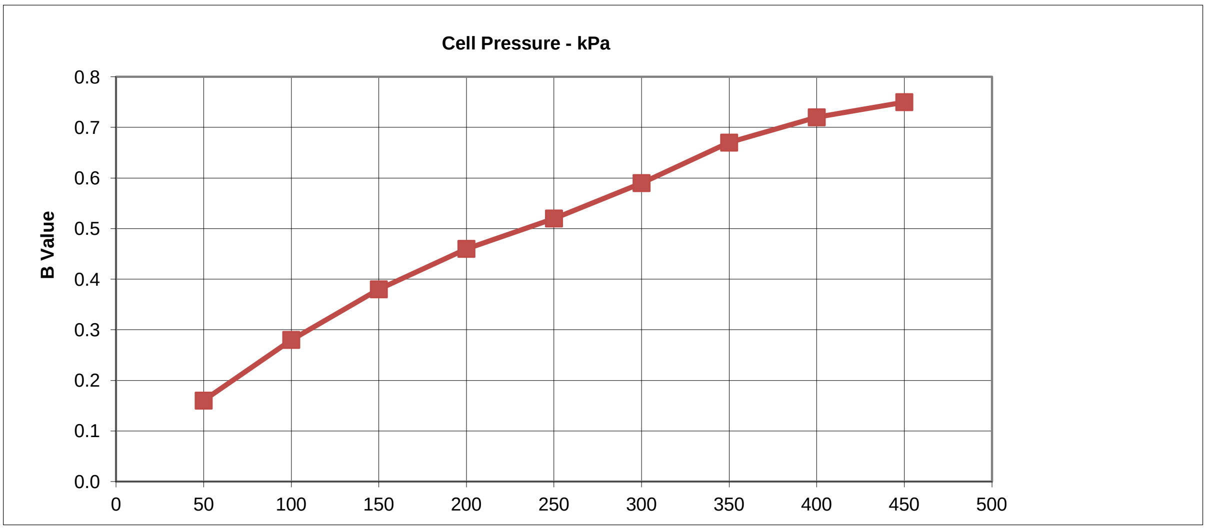
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

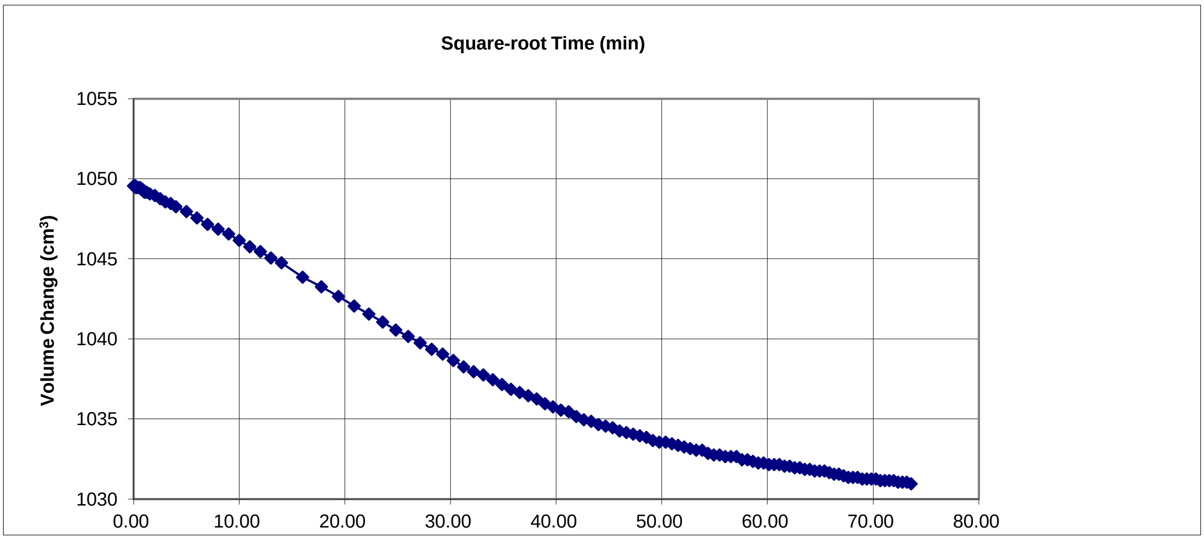
Specimen Details

Borehole		21D
Sample No.		1
Depth	m	
Date		06/05/2015

Saturation Stage



Consolidation Stage



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Client Ref

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UKAS TESTING 2788

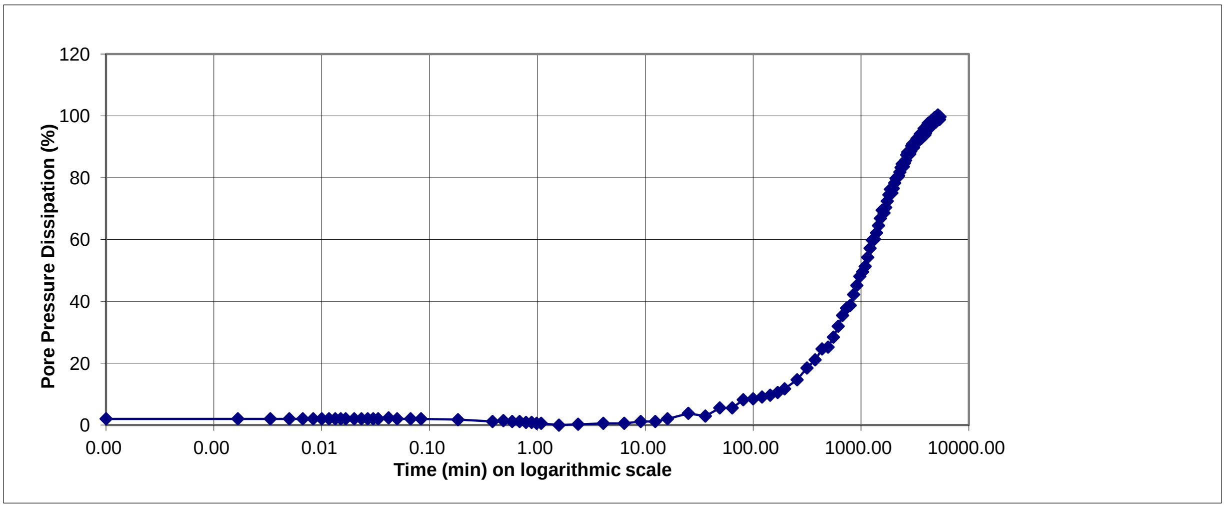
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

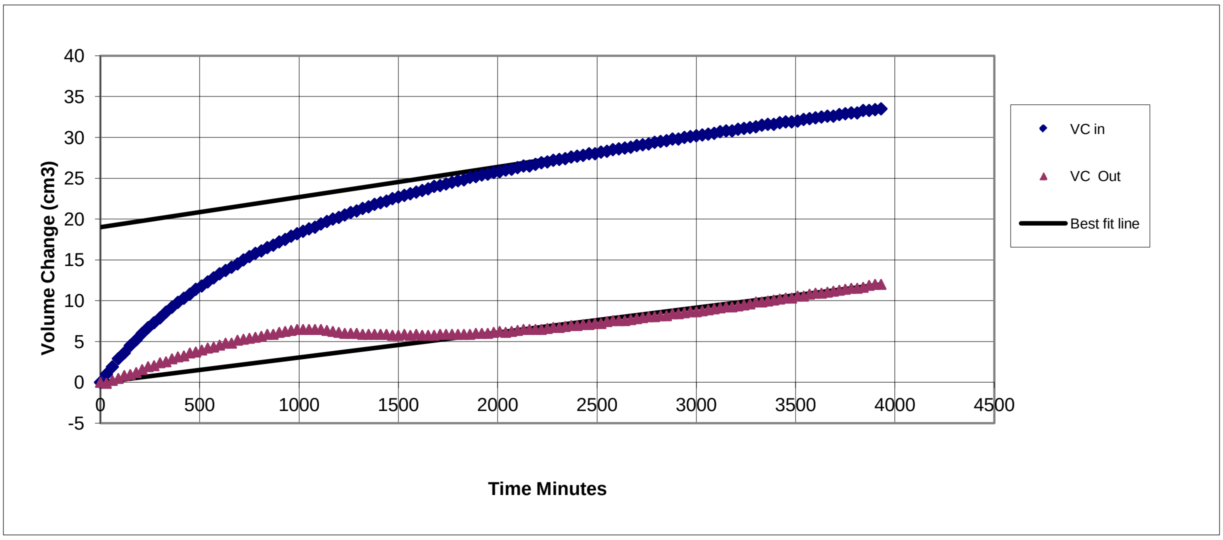
Specimen Details

Borehole	21D
Sample No.	1
Depth m	
Date	06/05/2015

Consolidation Stage



Permeability Stage



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Checked and Approved By

06/05/15
Date

Client Ref

Contract No

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UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		21D
Sample No.		2
Depth	m	0
Date		06/05/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Light greyish brown stiff clayey SILT

Initial Specimen Conditions

Height	mm	130.00
Diameter	mm	100.00
Area	mm^2	7853.98
Volume	cm^3	1021.02
Mass	g	1419.50
Dry Mass	g	781.90
Density	Mg/m^3	1.39
Dry Density	Mg/m^3	0.77
Moisture Content	%	81.5
Voids Ratio		2.460
Specific Gravity	kN/m^3	2.65
	(assumed/measured)	assumed

Final Specimen Conditions

Moisture Content	%	83.97
Density	Mg/m^3	1.52
Dry Density	Mg/m^3	0.83

Test Setup

Date started	29/04/2015
Date Finished	05/05/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	P12
Cell Number	C12

DP Gian

Checked and Approved By

06/05/15
Date

Client Ref

Contract No

UKAS TESTING 2788

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GSTL
GEO Site & Testing Services Limited

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		21D
Sample No.		2
Depth	m	0
Date		06/05/2015

Saturation

Cell Pressure Incr.	kPa	100.00
Back Pressure Incr.	kPa	102.00
Differential Pressure	kPa	-2.00
Final Cell Pressure	kPa	300.00
Final Pore Pressure	kPa	296.00
Final B Value		1.02

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	300.00
Back Pressure	kPa	200.00
Excess Pore Pressure	kPa	96.00
Pore Pressure at End	kPa	200.00
Consolidated Volume	cm^3	945.12
Consolidated Height	mm	126.78
Consolidated Area	mm^2	7464.75
Vol. Compressibility	m^2/MN	51.4476
Consolidation Coef.	m^2/yr.	0.7744
Final Voids Ratio		2.203

Permeability

Cell Pressure	kPa	300.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00303
Average Temperature	'C	20

Vertical Permeability Kv	**m/s**	**4.18 x 10-10**

D P Evans

Checked and Approved By

06/05/15
Date

Client Ref

Contract No

26678

GSTL
GEO Site & Testing Services Limited

UKAS TESTING
2788

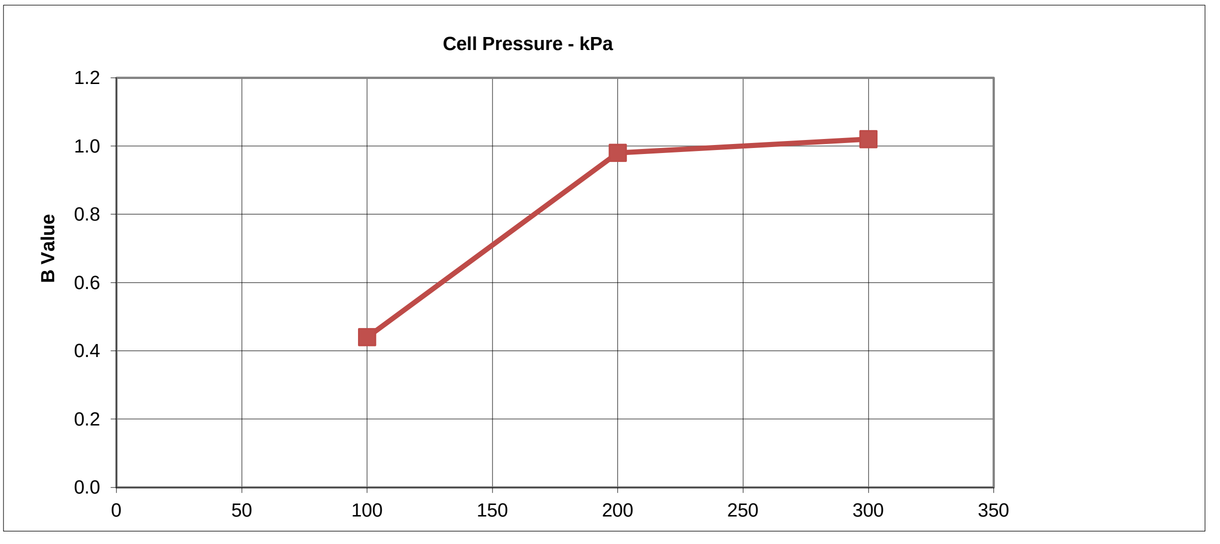
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

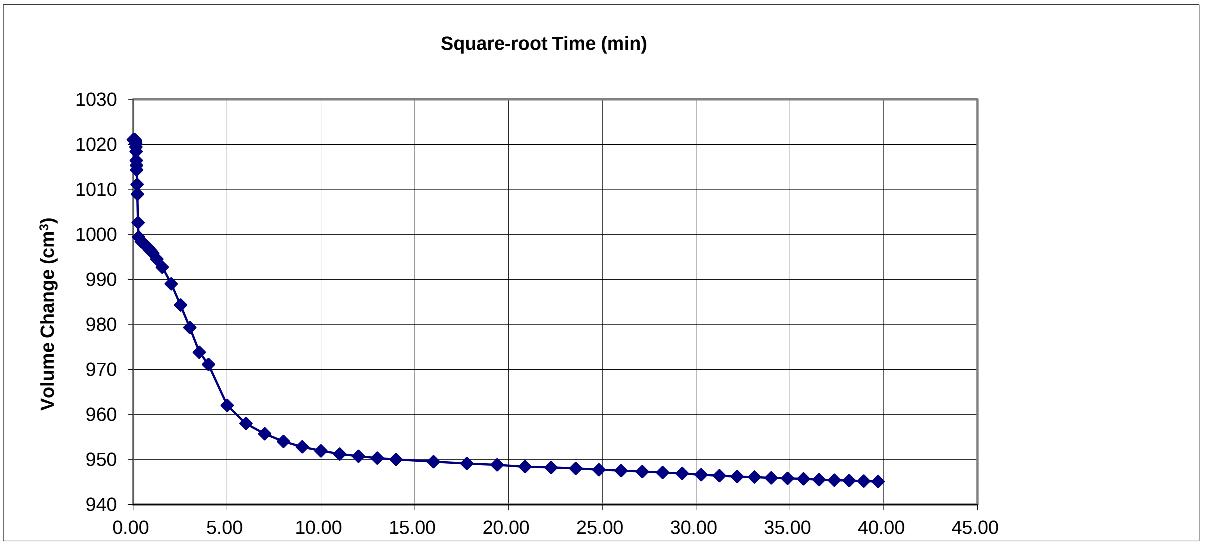
Specimen Details

Borehole		21D
Sample No.		2
Depth	m	0
Date		06/05/2015

Saturation Stage



Consolidation Stage



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Checked and Approved By

06/05/15
Date

Client Ref

Contract No

26678

GSTL
GEO Site & Testing Services Limited

UKAS TESTING 2788

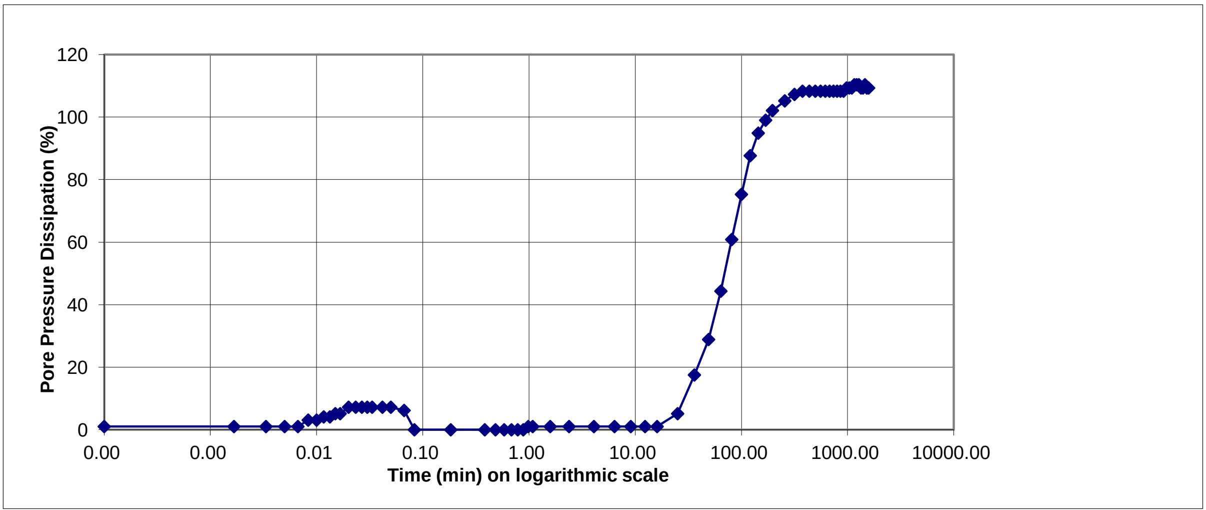
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

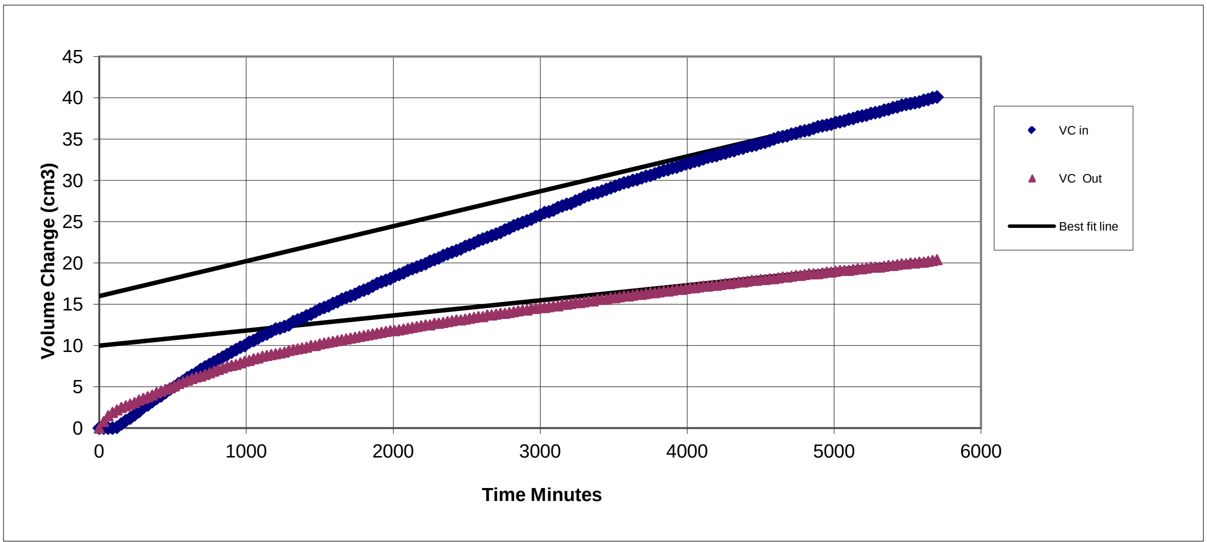
Specimen Details

Borehole		21D
Sample No.		2
Depth	m	0
Date		06/05/2015

Consolidation Stage



Permeability Stage



DP [signature]

Checked and Approved By

06/05/15
Date

Client Ref

GSTL
GEO Site & Testing Services Limited

Contract No

26678

UKAS TESTING 2788

Deep Soil Mixing Ltd
Newport Docksway

Date: 15/04/2015

Drawn by: ER

Template Issue: 4

Filename: J22073 / PERM / - _22D_pt.XLS

Date: 15/04/2015

Date: 15/04/2015

Checked by: RMB

Approved by: RMB

INITIAL CONDITIONS		
Initial sample height	(mm)	100.1
Initial sample diameter	(mm)	100.6
Sample condition		Compacted
Specimen orientation		Vertical
Preparation method		BS 1377: 1990: Part 6: Clause 5.3
Initial bulk density	(Mg/m^3)	1.37
Initial dry density	(Mg/m^3)	0.65
Initial moisture content	(%)	111
SATURATION		
Method of saturation		Constant moisture content
Value of pore pressure coefficient B achieved		0.96
PERMEABILITY		
Cell pressure	(kPa)	500
Top pressure	(kPa)	405
Base pressure	(kPa)	395
FINAL CONDITIONS		
Final bulk density	(Mg/m^3)	1.37
Final moisture content	(%)	108
PERMEABILITY CALCULATION		
Hydraulic gradient across sample		10.2
Coefficient of permeability at 20ºC	(m/s)	8.9E-10

Borehole	:	-
Sample	:	22D
Depth (m)	:	-

Tested in accordance with BS 1377: Part 6: 1990: Clause 6

CONSTANT HEAD TRIAXIAL
PERMEABILITY TEST RESULT - VERTICAL

Laboratory Report

GSTL
GEO Site & Testing Services Ltd

Contract Number: 26515

Client's Reference: Report Date:

Client **Deep Soil Mixing Ltd**
Deep Soil Mixing Ltd,
Birchwood,
Westoning Road,
Greenfield,
Bedfordshire,
MK45 5BH

Contract Title: **Unknown**
For the attention of: **Robert McGall**

Date Received: **07-04-2015**
Date Commenced: **07-04-2015**
Date Completed:

Test Description	Qty
Determination of Permeability in a triaxial cell BS1377 Part 6 :1990 Clause 6 - * UKAS	3
Extra Over Item (4 Days Over)	14
Disposal of Samples on Project	1

Notes: **Observations and Interpretations are outside the UKAS Accreditation**
*** - denotes test included in laboratory scope of accreditation**
 # - denotes test carried out by approved contractor
@ - denotes non accredited tests

Approved Signatories:
Alex Wynn (Associate Director) - Benjamin Sharp (Contracts Manager) - D V Edwards (Managing Director)
Emma Williams (Office Manager) - Paul Evans (Quality/Technical Manager)

GEO Site & Testing Services Ltd
Unit 4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN
Tel: 01554 784040 Fax: 01554 784041 info@geo.uk.com geo.uk.com

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		23B
Sample No.		
Depth	m	0
Date		20/04/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Dark greyish brown stiff silty CLAY

Initial Specimen Conditions

Height	mm	160.00
Diameter	mm	103.00
Area	mm^2	8332.29
Volume	cm^3	1333.17
Mass	g	1850.80
Dry Mass	g	868.20
Density	Mg/m^3	1.39
Dry Density	Mg/m^3	0.65
Moisture Content	%	113.2
Voids Ratio		3.069
Specific Gravity	kN/m^3	2.65
	(assumed/measured)	assumed

Final Specimen Conditions

Moisture Content	%	113.98
Density	Mg/m^3	1.43
Dry Density	Mg/m^3	0.67

Test Setup

Date started	09/04/2015
Date Finished	18/04/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	P8
Cell Number	C8

D P Evans

Checked and Approved By

20/04/15
Date

Client Ref

Contract No

UKAS TESTING 2788

26515

GSTL GEO Site & Testing Services Limited

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		23B
Sample No.		
Depth	m	0
Date		20/04/2015

Saturation

Cell Pressure Incr.	kPa	50.00
Back Pressure Incr.	kPa	50.00
Differential Pressure	kPa	0.00
Final Cell Pressure	kPa	300.00
Final Pore Pressure	kPa	295.00
Final B Value		1.00

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	300.00
Back Pressure	kPa	200.00
Excess Pore Pressure	kPa	95.00
Pore Pressure at End	kPa	200.00
Consolidated Volume	cm^3	1303.07
Consolidated Height	mm	158.80
Consolidated Area	mm^2	8206.87
Vol. Compressibility	m^2/MN	103.5359
Consolidation Coef.	m^2/yr.	0.2377
Final Voids Ratio		2.977

Permeability

Cell Pressure	kPa	300.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00553
Average Temperature	'C	20

Vertical Permeability Kv	**m/s**	**8.71 x 10-10**

D P Evans

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20/04/15
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GSTL GEO Site & Testing Services Limited

UKAS TESTING 2788

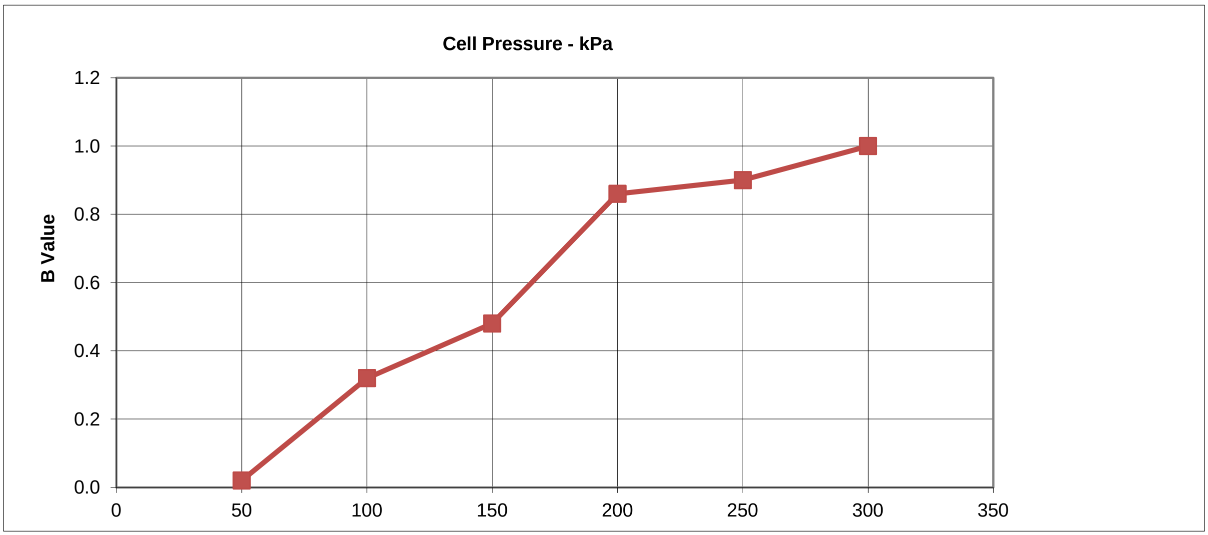
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

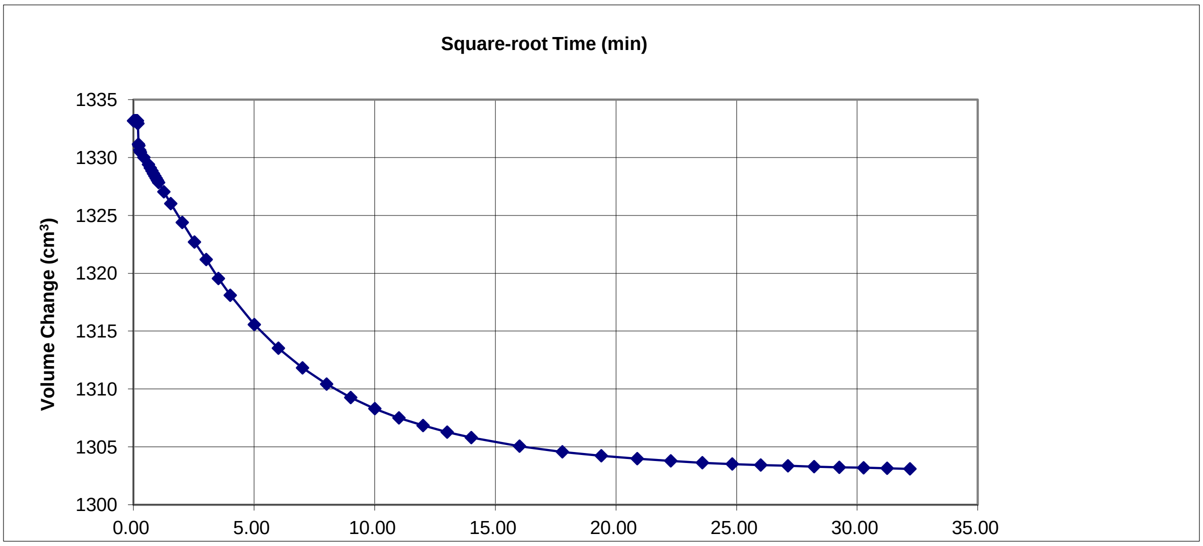
Specimen Details

Borehole		23B
Sample No.		
Depth	m	0
Date		20/04/2015

Saturation Stage



Consolidation Stage



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Contract No

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GEO Site & Testing Services Limited

UKAS TESTING 2788

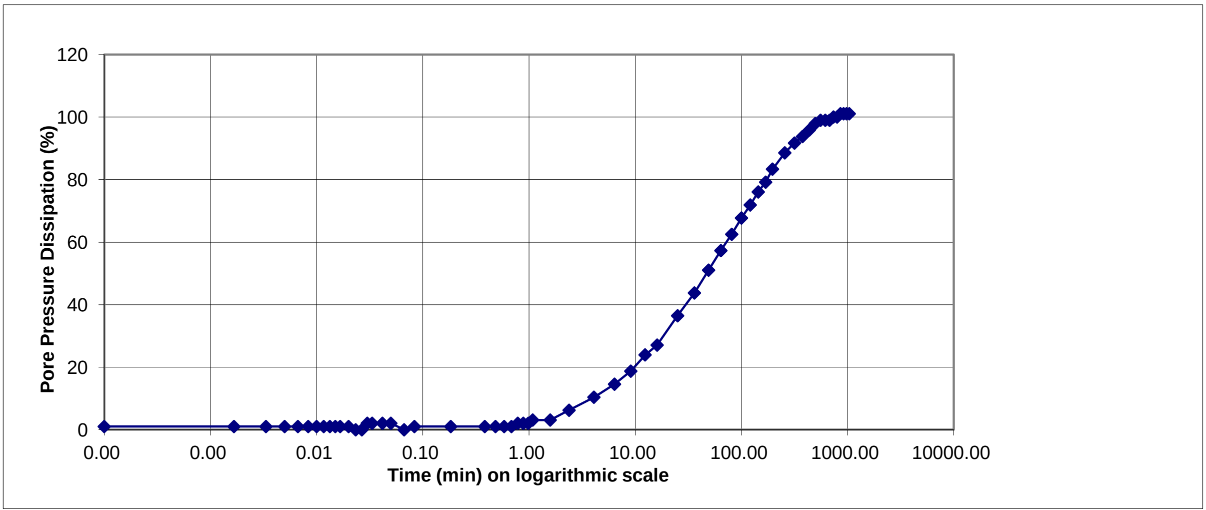
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

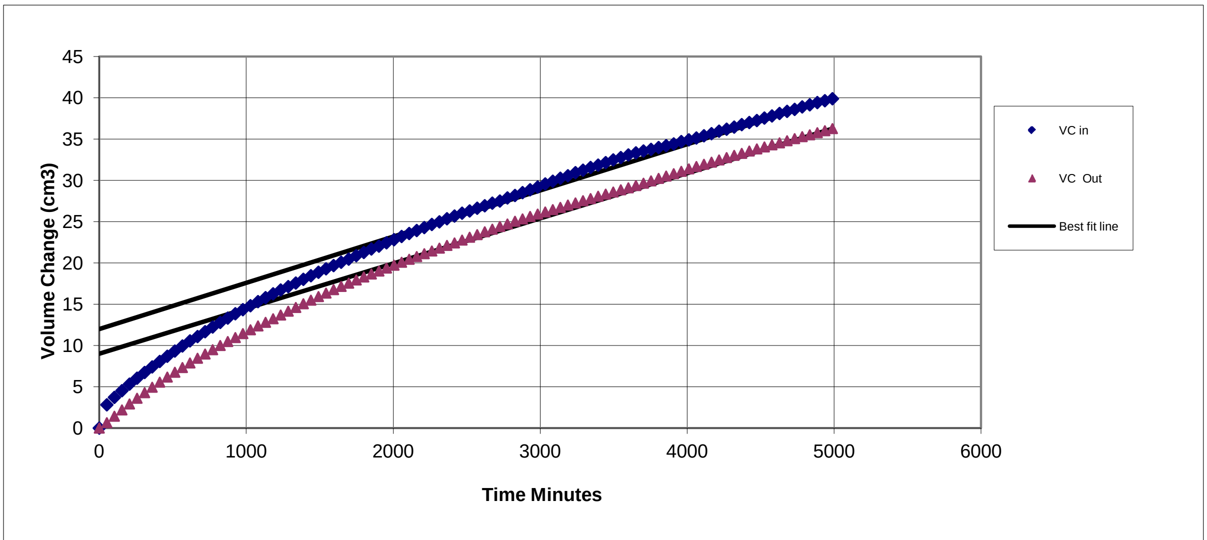
Specimen Details

Borehole		23B
Sample No.		
Depth	m	0
Date		20/04/2015

Consolidation Stage



Permeability Stage



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Checked and Approved By

20/04/15
Date

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Contract No

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GSTL
GEO Site & Testing Services Limited

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		23C
Sample No.		
Depth	m	0
Date		20/04/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Dark greyish brown stiff silty CLAY

Initial Specimen Conditions

Height	mm	130.00
Diameter	mm	100.00
Area	mm^2	7853.98
Volume	cm^3	1021.02
Mass	g	1420.30
Dry Mass	g	662.20
Density	Mg/m^3	1.39
Dry Density	Mg/m^3	0.65
Moisture Content	%	114.5
Voids Ratio		3.086
Specific Gravity	kN/m^3	2.65
	(assumed/measured)	assumed

Final Specimen Conditions

Moisture Content	%	115.54
Density	Mg/m^3	1.54
Dry Density	Mg/m^3	0.71

Test Setup

Date started	09/04/2015
Date Finished	18/04/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	P3
Cell Number	C3

D P Evans

Checked and Approved By

20/04/15
Date

Client Ref

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GEO Site & Testing Services Limited

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		23C
Sample No.		
Depth	m	0
Date		20/04/2015

Saturation

Cell Pressure Incr.	kPa	50.00
Back Pressure Incr.	kPa	51.00
Differential Pressure	kPa	-1.00
Final Cell Pressure	kPa	300.00
Final Pore Pressure	kPa	296.00
Final B Value		1.02

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	300.00
Back Pressure	kPa	200.00
Excess Pore Pressure	kPa	96.00
Pore Pressure at End	kPa	200.00
Consolidated Volume	cm^3	929.02
Consolidated Height	mm	126.10
Consolidated Area	mm^2	7382.19
Vol. Compressibility	m^2/MN	1.7479
Consolidation Coef.	m^2/yr.	0.9386
Final Voids Ratio		2.718

Permeability

Cell Pressure	kPa	300.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00669
Average Temperature	'C	20

Vertical Permeability Kv	**m/s**	**9.31 x 10-10**

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20/04/15
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GEO Site & Testing Services Limited

UKAS TESTING
2788

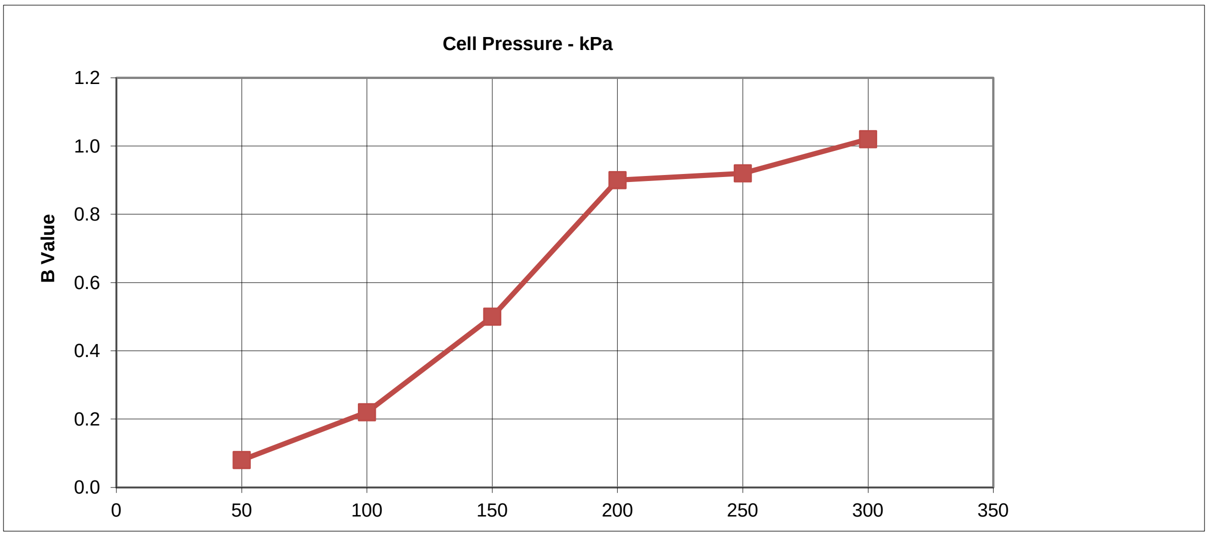
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

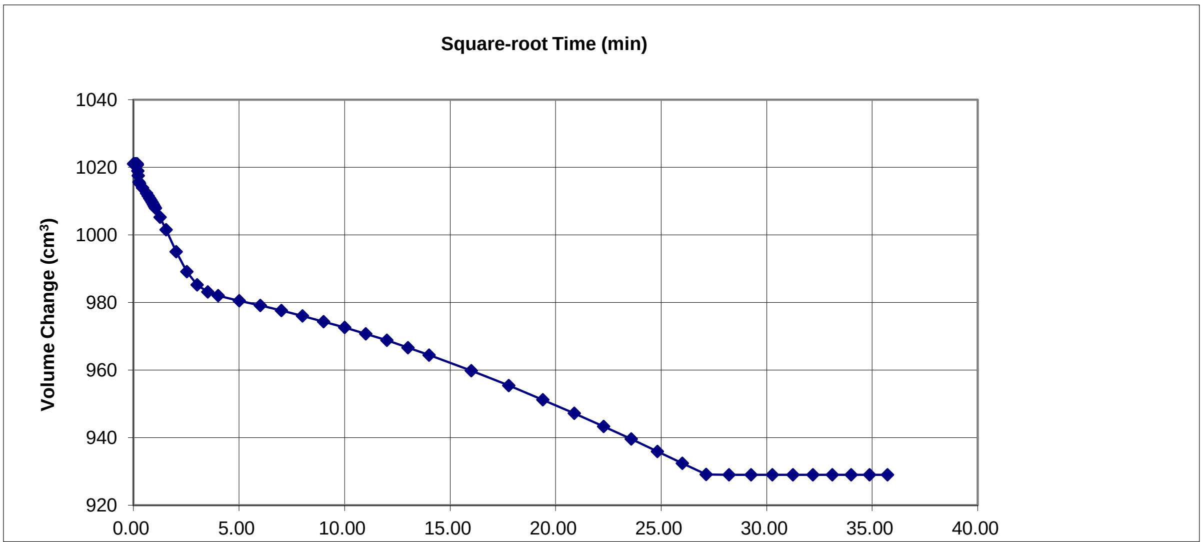
Specimen Details

Borehole		23C
Sample No.		
Depth	m	0
Date		20/04/2015

Saturation Stage



Consolidation Stage



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20/04/15
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UKAS TESTING 2788

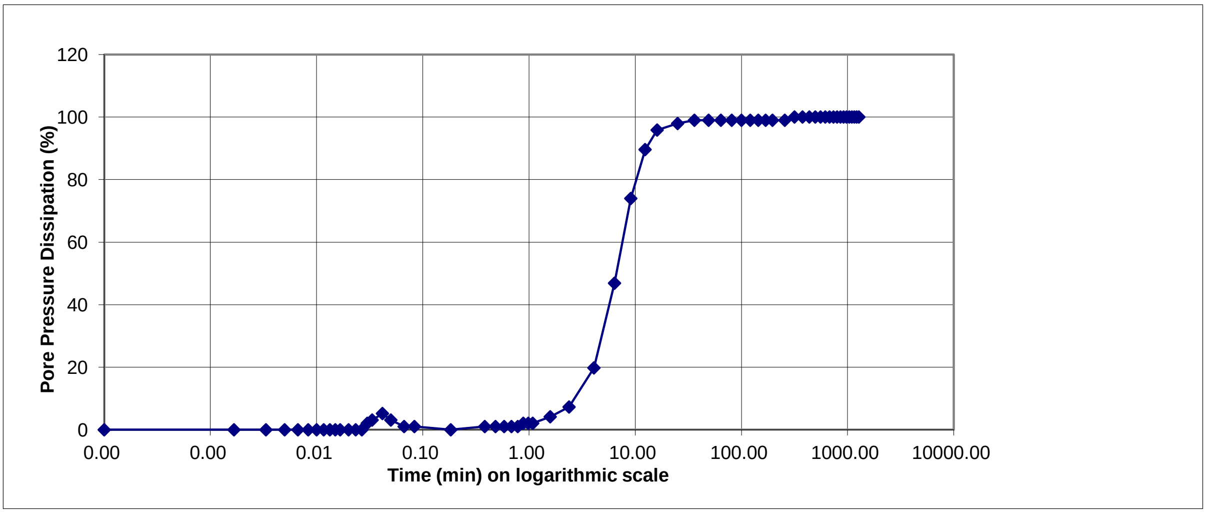
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

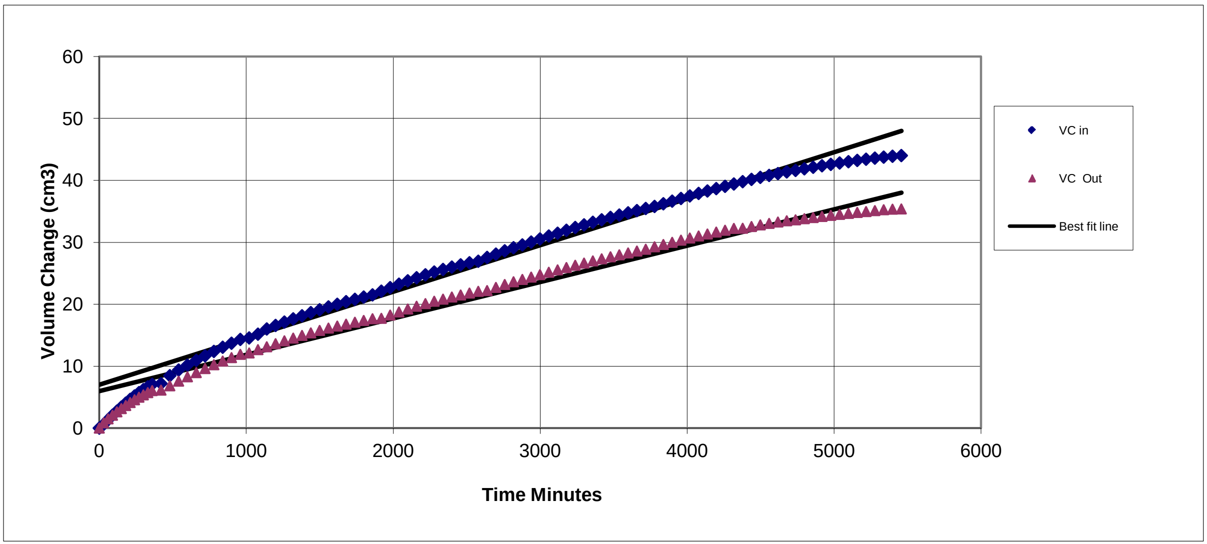
Specimen Details

Borehole		23C
Sample No.		
Depth	m	0
Date		20/04/2015

Consolidation Stage



Permeability Stage



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20/04/15
Date

Client Ref

Contract No

26515

GEO Site & Testing Services Limited

UKAS TESTING 2788

BS1377 : Part 6 : Clause 6 :1990

Determination of Permeability in a Triaxial Cell

Borehole / TP:	WS27	Description:	
Sample No:	-	Firm dark grey CLAY with rare rootlets	
Depth:	GL - 1.00		

SPECIMEN DETAILS	
Depth within original sample	30mm from top
Orientation within original	Vertical
Specimen preparation	Undisturbed

TEST DETAILS			
Cell Preparation		Performed in accordance with Clause 3.5	
		INITIAL	FINAL
Diameter	*mm*	99.4	97.4
Height	*mm*	101.2	99.3
Moisture Content	*%*	53	52
Bulk Density	*Mg/m³*	1.66	1.75
Dry Density	*Mg/m³*	1.09	1.15

SATURATION STAGE		
Saturation initially by constant moisture content, followed by back-pressure assistance using 5-10 kPa differential		
'B' value	0.99	1.00

CONSOLIDATION STAGE		
Effective pressure	*kPa*	100
Volume change	*mL*	44.5

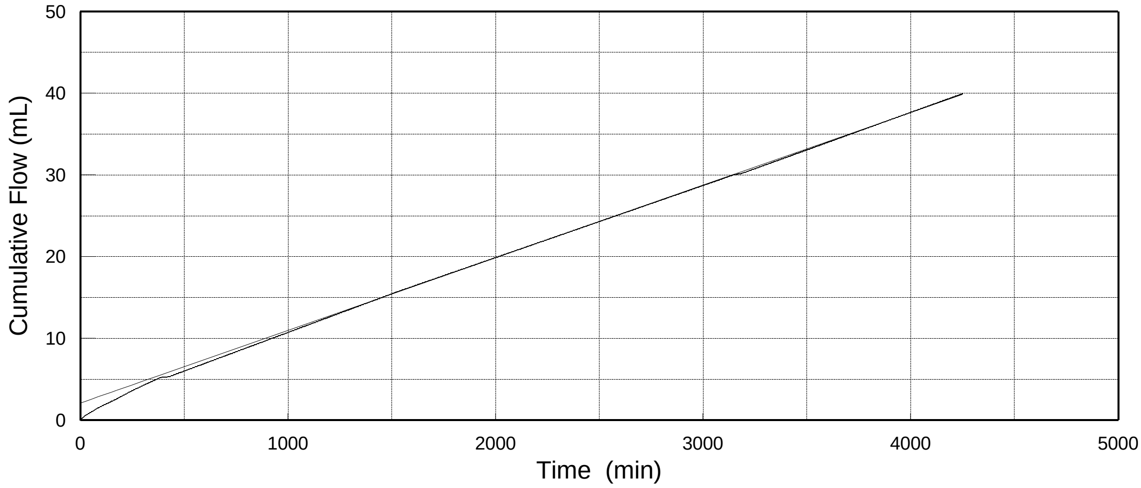
PERMEABILITY STAGE		
Pressure difference across specimen		20
Hydraulic gradient		20.5
Mean effective stress	*kPa*	90

TEST DURATIONS		
Saturation	*days*	2
Consolidation	*days*	1
Flow	*days*	2

RESULT

Coefficient of Permeability

kv at 20°C = 9.7 x 10^{-10} m/s



Checked and Approved	Project Number:	
Initials: RJP	**GEO / 22251**	
Date: 09/03/15	Project Name: **NEWPORT DOCKSWAY** **Project Number 1134**	GEOLABS®

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		24B
Sample No.		
Depth	m	
Date		25/07/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Brown/grey silty CLAY

Initial Specimen Conditions

Height	mm	105.00
Diameter	mm	100.00
Area	mm^2	7853.98
Volume	cm^3	824.67
Mass	g	1110.10
Dry Mass	g	540.90
Density	Mg/m^3	1.35
Dry Density	Mg/m^3	0.66
Moisture Content	%	105.2
Voids Ratio		3.040
Specific Gravity	kN/m^3	2.65
(assumed/measured)		assumed

Final Specimen Conditions

Moisture Content	%	108.91
Density	Mg/m^3	1.39
Dry Density	Mg/m^3	0.66

Test Setup

Date started	16/07/2015
Date Finished	24/07/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPerm 07
Cell Number	CPerm 07

D P Grang

Checked and Approved By

25/07/15
Date

Client Ref

Contract No

27378

GSTL
GEO Site & Testing Services Limited

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		24B
Sample No.		
Depth	m	
Date		25/07/2015

Saturation

Cell Pressure Incr.	kPa	25.00
Back Pressure Incr.	kPa	24.00
Differential Pressure	kPa	1.00
Final Cell Pressure	kPa	200.00
Final Pore Pressure	kPa	191.40
Final B Value		0.96

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	200.00
Back Pressure	kPa	100.00
Excess Pore Pressure	kPa	92.60
Pore Pressure at End	kPa	100.00
Consolidated Volume	cm^3	813.47
Consolidated Height	mm	104.52
Consolidated Area	mm^2	7782.87
Vol. Compressibility	m^2/MN	12.9822
Consolidation Coef.	m^2/yr.	0.1467
Final Voids Ratio		2.985

Permeability

Cell Pressure	kPa	200.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00119
Average Temperature	'C	20

Vertical Permeability I m/s	**1.3 x 10-10**

D P Grant

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25/07/15
Date

Client Ref

Contract No

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GSTL
GEO Site & Testing Services Limited

UKAS TESTING 2788

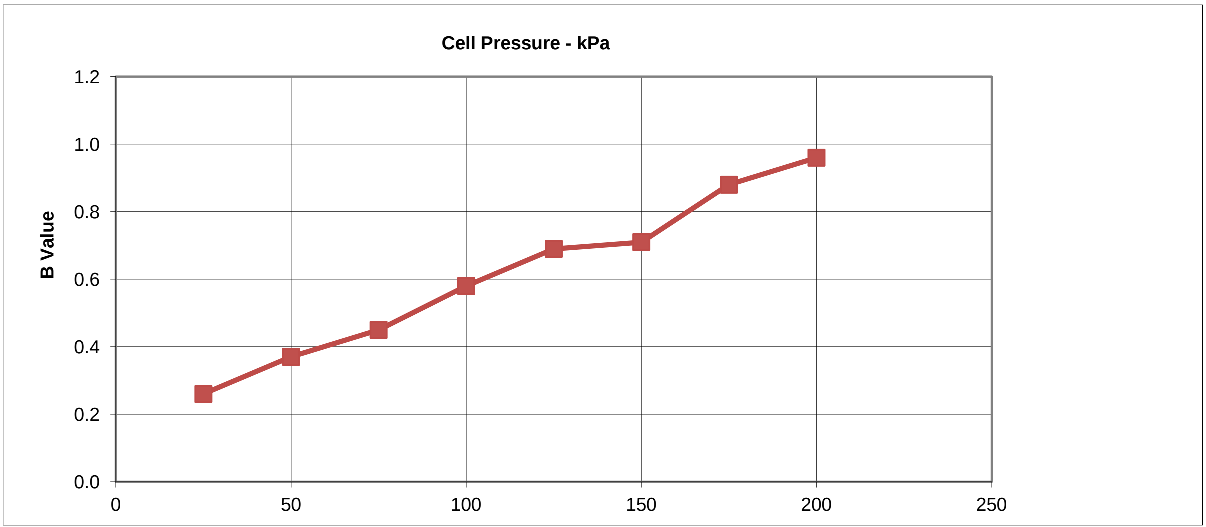
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

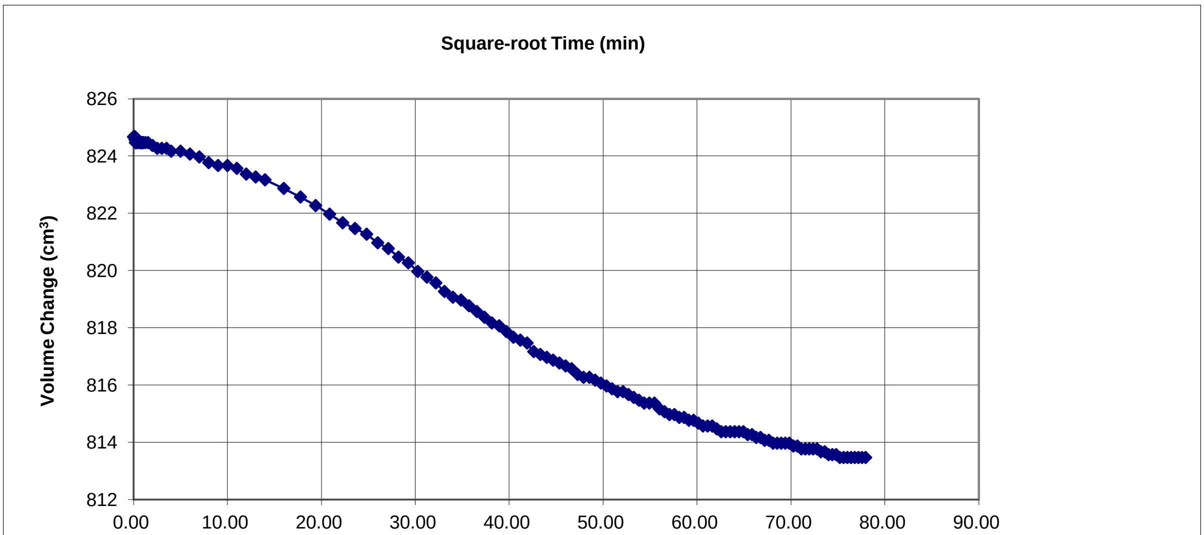
Specimen Details

Borehole	24B
Sample No.	
Depth m	
Date	25/07/2015

Saturation Stage



Consolidation Stage



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UKAS TESTING 2788

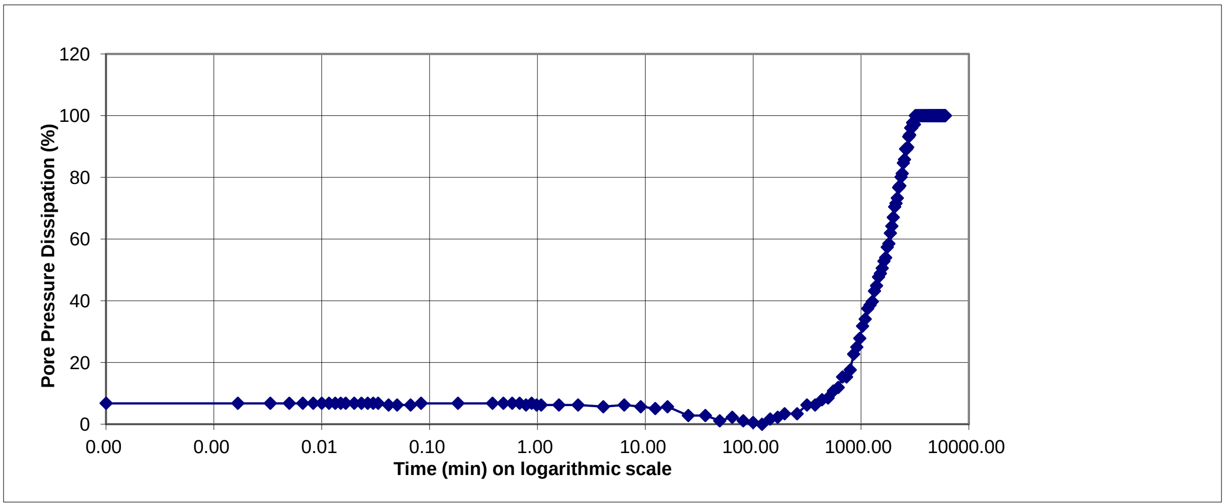
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

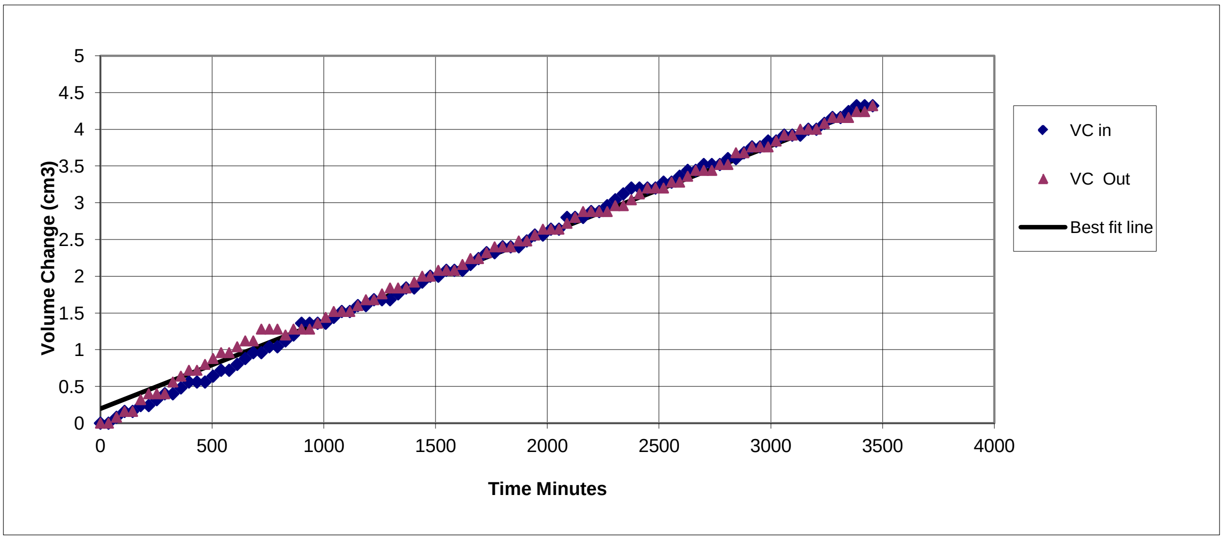
Specimen Details

Borehole	24B
Sample No.	
Depth m	
Date	25/07/2015

Consolidation Stage



Permeability Stage



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25/07/15
Date

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GEO Site & Testing Services Limited

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UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		24C
Sample No.		
Depth	m	
Date		25/07/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Brown/grey silty CLAY

Initial Specimen Conditions

Height	mm	105.00
Diameter	mm	98.00
Area	mm^2	7542.96
Volume	cm^3	792.01
Mass	g	1058.30
Dry Mass	g	520.90
Density	Mg/m^3	1.34
Dry Density	Mg/m^3	0.66
Moisture Content	%	103.2
Voids Ratio		3.029
Specific Gravity	kN/m^3	2.65
	(assumed/measured)	assumed

Final Specimen Conditions

Moisture Content	%	104.63
Density	Mg/m^3	1.35
Dry Density	Mg/m^3	0.66

Test Setup

Date started	15/07/2015
Date Finished	24/07/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPERM 06
Cell Number	CPERM 06

D P Evans

Checked and Approved By

25/07/15
Date

Client Ref

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UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		24C
Sample No.		
Depth	m	
Date		25/07/2015

Saturation

Cell Pressure Incr.	kPa	25.00
Back Pressure Incr.	kPa	24.00
Differential Pressure	kPa	1.00
Final Cell Pressure	kPa	175.00
Final Pore Pressure	kPa	170.00
Final B Value		0.96

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	175.00
Back Pressure	kPa	75.00
Excess Pore Pressure	kPa	95.00
Pore Pressure at End	kPa	75.00
Consolidated Volume	cm^3	787.51
Consolidated Height	mm	104.80
Consolidated Area	mm^2	7514.39
Vol. Compressibility	m^2/MN	34.3450
Consolidation Coef.	m^2/yr.	0.0598
Final Voids Ratio		3.006

Permeability

Cell Pressure	kPa	175.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00135
Average Temperature	'C	20

Vertical Permeability I m/s	**1.53 x 10-10**

D P Gans

Checked and Approved By

25/07/15
Date

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GEO Site & Testing Services Limited

UKAS TESTING 2788

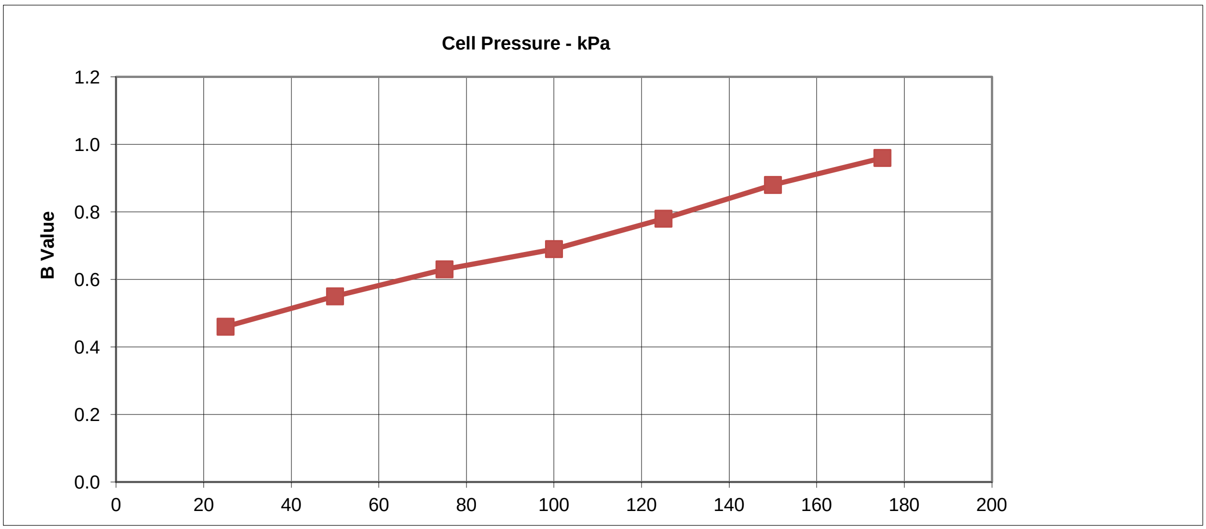
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

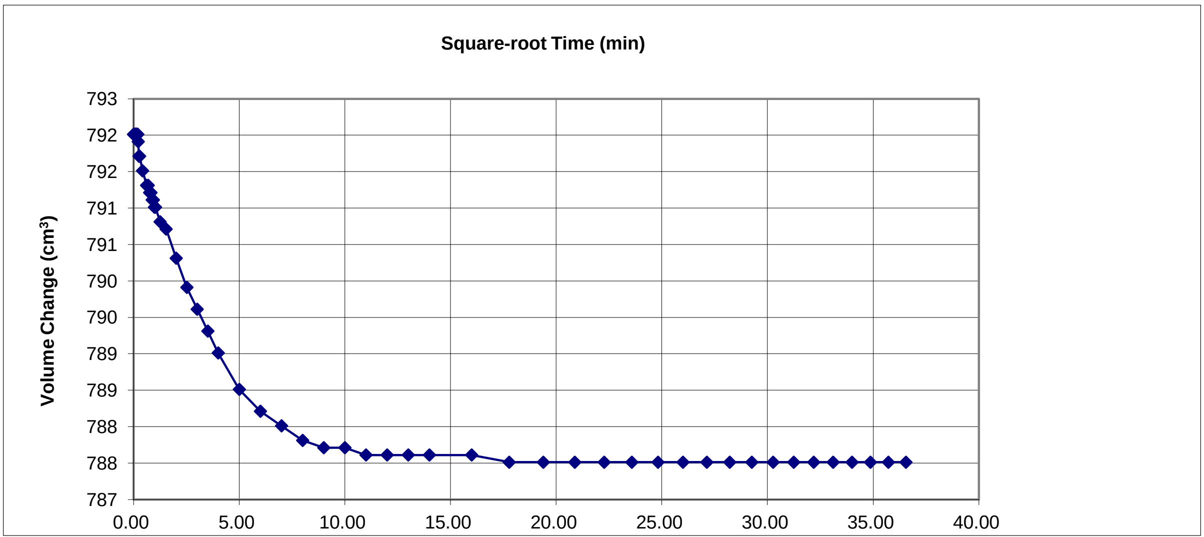
Specimen Details

Borehole	24C
Sample No.	
Depth m	
Date	25/07/2015

Saturation Stage



Consolidation Stage



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UKAS TESTING 2788

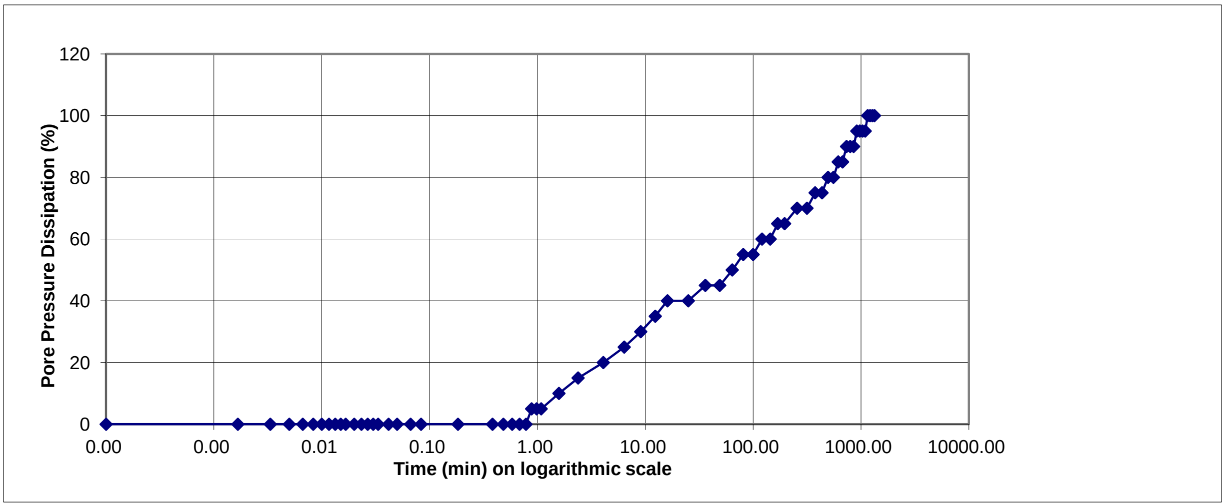
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

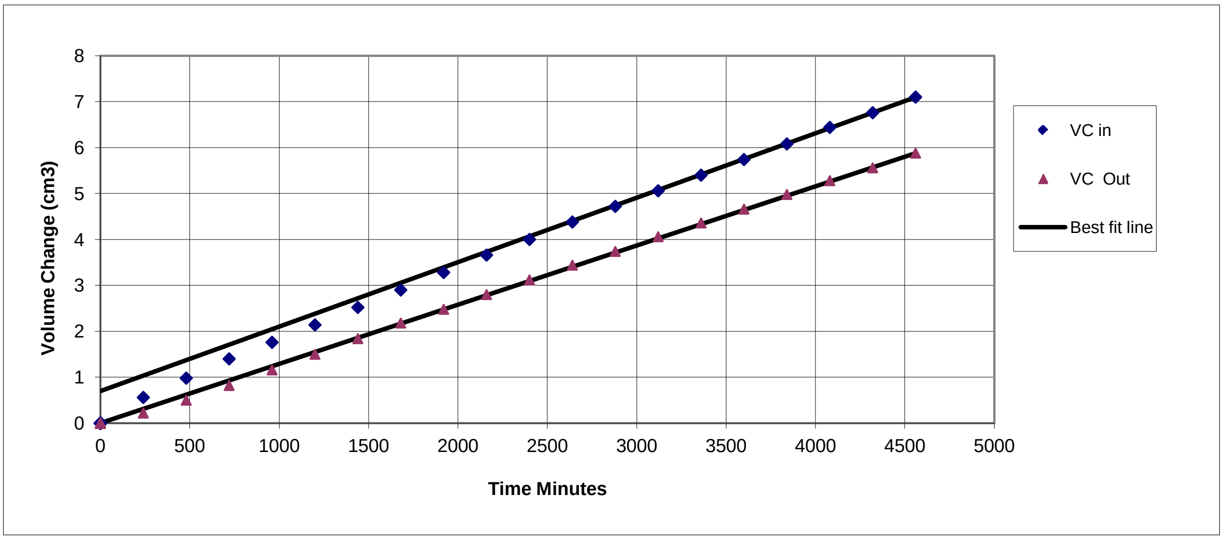
Specimen Details

Borehole		24C
Sample No.		
Depth	m	
Date		25/07/2015

Consolidation Stage



Permeability Stage



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25/07/15
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GEO Site & Testing Services Limited

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		24D
Sample No.		
Depth	m	
Date		15/07/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Brown/grey silty CLAY

Initial Specimen Conditions

Height	mm	104.00
Diameter	mm	99.00
Area	mm^2	7697.69
Volume	cm^3	800.56
Mass	g	1075.60
Dry Mass	g	541.80
Density	Mg/m^3	1.34
Dry Density	Mg/m^3	0.68
Moisture Content	%	98.5
Voids Ratio		2.916
Specific Gravity	kN/m^3	2.65
(assumed/measured)		assumed

Final Specimen Conditions

Moisture Content	%	103.21
Density	Mg/m^3	1.38
Dry Density	Mg/m^3	0.68

Test Setup

Date started	03/07/2015
Date Finished	14/07/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPerm 01
Cell Number	CPerm 01

D P Rans

Checked and Approved By

15/07/15
Date

Client Ref

Contract No

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GSTL
GEO Site & Testing Services Limited

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		24D
Sample No.		
Depth	m	
Date		15/07/2015

Saturation

Cell Pressure Incr.	kPa	25.00
Back Pressure Incr.	kPa	23.50
Differential Pressure	kPa	1.50
Final Cell Pressure	kPa	175.00
Final Pore Pressure	kPa	170.00
Final B Value		0.94

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	175.00
Back Pressure	kPa	75.00
Excess Pore Pressure	kPa	95.00
Pore Pressure at End	kPa	75.00
Consolidated Volume	cm^3	797.66
Consolidated Height	mm	103.87
Consolidated Area	mm^2	7679.10
Vol. Compressibility	m^2/MN	59.8833
Consolidation Coef.	m^2/yr.	0.0381
Final Voids Ratio		2.901

Permeability

Cell Pressure	kPa	175.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00085
Average Temperature	'C	20

Vertical Permeability I m/s	**9.36 x 10-11**

D P Nas

Checked and Approved By

15/07/15
Date

Client Ref

GSTL
GEO Site & Testing Services Limited

Contract No

27378

UKAS TESTING 2788

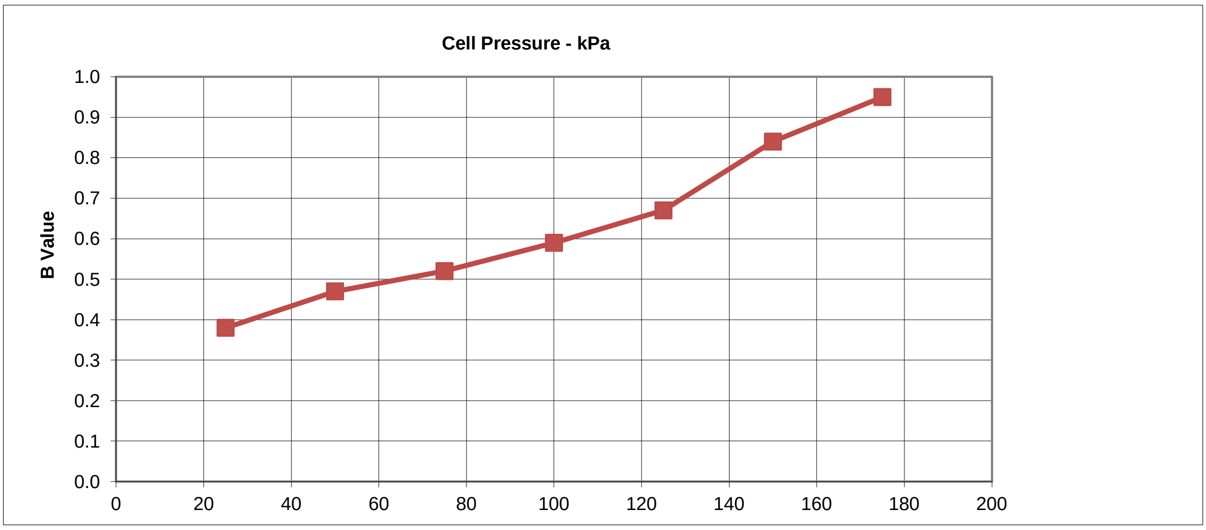
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

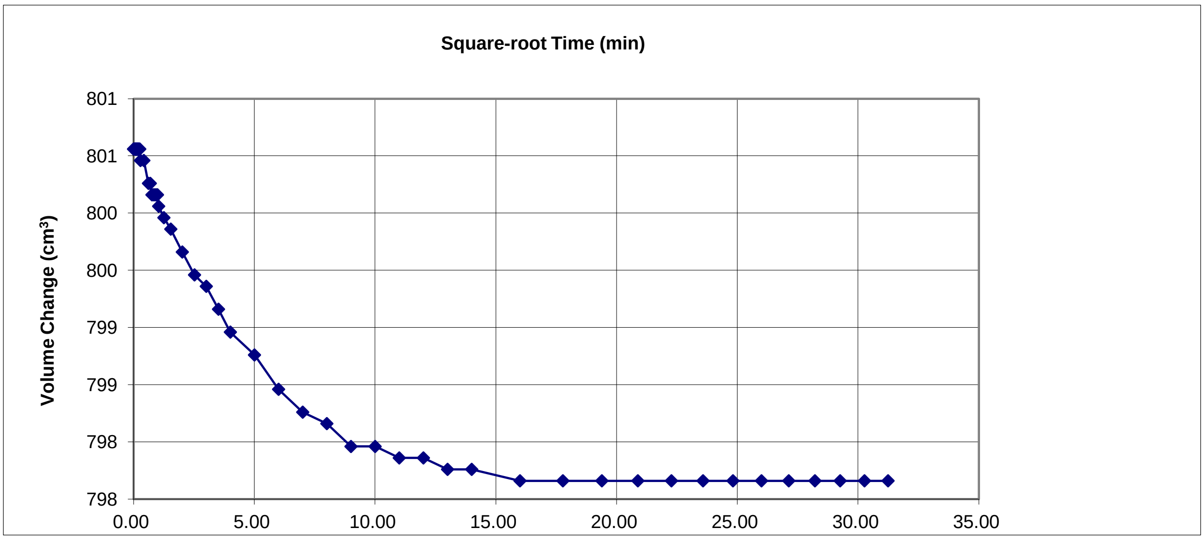
Specimen Details

Borehole		24D
Sample No.		
Depth	m	
Date		15/07/2015

Saturation Stage



Consolidation Stage



Checked and Approved By

15/07/15
Date

GSTL
GEO Site & Testing Services Limited

Client Ref

Contract No

27378

UKAS TESTING 2788

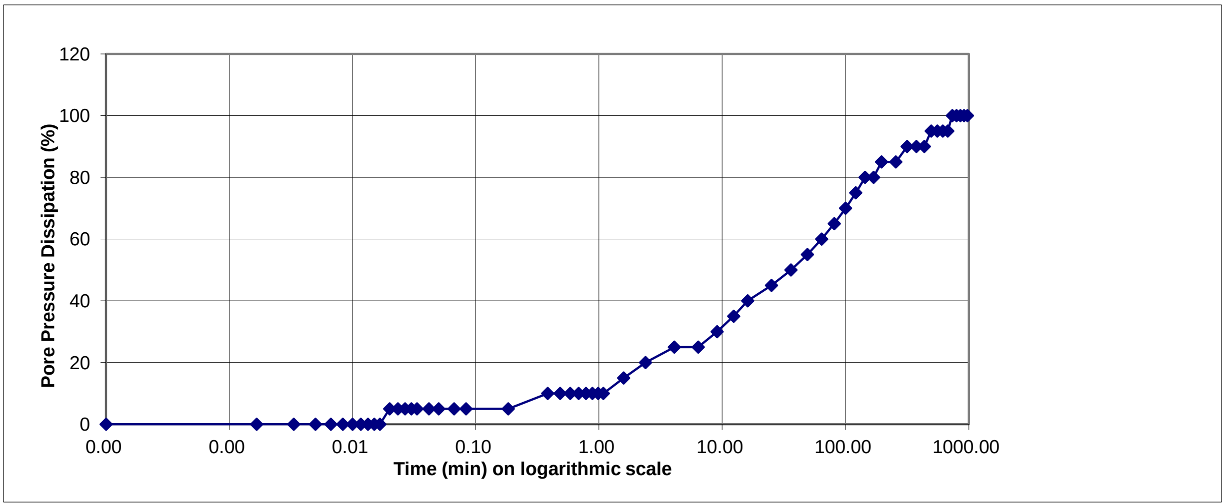
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

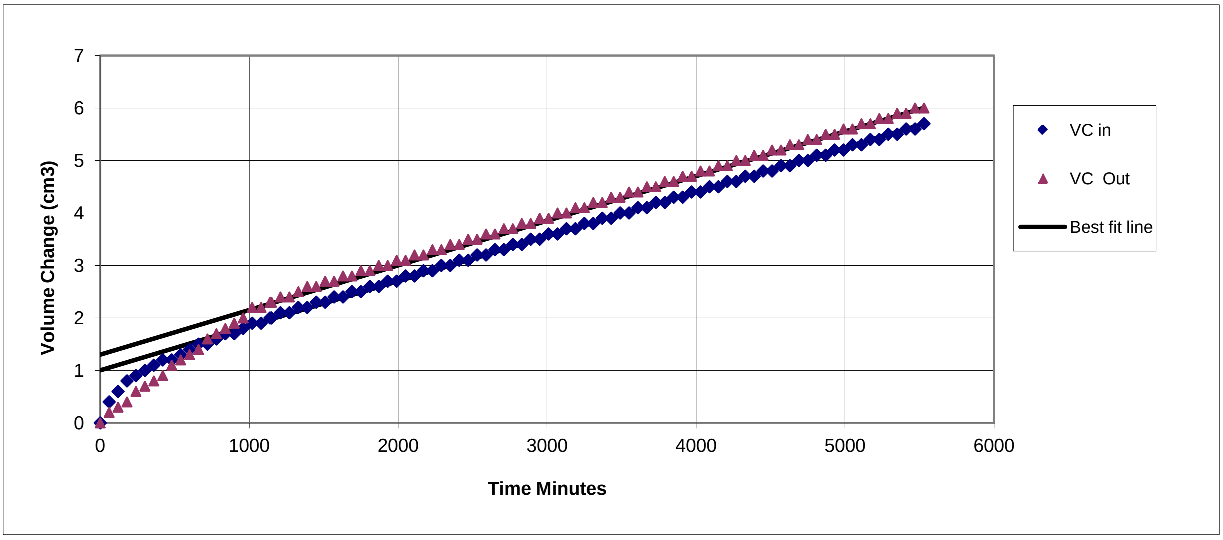
Specimen Details

Borehole	24D
Sample No.	
Depth m	
Date	15/07/2015

Consolidation Stage



Permeability Stage



D P Grans

Checked and Approved By

15/07/15
Date

Client Ref

Contract No

27378

GSTL
GEO Site & Testing Services Limited

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		25D
Sample No.		
Depth	m	
Date		25/07/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Brown/grey silty CLAY

Initial Specimen Conditions

Height	mm	105.00
Diameter	mm	97.00
Area	mm^2	7389.81
Volume	cm^3	775.93
Mass	g	1096.40
Dry Mass	g	559.50
Density	Mg/m^3	1.41
Dry Density	Mg/m^3	0.72
Moisture Content	%	96.0
Voids Ratio		2.675
Specific Gravity	kN/m^3	2.65
(assumed/measured)		assumed

Final Specimen Conditions

Moisture Content	%	98.61
Density	Mg/m^3	1.44
Dry Density	Mg/m^3	0.72

Test Setup

Date started	15/07/2015
Date Finished	24/07/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPerm 09
Cell Number	CPerm 09

D P Gians

Checked and Approved By

25/07/15
Date

Client Ref

GSTL
GEO Site & Testing Services Limited

Contract No

27378

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		25D
Sample No.		
Depth	m	
Date		25/07/2015

Saturation

Cell Pressure Incr.	kPa	75.00
Back Pressure Incr.	kPa	71.00
Differential Pressure	kPa	4.00
Final Cell Pressure	kPa	285.00
Final Pore Pressure	kPa	281.00
Final B Value		0.95

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	285.00
Back Pressure	kPa	185.00
Excess Pore Pressure	kPa	96.00
Pore Pressure at End	kPa	185.00
Consolidated Volume	cm^3	772.23
Consolidated Height	mm	104.83
Consolidated Area	mm^2	7366.32
Vol. Compressibility	m^2/MN	242.4556
Consolidation Coef.	$m^2/yr.$	0.0497
Final Voids Ratio		2.658

Permeability

Cell Pressure	kPa	285.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00087
Average Temperature	'C	20

Vertical Permeability l m/s	**1.01 x 10-10**

D P Gray

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UKAS TESTING 2788

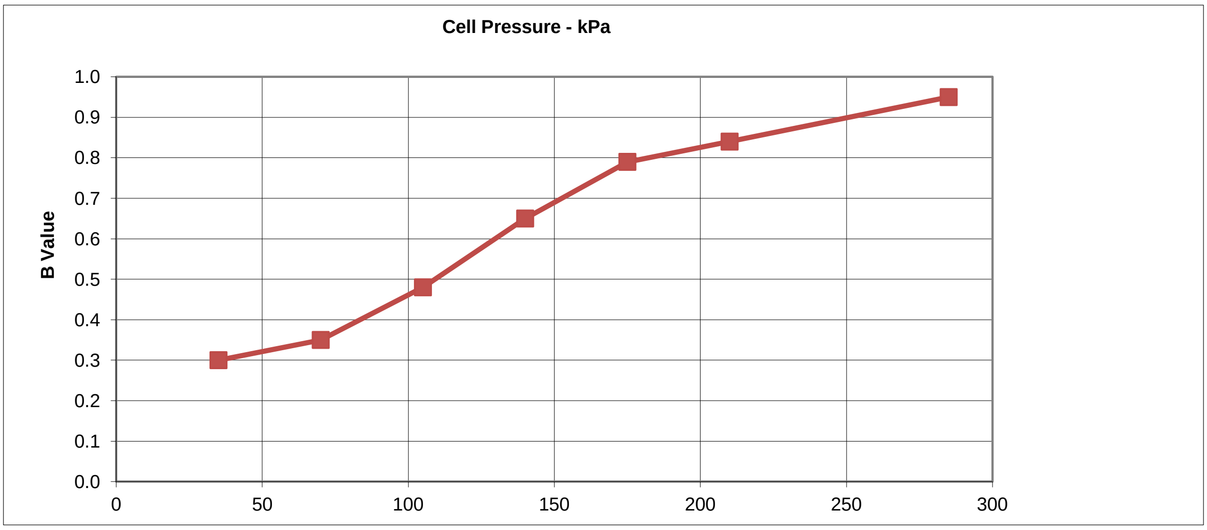
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

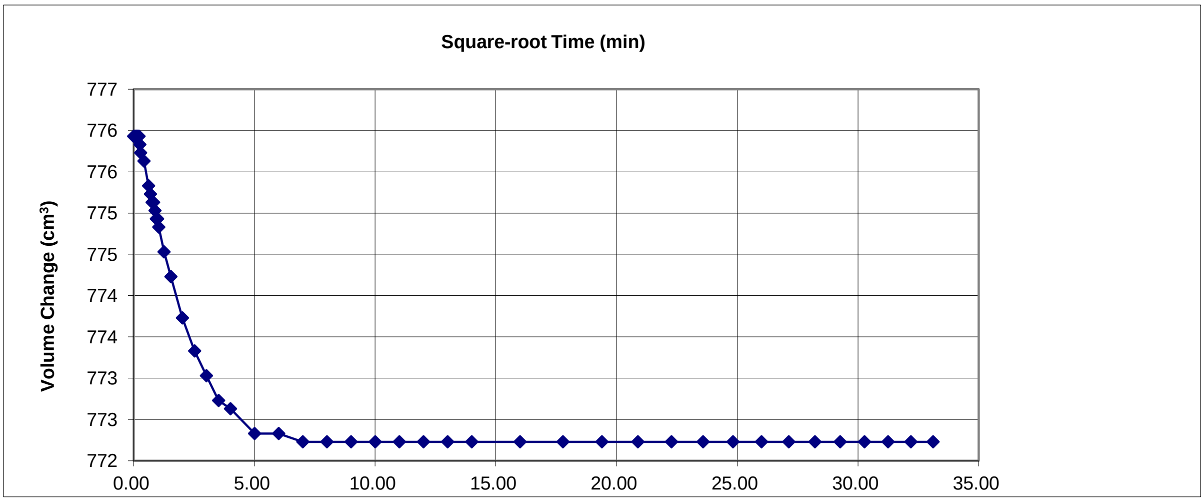
Specimen Details

Borehole		25D
Sample No.		
Depth	m	
Date		25/07/2015

Saturation Stage



Consolidation Stage



D P Evans

Checked and Approved By

25/07/15
Date

Client Ref

Contract No

27378

GSTL GEO Site & Testing Services Limited

UKAS TESTING 2788

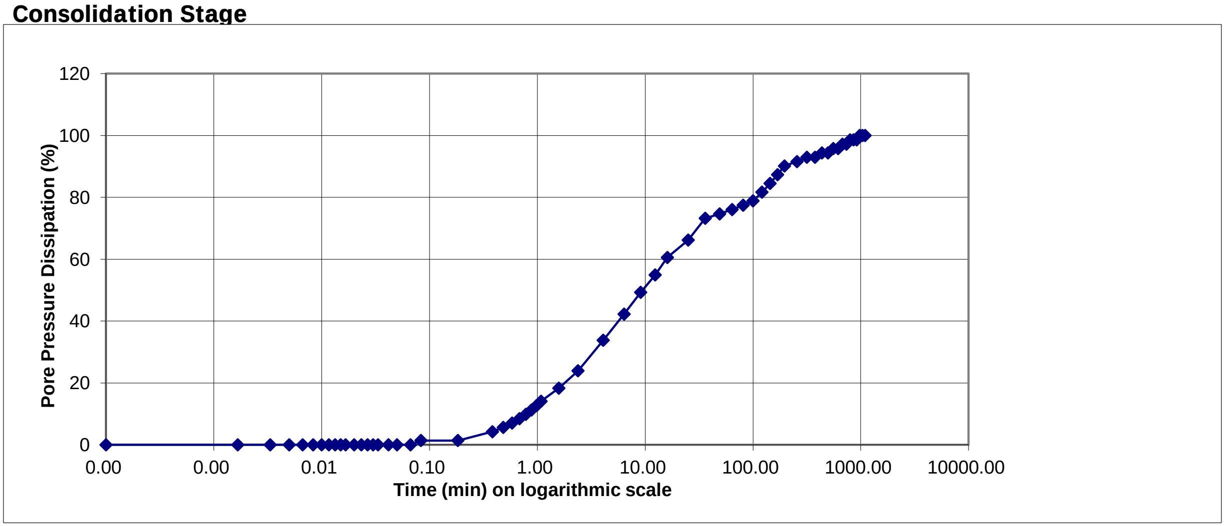
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

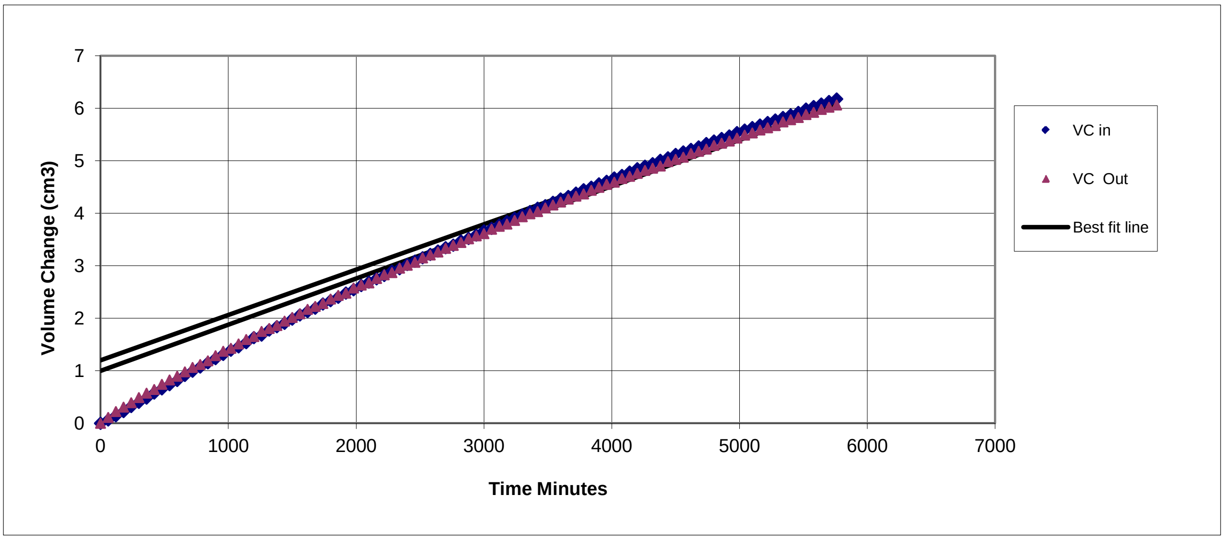
Specimen Details

Borehole	25D
Sample No.	
Depth m	
Date	25/07/2015

Consolidation Stage



Permeability Stage



D P Evans

Checked and Approved By

25/07/15
Date

Client Ref

Contract No

27378

GSTL GEO Site & Testing Services Limited

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		26C
Sample No.		
Depth	m	
Date		25/07/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Brown/grey silty CLAY

Initial Specimen Conditions

Height	mm	105.00
Diameter	mm	98.00
Area	mm^2	7542.96
Volume	cm^3	792.01
Mass	g	1096.00
Dry Mass	g	539.20
Density	Mg/m^3	1.38
Dry Density	Mg/m^3	0.68
Moisture Content	%	103.3
Voids Ratio		2.892
Specific Gravity	kN/m^3	2.65
(assumed/measured)		assumed

Final Specimen Conditions

Moisture Content	%	107.03
Density	Mg/m^3	1.42
Dry Density	Mg/m^3	0.68

Test Setup

Date started	15/07/2015
Date Finished	24/07/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPerm 05
Cell Number	CPerm 05

D P Ganz

Checked and Approved By

25/07/15
Date

Client Ref

Contract No

27378

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GEO Site & Testing Services Limited

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		26C
Sample No.		
Depth	m	
Date		25/07/2015

Saturation

Cell Pressure Incr.	kPa	25.00
Back Pressure Incr.	kPa	24.00
Differential Pressure	kPa	1.00
Final Cell Pressure	kPa	200.00
Final Pore Pressure	kPa	193.00
Final B Value		0.96

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	200.00
Back Pressure	kPa	100.00
Excess Pore Pressure	kPa	93.00
Pore Pressure at End	kPa	100.00
Consolidated Volume	cm^3	787.81
Consolidated Height	mm	104.81
Consolidated Area	mm^2	7516.30
Vol. Compressibility	m^2/MN	61.0062
Consolidation Coef.	m^2/yr.	0.0570
Final Voids Ratio		2.872

Permeability

Cell Pressure	kPa	200.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00117
Average Temperature	'C	20

Vertical Permeability I m/s	**1.33 x 10-10**

D P Gray

Checked and Approved By

25/07/15
Date

Client Ref

Contract No

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GEO Site & Testing Services Limited

UKAS TESTING 2788

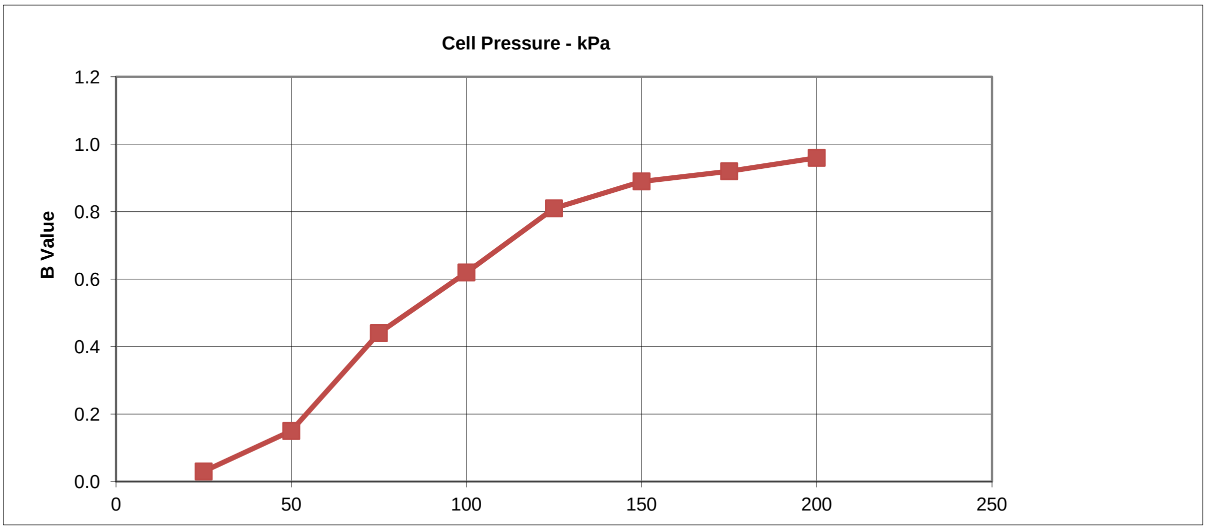
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

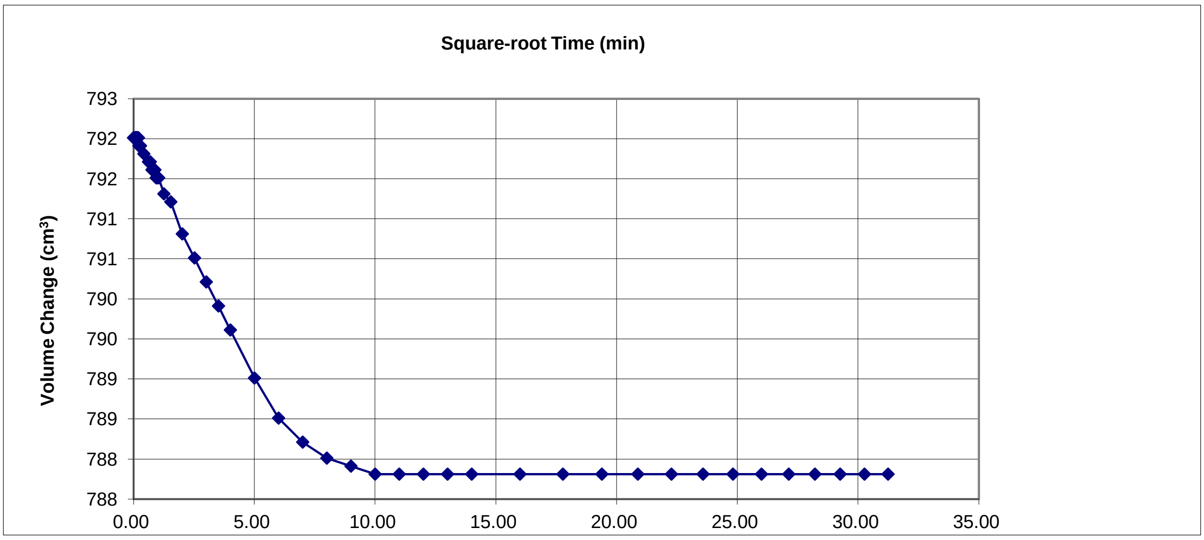
Specimen Details

Borehole		26C
Sample No.		
Depth	m	
Date		25/07/2015

Saturation Stage



Consolidation Stage



D P Grant

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25/07/15
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GEO Site & Testing Services Limited

Contract No

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UKAS TESTING 2788

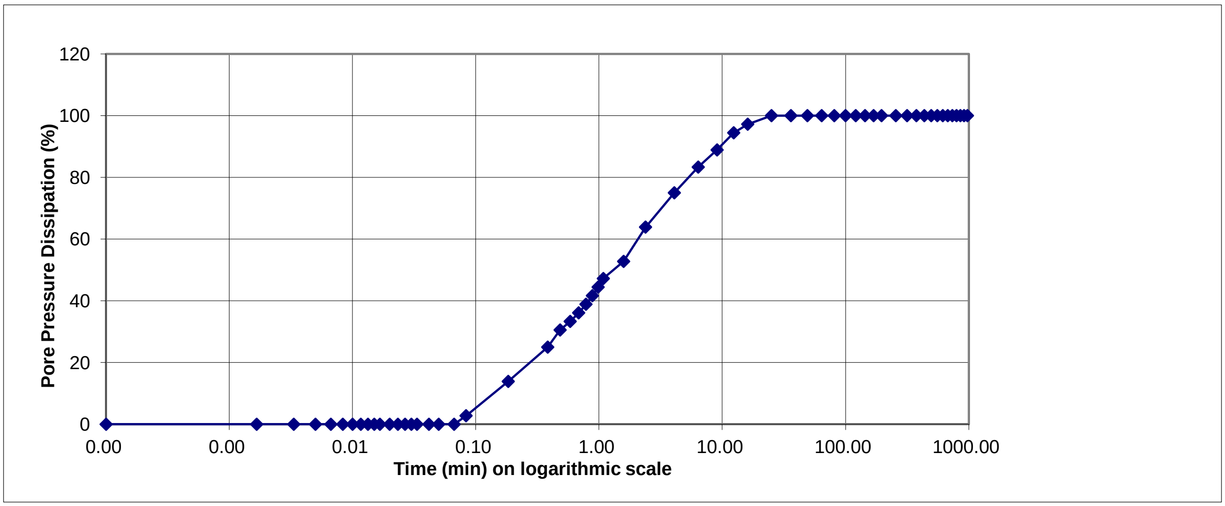
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

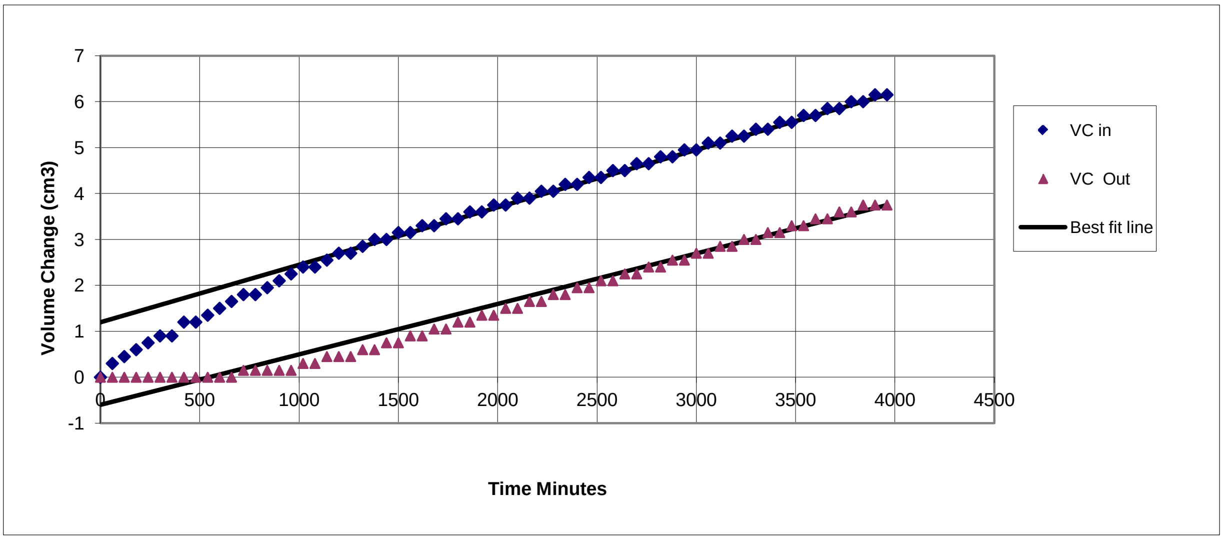
Specimen Details

Borehole	26C
Sample No.	
Depth m	
Date	25/07/2015

Consolidation Stage



Permeability Stage



D P Grant

Checked and Approved By

25/07/15
Date

Client Ref

Contract No

27378

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GEO Site & Testing Services Limited

UKAS TESTING 2788

Appendix 10

Cell No	Binder Percentage	Cement : Bentonite Ratio	Date Mixed	Permeability															
				Date Samples Taken	Method of Sampling	Method of Sealing	Date Delivered to Lab	Lab	Level of Mixed Material	Date Prepared for Testing	Date Test Started	Final Effective Pressure (kPa)	Final Result	Days in Saturation	Days in Consolidation	Initial Moisture Content (%)	Final Moisture Content (%)	Initial 'B' Saturation Value	Volume Change During Consolidation (mL)
031L	7.50%	50 : 50	28/05/2015	11/06/2015	Jack and Bucket	Cling Film	11/06/2015	GSTL	1.5m	12/06/2015	12/06/2015	100	1 x 10-10	2	3	105.4	108.68	0.26	4
013G	7.50%	50 : 50	09/07/2015	23/07/2015	Jack and Bucket	Cling Film	23/07/2015	GSTL	0.5m	23/07/2015	23/07/2015	100	2.43 X 10-10	3	3	88.9	89.84	0.32	50
015H	7.50%	50 : 50	06/07/2015	20/07/2015	Jack and Bucket	Cling Film	20/07/2015	GSTL	1.5m	21/07/2015	21/07/2015	100	7.11 x 10-10	2	3	86.8	89.15	0.21	73
017J	7.50%	50 : 50	18/06/2015	02/07/2015	Jack and Bucket	Cling Film	02/07/2015	GSTL	1.5m	03/07/2015	03/07/2015	100	3.11 x 10-10	2	2	79.8	81.02	0.37	4
019G	7.50%	50 : 50	25/06/2015	09/07/2015	Jack and Bucket	Cling Film	09/07/2015	GSTL	0.5m	10/07/2015	10/07/2015	100	6.86 x 10-11	2	2	83.18	85.65	0.2	40
021F	7.50%	50 : 50	30/06/2015	14/07/2015	Jack and Bucket	Cling Film	14/07/2015	GSTL	1m	15/07/2015	15/07/2015	100	5.63 x 10-11	2	3	93.5	94.46	0.21	13
022D	7.50%	50 : 50	08/07/2015	22/07/2015	Jack and Bucket	Cling Film	22/07/2015	GSTL	1.5m	23/07/2015	23/07/2015	100	1.7 x 10-10	2	4	91.6	92.75	0.2	18
023I	7.50%	50 : 50	17/06/2015	01/07/2015	Jack and Bucket	Cling Film	01/07/2015	GSTL	1m	03/07/2015	03/07/2015	100	1.72 x 10-10	2	4	83.7	86.54	0.21	20
024E	7.50%	50 : 50	01/07/2015	15/07/2015	Jack and Bucket	Cling Film	15/07/2015	GSTL	0.5m	17/07/2015	17/07/2015	100	2.4 x 10-10	2	3	83	83.03	0.34	12
025M	7.50%	50 : 50	01/06/2015	15/06/2015	Jack and Bucket	Cling Film	15/06/2015	GSTL	1m	18/06/2015	18/06/2015	100	3.25 x 10-10	2	3	87.4	87.35	0.25	81
027G	7.50%	50 : 50	23/06/2015	07/07/2015	Jack and Bucket	Cling Film	07/07/2015	GSTL	1.5m	09/07/2015	09/07/2015	100	6.93 x 10-10	2	2	97.3	98.99	0.1	108
029F	7.50%	50 : 50	29/06/2015	13/07/2015	Jack and Bucket	Cling Film	13/07/2015	GSTL	1.5m	14/07/2015	14/07/2015	100	3.86 x 10-10	3	2	100.3	101.59	0.38	15
028K	7.50%	50 : 50	04/06/2015	18/06/2015	Jack and Bucket	Cling Film	18/06/2015	GSTL	0.5m	19/06/2015	19/06/2015	100	5.22 x 10-10	3	3	86.1	89.1	0.2	5

Deep Soil Mixing. Birchwood, Westoning Road, Greenfield, Beds, MK45 5BH. Made by George Olney

Appendix 11

Laboratory Report

UKAS TESTING 2788

GEO Site & Testing Services Ltd

Contract Number: 27496

Client's Reference:

Report Date: **07-08-2015**

Client **Deep Soil Mixing Ltd**
Deep Soil Mixing Ltd,
Birchwood,
Westoning Road,
Greenfield,
Bedfordshire,
MK45 5BH

Contract Title: **Unknown**
For the attention of: **George Olney**

Date Received: **10-07-2015**
Date Commenced: **10-07-2015**
Date Completed: **07-08-2015**

Test Description	Qty
Quick Undrained Triaxial Compression test - single specimen at one confining pressure (100mm or 38mm diameter) 1377 : 1990 Part 7 : 8 - * UKAS	12
Determination of Permeability in a triaxial cell BS1377 Part 6 :1990 Clause 6 - * UKAS	12
Extra Over Item (4 Days Over)	54
Disposal of Samples on Project	1

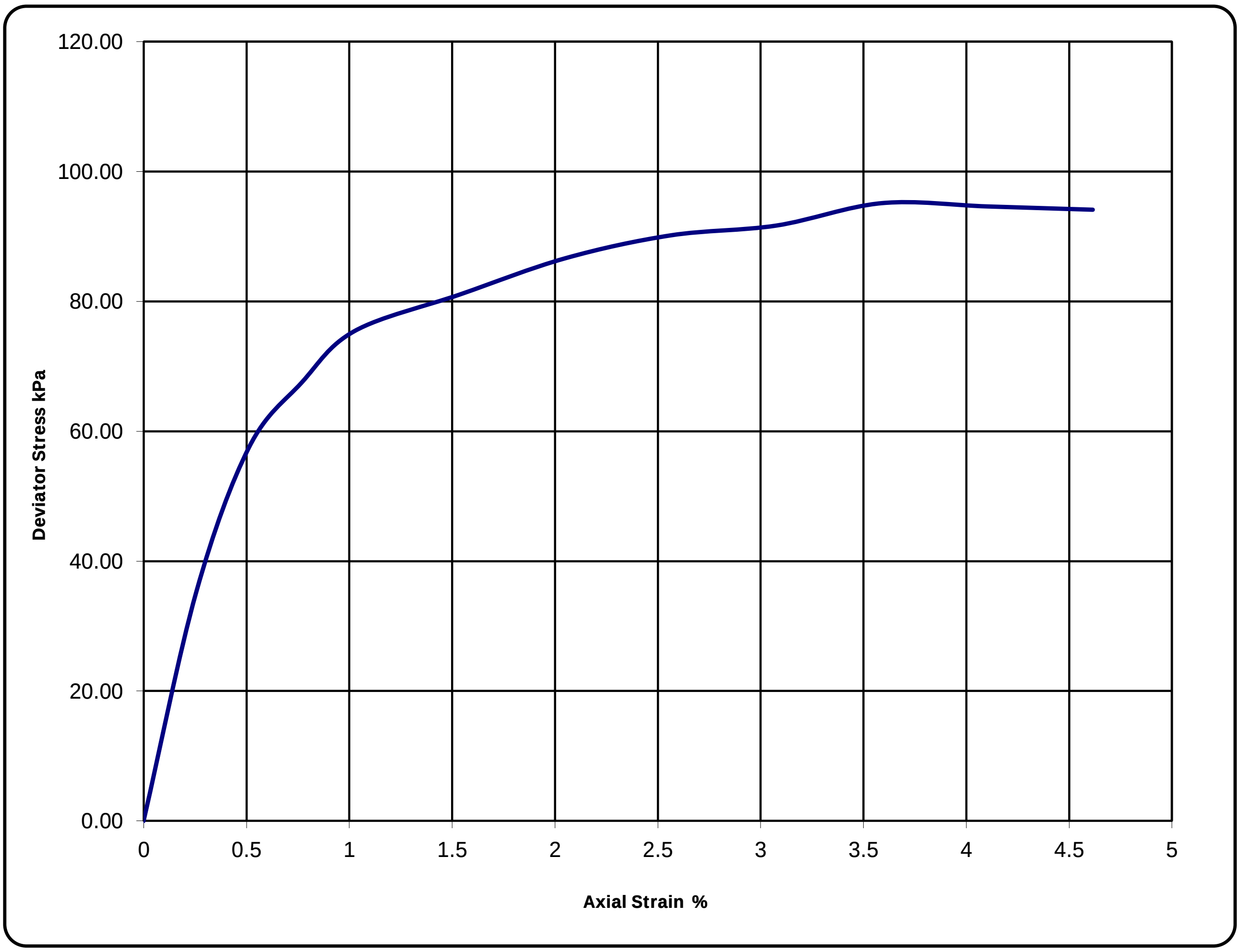
Notes: **Observations and Interpretations are outside the UKAS Accreditation**
*** - denotes test included in laboratory scope of accreditation**
 # - denotes test carried out by approved contractor
@ - denotes non accredited tests

Approved Signatories:
Alex Wynn (Associate Director) - Benjamin Sharp (Contracts Manager) - D V Edwards (Managing Director)
Emma Sharp (Office Manager) - Paul Evans (Quality/Technical Manager)

GEO Site & Testing Services Ltd
Unit 4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN
Tel: 01554 784040 Fax: 01554 784041 info@geo.uk.com geo.uk.com

Test Report: **Undrained Shear Strength in Triaxial Compression**
BS 1377 : Part7 : Clause 8 : 1990 Single Stage Test
without measurement of Pore Pressure

Client ref:	**N / A**
Location:	**Unknown**
Contract Number:	**27496-**
Hole Number	**013G**
Sample Number:	**N / A**
Depth (m) :	**N / A -**
Sample Type :	**U**
Sample Description :	**Firm greyish brown silty CLAY with additive**



Diameter (mm):		101	Height (mm):		195	Test:	U 101 mm Single Stage.			
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Remarks Sample taken from Top of tube Rate of strain = 2 %/min	
A	89.3	1.42	0.75	100	95	48	3.6	Brittle	Latex Membrane used 0.2 mm thickness	

GSTL
GEO Site & Testing Services Limited

Checked By
Emma Williams (Office Manager)
Date Approved: 7.8.15

Approved By:
Paul Evans (Quality Manager)

UKAS TESTING 2788

Test Report: **Undrained Shear Strength in Triaxial Compression**
BS 1377 : Part7 : Clause 8 : 1990 Single Stage Test
without measurement of Pore Pressure

Client ref:	**N/A**
Location:	**Unknown**
Contract Number:	**27496-**
Hole Number	**013G**
Sample Number:	**N/A**
Depth (m) :	**N/A -**
Sample Type :	**U**

Post Test Specimen

Specimen Split

Diameter (mm):		101	Height (mm):		195	Test:	U 101 mm Single Stage.			
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Remarks Sample taken from Top of tube Rate of strain = 2 %/min	
A	89.3	1.42	0.75	100	95	48	3.6	Brittle	Latex Membrane used 0.2 mm thickness	

GEO Site & Testing Services Limited

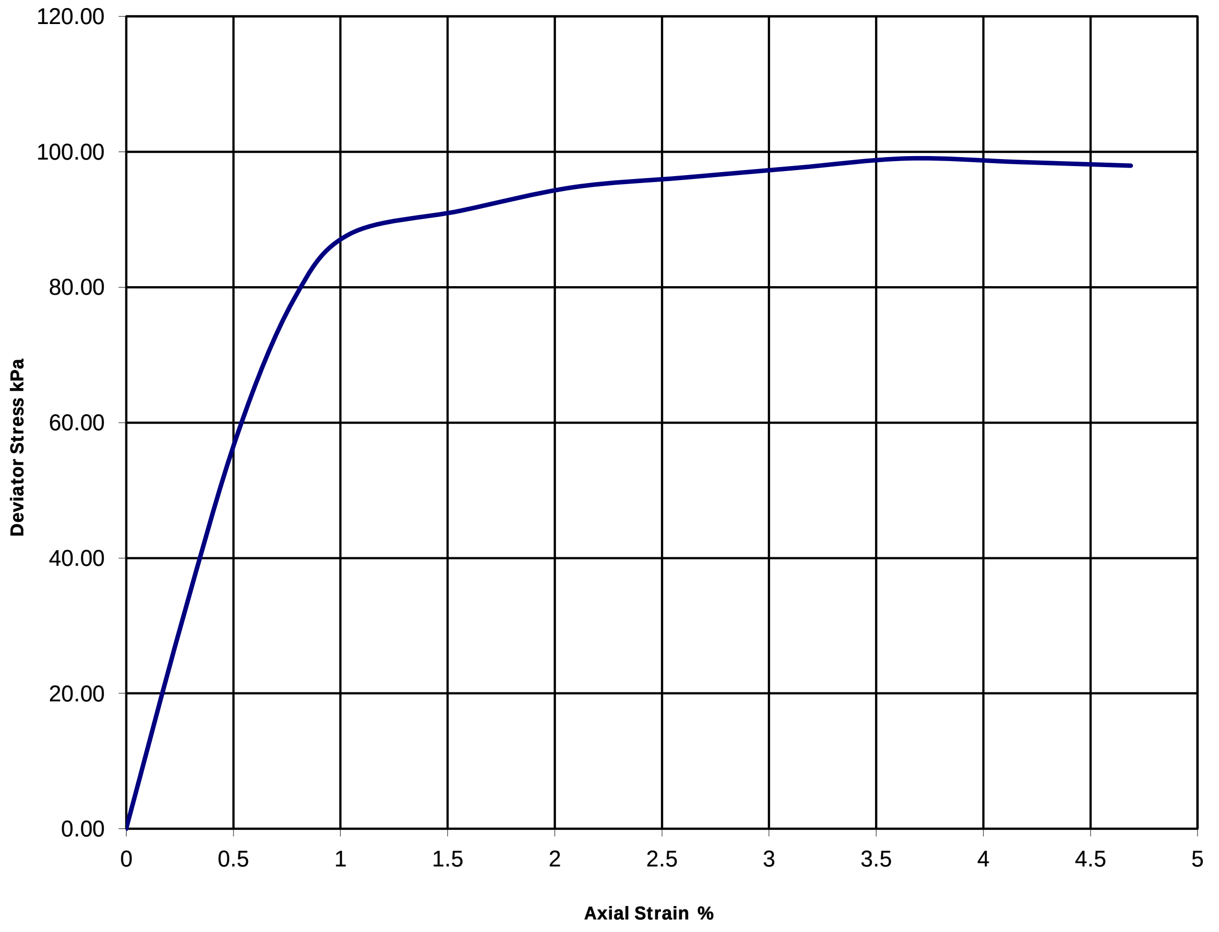
Checked Checked By
Emma Williams (Office Manager)
Date Approved: 7.8.15

Approved By:
Paul Evans (Quality Manager)

UKAS TESTING 2788

Test Report: **Undrained Shear Strength in Triaxial Compression**
BS 1377 : Part7 : Clause 8 : 1990 Single Stage Test
without measurement of Pore Pressure

Client ref:	**N/A**
Location:	**Unknown**
Contract Number:	**27496-**
Hole Number	**015H**
Sample Number:	**N/A**
Depth (m) :	**N/A -**
Sample Type :	**U**
Sample Description :	**Firm greyish brown silty CLAY with additive**



Diameter (mm):		102	Height (mm):		192	Test:	U 102 mm Single Stage.			
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Remarks	
									Sample taken from Top of tube	
									Rate of strain = 2 %/min	
A	92.6	1.37	0.71	100	99	49	3.6	Brittle	Latex Membrane used 0.2 mm thickness	

GSTL
GEO Site & Testing Services Limited

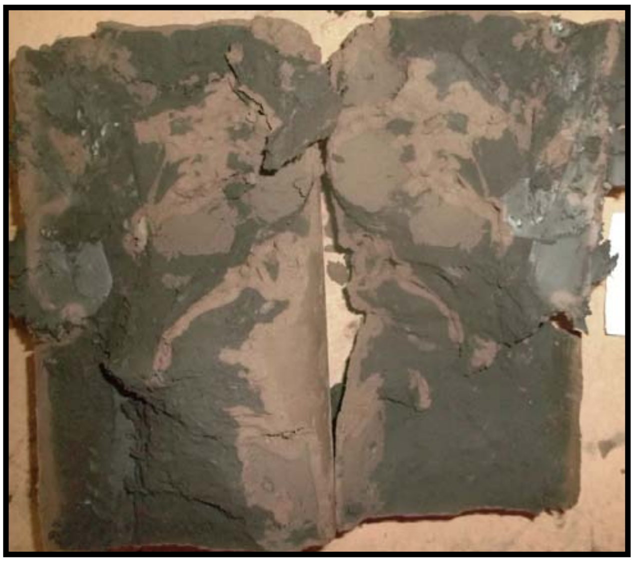
Checked By
Emma Williams (Office Manager)
Date Approved: 7.8.15

Approved By:
Paul Evans (Quality Manager)

UKAS TESTING 2788

Test Report: **Undrained Shear Strength in Triaxial Compression**
BS 1377 : Part7 : Clause 8 : 1990 Single Stage Test
without measurement of Pore Pressure

Client ref: N/A
Location: Unknown
Contract Number: 27496-
Hole Number 015H
Sample Number: N/A
Depth (m) : N/A -
Sample Type : U



Post Test Specimen

Specimen Split

Diameter (mm):		102	Height (mm):		192	Test:	U 102 mm Single Stage.		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Remarks Sample taken from Top of tube Rate of strain = 2 %/min
A	92.6	1.37	0.71	100	99	49	3.6	Brittle	Latex Membrane used 0.2 mm thickness

GSTL
GEO Site & Testing Services Limited

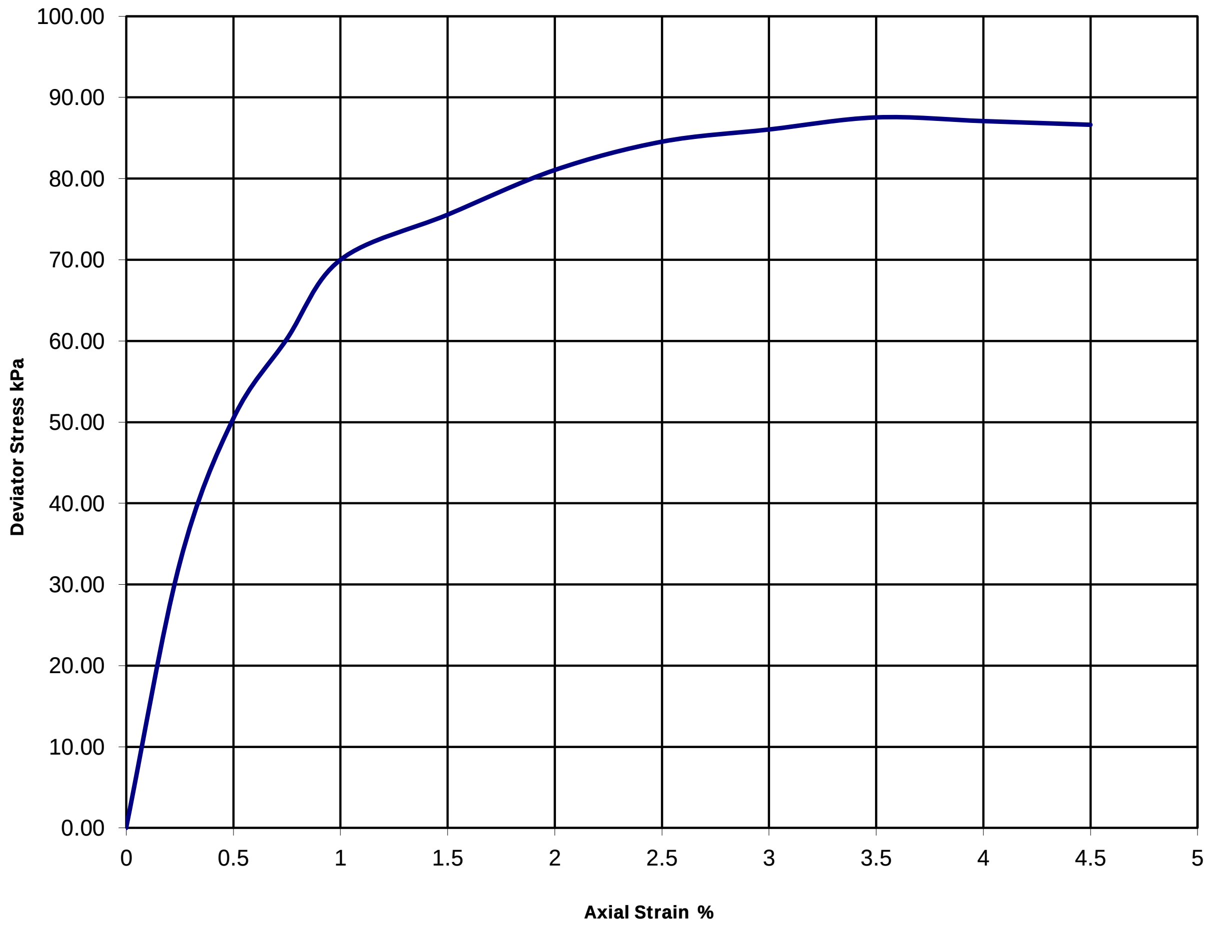
Checked Checked By
Emma Williams (Office Manager)
Date Approved: 7.8.15

D P Evans
Approved By:
Paul Evans (Quality Manager)

UKAS TESTING 2788

Test Report: **Undrained Shear Strength in Triaxial Compression**
BS 1377 : Part7 : Clause 8 : 1990 Single Stage Test
without measurement of Pore Pressure

Client ref:	**N/A**
Location:	**Unknown**
Contract Number:	**27496-**
Hole Number	**017J**
Sample Number:	**N/A**
Depth (m) :	**N/A -**
Sample Type :	**U**
Sample Description :	**Firm greyish brown silty CLAY with additive**



Diameter (mm):	102	Height (mm):	200	Test:	U 102 mm Single Stage.				
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Remarks Sample taken from Top of tube Rate of strain = 2 %/min
A	99.5	1.40	0.70	100	88	44	3.5	Brittle	Latex Membrane used 0.2 mm thickness

GSTL
GEO Site & Testing Services Limited

Checked By
Emma Williams (Office Manager)
Date Approved: 7.8.15

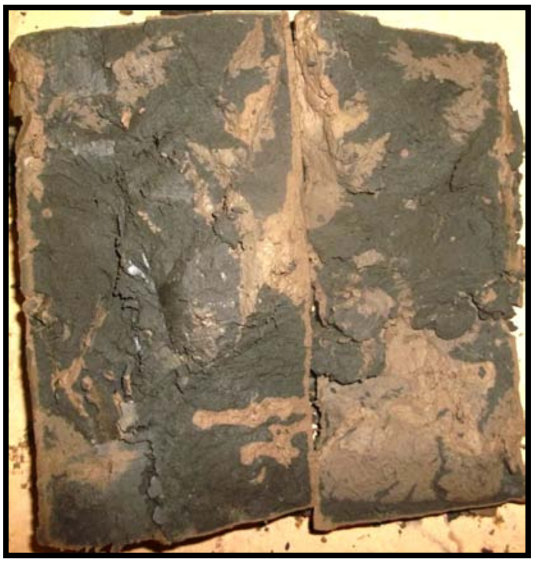
Approved By:
Paul Evans (Quality Manager)

UKAS TESTING 2788

Test Report: **Undrained Shear Strength in Triaxial Compression**
BS 1377 : Part7 : Clause 8 : 1990 Single Stage Test
without measurement of Pore Pressure

Client ref:	**N/A**
Location:	**Unknown**
Contract Number:	**27496-**
Hole Number	**017J**
Sample Number:	**N/A**
Depth (m) :	**N/A -**
Sample Type :	**U**

Post Test Specimen



Specimen Split

Diameter (mm):		102	Height (mm):		200	Test:	U 102 mm Single Stage.		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Remarks Sample taken from Top of tube Rate of strain = 2 %/min
A	99.5	1.40	0.70	100	88	44	3.5	Brittle	Latex Membrane used 0.2 mm thickness

GSTL
GEO Site & Testing Services Limited

Checked Checked By
Emma Williams (Office Manager)
Date Approved: 7.8.15

Approved By:
Paul Evans (Quality Manager)

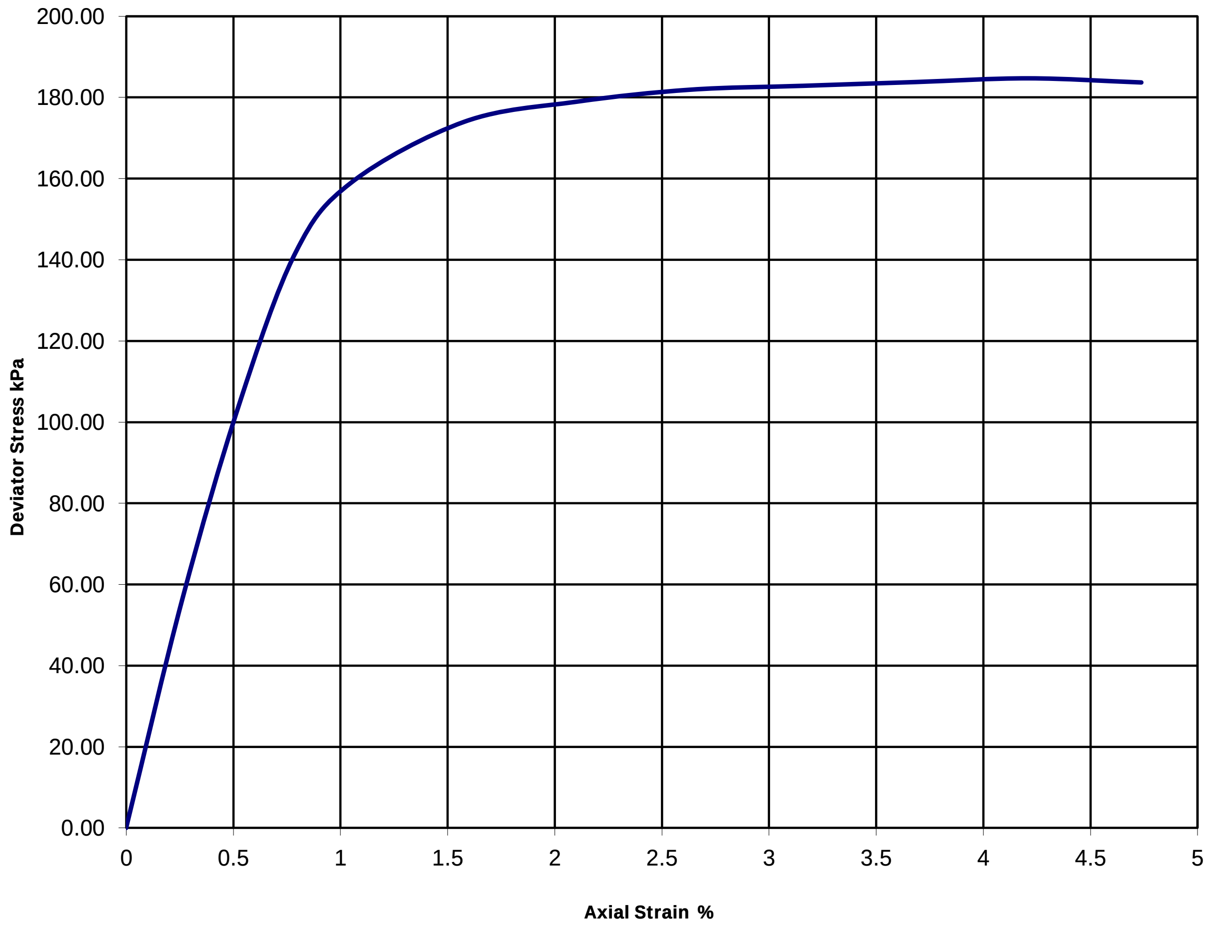
UKAS TESTING 2788

Test Report: **Undrained Shear Strength in Triaxial Compression**

BS 1377 : Part7 : Clause 8 : 1990 Single Stage Test

without measurement of Pore Pressure

Client ref:	**N/A**
Location:	**Unknown**
Contract Number:	**27496-**
Hole Number	**019G**
Sample Number:	**N/A**
Depth (m) :	**N/A -**
Sample Type :	**U**
Sample Description :	**Firm greyish brown silty CLAY with additive**



Diameter (mm):	102	Height (mm):	190	Test:	U 102 mm Single Stage.				
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Remarks Sample taken from Top of tube Rate of strain = 2 %/min
A	83.7	1.37	0.75	100	185	92	4.2	Brittle	Latex Membrane used 0.2 mm thickness

GSTL
GEO Site & Testing Services Limited

Checked By
Emma Williams (Office Manager)
Date Approved: 7.8.15

Approved By:
Paul Evans (Quality Manager)

UKAS TESTING 2788

Test Report: **Undrained Shear Strength in Triaxial Compression**
BS 1377 : Part7 : Clause 8 : 1990 Single Stage Test
without measurement of Pore Pressure

Client ref:	**N/A**
Location:	**Unknown**
Contract Number:	**27496-**
Hole Number	**019G**
Sample Number:	**N/A**
Depth (m) :	**N/A -**
Sample Type :	**U**

Post Test Specimen

Specimen Split

Diameter (mm):		102	Height (mm):		190	Test:	U 102 mm Single Stage.			
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Remarks Sample taken from Top of tube Rate of strain = 2 %/min	
A	83.7	1.37	0.75	100	185	92	4.2	Brittle	Latex Membrane used 0.2 mm thickness	

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UKAS TESTING 2788

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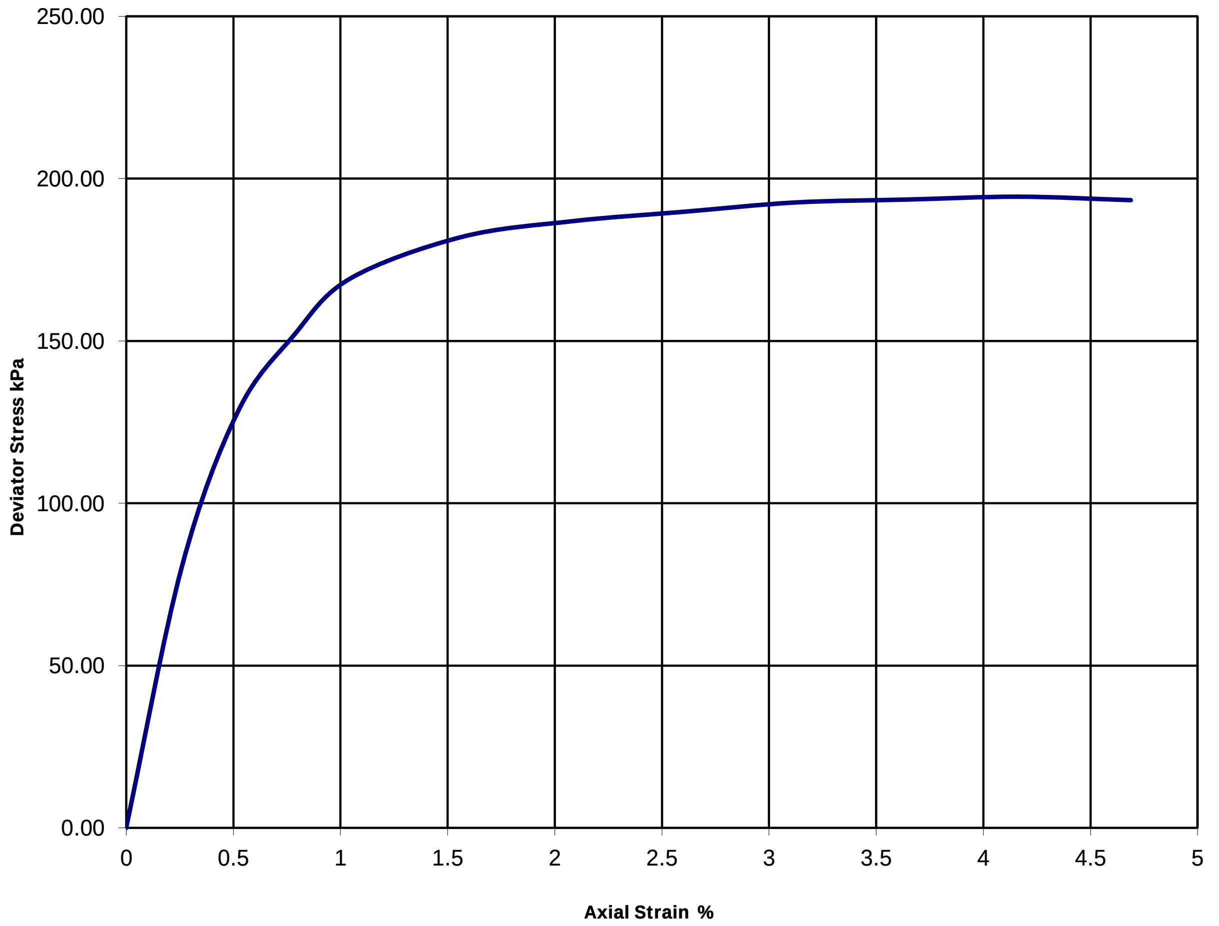
Test Report: **Undrained Shear Strength in Triaxial Compression**
BS 1377 : Part7 : Clause 8 : 1990 Single Stage Test
without measurement of Pore Pressure

Client ref:	**N/A**
Location:	**Unknown**
Contract Number:	**27496-**
Hole Number	**021F**
Sample Number:	**N/A**
Depth (m) :	**N/A -**
Sample Type :	**U**
Sample Description :	**Firm greyish brown silty CLAY with additive**



Diameter (mm):		102	Height (mm):		192	Test:	U 102 mm Single Stage.		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Remarks Sample taken from Top of tube Rate of strain = 2 %/min
A	101.4	1.41	0.70	100	194	97	4.2	Brittle	Latex Membrane used 0.2 mm thickness

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UKAS TESTING 2788

Test Report: **Undrained Shear Strength in Triaxial Compression**
BS 1377 : Part7 : Clause 8 : 1990 Single Stage Test
without measurement of Pore Pressure

Client ref: **N/A**
Location: **Unknown**
Contract Number: **27496-**
Hole Number **021F**
Sample Number: **N/A**
Depth (m) : **N/A -**
Sample Type : **U**

Post Test Specimen

Specimen Split

Diameter (mm):		102	Height (mm):		192	Test:	U 102 mm Single Stage.		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Remarks Sample taken from Top of tube Rate of strain = 2 %/min
A	101.4	1.41	0.70	100	194	97	4.2	Brittle	Latex Membrane used 0.2 mm thickness

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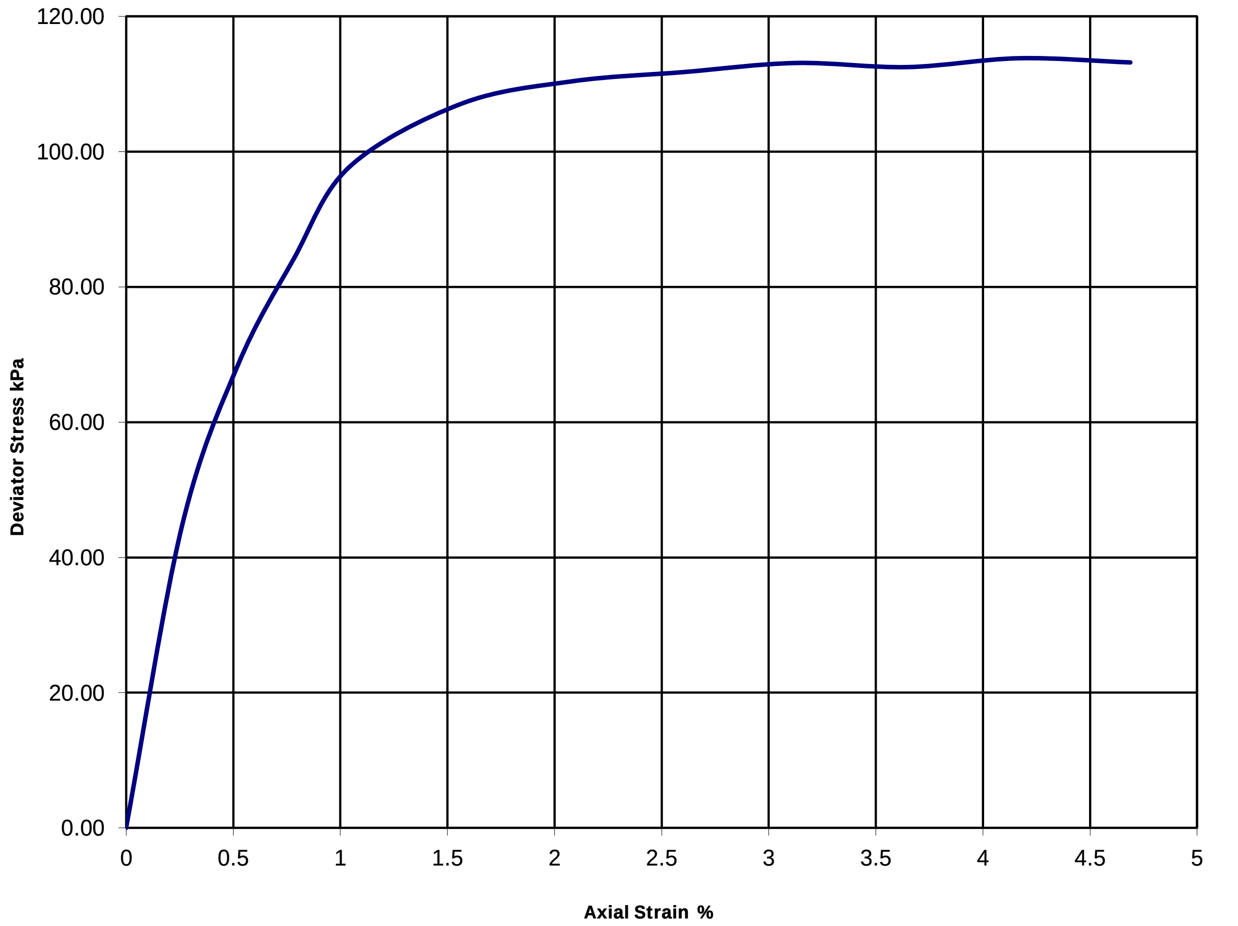
UKAS TESTING 2788

Test Report: **Undrained Shear Strength in Triaxial Compression**
BS 1377 : Part7 : Clause 8 : 1990 Single Stage Test
without measurement of Pore Pressure

Client ref:	**N/A**
Location:	**Unknown**
Contract Number:	**27496-**
Hole Number	**022D**
Sample Number:	**N/A**
Depth (m) :	**N/A -**
Sample Type :	**U**
Sample Description :	**Firm greyish brown silty CLAY with additive**



Diameter (mm):	102	Height (mm):	192	Test:	U 102 mm Single Stage.				
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Remarks Sample taken from Top of tube Rate of strain = 2 %/min
A	91.6	1.37	0.71	100	114	57	4.2	Brittle	Latex Membrane used 0.2 mm thickness

GSTL
GEO Site & Testing Services Limited

Checked By
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Date Approved: 7.8.15

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UKAS TESTING 2788

Test Report: **Undrained Shear Strength in Triaxial Compression**
BS 1377 : Part7 : Clause 8 : 1990 Single Stage Test
without measurement of Pore Pressure

Client ref:	**N/A**
Location:	**Unknown**
Contract Number:	**27496-**
Hole Number	**022D**
Sample Number:	**N/A**
Depth (m) :	**N/A -**
Sample Type :	**U**

Post Test Specimen

Specimen Split

Diameter (mm):		102	Height (mm):		192	Test:	U 102 mm Single Stage.			
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Remarks Sample taken from Top of tube Rate of strain = 2 %/min	
A	91.6	1.37	0.71	100	114	57	4.2	Brittle	Latex Membrane used 0.2 mm thickness	

GSTL
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Date Approved: 7.8.15

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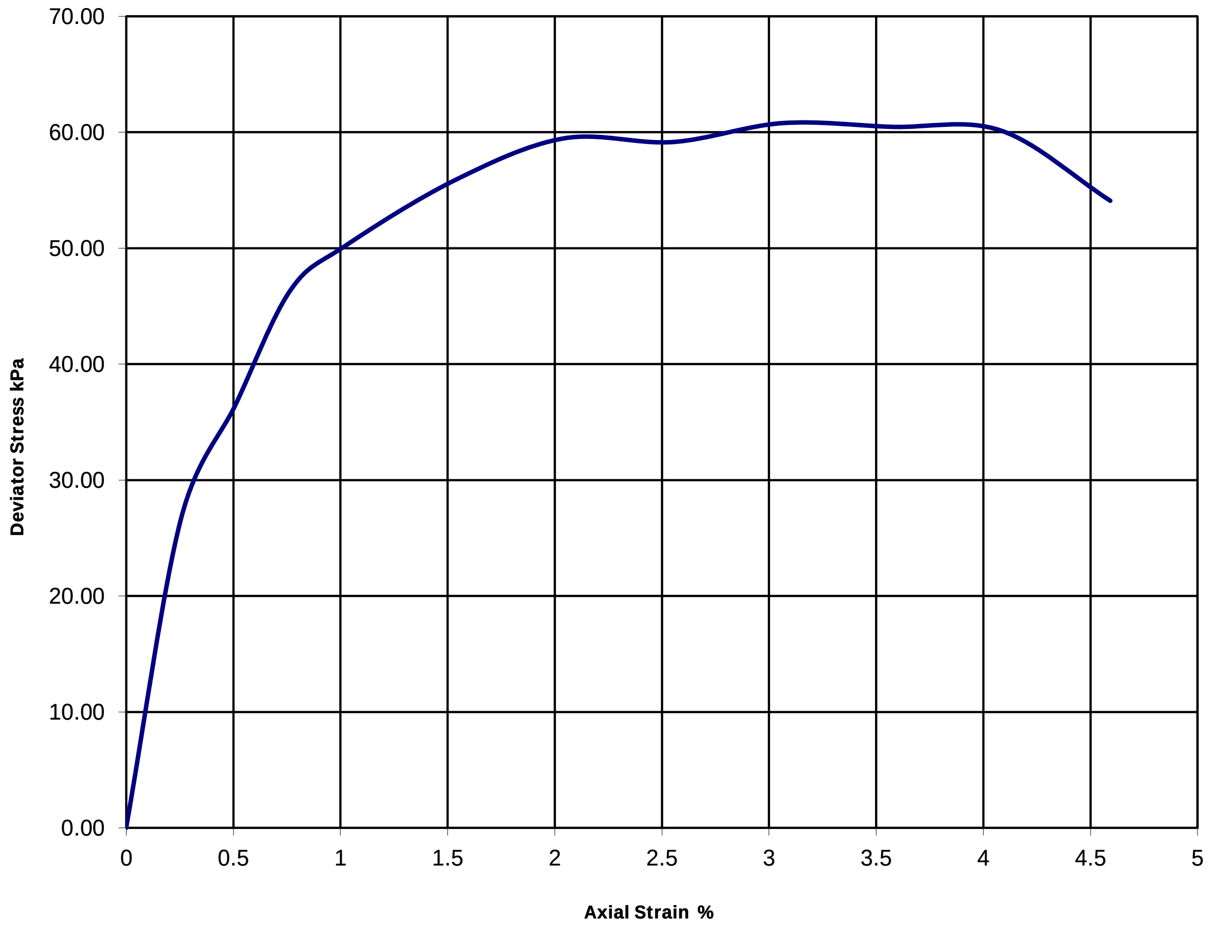
UKAS TESTING 2788

Test Report: **Undrained Shear Strength in Triaxial Compression**
BS 1377 : Part7 : Clause 8 : 1990 Single Stage Test
without measurement of Pore Pressure

Client ref:	**N/A**
Location:	**Unknown**
Contract Number:	**27496-**
Hole Number	**023I**
Sample Number:	**N/A**
Depth (m) :	**N/A -**
Sample Type :	**U**
Sample Description :	**Firm greyish brown silty CLAY with additive**



Diameter (mm):	102	Height (mm):	196	Test:	U 102 mm Single Stage.				
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Remarks: Sample taken from Top of tube; Rate of strain = 2 %/min
A	99.3	1.39	0.70	100	61	30	3.1	Brittle	Latex Membrane used 0.2 mm thickness

GSTL
GEO Site & Testing Services Limited

Checked By
Emma Williams (Office Manager)
Date Approved: 7.8.15

Approved By:
Paul Evans (Quality Manager)

UKAS TESTING 2788

Test Report: **Undrained Shear Strength in Triaxial Compression**
BS 1377 : Part7 : Clause 8 : 1990 Single Stage Test
without measurement of Pore Pressure

Client ref: **N/A**
Location: **Unknown**
Contract Number: **27496-**
Hole Number **023I**
Sample Number: **N/A**
Depth (m) : **N/A -**
Sample Type : **U**

Post Test Specimen

Specimen Split

Diameter (mm):		102	Height (mm):		196	Test:	U 102 mm Single Stage.		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Remarks Sample taken from Top of tube Rate of strain = 2 %/min
A	99.3	1.39	0.70	100	61	30	3.1	Brittle	Latex Membrane used 0.2 mm thickness

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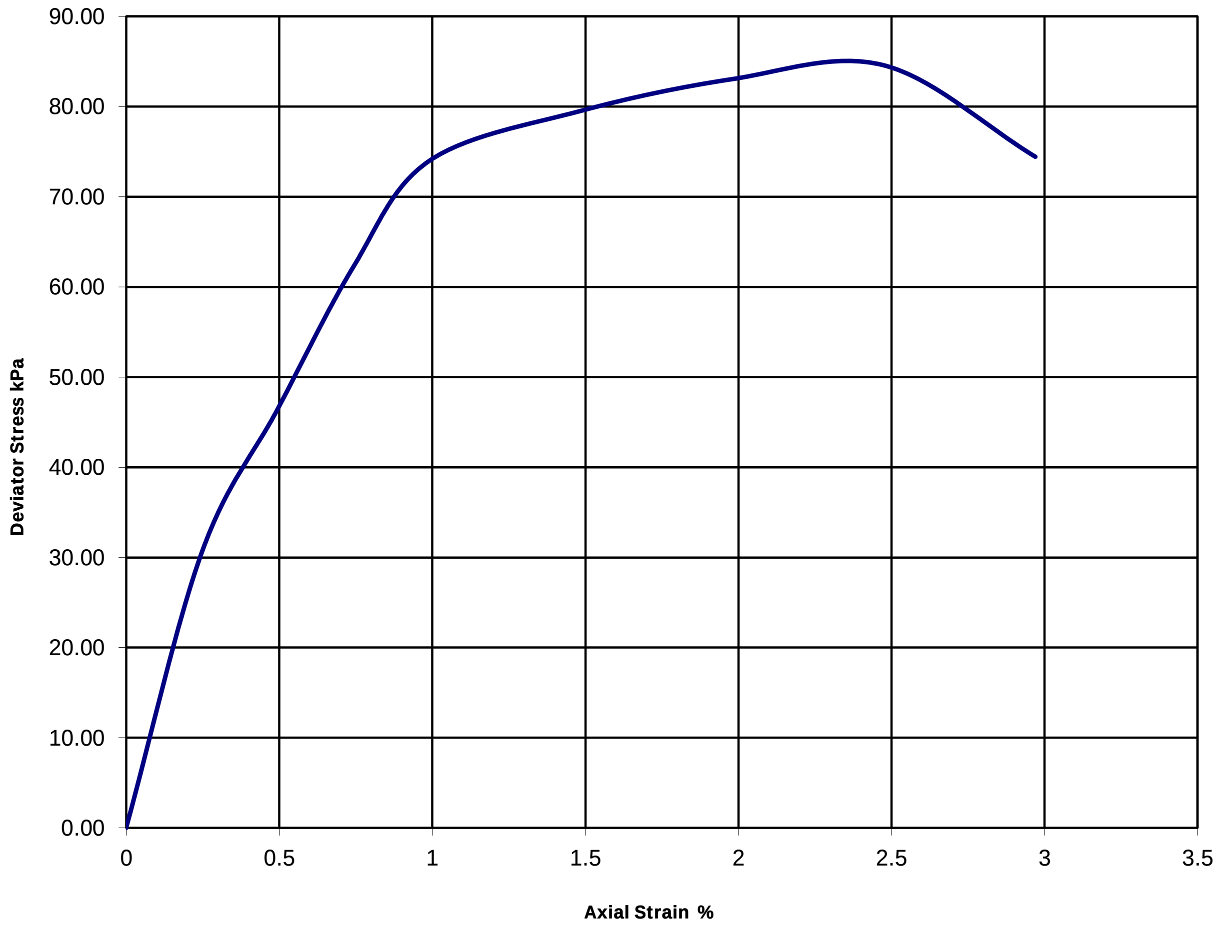
UKAS TESTING 2788

Test Report: **Undrained Shear Strength in Triaxial Compression**
BS 1377 : Part7 : Clause 8 : 1990 Single Stage Test
without measurement of Pore Pressure

Client ref:	**N/A**
Location:	**Unknown**
Contract Number:	**27496-**
Hole Number	**024E**
Sample Number:	**N/A**
Depth (m) :	**N/A -**
Sample Type :	**U**
Sample Description :	**Firm greyish brown silty CLAY with additive**



Diameter (mm):		102	Height (mm):		202	Test:	U 102 mm Single Stage.			
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Remarks Sample taken from Top of tube Rate of strain = 2 %/min
A	96.9	1.38	0.70	100	85	42	2.5	Brittle	Latex Membrane used 0.2 mm thickness

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GEO Site & Testing Services Limited

Checked By
Emma Williams (Office Manager)
Date Approved: 7.8.15

Approved By:
Paul Evans (Quality Manager)

UKAS TESTING 2788

Test Report: **Undrained Shear Strength in Triaxial Compression**
BS 1377 : Part7 : Clause 8 : 1990 Single Stage Test
without measurement of Pore Pressure

Client ref:	**N/A**
Location:	**Unknown**
Contract Number:	**27496-**
Hole Number	**024E**
Sample Number:	**N/A**
Depth (m) :	**N/A -**
Sample Type :	**U**

Post Test Specimen

Specimen Split

Diameter (mm):		102	Height (mm):		202	Test:	U 102 mm Single Stage.		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Remarks Sample taken from Top of tube Rate of strain = 2 %/min
A	96.9	1.38	0.70	100	85	42	2.5	Brittle	Latex Membrane used 0.2 mm thickness

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UKAS TESTING 2788

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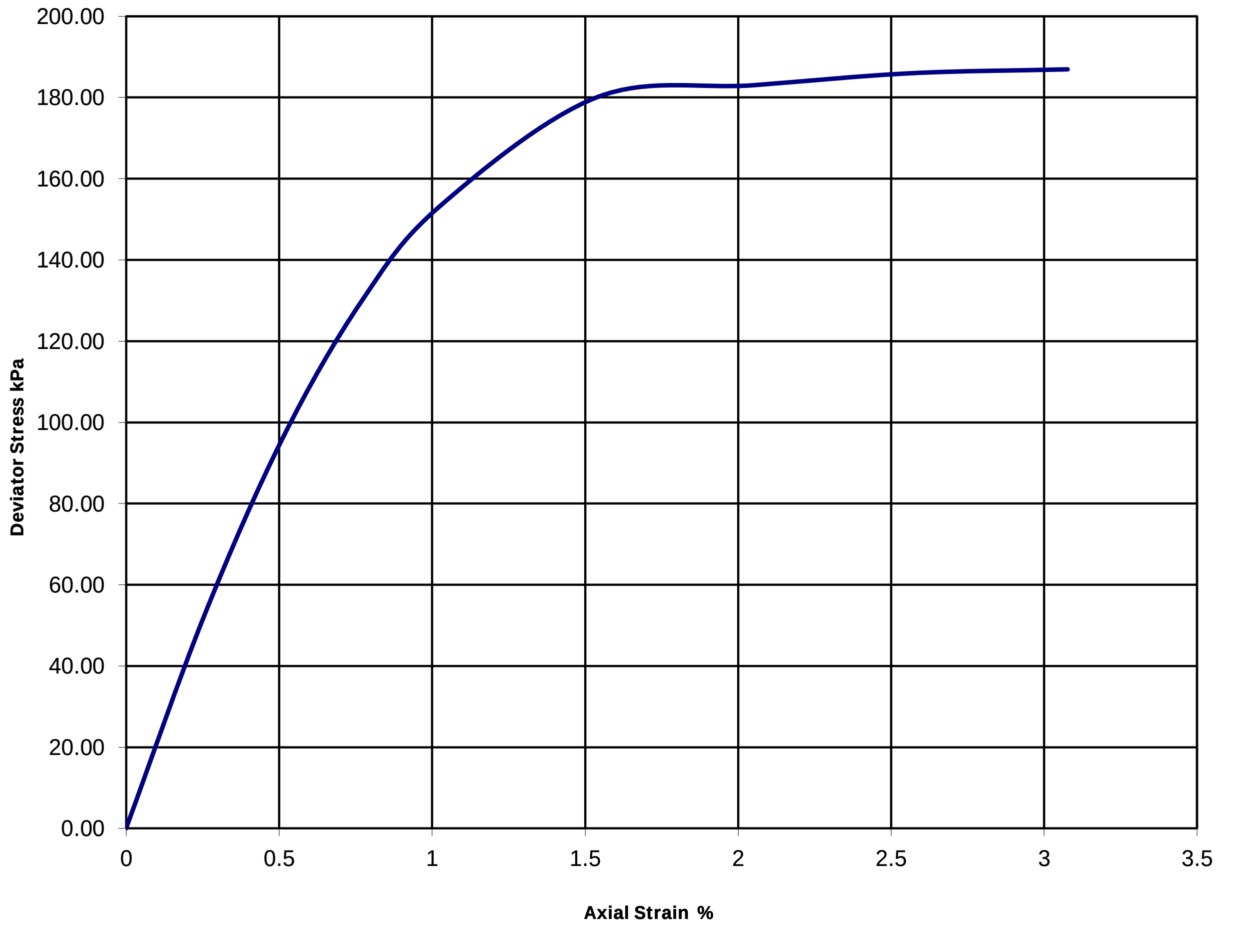
Paul Evans (Quality Manager)

Test Report: **Undrained Shear Strength in Triaxial Compression**
BS 1377 : Part7 : Clause 8 : 1990 Single Stage Test
without measurement of Pore Pressure

Client ref:	**N/A**
Location:	**Unknown**
Contract Number:	**27496-**
Hole Number	**025M**
Sample Number:	**N/A**
Depth (m) :	**N/A -**
Sample Type :	**U**
Sample Description :	**Firm greyish brown silty CLAY with additive**



Diameter (mm):	102	Height (mm):	195	Test:	U 102 mm Single Stage.				
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Remarks Sample taken from Top of tube Rate of strain = 2 %/min
A	84.2	1.35	0.73	100	187	93	3.1	Brittle	Latex Membrane used 0.2 mm thickness

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UKAS TESTING 2788

Test Report: **Undrained Shear Strength in Triaxial Compression**
BS 1377 : Part7 : Clause 8 : 1990 Single Stage Test
without measurement of Pore Pressure

Client ref:	**N/A**
Location:	**Unknown**
Contract Number:	**27496-**
Hole Number	**025M**
Sample Number:	**N/A**
Depth (m) :	**N/A -**
Sample Type :	**U**

Post Test Specimen

Specimen Split

Diameter (mm):		102	Height (mm):		195	Test:	U 102 mm Single Stage.			
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Remarks Sample taken from Top of tube Rate of strain = 2 %/min	
A	84.2	1.35	0.73	100	187	93	3.1	Brittle	Latex Membrane used 0.2 mm thickness	

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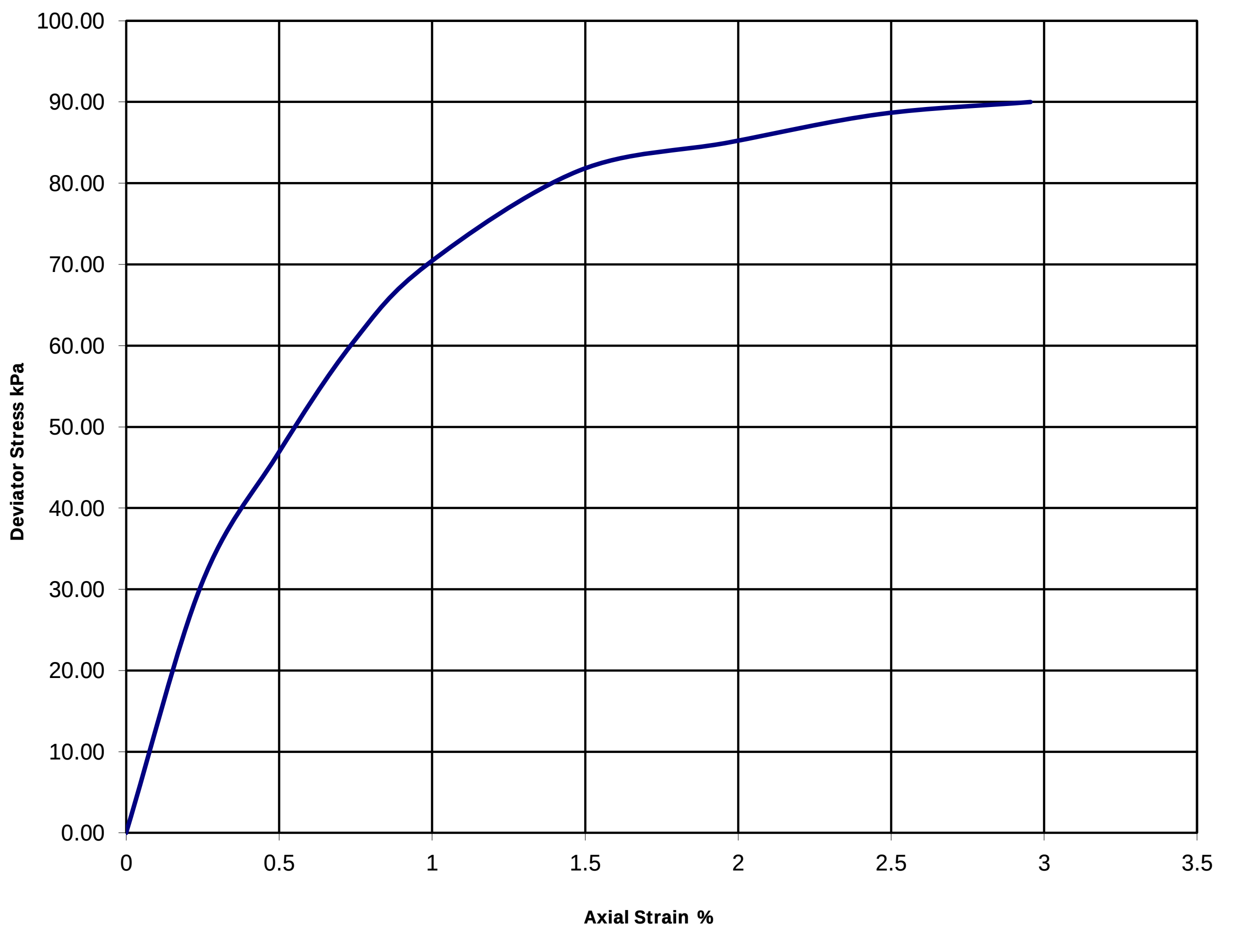
UKAS TESTING 2788

Test Report: **Undrained Shear Strength in Triaxial Compression**
BS 1377 : Part7 : Clause 8 : 1990 Single Stage Test
without measurement of Pore Pressure

Client ref:	**N/A**
Location:	**Unknown**
Contract Number:	**27496-**
Hole Number	**027G**
Sample Number:	**N/A**
Depth (m) :	**N/A -**
Sample Type :	**U**
Sample Description :	**Firm greyish brown silty CLAY with additive**



Diameter (mm):		102	Height (mm):		203	Test:	U 102 mm Single Stage.		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Remarks Sample taken from Top of tube Rate of strain = 2 %/min
A	92.2	1.44	0.75	100	91	46	3.4	Brittle	Latex Membrane used 0.2 mm thickness

GSTL
GEO Site & Testing Services Limited

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UKAS TESTING 2788

Test Report: **Undrained Shear Strength in Triaxial Compression**
BS 1377 : Part7 : Clause 8 : 1990 Single Stage Test
without measurement of Pore Pressure

Client ref: **N/A**
Location: **Unknown**
Contract Number: **27496-**
Hole Number **027G**
Sample Number: **N/A**
Depth (m) : **N/A -**
Sample Type : **U**

Post Test Specimen

Specimen Split

Diameter (mm):		102	Height (mm):		203	Test:	U 102 mm Single Stage.		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Remarks Sample taken from Top of tube Rate of strain = 2 %/min
A	92.2	1.44	0.75	100	91	46	3.4	Brittle	Latex Membrane used 0.2 mm thickness

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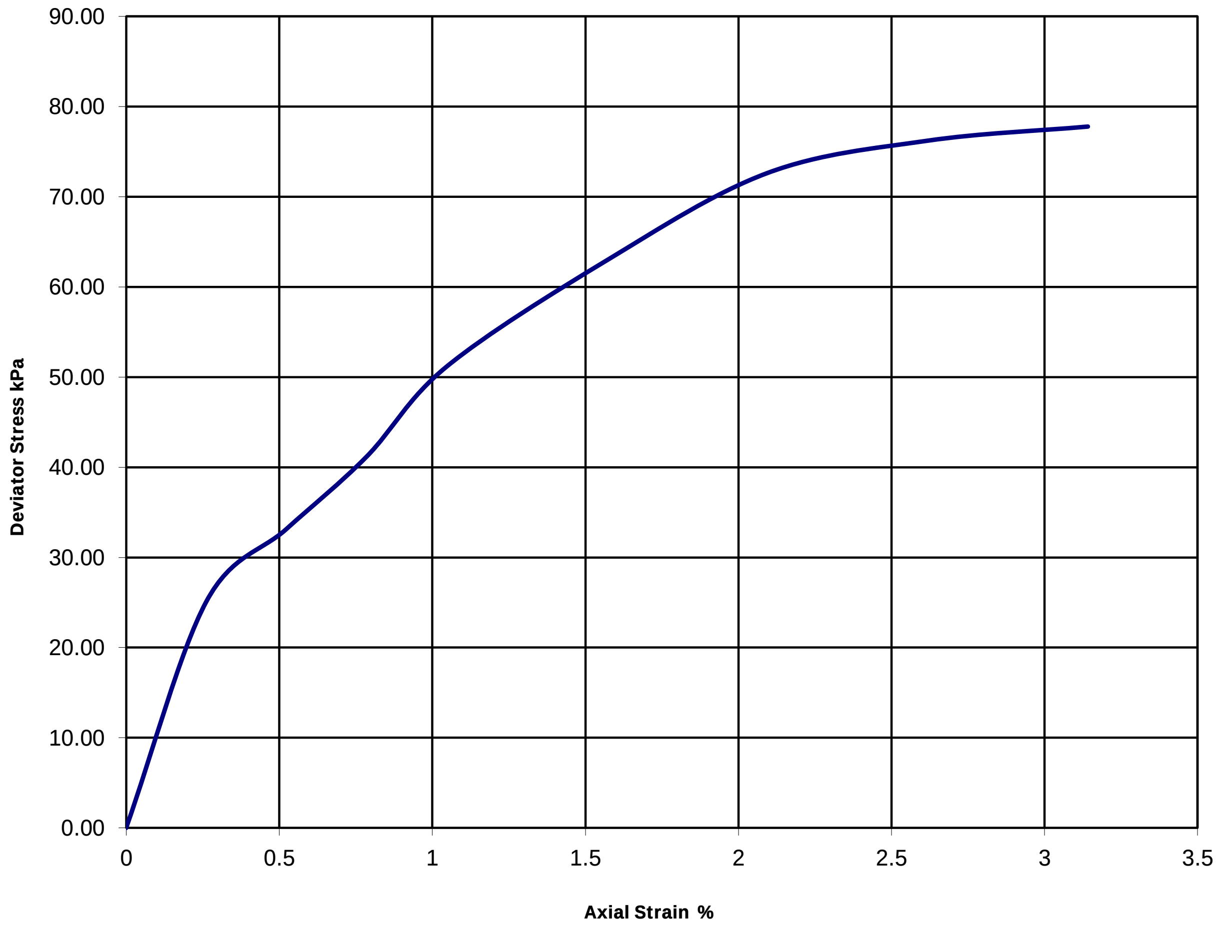
Test Report: **Undrained Shear Strength in Triaxial Compression**
BS 1377 : Part7 : Clause 8 : 1990 Single Stage Test
without measurement of Pore Pressure

Client ref:	**N/A**
Location:	**Unknown**
Contract Number:	**27496-**
Hole Number	**028K**
Sample Number:	**N/A**
Depth (m) :	**N/A -**
Sample Type :	**U**
Sample Description :	**Firm greyish brown silty CLAY with additive**



Diameter (mm):	101	Height (mm):		191	Test:	U 101 mm Single Stage.			
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Remarks: Sample taken from Top of tube; Rate of strain = 2 %/min
A	98.2	1.46	0.74	100	79	40	3.7	Brittle	Latex Membrane used 0.2 mm thickness

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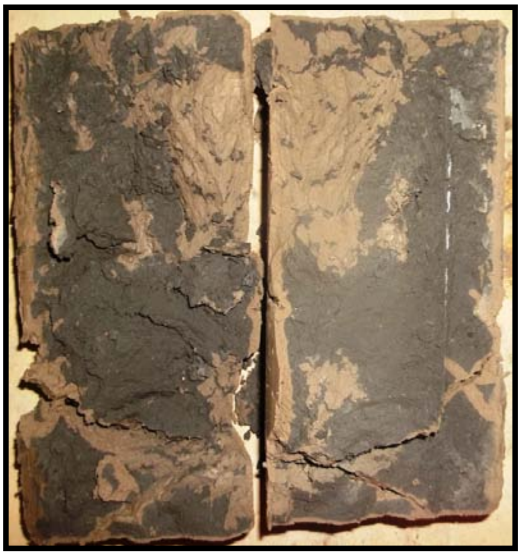
UKAS TESTING 2788

Test Report: **Undrained Shear Strength in Triaxial Compression**
BS 1377 : Part7 : Clause 8 : 1990 Single Stage Test
without measurement of Pore Pressure

Client ref:	**N/A**
Location:	**Unknown**
Contract Number:	**27496-**
Hole Number	**028K**
Sample Number:	**N/A**
Depth (m) :	**N/A -**
Sample Type :	**U**



Post Test Specimen **Specimen Split**

Diameter (mm):	101	Height (mm):	191	Test:	U 101 mm Single Stage.				
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Remarks Sample taken from Top of tube Rate of strain = 2 %/min
A	98.2	1.46	0.74	100	79	40	3.7	Brittle	Latex Membrane used 0.2 mm thickness

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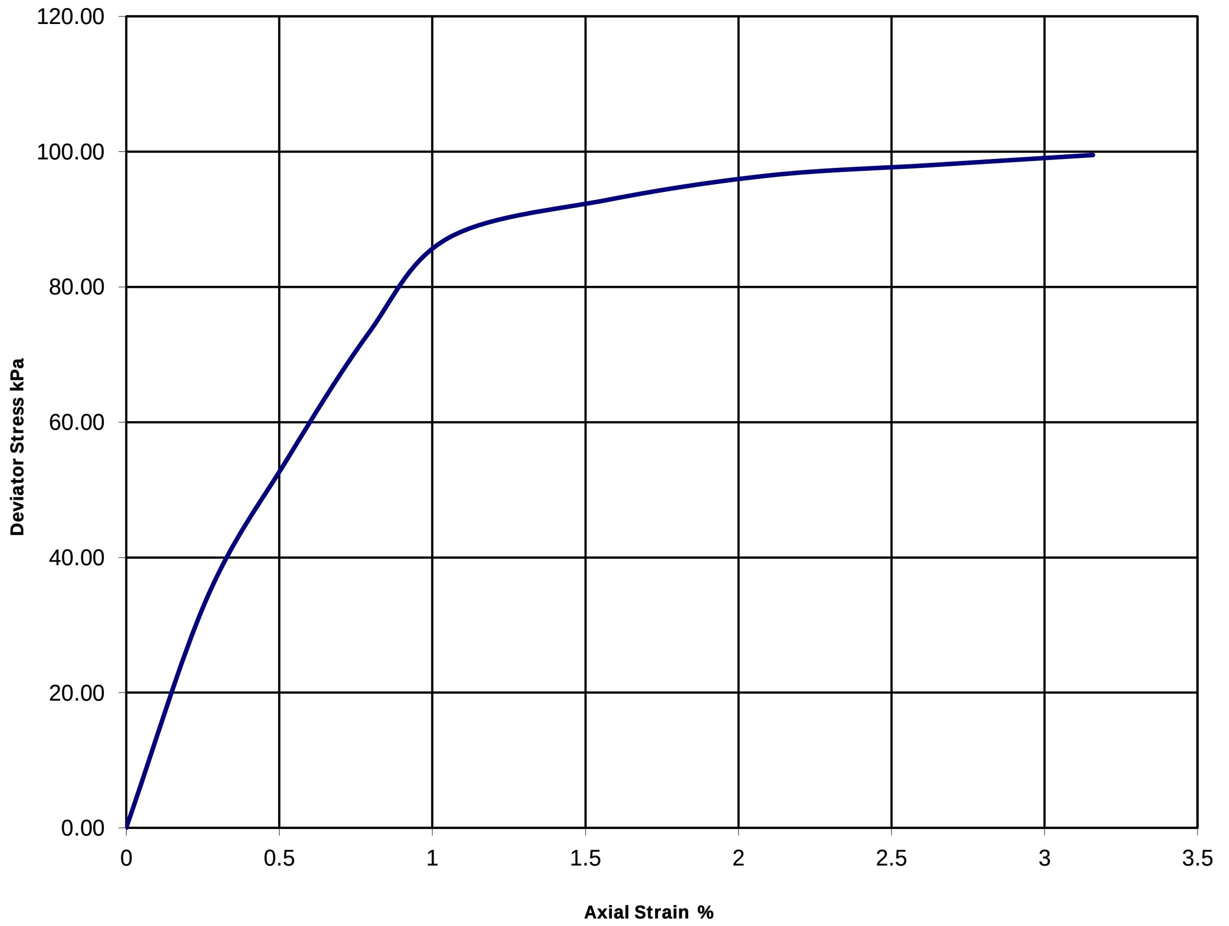
Test Report: **Undrained Shear Strength in Triaxial Compression**
BS 1377 : Part7 : Clause 8 : 1990 Single Stage Test
without measurement of Pore Pressure

Client ref:	**N/A**
Location:	**Unknown**
Contract Number:	**27496-**
Hole Number	**029F**
Sample Number:	**N/A**
Depth (m) :	**N/A -**
Sample Type :	**U**
Sample Description :	**Firm greyish brown silty CLAY with additive**



Diameter (mm):	100	Height (mm):	190	Test:	U 100 mm Single Stage.				
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Remarks Sample taken from Top of tube Rate of strain = 2 %/min
A	97.4	1.29	0.65	100	102	51	4.7	Brittle	Latex Membrane used 0.2 mm thickness

GSTL
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Date Approved: 7.8.15

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Paul Evans (Quality Manager)

UKAS TESTING 2788

Test Report: **Undrained Shear Strength in Triaxial Compression**
BS 1377 : Part7 : Clause 8 : 1990 Single Stage Test
without measurement of Pore Pressure

Client ref:	**N/A**
Location:	**Unknown**
Contract Number:	**27496-**
Hole Number	**029F**
Sample Number:	**N/A**
Depth (m) :	**N/A -**
Sample Type :	**U**

Post Test Specimen

Specimen Split

Diameter (mm):		100	Height (mm):		190	Test:	U 100 mm Single Stage.		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Remarks Sample taken from Top of tube Rate of strain = 2 %/min
A	97.4	1.29	0.65	100	102	51	4.7	Brittle	Latex Membrane used 0.2 mm thickness

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Date Approved: 7.8.15

Approved By:
Paul Evans (Quality Manager)

UKAS TESTING 2788

Permeability in a Triaxial Cell
BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		013G
Sample No.		
Depth	m	
Date		23/07/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Dark greyish brown very silty CLAY

Initial Specimen Conditions

Height	mm	102.00
Diameter	mm	100.00
Area	mm^2	7853.98
Volume	cm^3	801.11
Mass	g	1149.20
Dry Mass	g	608.40
Density	Mg/m^3	1.43
Dry Density	Mg/m^3	0.76
Moisture Content	%	88.9
Voids Ratio		2.489
Specific Gravity	kN/m^3	2.65
(assumed/measured)		assumed

Final Specimen Conditions

Moisture Content	%	89.84
Density	Mg/m^3	1.54
Dry Density	Mg/m^3	0.81

Test Setup

Date started	14/07/2015
Date Finished	22/07/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPerm 4
Cell Number	CPerm 4

D P Evans

Checked and Approved By

23/07/15
Date

UKAS TESTING 2788

Client Ref

GSTL GEO Site & Testing Services Limited

DSML

Contract No

27496

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		013G
Sample No.		
Depth	m	
Date		23/07/2015

Saturation

Cell Pressure Incr.	kPa	100.00
Back Pressure Incr.	kPa	100.00
Differential Pressure	kPa	0.00
Final Cell Pressure	kPa	300.00
Final Pore Pressure	kPa	297.00
Final B Value		1.00

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	300.00
Back Pressure	kPa	200.00
Excess Pore Pressure	kPa	97.00
Pore Pressure at End	kPa	200.00
Consolidated Volume	cm^3	749.71
Consolidated Height	mm	99.82
Consolidated Area	mm^2	7518.03
Vol. Compressibility	m^2/MN	1.8580
Consolidation Coef.	m^2/yr.	0.6615
Final Voids Ratio		2.265

Permeability

Cell Pressure	kPa	300.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00225
Average Temperature	'C	20

Verticle Permiability Kv m/s	**2.43 x 10-10**

D P Evans

Checked and Approved By

23/07/15

Date

UKAS TESTING 2788

Client Ref

GSTL GEO Site & Testing Services Limited

DSML

Contract No

27496

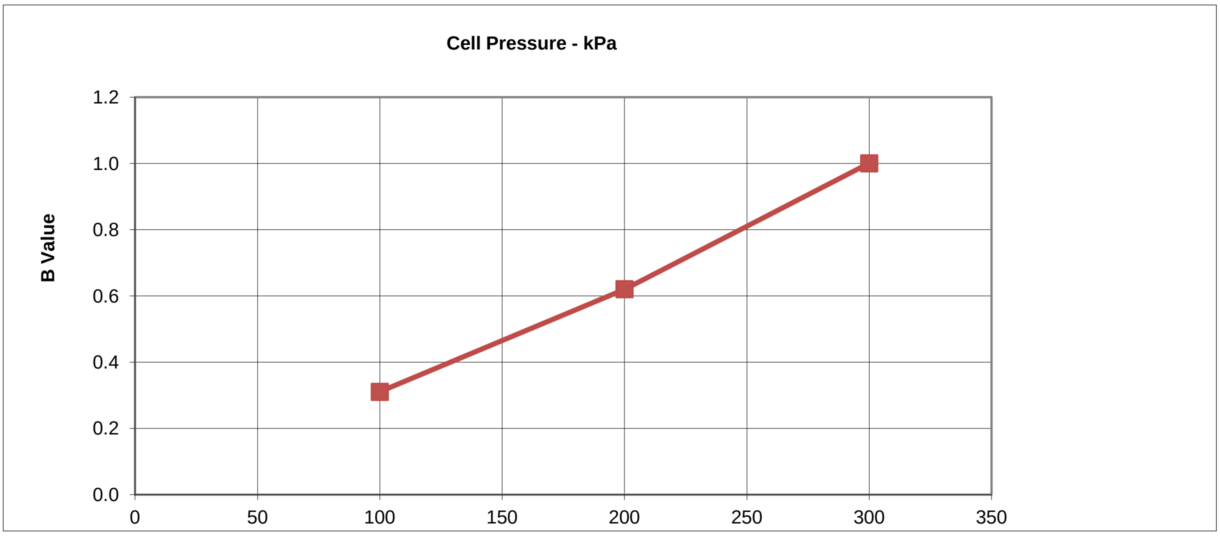
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

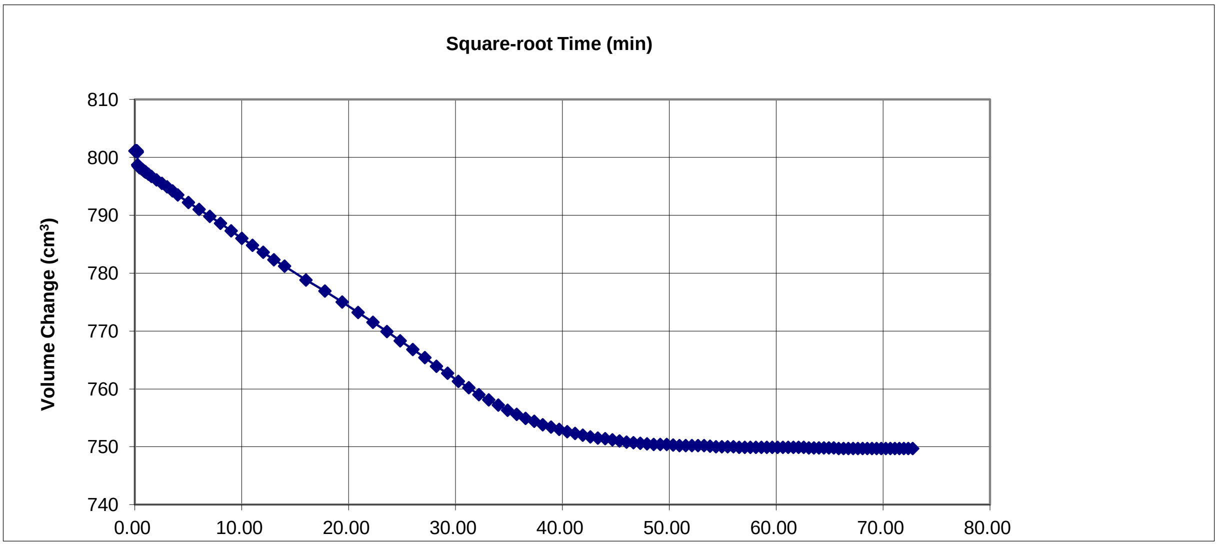
Specimen Details

Borehole	013G
Sample No.	
Depth m	
Date	23/07/2015

Saturation Stage



Consolidation Stage



D P Grans

Checked and Approved By

23/07/15
Date

UKAS TESTING 2788

Client Ref

GSTL GEO Site & Testing Services Limited

DSML

Contract No

27496

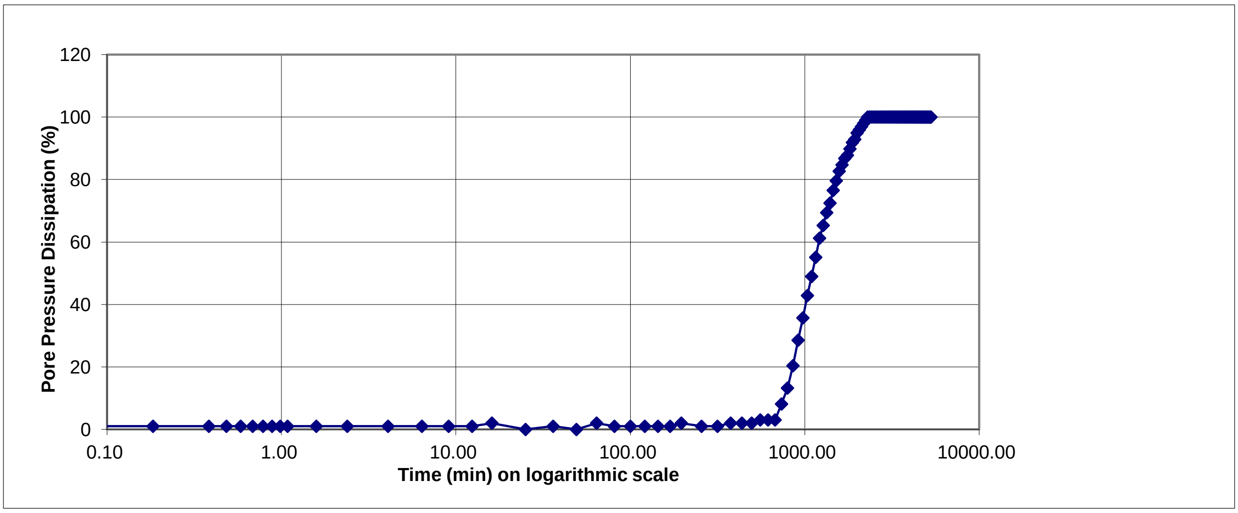
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

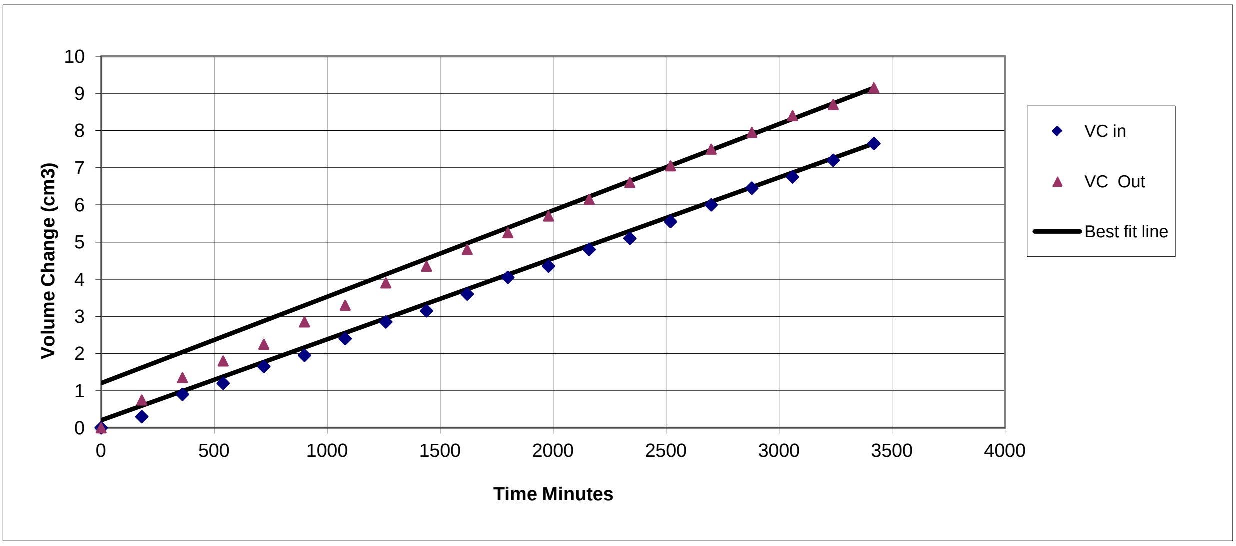
Specimen Details

Borehole		013G
Sample No.		
Depth	m	
Date		23/07/2015

Consolidation Stage



Permeability Stage



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Contract No

27496

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		015H
Sample No.		
Depth	m	
Date		21/07/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Dark greyish brown very silty CLAY

Initial Specimen Conditions

Height	mm	105.00
Diameter	mm	100.00
Area	mm^2	7853.98
Volume	cm^3	824.67
Mass	g	1203.00
Dry Mass	g	644.00
Density	Mg/m^3	1.46
Dry Density	Mg/m^3	0.78
Moisture Content	%	86.8
Voids Ratio		2.393
Specific Gravity	kN/m^3	2.65
	(assumed/measured)	assumed

Final Specimen Conditions

Moisture Content	%	89.15
Density	Mg/m^3	1.62
Dry Density	Mg/m^3	0.86

Test Setup

Date started	11/07/2015
Date Finished	19/07/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPerm 3
Cell Number	CPerm 3

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Client Ref

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Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		015H
Sample No.		
Depth	m	
Date		21/07/2015

Saturation

Cell Pressure Incr.	kPa	100.00
Back Pressure Incr.	kPa	100.00
Differential Pressure	kPa	0.00
Final Cell Pressure	kPa	300.00
Final Pore Pressure	kPa	299.60
Final B Value		1.00

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	300.00
Back Pressure	kPa	200.00
Excess Pore Pressure	kPa	99.00
Pore Pressure at End	kPa	200.00
Consolidated Volume	cm^3	752.47
Consolidated Height	mm	101.94
Consolidated Area	mm^2	7395.57
Vol. Compressibility	m^2/MN	107.0560
Consolidation Coef.	m^2/yr.	0.8843
Final Voids Ratio		2.096

Permeability

Cell Pressure	kPa	300.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00633
Average Temperature	'C	20

Verticle Permiability Kv m/s	**7.11 x 10-10**

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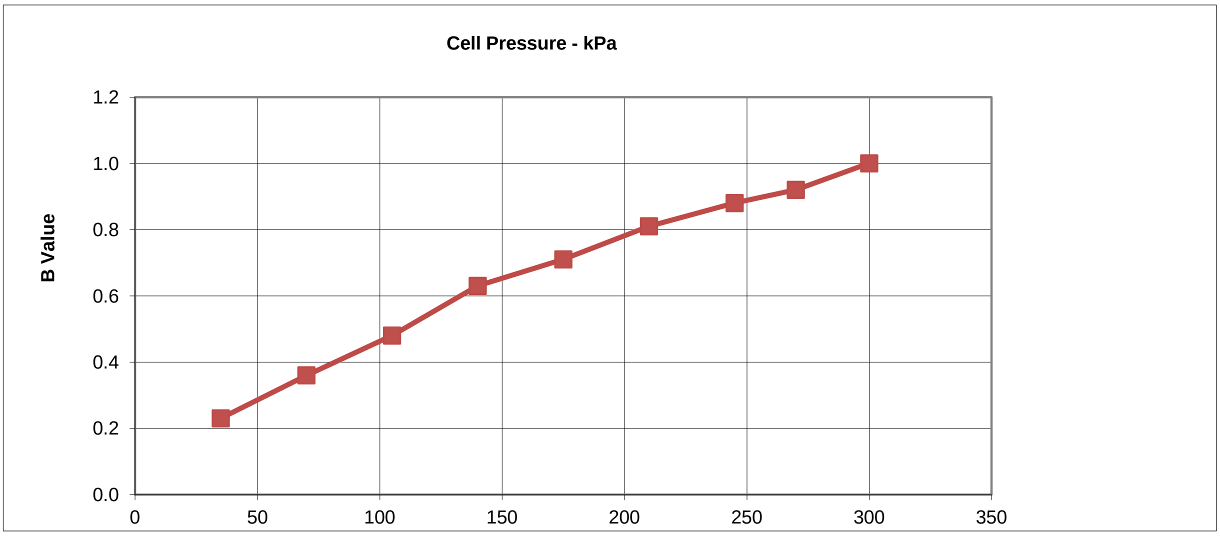
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

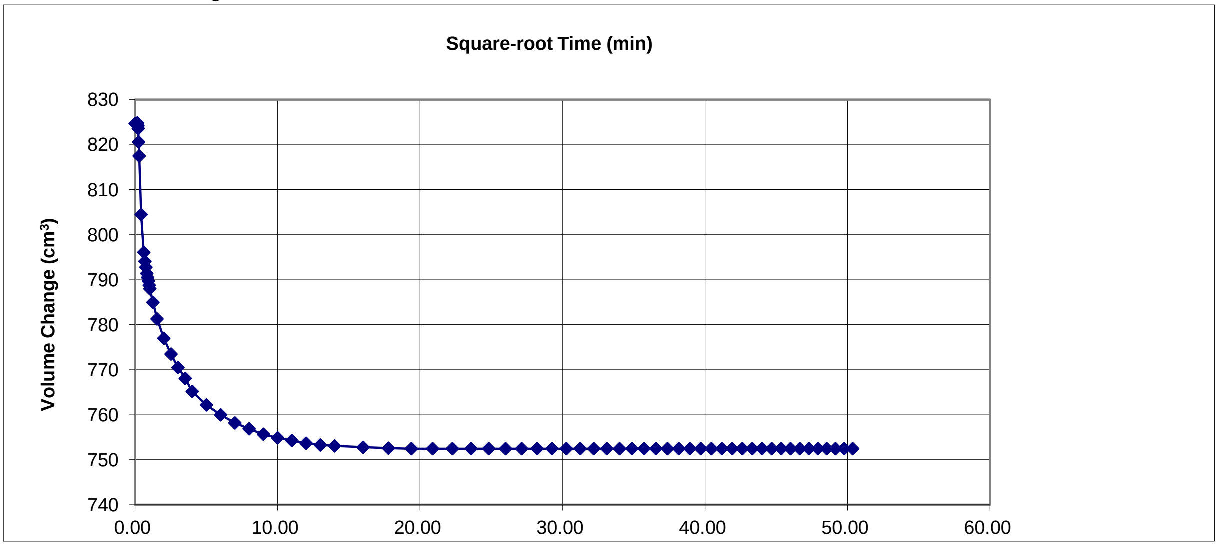
Specimen Details

Borehole	015H
Sample No.	
Depth m	
Date	21/07/2015

Saturation Stage



Consolidation Stage



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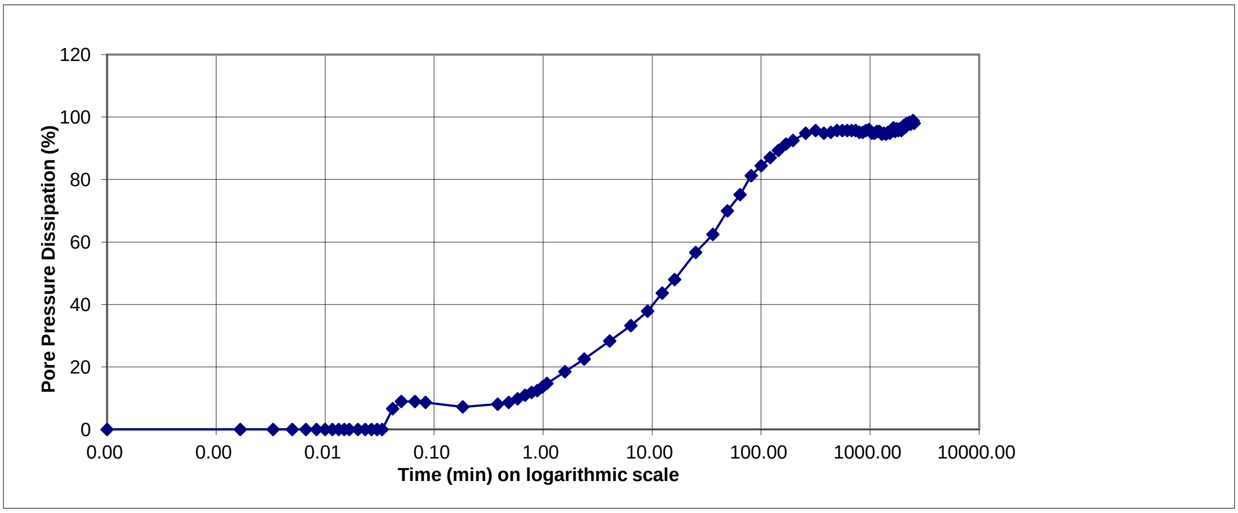
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

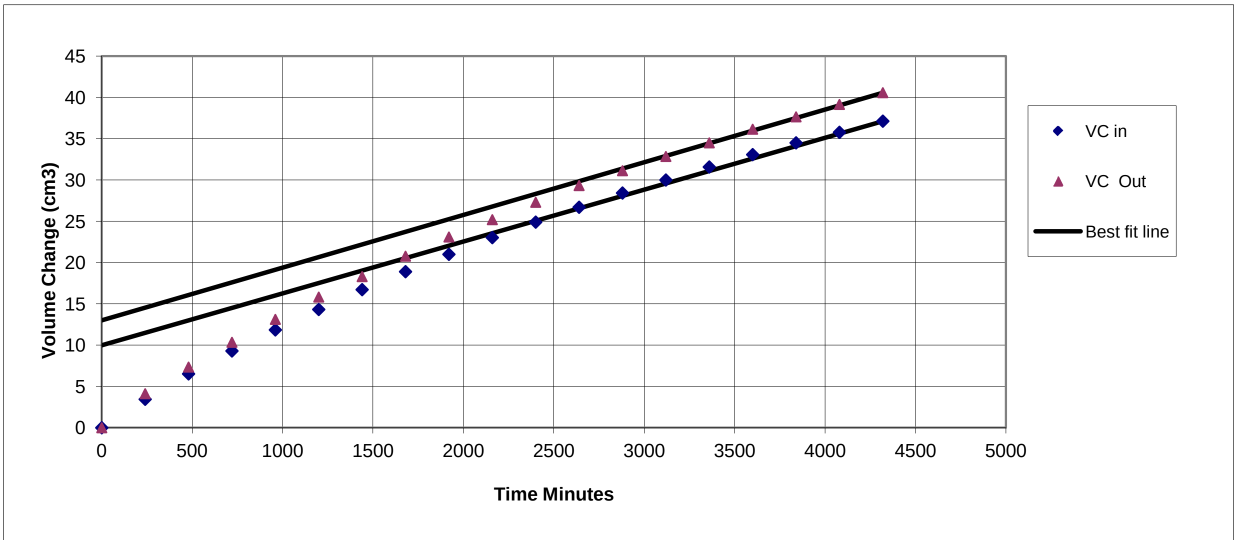
Specimen Details

Borehole	015H
Sample No.	
Depth m	
Date	21/07/2015

Consolidation Stage



Permeability Stage



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Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		017J
Sample No.		
Depth	m	
Date		03/08/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Dark greyish brown very silty CLAY

Initial Specimen Conditions

Height	mm	105.00
Diameter	mm	100.00
Area	mm^2	7853.98
Volume	cm^3	824.67
Mass	g	1159.70
Dry Mass	g	644.90
Density	Mg/m^3	1.41
Dry Density	Mg/m^3	0.78
Moisture Content	%	79.8
Voids Ratio		2.389
Specific Gravity	kN/m^3	2.65
(assumed/measured)		assumed

Final Specimen Conditions

Moisture Content	%	81.02
Density	Mg/m^3	1.42
Dry Density	Mg/m^3	0.79

Test Setup

Date started	23/07/2015
Date Finished	01/08/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPerm 8
Cell Number	CPerm 8

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Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		017J
Sample No.		
Depth	m	
Date		03/08/2015

Saturation

Cell Pressure Incr.	kPa	35.00
Back Pressure Incr.	kPa	34.00
Differential Pressure	kPa	1.00
Final Cell Pressure	kPa	175.00
Final Pore Pressure	kPa	173.00
Final B Value		0.97

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	175.00
Back Pressure	kPa	75.00
Excess Pore Pressure	kPa	98.00
Pore Pressure at End	kPa	75.00
Consolidated Volume	cm^3	820.57
Consolidated Height	mm	104.83
Consolidated Area	mm^2	7827.95
Vol. Compressibility	m^2/MN	3.9587
Consolidation Coef.	$m^2/yr.$	0.0507
Final Voids Ratio		2.372

Permeability

Cell Pressure	kPa	175.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00285
Average Temperature	'C	20

Verticle Permiability Kv m/s	**3.11 x 10-10**

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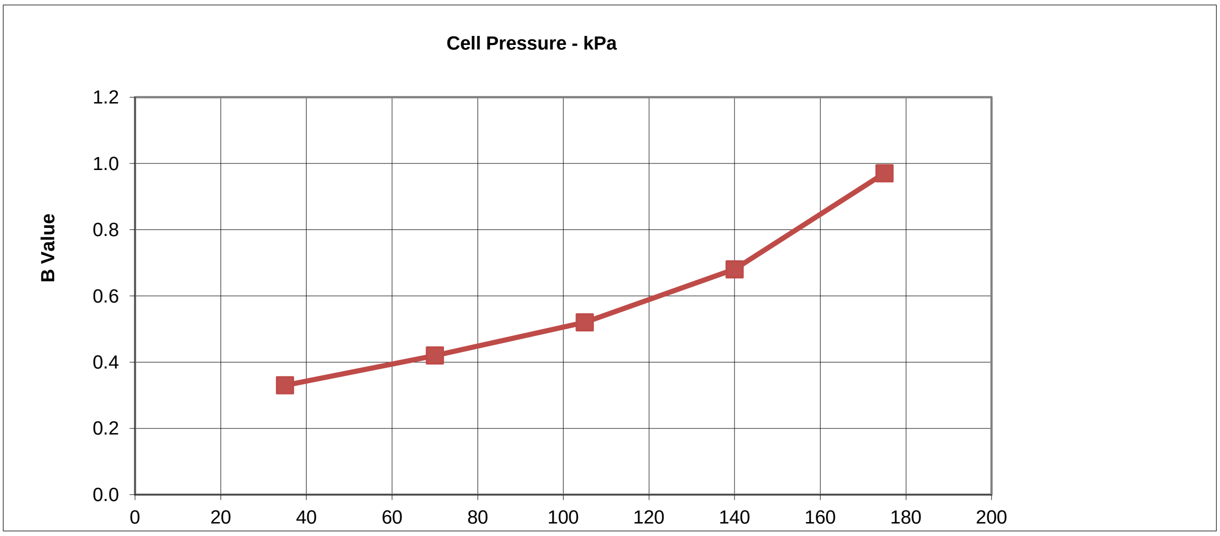
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

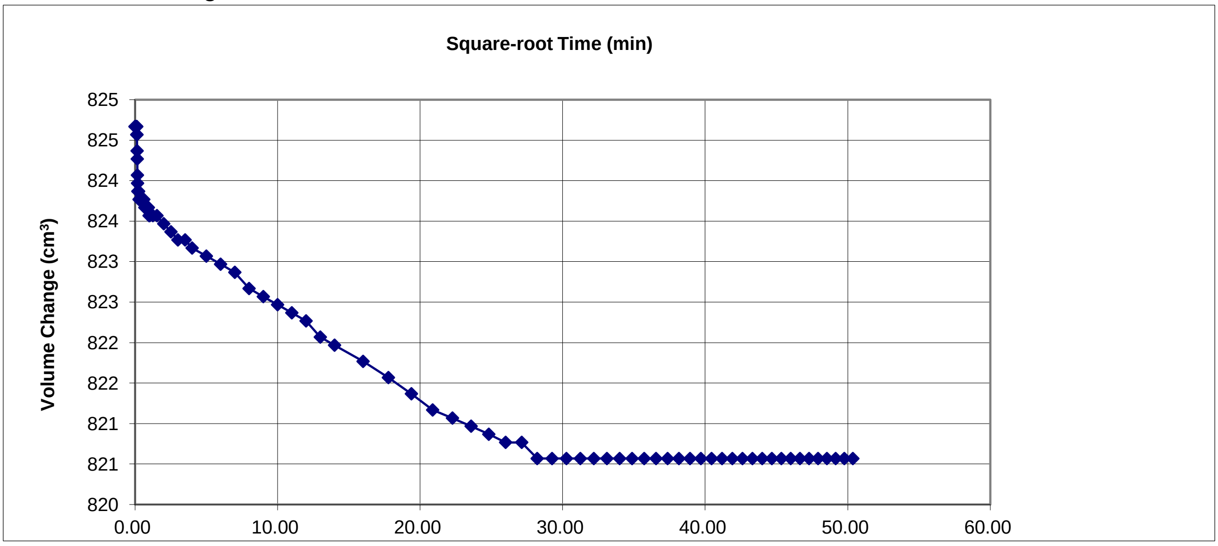
Specimen Details

Borehole	017J
Sample No.	
Depth m	
Date	03/08/2015

Saturation Stage



Consolidation Stage



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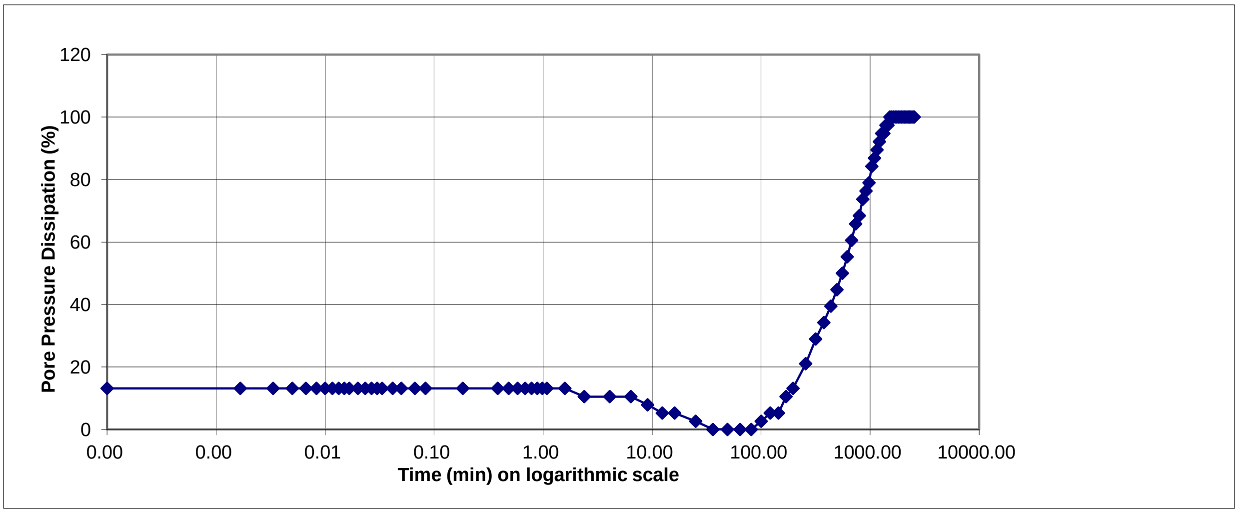
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

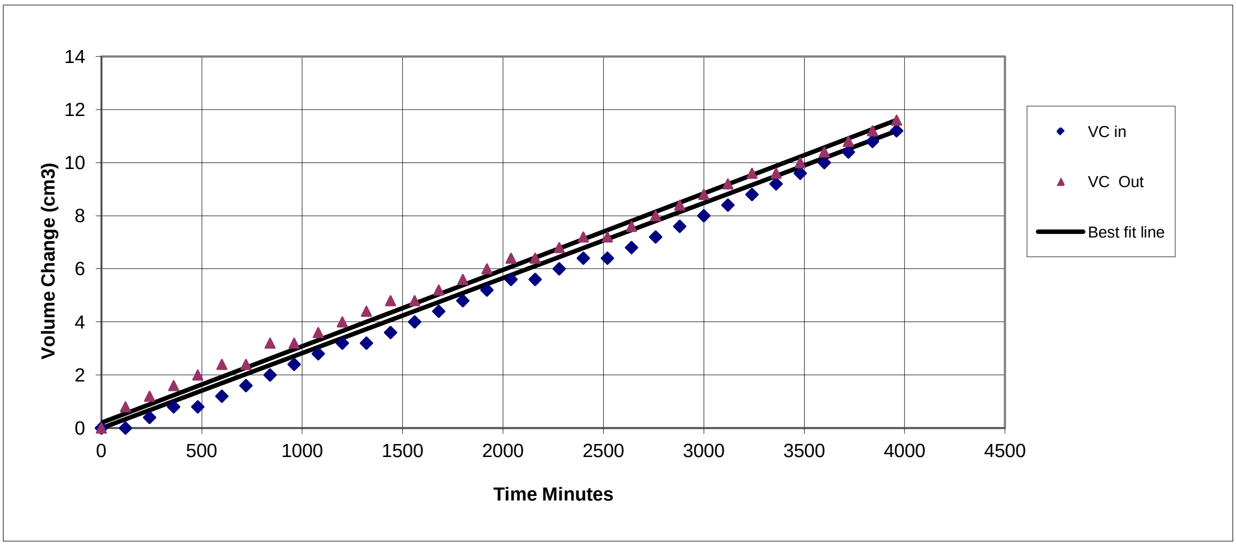
Specimen Details

Borehole	017J
Sample No.	
Depth m	
Date	03/08/2015

Consolidation Stage



Permeability Stage



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Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		019G
Sample No.		
Depth	m	
Date		03/08/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Dark greyish brown very silty firm CLAY

Initial Specimen Conditions

Height	mm	104.00
Diameter	mm	100.00
Area	mm^2	7853.98
Volume	cm^3	816.81
Mass	g	#VALUE!
Dry Mass	g	#VALUE!
Density	Mg/m^3	1.35
Dry Density	Mg/m^3	0.73
Moisture Content	%	83.8
Voids Ratio		2.621
Specific Gravity	kN/m^3	2.65
(assumed/measured)		assumed

Final Specimen Conditions

Moisture Content	%	85.85
Density	Mg/m^3	1.43
Dry Density	Mg/m^3	0.77

Test Setup

Date started	21/07/2015
Date Finished	31/07/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPerm 1
Cell Number	CPerm 1

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Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		019G
Sample No.		
Depth	m	
Date		03/08/2015

Saturation

Cell Pressure Incr.	kPa	50.00
Back Pressure Incr.	kPa	47.50
Differential Pressure	kPa	2.50
Final Cell Pressure	kPa	250.00
Final Pore Pressure	kPa	243.00
Final B Value		0.95

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	250.00
Back Pressure	kPa	150.00
Excess Pore Pressure	kPa	100.00
Pore Pressure at End	kPa	150.00
Consolidated Volume	cm^3	776.61
Consolidated Height	mm	102.29
Consolidated Area	mm^2	7596.29
Vol. Compressibility	m^2/MN	12.5849
Consolidation Coef.	$m^2/yr.$	0.4922
Final Voids Ratio		2.443

Permeability

Cell Pressure	kPa	250.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00063
Average Temperature	'C	20

Vertical Permeability I m/s	**6.86 x 10-11**

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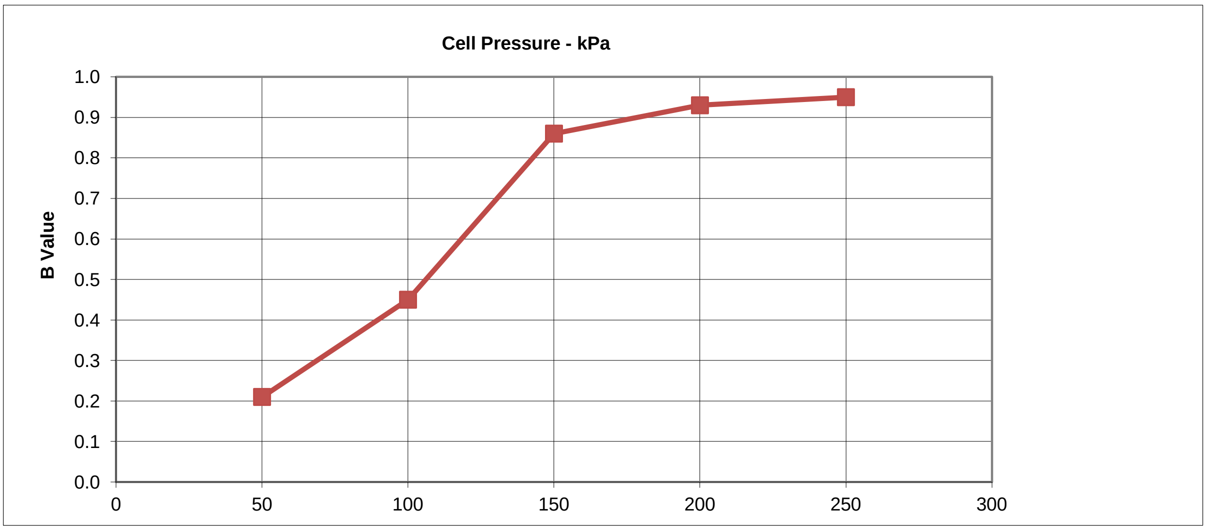
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

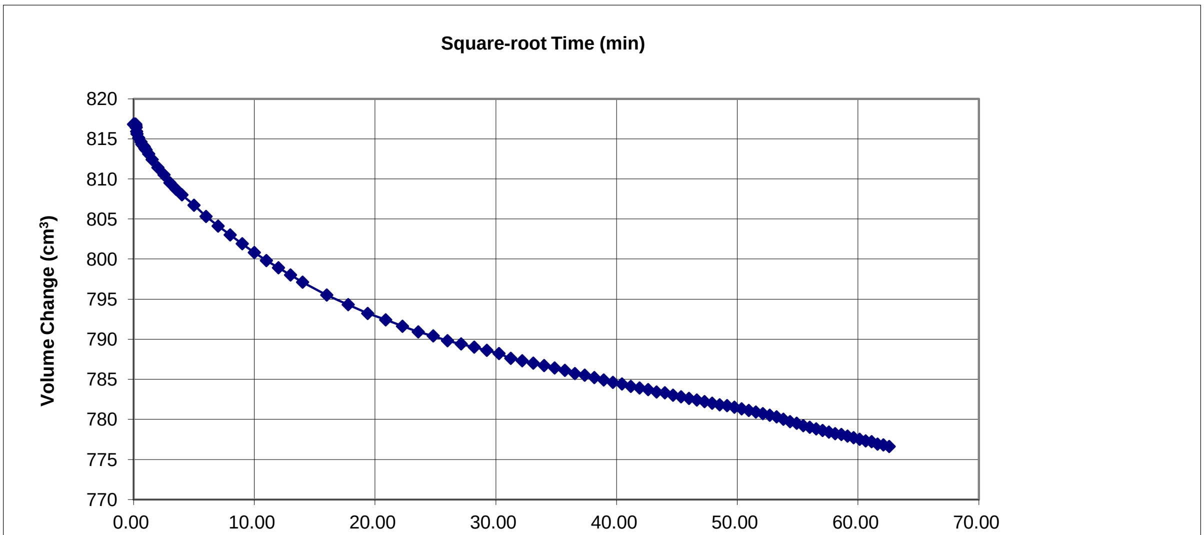
Specimen Details

Borehole	019G
Sample No.	
Depth m	
Date	03/08/2015

Saturation Stage



Consolidation Stage



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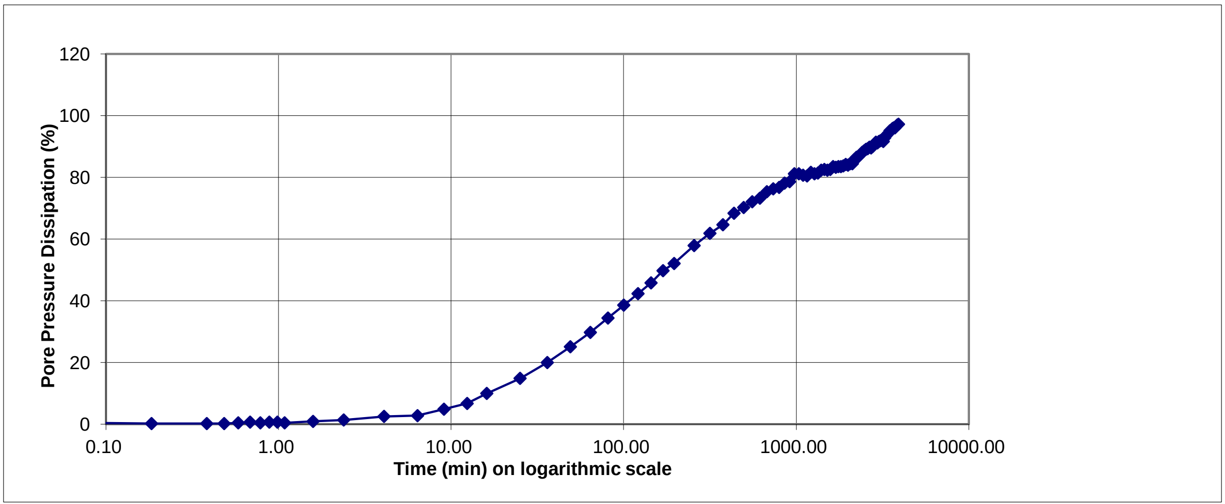
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

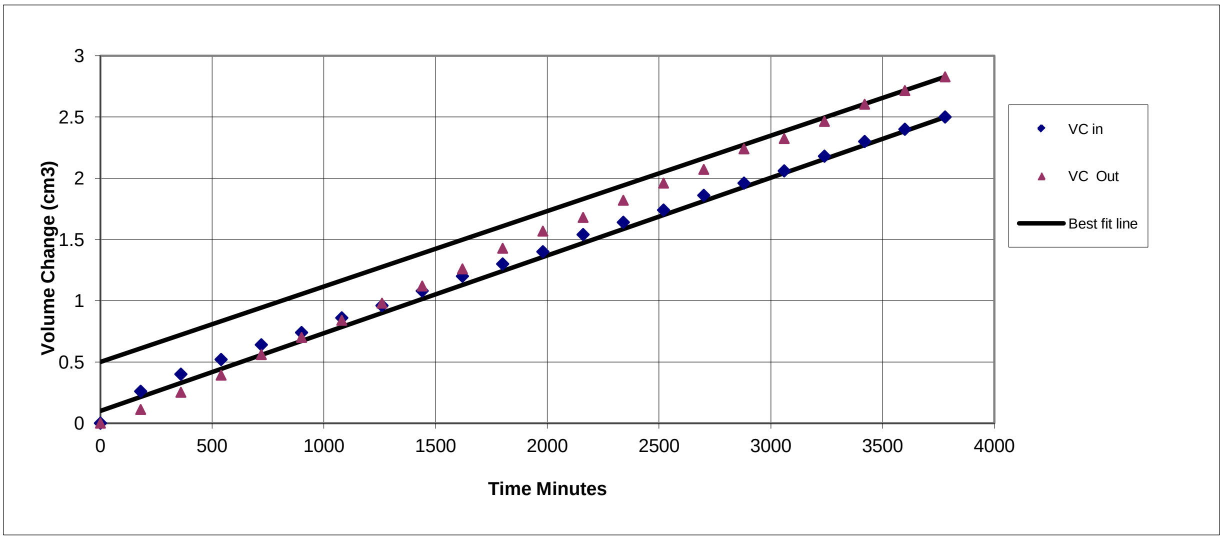
Specimen Details

Borehole Sample No. Depth m Date	019G 03/08/2015

Consolidation Stage



Permeability Stage



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Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		021F
Sample No.		
Depth	m	
Date		05/08/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Dark greyish brown very silty firm CLAY

Initial Specimen Conditions

Height	mm	103.00
Diameter	mm	101.00
Area	mm^2	8011.85
Volume	cm^3	825.22
Mass	g	1183.20
Dry Mass	g	611.60
Density	Mg/m^3	1.43
Dry Density	Mg/m^3	0.74
Moisture Content	%	93.5
Voids Ratio		2.576
Specific Gravity	kN/m^3	2.65
(assumed/measured)		assumed

Final Specimen Conditions

Moisture Content	%	94.46
Density	Mg/m^3	1.47
Dry Density	Mg/m^3	0.75

Test Setup

Date started	25/07/2015
Date Finished	04/08/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPerm 6
Cell Number	CPerm 6

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Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		021F
Sample No.		
Depth	m	
Date		05/08/2015

Saturation

Cell Pressure Incr.	kPa	50.00
Back Pressure Incr.	kPa	48.00
Differential Pressure	kPa	2.00
Final Cell Pressure	kPa	400.00
Final Pore Pressure	kPa	400.00
Final B Value		0.96

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	400.00
Back Pressure	kPa	300.00
Excess Pore Pressure	kPa	100.00
Pore Pressure at End	kPa	300.00
Consolidated Volume	cm^3	811.72
Consolidated Height	mm	102.44
Consolidated Area	mm^2	7924.47
Vol. Compressibility	m^2/MN	6.3356
Consolidation Coef.	$m^2/yr.$	0.1636
Final Voids Ratio		2.517

Permeability

Cell Pressure	kPa	400.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00535
Average Temperature	'C	20

Vertical Permeability I m/s	**5.63 x 10-11**

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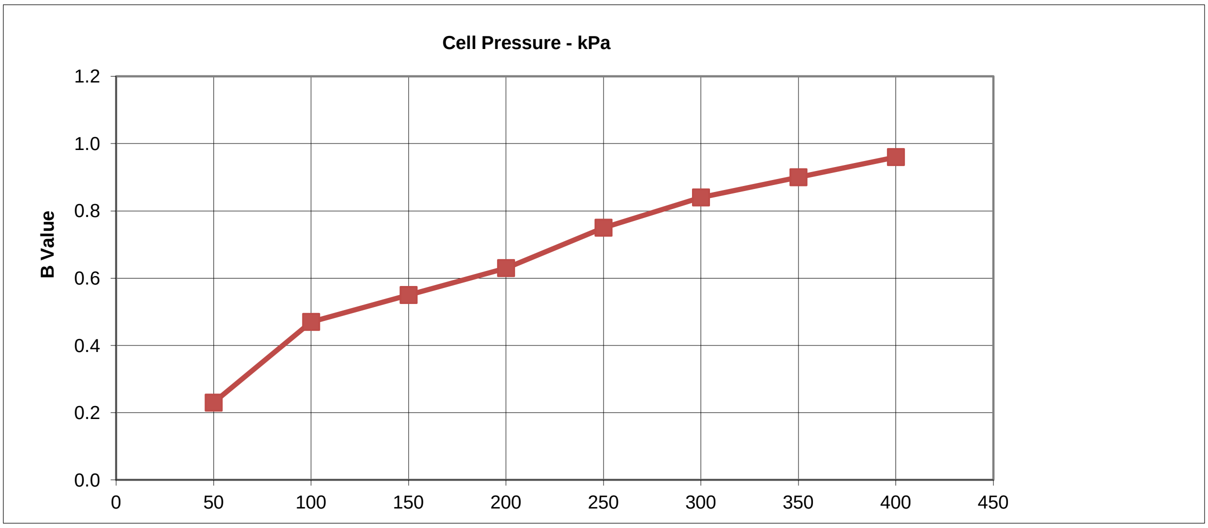
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

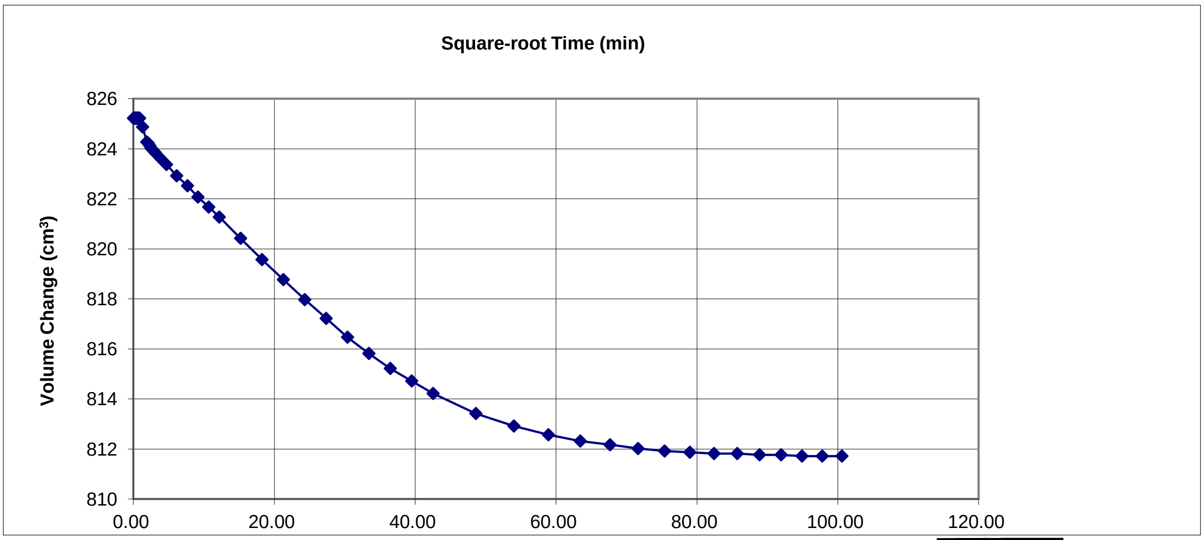
Specimen Details

Borehole	021F
Sample No.	
Depth m	
Date	05/08/2015

Saturation Stage



Consolidation Stage



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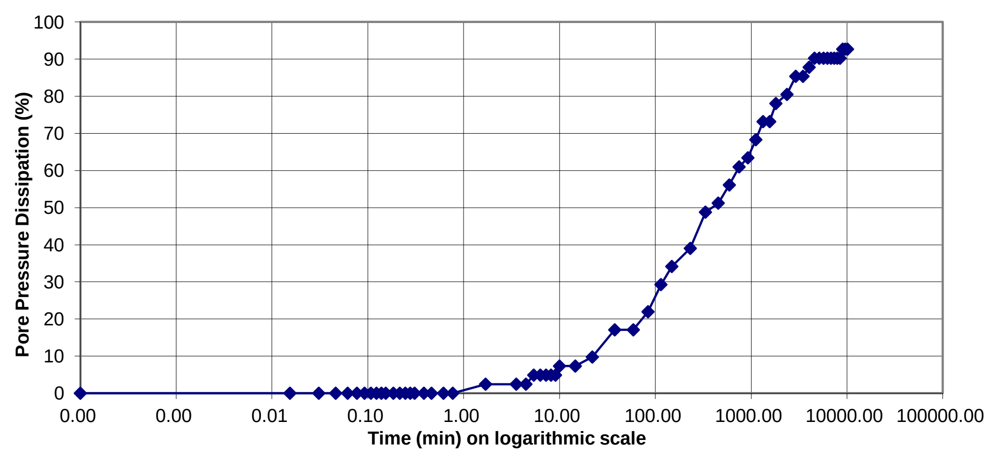
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

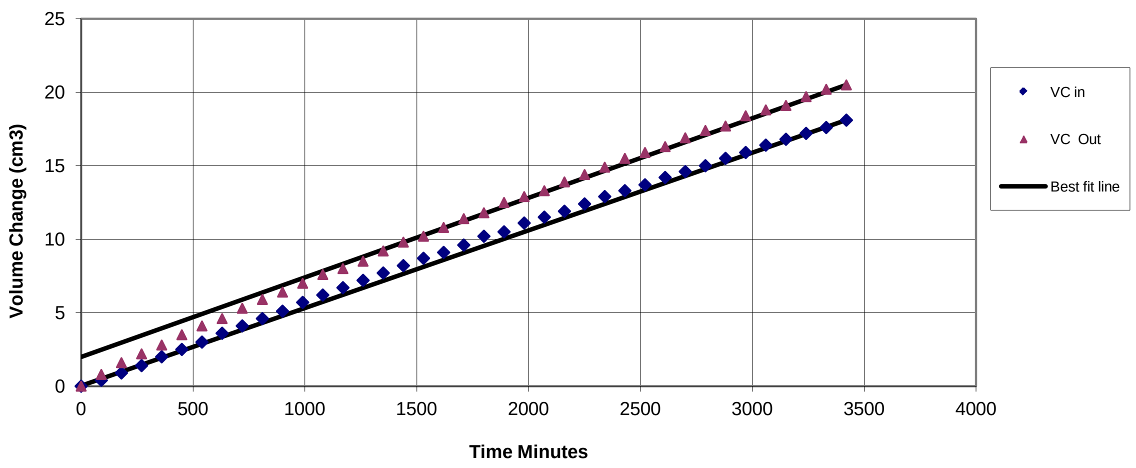
Specimen Details

Borehole		021F
Sample No.		
Depth	m	
Date		05/08/2015

Consolidation Stage



Permeability Stage



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Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		022D
Sample No.		
Depth	m	0
Date		31/07/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Dark greyish brown very silty CLAY

Initial Specimen Conditions

Height	mm	105.00
Diameter	mm	101.00
Area	mm^2	8011.85
Volume	cm^3	841.24
Mass	g	1135.90
Dry Mass	g	592.80
Density	Mg/m^3	1.35
Dry Density	Mg/m^3	0.70
Moisture Content	%	91.6
Voids Ratio		2.761
Specific Gravity	kN/m^3	2.65
	(assumed/measured)	assumed

Final Specimen Conditions

Moisture Content	%	92.75
Density	Mg/m^3	1.39
Dry Density	Mg/m^3	0.72

Test Setup

Date started	21/07/2015
Date Finished	30/07/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPerm 7
Cell Number	CPerm 7

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Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		022D
Sample No.		
Depth	m	0
Date		31/07/2015

Saturation

Cell Pressure Incr.	kPa	100.00
Back Pressure Incr.	kPa	95.00
Differential Pressure	kPa	5.00
Final Cell Pressure	kPa	300.00
Final Pore Pressure	kPa	290.00
Final B Value		0.95

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	250.00
Back Pressure	kPa	150.00
Excess Pore Pressure	kPa	140.00
Pore Pressure at End	kPa	200.00
Consolidated Volume	cm^3	821.84
Consolidated Height	mm	104.19
Consolidated Area	mm^2	7888.67
Vol. Compressibility	m^2/MN	1.2048
Consolidation Coef.	m^2/yr.	0.2562
Final Voids Ratio		2.674

Permeability

Cell Pressure	kPa	250.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00158
Average Temperature	'C	20

Vertical Permeability Kv	**m/s**	**1.7 x 10-10**

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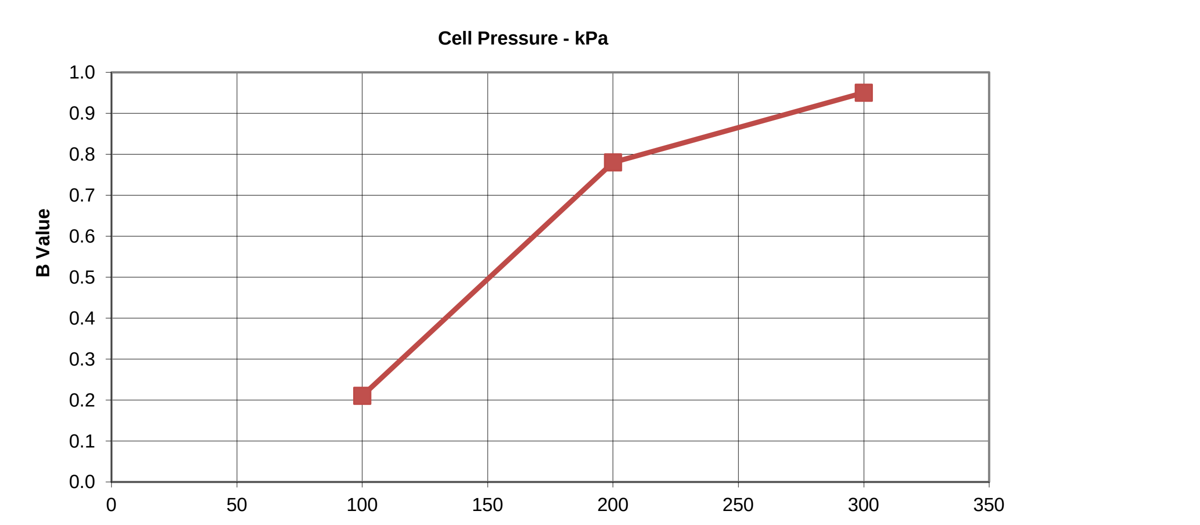
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

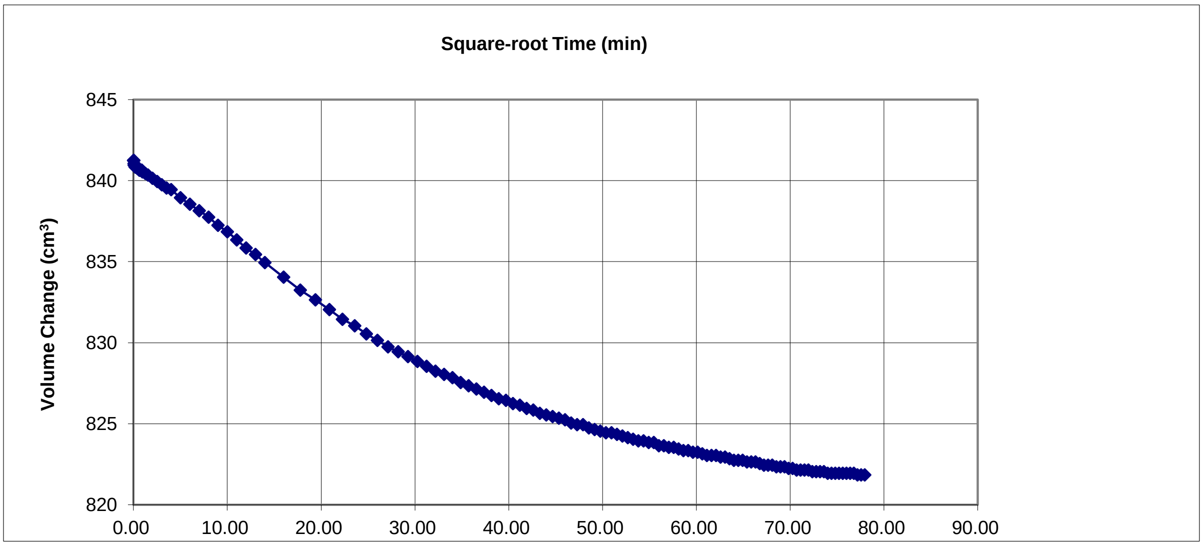
Specimen Details

Borehole		022D
Sample No.		
Depth	m	0
Date		31/07/2015

Saturation Stage



Consolidation Stage



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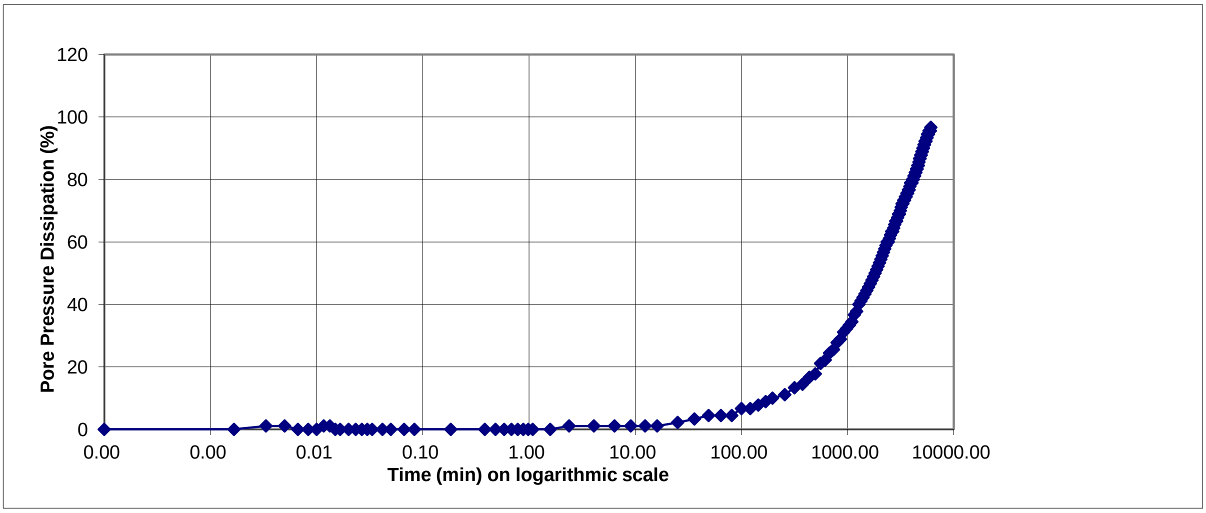
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

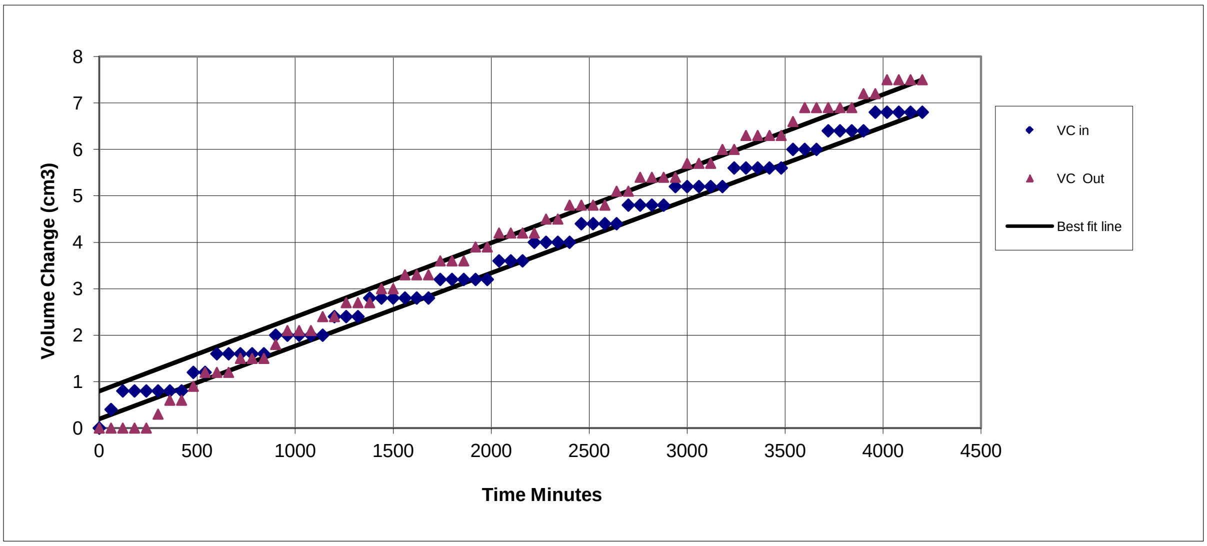
Specimen Details

Borehole		022D
Sample No.		
Depth	m	0
Date		31/07/2015

Consolidation Stage



Permeability Stage



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Date

Client Ref

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Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		023I
Sample No.		
Depth	m	
Date		27/07/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Dark greyish brown very silty CLAY

Initial Specimen Conditions

Height	mm	105.00
Diameter	mm	100.00
Area	mm^2	7853.98
Volume	cm^3	824.67
Mass	g	1148.00
Dry Mass	g	624.90
Density	Mg/m^3	1.39
Dry Density	Mg/m^3	0.76
Moisture Content	%	83.7
Voids Ratio		2.497
Specific Gravity	kN/m^3	2.65
	(assumed/measured)	assumed

Final Specimen Conditions

Moisture Content	%	86.54
Density	Mg/m^3	1.45
Dry Density	Mg/m^3	0.78

Test Setup

Date started	17/07/2015
Date Finished	26/07/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPerm 5
Cell Number	CPerm 5

D P Gran

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27/07/15

Date

UKAS TESTING 2788

Client Ref

GSTL GEO Site & Testing Services Limited

DSML

Contract No

27496

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		023I
Sample No.		
Depth	m	
Date		27/07/2015

Saturation

Cell Pressure Incr.	kPa	20.00
Back Pressure Incr.	kPa	19.00
Differential Pressure	kPa	1.00
Final Cell Pressure	kPa	155.00
Final Pore Pressure	kPa	146.40
Final B Value		0.95

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	155.00
Back Pressure	kPa	55.00
Excess Pore Pressure	kPa	91.40
Pore Pressure at End	kPa	55.00
Consolidated Volume	cm^3	804.97
Consolidated Height	mm	104.16
Consolidated Area	mm^2	7728.90
Vol. Compressibility	m^2/MN	8.5448
Consolidation Coef.	m^2/yr.	0.2614
Final Voids Ratio		2.414

Permeability

Cell Pressure	kPa	155.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00157
Average Temperature	'C	20

Vertical Permeability K\ m/s	**1.72 x 10-10**

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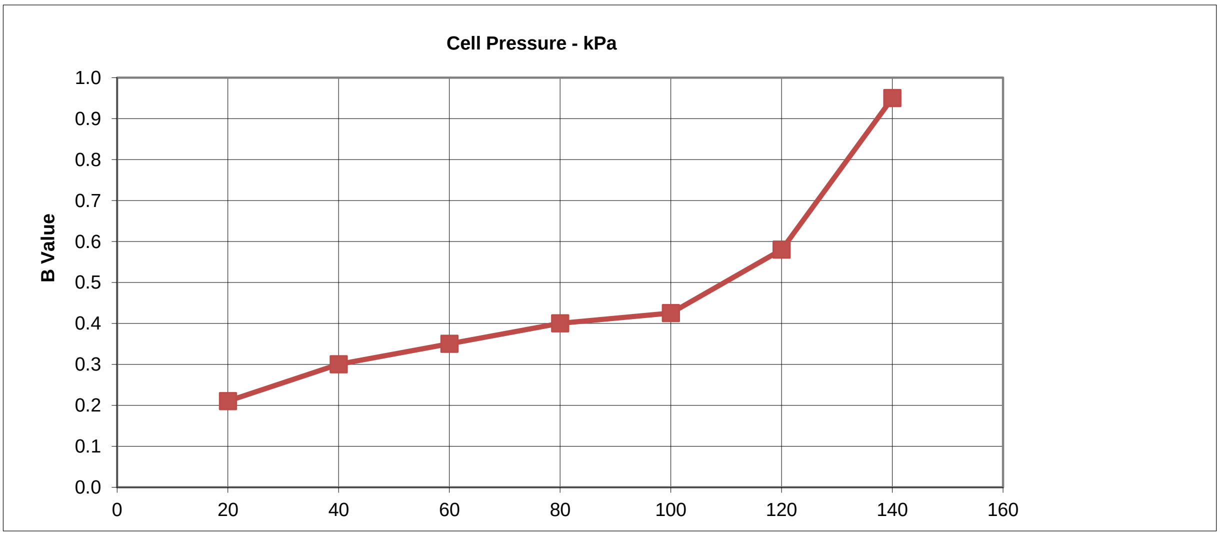
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole	023I
Sample No.	
Depth m	
Date	27/07/2015

Saturation Stage



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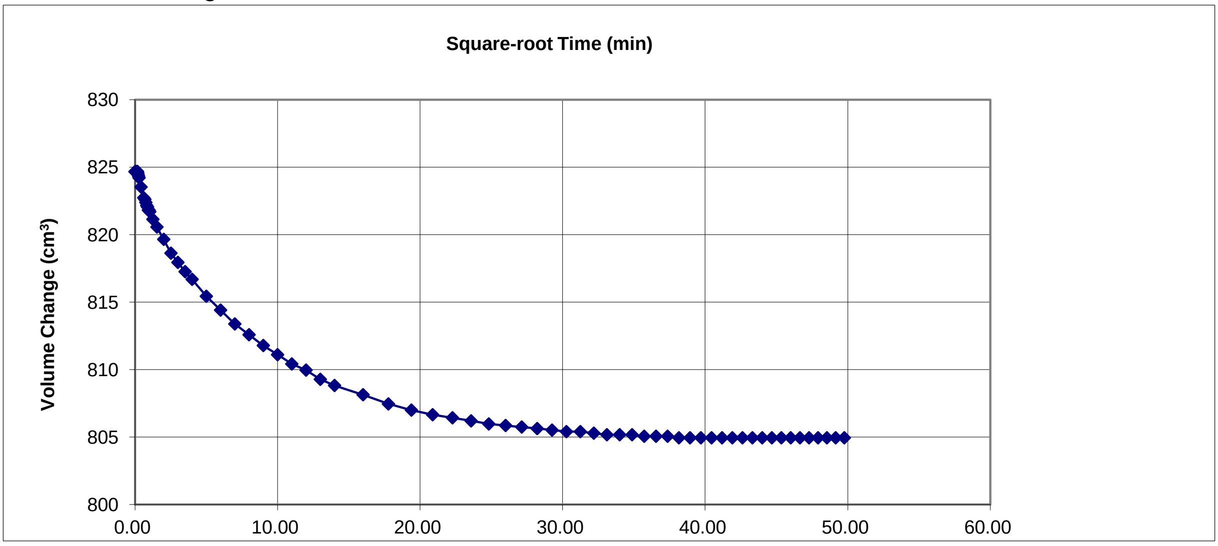

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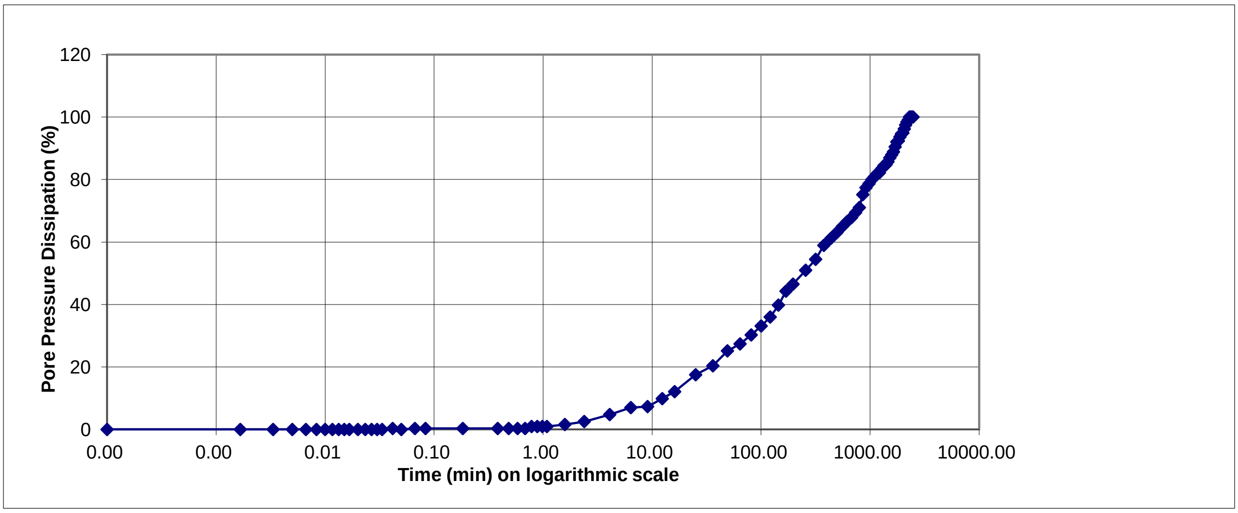
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

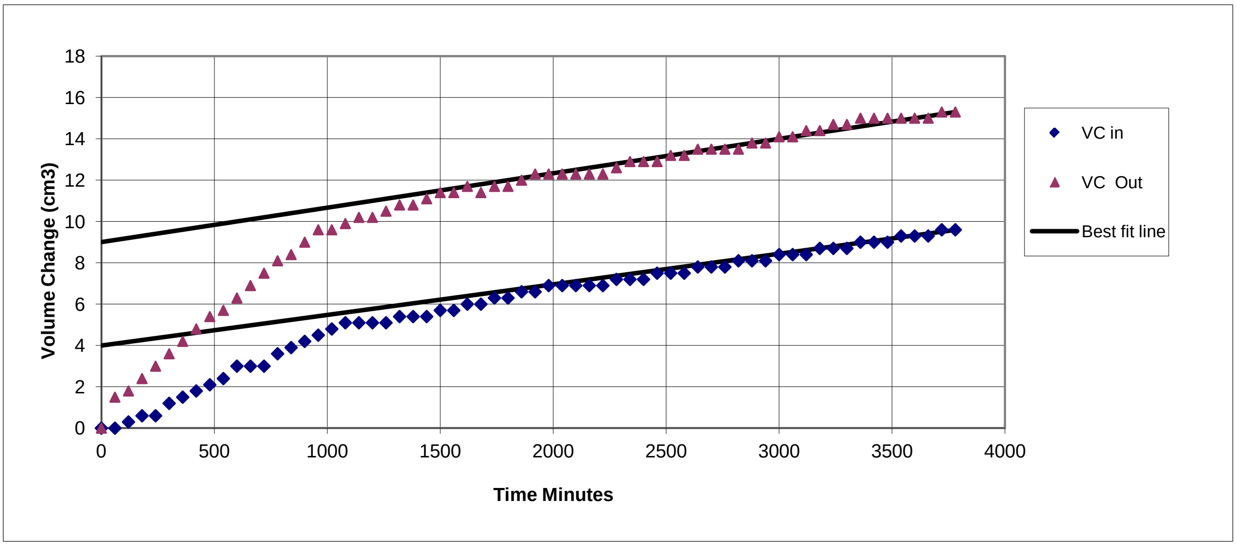
Specimen Details

Borehole	023I
Sample No.	
Depth m	
Date	27/07/2015

Consolidation Stage



Permeability Stage



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27496

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		024E
Sample No.		
Depth	m	
Date		24/07/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Dark greyish brown very silty CLAY

Initial Specimen Conditions

Height	mm	103.00
Diameter	mm	100.00
Area	mm^2	7853.98
Volume	cm^3	808.96
Mass	g	1151.60
Dry Mass	g	629.20
Density	Mg/m^3	1.42
Dry Density	Mg/m^3	0.78
Moisture Content	%	83.0
Voids Ratio		2.407
Specific Gravity	kN/m^3	2.65
(assumed/measured)		assumed

Final Specimen Conditions

Moisture Content	%	83.03
Density	Mg/m^3	1.44
Dry Density	Mg/m^3	0.79

Test Setup

Date started	15/07/2015
Date Finished	23/07/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPerm 6
Cell Number	CPerm 6

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Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		024E
Sample No.		
Depth	m	
Date		24/07/2015

Saturation

Cell Pressure Incr.	kPa	35.00
Back Pressure Incr.	kPa	34.60
Differential Pressure	kPa	0.40
Final Cell Pressure	kPa	200.00
Final Pore Pressure	kPa	191.40
Final B Value		0.99

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	200.00
Back Pressure	kPa	100.00
Excess Pore Pressure	kPa	91.40
Pore Pressure at End	kPa	100.00
Consolidated Volume	cm^3	797.26
Consolidated Height	mm	102.50
Consolidated Area	mm^2	7778.25
Vol. Compressibility	m^2/MN	0.8962
Consolidation Coef.	m^2/yr.	0.1582
Final Voids Ratio		2.358

Permeability

Cell Pressure	kPa	200.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00198
Average Temperature	'C	20

Verticle Permiability Kv m/s	**2.4 x 10-10**

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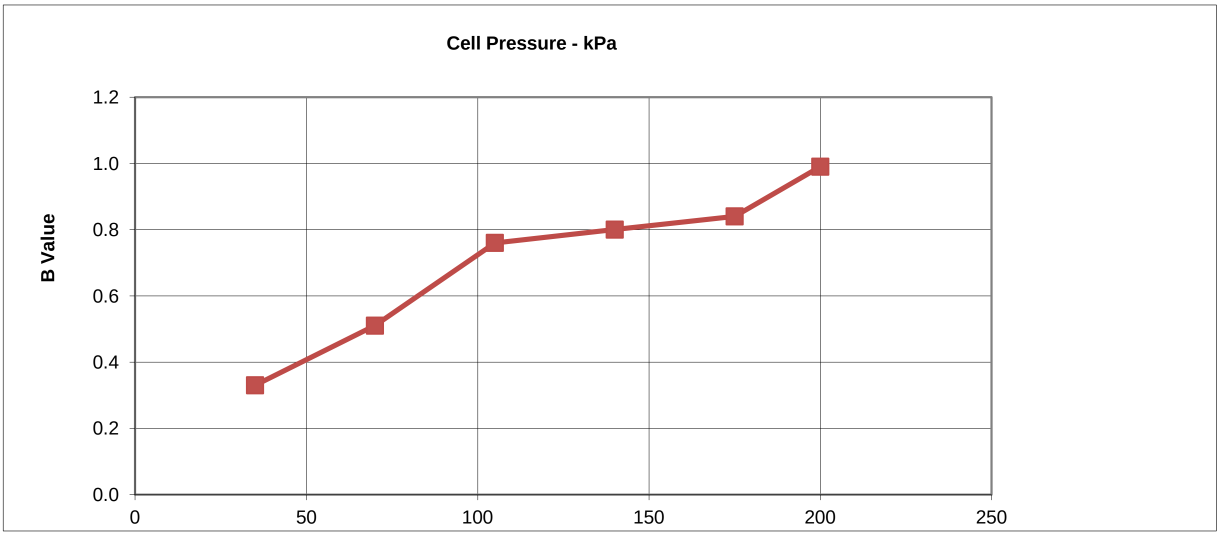
BS 1377 : Part 6 : 1990 Clause 6

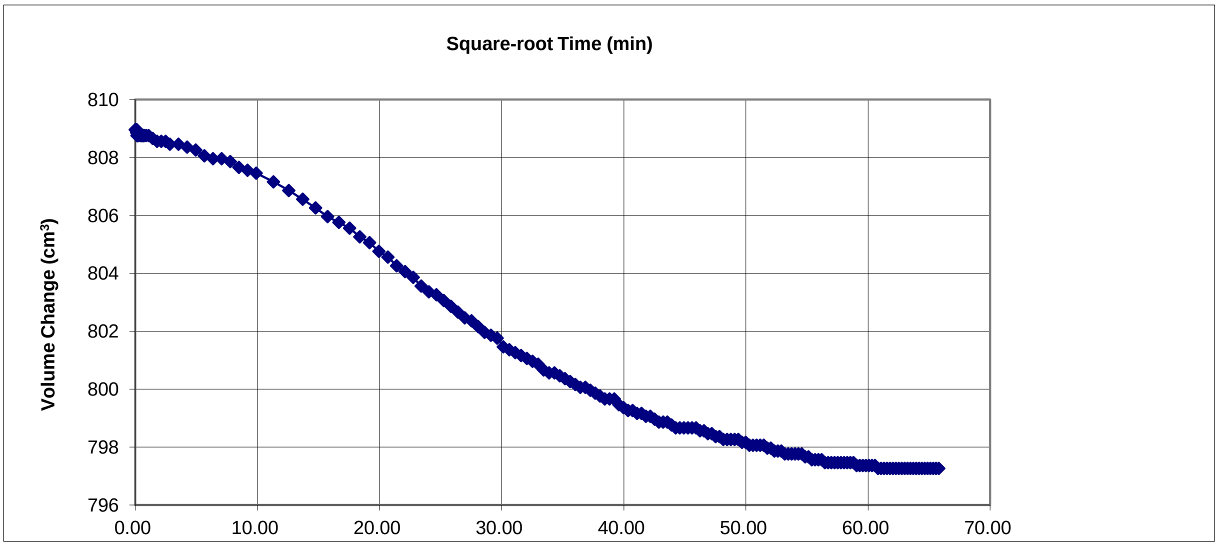
Specimen Details

Borehole	024E
Sample No.	
Depth m	
Date	24/07/2015

Saturation Stage



Consolidation Stage



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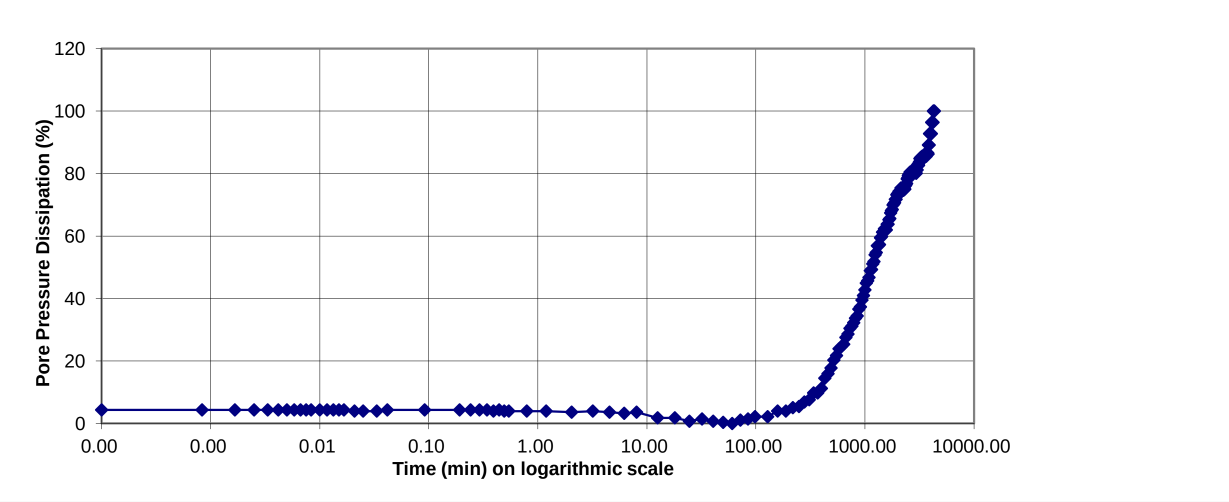
BS 1377 : Part 6 : 1990 Clause 6

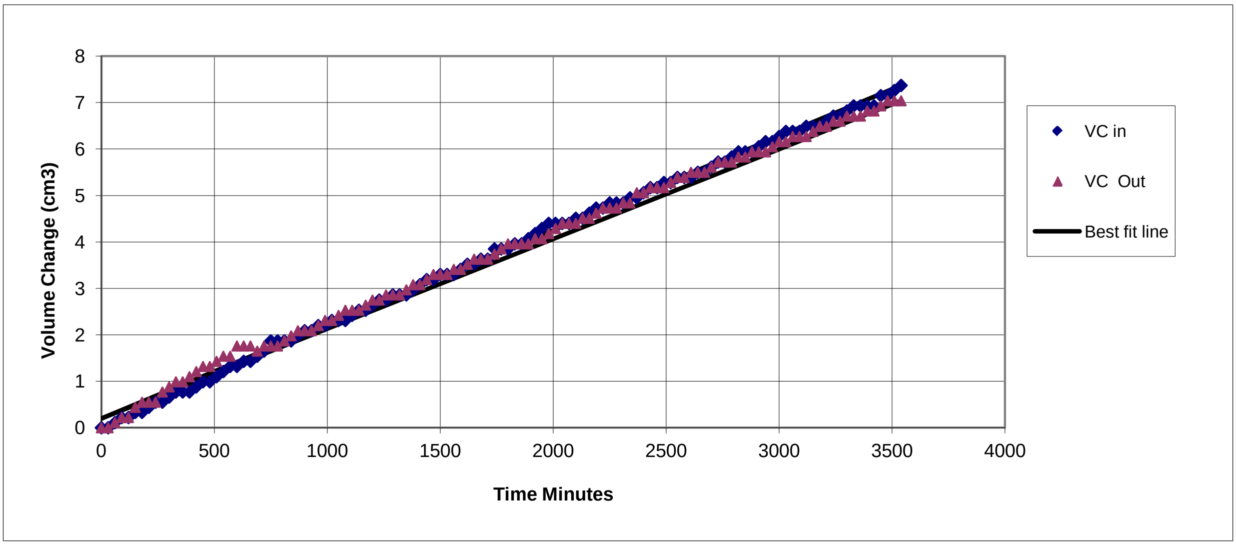
Specimen Details

Borehole	024E
Sample No.	
Depth m	
Date	24/07/2015

Consolidation Stage



Permeability Stage



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Contract No

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Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		025M
Sample No.		
Depth	m	
Date		03/08/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Dark greyish brown very silty firm CLAY

Initial Specimen Conditions

Height	mm	105.00
Diameter	mm	102.00
Area	mm^2	8171.28
Volume	cm^3	857.98
Mass	g	1155.40
Dry Mass	g	616.70
Density	Mg/m^3	1.35
Dry Density	Mg/m^3	0.72
Moisture Content	%	87.4
Voids Ratio		2.687
Specific Gravity	kN/m^3	2.65
(assumed/measured)		assumed

Final Specimen Conditions

Moisture Content	%	87.35
Density	Mg/m^3	1.49
Dry Density	Mg/m^3	0.79

Test Setup

Date started	22/07/2015
Date Finished	01/08/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPerm 3
Cell Number	CPerm 3

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Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		025M
Sample No.		
Depth	m	
Date		03/08/2015

Saturation

Cell Pressure Incr.	kPa	50.00
Back Pressure Incr.	kPa	47.50
Differential Pressure	kPa	2.50
Final Cell Pressure	kPa	150.00
Final Pore Pressure	kPa	247.10
Final B Value		0.95

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	250.00
Back Pressure	kPa	150.00
Excess Pore Pressure	kPa	100.00
Pore Pressure at End	kPa	150.00
Consolidated Volume	cm^3	775.98
Consolidated Height	mm	101.65
Consolidated Area	mm^2	7650.65
Vol. Compressibility	m^2/MN	1.9481
Consolidation Coef.	m^2/yr.	0.9557
Final Voids Ratio		2.334

Permeability

Cell Pressure	kPa	250.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00301
Average Temperature	'C	20

Vertical Permeability m/s	**3.25 x 10-10**

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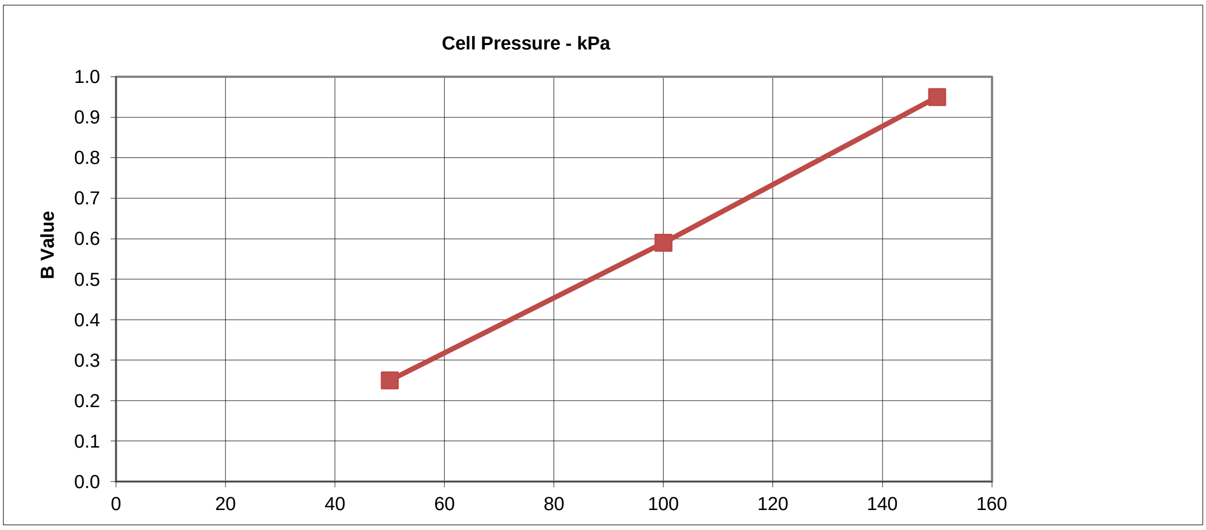
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

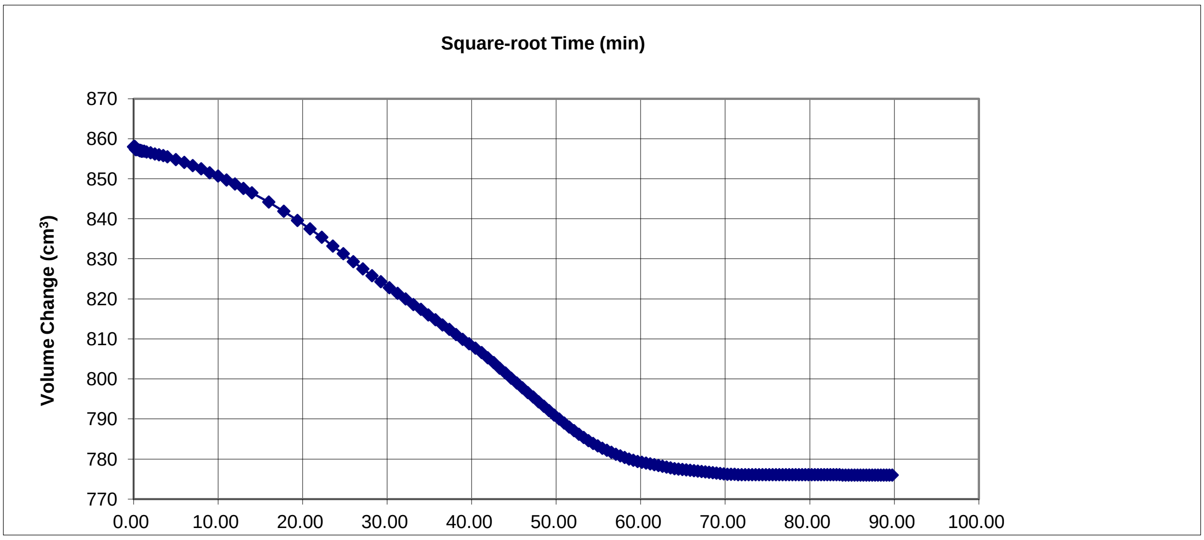
Specimen Details

Borehole	025M
Sample No.	
Depth m	
Date	03/08/2015

Saturation Stage



Consolidation Stage



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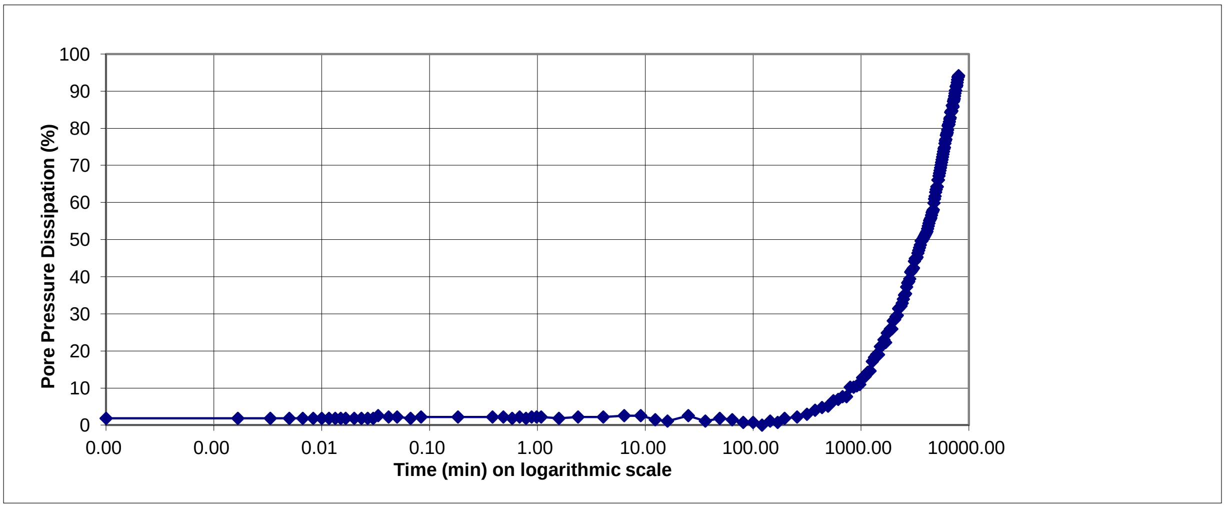
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

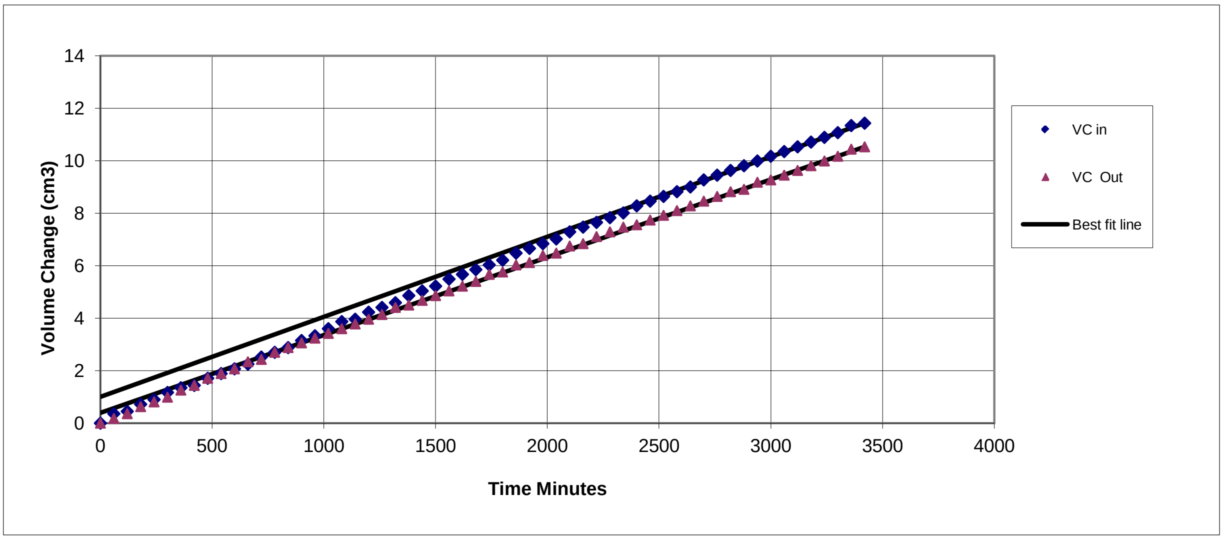
Specimen Details

Borehole	025M
Sample No.	
Depth m	
Date	03/08/2015

Consolidation Stage



Permeability Stage



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Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		027G
Sample No.		
Depth	m	
Date		20/07/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Dark greyish brown very silty firm CLAY

Initial Specimen Conditions

Height	mm	104.00
Diameter	mm	102.00
Area	mm^2	8171.28
Volume	cm^3	849.81
Mass	g	1170.00
Dry Mass	g	593.10
Density	Mg/m^3	1.38
Dry Density	Mg/m^3	0.70
Moisture Content	%	97.3
Voids Ratio		2.797
Specific Gravity	kN/m^3	2.65
	(assumed/measured)	assumed

Final Specimen Conditions

Moisture Content	%	98.99
Density	Mg/m^3	1.59
Dry Density	Mg/m^3	0.80

Test Setup

Date started	11/07/2015
Date Finished	17/07/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPERM 2
Cell Number	CPERM 2

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Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		027G
Sample No.		
Depth	m	
Date		20/07/2015

Saturation

Cell Pressure Incr.	kPa	100.00
Back Pressure Incr.	kPa	109.00
Differential Pressure	kPa	-9.00
Final Cell Pressure	kPa	300.00
Final Pore Pressure	kPa	305.00
Final B Value		1.09

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	300.00
Back Pressure	kPa	200.00
Excess Pore Pressure	kPa	105.00
Pore Pressure at End	kPa	200.00
Consolidated Volume	cm^3	740.21
Consolidated Height	mm	99.53
Consolidated Area	mm^2	7468.72
Vol. Compressibility	m^2/MN	1310.8885
Consolidation Coef.	$m^2/yr.$	1.2283
Final Voids Ratio		2.307

Permeability

Cell Pressure	kPa	300.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00639
Average Temperature	'C	20

Vertical Permeability Kv	**m / s**	**6.93 x 10-10**

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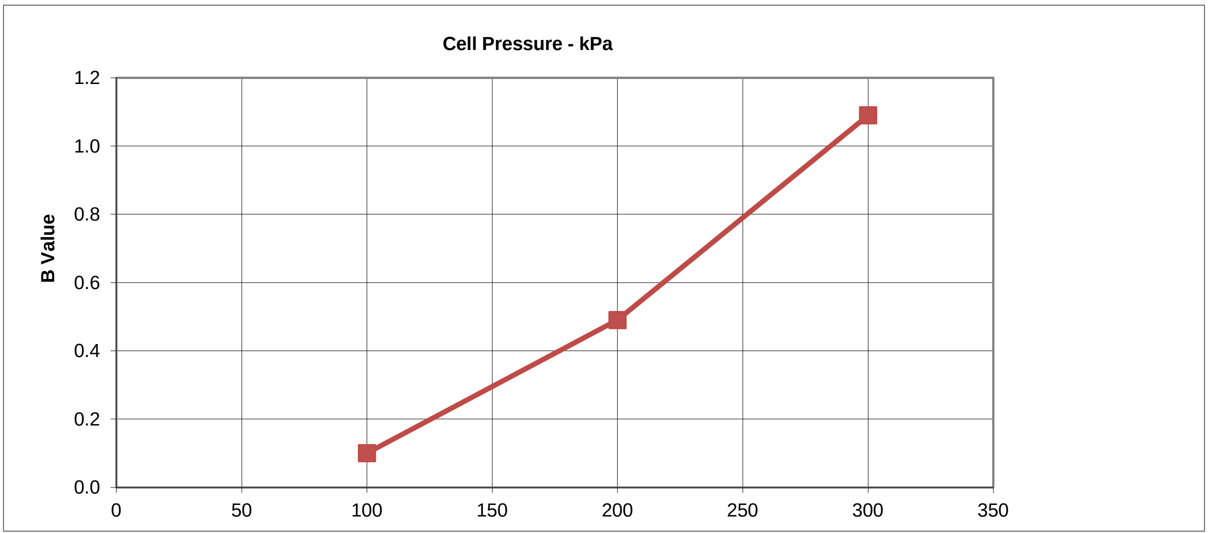
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

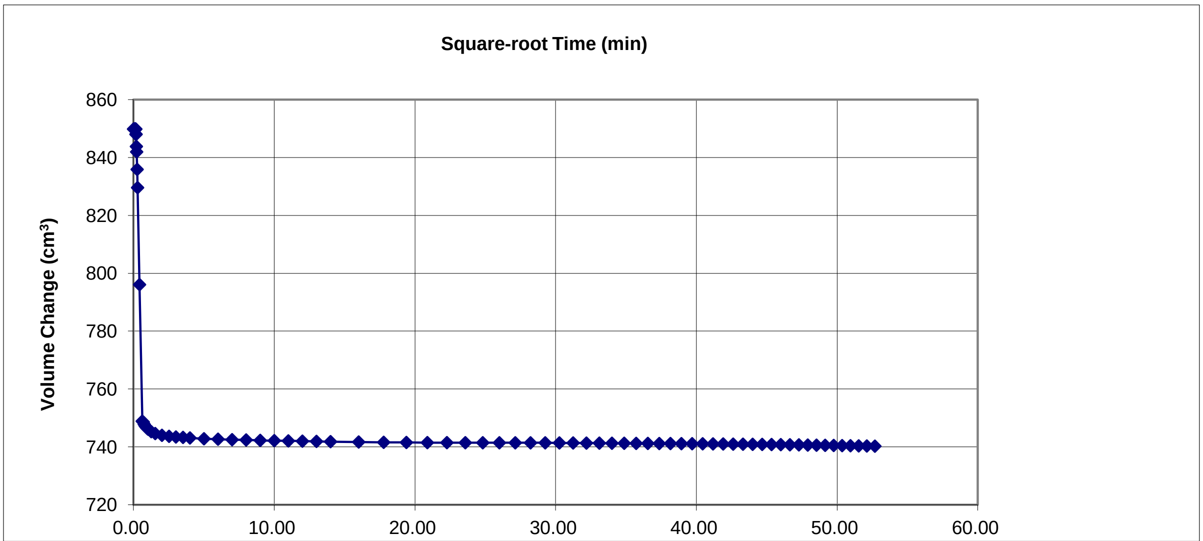
Specimen Details

Borehole		027G
Sample No.		
Depth	m	
Date		20/07/2015

Saturation Stage



Consolidation Stage



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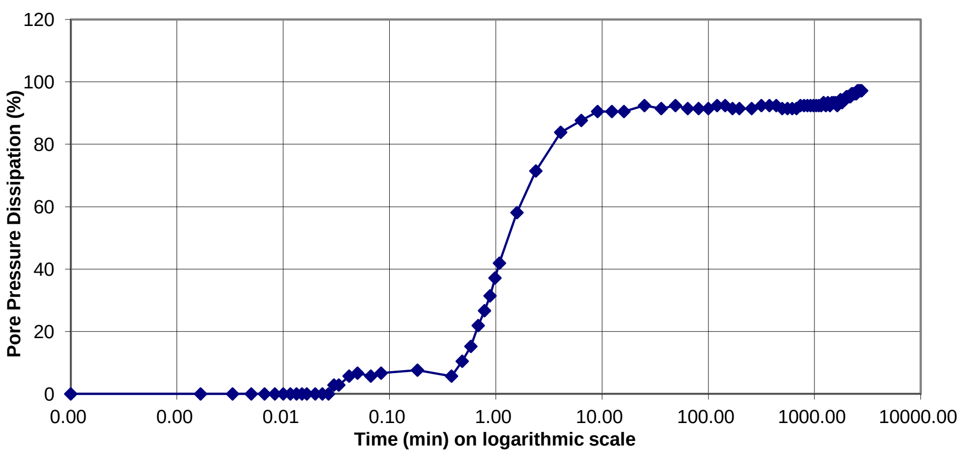
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

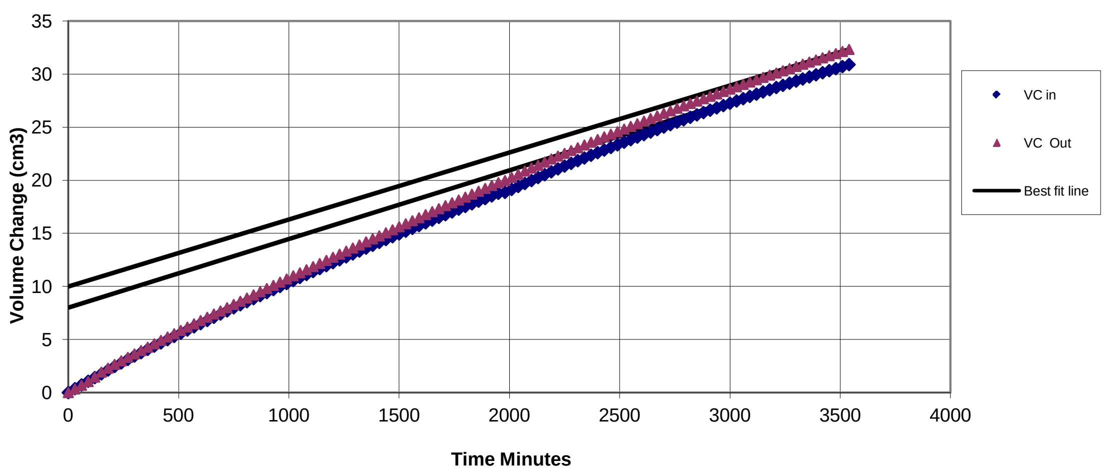
Specimen Details

Borehole		027G
Sample No.		
Depth	m	
Date		20/07/2015

Consolidation Stage



Permeability Stage



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Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		028K
Sample No.		
Depth	m	
Date		20/07/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Dark greyish brown very silty stiff CLAY

Initial Specimen Conditions

Height	mm	103.00
Diameter	mm	100.00
Area	mm^2	7853.98
Volume	cm^3	808.96
Mass	g	1161.40
Dry Mass	g	624.00
Density	Mg/m^3	1.44
Dry Density	Mg/m^3	0.77
Moisture Content	%	86.1
Voids Ratio		2.435
Specific Gravity	kN/m^3	2.65
	(assumed/measured)	assumed

Final Specimen Conditions

Moisture Content	%	89.10
Density	Mg/m^3	1.47
Dry Density	Mg/m^3	0.78

Test Setup

Date started	11/07/2015
Date Finished	17/07/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPERM 1
Cell Number	CPERM 1

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Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		028K
Sample No.		
Depth	m	
Date		20/07/2015

Saturation

Cell Pressure Incr.	kPa	100.00
Back Pressure Incr.	kPa	97.00
Differential Pressure	kPa	3.00
Final Cell Pressure	kPa	500.00
Final Pore Pressure	kPa	491.00
Final B Value		0.97

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	500.00
Back Pressure	kPa	400.00
Excess Pore Pressure	kPa	91.00
Pore Pressure at End	kPa	400.00
Consolidated Volume	cm^3	803.46
Consolidated Height	mm	102.77
Consolidated Area	mm^2	7818.38
Vol. Compressibility	m^2/MN	1339.8697
Consolidation Coef.	m^2/yr.	0.0747
Final Voids Ratio		2.412

Permeability

Cell Pressure	kPa	500.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00488
Average Temperature	'C	20

Vertical Permeability Kv	**m/s**	**5.22 x 10-10**

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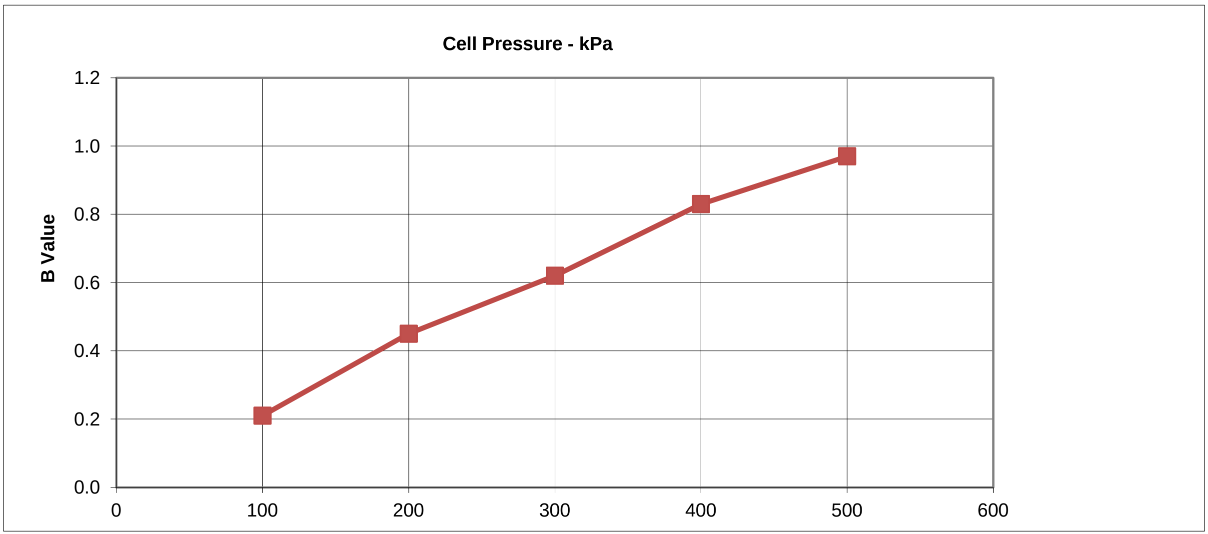
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

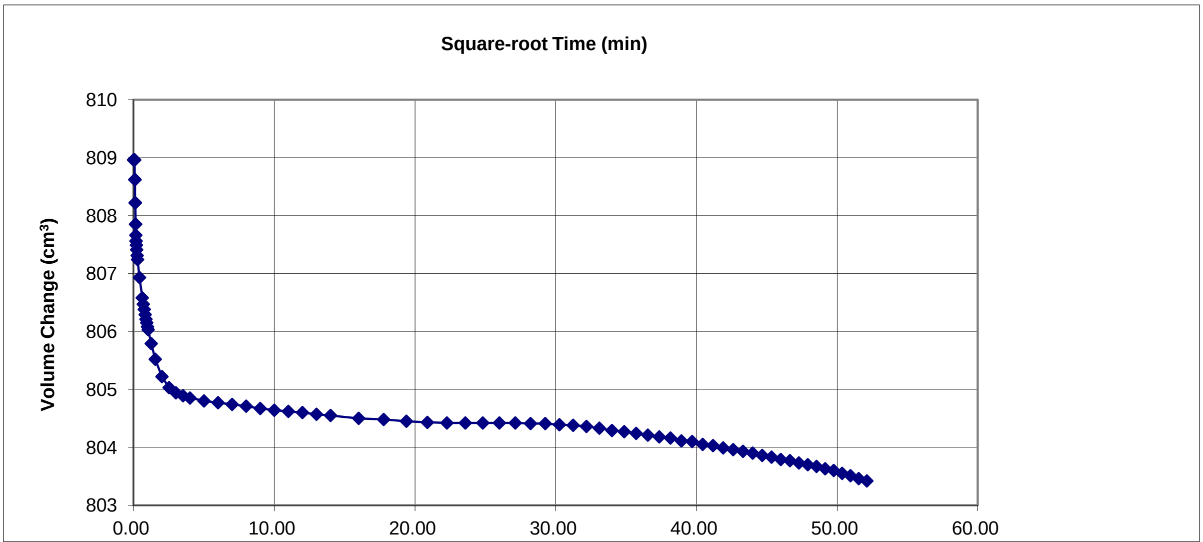
Specimen Details

Borehole		028K
Sample No.		
Depth	m	
Date		20/07/2015

Saturation Stage



Consolidation Stage



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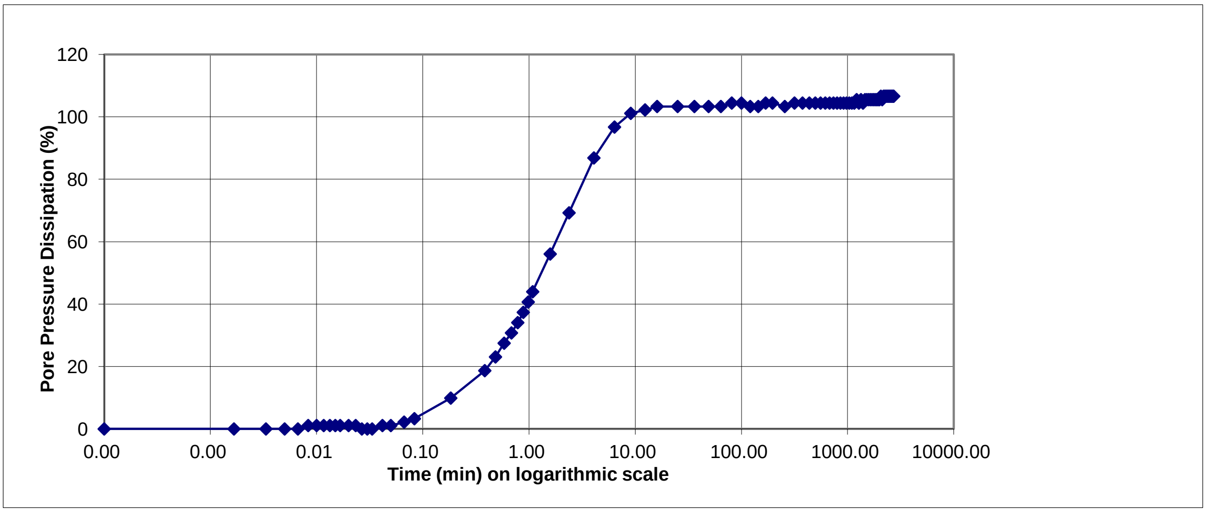
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

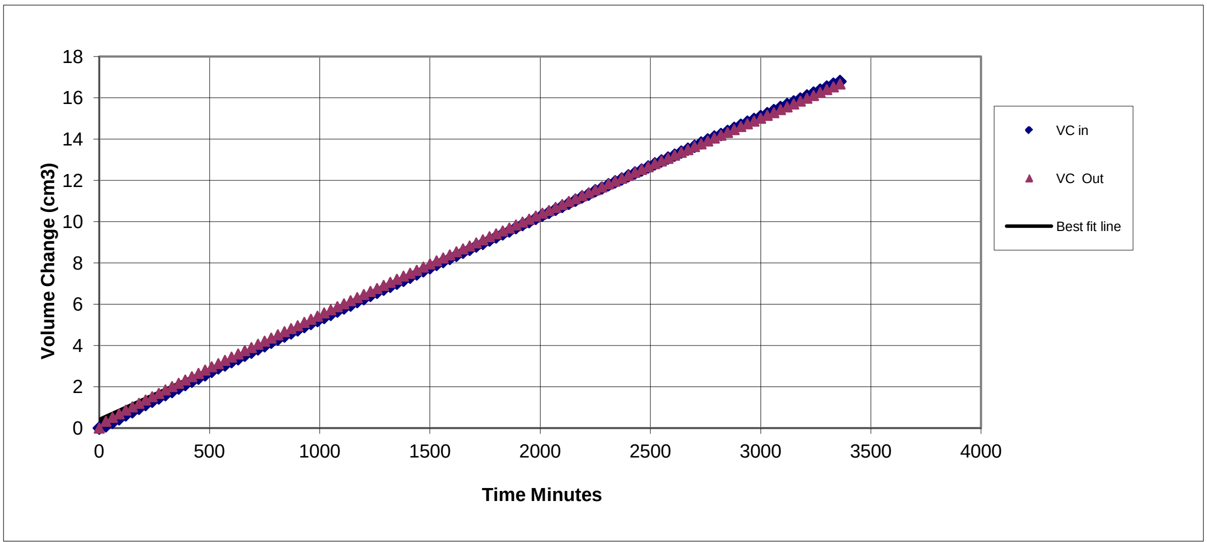
Specimen Details

Borehole		028K
Sample No.		
Depth	m	
Date		20/07/2015

Consolidation Stage



Permeability Stage



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Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		029F
Sample No.		
Depth	m	
Date		03/08/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Dark greyish brown silty CLAY

Initial Specimen Conditions

Height	mm	104.00
Diameter	mm	100.00
Area	mm^2	7853.98
Volume	cm^3	816.81
Mass	g	1160.70
Dry Mass	g	579.40
Density	Mg/m^3	1.42
Dry Density	Mg/m^3	0.71
Moisture Content	%	100.3
Voids Ratio		2.736
Specific Gravity	kN/m^3	2.65
(assumed/measured)		assumed

Final Specimen Conditions

Moisture Content	%	101.59
Density	Mg/m^3	1.46
Dry Density	Mg/m^3	0.72

Test Setup

Date started	21/07/2015
Date Finished	31/07/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPerm 2
Cell Number	CPerm 2

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GSTL GEO Site & Testing Services Limited

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		029F
Sample No.		
Depth	m	
Date		03/08/2015

Saturation

Cell Pressure Incr.	kPa	50.00
Back Pressure Incr.	kPa	47.50
Differential Pressure	kPa	2.50
Final Cell Pressure	kPa	200.00
Final Pore Pressure	kPa	244.90
Final B Value		0.95

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	250.00
Back Pressure	kPa	150.00
Excess Pore Pressure	kPa	100.00
Pore Pressure at End	kPa	150.00
Consolidated Volume	cm^3	802.01
Consolidated Height	mm	103.37
Consolidated Area	mm^2	7759.11
Vol. Compressibility	m^2/MN	1.9617
Consolidation Coef.	m^2/yr.	0.1812
Final Voids Ratio		2.668

Permeability

Cell Pressure	kPa	250.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00339
Average Temperature	'C	20

Vertical Permeability l m/s	**3.68 x 10-10**

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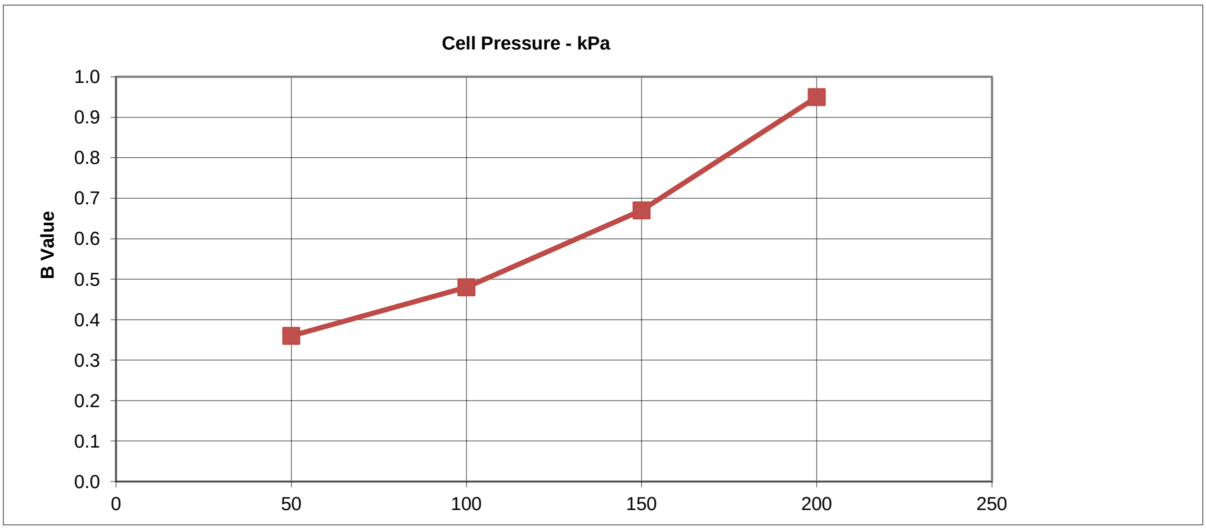
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

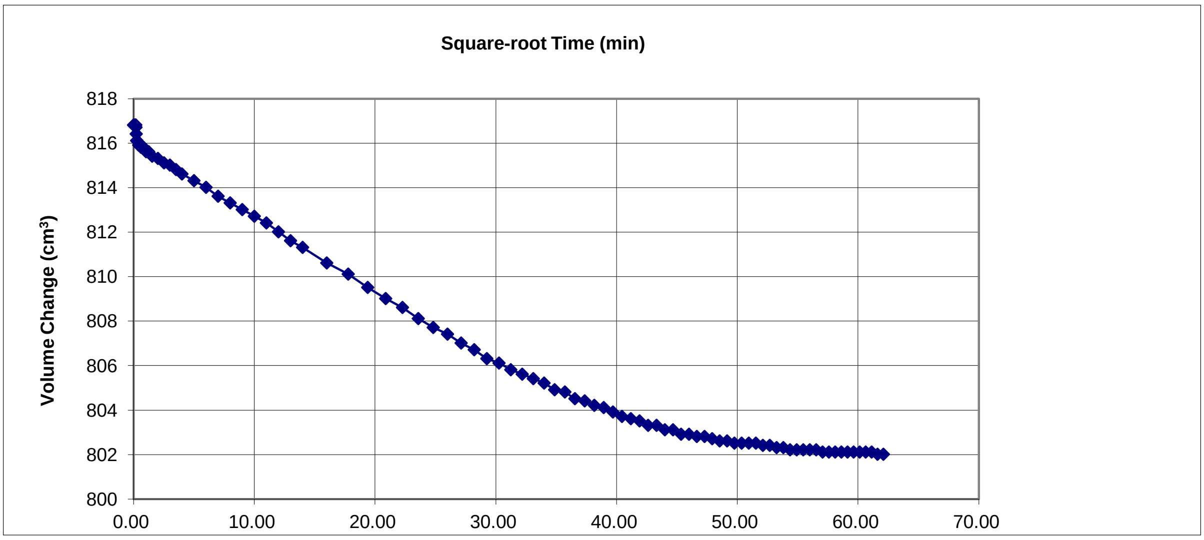
Specimen Details

Borehole	029F
Sample No.	
Depth m	
Date	03/08/2015

Saturation Stage



Consolidation Stage



Checked and Approved By

03/08/15
Date

Client Ref

GSTL
GEO Site & Testing Services Limited

DSML

Contract No

27496

UKAS TESTING 2788

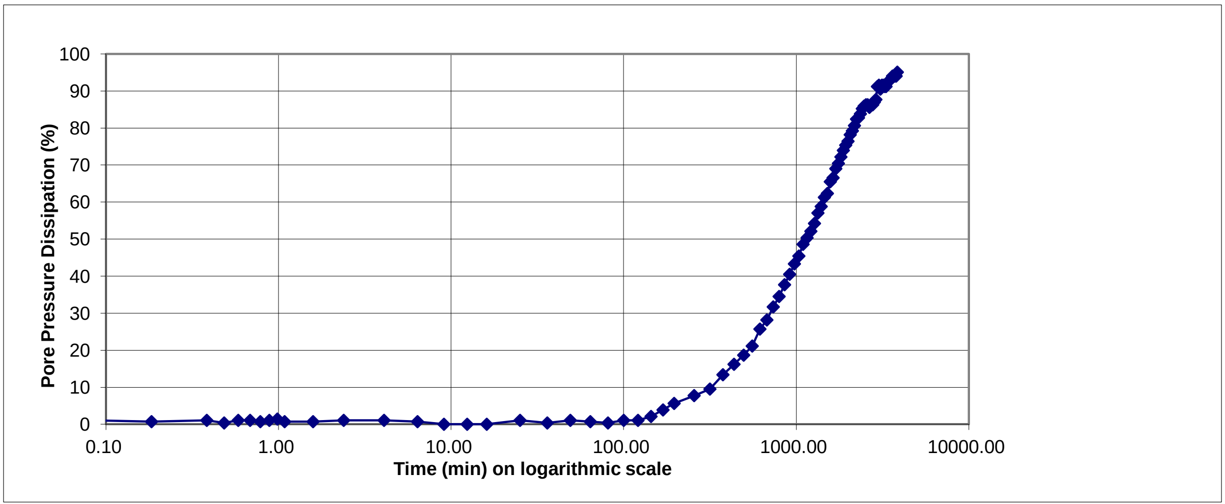
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

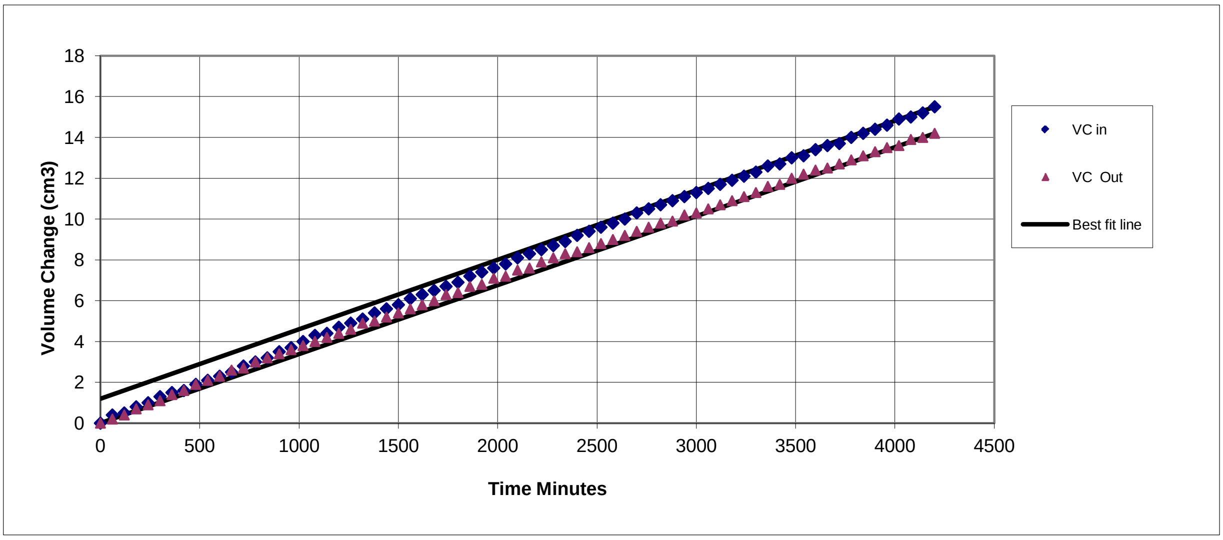
Specimen Details

Borehole	029F
Sample No.	
Depth m	
Date	03/08/2015

Consolidation Stage



Permeability Stage



D P Gang

Checked and Approved By

03/08/15
Date

Client Ref

GSTL
GEO Site & Testing Services Limited

DSML

Contract No

27496

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		031L
Sample No.		
Depth	m	
Date		14/07/2015
Disturbed / Undisturbed		Undisturbed

Description of Specimen

Brown/Grey silty CLAY

Initial Specimen Conditions

Height	mm	104.00
Diameter	mm	99.00
Area	mm^2	7697.69
Volume	cm^3	800.56
Mass	g	1093.00
Dry Mass	g	532.10
Density	Mg/m^3	1.37
Dry Density	Mg/m^3	0.66
Moisture Content	%	105.4
Voids Ratio		2.987
Specific Gravity	kN/m^3	2.65
(assumed/measured)		assumed

Final Specimen Conditions

Moisture Content	%	108.68
Density	Mg/m^3	1.39
Dry Density	Mg/m^3	0.67

Test Setup

Date started	03/07/2015
Date Finished	13/07/2015
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPerm 01
Cell Number	CPerm 01

D P Evans

Checked and Approved By

14/07/15
Date

Client Ref

Contract No

27378

GEO Site & Testing Services Limited

UKAS TESTING 2788

Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		031L
Sample No.		
Depth	m	
Date		14/07/2015

Saturation

Cell Pressure Incr.	kPa	25.00
Back Pressure Incr.	kPa	24.00
Differential Pressure	kPa	1.00
Final Cell Pressure	kPa	225.00
Final Pore Pressure	kPa	220.00
Final B Value		0.96

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	225.00
Back Pressure	kPa	125.00
Excess Pore Pressure	kPa	95.00
Pore Pressure at End	kPa	125.00
Consolidated Volume	cm^3	796.96
Consolidated Height	mm	103.84
Consolidated Area	mm^2	7674.61
Vol. Compressibility	m^2/MN	59.8658
Consolidation Coef.	m^2/yr.	0.0473
Final Voids Ratio		2.969

Permeability

Cell Pressure	kPa	225.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00091
Average Temperature	'C	20

Vertical Permeability I m/s	**1 x 10-10**

D P Grant

Checked and Approved By

14/07/15
Date

Client Ref

GSTL
GEO Site & Testing Services Limited

Contract No

27378

UKAS TESTING 2788

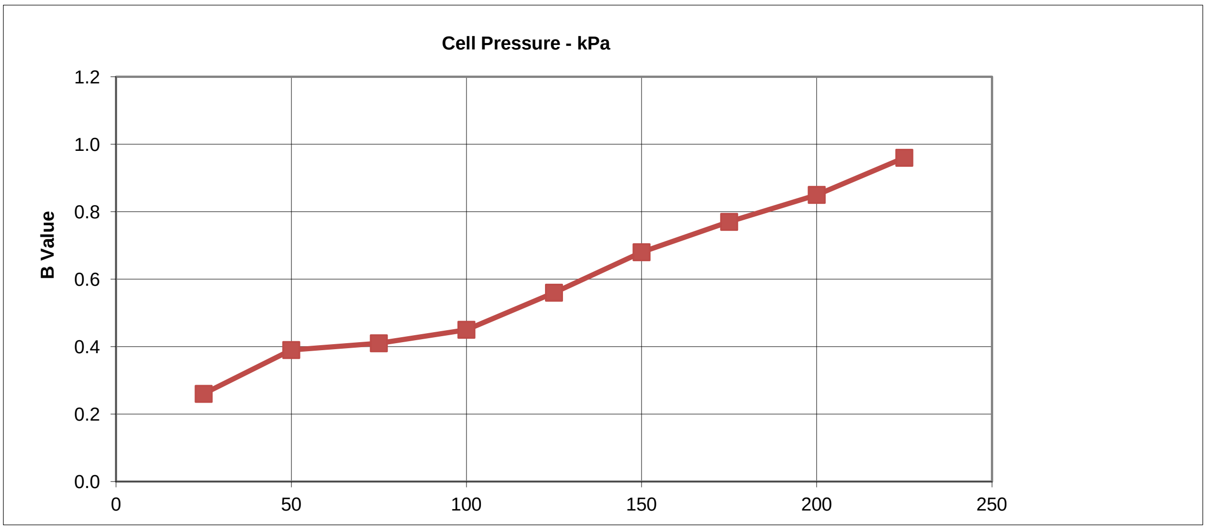
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

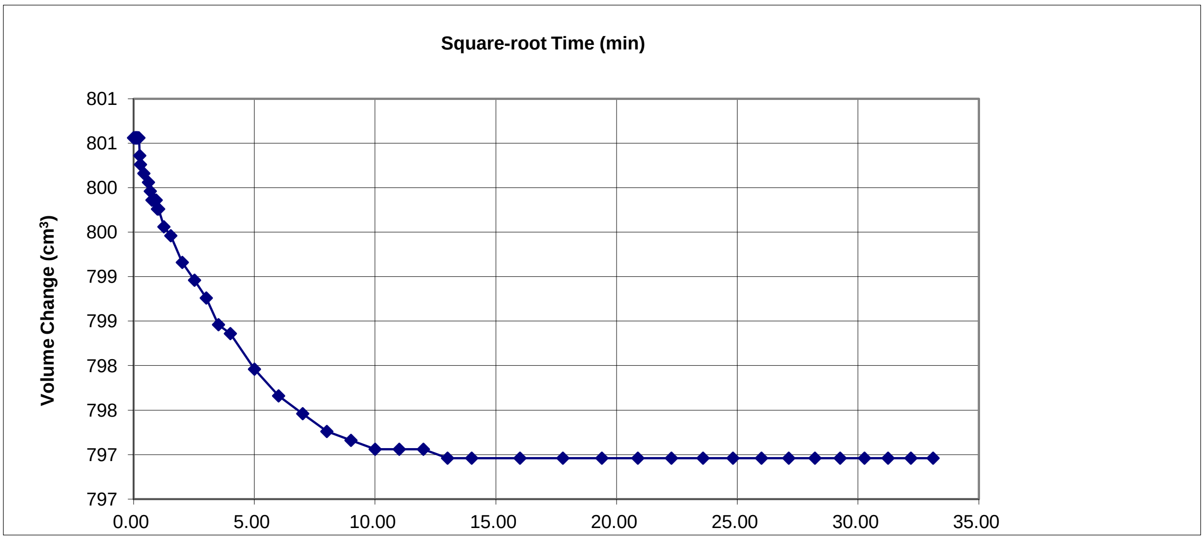
Specimen Details

Borehole	031L
Sample No.	
Depth m	
Date	14/07/2015

Saturation Stage



Consolidation Stage



D P Grant

Checked and Approved By

14/07/15
Date

Client Ref

Contract No

27378

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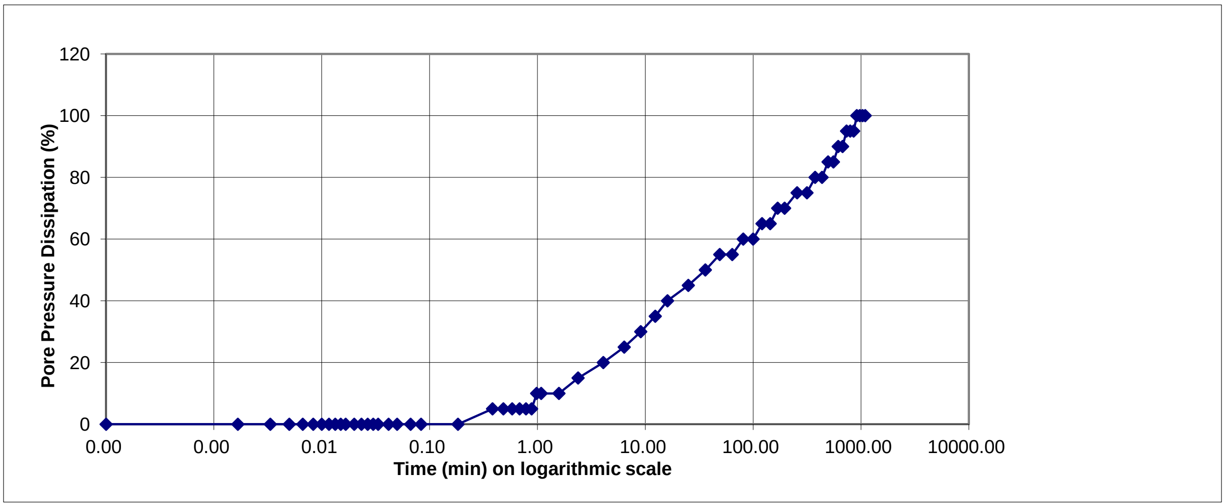
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

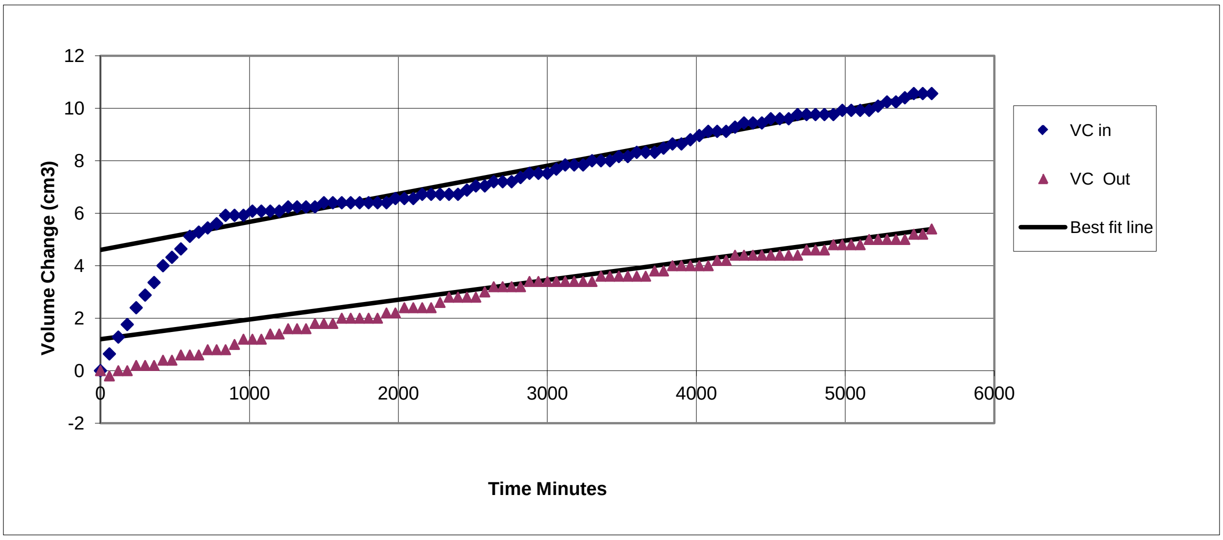
Specimen Details

Borehole	031L
Sample No.	
Depth m	
Date	14/07/2015

Consolidation Stage



Permeability Stage



D P Gans

Checked and Approved By

14/07/15
Date

Client Ref

Contract No

27378

GSTL
GEO Site & Testing Services Limited

UKAS TESTING 2788

Appendix 12

The Deep Soil Mixing Technique

Applications

Technology

Benefits

The Future

Soil Mixing For Flood Protection

Technology

Mass Mixing

The Allu System

DSML uses the ALLU system, which provides a fast, cost effective and environmentally friendly work method for the hardening and dynamic strengthening of soft soils, as well as improving the soil's deformation properties. The system is designed to improve soft soils by mixing a cementitious binder into clay, peat, mud or dredged sediments. It consists of three components:

1. A power mix attachment mounted to the dipper arm of a suitable excavator, using a pin mounting or quick-hitch adaptor plate. At the end of this substantial attachment, a pair of mixing/cutting drums measuring 1.6m across and 0.9m in diameter is used to mix the binder material into the ground.
2. The pressure feeder mounted on a powered crawler chassis. This injects the dry binder into the ground by compressed air via hoses to a selected location near the drums. Wet binder can be injected using a computer controlled batching plant which mixes the chosen proportions of binders and then pumps the slurry mix to the mass mixing system.
3. The data acquisition control (DAC). The DAC adjusts and controls the accurate flow and pressure of the binder via a control panel located in the excavator's cab, which allows the driver to manage the entire system. The DAC also saves data during the stabilisation project, which can be downloaded to a company's computer via an USB port to provide an extensive report for the entire duration of the work.

Latest News

9 July 2015

One Project Ends, Another Begins!

This is a busy summer for DSML, with the Newton Farm project successfully completed and the new Walney Onshore Substation project starting.

9 July 2015

Introducing George Olney, New Site Supervisor

DSML is pleased to introduce George Olney, our new engineer and site supervisor.

Appendix 13

BS1377 : Part 6 : Clause 6 :1990

Determination of Permeability in a Triaxial Cell

Borehole / TP:	WS1	Description: Firm to stiff brown CLAY with roots.
Sample No:		
Depth:	1.00 - 2.00	

SPECIMEN DETAILS	
Depth within original sample	25mm from top
Orientation within original	Vertical
Specimen preparation	Undisturbed

TEST DETAILS			
Cell Preparation		Performed in accordance with Clause 3.5	
		INITIAL	FINAL
Diameter	*mm*	81.9	80.9
Height	*mm*	86.2	85.1
Moisture Content	*%*	58	57
Bulk Density	*Mg/m³*	1.62	1.67
Dry Density	*Mg/m³*	1.03	1.07

SATURATION STAGE		
Saturation initially by constant moisture content, followed by back-pressure assistance using 5-10 kPa differential		
'B' value	0.62	0.98

CONSOLIDATION STAGE		
Effective pressure	*kPa*	200
Volume change	*mL*	16.4

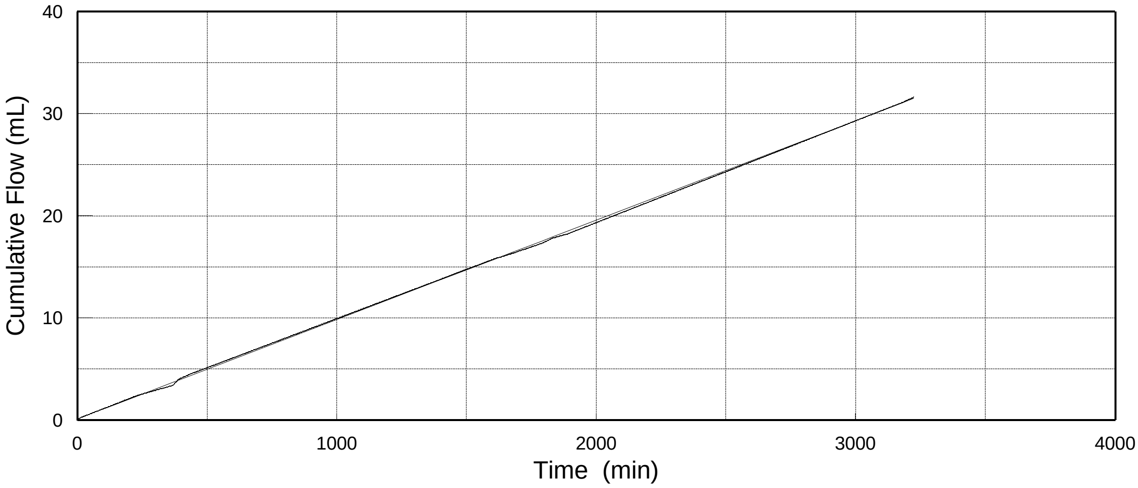
PERMEABILITY STAGE		
Pressure difference across specimen		20
Hydraulic gradient		24.0
Mean effective stress	*kPa*	190

TEST DURATIONS		
Saturation	*days*	4
Consolidation	*days*	2
Flow	*days*	7

RESULT

Coefficient of Permeability

kv at 20°C = 1.3 x 10^{-9} m/s



Checked and Approved	Project Number: **GEO / 22251**
Initials: RJP	Project Name: **NEWPORT DOCKSWAY**
Date: 09/03/15	**Project Number 1134**

UKAS TESTING 1982

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BS1377 : Part 6 : Clause 6 :1990

Determination of Permeability in a Triaxial Cell

Borehole / TP:	WS1
Sample No:	-
Depth:	GL - 1.00

Description:
Firm brown silty CLAY with roots.

SPECIMEN DETAILS	
Depth within original sample	610mm from top
Orientation within original	Vertical
Specimen preparation	Undisturbed

TEST DETAILS			
Cell Preparation		Performed in accordance with Clause 3.5	
		INITIAL	FINAL
Diameter	*mm*	96.6	95.4
Height	*mm*	101.5	100.2
Moisture Content	*%*	71	70
Bulk Density	*Mg/m³*	1.59	1.64
Dry Density	*Mg/m³*	0.93	0.97

SATURATION STAGE		
Saturation initially by constant moisture content, followed by back-pressure assistance using 5-10 kPa differential		
'B' value	0.50	0.99

CONSOLIDATION STAGE		
Effective pressure	*kPa*	200
Volume change	*mL*	27.8

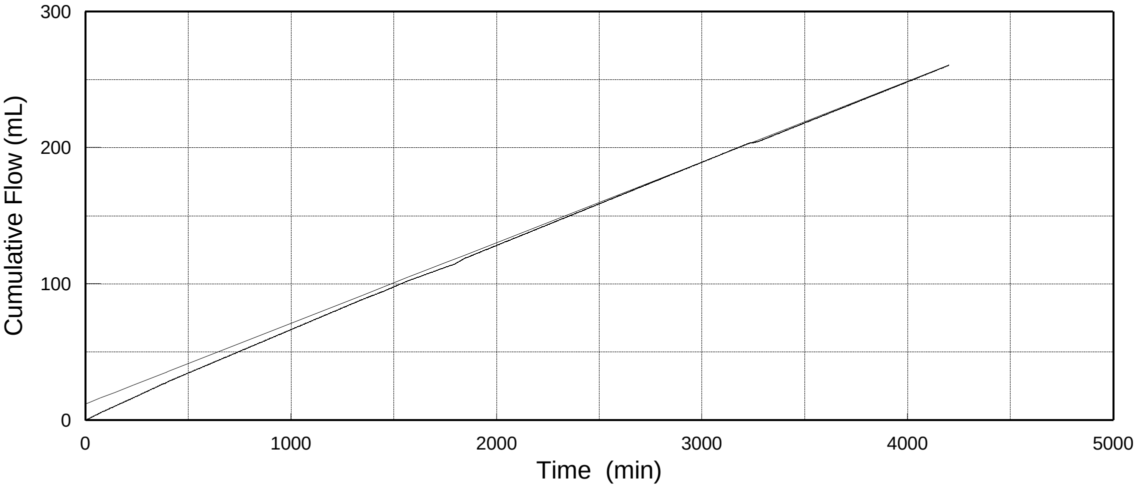
PERMEABILITY STAGE		
Pressure difference across specimen		20
Hydraulic gradient		20.3
Mean effective stress	*kPa*	190

TEST DURATIONS		
Saturation	*days*	5
Consolidation	*days*	2
Flow	*days*	6

RESULT

Coefficient of Permeability

kv at 20°C = 6.8 x 10^{-9} m/s



Checked and Approved	Project Number:	
Initials: RJP	**GEO / 22251**	
Date: 09/03/15	Project Name: **NEWPORT DOCKSWAY** **Project Number 1134**	GEOLABS®

BS1377 : Part 6 : Clause 6 :1990

Determination of Permeability in a Triaxial Cell

Borehole / TP:	WS2
Sample No:	-
Depth:	GL - 1.00

Description:
Firm dark grey CLAY with rare rootlets

SPECIMEN DETAILS	
Depth within original sample	30mm from top
Orientation within original	Vertical
Specimen preparation	Undisturbed

TEST DETAILS			
Cell Preparation		Performed in accordance with Clause 3.5	
		INITIAL	FINAL
Diameter	*mm*	99.4	97.4
Height	*mm*	101.2	99.3
Moisture Content	*%*	53	52
Bulk Density	*Mg/m³*	1.66	1.75
Dry Density	*Mg/m³*	1.09	1.15

SATURATION STAGE		
Saturation initially by constant moisture content, followed by back-pressure assistance using 5-10 kPa differential		
'B' value	0.99	1.00

CONSOLIDATION STAGE		
Effective pressure	*kPa*	100
Volume change	*mL*	44.5

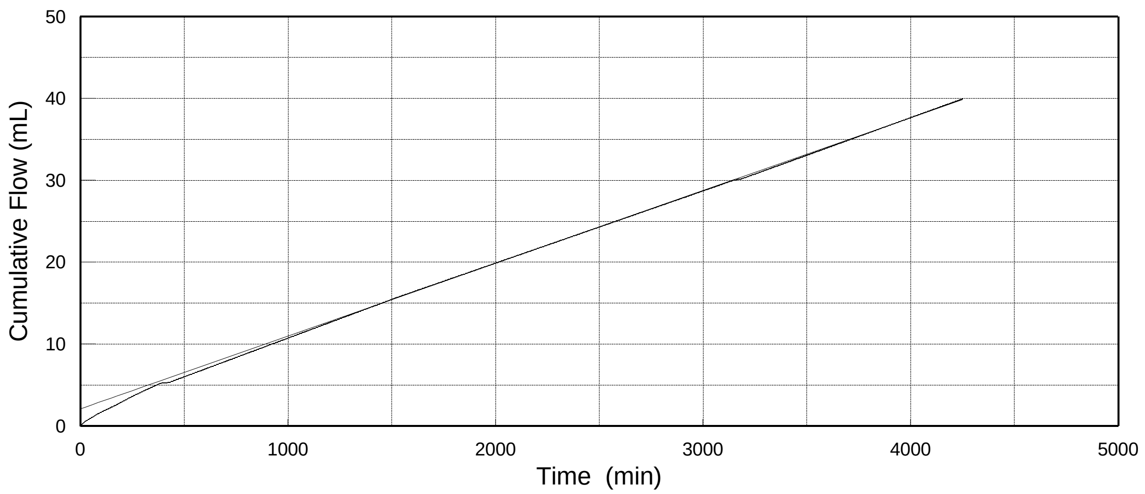
PERMEABILITY STAGE		
Pressure difference across specimen		20
Hydraulic gradient		20.5
Mean effective stress	*kPa*	90

TEST DURATIONS		
Saturation	*days*	2
Consolidation	*days*	1
Flow	*days*	2

RESULT

Coefficient of Permeability

kv at 20°C = 9.7×10^{-10} m/s



Checked and Approved Initials: RJP Date: 09/03/15	Project Number: **GEO / 22251** Project Name: **NEWPORT DOCKSWAY** **Project Number 1134**	GEOLABS®

BS1377 : Part 6 : Clause 6 :1990

Determination of Permeability in a Triaxial Cell

Borehole / TP:	WS3A
Sample No:	-
Depth:	GL - 1.00

Description:
Firm dark brownish grey CLAY with roots.

SPECIMEN DETAILS	
Depth within original sample	50mm from top
Orientation within original	Vertical
Specimen preparation	Undisturbed

TEST DETAILS			
Cell Preparation		Performed in accordance with Clause 3.5	
		INITIAL	FINAL
Diameter	*mm*	100.2	99.2
Height	*mm*	101.3	100.3
Moisture Content	*%*	63	64
Bulk Density	*Mg/m³*	1.50	1.56
Dry Density	*Mg/m³*	0.92	0.95

SATURATION STAGE		
Saturation initially by constant moisture content, followed by back-pressure assistance using 5-10 kPa differential		
'B' value	0.39	0.96

CONSOLIDATION STAGE		
Effective pressure	*kPa*	200
Volume change	*mL*	22.2

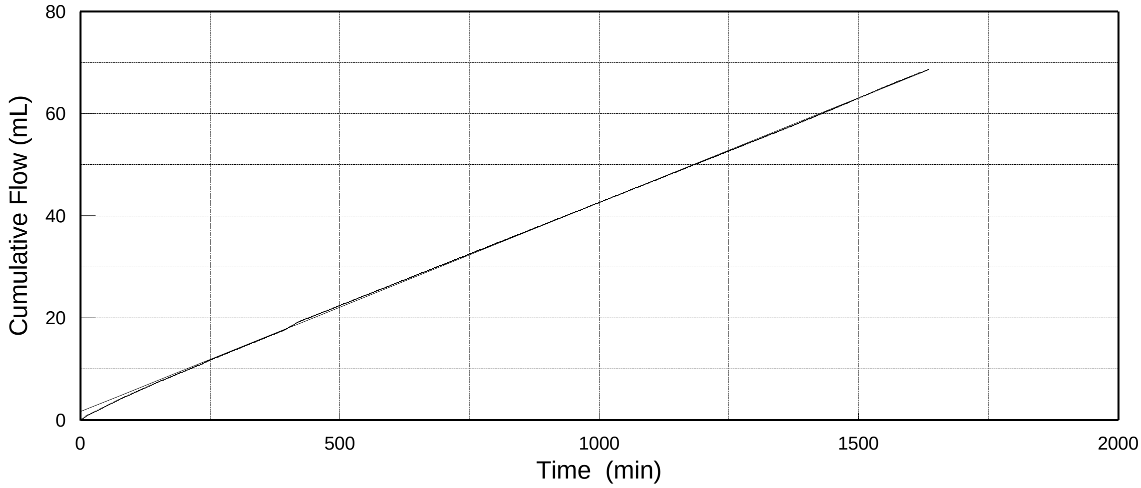
PERMEABILITY STAGE		
Pressure difference across specimen		20
Hydraulic gradient		20.3
Mean effective stress	*kPa*	190

TEST DURATIONS		
Saturation	*days*	4
Consolidation	*days*	2
Flow	*days*	6

RESULT

Coefficient of Permeability

kv at 20°C = 4.4 x 10^{-9} m/s



Checked and Approved	Project Number: **GEO / 22251**
Initials: RJP	Project Name: **NEWPORT DOCKSWAY**
Date: 09/03/15	**Project Number 1134**

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BS1377 : Part 6 : Clause 6 :1990

Determination of Permeability in a Triaxial Cell

Borehole / TP: WS4	Description:
Sample No: -	Firm dark brown silty CLAY with roots
Depth: 1.00 - 2.00	

SPECIMEN DETAILS	
Depth within original sample	40mm from top
Orientation within original	Vertical
Specimen preparation	Undisturbed

TEST DETAILS			
Cell Preparation		Performed in accordance with Clause 3.5	
		INITIAL	FINAL
Diameter	*mm*	81.0	80.2
Height	*mm*	79.9	79.2
Moisture Content	*%*	71	70
Bulk Density	*Mg/m³*	1.43	1.45
Dry Density	*Mg/m³*	0.83	0.86

SATURATION STAGE		
Saturation initially by constant moisture content, followed by back-pressure assistance using 5-10 kPa differential		
'B' value	0.59	0.98

CONSOLIDATION STAGE		
Effective pressure	*kPa*	200
Volume change	*mL*	11.0

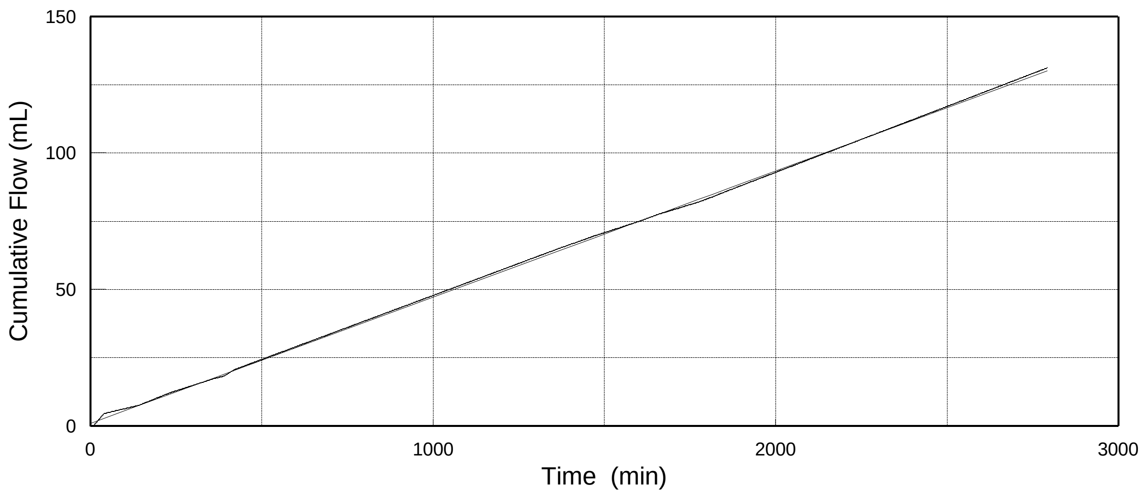
PERMEABILITY STAGE		
Pressure difference across specimen		20
Hydraulic gradient		25.7
Mean effective stress	*kPa*	190

TEST DURATIONS		
Saturation	*days*	4
Consolidation	*days*	2
Flow	*days*	6

RESULT

Coefficient of Permeability

kv at 20°C = 5.9 x 10^{-9} m/s



Checked and Approved Initials: RJP Date: 09/03/15	Project Number: **GEO / 22251** Project Name: **NEWPORT DOCKSWAY** **Project Number 1134**	GEOLABS®

BS1377 : Part 6 : Clause 6 :1990

Determination of Permeability in a Triaxial Cell

Borehole / TP:	WS4	Description:
Sample No:	-	Firm to stiff dark brown silty CLAY
Depth:	GL - 1.00	

SPECIMEN DETAILS

Depth within original sample	350mm from top
Orientation within original	Vertical
Specimen preparation	Undisturbed

TEST DETAILS

Cell Preparation		Performed in accordance with Clause 3.5	
		INITIAL	FINAL
Diameter	*mm*	97.7	96.8
Height	*mm*	100.9	100.0
Moisture Content	*%*	68	67
Bulk Density	*Mg/m³*	1.60	1.64
Dry Density	*Mg/m³*	0.95	0.98

SATURATION STAGE

Saturation initially by constant moisture content, followed by back-pressure assistance using 5-10 kPa differential

'B' value	0.71	1.00

CONSOLIDATION STAGE

Effective pressure	*kPa*	200
Volume change	*mL*	21.5

PERMEABILITY STAGE

Pressure difference across specimen		20
Hydraulic gradient		20.4
Mean effective stress	*kPa*	190

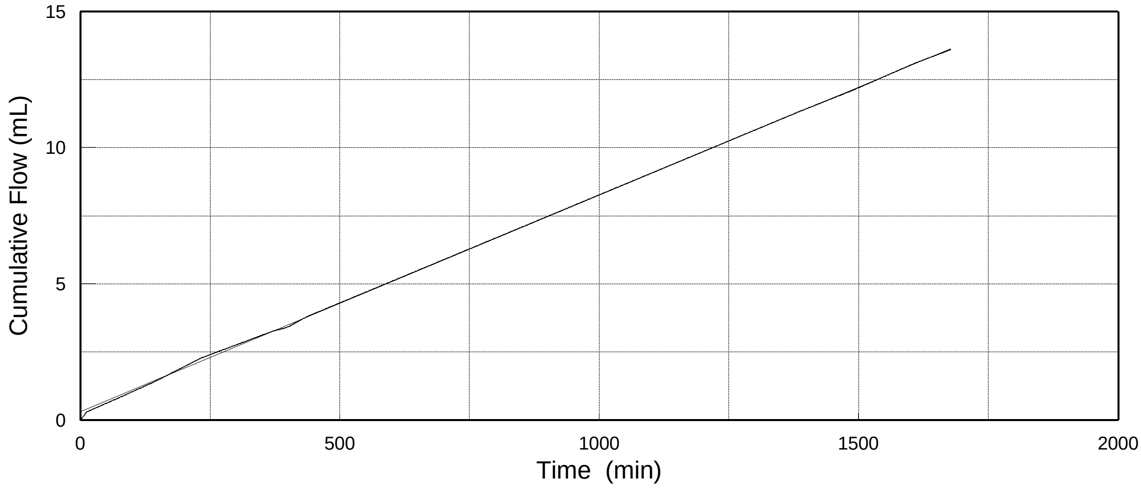
TEST DURATIONS

Saturation	*days*	6
Consolidation	*days*	2
Flow	*days*	6

RESULT

Coefficient of Permeability

kv at 20°C = 8.8 x 10^{-10}m/s



Checked and Approved	Project Number:	GEO / 22251
Initials: RJP	Project Name:	NEWPORT DOCKSWAY
Date: 09/03/15		Project Number 1134

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Appendix 14

SAMPLING METHOD STATEMENT

For

Soil Remediation at Docksway Waste Disposal Site, Newport

The performance specification is as follows:

General Material Description	Material Properties Required for Acceptability				Comments
	Property (See exceptions in previous column)	Defined and Tested in Accordance with:	Acceptable Limits within		
			Lower	Upper	
Stabilised Clay	(i) Direct Shear Strength by Hand Shear Vane	BS 1377: Part 7	$50kN/m^2$	$150kN/m^2$	The Stabilised/ Treated Clay will remain plastic after treatment and the testing shall demonstrate that failure during shear strength testing is a ductile plastic type failure (none brittle). The plate size for the plate bearing tests shall be a min 450mm diameter.
	(ii) Quick Undrained Triaxial Shear Strength on Core Sample	BS 1377: Part 7	$50kN/m^2$	$150kN/m^2$	
	(iii) Permeability in Triaxial Cell on Core Sample	BS 1377: Part 6	-	$1x10^{-9}m/s$	
	~~(iv) CBR~~	~~Plate Bearing Test~~	~~15%~~	-	
	(v) Thickness of underlying natural soils	Contractor to determine and agree with Project Manager	2m	-	

The acceptability testing frequency is as follows:

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
SHW SERIES 600 EARTHWORKS					
630, 633 & 640	Soil Mixing	Hand Shear Vane	1 per 200m^2 within the upper 0.5m of the treated soil	Required	Tests to be undertaken at 2 days and 5 days after mixing
		Undrained Shear Strength on Core	1 per 500m^2 with cores taken from various depths of the treated soil	Required	Quick undrained triaxial cores to be taken at 5 days after mixing
		Permeability	On cores recovered from treated soil at a frequency of 1 per 500m^2 with cores taken from various depths of the treated soil	Required	By triaxial method cores to be taken 7 days after mixing
		~~CBR~~	~~1 per 500m^2~~	~~Required~~	~~Plate Bearing Test across the finished treated area at a minimum of 5 days after completion of soil mixing~~
Note: UKAS accredited tests and test certification should be assumed to be required in all cases unless such accreditation is unavailable for a particular test, or agreement is otherwise reached with the Engineer that accreditation is not required.					

Following the failure to meet the minimum permeability criteria during the early trials, the sample extraction method was cited as a principle contributing factor to the increase in sample permeability due to the significant disturbance associated with extraction.

The initial method was amended to the following to enable an undisturbed sample to be extracted.

Plant used
13t excavator with trenching bucket and slings

Equipment used
Slotted casting cylinder 150mm dia x 350mm length, refer to Appendix A

Permeability and Shear testing Methodology.

Mixing and placement

Immediately following mixing and whilst the cement / bentonite / soil is at its most fluid the slotted cast is placed into the mix at the pre designated depth and allowed to fill naturally due to the relative low viscosity of the material. Should the mixture in any particular sample be too stiff the CQA Engineer has permitted the placing of the mix by hand into the mix, no compaction will be permitted the material will be allowed to settle under its own weight.

The cylinders used for the samples are slotted around their circumference and remain open at the top and bottom. This is designed to minimise the confining effect of the cylinder and to replicate insitu samples as much as possible.

Once in position the cylinder is given a bespoke cell reference and the date and depth logged. The sample is then left in position for a minimum of 14 days. The initial prescribed time between mixing and sampling was initially 7 days.

Following the trial period it was agreed that the curing period of 7 days for permeability samples and 5 days for shear samples identified in the original spec should have read no less than 7 days and 5days respectively. It was agreed there was no value in precluding the additional curing time.

Extraction

A 13t excavator will be used to remove the cylinders. The cylinder is excavated using a trenching bucket with minimal disruption to the remaining stabilised cell. Once removed the excavated area is reinstated with mixed material taken from the live mixing face.

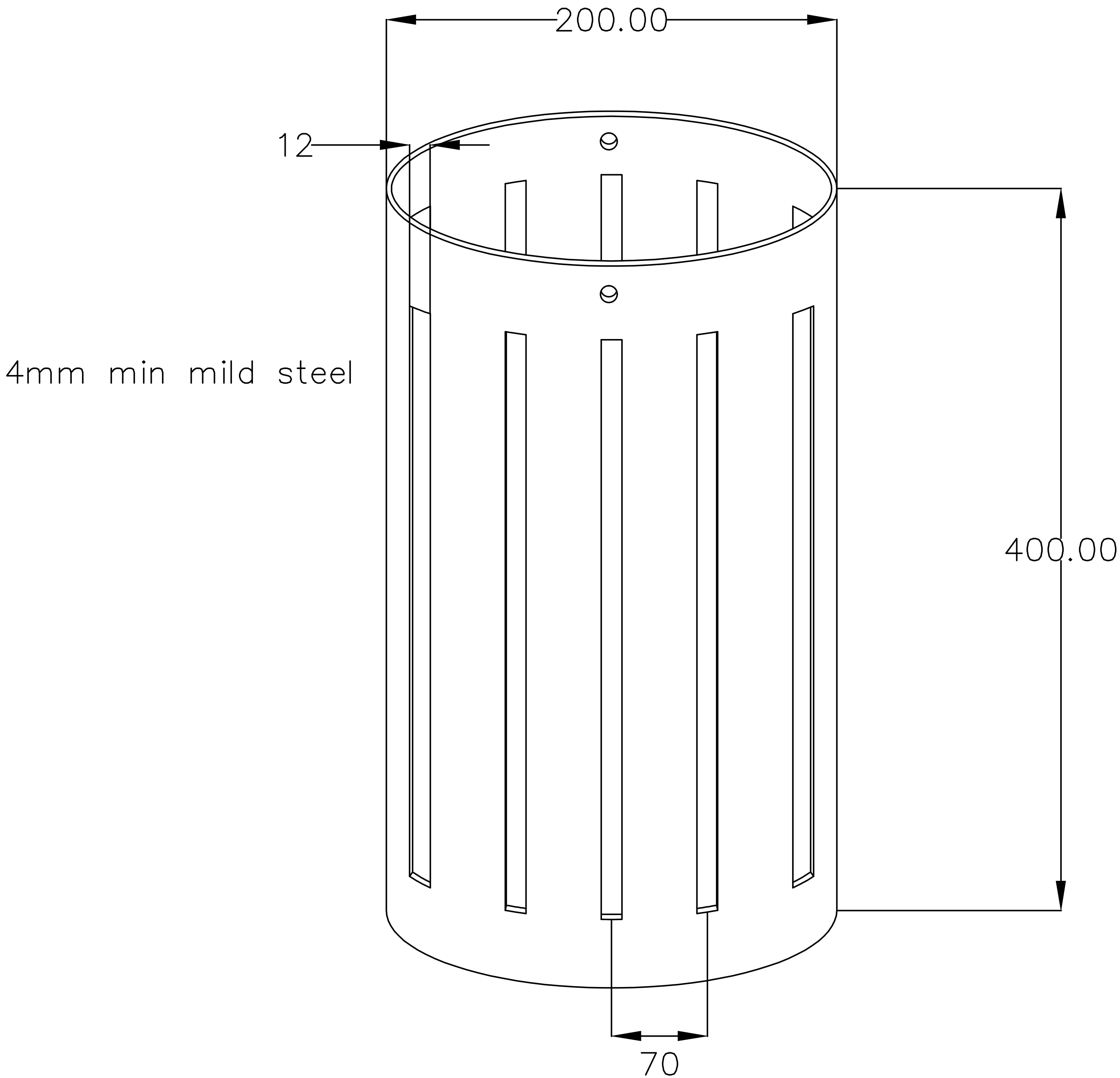
The sample is trimmed and delivered to the labs GSTL the same day. Details of the lab and its accreditation are included in Appendix B.

CBR testing

Following the trial period the practicality of carrying out the CBR testing was discussed during the project team meeting.

DSM proposed that a more practical demonstration of the bearing capacity of the stabilised area would be to observe the effect of the mixing plant as it moves about the stabilised area. This plant is much heavier and its movement more aggressive than the lighter plant that is proposed by Jim Davies Civil Engineering for the lining works. This was agreed in principle and it was demonstrated during the course of the works that the bearing capacity of the stabilised platform was more than sufficient. Consequently CBR testing was deleted from the testing schedule.

APPENDIX A – SAMPLE CYLINDER


200.00
12
4mm min mild steel
400.00
70

APPENDIX B – LABORITORY DETAILS AND ACCREDITATION

About GEO Site & Testing Services Ltd (GSTL)

Company

GEO Site & Testing Services Ltd was incorporated in March 2012 and registered at UK's Companies House based in Cardiff.

Here is a direct link to the record at companieshouse.gov.uk

```
Name: GEO Site & Testing Services Ltd
Company No: 07747010
VAT No: 128455602
```

UKAS - United Kingdom Accreditation Service

2788

- **ukas.com** website and it accreditation page
- *The United Kingdom Accreditation Service is the sole national accreditation body recognised by government to assess, against internationally agreed standards, organisations that provide certification, testing, inspection and calibration services.*
- GSTL are proud holders of UKAS certificate no **2788**. You can view the docs at the UKAS website, here and here

Schedule of Accreditation

issued by

United Kingdom Accreditation Service

21 - 47 High Street, Feltham, Middlesex, TW13 4UN, UK

2788 **Accredited to ISO/IEC 17025:2005**	**GEO Site and Testing Services Limited** **Issue No:** 011 **Issue date:** 03 June 2014	
	Unit 4 **Heol Aur** **Dafen Industrial Estate** **Dafen** **Carmarthenshire** **SA14 8QN**	**Contact: Mr P Evans** **Tel: +44 (0)1554 784040** **Fax: +44 (0)1554 784041** **E-Mail: pevans@geo.uk.com** **Website: www.geo.uk.com**

Testing performed by the organisation at the locations specified below

Locations covered by the organisation and their relevant activities

Laboratory locations:

Location details		Activity	Location code
Address Unit 4 Heol Aur Dafen Industrial Estate Dafen Carmarthenshire SA14 8QN	**Local contact** Mr P Evans	Aggregates: physical tests Concrete - fresh: physical tests Concrete - hardened: physical tests Rock: point load test Soils: physical tests Stabilized materials: physical tests	Laboratory

Site activities performed away from the location listed above:

Location details		Activity	Location code
All locations suitable for the activities listed	**Local contact** Mr P Evans	Aggregates: sampling Concrete - fresh: physical tests Soils: physical tests	Site

DETAIL OF ACCREDITATION

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
AGGREGATES	Sampling aggregates - from stockpiles	BS EN 932-1:1997	Site
	Particle size distribution - sieving method	BS EN 933-1:2012	Laboratory
	Flakiness index	BS EN 933-3:2012	Laboratory
	Shape index	BS EN 933-4:2008	Laboratory
	Resistance to fragmentation by the Los Angeles test method	BS EN 1097-2:2010	Laboratory
	Loose bulk density and voids	BS EN 1097-3:1998	Laboratory
	Water content	BS EN 1097-5:2008	Laboratory
	Magnesium sulfate test	BS EN 1367-2:2009	Laboratory
CONCRETE - fresh	Slump	BS EN 12350-2:2009	Site
	Making cubic specimens for strength tests	BS EN 12390-2:2009	Laboratory / Site
	Curing cubic specimens for strength tests	BS EN 12390-2:2009	Laboratory
CONCRETE - hardened	Compressive strength of cubes - including curing	BS EN 12390-3:2009 BS EN 12390-2:2009	Laboratory
	Density	BS EN 12390-7:2009	Laboratory
	Cored specimens - examining and testing in compression	BS EN 12504-1:2009	Laboratory
ROCK	Point load strength	ISRM commission on testing methods. Suggested method for determining point load strength. 1985	Laboratory

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
SOILS for civil engineering purposes	Moisture content - oven drying method	BS 1377-2:1990	Laboratory
	Liquid limit - cone penetrometer	BS 1377-2:1990	Laboratory
	Liquid limit - cone penetrometer - one point	BS 1377-2:1990	Laboratory
	Plastic limit	BS 1377-2:1990	Laboratory
	Plasticity index and liquidity index	BS 1377-2:1990	Laboratory
	Linear shrinkage	BS 1377-2:1990	Laboratory
	Particle density - gas jar	BS 1377-2:1990	Laboratory
	Particle size distribution - wet sieving	BS 1377-2:1990	Laboratory
	Particle size distribution - dry sieving	BS 1377-2:1990	Laboratory
	Particle size distribution - sedimentation - pipette method	BS 1377-2:1990	Laboratory
	Dry density/moisture content relationship (2.5 kg rammer)	BS 1377-4:1990	Laboratory
	Dry density/moisture content relationship (4.5 kg rammer)	BS 1377-4:1990	Laboratory
	Dry density/moisture content relationship (vibrating hammer)	BS 1377-4:1990	Laboratory
	Moisture condition value (MCV)	BS 1377-4:1990	Laboratory
	MCV - natural moisture content	BS 1377-4:1990	Laboratory
	MCV/moisture content relation	BS 1377-4:1990	Laboratory

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
SOILS for civil engineering purposes	California Bearing Ratio (CBR)	BS 1377-4:1990	Laboratory
	One-dimensional consolidation properties	BS 1377-5:1990	Laboratory
	Permeability in a triaxial cell	BS 1377-6:1990	Laboratory
	Shear strength by direct shear (small shearbox apparatus)	BS 1377-7:1990	Laboratory
	Undrained shear strength - triaxial compression without measurement of pore pressure	BS 1377-7:1990	Laboratory
	Undrained shear strength - triaxial compression with multistage loading and without measurement of pore pressure	BS 1377-7:1990	Laboratory
	In-situ density - sand replacement method (large pouring cylinder)	BS 1377-9:1990	Site
	In-situ density - core cutter method	BS 1377-9:1990	Site
	Vertical deformation and strength characteristics by the incremental plate loading test	BS 1377-9:1990	Site
	In-situ California Bearing Ratio	BS 1377-9:1990	Site
	Uniformity coefficient (221 2217)	BS 6100-2.2.1:1992 (withdrawn)	Laboratory
	Determination of equivalent CBR value using the plate bearing test	Specification for Highway Works: Design Guidance for Road Pavement Foundations Interim Advice Note 73/06	Site
	Determination of the permeability of clayey soils in a triaxial cell using the accelerated permeability test	Environment Agency R & D Technical Report P1-398/TR/2: January 2003	Laboratory
	Soil suction (filter paper method)	BRE IP4/93	Laboratory

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
SOILS for civil engineering purposes	One dimensional swell / strain	Documented In-House Method No 001	Laboratory
STABILIZED MATERIALS for civil engineering purposes - cement-stabilized and lime-stabilized materials	Dry density/moisture content relationship (2.5 kg rammer)	BS 1924-2:1990 (withdrawn)	Laboratory
	Dry density/moisture content relationship (4.5 kg rammer)	BS 1924-2:1990 (withdrawn)	Laboratory

END

Appendix 15

METHOD STATEMENT

For

Soil Remediation

Soil remediation is needed for the Newport Landfill site in the trial area of the works undertaken by Deep Soil Mixing. The trial area is the area marked trial in the attached stabilisation grid. This is because some of the permeability results in the trial area, mixed with an Allu arm during the trial period of the works have not met the specification requirements of a ground permeability of less than 1×10^{-9}.

It has been decided by Deep Soil Mixing and Newport County Council that this area needs to be remediated in order to properly obtain the specification requirement permeability. This will be done by digging out the cells in question (where the required results have not been achieved) and adding in new, unmixed material that is dug out a location on the same site so that the same original soil properties are preserved.

- This shall be done on all cells that have not passed the permeability test.
- The soil is being dug out and removed using a CAT320 excavator and transported by dumper truck to be deposited elsewhere on the site, outside of the area of stabilisation for Deep Soil Mixing at a location of choosing of the client, Newport County Council.
- The areas for remediation that has been dug out shall be refilled with unmixed material removed from an alternate location and placed into the area of failed results.
- This shall then be compacted to ensure consistency over the whole site.

All have passed and no failures have been recorded since the introduction of more stringent sampling, transportation and testing methods have been put into place. Also Deep Soil Mixing have been using a REMU bucket that is achieving a much more consistent mix with this new bucket rather than the Allu arm. The new area of soil that has been installed shall be mixed at a 7.5% binder percentage and a 50:50 cement to bentonite ratio, in keeping with the actual works area that has seen positive results. This shall be done using the CAT 330D excavator from the steel mats. The area, once fully mixed, shall then be left for a total of 2 weeks (14 days) before permeability testing is done on every remediated cell, as well as triaxial strength testing.