Measured and Derived Geotechnical Parameters and Final Results

Golfe du Lion Geotechnical Site Investigation Centre (Z5) | Mediterranean Sea

F254727-REP-003 04 | 17 October 2025

IFE

Direction Générale de l'Énergie et du Climat – DGEC

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17 October 2025

Attention: Jérôme MINVIELLE

Dear Mr MINVIELLE

Please find below the interim Measured and Derived Geotechnical Parameters and Final Results. It was prepared by Mira Richa and Tilio Le Guilly under the supervision of Kah Jun Lee, in accordance with Call-Off n° 1406589329 between Direction Générale de l'Énergie et du Climat – DGEC and Fugro France SAS.

If you require any additional information or clarification, please do not hesitate to contact us. Thank you for the opportunity to participate in this project.

Yours sincerely

Mira RICHA
Geotechnical engineer

Reporting Structure

Operational Report

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Quality Assurance Record

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Executive Summary

Introduction

Direction Générale de l'Énergie et du Climat – DGEC contracted Fugro France to carry out a geotechnical site investigation and provide ground information at the floating windfarm locations of the development area in Golfe du Lion Ouest (Z3), Est (Z4) and Centre (Z5), France. Fieldwork was performed from the MV Fugro Quest from 11 January to 27 January 2025.

This report details the measured and derived geotechnical parameters and final results for the investigated locations in Golfe du Lion Centre (Z5). It presents:

1. A description of the geotechnical site investigation;
2. Geotechnical logs and descriptions of the soil strata;
3. Results of the in situ testing, sampling, and laboratory testing;
4. Positioning and water depth measurements.

Fieldwork

Table S.1 shows the number of test locations.

Table S.1: Summary of test locations

Test Type	Total No. of Test Locations	No. of Retest Locations
Downhole Mode		
Composite Borehole (sampling/CPT)	6	1
Notes CPT = Cone penetration test		

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Abbreviations

BHA	Bottom-hole assembly
BSF	Below seafloor
CID	Consolidated isotropically drained triaxial
CIU	Consolidated isotropically undrained triaxial
CPT	Cone penetrometer test
LAT	Lowest astronomical tide
MM	Maximum and minimum density
MV	Marine vessel

PD	Particle density
PI	Plasticity index
PP	Pocket penetrometer
PSD	Particle size distribution
SB	Shear box
SRB	Sulphate reducing bacteria
TRT	Thermal resistivity test
TV	Torvane
UU	Unconsolidated undrained triaxial
UUr	Unconsolidated undrained triaxial remoulded
UTM	Universal Transverse Mercator
WIP	Wireline push

1. Project Information

1.1 Introduction

Direction Générale de l’Énergie et du Climat – DGEC contracted Fugro France to carry out a geotechnical site investigation and provide ground information at the floating windfarm locations of the development area in Golfe du Lion Ouest (Z3), Est (Z4) and Centre (Z5), France. Fieldwork was performed from the MV Fugro Quest from 11 January to 27 January 2025.

This report details the measured and derived geotechnical parameters and final results for the investigated locations in Golfe du Lion Centre (Z5) site.

Plate 1.1 is a map showing the general location of the investigated area. Plate 1.2 is the detailed plan of the investigated locations for Golfe du Lion Centre (Z5).

1.2 Scope of Report

This report presents:

1. A description of the geotechnical site investigation;
2. Geotechnical logs and descriptions of the soil strata;
3. Results of the in situ testing, sampling, and laboratory testing;
4. Positioning and water depth measurements.

1.3 Summary of Fieldwork

Table 1.1 summarises the fieldwork carried out during the site investigation. For full details, see operational report (Fugro, 2025).

Table 1.1: Summary of fieldwork

Location	Final Recovery [m BSF]	Sampling and Testing Details
Z5_OWF_BH01-COMP	21.33	07 WIPs and 07 CPTs
Z5_OWF_BH02-COMP	20.20	06 WIPs and 06 CPTs
Z5_OWF_BH03-COMP	22.91	06 WIPs and 07 CPTs
Z5_OWF_BH05-COMP	20.38	07 WIPs and 06 CPTs
Z5_OWF_BH07-COMP_a*	20.65	08 WIPs and 05 CPTs
Z5_OWF_BH09-COMP	20.05	08 WIPs and 06 CPTs

Notes
BSF = Below seafloor
CPT = Cone penetration test
WIP = Wireline push sample
* Location Z5_OWF_BH07-COMP was not started, all testing was performed at Z5_OWF_BH07-COMP_a

1.4 Data Sources

The data used in the preparation of this report were obtained during the offshore site investigation, which included in situ tests and laboratory testing and the subsequent onshore laboratory test programme.

1.5 Geodetic Data

Appendix E summarises the borehole coordinates and water depths of the investigated locations. The coordinates presented in these positioning reports are the calculated location coordinates. Coordinates for all boreholes are expressed using the Universal Transverse Mercator (UTM) projection 31 N, World Geodetic System 1984, International Spheroid, with a central meridian of 3° east.

Measured water depths were reduced to the Lowest astronomical tide (LAT) based on chart datum FR Bathyelli.

The user must consider the accuracy of all measurements, particularly where use may differ from original intentions. For example, water depths presented are indicative only and should not be used for design purposes, such as estimating current or wave forces on platforms.

1.6 Guidelines on Use of Report

Appendix A outlines the limitations of this report in terms of a range of considerations including, but not limited to, its purpose, its scope, the data on which it is based, its use by third parties, possible future changes in design procedures and possible changes in the conditions at the site over time. It represents a clear exposition of the constraints which apply to all reports issued by Fugro. It should be noted that these guidelines do not in any way supersede the terms and conditions of the contract between Fugro and DGEC.

2. Geotechnical Description and Profiles

2.1 Introduction

This section presents geotechnical logs for the Golfe du Lion Centre (Z5). Based on laboratory test results and in situ test data, the logs indicate measured and inferred:

- Sample and cone penetration test (CPT) depths;
- Soil layering, including classifications of undrained shear strength (s_u) in fine-grained cohesive soils;
- Measured (s_u) values from strength tests;
- Interpreted (s_u) from CPT data;
- Relative density (D_r) interpreted from CPT data;
- Measured water content, unit weight (γ), plasticity index (PI) and particle size distribution (PSD) data;
- Measured carbonate content and organic matter results.

Plate 2.1 defines the symbols and terms used in the geotechnical logs.

2.2 Interpretation of Undrained Shear Strength from In situ Tests

In fine-grained cohesive (clay) soils, undrained shear strength (s_u) was interpreted from CPT data using Equation 2.1.

$$s_u = q_n / N_{kt}$$

Equation 2.1

Where:

s_u = Inferred undrained shear strength [kPa]

q_n = Net cone resistance [kPa]

N_{kt} = Empirical factor relating cone resistance to undrained shear strength

Cone factor (N_{kt}) values of 15 and 20 were adopted to infer the s_u profiles presented in the geotechnical logs. Appendix B further details the methods used to infer q_n from CPT data.

2.3 Interpretation of Relative Density from Cone Penetration Tests

The relative density of coarse-grained cohesionless soils was estimated using the relationship proposed by Jamiolkowski et al. (2003), and presented in Equations 2.2 and 2.3.

$$D_r(dry) = \frac{1}{0.0296} \cdot ln \left[q_c \Big/ 2.494 \cdot \left[\frac{\sigma'_{v0} \cdot \left[\frac{1 + 2 \cdot K_0}{3} \right]}{100} \right]^{0.46} \right]$$

Equation 2.2

$$D_r(saturated) = \left[\frac{-1.87 + 2.32 \cdot ln\frac{1000 \cdot q_c}{(100 \cdot \sigma'_{v0})^{0.5}}}{100} + 1\right] \cdot D_r(dry)$$

Equation 2.3

Where:

D_r (dry) = Estimated relative density [%]
D_r (saturated) = Estimated saturated relative density [%]
q_c = Measured cone resistance [MPa]
σ'_{v0} = Vertical effective overburden stress [kPa]
K_0 = Coefficient of lateral earth pressure

The sensitivity of inferred relative density to changes in estimated horizontal stress can be evaluated using Jamiolkowski et al.'s (2003) chart, which presents a relationship between relative density, cone resistance and mean effective stress. Values of K_0 of 0.5 and 1.0 were used to estimate the relative density D_r (saturated) presented in the borehole logs.

2.4 Discussion of Results

Plates 2.2 to 2.13 present geotechnical logs for the tested locations. The soil profiles shown are based on analysed CPT data, visual descriptions of recovered samples, and the results of offshore and onshore laboratory testing. Sections 2.2 and 2.3 outline the methods used to interpret the CPT results.

Soil descriptions are based on BS 5930:2015+A1:2020 (BSI, 2015a), ISO 14688-1:2017 (ISO, 2017a) and ISO 14688-2:2017 (ISO, 2017b). The limits of consistency in predominantly cohesive soils follow BSI 5930:2015+A1:2020, and in predominantly coarse-grained soils Lambe and Whitman (1969). Appendix C details the limits of consistency used.

The description of the carbonate content presented on the geotechnical logs was carried out in accordance with ISO 14688-1:2017 (ISO, 2017a) and ISO 14688-2:2017 (ISO, 2017b). A first qualitative determination was done during sample description by the application of droplets of dilute hydrochloric acid (10% HCl). Then, during onshore laboratory testing phase Modifications to the carbonate content description of the soil were carried out according to the results of the tests performed onshore.

The description of the organic matter presented on the geotechnical logs was carried out in accordance with ISO 14688-1:2017 (ISO, 2017a) and ISO 14688-2:2017 (ISO, 2017b) following onshore laboratory testing phase.

Modifications on main soil types and secondary fractions were carried out on the log descriptions based on particle size distribution test and plasticity index results. In case of a discrepancy between these test outcomes, priority is given to the plasticity index results, as it determines the main soil behaviour. In accordance with ISO 14688-1:2017 (ISO, 2017a), the intermediate terms of "silty CLAY" or "clayey SILT" are used for material that is borderline in behaviour between clay and silt.

Soil strength classifications are based on the results of soil strength tests, advanced laboratory strength tests, and interpreted CPT data. Consistency was assessed in the field following ISO 14688-1:2017 (ISO, 2017a) and BS 5930:2015+A1:2020 (BSI, 2015a). Terms of s_u always take precedence when considering the strata described and should not be confused with consistency. Consistency and s_u of the soil are not directly comparable; large differences between the two can be due to a number of factors, including soil fabric, sample quality and moisture content. Consistency descriptions are not included in the geotechnical logs as they are more applicable to individual samples than to an entire soil layer.

CPT cone resistance may be influenced by the material ahead of and behind the penetrating cone. The cone starts to sense a change in strata type before it reaches the new material and continues to sense a past strata material even after entering a new one. Consequently, the CPT does not always measure accurately the in situ mechanical properties in thin soil beds.

The distance over which the cone senses an interface decreases with material stiffness. Narrow soft strata layer less than 100 mm thick can be fully detected by cone resistance, whereas stiff strata layers may need to be at least 750 mm thick for cone resistance to reach its full value (Lunne et al., 1997). The CPT will detect stiff strata layers, but their strength could be underestimated if the layer under investigation is less than 750 mm thick. This effect scales when using cones of a larger diameter (Lunne et al., 1997).

With reference to the above and using engineering judgement, sublayer behaviour (drained or undrained) was assigned during CPT processing and geotechnical log drafting. Where sublayers were assigned a behaviour different to the main layer behaviour, the thickness and stiffness of the layer and its effect on the CPT cone should be considered when deriving representative engineering profiles.

3. In Situ Test Data

3.1 Introduction

Thirty-seven (37) successful downhole CPTs were completed in six (6) composite geotechnical boreholes using the Fugro WISON® MkIV system.

See operational report (Fugro, 2025) for details of the testing systems and equipment used.

3.2 Cone Penetration Tests

3.2.1 Downhole Cone Penetration Tests

Cones with a projected area of 10 cm^2 and a 5 tonnes capacity (CP10 cones) were used for the testing, and pore pressure measurements were made on the shoulder of the cone. Corresponding net area ratio of the cone, alpha (α) and net area ratio of the friction sleeve, beta (β) values for the cones used were respectively 0.75 and 0. In harder soils, a cone with a projected area of 5 cm^2 and an 8 tonne capacity (CP5 cones) was used, with corresponding alpha (α) and beta (β) values of 0.5 and 0.01669.

The Fugro SEACLAM® seabed reaction frame provided a reaction weight of approximately 10 tonnes for the tests.

Digital signals from the cones transmitted from the seabed unit and stored for subsequent computer processing included:

- Penetration;
- Cone resistance (q_c);
- Sleeve friction (f_s);
- Pore-water pressure (u).

Zero readings were taken on deck before and after each test and monitored to ensure that the cone channels did not drift beyond acceptable limits during the test. The zero readings taken at the start and end of the test were absolute values of pressure expressed as MPa.

Hydrostatic offsets were applied to the cone readings before penetration started and the values presented are relative to seabed.

Tests were terminated at the operator's discretion, taking into account the total thrust applied to the cone, the tip resistance, and the soil conditions.

Cones used in this project were calibrated before mobilisation in Fugro's onshore laboratory in Nootdorp, the Netherlands. Table 3.1 summarises the test numbers, depth ranges, and cones used for the tests; Plates 3.1 to 3.54 present the cone calibration certificates.

Table 3.1: Summary of downhole cone penetration tests

Location	CPT Number	Depth Range [m BSF]	Cones Used
Z5_OWF_BH03-COMP	CPT01 - CPT07	0.0 - 22.91	CP10-1706-2445
Z5_OWF_BH07-COMP_a	CPT01 - CPT05	0.0 - 18.87	CP10-1706-1317
Z5_OWF_BH09-COMP	CPT01 – CPT03 CPT04 - CPT06	0.0 - 6.81 8.0 - 19.39	CP10-1706-2622 CP10-1706-1317
Z5_OWF_BH05-COMP	CPT01 - CPT06	0.0 - 20.38	CP10-1706-1317
Z5_OWF_BH02-COMP	CPT01 - CPT06	0.0 - 18.36	CP10-1706-1784
Z5_OWF_BH01-COMP	CPT01 – CPT06 CPT07	0.0 - 19.07 20.0 - 21.34	CP10-1706-1784 CP5-1709-0513

Notes
CPT = Cone penetration test
BSF = Below seafloor

3.2.2 Test Results

Plates 3.55 to 3.78 show the results of the CPTs. Two plots and one table are presented:

- The first plot presents the measured (q_c, f_s and u) and derived parameters (q_n, q_t, B_q, f_t, R_f, R_{ft}) obtained during the tests;
- The second plot presents the normalised (Q_{tn}, Q_t and F_r) and classification parameters (I_c, I_{SBT}, γ, S_u, D_r);
- A summary table presents the zero loads of the cone before and after each test, and the subsequent amount of drift as per ISO 19901-8:2014 (ISO, 2014a).

3.2.3 Discussion of Cone Penetration Test Results

The CPT results obtained during the geotechnical site investigation were generally of good quality and characterised the in situ soil conditions when compared with recovered samples and adjacent CPT locations. The hydrostatic offsets measured before the start of each test were monitored to ensure that the measured value was within acceptable limits of the theoretical value.

The zero readings taken on deck before and after each test did not drift beyond acceptable limits during the test. Good results were observed at all tested locations. All tests satisfied the requirements for Class 1 or Class 2 based on the zero drift test classifications outlined by ISO 19901-8:2023 (ISO, 2023).

3.3 Operational Issues

The in-situ testing operations were completed successfully without any significant challenges. However, the tool failed to latch on a few occasions due to soil cuttings at the bottom of the hole. When this occurred, the drill string was lifted slightly, and the bottom of the hole flushed, testing was then reattempted from the same depths.

3.4 Practice for Cone Penetration Testing

Table 3.2 summarises the specifications of the CPT equipment used.

Table 3.2: Practice for cone penetration testing

Test Control	
General Procedure	According to ISO 19901-8:2014 (ISO, 2014a) Refer to document titled Cone Penetration Test (Appendix B)
Metrological Confirmation	According to ISO 10012:2003 (ISO, 2003) (Appendix B)
Target Application Class	Class 1 or Class 2 in accordance with ISO 19901-8:2014 (ISO, 2014a)
Test Termination	Refer to document titled Cone Penetration Test (Appendix B)
Downhole Cone Penetration Testing Apparatus	
Thrust Machine	Fugro WISON® MkV
Mounting of Thrust Machine	Fixed
Reaction Equipment	Fugro SEACLAM® MkII
Push Rods	3.0 m (CP10) and 1.5 m (CP5)
Push Rod Casing	Stainless steel
Penetrometer Type	CP10 (10 cm^2) and CP5 (5 cm^2) piezocone
Communication	Fibre optic
Test Results	
Data Processing and Management	Discovery, GeoVisual, Topaz
Depth Reference Level	Seabed
Water Depth Reference	LAT

Notes
LAT = Lowest Astronomical Tide

4. Sampling Data

4.1 Overview

Forty-two (42) downhole wireline push (WIP) samples were taken from six (6) composite geotechnical boreholes.

Plates 4.1 to 4.42 presents the photographs of the acquired samples and Plates 4.43 to 4.46 summarise the samples acquired during the fieldwork, the testing performed offshore and the scheduled onshore testing.

4.2 Downhole Samples

Table 4.1 summarises the downhole sampling equipment used during the fieldwork.

Table 4.1: Sampling equipment

Sampler Type	Inside Diameter D_1 [mm]	Outside Diameter D_2 [mm]	Inside Diameter D_3 [mm]	Wall Thickness [mm]	Tube Length* [mm]	Sample Length* [mm]	Rate of Penetration† [mm/s]
Thin-walled 3″ tube	72.0	76.0	72.0	2.0	1028.0	950.0	20.0
Thick-walled 3″ tube	72.0	80.0	72.0	4.0	1028.0	950.0	20.0
Thick-walled 2″ tube	53.0	60.3	53.1	3.6	1028	950	20.0

Notes

D_1 = Inside diameter of cutting shoe

D_2 = Greatest outside diameter of sample tube and/or cutting shoe

D_3 = Inside diameter of flush portion of sample tube or liner

* = Stated manufactured length. If cutting edge becomes blunted during sampling process, tubes may be trimmed to sharpen it

4.2.1 Downhole Piston and Push Samples

Most of the downhole push samples were taken using Fugro's wireline WIPSAMPLER in combination with seamless 3″ WIP thin-walled tubes. To prevent buckling, 2″ and 3″ WIP thick-walled tubes were used where dense to very dense sand soils (2″ tubes) or very high strength clay soils (3″ tubes) were expected. In cohesionless material, a core catcher was used in conjunction with the 3″ WIP thin-walled and 2″ WIP thick-walled tubes to prevent the sample from slipping out of the tube during recovery to deck.

A core catcher was used with thin-walled 3″ (72 mm) and thick-walled 2″ (53 mm) tubes in cohesionless material, to prevent the sample from slipping out of the tube during recovery to deck. The thick-walled 2″ (53 mm) tube was only used for dense cohesionless material. The sample tube was pushed into the soil at a constant rate of 20 mm/s using the reaction obtained by clamping the drill pipe at seafloor with the Fugro SEACLAM® system.

4.3 Operational Issues

The sampling was completed successfully without any major challenges.

Table 4.2 lists the operational issues in chronological order.

Table 4.2: Summary of operational issues: sampling tests

Location	Depth [m BSF]	Test No.	Description
Z5_OWF_BH09-COMP	7.0	W02	No recovery, sample slipped out of the WIP when arriving on deck. OCR requested a retest from the same depth. Recovery of 35 cm for the retest

Notes
BSF = Below seafloor
WIP = Wireline push
OCR = Offshore client representative

4.4 Practice for Sample Handling

Immediately after recovery, the samples were extruded from their tubes and visually described. In clay, some sections were first selected for intact preservation for further testing in onshore laboratory. Some basic index tests were performed based on this visual description, including moisture content determination, bulk and dry density determination, index strength tests (pocket penetrometer, torvane) and thermal resistivity tests in shallow sediments up to 6 m BSF. Additional tests included unconsolidated undrained triaxial and sulphate reducing bacteria tests. Any remaining lengths are preserved in bags.

In coarse grained soil, basic tests included moisture content determination and bulk and dry density determination. Any remaining lengths are preserved in bags.

All soil samples were stored in a reefer container at 7°C.

Full visual descriptions were made of the recovered samples in accordance with BS 5930:2015+A1:2020 (BSI, 2015), ISO 14688-1:2017 (ISO, 2017a) and ISO 14688 2:2017 (ISO, 2017b) and Munsell Color (2009).

Table 4.3 summarises the procedures for sample handling.

Table 4.3: Practice for handling seabed samples

Stage	Process	Description
Initial sample handling	Initial handling	Detach sample tube from WIPSAMPLER
	Push samples	Transfer to site laboratory
Site geotechnical laboratory	Push samples	■ Extrude sample from sample tube ■ Measure recovery ■ Photograph sample ■ Make visual geotechnical description of sample ■ Test soil where appropriate (e.g. water content, unit weight, pocket penetrometer, torvane, fall cone, reaction to 10 % hydrochloric acid)

Stage	Process	Description
		■ Thermal resistivity tests (TRT) to be conducted at frequency agreed on board according to procedure defined in Fugro document F254727-TN-002 02 (Fugro, 2024a) ■ Sulphate reducing bacteria (SRB) measurement was conducted at frequency agreed on board according to protocol defined in Fugro document F254727-TN-003 02 (Fugro, 2024b)
Sample protection	Packaging of disturbed material (bag subsamples)	■ Pack disturbed material in double bulk bags ■ Label each bag
	Packaging of undisturbed material (wax subsamples)	■ Wrap in cling film (add label) ■ Wrap in aluminium foil ■ Insert in cardboard tube (add label) ■ Add wax to seal sample in tube ■ Insert waxed sample into inflatable packaging (add label)
Onboard sample storage	n/a	■ Samples stored in a reefer container
Sample transport	n/a	■ Pack samples into wooden crates and strap to pallet ■ Wrap pallets in heavy-duty shrink film

Notes
n/a = Not applicable

5. Laboratory Test Data

5.1 Introduction

Laboratory tests were carried out in accordance with the standards listed in Appendix D where it is also noted which tests are accredited. The results relate only to the samples tested and are considered to be representative of those samples.

The summary of laboratory test results sheets (Plates 5.1 to 5.8) present tabulated results from the offshore and onshore laboratory testing.

Table 5.1 summarisers the performed tests offshore and onshore according to the soil type and the preservation condition necessary for the tests to be performed.

Table 5.1: Summary of offshore and onshore laboratory tests

Tests	Soil Type	Sample Type	Condition
Offshore			
Index soil strength pocket penetrometer (PP) & torvane (TV)	Cohesive soil	-	Undisturbed
Moisture content & bulk density	Cohesive and cohesionless soil	-	Disturbed
Unconsolidated undrained triaxial (UU)	Cohesive soil	-	Undisturbed
Thermal resistivity test (TRT)	Cohesive and fine cohesionless soil - non gravelly	Performed in Shelby tube immediately after sampling	Undisturbed
Sulphate reducing bacteria (SRB)	Cohesive and cohesionless soil	-	Undisturbed
Onshore			
Plasticity index (PI)	Cohesive soil	Wax/Bag	Undisturbed/Disturbed
Particle size distribution (PSD)	Cohesive and cohesionless soil	Wax/Bag	Disturbed
Particle density (PD)	Cohesive and cohesionless soil	Wax/Bag	Disturbed
Maximum and minimum density (MM)	Cohesionless soil	Bag	Disturbed
Incremental loading oedometer	Cohesive soil	Wax	Undisturbed
Permeability in permeameter (constant head method)	Cohesive and cohesionless soil	Wax/Bag	Disturbed, recompacted

Tests	Soil Type	Sample Type	Condition
Permeability in triaxial cell (constant head method)	Cohesive soil	Wax	Undisturbed
Unconsolidated undrained triaxial (UU)	Cohesive soil	Wax	Undisturbed
Unconsolidated undrained triaxial remoulded (UU_r)	Cohesive soil	Bag (when UU done offshore) / remoulded from Wax (when UU done onshore)	Disturbed
Consolidated isotropically drained triaxial (CID)	Cohesionless soil	Bag	Disturbed, recompacted
Consolidated isotropically undrained triaxial (CIU)	Cohesive soil	Wax	Undisturbed
Shear box (SB)	Cohesionless soil	Bag	Disturbed, recompacted
Chemical tests	Cohesive and cohesionless soil	Wax/Bag	Undisturbed/Disturbed
Notes - = Not applicable			

Refer to the summary of laboratory test results for full sample descriptions. The geotechnical descriptions given in the individual test reports are indicative only of the specimens tested.

5.2 Index Laboratory Tests

Basic index laboratory tests completed offshore on soils obtained during the site investigation included soil description, colour identification using Munsell Color (2009) charts, water content (w), unit weight (γ) and dry unit weight (γ_d), pocket penetrometer (PP), torvane (TV), and unconsolidated undrained triaxial (UU).

Decisions to perform PP and TV tests were based on soil type, soil strength, and gravel and shell fragments contents.

Except for sulphate reducing bacteria (SRB) and thermal resistivity test (TRT), the test results are presented in the geotechnical logs (Plates 2.2 to 2.13) and the summary of laboratory test results sheets (Plates 5.1 to 5.8).

Further index tests will be performed onshore. These include particle size distribution (PSD), plasticity index (PI), particle density (PD), maximum and minimum density (MM) and further UU triaxial tests.

5.2.1 Water Content and Wet and Dry Density Determination

Water content* (w) (also called moisture content) and unit weight (γ) were measured in representative samples from the investigated locations. Dry unit weight (γ_d) was then inferred from the measured γ and w content values.

The geotechnical logs (Plates 2.2 to 2.13) and the summary of laboratory test results sheets (Plates 5.1 to 5.8) present the individual test results.

5.2.2 Index Soil Strength

Index undrained shear strength (s_u) for cohesive soil samples was measured using PP and TV tests. The summary of laboratory test results sheets (Plates 5.1 to 5.8) present tables showing the individual test results. The geotechnical logs (Plates 2.2 to 2.13) present the individual test results graphically.

The results generally agree well with s_u derived from CPT data using cone factor values (N_{kt}) of 15 and 20.

5.2.3 Plasticity Index

Eight (8) liquid and plastic limit tests were conducted on selected specimens of fine-grained soils to assess plasticity. Plate 5.9 summarises the test results and Plate 5.10 presents the plasticity chart.

Most of the samples were classified as low plasticity. Two (2) samples were of medium plasticity, both in borehole Z5_OWF_BH09-COMP at 11.00 m and 12.70 m.

5.2.4 Particle Size Distribution

Twenty-eight (28) wet sieving and sixteen (16) sedimentation tests were conducted on selected samples to confirm the geotechnical descriptions made offshore.

Plate 5.11 summarises the test results and plates 5.12 to 5.41 present the composite PSD curves.

The PSD results largely confirmed the descriptions made offshore; a few minor adjustments were made regarding the secondary soil constituent.

Variations might be noted between the PSD curves and the sample description, particularly concerning gravel content. In some PSD tests, gravel content is present where shells and shell fragments were visually described, in such cases, no modifications were made to the soil description. Similarly, no changes were made where the soil description indicated a heterogeneous (lamination or pockets of clay) constitution, as the PSD test result would not be representative of the soil layer.

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* The terms ‘water content’ and ‘moisture content’ may both be used in this report depending on the terminology of the applicable standard.

Where the fine fraction was <10% the sedimentation by pipette method was cancelled. Conversely where <10% dry mass was retained on a 2 mm sieve during wet sieving, the sieving was cancelled. In accordance with the ISO 17892-4 standard for PSD test, the laboratory has the flexibility to decide the appropriate sieve size according to the type of soil encountered, with the objective of ensuring continuity of the PSD grading curve. In this project, when the soil sample was assessed as containing high fine contents, only three sieve sizes were used for the coarse-grained fraction (sieves corresponding to coarse, medium and fine sand).

In total two (2) wet sieving and fourteen (14) sedimentation tests were cancelled.

Two (2) tests were performed on batched samples due to insufficient material (Table 5.4). The batched bag samples were selected based on similar soil description and depth proximity.

Table 5.2: Batched samples

Location	Sample	Depth BSF (m)
Z5_OWF_BH05-COMP	05-1 + 05-2	13.00
Z5_OWF_BH07-COMP_a	08-1 + 08-2	20.00
Notes BSF = Below Seafloor		

5.2.5 Particle Density

PD tests were performed using the fluid pycnometer method. Nineteen (19) PD tests were conducted on selected cohesionless and cohesive soil samples. Plate 5.43 summarises the test results.

Two (2) tests were repeated for having high values. Re-tests resulted in values within the expected range as shown in Table 5.3

Table 5.3: Repeated PD tests

Location	Sample	Depth BSF (m)
Z5_OWF_BH02-COMP	01-1	3.00
Z5_OWF_BH07-COMP_a	04-1	10.00
Notes BSF = Below Seafloor		

Values of particle density display average values of 2.67 Mg/m^3 for sand samples and 2.75 Mg/m^3 for clay samples. To be noted that all clay samples were slightly sandy to sandy.

5.2.6 Maximum and Minimum Density

Eight (8) MM tests were conducted on selected cohesionless soil samples. Plate 5.43 summarises the test results.

Tests were performed according to the method developed by the Norwegian Geotechnical Institute (NGI) and Geolabs (NGI Geolabs, 2019a and 2019b). The method accepts a maximum of 12% fines. As a significant fines content was expected, based on soil descriptions, it was agreed with the Client to extend this maximum value to 20% and to identify test results that were performed on sample with more than 12% fines.

Three (3) tests (Table 5.4) were performed on batched samples due to insufficient material. The bag samples selected for the batch were selected based on similar soil description and depth proximity.

Table 5.4: Batched samples

Location	Sample	Depth BSF (m)
Z5_OWF_BH02-COMP	02-1 + 02-2	6.50
Z5_OWF_BH05-COMP	05-1 + 05-2	13.00
Z5_OWF_BH07-COMP_a	08-1 + 08-2	20.00
Notes BSF = Below Seafloor		

5.3 Consolidation Tests

Oedometer tests to provide stress history, drained stiffness and time-dependent behaviour of the soils data under one-dimensional consolidation were carried out to assist engineering design. Undisturbed test specimens were loaded beyond their estimated preconsolidation pressure (p'_c) to enable measurement of the actual p'_c and other settlement parameters. Casagrande's (1936) construction method was used to estimate p'_c.

5.3.1 Incremental Oedometer Tests

Four (4) undisturbed incremental oedometer tests were conducted on selected cohesive soil samples. Plate 5.44 summarises the results and Plates 5.45 to 5.48 show the individual results.

At Z5_OWF_BH09-COMP, two oedometers were performed in the same clay layer at 11.45 m BSF (sample 04-3) and at 12.30 m BSF (sample 05-3). Interpretation of preconsolidation pressure indicates two different values of 182 kPa and 460 kPa, respectively while similar range of values should have been expected. For the oedometer carried out on sample 05-3, the interpreted preconsolidation pressure of 460 kPa corresponds to the loading stage just before the unload and reload loop. For all others oedometers, the preconsolidation pressure is reached few loading stages prior to the unload and reload loop. For this reason, the interpretation of preconsolidation pressure the oedometer done at Z5_OWF_BH09-COMP on sample 05-3 should be considered with caution.

5.3.2 Sample Quality Assessments

The quality of the samples used in the consolidation tests is evaluated based on the changes in void ratio noted between the start of each test and at the estimated in situ effective overburden pressure (p'_0), as recommended by Lunne et al. (1998) and summarised in Table 5.5. The estimated overconsolidation ratio (OCR) is based on the ratio of the estimated p'_0 and p'_c.

Sample quality is very poor (vp) for all of the samples. The apparent deterioration in estimated sample quality may have been caused by stress relaxation rather than handling. In addition, despite plasticity index results classify the cohesive soil as clay, PSD indicate higher proportion of silt particles compared to clay particles. Also, for the oedometer test carried out at Z5_OWF_BH01-COMP sample 05-3, the PSD test performed at Z5_OWF_BH01-COMP sample 05-1 indicate up to 47 % of sand. This could have affected the cohesion of the samples and therefore impacted the initial void ratio.

Table 5.5: Proposed criteria for evaluation of sample disturbance (after Lunne et al., 1998)

Overconsolidation Ratio	$\Delta e/e_0$			
	Very Good to Excellent	Good to Fair	Poor	Very Poor
1–2	< 0.04	0.04–0.07	0.07–0.14	> 0.14
2–4	< 0.03	0.03–0.05	0.05–0.10	> 0.10

5.4 Triaxial Tests

This section describes the following tests:

- Unconsolidated undrained triaxial (UU);
- Consolidated isotropically undrained triaxial (CIU);
- Consolidated isotropically drained triaxial (CID);

5.4.1 Unconsolidated Undrained Triaxial Tests

Two (2) UU tests were conducted offshore and seven (7) were conducted onshore. Five (5) UUr tests were carried out to help determine soil sensitivity. The geotechnical logs (Plates 2.2 to 2.13) present the test results.

Plate 5.49 summarises the UU data performed offshore and plates 5.50 to 5.53 present the individual test results of offshore results.

Plate 5.54 summarises the UU data performed onshore. and plates 5.55 to 5.61 the present the individual test results of onshore results. The UU results are considered to be representative of the soils tested. They agree well with the full range of index strengths measured, and with the s_u inferred from CPT data using cone factor values (N_{kt}) of 15 and 20.

Failure was taken at 20% axial strain unless the deviator stress peaked at a lower strain.

5.4.2 Consolidated Isotropically Undrained Triaxial Tests

Four (4) CIU triaxial tests were scheduled on selected samples. Plate 5.62 summarises the test results and plates 5.63 to 5.101 present the individual results.

Samples were consolidated to a best estimate of their in situ stress conditions, based on estimates of the overburden and lateral earth pressures. As per standard Fugro practice, (CIU) test failure is taken at 10% axial strain except where the peak deviator stress occurred at a lower axial strain.

Most of the laboratory test results are considered to be representative of the soils tested and are within the expected range. At location Z5_OWF_BH01-COMP sample 05-3 (at 15.65 m BSF), a significant sand content (47 % in location Z5_OWF_BH01-COMP sample 05-1) is noted in the PSD test performed in the vicinity of this CIU test. This could explain the discrepancy between the s_u derived from the CIU test, the index strengths measured and the s_u inferred from CPT data using cone factor values (N_{kt}) of 15 and 20 as seen in section 2.2 to 2.13. This value should be used with caution.

5.4.3 Consolidated Isotropically Drained Triaxial Tests

Twelve (12) set-of-three CID tests were conducted to assess soil behaviour under drained conditions. Plate 5.102 to 5.103 summarises the test results and plates 5.104 to 5.199 present the individual results.

The results include an effective apparent cohesion (c') and effective internal friction (ϕ') value based on best-fit line through the set-of-three test. However, the c' and ϕ' are dependent on the vertical stress and are not therefore constant values for the given soils type.

The test specimens are prepared to an initial dry density based on relative density and minimum and maximum dry density test results, if these were not available, dry density was calculated from dry density measured offshore. Alternatively, reconstituted samples are compacted to the maximum achievable density if the sand layer was defined with Dr higher than 80%.

Generally, if minimum and maximum dry density test results are available, they take precedence over using the maximum achievable density when Dr is higher than 80%. Four (4) tests, detailed in Table 5.6 were performed according to the maximum achievable density before the issue of the minimum and maximum test results as the Dr was higher than 80%, as agreed. This may have resulted in an over-compaction, possibly resulting in overestimatedϕ' and c' values.

In total nine (9) tests show high ϕ' and c' values (Table 5.6). A contractive behaviour during shearing is also observed (negative volumetric strain) in the tests performed to the maximum achievable density.

While CIDs present a dilatant behaviour, this contractive behaviour would tend to confirm that these samples were more compacted than in situ conditions. Therefore, these results are likely not representative of the ground conditions.

Table 5.6: CID test results with high ϕ' and/or c'

Location	Sample	Depth BSF [m]	ϕ' [°]	c' [kPa]	Remarks
Z5_OWF_BH02-COMP	03-2	10.85	49.0	0	Possibly due to an over-compaction as max achievable density was used
Z5_OWF_BH02-COMP	05-1	18.50	40.5	71	Possibly due to an over-compaction as max achievable density was used

Location	Sample	Depth BSF [m]	ϕ' [°]	c' [kPa]	Remarks
Z5_OWF_BH03-COMP	01-1	1.50	47.0	8	Possibly due to an over-compaction as MM test results were used considering Dr of 100%
Z5_OWF_BH03-COMP	04-1	11.50	47.0	0	Possibly due to an over-compaction as max achievable density was used instead of target dry density of 1.72 Mg/m³
Z5_OWF_BH03-COMP	05-1	15.00	49.0	0	Possibly due to an over-compaction as max achievable density was used
Z5_OWF_BH05-COMP	06-1	17.00	51.5	17	Possibly due to an over-compaction as max achievable density was used instead of target dry density of 1.83 Mg/m³
Z5_OWF_BH07-COMP_a	03-1	6.50	46.0	8	Possibly due to an over-compaction as max achievable density was used
Z5_OWF_BH07-COMP_a	07-1	19.00	49.5	42	Possibly due to an over-compaction as max achievable density was used instead of target dry density of 1.65 Mg/m³
Z5_OWF_BH09-COMP	06-1	15.50	39.0	60	Possibly due to an over-compaction as max achievable density was used instead of target dry density of 1.72 Mg/m³

Notes
BSF = Below Seafloor

Seven (7) tests were repeated for having high values. Two (2) re-tests show improved values. Repeated tests are shown in Table 5.7.

Table 5.7: Repeated CID tests

Location	Sample	Depth BSF [m]	ϕ' [°]	c' [kPa]
Z5_OWF_BH01-COMP	04-1	14.00	34.0	0
Z5_OWF_BH02-COMP	03-2	10.85	49.0	0
Z5_OWF_BH02-COMP	05-1	18.50	40.5	71
Z5_OWF_BH03-COMP	04-1	11.50	47.0	0
Z5_OWF_BH05-COMP	04-3	9.40	32.0	0
Z5_OWF_BH05-COMP	06-1	17.00	46.0	8
Z5_OWF_BH09-COMP	06-1	15.50	39.0	60

Notes
BSF = Below Seafloor

5.5 Shear Box Tests

Ten (10) set-of-three shear box (SB) tests were conducted using a soil–soil interface. Plates 5.200 to 5.201 summarise the test results and plates 5.202 to 5.241 present the individual results.

The test specimens are prepared to an initial dry density based on relative density and minimum and maximum dry density test results, if these were not available, dry density was calculated from dry density measured offshore. Alternatively, reconstituted samples are compacted to the maximum achievable density if the sand layer was defined with Dr higher than 80%.

The results include a c' and ϕ' value based on best-fit line through the set-of-three test. However, c' and ϕ' are dependent on the vertical stress and are not therefore constant values for the given soils type.

The laboratory test results are considered to be representative of the soils tested and are within the expected range, based on the initial relative density to which the samples were prepared.

Generally, if minimum and maximum dry density test results are available, they take precedence over using the maximum achievable density when Dr is higher than 80%. One (1) test in borehole Z5_OWF_BH02-COMP sample 04-2 at 14.80 m BSF was performed before the issue of the minimum and maximum test results and according to the maximum achievable density. This may have resulted in an over-compaction, possibly resulting in overestimated ϕ' and c' values.

Two (2) tests showed high c' values as shown in Table 5.8. These high cohesion values are probably due to high fines content.

Table 5.8: SB test results with high c'

Location	Sample	Depth BSF [m]	ϕ' [°]	c' [kPa]	Remarks
Z5_OWF_BH01-COMP	07-2	19.25	26	56	Possibly due to the presence of 22% fines according to the PSD
Z5_OWF_BH09-COMP	07-2	6.50	29	59	Possibly due to the presence of closely spaced thick laminae to thin beds of clay as per offshore description

Notes
BSF = Below Seafloor

Five (5) tests were repeated for having high values. Three (3) re-tests show improved values. Repeated tests are shown in Table 5.9

Table 5.9: Repeated SB tests

Location	Sample	Depth BSF [m]	ϕ' [°]	c' [kPa]
Z5_OWF_BH02-COMP	Batch_01	6.50-7.20	42.0	2
Z5_OWF_BH02-COMP	04-2	14.80	35.5	20
Z5_OWF_BH03-COMP	03-2	9.90	38.0	9
Z5_OWF_BH03-COMP	06-2	19.40	29.0	6
Z5_OWF_BH09-COMP	07-2	19.80	29.0	59

Notes
BSF = Below Seafloor

Three (3) tests were performed on batched samples due to insufficient material (Table 5.10). The batched bag samples were selected based on similar soil description and depth proximity.

Table 5.10: Batched samples

Location	Sample	Depth BSF [m]
Z5_OWF_BH02-COMP	02-1 + 02-2	6.50
Z5_OWF_BH05-COMP	05-1 + 05-2	13.00
Z5_OWF_BH07-COMP_a	08-1 + 08-2	20.00

Notes
BSF = Below Seafloor

5.6 Permeability Tests

Permeameter permeability tests measure the coefficient of permeability in sand and silty sand soil types and triaxial permeability tests measure the coefficient of permeability in undisturbed clay samples.

Permeability is calculated in accordance with Darcy's equation for laminar flow (ISO 17892-11:2019). Darcy's law applies to laminar (non-turbulent) flow conditions.

Darcy's law (Equation 5.1) states that the volumetric flow rate, Q, is proportional to: (1) the difference in hydraulic head along a length interval, l; (2) a coefficient K (hydraulic conductivity), which accounts for restriction to flow imposed by the solid medium and for the density and viscosity of the fluid flowing through the porous medium (i.e. water through sand); and (3) the cross-sectional area perpendicular to the flow direction:

Equation 5.1

$$Q = -K \frac{(h_2 - h_1)}{l} A$$

The hydraulic gradient i as shown in Equation 5.2 is the ratio between Δh which is the water elevations in the piezometers and l the distance between the piezometers.

$$i = \frac{(h_2 - h_1)}{l} = \frac{\Delta h}{l}$$

Equation 5.2

Darcy's law can therefore be expressed as Equation 5.3:

$$Q = -K\, i\, A$$

Equation 5.3

Plate 5.242 summarises the test results of all permeability tests

5.6.1 Permeameter Permeability Tests

Three (3) permeameter tests were conducted to measure the coefficient of permeability in sand and silty sand soil types. Plates 5.243 to 5.245 present the individual results.

The test specimens are prepared to an initial dry density based on relative density and minimum and maximum dry density test results, if these were not available, dry density was calculated from dry density measured offshore. Alternatively, reconstituted samples are compacted to the maximum achievable density if the sand layer was defined with Dr higher than 80%.

Permeability is calculated in accordance with Darcy's equation for laminar flow (ISO, 2019).

The laboratory test results are considered to be representative of the soils tested and are within the expected range, based on the initial relative density to which the samples were prepared.

One (1) test was cancelled due to high fines content.

All three (3) tests were performed on batched samples due to insufficient material Table 5.11. The batched bag samples were selected based on similar soil description and depth proximity.

Table 5.11: Batched samples

Location	Sample	Depth BSF (m)
Z5_OWF_BH01-COMP	03-1 + 03-2	11.00
Z5_OWF_BH03-SAMP	06-2 + 06-3	5.50
Z5_OWF_BH07-COMP_a	06-1 + 06-2	15.00

Notes
BSF = Below Seafloor

5.6.2 Triaxial Permeability Tests

Three (3) triaxial permeability tests were conducted to measure the coefficient of permeability in undisturbed clay samples. Plate 5.246 to 5.254 present the individual results.

Permeability is calculated in accordance with Darcy's equation for laminar flow (ISO, 2019).

The laboratory test results are considered to be representative of the soils tested and are within the expected range.

5.7 Thermal Resistivity Tests

Thermal resistivity tests are conducted to measure the capacity of the ground to conduct or to dissipate heat. A total of five (5) tests were performed offshore. One (1) test was aborted due to the probe being positioned too close to the edge of the sample. One (1) thermal resistivity reconstituted was performed onshore on a selected soil sample from within the top 6.00 m (+/- 1.00 m) BSF.

TEMPOS Thermal Properties analyser package kit was used for both offshore and onshore thermal conductivity tests.

Plates 5.255 to 5.258 summarise the tests performed offshore. Plate 5.259 summarises the tests performed onshore and plate 5.260 presents the individual results. Values of thermal resistivity vary between 0.477 (m.K)/W and 0.669 (m.K)/W.

5.8 Chemical Testing

Chemical testing was carried out at third-party laboratories. The results relate only to the samples tested and are considered to be representative of those samples.

Appendix D lists the laboratory testing standards and statements used for the chemical tests.

5.8.1 Carbonate Content

Thirteen (13) tests were conducted on selected soil samples. Plate 5.261 summarises the test results.

The carbonate content of CO_2 measured ranged between 9.30 % and 18.0%. A conversion is required to get the actual amount of calcium carbonate (% $CaCO_3$) present in the soil and is presented in Table 5.12. The carbonate content of $CaCO_3$ measured ranged between 21.1 % and 40.9 %.

With the $CaCO_3$ carbonate content, corresponding layers descriptions were updated accordingly as mentioned in section 2.4.

Variations might be noted between the carbonate content $CaCO_3$ and the sample description. In some tests, calcareous soil, shells and shell fragments were present in occasional amounts and visually described, in such cases, no modifications were made to the soil description.

Table 5.12: Summary of the $CaCO_3$ carbonate content converted from CO_2

Location	Sample	Depth BSF [m]	CO_2 [%]	$CaCO_3$ [%]
Z5_OWF_BH01-COMP	01-2	3.65	16.0	36.4
Z5_OWF_BH01-COMP	04-3	14.50	12.0	27.3
Z5_OWF_BH02-COMP	01-2	3.20	10.0	22.7

Location	Sample	Depth BSF [m]	CO_2 [%]	$CaCO_3$ [%]
Z5_OWF_BH02-COMP	06-1	19.50	18.0	40.9
Z5_OWF_BH05-COMP	01-1	3.00	9.5	21.6
Z5_OWF_BH05-COMP	03-1	8.00	17.0	38.7
Z5_OWF_BH05-COMP	04-1	9.00	9.3	21.1
Z5_OWF_BH07-COMP_a	01-1	1.50	15.0	34.1
Z5_OWF_BH07-COMP_a	01-4	2.20	13.0	29.6
Z5_OWF_BH07-COMP_a	05-1	11.00	11.0	25.0
Z5_OWF_BH09-COMP	03-2	8.30	13.0	29.6
Z5_OWF_BH09-COMP	05-1	12.00	9.8	22.3
Z5_OWF_BH03-COMP	03-1	9.50	9.6	21.8

Notes
BSF = Below Seafloor

5.8.2 Organic Content

Thirteen (13) loss on ignition tests will be conducted to measure the organic content on selected soil samples. Plate 5.262 summarises the test results.

The organic content measured ranged between 3.10 % and 12 %.

Seven (7) samples presented organic content higher than 6%, corresponding layers descriptions were updated accordingly as mentioned in section 2.4.

5.8.3 Chloride Content

Thirteen (13) water soluble chloride tests were conducted on selected soil samples. Plate 5.263 summarises the test results. The chloride content ranges from 0.39% and 0.67%.

5.8.4 Sulphate Content and pH

Thirteen (13) total sulphate content tests were conducted on selected soil samples. Plate 5.264 summarises the test results.

The sulphate content measured as total acid soluble sulphate (SO_4) ranges from 1010 mg/l to 2760 mg/l and the pH ranges from 8.40 to 9.00.

5.9 Sulphate Reducing Bacteria test

A total of twenty-five (25) sulphate reducing bacteria tests were conducted offshore on selected soil samples and residual soil of weathered rock to determine the presence of sulphate reducing bacteria at approximately every 5 m and when presence of organic matter, along the borehole. Sig Sulphide ® SRB kits from Echa were used for these tests.

Test results are presented in Plates 5.265 to 5.289. Table 5.13 summarises the SRB tests qualitative interpretation after six days.

Table 5.13: Summary of SRB test results

Location	Sample	Depth BSF [m]	Qualitative interpretation – Day 6	SRB Concentration [SRB/ml]
Z5_OWF_BH01-COMP	W01	3.60	Moderate Contamination	1000-10000
Z5_OWF_BH01-COMP	W02	7.50	Light Contamination	10-100
Z5_OWF_BH01-COMP	W03	11.80	Light Contamination	10-100
Z5_OWF_BH01-COMP	W06	16.70	Moderate Contamination	1000-10000
Z5_OWF_BH02-COMP	W01	3.30	Light Contamination	<10
Z5_OWF_BH02-COMP	W02	6.90	Light Contamination	<10
Z5_OWF_BH02-COMP	W03	11.00	Light Contamination	<10
Z5_OWF_BH02-COMP	W04	14.90	Light Contamination	<10
Z5_OWF_BH02-COMP	W05	19.00	Light Contamination	10-100
Z5_OWF_BH03-COMP	W01	1.50	Moderate Contamination	100-1000
Z5_OWF_BH03-COMP	W04	11.70	Moderate Contamination	100-1000
Z5_OWF_BH03-COMP	W06	19.40	Light Contamination	10-100
Z5_OWF_BH05-COMP	W02	4.40	Light Contamination	<10
Z5_OWF_BH05-COMP	W03	8.20	Light Contamination	<10
Z5_OWF_BH05-COMP	W05	13.45	Light Contamination	<10
Z5_OWF_BH05-COMP	W06	17.50	Light Contamination	<10
Z5_OWF_BH07-COMP_a	W02	2.90	Light Contamination	<10
Z5_OWF_BH07-COMP_a	W03	6.75	Light Contamination	<10
Z5_OWF_BH07-COMP_a	W04	10.40	Light Contamination	<10
Z5_OWF_BH07-COMP_a	W06	15.50	Light Contamination	<10
Z5_OWF_BH07-COMP_a	W08	20.35	Light Contamination	<10
Z5_OWF_BH09-COMP	W01	3.00	Light Contamination	<10
Z5_OWF_BH09-COMP	W05	12.00	Light Contamination	10-100
Z5_OWF_BH09-COMP	W06	15.50	Moderate Contamination	100-1000
Z5_OWF_BH09-COMP	W07	20.00	Light Contamination	<10
Notes BSF = Below seafloor				

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7. Symbols and Terms

Every effort is made to avoid duplication or inconsistency in the use of symbols and terms in this report. However, this is not always possible as some different terms are commonly represented by the same symbol; similarly, some terms have multiple representations.

For example, I_p and PI both mean plasticity index, and I_L and LI both mean liquidity index, while a can mean both acceleration and net area ratio of cone penetrometer, depending on the context.

Table 7.1 presents symbols and terms that may be used in this report.

Table 7.1: Symbols and terms

Symbol	Unit	Full Term or Definition
General		
A	m^2	Area
a	m/s^2	Acceleration
B	m	Width
D	m	Diameter
d	m	Depth
g	m/s^2	Acceleration due to gravity [g = 9.81 m/s^2]
h	m	Height or thickness
h_{sf}	m	Height of reference point above seafloor
i	-	Inclination
L	m	Length
ln	-	Natural logarithm
log	-	Logarithm base 10
m	kg	Mass
t	s	Time
V	m^3	Volume
v	m/s	Velocity
W	kN	Weight
w or MC	%	Moisture content
W50	-	WIP sample in sample tube of 50 mm internal diameter
W72		WIP sample in sample tube of 72 mm internal diameter
z	m	Penetration or depth below reference level (usually ground surface) or height above seafloor for drilling mode in situ probe zero reference readings
Stress Strain		
E	MPa	Modulus of linear deformation (Young's modulus)

Symbol	Unit	Full Term or Definition
E_u	MPa	Modulus of linear deformation (Young's modulus for undrained stress change)
E_d	MPa	Modulus of linear deformation (Young's modulus for drained stress change)
G	MPa	Modulus of shear deformation (shear modulus)
G_{max}	MPa	Shear modulus at small strain or initial (small strain) shear modulus
U	MPa	Pore-water pressure
u_0	MPa	Hydrostatic pore pressure relative to seafloor or phreatic surface
u_f	kPa	Pore-water pressure at failure
Δu	kPa	Change in pore-water pressure
$\Delta\sigma_v$	kPa	Change in total vertical stress
$\Delta\sigma'_v$	kPa	Change in effective vertical stress
ε	%	Linear strain
$\varepsilon_1, \varepsilon_2, \varepsilon_3,$	%	Principal strains
ε_{50}	%	Vertical strain at half the maximum deviator stress
ε_v	%	Vertical strain
ε_{vf}	%	Vertical strain at failure
γ	%	Shear strain
μ	-	Coefficient of friction
ν	-	Poisson's ratio
ν_u	-	Poisson's ratio for undrained stress change
ν_d	-	Poisson's ratio for drained stress change
σ	kPa	Total stress
σ'	kPa	Effective stress
$\sigma_1, \sigma_2, \sigma_3$	kPa	Principal stresses
σ'_h	kPa	Effective horizontal stress
σ'_{h0}	kPa	In situ horizontal effective stress
σ'_v	kPa	Effective vertical stress
σ_{v0}	kPa	Total vertical stress relative to ground surface or phreatic surface
σ'_{v0}or p'_0	kPa	In situ vertical effective stress
σ'_{vc}	kPa	Vertical effective consolidation stress
σ'_r	kPa	Radial effective stress
τ	kPa	Shear stress
Physical Ground Characteristics		
Density and Unit Weights		
γ	kN/m^3	Unit weight of ground (or bulk unit weight or total unit weight)
γ_d	kN/m^3	Unit weight of dry ground

Symbol	Unit	Full Term or Definition
γ_s	kN/m^3	Unit weight of solid particles
γ_w	kN/m^3	Unit weight of water
γ_{dmin}	kN/m^3	Minimum index (dry) unit weight
γ_{dmax}	kN/m^3	Maximum index (dry) unit weight
γ' or γ_{sub}	kN/m^3	Unit weight of submerged ground or soil
ρ	Mg/m^3 [= t/m^3]	Density of ground/soil or bulk density
ρ_d	Mg/m^3 [= t/m^3]	Density of dry ground/soil or dry density
ρ_s	Mg/m^3 [= t/m^3]	Density of solid particles
σ_ω	Mg/m^3 [= t/m^3]	Density of water
D_r	-, %	Relative density [= $\gamma_{dmax}\ (\gamma_d - \gamma_{dmin})/\gamma_d(\gamma_{dmax} - \gamma_{dmin})$]
e	-	Void ratio
e_0	-	Initial void ratio
G_s	-	Specific gravity of solid particle
l_d	-, %	Density index [=$(\gamma_d - \gamma_{dmin})/\gamma_d(\gamma_{dmax} - \gamma_{dmin})$]
n	-, %	Porosity
w	%	Water content
S_r	%	Degree of saturation
Consistency		
w_L	%	Liquid limit
w_P	%	Plastic limit
I_P or PI	%	Plasticity index [= $w_L - w_P$]
I_L or LI	%	Liquidity index [= $(w - w_P)/(w_L - w_P)$]
I_C	%	Consistency index [= $(w_L - w)/(w_L - w_P)$]
Particle Size		
D	mm	Particle diameter
D_n	mm	n% diameter [$n\% < D$]
C_u	-	Uniformity coefficient [= D_{60}/D_{10}]
C_c	-	Curvature coefficient [= $(D_{30})2/D_{10}D_{60}$]
Hydraulic Properties		
k	m/s	Coefficient of permeability
k_v	m/s	Coefficient of vertical permeability
k_h	m/s	Coefficient of horizontal permeability
Mechanical Ground Characteristics		
Cone Penetration Test		
A_c	mm^2	Cross-sectional projected area of the cone
A_n	mm^2	Cross-sectional area of load cell or shaft
A_s	mm^2	Surface area of friction sleeve

Symbol	Unit	Full Term or Definition
a	-	Net area ratio of the cone penetrometer
B_q	-	Pore pressure ratio
Δ_{u1}, Δ_{u2}, Δ_{u3}	MPa	Excess pore pressure at filter locations 1, 2 and 3
F_r	%	Normalised friction ratio [= f_t/q_n]
f_s	MPa	Sleeve friction or measured sleeve friction
f_t	MPa	Measured sleeve friction corrected for pore pressure effects
i	°	Inclination
K	-	Adjustment factor for ratio of pore pressure at u_1 to u_2 location
l	m	Penetration length
N_c	-	Cone factor between q_c and s_u or c_u
N_k	-	Cone factor between q_n and s_u or c_u
Q_t	-	Normalised cone resistance [= q_n/σ'_{v0}]
q_c	MPa	Cone resistance or measured cone resistance
q_n	MPa	Net cone resistance
q_t	MPa	Corrected cone resistance (i.e. total cone resistance) or cone penetration resistance corrected for pore-water pressure effects
R_f	%	Friction ratio
R_{ft}	%	Corrected friction ratio [= f_s/q_t or f_t/q_t]
R_{ftn}	%	Net friction ratio
U	-	Normalised excess pore pressure
u	MPa	Pore pressure
u_0	MPa	In situ pore pressure
u_1, u_2, u_3	MPa	Pore pressure measured at locations 1, 2 and 3
u_i	MPa	Measured pore pressure at the start of the dissipation test
u_t	MPa	Measured pore pressure at time t during a dissipation test
α	-	Ratio of the cone shaft to the area of the cone face
β	-	Pore-water pressure correction factor (CPTu)
Strength of Soil		
$s_u$or c_u	kPa	Undrained shear strength or undrained (undisturbed) shear strength of soil
s_{ufv}	kPa	Shear strength by field vane testing
$s_{ufv,rem}$	kPa	Remoulded shear strength by field vane testing
$s_{ufv,res}$	kPa	Residual shear strength by field vane testing
s_{uu} or s_{uUU}	kPa	Undrained shear strength from UU test or static unconsolidated undrained triaxial shear strength
s_u/σ'_{v0} or c_u/σ'_{v0}	-	Undrained strength ratio
φ' or ϕ'	° (degree)	Effective angle of internal friction
ε_{50}	%	Strain at 50% of peak deviator stress (or ε_c)

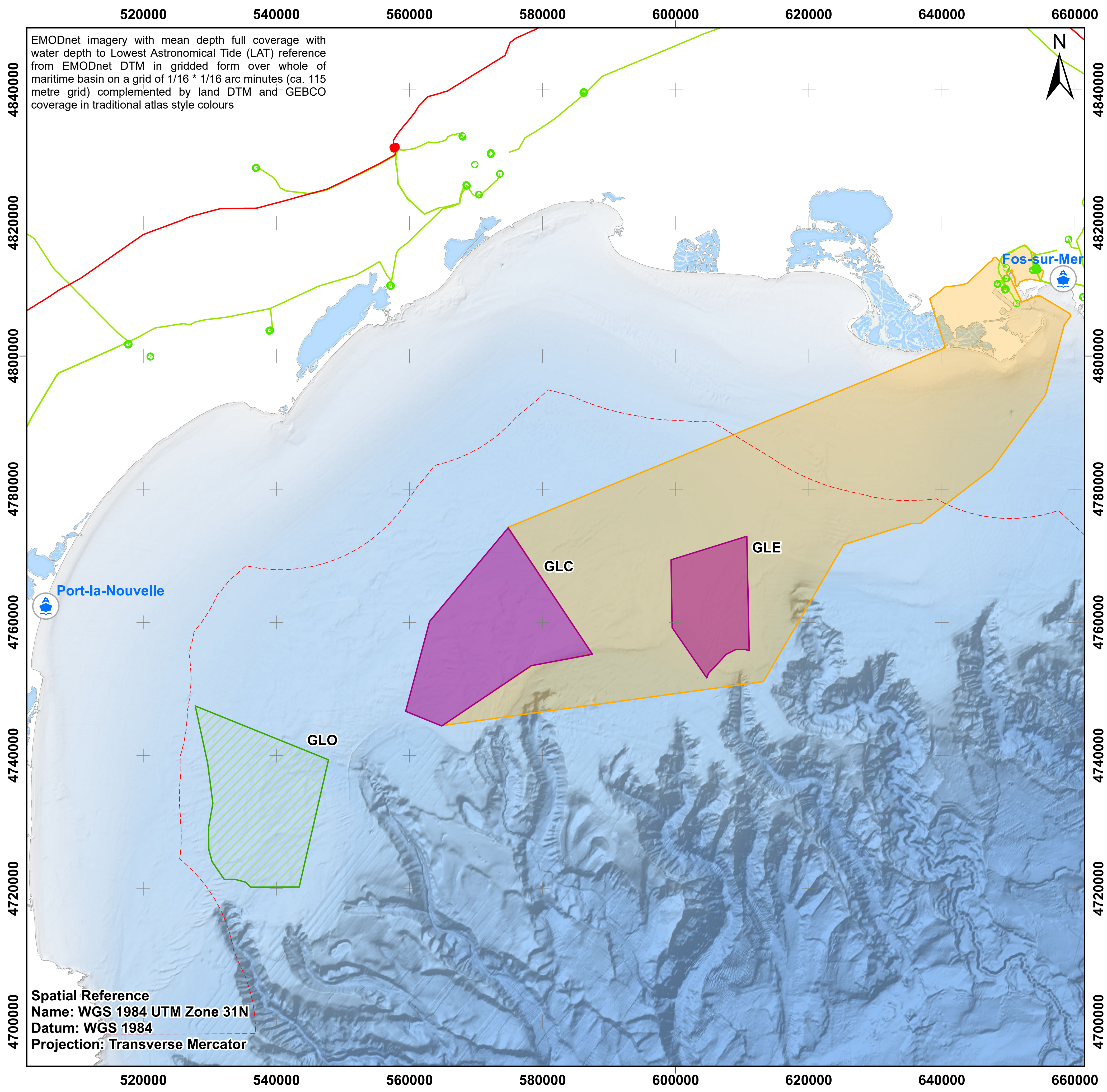
Symbol	Unit	Full Term or Definition
E_{50}	MPa	Young's modulus at 50% of peak deviator stress
$c_{u;r}$ or $s_u(R)$	kPa	Undrained shear strength of remoulded soil
C_R	kPa	Undrained residual shear strength
S_t	-	Soil sensitivity [$=c_u/c_{u;r}$ or $s_u/s_u(R)$]
tan ϕ	° (degree)	Internal friction
ϕ_u	° (degree)	Undrained friction angle
ϕ_d	° (degree)	Drained friction angle
Consolidation (One-Dimensional)		
C_c	-	Compression index
C_s	-	Swelling index (or recompression)
c_v	m^2/s	Coefficient of consolidation
e	-	Void ratio
m_v	m^2/MN	Coefficient of compressibility
OCR	-	Overconsolidation ratio [$=\sigma'_p/\sigma'_{vo}$ or p'_c/p'_0]
p	kPa	Vertical pressure
$p'_c = \sigma'_p$	kPa	Preconsolidation stress
YSR	-	Yield stress ratio [$= \sigma'_{vy}/\sigma'_{v0}$]
Dp	kPa	$p'_c - p'_0$
σ_{vy}	kPa	Effective vertical yield stress in oedometer compression
σ'_{v0}	kPa	Effective in situ vertical stress (or p'_0)
Geotechnical Design		
Earth Pressure		
δ	° (degree)	Angle of interface friction (between ground and foundation)
K	-	Coefficient of lateral earth pressure
K_a	-	Coefficient of active earth pressure
K_p	-	Coefficient of passive earth pressure
K_0	-	Coefficient of earth pressure at rest [$= \sigma'_{h0}/\sigma'_{v0}$]
$K_{0,nc}$	-	K_0 for normally consolidated soil
$K_{0,oc}$	-	K_0 for overconsolidated soil

Notes
Hyphen (-) in Unit column means no unit applies
Single prime (') applies to effective stress

List of Plates

1. Project Information

Title	Plate No.
Vicinity Map	1.1
General Location Plan	1.2



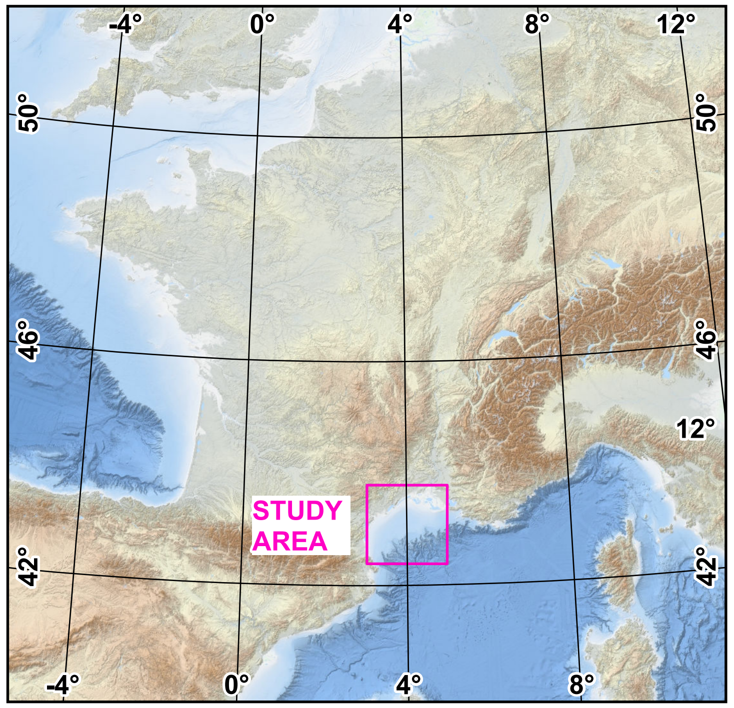
EMODnet imagery with mean depth full coverage with water depth to Lowest Astronomical Tide (LAT) reference from EMODnet DTM in gridded form over whole of maritime basin on a grid of 1/16 * 1/16 arc minutes (ca. 115 metre grid) complemented by land DTM and GEBCO coverage in traditional atlas style colours

Spatial Reference
Name: WGS 1984 UTM Zone 31N
Datum: WGS 1984
Projection: Transverse Mercator

Priority areas resulting from the planning exercise:
- 🟪 Golfe du Lion Centre (GLC)
- 🟪 Golfe du Lion Est (GLE)
- ▨ Golfe du Lion Ouest (GLO)
- 🟧 Study area for the connection of the priority zone within 10 years

Overhead power lines (RTE)
- — 225kV
- — 400kV

Electrical substation enclosure (RTE)
- 🟩 225kV
- 🟥 400kV
- ⚓ Main ports



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at original A3 page size

0 5 10 20 30 40 Kilometers

Golfe du Lion Site Investigation - Vicinity Map

Project name: Golfe du Lion Site Investigation
Project no. F254727
Report no. F254727-REP-003

Contractor: FUGRO

Client: MINISTÈRE DE LA TRANSITION ÉNERGÉTIQUE
Liberté
Égalité
Fraternité

Plate number: 1.1
Site location: Mediterranean Sea, France

Prepared by	Checked by	Approved by
A. Thiéblemont	B. Q. Mendoza	J. Pitel

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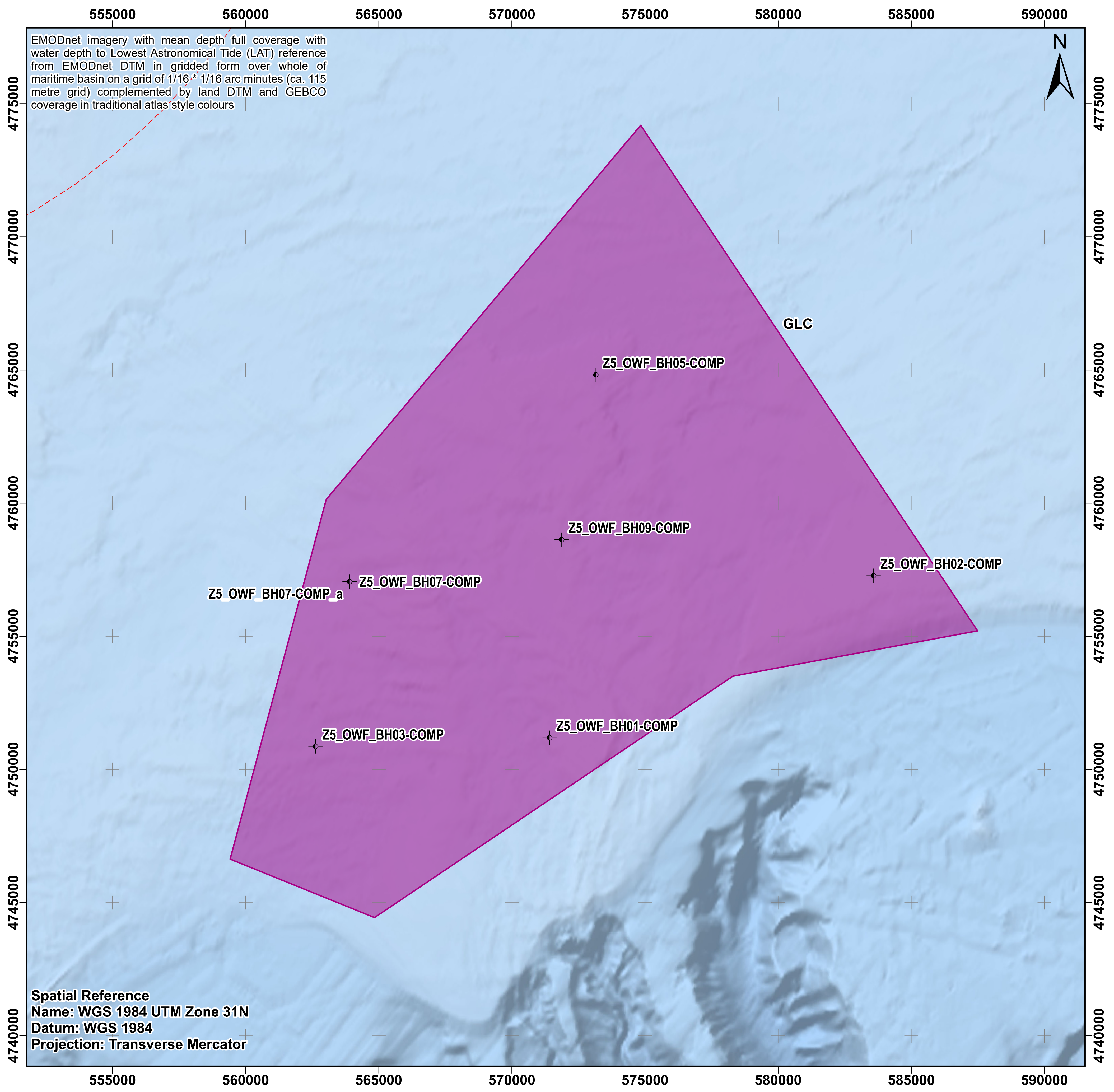
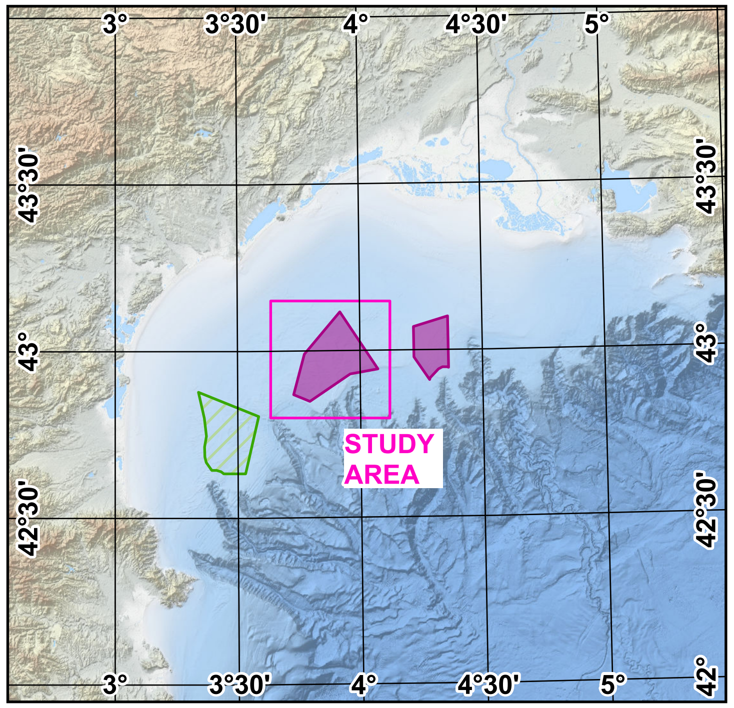


EMODnet imagery with mean depth full coverage with water depth to Lowest Astronomical Tide (LAT) reference from EMODnet DTM in gridded form over whole of maritime basin on a grid of 1/16 * 1/16 arc minutes (ca. 115 metre grid) complemented by land DTM and GEBCO coverage in traditional atlas style colours

Spatial Reference
Name: WGS 1984 UTM Zone 31N
Datum: WGS 1984
Projection: Transverse Mercator

Priority areas resulting from the planning exercise:
- 🟪 Golfe du Lion Centre (GLC)
- 🟪 Golfe du Lion Est (GLE)
- ▨ Golfe du Lion Ouest (GLO)
- ☐ Limit of the territorial sea (12 Nq)

Type:
- ⌖ CPT and Sampling
- ⌖ Sampling



SCALE 1: 150 000
at original A3 page size

0 1.25 2.5 5 7.5 10 Kilometers

Golfe du Lion Site Investigation - Centre (Z5) - Detailed Location Plan

Project name:	Golfe du Lion Site Investigation
Project no.	F254727
Report no.	F254727-REP-003

Contractor: FUGRO

Client: MINISTÈRE DE LA TRANSITION ÉNERGÉTIQUE
Liberté
Égalité
Fraternité

Plate number: 1.4
Site location: Mediterranean Sea, France

Prepared by	Checked by	Approved by
A. Thiéblemont	B. Q. Mendoza	J. Pitel

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2. Geotechnical Description and Profiles

Title	Plate No.
List of Symbols and Classification Systems Used	2.1
Geotechnical Logs	2.2 to 2.13

Drawn by : DRF Date : 31/07/2013

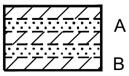
Filename: J:\..\..\CAD\Symbols_and_Terms_Used_on_Geotechnical_Logs_ISO.dwg

SOIL IDENTIFICATION SYMBOLS

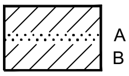
▨	Clay	░	Sand	◎	Cobbles	⌄	Shell Debris
▥	Silt	▦	Chalk	○	Gravel	▤	Peat

Note:
These soil identification symbols differ from BS 5930 (1999) but they are used to conform with those generally adopted for offshore purposes
Vertical symbols on the log indicate a soil mixture of primary, secondary and tertiary constituents as presented in the soil descriptions

SOIL STRUCTURE SYMBOLS



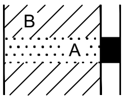
Interbedded/laminated Soil A and Soil B



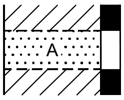
Bed of Soil A in layer of Soil B

Note:
1. Pockets are not continuous through the sample
2. Partings are 1 to 2 grains thick
3. Thinly laminated is under 6 mm thick
4. Thickly laminated is from 6 mm to 20 mm thick
5. Very thinly bedded is from 20 mm to 60 mm thick
6. Thinly bedded is from 60 mm to 200 mm thick
7. Medium bedded is from 200 mm to 600 mm thick
8. Thickly bedded is from 600 mm to 2000 mm thick
9. Very thickly bedded is over 2000 mm thick

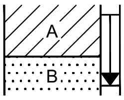
SOIL STRATIFICATION SYMBOLS



Bed of Soil A found in layer of Soil B detected by sampling



Layer of Soil A detected during drilling



Layer change from Soil A to Soil B detected during cone penetration test

Note:
Depth and thickness of layers detected during drilling are less accurate than those determined by sampling or cone penetration tests

SOIL SAMPLING AND TESTING SYMBOLS

▮	BC1 (Box core sample No.1)	▮	PUS1 (Push sample No.1)	▼	CPT1 (Cone penetration test No.1)
▮	GC1 (Gravity core sample No.1)	▮	SC1 (STACOR® sample No.1)	●	TBT1 (T-Bar test No.1)
▮	H1 (Hammer sample No.1)	▮	VC1 (Vibrocore sample No.1)		
▮	P1 (Piston sample No.1)	▮	W1 (Wireline push sample No.1)	⊢⊣	Sample attempted but no recovery obtained

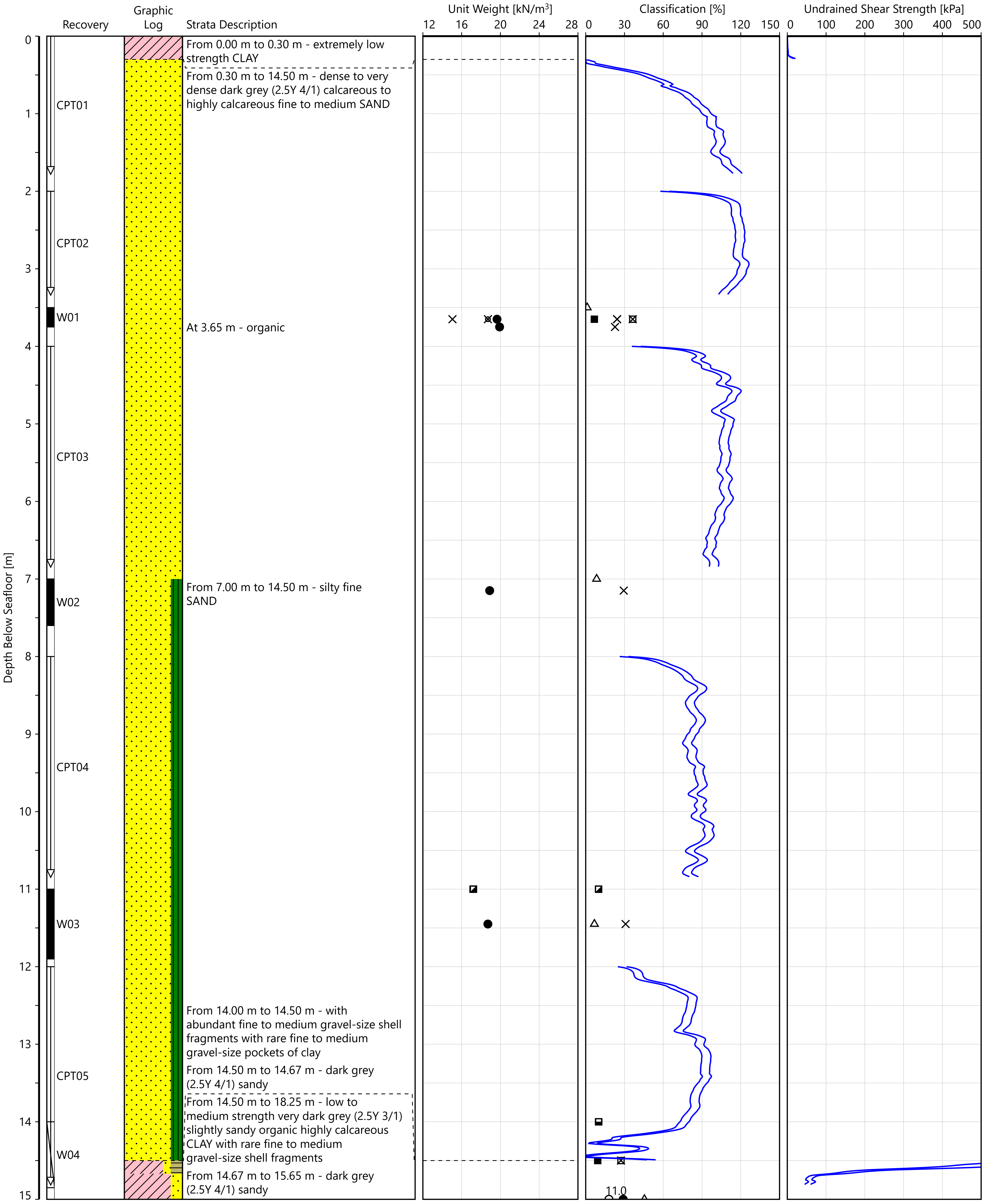
TERMS FOR SOIL STRENGTH AND DENSITY

Fine-grained Soils

Term	Undrained Shear Strength [kPa]
Extremely low	< 10
Very low	10 – 20
Low	20 – 40
Medium	40 – 75
High	75 – 150
Very high	150 – 300
Extremely high	300 – 600
Ultra high	> 600

Coarse-grained Soils

Term	Estimated Relative Density [%]
Very loose	0 – 15
Loose	15 – 35
Medium dense	35 – 65
Dense	65 – 85
Very dense	85 – 100



From 0.00 m to 0.30 m - extremely low strength CLAY

From 0.30 m to 14.50 m - dense to very dense dark grey (2.5Y 4/1) calcareous to highly calcareous fine to medium SAND

At 3.65 m - organic

From 7.00 m to 14.50 m - silty fine SAND

From 14.00 m to 14.50 m - with abundant fine to medium gravel-size shell fragments with rare fine to medium gravel-size pockets of clay

From 14.50 m to 14.67 m - dark grey (2.5Y 4/1) sandy

From 14.50 m to 18.25 m - low to medium strength very dark grey (2.5Y 3/1) slightly sandy organic highly calcareous CLAY with rare fine to medium gravel-size shell fragments

From 14.67 m to 15.65 m - dark grey (2.5Y 4/1) sandy

Start date	: 13-Jan-2025
Deployment method	: Rotary borehole drilling, sampling and in situ testing
Recovery depth	: 21.34 m below Seafloor
Penetration depth	: 21.34 m below Seafloor
Water depth	: LAT +92.90 m
Coordinate	: E 571413.7 m N 4751192.8 m
Coordinate system	: WGS 84 / UTM zone 31N

- ⊠ Unit weight from volume mass calculation
- ● Unit weight from water content
- × Dry unit weight
- ⊠ UU-triaxial
- ⬒ CU-triaxial
- □ OED
- ◪ SB
- — Unit weight from CPT

- × Water content
- ○—● Plasticity index
- ○ Plastic limit
- ● Liquid limit
- ⊠ UU-triaxial
- ⬒ CU-triaxial
- □ OED
- ◪ SB
- ⬓ CID
- △ Percentage fines
- ⊠ Carbonate content
- ■ Organic content
- — Relative density from CPT

- △ Pocket penetrometer
- ○ Torvane
- ● UU-triaxial
- ■ CU-triaxial
- — Undrained shear strength from CPT

Slashed symbols refer to tests on remoulded soil

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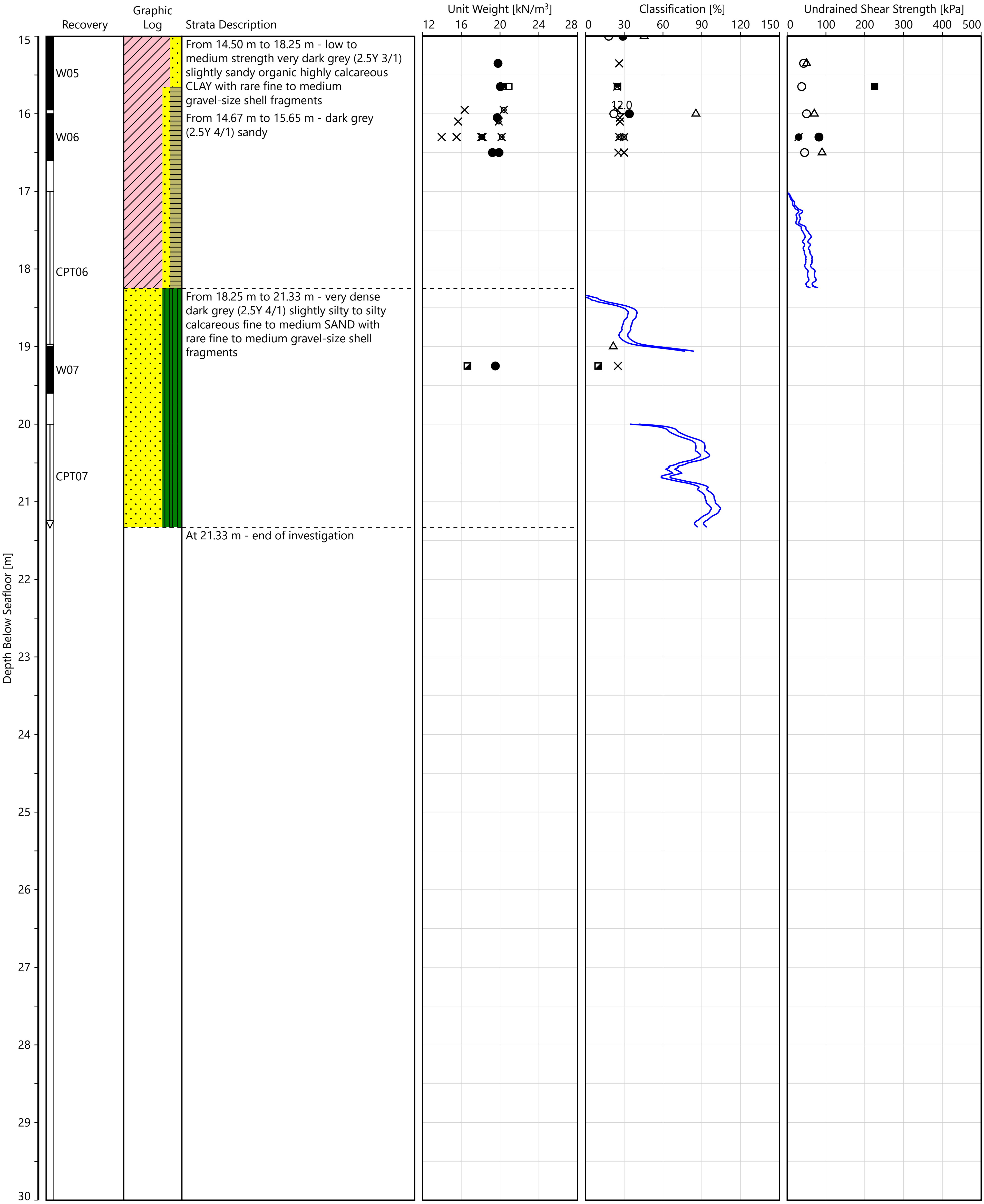
Geotechnical Log

Z5_OWF_BH01-COMP



From 14.50 m to 18.25 m - low to medium strength very dark grey (2.5Y 3/1) slightly sandy organic highly calcareous CLAY with rare fine to medium gravel-size shell fragments

From 14.67 m to 15.65 m - dark grey (2.5Y 4/1) sandy

From 18.25 m to 21.33 m - very dense dark grey (2.5Y 4/1) slightly silty to silty calcareous fine to medium SAND with rare fine to medium gravel-size shell fragments

At 21.33 m - end of investigation

Start date	: 13-Jan-2025
Deployment method	: Rotary borehole drilling, sampling and in situ testing
Recovery depth	: 21.34 m below Seafloor
Penetration depth	: 21.34 m below Seafloor
Water depth	: LAT +92.90 m
Coordinate	: E 571413.7 m N 4751192.8 m
Coordinate system	: WGS 84 / UTM zone 31N

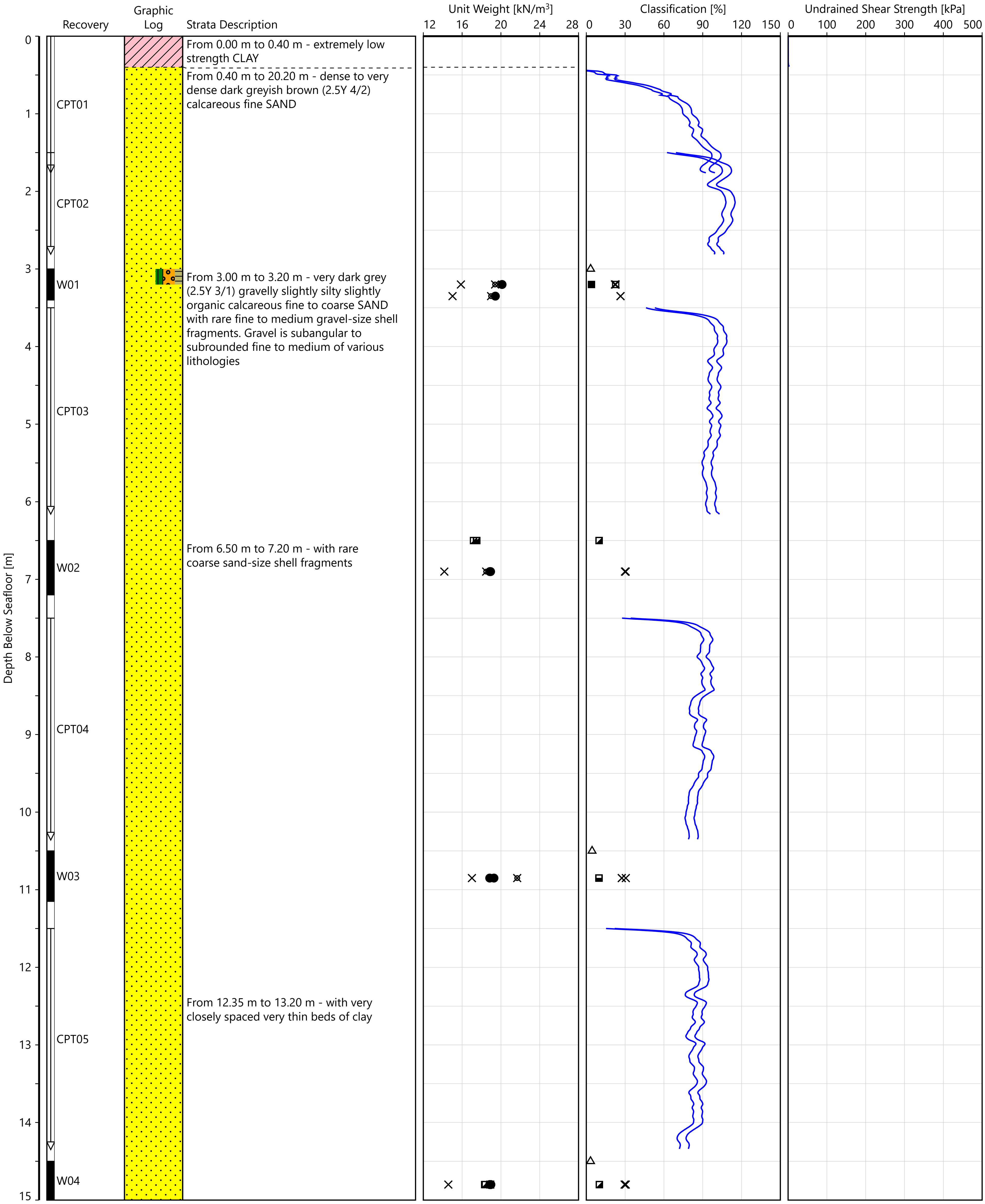
⊠ Unit weight from volume mass calculation
● Unit weight from water content
× Dry unit weight
⊠ UU-triaxial
⊟ CU-triaxial
□ OED
◩ SB
— Unit weight from CPT

× Water content
○—● Plasticity index
○ Plastic limit
● Liquid limit
⊠ UU-triaxial
⊟ CU-triaxial
□ OED
◩ SB
⊟ CID
△ Percentage fines
⊠ Carbonate content
■ Organic content
— Relative density from CPT

△ Pocket penetrometer
○ Torvane
● UU-triaxial
■ CU-triaxial
— Undrained shear strength from CPT

Slashed symbols refer to tests on remoulded soil

Geotechnical Log
Z5_OWF_BH01-COMP



From 0.00 m to 0.40 m - extremely low strength CLAY

From 0.40 m to 20.20 m - dense to very dense dark greyish brown (2.5Y 4/2) calcareous fine SAND

From 3.00 m to 3.20 m - very dark grey (2.5Y 3/1) gravelly slightly silty slightly organic calcareous fine to coarse SAND with rare fine to medium gravel-size shell fragments. Gravel is subangular to subrounded fine to medium of various lithologies

From 6.50 m to 7.20 m - with rare coarse sand-size shell fragments

From 12.35 m to 13.20 m - with very closely spaced very thin beds of clay

Start date	: 14-Jan-2025
Deployment method	: Rotary borehole drilling, sampling and in situ testing
Recovery depth	: 20.20 m below Seafloor
Penetration depth	: 20.50 m below Seafloor
Water depth	: LAT +93.60 m
Coordinate	: E 583584.1 m N 4757276.9 m
Coordinate system	: WGS 84 / UTM zone 31N

☒ Unit weight from volume mass calculation
● Unit weight from water content
× Dry unit weight
☒ UU-triaxial
⬒ CU-triaxial
□ OED
◪ SB
— Unit weight from CPT

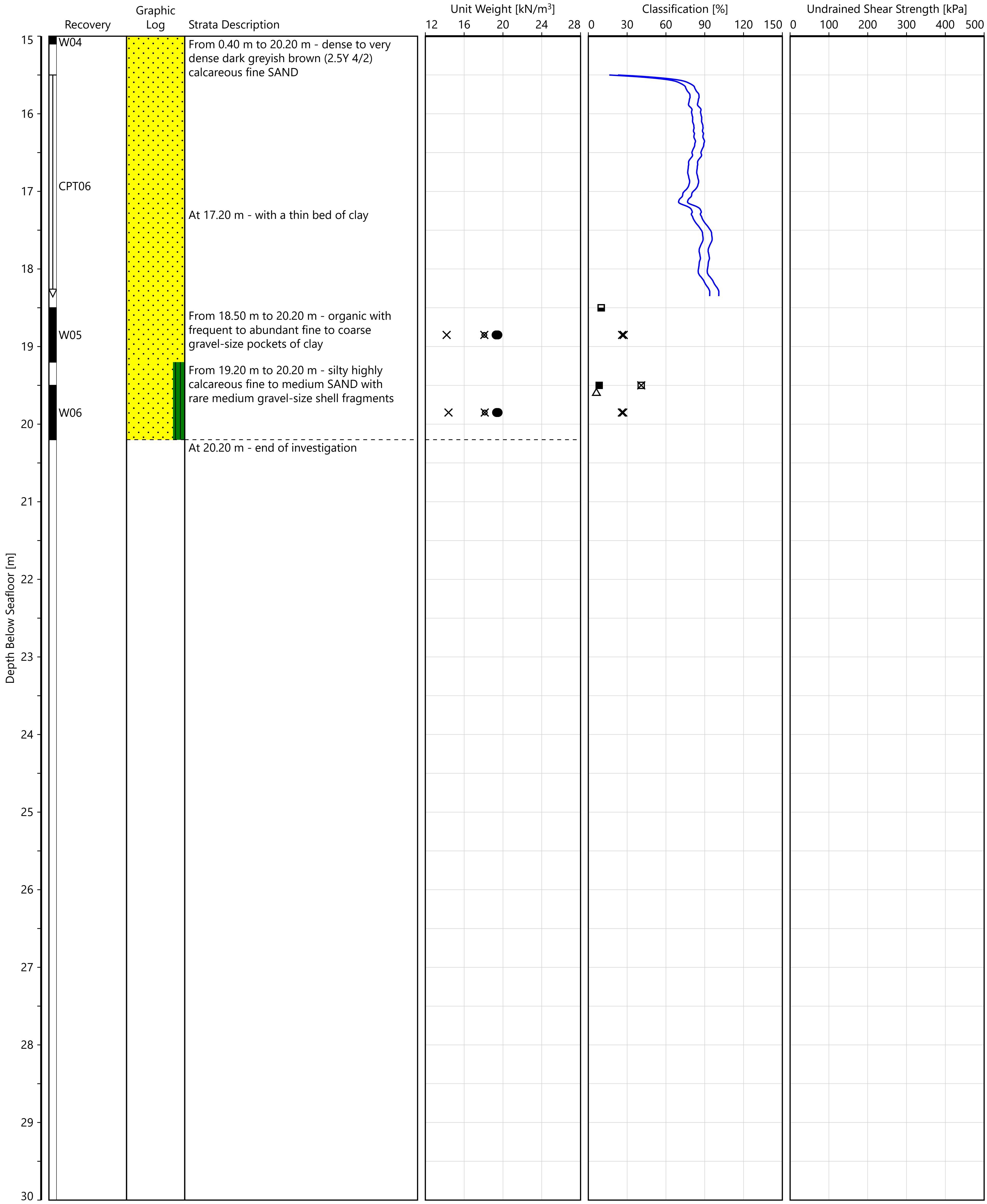
× Water content
○—● Plasticity index
○ Plastic limit
● Liquid limit
☒ UU-triaxial
⬒ CU-triaxial
□ OED
◪ SB
⬒ CID
△ Percentage fines
☒ Carbonate content
■ Organic content
— Relative density from CPT

△ Pocket penetrometer
○ Torvane
● UU-triaxial
■ CU-triaxial
— Undrained shear strength from CPT

Slashed symbols refer to tests on remoulded soil

Geotechnical Log

Z5_OWF_BH02-COMP



From 0.40 m to 20.20 m - dense to very dense dark greyish brown (2.5Y 4/2) calcareous fine SAND

At 17.20 m - with a thin bed of clay

From 18.50 m to 20.20 m - organic with frequent to abundant fine to coarse gravel-size pockets of clay

From 19.20 m to 20.20 m - silty highly calcareous fine to medium SAND with rare medium gravel-size shell fragments

At 20.20 m - end of investigation

Start date	: 14-Jan-2025
Deployment method	: Rotary borehole drilling, sampling and in situ testing
Recovery depth	: 20.20 m below Seafloor
Penetration depth	: 20.50 m below Seafloor
Water depth	: LAT +93.60 m
Coordinate	: E 583584.1 m N 4757276.9 m
Coordinate system	: WGS 84 / UTM zone 31N

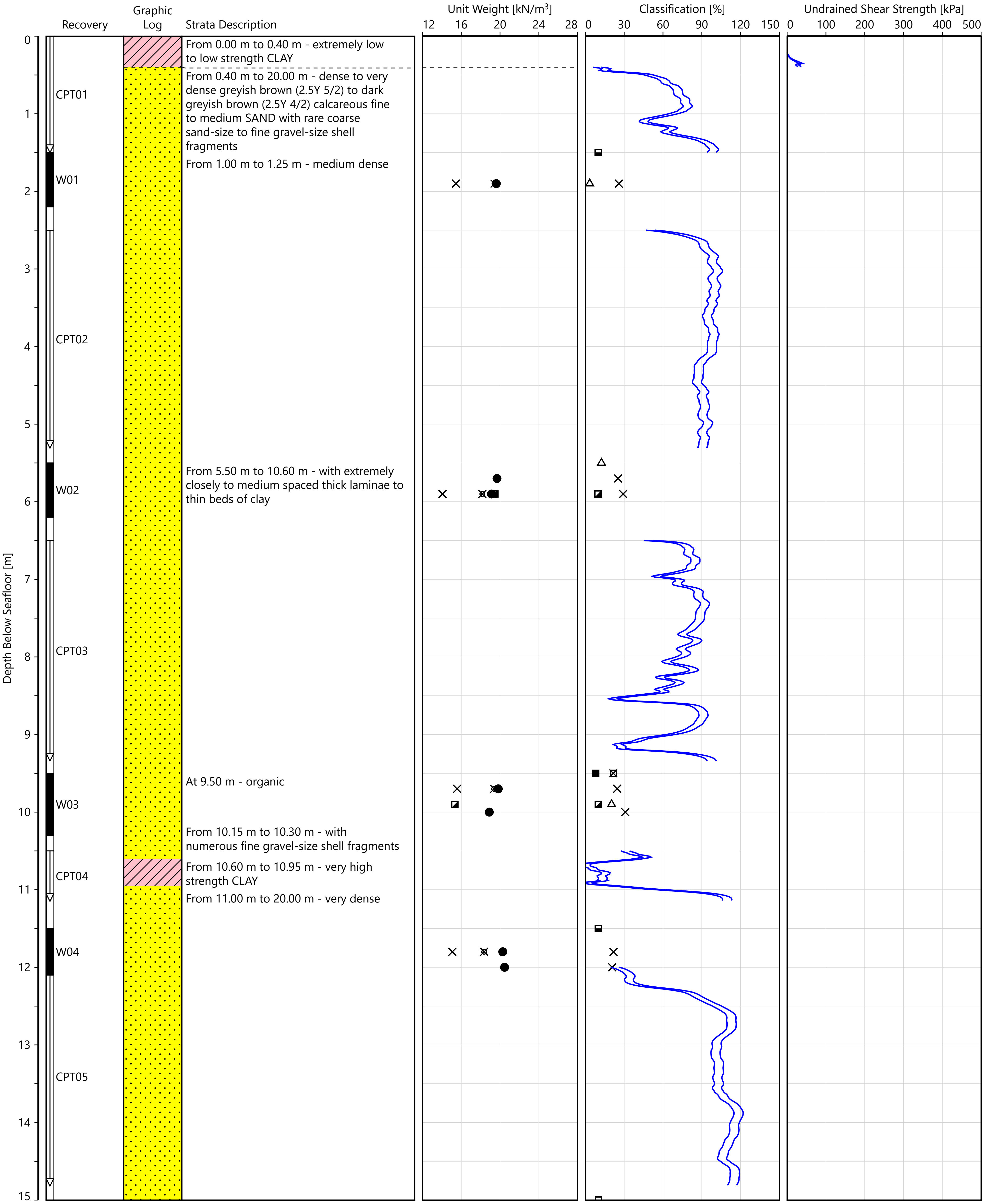
⊠ Unit weight from volume mass calculation
● Unit weight from water content
× Dry unit weight
⊠ UU-triaxial
⊟ CU-triaxial
☐ OED
◩ SB
— Unit weight from CPT

× Water content
○—● Plasticity index
○ Plastic limit
● Liquid limit
⊠ UU-triaxial
⊟ CU-triaxial
☐ OED
◩ SB
⊟ CID
△ Percentage fines
⊠ Carbonate content
■ Organic content
— Relative density from CPT

△ Pocket penetrometer
○ Torvane
● UU-triaxial
■ CU-triaxial
— Undrained shear strength from CPT

Slashed symbols refer to tests on remoulded soil

Geotechnical Log
Z5_OWF_BH02-COMP



From 0.00 m to 0.40 m - extremely low to low strength CLAY

From 0.40 m to 20.00 m - dense to very dense greyish brown (2.5Y 5/2) to dark greyish brown (2.5Y 4/2) calcareous fine to medium SAND with rare coarse sand-size to fine gravel-size shell fragments

From 1.00 m to 1.25 m - medium dense

From 5.50 m to 10.60 m - with extremely closely to medium spaced thick laminae to thin beds of clay

At 9.50 m - organic

From 10.15 m to 10.30 m - with numerous fine gravel-size shell fragments

From 10.60 m to 10.95 m - very high strength CLAY

From 11.00 m to 20.00 m - very dense

Start date	: 20-Jan-2025
Deployment method	: Rotary borehole drilling, sampling and in situ testing
Recovery depth	: 22.91 m below Seafloor
Penetration depth	: 22.91 m below Seafloor
Water depth	: LAT +97.40 m
Coordinate	: E 562622.4 m N 4750866.4 m
Coordinate system	: WGS 84 / UTM zone 31N

- ☒ Unit weight from volume mass calculation
- ● Unit weight from water content
- × Dry unit weight
- ☒ UU-triaxial
- ⬒ CU-triaxial
- ☐ OED
- ◩ SB
- — Unit weight from CPT

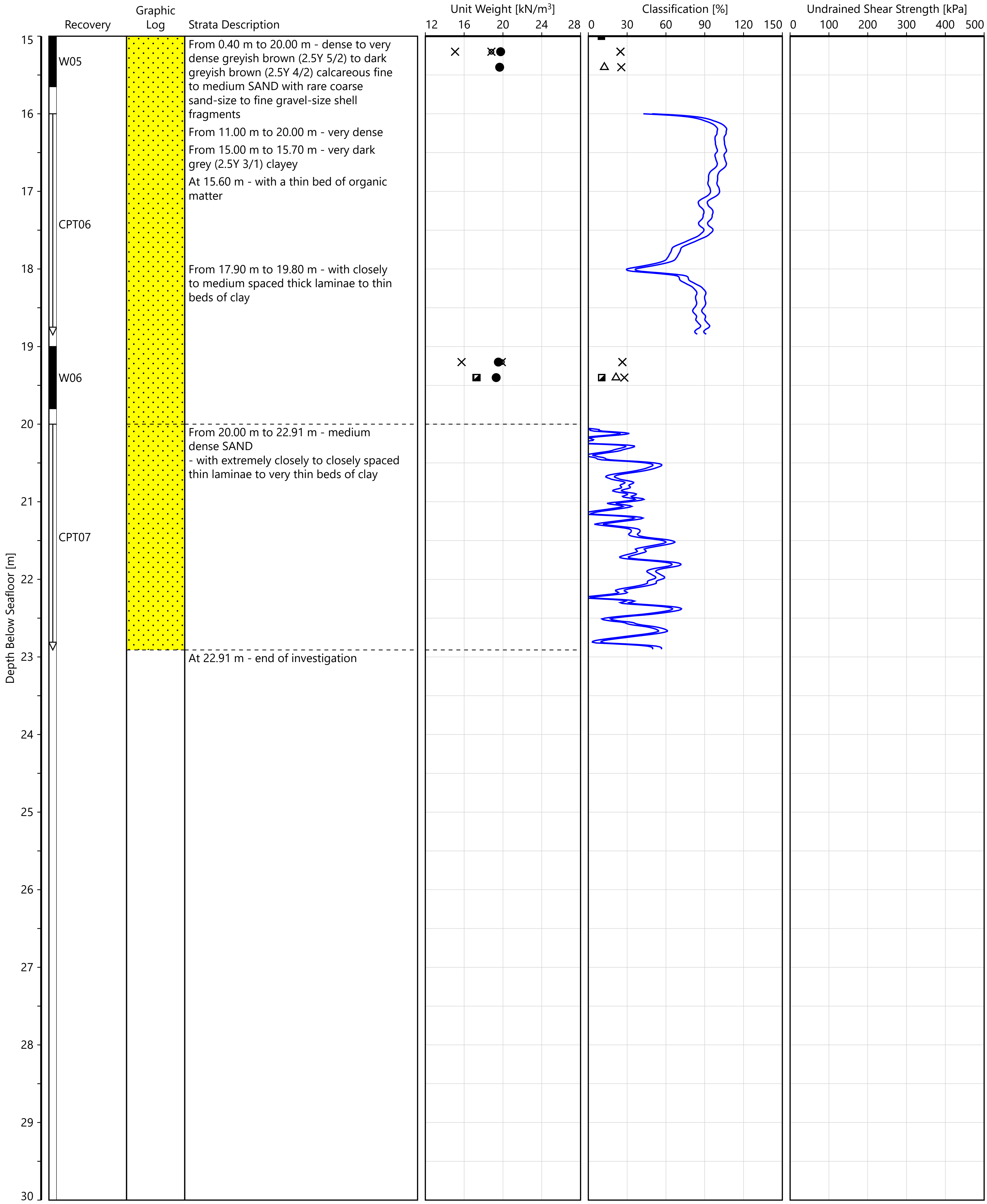
- × Water content
- ○—● Plasticity index
- ○ Plastic limit
- ● Liquid limit
- ☒ UU-triaxial
- ⬒ CU-triaxial
- ☐ OED
- ◩ SB
- ⬓ CID
- △ Percentage fines
- ☒ Carbonate content
- ■ Organic content
- — Relative density from CPT

- △ Pocket penetrometer
- ○ Torvane
- ● UU-triaxial
- ■ CU-triaxial
- — Undrained shear strength from CPT

Slashed symbols refer to tests on remoulded soil

Geotechnical Log

Z5_OWF_BH03-COMP



From 0.40 m to 20.00 m - dense to very dense greyish brown (2.5Y 5/2) to dark greyish brown (2.5Y 4/2) calcareous fine to medium SAND with rare coarse sand-size to fine gravel-size shell fragments

From 11.00 m to 20.00 m - very dense

From 15.00 m to 15.70 m - very dark grey (2.5Y 3/1) clayey

At 15.60 m - with a thin bed of organic matter

From 17.90 m to 19.80 m - with closely to medium spaced thick laminae to thin beds of clay

From 20.00 m to 22.91 m - medium dense SAND

- with extremely closely to closely spaced thin laminae to very thin beds of clay

At 22.91 m - end of investigation

Start date	: 20-Jan-2025
Deployment method	: Rotary borehole drilling, sampling and in situ testing
Recovery depth	: 22.91 m below Seafloor
Penetration depth	: 22.91 m below Seafloor
Water depth	: LAT +97.40 m
Coordinate	: E 562622.4 m N 4750866.4 m
Coordinate system	: WGS 84 / UTM zone 31N

⊗ Unit weight from volume mass calculation
● Unit weight from water content
× Dry unit weight
⊗ UU-triaxial
⬒ CU-triaxial
□ OED
◪ SB
— Unit weight from CPT

× Water content
○—● Plasticity index
○ Plastic limit
● Liquid limit
⊗ UU-triaxial
⬒ CU-triaxial
□ OED
◪ SB
⬓ CID
△ Percentage fines
⊠ Carbonate content
■ Organic content
— Relative density from CPT

△ Pocket penetrometer
○ Torvane
● UU-triaxial
■ CU-triaxial
— Undrained shear strength from CPT

Slashed symbols refer to tests on remoulded soil

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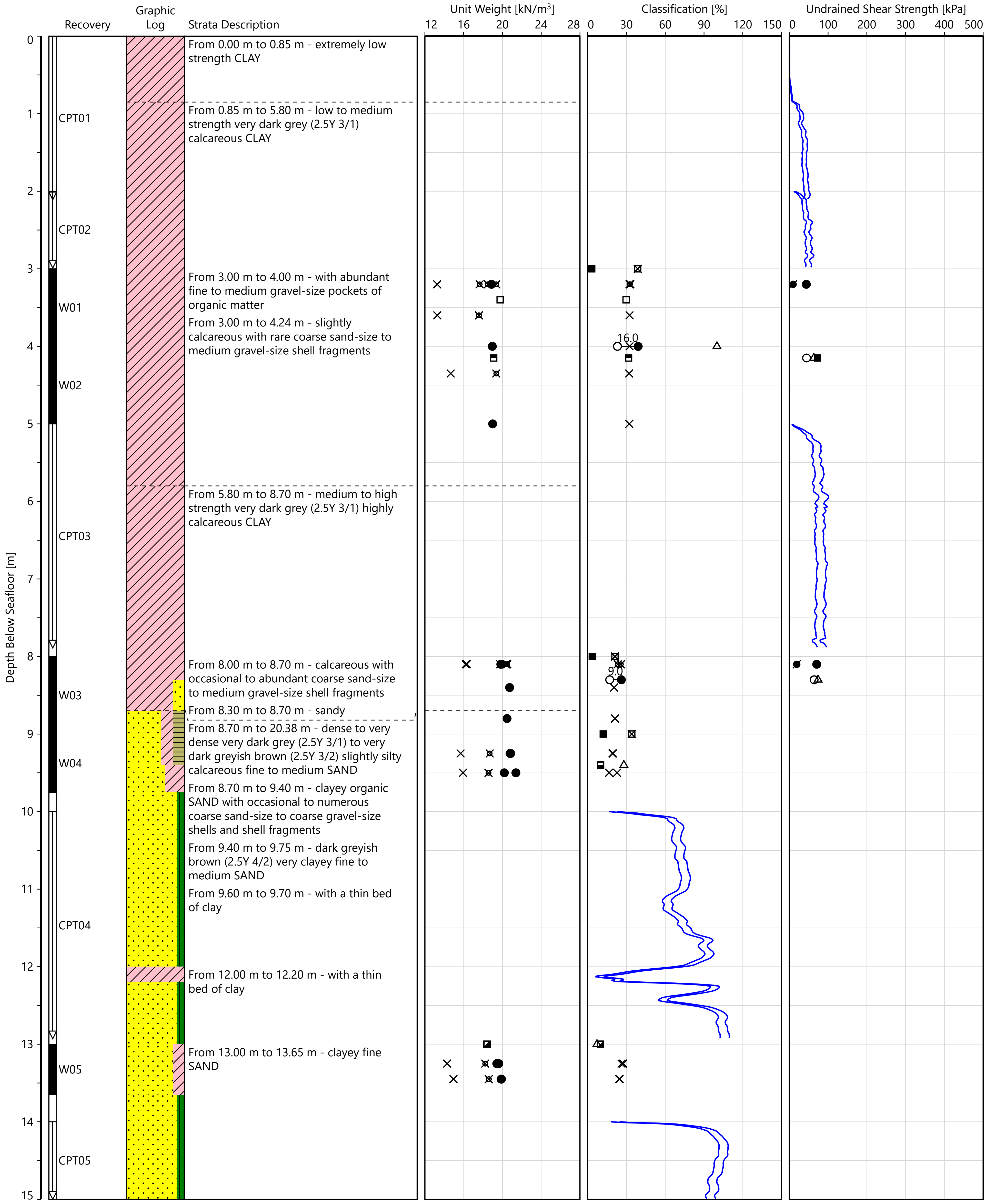
Geotechnical Log

Z5_OWF_BH03-COMP



From 0.00 m to 0.85 m - extremely low strength CLAY

From 0.85 m to 5.80 m - low to medium strength very dark grey (2.5Y 3/1) calcareous CLAY

From 3.00 m to 4.00 m - with abundant fine to medium gravel-size pockets of organic matter

From 3.00 m to 4.24 m - slightly calcareous with rare coarse sand-size to medium gravel-size shell fragments

From 5.80 m to 8.70 m - medium to high strength very dark grey (2.5Y 3/1) highly calcareous CLAY

From 8.00 m to 8.70 m - calcareous with occasional to abundant coarse sand-size to medium gravel-size shell fragments

From 8.30 m to 8.70 m - sandy

From 8.70 m to 20.38 m - dense to very dense very dark grey (2.5Y 3/1) to very dark greyish brown (2.5Y 3/2) slightly silty calcareous fine to medium SAND

From 8.70 m to 9.40 m - clayey organic SAND with occasional to numerous coarse sand-size to coarse gravel-size shells and shell fragments

From 9.40 m to 9.75 m - dark greyish brown (2.5Y 4/2) very clayey fine to medium SAND

From 9.60 m to 9.70 m - with a thin bed of clay

From 12.00 m to 12.20 m - with a thin bed of clay

From 13.00 m to 13.65 m - clayey fine SAND

Start date : 15-Jan-2025
Deployment method : Rotary borehole drilling, sampling and in situ testing
Recovery depth : 20.38 m below Seafloor
Penetration depth : 20.38 m below Seafloor
Water depth : LAT +95.00 m
Coordinate : E 573152.1 m N 4764819.8 m
Coordinate system : WGS 84 / UTM zone 31N

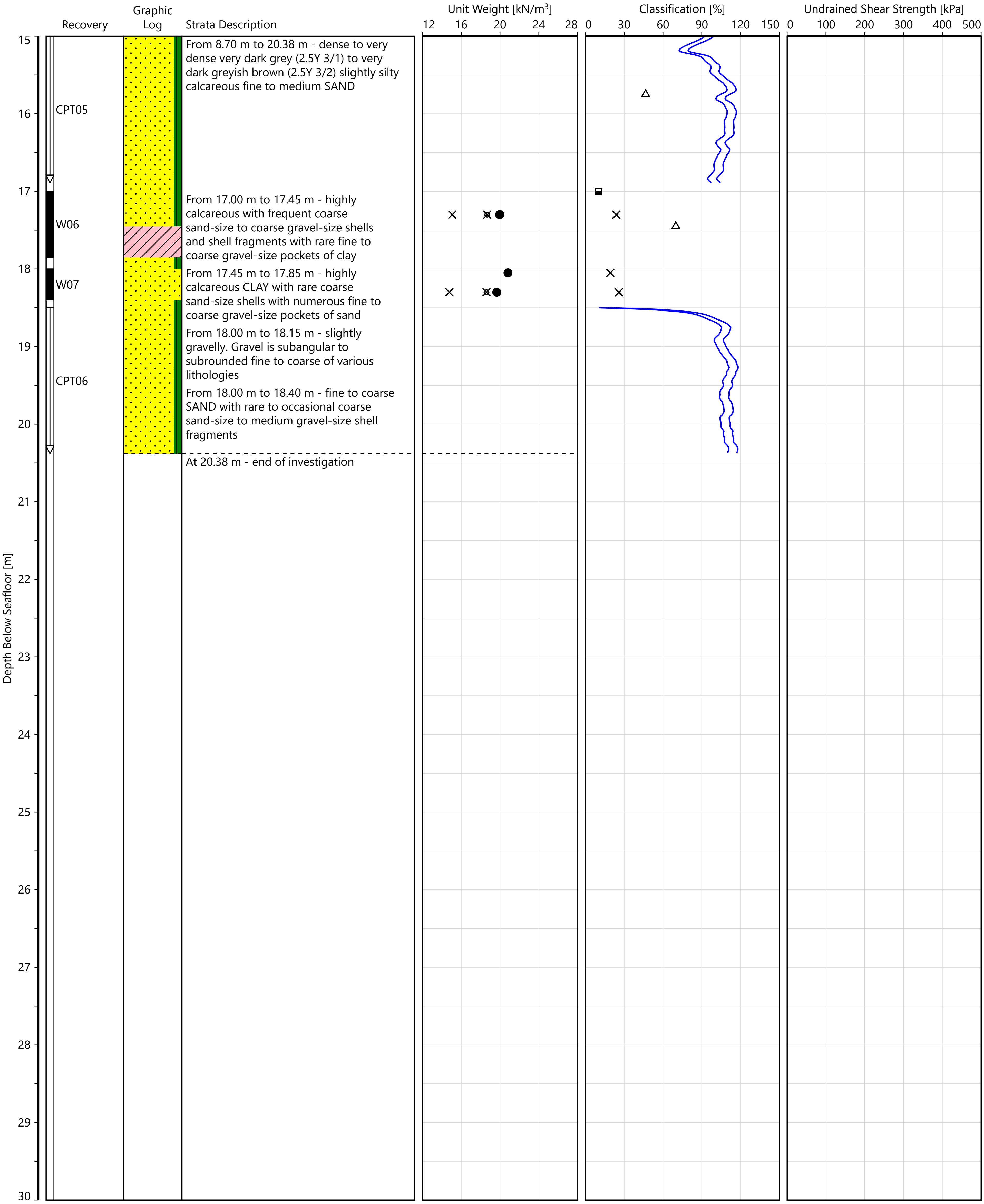
- ⊠ Unit weight from volume mass calculation
- ● Unit weight from water content
- ✕ Dry unit weight
- ⊠ UU-triaxial
- ⬒ CU-triaxial
- □ OED
- ◪ SB
- — Unit weight from CPT

- ✕ Water content
- ○—● Plasticity index
- ○ Plastic limit
- ● Liquid limit
- ⊠ UU-triaxial
- ⬒ CU-triaxial
- □ OED
- ◪ SB
- ⬓ CID
- △ Percentage fines
- ⊠ Carbonate content
- ■ Organic content
- — Relative density from CPT

- △ Pocket penetrometer
- ○ Torvane
- ● UU-triaxial
- ■ CU-triaxial
- — Undrained shear strength from CPT

Slashed symbols refer to tests on remoulded soil

Geotechnical Log
Z5_OWF_BH05-COMP



From 8.70 m to 20.38 m - dense to very dense very dark grey (2.5Y 3/1) to very dark greyish brown (2.5Y 3/2) slightly silty calcareous fine to medium SAND

From 17.00 m to 17.45 m - highly calcareous with frequent coarse sand-size to coarse gravel-size shells and shell fragments with rare fine to coarse gravel-size pockets of clay

From 17.45 m to 17.85 m - highly calcareous CLAY with rare coarse sand-size shells with numerous fine to coarse gravel-size pockets of sand

From 18.00 m to 18.15 m - slightly gravelly. Gravel is subangular to subrounded fine to coarse of various lithologies

From 18.00 m to 18.40 m - fine to coarse SAND with rare to occasional coarse sand-size to medium gravel-size shell fragments

At 20.38 m - end of investigation

Start date	: 15-Jan-2025
Deployment method	: Rotary borehole drilling, sampling and in situ testing
Recovery depth	: 20.38 m below Seafloor
Penetration depth	: 20.38 m below Seafloor
Water depth	: LAT +95.00 m
Coordinate	: E 573152.1 m N 4764819.8 m
Coordinate system	: WGS 84 / UTM zone 31N

⊠ Unit weight from volume mass calculation
● Unit weight from water content
× Dry unit weight
⊠ UU-triaxial
⬓ CU-triaxial
☐ OED
◩ SB
— Unit weight from CPT

× Water content
○—● Plasticity index
○ Plastic limit
● Liquid limit
⊠ UU-triaxial
⬓ CU-triaxial
☐ OED
◩ SB
⬒ CID
△ Percentage fines
⊠ Carbonate content
■ Organic content
— Relative density from CPT

△ Pocket penetrometer
○ Torvane
● UU-triaxial
■ CU-triaxial
— Undrained shear strength from CPT

Slashed symbols refer to tests on remoulded soil

Geotechnical Log

Z5_OWF_BH05-COMP

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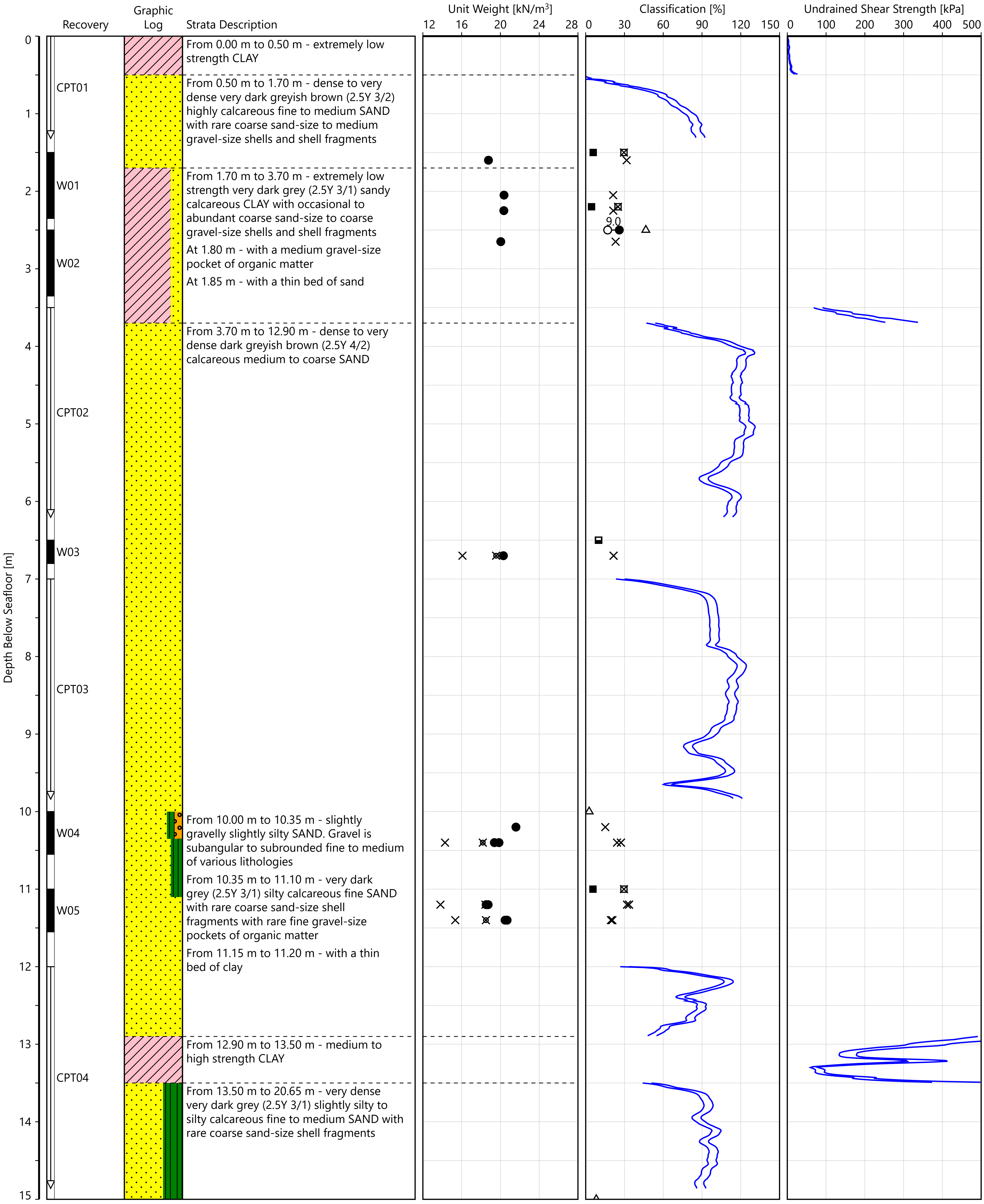


From 0.00 m to 0.50 m - extremely low strength CLAY

From 0.50 m to 1.70 m - dense to very dense very dark greyish brown (2.5Y 3/2) highly calcareous fine to medium SAND with rare coarse sand-size to medium gravel-size shells and shell fragments

From 1.70 m to 3.70 m - extremely low strength very dark grey (2.5Y 3/1) sandy calcareous CLAY with occasional to abundant coarse sand-size to coarse gravel-size shells and shell fragments

At 1.80 m - with a medium gravel-size pocket of organic matter

At 1.85 m - with a thin bed of sand

From 3.70 m to 12.90 m - dense to very dense dark greyish brown (2.5Y 4/2) calcareous medium to coarse SAND

From 10.00 m to 10.35 m - slightly gravelly slightly silty SAND. Gravel is subangular to subrounded fine to medium of various lithologies

From 10.35 m to 11.10 m - very dark grey (2.5Y 3/1) silty calcareous fine SAND with rare coarse sand-size shell fragments with rare fine gravel-size pockets of organic matter

From 11.15 m to 11.20 m - with a thin bed of clay

From 12.90 m to 13.50 m - medium to high strength CLAY

From 13.50 m to 20.65 m - very dense very dark grey (2.5Y 3/1) slightly silty to silty calcareous fine to medium SAND with rare coarse sand-size shell fragments

Start date : 16-Jan-2025
Deployment method : Rotary borehole drilling, sampling and in situ testing
Recovery depth : 20.65 m below Seafloor
Penetration depth : 20.92 m below Seafloor
Water depth : LAT +96.90 m
Coordinate : E 563905.0 m N 4757059.1 m
Coordinate system : WGS 84 / UTM zone 31N

- ☒ Unit weight from volume mass calculation
- ● Unit weight from water content
- × Dry unit weight
- ☒ UU-triaxial
- ⊟ CU-triaxial
- ☐ OED
- ◪ SB
- — Unit weight from CPT

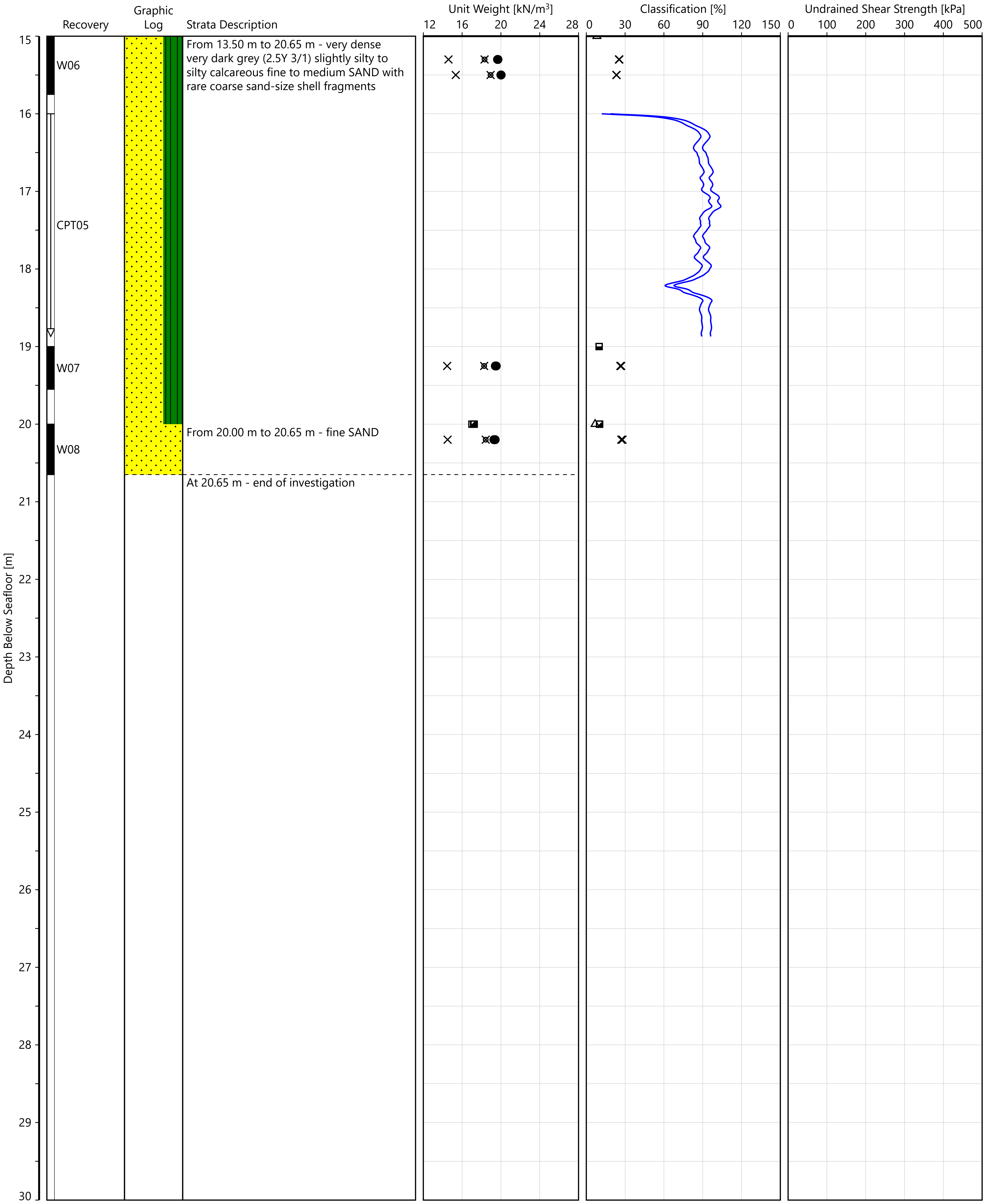
- × Water content
- ○—● Plasticity index
- ○ Plastic limit
- ● Liquid limit
- ☒ UU-triaxial
- ⊟ CU-triaxial
- ☐ OED
- ◪ SB
- ⊟ CID
- △ Percentage fines
- ☒ Carbonate content
- ■ Organic content
- — Relative density from CPT

- △ Pocket penetrometer
- ○ Torvane
- ● UU-triaxial
- ■ CU-triaxial
- — Undrained shear strength from CPT

Slashed symbols refer to tests on remoulded soil

Geotechnical Log

Z5_OWF_BH07-COMP_a



Start date : 16-Jan-2025
Deployment method : Rotary borehole drilling, sampling and in situ testing
Recovery depth : 20.65 m below Seafloor
Penetration depth : 20.92 m below Seafloor
Water depth : LAT +96.90 m
Coordinate : E 563905.0 m N 4757059.1 m
Coordinate system : WGS 84 / UTM zone 31N

⊠ Unit weight from volume mass calculation
● Unit weight from water content
✕ Dry unit weight
⊠ UU-triaxial
⬒ CU-triaxial
□ OED
◪ SB
— Unit weight from CPT

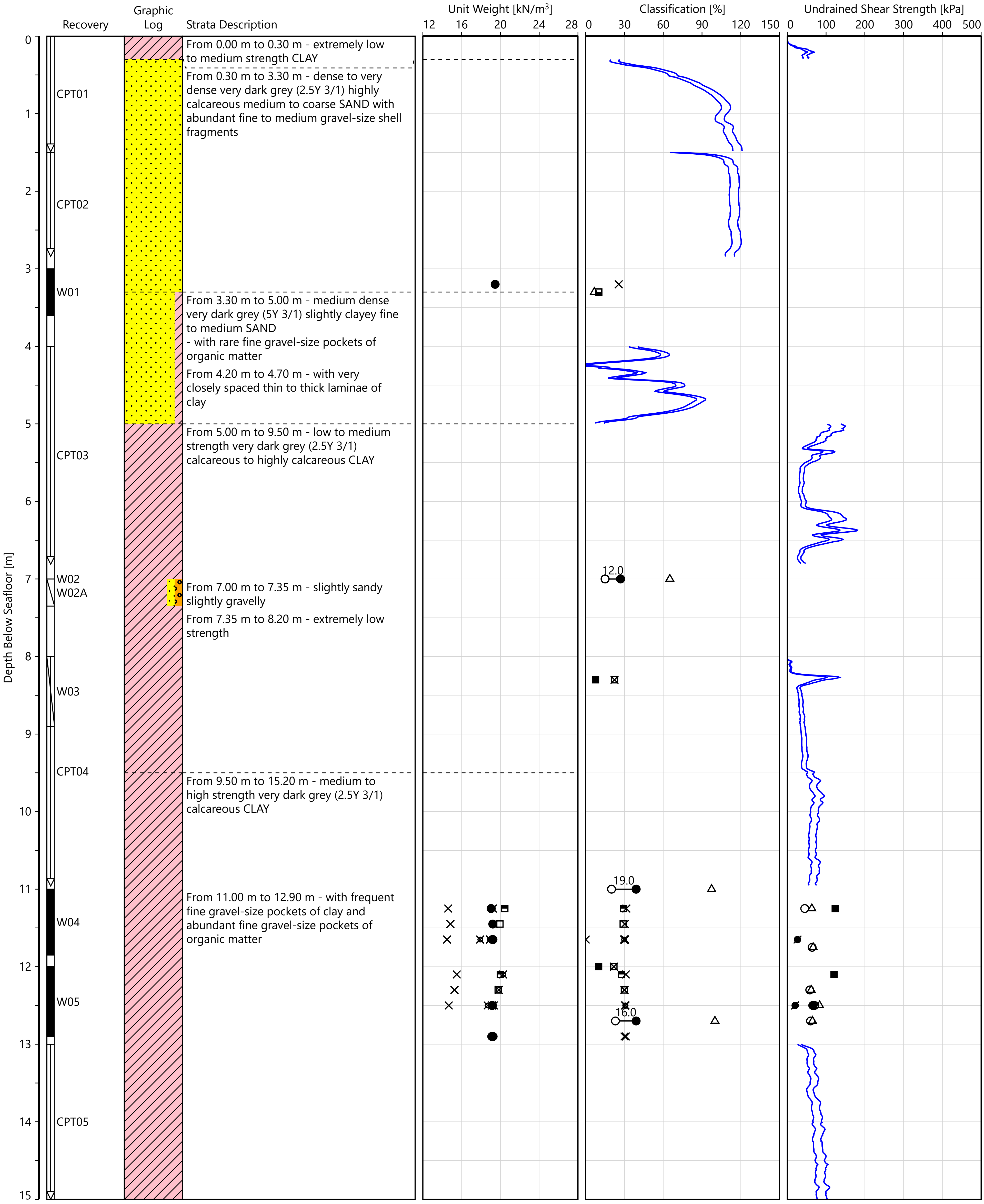
✕ Water content
○—● Plasticity index
○ Plastic limit
● Liquid limit
⊠ UU-triaxial
⬒ CU-triaxial
□ OED
◪ SB
⬓ CID
△ Percentage fines
⊠ Carbonate content
■ Organic content
— Relative density from CPT

△ Pocket penetrometer
○ Torvane
● UU-triaxial
■ CU-triaxial
— Undrained shear strength from CPT

Slashed symbols refer to tests on remoulded soil

Geotechnical Log

Z5_OWF_BH07-COMP_a



From 0.00 m to 0.30 m - extremely low to medium strength CLAY

From 0.30 m to 3.30 m - dense to very dense very dark grey (2.5Y 3/1) highly calcareous medium to coarse SAND with abundant fine to medium gravel-size shell fragments

From 3.30 m to 5.00 m - medium dense very dark grey (5Y 3/1) slightly clayey fine to medium SAND
- with rare fine gravel-size pockets of organic matter

From 4.20 m to 4.70 m - with very closely spaced thin to thick laminae of clay

From 5.00 m to 9.50 m - low to medium strength very dark grey (2.5Y 3/1) calcareous to highly calcareous CLAY

From 7.00 m to 7.35 m - slightly sandy slightly gravelly

From 7.35 m to 8.20 m - extremely low strength

From 9.50 m to 15.20 m - medium to high strength very dark grey (2.5Y 3/1) calcareous CLAY

From 11.00 m to 12.90 m - with frequent fine gravel-size pockets of clay and abundant fine gravel-size pockets of organic matter

Start date : 14-Jan-2025
Deployment method : Rotary borehole drilling, sampling and in situ testing
Recovery depth : 20.05 m below Seafloor
Penetration depth : 20.16 m below Seafloor
Water depth : LAT +93.60 m
Coordinate : E 571867.4 m N 4758631.1 m
Coordinate system : WGS 84 / UTM zone 31N

☒	Unit weight from volume mass calculation
●	Unit weight from water content
×	Dry unit weight
☒	UU-triaxial
⊟	CU-triaxial
☐	OED
◪	SB
—	Unit weight from CPT

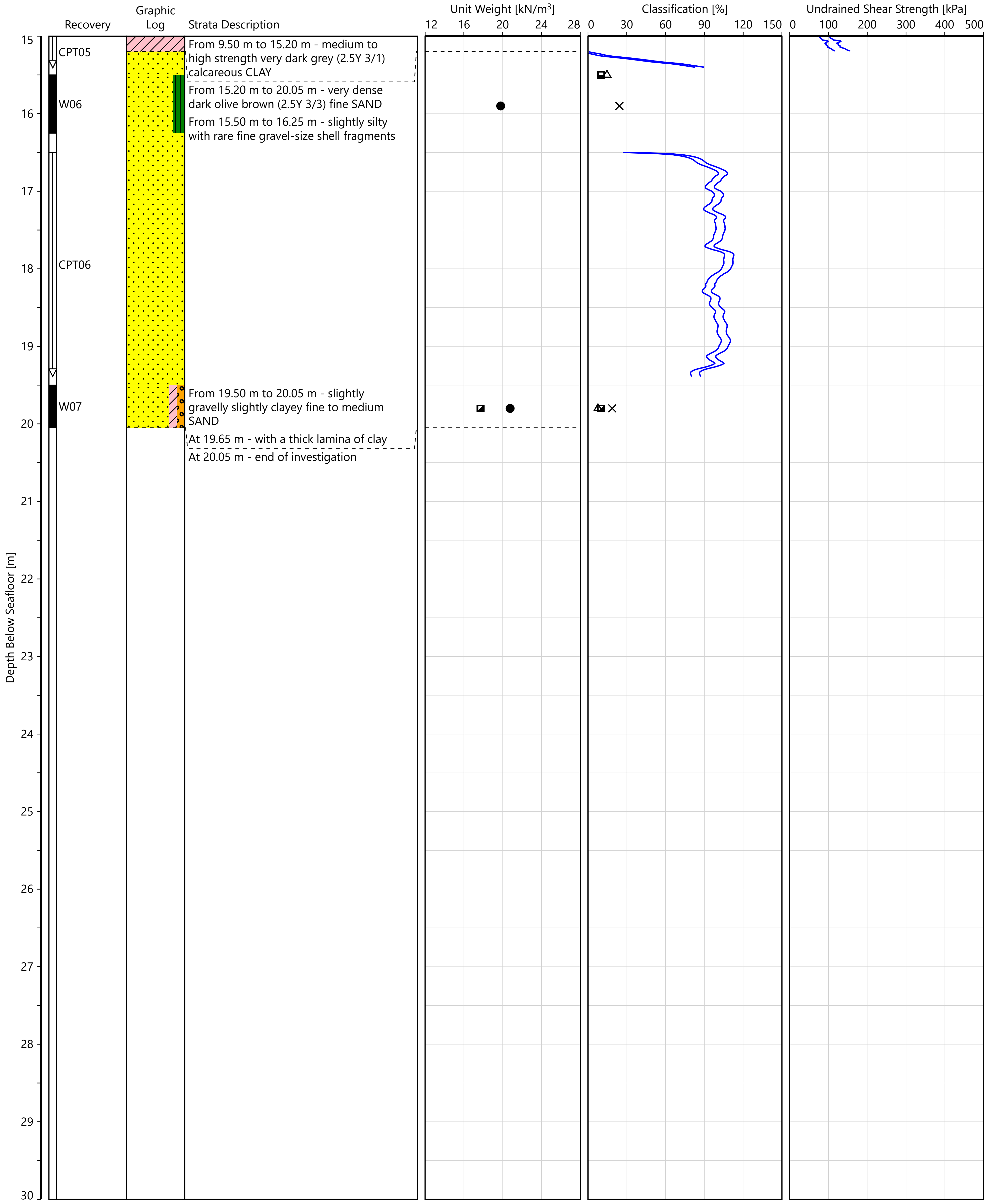
×	Water content
○—●	Plasticity index
○	Plastic limit
●	Liquid limit
☒	UU-triaxial
⊟	CU-triaxial
☐	OED
◪	SB
⊟	CID
△	Percentage fines
⊠	Carbonate content
■	Organic content
—	Relative density from CPT

△	Pocket penetrometer
○	Torvane
●	UU-triaxial
■	CU-triaxial
—	Undrained shear strength from CPT

Slashed symbols refer to tests on remoulded soil

Geotechnical Log

Z5_OWF_BH09-COMP



From 9.50 m to 15.20 m - medium to high strength very dark grey (2.5Y 3/1) calcareous CLAY

From 15.20 m to 20.05 m - very dense dark olive brown (2.5Y 3/3) fine SAND

From 15.50 m to 16.25 m - slightly silty with rare fine gravel-size shell fragments

From 19.50 m to 20.05 m - slightly gravelly slightly clayey fine to medium SAND

At 19.65 m - with a thick lamina of clay

At 20.05 m - end of investigation

Start date : 14-Jan-2025
Deployment method : Rotary borehole drilling, sampling and in situ testing
Recovery depth : 20.05 m below Seafloor
Penetration depth : 20.16 m below Seafloor
Water depth : LAT +93.60 m
Coordinate : E 571867.4 m N 4758631.1 m
Coordinate system : WGS 84 / UTM zone 31N

⊠ Unit weight from volume mass calculation
● Unit weight from water content
× Dry unit weight
⊠ UU-triaxial
⊟ CU-triaxial
☐ OED
◪ SB
— Unit weight from CPT

× Water content
○—● Plasticity index
○ Plastic limit
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⊠ UU-triaxial
⊟ CU-triaxial
☐ OED
◪ SB
⊟ CID
△ Percentage fines
⊠ Carbonate content
■ Organic content
— Relative density from CPT

△ Pocket penetrometer
○ Torvane
● UU-triaxial
■ CU-triaxial
— Undrained shear strength from CPT

Slashed symbols refer to tests on remoulded soil

Geotechnical Log

Z5_OWF_BH09-COMP

3. In Situ Test Data

Calibration Certificate

Applicant	**Fugro Netherlands Marine B.V.**
	Prismastraat 4 2631 RT, Nootdorp The Netherlands

CALIBRATION
RvA K 167

Certificate Number
FCN24035011

Instrument	**Cone Penetrometer**		
Manufacturer	Fugro		
Type	CP10-CF80PB10-P1E1M1-V1		
Serial Number	1706-2404	Electronics	7512
Node Type	7001	Hardware Version	5.01
Software Version	8.01		

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions	
Ambient air temperature during calibration	20.5 ± 3 °C
Temperature change during calibration	< ±1 °C
Atmospheric pressure during calibration	1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability The measurements have been executed using standards for which the traceability to (inter)national standards has been demonstrated towards the RvA (Raad voor Accreditatie).

Calibration date 19-Sep-2024

Calibrate before 19-Mar-2025

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 80 kN	0 to 100 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 80 kN	0 to 100 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-8/100bar (8467.8)	0 to 10 MPa	0 to 15 MPa	EUAF-FNLM- CAL-PR-004

	Before adjustment		After adjustment		Drift	
Calibrated Sensor	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	25.1 μV/V/kN	14.7 μV/V	25.1 μV/V/kN	18.2 μV/V	0.00 %	0.18 %
Cone+Fric. [Force]	25.4 μV/V/kN	72.6 μV/V	25.3 μV/V/kN	184 μV/V	-0.08 %	5.51 %
Pore 2 [Pressure]	3.08 mV/V/MPa	-3.12 mV/V	3.08 mV/V/MPa	-3.06 mV/V	-0.04 %	0.21 %

Nootdorp, 20-Sep-2024

Ruud Schrijvers
Deputy Manager Transducer Workshop

This certificate is issued provided that neither Fugro nor the Raad voor Accreditatie assumes any liability.

The Raad voor Accreditatie is one of the signatories of the Multilateral Agreement of the European Cooperation for Accreditation (EA) for the mutual recognition of calibration certificates.

Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1 M1-V1
Serial Number	1706-2404
Electronics	7512
Node Type	7001
Hardware Version	5.01
Software Version	8.01

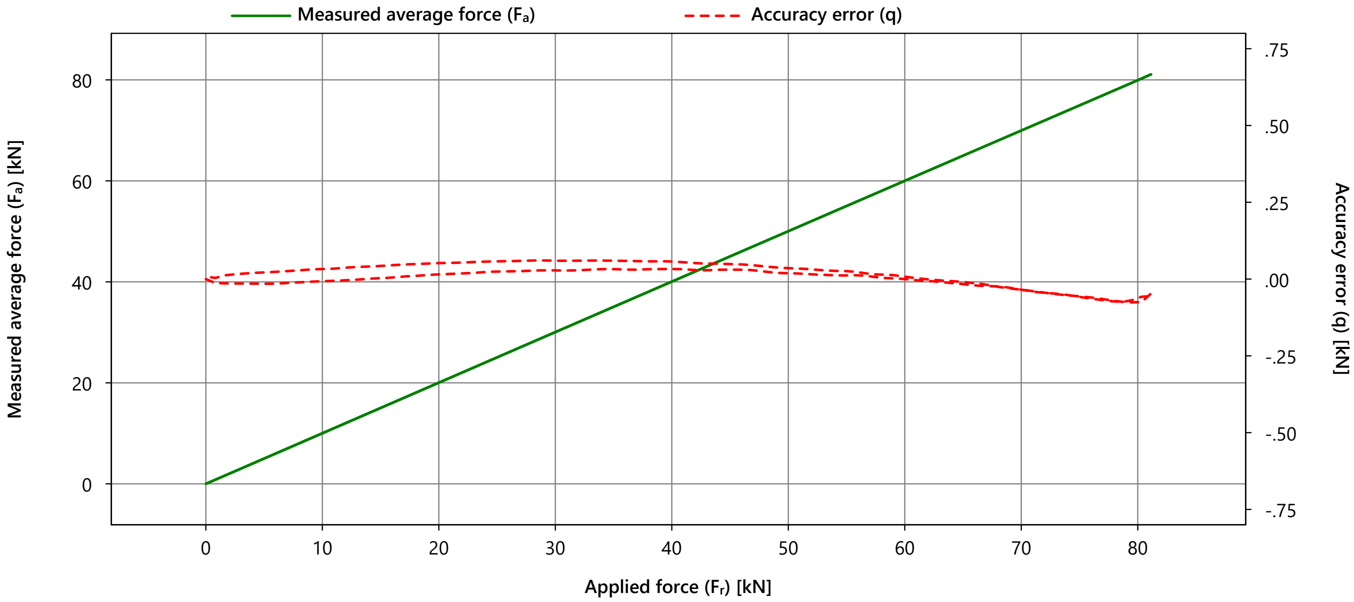
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	$0.0025 \cdot F_r + 0.011$ [kN]

Calibration Details	
Calibration Date	19 Sep 2024 05:31:09
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.4.1.56591

Certificate Number
FCN24035011

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 80 kN
Maximum Rating	0 to 100 kN

Characteristics	**Unit**	**Value**
Max accuracy error (q)	[kN]	0.062
Max repeatability error (b)	[kN]	0.029
Max reversibility error (v)	[kN]	0.040
Zero load error (F_{c0})	[kN]	0.008
Zero load offset (F_0)	[kN]	0.001
Resolution	[kN]	$3.71 \cdot 10^{-5}$
Noise RMS	[kN]	0.000



Applied force (F_r) [kN]	Measured force 1 ($F_{a,1}$) [kN]	Measured force 2 ($F_{a,2}$) [kN]	Measured force 3 ($F_{a,3}$) [kN]	Measured average force (F_a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.009	-0.004	-0.004	0.000	0.000	0.013		0.027
16.000	15.996	16.009	16.011	16.005	0.005	0.015	0.040	0.081
32.000	32.014	32.036	32.035	32.029	0.029	0.022	0.031	0.104
48.000	48.013	48.029	48.031	48.024	0.024	0.018	0.017	0.138
64.000	63.974	63.994	63.993	63.987	-0.013	0.019	0.006	0.177
80.000	79.920	79.944	79.949	79.938	-0.062	0.029		0.219
64.000	63.982	63.999	63.999	63.993	-0.007	0.017	0.006	0.177
48.000	48.030	48.046	48.048	48.041	0.041	0.018	0.017	0.138
32.000	32.050	32.063	32.066	32.060	0.060	0.016	0.031	0.102
16.000	16.036	16.049	16.051	16.045	0.045	0.016	0.040	0.081
0.000	0.007	0.009	0.008	0.008	0.008	0.002		0.017

Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1 M1-V1
Serial Number	1706-2404
Electronics	7512
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	$0.0025 \cdot F_r + 0.011$ [kN]

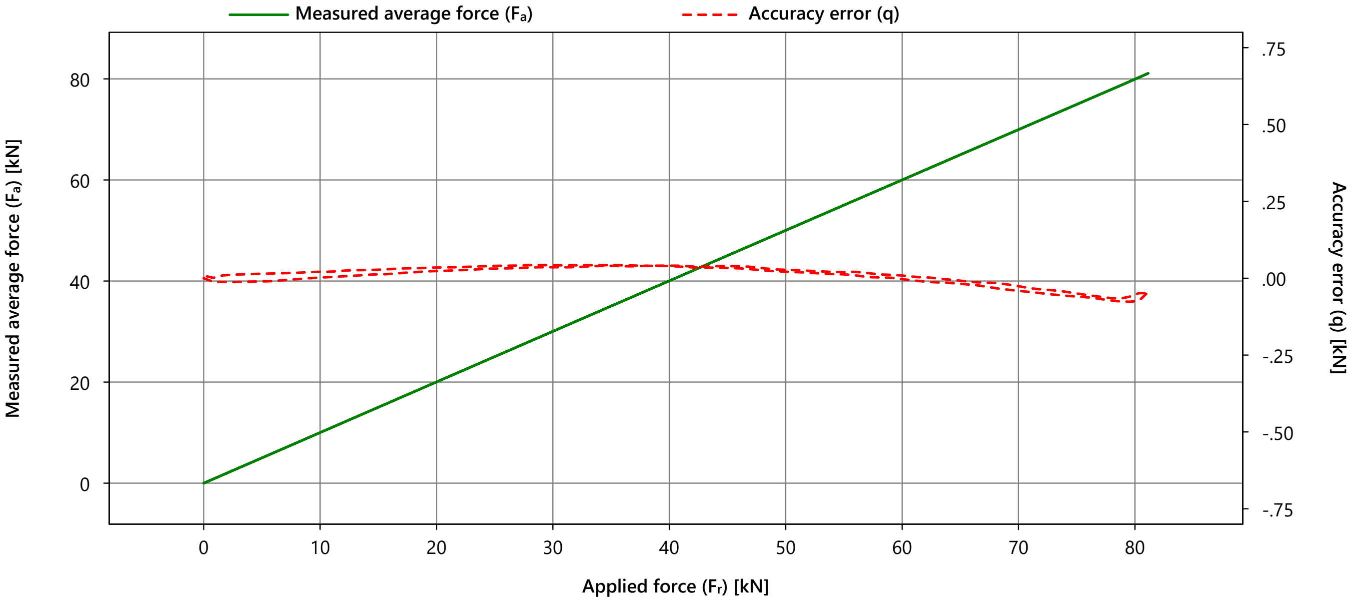
CALIBRATION
RvA K 167

Calibration Details	
Calibration Date	19 Sep 2024 05:31:09
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.4.1.56591

Certificate Number
FCN24035011

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 80 kN
Maximum Rating	0 to 100 kN

Characteristics	**Unit**	**Value**
Max accuracy error (q)	[kN]	0.054
Max repeatability error (b)	[kN]	0.044
Max reversibility error (v)	[kN]	0.016
Zero load error (F_{c0})	[kN]	0.008
Zero load offset (F_0)	[kN]	0.015
Resolution	[kN]	$3.68 \cdot 10^{-5}$
Noise RMS	[kN]	0.000
Tip-Sleeve Interaction %	[%]	0.030



Applied force (F_r) [kN]	Measured force 1 ($F_{a,1}$) [kN]	Measured force 2 ($F_{a,2}$) [kN]	Measured force 3 ($F_{a,3}$) [kN]	Measured average force (F_a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.007	-0.003	-0.005	0.000	0.000	0.012		0.025
16.000	16.000	16.018	16.024	16.014	0.014	0.023	0.016	0.063
32.000	32.017	32.044	32.047	32.036	0.036	0.030	0.006	0.101
48.000	48.015	48.037	48.045	48.033	0.033	0.030	-0.007	0.140
64.000	63.977	64.002	64.008	63.996	-0.004	0.031	-0.011	0.180
80.000	79.921	79.953	79.965	79.946	-0.054	0.044		0.223
64.000	63.966	63.991	63.997	63.985	-0.015	0.031	-0.011	0.180
48.000	48.009	48.031	48.038	48.026	0.026	0.029	-0.007	0.139
32.000	32.028	32.044	32.054	32.042	0.042	0.026	0.006	0.099
16.000	16.018	16.032	16.039	16.030	0.030	0.021	0.016	0.062
0.000	0.010	0.008	0.008	0.008	0.008	0.002		0.017

Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1 M1-V1
Serial Number	1706-2404
Electronics	7512
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	$0.00022 \cdot P_r + 0.0013$ [MPa]

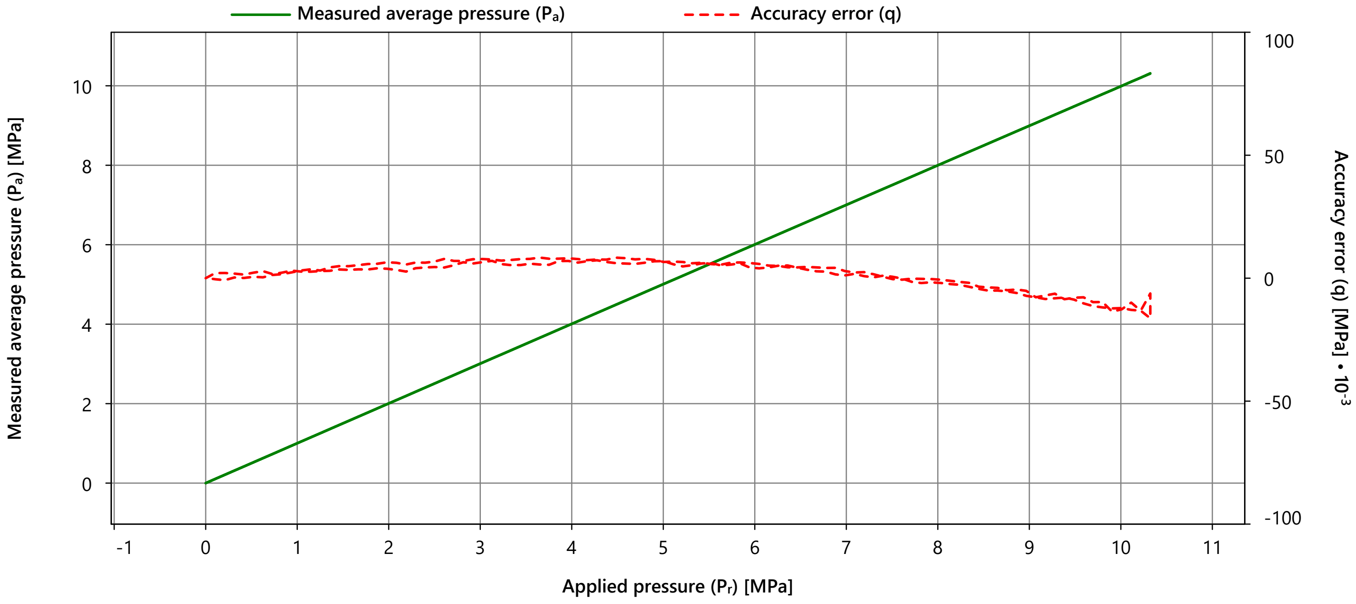
Calibration Details	
Calibration Date	19 Sep 2024 07:00:41
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.4.1.56591

CALIBRATION
RvA K 167

Certificate Number
FCN24035011

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-8/100bar (8467.8)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 15 MPa

Characteristics	**Unit**	**Value**
Max accuracy error (q)	[MPa]	0.012
Max repeatability error (b)	[MPa]	0.005
Max reversibility error (v)	[MPa]	0.003
Zero load error (P_{c0})	[MPa]	0.000
Zero load offset (P_0)	[MPa]	0.000
Resolution	[MPa]	$2.42 \cdot 10^{-6}$
Noise RMS	[MPa]	0.000



Applied pressure (P_r) [MPa]	Measured pressure 1 ($P_{a,1}$) [MPa]	Measured pressure 2 ($P_{a,2}$) [MPa]	Measured pressure 3 ($P_{a,3}$) [MPa]	Measured average pressure (P_a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.002
2.000	2.001	2.005	2.006	2.004	0.004	0.005	0.003	0.011
4.000	4.007	4.007	4.006	4.007	0.007	0.002	0.001	0.004
6.000	6.004	6.004	6.003	6.004	0.004	0.002	0.002	0.005
8.000	7.997	7.999	7.999	7.998	-0.002	0.002	0.001	0.005
10.000	9.987	9.988	9.989	9.988	-0.012	0.001		0.005
8.000	8.000	8.000	7.998	7.999	-0.001	0.002	0.001	0.005
6.000	6.006	6.005	6.007	6.006	0.006	0.002	0.002	0.005
4.000	4.007	4.008	4.009	4.008	0.008	0.002	0.001	0.004
2.000	2.006	2.007	2.007	2.007	0.007	0.001	0.003	0.006
0.000	0.000	0.001	-0.001	0.000	0.000	0.001		0.003

Symbols, Definitions and References

Certificate Number
FCN24035011

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F or P, as appropriate)

Q_0	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
$Q_{a,x}$	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_r	Applied reference quantity value.

Quantities

F	Force
P	Pressure

References

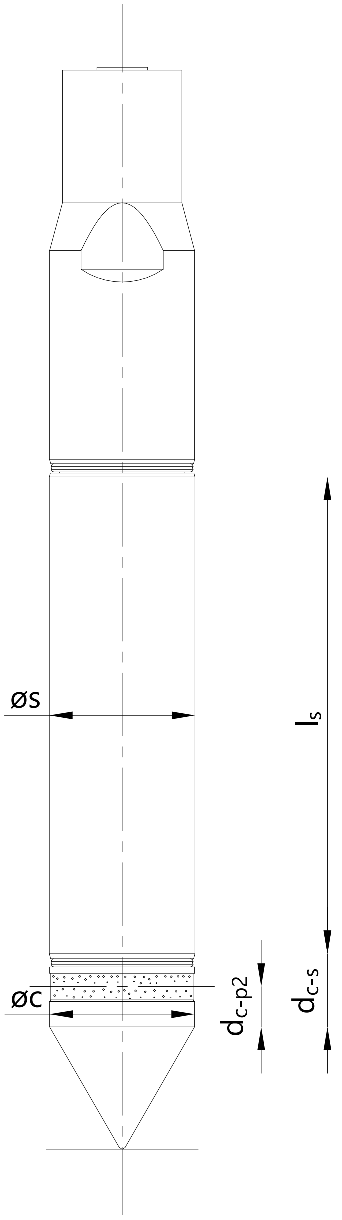
International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test.* Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration.* European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

Typical Dimensions

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1M1-V1
Serial Number	1706-2404

Appendix Applicable to Certificate Number FCN24035011



Typical Dimensions		
A_c	Cross-sectional projected area of the cone	0.001 m^2
A_s	Surface area of the friction sleeve	0.015 m^2
af	Cone net area ratio	0.75
bf	Friction sleeve net area ratio	0
øc	Diameter of the cylindrical part of the cone	35.8 mm
øs	Diameter of the friction sleeve	36.1 mm
l_s	Length of the friction sleeve	132.7 mm
$d_{c\text{-}s}$	Cone - friction sleeve distance	13.5 mm
$d_{c\text{-}p2}$	Cone - pore 2 distance	5 mm

Diagram is not to scale

Cone Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1 M1-V1
Serial Number	1706-2404
Electronics	7512
Node Type	7001
Hardware Version	5.01
Software Version	8.01

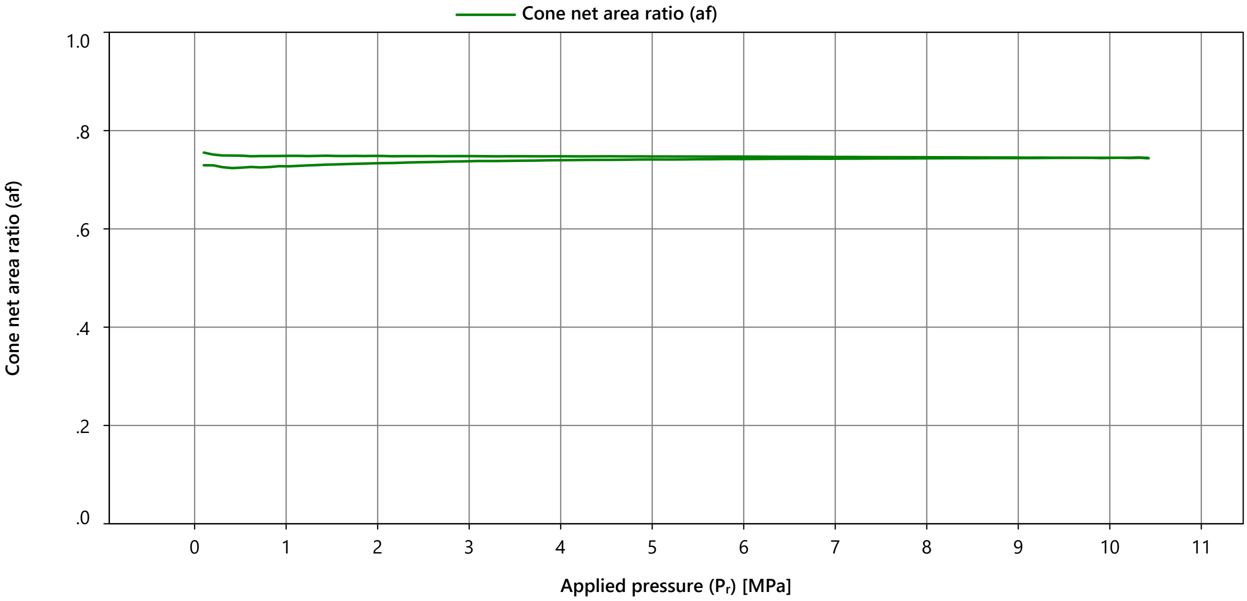
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.00022 · P_r + 0.0013 [MPa]

Measurement Details	
Measurement Date	19 Sep 2024 07:00:41
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.4.1.56591

Appendix Applicable to Certificate Number FCN24035011

Characteristics	**Unit**	**Value**
Cone net area ratio (af)	[-]	0.74

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P_r) [MPa]	**Measured cone net area ratio 1 (af,1)**	**Measured cone net area ratio 2 (af,2)**	**Measured cone net area ratio 3 (af,3)**	**Measured average cone net area ratio (af)**
2.000	0.733	0.734	0.734	0.734
4.000	0.740	0.740	0.739	0.740
6.000	0.742	0.742	0.742	0.742
8.000	0.744	0.744	0.744	0.744
10.000	0.745	0.745	0.745	0.745
8.000	0.746	0.746	0.746	0.746
6.000	0.747	0.747	0.747	0.747
4.000	0.748	0.748	0.748	0.748
2.000	0.749	0.749	0.748	0.749

Friction Sleeve Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1 M1-V1
Serial Number	1706-2404
Electronics	7512
Node Type	7001
Hardware Version	5.01
Software Version	8.01

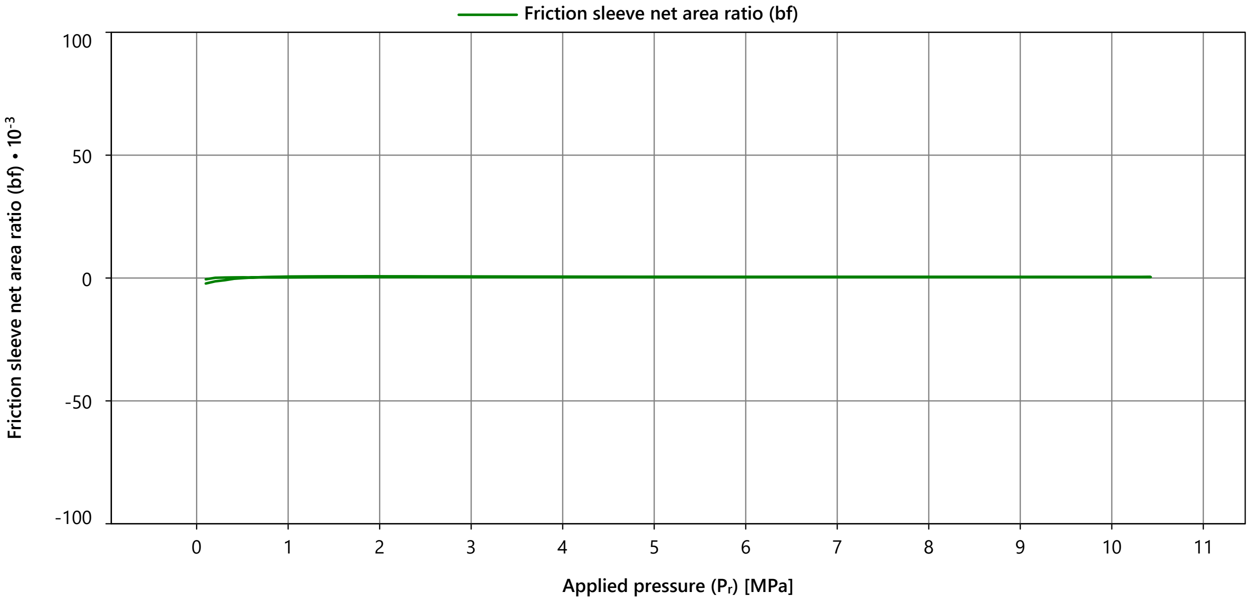
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	$0.00022 \cdot P_r + 0.0013$ [MPa]

Measurement Details	
Measurement Date	19 Sep 2024 07:00:41
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.4.1.56591

Appendix Applicable to Certificate Number FCN24035011

Characteristics	**Unit**	**Value**
Friction sleeve net area ratio (bf)	[-]	0.00041

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P_r) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.001	0.001	0.001	0.001
4.000	0.001	0.001	0.001	0.001
6.000	0.001	0.001	0.001	0.001
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN24035011

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Qw	Applied reference quantity value.

Quantities

P	Pressure

Calibration Certificate

Applicant	**Fugro Netherlands Marine B.V.**
	Prismastraat 4 2631 RT, Nootdorp The Netherlands

CALIBRATION
RvA K 167

Certificate Number
FCN24035013

Instrument	**Cone Penetrometer**		
Manufacturer	Fugro		
Type	CP10-CF80PB10-P1E1M1-V1		
Serial Number	1706-1317	Electronics	9143
Node Type	7001	Hardware Version	6.00
Software Version	8.01		

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions	
Ambient air temperature during calibration	20.5 ± 3 °C
Temperature change during calibration	< ±1 °C
Atmospheric pressure during calibration	1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability The measurements have been executed using standards for which the traceability to (inter)national standards has been demonstrated towards the RvA (Raad voor Accreditatie).

Calibration date 19-Sep-2024

Calibrate before 19-Mar-2025

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 80 kN	0 to 100 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 80 kN	0 to 100 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-8/100bar (8467.8)	0 to 10 MPa	0 to 15 MPa	EUAF-FNLM- CAL-PR-004

	Before adjustment		After adjustment		Drift	
Calibrated Sensor	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	25.0 μV/V/kN	-1.46 μV/V	25.0 μV/V/kN	-1.59 μV/V	-0.02 %	-0.01 %
Cone+Fric. [Force]	24.9 μV/V/kN	83.0 μV/V	24.9 μV/V/kN	88.5 μV/V	0.22 %	0.28 %
Pore 2 [Pressure]	968 μV/V/MPa	-595 μV/V	967 μV/V/MPa	-616 μV/V	-0.11 %	-0.22 %

Nootdorp, 20-Sep-2024

Ruud Schrijvers
Deputy Manager Transducer Workshop

This certificate is issued provided that neither Fugro nor the Raad voor Accreditatie assumes any liability.

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This certificate shall not be reproduced, except in full, without written permission of Fugro

Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1 M1-V1
Serial Number	1706-1317
Electronics	9143
Node Type	7001
Hardware Version	6.00
Software Version	8.01

Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0002
Uncertainty	$0.0025 \cdot F_r + 0.014$ [kN]

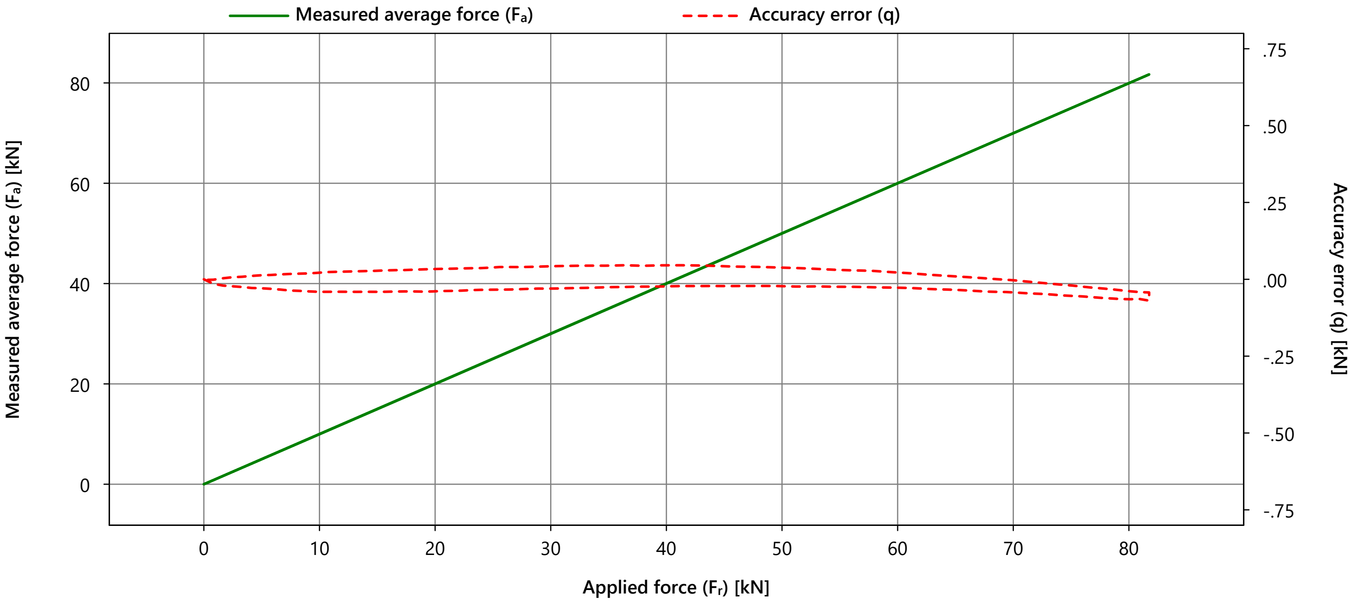
CALIBRATION
RvA K 167

Calibration Details	
Calibration Date	19 Sep 2024 06:01:52
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.4.1.56591

Certificate Number
FCN24035013

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 80 kN
Maximum Rating	0 to 100 kN

Characteristics	**Unit**	**Value**
Max accuracy error (q)	[kN]	0.065
Max repeatability error (b)	[kN]	0.036
Max reversibility error (v)	[kN]	0.072
Zero load error (F_{c0})	[kN]	0.002
Zero load offset (F_0)	[kN]	-0.001
Resolution	[kN]	$3.73 \cdot 10^{-5}$
Noise RMS	[kN]	0.001



Applied force (F_r) [kN]	Measured force 1 ($F_{a,1}$) [kN]	Measured force 2 ($F_{a,2}$) [kN]	Measured force 3 ($F_{a,3}$) [kN]	Measured average force (F_a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.001	0.000	0.000	0.000	0.000	0.001		0.016
16.000	15.969	15.958	15.952	15.960	-0.040	0.016	0.070	0.142
32.000	31.983	31.970	31.962	31.972	-0.028	0.022	0.072	0.146
48.000	47.993	47.977	47.965	47.978	-0.022	0.028	0.062	0.160
64.000	63.983	63.965	63.952	63.967	-0.033	0.031	0.045	0.190
80.000	79.953	79.935	79.917	79.935	-0.065	0.036		0.223
64.000	64.028	64.010	63.998	64.012	0.012	0.030	0.045	0.190
48.000	48.055	48.039	48.026	48.040	0.040	0.029	0.062	0.160
32.000	32.057	32.042	32.033	32.044	0.044	0.025	0.072	0.145
16.000	16.039	16.028	16.021	16.030	0.030	0.018	0.070	0.143
0.000	-0.001	-0.002	-0.003	-0.002	-0.002	0.001		0.016

Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1 M1-V1
Serial Number	1706-1317
Electronics	9143
Node Type	7001
Hardware Version	6.00
Software Version	8.01

Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0002
Uncertainty	$0.0025 \cdot F_r + 0.014$ [kN]

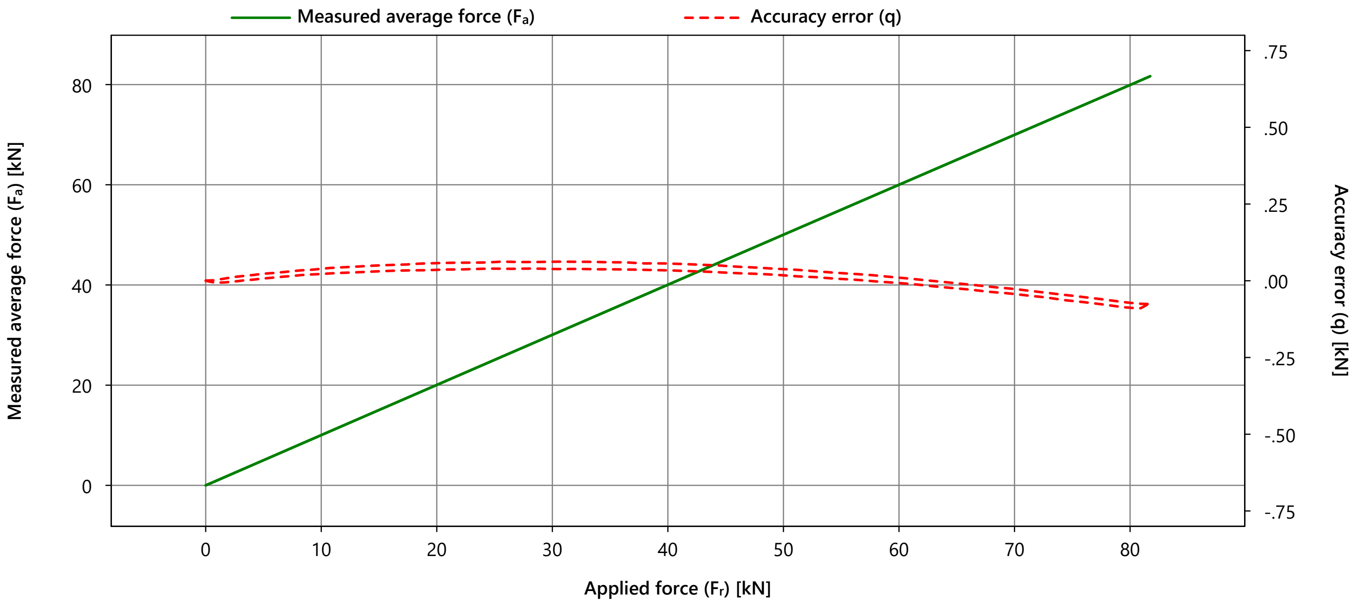
Calibration Details	
Calibration Date	19 Sep 2024 06:01:52
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.4.1.56591

CALIBRATION
RvA K 167

Certificate Number
FCN24035013

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 80 kN
Maximum Rating	0 to 100 kN

Characteristics	**Unit**	**Value**
Max accuracy error (q)	[kN]	0.088
Max repeatability error (b)	[kN]	0.016
Max reversibility error (v)	[kN]	0.023
Zero load error (F_{c0})	[kN]	0.001
Zero load offset (F_0)	[kN]	-0.017
Resolution	[kN]	$3.74 \cdot 10^{-5}$
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.068



Applied force (F_r) [kN]	Measured force 1 ($F_{a,1}$) [kN]	Measured force 2 ($F_{a,2}$) [kN]	Measured force 3 ($F_{a,3}$) [kN]	Measured average force (F_a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.001	-0.001	-0.001	0.000	0.000	0.002		0.016
16.000	16.027	16.032	16.038	16.032	0.032	0.010	0.019	0.061
32.000	32.032	32.039	32.045	32.039	0.039	0.013	0.023	0.101
48.000	48.015	48.023	48.029	48.022	0.022	0.013	0.020	0.140
64.000	63.970	63.978	63.986	63.978	-0.022	0.016	0.017	0.181
80.000	79.903	79.914	79.919	79.912	-0.088	0.016		0.220
64.000	63.987	63.996	64.003	63.996	-0.004	0.016	0.017	0.181
48.000	48.035	48.043	48.049	48.042	0.042	0.014	0.020	0.140
32.000	32.056	32.061	32.068	32.062	0.062	0.012	0.023	0.101
16.000	16.045	16.052	16.058	16.052	0.052	0.013	0.019	0.062
0.000	0.002	0.001	-0.001	0.001	0.001	0.002		0.016

Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1 M1-V1
Serial Number	1706-1317
Electronics	9143
Node Type	7001
Hardware Version	6.00
Software Version	8.01

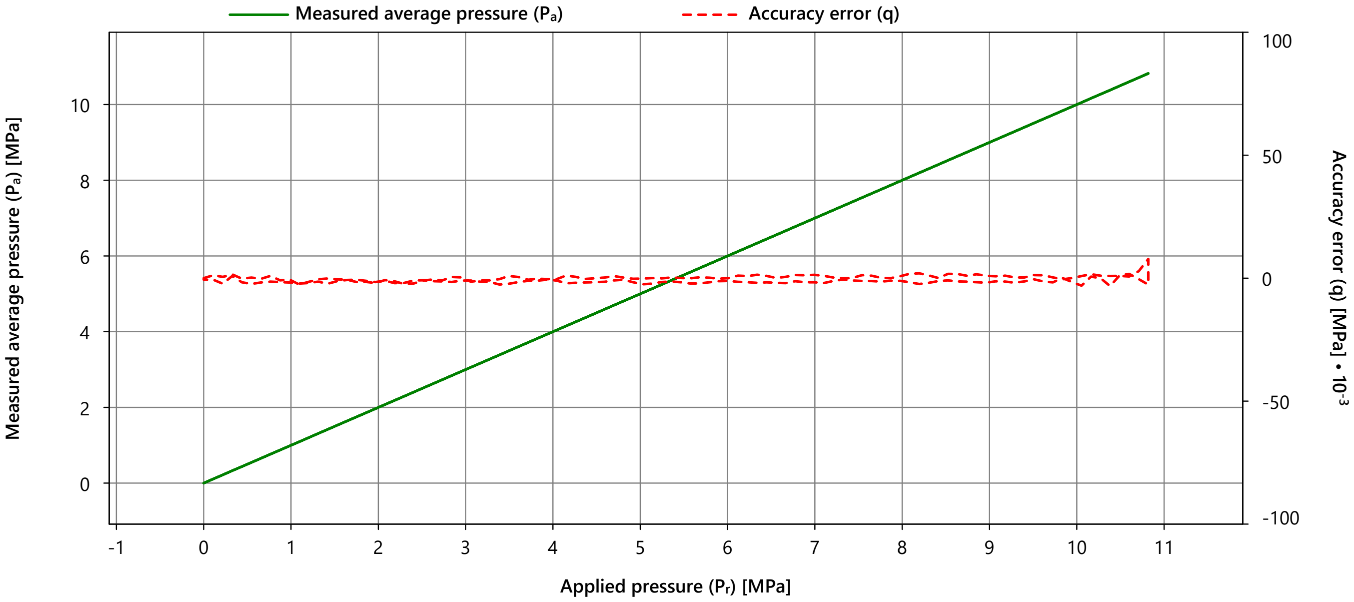
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	$0.00022 \cdot P_r + 0.0013$ [MPa]

Certificate Number
FCN24035013

Calibration Details	
Calibration Date	19 Sep 2024 07:36:48
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.4.1.56591

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-8/100bar (8467.8)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 15 MPa

Characteristics	**Unit**	**Value**
Max accuracy error (q)	[MPa]	0.002
Max repeatability error (b)	[MPa]	0.004
Max reversibility error (v)	[MPa]	0.002
Zero load error (P_{c0})	[MPa]	0.001
Zero load offset (P_0)	[MPa]	-0.017
Resolution	[MPa]	$7.71 \cdot 10^{-6}$
Noise RMS	[MPa]	0.000



Applied pressure (P_r) [MPa]	Measured pressure 1 ($P_{a,1}$) [MPa]	Measured pressure 2 ($P_{a,2}$) [MPa]	Measured pressure 3 ($P_{a,3}$) [MPa]	Measured average pressure (P_a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.002
2.000	1.998	1.998	1.998	1.998	-0.002	0.000	0.000	0.003
4.000	3.998	4.001	4.000	3.999	-0.001	0.003	0.000	0.006
6.000	5.998	6.001	6.001	6.000	0.000	0.004	-0.001	0.008
8.000	8.000	8.002	8.001	8.001	0.001	0.001	-0.002	0.005
10.000	9.999	10.001	10.001	10.000	0.000	0.002		0.005
8.000	8.000	7.999	7.997	7.999	-0.001	0.003	-0.002	0.007
6.000	5.999	5.999	5.999	5.999	-0.001	0.000	-0.001	0.004
4.000	4.000	4.000	3.998	3.999	-0.001	0.002	0.000	0.004
2.000	1.997	2.000	1.998	1.999	-0.001	0.002	0.000	0.005
0.000	-0.001	-0.001	-0.001	-0.001	-0.001	0.000		0.002

Symbols, Definitions and References

CALIBRATION
RvA K 167

Certificate Number
FCN24035013

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F or P, as appropriate)

Q_0	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
$Q_{a,x}$	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_r	Applied reference quantity value.

Quantities

F	Force
P	Pressure

References

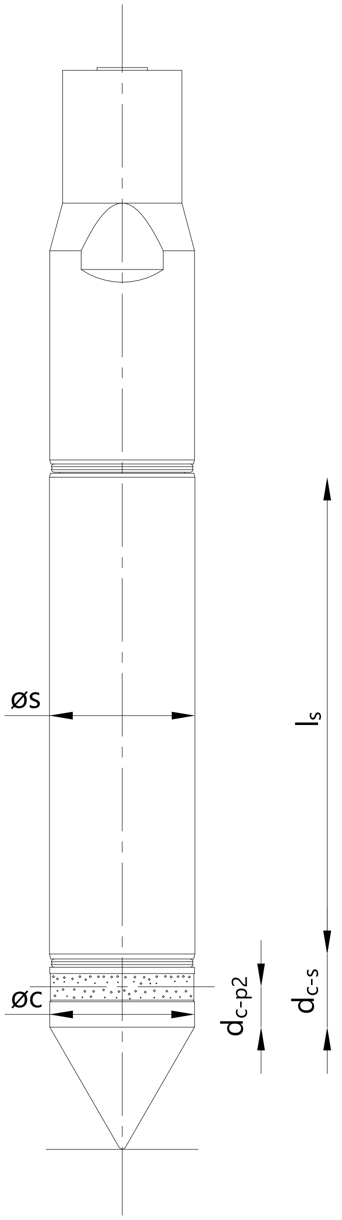
International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test.* Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration.* European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

Typical Dimensions

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1M1-V1
Serial Number	1706-1317

Appendix Applicable to Certificate Number FCN24035013



Typical Dimensions		
A_c	Cross-sectional projected area of the cone	0.001 m^2
A_s	Surface area of the friction sleeve	0.015 m^2
af	Cone net area ratio	0.75
bf	Friction sleeve net area ratio	0
øc	Diameter of the cylindrical part of the cone	35.8 mm
øs	Diameter of the friction sleeve	36.1 mm
l_s	Length of the friction sleeve	132.7 mm
d_{c-s}	Cone - friction sleeve distance	13.5 mm
d_{c-p2}	Cone - pore 2 distance	5 mm

Diagram is not to scale

Cone Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1 M1-V1
Serial Number	1706-1317
Electronics	9143
Node Type	7001
Hardware Version	6.00
Software Version	8.01

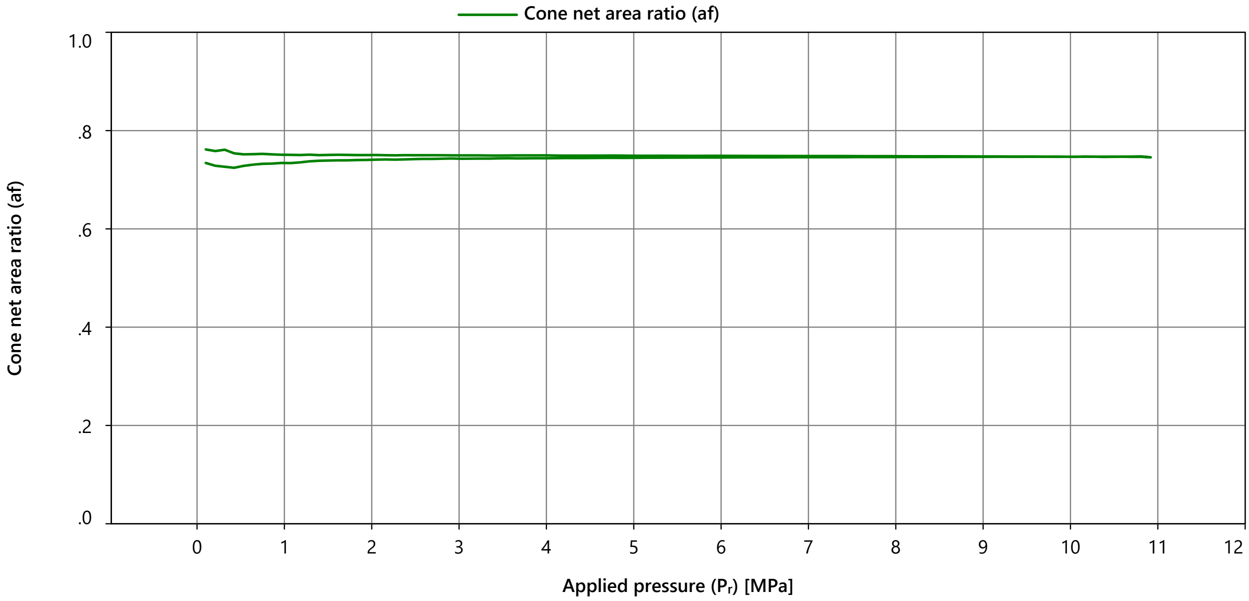
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.00022 · P_r + 0.0013 [MPa]

Measurement Details	
Measurement Date	19 Sep 2024 07:36:48
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.4.1.56591

Appendix Applicable to Certificate Number FCN24035013

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.75

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P_r) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.740	0.741	0.741	0.741
4.000	0.743	0.744	0.744	0.744
6.000	0.745	0.745	0.745	0.745
8.000	0.746	0.746	0.746	0.746
10.000	0.747	0.747	0.747	0.747
8.000	0.748	0.748	0.748	0.748
6.000	0.749	0.749	0.749	0.749
4.000	0.750	0.750	0.749	0.750
2.000	0.750	0.751	0.750	0.750

Friction Sleeve Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1 M1-V1
Serial Number	1706-1317
Electronics	9143
Node Type	7001
Hardware Version	6.00
Software Version	8.01

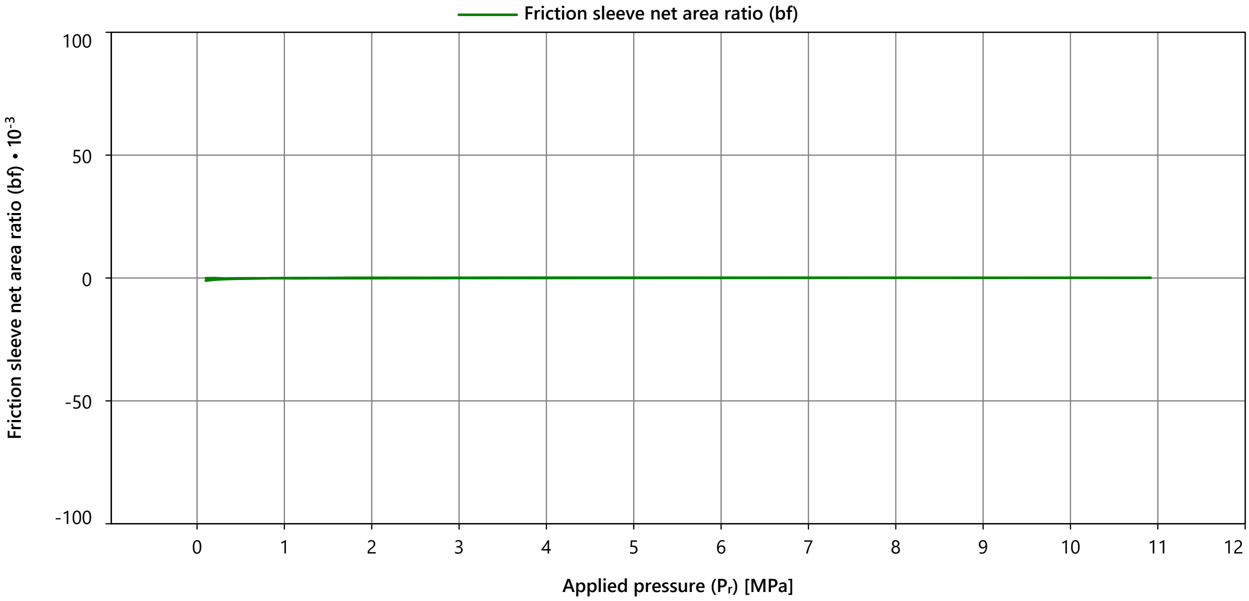
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	$0.00022 \cdot P_r + 0.0013$ [MPa]

Measurement Details	
Measurement Date	19 Sep 2024 07:36:48
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.4.1.56591

Appendix Applicable to Certificate Number FCN24035013

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00012

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P_r) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to Certificate Number FCN24035013

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Qw	Applied reference quantity value.

Quantities

P	Pressure

Calibration Certificate

Applicant	**Fugro Netherlands Marine B.V.**
	Prismastraat 4 2631 RT, Nootdorp The Netherlands

Instrument	**Cone Penetrometer**		
Manufacturer	Fugro		
Type	CP10-CF80PB10-P1E1M1-V1		
Serial Number	1706-1784	Electronics	5634
Node Type	7001	Hardware Version	4.00
Software Version	8.01		

CALIBRATION
RvA K 167

Certificate Number
FCN24035014

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions	
Ambient air temperature during calibration	20.5 ± 3 °C
Temperature change during calibration	< ±1 °C
Atmospheric pressure during calibration	1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability The measurements have been executed using standards for which the traceability to (inter)national standards has been demonstrated towards the RvA (Raad voor Accreditatie).

Calibration date 19-Sep-2024

Calibrate before 19-Mar-2025

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 80 kN	0 to 100 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 80 kN	0 to 100 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-8/100bar (8467.8)	0 to 10 MPa	0 to 15 MPa	EUAF-FNLM- CAL-PR-004

	Before adjustment		After adjustment		Drift	
Calibrated Sensor	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	24.9 µV/V/kN	38.6 µV/V	24.9 µV/V/kN	47.5 µV/V	0.05 %	0.44 %
Cone+Fric. [Force]	24.8 µV/V/kN	-14.9 µV/V	24.8 µV/V/kN	-5.51 µV/V	0.05 %	0.47 %
Pore 2 [Pressure]	3.23 mV/V/MPa	-139 µV/V	3.23 mV/V/MPa	-48.0 µV/V	-0.02 %	0.28 %

Nootdorp, 20-Sep-2024

Ruud Schrijvers
Deputy Manager Transducer Workshop

This certificate is issued provided that neither Fugro nor the Raad voor Accreditatie assumes any liability.

The Raad voor Accreditatie is one of the signatories of the Multilateral Agreement of the European Cooperation for Accreditation (EA) for the mutual recognition of calibration certificates.

This certificate shall not be reproduced, except in full, without written permission of Fugro

Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1 M1-V1
Serial Number	1706-1784
Electronics	5634
Node Type	7001
Hardware Version	4.00
Software Version	8.01

Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0002
Uncertainty	$0.0025 \cdot F_r + 0.014$ [kN]

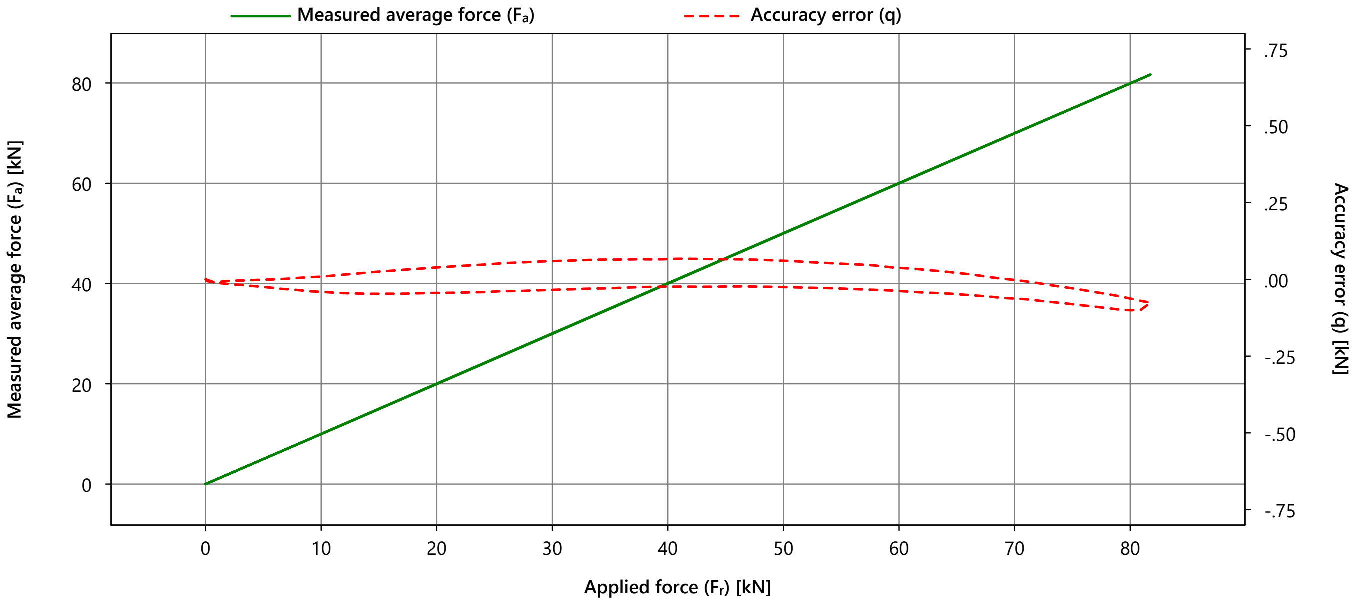
Calibration Details	
Calibration Date	19 Sep 2024 06:13:50
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.4.1.56591

CALIBRATION
RvA K 167

Certificate Number
FCN24035014

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 80 kN
Maximum Rating	0 to 100 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.101
Max repeatability error (b)	[kN]	0.029
Max reversibility error (v)	[kN]	0.094
Zero load error (F_{c0})	[kN]	0.005
Zero load offset (F_0)	[kN]	-0.003
Resolution	[kN]	$3.73 \cdot 10^{-5}$
Noise RMS	[kN]	0.000



Applied force (F_r) [kN]	Measured force 1 ($F_{a,1}$) [kN]	Measured force 2 ($F_{a,2}$) [kN]	Measured force 3 ($F_{a,3}$) [kN]	Measured average force (F_a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	-0.002	0.001	0.002	0.000	0.000	0.004		0.016
16.000	15.957	15.953	15.950	15.953	-0.047	0.006	0.075	0.169
32.000	31.977	31.967	31.960	31.968	-0.032	0.017	0.094	0.182
48.000	47.989	47.975	47.965	47.976	-0.024	0.024	0.087	0.185
64.000	63.969	63.954	63.941	63.954	-0.046	0.028	0.071	0.200
80.000	79.914	79.899	79.885	79.899	-0.101	0.029		0.222
64.000	64.039	64.025	64.011	64.025	0.025	0.028	0.071	0.200
48.000	48.075	48.064	48.052	48.064	0.064	0.023	0.087	0.185
32.000	32.072	32.061	32.051	32.062	0.062	0.021	0.094	0.183
16.000	16.037	16.028	16.018	16.028	0.028	0.019	0.075	0.149
0.000	-0.004	-0.005	-0.005	-0.005	-0.005	0.001		0.016

Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1 M1-V1
Serial Number	1706-1784
Electronics	5634
Node Type	7001
Hardware Version	4.00
Software Version	8.01

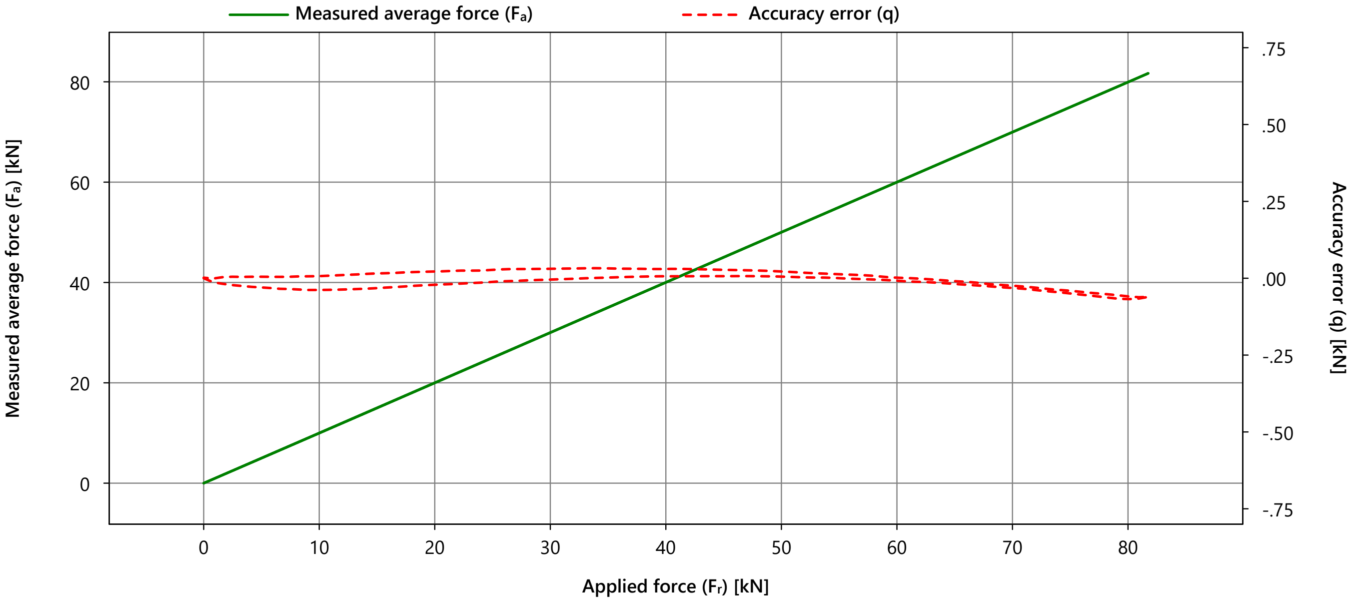
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0002
Uncertainty	$0.0025 \cdot F_r + 0.014$ [kN]

Calibration Details	
Calibration Date	19 Sep 2024 06:13:50
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.4.1.56591

Certificate Number
FCN24035014

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 80 kN
Maximum Rating	0 to 100 kN

Characteristics	**Unit**	**Value**
Max accuracy error (q)	[kN]	0.068
Max repeatability error (b)	[kN]	0.027
Max reversibility error (v)	[kN]	0.047
Zero load error (F_{c0})	[kN]	0.002
Zero load offset (F_0)	[kN]	-0.005
Resolution	[kN]	$3.75 \cdot 10^{-5}$
Noise RMS	[kN]	0.000
Tip-Sleeve Interaction %	[%]	0.069



Applied force (F_r)	Measured force 1 ($F_{a,1}$)	Measured force 2 ($F_{a,2}$)	Measured force 3 ($F_{a,3}$)	Measured average force (F_a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
0.000	0.000	-0.001	0.000	0.000	0.000	0.001		0.016
16.000	15.977	15.969	15.964	15.970	-0.030	0.014	0.047	0.092
32.000	32.009	31.998	31.988	31.998	-0.002	0.020	0.033	0.107
48.000	48.019	48.005	47.995	48.007	0.007	0.024	0.018	0.142
64.000	63.997	63.984	63.972	63.984	-0.016	0.026	0.009	0.181
80.000	79.945	79.932	79.919	79.932	-0.068	0.026		0.222
64.000	64.007	63.993	63.980	63.993	-0.007	0.027	0.009	0.181
48.000	48.036	48.025	48.013	48.025	0.025	0.023	0.018	0.142
32.000	32.042	32.032	32.022	32.032	0.032	0.020	0.033	0.107
16.000	16.025	16.017	16.008	16.017	0.017	0.017	0.047	0.091
0.000	0.002	0.002	0.001	0.002	0.002	0.001		0.016

Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1 M1-V1
Serial Number	1706-1784
Electronics	5634
Node Type	7001
Hardware Version	4.00
Software Version	8.01

Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	$0.00022 \cdot P_r + 0.0013$ [MPa]

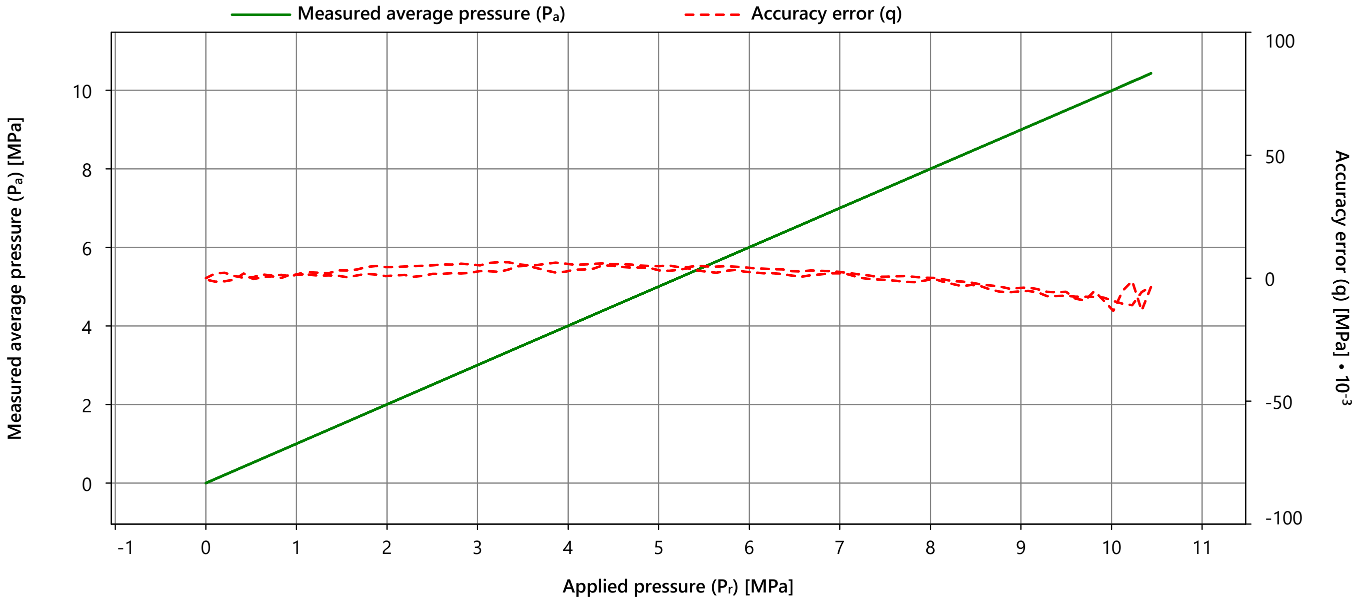
CALIBRATION
RvA K 167

Calibration Details	
Calibration Date	19 Sep 2024 06:48:01
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.4.1.56591

Certificate Number
FCN24035014

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-8/100bar (8467.8)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 15 MPa

Characteristics	**Unit**	**Value**
Max accuracy error (q)	[MPa]	0.009
Max repeatability error (b)	[MPa]	0.005
Max reversibility error (v)	[MPa]	0.004
Zero load error (P_{c0})	[MPa]	0.001
Zero load offset (P_0)	[MPa]	0.007
Resolution	[MPa]	$2.31 \cdot 10^{-6}$
Noise RMS	[MPa]	0.000



Applied pressure (P_r) [MPa]	Measured pressure 1 ($P_{a,1}$) [MPa]	Measured pressure 2 ($P_{a,2}$) [MPa]	Measured pressure 3 ($P_{a,3}$) [MPa]	Measured average pressure (P_a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.002
2.000	2.002	2.000	2.000	2.001	0.001	0.002	0.004	0.008
4.000	4.006	4.002	4.001	4.003	0.003	0.005	0.003	0.012
6.000	6.002	6.002	6.004	6.002	0.002	0.002	0.002	0.005
8.000	8.000	7.998	8.001	8.000	0.000	0.002	0.000	0.005
10.000	9.990	9.993	9.990	9.991	-0.009	0.003		0.006
8.000	8.001	7.999	8.000	8.000	0.000	0.002	0.000	0.004
6.000	6.004	6.004	6.004	6.004	0.004	0.000	0.002	0.004
4.000	4.006	4.004	4.006	4.006	0.006	0.002	0.003	0.006
2.000	2.005	2.005	2.004	2.004	0.004	0.001	0.004	0.008
0.000	-0.001	-0.001	-0.001	-0.001	-0.001	0.000		0.002

Symbols, Definitions and References

CALIBRATION
RvA K 167

Certificate Number
FCN24035014

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F or P, as appropriate)

Q_0	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
$Q_{a,x}$	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_r	Applied reference quantity value.

Quantities

F	Force
P	Pressure

References

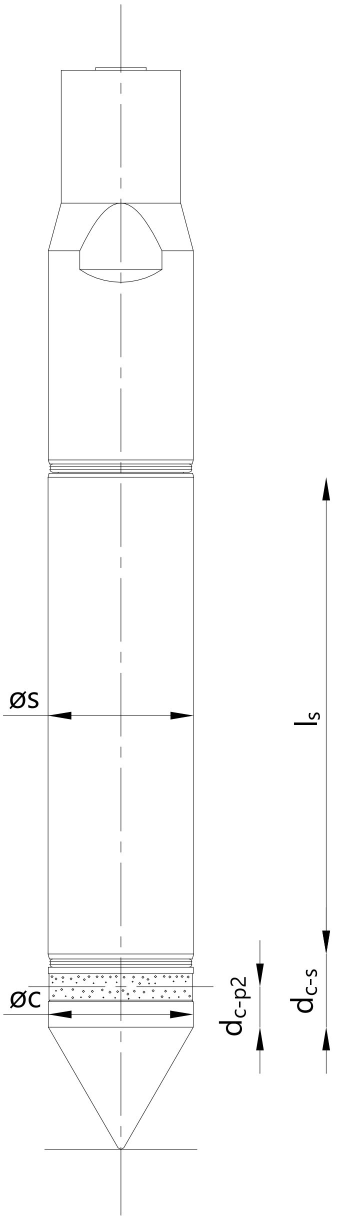
International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test.* Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration.* European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

Typical Dimensions

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1M1-V1
Serial Number	1706-1784

Appendix Applicable to Certificate Number FCN24035014



Typical Dimensions		
A_c	Cross-sectional projected area of the cone	0.001 m^2
A_s	Surface area of the friction sleeve	0.015 m^2
af	Cone net area ratio	0.75
bf	Friction sleeve net area ratio	0
øc	Diameter of the cylindrical part of the cone	35.8 mm
øs	Diameter of the friction sleeve	36.1 mm
l_s	Length of the friction sleeve	132.7 mm
d_{c-s}	Cone - friction sleeve distance	13.5 mm
d_{c-p2}	Cone - pore 2 distance	5 mm

Diagram is not to scale

Cone Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1 M1-V1
Serial Number	1706-1784
Electronics	5634
Node Type	7001
Hardware Version	4.00
Software Version	8.01

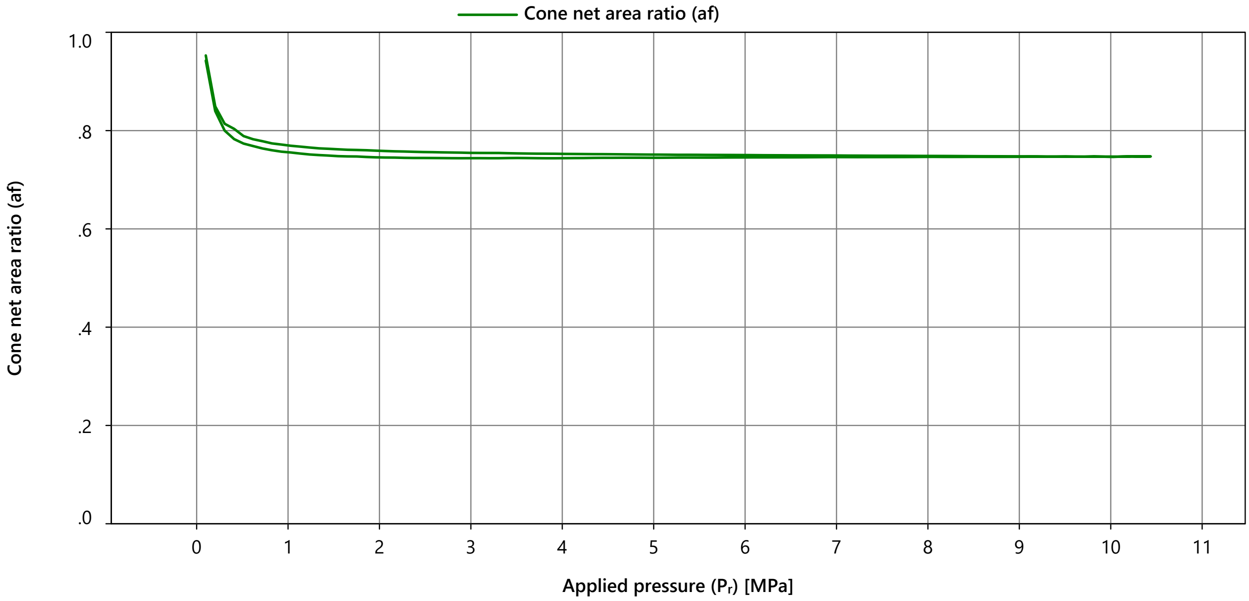
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	$0.00022 \cdot P_r + 0.0013$ [MPa]

Measurement Details	
Measurement Date	19 Sep 2024 06:48:01
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.4.1.56591

Appendix Applicable to Certificate Number FCN24035014

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.75

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P_r) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.746	0.745	0.745	0.745
4.000	0.744	0.744	0.743	0.744
6.000	0.745	0.745	0.746	0.745
8.000	0.747	0.746	0.747	0.747
10.000	0.747	0.747	0.747	0.747
8.000	0.748	0.748	0.749	0.748
6.000	0.750	0.750	0.750	0.750
4.000	0.752	0.752	0.753	0.753
2.000	0.759	0.759	0.759	0.759

Friction Sleeve Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1 M1-V1
Serial Number	1706-1784
Electronics	5634
Node Type	7001
Hardware Version	4.00
Software Version	8.01

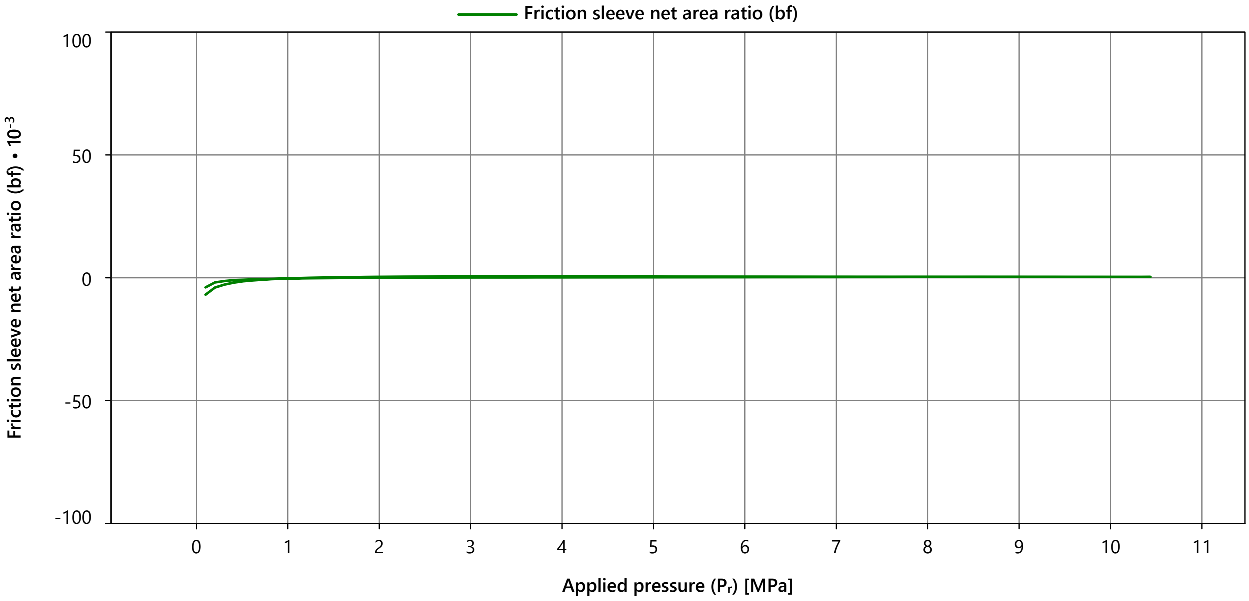
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	$0.00022 \cdot P_r + 0.0013$ [MPa]

Measurement Details	
Measurement Date	19 Sep 2024 06:48:01
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.4.1.56591

Appendix Applicable to Certificate Number FCN24035014

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00036

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P_r) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.001	0.001	0.001	0.001
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to Certificate Number FCN24035014

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Qw	Applied reference quantity value.

Quantities

P	Pressure

Calibration Certificate

CALIBRATION
RvA K 167

Certificate Number
FCN24035099

Applicant	**Fugro Netherlands Marine B.V.**
	Prismastraat 4 2631 RT, Nootdorp The Netherlands

Instrument	**Cone Penetrometer**		
Manufacturer	Fugro		
Type	CP10-CF80PB10-P1E1M1-V1		
Serial Number	1706-2445	Electronics	6880
Node Type	7001	Hardware Version	4.00
Software Version	8.01		

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions	
Ambient air temperature during calibration	20.5 ± 3 °C
Temperature change during calibration	< ±1 °C
Atmospheric pressure during calibration	1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability The measurements have been executed using standards for which the traceability to (inter)national standards has been demonstrated towards the RvA (Raad voor Accreditatie).

Calibration date 25-Sep-2024

Calibrate before 25-Mar-2025

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 80 kN	0 to 100 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 80 kN	0 to 100 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-8/100bar (8467.8)	0 to 10 MPa	0 to 15 MPa	EUAF-FNLM- CAL-PR-004

	Before adjustment		After adjustment		Drift	
Calibrated Sensor	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	25.3 µV/V/kN	111 µV/V	25.4 µV/V/kN	100 µV/V	0.09 %	-0.51 %
Cone+Fric. [Force]	25.3 µV/V/kN	386 µV/V	25.3 µV/V/kN	387 µV/V	0.05 %	0.02 %
Pore 2 [Pressure]	3.24 mV/V/MPa	-3.21 mV/V	3.24 mV/V/MPa	-3.25 mV/V	-0.02 %	-0.13 %

Nootdorp, 27-Sep-2024

Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1 M1-V1
Serial Number	1706-2445
Electronics	6880
Node Type	7001
Hardware Version	4.00
Software Version	8.01

Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	$0.0025 \cdot F_r + 0.011$ [kN]

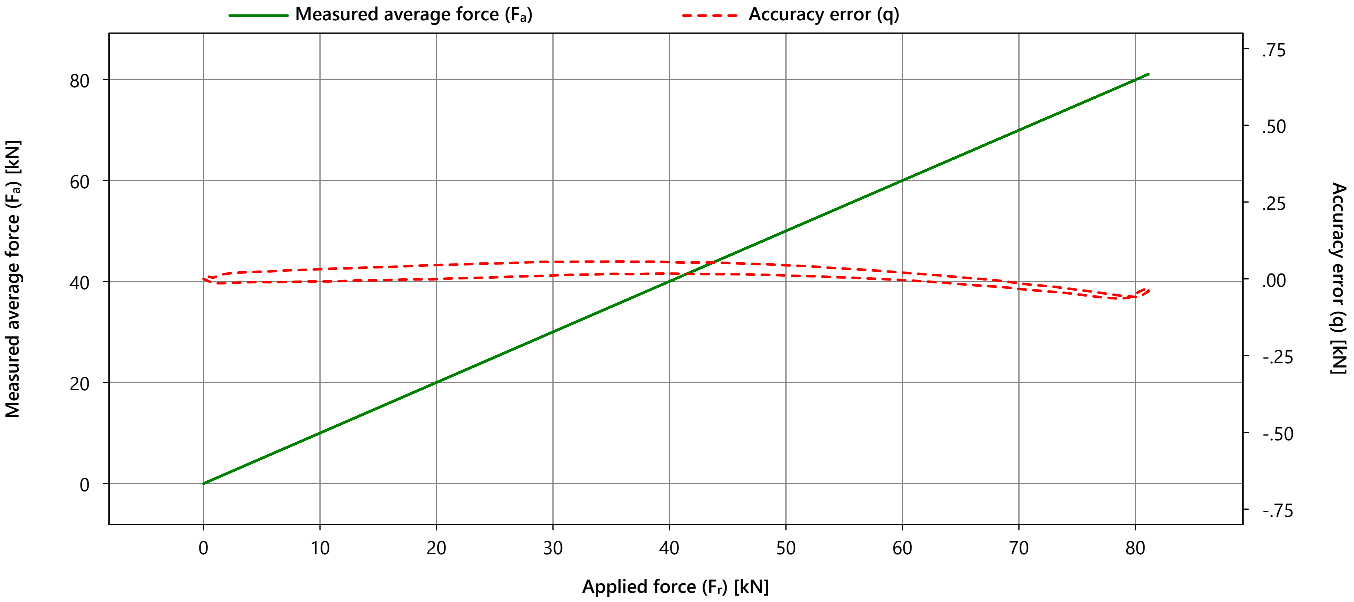
CALIBRATION
RvA K 167

Calibration Details	
Calibration Date	25 Sep 2024 07:08:56
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.4.2.56595

Certificate Number
FCN24035099

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 80 kN
Maximum Rating	0 to 100 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.056
Max repeatability error (b)	[kN]	0.020
Max reversibility error (v)	[kN]	0.042
Zero load error (F_{c0})	[kN]	0.011
Zero load offset (F_0)	[kN]	-0.002
Resolution	[kN]	$3.67 \cdot 10^{-5}$
Noise RMS	[kN]	0.001



Applied force (F_r) [kN]	Measured force 1 ($F_{a,1}$) [kN]	Measured force 2 ($F_{a,2}$) [kN]	Measured force 3 ($F_{a,3}$) [kN]	Measured average force (F_a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.007	-0.006	-0.001	0.000	0.000	0.013		0.028
16.000	15.993	15.996	16.000	15.996	-0.004	0.007	0.042	0.084
32.000	32.009	32.013	32.018	32.013	0.013	0.008	0.042	0.108
48.000	48.008	48.014	48.018	48.013	0.013	0.010	0.034	0.141
64.000	63.978	63.987	63.992	63.986	-0.014	0.014	0.022	0.179
80.000	79.948	79.942	79.961	79.950	-0.050	0.020		0.218
64.000	63.998	64.010	64.017	64.008	0.008	0.019	0.022	0.179
48.000	48.037	48.050	48.056	48.048	0.048	0.019	0.034	0.143
32.000	32.044	32.058	32.065	32.056	0.056	0.020	0.042	0.110
16.000	16.030	16.041	16.045	16.039	0.039	0.015	0.042	0.084
0.000	0.009	0.011	0.013	0.011	0.011	0.004		0.022

Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1 M1-V1
Serial Number	1706-2445
Electronics	6880
Node Type	7001
Hardware Version	4.00
Software Version	8.01

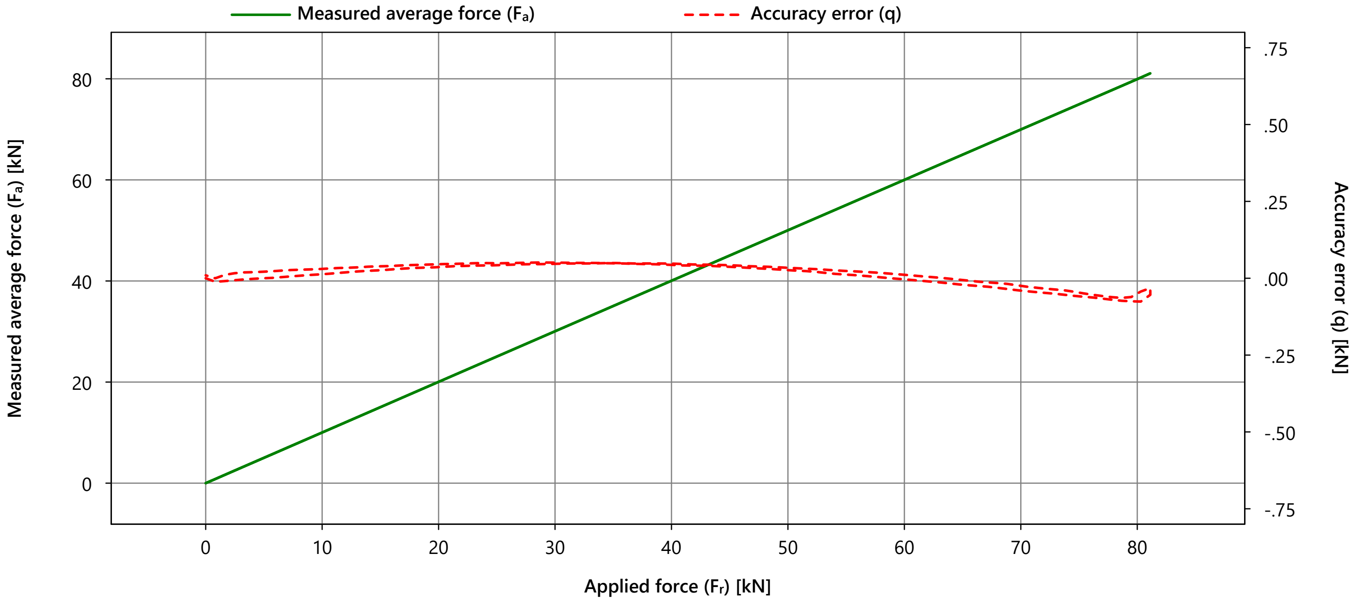
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	$0.0025 \cdot F_r + 0.011$ [kN]

Calibration Details	
Calibration Date	25 Sep 2024 07:08:56
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.4.2.56595

Certificate Number
FCN24035099

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 80 kN
Maximum Rating	0 to 100 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.050
Max repeatability error (b)	[kN]	0.017
Max reversibility error (v)	[kN]	0.015
Zero load error (F_{c0})	[kN]	0.009
Zero load offset (F_0)	[kN]	-0.003
Resolution	[kN]	$3.68 \cdot 10^{-5}$
Noise RMS	[kN]	0.000
Tip-Sleeve Interaction %	[%]	0.027



Applied force (F_r) [kN]	Measured force 1 ($F_{a,1}$) [kN]	Measured force 2 ($F_{a,2}$) [kN]	Measured force 3 ($F_{a,3}$) [kN]	Measured average force (F_a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.008	-0.006	-0.002	0.000	0.000	0.014		0.028
16.000	16.028	16.028	16.031	16.029	0.029	0.003	0.011	0.056
32.000	32.047	32.046	32.051	32.048	0.048	0.004	0.002	0.096
48.000	48.037	48.037	48.039	48.038	0.038	0.003	-0.007	0.136
64.000	63.995	63.998	64.001	63.998	-0.002	0.006	-0.015	0.177
80.000	79.953	79.939	79.956	79.950	-0.050	0.017		0.218
64.000	63.978	63.982	63.988	63.983	-0.017	0.009	-0.015	0.177
48.000	48.027	48.031	48.035	48.031	0.031	0.009	-0.007	0.136
32.000	32.045	32.050	32.055	32.050	0.050	0.010	0.002	0.096
16.000	16.037	16.041	16.042	16.040	0.040	0.006	0.011	0.056
0.000	0.009	0.009	0.011	0.009	0.009	0.002		0.019

Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1 M1-V1
Serial Number	1706-2445
Electronics	6880
Node Type	7001
Hardware Version	4.00
Software Version	8.01

Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.00022 · P_r + 0.0013 [MPa]

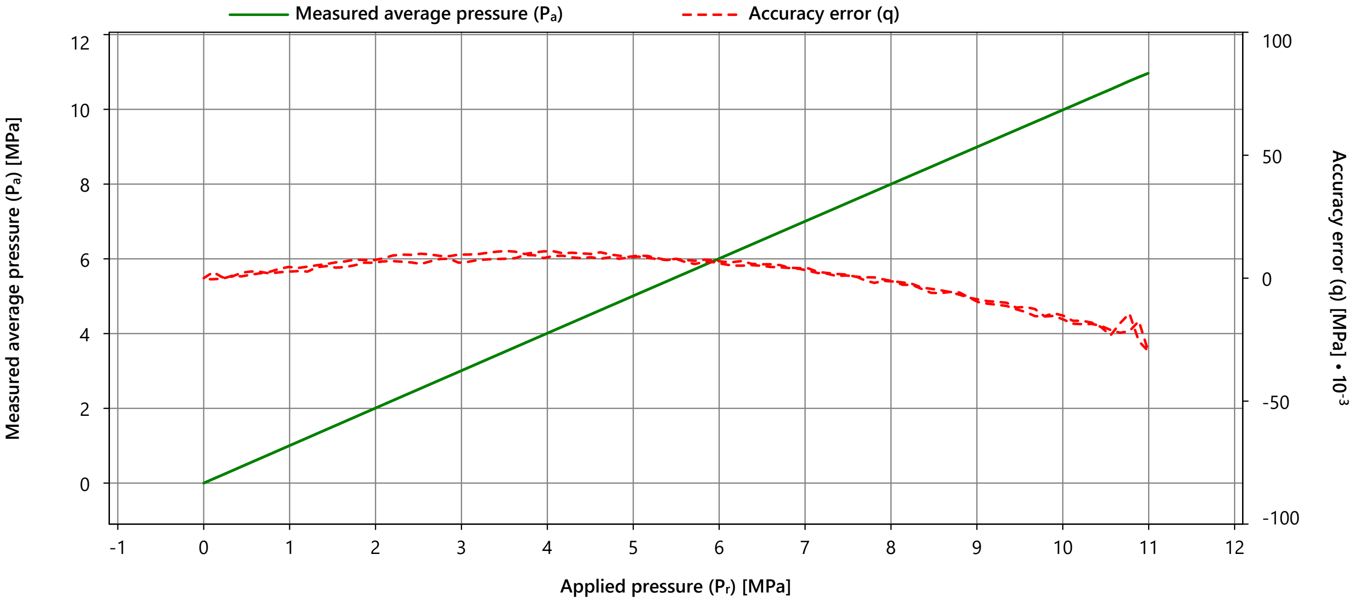
Calibration Details	
Calibration Date	25 Sep 2024 09:00:09
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.4.2.56595

CALIBRATION
RvA K 167

Certificate Number
FCN24035099

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-8/100bar (8467.8)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 15 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.017
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.003
Zero load error (P_{c0})	[MPa]	0.000
Zero load offset (P_0)	[MPa]	0.022
Resolution	[MPa]	$2.3 \cdot 10^{-6}$
Noise RMS	[MPa]	0.000



Applied pressure (P_r) [MPa]	Measured pressure 1 ($P_{a,1}$) [MPa]	Measured pressure 2 ($P_{a,2}$) [MPa]	Measured pressure 3 ($P_{a,3}$) [MPa]	Measured average pressure (P_a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.002
2.000	2.007	2.004	2.007	2.006	0.006	0.003	0.001	0.006
4.000	4.009	4.009	4.007	4.008	0.008	0.002	0.003	0.006
6.000	6.005	6.006	6.008	6.006	0.006	0.003	0.001	0.006
8.000	7.998	7.999	8.000	7.999	-0.001	0.001	0.000	0.004
10.000	9.983	9.982	9.984	9.983	-0.017	0.002		0.005
8.000	7.999	7.999	7.998	7.999	-0.001	0.001	0.000	0.004
6.000	6.008	6.007	6.006	6.007	0.007	0.002	0.001	0.004
4.000	4.011	4.011	4.012	4.011	0.011	0.001	0.003	0.005
2.000	2.007	2.008	2.007	2.007	0.007	0.001	0.001	0.003
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.002

Symbols, Definitions and References

CALIBRATION
RvA K 167

Certificate Number
FCN24035099

Symbols and Definitions (general)	
b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F or P, as appropriate)	
Q_0	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
$Q_{a,x}$	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_r	Applied reference quantity value.

Quantities	
F	Force
P	Pressure

References

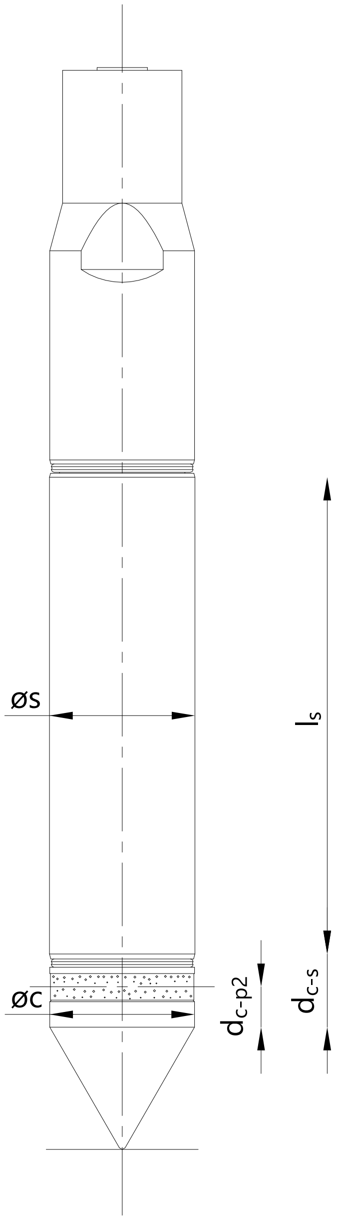
International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test.* Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration.* European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

Typical Dimensions

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1M1-V1
Serial Number	1706-2445

Appendix Applicable to Certificate Number FCN24035099



Typical Dimensions		
A_c	Cross-sectional projected area of the cone	0.001 m^2
A_s	Surface area of the friction sleeve	0.015 m^2
af	Cone net area ratio	0.75
bf	Friction sleeve net area ratio	0
øc	Diameter of the cylindrical part of the cone	35.8 mm
øs	Diameter of the friction sleeve	36.1 mm
l_s	Length of the friction sleeve	132.7 mm
d_{c-s}	Cone - friction sleeve distance	13.5 mm
d_{c-p2}	Cone - pore 2 distance	5 mm

Diagram is not to scale

Cone Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1 M1-V1
Serial Number	1706-2445
Electronics	6880
Node Type	7001
Hardware Version	4.00
Software Version	8.01

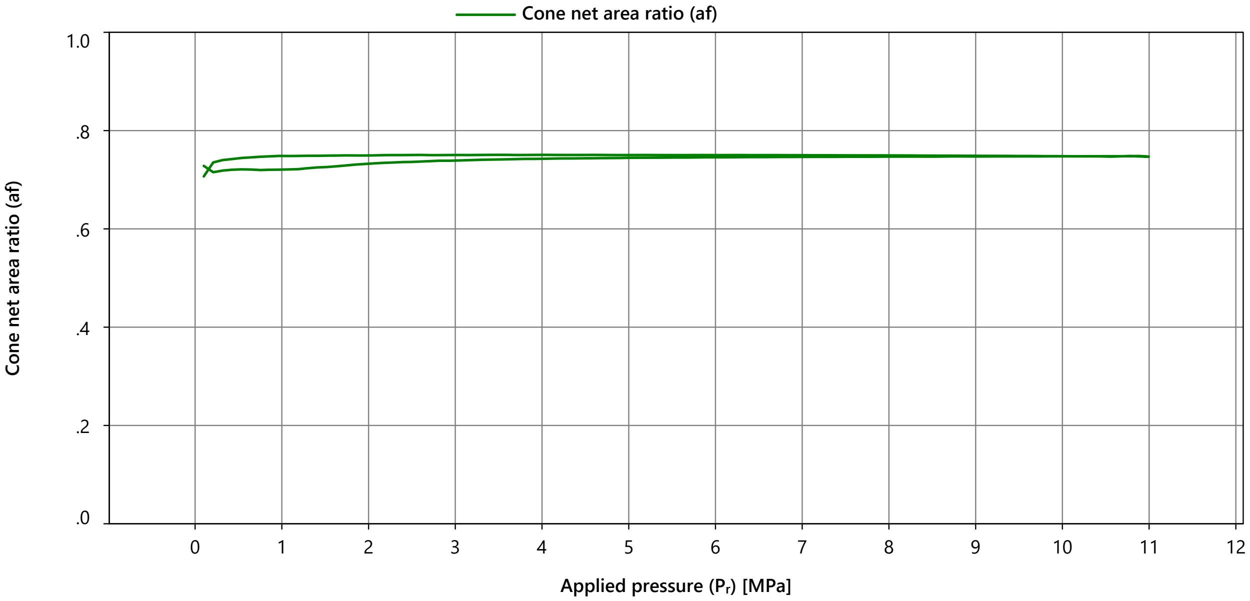
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	$0.00022 \cdot P_r + 0.0013$ [MPa]

Measurement Details	
Measurement Date	25 Sep 2024 09:00:09
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.4.2.56595

Appendix Applicable to Certificate Number FCN24035099

Characteristics	**Unit**	**Value**
Cone net area ratio (af)	[-]	0.75

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P_r) [MPa]	**Measured cone net area ratio 1 (af,1)**	**Measured cone net area ratio 2 (af,2)**	**Measured cone net area ratio 3 (af,3)**	**Measured average cone net area ratio (af)**
2.000	0.733	0.732	0.733	0.732
4.000	0.743	0.743	0.742	0.743
6.000	0.746	0.746	0.746	0.746
8.000	0.747	0.747	0.747	0.747
10.000	0.748	0.748	0.748	0.748
8.000	0.749	0.750	0.749	0.749
6.000	0.750	0.750	0.750	0.750
4.000	0.751	0.751	0.751	0.751
2.000	0.749	0.749	0.749	0.749

Friction Sleeve Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1 M1-V1
Serial Number	1706-2445
Electronics	6880
Node Type	7001
Hardware Version	4.00
Software Version	8.01

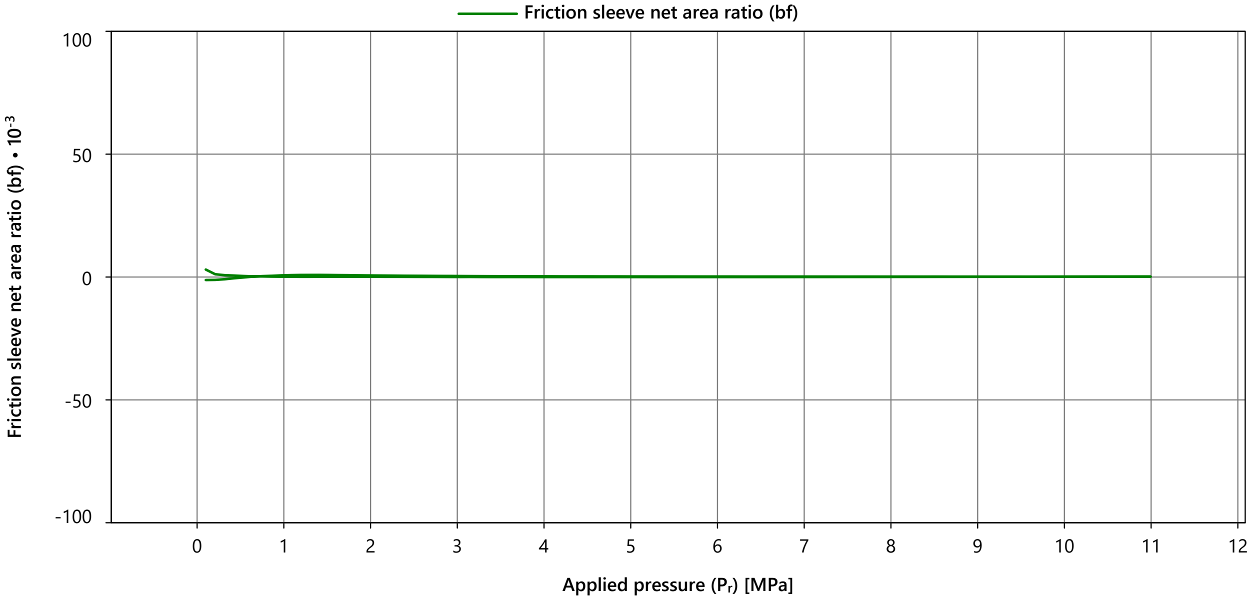
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.00022 · P_r + 0.0013 [MPa]

Measurement Details	
Measurement Date	25 Sep 2024 09:00:09
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.4.2.56595

Appendix Applicable to Certificate Number FCN24035099

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00016

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P_r) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.001	0.001	0.001	0.001
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to Certificate Number FCN24035099

Symbols and Definitions (general)	
af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)	
Qw	Applied reference quantity value.

Quantities	
P	Pressure

Calibration Certificate

Certificate Number
FCN24035897

Applicant	**Fugro Netherlands Marine B.V.**
	Prismastraat 4 2631 RT, Nootdorp The Netherlands

Instrument	**Cone Penetrometer**		
Manufacturer	Fugro		
Type	CP5-CF50PB17-P1E1M2-V1		
Serial Number	1709-0513	Electronics	7776
Node Type	7001	Hardware Version	5.01
Software Version	8.01		

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions	
Ambient air temperature during calibration	20.5 ± 3 °C
Temperature change during calibration	< 1 °C
Atmospheric pressure during calibration	1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 2 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability The measurements have been executed using standards for which the traceability to (inter)national standards has been demonstrated towards the RvA (Raad voor Accreditatie).

Calibration date 02-Dec-2024

Calibrate before 02-Jun-2025

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 50 kN	0 to 80 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 50 kN	0 to 80 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Kulite XTM – 190M – 170BARSG	0 to 17 MPa	0 to 21 MPa	EUAF-FNLM- CAL-PR-004

Nootdorp, 03-Dec-2024

Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP5-CF50PB17-P1E1M 2-V1
Serial Number	1709-0513
Electronics	7776
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	$0.0025 \cdot F_r + 0.011$ [kN]

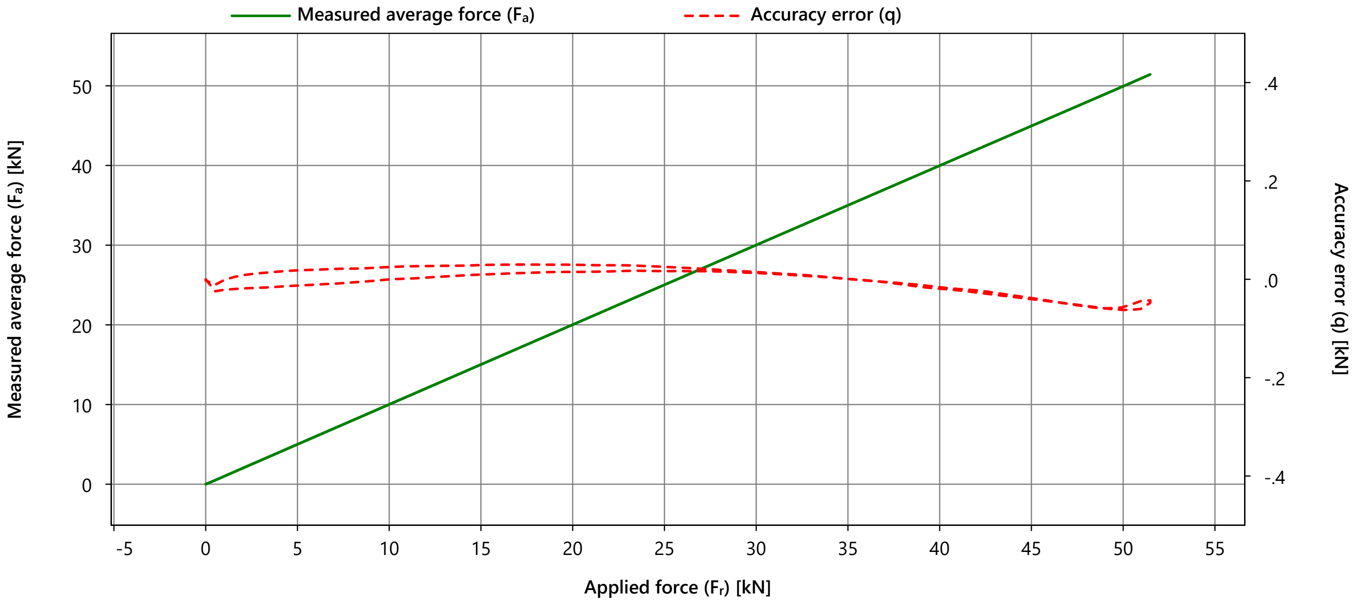
CALIBRATION
RvA K 167

Calibration Details	
Calibration Date	02 Dec 2024 06:42:22
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.4.2.56595

Certificate Number
FCN24035897

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 50 kN
Maximum Rating	0 to 80 kN

Characteristics	**Unit**	**Value**
Max accuracy error (q)	[kN]	0.056
Max repeatability error (b)	[kN]	0.003
Max reversibility error (v)	[kN]	0.025
Zero load error (F_{c0})	[kN]	0.002
Zero load offset (F_0)	[kN]	0.007
Resolution	[kN]	$1.84 \cdot 10^{-5}$
Noise RMS	[kN]	0.000



Applied force (F_r) [kN]	Measured force 1 ($F_{a,1}$) [kN]	Measured force 2 ($F_{a,2}$) [kN]	Measured force 3 ($F_{a,3}$) [kN]	Measured average force (F_a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.000	0.000	0.000	0.000	0.000	0.001		0.016
10.000	10.000	10.001	9.999	10.000	0.000	0.002	0.025	0.051
20.000	20.014	20.015	20.016	20.015	0.015	0.002	0.015	0.066
30.000	30.013	30.013	30.013	30.013	0.013	0.000	0.002	0.091
40.000	39.983	39.984	39.984	39.984	-0.016	0.001	-0.003	0.116
50.000	49.945	49.944	49.942	49.944	-0.056	0.003		0.141
40.000	39.981	39.981	39.980	39.981	-0.019	0.001	-0.003	0.116
30.000	30.015	30.015	30.015	30.015	0.015	0.001	0.002	0.091
20.000	20.030	20.029	20.030	20.030	0.030	0.001	0.015	0.066
10.000	10.026	10.025	10.024	10.025	0.025	0.003	0.025	0.051
0.000	-0.002	-0.002	-0.003	-0.002	-0.002	0.001		0.016

Cone+Fric. Calibration Result [Force]

Instrument

Manufacturer	Fugro
Type	CP5-CF50PB17-P1E1M 2-V1
Serial Number	1709-0513
Electronics	7776
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference

Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	$0.0025 \cdot F_r + 0.011$ [kN]

Calibration Details

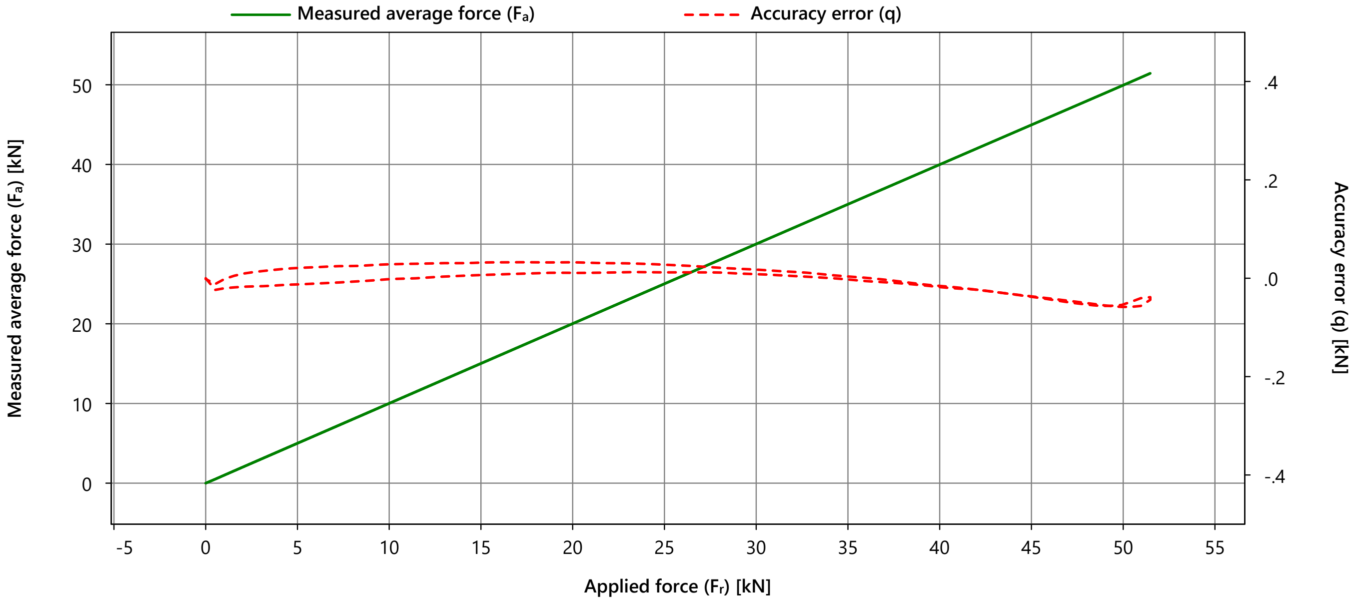
Calibration Date	02 Dec 2024 06:42:22
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.4.2.56595

Certificate Number
FCN24035897

Sensor

Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 50 kN
Maximum Rating	0 to 80 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.053
Max repeatability error (b)	[kN]	0.003
Max reversibility error (v)	[kN]	0.030
Zero load error (F_{c0})	[kN]	0.002
Zero load offset (F_0)	[kN]	-0.003
Resolution	[kN]	$2.56 \cdot 10^{-5}$
Noise RMS	[kN]	0.000
Tip-Sleeve Interaction %	[%]	0.007



Applied force (F_r) [kN]	Measured force 1 ($F_{a,1}$) [kN]	Measured force 2 ($F_{a,2}$) [kN]	Measured force 3 ($F_{a,3}$) [kN]	Measured average force (F_a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.016
10.000	9.998	9.999	9.997	9.998	-0.002	0.002	0.030	0.059
20.000	20.010	20.011	20.012	20.011	0.011	0.003	0.021	0.068
30.000	30.008	30.008	30.009	30.008	0.008	0.001	0.009	0.091
40.000	39.981	39.982	39.983	39.982	-0.018	0.001	0.002	0.116
50.000	49.947	49.947	49.946	49.947	-0.053	0.002		0.141
40.000	39.984	39.985	39.984	39.984	-0.016	0.000	0.002	0.116
30.000	30.017	30.017	30.018	30.018	0.018	0.001	0.009	0.091
20.000	20.032	20.032	20.033	20.032	0.032	0.001	0.021	0.067
10.000	10.030	10.028	10.027	10.028	0.028	0.002	0.030	0.059
0.000	-0.002	-0.002	-0.001	-0.002	-0.002	0.001		0.016

Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP5-CF50PB17-P1E1M 2-V1
Serial Number	1709-0513
Electronics	7776
Node Type	7001
Hardware Version	5.01
Software Version	8.01

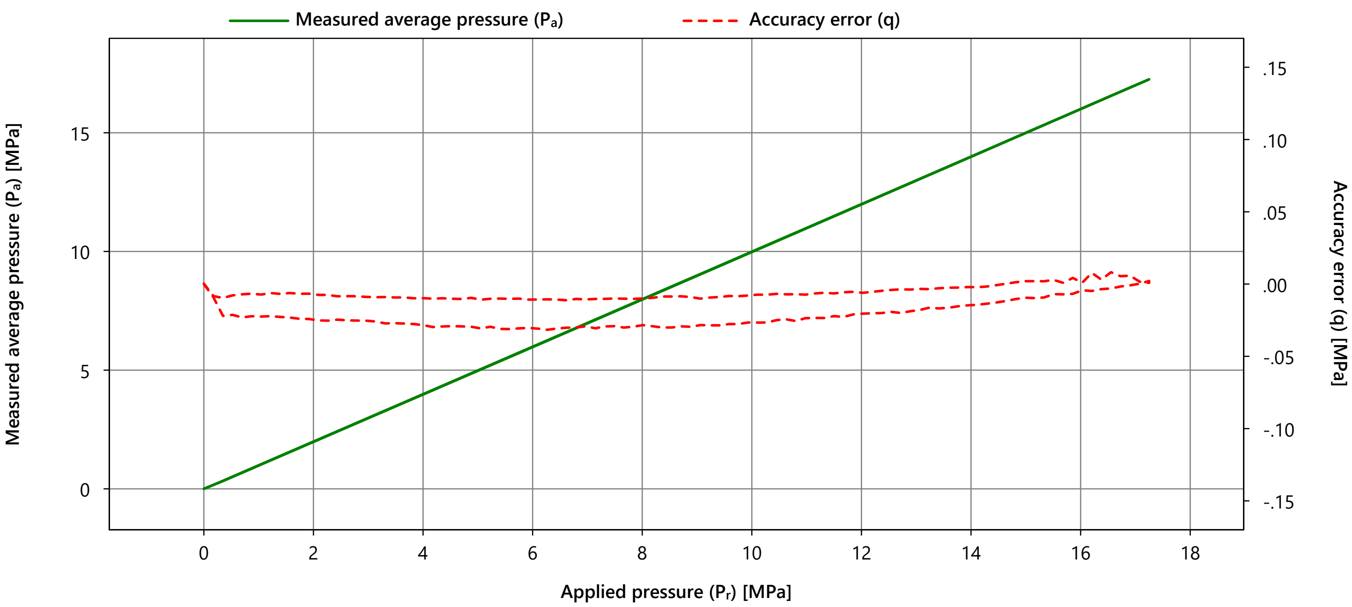
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005 · P_r + 0.0033 [MPa]

Calibration Details	
Calibration Date	02 Dec 2024 08:58:31
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.4.2.56595

Certificate Number
FCN24035897

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Kulite XTM – 190M – 170BARSG
Calibrated Range	0 to 17 MPa
Maximum Rating	0 to 21 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.030
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.020
Zero load error (P_{c0})	[MPa]	0.000
Zero load offset (P_0)	[MPa]	0.159
Resolution	[MPa]	$9.02 \cdot 10^{-6}$
Noise RMS	[MPa]	0.000



Applied pressure (P_r) [MPa]	Measured pressure 1 ($P_{a,1}$) [MPa]	Measured pressure 2 ($P_{a,2}$) [MPa]	Measured pressure 3 ($P_{a,3}$) [MPa]	Measured average pressure (P_a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.001		0.004
3.400	3.371	3.373	3.373	3.372	-0.028	0.002	0.019	0.050
6.800	6.769	6.771	6.770	6.770	-0.030	0.002	0.020	0.054
10.200	10.171	10.174	10.173	10.173	-0.027	0.003	0.020	0.056
13.600	13.585	13.583	13.583	13.584	-0.016	0.002	0.014	0.027
17.000	17.000	17.001	16.998	17.000	0.000	0.003		0.013
13.600	13.597	13.597	13.598	13.597	-0.003	0.001	0.014	0.027
10.200	10.193	10.192	10.193	10.193	-0.007	0.001	0.020	0.056
6.800	6.791	6.790	6.789	6.790	-0.010	0.002	0.020	0.054
3.400	3.391	3.390	3.392	3.391	-0.009	0.002	0.019	0.050
0.000	0.000	0.000	0.001	0.000	0.000	0.001		0.004

Symbols, Definitions and References

CALIBRATION
RvA K 167

Certificate Number
FCN24035897

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F or P, as appropriate)

Q_0	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
$Q_{a,x}$	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_r	Applied reference quantity value.

Quantities

F	Force
P	Pressure

References

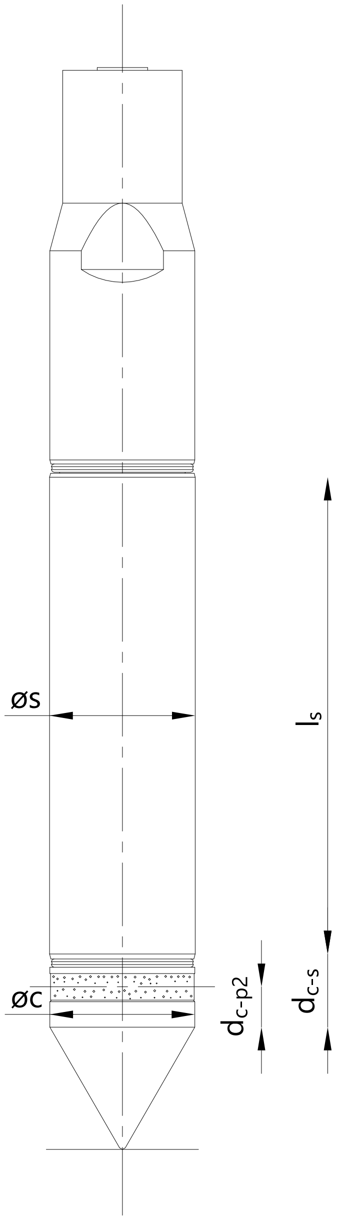
International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test.* Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration.* European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

Typical Dimensions

Instrument	
Manufacturer	Fugro
Type	CP5-CF50PB17-P1E1M2-V1
Serial Number	1709-0513

Appendix Applicable to Certificate Number FCN24035897



Typical Dimensions		
A_c	Cross-sectional projected area of the cone	0.0005 m^2
A_s	Surface area of the friction sleeve	0.0075 m^2
af	Cone net area ratio	0.5
bf	Friction sleeve net area ratio	0.01669
øc	Diameter of the cylindrical part of the cone	25.3 mm
øs	Diameter of the friction sleeve	25.6 mm
l_s	Length of the friction sleeve	93.6 mm
d_{c-s}	Cone - friction sleeve distance	10 mm
d_{c-p2}	Cone - pore 2 distance	4 mm

Diagram is not to scale

Cone Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP5-CF50PB17-P1E1M 2-V1
Serial Number	1709-0513
Electronics	7776
Node Type	7001
Hardware Version	5.01
Software Version	8.01

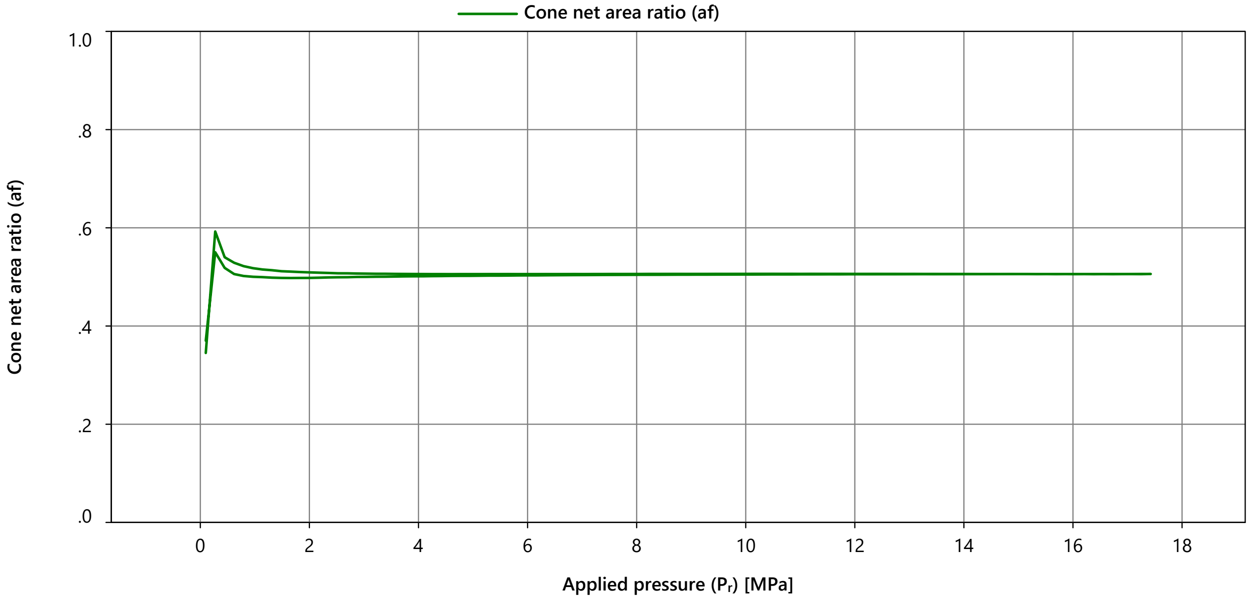
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	$0.0005 \cdot P_r + 0.0033$ [MPa]

Measurement Details	
Measurement Date	02 Dec 2024 08:58:31
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.4.2.56595

Appendix Applicable to Certificate Number FCN24035897

Characteristics	**Unit**	**Value**
Cone net area ratio (af)	[-]	0.51

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P_r) **[MPa]**	**Measured cone net area ratio 1 (af,1)**	**Measured cone net area ratio 2 (af,2)**	**Measured cone net area ratio 3 (af,3)**	**Measured average cone net area ratio (af)**
3.400	0.500	0.501	0.501	0.500
6.800	0.503	0.504	0.504	0.504
10.200	0.505	0.505	0.505	0.505
13.600	0.506	0.506	0.506	0.506
17.000	0.506	0.506	0.506	0.506
13.600	0.506	0.506	0.506	0.506
10.200	0.506	0.506	0.506	0.506
6.800	0.506	0.506	0.506	0.506
3.400	0.506	0.506	0.507	0.506

Friction Sleeve Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP5-CF50PB17-P1E1M 2-V1
Serial Number	1709-0513
Electronics	7776
Node Type	7001
Hardware Version	5.01
Software Version	8.01

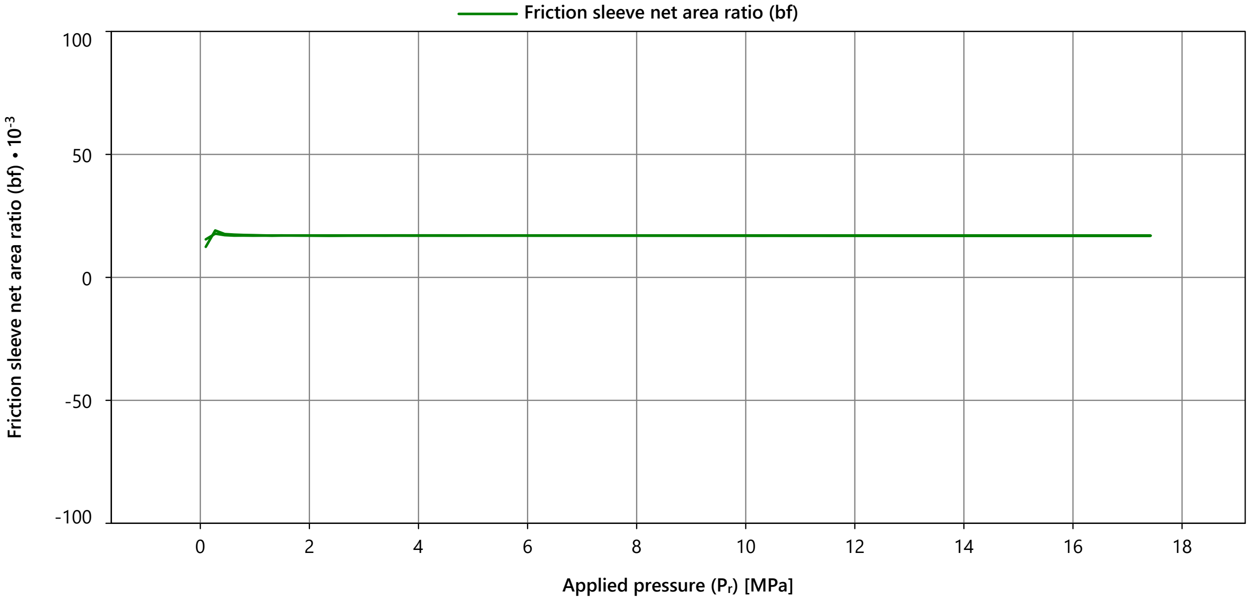
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005 · P_r + 0.0033 [MPa]

Measurement Details	
Measurement Date	02 Dec 2024 08:58:31
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.4.2.56595

Appendix Applicable to Certificate Number FCN24035897

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.01696

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P_r) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
3.400	0.017	0.017	0.017	0.017
6.800	0.017	0.017	0.017	0.017
10.200	0.017	0.017	0.017	0.017
13.600	0.017	0.017	0.017	0.017
17.000	0.017	0.017	0.017	0.017
13.600	0.017	0.017	0.017	0.017
10.200	0.017	0.017	0.017	0.017
6.800	0.017	0.017	0.017	0.017
3.400	0.017	0.017	0.017	0.017

Symbols and Definitions

Appendix Applicable to Certificate Number FCN24035897

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Qw	Applied reference quantity value.

Quantities

P	Pressure

Calibration Certificate

Applicant	**Fugro Netherlands Marine B.V.**
	Prismastraat 4 2631 RT, Nootdorp The Netherlands

CALIBRATION
RvA K 167

Certificate Number
FCN24034904

Instrument	**Cone Penetrometer**		
Manufacturer	Fugro		
Type	CP10-CF80PB10-P1E1M1-V1		
Serial Number	1706-2622	Electronics	7249
Node Type	7001	Hardware Version	5.01
Software Version	8.01		

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions	
Ambient air temperature during calibration	20.5 ± 3 °C
Temperature change during calibration	< ±1 °C
Atmospheric pressure during calibration	1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 2 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability The measurements have been executed using standards for which the traceability to (inter)national standards has been demonstrated towards the RvA (Raad voor Accreditatie).

Calibration period 16-Sep-2024 through 17-Sep-2024

Calibrate before 16-Mar-2025

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 80 kN	0 to 100 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 80 kN	0 to 100 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-8/100bar (8467.8)	0 to 10 MPa	0 to 15 MPa	EUAF-FNLM- CAL-PR-004

	Before adjustment		After adjustment		Drift	
Calibrated Sensor	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	25.2 µV/V/kN	4.83 µV/V	25.2 µV/V/kN	19.8 µV/V	0.32 %	0.74 %
Cone+Fric. [Force]	25.2 µV/V/kN	4.33 µV/V	25.1 µV/V/kN	19.1 µV/V	-0.50 %	0.74 %
Pore 2 [Pressure]	3.00 mV/V/MPa	1.01 mV/V	2.99 mV/V/MPa	1.06 mV/V	-0.07 %	0.16 %

Nootdorp, 18-Sep-2024

Ruud Schrijvers
Deputy Manager Transducer Workshop

Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1 M1-V1
Serial Number	1706-2622
Electronics	7249
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	$0.0025 \cdot F_r + 0.011$ [kN]

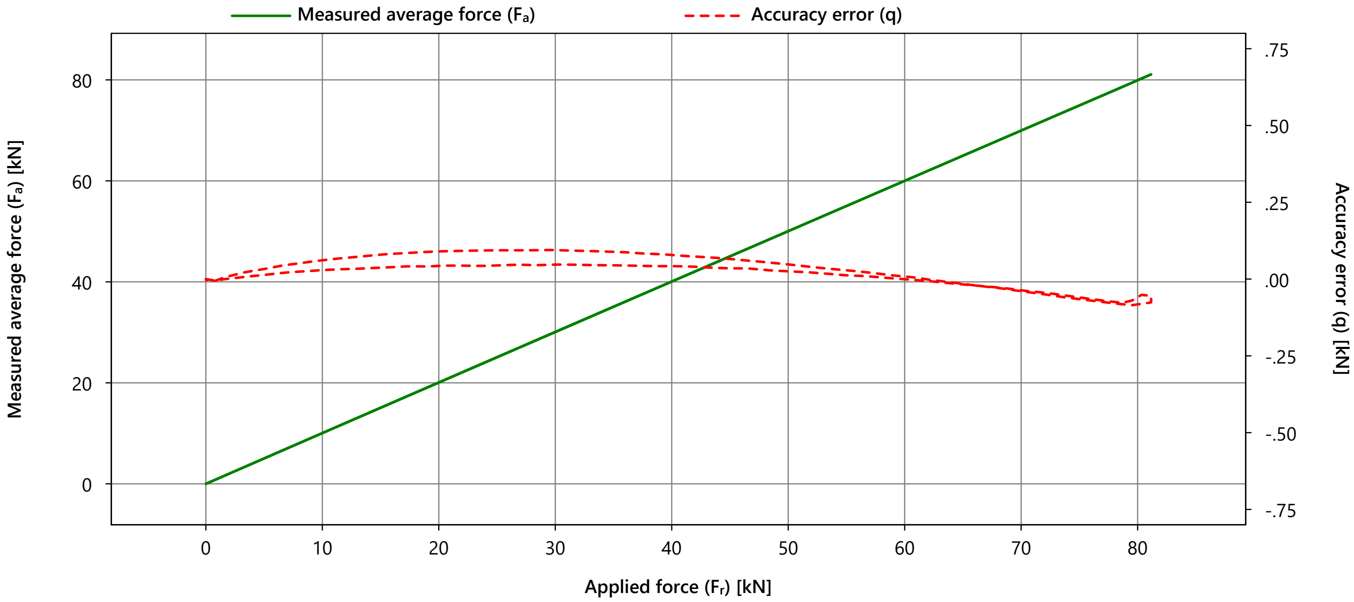
Calibration Details	
Calibration Date	16 Sep 2024 10:17:53
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.4.0.56586

CALIBRATION
RvA K 167

Certificate Number
FCN24034904

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 80 kN
Maximum Rating	0 to 100 kN

Characteristics	**Unit**	**Value**
Max accuracy error (q)	[kN]	0.092
Max repeatability error (b)	[kN]	0.037
Max reversibility error (v)	[kN]	0.046
Zero load error (F_{c0})	[kN]	0.003
Zero load offset (F_0)	[kN]	-0.005
Resolution	[kN]	$3.69 \cdot 10^{-5}$
Noise RMS	[kN]	0.001



Applied force (F_r) [kN]	Measured force 1 ($F_{a,1}$) [kN]	Measured force 2 ($F_{a,2}$) [kN]	Measured force 3 ($F_{a,3}$) [kN]	Measured average force (F_a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.008	0.001	-0.009	0.000	0.000	0.017		0.038
16.000	16.056	16.037	16.024	16.039	0.039	0.032	0.044	0.092
32.000	32.064	32.045	32.030	32.047	0.047	0.034	0.046	0.117
48.000	48.048	48.027	48.013	48.030	0.030	0.035	0.026	0.144
64.000	64.004	63.988	63.967	63.986	-0.014	0.037	0.003	0.181
80.000	79.957	79.942	79.925	79.941	-0.059	0.032		0.220
64.000	64.006	63.986	63.977	63.989	-0.011	0.029	0.003	0.179
48.000	48.068	48.050	48.047	48.055	0.055	0.021	0.026	0.140
32.000	32.101	32.088	32.087	32.092	0.092	0.014	0.046	0.111
16.000	16.093	16.077	16.076	16.082	0.082	0.017	0.044	0.086
0.000	0.001	-0.007	-0.002	-0.003	-0.003	0.007		0.016

Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1 M1-V1
Serial Number	1706-2622
Electronics	7249
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	$0.0025 \cdot F_r + 0.011$ [kN]

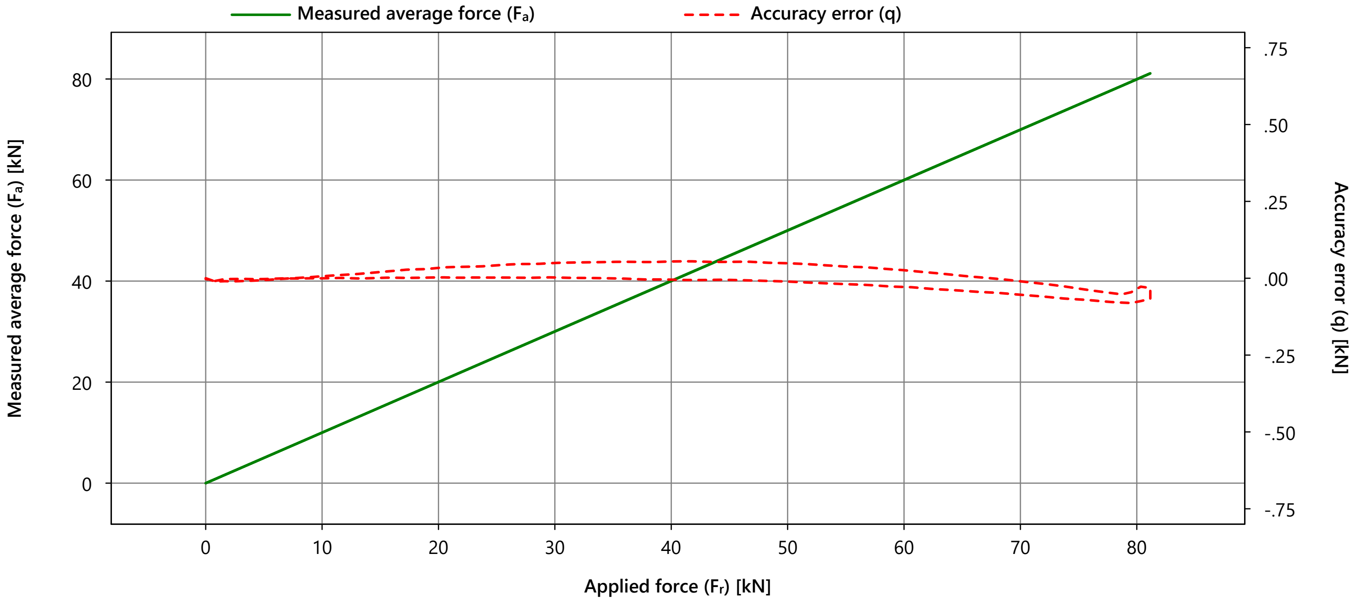
CALIBRATION
RvA K 167

Calibration Details	
Calibration Date	16 Sep 2024 10:17:53
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.4.0.56586

Certificate Number
FCN24034904

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 80 kN
Maximum Rating	0 to 100 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.051
Max repeatability error (b)	[kN]	0.036
Max reversibility error (v)	[kN]	0.060
Zero load error (F_{c0})	[kN]	0.003
Zero load offset (F_0)	[kN]	0.011
Resolution	[kN]	$3.71 \cdot 10^{-5}$
Noise RMS	[kN]	0.002
Tip-Sleeve Interaction %	[%]	0.062



Applied force (F_r) [kN]	Measured force 1 ($F_{a,1}$) [kN]	Measured force 2 ($F_{a,2}$) [kN]	Measured force 3 ($F_{a,3}$) [kN]	Measured average force (F_a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.012	0.001	-0.013	0.000	0.000	0.025		0.072
16.000	16.010	16.029	16.031	16.023	0.023	0.022	-0.022	0.064
32.000	32.037	32.058	32.059	32.051	0.051	0.022	-0.050	0.117
48.000	48.038	48.056	48.059	48.051	0.051	0.021	-0.060	0.155
64.000	63.997	64.020	64.019	64.012	0.012	0.022	-0.050	0.187
80.000	79.948	79.973	79.974	79.965	-0.035	0.026		0.219
64.000	63.948	63.958	63.979	63.962	-0.038	0.030	-0.050	0.189
48.000	47.977	47.984	48.013	47.992	-0.008	0.036	-0.060	0.159
32.000	31.988	31.995	32.020	32.001	0.001	0.031	-0.050	0.120
16.000	15.993	15.998	16.015	16.002	0.002	0.022	-0.022	0.065
0.000	0.000	-0.010	0.002	-0.003	-0.003	0.011		0.022

Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1 M1-V1
Serial Number	1706-2622
Electronics	7249
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	$0.00022 \cdot P_r + 0.0013$ [MPa]

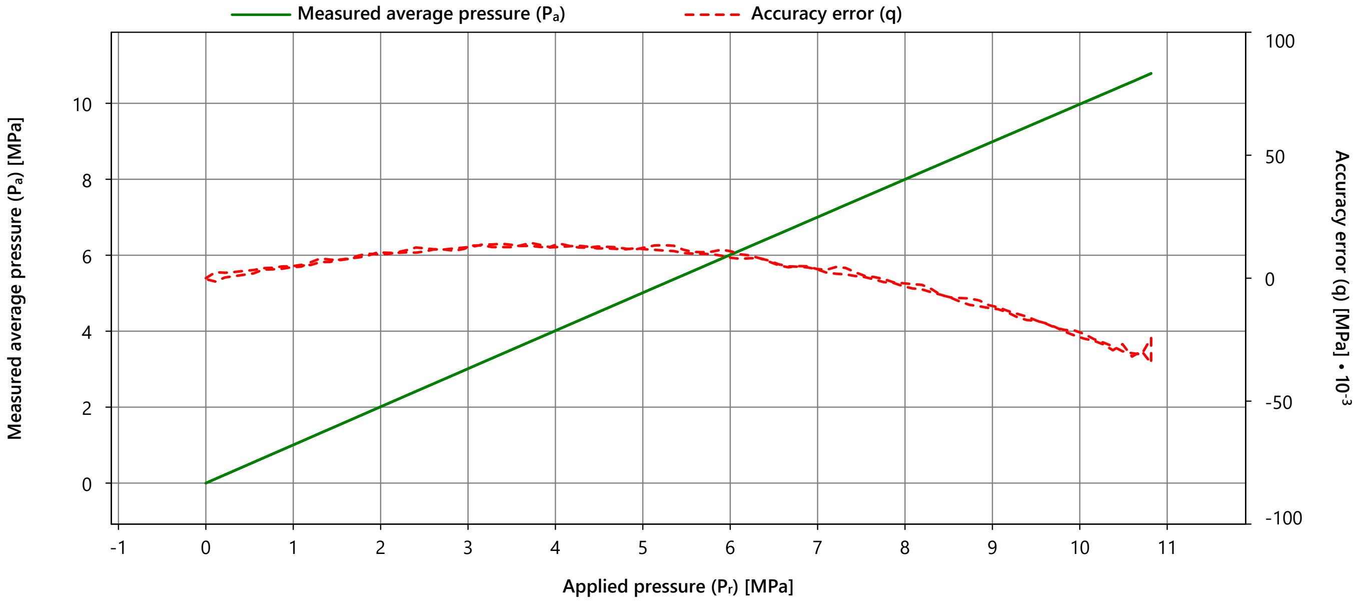
CALIBRATION
RvA K 167

Certificate Number
FCN24034904

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-8/100bar (8467.8)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 15 MPa

Calibration Details	
Calibration Date	17 Sep 2024 05:42:02
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.4.0.56586

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.022
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.003
Zero load error (P_{c0})	[MPa]	0.000
Zero load offset (P_0)	[MPa]	0.002
Resolution	[MPa]	$2.49 \cdot 10^{-6}$
Noise RMS	[MPa]	0.000



Applied pressure (P_r) [MPa]	Measured pressure 1 ($P_{a,1}$) [MPa]	Measured pressure 2 ($P_{a,2}$) [MPa]	Measured pressure 3 ($P_{a,3}$) [MPa]	Measured average pressure (P_a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.002
2.000	2.012	2.011	2.009	2.011	0.011	0.003	-0.001	0.006
4.000	4.013	4.013	4.015	4.014	0.014	0.002	-0.001	0.005
6.000	6.012	6.012	6.010	6.011	0.011	0.001	-0.003	0.006
8.000	8.000	7.997	7.996	7.998	-0.002	0.003	-0.001	0.007
10.000	9.977	9.979	9.978	9.978	-0.022	0.002		0.005
8.000	7.996	7.996	7.997	7.996	-0.004	0.000	-0.001	0.004
6.000	6.009	6.008	6.008	6.008	0.008	0.001	-0.003	0.006
4.000	4.012	4.012	4.013	4.013	0.013	0.001	-0.001	0.003
2.000	2.011	2.010	2.009	2.010	0.010	0.002	-0.001	0.004
0.000	-0.001	-0.001	0.000	0.000	0.000	0.000		0.002

Symbols, Definitions and References

CALIBRATION
RvA K 167

Certificate Number
FCN24034904

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F or P, as appropriate)

Q_0	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
$Q_{a,x}$	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_r	Applied reference quantity value.

Quantities

F	Force
P	Pressure

References

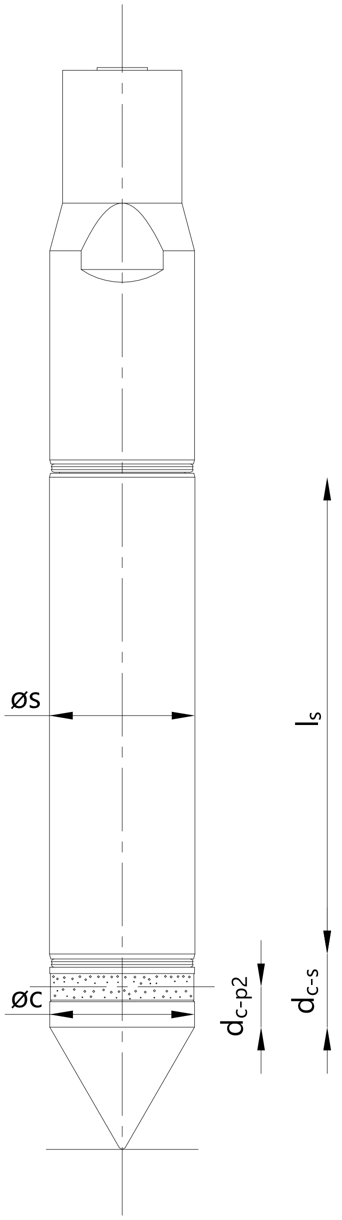
International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test.* Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration.* European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

Typical Dimensions

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1M1-V1
Serial Number	1706-2622

Appendix Applicable to Certificate Number FCN24034904



Typical Dimensions		
A_c	Cross-sectional projected area of the cone	0.001 m^2
A_s	Surface area of the friction sleeve	0.015 m^2
af	Cone net area ratio	0.75
bf	Friction sleeve net area ratio	0
øc	Diameter of the cylindrical part of the cone	35.8 mm
øs	Diameter of the friction sleeve	36.1 mm
l_s	Length of the friction sleeve	132.7 mm
d_{c-s}	Cone - friction sleeve distance	13.5 mm
d_{c-p2}	Cone - pore 2 distance	5 mm

Diagram is not to scale

Cone Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1 M1-V1
Serial Number	1706-2622
Electronics	7249
Node Type	7001
Hardware Version	5.01
Software Version	8.01

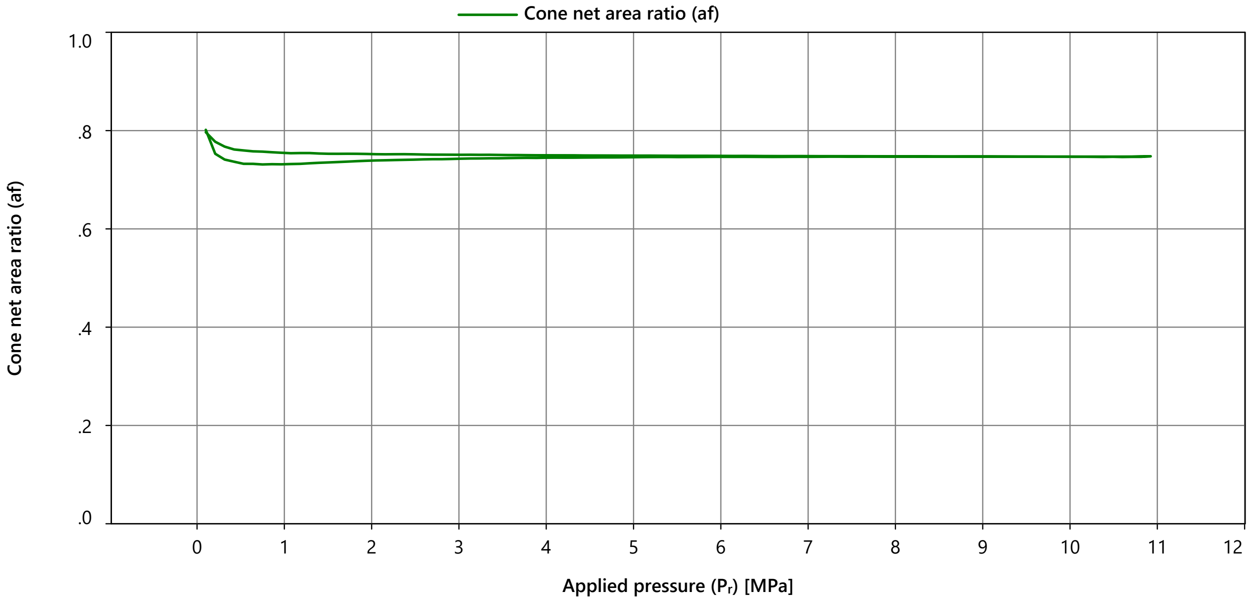
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.00022 · P_r + 0.0013 [MPa]

Measurement Details	
Measurement Date	17 Sep 2024 05:42:02
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.4.0.56586

Appendix Applicable to Certificate Number FCN24034904

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.75

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P_r) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.740	0.739	0.738	0.739
4.000	0.745	0.745	0.745	0.745
6.000	0.747	0.747	0.746	0.747
8.000	0.747	0.747	0.747	0.747
10.000	0.747	0.747	0.747	0.747
8.000	0.748	0.748	0.748	0.748
6.000	0.749	0.748	0.748	0.749
4.000	0.750	0.750	0.749	0.750
2.000	0.753	0.752	0.752	0.752

Friction Sleeve Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP10-CF80PB10-P1E1 M1-V1
Serial Number	1706-2622
Electronics	7249
Node Type	7001
Hardware Version	5.01
Software Version	8.01

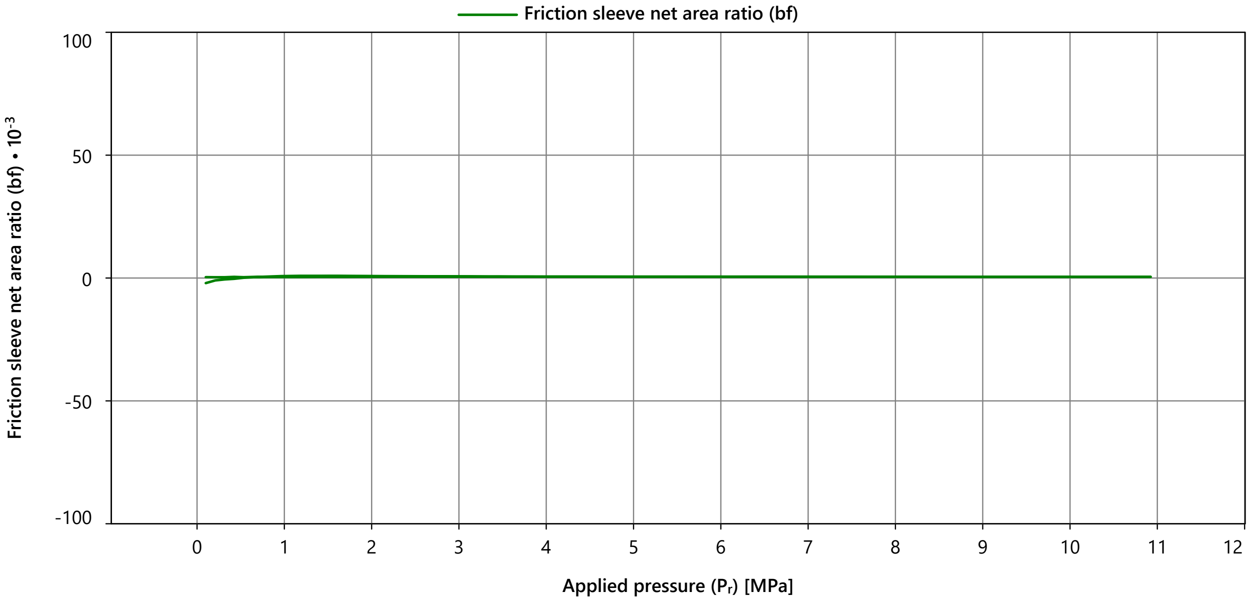
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.00022 · P_r + 0.0013 [MPa]

Measurement Details	
Measurement Date	17 Sep 2024 05:42:02
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.4.0.56586

Appendix Applicable to Certificate Number FCN24034904

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00050

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P_r) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.001	0.001	0.001	0.001
4.000	0.001	0.001	0.001	0.001
6.000	0.000	0.000	0.001	0.000
8.000	0.000	0.000	0.001	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.001	0.001	0.001	0.001
6.000	0.001	0.001	0.001	0.001
4.000	0.001	0.001	0.001	0.001
2.000	0.000	0.001	0.001	0.001

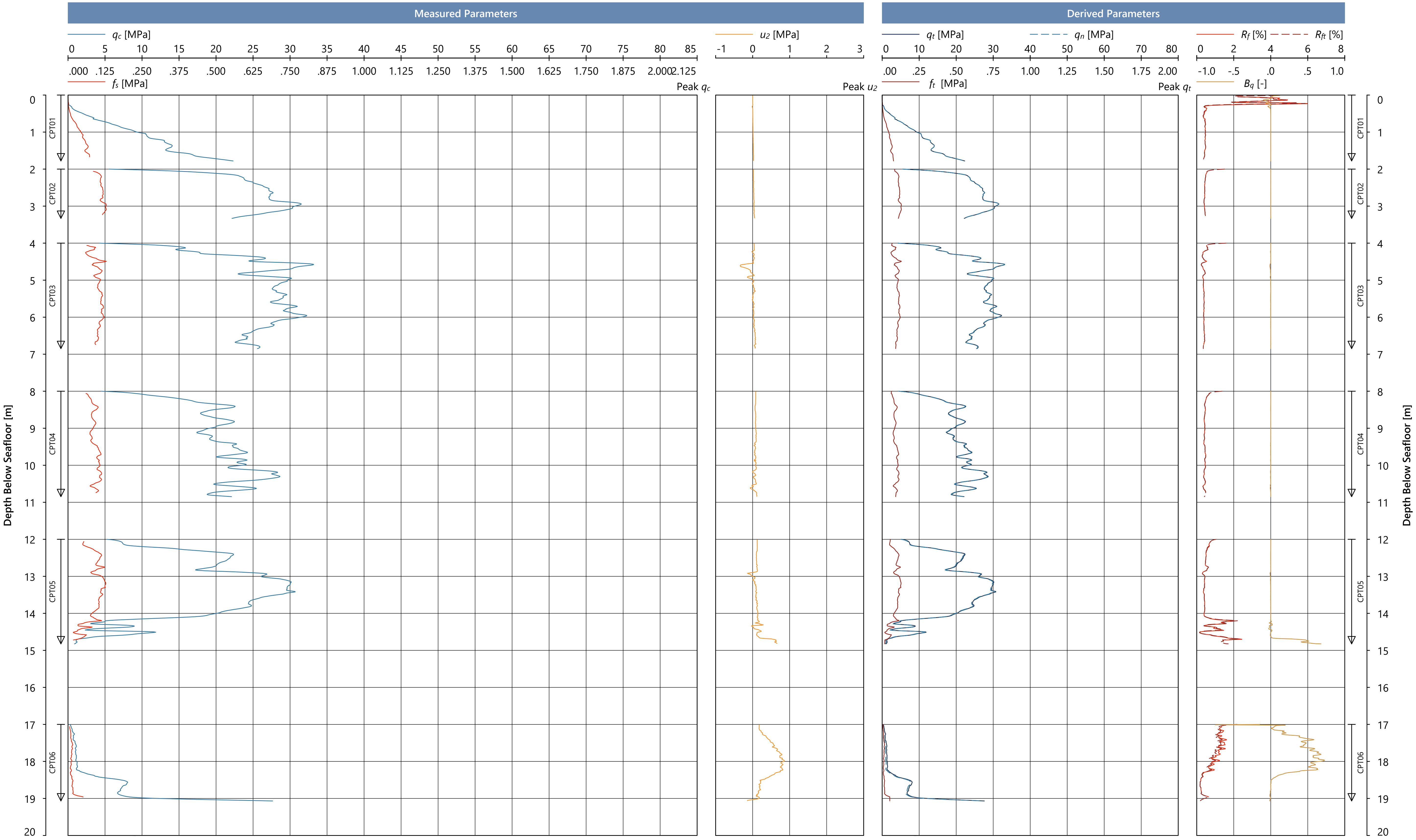
Symbols and Definitions

Appendix Applicable to Certificate Number FCN24034904

Symbols and Definitions (general)	
af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

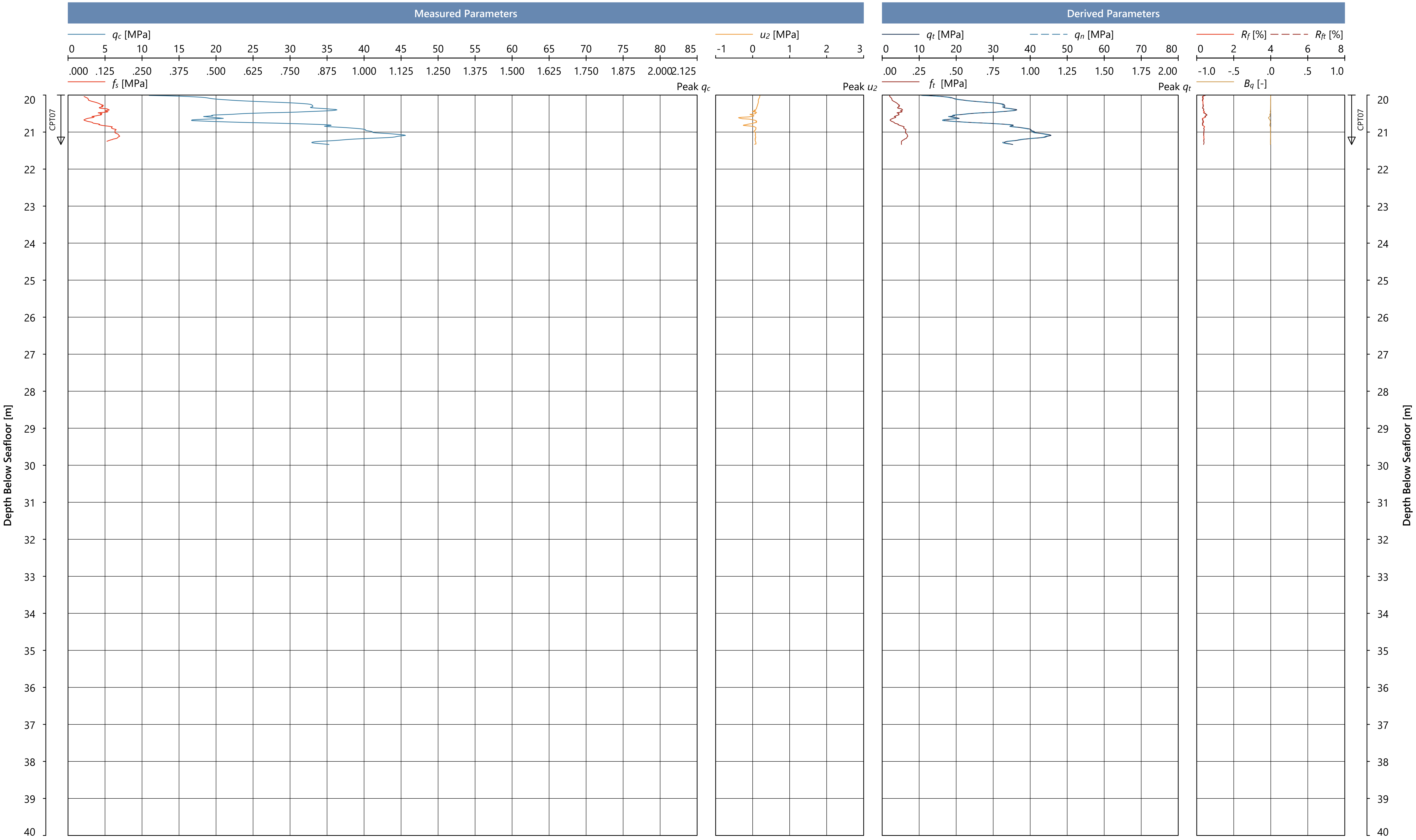
Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)	
Qw	Applied reference quantity value.

Quantities	
P	Pressure



Date of Testing	: 13 January 2025
Location	: Z5_OWF_BH01-COMP
Water Depth [m]	: 92.9
Coordinates [m]	: E 571413.7 N 4751192.8

Cone Penetration Test Results: Measured and Derived Parameters



Date of Testing	: 13 January 2025
Location	: Z5_OWF_BH01-COMP
Water Depth [m]	: 92.9
Coordinates [m]	: E 571413.7 N 4751192.8

Cone Penetration Test Results: Measured and Derived Parameters

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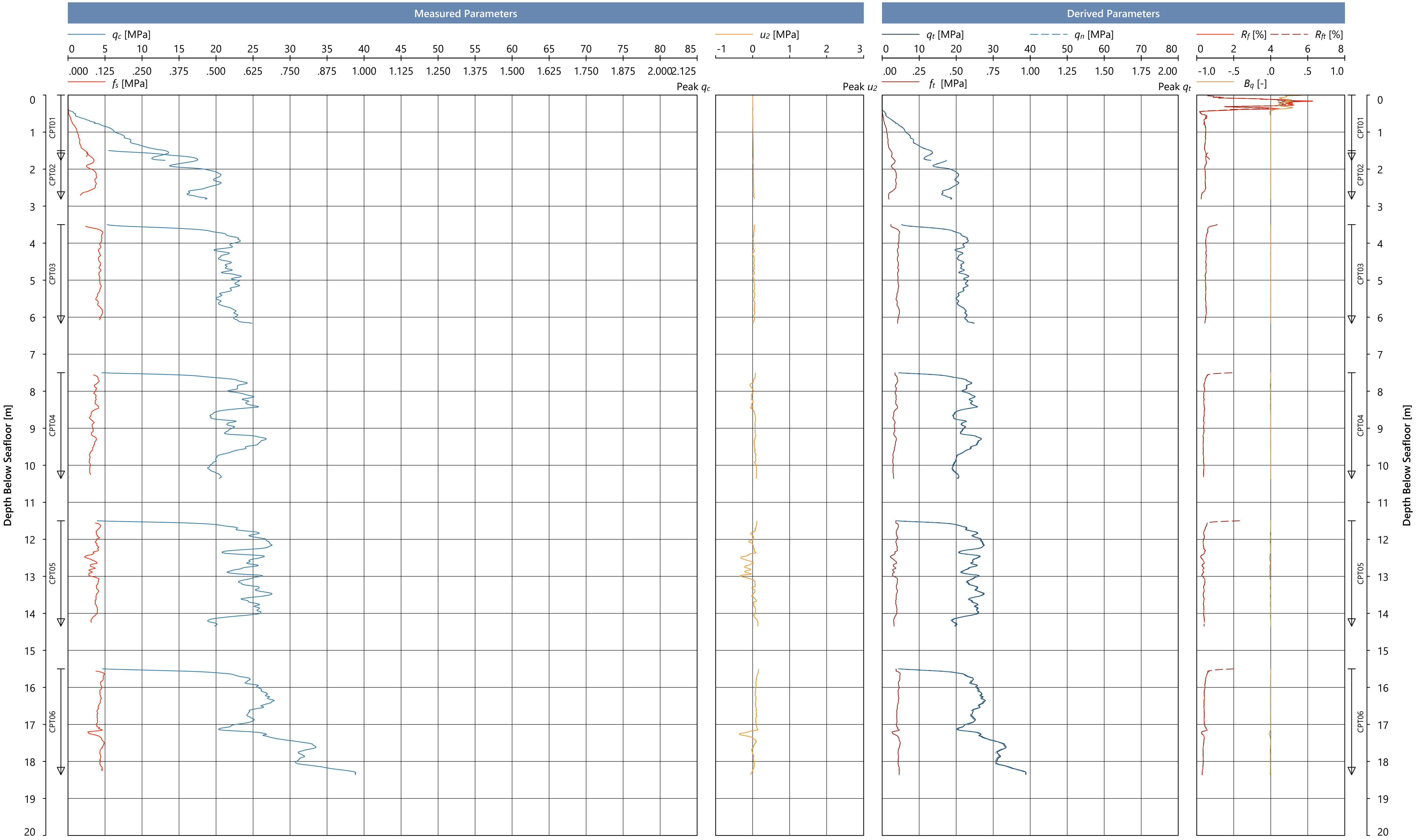
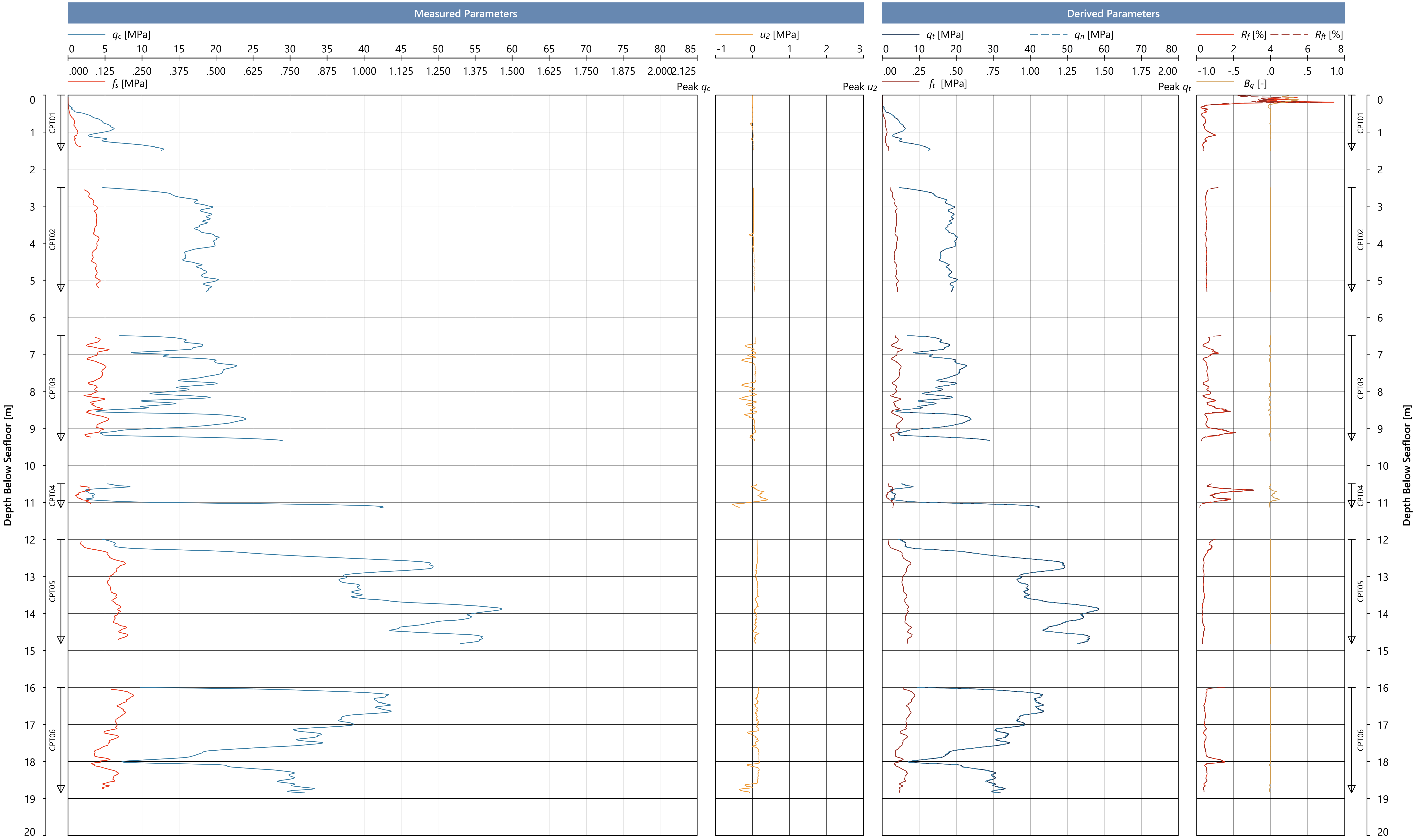


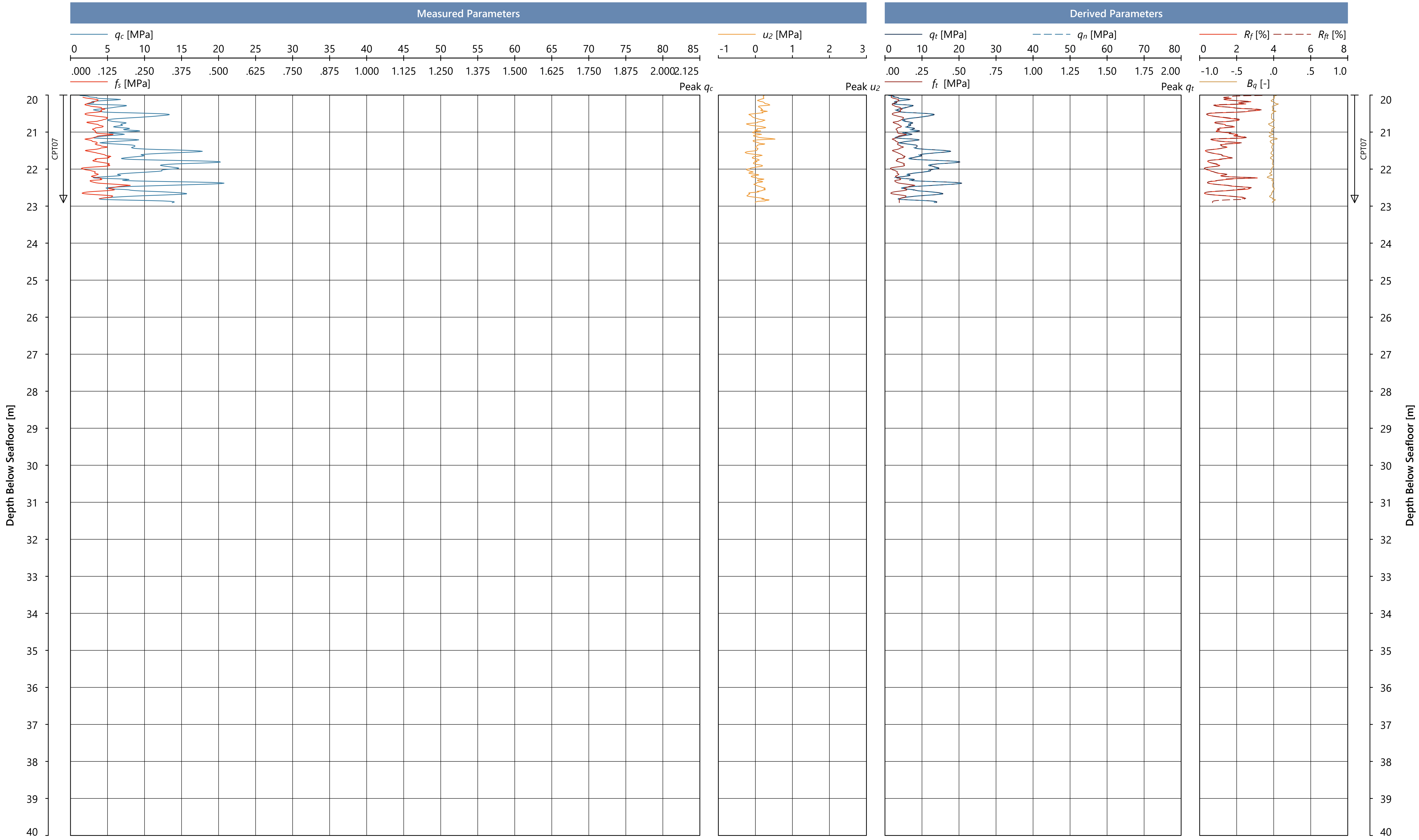
Date of Testing	: 14 January 2025
Location	: Z5_OWF_BH02-COMP
Water Depth [m]	: 93.6
Coordinates [m]	: E 583584.1 N 4757276.9

Cone Penetration Test Results: Measured and Derived Parameters



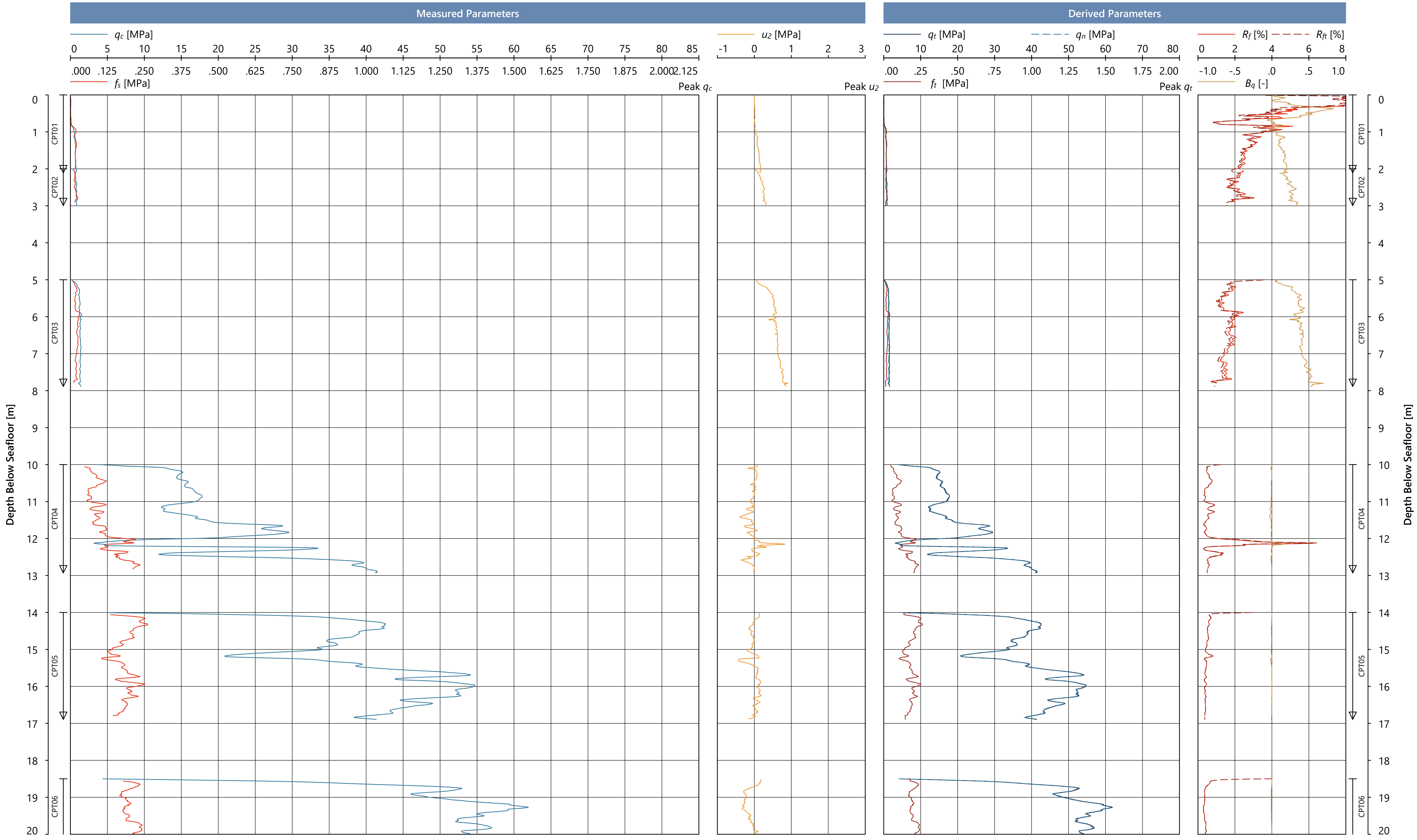
Date of Testing	: 20 January 2025
Location	: Z5_OWF_BH03-COMP
Water Depth [m]	: 97.4
Coordinates [m]	: E 562622.4 N 4750866.4

Cone Penetration Test Results: Measured and Derived Parameters



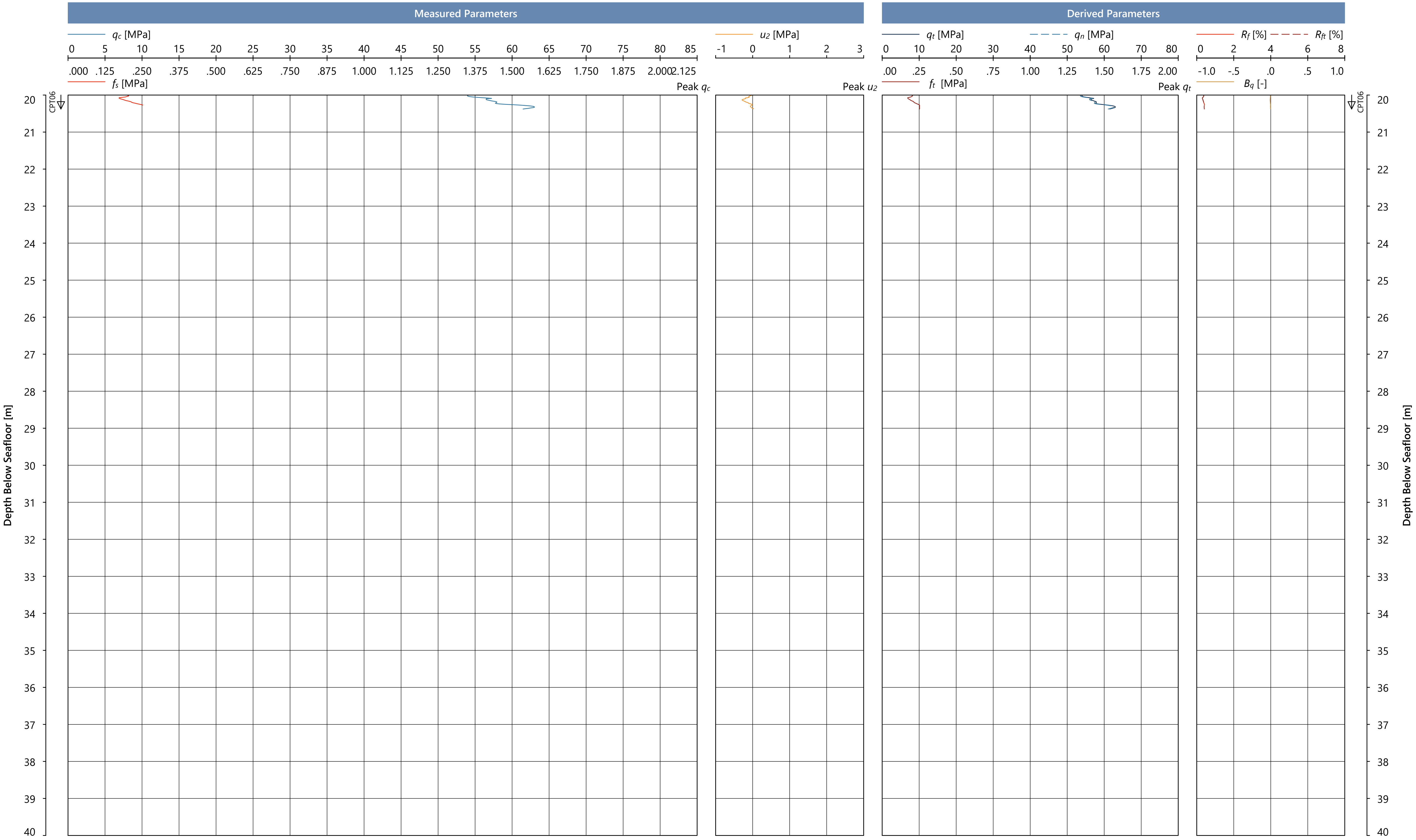
Date of Testing	: 20 January 2025
Location	: Z5_OWF_BH03-COMP
Water Depth [m]	: 97.4
Coordinates [m]	: E 562622.4 N 4750866.4

Cone Penetration Test Results: Measured and Derived Parameters



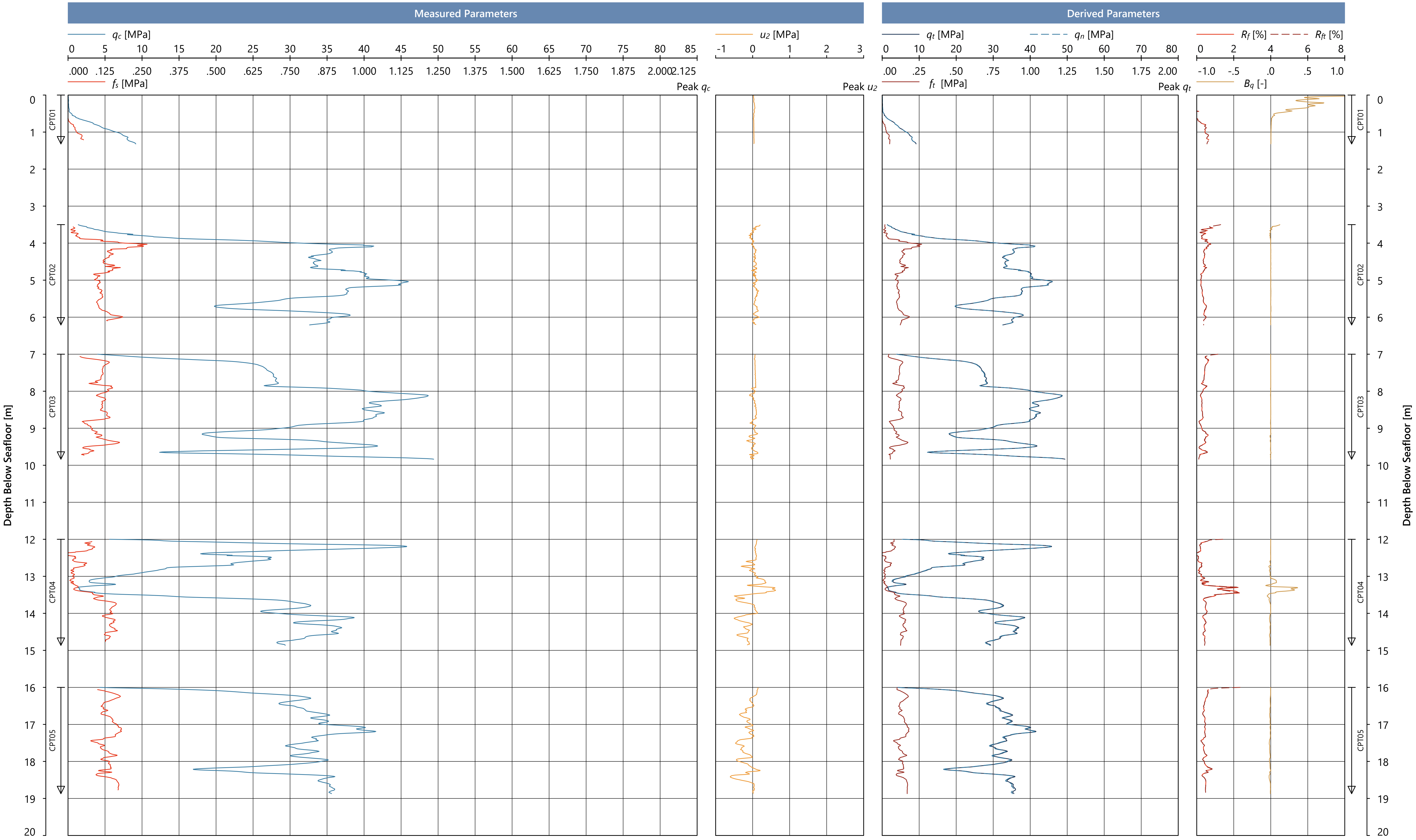
Date of Testing : 15 January 2025
Location : Z5_OWF_BH05-COMP
Water Depth [m] : 95.0
Coordinates [m] : E 573152.1 N 4764819.8

Cone Penetration Test Results: Measured and Derived Parameters



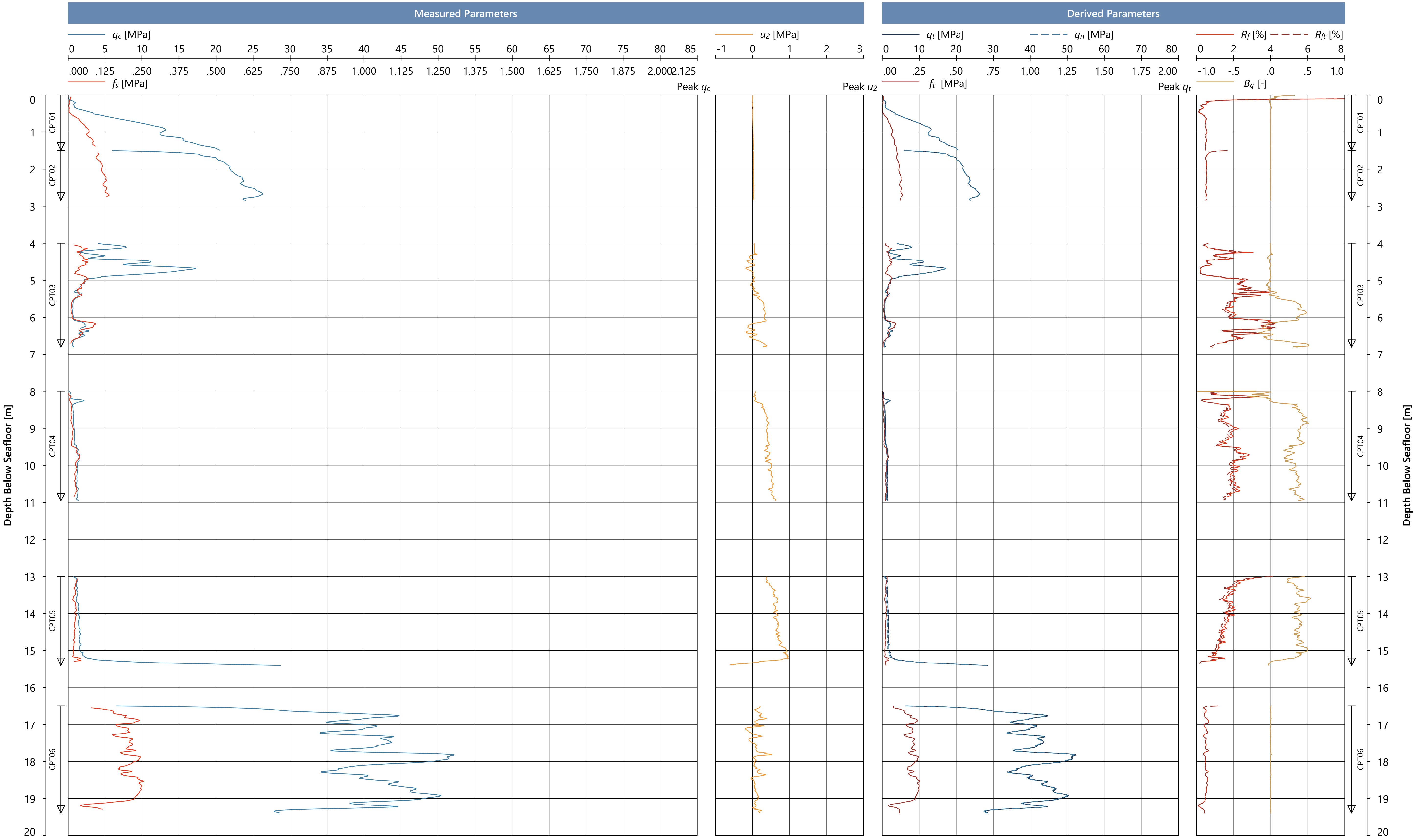
Date of Testing : 15 January 2025
Location : Z5_OWF_BH05-COMP
Water Depth [m] : 95.0
Coordinates [m] : E 573152.1 N 4764819.8

Cone Penetration Test Results: Measured and Derived Parameters



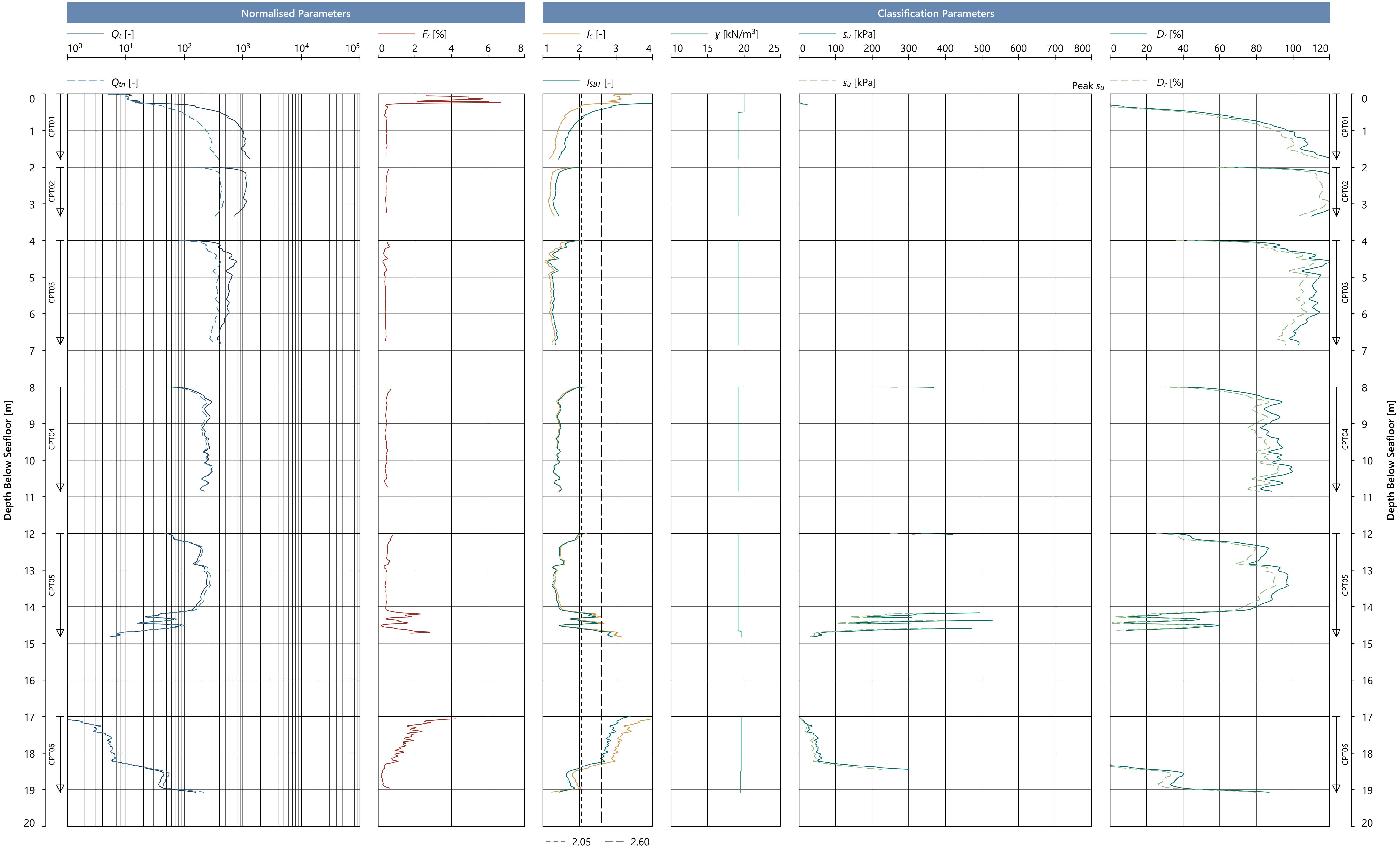
Date of Testing	: 16 January 2025
Location	: Z5_OWF_BH07-COMP_a
Water Depth [m]	: 96.9
Coordinates [m]	: E 563905.0 N 4757059.1

Cone Penetration Test Results: Measured and Derived Parameters



Date of Testing : 14 January 2025
Location : Z5_OWF_BH09-COMP
Water Depth [m] : 93.6
Coordinates [m] : E 571867.4 N 4758631.1

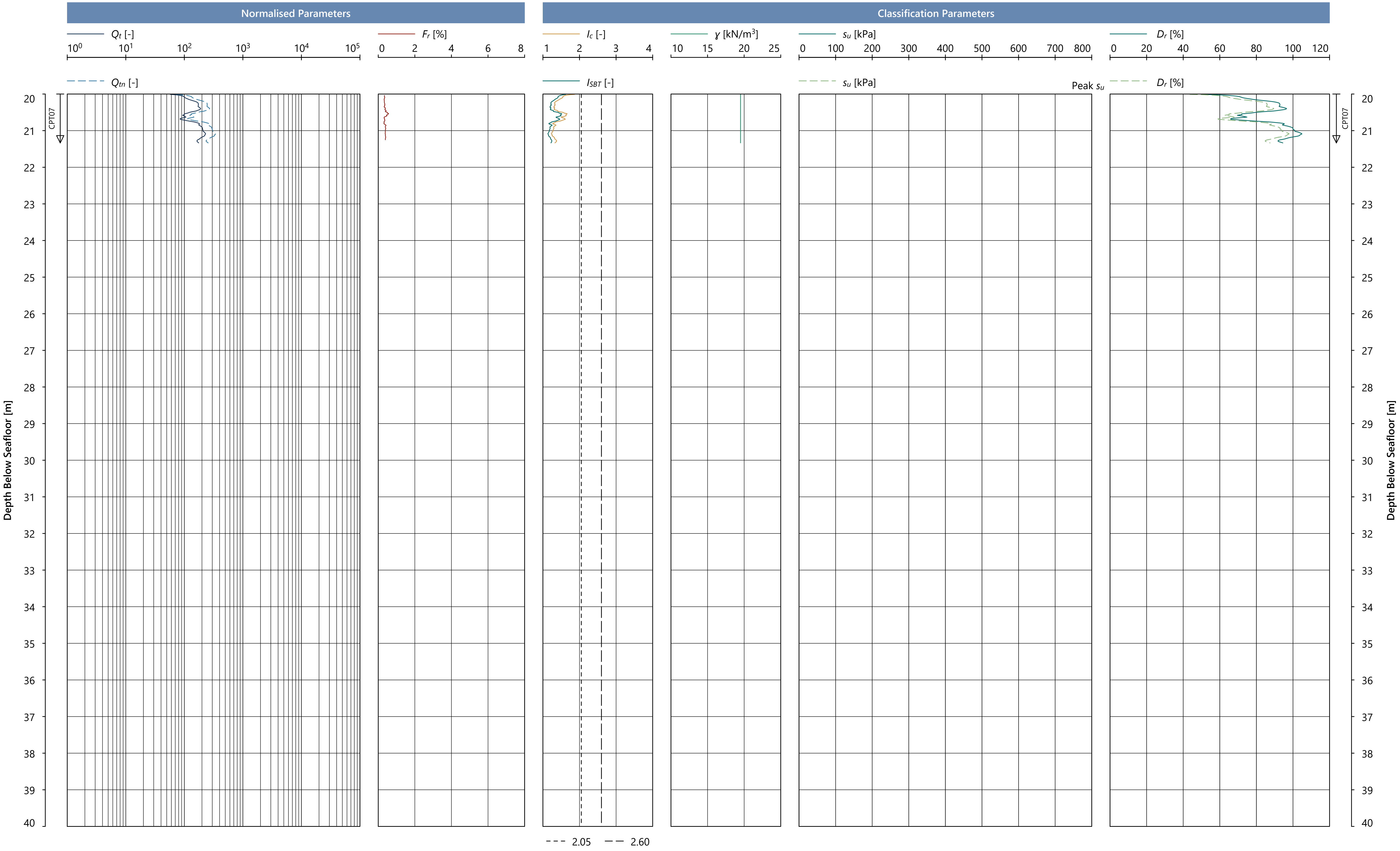
Cone Penetration Test Results: Measured and Derived Parameters



Date of Testing : 13 January 2025
Location : Z5_OWF_BH01-COMP
Water Depth [m] : 92.9
Coordinates [m] : E 571413.7 N 4751192.8

Cone Penetration Test Results: Normalised and Classification Parameters

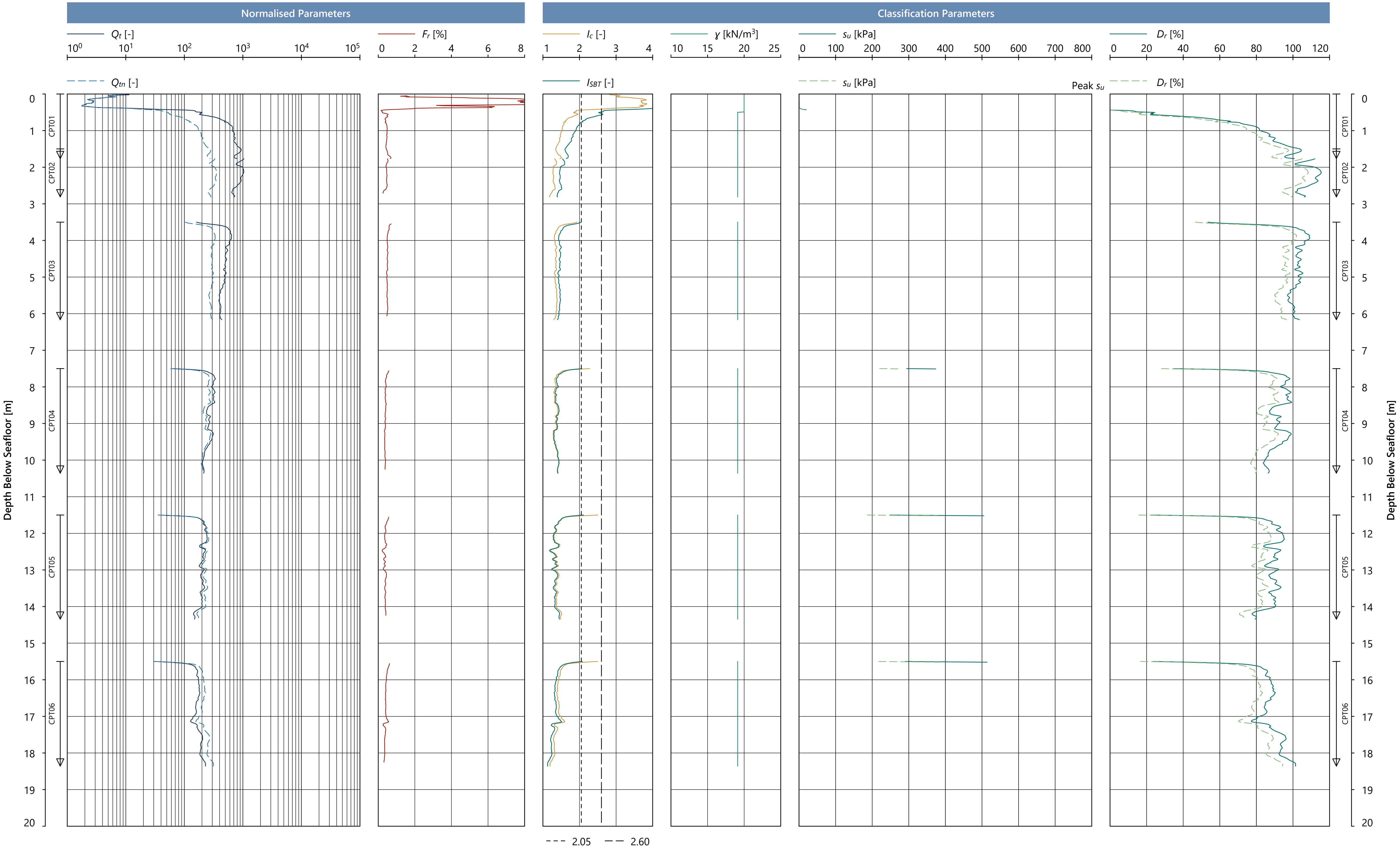
GeoVisual 4.4.3 | DM-NCP(multi) | 2025-02-04 13:00:25



Date of Testing : 13 January 2025
Location : Z5_OWF_BH01-COMP
Water Depth [m] : 92.9
Coordinates [m] : E 571413.7 N 4751192.8

Cone Penetration Test Results: Normalised and Classification Parameters

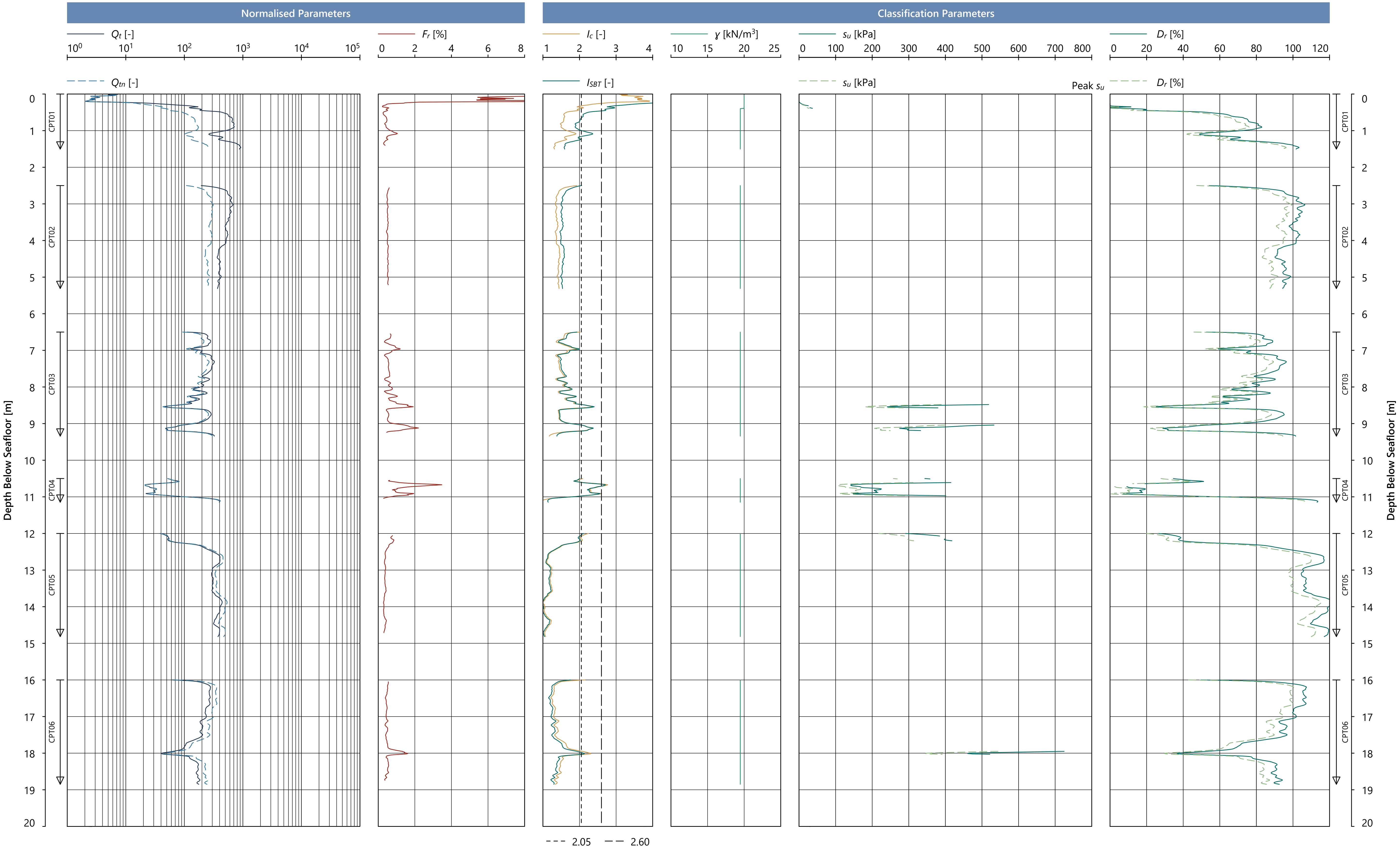
GeoVisual 4.4.3 | DM-NCP(multi) | 2025-02-04 13:00:25



Date of Testing : 14 January 2025
Location : Z5_OWF_BH02-COMP
Water Depth [m] : 93.6
Coordinates [m] : E 583584.1 N 4757276.9

Cone Penetration Test Results: Normalised and Classification Parameters

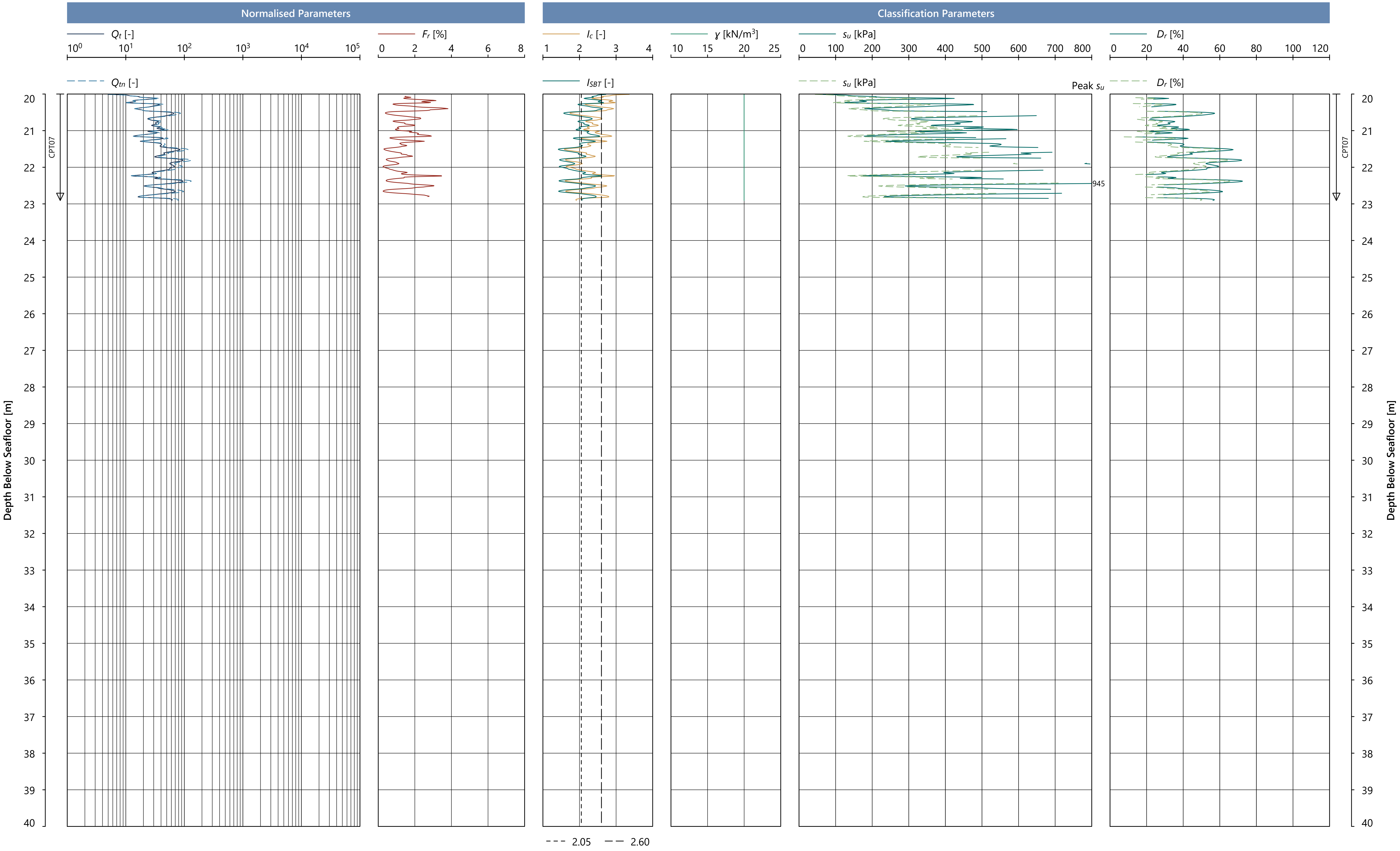
GeoVisual 4.4.3 | DM-NCP(multi) | 2025-02-04 13:00:25



Date of Testing : 20 January 2025
Location : Z5_OWF_BH03-COMP
Water Depth [m] : 97.4
Coordinates [m] : E 562622.4 N 4750866.4

Cone Penetration Test Results: Normalised and Classification Parameters

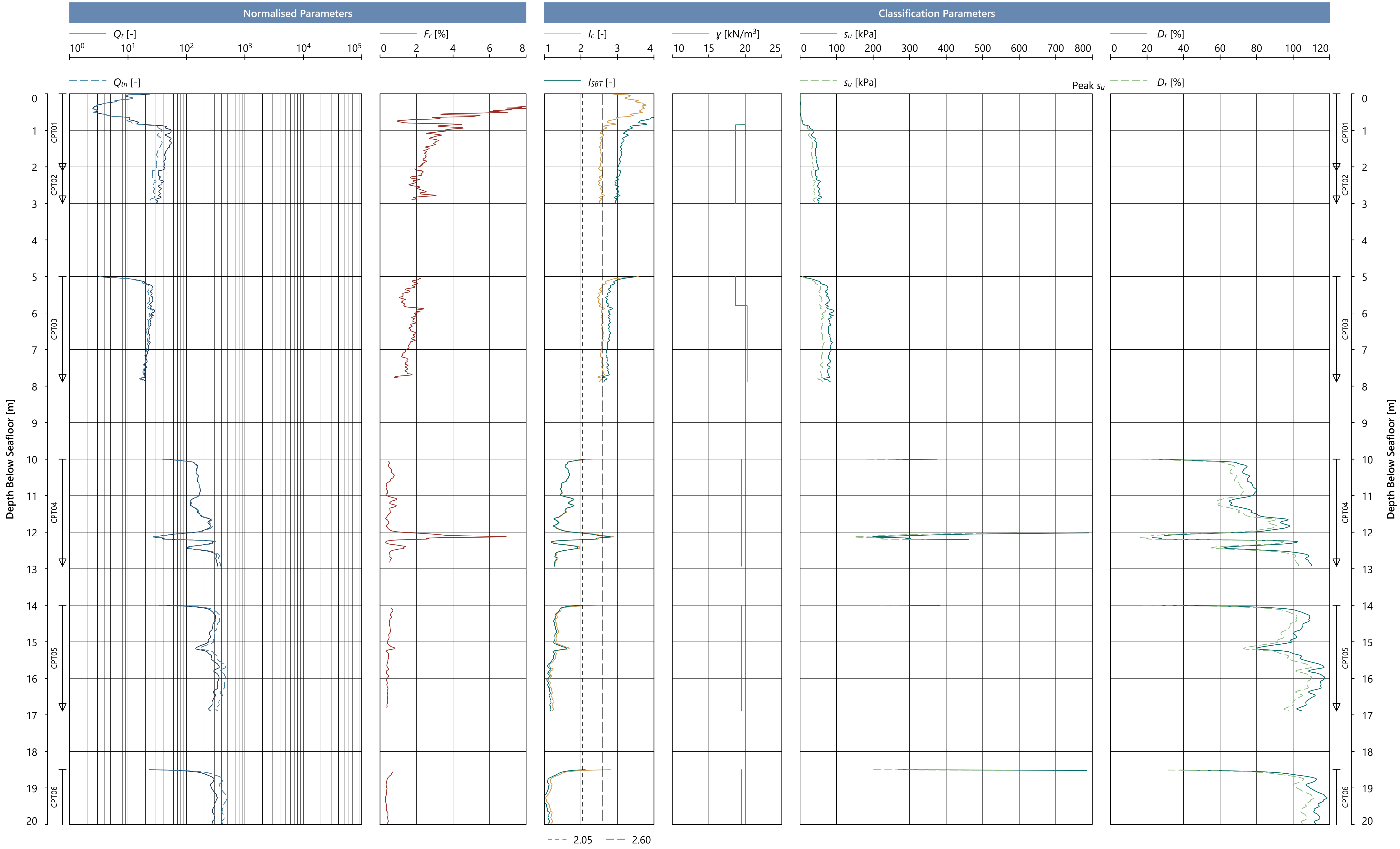
GeoVisual 4.4.3 | DM-NCP(multi) | 2025-02-04 13:00:25



Date of Testing	: 20 January 2025
Location	: Z5_OWF_BH03-COMP
Water Depth [m]	: 97.4
Coordinates [m]	: E 562622.4 N 4750866.4

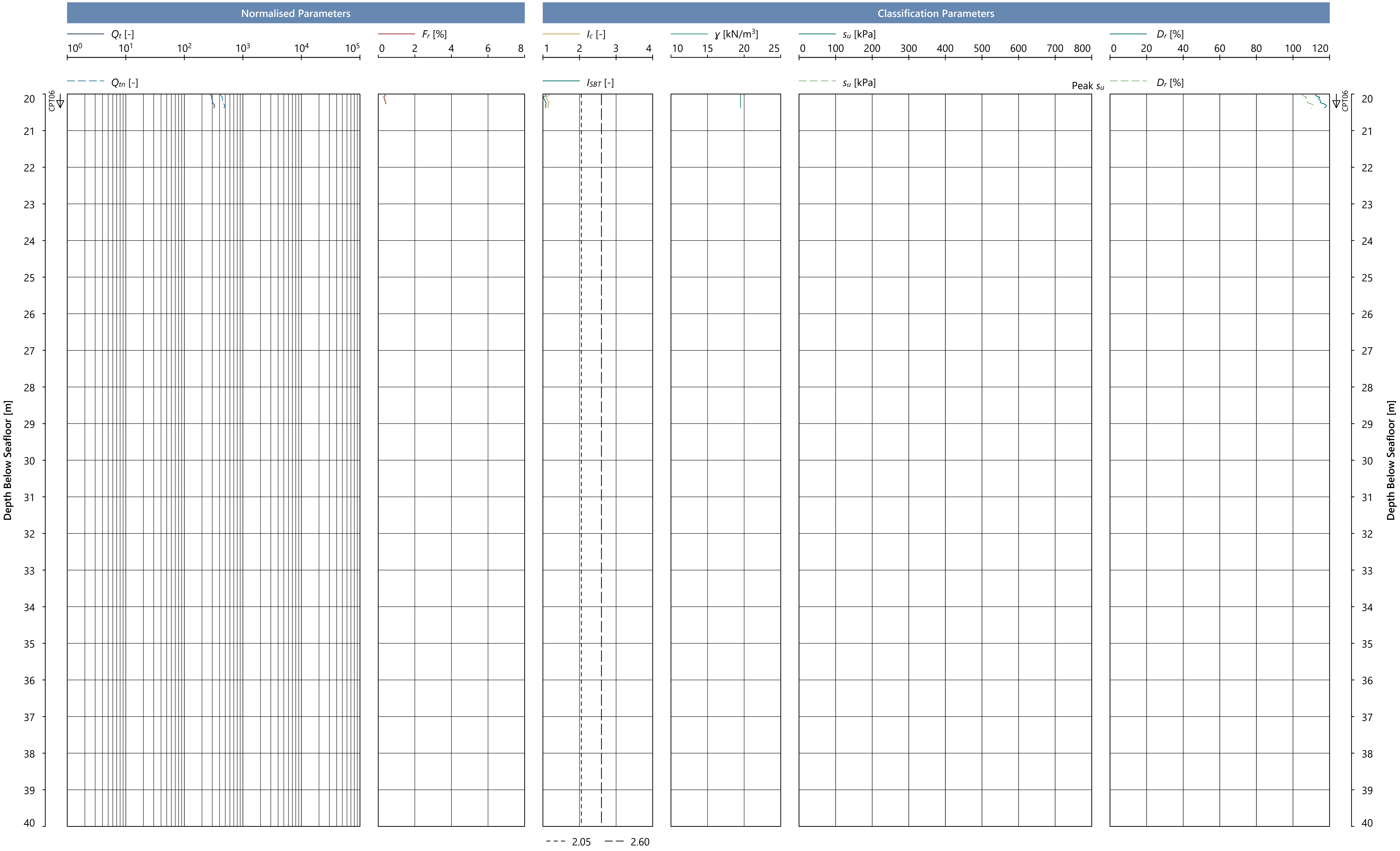
Cone Penetration Test Results: Normalised and Classification Parameters

GeoVisual 4.4.3 | DM-NCP(multi) | 2025-02-04 13:00:25



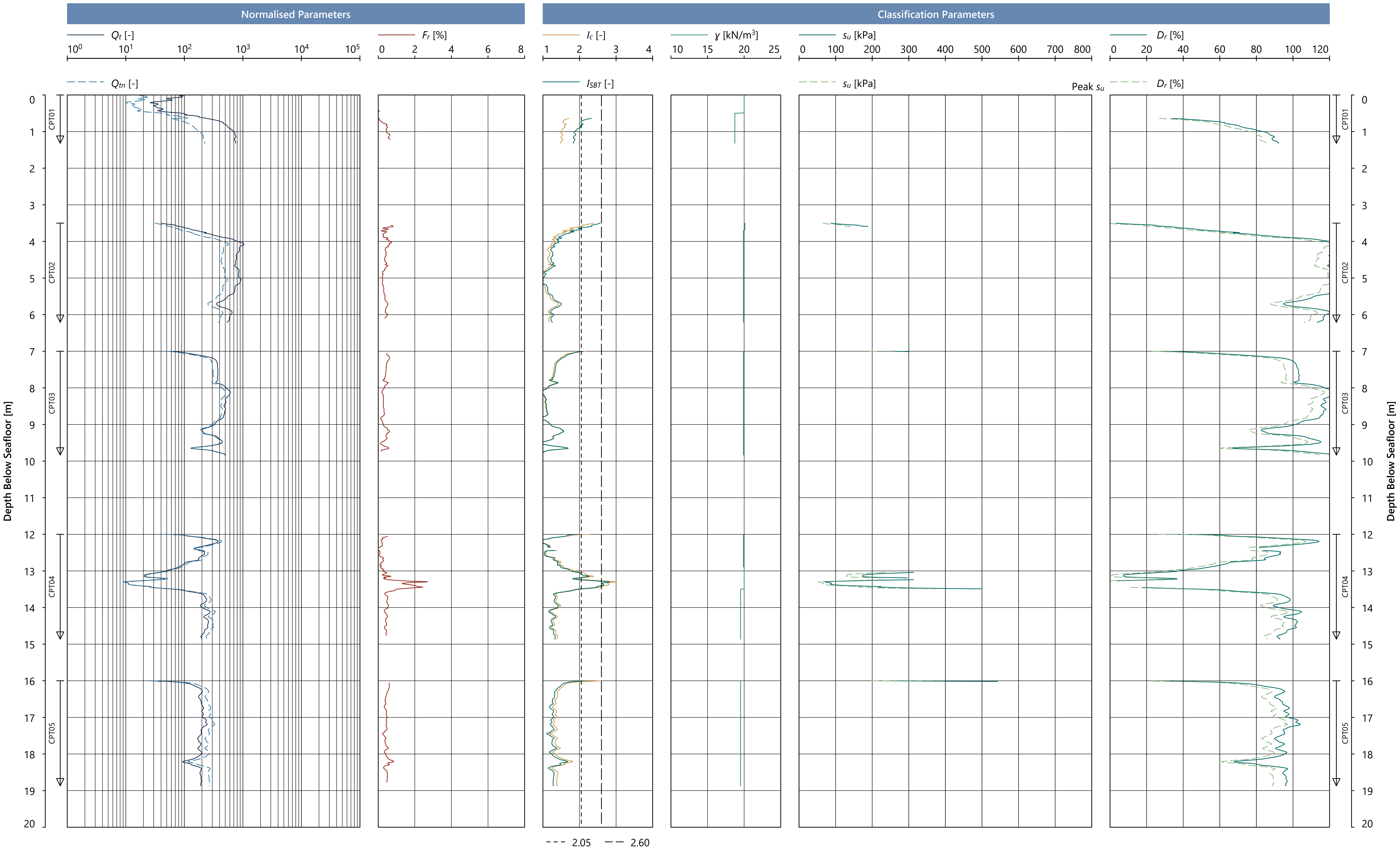
Date of Testing	: 15 January 2025
Location	: Z5_OWF_BH05-COMP
Water Depth [m]	: 95.0
Coordinates [m]	: E 573152.1 N 4764819.8

Cone Penetration Test Results: Normalised and Classification Parameters



Date of Testing	: 15 January 2025
Location	: Z5_OWF_BH05-COMP
Water Depth [m]	: 95.0
Coordinates [m]	: E 573152.1 N 4764819.8

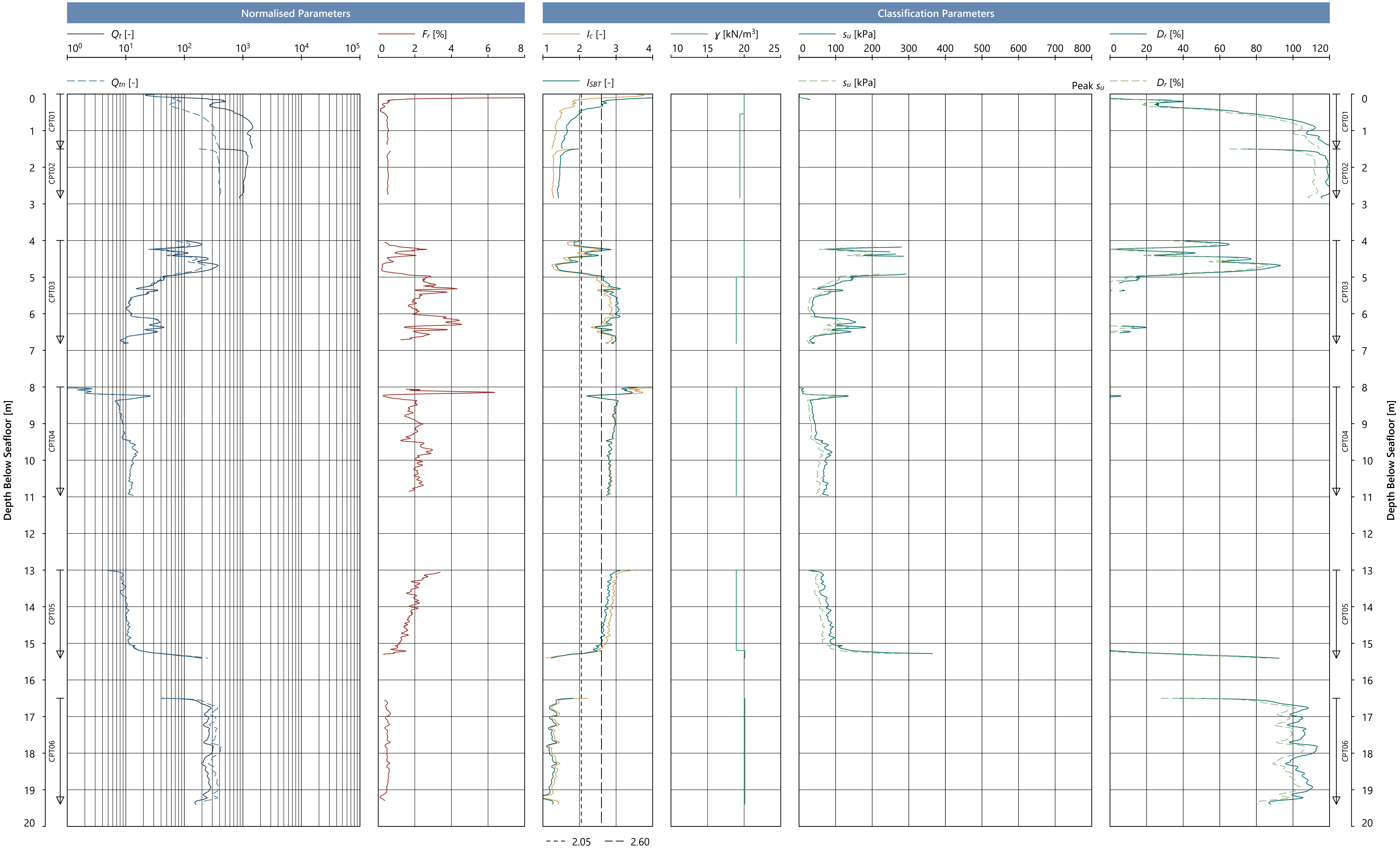
Cone Penetration Test Results: Normalised and Classification Parameters



Date of Testing : 16 January 2025
Location : Z5_OWF_BH07-COMP_a
Water Depth [m] : 96.9
Coordinates [m] : E 563905.0 N 4757059.1

Cone Penetration Test Results: Normalised and Classification Parameters

GeoVisual 4.4.3 | DM-NCP(multi) | 2025-02-04 13:00:25



Date of Testing : 14 January 2025
Location : Z5_OWF_BH09-COMP
Water Depth [m] : 93.6
Coordinates [m] : E 571867.4 N 4758631.1

Cone Penetration Test Results: Normalised and Classification Parameters

Location	Test ID	Zero Reading at Start of Test			Zero Drift*			Cone Penetrometer	Serial Number	Net Area Ratio
		q_c [MPa]	f_s [MPa]	u_2 [MPa]	q_c [MPa]	f_s [MPa]	u_2 [MPa]			a [-]
Z5_OWF_BH01-COMP	CPT01	0.197	0.009	-0.014	-0.034	0.000	0.002	CP10-CF80PB10	1706-1784	0.75
Z5_OWF_BH01-COMP	CPT02	0.192	0.009	-0.015	-0.032	-0.002	0.003	CP10-CF80PB10	1706-1784	0.75
Z5_OWF_BH01-COMP	CPT03	0.192	0.008	-0.016	-0.031	-0.001	0.004	CP10-CF80PB10	1706-1784	0.75
Z5_OWF_BH01-COMP	CPT04	0.199	0.008	-0.016	-0.027	-0.001	0.000	CP10-CF80PB10	1706-1784	0.75
Z5_OWF_BH01-COMP	CPT05	0.201	0.008	-0.017	-0.032	-0.001	0.001	CP10-CF80PB10	1706-1784	0.75
Z5_OWF_BH01-COMP	CPT06	0.201	0.008	-0.018	-0.017	-0.001	0.004	CP10-CF80PB10	1706-1784	0.75
Z5_OWF_BH01-COMP	CPT07	0.000	-0.001	-0.040	-0.050	0.000	-0.010	CP5-CF50PB17	1709-0513	0.50

Notes

* : Zero drift is the difference between the zero output at the start of the test and the zero output at the end of the test. The zero reading at start of test is a value presented in units of measurement result. The value itself is a conversion from system output, usually in mV or in bits. It has no explicit physical meaning.

\- : Zero drift could not be calculated. Zero drift can be assessed by comparing zero drift values of successive tests.

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Cone Penetration Test Results: Zero Drift

Location	Test ID	Zero Reading at Start of Test			Zero Drift*			Cone Penetrometer	Serial Number	Net Area Ratio
		q_c [MPa]	f_s [MPa]	u_2 [MPa]	q_c [MPa]	f_s [MPa]	u_2 [MPa]			a [-]
Z5_OWF_BH02-COMP	CPT01	0.241	0.008	-0.018	-0.024	-0.001	0.005	CP10-CF80PB10	1706-1784	0.75
Z5_OWF_BH02-COMP	CPT02	0.237	0.007	-0.018	-0.031	0.000	-0.001	CP10-CF80PB10	1706-1784	0.75
Z5_OWF_BH02-COMP	CPT03	0.239	0.008	-0.019	-0.051	0.000	-0.001	CP10-CF80PB10	1706-1784	0.75
Z5_OWF_BH02-COMP	CPT04	0.236	0.008	-0.020	-0.073	-0.001	0.007	CP10-CF80PB10	1706-1784	0.75
Z5_OWF_BH02-COMP	CPT05	0.238	0.008	-0.021	-0.077	-0.001	0.006	CP10-CF80PB10	1706-1784	0.75
Z5_OWF_BH02-COMP	CPT06	0.235	0.007	-0.020	-0.062	-0.001	0.005	CP10-CF80PB10	1706-1784	0.75

Notes

* : Zero drift is the difference between the zero output at the start of the test and the zero output at the end of the test. The zero reading at start of test is a value presented in units of measurement result. The value itself is a conversion from system output, usually in mV or in bits. It has no explicit physical meaning.

\- : Zero drift could not be calculated. Zero drift can be assessed by comparing zero drift values of successive tests.

Cone Penetration Test Results: Zero Drift

Location	Test ID	Zero Reading at Start of Test			Zero Drift*			Cone Penetrometer	Serial Number	Net Area Ratio
		q_c [MPa]	f_s [MPa]	u_2 [MPa]	q_c [MPa]	f_s [MPa]	u_2 [MPa]			a [-]
Z5_OWF_BH03-COMP	CPT01	0.100	0.003	0.035	-0.016	0.000	-0.001	CP10-CF80PB10	1706-2445	0.75
Z5_OWF_BH03-COMP	CPT02	0.099	0.004	0.035	-0.034	-0.004	-0.002	CP10-CF80PB10	1706-2445	0.75
Z5_OWF_BH03-COMP	CPT03	0.100	0.000	0.033	-0.023	0.001	0.000	CP10-CF80PB10	1706-2445	0.75
Z5_OWF_BH03-COMP	CPT04	0.104	0.003	0.033	-0.007	0.000	0.000	CP10-CF80PB10	1706-2445	0.75
Z5_OWF_BH03-COMP	CPT05	0.107	0.003	0.032	-0.035	0.001	-0.001	CP10-CF80PB10	1706-2445	0.75
Z5_OWF_BH03-COMP	CPT06	0.096	0.004	0.032	-0.028	0.001	0.000	CP10-CF80PB10	1706-2445	0.75
Z5_OWF_BH03-COMP	CPT07	0.097	0.004	0.031	-0.021	0.001	0.000	CP10-CF80PB10	1706-2445	0.75

Notes

* : Zero drift is the difference between the zero output at the start of the test and the zero output at the end of the test. The zero reading at start of test is a value presented in units of measurement result. The value itself is a conversion from system output, usually in mV or in bits. It has no explicit physical meaning.

\- : Zero drift could not be calculated. Zero drift can be assessed by comparing zero drift values of successive tests.

Cone Penetration Test Results: Zero Drift

Location	Test ID	Zero Reading at Start of Test			Zero Drift*			Cone Penetrometer	Serial Number	Net Area Ratio
		q_c [MPa]	f_s [MPa]	u_2 [MPa]	q_c [MPa]	f_s [MPa]	u_2 [MPa]			a [-]
Z5_OWF_BH05-COMP	CPT01	-0.040	0.002	-0.033	-0.017	0.000	0.003	CP10-CF80PB10	1706-1317	0.75
Z5_OWF_BH05-COMP	CPT02	-0.033	0.002	-0.037	-0.015	0.000	0.005	CP10-CF80PB10	1706-1317	0.75
Z5_OWF_BH05-COMP	CPT03	-0.033	0.002	-0.040	-0.017	0.000	0.009	CP10-CF80PB10	1706-1317	0.75
Z5_OWF_BH05-COMP	CPT04	-0.034	0.002	-0.039	-0.074	0.001	0.008	CP10-CF80PB10	1706-1317	0.75
Z5_OWF_BH05-COMP	CPT05	-0.022	0.002	-0.039	-0.060	0.000	0.004	CP10-CF80PB10	1706-1317	0.75
Z5_OWF_BH05-COMP	CPT06	-0.024	0.002	-0.039	-0.032	-0.001	0.005	CP10-CF80PB10	1706-1317	0.75

Notes

* : Zero drift is the difference between the zero output at the start of the test and the zero output at the end of the test. The zero reading at start of test is a value presented in units of measurement result. The value itself is a conversion from system output, usually in mV or in bits. It has no explicit physical meaning.

\- : Zero drift could not be calculated. Zero drift can be assessed by comparing zero drift values of successive tests.

GeoVisual 4.4.3 / DM-ZD / 2025-02-04 13:01:46

Cone Penetration Test Results: Zero Drift

Location	Test ID	Zero Reading at Start of Test			Zero Drift*			Cone Penetrometer	Serial Number	Net Area Ratio
		q_c [MPa]	f_s [MPa]	u_2 [MPa]	q_c [MPa]	f_s [MPa]	u_2 [MPa]			a [-]
Z5_OWF_BH07-COMP_a	CPT01	-0.016	0.003	-0.030	-0.029	-0.001	0.005	CP10-CF80PB10	1706-1317	0.75
Z5_OWF_BH07-COMP_a	CPT02	-0.020	0.004	-0.034	-0.058	-0.001	0.004	CP10-CF80PB10	1706-1317	0.75
Z5_OWF_BH07-COMP_a	CPT03	-0.017	0.003	-0.037	-0.085	0.000	0.005	CP10-CF80PB10	1706-1317	0.75
Z5_OWF_BH07-COMP_a	CPT04	-0.020	0.003	-0.038	-0.077	0.000	0.006	CP10-CF80PB10	1706-1317	0.75
Z5_OWF_BH07-COMP_a	CPT05	-0.012	0.004	-0.039	-0.067	-0.001	0.005	CP10-CF80PB10	1706-1317	0.75

Notes

* : Zero drift is the difference between the zero output at the start of the test and the zero output at the end of the test. The zero reading at start of test is a value presented in units of measurement result. The value itself is a conversion from system output, usually in mV or in bits. It has no explicit physical meaning.

\- : Zero drift could not be calculated. Zero drift can be assessed by comparing zero drift values of successive tests.

Cone Penetration Test Results: Zero Drift

Location	Test ID	Zero Reading at Start of Test			Zero Drift*			Cone Penetrometer	Serial Number	Net Area Ratio
		q_c [MPa]	f_s [MPa]	u_2 [MPa]	q_c [MPa]	f_s [MPa]	u_2 [MPa]			a [-]
Z5_OWF_BH09-COMP	CPT01	-0.185	0.000	-0.018	-0.025	-0.003	0.001	CP10-CF80PB10	1706-2622	0.75
Z5_OWF_BH09-COMP	CPT02	-0.191	-0.002	-0.018	-0.034	-0.004	0.002	CP10-CF80PB10	1706-2622	0.75
Z5_OWF_BH09-COMP	CPT03	-0.189	-0.005	-0.019	-0.017	-0.001	0.002	CP10-CF80PB10	1706-2622	0.75
Z5_OWF_BH09-COMP	CPT04	-0.055	0.003	-0.024	-0.017	0.000	0.002	CP10-CF80PB10	1706-1317	0.75
Z5_OWF_BH09-COMP	CPT05	-0.046	0.002	-0.028	-0.013	0.000	0.001	CP10-CF80PB10	1706-1317	0.75
Z5_OWF_BH09-COMP	CPT06	-0.043	0.002	-0.030	-0.022	-0.002	-0.001	CP10-CF80PB10	1706-1317	0.75

Notes

* : Zero drift is the difference between the zero output at the start of the test and the zero output at the end of the test. The zero reading at start of test is a value presented in units of measurement result. The value itself is a conversion from system output, usually in mV or in bits. It has no explicit physical meaning.

\- : Zero drift could not be calculated. Zero drift can be assessed by comparing zero drift values of successive tests.

Cone Penetration Test Results: Zero Drift

4. Sampling Data

Location : Z5_OWF_BH01-COMP
Sample : W01
Depth [m BSF] : 3.50
Note(s) : Intact

Location : Z5_OWF_BH01-COMP
Sample : W01
Depth [m BSF] : 3.50
Note(s) : Split

Release Date: 17-1-2025
Drawn with:
Photo_Plate_Maker v 6.0
Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH01-COMP
Presented Plate:
Downhole_Portrait
Processed by:
Date: 17-1-2025

SAMPLE PHOTOGRAPHS

Z5_OWF_BH01_COMP

Release Date: 17-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH01-COMP

Presented Plate:
Downhole_Portrait

Processed by:
Date: 17-1-2025

Location : Z5_OWF_BH01-COMP
Sample : W02
Depth [m BSF] : 7.00
Note(s) : Intact

Location : Z5_OWF_BH01-COMP
Sample : W02
Depth [m BSF] : 7.00
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH01_COMP

Location	:	Z5_OWF_BH01-COMP
Sample	:	W03
Depth [m BSF]	:	11.00
Note(s)	:	Intact

Location	:	Z5_OWF_BH01-COMP
Sample	:	W03
Depth [m BSF]	:	11.00
Note(s)	:	Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH01_COMP

Release Date: 17-1-2025
Drawn with: Photo_Plate_Maker v 6.0
Photo Folder: d\Golfe du Lion Centre (Z5)\Z5_OWF_BH01-COMP
Presented Plate: Downhole_Portrait
Processed by:
Date: 17-1-2025

Location : Z5_OWF_BH01-COMP
Sample : W04
Depth [m BSF] : 14.00
Note(s) : Intact

Location : Z5_OWF_BH01-COMP
Sample : W04
Depth [m BSF] : 14.00
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH01_COMP

Release Date: 17-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH01-COMP

Presented Plate:
Downhole_Portrait

Processed by:
Date: 17-1-2025

Location : Z5_OWF_BH01-COMP
Sample : W05
Depth [m BSF] : 15.00
Note(s) : Intact

Location : Z5_OWF_BH01-COMP
Sample : W05
Depth [m BSF] : 15.00
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH01_COMP

Release Date: 17-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH01-COMP

Presented Plate:
Downhole_Portrait

Processed by:
Date: 17-1-2025

Location	:	Z5_OWF_BH01-COMP
Sample	:	W06
Depth [m BSF]	:	16.00
Note(s)	:	Intact

Location	:	Z5_OWF_BH01-COMP
Sample	:	W06
Depth [m BSF]	:	16.00
Note(s)	:	Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH01_COMP

Release Date: 17-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH01-COMP

Presented Plate:
Downhole_Portrait

Processed by:
Date: 17-1-2025

Location : Z5_OWF_BH01-COMP
Sample : W07
Depth [m BSF] : 19.00
Note(s) : Intact

Location : Z5_OWF_BH01-COMP
Sample : W07
Depth [m BSF] : 19.00
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH01_COMP

Release Date: 17-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH02-COMP

Presented Plate:
Downhole_Portrait

Processed by:
Date: 17-1-2025

Location	:	Z5_OWF_BH02-COMP
Sample	:	W01
Depth [m BSF]	:	3.00
Note(s)	:	Intact

Location	:	Z5_OWF_BH02-COMP
Sample	:	W01
Depth [m BSF]	:	3.00
Note(s)	:	Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH02-COMP

Release Date: 17-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH02-COMP

Presented Plate:
Downhole_Portrait

Processed by:
Date: 17-1-2025

Location	:	Z5_OWF_BH02-COMP
Sample	:	W02
Depth [m BSF]	:	6.50
Note(s)	:	Intact

Location	:	Z5_OWF_BH02-COMP
Sample	:	W02
Depth [m BSF]	:	6.50
Note(s)	:	Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH02-COMP

Release Date: 17-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH02-COMP

Presented Plate:
Downhole_Portrait

Processed by:
Date: 17-1-2025

Location	:	Z5_OWF_BH02-COMP
Sample	:	W03
Depth [m BSF]	:	10.50
Note(s)	:	Intact

Location	:	Z5_OWF_BH02-COMP
Sample	:	W03
Depth [m BSF]	:	10.50
Note(s)	:	Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH02-COMP

Release Date: 17-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH02-COMP

Presented Plate:
Downhole_Portrait

Processed by:
Date: 17-1-2025

Location : Z5_OWF_BH02-COMP
Sample : W04
Depth [m BSF] : 14.50
Note(s) : Intact

Location : Z5_OWF_BH02-COMP
Sample : W04
Depth [m BSF] : 14.50
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH02-COMP

Release Date: 17-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH02-COMP

Presented Plate:
Downhole_Portrait

Processed by:
Date: 17-1-2025

Location : Z5_OWF_BH02-COMP
Sample : W05
Depth [m BSF] : 18.50
Note(s) : Intact

Location : Z5_OWF_BH02-COMP
Sample : W05
Depth [m BSF] : 18.50
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH02-COMP

Location : Z5_OWF_BH02-COMP
Sample : W06
Depth [m BSF] : 19.50
Note(s) : Intact

Location : Z5_OWF_BH02-COMP
Sample : W06
Depth [m BSF] : 19.50
Note(s) : Split

Release Date: 17-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH02-COMP

Presented Plate:
Downhole_Portrait

Processed by:
Date: 17-1-2025

SAMPLE PHOTOGRAPHS

Z5_OWF_BH02-COMP

Release Date: 27-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH03-COMP

Presented Plate:
Downhole_Portrait

Processed by:
Date: 27-1-2025

Location	:	Z5_OWF_BH03-COMP
Sample	:	W01
Depth [m BSF]	:	1.50
Note(s)	:	Intact

Location	:	Z5_OWF_BH03-COMP
Sample	:	W01
Depth [m BSF]	:	1.50
Note(s)	:	Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH03-COMP

Release Date: 27-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH03-COMP

Presented Plate:
Downhole_Portrait

Processed by:
Date: 27-1-2025

Location : Z5_OWF_BH03-COMP
Sample : W02
Depth [m BSF] : 5.50
Note(s) : Intact

Location : Z5_OWF_BH03-COMP
Sample : W02
Depth [m BSF] : 5.50
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH03-COMP

Release Date: 27-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Location : Z5_OWF_BH03-COMP
Sample : W03
Depth [m BSF] : 9.50
Note(s) : Intact

Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH03-COMP

Presented Plate:
Downhole_Portrait

Location : Z5_OWF_BH03-COMP
Sample : W03
Depth [m BSF] : 9.50
Note(s) : Split

Processed by:
Date: 27-1-2025

SAMPLE PHOTOGRAPHS

Z5_OWF_BH03-COMP

Release Date: 27-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH03-COMP

Presented Plate:
Downhole_Portrait

Processed by:
Date: 27-1-2025

Location : Z5_OWF_BH03-COMP
Sample : W04
Depth [m BSF] : 11.50
Note(s) : Intact

Location : Z5_OWF_BH03-COMP
Sample : W04
Depth [m BSF] : 11.50
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH03-COMP

Release Date: 27-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH03-COMP

Presented Plate:
Downhole_Portrait

Processed by:
Date: 27-1-2025

Location : Z5_OWF_BH03-COMP
Sample : W05
Depth [m BSF] : 15.00
Note(s) : Intact

Location : Z5_OWF_BH03-COMP
Sample : W05
Depth [m BSF] : 15.00
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH03-COMP

Location : Z5_OWF_BH03-COMP
Sample : W06
Depth [m BSF] : 19.00
Note(s) : Intact

Location : Z5_OWF_BH03-COMP
Sample : W06
Depth [m BSF] : 19.00
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH03-COMP

Release Date: 27-1-2025
Drawn with:
Photo_Plate_Maker v 6.0
Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH03-COMP
Presented Plate:
Downhole_Portrait
Processed by:
Date: 27-1-2025

Release Date: 20-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH05-COMP

Presented Plate:
Downhole_Portrait

Processed by:
Date: 20-1-2025

Location : Z5_OWF_BH05-COMP
Sample : W01
Depth [m BSF] : 3.00
Note(s) : Intact

Location : Z5_OWF_BH05-COMP
Sample : W01
Depth [m BSF] : 3.00
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH05_COMP

Release Date: 20-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH05-COMP

Presented Plate:
Downhole_Portrait

Processed by:
Date: 20-1-2025

Location	:	Z5_OWF_BH05-COMP
Sample	:	W02
Depth [m BSF]	:	4.00
Note(s)	:	Intact

Location	:	Z5_OWF_BH05-COMP
Sample	:	W02
Depth [m BSF]	:	4.00
Note(s)	:	Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH05_COMP

Release Date: 20-1-2025
Drawn with: Photo_Plate_Maker v 6.0
Photo Folder: d\Golfe du Lion Centre (Z5)\Z5_OWF_BH05-COMP
Presented Plate: Downhole_Portrait
Processed by: Date: 20-1-2025

Location : Z5_OWF_BH05-COMP
Sample : W03
Depth [m BSF] : 8.00
Note(s) : Intact

Location : Z5_OWF_BH05-COMP
Sample : W03
Depth [m BSF] : 8.00
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH05_COMP

Release Date: 20-1-2025
Drawn with: Photo_Plate_Maker v 6.0
Photo Folder: d\Golfe du Lion Centre (Z5)\Z5_OWF_BH05-COMP
Presented Plate: Downhole_Portrait
Processed by: Date: 20-1-2025

Location	:	Z5_OWF_BH05-COMP
Sample	:	W04
Depth [m BSF]	:	9.00
Note(s)	:	Intact

Location	:	Z5_OWF_BH05-COMP
Sample	:	W04
Depth [m BSF]	:	9.00
Note(s)	:	Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH05_COMP

Release Date: 20-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH05-COMP

Presented Plate:
Downhole_Portrait

Processed by:
Date: 20-1-2025

Location : Z5_OWF_BH05-COMP
Sample : W05
Depth [m BSF] : 13.00
Note(s) : Intact

Location : Z5_OWF_BH05-COMP
Sample : W05
Depth [m BSF] : 13.00
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH05_COMP

Release Date: 20-1-2025
Drawn with: Photo_Plate_Maker v 6.0
Photo Folder: d\Golfe du Lion Centre (Z5)\Z5_OWF_BH05-COMP
Presented Plate: Downhole_Portrait
Processed by:
Date: 20-1-2025

Location : Z5_OWF_BH05-COMP
Sample : W06
Depth [m BSF] : 17.00
Note(s) : Intact

Location : Z5_OWF_BH05-COMP
Sample : W06
Depth [m BSF] : 17.00
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH05_COMP

Release Date: 20-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH05-COMP

Presented Plate:
Downhole_Portrait

Processed by:
Date: 20-1-2025

No photograph available

Location : Z5_OWF_BH05-COMP
Sample : W07
Depth [m BSF] : 18.00

Location : Z5_OWF_BH05-COMP
Sample : W07
Depth [m BSF] : 18.00
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH05_COMP

Location : Z5_OWF_BH07_COMP_a
Sample : W01
Depth [m BSF] : 1.50
Note(s) : Intact

Location : Z5_OWF_BH07_COMP_a
Sample : W01
Depth [m BSF] : 1.50
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH07-COMP_a

Release Date: 21-1-2025
Drawn with: Photo_Plate_Maker v 6.0
Photo Folder: Golfe du Lion Centre (Z5)\Z5_OWF_BH07-COMP_a
Presented Plate: Downhole_Portrait
Processed by: Date: 21-1-2025

Release Date: 21-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
Golfe du Lion Centre (Z5)\Z5_OWF_BH07-COMP_a

Presented Plate:
Downhole_Portrait

Processed by:
Date: 21-1-2025

Location : Z5_OWF_BH07_COMP_a
Sample : W02
Depth [m BSF] : 2.50
Note(s) : Intact

Location : Z5_OWF_BH07_COMP_a
Sample : W02
Depth [m BSF] : 2.50
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH07-COMP_a

Release Date: 21-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Location : Z5_OWF_BH07_COMP_a
Sample : W03
Depth [m BSF] : 6.50
Note(s) : Intact

Photo Folder:
Golfe du Lion Centre (Z5)\Z5_OWF_BH07-COMP_a

Presented Plate:
Downhole_Portrait

Location : Z5_OWF_BH07_COMP_a
Sample : W03
Depth [m BSF] : 6.50
Note(s) : Split

Processed by:
Date: 21-1-2025

SAMPLE PHOTOGRAPHS

Z5_OWF_BH07-COMP_a

Release Date: 21-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Location : Z5_OWF_BH07_COMP_a
Sample : W04
Depth [m BSF] : 10.00
Note(s) : Intact

Photo Folder:
Golfe du Lion Centre (Z5)\Z5_OWF_BH07-COMP_a

Presented Plate:
Downhole_Portrait

Location : Z5_OWF_BH07_COMP_a
Sample : W04
Depth [m BSF] : 10.00
Note(s) : Split

Processed by:
Date: 21-1-2025

SAMPLE PHOTOGRAPHS

Z5_OWF_BH07-COMP_a

Release Date: 21-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
Golfe du Lion Centre (Z5)\Z5_OWF_BH07-COMP_a

Presented Plate:
Downhole_Portrait

Processed by:
Date: 21-1-2025

Location : Z5_OWF_BH07_COMP_a
Sample : W05
Depth [m BSF] : 11.00
Note(s) : Intact

No photograph available

Location : Z5_OWF_BH07_COMP_a
Sample : W05
Depth [m BSF] : 11.00

SAMPLE PHOTOGRAPHS

Z5_OWF_BH07-COMP_a

Release Date: 21-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
Golfe du Lion Centre (Z5)\Z5_OWF_BH07-COMP_a

Presented Plate:
Downhole_Portrait

Processed by:
Date: 21-1-2025

Location : Z5_OWF_BH07_COMP_a
Sample : W06
Depth [m BSF] : 15.00
Note(s) : Intact

Location : Z5_OWF_BH07_COMP_a
Sample : W06
Depth [m BSF] : 15.00
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH07-COMP_a

Release Date: 21-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
Golfe du Lion Centre (Z5)\Z5_OWF_BH07-COMP_a

Presented Plate:
Downhole_Portrait

Processed by:
Date: 21-1-2025

Location : Z5_OWF_BH07_COMP_a
Sample : W07
Depth [m BSF] : 19.00
Note(s) : Intact

Location : Z5_OWF_BH07_COMP_a
Sample : W07
Depth [m BSF] : 19.00
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH07-COMP_a

Release Date: 21-1-2025
Drawn with: Photo_Plate_Maker v 6.0
Photo Folder: Golfe du Lion Centre (Z5)\Z5_OWF_BH07-COMP_a
Presented Plate: Downhole_Portrait
Processed by: Date: 21-1-2025

Location : Z5_OWF_BH07_COMP_a
Sample : W08
Depth [m BSF] : 20.00
Note(s) : Intact

Location : Z5_OWF_BH07_COMP_a
Sample : W08
Depth [m BSF] : 20.00
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH07-COMP_a

Release Date: 17-1-2025
Drawn with:
Photo_Plate_Maker v 6.0
Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH09-COMP
Presented Plate:
Downhole_Portrait
Processed by:
Date: 17-1-2025

Location : Z5_OWF_BH09-COMP
Sample : W01
Depth [m BSF] : 3.00
Note(s) : Intact

Location : Z5_OWF_BH09-COMP
Sample : W01
Depth [m BSF] : 3.00
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH09-COMP

Location : Z5_OWF_BH09-COMP
Sample : W02
Depth [m BSF] : 7.00
Note(s) : No sample recovery.

No photograph available

Location : Z5_OWF_BH09-COMP
Sample : W02
Depth [m BSF] : 7.00
Note(s) : No sample recovery.

Release Date: 17-1-2025
Drawn with: Photo_Plate_Maker v 6.0
Photo Folder: d\Golfe du Lion Centre (Z5)\Z5_OWF_BH09-COMP
Presented Plate: Downhole_Portrait
Processed by: Date: 17-1-2025

SAMPLE PHOTOGRAPHS

Z5_OWF_BH09-COMP

Release Date: 17-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH09-COMP

Presented Plate:
Downhole_Portrait

Processed by:
Date: 17-1-2025

Location : Z5_OWF_BH09-COMP
Sample : W02A
Depth [m BSF] : 7.00
Note(s) : Intact

Location : Z5_OWF_BH09-COMP
Sample : W02A
Depth [m BSF] : 7.00
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH09-COMP

Location : Z5_OWF_BH09-COMP
Sample : W03
Depth [m BSF] : 8.00
Note(s) : Intact

Location : Z5_OWF_BH09-COMP
Sample : W03
Depth [m BSF] : 8.00
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH09-COMP

Release Date: 17-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH09-COMP

Presented Plate:
Downhole_Portrait

Processed by:
Date: 17-1-2025

Release Date: 17-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH09-COMP

Presented Plate:
Downhole_Portrait

Processed by:
Date: 17-1-2025

Location : Z5_OWF_BH09-COMP
Sample : W04
Depth [m BSF] : 11.00
Note(s) : Intact

Location : Z5_OWF_BH09-COMP
Sample : W04
Depth [m BSF] : 11.00
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH09-COMP

Release Date: 17-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH09-COMP

Presented Plate:
Downhole_Portrait

Processed by:
Date: 17-1-2025

Location : Z5_OWF_BH09-COMP
Sample : W05
Depth [m BSF] : 12.00
Note(s) : Intact

Location : Z5_OWF_BH09-COMP
Sample : W05
Depth [m BSF] : 12.00
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH09-COMP

Release Date: 17-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH09-COMP

Presented Plate:
Downhole_Portrait

Processed by:
Date: 17-1-2025

Location : Z5_OWF_BH09-COMP
Sample : W06
Depth [m BSF] : 15.50
Note(s) : Intact

Location : Z5_OWF_BH09-COMP
Sample : W06
Depth [m BSF] : 15.50
Note(s) : Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH09-COMP

Release Date: 17-1-2025

Drawn with:
Photo_Plate_Maker v 6.0

Photo Folder:
d\Golfe du Lion Centre (Z5)\Z5_OWF_BH09-COMP

Presented Plate:
Downhole_Portrait

Processed by:
Date: 17-1-2025

Location	:	Z5_OWF_BH09-COMP
Sample	:	W07
Depth [m BSF]	:	19.50
Note(s)	:	Intact

Location	:	Z5_OWF_BH09-COMP
Sample	:	W07
Depth [m BSF]	:	19.50
Note(s)	:	Split

SAMPLE PHOTOGRAPHS

Z5_OWF_BH09-COMP

Lab Testing Schedule

CLIENT: DGEC
SITE: Golfe du Lion Geotechnical Site Investigation Centre (Z5)
JOB NO: F254727

Drawn by:
MRI/BQM
Date:
10/2/2025

Borehole Number	Sample	Depth from (m)	Sample Type	Sample Length (cm)	Sample Diameter (mm)	Mass (g)	Wallingford / LLN	Sample received	Sample location	Sample used up	Moisture Content	Bulk Density	PP	TV	Sulphate Reducing Bacteria	Thermal Conductivity/Resistivity	Thermal Conductivity Reconstituted	Plasticity Index	Sieve	Sedimentation	PD	Min/Max Density	Permeameter Permeability [Constant	OED	Shear Box	UU	UU remould	TXL Permeability [constant head]	CIDc (set of 3 tests)	CIUc	Loss on Ignition	Total Sulphate Content	Water Soluble Chloride	Carbonate Content of Soil	pH Value of Soil and Water	Soil Type	Remarks
Total number of offshore tests (#)											78	60	19	17	25	5	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0		
Total number of onshore tests (/)											0	0	0	0	0	0	1	8	30	30	19	8	6	4	10	2	5	3	12	4	13	13	13	13	13		
Z5_OWF_BH01-COMP	01-1	3.5	Bag	15	69	696			Box 01		#	#			#				/	/	/															SAND	SRB
Z5_OWF_BH01-COMP	01-2	3.65	Bag	10	69	589			Box 01		#	#																			/	/	/	/	/	SAND	
Z5_OWF_BH01-COMP	02-1	7	Bag	60	53	2379			Box 01		#				#		/		/	/		/														SAND	SRB@7.5m
Z5_OWF_BH01-COMP	03-1	11	Bag	45	53	1504			Box 01		#														/											SAND	
Z5_OWF_BH01-COMP	03-2	11.45	Bag	45	53	1926			Box 01		#				#				/	/	/		/													SAND	SRB@11.8
Z5_OWF_BH01-COMP	04-1	14	Bag	25	53	1075			Box 01																				/							SAND	
Z5_OWF_BH01-COMP	04-2	14.25	Bag	25	53	1267			Box 01																											SAND	
Z5_OWF_BH01-COMP	04-3	14.5	Bag	35	53	1449			Box 01																						/	/	/	/	/	CLAY	
Z5_OWF_BH01-COMP	05-1	15	Bag	35	72	3000			Box 01		#		#	#				/	/	/																CLAY	
Z5_OWF_BH01-COMP	05-2	15.35	Bag	30	72	2266			Box 01		#		#	#																						CLAY	
Z5_OWF_BH01-COMP	05-3	15.65	Wax	30	72	1820			Box 02 WAX		#	#	#	#										/						/						CLAY	
Z5_OWF_BH01-COMP	06-1	16	Bag	10	72	736			Box 01		#	#	#	#				/	/	/	/															CLAY	
Z5_OWF_BH01-COMP	06-2	16.1	Wax	20	72	1644			Box 02 WAX			#																/								CLAY	
Z5_OWF_BH01-COMP	06-3	16.3	Bag	20	72	1675			Box 01		#	#	#	#												#	/									CLAY	UU
Z5_OWF_BH01-COMP	06-4	16.5	Bag	10	72	514.5			Box 01		#		#	#																						CLAY	
Z5_OWF_BH01-COMP	07-1	19	Bag	25	72	1001.5			Box 01		#	#							/	/																SAND	
Z5_OWF_BH01-COMP	07-2	19.25	Bag	35	72	1385			Box 01		#	#													/											SAND	
Z5_OWF_BH02-COMP	01-1	3	Bag	20	69	985			Box 03		#	#							/	/	/															SAND	
Z5_OWF_BH02-COMP	01-2	3.2	Bag	20	69	913			Box 03		#	#																			/	/	/	/	/	SAND	
Z5_OWF_BH02-COMP	02-1	6.5	Bag	35	53	1375			Box 03													/			/											SAND	
Z5_OWF_BH02-COMP	02-2	6.85	Bag	35	53	1280			Box 03		#	#																								SAND	
Z5_OWF_BH02-COMP	03-1	10.5	Bag	35	53	1283			Box 03		#	#							/	/	/															SAND	
Z5_OWF_BH02-COMP	03-2	10.85	Bag	30	53	1258			Box 03		#	#																	/							SAND	
Z5_OWF_BH02-COMP	04-1	14.5	Bag	30	53	987			Box 03		#	#							/	/																SAND	
Z5_OWF_BH02-COMP	04-2	14.8	Bag	30	53	1415			Box 03		#	#													/											SAND	
Z5_OWF_BH02-COMP	05-1	18.5	Bag	40	53	1507			Box 03		#	#																	/							SAND	
Z5_OWF_BH02-COMP	05-2	18.9	Bag	30	53	1168			Box 03																											SAND	
Z5_OWF_BH02-COMP	06-1	19.5	Bag	10	53	514			Box 03																						/	/	/	/	/	SAND	
Z5_OWF_BH02-COMP	06-2	19.6	Bag	45	53	1733			Box 03		#	#							/	/	/		/													SAND	
Z5_OWF_BH02-COMP	06-3	20.05	Bag	15	53	768			Box 03																											SAND	

Lab Testing Schedule

CLIENT: DGEC
SITE: Golfe du Lion Geotechnical Site Investigation Centre (Z5)
JOB NO: F254727

Drawn by: MRI/BQM
Date: 10/2/2025

Borehole Number	Sample	Depth from (m)	Sample Type	Sample Length (cm)	Sample Diameter (mm)	Mass (g)	Wallingford / LLN	Sample received	Sample location	Sample used up	Moisture Content	Bulk Density	PP	TV	Sulphate Reducing Bacteria	Thermal Conductivity/Resistivity	Thermal Conductivity Reconstituted	Plasticity Index	Sieve	Sedimentation	PD	Min/Max Density	Permeameter Permeability [Constant I	OED	Shear Box	UU	UU remould	TXL Permeability [constant head]	CIDc (set of 3 tests)	CIUc	Loss on Ignition	Total Sulphate Content	Water Soluble Chloride	Carbonate Content of Soil	pH Value of Soil and Water	Soil Type	Remarks
Total number of offshore tests (#)											78	60	19	17	25	5	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0		
Total number of onshore tests (/)											0	0	0	0	0	0	1	8	30	30	19	8	6	4	10	2	5	3	12	4	13	13	13	13	13		
Z5_OWF_BH05-COMP	01-1	3	Bag	20	69	995.5			Box 04		#	#																			/	/	/	/	/	CLAY	
Z5_OWF_BH05-COMP	01-2	3.2	Wax	20	69	1332			Box 02 WAX		#	#														/	/									CLAY	cc on clay
Z5_OWF_BH05-COMP	01-3	3.4	Wax	20	69	1340			Box 02 WAX			#												/				/								CLAY	cc on clay
Z5_OWF_BH05-COMP	01-4	3.6	Bag	20	69	1118			Box 04			#																								CLAY	
Z5_OWF_BH05-COMP	01-5	3.8	Bag	20	69	1063			Box 04		#																									CLAY	
Z5_OWF_BH05-COMP	02-1	4	Bag	15	72	1019			Box 04				#	#				/	/	/	/															CLAY	
Z5_OWF_BH05-COMP	02-2	4.15	Wax	20	72	1479.5			Box 02 WAX			#	#	#																/						CLAY	
Z5_OWF_BH05-COMP	02-3	4.35	Bag	15	72	816			Box 04			#			#																					CLAY	SRB
Z5_OWF_BH05-COMP	02-4	4.5	Bag	20	72	1411			Box 04																											CLAY	
Z5_OWF_BH05-COMP	02-5	4.7	Bag	15	72	1109			Box 04																											CLAY	
Z5_OWF_BH05-COMP	02-6	4.85	Bag	15	72	1033			Box 04		#																									CLAY	
Z5_OWF_BH05-COMP	03-1	8	Bag	10	72	436			Box 04		#	#																			/	/	/	/	/	CLAY	
Z5_OWF_BH05-COMP	03-2	8.1	Bag	20	72	1719			Box 04		#	#	#	#												#	/									CLAY	UU
Z5_OWF_BH05-COMP	03-3	8.3	Bag	25	72	1995			Box 04		#		#	#				/	/	/	/															CLAY	
Z5_OWF_BH05-COMP	03-4	8.55	Bag	15	72	1192			Box 04																											CLAY	
Z5_OWF_BH05-COMP	03-5	8.7	Bag	30	72	2111			Box 04		#																									SAND	
Z5_OWF_BH05-COMP	04-1	9	Bag	20	72	1493			Box 05																						/	/	/	/	/	SAND	
Z5_OWF_BH05-COMP	04-2	9.2	Bag	20	72	1303			Box 05		#	#																								SAND	
Z5_OWF_BH05-COMP	04-3	9.4	Bag	20	72	1829			Box 05		#	#							/	/	/								/							SAND	
Z5_OWF_BH05-COMP	04-4	9.6	Bag	15	72	709			Box 05																											SAND	
Z5_OWF_BH05-COMP	05-1	13	Bag	30	53	1163			Box 05		#	#							/	/		/			/											SAND	
Z5_OWF_BH05-COMP	05-2	13.3	Bag	35	53	1265			Box 05		#	#			#																					SAND	SRB
Z5_OWF_BH05-COMP	06-1	17	Bag	45	53	1831			Box 05		#	#																	/							SAND	
Z5_OWF_BH05-COMP	06-2	17.45	Bag	40	53	1591			Box 05						#				/	/	/															CLAY	SRB
Z5_OWF_BH05-COMP	07-1	18	Bag	15	72	1011			Box 05		#																									SAND	
Z5_OWF_BH05-COMP	07-2	18.15	Bag	25	72	1662			Box 05		#	#											/													SAND	
Z5_OWF_BH07-COMP_a	01-1	1.5	Bag	20	69	809			Box 05		#																				/	/	/	/	/	SAND	
Z5_OWF_BH07-COMP_a	01-2	1.7	Bag	25	69	2220			Box 05																											CLAY	
Z5_OWF_BH07-COMP_a	01-3	1.95	Bag	25	69	1882			Box 05		#																									CLAY	
Z5_OWF_BH07-COMP_a	01-4	2.2	Bag	15	69	682			Box 05		#																				/	/	/	/	/	CLAY	

Lab Testing Schedule

CLIENT: DGEC
SITE: Golfe du Lion Geotechnical Site Investigation Centre (Z5)
JOB NO: F254727

Drawn by: MRI/BQM
Date: 10/2/2025

Total number of offshore tests (#)											78	60	19	17	25	5	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0		
Total number of onshore tests (/)											0	0	0	0	0	0	1	8	30	30	19	8	6	4	10	2	5	3	12	4	13	13	13	13	13		
Borehole Number	Sample	Depth from (m)	Sample Type	Sample Length (cm)	Sample Diameter (mm)	Mass (g)	Wallingford / LLN	Sample received	Sample location	Sample used up	Moisture Content	Bulk Density	PP	TV	Sulphate Reducing Bacteria	Thermal Conductivity/Resistivity	Thermal Conductivity Reconstituted	Plasticity Index	Sieve	Sedimentation	PD	Min/Max Density	Permeameter Permeability [Constant I	OED	Shear Box	UU	UU remould	TXL Permeability [constant head]	CIDc (set of 3 tests)	CIUc	Loss on Ignition	Total Sulphate Content	Water Soluble Chloride	Carbonate Content of Soil	pH Value of Soil and Water	Soil Type	Remarks
Z5_OWF_BH07-COMP_a	02-1	2.5	Bag	25	72	1453			Box 05		#					#		/	/	/	/															CLAY	TR
Z5_OWF_BH07-COMP_a	02-2	2.75	Bag	25	72	2260			Box 05						#																					CLAY	SRB
Z5_OWF_BH07-COMP_a	02-3	3	Bag	20	72	1873			Box 05				#																							CLAY	
Z5_OWF_BH07-COMP_a	02-4	3.2	Bag	15	72	986			Box 05				#																							CLAY	
Z5_OWF_BH07-COMP_a	03-1	6.5	Bag	30	72	2149			Box 05		#	#										/							/							SAND	
Z5_OWF_BH07-COMP_a	04-1	10	Bag	35	53	1450			Box 06		#								/	/	/															SAND	
Z5_OWF_BH07-COMP_a	04-2	10.35	Bag	20	53	687			Box 06		#	#			#																					SAND	SRB
Z5_OWF_BH07-COMP_a	05-1	11	Bag	10	53	525			Box 06																						/	/	/	/	/	SAND	
Z5_OWF_BH07-COMP_a	05-2	11.1	Bag	45	53	1779			Box 06		#	#																								SAND	
Z5_OWF_BH07-COMP_a	06-1	15	Bag	35	53	1293					#	#							/	/	/															SAND	
Z5_OWF_BH07-COMP_a	06-2	15.35	Bag	40	53	1647					#	#			#								/													SAND	SRB
Z5_OWF_BH07-COMP_a	07-1	19	Bag	55	53	1982			Box 06		#	#																	/							SAND	
Z5_OWF_BH07-COMP_a	08-1	20	Bag	30	53	1347			Box 06		#	#							/	/		/			/											SAND	
Z5_OWF_BH07-COMP_a	08-2	20.3	Bag	35	53	1316			Box 06						#																					SAND	SRB
Z5_OWF_BH09-COMP	01-1	3	Bag	30	53	1090			Box 03		#												/													SAND	
Z5_OWF_BH09-COMP	01-2	3.3	Bag	30	53	1316			Box 03						#				/	/	/								/							SAND	SRB
Z5_OWF_BH09-COMP	02A-1	7	Bag	35	69	1642			Box 03									/	/	/																CLAY	DISTURBED
Z5_OWF_BH09-COMP	03-1	8	Bag	30	69	1969			Box 03																											CLAY	
Z5_OWF_BH09-COMP	03-2	8.3	Bag	30	69	2429			Box 03																						/	/	/	/	/	CLAY	
Z5_OWF_BH09-COMP	03-3	8.6	Bag	30	69	2374			Box 03																											CLAY	
Z5_OWF_BH09-COMP	04-1	11	Bag	25	72	1551			Box 04		#	#	#	#				/	/	/	/															CLAY	
Z5_OWF_BH09-COMP	04-2	11.25	Wax	20	72	1596			Box 02 WAX		#	#	#	#																/						CLAY	
Z5_OWF_BH09-COMP	04-3	11.45	Wax	20	72	1511			Box 02 WAX		#	#												/				/								CLAY	
Z5_OWF_BH09-COMP	04-4	11.65	Bag	20	72	1396			Box 04		#	#	#	#												#	/									CLAY	UU
Z5_OWF_BH09-COMP	05-1	12	Bag	10	72	528			Box 04			#			#																/	/	/	/	/	CLAY	SRB
Z5_OWF_BH09-COMP	05-2	12.1	Wax	20	72	1730			Box 02 WAX			#	#	#																/						CLAY	
Z5_OWF_BH09-COMP	05-3	12.3	Wax	20	72	1653			Box 02 WAX		#	#	#	#										/												CLAY	
Z5_OWF_BH09-COMP	05-4	12.5	Wax	20	72	1484			Box 02 WAX		#	#	#	#												/	/									CLAY	
Z5_OWF_BH09-COMP	05-5	12.7	Bag	20	72	1483			Box 04		#		#	#				/	/	/																CLAY	
Z5_OWF_BH09-COMP	06-1	15.5	Bag	40	53	1515			Box 04		#								/	/									/							SAND	

Lab Testing Schedule

CLIENT: DGEC
SITE: Golfe du Lion Geotechnical Site Investigation Centre (Z5)
JOB NO: F254727

Drawn by:
MRI/BQM
Date:
10/2/2025

Borehole Number	Sample	Depth from (m)	Sample Type	Sample Length (cm)	Sample Diameter (mm)	Mass (g)	Wallingford / LLN	Sample received	Sample location	Sample used up	Moisture Content	Bulk Density	PP	TV	Sulphate Reducing Bacteria	Thermal Conductivity/Resistivity	Thermal Conductivity Reconstituted	Plasticity Index	Sieve	Sedimentation	PD	Min/Max Density	Permeameter Permeability [Constant I	OED	Shear Box	UU	UU remould	TXL Permeability [constant head]	CIDc (set of 3 tests)	CIUc	Loss on Ignition	Total Sulphate Content	Water Soluble Chloride	Carbonate Content of Soil	pH Value of Soil and Water	Soil Type	Remarks
Total number of offshore tests (#)											78	60	19	17	25	5	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0		
Total number of onshore tests (/)											0	0	0	0	0	0	1	8	30	30	19	8	6	4	10	2	5	3	12	4	13	13	13	13	13		
Z5_OWF_BH09-COMP	06-2	15.9	Bag	40	53	1681			Box 04		#				#							/														SAND	SRB
Z5_OWF_BH09-COMP	07-1	19.5	Bag	30	53	1060.5			Box 04		#																									SAND	
Z5_OWF_BH09-COMP	07-2	19.8	Bag	30	53	1680			Box 04		#				#				/	/	/				/											SAND	SRB
Z5_OWF_BH03-COMP	01-1	1.5	Bag	40	69	2579			Box 20		#	#			#	#						/							/							SAND	TC;SRB
Z5_OWF_BH03-COMP	01-2	1.9	Bag	30	69	1559			Box 20		#	#							/	/	/															SAND	
Z5_OWF_BH03-COMP	02-1	5.5	Bag	40	53	1661			Box 20		#	#							/	/	/		/													SAND	
Z5_OWF_BH03-COMP	02-2	5.9	Bag	30	53	1992.5			Box 20		#	#													/											SAND	
Z5_OWF_BH03-COMP	03-1	9.5	Bag	40	53	1575			Box 20		#	#																			/	/	/	/	/	SAND	
Z5_OWF_BH03-COMP	03-2	9.9	Bag	40	53	1600			Box 20		#								/	/					/											SAND	
Z5_OWF_BH03-COMP	04-1	11.5	Bag	60	53	2440			Box 20		#	#			#														/							SAND	SRB at 11.70m
Z5_OWF_BH03-COMP	05-1	15	Bag	40	53	1663			Box 20		#	#																	/							SAND	
Z5_OWF_BH03-COMP	05-2	15.4	Bag	25	53	1054			Box 20		#								/	/																SAND	
Z5_OWF_BH03-COMP	06-1	19	Bag	40	53	1611			Box 20		#	#										/														SAND	
Z5_OWF_BH03-COMP	06-2	19.4	Bag	40	53	1756			Box 20		#				#				/	/	/				/											SAND	SRB at 19.40m

5. Laboratory Test Data

Laboratory Classification Test Results

Z5_OWF_BH01-COMP

Sample		Depth		Unit Weight [kN/m^3]							Atterberg Limits				Undrained Shear Strength				
No	Ground Description	BSF [m]	w [%]	γ-w	γ	$\gamma_{d,min}$	$\gamma_{d,max}$	ρ_s [Mg/m^3]	CC [%]	OC [%]	w_P [%]	w_L [%]	I_P [%]	Fines [%]	PP [kPa]	TV [kPa]	FC [kPa]	LV [kPa]	UU [kPa]
01	From 3.50 m to 3.65 m - dark grey (2.5Y 4/1) calcareous fine to medium SAND From 3.65 m to 3.75 m - light brownish grey (2.5Y 6/2) gravelly calcareous medium to coarse SAND with rare fine gravel-size shell fragments. Gravel is subangular to subrounded of various lithologies	3.50						2.66						1.2					
		3.65	24.3	19.6	18.7				36.4	6.7									
		3.75	22.7	19.9															
02	From 7.00 m to 7.60 m - dark grey (2.5Y 4/1) highly calcareous fine SAND	7.00				12.7	17.1							8.5					
		7.15	29.5	18.9															
03	From 11.00 m to 11.90 m - dark grey (2.5Y 4/1) slightly silty highly calcareous fine SAND	11.00																	
		11.45	30.9	18.7										6.7					
04	From 14.00 m to 14.25 m - dark grey (2.5Y 4/1) slightly silty highly calcareous fine SAND - with rare fine to medium gravel-size pockets of clay From 14.25 m to 14.50 m - dark grey (2.5Y 4/1) slightly silty highly calcareous medium to coarse SAND with abundant fine to medium gravel-size shell fragments - with rare fine to medium gravel-size pockets of clay From 14.50 m to 14.85 m - soft very dark grey (10YR 3/1) sandy calcareous CLAY with rare coarse sand-size shell fragments	14.00																	
		14.50							27.3	9.3									
05	From 15.00 m to 15.65 m - firm very low to medium strength dark grey (2.5Y 4/1) sandy highly calcareous CLAY with abundant fine to medium gravel-size shells and shell fragments From 15.65 m to 15.95 m - stiff low to medium strength dark grey (2.5Y 4/1) slightly sandy highly calcareous CLAY with rare fine to medium gravel-size shell fragments	15.00									18.0	29.0	11.0	45.4					
		15.35	26.1	19.8											50	43			
		15.65	24.6	20.0												38			
		15.95			20.4														
06	From 16.00 m to 16.60 m - stiff medium to high strength very dark grey (2.5Y 3/1) slightly silty highly calcareous CLAY with rare fine to medium gravel-size shell fragments	16.00						2.75			22.0	34.0	12.0	85.4	70	50			
		16.05	26.6	19.7															
		16.10			19.9														
		16.30			20.2														82
		16.30			18.2														
		16.50	25.5	19.9											90	45			
		16.50	29.9	19.2															
07	From 19.00 m to 19.60 m - dark grey (2.5Y 4/1) slightly silty calcareous fine to medium SAND with rare fine to medium gravel-size shell fragments	19.00												21.6					
		19.25	25.2	19.5															

Notes

w : Water content
γ-w : Unit weight derived from water content
γ : Unit weight from volume mass calculation
$\gamma_{d,min}$: Minimum index dry unit weight
$\gamma_{d,max}$: Maximum index dry unit weight
ρ_s : Particle density

CC : $CaCO_3$ content
OC : Organic content
w_P : Plastic limit
w_L : Liquid limit
I_P : Plasticity index
Fines : Mass percentage of material passing 63 µm or 75 µm sieve

PP : Pocket penetrometer
TV : Torvane
FC : Fall cone
LV : Laboratory vane
UU : Unconsolidated undrained triaxial

10^r : r refers to test on remoulded soil
10^d : d refers to test on disturbed soil
10^s : Residual undrained shear strength
BSF: Below seafloor
W : WIP
RC : Rock Core

Note that both Rock Core (RC) and WIPS (W) were used for this location and the numbering is a reflection of switching between the different sampling method

Laboratory Classification Test Results

Z5_OWF_BH02-COMP

Sample		Depth		Unit Weight [kN/m^3]				ρ_s	CC	OC	Atterberg Limits			Fines	Undrained Shear Strength				
No	Ground Description	BSF [m]	w [%]	γ-w	γ	$\gamma_{d,min}$	$\gamma_{d,max}$	[Mg/m^3]	[%]	[%]	w_P [%]	w_L [%]	I_P [%]	[%]	PP [kPa]	TV [kPa]	FC [kPa]	LV [kPa]	UU [kPa]
01	From 3.00 m to 3.20 m - very dark grey (2.5Y 3/1) slightly gravelly calcareous fine to coarse SAND with rare fine to medium gravel-size shell fragments. Gravel is subangular to subrounded fine to medium of various lithologies From 3.20 m to 3.40 m - dark greyish brown (2.5Y 4/2) calcareous fine SAND	3.00						2.67						3.3					
		3.20	22.2	20.1	19.4				22.7	4.0									
		3.35	26.5	19.4	19.0														
02	From 6.50 m to 7.20 m - dark greyish brown (2.5Y 4/2) slightly calcareous fine SAND with rare coarse sand-size shell fragments	6.50				12.3	16.1												
		6.90	29.9	18.9	18.5														
		6.90	30.4	18.9															
03	From 10.50 m to 11.15 m - dark greyish brown (2.5Y 4/2) slightly calcareous fine SAND	10.50						2.68						4.5					
		10.85	30.6	18.8	21.7														
		10.85	27.4	19.3															
04	From 14.50 m to 15.10 m - dark greyish brown (2.5Y 4/2) slightly calcareous fine SAND	14.50												3.3					
		14.80	30.5	18.8	18.9														
		14.80	29.7	19.0															
05	From 18.50 m to 18.90 m - dark greyish brown (2.5Y 4/2) slightly calcareous fine SAND At 18.75 m - with a fine gravel-size pocket of clay From 18.90 m to 19.20 m - dark greyish brown (2.5Y 4/2) slightly calcareous fine SAND - with abundant fine to coarse gravel-size pockets of clay	18.50																	
		18.85	27.4	19.3	18.1														
		18.85	26.1	19.5															
06	From 19.50 m to 19.60 m - very dark grey (2.5Y 3/1) slightly calcareous fine SAND with occasional fine to medium gravel-size shell fragments At 19.60 m - with a medium gravel-size pocket of clay From 19.60 m to 20.05 m - very dark grey (2.5Y 3/1) slightly calcareous fine SAND - with occasional fine to medium gravel-size pockets of clay From 20.05 m to 20.20 m - very dark grey (2.5Y 3/1) slightly calcareous fine SAND with rare fine gravel-size shell fragments - with abundant fine to medium gravel-size pockets of clay	19.50							40.9	8.4									
		19.60												6.2					
		19.85	27.0	19.3	18.1														
		19.85	26.0	19.5															

Notes

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CC : $CaCO_3$ content
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w_P : Plastic limit
w_L : Liquid limit
I_P : Plasticity index
Fines : Mass percentage of material passing 63 µm or 75 µm sieve

PP : Pocket penetrometer
TV : Torvane
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10^r : r refers to test on remoulded soil
10^d: d refers to test on disturbed soil
10^s : Residual undrained shear strength
BSF: Below seafloor
W : WIP
RC : Rock Core

Note that both Rock Core (RC) and WIPS (W) were used for this location and the numbering is a reflection of switching between the different sampling method

Laboratory Classification Test Results

Z5_OWF_BH03-COMP

Sample		Depth		Unit Weight [kN/m^3]							Atterberg Limits				Undrained Shear Strength				
No	Ground Description	BSF [m]	w [%]	γ-w	γ	$\gamma_{d,min}$	$\gamma_{d,max}$	ρ_s [Mg/m^3]	CC [%]	OC [%]	w_P [%]	w_L [%]	I_P [%]	Fines [%]	PP [kPa]	TV [kPa]	FC [kPa]	LV [kPa]	UU [kPa]
01	From 1.50 m to 2.20 m - dark greyish brown (2.5Y 4/2) slightly calcareous fine to medium SAND with rare coarse sand-size to fine gravel-size shell fragments	1.50				13.1	16.8												
		1.90	25.8	19.6	19.4			2.69						3.3					
02	From 5.50 m to 6.20 m - greyish brown (2.5Y 5/2) slightly calcareous fine to medium SAND with rare coarse sand-size to fine gravel-size shell fragments At 5.95 m - with a thick lamina of clay	5.50												12.4					
		5.70	25.3	19.7															
		5.90	29.1	19.1	18.2														
03	From 9.50 m to 10.30 m - dark greyish brown (2.5Y 4/2) slightly calcareous fine to medium SAND - with extremely closely to closely spaced thick laminae of clay From 10.15 m to 10.30 m - with numerous fine gravel-size shell fragments	9.50							21.6	8.0									
		9.70	24.5	19.8	19.4														
		9.90												20.2					
		10.00	30.8	18.9															
04	From 11.50 m to 12.10 m - dark greyish brown (2.5Y 4/2) slightly calcareous fine to medium SAND with rare coarse sand-size shell fragments	11.50																	
		11.80	21.8	20.3	18.4														
		12.00	20.8	20.5															
05	From 15.00 m to 15.65 m - very dark grey (2.5Y 3/1) slightly calcareous fine to medium SAND with rare coarse sand-size shell fragments - with a thin bed of organic matter	15.00																	
		15.20	24.9	19.8	18.8														
		15.40	25.5	19.7										12.4					
06	From 19.00 m to 19.80 m - dark greyish brown (2.5Y 4/2) slightly calcareous fine to medium SAND - with closely spaced thick laminae to thin beds of clay	19.00				12.4	19.2												
		19.20	26.3	19.5	19.9														
		19.40	27.9	19.3				2.70						21.4					

Notes

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OC : Organic content
w_P : Plastic limit
w_L : Liquid limit
I_P : Plasticity index
Fines : Mass percentage of material passing 63 µm or 75 µm sieve
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TV : Torvane
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UU : Unconsolidated undrained triaxial
10^r : r refers to test on remoulded soil
10^d : d refers to test on disturbed soil
10^s : Residual undrained shear strength
BSF: Below seafloor
W : WIP
RC : Rock Core

Note that both Rock Core (RC) and WIPS (W) were used for this location and the numbering is a reflection of switching between the different sampling method

Laboratory Classification Test Results

Z5_OWF_BH05-COMP

Sample		Depth		Unit Weight [kN/m^3]							Atterberg Limits				Undrained Shear Strength				
No	Ground Description	BSF [m]	w [%]	γ-w	γ	$\gamma_{d,min}$	$\gamma_{d,max}$	ρ_s [Mg/m^3]	CC [%]	OC [%]	w_P [%]	w_L [%]	I_P [%]	Fines [%]	PP [kPa]	TV [kPa]	FC [kPa]	LV [kPa]	UU [kPa]
01	From 3.00 m to 4.00 m - firm very dark grey (2.5Y 3/1) slightly calcareous CLAY with rare coarse sand-size to medium gravel-size shells and shell fragments - with abundant fine to medium gravel-size pockets of organic matter	3.00							38.7	3.1									
		3.20	33.0	18.9	17.6														
		3.60			17.6														
		4.00	32.4	19.0															
02	From 4.00 m to 5.00 m - firm very dark grey (2.5Y 3/1) slightly calcareous CLAY with rare coarse sand-size to fine gravel-size shell fragments	4.00						2.77			23.0	39.0	16.0	100.0					
		4.15													63	45			
		4.35			19.4														
		5.00	32.1	19.0															
03	From 8.00 m to 8.30 m - firm medium strength very dark grey (2.5Y 3/1) slightly calcareous CLAY with occasional coarse sand-size to fine gravel-size shell fragments From 8.30 m to 8.70 m - stiff very dark grey (2.5Y 3/1) sandy calcareous CLAY with abundant coarse sand-size to medium gravel-size shells and shell fragments From 8.70 m to 9.00 m - very dark greyish brown (2.5Y 3/2) clayey calcareous fine to medium SAND with numerous coarse sand-size to coarse gravel-size shells and shell fragments	8.00							21.1	3.5									
		8.10	25.6	19.8	20.5														71
		8.10			20.4														
		8.30						2.74			17.0	26.0	9.0		74	64			
		8.40	20.5	20.7															
		8.80	21.1	20.5															
		15.75												46.5					
04	From 9.00 m to 9.40 m - very dark greyish brown (2.5Y 3/2) clayey calcareous fine to medium SAND with occasional coarse sand-size to coarse gravel-size shells and shell fragments At 9.35 m - with a coarse gravel-size pocket of clay From 9.40 m to 9.75 m - dark greyish brown (2.5Y 4/2) slightly silty calcareous fine to coarse SAND At 9.60 m - with a thin bed of clay	9.00							34.1	12.0									
		9.25	19.5	20.8	18.7														
		9.25	19.1	20.8															
		9.40						2.69						28.0					
		9.50	16.5	21.4	18.6														
		9.50	22.7	20.2															
05	From 13.00 m to 13.65 m - very dark grey (2.5Y 3/1) slightly silty slightly calcareous fine to medium SAND	13.00				12.4	16.7							7.2					
		13.25	26.1	19.6	18.2														
		13.25	27.5	19.4															
		13.45	24.6	19.9	18.6														
		13.45	24.4	19.9															

Notes

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$\gamma_{d,max}$: Maximum index dry unit weight
ρ_s : Particle density
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OC : Organic content
w_P : Plastic limit
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I_P : Plasticity index
Fines : Mass percentage of material passing 63 µm or 75 µm sieve
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10^r : r refers to test on remoulded soil
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10^s : Residual undrained shear strength
BSF: Below seafloor
W : WIP
RC : Rock Core

Note that both Rock Core (RC) and WIPS (W) were used for this location and the numbering is a reflection of switching between the different sampling method

Laboratory Classification Test Results

Z5_OWF_BH05-COMP

Sample No	Sample Ground Description	Depth BSF [m]	w [%]	Unit Weight [kN/m³] γ-w	Unit Weight [kN/m³] γ	Unit Weight [kN/m³] $\gamma_{d,min}$	Unit Weight [kN/m³] $\gamma_{d,max}$	ρ_s [Mg/m³]	CC [%]	OC [%]	Atterberg Limits w_P [%]	Atterberg Limits w_L [%]	Atterberg Limits I_P [%]	Fines [%]	Undrained Shear Strength PP [kPa]	Undrained Shear Strength TV [kPa]	Undrained Shear Strength FC [kPa]	Undrained Shear Strength LV [kPa]	Undrained Shear Strength UU [kPa]
06	From 17.00 m to 17.45 m - very dark grey (2.5Y 3/1) slightly silty highly calcareous fine to medium SAND with frequent coarse sand-size to coarse gravel-size shells and shell fragments - with rare fine to coarse gravel-size pockets of clay At 17.10 m - with a thin lamina of organic matter From 17.45 m to 17.85 m - firm very dark grey (2.5Y 3/1) highly calcareous CLAY with rare coarse sand-size shell fragments - with numerous fine to coarse gravel-size pockets of sand	17.00																	
		17.30	24.1	20.0	18.7														
		17.30	23.9	20.0															
		17.45						2.73						69.9					
07	From 18.00 m to 18.15 m - very dark grey (2.5Y 3/1) slightly gravelly slightly calcareous fine to coarse SAND with occasional fine to medium gravel-size shell fragments. Gravel is subangular to subrounded fine to coarse of various lithologies - with rare medium gravel-size pockets of organic matter From 18.15 m to 18.40 m - very dark greyish brown (2.5Y 3/2) slightly calcareous fine to medium SAND with rare coarse sand-size shell fragments	18.00																	
		18.05	19.3	20.8															
		18.30	25.9	19.7	18.6														

Notes

w : Water content
γ-w : Unit weight derived from water content
γ : Unit weight from volume mass calculation
$\gamma_{d,min}$: Minimum index dry unit weight
$\gamma_{d,max}$: Maximum index dry unit weight
ρ_s : Particle density

CC : $CaCO_3$ content
OC : Organic content
w_P : Plastic limit
w_L : Liquid limit
I_P : Plasticity index
Fines : Mass percentage of material passing 63 µm or 75 µm sieve

PP : Pocket penetrometer
TV : Torvane
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10^r : r refers to test on remoulded soil
10^d : d refers to test on disturbed soil
10^s : Residual undrained shear strength
BSF: Below seafloor
W : WIP
RC : Rock Core

Note that both Rock Core (RC) and WIPS (W) were used for this location and the numbering is a reflection of switching between the different sampling method

Laboratory Classification Test Results

Z5_OWF_BH07-COMP_a

Sample		Depth		Unit Weight [kN/m³]							Atterberg Limits				Undrained Shear Strength				
No	Ground Description	BSF [m]	w [%]	γ-w	γ	$\gamma_{d,min}$	$\gamma_{d,max}$	ρ_s [Mg/m³]	CC [%]	OC [%]	w_P [%]	w_L [%]	I_P [%]	Fines [%]	PP [kPa]	TV [kPa]	FC [kPa]	LV [kPa]	UU [kPa]
01	From 1.50 m to 1.70 m - very dark greyish brown (2.5Y 3/2) slightly calcareous fine to medium SAND with rare coarse sand-size to fine gravel-size shells and shell fragments From 1.70 m to 2.20 m - very dark grey (2.5Y 3/1) sandy slightly calcareous CLAY with abundant coarse sand-size to coarse gravel-size shells and shell fragments At 1.80 m - with a medium gravel-size pocket of organic matter At 1.85 m - with a thin bed of sand From 2.20 m to 2.35 m - very dark grey (2.5Y 3/1) sandy slightly calcareous CLAY with occasional coarse sand-size to fine gravel-size shells and shell fragments	1.50							29.6	5.8									
		1.60	31.7	18.8															
		2.05	21.2	20.4															
		2.20							25.0	4.5									
		2.25	21.3	20.4															
02	From 2.50 m to 3.35 m - very dark grey (2.5Y 3/1) sandy slightly calcareous CLAY with occasional coarse sand-size to fine gravel-size shells and shell fragments	2.50						2.73			17.0	26.0	9.0	46.5					
		2.65	23.1	20.0															
03	From 6.50 m to 6.80 m - dark greyish brown (2.5Y 4/2) slightly calcareous medium to coarse SAND	6.50				14.4	18.0												
		6.70	21.6	20.3	19.6														
04	From 10.00 m to 10.35 m - dark greyish brown (2.5Y 4/2) slightly gravelly slightly calcareous medium to coarse SAND with frequent fine to coarse gravel-size shell fragments. Gravel is subangular to subrounded fine of various lithologies From 10.35 m to 10.55 m - very dark grey (2.5Y 3/1) silty calcareous fine SAND with rare coarse sand-size shell fragments - with rare fine gravel-size pockets of organic matter	10.00						2.67						2.7					
		10.20	15.2	21.6															
		10.40	24.2	19.9	18.2														
		10.40	27.3	19.4															
05	From 11.00 m to 11.10 m - very dark grey (2.5Y 3/1) silty calcareous fine SAND with rare coarse sand-size shell fragments - with rare fine gravel-size pockets of organic matter From 11.10 m to 11.55 m - dark greyish brown (2.5Y 4/2) gravelly slightly calcareous medium to coarse SAND with occasional coarse sand-size shell fragments. Gravel is subangular to subrounded fine of various lithologies From 11.15 m to 11.20 m - with a thin bed of clay	11.00							29.6	5.6									
		11.20	33.5	18.5	18.4														
		11.20	31.9	18.7															
		11.40	19.5	20.7	18.5														
		11.40	20.6	20.5															

Notes

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$\gamma_{d,max}$: Maximum index dry unit weight
ρ_s : Particle density

CC : $CaCO_3$ content
OC : Organic content
w_P : Plastic limit
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Fines : Mass percentage of material passing 63 µm or 75 µm sieve

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10^s : Residual undrained shear strength
BSF: Below seafloor
W : WIP
RC : Rock Core

Note that both Rock Core (RC) and WIPS (W) were used for this location and the numbering is a reflection of switching between the different sampling method

Direction générale de l'énergie et du climat

Laboratory Classification Test Results
Z5_OWF_BH07-COMP_a

Sample		Depth		Unit Weight [kN/m³]							Atterberg Limits				Undrained Shear Strength				
No	Ground Description	BSF [m]	w [%]	γ-w	γ	$\gamma_{d,min}$	$\gamma_{d,max}$	ρ_s [Mg/m³]	CC [%]	OC [%]	w_P [%]	w_L [%]	I_P [%]	Fines [%]	PP [kPa]	TV [kPa]	FC [kPa]	LV [kPa]	UU [kPa]
06	From 15.00 m to 15.75 m - very dark grey (2.5Y 3/1) slightly silty calcareous fine to medium SAND with rare coarse sand-size shell fragments	15.00						2.68						8.2					
		15.30	25.2	19.7	18.3														
		15.30	25.5	19.7															
		15.50	23.2	20.0	18.9														
		15.50	23.4	20.0															
07	From 19.00 m to 19.55 m - very dark grey (2.5Y 3/1) slightly silty calcareous fine to medium SAND with rare coarse sand-size shell fragments	19.00																	
		19.25	27.0	19.4	18.3														
		19.25	26.3	19.5															
08	From 20.00 m to 20.65 m - very dark grey (2.5Y 3/1) slightly silty calcareous fine to medium SAND with rare coarse sand-size shell fragments	20.00				12.7	16.6							6.8					
		20.20	28.0	19.3	18.4														
		20.20	27.1	19.4															

Notes

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γ : Unit weight from volume mass calculation
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$\gamma_{d,max}$: Maximum index dry unit weight
ρ_s : Particle density

CC : $CaCO_3$ content
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BSF: Below seafloor
W : WIP
RC : Rock Core

Note that both Rock Core (RC) and WIPS (W) were used for this location and the numbering is a reflection of switching between the different sampling method

Laboratory Classification Test Results

Z5_OWF_BH09-COMP

Sample		Depth BSF [m]	w [%]	Unit Weight [kN/m³]				ρ_s [Mg/m³]	CC [%]	OC [%]	Atterberg Limits			Fines [%]	Undrained Shear Strength				
No	Ground Description			γ-w	γ	$\gamma_{d,min}$	$\gamma_{d,max}$				w_P [%]	w_L [%]	I_P [%]		PP [kPa]	TV [kPa]	FC [kPa]	LV [kPa]	UU [kPa]
01	From 3.00 m to 3.30 m - very dark grey (5Y 3/1) highly calcareous medium to coarse SAND with abundant fine to medium gravel-size shell fragments From 3.30 m to 3.60 m - very dark grey (5Y 3/1) slightly silty fine to medium SAND - with rare fine gravel-size pockets of organic matter	3.00																	
		3.20	25.5	19.5															
		3.30						2.66						6.7					
02	From 7.00 m to 7.00 m - No recovery	7.00																	
02A	From 7.00 m to 7.35 m - very soft extremely low strength very dark grey (2.5Y 3/1) highly calcareous CLAY	7.00									15.0	27.0	12.0	65.1					
03	From 8.00 m to 8.90 m - soft very dark grey (2.5Y 3/1) highly calcareous CLAY	8.00																	
		8.30							22.3	7.6									
04	From 11.00 m to 11.85 m - stiff medium strength very dark grey (2.5Y 3/1) highly calcareous CLAY - with frequent fine gravel-size pockets of organic matter	11.00						2.76			20.0	39.0	19.0	97.4					
		11.25	31.5	19.0	19.2										63	45			
		11.45	30.3	19.2	19.3														
		11.65	30.1	19.2	18.9														
		11.65	30.5	19.2	17.9														
		11.75													67	64			
05	From 12.00 m to 12.90 m - stiff medium to high strength very dark grey (2.5Y 3/1) highly calcareous CLAY - with abundant fine gravel-size pockets of organic matter	12.00							21.8	10.0									
		12.10			20.3														
		12.30			19.8										62	58			
		12.50	30.6	19.2	19.1										83	70			
		12.70									23.0	39.0	16.0	100.0	65	60			
		12.90	31.0	19.1															
		12.90	30.0	19.2															
06	From 15.50 m to 16.25 m - dark olive brown (2.5Y 3/3) slightly silty highly calcareous fine SAND with rare fine gravel-size shell fragments	15.50												14.7					
		15.90	24.2	19.8		12.7	17.2												
07	From 19.50 m to 20.05 m - dark olive brown (2.5Y 3/3) highly calcareous fine to medium SAND with rare fine gravel-size shell fragments - with closely spaced thick laminae to thin beds of clay	19.50																	
		19.80	18.8	20.8				2.68						7.7					

Notes

w	: Water content	CC	: $CaCO_3$ content	PP	: Pocket penetrometer	10^r	: r refers to test on remoulded soil
γ-w	: Unit weight derived from water content	OC	: Organic content	TV	: Torvane	10^d	: d refers to test on disturbed soil
γ	: Unit weight from volume mass calculation	w_P	: Plastic limit	FC	: Fall cone	10^s	: Residual undrained shear strength
$\gamma_{d,min}$	: Minimum index dry unit weight	w_L	: Liquid limit	LV	: Laboratory vane	BSF	: Below seafloor
$\gamma_{d,max}$	: Maximum index dry unit weight	I_P	: Plasticity index	UU	: Unconsolidated undrained triaxial	W	: WIP
ρ_s	: Particle density	Fines	: Mass percentage of material passing 63 µm or 75 µm sieve			RC	: Rock Core

Note that both Rock Core (RC) and WIPS (W) were used for this location and the numbering is a reflection of switching between the different sampling method

Test Report

Liquid Limit, Plastic Limit and Plasticity Index

ISO 17892-12:2018

0919

No.	Test Date	Location	Sample	Depth [m]	Preparation Method (% passing 0.425 mm)	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	Laboratory
1	25/03/2025	Z5_OWF_BH01-COMP	05-1	15.00	Sieved (66)	29	18	11	F
2	20/03/2025	Z5_OWF_BH01-COMP	06-1	16.00	Natural soil	34	22	12	F
3	20/03/2025	Z5_OWF_BH05-COMP	02-1	4.00	Natural soil	39	23	16	F
4	25/03/2025	Z5_OWF_BH05-COMP	03-3	8.30	Sieved (80)	26	17	9	F
5	25/03/2025	Z5_OWF_BH07-COMP_a	02-1	2.50	Sieved (74)	26	17	9	F
6	25/03/2025	Z5_OWF_BH09-COMP	02A-1	7.00	Sieved (72)	27	15	12	F
7	19/03/2025	Z5_OWF_BH09-COMP	04-1	11.00	Natural soil	39	20	19	F
8	21/03/2025	Z5_OWF_BH09-COMP	05-5	12.70	Natural soil	39	23	16	F

Fall cone method with 4 points, 80 gr/30° cone used and increasing water content

NP=Non-plastic sample

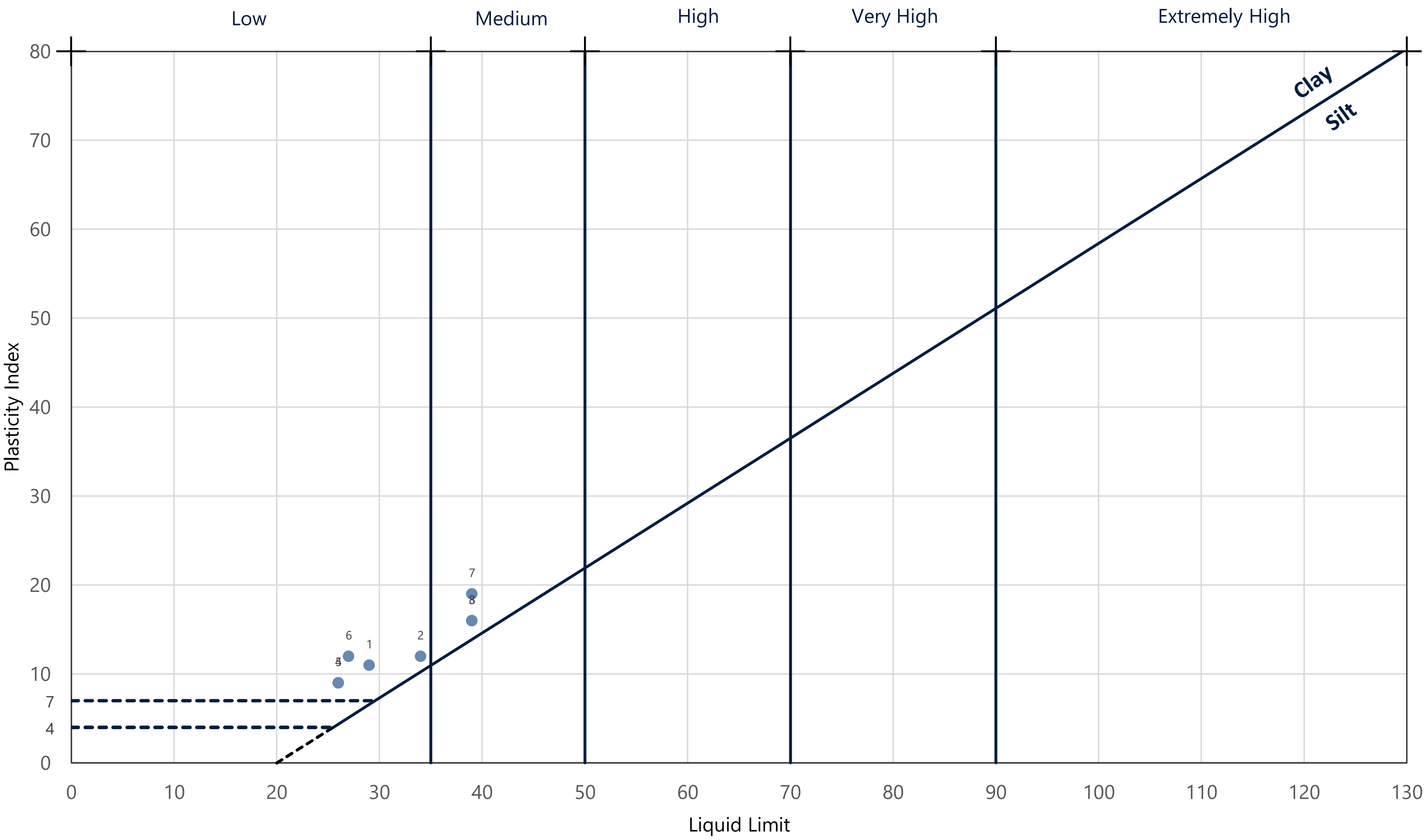
Note: For sample descriptions, please refer to the report section presenting laboratory test results.

Test Page 1 / 2

A: Wallingford, UK
F: Louvain-la-Neuve, Belgium

Approved by ET - 15/07/2025

Plasticity Chart



Location ID	Sample ID	Depth [m]	Percentage Soil Types					D10 [mm]	D30 [mm]	D50 [mm]	D60 [mm]	Cc [-]	Cu [-]
			Fines	Clay	Silt	Sand	Gravel						
Z5_OWF_BH01-COMP	01-1	3.50	1	-	-	98	0	0.151	0.169	0.189	0.2	0.9	1.3
Z5_OWF_BH01-COMP	02-1	7.00	8	-	-	92	0	0.064	0.084	0.11	0.125	0.9	2.0
Z5_OWF_BH01-COMP	03-2	11.45	7	-	-	93	0	0.066	0.083	0.105	0.119	0.9	1.8
Z5_OWF_BH01-COMP	05-1	15.00	45	14	32	47	8	-	0.015	0.166	0.323	-	-
Z5_OWF_BH01-COMP	06-1	16.00	85	20	65	12	2	-	0.004	0.012	0.018	-	-
Z5_OWF_BH01-COMP	07-1	19.00	22	8	14	77	1	0.004	0.166	0.238	0.26	28.2	68.8
Z5_OWF_BH02-COMP	01-1	3.00	3	-	-	87	10	0.08	0.156	0.211	0.319	1.0	4.0
Z5_OWF_BH02-COMP	03-1	10.50	4	-	-	96	0	0.068	0.091	0.123	0.142	0.9	2.1
Z5_OWF_BH02-COMP	04-1	14.50	3	-	-	97	0	0.068	0.086	0.108	0.121	0.9	1.8
Z5_OWF_BH02-COMP	06-2	19.60	6	-	-	94	0	0.066	0.087	0.115	0.131	0.9	2.0
Z5_OWF_BH03-COMP	01-2	1.90	3	-	-	97	0	0.075	0.128	0.163	0.173	1.3	2.3
Z5_OWF_BH03-COMP	02-1	5.50	12	7	6	87	1	0.009	0.103	0.157	0.169	6.8	18.3
Z5_OWF_BH03-COMP	03-2	9.90	20	6	14	74	6	0.008	0.077	0.115	0.14	5.5	18.6
Z5_OWF_BH03-COMP	05-2	15.40	12	4	9	87	1	0.037	0.136	0.217	0.249	2.0	6.7
Z5_OWF_BH03-COMP	06-2	19.40	21	6	15	79	-	0.007	0.073	0.101	0.119	6.2	16.5
Z5_OWF_BH05-COMP	02-1	4.00	100	26	74	0	0	-	0.002	0.006	0.009	-	-
Z5_OWF_BH05-COMP	03-3	15.75	47	13	34	51	3	-	0.013	0.091	0.198	-	-
Z5_OWF_BH05-COMP	04-3	9.40	28	9	19	71	1	0.003	0.072	0.187	0.232	7.7	81.1
Z5_OWF_BH05-COMP	Batch_02	13.00	7	-	-	93	0	0.066	0.091	0.125	0.147	0.9	2.2
Z5_OWF_BH05-COMP	06-2	17.45	70	22	48	30	0	-	0.004	0.017	0.033	-	-
Z5_OWF_BH07-COMP_a	02-1	2.50	47	16	31	44	9	-	0.011	0.084	0.172	-	-
Z5_OWF_BH07-COMP_a	04-1	10.00	3	-	-	77	20	0.236	0.379	0.535	0.648	0.9	2.7
Z5_OWF_BH07-COMP_a	06-1	15.00	8	-	-	92	0	0.065	0.085	0.112	0.128	0.9	2.0
Z5_OWF_BH07-COMP_a	Batch_03	20.00	7	-	-	93	0	0.066	0.088	0.118	0.136	0.9	2.1
Z5_OWF_BH09-COMP	01-2	3.30	7	-	-	93	0	0.078	0.161	0.186	0.2	1.7	2.6
Z5_OWF_BH09-COMP	02A-1	7.00	65	14	51	25	10	-	0.011	0.034	0.051	-	-
Z5_OWF_BH09-COMP	04-1	11.00	97	24	74	3	0	-	0.003	0.008	0.011	-	-
Z5_OWF_BH09-COMP	05-5	12.70	100	28	72	0	0	-	0.002	0.006	0.009	-	-
Z5_OWF_BH09-COMP	06-1	15.50	15	2	13	85	0	0.031	0.094	0.153	0.17	1.7	5.5
Z5_OWF_BH09-COMP	07-2	19.80	8	-	-	89	3	0.081	0.206	0.24	0.257	2.1	3.2

Test method : ISO 17892-4 (2016)

TOPAZ / PSD Summary of particle size distribution test results with %Fines (FFSA) / 2025-09-03 09:53:08 +02:00

Summary of Particle Size Distribution Test Results

Test Report

Particle Size Distribution

ISO 17892-4: 2016 - 5.2 - Sieving Method

Test Identification			
Location	Z5_OWF_BH01-COMP	Depth [m]	3.50
Sample	01-1	Test start date	21/03/2025

Sieving

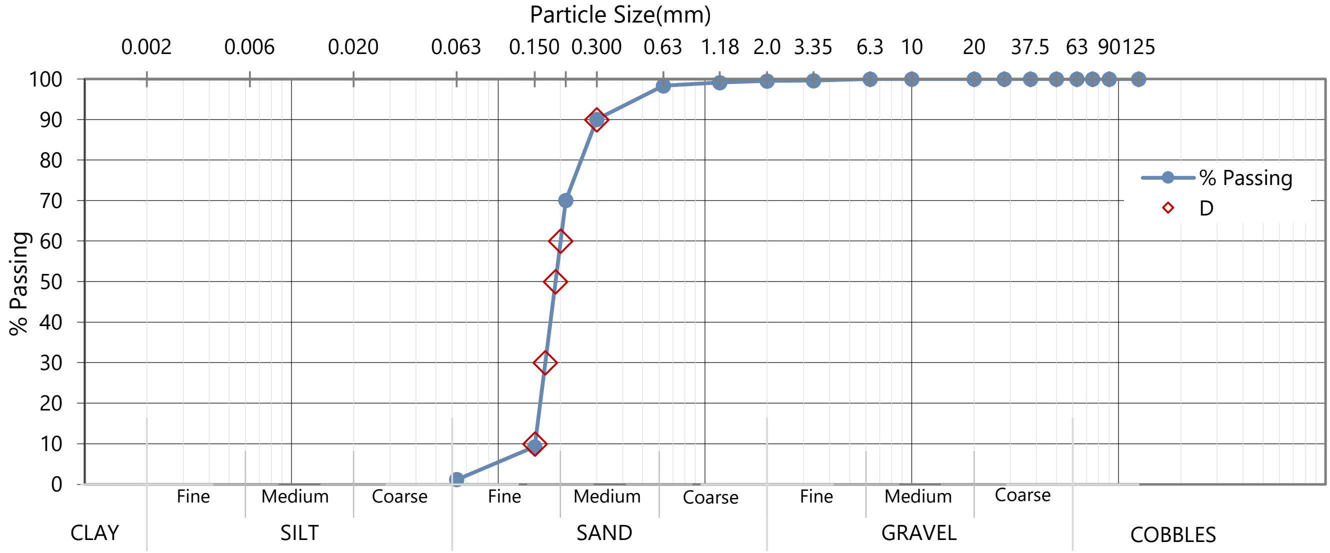
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	100
3.35	100
2.00	100
1.18	99
0.630	98
0.300	90
0.212	70
0.150	9
0.063	1

Sedimentation

Particle Size [mm]	Passing [%]

Curve Characteristics		
D_{90}	0.300 mm	Uniformity Coefficient
D_{60}	0.200 mm	C_U 1.33
D_{50}	0.189 mm	Coefficient of Curvature
D_{30}	0.169 mm	C_C 0.94
D_{10}	0.151 mm	

Soil fractions [%]	
Cobbles	0
Gravel	0
Sand	99
Silt*	1
Clay	0



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

Project: 503387 - F254727 Laboratory: Louvain-la-Neuve Approved by: TG - 22/04/2025

Test Page - 1/1

Test Report

Particle Size Distribution

ISO 17892-4: 2016 - 5.2 - Sieving Method

UKAS TESTING 0919

Test Identification			
Location	Z5_OWF_BH01-COMP	Depth [m]	7.00
Sample	02-1	Test start date	28/03/2025

Sieving

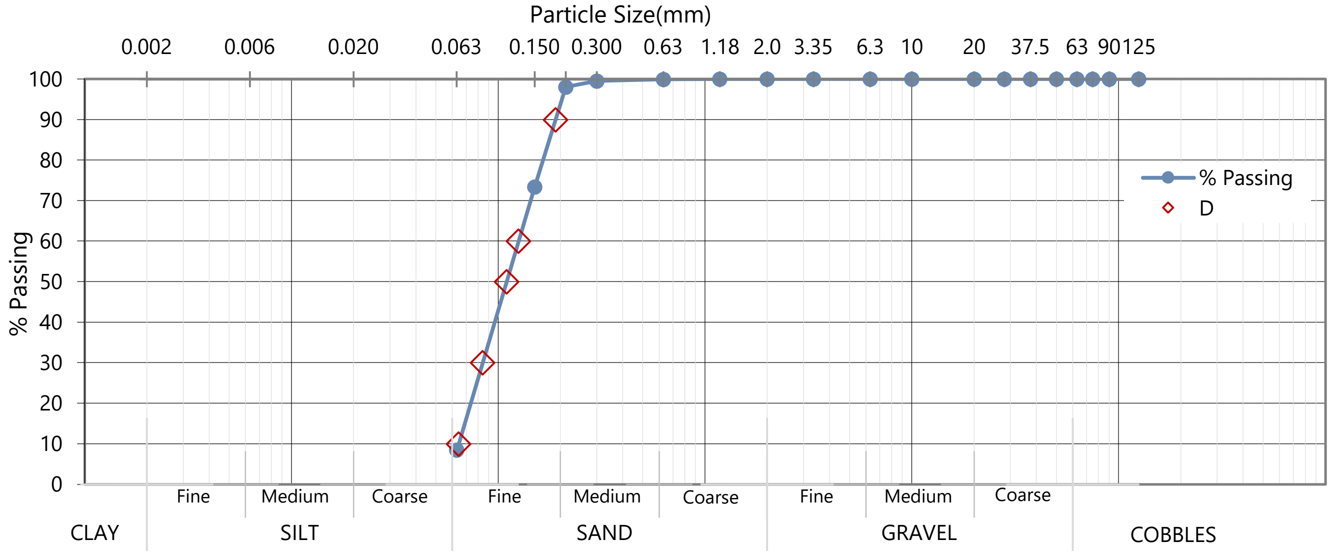
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	100
3.35	100
2.00	100
1.18	100
0.630	100
0.300	100
0.212	98
0.150	73
0.063	8

Sedimentation

Particle Size [mm]	Passing [%]

Curve Characteristics			
D_{90}	0.189 mm	Uniformity Coefficient	
D_{60}	0.125 mm	C_U	1.95
D_{50}	0.110 mm	Coefficient of Curvature	
D_{30}	0.084 mm	C_C	0.87
D_{10}	0.064 mm		

Soil fractions [%]	
Cobbles	0
Gravel	0
Sand	92
Silt*	8
Clay	0



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

Project: 503387 - F254727 Laboratory: Wallingford Approved by: ET - 07/05/2025

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FUGRO

Test Report

Particle Size Distribution

ISO 17892-4: 2016 - 5.2 - Sieving Method

UKAS TESTING 0919

Test Identification			
Location	Z5-OWF_BH01-COMP	Depth [m]	11.45
Sample	03-2	Test start date	05/05/2025

Sieving

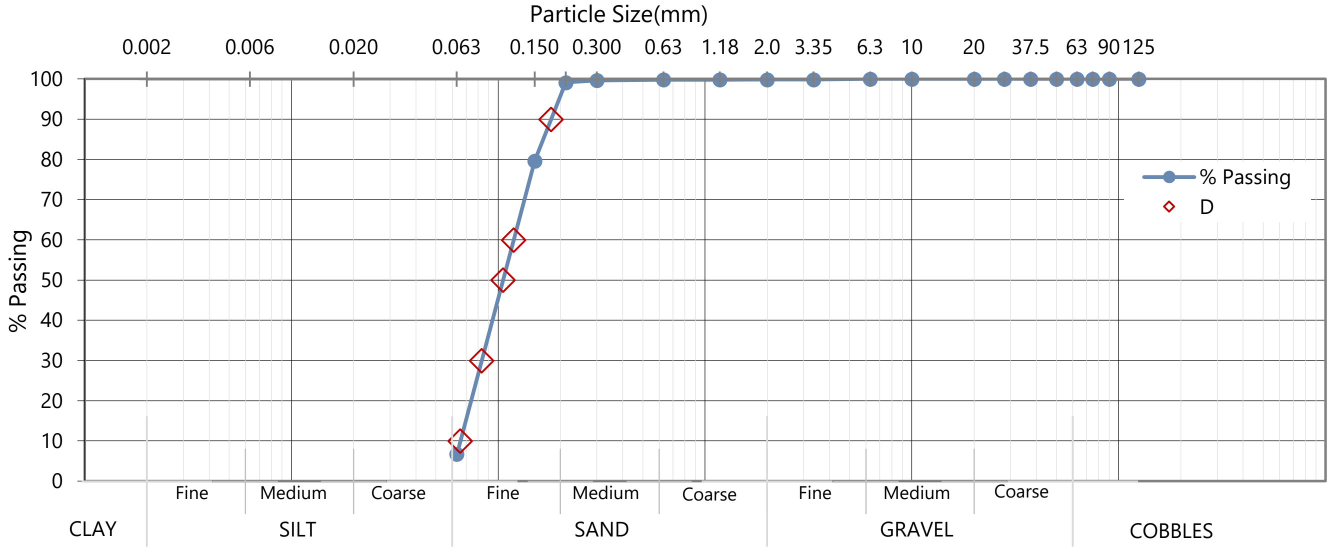
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	100
3.35	100
2.00	100
1.18	100
0.630	100
0.300	100
0.212	99
0.150	80
0.063	7

Sedimentation

Particle Size [mm]	Passing [%]

Curve Characteristics			
D_{90}	0.180 mm	Uniformity Coefficient	
D_{60}	0.119 mm	C_U	1.81
D_{50}	0.105 mm	Coefficient of Curvature	
D_{30}	0.083 mm	C_C	0.89
D_{10}	0.066 mm		

Soil fractions [%]	
Cobbles	0
Gravel	0
Sand	93
Silt*	7
Clay	0



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

Project: 503387 - F254727 Laboratory: Louvain-la-Neuve Approved by: TG - 31/05/2025

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Test Report

Particle Size Distribution

ISO 17892-4: 2016 - 5.2 & 5.4 - Sieving & Sedimentation by Pipette Method

UKAS TESTING 0919

Test Identification			
Location	Z5_OWF_BH01-COMP	Depth [m]	15.00
Sample	05-1	Test start date	14/03/2025

Sieving

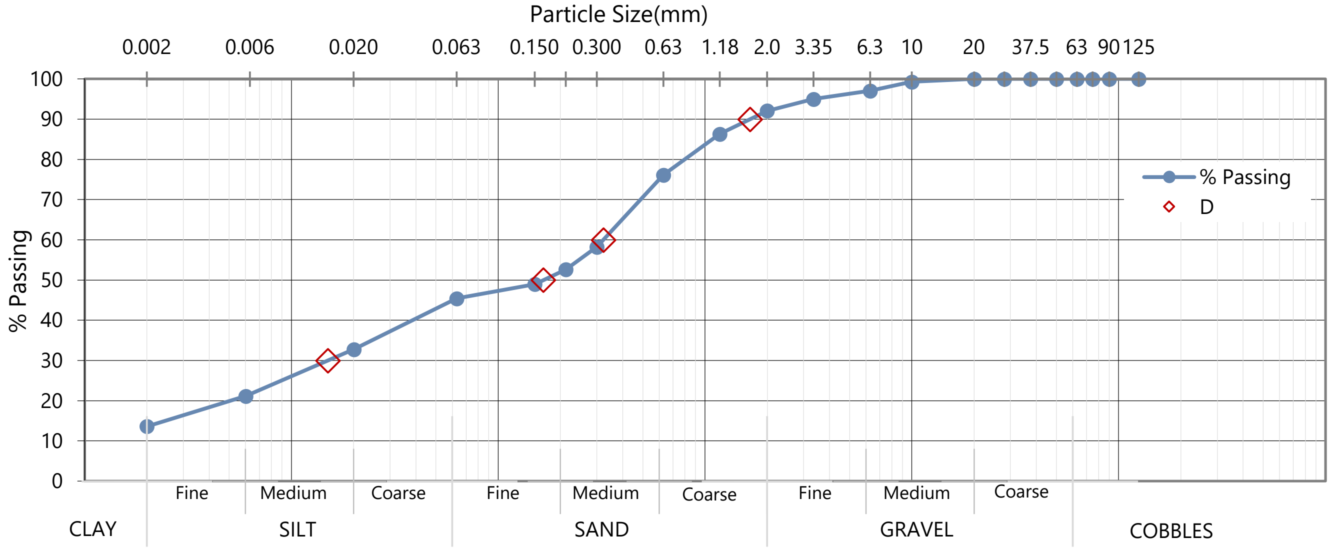
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	99
6.3	97
3.35	95
2.00	92
1.18	86
0.630	76
0.300	58
0.212	53
0.150	49
0.063	45

Sedimentation

Particle Size [mm]	Passing [%]
0.0200	33
0.0060	21
0.0020	14

Curve Characteristics			
D_{90}	1.653 mm	Uniformity Coefficient	
D_{60}	0.323 mm	C_U	-
D_{50}	0.166 mm	Coefficient of Curvature	
D_{30}	0.015 mm	C_C	-
D_{10}	-		

Soil fractions [%]	
Cobbles	0
Gravel	8
Sand	47
Silt*	31
Clay	14



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

Project: 503387 - F254727
Laboratory: Louvain-la-Neuve
Approved by: TG - 22/04/2025

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Test Report

Particle Size Distribution

ISO 17892-4: 2016 - 5.2 & 5.4 - Sieving & Sedimentation by Pipette Method

Test Identification			
Location	Z5_OWF_BH01-COMP	Depth [m]	16.00
Sample	06-1	Test start date	14/03/2025

Sieving

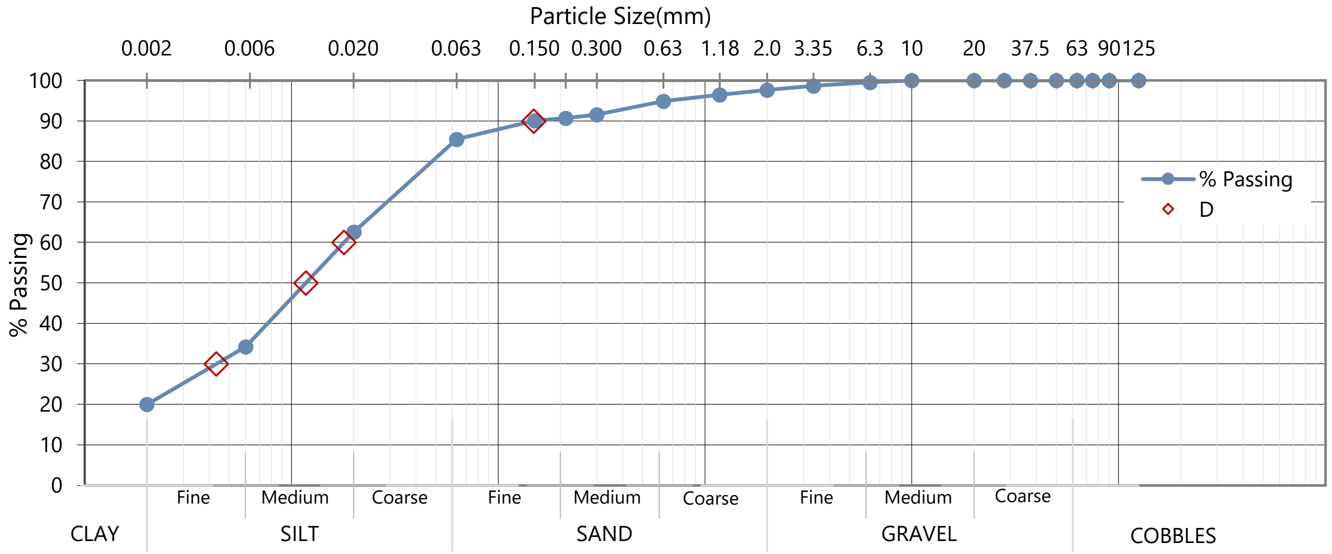
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	100
3.35	99
2.00	98
1.18	96
0.630	95
0.300	92
0.212	91
0.150	90
0.063	85

Sedimentation

Particle Size [mm]	Passing [%]
0.0200	63
0.0060	34
0.0020	20

Curve Characteristics			
D_{90}	0.149 mm	Uniformity Coefficient	
D_{60}	0.018 mm	C_U	-
D_{50}	0.012 mm	Coefficient of Curvature	
D_{30}	0.004 mm	C_C	-
D_{10}	-		

Soil fractions [%]	
Cobbles	0
Gravel	2
Sand	13
Silt*	65
Clay	20



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

Project: 503387 - F254727

Laboratory: Louvain-la-Neuve

Approved by: SW - 25/06/2025

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Test Report

Particle Size Distribution

ISO 17892-4: 2016 - 5.2 & 5.4 - Sieving & Sedimentation by Pipette Method

UKAS TESTING 0919

Test Identification			
Location	Z5_OWF_BH01-COMP	Depth [m]	19.00
Sample	07-1	Test start date	21/03/2025

Sieving

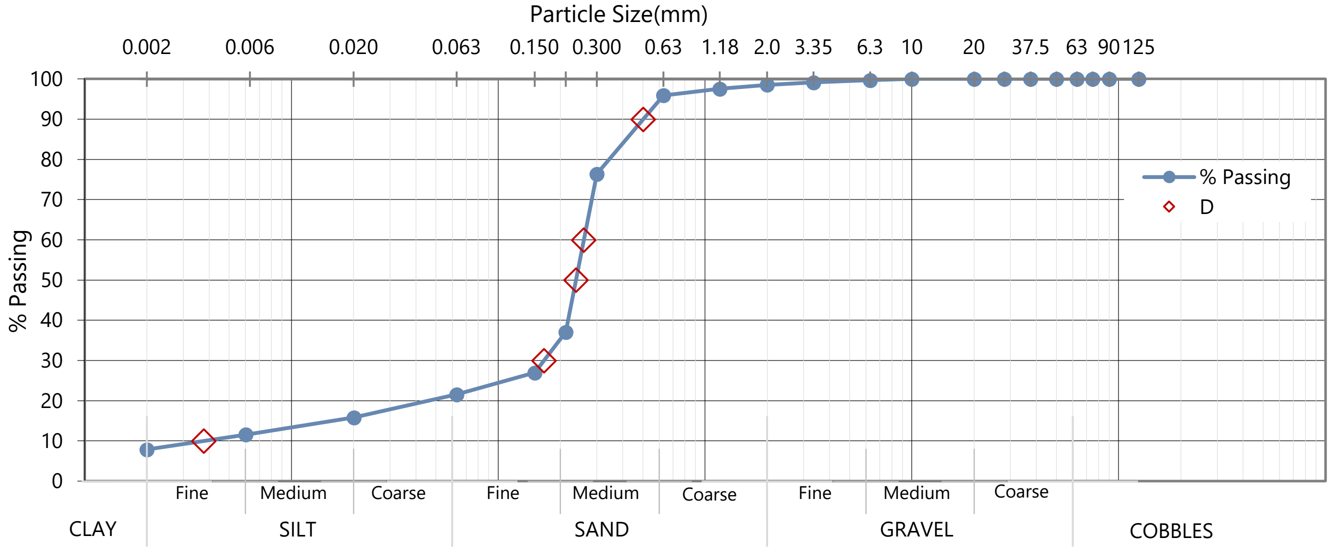
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	100
3.35	99
2.00	99
1.18	98
0.630	96
0.300	76
0.212	37
0.150	27
0.063	22

Sedimentation

Particle Size [mm]	Passing [%]
0.0200	16
0.0060	12
0.0020	8

Curve Characteristics			
D_{90}	0.503 mm	Uniformity Coefficient	
D_{60}	0.260 mm	**C_U**	68.76
D_{50}	0.238 mm	Coefficient of Curvature	
D_{30}	0.166 mm	**C_C**	28.24
D_{10}	0.004 mm		

Soil fractions [%]	
Cobbles	0
Gravel	1
Sand	77
Silt*	14
Clay	8



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

Project: 503387 - F254727

Laboratory: Louvain-la-Neuve

Approved by: TG - 22/04/2025

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Test Report

Particle Size Distribution

ISO 17892-4: 2016 - 5.2 - Sieving Method

Test Identification			
Location	Z5_OWF_BH02-COMP	Depth [m]	3.00
Sample	01-1	Test start date	21/03/2025

Sieving

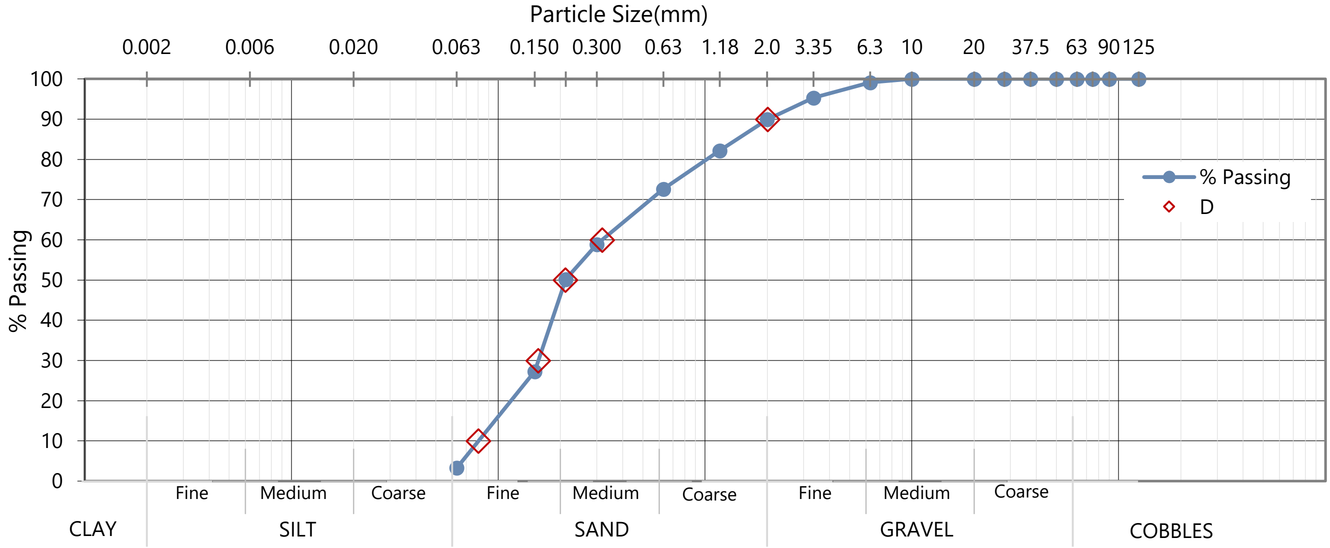
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	99
3.35	95
2.00	90
1.18	82
0.630	73
0.300	59
0.212	50
0.150	27
0.063	3

Sedimentation

Particle Size [mm]	Passing [%]

Curve Characteristics			
D_{90}	2.011 mm	Uniformity Coefficient	
D_{60}	0.319 mm	C_U	3.97
D_{50}	0.211 mm	Coefficient of Curvature	
D_{30}	0.156 mm	C_C	0.96
D_{10}	0.080 mm		

Soil fractions [%]	
Cobbles	0
Gravel	10
Sand	87
Silt*	3
Clay	0



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

Project: 503387 - F254727 Laboratory: Louvain-la-Neuve Approved by: TG - 23/04/2025

Test Page - 1/1

Test Report

Particle Size Distribution

ISO 17892-4: 2016 - 5.2 - Sieving Method

Test Identification			
Location	Z5_OWF_BH02-COMP	Depth [m]	10.50
Sample	03-1	Test start date	21/03/2025

Sieving

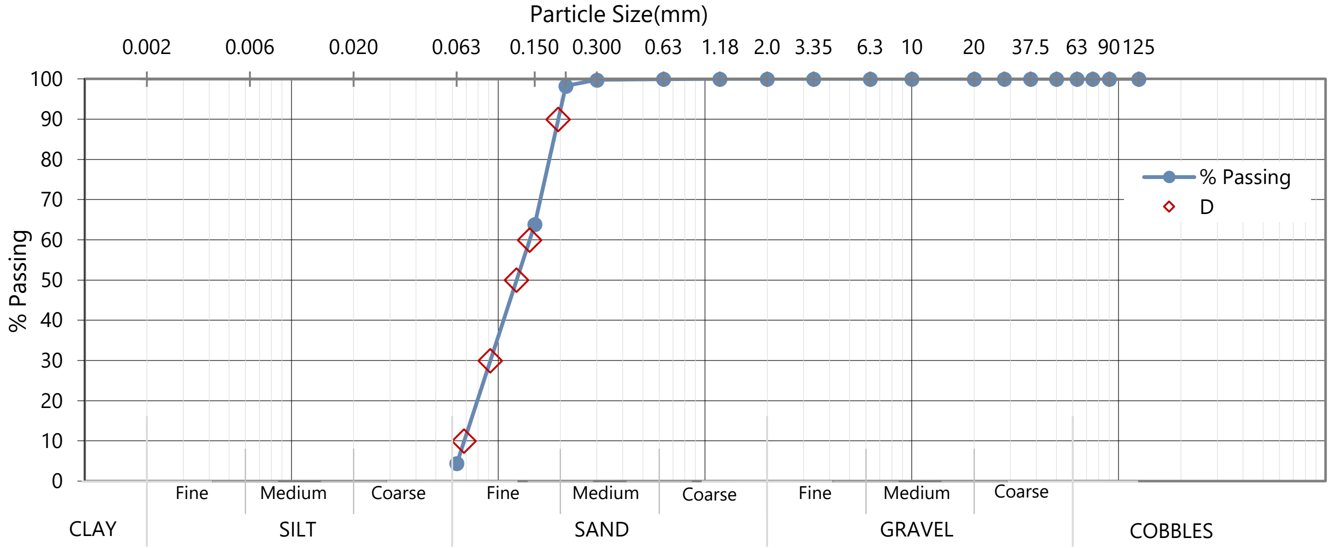
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	100
3.35	100
2.00	100
1.18	100
0.630	100
0.300	100
0.212	98
0.150	64
0.063	4

Sedimentation

Particle Size [mm]	Passing [%]

Curve Characteristics			
D_{90}	0.195 mm	Uniformity Coefficient	
D_{60}	0.142 mm	C_U	2.08
D_{50}	0.123 mm	Coefficient of Curvature	
D_{30}	0.091 mm	C_C	0.86
D_{10}	0.068 mm		

Soil fractions [%]	
Cobbles	0
Gravel	0
Sand	96
Silt*	4
Clay	0



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

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Test Report

Particle Size Distribution

ISO 17892-4: 2016 - 5.2 - Sieving Method

UKAS TESTING 0919

Test Identification			
Location	Z5_OWF_BH02-COMP	Depth [m]	14.50
Sample	04-1	Test start date	21/03/2025

Sieving

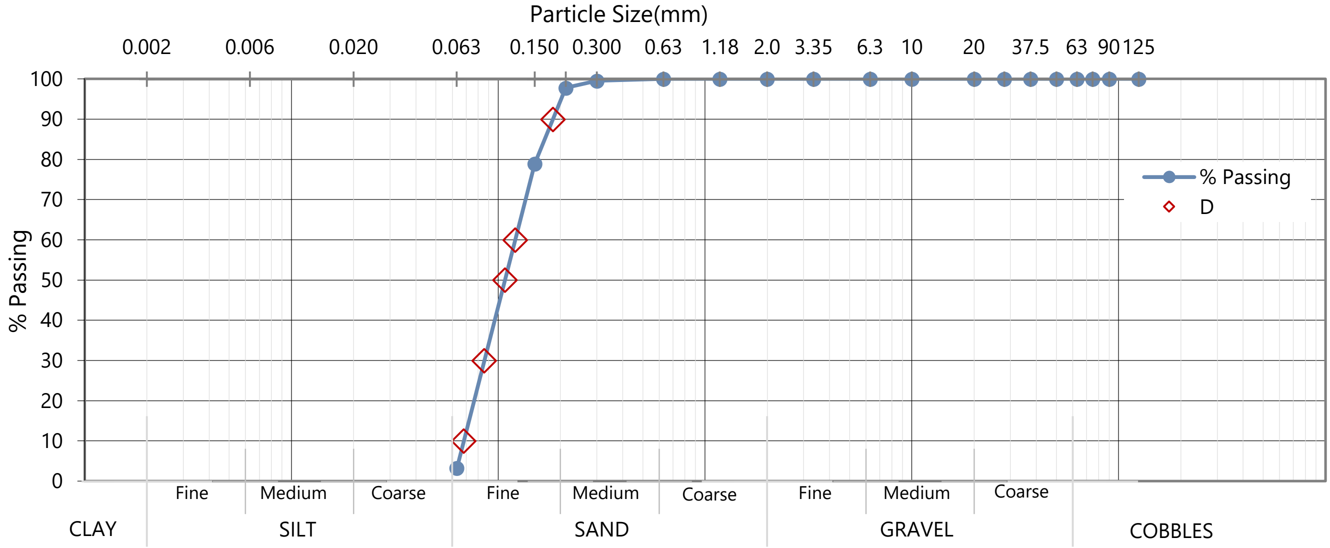
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	100
3.35	100
2.00	100
1.18	100
0.630	100
0.300	100
0.212	98
0.150	79
0.063	3

Sedimentation

Particle Size [mm]	Passing [%]

Curve Characteristics			
D_{90}	0.184 mm	Uniformity Coefficient	
D_{60}	0.121 mm	C_U	1.77
D_{50}	0.108 mm	Coefficient of Curvature	
D_{30}	0.086 mm	C_C	0.89
D_{10}	0.068 mm		

Soil fractions [%]	
Cobbles	0
Gravel	0
Sand	97
Silt*	3
Clay	0



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

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Test Report

Particle Size Distribution

ISO 17892-4: 2016 - 5.2 - Sieving Method

UKAS TESTING 0919

Test Identification			
Location	Z5_OWF_BH02-COMP	Depth [m]	19.60
Sample	06-2	Test start date	05/05/2025

Sieving

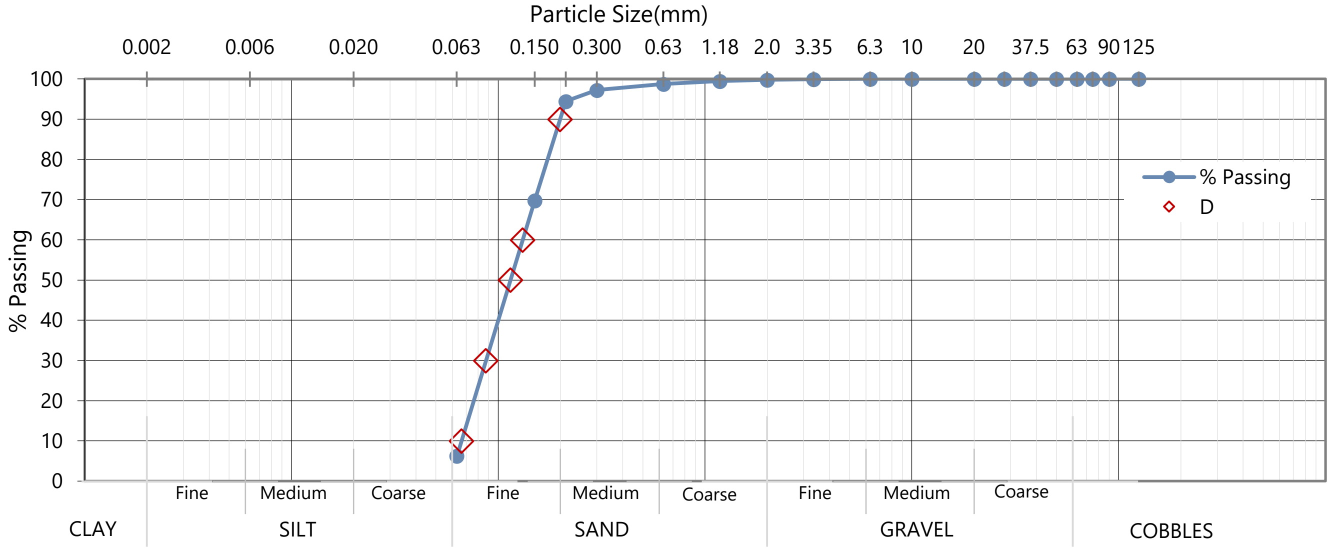
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	100
3.35	100
2.00	100
1.18	99
0.630	99
0.300	97
0.212	94
0.150	70
0.063	6

Sedimentation

Particle Size [mm]	Passing [%]

Curve Characteristics			
D_{90}	0.199 mm	Uniformity Coefficient	
D_{60}	0.131 mm	C_U	1.98
D_{50}	0.115 mm	Coefficient of Curvature	
D_{30}	0.087 mm	C_C	0.87
D_{10}	0.066 mm		

Soil fractions [%]	
Cobbles	0
Gravel	0
Sand	94
Silt*	6
Clay	0



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

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Test Report

Particle Size Distribution

ISO 17892-4: 2016 - 5.2 - Sieving Method

Test Identification			
Location	Z5_OWF_BH03-COMP	Depth [m]	1.90
Sample	01-2	Test start date	21/03/2025

Sieving

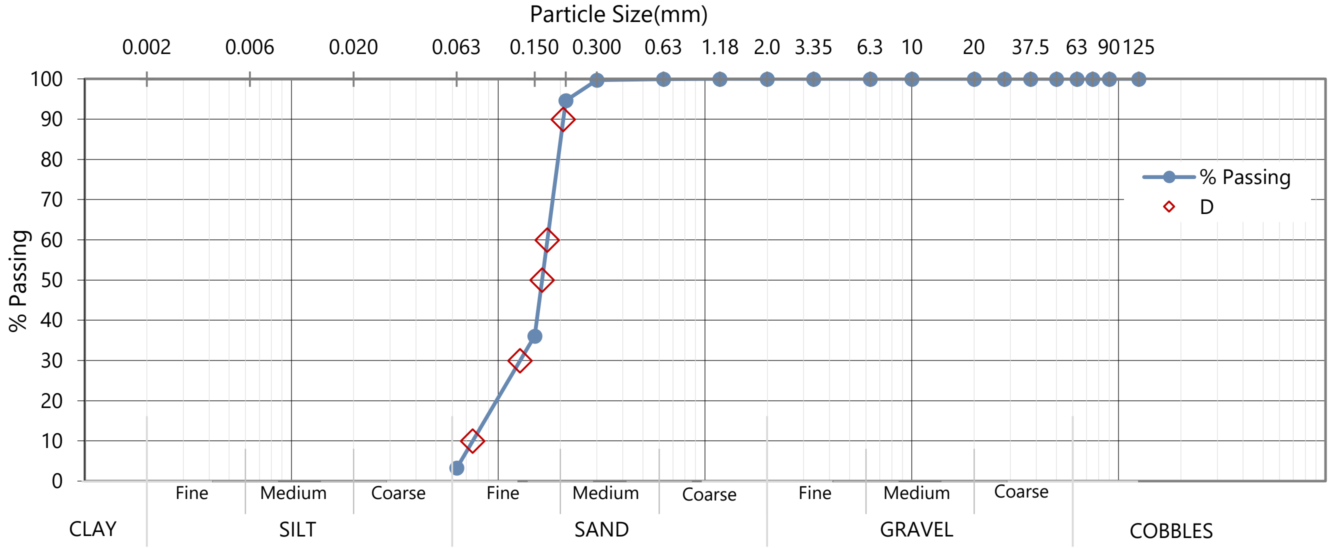
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	100
3.35	100
2.00	100
1.18	100
0.630	100
0.300	100
0.212	95
0.150	36
0.063	3

Sedimentation

Particle Size [mm]	Passing [%]

Curve Characteristics			
D_{90}	0.206 mm	Uniformity Coefficient	
D_{60}	0.173 mm	**C_U**	2.30
D_{50}	0.163 mm	Coefficient of Curvature	
D_{30}	0.128 mm	**C_C**	1.25
D_{10}	0.075 mm		

Soil fractions [%]	
Cobbles	0
Gravel	0
Sand	97
Silt*	3
Clay	0



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

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Particle Size Distribution

ISO 17892-4: 2016 - 5.2 & 5.4 - Sieving & Sedimentation by Pipette Method

UKAS TESTING 0919

Test Identification			
Location	Z5_OWF_BH03-COMP	Depth [m]	5.50
Sample	02-1	Test start date	05/05/2025

Sieving

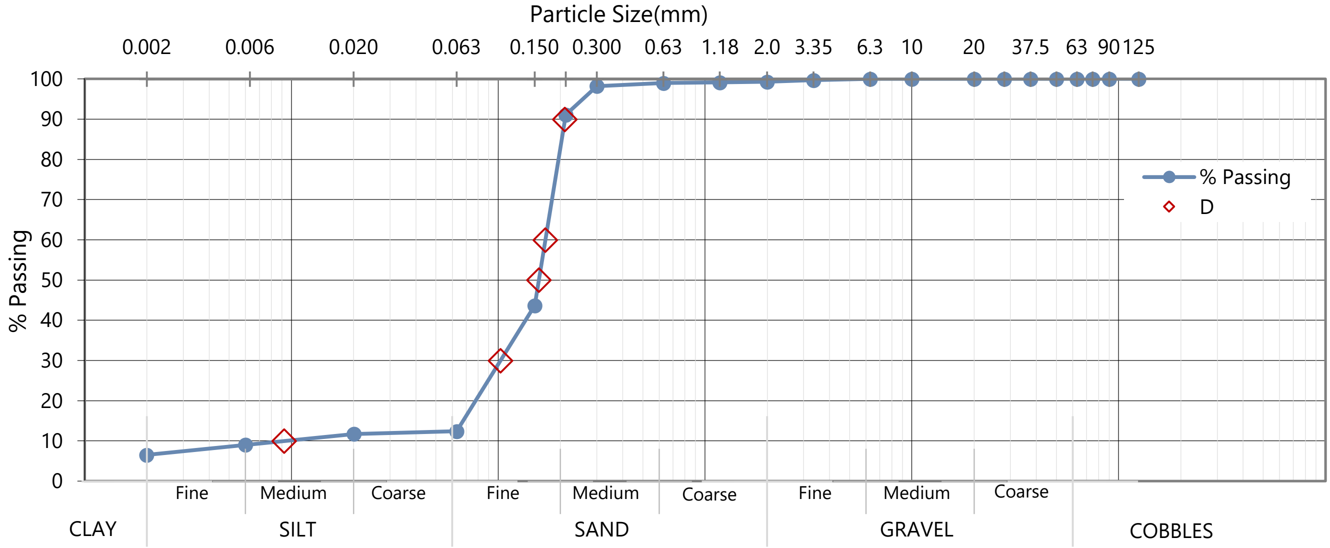
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	100
3.35	100
2.00	99
1.18	99
0.630	99
0.300	98
0.212	91
0.150	44
0.063	12

Sedimentation

Particle Size [mm]	Passing [%]
0.0200	12
0.0060	9
0.0020	7

Curve Characteristics			
D_{90}	0.210 mm	Uniformity Coefficient	
D_{60}	0.169 mm	C_U	18.33
D_{50}	0.157 mm	Coefficient of Curvature	
D_{30}	0.103 mm	C_C	6.76
D_{10}	0.009 mm		

Soil fractions [%]	
Cobbles	0
Gravel	1
Sand	87
Silt*	5
Clay	7



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

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Particle Size Distribution

ISO 17892-4: 2016 - 5.2 & 5.4 - Sieving & Sedimentation by Pipette Method

UKAS TESTING 0919

Test Identification			
Location	Z5_OWF_BH03-COMP	Depth [m]	9.90
Sample	03-2	Test start date	30/04/2025

Sieving

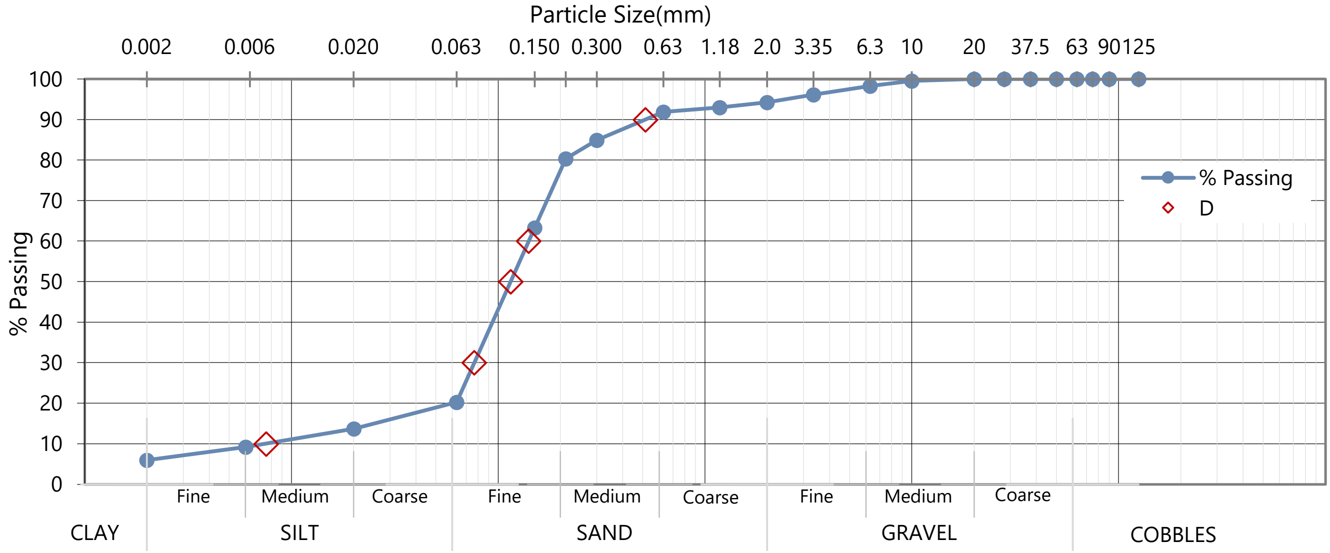
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	98
3.35	96
2.00	94
1.18	93
0.630	92
0.300	85
0.212	80
0.150	63
0.063	20

Sedimentation

Particle Size [mm]	Passing [%]
0.0200	14
0.0060	9
0.0020	6

Curve Characteristics			
D_{90}	0.516 mm	Uniformity Coefficient	
D_{60}	0.140 mm	C_U	18.59
D_{50}	0.115 mm	Coefficient of Curvature	
D_{30}	0.077 mm	C_C	5.55
D_{10}	0.008 mm		

Soil fractions [%]	
Cobbles	0
Gravel	6
Sand	74
Silt*	14
Clay	6



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

*** Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.**

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Particle Size Distribution

ISO 17892-4: 2016 - 5.2 & 5.4 - Sieving & Sedimentation by Pipette Method

UKAS TESTING 0919

Test Identification			
Location	Z5_OWF_BH03-COMP	Depth [m]	15.40
Sample	05-2	Test start date	21/03/2025

Sieving

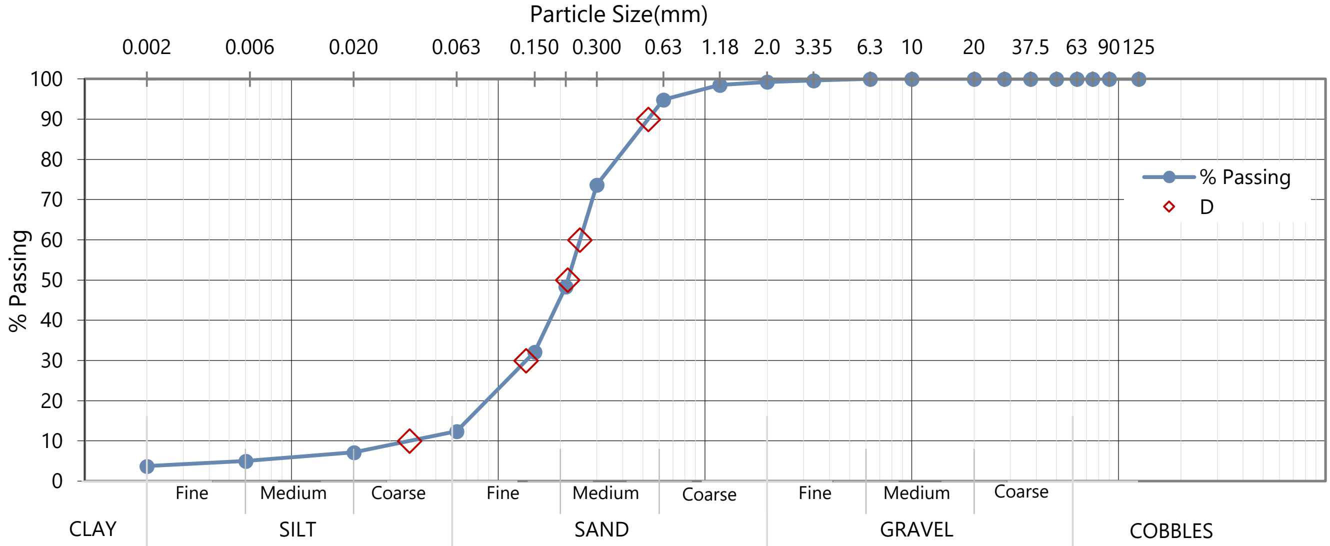
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	100
3.35	100
2.00	99
1.18	98
0.630	95
0.300	74
0.212	48
0.150	32
0.063	12

Sedimentation

Particle Size [mm]	Passing [%]
0.0200	7
0.0060	5
0.0020	4

Curve Characteristics			
D_{90}	0.532 mm	Uniformity Coefficient	
D_{60}	0.249 mm	**C_U**	6.67
D_{50}	0.217 mm	Coefficient of Curvature	
D_{30}	0.136 mm	**C_C**	2.01
D_{10}	0.037 mm		

Soil fractions [%]	
Cobbles	0
Gravel	1
Sand	87
Silt*	8
Clay	4



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

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Particle Size Distribution

ISO 17892-4: 2016 - 5.4 - Sedimentation by Pipette Method

UKAS TESTING 0919

Test Identification			
Location	Z5_OWF_BH03-COMP	Depth [m]	19.40
Sample	06-2	Test start date	23/04/2025

Sieving

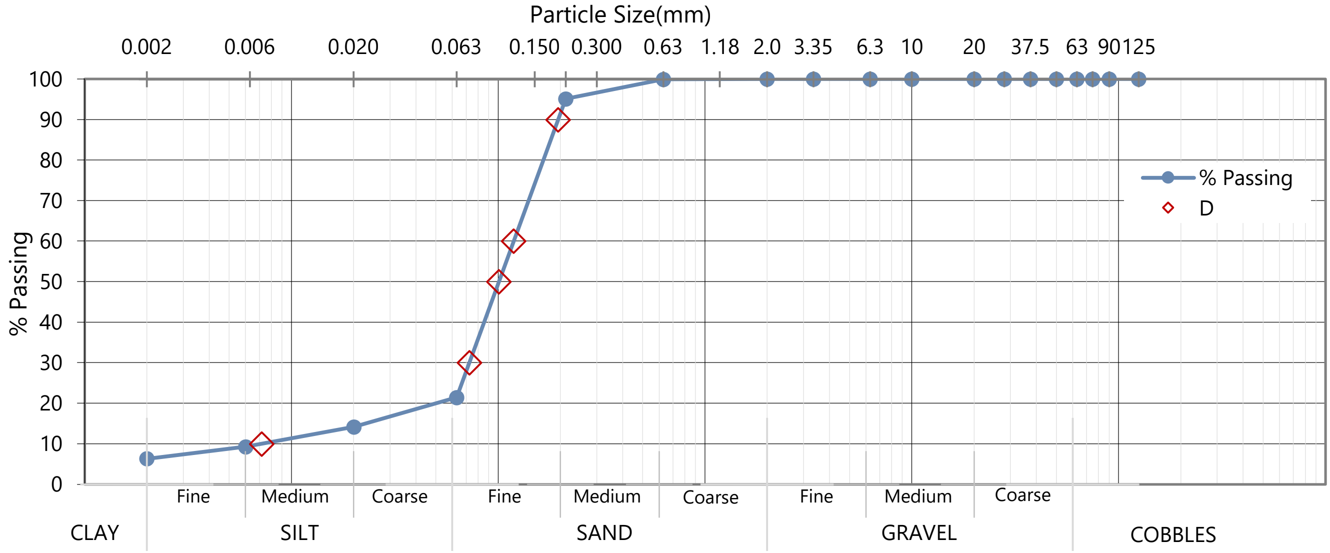
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	100
3.35	100
2.00	100
0.630	100
0.212	95
0.063	21

Sedimentation

Particle Size [mm]	Passing [%]
0.0200	14
0.0060	9
0.0020	6

Curve Characteristics			
D_{90}	0.195 mm	Uniformity Coefficient	
D_{60}	0.119 mm	C_U	16.54
D_{50}	0.101 mm	Coefficient of Curvature	
D_{30}	0.073 mm	C_C	6.16
D_{10}	0.007 mm		

Soil fractions [%]	
Cobbles	0
Gravel	0
Sand	79
Silt*	15
Clay	6



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

*** Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.**

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Particle Size Distribution

ISO 17892-4: 2016 - 5.2 & 5.4 - Sieving & Sedimentation by Pipette Method

UKAS TESTING 0919

Test Identification			
Location	Z5_OWF_BH05-COMP	Depth [m]	4.00
Sample	02-1	Test start date	14/03/2025

Sieving

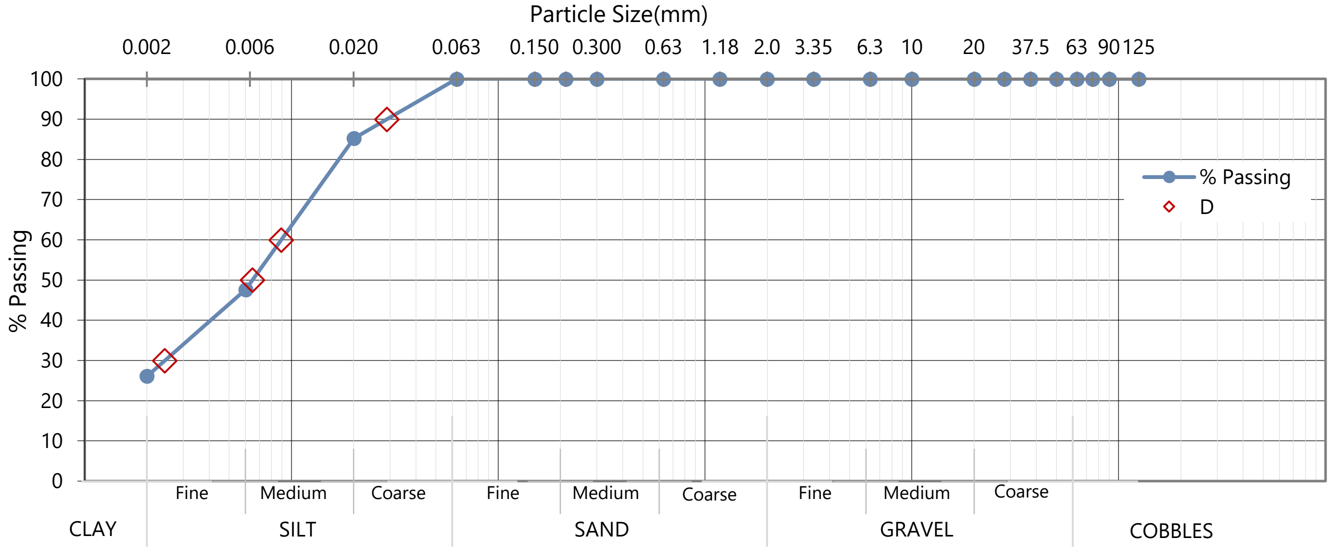
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	100
3.35	100
2.00	100
1.18	100
0.630	100
0.300	100
0.212	100
0.150	100
0.063	100

Sedimentation

Particle Size [mm]	Passing [%]
0.0200	85
0.0060	48
0.0020	26

Curve Characteristics			
D_{90}	0.029 mm	Uniformity Coefficient	
D_{60}	0.009 mm	C_U	-
D_{50}	0.006 mm	Coefficient of Curvature	
D_{30}	0.002 mm	C_C	-
D_{10}	-		

Soil fractions [%]	
Cobbles	0
Gravel	0
Sand	0
Silt*	74
Clay	26



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

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Particle Size Distribution

ISO 17892-4: 2016 - 5.2 & 5.4 - Sieving & Sedimentation by Pipette Method

UKAS TESTING 0919

Test Identification			
Location	Z5_OWF_BH05-COMP	Depth [m]	8.30
Sample	03-3	Test start date	14/03/2025

Sieving

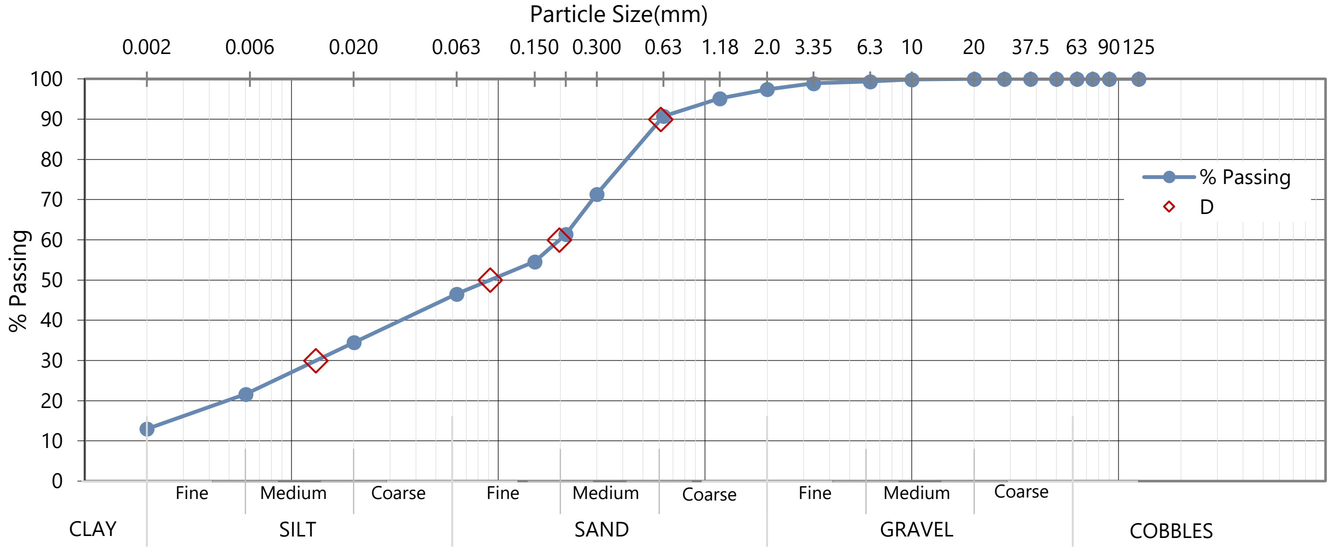
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	99
3.35	99
2.00	97
1.18	95
0.630	91
0.300	71
0.212	61
0.150	55
0.063	47

Sedimentation

Particle Size [mm]	Passing [%]
0.0200	34
0.0060	22
0.0020	13

Curve Characteristics			
D_{90}	0.612 mm	Uniformity Coefficient	
D_{60}	0.198 mm	C_U	-
D_{50}	0.091 mm	Coefficient of Curvature	
D_{30}	0.013 mm	C_C	-
D_{10}	-		

Soil fractions [%]	
Cobbles	0
Gravel	3
Sand	50
Silt*	34
Clay	13



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

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Particle Size Distribution

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Test Identification			
Location	Z5_OWF_BH05-COMP	Depth [m]	9.40
Sample	04-3	Test start date	30/04/2025

Sieving

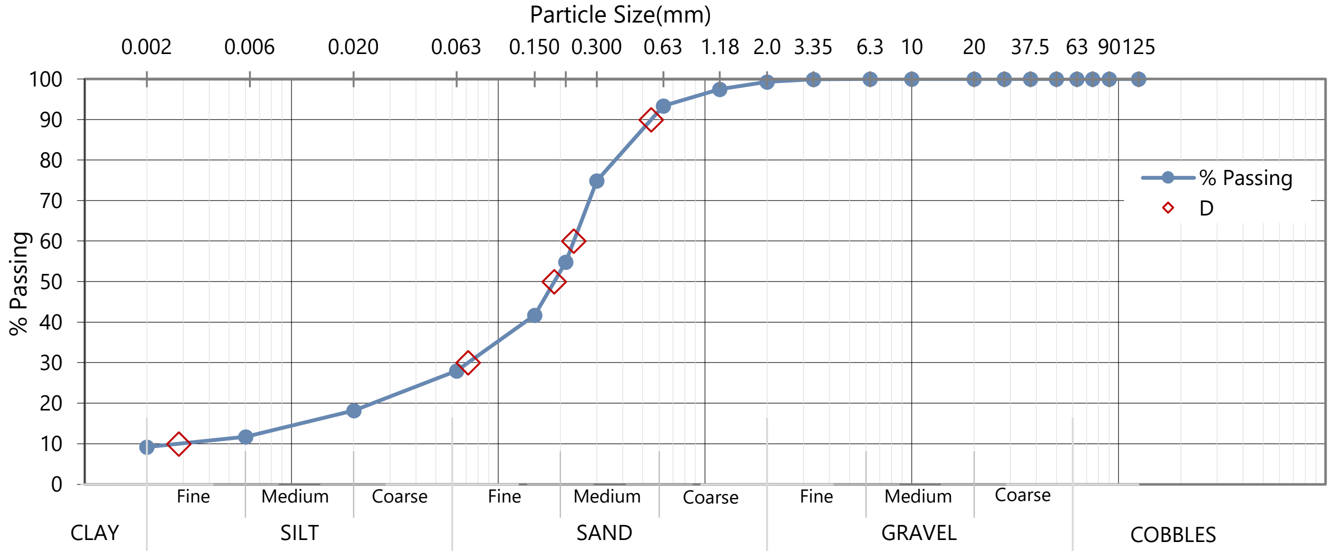
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	100
3.35	100
2.00	99
1.18	97
0.630	93
0.300	75
0.212	55
0.150	42
0.063	28

Sedimentation

Particle Size [mm]	Passing [%]
0.0200	18
0.0060	12
0.0020	9

Curve Characteristics			
D_{90}	0.550 mm	Uniformity Coefficient	
D_{60}	0.232 mm	C_U	81.09
D_{50}	0.187 mm	Coefficient of Curvature	
D_{30}	0.072 mm	C_C	7.74
D_{10}	0.003 mm		

Soil fractions [%]	
Cobbles	0
Gravel	1
Sand	71
Silt*	19
Clay	9



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

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Particle Size Distribution

ISO 17892-4: 2016 - 5.2 & 5.4 - Sieving & Sedimentation by Pipette Method

UKAS TESTING 0919

Test Identification			
Location	Z5_OWF_BH05-COMP	Depth [m]	17.45
Sample	06-2	Test start date	21/03/2025

Sieving

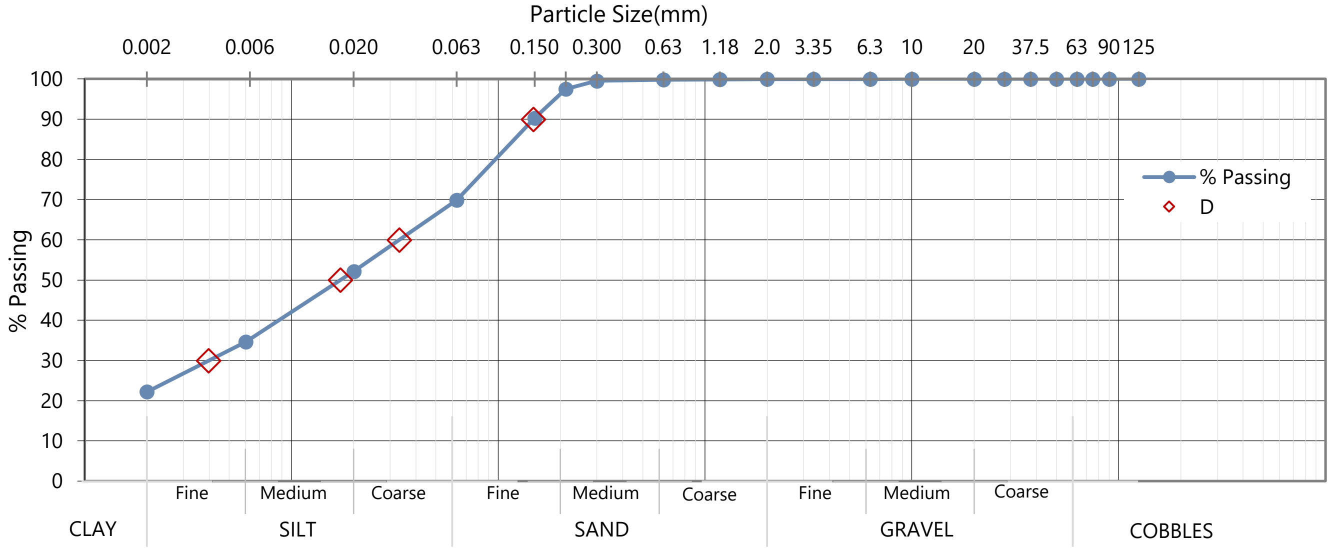
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	100
3.35	100
2.00	100
1.18	100
0.630	100
0.300	100
0.212	98
0.150	90
0.063	70

Sedimentation

Particle Size [mm]	Passing [%]
0.0200	52
0.0060	35
0.0020	22

Curve Characteristics			
D_{90}	0.148 mm	Uniformity Coefficient	
D_{60}	0.033 mm	C_U	-
D_{50}	0.017 mm	Coefficient of Curvature	
D_{30}	0.004 mm	C_C	-
D_{10}	-		

Soil fractions [%]	
Cobbles	0
Gravel	0
Sand	30
Silt*	48
Clay	22



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

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Test Report

Particle Size Distribution

ISO 17892-4: 2016 - 5.2 - Sieving Method

UKAS TESTING 0919

Test Identification			
Location	Z5_OWF_BH05-COMP	Depth [m]	13.00
Sample	Batch_02	Test start date	07/03/2025

Sieving

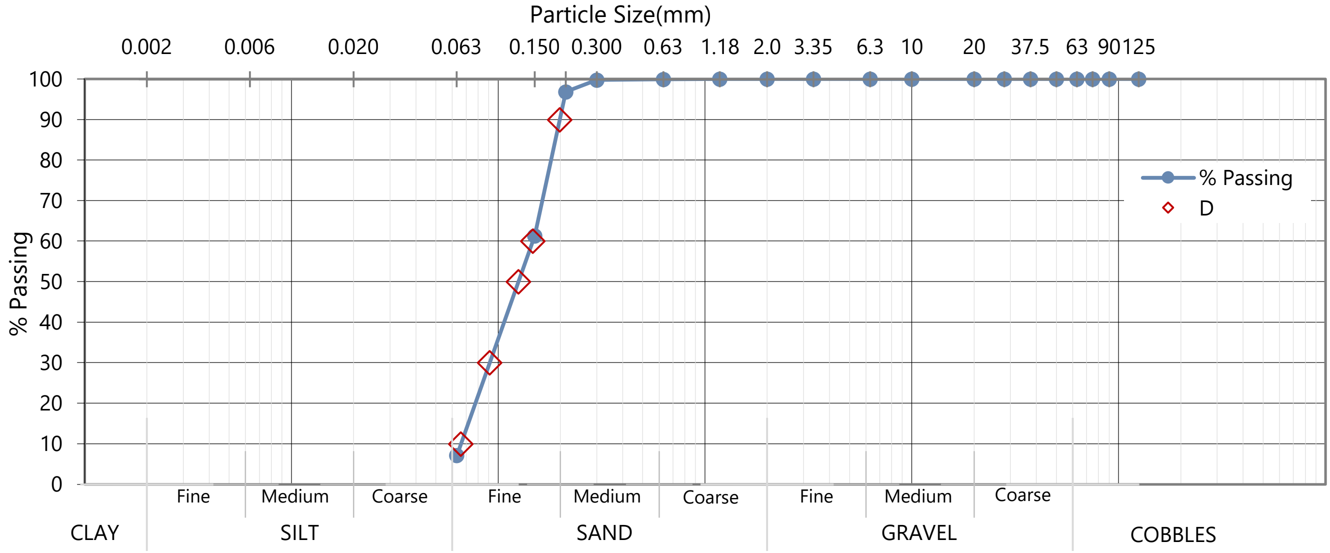
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	100
3.35	100
2.00	100
1.18	100
0.630	100
0.300	100
0.212	97
0.150	61
0.063	7

Sedimentation

Particle Size [mm]	Passing [%]

Curve Characteristics			
D_{90}	0.198 mm	Uniformity Coefficient	
D_{60}	0.147 mm	C_U	2.23
D_{50}	0.125 mm	Coefficient of Curvature	
D_{30}	0.091 mm	C_C	0.85
D_{10}	0.066 mm		

Soil fractions [%]	
Cobbles	0
Gravel	0
Sand	93
Silt*	7
Clay	0



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

*** Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.**

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Test Report

Particle Size Distribution

ISO 17892-4: 2016 - 5.2 & 5.4 - Sieving & Sedimentation by Pipette Method

UKAS TESTING 0919

Test Identification

Location	Z5_OWF_BH07-COMP_a	Depth [m]	2.50
Sample	02-1	Test start date	14/03/2025

Sieving

Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	96
6.3	95
3.35	93
2.00	91
1.18	87
0.630	81
0.300	71
0.212	65
0.150	57
0.063	47

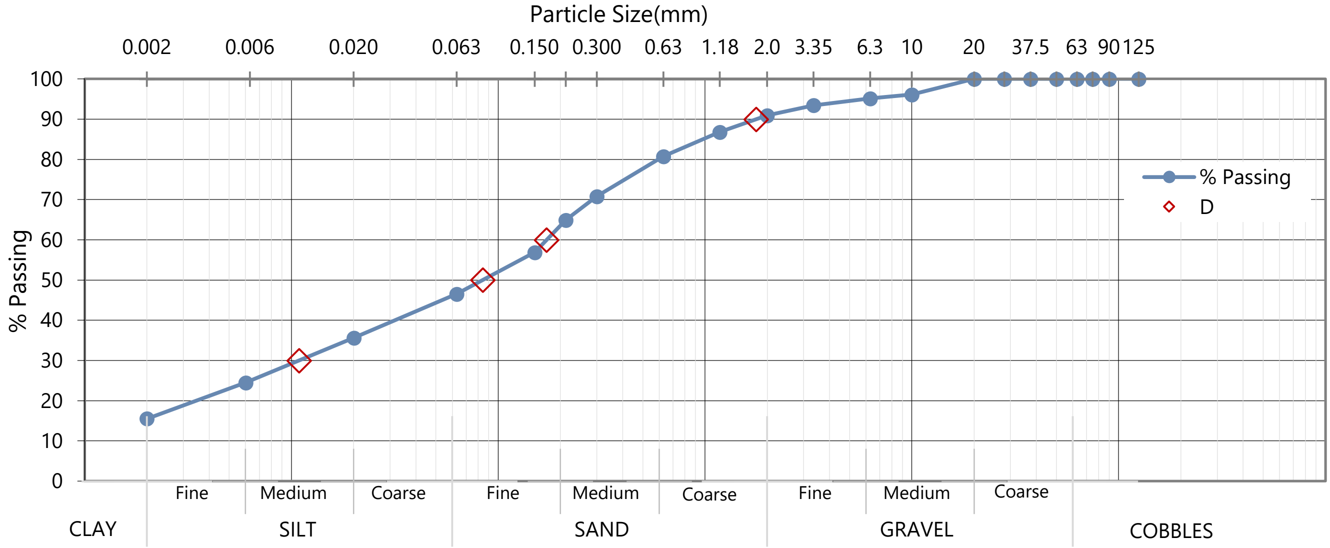
Sedimentation

Particle Size [mm]	Passing [%]
0.0200	36
0.0060	24
0.0020	16

Curve Characteristics

D_{90}	1.772 mm	Uniformity Coefficient	
D_{60}	0.172 mm	C_U	-
D_{50}	0.084 mm	Coefficient of Curvature	
D_{30}	0.011 mm	C_C	-
D_{10}	-		

Soil fractions [%]	
Cobbles	0
Gravel	9
Sand	44
Silt*	31
Clay	16



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

Project: 503387 - F254727 Laboratory: Louvain-la-Neuve Approved by: TG - 23/04/2025

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Test Report

Particle Size Distribution

ISO 17892-4: 2016 - 5.2 - Sieving Method

UKAS TESTING 0919

Test Identification			
Location	Z5_OWF_BH07-COMP_a	Depth [m]	10.00
Sample	04-1	Test start date	21/03/2025

Sieving

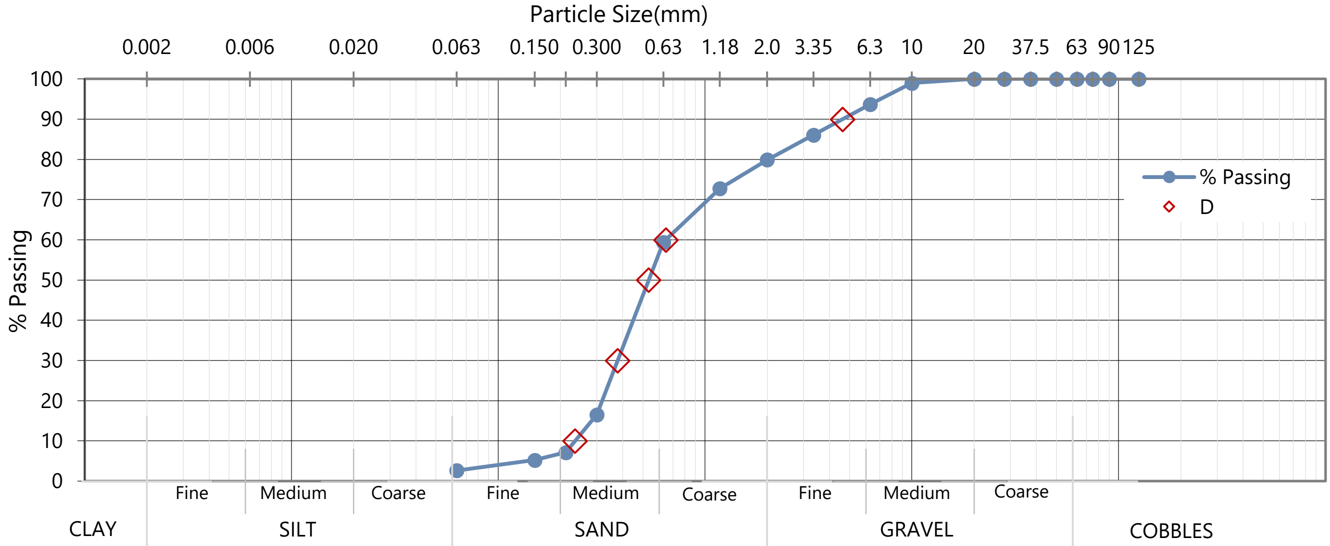
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	99
6.3	94
3.35	86
2.00	80
1.18	73
0.630	59
0.300	17
0.212	7
0.150	5
0.063	3

Sedimentation

Particle Size [mm]	Passing [%]

Curve Characteristics			
D_{90}	4.630 mm	Uniformity Coefficient	
D_{60}	0.648 mm	C_U	2.75
D_{50}	0.535 mm	Coefficient of Curvature	
D_{30}	0.379 mm	C_C	0.94
D_{10}	0.236 mm		

Soil fractions [%]	
Cobbles	0
Gravel	20
Sand	77
Silt*	3
Clay	0



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

Project: 503387 - F254727

Laboratory: Louvain-la-Neuve

Approved by: TG - 23/04/2025

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Test Report

Particle Size Distribution

ISO 17892-4: 2016 - 5.2 - Sieving Method

Test Identification			
Location	Z5_OWF_BH07-COMP_a	Depth [m]	15.00
Sample	06-1	Test start date	21/03/2025

Sieving

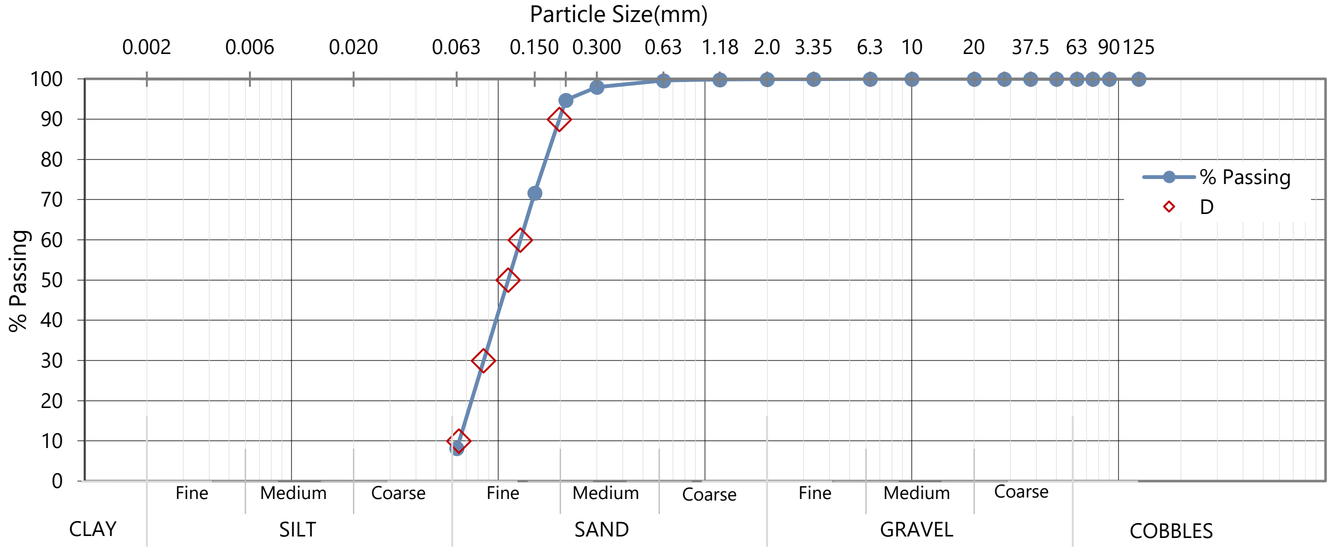
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	100
3.35	100
2.00	100
1.18	100
0.630	100
0.300	98
0.212	95
0.150	72
0.063	8

Sedimentation

Particle Size [mm]	Passing [%]

Curve Characteristics		
D_{90}	0.197 mm	Uniformity Coefficient
D_{60}	0.128 mm	C_U 1.98
D_{50}	0.112 mm	Coefficient of Curvature
D_{30}	0.085 mm	C_C 0.87
D_{10}	0.065 mm	

Soil fractions [%]	
Cobbles	0
Gravel	0
Sand	92
Silt*	8
Clay	0



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

Project: 503387 - F254727
Laboratory: Louvain-la-Neuve
Approved by: TG - 23/04/2025

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Test Report

Particle Size Distribution

ISO 17892-4: 2016 - 5.2 - Sieving Method

UKAS TESTING 0919

Test Identification

Location	Z5_OWF_BH07-COMP_a	Depth [m]	20.00
Sample	Batch_03	Test start date	08/05/2025

Sieving

Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	100
3.35	100
2.00	100
1.18	99
0.630	99
0.300	99
0.212	96
0.150	67
0.063	7

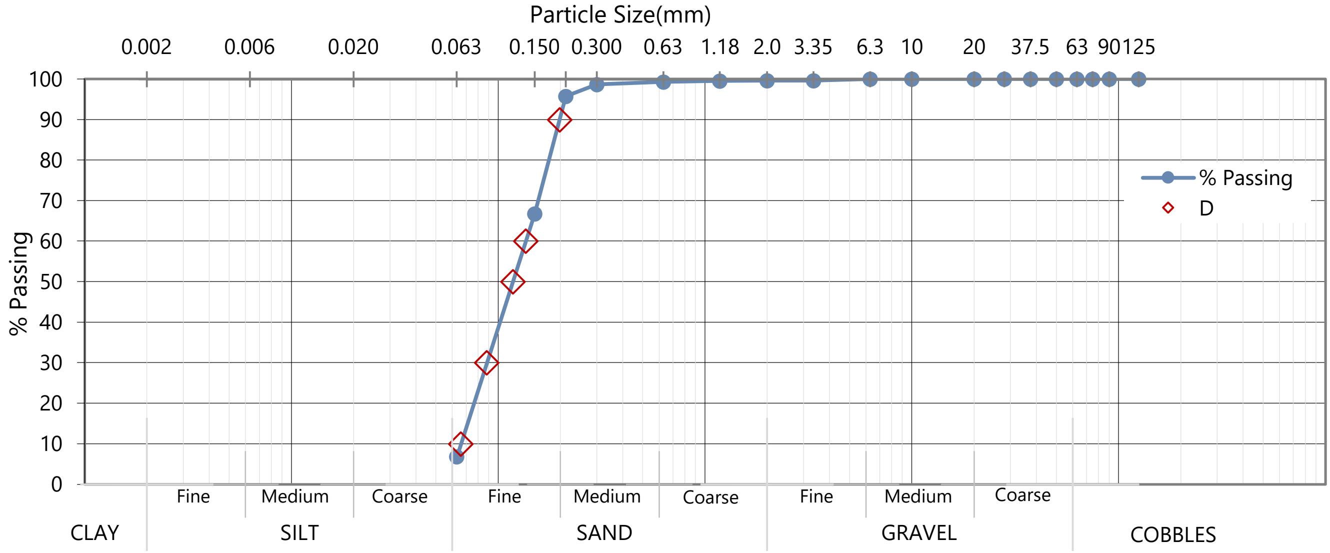
Sedimentation

Particle Size [mm]	Passing [%]

Curve Characteristics

D_{90}	0.198 mm	Uniformity Coefficient	
D_{60}	0.136 mm	C_U	2.06
D_{50}	0.118 mm	Coefficient of Curvature	
D_{30}	0.088 mm	C_C	0.87
D_{10}	0.066 mm		

Soil fractions [%]	
Cobbles	0
Gravel	0
Sand	93
Silt*	7
Clay	0



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

Project: 503387 - F254727 Laboratory: Wallingford Approved by: SW - 24/06/2025

Test Page - 1/1

Test Report

Particle Size Distribution

ISO 17892-4: 2016 - 5.2 - Sieving Method

Test Identification

Location	Z5_OWF_BH09-COMP	Depth [m]	3.30
Sample	01-2	Test start date	27/05/2025

Sieving

Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	100
3.35	100
2.00	100
1.18	99
0.630	98
0.300	90
0.212	68
0.150	20
0.063	7

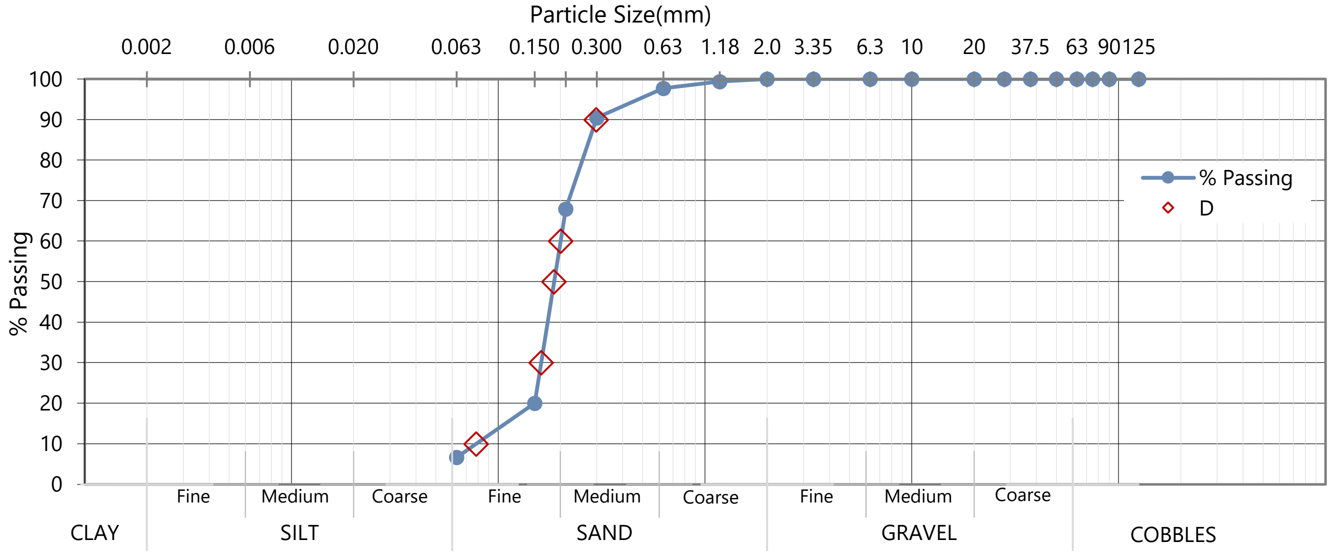
Sedimentation

Particle Size [mm]	Passing [%]

Curve Characteristics

D_{90}	0.298 mm	Uniformity Coefficient	
D_{60}	0.200 mm	C_U	2.56
D_{50}	0.186 mm	Coefficient of Curvature	
D_{30}	0.161 mm	C_C	1.66
D_{10}	0.078 mm		

Soil fractions [%]	
Cobbles	0
Gravel	0
Sand	93
Silt*	7
Clay	0



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

Project: 503387 - F254727 Laboratory: Wallingford Approved by: SW - 24/06/2025

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Test Report

Particle Size Distribution

ISO 17892-4: 2016 - 5.2 & 5.4 - Sieving & Sedimentation by Pipette Method

UKAS TESTING 0919

Test Identification			
Location	Z5_OWF_BH09-COMP	Depth [m]	7.00
Sample	02A-1	Test start date	14/03/2025

Sieving

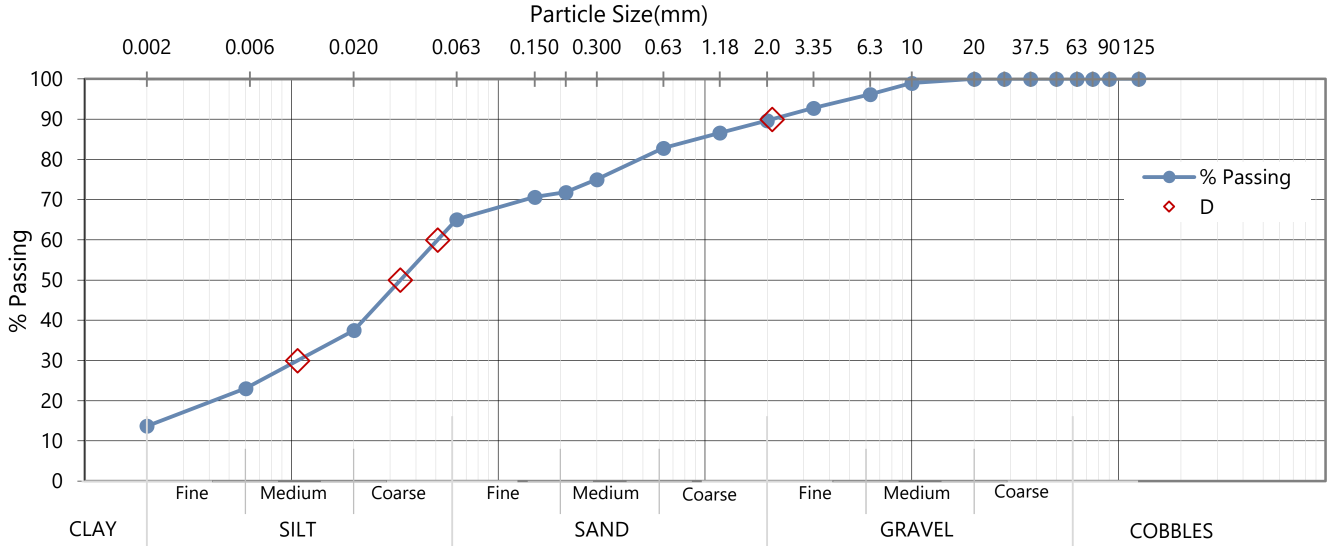
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	99
6.3	96
3.35	93
2.00	90
1.18	87
0.630	83
0.300	75
0.212	72
0.150	71
0.063	65

Sedimentation

Particle Size [mm]	Passing [%]
0.0200	38
0.0060	23
0.0020	14

Curve Characteristics			
D_{90}	2.111 mm	Uniformity Coefficient	
D_{60}	0.051 mm	C_U	-
D_{50}	0.034 mm	Coefficient of Curvature	
D_{30}	0.011 mm	C_C	-
D_{10}	-		

Soil fractions [%]	
Cobbles	0
Gravel	10
Sand	25
Silt*	51
Clay	14



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

Project: 503387 - F254727 Laboratory: Louvain-la-Neuve Approved by: TG - 23/04/2025

Test Page - 1/1

Test Report

Particle Size Distribution

ISO 17892-4: 2016 - 5.4 - Sedimentation by Pipette Method

UKAS TESTING 0919

Test Identification			
Location	Z5_OWF_BH09-COMP	Depth [m]	11.00
Sample	04-1	Test start date	14/03/2025

Sieving

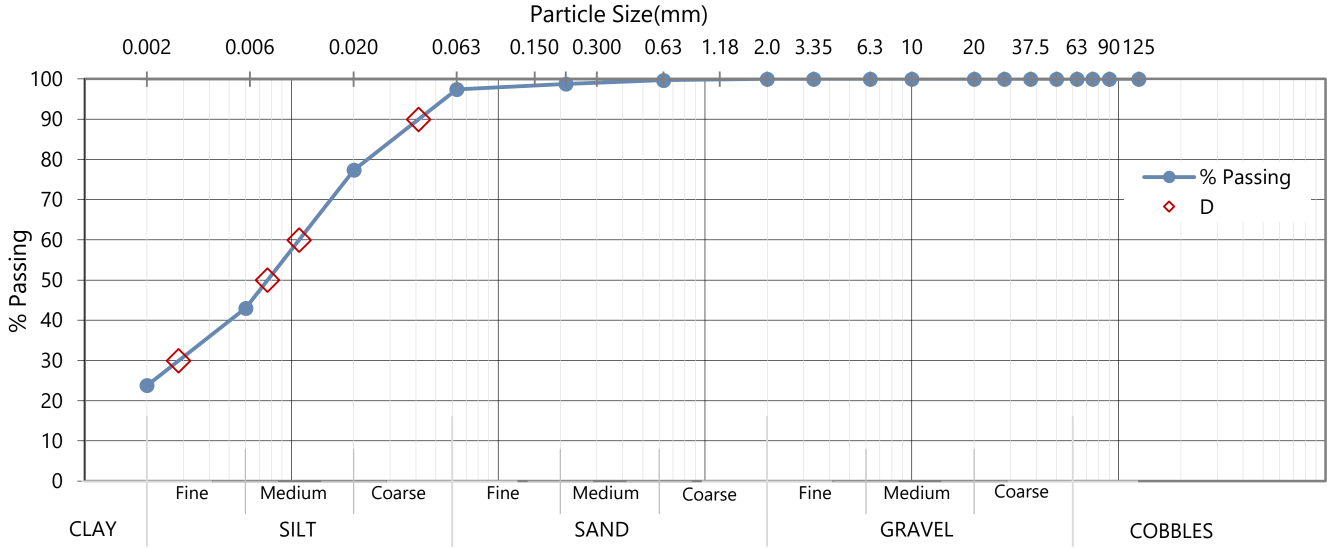
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	100
3.35	100
2.00	100
0.630	100
0.212	99
0.063	97

Sedimentation

Particle Size [mm]	Passing [%]
0.0200	77
0.0060	43
0.0020	24

Curve Characteristics		
D_{90}	0.041 mm	Uniformity Coefficient
D_{60}	0.011 mm	C_U -
D_{50}	0.008 mm	Coefficient of Curvature
D_{30}	0.003 mm	C_C -
D_{10}	-	

Soil fractions [%]	
Cobbles	0
Gravel	0
Sand	3
Silt*	73
Clay	24



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

Project: 503387 - F254727 Laboratory: Louvain-la-Neuve Approved by: TG - 23/04/2025

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Test Report

Particle Size Distribution

ISO 17892-4: 2016 - 5.2 & 5.4 - Sieving & Sedimentation by Pipette Method

UKAS TESTING 0919

Test Identification			
Location	Z5_OWF_BH09-COMP	Depth [m]	12.70
Sample	05-5	Test start date	14/03/2025

Sieving

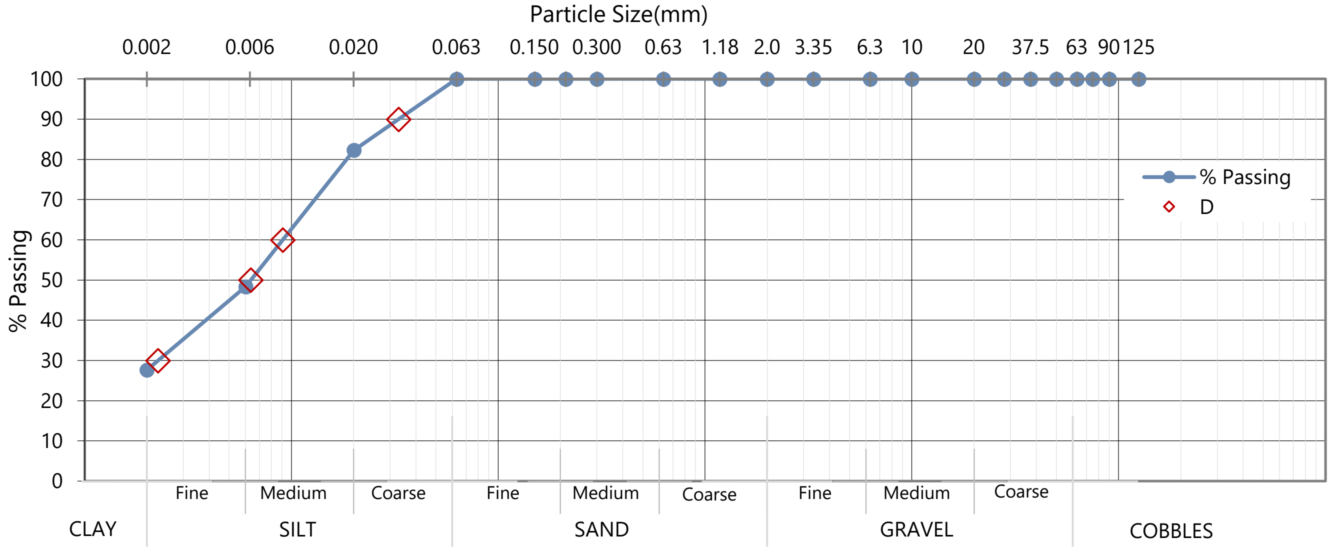
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	100
3.35	100
2.00	100
1.18	100
0.630	100
0.300	100
0.212	100
0.150	100
0.063	100

Sedimentation

Particle Size [mm]	Passing [%]
0.0200	82
0.0060	48
0.0020	28

Curve Characteristics			
D_{90}	0.033 mm	Uniformity Coefficient	
D_{60}	0.009 mm	C_U	-
D_{50}	0.006 mm	Coefficient of Curvature	
D_{30}	0.002 mm	C_C	-
D_{10}	-		

Soil fractions [%]	
Cobbles	0
Gravel	0
Sand	0
Silt*	72
Clay	28



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

Project: 503387 - F254727

Laboratory: Louvain-la-Neuve

Approved by: TG - 23/04/2025

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Test Report

Particle Size Distribution

ISO 17892-4: 2016 - 5.2 & 5.4 - Sieving & Sedimentation by Pipette Method

UKAS TESTING 0919

Test Identification			
Location	Z5_OWF_BH09-COMP	Depth [m]	15.50
Sample	06-1	Test start date	16/07/2025

Sieving

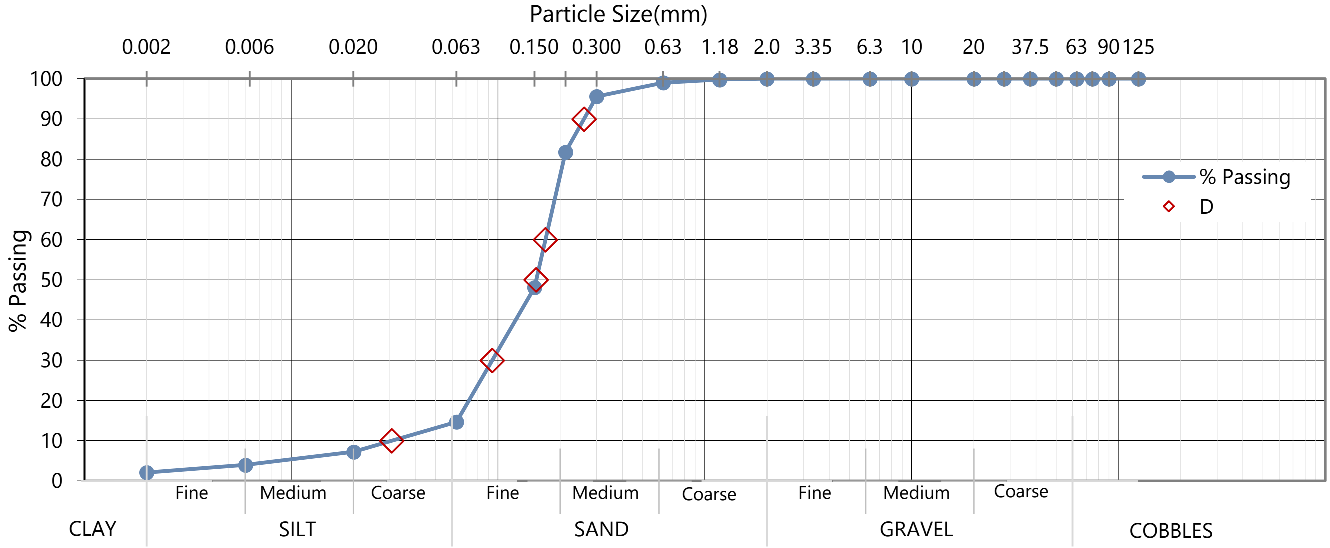
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	100
3.35	100
2.00	100
1.18	100
0.630	99
0.300	96
0.212	82
0.150	48
0.063	15

Sedimentation

Particle Size [mm]	Passing [%]
0.0200	7
0.0060	4
0.0020	2

Curve Characteristics		
D_{90}	0.261 mm	Uniformity Coefficient
D_{60}	0.170 mm	C_U 5.53
D_{50}	0.153 mm	Coefficient of Curvature
D_{30}	0.094 mm	C_C 1.69
D_{10}	0.031 mm	

Soil fractions [%]	
Cobbles	0
Gravel	0
Sand	85
Silt*	13
Clay	2



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

Project: 503387 - F254727

Laboratory: Wallingford

Approved by: ET - 21/08/2025

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Test Report

Particle Size Distribution

ISO 17892-4: 2016 - 5.2 - Sieving Method

UKAS TESTING 0919

Test Identification			
Location	Z5_OWF_BH09-COMP	Depth [m]	19.80
Sample	07-2	Test start date	16/04/2025

Sieving

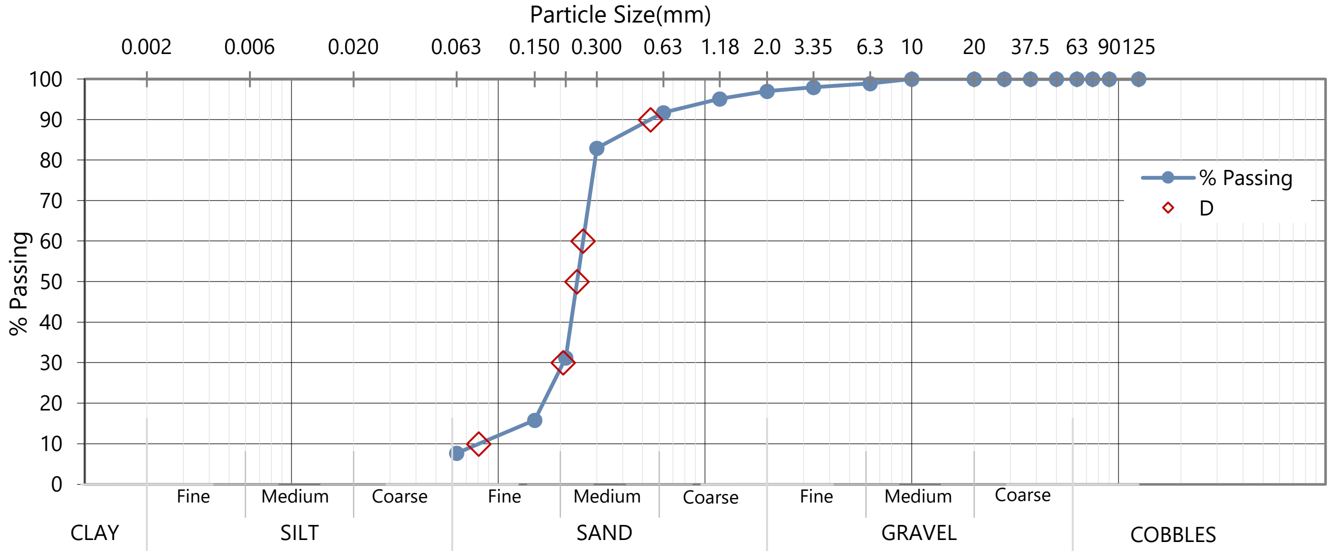
Particle Size [mm]	Passing [%]
125.0	100
90.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
10.0	100
6.3	99
3.35	98
2.00	97
1.18	95
0.630	92
0.300	83
0.212	31
0.150	16
0.063	8

Sedimentation

Particle Size [mm]	Passing [%]

Curve Characteristics			
D_{90}	0.545 mm	Uniformity Coefficient	
D_{60}	0.257 mm	C_U	3.19
D_{50}	0.240 mm	Coefficient of Curvature	
D_{30}	0.206 mm	C_C	2.05
D_{10}	0.081 mm		

Soil fractions [%]	
Cobbles	0
Gravel	3
Sand	89
Silt*	8
Clay	0



Note 1: For sample descriptions, please refer to the report section presenting laboratory test results.

Note 2: Particle density for sedimentation is assumed to be 2.70 Mg/m^3.

* Where a sedimentation test was not carried out, this represents total fines, particles less than 0.063 mm.

Project: 503387 - F254727 Laboratory: Wallingford Approved by: SW - 24/06/2025

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Test Report

Particle Density

Fluid Pycnometer Method

ISO 17892-3:2015

No.	Test Date	Location	Sample	Depth [m]	Particle Density [Mg/m^3]	Laboratory
1	24/03/2025	Z5_OWF_BH01-COMP	01-1	3.50	2.66	F
2	09/05/2025	Z5_OWF_BH01-COMP	03-2	11.45	2.67	F
3	21/03/2025	Z5_OWF_BH01-COMP	06-1	16.00	2.75	F
4	09/04/2025	Z5_OWF_BH02-COMP	01-1	3.00	2.67	F
5	24/03/2025	Z5_OWF_BH02-COMP	03-1	10.50	2.68	F
6	09/05/2025	Z5_OWF_BH02-COMP	06-2	19.60	2.66	F
7	25/03/2025	Z5_OWF_BH03-COMP	01-2	1.90	2.69	F
8	09/05/2025	Z5_OWF_BH03-COMP	02-1	5.50	2.65	F
9	22/04/2025	Z5_OWF_BH03-COMP	06-2	19.40	2.70	A
10	20/03/2025	Z5_OWF_BH05-COMP	02-1	4.00	2.77	F
11	21/03/2025	Z5_OWF_BH05-COMP	03-3	8.30	2.74	F
12	22/04/2025	Z5_OWF_BH05-COMP	04-3	9.40	2.69	A
13	26/03/2025	Z5_OWF_BH05-COMP	06-2	17.45	2.73	F
14	20/03/2025	Z5_OWF_BH07-COMP_a	02-1	2.50	2.73	F
15	09/04/2025	Z5_OWF_BH07-COMP_a	04-1	10.00	2.67	F
16	24/03/2025	Z5_OWF_BH07-COMP_a	06-1	15.00	2.68	F
17	22/05/2025	Z5_OWF_BH09-COMP	01-2	3.30	2.66	A
18	20/03/2025	Z5_OWF_BH09-COMP	04-1	11.00	2.76	F
19	22/04/2025	Z5_OWF_BH09-COMP	07-2	19.80	2.68	A

Note: For sample descriptions, please refer to the report section presenting laboratory test results.

Project: 503387 - F25472
Test Page 1 / 1

A: Wallingford, UK
F: Louvain-la-Neuve, Belgium

Approved by ET - 15/07/2025

Test Report

Maximum and Minimum Dry Densities

Norwegian Geotechnical Institute (NGI) and Geolabs Method

No.	Test Date	Borehole	Sample	Depth [m]	Maximum Dry Density [Mg/m^3]				Maximum Dry Density [Mg/m^3]	Minimum Dry Density [Mg/m^3]	Location	
					Before Surcharge		After Surcharge					
					Specimen 1	Specimen 2	Specimen 1	Specimen 2				
1	27/03/2025	Z5_OWF_BH01-COMP	02-1	7.00	1.70	1.68	1.76	1.74	1.75	1.30	A	
2	05/03/2025	Z5_OWF_BH02-COMP	Batch_01	6.50-7.20	1.62	1.62	1.64	1.64	1.64	1.25	A	
3	03/03/2025	Z5_OWF_BH03-COMP	01-1	1.50	1.65	1.65	1.71	1.71	1.71	1.34	A	
4	05/03/2025	Z5_OWF_BH03-COMP	06-1	19.00	1.80	1.87	1.91	2.01	1.96	1.26	A	*
5	28/02/2025	Z5_OWF_BH05-COMP	Batch_02	13.00-13.65	1.66	1.66	1.71	1.71	1.71	1.26	A	
6	05/03/2025	Z5_OWF_BH07-COMP_a	03-1	6.50	1.79	1.81	1.83	1.84	1.83	1.47	A	
7	05/03/2025	Z5_OWF_BH07-COMP_a	Batch_03	20.00-20.65	1.68	1.69	1.69	1.70	1.70	1.29	A	
8	05/03/2025	Z5_OWF_BH09-COMP	06-2	15.90	1.73	1.72	1.76	1.74	1.75	1.30	A	

*** Indicative results as test was performed on a sample ouf of specification with more than 12 % fines**

Note: For sample descriptions, please refer to the report section presenting laboratory test results.

Project: 503387 - F254727
Test page no. 1 / 1

A: Wallingford, UK
F: Louvain-la-Neuve, Belgium

Approved by ET 15/07/2025

Location	Sample ID	Depth BSF [m]	Test Type	Sample Quality*	Index Property						Consolidation Parameters								
					ρ [Mg/m^3]	U_W [kN/m^3]	W_i [%]	e_0 [-]	S_r [%]	PD [Mg/m^3]	P'_0 [kPa]	P'_c [kPa]	OCR [-]	Cc [-]	Cs [-]	CR [-]	Cv At Est. P'_0 [m^2/year]	M At Est. P'_0 [Mn/m^2]	Kv At Est. P'_0 [m/year]
Z5_OWF_BH01-COMP	05-3	15.65	il	vp	2.01	19.8	24.9	0.582	100	2.70	147	227	1.55	0.119	0.020	0.075	26.980	5.859	0.045
Z5_OWF_BH05-COMP	01-3	3.40	il	vp	2.03	20.0	29.7	0.738	100	2.70	31	67	2.15	0.141	0.021	0.081	6.131	0.974	0.059
Z5_OWF_BH09-COMP	04-3	11.45	il	vp	2.02	19.8	29.0	0.713	100	2.70	108	182	1.68	0.156	0.014	0.091	20.057	3.041	0.065
Z5_OWF_BH09-COMP	05-3	12.30	il	vp	3.02	29.6	29.9	0.741	100	2.70	117	460	3.95	0.201	0.020	0.116	33.012	5.278	0.061

Notes

* : Estimated sample quality based on Lune et al. (2006)

BSF : Below seafloor

ρ : Bulk density

U_w : Unit weight

w : Water content

e_0 : Initial void ratio

S_r : Degree of saturation

PD : Particle density

P'_0 : In-situ pressure

P'_c : Pre-consolidatio pressure

OCR : Over consolidation ratio

Cc : Compression index

Cs : Swelling index

Cv : Coefficient of consolidation

M : Coefficient of volume compressibility

Kv : Permeability

CRS : Constant rate of strain

IL : Incremental loading

CR : primary compression ratio

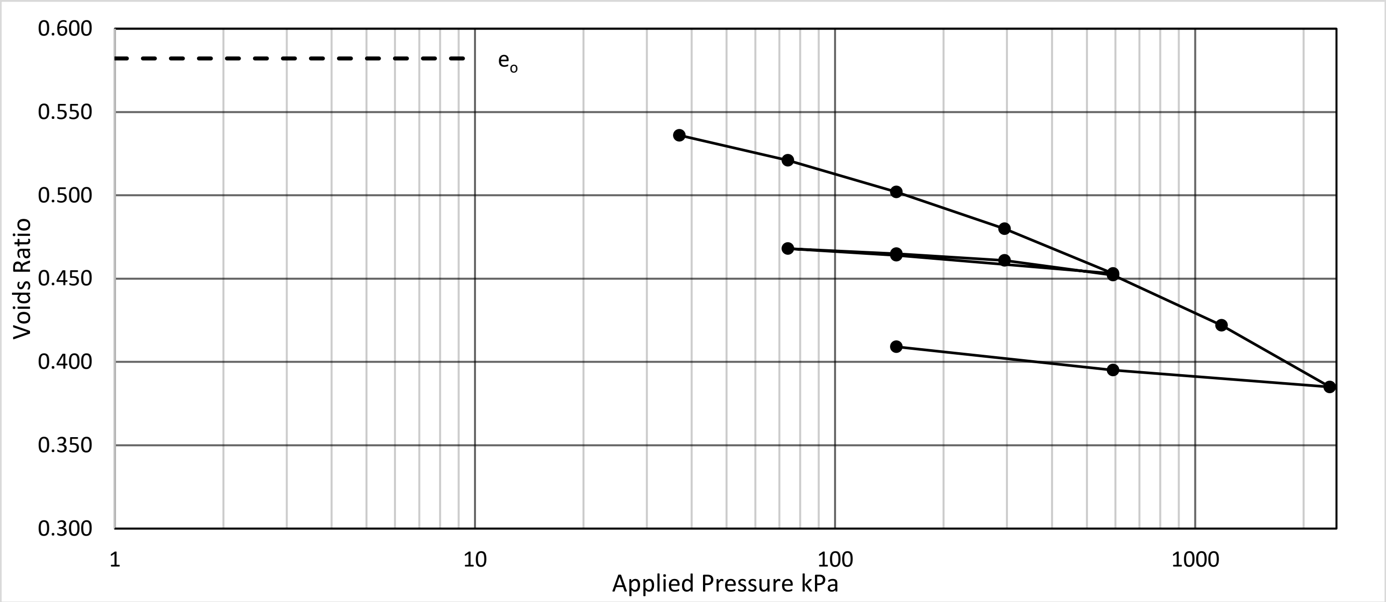
Summary of One-Dimensional Consolidation Test Results

LABORATORY TEST CERTIFICATE
Incremental Loading Oedometer Test

BS EN ISO 17892-5:2017

1483

Project Reference	F254727	Location ID	Z5_OWF_BH01-COMP
Project Name	Golfe du Lion	Depth Top [m]	15.65
Specimen Description	Grey slightly sandy CLAY	Sample Type	Wax
Specimen Reference		Sample Reference	05-3
Specimen Depth [m]	15.67		



Applied Pressure kPa	Voids ratio	m_v m²/MN	C_v [$t_{50/log}$] m²/yr	C_v [$t_{90,\ root}$] m²/yr	C_{sec}
2.5	0.582	-	-	-	-
37	0.536	0.84	15	22	0.00100
74	0.521	0.28	22	25	0.00110
148	0.502	0.17	25	27	0.00120
296	0.480	0.099	31	28	0.00130
592	0.453	0.062	35	24	0.00200
148	0.464				
74	0.468				
148	0.465	0.020	20	46	0.00011
296	0.461	0.021	20	46	0.00021
592	0.452	0.021	24	39	0.00053
1,184	0.422	0.035	39	22	0.00220
2,368	0.385	0.022	34	39	0.00260
592	0.395				
148	0.409				

Date of Test	25/03/2025	
Preparation	Hand Trimming	
Particle density	2.70	Mg/m³
Average temperature for test	21	°C
Swelling Pressure		kPa
Settlement on saturation		%
Degree of Saturation	100	%

	Initial	Final	
Diameter	50.05	-	mm
Height	19.82	17.65	mm
Water Content	24.9	21.4	%
Bulk density	2.13	2.33	Mg/m³
Dry density	1.71	1.92	Mg/m³
Voids Ratio	0.582	0.409	

Frame correction applied to height changes

Cv corrected to 20°C

* Negative Csec determination

Issue Date	14/04/2025	Authorised By	huntc
Certificate Reference	Issue 1		
Client	DGEC	Authorised Date	09/04/2025 08:37
Remarks			

Fugro GB Limited. Unit 43, Number One Industrial Estate, Medomsley Road, Consett, DH8 6TW

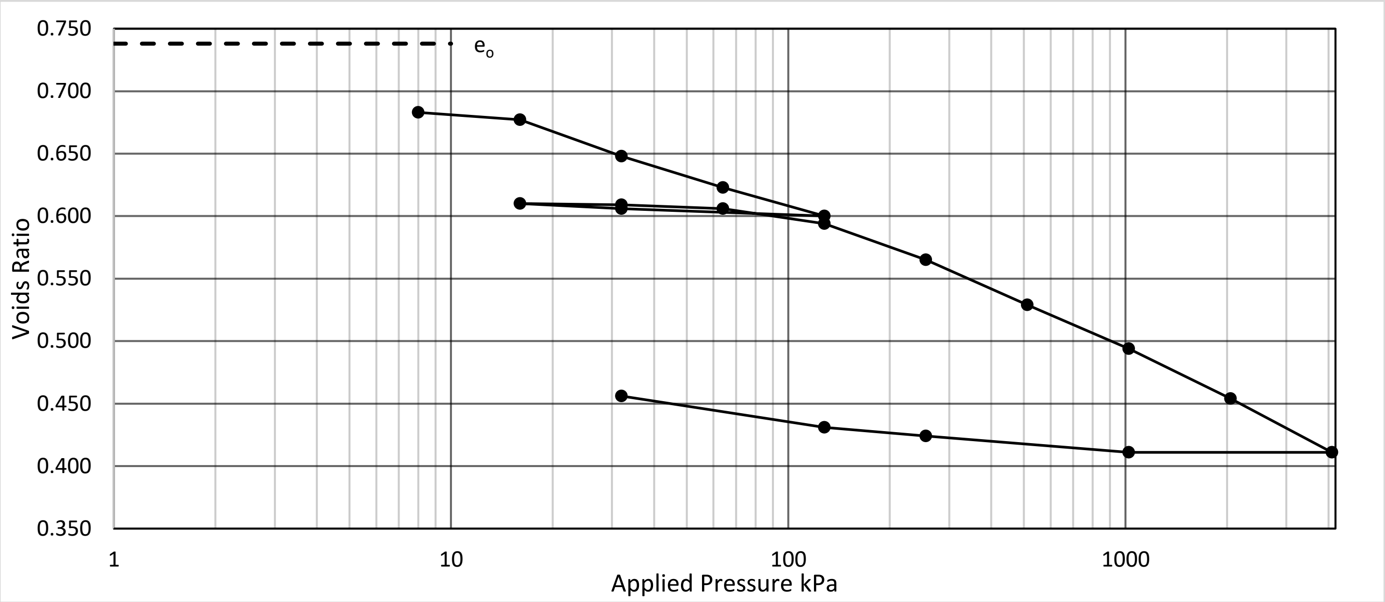
Testing was performed at the Fugro GB Limited laboratory at the address shown above. Results relate only to the sample tested, having been authorised by persons qualified to do so. Opinions and interpretations are outside the scope of accreditation. Unless stated otherwise the sample was tested in the condition it was received at the laboratory.

LABORATORY TEST CERTIFICATE
Incremental Loading Oedometer Test

BS EN ISO 17892-5:2017

1483

Project Reference	F254727			Location ID	Z5_OWF_BH05-COMP
Project Name	Golfe du Lion			Depth Top [m]	3.40
Specimen Description	Grey slightly sandy CLAY with occasional shell fragments			Sample Type	Wax
Specimen Reference		Specimen Depth [m]	3.50	Sample Reference	01-3



Applied Pressure kPa	Voids ratio	m_v m²/MN	C_v [$t_{50/log}$] m²/yr	C_v [$t_{90, root}$] m²/yr	C_{sec}
0.0	0.738	-	-	-	-
8.0	0.683	4.0	1.5	1.7	0.00120
16	0.677	0.41	16	25	0.00007
32	0.648	1.1	6.4	5.3	0.00160
64	0.623	0.48	9.9	19	0.00200
128	0.600	0.22	9.7	20	0.00006
32	0.606				
16	0.610				
32	0.609	0.023	25	43	0.00013
64	0.606	0.073	31	23	0.00023
128	0.594	0.11	30	36	0.00096
256	0.565	0.14	22	22	0.00240
512	0.529	0.089	27	24	0.00270
1,024	0.494	0.045	34	32	0.00300
2,048	0.454	0.026	31	20	0.00320
4,096	0.411	0.015	29	33	0.00310
1,024	0.411				
256	0.424				
128	0.431				
32	0.456				

Date of Test	02/05/2025	
Preparation	Hand Trimming	
Particle density	2.70	Mg/m³
Average temperature for test	21	°C
Swelling Pressure		kPa
Settlement on saturation		%
Degree of Saturation	100	%

	Initial	Final	
Diameter	49.99	-	mm
Height	19.96	16.73	mm
Water Content	29.7	23.3	%
Bulk density	2.01	2.29	Mg/m³
Dry density	1.55	1.85	Mg/m³
Voids Ratio	0.738	0.456	

Frame correction applied to height changes

Cv corrected to 20°C

* Negative Csec determination

Issue Date	20/05/2025	Certificate Reference	Issue 1	Authorised By	huntc
Client	DGEC			Authorised Date	20/05/2025 12:15
Remarks					

Fugro GB Limited. Unit 43, Number One Industrial Estate, Medomsley Road, Consett, DH8 6TW

Testing was performed at the Fugro GB Limited laboratory at the address shown above. Results relate only to the sample tested, having been authorised by persons qualified to do so. Opinions and interpretations are outside the scope of accreditation. Unless stated otherwise the sample was tested in the condition it was received at the laboratory.

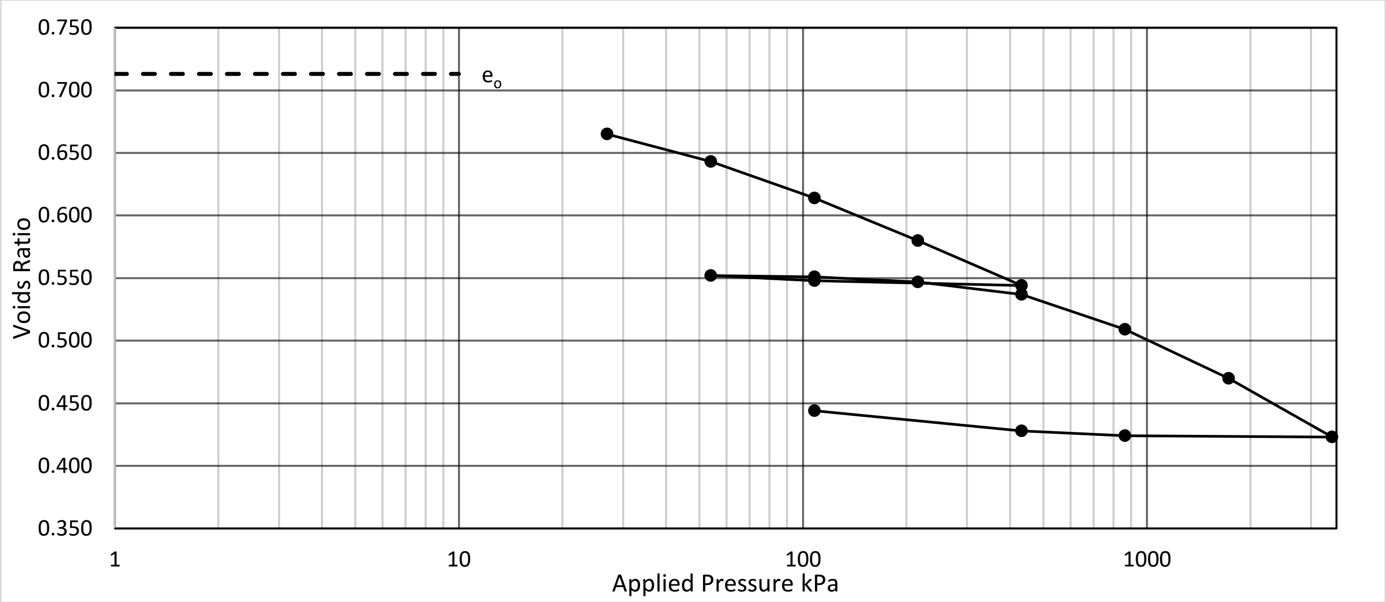
LABORATORY TEST CERTIFICATE
Incremental Loading Oedometer Test

BS EN ISO 17892-5:2017

1483

Project Reference	F254727	Location ID	Z5_OWF_BH09-COMP
Project Name	Golfe du Lion	Depth Top [m]	11.45
Specimen Description	Brown slightly sandy CLAY	Sample Type	Wax

Specimen Reference		Specimen Depth [m]	11.55	Sample Reference	04-3



Applied Pressure kPa	Voids ratio	m_v m²/MN	C_v [$t_{50,log}$] m²/yr	C_v [$t_{90, root}$] m²/yr	C_{sec}
2.7	0.713	-	-	-	-
27	0.665	1.2	4.3	4.6	0.00150
54	0.643	0.49	9.3	11	0.00150
108	0.614	0.33	19	20	0.00190
216	0.580	0.19	32	32	0.00220
432	0.544	0.11	47	45	0.00260
108	0.548				
54	0.552				
108	0.551	0.012	170	140	0.00011
216	0.547	0.023	160	170	0.00025
432	0.537	0.030	140	110	0.00070
864	0.509	0.042	65	79	0.00230
1,728	0.470	0.030	57	63	0.00260
3,456	0.423	0.019	57	72	0.00290
864	0.424				
432	0.428				
108	0.444				

Date of Test	02/05/2025	
Preparation	Hand Trimming	
Particle density	2.70	Mg/m³
Average temperature for test	21	°C
Swelling Pressure		kPa
Settlement on saturation		%
Degree of Saturation	100	%

	Initial	Final	
Diameter	49.99	-	mm
Height	20.07	16.92	mm
Water Content	29.0	21.6	%
Bulk density	2.03	2.27	Mg/m³
Dry density	1.58	1.87	Mg/m³
Voids Ratio	0.713	0.444	

Frame correction applied to height changes

Cv corrected to 20°C

* Negative Csec determination

Issue Date	20/05/2025	Certificate Reference	Issue 1	Authorised By	huntc
Client	DGEC			Authorised Date	20/05/2025 12:15
Remarks					

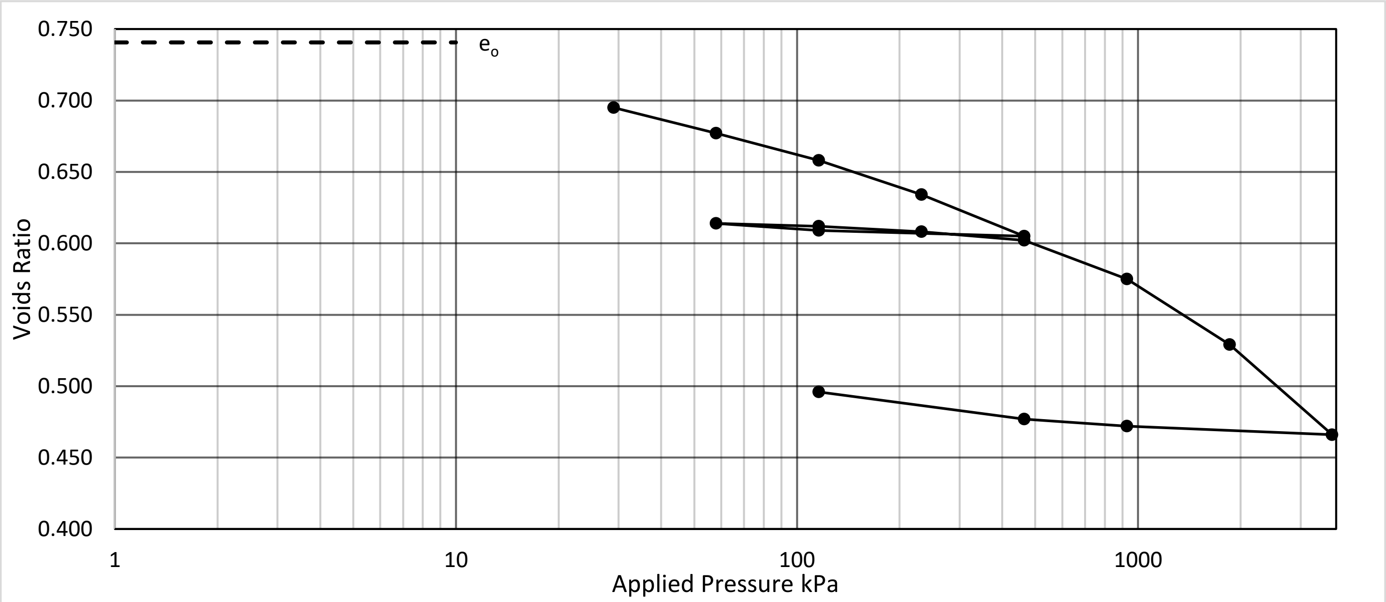
Fugro GB Limited. Unit 43, Number One Industrial Estate, Medomsley Road, Consett, DH8 6TW

LABORATORY TEST CERTIFICATE
Incremental Loading Oedometer Test

BS EN ISO 17892-5:2017

1483

Project Reference	F254727			Location ID	Z5_OWF_BH09-COMP
Project Name	Golfe du Lion			Depth Top [m]	12.30
Specimen Description	Grey slightly sandy CLAY			Sample Type	Wax
Specimen Reference		Specimen Depth [m]	12.31	Sample Reference	05-3



Applied Pressure kPa	Voids ratio	m_v m²/MN	C_v [$t_{50/log}$] m²/yr	C_v [$t_{90,\ root}$] m²/yr	C_{sec}
2.5	0.741	-	-	-	-
29	0.695	0.99	11	10	0.00160
58	0.677	0.37	18	20	0.00130
116	0.658	0.19	30	33	0.00150
232	0.634	0.13	42	35	0.00190
464	0.605	0.076	52	44	0.00220
116	0.609				
58	0.614				
116	0.612	0.016	190	190	0.00014
232	0.608	0.020	180	170	0.00025
464	0.602	0.017	180	190	0.00064
928	0.575	0.036	71	78	0.00230
1,856	0.529	0.031	62	64	0.00290
3,712	0.466	0.022	80	74	0.00350
928	0.472				
464	0.477				
116	0.496				

Date of Test	26/03/2025	
Preparation	Hand Trimming	
Particle density	2.70	Mg/m³
Average temperature for test	21	°C
Swelling Pressure		kPa
Settlement on saturation		%
Degree of Saturation	100	%

	Initial	Final	
Diameter	49.99	-	mm
Height	19.96	17.16	mm
Water Content	29.9	23.9	%
Bulk density	2.02	2.24	Mg/m³
Dry density	1.55	1.80	Mg/m³
Voids Ratio	0.741	0.496	

Frame correction applied to height changes

Cv corrected to 20°C

* Negative Csec determination

Issue Date	09/05/2025	Certificate Reference	Issue 1	Authorised By	huntc
Client	DGEC			Authorised Date	24/04/2025 15:23
Remarks					

Fugro GB Limited. Unit 43, Number One Industrial Estate, Medomsley Road, Consett, DH8 6TW

Testing was performed at the Fugro GB Limited laboratory at the address shown above. Results relate only to the sample tested, having been authorised by persons qualified to do so. Opinions and interpretations are outside the scope of accreditation. Unless stated otherwise the sample was tested in the condition it was received at the laboratory.

Standard 20 stage Oedometer ISO Output.xlsm - Rev 6

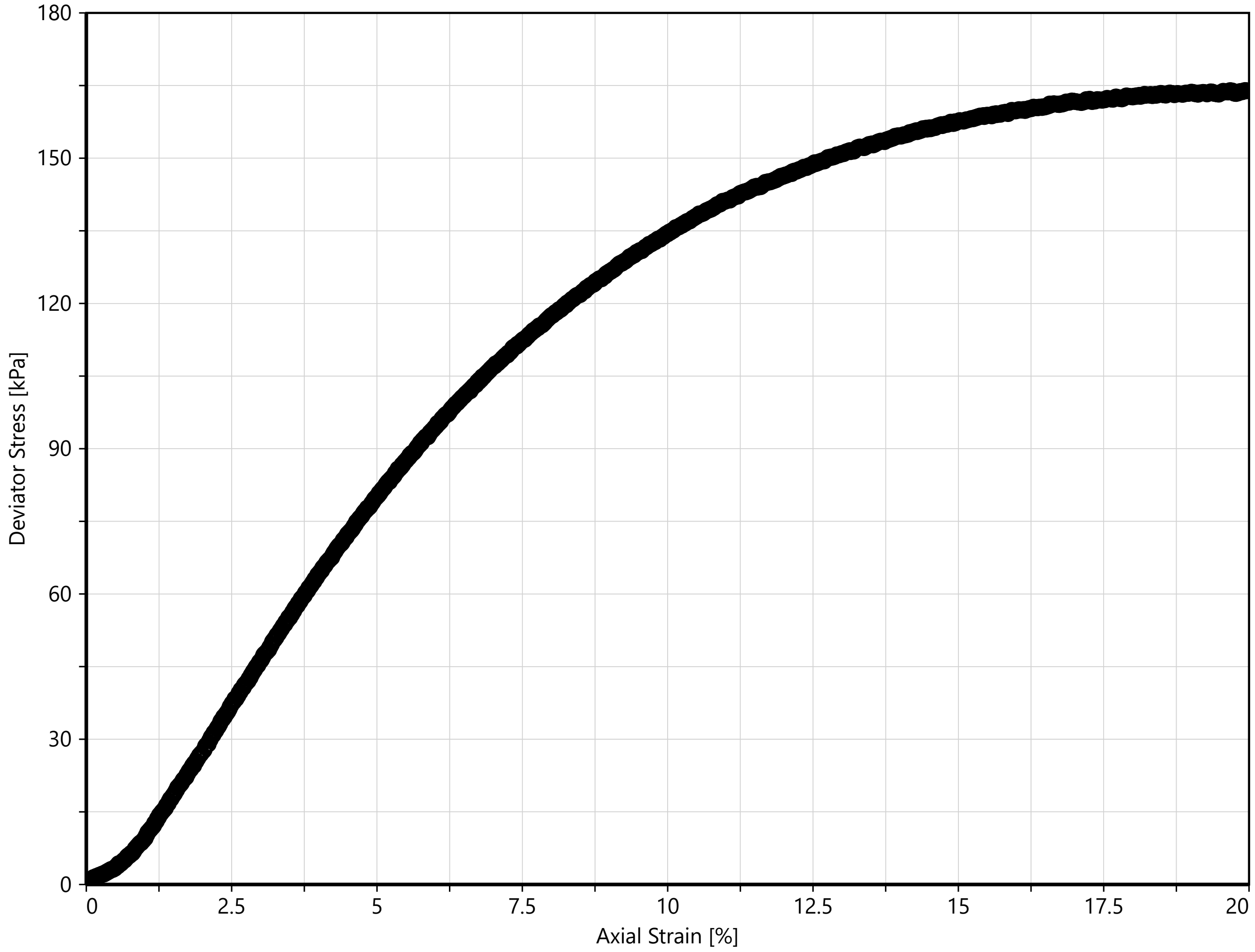
Location	Sample ID	Depth BSF [m]	Specimen Condition	w [%]	ρ [Mg/m^3]	ρ_d [Mg/m^3]	S_r [%]	P_c [kPa]	s_u [kPa]	ε_{50} [%]	ε_f [%]
Z5_OWF_BH01-COMP	06-3	16.30	Undisturbed	29.9	1.85	1.43	89	1244	82	5.12	19.93
Z5_OWF_BH05-COMP	03-2	8.10	Undisturbed	25.6	2.09	1.66	100	1103	71	3.29	12.27

Notes

BSF : Below seafloor
w : Water content
S_r : Degree of saturation
ρ : Bulk density
ρ_d : Dry density
s_u : Undrained shear strength
ε_{50} : Axial strain at 50 % of maximum deviator stress
P_c : Cell pressure
ε_f : Axial strain at failure

TOPAZ / UU Summary of UU triaxial test results (FFSA) / 2025-09-03 17:34:34 +02:00

Summary of Unconsolidated Undrained Triaxial Test Results



Curve	○—○
INITIAL CONDITIONS	
Specimen condition	Undisturbed
Laboratory	Field laboratory
Specimen diameter [mm]	72.0
Specimen length [mm]	144.0
Unit weight [kN/m^3]	18.2
Water content [%]	30
Membrane thickness [mm]	0.3
Membrane correction [kPa]	3.0
Strain Rate [%/h]	60.3
FAILURE CONDITIONS	
Cell pressure [kPa]	1244
Undrained shear strength, s_u [kPa]	82
Axial strain at 50% of max deviator stress, ε_{50} [%]	5.1
Young's modulus at 50% of max deviator stress, E_{50} [MPa]	1.6
Axial strain at failure, ε_f [%]	19.9
Failure type	Bulge failure

Sample : 06-3

Test method : ISO 17892-8 (2018)

Test depth : 16.3 m

Visual identification : stiff medium to high strength very dark grey (2.5Y 3/1) slightly silty highly calcareous CLAY with rare fine to medium gravel-size shell fragments

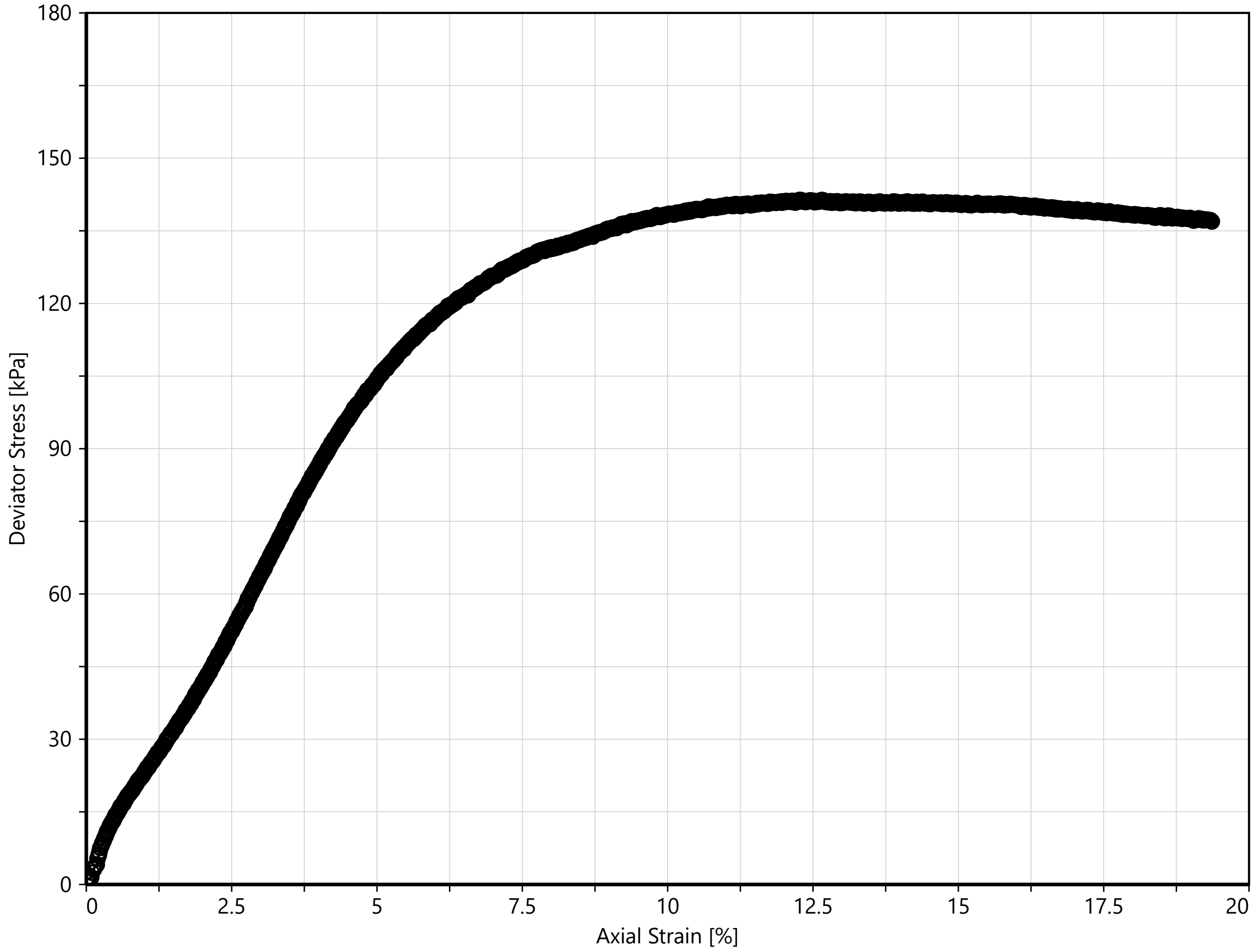
TOPAZ / UU-triaxial test results / 2025-09-03 17:34:34 +02:00

Uu-Triaxial Test Results

Z5_OWF_BH01-COMP


PROJECT NO. : F254727 DGEC
PROJECT TITLE: Golfe du Lion GSI
DATE : 14-01-2025
BOREHOLE : Z5_OWF_BH01_COMP
SAMPLE : 06-3
DEPTH (m) : 16.30
FUGRO
BOTTOM


PROJECT NO. : F254727 DGEC
PROJECT TITLE: Golfe du Lion GSI
DATE : 14-01-2025
BOREHOLE : Z5_OWF_BH01_COMP
SAMPLE : 06-3
DEPTH (m) : 16.30
FUGRO
BOTTOM



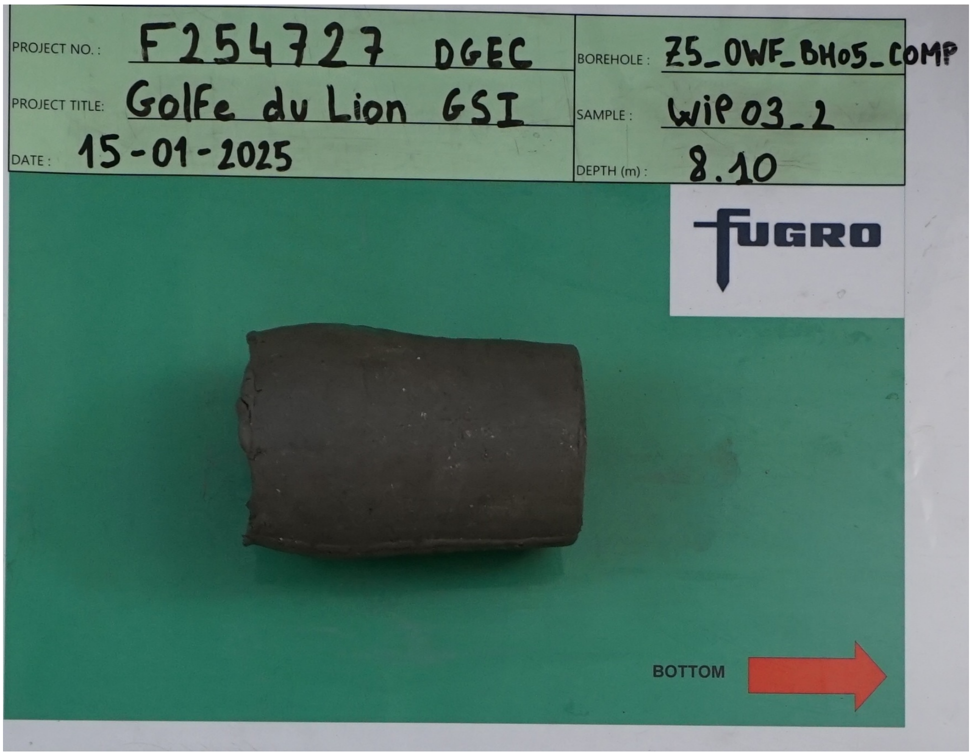
Curve	⊖—⊖
INITIAL CONDITIONS	
Specimen condition	Undisturbed
Laboratory	Field laboratory
Specimen diameter [mm]	72.0
Specimen length [mm]	145.0
Unit weight [kN/m^3]	20.5
Water content [%]	26
Membrane thickness [mm]	0.3
Membrane correction [kPa]	1.9
Strain Rate [%/h]	59.6
FAILURE CONDITIONS	
Cell pressure [kPa]	1103
Undrained shear strength, s_u [kPa]	71
Axial strain at 50% of max deviator stress, ε_{50} [%]	3.3
Young's modulus at 50% of max deviator stress, E_{50} [MPa]	2.1
Axial strain at failure, ε_f [%]	12.3
Failure type	Bulge failure

Sample : 03-2 Test method : ISO 17892-8 (2018)
Test depth : 8.1 m
Visual identification : firm medium strength very dark grey (2.5Y 3/1) slightly calcareous CLAY with occasional coarse sand-size to fine gravel-size shell fragments

TOPAZ / UU-triaxial test results / 2025-09-03 17:34:34 +02:00

Uu-Triaxial Test Results

Z5_OWF_BH05-COMP


PROJECT NO. : F254727 DGEC
PROJECT TITLE: Golfe du Lion GSI
DATE : 15-01-2025
BOREHOLE : Z5_OWF_BH05_COMP
SAMPLE : WIP03_2
DEPTH (m) : 8.10
FUGRO
BOTTOM


PROJECT NO. : F254727 DGEC
PROJECT TITLE: Golfe du Lion GSI
DATE : 15-01-2025
BOREHOLE : Z5_OWF_BH05_COMP
SAMPLE : WIP03_2
DEPTH (m) : 8.10
FUGRO
BOTTOM

Location	Sample ID	Depth BSF [m]	Specimen Condition	w [%]	ρ [Mg/m^3]	ρ_d [Mg/m^3]	S_r [%]	P_c [kPa]	s_u [kPa]	ε_{50} [%]	ε_f [%]
Z5_OWF_BH01-COMP	06-3	16.30	REMOULDED	26.2	1.84	1.46	83	1255	30	8.01	20.07
Z5_OWF_BH05-COMP	01-2	3.20	UNDISTURBED	32.7	1.97	1.49	100	1014	44	4.82	19.01
Z5_OWF_BH05-COMP	01-2	3.20	REMOULDED	32.3	1.88	1.42	97	1014	10	8.34	20.02
Z5_OWF_BH05-COMP	03-2	8.10	REMOULDED	23.2	2.02	1.64	96	1112	19	4.16	20.02
Z5_OWF_BH09-COMP	04-4	11.65	REMOULDED	29.7	1.83	1.41	88	1169	26	7.18	20.04
Z5_OWF_BH09-COMP	05-4	12.50	UNDISTURBED	30.8	1.97	1.51	100	1186	66	5.50	19.89
Z5_OWF_BH09-COMP	05-4	12.50	REMOULDED	30.6	1.90	1.46	97	1186	20	9.33	20.00

Notes

BSF : Below seafloor
w : Water content
S_r : Degree of saturation
ρ : Bulk density
ρ_d : Dry density
s_u : Undrained shear strength
ε_{50} : Axial strain at 50 % of maximum deviator stress
P_c : Cell pressure
ε_f : Axial strain at failure

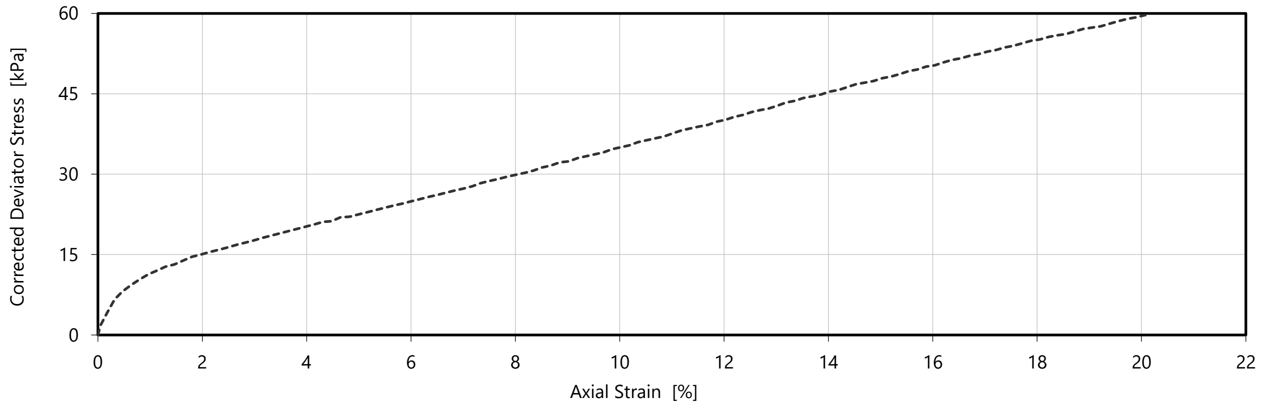
Summary of Unconsolidated Undrained Triaxial Test Results

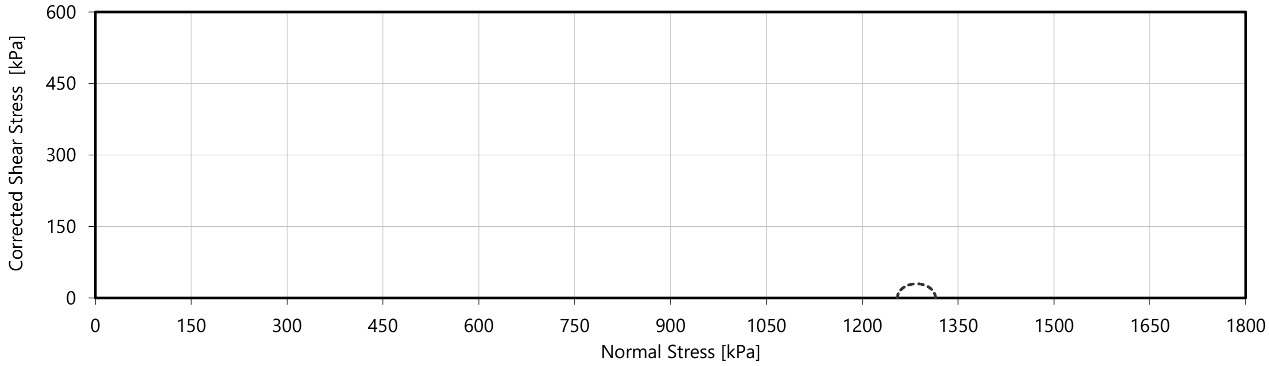
LABORATORY TEST CERTIFICATE
Unconsolidated Undrained Triaxial Test

BS EN ISO 17892-8:2018

1483

Project Reference	F254727			Location ID	Z5_OWF_BH01-COMP
Project Name	Golfe du Lion			Depth Top [m]	16.30
Specimen Description	Soft grey slightly sandy SILT			Sample Type	B
Specimen Reference		Specimen Depth [m]		Sample Reference	06-3





Test number	1		
Specimen Preparation	REMOULDED		
Length [mm]	139.47		
Diameter [mm]	70.40		
Bulk Density [Mg/m³]	1.841		
Specimen Water Content [%]	26.2		
Failure Surface Water Content [%]			
Dry Density [Mg/m³]	1.459		
Initial Voids Ratio	0.850		
Degree of Saturation [%]	83		
Application of Deviator Stress			
Cell Pressure [kPa]	1255		
Specimen Height [mm]	137.14		
Mean Rate of Shear [mm/min]	2.79		
Peak Values			
Undrained Shear Strength [kPa]	30		
Strain at Failure [%]	20.1		
Failure Mode	Plastic		

Issue Date	14/04/2025	Certificate Reference	Issue 1	Authorised By	huntc
Client	DGEC			Authorised Date	25/03/2025 09:09
Remarks					

Fugro GB Limited. Unit 43, Number One Industrial Estate, Medomsley Road, Consett, DH8 6TW

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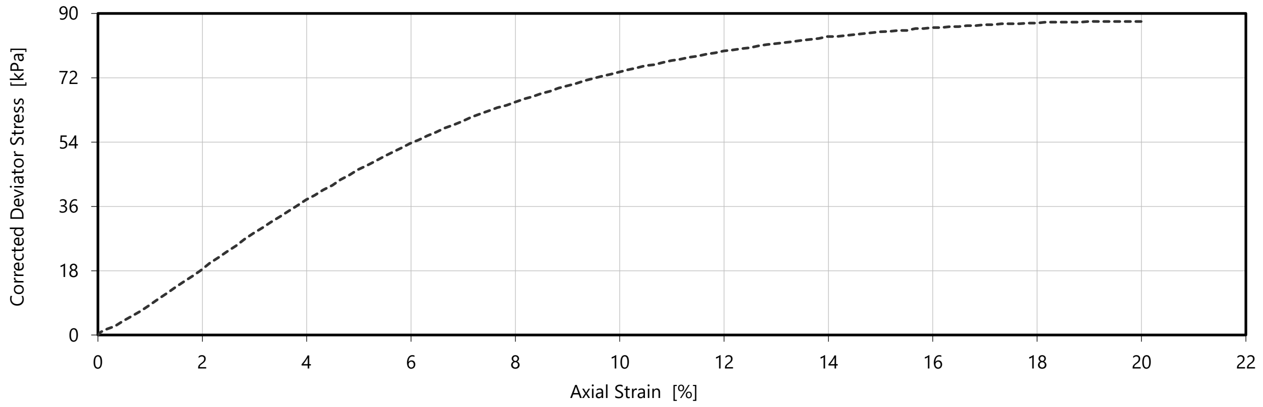
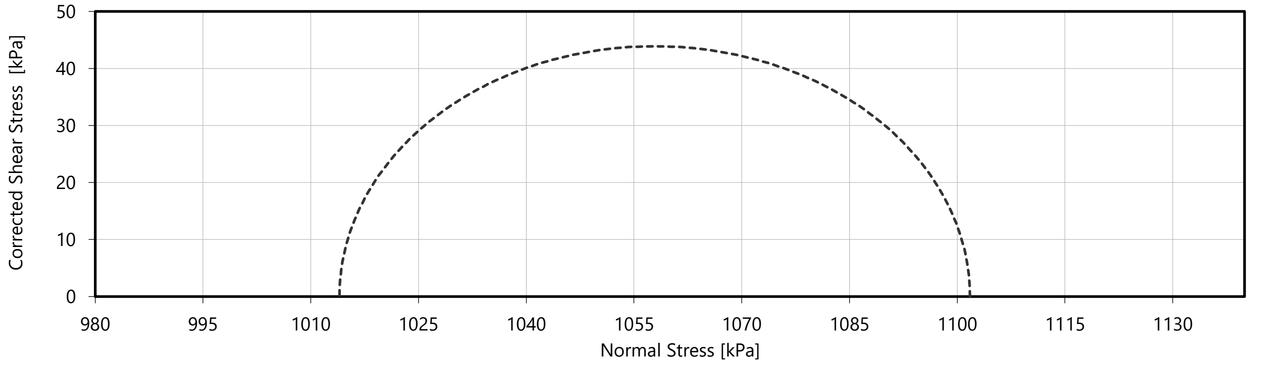
LABORATORY TEST CERTIFICATE
Unconsolidated Undrained Triaxial Test

BS EN ISO 17892-8:2018

1483

Project Reference	F254727			Location ID	Z5_OWF_BH05-COMP
Project Name	Golfe du Lion			Depth Top [m]	3.20
Specimen Description	Firm grey black slightly sandy CLAY			Sample Type	Wax
Specimen Reference	1	Specimen Depth [m]	3.22	Sample Reference	01-2





Test number	1		
Specimen Preparation	UNDISTURBED		
Length [mm]	140.21		
Diameter [mm]	66.46		
Bulk Density [Mg/m³]	1.974		
Specimen Water Content [%]	32.7		
Failure Surface Water Content [%]			
Dry Density [Mg/m³]	1.488		
Initial Voids Ratio	0.815		
Degree of Saturation [%]	100		
Application of Deviator Stress			
Cell Pressure [kPa]	1014		
Specimen Height [mm]	138.49		
Mean Rate of Shear [mm/min]	2.80		
Peak Values			
Undrained Shear Strength [kPa]	44		
Strain at Failure [%]	19.0		
Failure Mode	Plastic		

Issue Date	28/08/2025	Certificate Reference	Issue 2	Authorised By	lindsayc
Client	DGEC			Authorised Date	28/08/2025 09:35
Remarks					

Fugro GB Limited. Unit 43, Number One Industrial Estate, Medomsley Road, Consett, DH8 6TW

Testing was performed at the Fugro GB Limited laboratory at the address shown above. Results relate only to the sample tested, having been authorised by persons qualified to do so. Opinions and interpretations are outside the scope of accreditation. Unless stated otherwise the sample was tested in the condition it was received at the laboratory.

Standard UUTX Single Stage ISO Output.xlsm - Rev 7

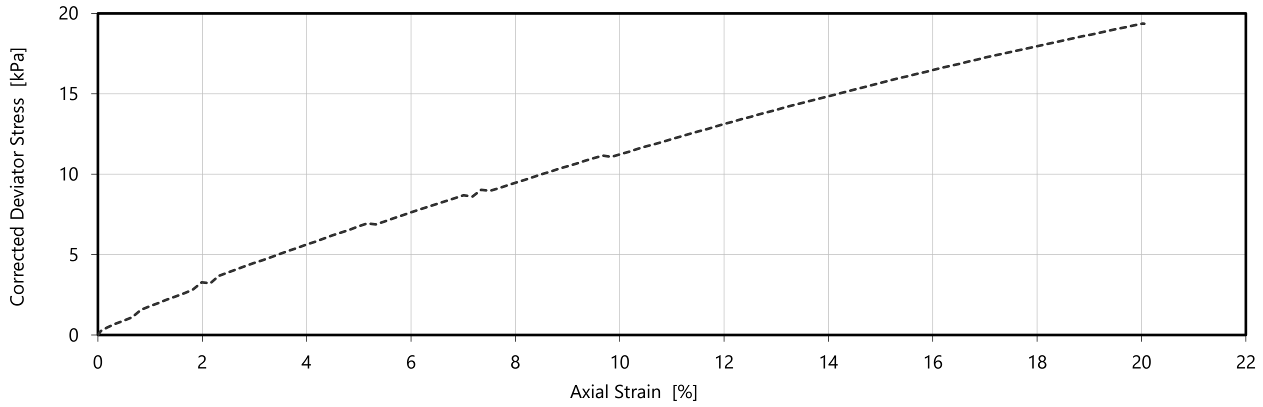
Page 1 of 1

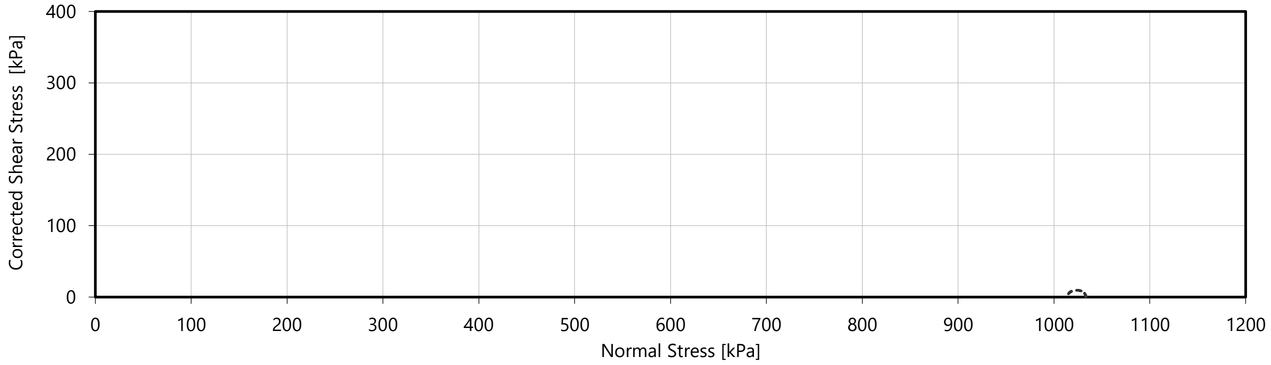
LABORATORY TEST CERTIFICATE
Unconsolidated Undrained Triaxial Test

BS EN ISO 17892-8:2018

1483

Project Reference	F254727			Location ID	Z5_OWF_BH05-COMP
Project Name	Golfe du Lion			Depth Top [m]	3.20
Specimen Description	Grey black slightly sandy CLAY			Sample Type	Wax
Specimen Reference	2	Specimen Depth [m]		Sample Reference	01-2





Test number	1		
Specimen Preparation	REMOULDED		
Length [mm]	144.53		
Diameter [mm]	70.20		
Bulk Density [Mg/m^3]	1.885		
Specimen Water Content [%]	32.3		
Failure Surface Water Content [%]			
Dry Density [Mg/m^3]	1.424		
Initial Voids Ratio	0.895		
Degree of Saturation [%]	97		
Application of Deviator Stress			
Cell Pressure [kPa]	1014		
Specimen Height [mm]	141.14		
Mean Rate of Shear [mm/min]	2.89		
Peak Values			
Undrained Shear Strength [kPa]	10		
Strain at Failure [%]	20.0		
Failure Mode	Plastic		

Issue Date	14/04/2025	Certificate Reference	Issue 1	Authorised By	huntc
Client	DGEC			Authorised Date	14/04/2025 11:00
Remarks	Prepared to maximum achievable density				

Fugro GB Limited. Unit 43, Number One Industrial Estate, Medomsley Road, Consett, DH8 6TW

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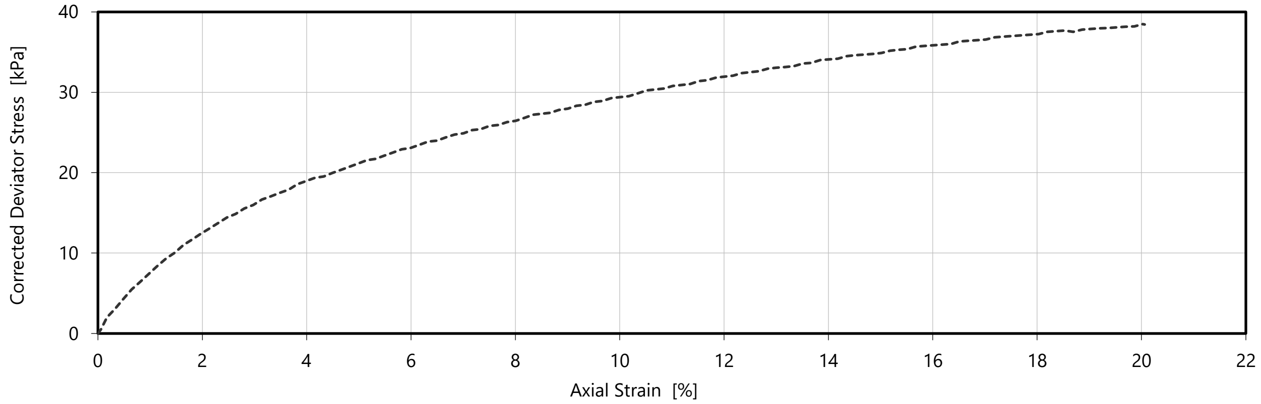
Standard UUTX Single Stage ISO Output.xlsm - Rev 7

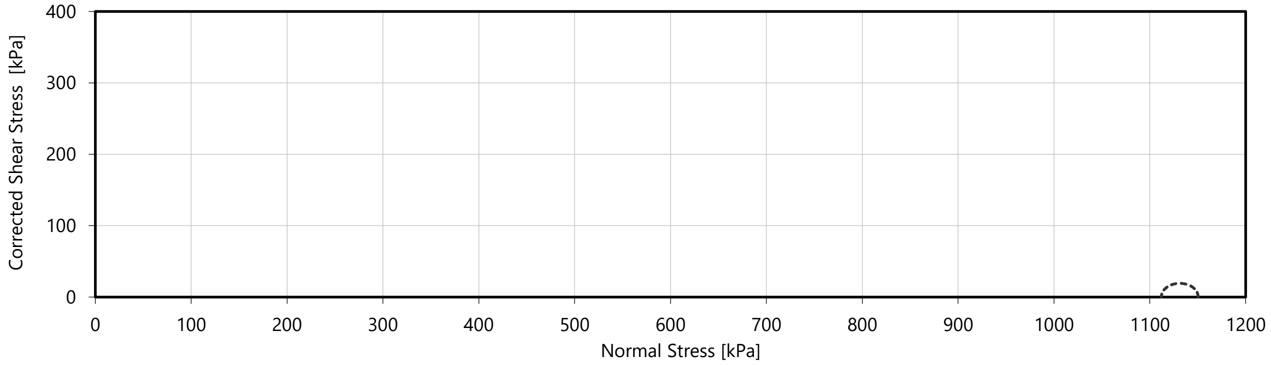
LABORATORY TEST CERTIFICATE
Unconsolidated Undrained Triaxial Test

BS EN ISO 17892-8:2018

1483

Project Reference	F254727	Location ID	Z5_OWF_BH05-COMP
Project Name	Golfe du Lion	Depth Top [m]	8.10
Specimen Description	Soft grey slightly sandy CLAY with some shell fragments	Sample Type	B
Specimen Reference	Specimen Depth [m]	Sample Reference	03-2





Test number	1		
Specimen Preparation	REMOULDED		
Length [mm]	144.53		
Diameter [mm]	70.20		
Bulk Density [Mg/m³]	2.015		
Specimen Water Content [%]	23.2		
Failure Surface Water Content [%]			
Dry Density [Mg/m³]	1.636		
Initial Voids Ratio	0.650		
Degree of Saturation [%]	96		
Application of Deviator Stress			
Cell Pressure [kPa]	1112		
Specimen Height [mm]	144.17		
Mean Rate of Shear [mm/min]	2.89		
Peak Values			
Undrained Shear Strength [kPa]	19		
Strain at Failure [%]	20.0		
Failure Mode	Plastic		

Issue Date	14/04/2025	Certificate Reference	Issue 1	Authorised By	huntc
Client	DGEC			Authorised Date	14/04/2025 11:22
Remarks	Prepared to maximum achievable density				

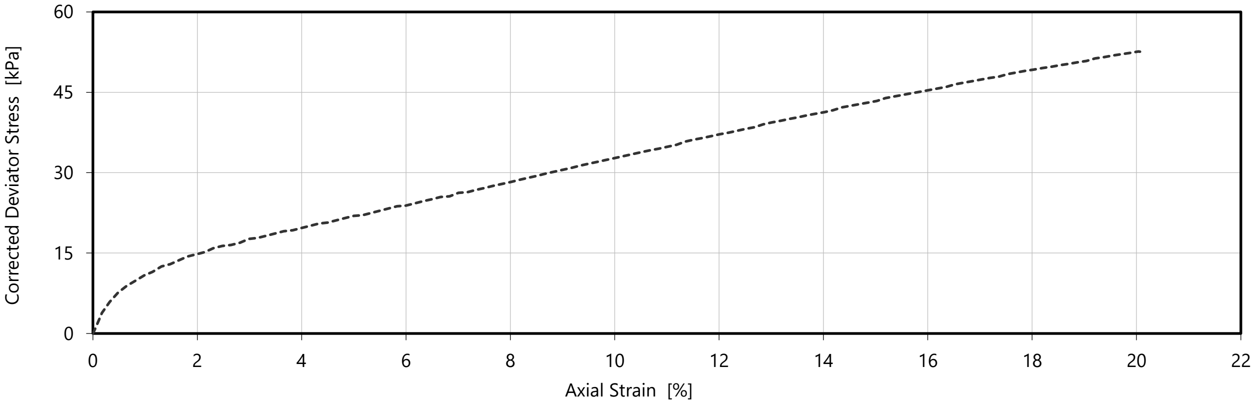
Fugro GB Limited. Unit 43, Number One Industrial Estate, Medomsley Road, Consett, DH8 6TW

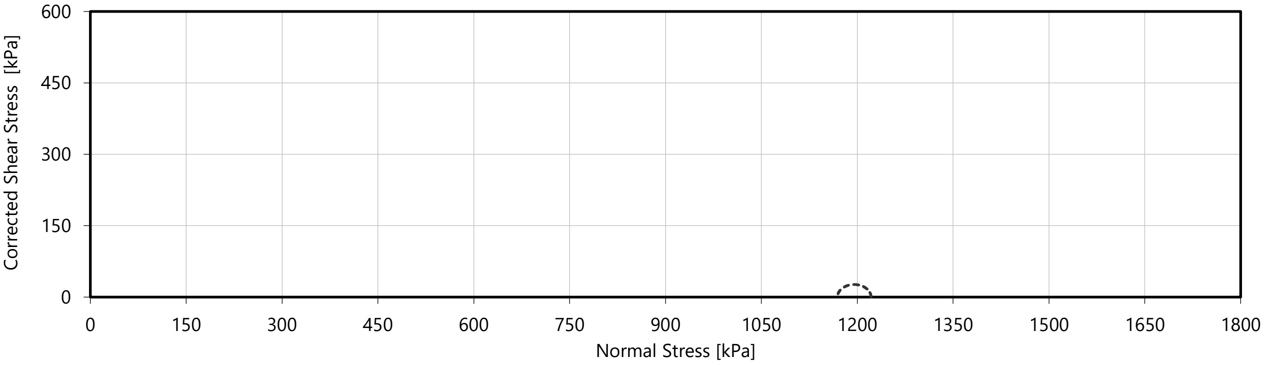
LABORATORY TEST CERTIFICATE
Unconsolidated Undrained Triaxial Test

BS EN ISO 17892-8:2018

UKAS TESTING 1483

Project Reference	F254727			Location ID	Z5_OWF_BH09-COMP
Project Name	Golfe du Lion			Depth Top [m]	11.65
Specimen Description	Soft grey slightly sandy CLAY			Sample Type	B
Specimen Reference		Specimen Depth [m]		Sample Reference	04-4





Test number	1		
Specimen Preparation	REMOULDED		
Length [mm]	140.00		
Diameter [mm]	70.20		
Bulk Density [Mg/m³]	1.827		
Specimen Water Content [%]	29.7		
Failure Surface Water Content [%]			
Dry Density [Mg/m³]	1.409		
Initial Voids Ratio	0.917		
Degree of Saturation [%]	88		
Application of Deviator Stress			
Cell Pressure [kPa]	1169		
Specimen Height [mm]	138.24		
Mean Rate of Shear [mm/min]	2.80		
Peak Values			
Undrained Shear Strength [kPa]	26		
Strain at Failure [%]	20.0		
Failure Mode	Plastic		

Issue Date	14/04/2025	Certificate Reference	Issue 1	Authorised By	huntc
Client	DGEC			Authorised Date	14/04/2025 11:28
Remarks					

Fugro GB Limited. Unit 43, Number One Industrial Estate, Medomsley Road, Consett, DH8 6TW

Testing was performed at the Fugro GB Limited laboratory at the address shown above. Results relate only to the sample tested, having been authorised by persons qualified to do so. Opinions and interpretations are outside the scope of accreditation. Unless stated otherwise the sample was tested in the condition it was received at the laboratory.

FUGRO

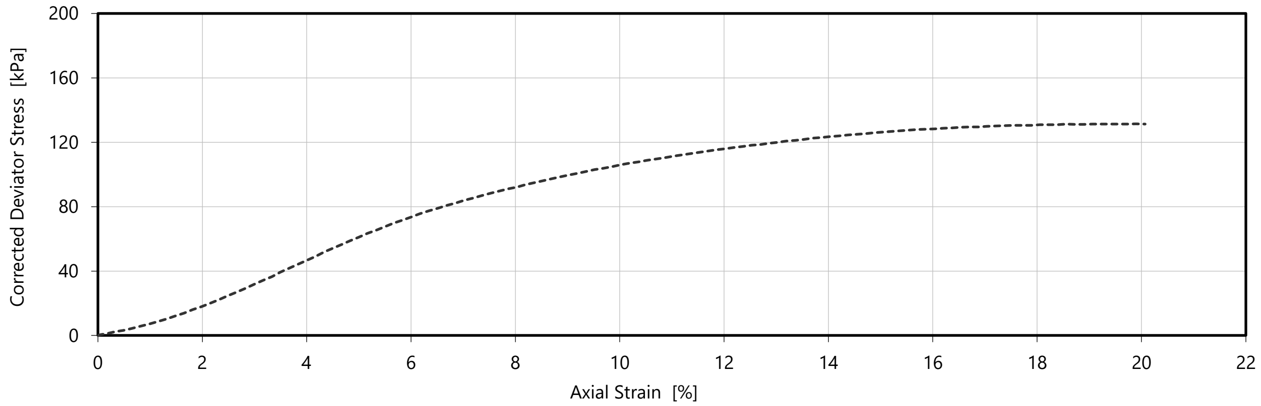
Standard UUTX Single Stage ISO Output.xlsm - Rev 7

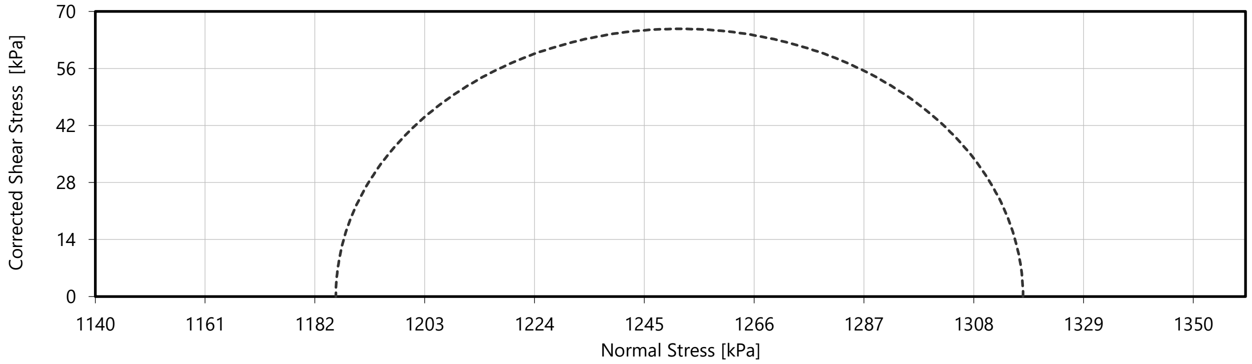
LABORATORY TEST CERTIFICATE
Unconsolidated Undrained Triaxial Test

BS EN ISO 17892-8:2018

1483

Project Reference	F254727			Location ID	Z5_OWF_BH09-COMP
Project Name	Golfe du Lion			Depth Top [m]	12.50
Specimen Description	Firm grey black slightly sandy CLAY			Sample Type	Wax
Specimen Reference	1	Specimen Depth [m]	12.51	Sample Reference	05-4





Test number	1		
Specimen Preparation	UNDISTURBED		
Length [mm]	139.26		
Diameter [mm]	72.98		
Bulk Density [Mg/m³]	1.969		
Specimen Water Content [%]	30.8		
Failure Surface Water Content [%]			
Dry Density [Mg/m³]	1.505		
Initial Voids Ratio	0.794		
Degree of Saturation [%]	100		
Application of Deviator Stress			
Cell Pressure [kPa]	1186		
Specimen Height [mm]	138.00		
Mean Rate of Shear [mm/min]	2.79		
Peak Values			
Undrained Shear Strength [kPa]	66		
Strain at Failure [%]	19.9		
Failure Mode	Plastic		

Issue Date	28/08/2025	Certificate Reference	Issue 2	Authorised By	lindsayc
Client	DGEC			Authorised Date	28/08/2025 09:35
Remarks					

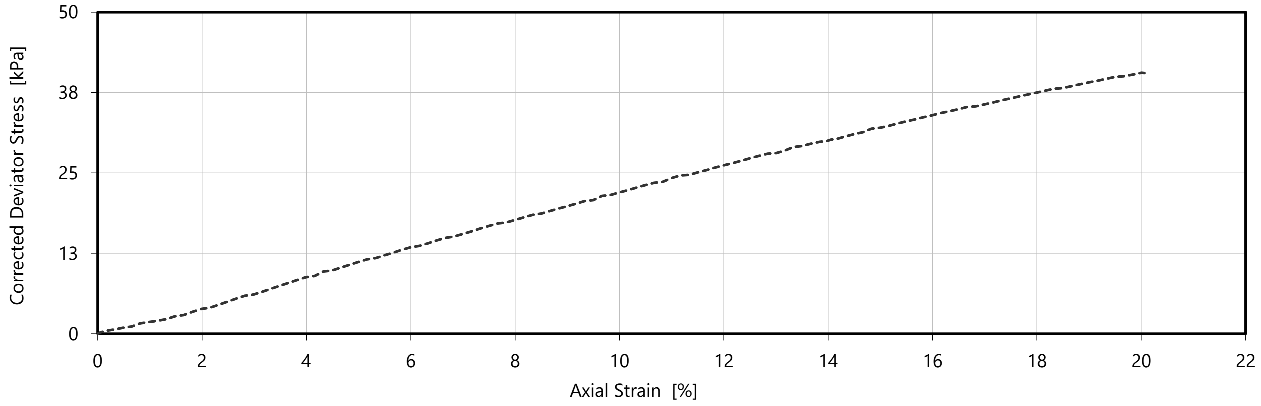
Fugro GB Limited. Unit 43, Number One Industrial Estate, Medomsley Road, Consett, DH8 6TW

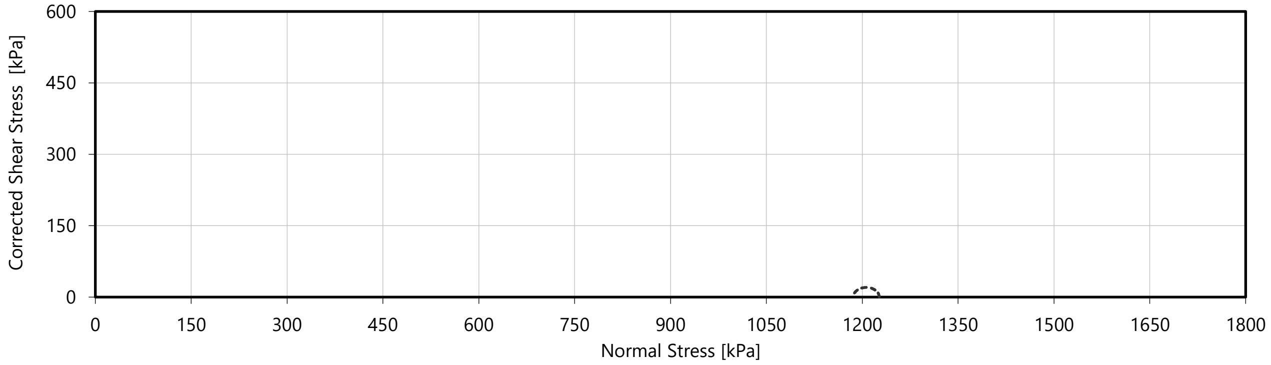
LABORATORY TEST CERTIFICATE
Unconsolidated Undrained Triaxial Test

BS EN ISO 17892-8:2018

1483

Project Reference	F254727	Location ID	Z5_OWF_BH09-COMP
Project Name	Golfe du Lion	Depth Top [m]	12.50
Specimen Description	Grey black slightly sandy CLAY	Sample Type	Wax
Specimen Reference	2	Specimen Depth [m]	
		Sample Reference	05-4





Test number	1		
Specimen Preparation	REMOULDED		
Length [mm]	144.53		
Diameter [mm]	70.20		
Bulk Density [Mg/m³]	1.904		
Specimen Water Content [%]	30.6		
Failure Surface Water Content [%]			
Dry Density [Mg/m³]	1.458		
Initial Voids Ratio	0.852		
Degree of Saturation [%]	97		
Application of Deviator Stress			
Cell Pressure [kPa]	1186		
Specimen Height [mm]	138.95		
Mean Rate of Shear [mm/min]	2.89		
Peak Values			
Undrained Shear Strength [kPa]	20		
Strain at Failure [%]	20.0		
Failure Mode	Plastic		

Issue Date	14/04/2025	Certificate Reference	Issue 1	Authorised By	huntc
Client	DGEC			Authorised Date	14/04/2025 11:02
Remarks	Prepared to maximum achievable density				

Fugro GB Limited. Unit 43, Number One Industrial Estate, Medomsley Road, Consett, DH8 6TW

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Standard UUTX Single Stage ISO Output.xlsm - Rev 7

Location	Sample ID	Depth BSF [m]	Test Type	Specimen Condition	Initial Conditions*							Consolidation Stage†							
					D [mm]	h [mm]	w [%]	ρ [Mg/m^3]	ρ_d [Mg/m^3]	e_0 [-]	S_r [%]	w [%]	ρ [Mg/m^3]	ρ_d [Mg/m^3]	e [-]	σ'_{rc} [kPa]	σ'_{vc} [kPa]	ε_{vol} [%]	ε_v [%]
Z5_OWF_BH01-COMP	05-3	15.65	CIU14	Undisturbed	71.9	138.0	24.7	2.08	1.66	0.623	100	21.8	2.07	1.70	0.588	95	95	2.17	0.59
Z5_OWF_BH05-COMP	02-2	4.15	CIU15	Undisturbed	72.2	139.0	31.6	1.95	1.48	0.825	100	30.6	1.96	1.50	0.797	41	41	1.58	0.47
Z5_OWF_BH09-COMP	04-2	11.25	CIU16	Undisturbed	71.3	130.4	29.3	2.08	1.61	0.675	100	22.0	2.07	1.69	0.593	88	88	4.87	1.17
Z5_OWF_BH09-COMP	05-2	12.10	CIU17	Undisturbed	71.7	136.9	27.6	2.04	1.60	0.691	100	22.2	2.03	1.66	0.626	93	93	4.35	0.89

Location	Sample ID	Depth BSF [m]	Test Type	Specimen Condition	Shear Stage				Final Conditions‡				Bender Element	
					q [kPa]	ε_{50} [%]	E_{50} [kPa]	ε_f [%]	w [%]	ρ [Mg/m^3]	ρ_d [Mg/m^3]	e [-]	v_s [m/s]	G_{max} [MPa]
Z5_OWF_BH01-COMP	05-3	15.65	CIU14	Undisturbed	451	3.65	6179	10.00	21.8	2.07	1.70	0.588	-	-
Z5_OWF_BH05-COMP	02-2	4.15	CIU15	Undisturbed	145	2.23	3266	10.00	30.6	1.96	1.50	0.797	-	-
Z5_OWF_BH09-COMP	04-2	11.25	CIU16	Undisturbed	247	3.51	3523	10.00	22.0	2.07	1.69	0.593	-	-
Z5_OWF_BH09-COMP	05-2	12.10	CIU17	Undisturbed	241	2.37	5085	10.00	22.2	2.03	1.66	0.626	-	-

Notes

BSF : Below seafloor
* : Specimen conditions after preparation and before saturation
† : Specimen conditions after last consolidation and before shearing
‡ : Specimen conditions after testing
CIU : Isotropically consolidated undrained
CAU : Anisotropically consolidated undrained
c/e : In compression/extension
BE : Bender element measurements

D : Diameter
h : Height
w : Water content
ρ : Bulk density
ρ_d : Dry density
e_0 : Initial void ratio
S_r : Degree of saturation
\- : not recorded/assigned

e : Void ratio
σ'_{rc} : Radial effective consolidation stress
σ'_{vc} : Vertical effective consolidation stress
ε_{vol} : Volumetric strain
ε_v : Vertical strain
q : Deviator stress at failure
ε_{50} : Axial strain at 50 % of q_{max}

E_{50} : Secant modulus at ε_{50}
ε_f : Axial strain at failure
v_s : Shear wave velocity after last consolidation
G_{max} : Small strain shear modulus after last consolidation

Summary of Consolidated Undrained Triaxial Test Results

Test Report
Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

UKAS TESTING 0919

ISO 17892-9:2018

Test Identification	
Location	Z5_OWF_BH01-COMP
Sample	05-3
Depth [m]	15.65
Test number	CIU14

Specimen Visual Description

Firm high strength silty dark grey CLAY with pockets of coarse sand and shell fragments

Initial Specimen Conditions	
Test start date	02/06/2026
Type of sample	Undisturbed
Diameter [mm]	71.9
Height [mm]	138.0
Water content [%]	24.7
Bulk density [Mg/m^3]	2.08
Dry density [Mg/m^3]	1.66
Void ratio [-]	0.623
Degree of saturation [%]	100
Particle density - Assumed [Mg/m^3]	2.70
Torvane [kPa]	54
Pocket penetrometer [kPa]	-
Type of drains	One end only

Project: 503387 - F254727
Laboratory: Wallingford, UK
Approved by: ET - 23/06/2025
Z5_OWF_BH01-COMP_05-3_CIU14

Test Report
Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

0919

Saturation	
Pressure increments applied [kPa]	100
Differential pressure used [kPa]	N/A
Cell pressure [kPa]	1342
Base PWP [kPa]	1334
Mid height PWP [kPa]	-
B value achieved [-]	1.00

Isotropic Consolidation	
Cell pressure [kPa]	1430
Back pressure [kPa]	1334
Base PWP [kPa]	1335
Mid height PWP [kPa]	-
Effective radial pressure [kPa]	95
Effective axial pressure [kPa]	95
Deviator stress [kPa]	0
Volumetric strain [%]	2.17
Volumetric strain rate - end of stage [%/hr]	0.01
External axial strain [%]	0.59
Local axial strain [%]	-
Local radial strain [%]	-
Water content [%]	21.8
Bulk density [Mg/m^3]	2.07
Dry density [Mg/m^3]	1.70
Void ratio [-]	0.588
Degree of saturation [%]	100

Project: 503387 - F254727 Laboratory: Wallingford, UK Approved by: ET - 23/06/2025

Z5_OWF_BH01-COMP_05-3_CIU14

Test Report
Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

0919

Shearing Stage	
Initial effective radial pressure [kPa]	95
Initial effective axial pressure [kPa]	95
Rate of strain [%/hour]	0.30
At peak deviator stress	
Corrected deviator stress [kPa]	547
Membrane correction applied [kPa]	5
Drain correction applied [kPa]	0
External axial strain [%]	20.00
Local axial strain [%]	-
Local radial strain [%]	-
Excess base PWP [kPa]	-139
Excess mid height PWP [kPa]	-
Effective radial pressure [kPa]	234
Effective axial pressure [kPa]	780
Principal effective stress ratio [-]	3.34
ε_{50} [%]	4.66
Secant modulus (E_{50}) at ε_{50} [kPa]	5867
At peak principal effective stress ratio	
Corrected deviator stress [kPa]	248
Membrane correction applied [kPa]	1
Drain correction applied [kPa]	0
External axial strain [%]	4.11
Local axial strain [%]	-
Local radial strain [%]	-
Excess base PWP [kPa]	17
Excess mid height PWP [kPa]	-
Effective radial pressure [kPa]	78
Effective axial pressure [kPa]	326
Principal effective stress ratio [-]	4.19
At 10% external axial strain	
Corrected deviator stress [kPa]	451
Membrane correction applied [kPa]	2
Drain correction applied [kPa]	0
External axial strain [%]	10.00
Excess base PWP [kPa]	-66
Excess mid height PWP [kPa]	-
Effective radial pressure [kPa]	161
Effective axial pressure [kPa]	612
Principal effective stress ratio [-]	3.79
ε_{50} [%]	3.65
Secant modulus (E_{50}) at ε_{50} [kPa]	6179

Project: 503387 - F254727 Laboratory: Wallingford, UK Approved by: ET - 23/06/2025

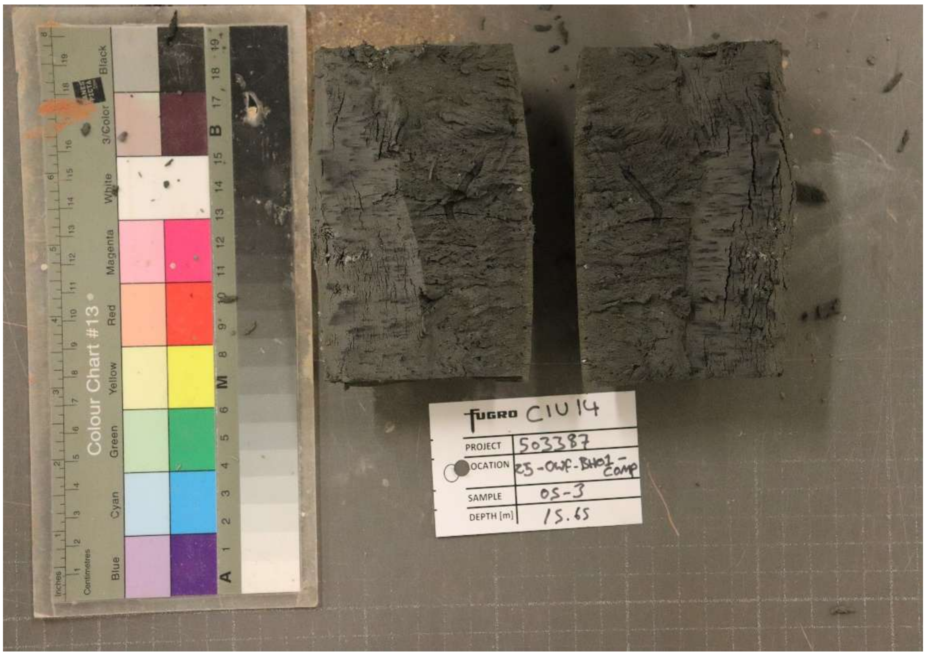
Z5_OWF_BH01-COMP_05-3_CIU14

Test Report
Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

UKAS TESTING 0919

Specimen Photographs



FINAL CONDITIONS	
Water content [%]	21.8
Bulk density [Mg/m³]	2.07
Dry density [Mg/m³]	1.70
Void ratio [-]	0.588

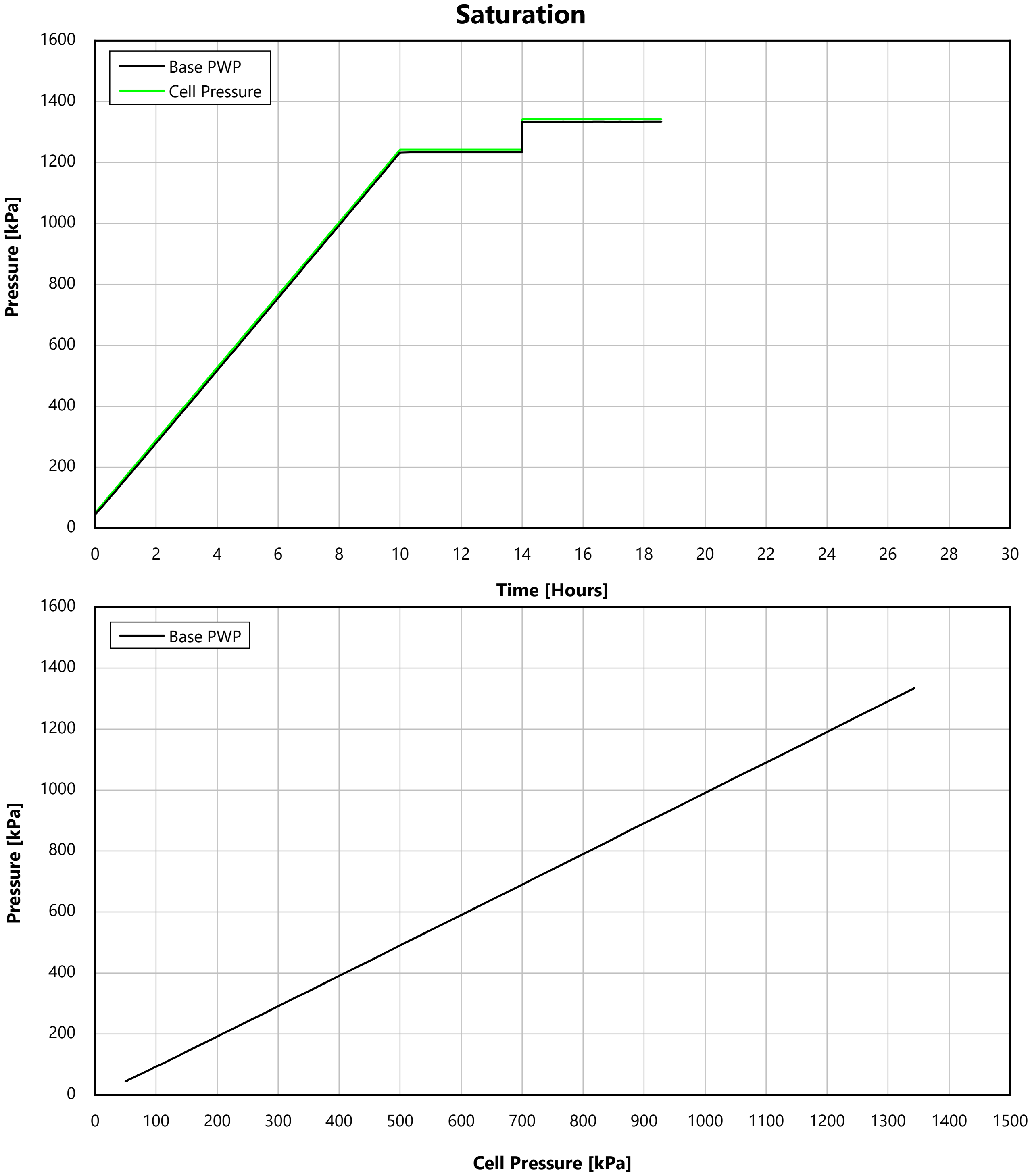
Project: 503387 - F254727
Laboratory: Wallingford, UK
Approved by: ET - 23/06/2025
Z5_OWF_BH01-COMP_05-3_CIU14

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

0919



SATURATION

B value : 1.00

Initial σ'_a : 5 kPa

Final σ'_a : 8 kPa

Project: 503387 - F254727

Laboratory: Wallingford, UK
Z5_OWF_BH01-COMP_05-3_CIU14

Approved by: ET 23/06/2025

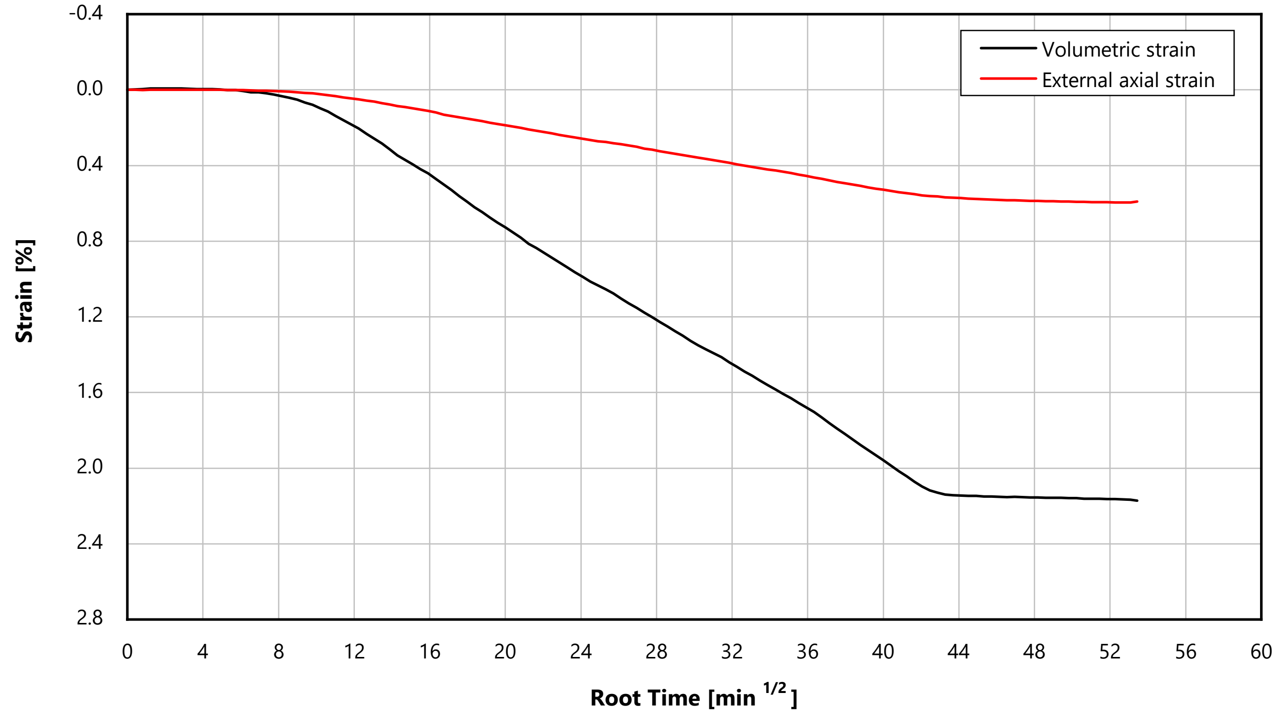
Test Report

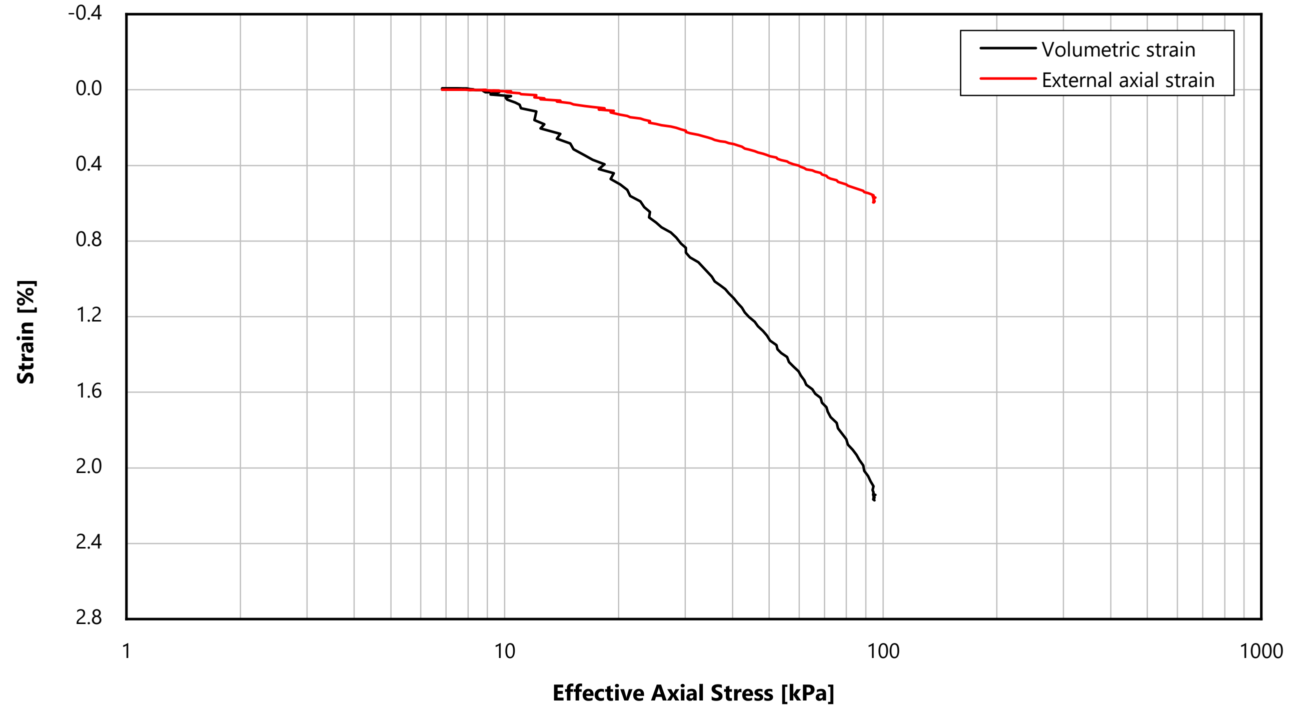
Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

UKAS TESTING 0919

Consolidation





CONSOLIDATION

Stage 1 σ'$_{rc}$: 95 kPa

Stage 1 σ'$_{ac}$: 95 kPa

Project: 503387 - F254727

Laboratory: Wallingford, UK
Z5_OWF_BH01-COMP_05-3_CIU14

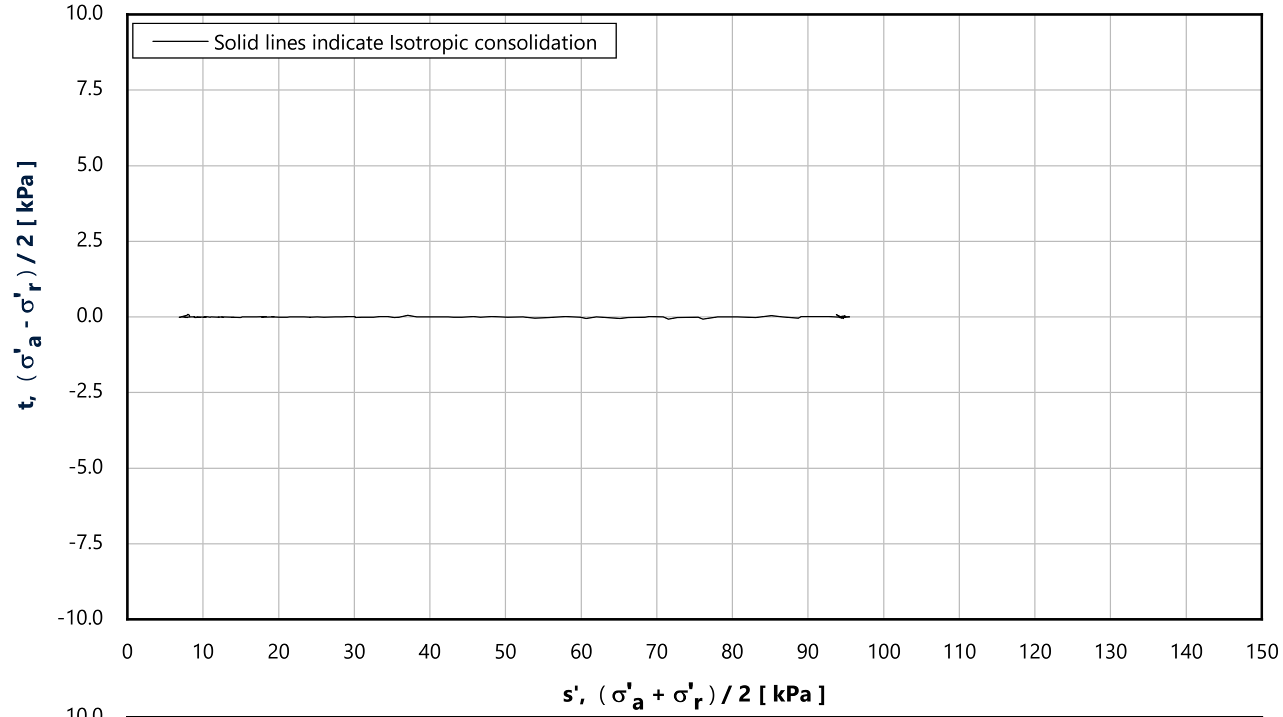
Approved by: ET 23/06/2025

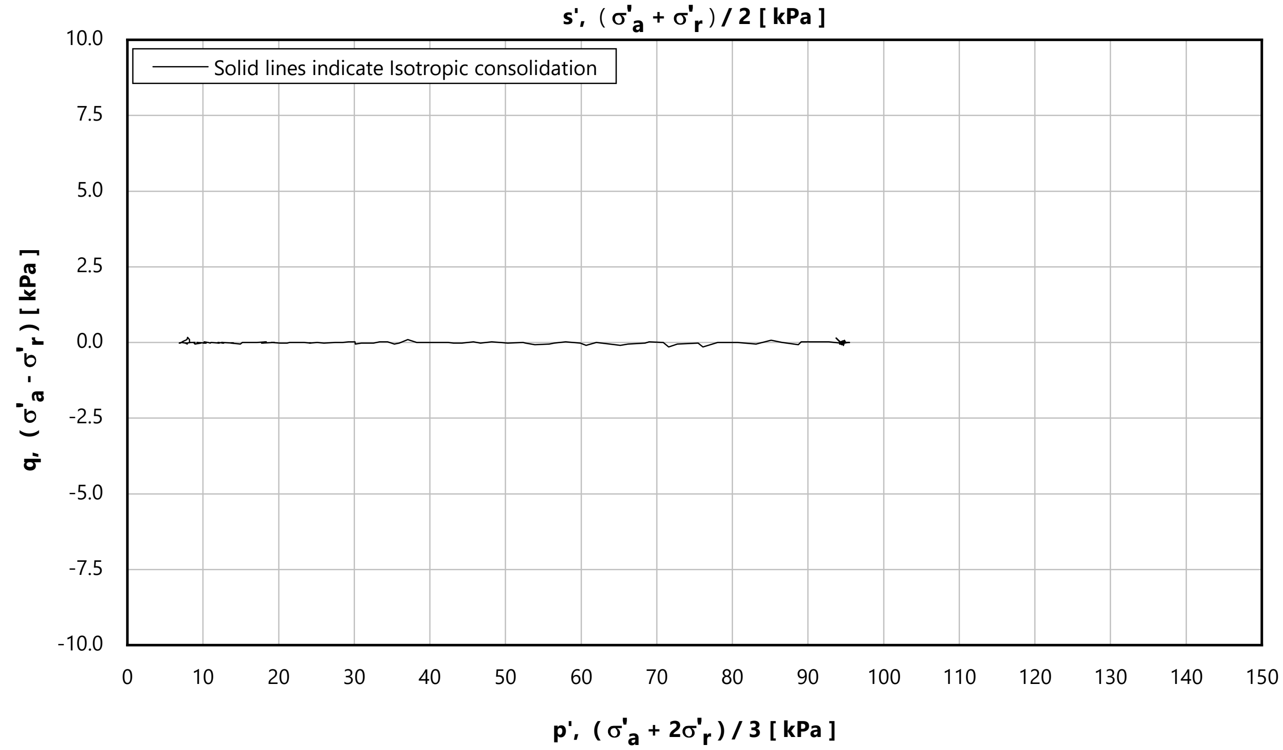
Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

Consolidation





CONSOLIDATION

Stage 1 σ'_{rc} : 95 kPa
Stage 1 σ'_{ac} : 95 kPa

Project: 503387 - F254727

Laboratory: Wallingford, UK
Z5_OWF_BH01-COMP_05-3_CIU14

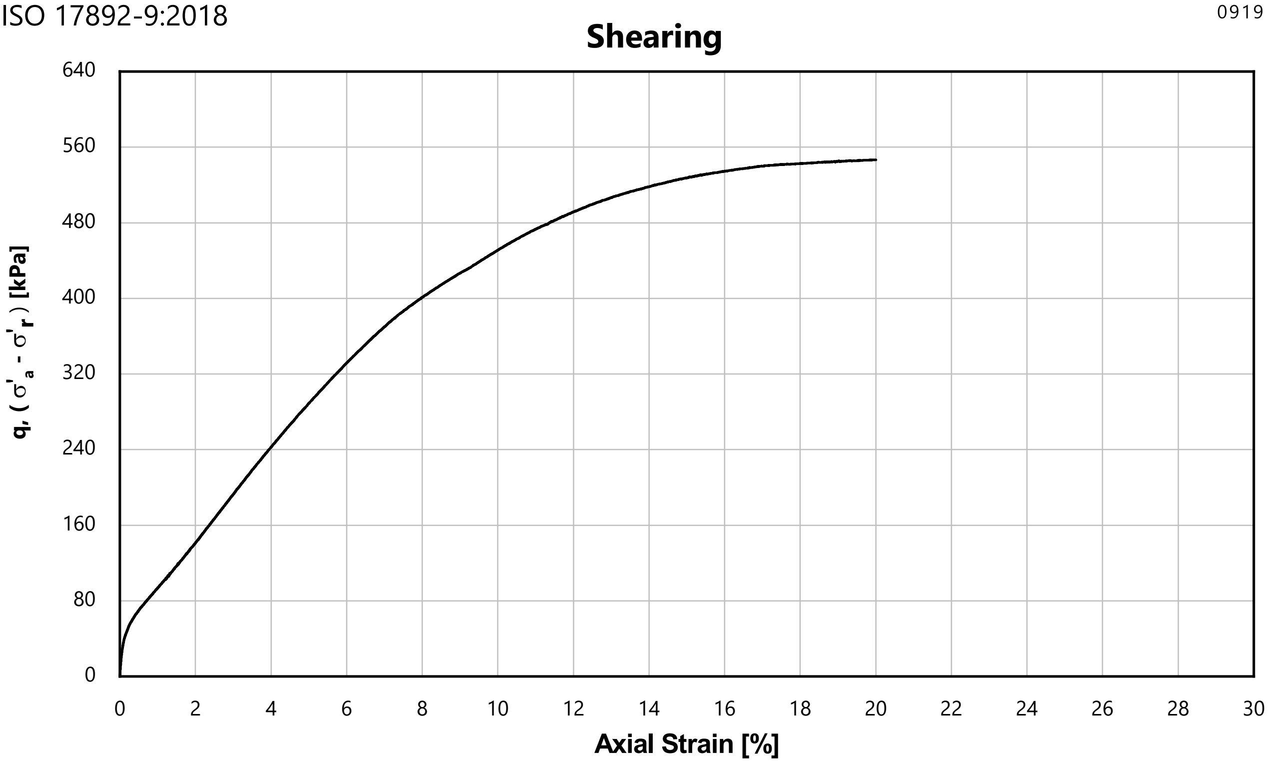
Approved by: ET 23/06/2025

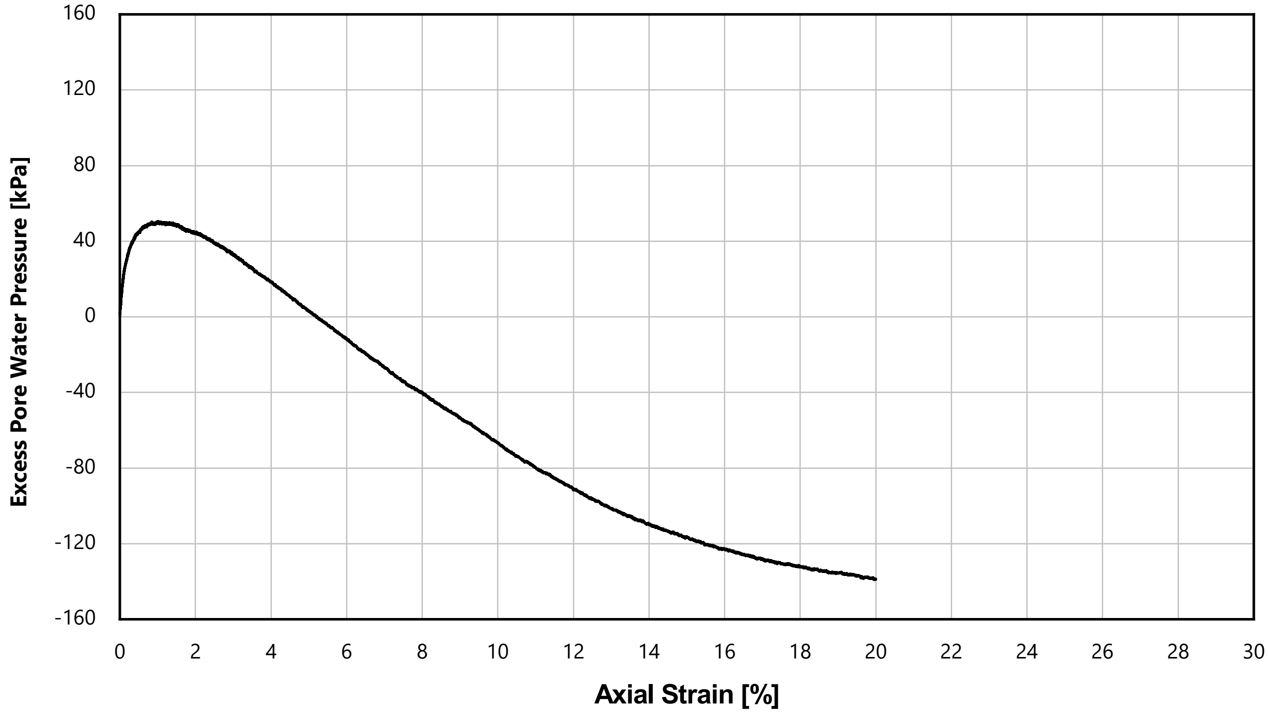
Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

UKAS TESTING 0919





SHEAR		
Initial σ'$_r$: 95 kPa	Rate of strain : 0.30 %/hour	q$_{peak}$: 547 kPa
Initial σ'$_a$: 95 kPa	Ext. ε at q$_{peak}$: 20.00 %	

Project: 503387 - F254727

Laboratory: Wallingford, UK
Z5_OWF_BH01-COMP_05-3_CIU14

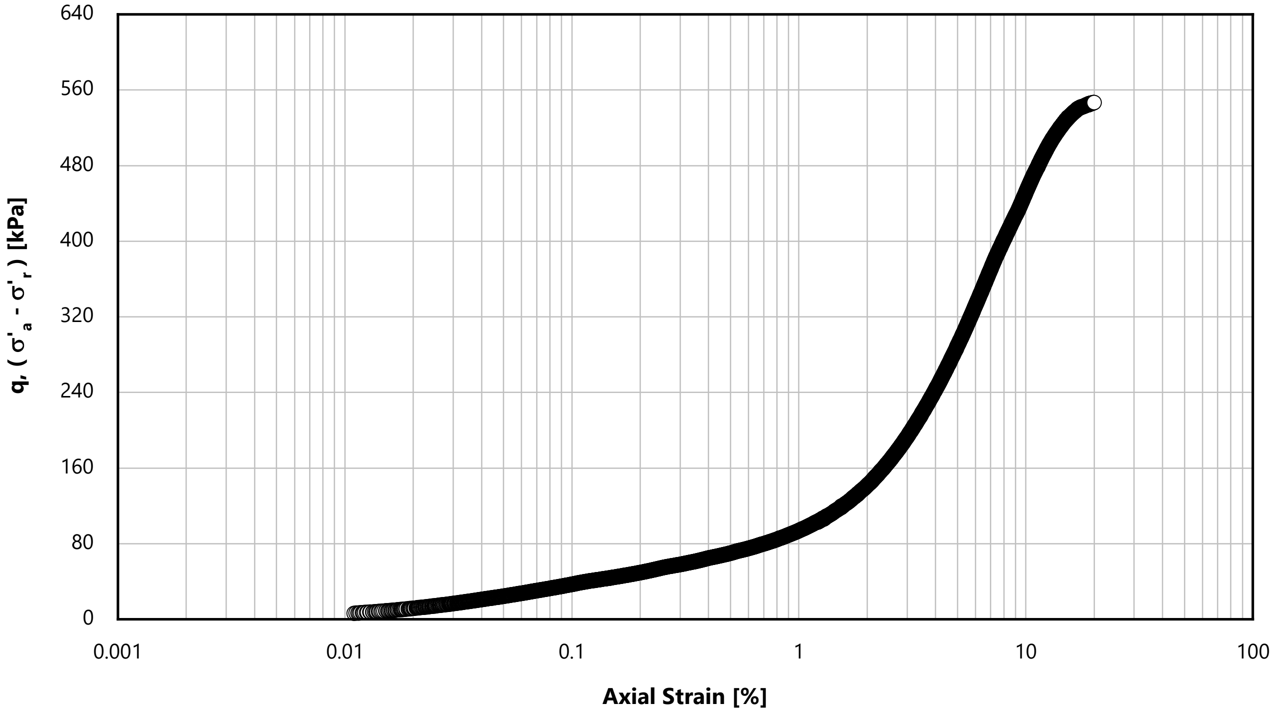
Approved by: ET 23/06/2025

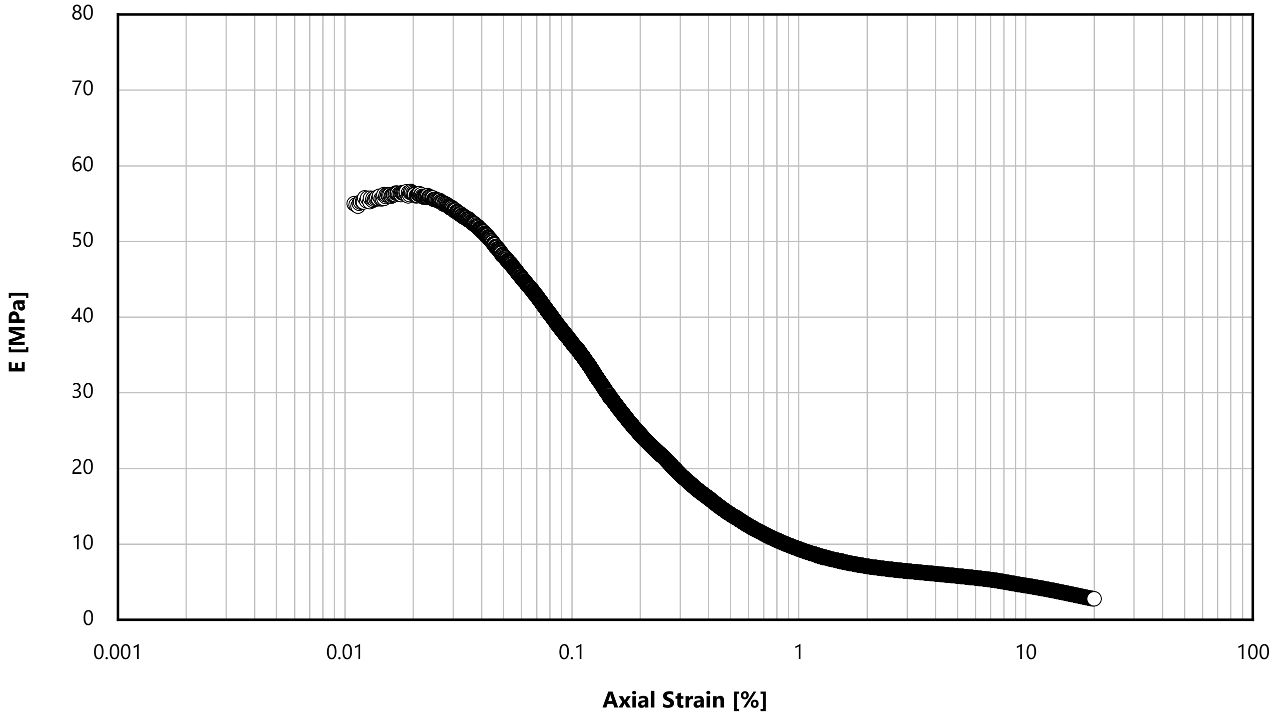
Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

Shearing





SHEAR		
Initial σ'_r : 95 kPa	Rate of strain : 0.30 %/hour	q_{peak} : 547 kPa
Initial σ'_a : 95 kPa	Ext. ε at q_{peak} : 20.00 %	

Project: 503387 - F254727

Laboratory: Wallingford, UK
Z5_OWF_BH01-COMP_05-3_CIU14

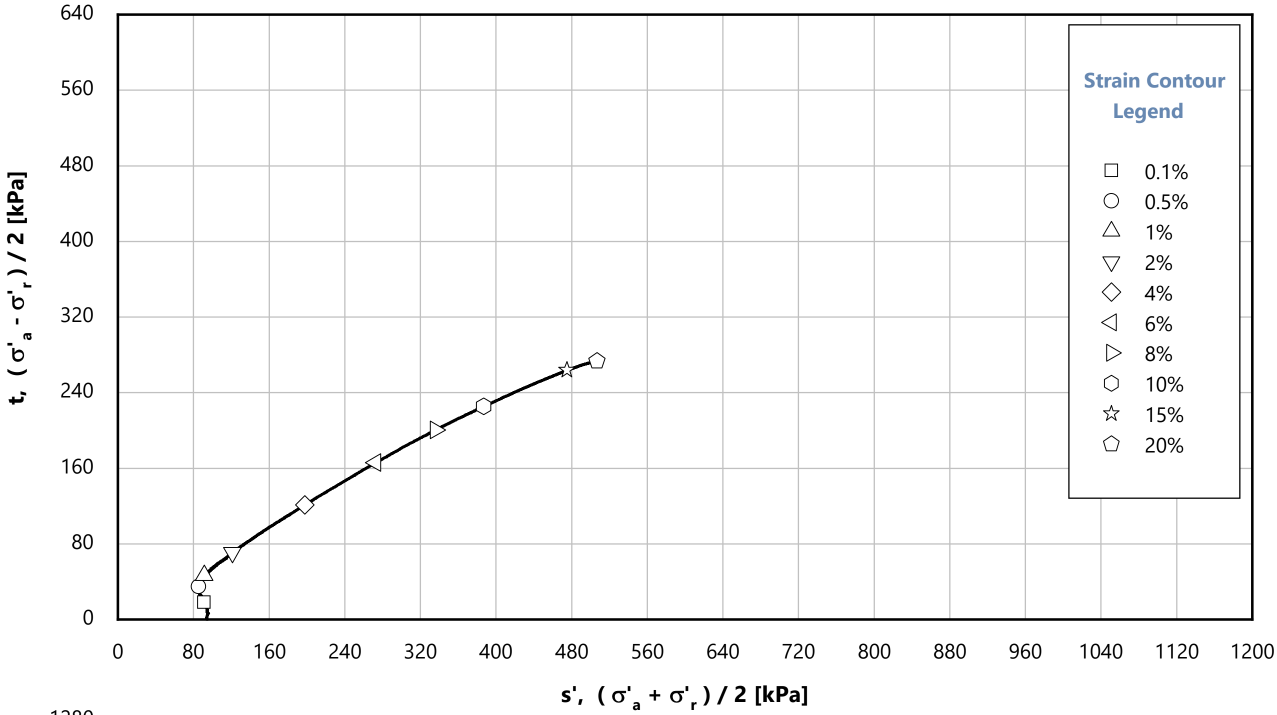
Approved by: ET 23/06/2025

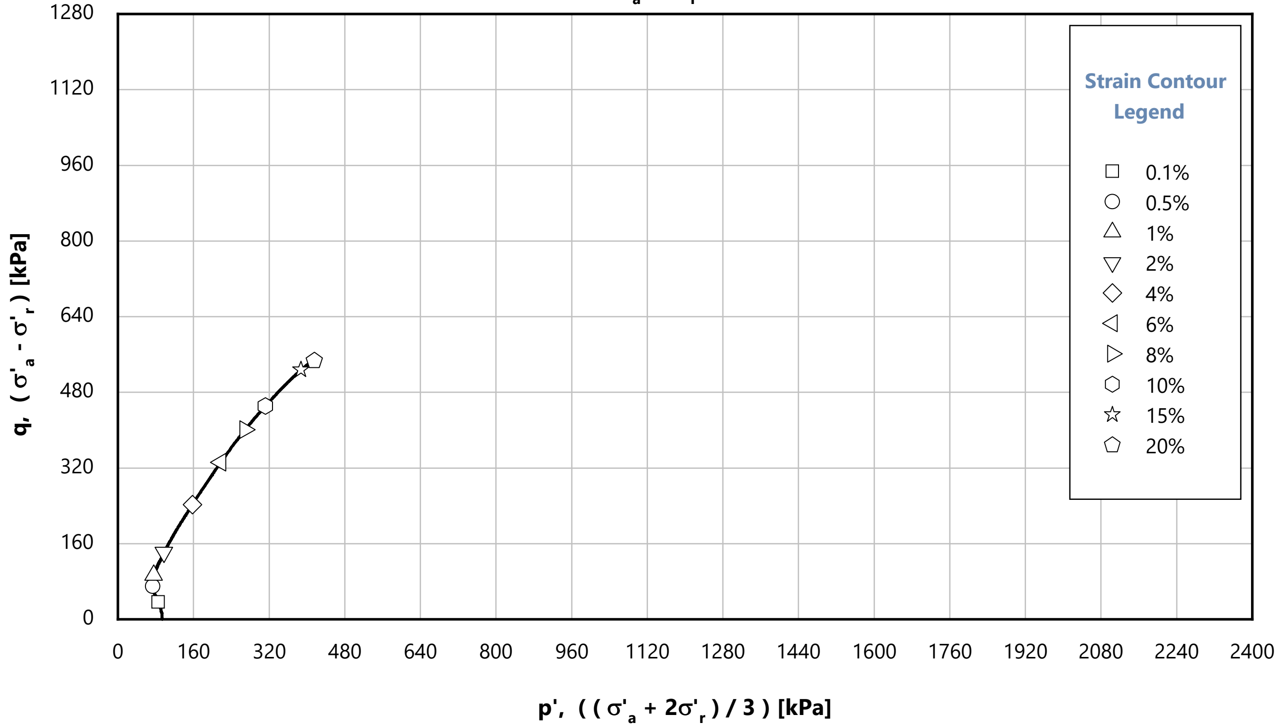
Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

Shearing





SHEAR		
Initial σ'_r : 95 kPa	Rate of strain : 0.30 %/hour	q_{peak} : 547 kPa
Initial σ'_a : 95 kPa	Ext. ε at q_{peak} : 20.00 %	

Project: 503387 - F254727

Laboratory: Wallingford, UK
Z5_OWF_BH01-COMP_05-3_CIU14

Approved by: ET 23/06/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

UKAS TESTING 0919

Test Identification	
Location	Z5_OWF_BH05-COMP
Sample	02-2
Depth [m]	4.15
Test number	CIU15

Specimen Visual Description

Firm medium strength dark grey CLAY

Initial Specimen Conditions	
Test start date	02/06/2025
Type of sample	Undisturbed
Diameter [mm]	72.2
Height [mm]	139.0
Water content [%]	31.6
Bulk density [Mg/m^3]	1.95
Dry density [Mg/m^3]	1.48
Void ratio [-]	0.825
Degree of saturation [%]	100
Particle density - Assumed [Mg/m^3]	2.70
Torvane [kPa]	56
Pocket penetrometer [kPa]	73
Type of drains	Radial (spiral) & one end only

Project: 503387 - F254727 Laboratory: Wallingford, UK Approved by: ET - 24/06/2025

Z5_OWF_BH05-COMP_02-2_CIU15

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

Saturation	
Pressure increments applied [kPa]	100
Differential pressure used [kPa]	N/A
Cell pressure [kPa]	1133
Base PWP [kPa]	1130
Mid height PWP [kPa]	-
B value achieved [-]	1.00

Isotropic Consolidation	
Cell pressure [kPa]	1171
Back pressure [kPa]	1130
Base PWP [kPa]	1130
Mid height PWP [kPa]	-
Effective radial pressure [kPa]	41
Effective axial pressure [kPa]	41
Deviator stress [kPa]	0
Volumetric strain [%]	1.58
Volumetric strain rate - end of stage [%/hr]	0.00
External axial strain [%]	0.47
Local axial strain [%]	-
Local radial strain [%]	-
Water content [%]	30.6
Bulk density [Mg/m^3]	1.96
Dry density [Mg/m^3]	1.50
Void ratio [-]	0.797
Degree of saturation [%]	100

Project: 503387 - F254727 Laboratory: Wallingford, UK Approved by: ET - 24/06/2025

Z5_OWF_BH05-COMP_02-2_CIU15

Test Report
Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

0919

Shearing Stage	
Initial effective radial pressure [kPa]	41
Initial effective axial pressure [kPa]	41
Rate of strain [%/hour]	0.30
At peak deviator stress	
Corrected deviator stress [kPa]	152
Membrane correction applied [kPa]	4
Drain correction applied [kPa]	0
External axial strain [%]	14.99
Local axial strain [%]	-
Local radial strain [%]	-
Excess base PWP [kPa]	-24
Excess mid height PWP [kPa]	-
Effective radial pressure [kPa]	65
Effective axial pressure [kPa]	217
Principal effective stress ratio [-]	3.35
ε_{50} [%]	2.38
Secant modulus (E_{50}) at ε_{50} [kPa]	3192
At peak principal effective stress ratio	
Corrected deviator stress [kPa]	79
Membrane correction applied [kPa]	1
Drain correction applied [kPa]	0
External axial strain [%]	2.51
Local axial strain [%]	-
Local radial strain [%]	-
Excess base PWP [kPa]	16
Excess mid height PWP [kPa]	-
Effective radial pressure [kPa]	25
Effective axial pressure [kPa]	103
Principal effective stress ratio [-]	4.19
At 10% external axial strain	
Corrected deviator stress [kPa]	145
Membrane correction applied [kPa]	2
Drain correction applied [kPa]	0
External axial strain [%]	10.00
Excess base PWP [kPa]	-15
Excess mid height PWP [kPa]	-
Effective radial pressure [kPa]	57
Effective axial pressure [kPa]	202
Principal effective stress ratio [-]	3.56
ε_{50} [%]	2.23
Secant modulus (E_{50}) at ε_{50} [kPa]	3266

Project: 503387 - F254727 Laboratory: Wallingford, UK Approved by: ET - 24/06/2025

Z5_OWF_BH05-COMP_02-2_CIU15

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

Specimen Photographs

FINAL CONDITIONS	
Water content [%]	30.6
Bulk density [Mg/m^3]	1.96
Dry density [Mg/m^3]	1.50
Void ratio [-]	0.797

Project: 503387 - F254727 Laboratory: Wallingford, UK Approved by: ET - 24/06/2025

Z5_OWF_BH05-COMP_02-2_CIU15

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

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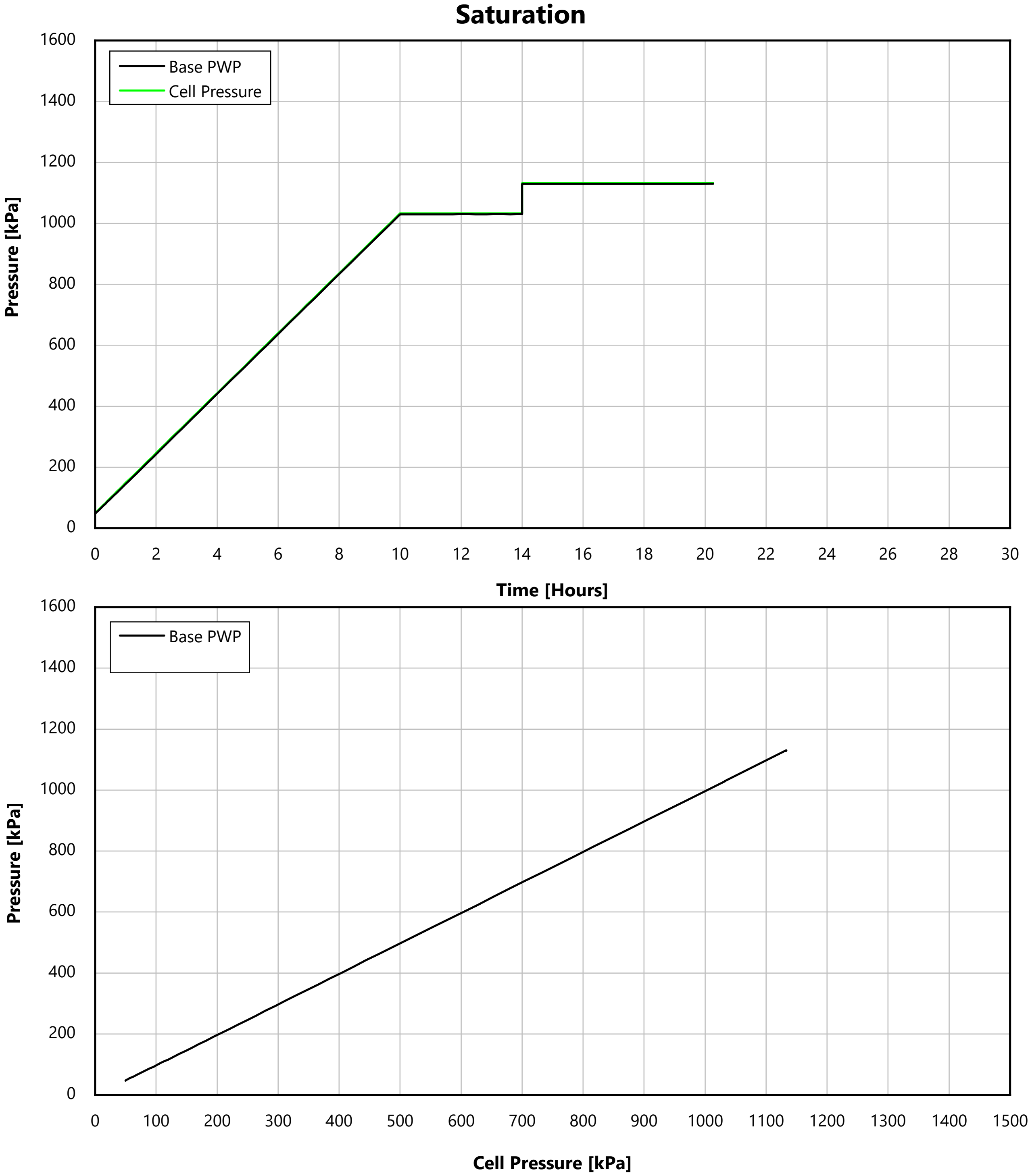


SATURATION	
B value : 1.00	Initial σ'_a : 3 kPa
	Final σ'_a : 3 kPa

Project: 503387 - F254727

Laboratory: Wallingford, UK
Z5_OWF_BH05-COMP_02-2_CIU15

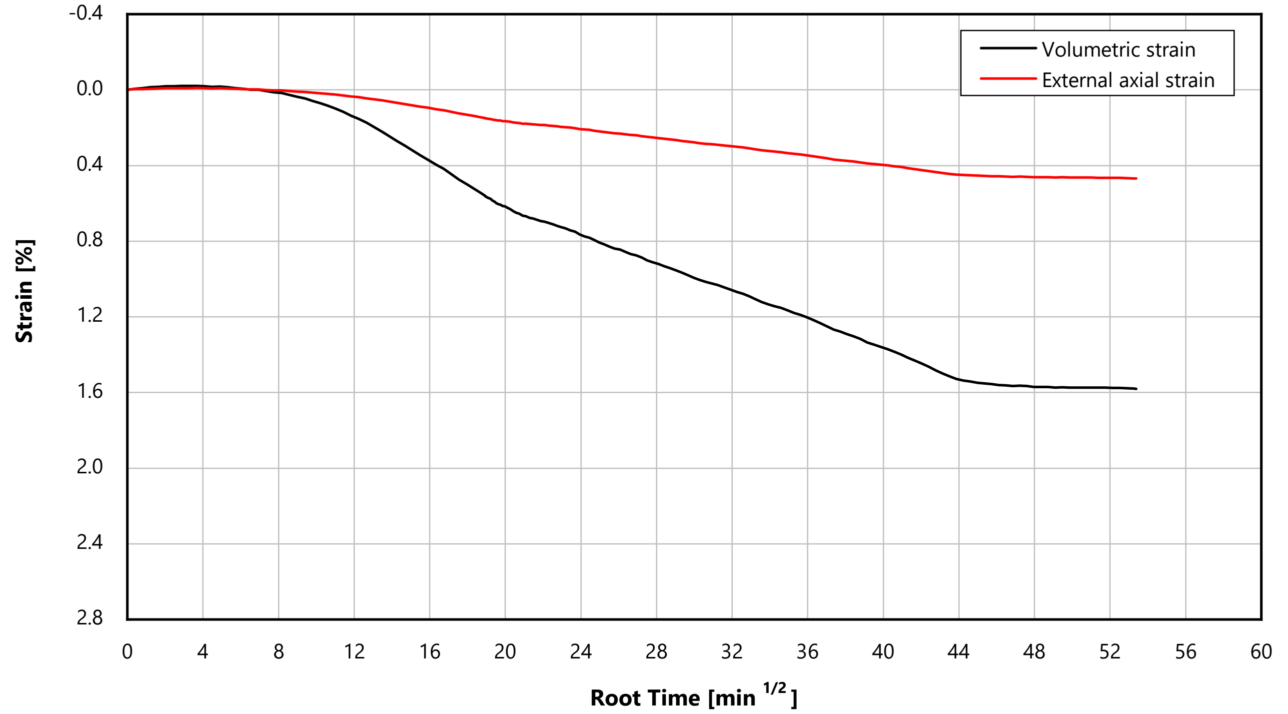
Approved by: ET 24/06/2025

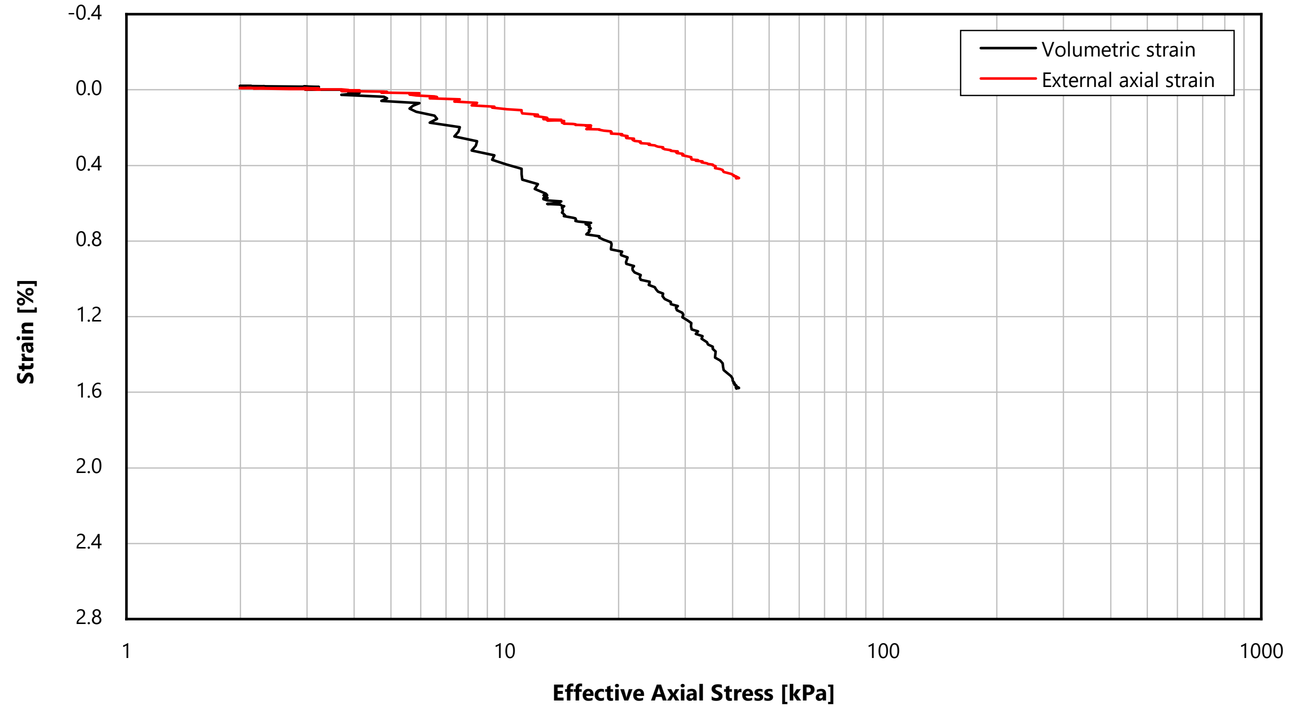
Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

Consolidation





CONSOLIDATION
Stage 1 σ'_{rc} : 41 kPa
Stage 1 σ'_{ac} : 41 kPa

Project: 503387 - F254727

Laboratory: Wallingford, UK
Z5_OWF_BH05-COMP_02-2_CIU15

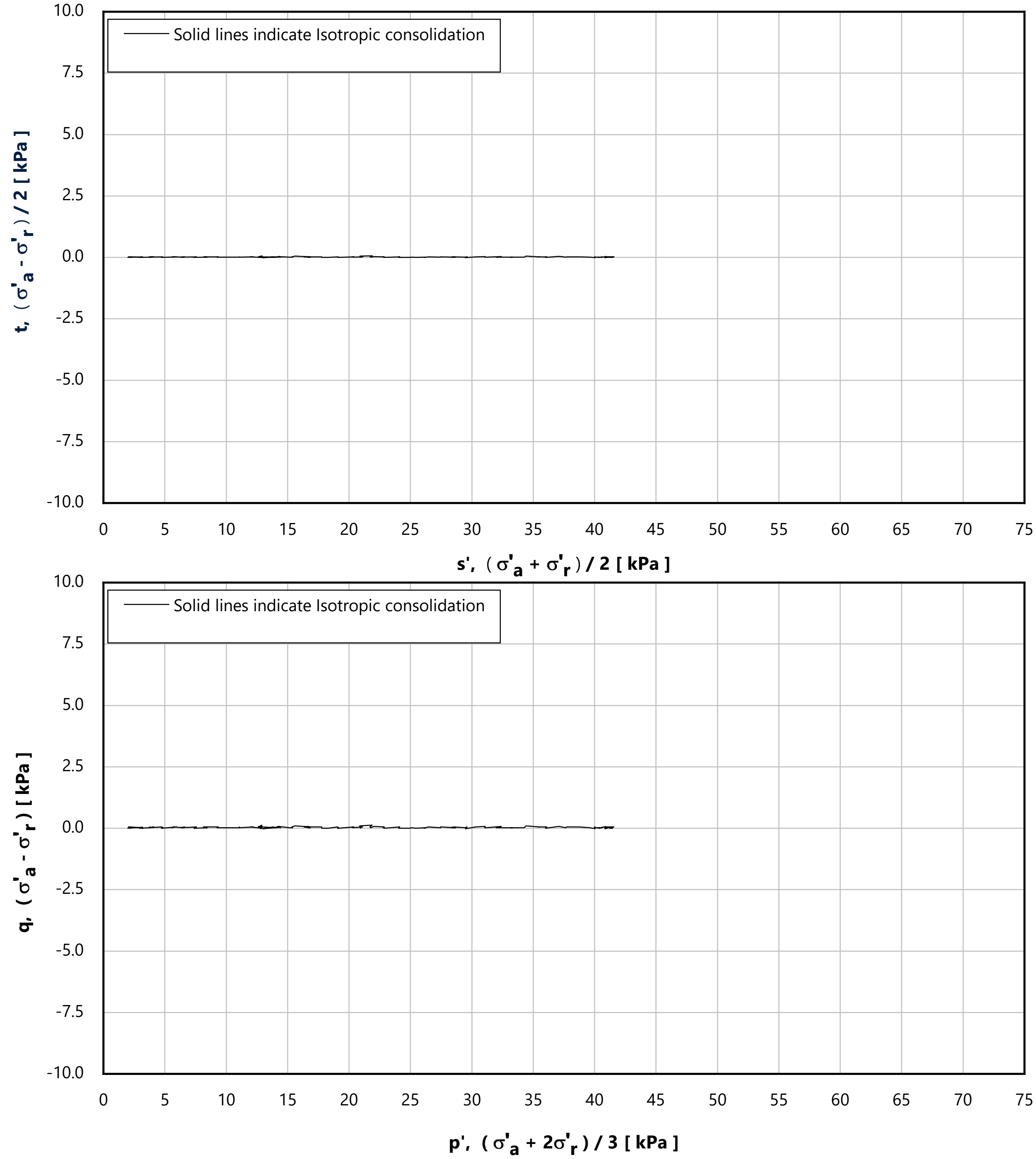
Approved by: ET 24/06/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

Consolidation



CONSOLIDATION
Stage 1 σ'_{rc} : 41 kPa
Stage 1 σ'_{ac} : 41 kPa

Project: 503387 - F254727

Laboratory: Wallingford, UK
Z5_OWF_BH05-COMP_02-2_CIU15

Approved by: ET 24/06/2025

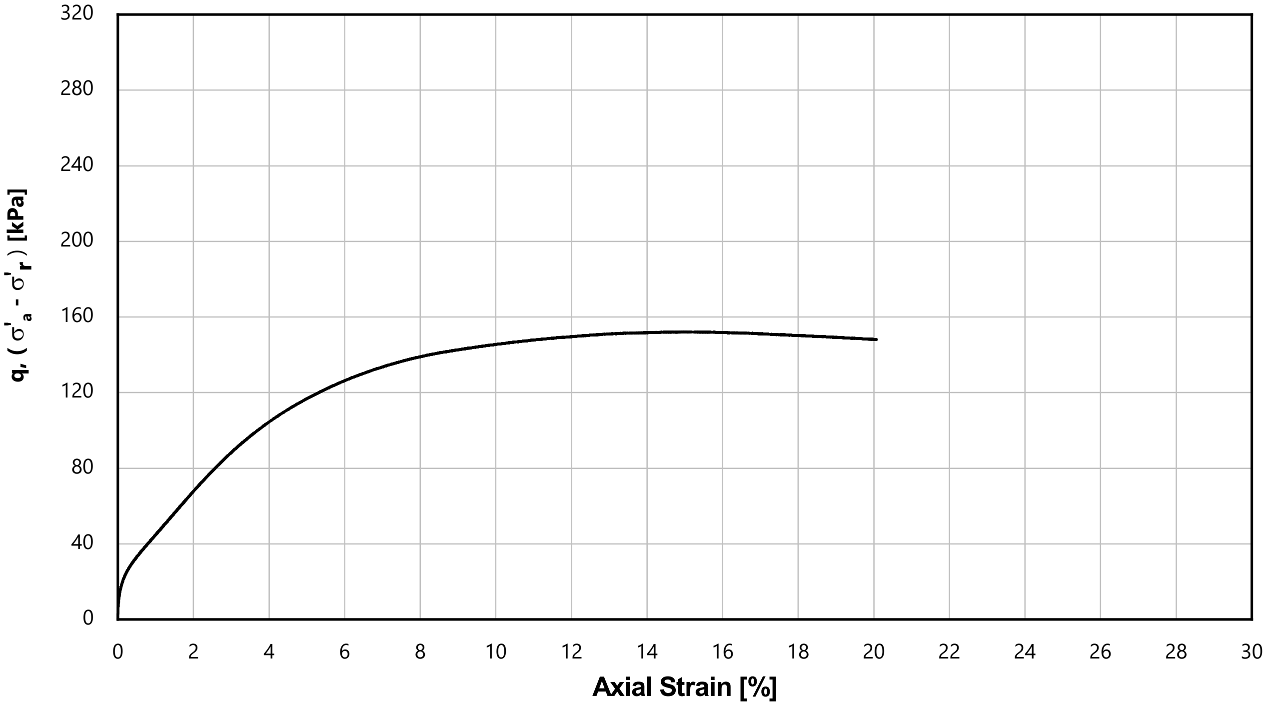
Test Report

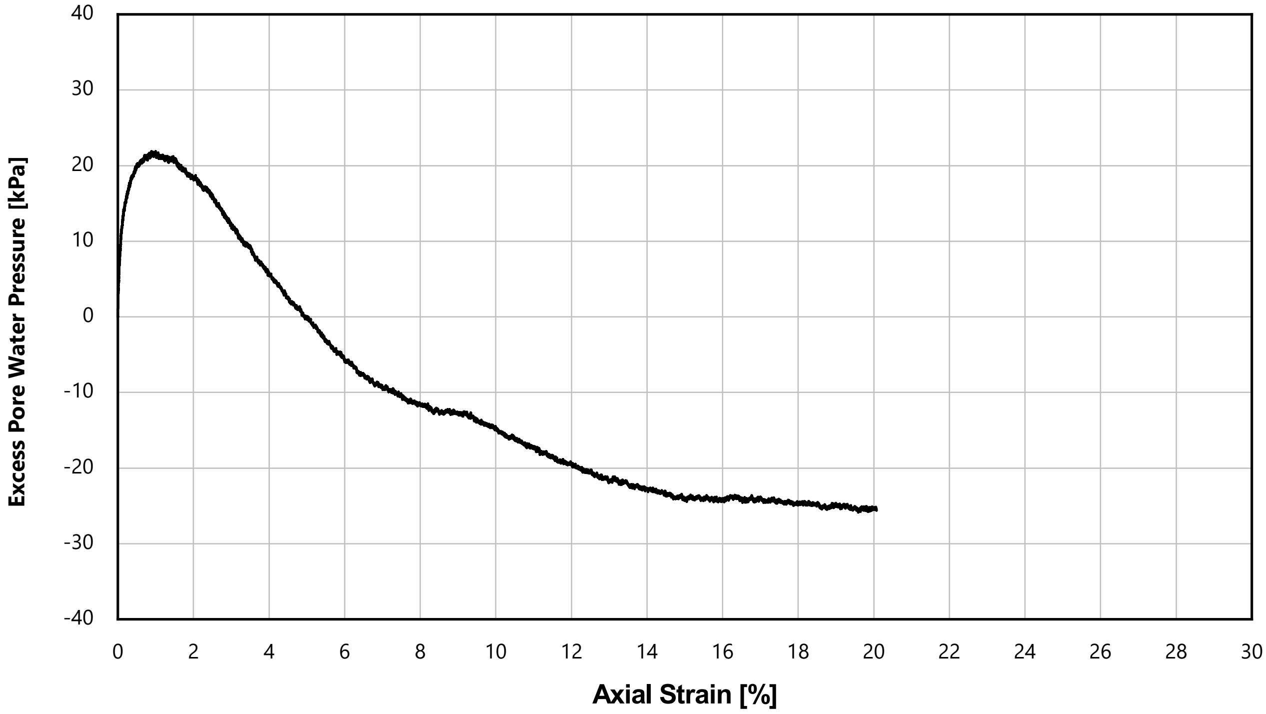
Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

0919

Shearing





SHEAR		
Initial σ'_r : 41 kPa	Rate of strain : 0.30 %/hour	q_{peak} : 152 kPa
Initial σ'_a : 41 kPa	Ext. ε at q_{peak} : 14.99 %	

Project: 503387 - F254727

Laboratory: Wallingford, UK
Z5_OWF_BH05-COMP_02-2_CIU15

Approved by: ET 24/06/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

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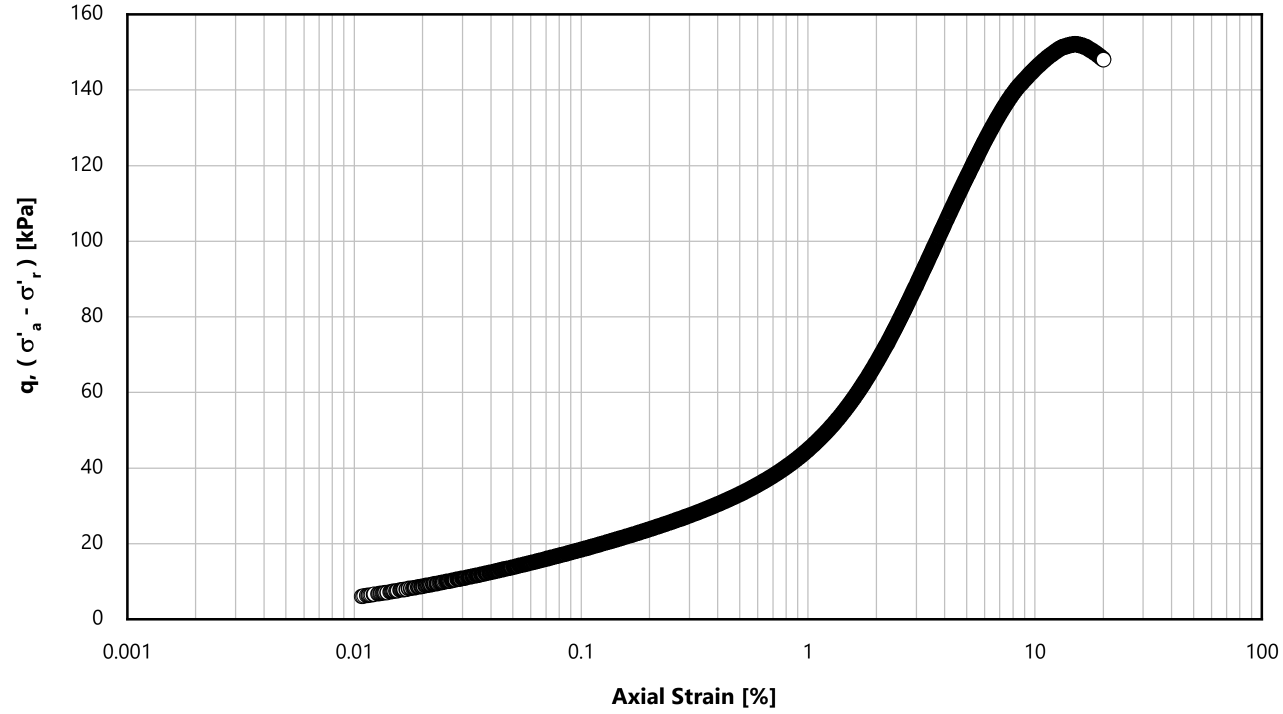
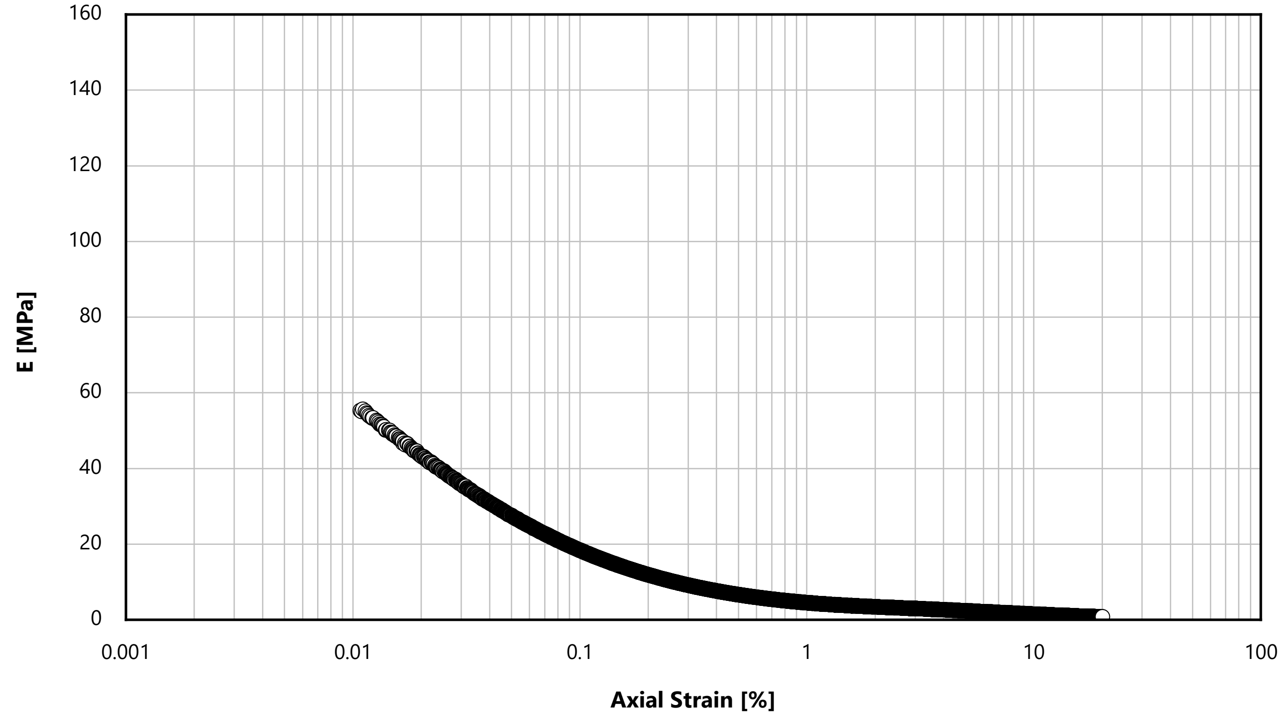
Shearing





SHEAR		
Initial σ'$_r$: 41 kPa	Rate of strain : 0.30 %/hour	q$_{peak}$: 152 kPa
Initial σ'$_a$: 41 kPa	Ext. ε at q$_{peak}$: 14.99 %	

Project: 503387 - F254727

Laboratory: Wallingford, UK
Z5_OWF_BH05-COMP_02-2_CIU15

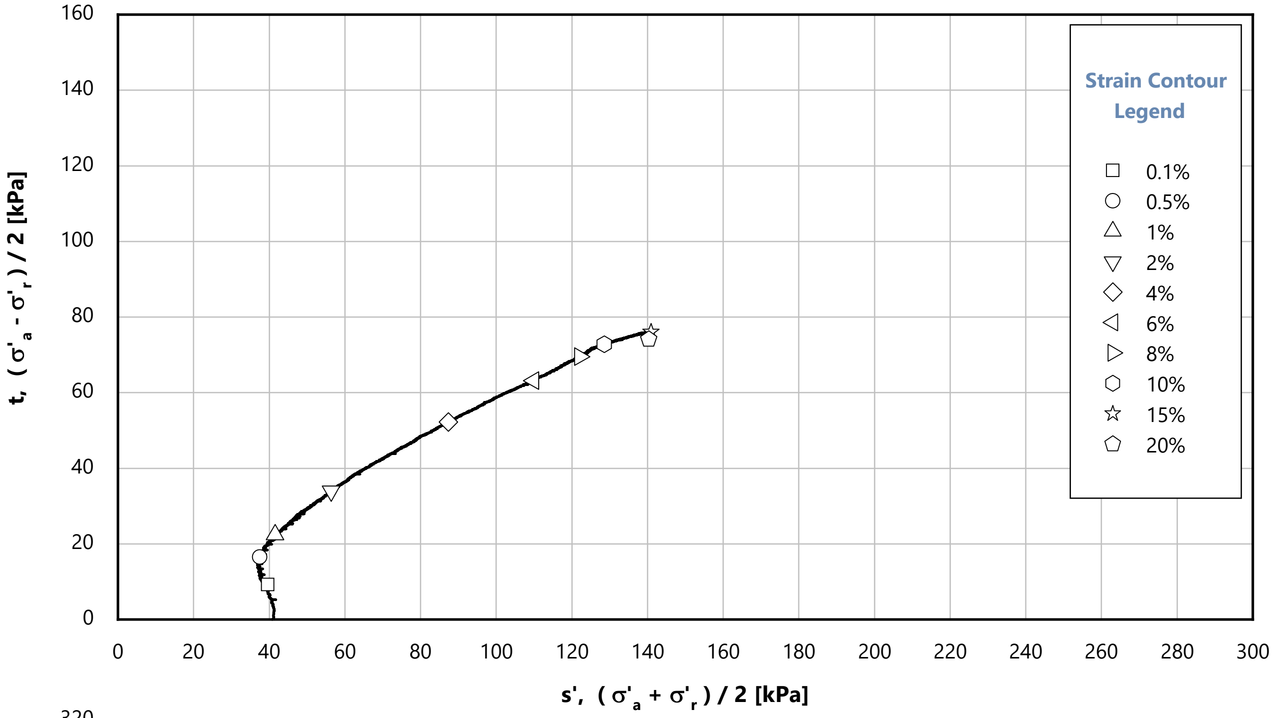
Approved by: ET 24/06/2025

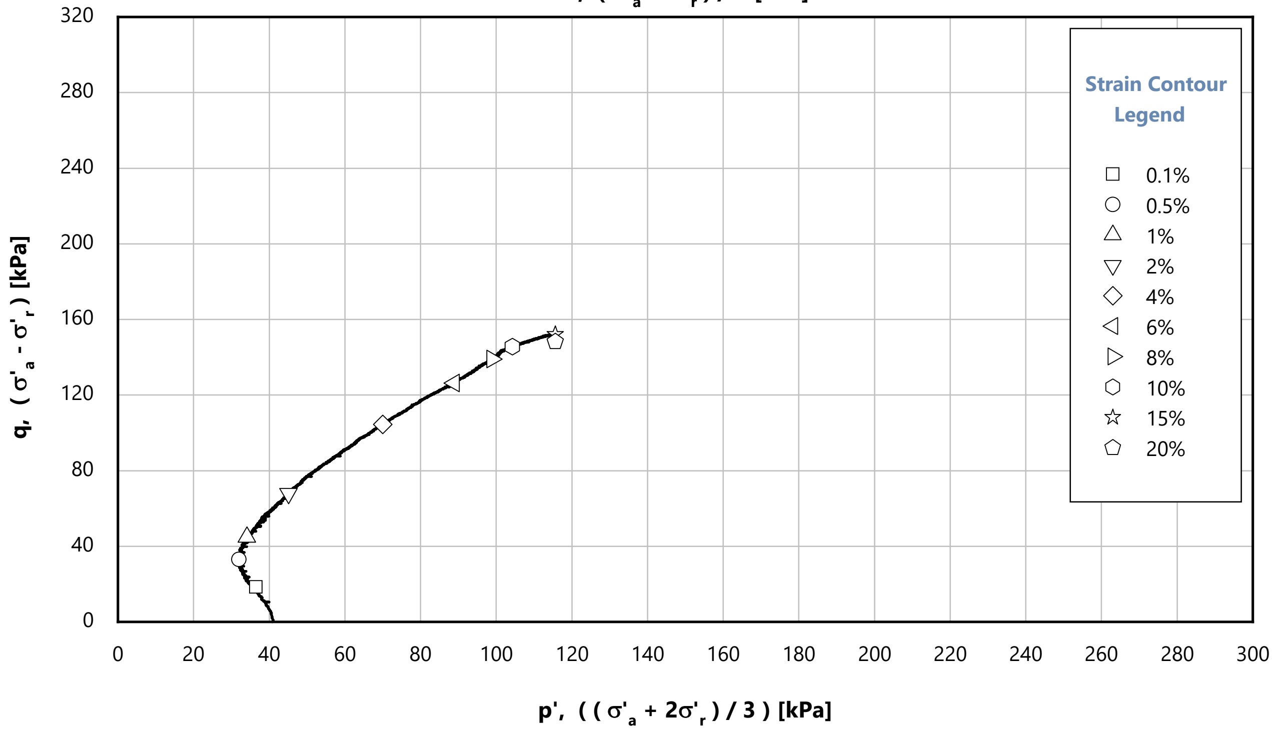
Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

Shearing





SHEAR		
Initial σ'_r : 41 kPa	Rate of strain : 0.30 %/hour	q_{peak} : 152 kPa
Initial σ'_a : 41 kPa	Ext. ε at q_{peak} : 14.99 %	

Project: 503387 - F254727

Laboratory: Wallingford, UK
Z5_OWF_BH05-COMP_02-2_CIU15

Approved by: ET 24/06/2025

Test Report
Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

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Test Identification	
Location	Z4_OWF_BH09-COMP
Sample	04-2
Depth [m]	11.25
Test number	CIU16

Specimen Visual Description

Firm medium to high strength dark grey silty CALY

Initial Specimen Conditions	
Test start date	30/05/2025
Type of sample	Undisturbed
Diameter [mm]	71.3
Height [mm]	130.4
Water content [%]	29.3
Bulk density [Mg/m^3]	2.08
Dry density [Mg/m^3]	1.61
Void ratio [-]	0.675
Degree of saturation [%]	100
Particle density - Assumed [Mg/m^3]	2.70
Torvane [kPa]	65
Pocket penetrometer [kPa]	88
Type of drains	Radial (spiral) & one end only

Project: 503387 - F254727　Laboratory: Wallingford, UK　Approved by: ET - 24/06/2025

Z4_OWF_BH09-COMP_04-2_CIU16

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

0919

Saturation	
Pressure increments applied [kPa]	100
Differential pressure used [kPa]	N/A
Cell pressure [kPa]	1365
Base PWP [kPa]	1353
Mid height PWP [kPa]	-
B value achieved [-]	1.00

Isotropic Consolidation	
Cell pressure [kPa]	1440
Back pressure [kPa]	1352
Base PWP [kPa]	1352
Mid height PWP [kPa]	-
Effective radial pressure [kPa]	88
Effective axial pressure [kPa]	88
Deviator stress [kPa]	0
Volumetric strain [%]	4.87
Volumetric strain rate - end of stage [%/hr]	0.01
External axial strain [%]	1.17
Local axial strain [%]	-
Local radial strain [%]	-
Water content [%]	22.0
Bulk density [Mg/m^3]	2.07
Dry density [Mg/m^3]	1.69
Void ratio [-]	0.593
Degree of saturation [%]	100

Project: 503387 - F254727

Laboratory: Wallingford, UK

Approved by: ET - 24/06/2025

Z4_OWF_BH09-COMP_04-2_CIU16

Test Report
Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

0919

Shearing Stage	
Initial effective radial pressure [kPa]	88
Initial effective axial pressure [kPa]	88
Rate of strain [%/hour]	0.30
At peak deviator stress	
Corrected deviator stress [kPa]	290
Membrane correction applied [kPa]	5
Drain correction applied [kPa]	0
External axial strain [%]	19.03
Local axial strain [%]	-
Local radial strain [%]	-
Excess base PWP [kPa]	-52
Excess mid height PWP [kPa]	-
Effective radial pressure [kPa]	140
Effective axial pressure [kPa]	430
Principal effective stress ratio [-]	3.08
ε_{50} [%]	4.40
Secant modulus (E_{50}) at ε_{50} [kPa]	3294
At peak principal effective stress ratio	
Corrected deviator stress [kPa]	198
Membrane correction applied [kPa]	2
Drain correction applied [kPa]	0
External axial strain [%]	6.85
Local axial strain [%]	-
Local radial strain [%]	-
Excess base PWP [kPa]	10
Excess mid height PWP [kPa]	-
Effective radial pressure [kPa]	78
Effective axial pressure [kPa]	276
Principal effective stress ratio [-]	3.54
At 10% external axial strain	
Corrected deviator stress [kPa]	247
Membrane correction applied [kPa]	2
Drain correction applied [kPa]	0
External axial strain [%]	10.00
Excess base PWP [kPa]	-16
Excess mid height PWP [kPa]	-
Effective radial pressure [kPa]	103
Effective axial pressure [kPa]	350
Principal effective stress ratio [-]	3.40
ε_{50} [%]	3.51
Secant modulus (E_{50}) at ε_{50} [kPa]	3523

Project: 503387 - F254727 Laboratory: Wallingford, UK Approved by: ET - 24/06/2025

Z4_OWF_BH09-COMP_04-2_CIU16

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

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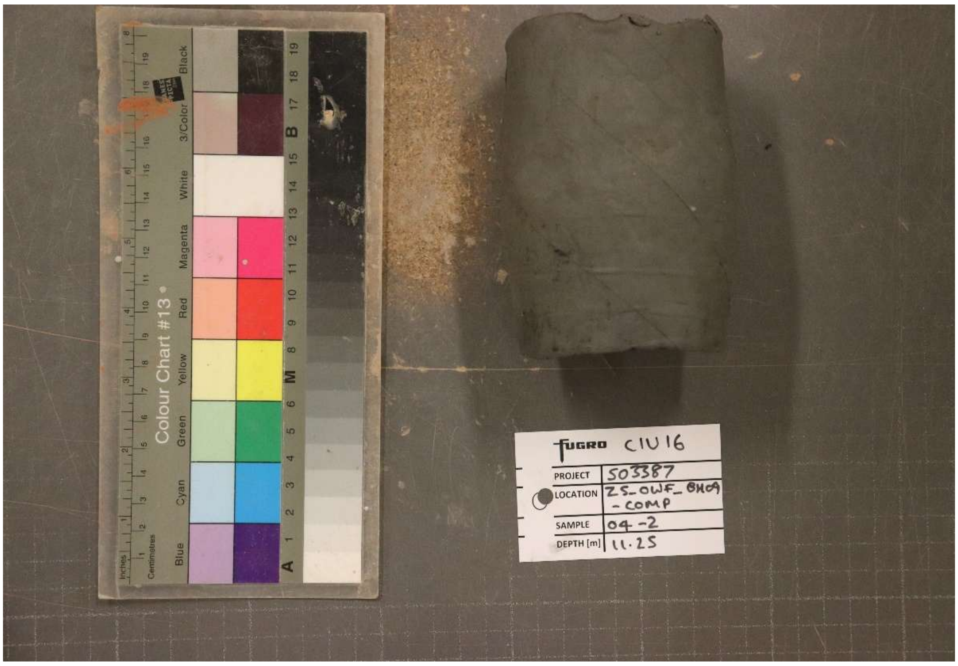
Specimen Photographs



FINAL CONDITIONS	
Water content [%]	22.0
Bulk density [Mg/m³]	2.07
Dry density [Mg/m³]	1.69
Void ratio [-]	0.593

Project: 503387 - F254727 Laboratory: Wallingford, UK Approved by: ET - 24/06/2025

Z4_OWF_BH09-COMP_04-2_CIU16

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

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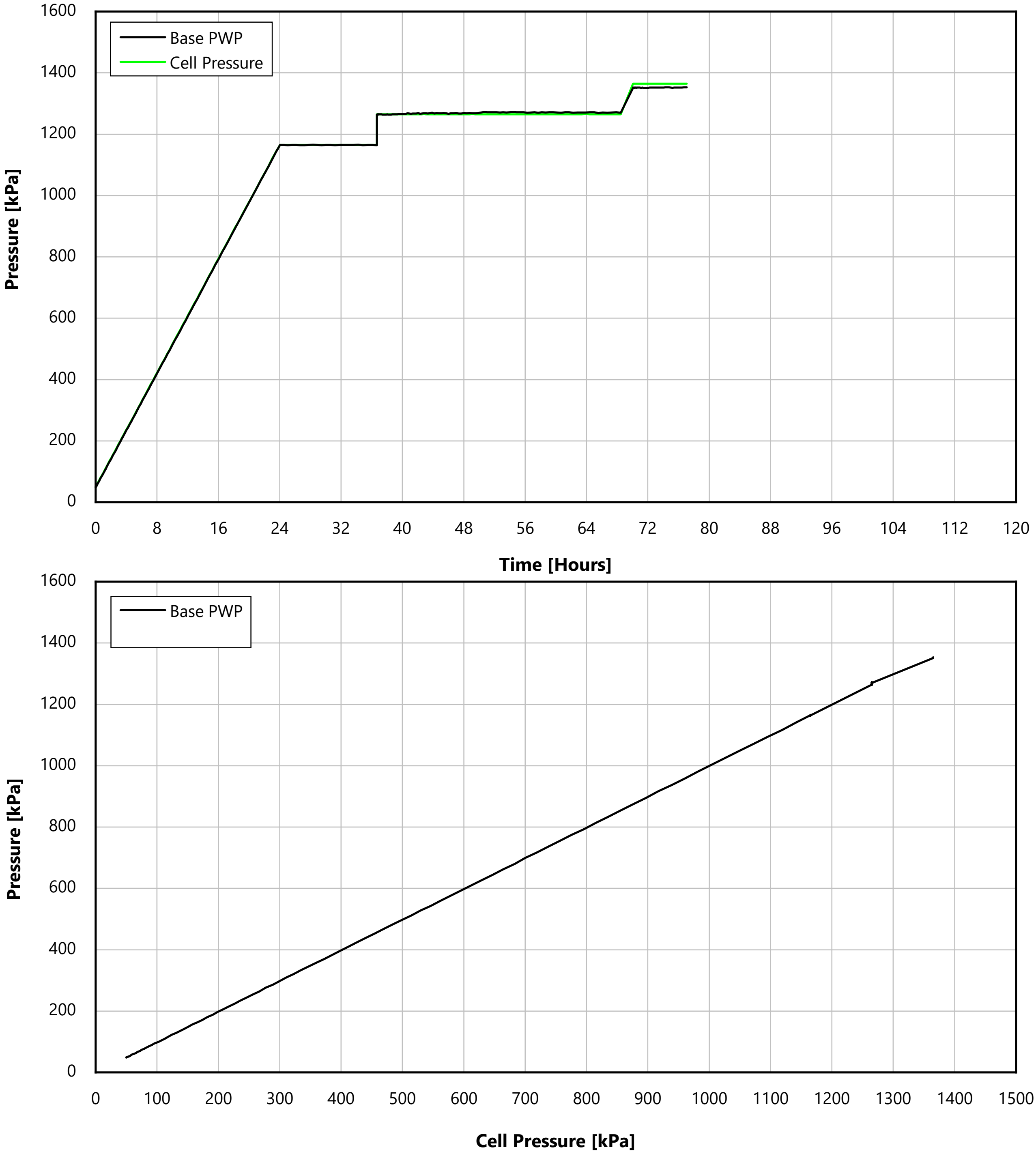
Saturation



SATURATION	
B value : 1.00	Initial σ'_a : 2 kPa
	Final σ'_a : 12 kPa

Project: 503387 - F254727

Laboratory: Wallingford, UK
Z4_OWF_BH09-COMP_04-2_CIU16

Approved by: ET 24/06/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

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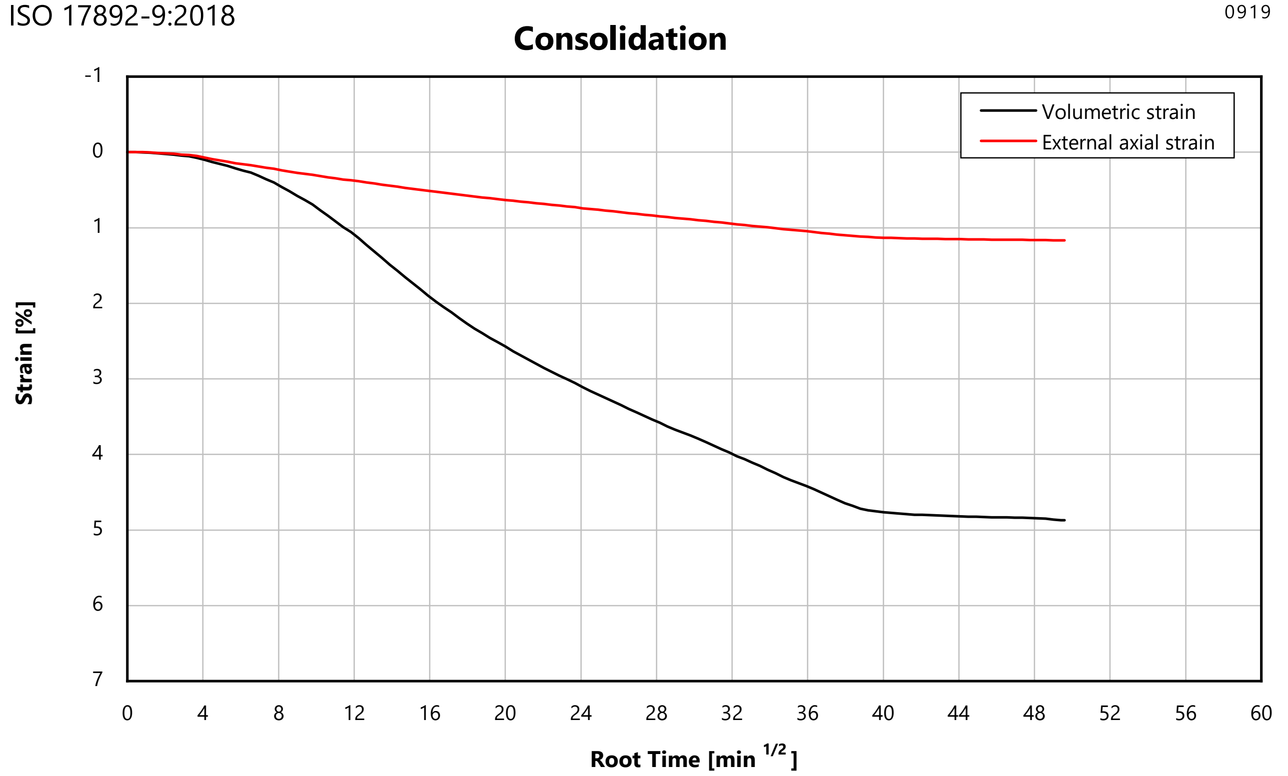

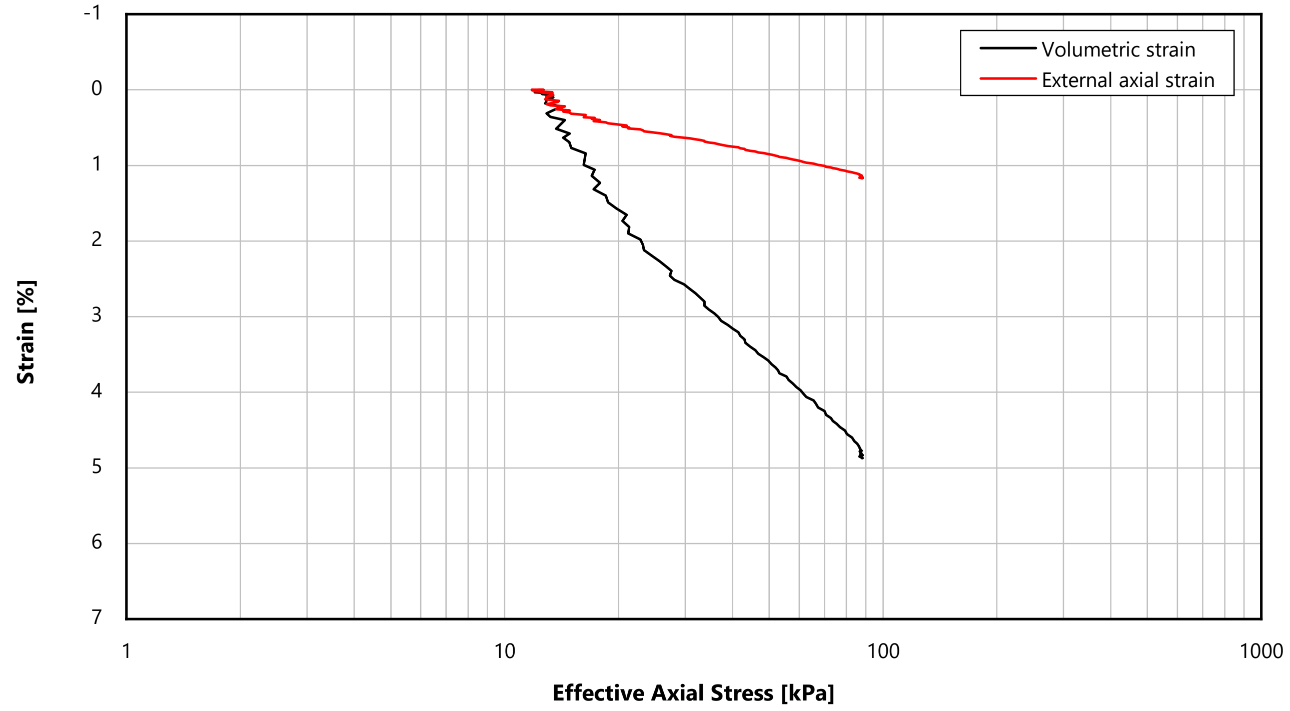

CONSOLIDATION
Stage 1 σ'$_{rc}$: 88 kPa
Stage 1 σ'$_{ac}$: 88 kPa

Project: 503387 - F254727

Laboratory: Wallingford, UK
Z4_OWF_BH09-COMP_04-2_CIU16

Approved by: ET 24/06/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

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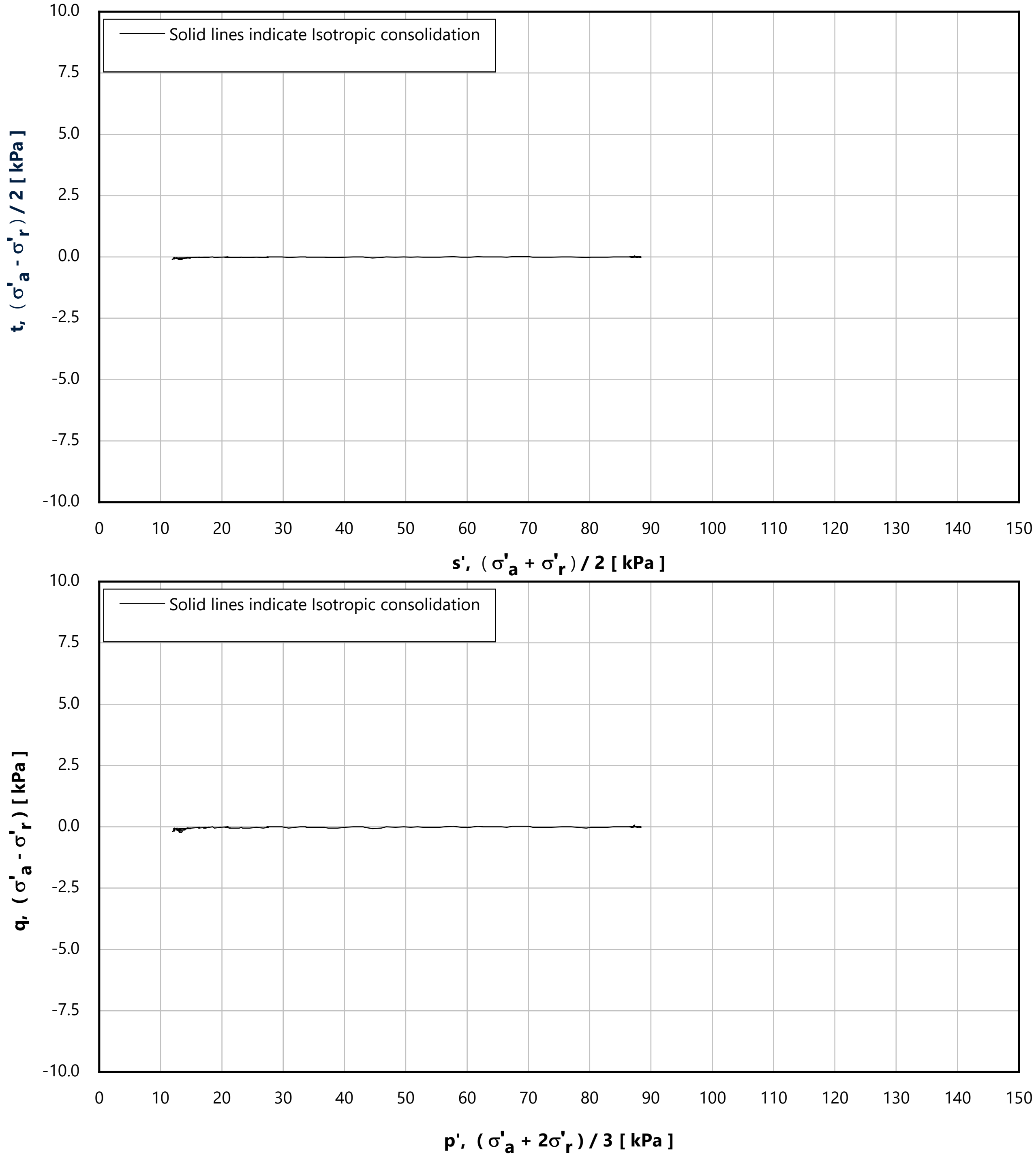
Consolidation



CONSOLIDATION
Stage 1 σ'_{rc} : 88 kPa
Stage 1 σ'_{ac} : 88 kPa

Project: 503387 - F254727

Laboratory: Wallingford, UK
Z4_OWF_BH09-COMP_04-2_CIU16

Approved by: ET 24/06/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

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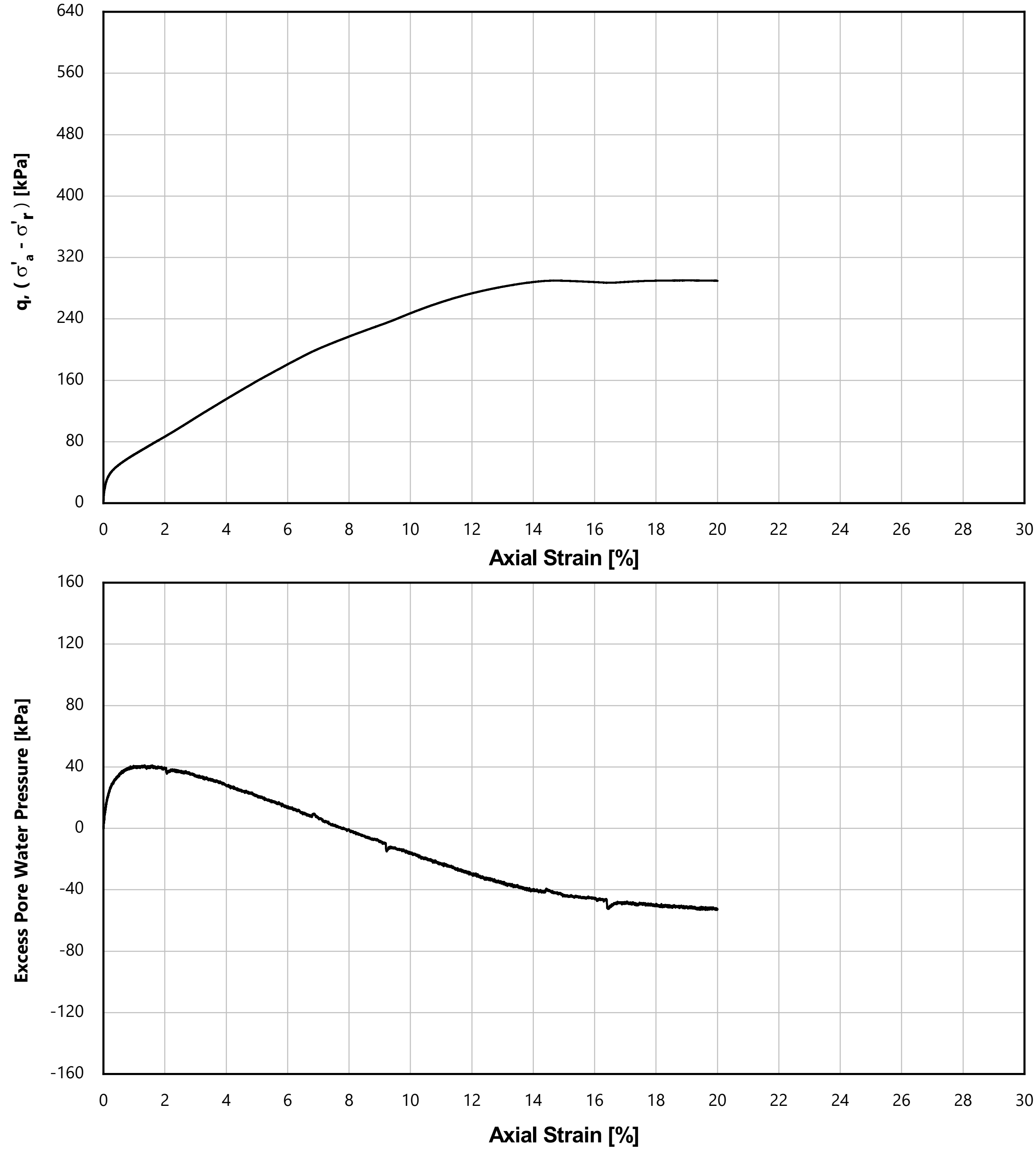
Shearing



SHEAR

Initial σ'$_r$: 88 kPa	Rate of strain : 0.30 %/hour	q$_{peak}$: 290 kPa
Initial σ'$_a$: 88 kPa	Ext. ε at q$_{peak}$: 19.03 %	

Project: 503387 - F254727

Laboratory: Wallingford, UK
Z4_OWF_BH09-COMP_04-2_CIU16

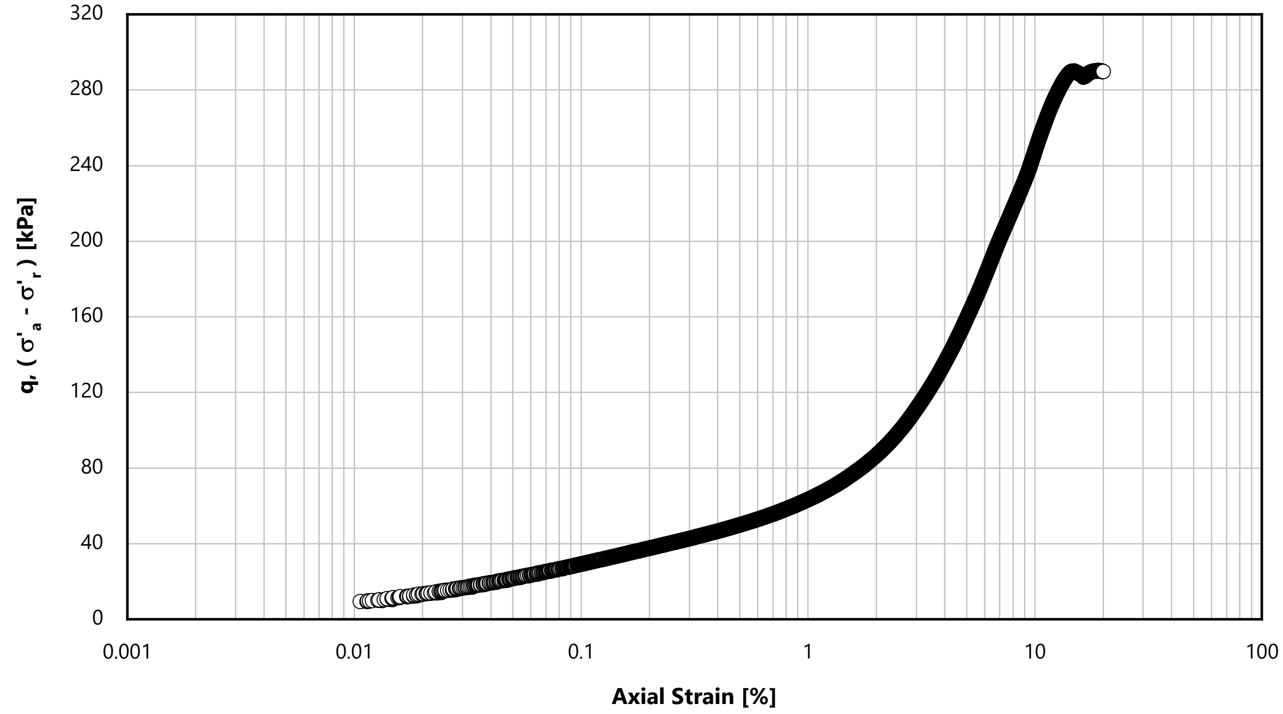
Approved by: ET 24/06/2025

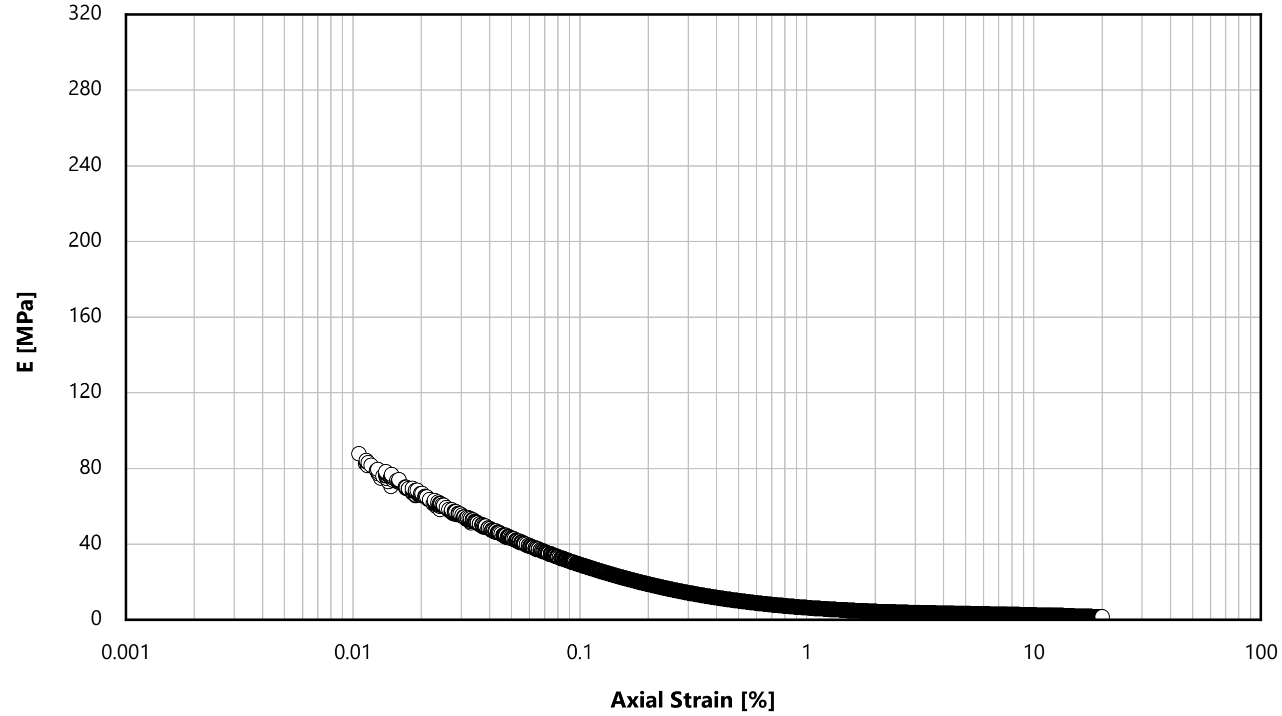
Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

Shearing





SHEAR		
Initial σ'$_r$: 88 kPa	Rate of strain : 0.30 %/hour	q$_{peak}$: 290 kPa
Initial σ'$_a$: 88 kPa	Ext. ε at q$_{peak}$: 19.03 %	

Project: 503387 - F254727

Laboratory: Wallingford, UK
Z4_OWF_BH09-COMP_04-2_CIU16

Approved by: ET 24/06/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

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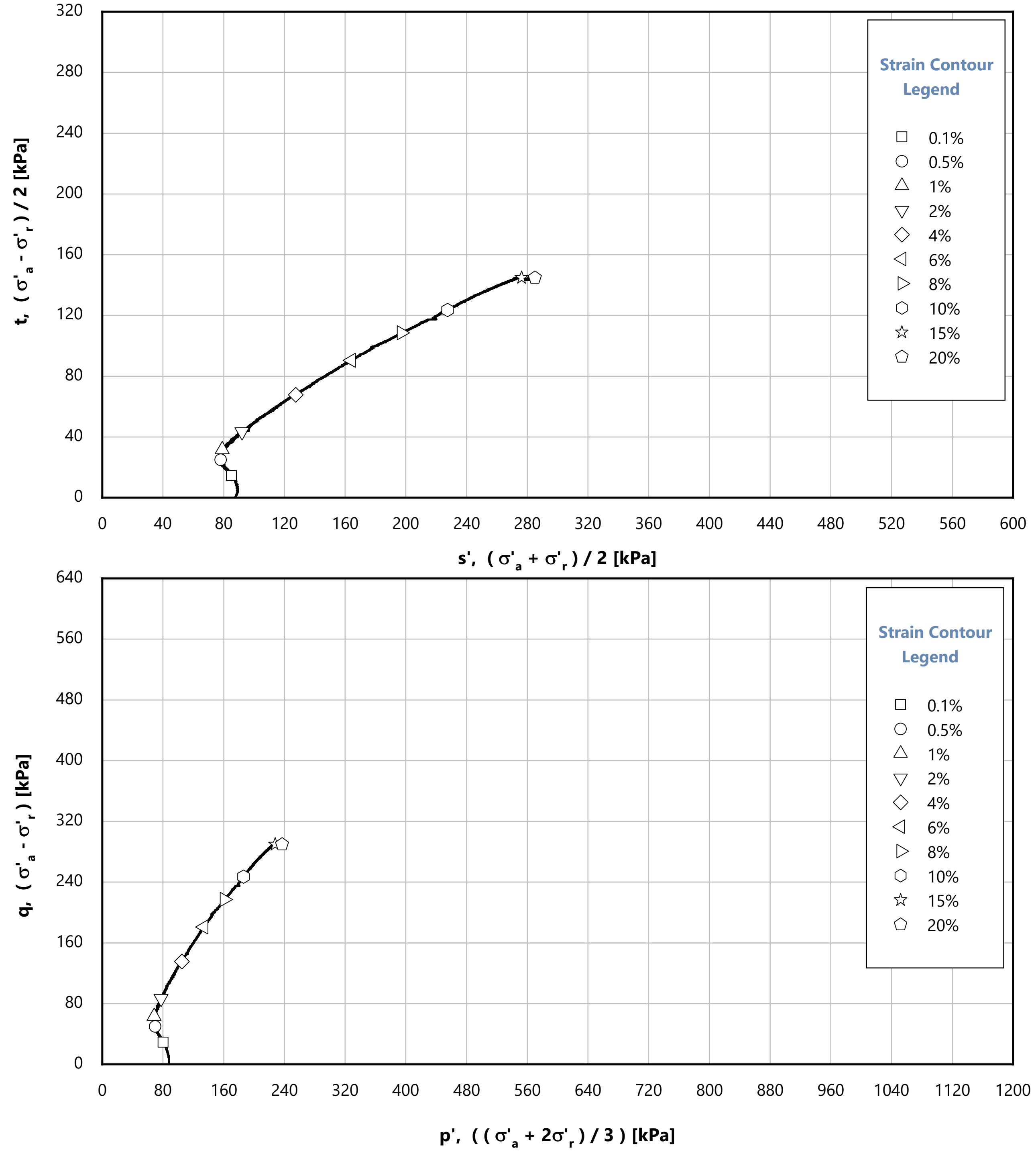
Shearing



SHEAR		
Initial σ'_r : 88 kPa	Rate of strain : 0.30 %/hour	q_{peak} : 290 kPa
Initial σ'_a : 88 kPa	Ext. ε at q_{peak} : 19.03 %	

Project: 503387 - F254727

Laboratory: Wallingford, UK
Z4_OWF_BH09-COMP_04-2_CIU16

Approved by: ET 24/06/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

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0919

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Test Identification	
Location	Z5_OWF_BH09-COMP
Sample	05-2
Depth [m]	12.10
Test number	CIU17

Specimen Visual Description
Firm medium to high strenght dark grey silty CLAY with rare shell fragments

Initial Specimen Conditions	
Test start date	02/07/2025
Type of sample	Undisturbed
Diameter [mm]	71.7
Height [mm]	136.9
Water content [%]	27.6
Bulk density [Mg/m^3]	2.04
Dry density [Mg/m^3]	1.60
Void ratio [-]	0.691
Degree of saturation [%]	100
Particle density - Assumed [Mg/m^3]	2.70
Torvane [kPa]	48
Pocket penetrometer [kPa]	79
Type of drains	One end only

Project: 503387 - F254727
Laboratory: Wallingford, UK
Approved by: AF - 19/08/2025
Z4_OWF_BH05-SAMP_20-4_CIU04

Test Report
Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

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Saturation	
Pressure increments applied [kPa]	100
Differential pressure used [kPa]	N/A
Cell pressure [kPa]	1283
Base PWP [kPa]	1283
Mid height PWP [kPa]	-
B value achieved [-]	0.97

Isotropic Consolidation	
Cell pressure [kPa]	1375
Back pressure [kPa]	1282
Base PWP [kPa]	1282
Mid height PWP [kPa]	-
Effective radial pressure [kPa]	93
Effective axial pressure [kPa]	93
Deviator stress [kPa]	0
Volumetric strain [%]	4.35
Volumetric strain rate - end of stage [%/hr]	0.00
External axial strain [%]	0.89
Local axial strain [%]	-
Local radial strain [%]	-
Water content [%]	22.2
Bulk density [Mg/m^3]	2.03
Dry density [Mg/m^3]	1.66
Void ratio [-]	0.626
Degree of saturation [%]	96

Project: 503387 - F254727   Laboratory: Wallingford, UK   Approved by: AF - 19/08/2025

Z4_OWF_BH05-SAMP_20-4_CIU04

Test Report
Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

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Shearing Stage	
Initial effective radial pressure [kPa]	93
Initial effective axial pressure [kPa]	93
Rate of strain [%/hour]	0.30
At peak deviator stress	
Corrected deviator stress [kPa]	280
Membrane correction applied [kPa]	5
Drain correction applied [kPa]	0
External axial strain [%]	19.11
Local axial strain [%]	-
Local radial strain [%]	-
Excess base PWP [kPa]	-29
Excess mid height PWP [kPa]	-
Effective radial pressure [kPa]	122
Effective axial pressure [kPa]	402
Principal effective stress ratio [-]	3.29
ε_{50} [%]	3.19
Secant modulus (E_{50}) at ε_{50} [kPa]	4386
At peak principal effective stress ratio	
Corrected deviator stress [kPa]	173
Membrane correction applied [kPa]	1
Drain correction applied [kPa]	0
External axial strain [%]	4.75
Local axial strain [%]	-
Local radial strain [%]	-
Excess base PWP [kPa]	33
Excess mid height PWP [kPa]	-
Effective radial pressure [kPa]	60
Effective axial pressure [kPa]	233
Principal effective stress ratio [-]	3.89
At 10% external axial strain	
Corrected deviator stress [kPa]	241
Membrane correction applied [kPa]	2
Drain correction applied [kPa]	0
External axial strain [%]	10.00
Excess base PWP [kPa]	2
Excess mid height PWP [kPa]	-
Effective radial pressure [kPa]	91
Effective axial pressure [kPa]	332
Principal effective stress ratio [-]	3.64
ε_{50} [%]	2.37
Secant modulus (E_{50}) at ε_{50} [kPa]	5085

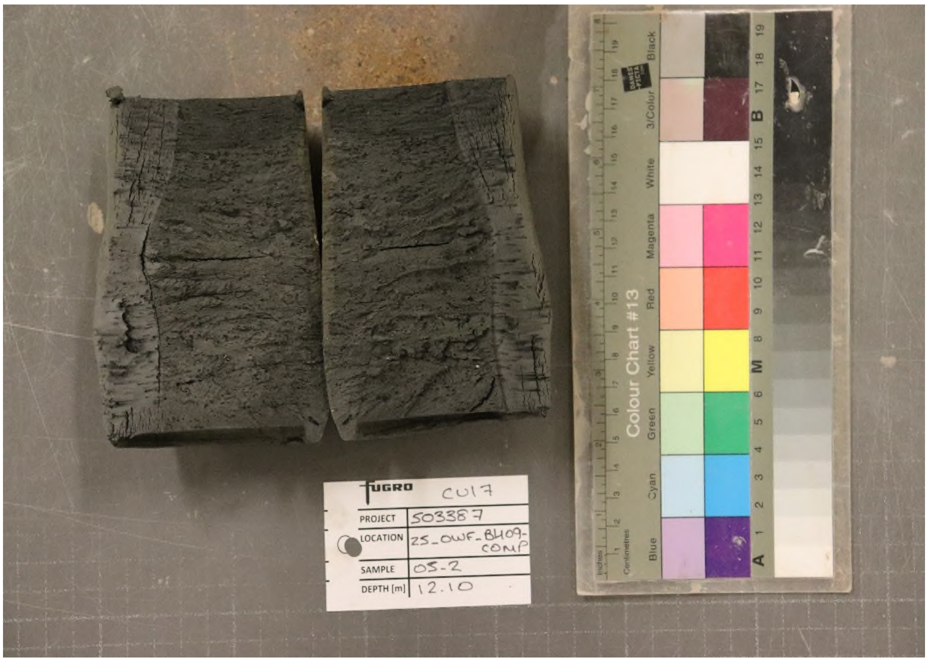
Project: 503387 - F254727 Laboratory: Wallingford, UK Approved by: AF - 19/08/2025

Z4_OWF_BH05-SAMP_20-4_CIU04

Test Report
Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

Specimen Photographs



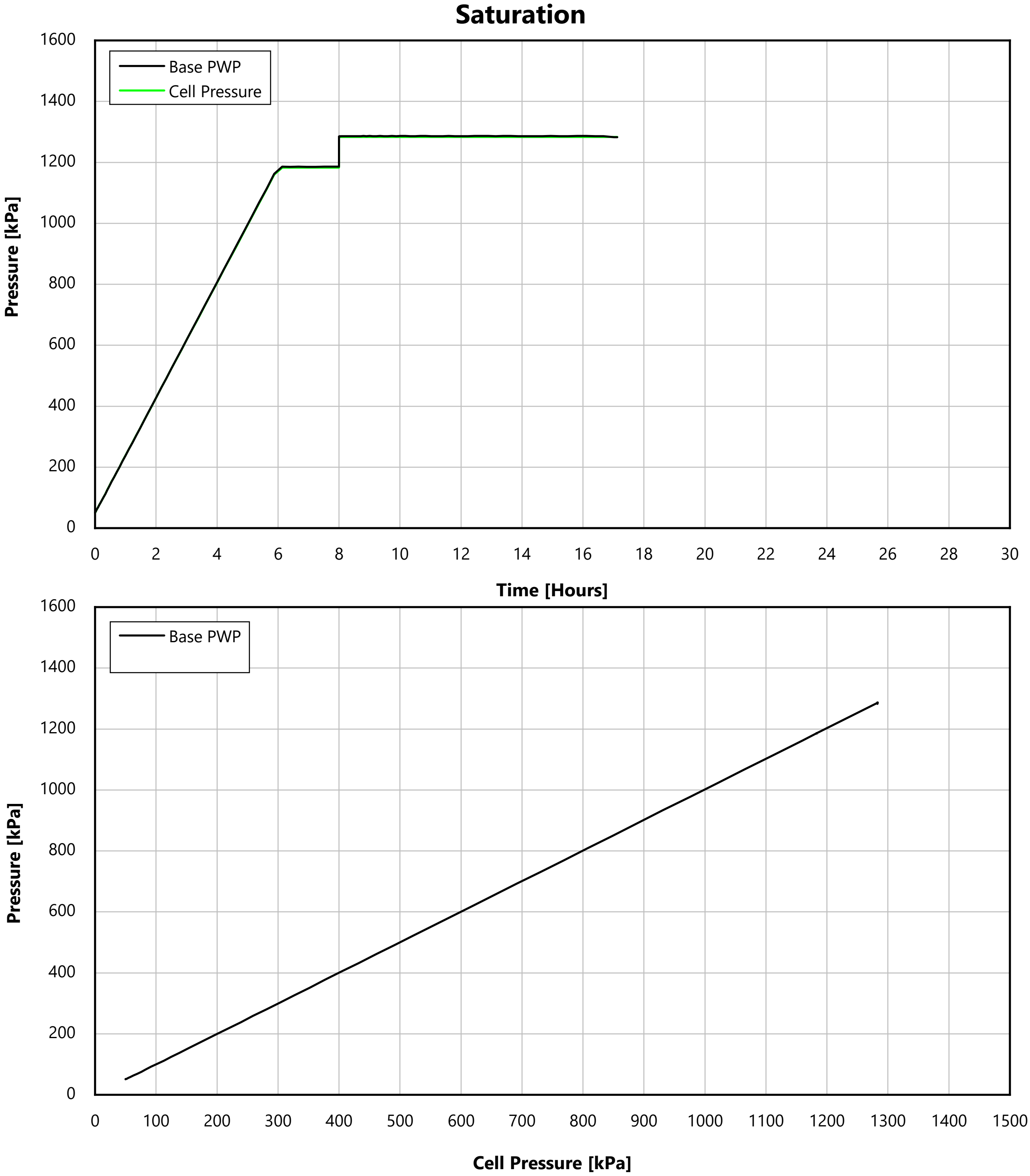
FINAL CONDITIONS

Water content [%]	22.2
Bulk density [Mg/m^3]	2.03
Dry density [Mg/m^3]	1.66
Void ratio [-]	0.626

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018



SATURATION	
B value : 0.97	Initial σ'$_a$: 1 kPa
	Final σ'$_a$: 1 kPa

Project: 503387 - F254727

Laboratory: Wallingford, UK
Z4_OWF_BH05-SAMP_20-4_CIU04

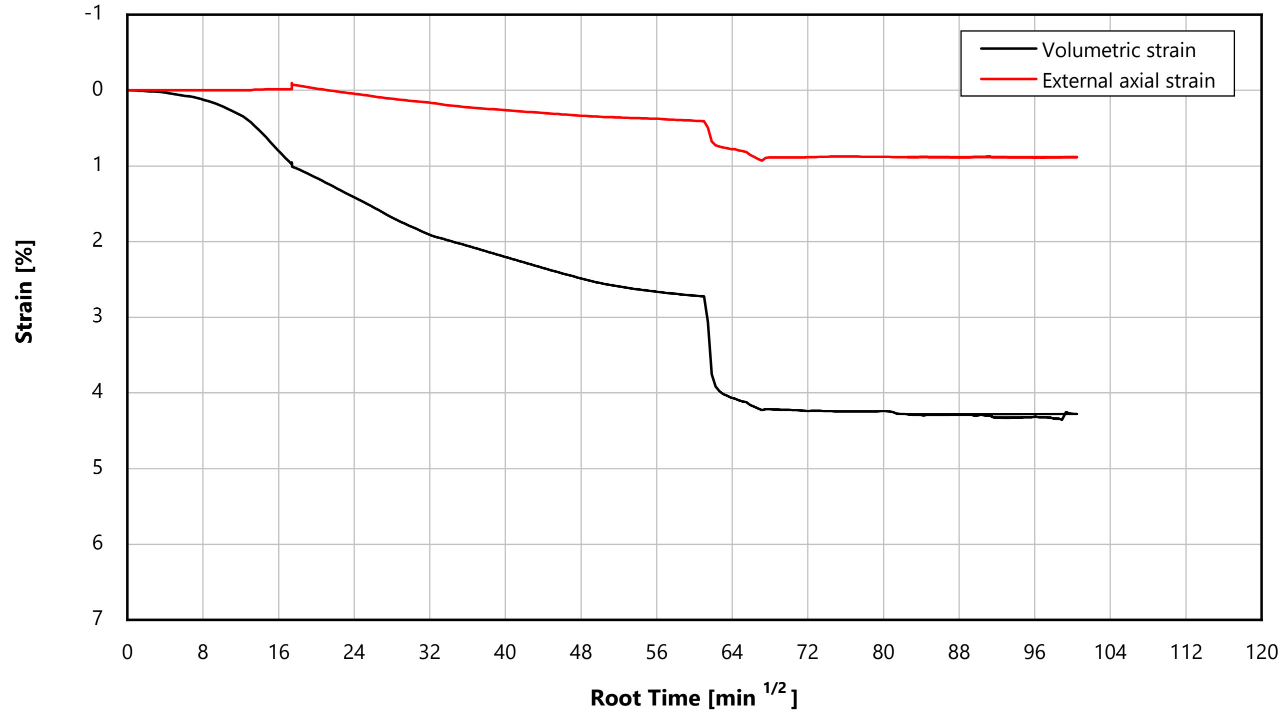
Approved by: AF 19/08/2025

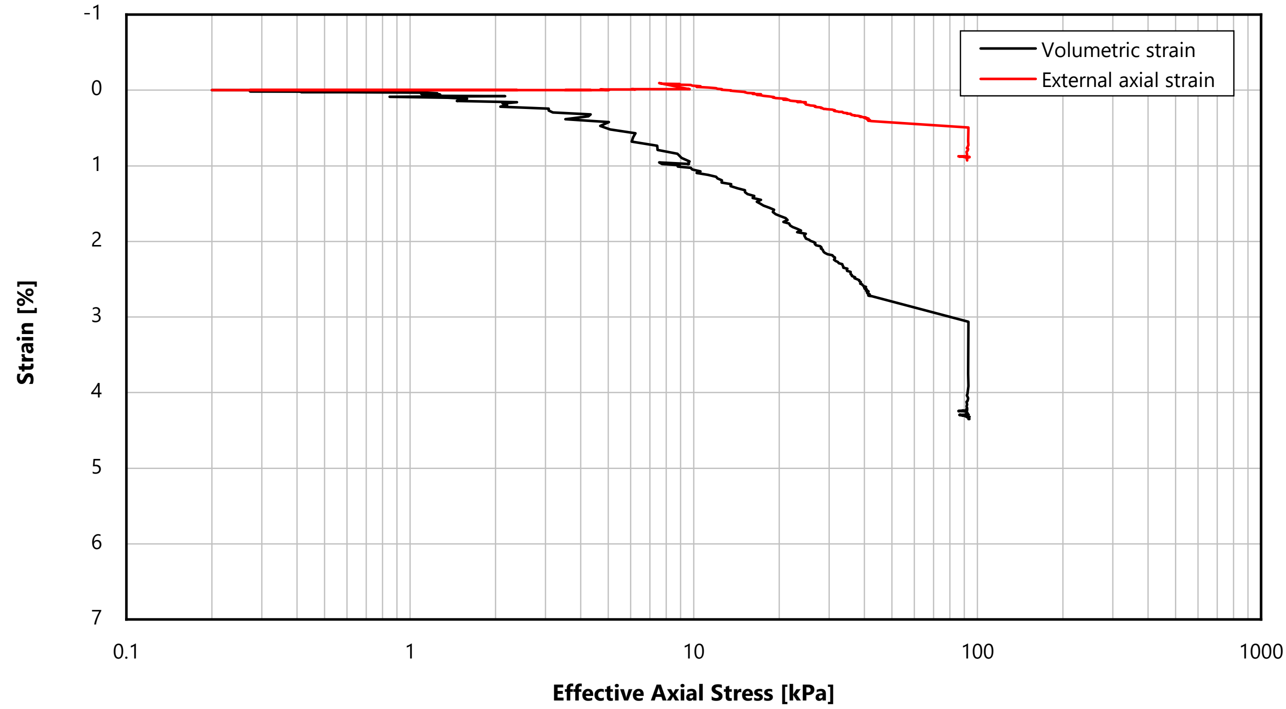
Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

Consolidation





CONSOLIDATION

Stage 1 σ'$_{rc}$: 93 kPa

Stage 1 σ'$_{ac}$: 93 kPa

Project: 503387 - F254727

Laboratory: Wallingford, UK
Z4_OWF_BH05-SAMP_20-4_CIU04

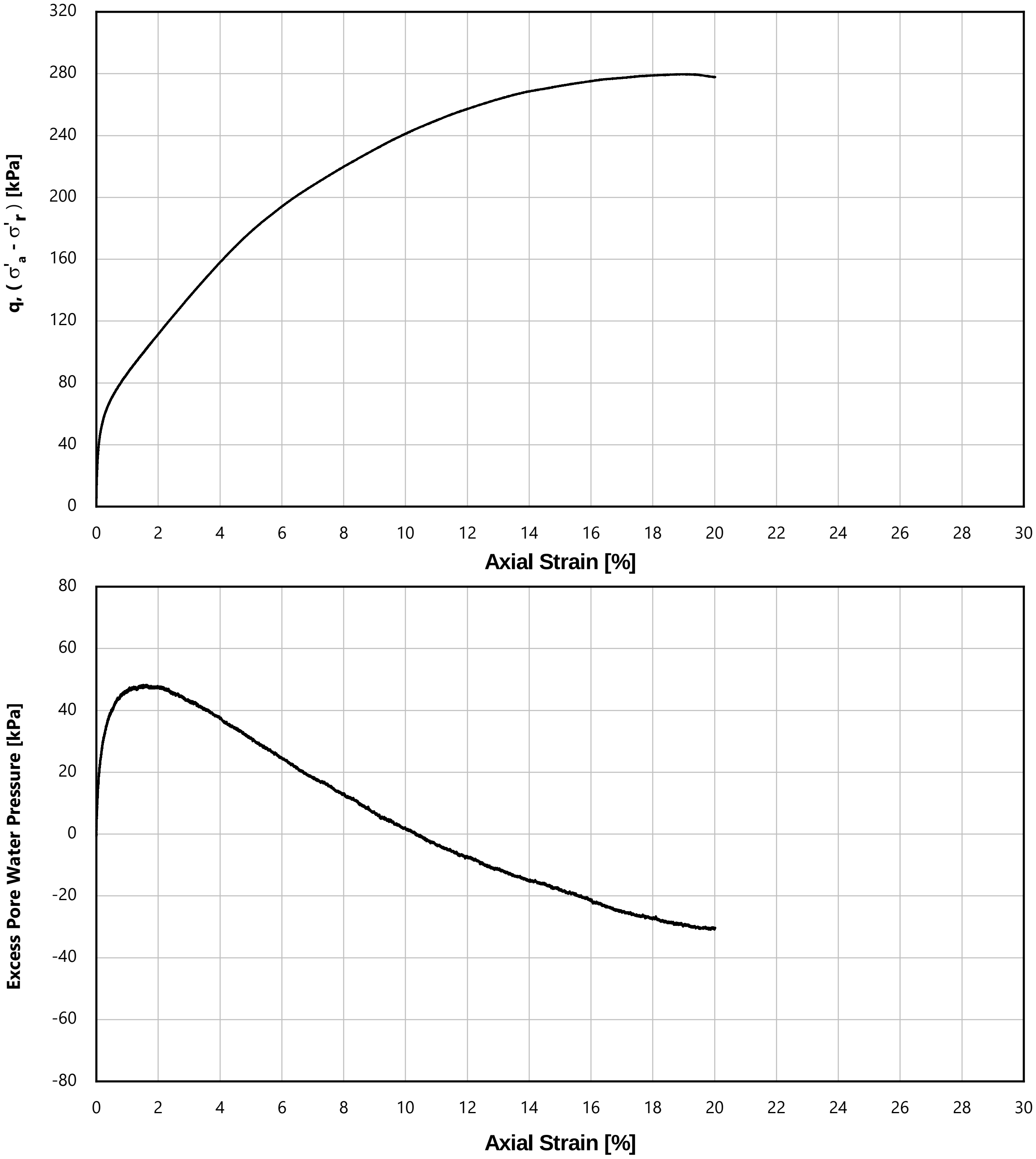
Approved by: AF 19/08/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

Shearing



SHEAR		
Initial σ'$_r$: 93 kPa	Rate of strain : 0.30 %/hour	q$_{peak}$: 280 kPa
Initial σ'$_a$: 93 kPa	Ext. ε at q$_{peak}$: 19.11 %	

Project: 503387 - F254727

Laboratory: Wallingford, UK
Z4_OWF_BH05-SAMP_20-4_CIU04

Approved by: AF 19/08/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

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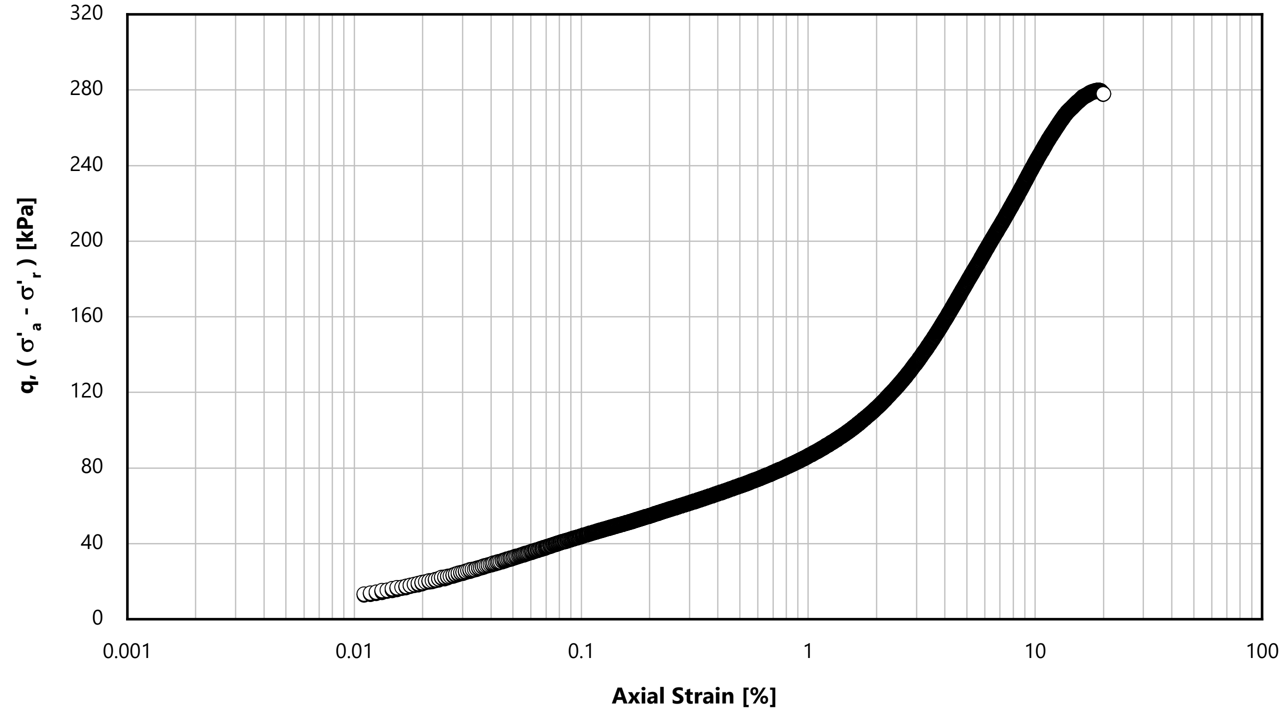
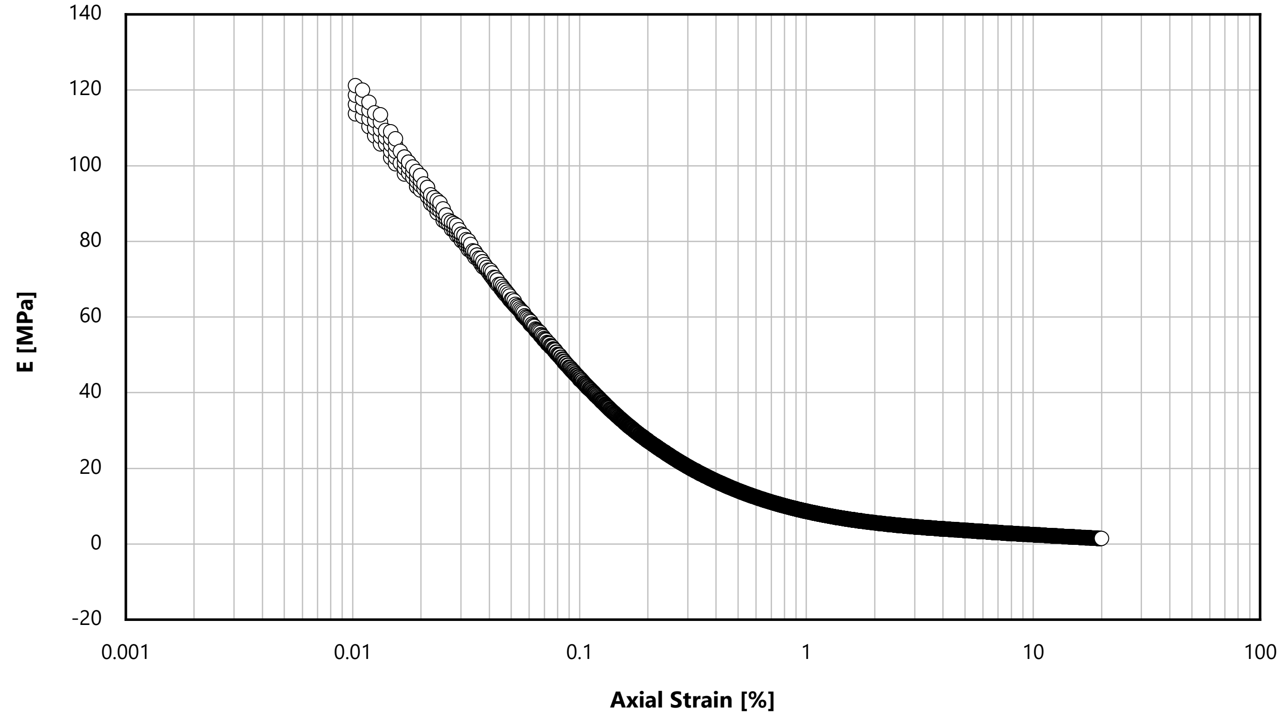
Shearing





SHEAR		
Initial σ'_r : 93 kPa	Rate of strain : 0.30 %/hour	q_{peak} : 280 kPa
Initial σ'_a : 93 kPa	Ext. ε at q_{peak} : 19.11 %	

Project: 503387 - F254727

Laboratory: Wallingford, UK
Z4_OWF_BH05-SAMP_20-4_CIU04

Approved by: AF 19/08/2025

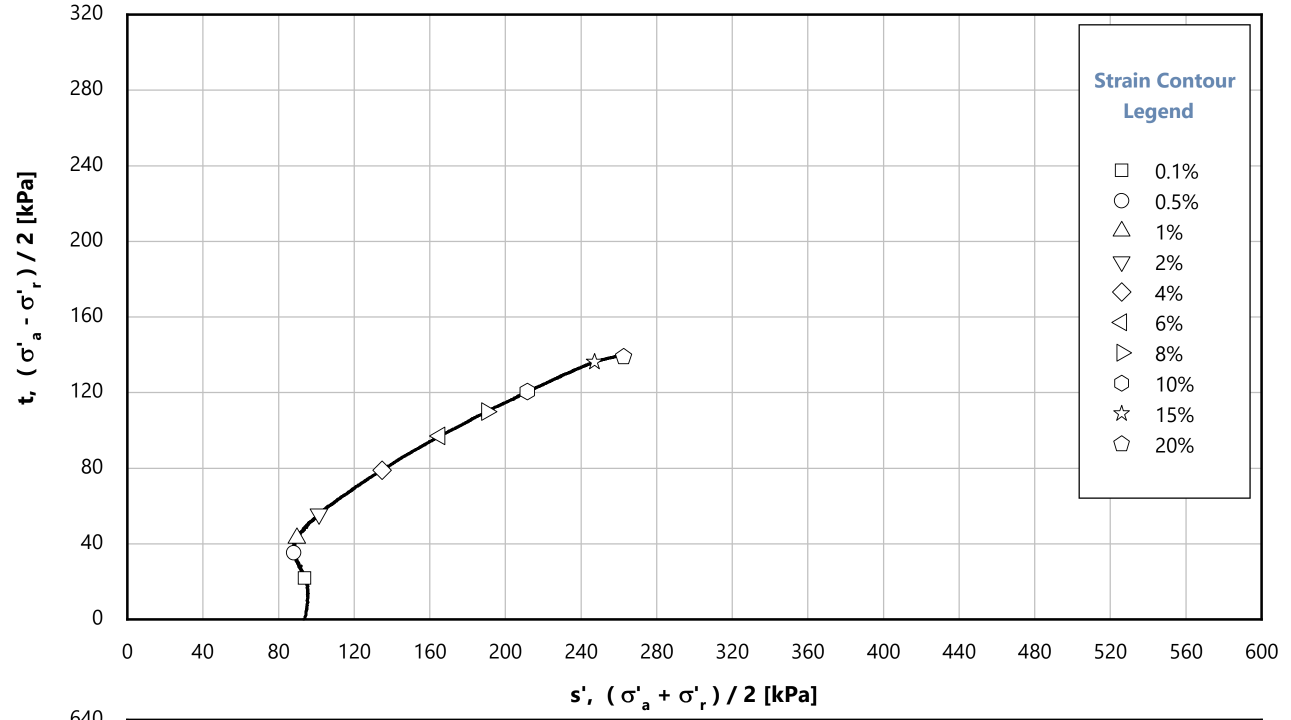
Test Report

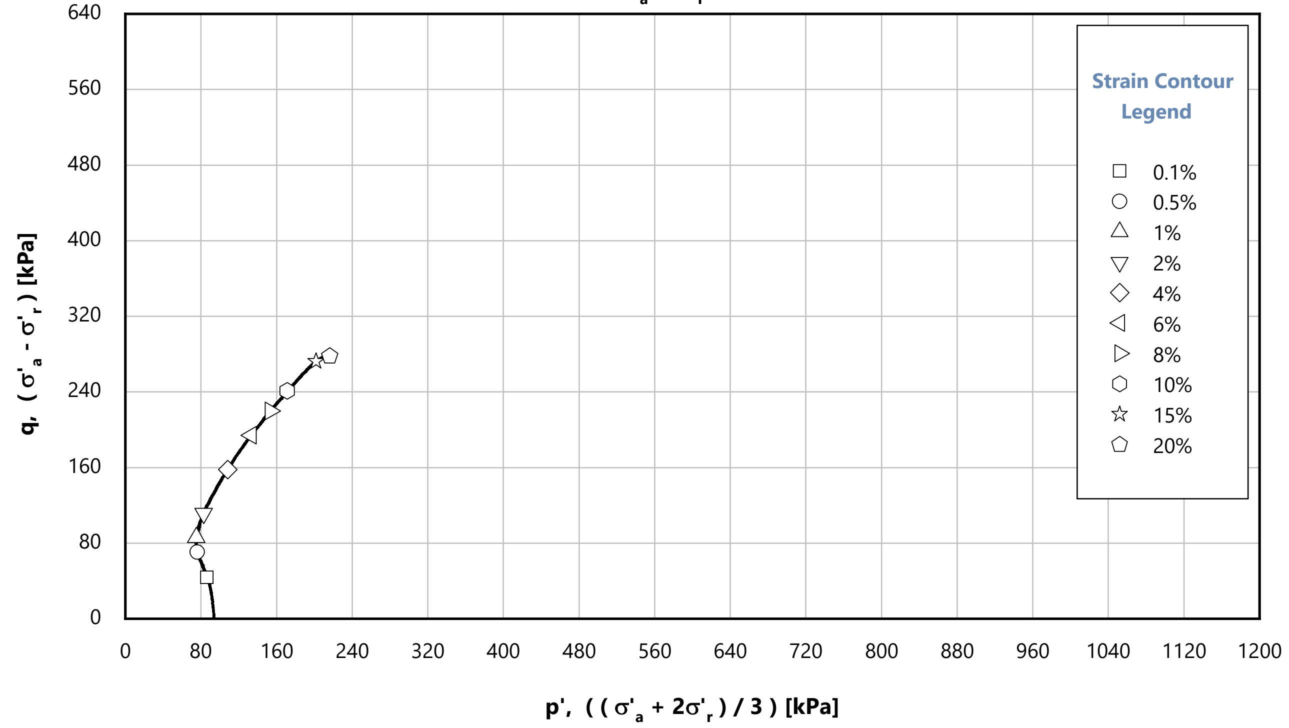
Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Undrained (CIUc)

ISO 17892-9:2018

UKAS TESTING 0919

Shearing





SHEAR		
Initial σ'_r : 93 kPa	Rate of strain : 0.30 %/hour	q_{peak} : 280 kPa
Initial σ'_a : 93 kPa	Ext. ε at q_{peak} : 19.11 %	

Project: 503387 - F254727

Laboratory: Wallingford, UK
Z4_OWF_BH05-SAMP_20-4_CIU04

Approved by: AF 19/08/2025

Location	Sample ID	Depth BSF	Specimen Condition	Specimen ID	Initial Conditions*							B	Consolidation Stage†				
					D	h	w	ρ	ρ_d	e_0	S_r		e	σ'_{rc}	σ'_{vc}	ε_{vol}	ε_v
		[m]			[mm]	[mm]	[%]	[Mg/m^3]	[Mg/m^3]	[-]	[%]	[-]	[-]	[kPa]	[kPa]	[%]	[%]
Z5_OWF_BH01-COMP	04-1	14.00	Recompacted	CID26Ar	50.8	95.0	10.0	1.78	1.61	0.643	41	0.96	0.628	87	87	0.88	0.29
Z5_OWF_BH01-COMP	04-1	14.00	Recompacted	CID26B	50.5	95.0	9.9	1.77	1.61	0.642	41	0.92	0.620	131	131	1.36	0.45
Z5_OWF_BH01-COMP	04-1	14.00	Recompacted	CID26C	50.5	95.0	10.1	1.77	1.61	0.645	41	0.92	0.615	219	219	1.86	0.62
Z5_OWF_BH02-COMP	03-2	10.85	Recompacted	CID27a	50.8	95.0	9.9	2.10	1.91	0.390	67	0.92	0.385	66	66	0.37	0.12
Z5_OWF_BH02-COMP	03-2	10.85	Recompacted	CID27br	50.5	95.0	9.8	2.10	1.91	0.387	67	0.92	0.383	99	99	0.23	0.08
Z5_OWF_BH02-COMP	03-2	10.85	Recompacted	CID27cr	50.5	95.0	9.8	2.09	1.91	0.391	66	0.92	0.380	165	165	0.75	0.25
Z5_OWF_BH02-COMP	05-1	18.50	Recompacted	CID28a	50.8	95.0	9.9	1.94	1.77	0.500	53	0.96	0.493	113	113	0.43	0.14
Z5_OWF_BH02-COMP	05-1	18.50	Recompacted	CID28b	50.5	95.0	10.0	1.95	1.77	0.494	54	0.96	0.482	169	169	0.83	0.28
Z5_OWF_BH02-COMP	05-1	18.50	Recompacted	CID28c	50.5	95.0	10.0	1.95	1.77	0.494	54	0.96	0.479	281	281	1.01	0.34
Z5_OWF_BH03-COMP	01-1	1.50	Recompacted	CID35a	50.5	95.0	10.1	1.88	1.71	0.554	49	1.00	0.552	15	15	0.14	0.05
Z5_OWF_BH03-COMP	01-1	1.50	Recompacted	CID35b	50.5	95.0	9.9	1.87	1.70	0.555	47	0.90	0.552	23	23	0.19	0.06
Z5_OWF_BH03-COMP	01-1	1.50	Recompacted	CID35c	50.5	95.0	10.0	1.87	1.70	0.561	47	0.90	0.557	38	38	0.26	0.09
Z5_OWF_BH03-COMP	04-1	11.50	Recompacted	CID36a	50.8	95.0	10.2	2.09	1.89	0.399	67	0.92	0.392	74	74	0.49	0.16
Z5_OWF_BH03-COMP	04-1	11.50	Recompacted	CID36b	50.8	95.0	10.2	2.08	1.89	0.402	67	0.92	0.393	111	111	0.60	0.20
Z5_OWF_BH03-COMP	04-1	11.50	Recompacted	CID36c	50.8	95.0	10.0	2.08	1.89	0.403	66	0.92	0.389	184	184	1.01	0.34
Z5_OWF_BH03-COMP	05-1	15.00	Recompacted	CID37a	50.8	95.0	10.1	2.07	1.88	0.408	66	0.96	0.397	97	97	0.75	0.25
Z5_OWF_BH03-COMP	05-1	15.00	Recompacted	CID37b	50.8	95.0	10.1	2.08	1.89	0.406	66	0.92	0.391	145	145	1.06	0.35
Z5_OWF_BH03-COMP	05-1	15.00	Recompacted	CID37c	50.8	95.0	10.1	2.08	1.89	0.403	66	0.92	0.386	242	242	1.21	0.40

Location	Sample ID	Depth BSF	Specimen ID	Shear Stage					Mohr Envelope		Bender Element	
				q_{max}	ε_{vol}	ε_v	σ'_v / σ'_h	Rate of Strain	φ'	c'	v_s	G_{max}
		[m]		[kPa]	[%]	[%]	[-]	[%/hour]	[°]	[kPa]	[m/s]	[MPa]
Z5_OWF_BH01-COMP	04-1	14.00	CID26Ar	198	2.50	15.87	3.49	1.30	34.0	0.0	-	-
Z5_OWF_BH01-COMP	04-1	14.00	CID26B	318	1.93	9.91	3.48	1.30			-	-
Z5_OWF_BH01-COMP	04-1	14.00	CID26C	621	2.14	13.25	3.71	1.30			-	-
Z5_OWF_BH02-COMP	03-2	10.85	CID27a	348	-0.96	2.03	6.10	1.30	49.0	0.0	-	-
Z5_OWF_BH02-COMP	03-2	10.85	CID27br	625	-1.58	2.43	7.23	1.30			-	-
Z5_OWF_BH02-COMP	03-2	10.85	CID27cr	1044	-1.13	2.63	7.20	1.30			-	-
Z5_OWF_BH02-COMP	05-1	18.50	CID28a	790	-1.34	2.29	7.75	1.30	40.5	71.0	-	-
Z5_OWF_BH02-COMP	05-1	18.50	CID28b	910	-1.13	2.48	6.35	1.30			-	-
Z5_OWF_BH02-COMP	05-1	18.50	CID28c	1354	-0.60	2.50	5.81	1.30			-	-
Z5_OWF_BH03-COMP	01-1	1.50	CID35a	115	-1.53	2.13	8.10	1.30	47.0	8.0	-	-
Z5_OWF_BH03-COMP	01-1	1.50	CID35b	204	-1.60	2.50	9.16	1.30			-	-
Z5_OWF_BH03-COMP	01-1	1.50	CID35c	245	-1.22	2.18	7.18	1.30			-	-
Z5_OWF_BH03-COMP	04-1	11.50	CID36a	409	-1.28	2.72	6.33	1.30	47.0	0.0	-	-
Z5_OWF_BH03-COMP	04-1	11.50	CID36b	581	-1.09	3.02	6.29	1.30			-	-
Z5_OWF_BH03-COMP	04-1	11.50	CID36c	1050	-1.03	2.56	6.68	1.30			-	-
Z5_OWF_BH03-COMP	05-1	15.00	CID37a	625	-1.25	2.35	7.48	1.30	49.0	0.0	-	-
Z5_OWF_BH03-COMP	05-1	15.00	CID37b	828	-1.01	2.47	6.68	1.30			-	-
Z5_OWF_BH03-COMP	05-1	15.00	CID37c	1505	-0.84	3.07	7.17	1.30			-	-

Notes

BSF : Below seafloor
* : Specimen conditions after preparation and before saturation
† : Specimen conditions after consolidation and before shearing
CID : Isotropically consolidated drained
c/e : In compression/extension
BE : Bender element measurements
D : Diameter

h : Height
w : Water content
ρ : Bulk density
ρ_d : Dry density
e_0 : Initial void ratio
S_r : Degree of saturation
B : Skempton parameter

e : Void ratio
σ'_{rc} : Radial effective consolidation stress
σ'_{vc} : Vertical effective consolidation stress
ε_{vol} : Volumetric strain
ε_v : Vertical strain
q_{max} Maximum deviator stress

σ'_v / σ'_h : Effective stress ratio
φ' : Effective angle of internal friction
c' : Effective cohesion
v_s : Shear wave velocity
G_{max} : Small strain shear modulus

Summary of Consolidated Drained Triaxial Test Results

Location	Sample ID	Depth BSF [m]	Specimen Condition	Specimen ID	Initial Conditions*							B	Consolidation Stage†				
					D [mm]	h [mm]	w [%]	ρ [Mg/m^3]	ρ_d [Mg/m^3]	e_0 [-]	S_r [%]	[-]	e [-]	σ'_{rc} [kPa]	σ'_{vc} [kPa]	ε_{vol} [%]	ε_v [%]
Z5_OWF_BH05-COMP	04-3	9.40	Recompacted	CID29ar	50.8	95.0	10.0	1.74	1.58	0.675	39	0.96	0.666	60	60	0.55	0.18
Z5_OWF_BH05-COMP	04-3	9.40	Recompacted	CID29b	50.8	95.0	9.9	1.74	1.58	0.674	39	0.92	0.659	90	90	0.87	0.29
Z5_OWF_BH05-COMP	04-3	9.40	Recompacted	CID29c	50.8	95.0	9.9	1.74	1.58	0.674	39	0.94	0.655	150	150	1.12	0.37
Z5_OWF_BH05-COMP	06-1	17.00	Recompacted	CID30a	50.8	95.0	9.9	2.09	1.90	0.393	67	0.90	0.387	108	108	0.47	0.16
Z5_OWF_BH05-COMP	06-1	17.00	Recompacted	CID30b	50.8	95.0	9.9	2.09	1.90	0.392	67	0.92	0.382	162	162	0.73	0.24
Z5_OWF_BH05-COMP	06-1	17.00	Recompacted	CID30c	50.8	95.0	10.1	2.15	1.95	0.358	75	0.92	0.333	270	270	1.85	0.62
Z5_OWF_BH07-COMP_a	03-1	6.50	Recompacted	CID31a	50.8	95.0	9.9	2.08	1.90	0.397	66	0.95	0.392	43	43	0.33	0.11
Z5_OWF_BH07-COMP_a	03-1	6.50	Recompacted	CID31b	50.8	95.0	10.1	2.09	1.90	0.394	68	0.96	0.389	64	64	0.35	0.12
Z5_OWF_BH07-COMP_a	03-1	6.50	Recompacted	CID31c	50.8	95.0	9.8	2.11	1.92	0.377	69	0.96	0.365	106	106	0.85	0.28
Z5_OWF_BH07-COMP_a	07-1	19.00	Recompacted	CID32a	50.8	95.0	9.9	2.07	1.89	0.405	65	0.92	0.395	124	124	0.78	0.26
Z5_OWF_BH07-COMP_a	07-1	19.00	Recompacted	CID32b	50.8	95.0	9.9	2.06	1.87	0.414	64	0.96	0.401	186	186	0.92	0.31
Z5_OWF_BH07-COMP_a	07-1	19.00	Recompacted	CID32c	50.8	95.0	9.9	2.05	1.87	0.419	63	0.96	0.398	309	309	1.50	0.50
Z5_OWF_BH09-COMP	01-2	3.30	Recompacted	CID33A	50.5	95.0	10.1	1.65	1.50	0.766	35	0.93	0.765	21	21	0.07	0.02
Z5_OWF_BH09-COMP	01-2	3.30	Recompacted	CID33B	50.5	95.0	10.1	1.65	1.50	0.767	35	0.96	0.761	32	32	0.39	0.13
Z5_OWF_BH09-COMP	01-2	3.30	Recompacted	CID33C	50.5	95.0	10.1	1.65	1.50	0.768	35	0.96	0.762	53	53	0.38	0.13
Z5_OWF_BH09-COMP	06-1	15.50	Recompacted	CID34a	50.5	95.0	10.2	2.07	1.87	0.414	65	0.96	0.404	99	99	0.71	0.24
Z5_OWF_BH09-COMP	06-1	15.50	Recompacted	CID34b	50.5	95.0	10.0	2.07	1.88	0.409	65	0.96	0.400	149	149	0.67	0.22
Z5_OWF_BH09-COMP	06-1	15.50	Recompacted	CID34c	50.5	95.0	9.9	2.06	1.88	0.411	64	0.96	0.398	248	248	0.97	0.32

Location	Sample ID	Depth BSF [m]	Specimen ID	Shear Stage					Mohr Envelope		Bender Element	
				q_{max} [kPa]	ε_{vol} [%]	ε_v [%]	σ'_v / σ'_h [-]	Rate of Strain [%/hour]	φ' [°]	c' [kPa]	v_s [m/s]	G_{max} [MPa]
Z5_OWF_BH05-COMP	04-3	9.40	CID29ar	132	2.33	13.01	3.05	1.30	32.0	0.0	-	-
Z5_OWF_BH05-COMP	04-3	9.40	CID29b	193	2.65	10.75	3.17	1.30			-	-
Z5_OWF_BH05-COMP	04-3	9.40	CID29c	341	3.93	20.50	3.34	1.30			-	-
Z5_OWF_BH05-COMP	06-1	17.00	CID30a	591	-1.13	2.65	6.33	1.30	46.0	8.0	-	-
Z5_OWF_BH05-COMP	06-1	17.00	CID30b	903	-0.91	2.50	6.52	1.30			-	-
Z5_OWF_BH05-COMP	06-1	17.00	CID30c	1413	-0.26	3.35	6.23	1.30			-	-
Z5_OWF_BH07-COMP_a	03-1	6.50	CID31a	410	-1.31	1.96	9.75	1.30	51.5	17.0	-	-
Z5_OWF_BH07-COMP_a	03-1	6.50	CID31b	640	-1.43	2.00	10.32	1.30			-	-
Z5_OWF_BH07-COMP_a	03-1	6.50	CID31c	852	-1.22	1.63	8.93	1.30			-	-
Z5_OWF_BH07-COMP_a	07-1	19.00	CID32a	1050	-1.50	2.58	9.19	1.30	49.5	42.0	-	-
Z5_OWF_BH07-COMP_a	07-1	19.00	CID32b	1433	-1.51	2.31	8.63	1.30			-	-
Z5_OWF_BH07-COMP_a	07-1	19.00	CID32c	2213	-0.93	3.21	8.09	1.30			-	-
Z5_OWF_BH09-COMP	01-2	3.30	CID33A	72	-0.76	2.75	4.38	1.30	37.0	2.0	-	-
Z5_OWF_BH09-COMP	01-2	3.30	CID33B	100	-0.41	2.63	4.14	1.30			-	-
Z5_OWF_BH09-COMP	01-2	3.30	CID33C	172	-0.39	3.14	4.13	1.30			-	-
Z5_OWF_BH09-COMP	06-1	15.50	CID34a	624	-1.29	2.74	6.98	1.30	39.0	60.0	-	-
Z5_OWF_BH09-COMP	06-1	15.50	CID34b	784	-0.83	2.20	6.13	1.30			-	-
Z5_OWF_BH09-COMP	06-1	15.50	CID34c	1109	-0.97	2.95	5.40	1.30			-	-

Notes

BSF : Below seafloor
* : Specimen conditions after preparation and before saturation
† : Specimen conditions after consolidation and before shearing
CID : Isotropically consolidated drained
c/e : In compression/extension
BE : Bender element measurements
D : Diameter

h : Height
w : Water content
ρ : Bulk density
ρ_d : Dry density
e_0 : Initial void ratio
S_r : Degree of saturation
B : Skempton parameter

e : Void ratio
σ'_{rc} : Radial effective consolidation stress
σ'_{vc} : Vertical effective consolidation stress
ε_{vol} : Volumetric strain
ε_v : Vertical strain
q_{max} Maximum deviator stress

σ'_v / σ'_h : Effective stress ratio
φ' : Effective angle of internal friction
c' : Effective cohesion
v_s : Shear wave velocity
G_{max} : Small strain shear modulus

Summary of Consolidated Drained Triaxial Test Results

TOPAZ / CD Summary of CD-nps triaxial test (From Tabular data)(FFSA)_v4 / 2025-09-03 14:04:55 +02:00

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

UKAS TESTING 0919

Test Identification	Specimen 1	Specimen 2	Specimen 3
Location	Z5_OWF_BH01-COMP	Z5_OWF_BH01-COMP	Z5_OWF_BH01-COMP
Sample	04-1	04-1	04-1
Depth [m]	14.00	14.00	14.00
Test number	CID26Ar	CID26B	CID26C

Specimen Visual Description
Olive brown fine SAND

Initial Specimen Conditions	Specimen 1	Specimen 2	Specimen 3
Test start date	30/06/2025	25/04/2025	06/05/2025
Type of sample	Recompacted	Recompacted	Recompacted
Diameter [mm]	50.8	50.5	50.5
Length [mm]	95.0	95.0	95.0
Water content [%]	10.0	9.9	10.1
Bulk density [Mg/m^3]	1.78	1.77	1.77
Dry density [Mg/m^3]	1.61	1.61	1.61
Void ratio [-]	0.643	0.642	0.645
Degree of saturation [%]	41	41	41
Type of drains fitted	One end	One end	One end

Test Report
Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

0919

Saturation	Specimen 1	Specimen 2	Specimen 3
Pressure increments applied [kPa]	50	50	50
Differential pressure used [kPa]	10	10	10
Pore pressure on completion [kPa]	490	390	640
Cell pressure on completion [kPa]	500	400	650
B value achieved	0.96	0.92	0.92

Consolidation: Isotropic	Specimen 1	Specimen 2	Specimen 3
Cell pressure [kPa]	587	531	869
Back pressure [kPa]	500	400	650
Effective cell pressure [kPa]	87	131	219
Pore pressure on completion [kPa]	500	400	650
Pore pressure dissipation [%]	100	100	100
Water content [%]	23.7	23.4	23.2
Bulk density [Mg/m^3]	2.01	2.02	2.02
Dry density [Mg/m^3]	1.63	1.64	1.64
Void ratio [-]	0.628	0.620	0.615
Degree of saturation [%]	100	100	100
Axial strain [%]	0.29	0.45	0.62
Volumetric strain [%]	0.88	1.36	1.86
Volumetric strain rate-end of stage [%/hr]	0.04	0.05	0.02

Project: 503387 - F254727
Test page CID26-2/8

Laboratory: Wallingford, UK
Z5_OWF_BH01-COMP / 04-1 / 14

Approved by: ET - 16/07/2025

Test Report
Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

UKAS TESTING 0919

Shearing	Specimen 1	Specimen 2	Specimen 3
Initial pore pressure [kPa]	500	400	650
Initial effective cell pressure [kPa]	87	131	219
Rate of strain [%/hour]	1.30	1.30	1.30
At peak deviator stress			
Corrected deviator stress [kPa]	198	318	621
Membrane correction applied [kPa]	4.1	2.9	3.6
Drain correction applied [kPa]	0	0	0
Axial strain [%]	15.87	9.91	13.25
Volumetric strain [%]	2.50	1.93	2.14
Major principal effective stress [kPa]	278	447	851
Minor principal effective stress [kPa]	80	128	229
Principal effective stress ratio	3.49	3.48	3.71
ε_{50} [%]	0.60	0.99	1.39
Secant modulus (E_{50}) at ε_{50} [kPa]	16560	16039	22400
At peak principal effective stress ratio			
Corrected deviator stress [kPa]	197	318	620
Membrane correction applied [kPa]	3.8	3.0	3.7
Drain correction applied [kPa]	0	0	0
Axial strain [%]	14.12	10.16	13.50
Volumetric strain [%]	2.40	1.94	2.15
Major principal effective stress [kPa]	275	446	849
Minor principal effective stress [kPa]	79	128	228
Principal effective stress ratio	3.49	3.48	3.72
At 10% axial strain			
Corrected deviator stress [kPa]	190	318	609
Membrane correction applied [kPa]	2.9	2.9	2.9
Drain correction applied [kPa]	0	0	0
Axial strain [%]	10.00	10.00	10.00
Volumetric strain [%]	2.05	1.93	2.06
Major principal effective stress [kPa]	271	446	836
Minor principal effective stress [kPa]	80	128	227
Principal effective stress ratio	3.37	3.48	3.68

Project: 503387 - F254727
Test page CID26-3/8

Laboratory: Wallingford, UK
Z5_OWF_BH01-COMP / 04-1 / 14

Approved by: ET - 16/07/2025

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

UKAS TESTING 0919

Photographs		
Specimen 1	**Specimen 2**	**Specimen 3**
Photograph Unavailable	Photograph Unavailable	Photograph Unavailable

Final Conditions	Specimen 1	Specimen 2	Specimen 3
Water content [%]	22.1	22.0	21.9
Bulk density [Mg/m^3]	2.04	2.04	2.04
Dry density [Mg/m^3]	1.67	1.67	1.68
Mode of failure	Barrel	Barrel	Barrel

Project: 503387 - F254727
Test page CID26-4/8

Laboratory: Wallingford, UK
Z5_OWF_BH01-COMP / 04-1 / 14

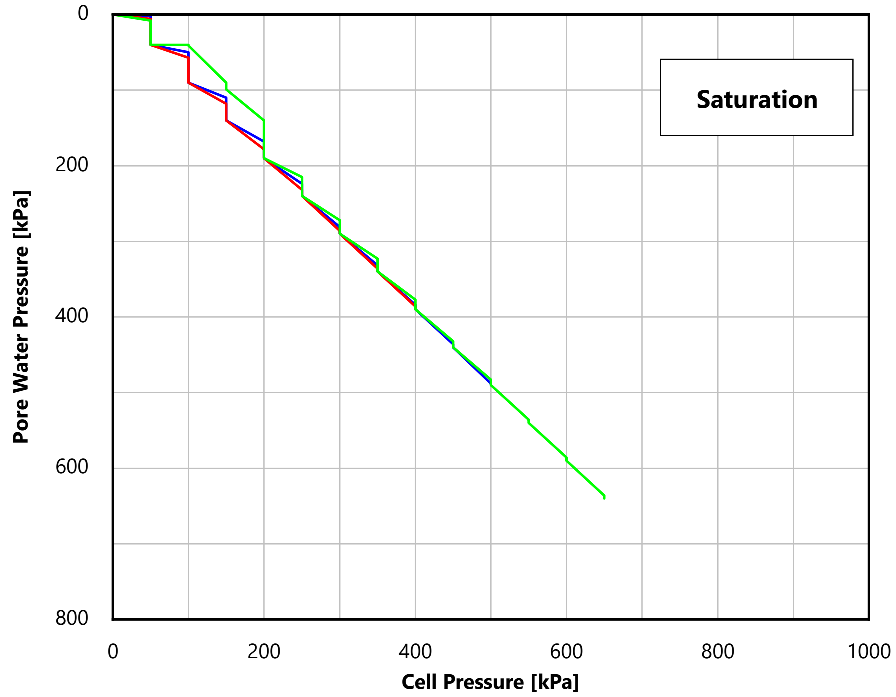
Approved by: ET - 16/07/2025

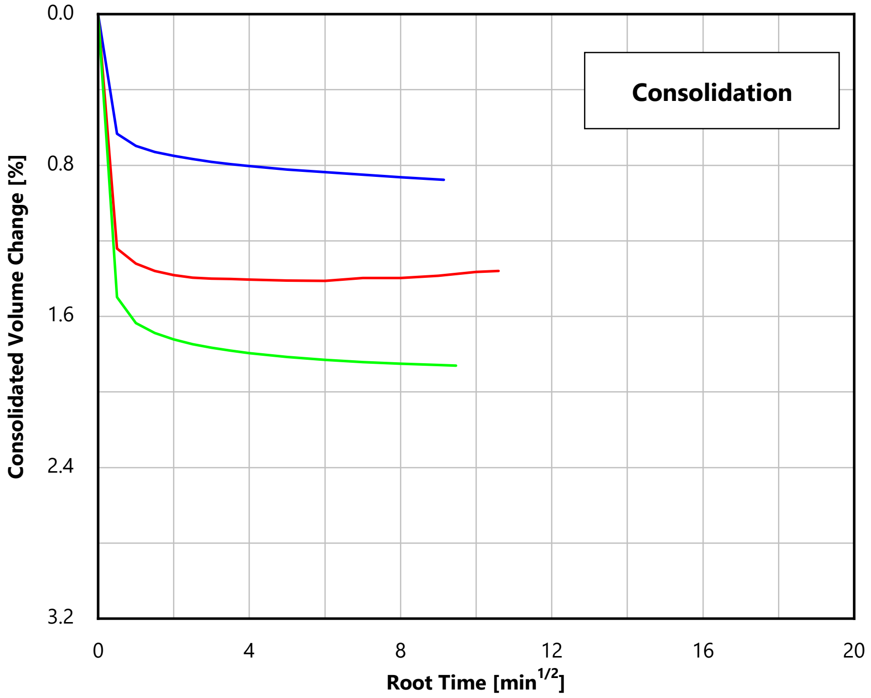
Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils
Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

0919





Consolidation				
Stage 1 σ'$_{rc}$: 87 kPa	Stage 2 σ'$_{rc}$: 131 kPa	Stage 3 σ'$_{rc}$: 219 kPa	—	1
Stage 1 σ'$_{vc}$: 87 kPa	Stage 2 σ'$_{vc}$: 131 kPa	Stage 3 σ'$_{vc}$: 219 kPa	—	2
			—	3

Project: 503387 - F254727
CID26

Laboratory: Wallingford, UK
Z5_OWF_BH01-COMP / 04-1 / 14

Approved by: ET 16/07/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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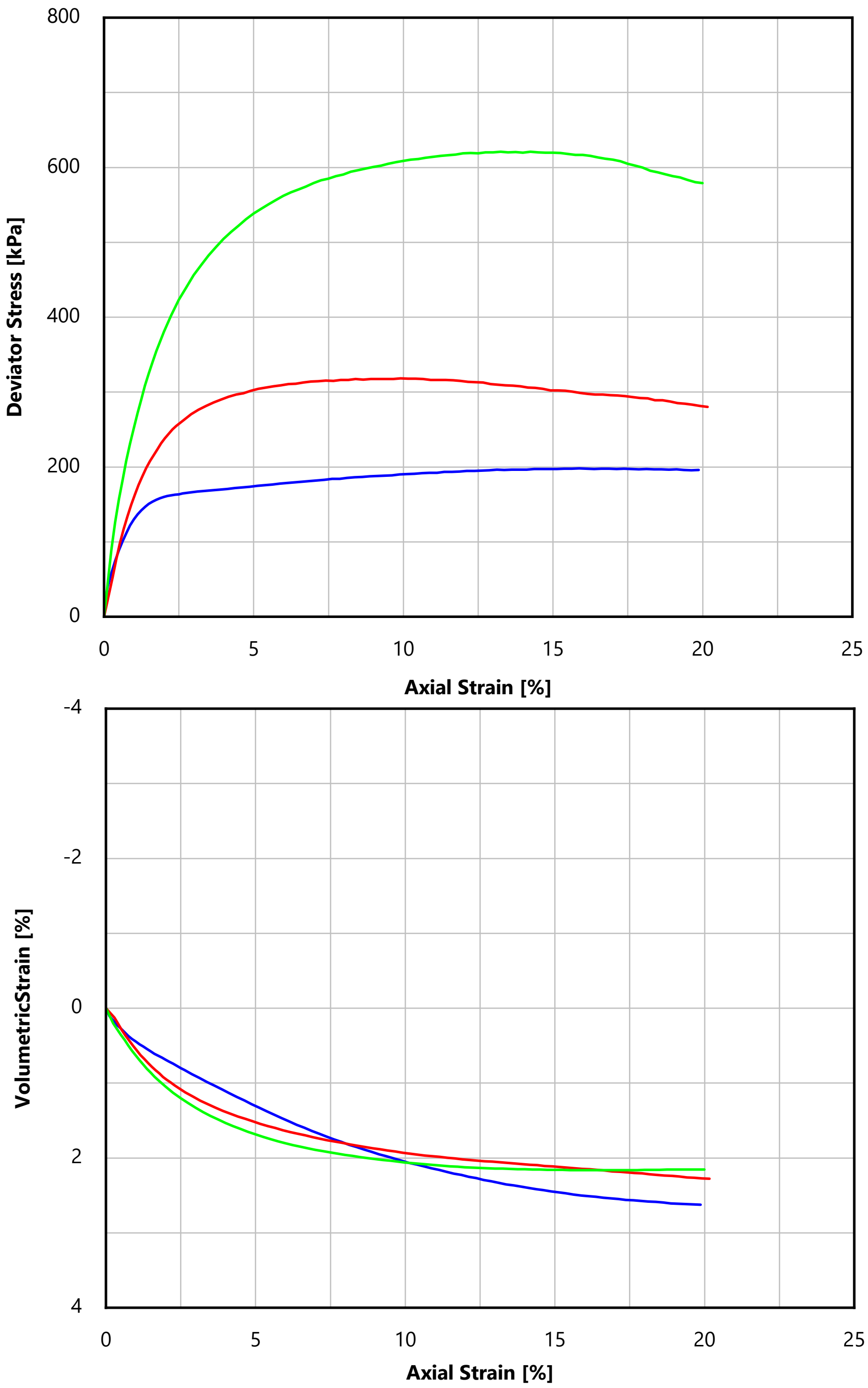
Shearing



Consolidation				
			—	1
Stage 1 σ'_{rc} : 87 kPa	Stage 2 σ'_{rc} : 131 kPa	Stage 3 σ'_{rc} : 219 kPa	—	2
Stage 1 σ'_{vc} : 87 kPa	Stage 2 σ'_{vc} : 131 kPa	Stage 3 σ'_{vc} : 219 kPa	—	3

Project: 503387 - F254727
CID26

Laboratory: Wallingford, UK
Z5_OWF_BH01-COMP / 04-1 / 14

Approved by: ET 16/07/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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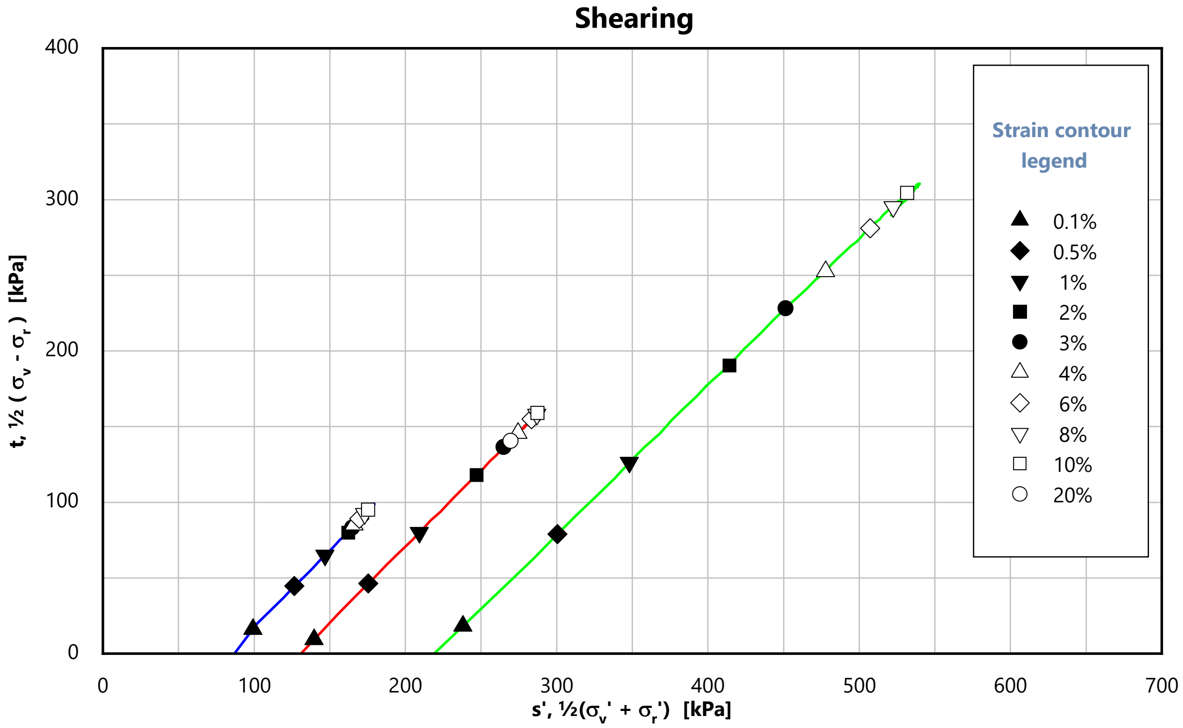

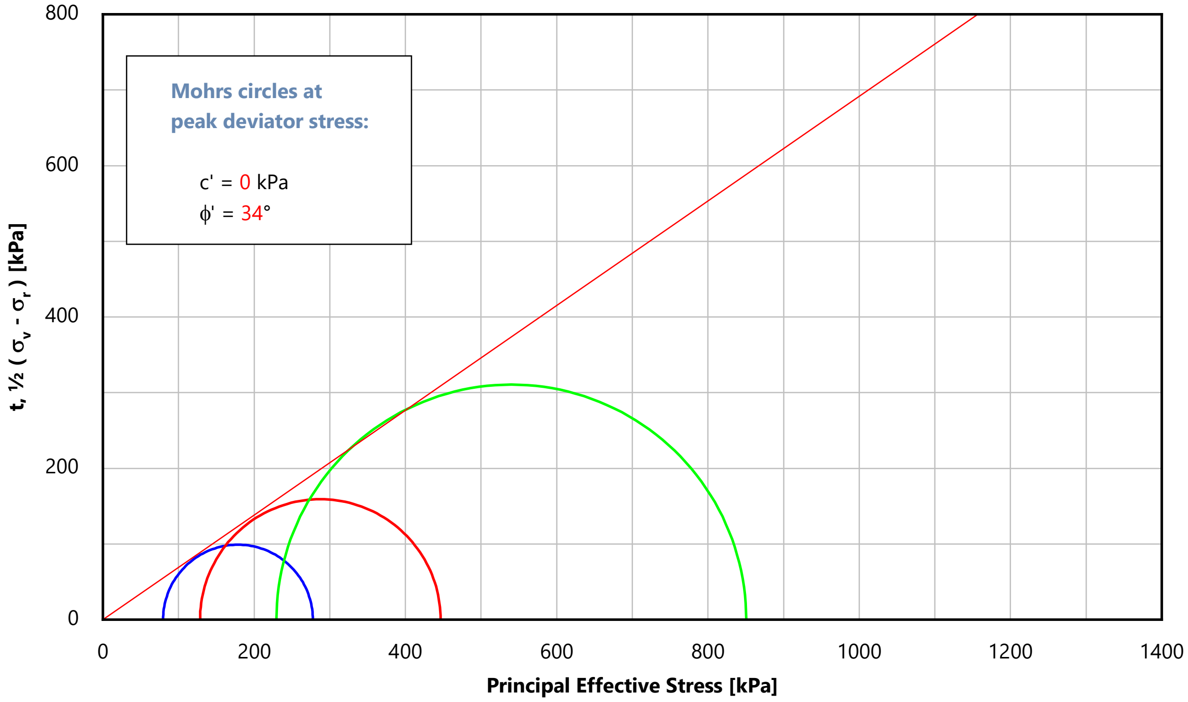

Consolidation				
Stage 1 σ'_{rc} : 87 kPa	Stage 2 σ'_{rc} : 131 kPa	Stage 3 σ'_{rc} : 219 kPa	—	1
Stage 1 σ'_{vc} : 87 kPa	Stage 2 σ'_{vc} : 131 kPa	Stage 3 σ'_{vc} : 219 kPa	—	2
			—	3

Project: 503387 - F254727
CID26

Laboratory: Wallingford, UK
Z5_OWF_BH01-COMP / 04-1 / 14

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Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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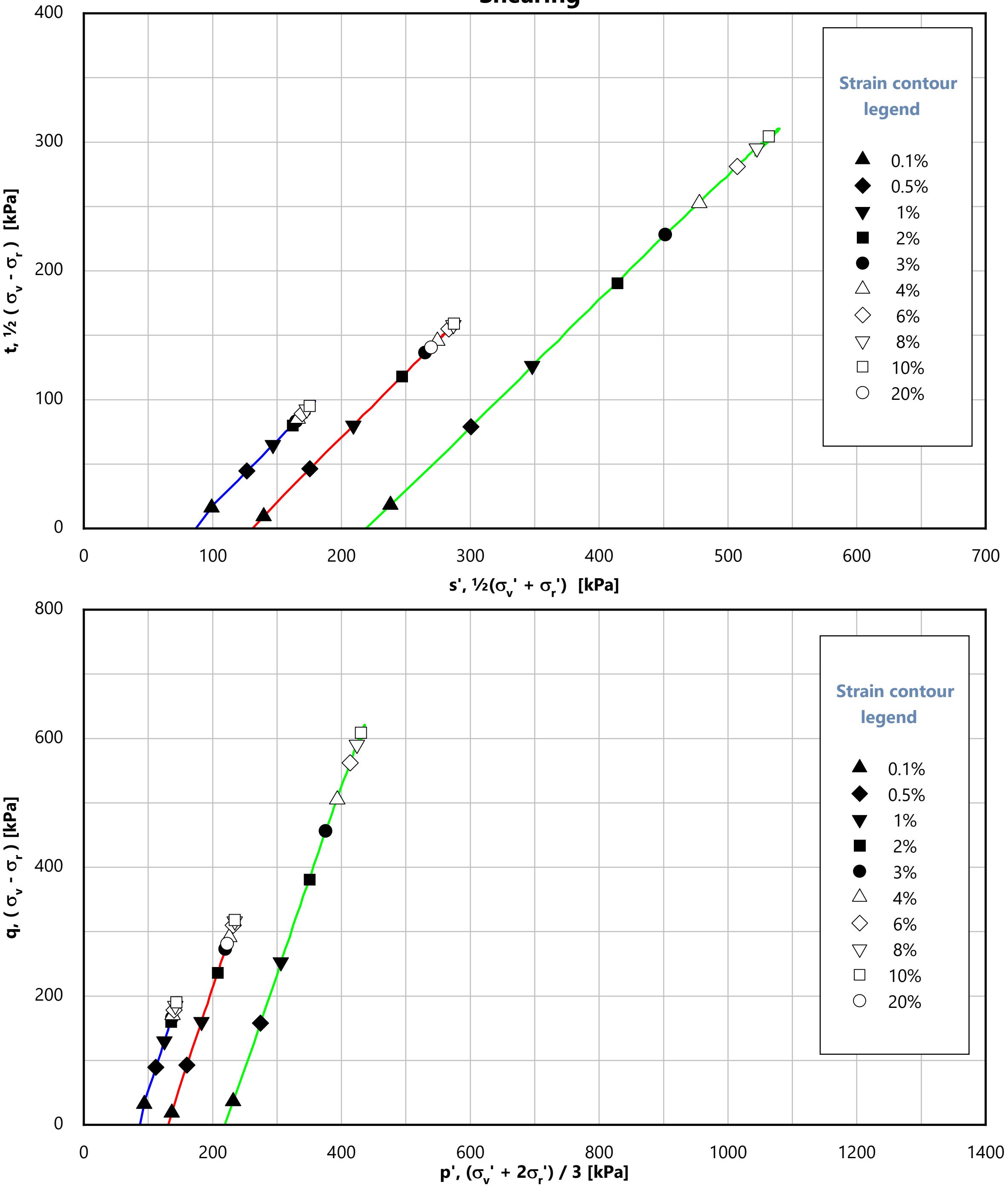
Shearing



Consolidation

Stage 1 σ'$_{rc}$: 87 kPa	Stage 2 σ'$_{rc}$: 131 kPa	Stage 3 σ'$_{rc}$: 219 kPa	🟦	1
Stage 1 σ'$_{vc}$: 87 kPa	Stage 2 σ'$_{vc}$: 131 kPa	Stage 3 σ'$_{vc}$: 219 kPa	🟥	2
			🟩	3

Project: 503387 - F254727
CID26

Laboratory: Wallingford, UK
Z5_OWF_BH01-COMP / 04-1 / 14

Approved by: ET 16/07/2025

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Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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Test Identification	**Specimen 1**	**Specimen 2**	**Specimen 3**
Location	Z5_OWF_BH02-COMP	Z5_OWF_BH02-COMP	Z5_OWF_BH02-COMP
Sample	03-2	03-2	03-2
Depth [m]	10.85	10.85	10.85
Test number	CID27a	CID27br	CID27cr

Specimen Visual Description
Brown fine SAND

Initial Specimen Conditions	**Specimen 1**	**Specimen 2**	**Specimen 3**
Test start date	16/04/2025	23/06/2025	23/06/2025
Type of sample	Recompacted	Recompacted	Recompacted
Diameter [mm]	50.8	50.5	50.5
Length [mm]	95.0	95.0	95.0
Water content [%]	9.9	9.8	9.8
Bulk density [Mg/m^3]	2.10	2.10	2.09
Dry density [Mg/m^3]	1.91	1.91	1.91
Void ratio [-]	0.390	0.387	0.391
Degree of saturation [%]	67	67	66
Type of drains fitted	One end	One end	One end

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Test page CID27-1/8

Laboratory: Wallingford, UK
Z5_OWF_BH02-COMP / 03-2 / 10.85

Approved by: ET - 18/08/2025

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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Saturation	Specimen 1	Specimen 2	Specimen 3
Pressure increments applied [kPa]	50	50	50
Differential pressure used [kPa]	10	10	10
Pore pressure on completion [kPa]	540	490	690
Cell pressure on completion [kPa]	550	500	700
B value achieved	0.92	0.92	0.92

Consolidation: Isotropic	Specimen 1	Specimen 2	Specimen 3
Cell pressure [kPa]	616	599	865
Back pressure [kPa]	550	500	700
Effective cell pressure [kPa]	66	99	165
Pore pressure on completion [kPa]	550	500	700
Pore pressure dissipation [%]	100	100	100
Water content [%]	14.5	14.5	14.3
Bulk density [Mg/m^3]	2.19	2.19	2.20
Dry density [Mg/m^3]	1.91	1.92	1.92
Void ratio [-]	0.385	0.383	0.380
Degree of saturation [%]	100	100	100
Axial strain [%]	0.12	0.08	0.25
Volumetric strain [%]	0.37	0.23	0.74
Volumetric strain rate-end of stage [%/hr]	0.01	0.02	0.04

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Laboratory: Wallingford, UK
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Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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Shearing	Specimen 1	Specimen 2	Specimen 3
Initial pore pressure [kPa]	550	500	700
Initial effective cell pressure [kPa]	66	99	165
Rate of strain [%/hour]	1.30	1.30	1.30
At peak deviator stress			
Corrected deviator stress [kPa]	348	625	1044
Membrane correction applied [kPa]	0.7	0.8	0.9
Drain correction applied [kPa]	0	0	0
Axial strain [%]	2.03	2.43	2.63
Volumetric strain [%]	-0.96	-1.58	-1.13
Major principal effective stress [kPa]	417	725	1212
Minor principal effective stress [kPa]	68	100	168
Principal effective stress ratio	6.10	7.23	7.20
ε_{50} [%]	0.69	0.75	1.00
Secant modulus (E_{50}) at ε_{50} [kPa]	25337	41726	52434
At peak principal effective stress ratio			
Corrected deviator stress [kPa]	348	625	1043
Membrane correction applied [kPa]	0.7	0.8	0.8
Drain correction applied [kPa]	0	0	0
Axial strain [%]	2.03	2.43	2.50
Volumetric strain [%]	-0.96	-1.58	-0.99
Major principal effective stress [kPa]	417	725	1210
Minor principal effective stress [kPa]	68	100	167
Principal effective stress ratio	6.10	7.23	7.24
At 10% axial strain			
Corrected deviator stress [kPa]	198	321	572
Membrane correction applied [kPa]	2.9	3.0	3.0
Drain correction applied [kPa]	0	0	0
Axial strain [%]	10.00	10.00	10.00
Volumetric strain [%]	-2.65	-3.09	-2.68
Major principal effective stress [kPa]	266	422	744
Minor principal effective stress [kPa]	68	101	172
Principal effective stress ratio	3.90	4.18	4.34

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Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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Photographs

Specimen 1	Specimen 2	Specimen 3
Photograph Unavailable	Photograph Unavailable	Photograph Unavailable

Final Conditions	Specimen 1	Specimen 2	Specimen 3
Water content [%]	14.5	14.5	16.1
Bulk density [Mg/m^3]	2.19	2.19	2.16
Dry density [Mg/m^3]	1.91	1.92	1.86
Mode of failure	Compound failure	Compound failure	Compound failure

Project: 503387 - F254727
Test page CID27-4/8

Laboratory: Wallingford, UK
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Approved by: ET - 18/08/2025

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Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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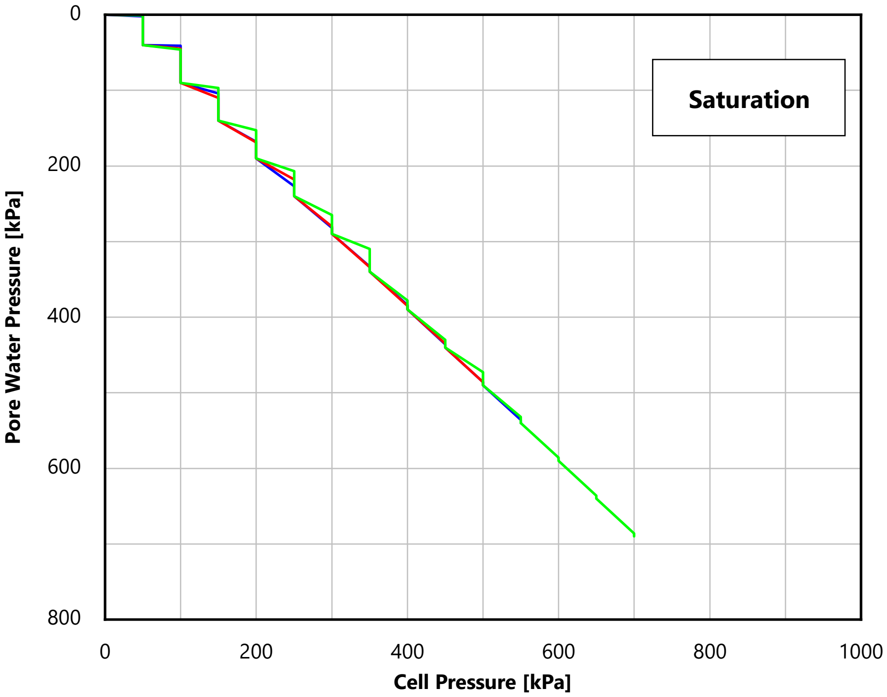

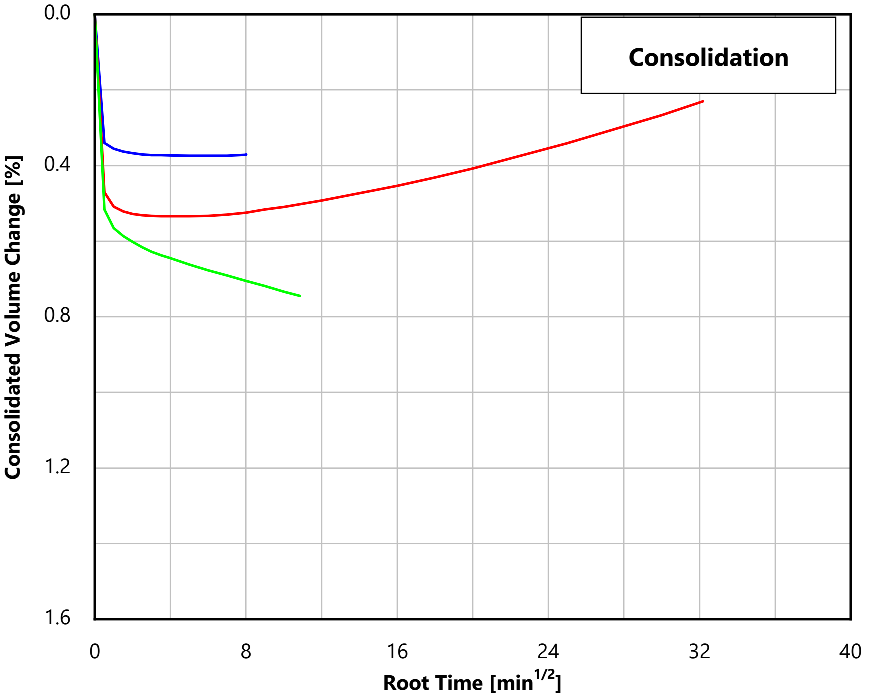

Consolidation				
Stage 1 σ'$_{rc}$: 66 kPa	Stage 2 σ'$_{rc}$: 99 kPa	Stage 3 σ'$_{rc}$: 165 kPa	🟦	1
Stage 1 σ'$_{vc}$: 66 kPa	Stage 2 σ'$_{vc}$: 99 kPa	Stage 3 σ'$_{vc}$: 165 kPa	🟥	2
			🟩	3

Project: 503387 - F254727
CID27

Laboratory: Wallingford, UK
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Approved by: ET 18/08/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils
Isotropic, Drained - Set of three (3) tests

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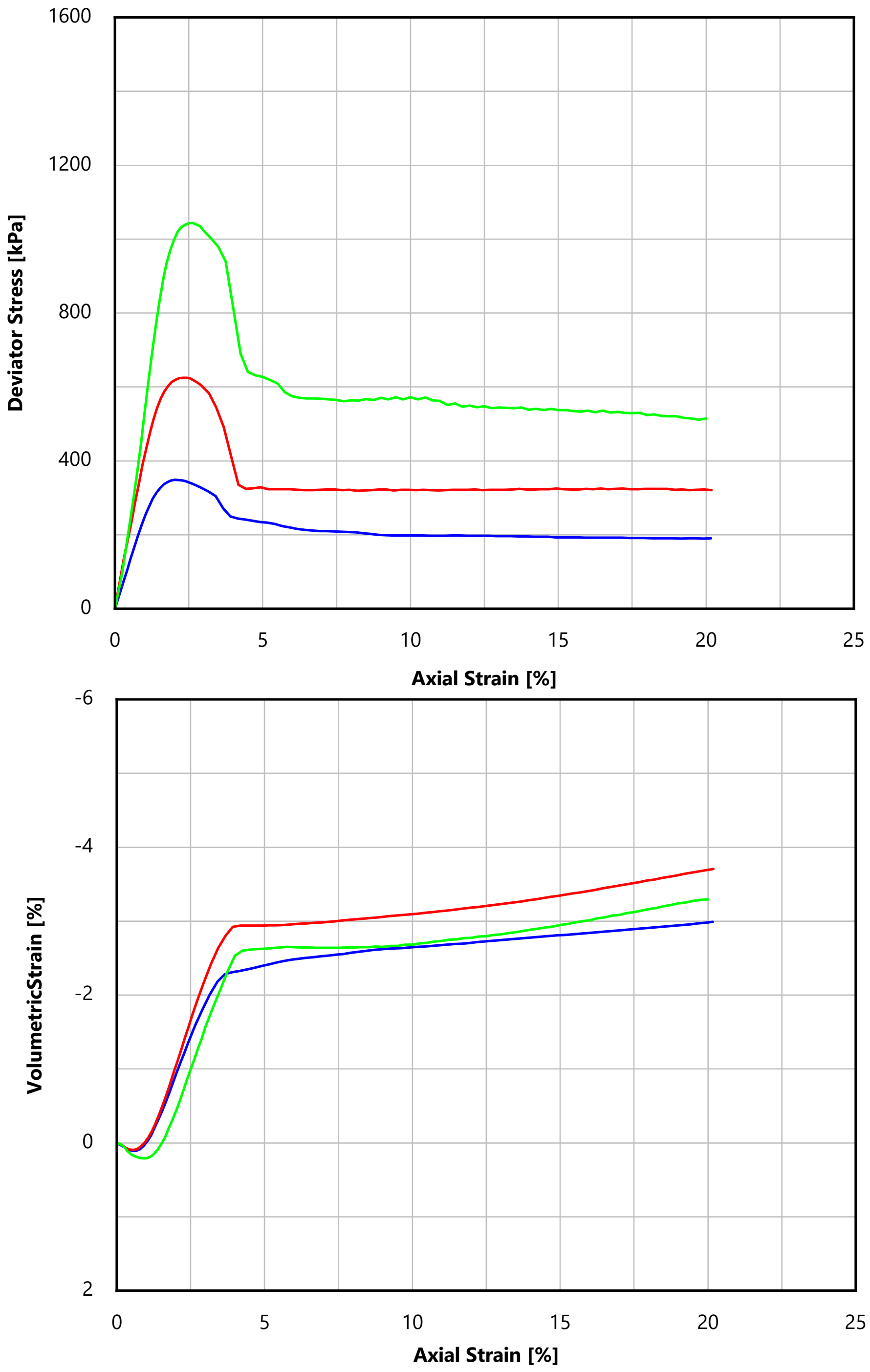
Shearing



Consolidation

Stage 1 σ'_{rc} : 66 kPa	Stage 2 σ'_{rc} : 99 kPa	Stage 3 σ'_{rc} : 165 kPa	—	1
Stage 1 σ'_{vc} : 66 kPa	Stage 2 σ'_{vc} : 99 kPa	Stage 3 σ'_{vc} : 165 kPa	—	2
			—	3

Project: 503387 - F254727
CID27

Laboratory: Wallingford, UK
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Approved by: ET 18/08/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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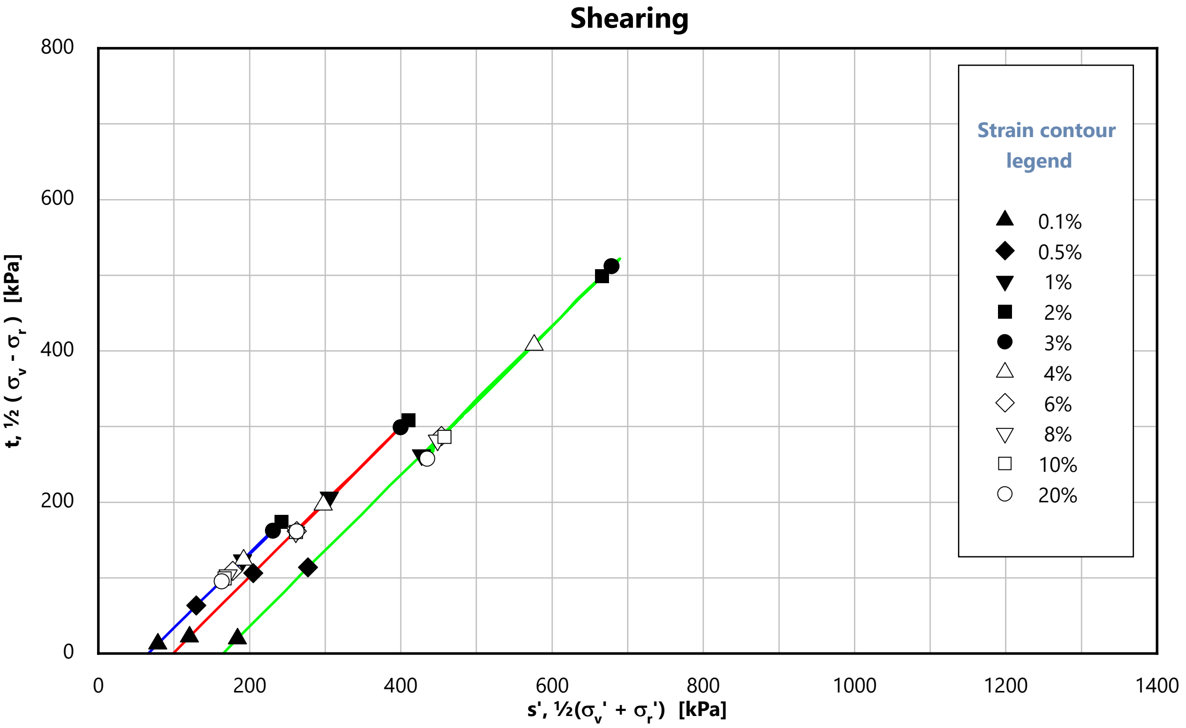

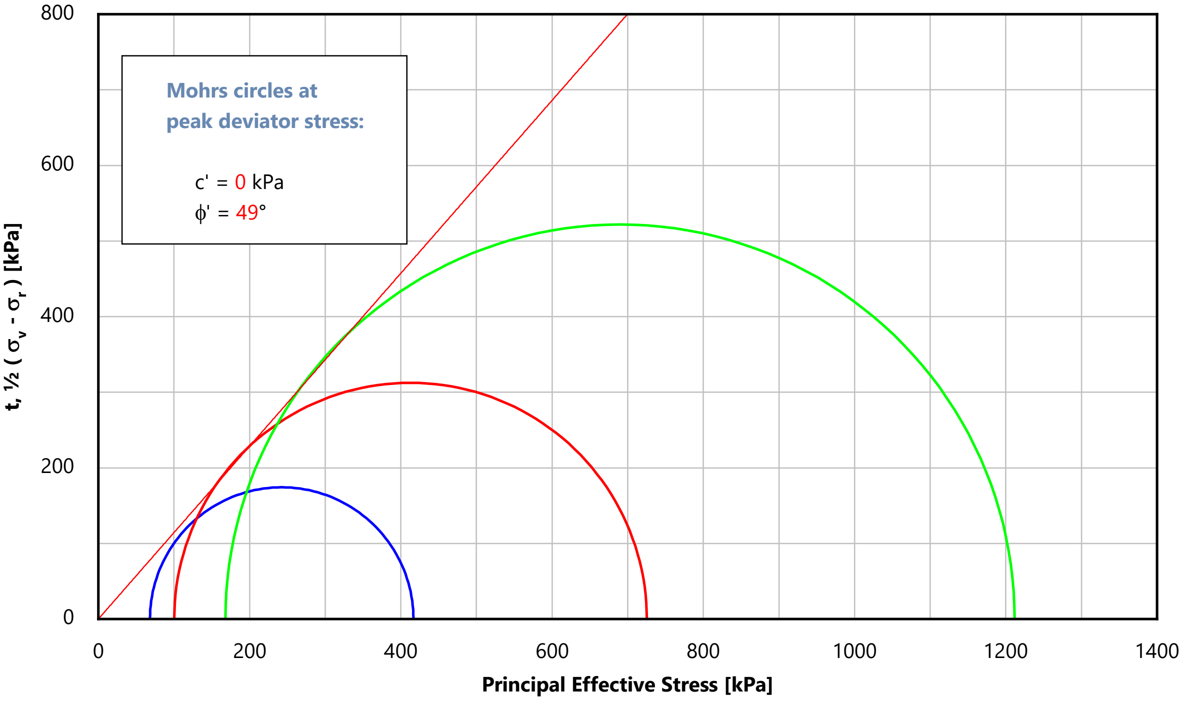

Consolidation

Stage 1 σ'_{rc} : 66 kPa	Stage 2 σ'_{rc} : 99 kPa	Stage 3 σ'_{rc} : 165 kPa	—	1
Stage 1 σ'_{vc} : 66 kPa	Stage 2 σ'_{vc} : 99 kPa	Stage 3 σ'_{vc} : 165 kPa	—	2
			—	3

Project: 503387 - F254727
CID27

Laboratory: Wallingford, UK
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Approved by: ET 18/08/2025

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Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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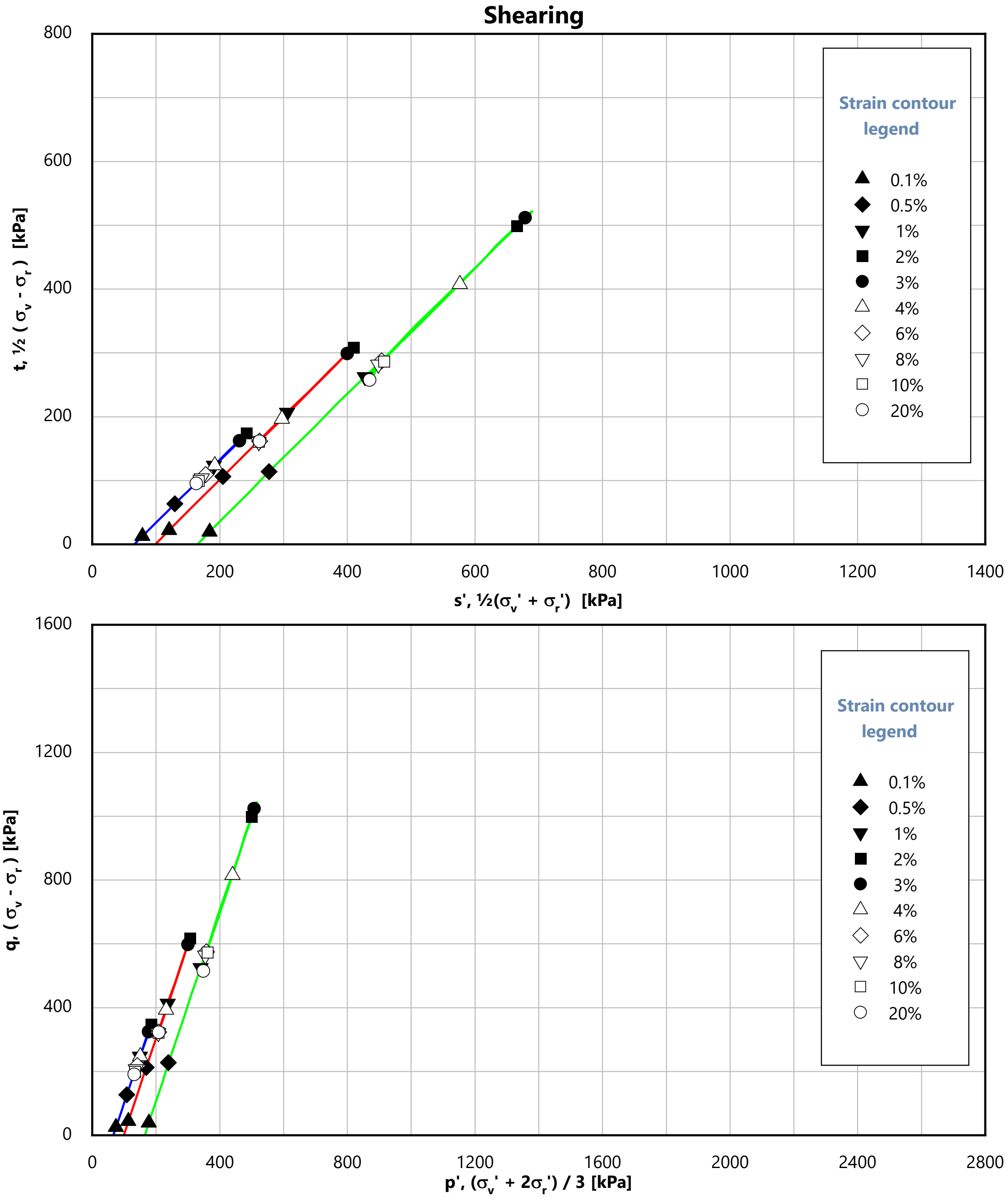

Consolidation			
Stage 1 σ'_{rc} : 66 kPa	Stage 2 σ'_{rc} : 99 kPa	Stage 3 σ'_{rc} : 165 kPa	1
Stage 1 σ'_{vc} : 66 kPa	Stage 2 σ'_{vc} : 99 kPa	Stage 3 σ'_{vc} : 165 kPa	2
			3

Project: 503387 - F254727
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Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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Test Identification	Specimen 1	Specimen 2	Specimen 3
Location	Z5_OWF_BH02-COMP	Z5_OWF_BH02-COMP	Z5_OWF_BH02-COMP
Sample	05-1	05-1	05-1
Depth [m]	18.50	18.50	18.50
Test number	CID28a	CID28b	CID28c

Specimen Visual Description
Olive brown fine SAND

Initial Specimen Conditions	Specimen 1	Specimen 2	Specimen 3
Test start date	30/06/2025	29/05/2025	29/05/2025
Type of sample	Recompacted	Recompacted	Recompacted
Diameter [mm]	50.8	50.5	50.5
Length [mm]	95.0	95.0	95.0
Water content [%]	9.9	10.0	10.0
Bulk density [Mg/m^3]	1.94	1.95	1.95
Dry density [Mg/m^3]	1.77	1.77	1.77
Void ratio [-]	0.500	0.494	0.494
Degree of saturation [%]	53	54	54
Type of drains fitted	One end	One end	One end

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Test page CID28r-1/8

Laboratory: Wallingford, UK
Z5_OWF_BH02-COMP / 05-1 / 18.5

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Saturation	Specimen 1	Specimen 2	Specimen 3
Pressure increments applied [kPa]	50	50	50
Differential pressure used [kPa]	10	10	10
Pore pressure on completion [kPa]	540	340	390
Cell pressure on completion [kPa]	550	350	400
B value achieved	0.96	0.96	0.96

Consolidation: Isotropic	Specimen 1	Specimen 2	Specimen 3
Cell pressure [kPa]	663	519	681
Back pressure [kPa]	550	350	400
Effective cell pressure [kPa]	113	169	281
Pore pressure on completion [kPa]	550	351	401
Pore pressure dissipation [%]	100	99	100
Water content [%]	18.6	18.2	18.1
Bulk density [Mg/m^3]	2.11	2.11	2.12
Dry density [Mg/m^3]	1.77	1.79	1.79
Void ratio [-]	0.493	0.482	0.479
Degree of saturation [%]	100	100	100
Axial strain [%]	0.14	0.28	0.34
Volumetric strain [%]	0.43	0.83	1.01
Volumetric strain rate-end of stage [%/hr]	0.00	0.01	0.04

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Laboratory: Wallingford, UK
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Shearing	Specimen 1	Specimen 2	Specimen 3
Initial pore pressure [kPa]	550	350	400
Initial effective cell pressure [kPa]	113	169	281
Rate of strain [%/hour]	1.30	1.30	1.30
At peak deviator stress			
Corrected deviator stress [kPa]	790	910	1354
Membrane correction applied [kPa]	0.9	1.0	1.0
Drain correction applied [kPa]	0	0	0
Axial strain [%]	2.29	2.48	2.50
Volumetric strain [%]	-1.34	-1.13	-0.60
Major principal effective stress [kPa]	907	1080	1636
Minor principal effective stress [kPa]	117	170	282
Principal effective stress ratio	7.75	6.35	5.81
ε_{50} [%]	0.74	0.76	0.85
Secant modulus (E_{50}) at ε_{50} [kPa]	53252	59694	79670
At peak principal effective stress ratio			
Corrected deviator stress [kPa]	790	910	1354
Membrane correction applied [kPa]	0.9	1.0	1.0
Drain correction applied [kPa]	0	0	0
Axial strain [%]	2.29	2.48	2.50
Volumetric strain [%]	-1.34	-1.13	-0.60
Major principal effective stress [kPa]	907	1080	1636
Minor principal effective stress [kPa]	117	170	282
Principal effective stress ratio	7.75	6.35	5.81
At 10% axial strain			
Corrected deviator stress [kPa]	401	535	913
Membrane correction applied [kPa]	3.4	3.4	3.4
Drain correction applied [kPa]	0	0	0
Axial strain [%]	10.00	10.00	10.00
Volumetric strain [%]	-3.20	-3.89	-3.05
Major principal effective stress [kPa]	518	706	1195
Minor principal effective stress [kPa]	117	170	282
Principal effective stress ratio	4.41	4.14	4.24

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Test page CID28r-3/8

Laboratory: Wallingford, UK
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Photographs		
Specimen 1	**Specimen 2**	**Specimen 3**
Photograph unavailable	Photograph unavailable	Photograph unavailable

Final Conditions	Specimen 1	Specimen 2	Specimen 3
Water content [%]	20.8	20.6	20.0
Bulk density [Mg/m^3]	2.06	2.07	2.08
Dry density [Mg/m^3]	1.71	1.72	1.73
Mode of failure	Compound failure	Compound failure	Compound failure

Project: 503387 - F254727
Test page CID28r-4/8

Laboratory: Wallingford, UK
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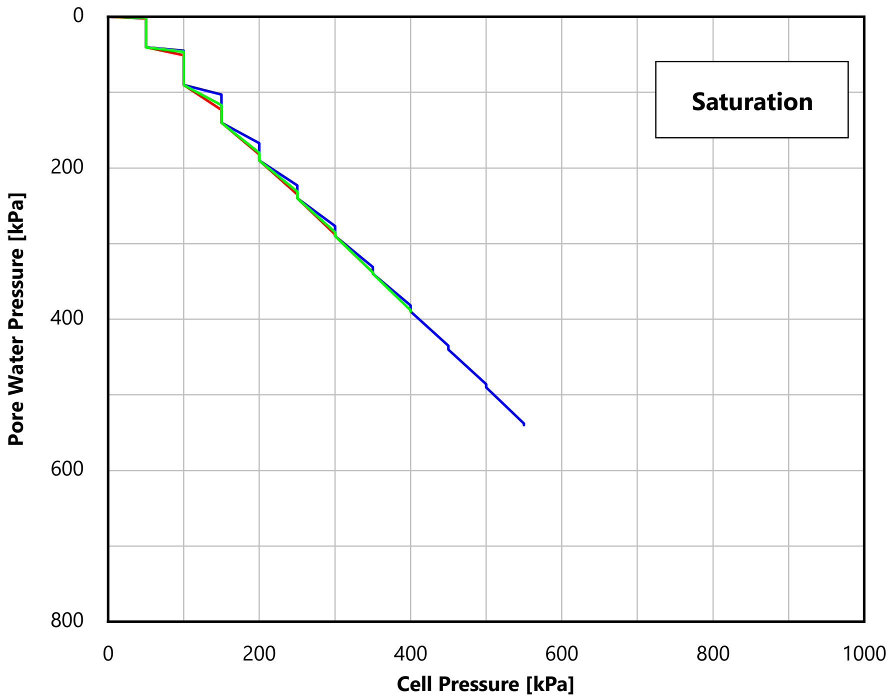

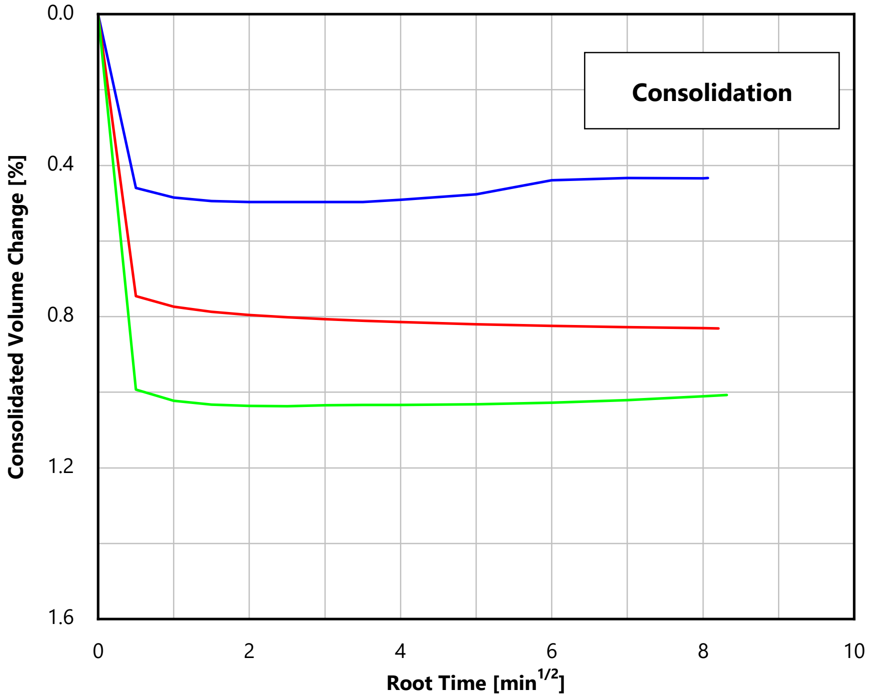

Consolidation

Stage 1 σ'_{rc} : 113 kPa   Stage 2 σ'_{rc} : 169 kPa   Stage 3 σ'_{rc} : 281 kPa
Stage 1 σ'_{vc} : 113 kPa   Stage 2 σ'_{vc} : 169 kPa   Stage 3 σ'_{vc} : 281 kPa

🟦	1
🟥	2
🟩	3

Project: 503387 - F254727
CID28r

Laboratory: Wallingford, UK
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Approved by: ET 04/08/2025

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Consolidated Triaxial Compression Test On Water Saturated Soils

Isotropic, Drained - Set of three (3) tests

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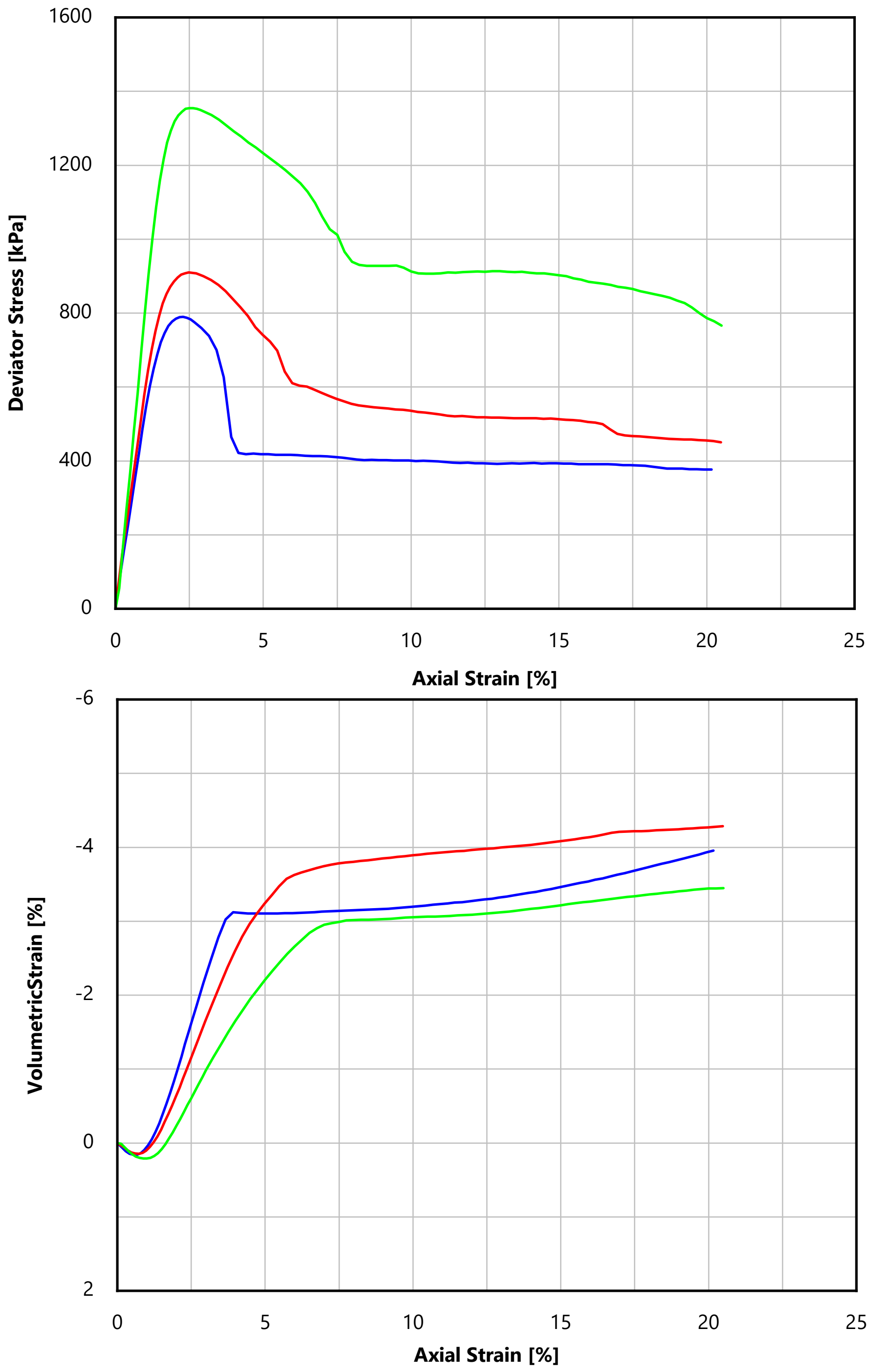
Shearing



Consolidation				
Stage 1 σ'$_{rc}$: 113 kPa	Stage 2 σ'$_{rc}$: 169 kPa	Stage 3 σ'$_{rc}$: 281 kPa	🟦	1
			🟥	2
Stage 1 σ'$_{vc}$: 113 kPa	Stage 2 σ'$_{vc}$: 169 kPa	Stage 3 σ'$_{vc}$: 281 kPa	🟩	3

Project: 503387 - F254727
CID28r

Laboratory: Wallingford, UK
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Approved by: ET 04/08/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils
Isotropic, Drained - Set of three (3) tests

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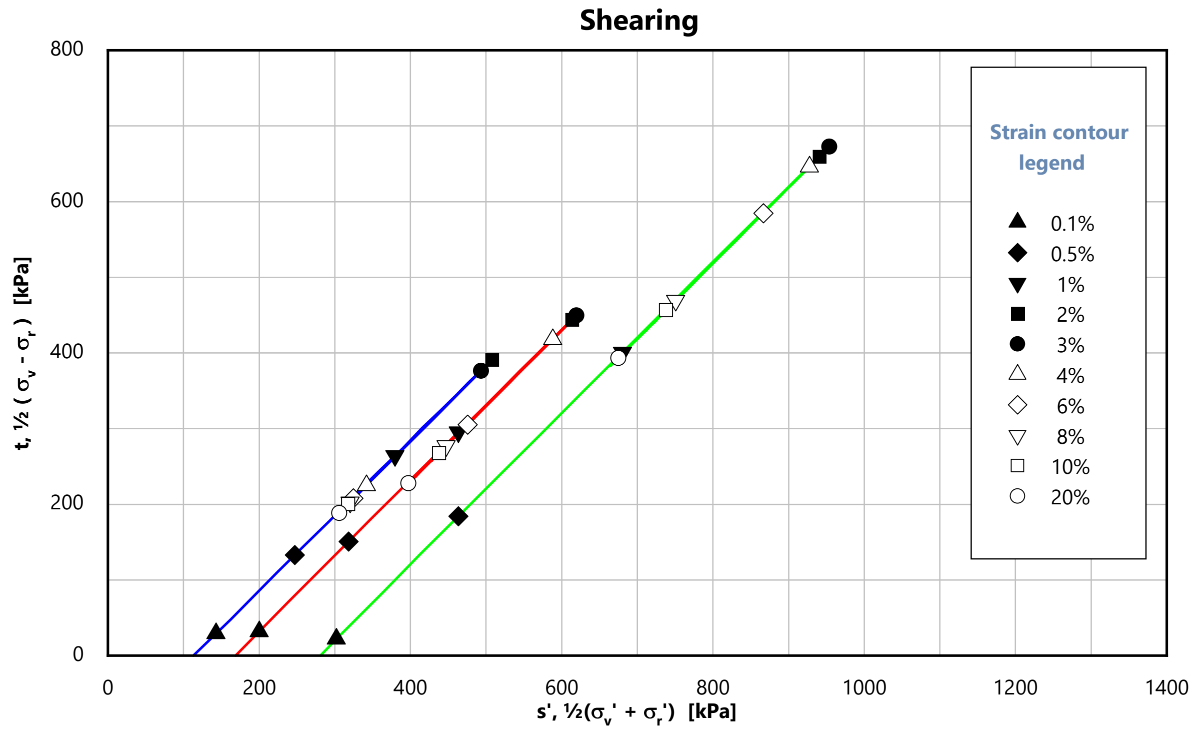

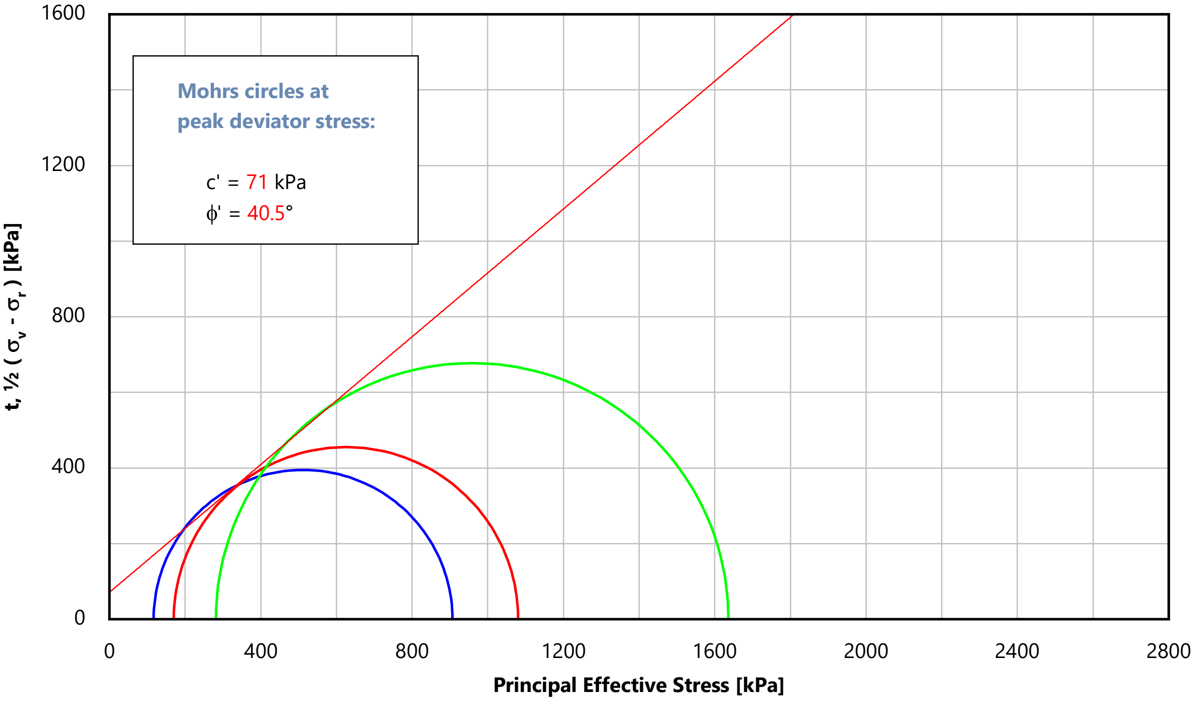

Consolidation

Stage 1 σ'_{rc} : 113 kPa	Stage 2 σ'_{rc} : 169 kPa	Stage 3 σ'_{rc} : 281 kPa	1
Stage 1 σ'_{vc} : 113 kPa	Stage 2 σ'_{vc} : 169 kPa	Stage 3 σ'_{vc} : 281 kPa	2
			3

Project: 503387 - F254727
CID28r

Laboratory: Wallingford, UK
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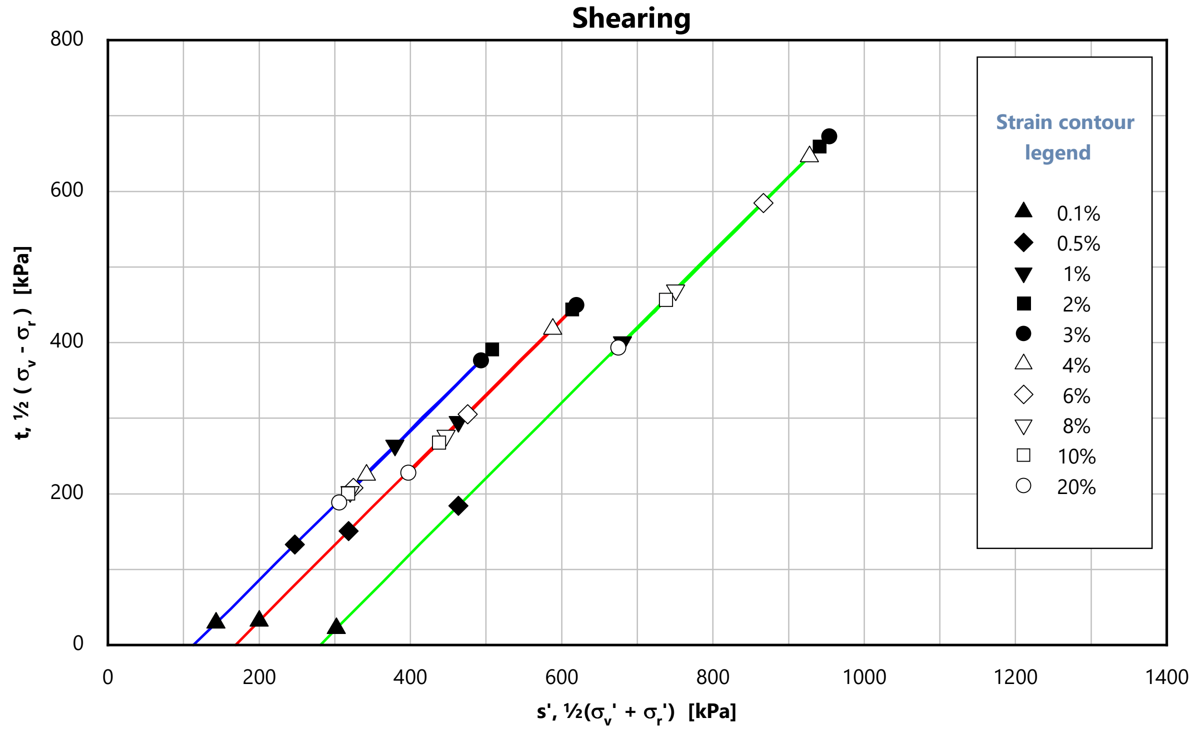

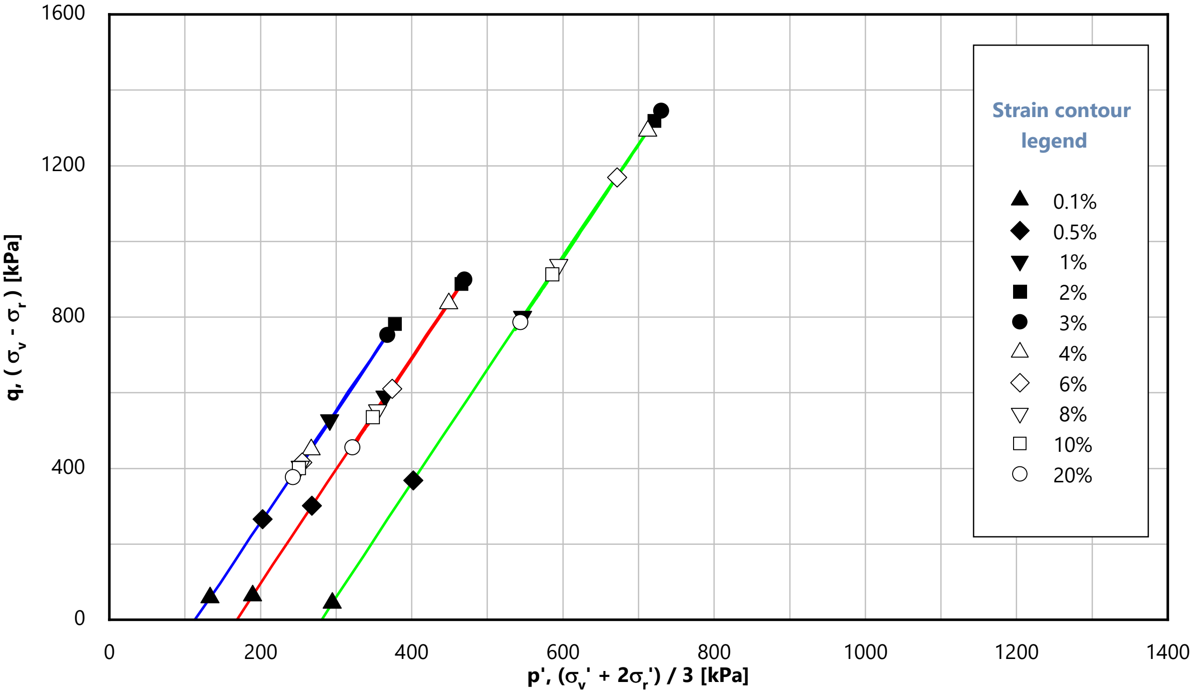

Consolidation

Stage 1 σ'_{rc} : 113 kPa	Stage 2 σ'_{rc} : 169 kPa	Stage 3 σ'_{rc} : 281 kPa	blue line	1
Stage 1 σ'_{vc} : 113 kPa	Stage 2 σ'_{vc} : 169 kPa	Stage 3 σ'_{vc} : 281 kPa	red line	2
			green line	3

Project: 503387 - F254727
CID28r

Laboratory: Wallingford, UK
Z5_OWF_BH02-COMP / 05-1 / 18.5

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Test Identification	Specimen 1	Specimen 2	Specimen 3
Location	Z5_OWF_BH03-COMP	Z5_OWF_BH03-COMP	Z5_OWF_BH03-COMP
Sample	01-1	01-1	01-1
Depth [m]	1.50	1.50	1.50
Test number	CID35a	CID35b	CID35c

Specimen Visual Description
Greyish brown very fine SAND

Initial Specimen Conditions	Specimen 1	Specimen 2	Specimen 3
Test start date	30/04/2025	29/05/2025	23/05/2025
Type of sample	Recompacted	Recompacted	Recompacted
Diameter [mm]	50.5	50.5	50.5
Length [mm]	95.0	95.0	95.0
Water content [%]	10.1	9.9	10.0
Bulk density [Mg/m^3]	1.88	1.87	1.87
Dry density [Mg/m^3]	1.71	1.70	1.70
Void ratio [-]	0.554	0.555	0.561
Degree of saturation [%]	49	47	47
Type of drains fitted	One end	One end	One end

Project: 503387 - F254727
Test page CID35-1/8

Laboratory: Wallingford, UK
Z5_OWF_BH03-COMP / 01-1 / 1.5

Approved by: ET - 19/08/2025

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils
Isotropic, Drained - Set of three (3) tests

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Saturation	Specimen 1	Specimen 2	Specimen 3
Pressure increments applied [kPa]	10	20	30
Differential pressure used [kPa]	5	5	10
Pore pressure on completion [kPa]	305	355	440
Cell pressure on completion [kPa]	310	360	450
B value achieved	1.00	0.90	0.90

Consolidation: Isotropic	Specimen 1	Specimen 2	Specimen 3
Cell pressure [kPa]	325	383	488
Back pressure [kPa]	310	360	450
Effective cell pressure [kPa]	15	23	38
Pore pressure on completion [kPa]	310	360	450
Pore pressure dissipation [%]	100	100	100
Water content [%]	20.8	20.8	21.0
Bulk density [Mg/m^3]	2.06	2.06	2.06
Dry density [Mg/m^3]	1.71	1.71	1.70
Void ratio [-]	0.552	0.552	0.557
Degree of saturation [%]	100	100	100
Axial strain [%]	0.05	0.06	0.08
Volumetric strain [%]	0.14	0.19	0.25
Volumetric strain rate-end of stage [%/hr]	0.00	0.00	0.00

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Test page CID35-2/8

Laboratory: Wallingford, UK
Z5_OWF_BH03-COMP / 01-1 / 1.5

Approved by: ET - 19/08/2025

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

UKAS TESTING 0919

Shearing	Specimen 1	Specimen 2	Specimen 3
Initial pore pressure [kPa]	310	360	450
Initial effective cell pressure [kPa]	15	23	38
Rate of strain [%/hour]	1.30	1.30	1.30
At peak deviator stress			
Corrected deviator stress [kPa]	115	204	245
Membrane correction applied [kPa]	0.6	0.7	0.6
Drain correction applied [kPa]	0	0	0
Axial strain [%]	2.13	2.50	2.18
Volumetric strain [%]	-1.53	-1.60	-1.22
Major principal effective stress [kPa]	131	229	284
Minor principal effective stress [kPa]	16	25	40
Principal effective stress ratio	8.10	9.16	7.18
ε_{50} [%]	0.40	0.85	0.80
Secant modulus (E_{50}) at ε_{50} [kPa]	14222	11938	15319
At peak principal effective stress ratio			
Corrected deviator stress [kPa]	115	203	245
Membrane correction applied [kPa]	0.6	0.6	0.6
Drain correction applied [kPa]	0	0	0
Axial strain [%]	2.13	2.25	2.18
Volumetric strain [%]	-1.53	-1.24	-1.22
Major principal effective stress [kPa]	131	227	284
Minor principal effective stress [kPa]	16	24	40
Principal effective stress ratio	8.10	9.53	7.18
At 10% axial strain			
Corrected deviator stress [kPa]	65	108	114
Membrane correction applied [kPa]	2.3	2.3	2.3
Drain correction applied [kPa]	0	0	0
Axial strain [%]	10.00	10.00	10.00
Volumetric strain [%]	-4.12	-4.85	-4.05
Major principal effective stress [kPa]	81	132	155
Minor principal effective stress [kPa]	16	24	41
Principal effective stress ratio	4.94	5.47	3.81

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Test page CID35-3/8

Laboratory: Wallingford, UK
Z5_OWF_BH03-COMP / 01-1 / 1.5

Approved by: ET - 19/08/2025

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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Photographs

Specimen 1	Specimen 2	Specimen 3
Photograph unavailable	Photograph unavailable	Photograph unavailable

Final Conditions	Specimen 1	Specimen 2	Specimen 3
Water content [%]	20.8	23.9	23.7
Bulk density [Mg/m^3]	2.06	2.01	2.01
Dry density [Mg/m^3]	1.71	1.62	1.63
Mode of failure	Compound failure	Compound failure	Compound failure

Project: 503387 - F254727
Test page CID35-4/8

Laboratory: Wallingford, UK
Z5_OWF_BH03-COMP / 01-1 / 1.5

Approved by: ET - 19/08/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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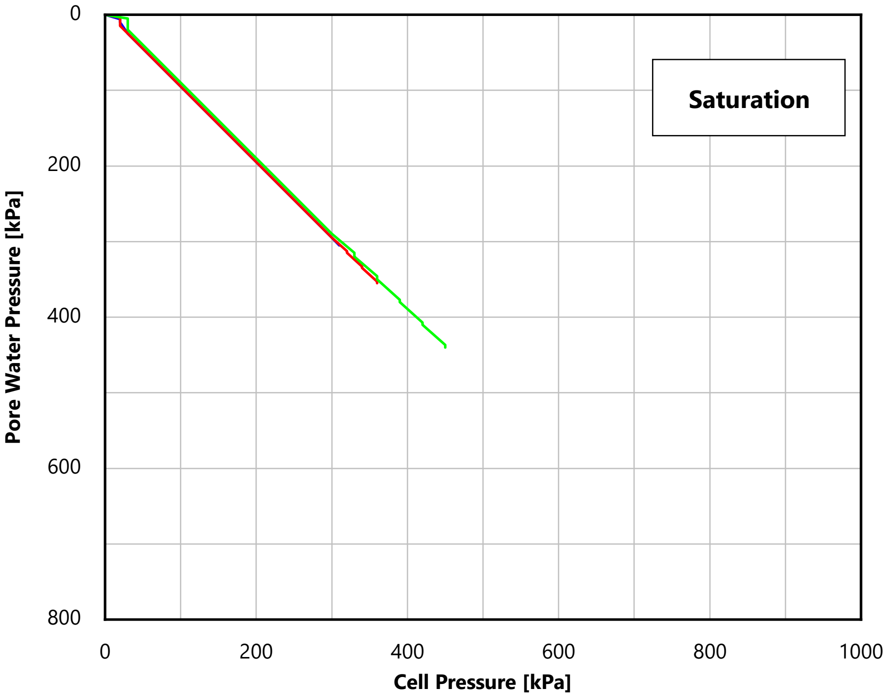

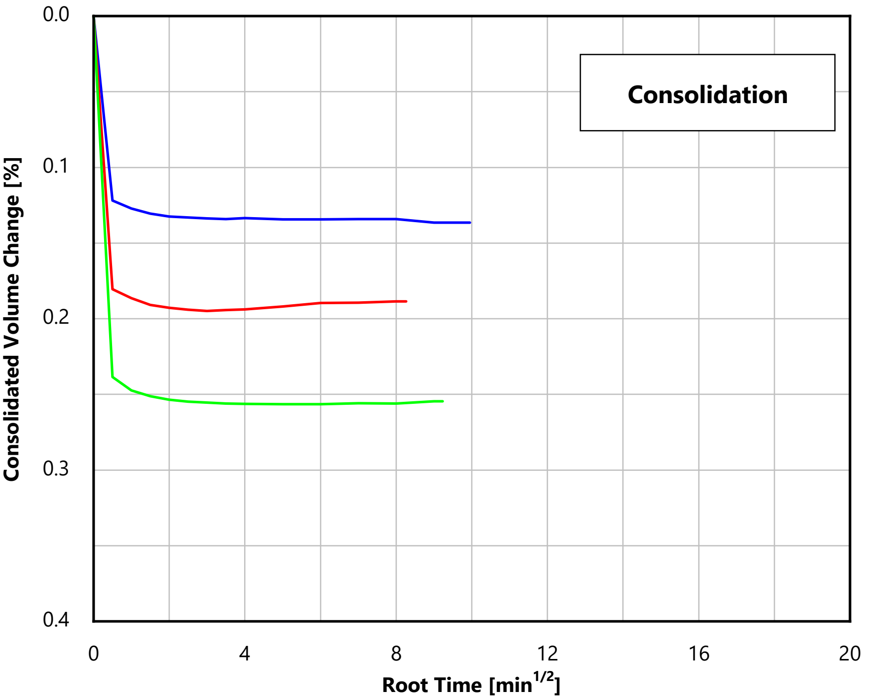

Consolidation

Stage 1 σ'$_{rc}$: 15 kPa	Stage 2 σ'$_{rc}$: 23 kPa	Stage 3 σ'$_{rc}$: 38 kPa	—	1
Stage 1 σ'$_{vc}$: 15 kPa	Stage 2 σ'$_{vc}$: 23 kPa	Stage 3 σ'$_{vc}$: 38 kPa	—	2
			—	3

Project: 503387 - F254727
CID35

Laboratory: Wallingford, UK
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Approved by: ET 19/08/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils

Isotropic, Drained - Set of three (3) tests

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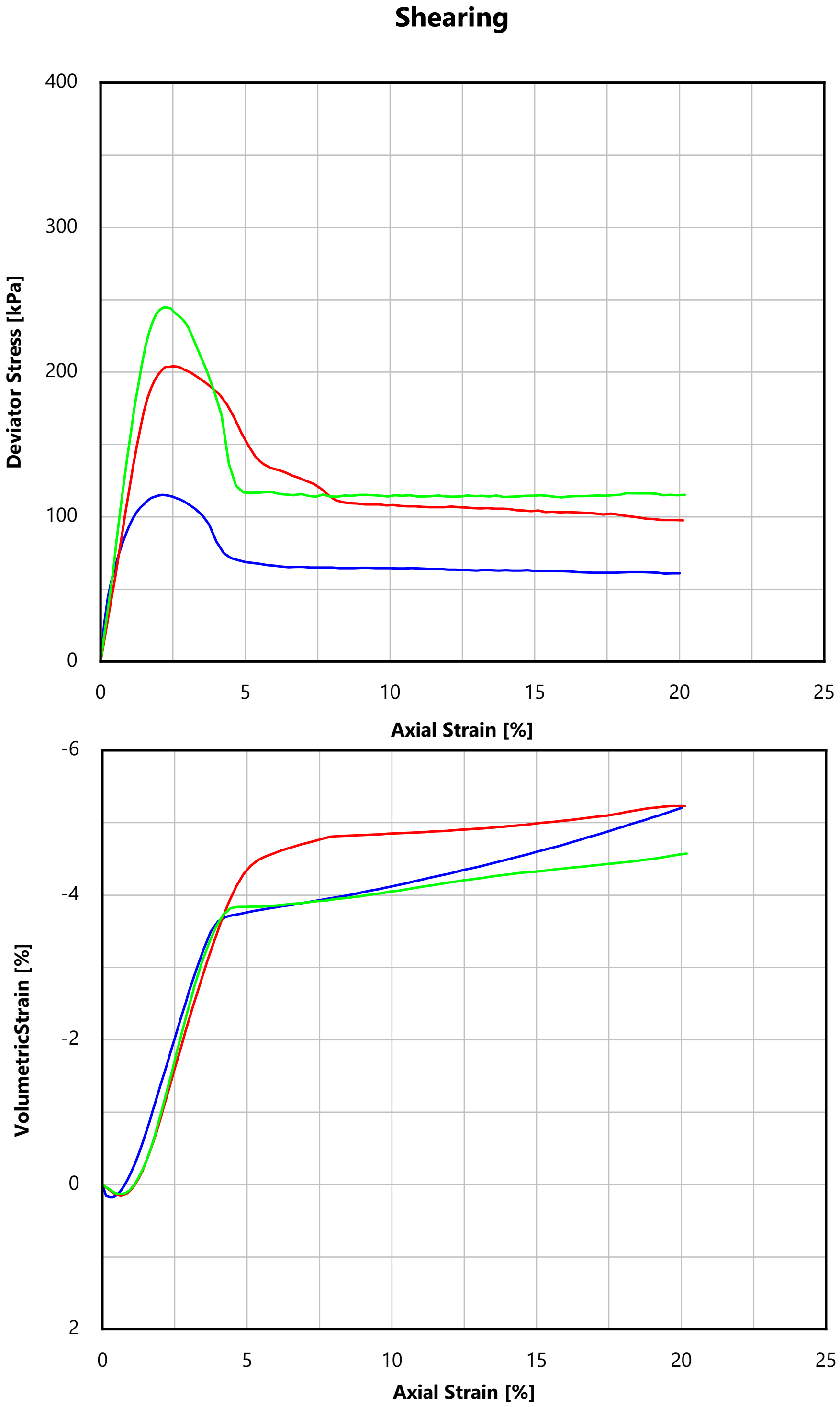

Consolidation				
			—	1
Stage 1 σ'_{rc} : 15 kPa	Stage 2 σ'_{rc} : 23 kPa	Stage 3 σ'_{rc} : 38 kPa	—	2
Stage 1 σ'_{vc} : 15 kPa	Stage 2 σ'_{vc} : 23 kPa	Stage 3 σ'_{vc} : 38 kPa	—	3

Project: 503387 - F254727
CID35

Laboratory: Wallingford, UK
Z5_OWF_BH03-COMP / 01-1 / 1.5

Approved by: ET 19/08/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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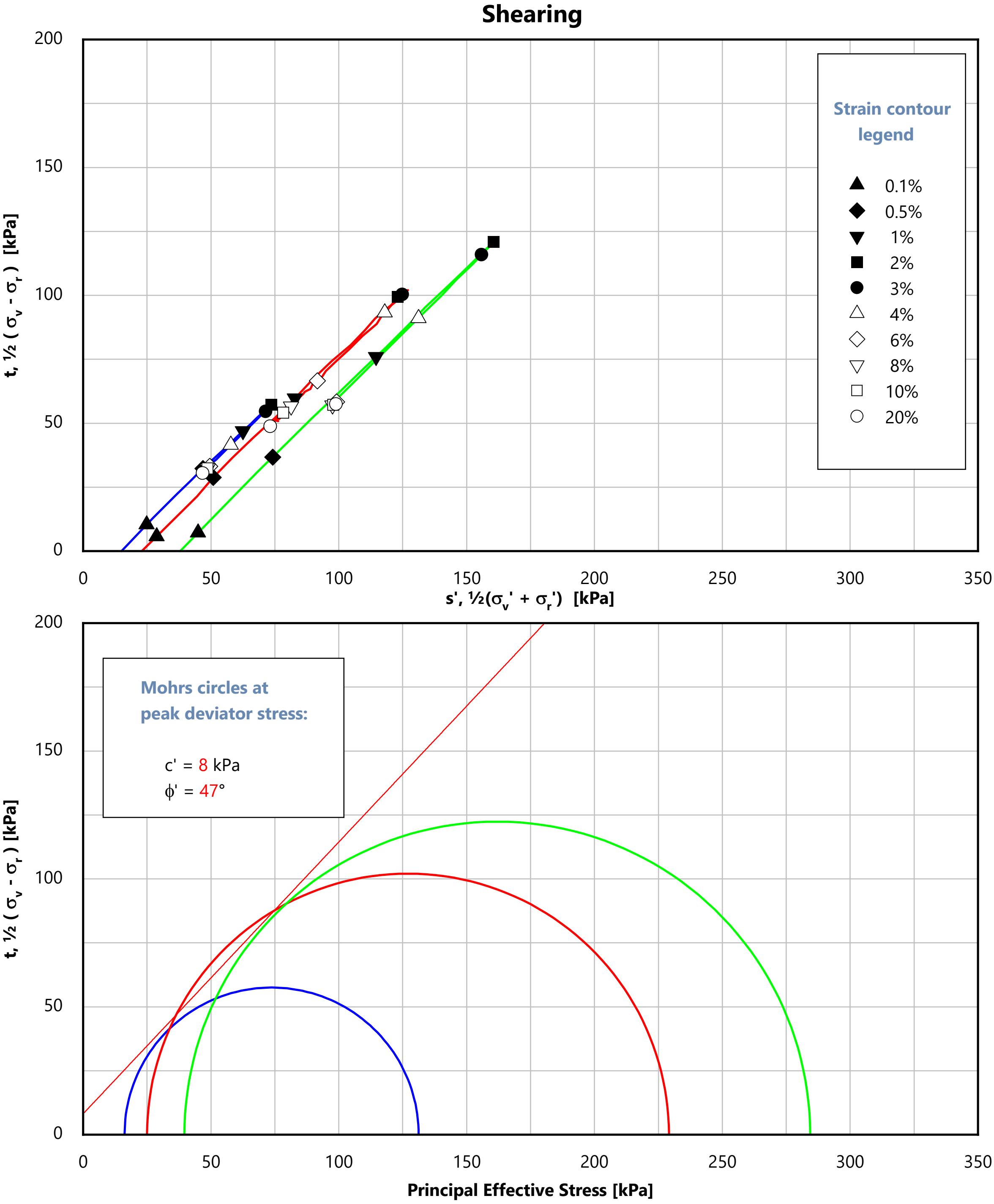

Consolidation			
Stage 1 σ'_{rc} : 15 kPa	Stage 2 σ'_{rc} : 23 kPa	Stage 3 σ'_{rc} : 38 kPa	— 1
Stage 1 σ'_{vc} : 15 kPa	Stage 2 σ'_{vc} : 23 kPa	Stage 3 σ'_{vc} : 38 kPa	— 2
			— 3

Project: 503387 - F254727
CID35

Laboratory: Wallingford, UK
Z5_OWF_BH03-COMP / 01-1 / 1.5

Approved by: ET 19/08/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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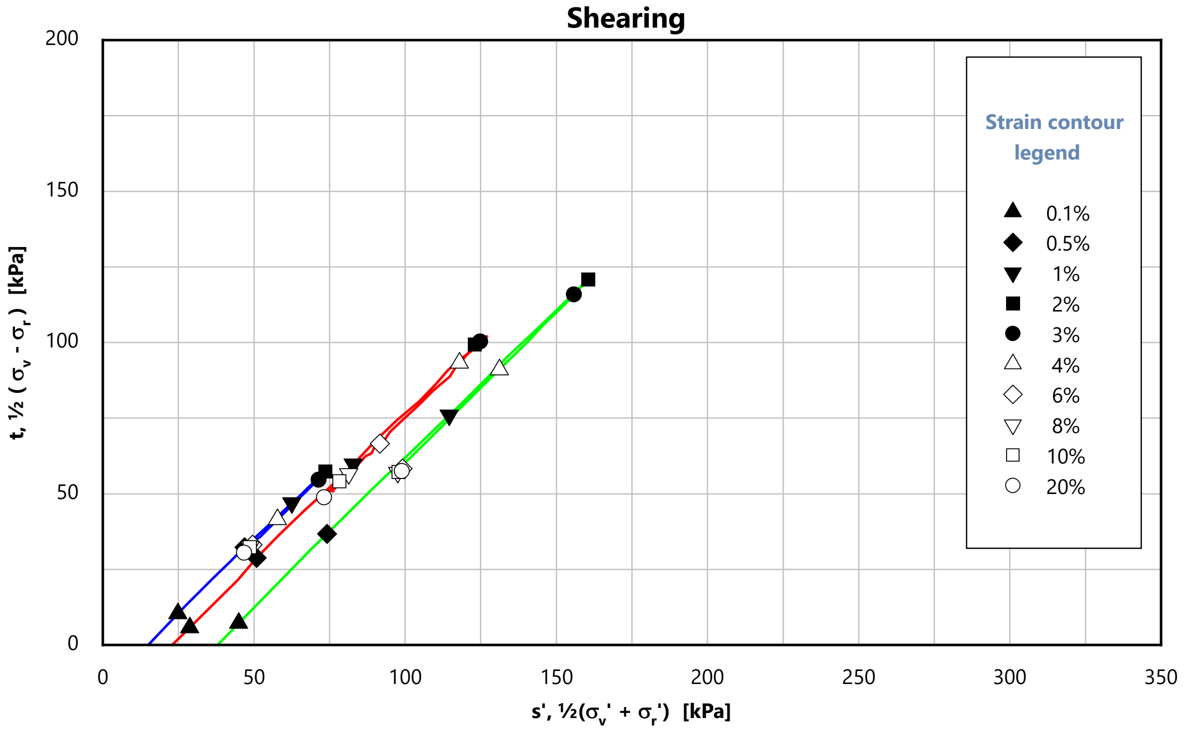

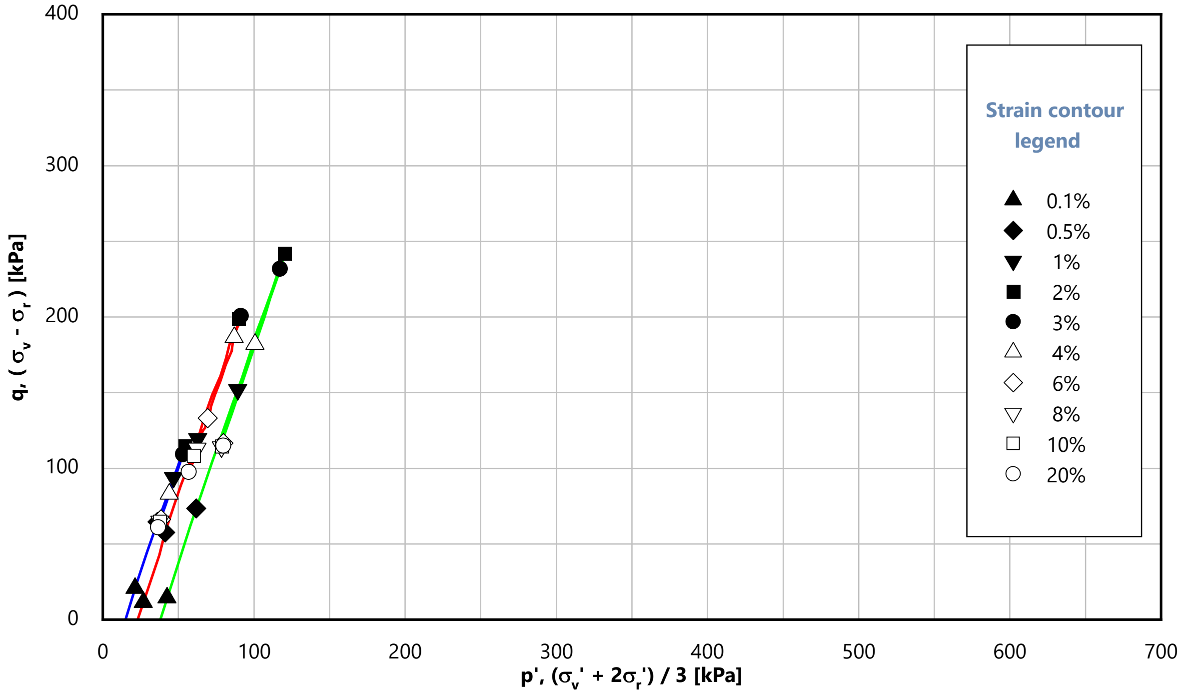

Consolidation				
Stage 1 σ'_{rc} : 15 kPa	Stage 2 σ'_{rc} : 23 kPa	Stage 3 σ'_{rc} : 38 kPa	—	1
Stage 1 σ'_{vc} : 15 kPa	Stage 2 σ'_{vc} : 23 kPa	Stage 3 σ'_{vc} : 38 kPa	—	2
			—	3

Project: 503387 - F254727
CID35

Laboratory: Wallingford, UK
Z5_OWF_BH03-COMP / 01-1 / 1.5

Approved by: ET 19/08/2025

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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Test Identification	Specimen 1	Specimen 2	Specimen 3
Location	Z5_OWF_BH03-COMP	Z5_OWF_BH03-COMP	Z5_OWF_BH03-COMP
Sample	04-1	04-1	04-1
Depth [m]	11.50	11.50	11.50
Test number	CID36a	CID36b	CID36c

Specimen Visual Description
Yellowish brown medium SAND

Initial Specimen Conditions	Specimen 1	Specimen 2	Specimen 3
Test start date	23/03/2025	24/03/2025	31/03/2025
Type of sample	Recompacted	Recompacted	Recompacted
Diameter [mm]	50.8	50.8	50.8
Length [mm]	95.0	95.0	95.0
Water content [%]	10.1	10.1	10.0
Bulk density [Mg/m^3]	2.09	2.08	2.08
Dry density [Mg/m^3]	1.89	1.89	1.89
Void ratio [-]	0.399	0.402	0.403
Degree of saturation [%]	67	67	66
Type of drains fitted	One end	One end	One end

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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Saturation	Specimen 1	Specimen 2	Specimen 3
Pressure increments applied [kPa]	50	50	50
Differential pressure used [kPa]	10	10	10
Pore pressure on completion [kPa]	640	640	490
Cell pressure on completion [kPa]	650	650	500
B value achieved	0.92	0.92	0.92

Consolidation: Isotropic	Specimen 1	Specimen 2	Specimen 3
Cell pressure [kPa]	724	761	684
Back pressure [kPa]	650	650	500
Effective cell pressure [kPa]	74	111	184
Pore pressure on completion [kPa]	650	653	500
Pore pressure dissipation [%]	101	96	100
Water content [%]	14.8	14.8	14.7
Bulk density [Mg/m^3]	2.19	2.18	2.19
Dry density [Mg/m^3]	1.90	1.90	1.91
Void ratio [-]	0.392	0.393	0.389
Degree of saturation [%]	100	100	100
Axial strain [%]	0.16	0.20	0.33
Volumetric strain [%]	0.49	0.60	1.00
Volumetric strain rate-end of stage [%/hr]	0.00	0.00	0.00

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Test page CID36-2/8

Laboratory: Wallingford, UK
Z5_OWF_BH03-COMP / 04-1 / 11.5

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Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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Shearing	Specimen 1	Specimen 2	Specimen 3
Initial pore pressure [kPa]	650	653	500
Initial effective cell pressure [kPa]	74	108	184
Rate of strain [%/hour]	1.30	1.30	1.30
At peak deviator stress			
Corrected deviator stress [kPa]	409	581	1049
Membrane correction applied [kPa]	0.7	0.8	0.7
Drain correction applied [kPa]	0	0	0
Axial strain [%]	2.72	3.02	2.56
Volumetric strain [%]	-1.28	-1.09	-1.03
Major principal effective stress [kPa]	485	691	1234
Minor principal effective stress [kPa]	77	110	185
Principal effective stress ratio	6.33	6.29	6.68
ε_{50} [%]	0.92	0.92	0.84
Secant modulus (E_{50}) at ε_{50} [kPa]	22146	31480	62513
At peak principal effective stress ratio			
Corrected deviator stress [kPa]	408	581	1049
Membrane correction applied [kPa]	0.7	0.8	0.6
Drain correction applied [kPa]	0	0	0
Axial strain [%]	2.85	3.02	2.43
Volumetric strain [%]	-1.42	-1.09	-0.88
Major principal effective stress [kPa]	484	691	1234
Minor principal effective stress [kPa]	76	110	185
Principal effective stress ratio	6.34	6.29	6.68
At 10% axial strain			
Corrected deviator stress [kPa]	205	316	515
Membrane correction applied [kPa]	2.3	2.3	2.3
Drain correction applied [kPa]	0	0	0
Axial strain [%]	10.00	10.00	10.00
Volumetric strain [%]	-3.85	-3.18	-3.13
Major principal effective stress [kPa]	282	426	699
Minor principal effective stress [kPa]	77	110	185
Principal effective stress ratio	3.67	3.89	3.78

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Laboratory: Wallingford, UK
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Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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Photographs

Specimen 1	Specimen 2	Specimen 3
Photograph Unavailable	Photograph Unavailable	Photograph Unavailable

Final Conditions	Specimen 1	Specimen 2	Specimen 3
Water content [%]	16.9	16.8	16.5
Bulk density [Mg/m^3]	2.14	2.14	2.15
Dry density [Mg/m^3]	1.83	1.83	1.84
Mode of failure	Compound failure	Compound failure	Compound failure

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Laboratory: Wallingford, UK
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Approved by: ET - 19/08/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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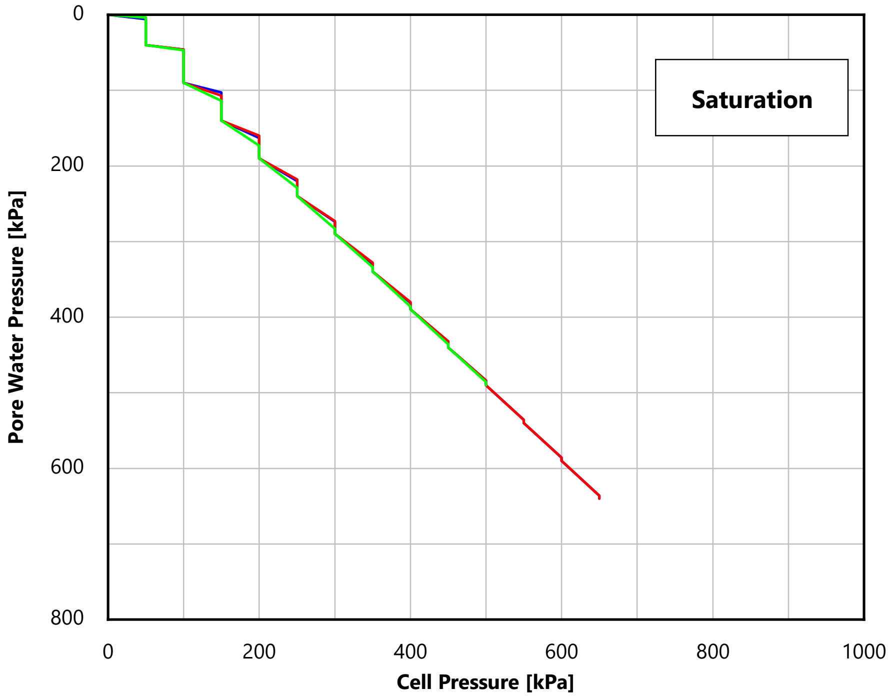

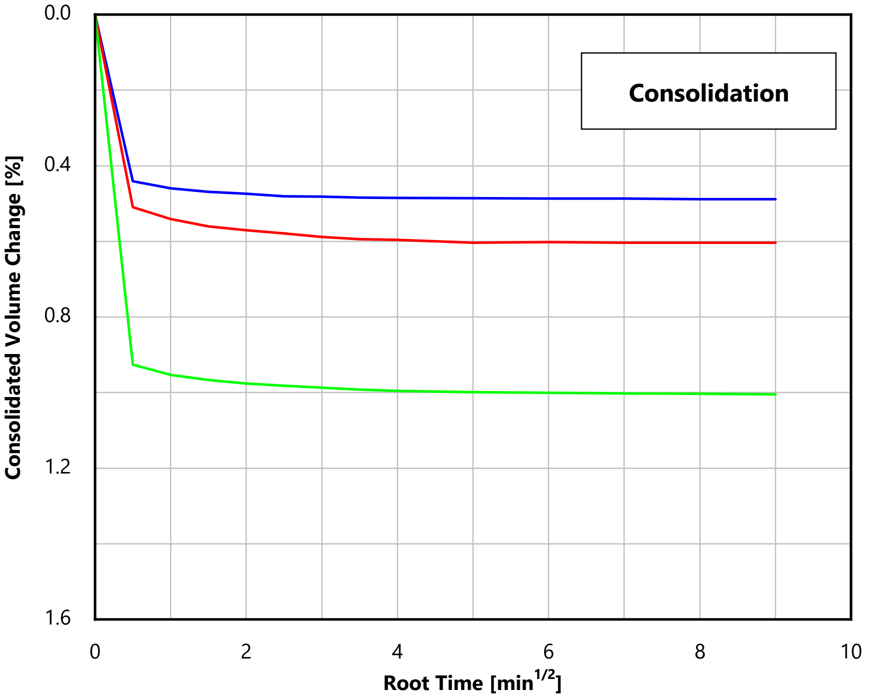

Consolidation

Stage 1 σ'_{rc} : 74 kPa	Stage 2 σ'_{rc} : 111 kPa	Stage 3 σ'_{rc} : 184 kPa	🟦	1
Stage 1 σ'_{vc} : 74 kPa	Stage 2 σ'_{vc} : 111 kPa	Stage 3 σ'_{vc} : 184 kPa	🟥	2
			🟩	3

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Laboratory: Wallingford, UK
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Approved by: ET 19/08/2025

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Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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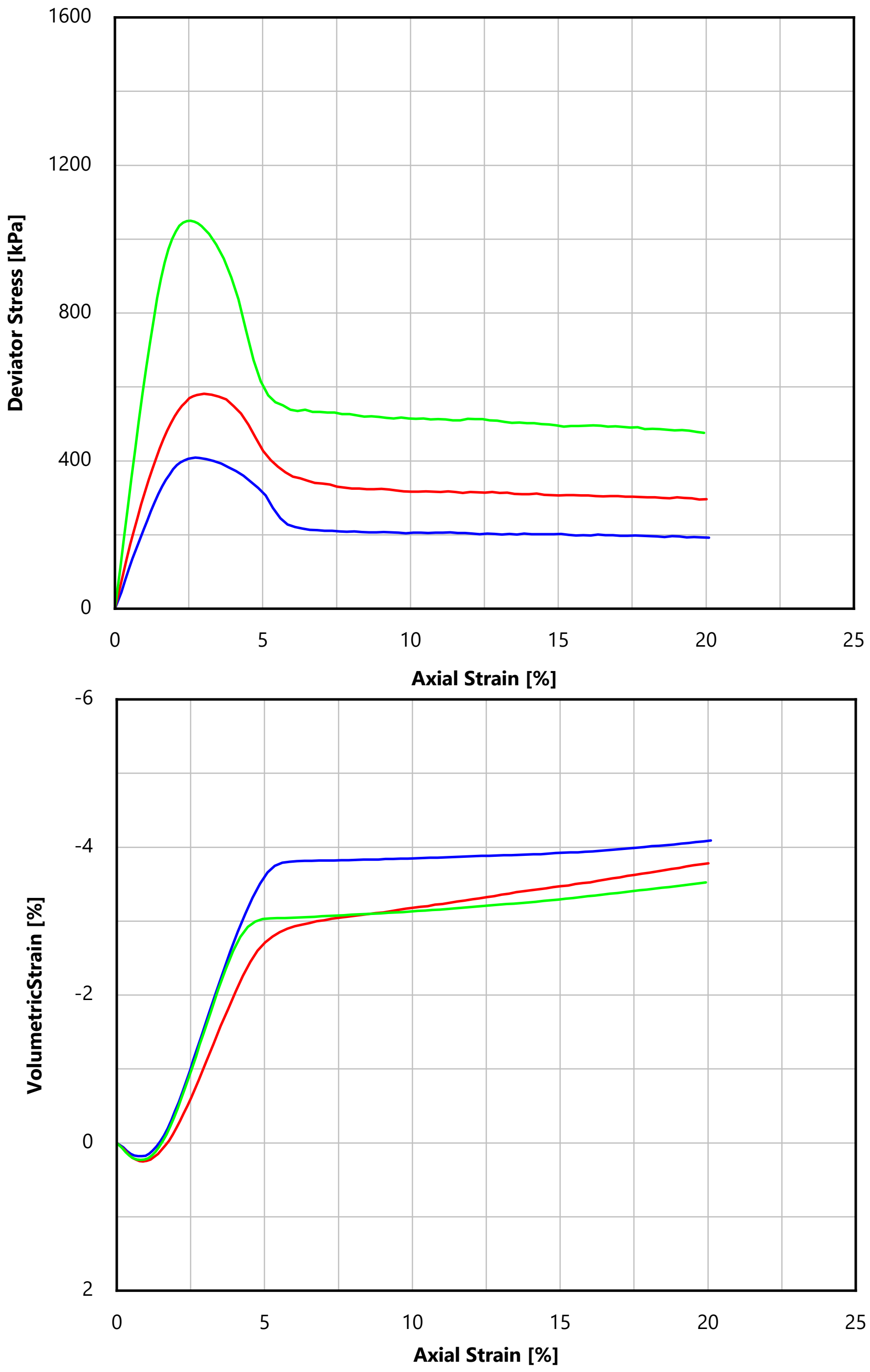
Shearing



Consolidation			
			— 1
Stage 1 σ'_{rc} : 74 kPa	Stage 2 σ'_{rc} : 111 kPa	Stage 3 σ'_{rc} : 184 kPa	— 2
Stage 1 σ'_{vc} : 74 kPa	Stage 2 σ'_{vc} : 111 kPa	Stage 3 σ'_{vc} : 184 kPa	— 3

Project: 503387 - F254727
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Laboratory: Wallingford, UK
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Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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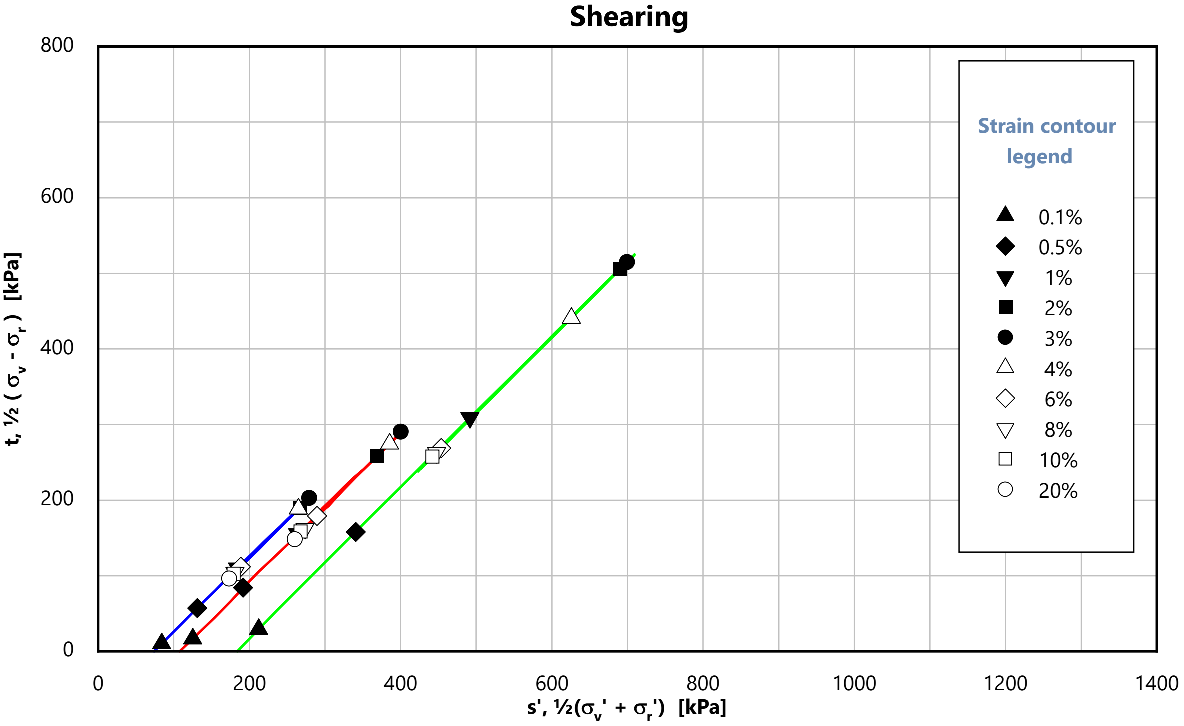

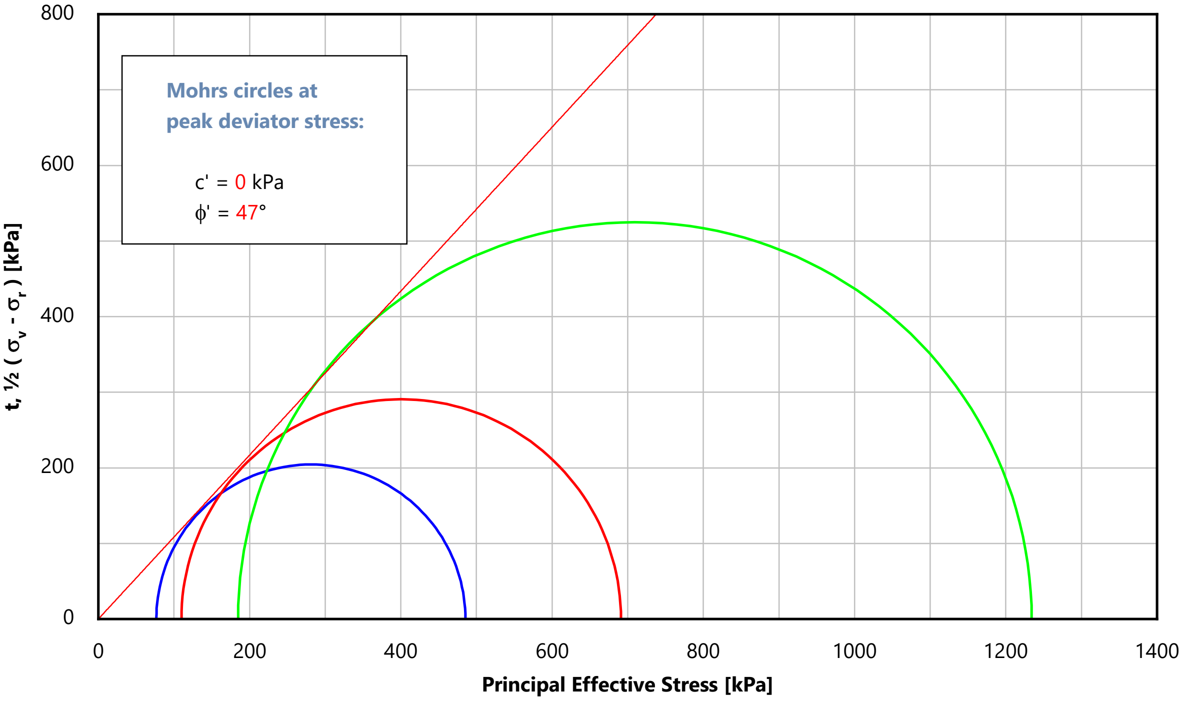

Consolidation				
Stage 1 σ'$_{rc}$: 74 kPa	Stage 2 σ'$_{rc}$: 111 kPa	Stage 3 σ'$_{rc}$: 184 kPa	—	1
Stage 1 σ'$_{vc}$: 74 kPa	Stage 2 σ'$_{vc}$: 111 kPa	Stage 3 σ'$_{vc}$: 184 kPa	—	2
			—	3

Project: 503387 - F254727
CID36

Laboratory: Wallingford, UK
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Approved by: ET 19/08/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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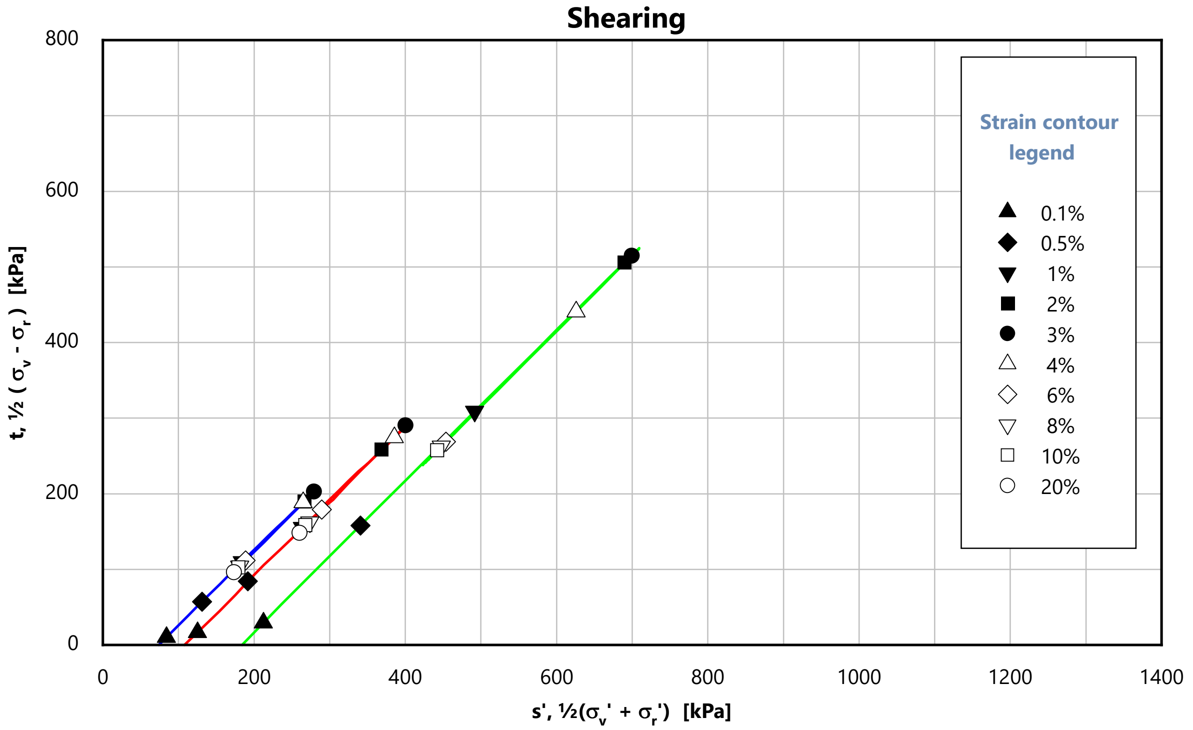

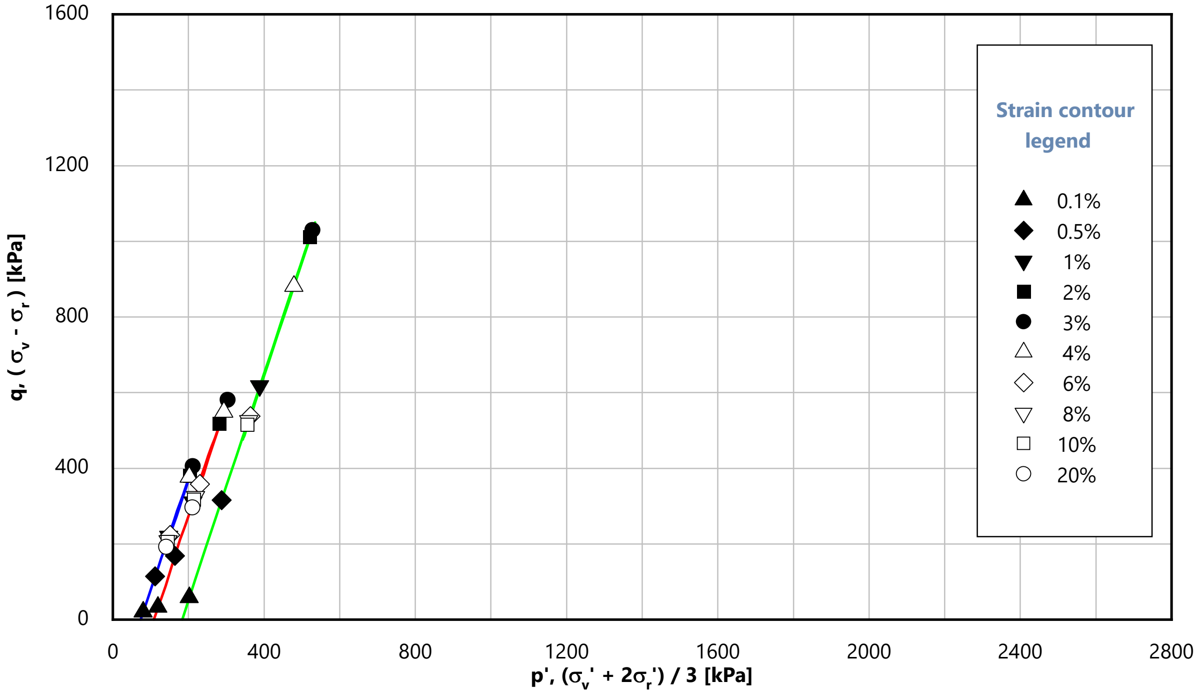

Consolidation				
Stage 1 σ'$_{rc}$: 74 kPa	Stage 2 σ'$_{rc}$: 111 kPa	Stage 3 σ'$_{rc}$: 184 kPa	▬	1
Stage 1 σ'$_{vc}$: 74 kPa	Stage 2 σ'$_{vc}$: 111 kPa	Stage 3 σ'$_{vc}$: 184 kPa	▬	2
			▬	3

Project: 503387 - F254727
CID36

Laboratory: Wallingford, UK
Z5_OWF_BH03-COMP / 04-1 / 11.5

Approved by: ET 19/08/2025

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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Test Identification	Specimen 1	Specimen 2	Specimen 3
Location	Z5_OWF_BH03-COMP	Z5_OWF_BH03-COMP	Z5_OWF_BH03-COMP
Sample	05-1	05-1	05-1
Depth [m]	15.00	15.00	15.00
Test number	CID37a	CID37b	CID37c

Specimen Visual Description
Greyish brown fine to medium SAND

Initial Specimen Conditions	Specimen 1	Specimen 2	Specimen 3
Test start date	31/03/2025	26/03/2025	31/03/2025
Type of sample	Recompacted	Recompacted	Recompacted
Diameter [mm]	50.8	50.8	50.8
Length [mm]	95.0	95.0	95.0
Water content [%]	10.1	10.1	10.1
Bulk density [Mg/m^3]	2.07	2.08	2.08
Dry density [Mg/m^3]	1.88	1.89	1.89
Void ratio [-]	0.408	0.406	0.403
Degree of saturation [%]	66	66	66
Type of drains fitted	One end	One end	One end

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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Saturation	Specimen 1	Specimen 2	Specimen 3
Pressure increments applied [kPa]	50	50	50
Differential pressure used [kPa]	10	10	10
Pore pressure on completion [kPa]	390	440	590
Cell pressure on completion [kPa]	400	450	600
B value achieved	0.96	0.92	0.92

Consolidation: Isotropic	Specimen 1	Specimen 2	Specimen 3
Cell pressure [kPa]	497	595	842
Back pressure [kPa]	400	450	600
Effective cell pressure [kPa]	97	145	242
Pore pressure on completion [kPa]	400	450	600
Pore pressure dissipation [%]	100	100	100
Water content [%]	15.0	14.7	14.6
Bulk density [Mg/m^3]	2.18	2.19	2.19
Dry density [Mg/m^3]	1.90	1.91	1.91
Void ratio [-]	0.397	0.391	0.386
Degree of saturation [%]	100	100	100
Axial strain [%]	0.25	0.35	0.40
Volumetric strain [%]	0.75	1.06	1.21
Volumetric strain rate-end of stage [%/hr]	0.00	0.03	0.00

Project: 503387 - F254727
Test page CID37-2/8

Laboratory: Wallingford, UK
Z5_OWF_BH03-COMP / 05-1 / 15

Approved by: ET - 19/08/2025

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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Shearing	Specimen 1	Specimen 2	Specimen 3
Initial pore pressure [kPa]	400	450	600
Initial effective cell pressure [kPa]	97	145	242
Rate of strain [%/hour]	1.30	1.30	1.30
At peak deviator stress			
Corrected deviator stress [kPa]	625	828	1505
Membrane correction applied [kPa]	0.6	0.6	0.8
Drain correction applied [kPa]	0	0	0
Axial strain [%]	2.35	2.47	3.07
Volumetric strain [%]	-1.25	-1.01	-0.84
Major principal effective stress [kPa]	722	974	1749
Minor principal effective stress [kPa]	97	146	244
Principal effective stress ratio	7.48	6.68	7.17
ε_{50} [%]	0.68	0.72	1.18
Secant modulus (E_{50}) at ε_{50} [kPa]	45826	57709	63746
At peak principal effective stress ratio			
Corrected deviator stress [kPa]	624	828	1505
Membrane correction applied [kPa]	0.6	0.7	0.8
Drain correction applied [kPa]	0	0	0
Axial strain [%]	2.23	2.60	3.07
Volumetric strain [%]	-1.09	-1.15	-0.84
Major principal effective stress [kPa]	720	973	1749
Minor principal effective stress [kPa]	96	146	244
Principal effective stress ratio	7.51	6.68	7.17
At 10% axial strain			
Corrected deviator stress [kPa]	303	413	706
Membrane correction applied [kPa]	2.2	2.2	2.2
Drain correction applied [kPa]	0	0	0
Axial strain [%]	10.00	10.00	10.00
Volumetric strain [%]	-3.70	-3.89	-2.64
Major principal effective stress [kPa]	399	559	950
Minor principal effective stress [kPa]	96	147	244
Principal effective stress ratio	4.16	3.82	3.90

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Laboratory: Wallingford, UK
Z5_OWF_BH03-COMP / 05-1 / 15

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Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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Photographs

Specimen 1	Specimen 2	Specimen 3
Photograph Unavailable	Photograph Unavailable	Photograph Unavailable

Final Conditions	Specimen 1	Specimen 2	Specimen 3
Water content [%]	17.2	17.1	16.1
Bulk density [Mg/m^3]	2.13	2.14	2.16
Dry density [Mg/m^3]	1.82	1.82	1.86
Mode of failure	Compound failure	Compound failure	Compound failure

Project: 503387 - F254727
Test page CID37-4/8

Laboratory: Wallingford, UK
Z5_OWF_BH03-COMP / 05-1 / 15

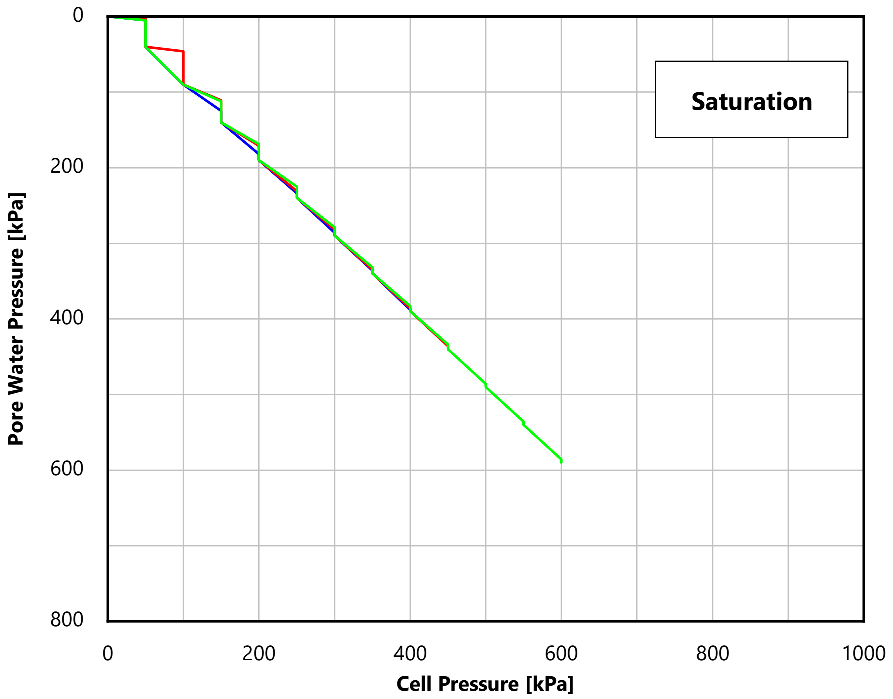
Approved by: ET - 19/08/2025

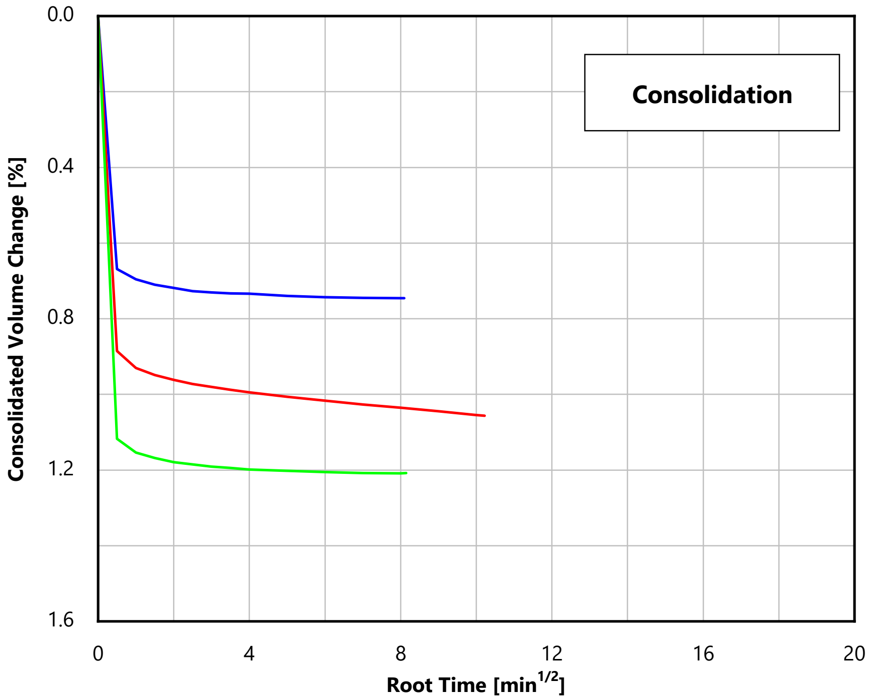
Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

0919





Consolidation

			—	1
Stage 1 σ'_{rc} : 97 kPa	Stage 2 σ'_{rc} : 145 kPa	Stage 3 σ'_{rc} : 242 kPa	—	2
Stage 1 σ'_{vc} : 97 kPa	Stage 2 σ'_{vc} : 145 kPa	Stage 3 σ'_{vc} : 242 kPa	—	3

Project: 503387 - F254727
CID37

Laboratory: Wallingford, UK
Z5_OWF_BH03-COMP / 05-1 / 15

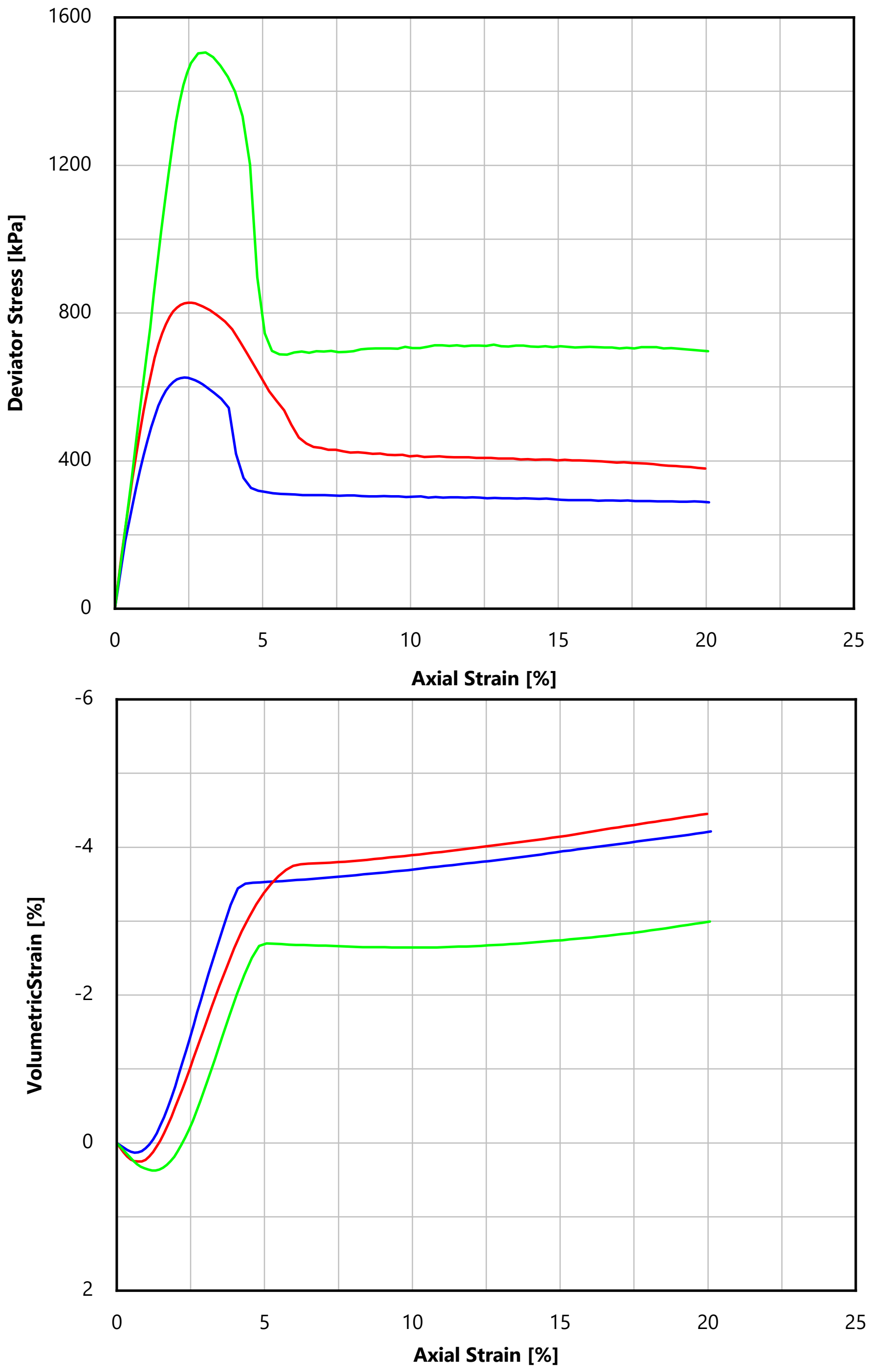
Approved by: ET 19/08/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

Shearing



Consolidation

Stage 1 σ'_{rc} : 97 kPa	Stage 2 σ'_{rc} : 145 kPa	Stage 3 σ'_{rc} : 242 kPa
Stage 1 σ'_{vc} : 97 kPa	Stage 2 σ'_{vc} : 145 kPa	Stage 3 σ'_{vc} : 242 kPa

🟦	1
🟥	2
🟩	3

Project: 503387 - F254727
CID37

Laboratory: Wallingford, UK
Z5_OWF_BH03-COMP / 05-1 / 15

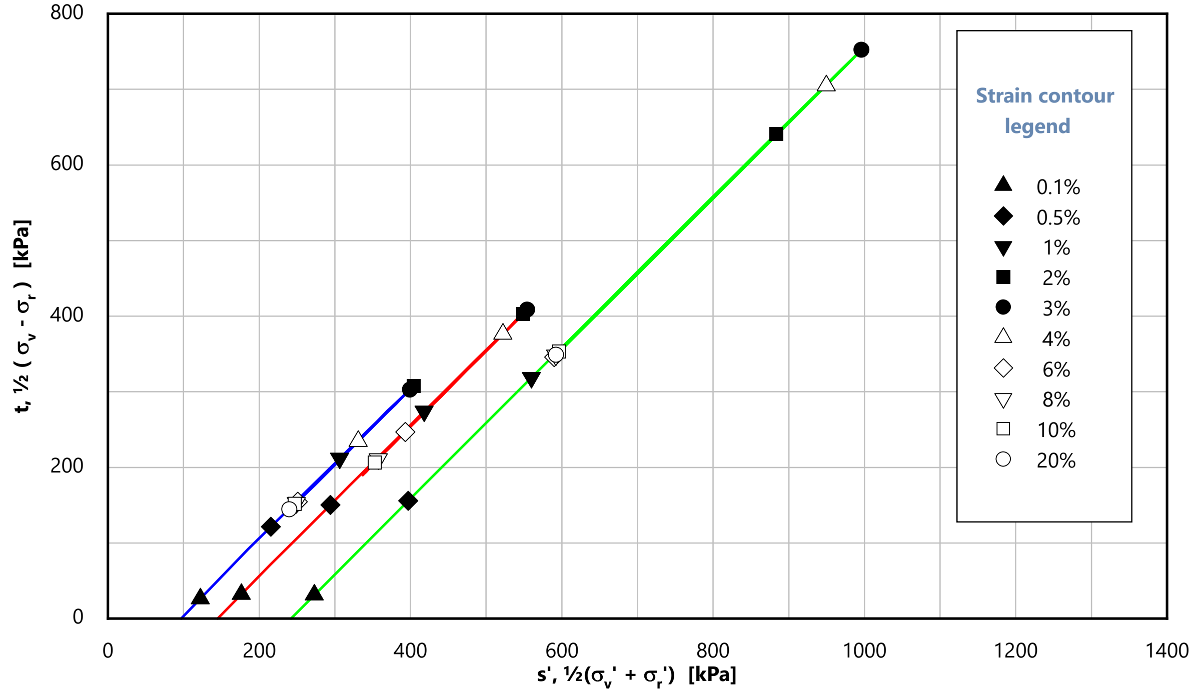
Approved by: ET 19/08/2025

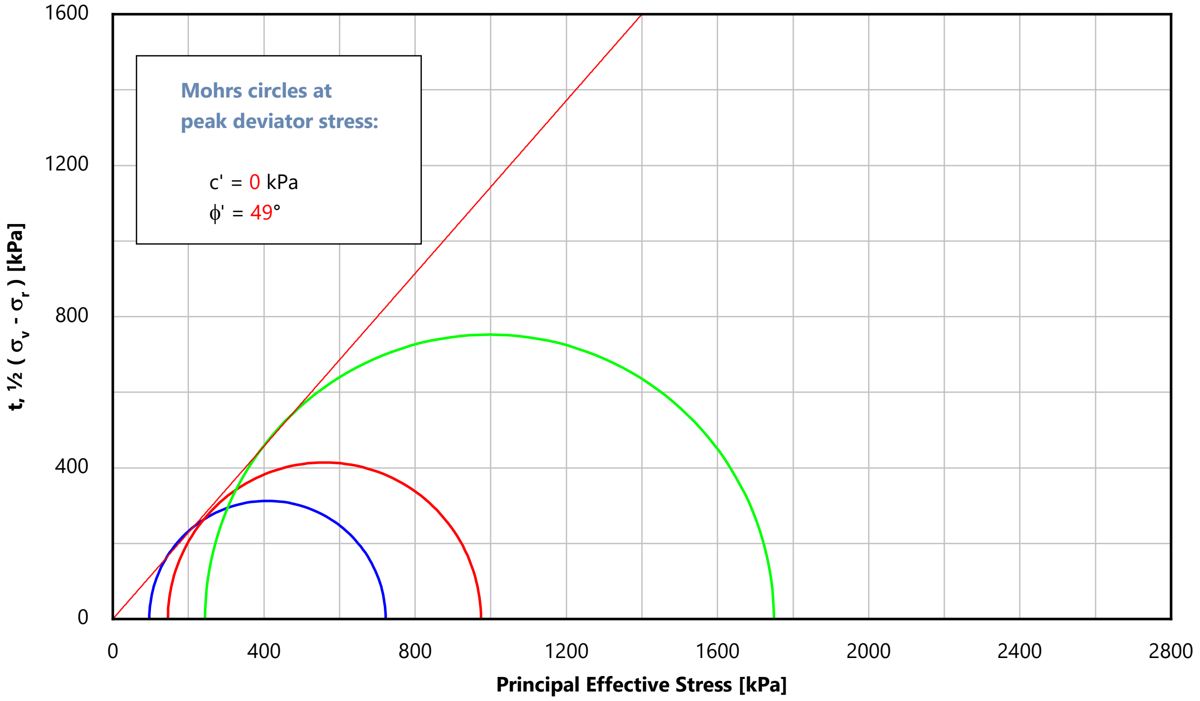
Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

Shearing





Consolidation				
Stage 1 σ'_{rc} : 97 kPa	Stage 2 σ'_{rc} : 145 kPa	Stage 3 σ'_{rc} : 242 kPa	—	1
Stage 1 σ'_{vc} : 97 kPa	Stage 2 σ'_{vc} : 145 kPa	Stage 3 σ'_{vc} : 242 kPa	—	2
			—	3

Project: 503387 - F254727
CID37

Laboratory: Wallingford, UK
Z5_OWF_BH03-COMP / 05-1 / 15

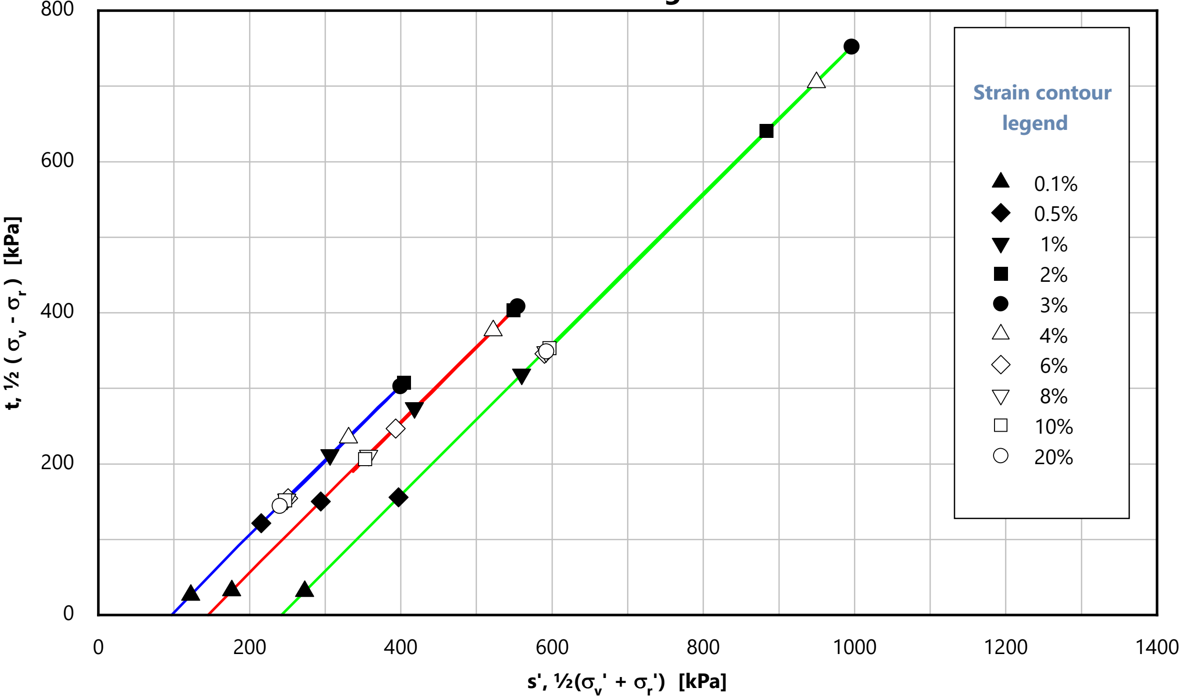
Approved by: ET 19/08/2025

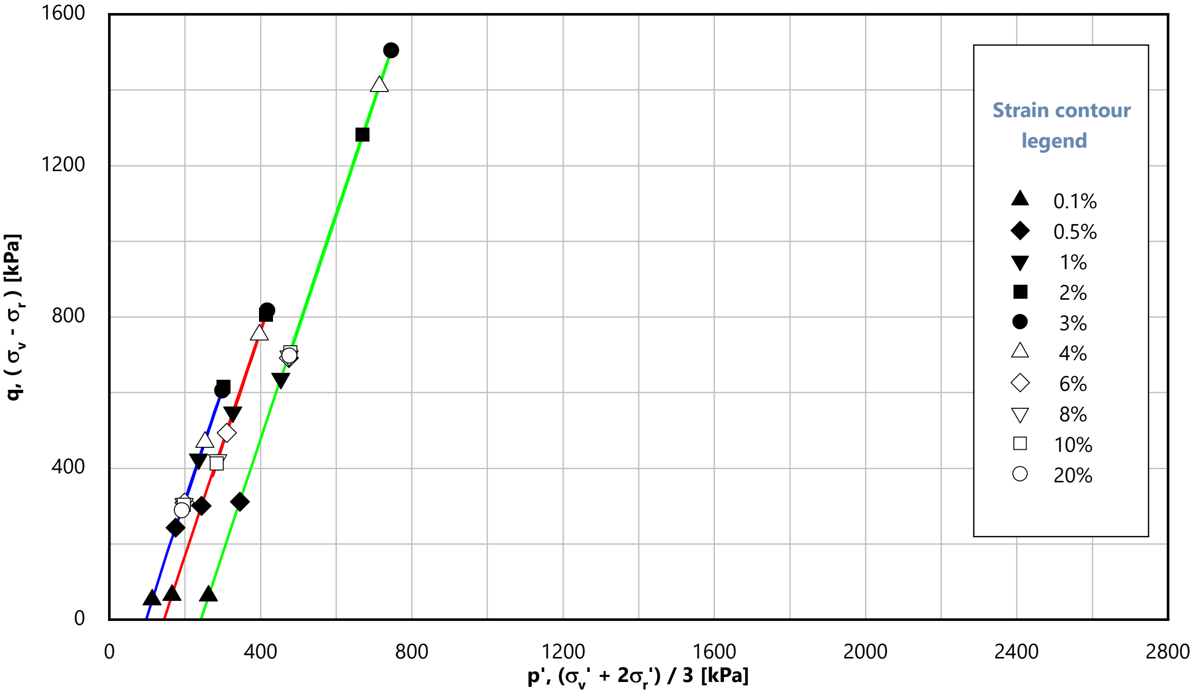
Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

Shearing





Consolidation				
Stage 1 σ'_{rc} : 97 kPa	Stage 2 σ'_{rc} : 145 kPa	Stage 3 σ'_{rc} : 242 kPa	—	1
Stage 1 σ'_{vc} : 97 kPa	Stage 2 σ'_{vc} : 145 kPa	Stage 3 σ'_{vc} : 242 kPa	—	2
			—	3

Project: 503387 - F254727
CID37

Laboratory: Wallingford, UK
Z5_OWF_BH03-COMP / 05-1 / 15

Approved by: ET 19/08/2025

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

UKAS TESTING 0919

ISO 17892-9:2018

Test Identification	Specimen 1	Specimen 2	Specimen 3
Location	Z5_OWF_BH05-COMP	Z5_OWF_BH05-COMP	Z5_OWF_BH05-COMP
Sample	04-3	04-3	04-3
Depth [m]	9.40	9.40	9.40
Test number	CID29ar	CID29b	CID29c

Specimen Visual Description
Greyish brown fine SAND

Initial Specimen Conditions	Specimen 1	Specimen 2	Specimen 3
Test start date	23/06/2025	28/04/2025	28/04/2025
Type of sample	Recompacted	Recompacted	Recompacted
Diameter [mm]	50.8	50.8	50.8
Length [mm]	95.0	95.0	95.0
Water content [%]	10.0	9.9	9.9
Bulk density [Mg/m^3]	1.74	1.74	1.74
Dry density [Mg/m^3]	1.58	1.58	1.58
Void ratio [-]	0.675	0.674	0.674
Degree of saturation [%]	39	39	39
Type of drains fitted	One end	One end	One end

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

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Saturation	Specimen 1	Specimen 2	Specimen 3
Pressure increments applied [kPa]	50	50	50
Differential pressure used [kPa]	10	10	10
Pore pressure on completion [kPa]	440	540	640
Cell pressure on completion [kPa]	450	550	650
B value achieved	0.96	0.92	0.94

Consolidation: Isotropic	Specimen 1	Specimen 2	Specimen 3
Cell pressure [kPa]	510	640	800
Back pressure [kPa]	450	550	650
Effective cell pressure [kPa]	60	90	150
Pore pressure on completion [kPa]	449	550	652
Pore pressure dissipation [%]	102	100	98
Water content [%]	25.1	24.9	24.7
Bulk density [Mg/m^3]	1.99	1.99	2.00
Dry density [Mg/m^3]	1.59	1.60	1.60
Void ratio [-]	0.666	0.659	0.655
Degree of saturation [%]	100	100	100
Axial strain [%]	0.18	0.29	0.37
Volumetric strain [%]	0.55	0.87	1.12
Volumetric strain rate-end of stage [%/hr]	0.00	0.00	0.01

Project: 503387 - F254727
Test page CID29-2/8

Laboratory: Wallingford, UK
Z5_OWF_BH05-COMP / 04-3 / 9.4

Approved by: ET - 07/07/2025

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Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

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Shearing	Specimen 1	Specimen 2	Specimen 3
Initial pore pressure [kPa]	450	550	650
Initial effective cell pressure [kPa]	60	90	150
Rate of strain [%/hour]	1.30	1.30	1.30
At peak deviator stress			
Corrected deviator stress [kPa]	132	193	341
Membrane correction applied [kPa]	2.9	2.5	3.9
Drain correction applied [kPa]	0	0	0
Axial strain [%]	13.01	10.75	20.50
Volumetric strain [%]	2.33	2.65	3.93
Major principal effective stress [kPa]	197	282	486
Minor principal effective stress [kPa]	64	89	145
Principal effective stress ratio	3.05	3.17	3.34
ε_{50} [%]	0.78	0.53	1.20
Secant modulus (E_{50}) at ε_{50} [kPa]	8474	18121	14241
At peak principal effective stress ratio			
Corrected deviator stress [kPa]	132	193	341
Membrane correction applied [kPa]	2.7	2.5	3.9
Drain correction applied [kPa]	0	0	0
Axial strain [%]	11.76	10.75	20.50
Volumetric strain [%]	2.20	2.65	3.93
Major principal effective stress [kPa]	196	282	486
Minor principal effective stress [kPa]	64	89	145
Principal effective stress ratio	3.05	3.17	3.34
At 10% axial strain			
Corrected deviator stress [kPa]	131	190	323
Membrane correction applied [kPa]	2.4	2.4	2.4
Drain correction applied [kPa]	0	0	0
Axial strain [%]	10.00	10.00	10.00
Volumetric strain [%]	1.99	2.57	2.71
Major principal effective stress [kPa]	195	280	469
Minor principal effective stress [kPa]	64	90	147
Principal effective stress ratio	3.04	3.11	3.20

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Test page CID29-3/8

Laboratory: Wallingford, UK
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Approved by: ET - 07/07/2025

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

Photographs		
Specimen 1	**Specimen 2**	**Specimen 3**
Photograph Unavailable	Photograph Unavailable	

Final Conditions	Specimen 1	Specimen 2	Specimen 3
Water content [%]	23.4	22.8	22.3
Bulk density [Mg/m^3]	2.02	2.03	2.04
Dry density [Mg/m^3]	1.64	1.65	1.67
Mode of failure	Barrel	Barrel	Barrel

Project: 503387 - F254727
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Laboratory: Wallingford, UK
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Approved by: ET - 07/07/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

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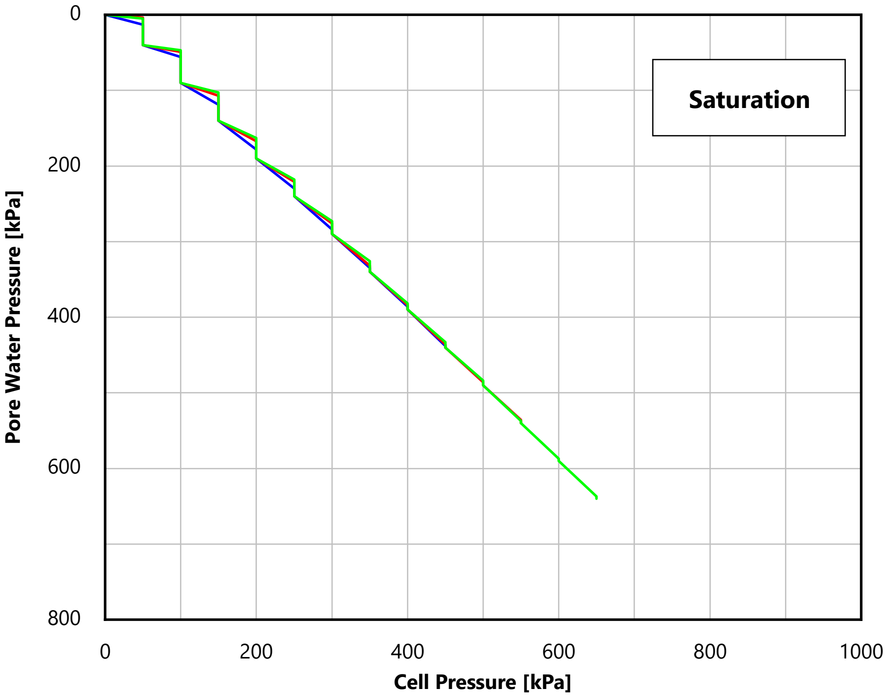

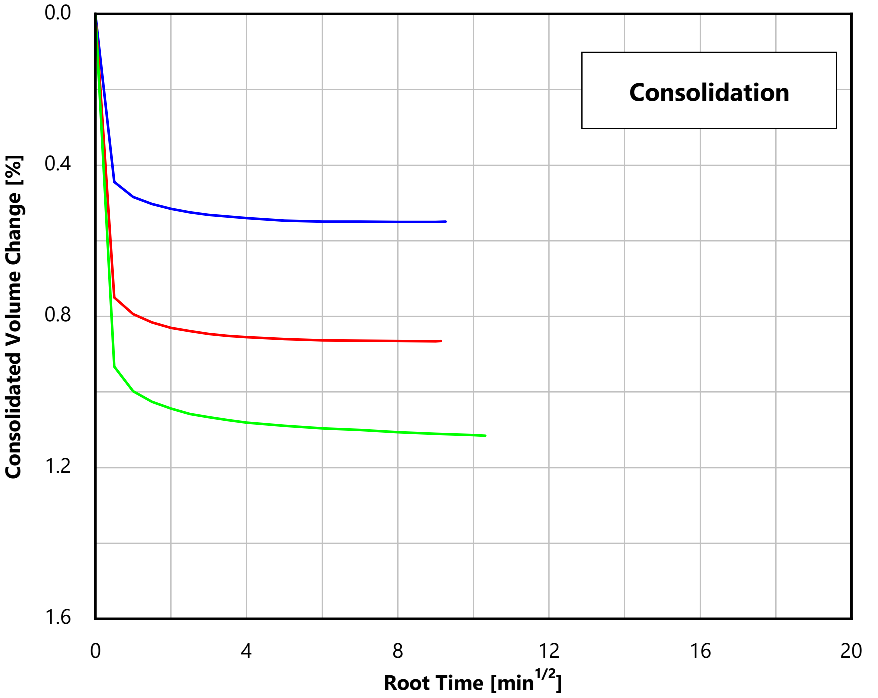

Consolidation				
Stage 1 σ'$_{rc}$: 60 kPa	Stage 2 σ'$_{rc}$: 90 kPa	Stage 3 σ'$_{rc}$: 150 kPa	🟦	1
Stage 1 σ'$_{vc}$: 60 kPa	Stage 2 σ'$_{vc}$: 90 kPa	Stage 3 σ'$_{vc}$: 150 kPa	🟥	2
			🟩	3

Project: 503387 - F254727
CID29

Laboratory: Wallingford, UK
Z5_OWF_BH05-COMP / 04-3 / 9.4

Approved by: ET 07/07/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils

Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

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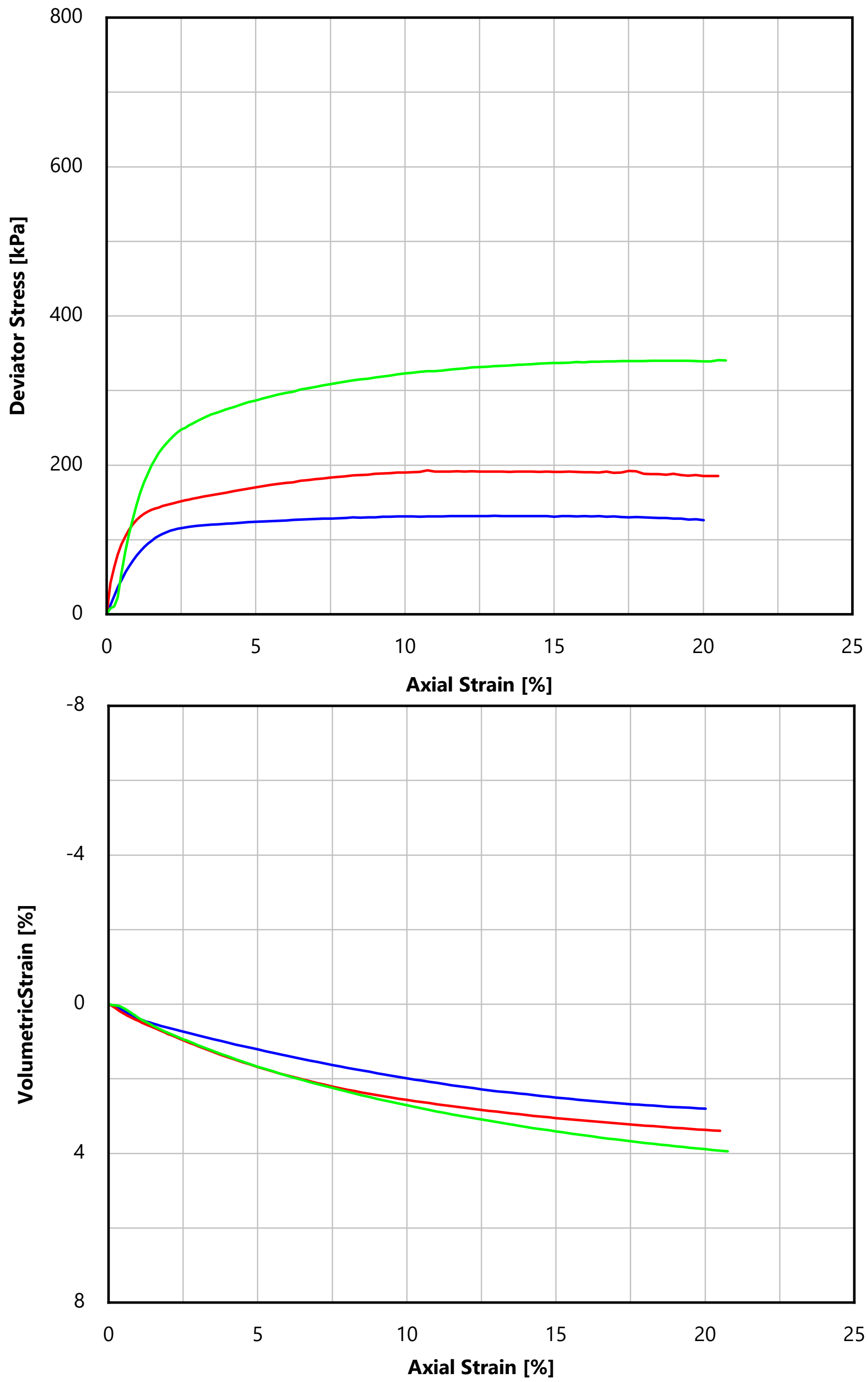
Shearing



Consolidation				
			🟦	1
Stage 1 σ'$_{rc}$: 60 kPa	Stage 2 σ'$_{rc}$: 90 kPa	Stage 3 σ'$_{rc}$: 150 kPa	🟥	2
Stage 1 σ'$_{vc}$: 60 kPa	Stage 2 σ'$_{vc}$: 90 kPa	Stage 3 σ'$_{vc}$: 150 kPa	🟩	3

Project: 503387 - F254727
CID29

Laboratory: Wallingford, UK
Z5_OWF_BH05-COMP / 04-3 / 9.4

Approved by: ET 07/07/2025

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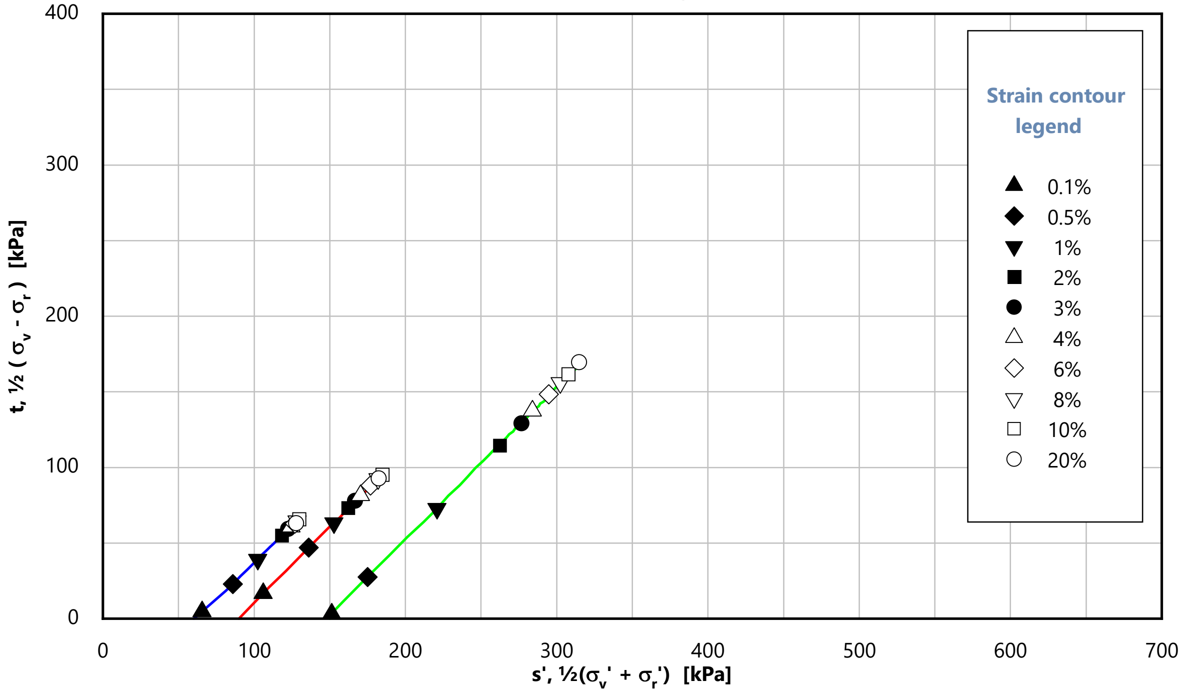
Test Report

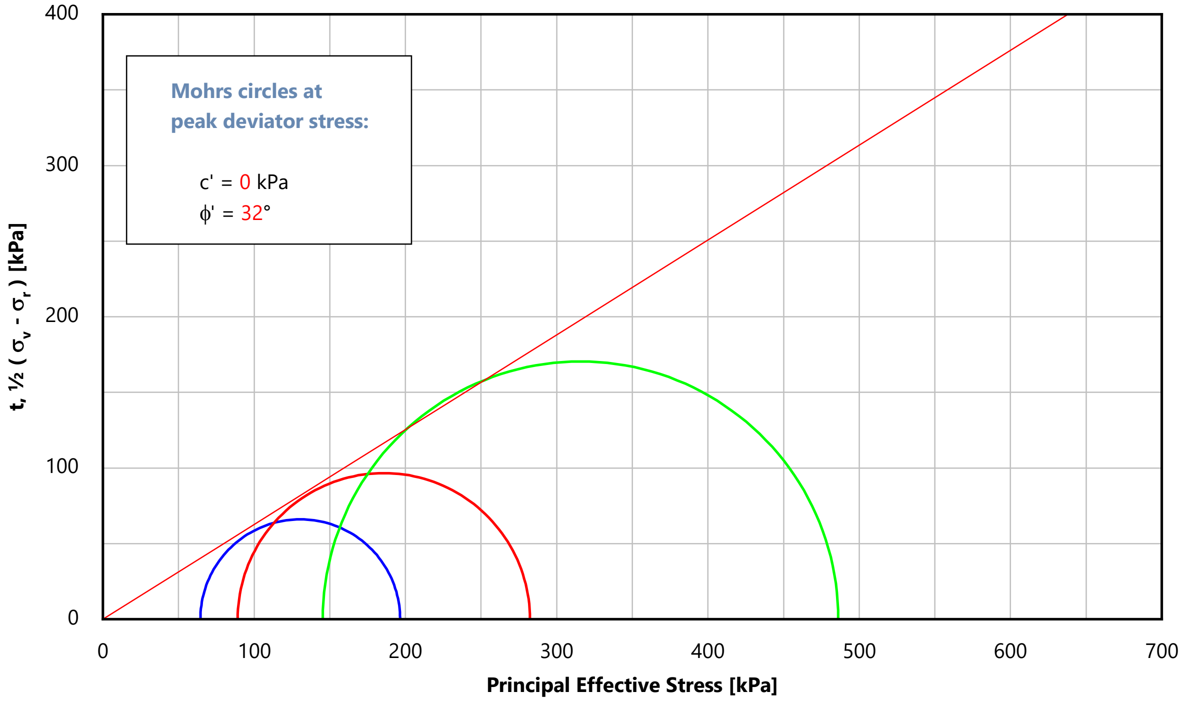
Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

UKAS TESTING 0919

Shearing





Consolidation				
Stage 1 σ'$_{rc}$: 60 kPa	Stage 2 σ'$_{rc}$: 90 kPa	Stage 3 σ'$_{rc}$: 150 kPa	🟦	1
Stage 1 σ'$_{vc}$: 60 kPa	Stage 2 σ'$_{vc}$: 90 kPa	Stage 3 σ'$_{vc}$: 150 kPa	🟥	2
			🟩	3

Project: 503387 - F254727
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Approved by: ET 07/07/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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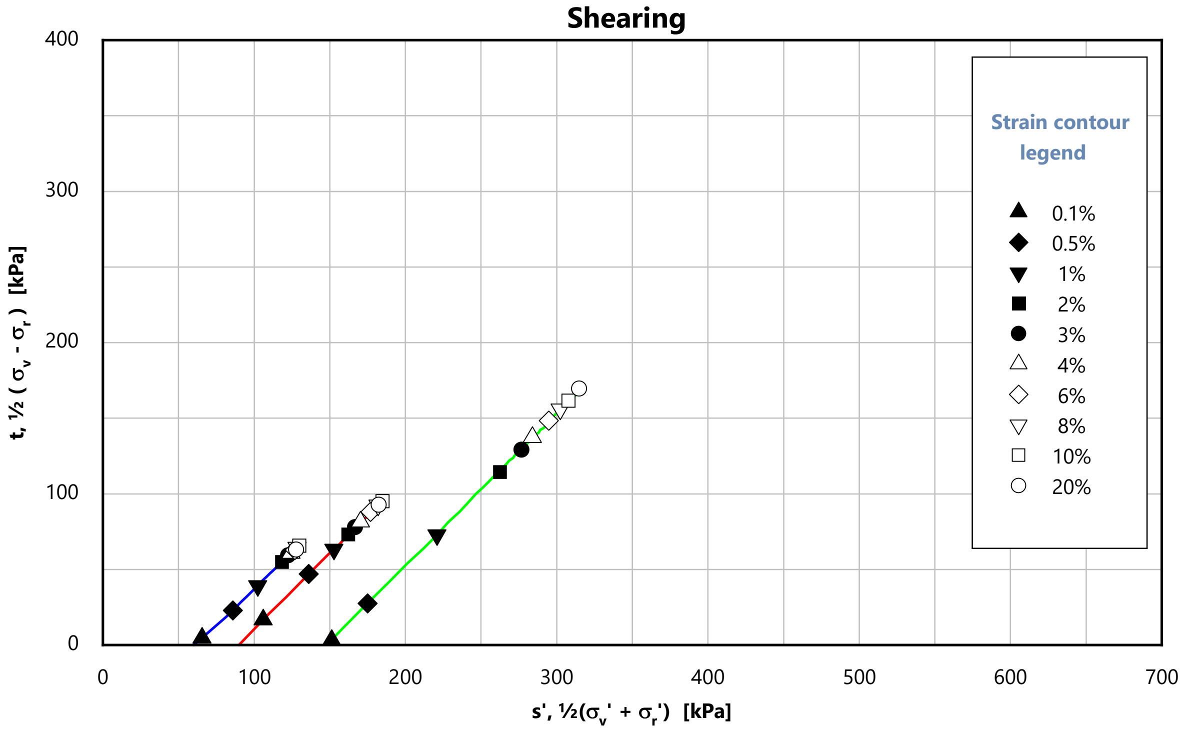

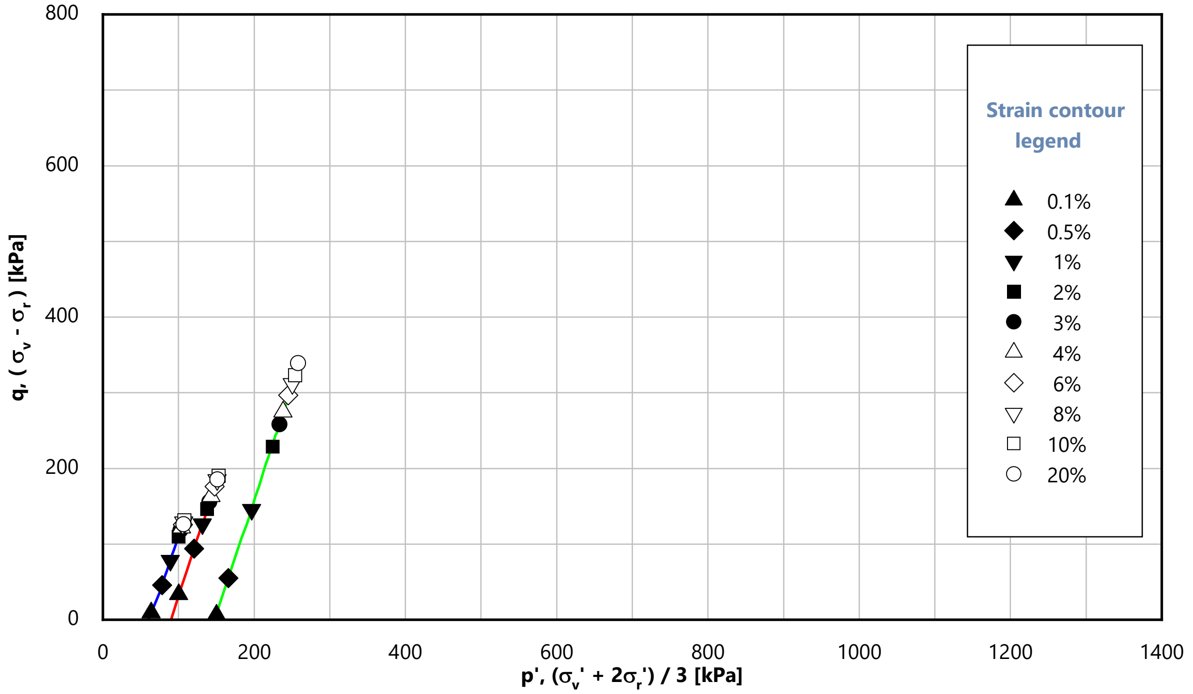

Consolidation				
Stage 1 σ'_{rc} : 60 kPa	Stage 2 σ'_{rc} : 90 kPa	Stage 3 σ'_{rc} : 150 kPa	—	1
Stage 1 σ'_{vc} : 60 kPa	Stage 2 σ'_{vc} : 90 kPa	Stage 3 σ'_{vc} : 150 kPa	—	2
			—	3

Project: 503387 - F254727
CID29

Laboratory: Wallingford, UK
Z5_OWF_BH05-COMP / 04-3 / 9.4

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Test Report
Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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Test Identification	Specimen 1	Specimen 2	Specimen 3
Location	Z5_OWF_BH05-COMP	Z5_OWF_BH05-COMP	Z5_OWF_BH05-COMP
Sample	06-1	06-1	06-1
Depth [m]	17.00	17.00	17.00
Test number	CID30a	CID30b	CID30c

Specimen Visual Description
Grey fine SAND

Initial Specimen Conditions	Specimen 1	Specimen 2	Specimen 3
Test start date	31/03/2025	31/03/2025	25/03/2025
Type of sample	Recompacted	Recompacted	Recompacted
Diameter [mm]	50.8	50.8	50.8
Length [mm]	95.0	95.0	95.0
Water content [%]	9.9	9.9	10.1
Bulk density [Mg/m^3]	2.09	2.09	2.15
Dry density [Mg/m^3]	1.90	1.90	1.95
Void ratio [-]	0.393	0.392	0.358
Degree of saturation [%]	67	67	75
Type of drains fitted	One end	One end	One end

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Test page CID30-1/8

Laboratory: Wallingford, UK
Z5_OWF_BH05-COMP / 06-1 / 17

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Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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Saturation	Specimen 1	Specimen 2	Specimen 3
Pressure increments applied [kPa]	50	50	50
Differential pressure used [kPa]	10	10	10
Pore pressure on completion [kPa]	590	590	540
Cell pressure on completion [kPa]	600	600	550
B value achieved	0.90	0.92	0.92

Consolidation: Isotropic	Specimen 1	Specimen 2	Specimen 3
Cell pressure [kPa]	708	762	820
Back pressure [kPa]	600	600	550
Effective cell pressure [kPa]	108	162	270
Pore pressure on completion [kPa]	600	600	550
Pore pressure dissipation [%]	100	100	100
Water content [%]	14.6	14.4	12.5
Bulk density [Mg/m^3]	2.19	2.19	2.24
Dry density [Mg/m^3]	1.91	1.92	1.99
Void ratio [-]	0.387	0.382	0.333
Degree of saturation [%]	100	100	100
Axial strain [%]	0.16	0.24	0.62
Volumetric strain [%]	0.47	0.73	1.85
Volumetric strain rate-end of stage [%/hr]	0.05	0.01	0.04

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Test page CID30-2/8

Laboratory: Wallingford, UK
Z5_OWF_BH05-COMP / 06-1 / 17

Approved by: ET - 18/08/2025

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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Shearing	Specimen 1	Specimen 2	Specimen 3
Initial pore pressure [kPa]	600	600	550
Initial effective cell pressure [kPa]	108	162	270
Rate of strain [%/hour]	1.30	1.30	1.30
At peak deviator stress			
Corrected deviator stress [kPa]	591	903	1413
Membrane correction applied [kPa]	0.9	0.8	1.1
Drain correction applied [kPa]	0	0	0
Axial strain [%]	2.65	2.50	3.35
Volumetric strain [%]	-1.13	-0.91	-0.26
Major principal effective stress [kPa]	701	1067	1683
Minor principal effective stress [kPa]	111	164	270
Principal effective stress ratio	6.33	6.52	6.23
ε_{50} [%]	0.98	0.97	1.40
Secant modulus (E_{50}) at ε_{50} [kPa]	29999	46407	50418
At peak principal effective stress ratio			
Corrected deviator stress [kPa]	591	901	1413
Membrane correction applied [kPa]	0.9	0.8	1.1
Drain correction applied [kPa]	0	0	0
Axial strain [%]	2.65	2.38	3.35
Volumetric strain [%]	-1.13	-0.78	-0.26
Major principal effective stress [kPa]	701	1064	1683
Minor principal effective stress [kPa]	111	163	270
Principal effective stress ratio	6.33	6.53	6.23
At 10% axial strain			
Corrected deviator stress [kPa]	313	490	892
Membrane correction applied [kPa]	2.9	2.9	2.9
Drain correction applied [kPa]	0	0	.
Axial strain [%]	10.00	10.00	10.00
Volumetric strain [%]	-2.71	-2.35	-1.03
Major principal effective stress [kPa]	423	654	1162
Minor principal effective stress [kPa]	111	163	270
Principal effective stress ratio	3.82	4.01	4.30

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

Photographs		
Specimen 1	**Specimen 2**	**Specimen 3**
Photograph Unavailable	Photograph Unavailable	

Final Conditions	Specimen 1	Specimen 2	Specimen 3
Water content [%]	16.2	15.6	13.1
Bulk density [Mg/m^3]	2.15	2.17	2.23
Dry density [Mg/m^3]	1.85	1.87	1.97
Mode of failure	Compound failure	Compound failure	Compound failure

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Laboratory: Wallingford, UK
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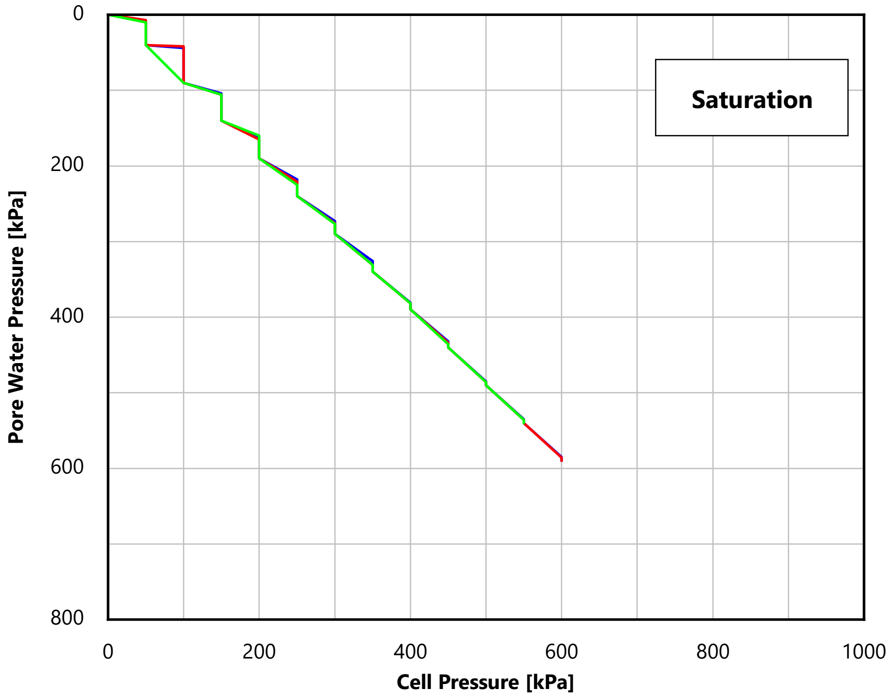

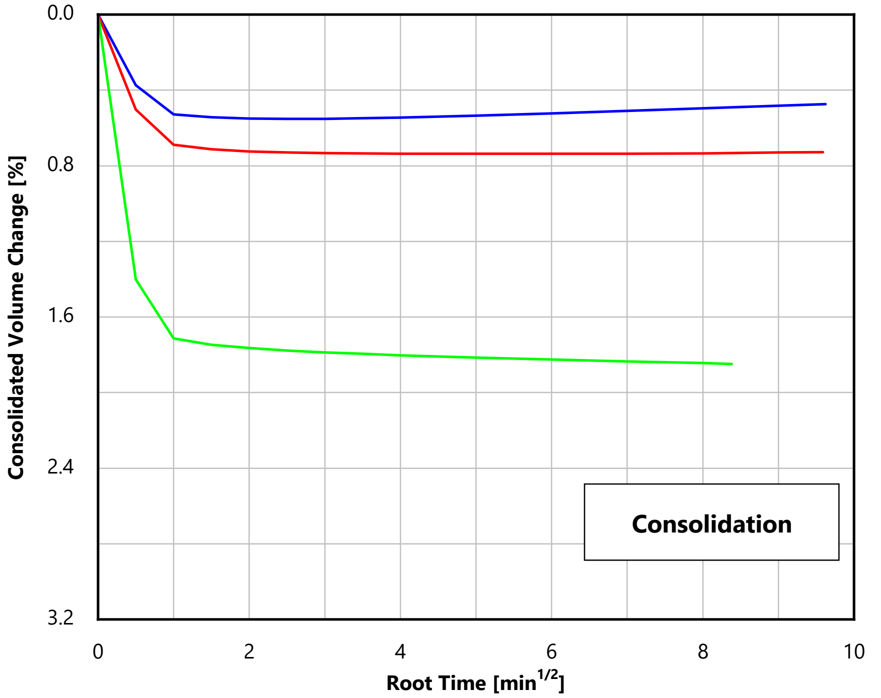

Consolidation				
Stage 1 σ'_{rc} : 108 kPa	Stage 2 σ'_{rc} : 162 kPa	Stage 3 σ'_{rc} : 270 kPa	—	1
Stage 1 σ'_{vc} : 108 kPa	Stage 2 σ'_{vc} : 162 kPa	Stage 3 σ'_{vc} : 270 kPa	—	2
			—	3

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CID30

Laboratory: Wallingford, UK
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Approved by: ET 18/08/2025

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Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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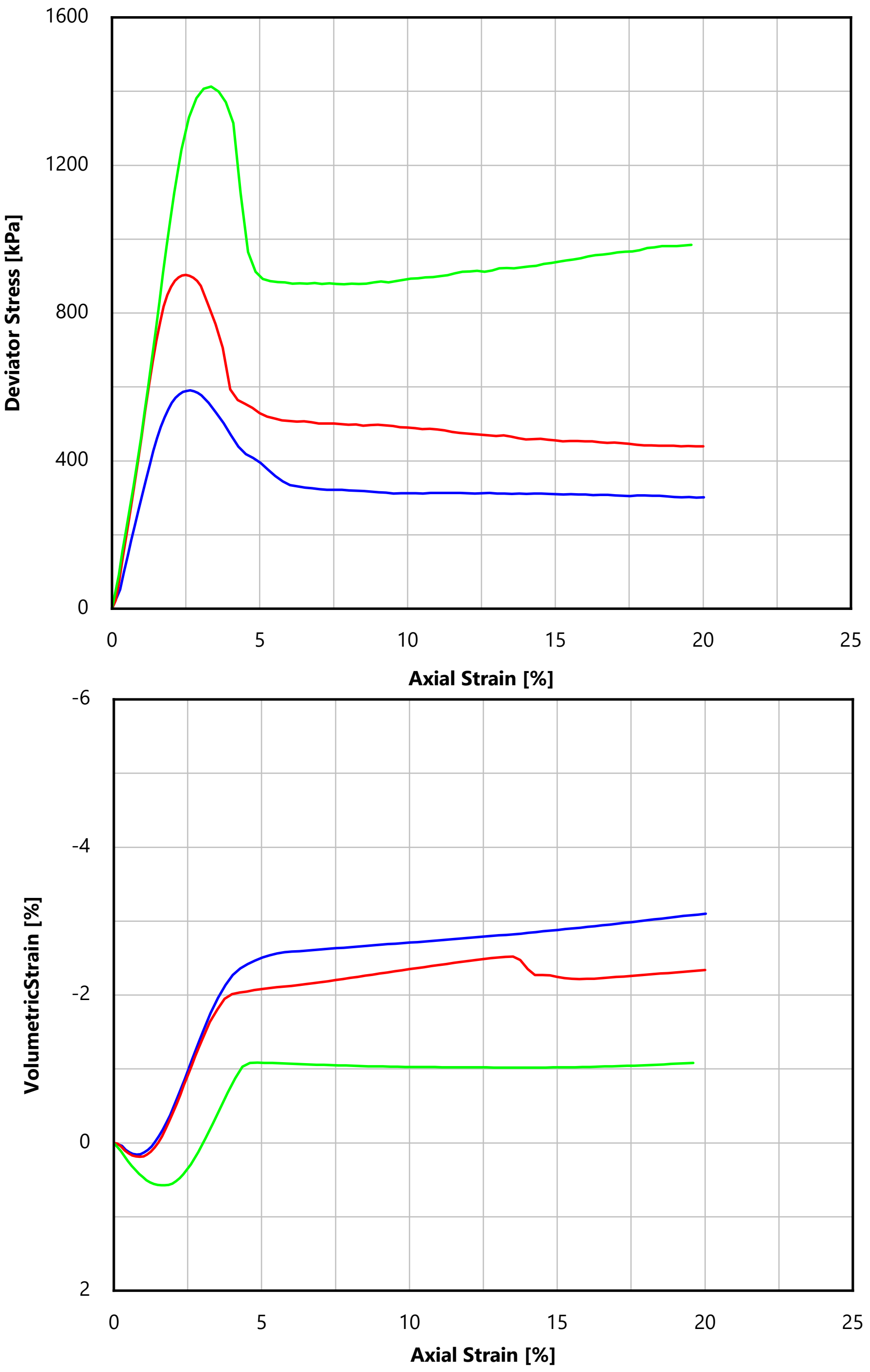
Shearing



Consolidation				
Stage 1 σ'_{rc} : 108 kPa	Stage 2 σ'_{rc} : 162 kPa	Stage 3 σ'_{rc} : 270 kPa	🟦	1
Stage 1 σ'_{vc} : 108 kPa	Stage 2 σ'_{vc} : 162 kPa	Stage 3 σ'_{vc} : 270 kPa	🟥	2
			🟩	3

Project: 503387 - F254727
CID30

Laboratory: Wallingford, UK
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Approved by: ET 18/08/2025

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Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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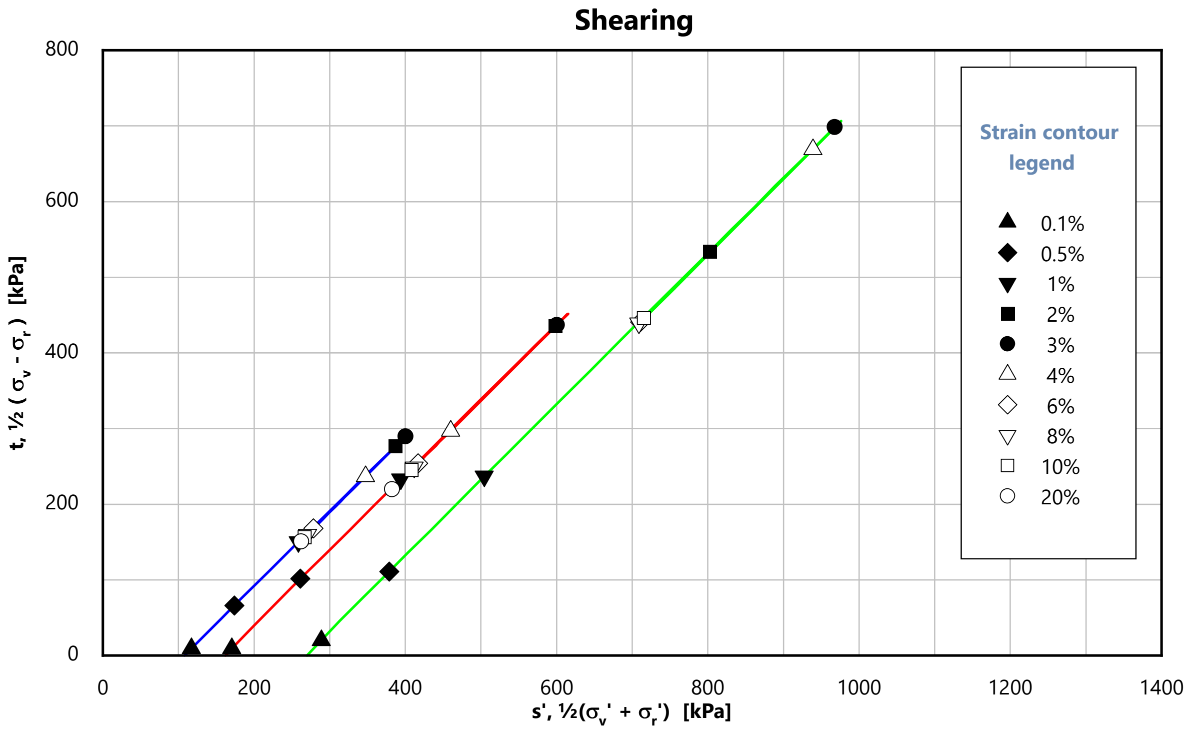

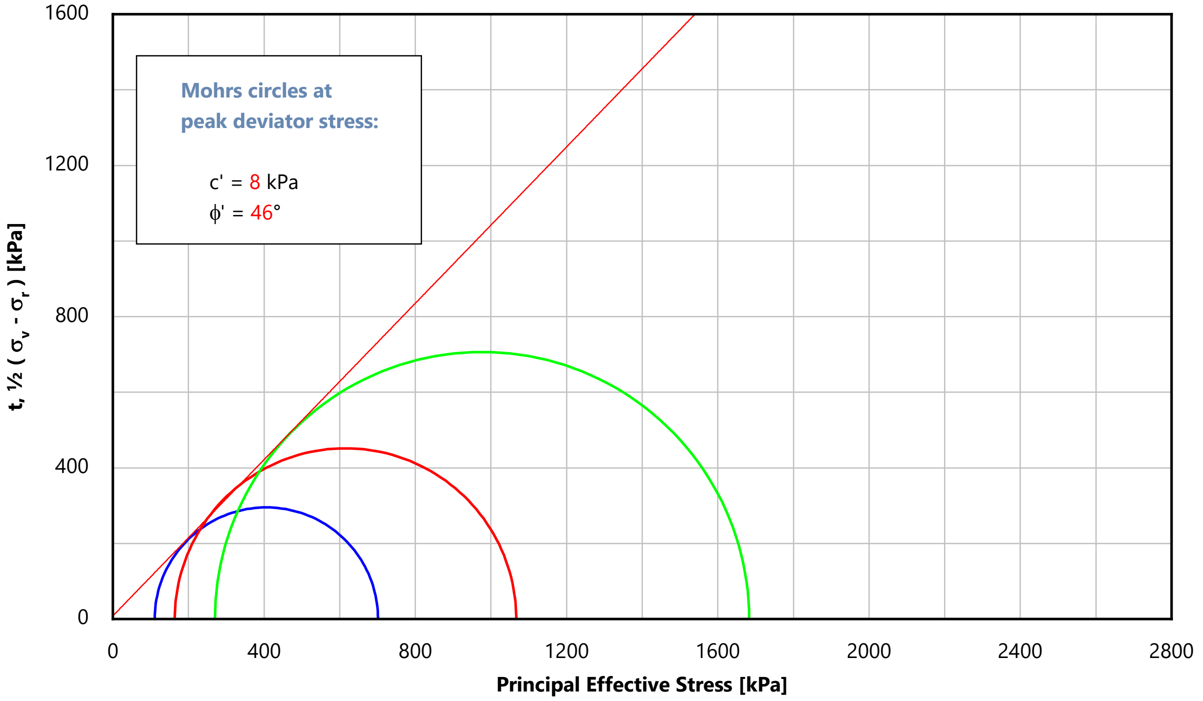

Consolidation				
Stage 1 σ'_{rc} : 108 kPa	Stage 2 σ'_{rc} : 162 kPa	Stage 3 σ'_{rc} : 270 kPa	🟦	1
Stage 1 σ'_{vc} : 108 kPa	Stage 2 σ'_{vc} : 162 kPa	Stage 3 σ'_{vc} : 270 kPa	🟥	2
			🟩	3

Project: 503387 - F254727
CID30

Laboratory: Wallingford, UK
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Approved by: ET 18/08/2025

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Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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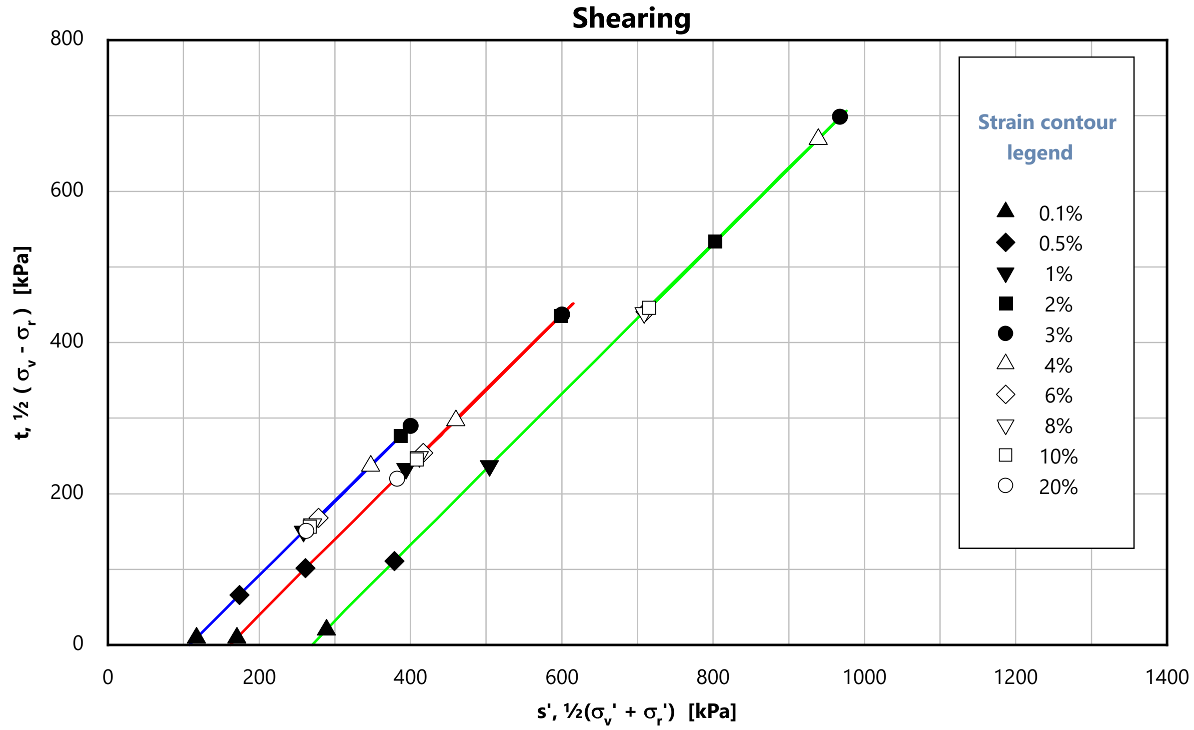
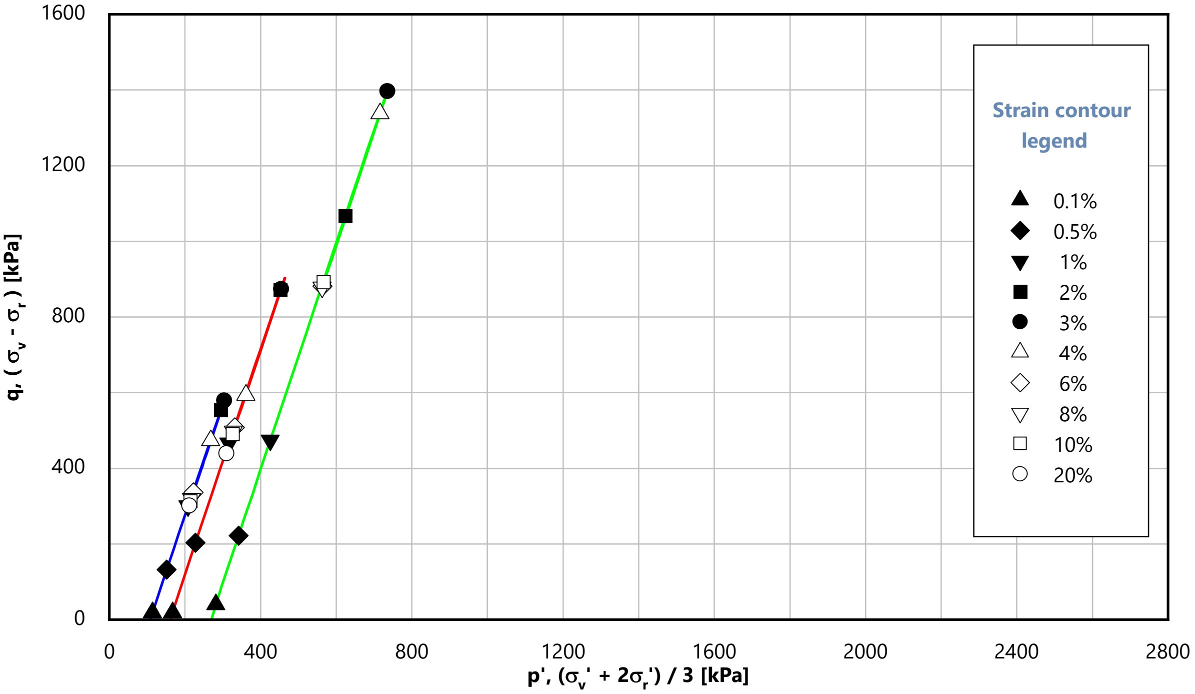
UKAS TESTING 0919





Consolidation

Stage 1 σ'_{rc} : 108 kPa	Stage 2 σ'_{rc} : 162 kPa	Stage 3 σ'_{rc} : 270 kPa	🟦	1
Stage 1 σ'_{vc} : 108 kPa	Stage 2 σ'_{vc} : 162 kPa	Stage 3 σ'_{vc} : 270 kPa	🟥	2
			🟩	3

Project: 503387 - F254727
CID30

Laboratory: Wallingford, UK
Z5_OWF_BH05-COMP / 06-1 / 17

Approved by: ET 18/08/2025

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

UKAS TESTING 0919

Test Identification	Specimen 1	Specimen 2	Specimen 3
Location	Z5_OWF_BH07-COMP_a	Z5_OWF_BH07-COMP_a	Z5_OWF_BH07-COMP_a
Sample	03-1	03-1	03-1
Depth [m]	6.50	6.50	6.50
Test number	CID31a	CID31b	CID31c

Specimen Visual Description
Yellowish brown medium SAND

Initial Specimen Conditions	Specimen 1	Specimen 2	Specimen 3
Test start date	08/04/2025	01/04/2025	09/04/2025
Type of sample	Recompacted	Recompacted	Recompacted
Diameter [mm]	50.8	50.8	50.8
Length [mm]	95.0	95.0	95.0
Water content [%]	9.9	10.1	9.8
Bulk density [Mg/m^3]	2.08	2.09	2.11
Dry density [Mg/m^3]	1.90	1.90	1.92
Void ratio [-]	0.397	0.394	0.377
Degree of saturation [%]	66	68	69
Type of drains fitted	One end	One end	One end

Project: 503387 - F254727
Test page CID31-1/8

Laboratory: Wallingford, UK
Z5_OWF_BH07-COMP_a / 03-1 / 6.5

Approved by: ET - 18/08/2025

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

UKAS TESTING 0919

Saturation	Specimen 1	Specimen 2	Specimen 3
Pressure increments applied [kPa]	40	50	50
Differential pressure used [kPa]	10	10	10
Pore pressure on completion [kPa]	430	640	340
Cell pressure on completion [kPa]	440	650	350
B value achieved	0.95	0.96	0.96

Consolidation: Isotropic	Specimen 1	Specimen 2	Specimen 3
Cell pressure [kPa]	483	714	456
Back pressure [kPa]	440	650	350
Effective cell pressure [kPa]	43	64	106
Pore pressure on completion [kPa]	440	650	350
Pore pressure dissipation [%]	100	100	100
Water content [%]	14.8	14.7	13.8
Bulk density [Mg/m^3]	2.19	2.19	2.21
Dry density [Mg/m^3]	1.90	1.91	1.94
Void ratio [-]	0.392	0.389	0.365
Degree of saturation [%]	100	100	100
Axial strain [%]	0.11	0.12	0.28
Volumetric strain [%]	0.33	0.35	0.85
Volumetric strain rate-end of stage [%/hr]	0.05	0.01	0.00

Project: 503387 - F254727
Test page CID31-2/8

Laboratory: Wallingford, UK
Z5_OWF_BH07-COMP_a / 03-1 / 6.5

Approved by: ET - 18/08/2025

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

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Shearing	Specimen 1	Specimen 2	Specimen 3
Initial pore pressure [kPa]	440	650	350
Initial effective cell pressure [kPa]	43	64	106
Rate of strain [%/hour]	1.30	1.30	1.30
At peak deviator stress			
Corrected deviator stress [kPa]	410	640	852
Membrane correction applied [kPa]	0.5	0.5	0.4
Drain correction applied [kPa]	0	0	0
Axial strain [%]	1.96	2.00	1.63
Volumetric strain [%]	-1.31	-1.43	-1.22
Major principal effective stress [kPa]	457	708	960
Minor principal effective stress [kPa]	47	69	107
Principal effective stress ratio	9.75	10.32	8.93
ε_{50} [%]	0.65	0.70	0.45
Secant modulus (E_{50}) at ε_{50} [kPa]	31785	45433	95500
At peak principal effective stress ratio			
Corrected deviator stress [kPa]	410	640	852
Membrane correction applied [kPa]	0.5	0.5	0.4
Drain correction applied [kPa]	0	0	0
Axial strain [%]	1.96	2.00	1.63
Volumetric strain [%]	-1.31	-1.43	-1.22
Major principal effective stress [kPa]	457	708	960
Minor principal effective stress [kPa]	47	69	107
Principal effective stress ratio	9.75	10.32	8.93
At 10% axial strain			
Corrected deviator stress [kPa]	164	229	383
Membrane correction applied [kPa]	2.2	2.2	2.2
Drain correction applied [kPa]	0	0	0
Axial strain [%]	10.00	10.00	10.00
Volumetric strain [%]	-3.43	-4.07	-3.38
Major principal effective stress [kPa]	212	299	490
Minor principal effective stress [kPa]	48	70	108
Principal effective stress ratio	4.44	4.27	4.55

Project: 503387 - F254727
Test page CID31-3/8

Laboratory: Wallingford, UK
Z5_OWF_BH07-COMP_a / 03-1 / 6.5

Approved by: ET - 18/08/2025

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

UKAS TESTING 0919

Photographs		
Specimen 1	**Specimen 2**	**Specimen 3**
Photograph unavailable	Photograph unavailable	Photograph unavailable

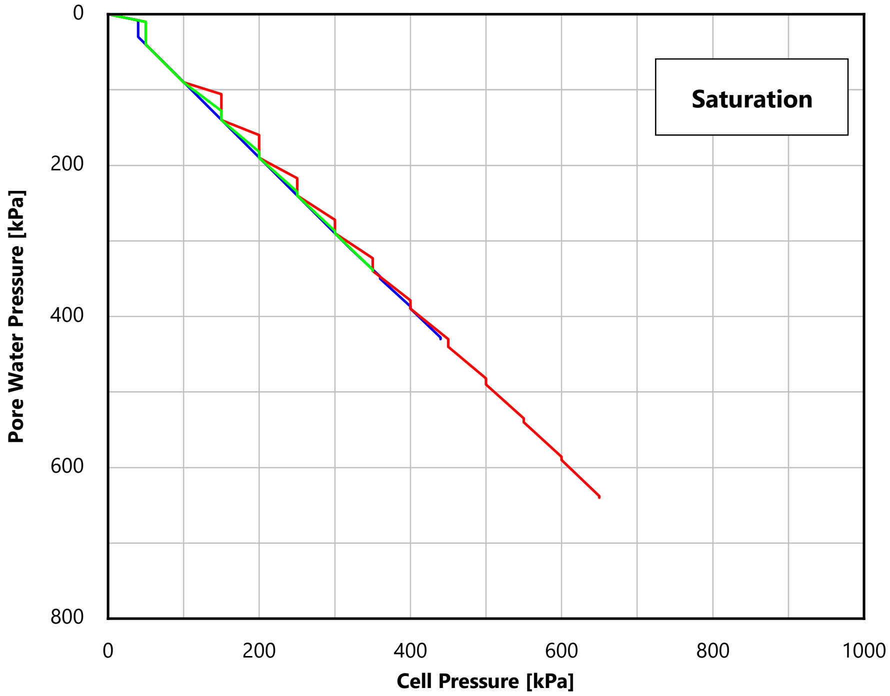
Final Conditions	Specimen 1	Specimen 2	Specimen 3
Water content [%]	16.7	14.7	13.8
Bulk density [Mg/m^3]	2.14	2.19	2.21
Dry density [Mg/m^3]	1.84	1.91	1.94
Mode of failure	Compound failure	Compound failure	Compound failure

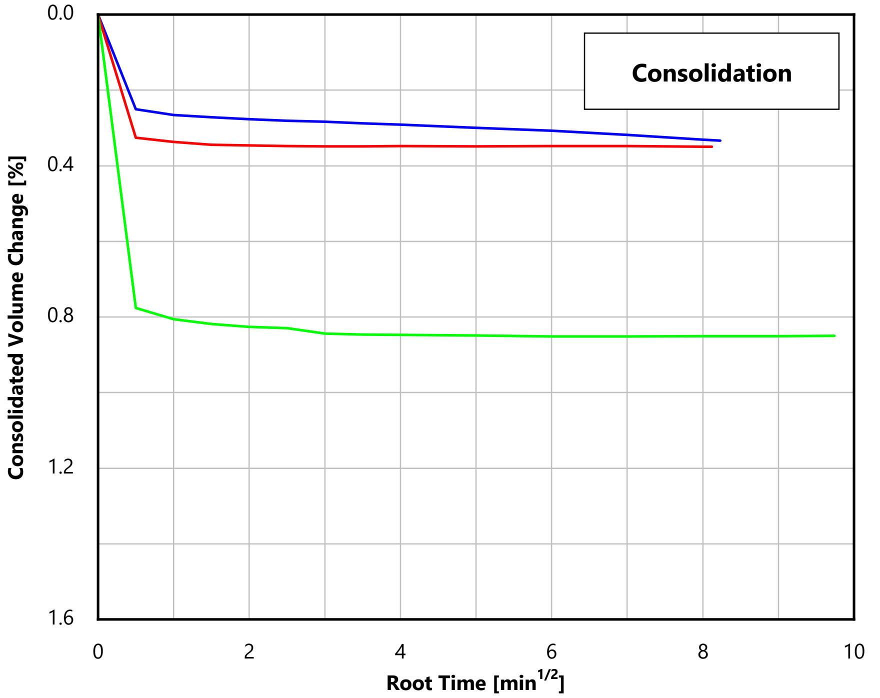
Project: 503387 - F254727	Laboratory: Wallingford, UK	Approved by: ET - 18/08/2025
Test page CID31-4/8	Z5_OWF_BH07-COMP_a / 03-1 / 6.5	

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018





Consolidation				
Stage 1 σ'$_{rc}$: 43 kPa	Stage 2 σ'$_{rc}$: 64 kPa	Stage 3 σ'$_{rc}$: 106 kPa	🟦	1
Stage 1 σ'$_{vc}$: 43 kPa	Stage 2 σ'$_{vc}$: 64 kPa	Stage 3 σ'$_{vc}$: 106 kPa	🟥	2
			🟩	3

Project: 503387 - F254727
CID31

Laboratory: Wallingford, UK
Z5_OWF_BH07-COMP_a / 03-1 / 6.5

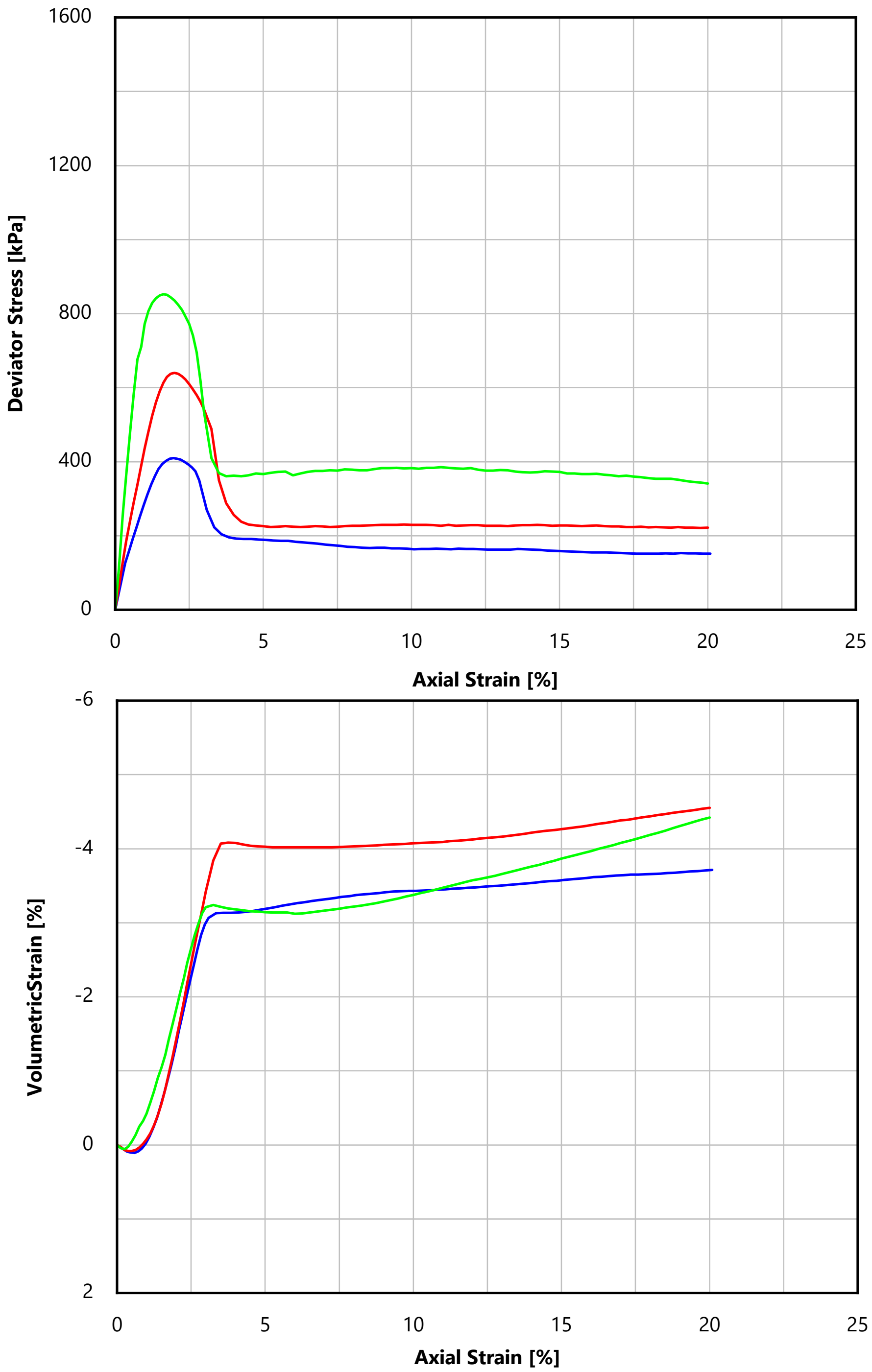
Approved by: ET 18/08/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

Shearing



Consolidation

Stage 1 σ'_{rc} : 43 kPa   Stage 2 σ'_{rc} : 64 kPa   Stage 3 σ'_{rc} : 106 kPa
Stage 1 σ'_{vc} : 43 kPa   Stage 2 σ'_{vc} : 64 kPa   Stage 3 σ'_{vc} : 106 kPa

— 1
— 2
— 3

Project: 503387 - F254727
CID31

Laboratory: Wallingford, UK
Z5_OWF_BH07-COMP_a / 03-1 / 6.5

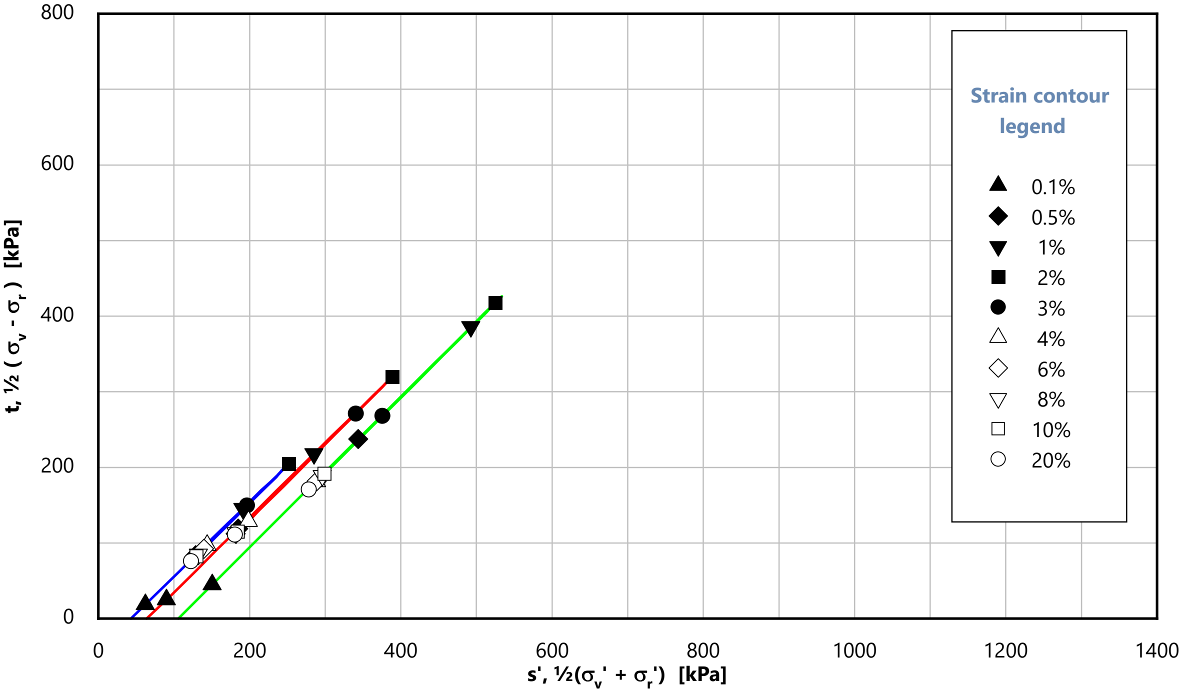
Approved by: ET 18/08/2025

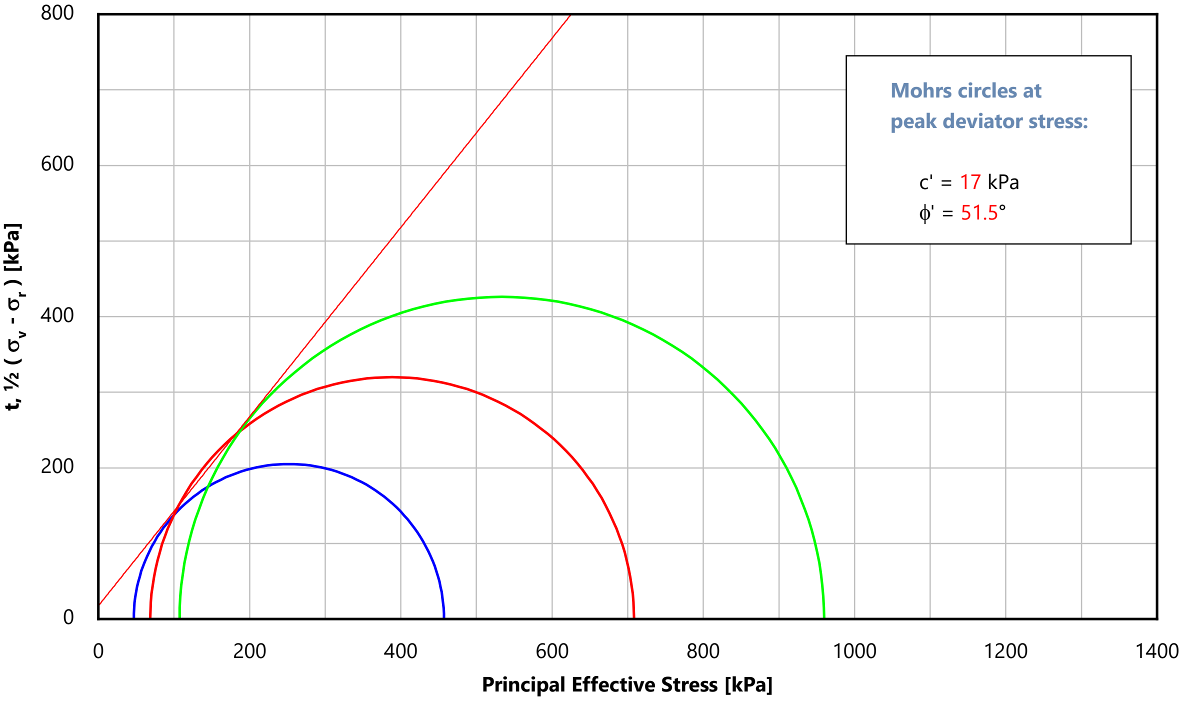
Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils
Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

Shearing





Consolidation			
Stage 1 σ'_{rc} : 43 kPa	Stage 2 σ'_{rc} : 64 kPa	Stage 3 σ'_{rc} : 106 kPa	— 1
Stage 1 σ'_{vc} : 43 kPa	Stage 2 σ'_{vc} : 64 kPa	Stage 3 σ'_{vc} : 106 kPa	— 2
			— 3

Project: 503387 - F254727
CID31

Laboratory: Wallingford, UK
Z5_OWF_BH07-COMP_a / 03-1 / 6.5

Approved by: ET 18/08/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

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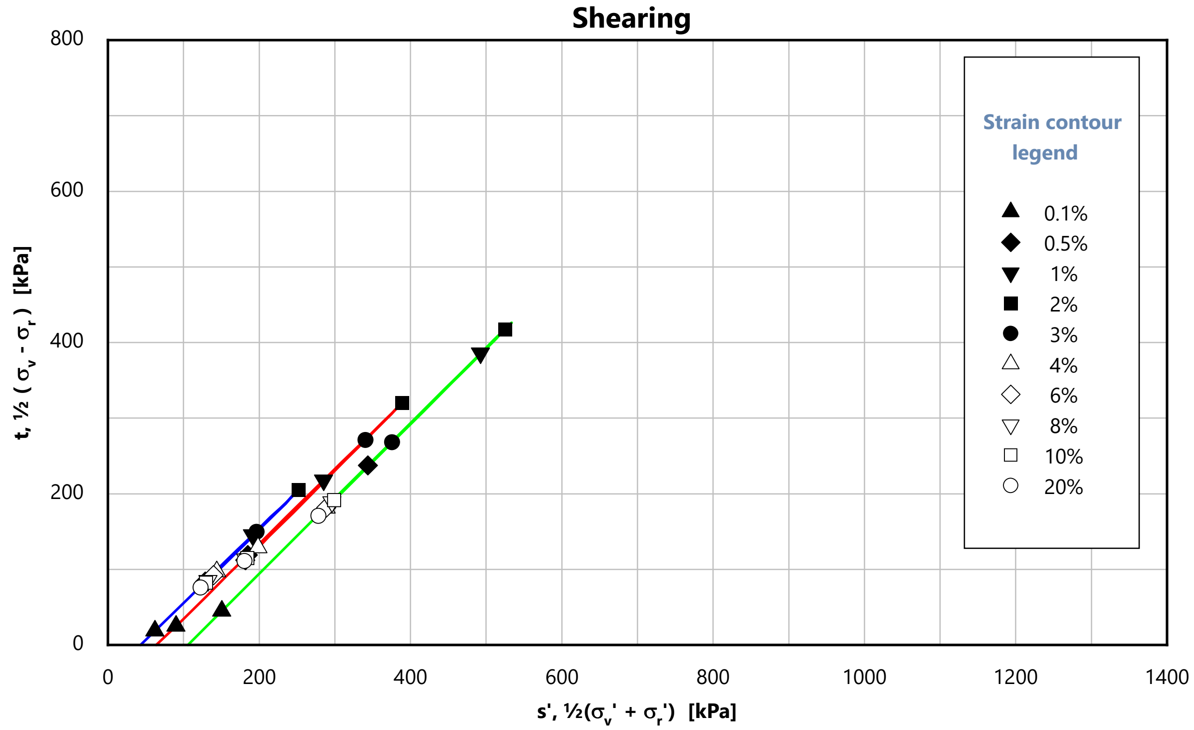

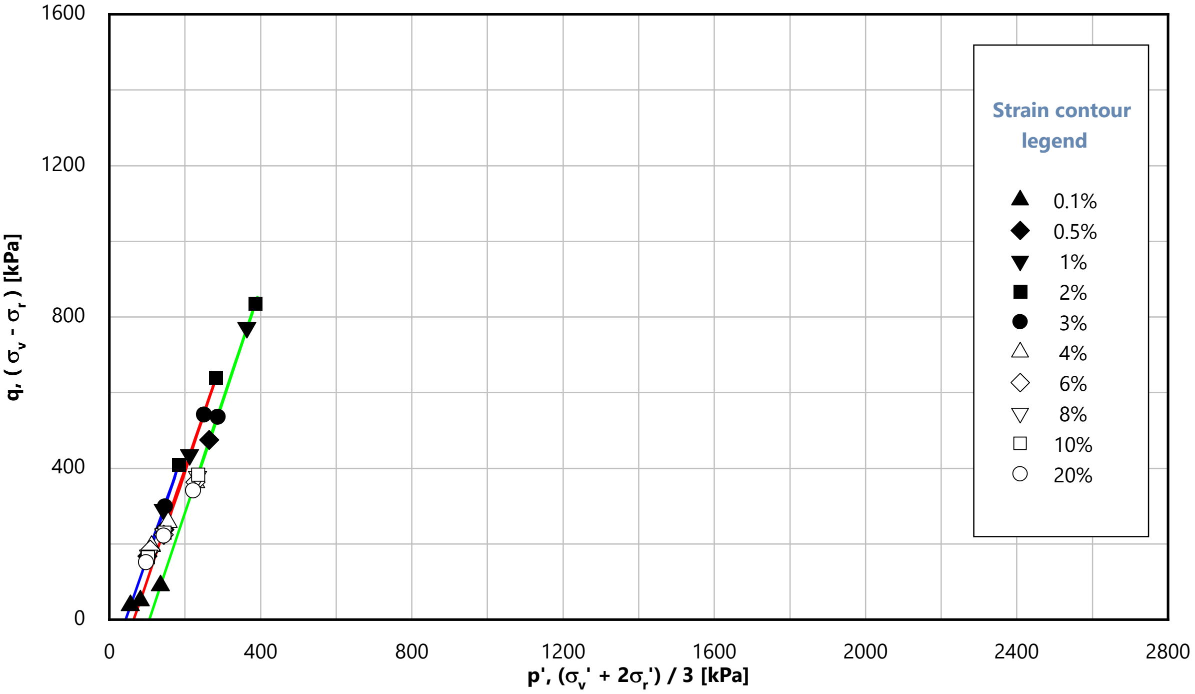

Consolidation

			🟦	1
Stage 1 σ'_{rc} : 43 kPa	Stage 2 σ'_{rc} : 64 kPa	Stage 3 σ'_{rc} : 106 kPa	🟥	2
Stage 1 σ'_{vc} : 43 kPa	Stage 2 σ'_{vc} : 64 kPa	Stage 3 σ'_{vc} : 106 kPa	🟩	3

Project: 503387 - F254727
CID31

Laboratory: Wallingford, UK
Z5_OWF_BH07-COMP_a / 03-1 / 6.5

Approved by: ET 18/08/2025

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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Test Identification	Specimen 1	Specimen 2	Specimen 3
Location	Z5_OWF_BH07-COMP_a	Z5_OWF_BH07-COMP_a	Z5_OWF_BH07-COMP_a
Sample	07-1	07-1	07-1
Depth [m]	19.00	19.00	19.00
Test number	CID32a	CID32b	CID32c

Specimen Visual Description
Dark greenish grey fine SAND

Initial Specimen Conditions	Specimen 1	Specimen 2	Specimen 3
Test start date	14/04/2025	14/04/2025	14/04/2025
Type of sample	Recompacted	Recompacted	Recompacted
Diameter [mm]	50.8	50.8	50.8
Length [mm]	95.0	95.0	95.0
Water content [%]	9.9	9.9	9.9
Bulk density [Mg/m^3]	2.07	2.06	2.05
Dry density [Mg/m^3]	1.89	1.87	1.87
Void ratio [-]	0.405	0.414	0.419
Degree of saturation [%]	65	64	63
Type of drains fitted	One end	One end	One end

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

UKAS TESTING 0919

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Saturation	Specimen 1	Specimen 2	Specimen 3
Pressure increments applied [kPa]	50	50	50
Differential pressure used [kPa]	10	10	10
Pore pressure on completion [kPa]	590	440	490
Cell pressure on completion [kPa]	600	450	500
B value achieved	0.92	0.96	0.96

Consolidation: Isotropic	Specimen 1	Specimen 2	Specimen 3
Cell pressure [kPa]	724	636	809
Back pressure [kPa]	600	450	500
Effective cell pressure [kPa]	124	186	309
Pore pressure on completion [kPa]	600	450	500
Pore pressure dissipation [%]	100	100	100
Water content [%]	14.9	15.1	15.0
Bulk density [Mg/m^3]	2.18	2.18	2.18
Dry density [Mg/m^3]	1.90	1.89	1.90
Void ratio [-]	0.395	0.401	0.398
Degree of saturation [%]	100	100	100
Axial strain [%]	0.26	0.31	0.50
Volumetric strain [%]	0.78	0.92	1.50
Volumetric strain rate-end of stage [%/hr]	0.00	0.01	0.00

Project: 503387 - F254727
Test page CID32-2/8

Laboratory: Wallingford, UK
Z5_OWF_BH07-COMP_a / 07-1 / 19

Approved by: ET - 18/08/2025

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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Shearing	Specimen 1	Specimen 2	Specimen 3
Initial pore pressure [kPa]	600	450	500
Initial effective cell pressure [kPa]	124	186	309
Rate of strain [%/hour]	1.30	1.30	1.30
At peak deviator stress			
Corrected deviator stress [kPa]	1050	1433	2213
Membrane correction applied [kPa]	0.6	0.5	0.8
Drain correction applied [kPa]	0	0	0
Axial strain [%]	2.58	2.31	3.21
Volumetric strain [%]	-1.50	-1.51	-0.93
Major principal effective stress [kPa]	1178	1620	2526
Minor principal effective stress [kPa]	128	188	312
Principal effective stress ratio	9.19	8.63	8.09
ε_{50} [%]	0.97	0.72	1.39
Secant modulus (E_{50}) at ε_{50} [kPa]	54211	99829	79400
At peak principal effective stress ratio			
Corrected deviator stress [kPa]	1050	1433	2213
Membrane correction applied [kPa]	0.6	0.5	0.8
Drain correction applied [kPa]	0	0	0
Axial strain [%]	2.58	2.31	3.21
Volumetric strain [%]	-1.50	-1.51	-0.93
Major principal effective stress [kPa]	1178	1620	2526
Minor principal effective stress [kPa]	128	188	312
Principal effective stress ratio	9.19	8.63	8.09
At 10% axial strain			
Corrected deviator stress [kPa]	427	693	1000
Membrane correction applied [kPa]	2.1	2.1	2.1
Drain correction applied [kPa]	0	0	0
Axial strain [%]	10.00	10.00	10.00
Volumetric strain [%]	-3.58	-3.49	-2.69
Major principal effective stress [kPa]	555	882	1313
Minor principal effective stress [kPa]	127	188	313
Principal effective stress ratio	4.35	4.69	4.20

Project: 503387 - F254727
Test page CID32-3/8

Laboratory: Wallingford, UK
Z5_OWF_BH07-COMP_a / 07-1 / 19

Approved by: ET - 18/08/2025

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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Photographs		
Specimen 1	**Specimen 2**	**Specimen 3**
		

Final Conditions	Specimen 1	Specimen 2	Specimen 3
Water content [%]	14.9	15.1	16.6
Bulk density [Mg/m^3]	2.18	2.18	2.15
Dry density [Mg/m^3]	1.90	1.89	1.84
Mode of failure	Compound failure	Compound failure	Compound failure

Project: 503387 - F254727
Test page CID32-4/8

Laboratory: Wallingford, UK
Z5_OWF_BH07-COMP_a / 07-1 / 19

Approved by: ET - 18/08/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

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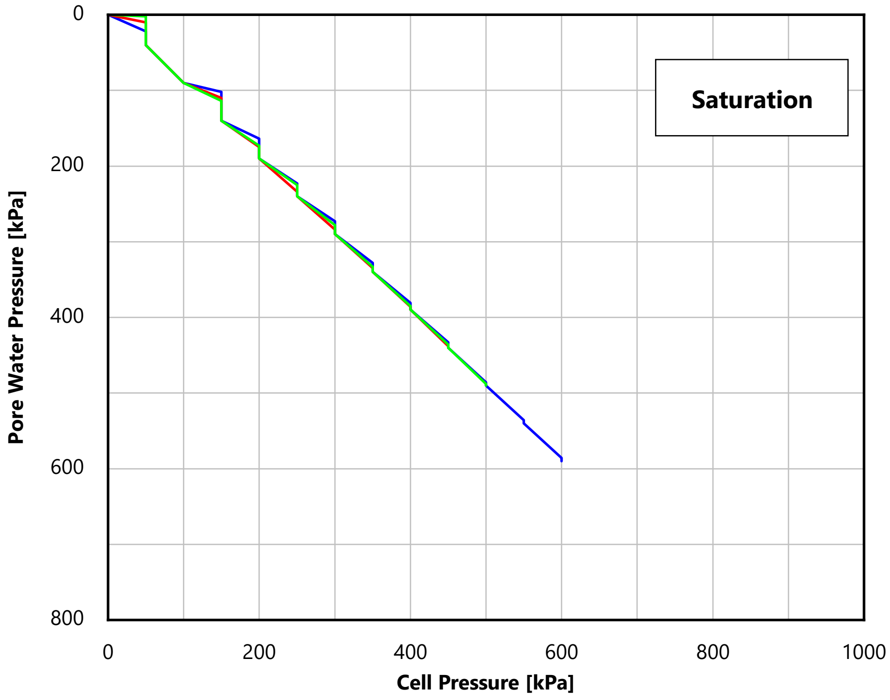

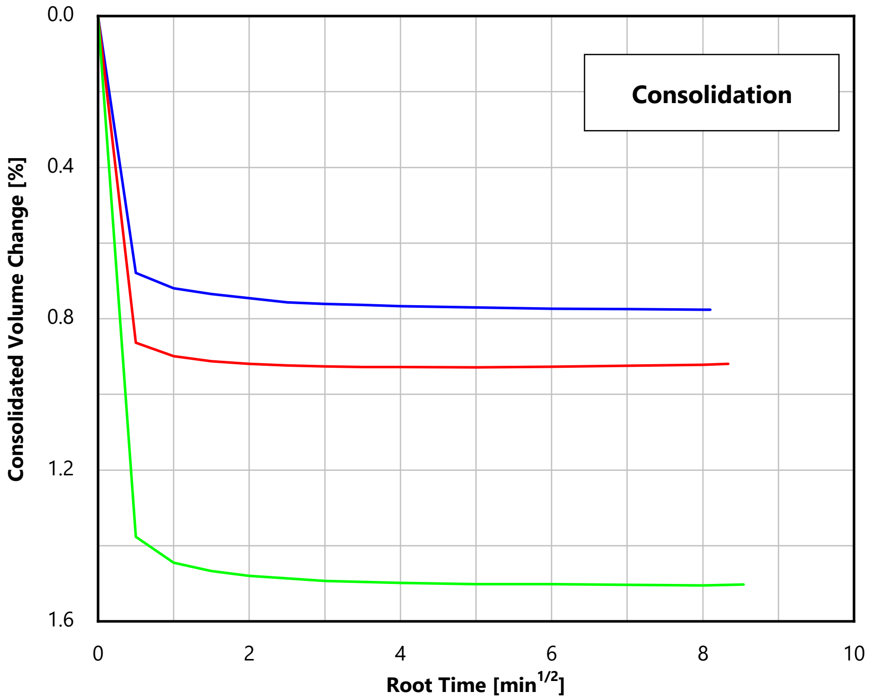

Consolidation

Stage 1 σ'_{rc} : 124 kPa	Stage 2 σ'_{rc} : 186 kPa	Stage 3 σ'_{rc} : 309 kPa	—	1
Stage 1 σ'_{vc} : 124 kPa	Stage 2 σ'_{vc} : 186 kPa	Stage 3 σ'_{vc} : 309 kPa	—	2
			—	3

Project: 503387 - F254727
CID32

Laboratory: Wallingford, UK
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Approved by: ET 18/08/02025

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Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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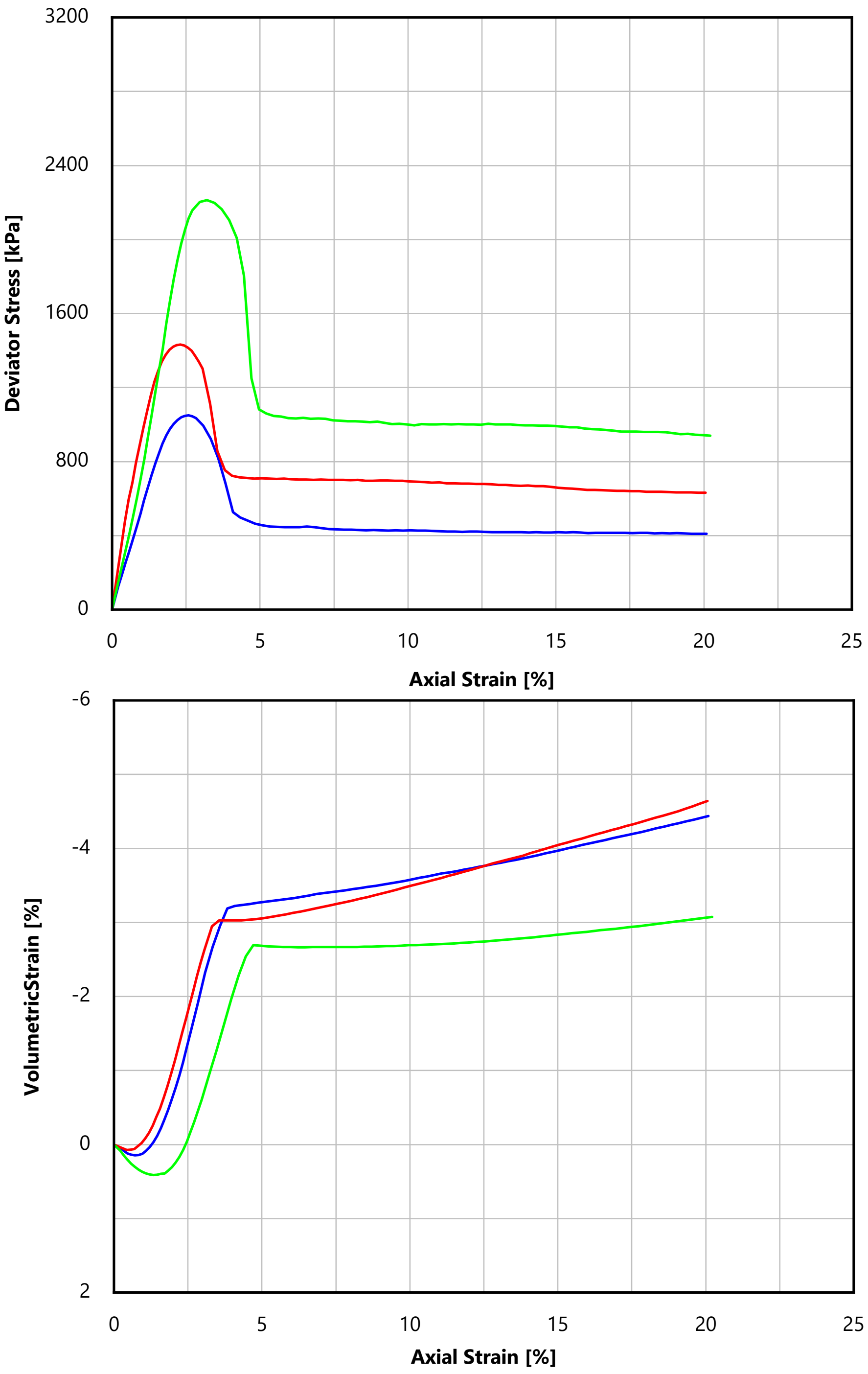
Shearing



Consolidation

			🟦	1
Stage 1 σ'_{rc} : 124 kPa	Stage 2 σ'_{rc} : 186 kPa	Stage 3 σ'_{rc} : 309 kPa	🟥	2
Stage 1 σ'_{vc} : 124 kPa	Stage 2 σ'_{vc} : 186 kPa	Stage 3 σ'_{vc} : 309 kPa	🟩	3

Project: 503387 - F254727
CID32

Laboratory: Wallingford, UK
Z5_OWF_BH07-COMP_a / -- / 19

Approved by: ET 18/08/02025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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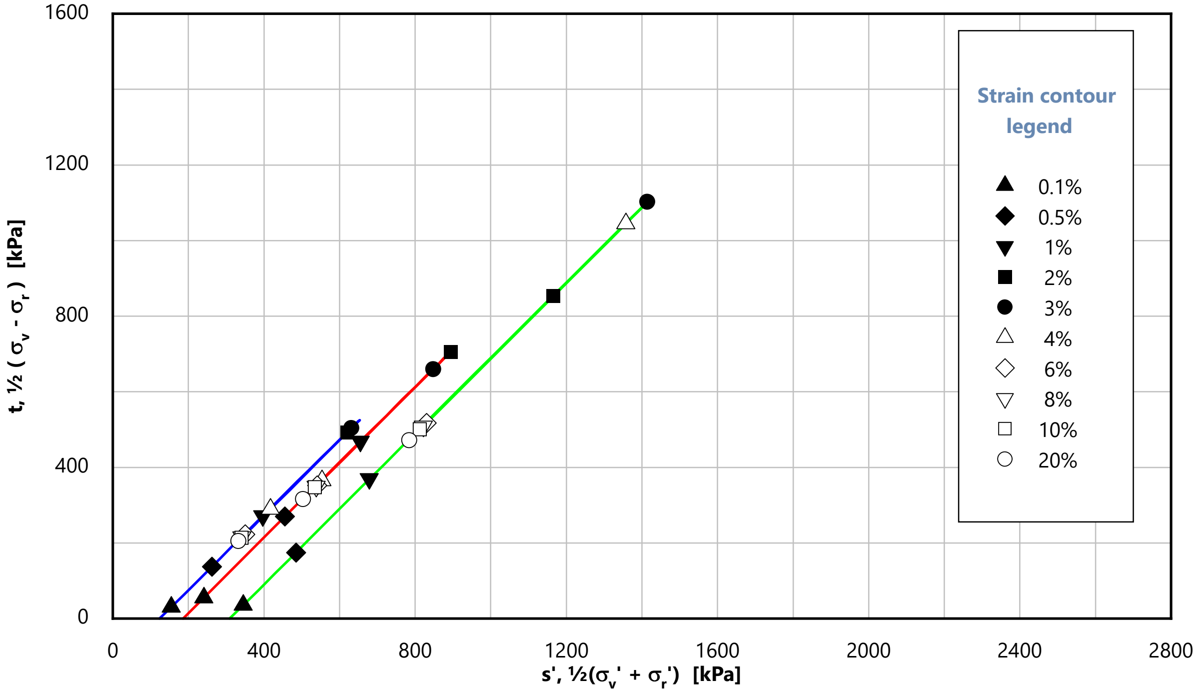
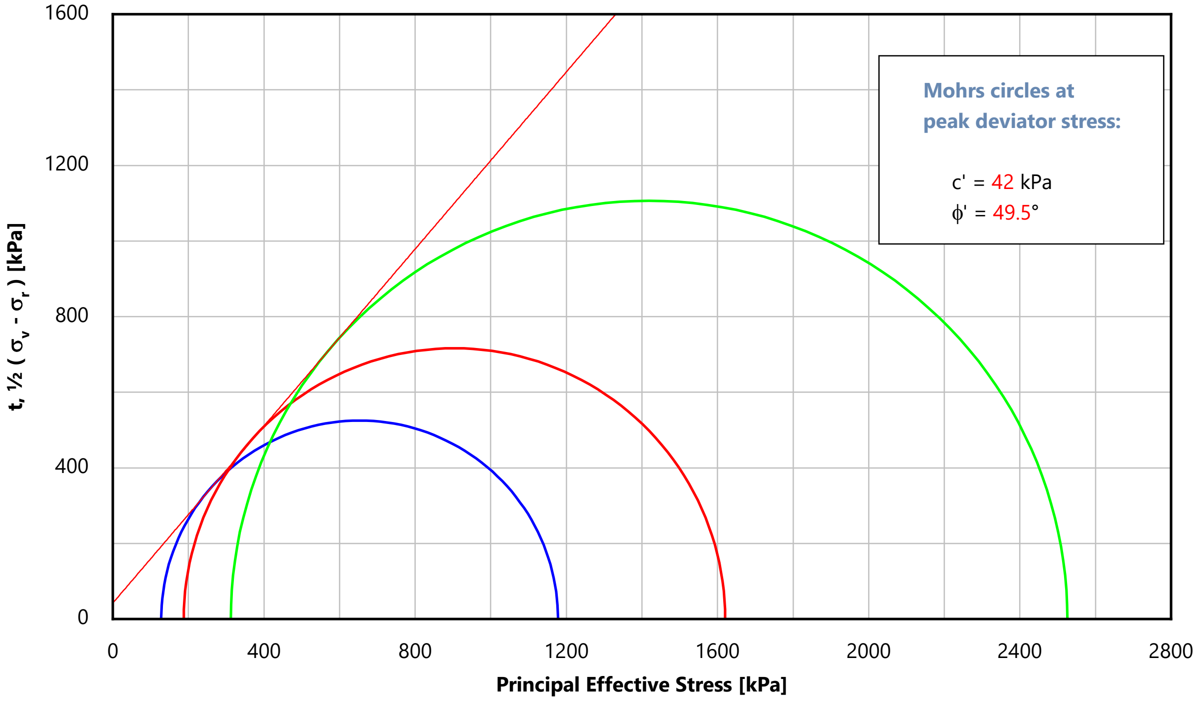
Shearing





Consolidation				
Stage 1 σ'_{rc} : 124 kPa	Stage 2 σ'_{rc} : 186 kPa	Stage 3 σ'_{rc} : 309 kPa	🟦	1
Stage 1 σ'_{vc} : 124 kPa	Stage 2 σ'_{vc} : 186 kPa	Stage 3 σ'_{vc} : 309 kPa	🟥	2
			🟩	3

Project: 503387 - F254727
CID32

Laboratory: Wallingford, UK
Z5_OWF_BH07-COMP_a / -- / 19

Approved by: ET 18/08/02025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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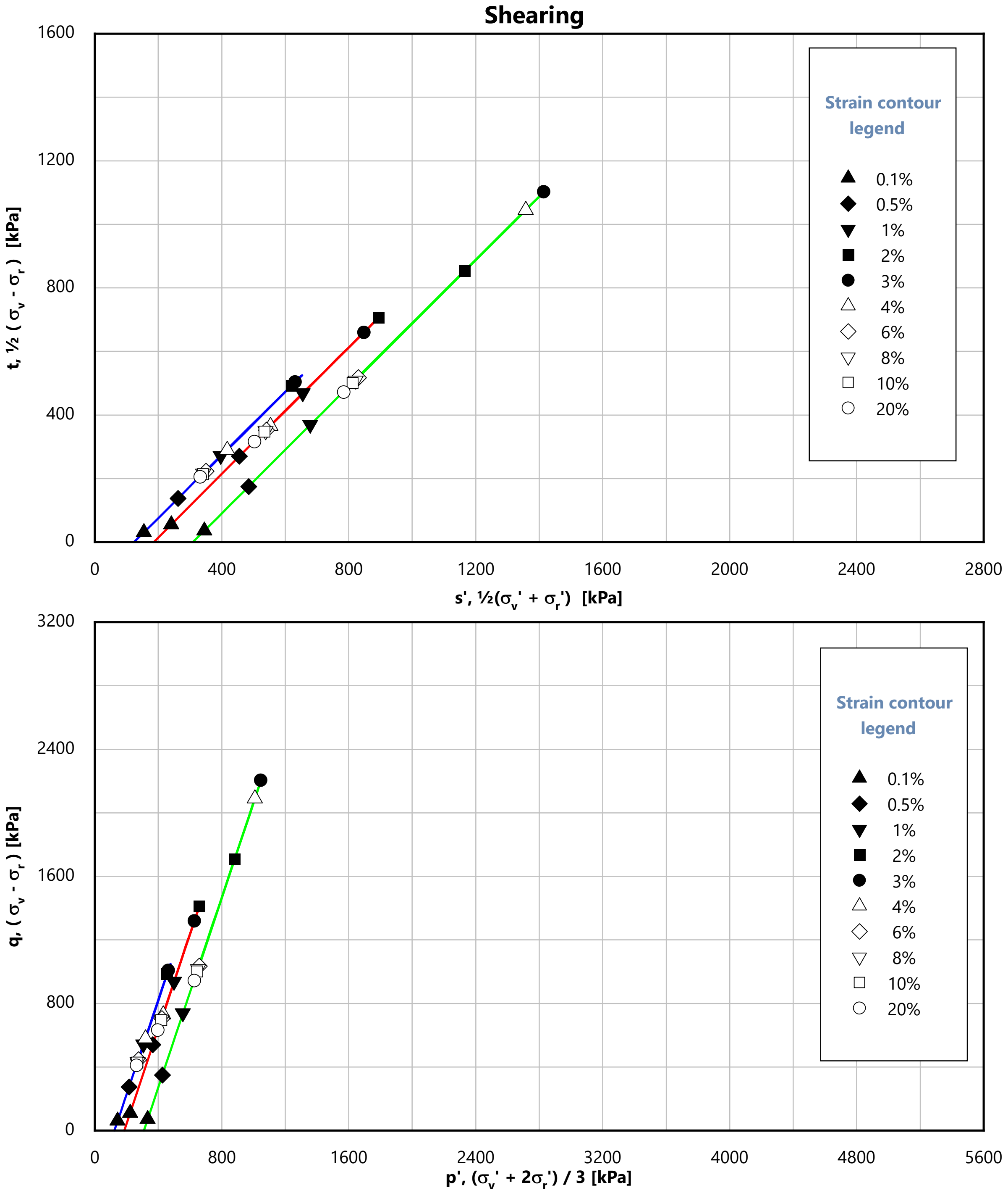
Shearing

Consolidation

Stage 1 σ'_{rc} : 124 kPa	Stage 2 σ'_{rc} : 186 kPa	Stage 3 σ'_{rc} : 309 kPa	—	1
Stage 1 σ'_{vc} : 124 kPa	Stage 2 σ'_{vc} : 186 kPa	Stage 3 σ'_{vc} : 309 kPa	—	2
			—	3

Project: 503387 - F254727
CID32

Laboratory: Wallingford, UK
Z5_OWF_BH07-COMP_a / -- / 19

Approved by: ET 18/08/02025

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

UKAS TESTING 0919

Test Identification	Specimen 1	Specimen 2	Specimen 3
Location	Z5_OWF_BH09-COMP	Z5_OWF_BH09-COMP	Z5_OWF_BH09-COMP
Sample	01-2	01-2	01-2
Depth [m]	3.30	3.30	3.30
Test number	CID33A	CID33B	CID33C

Specimen Visual Description
Yellowish brown fine to medium SAND

Initial Specimen Conditions	Specimen 1	Specimen 2	Specimen 3
Test start date	14/05/2025	08/05/2025	14/05/2025
Type of sample	Recompacted	Recompacted	Recompacted
Diameter [mm]	50.5	50.5	50.5
Length [mm]	95.0	95.0	95.0
Water content [%]	10.1	10.1	10.1
Bulk density [Mg/m^3]	1.65	1.65	1.65
Dry density [Mg/m^3]	1.50	1.50	1.50
Void ratio [-]	0.766	0.767	0.768
Degree of saturation [%]	35	35	35
Type of drains fitted	One end	One end	One end

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

Saturation	Specimen 1	Specimen 2	Specimen 3
Pressure increments applied [kPa]	15	50	50
Differential pressure used [kPa]	5	10	10
Pore pressure on completion [kPa]	355	320	575
Cell pressure on completion [kPa]	360	325	585
B value achieved	0.93	0.96	0.96

Consolidation: Isotropic	Specimen 1	Specimen 2	Specimen 3
Cell pressure [kPa]	381	357	638
Back pressure [kPa]	360	325	585
Effective cell pressure [kPa]	21	32	53
Pore pressure on completion [kPa]	360	325	585
Pore pressure dissipation [%]	100	100	100
Water content [%]	28.9	28.7	28.7
Bulk density [Mg/m^3]	1.93	1.94	1.94
Dry density [Mg/m^3]	1.50	1.51	1.50
Void ratio [-]	0.765	0.761	0.762
Degree of saturation [%]	100	100	100
Axial strain [%]	0.02	0.13	0.12
Volumetric strain [%]	0.07	0.39	0.37
Volumetric strain rate-end of stage [%/hr]	0.01	0.00	0.01

Project: 503387 - F254727
Test page CID33-2/8

Laboratory: Wallingford, UK
Z5_OWF_BH09-COMP / 01-2 / 3.3

Approved by: ET - 24/06/2025

Test Report
Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

Shearing	Specimen 1	Specimen 2	Specimen 3
Initial pore pressure [kPa]	360	325	585
Initial effective cell pressure [kPa]	21	32	53
Rate of strain [%/hour]	1.30	1.30	1.30
At peak deviator stress			
Corrected deviator stress [kPa]	72	100	172
Membrane correction applied [kPa]	0.6	0.6	0.7
Drain correction applied [kPa]	0	0	0
Axial strain [%]	2.75	2.63	3.14
Volumetric strain [%]	-0.76	-0.41	-0.39
Major principal effective stress [kPa]	93	132	227
Minor principal effective stress [kPa]	21	32	55
Principal effective stress ratio	4.38	4.14	4.13
ε_{50} [%]	0.30	0.33	0.78
Secant modulus (E_{50}) at ε_{50} [kPa]	11989	14991	11111
At peak principal effective stress ratio			
Corrected deviator stress [kPa]	72	100	171
Membrane correction applied [kPa]	0.5	0.6	0.7
Drain correction applied [kPa]	0	0	0
Axial strain [%]	2.12	2.88	3.26
Volumetric strain [%]	-0.51	-0.47	-0.43
Major principal effective stress [kPa]	93	131	225
Minor principal effective stress [kPa]	21	31	54
Principal effective stress ratio	4.40	4.20	4.17
At 10% axial strain			
Corrected deviator stress [kPa]	61	87	149
Membrane correction applied [kPa]	2.0	2.0	2.0
Drain correction applied [kPa]	0	0	0
Axial strain [%]	10.00	10.00	10.00
Volumetric strain [%]	-2.19	-1.33	-1.65
Major principal effective stress [kPa]	82	120	204
Minor principal effective stress [kPa]	21	32	55
Principal effective stress ratio	3.91	3.72	3.69

Project: 503387 - F254727
Test page CID33-3/8

Laboratory: Wallingford, UK
Z5_OWF_BH09-COMP / 01-2 / 3.3

Approved by: ET - 24/06/2025

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

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Photographs

Specimen 1	Specimen 2	Specimen 3
Photograph unavailable	Photograph unavailable	Photograph unavailable

Final Conditions	Specimen 1	Specimen 2	Specimen 3
Water content [%]	30.7	29.8	28.7
Bulk density [Mg/m^3]	1.91	1.92	1.94
Dry density [Mg/m^3]	1.46	1.48	1.50
Mode of failure	Barrel	Compound failure	Barrel

Project: 503387 - F254727
Test page CID33-4/8

Laboratory: Wallingford, UK
Z5_OWF_BH09-COMP / 01-2 / 3.3

Approved by: ET - 24/06/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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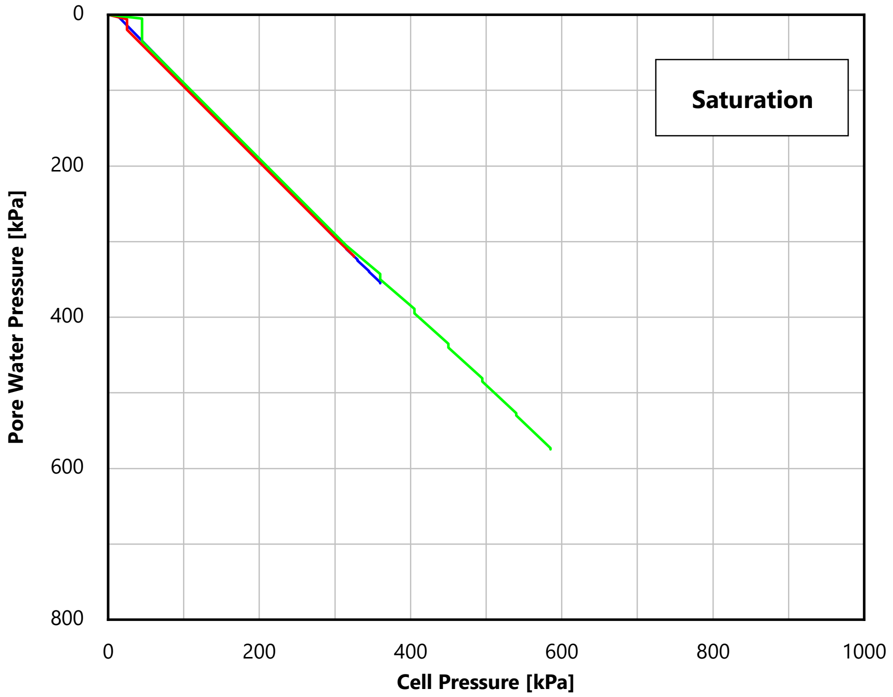
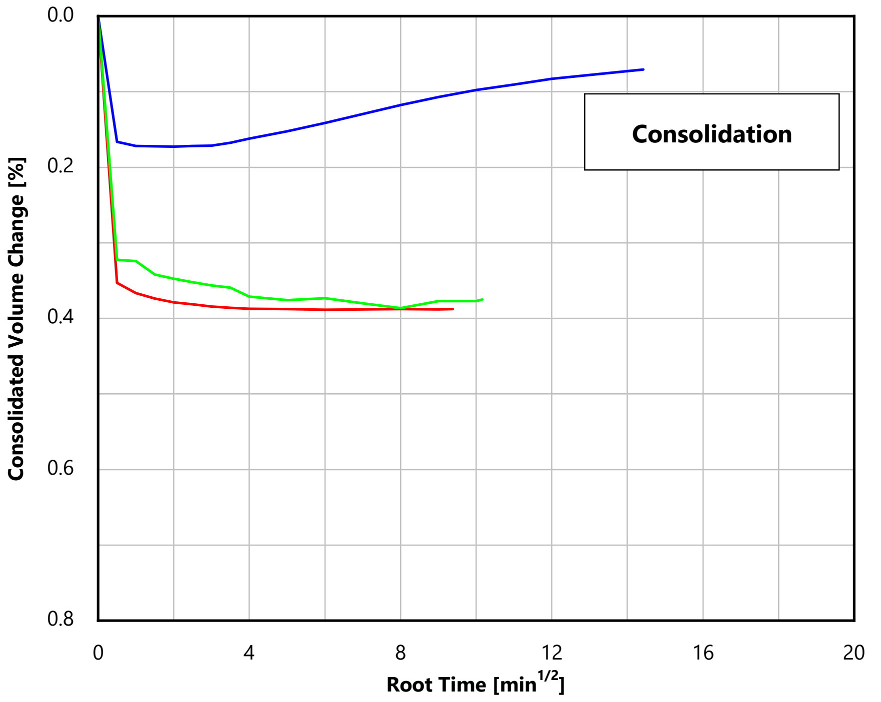




Consolidation				
Stage 1 σ'_{rc} : 21 kPa	Stage 2 σ'_{rc} : 32 kPa	Stage 3 σ'_{rc} : 53 kPa	🟦	1
Stage 1 σ'_{vc} : 21 kPa	Stage 2 σ'_{vc} : 32 kPa	Stage 3 σ'_{vc} : 53 kPa	🟥	2
			🟩	3

Project: 503387 - F254727
CID33

Laboratory: Wallingford, UK
Z5_OWF_BH09-COMP / 01-2 / 3.3

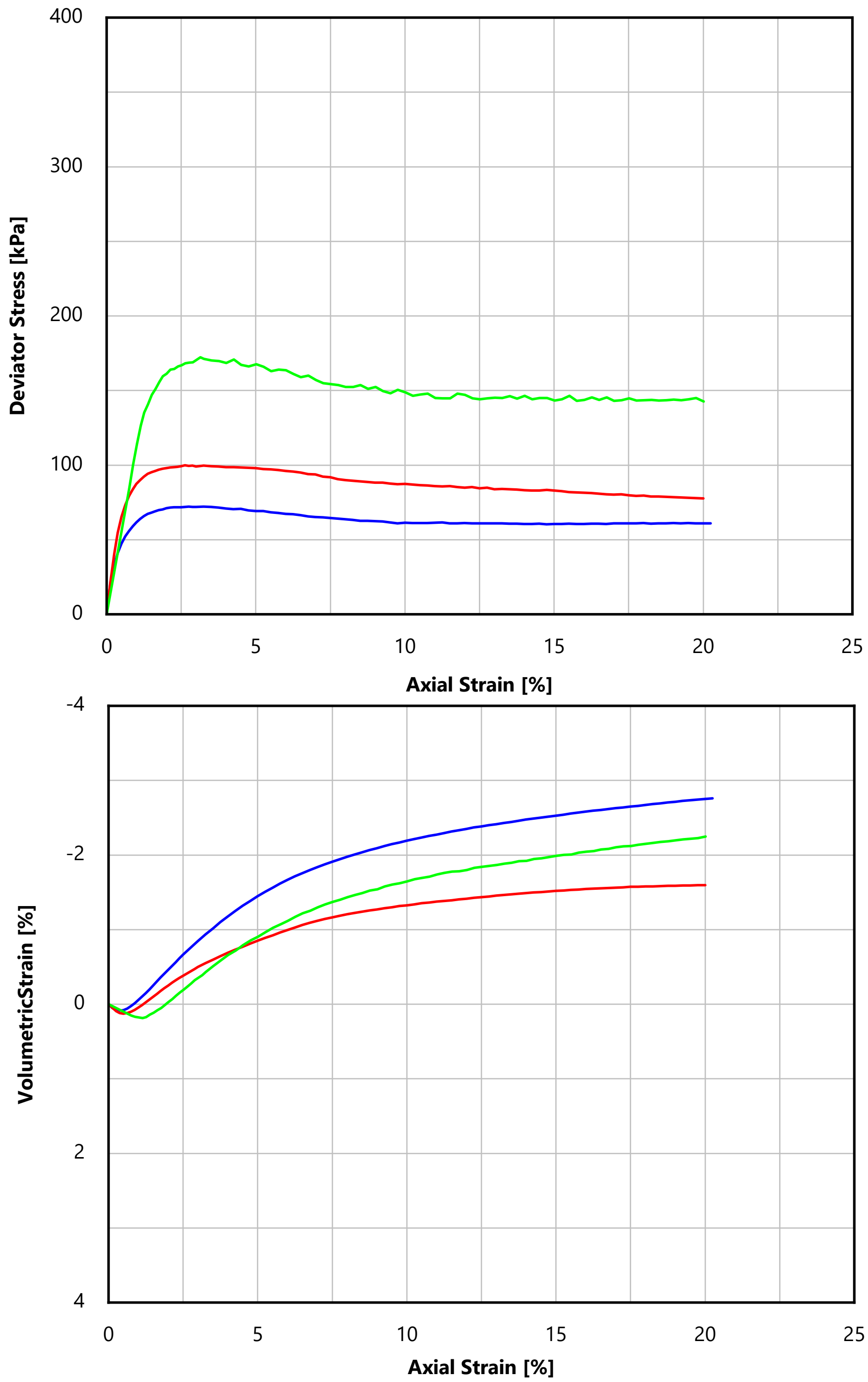
Approved by: ET 24/06/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils
Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

Shearing



Consolidation				
			🟦	1
Stage 1 σ'_{rc} : 21 kPa	Stage 2 σ'_{rc} : 32 kPa	Stage 3 σ'_{rc} : 53 kPa	🟥	2
Stage 1 σ'_{vc} : 21 kPa	Stage 2 σ'_{vc} : 32 kPa	Stage 3 σ'_{vc} : 53 kPa	🟩	3

Project: 503387 - F254727
CID33

Laboratory: Wallingford, UK
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Approved by: ET 24/06/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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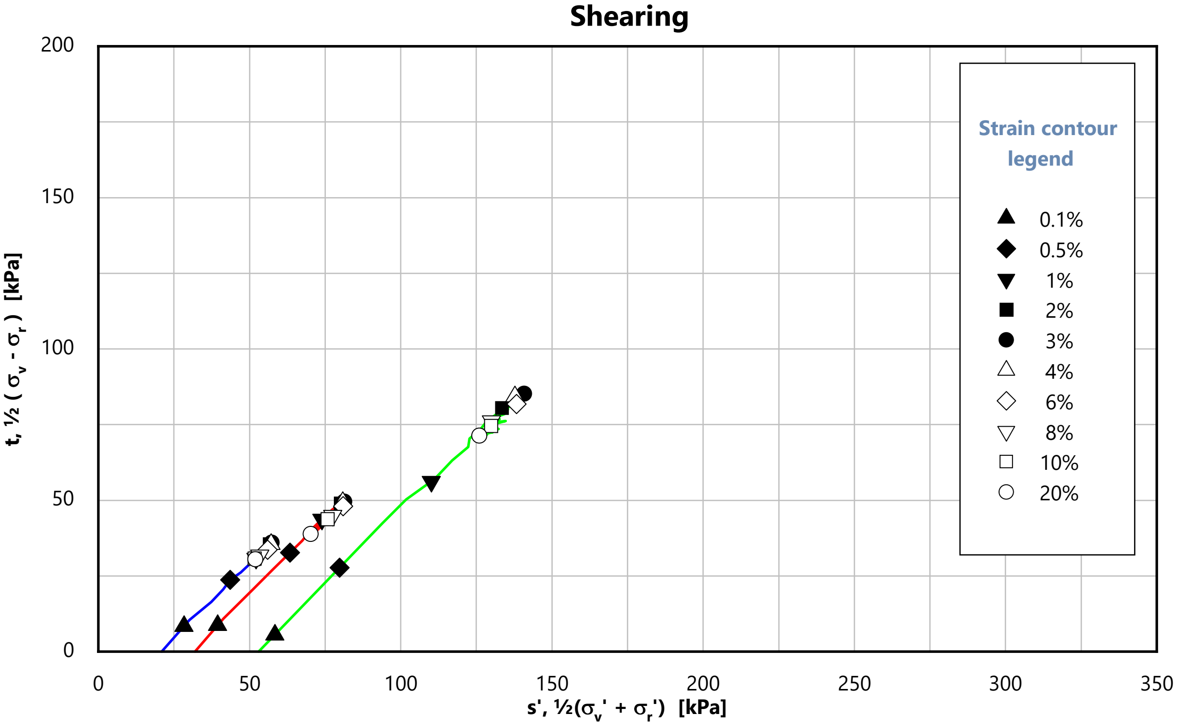

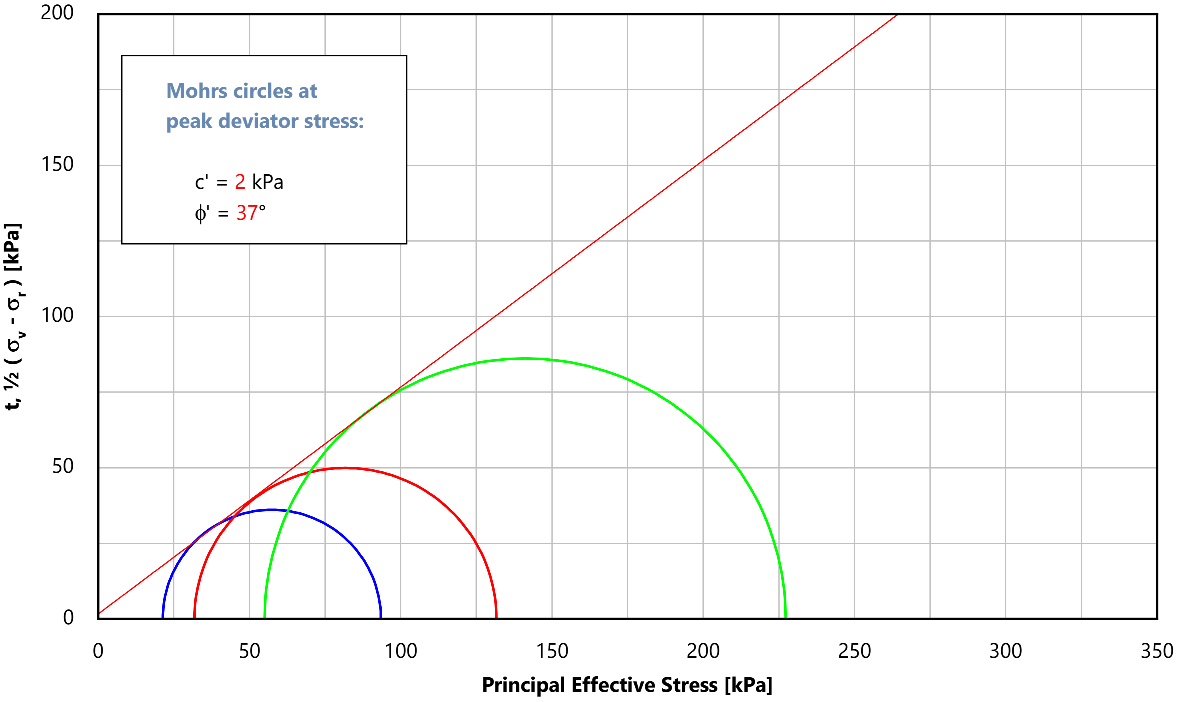

Consolidation				
Stage 1 σ'_{rc} : 21 kPa	Stage 2 σ'_{rc} : 32 kPa	Stage 3 σ'_{rc} : 53 kPa	━	1
Stage 1 σ'_{vc} : 21 kPa	Stage 2 σ'_{vc} : 32 kPa	Stage 3 σ'_{vc} : 53 kPa	━	2
			━	3

Project: 503387 - F254727
CID33

Laboratory: Wallingford, UK
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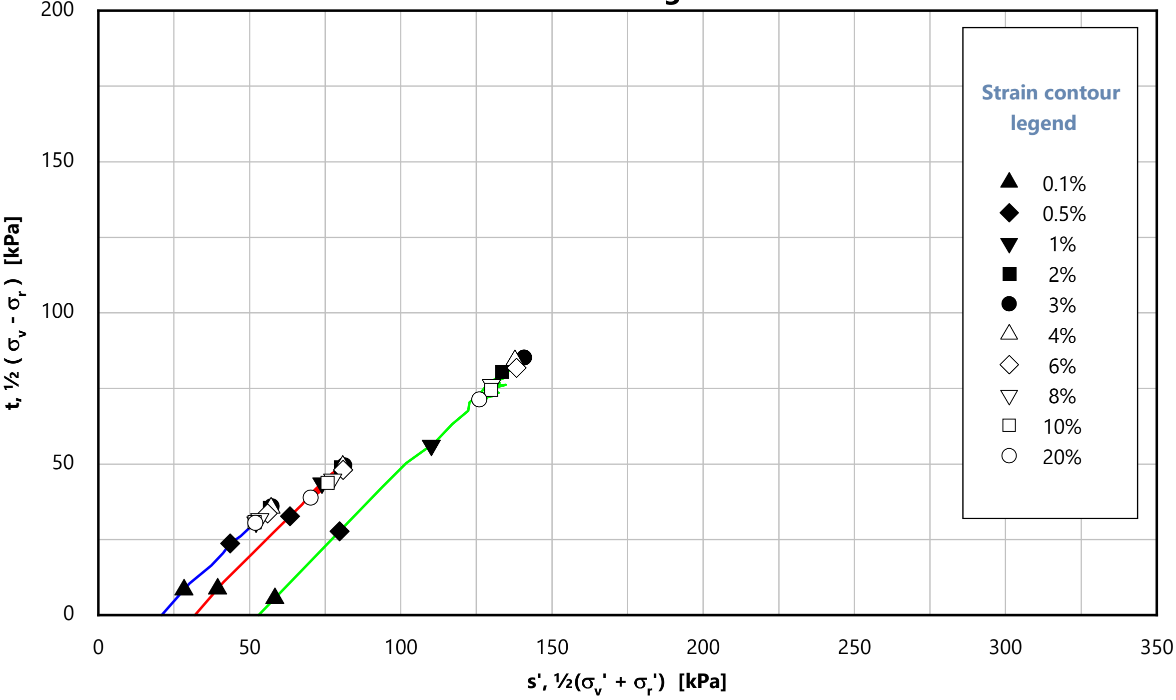
Approved by: ET 24/06/2025

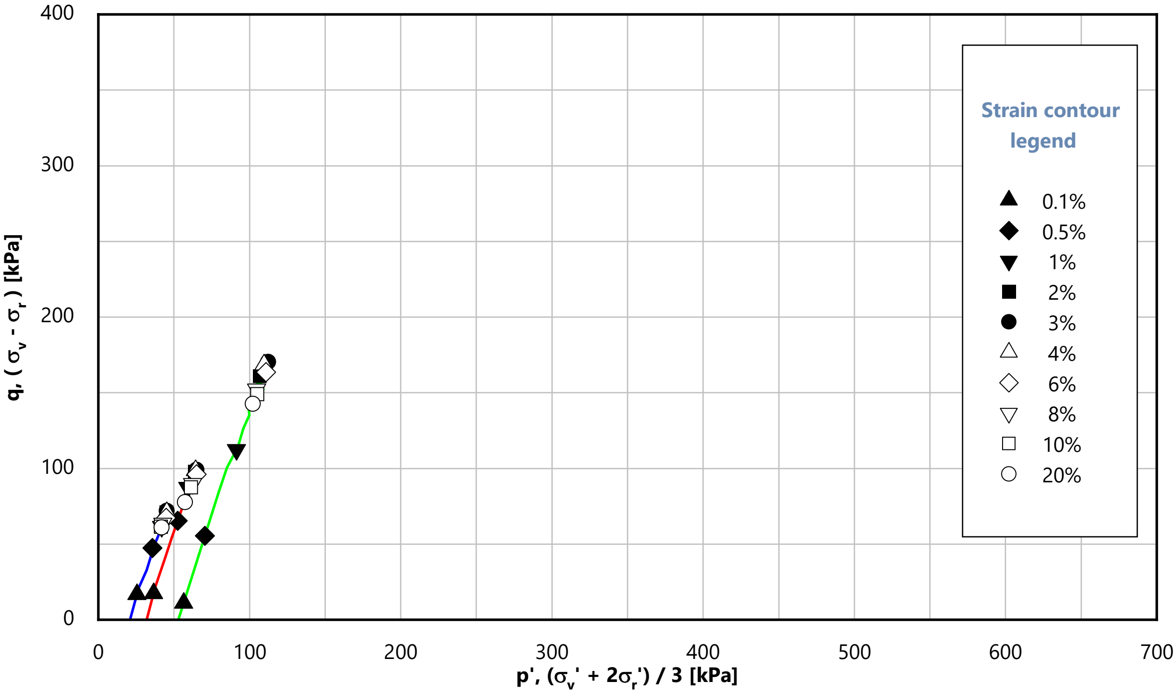
Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

ISO 17892-9:2018

Shearing





Consolidation				
Stage 1 σ'_{rc} : 21 kPa	Stage 2 σ'_{rc} : 32 kPa	Stage 3 σ'_{rc} : 53 kPa	🟦	1
Stage 1 σ'_{vc} : 21 kPa	Stage 2 σ'_{vc} : 32 kPa	Stage 3 σ'_{vc} : 53 kPa	🟥	2
			🟩	3

Project: 503387 - F254727
CID33

Laboratory: Wallingford, UK
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Approved by: ET 24/06/2025

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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Test Identification	Specimen 1	Specimen 2	Specimen 3
Location	Z5_OWF_BH09-COMP	Z5_OWF_BH09-COMP	Z5_OWF_BH09-COMP
Sample	06-1	06-1	06-1
Depth [m]	15.50	15.50	15.50
Test number	CID34a	CID34b	CID34c

Specimen Visual Description
Olive brown fine SAND

Initial Specimen Conditions	Specimen 1	Specimen 2	Specimen 3
Test start date	26/06/2025	26/06/2025	11/07/2025
Type of sample	Recompacted	Recompacted	Recompacted
Diameter [mm]	50.5	50.5	50.5
Length [mm]	95.0	95.0	95.0
Water content [%]	10.2	10.0	9.9
Bulk density [Mg/m^3]	2.07	2.07	2.06
Dry density [Mg/m^3]	1.87	1.88	1.88
Void ratio [-]	0.414	0.409	0.411
Degree of saturation [%]	65	65	64
Type of drains fitted	Radial & one end	Radial & one end	Radial & one end

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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0919

Saturation	Specimen 1	Specimen 2	Specimen 3
Pressure increments applied [kPa]	50	50	50
Differential pressure used [kPa]	10	10	10
Pore pressure on completion [kPa]	640	390	390
Cell pressure on completion [kPa]	650	400	400
B value achieved	0.96	0.96	0.96

Consolidation: Isotropic	Specimen 1	Specimen 2	Specimen 3
Cell pressure [kPa]	749	549	648
Back pressure [kPa]	650	400	400
Effective cell pressure [kPa]	99	149	248
Pore pressure on completion [kPa]	650	400	400
Pore pressure dissipation [%]	100	100	100
Water content [%]	15.3	15.1	15.0
Bulk density [Mg/m^3]	2.17	2.18	2.18
Dry density [Mg/m^3]	1.89	1.89	1.90
Void ratio [-]	0.404	0.400	0.398
Degree of saturation [%]	100	100	100
Axial strain [%]	0.24	0.22	0.32
Volumetric strain [%]	0.71	0.67	0.97
Volumetric strain rate-end of stage [%/hr]	0.07	0.01	0.01

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Test page CID34-2/8

Laboratory: Wallingford, UK
Z5_OWF_BH09-COMP / 06-1 / 15.5

Approved by: ET - 19/08/2025

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

UKAS TESTING 0919

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Shearing	Specimen 1	Specimen 2	Specimen 3
Initial pore pressure [kPa]	650	400	400
Initial effective cell pressure [kPa]	99	149	248
Rate of strain [%/hour]	1.30	1.30	1.30
At peak deviator stress			
Corrected deviator stress [kPa]	623	784	1109
Membrane correction applied [kPa]	0.7	0.6	0.8
Drain correction applied [kPa]	7	7	7
Axial strain [%]	2.74	2.20	2.95
Volumetric strain [%]	-1.29	-0.83	-0.97
Major principal effective stress [kPa]	728	937	1361
Minor principal effective stress [kPa]	104	153	252
Principal effective stress ratio	6.98	6.13	5.40
ε_{50} [%]	1.02	0.63	0.63
Secant modulus (E_{50}) at ε_{50} [kPa]	30523	62545	87977
At peak principal effective stress ratio			
Corrected deviator stress [kPa]	623	783	1109
Membrane correction applied [kPa]	0.7	0.5	0.8
Drain correction applied [kPa]	7	7	7
Axial strain [%]	2.74	2.07	2.95
Volumetric strain [%]	-1.29	-0.70	-0.97
Major principal effective stress [kPa]	728	935	1361
Minor principal effective stress [kPa]	104	152	252
Principal effective stress ratio	6.98	6.14	5.40
At 10% axial strain			
Corrected deviator stress [kPa]	311	140	733
Membrane correction applied [kPa]	2.3	2.4	2.3
Drain correction applied [kPa]	7	7	7
Axial strain [%]	10.00	10.00	10.00
Volumetric strain [%]	-3.53	-3.83	-3.15
Major principal effective stress [kPa]	415	257	985
Minor principal effective stress [kPa]	105	117	252
Principal effective stress ratio	3.97	2.79	3.91

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Test page CID34-3/8

Laboratory: Wallingford, UK
Z5_OWF_BH09-COMP / 06-1 / 15.5

Approved by: ET - 19/08/2025

Test Report

Consolidated Triaxial Compression Test on Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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Photographs		
Specimen 1	**Specimen 2**	**Specimen 3**
Photograph Unavailable	Photograph Unavailable	Photograph Unavailable

Final Conditions	Specimen 1	Specimen 2	Specimen 3
Water content [%]	17.4	16.8	15.0
Bulk density [Mg/m^3]	2.13	2.14	2.18
Dry density [Mg/m^3]	1.81	1.84	1.90
Mode of failure	Compound failure	Compound failure	Compound failure

Project: 503387 - F254727
Test page CID34-4/8

Laboratory: Wallingford, UK
Z5_OWF_BH09-COMP / 06-1 / 15.5

Approved by: ET - 19/08/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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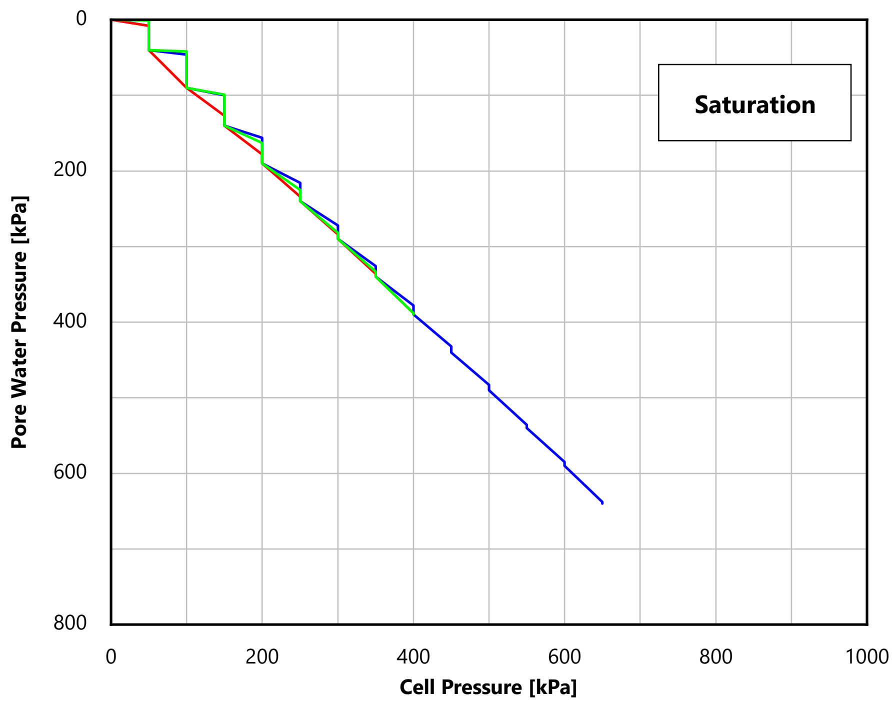

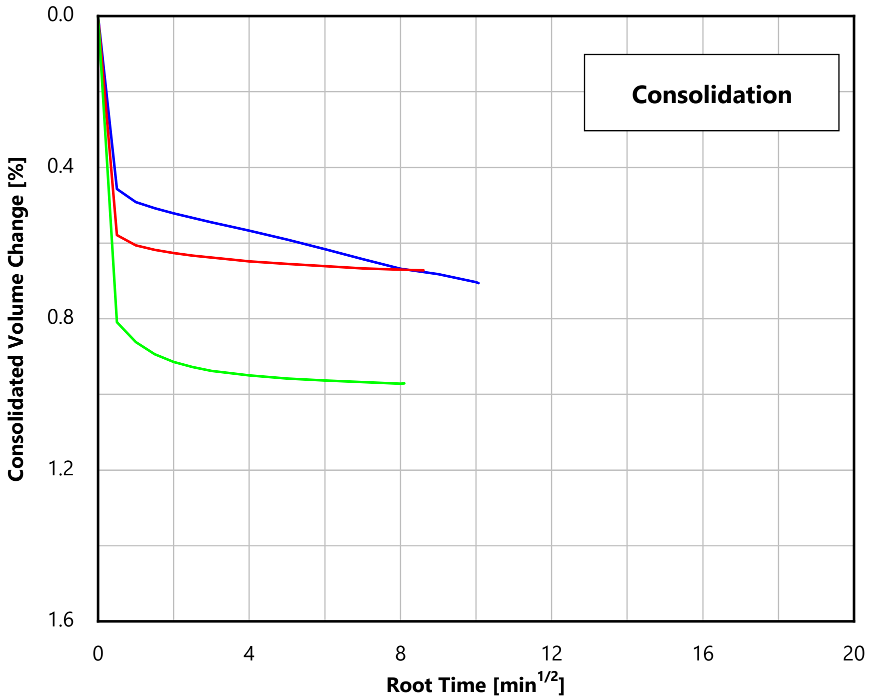

Consolidation

Stage 1 σ'_{rc} : 99 kPa	Stage 2 σ'_{rc} : 149 kPa	Stage 3 σ'_{rc} : 248 kPa	— 1
Stage 1 σ'_{vc} : 99 kPa	Stage 2 σ'_{vc} : 149 kPa	Stage 3 σ'_{vc} : 248 kPa	— 2
			— 3

Project: 503387 - F254727
CID34

Laboratory: Wallingford, UK
Z5_OWF_BH09-COMP / 06-1 / 15.5

Approved by: ET 19/08/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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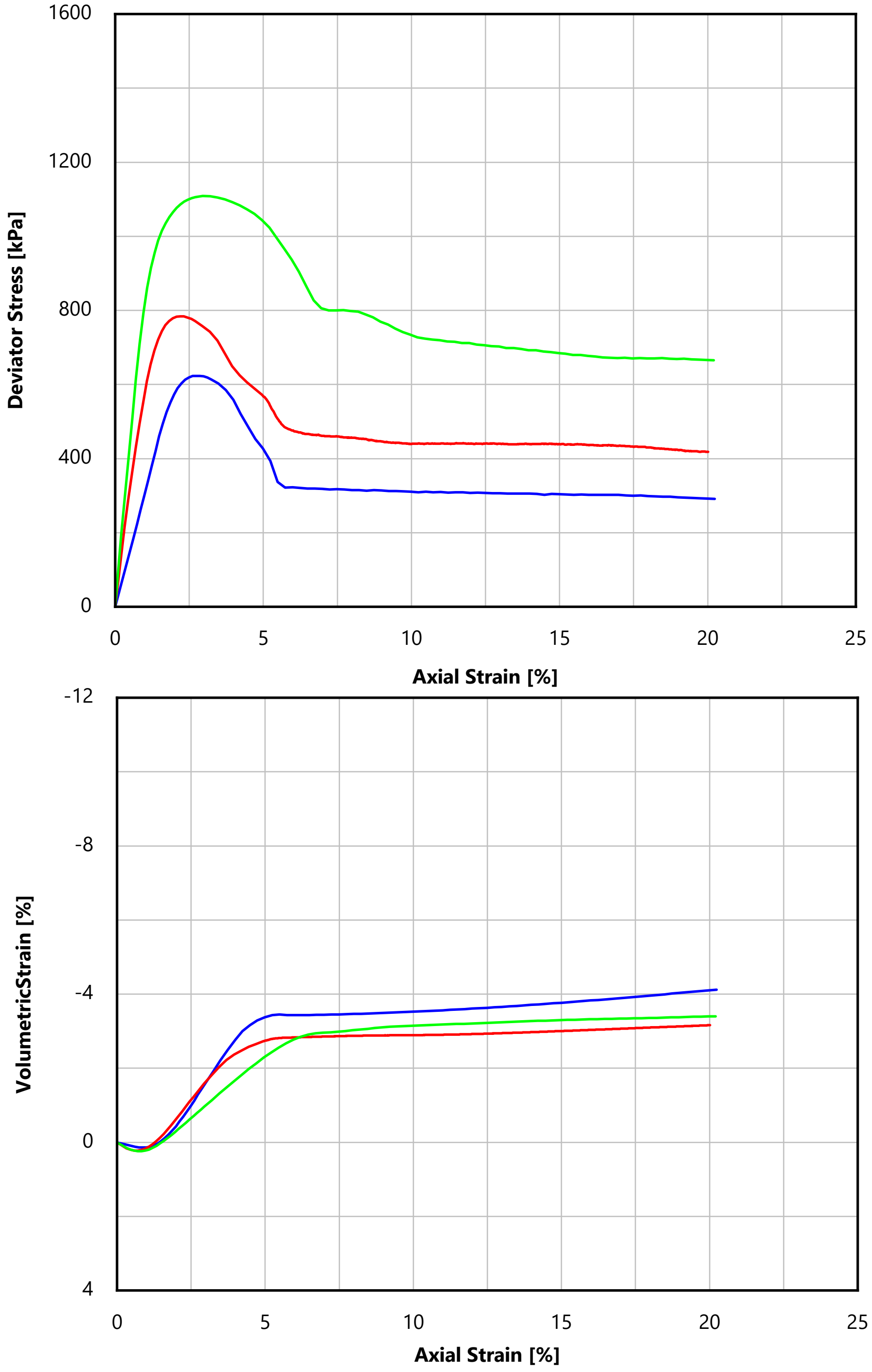
Shearing



Consolidation

Stage 1 σ'_{rc} : 99 kPa	Stage 2 σ'_{rc} : 149 kPa	Stage 3 σ'_{rc} : 248 kPa	🟦	1
Stage 1 σ'_{vc} : 99 kPa	Stage 2 σ'_{vc} : 149 kPa	Stage 3 σ'_{vc} : 248 kPa	🟥	2
			🟩	3

Project: 503387 - F254727
CID34

Laboratory: Wallingford, UK
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Approved by: ET 19/08/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils
Isotropic, Drained - Set of three (3) tests

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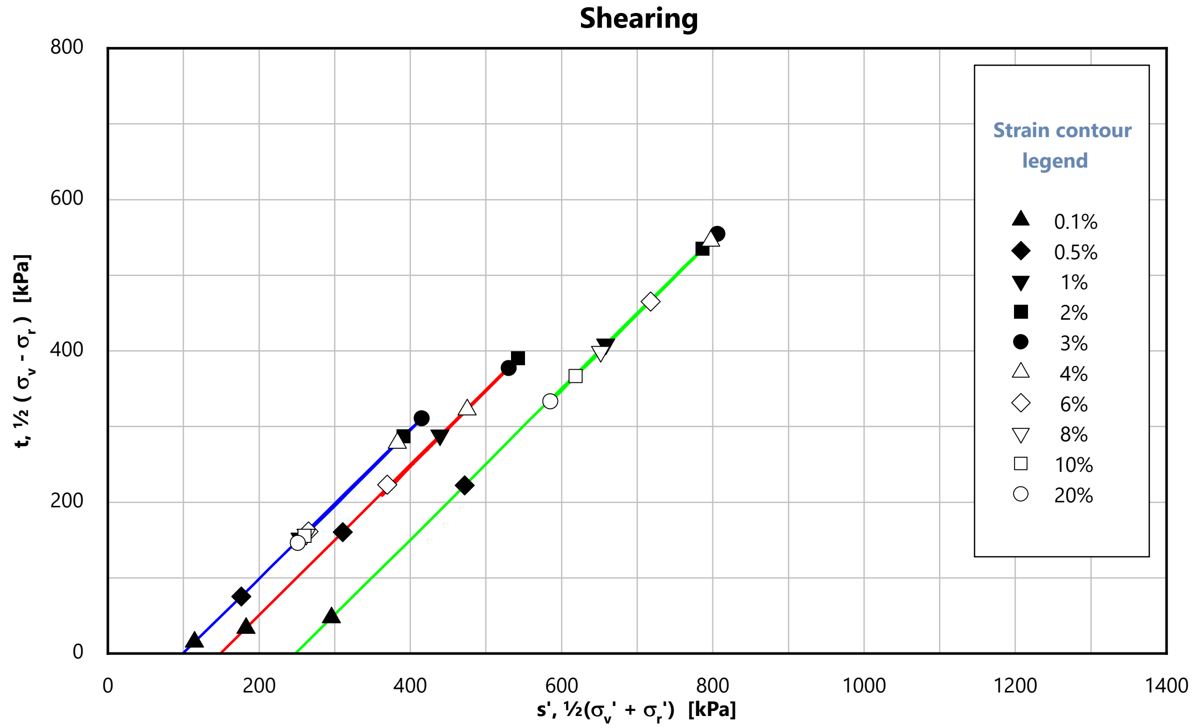

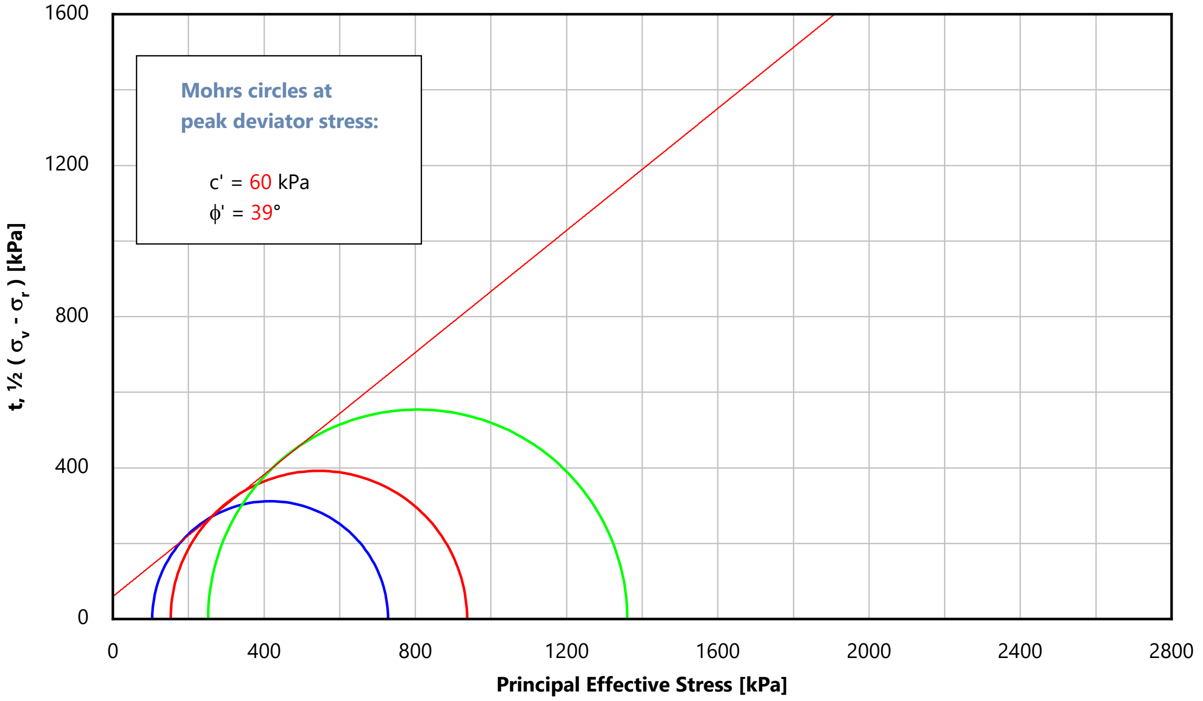

Consolidation				
Stage 1 σ'_{rc} : 99 kPa	Stage 2 σ'_{rc} : 149 kPa	Stage 3 σ'_{rc} : 248 kPa	🟦	1
Stage 1 σ'_{vc} : 99 kPa	Stage 2 σ'_{vc} : 149 kPa	Stage 3 σ'_{vc} : 248 kPa	🟥	2
			🟩	3

Project: 503387 - F254727
CID34

Laboratory: Wallingford, UK
Z5_OWF_BH09-COMP / 06-1 / 15.5

Approved by: ET 19/08/2025

Test Report

Consolidated Triaxial Compression Test On Water Saturated Soils Isotropic, Drained - Set of three (3) tests

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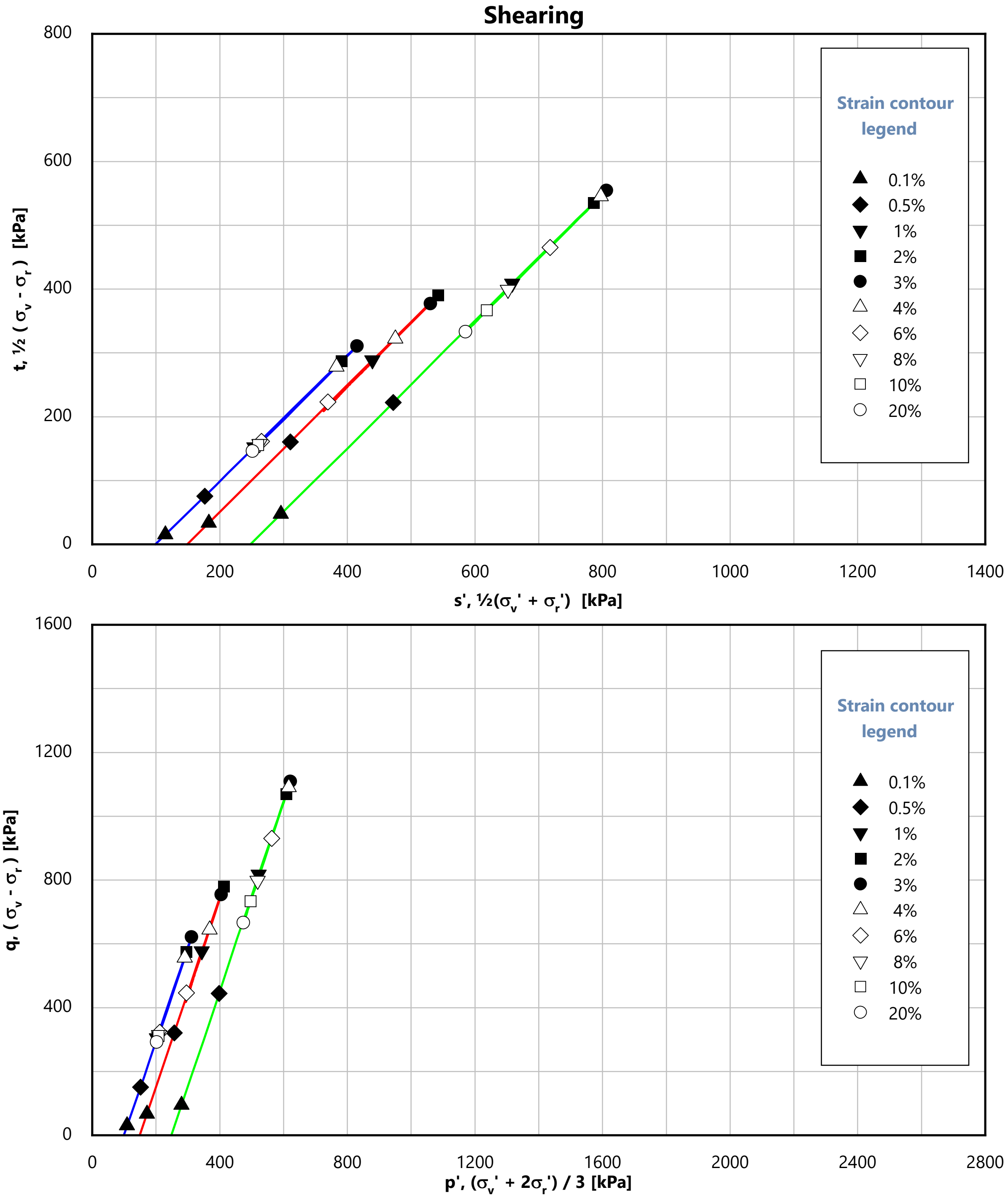

Consolidation				
Stage 1 σ'_{rc} : 99 kPa	Stage 2 σ'_{rc} : 149 kPa	Stage 3 σ'_{rc} : 248 kPa	—	1
Stage 1 σ'_{vc} : 99 kPa	Stage 2 σ'_{vc} : 149 kPa	Stage 3 σ'_{vc} : 248 kPa	—	2
			—	3

Project: 503387 - F254727
CID34

Laboratory: Wallingford, UK
Z5_OWF_BH09-COMP / 06-1 / 15.5

Approved by: ET 19/08/2025

Location	Sample ID	Depth BSF	Initial Conditions*					Shear Stage		φ'	c'
		[m]	w [%]	ρ [Mg/m^3]	ρ_d [Mg/m^3]	e_0 [-]	S_r [%]	σ_v [kPa]	τ_{peak} [kPa]	[°]	[kPa]
Z5_OWF_BH01-COMP	03-1	11.00	10.0	1.75	1.60	0.661	40	51	51	31.5	32.0
			10.0	1.75	1.59	0.664	40	103	95		
			10.0	1.76	1.60	0.660	40	205	158		
Z5_OWF_BH01-COMP	07-2	19.25	9.8	1.69	1.54	0.718	36	91	85	26.0	56.0
			9.8	1.70	1.54	0.716	36	181	118		
			9.8	1.70	1.55	0.714	37	363	246		
Z5_OWF_BH02-COMP	Batch_01	6.50	9.9	1.75	1.59	0.663	39	30	29	41.5	2.0
			9.9	1.79	1.62	0.631	42	59	55		
			9.9	1.78	1.62	0.635	41	120	109		
Z5_OWF_BH02-COMP	04-2	14.80	10.1	1.87	1.70	0.562	48	68	68	35.5	20.0
			10.1	1.88	1.70	0.556	48	135	118		
			10.1	1.87	1.70	0.556	48	270	212		
Z5_OWF_BH03-COMP	02-2	5.90	9.8	1.99	1.81	0.465	56	28	31	38.0	9.0
			9.8	1.97	1.80	0.476	54	56	56		
			9.8	1.98	1.81	0.467	56	113	97		
Z5_OWF_BH03-COMP	03-2	9.90	10.0	1.56	1.42	0.864	31	48	56	38.0	9.0
			10.0	1.56	1.42	0.865	31	95	66		
			10.0	1.56	1.42	0.865	31	190	125		
Z5_OWF_BH03-COMP	06-2	19.40	10.4	1.77	1.60	0.657	42	94	56	29.0	6.0
			10.4	1.76	1.59	0.662	42	189	114		
			10.4	1.76	1.59	0.665	41	377	214		

Notes

BSF : Below seafloor
* : Specimen conditions after preparation and before consolidation
† : Specimen conditions after consolidation and before shearing
w : Water content
ρ : Bulk density
ρ_d : Dry density
e_0 : Initial void ratio
S_r : Degree of saturation
e : Void ratio
σ_v : Total vertical stress
τ_{peak} : Peak shear stress
φ' : Effective angle of internal friction
c' : Effective cohesion intercept

Summary of Direct Shear - Shear Box Test Results

Soil-Soil Interface

Location	Sample ID	Depth BSF	Initial Conditions*					Shear Stage		φ'	c'
		[m]	w [%]	ρ [Mg/m^3]	ρ_d [Mg/m^3]	e_0 [-]	S_r [%]	σ_v [kPa]	τ_{peak} [kPa]	[°]	[kPa]
Z5_OWF_BH05-COMP	Batch_02	13.00	9.9	1.87	1.70	0.557	47	62	56	39.0	3.0
			9.9	1.88	1.71	0.553	48	124	99		
			9.9	1.88	1.71	0.551	48	249	206		
Z5_OWF_BH07-COMP_a	Batch_03	20.00	10.3	1.75	1.59	0.668	41	98	75	36.0	6.0
			10.3	1.73	1.57	0.685	40	195	151		
			10.3	1.76	1.59	0.662	41	390	288		
Z5_OWF_BH09-COMP	07-2	19.80	10.1	1.80	1.64	0.619	43	96	85	29.0	59.0
			10.1	1.80	1.64	0.618	43	192	146		
			10.1	1.81	1.64	0.612	44	385	278		

Notes

BSF : Below seafloor
* : Specimen conditions after preparation and before consolidation
† : Specimen conditions after consolidation and before shearing
w : Water content
ρ : Bulk density
ρ_d : Dry density
e_0 : Initial void ratio
S_r : Degree of saturation
e : Void ratio
σ_v : Total vertical stress
τ_{peak} : Peak shear stress
φ' : Effective angle of internal friction
c' : Effective cohesion intercept

Summary of Direct Shear - Shear Box Test Results

Soil-Soil Interface

Test Report

Direct Shear Test

Shear Box, Soil:Soil Interface

ISO 17892-10:2018

UKAS TESTING 0919

Test Identification	
Location	Z5_OWF_BH01-COMP
Sample	03-1
Depth [m]	11.00

Specimen Visual Description

Grey fine to medium SAND

Initial Specimen Conditions	1	2	3
Test start date	07/04/2025	07/04/2025	07/04/2025
Length [mm]	60.0	60.1	60.0
Width [mm]	60.1	60.0	60.0
Water content [%]	10.0	10.0	10.0
Bulk density [Mg/m^3]	1.75	1.75	1.76
Dry density [Mg/m^3]	1.60	1.59	1.60
Void ratio [-]	0.661	0.664	0.660
Degree of saturation [%]	40	40	40
Assumed particle density [Mg/m^3]	2.65	2.65	2.65

End of Consolidation	1	2	3
Normal stress [kPa]	51	103	205
Void ratio [-]	0.629	0.623	0.609
Vertical displacement [mm]	0.48	0.63	0.77
Degree of saturation [%]	100	100	100

Shear Stage	1	2	3
Rate of displacement [mm/min]	0.45	0.45	0.45
Normal stress [kPa]	51	103	205
Shear stress at failure [kPa]	51	95	158
Horizontal displacement at failure [mm]	0.96	0.84	1.43
Vertical displacement at failure [mm]	-0.02	0.02	-0.03
Void ratio at the end of the test [-]	0.630	0.622	0.611

Notes

Sample tested submerged

Square sample

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Test Report

Direct Shear Test
Shear Box, Soil:Soil Interface

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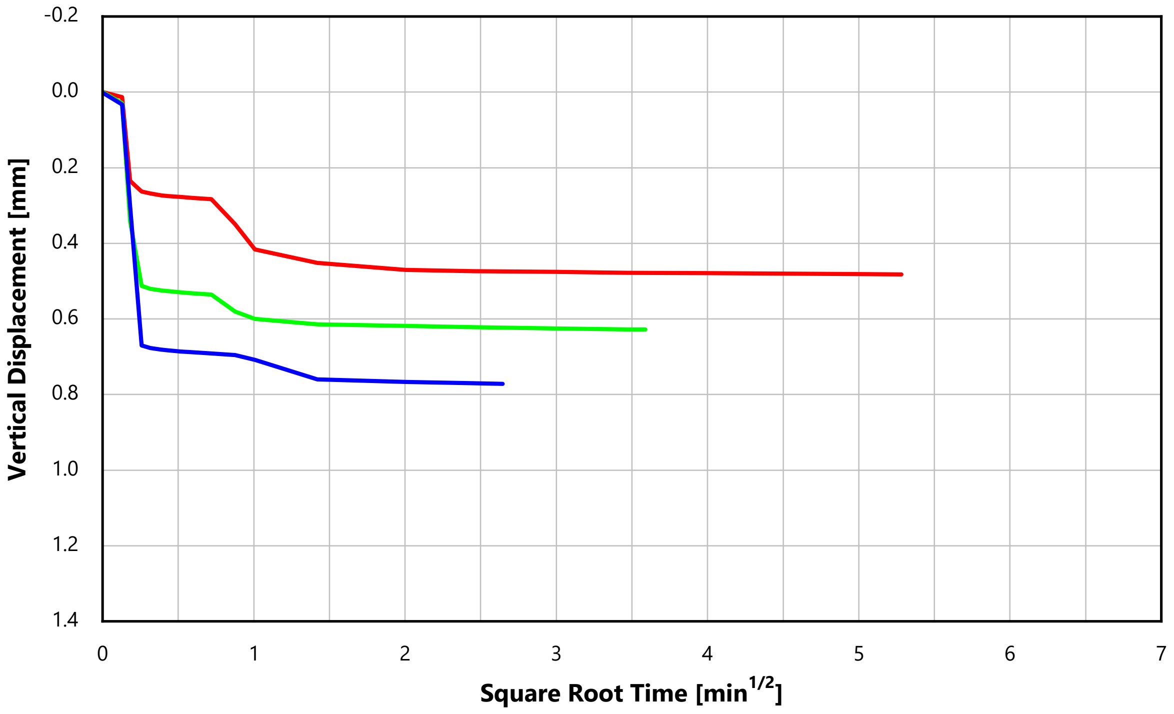
UKAS TESTING 0919

Consolidation Stage



🟥 Specimen 1: Normal stress 30 kPa	🟩 Specimen 2: Normal stress 103 kPa	🟦 Specimen 3: Normal stress 205 kPa

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Test Report

Direct Shear Test
Shear Box, Soil:Soil Interface

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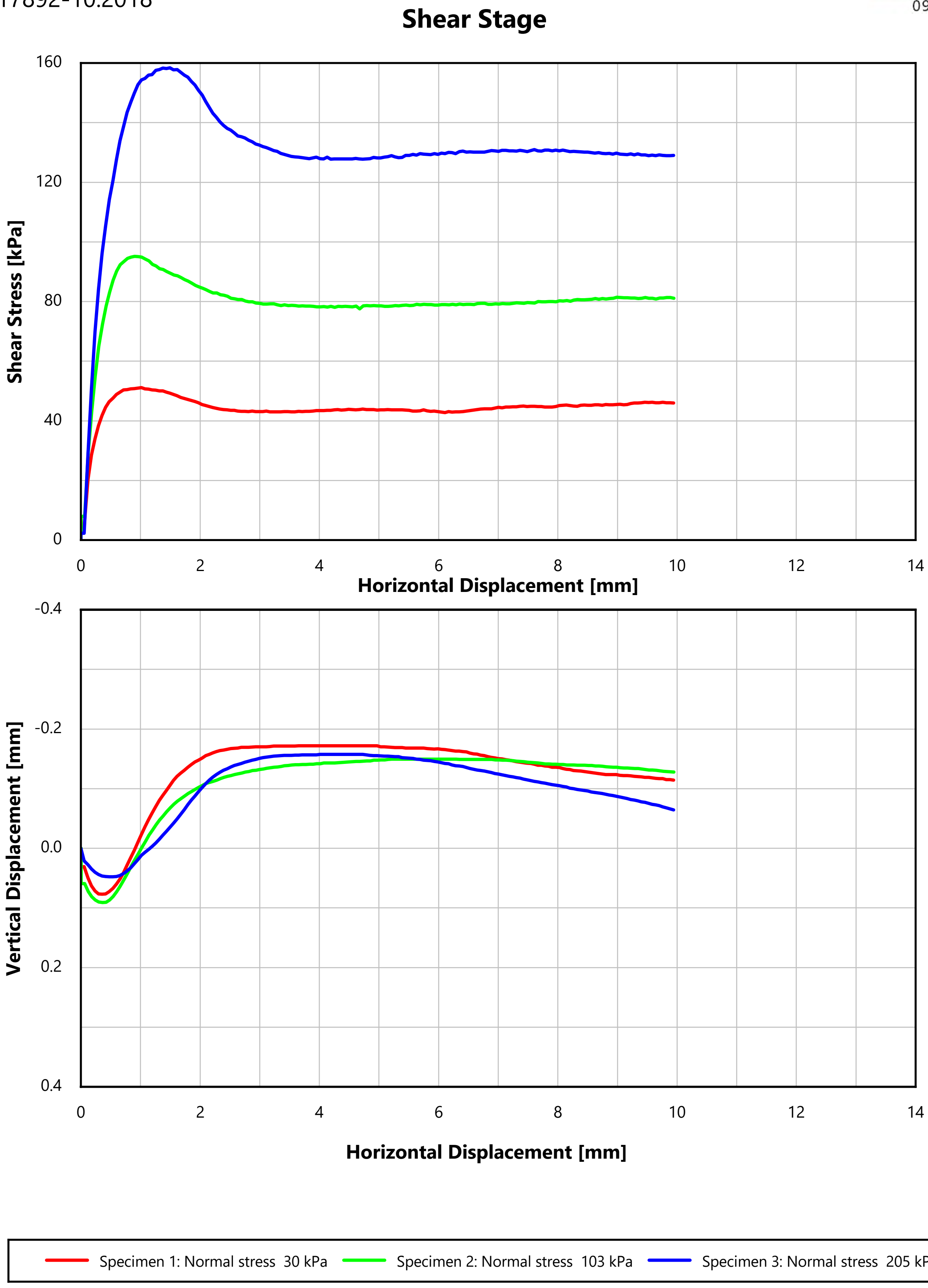

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Laboratory: Wallingford, UK

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Test Report

Direct Shear Test

Shear Box, Soil:Soil Interface

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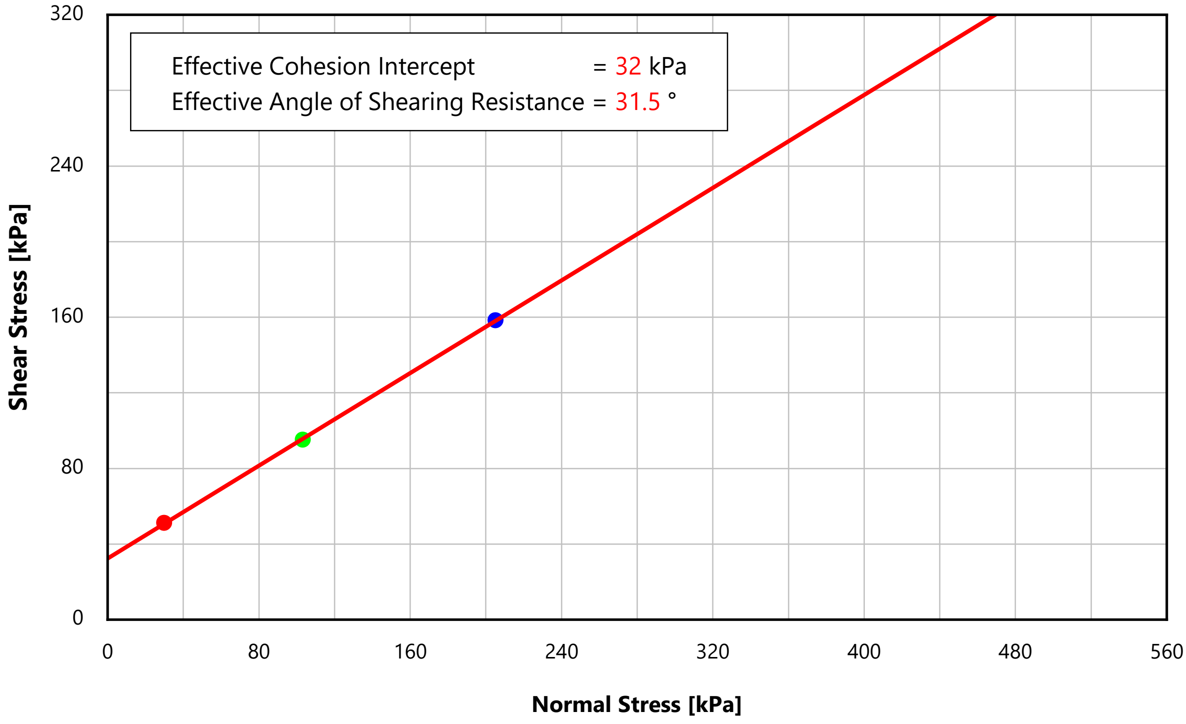
Friction Angle



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Test Page No.: SB19 - 4/4

Laboratory: Wallingford, UK

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Test Report
Direct Shear Test
Shear Box, Soil:Soil Interface
ISO 17892-10:2018

0919

Test Identification	
Location	Z5_OWF_BH01-COMP
Sample	07-2
Depth [m]	19.25

Specimen Visual Description
Dark grey medium SAND

Initial Specimen Conditions	1	2	3
Test start date	24/04/2025	24/04/2025	24/04/2025
Length [mm]	60.0	60.0	60.0
Width [mm]	60.1	60.0	60.0
Water content [%]	9.8	9.8	9.8
Bulk density [Mg/m^3]	1.69	1.70	1.70
Dry density [Mg/m^3]	1.54	1.54	1.55
Void ratio [-]	0.718	0.716	0.714
Degree of saturation [%]	36	36	37
Assumed particle density [Mg/m^3]	2.65	2.65	2.65

End of Consolidation	1	2	3
Normal stress [kPa]	91	181	363
Void ratio [-]	0.681	0.666	0.653
Vertical displacement [mm]	0.52	0.70	0.86
Degree of saturation [%]	83	85	89

Shear Stage	1	2	3
Rate of displacement [mm/min]	0.45	0.45	0.45
Normal stress [kPa]	91	181	363
Shear stress at failure [kPa]	85	118	246
Horizontal displacement at failure [mm]	1.38	1.79	2.45
Vertical displacement at failure [mm]	-0.02	-0.03	-0.03
Void ratio at the end of the test [-]	0.683	0.668	0.654

Notes
Sample tested submerged Square sample

Project: 503387 - F254727 Laboratory: Wallingford, UK Approved by: SW - 04/06/2025
Test page SB20-1/4

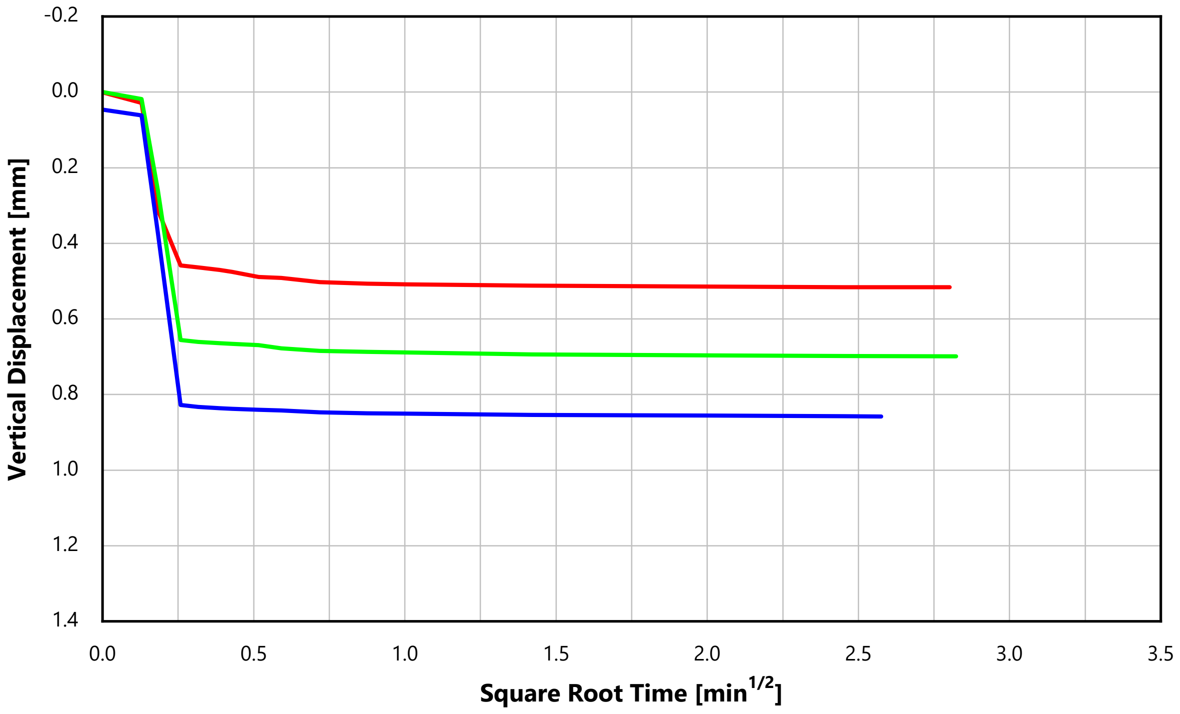
Test Report

Direct Shear Test

Shear Box, Soil:Soil Interface

ISO 17892-10:2018

Consolidation Stage



🟥 Specimen 1: Normal stress 30 kPa
🟩 Specimen 2: Normal stress 181 kPa
🟦 Specimen 3: Normal stress 363 kPa

Project: 503387 - F254727
Test Page No.: SB20 - 2/4

Laboratory: Wallingford, UK

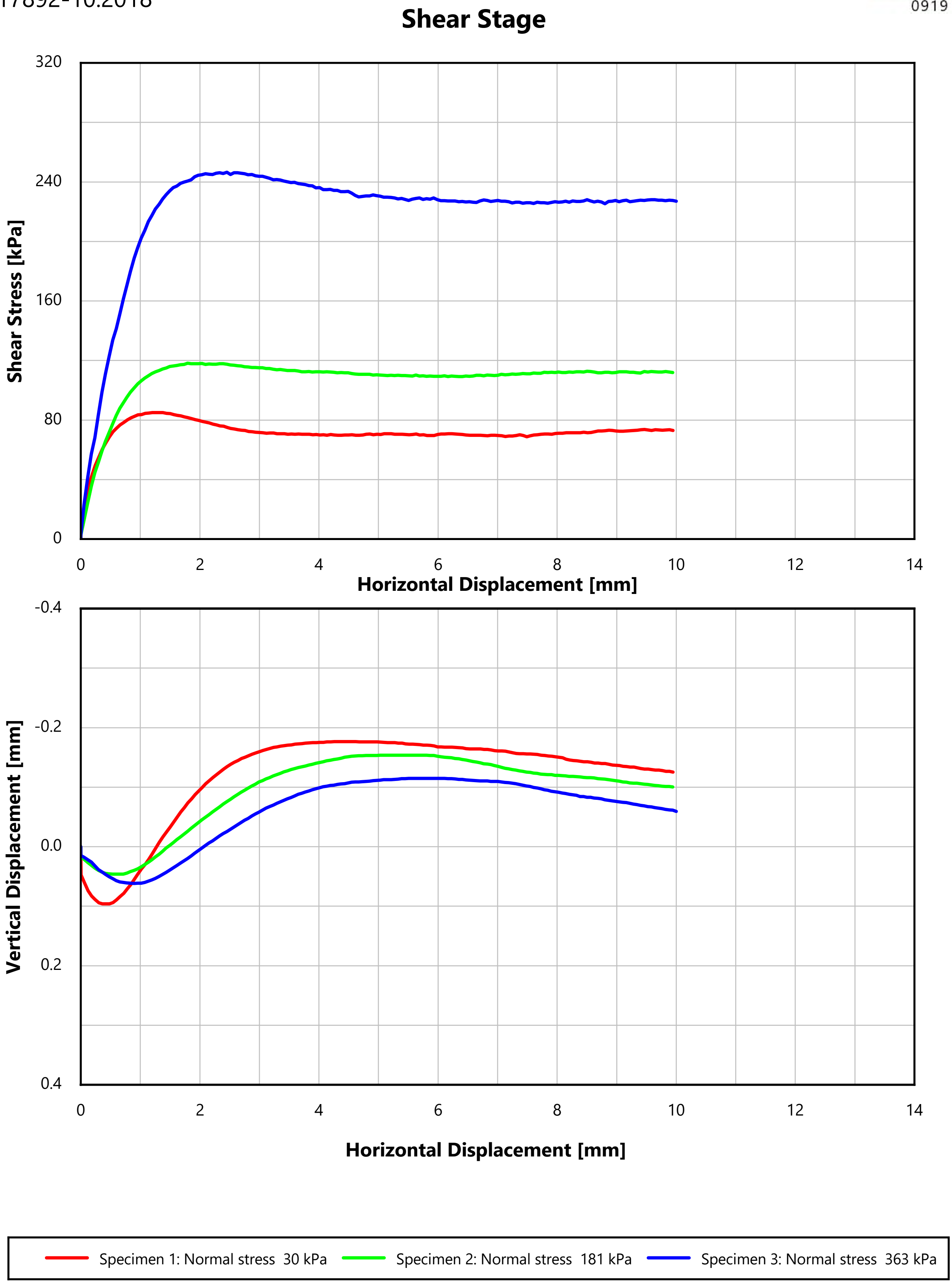
Approved by: SW - 04/06/2025

Test Report

Direction Shear Test

Shear Box, Soil:Soil Interface

ISO 17892-10:2018



Project: 503387 - F254727
Test Page No.: SB20 - 3/4

Laboratory: Wallingford, UK

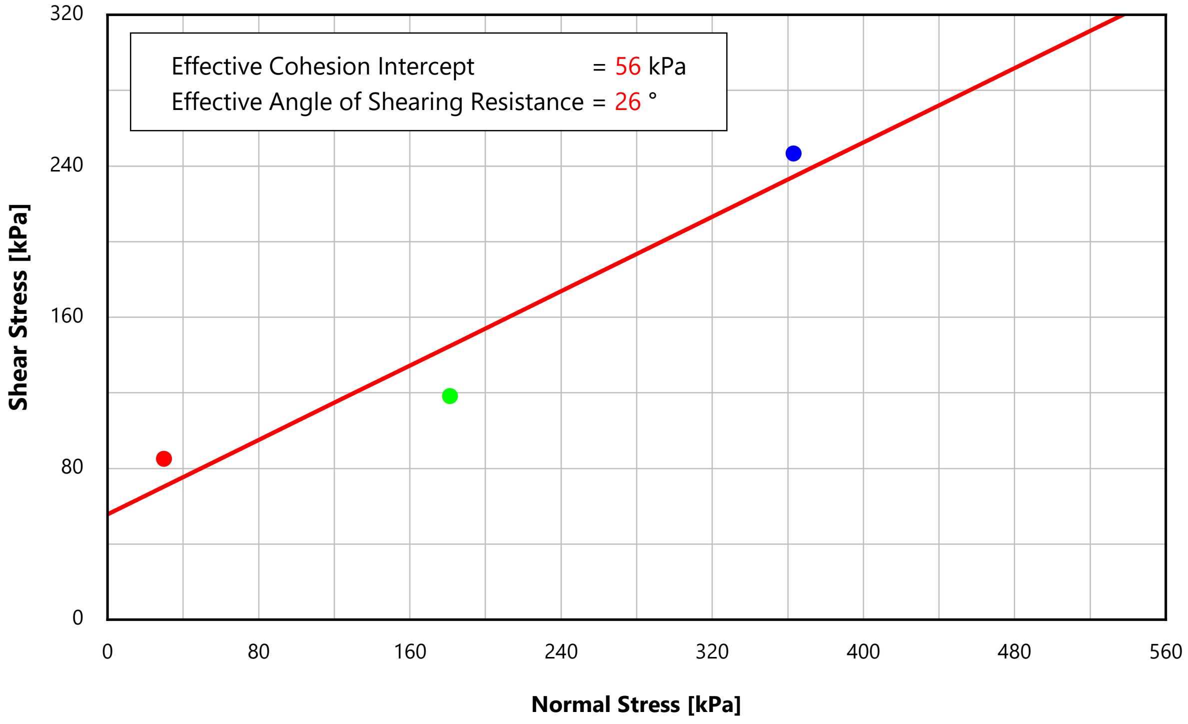
Approved by: SW - 04/06/2025

Test Report

Direct Shear Test
Shear Box, Soil:Soil Interface

ISO 17892-10:2018

Friction Angle



🟥 Specimen 1: Normal stress 30 kPa 🟩 Specimen 2: Normal stress 181 kPa 🟦 Specimen 3: Normal stress 363 kPa

Project: 503387 - F254727
Test Page No.: SB20 - 4/4

Laboratory: Wallingford, UK

Approved by: SW - 04/06/2025

Test Report
Direct Shear Test
Shear Box, Soil:Soil Interface
ISO 17892-10:2018

UKAS TESTING 0919

Test Identification	
Location	Z5_OWF_BH02-COMP
Sample	Batch_01
Depth [m]	6.50

Specimen Visual Description
Dark grey fine to medium SAND

Initial Specimen Conditions	1	2	3
Test start date	06/06/2025	18/03/2025	18/03/2025
Length [mm]	60.0	60.0	60.0
Width [mm]	60.0	60.0	60.0
Water content [%]	9.9	9.9	9.9
Bulk density [Mg/m^3]	1.75	1.79	1.78
Dry density [Mg/m^3]	1.59	1.62	1.62
Void ratio [-]	0.663	0.631	0.635
Degree of saturation [%]	39	42	41
Assumed particle density [Mg/m^3]	2.65	2.65	2.65

End of Consolidation	1	2	3
Normal stress [kPa]	30	59	120
Void ratio [-]	0.641	0.595	0.595
Vertical displacement [mm]	0.32	0.54	0.61
Degree of saturation [%]	93	100	99

Shear Stage	1	2	3
Rate of displacement [mm/min]	0.45	0.45	0.45
Normal stress [kPa]	30	59	119
Shear stress at failure [kPa]	29	55	109
Horizontal displacement at failure [mm]	0.96	0.78	1.26
Vertical displacement at failure [mm]	-0.03	-0.03	-0.04
Void ratio at the end of the test [-]	0.643	0.597	0.597

Notes
Sample tested submerged Square sample

Project: 503387 - F254727 Laboratory: Wallingford, UK Approved by: SW - 29/06/2025

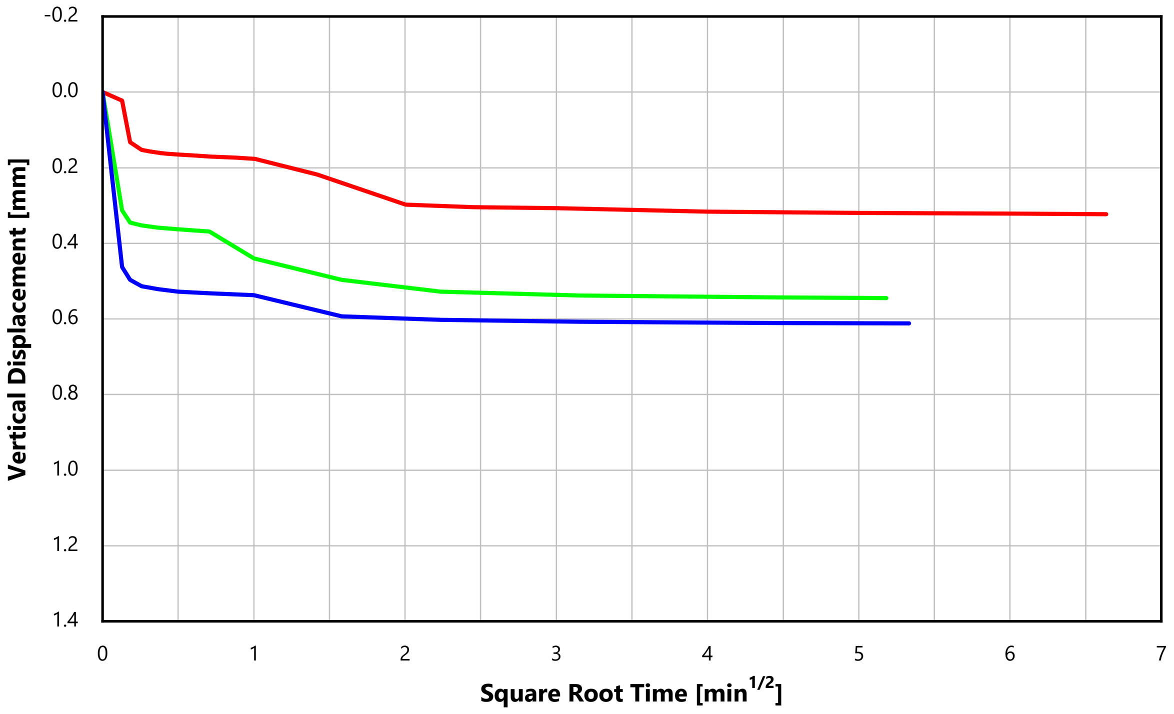
Test page SB21-1/4

Test Report

Direction Shear Test
Shear Box, Soil:Soil Interface

ISO 17892-10:2018

Consolidation Stage



🟥 Specimen 1: Normal stress 30 kPa
🟩 Specimen 2: Normal stress 59 kPa
🟦 Specimen 3: Normal stress 119 kPa

Project: 503387 - F254727
Test Page No.: SB21 - 2/4

Laboratory: Wallingford, UK

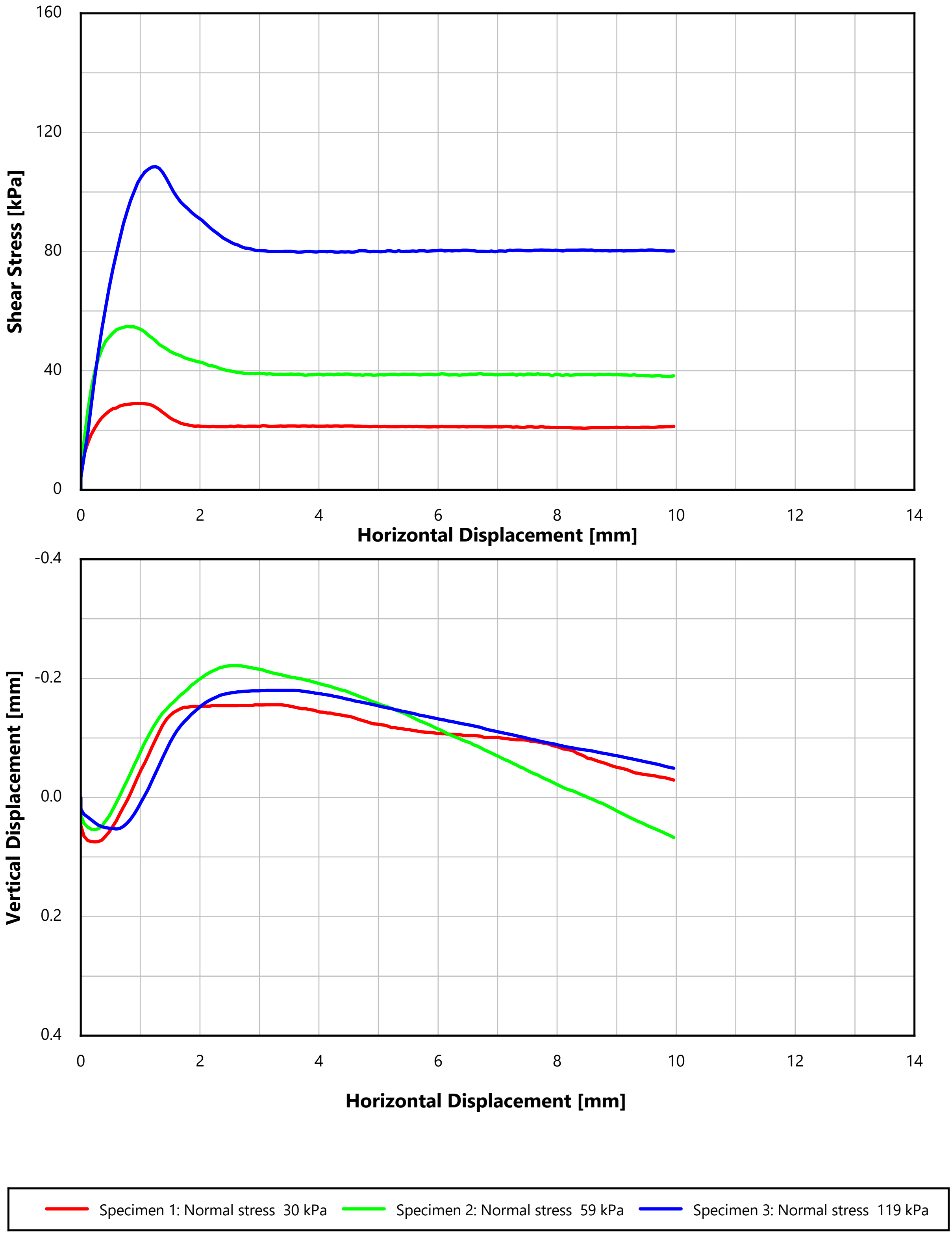
Approved by: SW - 29/06/2025

Test Report

Direct Shear Test
Shear Box, Soil:Soil Interface

ISO 17892-10:2018

Shear Stage



Project: 503387 - F254727
Test Page No.: SB21 - 3/4

Laboratory: Wallingford, UK

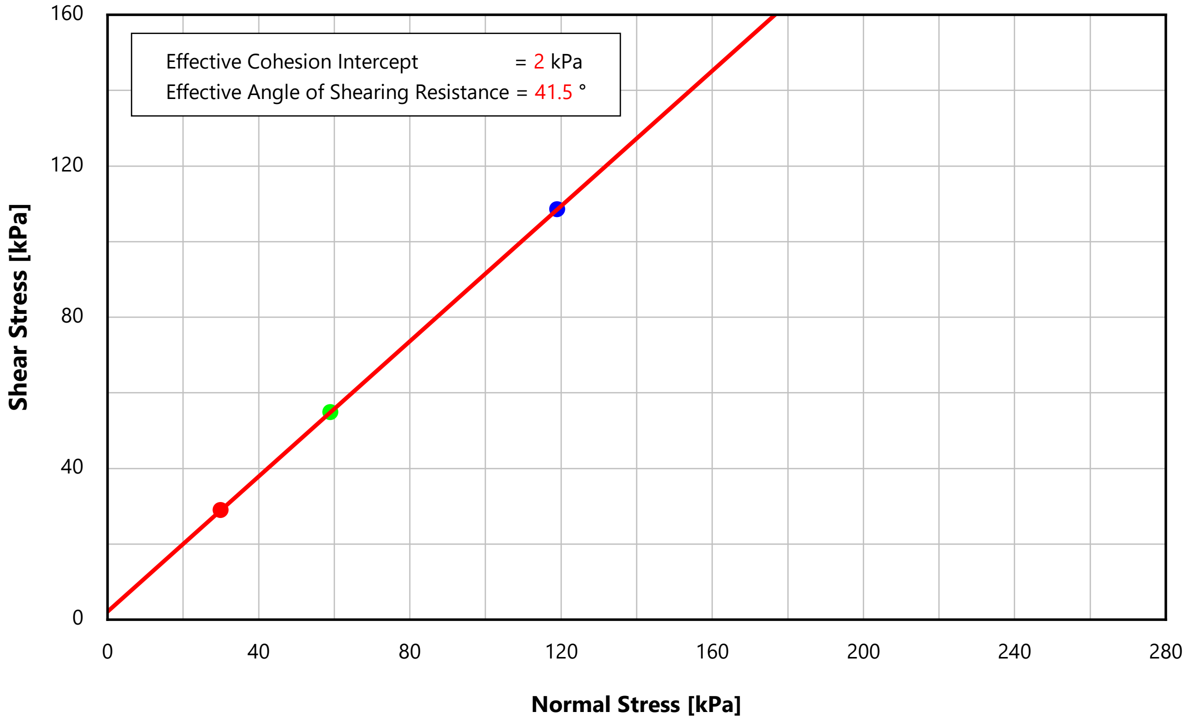
Approved by: SW - 29/06/2025

Test Report

Direct Shear Test
Shear Box, Soil:Soil Interface

ISO 17892-10:2018

Friction Angle



🟥 Specimen 1: Normal stress 30 kPa 🟩 Specimen 2: Normal stress 59 kPa 🟦 Specimen 3: Normal stress 119 kPa

Project: 503387 - F254727
Test Page No.: SB21 - 4/4

Laboratory: Wallingford, UK

Approved by: SW - 29/06/2025

Test Report
Direct Shear Test
Shear Box, Soil:Soil Interface
ISO 17892-10:2018

Test Identification	
Location	Z5_OWF_BH02-COMP
Sample	04-2
Depth [m]	14.8

Specimen Visual Description
Dark grey medium SAND

Initial Specimen Conditions	1	2	3
Test start date	06/06/2025	15/04/2025	15/04/2025
Length [mm]	60.0	60.0	59.9
Width [mm]	60.0	60.0	60.0
Water content [%]	10.1	10.1	10.1
Bulk density [Mg/m^3]	1.87	1.88	1.87
Dry density [Mg/m^3]	1.70	1.70	1.70
Void ratio [-]	0.562	0.556	0.556
Degree of saturation [%]	48	48	48
Assumed particle density [Mg/m^3]	2.65	2.65	2.65

End of Consolidation	1	2	3
Normal stress [kPa]	68	135	270
Void ratio [-]	0.529	0.493	0.507
Vertical displacement [mm]	0.51	0.95	0.75
Degree of saturation [%]	100	100	100

Shear Stage	1	2	3
Rate of displacement [mm/min]	0.45	0.45	0.45
Normal stress [kPa]	68	135	271
Shear stress at failure [kPa]	68	118	212
Horizontal displacement at failure [mm]	0.78	1.37	1.49
Vertical displacement at failure [mm]	-0.03	-0.03	-0.07
Void ratio at the end of the test [-]	0.531	0.495	0.511

Notes
Sample tested submerged Square sample

Project: 503387 - F254727 Laboratory: Wallingford, UK Approved by: ET - 22/08/2025
Test page SB22-1/4

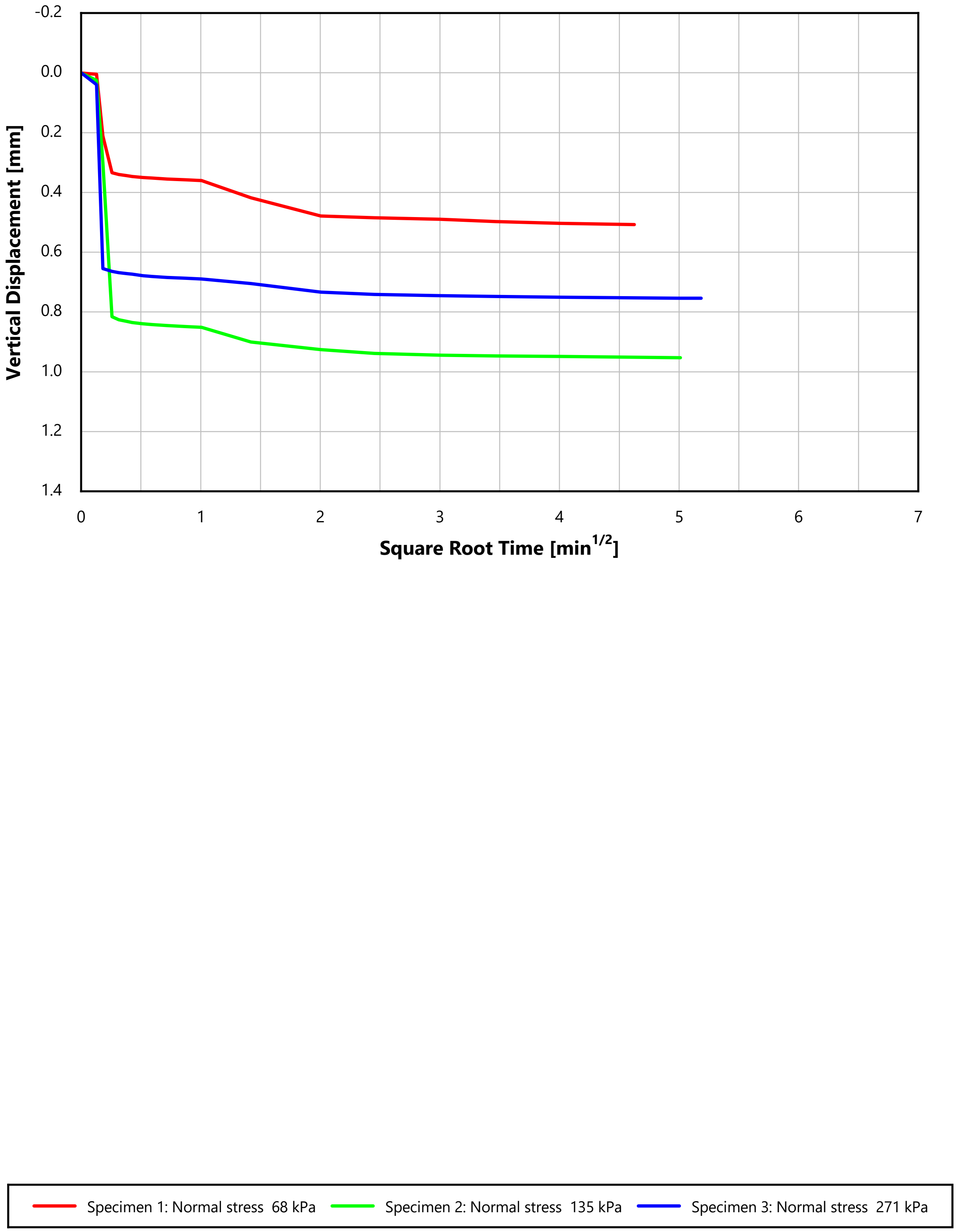
Test Report

Direction Shear Test

Shear Box, Soil:Soil Interface

ISO 17892-10:2018

Consolidation Stage



Test Report

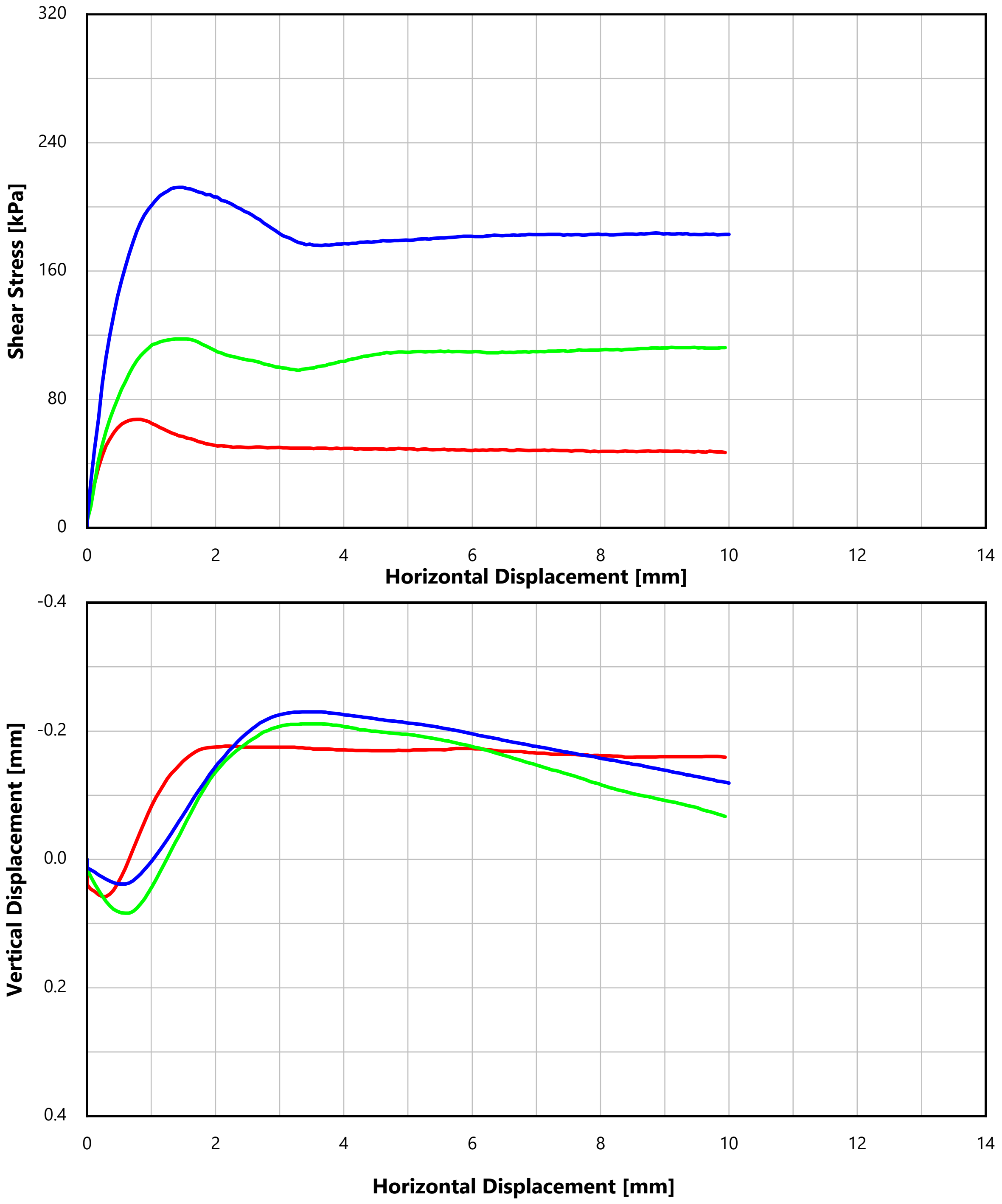
Direction Shear Test

Shear Box, Soil:Soil Interface

ISO 17892-10:2018

UKAS TESTING 0919

Shear Stage



🟥 Specimen 1: Normal stress 68 kPa	🟩 Specimen 2: Normal stress 135 kPa	🟦 Specimen 3: Normal stress 271 kPa

Project: 503387 - F254727
Test Page No.: SB22 - 3/4

Laboratory: Wallingford, UK

Approved by: ET - 22/08/2025

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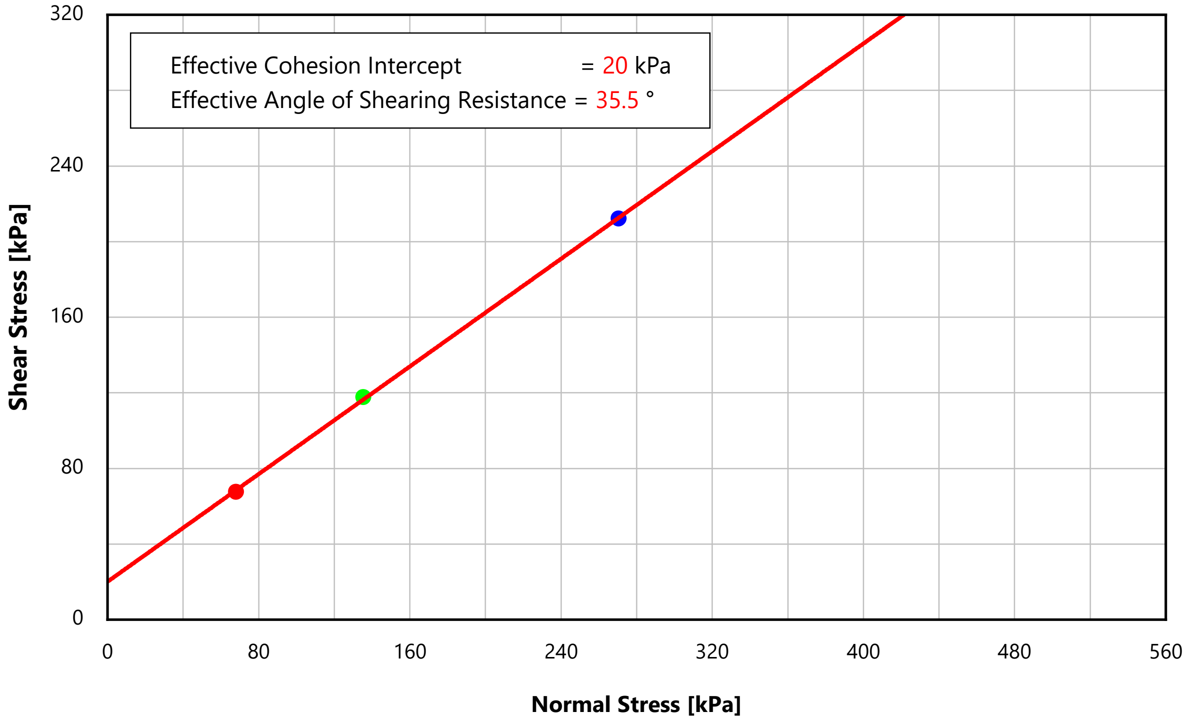
Test Report

Direct Shear Test
Shear Box, Soil:Soil Interface

ISO 17892-10:2018

Friction Angle



— Specimen 1: Normal stress 68 kPa — Specimen 2: Normal stress 135 kPa — Specimen 3: Normal stress 271 kPa

Project: 503387 - F254727
Test Page No.: SB22 - 4/4

Laboratory: Wallingford, UK

Approved by: ET - 22/08/2025

Test Report

Direct Shear Test

Shear Box, Soil:Soil Interface

ISO 17892-10:2018

0919

Test Identification	
Location	Z5_OWF_BH03-COMP
Sample	02-2
Depth [m]	5.90

Specimen Visual Description

Dark grey fine to medium SAND

Initial Specimen Conditions	1	2	3
Test start date	14/04/2025	14/04/2025	14/04/2025
Length [mm]	60.1	60.0	60.1
Width [mm]	60.0	60.1	60.0
Water content [%]	9.8	9.8	9.8
Bulk density [Mg/m^3]	1.99	1.97	1.98
Dry density [Mg/m^3]	1.81	1.80	1.81
Void ratio [-]	0.465	0.476	0.467
Degree of saturation [%]	56	54	56
Assumed particle density [Mg/m^3]	2.65	2.65	2.65

End of Consolidation	1	2	3
Normal stress [kPa]	28	56	113
Void ratio [-]	0.447	0.443	0.438
Vertical displacement [mm]	0.28	0.51	0.44
Degree of saturation [%]	96	98	100

Shear Stage	1	2	3
Rate of displacement [mm/min]	0.45	0.45	0.45
Normal stress [kPa]	28	56	113
Shear stress at failure [kPa]	31	56	97
Horizontal displacement at failure [mm]	0.96	1.13	1.43
Vertical displacement at failure [mm]	-0.06	-0.10	-0.08
Void ratio at the end of the test [-]	0.451	0.449	0.443

Notes

Sample tested submerged

Square sample

Project: 503387 - F254727 Laboratory: Wallingford, UK Approved by: AF - 02/05/2025

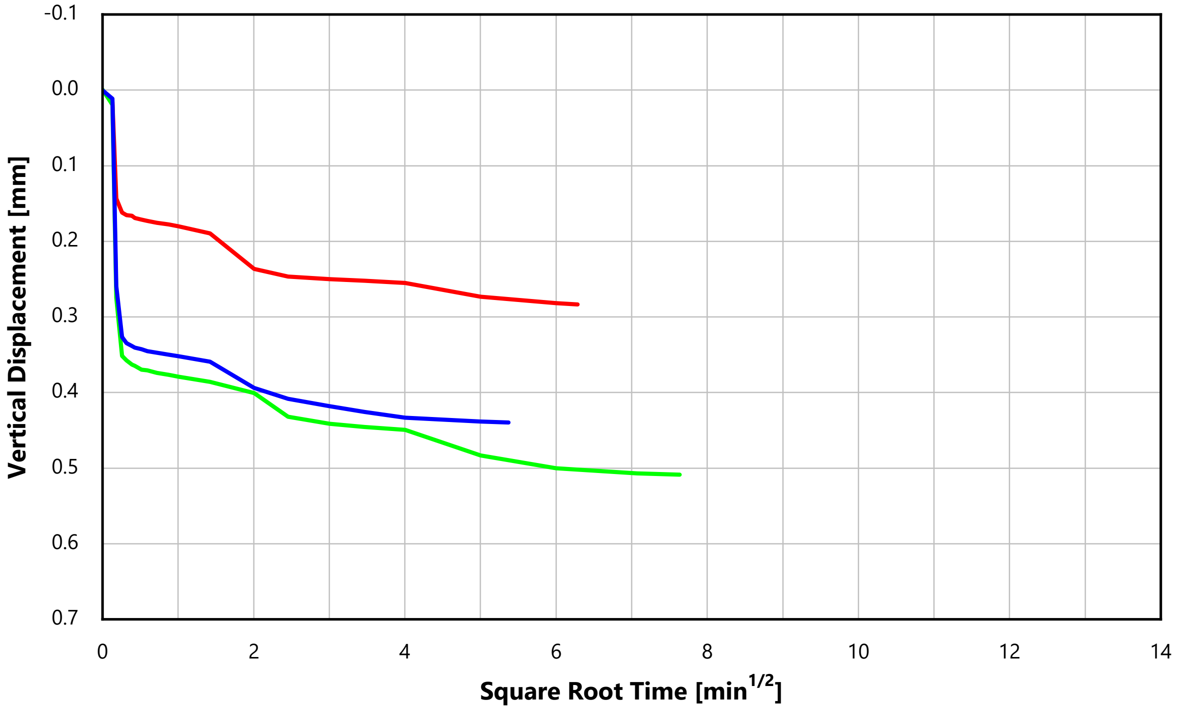
Test page SB26-1/4

Test Report

Direction Shear Test

UKAS TESTING 0919

Consolidation Stage



🟥 Specimen 1: Normal stress 30 kPa	🟩 Specimen 2: Normal stress 56 kPa	🟦 Specimen 3: Normal stress 113 kPa

Project: 503387 - F254727
Test Page No.: SB26 - 2/4

Laboratory: Wallingford, UK

Approved by: AF - 02/05/2025

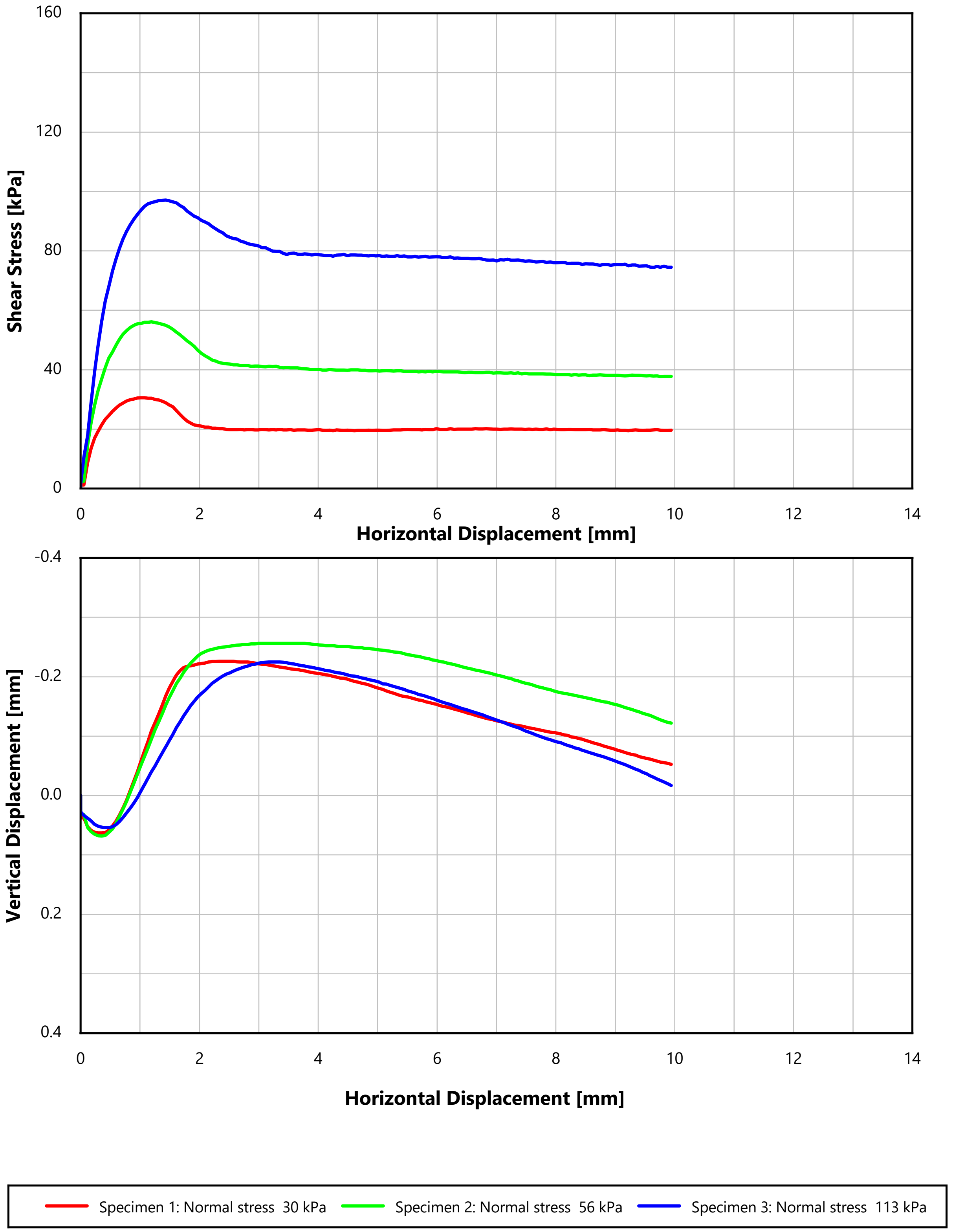
Test Report

Direct Shear Test
Shear Box, Soil:Soil Interface

ISO 17892-10:2018

UKAS TESTING 0919

Shear Stage



Project: 503387 - F254727
Test Page No.: SB26 - 3/4

Laboratory: Wallingford, UK

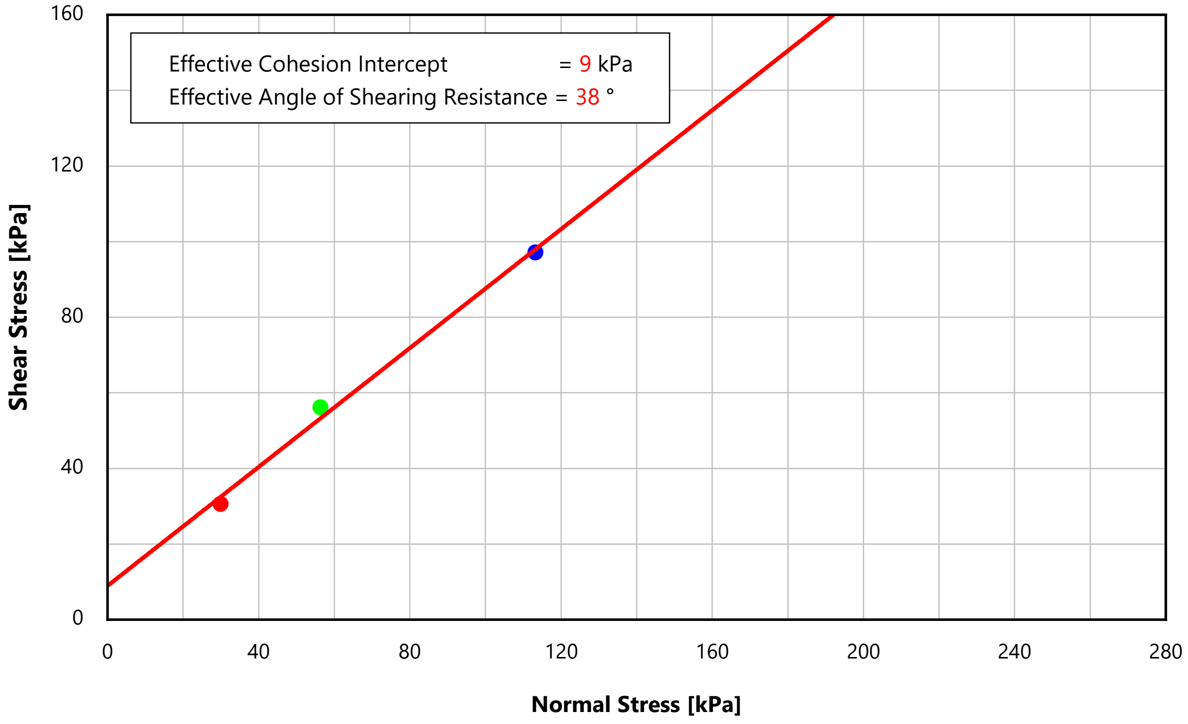
Approved by: AF - 02/05/2025

Test Report

Direct Shear Test
Shear Box, Soil:Soil Interface

ISO 17892-10:2018

Friction Angle



— Specimen 1: Normal stress 30 kPa	— Specimen 2: Normal stress 56 kPa	— Specimen 3: Normal stress 113 kPa

Project: 503387 - F254727
Test Page No.: SB26 - 4/4

Laboratory: Wallingford, UK

Approved by: AF - 02/05/2025

Test Report
Direct Shear Test
Shear Box, Soil:Soil Interface
ISO 17892-10:2018

UKAS TESTING 0919

Test Identification	
Location	Z5_OWF_BH03-COMP
Sample	03-2
Depth [m]	9.90

Specimen Visual Description
Dark grey fine to medium SAND

Initial Specimen Conditions	1	2	3
Test start date	28/04/2025	28/04/2025	28/04/2025
Length [mm]	60.0	60.0	60.0
Width [mm]	60.0	60.0	60.0
Water content [%]	10.0	10.0	10.0
Bulk density [Mg/m^3]	1.56	1.56	1.56
Dry density [Mg/m^3]	1.42	1.42	1.42
Void ratio [-]	0.864	0.865	0.865
Degree of saturation [%]	31	31	31
Assumed particle density [Mg/m^3]	2.65	2.65	2.65

End of Consolidation	1	2	3
Normal stress [kPa]	48	95	190
Void ratio [-]	0.783	0.732	0.747
Vertical displacement [mm]	1.03	1.70	1.52
Degree of saturation [%]	75	84	78

Shear Stage	1	2	3
Rate of displacement [mm/min]	0.45	0.45	0.45
Normal stress [kPa]	48	95	190
Shear stress at failure [kPa]	56	66	125
Horizontal displacement at failure [mm]	10.00	10.00	8.74
Vertical displacement at failure [mm]	0.94	0.82	0.92
Void ratio at the end of the test [-]	0.710	0.669	0.675

Notes
Sample tested submerged Square sample

Project: 503387 - F254727 Laboratory: Wallingford, UK Approved by: SW - 03/07/2025
Test page SB27-1/4

Test Report

Direct Shear Test
Shear Box, Soil:Soil Interface

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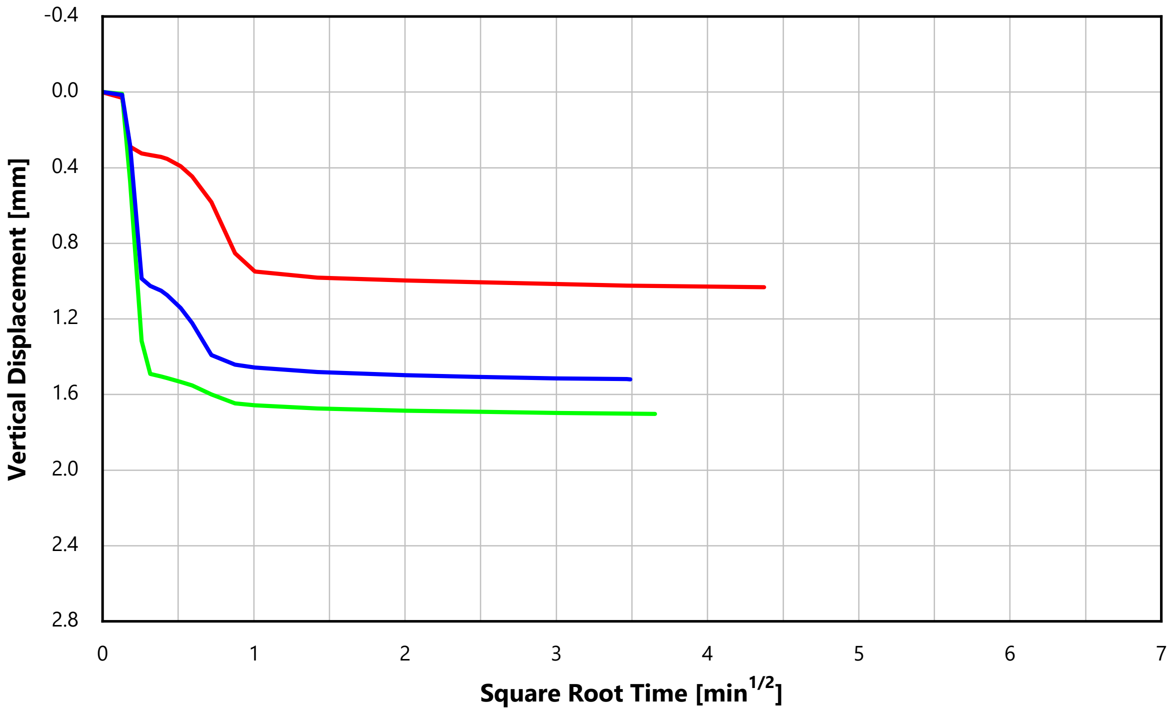
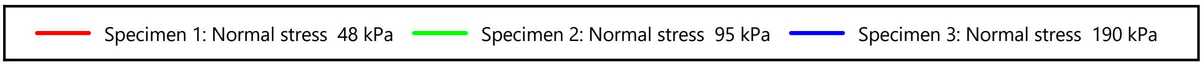
UKAS TESTING 0919

Consolidation Stage





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Laboratory: Wallingford, UK

Approved by: SW - 03/07/2025

Test Report

Direct Shear Test

Shear Box, Soil:Soil Interface

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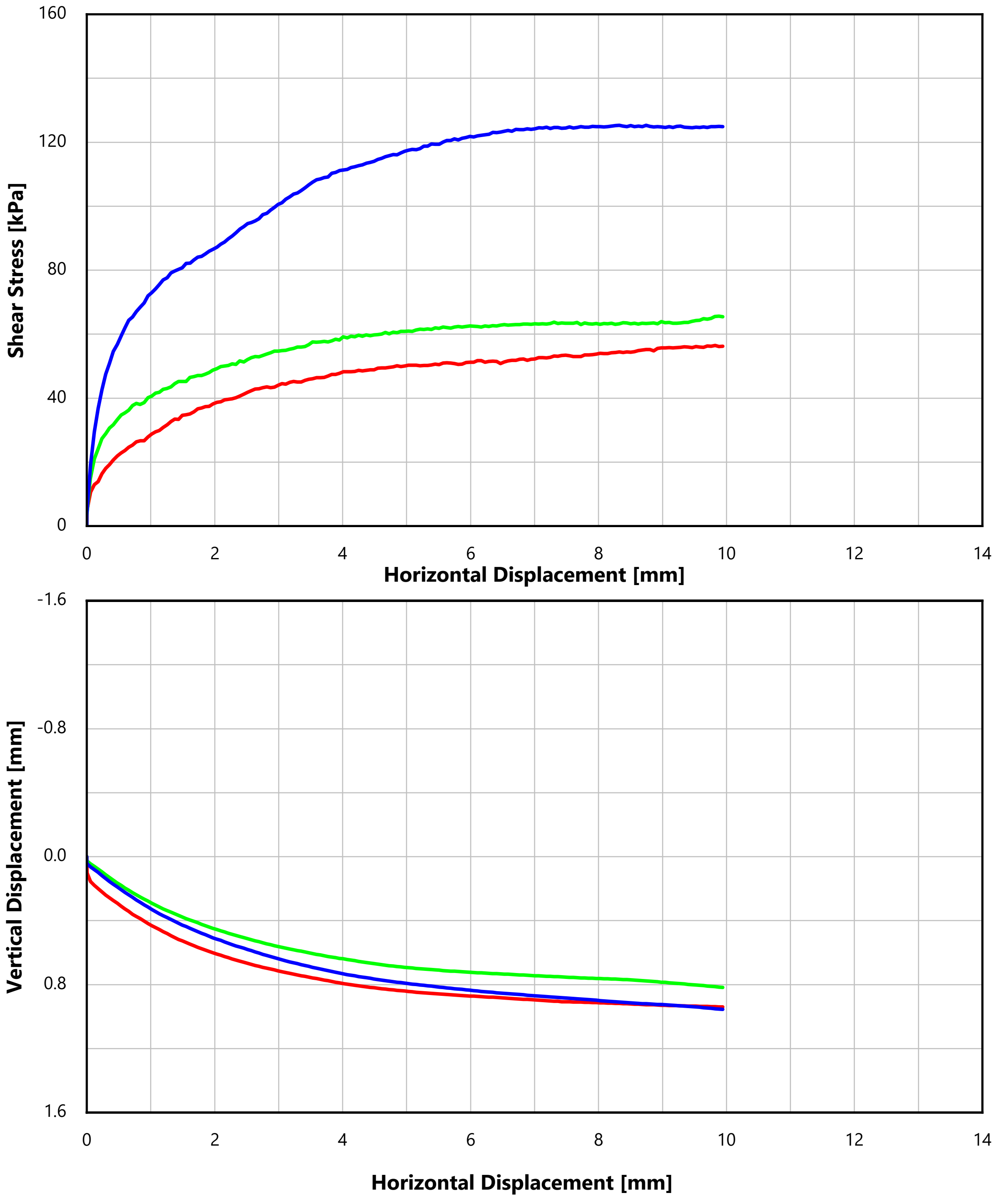
UKAS TESTING 0919

Shear Stage



Specimen 1: Normal stress 48 kPa	Specimen 2: Normal stress 95 kPa	Specimen 3: Normal stress 190 kPa

Project: 503387 - F254727
Test Page No.: SB27 - 3/4

Laboratory: Wallingford, UK

Approved by: SW - 03/07/2025

Test Report

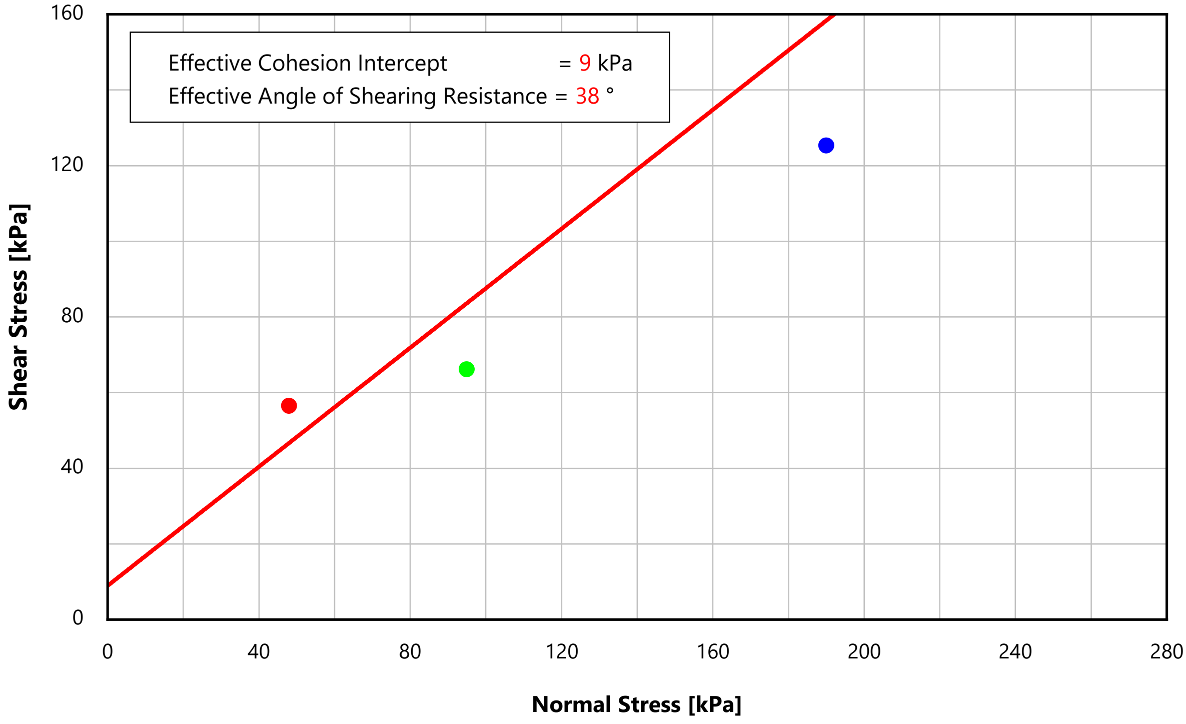
Direct Shear Test

Shear Box, Soil:Soil Interface

ISO 17892-10:2018

UKAS TESTING 0919

Friction Angle



🟥 Specimen 1: Normal stress 48 kPa 🟩 Specimen 2: Normal stress 95 kPa 🟦 Specimen 3: Normal stress 190 kPa

Project: 503387 - F254727
Test Page No.: SB27 - 4/4

Laboratory: Wallingford, UK

Approved by: SW - 03/07/2025

Test Report
Direct Shear Test
Shear Box, Soil:Soil Interface

ISO 17892-10:2018

0919

Test Identification	
Location	Z5_OWF_BH03-COMP
Sample	06-2
Depth [m]	19.40

Specimen Visual Description
Dark grey fine to medium silty SAND

Initial Specimen Conditions	1	2	3
Test start date	10/06/2025	10/06/2025	10/06/2025
Length [mm]	60.0	60.0	60.0
Width [mm]	60.0	60.0	60.1
Water content [%]	10.4	10.4	10.4
Bulk density [Mg/m^3]	1.77	1.76	1.76
Dry density [Mg/m^3]	1.60	1.59	1.59
Void ratio [-]	0.657	0.662	0.665
Degree of saturation [%]	42	42	41
Assumed particle density [Mg/m^3]	2.65	2.65	2.65

End of Consolidation	1	2	3
Normal stress [kPa]	94	189	377
Void ratio [-]	0.586	0.577	0.534
Vertical displacement [mm]	1.02	1.23	1.90
Degree of saturation [%]	82	88	83

Shear Stage	1	2	3
Rate of displacement [mm/min]	0.45	0.45	0.45
Normal stress [kPa]	94	189	377
Shear stress at failure [kPa]	56	114	214
Horizontal displacement at failure [mm]	3.70	3.67	3.71
Vertical displacement at failure [mm]	0.58	0.62	0.56
Void ratio at the end of the test [-]	0.546	0.534	0.495

Notes
Sample tested submerged Square sample

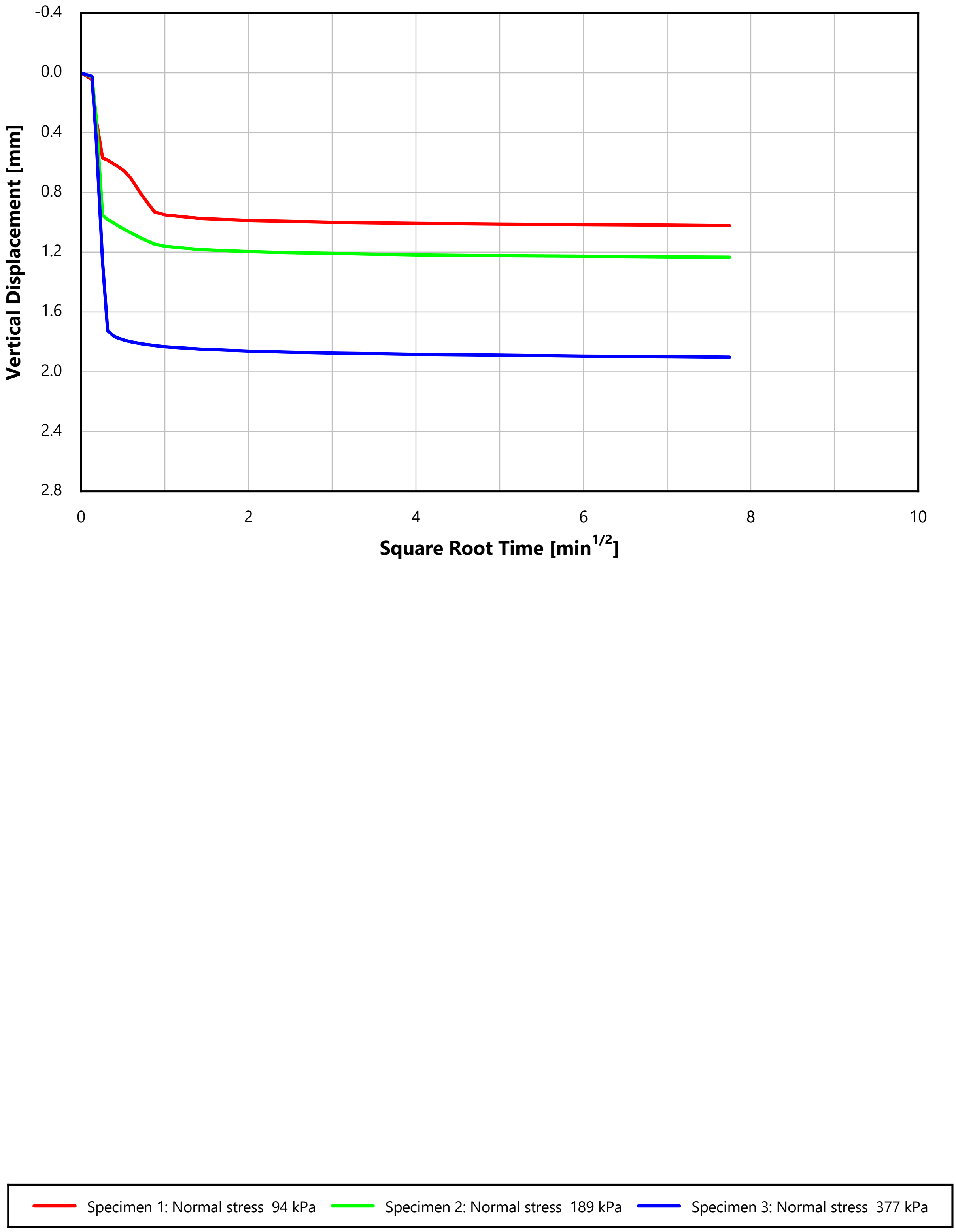
Project: 503387 - F254727 Laboratory: Wallingford, UK Approved by: SW - 19/06/2025
Test page SB28rr-1/4

Test Report

Direct Shear Test
Shear Box, Soil:Soil Interface

ISO 17892-10:2018

Consolidation Stage



Project: 503387 - F254727
Test Page No.: SB28rr - 2/4

Laboratory: Wallingford, UK

Approved by: SW - 19/06/2025

Test Report

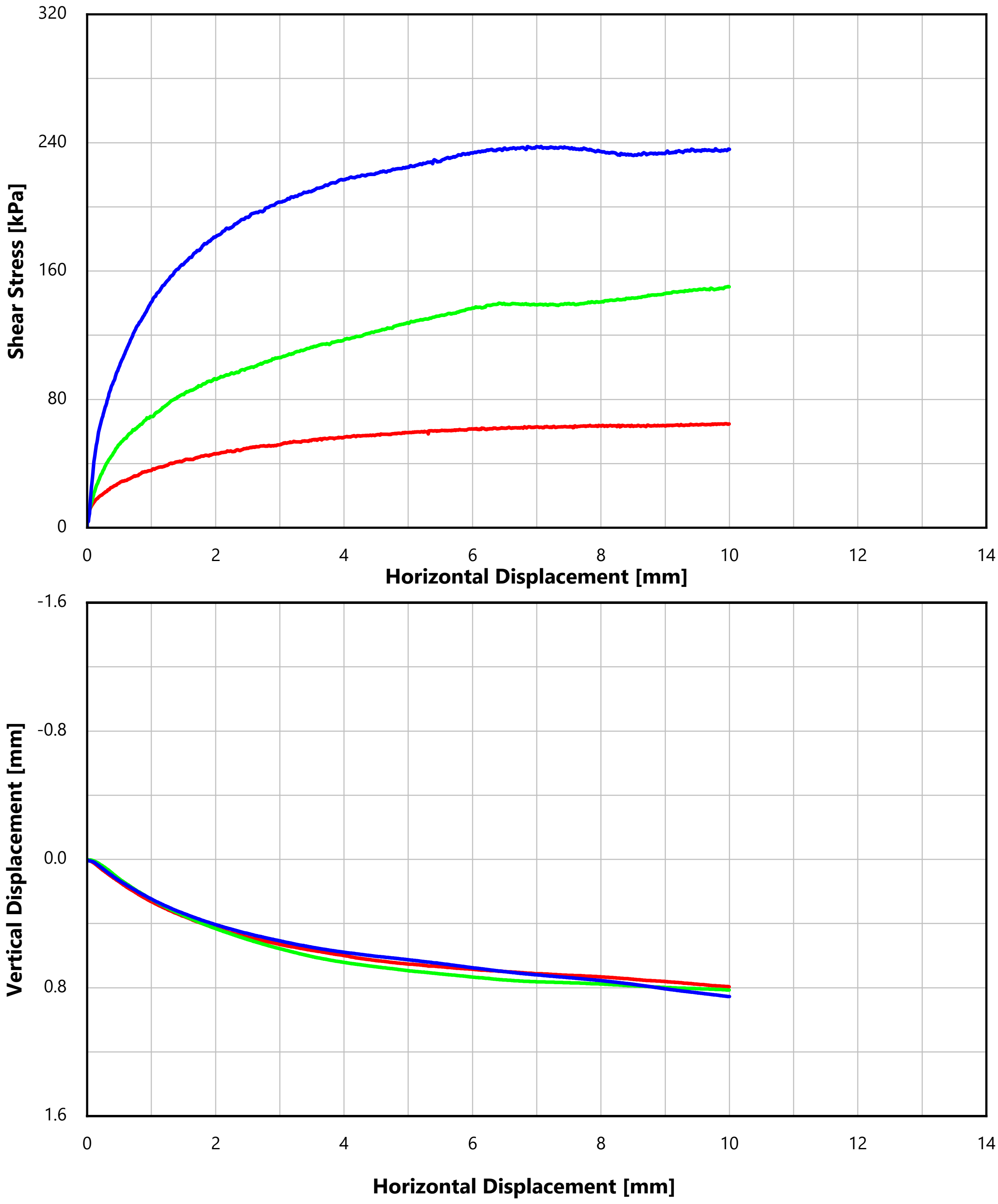
Direct Shear Test

Shear Box, Soil:Soil Interface

ISO 17892-10:2018

UKAS TESTING 0919

Shear Stage



🟥 Specimen 1: Normal stress 94 kPa	🟩 Specimen 2: Normal stress 189 kPa	🟦 Specimen 3: Normal stress 377 kPa

Project: 503387 - F254727
Test Page No.: SB28rr - 3/4

Laboratory: Wallingford, UK

Approved by: SW - 19/06/2025

Test Report

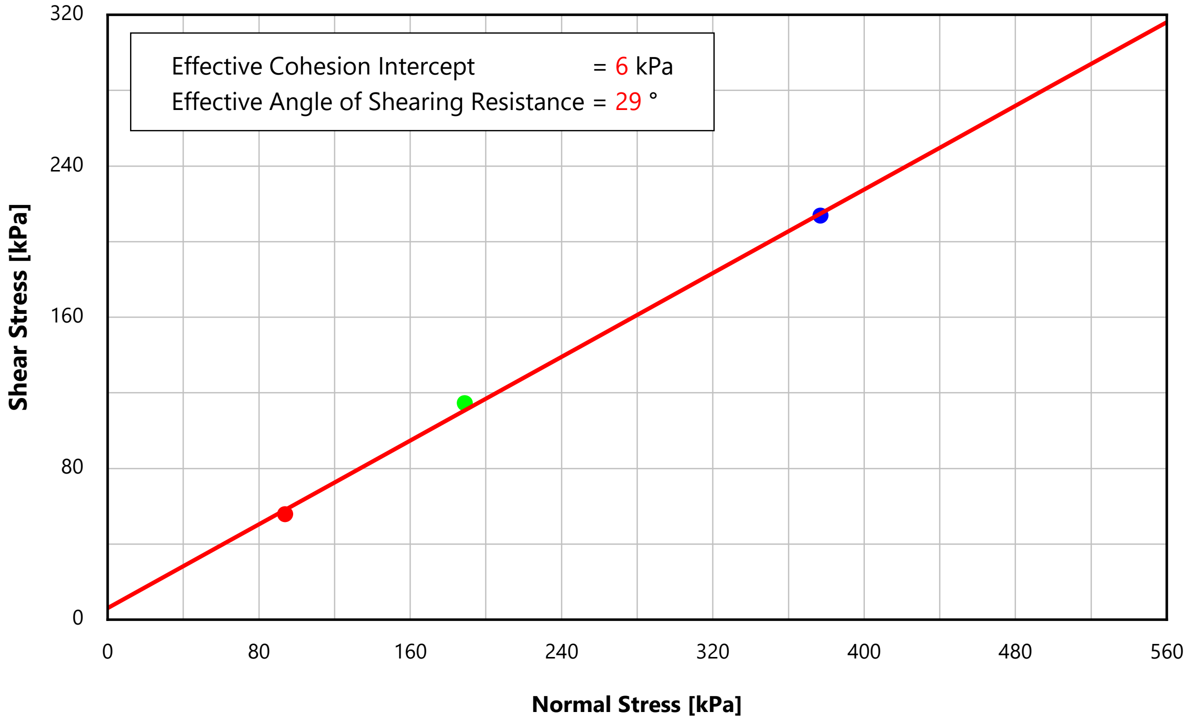
Direct Shear Test

Shear Box, Soil:Soil Interface

ISO 17892-10:2018

UKAS TESTING 0919

Friction Angle



Specimen 1: Normal stress 94 kPa	Specimen 2: Normal stress 189 kPa	Specimen 3: Normal stress 377 kPa

Project: 503387 - F254727
Test Page No.: SB28rr - 4/4

Laboratory: Wallingford, UK

Approved by: SW - 19/06/2025

Test Report

Direct Shear Test

Shear Box, Soil:Soil Interface

ISO 17892-10:2018

UKAS TESTING 0919

Test Identification	
Location	Z5_OWF_BH05-COMP
Sample	Batch_02
Depth [m]	13.00

Specimen Visual Description
Dark grey fine to medium SAND

Initial Specimen Conditions	1	2	3
Test start date	SSP07	SSP08	18/03/2025
Length [mm]	60.0	60.0	60.0
Width [mm]	60.0	60.0	60.0
Water content [%]	9.9	9.9	9.9
Bulk density [Mg/m^3]	1.87	1.88	1.88
Dry density [Mg/m^3]	1.70	1.71	1.71
Void ratio [-]	0.557	0.553	0.551
Degree of saturation [%]	47	48	48
Assumed particle density [Mg/m^3]	2.65	2.65	2.65

End of Consolidation	1	2	3
Normal stress [kPa]	62	124	249
Void ratio [-]	0.523	0.509	0.443
Vertical displacement [mm]	0.51	0.65	1.58
Degree of saturation [%]	100	100	100

Shear Stage	1	2	3
Rate of displacement [mm/min]	0.45	0.45	0.45
Normal stress [kPa]	63	124	250
Shear stress at failure [kPa]	56	99	206
Horizontal displacement at failure [mm]	0.78	1.20	1.86
Vertical displacement at failure [mm]	-0.03	-0.04	-0.04
Void ratio at the end of the test [-]	0.525	0.512	0.445

Notes
Sample tested submerged Square sample

Project: 503387 - F254727 Laboratory: Wallingford, UK Approved by: SW - 04/06/2025

Test page SB23-1/4

Test Report

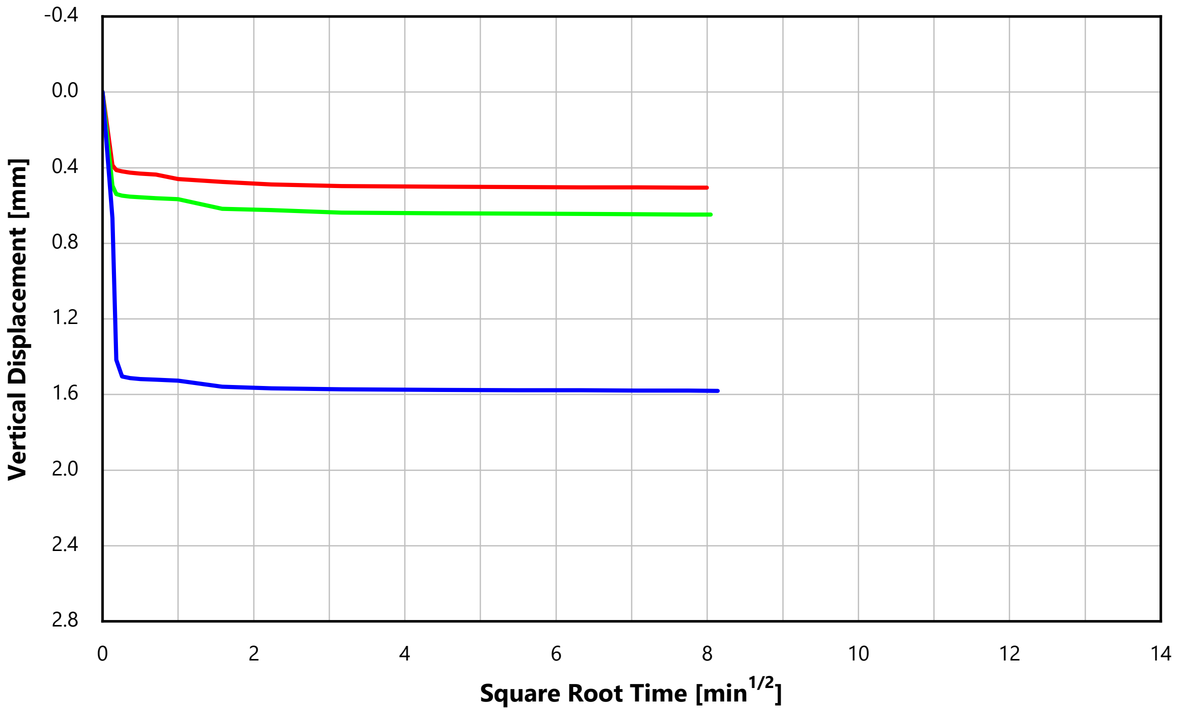
Direct Shear Test

Shear Box, Soil:Soil Interface

ISO 17892-10:2018

UKAS TESTING 0919

Consolidation Stage



🟥 Specimen 1: Normal stress 62 kPa	🟩 Specimen 2: Normal stress 124 kPa	🟦 Specimen 3: Normal stress 249 kPa

Project: 503387 - F254727
Test Page No.: SB23 - 2/4

Laboratory: Wallingford, UK

Approved by: SW - 04/06/2025

Test Report

Direct Shear Test

Shear Box, Soil:Soil Interface

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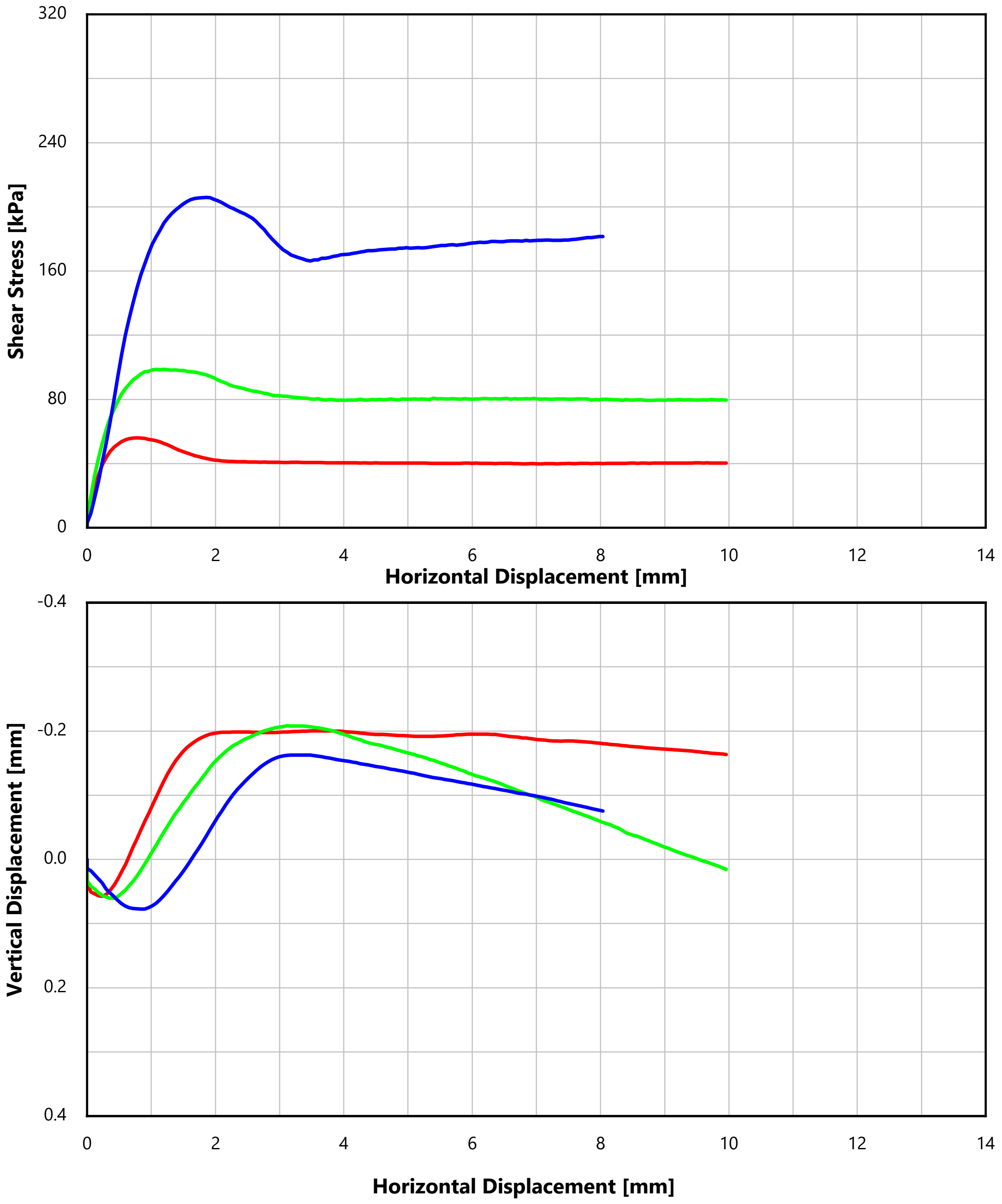
UKAS TESTING 0919

Shear Stage



🟥 Specimen 1: Normal stress 62 kPa 🟩 Specimen 2: Normal stress 124 kPa 🟦 Specimen 3: Normal stress 249 kPa

Project: 503387 - F254727
Test Page No.: SB23 - 3/4

Laboratory: Wallingford, UK

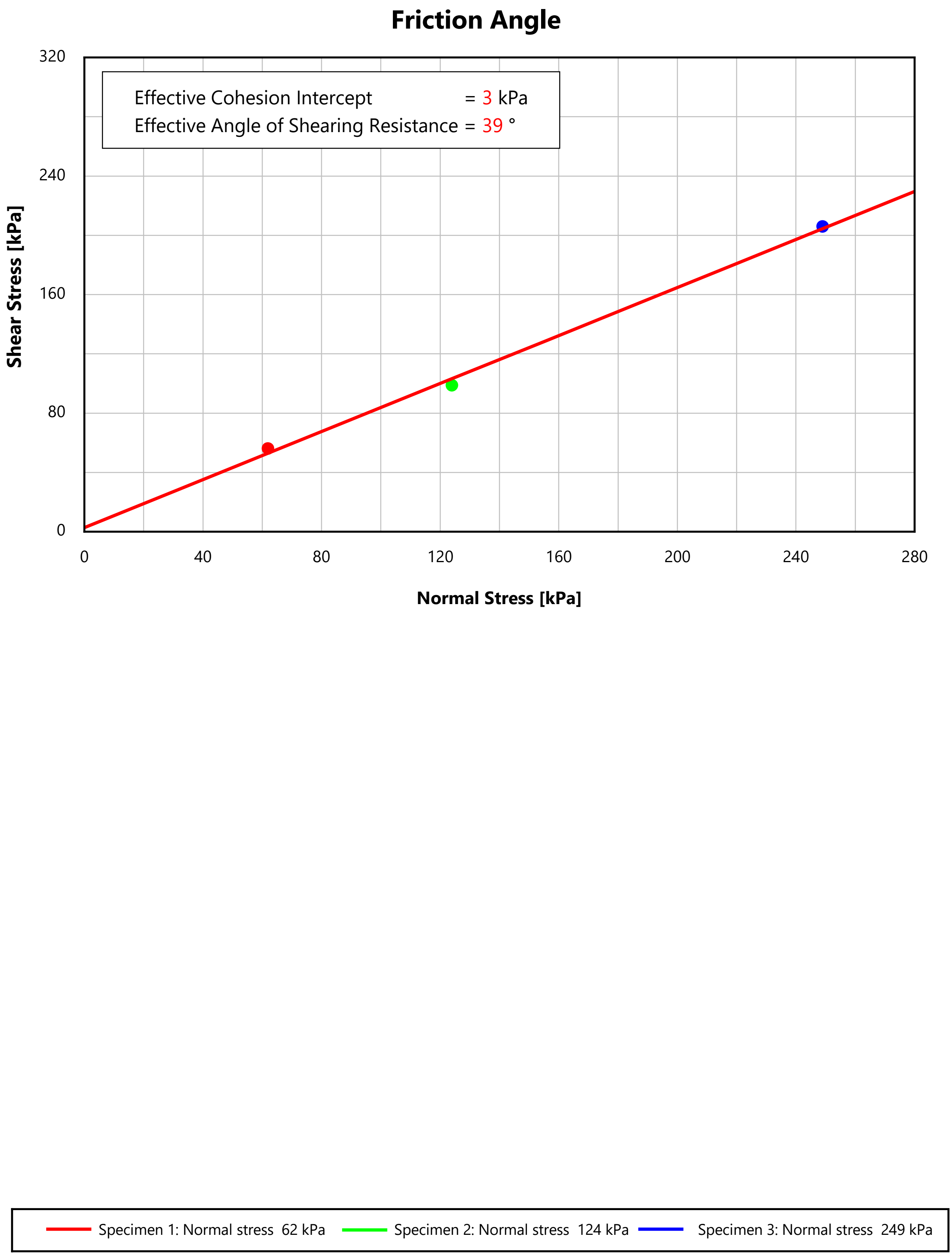
Approved by: SW - 04/06/2025

Test Report

Direction Shear Test

Shear Box, Soil:Soil Interface

ISO 17892-10:2018



Project: 503387 - F254727
Test Page No.: SB23 - 4/4

Laboratory: Wallingford, UK

Approved by: SW - 04/06/2025

Test Report
Direct Shear Test
Shear Box, Soil:Soil Interface
ISO 17892-10:2018

Test Identification	
Location	Z5_OWF_BH07-COMP_a
Sample	Batch_03
Depth [m]	20.00

Specimen Visual Description
Dark grey fine to medium SAND

Initial Specimen Conditions	1	2	3
Test start date	08/05/2025	08/05/2025	08/05/2025
Length [mm]	60.1	60.0	60.0
Width [mm]	60.0	60.0	60.0
Water content [%]	10.3	10.3	10.3
Bulk density [Mg/m^3]	1.75	1.73	1.76
Dry density [Mg/m^3]	1.59	1.57	1.59
Void ratio [-]	0.668	0.685	0.662
Degree of saturation [%]	41	40	41
Assumed particle density [Mg/m^3]	2.65	2.65	2.65

End of Consolidation	1	2	3
Normal stress [kPa]	98	195	390
Void ratio [-]	0.629	0.636	0.595
Vertical displacement [mm]	0.56	0.72	0.97
Degree of saturation [%]	99	99	100

Shear Stage	1	2	3
Rate of displacement [mm/min]	0.45	0.45	0.45
Normal stress [kPa]	98	195	390
Shear stress at failure [kPa]	75	151	288
Horizontal displacement at failure [mm]	1.31	1.32	2.51
Vertical displacement at failure [mm]	-0.07	-0.02	-0.08
Void ratio at the end of the test [-]	0.634	0.637	0.600

Notes

Sample tested submerged

Square sample

Project: 503387 - F254727 Laboratory: Wallingford, UK Approved by: SW - 10/06/2025
Test page SB24-1/4

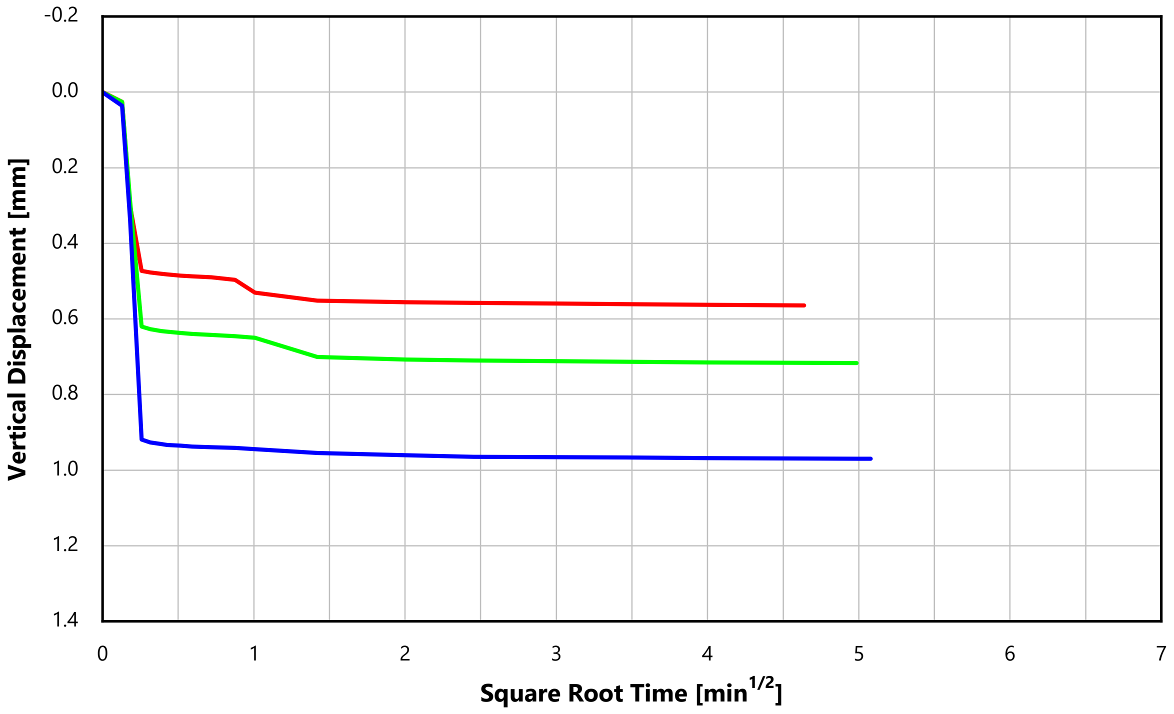
Test Report

Direct Shear Test
Shear Box, Soil:Soil Interface

ISO 17892-10:2018

UKAS TESTING 0919

Consolidation Stage



Specimen 1: Normal stress 98 kPa — Specimen 2: Normal stress 195 kPa — Specimen 3: Normal stress 390 kPa

Project: 503387 - F254727
Test Page No.: SB24 - 2/4

Laboratory: Wallingford, UK

Approved by: SW - 10/06/2025

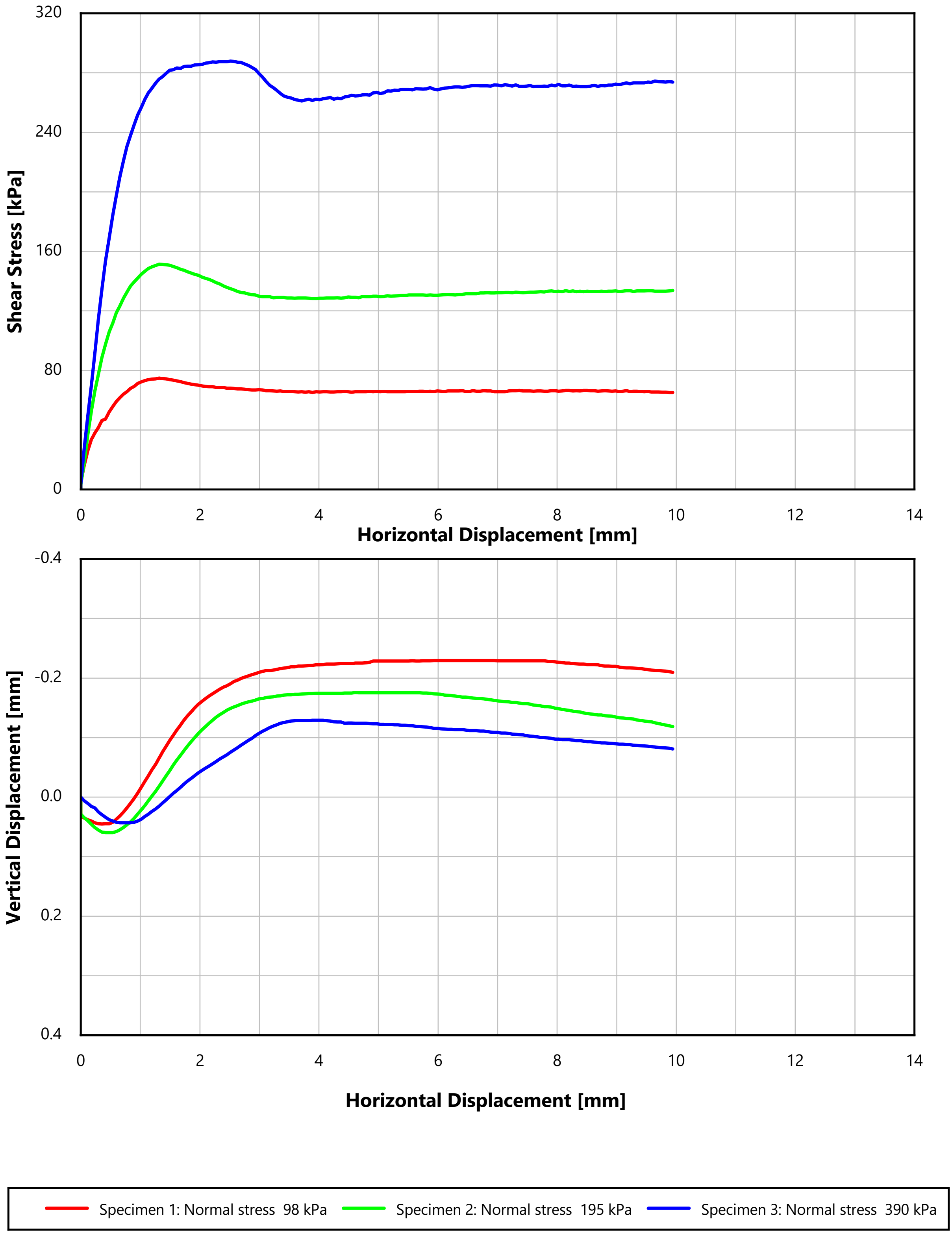
Test Report

Direct Shear Test
Shear Box, Soil:Soil Interface

ISO 17892-10:2018

UKAS TESTING 0919

Shear Stage



Project: 503387 - F254727
Test Page No.: SB24 - 3/4

Laboratory: Wallingford, UK

Approved by: SW - 10/06/2025

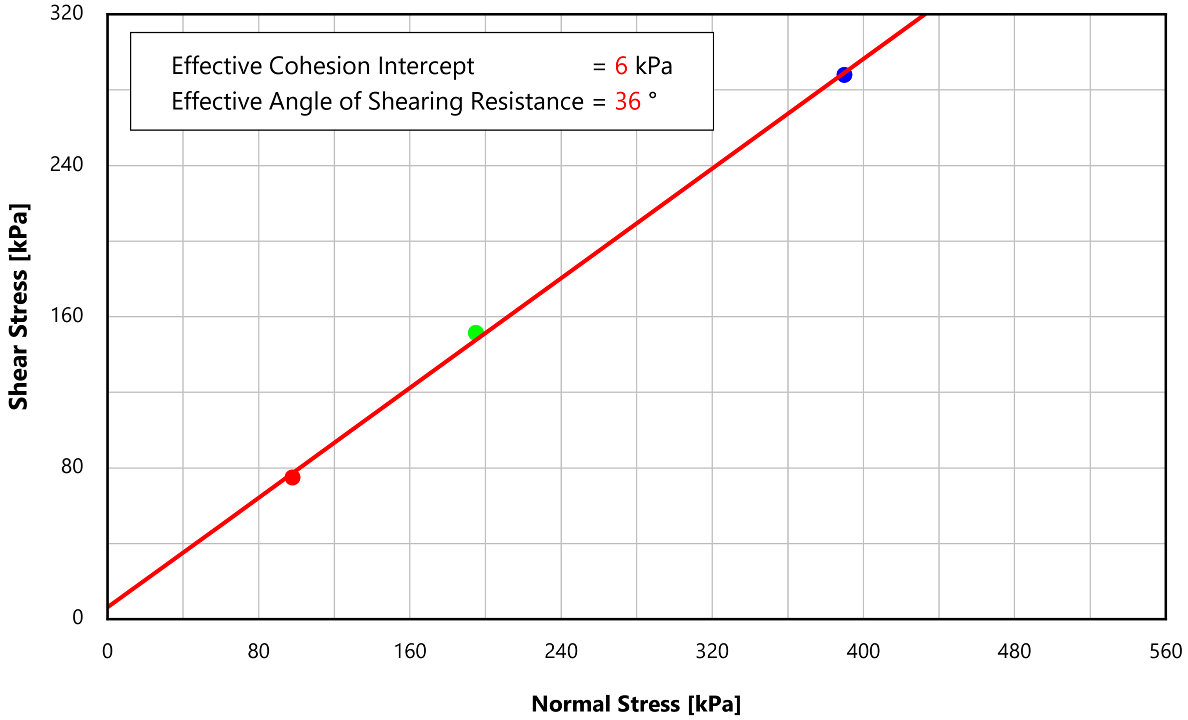
Test Report

Direct Shear Test

Shear Box, Soil:Soil Interface

ISO 17892-10:2018

Friction Angle



Specimen 1: Normal stress 98 kPa — Specimen 2: Normal stress 195 kPa — Specimen 3: Normal stress 390 kPa

Project: 503387 - F254727
Test Page No.: SB24 - 4/4

Laboratory: Wallingford, UK

Approved by: SW - 10/06/2025

Test Report
Direct Shear Test
Shear Box, Soil:Soil Interface
ISO 17892-10:2018

UKAS TESTING 0919

Test Identification	
Location	Z5_OWF_BH09-COMP
Sample	07-2
Depth [m]	19.80

Specimen Visual Description
Dark grey fine to medium SAND

Initial Specimen Conditions	1	2	3
Test start date	21/08/2025	21/08/2025	21/08/2025
Length [mm]	60.0	60.1	60.0
Width [mm]	60.1	60.0	59.9
Water content [%]	10.1	10.1	10.1
Bulk density [Mg/m^3]	1.80	1.80	1.81
Dry density [Mg/m^3]	1.64	1.64	1.64
Void ratio [-]	0.619	0.618	0.612
Degree of saturation [%]	43	43	44
Assumed particle density [Mg/m^3]	2.65	2.65	2.65

End of Consolidation	1	2	3
Normal stress [kPa]	96	192	385
Void ratio [-]	0.573	0.579	0.563
Vertical displacement [mm]	0.67	0.57	0.72
Degree of saturation [%]	76	84	83

Shear Stage	1	2	3
Rate of displacement [mm/min]	0.45	0.45	0.45
Normal stress [kPa]	97	192	385
Shear stress at failure [kPa]	85	146	278
Horizontal displacement at failure [mm]	10.02	10.02	9.96
Vertical displacement at failure [mm]	0.30	0.36	0.24
Void ratio at the end of the test [-]	0.553	0.555	0.547

Notes
Sample tested submerged
Square sample

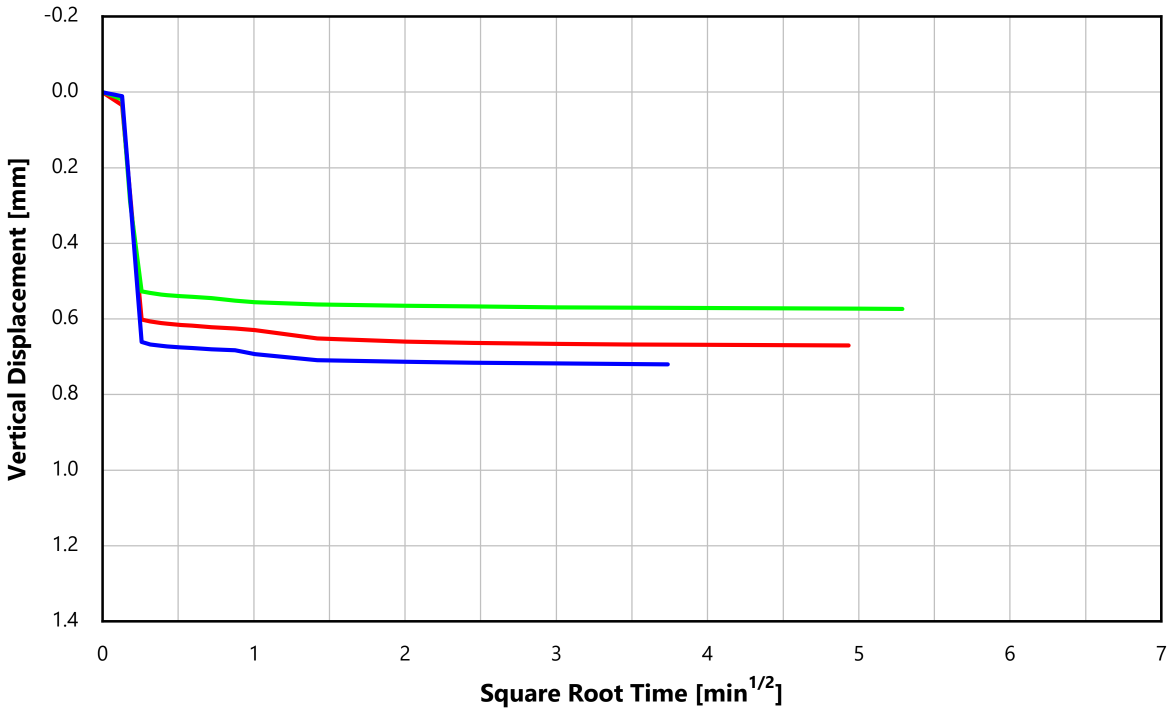
Project: 503387 - F254727 Laboratory: Wallingford, UK Approved by: ET - 22/08/2025
Test page SB25rrr-1/4

Test Report

Direct Shear Test
Shear Box, Soil:Soil Interface

ISO 17892-10:2018

Consolidation Stage



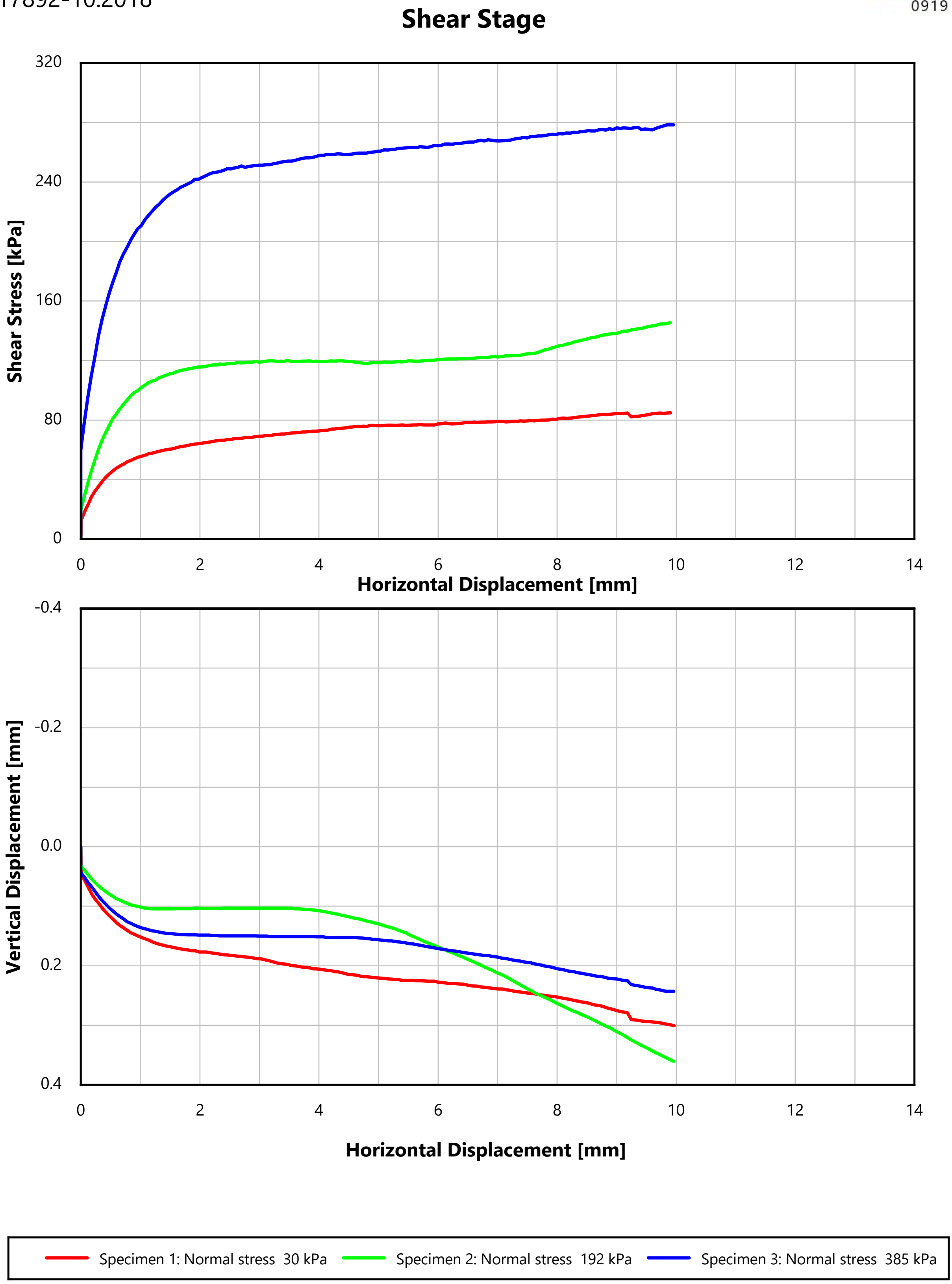
🟥 Specimen 1: Normal stress 30 kPa	🟩 Specimen 2: Normal stress 192 kPa	🟦 Specimen 3: Normal stress 385 kPa

Test Report

Direct Shear Test

Shear Box, Soil:Soil Interface

ISO 17892-10:2018



Project: 503387 - F254727
Test Page No.: SB25rrr - 3/4

Laboratory: Wallingford, UK

Approved by: ET - 22/08/2025

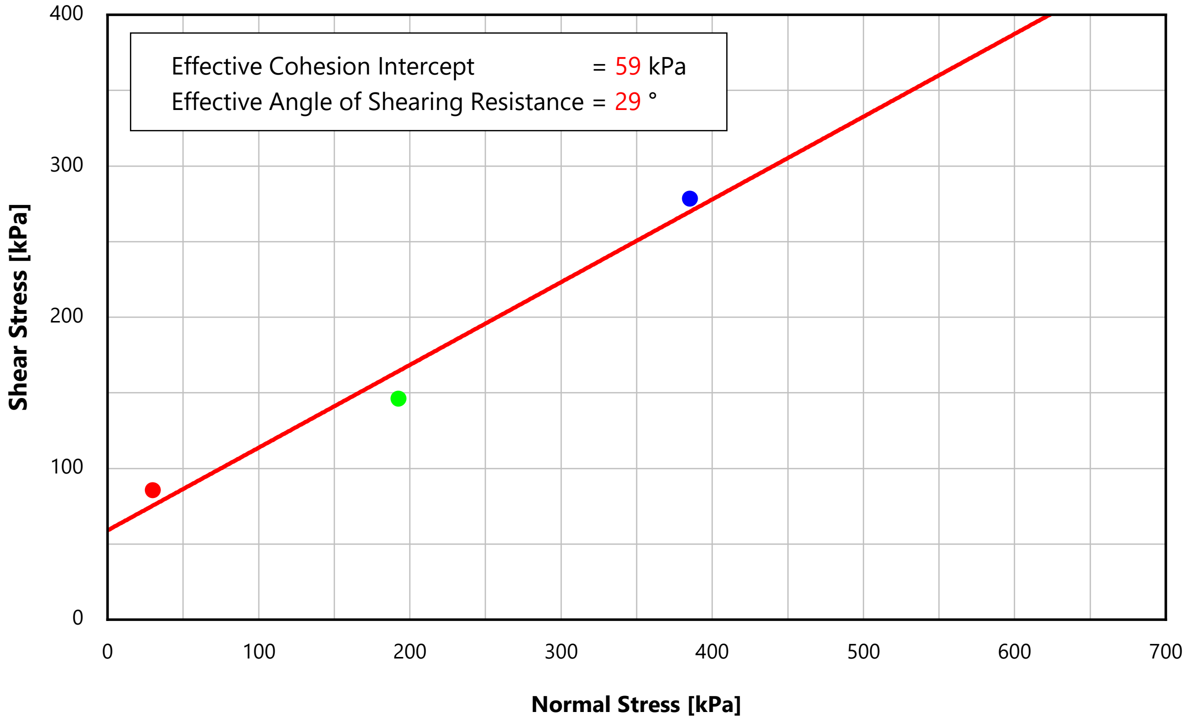
Test Report

Direct Shear Test

Shear Box, Soil:Soil Interface

ISO 17892-10:2018

Friction Angle



Project: 503387 - F254727
Test Page No.: SB25rrr - 4/4

Laboratory: Wallingford, UK

Approved by: ET - 22/08/2025

Location [-]	Sample No. [-]	Depth [m]	Test Type [-]	Index Properties ρ_{bulk} [Mg/m^3]	ρ_{dry} [Mg/m^3]	w_i [%]	w_f [%]	S_{ri} [%]	Effective Pressure [kPa]	k [m/s]
Z5_OWF_BH01-COMP	Batch_11	11.00 - 11.45	Constant head Permeameter	1.74	1.58	10.0	-	50	-	6.90E-06
Z5_OWF_BH01-COMP	06-2	16.10	Constant head Triaxial	2.11	1.70	24.3	21.5	100	105	1.30E-09
Z5_OWF_BH03-SAMP	Batch_12	5.50 - 5.90	Constant head Permeameter	1.79	1.63	9.6	-	53	-	2.06E-05
Z5_OWF_BH05-COMP	01-3	3.40	Constant head Triaxial	1.93	1.46	31.5	30.1	100	36	2.20E-09
Z5_OWF_BH07-COMP_a	Batch_04	15.00 - 15.75	Constant head Permeameter	1.82	1.65	10.4	-	60	-	9.55E-06
Z5_OWF_BH09-COMP	04-3	11.45	Constant head Triaxial	2.00	1.55	29.1	26.5	100	89	2.50E-07

Notes:
- = Data not available

SUMMARY OF PERMEABILITY TEST RESULTS

Test Report

Permeability tests - Rigid Wall Permeameter

ISO 17892-11:2019, clause 6.3.1.

UKAS TESTING 0919

Test Identification	
Location	Z5_OWF_BH01-COMP
Sample	Batch_11
Depth [m]	11.00
Specimen condition	Disturbed - Recompacted

Specimen Visual Description
Grey SAND with few shell fragments and gravel

Initial Specimen Conditions	
Test start date	11/06/2025
Diameter [mm]	101.47
Height [mm]	116.39
Water content [%]	9.99
Bulk density [Mg/m^3]	1.735
Dry density [Mg/m^3]	1.578
Void ratio [-]	0.527
Degree of saturation [%]	50
Particle density - assumed [Mg/m^3]	2.65
Preparation method	Blow compaction to target density

Test Conditions	
Apparatus	Rigid wall (cylindrical) permeameter
Test type	Constant head permeability
Average temperature [°C]	25
Hydraulic gradient	8.6
Water used	Deaired water

Test Results	
Hydraulic gradient applied [-]	8.59E+00
Coefficient of permeability corrected at 20°C [m/s]	6.90E-06

Project: 503387 - F254727 ######### Approved by: SW 25/06/2025

Test Page PERM10-1 of 1

Test Report

Permeability tests - Rigid Wall Permeameter

ISO 17892-11:2019, clause 6.3.1.

UKAS TESTING 0919

Test Identification	
Location	Z5_OWF_BH03-COMP
Sample	Batch_12
Depth [m]	5.50
Specimen condition	Disturbed - Recompacted

Specimen Visual Description
Brown SAND with few shell fragments and gravel

Initial Specimen Conditions	
Test start date	16/06/2025
Diameter [mm]	101.31
Height [mm]	116.24
Water content [%]	9.59
Bulk density [Mg/m^3]	1.788
Dry density [Mg/m^3]	1.631
Void ratio [-]	0.482
Degree of saturation [%]	53
Particle density - assumed [Mg/m^3]	2.65
Preparation method	Blow compaction to target density

Test Conditions	
Apparatus	Rigid wall (cylindrical) permeameter
Test type	Constant head permeability
Average temperature [°C]	25
Hydraulic gradient	8.6
Water used	Deaired water

Test Results	
Hydraulic gradient applied [-]	8.60E+00
Coefficient of permeability corrected at 20°C [m/s]	2.06E-05

Project: 503387 - F254727 ######### Approved by: SW 24/06/2025

Test Page PERM15-1 of 1

Test Report

Permeability tests - Rigid Wall Permeameter

ISO 17892-11:2019, clause 6.3.1.

UKAS TESTING 0919

Test Identification	
Location	Z5_OWF_BH07-COMP-a
Sample	Batch_04
Depth [m]	15.00 - 15.75
Specimen condition	Disturbed - Recompacted

Specimen Visual Description
Grey clayey SAND

Initial Specimen Conditions	
Test start date	28/05/2025
Diameter [mm]	101.31
Height [mm]	116.20
Water content [%]	10.40
Bulk density [Mg/m^3]	1.818
Dry density [Mg/m^3]	1.647
Void ratio [-]	0.458
Degree of saturation [%]	60
Particle density - assumed [Mg/m^3]	2.65
Preparation method	Blow compaction to target density

Test Conditions	
Apparatus	Rigid wall (cylindrical) permeameter
Test type	Constant head permeability
Average temperature [°C]	26
Hydraulic gradient	8.6
Water used	Deaired water

Test Results	
Hydraulic gradient applied [-]	8.61E+00
Coefficient of permeability corrected at 20°C [m/s]	9.55E-06

Project: 503387 - F254727 ######### Approved by: SW 25/06/2025

Test Page PERM13-1 of 1

SUMMARY OF TRIAXIAL PERMEABILITY TEST
SINGLESTAGE TEST
Constant Head Conditions

Project Reference	F254727	Location ID	Z5_OWF_BH01-COMP
Depth Top [m]	16.10	Sample Reference	06-2
Project Name	Golfe du Lion	Sample Type	Wax
Specimen Description	Firm grey slightly sandy CLAY	Date started	22/04/2025
Medium	Tap water		

Test Method	Specimen set-up	BS EN ISO 17892-11:2019 Clause 6.2
	Saturation	BS EN ISO 17892-11:2019 Clause 6.3
	Consolidation-Iso.	BS EN ISO 17892-11:2019 Clause 6.3
	Permeability	BS EN ISO 17892-11:2019 Clause 6.4

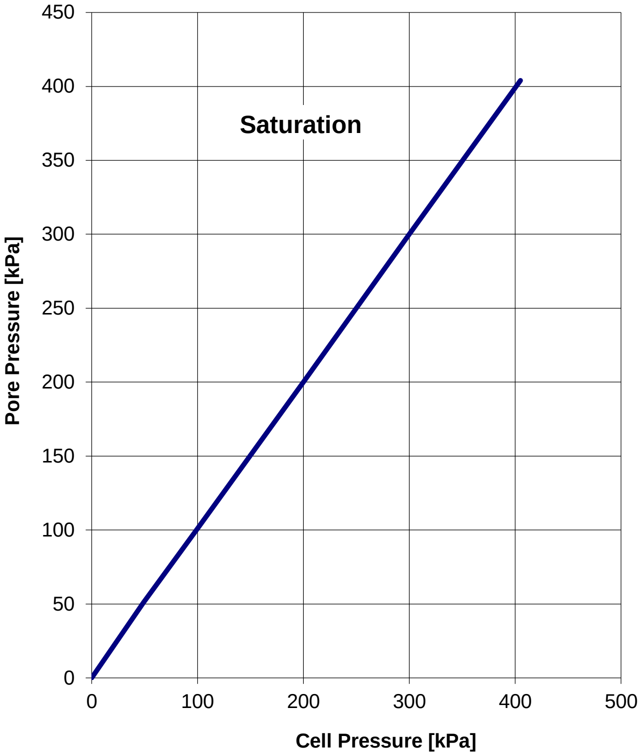
Initial Conditions

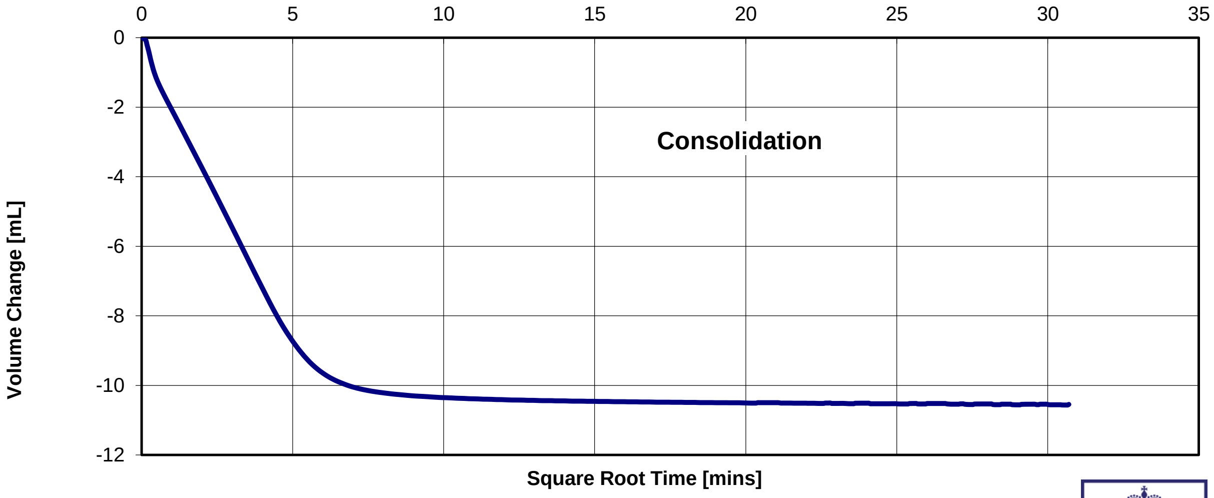
Sample orientation		Vertical
Specimen preparation		Undisturbed
Specimen depth	[m]	16.12
Diameter	[mm]	69.60
Length	[mm]	68.76
Water content (trimmings)	[%]	24.3
Bulk density	[Mg/m^3]	2.11
Dry density	[Mg/m^3]	1.70
Particle density[1]	[Mg/m^3]	#2.7
Voids ratio e	-	0.592
Degree of saturation	[%]	100
Drainage conditions		Both ends

[1] # denotes assumed

Saturation Stage

Saturation method	-	Const. Moist. Content
Final cell pressure	[kPa]	405
Final pore pressure	[kPa]	404
Press. Increm./ Diff. press.	[kPa]	50-100 / -
B value achieved	[%]	100
Duration	[days]	1





Remarks

UKAS TESTING
1483

Checked by: M.G. 28/04/2025 Approved by: C.H. 28/04/2025 Laboratory: Consett UK Page 1/3

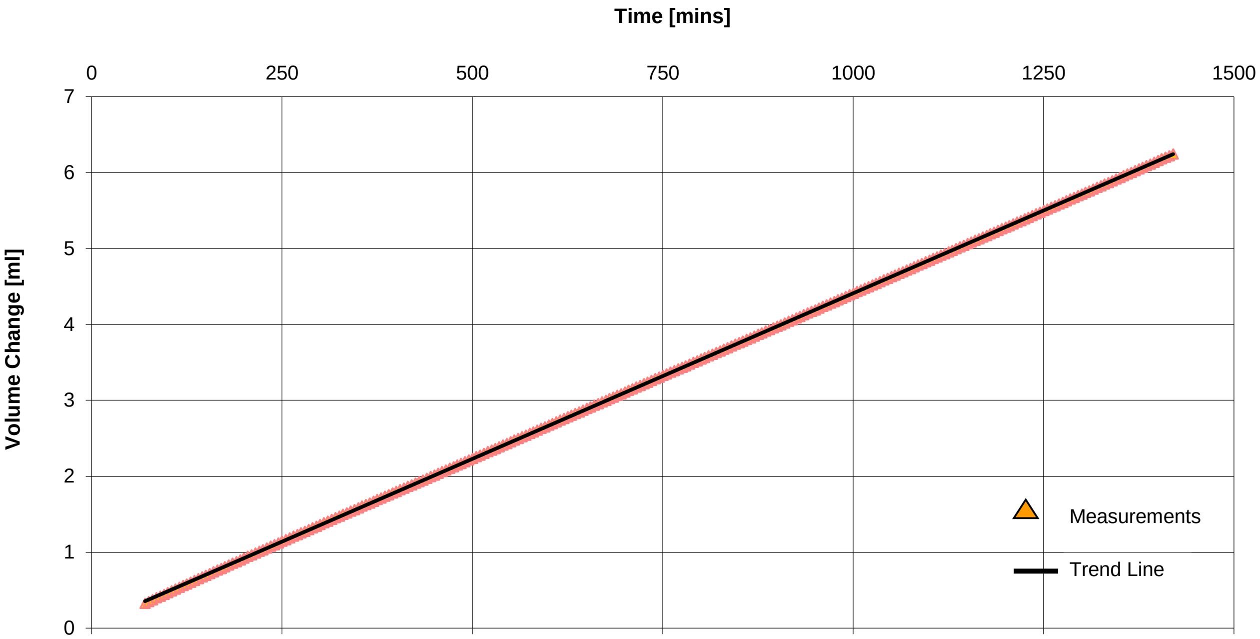
	SUMMARY OF TRIAXIAL PERMEABILITY TEST SINGLESTAGE TEST Constant Head Conditions	Project Reference	F254727
		Location ID	Z5_OWF_BH01-COMP
		Depth Top [m]	16.10
Project Name	Golfe du Lion	Sample Reference	06-2

Consolidation Stage

Cell pressure	[kPa]	405
Back pressure	[kPa]	300
Effective pressure	[kPa]	105
Final pore pressure	[kPa]	301
Final pore pressure dissipation	[%]	100
Duration	[days]	1

Permeability Stage

Pressure difference across specimen	[kPa]	10
Mean effective stress	[kPa]	105
Rate of flow	[ml/min]	0.004
Hydraulic gradient		15.04
Duration	[kPa]	1



COEFFICIENT OF PERMEABILITY AT 20 ^{0}C, 1.3E-09 [m/s]

Checked by: M.G. 28/04/2025 Approved by: C.H. 28/04/2025 Laboratory: Consett UK Page 2/3

	SUMMARY OF TRIAXIAL PERMEABILITY TEST SINGLESTAGE TEST Constant Head Conditions	Project Reference	F254727
		Location ID	Z5_OWF_BH01-COMP
		Depth Top [m]	16.10
Project Name	Golfe du Lion	Sample Reference	06-2

Final Conditions

Moisture content	[%]	21.5
Bulk density	[Mg/m^3]	2.15
Total duration	[days]	3

Specimen Photographs

Checked by: M.G. 28/04/2025 Approved by: C.H. 28/04/2025 Laboratory: Consett UK Page 3/3

	SUMMARY OF TRIAXIAL PERMEABILITY TEST SINGLESTAGE TEST Constant Head Conditions		Project Reference	F254727
			Location ID	Z5_OWF_BH05-COMP
			Depth Top [m]	3.40
Project Name	Golfe du Lion		Sample Reference	01-3
Specimen Description	Firm grey slightly sandy CLAY		Sample Type	Wax
Test Method	Specimen set-up	BS EN ISO 17892-11:2019 Clause 6.2	Date started	15/04/2025
	Saturation	BS EN ISO 17892-11:2019 Clause 6.3		
	Consolidation-Iso.	BS EN ISO 17892-11:2019 Clause 6.3	Medium	Tap water
	Permeability	BS EN ISO 17892-11:2019 Clause 6.4		

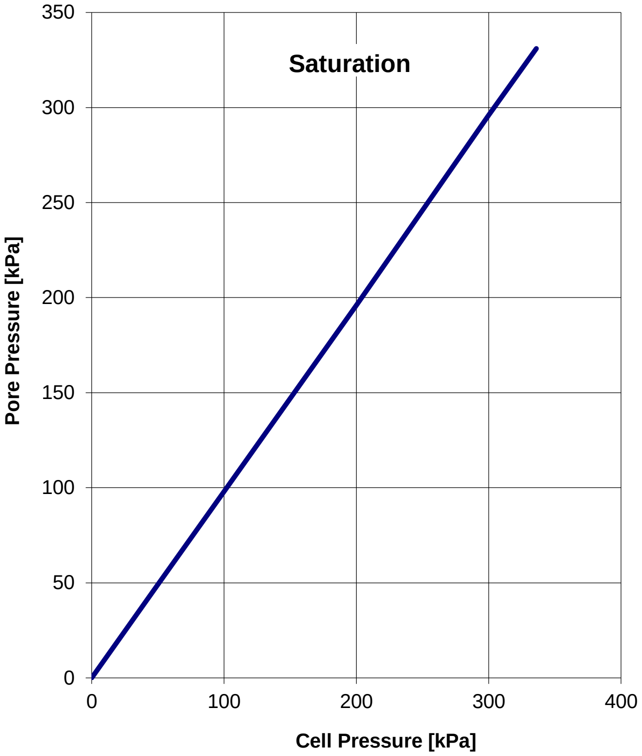
Initial Conditions

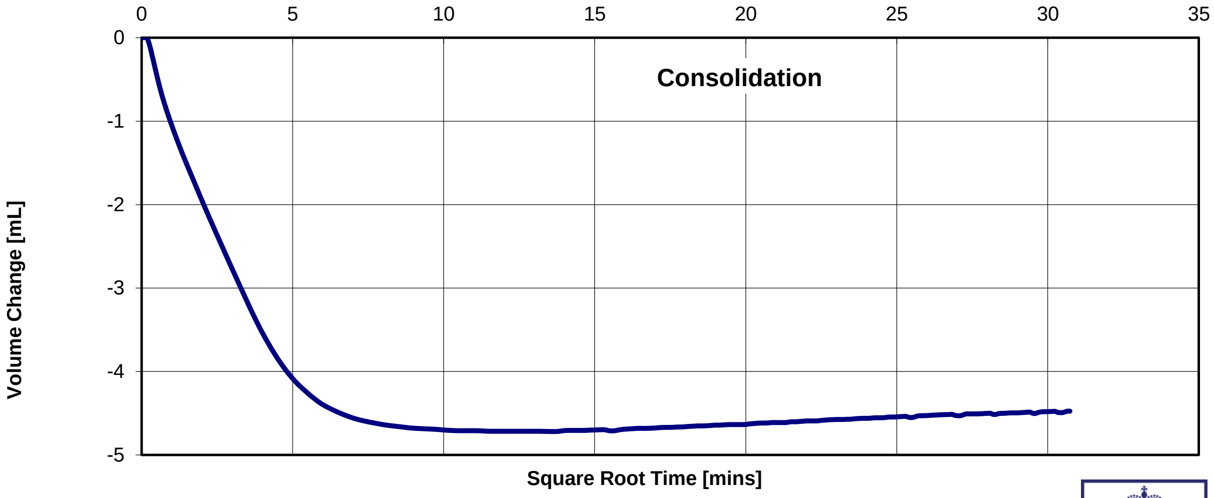
Sample orientation		Vertical
Specimen preparation		Undisturbed
Specimen depth	[m]	3.41
Diameter	[mm]	65.58
Length	[mm]	67.23
Water content (trimmings)	[%]	31.5
Bulk density	[Mg/m^3]	1.93
Dry density	[Mg/m^3]	1.46
Particle density[1]	[Mg/m^3]	#2.7
Voids ratio e	-	0.844
Degree of saturation	[%]	100
Drainage conditions		Both ends

[1] # denotes assumed

Saturation Stage

Saturation method	-	Const. Moist. Content
Final cell pressure	[kPa]	336
Final pore pressure	[kPa]	331
Press. Increm./ Diff. press.	[kPa]	50-100 / -
B value achieved	[%]	100
Duration	[days]	1





Remarks

UKAS TESTING 1483

Checked by: M.G. 23/04/2025 Approved by: C.H. 24/04/2025 Laboratory: Consett UK Page 1/3

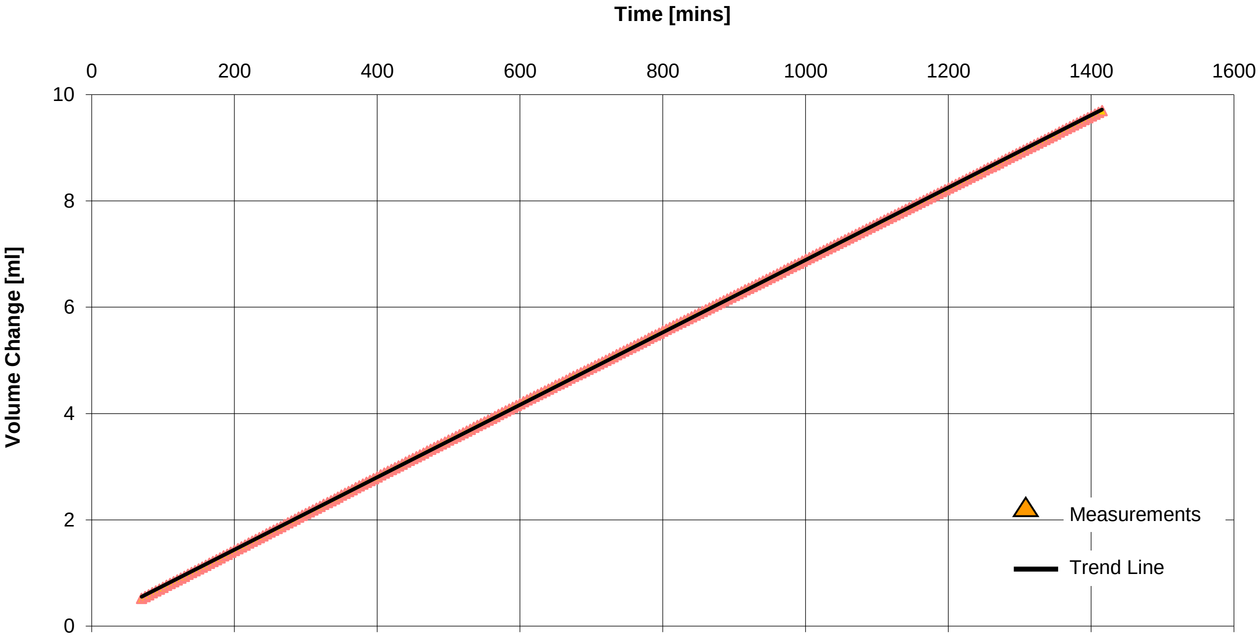
FUGRO	**SUMMARY OF TRIAXIAL PERMEABILITY TEST** **SINGLESTAGE TEST** **Constant Head Conditions**	Project Reference	F254727
		Location ID	Z5_OWF_BH05-COMP
		Depth Top [m]	3.40
Project Name	Golfe du Lion	Sample Reference	01-3

Consolidation Stage

Cell pressure	[kPa]	336
Back pressure	[kPa]	300
Effective pressure	[kPa]	36
Final pore pressure	[kPa]	301
Final pore pressure dissipation	[%]	100
Duration	[days]	1

Permeability Stage

Pressure difference across specimen	[kPa]	10
Mean effective stress	[kPa]	36
Rate of flow	[ml/min]	0.007
Hydraulic gradient		15.27
Duration	[kPa]	1



COEFFICIENT OF PERMEABILITY AT 20 ^{0}C, 2.2E-09 [m/s]

	SUMMARY OF TRIAXIAL PERMEABILITY TEST **SINGLESTAGE TEST** **Constant Head Conditions**	Project Reference	F254727
		Location ID	Z5_OWF_BH05-COMP
		Depth Top [m]	3.40
Project Name	Golfe du Lion	Sample Reference	01-3

Final Conditions

Moisture content	[%]	30.1
Bulk density	[Mg/m^3]	1.94
Total duration	[days]	3

Specimen Photographs

	SUMMARY OF TRIAXIAL PERMEABILITY TEST **SINGLESTAGE TEST** **Constant Head Conditions**		Project Reference	F254727
			Location ID	Z5_OWF_BH09-COMP
			Depth Top [m]	11.45
Project Name	Golfe du Lion		Sample Reference	04-3
Specimen Description	Firm grey brown slightly sandy CLAY		Sample Type	Wax
Test Method	Specimen set-up	BS EN ISO 17892-11:2019 Clause 6.2	Date started	15/04/2025
	Saturation	BS EN ISO 17892-11:2019 Clause 6.3		
	Consolidation-Iso.	BS EN ISO 17892-11:2019 Clause 6.3	Medium	Tap water
	Permeability	BS EN ISO 17892-11:2019 Clause 6.4		

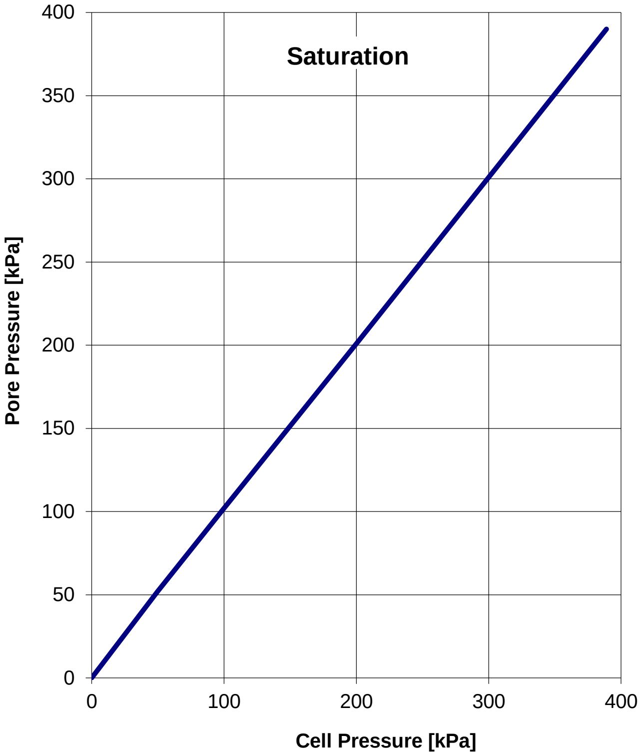
Initial Conditions

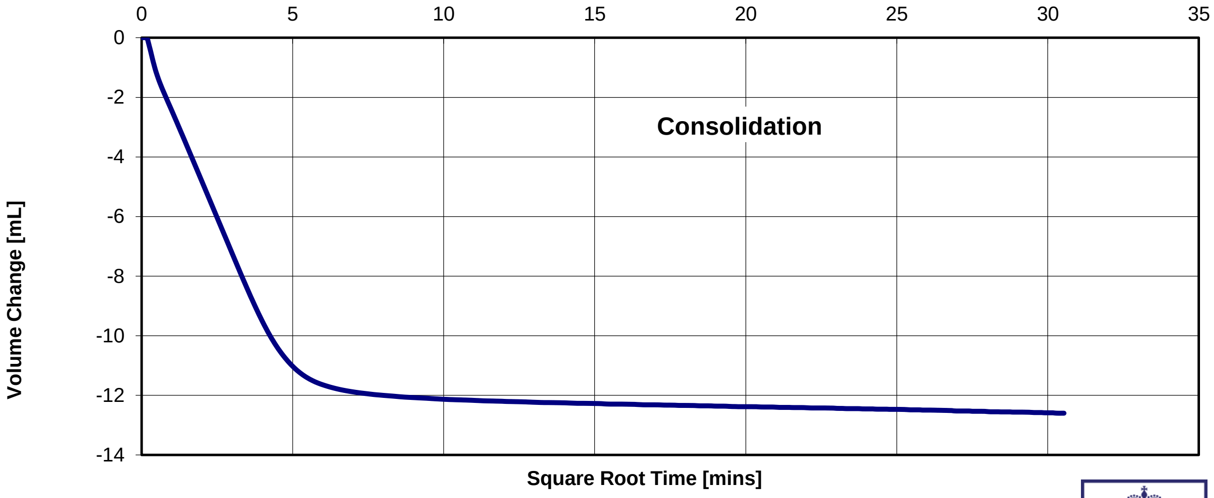
Sample orientation		Vertical
Specimen preparation		Undisturbed
Specimen depth	[m]	11.47
Diameter	[mm]	71.60
Length	[mm]	72.47
Water content (trimmings)	[%]	29.1
Bulk density	[Mg/m^3]	2.00
Dry density	[Mg/m^3]	1.55
Particle density[1]	[Mg/m^3]	#2.7
Voids ratio e	-	0.746
Degree of saturation	[%]	100
Drainage conditions		Both ends

[1] # denotes assumed

Saturation Stage

Saturation method -		Const. Moist. Content
Final cell pressure	[kPa]	389
Final pore pressure	[kPa]	390
Press. Increm./ Diff. press.	[kPa]	50-100 / -
B value achieved	[%]	100
Duration	[days]	1





Remarks

1483

Checked by: M.G.	23/04/2025	Approved by: C.H.	24/04/2025	Laboratory: Consett UK	Page 1/3

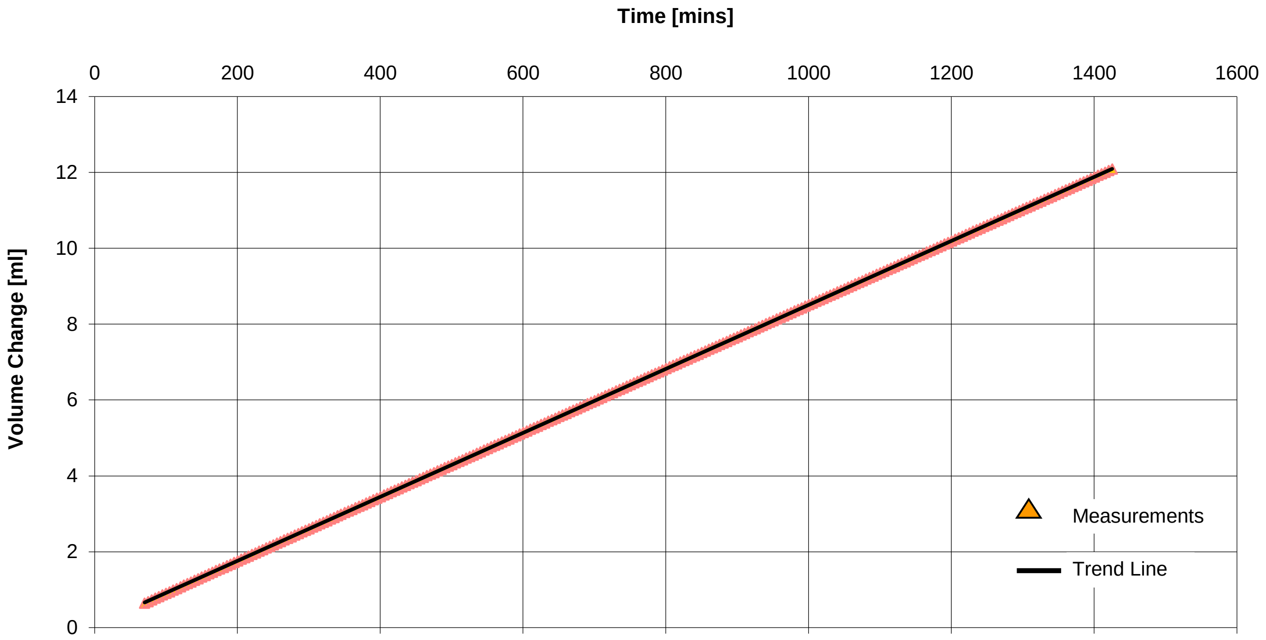
	SUMMARY OF TRIAXIAL PERMEABILITY TEST SINGLESTAGE TEST Constant Head Conditions	Project Reference	F254727
		Location ID	Z5_OWF_BH09-COMP
		Depth Top [m]	11.45
Project Name	Golfe du Lion	Sample Reference	04-3

Consolidation Stage

Cell pressure	[kPa]	389
Back pressure	[kPa]	300
Effective pressure	[kPa]	89
Final pore pressure	[kPa]	301
Final pore pressure dissipation	[%]	100
Duration	[days]	1

Permeability Stage

Pressure difference across specimen	[kPa]	10
Mean effective stress	[kPa]	89
Rate of flow	[ml/min]	0.008
Hydraulic gradient		14.28
Duration	[kPa]	1



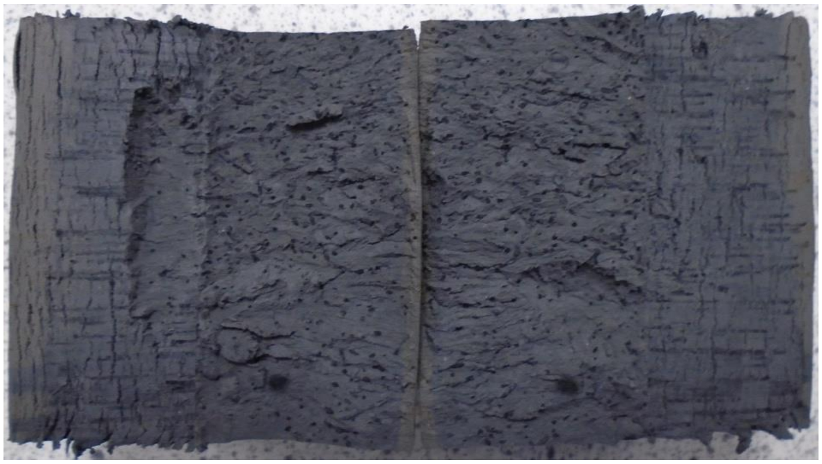
COEFFICIENT OF PERMEABILITY AT 20 ^{0}C, **2.5E-07 [m/s]**

FUGRO	**SUMMARY OF TRIAXIAL PERMEABILITY TEST** **SINGLESTAGE TEST** **Constant Head Conditions**	Project Reference	F254727
		Location ID	Z5_OWF_BH09-COMP
		Depth Top [m]	11.45
Project Name	Golfe du Lion	Sample Reference	04-3

Final Conditions

Moisture content	[%]	26.5
Bulk density	[Mg/m^3]	2.04
Total duration	[days]	3

Specimen Photographs



PROJECT No.	: **F254727**	
PROJECT TITLE	: **Golfe du Lion Geotechnical Site Investigation**	
CLIENT	: **DGEC**	
Location	: GL GSI CENTRE Z5	
Easting	: 562622.37 m	WGS84 UTM31N
Northing	: 4750866.37 m	
Water depth	: 97.40 m	LAT FR Bathyelli

SAMPLE IDENTIFICATION			AT SAMPLE COLLECTION			SAMPLE CHARACTERISTICS					MEASUREMENT CONDITIONS							THERMAL RESULTS					SAMPLE TEMPERATURE AT START [°C]		
BH name	Sample iD	Test depth [m BSB]	Date	Time	Ambient Temp. [°C]	Description	Condition	Moisture content [%]	Wet Unit Weight $[kN/m^3]$	Dry Unit Weight $[kN/m^3]$	Test No.	Date	Time	Kit Serial No.	Probe used	Probe Serial No.	Ambient Temp. [°C]	TC [W/(m.k)]	TR [(m.K)/W]	TR Mean value	Deviation	Error rate (r^2)	Temp	Mean value	Remarks
Z5_OWF_BH03-COMP	W01	1.60	20/01/2025	17:15	22.9	dark greyish brown (2.5Y 4/2) slightly calcareous fine to medium SAND with rare coarse sand-size to fine gravel-size shell fragments	Undisturbed	26	19	15	1	20/01/2025	17:15	8905-0011	TR-3	01075	22.9	1.565	0.639	0.580	18.3%	0.0066	16.6	17.2	-
											2	20/01/2025	17:30	8905-0011	TR-3	01075	22.9	1.916	0.522			0.0026	17.7		
											3	20/01/2025	17:45	8905-0011	TR-3	01075	22.9	1.907	0.524			0.0022	18.3		
Z5_OWF_BH03-COMP	W02	5.50	20/01/2025	19:10	22.9	greyish brown (2.5Y 5/2) slightly calcareous fine to medium SAND with rare coarse sand-size to fine gravel-size shell fragments	Undisturbed	25	20	16	1	20/01/2025	19:10	8905-0011	TR-3	01075	22.9	1.677	0.596	0.559	12.6%	0.0068	17.0	17.6	-
											2	20/01/2025	19:25	8905-0011	TR-3	01075	22.9	1.919	0.521			0.0024	18.1		
											3	20/01/2025	19:40	8905-0011	TR-3	01075	22.9	2.096	0.477			0.0012	18.8		

PROJECT No.	: **F254727**	
PROJECT TITLE	: **Golfe du Lion Geotechnical Site Investigation**	
CLIENT	: **DGEC**	
Location	: GL GSI CENTRE Z5	
Easting	: 573152 m	WGS84 UTM31N
Northing	: 4764820 m	
Water depth	: 95.00 m	LAT FR Bathyelli

SAMPLE IDENTIFICATION			AT SAMPLE COLLECTION			SAMPLE CHARACTERISTICS					MEASUREMENT CONDITIONS							THERMAL RESULTS					SAMPLE TEMPERATURE		
BH name	Sample iD	Test depth [m BSB]	Date	Time	Ambient Temp. [°C]	Description	Condition	Moisture content [%]	Wet Unit Weight [kN/m^3]	Dry Unit Weight [kN/m^3]	Test No.	Date	Time	Kit Serial No.	Probe used	Probe Serial No.	Ambient Temp. [°C]	TC [W/(m.k)]	TR [(m.K)/W]	TR Mean value	Deviation	Error rate (r^2)	Temp	Mean value	Remarks
Z5_OWF_BH05-COMP	W01	3.80	15/01/25	5:00	19.7	firm very dark grey (2.5Y 3/1) slightly calcareous CLAY with rare coarse sand size to medium gravel-size shells and shell fragments - with abundant fine to medium gravel-size pockets of organic matter	Undisturbed	33	18	13	1	15/01/25	5:15	8905-0011	TR-3	01075	17.5	1.613	0.620	0.649	6.9%	0.0072	13.4	13.6	-
											2	15/01/25	5:30	8905-0011	TR-3	01075	19.0	1.509	0.663			0.0013	13.6		
											3	15/01/25	5:45	8905-0011	TR-3	01075	19.0	1.502	0.666			0.0013	13.9		

PROJECT No. : **F254727**
PROJECT TITLE : **Golfe du Lion Geotechnical Site Investigation**
CLIENT : **DGEC**
Location : GL GSI CENTRE Z5
Easting : 563905 m
Northing : 4757059 m
WGS84 UTM31N
Water depth : 96.90 m LAT FR Bathyelli

SAMPLE IDENTIFICATION			AT SAMPLE COLLECTION			SAMPLE CHARACTERISTICS					MEASUREMENT CONDITIONS							THERMAL RESULTS					SAMPLE TEMPERATURE AT START [°C]		
BH name	Sample iD	Test depth [m BSB]	Date	Time	Ambient Temp. [°C]	Description	Condition	Moisture content [%]	Wet Unit Weight [kN/m^3]	Dry Unit Weight [kN/m^3]	Test No.	Date	Time	Kit Serial No.	Probe used	Probe Serial No.	Ambient Temp. [°C]	TC [W/(m.k)]	TR [(m.K)/W]	TR Mean value	Deviation	Error rate (r^2)	Temp	Mean value	Remarks
Z5_OWF_BH07-COMP_a	W02	2.70	16/01/2025	5:20	20.8	very dark grey (2.5Y 3/1) sandy slightly calcareous CLAY with occasional coarse sand-size to fine gravel-size shells and shell fragments	Undisturbed	23	-	-	1	16/01/2025	5:35	8905-0011	TR-3	01075	20.7	1.495	0.669	0.626	12.7%	0.0060	15.2	15.8	-
											2	16/01/2025	5:50	8905-0011	TR-3	01075	20.8	1.713	0.584			0.0058	16.3		no UW
												16/01/2025													-

PROJECT No.	: **F254727**	
PROJECT TITLE	: **Golfe du Lion Geotechnical Site Investigation**	
CLIENT	: **DGEC**	
Location	: GL GSI CENTRE Z5	
Easting	: 571867 m	WGS84 UTM31N
Northing	: 4758631 m	
Water depth	: 93.60 m	LAT FR Bathyelli

SAMPLE IDENTIFICATION			AT SAMPLE COLLECTION			SAMPLE CHARACTERISTICS					MEASUREMENT CONDITIONS							THERMAL RESULTS					SAMPLE TEMPERATURE		
BH name	Sample iD	Test depth [m BSB]	Date	Time	Ambient Temp. [°C]	Description	Condition	Moisture content [%]	Wet Unit Weight [kN/m^3]	Dry Unit Weight [kN/m^3]	Test No.	Date	Time	Kit Serial No.	Probe used	Probe Serial No.	Ambient Temp. [°C]	TC [W/(m.k)]	TR [(m.K)/W]	TR Mean value	Deviation	Error rate (r^2)	Temp	Mean value	Remarks
Z5_OWF_BH09-COMP	W01	3.55	14/01/2025	17:00	22.8	very dark grey (5Y 3/1) slightly silty fine to medium SAND	Undisturbed	24	19	15	1	14/01/2025	-	8905-0011	TR-3	01583	22.8	-	-			-	-		Unsuitable: probe positioned too close to the edge of the sample
											-	-	-	-	-	-	-	-	-			-	-		-
											-	-	-	-	-	-	-	-	-			-	-		-

Test Report

Thermal Conductivity by Thermal Needle Probe Procedure

ASTM D5334-22

No.	Borehole	Sample*	Depth [m]	Soil Type	Sample Condition	Water Content [%]	Dry Density [Mg/m^3]	Void Ratio	Thermal Conductivity [W/m.K]		
									No.1	No.2	No.3
1	Z5_OWF_BH01-COMP	02-1	7.00	SAND	Reconstituted	21.49	1.70	0.55	2.04	2.04	2.03

*** Detailed sample descriptions can be found in the "Summary of Laboratory Test Results" of the report.**

Project: 503387 - F254727

Location: Wallingford, UK

Approved by JP 14/05/2025

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Test Report

Thermal Conductivity by Thermal Needle Probe

ASTM D5334-22a$^{\varepsilon 1}$

UKAS TESTING 0919

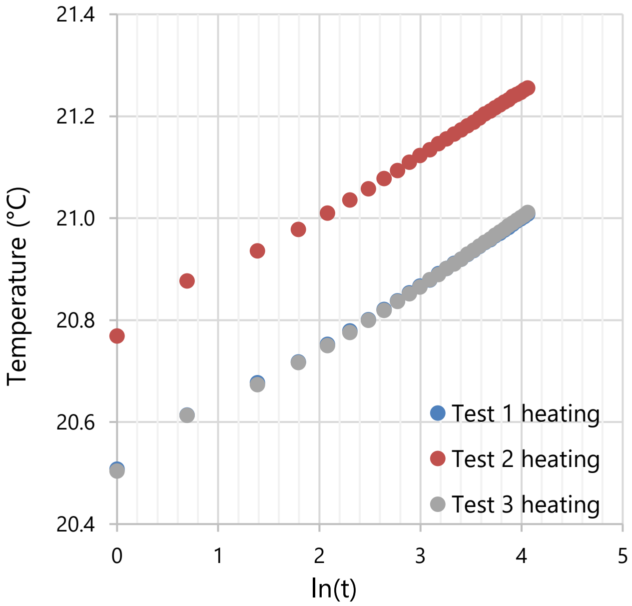
Test Identification			
Borehole	Z5_OWF_BH01-COMP	Sample Depth [m]	7.00
Sample	02-1	Test Depth [m]	7.00

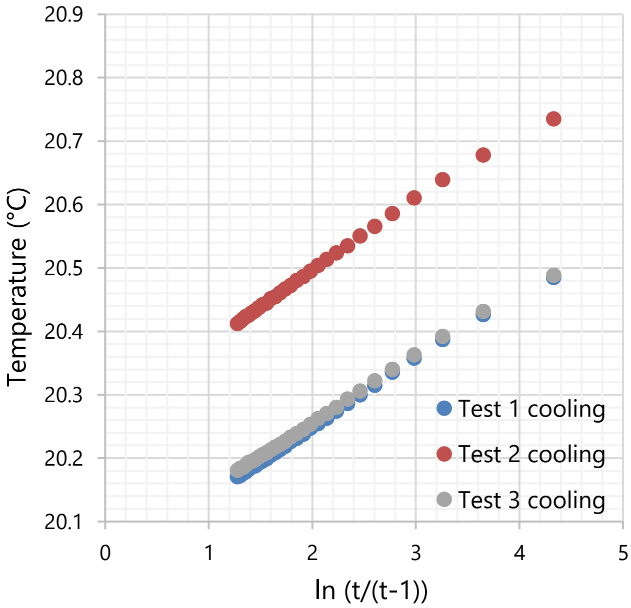
Visual Description
olive brown slightly silty slightly fine slightly calcareous fine SAND with rare mica

Specimen Conditions			
Sample condition	Reconstituted	Water content [%]	21.5
Wet mass [g]	1518.2	Dry density [g/cm^3]	1.70
Diameter [mm]	70.6	Bulk density [g/cm^3]	2.07
Length [mm]	187.4	Target wet density [g/cm^3]	MAX

Test Conditions			
Room Temperature [°C]	19.7	Needle diameter [mm]	2.4
Needle	TR-3	Needle length [mm]	100
Heating time [min]	2.5	Insertion type	Pushed
Cooling time [min]	2.5	Calculation method	Inbuilt

Test Results	Test 1	Test 2	Test 3
Thermal Conductivity [W/mK]	2.04	2.04	2.03
Sample Temperature [°C]	20.08	20.35	20.08
Error	0.002	0.002	0.002
Power [W/m]	3.69	3.69	3.69





Project: 503387 - F254727 | Location: Wallingford, UK | Approved by JP 14/05/2025

Note(s):

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Test Report

Carbonate Content of Soil by Rapid Titration

BS1377-3 : 2018, Section 8.3

No.	Location	Sample	Depth [m]	Carbonate Content 1 [% as CO_2]	Carbonate Content 2 [% as CO_3]	Carbonate Content 3 [% as $CaCO_3$]
1	Z5_OWF_BH01-COMP	01-2	3.65	16.00		
2	Z5_OWF_BH01-COMP	04-3	14.50	12.00		
3	Z5_OWF_BH02-COMP	01-2	3.20	10.00		
4	Z5_OWF_BH02-COMP	06-1	19.50	18.00		
5	Z5_OWF_BH03-COMP	03-1	9.50	9.60		
6	Z5_OWF_BH05-COMP	01-1	3.00	9.50		
7	Z5_OWF_BH05-COMP	03-1	8.00	17.00		
8	Z5_OWF_BH05-COMP	04-1	9.00	9.30		
9	Z5_OWF_BH07-COMP_a	01-1	1.50	15.00		
10	Z5_OWF_BH07-COMP_a	01-4	2.20	13.00		
11	Z5_OWF_BH07-COMP_a	05-1	11.00	11.00		
12	Z5_OWF_BH09-COMP	03-2	8.30	13.00		
13	Z5_OWF_BH09-COMP	05-1	12.00	9.80		

Note: This test was not performed by Fugro and was subcontracted.

Project: 503387 - F254727
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ET - 15/07/2025

Test Report

Organic Matter of Soil

BS1377-3 : 2018, Section 4 and 6

No.	Location	Sample	Depth [m]	Organic Matter [%]	Organic Matter - Loss On Ignition [%]
1	Z5_OWF_BH01-COMP	01-2	3.65		6.70
2	Z5_OWF_BH01-COMP	04-3	14.50		9.30
3	Z5_OWF_BH02-COMP	01-2	3.20		4.00
4	Z5_OWF_BH02-COMP	06-1	19.50		8.40
5	Z5_OWF_BH03-COMP	03-1	9.50		8.00
6	Z5_OWF_BH05-COMP	01-1	3.00		3.10
7	Z5_OWF_BH05-COMP	03-1	8.00		3.50
8	Z5_OWF_BH05-COMP	04-1	9.00		12.00
9	Z5_OWF_BH07-COMP_a	01-1	1.50		5.80
10	Z5_OWF_BH07-COMP_a	01-4	2.20		4.50
11	Z5_OWF_BH07-COMP_a	05-1	11.00		5.60
12	Z5_OWF_BH09-COMP	03-2	8.30		7.60
13	Z5_OWF_BH09-COMP	05-1	12.00		10.00

Note: This test was not performed by Fugro and was subcontracted.

Project: 503387 - F254727
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ET - 15/07/2025

Test Report

Chloride Content of Soil

BS1377-3 : 2018, Section 9.2 and 9.3

No.	Location	Sample	Depth [m]	Water Soluble Chloride [%]	Acid Soluble Chloride [%]
1	Z5_OWF_BH01-COMP	01-2	3.65	0.42	
2	Z5_OWF_BH01-COMP	04-3	14.50	0.67	
3	Z5_OWF_BH02-COMP	01-2	3.20	0.40	
4	Z5_OWF_BH02-COMP	06-1	19.50	0.49	
5	Z5_OWF_BH03-COMP	03-1	9.50	0.48	
6	Z5_OWF_BH05-COMP	01-1	3.00	0.47	
7	Z5_OWF_BH05-COMP	03-1	8.00	0.45	
8	Z5_OWF_BH05-COMP	04-1	9.00	0.59	
9	Z5_OWF_BH07-COMP_a	01-1	1.50	0.50	
10	Z5_OWF_BH07-COMP_a	01-4	2.20	0.39	
11	Z5_OWF_BH07-COMP_a	05-1	11.00	0.46	
12	Z5_OWF_BH09-COMP	03-2	8.30	0.47	
13	Z5_OWF_BH09-COMP	05-1	12.00	0.55	

Note: This test was not performed by Fugro and was subcontracted.

Project: 503387 - F254727
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Test Report

Total Acid Soluble Sulphate and pH

BS1377-3 : 2018, Section 7.5 and 12

No.	Location	Sample	Depth [m]	Total Acid Soluble Sulphate [mg/l as SO_4]	pH
1	Z5_OWF_BH01-COMP	01-2	3.65	2020.00	9.00
2	Z5_OWF_BH01-COMP	04-3	14.50	1650.00	8.70
3	Z5_OWF_BH02-COMP	01-2	3.20	1280.00	9.00
4	Z5_OWF_BH02-COMP	06-1	19.50	2760.00	8.50
5	Z5_OWF_BH03-COMP	03-1	9.50	1090.00	8.70
6	Z5_OWF_BH05-COMP	01-1	3.00	1010.00	9.00
7	Z5_OWF_BH05-COMP	03-1	8.00	1610.00	9.00
8	Z5_OWF_BH05-COMP	04-1	9.00	1590.00	8.40
9	Z5_OWF_BH07-COMP_a	01-1	1.50	1510.00	9.00
10	Z5_OWF_BH07-COMP_a	01-4	2.20	1630.00	8.70
11	Z5_OWF_BH07-COMP_a	05-1	11.00	1540.00	8.80
12	Z5_OWF_BH09-COMP	03-2	8.30	1640.00	8.60
13	Z5_OWF_BH09-COMP	05-1	12.00	1750.00	8.80

Note: This test was not performed by Fugro and was subcontracted.

Project: 503387 - F254727
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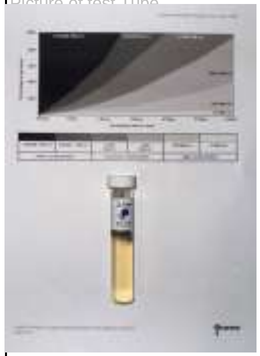
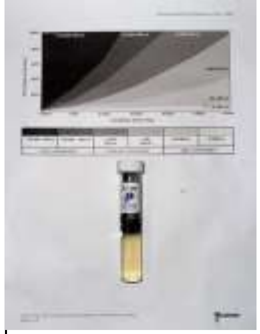
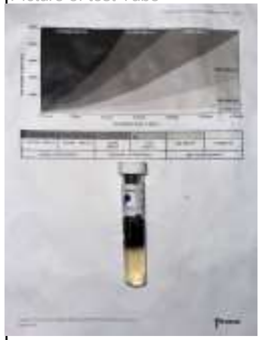
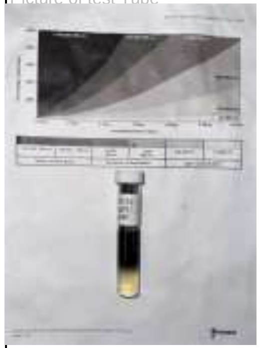
ET - 15/07/2025

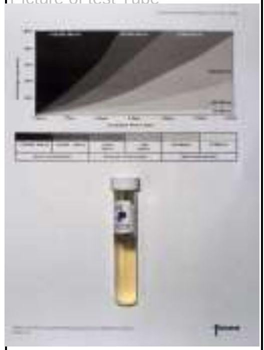
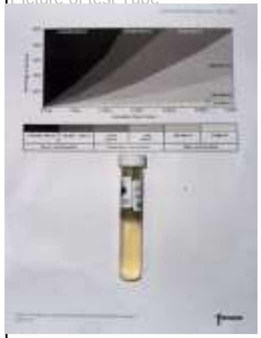
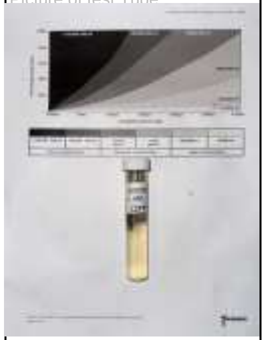
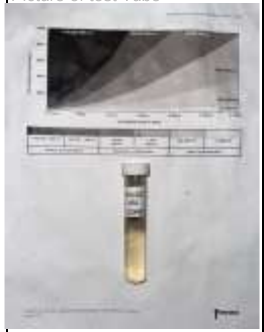
Sulphate-Reducing Bacteria (SRB) Test

Project No. : F254727
Location : Z5_OWF_BH01-COMP
Sample No. : W01
SRB Test Kit : Sig Sulphide®
Depth : 3.6 m BSF
Date of test : 13/01/2025

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 
Tube Appearance: No Visible Reaction	**Tube Appearance:** Light Grey	**Tube Appearance:** Light Grey	**Tube Appearance:** Dark Grey	**Tube Appearance:** Dark Grey	**Tube Appearance:** Dark Grey
SRB Concentration < 10 SRB/ml	**SRB Concentration** 10 - 100 SRB/ml	**SRB Concentration** 10 - 100 SRB/ml	**SRB Concentration** 1000 -10000 SRB/ml	**SRB Concentration** 1000 -10000 SRB/ml	**SRB Concentration** 1000 -10000 SRB/ml
Qualitative Interpretation Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Moderate Contamination	**Qualitative Interpretation** Moderate Contamination	**Qualitative Interpretation** Moderate Contamination

Sulphate-Reducing Bacteria (SRB) Test

Project No. : F254727
Location : Z5_OWF_BH01-COMP
Sample No. : W02
SRB Test Kit : Sig Sulphide®
Depth : 7.5 m BSF
Date of test : 13/01/2025

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 
Tube Appearance:	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**
No Visible Reaction	No Visible Reaction	No Visible Reaction	Light Grey	Light Grey	Light Grey
SRB Concentration	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**
< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	10 - 100 SRB/ml	10 - 100 SRB/ml	10 - 100 SRB/ml
Qualitative Interpretation	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**
Light Contamination	Light Contamination	Light Contamination	Light Contamination	Light Contamination	Light Contamination

Sulphate-Reducing Bacteria (SRB) Test

Project No. : F254727

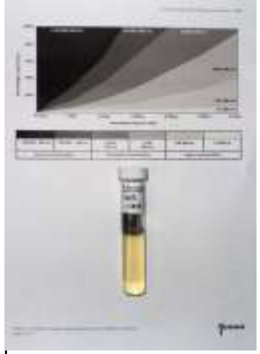
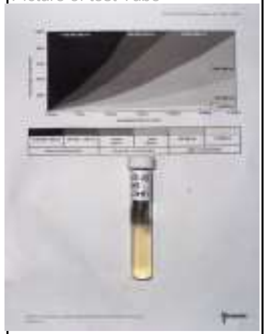
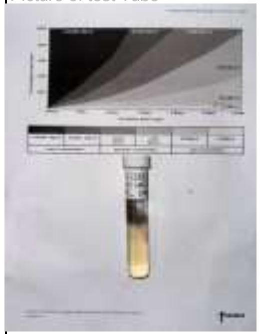
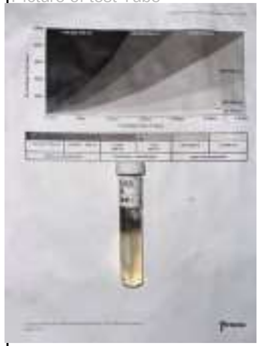
Location : Z5_OWF_BH01-COMP

Depth : 11.8 m BSF

Sample No. : W03

Date of test : 13/01/2025

SRB Test Kit : Sig Sulphide®

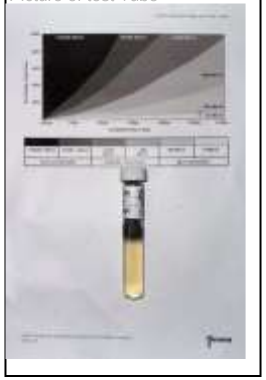
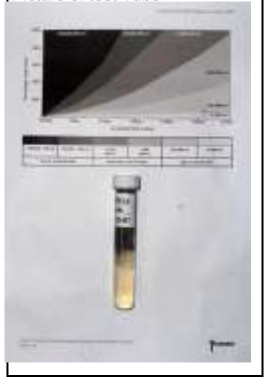
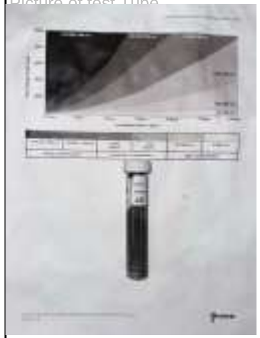
Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 
Tube Appearance:	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**
No Visible Reaction	No Visible Reaction	No Visible Reaction	Light Grey	Light Grey	Light Grey
SRB Concentration	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**
< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	10 - 100 SRB/ml	10 - 100 SRB/ml	10 - 100 SRB/ml
Qualitative Interpretation	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**
Light Contamination	Light Contamination	Light Contamination	Light Contamination	Light Contamination	Light Contamination

Sulphate-Reducing Bacteria (SRB) Test

Project No. : F254727
Location : Z5_OWF_BH01-COMP
Sample No. : W06
SRB Test Kit : Sig Sulphide®

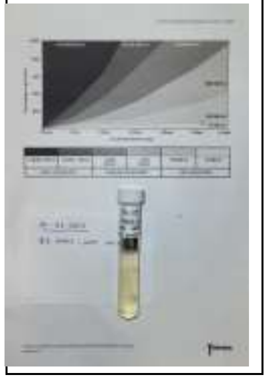
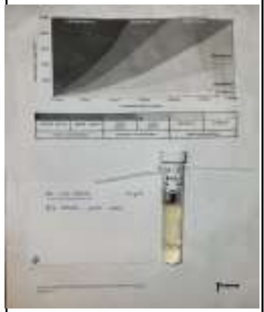
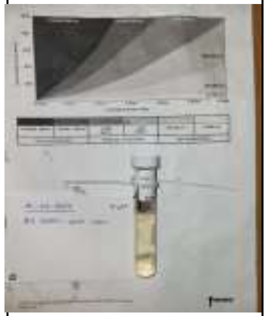
Depth : 16.7 m BSF
Date of test : 13/01/2025

Sample dropped (invalid?)

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
	Picture of test Tube 		Picture of test Tube 	Picture of test Tube 	
Tube Appearance:	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**
No Visible Reaction	No Visible Reaction	No Visible Reaction	Grey	Dark Grey	Dark Grey
SRB Concentration	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**
< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	100 - 1000 SRB/ml	1000 -10000 SRB/ml	1000 -10000 SRB/ml
Qualitative Interpretation	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**
Light Contamination	Light Contamination	Light Contamination	Moderate Contamination	Moderate Contamination	Moderate Contamination

Sulphate-Reducing Bacteria (SRB) Test

Project No. : F254727
Location : Z5_OWF_BH02-COMP
Depth : 3.3 m BSF
Sample No. : W01
Date of test : 14/01/2025
SRB Test Kit : Sig Sulphide®

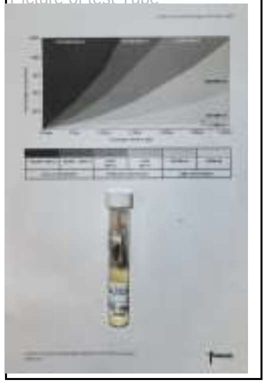
Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 
Tube Appearance:	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**
No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction
SRB Concentration	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**
< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml
Qualitative Interpretation	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**
Light Contamination	Light Contamination	Light Contamination	Light Contamination	Light Contamination	Light Contamination

Sulphate-Reducing Bacteria (SRB) Test

Project No. : F254727
Location : Z5_OWF_BH02-COMP
Sample No. : W02
SRB Test Kit : Sig Sulphide®
Depth : 6.9 m BSF
Date of test : 14/01/2025

Day 1

Picture of test Tube



Tube Appearance:

No Visible Reaction

SRB Concentration

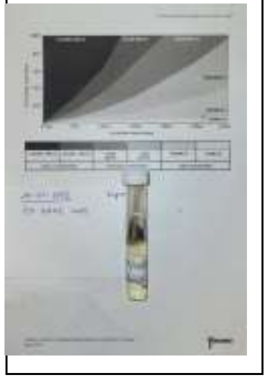
< 10 SRB/ml

Qualitative Interpretation

Light Contamination

Day 2

Picture of test Tube



Tube Appearance:

No Visible Reaction

SRB Concentration

< 10 SRB/ml

Qualitative Interpretation

Light Contamination

Day 3

Picture of test Tube

Tube Appearance:

No Visible Reaction

SRB Concentration

< 10 SRB/ml

Qualitative Interpretation

Light Contamination

Day 4

Picture of test Tube

Tube Appearance:

No Visible Reaction

SRB Concentration

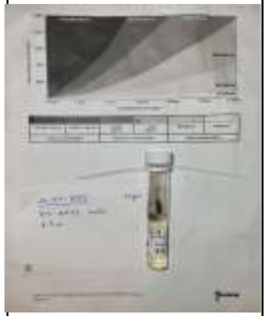
< 10 SRB/ml

Qualitative Interpretation

Light Contamination

Day 5

Picture of test Tube



Tube Appearance:

No Visible Reaction

SRB Concentration

< 10 SRB/ml

Qualitative Interpretation

Light Contamination

Day 6

Picture of test Tube

Tube Appearance:

No Visible Reaction

SRB Concentration

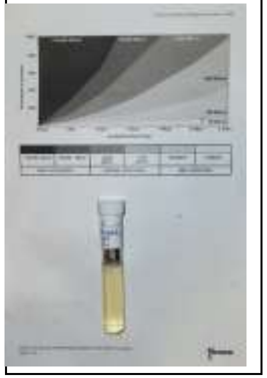
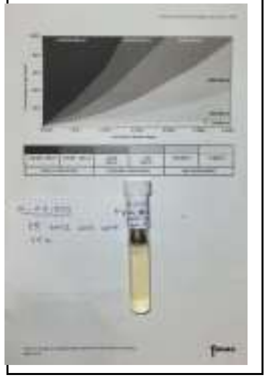
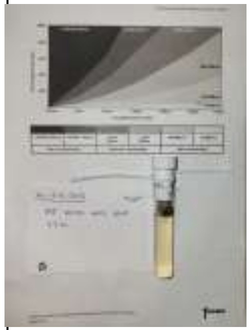
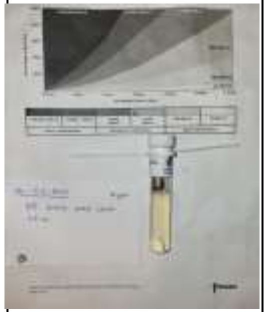
< 10 SRB/ml

Qualitative Interpretation

Light Contamination

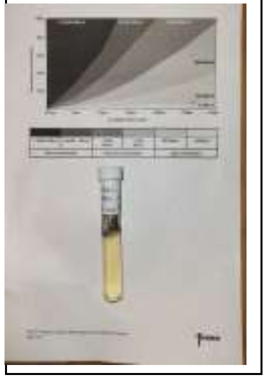
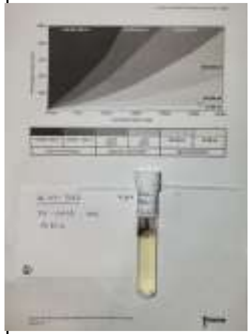
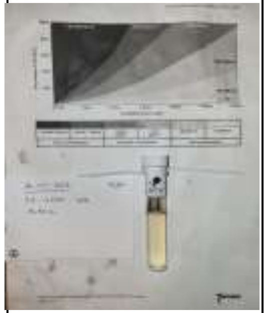
Sulphate-Reducing Bacteria (SRB) Test

Project No. : F254727
Location : Z5_OWF_BH02-COMP
Depth : 11 m BSF
Sample No. : W03
Date of test : 14/01/2025
SRB Test Kit : Sig Sulphide®

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 
Tube Appearance:	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**
No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction
SRB Concentration	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**
< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml
Qualitative Interpretation	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**
Light Contamination	Light Contamination	Light Contamination	Light Contamination	Light Contamination	Light Contamination

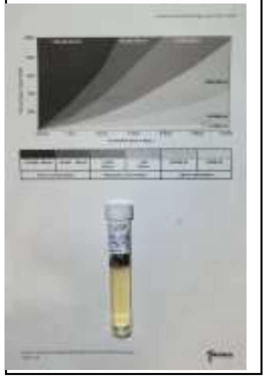
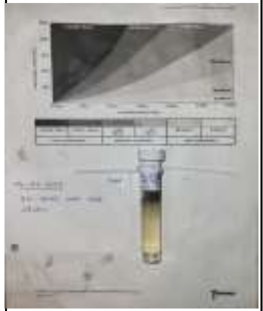
Sulphate-Reducing Bacteria (SRB) Test

Project No. : F254727
Location : Z5_OWF_BH02-COMP
Depth : 14.9 m BSF
Sample No. : W04
Date of test : 14/01/2025
SRB Test Kit : Sig Sulphide®

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 
Tube Appearance:	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**
No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction
SRB Concentration	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**
< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml
Qualitative Interpretation	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**
Light Contamination	Light Contamination	Light Contamination	Light Contamination	Light Contamination	Light Contamination

Sulphate-Reducing Bacteria (SRB) Test

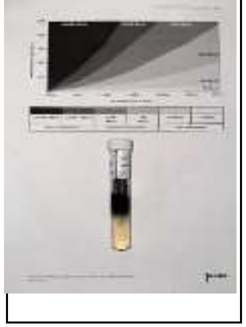
Project No.	:	F254727			
Location	:	Z5_OWF_BH02-COMP	Depth	:	19 m BSF
Sample No.	:	W05	Date of test	:	14/01/2025
SRB Test Kit	:	Sig Sulphide®			

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 
Tube Appearance:	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**
No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction	Light Grey
SRB Concentration	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**
< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	10 - 100 SRB/ml
Qualitative Interpretation	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**
Light Contamination	Light Contamination	Light Contamination	Light Contamination	Light Contamination	Light Contamination

Sulphate-Reducing Bacteria (SRB) Test

Project No. : F254727
Location : Z5_OWF_BH03-COMP
Sample No. : W01
SRB Test Kit : Sig Sulphide®

Depth : 1.5 m BSF
Date of test : 20/10/2025

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 
Tube Appearance:	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**
No Visible Reaction	No Visible Reaction	No Visible Reaction	Light Grey	Grey	Grey
SRB Concentration	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**
< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	10 - 100 SRB/ml	100 - 1000 SRB/ml	100 - 1000 SRB/ml
Qualitative Interpretation	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**
Light Contamination	Light Contamination	Light Contamination	Light Contamination	Moderate Contamination	Moderate Contamination

Sulphate-Reducing Bacteria (SRB) Test

Project No. : F254727

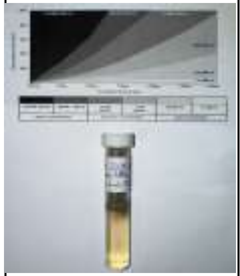
Location : Z5_OWF_BH03-COMP

Depth : 11.7 m BSF

Sample No. : W04

Date of test : 20/10/2025

SRB Test Kit : Sig Sulphide®

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 
Tube Appearance: No Visible Reaction	**Tube Appearance:** Light Grey	**Tube Appearance:** Grey	**Tube Appearance:** Grey	**Tube Appearance:** Grey	**Tube Appearance:** Grey
SRB Concentration < 10 SRB/ml	**SRB Concentration** 10 - 100 SRB/ml	**SRB Concentration** 100 - 1000 SRB/ml	**SRB Concentration** 100 - 1000 SRB/ml	**SRB Concentration** 100 - 1000 SRB/ml	**SRB Concentration** 100 - 1000 SRB/ml
Qualitative Interpretation Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Moderate Contamination	**Qualitative Interpretation** Moderate Contamination	**Qualitative Interpretation** Moderate Contamination	**Qualitative Interpretation** Moderate Contamination

Sulphate-Reducing Bacteria (SRB) Test

Project No. : F254727

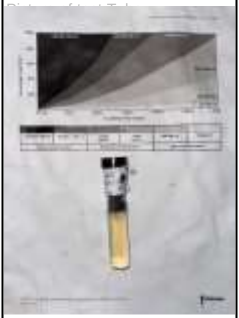
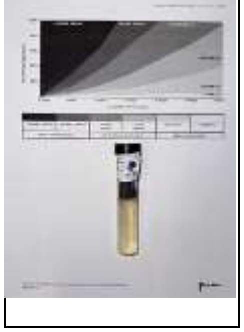
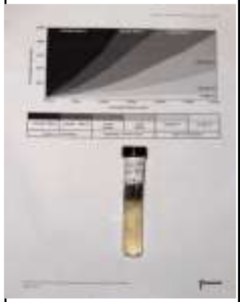
Location : Z5_OWF_BH03-COMP

Sample No. : W06

SRB Test Kit : Sig Sulphide®

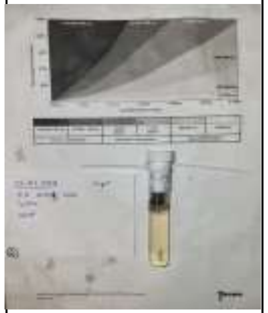
Depth : 19.4 m BSF

Date of test : 20/10/2025

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Picture of test Tube 		Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 
Tube Appearance: No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** Light Grey	**Tube Appearance:** Light Grey	**Tube Appearance:** Light Grey
SRB Concentration < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** 10 - 100 SRB/ml	**SRB Concentration** 10 - 100 SRB/ml	**SRB Concentration** 10 - 100 SRB/ml
Qualitative Interpretation Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination

Sulphate-Reducing Bacteria (SRB) Test

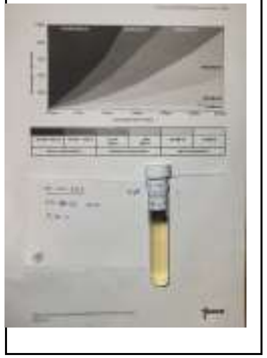
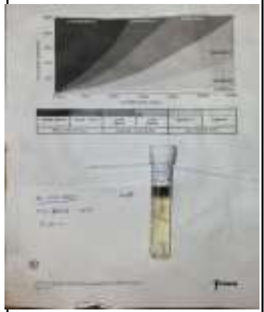
Project No. : F254727
Location : Z5_OWF_BH05-COMP
Sample No. : W02
SRB Test Kit : Sig Sulphide®
Depth : 4.4 m BSF
Date of test : 15/01/2025

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 
Tube Appearance: No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** No Visible Reaction
SRB Concentration < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml
Qualitative Interpretation Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination

Sulphate-Reducing Bacteria (SRB) Test

Project No. : F254727
Location : Z5_OWF_BH05-COMP
Sample No. : W03
SRB Test Kit : Sig Sulphide®

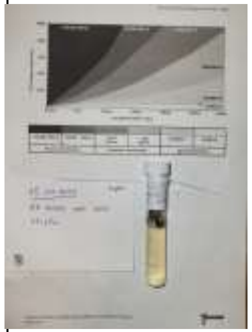
Depth : 8.2 m BSF
Date of test : 16/01/2025

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 
Tube Appearance:	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**
No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction
SRB Concentration	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**
< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml
Qualitative Interpretation	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**
Light Contamination	Light Contamination	Light Contamination	Light Contamination	Light Contamination	Light Contamination

Sulphate-Reducing Bacteria (SRB) Test

Project No. : F254727
Location : Z5_OWF_BH05-COMP
Sample No. : W05
SRB Test Kit : Sig Sulphide®

Depth : 13.45 m BSF
Date of test : 15/01/2025

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 
Tube Appearance: No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** No Visible Reaction
SRB Concentration < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml
Qualitative Interpretation Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination

Sulphate-Reducing Bacteria (SRB) Test

Project No. : F254727

Location : Z5_OWF_BH05-COMP

Depth : 17.5 m BSF

Sample No. : W06

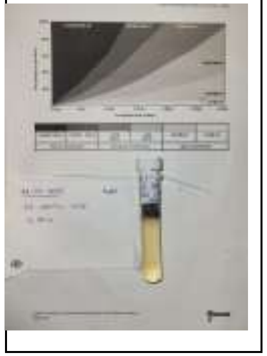
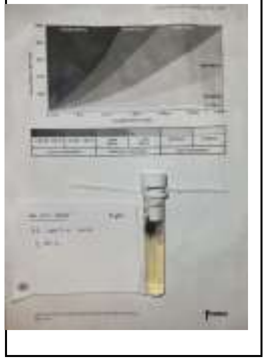
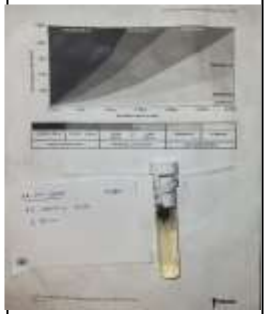
Date of test : 15/01/2025

SRB Test Kit : Sig Sulphide®

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 
Tube Appearance: No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** No Visible Reaction
SRB Concentration < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml
Qualitative Interpretation Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination

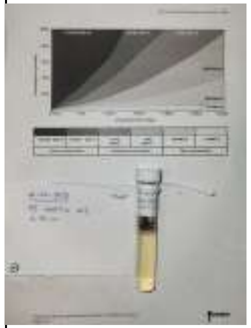
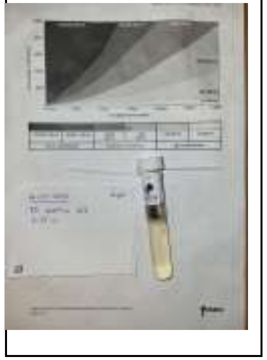
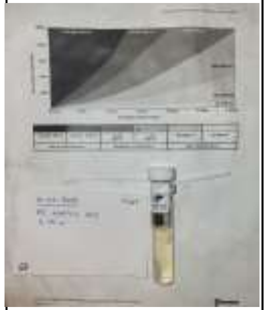
Sulphate-Reducing Bacteria (SRB) Test

Project No. : F254727
Location : Z5_OWF_BH07-COMP_a
Sample No. : W02
SRB Test Kit : Sig Sulphide®
Depth : 2.9 m BSF
Date of test : 16/01/2025

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 
Tube Appearance: No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** No Visible Reaction
SRB Concentration < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml
Qualitative Interpretation Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination

Sulphate-Reducing Bacteria (SRB) Test

Project No. : F254727
Location : Z5_OWF_BH07-COMP_a
Depth : 6.75 m BSF
Sample No. : W03
Date of test : 16/01/2025
SRB Test Kit : Sig Sulphide®

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 
Tube Appearance:	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**
No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction
SRB Concentration	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**
< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml
Qualitative Interpretation	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**
Light Contamination	Light Contamination	Light Contamination	Light Contamination	Light Contamination	Light Contamination

Sulphate-Reducing Bacteria (SRB) Test

Project No. : F254727

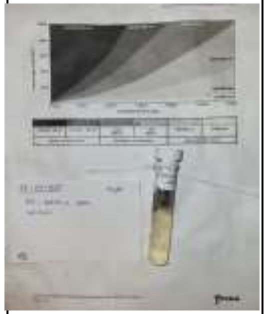
Location : Z5_OWF_BH07-COMP_a

Depth : 10.4 m BSF

Sample No. : W04

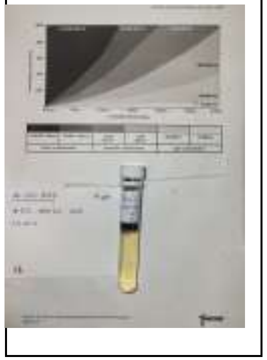
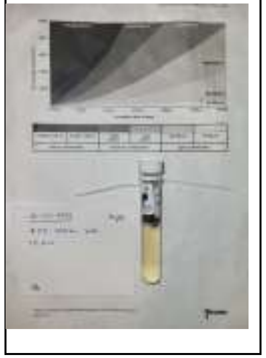
Date of test : 16/01/2025

SRB Test Kit : Sig Sulphide®

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 
Tube Appearance:	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**
No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction
SRB Concentration	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**
< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml
Qualitative Interpretation	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**
Light Contamination	Light Contamination	Light Contamination	Light Contamination	Light Contamination	Light Contamination

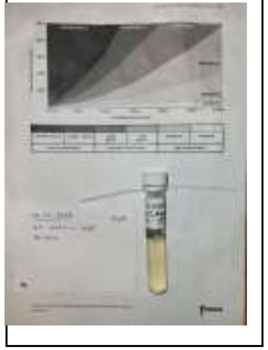
Sulphate-Reducing Bacteria (SRB) Test

Project No. : F254727
Location : Z5_OWF_BH07-COMP_a
Sample No. : W06
SRB Test Kit : Sig Sulphide®
Depth : 15.5 m BSF
Date of test : 16/01/2025

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 
Tube Appearance: No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** No Visible Reaction
SRB Concentration < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml
Qualitative Interpretation Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination

Sulphate-Reducing Bacteria (SRB) Test

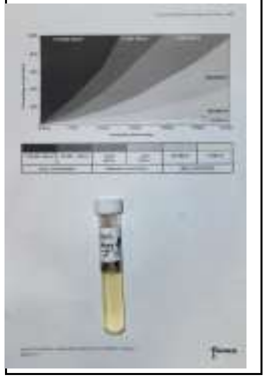
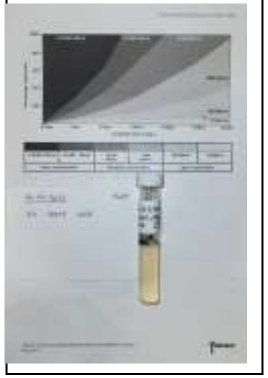
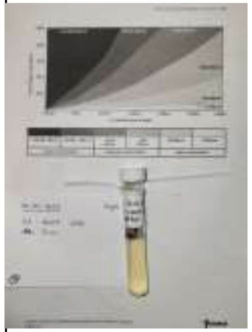
Project No. : F254727
Location : Z5_OWF_BH07-COMP_a
Sample No. : W08
SRB Test Kit : Sig Sulphide®
Depth : 20.35 m BSF
Date of test : 16/01/2025

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 
Tube Appearance: No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** No Visible Reaction	**Tube Appearance:** No Visible Reaction
SRB Concentration < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml	**SRB Concentration** < 10 SRB/ml
Qualitative Interpretation Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination	**Qualitative Interpretation** Light Contamination

Sulphate-Reducing Bacteria (SRB) Test

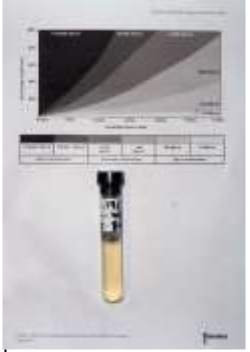
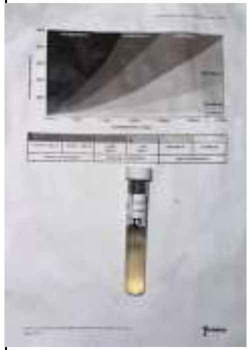
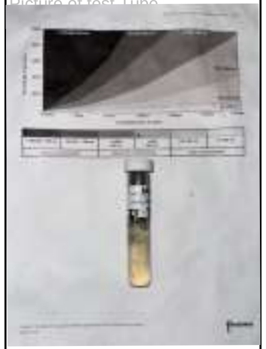
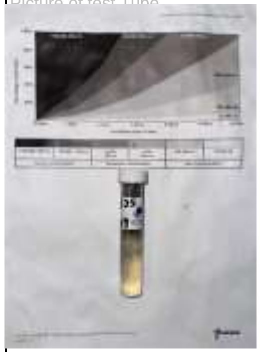
Project No. : F254727
Location : Z5_OWF_BH09-COMP
Sample No. : W01
SRB Test Kit : Sig Sulphide®

Depth : 3 m BSF
Date of test : 14/01/2025

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 
Tube Appearance:	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**
No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction
SRB Concentration	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**
< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml
Qualitative Interpretation	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**
Light Contamination	Light Contamination	Light Contamination	Light Contamination	Light Contamination	Light Contamination

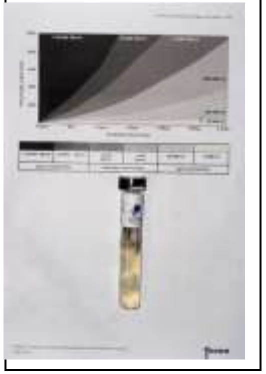
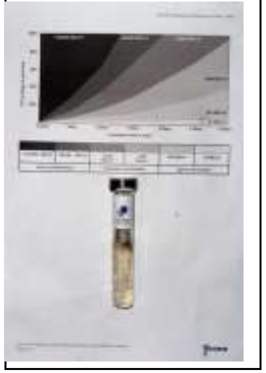
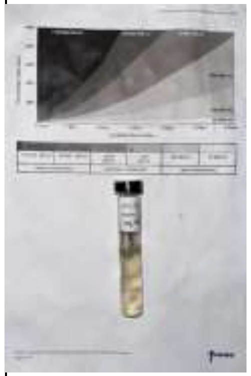
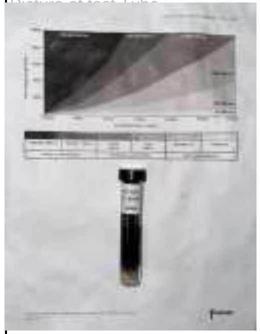
Sulphate-Reducing Bacteria (SRB) Test

Project No. : F254727
Location : Z5_OWF_BH09-COMP
Depth : 12 m BSF
Sample No. : W05
Date of test : 14/01/2025
SRB Test Kit : Sig Sulphide®

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 
Tube Appearance:	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**
No Visible Reaction	No Visible Reaction	Light Grey	Light Grey	Light Grey	Light Grey
SRB Concentration	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**
< 10 SRB/ml	< 10 SRB/ml	10 - 100 SRB/ml	10 - 100 SRB/ml	10 - 100 SRB/ml	10 - 100 SRB/ml
Qualitative Interpretation	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**
Light Contamination	Light Contamination	Light Contamination	Light Contamination	Light Contamination	Light Contamination

Sulphate-Reducing Bacteria (SRB) Test

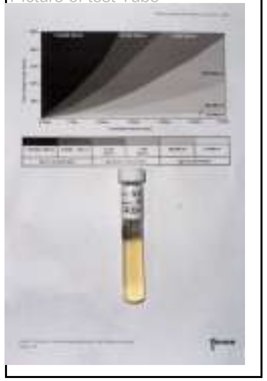
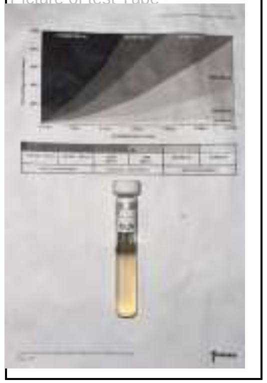
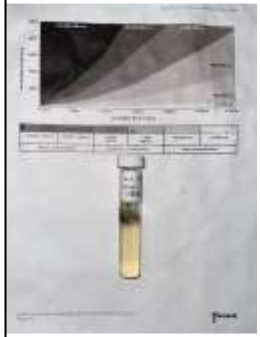
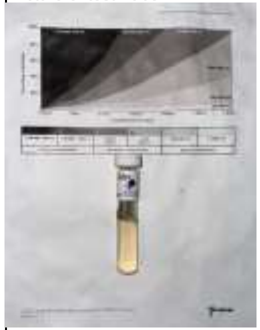
Project No. : F254727
Location : Z5_OWF_BH09-COMP
Sample No. : W06
SRB Test Kit : Sig Sulphide®
Depth : 15.5 m BSF
Date of test : 14/01/2025

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Picture of test Tube 	Picture of test Tube 	Picture of test Tube 			
Tube Appearance:	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**
No Visible Reaction	Light Grey	Light Grey	Light Grey	Light Grey	Grey
SRB Concentration	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**
< 10 SRB/ml	10 - 100 SRB/ml	10 - 100 SRB/ml	10 - 100 SRB/ml	10 - 100 SRB/ml	100 - 1000 SRB/ml
Qualitative Interpretation	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**
Light Contamination	Light Contamination	Light Contamination	Light Contamination	Light Contamination	Moderate Contamination

Sulphate-Reducing Bacteria (SRB) Test

Project No. : F254727
Location : Z5_OWF_BH09-COMP
Sample No. : W07
SRB Test Kit : Sig Sulphide®

Depth : 20 m BSF
Date of test : 14/01/2025

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 	Picture of test Tube 
Tube Appearance:	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**	**Tube Appearance:**
No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction	No Visible Reaction
SRB Concentration	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**	**SRB Concentration**
< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml	< 10 SRB/ml
Qualitative Interpretation	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**	**Qualitative Interpretation**
Light Contamination	Light Contamination	Light Contamination	Light Contamination	Light Contamination	Light Contamination

Appendices

Appendix A

Guidelines on Use of Report

A.1 Guidelines on Use of Report

This report (the 'Report') was prepared as part of the services (the 'Services') provided by Fugro France SAS ('Fugro') for its client (the 'Client') under the terms of the relevant contract between the two parties (the 'Contract'). The Services were performed by Fugro based on the requirements of the Client set out in the Contract or otherwise made known by the Client to Fugro at the time.

Fugro's obligations and liabilities to the Client or any other party in respect of the Services and this Report are limited in time and value as defined in Contract (or in the absence of any express provision in the Contract as implied by the law of the Contract) and Fugro provides no other representation or warranty whether express or implied, in relation to the Services or for the use of this Report for any other purpose. Furthermore, Fugro has no obligation to update or revise this Report based on changes in conditions or information which emerge following issue of this Report unless expressly required by the Contract.

The Services were performed by Fugro exclusively for the Client and any other party identified in the Contract for the purpose set out therein. Any use and/or reliance on the Report or the Services for purposes not expressly stated in the Contract, by the Client or any other party is that party's risk and Fugro accepts no liability whatsoever for any such use and/or reliance.

Appendix B

Cone Penetration Tests

B.1 Cone Penetration Test Definitions

This section details the cone penetration test equipment, procedures and applicable equations.

Description	Document Number
Cone Penetration Test	FNLM-GEO-APP-001

Cone Penetration Test

Scope

This document summarises cone penetration test (CPT) methods.

A CPT involves the measurement of the resistance of ground to steady and continuous penetration of a cone penetrometer equipped with internal sensors. The measurements comprise penetration depth, cone resistance, sleeve friction and, optionally, pore pressure and inclination from vertical. These measurements permit interpretation of ground conditions.

CPT apparatus and procedures adopted by Fugro are in general accordance with ISSMGE (1999), ASTM D5778-20, ISO 22476-1:2022, and ISO 19901-8:2014. General agreement also applies to Eurocode 7 (CEN, 2007).

Some of the test activities allow optional sensor add-ons and procedures, including data processing. These options are not applicable, unless specifically agreed.

This document excludes geotechnical advice, for example advice on a test programme and advice on CPT-based correlations.

CPT Apparatus

General

Fugro offers CPT systems operated from (1) ground surface and seafloor (non-drilling deployment mode) and (2) downhole in a borehole (drilling deployment mode).

CPT apparatus includes various parts as described below:

- Thrust machine: apparatus providing thrust to the push rods so that the recommended rate of penetration (20 mm/s) is controlled;
- Reaction equipment: reaction for the thrust machine;
- Push rod: thick-walled cylindrical tube used for advancing the penetrometer to the required test depth. Push rods may also consist of drill pipe;
- Friction-cone penetrometer (CPT): cylindrical terminal body mounted on the lower end of the push rods, including a cone, a friction sleeve and internal sensing devices for the measurement of cone resistance, sleeve friction and, optionally, inclination;
- Piezocone penetrometer (CPTU or PCPT): cylindrical terminal body mounted on the lower end of the push rods, including a cone, a friction sleeve, a filter and internal sensing devices for the measurement of cone resistance, sleeve friction, pressure and, optionally, inclination and temperature;
- Measuring system: apparatus and software, including sensors, data transmission apparatus, recording apparatus and data processing apparatus.

Deployment from Ground Surface or Seafloor

Specific additional apparatus for CPT deployment from ground surface and seafloor (non-drilling deployment) can include:

- Push rod casing: guide for the part of the push rods protruding above the soil, and for the push rod length exposed in water or soil, to prevent buckling when the required penetration pressure increases beyond the safe limit for the exposed upstanding length of push rods;
- Friction reducer to reduce soil friction acting on the push rods: (1) ring or special projections fixed on the outside of the push rods, with an outside diameter larger than the base of the cone and/or (2) injection of low-friction fluid from the push rod at a fixed distance above the cone penetrometer.

Downhole Borehole Deployment

Downhole CPT systems latch into a bottom hole assembly at the lower end of a drill pipe. System options are:

1. Operation of a downhole thrust machine by applying mud pressure in the borehole;
2. Remote control of a downhole thrust machine by hydraulic pressure transmitted through an umbilical cable connected to a surface-based pump unit, together with;
3. Application of thrust to drill rods where CPT apparatus and a short push rod are latched in the bottom hole assembly; the thrust machine is at ground surface or seafloor.

Downhole CPTs require drilling apparatus for advancing the borehole. The maximum CPT stroke is generally 1.5 m or 3 m.

Data recording can be surface-based and/or downhole.

Cone Penetrometer

Typical features of Fugro penetrometers (Figure 1) include:

- Cone base areas of 500 mm^2, 1000 mm^2 or 1500 mm^2;
- Cone and friction sleeve sensors placed in series, i.e. subtraction-type penetrometers;
- Pore pressure measurements either at the face of the cone (u_1 location) or at the cylindrical extension of the cone (u_2 location). Multiple-sensor penetrometers (u_1, u_2 and u_3 locations) are also available. The u_3 location is immediately above the friction sleeve;
- Inclinometer;
- Temperature sensor, e.g. for cone penetrometer class 0 specified in ISO 22476-1:2022;
- Storage of signals from the penetrometer in digital form for subsequent computer-based processing and presentation.

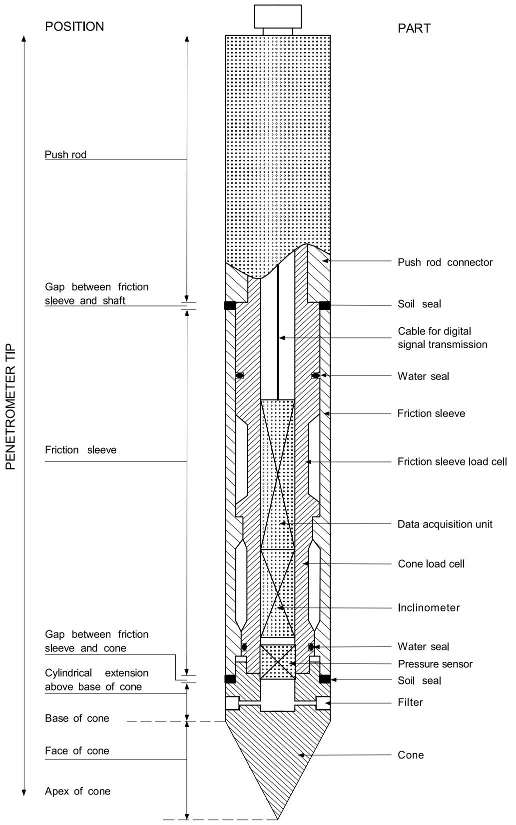


Figure 1: Piezocone penetrometer

Apparatus for Additional Measurements

Add-on apparatus (and procedures) can apply to specific additional measurements, refer to section 'Additional Measurements' below.

Procedure

General

Figure 2 summarises the test procedure. The procedure includes several stages. The stage of Additional Measurements is optional.

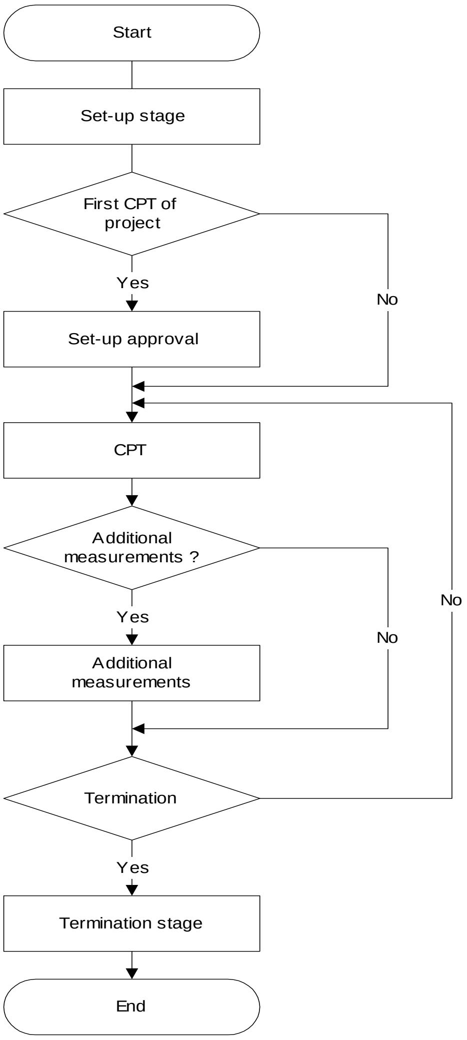


Figure 2: Flow chart

Set-up Stage and Termination Stage

The set-up stage is at discretion of the equipment operator, particularly considering suitability of expected ground type(s), accessibility, risk of damage to equipment and safety of persons.

Set-up requires a reasonably flat, accessible, ground surface with a slope of 5° or less. Most onshore thrust machines have levelling facilities allowing a vertical start of penetration. Seabed frames used for offshore CPT activities have no levelling facilities, i.e. start of penetration may not be vertical.

For over-water (marine/offshore activities), additional accessibility considerations include:

- Minimum water depth for the selected pontoon, jack-up or vessel and the selected test equipment;
- Maximum water depth for the selected pontoon, jack-up or vessel;
- Maximum depth below water (sea) level of selected test equipment;
- Metocean conditions, particularly wind, waves, currents.

The set-up stage typically includes selection of equipment and procedures according to a required type of cone penetrometer, application class, cone penetrometer class, test category and data processing/submission.

The set-up stage or the termination stage includes the location survey, i.e. the determination of the coordinates and the ground surface elevation (or the water depth).

The set-up stage and the termination stage for a downhole CPT include lowering of the CPT apparatus into the borehole and lifting respectively. Most projects require multiple downhole tests in a single borehole.

For piezocone testing, the set-up stage also includes the following steps:

- Office-based or site-based: de-airing of the filter in glycerine by application of 24-hour vacuum and storage in a glycerine-filled container;
- On-site: glycerine filling of hollow space in the cone penetrometer and subsequent mounting of the filter;
- On-site: application of a flexible membrane around the filter to prevent loss of saturating fluid prior to the start of a test.

Land-based tests may include specific measures to help retention of filter saturation during penetration of partially saturated zones. Relaxation of requirements typically applies to offshore tests where water pressures will force entrapped air into solution.

Criteria for test termination are as follows, unless specifically agreed otherwise:

- As instructed by client;
- Reaching target penetration;
- Reaching maximum capacity of the thrust machine, reaction equipment, push rods and/or measuring sensors;
- Sudden increase in penetrometer inclination;
- Risk of damage to apparatus or safety of persons, at discretion of equipment operator or as determined by software algorithms;

whichever occurs first and as applicable. Note that ASTM and ISO standards provide no specific requirements for maximum penetrometer inclination from vertical. A value of 15° is commonly considered.

Application Classes – ISO 19901-8:2014

Table 1 summarises application classes specified in ISO 19901-8:2014 for offshore and nearshore CPTs. The allowable minimum accuracy of a measured parameter is the larger value of the two quoted. A percentage value applies to the measured value and not to the measuring range.

The concept of application classes considers intended soil conditions for selection of an application class. For example, Application Class 1 of ISO 19901-8:2014 can be selected for 'very soft to soft soil deposits', which is approximately equivalent to $q_c < 0.5$ to $q_c < 1$ MPa. In other words, Application Class 1 should not apply to 'mixed bedded soil profiles with weak to strong layers'.

The accuracy values apply to seafloor as reference. They are uncoupled from uncertainty of spatial position below ground surface or seafloor.

Table 1: Application classes (ISO 19901-8:2014)

Application Class	Parameter	Allowable Minimum Accuracy
1	Cone resistance	35 kPa or 5 %
	Sleeve friction	5 kPa or 10 %
	Pore pressure	25 kPa or 5 %
2	Cone resistance	100 kPa or 5 %
	Sleeve friction	15 kPa or 15 %
	Pore pressure	50 kPa or 5 %
3	Cone Resistance	200 kPa or 5 %
	Sleeve friction	25 kPa or 15 %
	Pore pressure	100 kPa or 5 %

Historically, the concept of application classes was based on an international reference test procedure (ISSMGE, 1999), which specifies 'performance' criteria for cone penetration test measurements. The test results should meet the requirements of one of the application classes.

The following comments apply:

- Accuracy is the 'closeness of a measurement to the true value of the quantity being measured'. It is the accuracy as a whole that is ultimately important not the individual parts. Precision is the 'closeness of each set of measurements to each other'. The resolution of a measuring system is the 'minimum size of the change in the value of a quantity that it can detect'. It will influence the accuracy and precision of a measurement.
- Application Class 3 typically represents industry practice. They are approximately equivalent to the more implicit requirements of ASTM International. Class 3 applies, unless specifically agreed otherwise.

Differences in interpretation about compliance with the ISO box values for accuracy became apparent after publication of a predecessor of ISO 22476-1:2022 and, subsequently, publication of ISO 19901-8:2014. Unfortunately, the interpretational challenges emerged from contractual disputes, unnecessary re-work and CPT results assigned higher confidence than actual (e.g. Peuchen and Parasie, 2019).

The zero drift of a measured parameter can be compared with the allowable minimum accuracy according to the selected application class, per test. This comparison considers the maximum range of values of q_c, f_s and, where applicable, u_1 or u_2 for calculation of the percentage box values (Table 1). Zero drift of a measured parameter is an approximate performance indicator for the measuring system (Peuchen and Terwindt, 2014). Zero drift is the absolute difference of the zero readings, reference readings or zero reference reading of a measuring system between the start and completion of the cone penetration test. The reference readings can be taken at (1) atmospheric pressure at ground surface or above water level or (2) under hydrostatic water pressure close to seafloor.

Cone Penetrometer Classes and Test Categories – ISO 19901-8:2023

ISO 19901-8:2023 includes cone penetrometer classes and test categories that are similar to those of ISO 22476-1:2022. Fugro's implementation of ISO 19901-8:2023 is in progress (*for future update of this document*).

Cone Penetrometer Classes and Test Categories – ISO 22476-1:2022

The applicability of ISO 22476-1:2022 is onshore and nearshore. The standard allows selection of cone penetrometer classes and test categories, i.e. method-based criteria. Compliance with a particular cone penetrometer class and test category then provides some indication for uncertainty of CPT results.

Cone penetrometer classes rely on results of detailed laboratory calibration and verification of cone penetrometers. The results determine compliance of a cone penetrometer with one of four cone penetrometer classes (Table 2). A cone penetrometer can conform to more than one cone penetrometer class, for the case of multiple intervals for calibration.

Input criteria for the cone penetrometer classes include:

- Minimum measurands per cone penetrometer class (Table 2);
- Laboratory cone resistance and sleeve friction: (1) selected uncertainty components for axial force, (2) resolution and output stability, (3) verification values of ambient temperature stability, transient temperature stability and bending influence;
- Laboratory pore pressure: (1) selected uncertainty components for water (or gas) pressure, (2) resolution and output stability, (3) verification values of ambient temperature stability, transient temperature stability and bending influence;
- Inclination: expanded measurement uncertainty for inclination values determined in a calibration laboratory.

Table 2: Required measurands per cone penetrometer class (ISO 22476-1:2022)

Cone Penetrometer Class	q_c	f_s	u_2	T
0	√	√	√	√
1	√	√	√	
2	√	√		
3	√	√		

Notes

q_c = cone resistance

f_s = sleeve friction

u_2 = pore pressure (and/or u_1)

T = temperature

Test categories consider requirements for (1) cone penetrometer class and (2) reference readings and output stability of a cone penetrometer recorded just before the cone penetrometer penetrates the ground and just after the cone penetrometer leaves the ground (Table 3). The requirements for pore pressure u_2 (or u_1) apply according to cone penetrometer class (Table 2).

The difference in reference readings (e.g. $\Delta q_{c;0}$) of a sensor is calculated from sensor output recorded at a frequency of ≥1 Hz, as follows:

- Subtracting the mean value of reference readings of a particular sensor (e.g. sensor for q_c), for a period of one minute shortly before the penetration phase from the mean value of reference readings for a period of one minute shortly after the extraction phase, expressed as an absolute value;
- Cone penetrometer is vertical and under no load, atmospheric or selected ambient water pressure;
- Cone penetrometer is under temperature conditions close to ground temperature.

Calculation of output stability (peak-to-peak) of a sensor (e.g. $2\hat{u}_{qc}$) makes use of reference readings as described above. The calculation considers the larger value of subtracting the maximum and minimum sensor values for a period of one minute shortly before the penetration phase and for a period of one minute shortly after the extraction phase.

Table 3: Requirements for test categories (ISO 22476-1:2022)

Test Category	Reference Readings [kPa]	Output Stability [kPa]	Cone Penetrometer Class
A	$\Delta q_{c;0} \leq 15$	$2\hat{u}_{qc} \leq 1$	0
	$\Delta f_{s;0} \leq 5$	$2\hat{u}_{fs} \leq 0.5$	
	$\Delta u_{2;0} \leq 3$	$2\hat{u}_{u2} \leq 0.5$	
B	$\Delta q_{c;0} \leq 35$	$2\hat{u}_{qc} \leq 5$	0 or 1
	$\Delta f_{s;0} \leq 5$	$2\hat{u}_{fs} \leq 1.5$	
	$\Delta u_{2;0} \leq 10$	$2\hat{u}_{u2} \leq 3$	
C	$\Delta q_{c;0} \leq 100$	$2\hat{u}_{qc} \leq 11$	0, 1, or 2
	$\Delta f_{s;0} \leq 15$	$2\hat{u}_{fs} \leq 3$	
	$\Delta u_{2;0} \leq 25$	$2\hat{u}_{u2} \leq 8$	
D	$\Delta q_{c;0} \leq 200$	$2\hat{u}_{qc} \leq 33$	0, 1, 2, or 3
	$\Delta f_{s;0} \leq 25$	$2\hat{u}_{fs} \leq 5$	
	$\Delta u_{2;0} \leq 50$	$2\hat{u}_{u2} \leq 16$	

Notes

$\Delta q_{c;0}$ = difference in reference readings for cone resistance q_c

$\Delta f_{s;0}$ = difference in reference readings for sleeve friction f_s

$\Delta u_{2;0}$ = difference in reference readings for pore pressure u_2 (or u_1)

$2\hat{u}_{qc}$ = output stability for q_c

$2\hat{u}_{fs}$ = output stability for f_s

$2\hat{u}_{u2}$ = output stability for u_2 (or u_1)

Results

CPT Parameters

Presentation of results from cone penetration tests typically includes:

- CPT parameters q_c, f_s and R_f versus depth below ground surface or versus elevation;
- Additional CPTU parameters u_1 or u_2 and, optionally, q_t, q_n, f_t, R_{ft}, B_q, Q_t, Q_{tn}, F_r, I_c, I_B and CD for tests with pore pressure measurements;
- Additional (optional) CPT parameter T, temperature;
- Inclination i for tests with inclination measurements;
- Standard graphical format and digital (tabular) ASCII or AGS formats.

Presentation of temperature T versus depth only applies to test results meeting the requirements of both cone penetrometer class 0 of Table 2 and test category A of Table 4.

Most standards specify scales for graphical presentation as follows:

- Axis for penetration depth z: 1 scale unit = 1 m;
- Axis for cone resistance q_c, corrected cone resistance q_t and net cone resistance q_n: 1 scale unit = 2 MPa or 0.5 MPa;
- Axis for sleeve friction f_s: 1 scale unit = 50 kPa;
- Axis for friction ratio R_f: 1 scale unit = 2 %;
- Axis for pore pressure u: 1 scale unit = 0.2 MPa or 0.02 MPa;
- Axis for pore pressure ratio B_q: 1 scale unit = 0.5.

Graphical presentation aims for these scale units and scale ratios, where suitable and practicable.

The reference level of a test is (1) the ground surface for onshore tests, (2) the seafloor for nearshore and offshore tests. Data processing presumes a hydrostatic pore pressure profile relative to seafloor, unless specifically indicated otherwise. The definition of CPT parameters is as follows:

z = penetration depth relative to ground surface or seafloor, corrected for inclination from vertical (i) where a test includes inclination measurements, as follows:

$$z = \int_0^l \cos\, i \cdot \mathrm{d}l$$

where:

z = penetration depth for the conical base of the cone penetrometer
l = recorded penetration length
i = recorded inclination from vertical

q_c = cone resistance relative to the reference level of the test.

f_s = sleeve friction relative to the reference level of the test. A calculated depth correction applies so that the presented sleeve friction corresponds with the cone depth.

f_t = corrected sleeve friction relative to the reference level of the test. Sleeve friction is corrected for pore pressures acting on the end areas of the friction sleeve

$$f_t = f_s - \frac{(u_2 * A_{sb} - u_3 \; *A_{st})}{A_s}$$

or simplified to:

$$f_t = f_s - u_2 \frac{(A_{sb} - A_{st})}{A_s} \qquad \text{or}$$

$$f_t = f_s - (u_2 \; * a_{fs})$$

where:

A_{sb} = cross sectional area in the gap between the friction sleeve and the cone
A_{st} = cross sectional area in the gap above the friction sleeve
A_s = surface area of the friction sleeve
a_{fs} = net area ratio of the friction sleeve $(A_{sb} - A_{st})/A_s$

R_f = ratio of sleeve friction to cone resistance ($f_s/\, q_c$). This calculated ratio is for the cone depth.

R_{ft} = corrected friction ratio ($f_s/\, q_t$). The ratio f_t/q_t applies if f_t is known.

u_1 = pore pressure at the face of the cone, relative to the reference level of the test.

u_2 = pore pressure at the cylindrical extension above the base of the cone or in the gap between the friction sleeve and the cone, relative to the reference level of the test.

u_3 = pore pressure immediately above the friction sleeve or in the gap above the friction sleeve, relative to the reference level of the test.

Commonly, no measurement of u_3 applies. An estimate can be obtained using $u_3 = 0.7\,(u_2 - u_0) + u_0$ according to SGI (1991). This estimate is independent of positive or negative values of $u_2 - u_0$.

u_0 = hydrostatic pore pressure at the cone, relative to the phreatic surface or the seafloor. This is a calculated value.

q_t = corrected cone resistance (also called total cone resistance). This includes corrections for hydrostatic and transient pore pressures, and cone construction. The corrected cone resistance is relative to ground surface or seafloor:

$$q_t = q_c + (1\text{-}a)u_2 \;\; \text{or}$$

$$q_t = q_c + (1\text{-}a)[K(u_1 - u_0) + u_0]$$

Historically, equations for downhole tests were:

$q_t = q_c + (1\text{-}a)u_2 + u_{0i}$ or

$q_t = q_c + (1\text{-}a)[K(u_1 + u_{0i} - u_0) + u_0] + a * u_{0i}$

where:

a = net area ratio of the cross-sectional steel area at the gap between cone and friction sleeve to the cone base area. This ratio is penetrometer-type dependent. The a-factor indicates the effect of pore pressure on unequal cross-sectional areas of the cone.

u_{0i} = hydrostatic pore pressure at the bottom of the borehole, relative to seafloor. This is a calculated value.

K = adjustment factor for the ratio of pore pressure at the cylindrical extension above the base of the cone to pore pressure on the cone face $K = (u_2 - u_0)/(u_1 - u_0)$

The term $u_2 - u_0$ refers to excess pore pressure (with respect to hydrostatic pore pressure). Common symbols for excess pore pressure are du_2 and Δu_2. Similarly, du_1 and Δu_1 can represent the term $u_1 - u_0$.

The K-factor is only of interest for processing of CPTU results with pore pressure measurement at the cone face (u_1). The factor depends on soil characteristics such as fabric, overconsolidation ratio, compressibility and crushability. The K-factor (Peuchen et al., 2010) can be estimated from:

$$K = 0.91\mathrm{e}^{-0.09{Q_t}^{0.47}}\left(\frac{1}{1+F_r(0.17+0.061(Q_t-21.6)^{1/3})} - \mathrm{e}^{-2F_r}\right)$$

q_n = $q_t - \sigma_{vo}$ = net cone resistance. This includes corrections for hydrostatic and transient pore pressures, in situ stress, and cone construction. The symbol for q_n may also be q_{net}.

where:

σ_{vo} = total in situ vertical stress at the cone base, relative to ground surface or seafloor. This is a calculated value.

B_q = pore pressure ratio $B_q = (u_2 - u_0)/q_n$ or

$B_q = K(u_1 - u_0)/q_n$

Q_t = q_n/σ'_{v0} = normalized cone resistance

where:

σ'_{v0} = effective in situ vertical stress at the cone base, relative to ground surface or seafloor. This is a calculated value.

Q_{tn} = normalized cone resistance with variable stress exponent n, where:

$Q_{tn} = [(q_t - \sigma_{v0})/P_a](P_a/\sigma'_{v0})^n$

$n = 0.381\ (I_c) + 0.05\ (\sigma'_{vo}\ /\ P_a) - 0.15$ and $n \le 1$ (Zhang et al., 2002)

where:

P_a = atmospheric pressure

F_r = f_t/q_n = normalized friction ratio

U_2 = normalized excess pore pressure $(u_2 - u_0)/\sigma'_{v0}$

I_B = soil behaviour type index (Robertson, 2016)

$I_B = 100(Q_{tn} + 10)/(70 + Q_{tn}F_r)$

I_c = soil behaviour type index (Robertson and Wride,1998)

$I_c = [(3.47 - \log Q_{tn})^2 + (\log F_r + 1.22)^2]^{0.5}$

I_{SBT} = soil behaviour type index (Robertson, 2010)

$I_{SBT} = [(3.47 - \log (q_c/P_a))^2 + (\log R_f + 1.22)^2]^{0.5}$

CD = contractive-dilative boundary (Robertson, 2016)

$CD = (Q_{tn} - 11)(1 + 0.06F_r)^{17}$

Presented values for u_2, q_t, q_n, f_t, R_{ft}, Q_t and B_q may be annotated with an asterisk, e.g. u_2^*, q_t^* or q_n^*, if u_2 is derived rather than measured, for example if derived by applying a K-factor.

Pore pressure u_2 at the cylindrical extension is commonly assumed equal to u_{2g} in the gap. The assumption $u_2 = u_{2g}$ is probably reasonable for deepwater CPTs and associated high values of ambient pressure that promote saturated conditions in the gap. A similar comment applies to u_3. Note that CPTU saturation procedures apply to the pore pressure measuring system only. These procedures exclude the gaps below and above the friction sleeve.

Some deployment systems allow monitoring of CPT parameters in reverse mode, i.e. upon retraction of the cone penetrometer. This optional feature presents additional information that can improve interpretation of ground behaviour, for example strength sensitivity of fine-grained soil.

Metrological Confirmation

CPT results include information on metrological confirmation. Examples covered by CPT standards include reporting of application class, cone penetrometer class, test category and reference readings.

The ISO standard on metrological confirmation (ISO 10012:2003) provides the general framework for assessment of performance compliance.

Cone penetration test standards can follow a ‘prescriptive’ approach, whereby specific detailed measures provided a ‘deemed to comply’ practice. ASTM D5778-20 and ISO 22476-1:2022 provide examples of this approach.

The level of detail required by standards can be high. For example, ISO 22476-1:2022 includes detailed procedures for calibration and verification of CPT systems, with normative references to ISO/IEC 17025:2017. Fugro’s calibration laboratory holds formal accreditation for cone penetrometer calibration and verification according to ISO/IEC 17025:2017. Results provided by Fugro’s calibration laboratory meet the requirements of ISO 22476-1:2012, ISO 19901-8:2014 and ASTM D5778-20. Fugro is implementing updates to meet the requirements of ISO 22476-1:2022 and ISO 19901-8:2023.

Peuchen and Terwindt (2014, 2015) provide guidance on uncertainty estimation for cone penetration test results. The calculation model for uncertainty estimates for q_c, f_s and u considers the following uncertainty contributions, where applicable: (1) force and pressure sensors, (2) geometry of the cone penetrometer, (3) effects from ambient and transient temperature, (4) non-axial force on cone penetrometer (bending moment), (5) ambient fluid pressure in soil and (6) zero offsets for q_c, f_s and u relative to seafloor.

Temperature Stability of Cone Penetrometer

Uncertainty considerations for strongly layered soils should allow for heat flux phenomena. Heat flux gives an apparent shift in cone resistance. For example, friction in dense sand causes a cone to heat by about 1°C/MPa cone resistance. Resulting heat flux changes cone resistance by an apparent shift in the order of 100 kPa to 200 kPa for a penetrating probe going from dense sand into clay. This is a temporary change lasting about 5 minutes. Penetration interruption can serve as mitigation measure for transient temperature effects. The incorporation of one or more add-on temperature sensors in a cone penetrometer, and associated data algorithms, can reduce the effects from ambient and transient temperature fluctuations (Peuchen et al., 2020).

Sleeve Friction

Sleeve friction values will show some dependence on details of cone penetrometers, each of which meeting the requirements outlined in ISO (2022, 2023) and ASTM (2020). Peuchen and Terwindt (2014, 2015) list factors which can contribute to variation in f_s values, including:

- Geometry and surface area tolerances: ISO (2022, 2023) and ASTM (2020) standards allow for variations (tolerances) in geometry of a cone penetrometer, including diameter of the cone, diameter of the friction sleeve and the surface area (length) of the friction sleeve. Particularly, presented values of sleeve friction cover 'friction' and 'end bearing' components. Furthermore, the friction component can depend on cavity expansion causing soil to move from space defined by the diameter of the cone to space defined by the diameter of the friction sleeve. This effect can be important for dense sands.
- Surface roughness: The surface roughness of the friction sleeve can change upon use of the cone penetrometer, affecting f_s values. Variations in roughness affect how soil particles interact with the sleeve surface.
- Gaps between components: Gaps between the friction sleeve and other components of the cone penetrometer (e.g., the cone and the shaft) affect f_s values. Contributors include (1) soil-soil shear forces and (2) water or gas pressures in these gaps and (3) changes in gap volume due to pressure and displacement. Some dependencies on the net area ratio of the friction sleeve a_{fs} also apply. Effects on f_s can be particularly significant in soils with varying penetration-induced pore pressures.

Pore Pressures

A CPTU pore pressure measuring system is intended for use in water-saturated uncemented fine-grained soil. Pore pressure measurements (u) are commonly assumed to represent pore water pressures. This assumption is reasonable for soils saturated under in situ stress conditions and remaining saturated during penetration of the cone penetrometer.

Pore pressure results obtained for ground conditions such as partially saturated soils, very dense sands and cemented soils may not be representative and/or repeatable. For example, stiffness differences between the steel components of the cone penetrometer and the piezocone filter can affect results for very dense sands.

Loss of saturation of the pore pressure measuring system can occur during a test (Peuchen et al. 2020). Loss of saturation usually causes a sluggish pore pressure response during penetration of ground below the zone causing desaturation of the pore pressure measuring system. Reasons for loss of saturation include:

- Penetration of partially saturated ground, for example ground containing significant amounts of gas;
- Reduction of pore pressure to below in situ pore pressure, causing gas in solution to become free gas;
- Penetration interruption for a stationary in situ test or for add-on of a push rod, that will cause:
  - Abrupt cone penetrometer deceleration and acceleration, with a possibility of upward movement of the cone penetrometer
  - Change of stress conditions around the cone penetrometer, including pore pressure and gas migration where applicable
  - Small volume change of the gaps below and above the friction sleeve of the cone penetrometer
- For u_2 filter position: proximity of gap between cone tip and friction sleeve, i.e. net area ratio $a < 1$. This gap may not be water-saturated, which in turn can lead to (1) substantial, local (undesired) pore pressure gradients and (2) loss of saturation of the u_2 filter itself;
- Measurement of negative pore pressures such that cavitation occurs; for example, this is not uncommon for a piezocone filter located at the cylindrical extension above the base of the cone (u_2 location), at the time of penetration of dense sand or overconsolidated clay layers.

Re-saturation of a pore pressure measurement system can take place upon further penetration into soil. Particularly, re-saturation may take place in saturated low-permeability soils (clays) that are normally consolidated or lightly overconsolidated and where the gap can become saturated by adequate supply of water and/or water pressure.

Measured pore pressures affected by desaturation of the pore pressure measurement system may not be representative of soil behaviour. Consequently, derived parameter values that use pore pressure may also not be representative.

Shallow Penetration

Shallow penetration will affect CPT measurements. Values of q_c, f_s and u for initial penetration of a cone penetrometer below ground surface, seafloor or bottom of a borehole will differ from a fully embedded cone penetrometer. As a general guide, initial penetration effects can be expected for a distance of about 8 times the diameter of the cone penetrometer for q_c, u_1 and u_2, and for a distance of about 15 times the diameter of the cone penetrometer for f_s. Initial penetration effects can be deeper for downhole borehole deployment. This is because of (1) complex ground stress conditions immediately below the required borehole and (2) borehole-induced ground disturbance that cannot be avoided.

Use of reaction equipment will affect stress conditions for shallow penetration. Particularly, offshore conditions may include extremely soft ground at seafloor. Soil disturbance, pore pressure build-up and consolidation of near-surface soft soil may take place.

Penetration Rate

CPT standards typically provide limits of ± 5 mm/s for a nominal penetration rate of 20 mm/s. Considerations include:

- A typical thrust machine provides a push speed with an uncertainty within ± 5 mm/s under favourable conditions. Under adverse conditions, penetration rates may be outside these limits, for example with strongly varying thrust and towards the thrust limit of a thrust machine;

- The penetration rate is not necessarily equal to the push speed because of inevitable vertical movements of the thrust machine and length variation and bending of the push-rod string.

Penetration Interruption

A penetration interruption may be unavoidable, for example to add a push rod or to perform a pore pressure dissipation test. This will affect test results.

Consolidation of low-permeability soil around a cone tip is of particular interest. A stationary cone penetrometer can apply local stresses that approach failure conditions, i.e. about 9 times the undrained shear strength or about 2 times the in situ mean effective stress. Pore pressure re-distribution and dissipation occur, resulting in a local increase in undrained shear strength and hence cone (bearing) resistance. A doubling of cone resistance may not be unreasonable for 100 % consolidation. Supplementary considerations include:

- Small downward movement of a penetrometer (order of millimetres) during a test can contribute to maintaining local stresses approaching failure conditions;
- Soil consolidation around a cone penetrometer may lead to soil/penetrometer adhesion that is sufficient to give an increase in 'cone' diameter. Resumption of penetration will lead to loss of adhered soil, usually within an equivalent distance of a few times the cone diameter;
- A low B_q value may imply partially drained penetration conditions. It is likely that any steady-state penetration conditions will not apply instantaneously upon resumption of penetration;
- Measuring sensors in a probe generate heat, but this is probably not significant for any stationary measurement. Fugro's strain-gauge load sensors are compensated for ambient temperature fluctuations.

Depth Measurement for Offshore Conditions

Table 4 presents depth accuracy classes according to ISO 19901-8:2014. The type of uncertainty is undefined (e.g. combined standard uncertainty or expanded measurement uncertainty with a coverage factor $k = 2$).

Peuchen and Wemmenhove (2020) present a probabilistic approach to depth uncertainty assessment for in situ testing data points, with reference to these accuracy classes.

Offshore definition of the seafloor (ground surface) is difficult for extremely soft ground at seafloor (ISO 19901-8:2014). Penetration of the reaction equipment into a near-fluid zone of the seabed may take place unnoticed. Such settlement affects the start of penetration depth z. Also, settlement may continue at the time of testing.

Downhole CPT systems rely on depth control applicable to borehole drilling. Depth control according to Z2 of Table 4 is typically feasible for drilling systems deployed from a fixed platform, for example a jack-up. This value excludes uncertainty associated with determination of seafloor level. Drilling control from floating equipment, for example a geotechnical survey vessel, may be subject to the additional influence of waves and tides. Z2 is typically feasible for favourable conditions. Z3 or Z4 may apply for adverse conditions.

Table 4: Depth accuracy classes (ISO 19901-8:2014)

Depth Accuracy Class	Maximum Data Point Depth Uncertainty [m]
Z1	0.1
Z2	0.5
Z3	1.0
Z4	2.0
Z5	> 2.0

Zero-Correction for Offshore Conditions

Water pressures generate significant values of cone resistance and pore pressure. The standardised practice is to correct these reference readings to zero at seafloor. CPT systems for non-drilling mode and for seafloor drilling mode allow zero-correction to hydrostatic conditions prior to the start of a test, typically with a zero-correction uncertainty approaching the resolution of the CPT system. Downhole borehole CPT systems latch into the lower end of a drill pipe. The pressure conditions in the drill pipe may not be in full equilibrium with the surrounding ground water pressure and zero-correction will be subject to increased uncertainty, i.e. uncertainty for pore pressure in the order of 100 kPa for deepwater tests (Peuchen, 2000). This uncertainty depends on factors such as the free-flow and viscosity of drill fluid between the drill bit and the seafloor. The uncertainty typically decreases with decreasing depth of the drill bit below sea level and below seafloor. Uncertainty for the zero-correction of cone resistance is approximately equivalent, but by a factor representing the net area ratio effect.

Deepwater Tests

A deepwater environment presents some favourable conditions for cone penetration tests, notably temperature. Ambient temperature conditions are practically constant and the measuring system has ample time to adjust to these temperatures. In addition, transient heat flow phenomena in a cone penetrometer are usually not applicable. This is because a cone penetrometer accumulates negligible (frictional) heat when penetrating the generally prevalent soils of very soft consistency.

Deepwater (piezocone) pore pressure measurements are essentially similar to shallow-water measurements, with the exception of an increased measuring range for pore pressure leading to some reduction in sensor accuracy. Saturation of a pore pressure measuring system is excellent for a deepwater environment, as the high pressures will force any gas bubbles into solution.

Currently available evidence indicates that a high-quality subtraction-type cone penetrometer is adequate for very soft soil characterisation to a water depth of 3000 metres and probably beyond.

Additional Measurements

Friction-cone and piezocone penetrometers allow specific additional measurements, such as friction set-up tests, pore pressure dissipation tests and measurements of ground water pressure. These optional measurements require a penetration interruption or may be feasible at the end of a test. It is also common to add other (optional) in situ test devices to a cone penetrometer. Table 5 presents the more common types.

Table 5: Probes for additional in situ tests

Type of Probe	Properties	Units
Electrical Conductivity Penetrometer (ECPT)	Electrical conductivity, K	S/m
Temperature Cone Penetrometer (T-CPT)	Temperature T, thermal conductivity k, volumetric heat capacity C	K, W/(m·K), MJ/m^{3}K
Cone penetrometer with heatflow module (HF-CPTU or HF-T-CPT)	Temperature T, thermal conductivity k	K, W/(m·K)
Seismic Cone Penetrometer (SCPT)	S-wave velocity v_s	m/s
Cone Pressuremeter (CPMT)	Stress-strain-time response σ, ε, t	MPa, -, s
Natural Gamma Penetrometer (GCPT)	Natural gamma ray γ	CPS
Cone Magnetometer (CMMT)	Magnetic flux density B, magnetic field horizontal angle θ, vertical angle ϕ	μT, °, °
Hydraulic Profiling Tool (HPT)	Permeability k	m/s

Notes
S = Siemens
m = metre
K = Kelvin (or °C)
W = Watt
J = Joule
s = second
Pa = Pascal
CPS = counts per second
T = Tesla

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Appendix C

Geotechnical Classification Systems

C.1 Soil Classification Systems

Soil description and classification during the site investigation followed two standards:

- ISO 14688-1:2017 Geotechnical investigation and testing. Identification and classification of soil. Identification and description (ISO, 2017a);
- ISO 14688-2:2017 Geotechnical investigation and testing. Identification and classification of soil. Principles for a classification (ISO, 2017b).

Based on these two standards, the consistency of cohesive soils was determined offshore as outlined in Table C.1.

Table C.1: Definitions of consistency used in soil descriptions

Consistency Term	Field Assessment
Very soft	Exudes between the fingers when squeezed in the hand
Soft	Can be moulded by light finger pressure
Firm	Cannot be moulded by the fingers but can be rolled in the hand to 3 mm thick threads without breaking or crumbling
Stiff	Crumbles and breaks when rolled to 3 mm thick threads but is still sufficiently moist to be moulded to a lump again
Very stiff	Soil has dried out and is mostly light coloured. Cannot be moulded but crumbles under pressure. Can be indented by the thumbnail

Undrained shear strength of fine soils is defined using the results of basic laboratory and field tests. Table C.2 explains the terms for characterising undrained shear strength. An additional range for ultra high strength soils is included to cover the full range of soil strengths.

Table C.2: Definitions of undrained shear strength of fine soils used in soil descriptions

Strength Term	Undrained Shear Strength [kPa]
Extremely low	< 10
Very low	10–20
Low	20–40
Medium	40–75
High	75–150
Very high	150–300
Extremely high	300–600
Ultra high	> 600

Table C.3 presents the ranges of relative density (Lambe & Whitman, 1969) on which the limits of consistency adopted in sand soils are based.

Table C.3: Definitions of relative density used in soil descriptions

Relative Density Term	Relative Density [%]
Very loose	0–15
Loose	15–35
Medium dense	35–65
Dense	65–85
Very dense	85–100

Fugro has a standard code of practice that aims to standardise soil descriptions in accordance with BS 5930:2015+A1:2020 (BSI, 2015a), and has adopted equivalent qualitative terms for tertiary constituents. These are listed in Table C.4.

Table C.4: Standard terms used in soil descriptions for tertiary constituents

BS 5930:2015 Suggested Term	Fugro Standard Term	% by Volume*
Rare	With trace	< 1
Occasional	With a few	1–5
n/a	With	> 5–15
Frequent	With many	> 15

Notes
n/a = Not applicable: the BSI does not have a suggested term that equates to 'with'
* = Estimated visually

Appendix D

Laboratory Standards

D.1 Laboratory Testing Methods: Standards and Statements

Table D.1 lists the standards and procedures for laboratory tests performed by Fugro during this project. Non-standard laboratory test procedures (i.e. Fugro in-house testing procedures) are included; where tests were performed according to national or international standards, only the applicable standard number is referenced. Accredited tests are noted in the tables below. Tests performed offshore do not fall under the accreditation.

Table D.1: Laboratory method standards and statements

Laboratory Tests	Standard Reference or Fugro Document Number
Classification Tests	
Moisture content*	ISO 17892-1:2014 (ISO, 2014b)
Bulk and dry density*	ISO 17892-2:2014 (ISO, 2014c)
Torvane	L-M-011
Pocket penetrometer	L-M-015
Plastic and liquid limits*	ISO 17892-12:2018 (ISO, 2018c)
Particle density*	ISO 17892-3:2015 (ISO, 2015)
Maximum and minimum density	NGI GEOLABS (2019a, 2019b)
Particle size distribution*	ISO 17892-4:2016 (ISO, 2016)
Conductivity Tests	
Thermal conductivity*	ASTM D5334-22 (ASTM International, 2022)
Consolidation Tests	
Incremental loading oedometer*	ISO 17892-5:2017 (ISO, 2017)
Permeability Tests	
Permeability*	ISO 17892-11:2019 (ISO, 2019)
Permeability in triaxial cell*	ISO 17892-11:2019 (ISO, 2019)
Shear Strength Tests – Total Stress	
Unconsolidated undrained triaxial*	ISO 17892-8:2018 (ISO, 2018)
Direct shear, shear box*	ISO 17892-10:2018 (ISO, 2018b)
Shear Strength Tests – Effective Stress	
Consolidated triaxial compression on water saturated soils*	ISO 17892-9:2018 (ISO, 2018a)
Notes * = Accredited test	

Table D.2 lists additional tests that were subcontracted to a third-party laboratory and not performed by Fugro.

Table D.2: Subcontracted tests: method standards and statements

Laboratory Tests	Standard or Method Statement
Carbonate content of soil by rapid titration *	BS 1377-3:2018 (BSI, 2018)
Chloride content *	BS 1377-3:2018 (BSI, 2018)

Laboratory Tests	Standard or Method Statement
Organic matter by loss on ignition *	BS 1377-3:2018 (BSI, 2018)
pH value *	BS 1377-3:2018 (BSI, 2018)
Sulphate content *	BS 1377-3:2018 (BSI, 2018)
Notes * = Accredited test	

D.2 Laboratory Accreditations

Laboratory accreditations are provided in the below section for the following laboratories:

- Fugro GB Marine Limited (Wallingford and Louvain-la-Neuve laboratory);
- Fugro GeoServices Limited (Consett laboratory);
- Derwentside Environmental Testing Services Ltd.

Schedule of Accreditation

issued by

United Kingdom Accreditation Service

2 Pine Trees, Chertsey Lane, Staines-upon-Thames, TW18 3HR, UK

UKAS TESTING **0919** **Accredited to ISO/IEC 17025:2017**	**Fugro GB Limited** **Issue No:** 051 **Issue date:** 05 June 2025	
	Fugro House **Hithercroft Road** **Wallingford** **Oxon** **OX10 9RB**	**Contact: Ms S Burns** **Tel: +44 (0)131 4495030** **E-Mail: s.burns@fugro.com** **Website: www.fugro.com**

Testing performed by the Organisation at the locations specified

Locations covered by the organisation and their relevant activities

Laboratory locations:

Location details		Activity	Location code
Address Fugro House Hithercroft Road Wallingford Oxon OX10 9RB	**Local contact:** Ms A Miliopoulou Tel: +44 (0)1491 820443 Email: a.miliopoulou@fugro.com Website: www.fugro.com	**Support Functions:** Quality System Quality Audit Administration **Construction:** Soils – Physical and Mechanical Testing	A
Address Victory House Unit 16 Trafalgar Wharf Hamilton Road Portchester Hampshire PO6 4PX	**Local contact:** Mr A Addleton Tel: +44 (0)23 92205577 Email: a.addleton@fugro.com Website: www.fugro.com	**Support Functions:** Quality System Quality Audit Administration **Sampling and Testing:** Sediment Physical Testing Water Testing	B
Address 1-9 The Curve 32 Research Avenue North Heriot-Watt Research Park Edinburgh EH14 4AP	**Local contact** Mr A Matkin Tel: +44 (0)131 4495030 Email: a.matkin@fugro.com Website: www.fugro.com	**Support Functions:** Quality System Quality Audit Administration **Chemical Testing:** Sediment Testing Soils Testing Water Testing	C
Address Fugro Belgium SRL, Rue du Bosquet 9 1348 Louvain-La-Neuve, Belgium	**Local contact** Ms A Miliopoulou Tel: +44 (0)1491 820443 Email: a.miliopoulou@fugro.com Website: www.fugro.com	**Support Functions:** Quality System Quality Audit Administration **Construction:** Soils – Physical and Mechanical Testing	F

Site activities performed away from location B listed above:

Testing performed by the Organisation at the locations specified

Location details	**Activity**	**Location code**
Premises including domestic, commercial and industrial	Sampling for Microbiological Testing	D
Customer Locations - Marine and transitional water environments	Sampling for macrofaunal taxonomy and Physio-chemical analysis of sediments and water	E

DETAIL OF ACCREDITATION

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:Part 2:1990	A
	Electrical Resistivity – Cylindrical Samples	BS 1377-3: 2018 Clause 13.3	A
	One-dimensional consolidation properties of saturated cohesive soils using controlled-strain loading	ASTM D4186-12: 2020	A, F
SOIL and SOFT ROCK	Determination of Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe	ASTM D5334-22	A
ROCK	Water Content	ASTM D2216-19 The Complete ISRM Suggested Methods – Rock Characterization Testing and Monitoring 1974 – 2006, Editors: R Ulusay & J A Hudson	A A
	Determination of the Point Load Strength Index of Rock	ASTM D5731-16 The Complete ISRM Suggested Methods – Rock Characterization Testing and Monitoring 1974 – 2006, Editors: R Ulusay & J A Hudson	A A
GEOTECHNICAL INVESTIGATION and TESTING - Laboratory testing of soil	Water content	BS EN ISO 17892-1:2014 DIN EN ISO 17892-1:2014	A, F
	Bulk density - linear measurement method	BS EN ISO 17892-2:2014 DIN EN ISO 17892-2:2014	A, F
	Particle density - fluid pycnometer method	BS EN ISO 17892-3:2015 DIN EN ISO 17892-3:2015	A, F
	Particle size distribution - sieving method	BS EN ISO 17892-4:2016 DIN EN ISO 17892-4:2016	A, F
	Particle size distribution - pipette method	BS EN ISO 17892-4:2016 DIN EN ISO 17892-4:2016	A, F

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
GEOTECHNICAL INVESTIGATION and TESTING - Laboratory testing of soil (cont'd)	Particle size distribution - hydrometer method	BS EN ISO 17892-4:2016 DIN EN ISO 17892-4:2016	F
	Incremental loading oedometer test	BS EN ISO 17892-5:2017 DIN EN ISO 17892-5:2017	A, F
	Unconsolidated undrained triaxial test	BS EN ISO 17892-8:2018 DIN EN ISO 17892-8:2018	A, F
	Consolidated triaxial compression tests on water saturated soils: Isotropic consolidation (CIU and CID)	BS EN ISO 17892-9:2018 Clause 6.4 DIN EN ISO 17892-9:2018 Clause 6.4	A, F
	Consolidated triaxial compression tests on water saturated soils: Anisotropic consolidation (CAU and CAD)	BS EN ISO 17892-9:2018 Clause 6.5 DIN EN ISO 17892-9:2018 Clause 6.5	A, F
	Triaxial Extension Tests – Consolidated triaxial extension tests on water saturated soils: Isotropic tests	Documented in-house method UK-MLB-TCH-PR-711 Triaxial Extension Tests Issue 1.0 01/01/2023	A, F
	Triaxial Extension Tests – Consolidated triaxial extension tests on water saturated soils: Anisotropic tests	Documented in-house method UK-MLB-TCH-PR-711 Triaxial Extension Tests Issue 1.0 01/01/2023	A, F
	Direct shear – shear box test	BS EN ISO 17892-10:2018 DIN EN ISO 17892-10:2018	A, F
	Direct shear – ring shear test	BS EN ISO 17892-10:2018 DIN EN ISO 17892-10:2018	A, F
	Soil-steel interface (ICP) ring shear test	ICP design methods for driven piles in sands and clays' –Jardine et al 2005 (Appendix A)	A, F
	Permeability tests - Rigid wall permeameter	BS EN ISO 17892-11:2019 DIN EN ISO 17892-11:2019	A, F

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
GEOTECHNICAL INVESTIGATION and TESTING - Laboratory testing of soil (cont'd)	Permeability tests - Flexible wall permeameter	BS EN ISO 17892-11:2019 DIN EN ISO 17892-11:2019	A, F
	Liquid limit by fall cone method: four-point test	BS EN ISO 17892-12:2018 DIN EN ISO 17892-12:2018	A, F
	Plastic limit	BS EN ISO 17892-12:2018 DIN EN ISO 17892-12:2018	A, F
	Plasticity index	BS EN ISO 17892-12:2018 DIN EN ISO 17892-12:2018	A, F
	Physical Tests	Documented In-House Methods	
SEDIMENTS - Marine and freshwater sediments	Particle size distribution	UK-SED-TCH-WI-001 Particle Size Distribution based on NMBAQC's best practice guidance – Particle Size Analysis (PSA) for Supporting Biological Analysis 2022 using a dry sieving method UK-SED-TCH-WI-002 Particle Size Distribution based on BS 1377 Parts 1: 2016 and 2: 1990 using a dry sieving method	B
	Particle size distribution	UK-SED-TCH-WI-006 Particle Size Distribution by Laser Diffraction / 0.02um to 2000um by Laser Diffraction based on NMBAQC'S Best Practice Guidance – Particle Size Analysis (PSA) for Supporting Biological Analysis 2022 and BS ISO 13320:2020	B
WATERS - Saline and Freshwaters	Suspended solids (Glass fibre paper (1.2 µm) filtration method)	UK-SED-TCH-WI-010 – Total Suspended Solids based on HMSO Methods 1980 and BS 872:2005 using gravimetric weighing	B

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
	Ecological Tests		
SEDIMENTS - Sediments from Marine and Transitional Waters	Marine soft-bottom sediment macrofaunal taxonomy	UK-BEN-TCH-WI-001 - Macrobenthic Sample Analysis	B
	Chemical Tests		
MARINE SEDIMENTS SOILS	Total Petroleum Hydrocarbons C_{10} to C_{40}	UK-CHM-TCH-WI-003 - Extraction and Clean-up of Aliphatic and Aromatic Hydrocarbons from Sediments and Soils UK-CHM-TCH-WI-005 - Analysis of Total and Aliphatic Hydrocarbons from Sediments, Soils and Waters	C
WATERS - Saline and Freshwaters	Total Petroleum Hydrocarbons C_{10} to C_{40}	UK-CHM-TCH-WI-004 - Extraction and Clean-up of Aliphatic and Aromatic Hydrocarbons from Water UK-CHM-TCH-WI-005 - Analysis of Total and Aliphatic Hydrocarbons from Sediments, Soils and Waters	C
SEDIMENTS (marine, estuarine etc.)	Metals: Aluminium; Barium; Iron Manganese; Phosphorus Titanium; Vanadium	UK-CHM-TCH-WI-032 Aqua Regia Microwave Digestion of Sediments and Soils UK-CHM-TCH-WI-033 ICP-OES Analysis of Major and Trace Elements in Sediments Soils after an Aqua Regia Digest	C
	Metals: Antimony; Arsenic; Cadmium Chromium; Cobalt; Copper; Lead; Lithium Mercury; Molybdenum Nickel; Silver; Strontium; Zinc	UK-CHM-TCH-WI-032 Aqua Regia Microwave Digestion of Sediments and Soils UK-CHM-TCH-WI-034 ICP-MS Analysis of Trace Elements in Sediments and Soils after an Aqua Regia Digest	C

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
WATERS	Sampling and subsequent analysis by an ISO/IEC 17025 accredited laboratory for	Documented In-House Methods	
RECREATIONAL - Swimming Pools/SPA’s	Microbiological Testing	UK-WQS-TCH-WI-001 - Bacteriological Sampling	D
POTABLE - Non-Regulatory sampling (Hot and cold water supply)	Microbiological Testing	UK-WQS-TCH-WI-001 - Bacteriological Sampling	D
SEDIMENTS	Sampling and subsequent analysis by an ISO/IEC 17025 accredited laboratory for	Documented In-House Methods	
Sediments from Marine and Transitional Waters	Macrofaunal taxonomy and to determine physio-chemical properties of the marine sediment collected by means of grab sampler or corer	UK-ESR-OPL-PR-001 - Ecology Group Survey Methods and Procedures (based on ISO 5667-19:2004 and BS EN ISO 16665:2013).	E
END			

Schedule of Accreditation

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United Kingdom Accreditation Service

2 Pine Trees, Chertsey Lane, Staines-upon-Thames, TW18 3HR, UK

Fugro GB Limited

Issue No: 038 **Issue date:** 01 August 2025

1483

Accredited to ISO/IEC 17025:2017

Armstrong House
Unit 43
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DH8 6TW

Contact: Ms Shona Burns
Tel: +44 (0)1207-581120
Fax: +44 (0)1207-581609
E-Mail: s.burns@fugro.com
Website: www.fugro.com

Testing performed at the above address only

DETAIL OF ACCREDITATION

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used
ROCK	End preparation of rock specimens for compressive strength	ASTM D 4543-19
	Point load strength and anisotropy indices Water content Porosity and density - by saturation and calliper techniques Porosity and density - by saturation and buoyancy techniques Slake-durability index Uniaxial compressive strength Deformability of rock materials in uniaxial compression (Young's modulus & Poisson's ratio) Shore hardness	The Complete ISRM Suggested Methods for Rock Characterisation, Testing and Monitoring:1974-2006. Editors: R Ulusay & J A Hudson
	Dynamic Indirect Tensile Strength - by Brazilian Test Sound velocity	ISRM Suggested Methods for Rock Characterization Testing and Monitoring2007-2014. Editors R. Ulusay
	Abrasiveness of Rock using the CERCHAR Method	ASTM D7625-10
	Direct Shear Strength Tests of Rock Specimens Under Constant Normal Force	ASTM D5607-16

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used
SOILS for civil engineering purposes	Particle density - gas jar method	BS 1377-2:1990
	Determination of Linear Shrinkage	BS1377-2 :2022
	Dry density/moisture content relationship (2.5 kg rammer) (4.5 kg rammer) (vibrating hammer	BS 1377-4:1990
	Determination of maximum and minimum dry densities for granular soils	BS 1377-4:1990
	Moisture condition value (MCV)	BS 1377-4:1990
	Determination of MCV / moisture content relation of a soil	BS 1377-4:1990
	Chalk crushing value	BS 1377-4:1990
	California Bearing Ratio (CBR)	BS 1377-4:1990
		BS 1377-4:1990
	Shear strength by laboratory vane	BS 1377-7:1990
	Undrained shear strength - triaxial compression with multistage loading and without measurement of pore pressure	BS 1377-7:1990
	Consolidated undrained triaxial compression test with the measurement of pore water pressure using multistage loading	Documented In-House Method LTPMS 41: Feb 2016
	Consolidated drained triaxial compression test with measurement of volume change using multistage loading	Documented In-House Method LTPMS 42: Feb 2016
	Hand held shear vane	New Zealand Geotechnical Society Guidelines for Hand Held Shear Vane Test, August 2001
	Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe	ASTM D5334-14
	Calculating Thermal Diffusivity of Rock and Soil	ASTM D5334-14 / ASTM D4612-16
	Measurement of settlement on saturation	BS1377-2:2022

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used
SOILS for civil engineering purposes – cont'd	Measurement of swelling pressure	BS1377-2:2022
	Measurement of swelling	BS1377-2:2022
	Determination of electrical resistivity Undisturbed cylindrical samples	BS1377-3:2018+A1:2021
GEOTECHNICAL INVESTIGATION and TESTING - Laboratory testing of soil	Water content	BS EN ISO 17892-1:2014 DIN EN ISO 17892-1:2014
	Bulk density - linear measurement method - immersion in fluid method - fluid displacement method	BS EN ISO 17892-2:2014 DIN EN ISO 17892-2:2014
	Determination of particle density - fluid pycnometer method	BS EN ISO 17892-3:2015 DIN EN ISO 17892-3:2015
	Determination of particle size distribution - sieving method - pipette method	BS EN ISO 17892-4:2016 DIN EN ISO 17892-4:2016
	Incremental loading oedometer test	BS EN ISO 17892-5:2017 DIN EN ISO 17892-5:2017
	Unconfined compression test	BS EN ISO 17892-7:2018 DIN EN ISO 17892-7:2018
	Unconsolidated undrained triaxial test	BS EN ISO 17892-8:2018 DIN EN ISO 17892-8:2018
	Isotropically consolidated undrained triaxial compression test	BS EN ISO 17892-9:2018 DIN EN ISO 17892-9:2018
	Isotropically consolidated drained triaxial compression test	BS EN ISO 17892-9:2018 DIN EN ISO 17892-9:2018
	Determination of direct shear - small shearbox - large shearbox	BS EN ISO 17892-10:2018 DIN EN ISO 17892-10:2018
	Permeability in a triaxial cell	BS EN ISO 17892-11:2019 DIN EN ISO 17892-11:2019

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used
GEOTECHNICAL INVESTIGATION and TESTING - Laboratory testing of soil – cont'd	Determination of plastic limit	BS EN ISO 17892-12:2018 +A2:2022 DIN EN ISO 17892-12:2018 +A2:2022
	Determination of plasticity index	BS EN ISO 17892-12:2018 +A2:2022 DIN EN ISO 17892-12:2018 +A2:2022
	Determination of liquid limit - fall cone method	BS EN ISO 17892-12:2018 +A2:2022 DIN EN ISO 17892-12:2018 +A2:2022

END

Schedule of Accreditation

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United Kingdom Accreditation Service

2 Pine Trees, Chertsey Lane, Staines-upon-Thames, TW18 3HR, UK

2139 **Accredited to ISO/IEC 17025:2017**	**Derwentside Environmental Testing Services Ltd** **Issue No:** 066 **Issue date:** 22 August 2023	
	Unit 2 **Park Road Industrial Estate** **Consett** **Co Durham** **DH8 5PY**	**Contact: Mr J Coffer** **Tel: +44 (0)1207 582333** **E-Mail: info@dets.co.uk** **Website: www.dets.co.uk**

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 2 Park Road Industrial Estate Consett Co Durham DH8 5PY	**Local contact** Mr J Coffer	Environmental Analysis Health and Hygiene Asbestos – All Support Functions	A

Site activities performed away from the locations listed above:

Location details	Activity	Location code
Client Premises	Sampling	B

DETAIL OF ACCREDITATION

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
LEACHATES WATER, PROCESS WATER, SALINE/SEA WATER, WASTE WATER, NATURAL	<u>Analysis</u>		
	pH value	Documented In-House Method No DETCS 2008 based on BS 1377:Part 3:1990	A
	Electrical Conductivity	Documented In-House Method No DETCS 2009	A
	Alkalinity	Documented In-House Method No DETSC 2030 based on Standing Committee of Analysts Methods (HMSO) ISBN 011 751 6015	A
	Chemical Oxygen Demand	Documented In-House Method No DETSC 2032 based on Standing Committee of Analysts Method (HMSO) ISBN 011 751 9154, 1986, by colorimetry	A
	Suspended Solids	Documented In-House Method No DETSC 2034 based on Standing Committee of Analysts Method (HMSO) ISBN 011 751 957 X, 1980	A
	Total Dissolved Solids	Documented In-House Method No DETSC 2035 based on Standing Committee of Analysts Method (HMSO) ISBN 011 751 957 X, 1980	A
	Chloride content	Documented In-House Method No DETSC 2006 based on BS 1377:Part 3:1990	A
LEACHATES, WATER, PROCESS, WATER, SALINE/SEA, WATER, WASTE, WATER, NATURAL, TRADE EFFLUENTS	Biochemical Oxygen Demand	Documented In-House Method No DETSC 2031 based on Standing Committee of Analysts Method (HMSO) ISBN 011 752 2120, 1988, by meter	A

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
LEACHATES WATER, PROCESS WATER, SALINE/SEA WATER, WASTE WATER, NATURAL	<u>Analysis</u> (cont'd)		
	Boron (soluble)	Documented In-House Method No DETSC 2123 by colorimetry	A
	Anions, comprising: Chloride Nitrate Nitrite Phosphate Sulphate	Documented In-House Method No DETSC 2055 by ion chromatography based on EPA 9056A (Rev 1 November 2000)	A
Clean water (non-regulatory) Surface (River) water, Sewage Influent and Sewage effluent	Mercury (Total and Dissolved)	Documented in house Method No DETSC 2324 by AFS	A
	Low level Total and Dissolved Metals Aluminium Phosphorous Chromium Iron Nickel Copper Zinc Cadmium Lead	Documented in house Method No DETSC 2306 by ICPMS	A

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
	Analysis (cont'd)		
Clean water (non-regulatory) River water, Groundwater, Trade effluent, prepared and Landfill leachate	Metals: Dissolved only: Aluminium Antimony Arsenic Barium Calcium Cadmium Cobalt Chromium Copper Iron Lead Mercury Potassium Magnesium Manganese Nickel Phosphorus Selenium Sodium Vanadium Zinc	Documented in house method No DETSC 2306 by ICP-MS	A
Clean water (non-regulatory) River water, Groundwater, prepared and Landfill leachate	Molybdenum		
Clean water (non-regulatory) River water, Groundwater, Trade effluent, prepared and Landfill leachate	Hardness by Calculation Calcium Hardness by Calculation	Documented in-House method DETSC 2303	A
	Elemental Sulphur	Documented In-House Method No DETSC 3049 by HPLC based on standing committee of Analysts Method (HMSO) ISBN 011 751 726 7	A
	Oil and Grease (Hexane extractable material) Cyclohexane Extractable Material Toluene Extractable Material	Documented In-House Method No DETSC 3002 by extraction/ gravimetry	A
	Thiocyanate	Documented In-House Method No DETSC 2130 by Skalar	A

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
	Analysis (cont'd)		
Clean water (non-regulatory) River water, Groundwater, Trade effluent, prepared and Landfill leachate (cont'd)	Cyanide (total)	Documented In-House Method No DETSC 2130 by Skalar	A
	Cyanide (free)	Documented In-House Method No DETSC 2130 by Skalar	A
	Phenol (monohydric)	Documented In-House Method No DETSC 2130 by Skalar	A
	Low Level Cyanide (total)	Documented In-House Method No DETSC 2131 by Skalar	A
	Low Level Cyanide (free)	Documented In-House Method No DETSC 2131 by Skalar	A
	Low level Cyanide (Complex by Calculation)	Documented In-House Method No DETSC 2131 by Skalar	A
	Low Level Phenol (monohydric)	Documented In-House Method No DETSC 2131 by Skalar	A
	Volatile Organic Compounds (VOCs), specifically: Benzene Ethylbenzene Methyl-tert-butyl-ether (MTBE) Toluene o-Xylene (m+p)-Xylenes	Documented In-House Method No DETSC 3322 by GC-FID	A
	Extractable Petroleum Hydrocarbons (EPH) (C_{10}-C_{40})	Documented In-House Method No DETSC 3311 by GC-FID	
LEACHATES, TAP WATER (non-regulatory), RIVER WATER AND GROUNDWATER	Nitrite	Documented In-House Method No DETSC 2201 by KONELAB 60i	A
	TON	Documented In-House Method No DETSC 2202 by KONELAB 60i	A
	Hexavalent Chromium	Documented In-House Method No DETSC 2203 by KONELAB 60i	A
	Phosphorous (Soluble reactive)	Documented In-House Method No DETSC 2205 by KONELAB 60i	A

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
	Analysis (cont'd)		
LEACHATES, TAP WATER (non-regulatory), RIVER WATER AND GROUNDWATER (cont'd)	High level Ammonia	Documented In-House Method No DETSC 2206 by KONELAB 60i	A
	Low Level Ammonia	Documented In-House Method No DETSC 2207 by KONELAB 60i	A
	Sulphide	Documented In-House Method No DETSC 2208 by KONELAB 60i	A
LEACHATES (from soils), TAP WATER (non-regulatory), RIVER WATER AND GROUNDWATER	Petroleum range hydrocarbons (PRO) including banding: Total PRO C_5-C_{10} PRO C_5-C_6 PRO C_6-C_8 PRO C_8-C_{10} Total Aliphatic C_5-C_{10} Aliphatic C_5-C_6 Aliphatic $>C_6$-C_8 Aliphatic $>C_8$-C_{10} Total Aromatic C_5-C_{10} Aromatic C_5-C_7 Aromatic $>C_7$-C_8 Aromatic $>C_8$-C_{10}	Documented in house method No DETSC 3322 using GC-FID	A
LEACHATES (from soils), TAP WATER (non-regulatory), EFFLUENT, RIVER WATER AND GROUNDWATER	Polycyclic Aromatic Hydrocarbons (PAH's) specifically: Naphthalene Acenaphthylene Acenaphthene Fluorene Phenanthrene Anthracene Fluoranthene Pyrene Benz[a]anthracene Chrysene Benzo[b]fluoranthene Benzo[k]fluoranthene Benzo[a]pyrene Dibenz[a,h]anthracene Indeno(123,cd) pyrene Benzo(ghi) perylene Total PAH (sum of EPA 16)	Documented in house method No DETSC 3304 using GC-MS	A

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
	Analysis (cont'd)		
LEACHATES (from soils), TAP WATER (non-regulatory), EFFLUENT, RIVER WATER AND GROUNDWATER (cont'd)	Polychlorinated Biphenyls (PCB's) specifically: PCB 28 / 31 PCB 52 PCB 101 PCB 118 + PCB 123 PCB 153 PCB 138 PCB 180 PCB 105 PCB 114 PCB 126 PCB 156 PCB 157 PCB 167 PCB 169 PCB 189 PCB 77 PCB 81	Documented in house method No DETSC 3402 using GC-MS	A
TAP WATER (non-regulatory), RIVER WATER, GROUNDWATER AND LEACHATE	Total Organic Carbon (TOC) Range - 3 - 30mg/l Range - 30 - 300mg/l	Documented In-House Method No DETSC 2033 by spectrophotometry	A
Surface Water, Groundwater, Effluent, Landfill Leachates and Leachates from Soils	Total Organic Carbon Dissolved Organic Carbon	Documented in house method DETSC 2085 by Infra-red TOC Analyser	A

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
	Analysis (cont'd)		
TAP WATER (non-regulatory) SURFACE (river) WATER, GROUNDWATER, TRADE EFFLUENT and PREPARED LEACHATE	Volatile Organic Compounds: Dichlorodifluoromethane Chloromethane vinyl chloride Bromomethane Chloroethane 1,1-dichloroethylene trans-1,2-dichloroethylene 1,1-dichloroethane cis 1,2-dichloroethylene Chloroform Bromochloromethane 1,1,1-trichloroethane 1,1-dichloropropene Carbon tetrachloride 1,2-dichloroethane Benzene 1,2-dichloropropane Dibromomethane Bromodichloromethane cis-1,3-dichloropropene Toluene trans-1,3-dichloropropene 1,1,2-trichloroethane Tetrachloroethylene 1,3-dichloropropane Dibromochloromethane 1,2-dibromoethane Chlorobenzene 1,1,1,2-tetrachloroethane Ethylbenzene m+p-Xylene o-Xylene Styrene Bromoform Isopropylbenzene 1,1,2,2-tetrachloroethane Bromobenzene 1,2,3-trichloropropane n-propylbenzene 2-chlorotoluene 1,3,5-trimethylbenzene 4-chlorotoluene Tert-butylbenzene	Documented in house method No DETSC 3432 by headspace GC-MS	A

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
	Analysis (cont'd)		
TAP WATER (non-regulatory) SURFACE (river) WATER, GROUNDWATER, TRADE EFFLUENT and PREPARED LEACHATE (cont'd)	Volatile Organic Compounds: (cont'd) 1,2,4-trimethylbenzene sec-butylbenzene p-isopropyltoluene 1,3-dichlorobenzene 1,4-dichlorobenzene n-butylbenzene 1,2-dichlorobenzene 1,2-dibromo-3-chloropropane 1,2,4-trichlorobenzene Hexachlorobutadiene Naphthalene 1,2,3-trichlorobenzene		A
TAP WATER (non-regulatory) SURFACE WATER, GROUNDWATER, TRADE EFFLUENT and PREPARED LEACHATE LANDFILL LEACHATE	Acid Herbicides: Mecoprop Bentazone MCPA Clopyralid Dicamba 2,3,6-trichlorobenzoic acid Dichloprop Bromoxynil Fenoprop MCPB 2,4,5-T Fluroxypyr 2,4-DB Ioxynil	Documented In-House Method No DETSC 3448 by LC-MS-MS	A
LEACHATES, RIVER WATER AND GROUNDWATER	pH	Documented In-House Method No DETSC 2008 by voltammetry	A
	Conductivity	Documented In-House Method No DETSC 2009 by voltammetry	A
	Alkalinity	Documented In-House Method No DETSC 2030 by voltammetry	A

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
SOILS SEDIMENTS	Chemical Analysis		
	pH value	Documented In-House Method No DETSC 2008 based on BS 1377:Part 3:1990	A
	Electrical Conductivity	Documented In-House Method No DETSC 2009	A
	Organic Matter Content	Documented In-House Method No DETSC 2002 based on BS 1377:Part 3:1990	A
	Loss on Ignition	Documented In-House Method No DETSC 2003 based on BS 1377:Part 3:1990	A
	Sulphate content	Documented In-House Method No DETSC 2004 based on BS 1377:Part 3:1990	A
	Water Soluble Chloride content	Documented In-House Method No DETSC 2006 based on BS 1377:Part 3:1990	A
	Acid Soluble Chloride content	Documented In-House Method No DETSC 2007 based on BS 1377:Part 3:1990	A
	Anions, comprising: Chloride Fluoride Nitrate Nitrite Phosphate Sulphate	Method No DETSC 2055 by ion chromatography based on EPA 9056A (Rev 1 November 2000)	A
SOILS only	Boron (water soluble)	Documented In-House Method No DETSC 2311 by ICP-OES	A

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
SOILS SEDIMENTS (cont'd)	Chemical Analysis (cont'd)		
	Mercury	Documented In-House Method No DETSC 2325 by atomic fluorescence	A
SOILS only	Metals: Arsenic Barium Beryllium Cadmium Chromium Cobalt Copper Iron Lead Manganese Molybdenum Nickel Selenium Tin Vanadium Zinc	Documented In-House Method No DETSC 2301 by hotblock digestion and ICP-OES based on Standing Committee of Analysts Method (HMSO) ISBN 011 753 2444	A
	Sulphur (total)	Documented In-House Method No DETSC 2320 by hotblock digestion and ICP-OES	A
	Elemental Sulphur	Documented In-House Method No DETSC 3049 by HPLC based on standing committee of Analysts Method (HMSO) ISBN 011 751 726 7	A
	Volatile Organic Compounds (VOCs), specifically: Benzene Ethylbenzene Methyl-tert-butyl-ether (MTBE) Toluene o-Xylene (m+p)-Xylenes	Documented In-House Method No DETSC 3321 by GC-FID	A

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
SOILS SEDIMENTS (cont'd)	Chemical Analysis (cont'd)		
	Extractable Petroleum Hydrocarbons (EPH) (C_{10}-C_{40}) Diesel Range (C_{10}-C_{24}) Lube Oil range / Mineral Oil Range (C_{24}-C_{40})	Documented In-House Method No DETSC 3311 by GC-FID	A
	Polycyclic Aromatic Hydrocarbons (PAH's) specifically: Naphthalene Acenaphthylene Acenaphthene Fluorene Phenanthrene Anthracene Fluoranthene Pyrene Benz[a]anthracene Chrysene Benzo[b]fluoranthene Benzo[k]fluoranthene Benzo[a]pyrene Dibenz(a,h)anthracene Indeno(1,2,3-cd)pyrene Dibenz[a,h]anthracene Total PAH (sum of EPA 16)	Documented In-House Method No DETSC 3301 by GC based on EPA 8100 and BG Soil Analysis 1999	A
	Polychlorinated Biphenyls (total)	Documented In-House Method No DETSC 3401 by GC-MS	A
SOILS	Analysis		
	Sulphate (acid soluble)	Documented In-House Method No DETSC 2321 by ICP-OES	A
	Sulphate (water soluble)	Documented In-House Method No DETSC 2076 (ICP-OES)	A
	Ammonia	Documented In-House Method No DETSC 2119 by spectrophotometry	A
	Thiocyanate	Documented In-House Method No DETSC 2130 by Skalar	A

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
SOILS (cont'd)	Analysis (cont'd)		
	Cyanide (total) Cyanide (free) Phenol (monohydric)	Documented In-House Method No DETSC 2130 by Skalar	A
	Total Organic Carbon (TOC)	Documented In-House Method No DETSC 2084 by combustion and infra-red detection	A
	Loss on Drying at <30°C Moisture Content at 105°C	Documented In-House Method No DETSC 1004 by Gravimetry	A
	Fraction Organic Carbon by Calculation (Expressed as fraction of TOC)	Documented In-House Method No DETSC 2084	A
	Extractable Petroleum Hydrocarbons (EPH), C_{10}-C_{35}, specifically: Total EPH (C_{10}-C_{35})	Documented In-House Method DETSC 3072 by GC-FID	A
	Total Extractable Aliphatic Hydrocarbons (C_{10}-C_{35}) C_{10}-C_{12} (aliphatic) C_{12}-C_{16} (aliphatic) C_{16}-C_{21} (aliphatic) C_{21}-C_{35} (aliphatic) Total Extractable Aromatic Hydrocarbons (C_{10}-C_{35}) C_{10}-C_{12} (aromatic) C_{12}-C_{16} (aromatic) C_{16}-C_{21} (aromatic) C_{21}-C_{35} (aromatic)		
	Polychlorinated Biphenyls (total), comprising: PCB 28 / 31 PCB 52 PCB 101 PCB 118 PCB 138 PCB 153 PCB 180	Documented In-House Method No DETSC 3401 by GC-MS	A

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
SOILS (cont'd)	Analysis (cont'd)		
	Polyaromatic Hydrocarbons, comprising: Naphthalene Acenaphthylene Acenaphthene Fluorene Phenanthrene Anthracene Fluoranthene Pyrene Benzo(a)anthracene Chrysene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene Dibenzo(a.h)anthracene Indeno(1,2,3-cd)pyrene Benzo(ghi)perylene Total PAH's (Sum of EPA 16)	Documented in house method No DETSC 3303 by GC-MS	A
	Gross Calorific value	Documented In-House Method No DETSC 5008 using Bomb calorimetry	A
	Net Calorific value	Documented in house calculation	A
Soils	Carbonate as Equivalent Carbon Dioxide	Documented in house method DETSC 2005 using titrimetry	A
Soils	Semi Volatile Organic Compounds: Phenol 2-Chlorophenol 1,3-Dichlorobenzene 1,4-Dichlorobenzene 1,2-Dichlorobenzene Bis(2-chloroisopropyl)ether Benzyl alcohol 2-Methyl phenol N-Nitrosodi-n-propylamine Hexachloroethane 4-Methyl phenol & 3-Methylphenol Nitrobenzene Isophorone	Documented in house method DETSC 3433 using GCMS	A

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
SOILS (cont'd)	Analysis (cont'd)		
	Semi Volatile Organic Compounds: (cont'd) 2-Nitrophenol 2,4-Dimethyl phenol Bis (2-chloroethoxy) methane 2,4-Dichlorophenol 1,2,4-Trichlorobenzene Naphthalene Hexachlorobutadiene 4-Chloro-3-methyl phenol 2-Methylnaphthalene 1-Methylnaphthalene 2,4,6-Trichlorophenol 2-Chloronaphthalene Dimethylphthalate Acenaphthylene 2,6-Dinitrotoluene Acenaphthene Dibenzofuran Diethylphthalate Fluorene Diphenylamine Azobenzene 4-Bromophenyl-1-phenylether Hexachlorobenzene Phenanthrene Anthracene Di-n-butylphthalate Fluoranthene Pyrene Benzo(a)anthracene Chrysene Bis(2-ethylhexyl)phthalate Di-n-octylphthalate Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenzo(a,h)anthracene Benzo(g,h,i)perylene	Documented in house method DETSC 3433 using GCMS	A

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
SOILS (cont'd)	Analysis (cont'd)		
	Volatile Organic Compounds: Vinyl Chloride 1,1 Dichloroethylene Trans-1,2-dichloroethylene 1,1-dichloroethane Cis-1,2-dichloroethylene 2,2-dichloropropane Bromochloromethane Chloroform 1,1,1-trichloroethane 1,1-dichloropropene Carbon tetrachloride Benzene 1,2-dichloroethane Trichloroethylene 1,2-dichloropropane Dibromomethane Bromodichloromethane cis-1,3-dichloropropene Toluene trans-1,3-dichloropropene 1,1,2-trichloroethane Tetrachloroethylene 1,3-dichloropropane Dibromochloromethane 1,2-dibromoethane Chlorobenzene 1,1,1,2-tetrachloroethane Ethylbenzene m+p-Xylene o-Xylene Bromoform Isopropylbenzene Bromobenzene 1,2,3-trichloropropane n-propylbenzene 2-chlorotoluene 1,3,5-trimethylbenzene 4-chlorotoluene Tert-butylbenzene 1,2,4-trimethylbenzene sec-butylbenzene p-isopropyltoluene 1,3-dichlorobenzene 1,4-dichlorobenzene n-butylbenzene	Documented in house method DETSC 3431 using Headspace GCMS	A

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
SOILS (cont'd)	<u>Analysis</u> (cont'd)		
	Volatile Organic Compounds: (Cont'd) 1,2-dichlorobenzene 1,2-dibromo-3-chloropropane 1,2,4-trichlorobenzene Hexachlorobutadiene Naphthalene 1,2,3-trichlorobenzene	Documented in house method DETSC 3431 using Headspace GCMS	A
	Acid Herbicides, specifically: 2,4,5-TP (Fenoprop) Clopyralid Picloram 2,3,6-TBA Dicamba Benazolin Fluroxypyr Bentazone 2,4-D Bromoxynil MCPA Triclopyr Dichloprop Ioxynil Mecoprop 2,4,5-T 2,4-DB	Documented in house method DETSC 3447 ising LC-MS-MS	A

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
	Analysis (cont'd)		
BIOMASS and SOLID RECOVERED FUELS	Total Moisture	Documented In-House Method No DETSC 5004 using gravimetric techniques	A
	Analysis Moisture	Documented In-House Method No DETSC 5005 using gravimetric techniques	A
	Volatile matter	Documented In-House Method No DETSC 5003 using gravimetric techniques	A
	Gross Calorific value	Documented In-House Method No DETSC 5007 using Bomb calorimetry	A
	Net Calorific value	Documented in house calculation	A
	Ash Content	Documented In-House Method No DETSC 5002 using gravimetric techniques	A
	Mercury	Documented In-House Method No DETSC 5015 using hot block digestion and Cold Vapour Atomic Fluorescence	A

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
	Analysis (cont'd)		
BIOMASS and SOLID RECOVERED FUELS (cont'd)	Metals Aluminium Arsenic Antimony Barium Beryllium Cadmium Calcium Cobalt Chromium Copper Iron Lead Magnesium Manganese Molybdenum Nickel Phosphorous Potassium Selenium Sodium Thallium Tin Titanium Vanadium Zinc	Documented In-House Method No DETSC 5014 using hot block digestion and ICP-OES	A
	Sulphur	Documented In-House Method No DETSC 5016 using hot block digestion and ICP-OES	A
	Chlorine Fluorine	Documented In-House Method No DETSC 5017 using Ion Chromatography	A
	Biomass Content	Documented In-House Method No DETSC 5012 based on BS EN ISO 21644:2021 using Gravimetry	A
	Carbon, Hydrogen, Nitrogen	Documented In-House Method No DETSC 5013 using CHN analyser	A

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
	Analysis (cont'd)		
BIOMASS and SOLID RECOVERED FUELS (cont'd)	Oxygen (by calculation)	Documented In-House Method No DETSC 5013 by calculation	A
RECYCLED WASTE Trommel Fines	Loss on Ignition at 440°C	Documented in house method ref DETSC 5022 – using Gravimetric Analysis in accordance with HMRC Excise Notice LFT1 27 March 2015	A
	Health and Hygiene	Health and Safety Executive - Asbestos: The Analysts' Guide (HSG 248) – 2021	
ASBESTOS IN BULK MATERIALS including materials and products suspected of containing asbestos	Identification of: Amosite Chrysotile Crocidolite Fibrous Actinolite Fibrous Anthophyllite Fibrous Tremolite	Documented In-House Method DETSC 1101 using stereo-microscopy, polarised light optical microscopy and dispersion staining based on HSG 248.	A
ASBESTOS IN SOILS – The Identification of Asbestos fibres in bulk samples of Soil, *specifically*: *Soil* Aggregate Ballast	Identification of: Amosite Chrysotile Crocidolite Fibrous Actinolite Fibrous Anthophyllite Fibrous Tremolite	Documented In-House Method DETSC 1102 for identification using stereo-microscopy, polarised light optical microscopy and dispersion staining based on HSG 248.	A
ASBESTOS IN SOILS – The Identification and Quantification of Asbestos fibres in bulk samples of Soil, *specifically:* *Soil* *Ballast* *Aggregate*,	Identification and Quantification of Asbestos content of: Amosite Chrysotile Crocidolite Fibrous Actinolite Fibrous Anthophyllite Fibrous Tremolite	Documented In-House Method DETSC 1102 for identification using stereo-microscopy, polarised light optical microscopy and dispersion staining based on HSG 248 Documented In-House Method DETSC 1102 for quantification of asbestos using gravimetry and phase contrast microscopy	A
ASBESTOS CONTAINING MATERIALS	Water Absorption	Documented In-House Method DETSC 1103	A

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
SOILS	<u>Analysis</u>	Documented In-House Method to meet the requirements of the Environment Agency MCERTS Performance Standard - Chemical Testing of Soil	
	pH value	Documented In-House Method No DETSC 2008 by **v**oltammetry	A
	Loss on Ignition	Documented In-House Method No DETSC 2003 based on BS 1377:Part 3:1990	A
	Organic Matter Content	Documented In-House Method No DETSC 2002 based on BS 1377:Part 3:1990	A
	Total Organic Carbon (TOC)	Documented In-House Method No DETSC 2084 by combustion and infra-red detection	A
	Fraction Organic Carbon by Calculation (Expressed as fraction of TOC)	Documented In-House Method No DETSC 2084	A
	Sulphate (acid soluble)	Documented In-House Method No DETSC 2321 by ICP-OES	A
	Sulphate (water soluble)	Documented In-House Method No DETSC 2076 (ICP-OES)	A
	Sulphate (acid soluble)	Documented In-House Method No DETSC 2004	A
	Ammonia	Documented In-House Method No DETSC 2119	A
	Thiocyanate	Documented In-House Method No DETSC 2130	A
	Cyanide (total)	Documented In-House Method No DETSC 2130 by Skalar	A
	Cyanide (free)	Documented In-House Method No DETSC 2130 by Skalar	A

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
SOILS (cont'd)	Analysis (cont'd)	Documented In-House Method to meet the requirements of the Environment Agency MCERTS Performance Standard - Chemical Testing of Soil (cont'd)	
	Boron (water soluble)	Documented In-House Method No DETSC 2311 by ICP-OES	A
	Mercury	Documented In-House Method No DETSC 2325 by hotblock digestion and atomic fluorescence	A
	Sulphur (elemental)	Documented In-House Method No DETSC 3049 by HPLC based on Standing Committee of Analysts Method (HMSO) ISBN 011 751 726 7	A
	Metals: Arsenic Barium Beryllium Cadmium Chromium Cobalt Copper Lead Manganese Molybdenum Nickel Selenium Vanadium Zinc	Documented In-House Method No DETSC 2301 by hotblock digestion and ICP-OES based on Standing Committee of Analysts Method (HMSO) ISBN 011 753 2444	A
	Phenol (monohydric)	Documented In-House Method No DETSC 2130	A
	Volatile Organic Compounds (VOCs), specifically: Benzene Ethylbenzene Toluene o-Xylene (m+p)-Xylenes	Documented In-House Method No DETSC 3321	A

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
SOILS (cont'd)	Analysis (cont'd)	Documented In-House Method to meet the requirements of the Environment Agency MCERTS Performance Standard - Chemical Testing of Soil (cont'd)	
	Extractable Petroleum Hydrocarbons (EPH) (C_{10}-C_{40}) Diesel Range (C_{10}-C_{24}) Lube Oil Range / Mineral Oil Range (C_{24}-C_{40})	Documented In-House Method No DETSC 3311 by GC-FID	A
	Extractable Petroleum Hydrocarbons (EPH), C_{10}-C_{35}, specifically: Total EPH (C_{10}-C_{35}) Total Extractable Aliphatic Hydrocarbons (C_{10}-C_{35}) C_{10}-C_{12} (aliphatic) C_{12}-C_{16} (aliphatic) C_{16}-C_{21} (aliphatic) C_{21}-C_{35} (aliphatic)	Documented In-House Method DETSC 3072 by GC-FID	A
	Extractable Petroleum Hydrocarbons (EPH), C_{10}-C_{35}, specifically: Total Extractable Aromatic Hydrocarbons (C_{10}-C_{35}) C_{10}-C_{12} (aromatic) C_{12}-C_{16} (aromatic) C_{16}-C_{21} (aromatic) C_{21}-C_{35} (aromatic)	Documented In-House Method DETSC 3072 by GC-FID	A

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
SOILS (cont'd)	Analysis (cont'd)	Documented In-House Method to meet the requirements of the Environment Agency MCERTS Performance Standard - Chemical Testing of Soil (cont'd)	
	Extractable Petroleum Hydrocarbons (EPH) specifically: >EC10-EC12 >EC12-EC16 >EC16-EC21 >EC21-EC35 >EC35-EC40 >EC10-C35 >EC10-C40 >EC10-C24 >EC24-C40 Total Extractable Aliphatic Hydrocarbons specifically: >EC10-EC12 >EC12-EC16 >EC16-EC21 >EC21-EC35 >EC35-EC40 >EC10-C35 >EC10-C40 Total Extractable Aromatic Hydrocarbons specifically: >EC10-EC12 >EC12-EC16 >EC16-EC21 >EC21-EC35 >EC10-C35	Documented In-House Method DETSC 3521 by GC/GC-FID	A

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
SOILS (cont'd)	Analysis (cont'd)	Documented In-House Method to meet the requirements of the Environment Agency MCERTS Performance Standard - Chemical Testing of Soil (cont'd)	
	Polychlorinated Biphenyls (total), comprising: PCB 28 / 31 PCB 52 PCB 101 PCB 118 PCB 138 PCB 153 PCB 180	Documented In-House Method No DETSC 3401 by GC-MS	A
	Polyaromatic Hydrocarbons, comprising: Naphthalene Fluoranthene Acenaphthylene Acenaphthene Phenanthrene Pyrene Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene Dibenzo(a.h)anthracene Indeno(1,2,3-cd)pyrene Benzo(ghi)perylene	Documented in house method No DETSC 3303 by GC-MS	A
WASTEWATERS	Analysis	Documented In-House Method to meet the requirements of the Environment Agency MCERTS Performance Standard - sampling and chemical testing of untreated sewage, sewage effluent and trade effluent	
	Chemical Oxygen Demand	Method DETSC 2032 by Colorimetry	A

END

Appendix E

Positioning and Water Depth Data

E.1 Positioning and Water Depth Data

Fugro report PE1088-GEOT-01 issue 2 summarises the borehole location coordinates and water depth measurements.

Target coordinates for all borehole locations were specified by Direction Générale de l'Énergie et du Climat – DGEC /Client Consultant and the actual coordinates were approved before borehole and cone penetration test operations. The coordinates presented in this positioning and data report are the calculated location coordinates. Coordinates for all boreholes are expressed using the Universal Transverse Mercator (UTM) projection 31 N, World Geodetic System 1984, International Spheroid, with a central meridian of 3° east

Measured water depths were reduced to the Lowest Astronomical Tide (LAT) based on chart datum CD FR Bathyelli. It should be noted that all water depth measurements made during this investigation are considered sufficiently accurate for geotechnical use but should not be used in isolation for design purposes.

Positioning Data for Fugro Quest

Final Report | DGEC France Golfe du Lion Offshore Windfarm Zone 5 | South Coast of France, Mediterranean Sea

PE1088-GEOT-01 Issue 2 | 23 January 2025

Issue for Approval

DGEC

MINISTÈRE
DE LA TRANSITION
ÉNERGÉTIQUE
Liberté
Égalité
Fraternité

Document Control

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1	22 January 2025	Offshore Preliminary Issue	T. Sidney		
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Report Amendment

Issue	Section	Page No.	Table No.	Figure No.	Description
2	Entire				Office QC

Location Map

Location of DGEC France Golfe du Lion Offshore Windfarm Zone 5, South Coast of France, Mediterranean Sea.

Executive Summary

Fugro was contracted by DGEC to supply navigation and positioning services for the geotechnical drilling vessel MV Fugro Quest at seven sampling and/or in situ testing locations at DGEC France Golfe du Lion Offshore Windfarm Zone 5, South Coast of France, Mediterranean Sea.

The sampling and/or in situ testing was carried out between 13 and 20 January 2025.

Fugro navigated and positioned the geotechnical drill ship MV Fugro Quest to the intended positions given by the Client.

Two StarPack GNSS receivers for the surface positioning were used during the project. Underwater positioning was via the vessel's Kongsberg HiPAP 501 USBL system. All depths measurements were reduced to LAT (CD FR BATHYELLI). The real-time GNSS tides were used throughout the project.

Depths at each sample location were measured using the following techniques: USBL depth, pressure sensor and drill string.

During the operations speed of sound measurements were taken and the results were entered into the HiPAP 501 USBL system.

All positions and peripheral (gyrocompass, USBL, etc.) data were sent to the navigation computer which calculated offsets positions in the local geodesy and projection, WGS84/UTM Zone 31 N.

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Glossary

Accuracy	The accuracy of a measurement is its degree of closeness to its actual (true) value. Accuracy is the combination of the precision and reliability of an observation.
Augmentation Data	Additional information e.g. from a reference or tracking station, applied at a user receiver to improve the positioning solution. See also differential GNSS.
Azimuth	A horizontal angle measured from the spheroidal meridian clockwise from north through 360°. See also bearing and heading.
Bearing	Refers to a direction from one point to another on a chart right rotated from grid north (bearing = azimuth + convergence + arc to chord correction). See also azimuth and heading.
C-O Correction	Calculated minus observed correction. The difference found in a calibration procedure between a fixed value and an observation. The C O correction must always be added to the observation.
Chart Datum	Vertical Datum used in charting. Chart data e.g. Mean Sea Level (MSL), Lowest Astronomical Tide (LAT), Lowest Low Water Springs (LLWS), Normaal Amsterdams Peil (Amsterdam Ordnance Datum) (NAP), Normal Null (NN). See also Vertical Datum.
CM	Central meridian, the meridian that defines the central line of longitude of the chart projection. It is a zone constant used in chart projections.
Convergence	Clockwise angle in a point between true north and grid north.
CRP	Common Reference Point is the origin of all vessel coordinates. It is also referred to as the vessel datum. It often corresponds to the drill string on drilling vessels.
Datum (Geodetic)	A mathematical model designed to best-fit part or all of the geoid. It is defined by an ellipsoid and the relationship between the ellipsoid and a point on the topographic surface established as the origin of datum. This relationship can be defined by six quantities, generally (but not necessarily) the geodetic latitude, longitude and the height of the origin, the two components of the deflection of the vertical at the origin, and the geodetic azimuth of a line, from the origin to some other point.
Datum Rotation (Geodetic)	Defined as the anti-clockwise rotation around the X-axis, Y-axis and Z-axis (Rx, Ry, and Rz) in the origin of two spheroids in terms of the Cartesian or geocentric coordinates. See also datum shift and scale.
Datum Shift (Geodetic)	Defined as the difference (ΔX, ΔY, ΔZ) in the origin of two spheroids in terms of the Cartesian or geocentric coordinates. See also datum rotation and scale.
Datum (Vessel)	The vessel datum is the origin of all vessel coordinates. It is referred to as the common reference point or CRP.
DGNSS	Augmentation technique requiring a GNSS receiver(s) to be placed at one or multiple known points from which GNSS observable (pseudo-range) corrections can be deduced. These corrections can then be applied to the offshore mobile receiver.
Differential Positioning	Determination of relative coordinates between two or more satellite receivers that are simultaneously tracking the same satellite signal.
DP	Dynamic positioning, mainly referring to a system keeping the vessel in one position compensating for current, wind and other natural influences, using a variety of positioning systems as reference.
Dynamic Calibration	A technique of calibration on the heading and motion sensors that can be undertaken whilst in port, in transit or during production. GNSS data from three GNSS antennas, placed in large separation along or athwart the vessel, are acquired while the sensor data are also logged. As a result, C-Os for heading, pitch and roll can be determined.

Ellipsoid/Spheroid	In geodesy, unless otherwise specified, a mathematical figure formed by revolving an ellipse about its minor axis. It is often used interchangeably with spheroid. Two quantities define an ellipsoid: these are usually given as the length of the semi-major axis, a, and the inverse flattening, 1/f = a / (a-b), where b is the length of the semi-minor axis. Prolate and triaxial ellipsoids are invariably described as such.
False Easting/False Northing	Defined projection coordinate offsets to the origin point of the projection.
Geoid	The particular equipotential surface with coincides with mean sea level, and which may be imagined to extend through the continents. This surface is perpendicular to the force of gravity everywhere.
GLONASS	Russian global navigation satellite system.
GPS	Global positioning system.
GNSS	Global navigation satellite system. A combination solution of GPS and GLONASS with provision for the future European Galileo space system.
HDOP	Horizontal dilution of precision. A measure of the magnitude of DOP errors in latitude and longitude.
Heading	Course of a vessel measured with a heading system, i.e. a gyrocompass, or a GPS vector heading system. If the heading is magnetic this will be stated. See also azimuth and bearing.
HiPAP	High precision acoustic positioning. A USBL system developed by Simrad - Kongsberg. See USBL definition.
HPR	Hydro acoustic positioning reference. See USBL definition.
Line Scale Factor	The ratio of a distance from point A to point B on the grid to the corresponding distance on the spheroid. K = plane distance/spheroidal distance 1/k=1/6(1/kA + 4/kM +1/kB). (kA, kB, kM being point scale factors at A, B, M. See also point scale factor)
Multifix	Multi reference differential global positioning system based on simultaneous calculated single DGPS positions for each reference station which solutions are then applied to a least squares calculation by which a new solution is created by weighting the single solutions on distance of the used reference station used in the single computations.
NTRIP	Networked Transport of RTCM via Internet Protocol. NTRIP is a protocol of streaming DGPS corrections over the internet.
Offset	A station offset from the main survey station. Must be defined by an azimuth and distance or ΔX, ΔY, ΔZ, or starboard/port, forward/aft, above/below.
OWF	Offshore Wind Farm.
PDOP	Position dilution of precision. A unit-less figure of merit expressing the relationship between the error in user position and the error in satellite position.
PPP	Precise Point Positioning. A global GNSS augmentation technique that corrects for GNSS satellite clock and orbit errors and employs additional modelling techniques to further correct and improve the point positioning accuracy.
Precision	A measure of the random errors in observations and estimated parameters.
Reference Station	A GNSS receiver located at a precisely known location and used to determine the differential corrections employed for DGNSS augmentation techniques.
Satellite Configuration	State of the satellite configuration at a specific time, relative to a specific user or set of users.
Satellite Constellation	The arrangement in space of the complete set of satellites of a system such as GPS.

Scale	Reduction/expansion used in datum-datum transformations. Unit: ppm (parts per million). See also datum shift and datum rotation.
Scale Factor (Point)	Ratio of an infinitesimal distance at a point on the grid to the corresponding distance on the spheroid. K = Δ (plane distance) / Δ (spheroidal distance).
S/CTD (probe)	Salinity or conductivity, temperature and depth probe. Used to determine speed of sound through the water column. Pressure to depth conversions may be applied to provide true depth values.
SD	Standard deviation. Measure of the dispersion of random errors about the mean value. If a large number of measurements or observations of the same quantity are made, the standard deviation is the square root of the sum of the squares of deviations from the mean value divided by the number of observations less one.
Starfix.G2	A decimetre accuracy integrated GNSS service which utilises Fugro’s own global network of reference stations to measure carrier phase observations. This data is then processed, producing a corrections solution for each navigation satellite. These corrections are applied to the satellite time reference clock and ephemeris (“orbit”) information, hence “clock and orbit corrections”. This service utilises both GPS and GLONASS L1 and L2 frequencies, thereby providing an accurate measurement of variations in Ionospheric thickness. This enables signal delay to be calculated more precisely, resulting in a more accurate satellite to antenna range, and hence a more accurate position solution. Starfix.G2 provides a high availability, high integrity, global solution to an accuracy of 10 cm (95 % confidence level) both horizontally and vertically.
Starfix.G2+/G4+	Ultra-precise (3 cm) GPS and GLONASS Global Positioning Service, using Clock and Orbit Corrections enhanced with carrier-phase corrections from the Fugro G4 Network. Starfix.G2+/G4+ is an enhancement of Starfix.G2 service (based on GPS and GLONASS) and utilises advanced GNSS augmentation algorithms developed in-house by Fugro. The code and carrier-phase signals transmitted by GPS and GLONASS satellites are monitored globally by Fugro’s worldwide network of reference stations. These observations are processed centrally in real-time using the company’s proprietary algorithms to generate precise corrections which are used to augment the standard signals broadcast by GPS and GLONASS satellites. Corrections are received via communications satellites, providing at least two independent G2+/G4+ data sources.
Starfix.G4	A GPS, GLONASS, Galileo and BeiDou positioning system that is based on orbit and clock corrections generated from Fugro's own expanded network of multiple system reference stations. Starfix.G4 utilises Precise Point Positioning (PPP) technology, which distinguishes itself from the traditional differential approach as satellite errors are not lumped together but estimated at source on a per satellite basis. The GPS, GLONASS, Galileo and BeiDou orbit and clock corrections are computed separately, free of ionospheric and tropospheric effects.
Starfix.HP	This service utilises the Fugro international network of approximately 100 land-based reference stations. Unlike standard L1, which uses code based measurements, Starfix.HP is based upon carrier phase measurements which provide a much higher resolution. This service utilises the GPS L1 and L2 frequencies, thereby providing an accurate measurement of Ionospheric thickness. This results in a more accurate satellite to antenna range, and hence a more accurate position solution. At a distance of 1000 km from the nearest reference station Starfix.HP accuracies are typically 10 cm and 15 cm (95 % confidence level) in the horizontal and vertical planes respectively.

Starfix.XP2	This service utilises a third party global network of reference stations to measure carrier phase observations. This data is then processed, producing a corrections solution for each navigation satellite. These corrections are applied to the satellite time reference clock and ephemeris ("orbit") information, hence "clock and orbit corrections". This service utilises the GPS L1 and L2 frequencies, thereby providing an accurate measurement of variations in Ionospheric thickness. This enables signal delay to be calculated more precisely, resulting in a more accurate satellite to antenna range, and hence a more accurate position solution. Starfix.XP2 provides a high performance global solution to an accuracy of 10 cm and 20 cm (95 % confidence level) in the horizontal and vertical planes respectively.
Starfix.L1	This service is a GPS positioning correction system using single frequency code correction data from the Fugro network of reference stations, delivered via both Inmarsat and SpotBeam satellites. These corrections, combined with a single frequency GPS receiver, can provide a positional accuracy of better than 1.5 m (95 %) horizontally at a distance of 500 km from the closest reference station.
Starfix.NG	Fugro's in-house advanced vessel and ROV positioning software system.
StarPack	A StarPack unit consists of a survey grade GNSS receiver and powerful processor, running Linux multi-tasking operating system. The receiver is capable of tracking all current (GPS, GLONASS) and future (Galileo) systems. A StarPack can be extended with a second receiver (in the same unit), to provide accurate, GNSS derived heading.
Transceiver	A device that can transmit and receive signals.
Transducer	A device that converts electrical energy to acoustic energy and vice-versa.
Transponder	A device that can detect a signal on a particular frequency and in response transmits signal on another frequency.
UTM	Universal Transverse Mercator. A special case of the transverse Mercator projection whereby the projection parameters are specified by worldwide agreement, abbreviated as the UTM grid. It consists of 60 north south zones, each 6 degrees of longitude wide with a unique central meridian.
USBL	Ultra-Short BaseLine acoustic positioning method involving the measurement of range and bearing from a vessel-based transceiver to subsea transponders. It generally operates through phase discrimination of an acoustic signal as it passes over three transducers placed at right angles to each other within the Transducer head. Using this method, a three dimensional position of the beacon(s) can be determined.
Vertical Datum	An arbitrarily assumed value for a particular benchmark or a measured value at sea level at a tide station, or a fixed adjustment of many such measurements in a common adjustment. See also chart datum.
WGS 84	World Geodetic System 1984. A rotational ellipsoid having the following dimensions: semi-major axis 6378137.000 m, semi-minor axis (derived) 6356752.314 m, flattening (derived) 1/298.257224. This ellipsoid reference model / datum is the surface from which GPS coordinates are computed.

1. Introduction

Fugro was contracted by DGEC to supply navigation and positioning services for the geotechnical drilling vessel MV Fugro Quest at seven sampling and/or in situ testing locations at DGEC France Golfe du Lion Offshore Windfarm Zone 5, South Coast of France, Mediterranean Sea.

The positions and depths reported here were checked by Fugro offshore staff. Full quality control will be carried out by the Fugro office staff prior to the issues of the final report and, as such, some of the values reported in the final report may vary from the field issued report.

The sampling and/or in situ testing was carried out between 13 and 20 January 2025. The positioning results are given in Table 2.1 and Table 2.2.

System positioning performance parameters are outlined in Section 4.3.

2. Results

2.1 Field Locations

Table 2.1: Actual coordinates and water depths in local datum

Datum: WGS84/UTM Zone 31N, EPSG code: 32631					Depth LAT (CD FR BATHYELLI)*		
Location	Easting [m]	Northing [m]	Latitude [North]	Longitude [East]	Pressure Sensor [m]	USBL [m]	Drill String [m]
Z5_OWF_BH01-COMP	571 413.68	4 751 192.81	42° 54′ 36.0341″	003° 52′ 29.5445″	92.9	92.6	93.0
Z5_OWF_BH02-COMP	583 584.09	4 757 276.92	42° 57′ 48.7904″	004° 01′ 29.4852″	93.6	93.2	93.6
Z5_OWF_BH03-COMP	562 622.37	4 750 866.37	42° 54′ 28.2327″	003° 46′ 01.7281″	97.4	97.5	97.5
Z5_OWF_BH05-COMP	573 152.06	4 764 819.82	43° 01′ 57.1540″	003° 53′ 52.6227″	95.0	94.7	95.1
Z5_OWF_BH07-COMP†	563 904.27	4 757 054.17	42° 57′ 48.4316″	003° 47′ 00.7986″	96.8	96.5	N/A
Z5_OWF_BH07-COMP_a	563 905.01	4 757 059.06	42° 57′ 48.5900″	003° 47′ 00.8331″	96.9	96.6	96.7
Z5_OWF_BH09-COMP	571 867.39	4 758 631.13	42° 58′ 36.9925″	003° 52′ 52.9898″	93.6	93.3	93.8

Notes:
*: Refer to Section 5 (Methodology) for details on the different water depth measurement
†: This location doesn't have a drill string water depth as there was no drilling performed. The location was abandoned due to weather. The SBF had been on the ground and had to move location due to the disturbed soft topsoil.

Table 2.2: Actual location details

Datum: WGS84/UTM Zone 31N, EPSG code: 32631				Standard Deviation		Proposed to Actual	
Location	Easting [m]	Northing [m]	Fixes	Easting [m]	Northing [m]	Distance [m]	Bearing [°G]
Z5_OWF_BH01-COMP	571 413.68	4 751 192.81	120	0.07	0.06	2.61	242.85
Z5_OWF_BH02-COMP	583 584.09	4 757 276.92	120	0.10	0.12	0.92	265.03

Datum: WGS84/UTM Zone 31N, EPSG code: 32631				Standard Deviation		Proposed to Actual	
Location	Easting [m]	Northing [m]	Fixes	Easting [m]	Northing [m]	Distance [m]	Bearing [°G]
Z5_OWF_BH03-COMP	562 622.37	4 750 866.37	120	0.08	0.08	1.42	075.03
Z5_OWF_BH05-COMP	573 152.06	4 764 819.82	120	0.06	0.10	2.07	094.97
Z5_OWF_BH07-COMP	563 904.27	4 757 054.17	120	0.16	0.16	1.11	221.02
Z5_OWF_BH07-COMP_a	563 905.01	4 757 059.06	120	0.06	0.09	4.06	000.15
Z5_OWF_BH09-COMP	571 867.39	4 758 631.13	120	0.06	0.06	0.41	071.29

3. Operations

3.1 Scope of Work

Fugro was contracted to provide positioning support for navigation between the sampling and/or in situ testing locations and determination of the drill string position at each location. Sampling and/or in situ testing was planned to be carried out at six locations.

Table 3.1: Proposed coordinates in local datum

Datum: WGS84/UTM Zone 31N, EPSG code: 32631				
Location	Easting [m]	Nothing [m]	Latitude [North]	Longitude [East]
Z5_OWF_BH01-COMP	571 416.00	4 751 194.00	42° 54' 36.0719"	003° 52' 29.6473"
Z5_OWF_BH02-COMP	583 585.00	4 757 277.00	42° 57' 48.7926"	004° 01' 29.5256"
Z5_OWF_BH03-COMP	562 621.00	4 750 866.00	42° 54' 28.2212"	003° 46' 01.6675"
Z5_OWF_BH05-COMP	573 150.00	4 764 820.00	43° 01' 57.1605"	003° 53' 52.5318"
Z5_OWF_BH07-COMP	563 905.00	4 757 055.00	42° 57' 48.4584"	003° 47' 00.8310"
Z5_OWF_BH09-COMP	571 867.00	4 758 631.00	42° 58' 36.9884"	003° 52' 52.9727"

3.2 Resources

Personnel	Name	From	To
Surveyor	ROC	13 January 2025	20 January 2025

Only equipment used is listed below; refer to Section 5 (Methodology) for procedural explanations.

Positioning Equipment	
Navigation software	Starfix.NG 2024.1 R6 online navigation suite
Primary positioning	Port StarPack 334 with Starfix.G2+/G4+ solution, corrections via SASAT
Secondary positioning	Stbd StarPack 24 with Starfix.G2+/G4+ solution, corrections via ERSAT
Tertiary positioning	Port StarPack 334 with Starfix.XP2 solution, corrections via SASAT
Quaternary positioning	Stbd StarPack 24 with Starfix.XP2 solution, corrections via ERSAT
Quinary positioning	Port StarPack 334 with Starfix.HP solution, corrections via SASAT
Senary positioning	Stbd StarPack 24 with Starfix.HP solution, corrections via ERSAT
Acoustic positioning	Kongsberg HiPAP 501 USBL system (vessel)
Primary heading system	StarPack Starboard ProTrack
Secondary heading system	Raytheon Anschütz heading system – Gyro 1 (vessel)
Tertiary heading system	Raytheon Anschütz heading system – Gyro 2 (vessel)
Quinary heading system	Raytheon Anschütz heading system – Gyro 3 (vessel)
Reference stations	Leidschendam, Aberdeen, Jacou, Bergen, Brønnøysund
Spare correction source	NTRIP

Bathymetry Equipment	
Primary System	Sensordata SD204 Pressure Sensor
Secondary System	Kongsberg HiPAP 501 USBL system
Tertiary System	Drill string
Echo Sounder	Kongsberg EA640
Vertical Motion Compensator	Kongsberg Seatex MRU5 (2x) (vessel)
Atmospheric Pressure	Vaisala PTB210 Barometer
CTD sensor	Valeport Midas SVX2 (2x)
Sector Scan Sonar	Sonavision SV4040
Data Recording	Starfix.2024 online navigation suite

3.3 Offsets

3.3.1 MV Fugro Quest Vessel Offsets

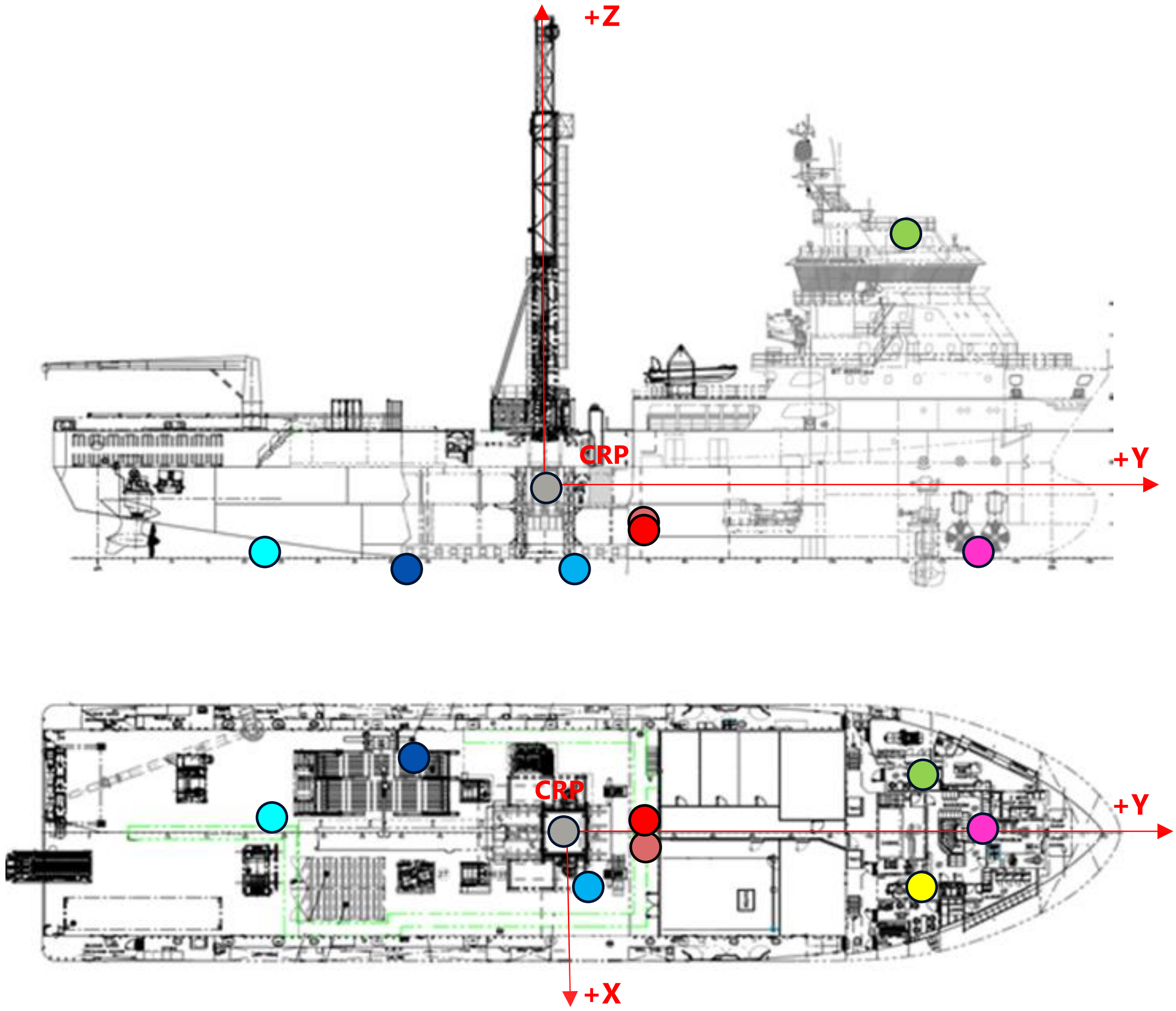

Figure 3.1: MV Fugro Quest offset diagram

Table 3.2: MV Fugro Quest vessel offsets

Offsets		Athwart (X) [m]	Along (Y) [m]	Height (Z) [m]
CRP (Drill String)	●	0.00	0.00	0.00
GNSS antenna Port	●	-4.64	31.11	20.22
GNSS antenna Starboard	●	4.65	31.10	20.22
Echo sounder transducer	●	-0.36	38.66	-7.41
HiPAP pole starboard	●	3.50	1.21	-9.83
HiPAP pole port	●	-6.38	-11.38	-9.16
ADCP	●	-1.84	-18.93	-7.44
MRU 3	●	-0.17	5.59	-3.88
MRU 2	●	0.10	5.59	-3.79

3.3.2 Seabed Frame Offsets

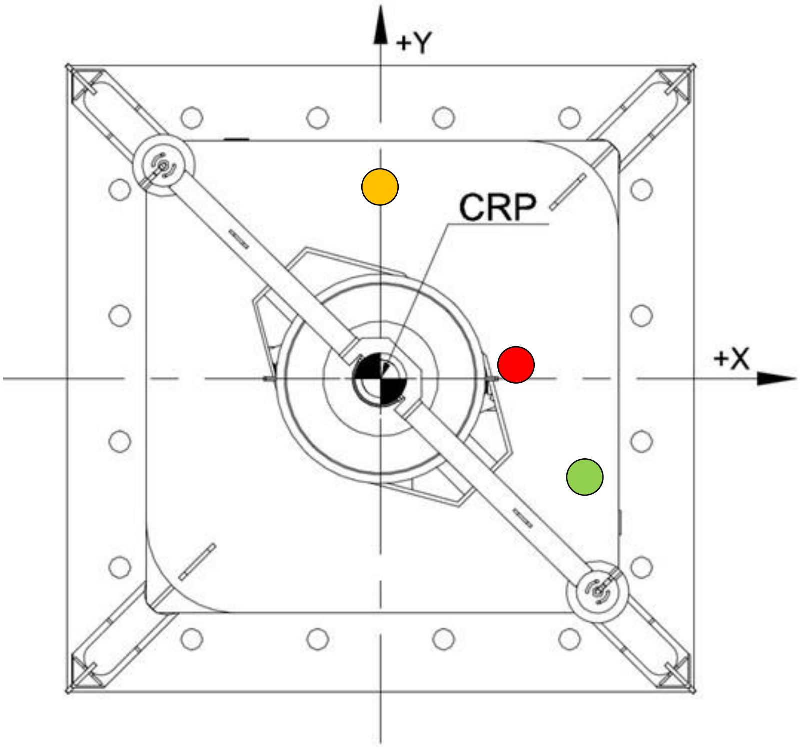

Figure 3.2: Seabed frame offset diagram

Table 3.3: Seabed frame offsets

Offsets		Athwart (X) [m]	Along (Y) [m]	Height (Z) [m]
CRP (Drill string centre)		0.00	0.00	0.00
USBL Beacon (M49)	🟢	1.22	-0.56	3.71
Pressure Sensor (Midas SVX2)	🔴	0.73	0.10	2.58
Sector Scan Sonar	🟠	0.00	1.02	2.27

3.4 Calibration Results

This section details the results of the system calibrations that were carried out prior to positioning operations. Refer to Section 5 (Methodology), for a detailed description of the calibration procedures. Detailed results of the calibrations are available on request.

3.4.1 Positioning Systems

A DGNSS positioning system verification was carried out on 9 January 2025, whilst the vessel was alongside Marseille-Fos, France, by means of Kinematic GNSS processing.

The results of the verification are presented in Table 3.4.

Table 3.4: Positioning system verification

Date	Location	Positioning System	ΔE [m]	S.D. [m]	ΔN [m]	S.D. [m]
9 January 2025	Marseille-Fos	SP Port Starfix.G4+	0.00	0.02	-0.01	0.02
9 January 2025	Marseille-Fos	SP Starboard Starfix.G4+	0.01	0.02	0.00	0.02

To check the integrity of the positioning systems, a positioning system comparison was performed whilst the vessel was alongside Marseille-Fos, France, between 11:32 and 13:32 on 9 January 2025. The positioning system comparison was performed between the primary positioning system (SP port antenna, Starfix.G4+ solution) and the other positioning system solutions (Starfix.G4+ and Starfix.XP2) of the two StarPacks (SP Port and SP Starboard). From the antenna locations, with respect to the vessel primary heading source, positions of the vessel’s datum point (CRP) were calculated and compared. The differences between the positioning systems were within the expected system accuracy. The results of the comparisons are presented in Table 3.5.

Table 3.5: Positioning system comparison

Date	Positioning systems	ΔE [m]	S.D. [m]	ΔN [m]	S.D. [m]
9 January 2025	SP Port G4+ vs SP Stbd G4+	0.01	0.02	-0.03	0.02
9 January 2025	SP Port G4+ vs SP Port XP2	0.00	0.01	-0.01	0.01
9 January 2025	SP Port G4+ vs SP Stbd XP2	0.04	0.02	-0.05	0.03

3.4.2 Heading Systems Alignment Check

The heading and motion systems alignments were checked by dynamic calibration in Bergen, Norway, on 4 September 2024. After completion of the checks, the corrections were entered into the online navigation software. The results of the heading checks are presented in Table 3.6.

Table 3.6: Heading systems alignment check

Date	Location	Heading system	Method	C-O [°]	S.D. [°]
4 September 2024	Bergen	SP Stbd ProTrack	Dynamic Calibration	89.95	0.03
4 September 2024	Bergen	SP Port ProTrack	Dynamic Calibration	-90.05	0.03
4 September 2024	Bergen	Gyro 1	Dynamic Calibration	-0.33	0.08
4 September 2024	Bergen	Gyro 2	Dynamic Calibration	-0.85	0.03
4 September 2024	Bergen	Gyro 3	Dynamic Calibration	-0.41	0.23

3.4.3 Speed of Sound and Water Density Measurements

Before the start of project data acquisition and at regular intervals during the project, conductivity, temperature and pressure measurements were taken to establish the local speed of sound profile and average water density. The speed of sound profile was entered into the Kongsberg HiPAP Ultra Short Baseline (USBL) system. The average water density was used for depth determination in conjunction with the pressure sensor. The results of these measurements are presented in Table 3.7.

Table 3.7: Speed of sound and water density measurements

Date	Location	Mean [m/s]	Transducer [m/s]	Seabed [m/s]	Density [kg/m^3]
13 January 2025	Z5_OWF_BH01-COMP	1508.75	1507.96	1509.46	1029.15
14 January 2025	Z5_OWF_BH02-COMP	1507.02	1507.27	1509.62	1029.01
14 January 2025	Z5_OWF_BH09-COMP	1507.95	1504.08	1509.42	1029.13
20 January 2025	Z5_OWF_BH03-COMP	1504.57	1501.60	1508.57	1029.03

3.4.4 Kongsberg HiPAP USBL System

The Kongsberg HiPAP system, installed on board the MV Fugro Quest, was interfaced to Starfix.NG as the subsea positioning system. A USBL Calibration was performed on 3 September 2024. The calibration was undertaken at Byfjorden, Norway, in a water depth of 228 m. The results of the calibration are presented in Table 3.8.

Table 3.8: Port USBL calibration results in Starfix.NG

System	Date	X Offset [m]	Y Offset [m]	Z Offset [m]	Orientation [°]	Scale	Pitch [°]	Roll [°]
USBL Port	3 September 2024	-	-	-	0.72	1.00	-0.25	0.04
USBL Stbd	3 September 2024	-	-	-	-0.43	1.00	-0.58	-0.20

4. Datum and Tolerances

4.1 Geodetic and Projection Parameters

Table 4.1: Project geodetic and projection parameters

Name: WGS 84/UTM zone 31N,CD FR(BATHYELLI) [Med v1.1 + Vertical Offset -0.27]		
EPSG Code:	32631	
Global Navigation Satellite System (GNSS) Geodetic Parameters[*]		
Datum:	World Geodetic System 1984	EPSG Code: 6326
Ellipsoid:	WGS 84	
Semi major axis:	a = 6 378 137.00 m	
Inverse Flattening:	1/f = 298.257 223 563	
Local Datum Geodetic Parameters[†]		
Datum:	European Terrestrial Reference System 1989	EPSG Code: 6326
Ellipsoid:	WGS 84	
Semi major axis:	a = 6 378 137.00 m	
Inverse Flattening:	1/f = 298.257 223 563	
Project Projection Parameters		
Map Projection:	Universal Transverse Mercator	
Grid system:	UTM Zone 31 North (UTM 31N)	EPSG Code: 16031
Latitude of Origin:	00° 00′ 00″ North	
Central Meridian:	003° 00′ 00″ East	
False Easting:	500 000 m	
False Northing:	0 m	
Scale factor on Central Meridian:	0.9996	
Units:	Metre	
Project Vertical Parameters		
Vertical coordinate reference system:	CD FR (BATHYELLI)	FUGRO Code: 41068
Datum:	CD FR (BATHYELLI)	FUGRO Code: 40935
Transformation:	RGF93 v1 to CD FR (BATHYELLI) to Vertical Offset	

Notes:
* = Fugro Starfix navigation software always uses WGS 84 geodetic parameters as a primary datum for any geodetic calculations.
† = Source: Client

4.2 Vertical Control

Chart Datum	LAT - CD FR (BATHYELLI)
Tidal Data	Real time GNSS tides reduced to LAT based on the RGF93 v1 to CD FR (BATHYELLI) model
Barometric pressure variation	Factored in pressure to depth calculation
Effect of wind	Factored in GNSS elevation measurements

4.3 System Performance Parameters

Surface positioning	± 0.1 m
USBL positioning	1 % slant range
Bathymetry (absolute)	± 0.5 m absolute using predicted tides
Bathymetry (relative)	Pressure sensor ± 0.01 % of range
	Drill string - variable
GNSS 3D mode	5 satellites minimum, PDOP < 6, Elevation > 10°
GNSS 2D mode	4 satellites minimum, HDOP < 4, Elevation > 10°
Heading system	1°

5. Methodology

5.1 Introduction

Sections 5.2 to 5.4 inclusive describe the procedures for determining the coordinates and water depths of geotechnical sample and/or in situ testing locations. Section 5.5 describes the calibration procedures carried out for the heading system, surface and subsurface positioning systems, and the echo sounder. The use of subsurface positioning systems, primarily USBL, depends on the type of geotechnical sampling and/or in situ testing methods used, hence some descriptions in the sections below may not be applicable to this report.

5.2 Position Determination

The actual location may be determined by surface positioning alone or with additional use of USBL. The USBL determines the position of the centre of the seabed frame on the seafloor. Particularly in deeper water, use of USBL provides a more accurate position of the sample and/or in situ testing location since the seabed frame may be offset from the surface position of the drill string due to currents.

The position is determined as soon as the seabed frame makes contact with the seafloor. A minimum of 100 position fixes are logged at two-second intervals. Data outliers are then discarded in accordance with standard statistical procedures. To determine the final seabed position of a sample and/or in situ testing location the following general sequence applies:

- From the global navigation satellite system (GNSS) receiver, the antenna’s latitude and longitude in WGS 84 are transmitted to the navigation computer and converted to Easting and Northing on the local projection by the navigation software;
- The grid heading and X and Y offsets from the antenna to the common reference point (CRP) are applied to the antenna Easting and Northing in order to compute the position of the CRP on the local projection. If the USBL system is not used then this corresponds to the sample and/or in situ testing location since the CRP has been defined as the centre of the drill string;
- The grid heading and X and Y offsets from the CRP to the USBL transducer, mounted on the vessel’s hull, are applied to the CRP Easting and Northing to determine the transducer position on the local projection;
- The USBL system measures the slant range and relative bearing (measured clockwise from the vessel centreline) from the USBL transducer to the beacon, mounted on the seabed frame, and also the depth of the beacon relative to the transducer. These values are converted to ΔX, ΔY in the horizontal plane and ΔZ in the vertical plane by the USBL processor;
- The ΔX, ΔY and ΔZ values are transmitted to the navigation computer where the Z offset of the USBL transducer is applied;

- The position of the beacon is computed in the local projection Easting and Northing and the beacon depth is computed relative to the water surface. The centre of the seabed frame, which corresponds to the seabed sample and/or in situ testing position, is derived from the USBL beacon position by applying the USBL beacons horizontal offsets. The heading of the frame is assumed to be the same as the vessel heading. When heading changes are implemented to the vessel after the location of the frame on the seafloor, the frame will be locked in its original heading by the use of a manual heading, derived from the position fix, in which heading information was logged.

5.3 System Configuration

5.3.1 DP Position System

The MV Fugro Quest is configured according to the classification “Offshore Supply DP Support Vessel, DP Class II”. The vessel’s DP system is fed with two independent DGPS positions. The system consists of two StarPack receivers. The position solutions are generated using different correction sources and calculation methods.

Position and correction data from the DP system are sent to the survey system by means of galvanic isolators. This enables survey personnel to monitor and compare the positional data from the DP system. All equipment is installed in 19” rack mount housings.

For safety reasons, changes to the DP positioning solution were restricted to changing the selection of the corrections satellite (i.e. SASAT & ERSAT) and shore reference stations when entering a new work area. The system was under the full control and responsibility of the DP Operator. Position details from the DP system were sent to the survey software. Quality control (QC) checks cannot be performed for this system and its performance was fully outside Fugro’s responsibility.

5.3.1.1 DP1 Position

The DP1 position is a Starfix.G2+/G4+ calculated positions by using clock and orbit corrections from the Fugro G2 network for both GPS and the Russian Global Navigation Satellite System (GLONASS) space vehicles. These corrections were received by the StarPack via ERSAT transmissions.

5.3.1.2 DP2 Position

The DP2 position is also a Starfix.G2+/G4+ calculated positions by using clock and orbit corrections from the Fugro G2 network for both GPS and the Russian Global Navigation Satellite System (GLONASS) space vehicles. These corrections were received by the StarPack via EASAT transmissions.

5.3.2 Survey Position and Navigation Systems

The survey team used two StarPack GNSS Precise Point Positioning (PPP) receivers for the surface positioning during the project. The three single modus calculation position solutions

(Starfix.G2+/G4+, Starfix.XP2, and Starfix.HP) from the two StarPack receivers were interfaced to the survey computer by means of a galvanic isolated network connection and were made available for comparison and QC. Differential correction signal redundancy was achieved by cross-linking the two StarPack receivers to provide corrections from different satellite transmissions, if required. Both Starfix.G2+/G4+ solutions were fed into Starfix.NG by means of a UDP Broadcast (serial backup). All six position solutions, three per receiver, were fed into StarPack QC suite for QC purposes.

All positions and peripheral (heading system, USBL, etc.) data were sent to the navigation computer where all data transformations, offset and survey calculations, and data integration and logging were performed. All data can be graphically and numerically presented on the navigation computer or any other computer connected to the survey network. An off-line computer is available for the survey crew to post-process and report survey data.

The geodetic and the datum transformation parameters used are presented in Section 4.1.

5.3.2.1 Primary Positioning System

The primary survey positioning service used by the survey team was Starfix.G4+ solution generated from Port StarPack Receiver 334. Positions were calculated by using clock and orbit corrections enhanced with carrier-phase corrections from the Fugro Starfix.G4 Network. These corrections were received by the StarPack via SASAT transmissions and positions were output to the Starfix.NG software package.

5.3.2.2 Secondary Positioning System

The secondary survey positioning service used by the survey team was Starfix.G4+ solution generated from Starboard StarPack Receiver 24. Positions were calculated by using clock and orbit corrections enhanced with carrier-phase corrections from the Fugro Starfix.G4 Network. These corrections were received by the StarPack via ERSAT transmissions and positions were output to the Starfix.NG software package.

5.3.2.3 Tertiary Positioning System

The tertiary positioning service used by the survey team was Starfix.XP2 solution generated from Port StarPack Receiver 334. Positions were calculated using carrier phase corrections from the Fugro Starfix network. The corrections are received by the StarPack via SASAT satellite transmissions and positions are output to the Starfix.NG software package.

5.3.2.4 Quaternary Positioning System

The quaternary positioning service used by the survey team was Starfix.XP2 solution generated from Starboard StarPack Receiver 24. Positions were calculated by using carrier phase corrections from the Fugro Starfix network. The corrections were received by the StarPack via ERSAT satellite transmissions and positions were output to the Starfix.NG software package.

5.3.3 Quality Control

The DGNSS and GNSS PPP data were quality controlled using StarPackQC quality control monitoring application. Real-time QC information was displayed as Time Series graphs, tabulated data and graphical displays such as Sky Plots, Error Ellipses and Lock Time graphs depicting satellite lock status. The quality of DGNSS and GNSS PPP derived position fixing data was monitored whilst logging position data for individual locations and also throughout the entire project period.

An assessment of quality was made based on Position Time Series View with the following time series graphs available to display:

- Standard Deviations (Latitude, Longitude and Height);
- HDOP and VDOP;
- Number of SVs;
- Number of Stations;
- Deltas (Easting, Northing and Height);
- Correction Age;
- F-Test.

An assessment of quality was also made by:

- Data Table Views;
- Satellite Lock Time View;
- Error Ellipses View;
- Satellite Constellation Views.

Within the area of operations the accuracy and repeatability of the Starfix.G2+/G4+ system was designed to be 0.03 m in the horizontal plane and 0.06 m in the vertical plane with 95 % confidence level.

5.4 Depth Determination

The depth at each location was measured using a combination of the following techniques:

- Pressure sensor;
- Drill string reading;
- USBL depth reading.

5.4.1 Conductivity, Temperature, and Depth (CTD) probe

A CTD probe or pressure sensor is secured to the seabed frame to measure water pressure using a Digiquartz sensor. The output from this unit is absolute pressure, i.e. atmospheric pressure plus water pressure. The atmospheric pressure is recorded on deployment and not updated until the probe returns to the surface. Adjustments are therefore necessary to take into account the actual atmospheric pressure changes that occur during the measurement cycle. Barometric pressure is recorded manually at four hourly intervals using the vessel’s barometer. An UNESCO-recognised formula is then used to convert the raw pressure values to depth values. The CTD was mounted on the seabed frame.

5.4.2 Drill String Reading

This is a physical measurement made by the drilling personnel and is the total length of drill pipe used to reach the seabed. The measurement is corrected for the distance between the drill floor and the water surface (air gap) and corrected for local tidal variations. When operating in deep water, errors due to the effects of current may be induced in the drill string depth measurement.

5.4.3 USBL Reading

This is a measurement made by taking the Kongsberg HiPAP system USBL beacon Z-values (depth) and applying the vertical offset of the frame-mounted beacon above the seabed frame base.

5.5 System Calibration Procedures

Calibrations of all position and depth measuring equipment are carried out prior to sampling and/or in situ testing. This checks that all equipment is operating within acceptable limits and that the accuracy of the logged data is not compromised. Most equipment is permanently installed on the geotechnical drilling vessel and therefore not all calibrations are performed before the start of every sampling and/or in situ testing programme. The most recent calibrations of the equipment are assessed and new calibrations are carried out if deemed necessary.

5.5.1 Offset Measurements

At the start of the mobilisation, offsets from the vessel’s datum (normally the centre of the drill string) to the various DGNSS antennas and other relevant offset points are measured. These measurements are compared with measurements taken from a scaled vessel plan or a previous vessel offset diagram. Seabed frame offsets from the frame’s CRP to its transponder and the Z offset for the CTD probe are also measured. Offsets are entered into the navigation software. The USBL transducer offset is already corrected to the vessel’s CRP by the vessel’s APOS programme.

5.5.2 Heading System Alignment Check

Four methods are possible when performing a heading system alignment check alongside. The resulting differences between computed and observed headings are entered into the navigation software as the heading system’s computed minus observed C-O correction.

5.5.2.1 Total Station

These methods of performing a heading system alignment check uses land survey techniques. Reflectors are placed at or near the bow and stern of the vessel on the centreline and their positions fixed at regular intervals. Simultaneous heading system readings and heading observations are taken. The true bearing between the reflectors is calculated and compared to the observed heading system reading.

5.5.2.2 Sun Azimuth

Sun azimuth observations are performed with a total station and a sun filter when the sun is at a maximum elevation of approximately 30°. The vessel’s heading is determined by measuring the angle between the vessel’s centreline and the sun azimuth and applying this angle to the computed sun azimuth. The logged heading subtracted from the heading derived from the azimuth of the sun will give the heading system’s C-O correction.

5.5.2.3 Taped Offsets

This method requires the known heading of the quay and two measurements are taken simultaneously from the quay to the vessel’s centreline. The distance between the two measurements provides a baseline for calculating the angle of the vessel’s centreline relative to the quay, which is then applied to the quay heading to derive the computed grid vessel heading. The convergence is applied to the computed grid heading to obtain the true heading which is compared with the observed heading system’s reading in order to obtain the C-O correction.

5.5.2.4 Dynamic Calibration

For this method three GNSS antennas are installed on the vessel, one at the bow, one at starboard and one at vessel port side. The antennas are installed preferably at the same height and with minimum baselines of 15 m. GNSS antenna data are logged for a minimum of six hours, while simultaneously raw heading systems data are logged. All data are logged at a rate of 1 Hz.

The logged GNSS data are converted to RINEX format and processed using the Natural Resources Canada website, applying the CSRS (Canadian Spatial Reference System) PPP (Precise Point Positioning) method. Novatel GrafNav software is used for quality control of the resulting PPP data and calculates accurate 3D antenna positions. Finally the GrafNav results are combined with the logged raw vessel heading systems data in Fugro software to calculate the C-O values for the heading systems.

5.5.3 Positioning System

In order to determine the integrity and reliability of the surface positioning systems, two main procedures are followed:

5.5.3.1 Positioning Verification

The position of the primary DGNSS antenna, in local projection coordinates, is verified using two independent methods.

The first method involves comparing the DGNSS antenna position to that derived through land survey techniques. A total station measures directly to the DGNSS antenna from a known point on the quay. The DGNSS antenna position and the position derived from the total station are logged simultaneously and should agree to better than 0.25 m. This method also validates the geodetic parameters entered into the online survey software.

The second method verifies the DGNSS antenna position by comparing logged SPK positions to results derived from kinematic GNSS processing. Raw GNSS data logged during operations is processed using the Natural Resources Canada website, applying the CSRS (Canadian Spatial Reference System) PPP (Precise Point Positioning) kinematic mode. The processed results are then compared to the SPK positions logged by Starfix.NG, ensuring agreement within 0.25 m and confirming the accuracy of the DGNSS antenna positioning.

Both methods provide independent verification to ensure precise and reliable positioning for geotechnical operations.

5.5.3.2 System Comparison

Once the position verification results are acceptable, a position comparison against all position computations is conducted. The antenna positions for all systems are logged and using the heading system and the measured antenna offsets are reduced to the vessel's CRP. The difference in the positions should agree to within 1 m and they are represented as Delta Easting (ΔE) and Delta Northing (ΔN).

5.5.4 Ultra-Short Baseline System

A USBL allows the measurement of range and bearing from a vessel-based transceiver to one or more subsea transponders. It generally operates through the phase discrimination of an acoustic signal recorded by three orthogonal transducers combined in one head. A USBL calibration is executed whenever work is carried out on the transducer and at least once a year. Calibrations are carried out in water depths slightly deeper than those in which the operations will occur.

5.5.4.1 Preparation

During the USBL calibration sequence, the vessel must be free to manoeuvre around a stationary transponder. Before starting the actual USBL calibration, it is assumed that:

- The vessel's positioning system has been verified;
- The vessel's heading system alignment has been checked;
- All relevant offsets, including the height of the transponder's transducer above the seabed, have been measured.

The actual water depth, measured by the echo sounder, and not corrected for tide, should also be known at the calibration site.

A speed of sound profile, determined at the calibration site, is entered into the USBL system before calibration data are collected.

For the USBL calibration a transponder, equipped with a remote controlled release mechanism or a surface buoy, is deployed, clear of all structures and pipelines, in an area with an approximate water depth slightly deeper than the proposed survey area. The surface positioning system is used to navigate the vessel during the calibration.

5.5.4.2 Range Scale, Orientation, Pitch and Roll

This phase of the calibration is carried out with the vessel positioned on the circumference of a circle of radius 1.5 to 2 times the water depth, centred on the beacon. The following describes a calibration with the vessel lying to the north, east, south, and west of the beacon with the vessel maintaining the same north heading. In the case of bad weather, this pattern may be rotated so that the vessel is heading into the current. The surface position of the vessel and the USBL position of the beacon are logged at each cardinal point. Generally a minimum of 100 fixes, at 5 second intervals, are logged at each cardinal point.

When the vessel is due north or south of the beacon and heading due north, roll errors are minimised and pitch errors are observed. Transducer alignment errors will plot the beacon offset to the east or west of its actual position. Range scaling errors will plot the beacon to the north or south of the actual position.

When the vessel moves to a position due east or west of the beacon, while still maintaining a heading of due north, roll errors are observed and pitch errors are minimised. Transducer alignment error will plot the beacon offset from its actual position. Range scaling errors will plot the beacon to the east or west of the actual position.

Any resultant errors will show the beacon plotted in four quadrants. If there are no errors, the beacon position will be shown as a circular scatter plot around the actual position.

The range error consists of a fixed error and the scalar multiplier. Overall it accounts for errors in ray path and speed of sound. The USBL module in Starfix.NG derives a range error value that contains and accounts for the range fixed error.

Starfix.NG computes the errors and displays the results as four parameters:

- Pitch error;
- Roll error;
- Transceiver misalignment;
- Range error.

5.5.4.3 Offset (Spin) Test

The first part of the calibration is carried out to verify the offsets between the USBL system and the navigation system. This is normally done by manoeuvring the vessel directly over a beacon deployed on the seabed and then rotating the vessel through 360° while logging the surface and USBL position. Any offset errors are displayed as a ‘snail trail’ showing the beacon position describing a circle around the intended beacon position. Alternatively, the vessel is positioned directly over the beacon, and an equal number of fixes are logged while the vessel is heading in each of the four cardinal directions.

The Z-offset is checked by comparing the Z component of the USBL observation and the value from the echo sounder, allowing for beacon height above the seafloor. As the vessel is directly over the seafloor beacon, this minimises any errors due to Range Scale and USBL transducer misalignment.

5.5.4.4 Verification of Results

The calibration results are checked using one of two methods:

1. Two lines are run at right angles and in opposite directions over the top of the beacon;
2. A static spin test at a location in a distance of 10 % of water depth from the calibrated beacon position.

In both cases the beacon's position is continuously logged and should not deviate, within operational parameters, from its calibrated position. A reasonably tight, circular scatter plot a few metres across, depending on the navigation system performance, the USBL system performance, and the depth of water, is an indication of a good calibration result.

Appendix F

Digital Data

F.1 Digital Data

This section details the digital data deliverables associated with the investigated locations.

Description	Document/File Name
AGS4 CPT data	F254727_GLC (Z5)_AGS4 CPT Data_i02.ags
AGS4 Field data	F254727_GLC (Z5)_AGS4 Field Data_i02.ags
AGS4 Onshore Laboratory data – FGBL	F254727_GLC (Z5)_AGS4_FGBL _i01.ags
AGS4 Onshore Laboratory data – FGSL	F254727_GLC (Z5)_AGS4_FGSL _i01.ags
ASCII Processed CPT data	F254727_GLC (Z5)_CPT data_i02.zip
Processed Photos	F254727_GLC (Z5)_Photos_i02.zip
Excel Digital Laboratory Test Results	F254727_GLC (Z5)_Laboratory Digital Data_i01
GSI database	GDL_Z5_GTC_FEATURES_2025.gdb