Grain to Tilbury

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SOIL ENGINEERING

REPORT ON A GROUND INVESTIGATION AT GRAIN TO TILBURY TUNNEL



REPORT QUALITY ASSURANCE SHEET

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1.0 INTRODUCTION

In March 2025 Soil Engineering Geoservices Ltd were instructed by Ferrovial Construction BEMO JV (The Employer) to carry out a ground investigation at Grain to Tilbury Tunnel. The investigation was carried out under the supervision of Mott MacDonald Limited (The Engineer). It is proposed to upgrade electricity infrastructure, involving the replacement of the existing 1960s Thames Cable Tunnel beneath the River Thames between Tilbury and Gravesend. The investigation comprised the formation of cable percussion boreholes extended by rotary drilling techniques together with in situ testing; open hole rotary boreholes with follow by rotary drilling techniques; seismic cone penetration tests together with in situ tests and Wenner tests.

This factual report presents the results of the fieldwork and laboratory testing undertaken together with information on the ground and groundwater conditions encountered. The fieldwork was carried out between 28th April and 7th July 2025 and in accordance with the ground investigation specification[1] and the addendum to ground investigation specification[2] issued by Ferrovial Construction BEMO JV.

[1] Specification for Ground Investigation: Gravesend Reach Tunnel (GRRT4) - 400kV Cable Tunnel, GRR-MOT-XX-PWIDE-Z3-GZ-000002
[2] Addendum Specification for Ground Investigation: Grain to Tilbury Tunnel Project

2.0 PURPOSE, SCOPE AND REPORT FORMAT

2.1 Purpose

The purpose of this investigation was to improve understanding of the subsurface ground and groundwater conditions at the site for the proposed upgrade of electricity infrastructure, involving the replacement of the existing 1960s Thames Cable Tunnel beneath the River Thames between Tilbury and Gravesend and to inform and validate the shaft and tunnel design. This information was obtained from a combination of intrusive and non-intrusive investigation techniques and laboratory testing.

2.2 Scope of Work

The scope of the investigation was as follows:

- To form four cable percussive boreholes with rotary core follow on in Tilbury
- To form three cable percussive boreholes with rotary core follow on in Gravesend
- To form two open hole rotary boreholes with rotary core follow on in Tilbury
- To form one rotary open hole borehole with rotary core follow on in Gravesend
- To form three open hole cable persuasive boreholes for deep datum installations in Tilbury
- To form three open hole cable persuasive boreholes for deep datum installations in Gravesend
- To undertake three seismic cone penetration tests with porewater pressure measurement (SCPTu) and dissipation tests in Tilbury
- To undertake three seismic cone penetration tests with porewater pressure measurement (SCPTu) and dissipation tests in Gravesend
- To undertake packer testing in selected boreholes
- To undertake variable head testing in selected boreholes
- To undertake high pressure dilatometer (HPD) testing in selected boreholes
- To undertake geophysical wireline logging in selected boreholes
- To undertake four soil resistivity tests using the Wenner method in Tilbury
- To undertake four soil resistivity tests using the Wenner method in Gravesend
- To undertake magnetometer tests in all exploratory holes for UXO clearance
- To install gas and groundwater monitoring points in selected boreholes
- To install vibrating wire piezometers in selected boreholes
- To install deep datum monitoring points in selected boreholes
- To monitor gas and groundwater monitoring points during and after fieldworks
- To survey the as-built position of each of the exploratory hole locations
- To undertake geotechnical laboratory testing
- To undertake geochemical laboratory testing
- To undertake environmental laboratory testing
- Provision of a factual report containing all findings from the investigation and including core and pre-post condition photographs
- Provision of electronic data.

During the fieldworks, in order to minimise water deliveries at the location of borehole BH105 which was scheduled as open hole rotary with rotary core follow on, the Employer instructed that the rotary open hole section of the borehole be replaced by cable percussive boring.

At request of the Employer, two boreholes BH103 and BH110 in Tilbury and boreholes BH107 and BH109 in Gravesend were not backfilled after formation, and instead these boreholes were left open with 150mm and 200mm casing support for additional testing to be undertaken by FBJV.

At request of the Employer three additional hand pits designated GW02,GW03 and GW04 were excavated in order to install ground gas monitoring pipes.

2.3 Limitations

This report has been prepared in accordance with the project specification. Soil Engineering accepts no liability for any deficiencies in the report that arise from the specification's non-compliance with either European or British Standards. This particularly applies to exploratory hole spacings and depths and to the scope of laboratory testing.

It should be noted that the investigation data on which this report is based is only indicative of the actual ground, groundwater and ground gas conditions that exist at the locations of the exploratory holes and may not be representative of the conditions that exist on the site as a whole.

2.4 Report Format

This factual report is presented in the following format:

- Written description of fieldwork, laboratory testing and investigation results.
- Section A: Field Records - including exploratory hole logs, in situ test results and gas and groundwater monitoring results
- Section B: Laboratory Test Results - from geotechnical, geochemical and environmental testing laboratories
- Section C: Drawings - including exploratory hole location plans.
- Section D: Photographs - from core and pre or post access surveys
- Appendix 1: General Notes - on fieldwork, the logging of soil, made ground, rock and organic deposits and geochemical testing.
- Appendix 2: Calibration Certificates

The sources of information used in the compilation of this report are detailed in the footnotes at the base of the page upon which they are first referenced.

3.0 DESK STUDY INFORMATION

3.1 Scope of Study

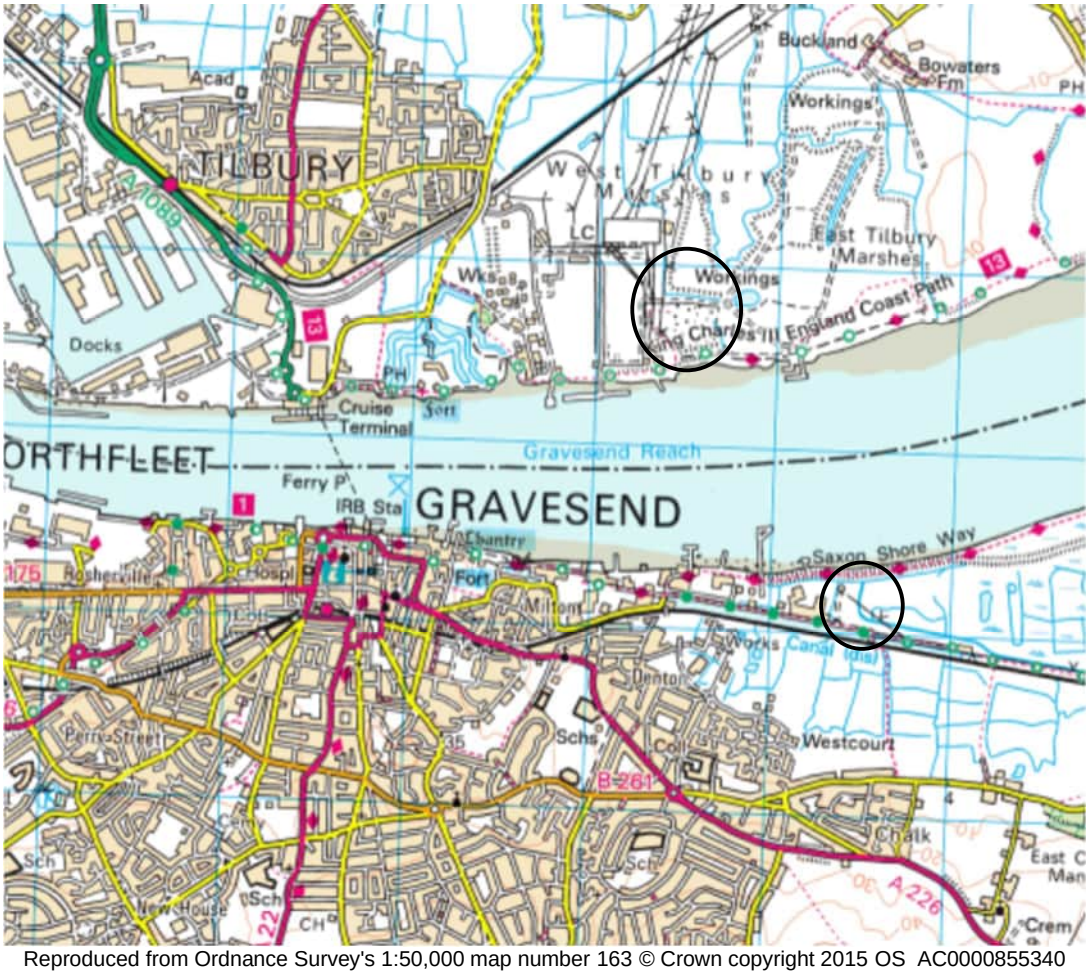
The following sections provide general details of site location and description as well as site geology as ascertained from published maps and memoirs, together with details of any previous investigation carried out on the site.

3.2 Site Location and Description

The site is located east of London in close vicinity to Tilbury and Gravesend and traverses the River Thames. The Tilbury Shaft site is located on a wide floodplain north of the River Thames on the West Tilbury Marshes. The Gravesend Shaft site is located on a floodplain south of the River Thames on the Shorne Marshes.

Both sites are illustrated in Figure 1 below.

FIGURE 1: SITE LOCATION PLAN



Reproduced from Ordnance Survey's 1:50,000 map number 163 © Crown copyright 2015 OS AC0000855340

TABLE 1: SITE LOCATION DETAILS TIBURY

Postcode	RM18 8UL
Approximate National Grid Reference	TQ 66297 75833
Northern Boundary	Open arable land
Eastern Boundary	Open arable land
Southern Boundary	Open arable land and river Thames
Western Boundary	Power Station Rd
Approximate Ground Level (m AOD)	2-8

TABLE 2: SITE LOCATION DETAILS GRAVESEND

Postcode	DA12 2HN
Approximate National Grid Reference	TQ 67394 74143
Northern Boundary	Eastcourt Marshes Electricity Substation
Eastern Boundary	Milton Rifle Range
Southern Boundary	Thames and Medway canal
Western Boundary	Thameside Campus - National Maritime Training Centre
Approximate Ground Level (m AOD)	2

During the investigation, our engineer noted that the Tilbury shaft area comprised a generally level concrete area and the area south of Tilbury shaft comprised of ash deposits. The Gravesend site comprised of a level grassed area.

3.3 Geology

From the available information on the 1:50,000 scale Geological Survey map of the area[3] the site is shown to be underlain by alluvial deposits. These overlie River Terrace Deposits which in turn overlie the White Chalk Subgroup which includes Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation.

3.4 Previous Investigations

In the project Pre Construction Information pack, The Engineer provided details of a previous Geotechnical Desk Study Report[4] commissioned by Baker Hicks.

[3] Sheet 271: 1998, Solid and Drift edition for Dartford
[4] Geotechnical Report, Doc Ref 100117927-MMD-PWIDE-XX-RPT-GT-000001.

4.0 FIELDWORK

4.1 Scope of Fieldwork

The scope of the fieldwork was specified by the Engineer and was undertaken in general accordance with Eurocodes[5] and, where there is no conflict, also with BS 5930[6]. Soil and rock logging has been undertaken in accordance with the relevant European Standards[7,8,9]. The exploratory hole locations were set out initially by the Employer however in accordance with the project specification, Soil Engineering were required to survey the as-built exploratory hole locations. Cable percussion boreholes extended by rotary coring, open hole rotary extended by rotary coring and cable percussion open holes were formed, together with downhole in situ testing and surface resistivity tests. The exploratory hole locations are shown on the site plan presented in Section C of this report. Details of the works undertaken are summarised in Table 3 below.

TABLE 3: SUMMARY OF FIELDWORKS

Activity	No.	Shallowest (m BGL)	Deepest (m BGL)	Notes
Cable Percussive Boreholes	8	19.50	28.50	All followed by rotary coring
Cable Percussive Open Holes	6	21.00	30.00	All with deep datum installations
Rotary Cored Boreholes	10	45.50	60.50	All as follow on to CP
Hand Pits	3	1.20	1.20	Excavated to install gas monitoring pipes
Rotary Open Holes	2	20.00	24.50	All followed by rotary coring
Installations - Standpipe	6	11.00	22.50	BH108 dual installation Two scheduled installations not completed to date Three swallow gas installations in hand pits
Installations – Vibrating Wire Piezometer	3	33.00	60.00	Two scheduled installations not completed to date
Combined magnetometer - Seismic Cone Penetration tests with pore pressure measurement (SCPTu)	6	14.28	18.68	
Dissipation Tests	22	9.28	16.56	
Magnetometer Tests	10	6.26	19.80	For UXO clearance
Shear Vane Tests	15	4.03	13.86	
High Pressure Dilatometer	33	42.40	50.35	
Geophysical Logging in Boreholes	9	45	60	
Soil Resistivity Tests	7			1 scheduled test not completed to date

[5] Eurocode 7 Part 2 (BS EN 1997-2: 2007)
[6] BS 5930: 2015 + A1 2020: Code of Practice for Site Investigation. British Standards Institution
[7] BS EN ISO 14688-1: 2018: Geotechnical Investigation and testing – Identification and Classification of Soil – Part 1: Identification and Description.
[8] BS EN ISO 14688-2: 2018: Geotechnical Investigation and testing – Identification and Classification of Soil – Part 2: Principles for a Classification
[9] BS EN ISO 14689-1: 2018: Geotechnical Investigation and testing – Identification and Classification of Rock – Part 1: Identification and description.

The exploratory holes were numbered using an alpha numeric sequence. In general, hole numbers commence with the hole type (BH) followed by a sequential identification number.

Backfill of the exploratory holes, including the installation of monitoring instrumentation, was undertaken in accordance with the specification and as instructed by the Engineer. Details of the backfill material used, and where relevant pipe construction, are provided on the individual exploratory hole logs presented in Section A of this report.

4.2 Inspection Pits

In order to reduce the risk of damaging buried services, the location of each exploratory hole was scanned using a cable avoidance tool (CAT) immediately prior to breaking ground. As a further precaution, an inspection pit was hand excavated to a depth of 1.20m at each location during which further scans were taken with the CAT at 300mm intervals to the base of each pit.

4.3 Hand Excavated Pits

As instructed by The Employer three hand pits were excavated to 1.20m depths to install gas monitoring pipes. The hand pits were excavated with insulated hand tools. Sampling was not undertaken.

The hand excavated pits were not shored and were logged from the surface by an Engineering Geologist in accordance with the terminology presented in Appendix 1 of this report. The strata encountered in the hand dug pits are described on the trial pit logs presented in Section A of this report and the location of pits is indicated on the site plan presented in Section C of this report.

4.4 Cable Percussion Boreholes

A total of seven boreholes designated BH101, BH102, BH103, BH107, BH108, BH109 and BH110 were formed to depths between 19.60m and 21.40m using conventional light cable percussion techniques together with 250mm, 200mm and 150mm diameter temporary steel casings. One borehole designated BH105 was formed to depth of 28.50m using cable percussive open hole techniques. All boreholes terminated at top of chalk and were followed by rotary drilling techniques The boreholes were all formed in order to obtain samples for laboratory testing and to provide geotechnical information for foundation design.

In addition, six boreholes designated BH301 to BH306 inclusive were formed to depths between 24.00m and 30.00m using cable percussive open hole techniques for deep datum installations. All boreholes terminated at least 2.00m into chalk.

A summary of cable percussive boring is presented in Table 4 below.

BH105 was scheduled as rotary open hole followed by rotary coring but following agreement with the Employer completed using cable percussive open hole techniques followed by rotary coring.

Due to the soft nature of some of the deposits encountered on the site, piston sampling was undertaken in order to minimise disturbance to the materials. A hydraulic piston sampler was used which pushed 100mm diameter 1.00m long aluminium tubes into the material at the required sampling depths. The samples were sealed with wax and end caps and were stored and transported in a vertical orientation to prevent disturbance to the sampled material. The depths at which these samples were taken are shown on the relevant exploratory holes presented in Section A of this report. Continuous piston sampling was undertaken in soft alluvium deposits at

BH102, BH103, BH108 and BH109. Intermittent piston sampling was undertaken in soft alluvium deposits at boreholes BH101, BH107 and BH110. These were sealed with wax to prevent moisture loss and were transported to the Leeds laboratory of Soil Engineering.

All of the piston samples from boreholes BH103 and BH108 were split and described in the laboratory. Thesesamples were described by an Engineering Geologist in accordance with the terminology presented in Appendix 1 of this report. Photographs and detailed description of all strata encountered presented in Section D of this report.

TABLE 4: SUMMARY OF CABLE PERCUSSIVE BORING

BH	Easting	Northing	Ground Level (mAOD)	Scheduled Depth CP (m)	Depth Achieved (m)	Rotary Follow On	Notes
BH101	566285.85	175892.13	2.15	20.00	19.50	Yes	Bd
BH102	566294.05	175858.59	2.38	20.00	21.20	Yes	Bd
BH103	566318.71	175904.63	2.78	20.00	21.40	Yes	Bd
BH105	566607.49	175538.41	8.34	20.00	28.50	Yes	Bd, OH
BH107	567423.32	174162.53	2.27	20.00	19.60	Yes	Bb
BH108	567435.35	174079.58	2.35	20.00	20.40	Yes	Bd
BH109	567417.56	174104.42	2.31	20.00	21.10	Yes	Bd
BH110	566284.40	175842.42	2.55	20.00	20.50	Yes	Bd
BH301	566441.32	175781.63	7.40	22.00	27.00	No	Bd, OH
BH302	566606.40	175776.42	8.21	22.00	30.00	No	Bd, OH
BH303	566408.66	175525.02	5.32	22.00	27.00	No	Bd, OH
BH304	567352.78	174259.48	2.38	18.00	21.00	No	Bd, OH
BH305	567402.08	174012.69	2.40	18.00	24.00	No	Bd, OH
BH306	567537.15	173995.66	2.54	18.00	24.00	No	Bd, OH
Key: Bd – Bedrock, OH – CP Open Hole							

In granular materials or where the presence of coarse material prevented the taking of piston tube samples, Standard Penetration Tests were carried out. The results of these tests are given as a Standard Penetration “N” value or as a blow count for a given penetration at the appropriate position on the borehole logs.

Representative disturbed samples of all materials encountered were obtained and these were placed in sealed containers for transport to the laboratory.

Small disturbed samples for environmental testing were also obtained in a variety of glass and/or plastic containers as required by the project specification. These were kept refrigerated after collection and in order to meet sample holding times, were dispatched to the testing laboratory within twenty four hours of sampling.

The samples recovered from the boreholes were described by an Engineering Geologist in accordance with the terminology presented in Appendix 1 of this report. A detailed description of all strata encountered, groundwater conditions and the position and type of samples taken are included on the borehole logs presented in Section A of this report.

4.5 Rotary Drilling

In order to obtain information on the solid geology beneath the site eight boreholes designated BH101, BH102, BH103, BH105, BH107, BH108, BH109 and BH110 were extended using rotary drilling techniques. Two boreholes designated BH104 and BH106 were formed to depths between 20.00m and 24.50m using rotary open hole techniques. All of the boreholes were extended to depths between 45.50m and 60.50m using a Geobore S core barrel together with a protective semi rigid plastic liner and a Polycrystalline Diamond (PCD) core bit with water flush to produce cores of 102mm nominal diameter. A summary of rotary drilling is presented in Table 5 below.

TABLE 5: SUMMARY OF ROTARY DRILLING

BH	Easting	Northing	Ground Level (mAOD)	Scheduled Depth (m)	Depth Achieved (m)	Core Barrel	Flush	Notes
BH101	566285.85	175892.13	2.15	60.00	60.50	G-S	Water	
BH102	566294.05	175858.59	2.38	60.00	60.50	G-S	Water	
BH103	566318.71	175904.63	2.78	50.00	50.00	G-S	Water	
BH104	566412.95	175708.95	5.95	60.00	60.50	G-S	Water	OH to 24.50m
BH105	566607.49	175538.41	8.34	60.00	60.50	G-S	Water	
BH106	567471.64	174224.02	2.00	60.00	60.00	G-S	Water	OH to 20.00m
BH107	567423.32	174162.53	2.27	60.00	60.50	G-S	Water	
BH108	567435.35	174079.58	2.35	60.00	60.50	G-S	Water	
BH109	567417.56	174104.42	2.31	60.00	60.50	G-S	Water	
BH110	566284.40	175842.42	2.55	45.00	45.50	G-S	Water	
Key: OH – Rotary Open Hole; G-S – Geobore-S								

Details of the strata encountered are given on the borehole logs along with the Engineering Geologist's assessment of Total Core Recovery (TCR), Solid Core Recovery (SCR), and Rock Quality Designation (RQD) each expressed as a percentage of the individual core runs. Where applicable a fracture spacing (I_f) has also been determined and this information is given on the logs. Where the fracture index has not been recorded due to either 'no recovery' or an 'assumed zone of core loss' greater than 300mm, this is shown in the fracture index column on the exploratory hole log with an 'NR' for Not Recorded. Zones of predominantly non intact core of greater than 300mm extent are shown in the fracture index column on the exploratory hole log with an 'NI' for Non Intact.

The symbols and abbreviations used on the rotary borehole logs are explained on the exploratory hole log legend and notation sheet presented in Section A of this report.

The core samples recovered were transported to the Leeds laboratory of Soil Engineering where they were photographed, sampled and described by an Engineering Geologist in accordance with the terminology presented in Appendix 1 of this report. The borehole logs are presented in Section A of this report and core photographic records are presented in Section D of this report.

Sub-samples of the core were obtained at depths specified by The Engineer and were taken by an Engineering Geologist once detailed logging of the core had been completed. Core sub-samples selected were wrapped in alternating layers of plastic film and wax then wrapped in protective plastic and placed into core boxes for secure onward transport to the laboratory. These undisturbed samples were given the sample type CS whilst disturbed samples taken from the

core that were placed within a plastic tub or plastic bag were given the sample types CD and CB respectively. Prior to transport to the laboratory, the samples were protected from the elements at all times in temporary site accommodation in which the maximum and minimum temperature was monitored on a daily basis.

4.6 Aquifer protection measures

Aquifer protection measures were installed in all boreholes to prevent migration of potential contaminants into the underlying strata and groundwater.

The aquifer protection seals were formed by advancing the boreholes to the top of secondary aquifer or top of the natural ground where the boreholes were dry. Once the secondary aquifer was determined, a 1m plug of bentonite pellets was placed in the base of the borehole. The pellets were allowed at least one hour to hydrate and form a seal. The boreholes were advanced by telescoping casing and advancing a smaller diameter casing through the bentonite seal. Where required and especially in the Tilbury boreholes, a second bentonite pellet plug was installed once the principal aquifer was encountered. A summary of aquifer protection seals is presented in Table 6 below.

TABLE 6: SUMMARY OF AQUIFER PROTECTION SEALS

BH	Depth of sealing (m)	Casing diameter (mm)	Drilling type	Flush	Notes
BH101	1.20-2.20	250	CP	Dry boring	Seal at base of Made Ground due to water strike in the inspection pit
BH101	15.00-16.00	200	CP	Dry boring	Seal at interface between Alluvium and RTD
BH102	1.20-2.00	250	CP	Dry boring	Seal at 2.00m due to water strike
BH102	16.00-17.00	200	CP	Dry boring	Seal at interface between Alluvium and RTD
BH103	2.20-3.20	300	CP	Dry boring	Seal at 3.20m due to water strike
BH103	14.60-15.60	250	CP	Dry boring	Seal at interface between Alluvium and RTD
BH104	19.50-20.50	200	Rotary OH	Water	Seal at interface between Alluvium and RTD
BH105	7.20-8.20	250	CP/OH	Dry boring	Seal at interface between Made Ground and Alluvium
BH105	21.00-22.00	200	CP/OH	Dry boring	Seal at interface between Alluvium and RTD
BH106	11.00-12.00	200	Rotary OH	Water	Seal at interface between Alluvium and RTD
BH107	11.90-12.90	200	CP	Dry boring	Seal at interface between Alluvium and RTD
BH108	11.00-12.00	200	CP	Dry boring	Seal at interface between Alluvium and RTD
BH109	11.00-12.00	200	CP	Dry boring	Seal at interface between Alluvium and RTD
BH110	1.30-2.30	250	CP	Dry boring	Seal at interface between Made Ground and Alluvium

BH110	14.00-15.00	200	CP	Dry boring	Seal at interface between Alluvium and RTD
BH301	6.20-7.20	250	CP	Dry boring	Seal at interface between Made Ground and Alluvium
BH301	20.60-21.60	200	CP	Dry boring	Seal at interface between Alluvium and RTD
BH302	5.50-6.50	250	CP	Dry boring	Seal at interface between Made Ground and Alluvium
BH302	21.50-22.50	200	CP	Dry boring	Seal at interface between Alluvium and RTD
BH303	4.00-5.00	250	CP	Dry boring	Seal at interface between Made Ground and Alluvium
BH303	18.50-19.50	200	CP	Dry boring	Seal at interface between Alluvium and RTD
BH304	11.50-12.50	250	CP	Dry boring	Seal at interface between Alluvium and RTD
BH305	12.00-13.00	200	CP	Dry boring	Seal at interface between Alluvium and RTD
BH306	13.00-14.00	200	CP	Dry boring	Seal at interface between Alluvium and RTD

BH104 was drilled using rotary open hole techniques. As the rotary rig used didn't have the capacity to hold 250mm casing it was agreed that a single aquifer seal be installed at the interface between the Alluvium and River Terrace deposits.

The Gravesend boreholes encountered Made Ground and the secondary aquifer was not encountered. In these boreholes, only one aquifer protection seal was installed and this was placed at the interface between the Alluvium and River Terrace deposits.

4.7 In situ Testing

4.7.1 Standard Penetration Testing

Standard Penetration Tests[10] were carried out in all of the cable percussive boreholes and dynamic sampling probe holes using either a split spoon sampler or a solid 60° cone.

The test consisted of driving a 50mm external diameter split barrel sampler into the soil using a 63.5kg hammer dropping 760mm. In coarse granular soils or in rock, the split barrel may be replaced by a solid cone. The penetration resistance is expressed as the number of blows required to obtain 300mm penetration, below an initial seating drive of 150mm through any disturbed ground at the bottom of the borehole. The number of blows for the 300mm test drive penetration is recorded on the borehole logs as the "N" value. A full record of the number of blows required to drive the sampler at 75mm intervals throughout the total 450mm drive is also tabulated along with the groundwater level and borehole casing depth at the time of test.

The tests are carried out using automatic trip hammers that have been calibrated. The hammer ID and energy ratio are recorded on the 'header page' of each log and calibration certificates for the hammers used on the project are contained in Appendix 2 of this report. It should be noted that the "N" values reported on the logs are uncorrected for hammer energy efficiency.

[10] BS EN ISO 22476-3:2005 + A1: 2011: Geotechnical Investigation and Testing – Field Testing – Part 3: Standard Penetration Test.

The results of the tests are given as a Standard Penetration "N" value at the appropriate position on the relevant exploratory hole logs presented in Section A of this report.

4.7.2 Photo Ionisation Detection

In order to determine the presence or otherwise of volatile organic compounds , all environmental samples were subject to head space testing using a photo ionisation detector (PID).

Test results are presented in Section A of this report and the PID calibration certificate is included in Appendix 2 of this report.

4.7.3 Variable Head Permeability Testing

In accordance with the Engineers instruction, falling head permeability tests were undertaken in boreholes BH101, BH102, BH103, BH107, BH108, BH109 and BH110 in accordance with BS EN ISO 22282-2[11] with shape factor (F) derived from BS EN ISO 22282-1:2012 Annex B[12]. As instructed by the Employer, four additional falling head tests were undertaken in chalk sections of borehole BH103. Three of these tests were undertaken using Packer equipment to isolate the test section. The results of the falling head testing are presented in Section A of this report.

4.7.4 Packer Testing

Packer testing was required in order to provide detailed information on the permeability of the ground at discrete depths. Packer tests were performed to the required standard[5] within boreholes BH102 and BH106, at depths specified by the Employer and at a frequency of three to six tests per borehole. A total of nine tests were carried out. Each test used double packers to isolate the test zone into which, once the packers were inflated to the required pressure, water was pumped and the flow rate measured.

Test pressures were unable to be obtained during any of the packer tests in either borehole. Further scheduled packer tests were cancelled by the Engineer.

Test results are presented in Section A of this report.

4.7.5 Static Cone and Seismic Penetration Testing

A total of six combined magnetometer-seismic cone penetration tests with pore pressure measurement (SCPTu) designated CPT101 to CTT106 inclusive were carried out by specialist subcontractor Lankelma Limited. Each test was performed using a 20.5 tonne truck mounted CPT rig. The tests were terminated when either completion to the scheduled depth was reached or when the maximum safe capacity of the equipment was reached. Each test measured cone resistance, sleeve friction and pore pressure and in addition piezocone, seismic piezocone and twenty two dissipation tests were undertaken in various holes across the site.

Full details of the results of the static cone penetration testing are included in Lankelma Limited's report presented in Section A of this report.

[11] BS EN ISO 22282-2:2012. Geotechnical investigation and testing – Geohydraulic testing. Part 2: Water permeability tests in a borehole using open systems

[12] BS EN ISO 22282-2:2012. Geotechnical investigation and testing – Geohydraulic testing. Part 1: General Rules

4.7.6 Shear Vane Testing in Boreholes

In order to provide an approximate undrained shear strength of the cohesive soils encountered within the boreholes, shear vane testing was carried out by specialist subcontractor Lankelma Limited where suitable cohesive material was encountered. The shear vane tests in BH101 failed to be processed below 5.00m depth due to inclination of the testing rods. A second test attempted but again failed to be processed below 4.00m depth for the same reason.

Full details of the results of the shear vane testing are included in Appendix L of Lankelma Limited's report presented in Section A of this report.

4.7.7 Downhole Geophysics Testing

Downhole geophysics tests were carried out in boreholes BH101 to BH109 inclusive as part of the works. Three different geophysics suites designated G26, G27 and G28 were run in stable and solid strata consisting of calliper, acoustic and optical borehole imagers, natural gamma, gamma-gamma density, resistivity, full wave sonic, P&S wave suspension logger, magnetic resonance and borehole deviation. A fluid suite consisting of fluid temperature and conductivity and impeller flowmeter was also undertaken in the water column in each borehole. The tests were undertaken by specialist subcontractor European Geophysical Services Limited.

Prior to logging a controlled flushing of the boreholes was carried out using clean water to purge the borehole of drilling debris. The water column was left to settle overnight and the casing was retracted to a predetermined depth to allow the logging to be completed.

Full details of the results of the downhole geophysics testing are included in European Geophysical Services Limited report presented in Section A of this report.

4.7.8 Pressuremeter Testing

Pressuremeter tests were undertaken in boreholes BH101, BH102, BH105, BH107 and BH108 by Cambridge Insitu Limited and In Situ Limited. A high-pressure dilatometer (HPD) was used to undertake tests at specified depths within pre-cored sections of the rotary boreholes.

Thirty three tests were attempted including tests that were aborted. Reasons for test termination comprised burst equipment and erroneous arm and pressure cell readings causing the data points to be off-scale.

On several occasions the pre-cored sections collapsed and the HPD tests were unable to be formed. As instructed by the Engineer tests were formed at alternate depths.

Further details are given in Cambridge Insitu and In Situ reports which is presented in Section A of this report.

4.7.9 On Land Geophysical Surveys

A geophysical electrical resistivity tomography survey comprising six soil resistivity tests using the Wenner method was undertaken by Zetica, a specialised subcontractor.

Full details of the results of the soil resistivity testing are included in Zetica Limited report presented in Section A of this report.

4.8 Installations

4.8.1 Standpipe Installations

50mm diameter standpipes were installed in boreholes BH102 and BH108 as summarised in Table 7 below. Two installations in boreholes BH107 and BH110 have not been completed to date following an instruction by the Employer to leave the holes cased but open for further testing.

TABLE 7: SUMMARY OF INSTALLATIONS

BH	Installation Number	Installation Type	Distance (mBGL)	Tip/Slotted Section (mBGL)	Response Zone Top (mBGL)	Response Zone Base (mBGL)
BH102	01	Standpipe	11.00	9.00	9.00	11.00
BH108	01	Standpipe	14.00	13.00	12.50	14.50
BH108	02	Standpipe	22.50	21.50	21.00	23.00
Notes:						

The slotted 50mm diameter UPVC tubes were installed in boreholes BH102 and BH108. This tubing was slotted and finished with a geosock filter over various depths with the slotted section being surrounded by pea gravel or sand response zone with a bentonite seal placed above and below. A metal stopcock cover was concreted into place on each of the installations and a plastic cap with a gas valve was placed onto each tube to facilitate long-term groundwater and gas monitoring. All groundwater installation were developed by surging during fieldworks. A schematic of each installation is shown on the relevant exploratory hole log presented in Section A of this report.

4.8.2 Vibrating Wire Piezometer

In accordance with the Employer's instructions, boreholes BH101, BH104 and BH105 had three or six data logged vibrating wire piezometers installed at varying depths. All vibrating wire piezometers were installed with a grout surround. Depending on location a metal stopcock cover was concreted into place on each of the installations to facilitate long-term groundwater monitoring. The dataloggers used were supplied by Geosense Ltd and were set up to be read manually and retain the capability to be reconfigured to enable remote download at a later date. A schematic of each installation is presented in Section A of this report. Calibration certificates are presented in Appendix 2 of this report.

4.9 Groundwater and Gas Monitoring

In accordance with the specification, monitoring of groundwater and gas was scheduled to be carried out during three return visits at fortnight intervals after completion of the site works. The monitoring results will be provided as an addendum to the Factual Report.

4.10 Surveying

Following completion of the fieldworks an 'as built' survey of each exploratory hole was undertaken by SEGL. Co-ordinates and elevations were established using Leica GPS equipment and were related to the Ordnance Survey Active Rinex Network.

5.0 LABORATORY TESTING

5.1 Scope of Testing

All geotechnical (soil, rock and chemical) and environmental testing was specified and scheduled by the Engineer. The scope of the testing was required to assist the Engineer in foundation design and in establishing any potential site contamination levels.

5.2 Geotechnical Soils Testing

In order to provide an indication of the properties of any made ground and superficial deposits encountered within the site, geotechnical soil testing was undertaken on selected samples. The programme of laboratory testing was carried out generally in accordance with BS 1377[13] and BS EN ISO 17892[14]. The testing was carried out at the Leeds laboratory of Soil Engineering, a UKAS accredited testing laboratory No 1265. The testing undertaken and the standards used are summarised in Table 8 below.

TABLE 8: SUMMARY OF SOILS TESTING

Test Name	Standard and Part	Year
General Requirements and Sample Preparation	BS 1377 -1	2016
Determination of Water Content	BS 1377-2 - 4.1/BS EN ISO 17892-1	2022
Determination of Liquid and Plastic Limits	BS 1377-2: / BS EN ISO 17892-12	2022
Determination of Linear Density	BS1377-2 Cl 8 /BS EN ISO17892-2: 5.1	2022
Determination of Immersion Density	BS1377-2 Cl 8 /BS EN ISO17892-2: 5.2	2022
Determination of Particle Density	BS1377-2 Cl 9.1 /BS EN ISO17892-3: 5.1	2022
Determination of Particle Size Distribution	BS 1377-2:2022 -10/ BS EN ISO 17892-4: 5.2/5.3	2022
Determination of One-dimensional Consolidation Properties	BS 1377-2:2022 -16/ BS EN ISO 17892-5	2022
Determination of Shear Strength by Direct Shear (small shearbox apparatus)	BS 1377-2:2022 -25.2/ BS EN ISO 17892-10	2022
Consolidated Undrained Triaxial Compression Test with Measurement of Pore Pressure	BS1377 -8.7	1990
Notes:		

Results completed to date are given on the summary sheets with individual test plots presented in Section B of this report.

[13] BS 1377: 1990: Parts 1 to 9: Methods of Test for Soils For Civil Engineering Purposes. British Standards Institution
[14] BS EN ISO 17892 Geotechnical Investigation and Testing – Laboratory Testing of Soil

5.3 Geotechnical Rock Testing

In order to provide an indication of the properties of any solid geology encountered within the site, geotechnical rock testing was undertaken on selected core samples. The programme of laboratory testing was carried out generally in accordance with ISRM suggested Methods[15,16]. The testing was carried out at the Leeds laboratory of Soil Engineering, a UKAS accredited testing laboratory No 1265. The testing undertaken and the standards used are summarised in Table 9 below.

TABLE 9: SUMMARY OF ROCK TESTING

Test Name	Standard
Determining Water Content	ISRM Suggested Methods 1974-2006
Determination of Porosity and Density	ISRM Suggested Methods 1974-2006
Determination of the Point Load Index Strength	ISRM Suggested Methods 1974-2006
Determination of the Uniaxial Compressive Strength	ISRM Suggested Methods 1974-2006
Determination of the Uniaxial Compressive Strength with Young's Modulus and Poisson's Ratio	ISRM Suggested Methods 1974-2006
Notes:	

Results completed to date are given on the summary sheets with individual test plots presented in Section B of this report.

5.4 Geotechnical Chemical Testing

In order to assess concrete requirements from BRE Special Digest No 1[17], geotechnical chemical testing was undertaken on selected samples. Testing was undertaken by Chemtest, a UKAS accredited testing laboratory No. 2183. Samples were tested for pH, Soluble Sulfate (2:1 water/soil extract) and Acid-Soluble Sulfate. The samples were prepared in general accordance with BS 1377 Part 3, although final analysis of total sulfate was performed using ICP and aqueous extract using Ion Chromatography.

5.5 Environmental Testing

In order to establish any potential contamination across the site, a programme of environmental testing was scheduled by the Engineer. The testing was scheduled by means of a series of pre-determined suites defined in the project specification and reproduced in Table 10 below. Testing was carried out by Chemtest, a UKAS accredited testing laboratory No. 2183.

[15] ISRM 2007 The complete ISRM Suggested Methods for Rock Characterization, Testing and Monitoring: 1974-2006. Ulusay, R. and Hudson, J.A. (Eds).
[16] ISRM 2015 The ISRM Suggested Methods for Rock Characterization, Testing and Monitoring: 2007-2014. Ulusay, R. (Ed).
[17] BRE Special Digest 1: 2005: Concrete in Aggressive Ground. BRE Construction Division.

TABLE 10: SUMMARY OF ENVIRONMENTAL TEST SUITES

Test Suite ID	Test Suite Composition
Suite E1	Antimony, Arsenic, Asbestos Screen Type and presence N/A, Barium, Beryllium, Boron, BTEX (Speciated), Cadmium, Chromium (III), Chromium (VI), Copper, Cyanide (Free), Fraction of Organic Carbon, Iron, Lead, Manganese, Total Mercury, Molybdenum, Nickel, pH, Polyaromatic, Hydrocarbons, Selenium, Sulphate (Water Soluble), Sulphur (Total), Total Petroleum Hydrocarbon, Vanadium, VOC, Zinc
Suite F1	Antimony, Arsenic, Asbestos Screen Type and presence N/A, Barium, Beryllium, Boron, Cadmium, Calcium, Chloride, Chromium (III), Chromium (VI), Copper, Cyanide (Free), Cyanide (Complex), Fluoride, Iron, Lead, Manganese, Total Mercury, Molybdenum, Nickel, pH, Polyaromatic, Hydrocarbons, Phenols, Selenium, Sulphate (Water Soluble), Sulphur (Total), Total Petroleum Hydrocarbon, Vanadium, Zinc
Suite G1	Ammoniacal Nitrogen, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chloride, Chromium (III), Chromium (VI), Copper, Cyanide (Free), Cyanide (Total), Fluoride, Hardness (CaCO3), Iron, Lead, Magnesium, Manganese, Mercury, Molybdenum, Nickel ,Nitrate as NO3, pH, Phenols (Speciated: phenol. Cresols, dimethylphenols, trimethylphenols), Polyaromatic Hydrocarbons (USEPA 16 speciated), Selenium, Sodium, Sulphate, Sulphur, Total Petroleum Hydrocarbon –Criteria Working Group: Ali-Aro Split, TPHCWG Bands, Vanadium, Volatile Organic Compounds, (Speciated USEPA Method 8260 Target List), Zinc, Total Dissolved Solids, Alkalinity – Bicarbonate
Notes:	

Testing was carried out in accordance with the methods identified in the test reports.

The results of the environmental testing are presented in Section B of this report.

6.0 RESULTS OF THE INVESTIGATION

6.1 Scope of Commentary

The results of this investigation appear to broadly concur with the published geology summarised in Section 3.3 of this report and also with the information presented in the previous investigation carried out on this site and referenced in Section 3.4 of this report. The following sections are only intended to provide a brief commentary on the ground conditions encountered during this investigation whilst the logs presented in Section A of this report give a detailed account of all the strata observed. The ground conditions encountered are summarised in Table 11 below.

6.2 Made Ground

Made ground was encountered to depths between 1.40m and 2.80m in the exploratory holes located in Tilbury shaft area. This was seen to comprise a mix of gravel and sand with concrete, bricks, ash and chert although locally other materials were also identified.

Made ground was encountered to depths between 4.30m and 7.00m in the exploratory holes located in the A1 area in the Ashfield.

In the Gravesend area made ground was encountered in boreholes BH304, BH305 and BH306 to depths between 0.40m and 0.50m. This was seen to comprise a mix of gravel and stone with concrete and bricks although locally other materials were also identified.

In the Tilbury shaft area and boreholes BH104 and BH303 in the A1 area comprised a mix of ash, soil, stone, concrete and metal although locally other materials were also identified. Ash fill was found to a depth of 5.10m in borehole BH301 and a depth of 5.70m in borehole BH302.

6.3 Alluvium

Underlying the made ground, alluvium was encountered to depths between 14.70m and 17.00m in the exploratory holes located in the Tilbury shaft area. Alluvium was encountered to depths between 20.50m and 22.10m in the exploratory holes located in the A1 area in the Ashfield.

In the Gravesend area, alluvium was encountered in all of the exploratory holes to depths between 12.00m and 15.40m.This was seen to comprise very soft to soft greenish grey to grey clay with organic materials and layers of spongy dark brown pseudo fibrous peat with light organic odour.

6.4 River Terrace Deposits

Underlying the alluvial deposits, River Terrace Deposits were encountered to depths between 19.50m and 21.40m in the exploratory holes located in Tilbury shaft area. River Terrace Deposits were encountered to depths between 24.50m and 27.90m in the exploratory holes located in the A1 area in the Ashfield.

In the Gravesend area, River Terrace Deposits were encountered in all of the exploratory holes to depths between 19.00m and 21.90m and comprised dense sand and gravel of flint, quartz and occasionally chalk.

6.5 Seaford Chalk Formation

Seaford Chalk Formation was encountered to depths between 39.60m and 45.00m in the exploratory holes located in the Tilbury shaft area. Seaford Chalk Formation was encountered to depths between 49.65m and 50.15m in the exploratory holes located in the A1 area in the Ashfield. In the Gravesend area, Seaford Chalk Formation deposits were proven to the base of each borehole at a depth of 60.50m.

6.6 Lewes Nodular Chalk Formation

Lewes Nodular Chalk Formation was encountered in the Tilbury shaft area and in the A1 area in the Ashfield and was proven to the base of each borehole to a maximum depth of 60.50m.

TABLE 11: SUMMARY OF GROUND CONDITIONS

Strata	Frequency Boreholes	Shallowest Depth Range (m BGL)	Deepest Depth Range (m BGL)
Made Ground	11/16	0.00	7.00
Alluvium	16/16	0.40	22.10
River Terrace Deposits	16/16	12.00	27.90
Seaford Chalk Formation	16/16	19.00	60.50
Lewes Nodular Chalk Formation	5/16	39.60	60.50

Notes:
1. All Tilbury boreholes completed in Lewes Nodular Chalk Formation
2. All Gravesend boreholes completed in Seaford Chalk Formation

6.7 Groundwater

Groundwater was encountered in all of the exploratory holes at various depths. A summary of exploratory hole groundwater inflows is given in Table 12 below, whilst the logs presented in Section A of this report provide full details of all groundwater information.

TABLE 12: SUMMARY OF GROUNDWATER INFLOWS DURING DRILLING

Exploratory Hole	Strike Depth	Rise to after 20mins	Strata	Notes
BH101	0.70	0.50	Made Ground	Slow
BH101	3.50	2.30	Alluvium	Slow
BH101	7.60	6.80	Alluvium	Medium
BH102	2.00	1.20	Made Ground	Fast
BH102	9.50	4.50	Alluvium	Fast
BH103	3.20	2.75	Alluvium	Very slow
BH103	15.60	4.50	Alluvium	Fast
BH105	21.90	15.60	River Terrace Deposits	Fast
BH107	12.80	4.60	River Terrace Deposits	Fast
BH108	12.00	4.31	River Terrace Deposits	Fast
BH109	12.30	4.50	Alluvium	Fast
BH110	6.00	5.65	Alluvium	Seepage

SOIL ENGINEERING

SUPPORTING FACTUAL DATA

SECTION A
Exploratory Hole Records and Field Data

EXPLORATORY HOLE LOG LEGEND AND NOTATION SHEET

Project Name	Grain to Tilbury Tunnel GI
Project ID	TB8754
Engineer	Mott MacDonald
Employer	FBJV

Legend Key Sheet

Geology Legends


101 - TOPSOIL


102 - MADE GROUND


201 - CLAY


202 - Silty CLAY


203 - Sandy CLAY


204 - Gravelly CLAY


207 - Silty sandy CLAY


219 - Silty organic CLAY


220 - Sandy gravelly CLAY


401 - SAND


402 - Clayey SAND


403 - Silty SAND


404 - Gravelly SAND


430 - SAND and GRAVEL


501 - GRAVEL


504 - Sandy GRAVEL


601 - PEAT


805 - CHALK


998 - No Recovery

Backfill Legends


901 - Sand backfill


902 - Gravel backfill


903 - Bentonite


904 - Grout


906 - Concrete

Project Name	Grain to Tilbury Tunnel GI
Project ID	TB8754
Engineer	Mott MacDonald
Employer	FBJV

Project Notation Sheet

Log Notation

TCR	Total Core Recovery
SCR	Solid Core Recovery
RQD	Rock Quality Designation
FI	Fracture Index
IF	Fracture Spacing
NI	Non Intact
NA	Data Not Applicable
NR	Data Not Recorded

In Situ Test Notation

SPT	Standard Penetration Test with a Split Spoon
SPT(C)	Standard Penetration Test with a Cone
C	Cone Penetration Test
NP	No Penetration for SPT or SPT(C)
V	Vane Test
HV	Hand Vane
HP	Hand Penetrometer
CBR	California Bearing Ratio Test
K	Permeability Test (Test Type Not Differentiated)
Pr	Pressuremeter Test

Installation Type

EPIE	Electronic Piezometer
SP	Standpipe

Graphics Used

Standing Water Level

Joining Bar Indicates Level Risen

Waterstrike Level

SOIL ENGINEERING

SUPPORTING FACTUAL DATA

SECTION A
Exploratory Hole Records and Field Data

CABLE PERCUSSION AND ROTARY DRILLING RECORDS

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 2

Ground Level	+2.16mOD	Coordinates	566285.85E, 175892.14N	Grid	OSGB
Date Started	13/05/2025	Date Completed	10/06/2025	Inclination	90° from horizontal

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit Used	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	13/05/2025 16:30	13/05/2025 18:00	WS	AW	NA	NA	Insulated Hand Tools	None	Stable	
0.00	7.60	SCP		09/05/2025 12:00								Magnetometer test only
1.20	19.50	CP	14/05/2025 07:30	16/05/2025 15:30	WS	AW	NA	NA	Dando 2000	NA	NA	
19.50	60.50	RC	28/05/2025 08:00	03/06/2025 18:00	KG	AW	Geobore S	PCD	Com 450	NA	NA	

CABLE PERCUSSION DETAILS

Depth Top	Depth Base	Time Start	Duration	Tool	Remarks

WATER STRIKES

Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Elapsed Time	Remarks
13/05/2025 17:15	0.70	0.00	1.20	0.40	20	Slow
14/05/2025 10:00	3.50	3.00		2.30	20	Slow
14/05/2025 13:00	7.60	7.60		6.80	20	Medium

HOLE DIAMETER

Depth	Diameter	Remarks
2.00	250	
16.00	200	
21.00	150	
60.50	146	

CASING DIAMETER

Depth	Diameter	Remarks
2.20	250	
16.00	200	
21.00	150	

ROTARY FLUSH DETAILS

Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks

DYNAMIC SAMPLING

Top	Base	Diameter	Duration	Recovery	Remarks

INSTALLATION DETAILS

Distance	ID	Type	Response Top	Response Base	Pipe Ref
10.00	01	EPIE			01
18.10	02	EPIE			02
28.10	03	EPIE			03
38.10	04	EPIE			04
48.10	05	EPIE			05
58.10	06	EPIE			06

PIPE CONSTRUCTION

Pipe Ref	Top	Base	Diameter	Pipe Type

BACKFILL DETAILS

Depth Top	Depth Base	Description	Remarks
0.00	60.50	Grout	

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

SOIL ENGINEERING

FINAL Print date and time 30/09/2025 09:22 Log checked by EC

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 2 of 2

Ground Level	+2.16mOD	Coordinates	566285.85E, 175892.14N	Grid	OSGB
Date Started	13/05/2025	Date Completed	10/06/2025	Inclination	90° from horizontal

PROGRESS

Date Time	Depth	Depth Casing	Depth Water	Remarks
13/05/2025 18:00	1.20	1.20	Dry	End of Shift
14/05/2025 07:30	1.20	1.20	Dry	Start of Shift
14/05/2025 18:00	10.00	10.00	1.60	End of Shift
15/05/2025 07:30	10.00	10.00	1.70	Start of Shift
15/05/2025 18:00	16.00	16.00	5.90	End of Shift
16/05/2025 07:30	16.00	16.00	1.20	Start of Shift
16/05/2025 15:30	19.50	19.50	7.00	End of CP
27/05/2025 00:00	21.50	19.00		End of Shift
28/05/2025 07:30	21.50	19.00		Start of Shift
28/05/2025 18:00	26.00	21.00		End of Shift
29/05/2025 07:30	26.00	21.00		Start of Shift
29/05/2025 18:00	36.00	21.00		End of Shift
30/05/2025 07:30	36.00	21.00		Start of Shift
30/05/2025 15:30	38.00	21.00		End of Shift
02/06/2025 07:30	38.00	21.00		Start of Shift
02/06/2025 18:00	46.00	21.00		End of Shift
03/06/2025 07:30	46.00	21.00		Start of Shift
03/06/2025 18:00	60.50	21.00		End of Hole
09/06/2025 14:00				Installation Complete

SPT DETAILS

Depth	Type	Reported Result	Hammer No.	Energy Ratio %	Casing Depth	Water Depth
1.50	C	N=8 (1,2:2,2,2,2)	AR503	57	1.50	Dry
9.00	S	0/0mm (1/150mm:0/0mm)	AR503	57	9.00	1.90
11.00	S	0/0mm (0/0mm:0/0mm)	AR503	57	11.00	1.90
13.00	S	0/0mm (0/0mm:0/0mm)	AR503	57	13.00	2.00
15.00	S	N=2 (1/150mm:0,0,1,1)	AR503	57	15.00	2.80
16.50	C	N=20 (2,3:4,4,5,7)	AR503	57	16.50	2.90
18.00	C	N=36 (3,5:8,9,8,11)	AR503	57	18.00	1.80

DEPTH RELATED REMARKS

Top Depth	Base Depth	Remarks
1.20	2.20	Bentonite seal. Casing reduced from 250mm to 200mm
4.03	4.03	Shear Vane Test completed. See CPT report for results
6.90	7.40	Falling Head Test in alluvium. Completed
15.00	16.00	Bentonite seal. Casing reduced from 200mm to 150mm
20.00	22.00	HPD pocket collapsed. Insufficient space to form HPD test. Poor recovery due to HPD barrel diameter and chalk nature (structureless)
24.90	24.90	HPD test completed. See HPD reports for results
29.30	29.30	HPD test completed. See HPD reports for results
33.20	33.20	HPD test completed. See HPD reports for results
37.40	37.40	HPD test completed. See HPD reports for results
41.40	41.40	HPD test completed. See HPD reports for results
45.20	45.20	HPD test completed. See HPD reports for results

GENERAL NOTES

1. Intermittent piston sampling in soft alluvium 2. VWP installation 3. 22 grout mixes used 4. Geophysical Logging completed 5. Shear Vane Test below 4.0m depths abandoned due to rods bending. Two tests attempted but both abandoned

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 13 Scale: 1:25

Ground Level	+2.16mOD	Coordinates	566285.85E, 175892.14N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
MADE GROUND: Bituminous material. (MG) [MADE GROUND]			0.05	2.11		B 2 0.05-0.10							
MADE GROUND: Blackish brown slightly sandy angular to subangular fine to coarse gravel sized fragments of flint, clinker, ash, brick with occasional roots (<7mm) and rootlets. Sand is fine to coarse. (MG) [MADE GROUND]			0.15	2.01		D 1 0.05-0.10 D 3 0.10-0.15 B 4 0.10-0.20 D 6 0.30-0.40 ES 5 0.30-0.40 B 7 0.30-0.50 ES 8 0.50-0.55							
MADE GROUND: Black mottled dark grey slightly gravelly fine to coarse sand. Gravel sized fragments are angular fine to medium of clinker. (MG) [MADE GROUND]			(2.05)			D 9 0.70-0.75 B 10 0.70-1.00 ES 11 1.00-1.05 B 12 1.50-2.00 D 13 2.00-2.10 ES 14 2.10-2.20						SPT(C) N=8 (1,2:2,2,2,2) 1.50	
Firm light brown greenish grey and greyish blue slightly gravelly CLAY. Gravel is subrounded to rounded fine to medium of flint. Strong organic odour. (ALV) [ALLUVIUM]			2.20	-0.04		ES 50 2.20-2.25 B 15 2.20-2.50 P 16 2.00-3.00	100	60					
			(1.25)			UT 17 3.00-3.45	100	100	9				
Very soft dark bluish grey CLAY with decayed organic material. (ALV) [ALLUVIUM]			3.45	-1.29		D 18 3.45-3.50 D 19 3.80-3.90 ES 51 4.00-4.05							
			(2.00)			P 20 4.00-5.00 D 21 5.00	100	80					

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 2 of 13 Scale: 1:25

Ground Level	+2.16mOD	Coordinates	566285.85E, 175892.14N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very soft dark bluish grey CLAY with decayed organic material. (ALV) [ALLUVIUM]													
from 5.00m to 5.45m frequent pockets (<20mm) of pseudo fibrous peat						UT 22 5.00-5.45	100	100	17				
			5.45	-3.29		D 23 5.45-5.50							
Very soft bluish grey CLAY with frequent pockets (<20mm) of black and brown plastic pseudo fibrous peat and amorphous peat deposit. (ALV) [ALLUVIUM]													
						D 24 5.80-5.90							
			(2.00)			P 25 6.00-7.00	100	80					
from 7.00m to 7.45m soft black mottled dark brown pseudo fibrous peat						D 26 7.00 ES 52 7.00-7.05 B 29 7.00-7.20 UT 27 7.00-7.45	100	100	6			K 7.40	
			7.45	-5.29		D 28 7.45-7.50						K 7.60	
Very soft grey CLAY with rare pockets (<20mm) of black pseudo peat. (ALV) [ALLUVIUM]													
						D 30 7.90-8.00							
						P 31 8.00-9.00	100	80					
at 9.00m slightly sandy. Sand is fine.						D 32 9.00 ES 53 9.00-9.05 D 33 9.00-9.45 B 34 9.00-9.50						SPT(S) 0/0mm (1/150mm:0/0m m) 9.00	
						D 35 9.90-10.00							

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 3 of 13 Scale: 1:25

Ground Level	+2.16mOD	Coordinates	566285.85E, 175892.14N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very soft grey CLAY with rare pockets (<20mm) of black pseudo peat. (ALV) [ALLUVIUM]			(6.00)			P 36 10.00-11.00	100	50					
						D 37 11.00						SPT(S) 0/0mm (0/0mm:0/0mm) 11.00	
						B 38 11.00-11.50							
						P 39 12.00-13.00	100	80					
from 13.00m to 13.45m firm laminated black orangish brown fibrous peat												SPT(S) 0/0mm (0/0mm:0/0mm) 13.00	
						D 40 13.00-13.45 B 41 13.00-13.50							
Very soft grey slightly sandy CLAY. Sand is fine. (ALV) [ALLUVIUM]			13.45	-11.29									
						D 42 13.70-13.80							
			(1.55)										
						P 43 14.00-15.00	100	50					
			15.00	-12.84		D 44 15.00						SPT(S) N=2 (1/150mm:0,0,1, 1) 15.00	

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 4 of 13 Scale: 1:25

Ground Level	+2.16mOD	Coordinates	566285.85E, 175892.14N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Soft dark grey slightly sandy CLAY with occasional orangish brown partially decayed organic material. Sand is fine. (ALV) [ALLUVIUM]													
from 15.00m to 15.60m with occasional partially decayed organic material						D 45 15.00-15.45 B 46 15.00-15.50							
			(1.00)										
						D 47 15.60-15.70							
						B 48 15.70-16.00							
			16.00	-13.84		D 49 16.00							
Black slightly sandy angular to subrounded fine to coarse GRAVEL of flint. Sand is fine to coarse. (RTD) [RIVER TERRACE DEPOSITS]												SPT(C) N=20 (2,3:4,4,5,7) 16.50	
						B 50 16.50-17.00							
from 17.50m to 17.60m dark grey and brown sandy, Sand is fine to coarse						D 51 17.50-17.60							
			(3.50)										
												SPT(C) N=36 (3,5:8,9,8,11) 18.00	
						B 52 18.00-18.50							
No recovery.			19.50	-17.34		D 53 19.50							
at 19.50m very weak low density white CHALK recovered as angular fine to coarse gravel and angular cobbles.							146	0	0	0			

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 5 of 13 Scale: 1:25

Ground Level	+2.16mOD	Coordinates	566285.85E, 175892.14N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
No recovery.			(2.00)				146	0	0	0	NR		
			21.50	-19.34							NI		
Non intact recovered as rounded fine to coarse GRAVEL of flint. (RTD) [RIVER TERRACE DEPOSITS]			21.60	-19.44									
Assumed zone of core loss.			(1.40)			C 54 21.50-23.00	146	7	0	0	NR		
			23.00	-20.84									
Assumed zone of core loss.			(0.50)								NR		
			23.50	-21.34		C 55 23.00-24.00	146	50	12	0			
Very weak low density white CHALK with occasional large rinded flint (<2mm) with white cortex. Recovered as non intact core. CIRIA Ungraded [SEAFORD CHALK FORMATION]			(0.50)								NI		
			24.00	-21.84									
No recovery.			(2.00)			C 56 24.00-26.00						HPD 24.90	

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 6 of 13 Scale: 1:25

Ground Level	+2.16mOD	Coordinates	566285.85E, 175892.14N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
No recovery.							146	0	0	0	NR		
Very weak low density white CHALK. Discontinuities: 1) 75-90 degrees widely spaced planar to undulating smooth clean. With rare medium to large nodular rinded flints (<1mm) with light grey cortex. CIRIA Grade A2 [SEAFORD CHALK FORMATION]			26.00	-23.84									
from 26.00m to 26.10m with fossil echinoid fragments (<25mm diameter)						C 57 26.00-27.50	146	93	39	23	NI 300 350		
at 26.80m with fossil echinoid fragments (<25mm diameter)			(2.00)			C 58 27.50-28.00	146	100	62	34			
No recovery.			28.00	-25.84		C 59 28.00-30.00	146	0	0	0	NR	HPD 29.30	
			(2.20)										

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

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SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 7 of 13 Scale: 1:25

Ground Level	+2.16mOD	Coordinates	566285.85E, 175892.14N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
No recovery.													
Very weak low density white CHALK with locally frequent small to large rinded flints (<2mm) with light grey cortex. Discontinuities: 1) 90 degrees closely to widely spaced planar smooth. 2) 0-15 degrees planar smooth. CIRIA Grade A2/3 [SEAFORD CHALK FORMATION - CUCKMERE BEDS]			30.20	-28.04		C 60 30.00-30.50	146	60	24	24			
at 31.51m tubular flint						C 61 30.50-32.00	146	90	67	47	30 100 290		
			(5.10)			C 62 32.00-34.00	146	68	57	12		HPD 33.20	
at 34.50m flints from 34.60m to 3.72m flint cobble						C 63 34.00-35.00	146	95	54	29			

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

FINAL Print date and time 30/09/2025 09:23 Log checked by EC

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 8 of 13 Scale: 1:25

Ground Level	+2.16mOD	Coordinates	566285.85E, 175892.14N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density white CHALK with locally frequent small to large rinded flints (<2mm) with light grey cortex. Discontinuities: 1) 90 degrees closely to widely spaced planar smooth. 2) 0-15 degrees planar smooth. CIRIA Grade A2/3 [SEAFORD CHALK FORMATION - CUCKMERE BEDS]			35.30	-33.14									
at 35.15m flints													
Very weak low density white and light grey CHALK with wispy grey subhorizontal marls (<5mm) and frequent pale grey trace fossils with rare nodular rinded flint (<1mm). Discontinuities: 1) 0-10 degrees widely spaced planar smooth. CIRIA Grade A1 [SEAFORD CHALK FORMATION - BELLE TOUT BEDS]						C 64 35.00-36.00	146	100	94	65			
						C 65 36.00-38.00	146	88	67	35		HPD 37.40	
			(4.70)								750		
at 38.20m nodular flint													
at 38.33m tubular flint						C 66 38.00-39.50	146	83	63	57			
at 39.60m tubular flint						C 67 39.50-40.00	146	88	74	74			
			40.00	-37.84									

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 9 of 13 Scale: 1:25

Ground Level	+2.16mOD	Coordinates	566285.85E, 175892.14N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
No recovery.			(2.00)			C 68 40.00-42.00	146	0			NR	HPD 41.40	
Very weak low density white and light grey CHALK with wispy grey subhorizontal marls (<5mm) and frequent pale grey trace fossils with rare nodular rinded flint (<1mm). Discontinuities: 1) 0-10 degrees widely spaced planar smooth. CIRIA Grade A1 [LEWES NODULAR CHALK FORMATION]			42.00	-39.84		C 69 42.00-42.50	146	76	44	44			
from 42.10m to 42.30m fragmented nodular flint at 42.35m tubular flint													
at 42.80m small thick with cortex tabular flint													
from 43.05m to 43.35m multiple small to large thin with white cortex tubular flints. Heavy drilling damage						C 70 42.50-44.00	146	94	71	53	300 300 500		
at 43.76m grey slightly plastic marl seam (up to 15mm thick) (Probable Shoreham Marl) from 43.76m to 44.00m Lewes Nodular Chalk - CIRIA Grade A1													
from 44.00m to 46.00m drilling core loss due to testing			(4.28)			C 71 44.00-46.00							

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 10 of 13 Scale: 1:25

Ground Level	+2.16mOD	Coordinates	566285.85E, 175892.14N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density white and light grey CHALK with wispy grey subhorizontal marls (<5mm) and frequent pale grey trace fossils with rare nodular rinded flint (<1mm). Discontinuities: 1) 0-10 degrees widely spaced planar smooth. CIRIA Grade A1 [LEWES NODULAR CHALK FORMATION]							146					HPD 45.20	
from 46.00m to 46.28m assumed zone of core loss													
Very weak low density pale greyish white CHALK with wispy grey subhorizontal marls (<5mm) and frequent pale grey trace fossils with rare nodular rinded flint (<1mm). Discontinuities: 1) 0-10 degrees widely spaced planar smooth. CIRIA Grade A1 [LEWES NODULAR CHALK FORMATION]			46.28	-44.12		C 72 46.00-47.00	146	72	64	50			
from 46.80m to 47.00m multiple small thick with white cortex tubular flints													
from 47.00m to 47.30m assumed zone of core loss													
from 47.50m to 47.62m large and medium thin with white cortex nodular flints													
from 47.62m to 48.05m zone of 3 vertical joints closely spaced closed						C 73 47.00-48.50	146	67	39	20			
at 48.02m small thin with white cortex tubular flints											30		
at 48.20m possible small thin tabular flints with phosphatic sponge bed													
at 49.48m dark grey/black phosphatic sponge bed			(4.52)										
at 48.57m medium thick with white cortex tubular flints													
at 48.80m dark grey marl seam containing relict slickensides													
at 49.20m small thick with white cortex tubular flints and dark grey marl						C 74 48.50-50.00	146	100	82	57			
at 49.34m medium thick with white cortex tubular flints													
at 49.67m grey slightly plastic marl seam with black phosphatic sponge													
from 49.76m to 49.83m 1 No. discontinuity 70 degrees inclined closed clean rough undulating													
at 49.91m medium thick with white cortex flints													

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Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 11 of 13 Scale: 1:25

Ground Level	+2.16mOD	Coordinates	566285.85E, 175892.14N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density pale greyish white CHALK with wispy grey subhorizontal marls (<5mm) and frequent pale grey trace fossils with rare nodular rinded flint (<1mm). Discontinuities: 1) 0-10 degrees widely spaced planar smooth. CIRIA Grade A1 [LEWES NODULAR CHALK FORMATION]													
at 50.14m small thin with white cortex nodular flints						C 75 50.00-51.00							
from 50.72m to 50.84m small to medium thick with grey and white cortex nodular or tubular flints (heavy drilling damage)							146	99	92	83			
			50.80	-48.64									
Very weak low density white CHALK with wispy grey subhorizontal marls (<5mm) and frequent pale grey trace fossils with rare nodular rinded flint (<1mm). Discontinuities: 1) 0-10 degrees widely spaced planar smooth. CIRIA Grade A1 [LEWES NODULAR CHALK FORMATION]													
at 50.86m dark orange iron staining possible sponges													
at 51.75m large fossilised coral fragment													
at 51.78m small phosphatic nodule (10mm x 10mm x 10mm)											NI 350 400		
			(2.20)										
at 52.27m orange iron stained sponge beds						C 76 51.50-53.00	146	92	85	73			
at 52.50nm small thick with grey cortex nodular flints													
from 52.70m to 52.75m multiple thin grey plastic marl seams													
			53.00	-50.84									
Structured very weak to weak low to medium density white CHALK with frequent pale grey trace fossil burrows. Locally very high density resulting from possible sponge beds. With occasional inoceramid shell fragments and coral fragments. With frequent wispy grey marl. Discontinuities: 1) 0 degrees subhorizontal. CIRIA Grade A1 [LEWES NODULAR CHALK FORMATION]													
at 53.30m medium thick with grey cortex nodular flints													
from 53.30m becoming nodular chalk with medium to high density nodules													
from 53.40m to 53.70m possible sponge bed hard ground with a slight orange iron staining						C 77 53.00-54.50	146	97	51	7			
from 54.50m to 54.60m pale bluish grey very high density chalk possibly slightly siliceous chalk with black phosphatic sponge bed													

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 12 of 13 Scale: 1:25

Ground Level	+2.16mOD	Coordinates	566285.85E, 175892.14N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Structured very weak to weak low to medium density white CHALK with frequent pale grey trace fossil burrows. Locally very high density resulting from possible sponge beds. With occasional inoceramid shell fragments and coral fragments. With frequent wispy grey marl. Discontinuities: 1) 0 degrees subhorizontal. CIRIA Grade A1 [LEWES NODULAR CHALK FORMATION]			(5.05)			C 78 54.50-56.00	146	100	69	28			
from 56.00m chalk nodules have relict stain on sides						C 79 56.00-57.50	146	93	69	35	1000		
at 57.40m pale greenish glauconite													
at 58.00m small thin with white cortex tubular flints			58.05	-55.89									
Very weak low density white with frequent pale grey trace fossil burrows. With occasional marl seams (up to 5m thick). Discontinuities; 1) 0 degrees subhorizontal planar smooth. CIRIA Grade A1 [LEWES NODULAR CHALK FORMATION]						C 80 57.50-59.00	146	100	93	72			
at 58.68m medium thin with white cortex tubular flints													
at 58.99m small thin with white cortex tubular flints											300 500 550		
			(2.45)										
						C 81 59.00-60.50	146	100	100	96			

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 13 of 13 Scale: 1:25

Ground Level	+2.16mOD	Coordinates	566285.85E, 175892.14N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density white with frequent pale grey trace fossil burrows. With occasional marl seams (up to 5m thick). Discontinuities; 1) 0 degrees subhorizontal planar smooth. CIRIA Grade A1 [LEWES NODULAR CHALK FORMATION]													
Complete at 60.50m. Termination Reason: Achieved Scheduled Depth			60.50	-58.34									

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH102
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 2

Ground Level	+2.38mOD	Coordinates	566294.05E, 175858.59N	Grid	OSGB		
Date Started	02/05/2025	Date Completed	27/05/2025	Inclination	90° from horizontal		

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit Used	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	02/05/2025 09:40	02/05/2025 11:00	WS	AW	NA	NA	Insulated Hand Tools	None	Stable	
0.00	19.12	SCP		01/05/2025 12:00								Magnetometer test only
1.20	21.20	CP	02/05/2025 11:00	13/05/2025 12:00	WS	AW	NA	NA	Dando 2000	NA	NA	
21.20	60.50	RC	14/05/2025 08:00	20/05/2025 18:00	PS	AW	Geobore S	PCD	Beretta GT54	NA	NA	

CABLE PERCUSSION DETAILS

Depth Top	Depth Base	Time Start	Duration	Tool	Remarks

WATER STRIKES

Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Elapsed Time	Remarks
06/05/2025 17:00	2.00	2.00		1.20	20	Fast
09/05/2025 09:20	9.50	9.50		4.50	20	Fast

HOLE DIAMETER

Depth	Diameter	Remarks
2.00	250	
13.00	200	
25.20	150	
60.50	146	

CASING DIAMETER

Depth	Diameter	Remarks
2.00	250	
17.00	200	
25.20	150	

ROTARY FLUSH DETAILS

Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks
21.20	60.50	WATER	80	White	

DYNAMIC SAMPLING

Top	Base	Diameter	Duration	Recovery	Remarks

INSTALLATION DETAILS

Distance	ID	Type	Response Top	Response Base	Pipe Ref
11.00	G1	SP	9.00	11.00	Pipe1

PIPE CONSTRUCTION

Pipe Ref	Top	Base	Diameter	Pipe Type
Pipe1	0.00	9.00	50	PLAIN
Pipe1	9.00	11.00	50	SLOTTED

BACKFILL DETAILS

Depth Top	Depth Base	Description	Remarks
0.00	0.50	Concrete	
0.50	0.80	Gravel backfill	
0.80	9.00	Bentonite	
9.00	11.00	Gravel backfill	
11.00	60.50	Grout	

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH102
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 2 of 2

Ground Level	+2.38mOD	Coordinates	566294.05E, 175858.59N	Grid	OSGB
Date Started	02/05/2025	Date Completed	27/05/2025	Inclination	90° from horizontal

PROGRESS

Date Time	Depth	Depth Casing	Depth Water	Remarks
02/05/2025 15:30	1.20	1.20	Dry	End of Shift
06/05/2025 07:30	1.20	0.00	Dry	Start of Shift
06/05/2025 18:00	2.00	2.00	1.20	End of Shift
07/05/2025 07:30	2.00	2.00	1.20	Start of Shift
07/05/2025 18:00	4.00	4.00	1.60	End of Shift
08/05/2025 07:30	4.00	4.00	2.00	Start of Shift
08/05/2025 18:00	9.00	8.00	Dry	End of Shift
09/05/2025 07:30	9.00	8.00	Dry	Start of Shift
09/05/2025 15:30	13.00	13.00	4.80	End of Shift
12/05/2025 07:30	13.00	13.00	4.00	Start of Shift
12/05/2025 18:00	17.00	17.00	5.00	End of Shift
13/05/2025 07:30	17.00	17.00	8.00	Start of Shift
13/05/2025 08:00	21.20	21.20	2.00	Start of Shift
13/05/2025 14:30	21.20	21.20	7.50	End of Shift
13/05/2025 18:00	21.20	21.20	2.00	End of Shift
14/05/2025 07:30	21.20	21.20	2.00	Start of Shift
14/05/2025 18:00	26.00	22.20	3.20	End of Shift
15/05/2025 07:30	26.00	22.20	2.50	Start of Shift
15/05/2025 18:00	35.00	23.70	2.10	End of Shift
16/05/2025 07:30	35.00	23.70	2.10	Start of Shift
16/05/2025 15:00	41.00	23.70	2.20	End of Shift
19/05/2025 07:30	41.00	23.70	1.50	Start of Shift
19/05/2025 18:00	50.00	25.20	1.40	End of Shift
20/05/2025 07:30	50.00	25.20	1.40	Start of Shift
20/05/2025 18:00	60.50	25.20	1.50	End of Hole

SPT DETAILS

Depth	Type	Reported Result	Hammer No.	Energy Ratio %	Casing Depth	Water Depth
18.50	C	N=26 (3,3:6,6,7,7)	ar503	57	18.50	6.00
20.00	C	N=28 (3,4:5,7,7,9)	ar503	57	20.00	6.20

DEPTH RELATED REMARKS

Top Depth	Base Depth	Remarks
1.20	2.00	Bentonite seal. Casing reduced from 250mm to 200mm
8.70	9.20	Falling Head Test in alluvium. See results at Section A of the report
16.00	17.00	Bentonite seal. Casing reduced from 200mm to 150mm
21.50	23.00	HPD pocket collapsed. Details in General Notes
23.00	24.50	HPD pocket collapsed. Details in General Notes
24.50	26.00	HPD pocket collapsed. Details in General Notes
27.40	27.40	HPD test completed. See HPD reports for results
30.40	30.40	HPD test completed. See HPD reports for results
33.40	33.40	HPD test completed. See HPD reports for results
34.00	35.00	Packer Test. Failed
35.90	35.90	HPD test completed. See HPD reports for results
36.00	37.00	Packer Test. Failed
38.00	39.00	Packer Test. Failed
38.70	38.70	HPD test completed. See HPD reports for results
41.70	41.70	HPD test completed. See HPD reports for results

GENERAL NOTES

1. Continuous piston sampling in soft alluvium 2. 14 grout mixes used below groundwater installation 3. HPD test at 21.50-23m not undertaken because the drill pocket collapsed. 4. Instructed to undertake HPD test at 23-24.5m but again not undertaken because the drill pocket collapsed again 5. Instructed to undertake HPD test at 24.5-26m but again not undertaken because the drill pocket collapsed again 6. Instructed to increase the HPD drill pocket to 2m length 7. Poor recovery due to HPD barrel diameter and chalk nature (structureless). 8. Geophysical Logging completed

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH102
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 13 Scale: 1:25

Ground Level	+2.38mOD	Coordinates	566294.05E, 175858.59N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
MADE GROUND: Bituminous material. (MG) [MADE GROUND]			0.10	2.28		D 1 0.00-0.20							
MADE GROUND: Grey sandy subangular to subrounded fine to coarse gravel sized fragments of ash, clinker and concrete. (MG) [MADE GROUND]			0.30	2.08		B 2 0.20-0.30 ES 3 0.30-0.35 B 4 0.30-0.50							
MADE GROUND: Dark brown gravelly fine to coarse sand with rare roots (<10m). Gravel sized fragments are subangular fine to medium of flint. (MG) [MADE GROUND]			(0.45)			ES 5 0.50-0.55							
MADE GROUND: Dark brown gravelly fine to coarse sand. Gravel sized fragments are subangular fine to medium of flint. (MG) [MADE GROUND] from 0.90m to 0.95m grey sandy subangular fine to coarse gravel sized fragments of concrete			0.75	1.63		B 6 0.50-1.00							
			(0.65)			ES 7 1.00-1.05							
						D 8 1.20 B 10 1.20-1.40							
Possible MADE GROUND: Grey clayey subangular to subrounded fine to coarse gravel sized fragments of flint. (MG) [Possible MADE GROUND]			1.40	0.98		D 9 1.40							
						B 12 1.50-2.00							
						D 11 2.00							
			(1.40)			B 13 2.00-2.50							
Very soft dark grey silty CLAY with occasional pockets (<25mm) of fibrous brown peat. (ALV) [ALLUVIUM] from 2.80m to 2.90m soft bluish grey. No peat			2.80	-0.42		D 14 2.80-2.85 B 15 2.80-3.00							
						D 16 3.00-3.05							
						P 17 3.00-4.00	100	100					
						D 18 4.00							
			(3.20)			P 19 4.00-5.00	100	100					
						D 20 5.00							

AGS

Notes: All depth in metres, all diameters in millimetres.
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For details of abbreviations, see key.

SOIL ENGINEERING

FINAL	Print date and time 30/09/2025 09:23	Log checked by EC
Form No. SIEXPHOLELOG	Issue.Revision No. 2.06	Issue Date 13/10/2023

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH102
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 2 of 13 Scale: 1:25

Ground Level	+2.38mOD	Coordinates	566294.05E, 175858.59N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very soft dark grey silty CLAY with occasional pockets (<25mm) of fibrous brown peat. (ALV) [ALLUVIUM]						P 21 5.00-6.00	100	100					
Very soft dark grey silty CLAY. Slight organic odour. (ALV) [ALLUVIUM]			6.00	-3.62		D 22 6.00							
			(1.00)			P 23 6.00-7.00	100	100					
Brown spongy fibrous PEAT with frequent lenses of very soft dark grey clay (<20mm). [PEAT]			7.00	-4.62		D 24 7.00							
			(1.00)			P 25 7.00-8.00	100	80					
Black plastic amorphous PEAT. [PEAT]			8.00	-5.62		D 26 8.00							
			(1.00)			P 27 8.00-9.00	100	100				K 8.70 - 9.20	
Very soft dark grey silty CLAY with occasional pockets (<10mm) of brown fibrous peat. (ALV) [ALLUVIUM]			9.00	-6.62		D 28 9.00 EW 1 9.00-9.10							
						P 29 9.00-10.00	100	40					
						~~D 30 10.00~~							

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH102
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 3 of 13 Scale: 1:25

Ground Level	+2.38mOD	Coordinates	566294.05E, 175858.59N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very soft dark grey silty CLAY with occasional pockets (<10mm) of brown fibrous peat. (ALV) [ALLUVIUM]						P 31 10.00-11.00	100	80					
			(4.00)			D 32 11.00							
						P 33 11.00-12.00	100	80					
						D 34 12.00							
						P 35 12.00-13.00	100	80					
			13.00	-10.62		D 36 13.00							
Very soft dark grey silty CLAY. (ALV) [ALLUVIUM]						P 37 13.00-14.00	100	80					
at 14.00m soft with occasional pockets (<5mm) of brown fibrous peat						D 38 14.00							
						P 39 14.00-15.00	100	80					
			(4.00)			D 40 15.00							

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH102
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 4 of 13 Scale: 1:25

Ground Level	+2.38mOD	Coordinates	566294.05E, 175858.59N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very soft dark grey silty CLAY. (ALV) [ALLUVIUM]						P 41 15.00-16.00	100	80					
at 16.00m slightly gravelly. Gravel is angular to subangular fine to medium of flint						D 42 16.00							
						P 43 16.00-17.00	100	20					
Dark grey slightly sandy angular to subrounded fine to coarse GRAVEL of flint. Sand is fine to coarse. (RTD) [RIVER TERRACE DEPOSITS]			17.00	-14.62		D 44 17.00							
at 17.10m mottled brown gravelly fine to coarse sand. Gravel is fine to coarse						D 46 17.10-17.20							
						B 45 17.00-17.50							
												SPT(C) N=26 (3,3:6,6,7,7) 18.50	
						B 47 18.50-19.00							
at 19.00m occasional fine to medium gravel sized nodules of chalk			(4.00)			D 48 19.00							
												~~SPT(C) N=28~~ (3,4:5,7,7,9) 20.00	

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH102
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 5 of 13 Scale: 1:25

Ground Level	+2.38mOD	Coordinates	566294.05E, 175858.59N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Dark grey slightly sandy angular to subrounded fine to coarse GRAVEL of flint. Sand is fine to coarse. (RTD) [RIVER TERRACE DEPOSITS]						B 49 20.00-20.50							
Extremely weak low density white CHALK. Recovered as angular fine to coarse gravel. [SEAFORD CHALK FORMATION]			21.00	-18.62		D 50 21.00-21.10 B 51 21.00-21.20							
Assumed zone of core loss.			21.20 (0.50)	-18.82			146	0	0	0	NR		
Very weak low density white CHALK . Recovered as angular to subrounded fine to coarse gravel. [SEAFORD CHALK FORMATION]			21.70 (1.30)	-19.32		C 52 21.50-23.00	146	80	16	0	NI		
Assumed zone of core loss.			23.00 (1.15)	-20.62		C 53 23.00-24.50	146	23	15	8	NR		
Weak medium density white mottled light grey CHALK with full diameter rinded flint cobble nodular (<1mm) white and grey cortex. [SEAFORD CHALK FORMATION]			24.15 (0.35)	-21.77							NI 90 120		
Assumed zone of core loss.			24.50	-22.12									

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH102
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 6 of 13 Scale: 1:25

Ground Level	+2.38mOD	Coordinates	566294.05E, 175858.59N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Assumed zone of core loss.			(1.37)			C 54 24.50-26.00	146	9	9	0	NR		
Weak medium density white CHALK with full core diameter rinded flint cobble nodular (<1mm) of grey cortex. [SEAFORD CHALK FORMATION]			25.87	-23.49							NI		
Assumed zone of core loss.			26.00	-23.62									
			(1.18)			C 55 26.00-28.00	146	41	29	8	NR		
Very weak low density white CHALK. Discontinuities: 1) 71-90 degrees closely to medium spaced smooth planar to undulating with occasional black speckling. 2) 0-44 degrees closely to medium spaced smooth planar to undulating. Occasional black speckling. Small to cobble flint rinded (<1mm) cortex white on grey with rare inoceramus fragments (<5mm). CIRIA Grade A3 [SEAFORD CHALK FORMATION]			27.18	-24.80								HPD 27.40	
at 27.20m 1 No. cobble of flint (100mm diameter)													
at 28.40m 1 No. cobble of flint (100mm diameter)						C 56 28.00-29.00	146	90	48	30			
from 29.00m to 29.50m assumed zone of core loss													
at 29.60m inoceramus fragments													
at 29.80m inoceramus fragments													
						C 57 29.00-31.00							

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH102
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 7 of 13 Scale: 1:25

Ground Level	+2.38mOD	Coordinates	566294.05E, 175858.59N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density white CHALK. Discontinuities: 1) 71-90 degrees closely to medium spaced smooth planar to undulating with occasional black speckling. 2) 0-44 degrees closely to medium spaced smooth planar to undulating. Occasional black speckling. Small to cobble flint rinded (<1mm) cortex white on grey with rare inoceramus fragments (<5mm). CIRIA Grade A3 [SEAFORD CHALK FORMATION]							146	75	26	0		HPD 30.40	
			(8.32)										
from 31.50m to 31.85m abundant orange brown sponges and inoceramus fossil						C 58 31.00-32.00	146	85	72	69			
from 32.00m to 32.30m assumed zone of core loss											NI 100 230		
						C 59 32.00-34.00	146	35	4	0			
at 33.30m 1 No. cobble of flint (100mm diameter)												HPD 33.40	
at 34.25m 1 No. cobble of flint (100mm diameter)						C 60 34.00-35.00	146	70	64	48			
at 34.70m inoceramus fragments													

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH102
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 8 of 13 Scale: 1:25

Ground Level	+2.38mOD	Coordinates	566294.05E, 175858.59N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density white CHALK. Discontinuities: 1) 71-90 degrees closely to medium spaced smooth planar to undulating with occasional black speckling. 2) 0-44 degrees closely to medium spaced smooth planar to undulating. Occasional black speckling. Small to cobble flint rinded (<1mm) cortex white on grey with rare inoceramus fragments (<5mm). CIRIA Grade A3 [SEAFORD CHALK FORMATION]													
			35.50	-33.12									
Very weak low density white and light grey CHALK with rare inoceramus fossil and rare rinded nodular flint with (<1mm) grey cortex. Frequent wispy light grey marl laminations (<5mm) and frequent light grey randomly orientated burrows. CIRIA Grade A1 [SEAFORD CHALK FORMATION]						C 61 35.00-36.80	146	89	62	17		HPD 35.90	
from 36.80m to 37.10m assumed zone of core loss						C 62 36.80-38.00	146	75	71	38			
			(4.50)								NA		
from 38.00m to 38.40m assumed zone of core loss												HPD 38.70	
						C 63 38.00-40.00	146	80	67	29			
at 39.90m 1 No. flint cobble													
			40.00	-37.62									

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH102
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 9 of 13 Scale: 1:25

Ground Level	+2.38mOD	Coordinates	566294.05E, 175858.59N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Assumed zone of core loss.			(0.65)			C 64 40.00-41.00	146	35	20	20	NR		
Very weak low density white and light grey CHALK with abundant randomly orientated light grey burrows with cobble of nodular rinded flint (<2mm) of grey cortex. [SEAFORD CHALK FORMATION]			40.65 (0.35) 41.00	-38.27 -38.62							NI		
Assumed zone of core loss.			(1.00)								NR	HPD 41.70	
Very weak low density white and light grey CHALK with abundant randomly orientated light grey burrows. CIRIA Grade A1 [SEAFORD CHALK FORMATION] at 42.10m medium rinded flint (<1mm) grey cortex. With rare echinoid fossil (70mm) full core diameter (<1mm thick)			42.00 (1.00) 43.00	-39.62 -40.62		C 65 41.00-43.00	146	50	48	20	NA		
Assumed zone of core loss.			(0.55)								NR		
Very weak low density white and light grey CHALK with randomly orientated light grey burrows. CIRIA Grade A1 [SEAFORD CHALK FORMATION]			43.55 (0.45) 44.00	-41.17 -41.62		C 66 43.00-44.00	146	45	45	31	NA		
Assumed zone of core loss.			(0.50)								NR		
Very weak low density white and light grey CHALK with randomly orientated light grey burrows. Discontinuities: 1) 0-8 degrees closely to medium spaced smooth planar. 2) 78 degrees closely to medium spaced smooth planar. CIRIA Grade A3 [SEAFORD CHALK FORMATION] from 44.50m to 44.60m 1 No. flint cobble rinded (<1mm) grey cortex			44.50	-42.12		C 67 44.00-46.00						HPD 44.65	

AGS

Notes: All depth in metres, all diameters in millimetres.
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For details of abbreviations, see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH102
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 10 of 13 Scale: 1:25

Ground Level	+2.38mOD	Coordinates	566294.05E, 175858.59N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density white and light grey CHALK with randomly orientated light grey burrows. Discontinuities: 1) 0-8 degrees closely to medium spaced smooth planar. 2) 78 degrees closely to medium spaced smooth planar. CIRIA Grade A3 [SEAFORD CHALK FORMATION]			(1.25)				146	75	55	41	NI 150 220		
Weak medium density white and light grey CHALK with randomly orientated light grey burrows. Discontinuities: 1) 70-90 degrees closely to medium spaced planar smooth slightly striated. 2) 8-26 degrees closely to medium spaced planar to undulating smooth. CIRIA Grade A3 [LEWES NODULAR CHALK FORMATION]			45.75	-43.37									
at 45.90m medium tabular rinded flint (<1mm) grey cortex from 46.20m to 46.60m black/dark grey sponge bed						C 68 46.00-47.00	146	80	66	66			
at 47.31m subhorizontal (5 degrees) 5mm thick sheet flint at 47.61m subhorizontal (5 degrees) 6mm thick sheet flint						C 69 47.00-48.50	146	90	69	61	NI 160 600		
			(4.25)										
at 49.15m medium tabular rinded flint (<1mm) grey cortex from 49.80m to 50.00m black/dark grey sponge fragments						C 70 48.50-50.00	146	90	71	63			
			50.00	-47.62									

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH102
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 11 of 13 Scale: 1:25

Ground Level	+2.38mOD	Coordinates	566294.05E, 175858.59N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Recovered as angular to subrounded fine to coarse gravel of flint.			(1.60)			C 71 50.00-51.50	146	3	3	0	NI		
Very weak low density white and light grey CHALK with randomly orientated light grey burrows. CIRIA Grade A1 [LEWES NODULAR CHALK FORMATION]			51.60	-49.22		C 72 51.50-53.00	146	93	72	60			
at 52.40m with regular nodular rinded large to small flints (3mm) grey cortex typical from 52.50m to 52.80m with occasional black sponge beds													
at 52.70m with regular nodular rinded large to small flints (3mm) grey cortex typical			(2.60)								NA		
from 53.30m to 53.40m with regular nodular rinded large to small flints (3mm) grey cortex typical						C 73 53.00-54.50	146	87	67	33			
at 54.00m with regular nodular rinded large to small flints (3mm) grey cortex typical at 54.10m with occasional black sponge beds													
Weak medium density white and light grey CHALK with randomly orientated burrows and marl laminae. Discontinuities: 1) 10-32 degrees medium to widely spaced smooth planar. CIRIA Grade A1/2 [LEWES NODULAR CHALK FORMATION]			54.20	-51.82									
from 54.20m to 54.40m beds are medium strong weak density at 54.40m rare glauconite nodule (10mm x 5mm) bluish/grey colour													

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH102
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 12 of 13 Scale: 1:25

Ground Level	+2.38mOD	Coordinates	566294.05E, 175858.59N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Weak medium density white and light grey CHALK with randomly orientated burrows and marl laminae. Discontinuities: 1) 10-32 degrees medium to widely spaced smooth planar. CIRIA Grade A1/2 [LEWES NODULAR CHALK FORMATION]						C 74 54.50-56.00	146	83	57	51			
from 55.10m to 55.50m beds are medium strong weak density													
at 55.70m marl laminae with relict slickensides 32 degrees inclined													
from 56.15m to 56.25m beds are medium strong weak density						C 75 56.00-57.50	146	87	65	48			
			(6.30)								NI 210 5000		
from 57.40m to 59.00m beds are medium strong weak density						C 76 57.50-59.00	146	95	70	41			
						C 77 59.00-60.50	146	100	100	67			

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH102
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 13 of 13 Scale: 1:25

Ground Level	+2.38mOD	Coordinates	566294.05E, 175858.59N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Weak medium density white and light grey CHALK with randomly orientated burrows and marl laminae. Discontinuities: 1) 10-32 degrees medium to widely spaced smooth planar. CIRIA Grade A1/2 [LEWES NODULAR CHALK FORMATION]													
			60.50	-58.12									
Complete at 60.50m. Termination Reason: Achieved Scheduled Depth													

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 2

Ground Level	+2.78mOD	Coordinates	566318.71E, 175904.64N	Grid	OSGB		
Date Started	07/05/2025	Date Completed	29/05/2025	Inclination	90° from horizontal		

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit Used	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	07/05/2025 09:15	07/05/2025 10:45	TM	EC	NA	NA	Insulated Hand Tools	None	Stable	
0.00	19.80	SCP		02/05/2025 12:00								Magnetometer test only
1.20	21.40	CP	07/05/2025 10:45	15/05/2025 17:30	TM	AW	NA	NA	Dando 3000	NA	NA	
21.40	50.00	RC	28/05/2025 07:30	29/05/2025 18:00	PS	DC	Geobore S	PCD	Beretta GT54	NA	NA	

CABLE PERCUSSION DETAILS

Depth Top	Depth Base	Time Start	Duration	Tool	Remarks

WATER STRIKES

Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Elapsed Time	Remarks
08/05/2025 11:40	3.20	3.00		2.75	20	Very slow
14/05/2025 10:00	15.60	15.00		4.50	20	Fast

HOLE DIAMETER

Depth	Diameter	Remarks
2.80	300	
9.00	250	
15.60	200	
21.40	150	

CASING DIAMETER

Depth	Diameter	Remarks
3.20	300	
15.60	250	
15.60	200	
26.50	150	

ROTARY FLUSH DETAILS

Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks
21.40	50.00	WATER	80	White	

DYNAMIC SAMPLING

Top	Base	Diameter	Duration	Recovery	Remarks

INSTALLATION DETAILS

Distance	ID	Type	Response Top	Response Base	Pipe Ref

PIPE CONSTRUCTION

Pipe Ref	Top	Base	Diameter	Pipe Type

BACKFILL DETAILS

Depth Top	Depth Base	Description	Remarks

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

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SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 2 of 2

Ground Level	+2.78mOD	Coordinates	566318.71E, 175904.64N	Grid	OSGB
Date Started	07/05/2025	Date Completed	29/05/2025	Inclination	90° from horizontal

PROGRESS

Date Time	Depth	Depth Casing	Depth Water	Remarks
07/05/2025 17:30	3.00	3.00	Dry	End of Shift
08/05/2025 07:30	3.00	3.00	Dry	Start of Shift
08/05/2025 17:30	4.00	3.00	2.70	End of Shift
12/05/2025 07:30	4.00	4.00	1.00	Start of Shift
12/05/2025 17:30	9.00	9.00	6.00	End of Shift
13/05/2025 07:30	9.00	9.00	4.50	Start of Shift
13/05/2025 17:30	15.00	14.00	8.70	End of Shift
14/05/2025 07:30	15.00	14.00	8.90	Start of Shift
14/05/2025 17:30	14.60	14.60	0.10	End of Shift
15/05/2025 07:30	16.00	16.00	1.50	Start of Shift
15/05/2025 17:30	21.40	21.40	5.90	End of Shift
28/05/2025 07:30	21.40	21.40	2.00	Start of Shift
28/05/2025 18:00	29.00	22.40	2.00	End of Shift
29/05/2025 07:30	29.00	22.40	2.00	Start of Shift
29/05/2025 18:00	50.00	22.40	2.00	End of Hole

SPT DETAILS

Depth	Type	Reported Result	Hammer No.	Energy Ratio %	Casing Depth	Water Depth
16.50	C	N=12 (4,4:5,3,2,2)	69	64	16.50	2.90
17.50	C	N=23 (4,5:5,6,6,6)	69	64	17.50	3.70
18.50	C	N=24 (3,5:4,6,7,7)	69	64	18.50	4.20
19.50	C	N=28 (4,6:6,6,8,8)	69	64	19.50	4.90
20.50	C	N=29 (5,6:6,7,7,9)	69	64	20.50	5.30

DEPTH RELATED REMARKS

Top Depth	Base Depth	Remarks
2.20	3.20	Bentonite seal. Casing reduced from 300mm to 250mm
14.60	15.60	Bentonite seal. Casing reduced from 250mm to 200mm and then to 150mm
15.10	15.60	Falling Head Test in alluvium. See results at Section A of the report
20.40	22.00	Falling Head Test in alluvium. See results at Section A of the report
27.00	28.00	Falling Head Test in chalk as instructed by the client. Failed
32.00	32.50	Falling Head Test in chalk as instructed by the client. Failed
36.50	37.00	Falling Head Test in chalk as instructed by the client. Failed

GENERAL NOTES

1. Borehole left open with 15.6m of 150mm casing and 26.5m of 200m casing in the ground awaiting additional testing to be organised by FBJV 2. Continuous piston sampling in soft alluvium 3. Geophysical Logging completed

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

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SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 10 Scale: 1:25

Ground Level	+2.78mOD	Coordinates	566318.71E, 175904.64N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
MADE GROUND: Greyish brown sandy angular to subrounded fine to coarse gravel sized fragments of concrete, brick, chert and flint and mudstone with occasional rootlets. Sand is fine to coarse. (MG) [MADE GROUND]			(0.30)			D 1 0.00-0.10 ES 3 0.10-0.15 B 2 0.00-0.30							
MADE GROUND: Black slightly gravelly slightly clayey fine to coarse sand. Gravel sized fragments are angular to subangular fine to coarse of ash, brick, chert, concrete and mudstone. (MG) [MADE GROUND]			0.30	2.48		D 4 0.30-0.35							
from 0.75m to 0.90m occasional rootlets and low cobble content. Cobble sized fragments are subangular of chert.			(0.60)			B 5 0.30-0.70 ES 6 0.50-0.55							
MADE GROUND: Black mottled greyish brown sandy slightly clayey gravel sized fragments of flint, chert ash and rare brick. Sand is fine to coarse. (MG) [MADE GROUND]			0.90	1.88		ES 8 0.75-0.80 D 7 0.75-0.85 B 9 0.75-0.90 D 10 0.90-0.95 ES 11 1.00-1.05 B 12 0.90-1.20							
Possible MADE GROUND: Dark grey gravelly clay. Gravel sized fragments are angular fine of chalk. (MG) [Possible MADE GROUND]			(0.30) 1.20	1.58									
Dark grey slightly sandy subrounded to rounded fine to coarse GRAVEL of flint. Sand is fine to coarse. (ALV) [ALLUVIUM]			1.40	1.38		D 13 1.70-1.80 B 14 1.70-2.00 D 15 2.00-2.10 B 16 2.00-2.50							
from 2.80m to 2.90m very soft very dark grey slightly gravelly silty clay. Gravel is angular fine to medium of flint			(1.60)			ES 18 2.80-2.85 D 17 2.80-2.90 B 19 2.80-3.00							
Very soft dark grey silty CLAY. (ALV) [ALLUVIUM]			3.00	-0.22		P 20 3.00-4.00 D 21 4.00 P 22 4.00-5.00 D 23 5.00	100	100					

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 2 of 10 Scale: 1:25

Ground Level	+2.78mOD	Coordinates	566318.71E, 175904.64N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very soft dark grey silty CLAY. (ALV) [ALLUVIUM]													
at 5.00m indistinct pockets (<3mm) of peat. Slightly sandy. Sand is fine.						P 24 5.00-6.00	100	100					
at 6.00m soft with occasional pockets (<3mm) of peat						D 25 6.00							
						P 26 6.00-7.00	100	100					
at 7.00m black plastic pseudo fibrous peat						D 27 7.00							
						P 28 7.00-8.00	100	100					
at 8.00m occasional pockets (<10mm) of peat			(10.00)			D 29 8.00							
						P 30 8.00-9.00	100	100					
						D 31 9.00							
						P 32 9.00-10.00	100	80					
						D 33 10.00							

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 3 of 10 Scale: 1:25

Ground Level	+2.78mOD	Coordinates	566318.71E, 175904.64N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very soft dark grey silty CLAY. (ALV) [ALLUVIUM]						P 34 10.00-11.00	100	100					
						D 35 11.00							
						P 36 11.00-12.00	100	100					
at 12.00m occasional pockets (<50mm) of dark brown fibrous spongy peat						D 37 12.00							
						P 38 12.00-13.00	100	100					
Black amorphous plastic PEAT. [PEAT]			13.00	-10.22		D 39 13.00							
			(1.00)			P 40 13.00-14.00	100	100					
Soft grey slightly sandy CLAY. Sand is fine. (ALV) [ALLUVIUM]			14.00	-11.22		D 41 14.00							
						P 42 14.00-15.00	100	70					
			(1.60)			D 43 15.00							

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 4 of 10 Scale: 1:25

Ground Level	+2.78mOD	Coordinates	566318.71E, 175904.64N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Soft grey slightly sandy CLAY. Sand is fine. (ALV) [ALLUVIUM]						P 44 15.00-16.00	100	60					
			15.60	-12.82		D 45 15.60-15.65						K 15.60	
Grey and brown sandy angular to subangular fine to coarse GRAVEL of flint. Sand is fine to medium. (RTD) [RIVER TERRACE DEPOSITS] from 15.60m to 15.85m gravel is fine to medium						B 46 15.60-16.00							
												SPT(C) N=12 (4,4:5,3,2,2) 16.50	
						B 47 16.50-17.00							
						D 48 17.20-17.25							
			(3.60)									SPT(C) N=23 (4,5:5,6,6,6) 17.50	
						B 49 17.50-18.00							
						D 50 18.20-18.25							
												SPT(C) N=24 (3,5:4,6,7,7) 18.50	
						B 51 18.50-19.00							
Grey slightly gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of flint. (RTD) [RIVER TERRACE DEPOSITS]			19.20	-16.42		D 52 19.20-19.25							
												SPT(C) N=28 (4,6:6,6,8,8) 19.50	
						B 53 19.50-20.00							

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 5 of 10 Scale: 1:25

Ground Level	+2.78mOD	Coordinates	566318.71E, 175904.64N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Grey slightly gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of flint. (RTD) [RIVER TERRACE DEPOSITS]			(2.20)			D 54 20.20-20.25						K 20.40 - 22.00 SPT(C) N=29 (5,6:6,7,7,9) 20.50	
						B 55 20.50-21.00							
No recovery.			21.40 (0.60)	-18.62		D 56 21.40	146	0	0	0	NR		
Structureless CHALK composed of slightly silty sandy GRAVEL. Clasts are very weak medium density white and light grey. Frequent nodular flints medium and large (<2mm) of light grey cortex. Matrix is white. CIRIA Grade Dc [SEAFORD CHALK FORMATION]			22.00 (1.00)	-19.22		C 57 21.50-23.00	146	67	0	0	NI		
No recovery.			23.00 (1.00)	-20.22		C 58 23.00-24.50	146	35	0	0	NR		
Structureless CHALK composed of slightly silty sandy GRAVEL. Clasts are very weak medium density white chalk. Occasional nodular flints fine to coarse (<1mm) of light grey cortex. Matrix is white. [SEAFORD CHALK FORMATION]			24.00	-21.22			146	92	0	0			

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 6 of 10 Scale: 1:25

Ground Level	+2.78mOD	Coordinates	566318.71E, 175904.64N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Structureless CHALK composed of slightly silty sandy GRAVEL. Clasts are very weak medium density white chalk. Occasional nodular flints fine to coarse (<1mm) of light grey cortex. Matrix is white. [SEAFORD CHALK FORMATION] from 25.00m to 25.22m assumed zone of core loss			(3.00)			C 59 24.50-26.00	146	78	0	0	NI		
						C 60 26.00-27.50	146	98	12	0			
Very weak low density white CHALK. 1 No. discontinuity 79 degrees smooth planar. CIRIA Grade A3 [SEAFORD CHALK FORMATION] from 27.00m to 27.21m locally recovered as non intact core			27.00 (0.50)	-24.22			146	84	44	44	NI 220 220	K 27.00 - 28.00	
No recovery.			27.50 (0.40)	-24.72							NR		
Very weak locally extremely weak low density white CHALK. 1 No. discontinuity 85 degrees smooth planar with rare echinoid fossil fragments (<10mm). Rare large rinded flint nodular (<1mm) white cortex. [SEAFORD CHALK FORMATION] from 28.00m to 28.21m locally recovered as non intact core from 28.38m to 28.52m locally recovered as non intact core from 28.45m to 28.50m sponge bed. Black phosphatic from 28.90m to 29.00m large rinded flint (<1mm) white cortex			27.90 (1.10)	-25.12		C 61 27.50-29.00	146	73	31	25	NI 300 370		
No recovery.			29.00 (0.50)	-26.22							NR		
Very weak medium density white CHALK. Discontinuities: 1) 0-10 degrees extremely closely to very closely spaced smooth planar closed with occasional black speckling. CIRIA Grade A4 [SEAFORD CHALK FORMATION] from 29.50m to 29.60m rare flint large nodular (broke up by drilling)			29.50 (1.00)	-26.72		C 62 29.00-30.50	146	67	14	9			

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 7 of 10 Scale: 1:25

Ground Level	+2.78mOD	Coordinates	566318.71E, 175904.64N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak medium density white CHALK. Discontinuities: 1) 0-10 degrees extremely closely to very closely spaced smooth planar closed with occasional black speckling. CIRIA Grade A4 [SEAFORD CHALK FORMATION]											5 60 130		
			30.50	-27.72									
No recovery.			(0.85)			C 63 30.50-32.00	146	43	13	7	NR		
			31.35	-28.57									
Very weak low density white CHALK. Discontinuities: 1) 0-10 degrees medium spaced smooth planar. With rare large nodular flints. [SEAFORD CHALK FORMATION]												K 32.00 - 32.50	
from 32.20m to 32.25m medium thin white cortex flint													
from 32.76m to 32.83m medium thin white cortex flint			(2.65)			C 64 32.00-33.50	146	90	72	61	NI 100 300		
from 33.91m to 33.96m wispy thin flaser marls											NI		
			34.00	-31.22									
Very weak low density CHALK. Discontinuities: 1) 0-10 degrees medium spaced clean with occasional pale grey brown fossil burrows. With rare inoceramus shell fragments. [SEAFORD CHALK FORMATION]						C 65 33.50-35.00	146	100	96	75			
from 34.35m to 34.45m orange stained sponge bed													

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

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SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 8 of 10 Scale: 1:25

Ground Level	+2.78mOD	Coordinates	566318.71E, 175904.64N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density CHALK. Discontinuities: 1) 0-10 degrees medium spaced clean with occasional pale grey brown fossil burrows. With rare inoceramus shell fragments. [SEAFORD CHALK FORMATION]													
from 35.00m to 35.15m large thick white cortex													
from 35.72m to 35.82m marl seams with moderate orange staining						C 66 35.00-36.50	146	97	75	45			
from 35.90m to 36.00m large nodular thick white cortex													
from 36.00m to 37.00m large vertical fractures													
from 36.50m to 36.58m large nodular thick white cortex			(5.15)									K 36.50 - 37.00	
at 36.75m small pseudo with large inoceramus shell fragments											NI 100 200		
from 37.28m to 37.35m zone of giotte marls and flaser marls with possible vug relict slickensided features with relict fracturing at 37.30m possible nodular chalk from 37.30m to 37.35m with possible small nodular flints from 37.30m to 39.15m possible nodular chalk						C 67 36.50-38.00	146	87	65	21			
from 37.85m to 38.00m medium to large nodular thick white cortex													
from 38.10m to 38.17m thin white cortex													
at 38.45m 10 degrees bedding planar with large inoceramoid shell fragments													
at 38.76m medium thin white cortex at 38.80m orange stained sponge bed						C 68 38.00-39.50	146	93	77	19			
Very weak to weak low to medium density very pale grey occasionally mottled bluish CHALK. [SEAFORD CHALK FORMATION]			39.15	-36.37									
from 39.15m to 39.30m with orange iron staining. With frequent small thin white cortex flint and pseudo flint. Possible phosphatic sponge bed/or pyrite forming			(0.45)								NI 80 150		
Weak medium density white with occasional pale grey trace fossil burrows CHALK. [LEWES NODULAR CHALK FORMATION]			39.60	-36.82									

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

FINAL	Print date and time 30/09/2025 09:23	Log checked by EC
Form No. SIEXPHOLELOG	Issue.Revision No. 2.06	Issue Date 13/10/2023

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 9 of 10 Scale: 1:25

Ground Level	+2.78mOD	Coordinates	566318.71E, 175904.64N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Weak medium density white with occasional pale grey trace fossil burrows CHALK. [LEWES NODULAR CHALK FORMATION]						C 69 39.50-41.00	146	99	60	50			
from 40.55m to 40.71m medium to large thick white cortex flint			(3.08)								NI 100 200		
from 41.23m to 41.36m medium to large thick white cortex flint													
at 41.50m phosphatic sponge beds. With some small thin white cortex flints													
at 41.55m orange stained sponge bed													
at 41.70m pale grey marl seams						C 70 41.00-42.50	146	84	40	13			
at 41.90m orange stained sponge bed													
at 41.98m small thick white cortex flint													
at 42.50m orange stained sponge bed			42.68	-39.90									
Very weak low density white CHALK with very rare pale grey trace fossil burrows. Discontinuities: 1) 42-55 degrees medium spaced smooth planar to undulating occasionally slickensided with black speckling. CIRIA Grade A [LEWES NODULAR CHALK FORMATION]													
at 42.85m bedding joint with dark orange staining and slight iron mineralisation with medium thick white cortex flint at 42.87m						C 71 42.50-44.00	146	100	59	42			
from 43.70m to 43.80m small to large thick white cortex nodular flints													
at 44.40m 5mm subhorizontal grey marl						C 72 44.00-45.50	146	97	77	61			

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 10 of 10 Scale: 1:25

Ground Level	+2.78mOD	Coordinates	566318.71E, 175904.64N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density white CHALK with very rare pale grey trace fossil burrows. Discontinuities: 1) 42-55 degrees medium spaced smooth planar to undulating occasionally slickensided with black speckling. CIRIA Grade A [LEWES NODULAR CHALK FORMATION]													
at 45.70m with occasional large to small rinded nodular flints. Cortex (1-3mm) off white/pale grey													
at 46.10m with occasional large to small rinded nodular flints. Cortex (1-3mm) off white/pale grey						C 73 45.50-47.00	146	87	63	47			
			(7.32)										
at 47.80m with occasional large to small rinded nodular flints. Cortex (1-3mm) off white/pale grey						C 74 47.00-48.50	146	100	95	64	NI 170 550		
at 48.00m with occasional large to small rinded nodular flints. Cortex (1-3mm) off white/pale grey													
at 48.60m with occasional large to small rinded nodular flints. Cortex (1-3mm) off white/pale grey													
from 49.00m to 50.00m wispy grey marls													
at 49.10m with occasional large to small rinded nodular flints. Cortex (1-3mm) off white/pale grey						C 75 48.50-50.00	146	93	68	49			
at 49.90m with occasional large to small rinded nodular flints. Cortex (1-3mm) off white/pale grey													
			50.00	-47.22									
Complete at 50.00m. Termination Reason: Achieved Scheduled Depth													

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		01



Description

Depth	Description
3.00-3.20	No Recovery
3.20-3.50	Very soft grey to dark grey silty CLAY with frequent subvertical relict roots <10mm
3.50-3.77	Removed for testing
3.77-4.00	Very soft grey to dark grey silty CLAY with frequent subvertical relict roots <10mm

Photographed by	Date photographed	Filename
Adam Watts	10/07/2025	BH103 3-4

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		02



Description

Depth	Description
4.00-4.19	No Recovery
4.19-4.54	Very soft grey to dark grey silty CLAY with frequent relict roots <10mm with vertical orientation
4.54-4.60	Removed for testing
4.60-5.00	Very soft grey to dark grey silty CLAY with frequent relict roots <10mm with vertical orientation

Photographed by	Date photographed	Filename
Adam Watts	09/07/2025	BH103 4-5

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		03



Description

Depth	Description
5.00-5.15	No Recovery
5.15-5.50	Very soft grey to dark grey silty CLAY with frequent subvertical relict roots <10mm
5.50-5.82	Removed for testing
5.82-6.00	Very soft grey to dark grey silty CLAY with frequent plant remains (lens) and subvertical relict roots <10mm

Photographed by	Date photographed	Filename
Adam Watts	10/07/2025	BH103 5-6

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		04



Description

Depth	Description
6.00-6.20	No Recovery
6.20-6.86	Very soft grey to dark grey thinly laminated silty CLAY. Laminations are extremely closely spaced, parralel with frequent subvertical relict roots <10mm and frequent partilaly decayed plant leaves
6.86-7.00	Spongy brown fibrous PEAT (H4) Very muddy, water relived, plant remains, loose structure often squezing. No paste

Photographed by	Date photographed	Filename
Adam Watts	09/07/2025	BH103 6-7

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		05



Description

Depth	Description
7.00-7.38	No Recovery
7.38-7.50	Spongy black pseudofibrous PEAT (H3) Muddy, water relived. No paste
7.50-7.62	Removed for testing
7.62-8.00	Spongy black pseudofibrous PEAT (H3) Muddy, water relived. No paste

Note: Hole number mislabeled in the photo board

Photographed by	Date photographed	Filename
Adam Watts	09/07/2025	BH103 7-8

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		06



Description

Depth	Description
8.00-8.17	No Recovery
8.17-8.21	Spongy black pseudofibrous PEAT with plant remains (H4)
8.21-8.45	Very soft grey to dark grey silty CLAY with frequent subvertical relict roots <5mm
8.45-8.72	Removed for testing
8.72-9.00	Very soft grey to dark grey silty CLAY with frequent subvertical relict roots <10mm and rear peat pockets <10mm

Photographed by	Date photographed	Filename
Adam Watts	10/07/2025	BH103 8-9

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		07



Description

Depth	Description
9.00-9.35	No Recovery
9.35-10.00	Grey sandy SILT with frequent subvertical relict roots <5mm. Sand is fine

Photographed by	Date photographed	Filename
Adam Watts	09/07/2025	BH103 9-10

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		08



Description

Depth	Description
10.00-10.28	No Recovery
10.28-11.00	Grey sandy SILT with frequent subvertical relict roots <5mm. Sand is fine

Photographed by	Date photographed	Filename
Adam Watts	09/07/2025	BH103 10-11

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		09



Description

Depth	Description
11.00-11.16	No Recovery
11.16-11.50	Grey sandy SILT. Sand is fine
11.50-11.58	Removed for testing
11.58-12.00	Grey sandy SILT with frequent subvertical relict roots <5mm. Sand is fine

Photographed by	Date photographed	Filename
Adam Watts	09/07/2025	BH103 11-12

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		10



Description

Depth	Description
12.00-12.18	No Recovery
12.18-12.41	Grey and brownish grey sandy SILT. Sand is fine
12.41-12.70	Removed for testing
12.70-12.92	Very soft grey to dark grey silty CLAY with frequent subvertical relict roots <10mm
12.92-13.00	Firm black fibrous PEAT (H1)

Photographed by	Date photographed	Filename
Adam Watts	10/07/2025	BH103 12-13

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		11



Description

Depth	Description
13.00-13.34	No Recovery
13.34-13.50	Firm black fibrous PEAT (H2?)
13.50-13.68	Removed for testing
13.68-14.00	Very soft grey to dark grey thinly laminated silty CLAY. Laminations are extremely closely spaced, parralel with frequent subvertical relict roots <10mm and frequent peat pockets <25mm

Photographed by	Date photographed	Filename
Adam Watts	09/07/2025	BH103 3-4

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		12



Description

Depth	Description
14.00-14.50	No Recovery
14.50-15.00	Very soft grey to dark grey thinly laminated silty CLAY. Laminations are extremely closely spaced, subhorizontal with frequent subvertical relict roots <5mm

Photographed by	Date photographed	Filename
Adam Watts	09/07/2025	BH103 14-15

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		13



Description

Depth	Description
15.00-15.50	No Recovery
15.52-15.61	Removed for testing
15.61-15.70	Very soft grey to dark grey thinly laminated silty CLAY. Laminations are extremely closely spaced, subhorizontal with frequent subvertical relict roots <10mm
15.70-16.00	Black plastic pseudofibrous PEAT (H7)

Photographed by	Date photographed	Filename
Adam Watts	09/07/2025	BH103 15-16

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH104
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 2

Ground Level	+5.95mOD	Coordinates	566412.96E, 175708.96N	Grid	OSGB
Date Started	11/06/2025	Date Completed	18/06/2025	Inclination	90° from horizontal

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit Used	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	11/06/2025 09:15	11/06/2025 09:45	PS	SP	NA	NA	Insulated Hand Tools	None	Stable	
0.00	6.26	SCP		01/05/2025 12:00								Magnetometer test only
1.20	24.50	RO	11/06/2025 09:45	11/06/2025 00:00	PS	PS	NA	NA	Beretta GT54	NA	NA	
24.50	60.50	RC	11/06/2025 00:00	16/06/2025 18:00	PS	AW	Geobore S	PCD	Beretta GT54	NA	NA	

CABLE PERCUSSION DETAILS

Depth Top	Depth Base	Time Start	Duration	Tool	Remarks

WATER STRIKES

Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Elapsed Time	Remarks

HOLE DIAMETER

Depth	Diameter	Remarks
60.50	146	

CASING DIAMETER

Depth	Diameter	Remarks
20.50	200	
26.50	150	

ROTARY FLUSH DETAILS

Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks
1.20	12.00	WATER	50	Grey	
12.00	24.50	WATER	60	Grey	
24.50	26.00	WATER	60	White	
26.00	27.50	WATER	70	Grey	
27.50	60.50	WATER	70	White	

DYNAMIC SAMPLING

Top	Base	Diameter	Duration	Recovery	Remarks

INSTALLATION DETAILS

Distance	ID	Type	Response Top	Response Base	Pipe Ref
8.10	01	EPIE			01
20.00	02	EPIE			02
30.00	03	EPIE			03
40.00	04	EPIE			04
50.00	05	EPIE			05
60.00	06	EPIE			06

PIPE CONSTRUCTION

Pipe Ref	Top	Base	Diameter	Pipe Type

BACKFILL DETAILS

Depth Top	Depth Base	Description	Remarks
0.00	60.00	Grout	

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

FINAL | Print date and time 30/09/2025 09:31 | Log checked by EC

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH104
Engineer	Mott MacDonald		Sheet 2 of 2
Employer	FBJV		

Ground Level	+5.95mOD	Coordinates	566412.96E, 175708.96N	Grid	OSGB
Date Started	11/06/2025	Date Completed	18/06/2025	Inclination	90° from horizontal

PROGRESS

Date Time	Depth	Depth Casing	Depth Water	Remarks
11/06/2025 18:00	12.00	12.00	3.80	End of Shift
12/06/2025 07:30	12.00	12.00	4.20	Start of Shift
12/06/2025 18:00	35.00	25.00	5.80	End of Shift
13/06/2025 07:30	35.00	25.00	4.50	Start of Shift
13/06/2025 18:00	42.50	26.50	4.80	End of Shift
16/06/2025 07:30	42.50	26.50	4.80	Start of Shift
16/06/2025 18:00	60.50	26.50	4.80	End of Hole

SPT DETAILS

Depth	Type	Reported Result	Hammer No.	Energy Ratio %	Casing Depth	Water Depth

DEPTH RELATED REMARKS

Top Depth	Base Depth	Remarks
19.50	20.50	Bentonite seal. Casing reduced from 200mm to 150mm
35.00	41.00	Core lose due flints stuck in the core bit of Gebre. As a result the Geobore string had to be pulled off twice and the core being scrubbed away

GENERAL NOTES

1. VWP installation 2. 18 grout mixes used below groundwater installation 3. Geophysical Logging completed

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH104
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 13 Scale: 1:25

Ground Level	+5.95mOD	Coordinates	566412.96E, 175708.96N	Grid	OSGB
Hole Type	IP+RO+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
MADE GROUND: Brown slightly gravelly sandy clay. Sand is fine to coarse. Gravel sized fragments are subrounded to rounded fine to coarse of flint. (MG) [MADE GROUND]						ES 1 0.10 B 2 0.10-0.20							
			0.25	5.70									
MADE GROUND: Orangish brown slightly gravelly silty fine to coarse sand. Gravel sized fragments are subangular to subrounded fine to medium of concrete. (MG) [MADE GROUND] at 0.25m with rare subangular cobble sized fragments of concrete			(0.35)			ES 3 0.50 B 4 0.50-0.60							
			0.60	5.35									
MADE GROUND: Dark brown gravelly slightly clayey fine to coarse sand. Gravel sized fragments are subangular to rounded fine to coarse of concrete, metal and brick. (MG) [MADE GROUND]			(0.30)			ES 5 0.80 B 6 0.80-0.90							
			0.90	5.05									
MADE GROUND: Dark brown gravelly clay. Gravel sized fragments are angular to rounded fine to coarse of flint, concrete, brick, clinker and metal. (MG) [MADE GROUND]			(0.30)			ES 7 1.10 B 8 1.10-1.20							
			1.20	4.75									
Rotary openhole drilling. Brown man made fill. (Driller's description) (MG) [MADE GROUND]													
			(4.80)										

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH104
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 2 of 13 Scale: 1:25

Ground Level	+5.95mOD	Coordinates	566412.96E, 175708.96N	Grid	OSGB
Hole Type	IP+RO+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Rotary openhole drilling. Brown man made fill. (Driller's description) (MG) [MADE GROUND]													
			6.00	-0.05									
Rotary openhole drilling. Soft grey CLAY. (Driller's description) (ALV) [ALLUVIUM]													

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH104
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 3 of 13 Scale: 1:25

Ground Level	+5.95mOD	Coordinates	566412.96E, 175708.96N	Grid	OSGB
Hole Type	IP+RO+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling		TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
						Details	Dia.						
Rotary openhole drilling. Soft grey CLAY. (Driller's description) (ALV) [ALLUVIUM]			(14.50)										

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH104
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 4 of 13 Scale: 1:25

Ground Level	+5.95mOD	Coordinates	566412.96E, 175708.96N	Grid	OSGB
Hole Type	IP+RO+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling		TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
						Details	Dia.						
Rotary openhole drilling. Soft grey CLAY. (Driller's description) (ALV) [ALLUVIUM]													

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

FINAL Print date and time 30/09/2025 09:31 Log checked by EC

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH104
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 5 of 13 Scale: 1:25

Ground Level	+5.95mOD	Coordinates	566412.96E, 175708.96N	Grid	OSGB
Hole Type	IP+RO+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Rotary openhole drilling. Soft grey CLAY. (Driller's description) (ALV) [ALLUVIUM]													
			20.50	-14.55									
Rotary openhole drilling. SAND and GRAVEL. (Driller's description) (RTD) [RIVER TERRACE DEPOSITS]													
			(4.00)										
			24.50	-18.55									
Assumed zone of core loss.													

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH104
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 6 of 13 Scale: 1:25

Ground Level	+5.95mOD	Coordinates	566412.96E, 175708.96N	Grid	OSGB
Hole Type	IP+RO+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Assumed zone of core loss.			(1.20)			C 9 24.50-26.00	146	20	0	0	NR		
Rounded fine to coarse GRAVEL of flint and pocket of white chalk (silt). (RTD) [RIVER TERRACE DEPOSITS]			25.70 (0.30)	-19.75							NI		
Assumed zone of core loss.			26.00 (1.15)	-20.05		C 10 26.00-27.50	146	23	0	0	NR		
Structureless CHALK composed of slightly silty GRAVEL of white chalk with frequent small to large rounded flints. CIRIA Grade Dc.			27.15 (0.35)	-21.20							NI		
Assumed zone of core loss.			27.50 (0.50)	-21.55							NR		
Structureless CHALK composed of slightly silty slightly sandy GRAVEL of white chalk. CIRIA Grade Dc.			28.00 (1.00)	-22.05		C 11 27.50-29.00	146	67	8	0	NI		
Assumed zone of core loss.			29.00 (0.75)	-23.05			146	50	9	0	NR		
Structureless CHALK composed of slightly silty slightly sandy GRAVEL of white chalk with occasional rinded flints (<1mm) light grey cortex. CIRIA Grade Dc.			29.75	-23.80		C 12 29.00-30.50							

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH104
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 7 of 13 Scale: 1:25

Ground Level	+5.95mOD	Coordinates	566412.96E, 175708.96N	Grid	OSGB
Hole Type	IP+RO+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Structureless CHALK composed of slightly silty slightly sandy GRAVEL of white chalk with occasional rinded flints (<1mm) light grey cortex. CIRIA Grade Dc.			(0.75)								NI		
			30.50	-24.55									
Assumed zone of core loss.			(0.70)								NR		
			31.20	-25.25									
Structureless CHALK composed of slightly silty slightly sandy GRAVEL of white chalk rare small to medium rinded flint (<2mm) light grey cortex. CIRIA Grade Dc.			(0.80)			C 13 30.50-32.00	146	53	24	0	NI		
			32.00	-26.05									
Assumed zone of core loss.			(0.50)								NR		
			32.50	-26.55									
Structureless CHALK composed of slightly silty slightly sandy GRAVEL of white chalk. CIRIA Grade Dc.			(0.75)			C 14 32.00-33.50	146	33	17	0	NI		
			33.25	-27.30									
Very weak medium density white CHALK. Discontinuities 1) 0-39 degrees closely to medium spaced planar smooth with black speckle. With rare large rinded nodular flint (<2mm) white cortex. CIRIA Grade A3/4. [SEAFORD CHALK FORMATION]			(1.75)			C 15 33.50-35.00	146	93	58	35	50 90 160		
			35.00	-29.05									

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

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SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH104
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 8 of 13 Scale: 1:25

Ground Level	+5.95mOD	Coordinates	566412.96E, 175708.96N	Grid	OSGB
Hole Type	IP+RO+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
No recovery.							146	0					
							146	0			NR		
			(6.00)				146	0					

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH104
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 9 of 13 Scale: 1:25

Ground Level	+5.95mOD	Coordinates	566412.96E, 175708.96N	Grid	OSGB
Hole Type	IP+RO+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
No recovery.						C 19 39.50-41.00	146	7	0	0			
from 40.90m to 41.00m nodular large rinded flint (<2mm) white cortex			41.00	-35.05									
Very weak low to medium density grey/white and light grey CHALK. Fractures are drill disturbance only. CIRIA Grade A1. [SEAFORD CHALK FORMATION - BELLE TOUT BEDS]													
at 41.10m wispy fossil inoceramus and echinoids													
from 41.40m to 41.50m with occasional nodular rinded flints small to medium (<4mm) grey cortex													
at 41.60m rare fossil echinoids (>100mm diameter)						C 20 41.00-42.50	146	93	90	70			
			(3.00)								NI 120 240		
						C 21 42.50-44.00	146	98	63	60			
Assumed zone of core loss.			44.00	-38.05									
			(0.95)				146	37	33	13	NR		
Very weak greyish white and light grey medium density CHALK with abundant light grey randomly orientated burrows. No natural fractures. With occasional rinded nodular and tabular small to large flints (<3mm light grey cortex). CIRIA Grade A1. [LEWES NODULAR CHALK FORMATION]						C 22 44.00-45.50							
			44.95	-39.00									

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH104
Engineer	Mott MacDonald		Sheet 10 of 13 Scale: 1:25
Employer	FBJV		

Ground Level	+5.95mOD	Coordinates	566412.96E, 175708.96N	Grid	OSGB
Hole Type	IP+RO+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak greyish white and light grey medium density CHALK with abundant light grey randomly orientated burrows. No natural fractures. With occasional rinded nodular and tabular small to large flints (<3mm light grey cortex). CIRIA Grade A1. [LEWES NODULAR CHALK FORMATION]													
at 45.40m rarely with inoceramus and echinoid fossils (50mm diameter)													
						C 23 45.50-47.00	146	95	88	81			
at 46.45m tabular small flint. Large echinoid fossil (>100mm)													
at 46.50m nodular flint													
			(3.55)								NI 190 290		
at 47.20m nodular flint													
at 47.50m nodular flint													
						C 24 47.00-48.50	146	83	63	41			
No recovery.			48.50	-42.55									
						C 25 48.50-50.00	146	7	0	0	NR		
			(1.65)										

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH104
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 11 of 13 Scale: 1:25

Ground Level	+5.95mOD	Coordinates	566412.96E, 175708.96N	Grid	OSGB
Hole Type	IP+RO+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
No recovery.													
Very weak medium to high density greyish white and light grey CHALK with randomly orientated burrows. No natural fractures noted. With occasional nodular and tabular rinded small to large flints (<2mm of light grey cortex). CIRIA Grade A1. [LEWES NODULAR CHALK FORMATION]			50.15	-44.20									
at 50.85m with 15mm thick subhorizontal marl seam						C 26 50.00-51.50	146	90	77	77			
from 51.20m to 51.30m large tabular flints													
						C 27 51.50-53.00	146	100	63	49	NI 140 400		
from 52.80m to 52.90m with phosphatic sponge bed													
			(5.85)										
						C 28 53.00-54.50	146	93	81	63			
from 54.60m to 54.70m large zoophycos flint													

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH104
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 12 of 13 Scale: 1:25

Ground Level	+5.95mOD	Coordinates	566412.96E, 175708.96N	Grid	OSGB
Hole Type	IP+RO+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak medium to high density greyish white and light grey CHALK with randomly orientated burrows. No natural fractures noted. With occasional nodular and tabular rinded small to large flints (<2mm of light grey cortex). CIRIA Grade A1. [LEWES NODULAR CHALK FORMATION]						C 29 54.50-56.00	146	93	75	49			
Assumed zone of core loss.			56.00 (0.50)	-50.05							NR		
Very weak medium to high density greyish white and light grey CHALK with abundant randomly orientated burrows. No natural fractures noted. With rare small to medium rinded nodular flints (<1mm grey cortex). CIRIA Grade A1. [LEWES NODULAR CHALK FORMATION] from 56.80m to 56.90m with rare wispy marls			56.50	-50.55		C 30 56.00-57.50	146	67	58	27			
						C 31 57.50-59.00	146	93	73	59	NI 90 300		
			(4.00)										
from 59.40m to 59.60m with rare wispy marls						C 32 59.00-60.50	146	83	49	25			

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH104
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 13 of 13 Scale: 1:25

Ground Level	+5.95mOD	Coordinates	566412.96E, 175708.96N	Grid	OSGB
Hole Type	IP+RO+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak medium to high density greyish white and light grey CHALK with abundant randomly orientated burrows. No natural fractures noted. With rare small to medium rinded nodular flints (<1mm grey cortex). CIRIA Grade A1. [LEWES NODULAR CHALK FORMATION] at 60.20m rare glauconitic fragment													
Complete at 60.50m. Termination Reason: Achieved Scheduled Depth			60.50	-54.55									

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH105
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 2

Ground Level	+8.34mOD	Coordinates	566607.50E, 175538.42N	Grid	OSGB
Date Started	13/06/2025	Date Completed	27/06/2025	Inclination	90° from horizontal

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit Used	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	13/06/2025 09:40	13/06/2025 10:10	DS	DS	NA	NA	Insulated Hand Tools	None	Stable	
1.20	28.50	CP	13/06/2025 10:10	17/06/2025 14:00	DS	DS	NA	NA	Dando 2000	NA	NA	
28.50	60.50	RC	19/06/2025 08:30	24/06/2025 11:30	PS	AW	Geobore S	PCD	Beretta GT54	NA	NA	

CABLE PERCUSSION DETAILS

Depth Top	Depth Base	Time Start	Duration	Tool	Remarks

WATER STRIKES

Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Elapsed Time	Remarks
17/06/2025 09:00	21.90	21.90		15.60	20	Fast

HOLE DIAMETER

Depth	Diameter	Remarks
8.20	250	
19.05	200	
28.50	150	
60.50	146	

CASING DIAMETER

Depth	Diameter	Remarks
8.20	250	
22.00	200	
31.00	150	

ROTARY FLUSH DETAILS

Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks
28.50	60.50	WATER	80	White	

DYNAMIC SAMPLING

Top	Base	Diameter	Duration	Recovery	Remarks

INSTALLATION DETAILS

Distance	ID	Type	Response Top	Response Base	Pipe Ref
15.50	01	EPIE			01
24.90	02	EPIE			02
33.00	03	EPIE			03

PIPE CONSTRUCTION

Pipe Ref	Top	Base	Diameter	Pipe Type

BACKFILL DETAILS

Depth Top	Depth Base	Description	Remarks
0.00	60.50	Grout	

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH105
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 2 of 2

Ground Level	+8.34mOD	Coordinates	566607.50E, 175538.42N	Grid	OSGB
Date Started	13/06/2025	Date Completed	27/06/2025	Inclination	90° from horizontal

PROGRESS

Date Time	Depth	Depth Casing	Depth Water	Remarks
13/06/2025 17:30	8.50	8.20	Dry	End of Shift
16/06/2025 07:30	8.50	8.20	Dry	Start of Shift
16/06/2025 17:30	22.50	19.05	Dry	End of Shift
17/06/2025 07:30	20.50	19.05	Dry	Start of Shift
17/06/2025 17:30	28.50	28.46	15.60	End of Shift
19/06/2025 07:30	28.50	28.50	7.50	Start of Shift
19/06/2025 18:00	37.00	31.00	7.50	End of Shift
20/06/2025 07:30	37.00	31.00	7.50	Start of Shift
20/06/2025 18:00	45.00	31.00	7.50	End of Shift
23/06/2025 07:30	45.00	31.00	7.50	Start of Shift
23/06/2025 18:00	51.00	31.00	7.50	End of Shift
24/06/2025 07:30	51.00	31.00	7.50	Start of Shift
24/06/2025 13:25	60.50	31.00	7.50	End of Hole

SPT DETAILS

Depth	Type	Reported Result	Hammer No.	Energy Ratio %	Casing Depth	Water Depth

DEPTH RELATED REMARKS

Top Depth	Base Depth	Remarks
7.20	8.20	Bentonite seal. Casing reduced from 250mm to 200mm
21.00	22.00	Bentonite seal. Casing reduced from 200mm to 150mm
33.90	33.90	HPD test completed. See HPD reports for results
38.15	38.15	HPD test completed. See HPD reports for results
42.40	42.40	HPD test completed. See HPD reports for results
46.20	46.20	HPD test completed. See HPD reports for results
50.35	50.35	HPD test completed. See HPD reports for results

GENERAL NOTES

1. VWP installation 2. 19 grout mixes used below groundwater installation 3. HPD test at 29-31m not undertaken because the drill pocket collapsed. 4. Instructed to undertake HPD test at 31-33m but again not undertaken because the drill pocket collapsed again. 5. Geophysical Logging completed

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH105
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 13 Scale: 1:25

Ground Level	+8.34mOD	Coordinates	566607.50E, 175538.42N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Stoney Made ground(Driller's description) (MG) [MADE GROUND]						B 2 0.00-0.20 ES 1 0.10							
			0.20	8.14									
Sandy ash fill. (Driller's description) (MG) [MADE GROUND]						ES 3 0.50 B 4 0.50-0.60							
						ES 5 1.00							
			(3.60)			B 6 2.00-2.50							
			3.80	4.54									
Clay ash fill. (Driller's description) (MG) [MADE GROUND]			(0.60)			B 7 4.00-4.50							
			4.40	3.94									
Very silty SAND, (Driller's description)													

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH105
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 2 of 13 Scale: 1:25

Ground Level	+8.34mOD	Coordinates	566607.50E, 175538.42N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very silty SAND, (Driller's description)			(3.40)			B 8 6.00-6.50							
Grey ALLUVIUM. (Driller's description) (ALV) [ALLUVIUM]			7.80	0.54		B 9 8.00-8.50							

Notes: All depth in metres, all diameters in millimetres.
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SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH105
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 3 of 13 Scale: 1:25

Ground Level	+8.34mOD	Coordinates	566607.50E, 175538.42N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Grey ALLUVIUM. (Driller's description) (ALV) [ALLUVIUM]						B 10 10.00-10.50							
			(6.30)										
						B 11 12.00-12.50							
PEAT. (Driller's description)			14.10	-5.76									
						B 12 14.00-14.50							
			(0.50)										
Grey ALLUVIUM. (Driller's description) (ALV) [ALLUVIUM]			14.60	-6.26									

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH105
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 4 of 13 Scale: 1:25

Ground Level	+8.34mOD	Coordinates	566607.50E, 175538.42N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Grey ALLUVIUM. (Driller's description) (ALV) [ALLUVIUM]			(2.00)			B 13 16.00-16.50							
PEAT. (Driller's description)			16.60 (0.40)	-8.26									
Grey ALLUVIUM with occasional peat. (Driller's description) (ALV) [ALLUVIUM]			17.00 (4.90)	-8.66		B 14 18.00-18.50							

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH105
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 5 of 13 Scale: 1:25

Ground Level	+8.34mOD	Coordinates	566607.50E, 175538.42N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Grey ALLUVIUM with occasional peat. (Driller's description) (ALV) [ALLUVIUM]						B 15 20.00-20.50							
SAND and GRAVEL. (Driller's description) (RTD) [RIVER TERRACE DEPOSITS]			21.90	-13.56		B 16 22.00-22.50							
			(5.70)			B 17 24.00-24.50							

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH105
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 6 of 13 Scale: 1:25

Ground Level	+8.34mOD	Coordinates	566607.50E, 175538.42N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
SAND and GRAVEL. (Driller's description) (RTD) [RIVER TERRACE DEPOSITS]						B 18 26.00-26.50							
CHALK with flint. (Driller's description)			27.60 (0.90)	-19.26		B 19 28.00-28.50							
Assumed zone of core loss.			28.50 (1.70)	-20.16		C 1 28.50-31.00	146	32	0	0	NR		

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH105
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 7 of 13 Scale: 1:25

Ground Level	+8.34mOD	Coordinates	566607.50E, 175538.42N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Assumed zone of core loss.													
			30.20	-21.86									
Structureless CHALK composed of slightly sandy gravelly SILT. Clasts are very weak low density white with rare small and medium rinded nodular flints (<3mm) white cortex. CIRIA Ungraded. [SEAFORD CHALK FORMATION]			(0.80)								NI		
			31.00	-22.66									
No recovery.							146	0	0	0			
			(3.20)								NR		
						C 2 33.00-35.00	146	43	8	5		HPD 33.90	
			34.20	-25.86									
Structureless CHALK composed of slightly sandy gravelly SILT. Clasts are very weak low density white with frequent small to large rinded nodular flints (<2mm) light grey cortex. CIRIA Ungraded. [SEAFORD CHALK FORMATION]			(0.80)								NI		
			35.00	-26.66									

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

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SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH105
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 8 of 13 Scale: 1:25

Ground Level	+8.34mOD	Coordinates	566607.50E, 175538.42N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Assumed zone of core loss.			(0.50)								NR		
Very weak low density white CHALK recovered predominantly non intact with occasional rinded nodular small to medium flints (<2mm) light grey cortex. CIRIA Ungraded. [SEAFORD CHALK FORMATION]			35.50	-27.16		C 3 35.00-36.00	146	50	0	0			
			(1.50)			C 4 36.00-37.00	146	90	50	0	NI		
Assumed zone of core loss.			37.00	-28.66							NR		
			(0.70)										
Very weak low density white CHALK recovered predominantly non intact with occasional small to large rinded nodular flints (<1mm) white cortex. CIRIA Ungraded. [SEAFORD CHALK FORMATION]			37.70	-29.36		C 5 37.00-39.00	146	68	25	5		HPD 38.15	
			(1.90)								NI		
at 39.10m rare inoceramus shell fragments 4mm thick						C 6 39.00-39.50	146	80	24	0			
from 39.50m to 39.60m assumed zone of core loss													
Very weak low density white CHALK. Discontinuities 1) 25-28 degrees medium to widely spaced smooth planar. 2) 90 degrees medium to widely spaced rough planar with rare nodular rinded small and medium flints (<2mm) light grey cortex. CIRIA Grade A2. [SEAFORD CHALK FORMATION - CUCKMERE BEDS]			39.60	-31.26									
from 39.90m to 40.25m fossiliferous band													

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH105
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 9 of 13 Scale: 1:25

Ground Level	+8.34mOD	Coordinates	566607.50E, 175538.42N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density white CHALK. Discontinuities 1) 25-28 degrees medium to widely spaced smooth planar. 2) 90 degrees medium to widely spaced rough planar with rare nodular rinded small and medium flints (<2mm) light grey cortex. CIRIA Grade A2. [SEAFORD CHALK FORMATION - CUCKMERE BEDS]						C 7 39.50-41.00	146	90	64	22			
			(3.90)								NI 80 140		
at 42.00m abundant echinoid fossils 2mm diameter full core width. Occasional phosphatic sponge beds						C 8 41.00-43.50	146	87	60	39		HPD 42.40	
at 43.00m abundant echinoid fossils 2mm diameter full core width. Occasional phosphatic sponge beds													
from 43.40m to 43.50m abundant echinoid fossils 2mm diameter full core width. Occasional phosphatic sponge beds													
			43.50	-35.16									
Assumed zone of core loss.			(0.35)								NR		
			43.85	-35.51									
Very weak low density white and light grey CHALK with light grey subhorizontal <3mm thick wispy marls. Discontinuities 1) 69-70 degrees medium to widely spaced planar slickensided black staining. CIRIA Grade A1. [SEAFORD CHALK FORMATION - BELLE TOUT BEDS]													
at 44.20m rare nodular rinded small to large flints (<2mm) white cortex						C 9 43.50-45.00	146	80	51	51			
at 44.70m phosphatic sponges													

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH105
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 10 of 13 Scale: 1:25

Ground Level	+8.34mOD	Coordinates	566607.50E, 175538.42N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density white and light grey subhorizontal <3mm thick wispy marls. Discontinuities 1) 69-70 degrees medium to widely spaced planar slickensided black staining. CIRIA Grade A1. [SEAFORD CHALK FORMATION - BELLE TOUT BEDS]													
at 45.30m rare nodular rinded small to large flints (<2mm) white cortex													
						C 10 45.00-47.00	146	85	82	49		HPD 46.20	
at 46.40m rare nodular rinded small to large flints (<2mm) white cortex			(5.15)										
											NI 120 240		
at 47.20m rare nodular rinded small to large flints (<2mm) white cortex													
at 47.80m rare nodular rinded small to large flints (<2mm) white cortex						C 11 47.00-48.50	146	83	64	26			
at 48.00m rare nodular rinded small to large flints (<2mm) white cortex													
						C 12 48.50-49.00	146	88	74	58			
Assumed zone of core loss.			49.00	-40.66									
			(0.65)								NR		
Very weak locally weak low to medium density white and light grey CHALK with randomly orientated light grey burrows subhorizontal wispy grey marls. No natural fractures noted. CIRIA Grade A1. [SEAFORD CHALK FORMATION - BELLE TOUT BEDS]			49.65	-41.31									
at 49.70m occasional small to large nodular rinded flints (<2mm) white cortex						C 13 49.00-51.00							

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH105
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 11 of 13 Scale: 1:25

Ground Level	+8.34mOD	Coordinates	566607.50E, 175538.42N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak locally weak low to medium density white and light grey CHALK with randomly orientated light grey burrows subhorizontal wispy grey marls. No natural fractures noted. CIRIA Grade A1. [SEAFORD CHALK FORMATION - BELLE TOUT BEDS]													
at 50.00m occasional small to large nodular rinded flints (<2mm) white cortex												HPD 50.35	
			(1.85)				146	67	51	12	20 70 340		
at 50.80m black phosphatic sponges													
from 50.90m to 51.00m occasional small to large nodular rinded flints (<2mm) white cortex													
from 51.00m to 51.15m assumed zone of core loss													
at 51.15m occasional small to large nodular rinded flints (<2mm) white cortex						C 14 51.00-51.50	146	100	68	68			
Assumed zone of core loss.			51.50	-43.16									
			(1.30)			C 15 51.50-53.00	146	13	13	9	NR		
Weak locally very weak low to medium density white and light grey CHALK. Abundant randomly orientated light grey burrows. No natural fractures noted. CIRIA Grade A1. [SEAFORD CHALK FORMATION - BELLE TOUT BEDS]			52.80	-44.46									
from 53.00m to 53.25m assumed zone of core loss													
at 53.40m occasional flints nodular rinded medium and large (<2mm) light grey cortex						C 16 53.00-54.50	146	83	65	45			
at 54.30m light grey and grey wispy marls subhorizontal <3mm thick													

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH105
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 12 of 13 Scale: 1:25

Ground Level	+8.34mOD	Coordinates	566607.50E, 175538.42N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Weak locally very weak low to medium density white and light grey CHALK. Abundant randomly orientated light grey burrows. No natural fractures noted. CIRIA Grade A1. [SEAFORD CHALK FORMATION - BELLE TOUT BEDS]						C 17 54.50-56.00	146	95	79	73	NI 100 310		
at 55.05m possible tabular flint medium rinded (<2mm) light grey cortex													
at 55.20m occasional flints nodular rinded medium and large (<2mm) light grey cortex													
at 55.50m occasional flints nodular rinded medium and large (<2mm) light grey cortex. Black phosphatic sponge beds/patches													
at 55.80m occasional flints nodular rinded medium and large (<2mm) light grey cortex													
at 56.15m occasional flints nodular rinded medium and large (<2mm) light grey cortex													
at 56.25m occasional flints nodular rinded medium and large (<2mm) light grey cortex													
at 56.55m light grey and grey wispy marls subhorizontal <3mm thick			(7.70)			C 18 56.00-57.50	146	97	91	84			
from 57.50m to 57.60m assumed zone of core loss													
at 57.60m occasional flints nodular rinded medium and large (<2mm) light grey cortex													
from 58.00m to 58.20m occasional flints nodular rinded medium and large (<2mm) light grey cortex						C 19 57.50-59.00	146	89	67	50			
at 58.50m occasional flints nodular rinded medium and large (<2mm) light grey cortex													
from 59.00m to 59.20m assumed zone of core loss													
at 59.40m black phosphatic sponge beds/patches						C 20 59.00-60.50	146	89	79	55			
at 59.90m occasional flints nodular rinded medium and large (<2mm) light grey cortex													

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH105
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 13 of 13 Scale: 1:25

Ground Level	+8.34mOD	Coordinates	566607.50E, 175538.42N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Weak locally very weak low to medium density white and light grey CHALK. Abundant randomly orientated light grey burrows. No natural fractures noted. CIRIA Grade A1. [SEAFORD CHALK FORMATION - BELLE TOUT BEDS]													
			60.50	-52.16									
Complete at 60.50m. Termination Reason: Achieved Scheduled Depth													

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 2

Ground Level	+2.01mOD	Coordinates	567471.65E, 174224.03N	Grid	OSGB		
Date Started	01/05/2025	Date Completed	22/05/2025	Inclination	90° from horizontal		

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit Used	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	6.26	SCP		02/05/2025 12:00								Magnetometer test only
0.00	1.20	IP	01/05/2025 15:30	01/05/2025 16:00	KG	SP	NA	NA	Insulated Hand Tools	None	Stable	
1.20	20.00	RO	02/05/2025 08:00	07/05/2025 09:30	KG	AW	NA	Tricone	Com 450	NA	NA	
20.00	60.00	RC	07/05/2025 09:30	22/05/2025 10:00	KG	AW	Geobore S	PCD	Com 450	NA	NA	

CABLE PERCUSSION DETAILS

Depth Top	Depth Base	Time Start	Duration	Tool	Remarks

WATER STRIKES

Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Elapsed Time	Remarks

HOLE DIAMETER

Depth	Diameter	Remarks
60.00	146	

CASING DIAMETER

Depth	Diameter	Remarks
12.00	200	
21.00	150	

ROTARY FLUSH DETAILS

Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks
1.20	12.00	WATER	60	Grey	
12.00	20.00	WATER	50	Grey	
20.00	60.00	WATER	70	White	

DYNAMIC SAMPLING

Top	Base	Diameter	Duration	Recovery	Remarks

INSTALLATION DETAILS

Distance	ID	Type	Response Top	Response Base	Pipe Ref

PIPE CONSTRUCTION

Pipe Ref	Top	Base	Diameter	Pipe Type

BACKFILL DETAILS

Depth Top	Depth Base	Description	Remarks
0.00	60.00	Grout	

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

SOIL ENGINEERING

FINAL | Print date and time 30/09/2025 09:31 | Log checked by PAR

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 2 of 2

Ground Level	+2.01mOD	Coordinates	567471.65E, 174224.03N	Grid	OSGB
Date Started	01/05/2025	Date Completed	22/05/2025	Inclination	90° from horizontal

PROGRESS

Date Time	Depth	Depth Casing	Depth Water	Remarks
01/02/2025 18:00	1.20	0.00		End of Shift
02/05/2025 07:30	1.20	0.00		Start of Shift
02/05/2025 18:00	1.20	0.00		End of Shift
06/05/2025 07:30	1.20	0.00		Start of Shift
06/05/2025 18:00	19.50	18.00		End of Shift
07/05/2025 07:30	19.50	18.00		End of Shift
07/05/2025 18:00	21.50	20.00		End of Shift
08/05/2025 07:30	21.50	20.00		Start of Shift
08/05/2025 18:00	36.50	21.00		End of Shift
09/05/2025 07:30	36.50	21.00		Start of Shift
09/05/2025 18:00	44.00	21.00		End of Shift
12/05/2025 07:30	44.00	21.00		Start of Shift
12/05/2025 18:00	53.00	21.00		End of Shift
13/05/2025 07:30	53.00	21.00		Start of Shift
13/05/2025 18:00	60.00	21.00		End of Borehole
14/05/2025 07:30	60.00	21.00		Start of Shift
14/05/2025 18:00	60.00	21.00		End of Shift
15/05/2025 07:30	60.00	21.00		Start of Shift
15/05/2025 18:00	60.00	21.00		End of Shift
16/05/2025 07:30	60.00	21.00		Start of Shift
16/05/2025 18:00	60.00	21.00		End of Shift
19/05/2025 07:30	60.00	21.00		Start of Shift
19/05/2025 18:00	60.00	21.00		End of Shift
20/05/2025 07:30	60.00	21.00		Start of Shift
20/05/2025 18:00	60.00	21.00		End of Shift
21/05/2025 07:30	60.00	21.00		Start of Shift
21/05/2025 18:00	60.00	21.00		End of Shift
22/05/2025 07:30	60.00	21.00		Start of Shift
22/05/2025 10:00				Backfill Complete

SPT DETAILS

Depth	Type	Reported Result	Hammer No.	Energy Ratio %	Casing Depth	Water Depth

DEPTH RELATED REMARKS

Top Depth	Base Depth	Remarks
11.00	12.00	Bentonite seal. Casing reduced from 200mm to 150mm
25.50	26.50	Packer Test. Failed
29.50	30.50	Packer Test. Failed
33.50	34.50	Packer Test. Failed
35.00	37.00	Packer Test. Failed
37.00	39.00	Packer Test. Failed
41.00	43.00	Packer Test. Failed

GENERAL NOTES

1. 16 grout mixes used 2. Geophysical Logging completed

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 12 Scale: 1:25

Ground Level	+2.01mOD	Coordinates	567471.65E, 174224.03N	Grid	OSGB
Hole Type	IP+RO+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
TOPSOIL: Dark grey clay with frequent rootlets. (TS) [TOPSOIL]			(0.40)			ES 1 0.10-0.15 ES 2 0.30-0.35							
Firm grey mottled orangish brown CLAY. (ALV) [ALLUVIUM]			0.40 (0.60)	1.61		D 5 0.50-0.55 ES 3 0.50-0.55							
Firm fissured grey mottled brown CLAY. Fissures are extremely closely spaced randomly orientated and closed. (ALV) [ALLUVIUM]			1.00	1.01		ES 4 1.00-1.05 D 7 1.00-1.10 B 6 1.00-1.20							
Rotary openhole drilling. CLAY. (Driller's description) (ALV) [ALLUVIUM]			1.20	0.81									

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 2 of 12 Scale: 1:25

Ground Level	+2.01mOD	Coordinates	567471.65E, 174224.03N	Grid	OSGB
Hole Type	IP+RO+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling		TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
						Details	Dia.						
Rotary openhole drilling. CLAY. (Driller's description) (ALV) [ALLUVIUM]			(10.80)										

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 3 of 12 Scale: 1:25

Ground Level	+2.01mOD	Coordinates	567471.65E, 174224.03N	Grid	OSGB
Hole Type	IP+RO+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Rotary openhole drilling. CLAY. (Driller's description) (ALV) [ALLUVIUM]													
			12.00	-9.99									
Rotary openhole drilling. SAND. (Driller's description) (RTD) [RIVER TERRACE DEPOSITS]													
			(5.00)										

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

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SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 4 of 12 Scale: 1:25

Ground Level	+2.01mOD	Coordinates	567471.65E, 174224.03N	Grid	OSGB
Hole Type	IP+RO+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Rotary openhole drilling. SAND. (Driller's description) (RTD) [RIVER TERRACE DEPOSITS]													
			17.00	-14.99									
Rotary openhole drilling. SAND and GRAVEL (Driller's description) (RTD) [RIVER TERRACE DEPOSITS]													
			(3.00)										
			20.00	-17.99									

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 5 of 12 Scale: 1:25

Ground Level	+2.01mOD	Coordinates	567471.65E, 174224.03N	Grid	OSGB
Hole Type	IP+RO+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Assumed zone of core loss.			(0.80)								NR		
Structureless CHALK composed of slightly silty slightly sandy GRAVEL. Clasts are very weak low density white with black specks. Rare fine gravel sized nodular flints with white cortex. Matrix is white. CIRIA Grade Dc [SEAFORD CHALK FORMATION]			20.80	-18.79		C 8 20.00-21.50	146	47	0	0			
			(1.50)			C 9 21.50-22.25	146	80	0	0	NA		
Very weak low density white stained yellow and speckled black CHALK with rare flint cobbles nodular with white cortex (<2mm). Recovered principally as non intact core. Discontinuities: 1) 90 degrees very closely spaced open planar smooth. 2) 27-30 degrees very closely spaced open planar smooth. CIRIA Grade B5 [SEAFORD CHALK FORMATION]			22.30	-20.29		C 10 22.25-23.00	146	100	0	0			
from 23.00m to 23.42m recovered as non intact core (angular to subrounded fine to coarse gravel and cobble sized fragments)			(1.20)								NI		
Very weak low density white locally stained orange brown CHALK with fine and medium gravel sized nodular rinded flints with white cortex. Discontinuities: 1) 70-90 degrees very closely to closely spaced smooth planar to undulating open to partially open. Chalk infill (up to 2mm). Black speckling on surfaces. 2) 0-45 degrees very closely to closely spaced smooth planar to undulating open to partially open with chalk infill (up to 2mm) and black speckling. CIRIA Grade B4 [SEAFORD CHALK FORMATION]			23.50	-21.49		C 11 23.00-24.50	146	100	49	23			
from 23.63m to 23.82m recovered as non intact core (angular to subrounded fine to coarse gravel sized fragments) from 24.00m to 24.15m recovered as non intact core (angular to subangular fine to coarse gravel sized fragments)													
from 24.50m to 24.88m recovered as non intact core (angular to subangular fine to coarse gravel sized fragments)													

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

FINAL	Print date and time 30/09/2025 09:31	Log checked by PAR
Form No. SIEXPHOLELOG	Issue.Revision No. 2.06	Issue Date 13/10/2023

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 6 of 12 Scale: 1:25

Ground Level	+2.01mOD	Coordinates	567471.65E, 174224.03N	Grid	OSGB
Hole Type	IP+RO+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density white locally stained orange brown CHALK with fine and medium gravel sized nodular rinded flints with white cortex. Discontinuities: 1) 70-90 degrees very closely to closely spaced smooth planar to undulating open to partially open. Chalk infill (up to 2mm). Black speckling on surfaces. 2) 0-45 degrees very closely to closely spaced smooth planar to undulating open to partially open with chalk infill (up to 2mm) and black speckling. CIRIA Grade B4 [SEAFORD CHALK FORMATION]			(4.00)			C 12 24.50-26.00	146	90	63	27			
from 25.20m to 25.30m recovered as non intact core (angular to subrounded fine to medium gravel sized fragments) from 25.33m to 25.62m recovered as non intact core (angular to subrounded fine to coarse gravel sized fragments)													
from 26.18m to 26.26m recovered as non intact core (angular to subangular fine to coarse gravel sized fragments)											NI 70 120		
						C 13 26.00-27.50	146	91	65	36			
from 27.25m to 27.50m recovered as non intact core (angular to subrounded fine to coarse gravel sized fragments)													
Very weak low density white rarely stained orange brown CHALK. Discontinuities: 1) 81-90 degrees closely to medium locally closely spaced smooth planar with black speckling. 2) 0-45 degrees closely to medium spaced smooth planar occasionally with black specking. CIRIA Grade A3/B3 [SEAFORD CHALK FORMATION]			27.50	-25.49									
from 28.02m to 28.09m recovered as non intact core (angular to subrounded fine to medium gravel sized fragments)						C 14 27.50-29.00	146	100	80	59	NI 120 250		
from 29.00m to 29.30m assumed zone of core loss													
from 29.30m to 29.55m recovered as non intact core (angular to subrounded fine to coarse gravel and cobble sized fragments) from 29.30m to 30.00m frequent medium rinded flint (<2mm) white cortex							146	80	48	19	NI 70 120		
from 29.60m to 29.88m recovered as non intact core (angular to subrounded fine to coarse gravel sized fragments)						C 15 29.00-30.50							

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 7 of 12 Scale: 1:25

Ground Level	+2.01mOD	Coordinates	567471.65E, 174224.03N	Grid	OSGB
Hole Type	IP+RO+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density white rarely stained orange brown CHALK. Discontinuities: 1) 81-90 degrees closely to medium locally closely spaced smooth planar with black speckling. 2) 0-45 degrees closely to medium spaced smooth planar occasionally with black specking. CIRIA Grade A3/B3 [SEAFORD CHALK FORMATION]													
from 30.65m to 35.00m Grade A3/A2													
from 31.10m to 31.15m frequent medium rinded flint (<2mm) white cortex			(7.50)			C 16 30.50-32.00	146	100	96	66			
from 31.48m to 31.50m recovered as non intact core (angular to subrounded fine to coarse gravel sized fragments)													
from 32.00m to 32.40m assumed zone of core loss													
at 32.45m rare fossils bivalves (100mm) (full core diameter) from 32.50m to 32.60m recovered as non intact core (angular to subrounded fine to coarse gravel sized fragments of chalk and frequent medium rinded flint with white cortex)						C 17 32.00-33.50	146	71	60	60	NI 120 250		
from 33.68m to 33.74m recovered as non intact core (angular to subrounded fine to coarse gravel sized fragments of chalk and predominantly flint)													
from 34.25m to 34.35m recovered as non intact core (angular to subrounded fine to coarse gravel sized fragments)						C 18 33.50-35.00	146	97	81	41			
			35.00	-32.99									

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 8 of 12 Scale: 1:25

Ground Level	+2.01mOD	Coordinates	567471.65E, 174224.03N	Grid	OSGB
Hole Type	IP+RO+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Weak medium density white with light grey (randomly orientated burrows) CHALK. Discontinuities: 1) 0-37 degrees medium spaced locally closely to widely spaced smooth planar. 2) 76-90 degrees medium spaced locally closely to widely spaced smooth planar. Rarely light black speckling. With occasional medium to large rinded flint (<2mm) with white cortex. CIRIA Grade A2 [SEAFORD CHALK FORMATION]						C 19 35.00-36.50	146	93	85	82			
from 37.30m to 37.34m recovered as non intact core (angular to subangular fine to medium gravel sized fragments of chalk and flint)						C 20 36.50-38.00	146	99	81	81	NI 250 830		
from 37.60m to 37.73m recovered as non intact core (clayey angular to subrounded fine to coarse gravel and cobble sized fragments)			(6.90)			C 21 38.00-39.50	146	100	93	93			
from 39.67m to 39.76m recovered as non intact core (angular to subrounded fine to coarse gravel and cobble sized fragments)													

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 9 of 12 Scale: 1:25

Ground Level	+2.01mOD	Coordinates	567471.65E, 174224.03N	Grid	OSGB
Hole Type	IP+RO+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Weak medium density white with light grey (randomly orientated burrows) CHALK. Discontinuities: 1) 0-37 degrees medium spaced locally closely to widely spaced smooth planar. 2) 76-90 degrees medium spaced locally closely to widely spaced smooth planar. Rarely light black speckling. With occasional medium to large rinded flint (<2mm) with white cortex. CIRIA Grade A2 [SEAFORD CHALK FORMATION]						C 22 39.50-41.00	146	100	94	83			
from 41.00m to 41.10m assumed zone of core loss													
from 41.88m to 41.95m recovered as non intact core (angular to subangular fine to medium gravel sized fragments)			41.90	-39.89		C 23 41.00-42.50	146	89	76	76			
Weak medium density white CHALK. Discontinuities: 1) 7-33 degrees closely to medium spaced smooth planar. 2) 72-90 degrees closely to medium spaced smooth undulating to planar with black speckling. With rare fossil bivalves (70mm). CIRIA Grade A2/A3 [SEAFORD CHALK FORMATION]													
from 42.10m to 42.20m 1 No. black flint													
from 42.20m to 42.46m orange brown staining/sponge bed occasional large nodular rinded flint (<2mm) of white or grey cortex													
from 42.50m to 42.80m assumed zone of core loss						C 24 42.50-44.00	146	80	53	50			
from 44.00m to 44.28m recovered as non intact core (angular to subrounded medium to coarse gravel and cobble sized fragments of chalk and flint)						C 25 44.00-45.50	146	100	89	76			

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 10 of 12 Scale: 1:25

Ground Level	+2.01mOD	Coordinates	567471.65E, 174224.03N	Grid	OSGB
Hole Type	IP+RO+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Weak medium density white CHALK. Discontinuities: 1) 7-33 degrees closely to medium spaced smooth planar. 2) 72-90 degrees closely to medium spaced smooth undulating to planar with black speckling. With rare fossil bivalves (70mm). CIRIA Grade A2/A3 [SEAFORD CHALK FORMATION]													
from 45.28m to 45.32m recovered as non intact core (angular to subrounded fine to coarse gravel sized fragments)													
			(8.10)			C 26 45.50-47.00	146	100	91	91			
from 46.40m to 46.50m recovered as non intact core (angular to subrounded coarse gravel sized fragments of chalk and flint)													
at 46.60m rare bryozoan full core diameter													
from 46.80m to 46.86m recovered as non intact core (angular to subrounded fine to coarse gravel sized fragments of chalk and flint)													
from 47.00m to 47.20m assumed zone of core loss													
from 47.40m to 47.50m recovered as non intact core (angular medium to coarse gravel and cobble sized fragments)						C 27 47.00-48.50	146	87	80	72	NI 250 280		
from 48.50m to 48.60m assumed zone of core loss													
from 48.85m to 48.95m large full core flint						C 28 48.50-50.00	146	92	85	64			
from 49.85m to 49.90m large full core flint			50.00	-47.99									

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 11 of 12 Scale: 1:25

Ground Level	+2.01mOD	Coordinates	567471.65E, 174224.03N	Grid	OSGB
Hole Type	IP+RO+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Weak medium density white and light grey CHALK. Discontinuities: 1) 0-20 degrees closely to medium spaced smooth planar to undulating locally with infill of chalk (<30mm). With abundant light grey randomly orientated burrows. Rare fossil bivalve (1 No. ceramas) up to full core diameter. Occasional small to medium rinded nodular flint white cortex (<1mm). Rare fossil echinoidea up to full core diameter. CIRIA Grade A2/3 locally B3 [SEAFORD CHALK FORMATION]													
from 50.00m to 50.25m assumed zone of core loss													
from 50.65m to 50.68m recovered as non intact core (angular fine to coarse gravel sized fragments)						C 29 50.00-51.50	146	77	62	52			
from 51.00m to 51.35m recovered as non intact core (angular to subrounded fine to coarse gravel and cobble sized fragements of flint)													
						C 30 51.50-53.00	146	100	97	93	NI 260 440		
			(5.20)										
						C 31 53.00-54.50	146	100	93	89			

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 12 of 12 Scale: 1:25

Ground Level	+2.01mOD	Coordinates	567471.65E, 174224.03N	Grid	OSGB
Hole Type	IP+RO+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Weak medium density white and light grey CHALK. Discontinuities: 1) 0-20 degrees closely to medium spaced smooth planar to undulating locally with infill of chalk (<30mm). With abundant light grey randomly orientated burrows. Rare fossil bivalve (1 No. ceramas) up to full core diameter. Occasional small to medium rinded nodular flint white cortex (<1mm). Rare fossil echinoidea up to full core diameter. CIRIA Grade A2/3 locally B3 [SEAFORD CHALK FORMATION]			55.20	-53.19		C 32 54.50-56.00	146	100	86	80			
from 55.00m to 55.10m recovered as non intact core (angular fine to coarse gravel sized fragments of chalk and flint)													
Weak medium density white light grey locally orange brown stained CHALK. Discontinuities: 1) 0-23 degrees closely to medium locally widely spaced planar with some chalk infill (40mm). With black speckling on surface. With rare pyrite crystals (30mm x 30mm). Rare medium to coarse nodular flints rinded (<2mm) cortex white/grey. Occasional wispy grey marl (1-5mm diameter). CIRIA Grade A2/A3 rarely B3 [SEAFORD CHALK FORMATION]													
from 55.30m to 55.50m orange brown sponge bed													
from 55.80m to 55.84m recovered as non intact core (angular to subrounded fine to coarse gravel sized fragments)													
from 55.97m to 56.02m recovered as non intact core (angular medium to coarse gravel sized fragments)													
from 56.70m to 56.80m orange brown bryozoans inside core sample						C 33 56.00-57.50	146	92	82	77			
from 57.30m to 57.40m recovered as non intact (angular coarse gravel and cobble sized fragments of flint)													
			(4.80)								150 300 640		
						C 34 57.50-59.00	146	100	100	87			
						C 35 59.00-60.00	146	97	88	61			
Complete at 60.00m. Termination Reason: Achieved Scheduled Depth			60.00	-57.99									

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 2

Ground Level	+2.27mOD	Coordinates	567423.32E, 174162.53N	Grid	OSGB
Date Started	22/05/2025	Date Completed	04/07/2025	Inclination	90° from horizontal

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit Used	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	27/05/2025 13:40	27/05/2025 14:20	DS	SP	NA	NA	Insulated Hand Tools	None	Stable	
0.00	6.26	SCP		01/05/2025 12:00								Magnetometer test only
1.20	19.60	CP	27/05/2025 14:20	29/05/2025 10:30	DS	AW	NA	NA	Dando 2000	NA	NA	
19.60	60.50	RC	01/07/2025 00:00	03/07/2025 00:00	PS	AW	Geobore S	PCD	Beretta GT54	NA	NA	

CABLE PERCUSSION DETAILS

Depth Top	Depth Base	Time Start	Duration	Tool	Remarks

WATER STRIKES

Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Elapsed Time	Remarks
28/05/2025 12:45	12.80	12.45		4.60	20	Fast

HOLE DIAMETER

Depth	Diameter	Remarks
12.45	200	
19.50	150	
60.50	146	

CASING DIAMETER

Depth	Diameter	Remarks
12.90	200	
20.60	150	

ROTARY FLUSH DETAILS

Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks
19.60	60.50	WATER	80	White	

DYNAMIC SAMPLING

Top	Base	Diameter	Duration	Recovery	Remarks

INSTALLATION DETAILS

Distance	ID	Type	Response Top	Response Base	Pipe Ref

PIPE CONSTRUCTION

Pipe Ref	Top	Base	Diameter	Pipe Type

BACKFILL DETAILS

Depth Top	Depth Base	Description	Remarks

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 2 of 2

Ground Level	+2.27mOD	Coordinates	567423.32E, 174162.53N	Grid	OSGB
Date Started	22/05/2025	Date Completed	04/07/2025	Inclination	90° from horizontal

PROGRESS

Date Time	Depth	Depth Casing	Depth Water	Remarks
27/05/2025 17:30	5.00	5.00	Dry	End of Shift
28/05/2025 07:30	5.00	5.00	Dry	Start of Shift
28/05/2025 17:30	16.00	16.00	3.80	End of Shift
29/05/2025 07:30	16.00	16.00	3.70	Start of Shift
29/05/2025 11:30	19.60	19.60	3.90	End of CP
30/06/2025 07:30	19.60	19.60	1.00	Start of Shift
30/06/2025 15:00	19.60	19.60	1.00	End of Shift
01/07/2025 07:30	19.60	19.60	1.50	Start of Shift
01/07/2025 18:00	30.00	20.60	1.50	End of Shift
02/07/2025 07:30	30.00	20.60	1.50	Start of Shift
02/07/2025 18:00	42.00	20.60	1.50	End of Shift
03/07/2025 07:30	42.00	20.60	1.50	Start of Shift
03/07/2025 18:00	60.50	20.60	1.50	End of Hole

SPT DETAILS

Depth	Type	Reported Result	Hammer No.	Energy Ratio %	Casing Depth	Water Depth
1.20	S	N=3 (1,0:1,0,1,1)	AR493	55	1.20	Dry
3.00	S	N=2 (1,0:0,1,0,1)	AR493	55	3.00	Dry
5.00	S	N=1 (1,0:0,0,1,0)	AR493	55	5.00	Dry
7.00	S	N=3 (1,0:0,1,1,1)	AR493	55	7.00	Dry
9.00	S	N=3 (1,0:1,0,1,1)	AR493	55	9.00	Dry
11.00	S	N=4 (1,1:1,1,1,1)	AR493	55	11.00	Dry
13.50	S	N=10 (2,2:2,2,3,3)	AR493	55	13.50	4.10
15.00	C	N=31 (4,5:6,8,8,9)	AR493	55	15.00	3.20
16.50	C	N=24 (3,4:5,5,7,7)	AR493	55	16.50	4.30
18.00	C	N=35 (4,6:8,8,9,10)	AR493	55	18.00	4.40

DEPTH RELATED REMARKS

Top Depth	Base Depth	Remarks
3.04	3.04	Shear Vane Test completed. See CPT report for results
5.00	5.00	Shear Vane Test completed. See CPT report for results
7.00	7.00	Shear Vane Test completed. See CPT report for results
9.00	9.00	Shear Vane Test completed. See CPT report for results
11.00	11.00	Shear Vane Test completed. See CPT report for results
11.90	12.90	Bentonite seal. Casing reduced from 200mm to 150mm
12.00	12.00	Shear Vane Test completed. See CPT report for results
12.45	12.80	Falling Head Test in alluvium. See results at Section A of the report
13.00	13.00	Shear Vane Test failed, No peak stress observed
22.80	22.80	HPD test completed. See HPD reports for results
27.00	27.00	HPD test completed. See HPD reports for results
30.80	30.80	HPD test completed. See HPD reports for results
35.00	35.00	HPD test completed. See HPD reports for results
39.00	39.00	HPD test completed. See HPD reports for results
43.50	43.50	HPD test completed. See HPD reports for results

GENERAL NOTES

1. Borehole left open with 12.45m of 150mm casing and 20.6m of 200mm casing in the ground awaiting additional testing to be organised by FBJV 2. Intermittent piston sampling in soft alluvium 3 All scheduled HPD tests completed 4. Geophysical Logging completed

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 13 Scale: 1:25

Ground Level	+2.27mOD	Coordinates	567423.32E, 174162.53N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
TOPSOIL: Dark grey mottled brown slightly gravelly CLAY with abundant rootlets. Gravel is angular medium to coarse of flint. (TS) [TOPSOIL]			(0.40)			D 1 0.00-0.05 B 3 0.00-0.40 ES 2 0.30-0.35							
Firm to stiff grey mottled brown CLAY with occasional rootlets. (ALV) [ALLUVIUM]			0.40 (0.50)	1.87		D 4 0.40-0.45 ES 5 0.60-0.65 B 6 0.40-0.90							
Very soft to soft grey mottled brown silty CLAY with occasional rootlets. (ALV) [ALLUVIUM]			0.90 (0.30)	1.37		D 7 0.90-0.95 ES 8 1.00-1.05 B 9 0.90-1.20							
Very soft dark grey silty CLAY. (ALV) [ALLUVIUM] from 1.20m to 1.65m brown			1.20	1.07		D 10 1.20-1.65 B 11 1.20-1.70 ES 12 2.00 P 13 2.00-3.00 D 14 3.00 D 15 3.00-3.45 B 16 3.00-3.50 D 17 3.70-3.75 ES 18 4.00 P 19 4.00-5.00 W 50 4.60 D 20 5.00	100	80				SPT(S) N=3 (1,0:1,0,1,1) 1.20 SPT(S) N=2 (1,0:0,1,0,1) 3.00 SPT(S) N=1 (1,0:0,0,1,0) 5.00	
			(6.20)										

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 2 of 13 Scale: 1:25

Ground Level	+2.27mOD	Coordinates	567423.32E, 174162.53N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very soft dark grey silty CLAY. (ALV) [ALLUVIUM]						B 21 5.00-5.50							
						D 22 5.70-5.75							
						ES 23 6.00							
						P 24 6.00-7.00	100	70					
						D 25 7.00						SPT(S) N=3 (1,0:0,1,1,1) 7.00	
						D 26 7.00-7.45 B 27 7.00-7.50							
Very soft dark grey mottled black silty CLAY. (ALV) [ALLUVIUM]			7.40	-5.13		D 28 7.40-7.45							
						ES 29 8.00							
						P 30 8.00-9.00	100	70					
from 9.00m to 9.45m with occasional decayed organic material						D 31 9.00						SPT(S) N=3 (1,0:1,0,1,1) 9.00	
			(3.80)			D 32 9.00-9.45 B 33 9.00-9.50							
						D 34 9.70-9.75							

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 3 of 13 Scale: 1:25

Ground Level	+2.27mOD	Coordinates	567423.32E, 174162.53N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very soft dark grey mottled black silty CLAY. (ALV) [ALLUVIUM]						P 35 10.00-11.00	100	70					
						D 36 11.00						SPT(S) N=4 (1,1:1,1,1,1) 11.00	
Very soft dark grey and black silty CLAY with frequent beds of black amorphous peat. (ALV) [ALLUVIUM]			11.20	-8.93		D 37 11.00-11.45 D 38 11.20-11.25 B 39 11.00-11.50 ES 40 11.30-11.35							
			(0.40)										
Very soft dark grey silty CLAY. (ALV) [ALLUVIUM]			11.60	-9.33		D 41 11.60							
						B 42 11.60-12.00							
						P 43 12.00-12.30	100	100					
			(1.30)			D 44 12.30-12.35							
						B 45 12.30-12.80						K 12.45 - 12.80	
Dark grey gravelly fine to coarse SAND. Gravel is subrounded to rounded fine to coarse of flint. (RTD) [RIVER TERRACE DEPOSITS] from 12.90m to 12.95m no gravel present			12.90	-10.63		D 46 12.90-12.95							
						B 47 12.90-13.40							
												SPT(S) N=10 (2,2:2,2,3,3) 13.50	
						D 48 13.50-13.95 B 49 13.50-14.00							
			(1.90)										
Brown mottled grey and black slightly sandy subangular to rounded fine to coarse GRAVEL of flint. (RTD) [RIVER TERRACE DEPOSITS]			14.80	-12.53		D 51 14.80-14.85 B 52 14.80-15.00							
												SPT(C) N=31 (4,5:6,8,8,9) 15.00	

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 4 of 13 Scale: 1:25

Ground Level	+2.27mOD	Coordinates	567423.32E, 174162.53N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Brown mottled grey and black slightly sandy subangular to rounded fine to coarse GRAVEL of flint. (RTD) [RIVER TERRACE DEPOSITS]						B 53 15.00-15.50							
from 16.00m to 16.50m greyish brown sandy						D 54 16.00						SPT(C) N=24 (3,4:5,5,7,7) 16.50	
						B 55 16.50-17.00							
			(4.50)										
						D 56 17.50-17.55						SPT(C) N=35 (4,6:8,8,9,10) 18.00	
						B 57 18.00-18.50							
White CHALK recovered as slightly silty angular fine to coarse gravel.			19.30	-17.03		D 58 19.30-19.35							
			(0.30)										
Structureless CHALK composed of slightly silty slightly sandy GRAVEL. Clasts are very weak medium density white with occasional small and medium rinded flints (<4mm) white cortex. CIRIA Grade Dc. [SEAFORD CHALK FORMATION]			19.60	-17.33									

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 5 of 13 Scale: 1:25

Ground Level	+2.27mOD	Coordinates	567423.32E, 174162.53N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Structureless CHALK composed of slightly silty slightly sandy GRAVEL. Clasts are very weak medium density white with occasional small and medium rinded flints (<4mm) white cortex. CIRIA Grade Dc. [SEAFORD CHALK FORMATION]			(0.90)			C 1 19.60-20.50	146	60	0	0	NI		
			20.50	-18.23									
No recovery.			(0.90)								NR		
						C 2 20.50-22.00	146	40	0	0			
			21.40	-19.13									
Structureless CHALK composed of slightly silty slightly sandy GRAVEL. Clasts are very weak medium density white with rare orange brown staining with rare medium sized rinded nodular flints (<2mm) white cortex. CIRIA Ungraded. [SEAFORD CHALK FORMATION]			(0.60)								NI		
			22.00	-19.73									
Assumed zone of core loss.			(1.10)								NR	HPD 22.80	
						C 3 22.00-24.00	146	45	0	0			
Structureless CHALK composed of slightly silty sandy GRAVEL. Clasts are very weak medium density white with rare orange brown staining with occasional small and medium rinded nodular flints (<3mm) white cortex. CIRIA Ungraded. [SEAFORD CHALK FORMATION]			23.10	-20.83							NI		
						C 4 24.00-24.50	146	100	18	0			
from 24.50m to 24.90m assumed zone of core loss			(2.90)										

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 6 of 13 Scale: 1:25

Ground Level	+2.27mOD	Coordinates	567423.32E, 174162.53N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Structureless CHALK composed of slightly silty sandy GRAVEL. Clasts are very weak medium density white with rare orange brown staining with occasional small and medium rinded nodular flints (<3mm) white cortex. CIRIA Ungraded. [SEAFORD CHALK FORMATION]						C 5 24.50-26.00	146	73	7	0			
Assumed zone of core loss.			26.00	-23.73							NR		
			(0.90)										
Structureless CHALK composed of slightly silty slightly sandy GRAVEL. Clasts are very weak medium density white with rare orange brown staining. CIRIA Ungraded. [SEAFORD CHALK FORMATION]			26.90	-24.63		C 6 26.00-28.00	146	55	9	0	NI	HPD 27.00	
			(1.30)										
Very weak low density white locally stained orange brown CHALK. Discontinuities 1) 85-90 degrees closely spaced smooth planar with black speckle or orange brown staining. 2) 26 degrees closely spaced planar smooth rare nodular flints small and medium rinded (<2mm) light grey cortex. CIRIA Grade A3/4. [SEAFORD CHALK FORMATION - CUCKMERE BEDS]			28.20	-25.93		C 7 28.00-29.00	146	100	50	31			
			(1.80)								NI 90 120		
from 29.90m to 30.00, orange brown sponges						C 8 29.00-30.00	146	55	30	18			
			30.00	-27.73									

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 7 of 13 Scale: 1:25

Ground Level	+2.27mOD	Coordinates	567423.32E, 174162.53N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Assumed zone of core loss.			(1.15)								NR	HPD 30.80	
						C 9 30.00-32.00	146	43	3	0			
Structureless CHALK composed of slightly silty slightly sandy GRAVEL. Clasts are very weak medium dense white locally stained orange brown. Occasional small and medium nodular rinded flints (<2mm) white cortex. CIRIA Ungraded. [SEAFORD CHALK FORMATION]			31.15	-28.88									
			(0.85)										
Assumed zone of core loss.			32.00	-29.73							NR		
			(0.50)										
Very weak low density white CHALK. Discontinuities 1) 85-90 degrees closely spaced planar smooth black speckling, occasionally polished. 2) 60 degrees closely spaced planar smooth with rare nodular rinded flints small to medium sized (<2mm) light grey cortex. CIRIA Grade A3. [SEAFORD CHALK FORMATION - CUCKMERE BEDS]			32.50	-30.23									
						C 10 32.00-33.50	146	67	48	31	NI 60 130		
			(1.50)										
						C 11 33.50-34.00	146	100	30	0			
Assumed zone of core loss.			34.00	-31.73							NR		
			(1.10)										
						C 12 34.00-36.00						HPD 35.00	

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 8 of 13 Scale: 1:25

Ground Level	+2.27mOD	Coordinates	567423.32E, 174162.53N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Assumed zone of core loss.													
Very weak low density white CHALK recovered mostly non intact fractures with occasional small and medium rinded nodular flints (<2mm) white cortex). CIRIA Ungraded. [SEAFORD CHALK FORMATION]			35.10	-32.83			146	45	3	0			
			(1.40)										
from 36.00m to 36.25m assumed zone of core loss						C 13 36.00-36.50	146	50	32	0			
Assumed zone of core loss.			36.50	-34.23							NR		
			(1.00)			C 14 36.50-38.00	146	33	5	0			
Very weak low density white CHALK recovered mostly non intact with occasional small and medium rinded nodular flints (<2mm) white cortex. CIRIA Ungraded. [SEAFORD CHALK FORMATION]			37.50	-35.23									
			(0.50)										
Assumed zone of core loss.			38.00	-35.73							NR		
			(0.90)										
Very weak low density white locally stained orange brown CHALK recovered mostly non intact with occasional small to large rinded nodular flints (<2mm) white cortex. CIRIA Ungraded. [SEAFORD CHALK FORMATION]			38.90	-36.63		C 15 38.00-40.00	146	55	12	0		HPD 39.00	
			(1.40)										

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 9 of 13 Scale: 1:25

Ground Level	+2.27mOD	Coordinates	567423.32E, 174162.53N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density white locally stained orange brown CHALK recovered mostly non intact with occasional small to large rinded nodular flints (<2mm) white cortex. CIRIA Ungraded. [SEAFORD CHALK FORMATION]													
from 40.00m to 40.30m assumed zone of core loss			40.30	-38.03									
Extremely weak and very weak low density white CHALK. Discontinuities 1) 80-90 degrees closely spaced planar smooth matt with black speckling. 2) 12-30 degrees closely spaced planar smooth clean rarely stained orange brown. CIRIA Grade A3/4. [SEAFORD CHALK FORMATION]						C 16 40.00-41.00	146	70	46	37			
from 41.00m to 41.25m assumed zone of core loss			(1.70)								NI 70 240		
						C 17 41.00-42.00	146	75	75	63			
Assumed zone of core loss.			42.00	-39.73									
			(1.60)								NR		
						C 18 42.00-44.00	146	20	5	0		HPD 43.50	
Very weak low density white locally stained orange brown CHALK with rare flint recovered mostly non intact. CIRIA Ungraded. [SEAFORD CHALK FORMATION]			43.60	-41.33									
			(0.40)										
Assumed zone of core loss.			44.00	-41.73									
			(0.65)								NR		
							146	57	39	27			
Very weak low density white locally orange brown stained CHALK. Discontinuities 1) 85 degrees closely spaced planar smooth orange brown stained. Occasional rinded nodular flint medium to large with (<1mm) light grey cortex. CIRIA Grade A2/3. [SEAFORD CHALK FORMATION - CUCKMERE BEDS]			44.65	-42.38		C 19 44.00-45.50							

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 10 of 13 Scale: 1:25

Ground Level	+2.27mOD	Coordinates	567423.32E, 174162.53N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density white locally orange brown stained CHALK. Discontinuities 1) 85 degrees closely spaced planar smooth orange brown stained. Occasional rinded nodular flint medium to large with (<1mm) light grey cortex. CIRIA Grade A2/3. [SEAFORD CHALK FORMATION - CUCKMERE BEDS]			(1.35)								NI 50 100		
						C 20 45.50-46.00	146	90	76	62			
Assumed zone of core loss.			46.00	-43.73							NR		
			(0.50)										
Very weak low density white locally orange brown stained CHALK. Discontinuities1) 70-90 degrees medium spaced planar smooth with occasional black staining and rarely orange brown staining. CIRIA Grade A2. [SEAFORD CHALK FORMATION - CUCKMERE BEDS]			46.50	-44.23									
						C 21 46.00-48.00	146	75	33	5		HPD 47.00	
at 47.30m with rare nodular rinded small to large flints (<2mm) light grey cortex													
from 48.00m to 48.25m assumed zone of core loss													
						C 22 48.00-48.50	146	50	42	26	NI 80 290		
at 48.30m with rare nodular rinded small to large flints (<2mm) light grey cortex													
from 48.50m to 48.60m assumed zone of core loss													
			(5.60)			C 23 48.50-50.00	146	93	54	34			
at 49.80m with rare nodular rinded small to large flints (<2mm) light grey cortex													

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 11 of 13 Scale: 1:25

Ground Level	+2.27mOD	Coordinates	567423.32E, 174162.53N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density white locally orange brown stained CHALK. Discontinuities1) 70-90 degrees medium spaced planar smooth with occasional black staining and rarely orange brown staining. CIRIA Grade A2. [SEAFORD CHALK FORMATION - CUCKMERE BEDS]													
at 50.50m with rare fossil fragment (<5mm)													
at 50.70m with rare nodular rinded small to large flints (<2mm) light grey cortex at 50.75m rare glauconite grain grey green (20mm x 3mm)						C 24 50.00-51.50	146	90	83	83			
from 51.10m to 51.70m assumed zone of core loss													
from 51.90m to 52.10m <3mm white cortex													
			52.10	-49.83									
Very weak low density white and light grey CHALK. Frequent randomly orientated light grey burrows. Discontinuities 1) 65-70 degrees medium to widely spaced planar smooth clean rarely slickensided and striated with black staining. Rare fossil echinoid fragments throughout. CIRIA Grade A1/2. [SEAFORD CHALK FORMATION - BELLE TOUT BEDS]						C 25 51.50-53.00	146	87	15	8			
at 52.60m with occasional orange brown sponge beds													
at 53.30m with occasional nodular rinded small to large flints (<2mm) white cortex													
at 53.50m with occasional nodular rinded small to large flints (<2mm) white cortex						C 26 53.00-54.50	146	90	56	36			
at 54.50m with occasional orange brown sponge beds													
at 54.60m with occasional nodular rinded small to large flints (<2mm) white cortex													
at 54.95m inoceramus fragment													

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 12 of 13 Scale: 1:25

Ground Level	+2.27mOD	Coordinates	567423.32E, 174162.53N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density white and light grey CHALK. Frequent randomly orientated light grey burrows. Discontinuities 1) 65-70 degrees medium to widely spaced planar smooth clean rarely slickensided and striated with black staining. Rare fossil echinoid fragments throughout. CIRIA Grade A1/2. [SEAFORD CHALK FORMATION - BELLE TOUT BEDS]						C 27 54.50-56.00							
at 55.00m with occasional nodular rinded small to large flints (<2mm) white cortex at 55.40m with occasional nodular rinded small to large flints (<2mm) white cortex							146	100	82	45			
at 55.90m rare light grey and grey wispy marls subhorizontal (1-5mm)			(8.40)										
						C 28 56.00-57.50	146	100	89	83	NI 130 290		
from 57.00m to 57.50m fossiliferous band contains abundant fossil echinoids >100mm wide, <3mm thick at 57.20m with occasional nodular rinded small to large flints (<2mm) white cortex													
at 58.00m with occasional nodular rinded small to large flints (<2mm) white cortex						C 29 57.50-59.00	146	100	86	78			
at 58.30m rare light grey and grey wispy marls subhorizontal (1-5mm). Occasional orange brown sponge beds													
at 59.20m rare light grey and grey wispy marls subhorizontal (1-5mm)							146	100	68	47			
at 59.80m with occasional nodular rinded small to large flints (<2mm) white cortex at 59.90m rare light grey and grey wispy marls subhorizontal (1-5mm)						C 30 59.00-60.50							

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 13 of 13 Scale: 1:25

Ground Level	+2.27mOD	Coordinates	567423.32E, 174162.53N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density white and light grey CHALK. Frequent randomly orientated light grey burrows. Discontinuities 1) 65-70 degrees medium to widely spaced planar smooth clean rarely slickensided and striated with black staining. Rare fossil echinoid fragments throughout. CIRIA Grade A1/2. [SEAFORD CHALK FORMATION - BELLE TOUT BEDS]													
at 60.00m with occasional nodular rinded small to large flints (<2mm) white cortex													
			60.50	-58.23									
Complete at 60.50m. Termination Reason: Achieved Scheduled Depth													

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 2

Ground Level	+2.35mOD	Coordinates	567435.36E, 174079.58N	Grid	OSGB		
Date Started	19/05/2025	Date Completed	19/06/2025	Inclination	90° from horizontal		

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit Used	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	19/05/2025 15:20	19/05/2025 16:20	DS	SP	NA	NA	Insulated Hand Tools	None	Stable	
0.00	6.26	SCP		01/05/2025 12:00								Magnetometer test only
1.20	20.40	CP	20/05/2025 07:30	22/05/2025 13:00	DS	AW	NA	NA	Dando 2000	NA	NA	
21.00	60.50	RC	09/06/2025 16:30	16/06/2025 12:00	KG	AW	Geobore S	PCD	Com 405	NA	NA	

CABLE PERCUSSION DETAILS

Depth Top	Depth Base	Time Start	Duration	Tool	Remarks

WATER STRIKES

Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Elapsed Time	Remarks
21/05/2025 09:50	12.00	12.00		4.31	20	Fast

HOLE DIAMETER

Depth	Diameter	Remarks
12.00	200	
21.00	150	
60.50	146	

CASING DIAMETER

Depth	Diameter	Remarks
12.00	200	
21.00	150	

ROTARY FLUSH DETAILS

Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks
21.00	60.50	WATER	80	White	

DYNAMIC SAMPLING

Top	Base	Diameter	Duration	Recovery	Remarks

INSTALLATION DETAILS

Distance	ID	Type	Response Top	Response Base	Pipe Ref
14.50	G2	SP	12.50	14.50	Pipe2
23.00	G1	SP	21.00	23.00	Pipe1

PIPE CONSTRUCTION

Pipe Ref	Top	Base	Diameter	Pipe Type
Pipe1	0.00	21.50	50	PLAIN
Pipe2	0.00	13.00	50	PLAIN
Pipe2	13.00	14.00	50	SLOTTED
Pipe1	21.50	22.50	50	SLOTTED

BACKFILL DETAILS

Depth Top	Depth Base	Description	Remarks
0.00	0.50	Concrete	
0.50	0.80	Gravel backfill	
0.80	12.50	Bentonite	
12.50	14.50	Sand backfill	
14.50	21.00	Bentonite	
21.00	23.00	Sand backfill	
23.00	60.50	Grout	

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 2 of 2

Ground Level	+2.35mOD	Coordinates	567435.36E, 174079.58N	Grid	OSGB
Date Started	19/05/2025	Date Completed	19/06/2025	Inclination	90° from horizontal

PROGRESS

Date Time	Depth	Depth Casing	Depth Water	Remarks
19/05/2025 17:30	1.20	1.20	Dry	End of Shift
20/05/2025 07:30	1.20	1.20	Dry	Start of Shift
20/05/2025 17:30	10.00	10.00	Dry	End of Shift
21/05/2025 07:30	10.00	10.00	Dry	Start of Shift
21/05/2025 17:30	16.30	16.00	5.10	End of Shift
22/05/2025 07:30	16.30	16.30	3.40	Start of Shift
22/05/2025 13:00	21.00	21.00	1.80	End of CP
09/06/2025 18:00	23.00	21.00		End of shift
10/06/2025 07:30	23.00	21.00	2.5	Start of Shift
10/06/2025 18:00	31.00	21.00		End of Shift
11/06/2025 07:30	31.00	21.00	2.3	Start of Shift
11/06/2025 18:00	37.00	21.00		End of Shift
12/06/2025 07:30	37.00	21.00	2.3	Start of Shift
12/06/2025 18:00	50.00	21.00		End of Shift
13/06/2025 07:30	50.00	21.00	2.6	Start of Shift
13/06/2025 14:00	57.50	21.00		End of Shift
16/06/2025 07:30	57.50	21.00	2.4	Start of Shift
16/06/2025 17:00	60.50	21.00		End of Hole
19/06/2025 10:00	0.00	0.00		Installation Complete

SPT DETAILS

Depth	Type	Reported Result	Hammer No.	Energy Ratio %	Casing Depth	Water Depth
1.20	S	N=10 (1,1:2,2,3,3)	AR493	55	1.20	Dry
2.00	S	N=8 (1,1:1,2,2,3)	AR493	55	2.00	Dry
13.50	S	N=3 (1,0:0,1,1,1)	AR493	55	13.50	3.70
15.00	S	N=4 (1,1:0,1,1,2)	AR493	55	15.00	4.90
16.50	C	N=15 (2,2:3,4,4,4)	AR493	55	16.50	3.80
18.00	C	N=18 (2,3:4,5,4,5)	AR493	55	18.00	4.40
19.50	C	N=24 (3,4:5,6,6,7)	AR493	55	19.50	2.10

DEPTH RELATED REMARKS

Top Depth	Base Depth	Remarks
11.00	12.00	Bentonite seal. Casing reduced from 200mm to 150mm
11.50	12.00	Falling Head Test in alluvium. See results at Section A of the report
21.00	23.00	HPD pocket collapsed. Insufficient space to form HPD test. Poor recovery due to HPD barrel diameter and chalk nature (structureless)
24.30	24.30	HPD test completed. See HPD reports for results
26.10	26.10	HPD test failed due to membrane rapture
27.90	27.90	HPD test completed. See HPD reports for results
32.20	32.20	HPD test completed. See HPD reports for results
34.20	34.20	HPD test completed. See HPD reports for results
36.40	36.40	HPD test completed. See HPD reports for results
40.30	40.30	HPD test completed. See HPD reports for results
42.40	42.40	HPD test completed. See HPD reports for results

GENERAL NOTES

1. Continuous piston sampling in soft alluvium 2. 10 grout mixes used below groundwater installation. 3. Geophysical Logging completed

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 13 Scale: 1:25

Ground Level	+2.35mOD	Coordinates	567435.36E, 174079.58N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
TOPSOIL: Dark grey clay with frequent rootlets. (TS) [TOPSOIL]			(0.30)			D 1 0.00-0.05 ES 2 0.10-0.15 B 3 0.00-0.30							
Yellowish brown slightly gravelly fine to coarse SAND. Gravel is angular to sub angular fine to medium of flint. (ALV) [ALLUVIUM]			0.30 (0.30)	2.05		D 4 0.30-0.35 ES 5 0.30-0.35 B 6 0.30-0.60							
Very stiff fissured brown mottled orangish brown CLAY. Fissures are extremely closely spaced randomly orientated and closed. (ALV) [ALLUVIUM]			0.60 (0.40)	1.75		D 7 0.60-0.65 ES 8 0.60-0.65 B 9 0.60-1.00							
Soft brown silty CLAY. (ALV) [ALLUVIUM] from 1.00m to 1.05m very soft			1.00 (3.00)	1.35		D 10 1.00-1.05 D 11 1.20-1.65 B 12 1.20-1.70 D 13 1.80-1.85 D 14 2.00-2.45 B 15 2.00-2.50 W 47 3.40 P 16 3.00-4.00	100	60				SPT(S) N=10 (1,1:2,2,3,3) 1.20 SPT(S) N=8 (1,1:1,2,2,3) 2.00	
Very soft dark grey silty CLAY with frequent pockets (<5mm) of black peat. (ALV) [ALLUVIUM]			4.00	-1.65		D 17 4.00 P 18 4.00-5.00 D 19 5.00	100	80					

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 2 of 13 Scale: 1:25

Ground Level	+2.35mOD	Coordinates	567435.36E, 174079.58N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very soft dark grey silty CLAY with frequent pockets (<5mm) of black peat. (ALV) [ALLUVIUM]						P 20 5.00-6.00	100	70					
from 6.00m to 7.00m pockets of peat (<10mm). Mild peaty odour			(4.00)			D 21 6.00							
						P 22 6.00-7.00	100	80					
						D 23 7.00							
						P 24 7.00-8.00	100	70					
Very soft dark grey silty CLAY. (ALV) [ALLUVIUM]			8.00	-5.65		D 25 8.00							
			(1.00)			P 26 8.00-9.00	100	60					
Firm amorphous dark grey PEAT with 1 No. gastropod fossil (<1mm). [PEAT]			9.00	-6.65		D 27 9.00							
			(1.00)			P 28 9.00-10.00	100	80					
			10.00	-7.65		D 29 10.00							

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 3 of 13 Scale: 1:25

Ground Level	+2.35mOD	Coordinates	567435.36E, 174079.58N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very soft dark grey silty CLAY. (ALV) [ALLUVIUM]													
from 10.00m to 11.00m with frequent pockets (<10mm) of peat						P 30 10.00-11.00	100	80					
from 11.00m to 11.80m soft			(2.00)			D 31 11.00							
						P 32 11.00-12.00	100	60					
						D 33 11.80							
						B 34 11.80-12.00							
Dark grey silty fine SAND. (RTD) [RIVER TERRACE DEPOSITS]			12.00	-9.65								K 12.00	
						PF 12.00-12.20	100	0					
						D 35 12.20							
						B 36 12.20-12.70							
from 13.0m to 13.50m with rare fossil fragments (<5mm)						D 37 13.00-13.10							
			(2.30)										
from 13.50m to 14.30m soft dark grey sandy clay												SPT(S) N=3 (1,0:0,1,1,1) 13.50	
						D 38 13.50-13.95							
						B 39 13.50-14.00							
Brown mottled grey clayey fine to coarse SAND. (RTD) [RIVER TERRACE DEPOSITS]			14.30	-11.95		D 40 14.30							
						B 41 14.30-14.80							
			(1.00)										
												SPT(S) N=4 (1,1:0,1,1,2) 15.00	

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 4 of 13 Scale: 1:25

Ground Level	+2.35mOD	Coordinates	567435.36E, 174079.58N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Brown mottled grey clayey fine to coarse SAND. (RTD) [RIVER TERRACE DEPOSITS] from 15.00m to 15.30m slightly sandy clayey subangular to rounded gravel of flint						D 42 15.00-15.45 B 43 15.00-15.50 D 44 15.30							
Brown slightly sandy subangular to rounded fine to coarse GRAVEL of flint. (RTD) [RIVER TERRACE DEPOSITS] from 15.30m to 15.80m sandy			15.30	-12.95		D 45 15.80 B 46 15.80-16.30						SPT(C) N=15 (2,2:3,4,4,4) 16.50	
			(5.10)			B 48 16.50-17.00 D 49 17.50 B 50 18.00-18.50 D 51 19.00 B 52 19.50-20.00						SPT(C) N=18 (2,3:4,5,4,5) 18.00 SPT(C) N=24 (3,4:5,6,6,7) 19.50	

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 5 of 13 Scale: 1:25

Ground Level	+2.35mOD	Coordinates	567435.36E, 174079.58N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Brown slightly sandy subangular to rounded fine to coarse GRAVEL of flint. (RTD) [RIVER TERRACE DEPOSITS]													
No recovery.			20.40	-18.05		D 53 20.40						HPD 24.30	

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 6 of 13 Scale: 1:25

Ground Level	+2.35mOD	Coordinates	567435.36E, 174079.58N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
No recovery.			(10.40)								NR	HPD 26.10 HPD 27.90	
						C 54 29.00-30.50	146	0					

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 7 of 13 Scale: 1:25

Ground Level	+2.35mOD	Coordinates	567435.36E, 174079.58N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
No recovery.													
						C 55 30.50-31.00	146	40	0	0			
Non intact core recovered as rounded fine to coarse gravel of flints (<1mm) light grey cortex. CIRIA Ungraded.			30.80	-28.45							NI		
No recovery.			31.00	-28.65							NR	HPD 32.20	
			(6.65)									HPD 34.20	

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

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SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 8 of 13 Scale: 1:25

Ground Level	+2.35mOD	Coordinates	567435.36E, 174079.58N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
No recovery.												HPD 36.40	
						C 56 37.00-38.00	146	35	0	0			
Non intact core recovered as rounded to subangular fine to coarse gravel of rinded flints small to large (<2mm) white cortex. CIRIA Ungraded.			37.65	-35.30							NI		
			(0.35)										
Very weak low density white CHALK. One Discontinuity 90 degrees smooth planar clean. CIRIA Grade A2/3. [SEAFORD CHALK FORMATION] from 38.00m to 38.20m assumed zone of core loss from 38.20m to 38.40m with rare rinded nodular large flint (<2mm) light grey cortex			38.00	-35.65		C 57 38.00-39.00	146	80	59	36	36 36 44		
			(1.00)										
No recovery.			39.00	-36.65									

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

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Form No. SIEXPHOLELOG	Issue.Revision No. 2.06	Issue Date 13/10/2023

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 9 of 13 Scale: 1:25

Ground Level	+2.35mOD	Coordinates	567435.36E, 174079.58N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
No recovery.			(4.00)								NR	HPD 40.30	
												HPD 42.40	
Very weak low density white locally light grey CHALK with occasional small to large rinded nodular flints (<1mm of light grey cortex). Discontinuities1) 0-60 degrees closely to medium spaced planar smooth closed speckled 2) 85-90 degrees closely to medium spaced planar undulating smooth clean speckled black with light grey burrow structures mostly subhorizontal. CIRIA Grade A3/4. [SEAFORD CHALK FORMATION - HAVEN BROW BEDS]			43.00	-40.65		C 58 43.00-44.00	146	70	38	0			
						C 59 44.00-45.50	146	93	74	51			
from 44.95m to 45.00m rare orangish brown sponges throughout													

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 10 of 13 Scale: 1:25

Ground Level	+2.35mOD	Coordinates	567435.36E, 174079.58N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density white locally light grey CHALK with occasional small to large rinded nodular flints (<1mm of light grey cortex). Discontinuities1) 0-60 degrees closely to medium spaced planar smooth closed speckled 2) 85-90 degrees closely to medium spaced planar undulating smooth clean speckled black with light grey burrow structures mostly subhorizontal. CIRIA Grade A3/4. [SEAFORD CHALK FORMATION - HAVEN BROW BEDS]													
						C 60 45.50-47.00	146	100	73	47			
			(7.00)										
						C 61 47.00-48.50	146	100	63	35	NI 100 180		
						C 62 48.50-50.00	146	100	76	59			
			50.00	-47.65									

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

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SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 11 of 13 Scale: 1:25

Ground Level	+2.35mOD	Coordinates	567435.36E, 174079.58N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Assumed zone of core loss.			(0.50)								NR		
Very weak low density white CHALK. Discontinuities 1) 85-90 degrees closely to medium spaced smooth planar speckled black with rare small to medium nodular rinded flints)<2mm light grey cortex). CIRIA Grade A1. [SEAFORD CHALK FORMATION - CUCKMERE BEDS]			50.50	-48.15		C 63 50.00-51.50	146	67	63	49	NI 180 300		
from 51.40m to 51.50m with orangish brown sponge beds, abundant shell fragments (<10mm)			(1.00)										
Assumed zone of core loss.			51.50	-49.15							NR		
			(0.50)										
Very weak locally weak low to medium density white locally orangish brown CHALK with occasional small to large nodular rinded flint (<2mm of light grey cortex). Discontinuities 1) 3-30 degrees closely to widely spaced planar undulating smooth speckled black. 2) 65-80 degrees closely to widely spaced planar undulating smooth speckled black. CIRIA Grade A2/3. [SEAFORD CHALK FORMATION - CUCKMERE BEDS]			52.00	-49.65		C 64 51.50-53.00	146	67	33	21			
						C 65 53.00-54.50	146	100	81	63			

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 12 of 13 Scale: 1:25

Ground Level	+2.35mOD	Coordinates	567435.36E, 174079.58N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak locally weak low to medium density white locally orangish brown CHALK with occasional small to large nodular rinded flint (<2mm of light grey cortex). Discontinuities 1) 3-30 degrees closely to widely spaced planar undulating smooth speckled black. 2) 65-80 degrees closely to widely spaced planar undulating smooth speckled black. CIRIA Grade A2/3. [SEAFORD CHALK FORMATION - CUCKMERE BEDS]						C 66 54.50-56.00	146	93	76	70			
at 55.70m with occasional orangish brown stained fossil sponge beds at 55.80m with occasional fossil echinoids shell fragments, rare wispy grey marl													
from 56.10m to 56.30m with occasional orangish brown stained fossil sponge beds			(8.50)										
						C 67 56.00-57.50	146	100	86	76			
at 56.85m with occasional orangish brown stained fossil sponge beds											NI 180 410		
						C 68 57.50-59.00	146	100	85	67			
at 59.50m with occasional fossil echinoids shell fragments, rare wispy grey marl							146	100	82	71			
						C 69 59.00-60.50							

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 13 of 13 Scale: 1:25

Ground Level	+2.35mOD	Coordinates	567435.36E, 174079.58N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak locally weak low to medium density white locally orangish brown CHALK with occasional small to large nodular rinded flint (<2mm of light grey cortex). Discontinuities 1) 3-30 degrees closely to widely spaced planar undulating smooth speckled black. 2) 65-80 degrees closely to widely spaced planar undulating smooth speckled black. CIRIA Grade A2/3. [SEAFORD CHALK FORMATION - CUCKMERE BEDS] from 60.00m to 60.30m with occasional orangish brown stained fossil sponge beds			60.50	-58.15									
Complete at 60.50m. Termination Reason: Achieved Scheduled Depth													

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		01



Description

Depth	Description
3.00-3.33	No Recovery
3.33-3.50	Very soft grey to dark grey silty CLAY with frequent subvertical relict roots <5mm
3.50-3.77	Removed for testing
3.77-4.00	Very soft grey to dark grey silty CLAY with frequent subvertical relict roots <3mm

Photographed by	Date photographed	Filename
Adam Watts	10/07/2025	BH108_3-4

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		02



Description

Depth	Description
4.00-4.33	No Recovery
4.33-5.00	Very soft grey to dark grey silty CLAY with frequent subvertical relict roots <5mm and rare peat pockets <30mm

Photographed by	Date photographed	Filename
Adam Watts	09/07/2025	BH108_4-5

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		03



Description

Depth	Description
5.00-5.26	No Recovery
5.26-5.50	Very soft grey to dark grey silty CLAY with frequent subvertical relict roots <5mm
5.50-5.80	Removed for testing
5.80-6.00	Very soft grey to dark grey silty CLAY with frequent subvertical relict roots <3mm

Photographed by	Date photographed	Filename
Adam Watts	10/07/2025	BH108_5-6

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		04



Description

Depth	Description
6.00-6.65	No Recovery
6.65-7.00	Very soft grey to dark grey silty CLAY with frequent subvertical relict roots <5mm

Photographed by	Date photographed	Filename
Adam Watts	09/07/2025	BH108_6-7

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		05



Description

Depth	Description
7.00-7.31	No Recovery
7.31-7.70	Very soft grey to dark grey silty CLAY with rare relict roots <5mm
7.70-8.00	Removed for testing

Photographed by	Date photographed	Filename
Adam Watts	10/07/2025	BH108_7-8

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		06



Description

Depth	Description
8.00-8.60	No Recovery
8.60-8.90	Very soft grey to dark grey silty CLAY with rare peat pockets <45mm
8.90-9.00	Spongy brown pseudofibrous PEAT (H4/5) Dry, mild peat oddour

Photographed by	Date photographed	Filename
Adam Watts	09/07/2025	BH108_8-9

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		07



Description

Depth	Description
9.00-9.23	No Recovery
9.23-9.50	Very soft grey to dark grey silty CLAY with frequent subvertical relict roots <10mm
9.50-9.80	Removed for testing
9.80-10.00	Very soft grey to dark grey silty CLAY with frequent subvertical relict roots <3mm Rare bivalve shell <10mm diameter at 9.90m

Photographed by	Date photographed	Filename
Adam Watts	10/07/2025	BH108_9-10

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		08



Description

Depth	Description
10.00-10.40	No Recovery
10.40-11.00	Grey clayey SILT with rare thin peat lences

Photographed by	Date photographed	Filename
Adam Watts	09/07/2025	BH108_10-11

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		09



Description

Depth	Description
11.00-11.40	No Recovery
11.40-11.80	Grey clayey SILT with rare black peat lamninae at 11.70m
11.80-12.00	Firm black fibrous PEAT (H2) No peat paste. Difficult to squeze, very little water

Photographed by	Date photographed	Filename
Adam Watts	09/07/2025	BH108_11-12

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 2

Ground Level	+2.32mOD	Coordinates	567417.57E, 174104.42N	Grid	OSGB		
Date Started	29/05/2025	Date Completed	24/06/2025	Inclination	90° from horizontal		

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit Used	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	29/05/2025 13:30	29/05/2025 14:30	DS	SP	NA	NA	Insulated Hand Tools	None	Stable	
1.20	21.10	CP	29/05/2025 14:30	02/06/2025 14:30	DS	AW	NA	NA	Dando 2000	NA	NA	
19.10	60.50	RC	19/06/2025 07:30	24/06/2025 17:30	KG	AW	Geobore S	PCD	Com 450	NA	NA	

CABLE PERCUSSION DETAILS

Depth Top	Depth Base	Time Start	Duration	Tool	Remarks

WATER STRIKES

Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Elapsed Time	Remarks
30/05/2025 14:00	12.00	12.00		4.50	20	Fast

HOLE DIAMETER

Depth	Diameter	Remarks
12.00	200	
21.10	150	
60.50	146	

CASING DIAMETER

Depth	Diameter	Remarks
12.00	200	
21.10	150	

ROTARY FLUSH DETAILS

Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks
20.10	60.50	WATER	70	White	

DYNAMIC SAMPLING

Top	Base	Diameter	Duration	Recovery	Remarks

INSTALLATION DETAILS

Distance	ID	Type	Response Top	Response Base	Pipe Ref

PIPE CONSTRUCTION

Pipe Ref	Top	Base	Diameter	Pipe Type

BACKFILL DETAILS

Depth Top	Depth Base	Description	Remarks

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 2 of 2

Ground Level	+2.32mOD	Coordinates	567417.57E, 174104.42N	Grid	OSGB
Date Started	29/05/2025	Date Completed	24/06/2025	Inclination	90° from horizontal

PROGRESS

Date Time	Depth	Depth Casing	Depth Water	Remarks
29/05/2025 17:30	5.00	5.00	Dry	End of Shift
30/05/2025 07:30	5.00	5.00	Dry	Start of shift
30/05/2025 17:30	12.00	12.00	Dry	End of Shift
02/06/2025 07:30	12.00	12.00	2.3	Start of Shift
02/06/2025 17:30	20.10	20.10	2.7	End of CP
19/06/2025 07:30	20.10	20.10		Start of Shift
19/06/2025 17:30	27.50	21.10		End of Shift
20/06/2025 07:30	27.50	21.10		Start of Shift
20/06/2025 17:30	38.00	21.10		End of Shift
24/06/2025 07:30	38.00	21.10		Start of Shift
24/06/2025 17:30	60.50	21.10		End of Hole

SPT DETAILS

Depth	Type	Reported Result	Hammer No.	Energy Ratio %	Casing Depth	Water Depth
1.20	S	N=15 (2,3:3,4,4,4)	AR493	55	1.20	Dry
2.20	S	N=5 (3,3:2,1,1,1)	AR493	55	2.20	Dry
13.50	S	N=4 (1,0:1,1,1,1)	AR493	55	13.50	4.1
15.00	C	N=13 (2,2:3,3,3,4)	AR493	55	15.00	4.3
16.50	C	N=23 (3,4:4,6,6,7)	AR493	55	16.50	4.2
18.00	C	N=33 (4,6:6,8,9,10)	AR493	55	18.00	4.7
19.50	C	N=23 (3,5:5,6,5,7)	AR493	55	19.50	3.2

DEPTH RELATED REMARKS

Top Depth	Base Depth	Remarks
11.00	12.00	Bentonite seal. Casing reduced from 200mm to 150mm
11.50	12.00	Falling Head Test in alluvium. See results at Section A of the report

GENERAL NOTES

1. Borehole left open with 12.0m of 150mm casing and 21.1m of 200mm casing in the ground awaiting additional testing to be organised by FBJV 2. Continuous piston sampling in soft alluvium 3. Geophysical Logging completed

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 13 Scale: 1:25
Ground Level	+2.32mOD	Coordinates	567417.57E, 174104.42N Grid OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
TOPSOIL: Dark grey mottled brown slightly gravelly clay with abundant rootlets. Gravel is angular medium to coarse of flint. (TS) [TOPSOIL]			(0.40)			D 1 0.05-0.10 B 3 0.05-0.40 ES 2 0.30-0.35							
Very stiff brown mottled grey slightly sandy slightly gravelly CLAY with frequent rootlets. Sand is fine to coarse. Gravel is angular fine to coarse of flint and chalk. (ALV) [ALLUVIUM]			0.40 (0.30)	1.92		D 4 0.40-0.45 B 6 0.40-0.70 ES 5 0.60-0.65							
Vey stiff dark grey mottled brown CLAY. (ALV) [ALLUVIUM]			0.70 (0.50)	1.62		D 7 0.70-0.75 B 9 0.70-1.20 ES 8 1.00-1.05							
Soft brown CLAY (ALV) [ALLUVIUM]			1.20 (1.20)	1.12		D 10 1.20-1.65 B 11 1.20-1.70 D 12 1.90-2.00						SPT(S) N=15 (2,3:3,4,4,4) 1.20 SPT(S) N=5 (3,3:2,1,1,1) 2.20	
Very soft dark grey silty CLAY. (ALV) [ALLUVIUM] at 2.40m frequent pockets (<50mm) of peat			2.40	-0.08		B 15 2.20-2.40 W 35 2.30 D 14 2.40 D 13 2.20-2.65 B 16 2.40-2.90 P 17 3.00-4.00 D 18 4.00 B 19 4.00-5.00 PF 4.00-5.00	100 100	70 0					

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 2 of 13 Scale: 1:25

Ground Level	+2.32mOD	Coordinates	567417.57E, 174104.42N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very soft dark grey silty CLAY. (ALV) [ALLUVIUM]			(5.30)			P 20 5.00-6.00	100	70					
at 6.00m frequent pockets (<100mm) of black peat. Mild peaty odour						D 21 6.00							
						P 22 6.00-7.00	100	70					
						D 23 7.00							
						B 24 7.00-8.00 PF 7.00-8.00	100	0					
Black and dark grey plastic locally firm pseudo fibrous PEAT. [PEAT]			7.70	-5.38		D 25 7.70 ES 26 7.80-7.85							
			(1.30)			P 27 8.00-9.00	100	80					
Very soft dark grey silty CLAY. (ALV) [ALLUVIUM] at 9.00m with frequent pockets (<50mm) of peat			9.00	-6.68		D 28 9.00							
						P 29 9.00-10.00	100	70					
			(2.00)			D 30 10.00							

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 3 of 13 Scale: 1:25

Ground Level	+2.32mOD	Coordinates	567417.57E, 174104.42N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very soft dark grey silty CLAY. (ALV) [ALLUVIUM]						P 31 10.00-11.00	100	70					
Black and dark grey firm fibrous PEAT [PEAT]			11.00	-8.68		D 32 11.00							
			(1.00)			P 33 11.00-12.00	100	60					
Very loose to loose dark grey clayey fine to medium SAND. (RTD) [RIVER TERRACE DEPOSITS]			12.00	-9.68		D 34 12.00						K 12.00	
						B 36 12.00-12.50							
from 13.00m to 13.50m grey						D 37 13.00-13.05							
			(2.90)									SPT(S) N=4 (1,0:1,1,1,1) 13.50	
						D 38 13.50-13.95							
						B 39 13.50-14.00							
from 13.90m to 14.50m sandy clay													
						D 40 14.50							
Medium dense to dense slightly sandy dark grey angular to subrounded fine to coarse GRAVEL of flint. Sand is fine to coarse. (RTD) [RIVER TERRACE DEPOSITS]			14.90	-12.58		D 41 14.90							
												SPT(C) N=13 (2,2:3,3,3,4) 15.00	

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 4 of 13 Scale: 1:25

Ground Level	+2.32mOD	Coordinates	567417.57E, 174104.42N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Medium dense to dense slightly sandy dark grey angular to subrounded fine to coarse GRAVEL of flint. Sand is fine to coarse. (RTD) [RIVER TERRACE DEPOSITS]						B 42 15.00-15.50							
						D 43 16.00						SPT(C) N=23 (3,4:4,6,6,7) 16.50	
						B 44 16.50-17.00							
			(4.90)			D 45 17.50						SPT(C) N=33 (4,6:6,8,9,10) 18.00	
						B 46 18.00-18.50							
from 19.00m to 19.50m sandy						D 47 19.00	146	0				SPT(C) N=23 (3,5:5,6,5,7) 19.50	
Structureless white chalk composed of silty sandy angular fine to coarse gravel with small to medium flint fragments. CIRIA Grade Dc			19.80 (0.30)	-17.48		B 48 19.50-20.00 D 49 19.80							

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 5 of 13 Scale: 1:25

Ground Level	+2.32mOD	Coordinates	567417.57E, 174104.42N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Structureless white chalk composed of silty sandy angular fine to coarse gravel with small to medium flint fragments. CIRIA Grade Dc			20.10	-17.78									
No recovery.							146	0					
							146	0					
			(4.10)				146	0					
						C 50 23.00-24.50	146	20	0	0			
Structureless CHALK composed of slightly silty sandy gravel. Clasts are very weak low density white frequent nodular small to large rinded flints (<1mm) light grey cortex. CIRIA Ungraded. [SEAFORD CHALK FORMATION]			24.20	-21.88									
			(0.30)										
Assumed zone of core loss.			24.50	-22.18									
			(0.70)										

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 6 of 13 Scale: 1:25

Ground Level	+2.32mOD	Coordinates	567417.57E, 174104.42N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Assumed zone of core loss.													
			25.20	-22.88									
Very weak low density white locally stained orange brown CHALK with rare medium rinded flints (<1mm) light grey cortex recovered as non intact core. (angular fine to coarse gravel) [SEAFORD CHALK FORMATION]			(0.80)			C 51 24.50-26.00	146	53	16	9	NI 20 130		
			26.00	-23.68									
No recovery.							146	0					
							146	0					
			(3.85)				146	0			NR		
							146	43	5	0			
Very weak low density white CHALK with rare medium rinded flints (<1mm) light grey cortex recovered as non intact core (angular fine to coarse gravel). [SEAFORD CHALK FORMATION]			29.85	-27.53		C 52 29.00-30.50							

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

FINAL Print date and time 30/09/2025 09:37 Log checked by EC

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 7 of 13 Scale: 1:25

Ground Level	+2.32mOD	Coordinates	567417.57E, 174104.42N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density white CHALK with rare medium rinded flints (<1mm) light grey cortex recovered as non intact core (angular fine to coarse gravel). [SEAFORD CHALK FORMATION]			(0.65)								NI 70		
Assumed zone of core loss.			30.50 (0.50)	-28.18							NR		
Very weak low density white locally orange brown CHALK with occasional nodular small to large rinded flints (<2mm) white cortex. Discontinuities 1) 60-90 degrees very closely to medium spaced smooth planar matt or black staining. 1 No. 30 degree discontinuity planar smooth infilled with silt (<3mm). CIRIA Grade A3/4. [SEAFORD CHALK FORMATION]			31.00	-28.68		C 53 30.50-32.00	146	67	27	15			
						C 54 32.00-33.50	146	60	8	0	NI 60 130		
			(5.00)			C 55 33.50-35.00	146	67	17	0			
at 34.80m orange brown staining													

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 8 of 13 Scale: 1:25

Ground Level	+2.32mOD	Coordinates	567417.57E, 174104.42N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density white locally orange brown CHALK with occasional nodular small to large rinded flints (<2mm) white cortex. Discontinuities 1) 60-90 degrees very closely to medium spaced smooth planar matt or black staining. 1 No. 30 degree discontinuity planar smooth infilled with silt (<3mm). CIRIA Grade A3/4. [SEAFORD CHALK FORMATION] from 35.00m to 35.50m assumed zone of core loss from 35.80m to 36.10m orange brown staining						C 56 35.00-36.50	146	63	20	7			
No recovery.			36.00	-33.68			146	0			NR		
Very weak low density white locally stained orange brown CHALK with occasional nodular small to large rinded flints (<4mm) white cortex. Discontinuities 1) 61-90 degrees closely to medium spaced planar smooth matt or black staining. 2) 0-17 degrees closely to medium spaced smooth planar matt and black staining. CIRIA Grade A2/3. [SEAFORD CHALK FORMATION - CUCKMERE BEDS] at 38.30m orange brown staining			(2.10) 38.10	-35.78		C 58 38.00-39.50	146	93	39	18			

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 9 of 13 Scale: 1:25

Ground Level	+2.32mOD	Coordinates	567417.57E, 174104.42N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density white locally stained orange brown CHALK with occasional nodular small to large rinded flints (<4mm) white cortex. Discontinuities 1) 61-90 degrees closely to medium spaced planar smooth matt or black staining. 2) 0-17 degrees closely to medium spaced smooth planar matt and black staining. CIRIA Grade A2/3. [SEAFORD CHALK FORMATION - CUCKMERE BEDS]						C 59 39.50-41.00							
at 40.20m orange brown staining							146	93	46	31			
at 40.95m orange brown staining													
at 41.60m orange brown staining													
from 41.80m to 41.93m light grey randomly orientated burrows						C 60 41.00-42.50	146	87	27	27			
at 43.80m orange brown staining						C 61 42.50-44.00	146	100	51	34			
at 44.10m orange brown staining			(11.90)										
at 44.95m orange brown staining						C 62 44.00-45.50	146	100	51	27			

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 10 of 13 Scale: 1:25

Ground Level	+2.32mOD	Coordinates	567417.57E, 174104.42N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density white locally stained orange brown CHALK with occasional nodular small to large rinded flints (<4mm) white cortex. Discontinuities 1) 61-90 degrees closely to medium spaced planar smooth matt or black staining. 2) 0-17 degrees closely to medium spaced smooth planar matt and black staining. CIRIA Grade A2/3. [SEAFORD CHALK FORMATION - CUCKMERE BEDS]													
at 45.20m orange brown staining													
at 45.80m orange brown staining						C 63 45.50-47.00	146	100	64	27			
at 46.75m orange brown staining						C 64 47.00-48.50	146	100	87	63			
						C 65 48.50-50.00	146	93	79	61			
			50.00	-47.68									

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 11 of 13 Scale: 1:25

Ground Level	+2.32mOD	Coordinates	567417.57E, 174104.42N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak locally weak low to medium density white CHALK. Discontinuities 1) 10-21 degrees medium spaced smooth planar 2) 54-90 degrees medium spaced smooth planar to undulating. CIRIA Grade A1/2. [SEAFORD CHALK FORMATION - CUCKMERE BEDS]													
from 50.00m to 50.15m with occasional large nodular rinded flints/cobble flints (<3mm) white cortex from 50.20m to 50.50m with fossiliferous band contains abundant echinoids, fragments and inoceramid bivalve up to 8mm thick full core diameter						C 66 50.00-51.50	146	100	88	77			
at 51.30m with rare small nodular and tabular flints smalll/ medium and fossil echinoids at 51.40m with rare small nodular and tabular flints smalll/ medium													
at 52.30m with rare small nodular and tabular flints smalll/ medium						C 67 51.50-53.00	146	100	93	75	NI 150 310		
from 52.80m to 52.90m with occasional large nodular rinded flints/cobble flints (<3mm) white cortex			(7.00)										
at 53.60m with occasional large nodular rinded flints/cobble flints (<3mm) white cortex						C 68 53.00-54.50	146	100	82	68			
at 53.80m with rare small nodular and tabular flints smalll/ medium at 53.90m with rare small nodular and tabular flints smalll/ medium													
from 54.50m to 55.00m assumed zone of core loss													

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 12 of 13 Scale: 1:25

Ground Level	+2.32mOD	Coordinates	567417.57E, 174104.42N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak locally weak low to medium density white CHALK. Discontinuities 1) 10-21 degrees medium spaced smooth planar 2) 54-90 degrees medium spaced smooth planar to undulating. CIRIA Grade A1/2. [SEAFORD CHALK FORMATION - CUCKMERE BEDS]						C 69 54.50-56.00	146	67	45	29			
from 55.40m to 55.50m with occasional large nodular rinded flints/cobble flints (<3mm) white cortex													
at 56.80m large fossil inoceramus stained blue green with glauconite 3mm thick full core diameter from 56.90m to 57.00m with occasional large nodular rinded flints/cobble flints (<3mm) white cortex						C 70 56.00-57.50	146	93	63	48			
Very weak locally weak low to medium density white and light grey locally stained orange brown CHALK with regular thin grey wispy marls, subhorizontal usually <5mm thick. Discontinuities 1) 68-72 degrees medium to widely spaced smooth planar slickensided with black staining. 2) 5 degrees medium to widely spaced smooth planar with orange brown staining. CIRIA Grade A1/2. [SEAFORD CHALK FORMATION - BELLE TOUT BEDS]			57.00	-54.68									
at 57.50m with occasional small to large rinded nodular flints with <2mm white cortex													
at 57.70m with occasional small to large rinded nodular flints with <2mm white cortex													
at 58.00m with occasional small to large rinded nodular flints with <2mm white cortex at 58.10m with occasional small to large rinded nodular flints with <2mm white cortex						C 71 57.50-59.00	146	100	94	84	80 260 440		
at 58.33m noticeable thicker wispy grey marls around 5mm thick													
at 58.55m noticeable thicker wispy grey marls around 5mm thick													
at 58.70m with occasional small to large rinded nodular flints with <2mm white cortex			(3.50)										
from 59.10m to 59.20m with occasional small to large rinded nodular flints with <2mm white cortex													
at 59.40m with occasional small to large rinded nodular flints with <2mm white cortex at 59.50m with occasional small to large rinded nodular flints with <2mm white cortex at 59.60m with occasional small to large rinded nodular flints with <2mm white cortex						C 72 59.00-60.50	146	100	81	81			

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 13 of 13 Scale: 1:25

Ground Level	+2.32mOD	Coordinates	567417.57E, 174104.42N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak locally weak low to medium density white and light grey locally stained orange brown CHALK with regular thin grey wispy marls, subhorizontal usually <5mm thick. Discontinuities 1) 68-72 degrees medium to widely spaced smooth planar slickensided with black staining. 2) 5 degrees medium to widely spaced smooth planar with orange brown staining. CIRIA Grade A1/2. [SEAFORD CHALK FORMATION - BELLE TOUT BEDS]													
from 60.40m to 60.50m with occasional small to large rinded nodular flints with <2mm white cortex			60.50	-58.18									
Complete at 60.50m. Termination Reason: Achieved Scheduled Depth													

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH110
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 2

Ground Level	+2.55mOD	Coordinates	566284.41E, 175842.43N	Grid	OSGB
Date Started	19/05/2025	Date Completed	05/06/2025	Inclination	90° from horizontal

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit Used	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	20/05/2025 10:15	20/05/2025 11:25	TM	DC	NA	NA	Insulated Hand Tools	None	Stable	
0.00	17.08	SCP		02/05/2025 12:00								Magnetometer test only
1.20	20.50	CP	20/05/2025 11:25	27/05/2025 17:30	TM	DC	NA	NA	Dando 3000	NA	NA	
26.00	45.50	RC	04/06/2025 07:30	05/06/2025 18:00	PS	AW	Geobore S	PCD	Beretta GT54	NA	NA	

CABLE PERCUSSION DETAILS

Depth Top	Depth Base	Time Start	Duration	Tool	Remarks

WATER STRIKES

Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Elapsed Time	Remarks
20/05/2025 16:45	6.00	5.00		5.65	20	Seepage

HOLE DIAMETER

Depth	Diameter	Remarks
2.20	250	
15.00	200	
26.00	150	
45.50	146	

CASING DIAMETER

Depth	Diameter	Remarks
2.30	250	
15.00	200	
26.00	150	

ROTARY FLUSH DETAILS

Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks
20.50	45.50	WATER	80	White	

DYNAMIC SAMPLING

Top	Base	Diameter	Duration	Recovery	Remarks

INSTALLATION DETAILS

Distance	ID	Type	Response Top	Response Base	Pipe Ref

PIPE CONSTRUCTION

Pipe Ref	Top	Base	Diameter	Pipe Type

BACKFILL DETAILS

Depth Top	Depth Base	Description	Remarks

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH110
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 2 of 2

Ground Level	+2.55mOD	Coordinates	566284.41E, 175842.43N	Grid	OSGB
Date Started	19/05/2025	Date Completed	05/06/2025	Inclination	90° from horizontal

PROGRESS

Date Time	Depth	Depth Casing	Depth Water	Remarks
20/05/2025 17:30	6.00	5.00	5.65	End of Shift
21/05/2025 07:30	6.00	5.00	3.40	Start of Shift
21/05/2025 17:30	12.50	12.50	8.30	End of Shift
22/05/2025 07:30	12.50	12.50	6.40	Start of Shift
22/05/2025 17:30	12.50	12.50	6.40	End of Shift
23/05/2025 07:30	12.50	12.50	6.40	Start of Shift
23/05/2025 17:30	15.00	15.00	12.80	End of Shift
27/05/2025 07:30	15.00	15.00	2.10	Start of Shift
27/05/2025 17:30	20.50	20.50	6.20	End of CP
04/06/2025 07:30	20.50	20.50	2.00	Start of Shift
04/06/2025 18:00	38.00	22.00	2.00	End of Shift
05/06/2025 07:30	38.00	22.00	2.00	Start of Shift
05/06/2025 18:00	45.50	26.00	2.00	End of Hole

SPT DETAILS

Depth	Type	Reported Result	Hammer No.	Energy Ratio %	Casing Depth	Water Depth
1.50	S	N=3 (1,0:1,0,1,1)	69	64	1.50	Dry
4.00	S	N=1 (1,0:0,0,0,1)	69	64	4.00	Dry
6.00	S	N=1 (1,0:0,0,1,0)	69	64	6.00	1.70
8.00	S	N=6 (1,1:2,2,1,1)	69	64	8.00	3.90
10.00	S	N=0 (1,0:0,0,0,0)	69	64	10.00	6.90
12.00	S	N=2 (1,0:0,1,0,1)	69	64	12.00	7.80
14.00	S	N=4 (1,0:1,0,2,1)	69	64	14.00	12.80
15.00	C	N=13 (2,2:2,3,4,4)	69	64	15.00	2.40
16.00	C	N=21 (2,4:4,5,6,6)	69	64	16.00	3.10
17.00	C	N=25 (3,4:5,5,7,8)	69	64	17.00	3.70
18.00	C	N=26 (3,5:6,6,7,7)	69	64	18.00	4.60
19.00	C	N=33 (4,6:7,7,9,10)	69	64	19.00	5.90

DEPTH RELATED REMARKS

Top Depth	Base Depth	Remarks
1.30	2.30	Bentonite seal. Casing reduced from 250mm to 200mm
4.00	4.00	Shear Vane Test completed. See CPT report for results
5.00	6.00	Falling Head Test in alluvium. See results at Section A of the report
6.00	6.00	Shear Vane Test completed. See CPT report for results
9.00	9.00	Shear Vane Test completed. See CPT report for results
11.00	11.00	Shear Vane Test completed. See CPT report for results
13.00	13.00	Shear Vane Test completed. See CPT report for results
13.86	13.86	Shear Vane Test completed. See CPT report for results
14.00	15.00	Bentonite seal. Casing reduced from 200mm to 150mm
14.50	15.00	Falling Head Test in alluvium. See results at Section A of the report

GENERAL NOTES

1. Borehole left open with 15.0m of 150mm casing and 26.0m of 200mm casing in the ground awaiting additional testing to be organised by FBJV 2. Intermittent piston sampling in soft alluvium

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

FINAL | Print date and time 30/09/2025 09:37 | Log checked by EC

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH110
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 10 Scale: 1:25

Ground Level	+2.55mOD	Coordinates	566284.41E, 175842.43N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
MADE GROUND: Brownish grey angular to subangular fine to coarse gravel sized fragments of limestone. (MG)			(0.40)			D 1 0.05-0.10 B 2 0.05-0.30 ES 3 0.30-0.35							
MADE GROUND: Greyish brown slightly gravelly clay. Gravel sized fragments are angular to subangular fine to coarse of limestone, flint and brick. (MG)			0.40	2.15		D 4 0.40-0.45 B 5 0.40-0.60							
MADE GROUND: Brownish grey sandy clay. Sand is fine to coarse. (MG)			0.60 (0.30)	1.95		D 7 0.60-0.65 ES 6 0.60-0.65 B 8 0.60-0.90							
Possible MADE GROUND: Greyish brown slightly sandy clay. Sand is fine to coarse. (MG)			0.90 (1.40)	1.65		D 9 0.90-0.95 ES 11 1.00-1.05 B 10 0.90-1.20 D 12 1.50-1.95 B 13 1.50-2.00 ES 14 2.00-2.05						SPT(S) N=3 (1,0:1,0,1,1) 1.50	
Soft bluish grey CLAY with slight organic odour. (ALV) [ALLUVIUM]			2.30	0.25		D 15 2.30-2.35 B 16 2.30-2.50 P 17 3.00-4.00	100	100					
at 4.00m occasional partially decayed organic material from 4.00m to 4.75m occasional pockets (<10mm) of dark grey and black peat						D 18 4.00 ES 21 4.00-4.05 D 19 4.00-4.45 B 20 4.00-4.50 D 22 4.70-4.75						SPT(S) N=1 (1,0:0,0,0,1) 4.00 K 5.00 - 6.00	

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH110
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 2 of 10 Scale: 1:25

Ground Level	+2.55mOD	Coordinates	566284.41E, 175842.43N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Soft bluish grey CLAY with slight organic odour. (ALV) [ALLUVIUM]			(6.30)			P 23 5.00-6.00	100	100					
						W 24 5.65							
						D 25 6.00						SPT(S) N=1 (1,0:0,0,1,0) 6.00	
						ES 28 6.00-6.05							
						D 26 6.00-6.45							
						B 27 6.00-6.50							
						D 29 6.70-6.75							
						P 30 7.00-8.00	100	40					
from 8.00m to 8.45m firm dark brown and black fibrous peat						D 31 8.00						SPT(S) N=6 (1,1:2,2,1,1) 8.00	
						D 32 8.00-8.45							
						B 33 8.00-8.50							
Soft dark bluish grey slightly sandy CLAY. Sand is fine. (ALV) [ALLUVIUM]			8.60	-6.05									
			(1.40)			P 34 9.00-10.00	100	100					
			10.00	-7.45		D 35 10.00						SPT(S) N=0 (1,0:0,0,0,0) 10.00	

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH110
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 3 of 10 Scale: 1:25

Ground Level	+2.55mOD	Coordinates	566284.41E, 175842.43N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Soft grey CLAY with frequent pockets (<10mm) of black decayed organic material. (ALV) [ALLUVIUM]						D 36 10.00-10.45 B 37 10.00-10.50							
						D 39 11.40-11.50 P 38 11.00-12.00	100	40					
						D 40 11.70-11.80							
												SPT(S) N=2 (1,0:0,1,0,1) 12.00	
						D 41 12.00-12.45 B 42 12.00-12.50							
			(4.70)										
						D 43 12.70-12.75							
						P 44 13.00-14.00	100	100					
from 14.00m to 14.10m slightly sandy. Sand is fine from 14.10m to 14.45m firm dark grey mottled black silty clay. Slight organic odour						D 45 14.00						SPT(S) N=4 (1,0:1,0,2,1) 14.00	
						D 46 14.00-14.45 B 47 14.00-14.50							
Dark grey mottled black slightly sandy angular to subrounded fine to coarse GRAVEL of flint. Sand is fine to coarse. (RTD) [RIVER TERRACE DEPOSITS]			14.70	-12.15		D 48 14.70-14.75 B 49 14.70-15.00 W 50 15.00						SPT(C) N=13 (2,2:2,3,4,4) 15.00 K 15.00	

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH110
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 4 of 10 Scale: 1:25

Ground Level	+2.55mOD	Coordinates	566284.41E, 175842.43N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Dark grey mottled black slightly sandy angular to subrounded fine to coarse GRAVEL of flint. Sand is fine to coarse. (RTD) [RIVER TERRACE DEPOSITS]						B 51 15.00-15.50							
from 15.70m to 15.75m sandy						D 52 15.70-15.75							
						B 53 16.00-16.50						SPT(C) N=21 (2,4:4,5,6,6) 16.00	
						D 54 16.70-16.75							
						B 55 17.00-17.50						SPT(C) N=25 (3,4:5,5,7,8) 17.00	
			(5.30)										
from 17.70m to 17.50m low cobble content. Cobbles are angular to subrounded of flint						D 56 17.70-17.75							
						B 57 18.00-18.50						SPT(C) N=26 (3,5:6,6,7,7) 18.00	
						D 58 18.70-18.75							
						B 59 19.00-19.50						SPT(C) N=33 (4,6:7,7,9,10) 19.00	
from 19.70m to 19.75m greyish white mottled dark grey gravel of flint and chalk						D 60 19.70-19.75							
			20.00	-17.45									

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH110
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 5 of 10 Scale: 1:25

Ground Level	+2.55mOD	Coordinates	566284.41E, 175842.43N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
White CHALK. Recovered as angular fine to coarse gravel with occasional flint. [SEAFORD CHALK FORMATION]			(0.50)			D 61 20.00-20.10							
Assumed zone of core loss.			20.50	-17.95							NR		
Structureless CHALK composed of slightly silty slightly sandy GRAVEL. Clasts are very weak medium density white chalk. Matrix is white. CIRIA Grade Dc. [SEAFORD CHALK FORMATION]			20.75 (0.75)	-18.20		C 1 20.50-21.50	146	75	0	0	NI		
Assumed zone of core loss.			21.50 (1.00)	-18.95		C 2 21.50-23.00	146	33	0	0	NR		
Structureless CHALK composed of slightly silty slightly sandy GRAVEL. Clasts are very weak medium density white. Matrix is white with occasional nodular rinded small to large flints rare medium fragment flint (<3mm of light grey cortex). CIRIA Grade Dc. [SEAFORD CHALK FORMATION] at 22.60m fragment flint from 23.00m to 23.25m assumed zone of core loss			22.50 (2.00)	-19.95		C 3 23.00-24.50	146	83	0	0	NI		
Assumed zone of core loss.			24.50 (0.50)	-21.95							NR		
			25.00	-22.45									

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH110
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 6 of 10 Scale: 1:25

Ground Level	+2.55mOD	Coordinates	566284.41E, 175842.43N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Structureless CHALK composed of slightly silty slightly sandy GRAVEL. Clasts are very weak medium density white. Matrix is white with occasional nodular rinded small to large flints rare medium fragment flint (<3mm of light grey cortex). CIRIA Grade Dc. [SEAFORD CHALK FORMATION]						C 4 24.50-26.00							
from 25.37m to 25.45m locally intact			(1.00)				146	67	8	8	NI		
Assumed zone of core loss.			26.00	-23.45									
			(1.10)			C 5 26.00-27.50	146	60	21	16	NR		
Structureless CHALK composed of slightly silty slightly sandy GRAVEL. Clasts are very weak medium density white. Matrix is white with occasional nodular rinded small to large flints rare medium fragment flint (<3mm of light grey cortex). CIRIA Grade Dc. [SEAFORD CHALK FORMATION]			27.10	-24.55							NI		
from 27.10m to 27.22m locally intact			(0.30)										
Very weak low density white CHALK. Discontinuities: 1) 6-15 degrees medium to widely spaced planar smooth with black staining. 2) 75-85 degrees medium to widely spaced smooth planar with occasional slickensides and black staining. With occasional rinded small to large nodular flints (<1mm) of light grey cortex. CIRIA Grade A2/3. [SEAFORD CHALK FORMATION - BELLE TOUT BEDS]			27.40	-24.85									
at 27.50m assumed zone of core loss													
at 27.80m with rare inoceramid shell fragments						C 6 27.50-29.00	146	83	50	14			
at 28.70m rare echinoid shell													
from 29.00m to 29.30m assumed zone of core loss.													
from 29.30m to 29.40m with rare inoceramid shell fragments							146	80	33	0			
						C 7 29.00-30.50							

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH110
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 7 of 10 Scale: 1:25

Ground Level	+2.55mOD	Coordinates	566284.41E, 175842.43N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density white CHALK. Discontinuities: 1) 6-15 degrees medium to widely spaced planar smooth with black staining. 2) 75-85 degrees medium to widely spaced smooth planar with occasional slickensides and black staining. With occasional rinded small to large nodular flints (<1mm) of light grey cortex. CIRIA Grade A2/3. [SEAFORD CHALK FORMATION - BELLE TOUT BEDS]													
from 30.50m to 31.00m assumed zone of core loss.			(6.90)			C 8 30.50-32.00	146	67	33	16			
from 31.80m to 31.90m with rare inoceramid shell fragments											NI 120 230		
from 32.40m to 32.50m with rare inoceramid shell fragments													
at 32.75m rare echinoid shell						C 9 32.00-33.50	146	100	71	49			
						C 10 33.50-35.00	146	100	88	69			
Very weak low density white locally stained orange CHALK. Discontinuities: 1) 35-45 degrees medium to widely spaced smooth planar locally black stained. With rare small to large nodular rinded flints (<1mm) white cortex. CIRIA Grade A1. [SEAFORD CHALK FORMATION - BELLE TOUT BEDS]			34.30	-31.75									
at 34.40m with rare inoceramid shell fragments													

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

FINAL	Print date and time 30/09/2025 09:37	Log checked by EC
Form No. SIEXPHOLELOG	Issue.Revision No. 2.06	Issue Date 13/10/2023

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH110
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 8 of 10 Scale: 1:25

Ground Level	+2.55mOD	Coordinates	566284.41E, 175842.43N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density white locally stained orange CHALK. Discontinuities: 1) 35-45 degrees medium to widely spaced smooth planar locally black stained. With rare small to large nodular rinded flints (<1mm) white cortex. CIRIA Grade A1. [SEAFORD CHALK FORMATION - BELLE TOUT BEDS]													
from 35.50m to 35.60m orange brown sponge beds						C 11 35.00-36.50	146	100	61	42			
			(3.25)										
from 36.20m to 36.40m orange brown sponge beds											NI 130 250		
from 36.50m to 36.80m assumed zone of core loss													
from 36.80m to 37.10m orange brown sponge beds						C 12 36.50-38.00	146	80	67	48			
at 37.51m 20mm subhorizontal light grey marl seam			37.55	-35.00									
Very weak low density white locally light grey CHALK rarely with light grey wispy marls subhorizontal (<3mm). Discontinuities: 1) 35-55 degrees medium to widely spaced smooth planar black speckled. 2) 75 degrees medium to widely spaced smooth planar slickensided. CIRIA Grade A2. [SEAFORD CHALK FORMATION - BELLE TOUT BEDS]													
at 37.85m with rare black phosphatic sponge beds													
from 38.20m to 38.25m with occasional small to large nodular rinded flints (<3mm) light grey cortex						C 13 38.00-39.50	146	83	71	59			

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH110
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 9 of 10 Scale: 1:25

Ground Level	+2.55mOD	Coordinates	566284.41E, 175842.43N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very weak low density white locally light grey CHALK rarely with light grey wispy marls subhorizontal (<3mm). Discontinuities: 1) 35-55 degrees medium to widely spaced smooth planar black speckled. 2) 75 degrees medium to widely spaced smooth planar slickensided. CIRIA Grade A2. [SEAFORD CHALK FORMATION - BELLE TOUT BEDS]						C 14 39.50-41.00	146	100	81	66			
			(6.45)										
at 40.95m with occasional small to large nodular rinded flints (<3mm) light grey cortex													
from 41.40m to 41.50m with occasional small to large nodular rinded flints (<3mm) light grey cortex						C 15 41.00-42.50	146	94	75	68	NI 170 280		
at 42.40m with occasional small to large nodular rinded flints (<3mm) light grey cortex													
from 43.20m to 43.30m with occasional small to large nodular rinded flints (<3mm) light grey cortex						C 16 42.50-44.00	146	87	74	49			
			44.00	-41.45									
Assumed zone of core loss.											NR		
			(1.05)			C 17 44.00-45.50	146	30	15	0			

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH110
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 10 of 10 Scale: 1:25

Ground Level	+2.55mOD	Coordinates	566284.41E, 175842.43N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Assumed zone of core loss.			45.05	-42.50									
Very weak low density white and light grey CHALK composed of slightly silty slightly sandy gravel. CIRIA Ungraded. [POSSIBLE LEWES NODULAR CHALK] from 45.05m to 45.15m with large nodular rinded flint (<1mm) light grey cortex			(0.45)								NI		
Complete at 45.50m. Termination Reason: Achieved Scheduled Depth			45.50	-42.95									

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH301
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 1

Ground Level	+7.40mOD	Coordinates	566441.32E, 175781.64N	Grid	OSGB		
Date Started	30/06/2025	Date Completed	03/07/2025	Inclination	90° from horizontal		

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	30/06/2025 11:10	30/06/2025 11:45	DS	DS	NA	NA	Insulated Hand Tools	None	Stable	
1.20	27.00	CP	30/06/2025 11:45	02/07/2025 14:30	DS	DS	NA	NA	Dando 2000	NA	NA	

PROGRESS

Date Time	Depth	Depth Casing	Depth Water	Remarks
30/06/2025 17:30	7.50	7.20	Dry	End of Shift
01/07/2025 07:30	7.50	7.20	Dry	Start of Shift
01/07/2025 17:30	21.60	21.00	17.80	End of Shift
02/07/2025 07:30	21.60	21.00	15.90	Start of Shift
02/07/2025 17:30	27.00	27.00	7.20	End of Hole
03/07/2025 19:30				Installation Complete

WATER STRIKES

Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks
01/07/2025 15:10	21.60	21.00		17.80	20	Medium

CABLE PERCUSSION DETAILS

Depth Top	Depth Base	Time Start	Duration	Tool	Remarks

SPT DETAILS

Depth Top	Test Type	Reported Result	Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water

ROTARY FLUSH DETAILS

Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks

HOLE DIAMETER / CASING DIAMETER / DYNAMIC SAMPLING

HOLE DIAMETER		CASING DIAMETER		DYNAMIC SAMPLING					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference
		7.20	250						
		21.60	200						
		27.00	150						

INSTALLATION DETAILS / PIPE CONSTRUCTION

Distance	ID	Type	Response Top	Response Base	Pipe Ref	Pipe Ref	Top	Base	Diameter	Pipe Type
27.00	S1	SP	0.00	27.00	Pipe1	Pipe1	0.00	27.00	60	PLAIN

DEPTH RELATED REMARKS

Depth Top	Depth Base	Remarks
6.20	7.20	Bentonite seal. Casing reduced from 250mm to 200mm
20.60	21.60	Bentonite seal. Casing reduced from 200mm to 150mm

BACKFILL DETAILS

Depth Top	Depth Base	Description	Remarks
0.00	27.00	Grout	

LOCATION DETAILS

Remarks

1. Deep datum Installation 2. 16 grout mixes used

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH301
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 3 Scale: 1:50

Ground Level	+7.40mOD	Coordinates	566441.32E, 175781.64N	Grid	OSGB
Hole Type	IP+CP	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
MADE GROUND: Light grey clayey fine to coarse sand sized fragments. (Ash Fill) (MG) [MADE GROUND]						B 1 0.00-0.50							
			(5.10)			B 2 3.00-3.50							
MADE GROUND: Light grey sandy silty clay. Sand sized fragments are fine to coarse. (MG) [MADE GROUND]			5.10	2.30		B 3 5.10-5.60							
			(1.90)										
Soft to firm grey sandy silty CLAY. Sand is fine to coarse. (ALV) [ALLUVIUM]			7.00	0.40		B 4 7.00-7.50							

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

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SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH301
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 2 of 3 Scale: 1:50

Ground Level	+7.40mOD	Coordinates	566441.32E, 175781.64N	Grid	OSGB
Hole Type	IP+CP	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Soft to firm grey sandy silty CLAY. Sand is fine to coarse. (ALV) [ALLUVIUM] from 10.00m light brownish grey slightly sandy			(12.00)			B 5 10.00-10.50 B 6 13.00-13.50 B 7 16.00-16.50							
Light brown and grey fine to coarse SAND and subangular to subrounded fine to coarse GRAVEL of flint and chalk.			19.00	-11.60		B 8 19.00-19.50							

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

FINAL Print date and time 02/10/2025 12:33 Log checked by EC

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH301
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 3 of 3 Scale: 1:50

Ground Level	+7.40mOD	Coordinates	566441.32E, 175781.64N	Grid	OSGB
Hole Type	IP+CP	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Light brown and grey fine to coarse SAND and subangular to subrounded fine to coarse GRAVEL of flint and chalk.			(5.60)			B 9 22.00-22.50							
			24.60	-17.20									
Structureless CHALK. Composed of subangular to subrounded GRAVEL. (Grade Dc) [SEAFORD CHALK FORMATION]			(2.10)			B 10 25.00-25.50							
			27.00	-19.60									
Complete at 27.00m. Termination Reason: Achieved Scheduled Depth													

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH302
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 1

Ground Level	+8.21mOD	Coordinates	566606.41E, 175776.43N	Grid	OSGB	
Date Started	09/07/2025	Date Completed	15/07/2025	Inclination	90° from horizontal	

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	09/07/2025 08:35	09/07/2025 09:05	DS	DS	NA	NA	Insulated Hand Tools	None	Stable	
1.20	30.00	CP	09/07/2025 09:05	11/07/2025 09:45	DS	DS	NA	NA	Dando 2000	NA	NA	

PROGRESS

Date Time	Depth	Depth Casing	Depth Water	Remarks
09/07/2025 17:30	18.00	18.00	17.80	End of shift
10/07/2025 07:30	18.00	18.00	17.10	Start of shift
10/07/2025 17:30	27.00	27.00	11.20	End of shift
11/07/2025 07:30	27.00	27.00	7.60	Start of shift
11/07/2025 17:30	30.00	30.00	8.30	End of Hole
15/07/2025 17:30				Installation Complete

WATER STRIKES

Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks
09/07/2025 10:20	5.60	5.20		5.00	20	Very Slow
10/07/2025 11:00	22.10	22.10		17.70	20	Medium

CABLE PERCUSSION DETAILS

Depth Top	Depth Base	Time Start	Duration	Tool	Remarks

SPT DETAILS

Depth Top	Test Type	Reported Result	Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water

ROTARY FLUSH DETAILS

Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks

HOLE DIAMETER / CASING DIAMETER

Hole Depth Base	Hole Diameter	Casing Depth Base	Casing Diameter
		6.50	250
		22.50	200
		30.00	150

DYNAMIC SAMPLING

Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference

INSTALLATION DETAILS

Distance	ID	Type	Response Top	Response Base	Pipe Ref
30.00	S1	SP	0.00	30.00	Pipe1

PIPE CONSTRUCTION

Pipe Ref	Top	Base	Diameter	Pipe Type
Pipe1	0.00	30.00	60	PLAIN

DEPTH RELATED REMARKS

Depth Top	Depth Base	Remarks
5.50	6.50	Bentonite seal. Casing reduced from 250mm to 200mm
21.50	22.50	Bentonite seal. Casing reduced from 200mm to 150mm

BACKFILL DETAILS

Depth Top	Depth Base	Description	Remarks
0.00	30.00	Grout	

LOCATION DETAILS

Remarks

1. Deep datum Installation 2. 17 grout mixes used

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

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SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH302
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 3 Scale: 1:50

Ground Level	+8.21mOD	Coordinates	566606.41E, 175776.43N	Grid	OSGB
Hole Type	IP+CP	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
MADE GROUND: Grey and white subangular to subrounded fine to coarse gravel of flint, chalk and brick. (MG) [MADE GROUND]			(0.30)			B 1 0.00-0.30							
			0.30	7.91									
MADE GROUND: Dark grey clayey fine to coarse sand. Driller notes ash fill. (MG) [MADE GROUND]						B 2 0.30-0.70							
			(5.40)			B 3 3.00-3.50							
Very stiff grey slightly sandy CLAY. (ALV) [ALLUVIUM]			5.70	2.51		B 4 6.00-6.50							
			(2.60)										
Firm to stiff grey slightly sandy CLAY. Sand is fine to coarse. (ALV) [ALLUVIUM]			8.30	-0.09		B 5 8.30-8.70							
			(2.70)										

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH302
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 2 of 3 Scale: 1:50

Ground Level	+8.21mOD	Coordinates	566606.41E, 175776.43N	Grid	OSGB
Hole Type	IP+CP	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Firm to stiff grey slightly sandy CLAY. Sand is fine to coarse. (ALV) [ALLUVIUM]													
			11.00	-2.79									
Grey clayey fine to coarse SAND.			(0.50)			B 6 11.00-11.50							
			11.50	-3.29									
Firm to stiff greyish brown slightly sandy CLAY. Sand is fine to coarse.													
			(4.10)			B 7 14.00-14.50							
			15.60	-7.39									
Greyish brown clayey amorphous PEAT. [PEAT]			(0.50)			B 8 15.60-16.10							
			16.10	-7.89									
Dark grey very sandy CLAY. Sand is fine to coarse. (ALV) [ALLUVIUM]						B 9 16.10-16.60							
			(6.00)			B 10 19.00-19.50							

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH302
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 3 of 3 Scale: 1:50

Ground Level	+8.21mOD	Coordinates	566606.41E, 175776.43N	Grid	OSGB
Hole Type	IP+CP	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Dark grey very sandy CLAY. Sand is fine to coarse. (ALV) [ALLUVIUM]													
			22.10	-13.89									
Dark brown fine to coarse SAND and subangular to subrounded fine to coarse GRAVEL of flint. (RTD) [RIVER TERRACE DEPOSITS]						B 11 22.10-22.60							
			(2.90)										
			25.00	-16.79									
Brown medium to coarse SAND.			(0.50)			B 12 25.00-25.50							
			25.50	-17.29									
Dark brown fine to coarse SAND and subangular to subrounded fine to coarse GRAVEL of flint.													
			(2.40)										
			27.90	-19.69									
CHALK with flint (Driller's description) [SEAFORD CHALK FORMATION]						B 13 28.00-28.50							
			(2.10)										
			30.00	-21.79									
Complete at 30.00m. Termination Reason: Achieved Scheduled Depth													

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH303
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 1

Ground Level	+5.32mOD	Coordinates	566408.67E, 175525.03N	Grid	OSGB	
Date Started	25/06/2025	Date Completed	30/06/2025	Inclination	90° from horizontal	

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	25/06/2025 10:15	25/06/2025 11:15	DS	DS	NA	NA	Insulated Hand Tools	None	Stable	
1.20	27.00	CP	25/06/2025 11:15	26/06/2025 17:30	DS	DS	NA	NA	Dando 2000	NA	NA	

PROGRESS

Date Time	Depth	Depth Casing	Depth Water	Remarks
25/06/2025 17:30	13.20	13.20	Dry	End of shift
26/06/2025 07:30	13.20	13.20	3.10	Start of shift
26/06/2025 17:30	27.00	27.00	Dry	End of Hole
27/06/2025 07:30	27.00	27.00	Dry	Start of shift
27/06/2025 15:30	0.00			End of shift
30/06/2025 07:30	6.00	0.00	Dry	Start of shift
30/06/2025 10:00				Installation Complete

WATER STRIKES

Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks
25/06/2025 13:15	3.20	3.20	6.80	2.70	20	Slow
26/06/2025 10:30	18.70	18.50		17.20	20	Medium

CABLE PERCUSSION DETAILS

Depth Top	Depth Base	Time Start	Duration	Tool	Remarks
1.40	1.70	25/06/2025 11:30	01:00		

SPT DETAILS

Depth Top	Test Type	Reported Result	Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water

ROTARY FLUSH DETAILS

Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks

HOLE DIAMETER / CASING DIAMETER

Hole Depth Base	Hole Diameter	Casing Depth Base	Casing Diameter
		5.00	250
		19.50	200
		27.00	150

DYNAMIC SAMPLING

Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference

INSTALLATION DETAILS

Distance	ID	Type	Response Top	Response Base	Pipe Ref
27.00	S1	SP	0.00	27.00	Pipe1

PIPE CONSTRUCTION

Pipe Ref	Top	Base	Diameter	Pipe Type
Pipe1	0.00	27.00	60	PLAIN

DEPTH RELATED REMARKS

Depth Top	Depth Base	Remarks
4.00	5.00	Bentonite seal. Casing reduced from 250mm to 200mm
18.50	19.50	Bentonite seal. Casing reduced from 200mm to 150mm

BACKFILL DETAILS

Depth Top	Depth Base	Description	Remarks
0.00	27.00	Grout	

LOCATION DETAILS

Remarks

1. Deep datum Installation 2. 16 grout mixes used

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

FINAL Print date and time 02/10/2025 12:33 Log checked by EC

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH303
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 3 Scale: 1:50

Ground Level	+5.32mOD	Coordinates	566408.67E, 175525.03N	Grid	OSGB
Hole Type	IP+CP	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
MADE GROUND: Dark grey slightly sandy slightly gravelly clay with low cobble content. Sand sized fragments are fine to coarse. Gravel sized fragments are angular to subangular fine to coarse of brick, concrete, wood, ash and flint. Cobble sized fragments are subangular of wood, concrete and brick. (MG) [MADE GROUND]			(4.30)			B 1 0.10-0.60							
						B 2 3.10-3.60							
Firm to stiff slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular of flint. (ALV) [ALLUVIUM]			4.30	1.02		B 3 4.50-5.00							
						B 4 5.50-6.00							
			(5.40)										
Stiff dark grey clayey amorphous PEAT. [PEAT]			9.70	-4.38		B 5 9.70-10.20							

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH303
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 2 of 3 Scale: 1:50

Ground Level	+5.32mOD	Coordinates	566408.67E, 175525.03N	Grid	OSGB
Hole Type	IP+CP	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Stiff dark grey clayey amorphous PEAT. [PEAT]			(0.90)										
			10.60	-5.28									
Stiff brown slightly sandy CLAY. Sand is fine to coarse. (ALV) [ALLUVIUM]						B 6 12.70-13.20							
			(8.10)										
						B 7 15.70-16.20							
			18.70	-13.38									
Brown very clayey fine to coarse SAND. (RTD) [RIVER TERRACE DEPOSITS]						B 8 18.70-19.20							
			(0.90)										
			19.60	-14.28									
Grey fine to coarse SAND and subangular to subrounded fine to coarse GRAVEL of flint. (RTD) [RIVER TERRACE DEPOSITS]													

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH303
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 3 of 3 Scale: 1:50

Ground Level	+5.32mOD	Coordinates	566408.67E, 175525.03N	Grid	OSGB
Hole Type	IP+CP	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Grey fine to coarse SAND and subangular to subrounded fine to coarse GRAVEL of flint. (RTD) [RIVER TERRACE DEPOSITS]			(4.80)			B 9 20.00-20.50							
						B 10 23.00-23.50							
Structureless CHALK Composed of subangular to subrounded GRAVEL and COBBLES (Grade Dc). [SEAFORD CHALK FORMATION]			24.40 (2.60)	-19.08		B 11 24.50-25.00							
Complete at 27.00m. Termination Reason: Achieved Scheduled Depth			27.00	-21.68									

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH304
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 1

Ground Level	+2.38mOD	Coordinates	567352.79E, 174259.48N	Grid	OSGB		
Date Started	18/06/2025	Date Completed	24/06/2025	Inclination	90° from horizontal		

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	19/06/2025 15:00	19/06/2025 15:45	DS	DS	NA	NA	Insulated Hand Tools	None	Stable	
1.20	21.00	CP	19/06/2025 15:45	23/06/2025 17:30	DS	DS	NA	NA	Dando 2000	NA	NA	

PROGRESS

Date Time	Depth	Depth Casing	Depth Water	Remarks
19/06/2025 17:30	6.00	5.00	Dry	End of shift
20/06/2025 07:30	6.00	5.00	Dry	Start of shift
20/06/2025 17:30	12.50	12.20	11.50	End of shift
23/06/2025 07:30	12.50	12.50	1.30	Start of shift
23/06/2025 17:30	21.00	21.00	1.90	End of Hole
24/06/2025 07:30	21.00	21.00	1.60	Start of shift
24/06/2025 17:30				Installation Complete

WATER STRIKES

Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks
20/06/2025 13:10	12.50	12.20		11.50	20	Medium

CABLE PERCUSSION DETAILS

Depth Top	Depth Base	Time Start	Duration	Tool	Remarks

SPT DETAILS

Depth Top	Test Type	Reported Result	Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water

ROTARY FLUSH DETAILS

Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks

HOLE DIAMETER / CASING DIAMETER

Hole Depth Base	Hole Diameter	Casing Depth Base	Casing Diameter
		12.50	250
		21.00	200

DYNAMIC SAMPLING

Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference

INSTALLATION DETAILS

Distance	ID	Type	Response Top	Response Base	Pipe Ref
21.00	S1	SP	0.00	21.00	Pipe1

PIPE CONSTRUCTION

Pipe Ref	Top	Base	Diameter	Pipe Type
Pipe1	0.00	21.00	60	PLAIN

DEPTH RELATED REMARKS

Depth Top	Depth Base	Remarks
11.50	12.50	Bentonite seal. Casing reduced from 200mm to 150mm

BACKFILL DETAILS

Depth Top	Depth Base	Description	Remarks
0.00	21.00	Grout	

LOCATION DETAILS

Remarks

1. UXO borehole clearance to 7.0m. depth 2. Deep datum Installation 3. 14 grout mixes used

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

SOIL ENGINEERING

FINAL | Print date and time 02/10/2025 12:33 | Log checked by EC

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH304
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 3 Scale: 1:50

Ground Level	+2.38mOD	Coordinates	567352.79E, 174259.48N	Grid	OSGB
Hole Type	IP+CP	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
MADE GROUND: Stone, brick fill (Driller's description) (MG) [MADE GROUND]			(0.50)										
Brown CLAY (Driller's description) (ALV) [ALLUVIUM]			0.50	1.88									
			(1.20)										
Firm to stiff greyish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of flint. (ALV) [ALLUVIUM]			1.70	0.68		B 1 2.00-2.50							
						B 2 4.00-4.50							
			(5.90)										
						B 3 6.00-6.50							
PEAT (Driller's description) [PEAT]			7.60	-5.22									
from 8.00m to 8.50m very stiff			(0.60)										
Firm to stiff greyish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of flint. (ALV) [ALLUVIUM]			8.20	-5.82		B 4 8.00-8.50							
			(3.60)										

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH304
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 2 of 3 Scale: 1:50

Ground Level	+2.38mOD	Coordinates	567352.79E, 174259.48N	Grid	OSGB
Hole Type	IP+CP	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Firm to stiff greyish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of flint. (ALV) [ALLUVIUM]						B 5 10.00-10.50							
Stiff greyish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of flint. (ALV) [ALLUVIUM]			11.80 (0.70)	-9.42		B 6 12.00-12.50							
SAND (Driller's description) (RTD) [RIVER TERRACE DEPOSITS]			12.50 (1.20)	-10.12									
Brown medium to coarse locally fine SAND and medium to coarse angular to subangular GRAVEL of flint. (RTD) [RIVER TERRACE DEPOSITS]			13.70 (5.30)	-11.32		B 7 14.00-14.50 B 8 16.00-16.50 B 9 18.00-18.50							
CHALK (Driller's description) [SEAFORD CHALK FORMATION]			19.00 (2.00)	-16.62									

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH304
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 3 of 3 Scale: 1:50

Ground Level	+2.38mOD	Coordinates	567352.79E, 174259.48N	Grid	OSGB
Hole Type	IP+CP	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
CHALK (Driller's description) [SEAFORD CHALK FORMATION]						B 10 20.00-20.50							
Complete at 21.00m. Termination Reason: Achieved Scheduled Depth			21.00	-18.62									

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

FINAL Print date and time 02/10/2025 12:33 Log checked by EC

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH305
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 1

Ground Level	+2.40mOD	Coordinates	567402.08E, 174012.69N	Grid	OSGB		
Date Started	09/06/2025	Date Completed	12/06/2025	Inclination	90° from horizontal		

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	05/06/2025 09:00	05/06/2025 09:45	DS	DS	NA	NA	Insulated Hand Tools	None	Stable	
0.00	7.20	SCP		16/05/2025 12:00								Magnetometer test only
1.20	24.00	CP	05/06/2025 09:45	11/06/2025 14:20	DS	DS	NA	NA	Dando 2000	NA	NA	

PROGRESS

Date Time	Depth	Depth Casing	Depth Water	Remarks
05/06/2025 17:30	12.60	12.60	5.50	End of shift
09/06/2025 07:30	12.60	12.60	2.10	Start of shift
09/06/2025 15:30	12.60	12.60	2.10	End of shift
11/06/2025 07:30	12.60	12.60	1.90	Start of shift
11/06/2025 17:30	24.00	24.00	5.60	End of Hole
12/06/2025 07:30	24.00	24.00	2.20	Start of shift
12/06/2025 17:30				Installation Complete

WATER STRIKES

Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks

CABLE PERCUSSION DETAILS

Depth Top	Depth Base	Time Start	Duration	Tool	Remarks

SPT DETAILS

Depth Top	Test Type	Reported Result	Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water

ROTARY FLUSH DETAILS

Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks

HOLE DIAMETER / CASING DIAMETER / DYNAMIC SAMPLING

HOLE DIAMETER		CASING DIAMETER		DYNAMIC SAMPLING					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference
		13.00	200						
		24.00	150						

INSTALLATION DETAILS / PIPE CONSTRUCTION

Distance	ID	Type	Response Top	Response Base	Pipe Ref	Pipe Ref	Top	Base	Diameter	Pipe Type
24.00	S1	SP	0.00	24.00	Pipe1	Pipe1	0.00	24.00	60	PLAIN

DEPTH RELATED REMARKS

Depth Top	Depth Base	Remarks
12.00	13.00	Bentonite seal. Casing reduced from 200mm to 150mm

BACKFILL DETAILS

Depth Top	Depth Base	Description	Remarks
0.00	24.00	Grout	

LOCATION DETAILS

Remarks
1. Deep datum Installation 2. 15 grout mixes used

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH305
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 3 Scale: 1:50

Ground Level	+2.40mOD	Coordinates	567402.08E, 174012.69N	Grid	OSGB
Hole Type	IP+CP	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
MADE GROUND: Stoney gravel fill (Driller's description) (MG) [MADE GROUND]			(0.40)										
			0.40	2.00									
Brown CLAY (Driller's description) (ALV) [ALLUVIUM]			(0.50)										
			0.90	1.50									
Grey ALLUVIUM. (Driller's description) (ALV) [ALLUVIUM]			(1.10)										
			2.00	0.40									
Firm to stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of flint.			(0.50)			B 1 2.00-2.50							
			2.50	-0.10									
Grey ALLUVIUM. (Driller's description) PEAT (Driller's description) [PEAT]			2.60	-0.20									
			(0.50)										
			3.10	-0.70									
Firm to stiff greyish brown slightly sandy CLAY. Sand is fine to coarse. (ALV) [ALLUVIUM]						B 2 4.00-4.50							
			(4.90)			B 3 6.00-6.50							
			8.00	-5.60									
Brown very clayey fine to coarse SAND.			(0.50)			B 4 8.00-8.50							
			8.50	-6.10									
Firm to stiff greyish brown CLAY.													

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH305
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 2 of 3 Scale: 1:50

Ground Level	+2.40mOD	Coordinates	567402.08E, 174012.69N	Grid	OSGB
Hole Type	IP+CP	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Firm to stiff greyish brown CLAY.			(3.20)			B 5 10.00-10.50							
PEAT (Driller's description) [PEAT]			11.70 (0.40)	-9.30									
Firm to stiff greyish brown CLAY. (ALV) [ALLUVIUM]			12.10 (0.50)	-9.70		B 6 12.00-12.50							
Brown clayey fine to coarse SAND. (RTD) [RIVER TERRACE DEPOSITS]			12.60 (2.80)	-10.20		B 7 14.00-14.50							
Brown fine to coarse SAND and subangular to subrounded medium to coarse GRAVEL of flint. (RTD) [RIVER TERRACE DEPOSITS]			15.40 (6.50)	-13.00		B 8 16.00-16.50 B 9 18.00-18.50							

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH305
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 3 of 3 Scale: 1:50

Ground Level	+2.40mOD	Coordinates	567402.08E, 174012.69N	Grid	OSGB
Hole Type	IP+CP	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Brown fine to coarse SAND and subangular to subrounded medium to coarse GRAVEL of flint. (RTD) [RIVER TERRACE DEPOSITS]						B 10 20.00-20.50							
Structureless CHALK composed of clayey sandy subangular to subrounded GRAVEL. Clasts are extremely weak low density white. (Grade Dc). [SEAFORD CHALK FORMATION]			21.90	-19.50		B 11 22.00-22.50							
			(2.10)										
Complete at 24.00m. Termination Reason: Achieved Scheduled Depth			24.00	-21.60									

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH306
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 1

Ground Level	+2.54mOD	Coordinates	567537.15E, 173995.66N	Grid	OSGB		
Date Started	10/06/2025	Date Completed	10/06/2025	Inclination	90° from horizontal		

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	03/06/2025 12:30	03/06/2025 13:30	DS	NA	NA	NA	Insulated Hand Tools	None	Stable	
0.00	7.44	SCP		16/05/2025 12:00								Magnetometer test only
1.20	24.00	CP	03/06/2025 13:30	04/06/2025 16:00	DS	AW	NA	NA	Dando 2000	NA	NA	

PROGRESS

Date Time	Depth	Depth Casing	Depth Water	Remarks
03/06/2024 17:30	12.90	12.90	5.40	End of Shift
04/06/2025 07:30	12.90	12.90	2.30	Start of Shift
04/06/2025 17:30	24.00	24.00	3.70	End of CP
10/06/2025 17:30				Installation Complete

WATER STRIKES

Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks
03/06/2025 15:20	12.90	12.90		5.40	20	Slow

CABLE PERCUSSION DETAILS

Depth Top	Depth Base	Time Start	Duration	Tool	Remarks

SPT DETAILS

Depth Top	Test Type	Reported Result	Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water

ROTARY FLUSH DETAILS

Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks

HOLE DIAMETER / CASING DIAMETER / DYNAMIC SAMPLING

HOLE DIAMETER		CASING DIAMETER		DYNAMIC SAMPLING					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference
12.90	200	14.00	200						
23.30	150	24.00	150						

INSTALLATION DETAILS

Distance	ID	Type	Response Top	Response Base	Pipe Ref
24.00	S1	SP	0.00	24.00	Pipe1

PIPE CONSTRUCTION

Pipe Ref	Top	Base	Diameter	Pipe Type
Pipe1	0.00	24.00	60	PLAIN

DEPTH RELATED REMARKS

Depth Top	Depth Base	Remarks
13.00	14.00	Bentonite seal. Casing reduced from 200mm to 150mm

BACKFILL DETAILS

Depth Top	Depth Base	Description	Remarks
0.00	24.00	Grout	

LOCATION DETAILS

Remarks

1. Deep datum Installation 2. 15 grout mixes used

AGS

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations see key.

SOIL ENGINEERING

FINAL | Print date and time 02/10/2025 12:33 | Log checked by EC

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH306
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 3 Scale: 1:50

Ground Level	+2.54mOD	Coordinates	567537.15E, 173995.66N	Grid	OSGB
Hole Type	IP+CP	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
MADE GROUND: Stone gravel (Drillers Description) (MG) [MADE GROUND]			(0.40)										
			0.40	2.14									
Brown CLAY (Drillers Description) (ALV) [ALLUVIUM]			(1.40)										
			1.80	0.74									
Very soft brown and dark brown grey silty CLAY. (ALV) [ALLUVIUM]						B 1 2.00-2.50							
			(2.20)										
			4.00	-1.46									
Very soft very dark grey silty CLAY with frequent pockets (<50mm) of peat. Mild organic odour. (ALV) [ALLUVIUM]						B 2 4.00-4.50							
			(4.00)			B 3 6.00-6.50							
			8.00	-5.46									
Very soft dark grey silty CLAY. (ALV) [ALLUVIUM]						B 4 8.00-8.50							

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

FINAL Print date and time 02/10/2025 12:33 Log checked by EC

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH306
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 2 of 3 Scale: 1:50

Ground Level	+2.54mOD	Coordinates	567537.15E, 173995.66N	Grid	OSGB
Hole Type	IP+CP	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Very soft dark grey silty CLAY. (ALV) [ALLUVIUM]			(6.00)			B 5 10.00-10.50							
						B 6 12.00-12.50							
Grey clayey fine to medium SAND (RTD) [RIVER TERRACE DEPOSITS]			14.00 (2.60)	-11.46		B 7 14.00-14.50							
						B 8 16.00-16.50							
Brown slightly sandy angular to subrounded fine to coarse GRAVEL of flint. (RTD) [RIVER TERRACE DEPOSITS]			16.60 (4.70)	-14.06		B 9 18.00-18.50							

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

FINAL Print date and time 02/10/2025 12:33 Log checked by EC

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Log	Hole ID
Project No.	TB8754		BH306
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 3 of 3 Scale: 1:50

Ground Level	+2.54mOD	Coordinates	567537.15E, 173995.66N	Grid	OSGB
Hole Type	IP+CP	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	Sampling Dia.	TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Install-ation
Brown slightly sandy angular to subrounded fine to coarse GRAVEL of flint. (RTD) [RIVER TERRACE DEPOSITS]						B 10 20.00-20.50							
Structureless white CHALK comprised of silty angular fine to coarse gravel with occasional flint fragments. [SEAFORD CHALK FORMATION]			21.30	-18.76									
			(2.00)			B 11 22.00-22.50							
			23.30	-20.76									
Complete at 24.00m. Termination Reason: Achieved Scheduled Depth													

Notes: All depth in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key.

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SOIL ENGINEERING

SOIL ENGINEERING

SUPPORTING FACTUAL DATA

SECTION A
Exploratory Hole Records and Field Data

EXCAVATION RECORDS

Project Name	Grain to Tilbury Tunnel GI	Excavation Log	Hole ID
Project No.	TB8754		GW102
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 1 Scale: 1:50

Ground Level	+2.79mOD	Coordinates	566358.81E, 175819.17N	Grid	OSGB
Hole Type	IP	Method/ Equipment	Insulated Hand Tools		
Date Started	24/07/2025	Date Completed	24/07/2025	Logged By	EC

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	In Situ Test Details	Install-ation
MADE GROUND: Brown slightly gravelly slightly clayey fine to coarse sand. Gravel sized fragments are angular to subangular fine to coarse of ash, brick, chert, concrete and mudstone. (MG) [MADE GROUND]			(1.20)					
End of excavation at 1.20m. Termination Reason: Achieved Scheduled Depth			1.20	2.79				

Stability	Stable
Shoring	None

DEPTH RELATED REMARKS

Depth Top	Depth Base	Remarks
0.00	0.70	Plain 50mm pipe for gas monitoring
0.70	1.20	Slotted 50mm pipe for gas monitoring

BACKFILL

Depth Top	Depth Base	Description	Remarks
0.00	0.25	Concrete	
0.25	0.70	Bentonite	
0.70	1.20	Gravel backfill	

DEPTH RELATED EXPLORATORY HOLE REMARKS

Depth Top	Depth Base	Remarks
0.000	1.200	Hand pit excavated to install ground gas pipe

Excavation Dimensions and Orientation

Length (Sides A and C)	0.50m
Length (Sides B and D)	0.50m
Depth	1.20m

WATER STRIKES

Date Time	Depth Strike	Depth Sealed	WATER STRIKES DETAIL: Depth Water	Time Elapsed

GENERAL NOTES

Remarks

Notes: All depth in metres, all soil strengths are average in kPa. For in situ test results, see accompanying records.
All bearings given relate to magnetic North.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Excavation Log	Hole ID
Project No.	TB8754		GW103
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 1 Scale: 1:50

Ground Level	+1.99mOD	Coordinates	567471.47E, 174227.48N	Grid	OSGB
Hole Type	IP	Method/ Equipment	Insulated Hand Tools		
Date Started	23/07/2025	Date Completed	23/07/2025	Logged By	EC

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	In Situ Test Details	Install-ation
TOPSOIL: Dark grey clay with frequent rootlets. (TS) [TOPSOIL]			(0.40)					
			0.40	1.99				
Firm grey mottled orangish brown CLAY. (ALV) [ALLUVIUM]			(0.80)					
End of excavation at 1.20m. Termination Reason: Achieved Scheduled Depth			1.20	1.99				

Stability	Stable
Shoring	None

Excavation Dimensions and Orientation

Length (Sides A and C)	0.50m
Length (Sides B and D)	0.50m
Depth	1.20m

DEPTH RELATED REMARKS

Depth Top	Depth Base	Remarks
0.00	0.70	Plain 50mm pipe for gas monitoring
0.70	1.20	Slotted 50mm pipe for gas monitoring

WATER STRIKES

Date Time	Depth Strike	Depth Sealed

WATER STRIKES DETAIL

Depth Water	Time Elapsed

BACKFILL

Depth Top	Depth Base	Description	Remarks
0.00	0.25	Concrete	
0.25	0.70	Bentonite	
0.70	1.20	Gravel backfill	

DEPTH RELATED EXPLORATORY HOLE REMARKS

Depth Top	Depth Base	Remarks
0.000	1.200	Hand pit excavated to install ground gas pipe

GENERAL NOTES

Remarks

Notes: All depth in metres, all soil strengths are average in kPa. For in situ test results, see accompanying records.
All bearings given relate to magnetic North.
For details of abbreviations, see key.

Project Name	Grain to Tilbury Tunnel GI	Excavation Log	Hole ID
Project No.	TB8754		GW104
Engineer	Mott MacDonald		
Employer	FBJV		Sheet 1 of 1 Scale: 1:50

Ground Level	+2.37mOD	Coordinates	567429.38E, 174063.26N	Grid	OSGB
Hole Type	IP	Method/ Equipment	Insulated Hand Tools		
Date Started	23/07/2025	Date Completed	23/07/2025	Logged By	EC

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	In Situ Test Details	Install-ation
TOPSOIL: Dark grey clay with frequent rootlets. (TS) [TOPSOIL]			(0.30) 0.30	2.37				
Yellowish brown slightly gravelly fine to coarse SAND. Gravel is angular to sub angular fine to medium of flint. (ALV) [ALLUVIUM]			(0.30) 0.60	2.37				
Very stiff fissured brown mottled orangish brown CLAY. Fissures are extremely closely spaced randomly orientated and closed. (ALV) [ALLUVIUM]			(0.60)					
End of excavation at 1.20m. Termination Reason: Achieved Scheduled Depth			1.20	2.37				

Stability	Stable
Shoring	None

Excavation Dimensions and Orientation

Length (Sides A and C)	0.50m
Length (Sides B and D)	0.50m
Depth	1.20m

DEPTH RELATED REMARKS

Depth Top	Depth Base	Remarks
0.00	0.70	Plain 50mm pipe for gas monitoring
0.70	1.20	Slotted 50mm pipe for gas monitoring

WATER STRIKES

Date Time	Depth Strike	Depth Sealed

WATER STRIKES DETAIL

Depth Water	Time Elapsed

BACKFILL

Depth Top	Depth Base	Description	Remarks
0.00	0.25	Concrete	
0.25	0.70	Bentonite	
0.70	1.20	Gravel backfill	

DEPTH RELATED EXPLORATORY HOLE REMARKS

Depth Top	Depth Base	Remarks
0.000	1.200	Hand pit excavated to install ground gas pipe

GENERAL NOTES

Remarks

Notes: All depth in metres, all soil strengths are average in kPa. For in situ test results, see accompanying records.
All bearings given relate to magnetic North.
For details of abbreviations, see key.

SOIL ENGINEERING

SUPPORTING FACTUAL DATA

SECTION A
Exploratory Hole Records and Field Data

IN SITU TEST DATA

Project Name	Grain to Tilbury Tunnel GI	**Packer or Lugeon Test Record**	Hole ID BH102
Project No.	TB8754		Ground Level
Engineer	Mott MacDonald		Date 22/05/2025
Client	FBJV	BS EN 15022282 Part 3	Page 1 of 1

Test no.	3	Depth below ground level to		
Packer type	Double - using initial groundwater level	Top of test section	m	34.00
Packer pressure	8 bar	Bottom of test section	m	35.00
Diameter of hole in test area	146 mm	Centre of test section	m	34.50
Weather	Sunny	Bottom of hole at time of test	m	60.50
Type of rock	Chalk	Bottom of casing	m	25.20
		Initial ground water level	m	1.35
		Assumed standing water level	m	
		Length of test section	m	1.00
		Gauge height above ground level	m	

1st period		Gauge Pressure	bar			Friction head loss	m	0.0					Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
2nd period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
3rd period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
4th period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
5th period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												

Pipework and Drill String Details

Type of drill rod		2 3/8"	Total length of drill rod (including 'stick up')	m	34.50
Diameter of delivery hose	mm	50	Total length of delivery hose in metres	m	2.00
Flow meter ID			Flow meter calibration date		

Remarks

Packer pressure set to 5 bar. Water levels rose to 1.20m. Packer pressure increased to 8 bar. Water level held at 1.35m.Flow was 100 litres per minute. Test Abandoned. 1000 litres of water used.

Crew/Operator	PS				
Form No.	SE-PGR-F-009	Revision No.	2.06	Issue Date	28/02/2024

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Packer or Lugeon Test Record**	Hole ID BH102
Project No.	TB8754		Ground Level
Engineer	Mott MacDonald		Date 22/05/2025
Client	FBJV	BS EN 15022282 Part 3	Page 1 of 1

Test no.	2	Depth below ground level to		
Packer type	Double - using initial groundwater level	Top of test section	m	36.00
Packer pressure	7 bar	Bottom of test section	m	37.00
Diameter of hole in test area	146 mm	Centre of test section	m	36.50
Weather	Sunny	Bottom of hole at time of test	m	60.50
Type of rock	Chalk	Bottom of casing	m	25.20
		Initial ground water level	m	1.35
		Assumed standing water level	m	
		Length of test section	m	1.00
		Gauge height above ground level	m	

1st period		Gauge Pressure	bar			Friction head loss	m	0.0					Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
2nd period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
3rd period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
4th period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
5th period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												

Pipework and Drill String Details

Type of drill rod		2 3/8"	Total length of drill rod (including 'stick up')	m	36.50
Diameter of delivery hose	mm	50	Total length of delivery hose in metres	m	2.00
Flow meter ID			Flow meter calibration date		

Remarks

Packer pressure set to 7 bar. Water level held at 1.35m. Unable to obtain pressure in packer test section. Flow was 100 litres per minute. Test Abandoned. 1000 litres of water used.

Crew/Operator	PS			
Form No.	SE-PGR-F-009	Revision No. 2.06	Issue Date	28/02/2024

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Packer or Lugeon Test Record**	Hole ID BH102
Project No.	TB8754		Ground Level
Engineer	Mott MacDonald		Date 22/05/2025
Client	FBJV	BS EN 15022282 Part 3	Page 1 of 1

Test no.	1		Depth below ground level to		
Packer type	Double - using initial groundwater level		Top of test section	m	38.00
Packer pressure	8 bar		Bottom of test section	m	39.00
Diameter of hole in test area	146 mm		Centre of test section	m	38.50
Weather	Sunny		Bottom of hole at time of test	m	60.50
Type of rock	Chalk		Bottom of casing	m	25.20
			Initial ground water level	m	1.35
			Assumed standing water level	m	
			Length of test section	m	1.00
			Gauge height above ground level	m	

1st period		Gauge Pressure	bar			Friction head loss	m	0.0					Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
2nd period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
3rd period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
4th period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
5th period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												

Pipework and Drill String Details

Type of drill rod		2 3/8"	Total length of drill rod (including 'stick up')	m	38.50
Diameter of delivery hose	mm	50	Total length of delivery hose in metres	m	2.00
Flow meter ID			Flow meter calibration date		

Remarks

Packer pressure set to 5 bar. Water levels rose to 1.18m. Packer pressure increased to 8 bar. Water level held at 1.35m. Unable to obtain pressure in packer test section. Flow was 80 litres per minute. Increased to 100 litres per minuite but still unable to obtain pressure in packer test section. Test Abandoned. 1000 litres of water used.

Crew/Operator	PS			
Form No.	SE-PGR-F-009	Revision No.	2.06	Issue Date 28/02/2024

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Packer or Lugeon Test Record**	Hole ID BH106
Project No.	TB8754		Ground Level
Engineer	Mott MacDonald		Date 19/05/2025
Client	FBJV	BS EN 15022282 Part 3	Page 1 of 1

Test no.	6	Depth below ground level to		
Packer type	Double - using initial groundwater level	Top of test section	m	25.50
Packer pressure	8 bar	Bottom of test section	m	26.50
Diameter of hole in test area	146 mm	Centre of test section	m	26.00
Weather	Sunny	Bottom of hole at time of test	m	60.00
Type of rock	Chalk	Bottom of casing	m	21.00
		Initial ground water level	m	1.75
		Assumed standing water level	m	
		Length of test section	m	1.00
		Gauge height above ground level	m	

1st period		Gauge Pressure	bar			Friction head loss	m	0.0					Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
2nd period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
3rd period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
4th period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
5th period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												

Pipework and Drill String Details

Type of drill rod		2 3/8"	Total length of drill rod (including 'stick up') m	26.00
Diameter of delivery hose	mm	50	Total length of delivery hose in metres m	2.00
Flow meter ID			Flow meter calibration date	

Remarks

Packer pressure set to 5 bar. Water levels rose to 1.65m. Packer pressure increased to 8 bar. Water level held at 1.75m. Unable to obtain pressure in packer test section. Flow was 60 litres per minute. Test Abandoned. 2000 litres of water used.

Crew/Operator	KG				
Form No.	SE-PGR-F-009	Revision No.	2.06	Issue Date	28/02/2024

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Packer or Lugeon Test Record**	Hole ID BH106
Project No.	TB8754		Ground Level
Engineer	Mott MacDonald		Date 19/05/2025
Client	FBJV	BS EN 15022282 Part 3	Page 1 of 1

Test no.	5		Depth below ground level to		
Packer type	Double - using initial groundwater level		Top of test section	m	29.50
Packer pressure	8 bar		Bottom of test section	m	30.50
Diameter of hole in test area	146 mm		Centre of test section	m	30.00
Weather	Sunny		Bottom of hole at time of test	m	60.00
Type of rock	Chalk		Bottom of casing	m	21.00
			Initial ground water level	m	1.80
			Assumed standing water level	m	
			Length of test section	m	1.00
			Gauge height above ground level	m	

1st period		Gauge Pressure	bar			Friction head loss	m	0.0					Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
2nd period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
3rd period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
4th period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
5th period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												

Pipework and Drill String Details

Type of drill rod		2 3/8"	Total length of drill rod (including 'stick up')	m	30.00
Diameter of delivery hose	mm	50	Total length of delivery hose in metres	m	2.00
Flow meter ID			Flow meter calibration date		

Remarks

Packer pressure set to 5 bar. Water levels rose to 1.70m. Packer pressure increased to 8 bar. Water level held at 1.80m. Unable to obtain pressure in packer test section. Flow was 60 litres per minute. Test Abandoned. 2000 litres of water used.

Crew/Operator	KG				
Form No.	SE-PGR-F-009	Revision No.	2.06	Issue Date	28/02/2024

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Packer or Lugeon Test Record**	Hole ID BH106
Project No.	TB8754		Ground Level
Engineer	Mott MacDonald		Date 19/05/2025
Client	FBJV	BS EN 15022282 Part 3	Page 1 of 1

Test no.	4	Depth below ground level to		
Packer type	Double - using initial groundwater level	Top of test section	m	33.50
Packer pressure	8 bar	Bottom of test section	m	34.50
Diameter of hole in test area	146 mm	Centre of test section	m	34.00
Weather	Sunny	Bottom of hole at time of test	m	60.00
Type of rock	Chalk	Bottom of casing	m	21.00
		Initial ground water level	m	1.55
		Assumed standing water level	m	
		Length of test section	m	1.00
		Gauge height above ground level	m	

1st period		Gauge Pressure	bar			Friction head loss	m	0.0					Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
2nd period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
3rd period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
4th period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
5th period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												

Pipework and Drill String Details

Type of drill rod		2 3/8"	Total length of drill rod (including 'stick up')	m	34.00
Diameter of delivery hose	mm	50	Total length of delivery hose in metres	m	2.00
Flow meter ID			Flow meter calibration date		

Remarks

Packer pressure set to 5 bar. Water levels rose to 1.50m. Packer pressure increased to 8 bar. Water level held at 1.55m. Unable to obtain pressure in packer test section. Flow was 70 litres per minute. Test Abandoned. 1500 litres of water used.

Crew/Operator	KG				
Form No.	SE-PGR-F-009	Revision No.	2.06	Issue Date	28/02/2024

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Packer or Lugeon Test Record**	Hole ID BH106
Project No.	TB8754		Ground Level
Engineer	Mott MacDonald		Date 15/05/2025
Client	FBJV	BS EN 15022282 Part 3	Page 1 of 1

Test no.	3	Depth below ground level to		
Packer type	Double - using initial groundwater level	Top of test section	m	35.00
Packer pressure	8 bar	Bottom of test section	m	37.00
Diameter of hole in test area	146 mm	Centre of test section	m	36.00
Weather	Sunny	Bottom of hole at time of test	m	60.00
Type of rock	Chalk	Bottom of casing	m	21.00
		Initial ground water level	m	1.65
		Assumed standing water level	m	
		Length of test section	m	2.00
		Gauge height above ground level	m	

1st period		Gauge Pressure	bar			Friction head loss	m	0.0				Average Flow l/min
Time	mins											
Readings	litres											
Take	litres											
2nd period		Gauge Pressure	bar			Friction head loss	m					Average Flow l/min
Time	mins											
Readings	litres											
Take	litres											
3rd period		Gauge Pressure	bar			Friction head loss	m					Average Flow l/min
Time	mins											
Readings	litres											
Take	litres											
4th period		Gauge Pressure	bar			Friction head loss	m					Average Flow l/min
Time	mins											
Readings	litres											
Take	litres											
5th period		Gauge Pressure	bar			Friction head loss	m					Average Flow l/min
Time	mins											
Readings	litres											
Take	litres											

Pipework and Drill String Details

Type of drill rod		2 3/8"	Total length of drill rod (including 'stick up')	m	36.00
Diameter of delivery hose	mm	50	Total length of delivery hose in metres	m	2.00
Flow meter ID			Flow meter calibration date		

Remarks

Packer pressure set to 8 bar. Water level held at 1.65m. Unable to obtain pressure in packer test section. Flow was 80 litres per minute. Test Abandoned. 1500 litres of water used.

Crew/Operator	KG		
Form No.	SE-PGR-F-009	Revision No. 2.06	Issue Date 28/02/2024

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Packer or Lugeon Test Record**	Hole ID BH106
Project No.	TB8754		Ground Level
Engineer	Mott MacDonald		Date 15/05/2025
Client	FBJV	BS EN 15022282 Part 3	Page 1 of 1

Test no.	1	Depth below ground level to		
Packer type	Double - using initial groundwater level	Top of test section	m	37.00
Packer pressure	8 bar	Bottom of test section	m	39.00
Diameter of hole in test area	146 mm	Centre of test section	m	38.00
Weather	Sunny	Bottom of hole at time of test	m	60.00
Type of rock	Chalk	Bottom of casing	m	21.00
		Initial ground water level	m	1.60
		Assumed standing water level	m	
		Length of test section	m	2.00
		Gauge height above ground level	m	

1st period		Gauge Pressure	bar			Friction head loss	m	0.0				Average Flow l/min
Time	mins											
Readings	litres											
Take	litres											
2nd period		Gauge Pressure	bar			Friction head loss	m					Average Flow l/min
Time	mins											
Readings	litres											
Take	litres											
3rd period		Gauge Pressure	bar			Friction head loss	m					Average Flow l/min
Time	mins											
Readings	litres											
Take	litres											
4th period		Gauge Pressure	bar			Friction head loss	m					Average Flow l/min
Time	mins											
Readings	litres											
Take	litres											
5th period		Gauge Pressure	bar			Friction head loss	m					Average Flow l/min
Time	mins											
Readings	litres											
Take	litres											

Pipework and Drill String Details

Type of drill rod		2 3/8"	Total length of drill rod (including 'stick up')	m	37.00
Diameter of delivery hose	mm	50	Total length of delivery hose in metres	m	2.00
Flow meter ID			Flow meter calibration date		

Remarks

Packer pressure set to 8 bar. Water level held at 1.60m. Unable to obtain pressure in packer test section. Flow was 80 litres per minute. Test Abandoned. 1500 litres of water used.

Crew/Operator	KG		
Form No.	SE-PGR-F-009	Revision No. 2.06	Issue Date 28/02/2024

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Packer or Lugeon Test Record**	Hole ID BH106
Project No.	TB8754		Ground Level
Engineer	Mott MacDonald		Date 15/05/2025
Client	FBJV	BS EN 15022282 Part 3	Page 1 of 1

Test no.	2	Depth below ground level to		
Packer type	Double - using initial groundwater level	Top of test section	m	41.00
Packer pressure	8 bar	Bottom of test section	m	43.00
Diameter of hole in test area	146 mm	Centre of test section	m	42.00
Weather	Sunny	Bottom of hole at time of test	m	60.00
Type of rock	Chalk	Bottom of casing	m	21.00
		Initial ground water level	m	1.65
		Assumed standing water level	m	
		Length of test section	m	2.00
		Gauge height above ground level	m	

1st period		Gauge Pressure	bar			Friction head loss	m	0.0					Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
2nd period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
3rd period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
4th period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												
5th period		Gauge Pressure	bar			Friction head loss	m						Average Flow l/min
Time	mins												
Readings	litres												
Take	litres												

Pipework and Drill String Details

Type of drill rod		2 3/8"	Total length of drill rod (including 'stick up')	m	42.00
Diameter of delivery hose	mm	50	Total length of delivery hose in metres	m	2.00
Flow meter ID			Flow meter calibration date		

Remarks

Packer pressure set to 8 bar. Water level held at 1.65m. Unable to obtain pressure in packer test section. Flow was 80 litres per minute. Test Abandoned. 1500 litres of water used.

Crew/Operator	KG		
Form No.	SE-PGR-F-009	Revision No. 2.06	Issue Date 28/02/2024

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Photo Ionisation Results	
Project No.	TB8754		
Engineer	Mott MacDonald		Table No.
Client	FBJV		

Hole ID	Sample Depth m	Sample Type	Sample Ref.	Test Number	Test Date yyyy-mm-dd	PID ppm	Temp. °C	Weather	Remarks	PID Device Type
BH102	0.30	ES	2	1	2025-05-02	0.5	18.0	Sunny		MiniRAE LITE
BH102	0.50	ES	5	2	2025-05-02	0.3	18.0	Sunny		MiniRAE LITE
BH102	1.00	ES	7	3	2025-05-02	<0.1	18.0	Sunny		MiniRAE LITE
BH106	0.10	ES	1	4	2025-05-02	<0.1	18.0	Sunny		MiniRAE LITE
BH106	0.30	ES	2	5	2025-05-02	<0.1	18.0	Sunny		MiniRAE LITE
BH106	0.50	ES	3	6	2025-05-02	<0.1	18.0	Sunny		MiniRAE LITE
BH106	1.00	ES	4	7	2025-05-02	<0.1	18.0	Sunny		MiniRAE LITE
BH103	0.10	ES	3	8	2025-05-08	0.4	15.0	Sunny		MiniRAE LITE
BH103	0.50	ES	6	9	2025-05-08	0.3	15.0	Sunny		MiniRAE LITE
BH103	0.75	ES	8	10	2025-05-08	0.3	15.0	Sunny		MiniRAE LITE
BH103	1.00	ES	11	11	2025-05-08	0.1	15.0	Sunny		MiniRAE LITE
BH103	2.80	ES	18	12	2025-05-08	<0.1	15.0	Sunny		MiniRAE LITE
BH101	0.30	ES	5	13	2025-05-16	0.3	18.0	Sunny		MiniRAE LITE
BH101	0.50	ES	8	14	2025-05-16	0.2	18.0	Sunny		MiniRAE LITE
BH101	1.00	ES	11	15	2025-05-16	0.1	18.0	Sunny		MiniRAE LITE
BH101	2.10	ES	14	16	2025-05-16	<0.1	18.0	Sunny		MiniRAE LITE
BH101	2.20	ES	50	17	2025-05-16	<0.1	18.0	Sunny		MiniRAE LITE
BH101	4.00	ES	51	18	2025-05-16	<0.1	18.0	Sunny		MiniRAE LITE
BH101	7.00	ES	52	19	2025-05-16	<0.1	18.0	Sunny		MiniRAE LITE
BH101	9.00	ES	53	20	2025-05-16	<0.1	18.0	Sunny		MiniRAE LITE
BH108	0.10	ES	2	21	2025-05-20	<0.1	19.0	Sunny		MiniRAE LITE
BH108	0.30	ES	5	22	2025-05-20	<0.1	19.0	Sunny		MiniRAE LITE
BH108	0.60	ES	8	23	2025-05-20	<0.1	19.0	Sunny		MiniRAE LITE
BH110	0.30	ES	3	24	2025-05-21	0.2	17.0	Cloudy		MiniRAE LITE
BH110	0.60	ES	6	25	2025-05-21	0.1	17.0	Cloudy		MiniRAE LITE
BH110	1.00	ES	11	26	2025-05-21	<0.1	17.0	Cloudy		MiniRAE LITE
BH110	2.00	ES	14	27	2025-05-21	<0.1	17.0	Cloudy		MiniRAE LITE
BH110	4.00	ES	21	28	2025-05-21	<0.1	17.0	Cloudy		MiniRAE LITE
BH110	6.00	ES	28	29	2025-05-22	<0.1	14.0	Cloudy		MiniRAE LITE
BH107	0.30	ES	2	30	2025-05-28	<0.1	20.0	Sunny		MiniRAE LITE
BH107	0.60	ES	5	31	2025-05-28	<0.1	20.0	Sunny		MiniRAE LITE
BH107	1.00	ES	8	32	2025-05-28	<0.1	20.0	Sunny		MiniRAE LITE
BH107	2.00	ES	12	33	2025-05-28	<0.1	20.0	Sunny		MiniRAE LITE

	Checked By: emily.cross	Approved By: rowan.mcmillan	SOIL ENGINEERING
	Date: 21/07/2025	Date: 21/07/2025	

Project Name	Grain to Tilbury Tunnel GI	Photo Ionisation Results	
Project No.	TB8754		Table No.
Engineer	Mott MacDonald		
Client	FBJV		

Hole ID	Sample Depth m	Sample Type	Sample Ref.	Test Number	Test Date yyyy-mm-dd	PID ppm	Temp. °C	Weather	Remarks	PID Device Type
BH107	4.00	ES	18	34	2025-05-28	<0.1	20.0	Sunny		MiniRAE LITE
BH107	0.60	ES	23	35	2025-05-30	<0.1	20.0	Sunny		MiniRAE LITE
BH107	0.80	ES	29	36	2025-05-30	<0.1	20.0	Sunny		MiniRAE LITE
BH107	11.30	ES	40	37	2025-05-30	<0.1	20.0	Sunny		MiniRAE LITE
BH109	0.30	ES	2	38	2025-05-30	<0.1	20.0	Sunny		MiniRAE LITE
BH109	0.60	ES	5	39	2025-05-30	<0.1	20.0	Sunny		MiniRAE LITE
BH109	1.00	ES	8	40	2025-05-30	<0.1	20.0	Sunny		MiniRAE LITE
BH109	7.80	ES	26	41	2025-06-02	<0.1	20.0	Sunny		MiniRAE LITE
BH104	0.10	ES	1	42	2025-06-12	<0.1	21.0	Sunny		MiniRAE LITE
BH104	0.50	ES	3	43	2025-06-12	<0.1	21.0	Sunny		MiniRAE LITE
BH104	0.80	ES	5	44	2025-06-12	<0.1	21.0	Sunny		MiniRAE LITE
BH104	1.10	ES	7	45	2025-06-12	<0.1	21.0	Sunny		MiniRAE LITE
BH105	0.10	ES	1	46	2025-06-13	<0.1	25.0	Sunny		MiniRAE LITE
BH105	0.50	ES	3	47	2025-06-13	<0.1	25.0	Sunny		MiniRAE LITE
BH105	1.00	ES	5	48	2025-06-13	<0.1	25.0	Sunny		MiniRAE LITE

	Checked By: emily.cross	Approved By: rowan.mcmillan	
	Date: 21/07/2025	Date: 21/07/2025	

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Borehole Falling Head Permeability Test	Hole ID BH101
Project No.	TB8754		Ground Level 2.16m AOD
Engineer	Mott MacDonald		Date 14/05/2025
Client	FBJV	BS EN ISO 22282-2: 2012	Page 1 of 2

Description: Grey CLAY

Type of test: Borehole — Installation type:

All depths are relative to ground level.

Initial ground water level	6.20	m	Top of test section	6.90	m
Height of casing above surface	0.20	m	Bottom of test section	7.40	m
Length of test section	0.50	m	Water level at end of test	0.23	m
Diameter of test section	200	mm	Diameter of casing/standpipe	200	mm

Quality of water used	Clean and fresh	Test start time	14:00
Weather	Fine	Test finish time	15:00

Time Minutes	Depth to water m	H	ln H_0/H	Time Minutes	Depth to water m	H	Log H/H0
0	-0.04	6.24	0.00				
0.25	-0.04	6.24	0.00				
0.5	-0.04	6.24	0.00				
0.75	-0.03	6.23	0.00				
1	-0.03	6.23	0.00				
1.5	-0.03	6.23	0.00				
2	-0.02	6.22	0.00				
2.5	-0.02	6.22	0.00				
3	-0.01	6.21	0.00				
3.5	-0.01	6.21	0.00				
4	0.00	6.20	0.01				
4.5	0.00	6.20	0.01				
5	0.01	6.19	0.01				
6	0.02	6.18	0.01				
7	0.02	6.18	0.01				
8	0.03	6.17	0.01				
10	0.04	6.16	0.01				
12	0.06	6.14	0.02				
14	0.06	6.14	0.02				
16	0.06	6.14	0.02				
18	0.07	6.13	0.02				
20	0.09	6.11	0.02				
25	0.11	6.09	0.02				
30	0.13	6.07	0.03				
40	0.17	6.03	0.03				
50	0.20	6.00	0.04				
60	0.23	5.97	0.04				

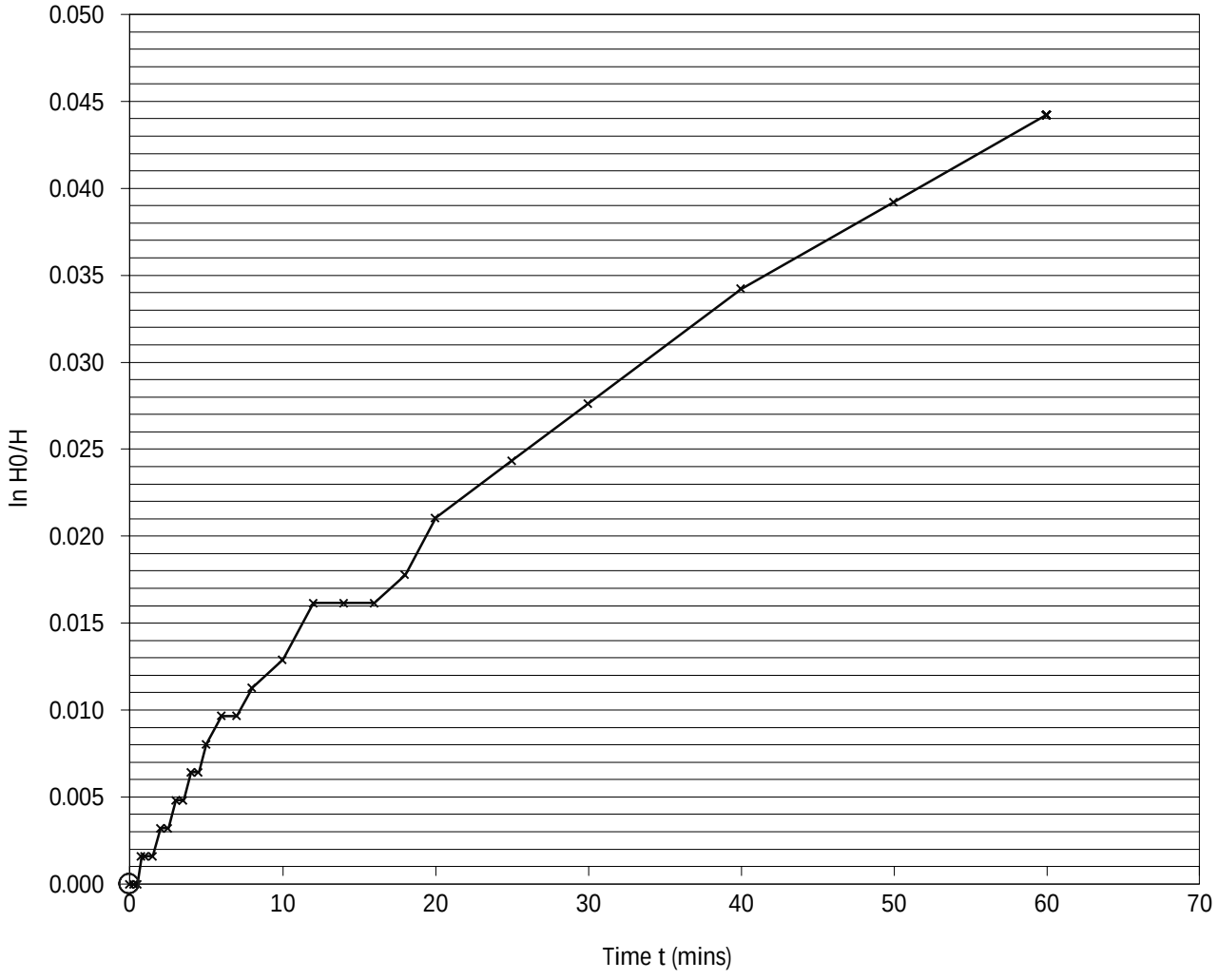
Remarks

Recorded by: EC

Project Name	Grain to Tilbury Tunnel GI	Borehole Falling Head Permeability Test	Hole ID BH101
Project No.	TB8754		Ground Level 2.16m AOD
Engineer	Mott MacDonald		Date 14/05/2025
Client	FBJV	BS EN ISO 22282-2: 2012	Page 2 of 2
Description	Grey CLAY		

Initial ground water level	6.20	m	Top of test section	6.90	m BGL
Height of casing above surface	0.20	m	Bottom of test section	7.40	m BGL
Length of test section	0.50	m	Water level at end of test	0.23	m
Diameter of test section	200	mm	Diameter of casing/standpipe	200	mm

Quality of water used	Clean and fresh	Test start time	14:00
Weather	Fine	Test finish time	15:00



using Velocity graph method $k = \alpha . S/F$ = 2.01×10^{-7} m/s

where $\alpha = 1.22 \times 10^{-5}\ s^{-1}$

$S = 0.0314 m^2$

F= 1.906m

Recorded by: EC			
			SOIL ENGINEERING
Form No. SE-PGR-F-003	Revision No. 3.04	Issue Date 24/01/2014	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	Borehole Falling Head Permeability Test	Hole ID BH102
Project No.	TB8754		Ground Level 2.38m AOD
Engineer	Mott MacDonald		Date 09/05/2025
Client	FBJV	BS EN ISO 22282-2: 2012	Page 1 of 2

Description: Dark grey CLAY

Type of test: Borehole — Installation type:

All depths are relative to ground level.

Initial ground water level	4.20	m	Top of test section	8.70	m
Height of casing above surface	0.30	m	Bottom of test section	9.20	m
Length of test section	0.50	m	Water level at end of test	0.37	m
Diameter of test section	200	mm	Diameter of casing/standpipe	200	mm

Quality of water used	Clean and fresh	Test start time	10:00
Weather	Fine	Test finish time	11:00

Time Minutes	Depth to water m	H	ln H_0/H	Time Minutes	Depth to water m	H	Log H/H0
0	-0.20	4.40	0.00				
0.25	-0.20	4.40	0.00				
0.5	-0.18	4.38	0.00				
0.75	-0.17	4.37	0.01				
1	-0.15	4.35	0.01				
1.5	-0.08	4.28	0.03				
2	-0.02	4.22	0.04				
2.5	0.02	4.18	0.05				
3	0.05	4.15	0.06				
3.5	0.08	4.12	0.07				
4	0.12	4.08	0.08				
4.5	0.15	4.05	0.08				
5	0.18	4.02	0.09				
6	0.20	4.00	0.10				
7	0.22	3.98	0.10				
8	0.24	3.96	0.11				
10	0.25	3.95	0.11				
12	0.25	3.95	0.11				
14	0.28	3.92	0.12				
16	0.30	3.90	0.12				
18	0.31	3.89	0.12				
20	0.32	3.88	0.13				
25	0.33	3.87	0.13				
30	0.34	3.86	0.13				
40	0.36	3.84	0.14				
50	0.36	3.84	0.14				
60	0.37	3.83	0.14				

Remarks

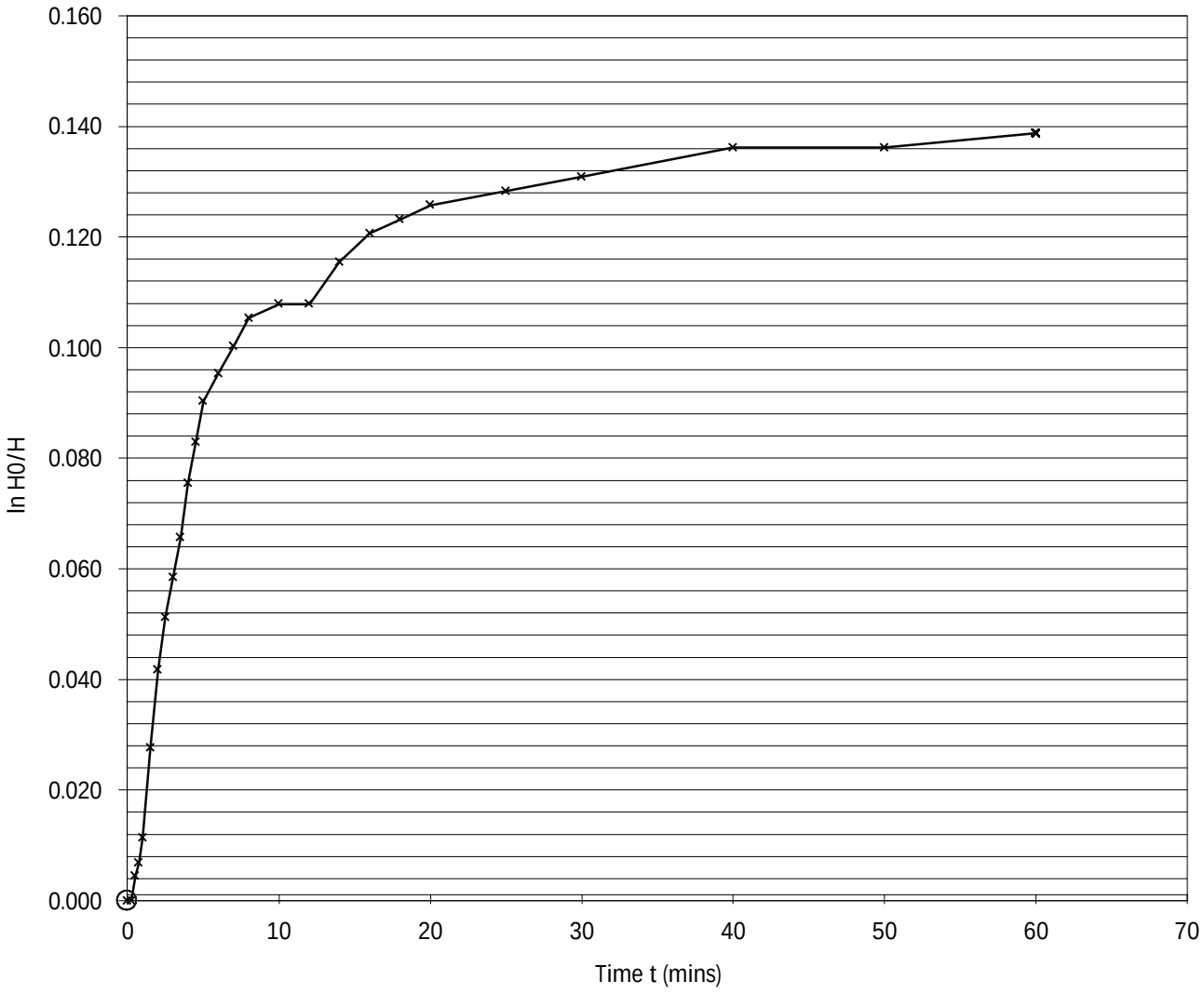
Recorded by: PS

Project Name	Grain to Tilbury Tunnel GI	Borehole Falling Head Permeability Test	Hole ID BH102
Project No.	TB8754		Ground Level 2.38m AOD
Engineer	Mott MacDonald		Date 09/05/2025
Client	FBJV	BS EN ISO 22282-2: 2012	Page 2 of 2

Description: Dark grey CLAY

Initial ground water level	4.20	m	Top of test section	8.70	m BGL
Height of casing above surface	0.30	m	Bottom of test section	9.20	m BGL
Length of test section	0.50	m	Water level at end of test	0.37	m
Diameter of test section	200	mm	Diameter of casing/standpipe	200	mm

Quality of water used	Clean and fresh	Test start time	10:00
Weather	Fine	Test finish time	11:00



using Velocity graph method $k = \alpha . S/F$ = 1.80×10^{-7} m/s

where $\alpha = 1.09 \times 10^{-5}\ s^{-1}$

$S = 0.0314 m^2$

F= 1.256m

Recorded by: PS			SOIL ENGINEERING
Form No. SE-PGR-F-003	Revision No. 3.04	Issue Date 24/01/2014	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	Borehole Falling Head Permeability Test	Hole ID BH103
Project No.	TB8754		Ground Level 2.78m AOD
Engineer	Mott MacDonald		Date 14/05/2025
Client	FBJV	BS EN ISO 22282-2: 2012	Page 1 of 2

Description: Grey and brown sandy GRAVEL of flint

Type of test: Borehole — Installation type:

All depths are relative to ground level.

Initial ground water level	4.50	m	Top of test section	15.10	m
Height of casing above surface	0.00	m	Bottom of test section	15.60	m
Length of test section	0.50	m	Water level at end of test	0.78	m
Diameter of test section	250	mm	Diameter of casing/standpipe	250	mm

Quality of water used	Clean and fresh	Test start time	11:15
Weather	Fine	Test finish time	12:15

Time Minutes	Depth to water m	H	ln H_0/H	Time Minutes	Depth to water m	H	Log H/H0
0	0.10	4.40	0.00				
0.25	0.10	4.40	0.00				
0.5	0.10	4.40	0.00				
0.75	0.11	4.39	0.00				
1	0.11	4.39	0.00				
1.5	0.12	4.38	0.00				
2	0.12	4.38	0.00				
2.5	0.13	4.37	0.01				
3	0.13	4.37	0.01				
3.5	0.14	4.36	0.01				
4	0.14	4.36	0.01				
4.5	0.15	4.35	0.01				
5	0.15	4.35	0.01				
6	0.17	4.33	0.02				
7	0.20	4.30	0.02				
8	0.23	4.27	0.03				
10	0.27	4.23	0.04				
12	0.32	4.18	0.05				
14	0.38	4.12	0.07				
16	0.46	4.04	0.09				
18	0.49	4.01	0.09				
20	0.54	3.96	0.11				
25	0.59	3.91	0.12				
30	0.61	3.89	0.12				
40	0.68	3.82	0.14				
50	0.73	3.77	0.15				
60	0.78	3.72	0.17				

Remarks

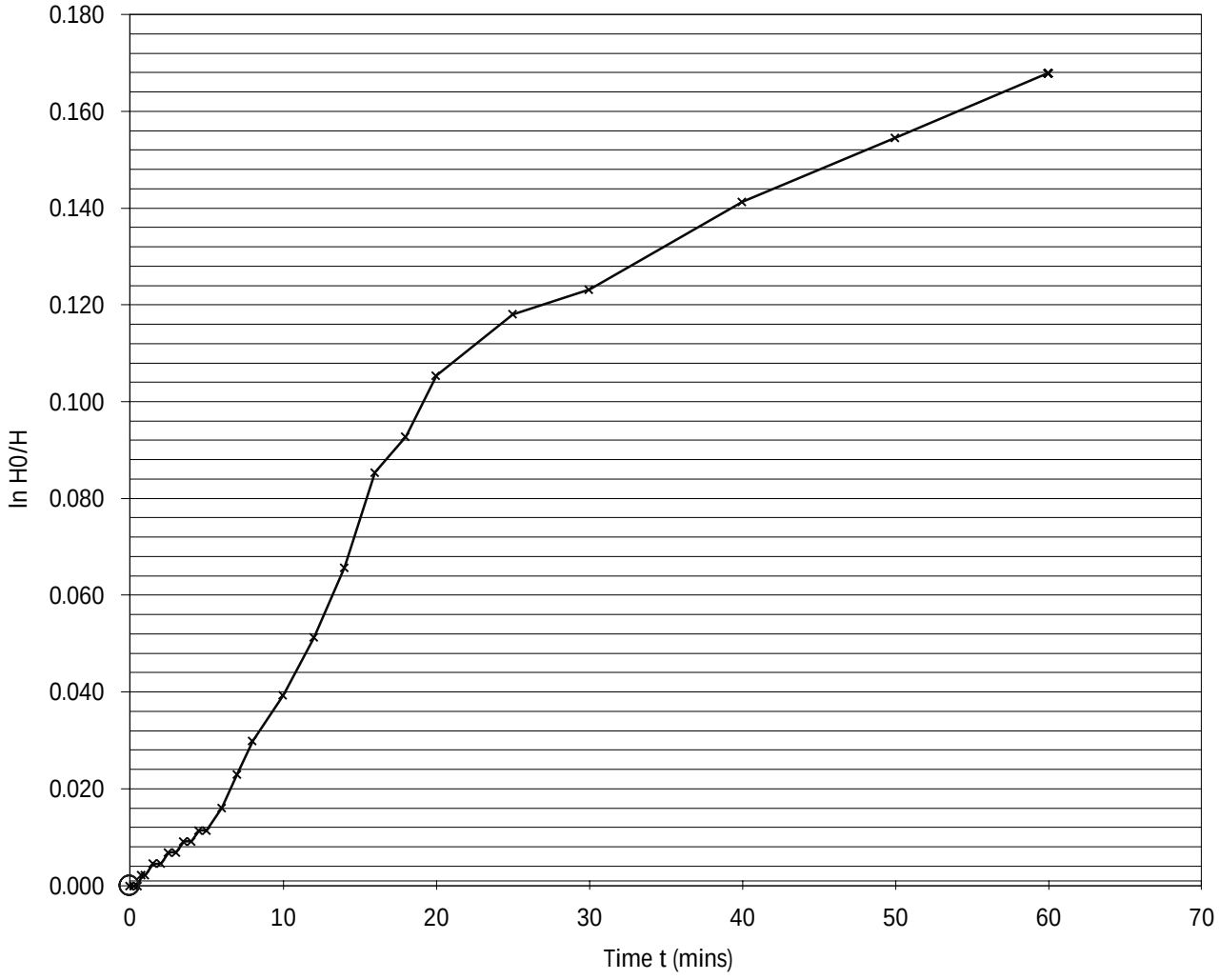
Recorded by: EC

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Borehole Falling Head Permeability Test	Hole ID BH103
Project No.	TB8754		Ground Level 2.78m AOD
Engineer	Mott MacDonald		Date 14/05/2025
Client	FBJV	BS EN ISO 22282-2: 2012	Page 2 of 2
Description	Grey and brown sandy GRAVEL of flint		

Initial ground water level	4.50	m	Top of test section	15.10	m BGL
Height of casing above surface	0.00	m	Bottom of test section	15.60	m BGL
Length of test section	0.50	m	Water level at end of test	0.78	m
Diameter of test section	250	mm	Diameter of casing/standpipe	250	mm

Quality of water used	Clean and fresh	Test start time	11:15
Weather	Fine	Test finish time	12:15



using Velocity graph method $k = \alpha . S/F$ = 1.77×10^{-6} m/s

where $\alpha = 7.87 \times 10^{-5}\ s^{-1}$

$S = 0.0491 m^2$

F= 2.175m

Recorded by: EC			
			SOIL ENGINEERING
Form No. SE-PGR-F-003	Revision No. 3.04	Issue Date 24/01/2014	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	Borehole Falling Head Permeability Test	Hole ID BH103
Project No.	TB8754		Ground Level 2.78m AOD
Engineer	Mott MacDonald		Date 28/05/2025
Client	FBJV	BS EN ISO 22282-2: 2012	Page 1 of 2

Description: Structureless CHALK composed of slightly silty sandy GRAVEL

Type of test: Borehole — Installation type:

All depths are relative to ground level.

Initial ground water level	2.05	m	Top of test section	20.40	m
Height of casing above surface	1.00	m	Bottom of test section	22.00	m
Length of test section	1.60	m	Water level at end of test	1.76	m
Diameter of test section	146	mm	Diameter of casing/standpipe	146	mm

Quality of water used	Clean and fresh	Test start time	11:15
Weather	Fine	Test finish time	11:30

Time Minutes	Depth to water m	H	ln H_0/H	Time Minutes	Depth to water m	H	Log H/H0
0	0.05	2.00	0.00				
0.25	0.72	1.33	0.41				
0.5	1.20	0.85	0.86				
0.75	1.54	0.51	1.37				
1	1.71	0.34	1.77				
1.5	1.75	0.30	1.90				
2	1.76	0.29	1.93				
2.5	1.76	0.29	1.93				
3	1.76	0.29	1.93				
3.5	1.76	0.29	1.93				
4	1.76	0.29	1.93				
4.5	1.76	0.29	1.93				
5	1.76	0.29	1.93				
6	1.76	0.29	1.93				
7	1.76	0.29	1.93				
8	1.76	0.29	1.93				
10	1.76	0.29	1.93				
12	1.76	0.29	1.93				
14	1.76	0.29	1.93				

Remarks

Recorded by: EC

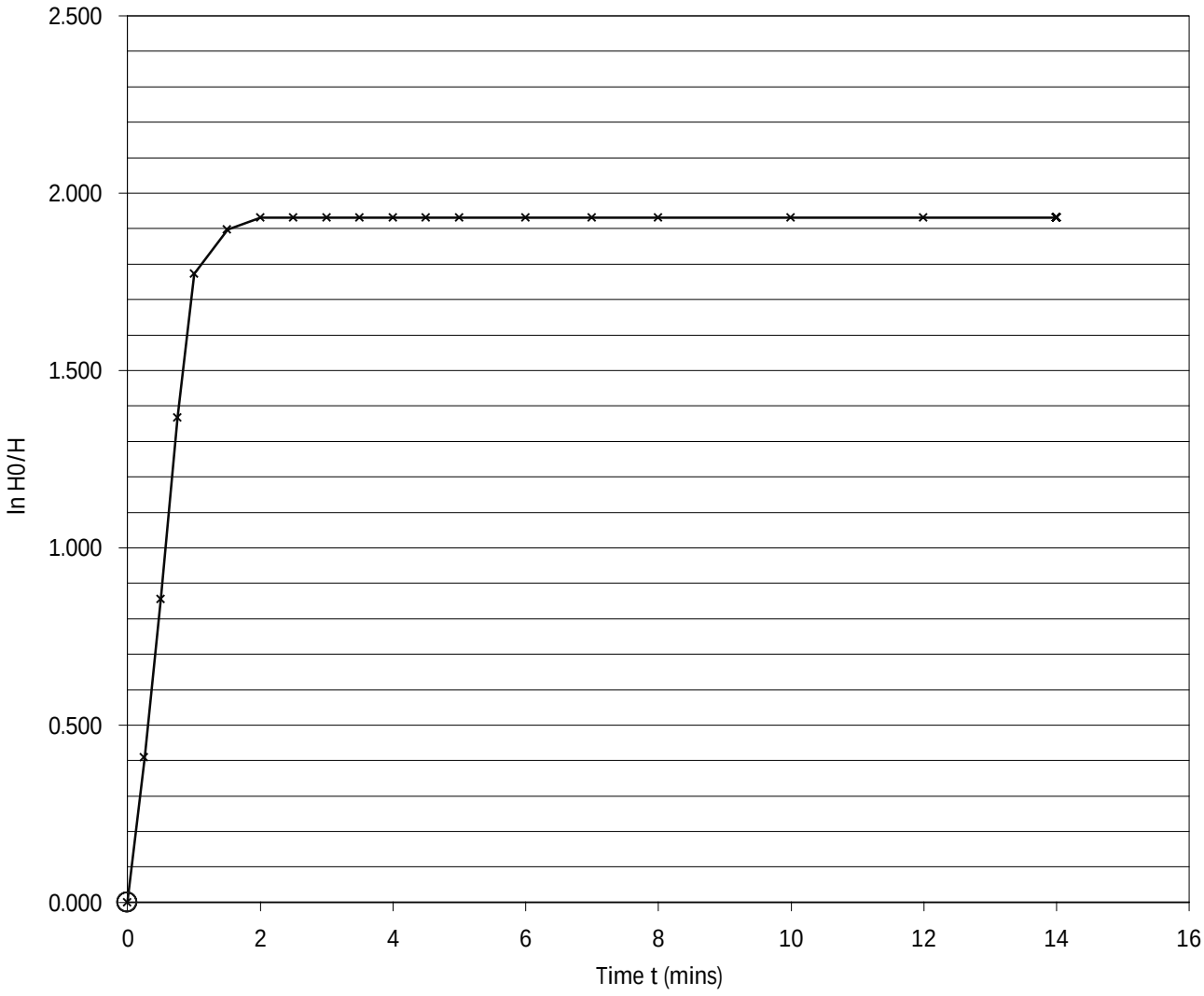
SOIL ENGINEERING
Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	Borehole Falling Head Permeability Test	Hole ID BH103
Project No.	TB8754		Ground Level 2.78m AOD
Engineer	Mott MacDonald		Date 28/05/2025
Client	FBJV	BS EN ISO 22282-2: 2012	Page 2 of 2

Description: Structureless CHALK composed of slightly silty sandy GRAVEL

Initial ground water level	2.05	m	Top of test section	20.40	m BGL
Height of casing above surface	1.00	m	Bottom of test section	22.00	m BGL
Length of test section	1.60	m	Water level at end of test	1.76	m
Diameter of test section	146	mm	Diameter of casing/standpipe	146	mm

Quality of water used	Clean and fresh	Test start time	11:15
Weather	Fine	Test finish time	11:30



using Velocity graph method $k = \alpha . S/F$ = 1.52×10^{-4} m/s

where $\alpha = 2.953 \times 10^{-2}\ s^{-1}$

$S = 0.0167 m^2$

F= 3.255m

Recorded by: EC			SOIL ENGINEERING
Form No. SE-PGR-F-003	Revision No. 3.04	Issue Date 24/01/2014	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	Borehole Falling Head Permeability Test	Hole ID BH103
Project No.	TB8754		Ground Level 2.78m AOD
Engineer	Mott MacDonald		Date 29/05/2025
Client	FBJV	BS EN ISO 22282-2: 2012	Page 1 of 2

Description: CHALK with flint gravel

Type of test: Borehole — Installation type:

All depths are relative to ground level.

Initial ground water level	1.00	m	Top of test section	27.00	m
Height of casing above surface	1.00	m	Bottom of test section	28.00	m
Length of test section	1.00	m	Water level at end of test	1.00	m
Diameter of test section	146	mm	Diameter of casing/standpipe	33	mm

Quality of water used	Clean and fresh	Test start time	12:44
Weather	Fine	Test finish time	12:45

Time Minutes	Depth to water m	H	ln H_0/H	Time Minutes	Depth to water m	H	Log H/H0
0	0.70	0.30	0.00				
0.25	0.99	0.01	3.40				

Remarks

Packer used to isolate the test section. Approximately 250 litres of water used. Rapid fall of head, permeability not calculated.

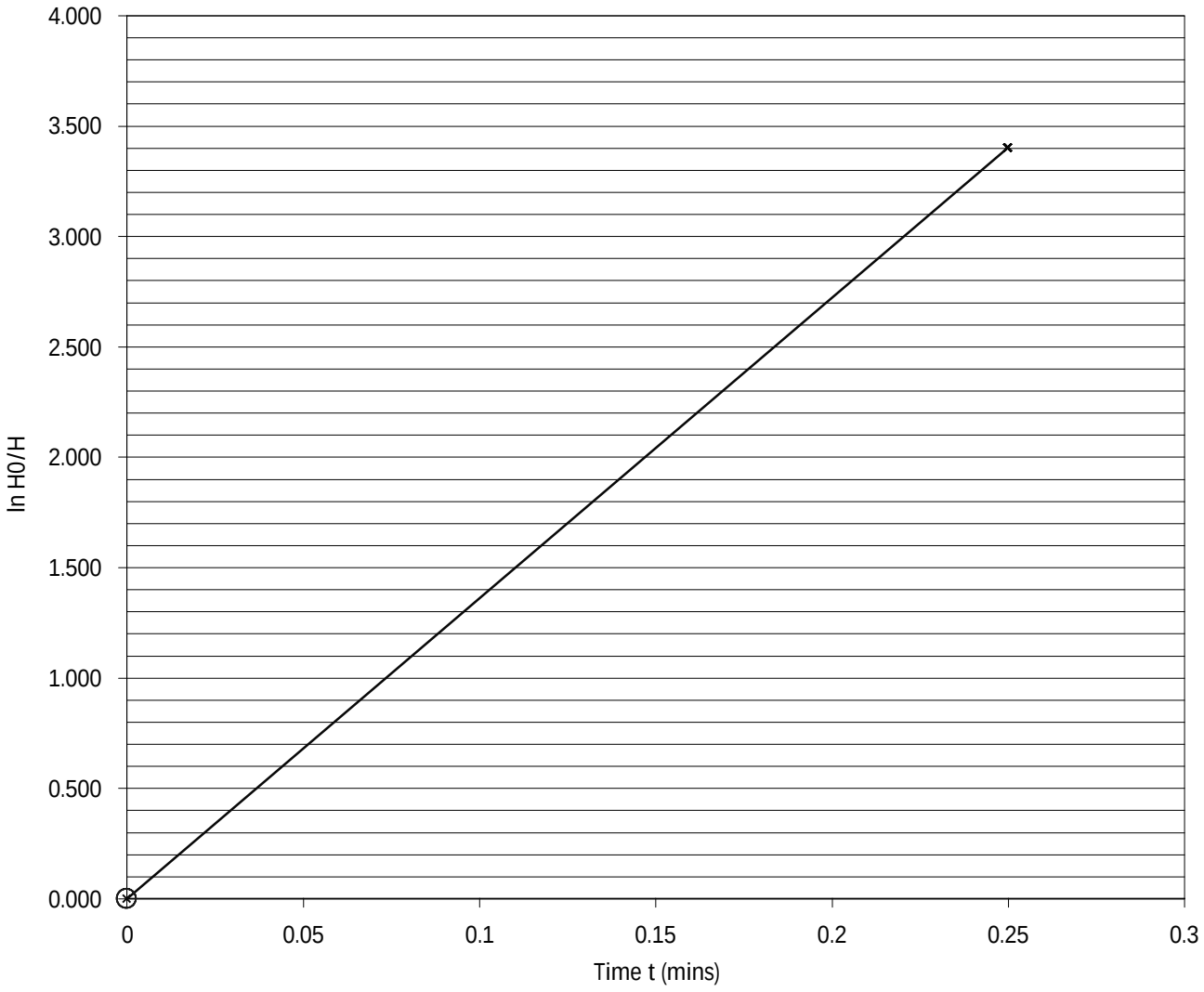
Recorded by: EC

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Borehole Falling Head Permeability Test	Hole ID BH103
Project No.	TB8754		Ground Level 2.78m AOD
Engineer	Mott MacDonald		Date 29/05/2025
Client	FBJV	BS EN ISO 22282-2: 2012	Page 2 of 2
Description	CHALK with flint gravel		

Initial ground water level	1.00	m	Top of test section	27.00	m BGL
Height of casing above surface	1.00	m	Bottom of test section	28.00	m BGL
Length of test section	1.00	m	Water level at end of test	1.00	m
Diameter of test section	146	mm	Diameter of casing/standpipe	33	mm

Quality of water used	Clean and fresh	Test start time	12:44
Weather	Fine	Test finish time	12:45



using Velocity graph method $k = \alpha . S/F$ = Not calculated m/s

where α= $0.2267\ s^{-1}$

S= $0.0167 m^2$

F= 2.395m

Recorded by: EC			SOIL ENGINEERING
Form No. SE-PGR-F-003	Revision No. 3.04	Issue Date 24/01/2014	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	Borehole Falling Head Permeability Test	Hole ID BH103
Project No.	TB8754		Ground Level 2.78m AOD
Engineer	Mott MacDonald		Date 29/05/2025
Client	FBJV	BS EN ISO 22282-2: 2012	Page 1 of 2

Description: CHALK with flint gravel

Type of test: Borehole — Installation type:

All depths are relative to ground level.

Initial ground water level	1.00	m	Top of test section	32.00	m
Height of casing above surface	1.00	m	Bottom of test section	32.50	m
Length of test section	0.50	m	Water level at end of test	1.00	m
Diameter of test section	146	mm	Diameter of casing/standpipe	33	mm

Quality of water used	Clean and fresh	Test start time	11:14
Weather	Fine	Test finish time	11:15

Time Minutes	Depth to water m	H	ln H_0/H	Time Minutes	Depth to water m	H	Log H/H0
0	0.60	0.40	0.00				
0.25	0.99	0.01	3.69				

Remarks

Packer used to isolate the test section. Approximately 250 litres of water used. Rapid fall of head, permeability not calculated.

Recorded by: EC

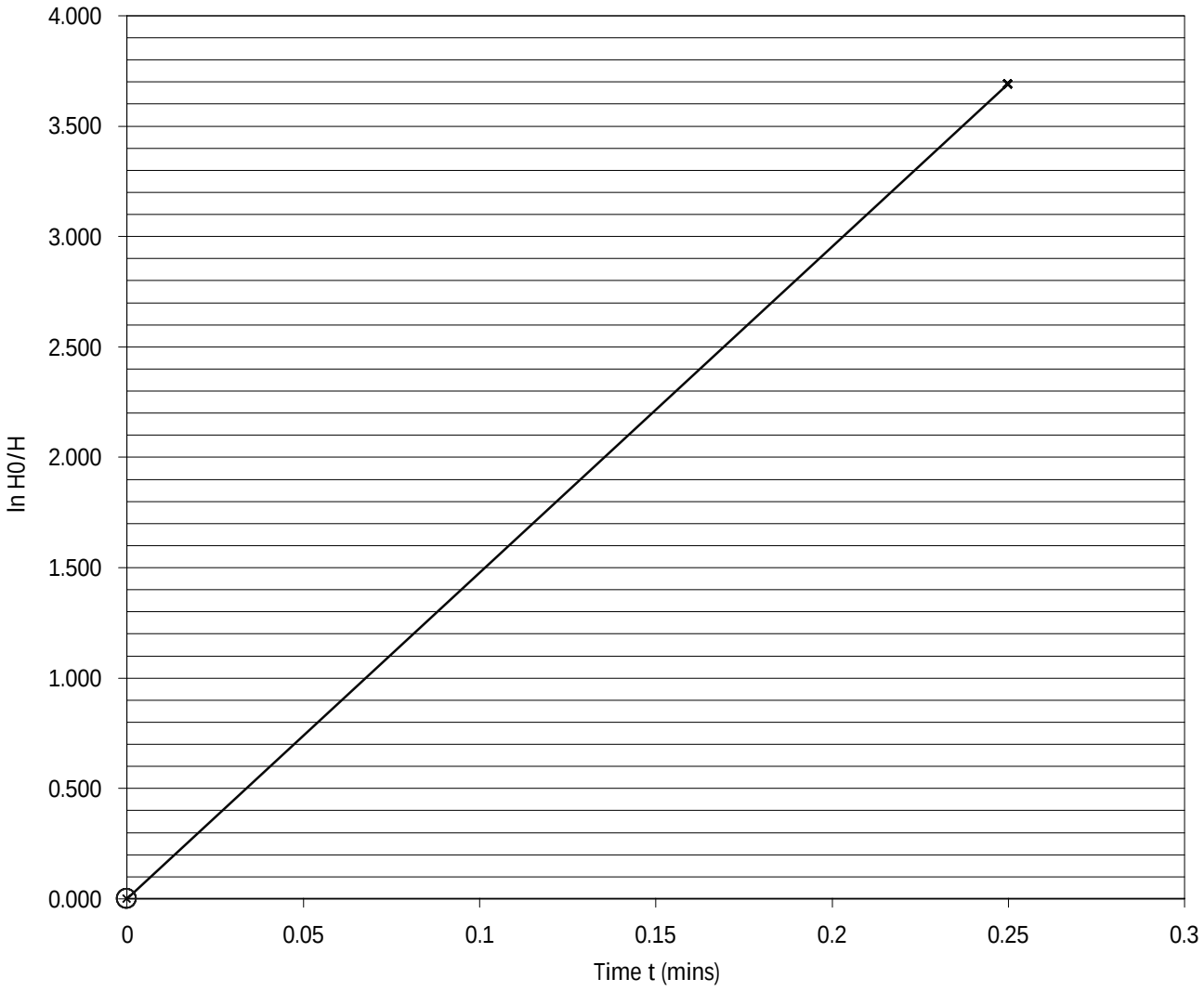
SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Borehole Falling Head Permeability Test	Hole ID BH103
Project No.	TB8754		Ground Level 2.78m AOD
Engineer	Mott MacDonald		Date 29/05/2025
Client	FBJV	BS EN ISO 22282-2: 2012	Page 2 of 2

Description: CHALK with flint gravel

Initial ground water level	1.00	m	Top of test section	32.00	m BGL
Height of casing above surface	1.00	m	Bottom of test section	32.50	m BGL
Length of test section	0.50	m	Water level at end of test	1.00	m
Diameter of test section	146	mm	Diameter of casing/standpipe	33	mm

Quality of water used	Clean and fresh	Test start time	11:14
Weather	Fine	Test finish time	11:15



using Velocity graph method $k = \alpha . S/F$ = Not calculated m/s

where α= $0.2459\ s^{-1}$

S= $0.0167 m^2$

F= 1.615m

Recorded by: EC

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Borehole Falling Head Permeability Test	Hole ID BH103
Project No.	TB8754		Ground Level 2.78m AOD
Engineer	Mott MacDonald		Date 29/05/2025
Client	FBJV	BS EN ISO 22282-2: 2012	Page 1 of 2

Description: CHALK with flint gravel

Type of test: Borehole — Installation type:

All depths are relative to ground level.

Initial ground water level	1.00	m	Top of test section	36.50	m
Height of casing above surface	1.00	m	Bottom of test section	37.00	m
Length of test section	0.50	m	Water level at end of test	1.00	m
Diameter of test section	146	mm	Diameter of casing/standpipe	33	mm

Quality of water used	Clean and fresh	Test start time	13:44
Weather	Fine	Test finish time	13:45

Time Minutes	Depth to water m	H	ln H_0/H	Time Minutes	Depth to water m	H	Log H/H0
0	0.60	0.40	0.00				
0.25	0.99	0.01	3.69				

Remarks

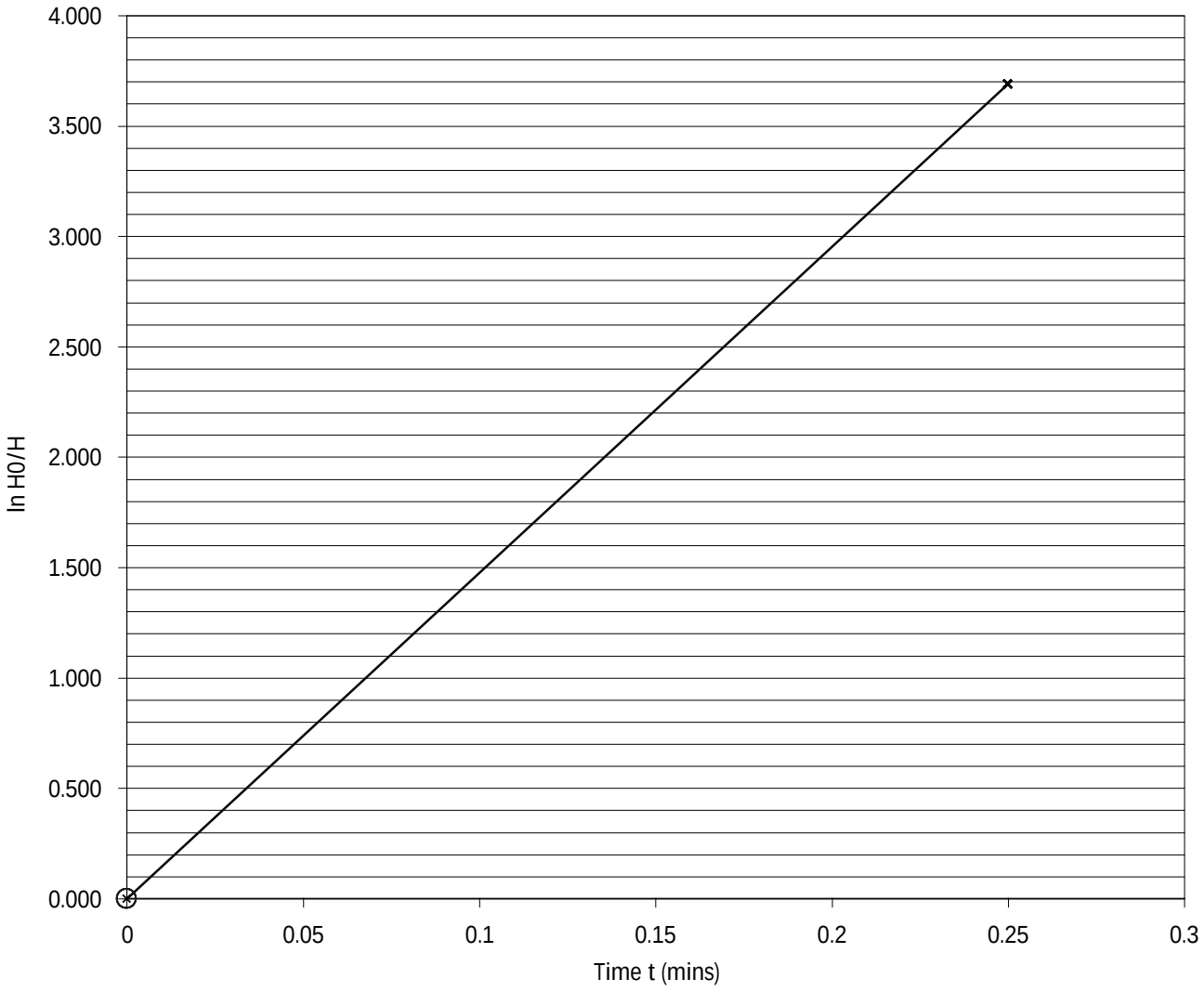
Packer used to isolate the test section. Approximately 500 litres of water used. Rapid fall of head, permeability not calculated.

Recorded by: EC

Project Name	Grain to Tilbury Tunnel GI	Borehole Falling Head Permeability Test	Hole ID BH103
Project No.	TB8754		Ground Level 2.78m AOD
Engineer	Mott MacDonald		Date 29/05/2025
Client	FBJV	BS EN ISO 22282-2: 2012	Page 2 of 2
Description	CHALK with flint gravel		

Initial ground water level	1.00	m	Top of test section	36.50	m BGL
Height of casing above surface	1.00	m	Bottom of test section	37.00	m BGL
Length of test section	0.50	m	Water level at end of test	1.00	m
Diameter of test section	146	mm	Diameter of casing/standpipe	33	mm

Quality of water used	Clean and fresh	Test start time	13:44
Weather	Fine	Test finish time	13:45



using Velocity graph method $k = \alpha . S/F$ = Not calculated m/s

where α= $0.2459\ s^{-1}$

S= $0.0167 m^2$

F= 1.615m

Recorded by: EC			

Project Name	Grain to Tilbury Tunnel GI	Borehole Falling Head Permeability Test	Hole ID BH107
Project No.	TB8754		Ground Level 2.27m AOD
Engineer	Mott MacDonald		Date 28/05/2025
Client	FBJV	BS EN ISO 22282-2: 2012	Page 1 of 2

Description: Dark grey CLAY

Type of test: Borehole — Installation type:

All depths are relative to ground level.

Initial ground water level	4.80	m	Top of test section	12.45	m
Height of casing above surface	0.00	m	Bottom of test section	12.80	m
Length of test section	0.35	m	Water level at end of test	0.65	m
Diameter of test section	200	mm	Diameter of casing/standpipe	200	mm

Quality of water used	Clean and fresh	Test start time	13:15
Weather	Fine	Test finish time	14:15

Time Minutes	Depth to water m	H	ln H_0/H	Time Minutes	Depth to water m	H	Log H/H0
0	0.00	4.80	0.00				
0.25	0.05	4.75	0.01				
0.5	0.07	4.73	0.01				
0.75	0.08	4.72	0.02				
1	0.10	4.70	0.02				
1.5	0.13	4.67	0.03				
2	0.15	4.65	0.03				
2.5	0.16	4.64	0.03				
3	0.18	4.62	0.04				
3.5	0.20	4.60	0.04				
4	0.21	4.59	0.04				
4.5	0.22	4.58	0.05				
5	0.22	4.58	0.05				
6	0.25	4.55	0.05				
7	0.28	4.52	0.06				
8	0.30	4.50	0.06				
10	0.34	4.46	0.07				
12	0.37	4.43	0.08				
14	0.41	4.39	0.09				
16	0.44	4.36	0.10				
18	0.48	4.32	0.11				
20	0.52	4.28	0.11				
25	0.55	4.25	0.12				
30	0.57	4.23	0.13				
40	0.60	4.20	0.13				
50	0.63	4.17	0.14				
60	0.65	4.15	0.15				

Remarks

Recorded by: EC

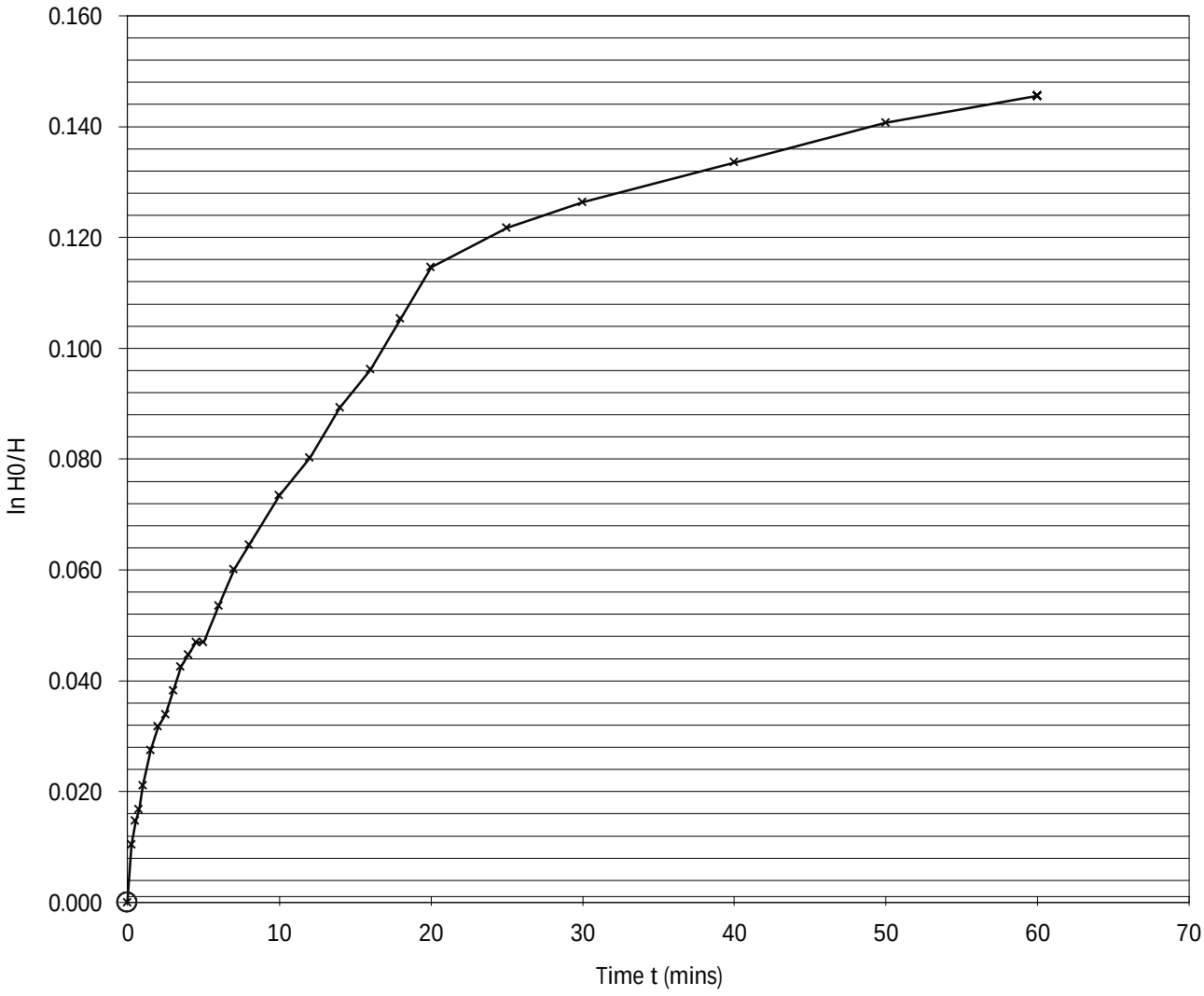
SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Borehole Falling Head Permeability Test	Hole ID BH107
Project No.	TB8754		Ground Level 2.27m AOD
Engineer	Mott MacDonald		Date 28/05/2025
Client	FBJV	BS EN ISO 22282-2: 2012	Page 2 of 2

Description: Dark grey CLAY

Initial ground water level	4.80	m	Top of test section	12.45	m BGL
Height of casing above surface	0.00	m	Bottom of test section	12.80	m BGL
Length of test section	0.35	m	Water level at end of test	0.65	m
Diameter of test section	200	mm	Diameter of casing/standpipe	200	mm

Quality of water used	Clean and fresh	Test start time	13:15
Weather	Fine	Test finish time	14:15



using Velocity graph method $k = \alpha . S/F$ = 1.56×10^{-6} m/s

where $\alpha = 8.246 \times 10^{-5}\ s^{-1}$

$S = 0.0314 m^2$

F= 1.658m

Recorded by: EC			SOIL ENGINEERING
Form No. SE-PGR-F-003	Revision No. 3.04	Issue Date 24/01/2014	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	Borehole Falling Head Permeability Test	Hole ID BH108
Project No.	TB8754		Ground Level 2.35m AOD
Engineer	Mott MacDonald		Date 21/05/2025
Client	FBJV	BS EN ISO 22282-2: 2012	Page 1 of 2

Description: Dark grey silty fine SAND

Type of test: Borehole — Installation type:

All depths are relative to ground level.

Initial ground water level	4.31	m	Top of test section	12.00	m
Height of casing above surface	0.00	m	Bottom of test section	12.00	m
Length of test section	0.00	m	Water level at end of test	0.58	m
Diameter of test section	200	mm	Diameter of casing/standpipe	200	mm

Quality of water used	Clean and fresh	Test start time	10:40
Weather	Fine	Test finish time	11:40

Time Minutes	Depth to water m	H	ln H_0/H	Time Minutes	Depth to water m	H	Log H/H0
0	0.00	4.31	0.00				
0.25	0.11	4.20	0.03				
0.5	0.12	4.19	0.03				
0.75	0.13	4.19	0.03				
1	0.14	4.18	0.03				
1.5	0.15	4.16	0.04				
2	0.18	4.14	0.04				
2.5	0.19	4.12	0.05				
3	0.21	4.10	0.05				
3.5	0.22	4.09	0.05				
4	0.23	4.08	0.05				
4.5	0.25	4.06	0.06				
5	0.26	4.06	0.06				
6	0.27	4.04	0.06				
7	0.30	4.01	0.07				
8	0.32	3.99	0.08				
10	0.34	3.97	0.08				
12	0.37	3.94	0.09				
14	0.38	3.93	0.09				
16	0.42	3.90	0.10				
18	0.42	3.89	0.10				
20	0.43	3.88	0.11				
25	0.46	3.86	0.11				
30	0.47	3.84	0.12				
40	0.51	3.80	0.13				
50	0.55	3.76	0.14				
60	0.58	3.73	0.14				

Remarks

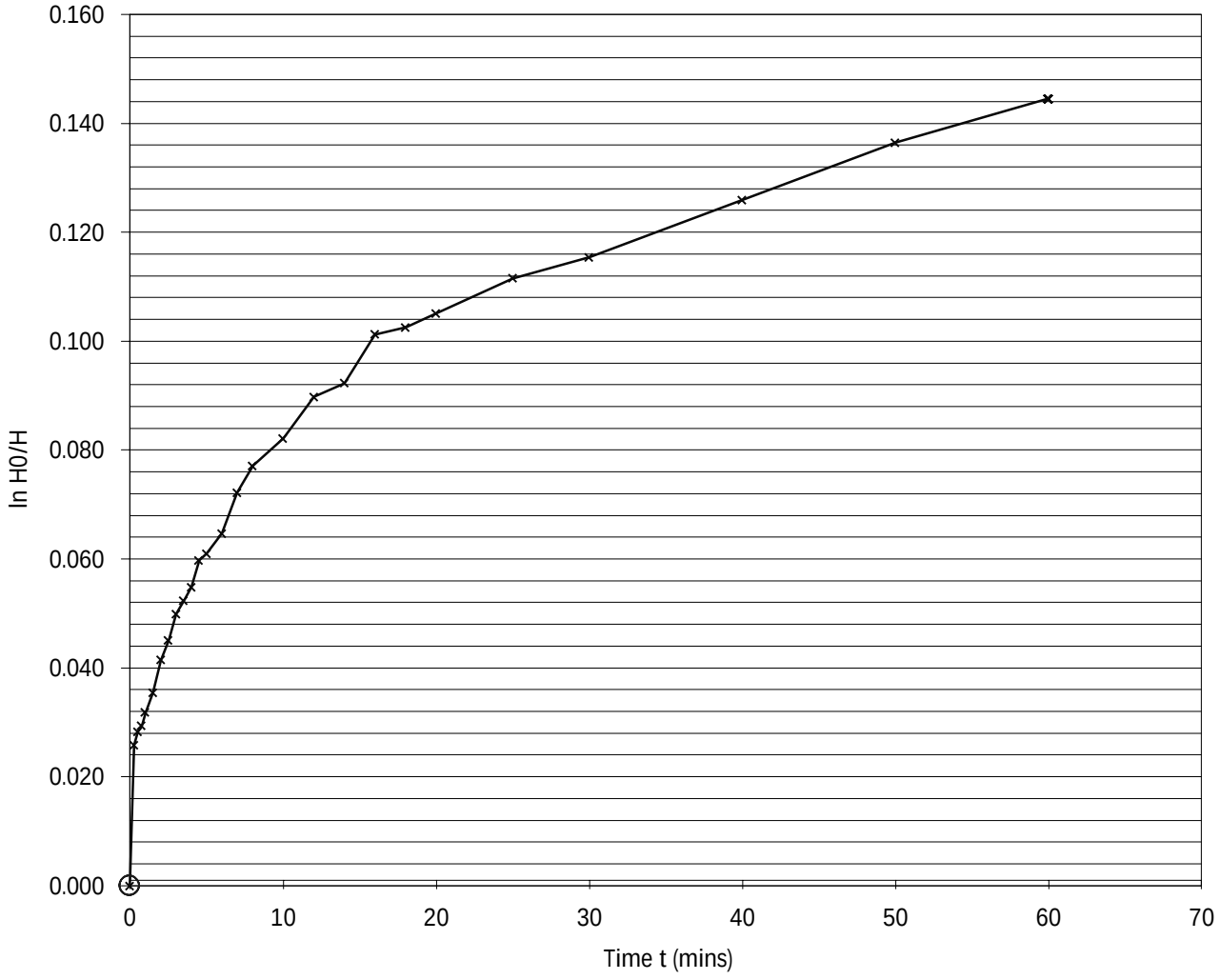
Recorded by: EC

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Borehole Falling Head Permeability Test	Hole ID BH108
Project No.	TB8754		Ground Level 2.35m AOD
Engineer	Mott MacDonald		Date 21/05/2025
Client	FBJV	BS EN ISO 22282-2: 2012	Page 2 of 2
Description	Dark grey silty fine SAND		

Initial ground water level	4.31	m	Top of test section	11.50	m BGL
Height of casing above surface	0.00	m	Bottom of test section	12.00	m BGL
Length of test section	0.00	m	Water level at end of test	0.58	m
Diameter of test section	200	mm	Diameter of casing/standpipe	200	mm

Quality of water used	Clean and fresh	Test start time	10:40
Weather	Fine	Test finish time	11:40



using Velocity graph method $k = \alpha . S/F$ = 1.31×10^{-6} m/s

where $\alpha = 7.94 \times 10^{-5}\ s^{-1}$

$S = 0.0314 m^2$

F= 1.906m

Recorded by: EC			
			SOIL ENGINEERING
Form No. SE-PGR-F-003	Revision No. 3.04	Issue Date 24/01/2014	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	Borehole Falling Head Permeability Test	Hole ID BH109
Project No.	TB8754		Ground Level 2.32m AOD
Engineer	Mott MacDonald		Date 02/06/2025
Client	FBJV	BS EN ISO 22282-2: 2012	Page 1 of 2

Description: Dark grey clayey fine to medium SAND

Type of test: Borehole — Installation type

All depths are relative to ground level.

Initial ground water level	2.30	m	Top of test section	11.50	m
Height of casing above surface	0.00	m	Bottom of test section	12.00	m
Length of test section	0.50	m	Water level at end of test	0.15	m
Diameter of test section	200	mm	Diameter of casing/standpipe	200	mm

Quality of water used	Clean and fresh	Test start time	08:00
Weather	Fine	Test finish time	09:00

Time Minutes	Depth to water m	H	ln H_0/H	Time Minutes	Depth to water m	H	Log H/H0
0	0.00	2.30	0.00				
0.25	0.00	2.30	0.00				
0.5	0.01	2.30	0.00				
0.75	0.01	2.29	0.00				
1	0.02	2.28	0.01				
1.5	0.03	2.27	0.01				
2	0.04	2.26	0.02				
2.5	0.05	2.25	0.02				
3	0.06	2.24	0.03				
3.5	0.06	2.24	0.03				
4	0.06	2.24	0.03				
4.5	0.07	2.24	0.03				
5	0.07	2.24	0.03				
6	0.07	2.23	0.03				
7	0.08	2.22	0.04				
8	0.08	2.22	0.04				
10	0.08	2.22	0.04				
12	0.08	2.22	0.04				
14	0.09	2.22	0.04				
16	0.09	2.21	0.04				
18	0.10	2.21	0.04				
20	0.10	2.21	0.04				
25	0.10	2.20	0.04				
30	0.12	2.18	0.05				
40	0.13	2.17	0.06				
50	0.15	2.15	0.07				
60	0.15	2.15	0.07				

Remarks

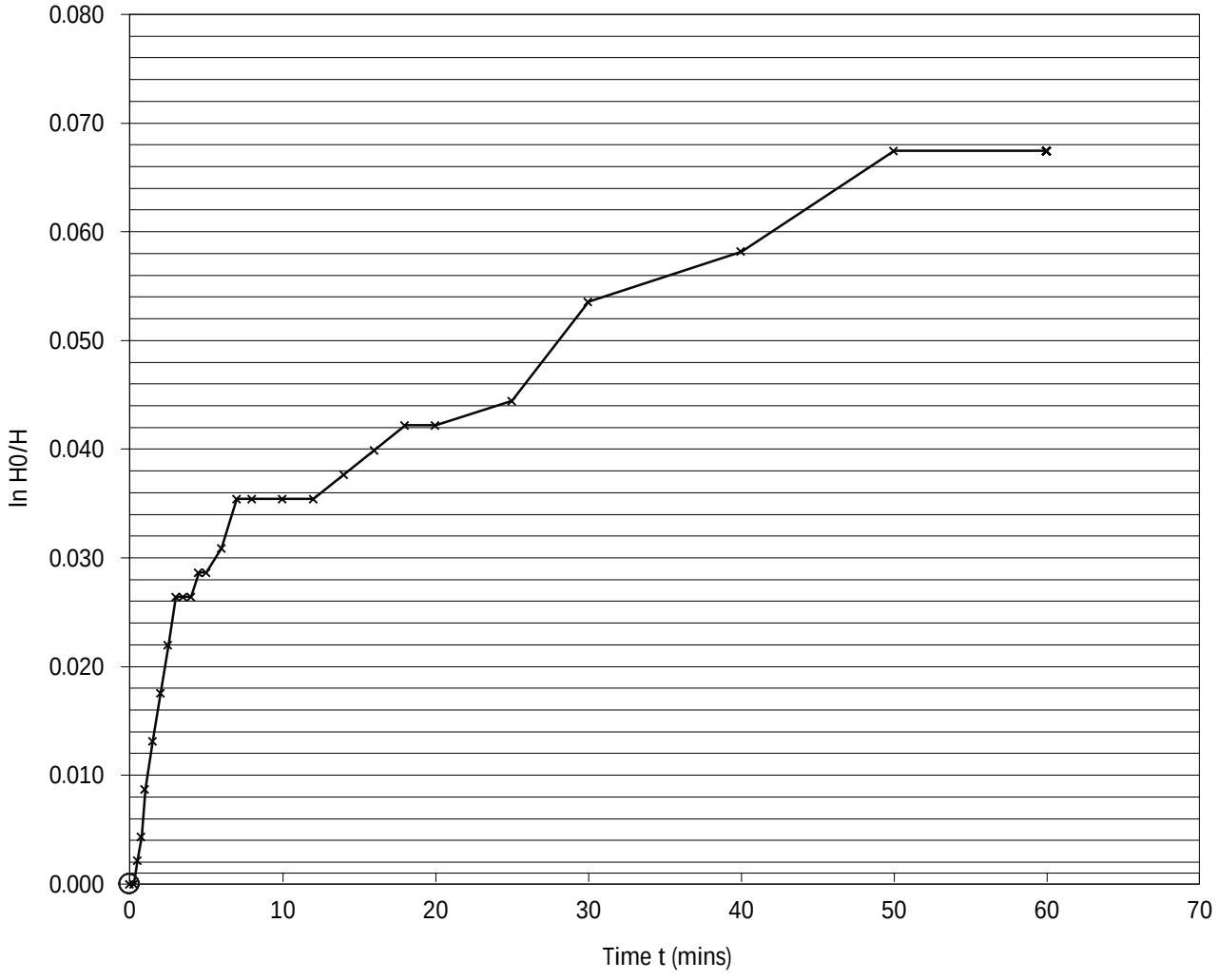
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SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Borehole Falling Head Permeability Test	Hole ID BH109
Project No.	TB8754		Ground Level 2.32m AOD
Engineer	Mott MacDonald		Date 02/06/2025
Client	FBJV	BS EN ISO 22282-2: 2012	Page 2 of 2
Description	Dark grey clayey fine to medium SAND		

Initial ground water level	2.30	m	Top of test section	11.50	m BGL
Height of casing above surface	0.00	m	Bottom of test section	12.00	m BGL
Length of test section	0.50	m	Water level at end of test	0.15	m
Diameter of test section	200	mm	Diameter of casing/standpipe	200	mm

Quality of water used	Clean and fresh	Test start time	08:00
Weather	Fine	Test finish time	09:00



using Velocity graph method $k = \alpha . S/F$ = 1.97×10^{-7} m/s

where $\alpha = 1.2 \times 10^{-5}\ s^{-1}$

$S = 0.0314 m^2$

F= 1.906m

Recorded by: EC			
			SOIL ENGINEERING
Form No. SE-PGR-F-003	Revision No. 3.04	Issue Date 24/01/2014	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	Borehole Falling Head Permeability Test	Hole ID BH110
Project No.	TB8754		Ground Level 2.55m AOD
Engineer	Mott MacDonald		Date 21/05/2025
Client	FBJV	BS EN ISO 22282-2: 2012	Page 1 of 2

Description: Bluish grey CLAY

Type of test: Borehole Installation type:

All depths are relative to ground level.

Initial ground water level	3.40	m	Top of test section	5.00	m
Height of casing above surface	0.00	m	Bottom of test section	6.00	m
Length of test section	1.00	m	Water level at end of test	0.67	m
Diameter of test section	200	mm	Diameter of casing/standpipe	200	mm

Quality of water used	Clean and fresh	Test start time	08:30
Weather	Fine	Test finish time	09:30

Time Minutes	Depth to water m	H	ln H_0/H	Time Minutes	Depth to water m	H	Log H/H0
0	0.00	3.40	0.00				
0.25	0.03	3.37	0.01				
0.5	0.05	3.35	0.01				
0.75	0.07	3.33	0.02				
1	0.10	3.30	0.03				
1.5	0.18	3.22	0.05				
2	0.20	3.20	0.06				
2.5	0.23	3.17	0.07				
3	0.25	3.15	0.08				
3.5	0.27	3.13	0.08				
4	0.29	3.11	0.09				
4.5	0.31	3.09	0.10				
5	0.33	3.07	0.10				
6	0.36	3.04	0.11				
7	0.39	3.01	0.12				
8	0.41	2.99	0.13				
10	0.45	2.95	0.14				
12	0.49	2.91	0.16				
14	0.50	2.90	0.16				
16	0.52	2.88	0.17				
18	0.53	2.87	0.17				
20	0.54	2.86	0.17				
25	0.56	2.84	0.18				
30	0.58	2.82	0.19				
40	0.61	2.79	0.20				
50	0.64	2.76	0.21				
60	0.67	2.73	0.22				

Remarks

Recorded by: EC

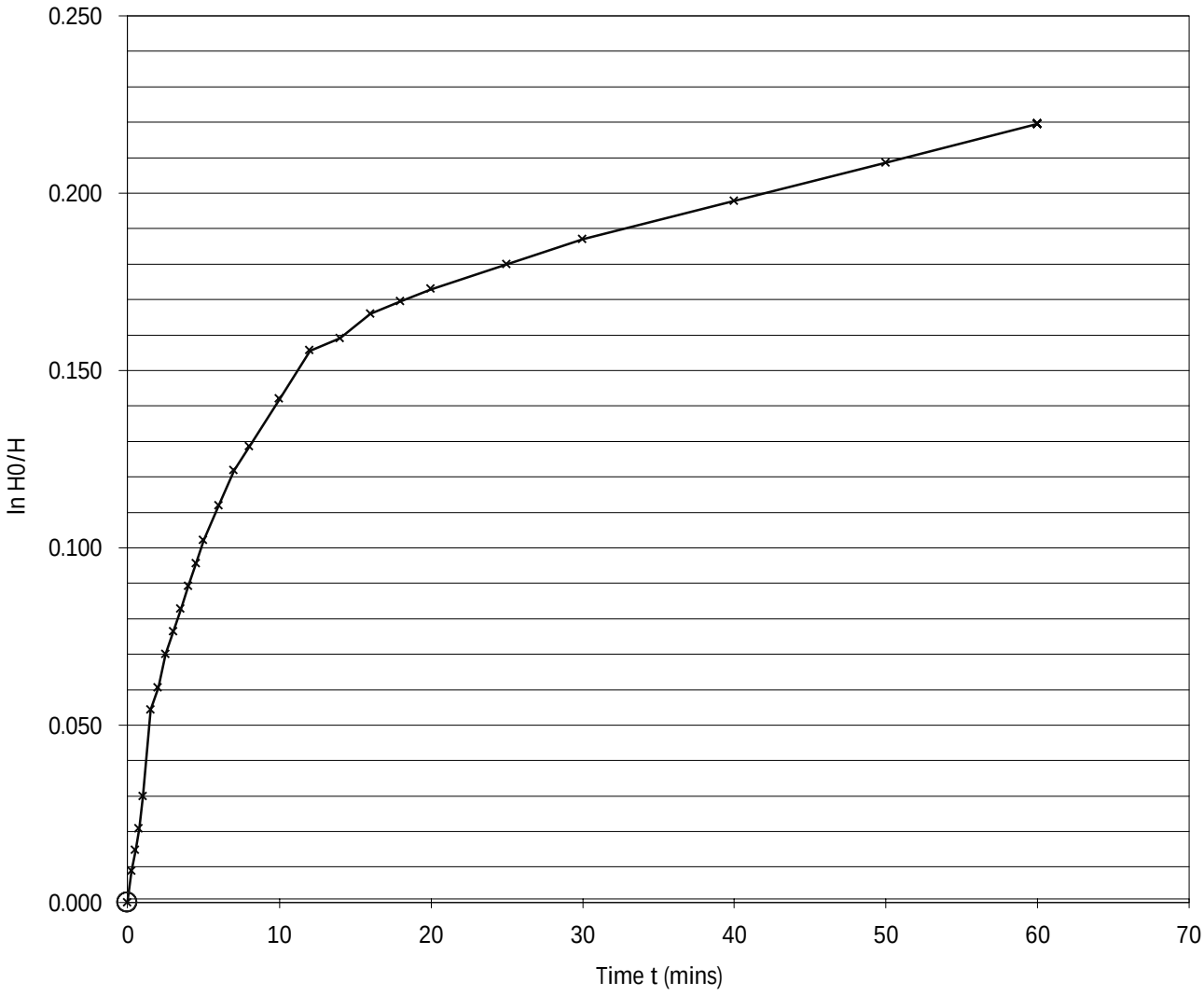
SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Borehole Falling Head Permeability Test	Hole ID BH110
Project No.	TB8754		Ground Level 2.55m AOD
Engineer	Mott MacDonald		Date 21/05/2025
Client	FBJV	BS EN ISO 22282-2: 2012	Page 2 of 2

Description: Bluish grey CLAY

Initial ground water level	3.40	m	Top of test section	5.00	m BGL
Height of casing above surface	0.00	m	Bottom of test section	6.00	m BGL
Length of test section	1.00	m	Water level at end of test	0.67	m
Diameter of test section	200	mm	Diameter of casing/standpipe	200	mm

Quality of water used	Clean and fresh	Test start time	08:30
Weather	Fine	Test finish time	09:30



using Velocity graph method $k = \alpha . S/F$ = 9.18×10^{-7} m/s

where $\alpha = 7.94 \times 10^{-5}\ s^{-1}$

$S = 0.0314 m^2$

F= 2.716m

Recorded by: EC

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Borehole Falling Head Permeability Test	Hole ID BH110
Project No.	TB8754		Ground Level 2.55m AOD
Engineer	Mott MacDonald		Date 27/05/2025
Client	FBJV	BS EN ISO 22282-2: 2012	Page 1 of 2

Description: Grey CLAY

Type of test: Borehole — Installation type:

All depths are relative to ground level.

Initial ground water level	2.10	m	Top of test section	14.50	m
Height of casing above surface	0.00	m	Bottom of test section	15.00	m
Length of test section	0.50	m	Water level at end of test	0.86	m
Diameter of test section	200	mm	Diameter of casing/standpipe	200	mm

Quality of water used	Clean and fresh	Test start time	07:30
Weather	Fine	Test finish time	08:30

Time Minutes	Depth to water m	H	ln H_0/H	Time Minutes	Depth to water m	H	Log H/H0
0	0.00	2.10	0.00				
0.25	0.03	2.07	0.01				
0.5	0.06	2.04	0.03				
0.75	0.08	2.02	0.04				
1	0.11	1.99	0.05				
1.5	0.14	1.96	0.07				
2	0.15	1.95	0.07				
2.5	0.17	1.93	0.08				
3	0.19	1.91	0.09				
3.5	0.21	1.89	0.11				
4	0.24	1.86	0.12				
4.5	0.26	1.84	0.13				
5	0.28	1.82	0.14				
6	0.31	1.79	0.16				
7	0.35	1.75	0.18				
8	0.38	1.72	0.20				
10	0.40	1.70	0.21				
12	0.44	1.66	0.24				
14	0.47	1.63	0.25				
16	0.49	1.61	0.27				
18	0.52	1.58	0.28				
20	0.55	1.55	0.30				
25	0.59	1.51	0.33				
30	0.63	1.47	0.36				
40	0.71	1.39	0.41				
50	0.79	1.31	0.47				
60	0.86	1.24	0.53				

Remarks

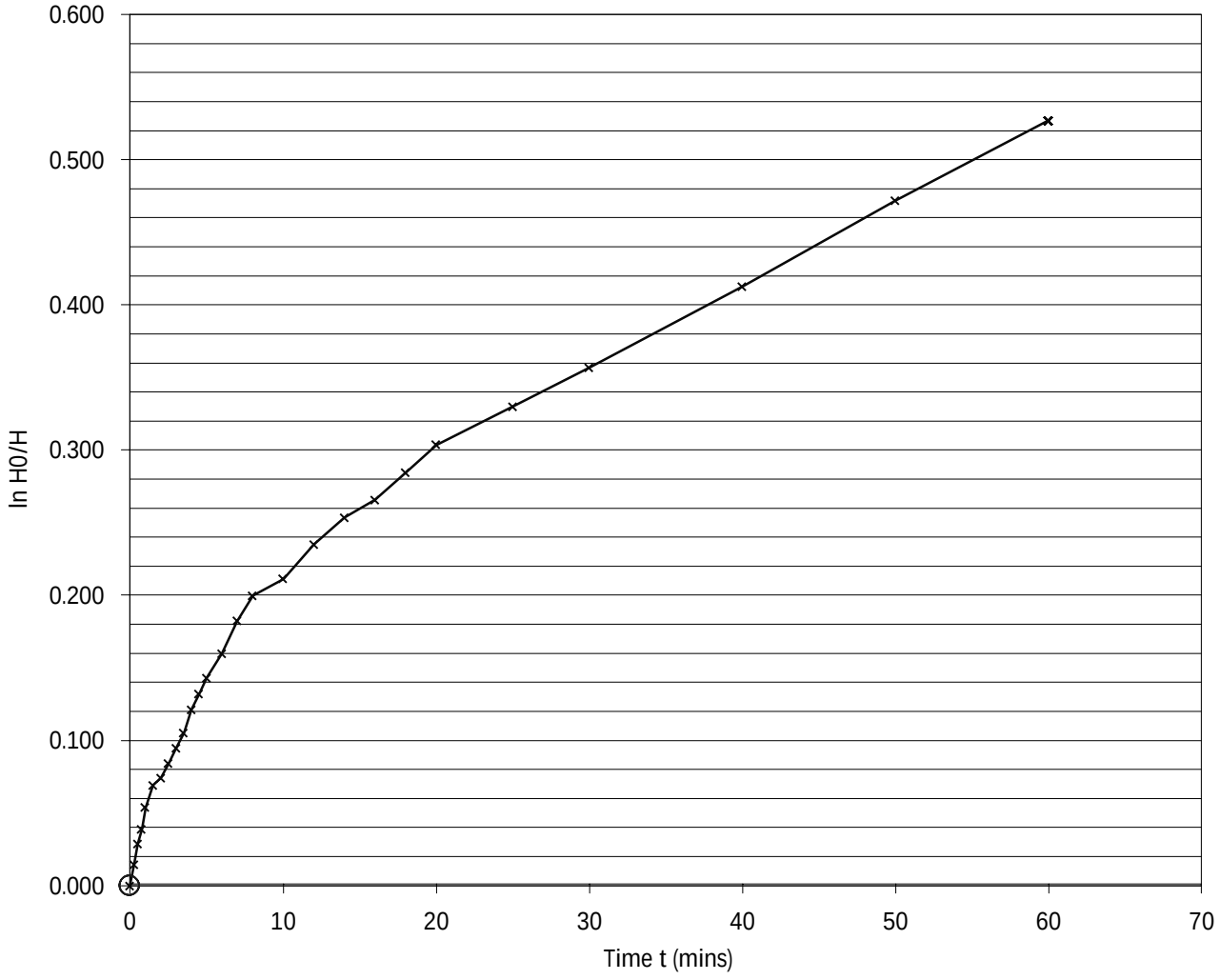
Recorded by: EC

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	Borehole Falling Head Permeability Test	Hole ID BH110
Project No.	TB8754		Ground Level 2.55m AOD
Engineer	Mott MacDonald		Date 27/05/2025
Client	FBJV	BS EN ISO 22282-2: 2012	Page 2 of 2
Description	Grey CLAY		

Initial ground water level	2.10	m	Top of test section	14.50	m BGL
Height of casing above surface	0.00	m	Bottom of test section	15.00	m BGL
Length of test section	0.50	m	Water level at end of test	0.86	m
Diameter of test section	200	mm	Diameter of casing/standpipe	200	mm

Quality of water used	Clean and fresh	Test start time	07:30
Weather	Fine	Test finish time	08:30



using Velocity graph method $k = \alpha . S/F$ = 1.53×10^{-6} m/s

where $\alpha = 9.29 \times 10^{-5}\ s^{-1}$

$S = 0.0314 m^2$

F= 1.906m

Recorded by: EC			
			SOIL ENGINEERING
Form No. SE-PGR-F-003	Revision No. 3.04	Issue Date 24/01/2014	Part of the Bachy Soletanche Group

EUROPEAN GEOPHYSICAL SERVICES

DRAFT REPORT ON THE

GEOPHYSICAL LOGGING

OF

NINE BOREHOLES

AT

TILBURY TO GRAVESEND CABLE ROUTE

Prepared For:

SOIL ENGINEERING

Soil Engineering
Parkside Ln
Leeds
LS11 5SX

JULY_2025/SENG2508A_Tilbury_Cable_Route_rpt/TQ67

	Name	Date
Logged by:	Multiple	May/July 2025
Report by:	R. Powell	23.07.25
Checked by:	M. Kynaston	23.07.25

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4. PROCESSING AND PRESENTATION OF RESULTS 10

5. BOREHOLE LOGGING CONSTRAINTS 12

LIST OF FIGURES

Figure 3.1	Location map showing site location highlighted by red circle. © Crown copyright 2025 OS100057099
Figure 4.1	Example P and S wave data
Appendix 1	Defect Classification
Appendix 2	Geophysical Logs

1.0 INTRODUCTION

At the request of Soil Engineering Ltd., the geophysical logging was carried out in nine boreholes for the Tilbury to Gravesend Cable Route Ground Investigation.

The work was carried out by European Geophysical Services between May & July 2025

The following logs were run:-

BH101	04/06/25		
Tool / Log (unit)		Log Depths (m)*	
Natural Gamma	Gam (API)	0.0	57.2
Three Arm Caliper	Cal (mm)	25.9	58.6
Optical Imager	Optical Image	25.9	59.0
Acoustic Image	Amplitude / Travel Time	25.9	58.9
Formation Density	g/cm³	0.0	58.3
P&S Wave Suspension Logger	Velocity m/s	30.0	56.0

BH102	21/05/25		
Tool / Log (unit)		Log Depths (m)*	
Natural Gamma	Gam (API)	1.5	60.0
Three Arm Caliper	Cal (mm)	24.9	59.0
Optical Imager	Optical Image	24.9	59.2
Acoustic Image	Amplitude / Travel Time	24.9	59.2
Focused Resistivity	Ohm.m	24.9	58.9
P&S Wave Suspension Logger	Velocity m/s	26.0	57.0
Fluid Temperature & Conductivity	°C / µS/cm	2.2	58.0
Fluid Velocity	mm/s	2.6	58.6

BH103	03/06/25		
Tool / Log (unit)		Log Depths (m)*	
Natural Gamma	Gam (API)	0.2	48.1
Three Arm Caliper	Cal (mm)	22.5	49.2
Optical Imager	Optical Image	22.5	49.3
Acoustic Image	Amplitude / Travel Time	22.5	49.3
P&S Wave Suspension Logger	Velocity m/s	25.0	46.0

BH104	17/06/25		
Tool / Log (unit)		Log Depths (m)*	
Natural Gamma	Gam (API)	1.4	60.5
Three Arm Caliper	Cal (mm)	26.3	59.8
Optical Imager	Optical Image	26.3	60.1
Acoustic Image	Amplitude / Travel Time	26.3	60.1
Formation Density	g/cm³	24.7	60.4
P&S Wave Suspension Logger	Velocity m/s	27.5	58.1

BH105	25/06/25		
Tool / Log (unit)		Log Depths (m)*	
Three Arm Caliper	Cal (mm)	30.7	60.0
Optical Imager	Optical Image	30.7	59.1
Acoustic Image	Amplitude / Travel Time	30.7	59.1
P&S Wave Suspension Logger	Velocity m/s	34.0	58.2

BH106	14/05/25		
Tool / Log (unit)		Log Depths (m)*	
Natural Gamma	Gam (API)	0.0	58.2
Three Arm Caliper	Cal (mm)	24.7	59.5
Optical Imager	Optical Image	24.7	59.4
Acoustic Image	Amplitude / Travel Time	24.7	59.4
Formation Density	g/cm³	0.5	59.4
P&S Wave Suspension Logger	Velocity m/s	23.0	56.6

BH107	07/07/25		
Tool / Log (unit)		Log Depths (m)*	
Three Arm Caliper	Cal (mm)	23.8	59.9
Optical Imager	Optical Image	23.8	59.0
Acoustic Image	Amplitude / Travel Time	23.8	59.0
P&S Wave Suspension Logger	Velocity m/s	26.0	57.5

BH108	17/05/25		
Tool / Log (unit)		Log Depths (m)*	
Natural Gamma	Gam (API)	0.8	58.8
Three Arm Caliper	Cal (mm)	26.0	58.1
Optical Imager	Optical Image	26.0	58.5
Acoustic Image	Amplitude / Travel Time	26.0	58.6
P&S Wave Suspension Logger	Velocity m/s	27.0	56.0

BH109	25/06/25 & 07/07/25		
Tool / Log (unit)		Log Depths (m)*	
Three Arm Caliper	Cal (mm)	25.7	58.6
Optical Imager	Optical Image	25.7	59.1
Acoustic Image	Amplitude / Travel Time	25.7	59.0
Focused Resistivity	Ohm.m	20.0	54.8
P&S Wave Suspension Logger	Velocity m/s	28.0	57.8
Fluid Temperature & Conductivity	°C / µS/cm	20.0	56.5
Fluid Velocity	mm/s	18.0	57.3

2.0 THE GEOPHYSICAL LOGGING METHODS

The Equipment and Field Procedure

A fully digital logging system with a 600m capacity motorised winch mounted in a 4x4 van was used.

All logging data was recorded digitally for reprocessing and archiving purposes.

With the exception of the fluid logs, all logs were run from the bottom of the boreholes upward.

The optical imager survey was carried out first to avoid the disturbance of the fluid by the geophysical logs which may affect water clarity.

Fluid Temperature (T)

There is a natural geothermal gradient of increasing temperature with depth. This gradient varies with the thermal conductivity of the geological formation and is modified by water flowing in, out or vertically though the borehole.

This log is used to determine any flow pattern within the borehole and to identify flow zones.

Differential logs are produced over a one metre spacing, these are an interpretative aid to detect gradient changes.

Fluid Conductivity (EC or EC25)

The electrical conductivity (EC) of the water is related to its salinity and dissolved solids and is therefore a measure of the quality of the borehole water. The shape of the log trace can indicate zones of inflow.

Using data from the temperature log the electrical conductivity is corrected to 25°C (EC25).

This log is used to identify different zones of water quality.

Differential logs are produced over a one metre spacing, these are an interpretative aid to detect gradient changes.

Impeller Flowmeter (FV)

This log is used to determine any flow pattern within the borehole and identify flow zones. The tool uses an impeller and is normally run at a constant logging speed against the anticipated flow for the best response. The data is corrected for logging speed and a fluid velocity (FV) log is produced.

2.0 THE GEOPHYSICAL LOGGING METHODS

Caliper (Cal)

This tool measures the mean diameter of the borehole. It is used to check the integrity of the borehole lining, and where the borehole is unlined to identify zones of washout, breakout or fissures.

Natural Gamma (Gam)

The tool measures the naturally occurring gamma radiation found in rocks and sediments. It is mainly used to detect the clays that contain potassium K^{40}, though the U^{238} series of elements and the Th^{232} series of elements also emit gamma radiation.

The higher the concentration of these clay minerals the greater the responses on the natural gamma log.

Focused Resistivity Log (Res Deep and Res Shallow)

The Focused Resistivity tool uses Guard Electrodes to focus the current into the formation. This gives excellent vertical resolution and good penetration, especially in highly conductive borehole fluids where a Normal Resistivity Sonde would not be as effective.

The tool has two electrode spacing's to allow a deep and shallow depth of investigation.

The response of this log is a function of porosity, type of formation / mineralogy and its pore water quality. These logs aid in the identification of strata and quality of the pore water.

P & S Wave

This tool is suspended stationary in the borehole at depth positions of interest and allows simultaneous measurement of P wave (Vp) and S wave (Vs) velocities.

There two sets of receivers at a spacing of 2m and 3m from a transmitter. Each receiver contains two transducers, a piezo-electric device for the detection P waves, and a geophone for the detection of S waves. The time of the P and S wave first arrivals to the receivers are recorded. The distance between the receivers is 1m and the time taken is the difference between the arrival times to the two sets of receivers. As the distance travelled and the time taken is known the speed of the P and S waves can be calculated. By using the difference in arrival times between the two receivers any borehole effects are greatly reduced.

The transmitter operates as a dipole source producing energy in two directions, 180° out of phase. The transmitter pulses are directed perpendicular to the borehole wall. This type of source generates strong shear waves within the formation.

2.0 THE GEOPHYSICAL LOGGING METHODS

Results can be affected by the competency of the rock material, fractured zones, low velocity zones and irregular borehole diameters.

The P and S Suspension tool is 4.5m long. Readings cannot be taken closer than 2m to the water level and no deeper than 3m from the base. This tool can only be used in fluid filled unlined boreholes**.**

Formation Density (Db)

The Formation Density tool has three detectors at different spacing's from a source of gamma radiation. The logs from each detector indicate the apparent bulk density of the material surrounding the tool at a radius of investigation related to the spacing's. The Long Spaced Density has a spacing of 48cm, the High Resolution Density has a spacing of 24cm and the Bed Resolution Density has a spacing of 14cm. The tool is run side-walled up the borehole wall.

The Bed Resolution Density (BRD) log has high resolution but very shallow penetration (2 – 3cm) and is very responsive to borehole diameter changes and fractures.

The High Resolution Density (HRD) has a larger radius of penetration than the BRD, up to around 10cm under average/medium range of densities.

The Long Spaced Density (LSD) has the greatest penetration of up to 15 - 20cm, but least resolution.

A compensated density log is produced using the HRD log to compensate the LSD for borehole effects and mud invasion, further corrections for borehole diameter changes are made using data from the caliper log to produce a bulk density log (Db) in ($g.cm^{-3}$).

Acoustic Borehole Imager (Amplitude and Travel Time)

This tool scans the borehole wall through 360 degrees and records the acoustic reflection of the resulting signal in terms of amplitude and transit time (the travel time from the tool to the borehole wall). This technique requires a fluid filled borehole with a minimum of suspended solids, polymers or muds within the fluid column.

This sensitive technique responds to small diameter changes, rugosity and the acoustic nature of the borehole wall. It is primarily used for detecting fractures and other discontinuities. The resultant images are orientated (to magnetic North) 0° through 90°, 180° and 270° back to 0°.

The logging tool is centralised during data acquisition by two sets of bow springs. The bow springs are adjusted to a variety of borehole diameters prior to acquisition. The image is viewed on the way down the borehole to allow fine tuning of the acquisition parameters. The settings are then adjusted and the image recorded on the way up the borehole which ensures a constant line speed during acquisition.

2.0 THE GEOPHYSICAL LOGGING METHODS

Images and associated data are viewed in real time during the data acquisition.

The orientation system employs a flux gate magnetometer and therefore the recorded data within approximately one metre of magnetic steel casing is un-orientated. This is corrected manually during the post-processing stage

Optical Borehole Imager (Optical)

A precision-machined prism and CCD camera assembly permits a high definition video image of the borehole wall to be captured in a variety of horizontal and vertical resolutions. The resulting image is digitised in the sonde for transmission to the surface acquisition system.

The image is then orientated to Magnetic North and displayed as an unwrapped image log. This enables a detailed structural interpretation to be made if required.

For the best results the optical imager should be run above the water level or in clean, clear fluid. The logging tool is centralised during data acquisition by two sets of bow springs. The bow springs are adjusted to a variety of borehole diameters prior to acquisition. The image is recorded on the way down the borehole to limit disturbance to the clarity of the water in the borehole by the logging tool.

Images and associated data are viewed in real time during the data acquisition.

The orientation system employs a flux gate magnetometer and therefore the recorded data within approximately one metre of magnetic steel casing is un-orientated. This is corrected manually during the post-processing stage

3.0 SITE DETAILS

Tilbury to Gravesend Cable Route **OS Grid Ref:** TQ 663 758

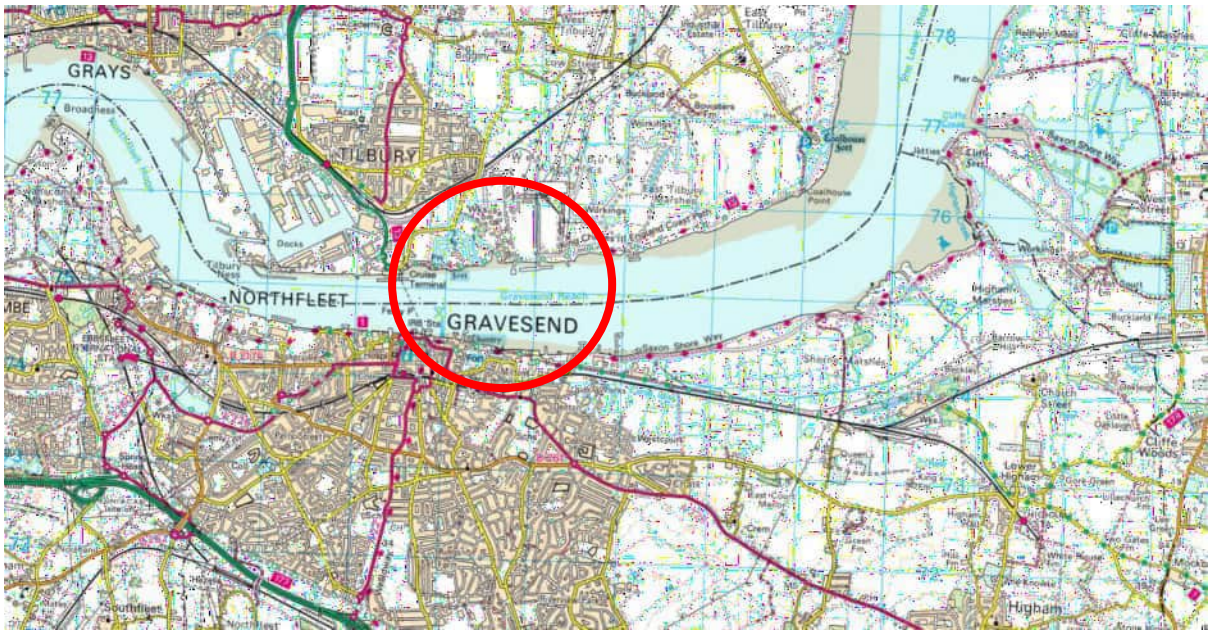


Figure 3.1 Location map showing site and approximate area of investigation highlighted by red circle.
© Crown copyright 2025 OS100057099

4.0 PROCESSING AND PRESENTATION OF RESULTS

4.1 Image Log Processing

Detailed logs of the imager data have been produced at a vertical scale of 1:100 1:10.

Constructional details and information on each borehole are given in the headers of each log.

All images have been referenced to Magnetic North.

The borehole's azimuth and tilt are plotted alongside the images.

The image of the borehole wall is presented in an unwrapped form with a horizontal scale marked 0° - North, through 90° - East, 180° - South, 270° - West, back to North.

Structural features and discontinuities have been picked from the images in the form of colour coded sinusoidal projections - see Appendix 1 for details. This 'Discontinuities' log is also presented with a horizontal scale marked 0° - North, through 90° - East, 180° - South, 270° - West, back to North.

Structure picking is not a definitive analysis of all the features within a borehole. Only the discontinuities that have a linear dip and direction are 'picked' and used in the analysis of the discontinuities. Features that do not have a regular sinusoidal shape do not have a linear dip and direction, 'best fit' picking of these features is done if approximately 80% coverage of the sinusoid can be achieved. Below this percentage the inaccuracy of the picking is too great and if included in any structural analysis may adversely skew the results. Vughs, solution holes, and angular break outs are examples of features not picked.

The apparent azimuth and apparent dip (i.e. relative to the borehole's azimuth and tilt) of the discontinuities are calculated using the diameter of the borehole and the geometric parameters of the sinusoids overlaid on the discontinuities. The final processing stage is to correct these apparent values to true azimuth (in relation to Magnetic North) and true dip (from horizontal) by correcting for the borehole's azimuth and tilt.

The final results are presented as a 'tadpole' plot (Discontinuities - True°). The horizontal position of the tadpole's head gives the defect's true dip angle and its tail points in the direction of the defect's azimuth. These logs are presented with a horizontal scale in degrees. By convention the top of the page is North (Magnetic) and the right hand edge of the paper is East.

The true structural data has been presented in digital format as an excel file (xls).

4.2 Composite Logs

Composite logs containing the geophysical data have also been produced. These logs have been presented as A4 plots for each borehole.

Processing of the geophysical data in the composite log is minimal, as the geophysical logs are calibrated to produce quantitative results, unlike imager logs, no interpretation has been specified.

P&S wave data have been processed in specialist software. This software displays whole P and S waveform for the different receivers, the software is used to pick the first arrivals times. The distance between the receivers is 1m and the time taken is the difference between the arrival times to the two sets of receivers. As the distance travelled and the time taken is known the velocity of the P and S waves can be calculated. Example waveforms and process screenshot are shown below (Figure 4.1).

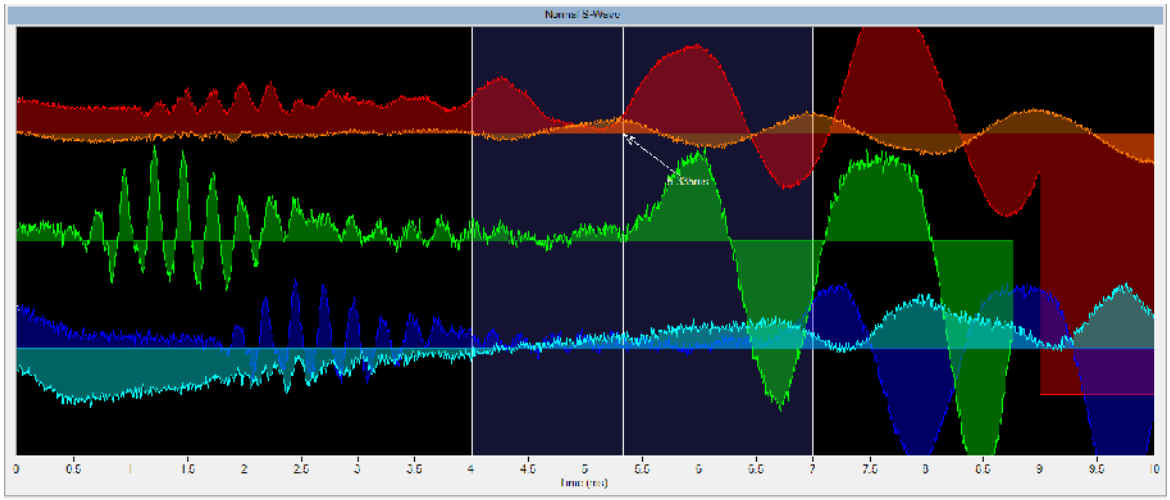


Figure 4.1 Example P and S wave data.

5.0 BOREHOLE LOGGING CONSTRAINTS

- **Vehicle access restrictions**
  None

- **Tool restrictions**
  Different log suites were specified for different boreholes; EGS were not party to this process and have only run what was instructed on site at each borehole.

- **Borehole conditions / risk to equipment**
  Fluid logs require fluid column to be flushed and equilibrated. Heat-pulse flowmeter was run in BH102 due to lack of measurable fluid flow.

- **Lack of fluid filled column / cloudy fluid**
  Cloudy fluid in several boreholes, details in log headers. BH109 was re-logged to obtain clearer optical image.

- **Time constraint**
  None

- **Borehole construction / casing**
  P&S-wave, Resistivity and Fluid logs require saturated borehole conditions. Density logs through steel casing are apparent values only.

Appendix 1

Discontinuity Classification.

Discontinuity	Colour	Classification Parameters
Major Fracture or Fissure	Blue	An open break in the formation, that is **continuous** across the entire image.
Minor Fracture or Fissure	Turquoise	A thin or closed break in the formation, that is **continuous or discontinuous** across the image.
Vein	Green	That may be **continuous or discontinuous** across the entire image.
Fabric	Red	Defines a feature generally metamorphic, igneous or sedimentary in origin that may be **continuous or discontinuous** across the image, such as bedding and cross-bedding, schistosity or gneissosity.
Intrusions	Purple	Intrusive features such as dykes and sills, generally **continuous** across the image
Unknown	Black	Faint features which **can not** be classified.

Appendix 2

Geophysical Logs

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Soil Engineering**

Borehole: **BH101**

Log Type: ***Composite***

Location: **Tilbury** Area: **London** Grid Ref: **TQ 66300 75899** Elevation:

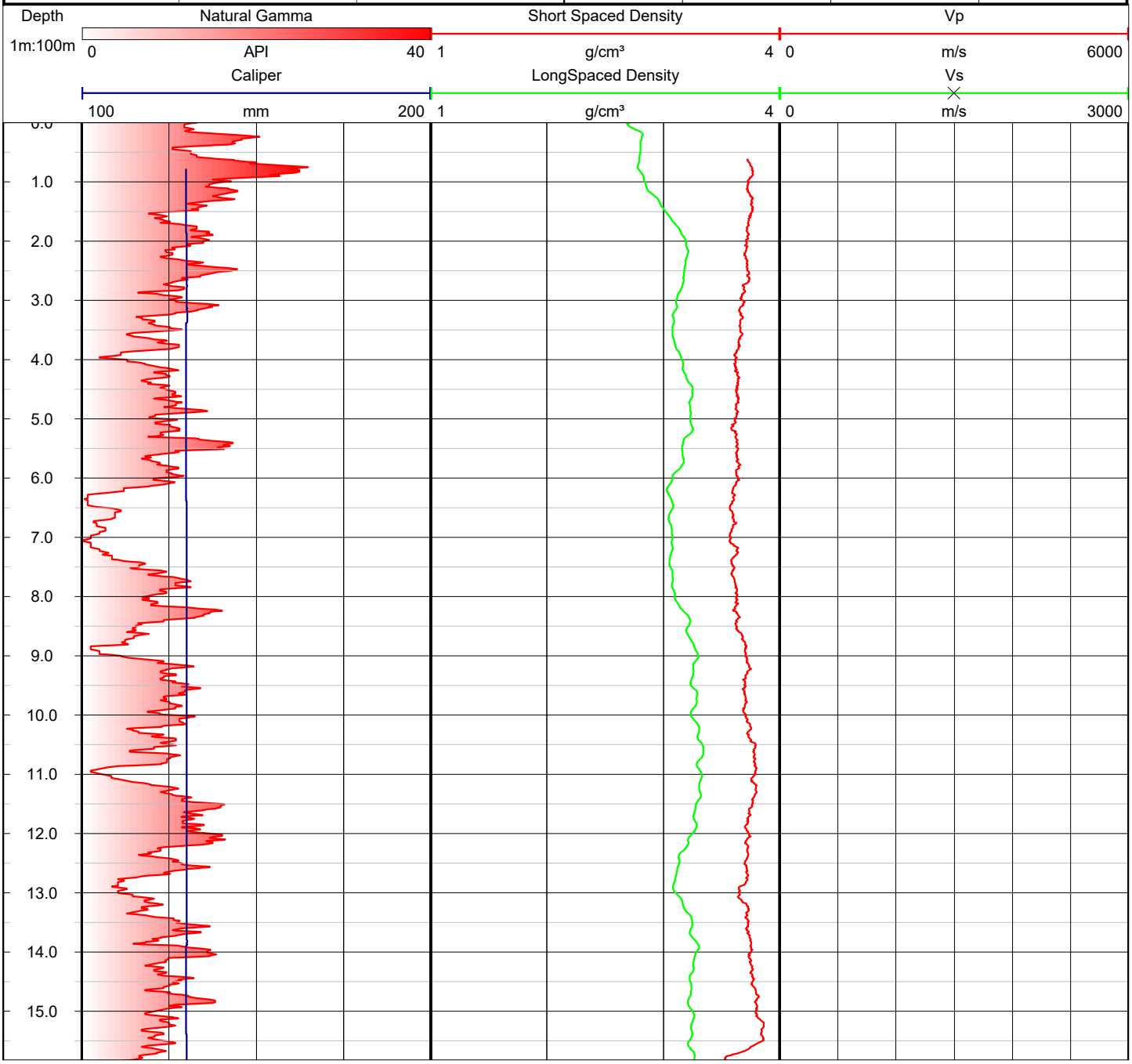
Drilled Depth: (m)	**60.0**	Date:	**04.06.25**
Logged Depth: (m)	**59.1**	Recorded By:	**L. Summers**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**0.0 - 59.1**		
Fluid Level: (m)	**1.2**		

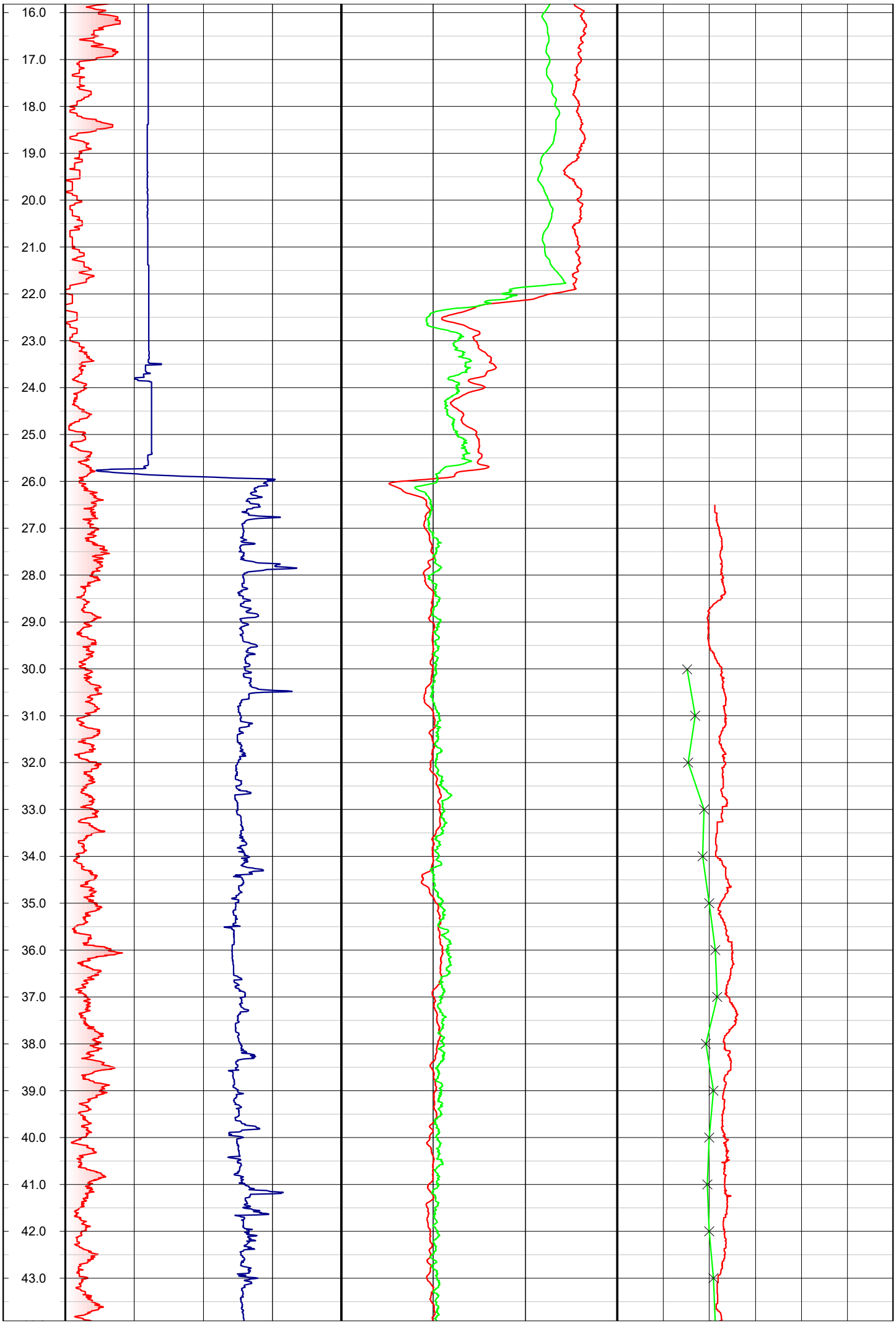
BOREHOLE RECORD

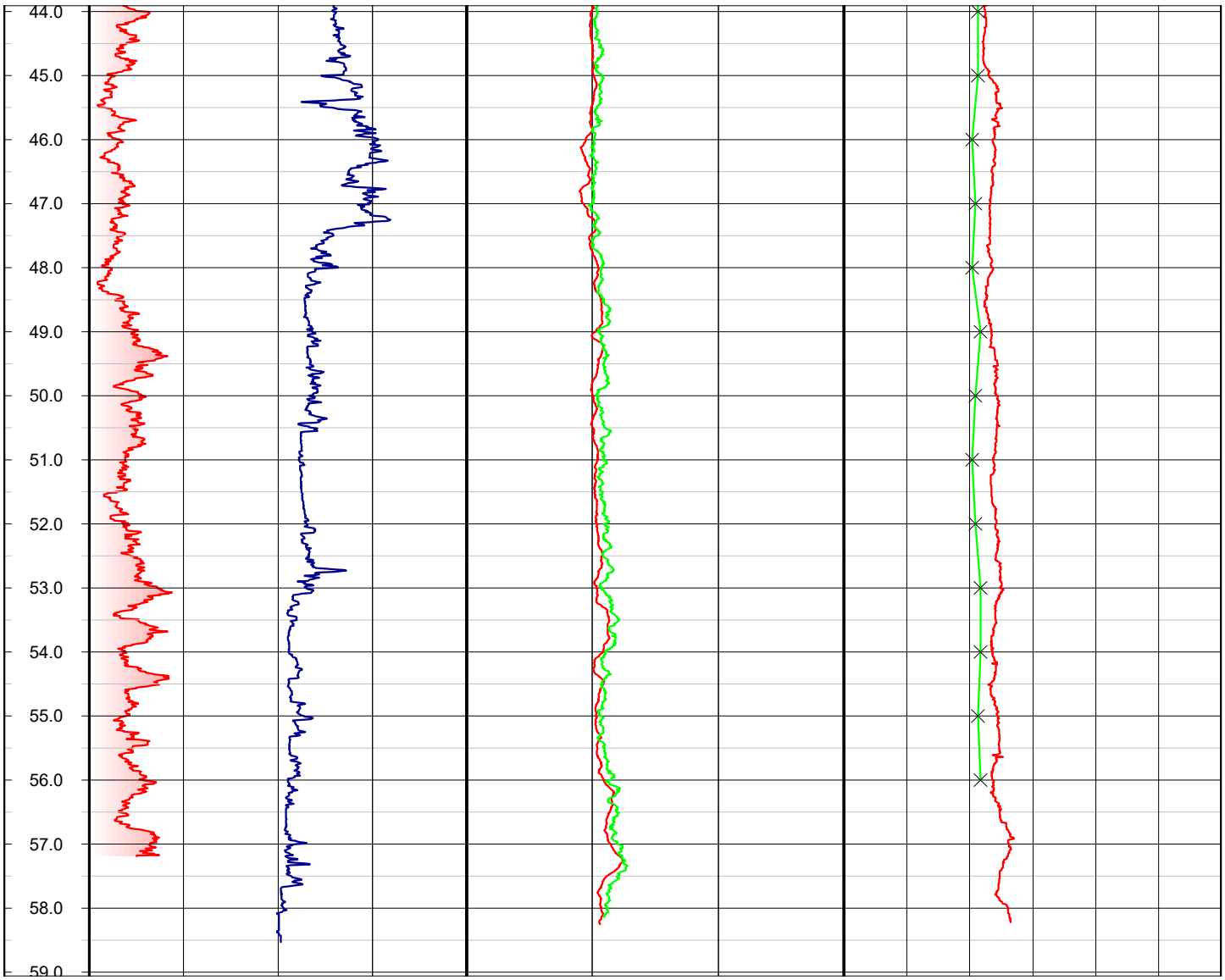
Bit: (mm)	From: (m)	To: (m)
130	**25.9**	**59.1**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Steel	**150**	**-1.0**	**25.9**




16.0
17.0
18.0
19.0
20.0
21.0
22.0
23.0
24.0
25.0
26.0
27.0
28.0
29.0
30.0
31.0
32.0
33.0
34.0
35.0
36.0
37.0
38.0
39.0
40.0
41.0
42.0
43.0


44.0
45.0
46.0
47.0
48.0
49.0
50.0
51.0
52.0
53.0
54.0
55.0
56.0
57.0
58.0
59.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Soil Engineering**

Borehole: **BH101**

Log Type: ***Image***

Location: **Tilbury** Area: **London** Grid Ref: Elevation:

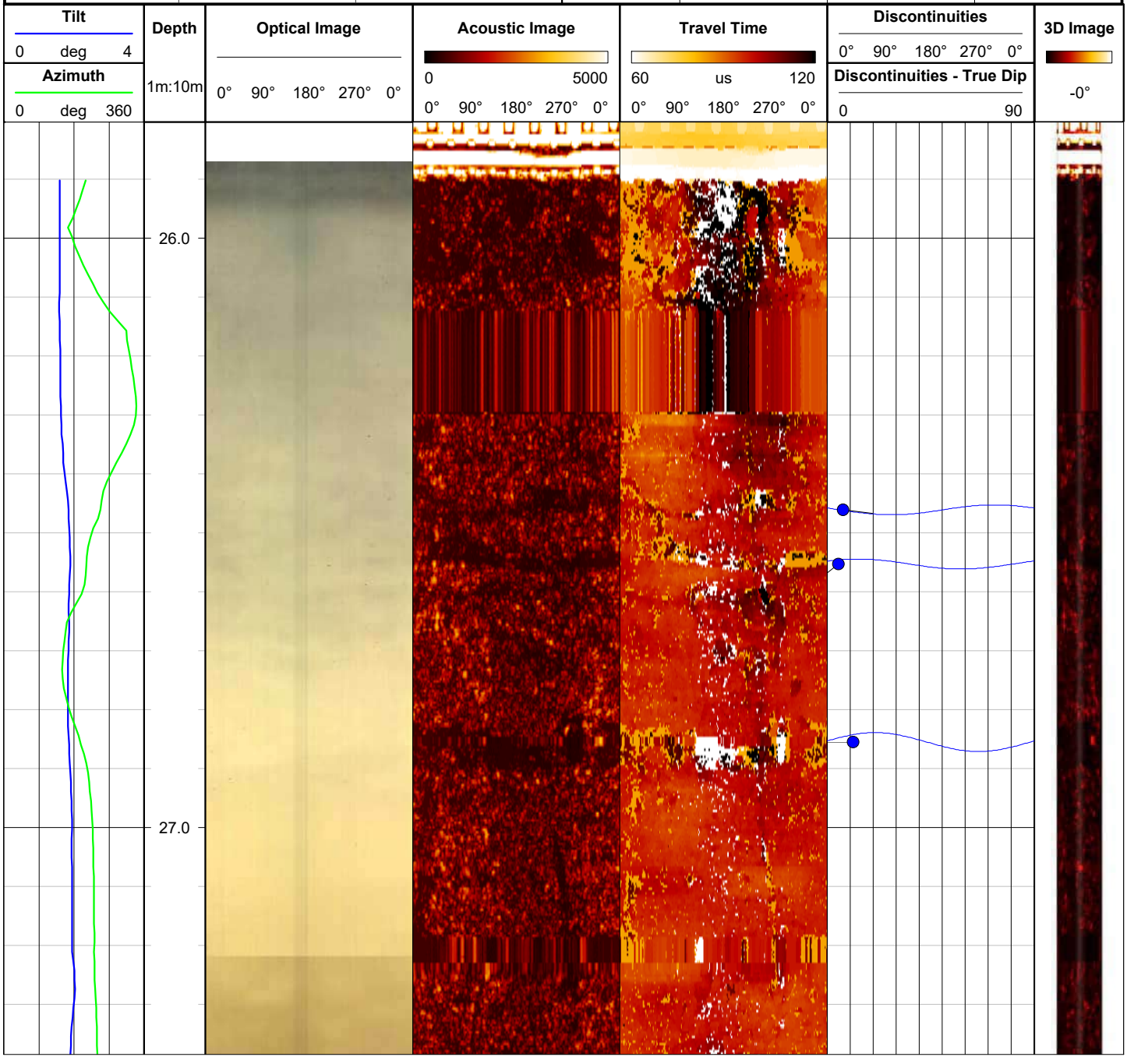
Drilled Depth: (m)	**60.0**	Date:	**04.06.25**
Logged Depth: (m)	**59.1**	Recorded By:	**L. Summers**
Logging Datum:	**Ground Level**	Remarks:	Highly turbid fluid, not flushed, bh silted up to ~48m, no structures visible below.
Logged Interval: (m)	**25.9 - 59.1**		
Fluid Level: (m)	**1.2**		

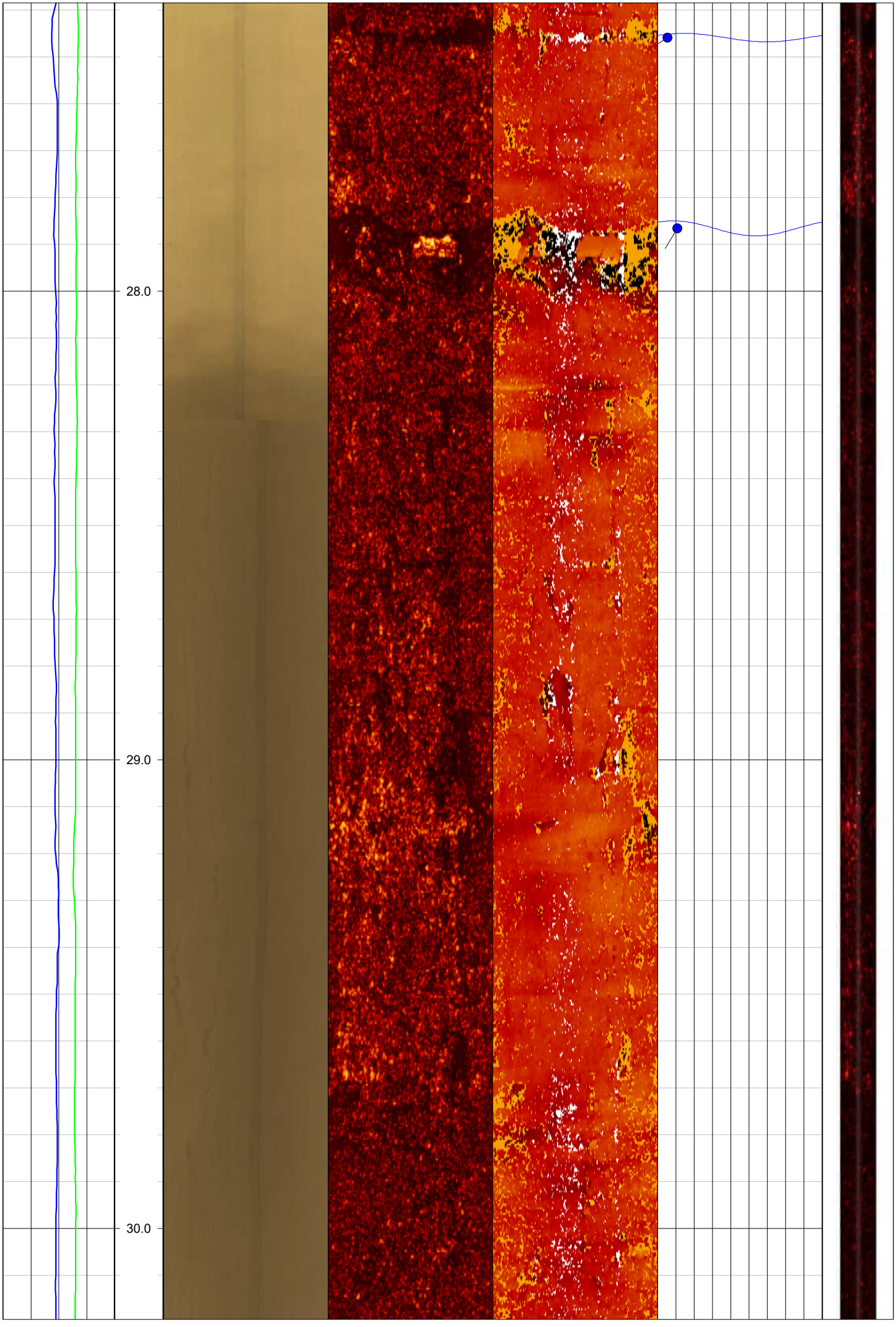
BOREHOLE RECORD

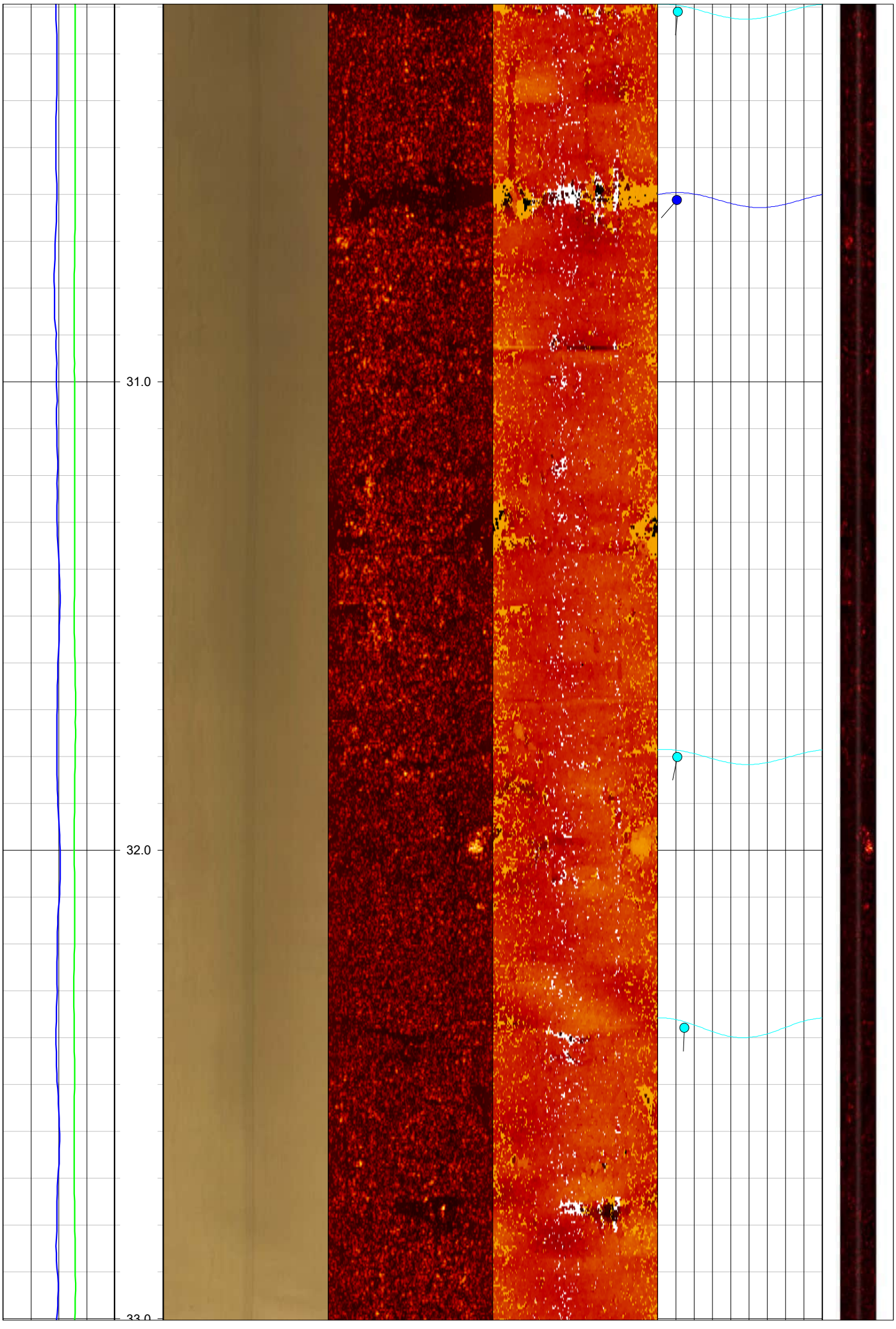
Bit: (mm)	From: (m)	To: (m)
146	**25.9**	**60.0**

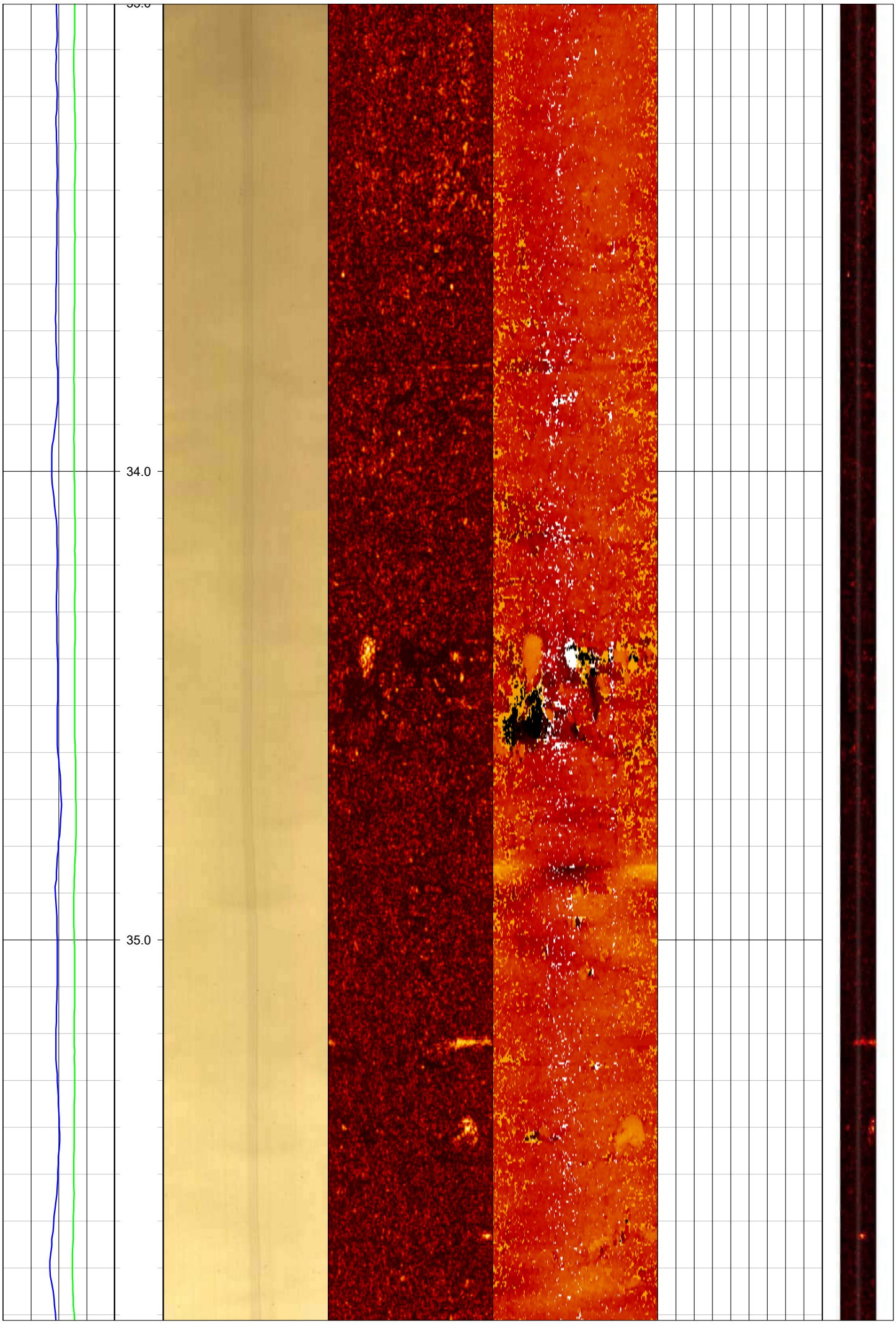
CASING RECORD

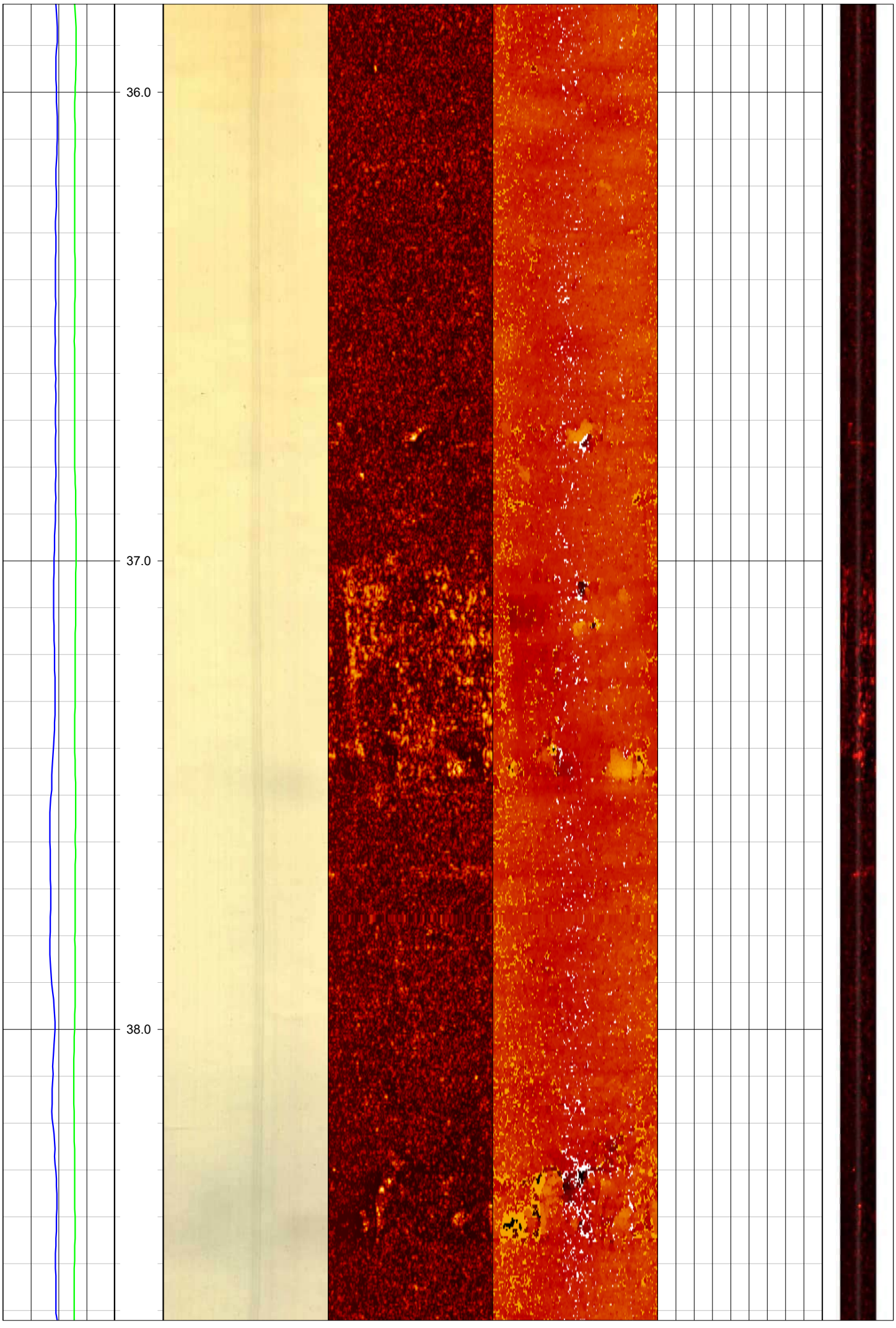
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Steel	**155**	**-1.0**	**25.9**

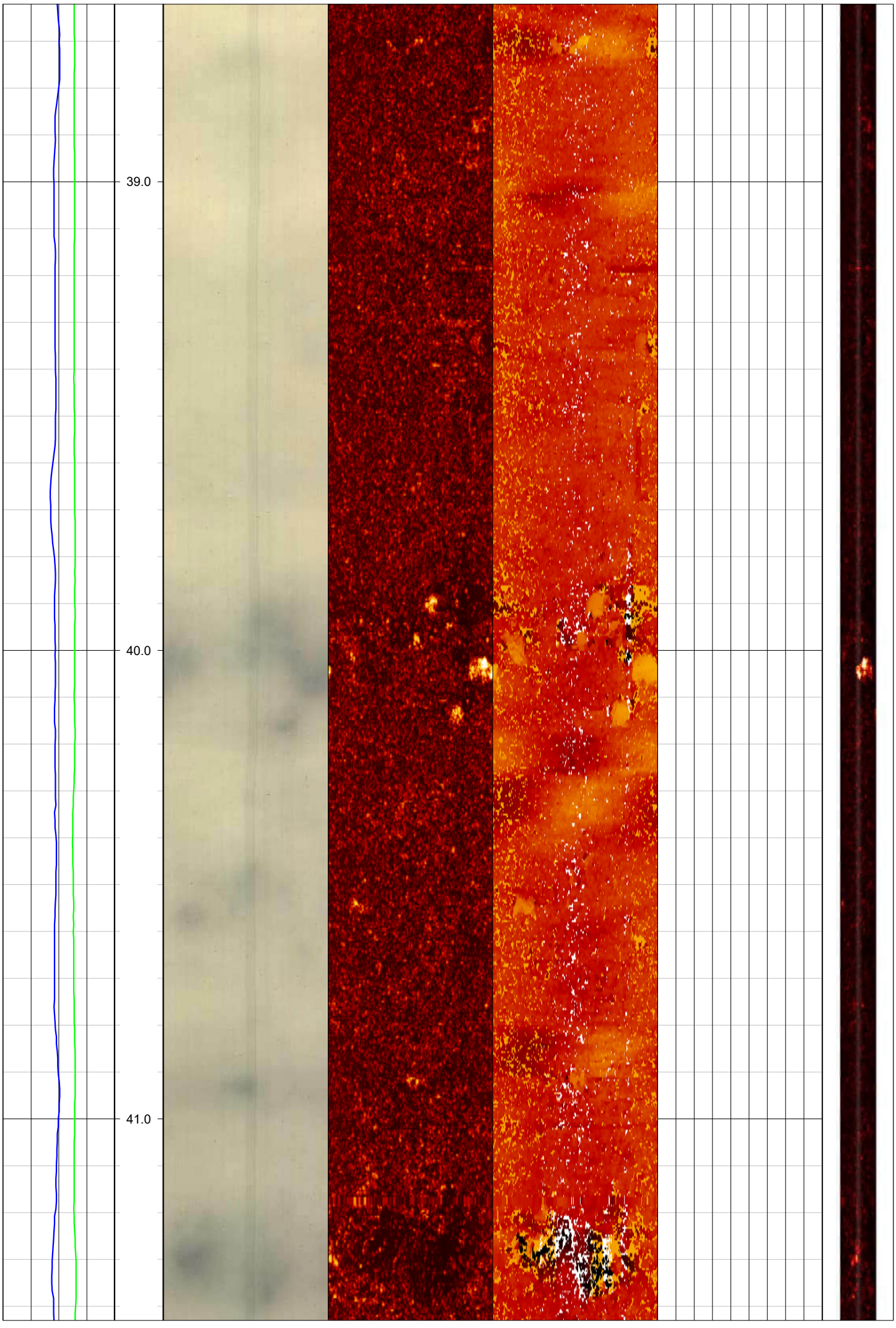


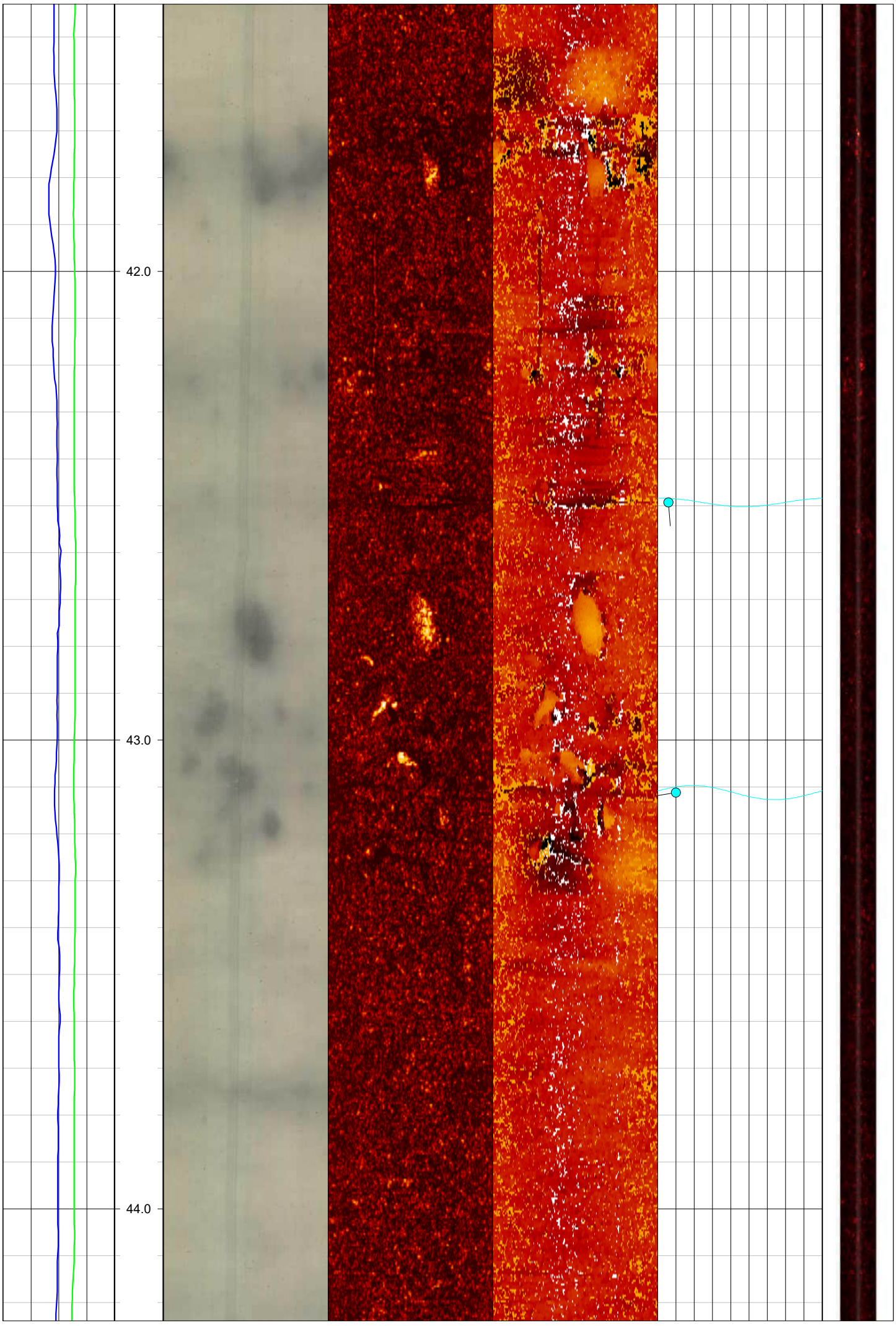

28.0
29.0
30.0

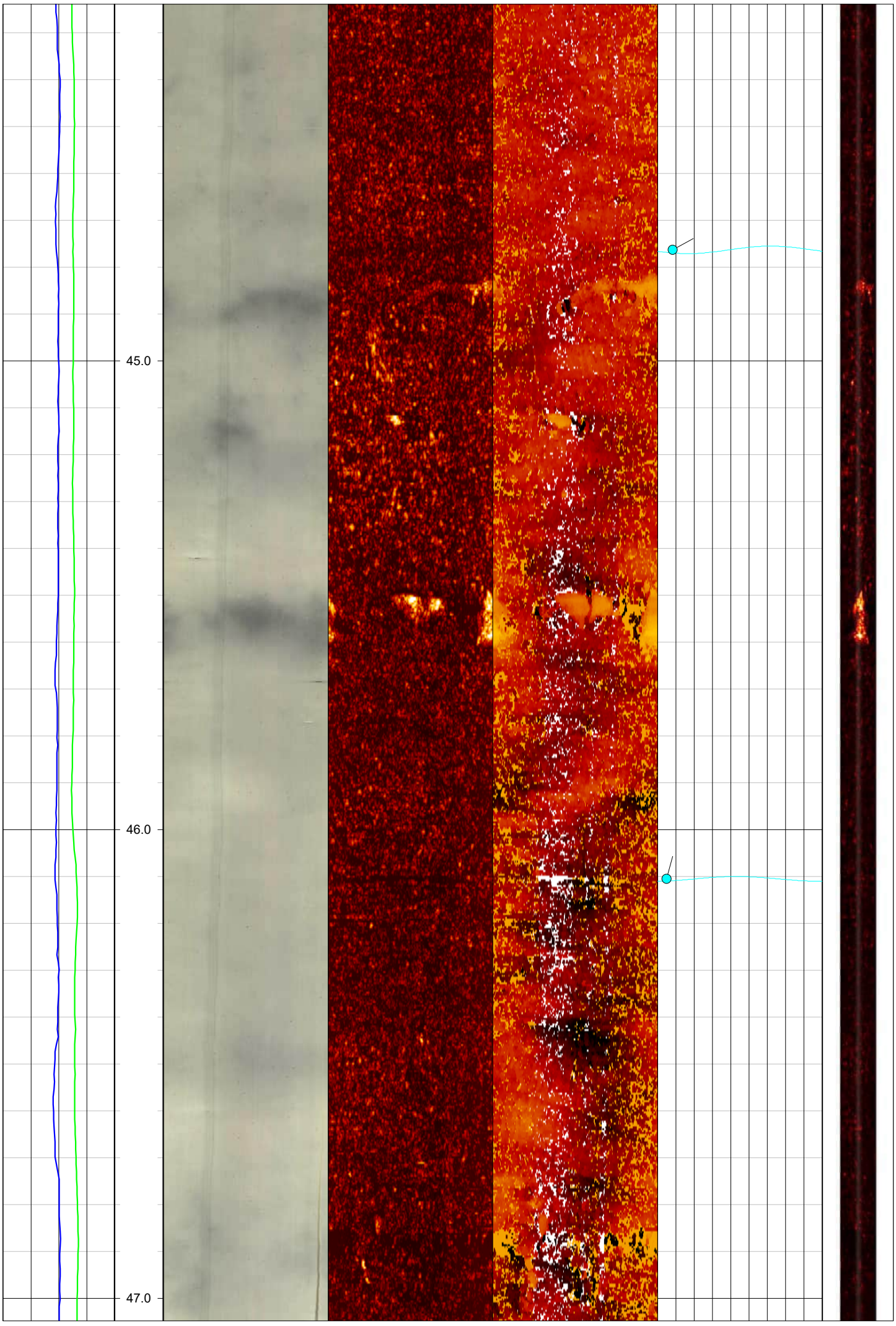

31.0
32.0
33.0

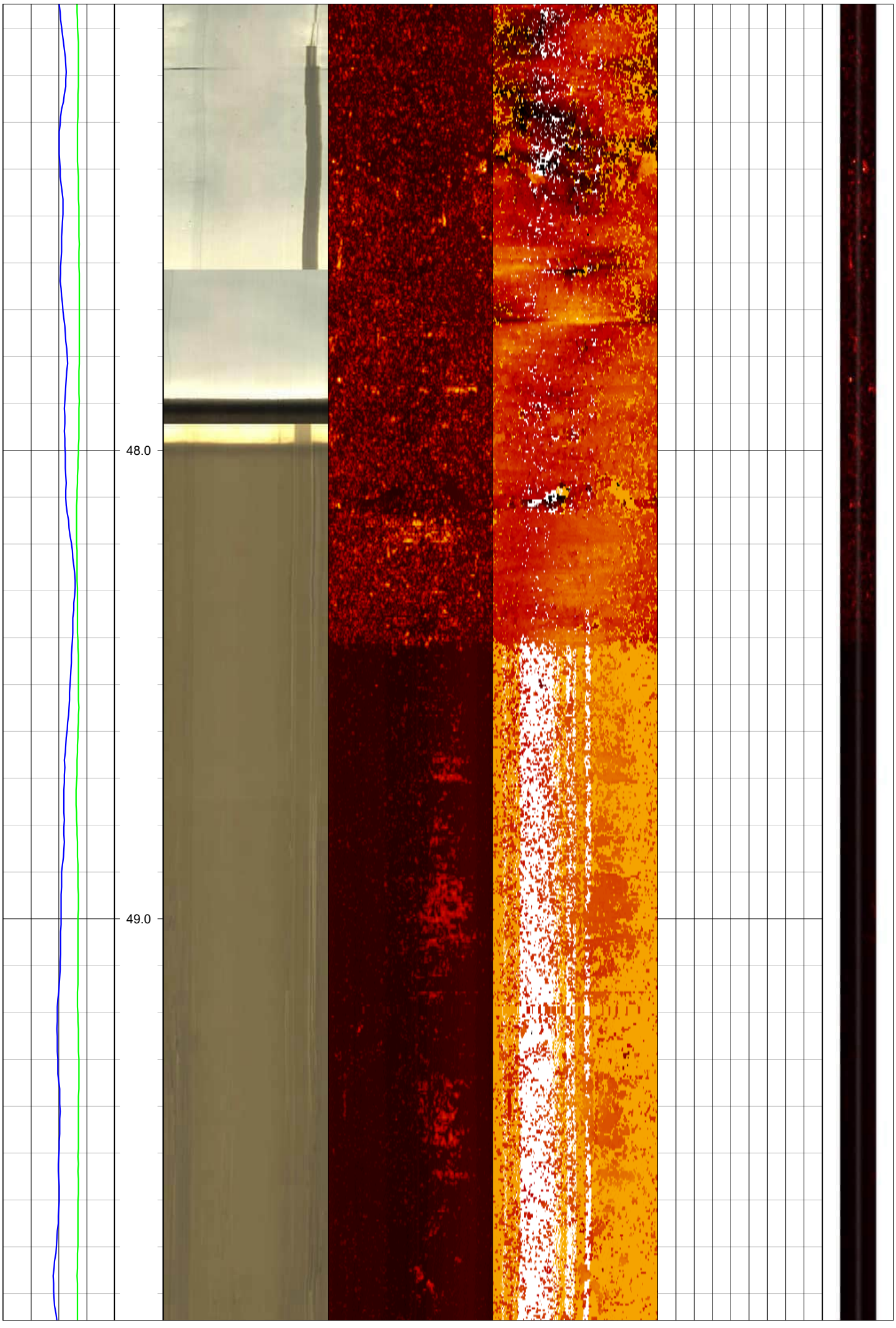

34.0
35.0

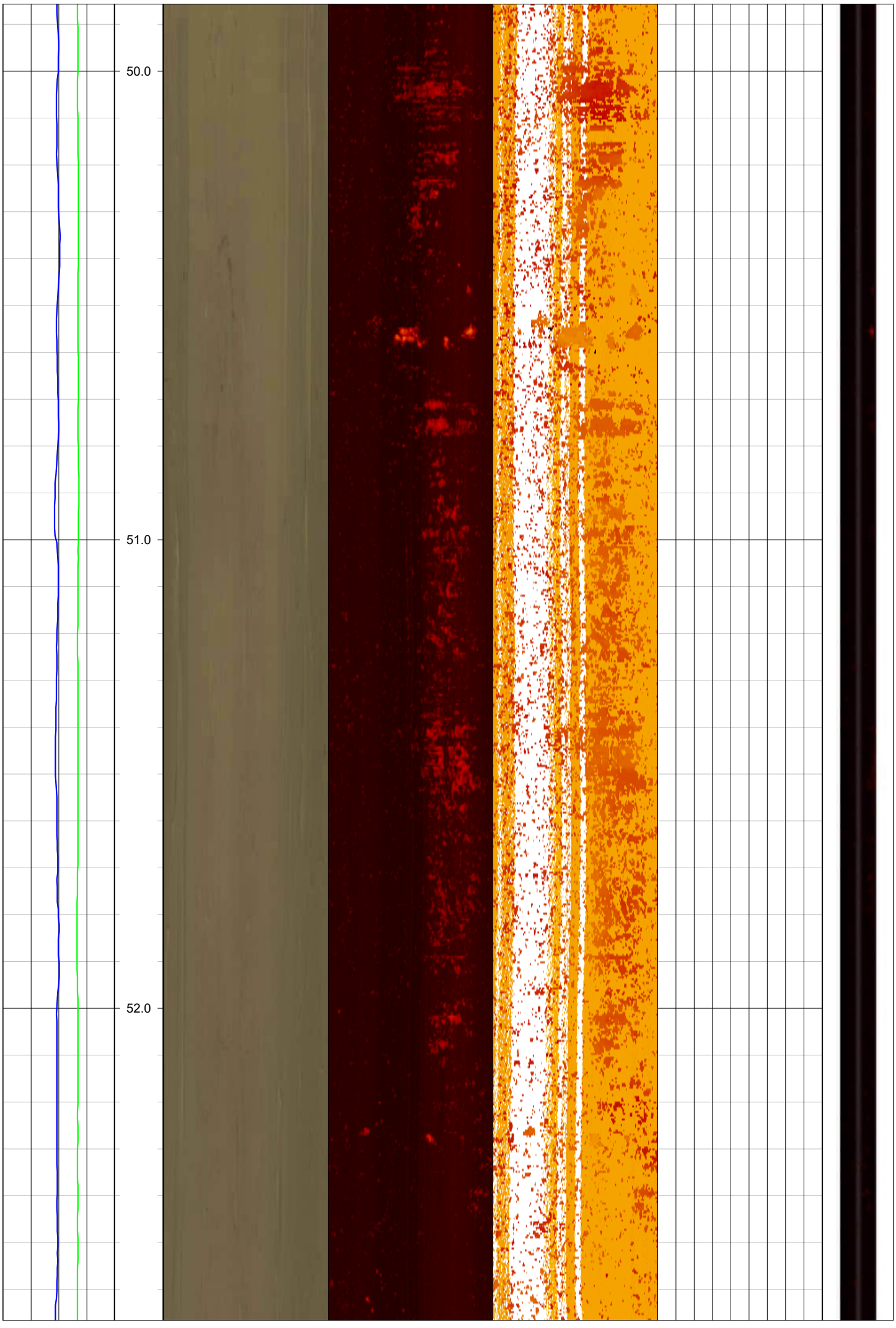

36.0
37.0
38.0

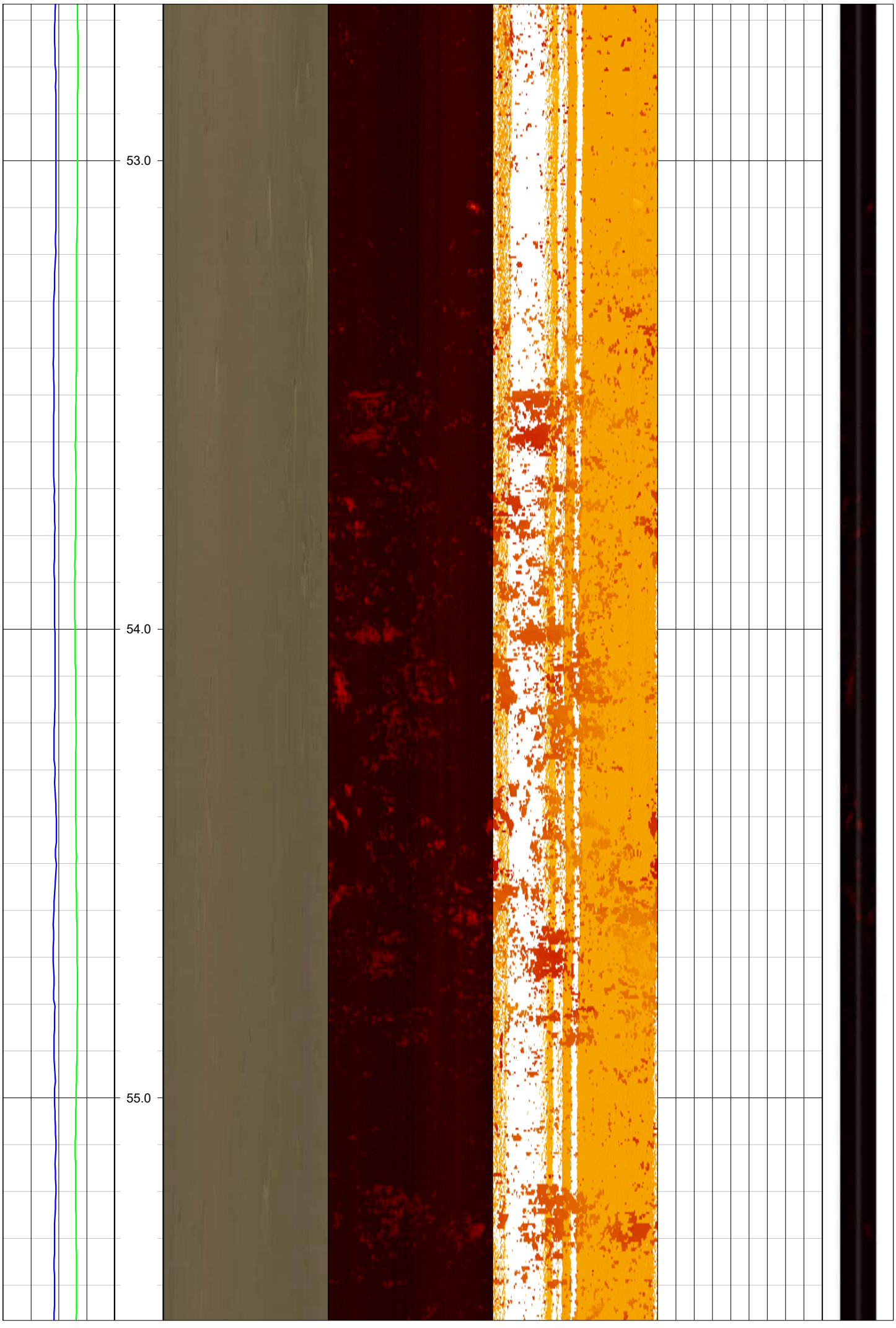

39.0
40.0
41.0

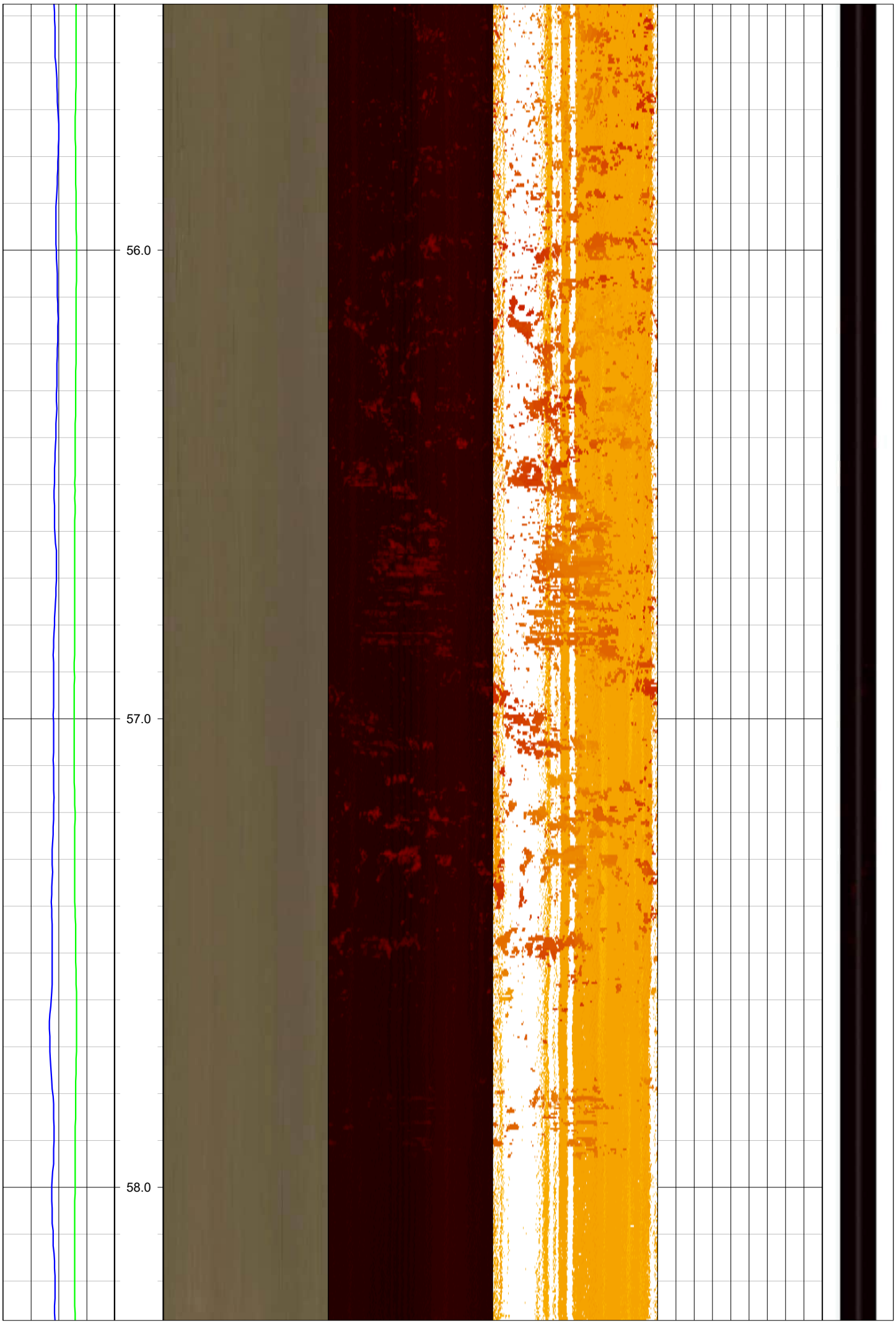

42.0
43.0
44.0

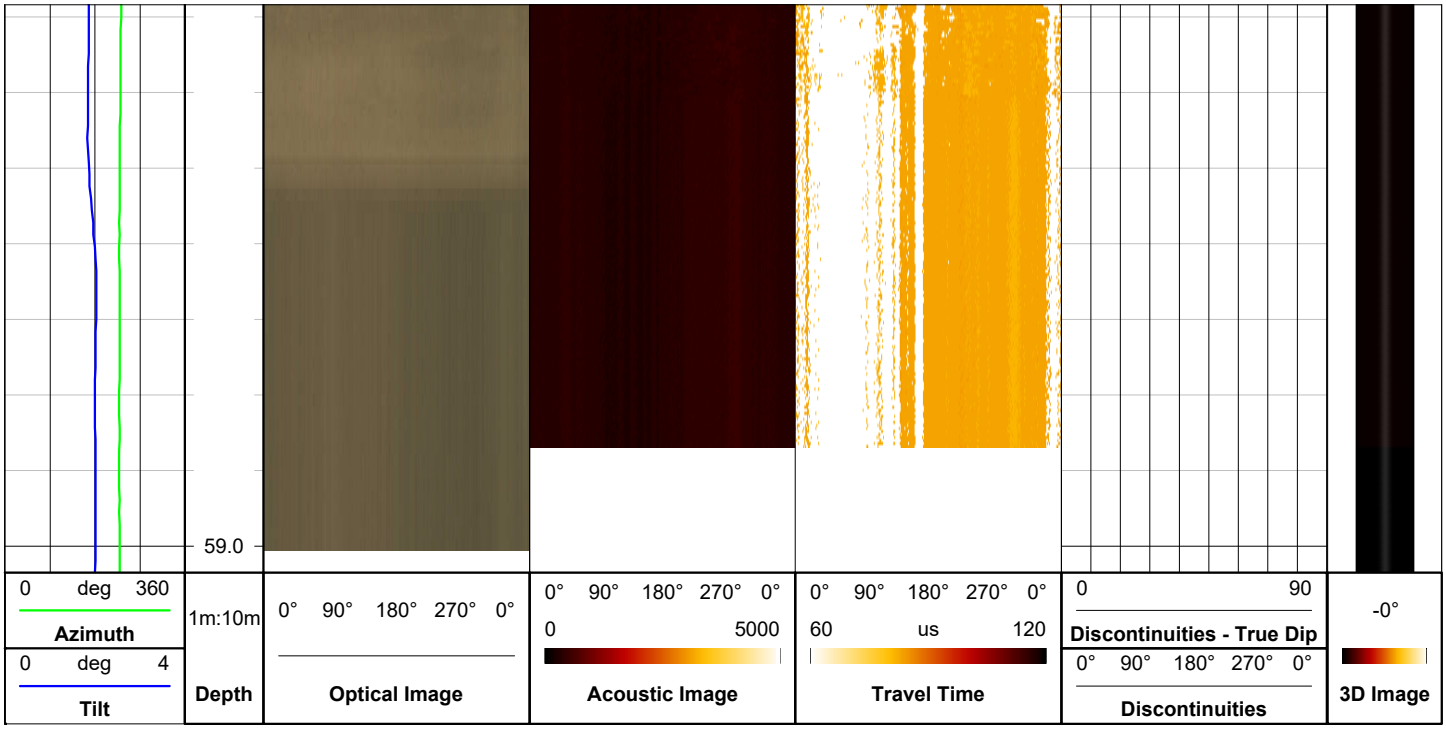

45.0
46.0
47.0


48.0
49.0


50.0
51.0
52.0


53.0
54.0
55.0


56.0
57.0
58.0


59.0
0 deg 360
Azimuth
0 deg 4
Tilt
1m:10m
Depth
0° 90° 180° 270° 0°
Optical Image
0° 90° 180° 270° 0°
0 5000
Acoustic Image
0° 90° 180° 270° 0°
60 us 120
Travel Time
0 90
Discontinuities - True Dip
0° 90° 180° 270° 0°
Discontinuities
-0°
3D Image

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Soil Engineering**

Borehole: **BH102**

Log Type: ***Composite***

Location: **Tilbury** Area: **Thurrock** Grid Ref: Elevation:

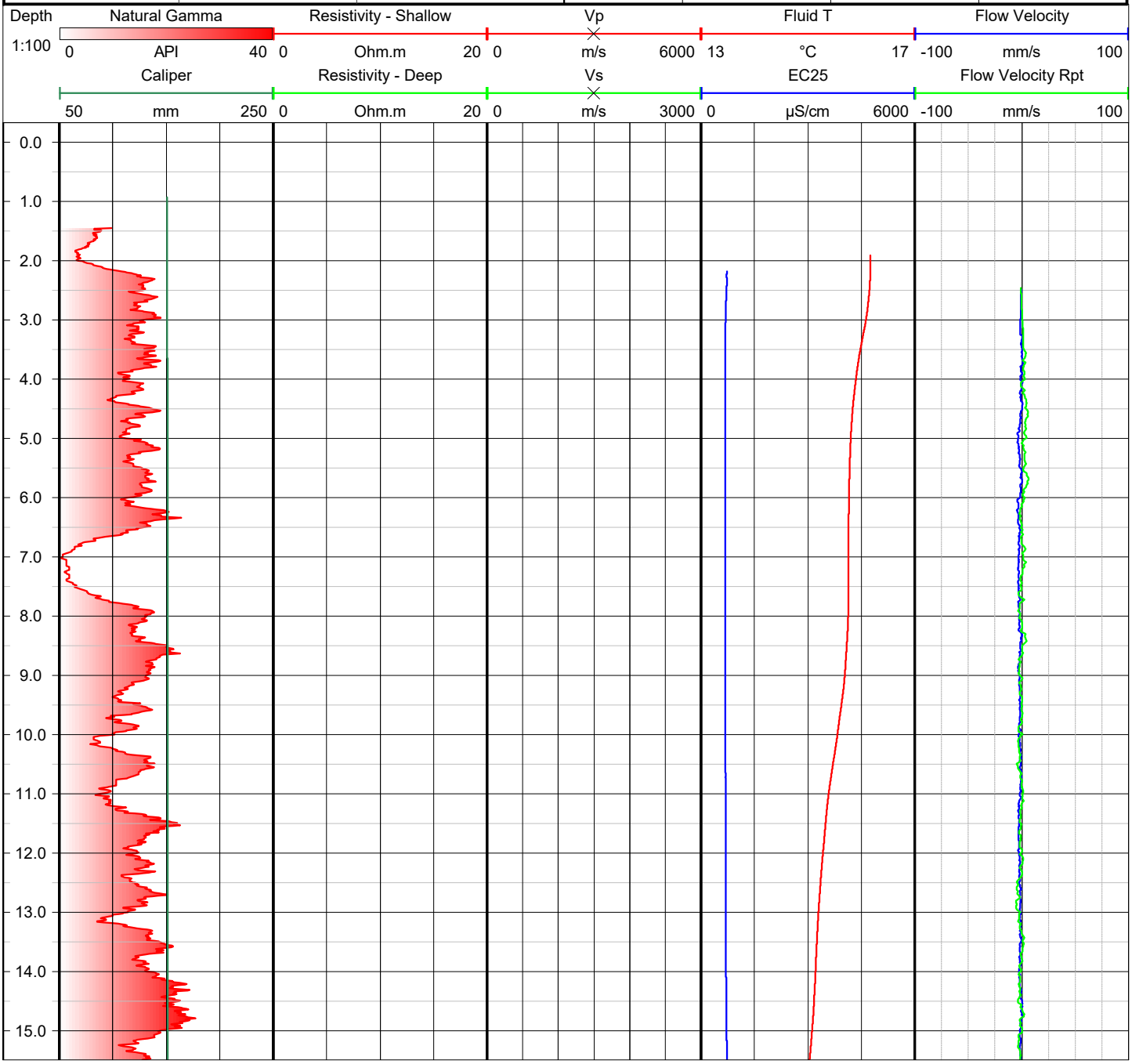
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Logged Depth: (m)	**59.8**	Recorded By:	**N. Clark**
Logging Datum:	**Ground Level**	Remarks:	Soft sediment below 59.1m.
Logged Interval: (m)	**1.5 - 59.8**		
Fluid Level: (m)	**~1.9**		

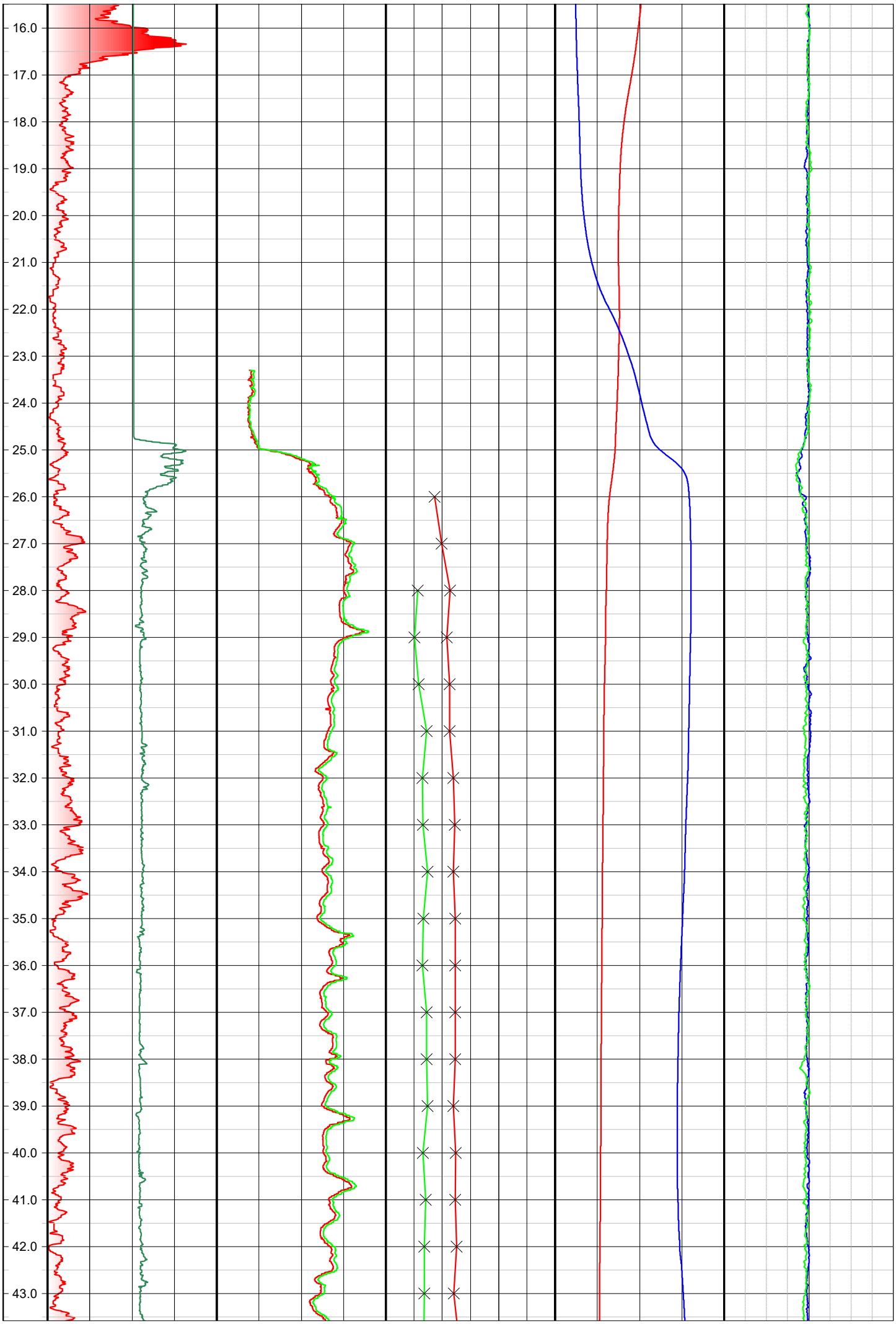
BOREHOLE RECORD

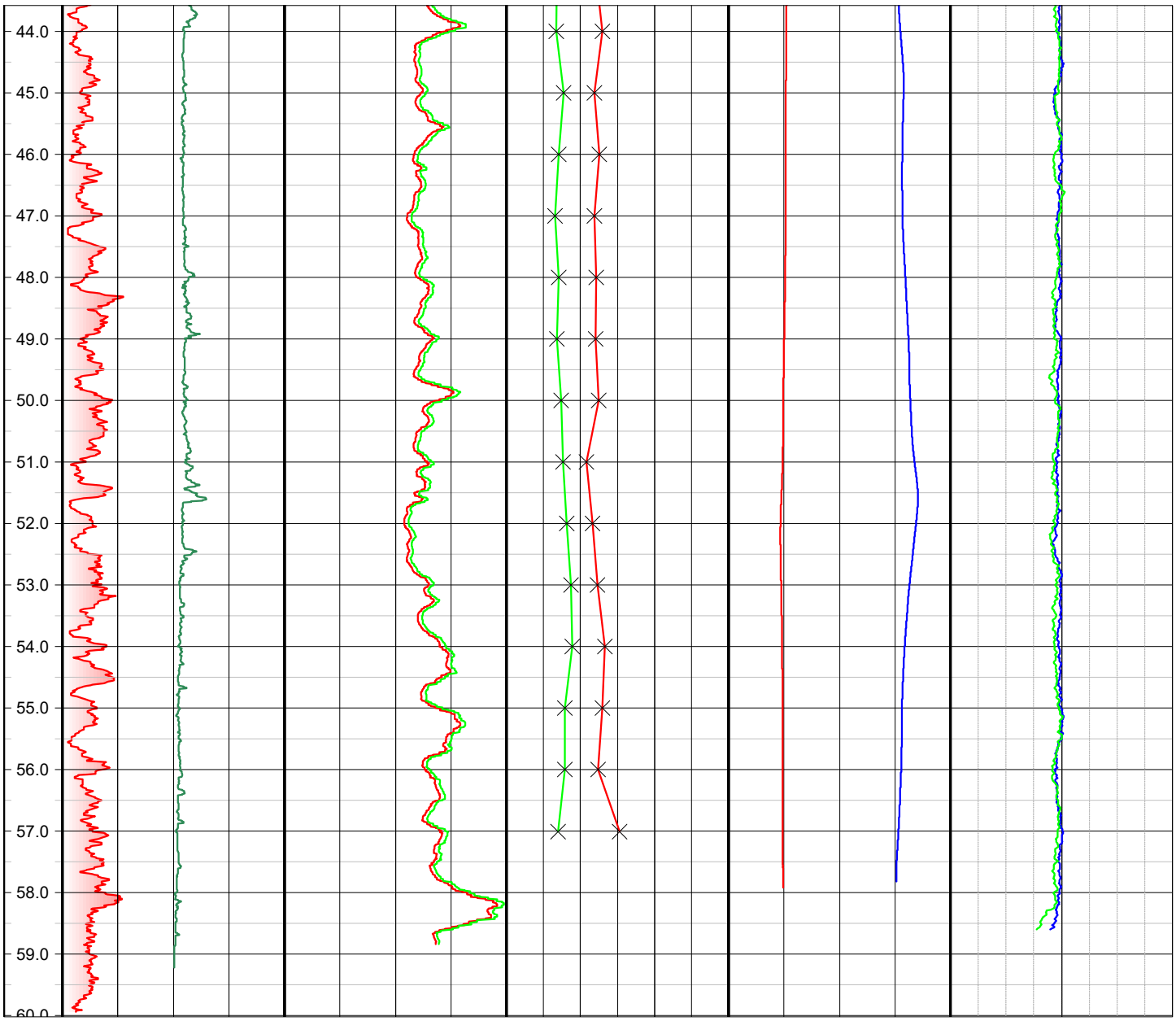
Bit: (mm)	From: (m)	To: (m)
147	**24.9**	**60.0**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
STEEL	**150**	**-0.28**	**24.9**




16.0
17.0
18.0
19.0
20.0
21.0
22.0
23.0
24.0
25.0
26.0
27.0
28.0
29.0
30.0
31.0
32.0
33.0
34.0
35.0
36.0
37.0
38.0
39.0
40.0
41.0
42.0
43.0


44.0
45.0
46.0
47.0
48.0
49.0
50.0
51.0
52.0
53.0
54.0
55.0
56.0
57.0
58.0
59.0
60.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Soil Engineering**

Borehole: **BH102**

Log Type: ***Image***

Location: **Tilbury** Area: **Thurrock** Grid Ref: Elevation:

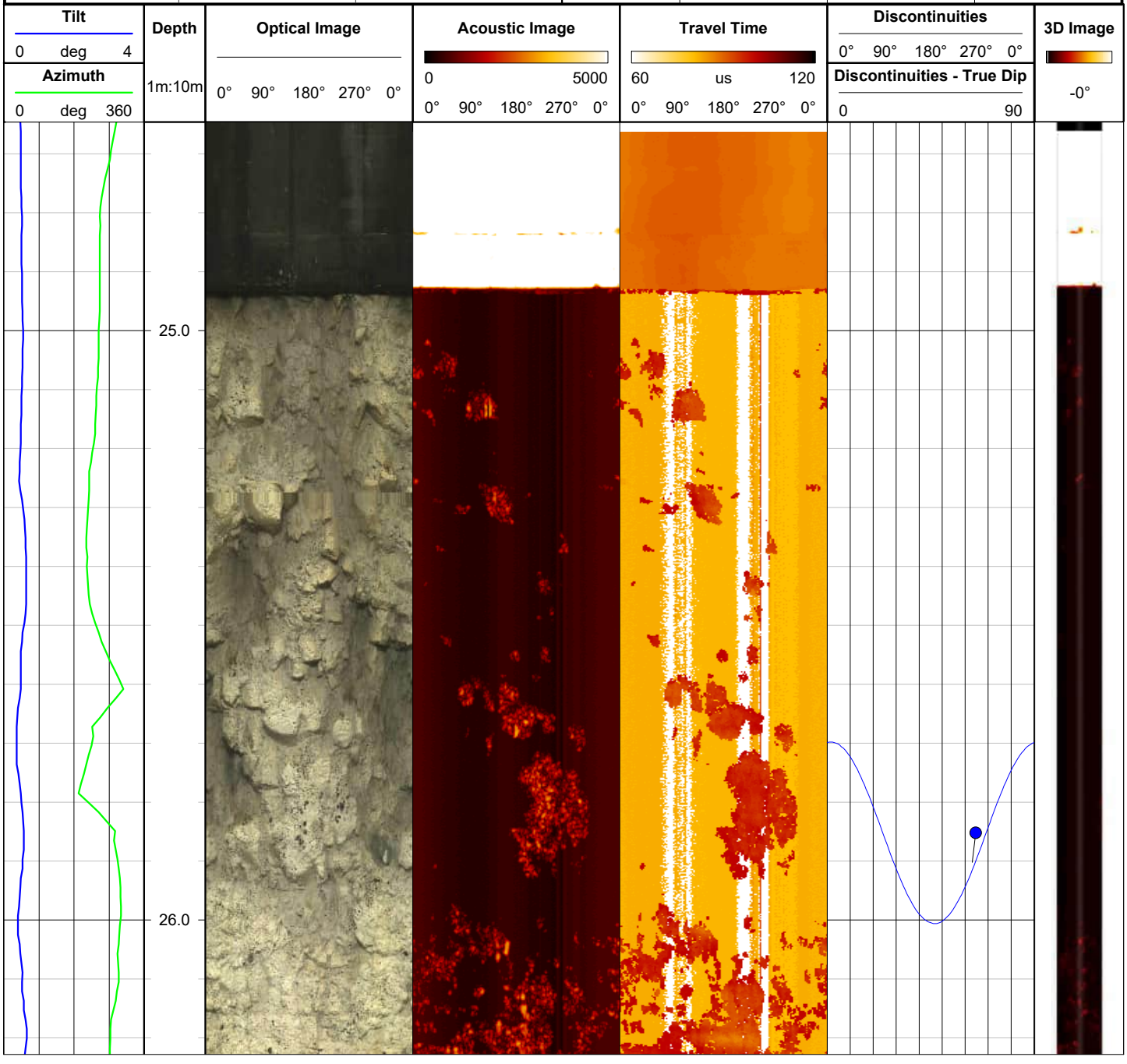
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Logged Depth: (m)	**59.2**	Recorded By:	**N. Clark**
Logging Datum:	**Ground Level**	Remarks:	Soft sediment below 59.1m.
Logged Interval: (m)	**24.9 - 59.2**		
Fluid Level: (m)	**~1.9**		

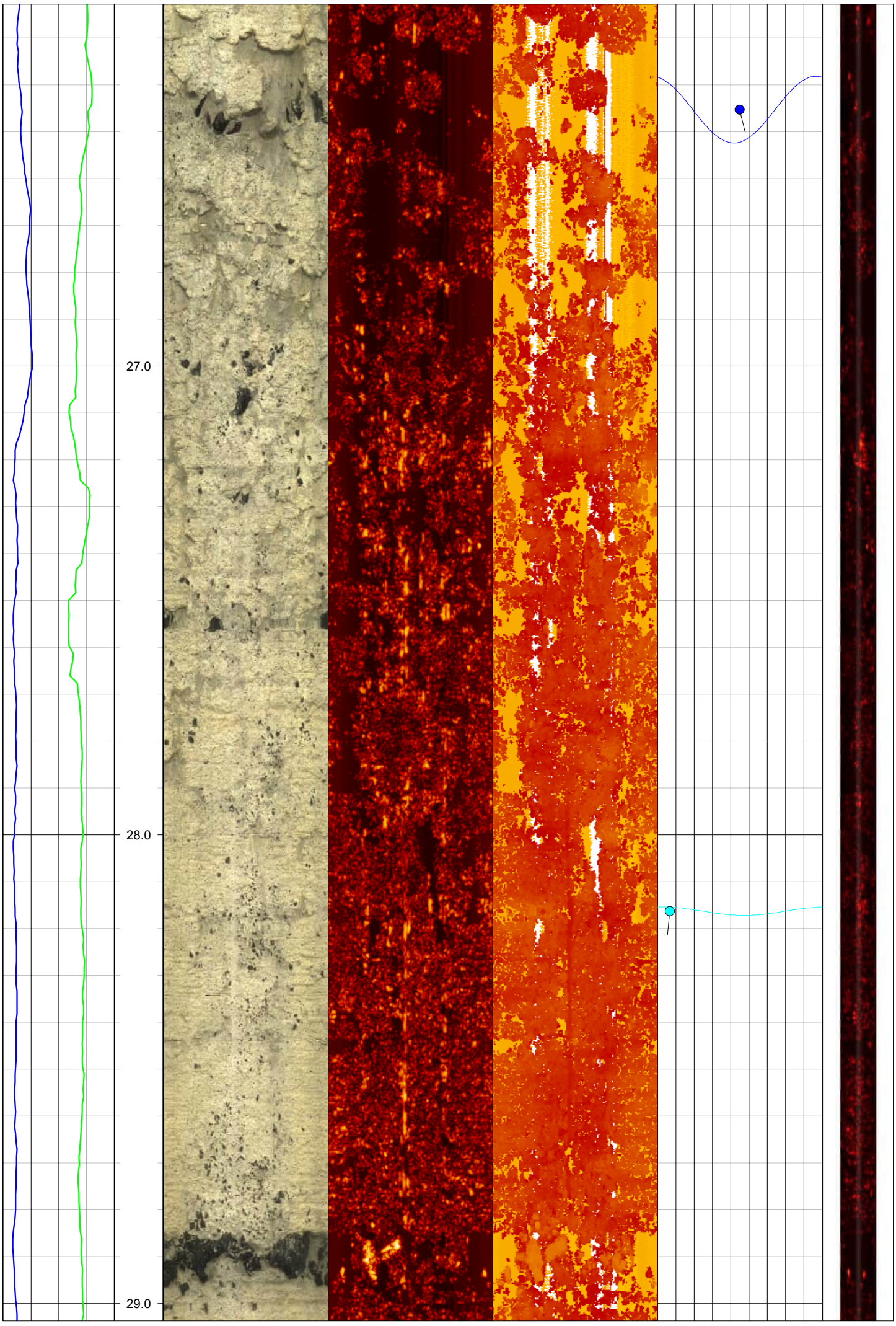
BOREHOLE RECORD

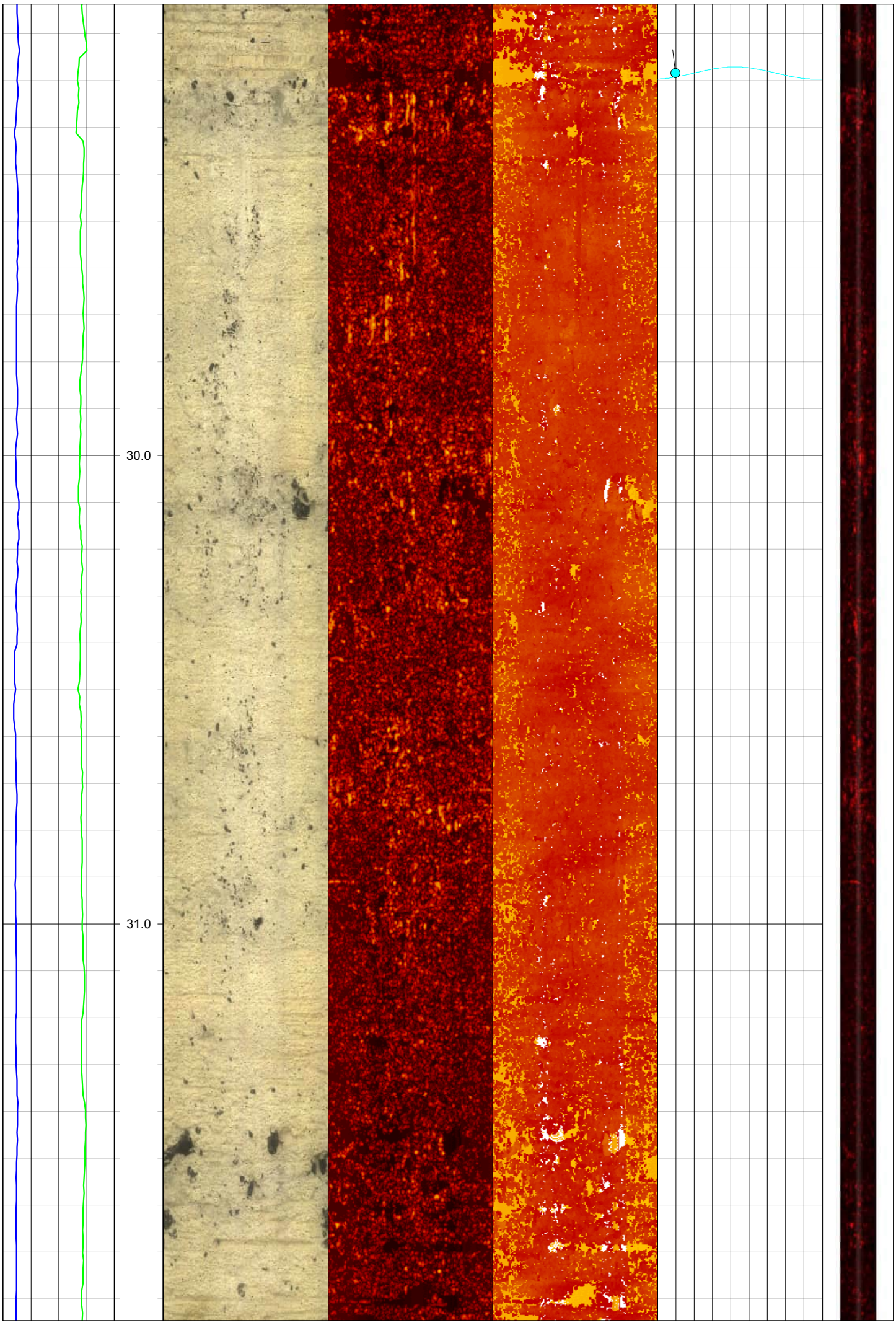
Bit: (mm)	From: (m)	To: (m)
147	**24.9**	**59.4**

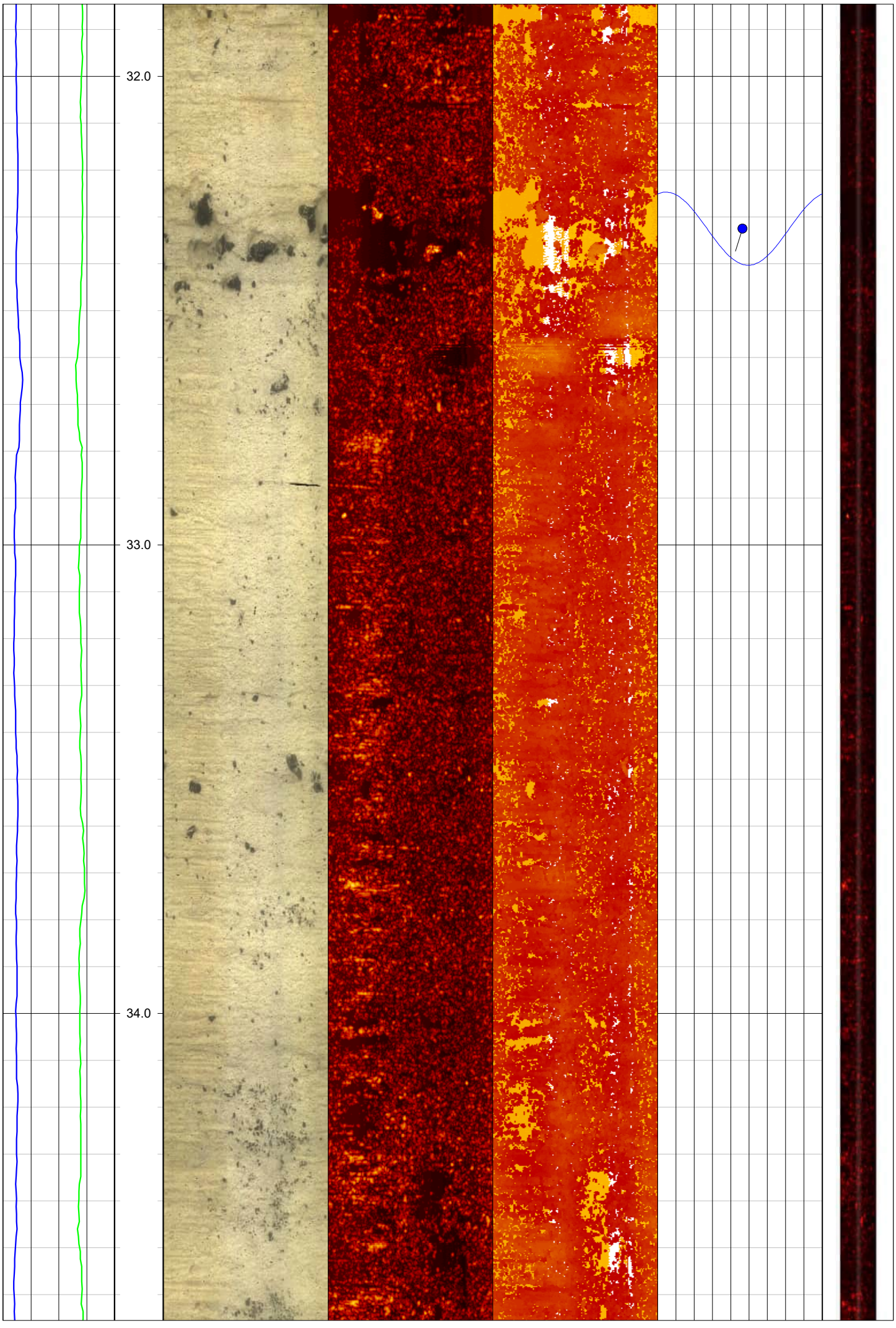
CASING RECORD

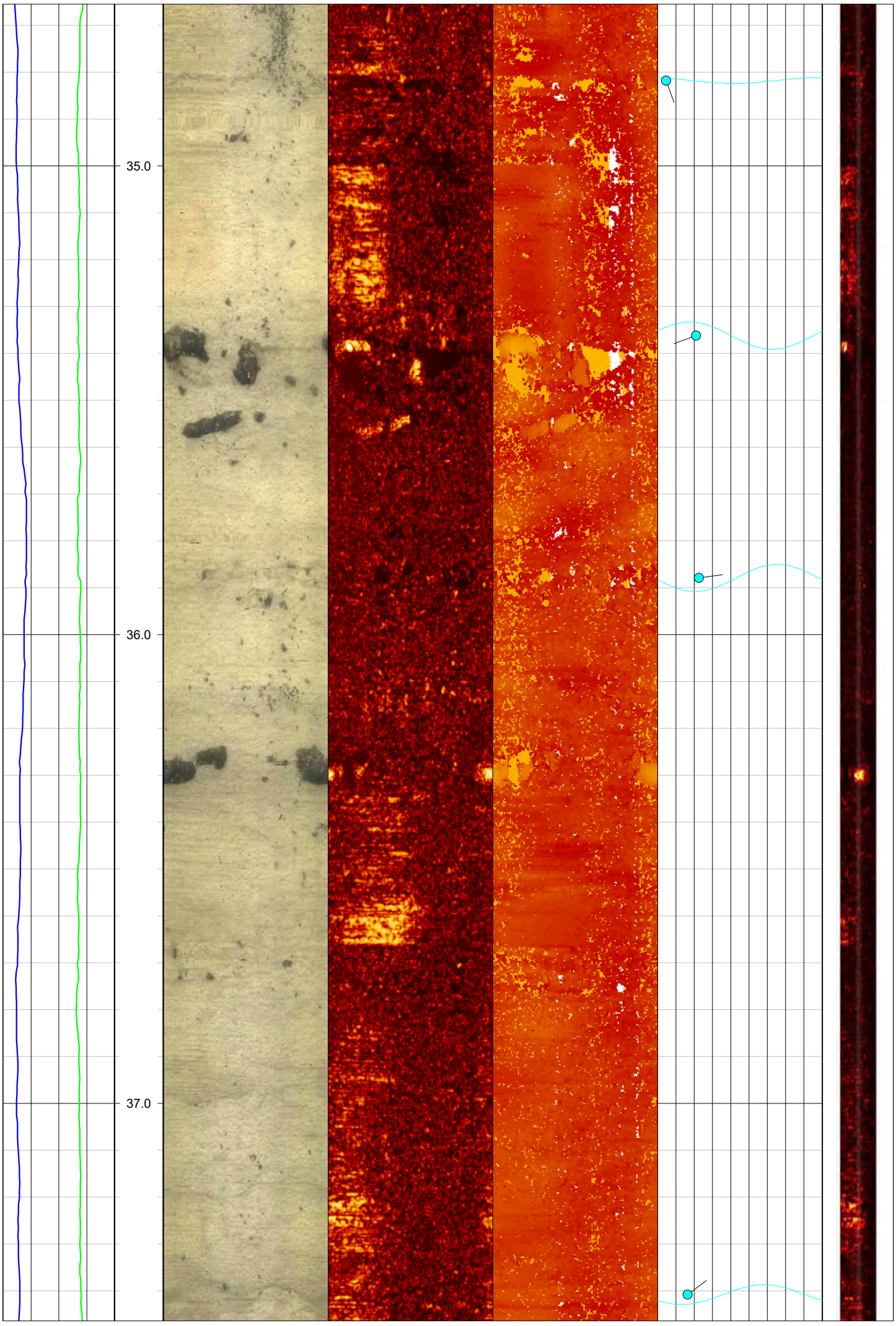
Type	Size: (mm)	From: (m)	To: (m)
STEEL	**150**	**-0.28**	**24.9**

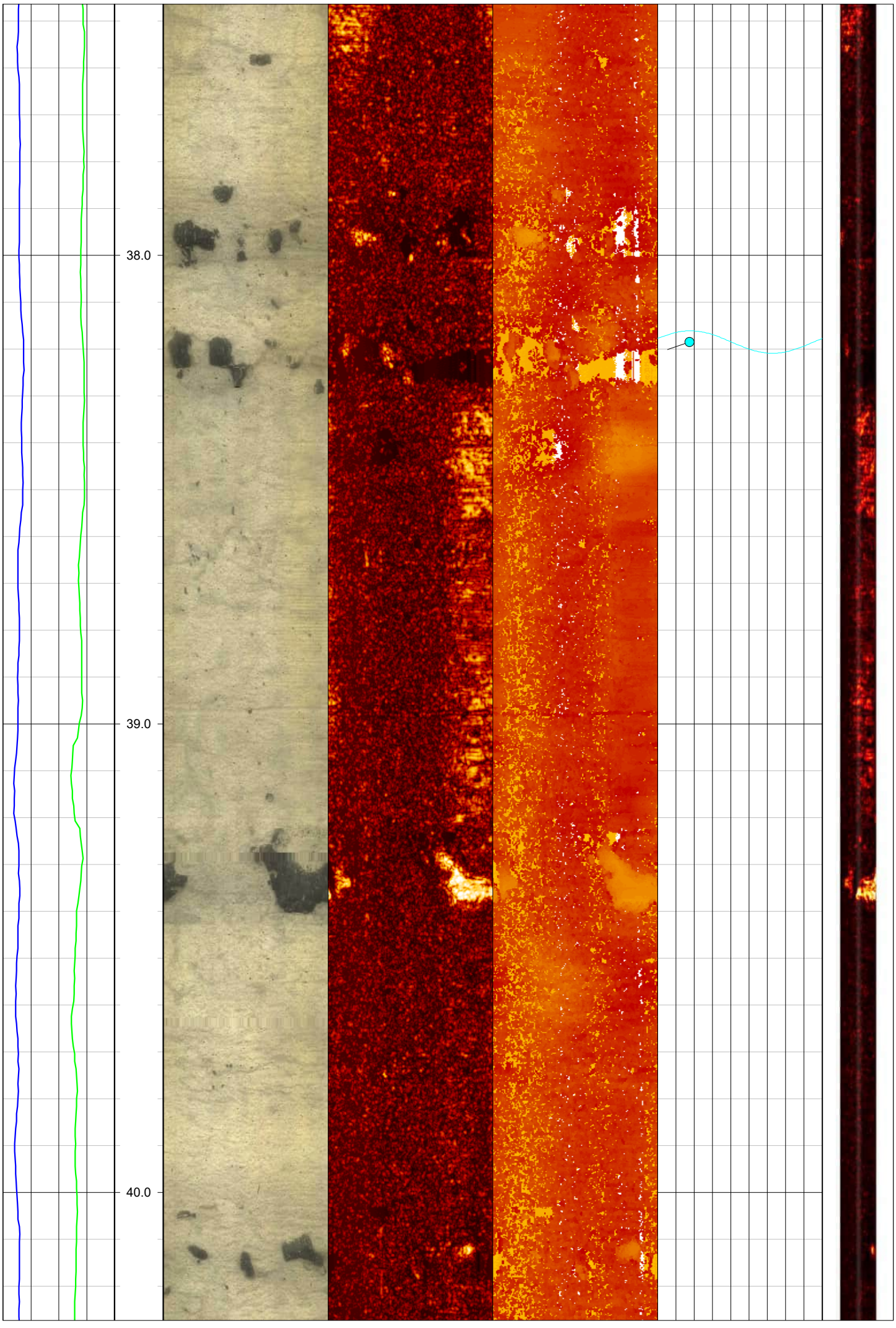


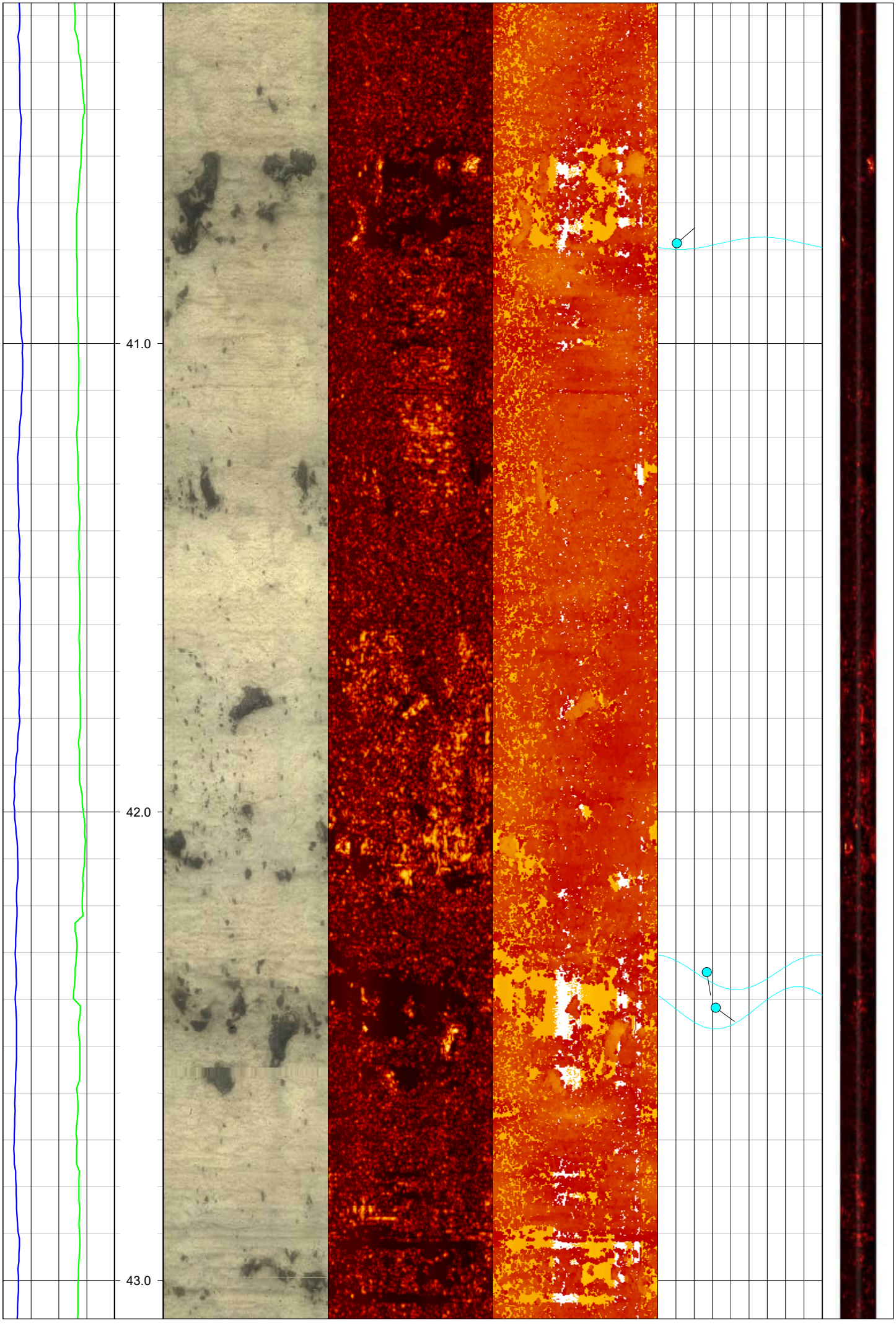

27.0
28.0
29.0

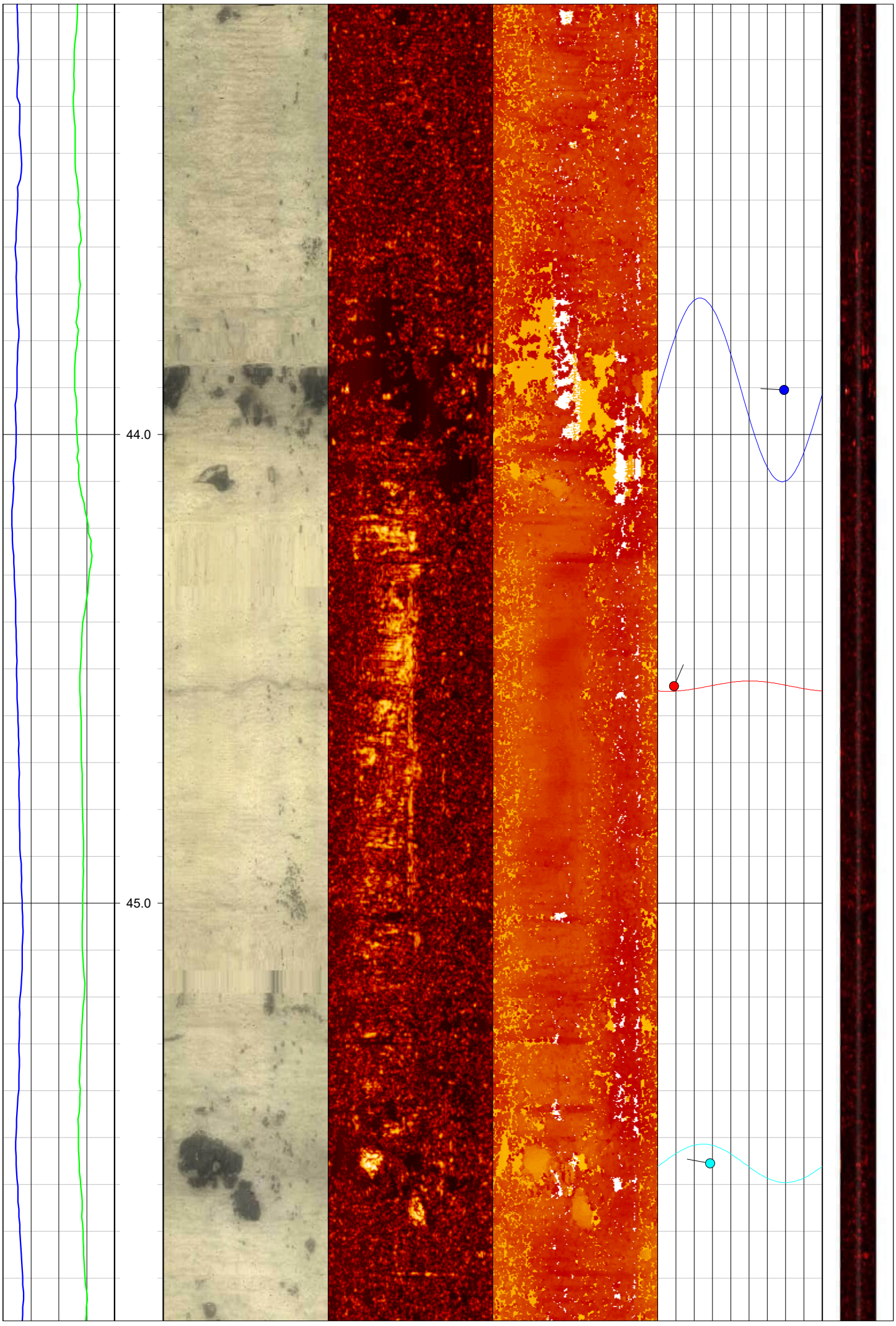

30.0
31.0

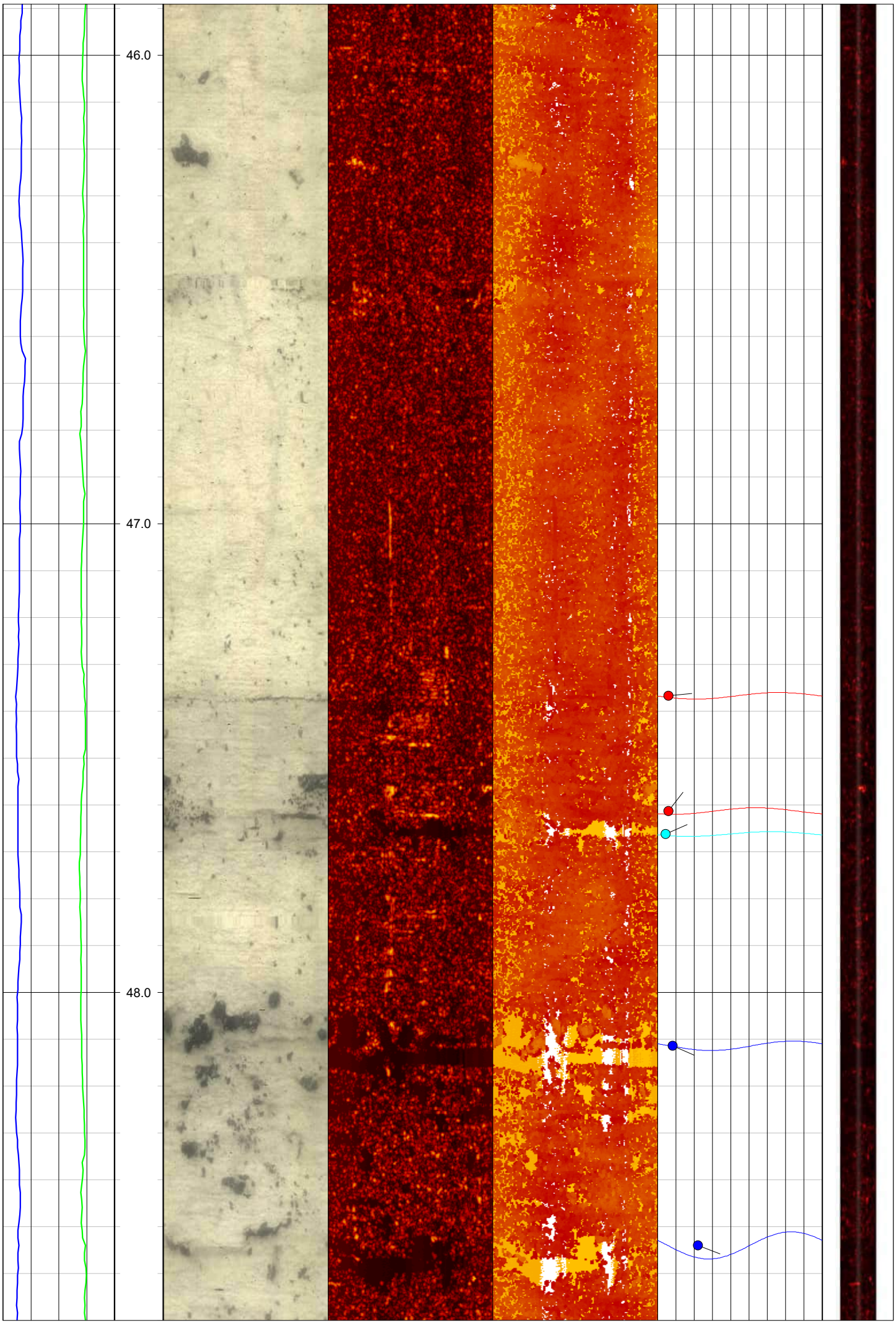

32.0
33.0
34.0

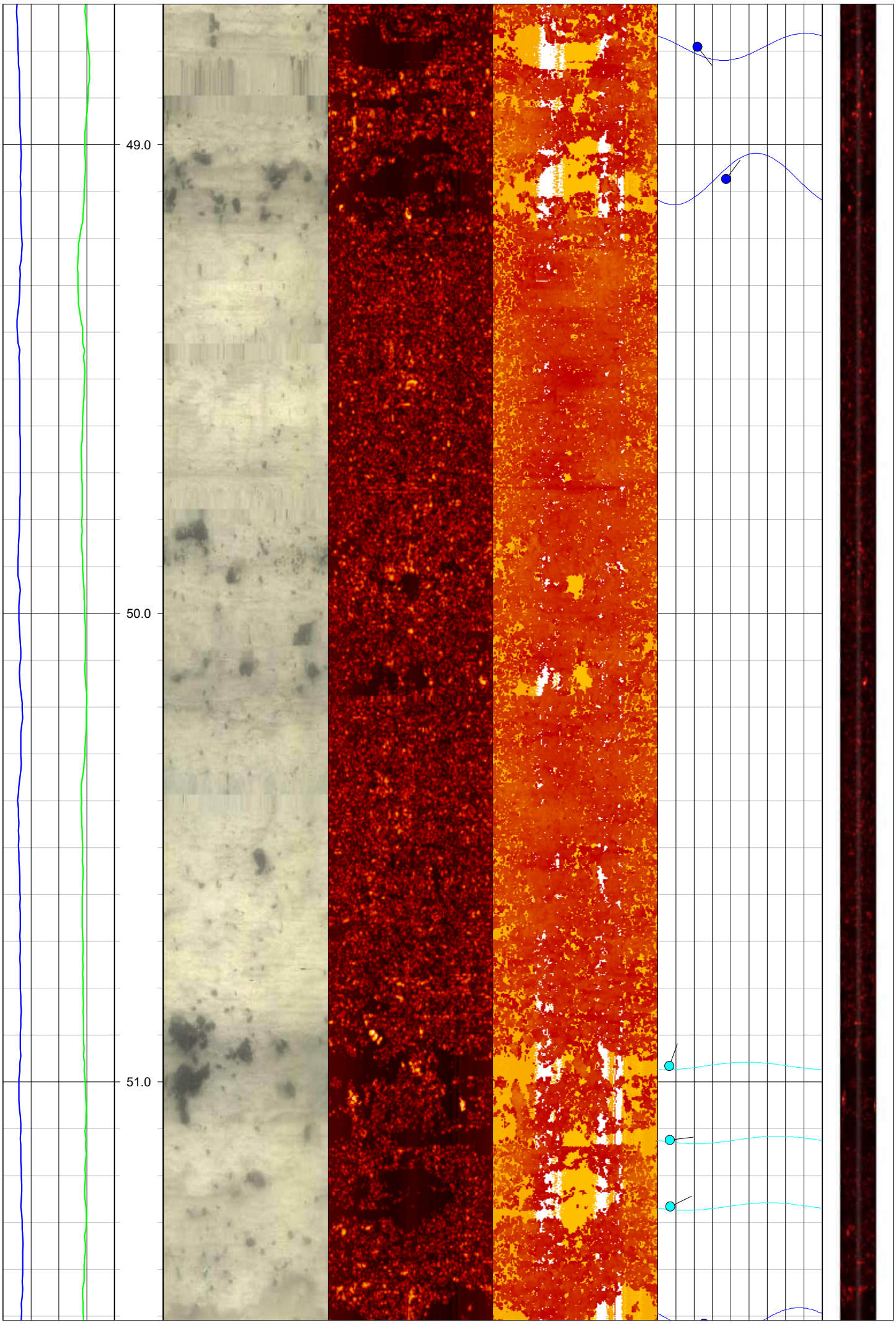

35.0
36.0
37.0

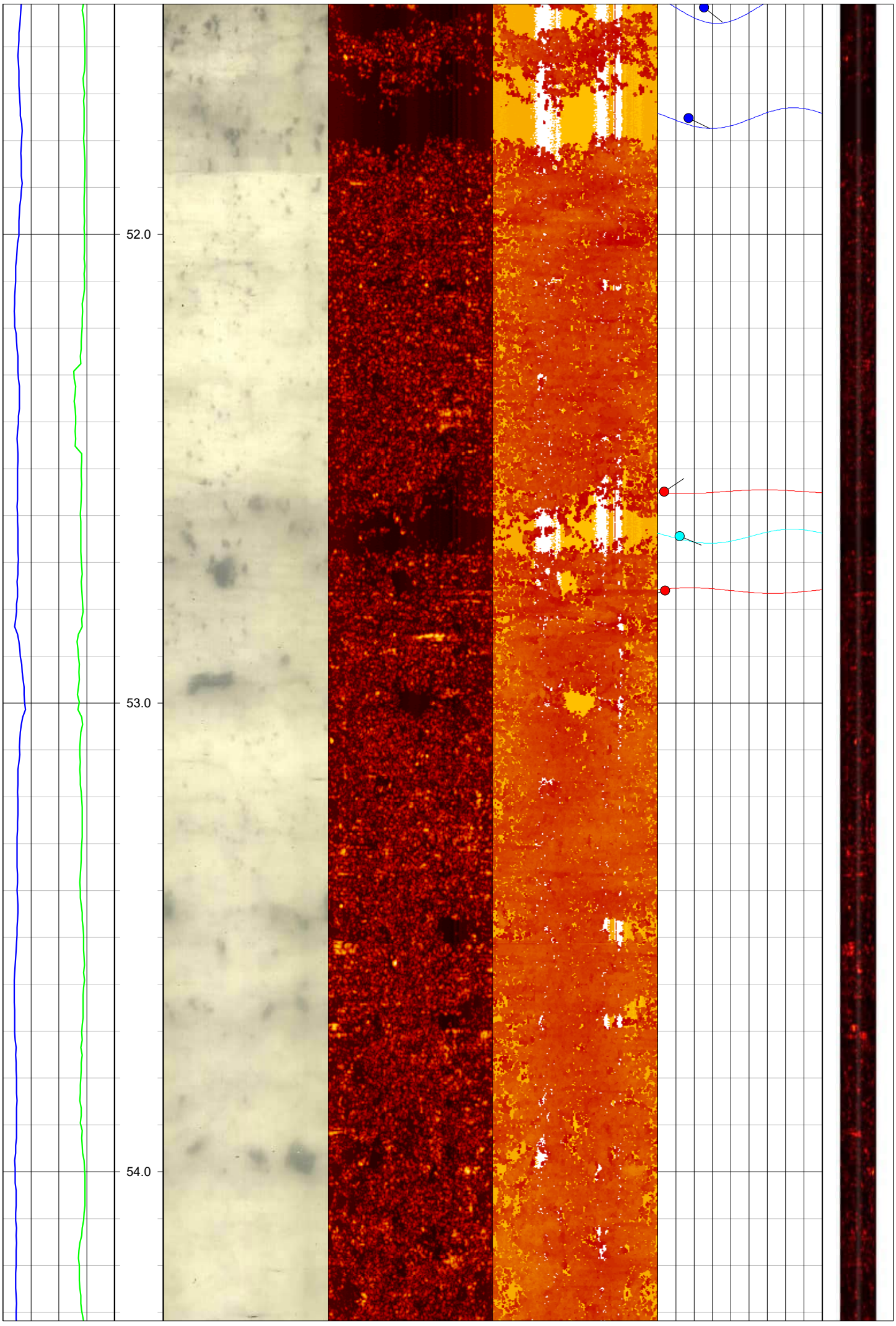

38.0
39.0
40.0

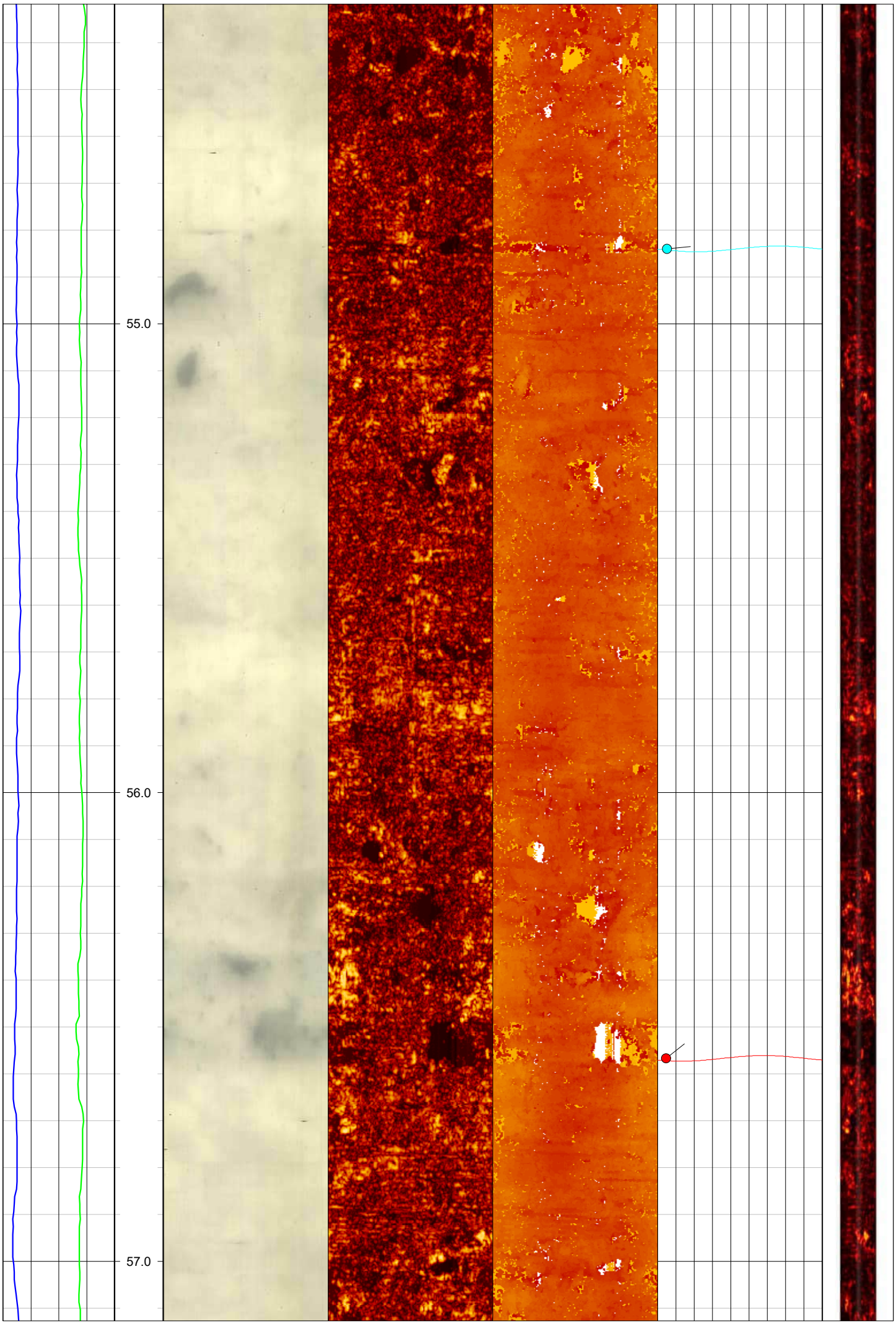

41.0
42.0
43.0

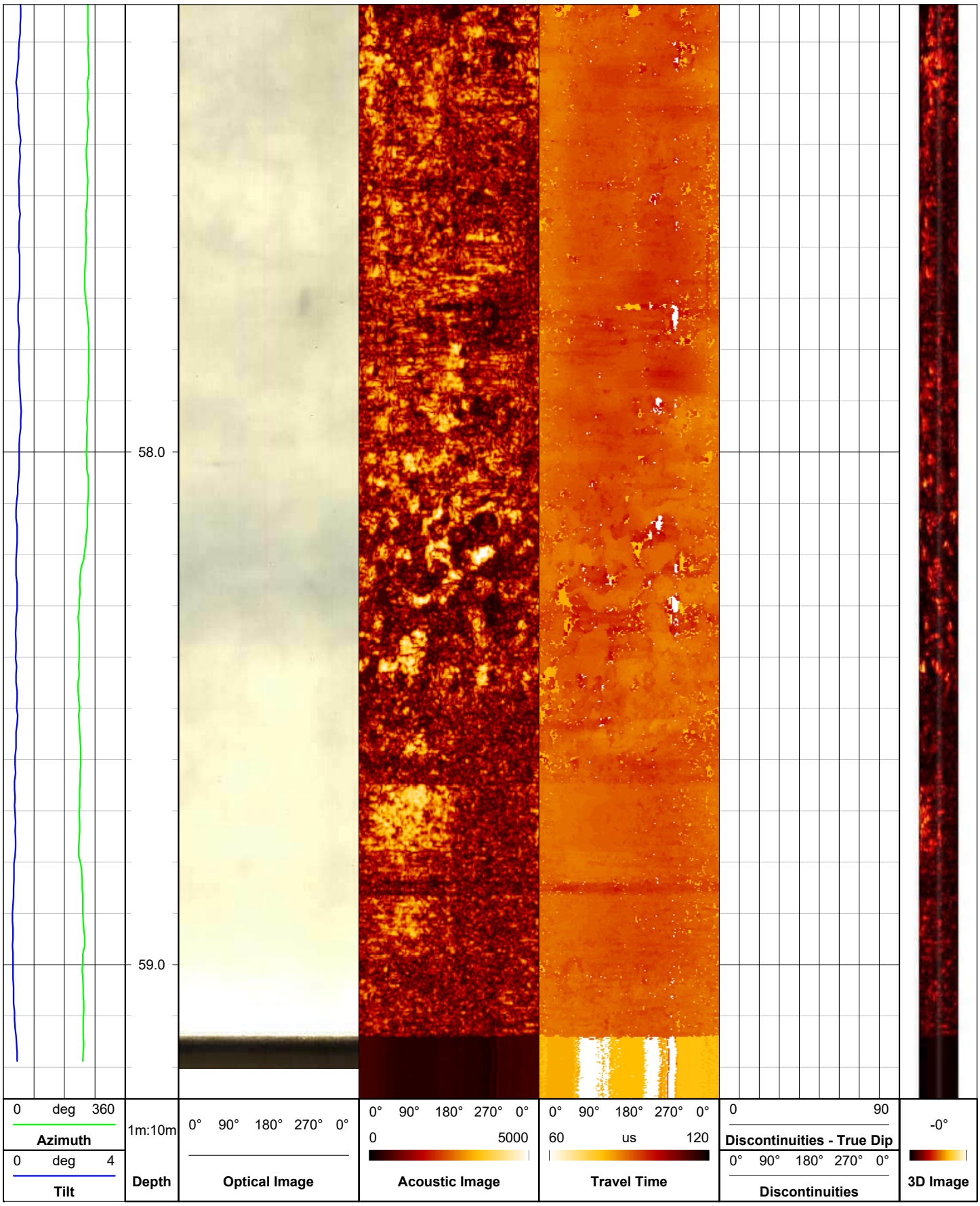

44.0
45.0


46.0
47.0
48.0


49.0
50.0
51.0


52.0
53.0
54.0


55.0
56.0
57.0


58.0
59.0
0 deg 360
Azimuth
0 deg 4
Tilt
1m:10m
Depth
0° 90° 180° 270° 0°
Optical Image
0° 90° 180° 270° 0°
0 5000
Acoustic Image
0° 90° 180° 270° 0°
60 us 120
Travel Time
0 90
Discontinuities - True Dip
0° 90° 180° 270° 0°
Discontinuities
-0°
3D Image

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Soil Engineering**

Borehole: **BH103**

Log Type: ***Composite***

Location: **Gravesend** Area: **London** Grid Ref: Elevation:

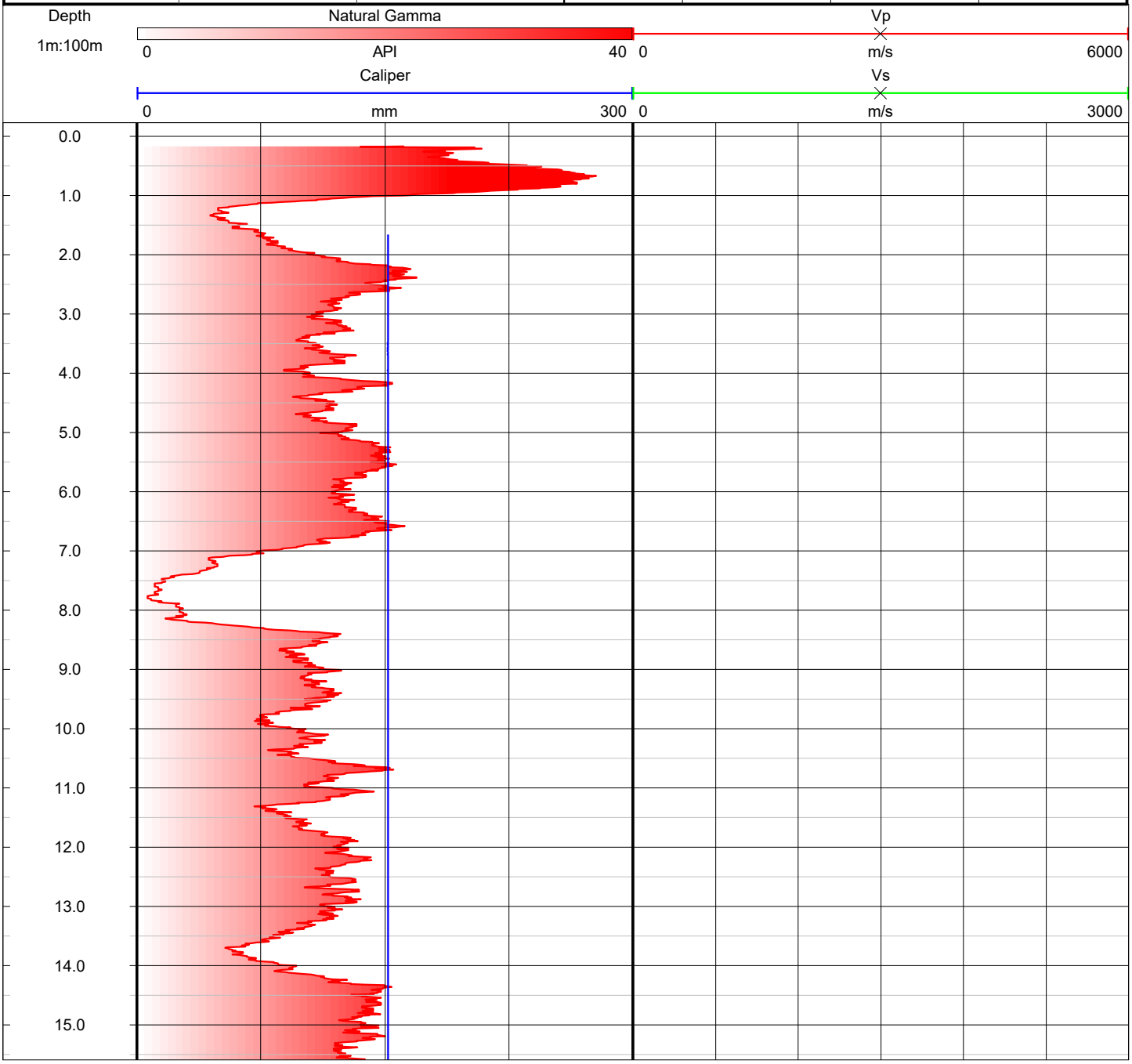
Drilled Depth: (m)	**50.0**	Date:	**03.06.25**
Logged Depth: (m)	**49.2**	Recorded By:	**L. Summers**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**0.0 - 49.2**		
Fluid Level: (m)	**2.2**		

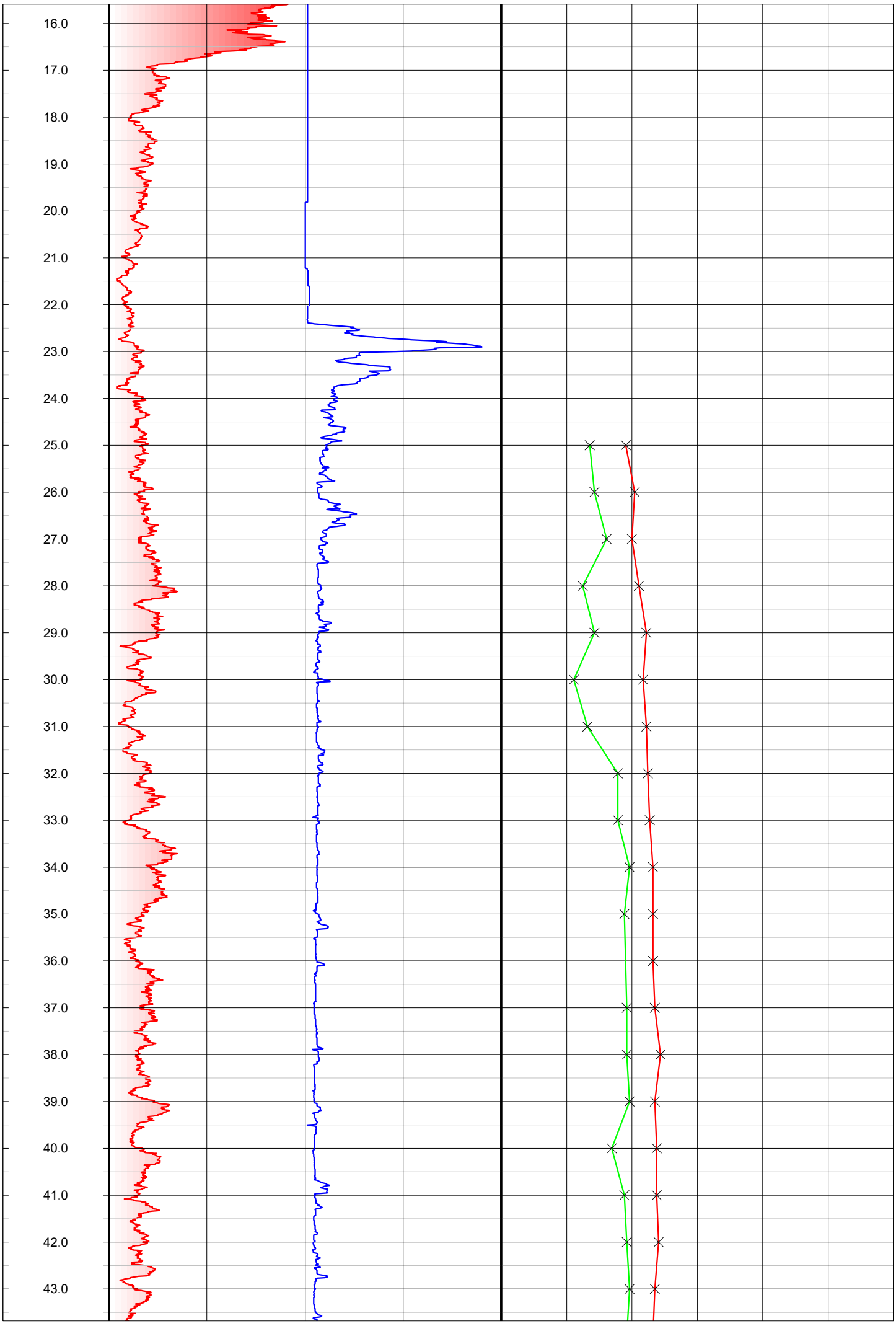
BOREHOLE RECORD

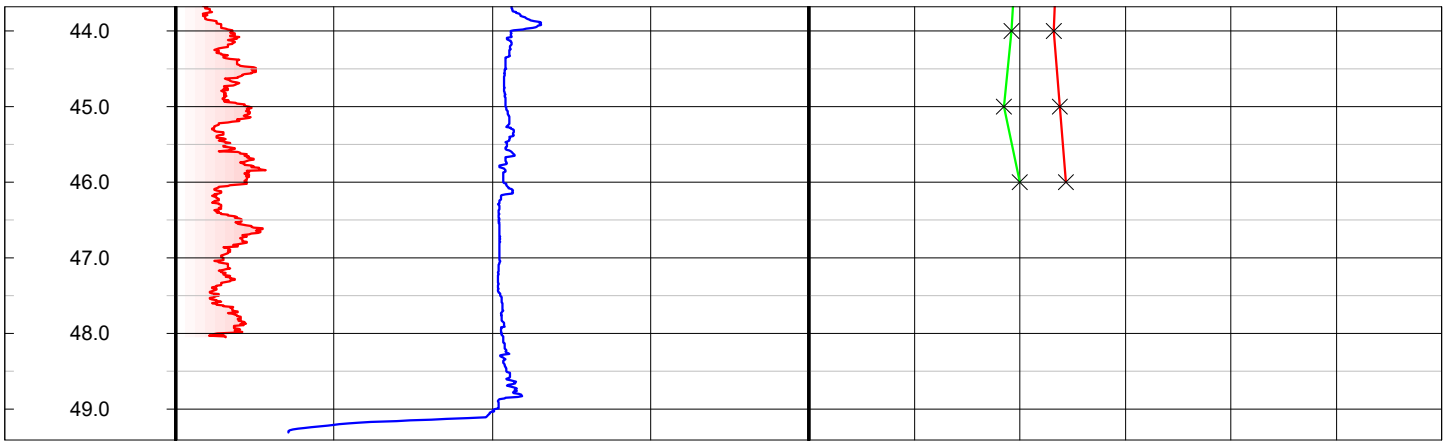
Bit: (mm)	From: (m)	To: (m)
146	**22.5**	**50.0**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Steel	**165**	**-0.1**	**22.5**




16.0
17.0
18.0
19.0
20.0
21.0
22.0
23.0
24.0
25.0
26.0
27.0
28.0
29.0
30.0
31.0
32.0
33.0
34.0
35.0
36.0
37.0
38.0
39.0
40.0
41.0
42.0
43.0


44.0
45.0
46.0
47.0
48.0
49.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Soil Engineering**

Borehole: **BH103**

Log Type: ***Image***

Location: **Gravesend** Area: **London** Grid Ref: **TQ 66327 75897** Elevation:

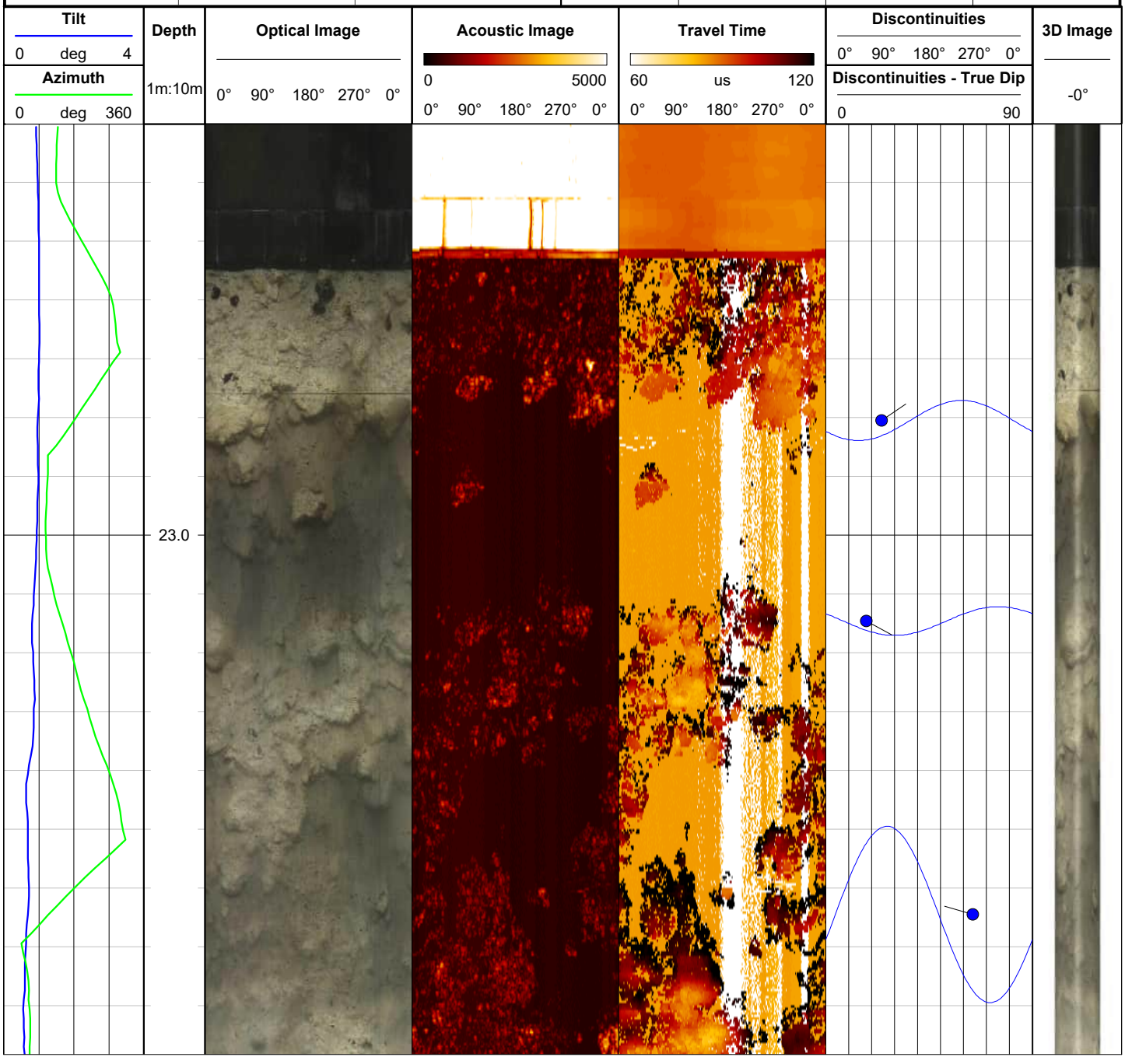
Drilled Depth: (m)	**50.0**	Date:	**03.06.25**
Logged Depth: (m)	**49.2**	Recorded By:	**L. Summers**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**22.5 - 49.2**		
Fluid Level: (m)	**2.2**		

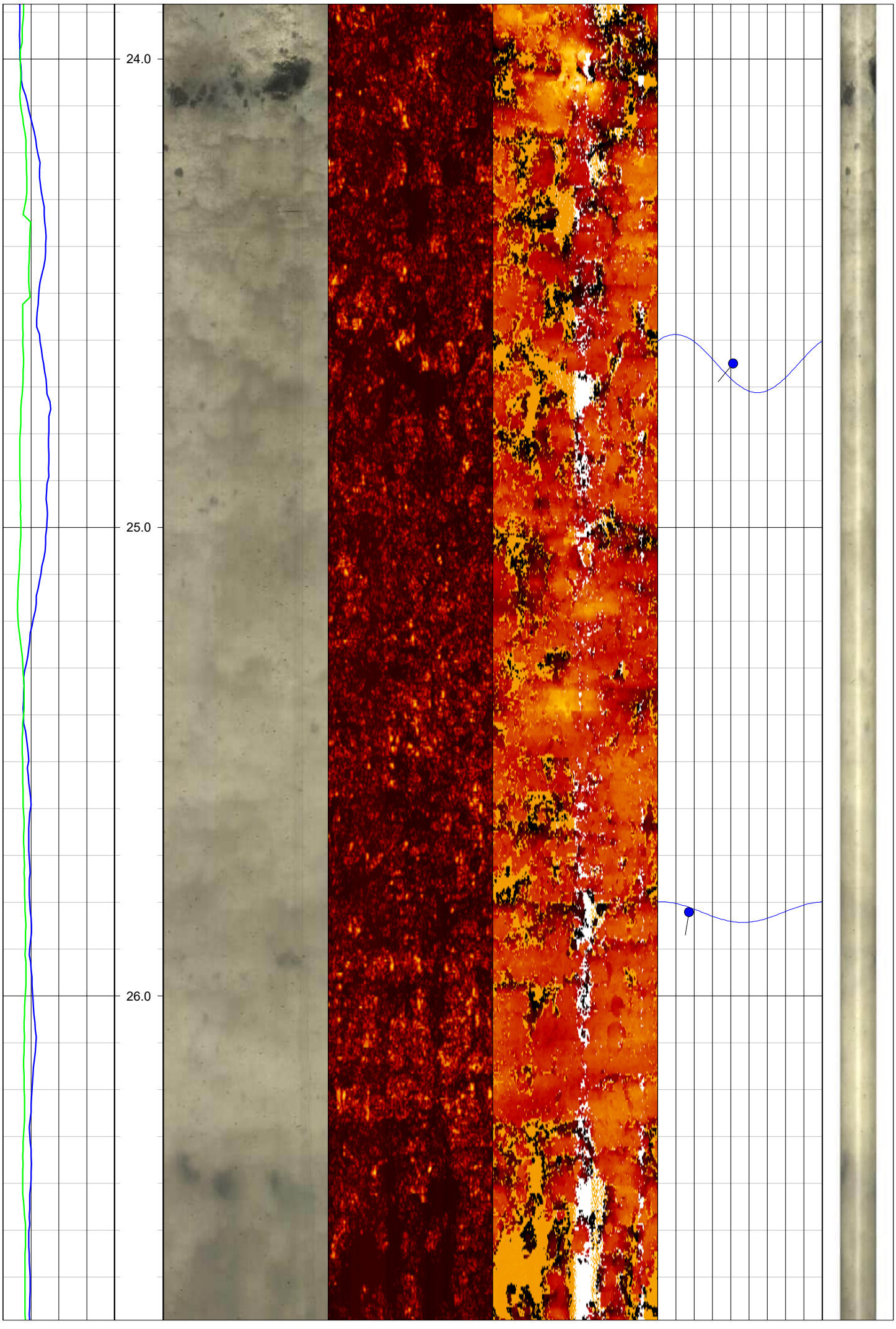
BOREHOLE RECORD

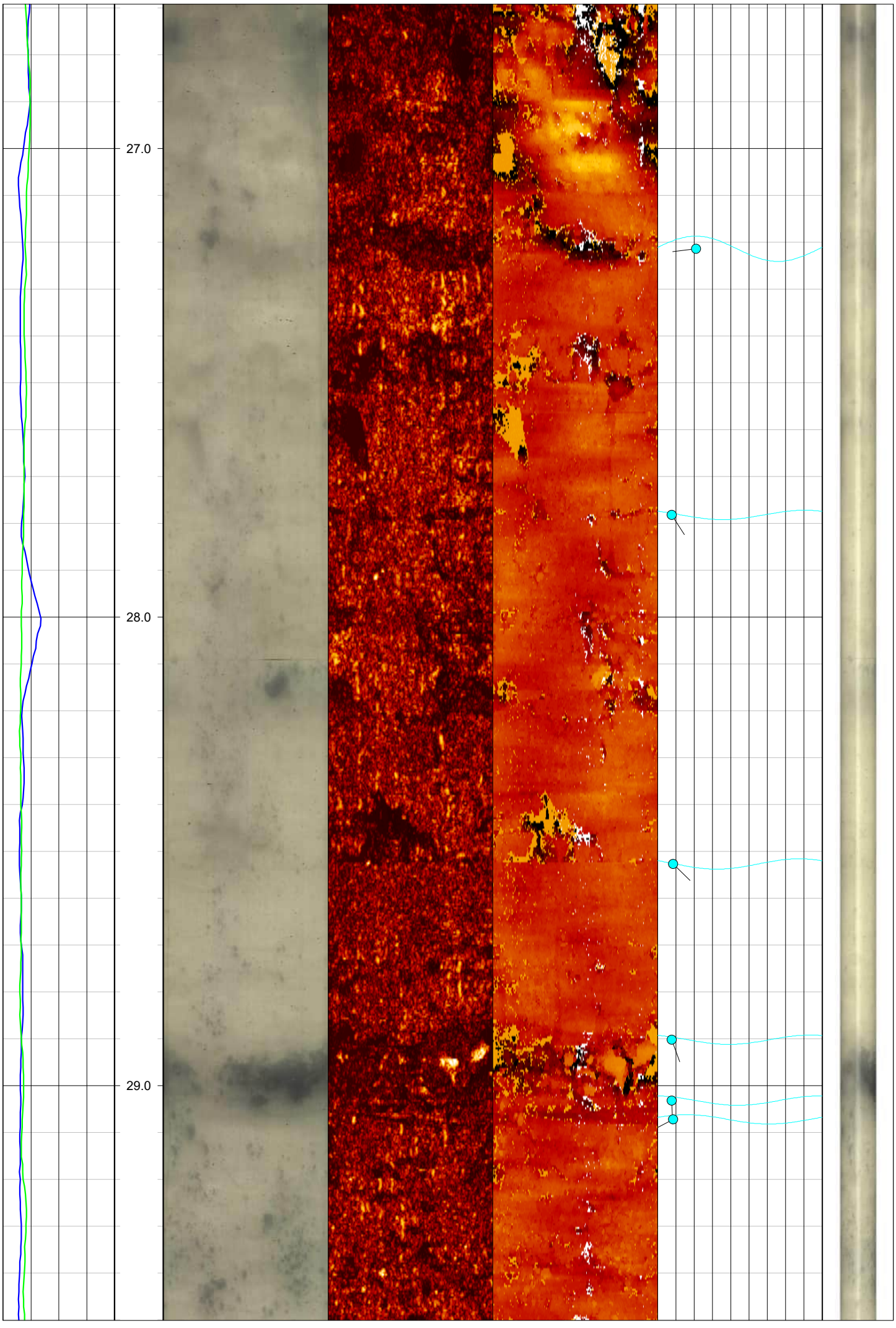
Bit: (mm)	From: (m)	To: (m)
146	**22.5**	**50.0**

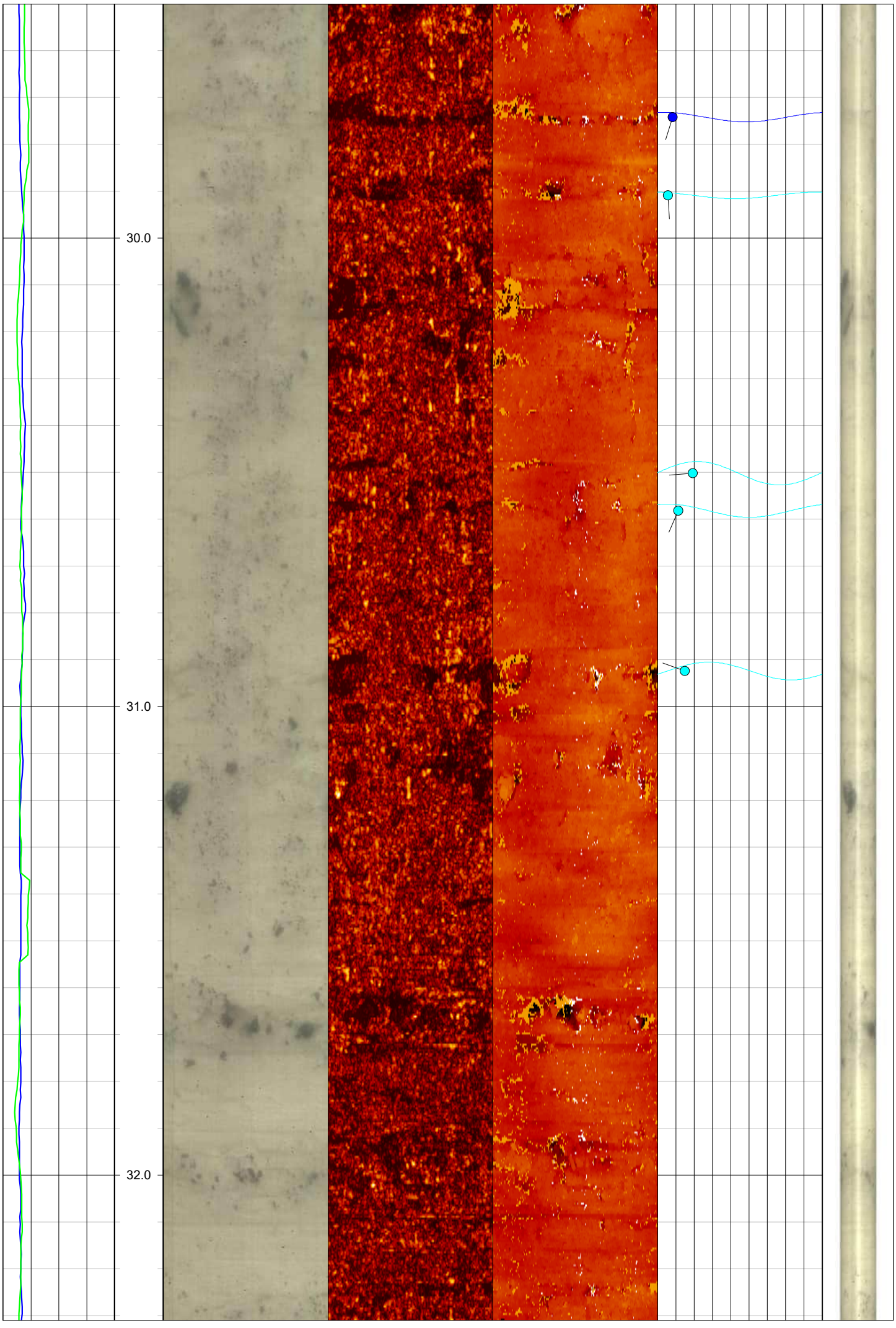
CASING RECORD

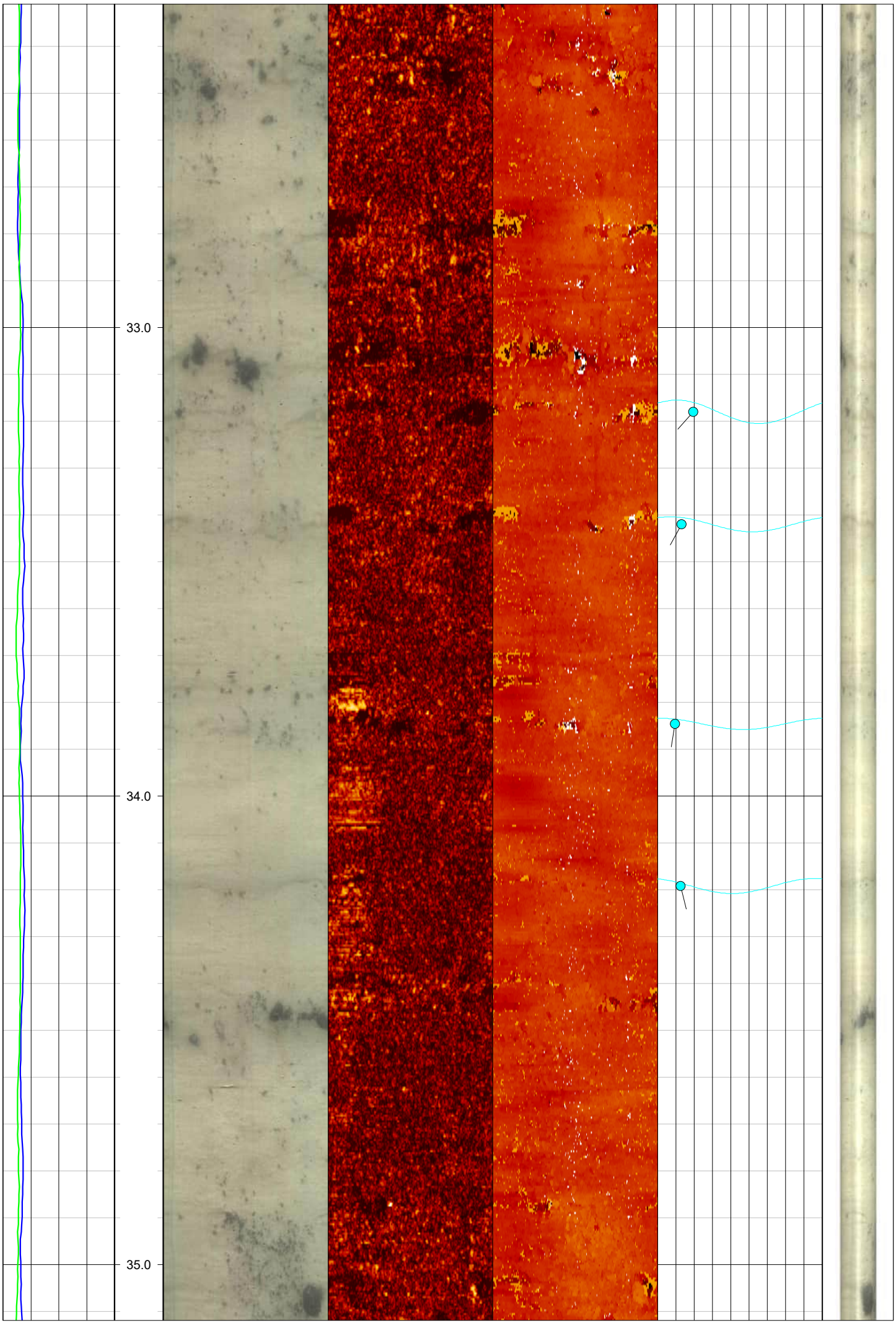
Type	Size: (mm)	From: (m)	To: (m)
Steel	**165**	**-0.1**	**22.5**

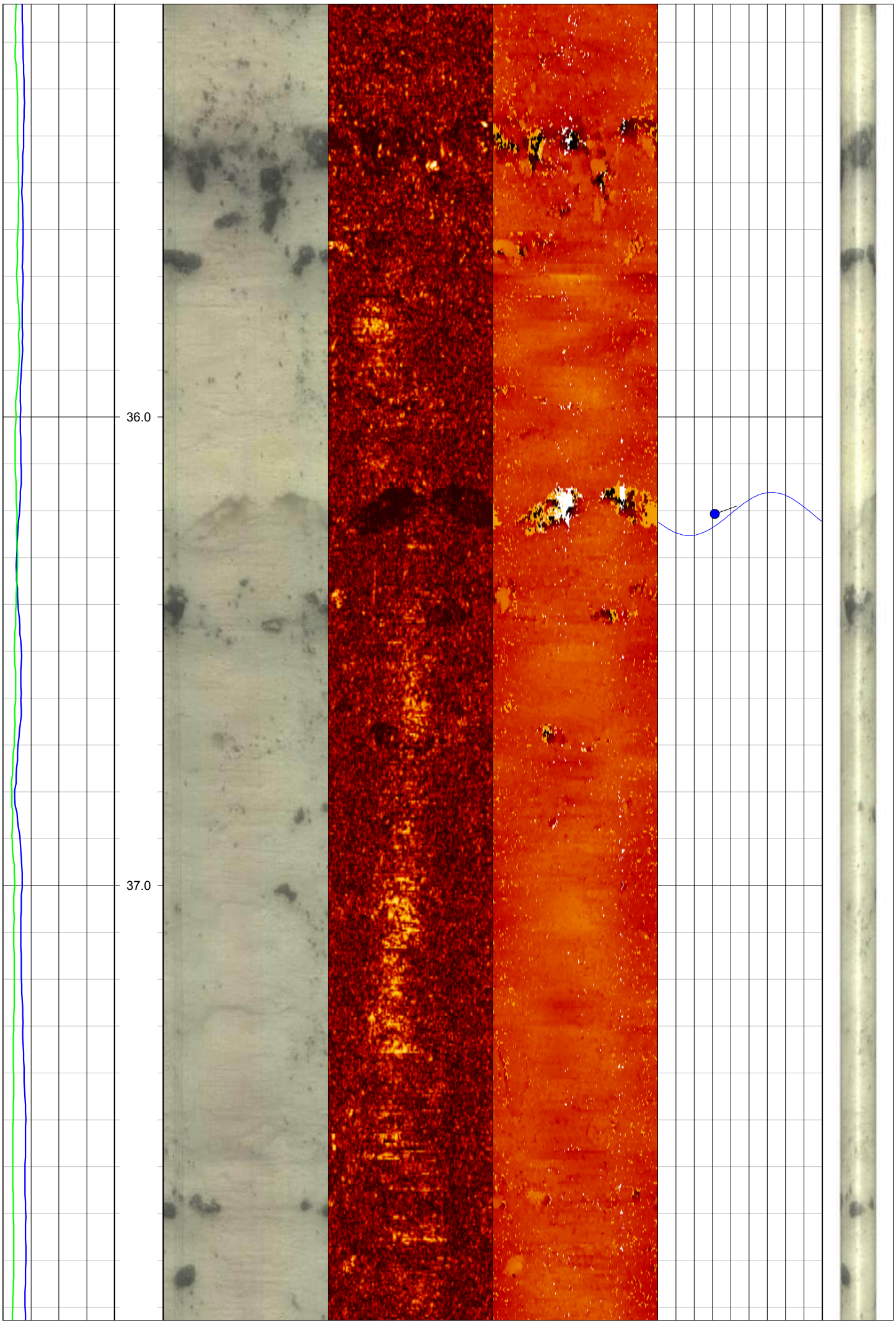


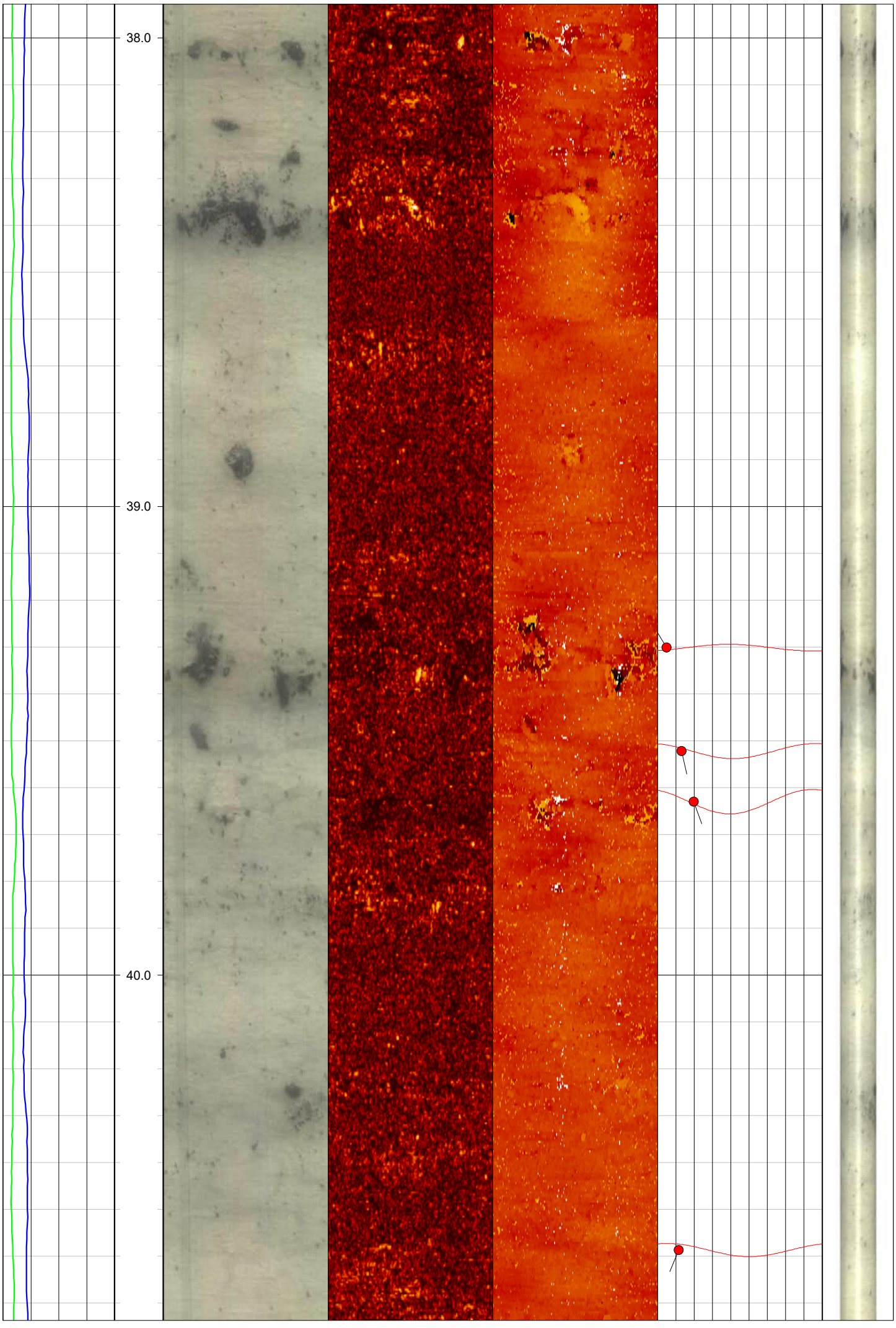

24.0
25.0
26.0

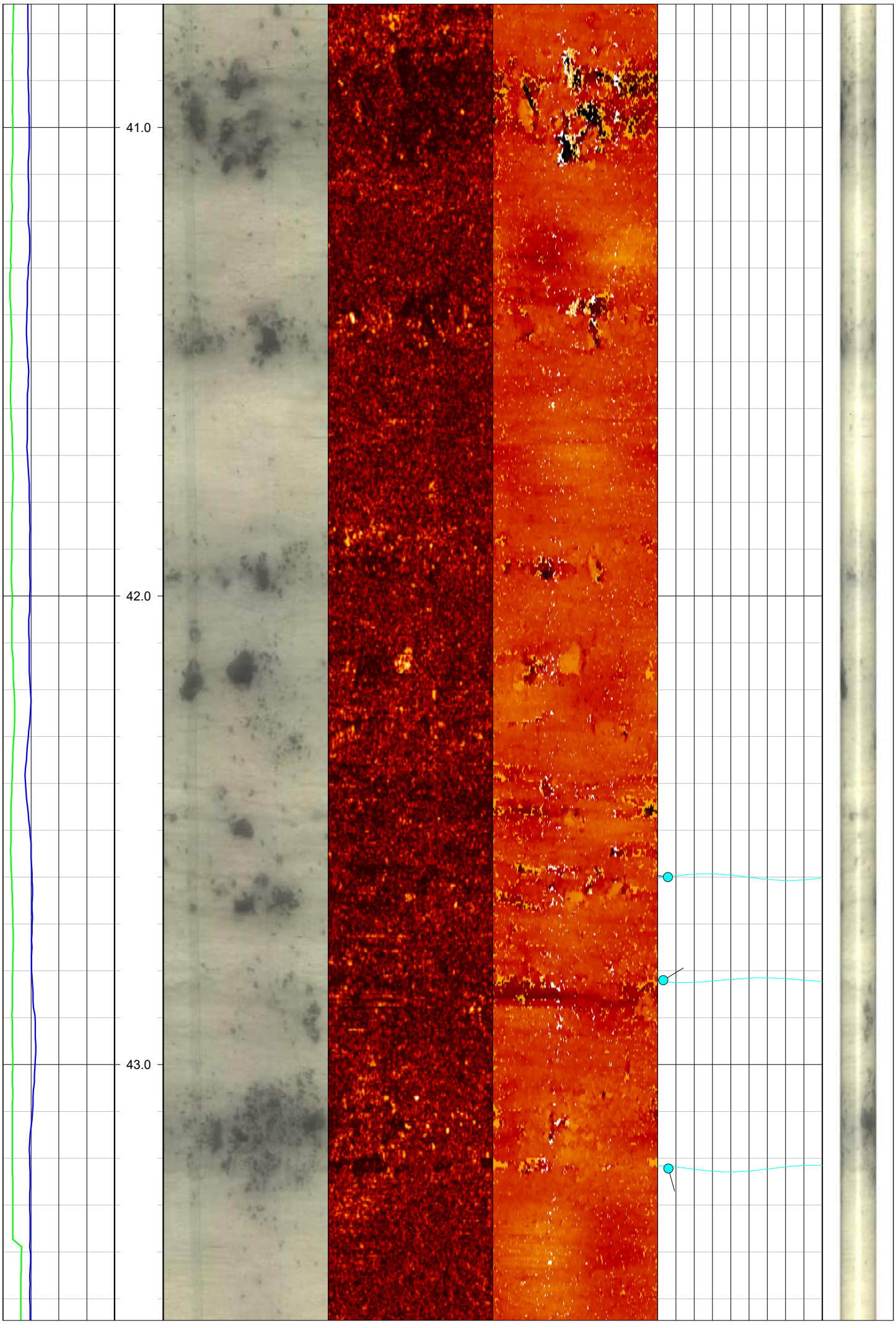

27.0
28.0
29.0

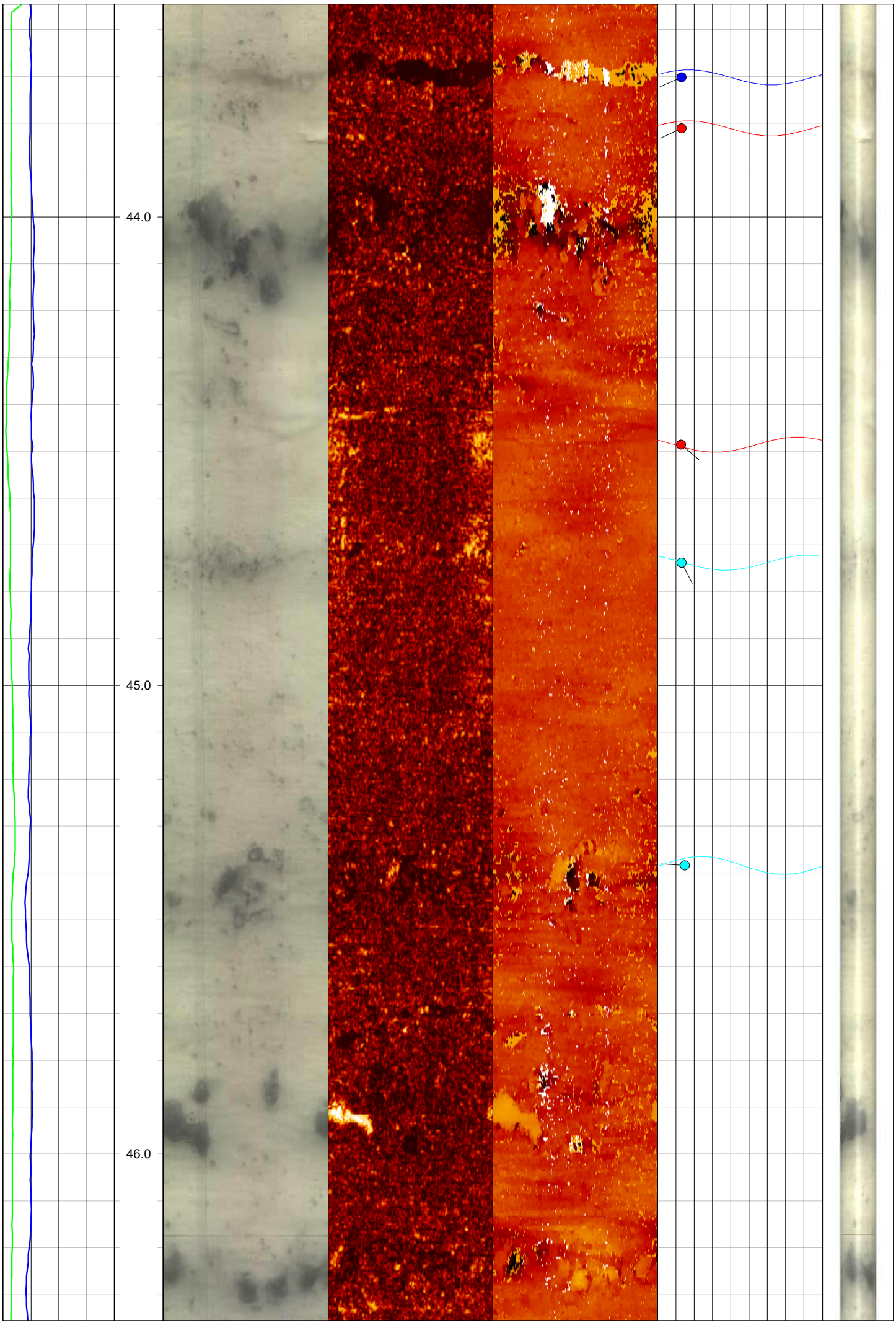

30.0
31.0
32.0

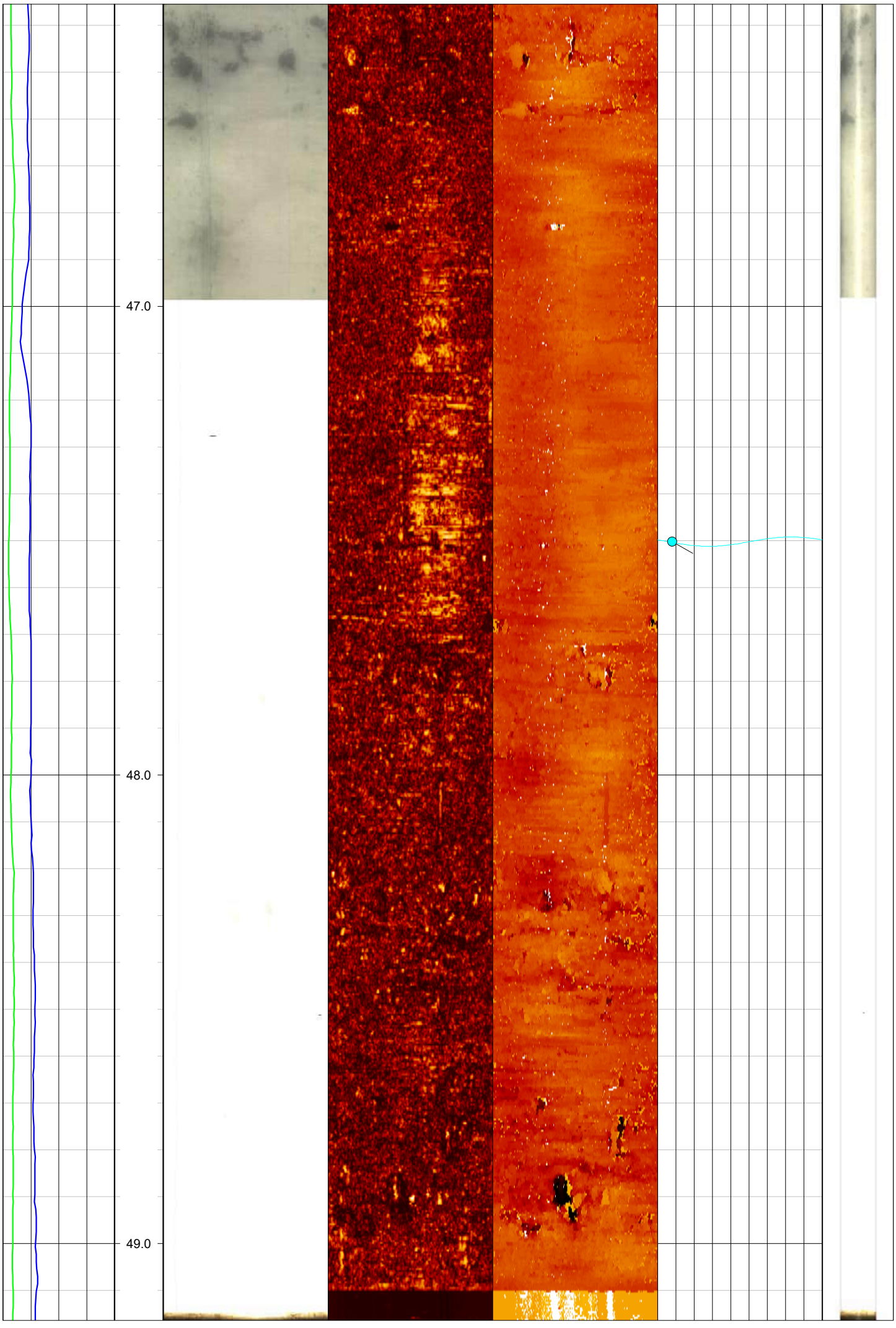

33.0
34.0
35.0

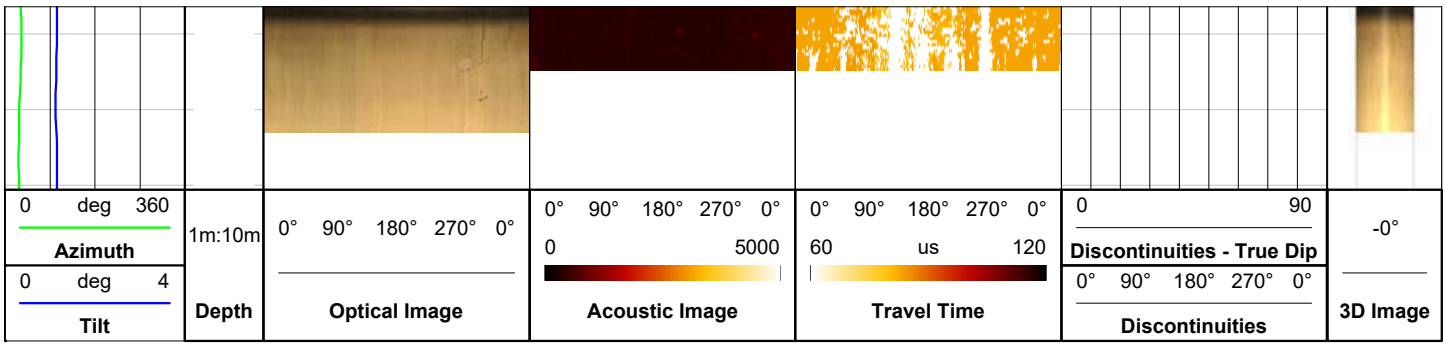

36.0
37.0


38.0
39.0
40.0


41.0
42.0
43.0


44.0
45.0
46.0


47.0
48.0
49.0


0 deg 360
Azimuth
0 deg 4
Tilt
1m:10m
Depth
0° 90° 180° 270° 0°
Optical Image
0° 90° 180° 270° 0°
0 5000
Acoustic Image
0° 90° 180° 270° 0°
60 us 120
Travel Time
0 90
Discontinuities - True Dip
0° 90° 180° 270° 0°
Discontinuities
-0°
3D Image

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Soil Engineering**

Borehole: **BH104**

Log Type: ***Composite***

Location: **Tilbury** Area: Grid Ref: Elevation:

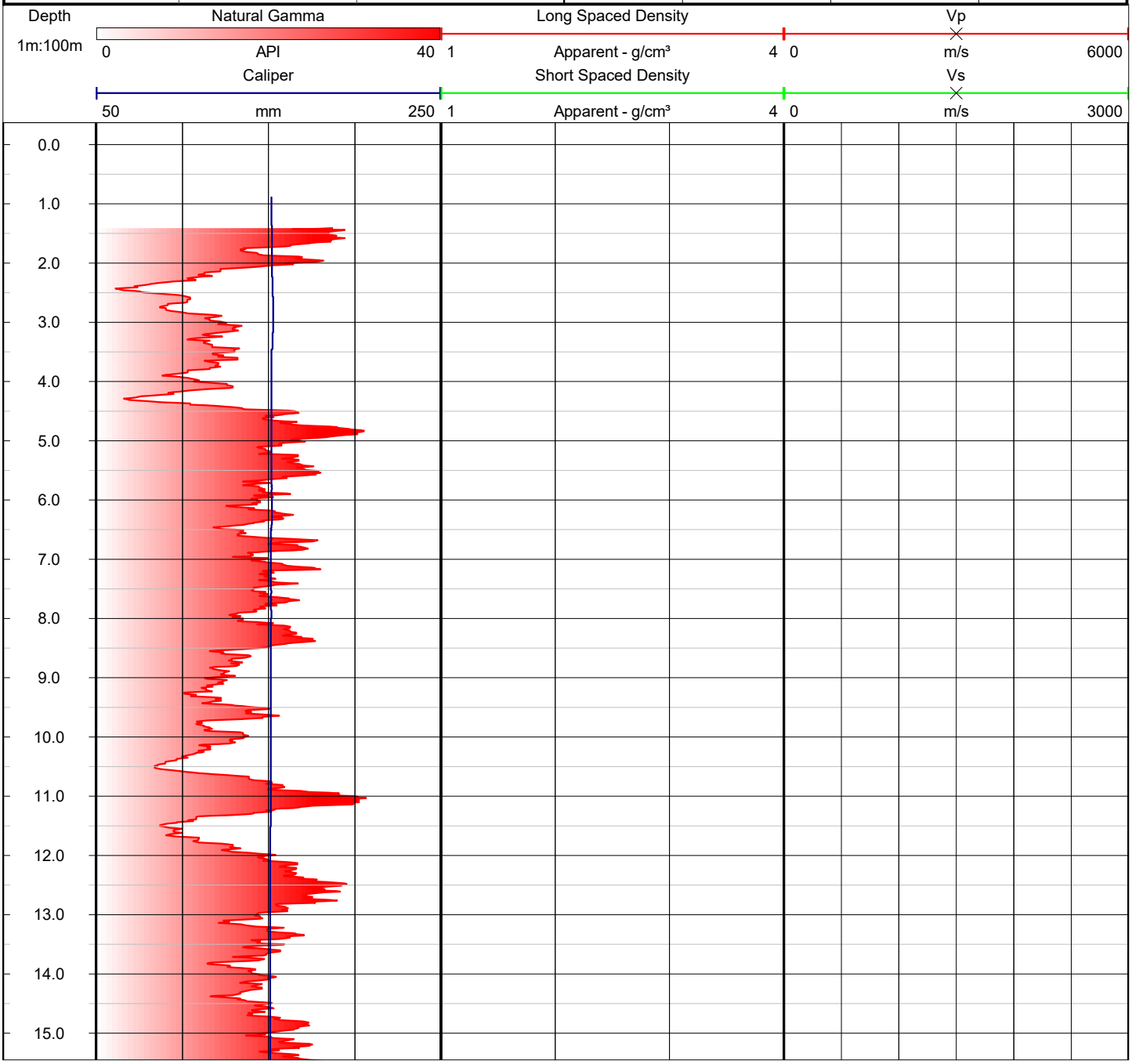
Drilled Depth: (m)	**60.5**	Date:	**17-06-2025**
Logged Depth: (m)	**60.4**	Recorded By:	**N. Clark**
Logging Datum:	**Ground Level**	Remarks:	Cloudy water column below ~38.0m. Soft sediment below 59.5m.
Logged Interval: (m)	**0.9 - 60.4**		
Fluid Level: (m)	**~5.8**		

BOREHOLE RECORD

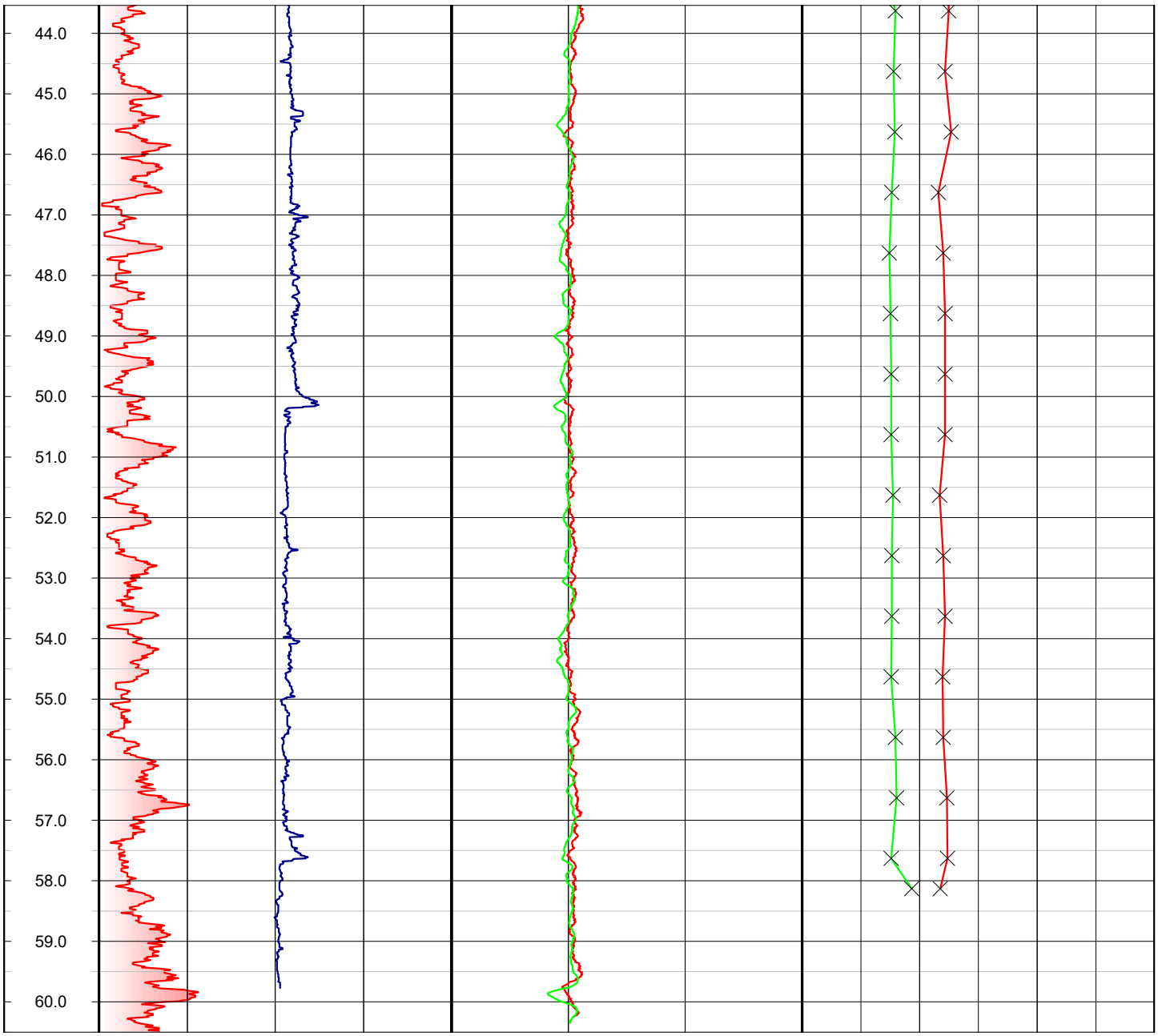
Bit: (mm)	From: (m)	To: (m)
147	**26.3**	**60.5**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
STEEL	**150**	**-0.37**	**26.3**




16.0
17.0
18.0
19.0
20.0
21.0
22.0
23.0
24.0
25.0
26.0
27.0
28.0
29.0
30.0
31.0
32.0
33.0
34.0
35.0
36.0
37.0
38.0
39.0
40.0
41.0
42.0
43.0


44.0
45.0
46.0
47.0
48.0
49.0
50.0
51.0
52.0
53.0
54.0
55.0
56.0
57.0
58.0
59.0
60.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Soil Engineering**

Borehole: **BH104**

Log Type: ***Image***

Location: **Tilbury** Area: Grid Ref: Elevation:

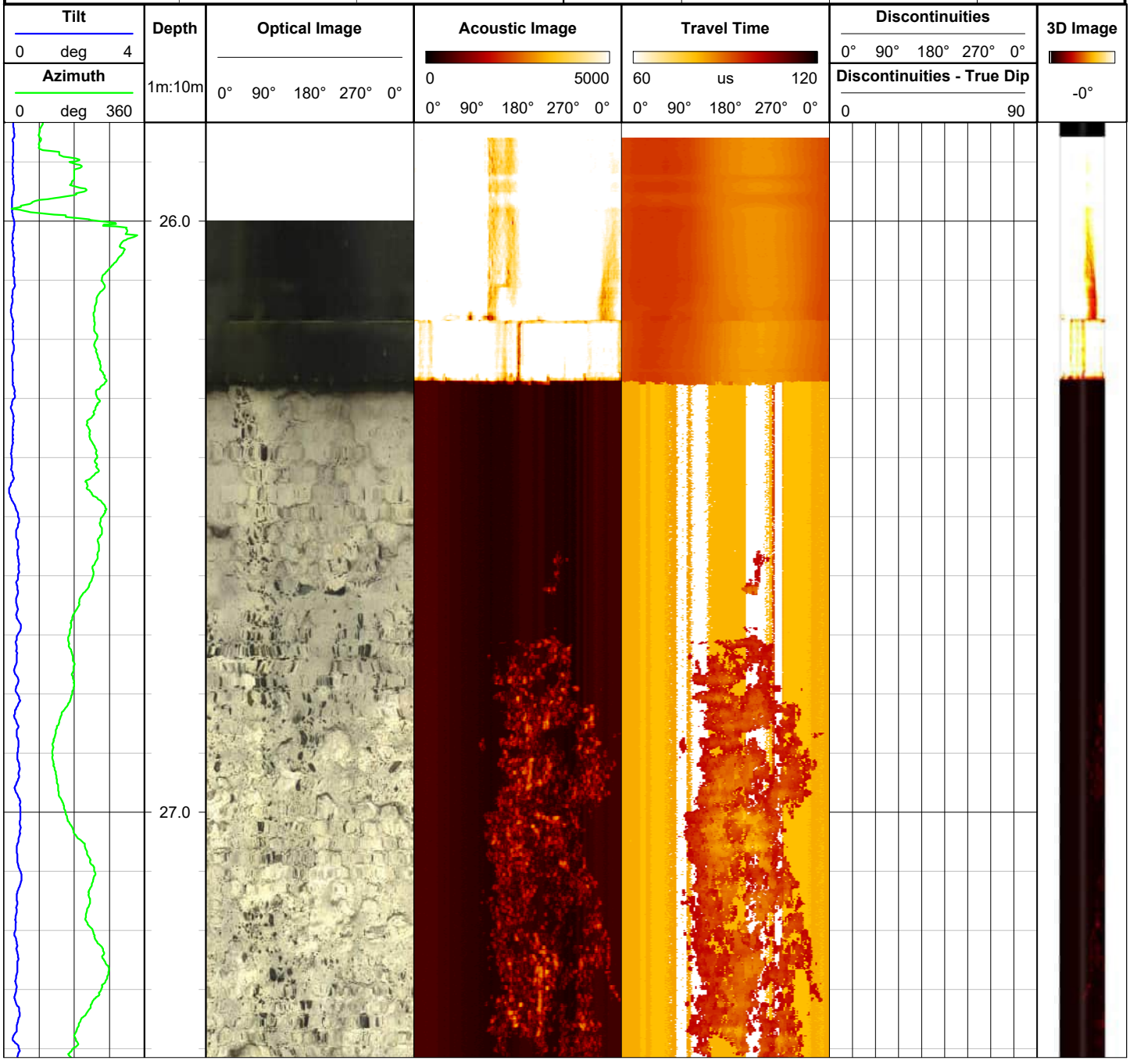
Drilled Depth: (m)	**60.5**	Date:	**17-06-2025**
Logged Depth: (m)	**60.1**	Recorded By:	**N. Clark**
Logging Datum:	**Ground Level**	Remarks:	Cloudy water column below ~38.0m, high degree of suspended sediment. Soft sediment settled below 59.5m.
Logged Interval: (m)	**26.3 - 60.1**		
Fluid Level: (m)	**~5.8**		

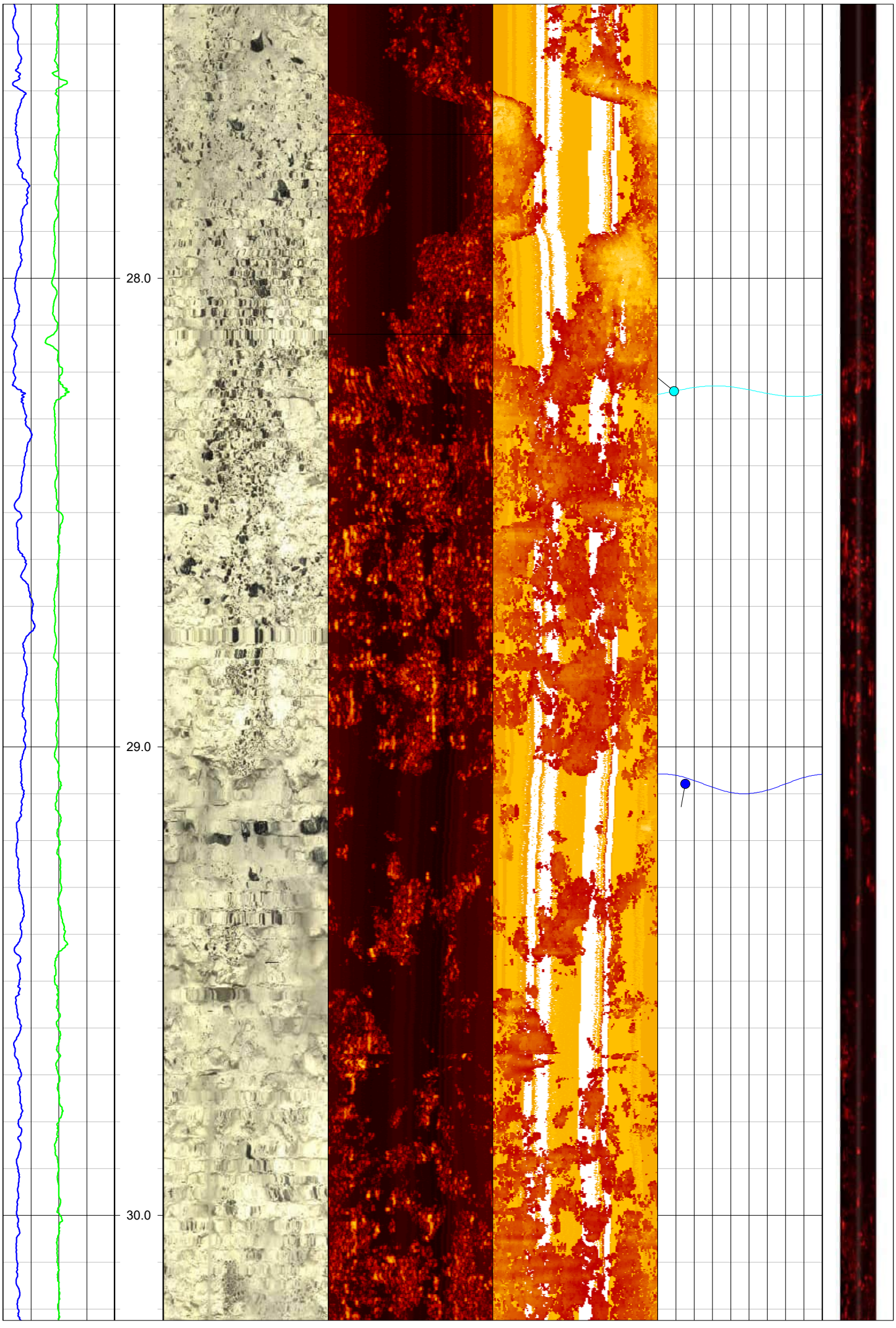
BOREHOLE RECORD

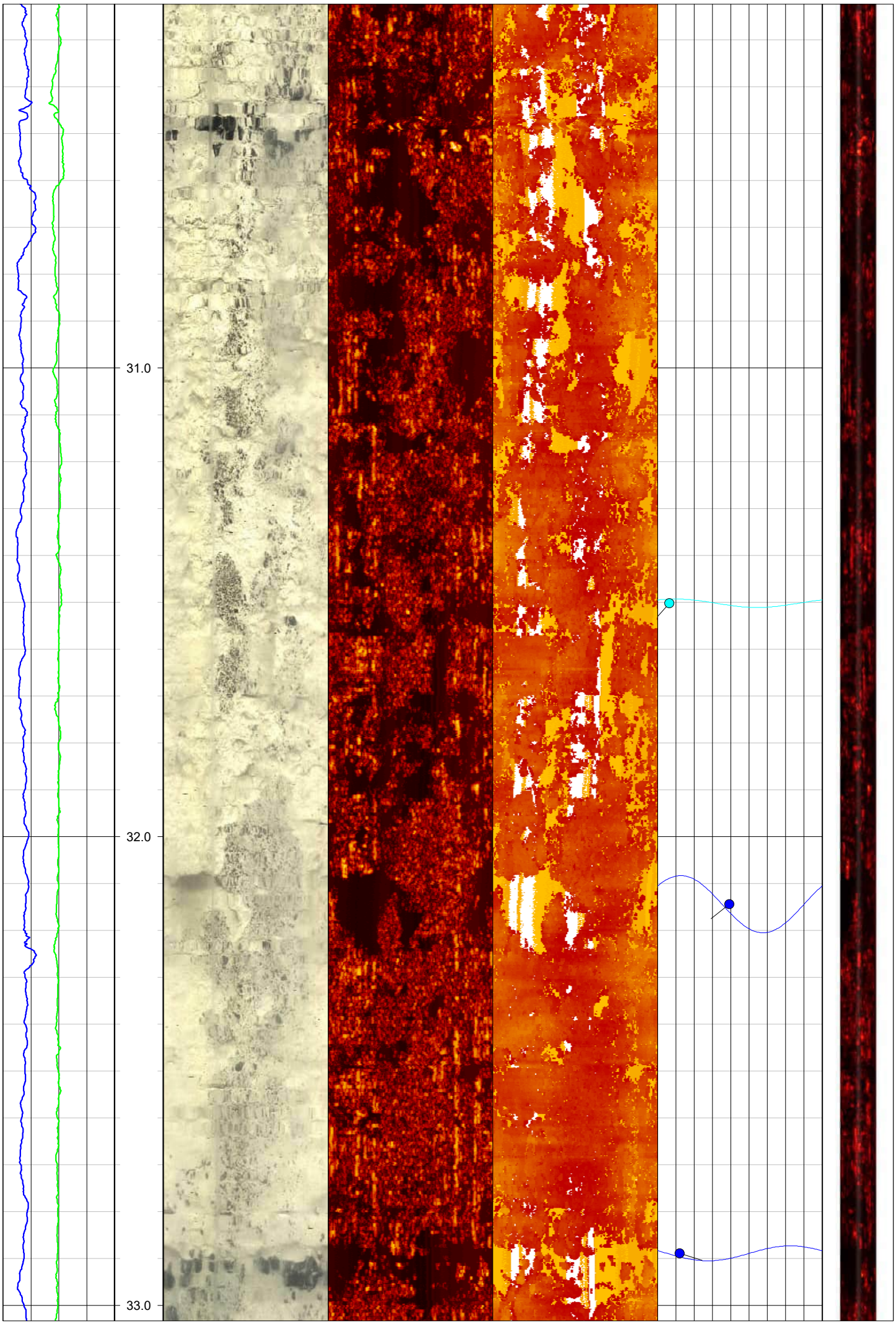
Bit: (mm)	From: (m)	To: (m)
147	**26.3**	**60.5**

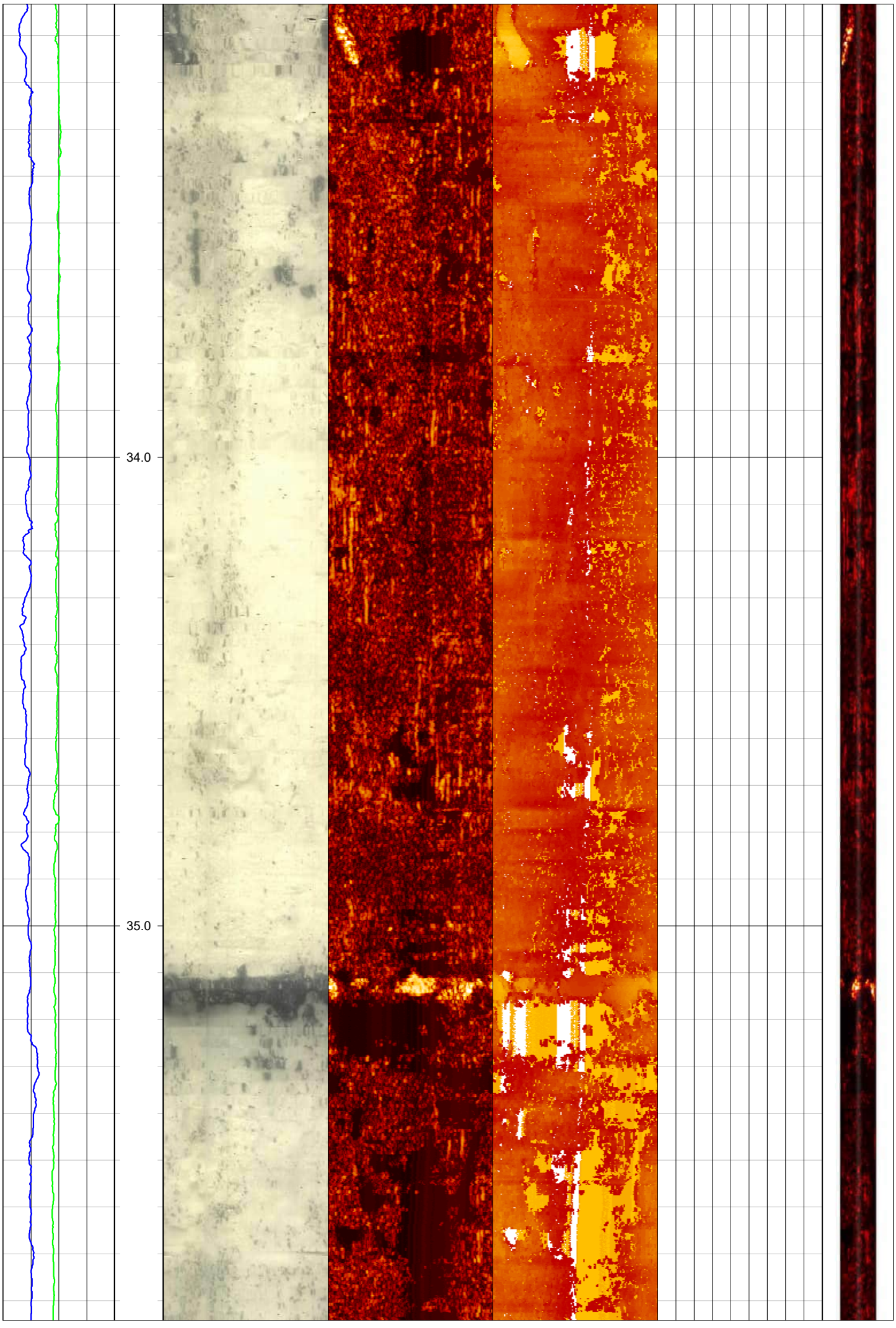
CASING RECORD

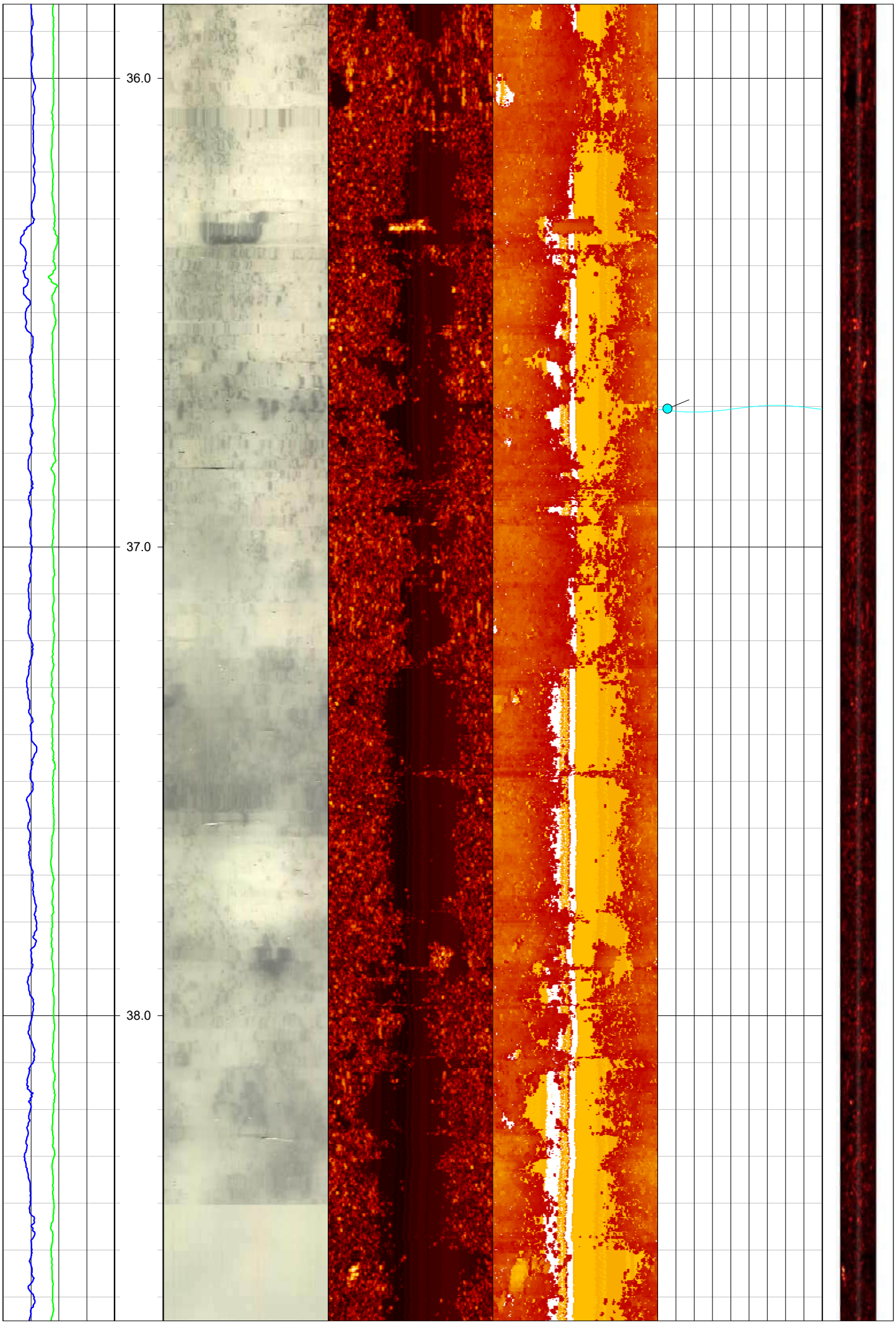
Type	Size: (mm)	From: (m)	To: (m)
STEEL	**130**	**-0.37**	**26.3**

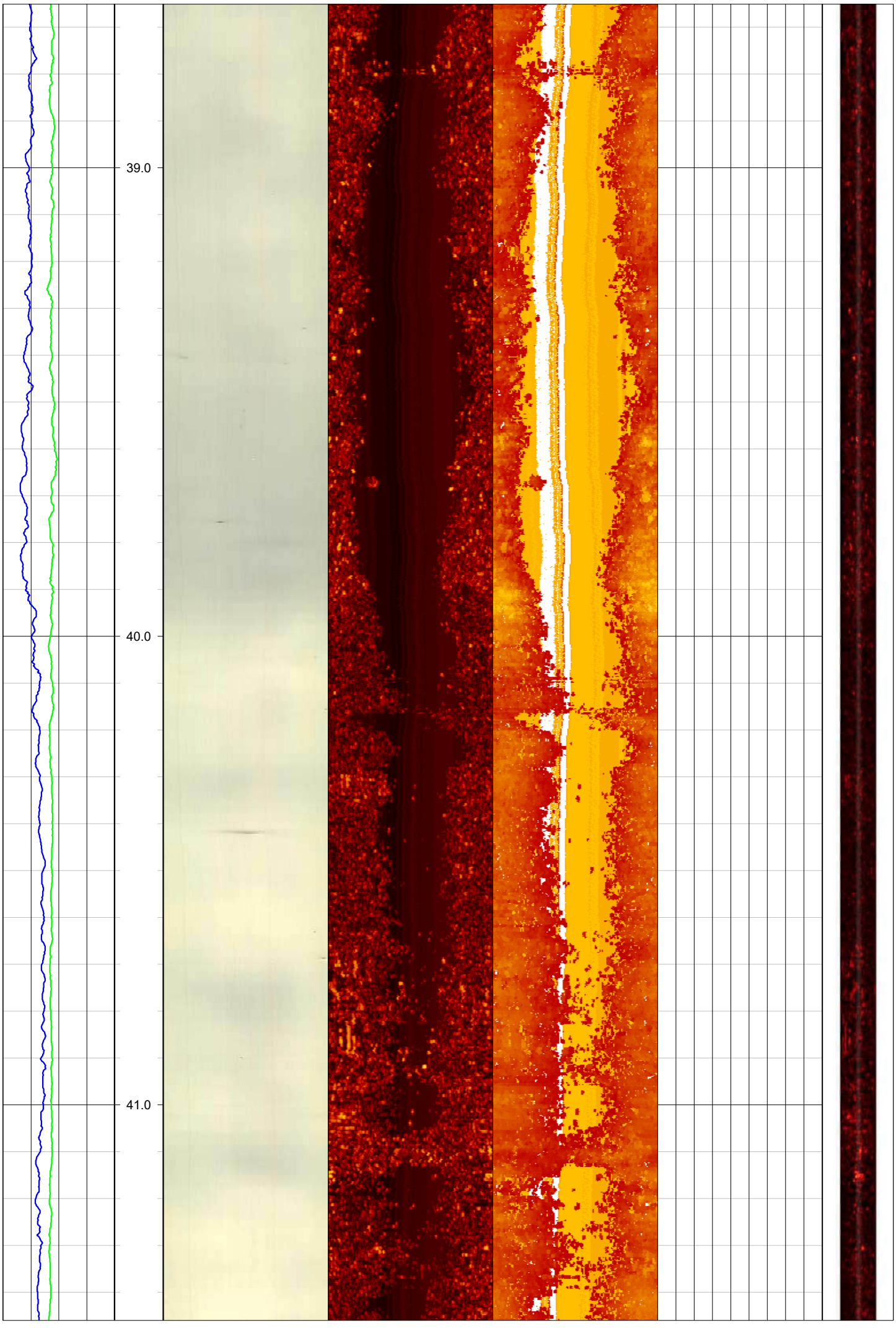


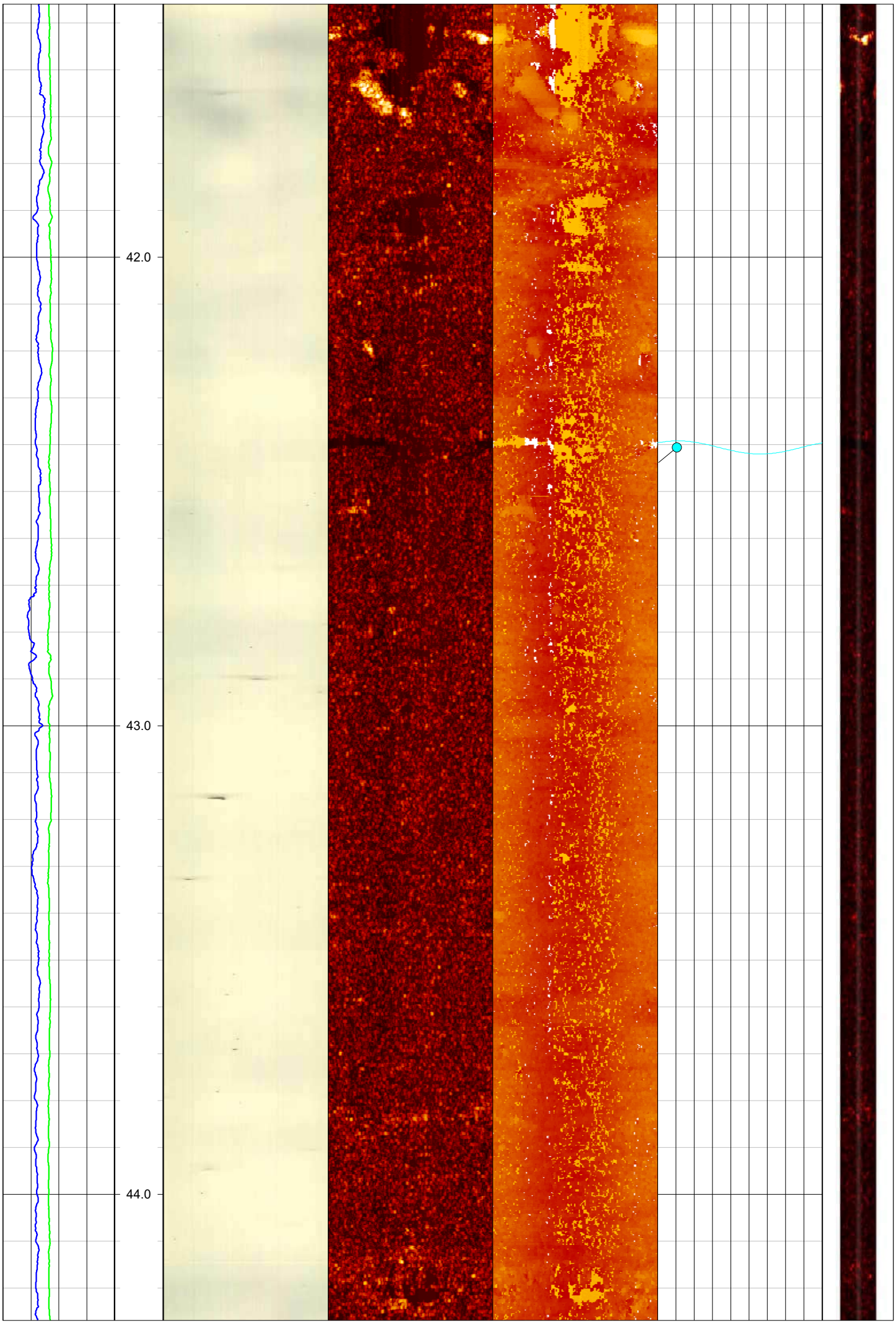

28.0
29.0
30.0

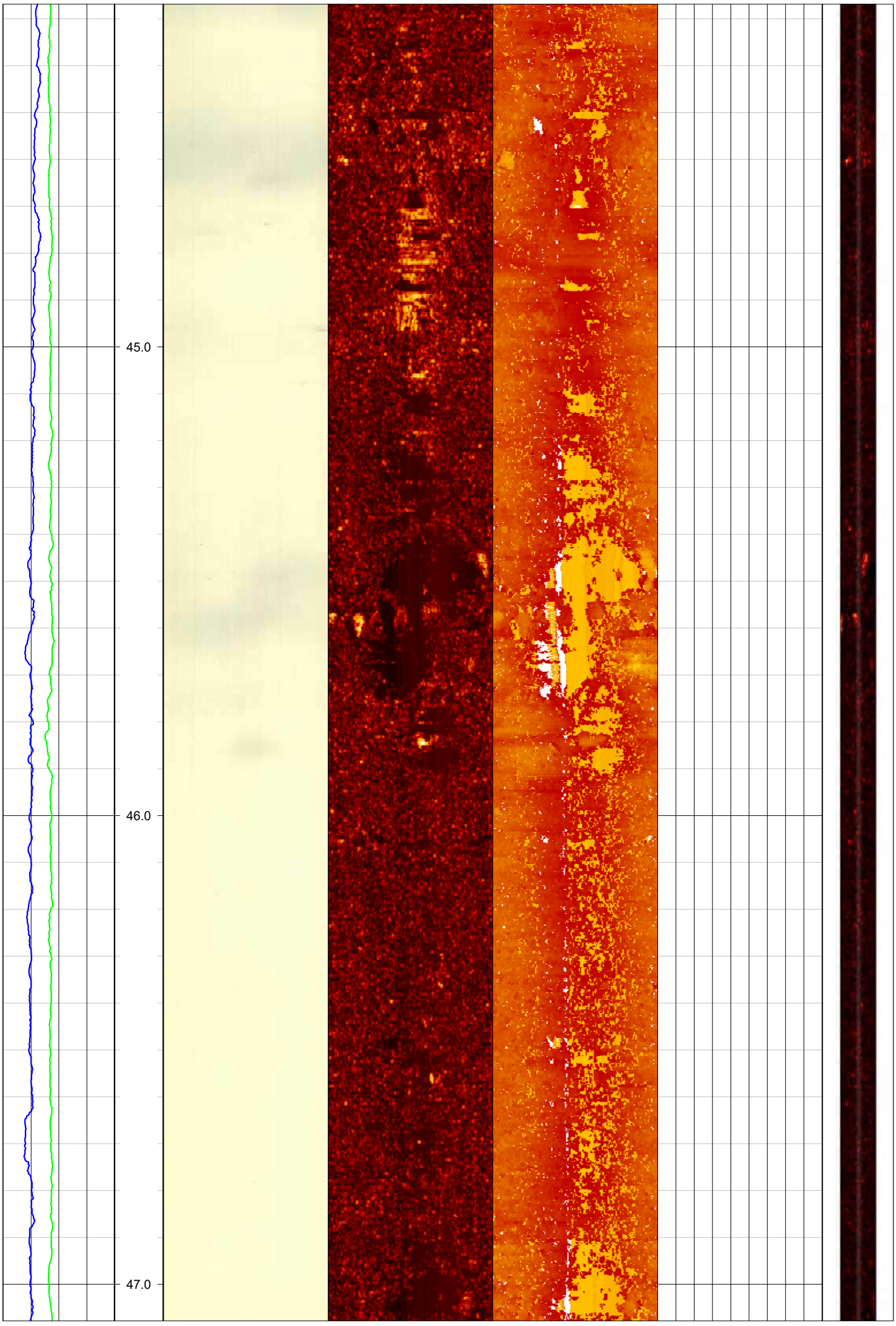

31.0
32.0
33.0

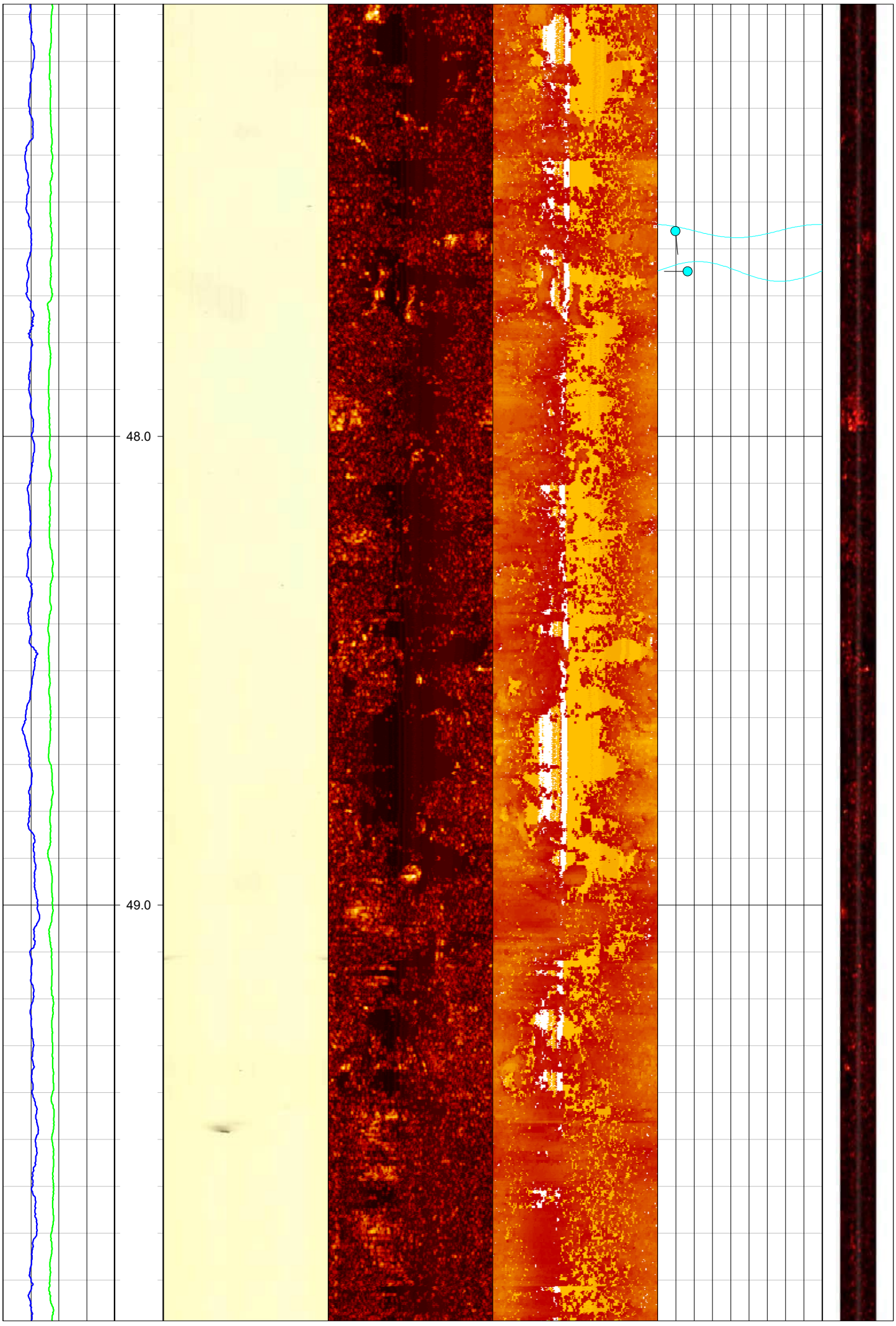

34.0
35.0

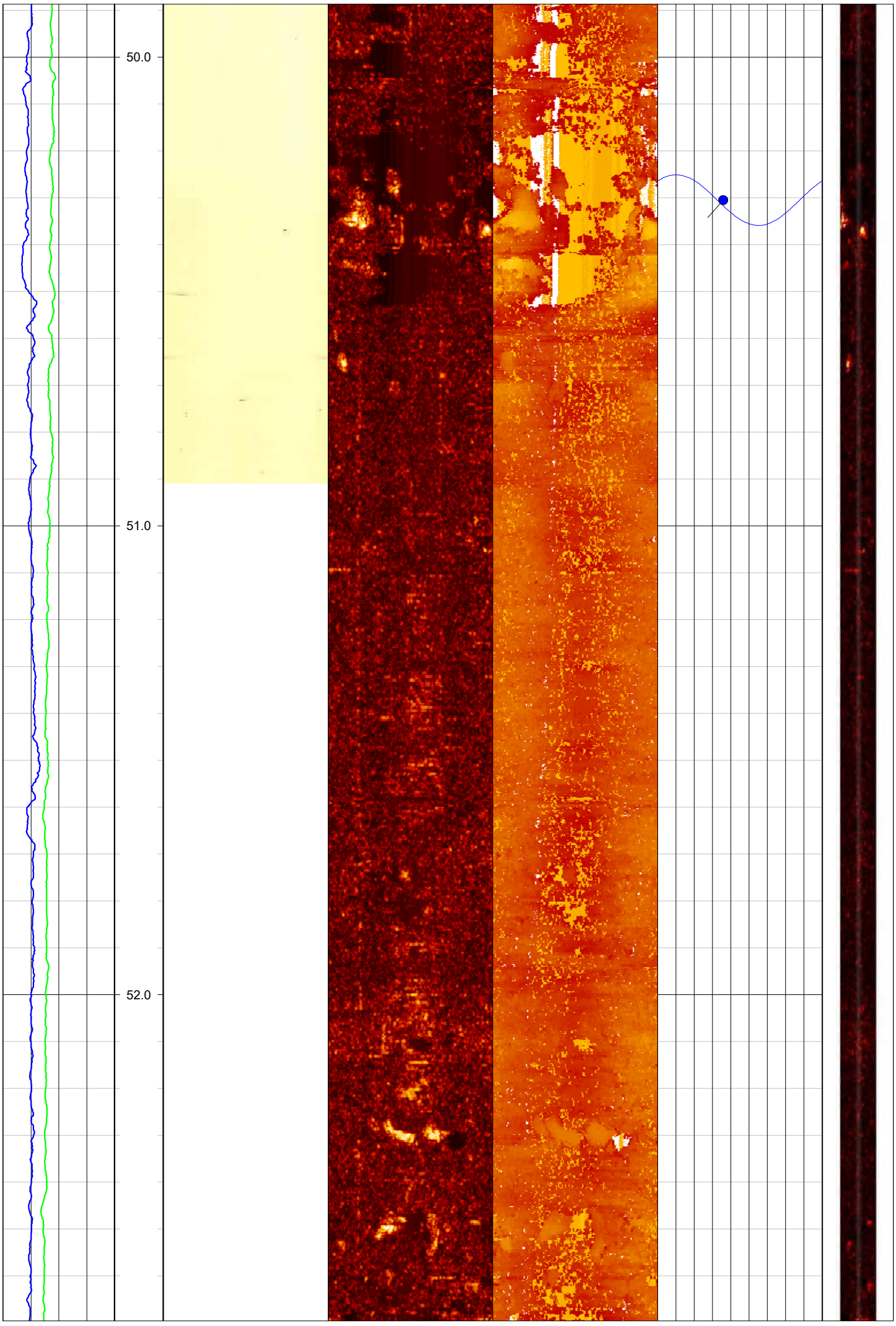

36.0
37.0
38.0

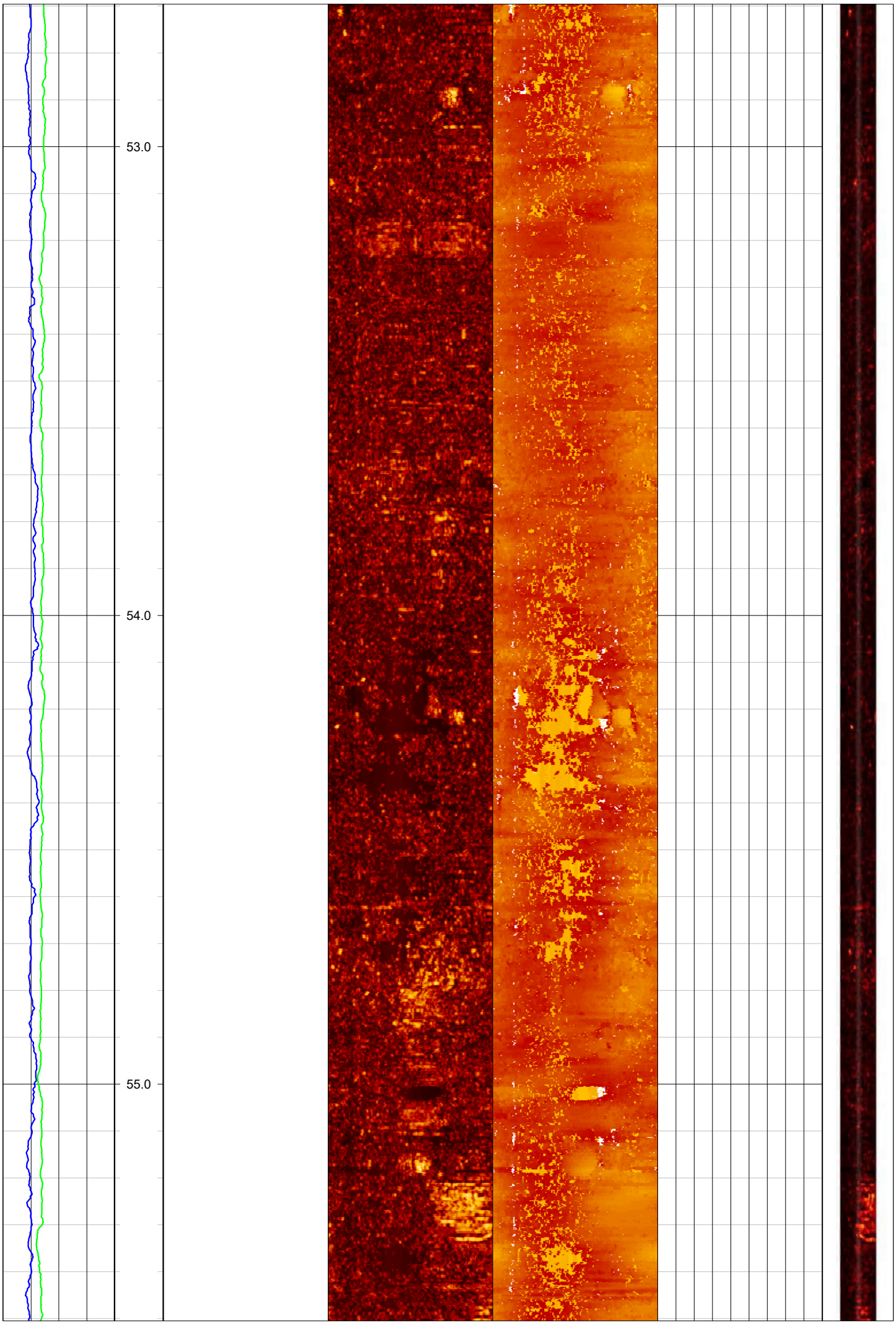

39.0
40.0
41.0

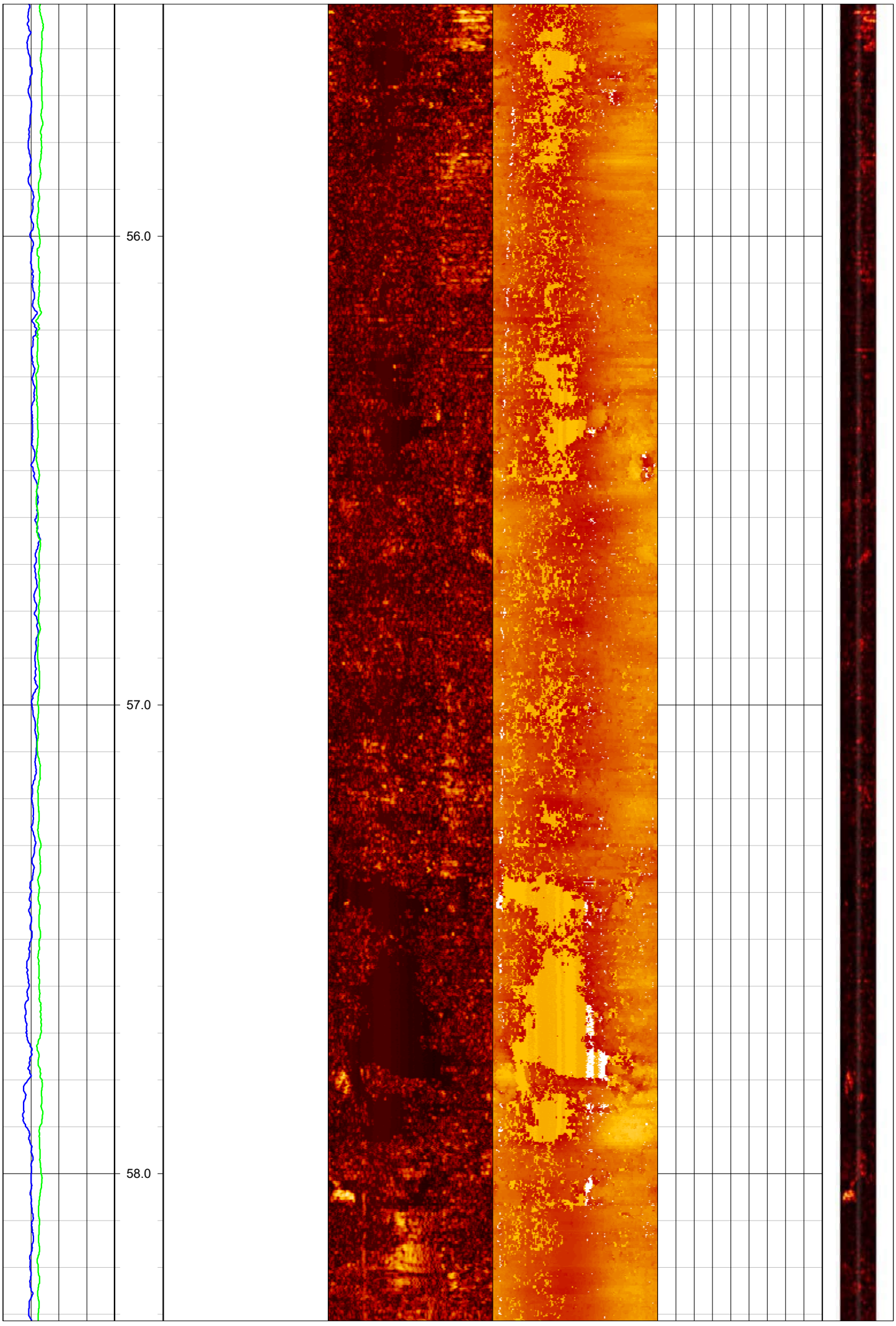

42.0
43.0
44.0

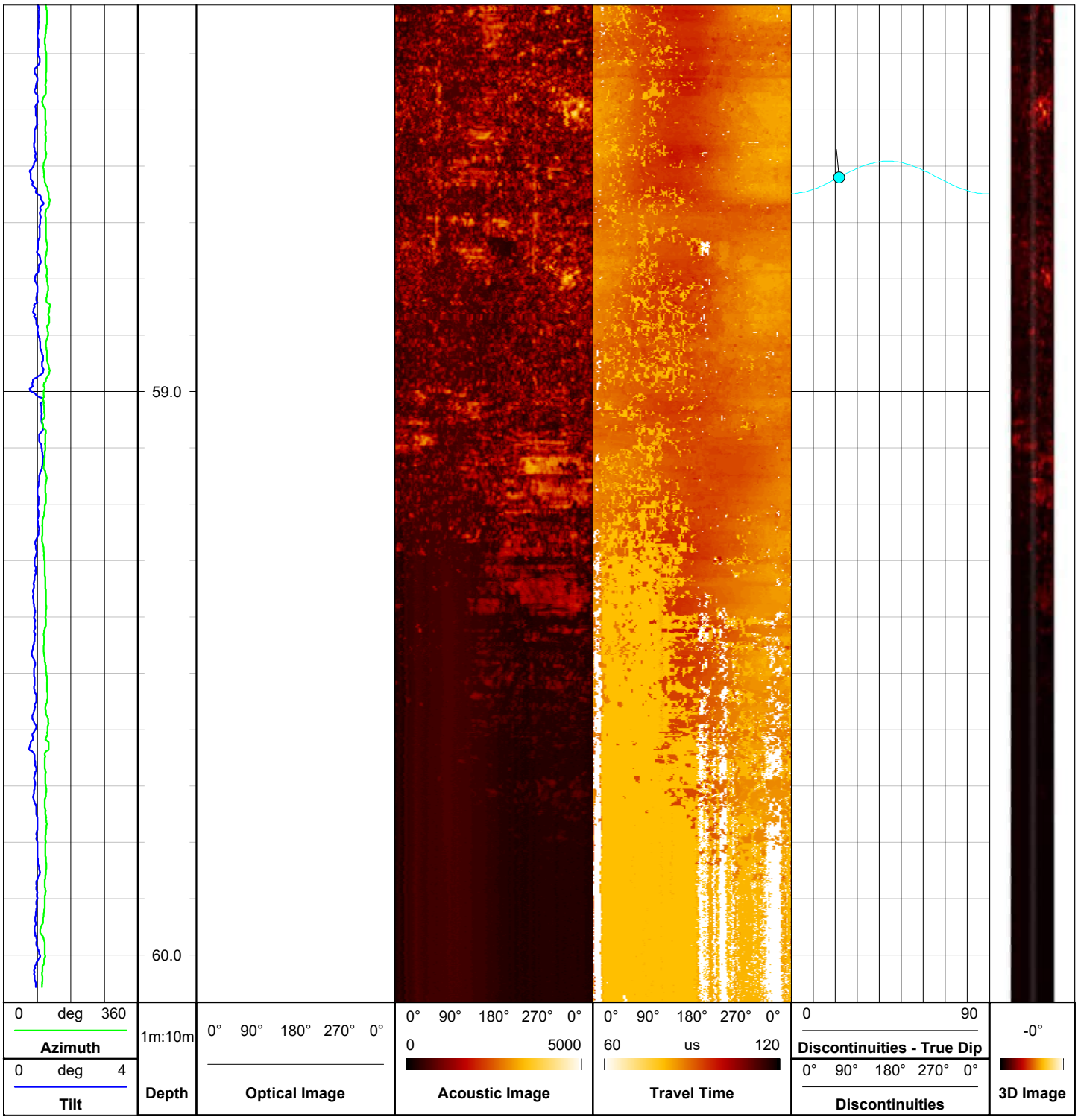

45.0
46.0
47.0


48.0
49.0


50.0
51.0
52.0


53.0
54.0
55.0


56.0
57.0
58.0


59.0
60.0
0 deg 360
Azimuth
0 deg 4
Tilt
1m:10m
Depth
0° 90° 180° 270° 0°
Optical Image
0° 90° 180° 270° 0°
0 5000
Acoustic Image
0° 90° 180° 270° 0°
60 us 120
Travel Time
0 90
Discontinuities - True Dip
0° 90° 180° 270° 0°
Discontinuities
-0°
3D Image

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Soil Engineering**

Borehole: **BH105**

Log Type: ***Composite***

Location: **Tilbury** Area: Grid Ref: Elevation:

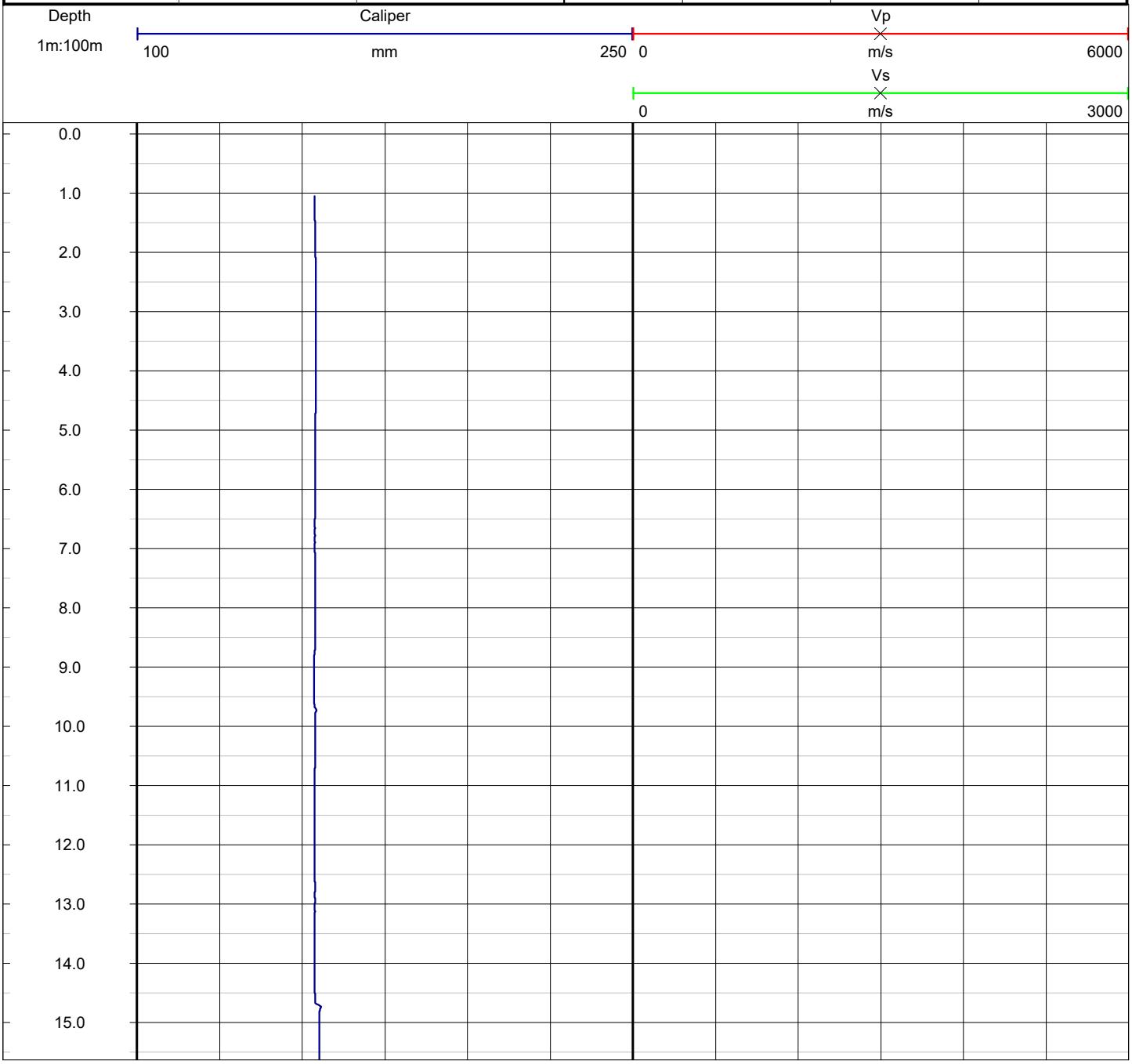
Drilled Depth: (m)	**60.5**	Date:	**25.06.25**
Logged Depth: (m)	**60.3**	Recorded By:	**H. Gilder**
Logging Datum:	**Ground Level**	Remarks:	Silt bottom 59.1 - 60.3m
Logged Interval: (m)	**1.1 - 60.3**		
Fluid Level: (m)	**7.0**		

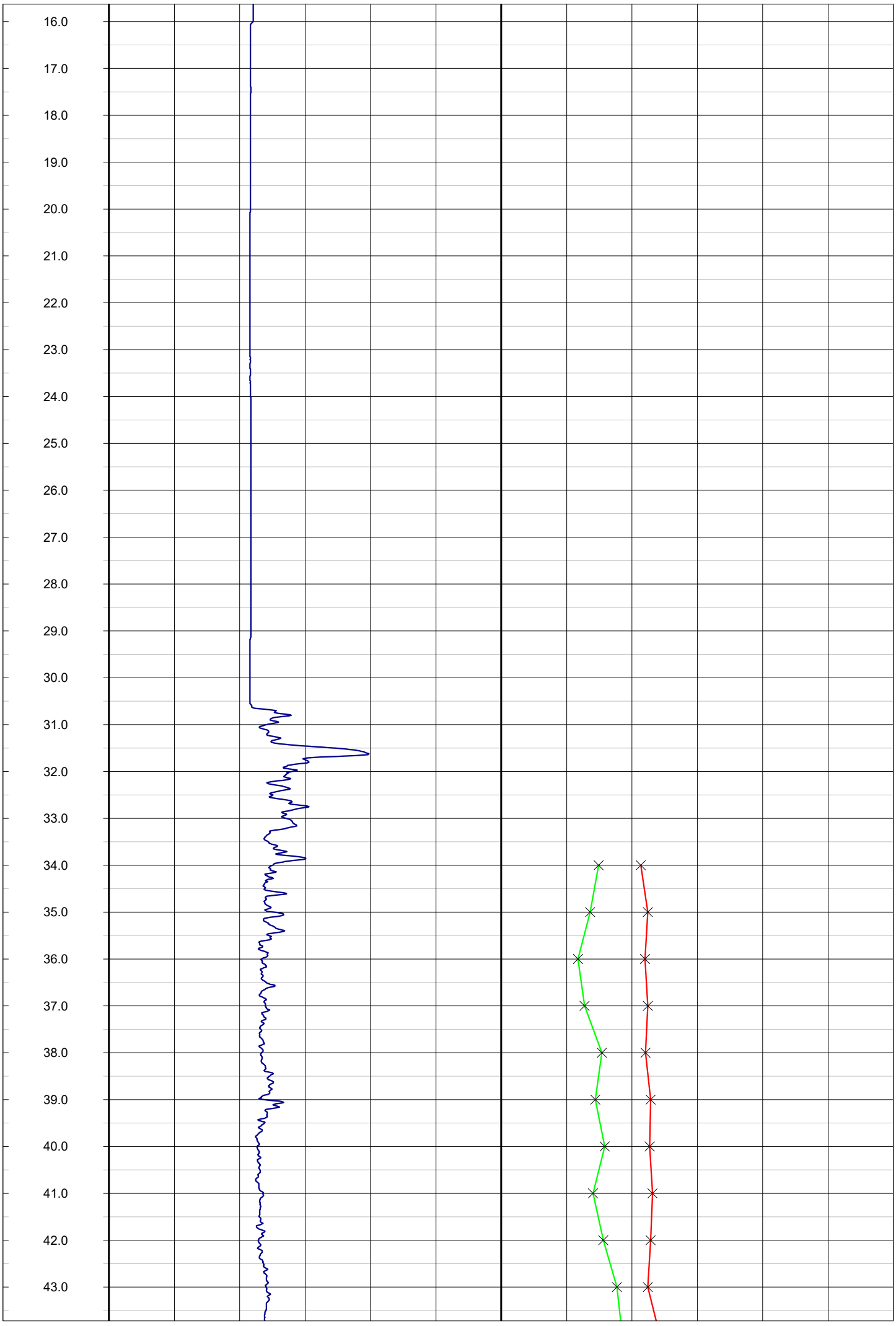
BOREHOLE RECORD

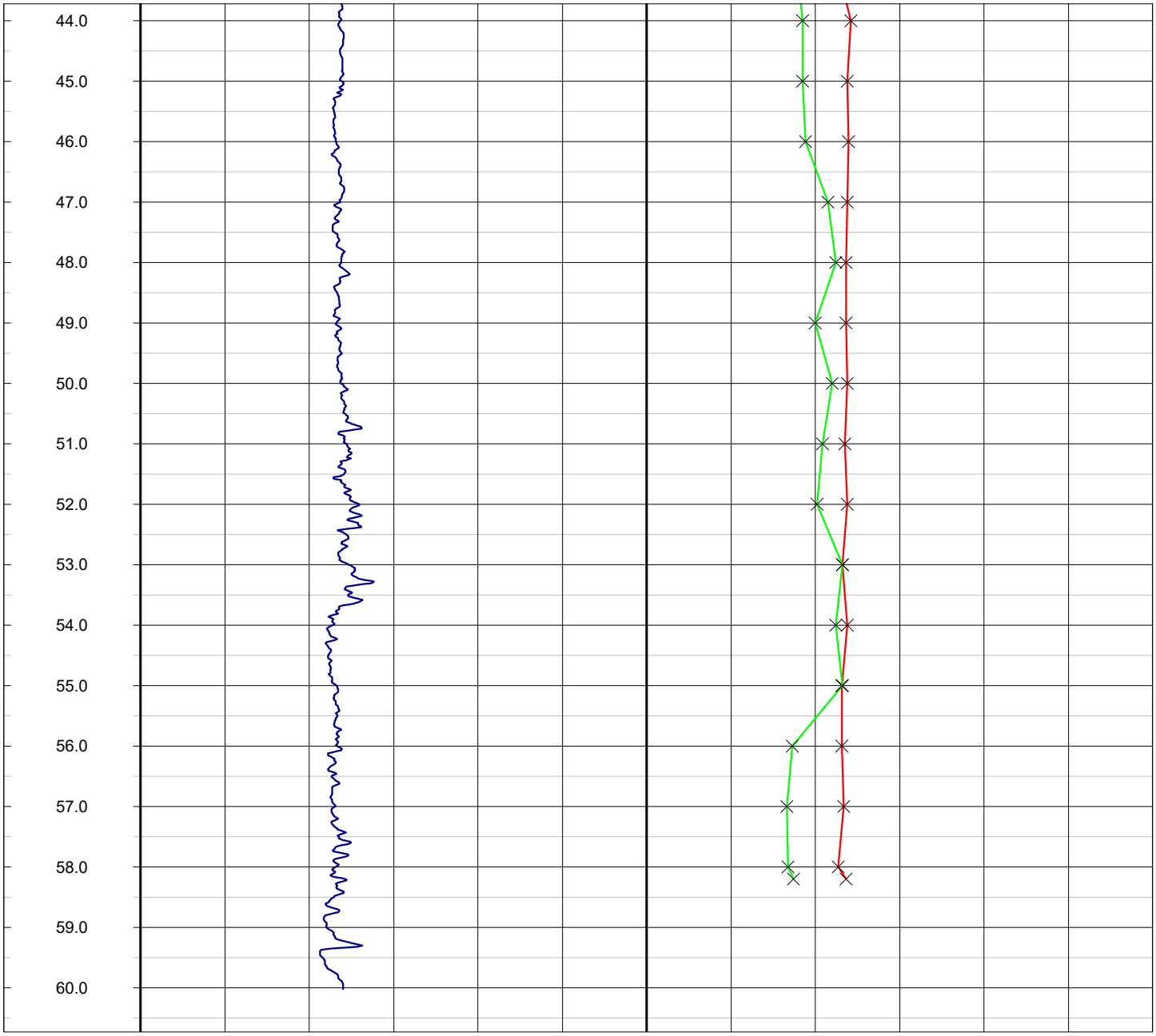
Bit: (mm)	From: (m)	To: (m)
147	**0.0**	**60.5**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
STEEL	**152**	**-0.3**	**30.7**




16.0
17.0
18.0
19.0
20.0
21.0
22.0
23.0
24.0
25.0
26.0
27.0
28.0
29.0
30.0
31.0
32.0
33.0
34.0
35.0
36.0
37.0
38.0
39.0
40.0
41.0
42.0
43.0


44.0
45.0
46.0
47.0
48.0
49.0
50.0
51.0
52.0
53.0
54.0
55.0
56.0
57.0
58.0
59.0
60.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Soil Engineering**

Borehole: **BH105**

Log Type: ***Image***

Location: **Gravesend** Area: Grid Ref: Elevation:

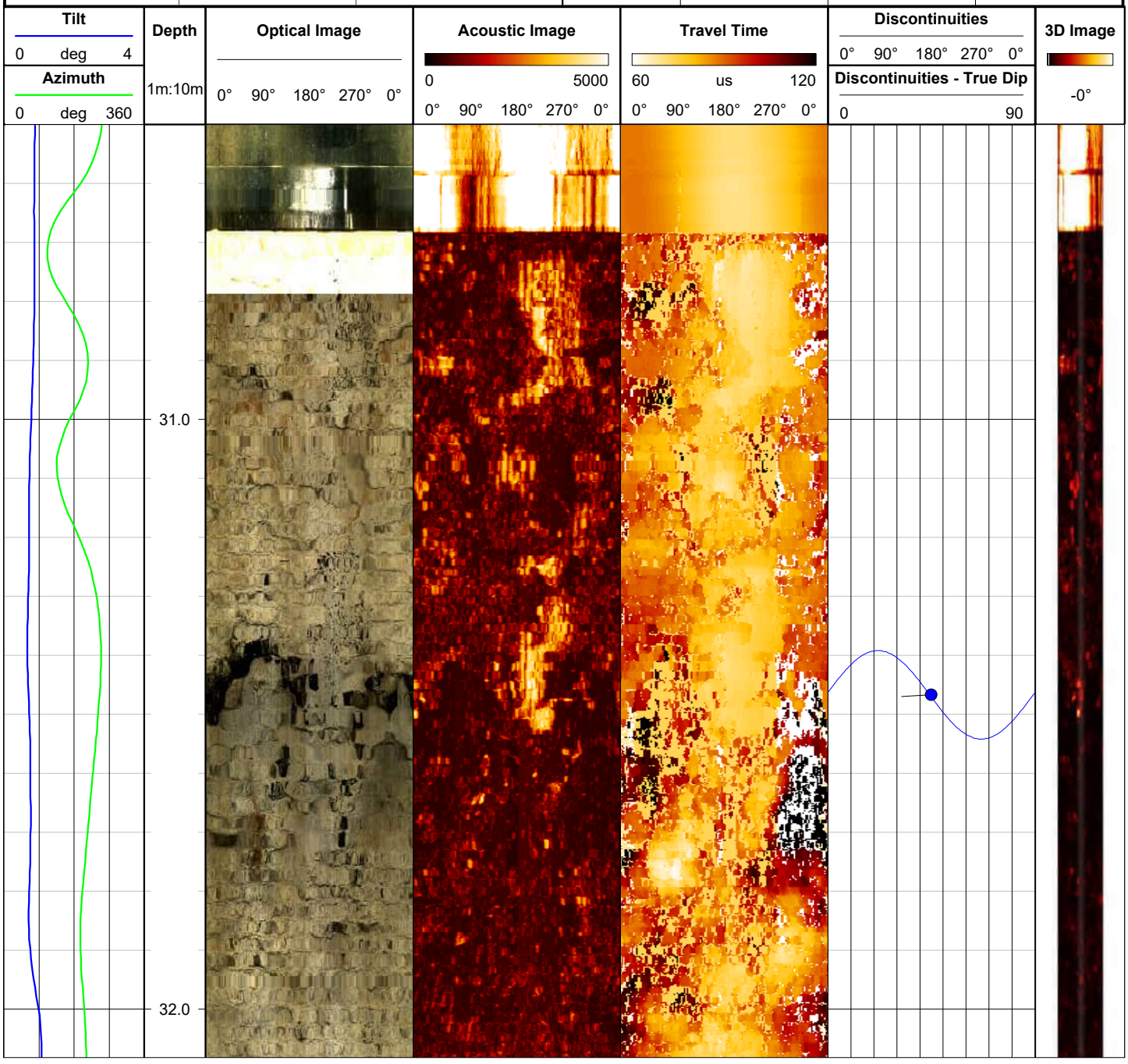
Drilled Depth: (m)	**60.5**	Date:	**25.06.25**
Logged Depth: (m)	**60.3**	Recorded By:	**H. Gilder**
Logging Datum:	**Ground Level**	Remarks:	Silt bottom 59.1 - 60.3m
Logged Interval: (m)	**30.5 - 59.1**		
Fluid Level: (m)	**7.0**		

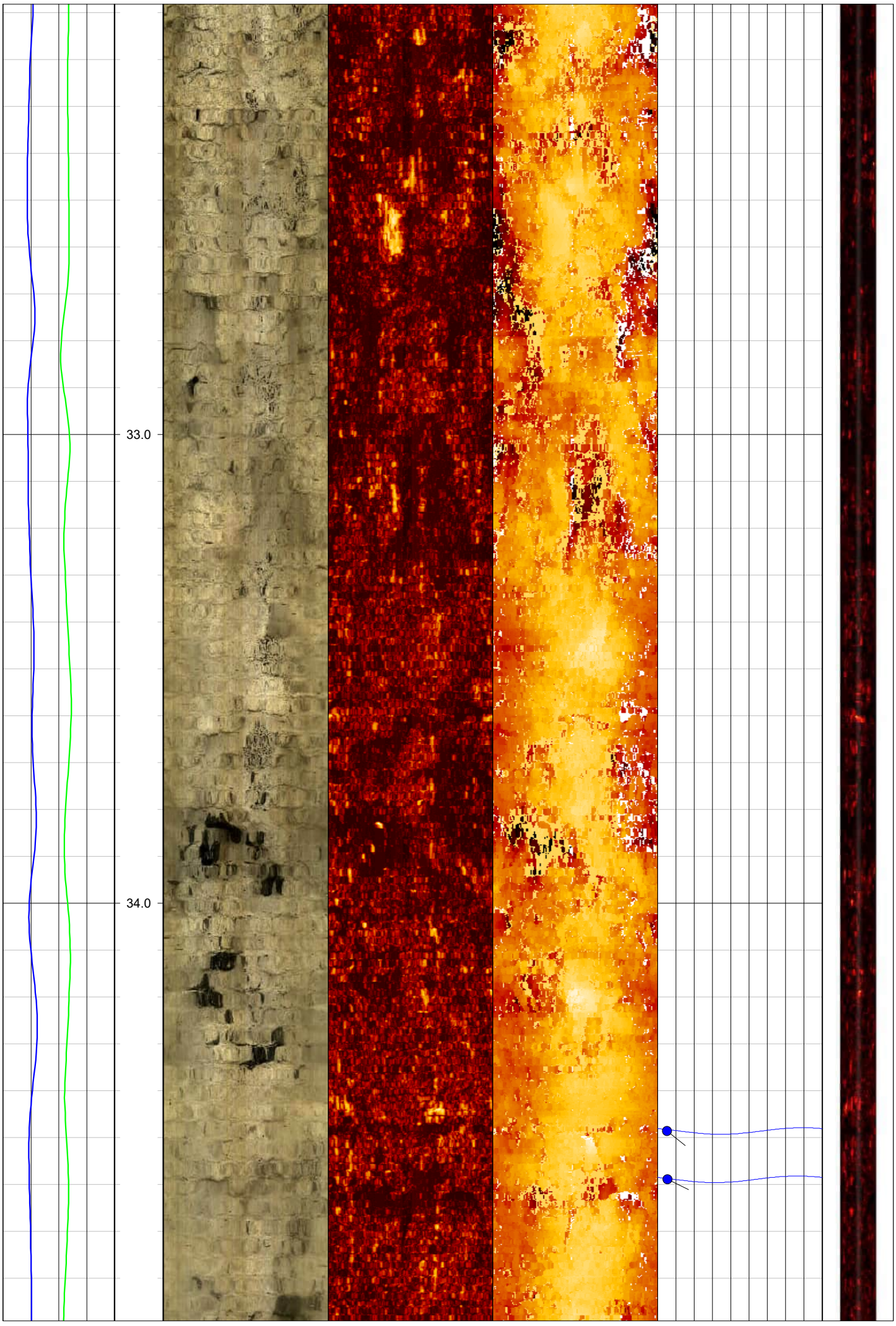
BOREHOLE RECORD

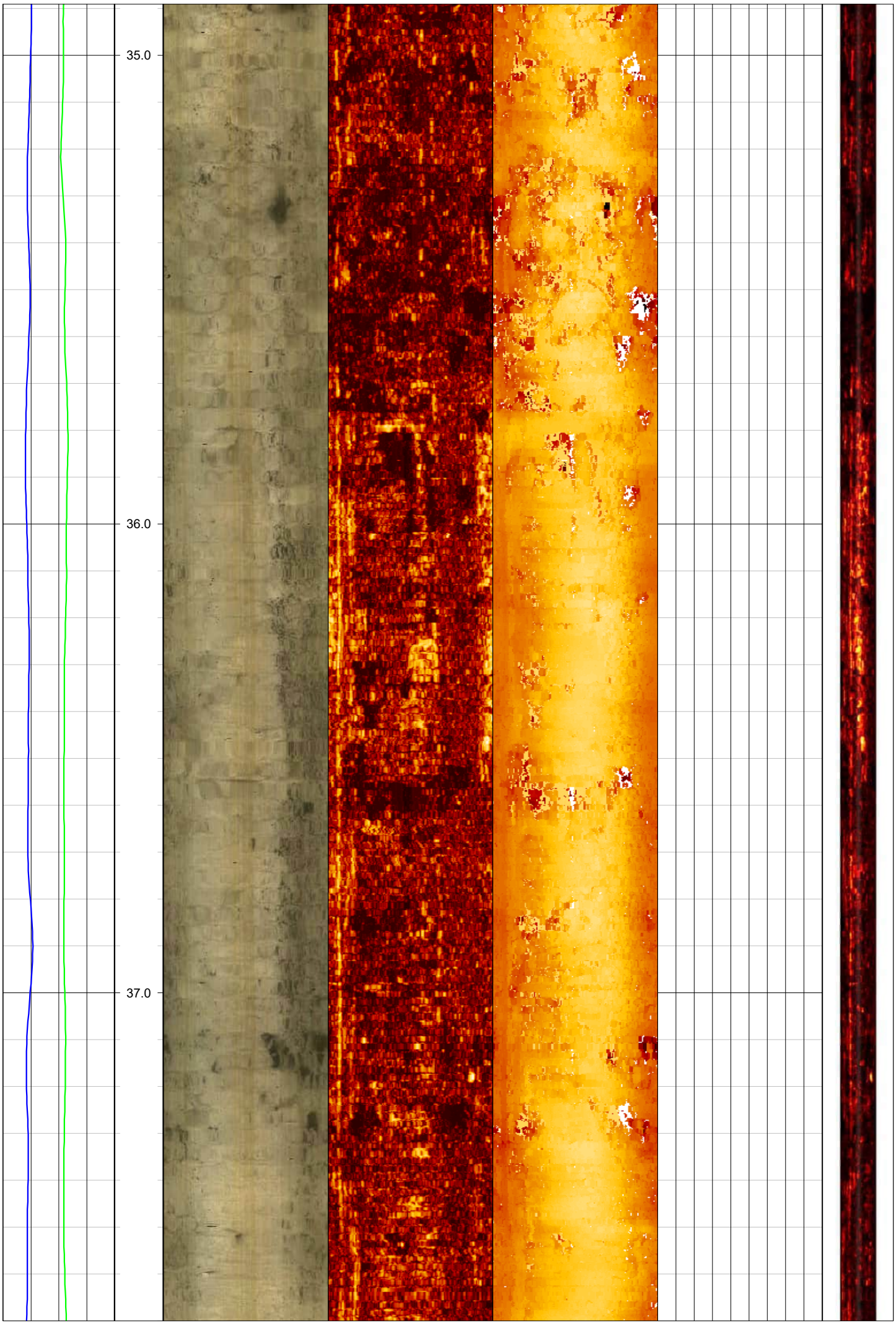
Bit: (mm)	From: (m)	To: (m)
147	**0.0**	**60.5**

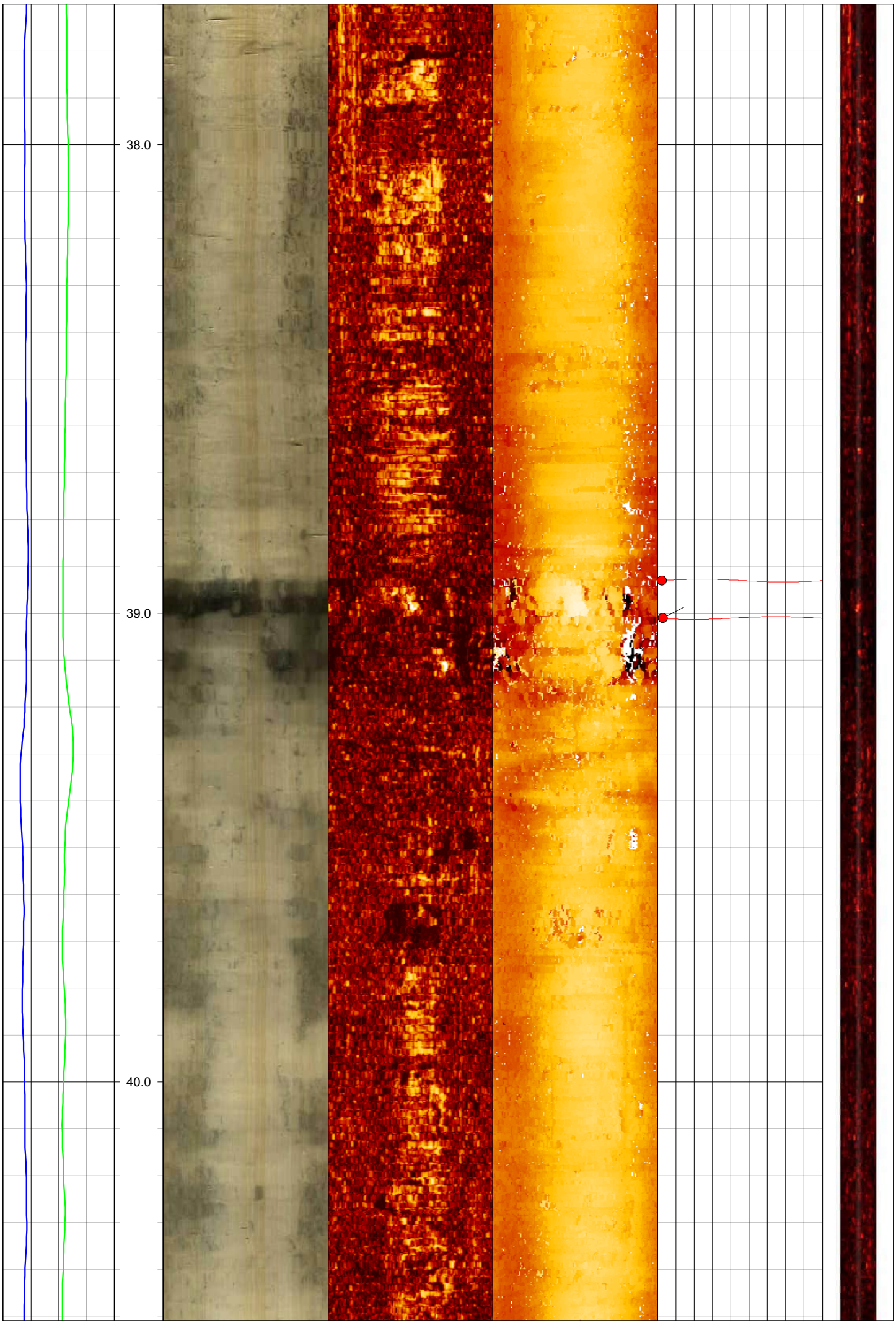
CASING RECORD

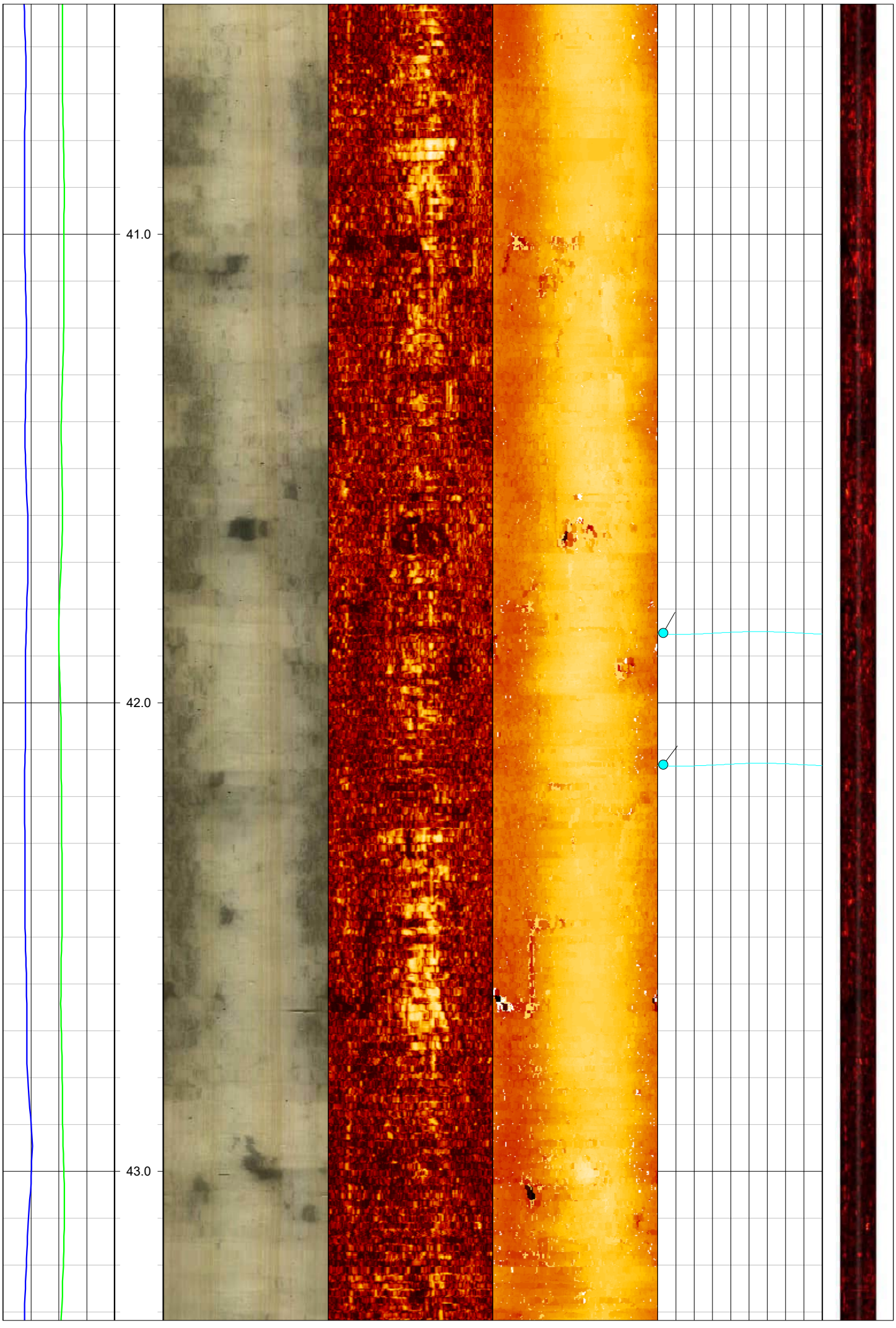
Type	Size: (mm)	From: (m)	To: (m)
STEEL	**152**	**-0.3**	**30.7**

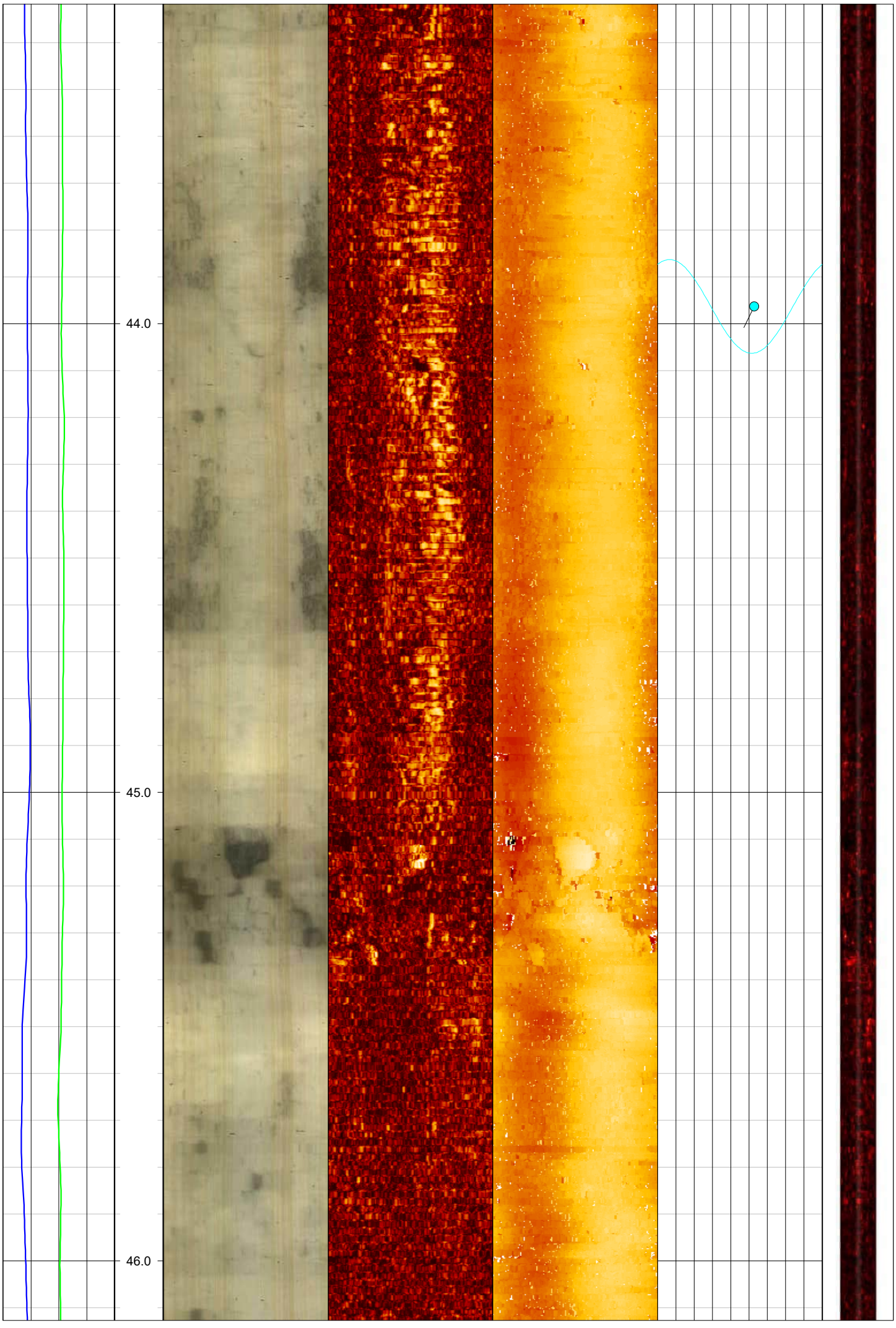


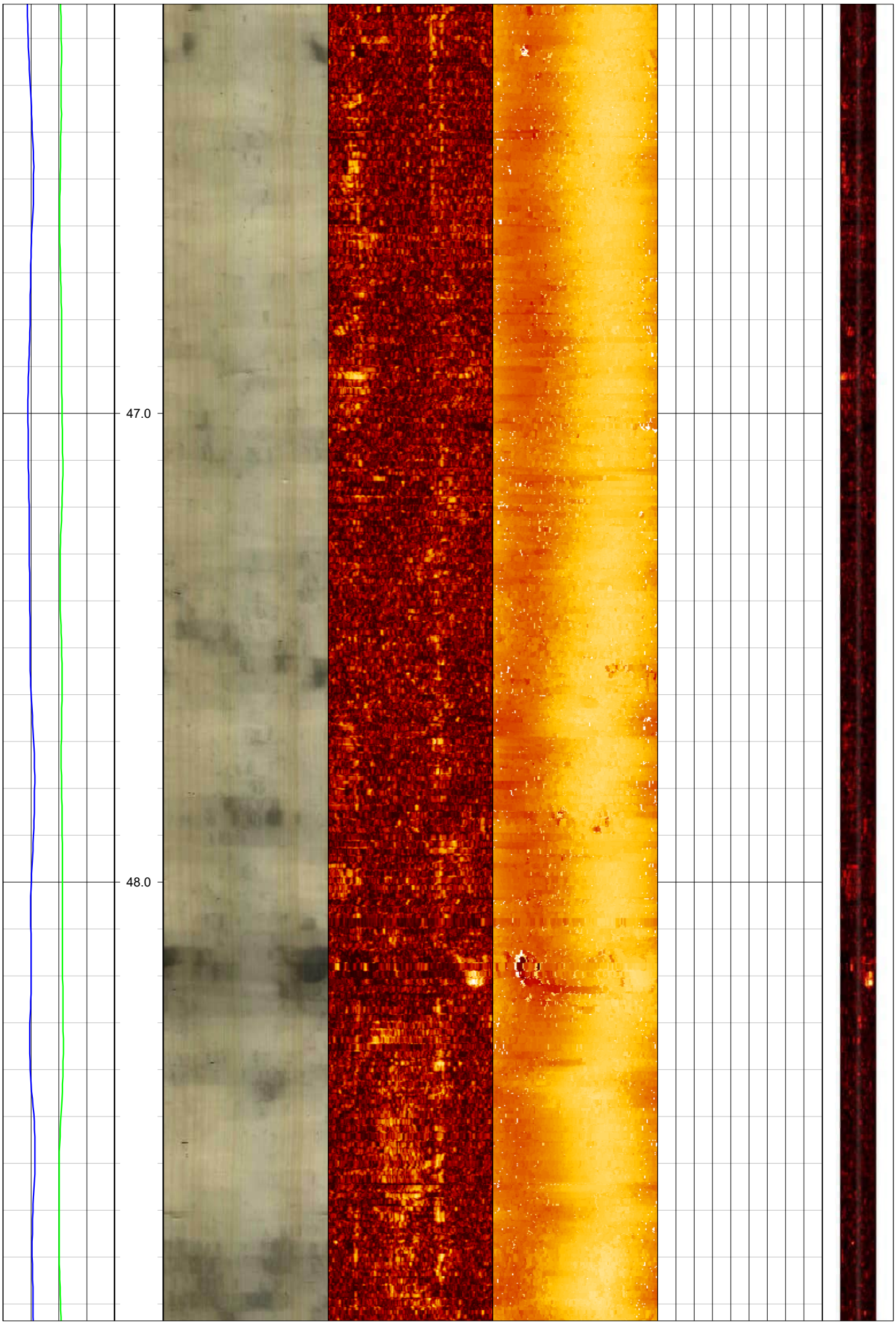

33.0
34.0

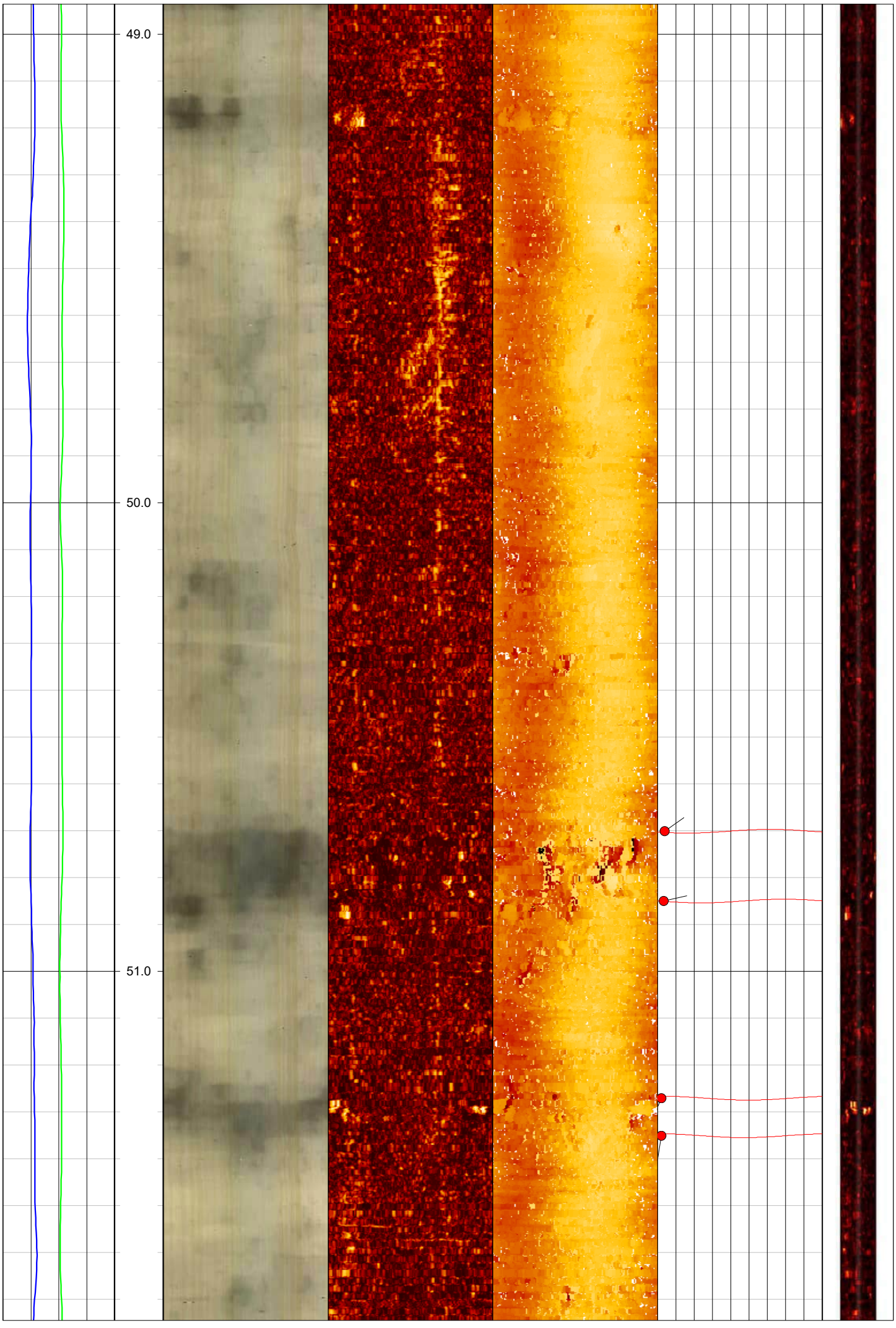

35.0
36.0
37.0

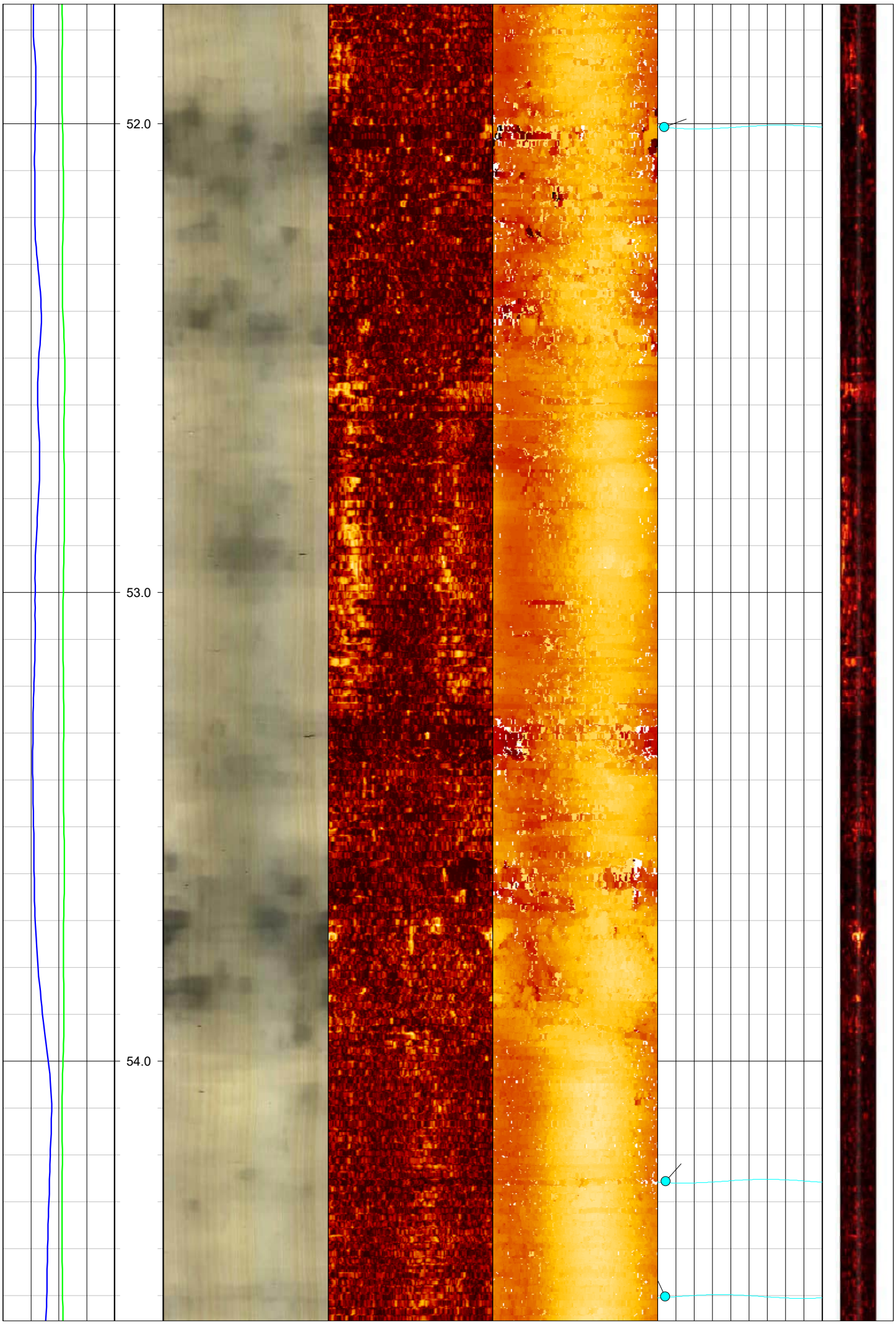

38.0
39.0
40.0

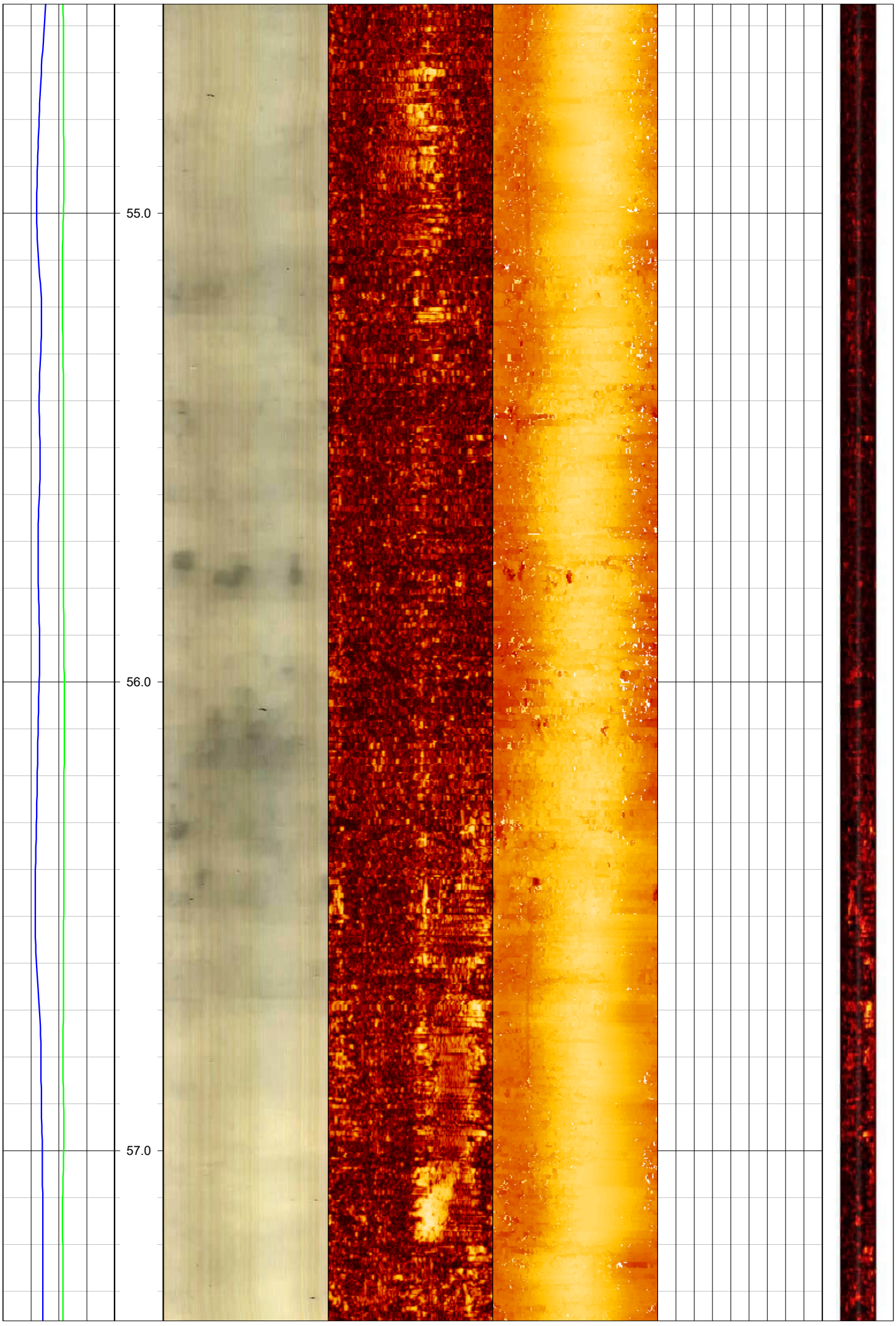

41.0
42.0
43.0

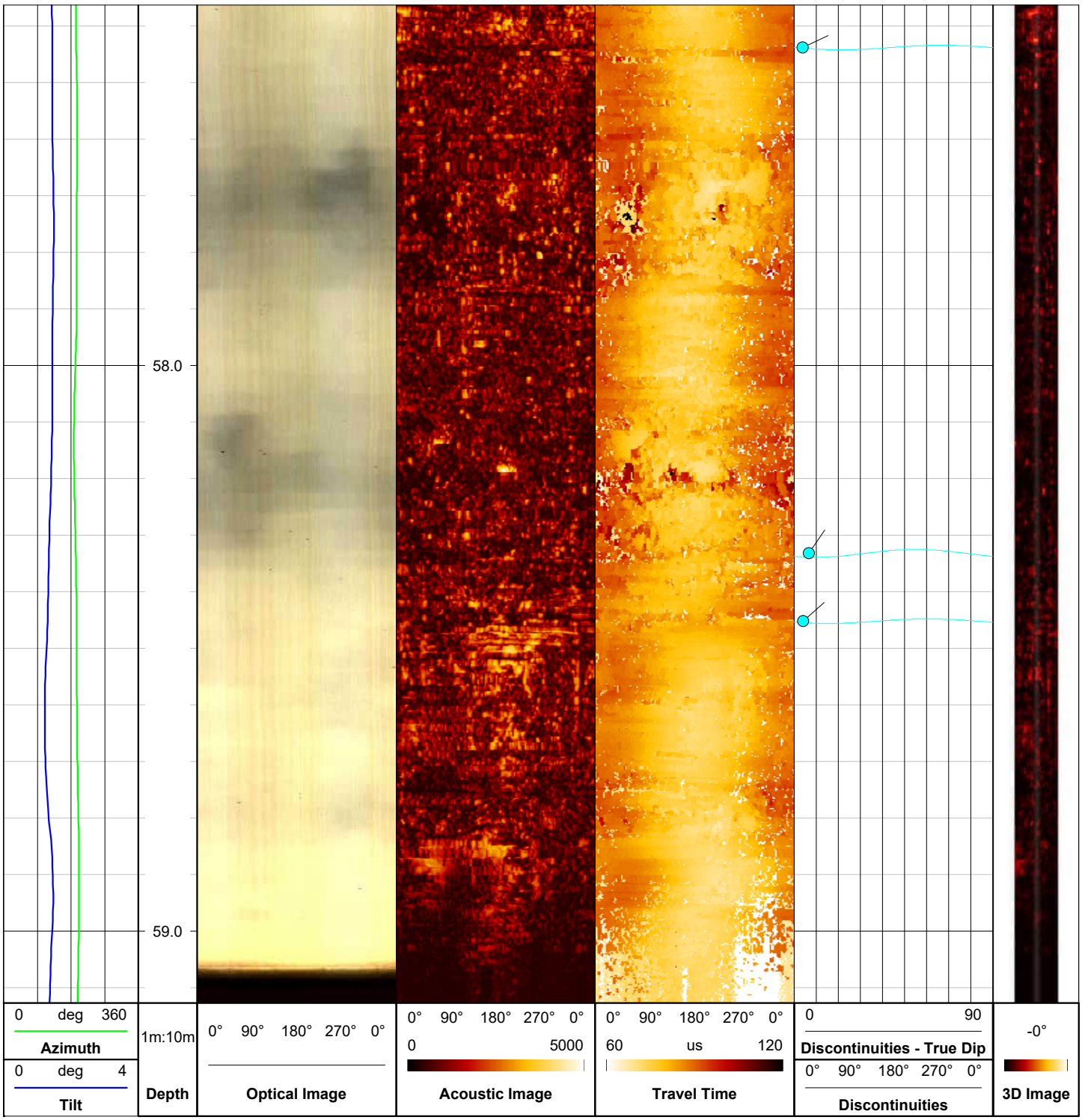

44.0
45.0
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48.0


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58.0
59.0
0 deg 360
Azimuth
0 deg 4
Tilt
1m:10m
Depth
0° 90° 180° 270° 0°
Optical Image
0° 90° 180° 270° 0°
0 5000
Acoustic Image
0° 90° 180° 270° 0°
60 us 120
Travel Time
0 90
Discontinuities - True Dip
0° 90° 180° 270° 0°
Discontinuities
-0°
3D Image

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Soil Engineering**

Borehole: **BH106**

Log Type: ***Composite***

Location: **Gravesend** Area: **London** Grid Ref: Elevation:

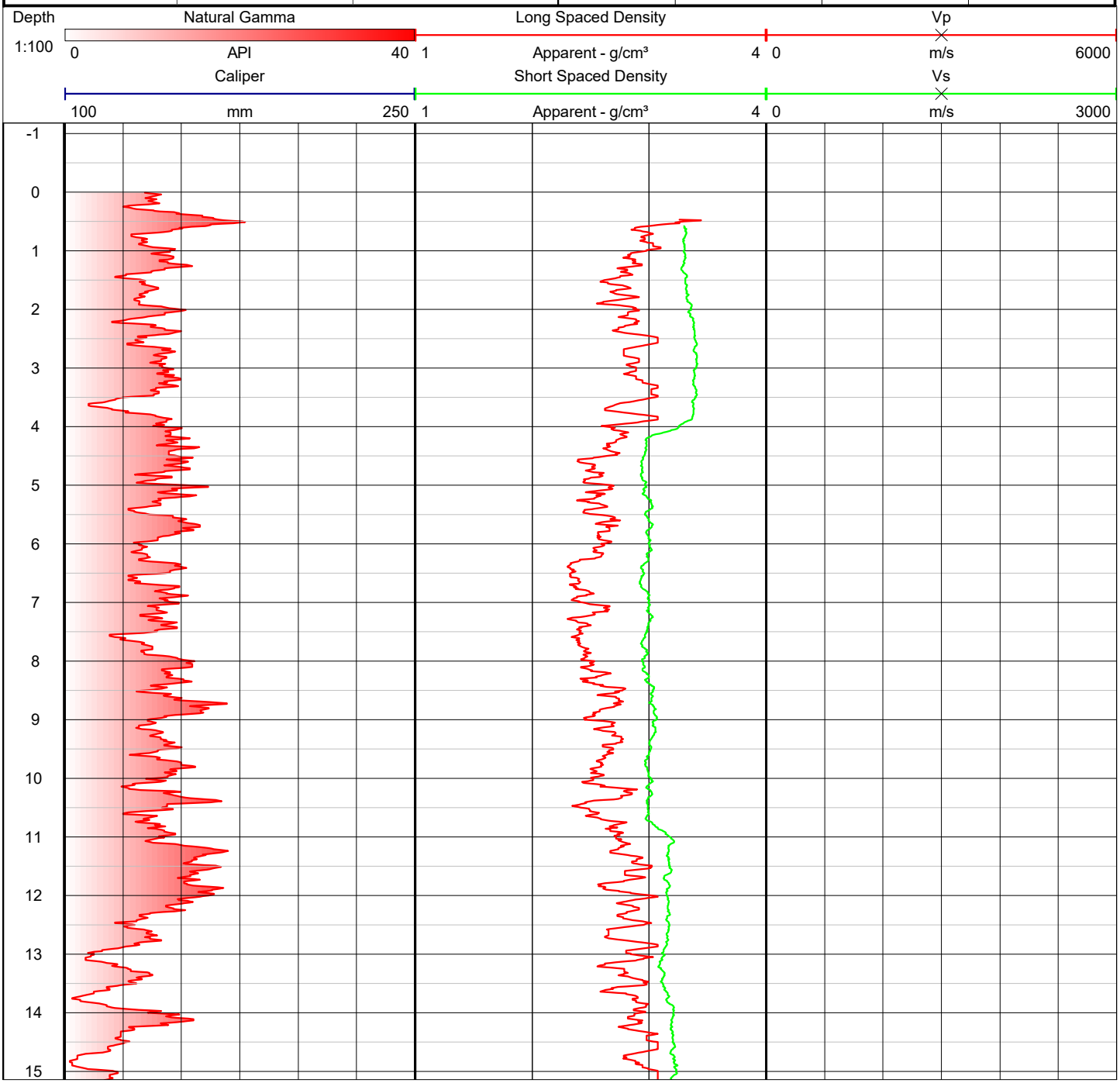
Drilled Depth: (m)	**60.0**	Date:	**14.05.25**
Logged Depth: (m)	**59.6**	Recorded By:	**K. Clark**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**24.7 - 59.6**		
Fluid Level: (m)	**1.0**		

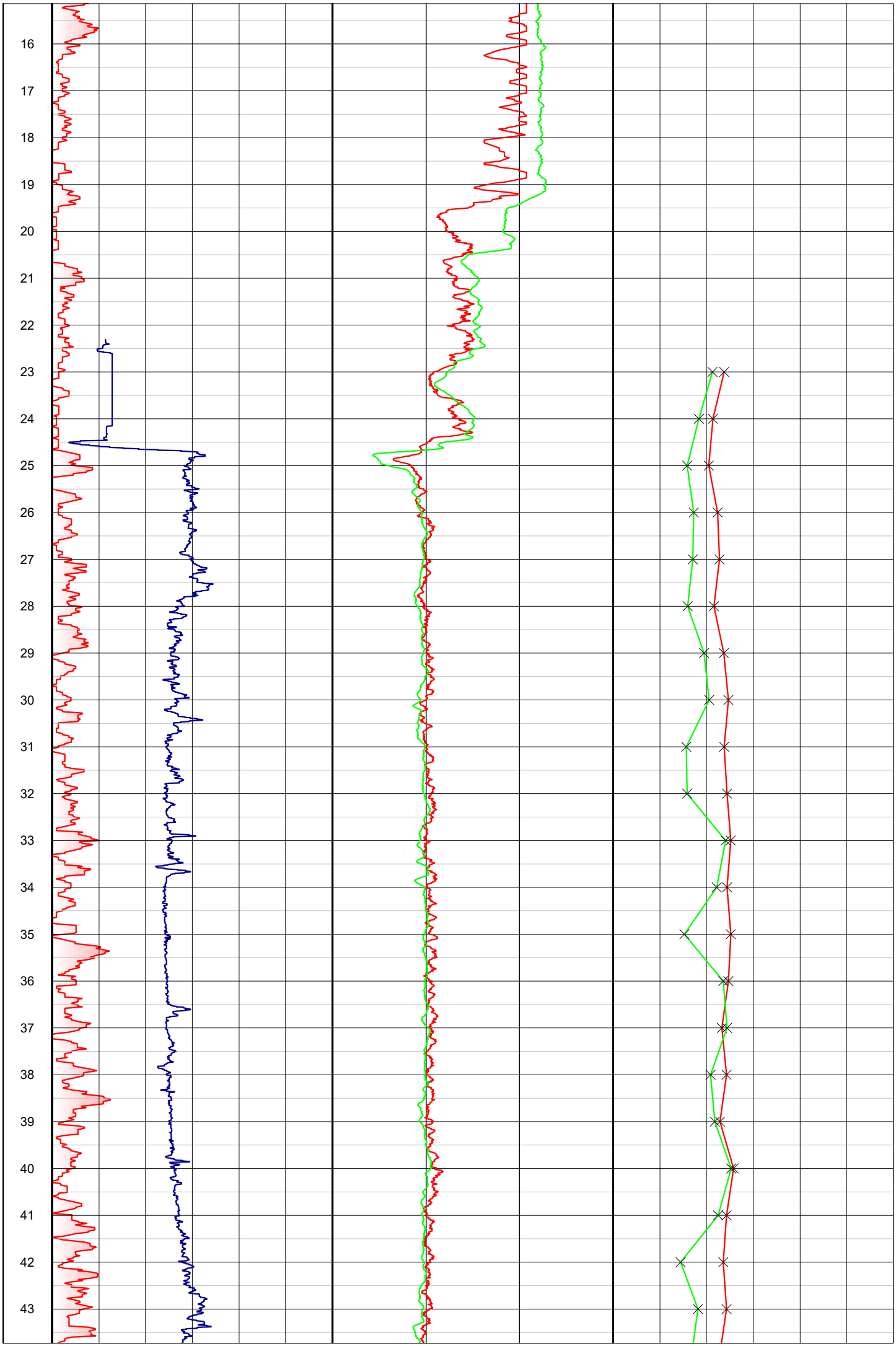
BOREHOLE RECORD

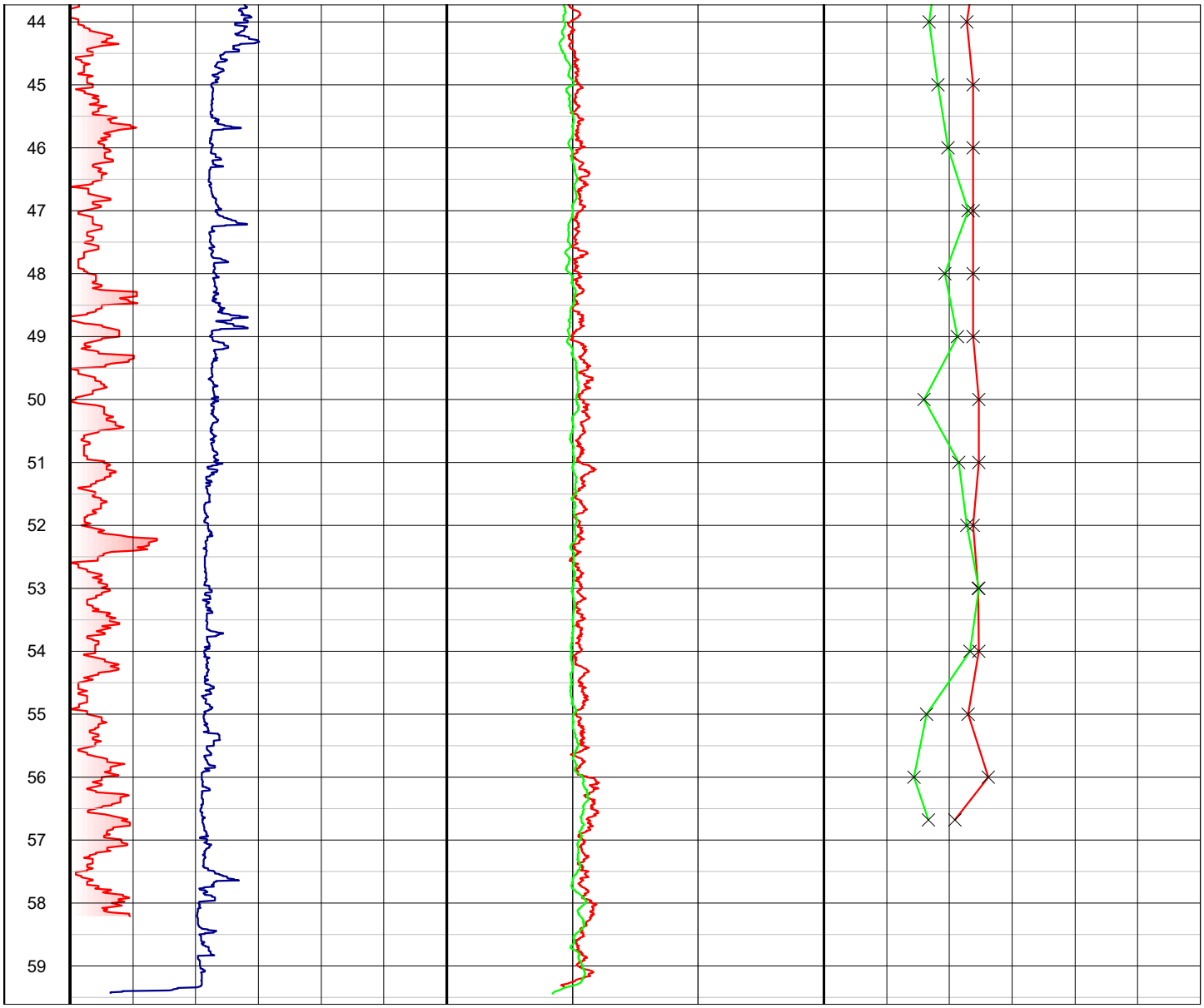
Bit: (mm)	From: (m)	To: (m)
148	**24.7**	**60.0**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Steel	**130**	**-1.03**	**24.7**




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EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Soil Engineering**

Borehole: **BH106**

Log Type: ***Image***

Location: **Gravesend** Area: **London** Grid Ref: Elevation:

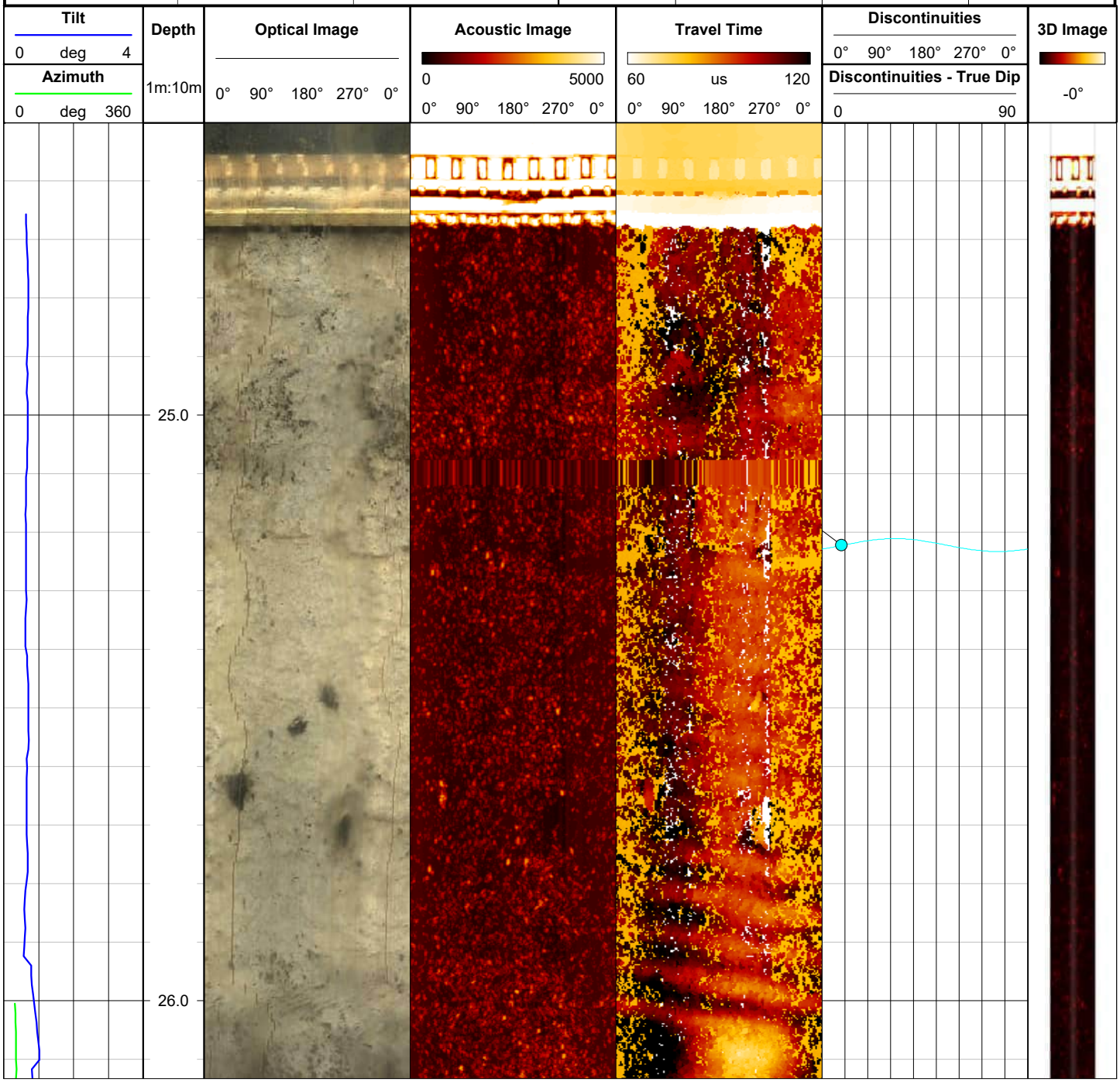
Drilled Depth: (m)	**60.0**	Date:	**14.05.25**
Logged Depth: (m)	**59.6**	Recorded By:	**K. Clark**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**24.7 - 59.6**		
Fluid Level: (m)	**1.0**		

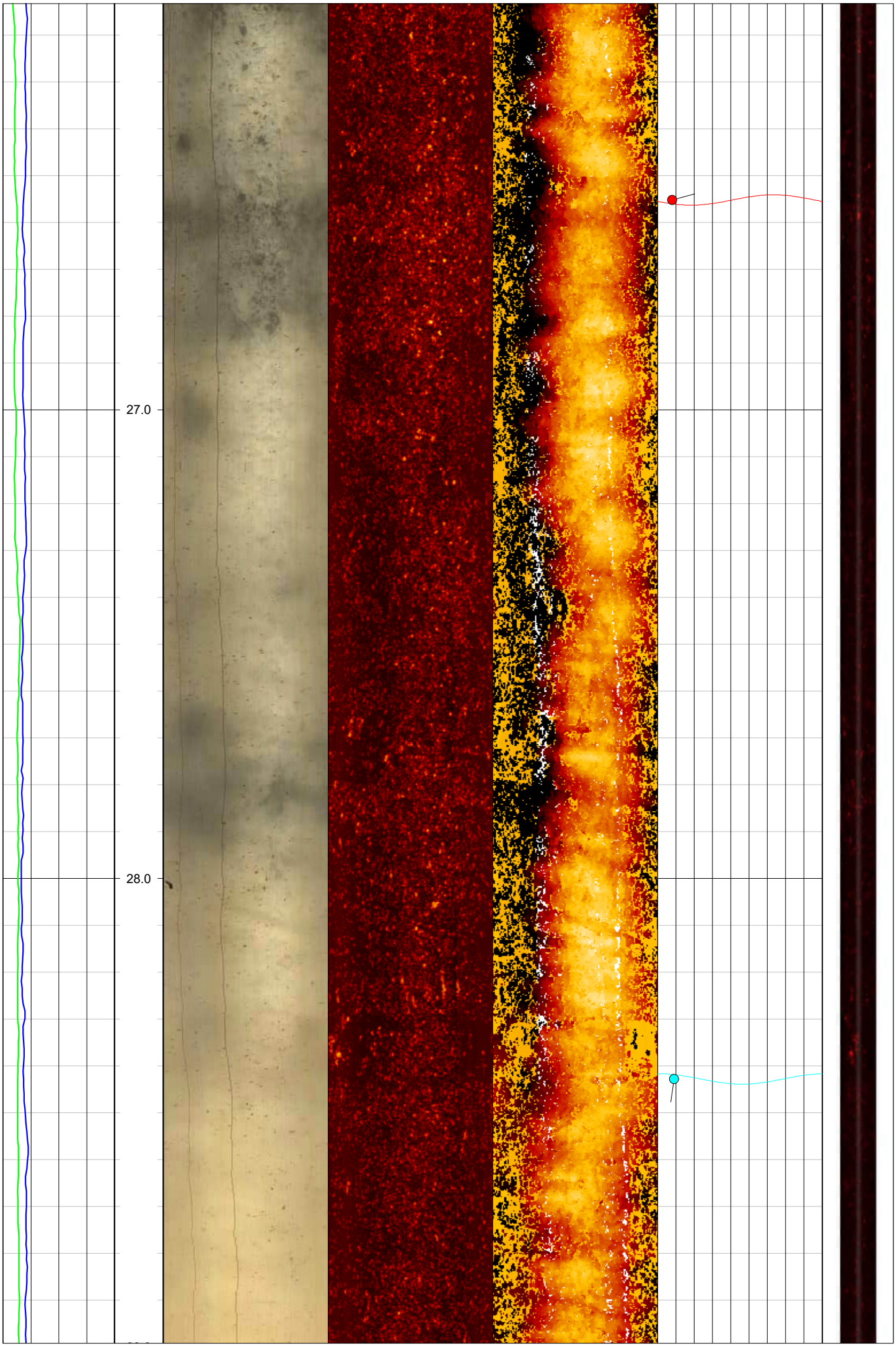
BOREHOLE RECORD

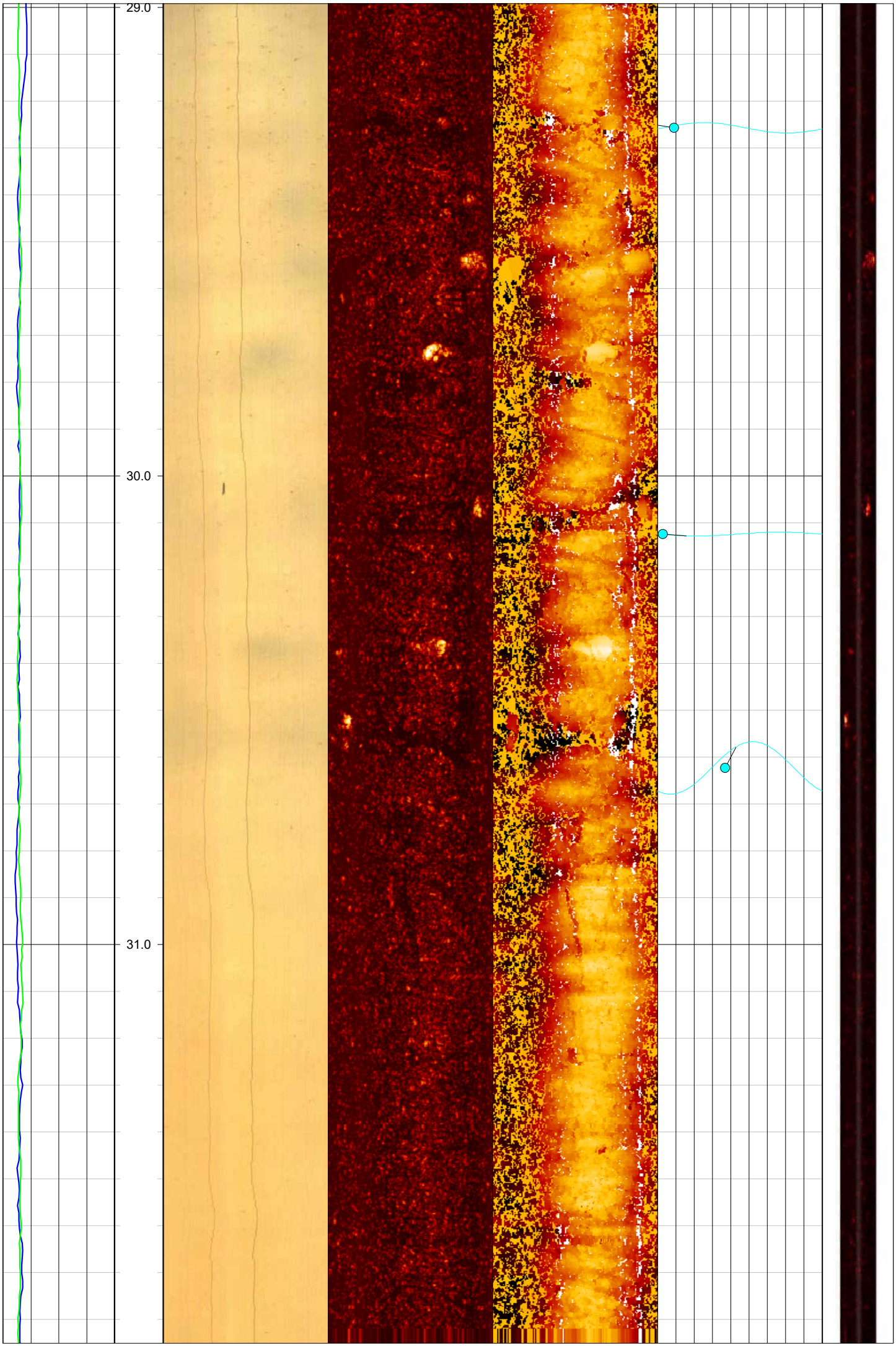
Bit: (mm)	From: (m)	To: (m)
148	**24.7**	**60.0**

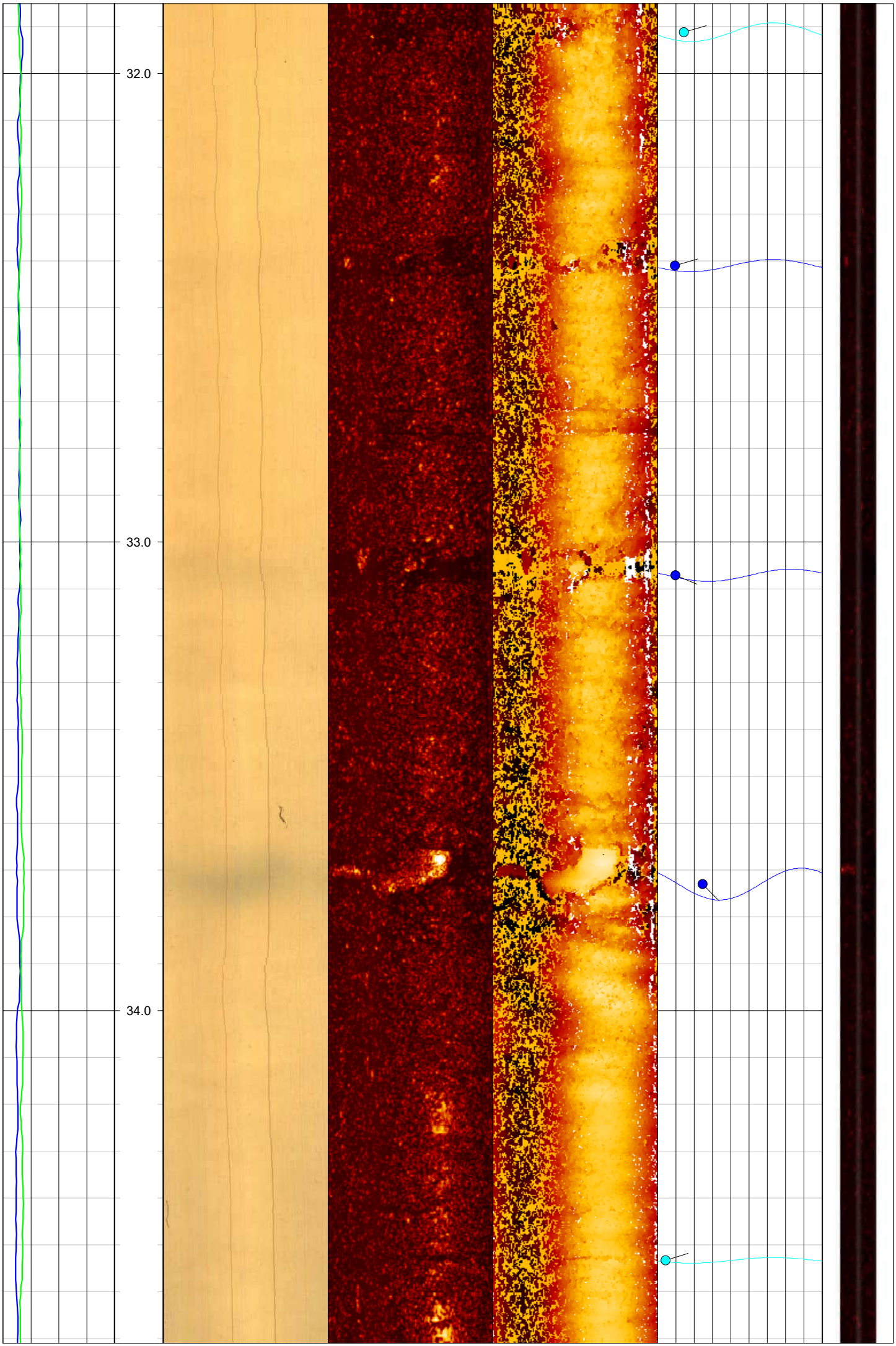
CASING RECORD

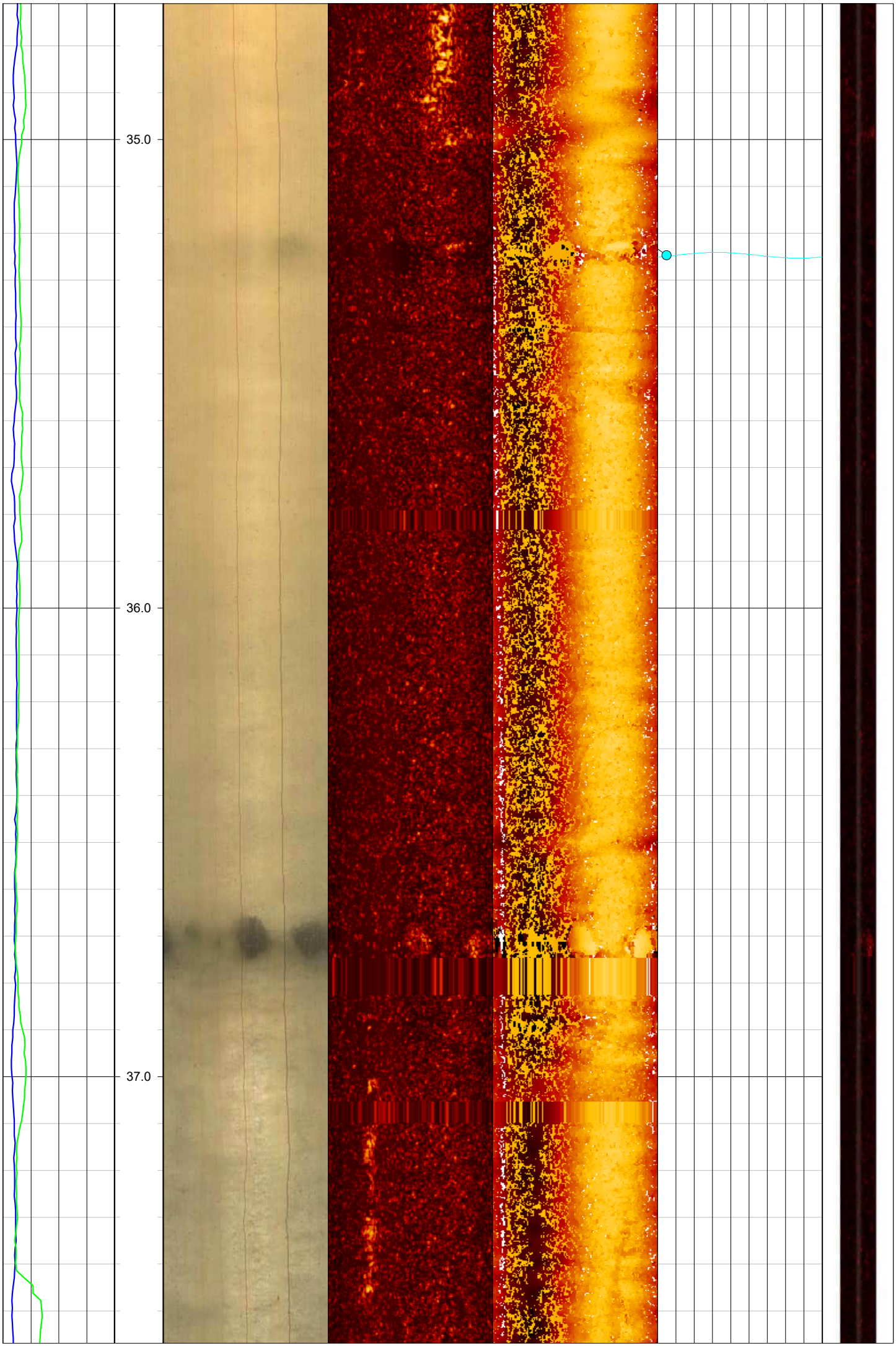
Type	Size: (mm)	From: (m)	To: (m)
Steel	**130**	**-1.03**	**24.7**

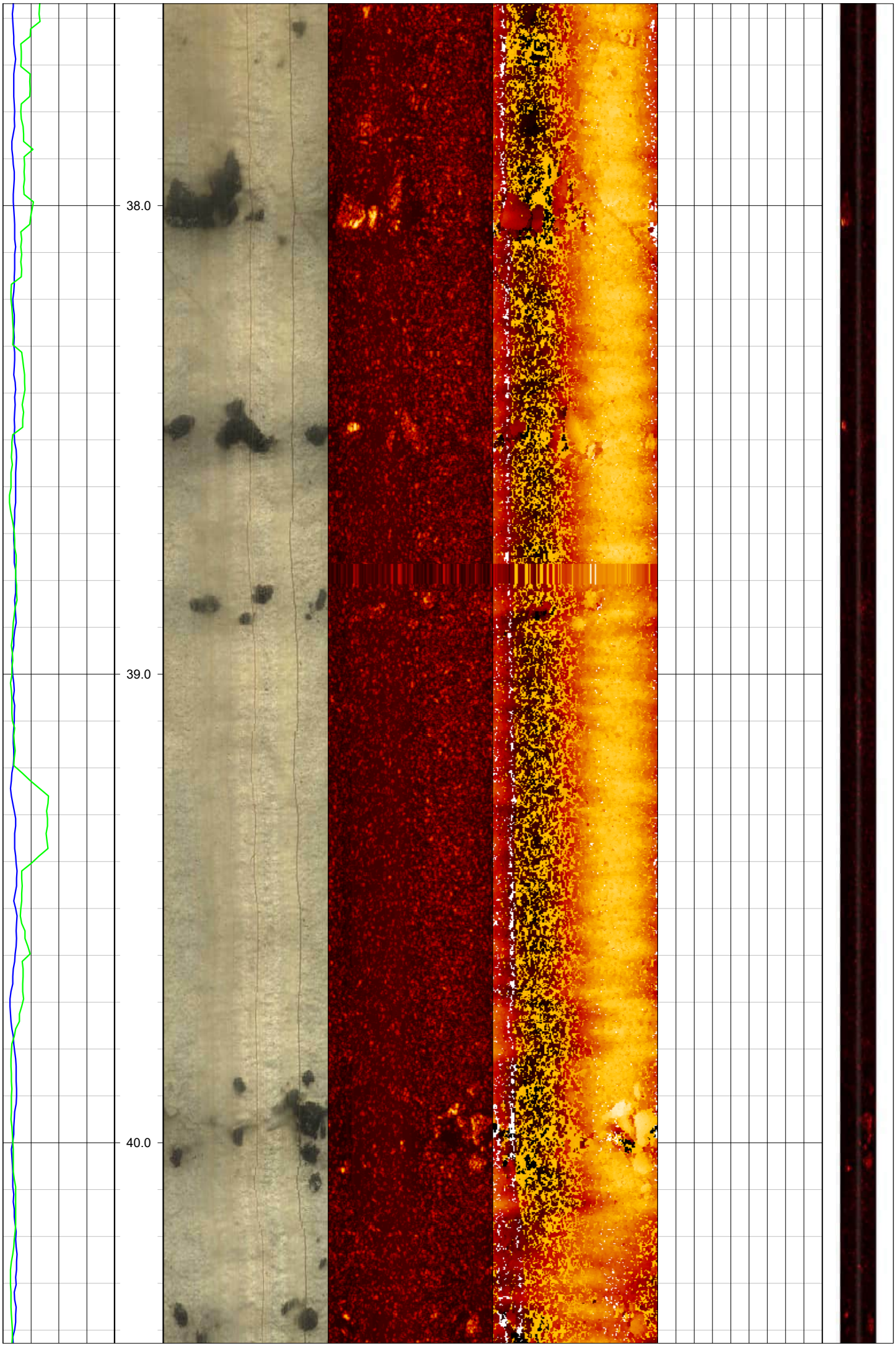


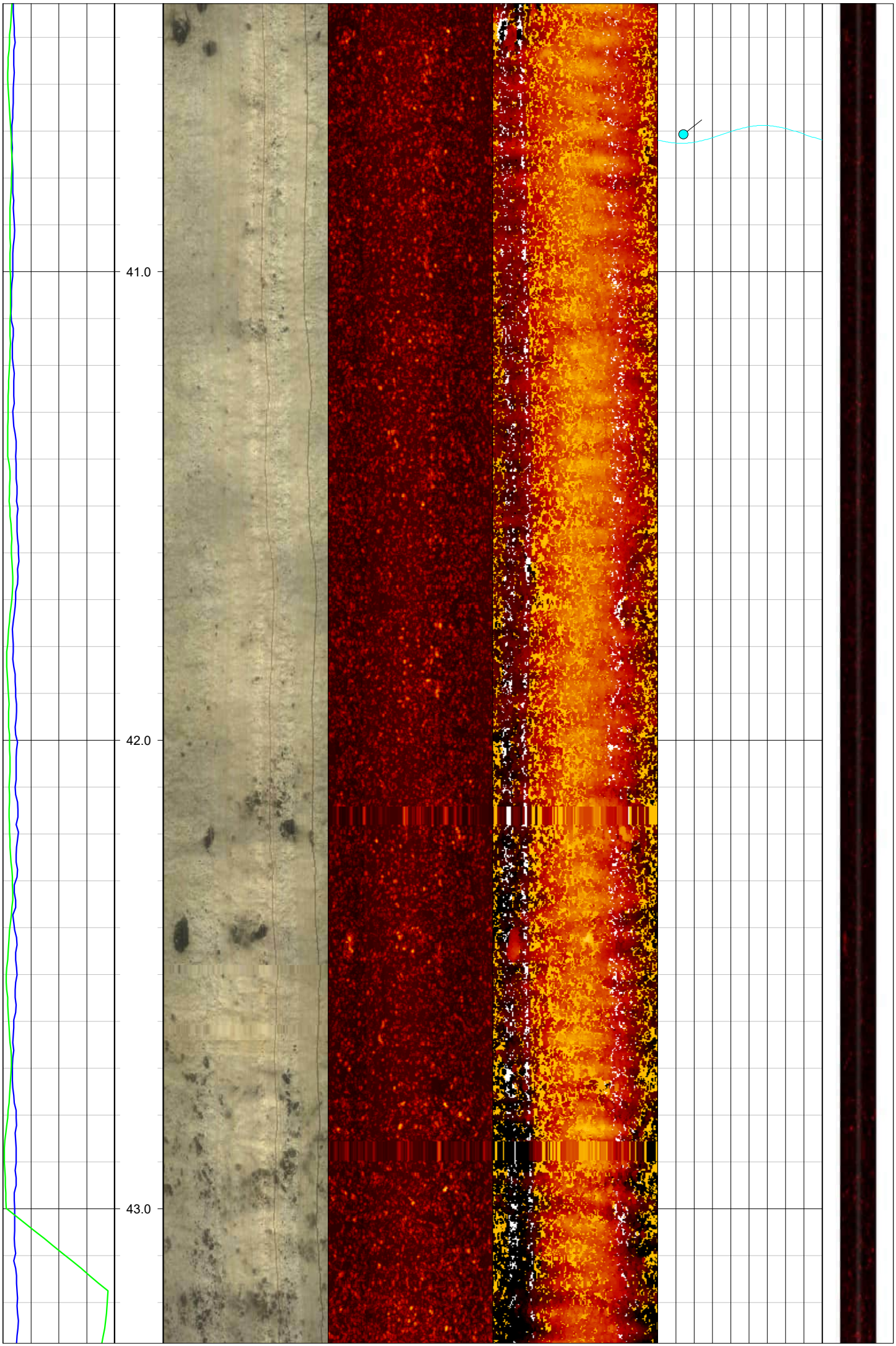

27.0
28.0

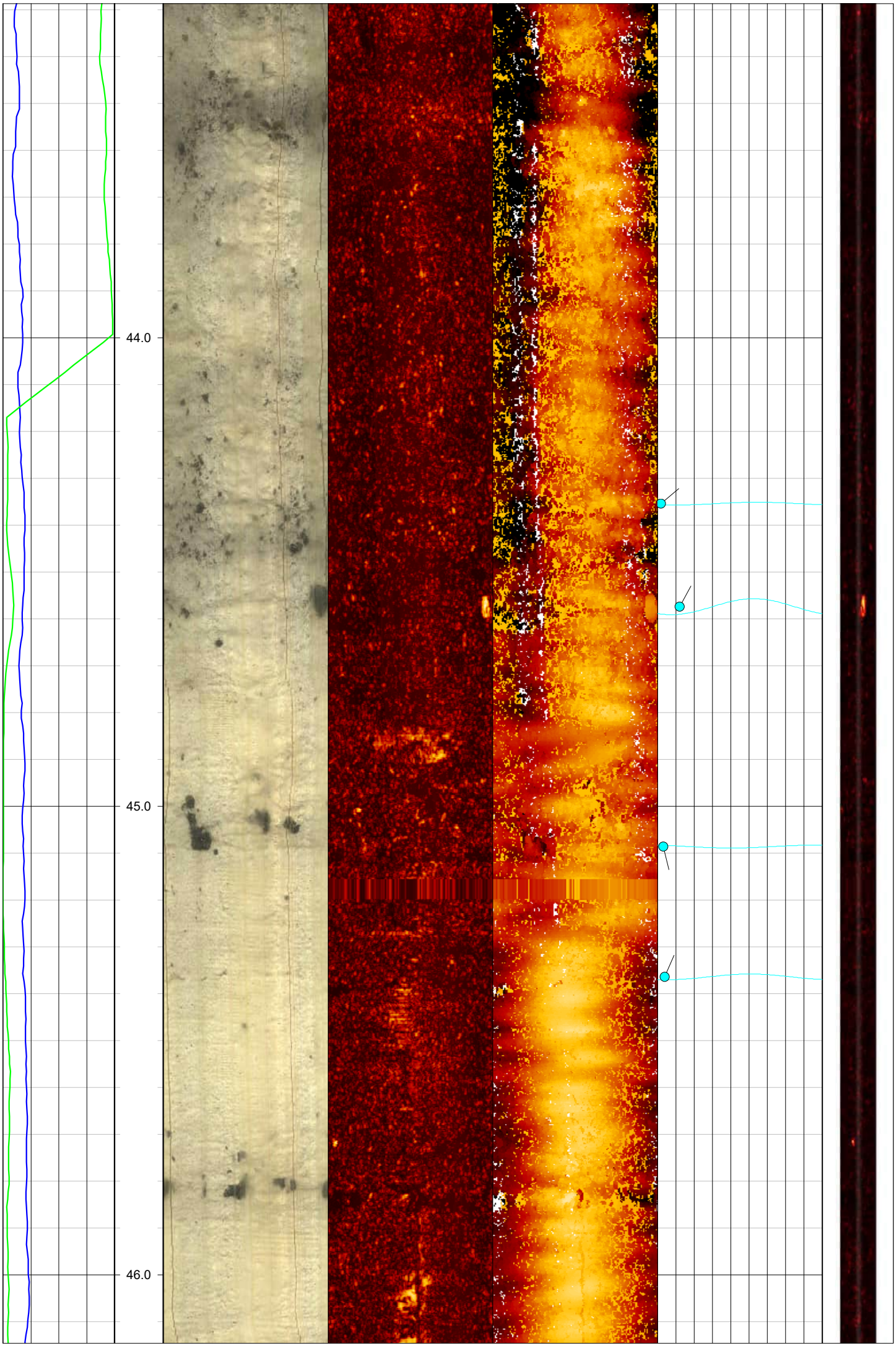

29.0
30.0
31.0

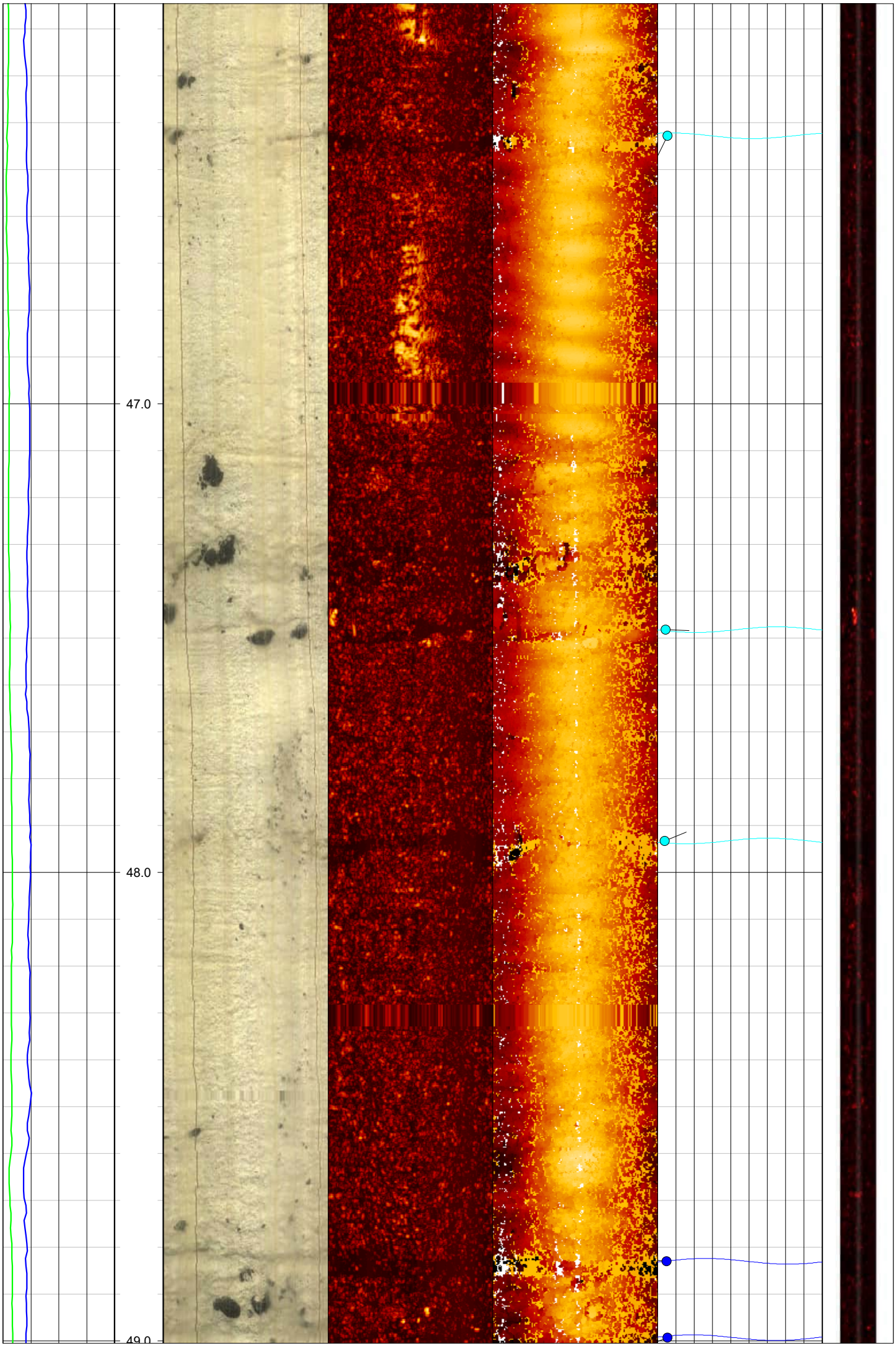

32.0
33.0
34.0

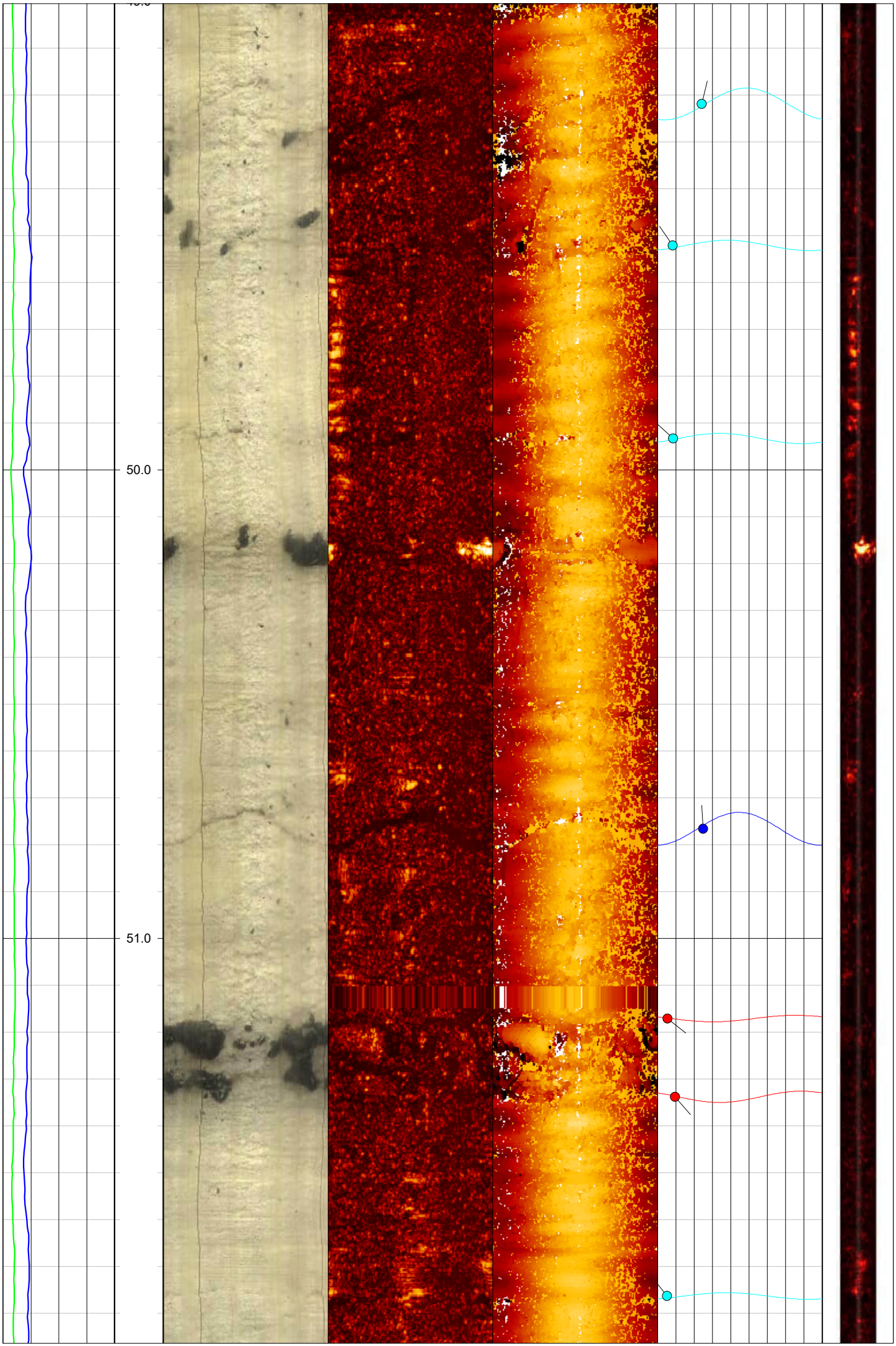

35.0
36.0
37.0

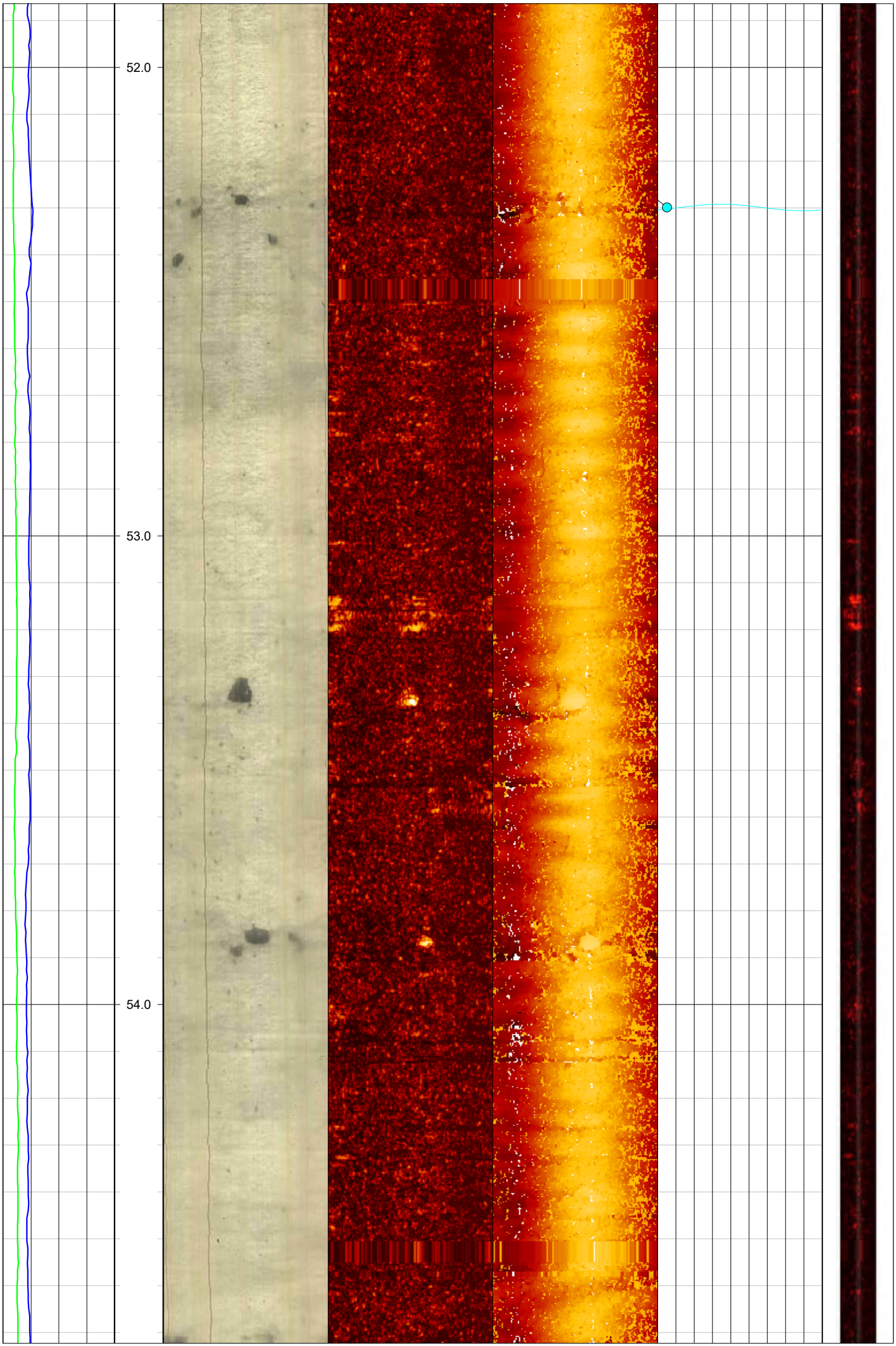

38.0
39.0
40.0

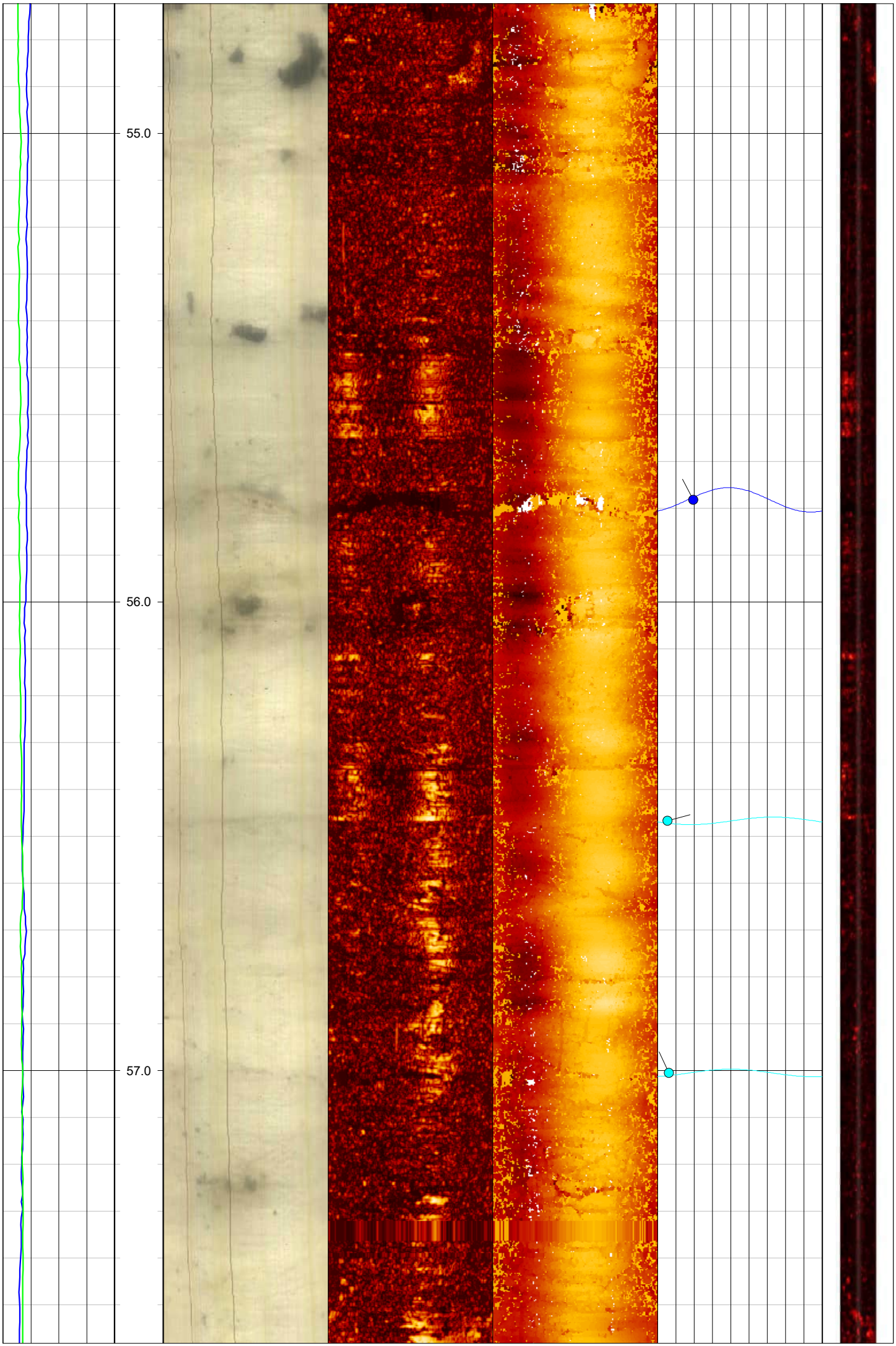

41.0
42.0
43.0

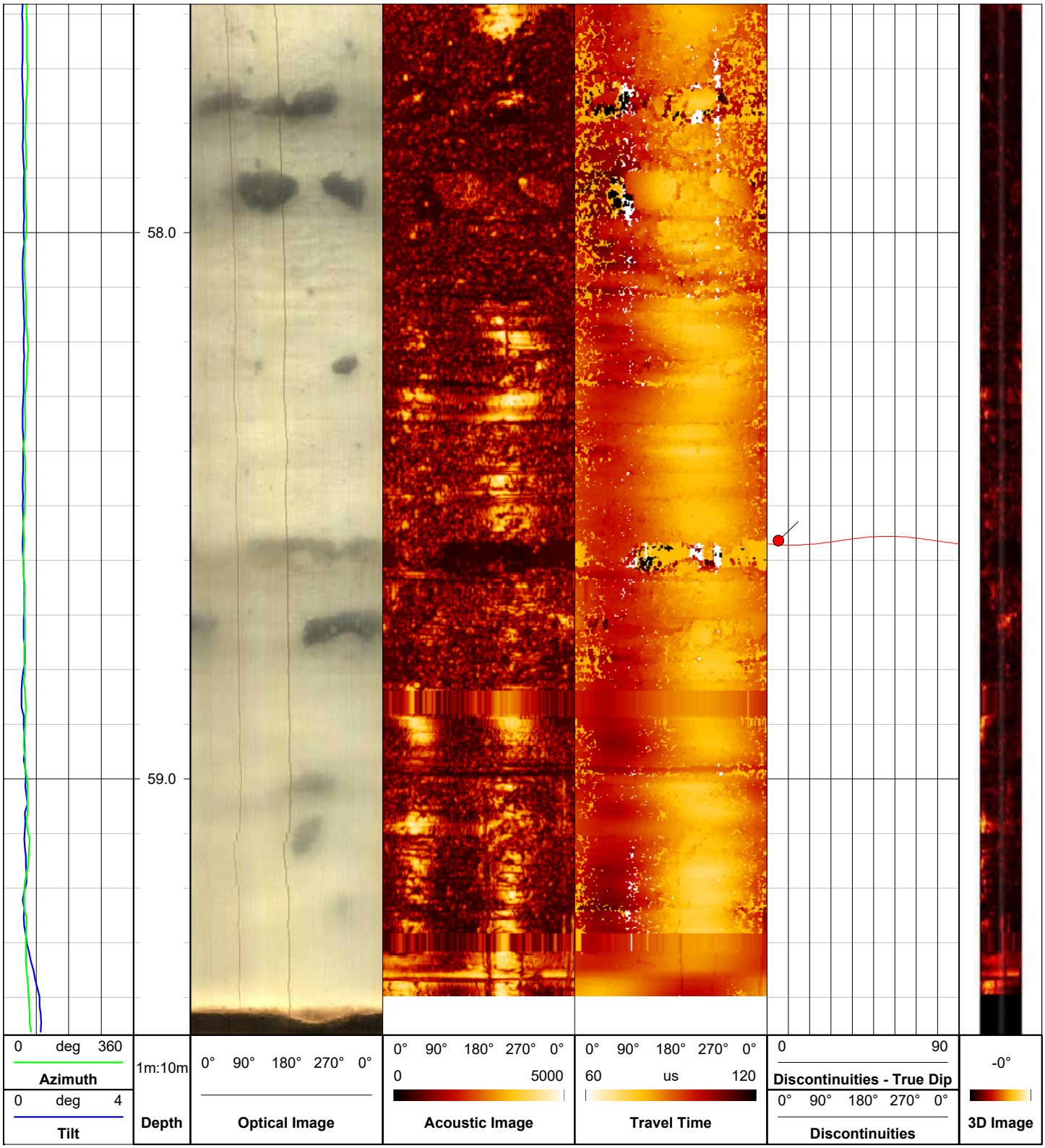

44.0
45.0
46.0


47.0
48.0
49.0


50.0
51.0


52.0
53.0
54.0


55.0
56.0
57.0


58.0
59.0
0 deg 360
Azimuth
0 deg 4
Tilt
1m:10m
Depth
0° 90° 180° 270° 0°
Optical Image
0° 90° 180° 270° 0°
0 5000
Acoustic Image
0° 90° 180° 270° 0°
60 us 120
Travel Time
0 90
Discontinuities - True Dip
0° 90° 180° 270° 0°
Discontinuities
-0°
3D Image

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Soil Engineering**

Borehole: **BH107**

Log Type: ***Composite***

Location: **Gravesend** Area: Grid Ref: Elevation:

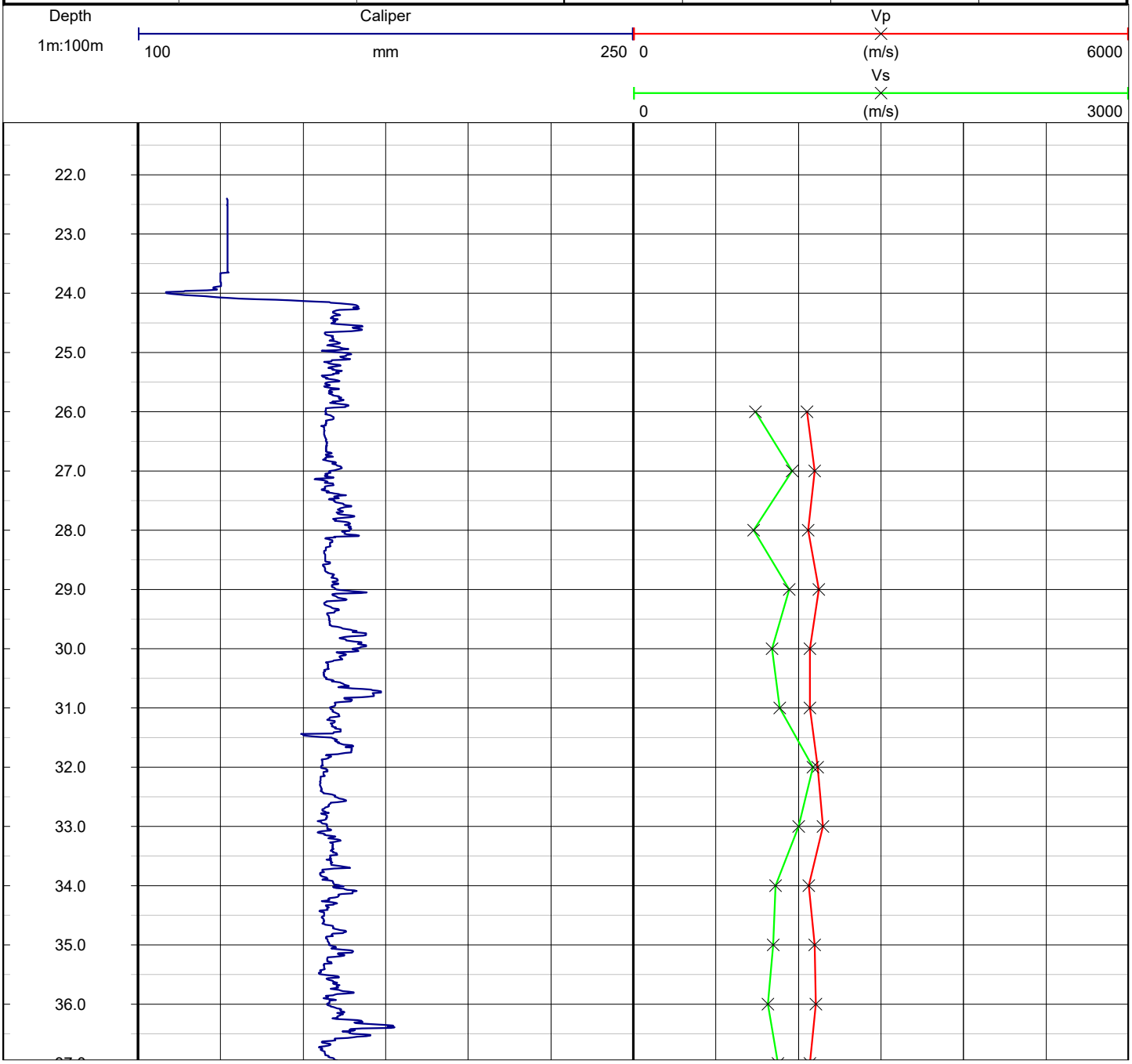
Drilled Depth: (m)	**60.0**	Date:	**07.07.25**
Logged Depth: (m)	**60.0**	Recorded By:	**C. Clinton**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**23.8 - 59.2**		
Fluid Level: (m)			

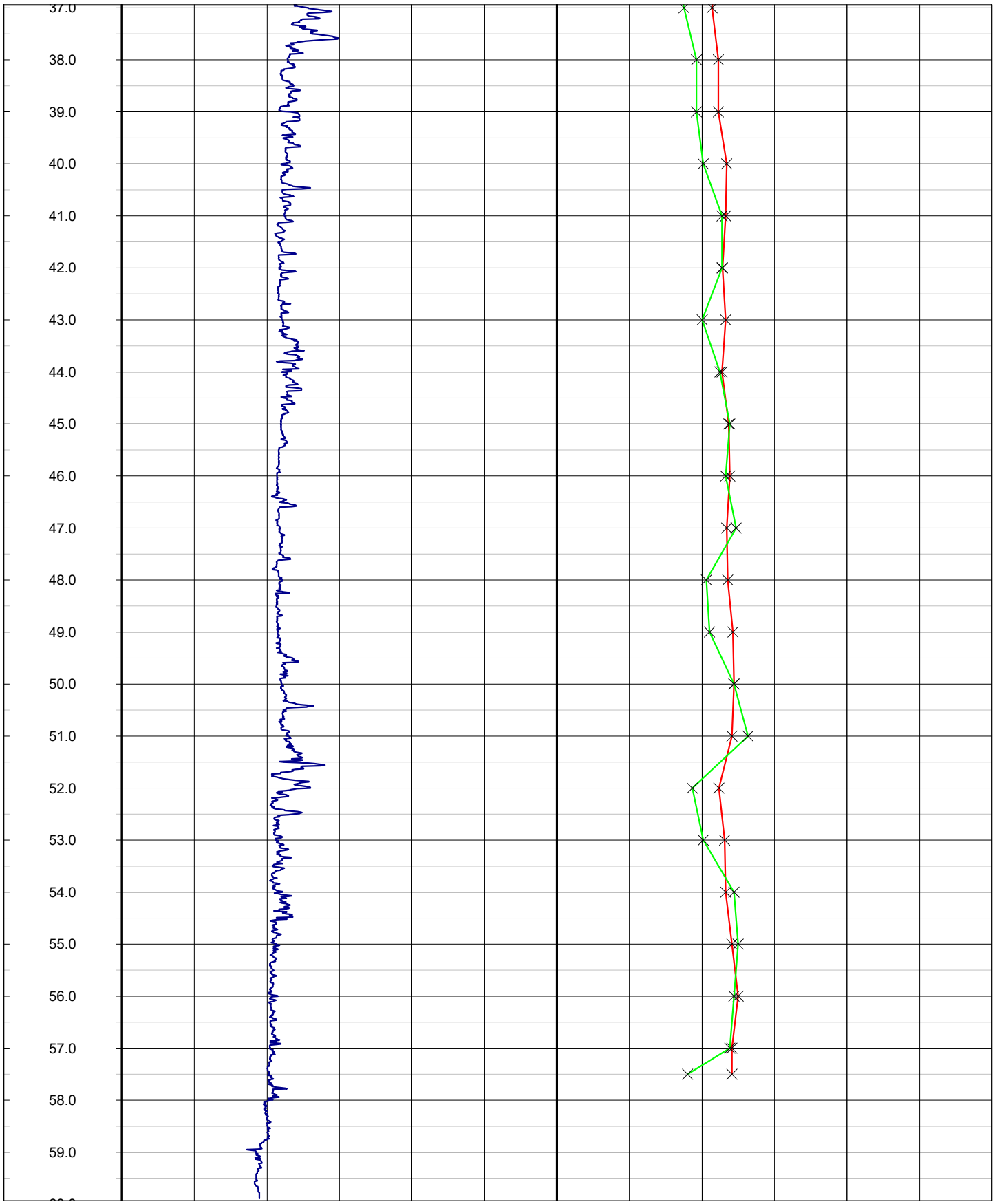
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
147	**23.8**	**60.0**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Steel	**130**	**-0.3**	**23.8**




37.0
38.0
39.0
40.0
41.0
42.0
43.0
44.0
45.0
46.0
47.0
48.0
49.0
50.0
51.0
52.0
53.0
54.0
55.0
56.0
57.0
58.0
59.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Soil Engineering**

Borehole: **BH107**

Log Type: ***Image***

Location: **Gravesend** Area: Grid Ref: Elevation:

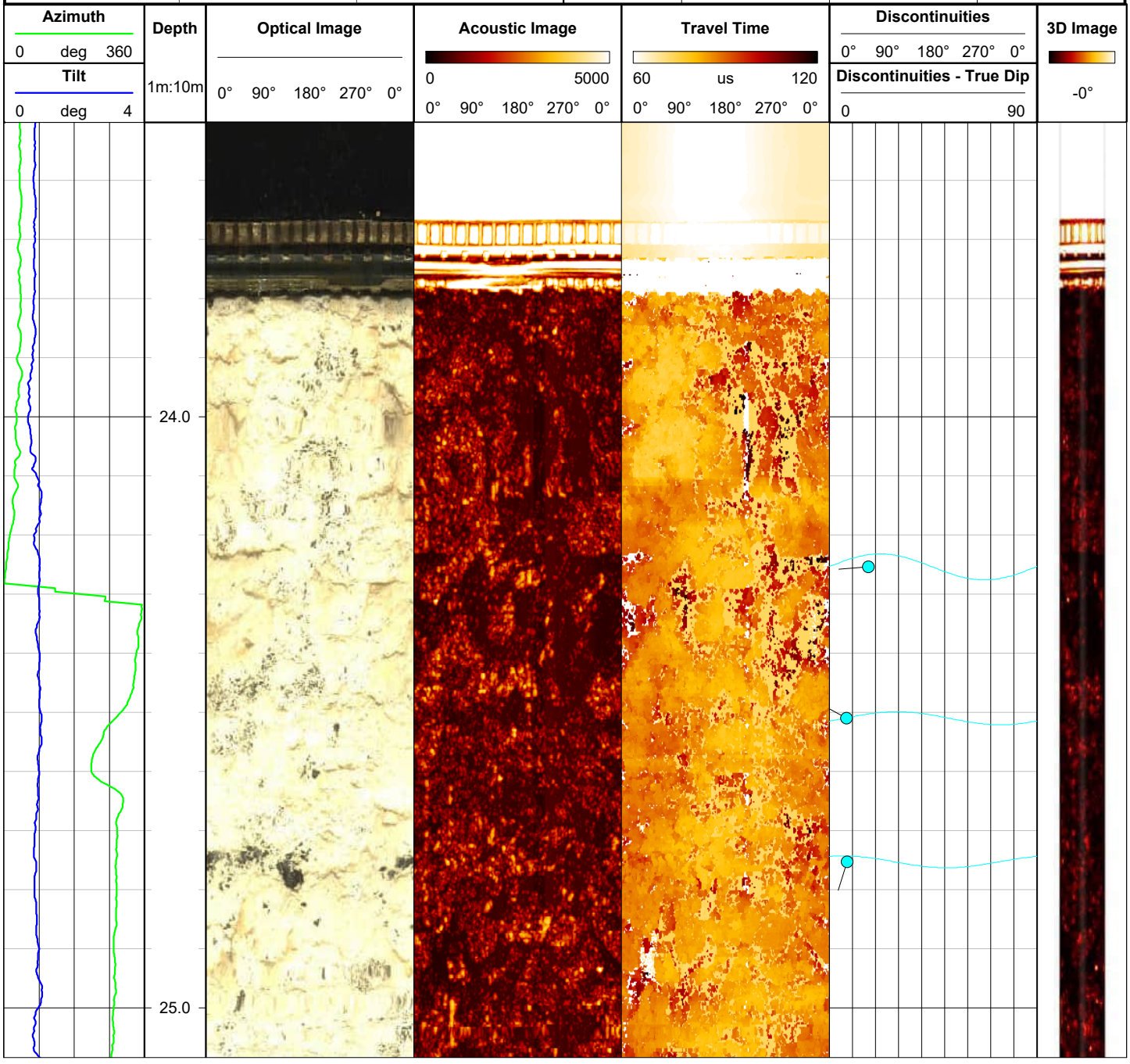
Drilled Depth: (m)	**60.0**	Date:	**07.07.25**
Logged Depth: (m)	**60.0**	Recorded By:	**C. Clinton**
Logging Datum:	**Ground Level**	Remarks:	Cloudy optical image below 40.0m
Logged Interval: (m)	**23.8 - 59.2**		
Fluid Level: (m)			

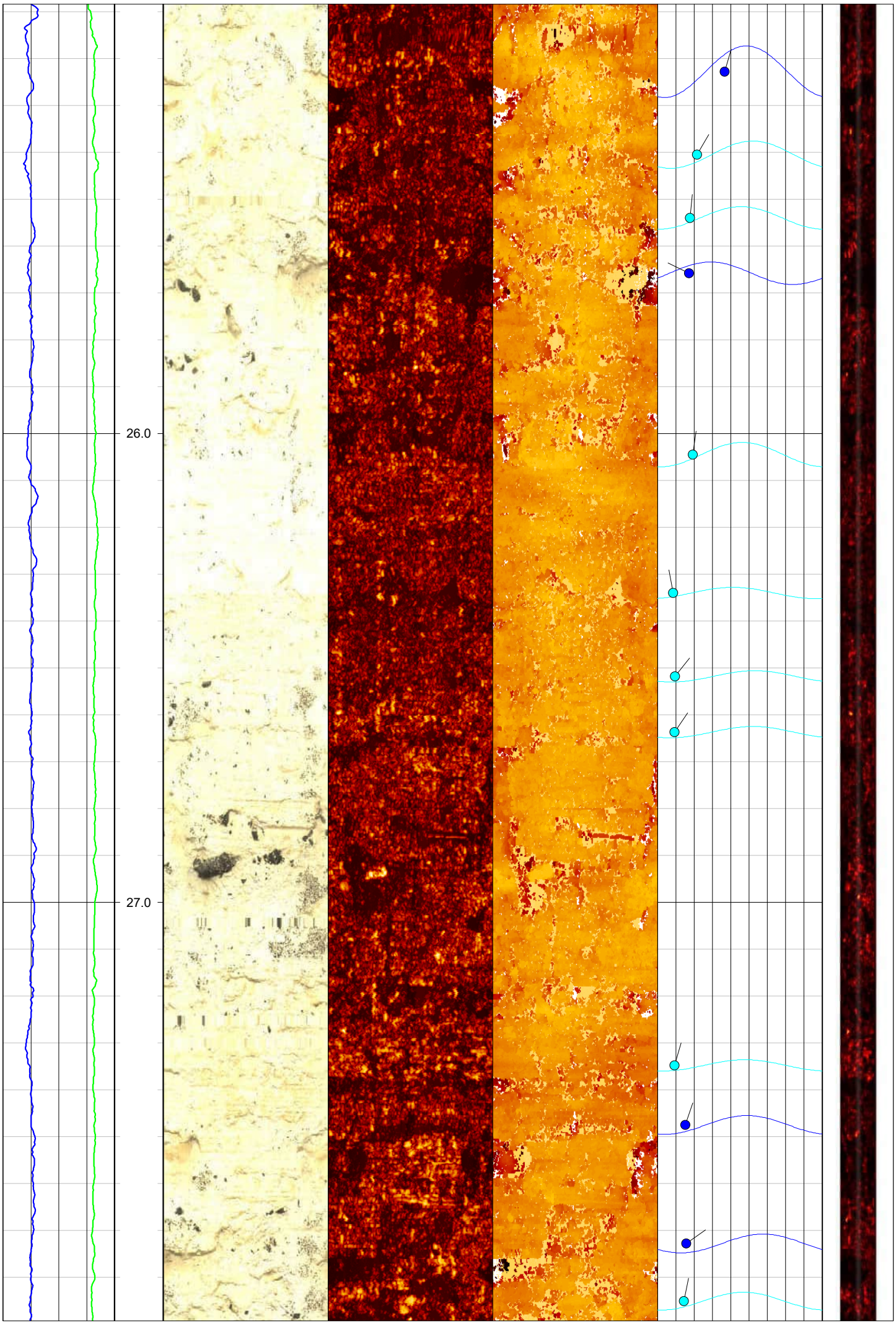
BOREHOLE RECORD

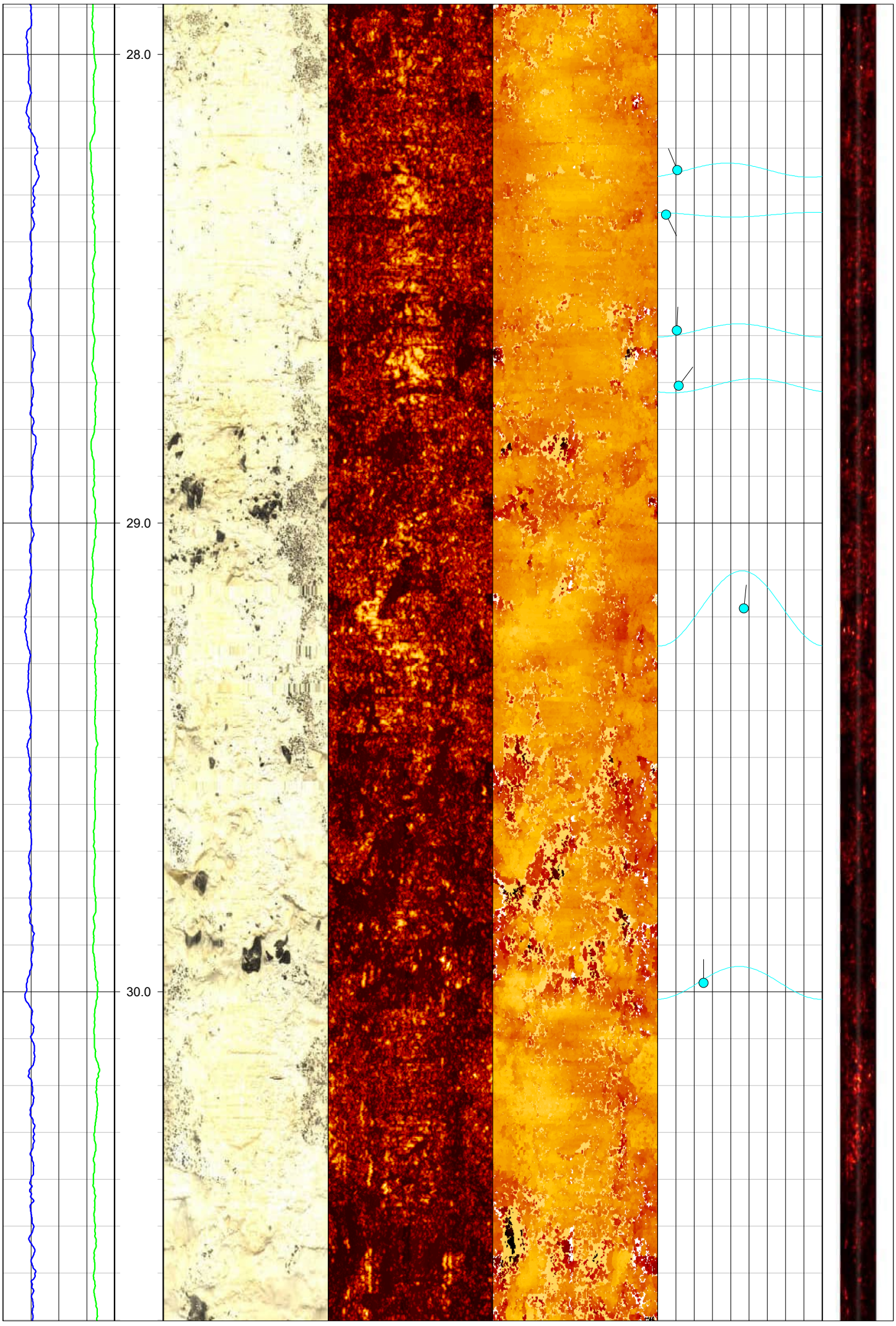
Bit: (mm)	From: (m)	To: (m)
147	**23.8**	**60.0**

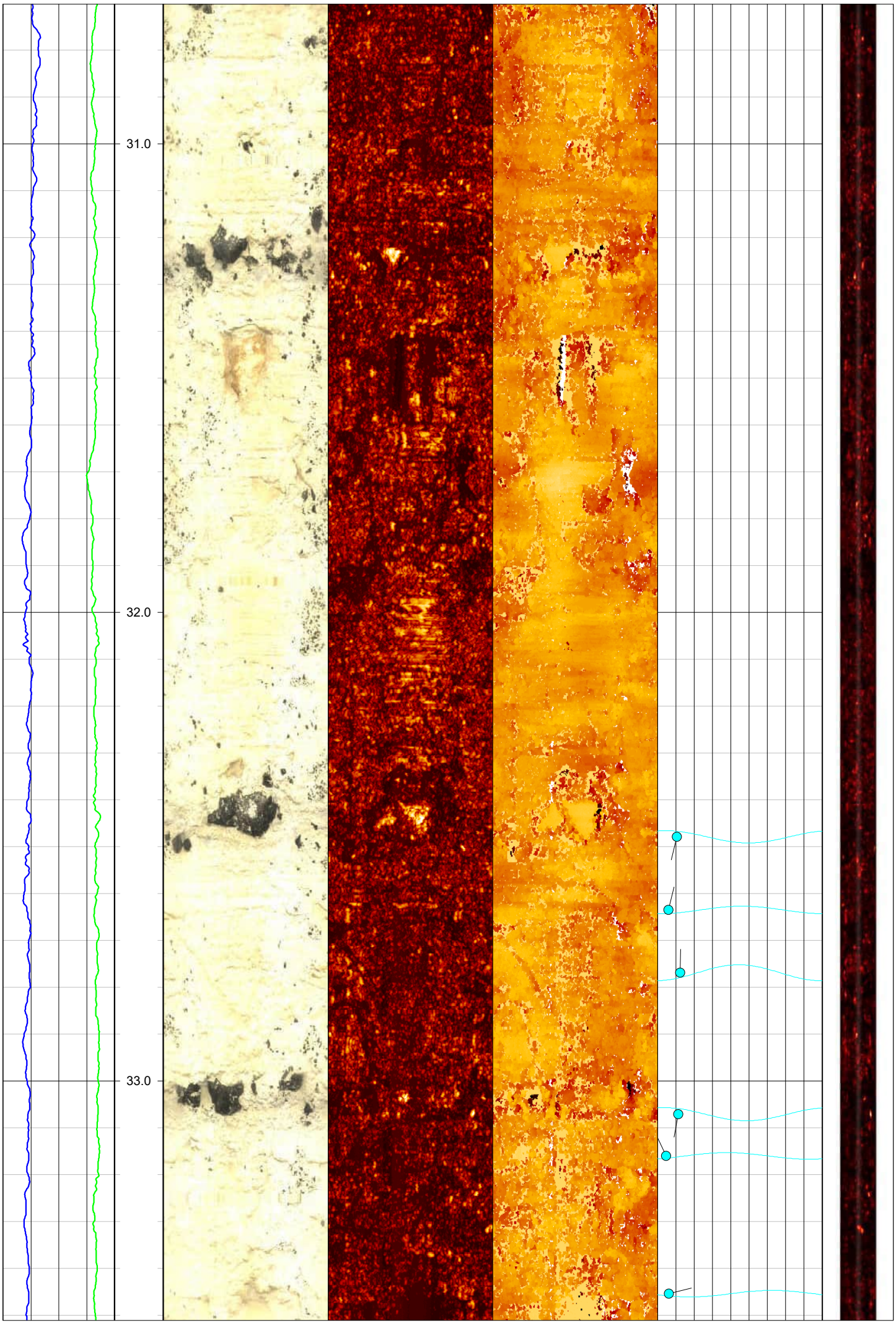
CASING RECORD

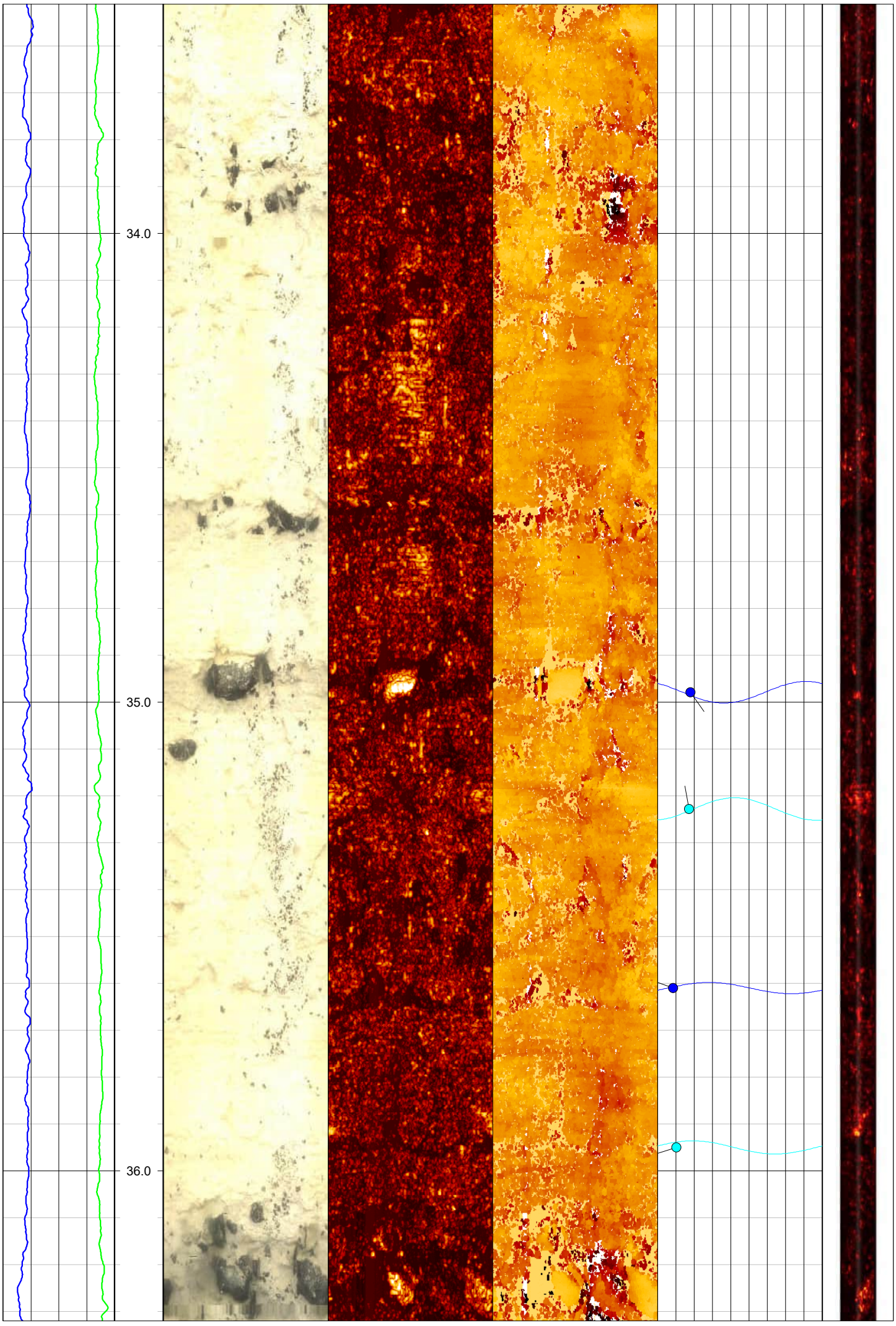
Type	Size: (mm)	From: (m)	To: (m)
Steel	**130**	**-0.3**	**23.8**

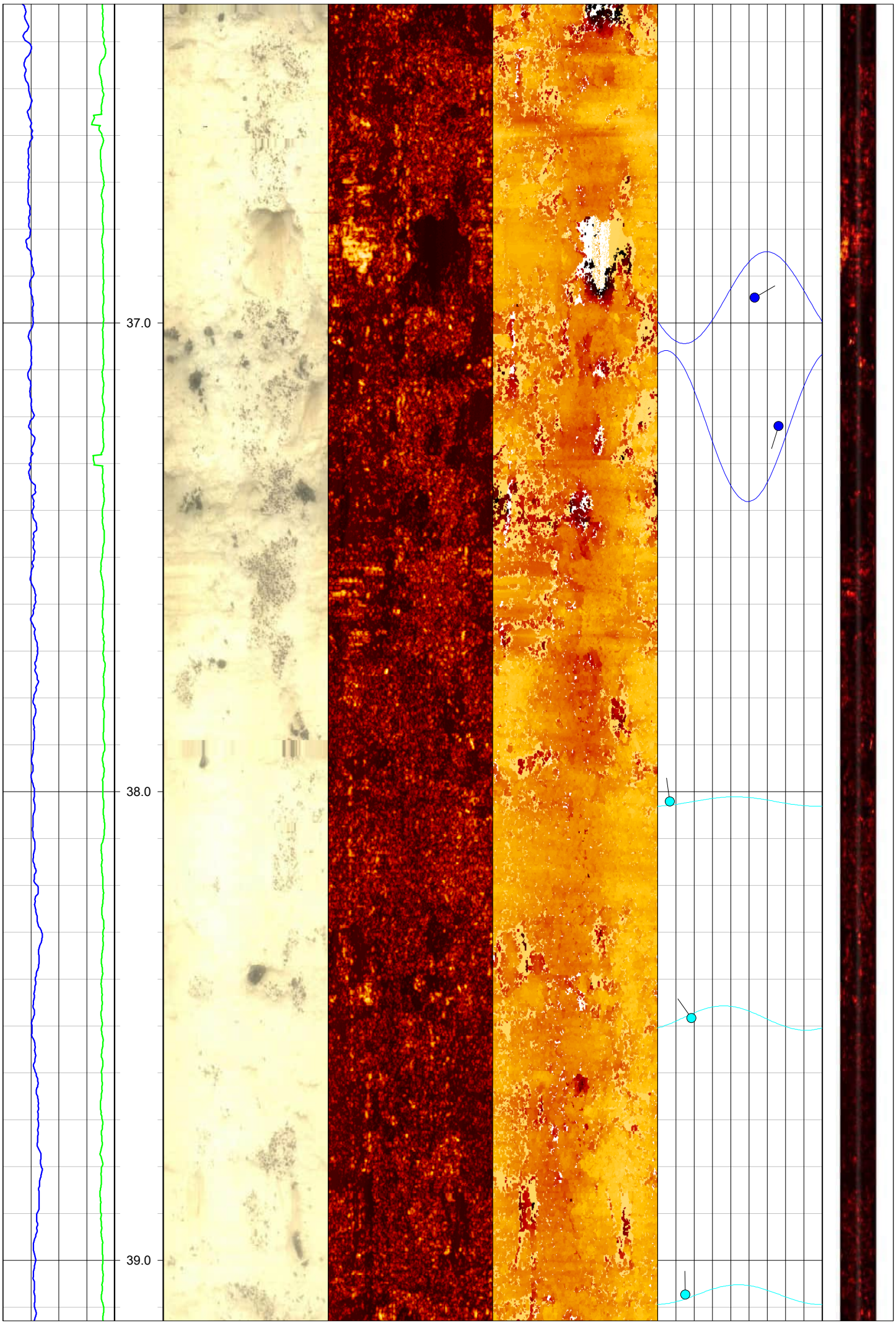


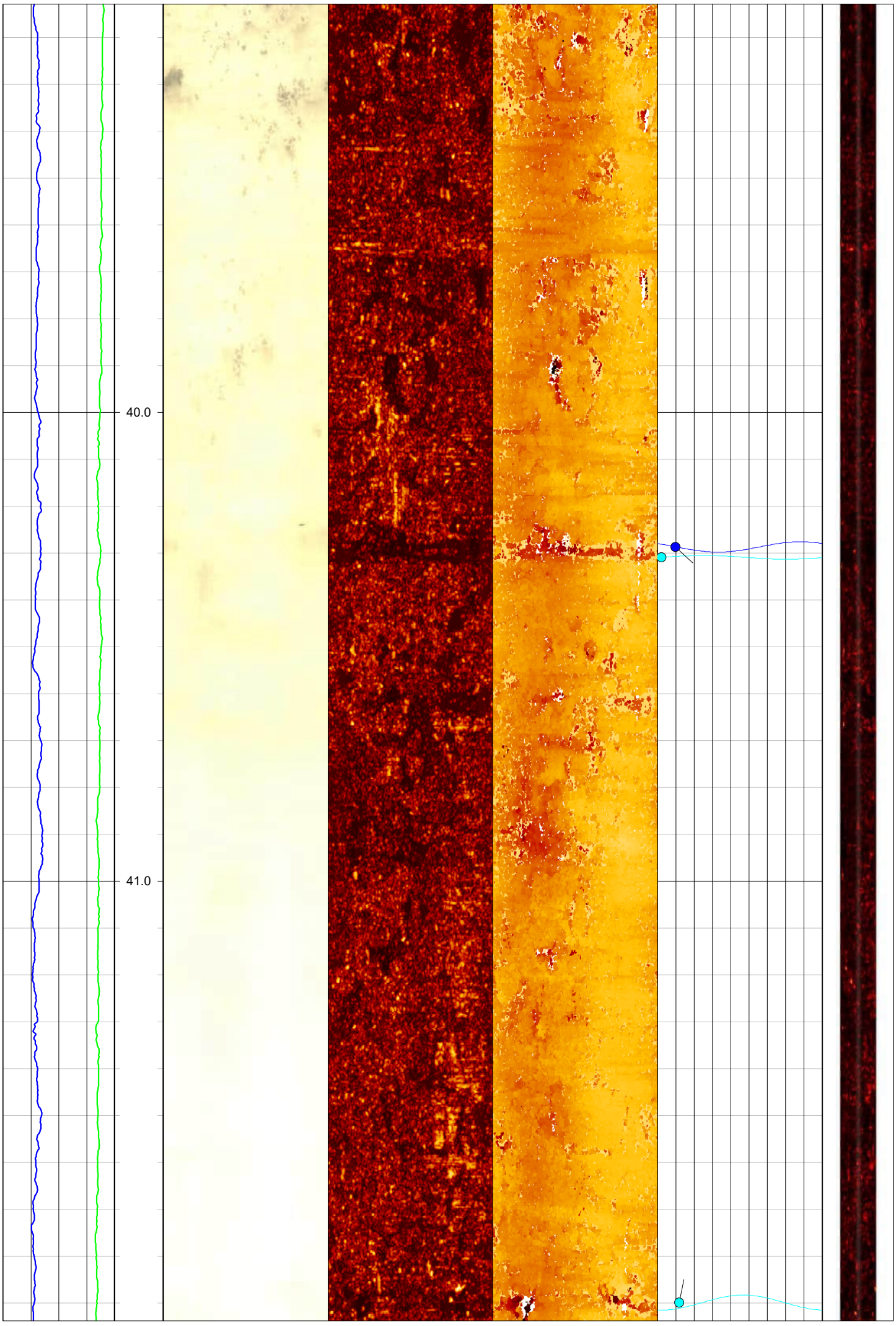

26.0
27.0

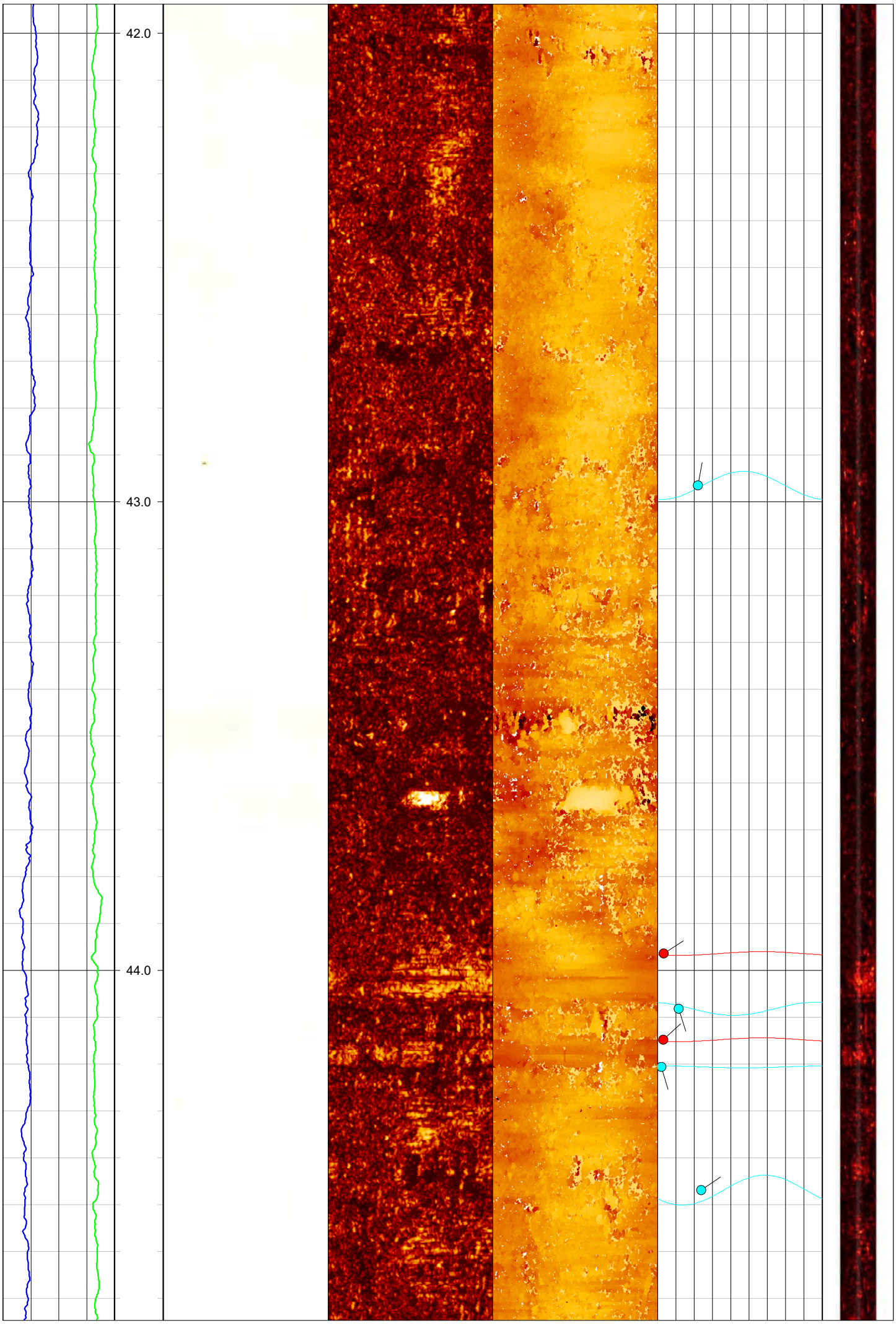

28.0
29.0
30.0

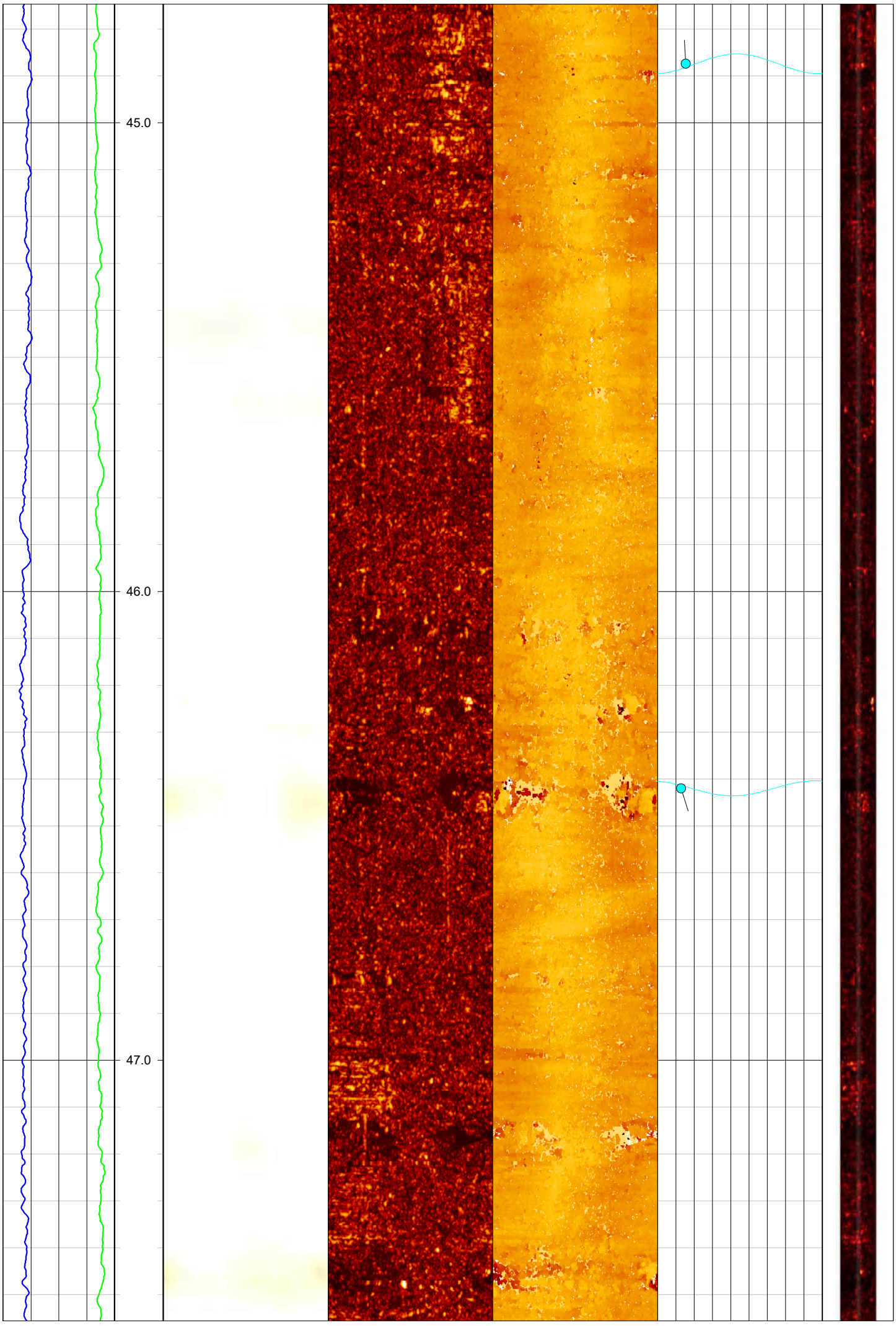

31.0
32.0
33.0

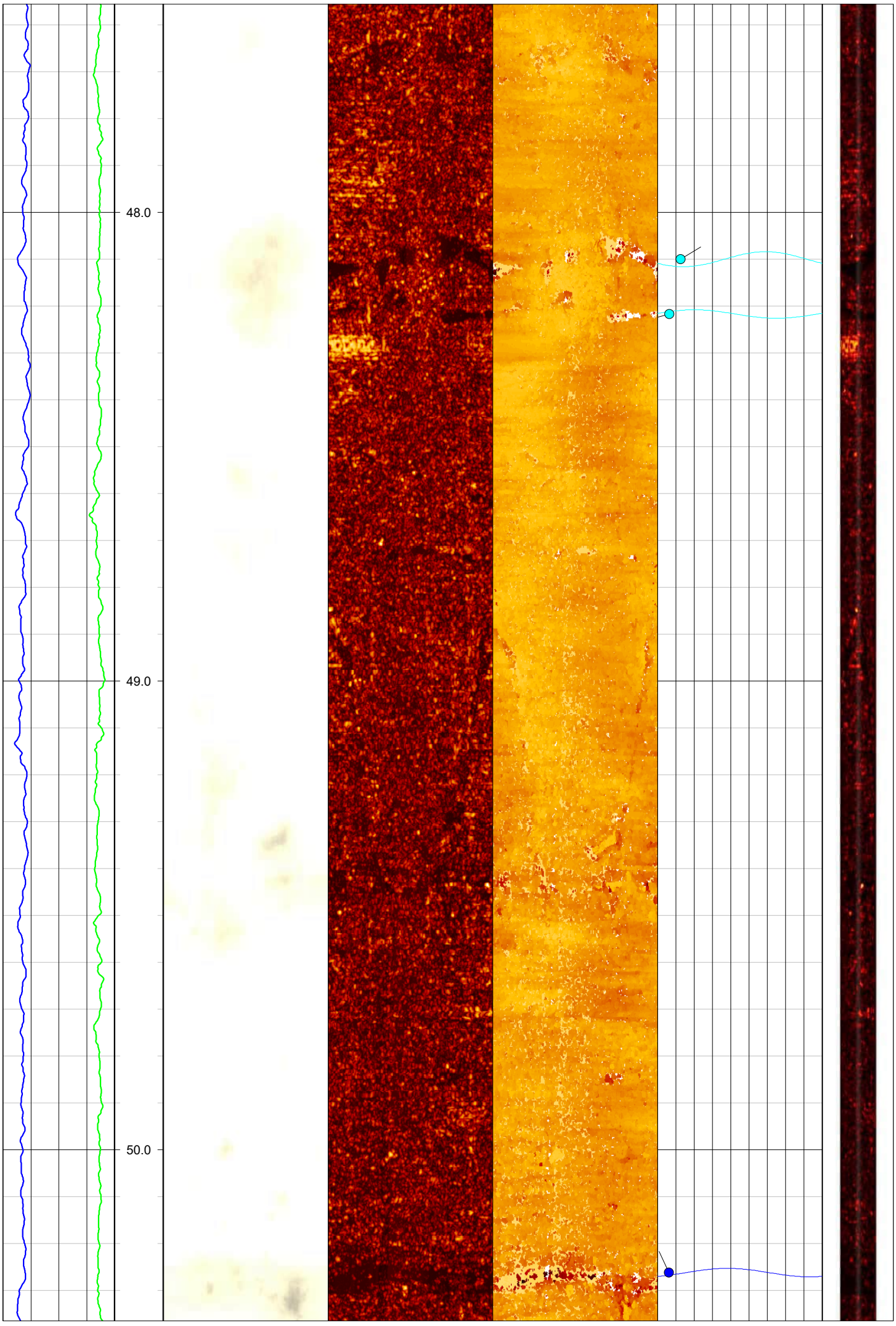

34.0
35.0
36.0

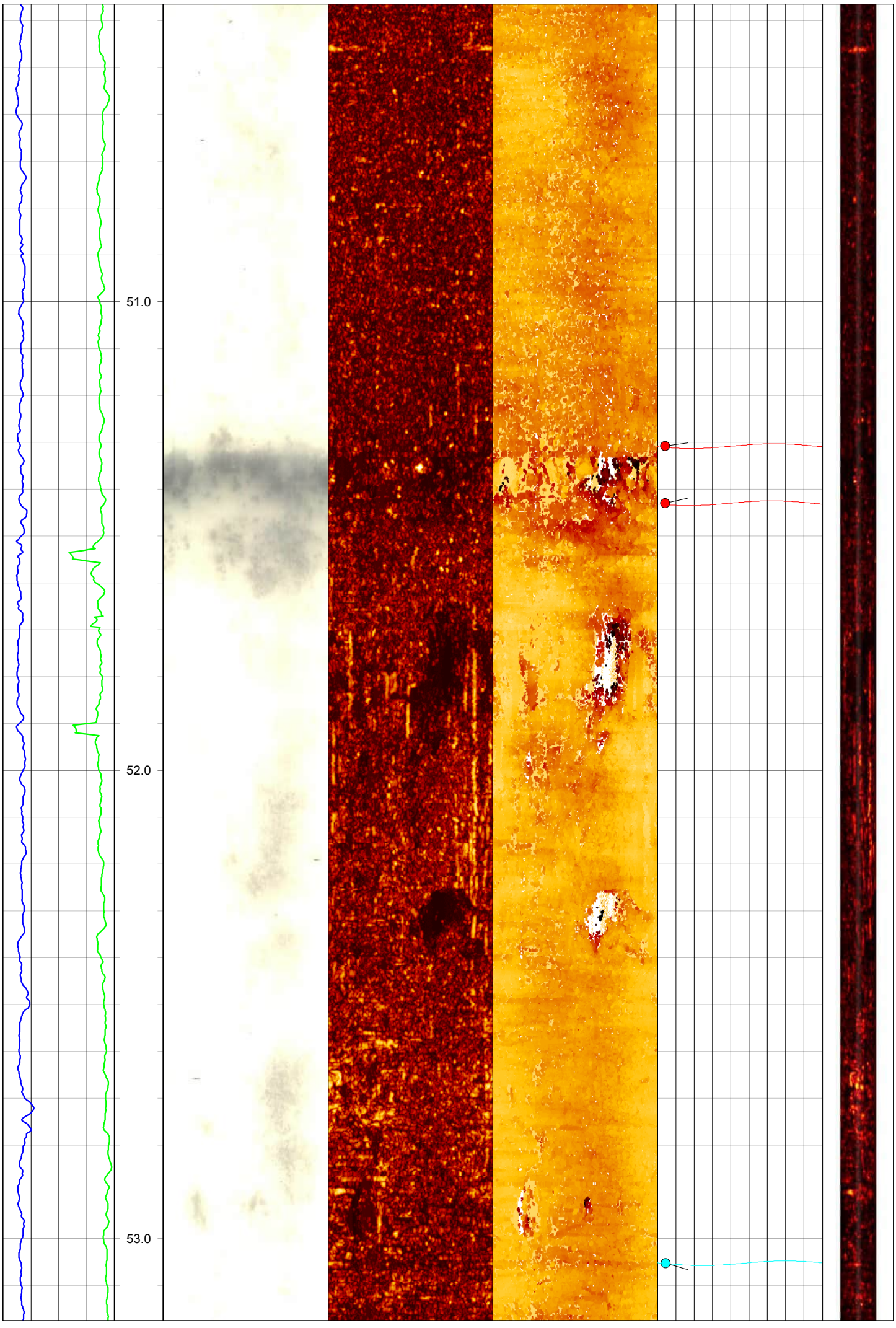

37.0
38.0
39.0

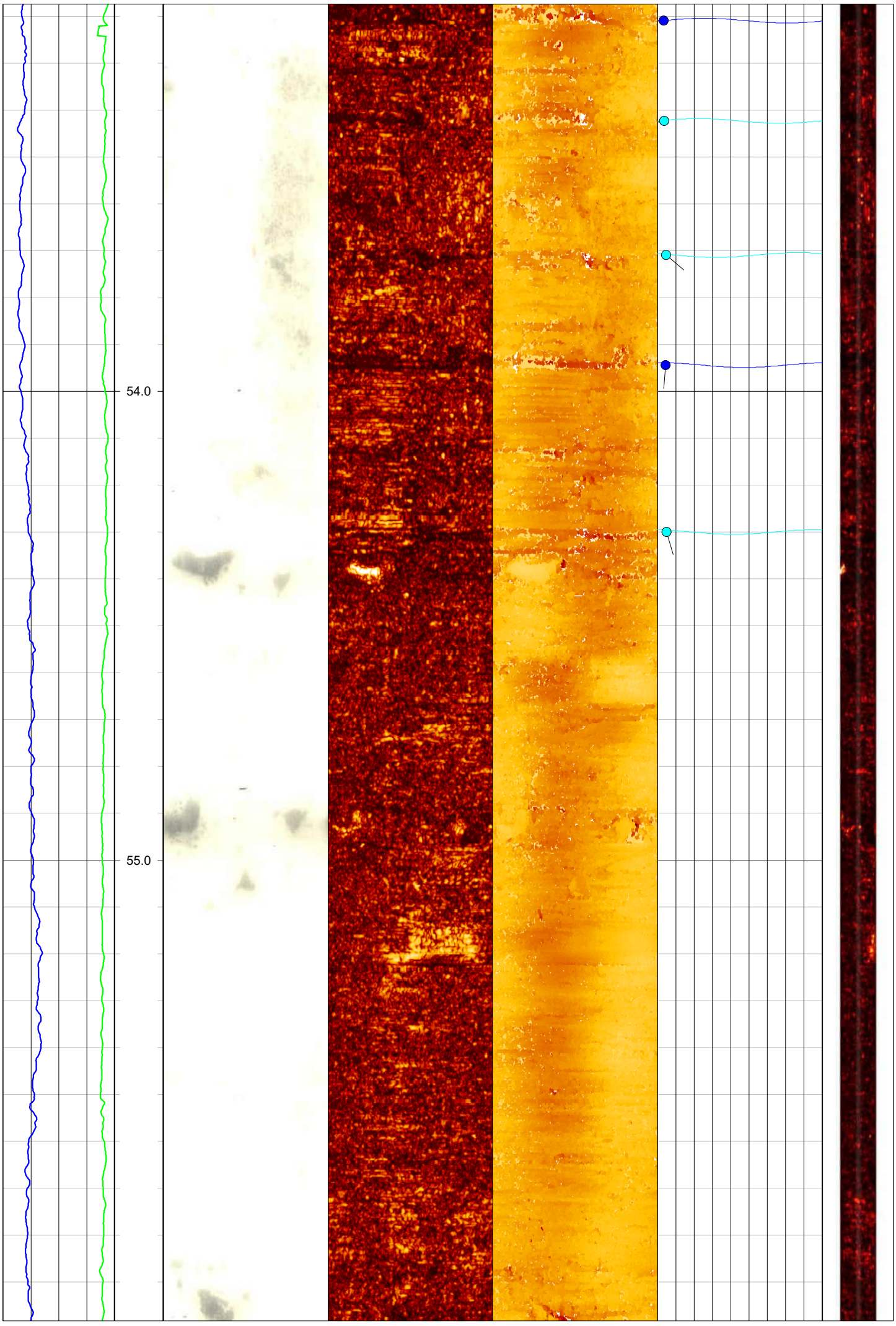

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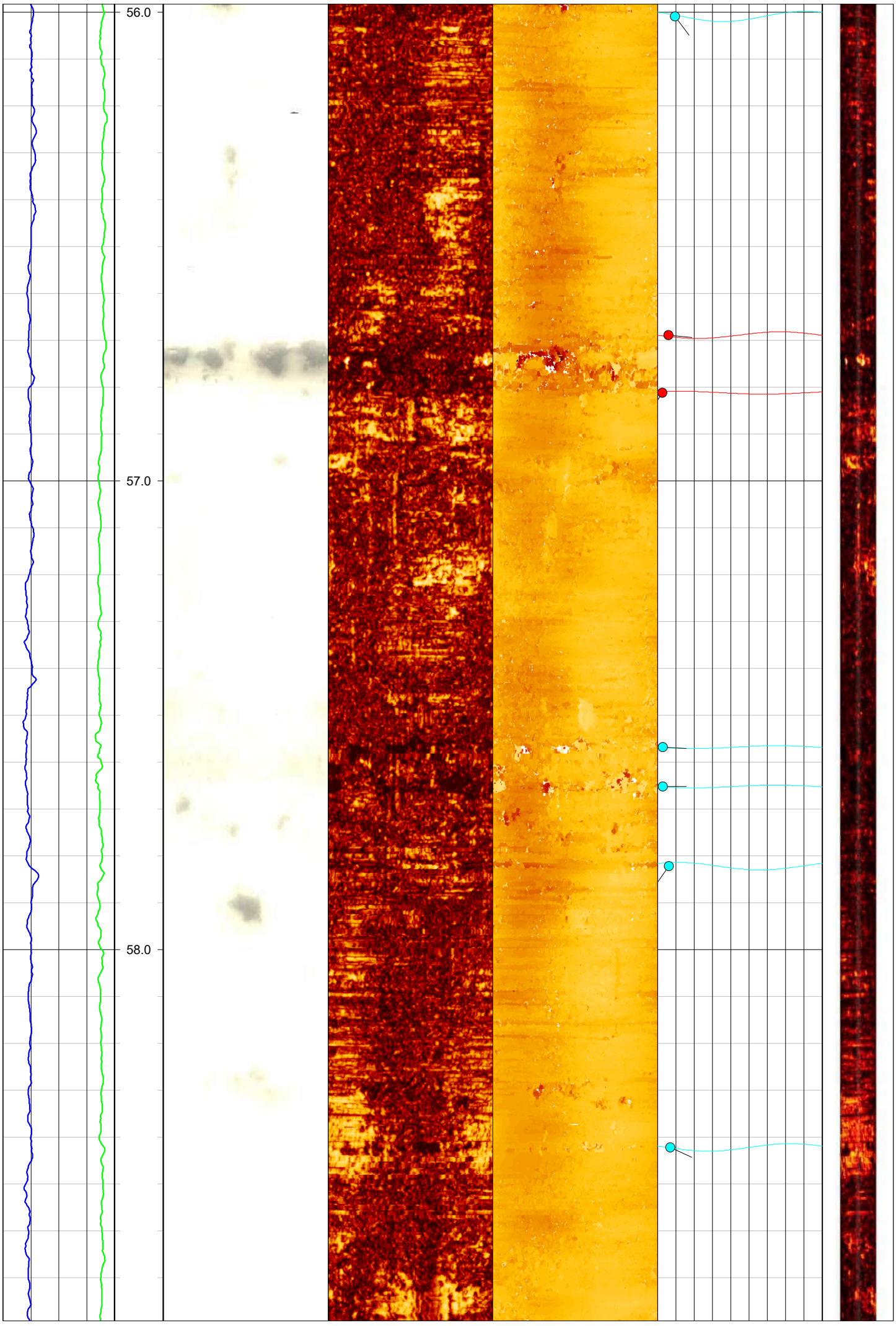

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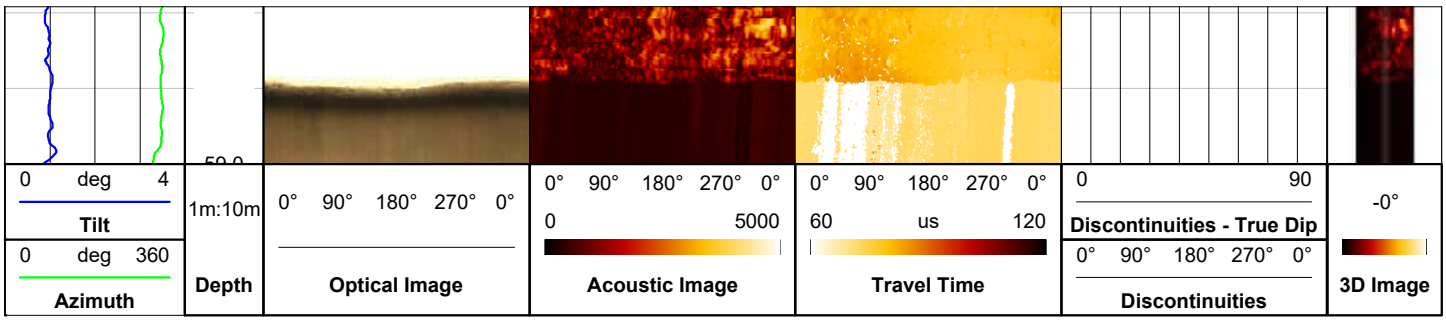

45.0
46.0
47.0


48.0
49.0
50.0


51.0
52.0
53.0


54.0
55.0


56.0
57.0
58.0


0 deg 4
Tilt
0 deg 360
Azimuth
1m:10m
Depth
0° 90° 180° 270° 0°
Optical Image
0° 90° 180° 270° 0°
0 5000
Acoustic Image
0° 90° 180° 270° 0°
60 us 120
Travel Time
0 90
Discontinuities - True Dip
0° 90° 180° 270° 0°
Discontinuities
-0°
3D Image

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Soil Engineering**

Borehole: **BH108**

Log Type: ***Composite***

Location: **Gravesend** Area: Grid Ref: Elevation:

Drilled Depth: (m)	**58.8**	Date:	**17-05-2025**
Logged Depth: (m)	**58.8**	Recorded By:	**N. Clark**
Logging Datum:	**Ground Level**	Remarks:	Slightly cloudy water column. Silt below 58.5m.
Logged Interval: (m)	**0.7 - 58.8**		
Fluid Level: (m)	**~1.5**		

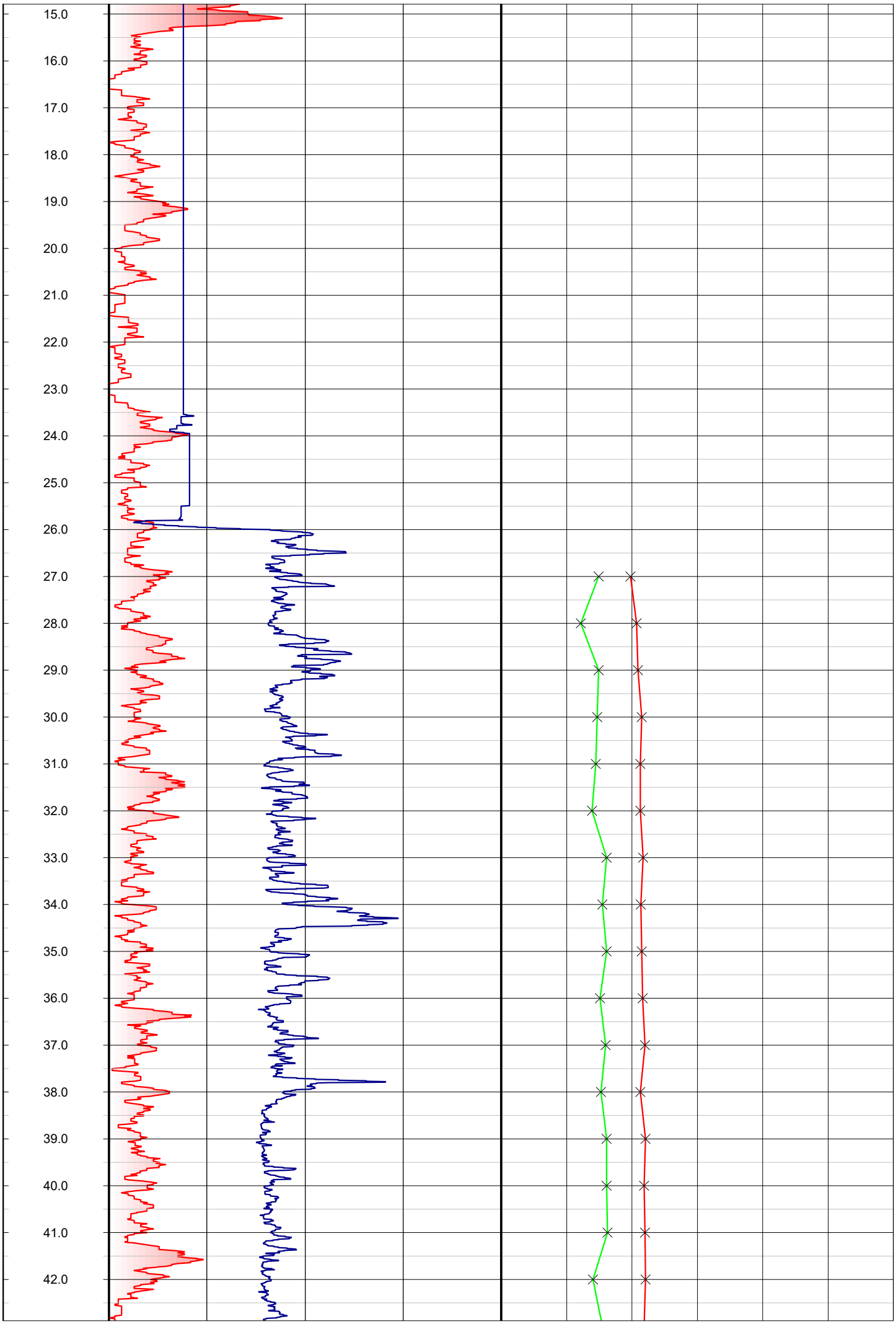
BOREHOLE RECORD

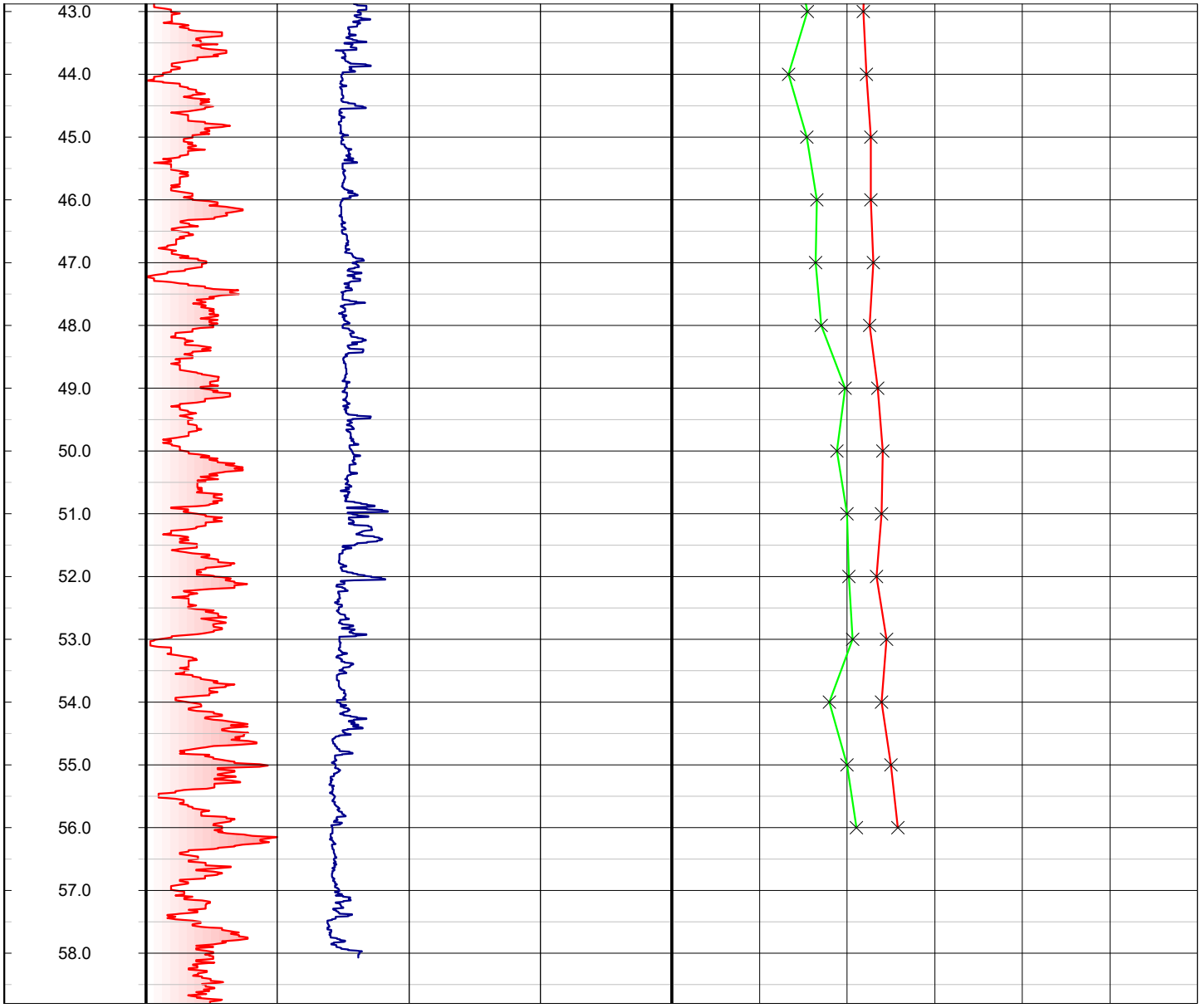
Bit: (mm)	From: (m)	To: (m)
147	**26.0**	**58.8**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
STEEL	**130**	**-1.01**	**26.0**




15.0
16.0
17.0
18.0
19.0
20.0
21.0
22.0
23.0
24.0
25.0
26.0
27.0
28.0
29.0
30.0
31.0
32.0
33.0
34.0
35.0
36.0
37.0
38.0
39.0
40.0
41.0
42.0


43.0
44.0
45.0
46.0
47.0
48.0
49.0
50.0
51.0
52.0
53.0
54.0
55.0
56.0
57.0
58.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Soil Engineering**

Borehole: **BH108**

Log Type: ***Image***

Location: **Gravesend** Area: Grid Ref: Elevation:

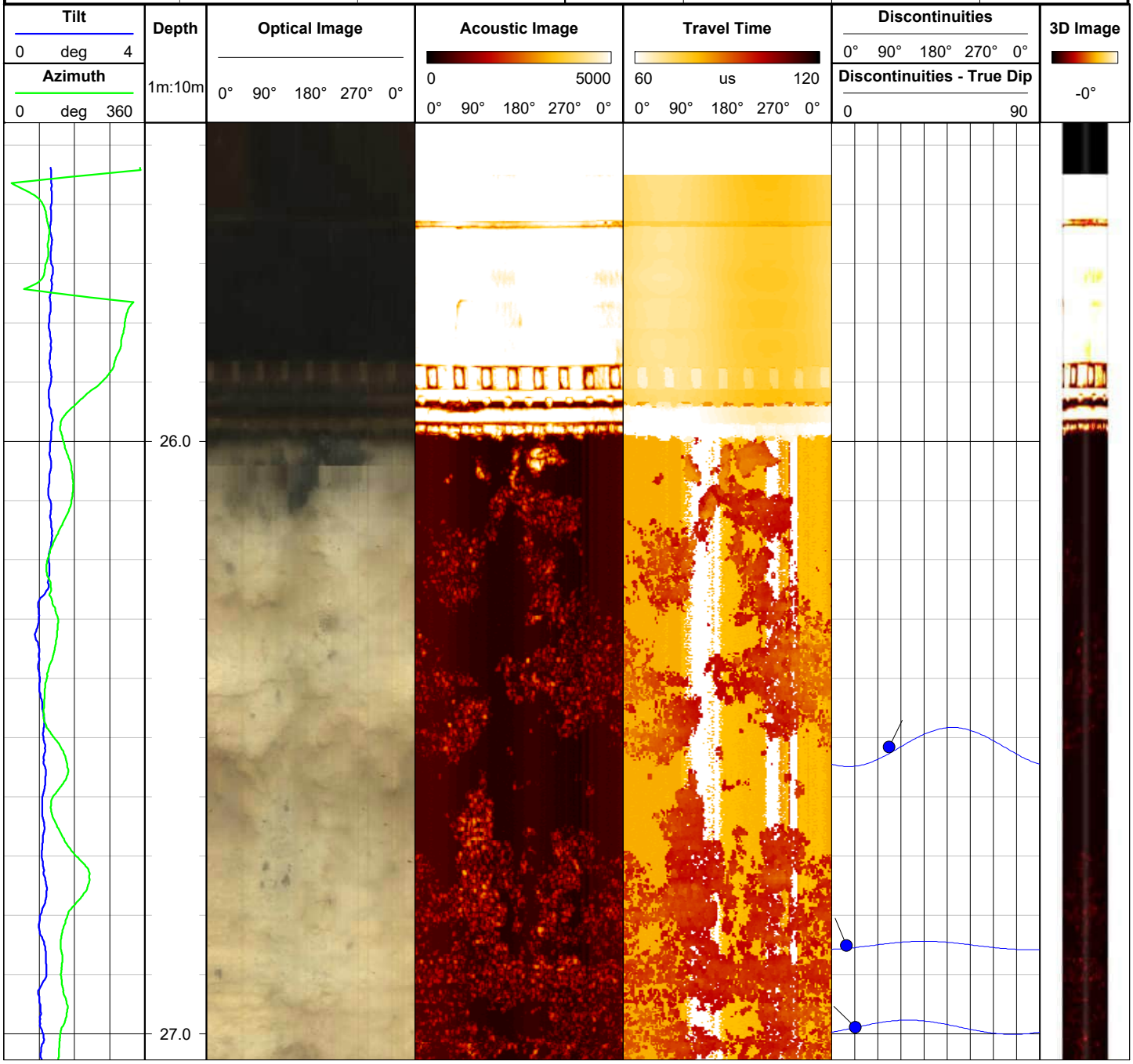
Drilled Depth: (m)	**58.8**	Date:	**17-06-2025**
Logged Depth: (m)	**58.6**	Recorded By:	**N. Clark**
Logging Datum:	**Ground Level**	Remarks:	Slightly cloudy water column. Silt below 58.5m.
Logged Interval: (m)	**26.0 - 58.6**		
Fluid Level: (m)	**~1.5**		

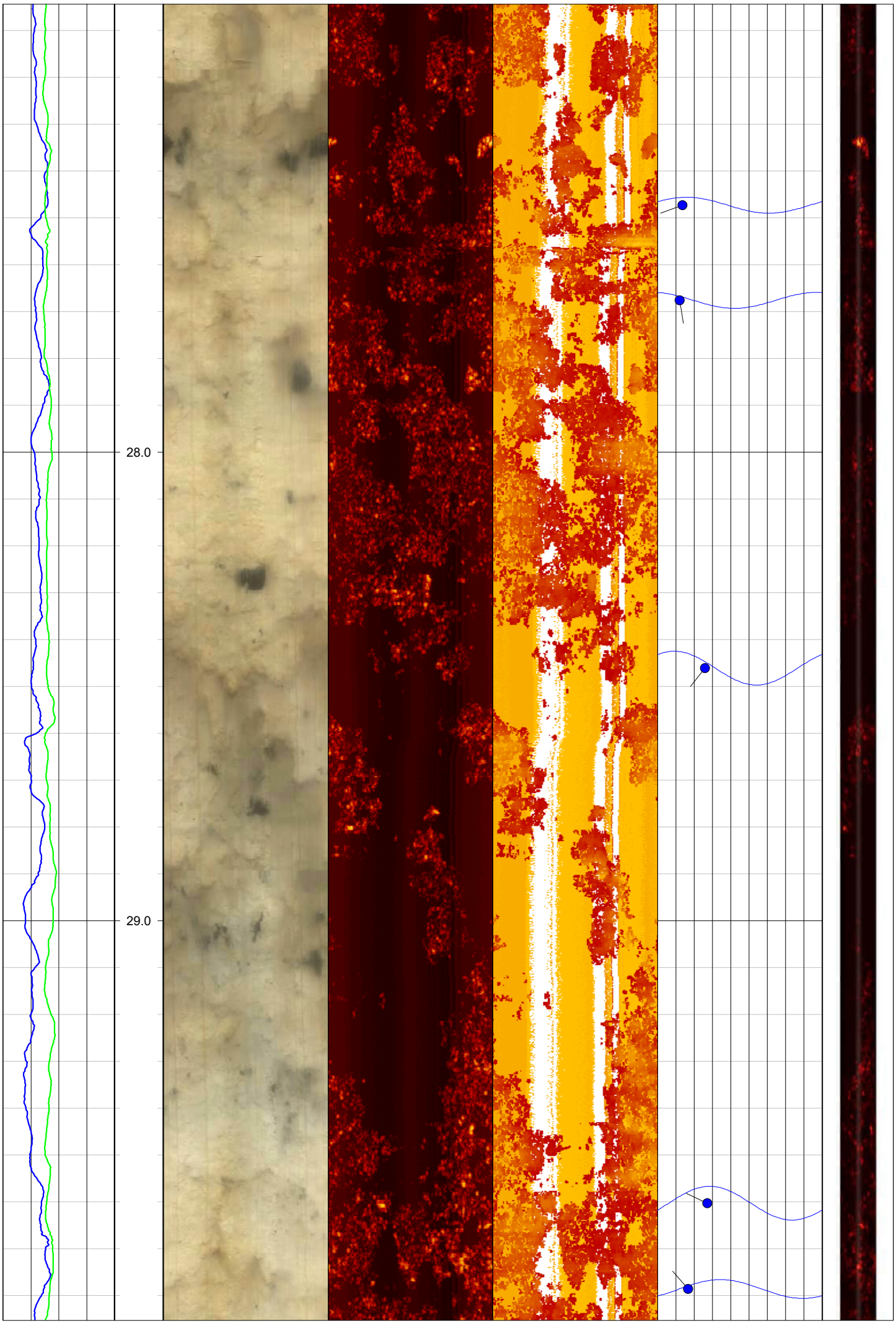
BOREHOLE RECORD

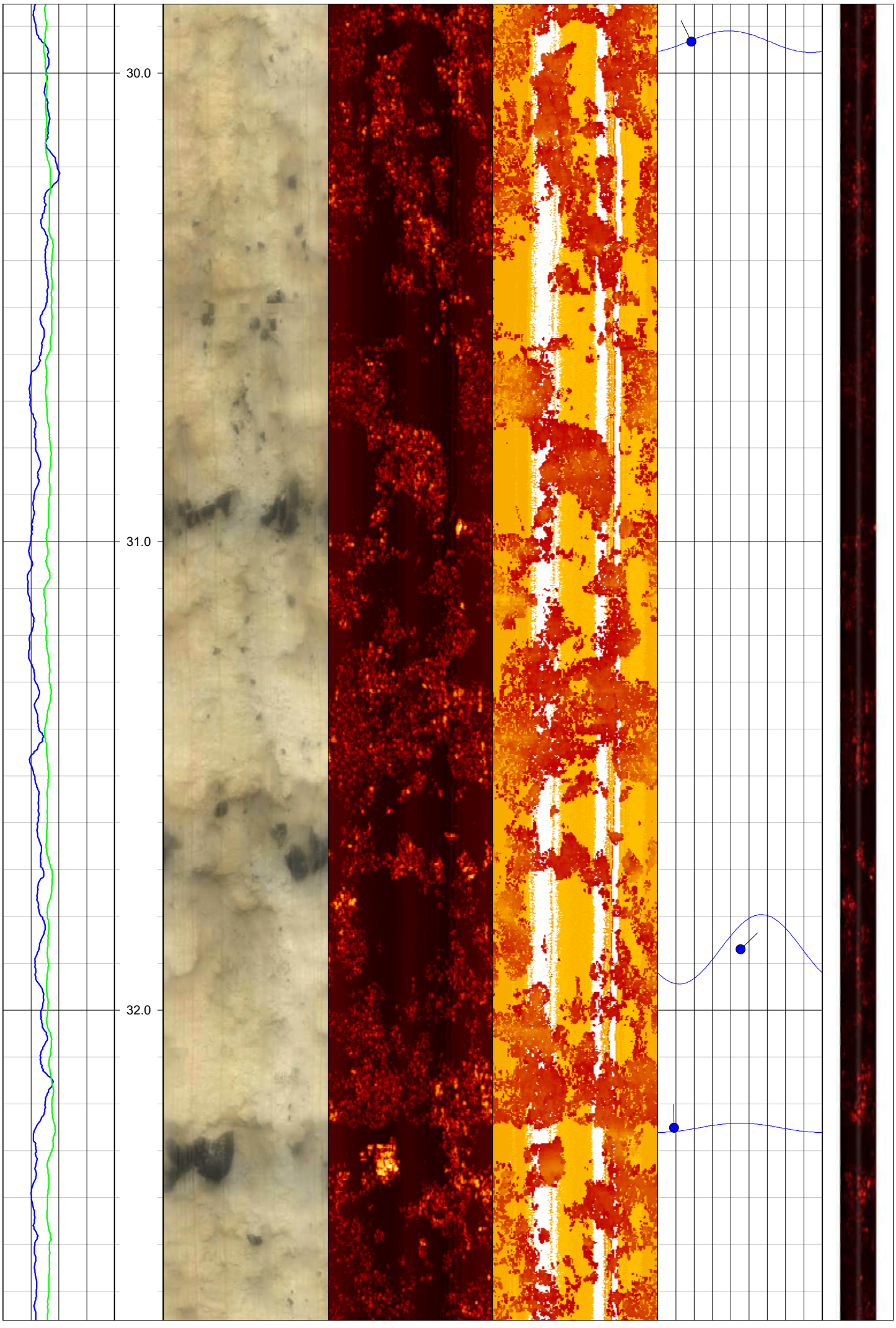
Bit: (mm)	From: (m)	To: (m)
147	**26.0**	**58.8**

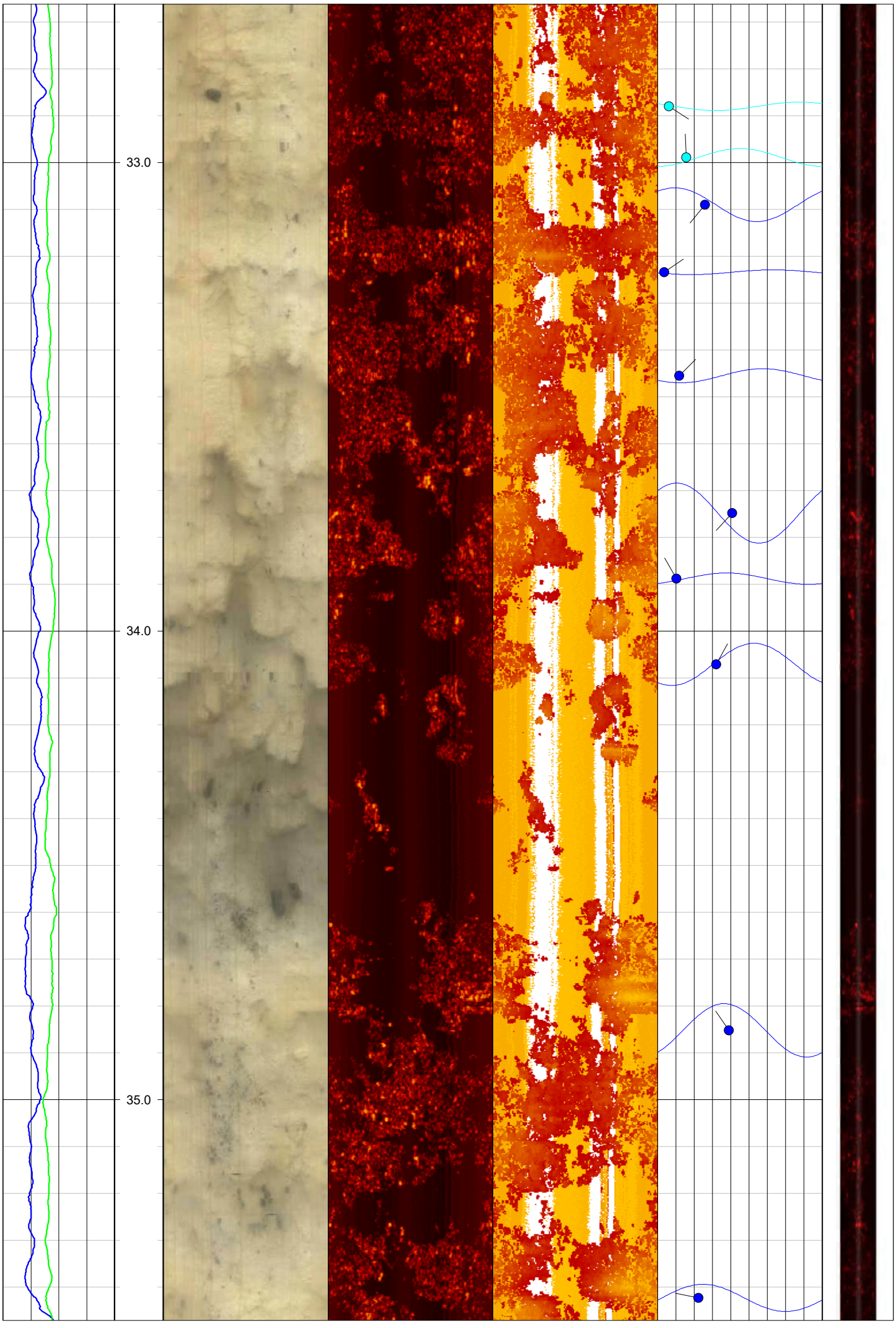
CASING RECORD

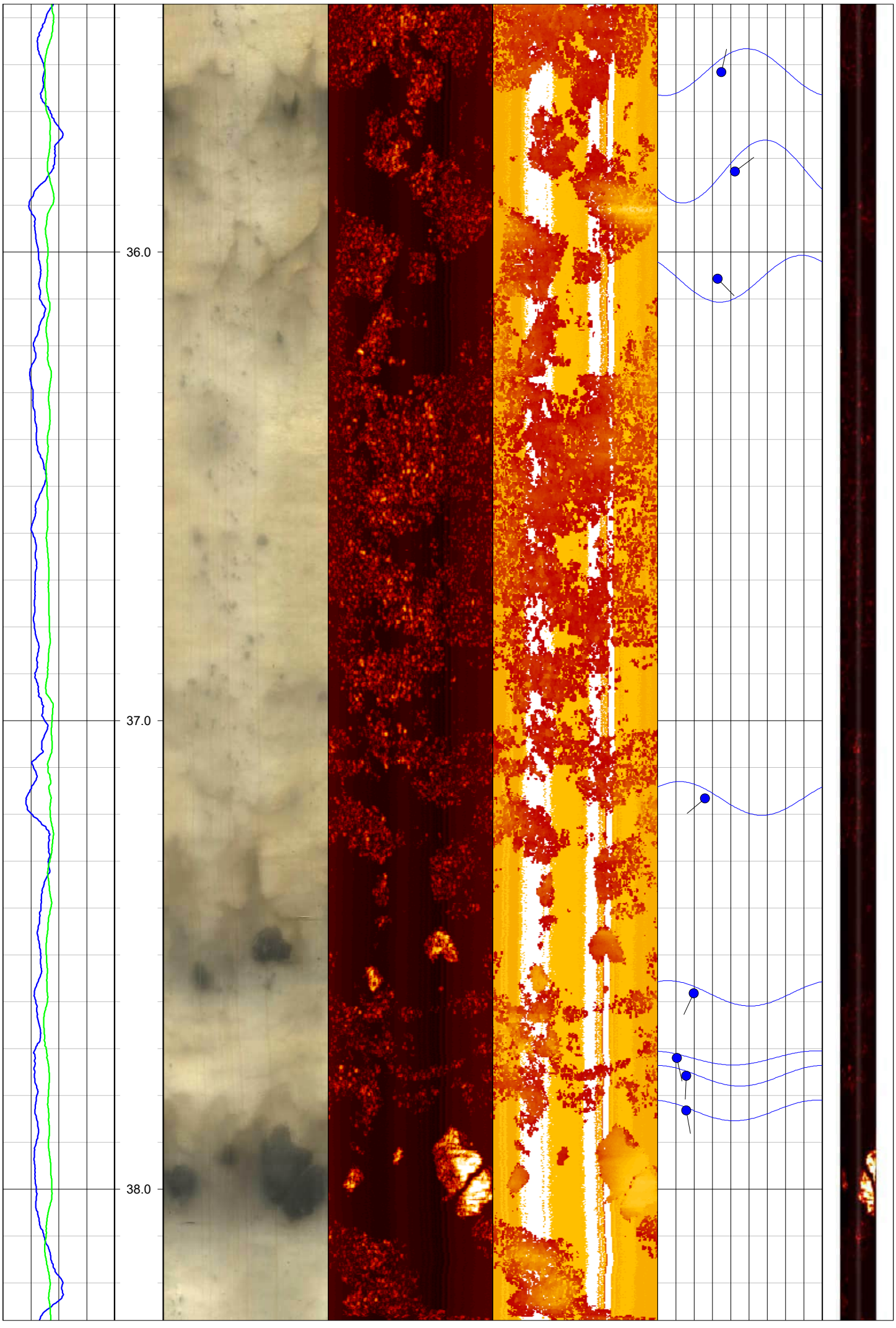
Type	Size: (mm)	From: (m)	To: (m)
STEEL	**130**	**-1.01**	**26.0**

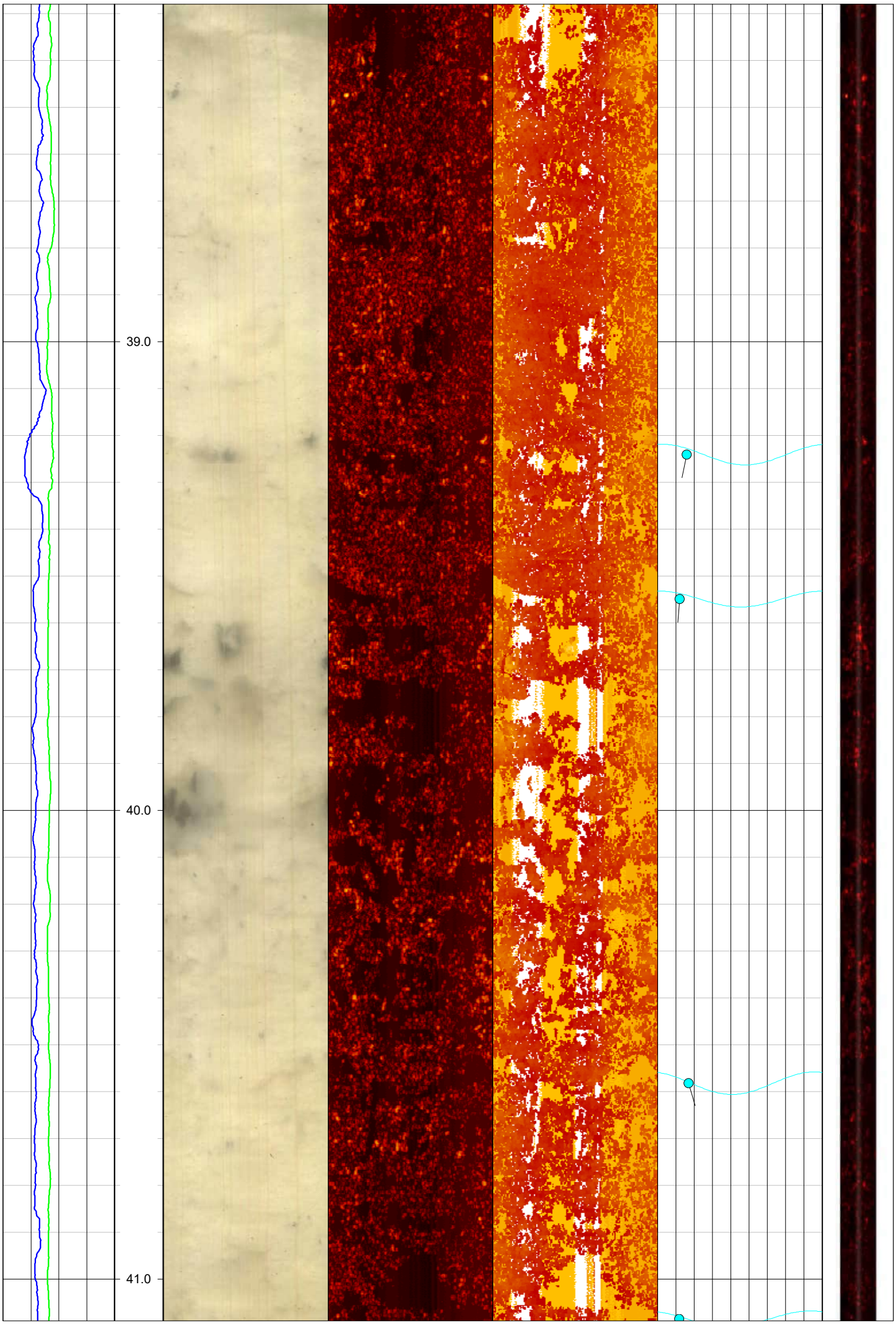


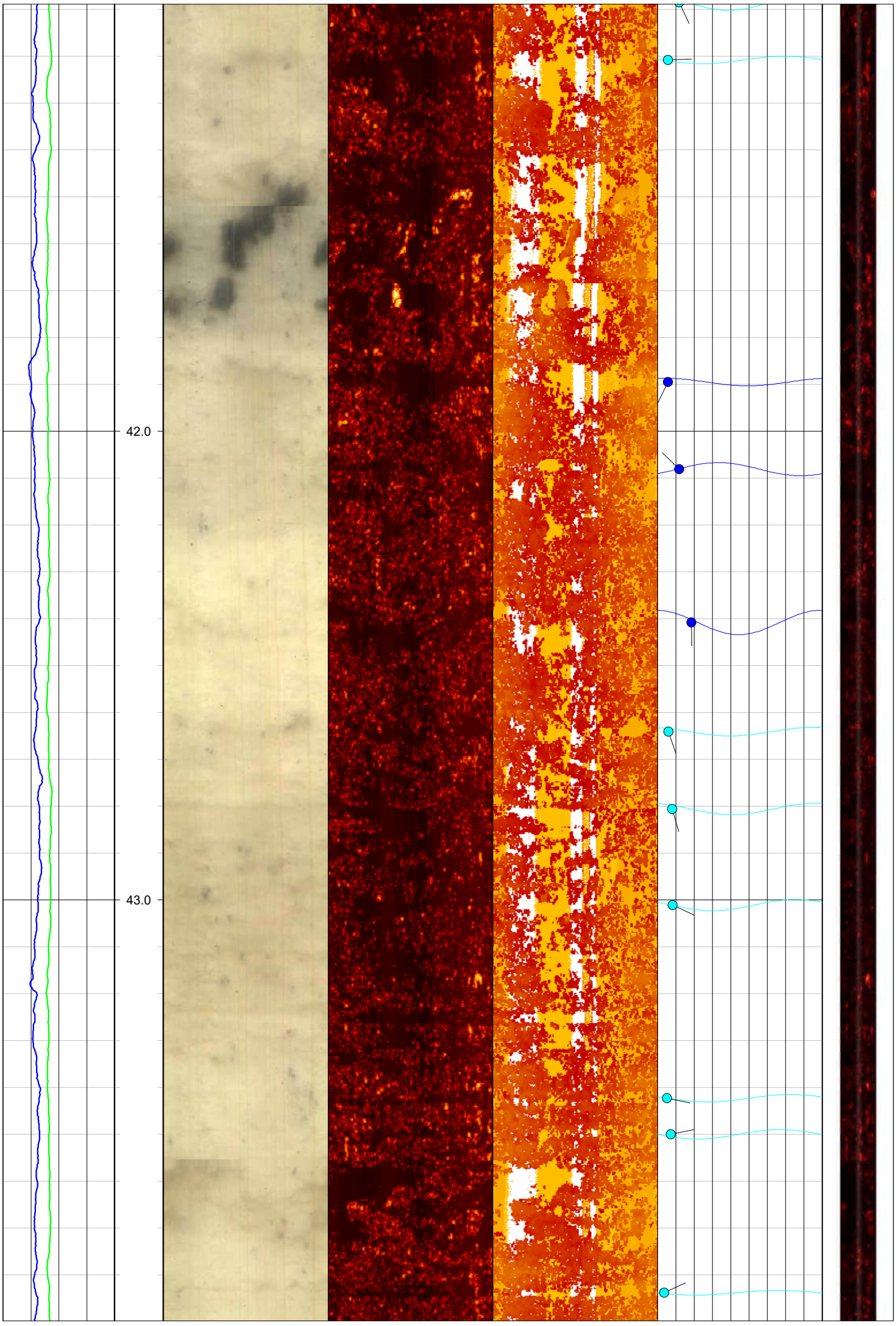

28.0
29.0

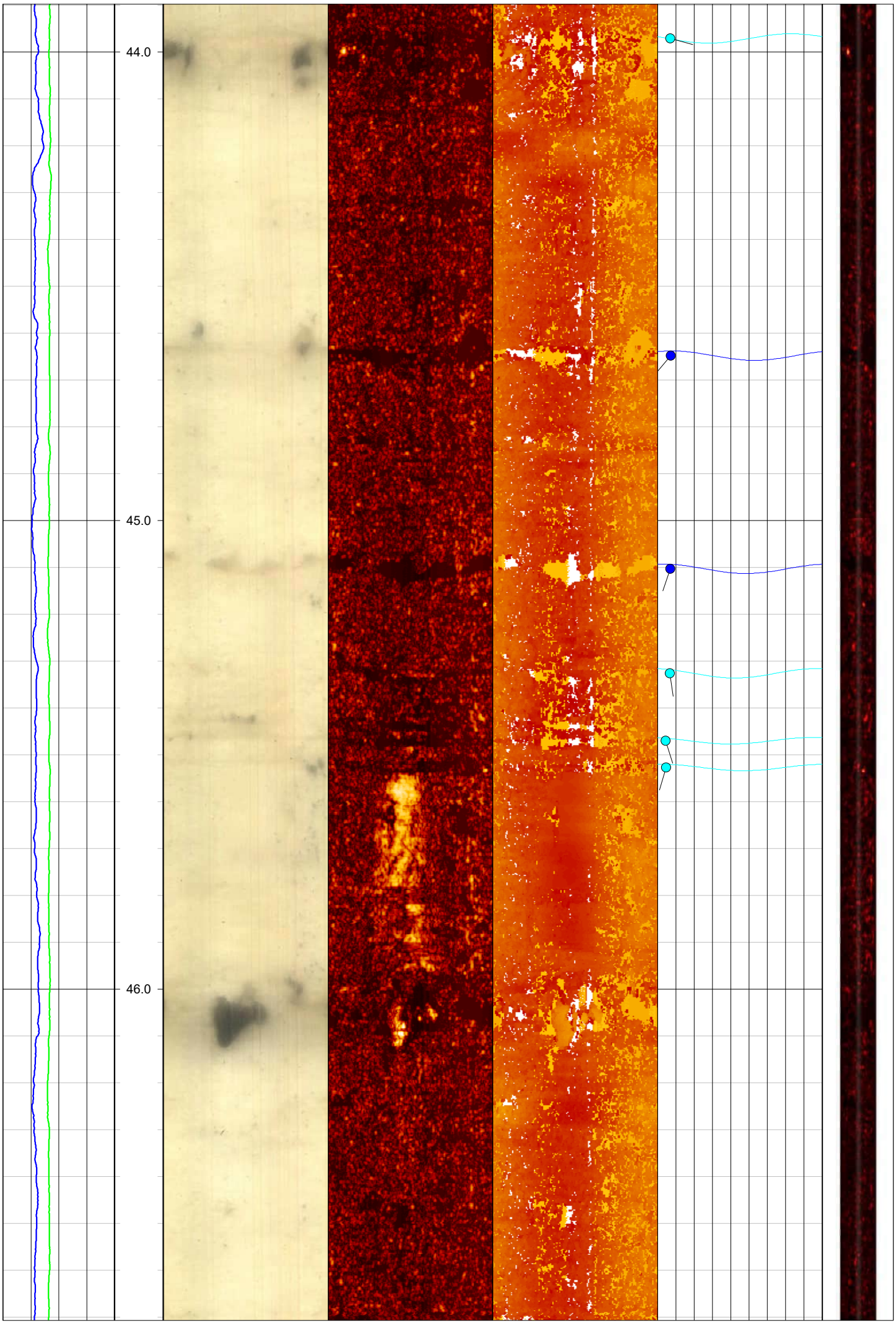

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31.0
32.0

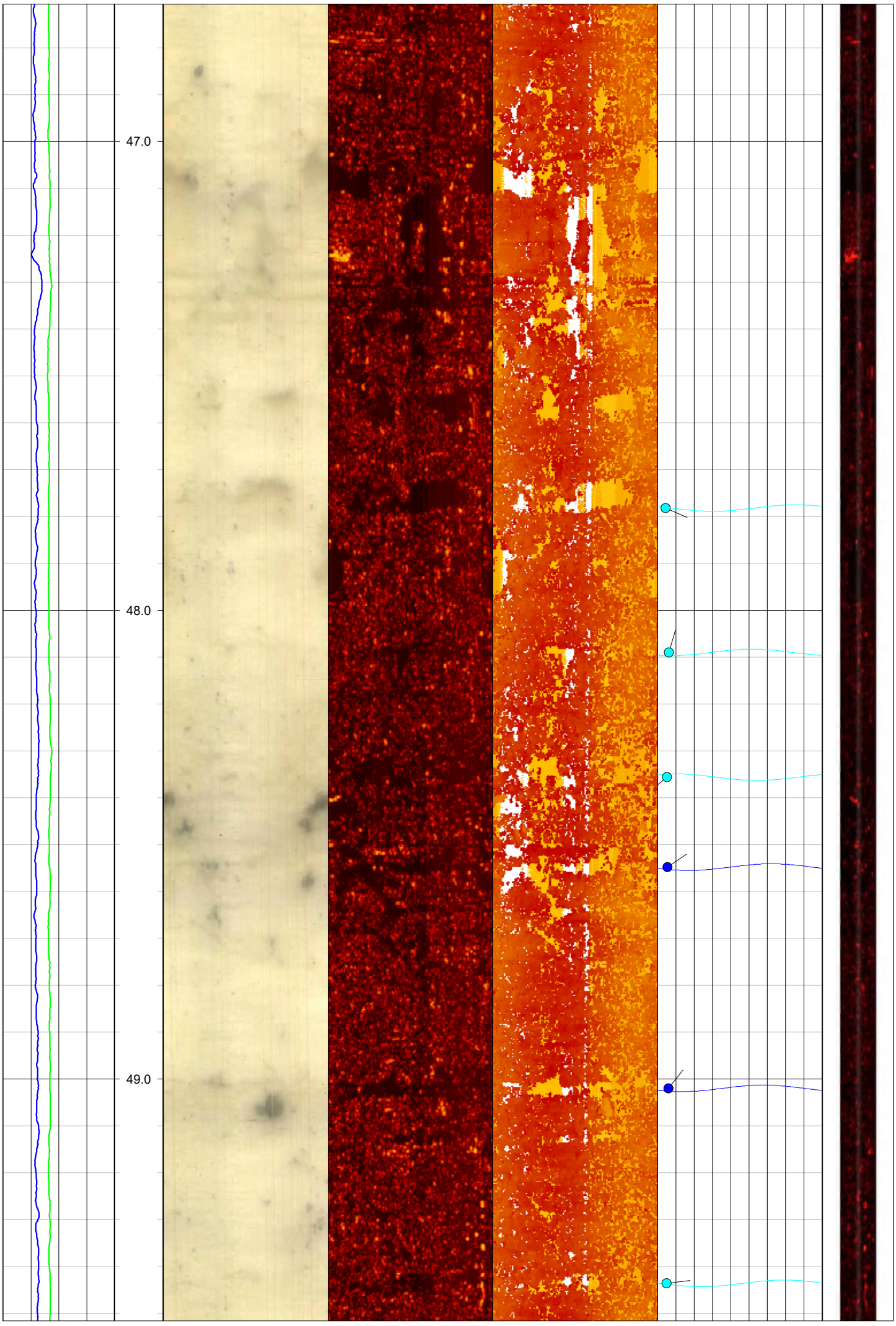

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34.0
35.0

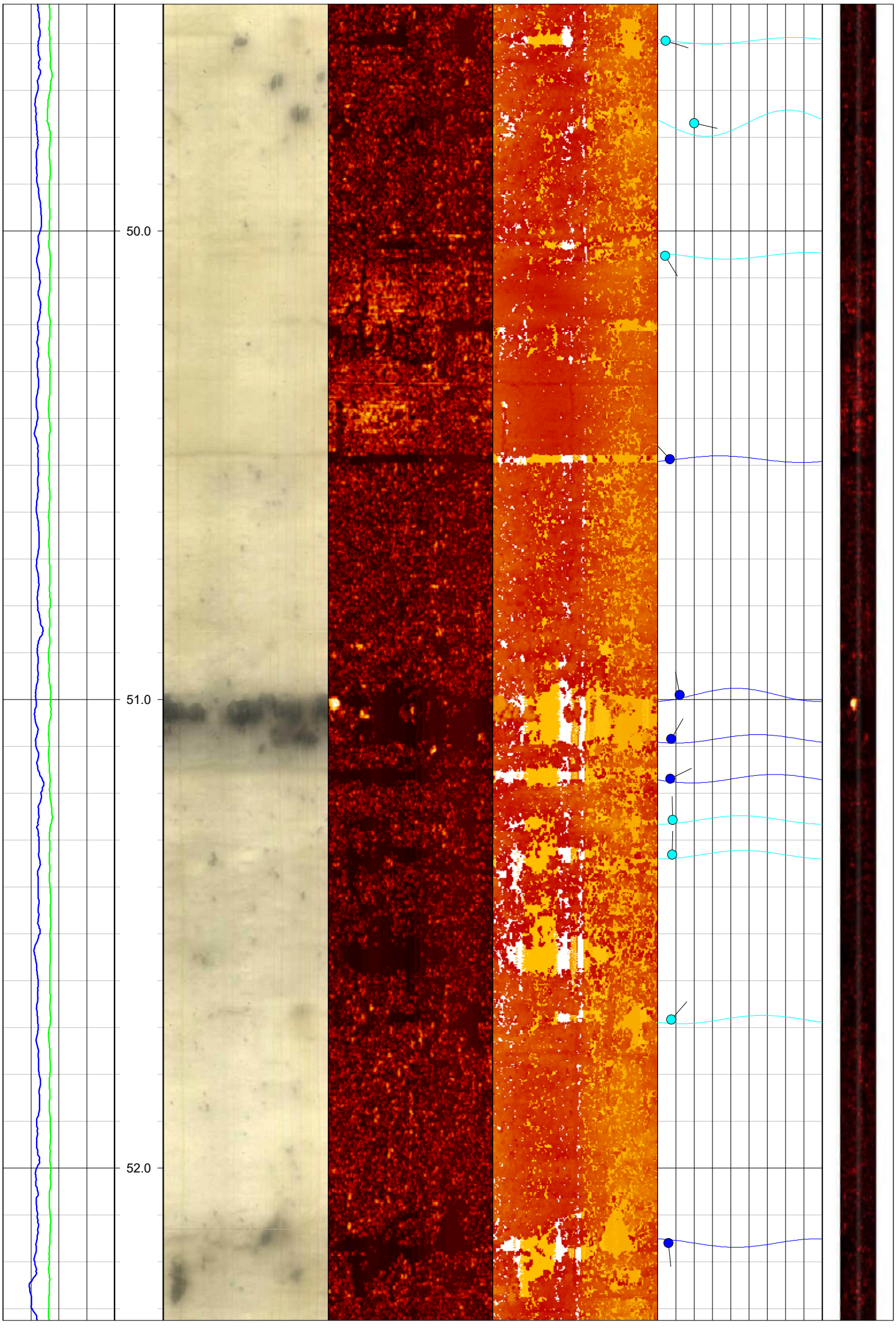

36.0
37.0
38.0

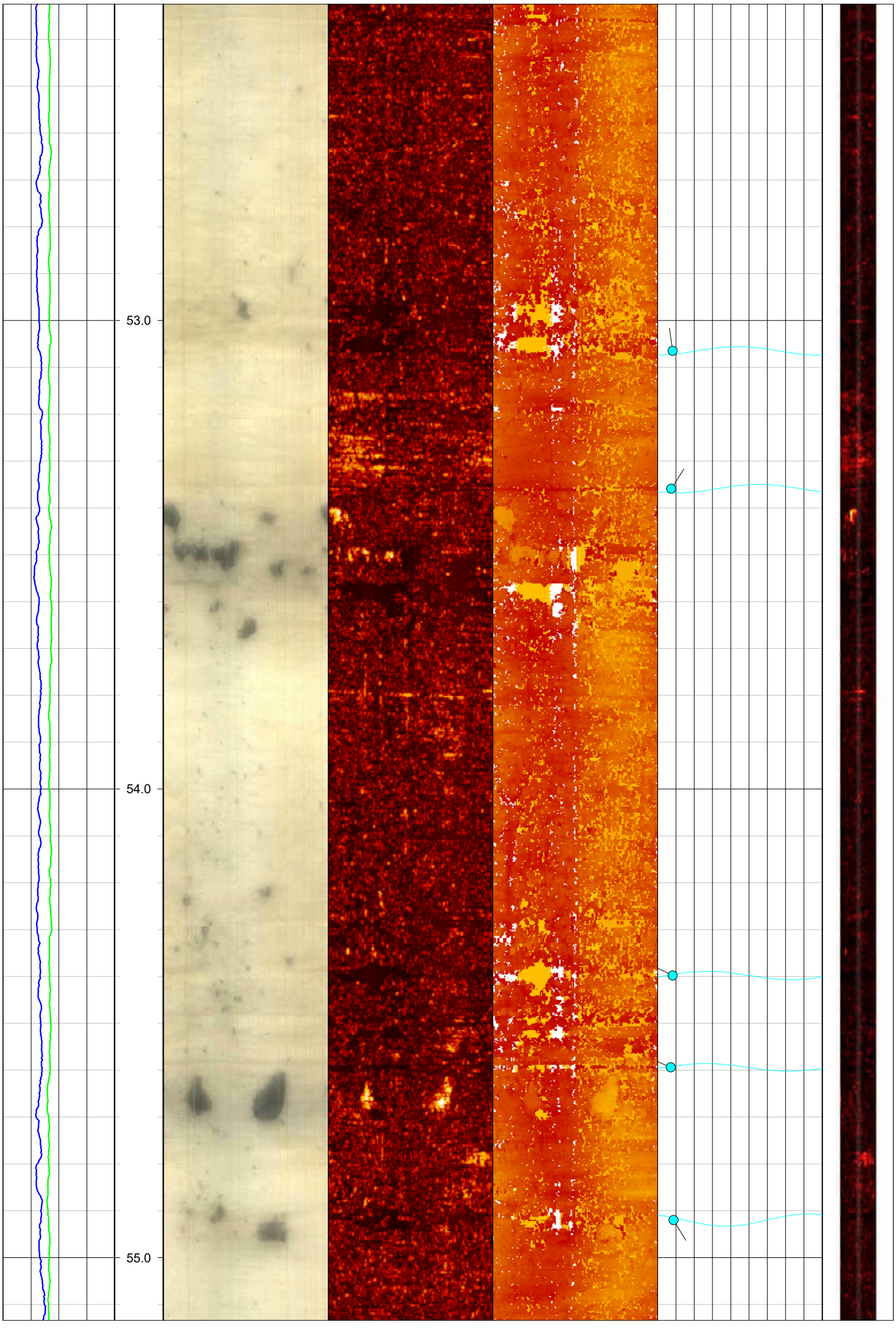

39.0
40.0
41.0

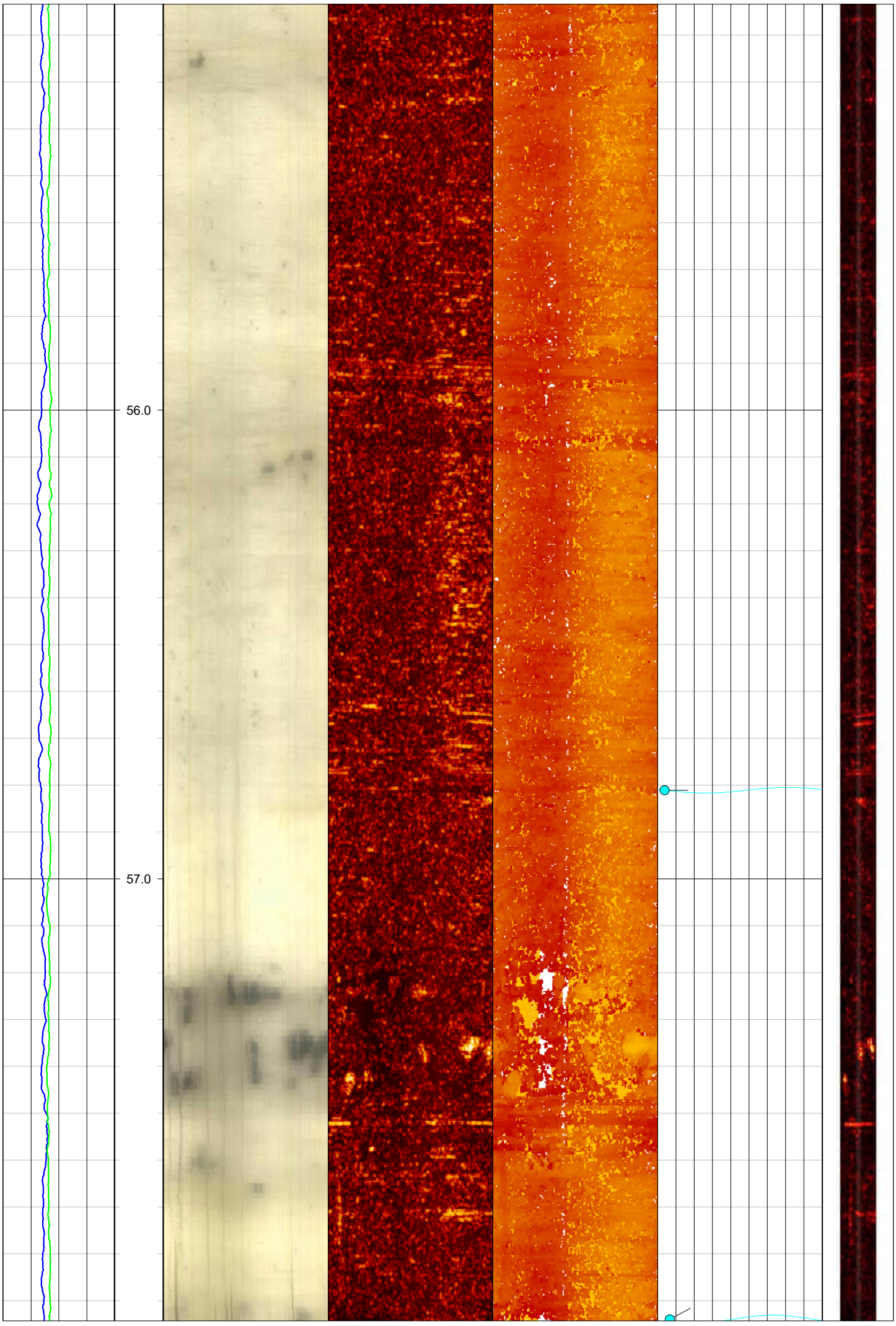

42.0
43.0

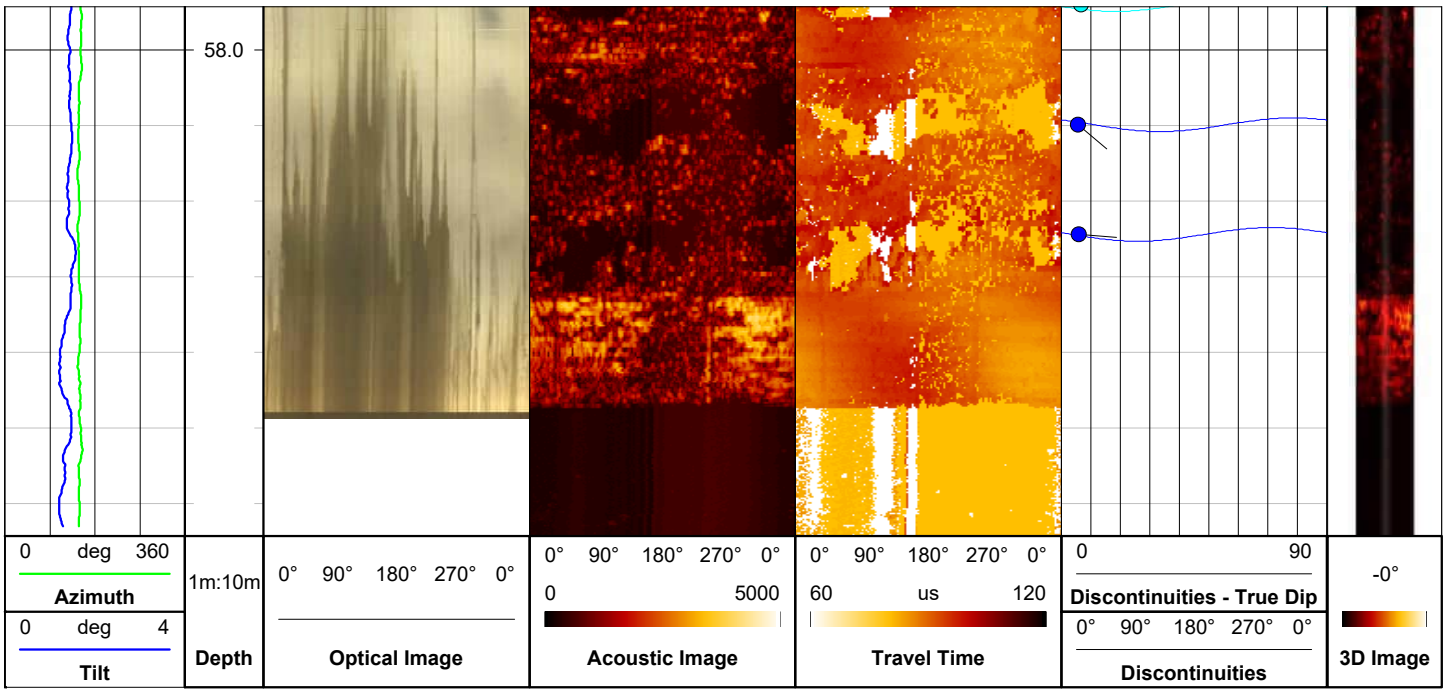

44.0
45.0
46.0


47.0
48.0
49.0


50.0
51.0
52.0


53.0
54.0
55.0


56.0
57.0


58.0
0 deg 360
Azimuth
0 deg 4
Tilt
1m:10m
Depth
0° 90° 180° 270° 0°
Optical Image
0° 90° 180° 270° 0°
0 5000
Acoustic Image
0° 90° 180° 270° 0°
60 us 120
Travel Time
0 90
Discontinuities - True Dip
0° 90° 180° 270° 0°
Discontinuities
-0°
3D Image

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Soil Engineering**

Borehole: **BH109**

Log Type: ***Composite***

Location: **Gravesend** Area: Grid Ref: Elevation:

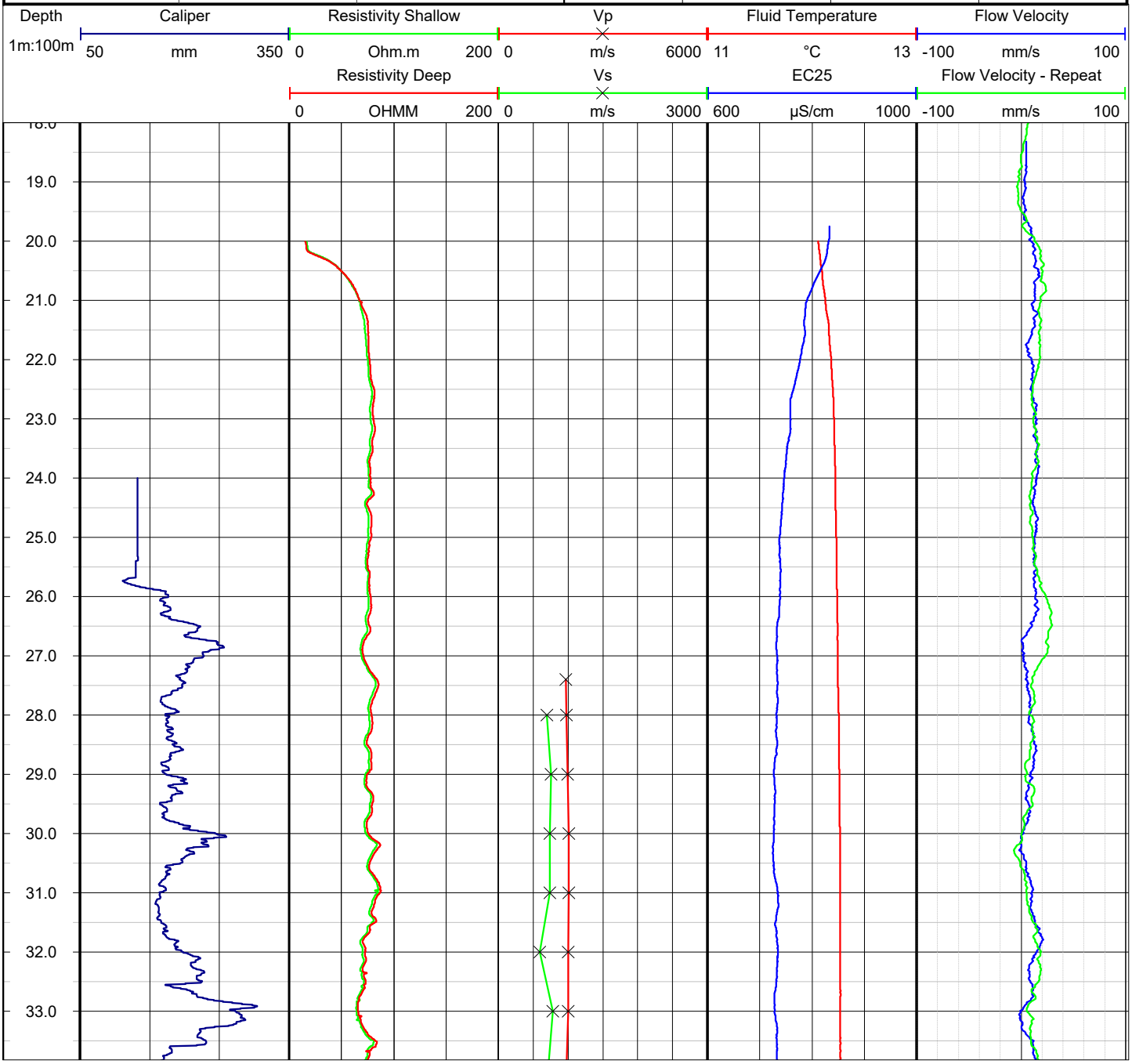
Drilled Depth: (m)	**59.0**	Date:	**25.06.25 & 07.07.25**
Logged Depth: (m)	**59.0**	Recorded By:	**H. Gilder & C. Clinton**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**0.0 - 58.7**		
Fluid Level: (m)	**1.8**		

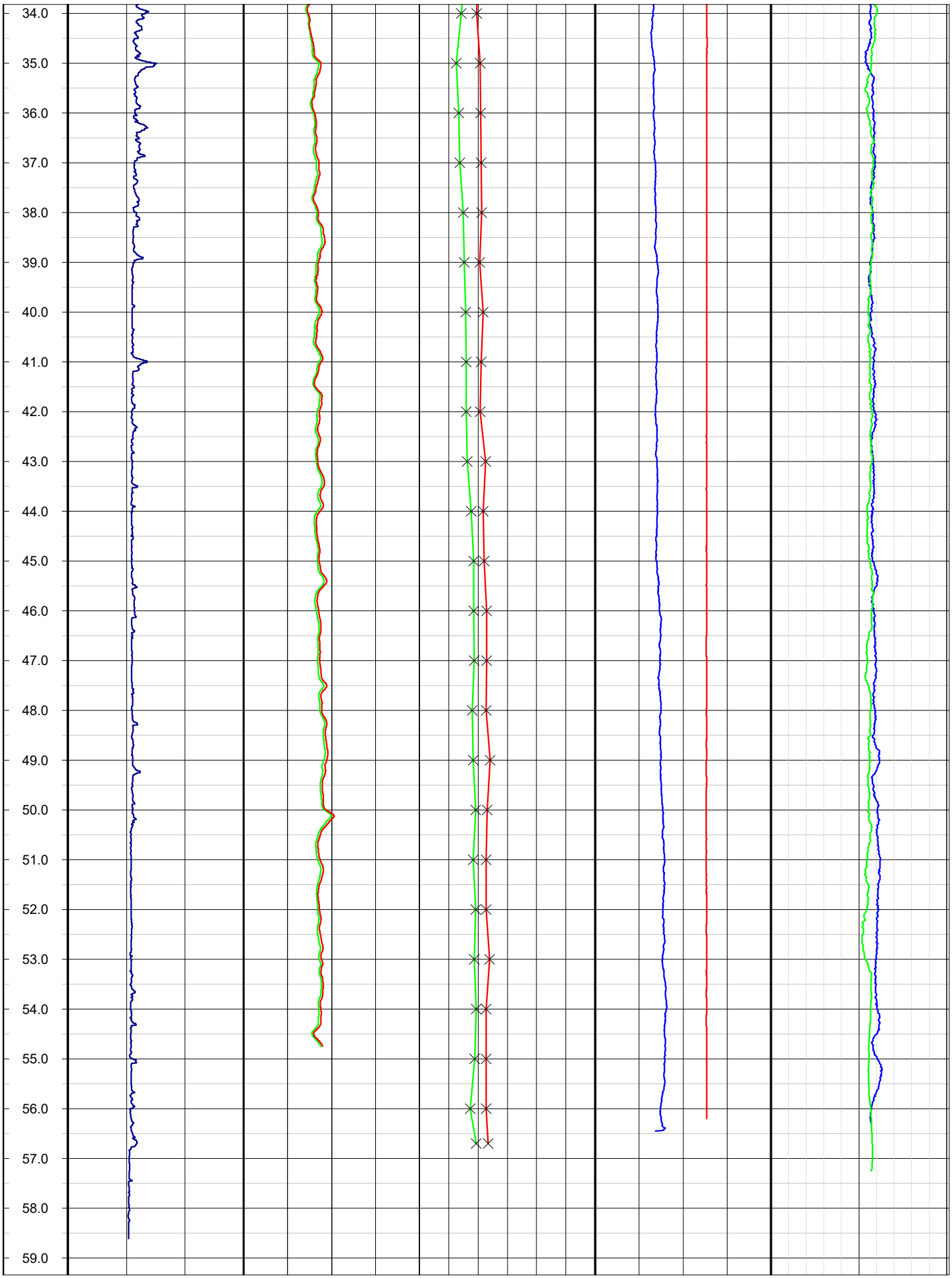
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
147	**25.7**	**59.2**
147	**20.2**	**56.2**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Steel	**130**	**-1.3**	**25.7**
Steel	**150**	**0.0**	**20.2**




34.0
35.0
36.0
37.0
38.0
39.0
40.0
41.0
42.0
43.0
44.0
45.0
46.0
47.0
48.0
49.0
50.0
51.0
52.0
53.0
54.0
55.0
56.0
57.0
58.0
59.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Soil Engineering**

Borehole: **BH109**

Log Type: ***Image***

Location: **Gravesend** Area: Grid Ref: Elevation:

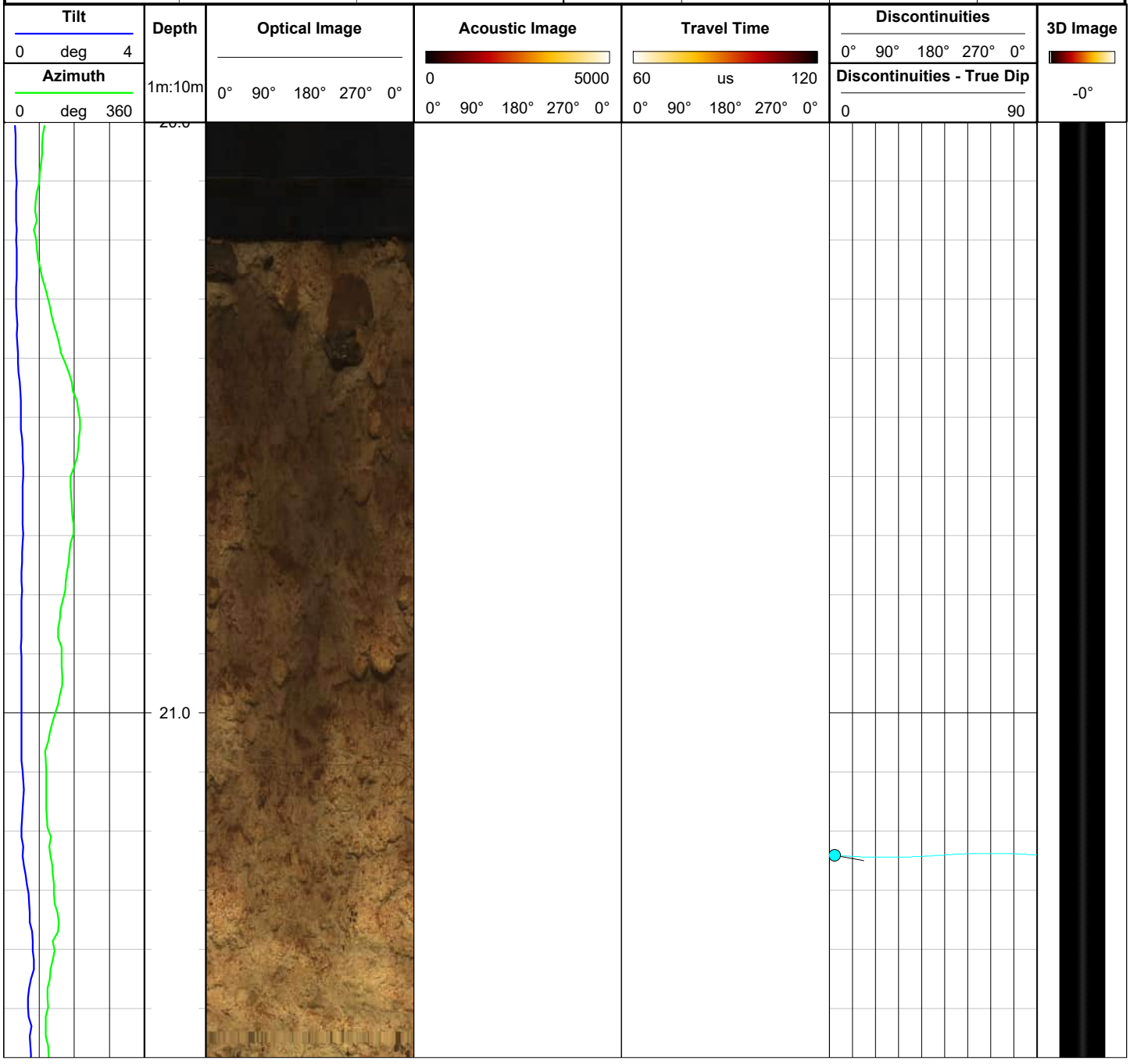
Drilled Depth: (m)	**59.0**	Date:	**25.06.25 & 07.07.25**
Logged Depth: (m)	**59.0**	Recorded By:	**H. Gilder & C. Clinton**
Logging Datum:	**Ground Level**	Remarks:	Optical image re-ran between 20.2 - 52.8m on 07.07.25
Logged Interval: (m)	**20.2 - 59.0**		
Fluid Level: (m)	**1.8**		

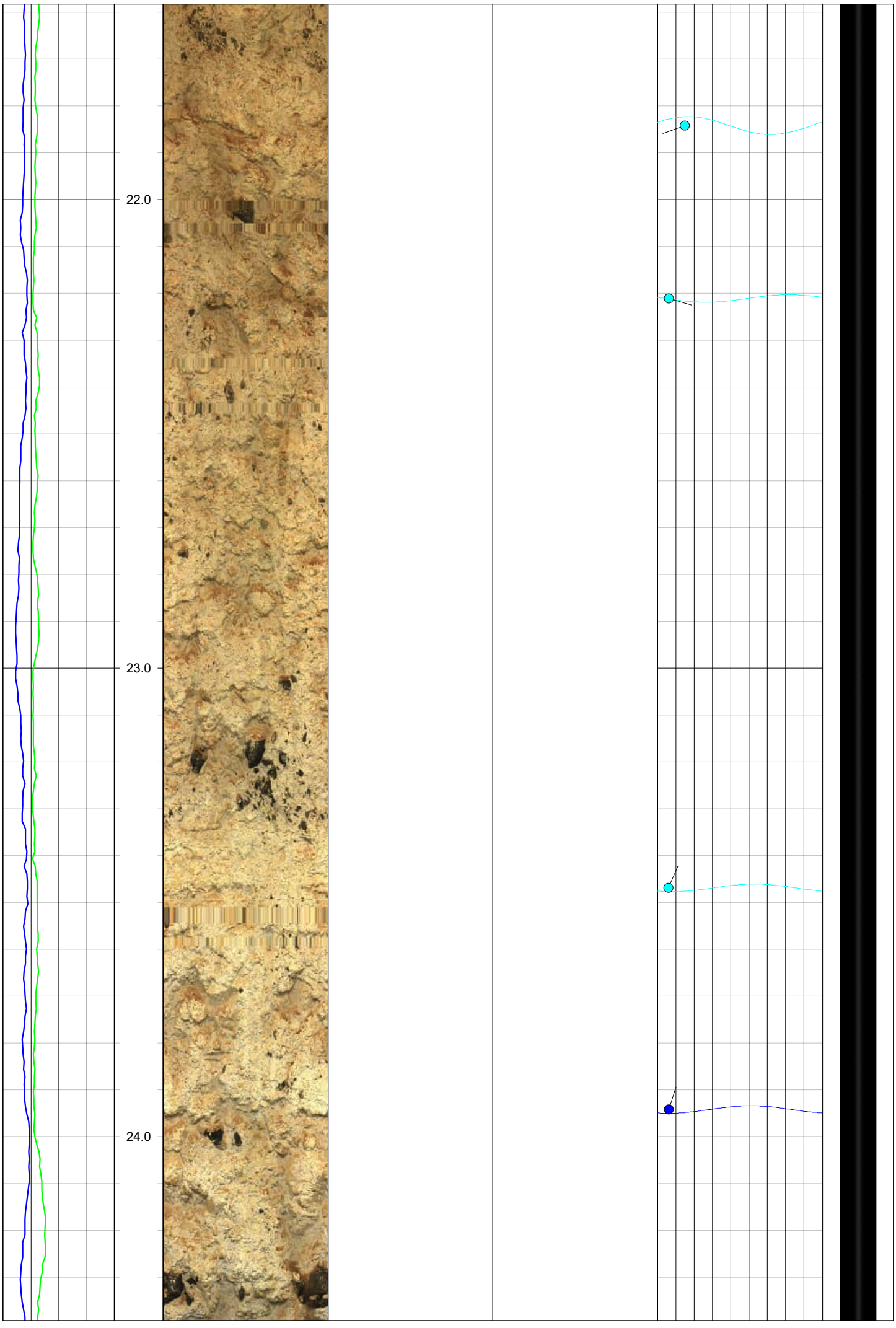
BOREHOLE RECORD

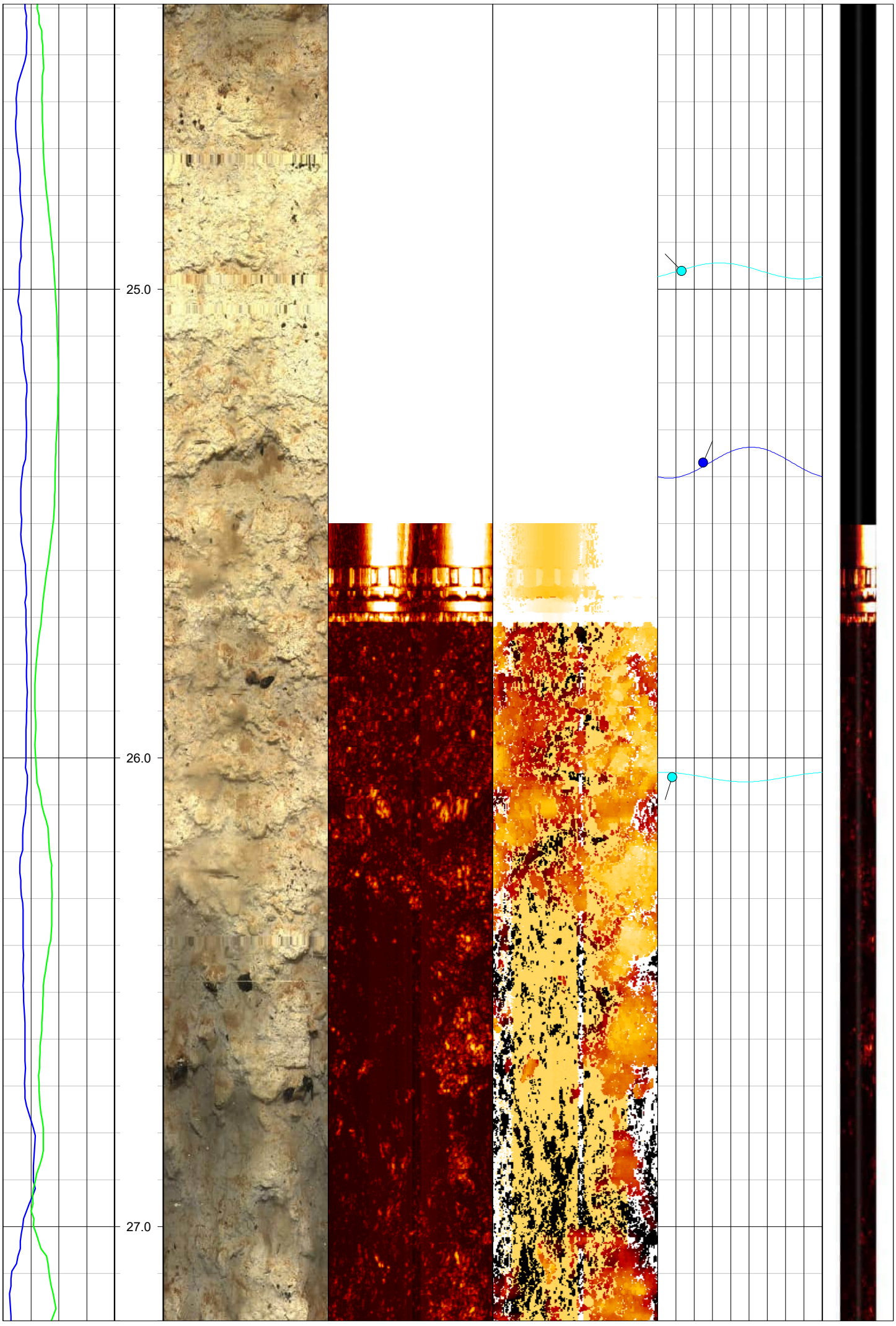
Bit: (mm)	From: (m)	To: (m)
147	**25.7**	**59.2**
147	**20.2**	**56.2**

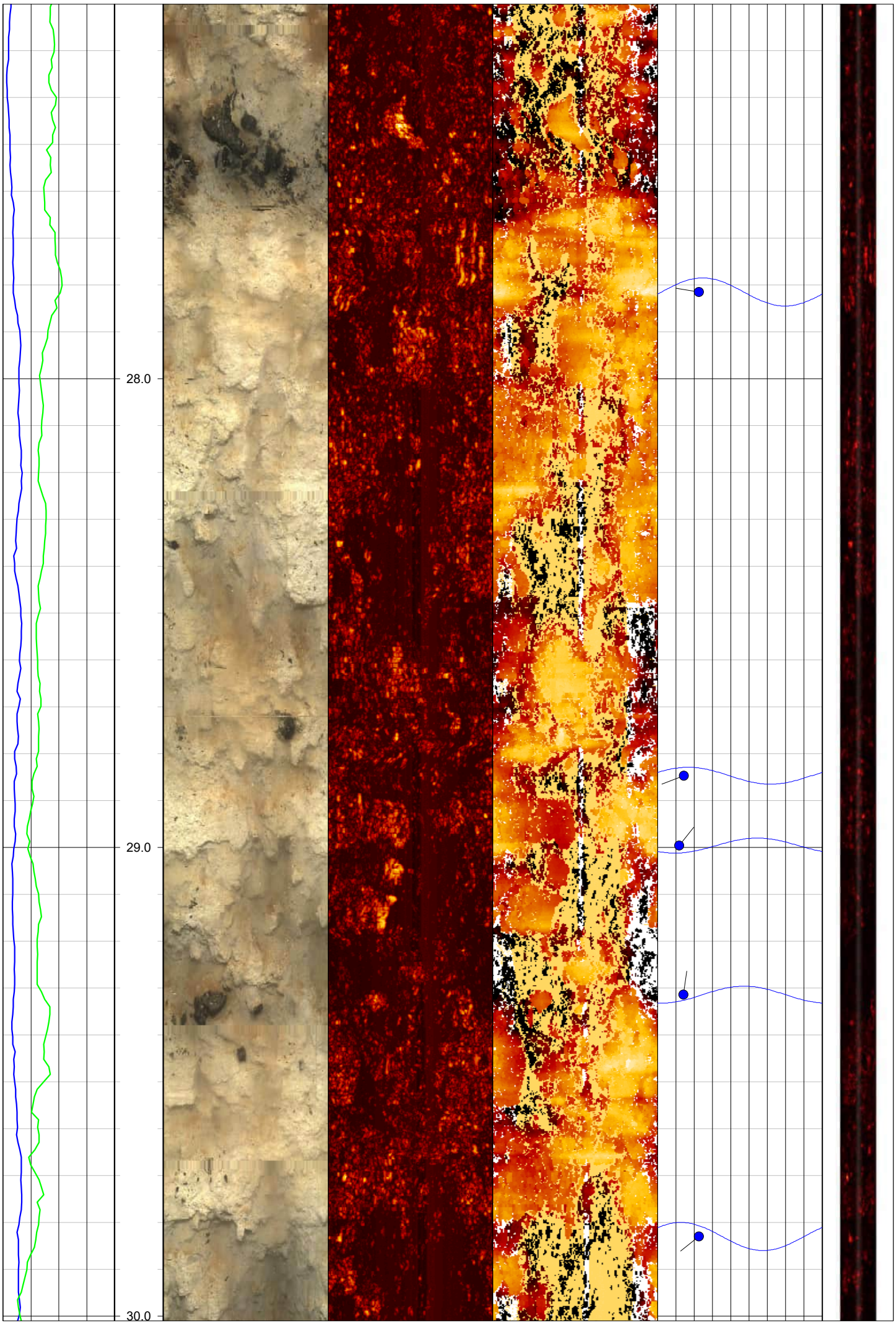
CASING RECORD

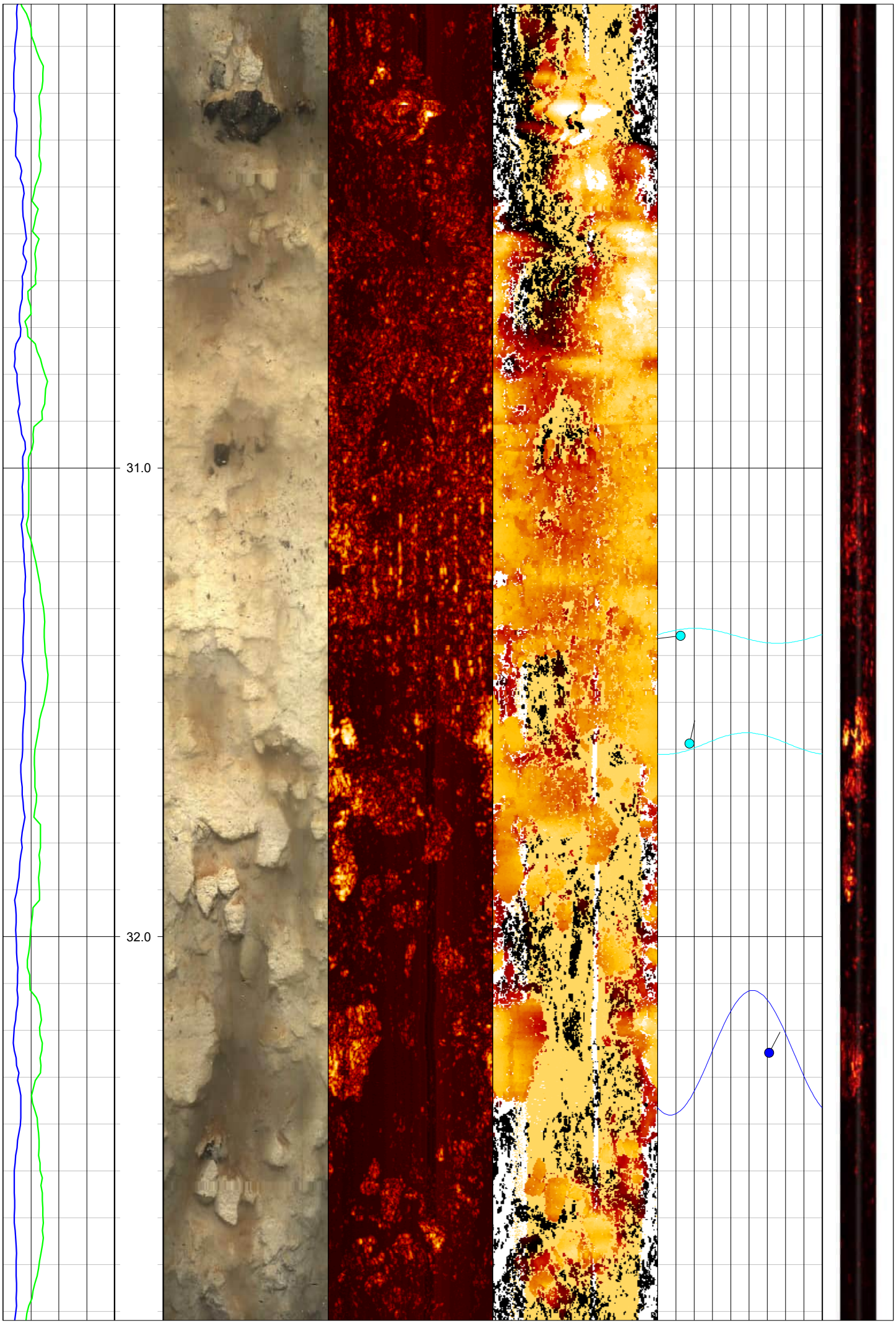
Type	Size: (mm)	From: (m)	To: (m)
Steel	**130**	**-1.3**	**25.7**
Steel	**150**	**0.0**	**20.2**

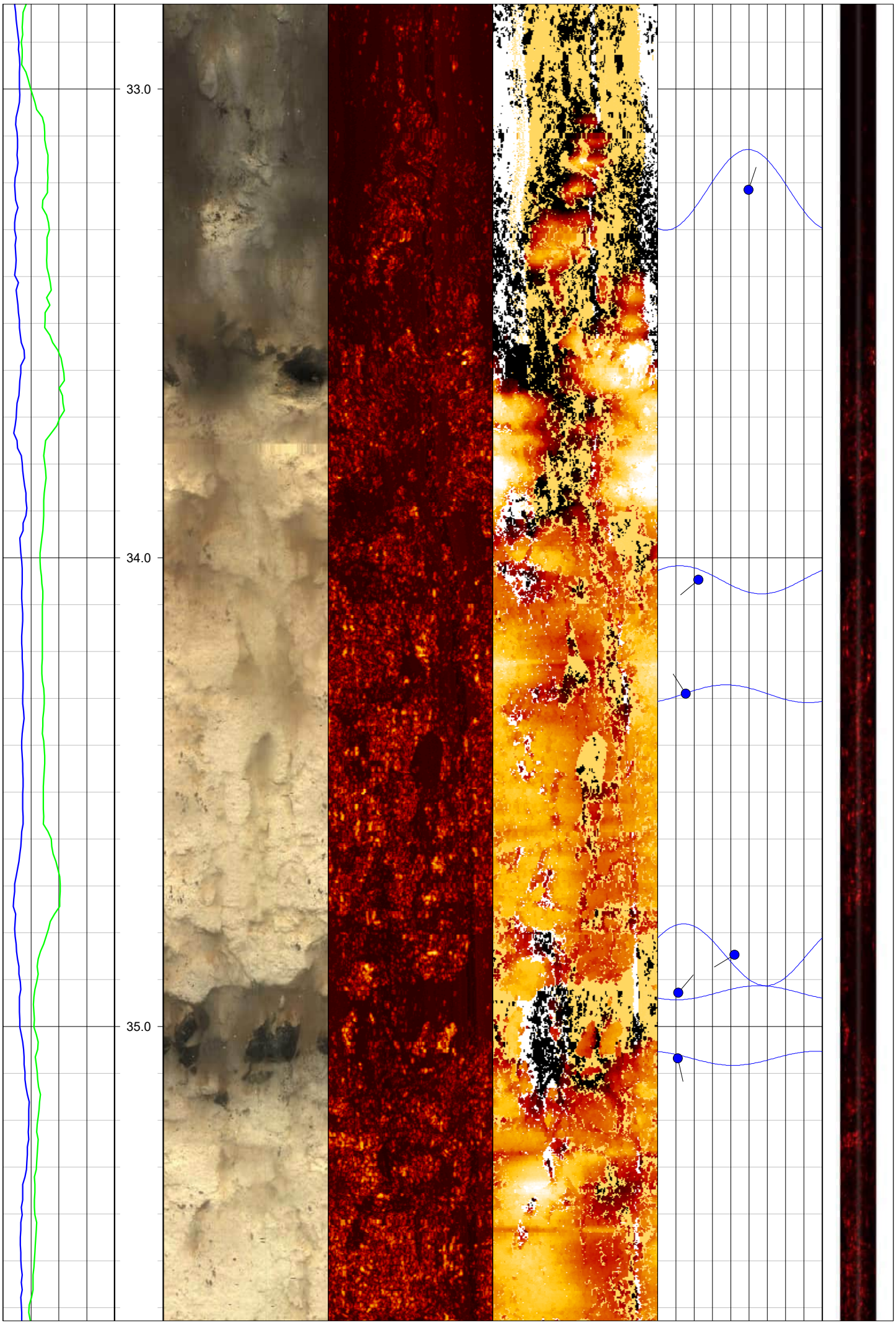


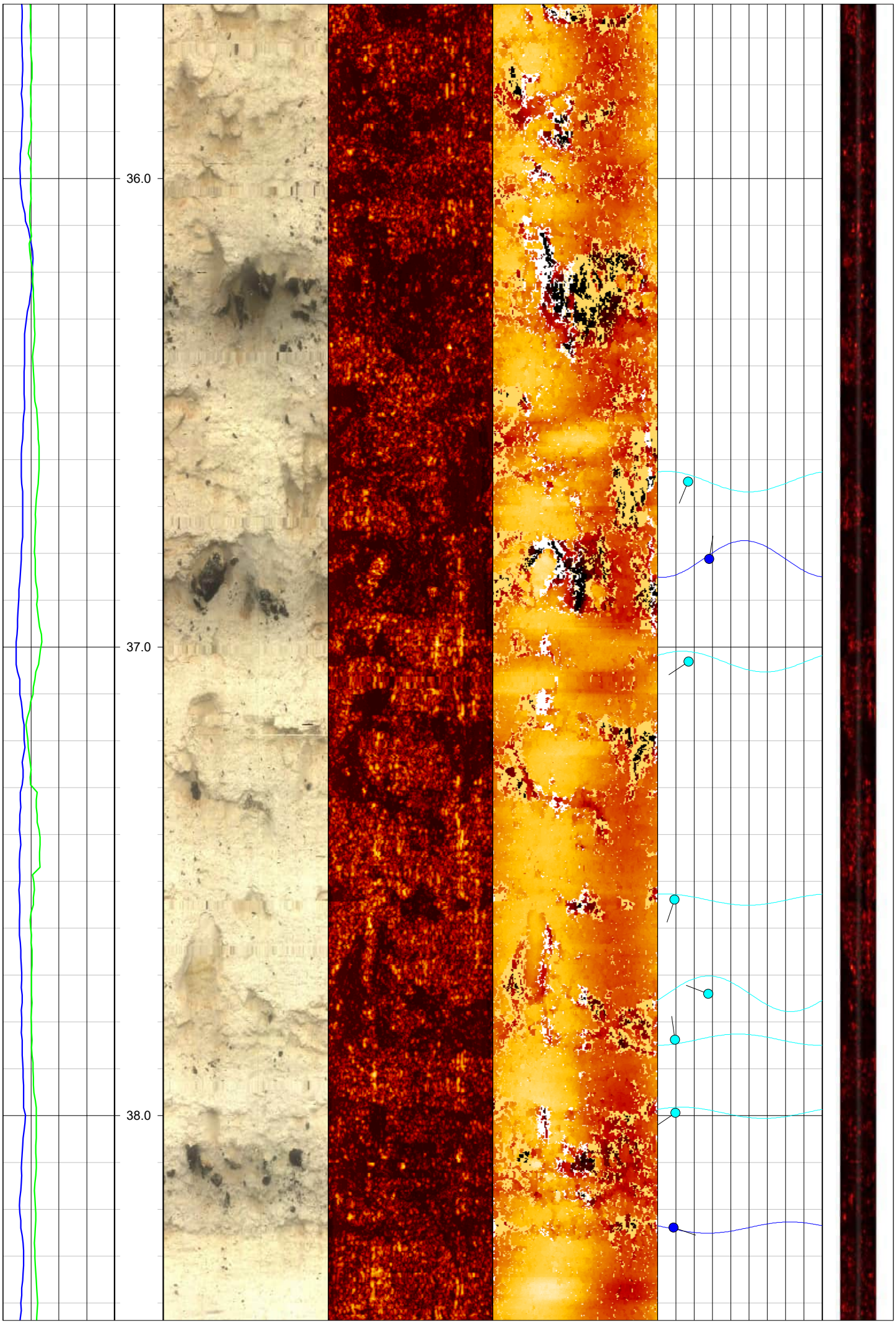

22.0
23.0
24.0

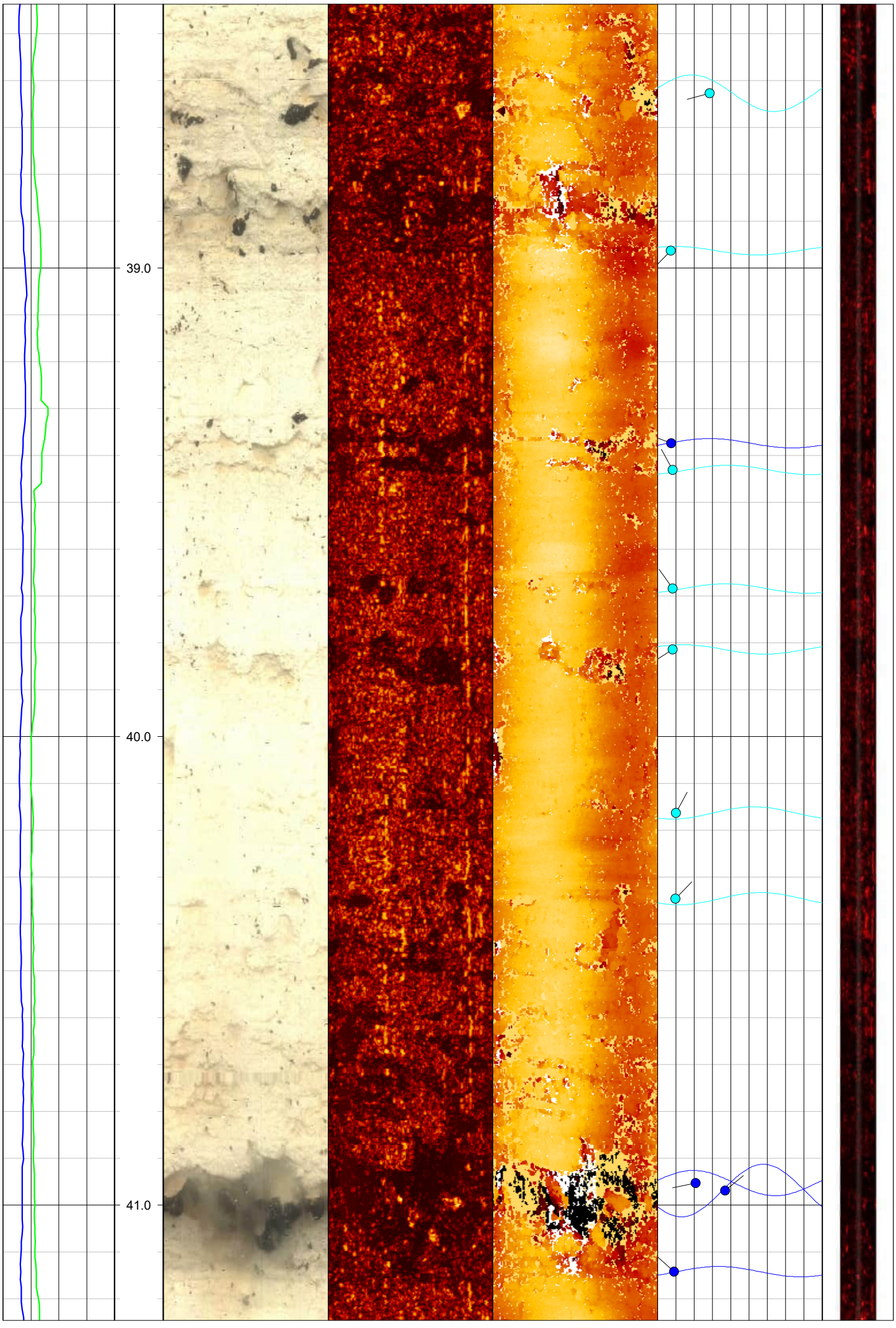

25.0
26.0
27.0

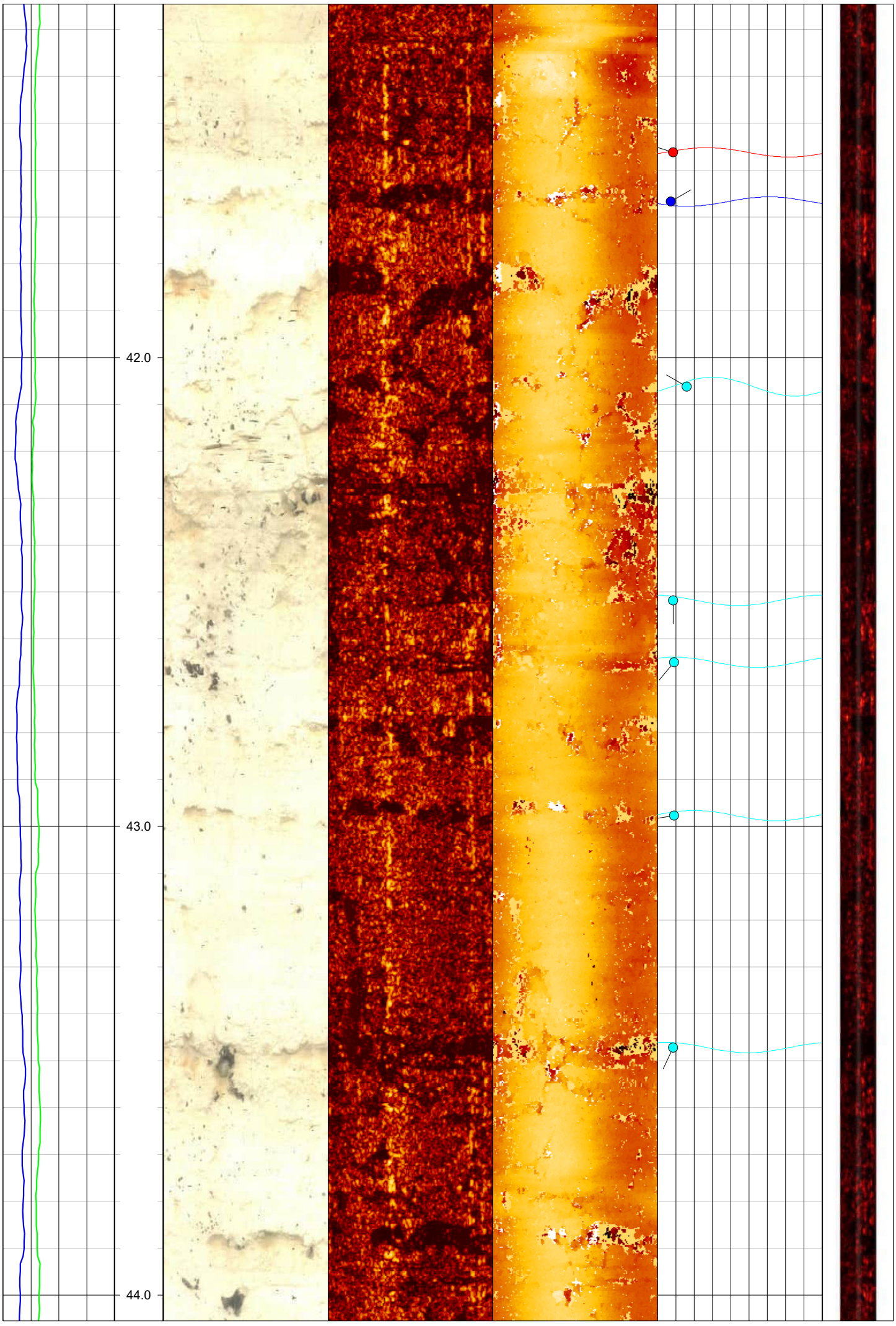

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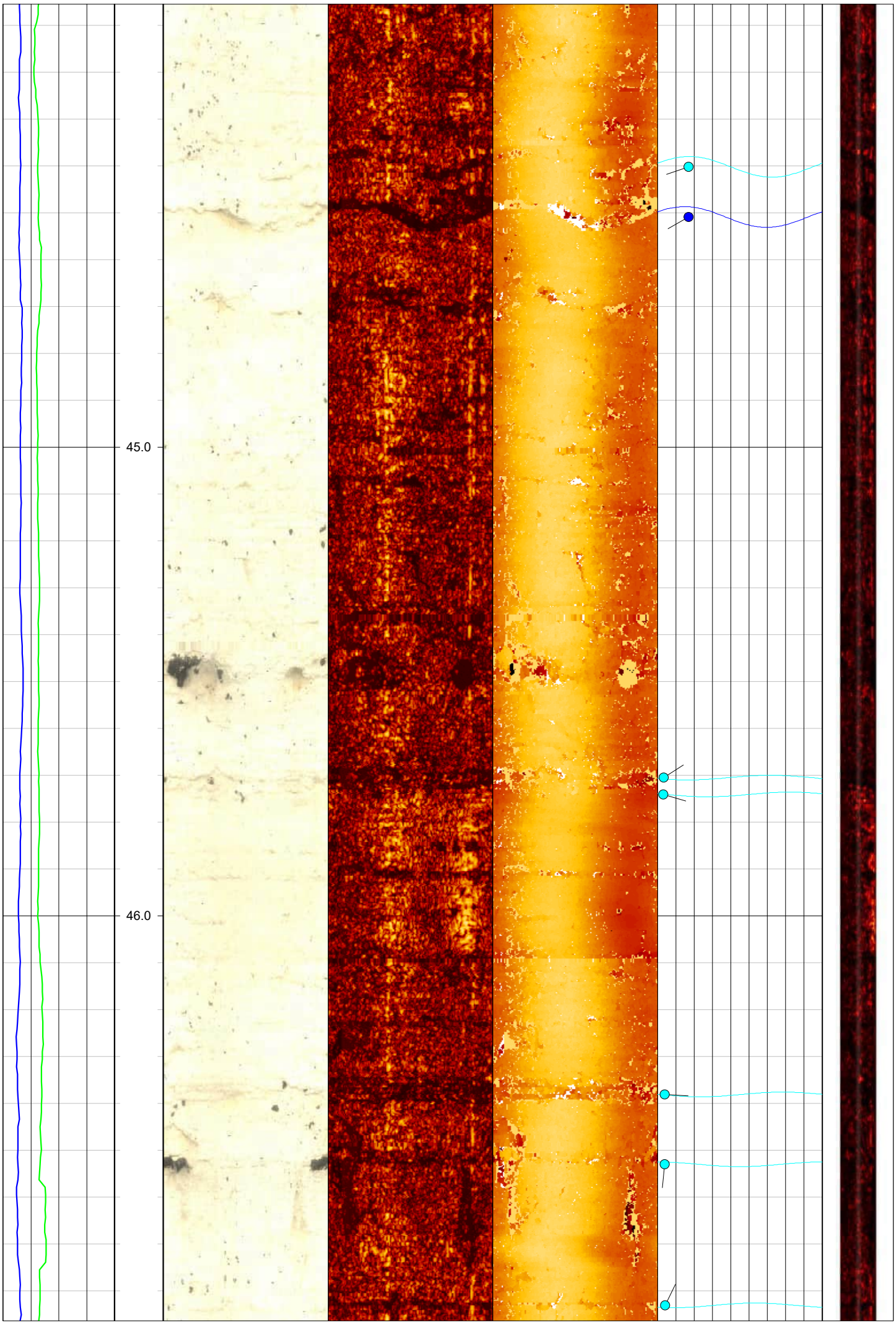

31.0
32.0

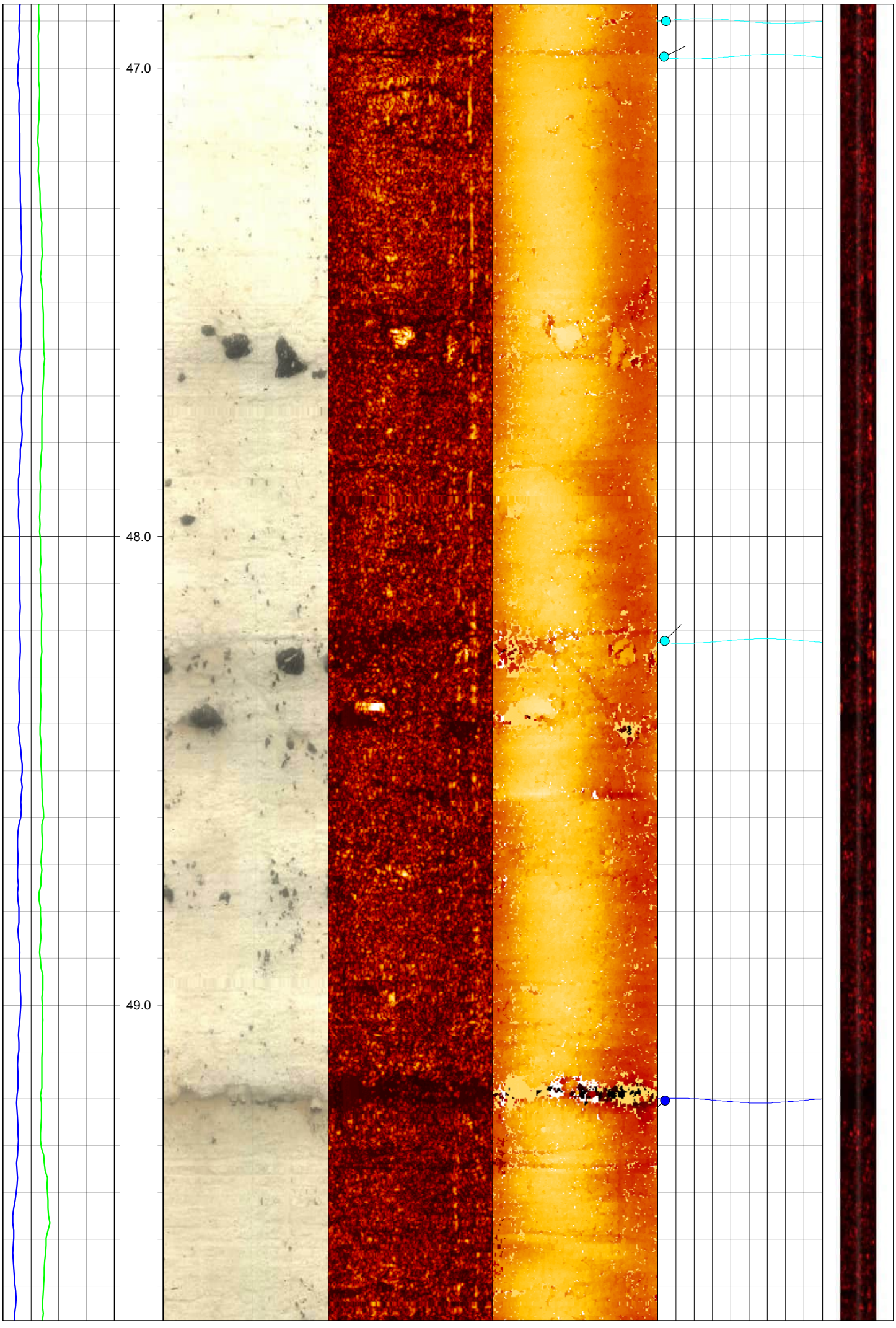

33.0
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35.0

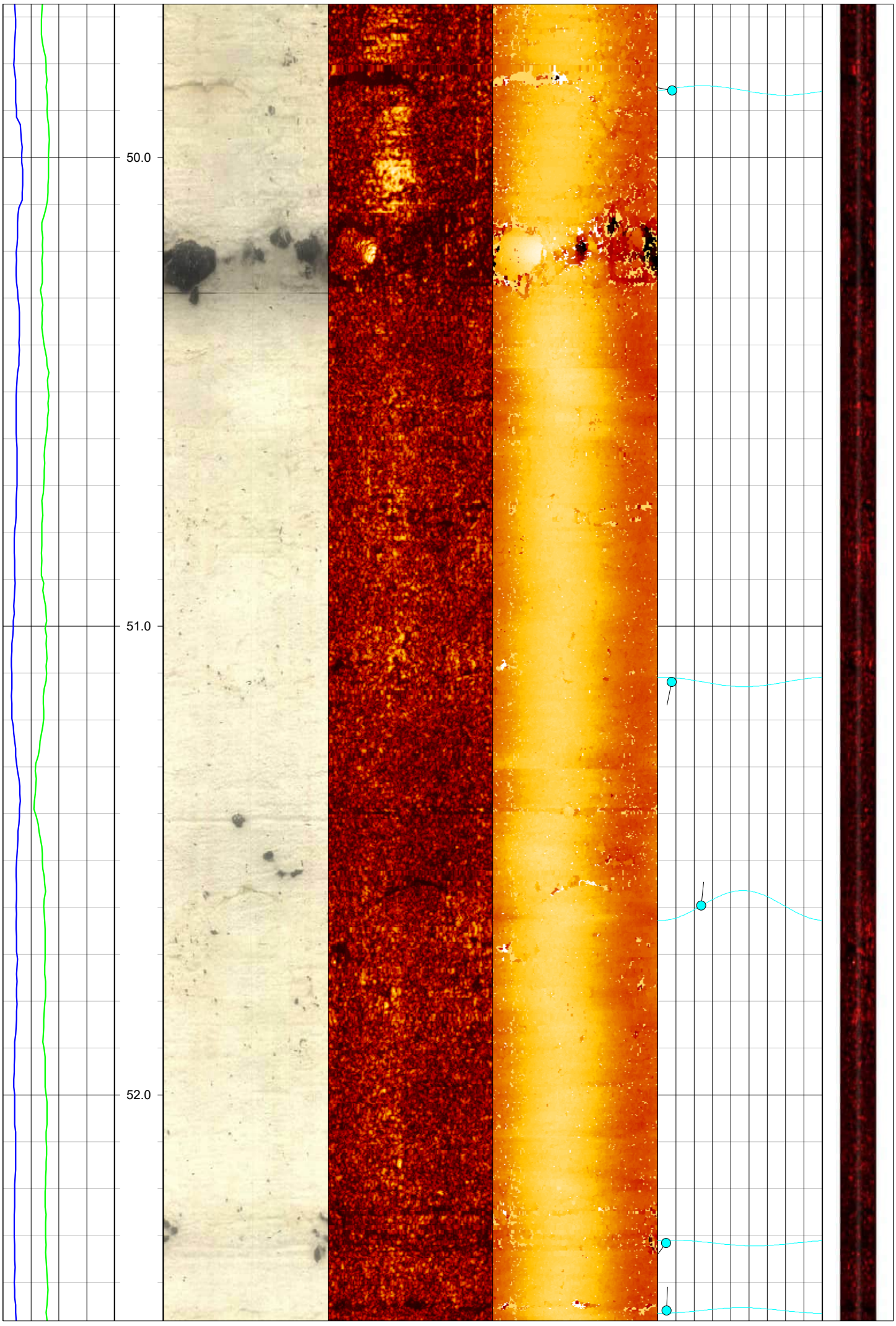

36.0
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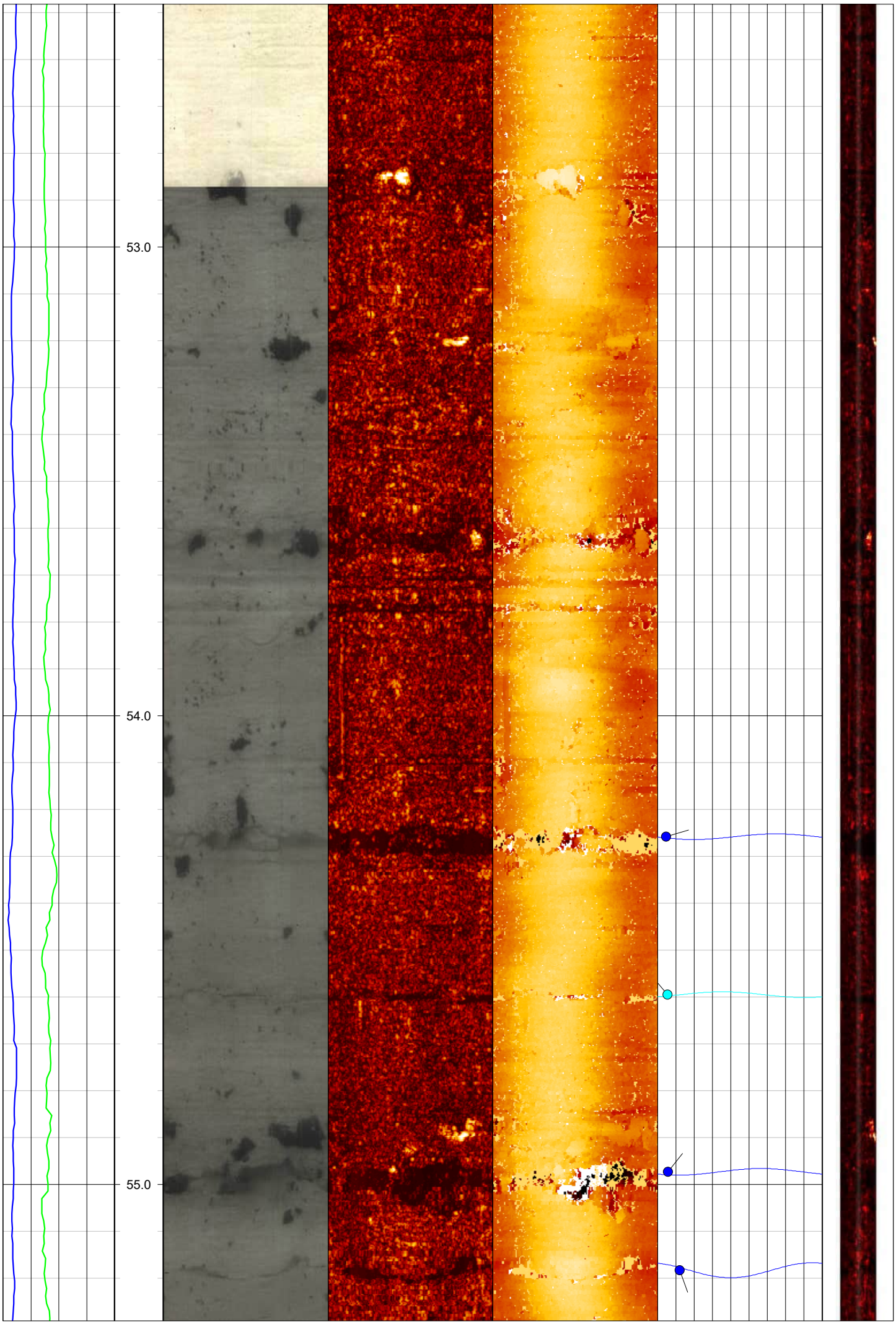

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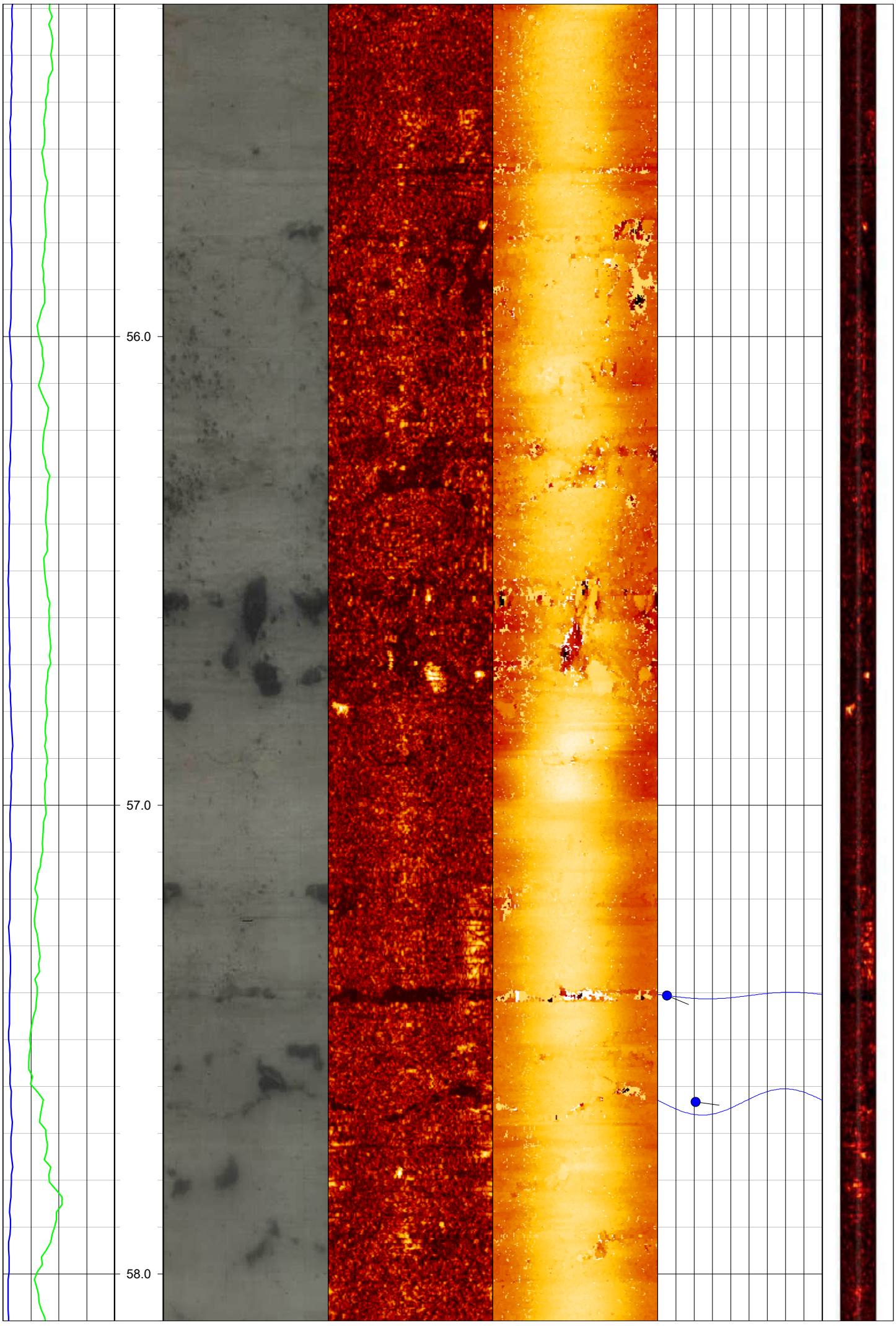

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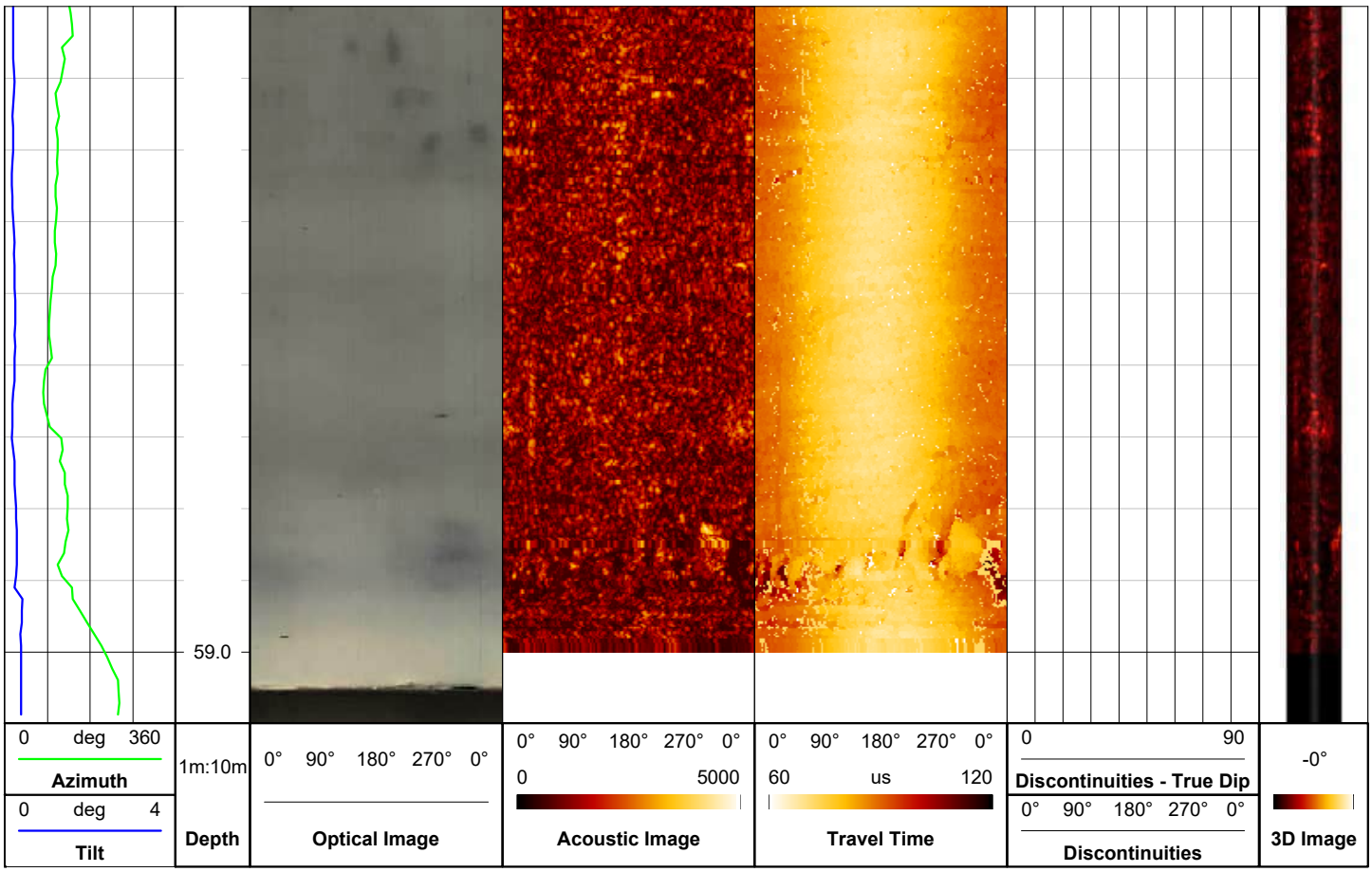

45.0
46.0


47.0
48.0
49.0


50.0
51.0
52.0


53.0
54.0
55.0


56.0
57.0
58.0


0 deg 360
Azimuth
0 deg 4
Tilt
59.0
1m:10m
Depth
0° 90° 180° 270° 0°
Optical Image
0° 90° 180° 270° 0°
0 5000
Acoustic Image
0° 90° 180° 270° 0°
60 us 120
Travel Time
0 90
Discontinuities - True Dip
0° 90° 180° 270° 0°
Discontinuities
-0°
3D Image

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www.lankelma.com

TILBURY

SOIL INVESTIGATION

CPT REPORT

Cone penetration testing
Magnetometer testing
Seismic testing
Dissipation testing
Shear vane testing
Parameter derivation

Project Reference.: 25-32-29428-10

Report Issue No.: 01 29428_01

PROJECT:	Tilbury

CLIENT:	Soil Engineering

FIELDWORK

CPT rig(s)	20.5-tonne track-truck mounted CPT unit (UK3)
Date fieldwork started	29th April 2025
Date fieldwork completed	22nd May 2025
Lankelma's representative	Paul Dimelow
Client's representative	Paschalis Staikos

DOCUMENT CHECKING

Action	Date	Name
Completed	23/07/2025	Christopher Player
Checked	23/07/2025	Joseph Hobbs
Approved	23/07/2025	Joseph Hobbs

Issue	Date	Status
01_01	23/07/2025	Final

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1 INTRODUCTION

At the request of Soil Engineering, a soils investigation was carried out on project *Tilbury*.

Site location:

(In the general region of)

Power Station Road
Tilbury
RM18 8UL

2 DISCLAIMER

The information contained in this report and all other associated reporting deliverables supplied in digital data files and AGS format data files referenced within this report (collectively "Report") are for the sole benefit of Lankelma's client ("Client") identified at the front of this report.

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3 GLOSSARY OF SYMBOLS, TERMS AND ABBREIATIONS

SYMBOLS (excluding base units)

B_q	Pore pressure ratio. The net pore pressure normalized with respect to the net cone resistance: $B_q = (u_2 - u_0)/(q_t - \sigma_v)$
c_{vh}	Coefficient of consolidation. Subscript vh indicates some combination of horizontal and vertical flow when assessed from CPTu dissipation tests.
E	Young's modulus (generic, E' and E_u apply to drained and undrained deformation conditions respectively)
F_r	Normalised friction sleeve resistance: $F_r = f_s / (q_c - \sigma_v)$
f_s	Friction sleeve resistance: The total frictional force acting on the friction sleeve, F_s, divided by its surface area A_s: $f_s = F_s / A_s$
g	Gravitational field strength: g = 9.81 N kg^{-1}
G	Shear modulus (generic, G_0 applies to small strain conditions, G_u applies to undrained shear (G at existing effective stress) and $G_{\%}$ applies to stress at variable % mobilised yield stress (e.g. G_{50}))

s	Specific gravity of solids
I_c & I_{SBT}	Soil Behaviour Type Index: Continuous numerical representations of Robertson soil behaviour type classification charts. I_c and I_{SBT} apply to the Robertson (1990) and Robertson and Cabal (2010) classification charts respectively.
	Soil Behaviour Type Index: Continuous numerical representation of Robertson & Cabal (2010) soil behaviour type classification chart based on dimensionless parameters.
I_R	Rigidity Index: Ratio of shear modulus to undrained shear strength, $I_R = G_u/s_u$
k	Coefficient of permeability with units of velocity
m_v	Coefficient of compressibility: $m_v = 1/M'$
m'	Pre-consolidation (yield) stress exponent (section 0).
M'	Constrained modulus
q_c	Cone resistance: The total force, Q_c, acting on the cone, divided by the projected area of the cone, A_c: $q_c = Q_c/A_c$
Q_t	Normalised cone resistance (method 1): $Q_t = (q_c - \sigma_v)/\sigma'v$
Q_{tn}	Normalised cone resistance where normalisation varies with soil type. See section 6.4.
q_t	Corrected tip resistance: The cone tip resistance q_c corrected for pore water pressure effects on the cone shoulder
$q_{t\text{-}net}$	Net cone resistance: $q_{t\text{-}net} = q_t - \sigma_v$. Where q_t is unavailable q_c is applied
q_{t1}	Normalised cone resistance (method 2): $q_{t1} = (q_t)/(\sigma'_v)^{0.5}$
Dr	Relative density (percentage)
R_f	Friction ratio: The ratio, expressed as a percentage, of the sleeve friction, f_s, to the cone resistance, q_c: $R_f = (f_s/q_c) \cdot 100$
s_u	Undrained shear strength (generic)
u_0	Equilibrium pore pressure
u_2	Measured pore pressure: Dynamic pore pressure measured at the shoulder position (u_2) during penetration and dissipation tests. $u_2 = \Delta u_2 + u_0$
Δu_2	Excess (or differential) pore pressure: $\Delta u_2 = u_2 - u_0$
V_s, V_p	Shear wave velocity, V_s, and pressure wave velocity, V_p. Measured with use of a seismic receiver

Greek

γ	Unit weight of soil
γ_w	Unit weight of water
ρ	Volumetric mass density (or specific mass) of soil: $\rho = \gamma/g$
σ_v	Total overburden stress
σ'_v	Effective overburden stress
σ_{atm}, P_a	Reference atmospheric stress: σ_{atm} = 101.3 kPa

TERMS AND ABBREVIATIONS

Cone or 'tip': The conical tip of the cone penetrometer. This is sometimes referred to as the 'point' in other literature

CPT: Cone penetration test

CPTu: Cone penetration test using a penetrometer with pore pressure measurement (piezocone).

Friction sleeve: The section of the cone penetrometer upon which the sleeve friction is measured, located behind the conical tip.

HOC: Heavily overconsolidated

LOC: Lightly overconsolidated

mBGL: Meters below ground level

NC: Normally consolidated

OC: Overconsolidated

Penetration length: CPT test length without correction for inclination

Piezocone: A cone penetrometer with a pore pressure sensor (u_2 or u_1 position).

Seismic cone: A cone penetrometer with a seismic receiver incorporated.

Dynamic pore pressure: The pore pressure measured during penetration (u_2 or u_1)

Soil behaviour type, or 'SBT': A classified soil type according to a classification system based on CPT or CPTu measurements.

Rod string: The series of hollow tube push rods that transmit thrust force to the penetrometer.

Zero value(s) or baseline value(s): The analog or digital output of a sensor (or set of sensors) with no load applied.

4 COMPLETED WORKS

- 5 nr. combined magnetometer-seismic cone penetration tests with pore pressure measurement (SCPTu)
- 1 nr. combined magnetometer-cone penetration tests with pore pressure measurement (CPTu)
- 22 nr. dissipation tests
- 15 nr. shear vane tests
- 10 nr. magnetometer tests
- Factual report including point data interpretation of selected parameters

Several non-scheduled short QA/QC dissipation tests were undertaken during the works during, seismic testing, penetration pauses, to verify drainage conditions, re-saturate or during temperature stabilisation pauses. As such, there was limited consideration of the degree of consolidation or quality. However, where these tests produced data suitable for interpretation, the results and interpretation were included in this report.

Appendix A contains tabulated details of the works completed together with analysis results where applicable.

5 FIELDWORK GENERAL

Fieldwork was performed with a 20.5-tonne track-truck mounted CPT unit (UK3) equipped with a 17.0-tonne capacity hydraulic ram set.

The Client was responsible for the positioning and re-survey of all investigative locations.

The target depth for the investigation was between 6 m and 25 m below ground level. Table 5 details the final test depths and reasons for test termination (*refusal factor).* Where required, each penetration refusal decision was verbally confirmed with the Client's on-site representative.

The depths of dissipation tests were advised by the Investigation Supervisor or Engineer's Representative.

6 CONE PENETRATION TESTS

Cone penetration testing was carried out in general accordance with BS ISO 22476-1:2022.

Penetrometer measurements included cone tip resistance, friction sleeve resistance and dynamic pore water pressure sampled at a 10 mm resolution.

Penetrometers were calibrated in accordance with BS ISO 22476-1:2022 and ISO 376:2011 within 6 months of the fieldwork completion. Copies of all calibration certificates for the cones used are provided in Appendix B.

The piezometer filter element was HDPE plastic with a nominal filtration of 40 to 60 microns. The filter was vacuum saturated in a > 99.9% vacuum under 1.5 Pa.s vegetable glycerine oil for > 7 days prior to mobilisation. The pore pressure system was vacuum saturated in the disassembled state under 0.042 Pa.s monopropylene glycol and assembled under oil prior to each test. The u_2 filter position was used for all piezocone tests.

At intervals during the fieldwork, the penetrometer was temperature stabilised in a water bath to obtain stabilised zero load baseline values (after extraction from the water). This was done prior to each test, or approximately every 30 m of testing where the final depths were relatively shallow, when larger zero drifts were observed, or when changing penetrometer. The purpose of this procedure is to prevent transient temperature effects from influencing the strain gauge sensors, so that representative baseline values may be subtracted from the data collected during penetration - where temperature is controlled, and temperature effects are corrected for based on the magnitude and rate of change in temperature. Additionally, it enables more reliable assessment of long-term shift in the baseline output of the sensors.

Penetrometer dimensional measurements and tolerance checks were obtained prior to each test, or following each 20-60 m of testing, depending on aggressiveness of ground conditions and closeness of prior measurements to tolerance limits. The tip measurement was based on the largest diameter portion of the tip (comprising the conical part, u_2 pore pressure filter and 'equal end area piece' adjacent to the friction sleeve), while the sleeve measurement was obtained at both ends of the sleeve and averaged for the purpose of determining the surface area.

6.1 CPT DATA REDUCTION AND PRESENTATION

The CPT results are presented in Appendix C. The corrected cone resistance (q_t), local side friction (f_s), dynamic pore water pressure (u_2), friction ratio (R_f) and inclination are all presented against depth and elevation in accordance with BS ISO 22476-1:2022. CPT data and the associated derived geotechnical parameters are included in the 4.0 data file provided.

The cone tip and sleeve force measurements were converted to pressure using the measured tip and sleeve diameters.

Zero load baseline values were recorded before and after each test, and periodically these were obtained after temperature stabilisation in a water bath to remove the influence of transient temperature effects. When selecting the most representative baseline values (for subtraction from the raw data), priority was given to values obtained following temperature stabilisation. Depending on the frequency of baseline output stabilisation, the stabilised values applied to the raw data may be obtained prior to a previous test, or, following a subsequent test when the average of pre & post stabilised baseline values is applied to the data.

Cone tip and sleeve force measurements were converted to pressure using the field measured dimensions of the penetrometer.

For piezocone tests the total cone resistance (or 'corrected cone resistance'), q_t, was calculated according to the formula

$$q_t = q_c + u_2 (1 - a)$$

Where a is the 'net area ratio' of projected shaft area divided by projected face area, and 1- a is the proportion of cross-sectional area between the cone tip and penetrometer body where pore pressures (positive or negative) can act to add or subtract from the total external axial force on the tip. The difference between measured and corrected values is largest in low strength collapsible soils with large excess pore pressures. The percentage adjustment is described by the curves on the chart below for a = 0.8:

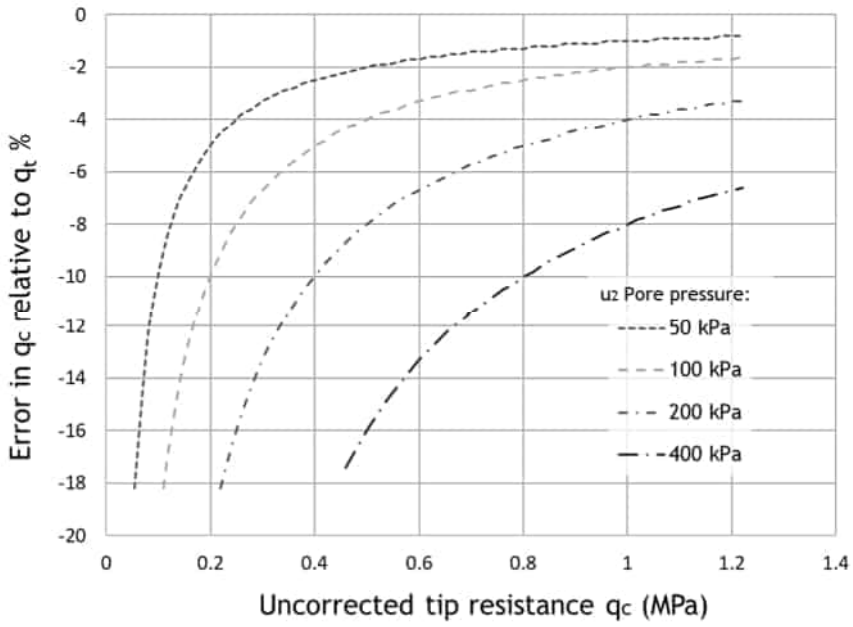


Figure 6-1 Uncorrected tip with % error for various pore pressure values

All penetrometers had equal sleeve end areas and no correction for pore pressure effects were applied to the sleeve readings.

Penetration length readings were corrected for inclination and sleeve readings were depth corrected for the dimensional offset between cone tip and sleeve during post processing.

Rod spikes (artefacts of the pause for push rod addition) were filtered from the cone tip and sleeve data and replaced with an interpolated value.

The data was re-sampled from 10 mm resolution to 20 mm to reduce the size of the data set to a more manageable size for end users. A 20 mm resolution is within the intrinsic influence zone of the cone tip measurement and the loss of meaningful resolution is negligible.

Raw data plots are presented in Appendix C and include the intermediate interpretation parameters friction ratio, R_f, and pore pressure ratio B_q. For piezocone tests q_t is reported on all logs, and q_c only

appears in the digital AGS data. Dissipation test curves are plotted in Appendix H. Dissipation interpretation values are presented alongside CPT test results in Appendix G.

Geotechnical parameters appropriate for drained and undrained cone penetration conditions were derived for corresponding drained and undrained derived soil behaviour types (SBTs) respectively, however, to account for uncertainty in the SBT correlation with drainage behaviour, all parameters were derived over a range of transitional soils within the range $2.4 < I_c < 2.7$ (see section 6.5). Geotechnical parameter plots are presented in Appendix D onwards.

6.2 IN-SITU STRESS CONDITIONS

An estimate of the equilibrium pore pressure and total and effective vertical stress states is required for derivation of net and normalised readings required for interpretation of most soil parameters obtained from the CPT and dissipation test.

The total vertical stress with depth was calculated as the sum of the derived soil unit weight above a given depth:

$$\sigma_{v0} = \sum_{i=1}^{n} \gamma_i \, h_i$$

Where γ_i is the soil unit weight (kN/m^3) assigned to the depth increment *I* and h_i is the depth increment (m).

See section 6.3 for information on the applied empirical estimate of soil unit weight.

The depth of the phreatic surface applied in the calculation of effective stress was estimated for each location based on interpretation of piezocone measurements in drained soils and/or the final pressure of dissipation tests which proceeded to equilibrium pressure. The project average piezometric depth (or elevation if available) was applied to locations without direct measurements.

The in-situ pore pressure for specific dissipation test interpretation was assumed as above or, where possible, assessed directly from the dissipation plot.

Note: The term phreatic surface is used here, and it is assumed that that the piezometric level measured by the piezometer, under hydrostatic conditions, coincides with the phreatic surface. The phreatic surface reported is intended to provide information about pore pressure distribution assumed for calculation purposes and may not represent the true position of the groundwater table or perched water bodies. Complex groundwater pressure distributions will be applied if they are observed from the measurements and are sufficiently well defined.

6.3 SOIL UNIT WEIGHT

The soil unit weight was estimated using the following method proposed by Robertson (2010b).

$$\frac{y}{y_w} = 0.27\,Log(R_f) + 0.36\,(Log(q_t/R_f)) + 1.236$$

Throughout pre-drilled zones (inspection pits or drill-out) the soil was assigned a nominal unit weight of 17 kN/m^3.

For depths where the friction sleeve resistance measurement was less than zero due to measurement limitations, the friction sleeve resistance input parameter was substituted with a nominal 1.0 kPa resistance for the purpose of obtaining an approximate soil unit weight necessary for estimation of total vertical stress over the entire test profile.

6.4 SOIL BEHAVIOUR TYPE (SBT)

The data were interpreted using 4 soil behaviour type schemes: Robertson (1990, 2010, 2016) and Schneider et al, 2008. The Robertson (1990) scheme is very widely used and forms the bases of the layer analysis whereby the profile is split into approximate zones of common classification or classification variance. The Robertson (2010 & 2016) and Schneider at al methods are less widely used in general practice but can provide classification that is more relevant to the design problem in many instances and the reader is directed to the relevant references for additional information.

For all SBT classification systems discussed in this report, it should be noted that:

- The systems provide a general soil type that tends to show biased towards the soil fraction that dominates the mechanical behaviour in relation to the CPT parameters on which the system is based.
- Significant bonding/microstructure will influence derived soil type (Robertson 2022).
- If cohesive soils are dry and/or heavily overconsolidated, the classification tends to shift towards a coarser soil type (or lower I_c index).
- Strictly, all SBT systems are applicable to saturated or near saturated soils. If applicable, performance of SBT systems in dryer soils should receive due scrutiny.
- While the repeatability and behavioural bias of the SBT is often of practical benefit, the classification may not be an appropriate substitute for classification based on particle size grading and/or consistency (Atterberg indices).

A dedicated SBT comparison log is provided in Appendix D.

<u>Robertson (1990, 2010)</u>

The Robertson 1990 and 2010 SBT classification systems, based on the same chart shown in Figure 6-3, provides 9 classification zones as a function of q_t (or q_c) and f_s.

The 1990 system is based on dimensionless stress normalised parameters of cone resistance (Q_t) and friction ratio (F_r). Where:

$$Q_t = \left(\frac{q_t - \sigma_{v0}}{\sigma'_{v0}}\right)$$

$$F_r = \left(\frac{f_s}{q_t - \sigma_{v0}}\right)$$

Robertson (2009) recommended use of an improved stress normalisation method for tip resistance (Q_{tn}) that uses a stress exponent *n* that varies with the derived soil type and is found iteratively (starting with Q_t) from:

$$Q_{tn} = \left(\frac{q_t - \sigma_{v0}}{p_a}\right) \cdot \left(\frac{p_a}{\sigma'_{v0}}\right)^n$$

and

$$n = 0.318(I_c) + 0.05\left(\frac{\sigma'_{v0}}{p_a}\right) - 0.15$$

where I_c is the SBT index discussed in section 6.5, and is continuous function of Q_{tn} and F_r.

Three iterations of Q_{tn} were performed during data processing, with the initial calculation based on an average of the non-normalised and normalised values of I_c for the upper 6 m to limit the effects of overconsolidation at shallow depth.

While the classification based on normalised parameters is more accurate, particularly for NC soils exceeding ~15 m depth, the classification is often significantly in error (artificially granular/drained) at shallow depth (< ~1-3 m). The error at shallow depth is largely associated with the potentially large difference between the estimated vertical effective stress (applied in normalisation of q_t and f_s) and the unknown horizontal stress influencing penetration resistance, especially at high OCR state.

Robertson (2010) proposed a non-normalised version of the 1990 chart which uses dimensionless cone resistance (q_c/Pa) and friction ratio (Rf). SBT classification according to this chart is generally more reliable at shallow depth in Lankelma's experience.

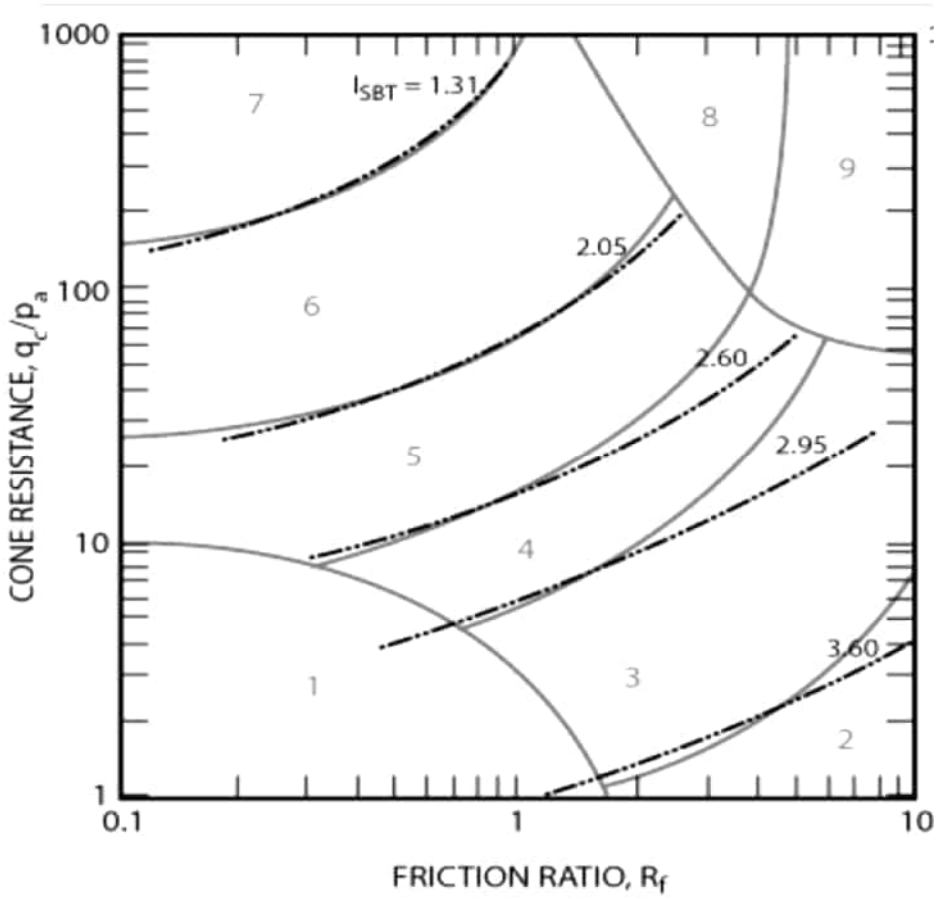


Figure 6-2 Non-normalised SBT chart by Robertson et al. (2010) based on dimensionless cone resistance (qc/Pa) and friction ration, Rf, showing contours of SBT index I_{SBT} (denoted I_c on the test plots). The chart is equally applicable to normalised tip resistance (Q_t, Q_{tn}) and normalised friction ratio (F_r) values using the same dimensionless scales.

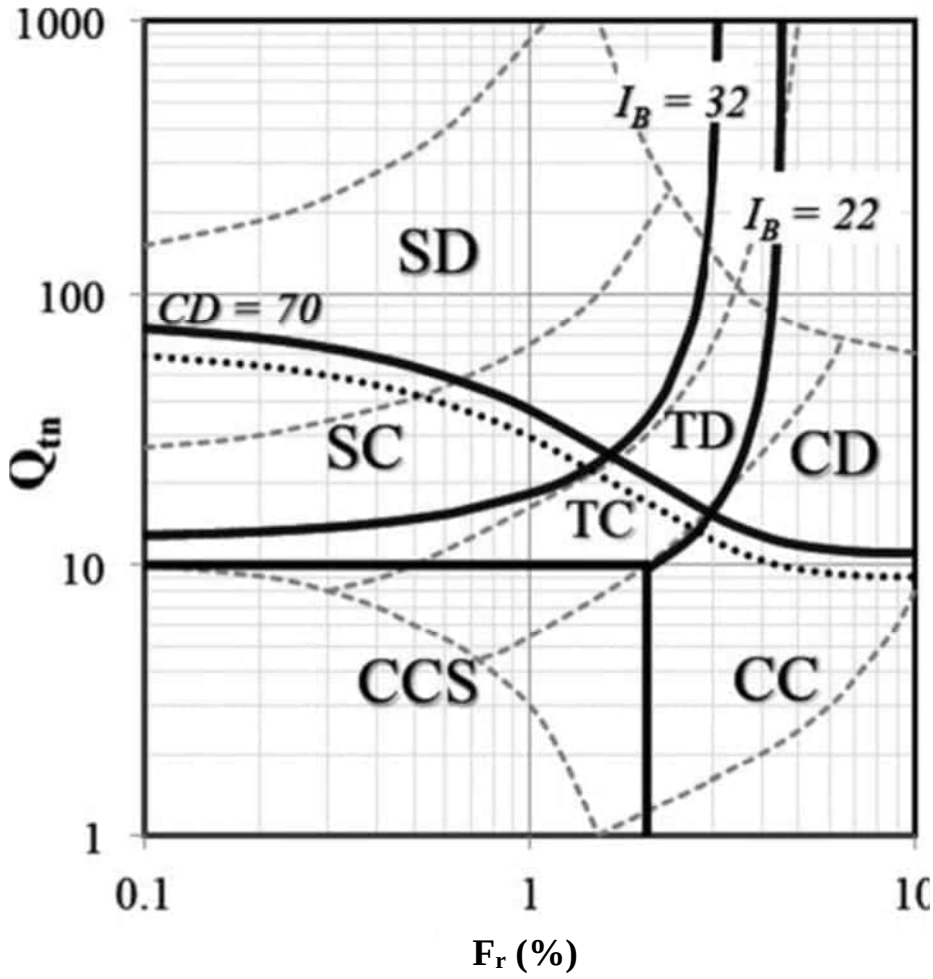
Table 1 Robertson (1990, 2010) soil behaviour type zone descriptions

Zone	**Soil Behaviour Type (SBT)**		
1	Sensitive fine-grained	6	Sands - clean sand to silty sand
2	Organic soils	7	Gravelly sand to sand
3	Clays – clay to silty clay	8*	Very stiff/dense sand to clayey sand[1]
4	Silt mixtures - clayey silt to silty clay	9*	Very stiff fine grained[1]
5	Sand mixtures – silty sand to sandy silt	**Heavily overconsolidated or cemented*	

[1]Note zones 8 and 9 appear as *'Very stiff/dense sand to clayey sand – HOC or cemented'* and *'Very stiff fine grained – HOC or cemented'* within the soil unit descriptions of plots in Appendix D.

Robertson 2016

Using the same Q_{tn} - F_r space as the 1990 and 2010 charts, Robertson (2016) proposed an alternative purely behavioural classification system that places less emphasis on classification according to composition/textural properties and more emphasis on mechanical behaviour – namely the tendency of the soil to dilate or collapse during large strain shear, and sensitivity.



Zone	Soil Behaviour Type (SBT)
CCS	Clay-like – contractive - sensitive
CC	Clay-like – Contractive
CD	Clay-like – Dilative
TC	Transitional - Contractive
TD	Transitional - Dilative
SC	Sand-like - Contractive
SD	Sand-like - Dilative

Figure 6-3 Robertson 2016 soil behaviour type classification chart and zone descriptions

Schneider *et al.* (2008)

Schneider *et al.* (2008) proposed a classification system based on the normalised pore pressure B_q and normalised tip resistance Q_t. This system is particularly useful for fully saturated soils with a repeatable and dynamic pore pressure response.

A set of logs showing both the Robertson and Schneider et al. classification results are provided for comparison in Appendix D.

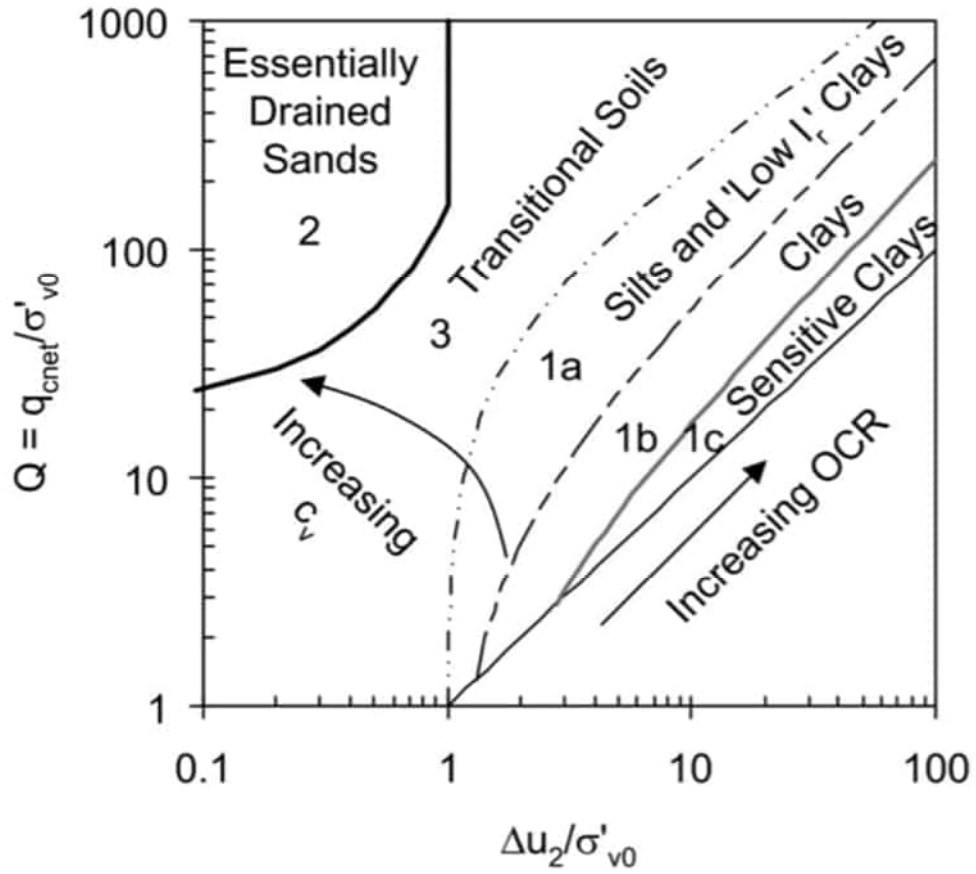


Figure 6-4 Schneider 2008 soil behaviour type classification chart

Layer Analysis

The layer boundaries are manually interpreted based on broad changes in Robertson's (1990) SBT classification or variance with depth. Once the layer boundaries are defined, the SBT zones within each layer are listed along with the corresponding percentage of data points, excluding null/filtered data. The modal classification is reported in full, while secondary zones are provided with abbreviated descriptions. For example: *'Clays – clay to silty clay [74%];* Silt mixtures [20%]', where the asterisk indicates an abbreviation of the full description 'Silt mixtures – clayey silt to silty clay'.

It is important to note that classification zone boundaries do not exist naturally, and minor variations in cone response can result in multiple classifications within layers of relatively uniform behaviour. This is particularly true when the data plot is near a zone boundary, contains spurious spikes, or includes very thin layers. Therefore, a system is necessary to limit the number of classified zones within each layer description. The following logic has been applied to retain only the most significant classifications:

For LT >= 1, C = 85
For 0.5 <= LT < 1, C = 75
For LT < 0.5, C = 65

Where
C = Minimum % SBT zone classification coverage within the layer description text
LT = Layer thickness (m)

For layers having a thickness of less than 1 m, 8% of data at the top and bottom of the layer (16% total) are excluded to limit the effect of transition zone data (measured resistance influenced by overlying or underlying strata of different stiffness) being included in the classification.

The continuous SBT index I_c can be used to assess the classification distribution and variation not accounted for by the layer description.

6.5 SOIL BEHAVIOUR TYPE INDEX – I_C

The principal trend in soil behaviour type (SBT) variation can be expressed by a continuous index, I_C, as proposed by Robertson and Wride (1998) based on a similar index proposed by Jefferies and Davies (1993). The index provides a continuous profile of SBT variation with depth for end-user analysis of soil units and variation within units. The equivalent non-normalised version proposed by Robertson (2010) is provided for comparison.

The basis of I_c and its approximation of the original chart classification zones may be seen from Figure 6-2. The method does not identify zones 1 (*sensitive fine grained)* or zones 8 & 9 (*heavily overconsolidated or cemented*).

Normalised SBT index I_C (Robertson and Wride, 1998), as updated by Robertson (2009) to use Q_{tn}:

$$I_c = [(3.47 - \log Q_{tn})^2 + (\log F_r + 1.22)^2]^{0.5}$$

Non-normalised SBT index I_C (Robertson, 2010):

$$I_c = \left[\left(3.47 - \log\left(\frac{q_c}{\sigma_{atm}}\right)\right)^2 + (\log R_f + 1.22)^2\right]^{0.5}$$

The normalised version of I_c is generally more accurate, while the non-normalised version is intended for compatibility with the non-normalised Robertson's (2010) SBT chart and may be more accurate at shallow depths in overconsolidated soils.

I_c results are presented in Appendix D and are repeated alongside derived parameters on all plot sheets to provide SBT context.

6.6 RELATIVE DENSITY

The relative density of sands was calculated based on an empirical relationship proposed by Jamiolkowski *et al.* (2001) based on a large database of undisturbed frozen samples and calibration chamber tests on clean sands.

$$D_r = 100\left[0.268 \cdot \ln\left(\frac{q_t/\sigma_{atm}}{\sqrt{\sigma_{vo}'/\sigma_{atm}}}\right) - k\right]$$

k = Compressibility dependant constant can be taken as -0.675 for medium compressibility (applied value in our interpretation), <= 1 for high compressibility and >= 2 for compressible sands.

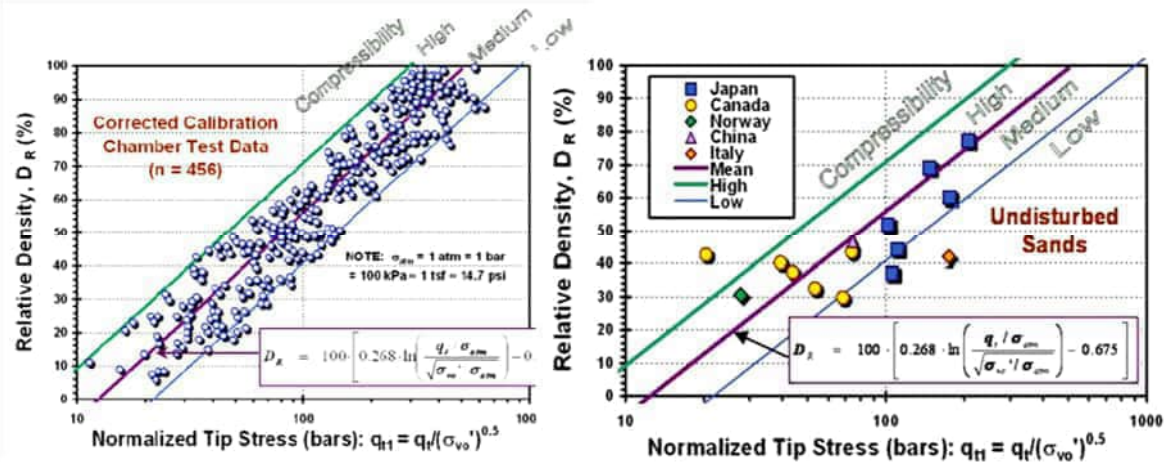


Figure 6-5 Relative density with normalised tip stress and sand compressibility from calibration chamber tests (left) and undisturbed frozen samples (right). Jamiolkowski *et al.* (2001). Reproduced from Mayne (2007).

The results are presented in Appendix F.

6.7 UNDRAINED SHEAR STRENGTH

The undrained shear strength s_u is usually estimated by dividing the net tip resistance by an empirical cone factor N_k (Lunne *et al*, 1997):

$$s_u = \frac{q_c - \sigma_{v0}}{N_k}$$

Mayne and Peuchen (2018) performed an evaluation of 407 high-quality undrained anisotropically consolidated triaxial compression tests (CAUC) with net tip resistance data pairs, resulting in N_{kt} factors with regression analysis details for five categories of clays shown in Table 3.

Table 2 Summary of CAUC s_u versus q_{net} for various clays. Reproduced from Mayne and Peuchen (2018).

Clay Group	Number of sites	Nr Data	Correlation Coefficient r^2	Factor N_{kt}	Mean Pore Pressure Parameter B_q
1) Offshore NC-LOC	17	115	0.98	12.32	0.51
2) Onshore NC-LOC	30	191	0.867	12.00	0.53
3) Sensitive NC-LOC	5	43	0.507	10.33	0.84
4) OC Intact	5	36	0.862	13.57	0.49
5) OC Fissured	5	22	0.393	22.47	-0.01
All clays	62	407	0.923	13.33	0.55

The test plots of Appendix E provide profiles of s_u corresponding to the N_{kt} factors of groups 2, 4 and 5, with the applicable N_{kt} value and soil group name indicated in the header legend. *'s_u3…reference'* on the logs corresponding to N_{kt} = 15 and is included for comparison to data interpreted using the commonly adopted N_{kt} value of 15 for 'normal' clays.

A variable N_{kt} factor can be estimated with depth as a function of the pore pressure parameter B_q, applicable for B_q values of > -0.01. The following equation proposed by Mayne and Peuchen is based on the same database evaluation:

$$N_{kt} = 10.5 - 4.6 \cdot \ln(B_q + 0.1)$$

Where the pore pressure parameter B_q is the ratio of excess pore pressure to net tip resistance:

$$B_q = \frac{u_2 - u_0}{q_t - \sigma_{v0}}$$

The estimate of N_{kt} has a standard error of 2.4 and correlation coefficient of 0.645.

When calculated, the s_u estimate based on B_q is presented as 's_u5 – Dynamic N_{kt} from Bq (CAUC)' on the plots and is only suitable for tests that have a high-quality pore pressure data, often indicated by a positive, repeatable, and dynamic response.

Note: N_{kt} (with subscript 'kt') indicates a N_k factor that has been established using the corrected (total) tip resistance q_t. N_{kt} can be applied to the uncorrected tip resistance q_c but results in a slightly lower estimate of s_u depending on the correction magnitude (q_c - q_t) in lower strength soils.

s_u results are presented in Appendix E.

6.8 OVERCONSOLIDATION RATIO

The preconsolidation stress σ_p' was calculated based on the method proposed by Mayne et al (2009):

$$\sigma_p' = k \cdot (q_t - \sigma_{vo})^{m\prime}$$

$$OCR = \sigma_p'/\sigma'_{v0}'$$

Mayne *et al* found that the trend with mean grain size followed a power law through the addition of exponent m' and that its value can be estimated by relation to soil behaviour type index I_c:

$$m' = 1 - \frac{0.28}{1 + (I_c/2.65)^{25}}$$

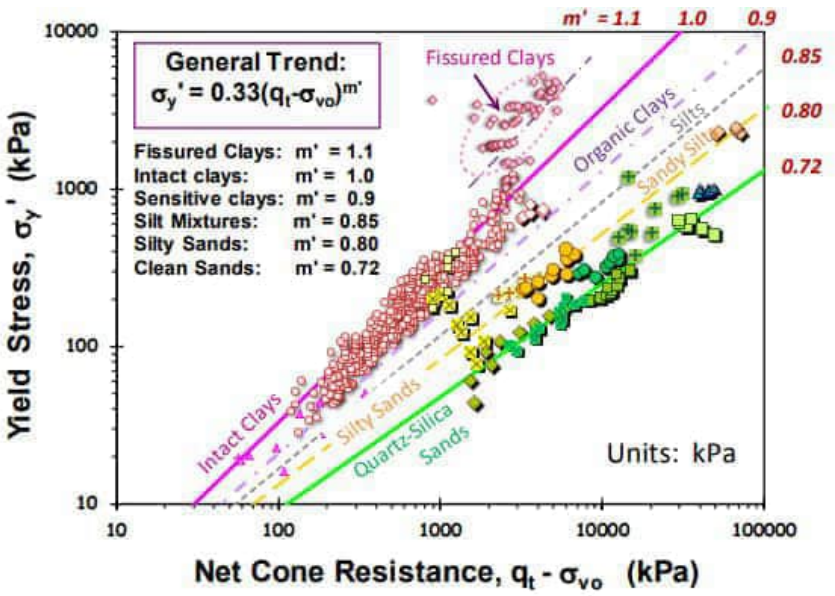


Figure 6-6 Preconsolidation stress with net cone resistance power law, reproduced from Mayne (2014).

An additional set of $\sigma_p^{'}$ and OCR values were calculated for $m^{'}$ = 1.1 to reflect the upper trend for over consolidated fissured clays not captured by the correlation with Ic.

The results are presented in Appendix E.

6.9 SPT N60 VALUES

Equivalent SPT N_{60} values, defined as the non-normalised SPT blow count over a 30 cm interval, with a reference hammer efficiency (energy transfer ratio, 'ETR' or 'ER') of 60%, were derived for two correlations.

Method 1 - Jefferies and Davies (1993) cited in, and modified by, Lunne *et al.* (1997) to use I_c according to normalised Robertson 1990 SBT chart:

$$N_{60} = \frac{q_t}{8.5 \cdot \sigma_{atm} \cdot (1 - I_c/4.6)}$$

Method 2 - Robertson (2012):

$$\frac{\left(\frac{q_t}{p_a}\right)}{N_{60}} = 10^{(1.268 - 0.2817 I_c)}$$

The correlations are intended for clays, silts and sands and not for carbonates or cemented geo-materials.

Conversion of N_{60} values for comparison to other hammer efficiency values, or vice-versa, can be performed using the relationship:

$$N_{60} \cdot \frac{60}{ETR} = N_{ETR}$$

Where ETR is entered as a percentage.

The results are presented in Appendix F.

6.10 FRICTION ANGLE

Sands

The peak friction angle of granular materials was calculated using the Kulhawy and Mayne (1990) method. The relationship is based on a calibration chamber database from 24 sands (mainly sampled by freezing) of varying mineralogy and is found from:

$$\phi^{'} = 17.6 + 11.0 \cdot \log\left(q_{t1}\right)$$

Where:

$\phi^{'}$ = Peak friction angle (degrees)

q_{t1} = stress normalised cone resistance:

$$q_{t1} = \left(\frac{q_t}{\sigma_{atm}}\right) / \left(\frac{\sigma_{v0'}}{\sigma_{atm}}\right)^{0.5}$$

The presence of compressible minerals or fines tends to reduce tip resistance resulting in lower estimate of friction angle, while very coarse (sand) or larger grain size tends to increase tip resistance resulting in higher estimate. Increased penetration resistance due to high k_0 conditions also results in an overestimate of friction angle.

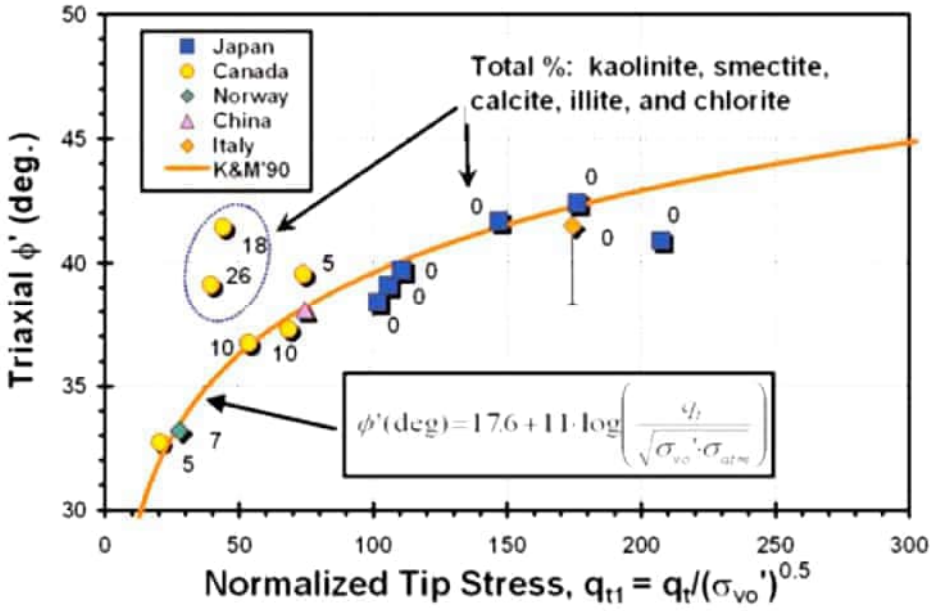


Figure 6-7 Peak triaxial friction angle from undisturbed sands with normalised cone resistance.

Fine grained soils

The effective friction angle for fine grained soils was calculated based on the Senneset *et al.* (1988, 1989) method, referred to as 'NTH' (Norwegian Institute of Technology) solution, using the modified and approximate closed form solution by Mayne & Campanella (2005) as a direct function of the pore pressure parameter Bq and normalised tip resistance Q_{tn} (referred to as Q in figure Figure 6-8 Triaxial ϕ' versus CPTu-evaluated value (NTH method) for 105 soft-firm clays with OCRs < 2.5 (Ouyang and Mayne 2018, cited in Mayne *et al* 2022). The method is generally applicable where $0.1 < B_q < 1.0$ and $20° < \phi' < 45°$ and is appropriate for non-cemented normally consolidated to lightly overconsolidated soils.

$$\phi' = 29.5° \, B_q^{0.121} [0.256 + 0.336 \, B_q + \log Q]$$

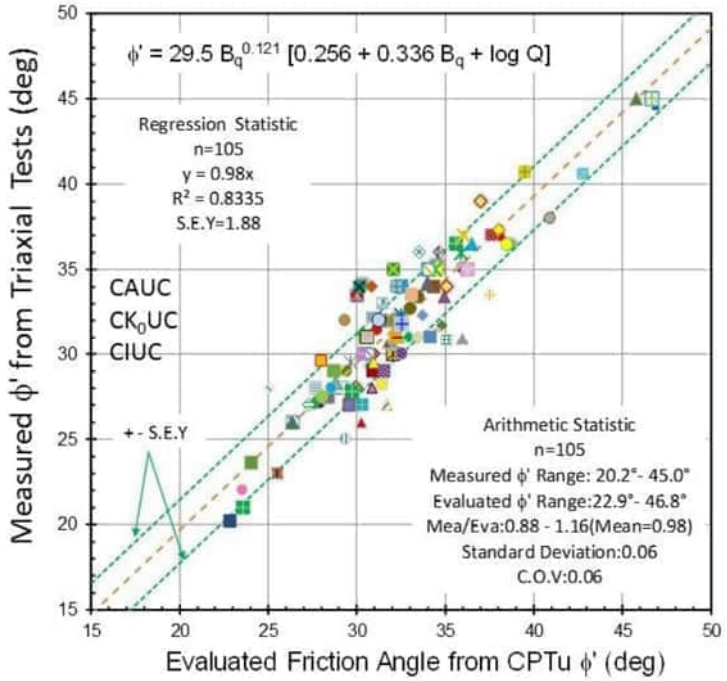


Figure 6-8 Triaxial ϕ' versus CPTu-evaluated value (NTH method) for 105 soft-firm clays with OCRs < 2.5 (Ouyang and Mayne 2018, cited in Mayne *et al* 2022).

The results are presented in Appendix F.

6.11 COEFFICIENT OF VOLUME CHANGE

Coefficient of volume change m_v defined as the inverse of the constrained modulus M, is evaluated for all soil types using the constrained modulus method proposed by Mayne (2006) cited in Mayne (2007). The value may be used to predict settlement at the end of primary consolidation and is applicable to the present state of vertical effective stress up to the pre-consolidation stress for overconsolidated soils.

$$m_v = 1/M'$$

Where:

$$M' = \alpha \cdot (q_t - \sigma_v)$$

$$\alpha = 5$$

An alpha factor of 8.25 reported by Kulhawy & Mayne (1990) for fine grained soils appears to provide a better fit through the data for intact non-organic clays, reducing to around 1 to 2 for organic plastic clays.

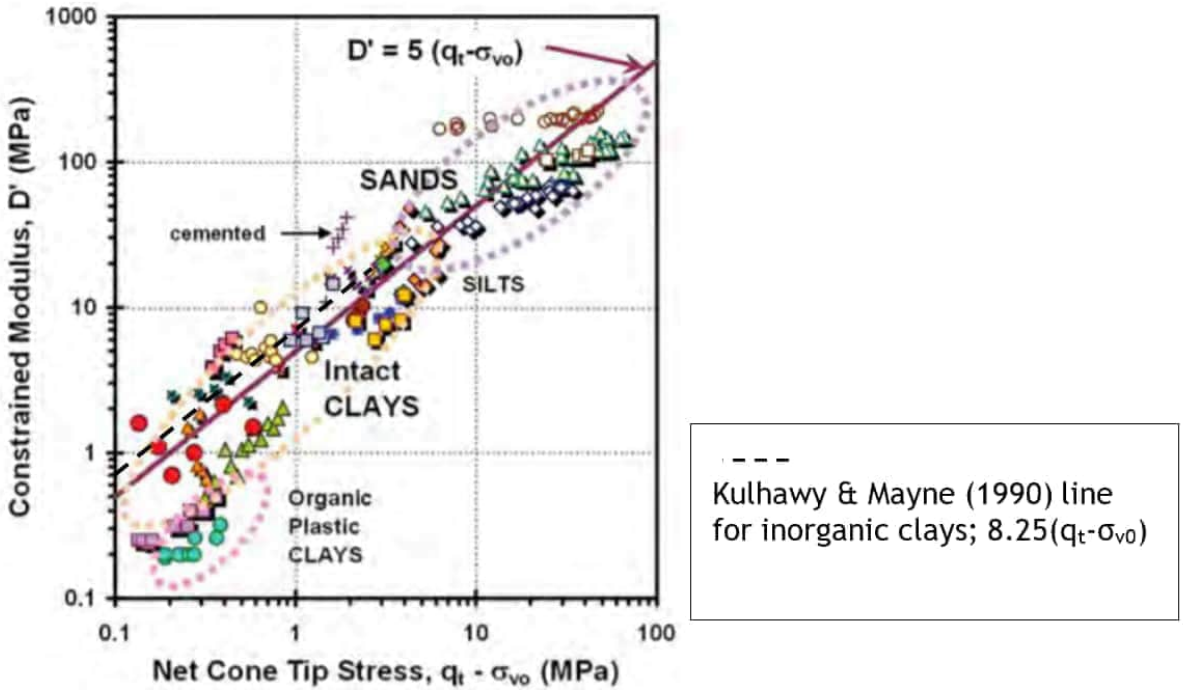


Figure 6-9 Constrained modulus of Mayne (2006). Annotated/redrawn from NCHRP Synthesis 368 (2007).

The results are presented in Appendix E.

6.12 YOUNG'S MODULUS

The secant Young's modulus $E^{'}$ at 25% mobilised shear strength (FOS = 4) was calculated according to the method proposed by Robertson (2009):

$E' = \alpha(q_t - \sigma_v)$
Where:

$\alpha = 0.015(10^{0.55\boldsymbol{Ic}+1.68})$

The method described by Robertson may be adapted to estimate E' for loading at different percentages of mobilised shear strength.

The results are presented in Appendix F.

6.13 SHEAR WAVE VELOCITY AND SMALL STRAIN SHEAR MODULUS (EMPIRICAL FROM CPT)

The shear wave velocity V_s (vertically propagating, horizontally polarised) has been derived according to empirical methods by Robertson (2009), Mayne and Rix (1995) and Baldi (1989) for comparison.

Method 1 (all soils)

Robertson (2009) method for all soils (coarse and fine predominantly silicate) as a function of the net tip resistance and a variable alpha factor α_{vs} which is a function of the soil behaviour type index I_c:

$$V_s = \sqrt{(\alpha_{vs}\,(q_t - \sigma_{v0})/p_a)} \quad (m/s)$$

Where:

$$\alpha_{vs} = 10^{(0.55\,Ic+1.68)}$$

I_c = Soil Behaviour Type Index (see section 6.5)

(See glossary of general terms and symbols Appendix A – General information)

Method 2 (clays)

Mayne & Rix (1995) (cited in Mayne, 2007) method for soft to stiff intact clays to fissured clay materials as a function of the corrected tip resistance.

$$V_s = 1.75(q_t)^{0.627} \quad (m/s)$$

This method has a correlation coefficient of 0.736.

Method 3 (sands)

Baldi *et al.* (1989) (cited in Mayne, 2007) method for sands as a function of the corrected tip resistance and effective stress.

$$V_s = 277(q_c)^{0.13}\,(\sigma'_{v0})^{0.27} \quad (m/s)$$

Small strain shear modulus G_0

For each method of deriving shear wave velocity above, the small strain shear modulus (G_0) is calculated per the relationship:

$$Go = \rho \cdot V_s^{\,2} \quad \text{(Mpa)}$$

Where: $\rho = \gamma/g$ (see section 6.3 for derivation of soil unit weight γ)

An additional estimate of G0 has been derived according to the method proposed by Rix and Stokoe (1992) for clean sand, which modifies the Baldi et al. (1989) approach to find Go/q_c as a function of $q_c/(\sigma'_{v0})$^0.5 based on calibration chamber and field measurements:

$$\frac{Go}{q_c} = 1634\left(\frac{q_c}{\sqrt{\sigma'_{v0}}}\right)^{-0.75}$$

Where Go, σ'_{v0} and q_c are in kPa.

Normalisation of tip resistance by the square root of effective stress is cited by Lunne et al (1997) as the correct method for comparison to shear wave velocity.

The results are presented in Appendix J.

7 DISSIPATION TESTS

Dissipation tests were performed during the CPT at depths specified by the Client's representative or Investigation Supervisor on site.

The hydraulic clamp was on and maintained pressure for the duration of the test.

Pore pressures were sampled at 1 second resolution up to 300 seconds followed by a 10 second resolution thereafter.

7.1 COEFFICIENT OF CONSOLIDATION

The interpretation of the dissipation test applies the method of Teh and Houlsby (1988). Modified dimensionless time factors T^* have been determined from which values of c_{vh} can be derived by the relationship:

$$T^* = \frac{c_{vh} \cdot t}{r^2 \cdot \sqrt{Ir}}$$

Where r^2 = Radius of the cone, Ir= Rigidity Index (Assumed = 100), T^*= Time factor for a given degree of pore water dissipation (see table below for values), t = Measured time to a given degree of pore water pressure dissipation.

Rigidity index is defined as:

$$Ir = \frac{G_u}{s_u}$$

Where G_u= Shear modulus and s_u= undrained shear strength

A Ir value of 100 has been assumed in the analysis. The initial peak pressure has been corrected for soil dilatancy (initial rise in pressure) using the Sully *et al* (1999) method by backwards extrapolation of the initial decay curve plotted in root time.

The saturated porous filter was in the shoulder (u_2) position in all cases. The results of the dissipation tests are presented in Appendix G.

Table 3 Modified time factors T^* from consolidation analysis (Teh and Houlsby, 1988)

Degree of dissipation (%)	u_1 measuring position	u_2 measuring position
0	0.014	0.038
30	0.032	0.078
40	0.063	0.142
50	0.118	0.245

Where a test is of insufficient duration to perform the above analysis an upper-bound value of c_{vh} will be calculated taking the time of the final value as equal to t_{50}. This should be treated with caution

but is usually a safe assumption given that the peak measured pore pressure is very rarely less than 65% of the corrected initial pressure estimated by the Sully *et al*. method described above.

For dissipation tests with t_{50} values of less than ~40 seconds in NC-LOC soils, the estimate of coefficient of consolidation may become significantly influenced by partial consolidation during penetration prior to the test beginning. This results in a lower bound value of c_{vh} and is indicated as such in the results table (Table 4) of Appendix A.

7.2 PERMEABILITY

Method 1: Parez and Fauriel (1988) method based on t_{50}:

$$k = \left(\frac{1}{251 \cdot t_{50}}\right)^{1.25}$$

Where t_{50} is the time to 50% dissipation of excess pore pressure, and k is permeability (cm/s).

This method is based on monotonic dissipation results and should be cautiously applied to dissipations that exhibit dilative behaviour (showing initial rise to peak pressure) where t_{50} is calculated using a corrected initial pore pressure. Permeability values are multiplied by a factor of 1.5 for 15 cm^2 cones.

Method 2: Theoretical method, as discussed by Robertson (2014), which accounts for the effect of soil stiffness:

$$k = \frac{c_{vh} \cdot \gamma_w}{M}$$

Where c_{vh} is the coefficient of consolidation; γ_w is the specific weight of water and M is the constrained modulus. The derivations of c_{vh} and M are described separately within this report.

Robertson (2014) proposed an approximate relationship between permeability (k) and the soil behaviour type index (I_c) as follows:

For $1.0 < I_c \leq 3.27$ $\quad k = 10^{(0.952 - 3.04\, I_c)}$

For $3.27 < I_c < 4.0$ $\quad k = 10^{(-4.52 - 1.37\, I_c)}$

The values have been derived and are presented in Appendix G.

Where dissipation tests have been performed, it is possible to reverse calculate the 'equivalent' SBT index I_c from the calculated permeability based on dissipation tests. These values have been derived and plotted in the I_c log as K1 and K2 corresponding to permeability method 1 and 2 above. Permeability values for K2 are only evaluated for t_{50} values exceeding 35 seconds.

This equivalent I_c values are not intended as a correction nor a more accurate version of the index; the index value evaluated from the CPT is a parameter describing the soil type which typically has mechanical properties consistent with the CPT measurements and often represents the soil

constituent controlling mechanical behaviour. The equivalent value based on permeability simply provides comparative insight into the soil type in terms of approximate drainage characteristics.

8 GENERAL INTERPRETATION NOTES

Provided below is a non-exhaustive set of notes on interpretation of the acquired CPT data with reference to examples within the dataset where appropriate.

DRAINED AND UNDRAINED SOIL BEHAVIOUR

Geotechnical parameters appropriate for drained and undrained cone penetration conditions are derived for drained and undrained soil behaviour types (SBTs) respectively, however, to help mitigate the uncertainty in the SBT correlation with drainage behaviour, all parameters are derived over the Soil Behaviour Type range $2.4 < I_c < 2.7$. For partially drained conditions, error will be introduced within derived parameters.

Piezocone dynamic pore pressure and dissipation tests may be used to identify drainage conditions. Dissipation t_{50} values exceeding 50 seconds indicate undrained penetration behaviour based on the findings of Kim *et al.* (2008).

In partially drained materials the friction sleeve resistance may rise significantly immediately following a pause in penetration due to consolidation and increased effective stress on the friction sleeve.

DYNAMIC PORE PRESSURE u_2 (CPTu)

While the piezo system is saturated before use, testing through unsaturated soils may result in some degree of desaturation leading to a less accurate and more 'sluggish' pore pressure response. Desaturation can also occur during penetration due to suction pressure causing cavitation during dilative shear at the cone shoulder. Dissipation tests that are undertaken following desaturation are likely to have a more pronounced initial rise and the results of analysis may have some degree of error.

If the piezometer system becomes desaturated it may re-saturate at higher excess pressures later in the test as gas dissolves under pressure. The pore pressure response in saturated contractive soils should normally have a dynamic 'peaky' appearance.

The tip resistance in lower strength contractive soils without pore pressure measurement in the u_2 position is likely to be significantly lower (up to 20%, typically ~10%) than the equivalent corrected tip resistance depending on the magnitude of excess pore pressure generated during penetration.

CONICAL TIP AND FRICTION SLEEVE OFFSET

The accuracy of the friction ratio (and derived SBT) over thin layers and at layer boundaries is sensitive to the offset between the focal point of shear in front of the conical tip and the centre of the friction sleeve, and the difference in the vertical extent of soil influencing the sensors. This often results in sharp peaks or troughs at boundaries when the sleeve rises or falls out of unison with tip resistance. More broadly, this error will be seen in any circumstances where the spacing between inclusions or discontinuities causes the cone tip and sleeve to experience heterogeneity, for example in disturbed

fill or landslip material with a 'blocky' macro fabric or large inclusions. The figure below provides an example of the tip-sleeve offset and resulting (erroneous) friction ratio spike.

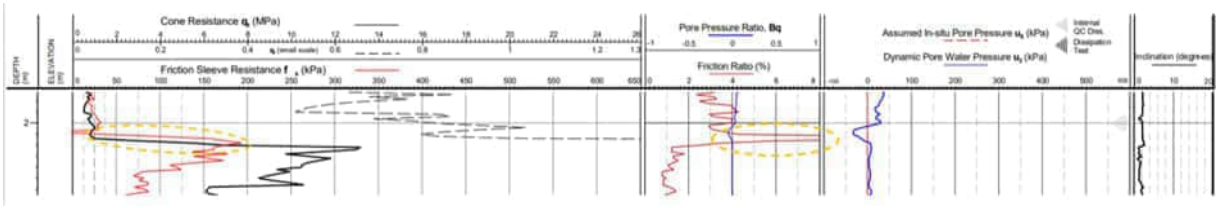


Figure 8-1 example of offset in tip and sleeve response at a strata boundary.

Note that the cone-sleeve offset results in the absence of friction ratio over the last ~14 cm of each test location, and therefore the SBT material description does not extend over this range.

FRICTION SLEEVE DATA

There are three common causes of friction sleeve measurement error; 1) unequal pore pressure acting on the sleeve end areas as the sleeve passes though materials of different permeability and hence excess pore pressure Δu_2, often resulting in a negative/positive spike, 2) Accuracy limitations and temperature effects in very low strength or sensitive soils, and 3) error associated with bending strain that occurs while the cone inclination deviates rapidly. Temperature effects are generally mitigated by temperature stabilisation during the test and at the time of zero output measurement.

CONE TYPE

The reference cone type has a 10 cm^2 projected cone tip area and 150 cm^2 friction sleeve area, however it is common to use a larger 15 cm^2 cone with a 225 cm^2 friction sleeve area for improved sensitivity, temperature stability, damage prevention and penetration depth potential due to the higher bending strength. Use of a 15 cm^2 cone does however require higher penetration force (reaction force) for a given penetration pressure and produces more pronounced transitions zones and thin layer effects due to the larger influence zone.

TRANSITION ZONES AND THIN LAYER EFFECTS

During penetration at the boundary between soils of contrasting stiffness, a transition zone is often evident prior to mobilisation of the true soil stiffness. These should be cautiously ignored in assessment of soil behaviour type and parameter evaluation. Where the stiff layer is thin (<~1 m) mobilised resistance may be significantly less than that of an equivalent thick layer. The effect for thin low stiffness layers is less significant. Procedures for thin-layer effect correction are provided by Robertson and Wride (1998) and Boulanger & DeJong (2018).

GRAVELS

The presence of gravel or larger clasts in a soil is often characterised by short peaks in the CPT tip and sleeve readings, possibly with associate inclinometer 'shake' and/or short sharp reductions in pore water readings due to dilation effects. Frequent gravels in soft or loose soils may generate localised erroneous friction ratio values.

9 SEISMIC FIELDWORK

Surface to down-hole seismic shear wave (S-wave) data were collected using a seismic cone penetrometer assembly advanced to the required depths, with the seismic impulse generated at the ground surface adjacent to the CPT rig.

The seismic source comprised of an anvil coupled to the ground and orientated with its long axis perpendicular to the line between the source and the top of the test hole. The seismic source offset, the lateral distance between the centre of the anvil and the top of the test hole, was recorded and accounted for in the analysis. The anvil was struck laterally with a 7 kg sledgehammer to generate shear waves.

At each depth tests were performed with up to 5 signals recorded. Repeat tests were required to verify the absence of variable trigger delay in the recorded signal and to allow post-stacking of the signals for improved signal to noise ratio.

A piezoelectric transducer mounted to the sledgehammer was used to trigger logging of the seismic signal.

The seismic receiver was of a geophone type situated immediately behind the 15 cm^2 cone penetrometer. The sensor captured the ground motion waveform of elastic waves generated by the source at incremental depths. The seismic tests were performed when the join between the 1 m push rods was exactly level with the floor reference level.

9.1 SEISMIC RAW DATA REDUCTION & PRESENTATION

A wide bandwidth filter of 0 to 200 Hz was applied to all signals.

Each independent signal for each polarisation/depth was stacked after removing any erroneous or outlying signals.

Some signals were omitted due to lack of clarity in the first arrival or due to irregular waveform. This is commonplace at shallow depth or where site noise affected the measurements. Test a shallow depth (< 2-4 m) should be treated with caution due to nearfield noise, low separation between P and S waves and significant refraction and resulting deviation from the straight travel path assumption.

A summary of the results is included in Table 7 of Appendix A.

Seismograms depicting the filtered raw data are presented in Appendix J. Each set of traces has been normalised by the maximum amplitude reading of the dataset for each profile. Interpreted data are presented together with the associated CPT results in Appendix I.

9.2 SEISMIC INTERPRETATION

For each stacked and filtered data set, the shear wave arrival times were analysed by visual pick (peak signal amplitude or first crossover of polarised signals).

The calculation error introduced by noise increases with decreasing measurement interval distance and increasing shear wave velocity, causing deviation about the true value in homogeneous materials.

To minimise this effect, the direct interval measurement is supplemented by a linear regression value over a range of 3 interval velocity values.

Small strain shear modulus (G_0) is calculated per the relationship:

$$Go = \rho \cdot V_s^2$$

$$V_s = \frac{\Delta d}{\Delta t}$$

$$\gamma = 8.32 \cdot \log(V_s) - 1.61 \cdot \log z \quad \text{(Mayne 2007)}$$

And

$$\rho = \gamma / g$$

Where G_0 is the small strain shear modulus, Vs is the shear wave velocity, Δd is the receiver depth difference for successive signals, Δt is the arrival time difference between successive shear wave signals, γ is the total unit weight (kN/m3), z is depth (m), ρ is the mass density and g is the gravitational constant 9.81.

10 MAGNETOMETER TESTING

The magnetometer used in the Lankelma 'magcone' system comprises a Bartington Instruments 3-axis flux gate magnetometer that is capable of measuring disturbances in the Earth's field of less than 1 part in a million. Buried ferrous items, such as UXO, result in localized distortions of the magnetic field. The detection radius of the works undertaken was dependent upon the level of magnetic field distortion noise and the size of the ferrous object(s) of interest.

The third-party Site Safe report and magnetometer test results are presented in Appendix K.

11 SHEAR VANE TESTING

Shear vane testing was carried out using an automatic digital Geomil GVT-100 push-in shear vane system, modified by Lankelma to use a protected (sleeved) vane shaft.

Tests were undertaken with a rectangular cruciform vane with dimension of 100 mm x 50 mm (BH101_VANE and BH110_VANE) and a tapered blade with 120 mm x 60 mm with 60-degree taper (with respect to vertical) at both ends (BH107_VANE).

The penetration vane system had a vane connected to a 0.6 m vane shaft, which passed through a protective penetration shoe, and in turn connected to Ø22 mm torque transmitting extension rods isolated from the ground by outer Ø55 mm casing. The torque transmitting part of the vane shaft was isolated from the surrounding soil by an outer non-rotating protective sleeve, designed to allow free rotation of the lubricated inner torque transmitting shaft.

Between discrete test depths, the vane was retracted into a protective penetration shoe so that the assembly could be pushed to the next test depth. For each test the assembly was hydraulically pushed to 0.5 m above the target depth, followed by 0.5 m penetration of the inner rods and vane to the

target depth. When the vane was in position, torque was applied using a PLC controlled motor reacting against a calibrated load cell, allowing measurement of the applied torque.

For each test torque was applied at a constant specified rate of rotation of 0.1 degrees/second until failure. Following the post-peak readings, the vane blade was then rapidly rotated ten times to completely remould the soil.

The remoulded shear strength was then measured by repeating the test at the standard rate of 0.1 degrees/second. Where necessary the remoulded strength was measured at intervals throughout 365 degrees rotation so that any non-stationarity of the vane (causing oscillation in resistance) was captured. On completion, the vane was retracted to the cruciform housing which also acted to clean the vane between tests.

Undrained shear strength from the shear vane, s_{u_vane} (kPa), is calculated from torque measurements using the following general equation taking into consideration the case of rectangular or tapered ends at the top and/or bottom of the vane blade.

$$S_{u\_vane} = \frac{12000000 \cdot T_{max}}{\pi D^2 \left(\frac{D}{\sin(i_T)} + \frac{D}{\sin(i_B)} + 6H \right)}$$

Where T_{max} = the maximum value of torque (Nm), D = vane diameter (mm), H = height of the rectangular portion of the vane (mm), i_T = angle of taper at vane top (with respect to vertical), i_B = angle of taper at vane bottom (with respect to vertical).

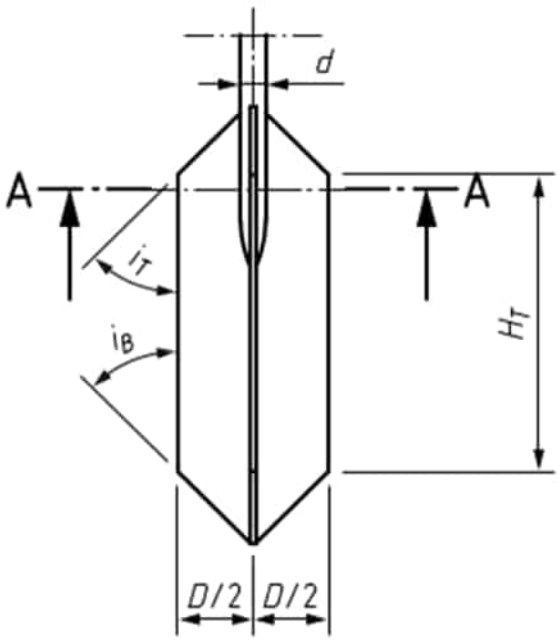


Figure 11-1 vane diagram (reproduced from ISO 22476-9:2020)

Test details and results are reported in Table 8. Shear vane results are presented in Appendix L. An example plot with annotation of test features and data artefacts is provided in Appendix M.

Note that shear vane test locations are associated with (performed adjacent to) boreholes performed by others.

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APPENDIX A SUMMARY TABLES

Table 4 CPT summary

Location ID	Stroke number	Final depth (m)	Cone ID	Piezocone test	Pre-drilled (m)	Pre-drilling details	Rig	Primary refusal factor	Applied zero values	Tip zero drift (kPa)	Sleeve zero drift (subtraction) (kPa)	Piezo. zero drift (kPa)	Nr dissipation tests	Raw file name	X Coordinate	Y Coordinate	Z Coordinate	Date	Remarks
BH101	1	1.42	DM15-I(200).01	NO	1.20	IP-BF	UK3	Tonnage + inclination	pre	0.00	0.00	0.00		29428-V1-300425-UK3-LP105.L08	566285.852	175892.136	2.156	02/05/2025	Magnetometer test only
BH101	1	7.60	DM15-I(200).03	YES	1.20	IP-BF	UK3	Target depth	pre	0.00	0.00	0.00		29428.L15	566285.852	175892.136	2.156	09/05/2025	Magnetometer test only
BH102	1	19.12	DM15-I(200).01	NO	1.20	IP-BF	UK3	Lateral support at depth	pre	0.00	0.00	0.00		29428-V1-300425-UK3-LP105.L01	566294.050	175858.591	2.378	01/05/2025	Magnetometer test only
BH103	1	19.80	DM15-I(200).01	NO	1.20	IP-BF	UK3	Sudden inclination	pre	0.00	0.00	0.00		29428-V1-300425-UK3-LP105.L09	566318.711	175904.636	2.782	02/05/2025	Magnetometer test only
BH104	1	6.26	DM15-I(200).01	NO	1.20	IP-BF	UK3	Target depth	pre	0.00	0.00	0.00		29428-V1-300425-UK3-LP105.L05	566412.959	175708.955	5.949	01/05/2025	Magnetometer test only
BH106	1	6.26	DM15-I(200).01	NO	1.20	IP-BF	UK3	Target depth	pre	0.00	0.00	0.00		29428-V1-300425-UK3-LP105.L06	567471.649	174224.027	2.005	02/05/2025	Magnetometer test only
BH107	1	6.26	DM15-I(200).01	NO	1.20	IP-BF	UK3	Target depth	pre	0.00	0.00	0.00		29428-V1-300425-UK3-LP105.L03	567423.320	174162.534	2.274	01/05/2025	Magnetometer test only
BH108	1	6.26	DM15-I(200).01	NO	1.20	IP-BF	UK3	Target depth	pre	0.00	0.00	0.00		29428-V1-300425-UK3-LP105.L04	567435.356	174079.583	2.354	01/05/2025	Magnetometer test only
BH110	1	17.08	DM15-I(200).01	NO	1.20	IP-BF	UK3	Lateral support at depth	pre	0.00	0.00	0.00		29428-V1-300425-UK3-LP105.L07	566284.405	175842.427	2.552	02/05/2025	Magnetometer test only
BH305	1	7.20	DM15-I(200).03	YES	1.20	IP-BF	UK3	Target depth	pre	0.00	0.00	0.00		29428-V1-130525-UK3-LP90.L21				16/05/2025	Magnetometer test only
BH306	1	7.44	DM15-I(200).03	YES	1.20	IP-BF	UK3	Target depth	pre	0.00	0.00	0.00		29428-V1-130525-UK3-LP90.L22				16/05/2025	Magnetometer test only
CPT101	1	18.68	S15-CFIPTTM250.2116	YES	1.20	IP-BF	UK3	Tip/sleeve load + inclination	pre	5.20	-1.00	2.60	3	29428-V1-300425-UK3-LP105.L13	566299.724	175912.182	2.341	07/05/2025	
CPT102	1	17.40	S15-CFIPTTM250.2116	YES	1.20	IP-BF	UK3	Lateral support at depth	pre	24.00	-2.60	4.50	3	29428.L14	566334.083	175912.213	2.724	08/05/2025	
CPT103	1	1.00	S15-CFIPTTM250.2116	YES	1.20	IP-BF	UK3	Acquisition error	pre	4.20	-0.30	3.60		29428-V1-300425-UK3-LP105.L10	566316.646	175907.221	2.709	06/05/2025	
CPT103	2	3.00	S15-CFIPTTM250.2116	YES	1.20	IP-BF	UK3	Data error	pre	4.20	-0.30	3.60		29428-V1-300425-UK3-LP105.L11	566316.646	175907.221	2.709	06/05/2025	
CPT103	3	16.58	S15-CFIPTTM250.2116	YES	1.20	IP-BF	UK3	Lateral support at depth	pre	4.20	-0.30	3.60	4	29428-V1-300425-UK3-LP105.L12	566316.646	175907.221	2.709	06/05/2025	
CPT104	1	14.28	S15-CFIPTTM250.2116	YES	1.20	IP-BF	UK3	Lateral support at depth	pre	36.80	-1.70	1.00	4	29428-V1-130525-UK3-LP90.L19	567408.732	174141.855	2.256	14/05/2025	
CPT105	1	15.52	S15-CFIPTTM250.2116	YES	1.20	IP-BF	UK3	Lateral support at depth	pre	-0.80	0.90	-0.60	4	29428-V1-130525-UK3-LP90.L20	567426.410	174081.075	2.301	15/05/2025	
CPT106	1	3.42	S15-CFIPTTM250.2116	YES	1.20	IP-BF	UK3	Acquisition error	pre	25.60	-2.70	0.00		29428-V1-130525-UK3-LP90.L16	567428.311	174166.814	2.179	13/05/2025	
CPT106	2	14.62	S15-CFIPTTM250.2116	YES	1.20	IP-BF	UK3	Lateral support at depth	pre	25.60	-2.70	0.00	4	29428-V1-130525-UK3-LP90.L17	567428.311	174166.814	2.179	13/05/2025	

Note: Coordinates and levels have been provided by the Client.

CPT test plots are presented in Appendix C.

Table 5 Dissipation test interpretation summary

Location ID	Depth (m)	Piezometric level (m)	u0 (kPa)	Piezometric level / u0 origin	Final interpreted time value (s)	Final interpreted degree dissipation (%)	Coefficient of consolidation c_vh (m2/yr)	Upper bound c_vh - final time as t50 (m2/yr)	Lower Bound c_vh - (m2/yr)	Constrained modulus (MPa)	Permeability 1 k (m/s)	Permeability 2 k (m/s)	Permeability 2 k (m/s) upper bound (based on upper bound c_vh)	Remarks
CPT101	2.29	0.83	14.32	Piezocone response in drained soils		43.1	7.4			1.1	3.450E-10	2.081E-09		*CIP
CPT101	7.29	0.83	63.37	Piezocone response in drained soils		50.0	124.1			2.1	1.178E-08	1.838E-08		*CIP
CPT101	9.28	0.83	82.89	Piezocone response in drained soils		50.0	86.1			1.0	7.463E-09	2.678E-08		*MD
CPT102	5.00	1.25	36.79	Average measured piezometric elevation from other location(s)		40.2	6.4			1.0	2.874E-10	1.978E-09		*CIP
CPT102	7.20	1.25	58.37	Average measured piezometric elevation from other location(s)		50.0	82.4			2.5	7.060E-09	1.025E-08		*CIP
CPT102	12.24	1.25	107.81	Average measured piezometric elevation from other location(s)		50.0	30.8			1.1	2.064E-09	8.707E-09		*CIP
CPT103	4.00	1.66	22.96	Average measured piezometric depth at this location, approx. +- 0.4 mbgl		50.0	36.0			0.9	2.508E-09	1.244E-08		*CIP
CPT103	7.13	1.66	53.66	Average measured piezometric depth at this location, approx. +- 0.4 mbgl		50.0	168.7			1.6	1.731E-08	3.280E-08		*CIP
CPT103	10.10	1.66	82.80	Average measured piezometric depth at this location, approx. +- 0.4 mbgl		50.0	97.1			0.8	8.674E-09	3.775E-08		*CIP
CPT103	16.56	1.66	146.20	u0 final dissipation pressure						128.0				*U0, *NEP, *NI
CPT104	2.14	0.79	13.24	Average measured piezometric elevation from other location(s)						0.5				*IEP, *NI
CPT104	5.21	0.79	43.36	Average measured piezometric elevation from other location(s)		50.0	27.3			0.8	1.775E-09	1.061E-08		*CIP
CPT104	8.36	0.79	74.26	Average measured piezometric elevation from other location(s)		45.4	8.3			1.7	3.985E-10	1.511E-09		*CIP
CPT104	10.20	0.79	92.31	Average measured piezometric elevation from other location(s)		50.0	15.6			1.9	8.809E-10	2.551E-09		*CIP
CPT105	2.35	0.44	18.74	Average measured piezometric depth at this location, approx. +- 0.4 mbgl						1.2				*ID, *NI
CPT105	8.42	0.44	78.28	Average measured piezometric depth at this location, approx. +- 0.4 mbgl		50.0	71.4			3.0	5.903E-09	7.399E-09		*CIP
CPT105	12.16	0.44	114.97	Average measured piezometric depth at this location, approx. +- 0.4 mbgl		50.0	136.1			2.2	1.323E-08	1.924E-08		*ICIP
CPT105	12.98	0.44	123.00	u0 final dissipation pressure		50.0		6327.28		30.4	1.606E-06			*PC, *LBI, *U0, *MD
CPT106	4.36	0.71	35.81	Average measured piezometric elevation from other location(s)		50.0	42.1			0.7	3.056E-09	1.873E-08		*CIP
CPT106	8.37	0.71	75.14	Average measured piezometric elevation from other location(s)		50.0	97.1			2.3	8.674E-09	1.313E-08		*CIP
CPT106	10.37	0.71	94.76	Average measured piezometric elevation from other location(s)		49.9	10.4			1.6	5.328E-10	2.026E-09		*CIP

Location ID	Depth (m)	Piezometric level (m)	u0 (kPa)	Piezometric level / u0 origin	Final interpreted time value (s)	Final interpreted degree dissipation (%)	Coefficient of consolidation c_vh (m2/yr)	Upper bound c_vh - final time as t50 (m2/yr)	Lower Bound c_vh - (m2/yr)	Constrained modulus (MPa)	Permeability 1 k (m/s)	Permeability 2 k (m/s)	Permeability 2 k (m/s) upper bound (based on upper bound c_vh)	Remarks
CPT106	11.37	0.71	104.57	Average measured piezometric elevation from other location(s)		50.0	99.6			2.9	8.959E-09	1.069E-08		*CIP

*Abbreviations:
CIP: Corrected initial pressure
DR: Drained response – little or no excess pressure observed, or dissipation is too fast to be interpreted.
DT: Disrupted test
ID: Insufficient test duration - insufficient or no decay of excess pore pressure
ICIP: Indicative corrected initial pressure
IEP: Insufficient excess pressure generated
LBI: Lower bound interpretation
MD: Monotonic decay
NEP: No excess pore pressure generated - excess pore pressure is required for interpretation of C_{vh})
PC: Partial consolidation/drainage during penetration is significant (t50 < 35 s) - c_{vh} is lower bound
NI: No interpretation
UBI: Upper bound interpretation
UR: Uncharacteristic response - uncharacteristic pore pressure dissipation response precludes interpretation
U0: Final dissipation pressure assessed to represent equilibrium pore pressure, u0, and has been used to establish effective stress in the normalisation of CPT data.

Graphical analysis of dissipation tests are presented in Appendix H

Table 6 Seismic interpretation summary

Test ID	Interval top (mBGL)	Interval bottom (mBGL)	Vs (m/s)	LR Vs (m/s)	Mass density (Mg/m^3)	LR Mass density (Mg/m^3)	Shear modulus G0 (MPa)	LR Shear modulus G0 (MPa)	Comments
CPT101	1.34	2.34	140.50		1.78		35.10		*U, *VP
CPT101	2.34	3.34	74.00	87.00	1.51	1.57	8.30	11.90	*U, *VP
CPT101	3.34	4.34	80.30	57.00	1.52	1.39	9.80	4.50	*U, *VP
CPT101	4.34	5.34	38.00	52.00	1.23	1.34	1.80	3.60	*U, *VP
CPT101	5.34	8.34	55.80	54.00	1.34	1.33	4.20	3.90	*U, *VP
CPT101	8.34	9.34	74.00	63.00	1.43	1.37	7.80	5.40	*U, *VP
CPT101	9.34	10.34	127.70	90.00	1.62	1.49	26.40	12.10	*U, *VP
CPT101	10.34	11.34	78.10	99.00	1.44	1.52	8.80	14.90	*U, *VP
CPT101	11.34	12.34	117.10	92.00	1.58	1.49	21.70	12.60	*U, *VP
CPT101	12.34	15.34	88.70	96.00	1.46	1.49	11.50	13.70	*U, *VP
CPT101	15.34	16.34	122.20	103.00	1.57	1.51	23.40	16.00	*U, *VP
CPT101	16.34	17.34	401.50		2.00		322.40		*U, *VP
CPT103	2.05	3.05	99.30		1.63		16.10		*U, *VP
CPT103	3.05	4.18	73.60	74.00	1.49	1.49	8.10	8.20	*U, *VP
CPT103	4.18	5.18	61.70	59.00	1.41	1.39	5.40	4.80	*U, *VP
CPT103	5.18	6.18	48.00	63.00	1.30	1.40	3.00	5.60	*U, *VP
CPT103	6.18	7.18	133.20	69.00	1.67	1.42	29.60	6.80	*U, *VP
CPT103	7.18	10.17	66.40	75.00	1.39	1.44	6.10	8.10	*U, *VP
CPT103	10.17	11.17	93.00	67.00	1.50	1.38	13.00	6.20	*U, *VP
CPT103	11.17	12.17	48.40	68.00	1.25	1.38	2.90	6.40	*U, *VP
CPT103	12.17	13.17	106.50	74.00	1.54	1.40	17.50	7.70	*U, *VP
CPT103	13.17	14.17	102.80	102.00	1.52	1.52	16.10	15.80	*U, *VP
CPT103	14.17	15.17	96.10	100.00	1.49	1.50	13.80	15.00	*U, *VP
CPT103	15.17	15.62	105.50		1.52		16.90		*U, *VP
CPT104	2.27	3.26	70.30		1.49		7.40		*U, *VP
CPT104	3.26	4.26	130.60	93.00	1.70	1.58	29.00	13.70	*U, *VP
CPT104	4.26	5.26	92.00		1.55		13.10		*U, *VP
CPT104	6.26	7.42	61.80		1.38		5.30		*U, *VP
CPT104	7.42	8.27	163.90	85.00	1.73	1.49	46.50	10.80	*U, *VP
CPT104	8.27	9.26	85.30	93.00	1.48	1.51	10.80	13.10	*U, *VP
CPT104	9.26	10.27	80.20		1.45		9.30		*U, *VP
CPT104	11.27	12.27	135.00		1.63		29.70		*U, *VP
CPT104	12.27	13.27	213.20		1.79		81.40		*U, *VP
CPT105	4.40	6.40	47.40		1.30		2.90		*U, *VP
CPT105	6.40	7.49	100.30	60.00	1.56	1.37	15.70	4.90	*U, *VP
CPT105	7.49	8.42	69.80	79.00	1.42	1.46	6.90	9.10	*U, *VP
CPT105	8.42	9.42	73.60	80.00	1.43	1.46	7.70	9.30	*U, *VP
CPT105	9.42	10.42	112.50	110.00	1.58	1.57	20.00	19.00	*U, *VP
CPT105	10.42	12.42	144.60	143.00	1.66	1.65	34.70	33.70	*U, *VP
CPT105	12.42	13.42	202.50	170.00	1.77	1.71	72.60	49.40	*U, *VP
CPT105	13.42	14.55	228.80		1.81		94.80		*U, *VP
CPT106	0.41	2.41	73.00		1.56		8.30		*U, *VP
CPT106	2.41	3.41	72.30	71.00	1.50	1.49	7.80	7.50	*U, *VP
CPT106	3.41	4.41	63.30	68.00	1.43	1.46	5.70	6.80	*U, *VP
CPT106	4.41	5.42	71.80	72.00	1.46	1.46	7.50	7.60	*U, *VP
CPT106	5.42	6.41	87.20	80.00	1.52	1.49	11.60	9.50	*U, *VP
CPT106	6.41	7.42	81.80	85.00	1.48	1.50	9.90	10.80	*U, *VP
CPT106	7.42	8.42	86.20	87.00	1.49	1.50	11.10	11.40	*U, *VP
CPT106	8.42	9.42	94.20	86.00	1.52	1.48	13.50	10.90	*U, *VP
CPT106	9.42	10.42	77.90	91.00	1.44	1.50	8.70	12.40	*U, *VP
CPT106	10.42	11.42	112.50	99.00	1.57	1.52	19.90	14.90	*U, *VP
CPT106	11.42	12.42	115.70	127.00	1.57	1.61	21.00	26.00	*U, *VP
CPT106	12.42	13.43	177.80		1.73		54.70		*U, *VP

Abbreviations

LR	3 interval linear regression	Vs	Shear wave velocity

**	Assumed erroneous data, associated with testing at shallower depths – see report notes (section 7.2)	U / L	Upper / Lower source wave polarisation. Where both are listed, values are calculated based on the average of these signals.
VP	Interval wave travel times by visual pick method	I	X+Y channel sensor full waveform
N/A	No interpretation available	CCF	Interval wave travel times by cross-correlation function
FMDSM	Shear wave velocity adjusted for refraction using Forward Modelling Downhill Simplex Method		

Seismic interpretation data are presented in Appendix I

Table 7 Shear vane test summary

Location ID	Depth (m)	Undrained shear strength s_{u_vane} (kPa)*	Remoulded $s_{ur\text{-}vane}$ (kPa)	Shear rate (Deg/s)	Vane diameter (mm)	Vane height (mm)	Operator	Date	Remarks
BH101_VANE	4.03	31.80	6.00	0.10	50.00	100.00	TFL	21/05/2025	Remoulded measurements higher than those recorded during remoulding phase. The remoulding response is relatively uniform, and the difference is not thought to be associated with non-stationarity of the vane axis and torque response due to vane eccentricity, or continuing drainage. Remoulded strength taken from lowest value recorded during remoulding stage.
BH107_VANE	3.04	15.40	3.30	0.10	60.00	120.00	TF	20/05/2025	Remoulding terminated at 50 degrees due to good uniformity of remoulding response
BH107_VANE	5.00	17.90	3.10	0.10	60.00	120.00	TF	20/05/2025	Remoulding terminated at 90 degrees due to good uniformity of remoulding response.
BH107_VANE	7.00	25.50	4.20	0.10	60.00	120.00	TF	20/05/2025	Remoulded strength taken from minimum value recoded during remoulding.
BH107_VANE	9.00	35.40	6.90	0.10	60.00	120.00	TF	20/05/2025	
BH107_VANE	11.00	36.80	6.80	0.10	60.00	120.00	TF	20/05/2025	Remoulded measurements slightly higher than those recorded during remoulding phase. The remoulding response is relatively uniform, and the difference is not thought to be associated with non-stationarity of the vane axis and torque response due to vane eccentricity, or continuing drainage. Remoulded strength taken from lowest value recorded during remoulding stage.
BH107_VANE	12.00	38.60	9.80	0.10	60.00	120.00	TF	20/05/2025	
BH107_VANE	13.00			0.10	60.00	120.00	TF	20/05/2025	No peak stress observed, assumed sand/drained.
BH107_VANE	13.30			0.10	60.00	120.00	TF	20/05/2025	Re-test of 13 m test. No peak stress observed, assumed sand/drained.
BH110_VANE	4.00	12.00	3.40	0.10	50.00	100.00	TF	22/05/2025	No initial slip coupling rotation due to motor placement
BH110_VANE	6.00	17.50	4.00	0.10	50.00	100.00	TF	22/05/2025	
BH110_VANE	9.00	22.90	5.20	0.10	50.00	100.00	TF	22/05/2025	

Location ID	Depth (m)	Undrained shear strength s_{u_vane} (kPa)*	Remoulded $s_{ur\text{-}vane}$ (kPa)	Shear rate (Deg/s)	Vane diameter (mm)	Vane height (mm)	Operator	Date	Remarks
BH110_VANE	11.00	24.60	4.70	0.10	50.00	100.00	TF	22/05/2025	Remoulded measurements higher than those recorded during remoulding phase. The remoulding response is uniform, and the difference is not thought to be associated with non-stationarity of the vane axis and torque response due to vane eccentricity, or continuing drainage. Remoulded strength taken from lowest value recorded during remoulding stage. Remoulded response appears to rise significantly with each measurement attempt (e.g. 312 to 324 degrees).
BH110_VANE	13.00		16.00	0.10	50.00	100.00	TF	22/05/2025	No peak observed after 170 degrees rotation and displayed increase in stress usually associated with drainage. Remould phase indicated failure after an additional 155 degrees rotation. Likely peat/organic layer indicated by local CPT tests undertaken at approx. 0.4 m higher elevation.
BH110_VANE	13.86	36.50	9.80	0.10	50.00	100.00	TF	22/05/2025	Test undertaken to compensate for unintentional material (assumed organic/peat) encountered at 13 m.

*= 60 ° tapered blade.

Note: shear vane test locations are associated with (performed adjacent to) boreholes performed by others.

Shear vane results plots are presented in Appendix L

APPENDIX B GENERAL INFORMATION

LIST OF FIGURES

Cone calibration certificate: S15-CFIP.2116

Data sheet: 20.5-tonne track-truck mounted CPT unit (UK3)

LANKELMA
A ConeTec Group Company

CERTIFICATE OF CALIBRATION

Certificate Number: 1719

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2116

Test Setup

Calibrated Instrument

Instrument type:	**Subtraction**	**Number of sensors:**	**6**
Serial number:	**DS15-CFIIPTTM.2116**	**Manufacturer:**	**Eijkelkamp Geopoint**
Nominal cone area:	**15 cm²**	**Nominal sleeve area:**	**227 cm²**
Calibration standard:	**BS EN ISO 22476-1:2023**	**Location:**	**Lankelma Calibration Laboratory**
Calibration date:	**02 April 2025**	**Calibration expiry:**	**02 October 2025**

Sensor measurand	Calibration range	Maximum rating	Momentary overload	Sensor stability (60 sec)	Max drift before re-calibration
Cone resistance (qc)	66.67 MPa	100 MPa	100 MPa	± 0.40 kPa	4 bar
Sleeve friction (fs)	4.41 MPa	1.00 MPa*	1.00 MPa	± 0.04 kPa	0.04 bar
Pore pressure (u)	4 MPa	10 MPa	13.5 MPa	± 0.02 kPa	0.14 bar
Inclination (i)	20 °	90 °		± 0.05 °	
Temperature (t)	30 °C	90 °C		± 0.023 °C	
Magnetic field (m)	200 uT	200 uT			

** The maximum usable sleeve friction stress is limited by the physical strength of the sleeve.*

ISO 22476-22 Cone Penetrometer Classification

Sensor measurand	Measurement uncertainty $U_{qc:class}$, $U_{fs:class}$, $U_{u:class}$	Ambient temperature stability		Transient temperature stability		Bending influence Δb_{qc}, Δb_{fs}, Δb_u	Overall classification *(highest number represents penetrometer class)*
		Uncorrected Δa_{qc}, Δa_{fs}, Δa_u	Corrected Δa_{qcc}, Δa_{fsc}, Δa_{uc}	Uncorrected Δt_{qc}, Δt_{fs}, Δt_u	Corrected Δt_{qcc}, Δt_{fsc}, Δt_{uc}		
Cone resistance	0	2	0	2	1	0	1
Sleeve friction	0	0	0	2	2	0	2
Pore pressure	0	N/A	0	3	0	0	0

Calibration signed by:

Paul Metcalf

Digitally signed by Paul Metcalf
DN: cn=Paul Metcalf, o=Lankelma Ltd, email=paulmetcalf@lankelma.co.uk
Date: 2025.04.16 08:46:04 +01'00'

P Metcalf

Calibration checked by:

Alastair Harman

Digitally signed by Alastair Harman
DN: cn=Alastair Harman, o=Lankelma Ltd, email=alastairharman@lankelma.co.uk
Date: 2025.04.16 08:46:39 +01'00'

A Harman

Cone penetrometer, serial number: DS15-CFIIPTTM.2116 was found to comply with the requirements of BS EN ISO 22476-1:2023 for the following classifications:
Cone Resistance - Class 1 Sleeve Friction - Class 2 Pore Pressure - Class 0

Reference Instruments

Device	Serial number	Uncertainty of recorded value	Calibration date
AM DSCCHA-100 kN	66914	0.02 ±%	19/06/2023
AM DSCCHA-5 kN	61065	0.05 ±%	19/06/2023
Keithley 7.5 Digit DMM	4496826	12.00 PPM	02/07/2024
MMG750V1P1MC0T3A6CE	547961	0.02 ±%	02/09/2024
ETI Ref Thermometer	D24276054	0.04 °C	17/09/2024
Lankelma HV6 Rotary Table	INC-JIG 01	0.10 °	17/07/2023
10 kg Calibration Weight	H1-S1 10kg	0.001 %	02/08/2024
Mitutoyo 200mm Caliper	A23044194	0.02 ±mm	20/06/2024

Calibration Standard

The calibration was performed according to BS EN ISO 22476-1:2023 & BS EN ISO 17025:2017 for the calibration of cone penetrometers.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation for each of the calibrated sensors has been carried out in accordance with BS EN ISO 22476-1:2023 requirements.

The report provides traceability of measurement to national standards and the SI system of units.

Clause 5.1.2 of BS EN ISO 22476-1:2023, states that the maximum period of validity of the calibration of the cone penetrometer shall not exceed 12 months. The cone penetrometer shall be recalibrated if the readings before a test show a zero baseline drift of over 2% of full scale output compared to the calibration zero load readings.

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CERTIFICATE OF CALIBRATION

Certificate Number: 1719

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2116

Cone Dimension Verification

Cone Tip

Cone shoulder diameter

Rotational position	d_c
0 °	43.85 mm
120 °	43.87 mm
240 °	43.85 mm

Height of the cylindrical extension of the cone

Rotational position	h_e
0 °	11.18 mm
120 °	11.18 mm
240 °	11.18 mm

Height of the conical section of the cone

Rotational position	h_c
0 °	35.78 mm
120 °	35.78 mm
240 °	35.78 mm

Filter element diameter

Rotational position	d_{fil}
0 °	43.47 mm
120 °	43.47 mm
240 °	43.47 mm

Friction Sleeve

Friction sleeve diameter

Rotational position	Upper section d_{2u}	Middle section d_{2m}	Lower section d_{2l}
0 °	43.99 mm	44.04 mm	44.14 mm
120 °	43.99 mm	44.00 mm	44.14 mm
240 °	43.99 mm	44.00 mm	44.13 mm

Friction sleeve length

Rotational position	l_s
0 °	165.11 mm
120 °	165.11 mm
240 °	165.11 mm

Gap between the cone and the lower end of the friction sleeve

Rotational position	l_{gl}
0 °	2.57 mm
120 °	2.57 mm
240 °	2.57 mm

Gap above the upper end of the friction sleeve

Rotational position	l_{gu}
0 °	2.35 mm
120 °	2.35 mm
240 °	2.34 mm

Cone Tip Dimension Uncertainty

Reference device uncertainty u_r	0.015 mm
Average diameter d_c	43.857 mm
Relative error b_c	0.030 %
Area A_c	1510.640 mm^2
Dimension uncertainty U_{dc}	0.017 mm
Area uncertainty u_{AC}	1.161 mm^2
Expanded area uncertainty U_{AC}	2.323 mm^2

Friction Sleeve Dimension Uncertainty

Reference device uncertainty u_r	0.015 mm
Average diameter d_2	44.047 mm
Relative error b_{c2}	0.212 %
Average length l_s	165.110 mm
Relative error b_{ls}	0.000 %
Area A_s	22847.374 mm^2
Dimension uncertainty diameter u_{d2}	0.056 mm
Dimension uncertainty length u_{ls}	0.015 mm
Area uncertainty u_{as}	29.088 mm^2
Expanded area uncertainty U_{as}	58.176 mm^2
Sleeve length to diameter ratio	3.749
Diameter difference, sleeve - tip	0.190 mm

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CERTIFICATE OF CALIBRATION

Certificate Number: 1719

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2116

Cone Resistance Calibration

Calibration method

1. The cone was loaded to full range 3 times for no less than 1 minute before calibration.
2. The cone was calibrated with 4 sets of increasing forces and 2 sets of decreasing forces, with rotation before set 3 and 5.
3. The coefficients of a linear and third order equation relating the the estimate of applied force as a function of the deflection were calculated and are shown in Table 1.
4. The forces applied, and the resulting deflections are given in Tables 2. No corrections for temperature have been applied to these results.
5. The combined expanded uncertainty* of deflection Ucqc and Uqc_class for each force is shown as a percentage of the recorded value and in units of pressure (kPa) as shown in Table 3.

* The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

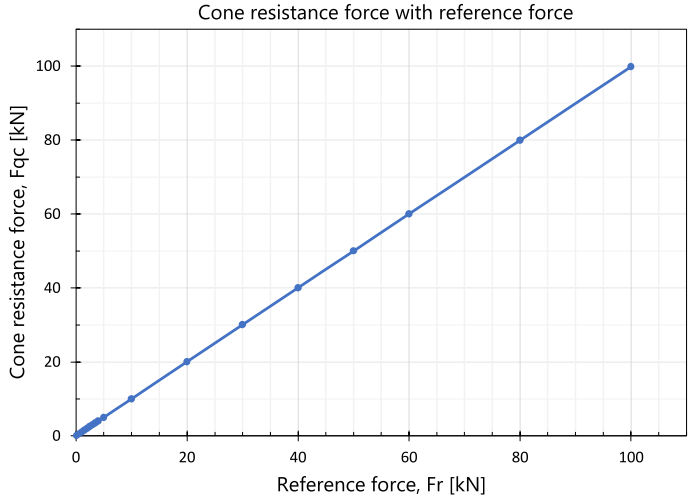
Cone Penetrometer	
Cone penetrometer type	Subtraction
Cone resistance capacity	150 kN
Calibration range	100 kN
Cone resistance effective resolution	0.0005 kN
Cone area	1,511 mm^2
Measured alpha factor cone area ratio	0.79
Historic drift between cone calibrations (u_{drift})	0.05774 %
Apparent pore pressure (u_a) at full range	0.23 kPa
Cone resistance max zero drift	4.23 kPa
Reference load cell max zero drift	2.83 kPa

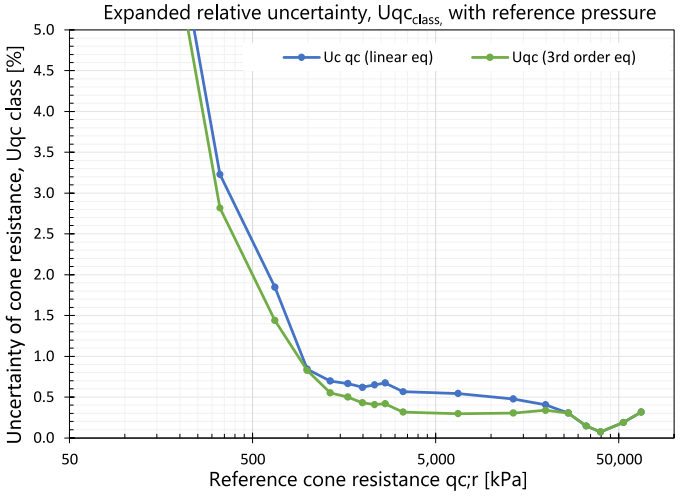
Calibration Conditions	
Ambient temperature	23.2 °C
Ambient temperature variation	0.31 °C
Instrument temperature variation	0.54 °C

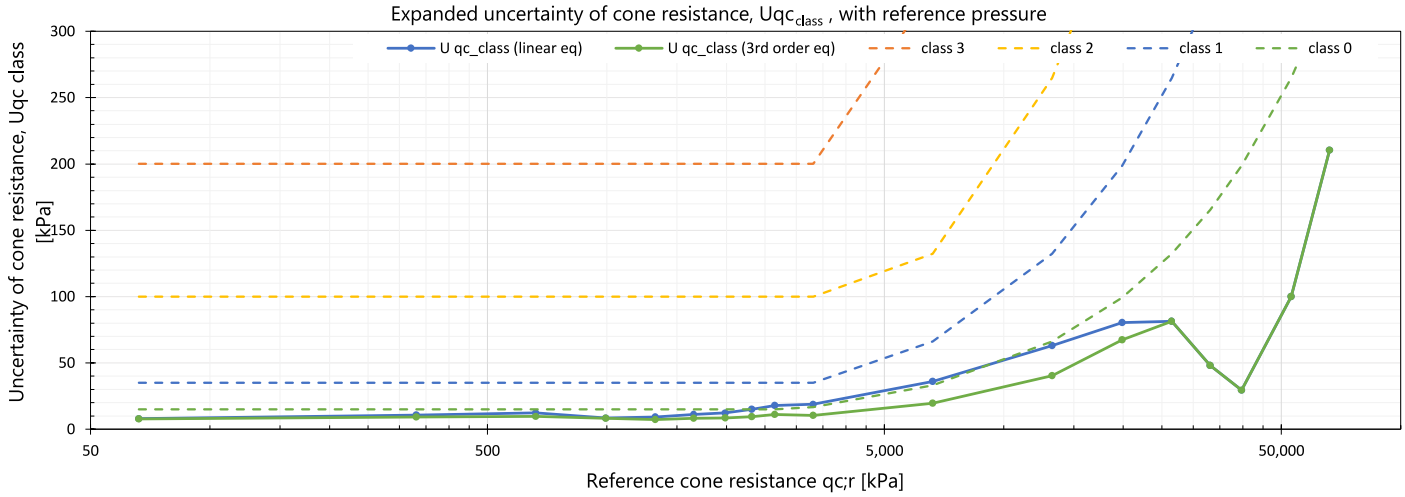
Reference Load Cell Uncertainty	
AM DSCCHA-100 kN	0.02 ±%
AM DSCCHA-5 kN	0.05 ±%

Reference Indicator Uncertainty	
Keithley 7.5 Digit DMM	12 PPM

Cone Resistance Calibration - Graphical Results







Interpolation

Table - 1

Linear Equation	*The cone output in force units of D (0.1 N) is derived using a linear factor from the raw cone output. D = Factor x RAW_Output*	0.1 N Factor = 0.009076
Polynomial Equation	*3rd order polynomial equation. For a given cone indicated output of D (in 0.1 N units), the corrected applied force, F (in 0.1 N units) is calculated from :*	a0 = 0 a1 = 0.99739681 a2 = -4.4716E-10 a3 = 9.40388E-15 *Polynomial calc. is only to be used when the cone load is under 30 kN*

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CERTIFICATE OF CALIBRATION

Certificate Number: 1719

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2116

Cone Resistance Calibration - Tabular Results

Table - 2a **Low range calibration results**

	0°	0°	120°	120°	240°	240°
kN	kN	kN	kN	kN	kN	kN
Fr	X1	X2	X3	X4'	X5	X6'
0	0.0041	0.0064	0.0021		0.0030	
0.1	0.1059	0.1075	0.1039		0.1048	
0.5	0.5066	0.5121	0.5050		0.5044	
1	1.0063	1.0115	1.0055		1.0037	
1.5	1.5004	1.5059	1.4988		1.4955	
2	2.0011	2.0059	1.9999		1.9967	
2.5	2.5013	2.5077	2.5007		2.4957	
3	3.0011	3.0071	2.9997		2.9973	
3.5	3.5026	3.5084	3.4996		3.4980	
4	4.0026	4.0080	4.0014		3.9983	
5	5.0010	5.0091	5.0023		4.9956	
4				3.9935		3.9961
3.5				3.4949		3.4958
3				2.9958		2.9955
2.5				2.4961		2.4965
2				1.9953		1.9962
1.5				1.4984		1.4942
1				0.9997		0.9965
0.5				0.5020		0.4959
0.1				0.1012		0.0958

Table -2b **High range calibration results**

	0°	0°	120°	120°	240°	240°
kN	kN	kN	kN	kN	kN	kN
Fr	X1	X2	X3	X4'	X5	X6'
10	9.9977	10.0106	10.0027		9.9981	
20	19.9841	20.0059	20.0026		19.9909	
30	29.9630	29.9974	29.9958		29.9715	
40	40.0269	40.0475	40.0875		40.0502	
50	50.0091	50.0261	50.0389		50.0406	
60	59.9859	59.9971	60.0175		60.0116	
80	79.9130	79.9268	79.9457		79.9309	
100	99.8309	99.8507	99.8744		99.8483	
80				79.9490		79.9329
60				60.0188		60.0110
50				50.0394		50.0374
40				40.0505		40.0479
30				29.9708		29.9731
20				19.9879		19.9940
10				9.9929		9.9978

Table - 3 **Uncertainty assessment**

Reference force	**Reference tip resistance**	**Standard uncertainty u1 - u8**								**Combined standard calibration uncertainty**		**Expanded calibration uncertainty [k=2]**				**BS EN ISO 22476:2023 class**	**Tip calibration drift**
kN	kPa	kN	kN	kN	kN	kN	kN	kN	kN	kN	kN	kPa	%	kPa	%		kPa
Fr	qc;r	u1*	u2	u3	u4	u5	u6	u7	u8	uc	uc;dim	Uc qc		Uqc class		Cone Class **	u_{drift}***
0	0	0.0000	0.0006	0.0000	0.0002	0.0000	0.0000	0.0000	0.0000	0.0006	0.0006	0.8		0.8		0	0.0
0.1	66	0.0007	0.0005	0.0009	0.0002	0.0000	0.0046	0.0032	0.0000	0.0058	0.0058	7.7	11.60	7.7	11.60	0	0.0
0.5	331	0.0011	0.0004	0.0031	0.0002	0.0000	0.0053	0.0033	0.0000	0.0070	0.0071	9.3	2.82	9.3	2.82	0	0.2
1	662	0.0012	0.0009	0.0030	0.0002	0.0001	0.0052	0.0038	0.0000	0.0072	0.0072	9.6	1.45	9.5	1.44	0	0.4
1.5	993	0.0048	0.0013	0.0032	0.0002	0.0001	0.0018	0.0005	0.0000	0.0062	0.0063	8.3	0.84	8.2	0.82	0	0.6
2	1,324	0.0041	0.0017	0.0027	0.0002	0.0001	0.0007	0.0015	0.0000	0.0055	0.0057	7.6	0.57	7.3	0.55	0	0.8
2.5	1,655	0.0041	0.0024	0.0037	0.0002	0.0002	0.0008	0.0016	0.0000	0.0063	0.0066	8.7	0.52	8.3	0.50	0	1.0
3	1,986	0.0044	0.0026	0.0035	0.0002	0.0002	0.0006	0.0016	0.0000	0.0064	0.0068	9.1	0.46	8.5	0.43	0	1.1
3.5	2,317	0.0053	0.0028	0.0033	0.0002	0.0002	0.0001	0.0020	0.0000	0.0072	0.0076	10.1	0.44	9.5	0.41	0	1.3
4	2,648	0.0061	0.0037	0.0031	0.0002	0.0003	0.0007	0.0029	0.0000	0.0084	0.0089	11.8	0.45	11.1	0.42	0	1.5
5	3,310	0.0020	0.0052	0.0047	0.0002	0.0003	0.0004	0.0032	0.0000	0.0079	0.0088	11.7	0.35	10.5	0.32	0	1.9
10	6,620	0.0048	0.0115	0.0075	0.0002	0.0006	0.0005	0.0029	0.0000	0.0148	0.0167	22.1	0.33	19.7	0.30	0	3.8
20	13,239	0.0074	0.0251	0.0126	0.0002	0.0013	0.0075	0.0051	0.0000	0.0305	0.0341	45.2	0.34	40.3	0.30	0	7.6
30	19,859	0.0107	0.0385	0.0199	0.0002	0.0019	0.0233	0.0077	0.0000	0.0509	0.0559	74.0	0.37	67.4	0.34	0	11.5
40	26,479	0.0135	0.0177	0.0119	0.0002	0.0026	0.0548	0.0113	0.0000	0.0614	0.0687	90.9	0.34	81.3	0.31	0	15.3
50	33,099	0.0153	0.0102	0.0098	0.0002	0.0032	0.0295	0.0011	0.0000	0.0363	0.0529	70.0	0.21	48.1	0.15	0	19.1
60	39,718	0.0179	0.0097	0.0065	0.0002	0.0038	0.0050	0.0006	0.0000	0.0223	0.0512	67.8	0.17	29.5	0.07	0	22.9
80	52,958	0.0244	0.0095	0.0080	0.0002	0.0051	0.0702	0.0015	0.0000	0.0755	0.0974	128.9	0.24	99.9	0.19	0	30.6
100	66,197	0.0521	0.0127	0.0115	0.0002	0.0064	0.1490	0.0000	0.0000	0.1589	0.1765	233.7	0.35	210.4	0.32	0	38.2

The class of the penetrometer is determined from the measurement uncertainty at any deflection
At each given deflection the expanded measurement uncertainty Uqc_class is calculated from the readings obtained during calibration.

$$Uqc_{class} = \frac{2}{S} \times \sqrt{\sum_{i=1}^{8} u_i^2}$$

where,
u1 is the standard uncertainty associated with the applied calibration force.
u2 is the standard uncertainty associated with the reproducibility of the calibration results.
u3 is the standard uncertainty associated with the repeatability of the calibration results.
u4 is the standard uncertainty associated with the resolution and noise of the system.
u5 is the standard uncertainty associated with the drift in zero output.
u6 is the standard uncertainty associated with interpolation.
u7 is the standard uncertainty associated with reversibility.
u8 is the standard uncertainty associated with apparent load transfer from other sensor.

** u1 is not a requirement for BS EN ISO 22476-1:2023 class uncertainty Uqc_class. We have included u1 for clarity and confidence in the result.*
*** If the classification is altered with the inclusion u1, then the lower classification will be given alongside a # symbol as identification.*
**** udrift is the standard uncertainty associated with the drift in sensitivity between calibrations. This is an uncertainty associated with subsequent use and not a calibration uncertainty.*

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CERTIFICATE OF CALIBRATION

Certificate Number: 1719

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2116

Sleeve Friction Calibration

Calibration method

1. The sleeve was loaded to full range 3 times for no less than 1 minute before calibration.
2. The sleeve was calibrated with 4 sets of increasing forces and 2 sets of decreasing forces, with rotation before set 3 and 5.
3. The coefficients of a linear and third order equation relating the estimate of applied force as a function of the deflection were calculated and are shown in Table 4.
4. The forces applied, and the resulting deflections are given in Tables 5. No corrections for temperature have been applied to these results.
5. The combined expanded uncertainty* of deflection Ucfs and Ufs_class for each force is shown as a percentage of the recorded value and in units of pressure (kPa) as shown in Table 6.

*The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

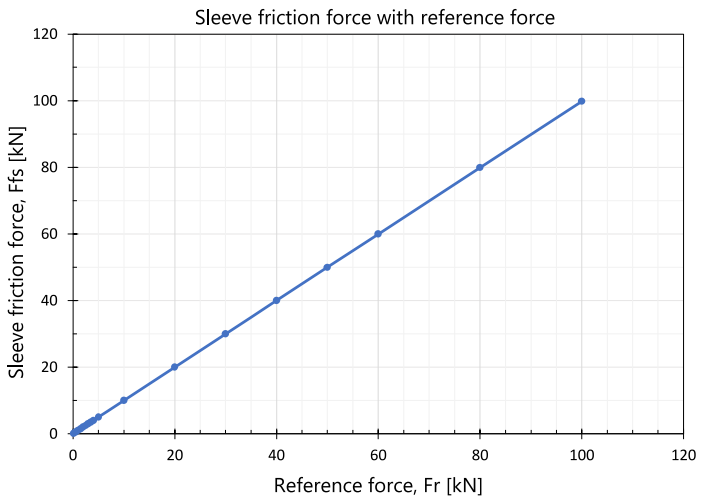
Cone Penetrometer	
Cone penetrometer type	Subtraction
Sleeve friction capacity	150 kN
Calibration range	100 kN
Sleeve friction effective resolution	0.005 kN
Sleeve area	22,847 mm^2
Measured beta factor sleeve area ratio	-0.003
Historic drift between sleeve calibrations (u_{drift})	0.05774 %
Apparent pore pressure (u_a) at full range	0.23 kPa
Sleeve friction max zero drift	0.53 kPa
Reference load cell max zero drift	0.19 kPa

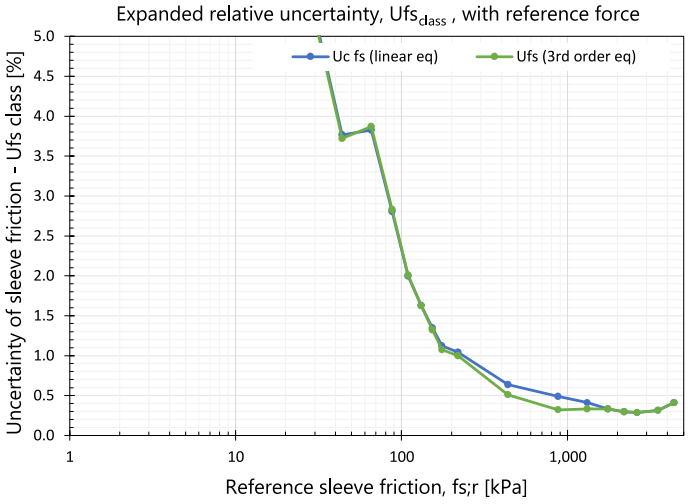
Calibration Conditions	
Ambient temperature	23.2 °C
Ambient temperature variation	0.31 °C
Instrument temperature variation	0.75 °C

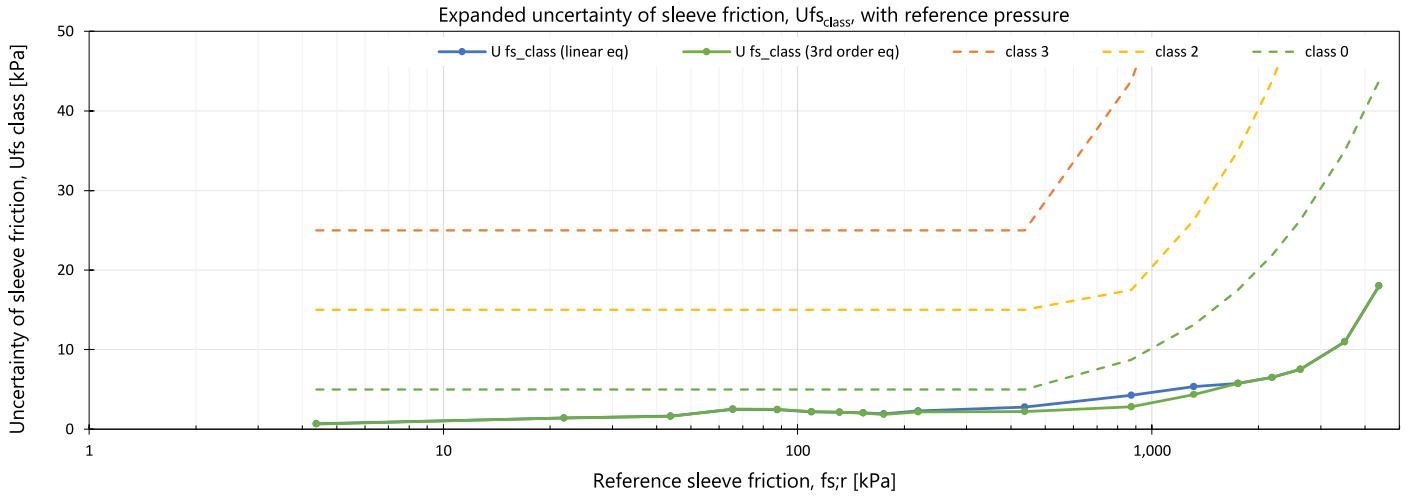
Reference Load Cell Uncertainty	
AM DSCCHA-100 kN	0.02 ±%
AM DSCCHA-5 kN	0.05 ±%

Reference Indicator Uncertainty	
Keithley 7.5 Digit DMM	12 PPM

Sleeve Friction Calibration - Graphical Results







Interpolation

Table - 4

Linear Equation	*The sleeve output in force units D (0.1 N) is derived using a linear factor from the raw sleeve output. D = Factor x RAW_Output*	0.1 N Factor = 0.008792
Polynomial Equation	*3rd order polynomial equation. For a given cone indicated output of D (0.1 N units), the corrected applied force, F (in 0.1 N units) is calculated from :*	a0 = 0 a1 = 0.998481581 a2 = 2.79418E-09 a3 = 7.34756E-16 *Polynomial calc. is only to be used when the sleeve load is under 30 kN*

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CERTIFICATE OF CALIBRATION

Certificate Number: 1719

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2116

Sleeve Friction Calibration - Tabular Results

Table - 6a **Low range calibration results**

	0°	0°	120°	120°	240°	240°
kN	kN	kN	kN	kN	kN	kN
Fr	X1	X2	X3	X4'	X5	X6'
0	0.0092	0.0022	0.0122		0.0005	
0.1	0.0982	0.1032	0.0987		0.1033	
0.5	0.4903	0.4993	0.4955		0.4966	
1	0.9892	0.9955	0.9912		0.9936	
1.5	1.4799	1.4862	1.4825		1.4804	
2	1.9794	1.9881	1.9833		1.9825	
2.5	2.4791	2.4863	2.4852		2.4855	
3	2.9795	2.9899	2.9860		2.9865	
3.5	3.4820	3.4906	3.4874		3.4870	
4	3.9853	3.9944	3.9882		3.9875	
5	4.9791	4.9936	4.9870		4.9888	
4				4.0017		3.9817
3.5				3.5083		3.4839
3				3.0063		2.9869
2.5				2.5076		2.4872
2				2.0081		1.9933
1.5				1.5069		1.4946
1				1.0123		0.9981
0.5				0.5166		0.5025
0.1				0.1133		0.1029

Table - 6b **High range calibration results**

	0°	0°	120°	120°	240°	240°
kN	kN	kN	kN	kN	kN	kN
Fr	X1	X2	X3	X4'	X5	X6'
10	9.9817	9.9969	9.9909		9.9904	
20	19.9773	20.0044	20.0004		19.9845	
30	29.9897	30.0283	30.0439		29.9897	
40	39.9708	39.9950	40.0558		39.9810	
50	49.9494	49.9668	50.0089		49.9651	
60	59.9239	59.9370	59.9906		59.9365	
80	79.8507	79.8696	79.9442		79.8767	
100	99.7739	99.7995	99.8660		99.7866	
80				80.0064		79.8506
60				60.0963		59.9462
50				50.1149		49.9763
40				40.1159		39.9957
30				30.1057		30.0070
20				20.0738		19.9874
10				10.0367		9.9821

Table - 6 **Uncertainty assessment**

Reference force	**Reference sleeve friction**	**Standard uncertainty u1 - u8**								**Combined standard calibration uncertainty**		**Expanded calibration uncertainty [k=2]**				**BS EN ISO 22476:2023 Class**	**Sleeve calibration drift**
kN	kPa	kN	kN	kN	kN	kN	kN	kN	kN	kN	kN	kPa	%	kPa	%		kPa
Fr	fs;r	u1*	u2	u3	u4	u5	u6	u7	u8	uc	uc;dim	Uc_{fs}		Ufs_{class}		Cone Class **	u_{drift}***
0	0	0.0000	0.0035	0.0000	0.0020	0.0000	0.0000	0.0000	0.0000	0.0041	0.0041	0.36		0.36		0	0.00
0.1	4	0.0007	0.0016	0.0028	0.0020	0.0000	0.0001	0.0044	-0.0048	0.0076	0.0076	0.67	15.20	0.67	15.20	0	0.00
0.5	22	0.0011	0.0020	0.0053	0.0020	0.0001	0.0059	0.0078	-0.0112	0.0161	0.0161	1.41	6.45	1.41	6.45	0	0.01
1	44	0.0012	0.0013	0.0037	0.0020	0.0001	0.0088	0.0075	-0.0139	0.0186	0.0186	1.63	3.73	1.63	3.73	0	0.03
1.5	66	0.0048	0.0008	0.0037	0.0020	0.0002	0.0193	0.0113	-0.0173	0.0290	0.0291	2.55	3.88	2.54	3.88	0	0.04
2	88	0.0041	0.0012	0.0051	0.0020	0.0002	0.0184	0.0103	-0.0175	0.0283	0.0284	2.49	2.84	2.48	2.84	0	0.05
2.5	109	0.0041	0.0021	0.0042	0.0020	0.0003	0.0168	0.0070	-0.0160	0.0251	0.0253	2.21	2.02	2.20	2.02	0	0.06
3	131	0.0044	0.0023	0.0060	0.0020	0.0004	0.0161	0.0060	-0.0154	0.0244	0.0247	2.16	1.65	2.14	1.65	0	0.08
3.5	153	0.0053	0.0018	0.0050	0.0020	0.0004	0.0146	0.0069	-0.0146	0.0231	0.0236	2.06	1.35	2.03	1.35	0	0.09
4	175	0.0061	0.0009	0.0053	0.0020	0.0005	0.0131	0.0056	-0.0138	0.0215	0.0221	1.93	1.10	1.88	1.10	0	0.10
5	219	0.0020	0.0030	0.0084	0.0020	0.0006	0.0151	0.0094	-0.0147	0.0249	0.0257	2.25	1.03	2.18	1.03	0	0.13
10	438	0.0048	0.0030	0.0088	0.0020	0.0012	0.0123	0.0156	-0.0118	0.0255	0.0285	2.50	0.57	2.23	0.57	0	0.25
20	875	0.0074	0.0068	0.0157	0.0020	0.0024	0.0126	0.0220	-0.0052	0.0321	0.0410	3.59	0.41	2.81	0.41	0	0.51
30	1,313	0.0107	0.0181	0.0223	0.0020	0.0037	0.0078	0.0228	0.0310	0.0500	0.0629	5.51	0.42	4.37	0.42	0	0.76
40	1,751	0.0135	0.0268	0.0140	0.0020	0.0049	0.0025	0.0216	-0.0523	0.0658	0.0832	7.29	0.42	5.76	0.42	0	1.01
50	2,188	0.0153	0.0178	0.0100	0.0020	0.0061	0.0255	0.0338	-0.0551	0.0743	0.0978	8.56	0.39	6.50	0.39	0	1.26
60	2,626	0.0179	0.0205	0.0076	0.0020	0.0073	0.0497	0.0333	-0.0546	0.0861	0.1151	10.08	0.38	7.54	0.38	0	1.52
80	3,501	0.0244	0.0279	0.0110	0.0020	0.0098	0.1096	0.0255	-0.0394	0.1257	0.1618	14.16	0.40	11.01	0.40	0	2.02
100	4,377	0.0521	0.0289	0.0148	0.0020	0.0122	0.1915	0.0000	-0.0424	0.2059	0.2421	21.19	0.48	18.03	0.48	0	2.53

The class of the penetrometer is determined from the measurement uncertainty at any deflection.
At each given deflection the expanded measurement uncertainty Ufs_class is calculated from the readings obtained during calibration.

$$Ufs_{class} = \frac{2}{S} \times \sqrt{\sum_{i=1}^{8} u_i^2}$$

where,
u1 is the standard uncertainty associated with the applied calibration force.
u2 is the standard uncertainty associated with the reproducibility of the calibration results.
u3 is the standard uncertainty associated with the repeatability of the calibration results.
u4 is the standard uncertainty associated with the resolution and noise of the system.
u5 is the standard uncertainty associated with the drift in zero output.
u6 is the standard uncertainty associated with interpolation.
u7 is the standard uncertainty associated with reversibility.
u8 is the standard uncertainty associated with apparent load transfer from other sensor. Includes subtraction error where: Fr;qc = Fr;fs.

** u1 is not a requirement for BS EN ISO 22476-1:2023 class uncertainty Ufs_class. We have included u1 for clarity and confidence in the result.*
*** If the classification is altered with the inclusion u1, then the lower classification will be given alongside a # symbol as identification.*
**** udrift is the standard uncertainty associated with the drift in sensitivity between calibrations. This is an uncertainty associated with subsequent use and not a calibration uncertainty.*

Sleeve Friction Calibration - Subtraction Error

In use, the forces acting on the sleeve load cell element are a combination of tip resistance and sleeve friction, with the tip resistance force value from the tip load cell element being subtracted to give the sleeve friction value. The resultant error values for differing tip and sleeve values are shown in Table 7.

The highlighted cell results in Table 7, show a direct reading of the subtraction error from the calibration results.

The non-highlighted cells in Table 7, show an interpolated subtraction error from the calibration results.

Sleeve friction - tip subtraction combined standard uncertainty uc_sub, where friction ratio is between 0.1% and 10%.

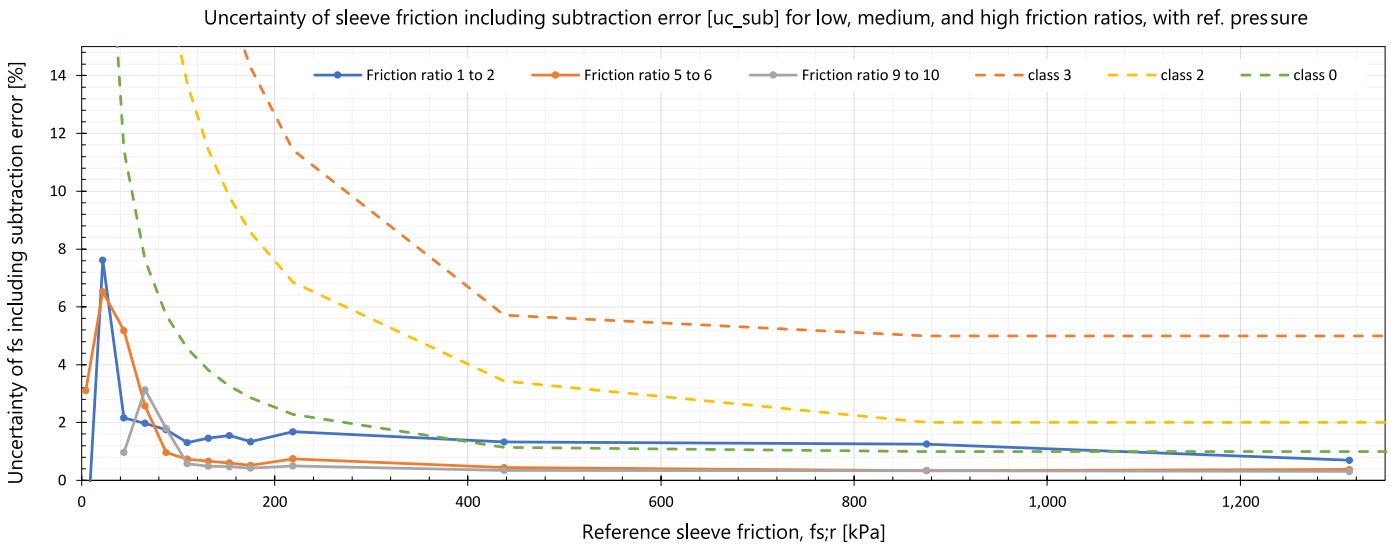
Table - 7

Sleeve friction combined standard uncertainty including subtraction error (%)

Tip resistance kPa ↓ / Sleeve friction kPa →	4	22	44	66	88	109	131	153	175	219	438	875	1,313
66	3.11	-	-	-	-	-	-	-	-	-	-	-	-
331	-2.68	***6.52***	-	-	-	-	-	-	-	-	-	-	-
662	-4.59	***10.66***	***5.18***	***3.13***	-	-	-	-	-	-	-	-	-
993	-7.24	***8.96***	***4.00***	***2.57***	***1.79***	-	-	-	-	-	-	-	-
1,324	-6.68	***8.22***	***3.97***	***2.46***	***1.69***	0.58	0.49	-	-	-	-	-	-
1,655	-4.35	***7.93***	***3.69***	1.28	0.96	0.67	0.56	0.47	-	-	-	-	-
1,986	-2.97	***7.41***	***3.39***	1.37	***1.96***	0.73	0.61	0.51	0.42	-	-	-	-
2,317	-1.46	***6.92***	1.09	1.48	1.11	0.79	0.66	0.55	0.46	0.47	-	-	-
2,648	0.16	1.86	***4.07***	1.58	1.19	0.85	0.71	0.60	0.50	0.50	-	-	-
3,310	0.79	1.98	1.32	1.63	1.22	0.88	0.74	0.62	0.52	***0.75***	-	-	-
6,620	-	4.09	2.37	2.33	1.75	1.30	1.09	0.92	0.78	0.72	***0.44***	-	-
13,239	-	8.51	4.58	3.80	2.85	2.19	1.82	1.55	1.33	1.17	***0.65***	***0.29***	0.31
19,859	-	18.83	9.74	7.24	5.43	4.25	3.54	3.02	2.62	2.20	***0.92***	***0.38***	***0.38***
26,479	-	-	2.95	2.71	2.04	1.53	1.28	1.08	0.93	0.84	***1.55***	***0.38***	0.35
33,099	-	-	4.22	3.56	2.67	2.04	1.70	1.45	1.24	1.09	***1.65***	0.43	***0.88***
39,718	-	-	5.81	4.62	3.47	2.67	2.23	1.90	1.64	1.41	0.79	***1.20***	0.45
52,958	-	-	-	7.69	5.77	4.52	3.77	3.22	2.79	2.33	1.25	***1.63***	0.60
66,197	-	-	-	-	7.16	5.63	4.70	4.01	3.49	2.89	1.53	0.87	0.69

Friction ratio (for a given row) →

Friction ratio (for a given column) ↑



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CERTIFICATE OF CALIBRATION

Certificate Number: 1719

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2116

Pore Pressure Calibration

Calibration method

1. The cone penetrometer was placed in a pressure vessel and was pressurised to full range 3 times for no less than 1 minute before calibration.
2. The pore pressure was calibrated with 2 sets of increasing pressures and 2 sets of decreasing pressures.
3. The coefficients of a linear and third order equation relating the estimate of applied pressure as a function of deflection were calculated and are shown in Table 8.
4. The pressures applied, and the resulting deflections are given in Tables 9. No corrections for temperature have been applied to these results.
5. The combined expanded uncertainty* of deflection Uu and Uu_class for each force is shown as a percentage of the recorded value and in units of pressure kPa as shown in Table 10.

* The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

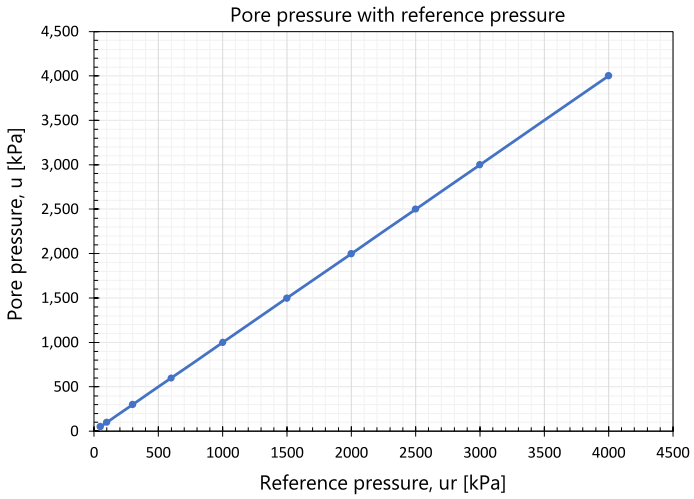
Cone Penetrometer	
Pore pressure sensor capacity	10 MPa
Calibration range	4 MPa
Pore pressure resolution	0.005 kPa
Historic drift between pore calibrations (u_{drift})	0.05774 %
Pore pressure sensor max zero drift	0.08 kPa
Reference pressure sensor max zero drift	0.04 kPa

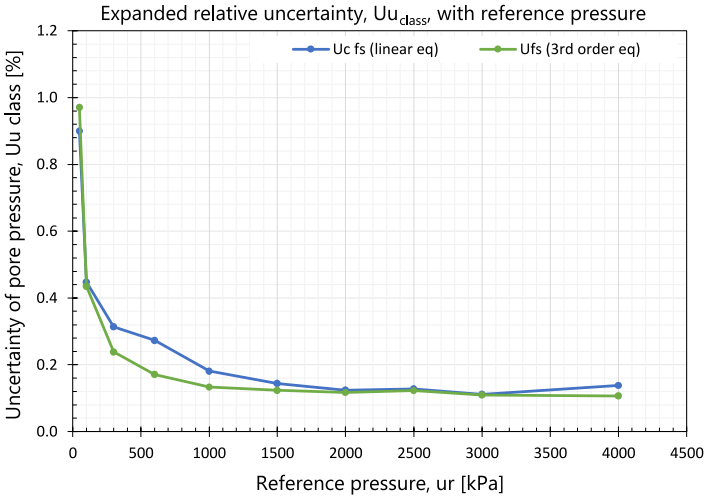
Calibration Conditions	
Ambient temperature	23.3 °C
Pressure chamber temperature variation	0.49 °C
Instrument temperature variation	0.10 °C

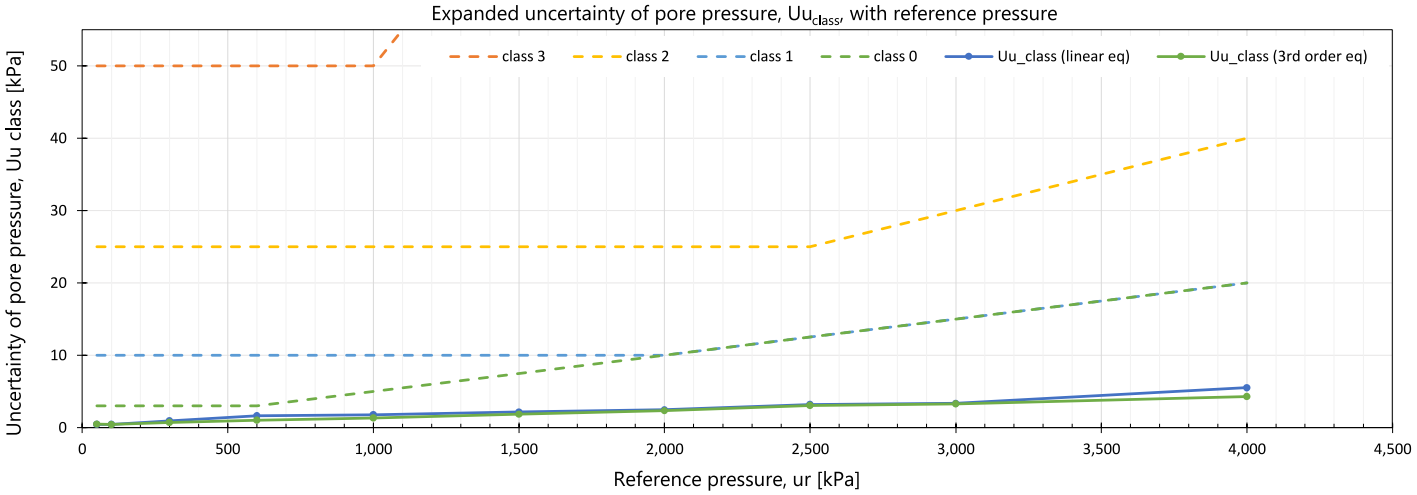
Reference Pressure Sensor Uncertainty	
MMG750V1P1MC0T3A6CE	0.02 ±%

Reference Indicator Uncertainty	
Keithley 7.5 Digit DMM	12 PPM

Pore Pressure Calibration - Graphical Results







Interpolation

Table - 8

Linear Equation	*The pore pressure output in pressure units D (0.1 Pa) is derived using a linear factor from the raw pore pressure output. D = Factor x RAW_Output*	0.1 Pa Factor = 0.050948
Polynomial Equation	*3rd order polynomial equation. For a given cone indicated output of D (0.1 Pa units), the corrected applied pressure, P (in 0.1 Pa units) is calculated from :* $P = (a3 \times D^3) + (a2 \times D^2) + (a1 \times D) + a0$	a0 = -1531.042088 a1 = 1.001362326 a2 = -5.38651E-11 a3 = 2.50761E-19

Pore Pressure Calibration - Tabular Results

Table - 9 **Calibration results**

kPa	kPa	kPa	kPa	kPa
ur	X1	X2'	X3	X4'
0	0.03		-0.08	
50	49.98		49.84	
100	100.08		100.03	
300	299.80		299.95	
600	599.76		599.87	
1000	1000.12		1000.04	
1500	1500.11		1500.25	
2000	2000.15		2000.20	
2500	2499.34		2500.26	
3000	3000.10		3000.09	
4000	4000.18		3999.88	
3000		3000.03		2999.98
2500		2500.16		2499.93
2000		2000.05		1999.74
1500		1500.11		1499.90
1000		999.93		999.87
600		600.00		600.10
300		300.12		300.02
100		100.00		100.06
50		50.16		50.01

Table - 10 **Uncertainty assessment**

Reference pressure	Standard uncertainty u1 to u6						Combined standard calibration uncertainty		Expanded calibration uncertainty [k=2]				BS EN ISO 22476:2023 class	Pore calibration drift
kPa	kPa	kPa	kPa	kPa	kPa	kPa	kPa	%	kPa	%	kPa	%		kPa
ur	u1*	u2	u3	u4	u5	u6	u_i		U_u		Uu_{class}		Cone Class **	u_{drift}***
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0	0.00
50	0.18	0.09	0.00	0.00	0.09	0.10	0.24	0.49	0.49	0.97	0.49	0.97	0	0.03
100	0.21	0.03	0.00	0.00	0.05	0.03	0.22	0.22	0.43	0.43	0.43	0.43	0	0.06
300	0.31	0.09	0.00	0.01	0.12	0.11	0.36	0.12	0.72	0.24	0.72	0.24	0	0.17
600	0.45	0.06	0.00	0.01	0.19	0.14	0.51	0.09	1.03	0.17	1.03	0.17	0	0.35
1000	0.65	0.05	0.00	0.02	0.08	0.10	0.67	0.07	1.33	0.13	1.33	0.13	0	0.58
1500	0.90	0.08	0.00	0.03	0.18	0.10	0.93	0.06	1.85	0.12	1.85	0.12	0	0.87
2000	1.15	0.03	0.00	0.04	0.18	0.16	1.17	0.06	2.34	0.12	2.34	0.12	0	1.15
2500	1.39	0.53	0.00	0.05	0.20	0.33	1.54	0.06	3.08	0.12	3.08	0.12	0	1.44
3000	1.64	0.01	0.00	0.06	0.09	0.05	1.64	0.05	3.29	0.11	3.29	0.11	0	1.73
4000	2.13	0.18	0.00	0.08	0.03	0.00	2.14	0.05	4.29	0.11	4.29	0.11	0	2.31

The class of the penetrometer is determined from the measurement uncertainty at any deflection

At each given deflection the expanded measurement uncertainty Uu_class is calculated from the readings obtained during calibration.

$$Uu_{class} = 2 \times \sqrt{\sum_{i=1}^{6} u_i^2}$$

where,
u1 is the standard uncertainty associated with the applied calibration pressure.
u2 is the standard uncertainty associated with the repeatability of the calibration results.
u3 is the standard uncertainty associated with the resolution and noise of the system.
u4 is the standard uncertainty associated with the drift in zero output.
u5 is the standard uncertainty associated with interpolation.
u6 is the standard uncertainty associated with reversibility.

** u1 is not a requirement for BS EN ISO 22476-1:2023 class uncertainty Uu_class. We have included u1 for clarity and confidence in the result.*
*** If the classification is altered with the inclusion u1, then the lower classification will be given alongside a # symbol as identification.*
**** udrift is the standard uncertainty associated with the drift in sensitivity between calibrations. This is an uncertainty associated with subsequent use and not a calibration uncertainty.*

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CERTIFICATE OF CALIBRATION

Certificate Number: 1719

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2116

Pore Pressure Calibration - Measured Area Ratios

Calibration method

1. The apparent cone resistance qc;a and apparent sleeve friction fs;a are recorded for all pore pressure calibration intervals, and shown in Table 11a and 11b.
2. The resulting net area ratios of the cone *a* and net area ratios of the sleeve *b* are computed and shown in Table 11a and 11b.
3. The final recorded cone net area ratio *a* and sleeve net area ration *b* are shown in Table 12, where reference pressure ur = 2000kPa

Table - 11a **Cone net area ratio assessment**

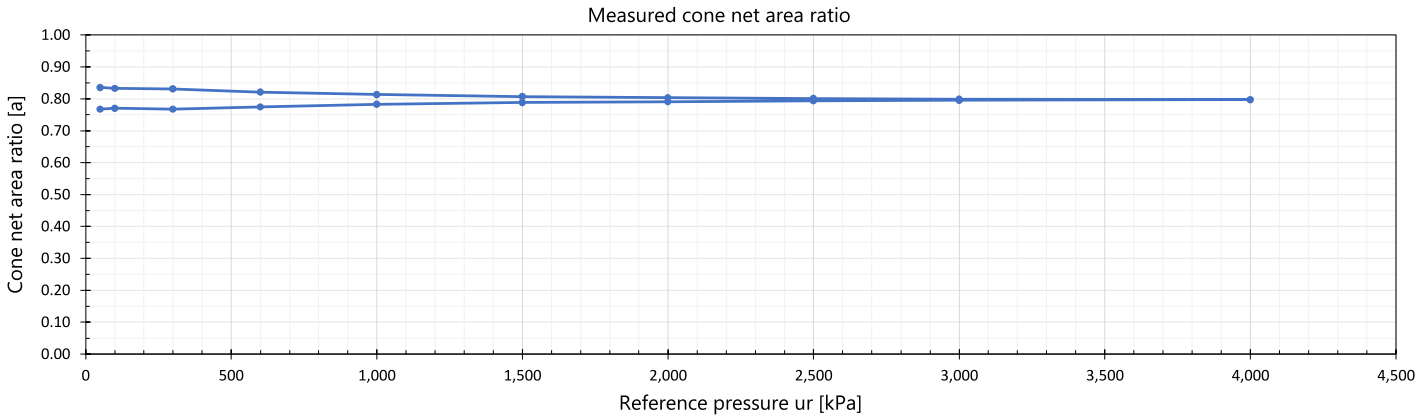
	Apparent cone resistance [qc;a]					
kPa	kPa	kPa	kPa	kPa	kPa	Alpha
ur	X1	X2'	X3	X4'	Mean	factor
50	38.0		38.8		38.4	0.77
100	77.5		76.6		77.1	0.77
300	230.4		230.2		230.3	0.77
600	465.0		464.2		464.6	0.77
1000	783.9		781.8		782.9	0.78
1500	1184.3		1180.5		1182.4	0.79
2000	1583.7		1580.4		1582.1	0.79
2500	1985.2		1983.1		1984.1	0.79
3000	2387.5		2385.3		2386.4	0.80
4000	3192.0		3189.1		3190.5	0.80
3000		2396.8		2396.6	2396.7	0.80
2500		2002.43		2001.89	2002.2	0.80
2000		1607.93		1606.95	1607.4	0.80
1500		1211.65		1210.33	1211.0	0.81
1000		814.003		812.845	813.4	0.81
600		492.056		493.298	492.7	0.82
300		250.224		248.595	249.4	0.83
100		83.4009		83.1989	83.3	0.83
50		41.8795		41.6653	41.8	0.84

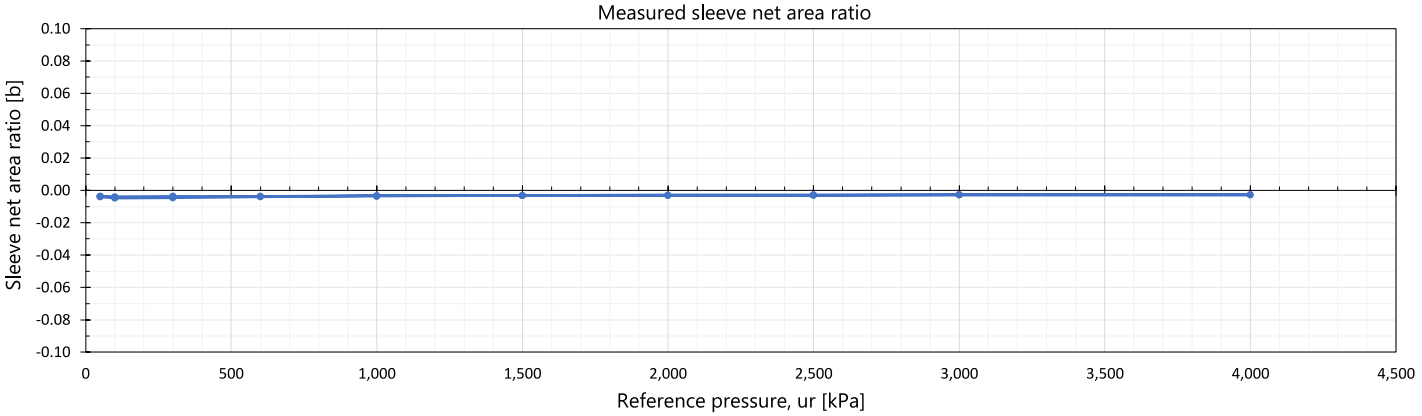
Table - 11b **Sleeve friction net area ratio assessment**

	Apparent sleeve friction [fs;a]					
kPa	kPa	kPa	kPa	kPa	kPa	Beta
ur	X1	X2'	X3	X4'	Mean	factor
50	-0.16		-0.19		-0.18	-0.004
100	-0.43		-0.37		-0.40	-0.004
300	-1.11		-1.13		-1.12	-0.004
600	-2.10		-2.27		-2.19	-0.004
1000	-3.42		-3.58		-3.50	-0.004
1500	-4.80		-4.87		-4.83	-0.003
2000	-5.94		-5.92		-5.93	-0.003
2500	-7.08		-7.25		-7.17	-0.003
3000	-8.31		-8.58		-8.44	-0.003
4000	-10.66		-10.95		-10.81	-0.003
3000		-8.23		-8.12	-8.18	-0.003
2500		-7.14		-7.12	-7.13	-0.003
2000		-6.15		-6.03	-6.09	-0.003
1500		-4.86		-4.70	-4.78	-0.003
1000		-3.58		-3.39	-3.49	-0.003
600		-2.33		-2.32	-2.32	-0.004
300		-1.46		-1.27	-1.37	-0.005
100		-0.51		-0.42	-0.47	-0.005
50		-0.26		-0.12	-0.19	-0.004

Table - 12

Cone net area ratio [a]	0.79
Sleeve friction net area ratio [b]	-0.003





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CERTIFICATE OF CALIBRATION

Certificate Number: 1719

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2116

Inclination Calibration

Calibration method

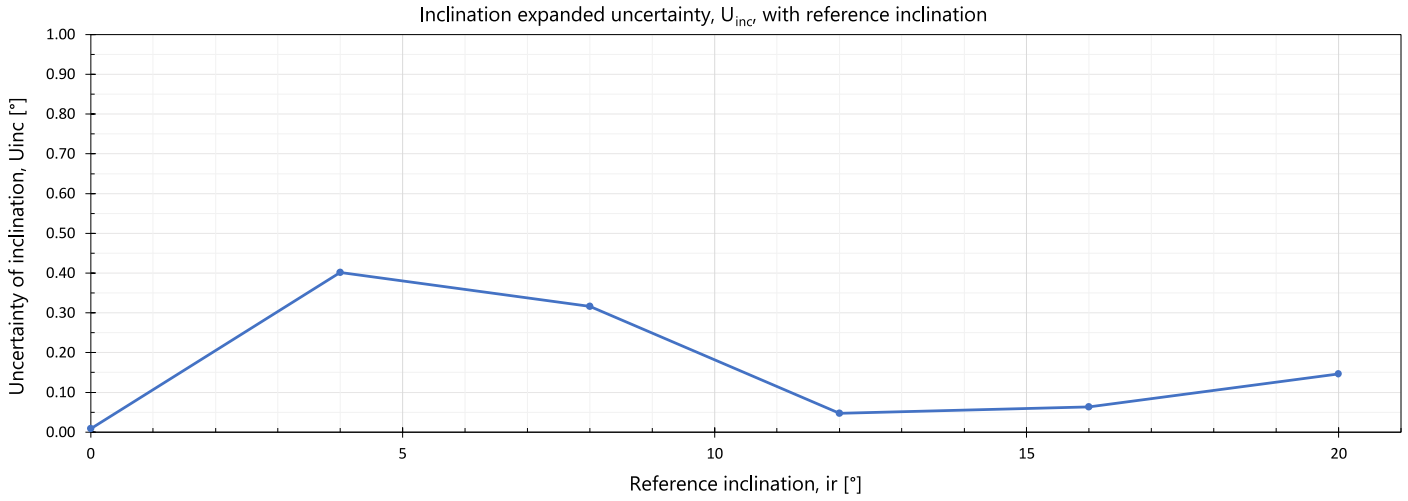
1. The cone penetrometer was placed in the inclination calibration frame and set to a vertical reference inclination of ir = 0°.
2. The inclination was calibrated from ir = 0° to ir = 20°. This was conducted twice, once with the cone at 0° rotation and once with the cone at 90° rotation.
3. The coefficients of a linear equation relating the estimate of the inclination as a function of raw sensor deflection were calculated and are shown in Table 13.
4. The inclination angle applied, and the resulting measurements are given in Table 14.
5. The combined expanded uncertainty* of measurement Uinc for each inclination angle is shown as a percentage of the recorded value and in units of arc degrees °, as shown in Table 15.

* The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

Cone Penetrometer	
Inclination sensor range	90 °
Calibration range	20 °
Inclination resolution	0.005 °
Inclinometer number of axis	2

Reference Inclination Rotary Table Uncertainty	
Lankelma HV6 Rotary Table	0.10 °

Inclination - Graphical Results



Interpolation

Table - 13

Linear Equation	*The Inclination output in angular units ($0.1° \times 10^{-3}$) is derived using a linear factor from the raw inclination output.*	X axis Factor =	9.669783
		Y axis Factor =	9.651382

Inclination Calibration - Tabular Results

Table - 14
Inclination calibration

° ir	° θ0	° θ90
0	0.00	0.00
4	4.16	4.25
8	8.16	8.16
12	12.02	11.99
16	15.98	15.97
20	19.92	19.94

Table - 15
Uncertainty assessment

Reference Inclination	Standard calibration uncertainty u1 to u4				Combined standard calibration uncertainty ui		Expanded calibration uncertainty Uinc [k=2]	
° ir	° u1	° u2	° u3	° u4	° u_i	%	° U_{inc}	%
0	0.00	0.00	0.00	0.00	0.00		0.01	
4	0.01	0.03	0.00	0.20	0.20	5.02	0.40	10.05
8	0.02	0.00	0.00	0.16	0.16	1.98	0.32	3.95
12	0.02	0.01	0.00	0.00	0.02	0.20	0.05	0.39
16	0.02	0.00	0.00	-0.02	0.03	0.20	0.06	0.40
20	0.02	0.01	0.00	-0.07	0.07	0.37	0.15	0.73

At each given deflection the expanded measurement uncertainty Uinc is calculated from the readings obtained during calibratio n.

$$U_{inc} = 2 \times \sqrt{\sum_{i=1}^{4} u_i^2}$$

where,
u1 is the standard uncertainty associated with the applied calibration inclination.
u2 is the standard uncertainty associated with the reproducibility of the calibration results.
u3 is the standard uncertainty associated with the resolution and noise of the system.
u4 is the standard uncertainty associated with interpolation.

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CERTIFICATE OF CALIBRATION

Certificate Number: 1719

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2116

Temperature Calibration

Calibration method

1. The cone penetrometer was placed in the thermostatic temperature calibration bath with the temperature set to 0°C.
2. The temperature was calibrated from Tr = 0°C to Tr = 30°C.
3. The coefficients of a linear equation relating the estimate of temperature as a function of raw temperature sensor deflection were calculated and are shown in Table 16.
4. The applied temperature, and the resulting measurements are given in Table 17.
5. The combined expanded uncertainty* of measurement Utemp for each temperature is shown as a percentage of the recorded value and in units of Celsius °C, as shown in Table 18.

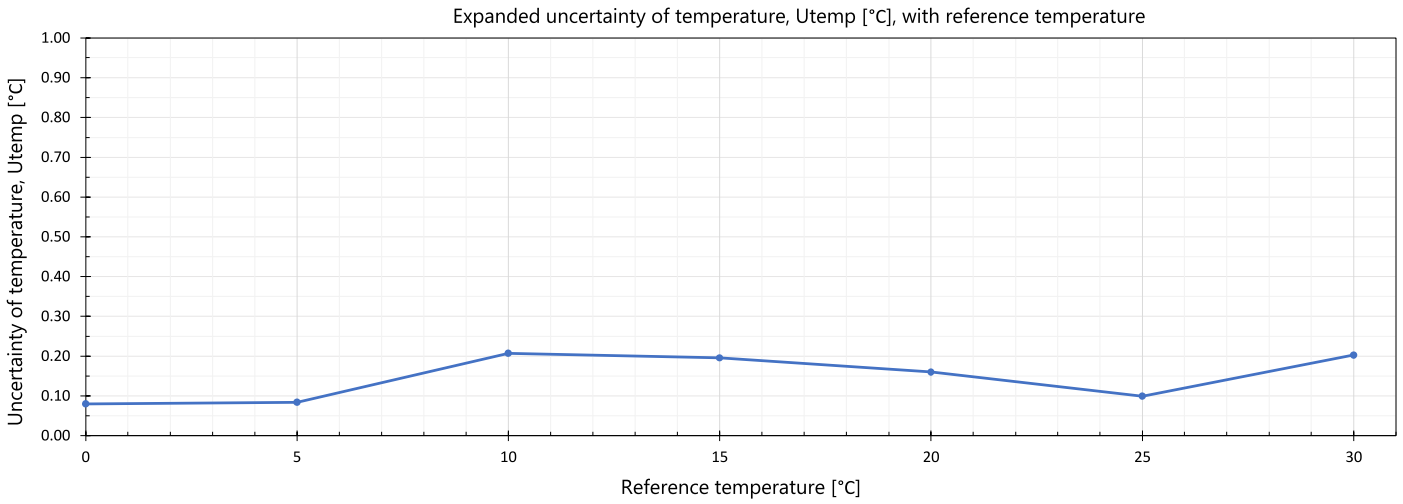
* The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

Cone Penetrometer	
Temperature sensor range	90 °
Calibration range	30 °
Temperature resolution	0.005 °
Temperature number of axis	2

Reference Thermometer Uncertainty	
ETI Ref Thermometer	0.04 °

Temperature Datalogger Uncertainty	
ETI ThermaData	0.4 °

Temperature Calibration - Graphical Results



Interpolation

Table - 16

Linear Equation	*The temperature sensor output in temperature units (0.1°C x 10^{-3}) is derived using a linear factor from the raw temperature output.*	Temperature sensor [qc] factor =	0.572412
		Temperature sensor [fs] factor =	0.577426

Temperature Calibration - Tabular Results

Table - 17
Temperature calibration

°C T_r	°C T_a
0	0.00
5	4.99
10	9.91
15	14.91
20	19.93
25	25.03
30	30.09

Table - 18 **Uncertainty assessment**

Reference temp	Standard calibration uncertainty u1 to u3			Combined standard calibration uncertainty u_t		Expanded calibration uncertainty U_{temp} [k=2]	
°C T_r	°C u1	°C u2	°C u3	°C	% u_t	°C	% U_{temp}
0	0.04	0.00	0.00	0.04		0.08	
5	0.04	0.00	-0.01	0.04	0.84	0.08	1.68
10	0.04	0.00	-0.10	0.10	1.04	0.21	2.07
15	0.04	0.00	-0.09	0.10	0.65	0.20	1.30
20	0.04	0.00	-0.07	0.08	0.40	0.16	0.80
25	0.04	0.00	0.03	0.05	0.20	0.10	0.40
30	0.04	0.00	0.09	0.10	0.34	0.20	0.68

At each given deflection the expanded measurement uncertainty Utemp is calculated from the readings obtained during calibration.

$$U_{temp} = 2 \times \sqrt{\sum_{i=1}^{3} u_i^2}$$

where,
u1 is the standard uncertainty associated with the applied calibration temperature.
u2 is the standard uncertainty associated with the resolution and noise of the system.
u3 is the standard uncertainty associated with interpolation.

Temperature Influence Verification

Verification method

1. The cone penetrometer was placed in the thermostatic temperature calibration bath with the temperature set to 30 °C, the second bath temperature was set to 0°C.
2. The test method for verification of a cone penetrometer for temperature influence was followed as set out in BS EN ISO 224 76-1:2023, clause B.2.7.2.
3. The bath temperatures, apparent cone resistance, apparent sleeve friction, apparent pore pressure, and apparent cone temperature were recorded for the duration of the test.
4. The correction factors for; corrected apparent cone resistance, corrected sleeve friction, and corrected pore pressure were applied in post processing.
5. The start and end apparent readings are shown in Table 19. The maximum and minimum apparent readings are shown in Table 20.
6. The ambient stability, transient stability, and resulting penetrometer class were calculated and are shown in Table 21.

Table - 19 **Start and end apparent readings**

	°C	°C	kPa	kPa	kPa	kPa	kPa	kPa
	Ta_{qc}	Ta_{fs}	qc;a	qc;ac	fs;a	fs;ac	u;a	u;ac
T30	30.1	30.1	-0.7	-0.8	0.0	0.0	0.0	0.0
T0	0.2	0.3	-68.7	9.3	0.9	2.6	-75.3	-1.0

Table - 20 **Maximum / minimum apparent readings**

	kPa	kPa	kPa	kPa	kPa	kPa
	qc;a	qc;ac	fs;a	fs;ac	u;a	u;ac
max	357.4	85.6	10.4	9.3	0.3	1.5
min	-383.5	-73.6	-9.4	-6.0	-76.6	-4.5

Maximum rate of change

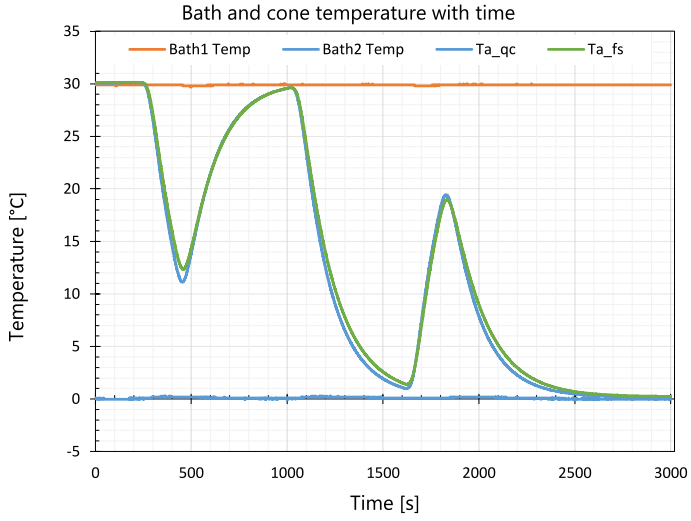
kPa/s	kPa/s	kPa/s	kPa/s	kPa/s	kPa/s
Δfgqc	Δfgqcc	Δfgfs	Δfgfsc	Δfgu	Δfguc
13.72	5.60	0.46	0.40	0.41	0.21

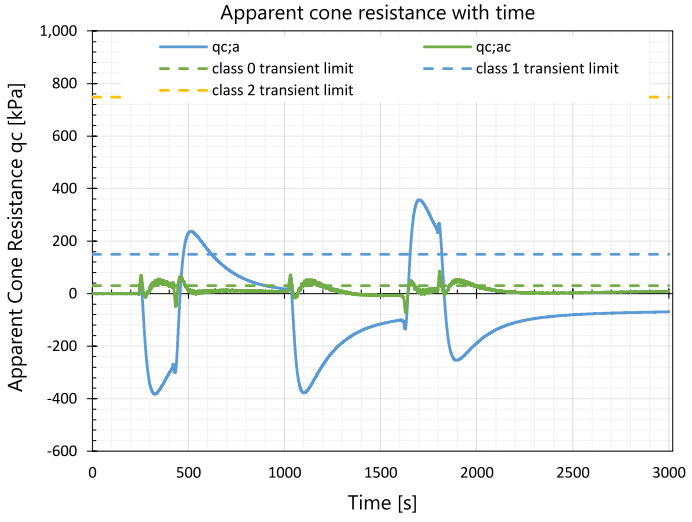
Table - 21a **Ambient temperature stability and classification**

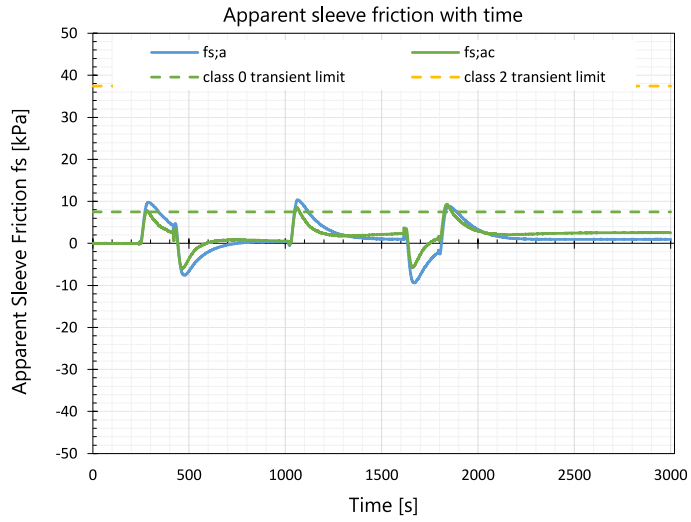
Ambient temperature stability		kPa/°C	Class
Uncorrected	Δaqc	2.27	2
	Δafs	-0.03	0
	Δau	2.52	N/A
Corrected	Δaqcc	-0.34	0
	Δafsc	-0.09	0
	Δauc	0.03	0

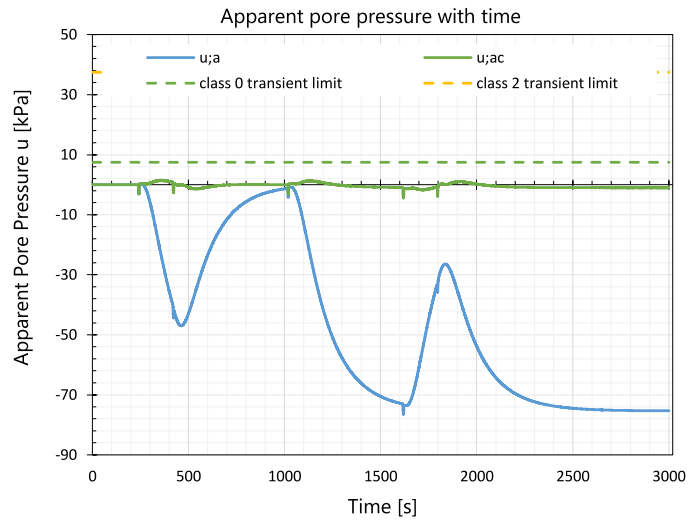
Table - 21b **Transient temperature stability and classification**

Transient temperature stability		kPa/°C	Class
Uncorrected	Δtqc	24.76	2
	Δtfs	0.66	2
	Δtu	2.57	3
Corrected	Δtqcc	5.32	1
	Δtfsc	0.51	2
	Δtuc	0.20	0









Bending Influence Verification

Verification Method

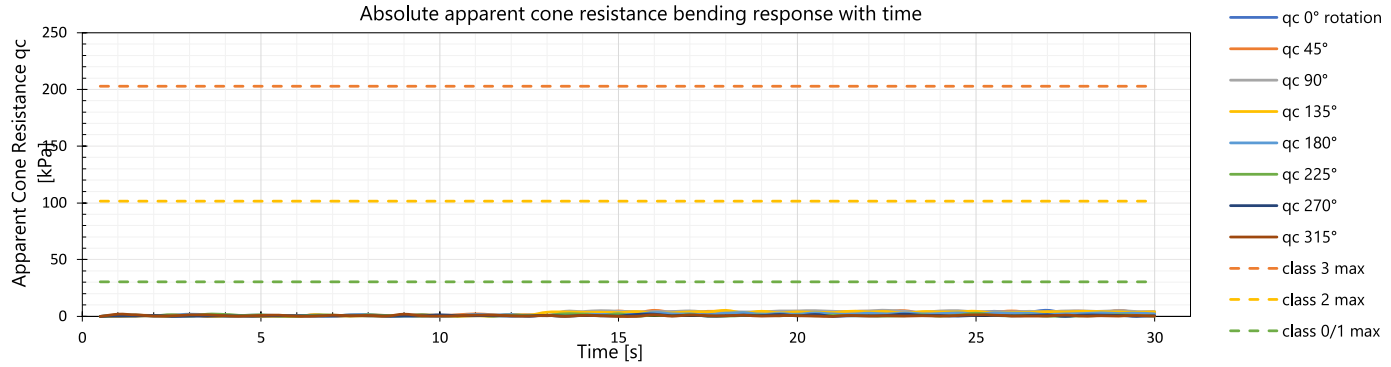
1. The cone penetrometer was placed in the bending influence frame, clamping the cone horizontally.
2. The test method for verification of a cone penetrometer for bending influence was followed as set out in BS EN ISO 22476-1:2023, clause B.2.8.2.
3. The air temperature, apparent cone resistance, apparent sleeve friction, and apparent pore pressure were recorded for the duration of each test. In total 8 tests were performed from 0° rotation to 315° rotation, evenly spaced with 45° rotation between tests.
4. The bending influence results and resulting cone penetrometer classification was calculated and are shown in Table 22.

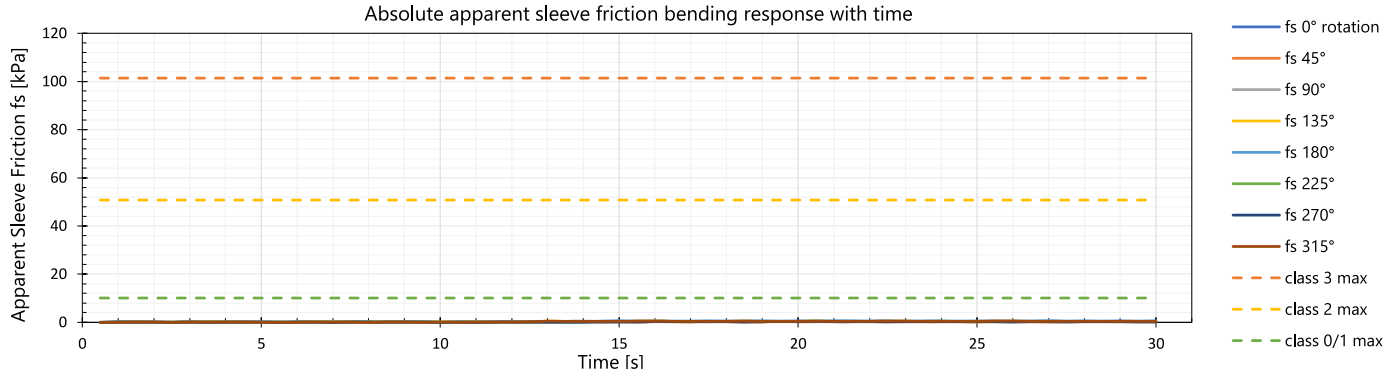
Table - 22 **Bending Influence results**

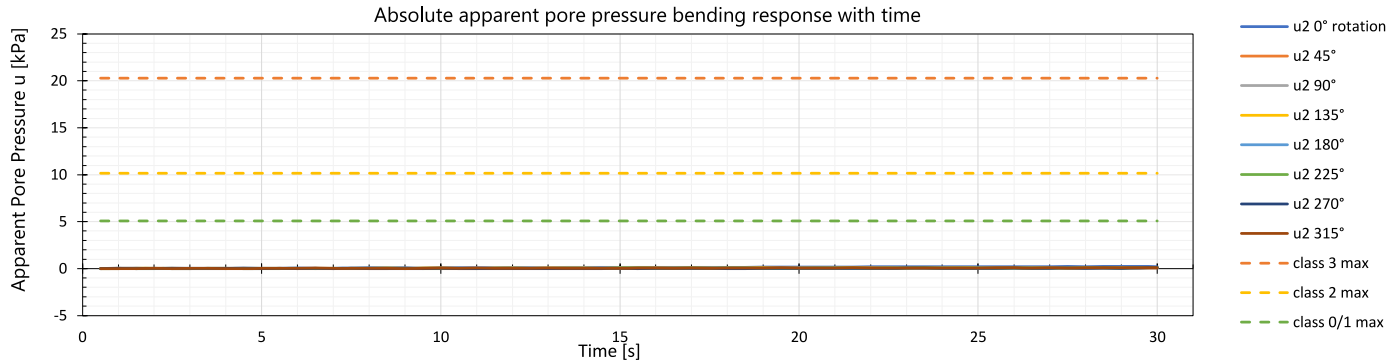
	qc;a [kPa/N]	fs;a [kPa/N]	u2;a [kPa/N]	Ambient Temp [°C]
max	0.043	0.002	0.002	28.7
min	-0.053	-0.006	0.000	28.6
max test Δb, Δt	0.096	0.008	0.003	0.1
class	0	0	0	

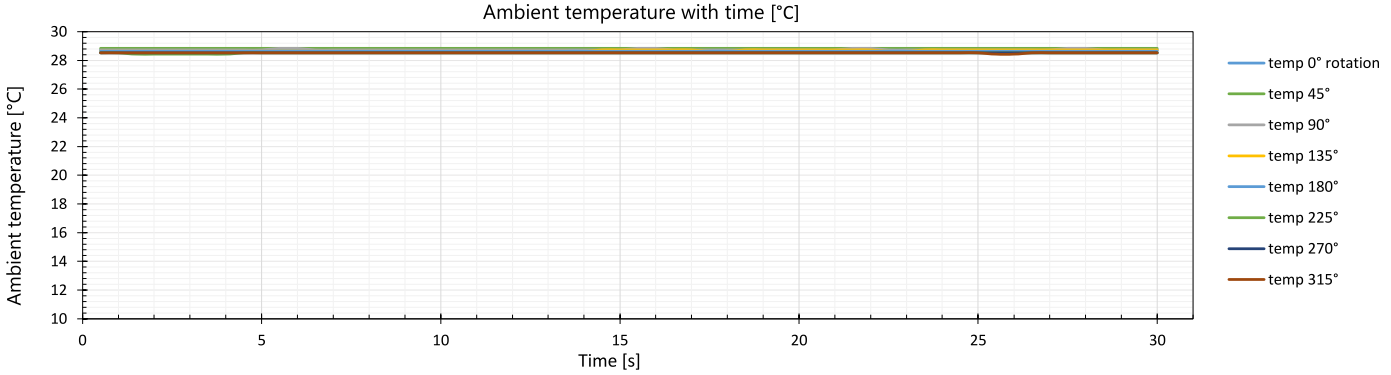
10 kg Calibration Weight Uncertainty	
10 kg Calibration Weight	0.001 %

10 kg Calibration Weight	
Reference weight	10.341 kg
Reference force	101.411 N









Sensor Stability Verification

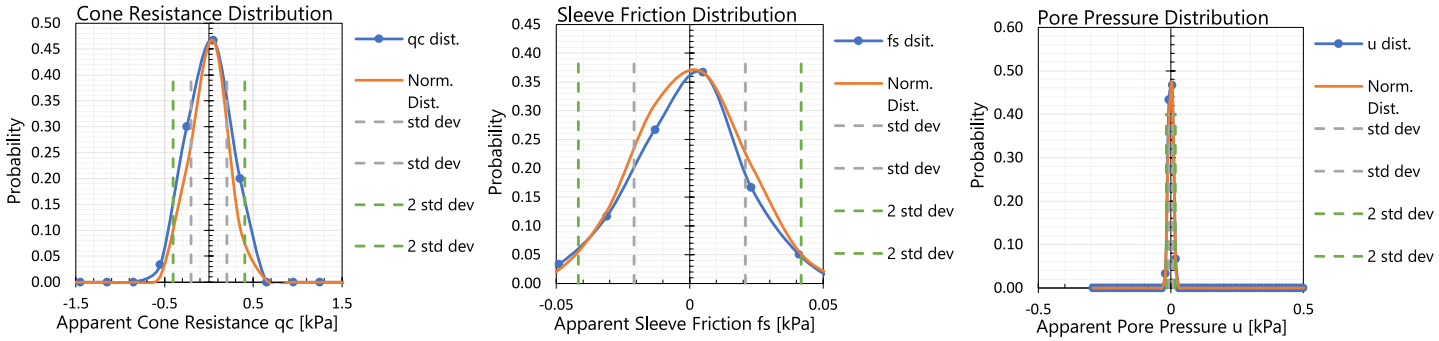
The purpose of this section is to quantify the stability of the geotechnical sensors (qc, fs, u) and demonstrate validity of applying a normal distribution, described by standard deviation and mean, when assessing probability of noise magnitude. The sampling duration has been limited to 60 seconds to allow direct comparison to the field verification data required under BS EN ISO 22476-1: 2023.

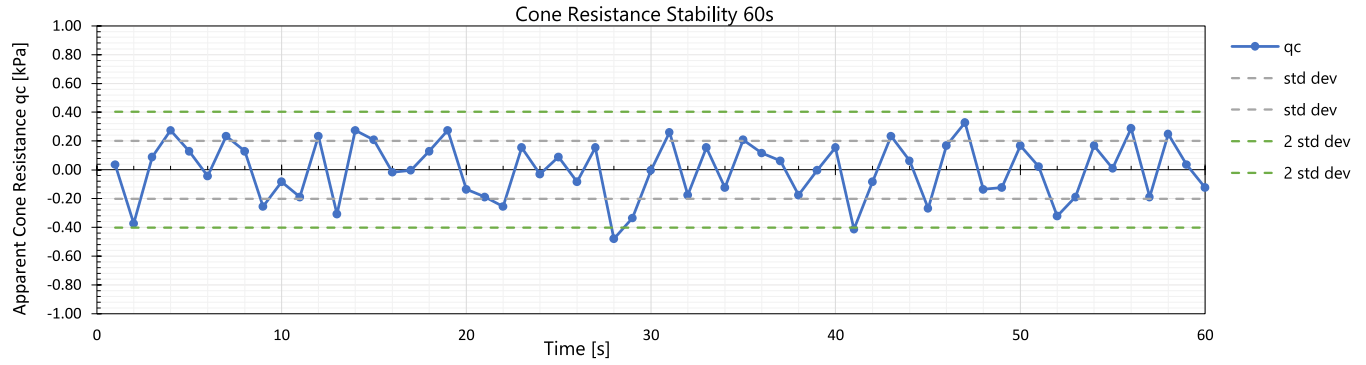
Verification method

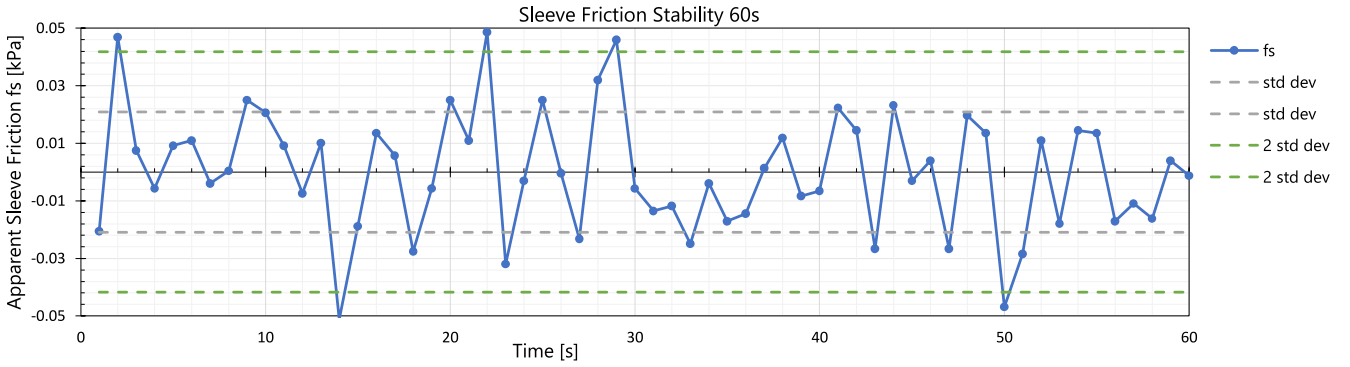
1. The cone penetrometer was placed in the thermostatic temperature calibration bath at ambient temperature.
2. The cone penetrometer was left for no less than 30 minuets or until the output was stable.
3. The output was recorded for 60 seconds at a frequency of 1Hz. The maximum change and standard deviation are shown in Table 23.

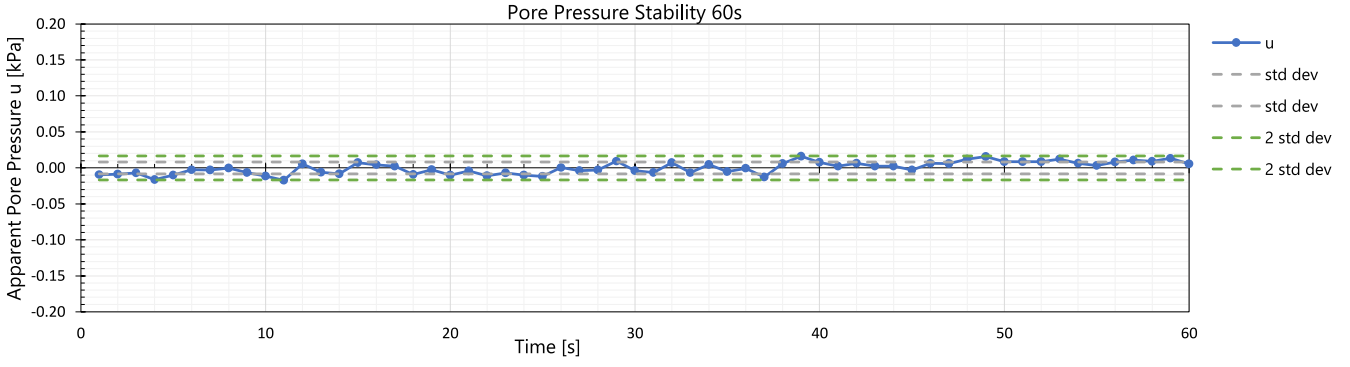
Table - 23 **Sensor stability results**

	qc (kPa)	fs (kPa)	u (kPa)	Inc (°)	Temp (°C)
Max	0.327	0.049	0.016	0.055	0.020
Min	-0.480	-0.051	-0.017	-0.062	-0.021
Δ (Max - Min)	0.808	0.100	0.033	0.127	0.100
Standard deviation (68% coverage)	± 0.201	± 0.021	± 0.008	± 0.025	± 0.012
2 standard deviations (95% coverage)	± 0.403	± 0.042	± 0.017	± 0.050	± 0.023









LANKELMA
A ConeTec Group Company

CERTIFICATE OF CALIBRATION

Certificate Number: 1719

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2116

Magnetometer Calibration

Calibration Method

1. The cone penetrometer was connected to a steel crossover rod.
2. The cone penetrometer was moved through the earths magnetic field for at least 5 minuets, at varying inclination and rotation angles.
3. The sensor was calibrated against the NOAA World Magnetic Model field estimate, using the coordinates of the calibration laboratory.
4. The resulting sensor bias, and sensor calibration factors for the calibration of soft iron effects are shown in Table 24.
5. The calibrated mean total field, total field mean error, and standard deviation of total field are shown in Table 25.

Cone Penetrometer Magnetometer	
Sensor range	200 uT
Resolution	10 nT

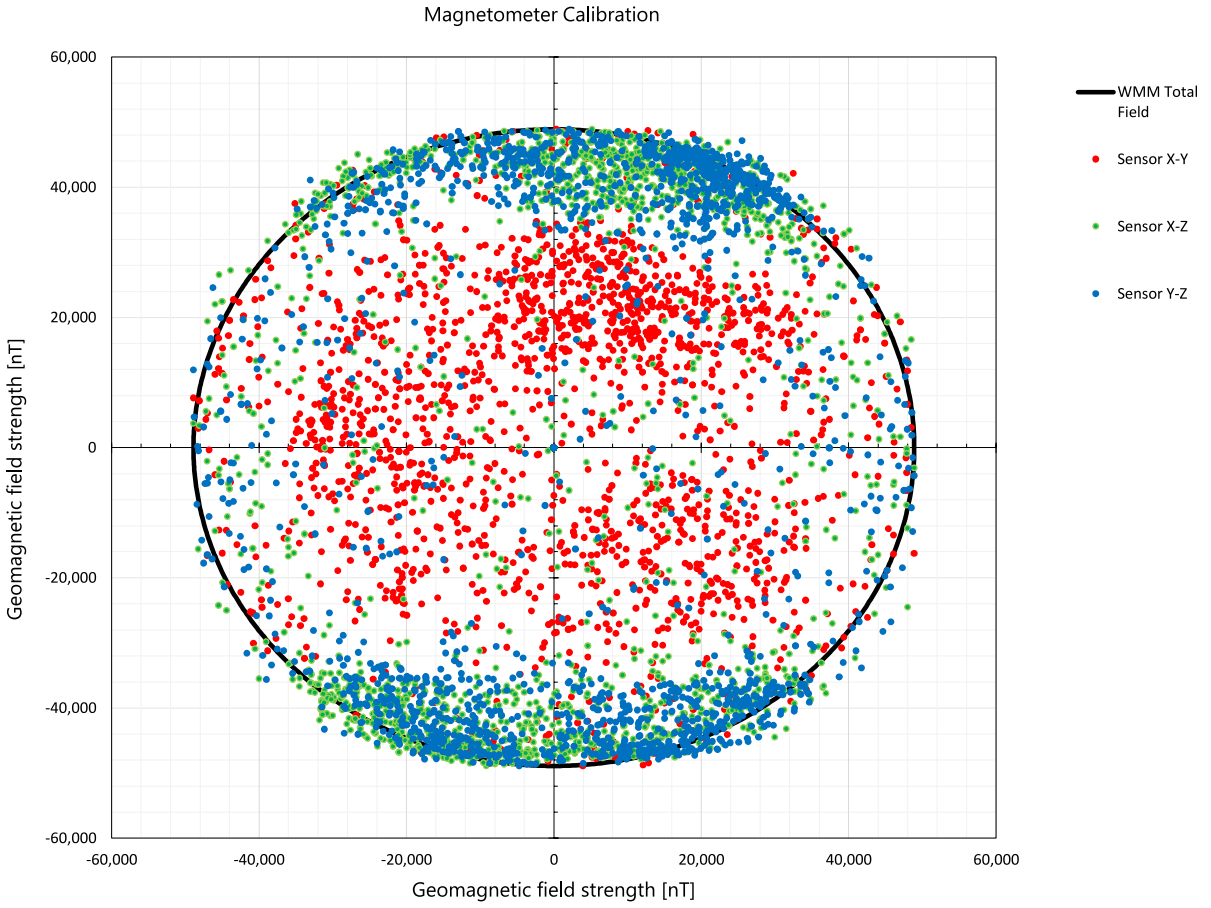
World Magnetic Model Total Field Calculations		
NOAA WMM total field estimate	48,900.8	nT
WMM field estimate uncertainty	145	nT
Latitude	50.975	N
Longitude	0.711	E
Elevation	0.031	km

Table - 24 ***Calibration factors***

X bias	-1058	nT
Y bias	1658	nT
Z bias	-26617	nT
X factor	1.11455	factor
Y factor	1.19198	factor
Z factor	0.57060	factor

Table - 25 ***Calibration for soft iron effects, including cone and crossover rod***

Calibrated average total field	49,292	nT
Calibrated total field std deviation	1,851	nT
Total field mean error	0.80	%





UK3
Track-truck

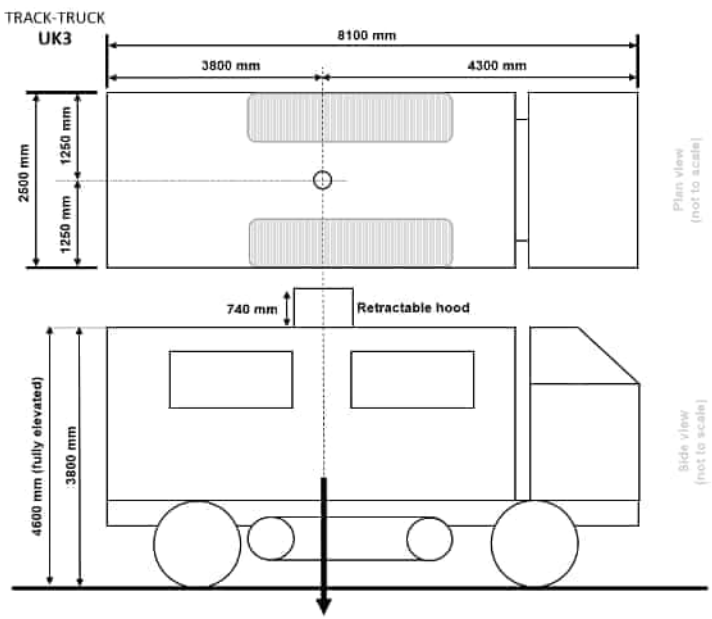
LANKELMA
01797 280050 – www.lankelma.com

Rig weight	20.5 T
Max. operating ram capacity	17 T
Max. travelling speed	86 km/h
Track material	Steel
Track length	3300 mm
Track width	650 mm
Jack plate dimensions	Tracks act as jacks
Jack arrangements	1nr. on each side
Max. ground clearance on jacks	210 mm
Max. ground bearing pressure	Tracking/pushing – 47 kPa Pulling – 88 kPa
Max. testing gradient	10 degrees
Max. traversing gradient	20 degrees (operator assessed)
Noise output at 2 m	Testing - 74 dBA Driving – 87 dBA
Clamp arrangement	36/55 push-pull clamp
Ram stroke	1.2 m
Max. casing size	55 mm

Lankelma's versatile track-truck is suitable for most geotechnical sites. The rig is driven to site as a self-contained HGV with tracks that can be deployed to cope with soft or uneven terrain. Fitted with a chalwyn valve and spark arrestor.

Typical production
An expected 100m+ of standard CPTu testing can be executed in a day (depending on conditions and access).

Specialist testing	**Installations**	**Sampling**
Seismic	VWP	MOSTAP
Pressuremeter	Piezometer	Shelby
Magnetometer	Inclinometer	
Video cone		
Wing cone		
Push-in shear vane		



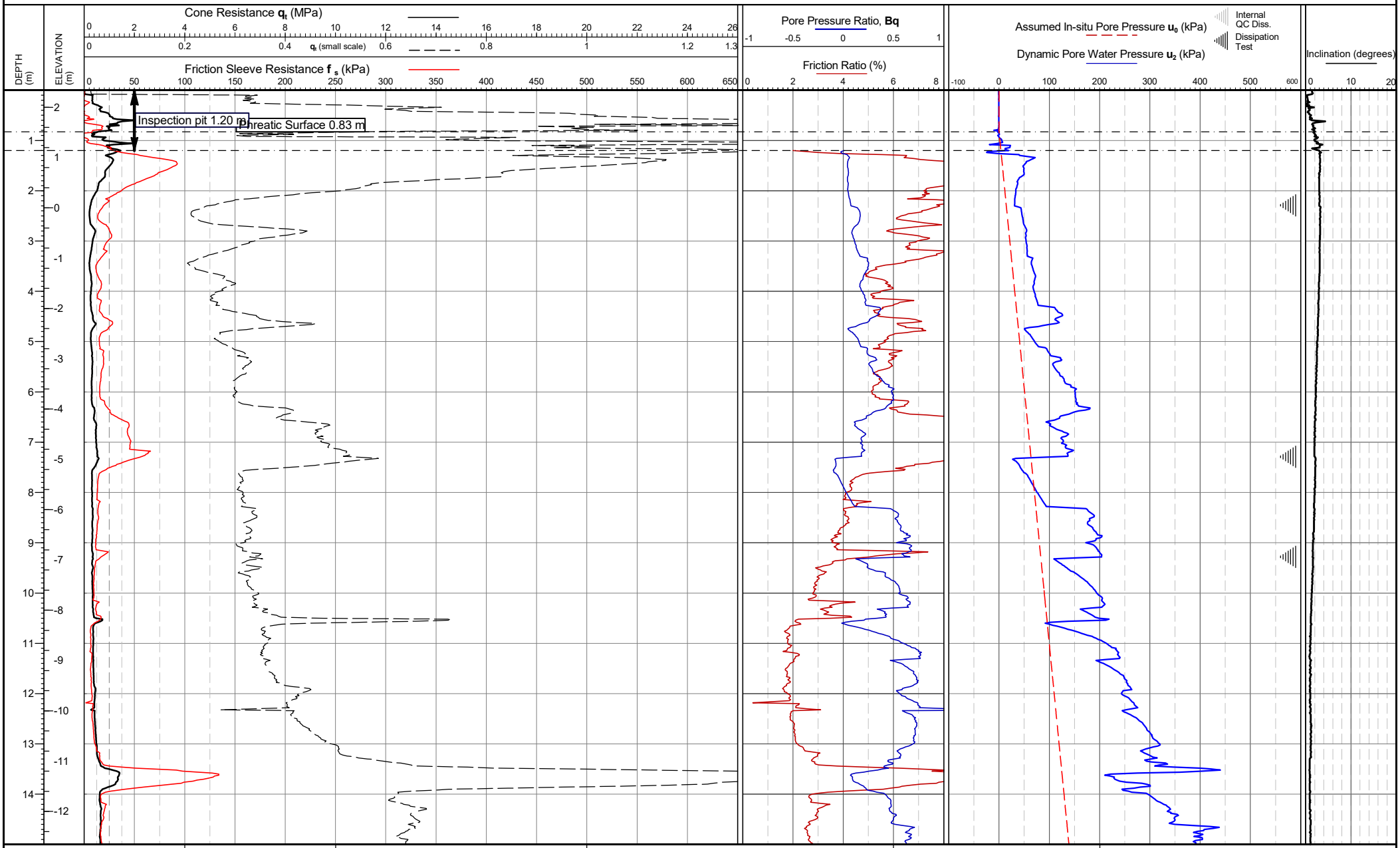
APPENDIX C CONE PENETRATION TEST RESULTS

Measured CPT parameters

intermediate parameters R_f and B_q

Project: TILBURY

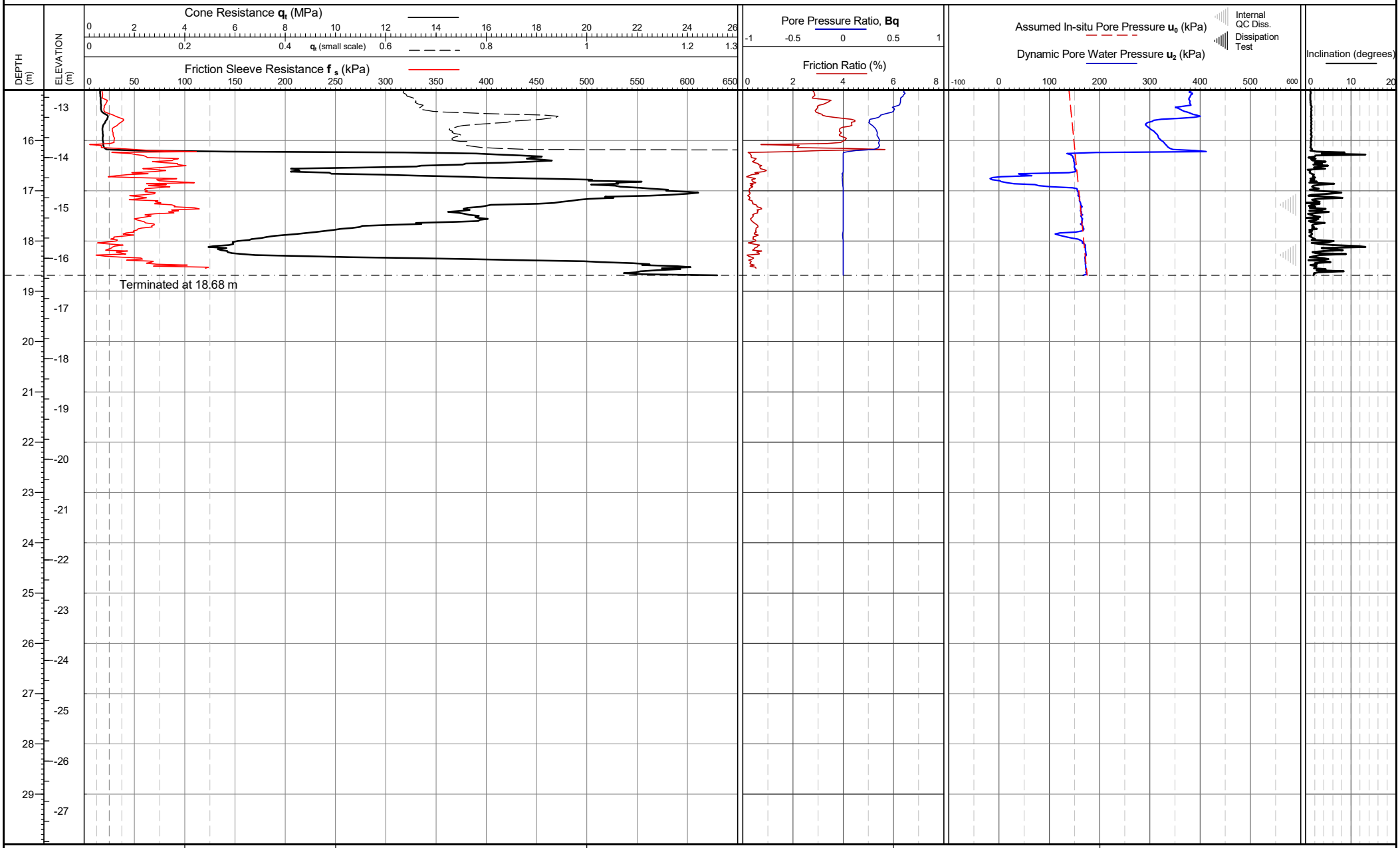
Client: SOIL ENGINEERING



Cone area (mm2): Cone ID: S15-CFIPTTM250.2116 Operator: Tom Freeland Rig Used: UK3 Date of test: 07/05/2025 08:47:52	Zero drift (Pre/post test) q_c (kPa): 5.2 f_s (kPa): -1.0 u_2 (kPa): 2.6	Location: Essex, UK Coordinates: 566299.724, 175912.182 Elevation: 2.341 Coordinate system:	Remarks: *Phreatic surface origin: Piezocone response in drained soils Termination Remark: Tip/sleeve load + inclination	Date of plot: 21-07-25 Checked by: Chris Player	Lankelma Project Ref: 25-32-29428-1	**TEST ID: CPT101** Page 1 of 2

Project: TILBURY

Client: SOIL ENGINEERING

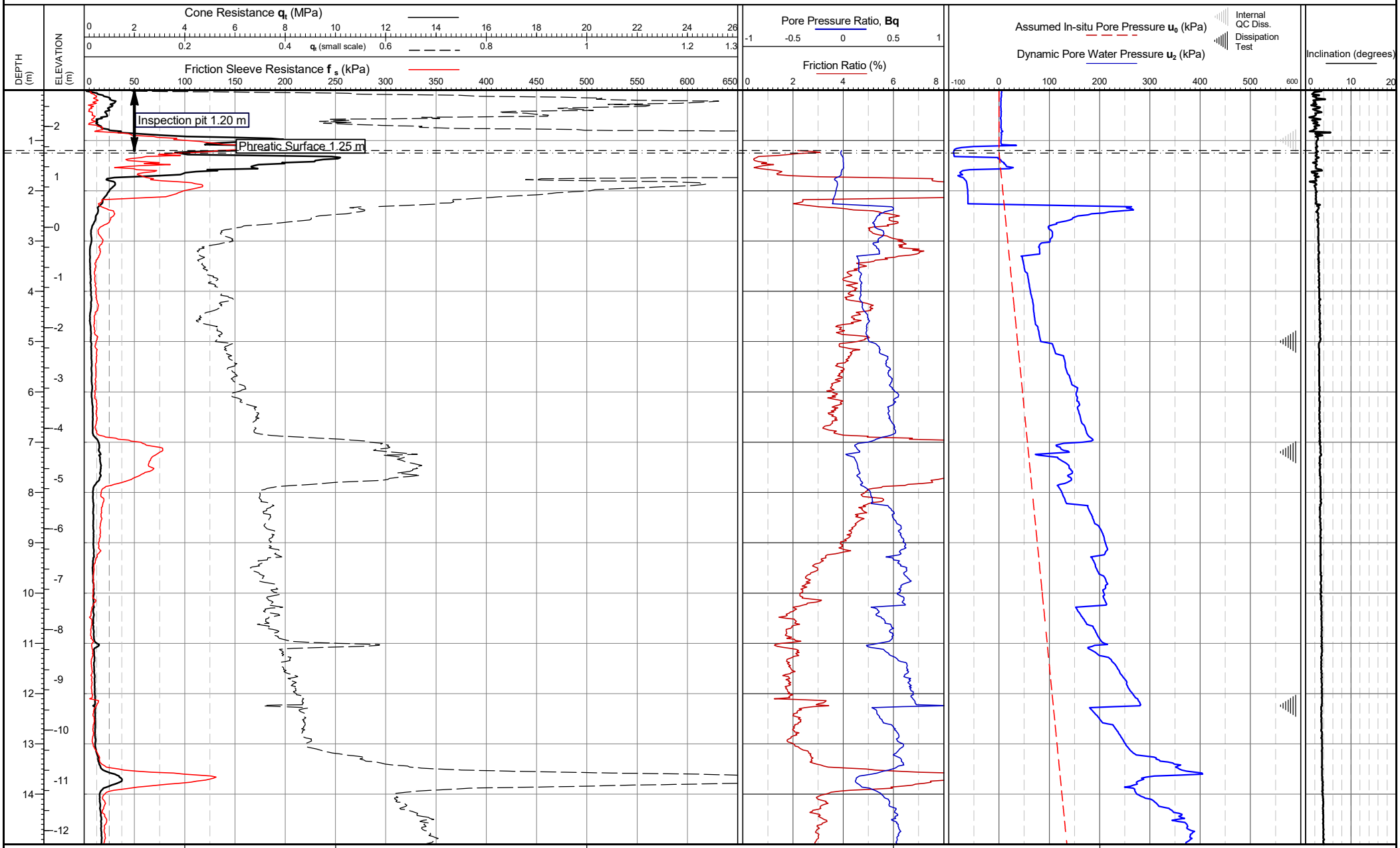


Cone area (mm2): Cone ID: S15-CFIPTTM250.2116 Operator: Tom Freeland Rig Used: UK3 Date of test: 07/05/2025 08:47:52	Zero drift (Pre/post test) q_c (kPa): 5.2 f_s (kPa): -1.0 u_2 (kPa): 2.6	Location: Essex, UK Coordinates: 566299.724, 175912.182 Elevation: 2.341 Coordinate system:	Remarks: *Phreatic surface origin: Piezocone response in drained soils Termination Remark: Tip/sleeve load + inclination	Date of plot: 21-07-25 Checked by: Chris Player	Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT101

Project: TILBURY

Client: SOIL ENGINEERING



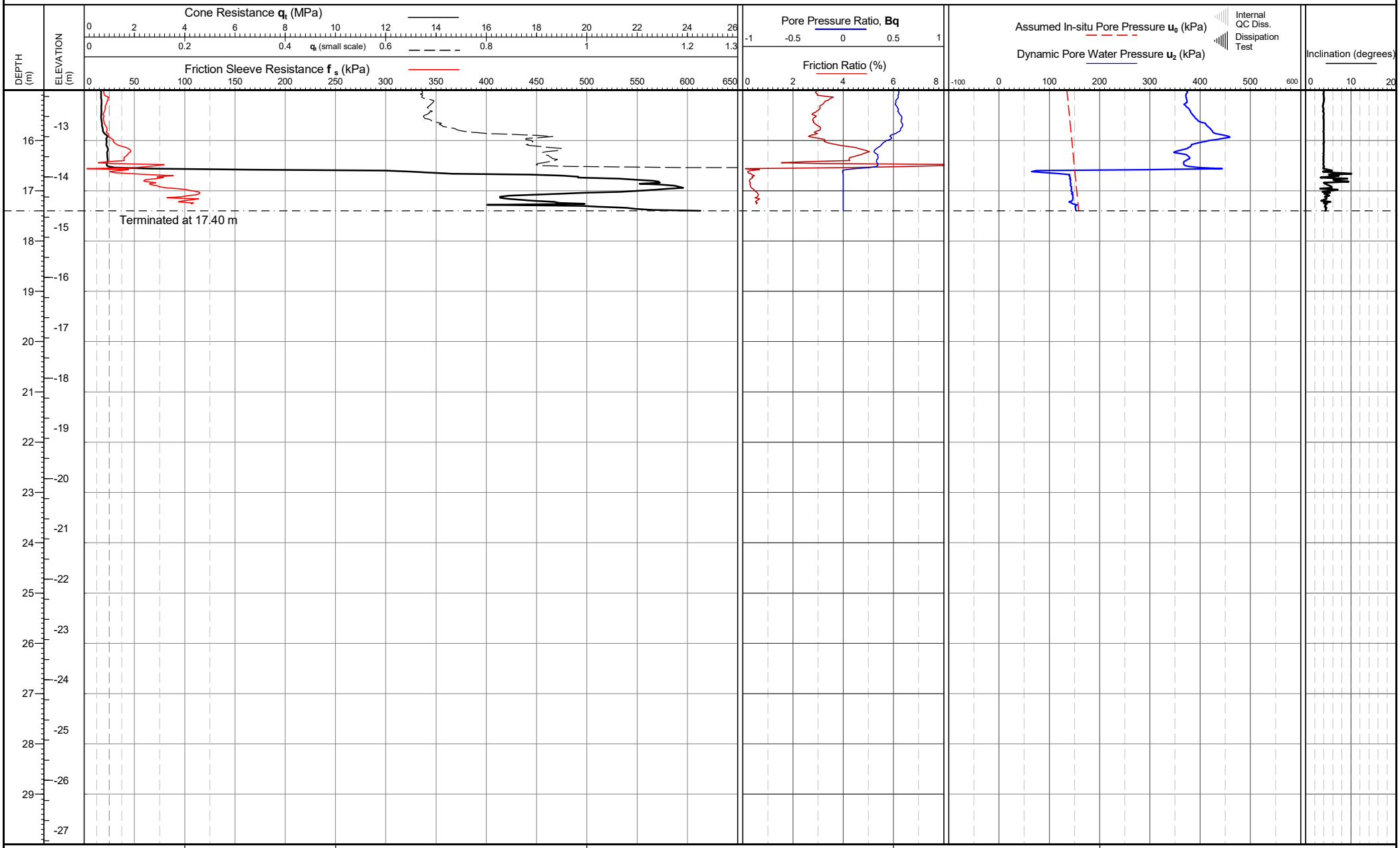
Cone area (mm2): Cone ID: S15-CFIPTTM250.2116 Operator: Tom Freeland Rig Used: UK3 Date of test: 08/05/2025 10:29:14	Zero drift (Pre/post test) q_c (kPa): 24.0 f_s (kPa): -2.6 u_2 (kPa): 4.5	Location: Essex, UK Coordinates: 566334.083, 175912.213 Elevation: 2.724 Coordinate system:	Remarks: *Phreatic surface origin: Average measured piezometric elevation from other location(s) Termination Remark: Lateral support at depth	Date of plot: 21-07-25 Checked by: Chris Player	Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT102

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING

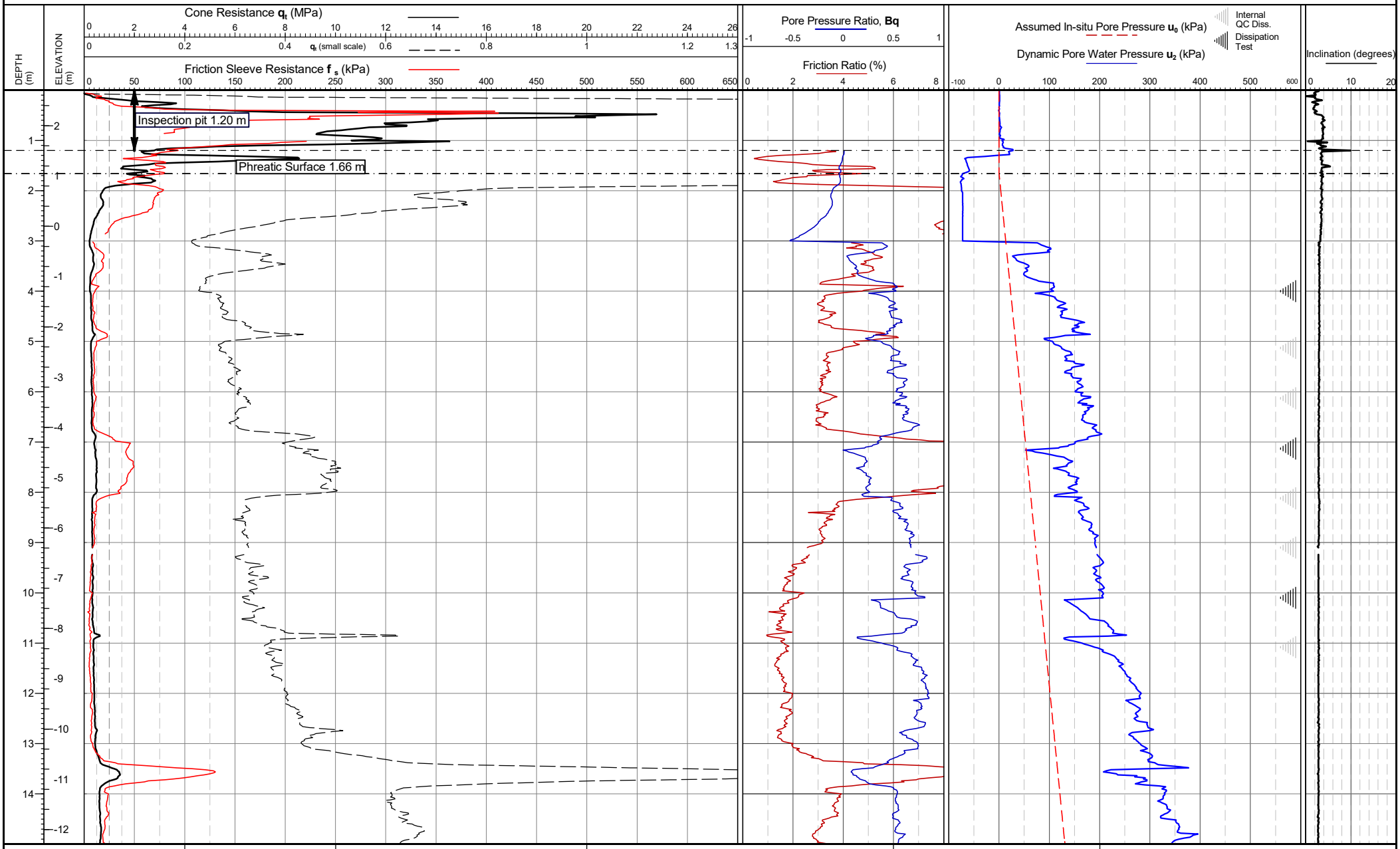


Cone area (mm2): Cone ID: S15-CFIPTTM250.2116 Operator: Tom Freeland Rig Used: UK3 Date of test: 08/05/2025 10:29:14	Zero drift (Pre/post test) q_c (kPa): 24.0 f_s (kPa): -2.6 u_2 (kPa): 4.5	Location: Essex, UK Coordinates: 566334.083, 175912.213 Elevation: 2.724 Coordinate system:	Remarks: *Phreatic surface origin: Average measured piezometric elevation from other location(s) Termination Remark: Lateral support at depth	Date of plot: 21-07-25 Checked by: Chris Player	Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT102

Project: TILBURY

Client: SOIL ENGINEERING

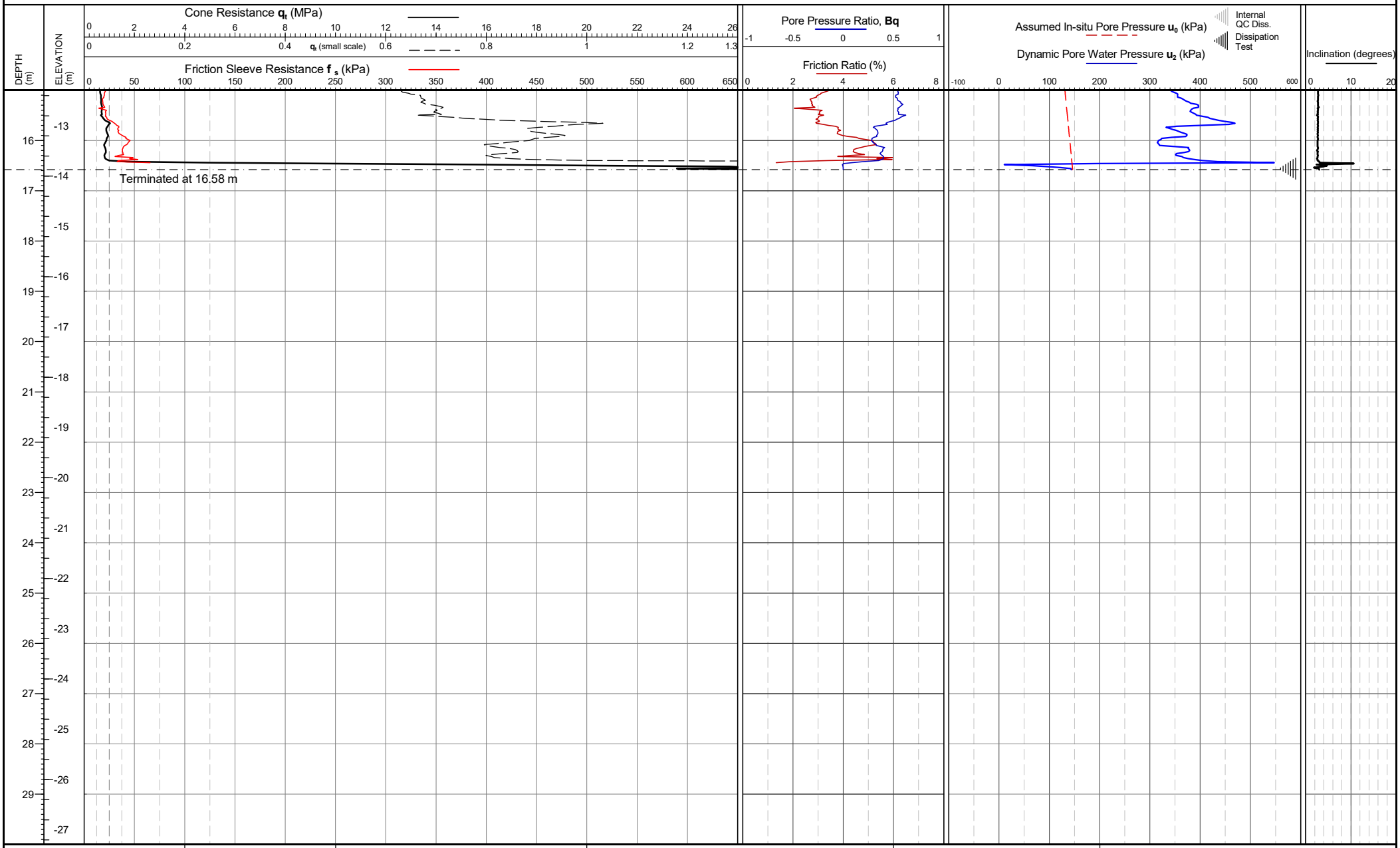


Cone area (mm2): Cone ID: S15-CFIPTTM250.2116 Operator: Riley Trevelyan Rig Used: UK3 Date of test: 06/05/2025 10:00:36	Zero drift (Pre/post test) q_c (kPa): 4.2 f_s (kPa): -0.3 u_2 (kPa): 3.6	Location: Essex, UK Coordinates: 566316.646, 175907.221 Elevation: 2.709 Coordinate system:	Remarks: *Phreatic surface origin: Average measured piezometric depth at this location, approx. +- 0.4 mbgl Termination Remark: Lateral support at depth	Date of plot: 21-07-25 Checked by: Chris Player	Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT103

Project: TILBURY

Client: SOIL ENGINEERING

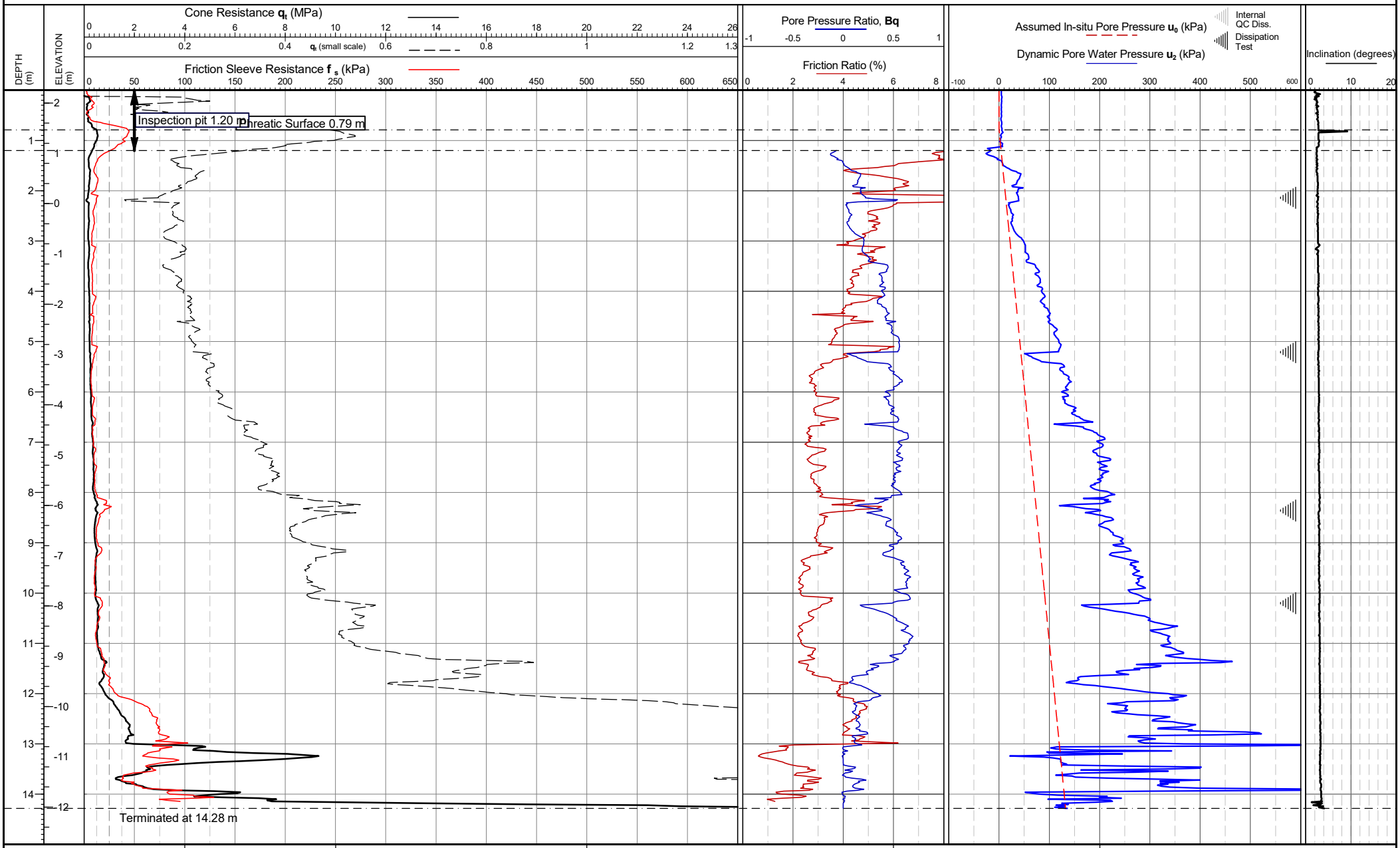


Cone area (mm2): Cone ID: S15-CFIPTTM250.2116 Operator: Riley Trevelyan Rig Used: UK3 Date of test: 06/05/2025 10:00:36	Zero drift (Pre/post test) q_c (kPa): 4.2 f_s (kPa): -0.3 u_2 (kPa): 3.6	Location: Essex, UK Coordinates: 566316.646, 175907.221 Elevation: 2.709 Coordinate system:	Remarks: *Phreatic surface origin: Average measured piezometric depth at this location, approx. +- 0.4 mbgl Termination Remark: Lateral support at depth	Date of plot: 21-07-25 Checked by: Chris Player	Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT103

Project: TILBURY

Client: SOIL ENGINEERING

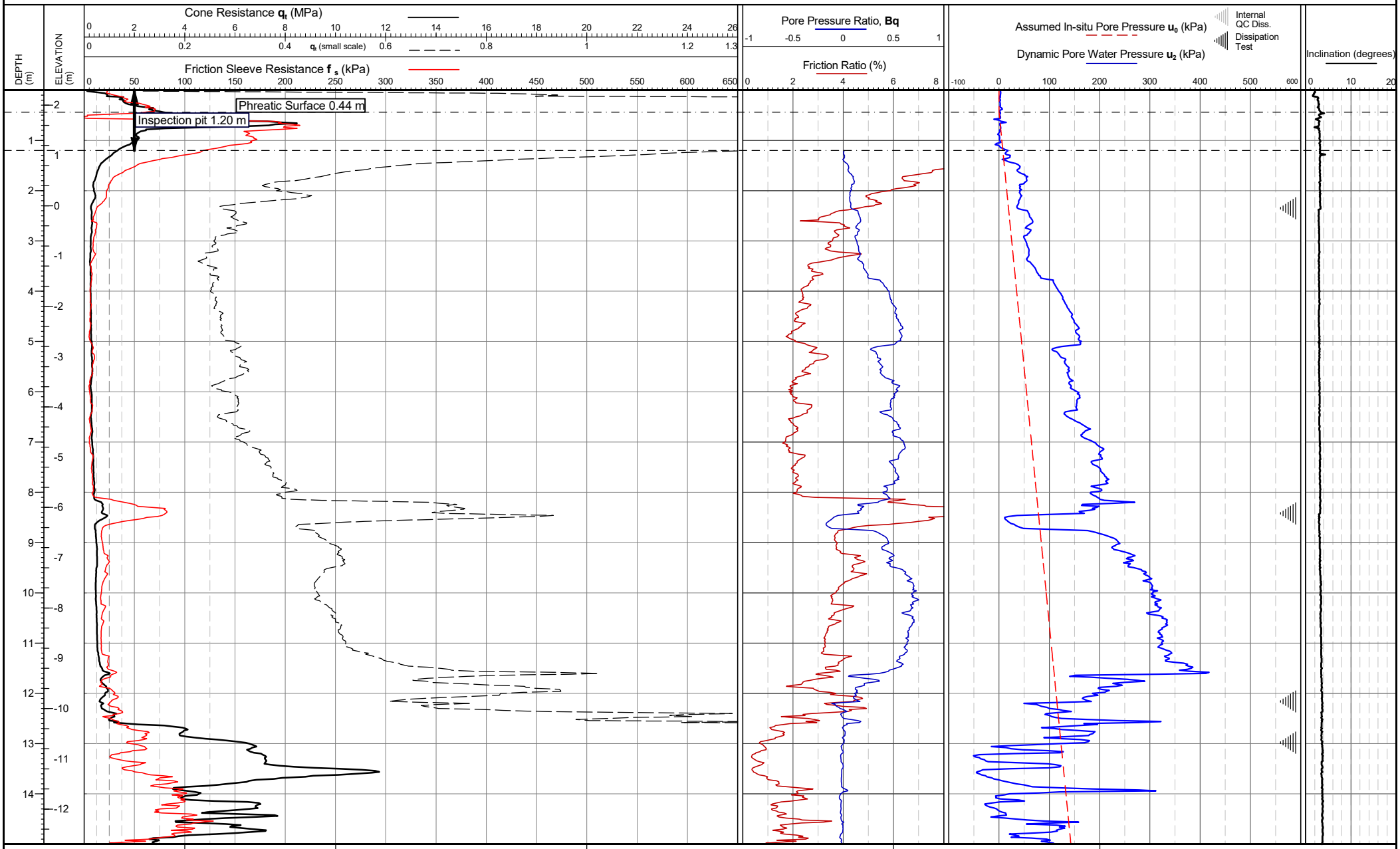


Cone area (mm2): Cone ID: S15-CFIPTTM250.2116 Operator: Tom Freeland Rig Used: UK3 Date of test: 14/05/2025 10:26:20	Zero drift (Pre/post test) q_c (kPa): 36.8 f_s (kPa): -1.7 u_2 (kPa): 1.0	Location: Essex, UK Coordinates: 567408.732, 174141.855 Elevation: 2.256 Coordinate system:	Remarks: *Phreatic surface origin: Average measured piezometric elevation from other location(s) Termination Remark: Lateral support at depth	Date of plot: 21-07-25 Checked by: Chris Player	Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT104

Project: TILBURY

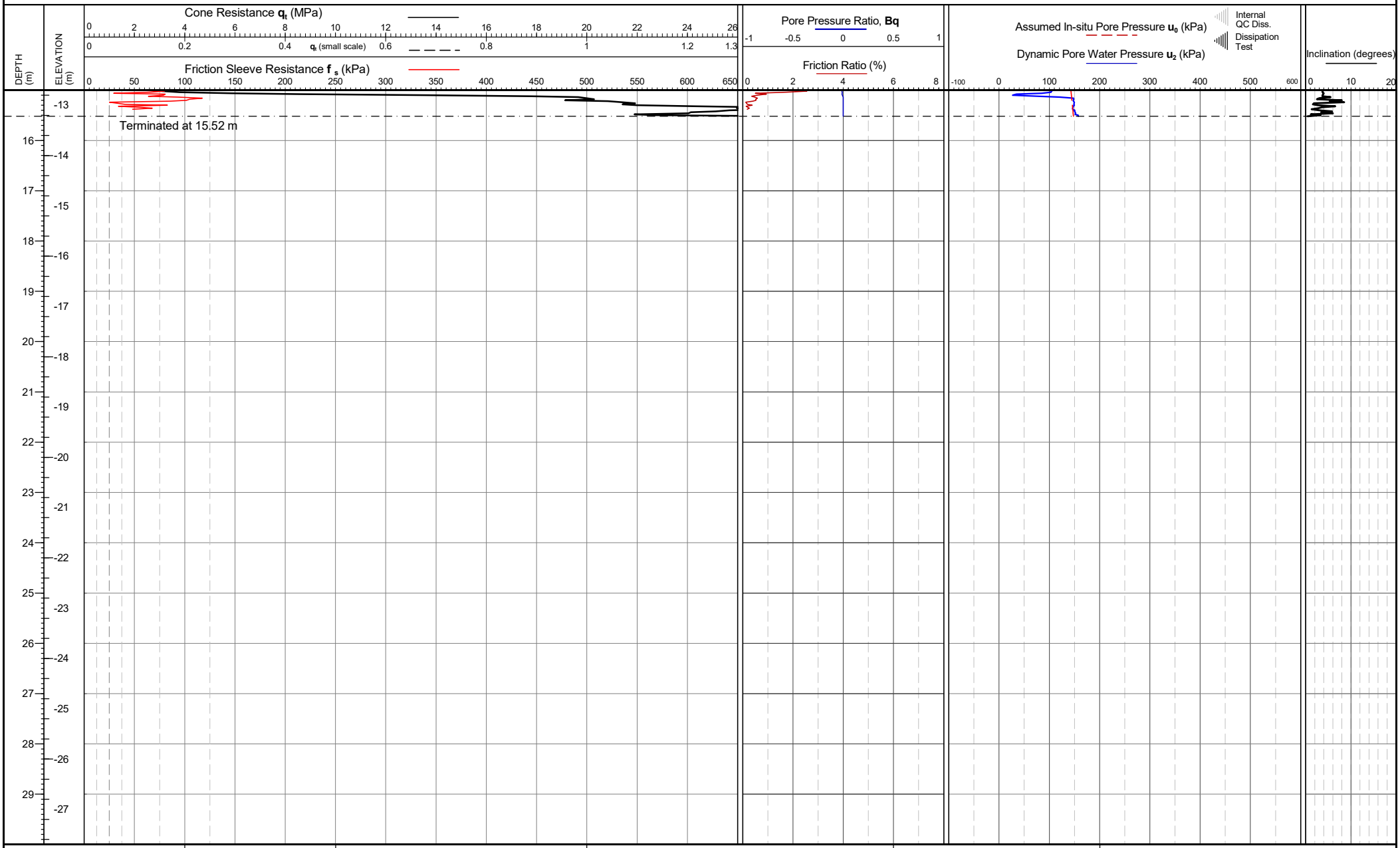
Client: SOIL ENGINEERING



Cone area (mm2): Cone ID: S15-CFIPTTM250.2116 Operator: Tom Freeland Rig Used: UK3 Date of test: 15/05/2025 10:07:33	Zero drift (Pre/post test) q_c (kPa): -0.8 f_s (kPa): 0.9 u_2 (kPa): -0.6	Location: Essex, UK Coordinates: 567426.41, 174081.075 Elevation: 2.301 Coordinate system:	Remarks: *Phreatic surface origin: Average measured piezometric depth at this location, approx. +- 0.4 mbgl Termination Remark: Lateral support at depth	Date of plot: 21-07-25 Checked by: Chris Player	Lankelma Project Ref: 25-32-29428-1	**TEST ID: CPT105** Page 1 of 2

Project: TILBURY

Client: SOIL ENGINEERING

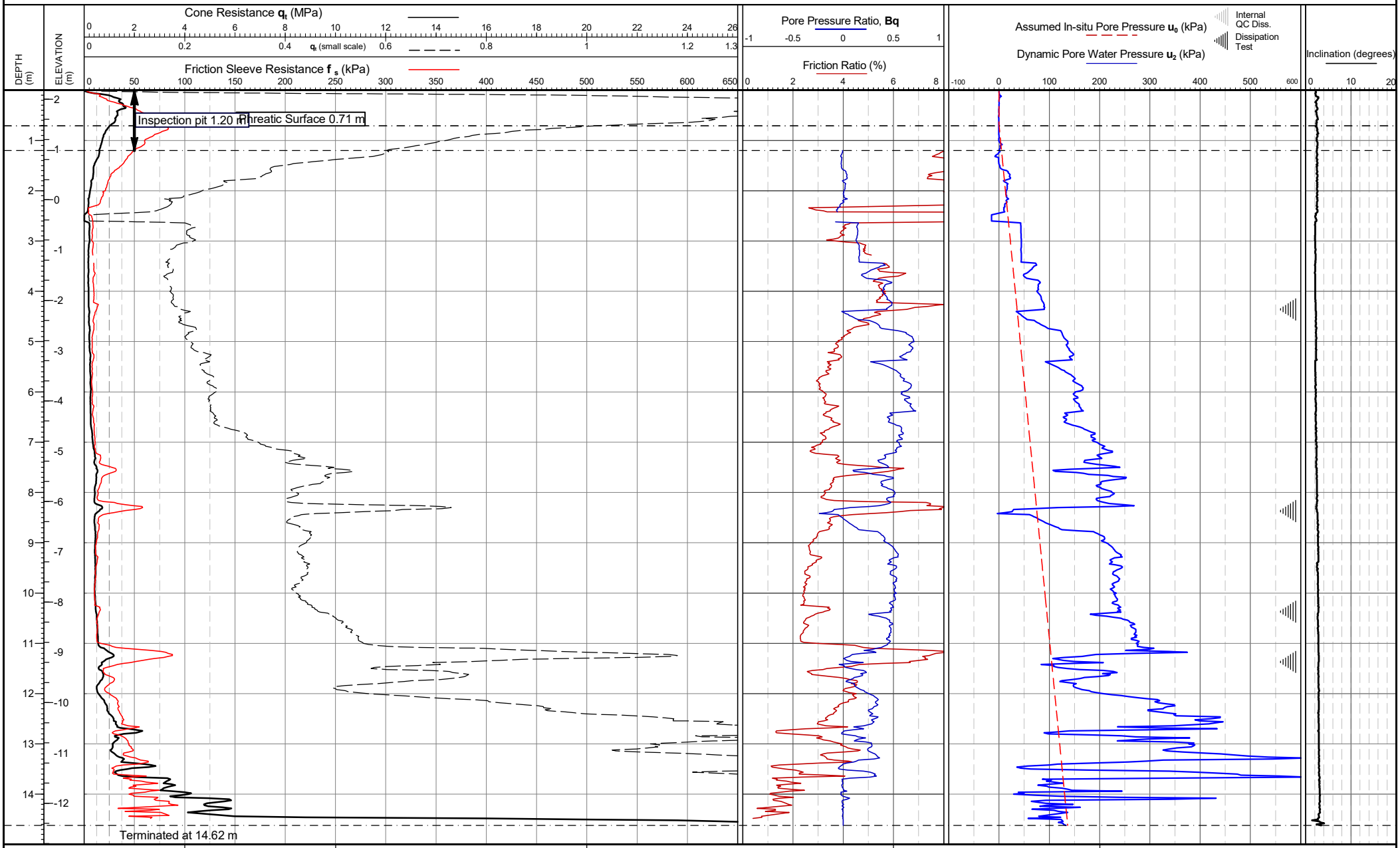


Cone area (mm2): Cone ID: S15-CFIPTTM250.2116 Operator: Tom Freeland Rig Used: UK3 Date of test: 15/05/2025 10:07:33	Zero drift (Pre/post test) q_c (kPa): -0.8 f_s (kPa): 0.9 u_2 (kPa): -0.6	Location: Essex, UK Coordinates: 567426.41, 174081.075 Elevation: 2.301 Coordinate system:	Remarks: *Phreatic surface origin: Average measured piezometric depth at this location, approx. +- 0.4 mbgl Termination Remark: Lateral support at depth	Date of plot: 21-07-25 Checked by: Chris Player	Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT105

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2): Cone ID: S15-CFIPTTM250.2116 Operator: Tom Freeland Rig Used: UK3 Date of test: 13/05/2025 09:45:35	Zero drift (Pre/post test) q_c (kPa): 25.6 f_s (kPa): -2.7 u_2 (kPa): 0.0	Location: Essex, UK Coordinates: 567428.311, 174166.814 Elevation: 2.179 Coordinate system:	Remarks: *Phreatic surface origin: Average measured piezometric elevation from other location(s) Termination Remark: Lateral support at depth	Date of plot: 21-07-25 Checked by: Chris Player	Lankelma Project Ref: 25-32-29428-1	**TEST ID: CPT106** Page 1 of 1

APPENDIX D SOIL BEHAVIOUR TYPE RESULTS

Soil behaviour type (SBT) point data evaluation according to:

Schneider et al (2008)

Robertson (2016)

Robertson (2010) with aggregate layer descriptions

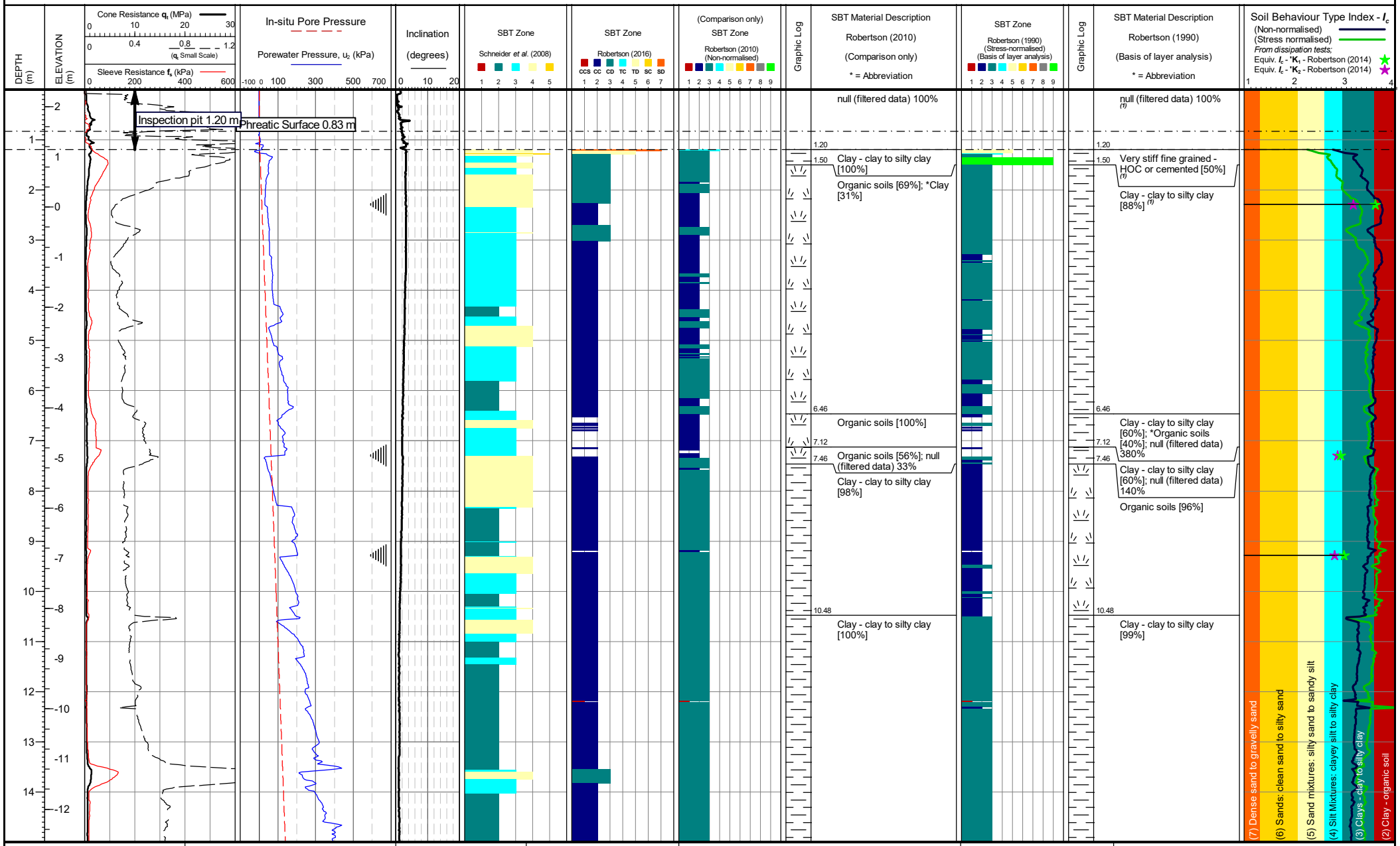
Robertson (1990) with aggregate layer descriptions

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING

Lankelma Project Ref: 25-32-29428-1



Cone area (mm2):
ConeID: S15-CFIPTTM250.2116
Location: Essex, UK
Rig Used: UK3
Date of test: 07/05/2025 08:47:52

Remarks: *Phreatic surface origin: Piezocone response in drained soils

Coordinates: 566299.724, 175912.182
Elevation: 2.341

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I_c clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
3 - Clays - clay to silty clay
4 - Silt mixtures - clayey silt to silty clay
5 - Sand mixtures - silty sand to sandy silt
6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

Internal QA Diss.
Dissipation Test

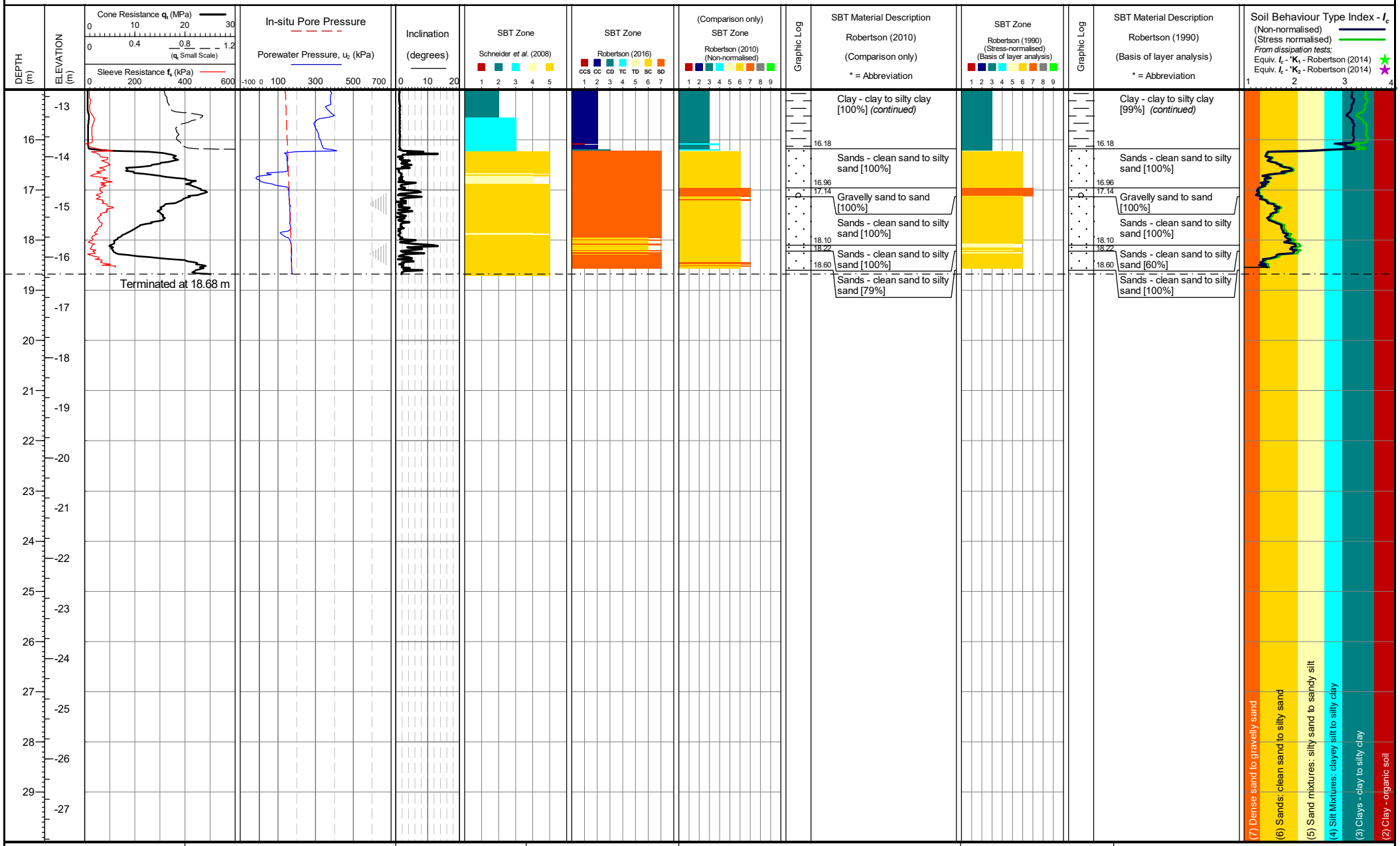
TEST ID: CPT101

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING

Lankelma Project Ref: 25-32-29428-1



Cone area (mm2):
ConeID: S15-CFIPTTM250.2116
Location: Essex, UK
Rig Used: UK3
Date of test: 07/05/2025 08:47:52

Remarks: *Phreatic surface origin: Piezocone response in drained soils

Coordinates: 566299.724, 175912.182
Elevation: 2.341

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I_c clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
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6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

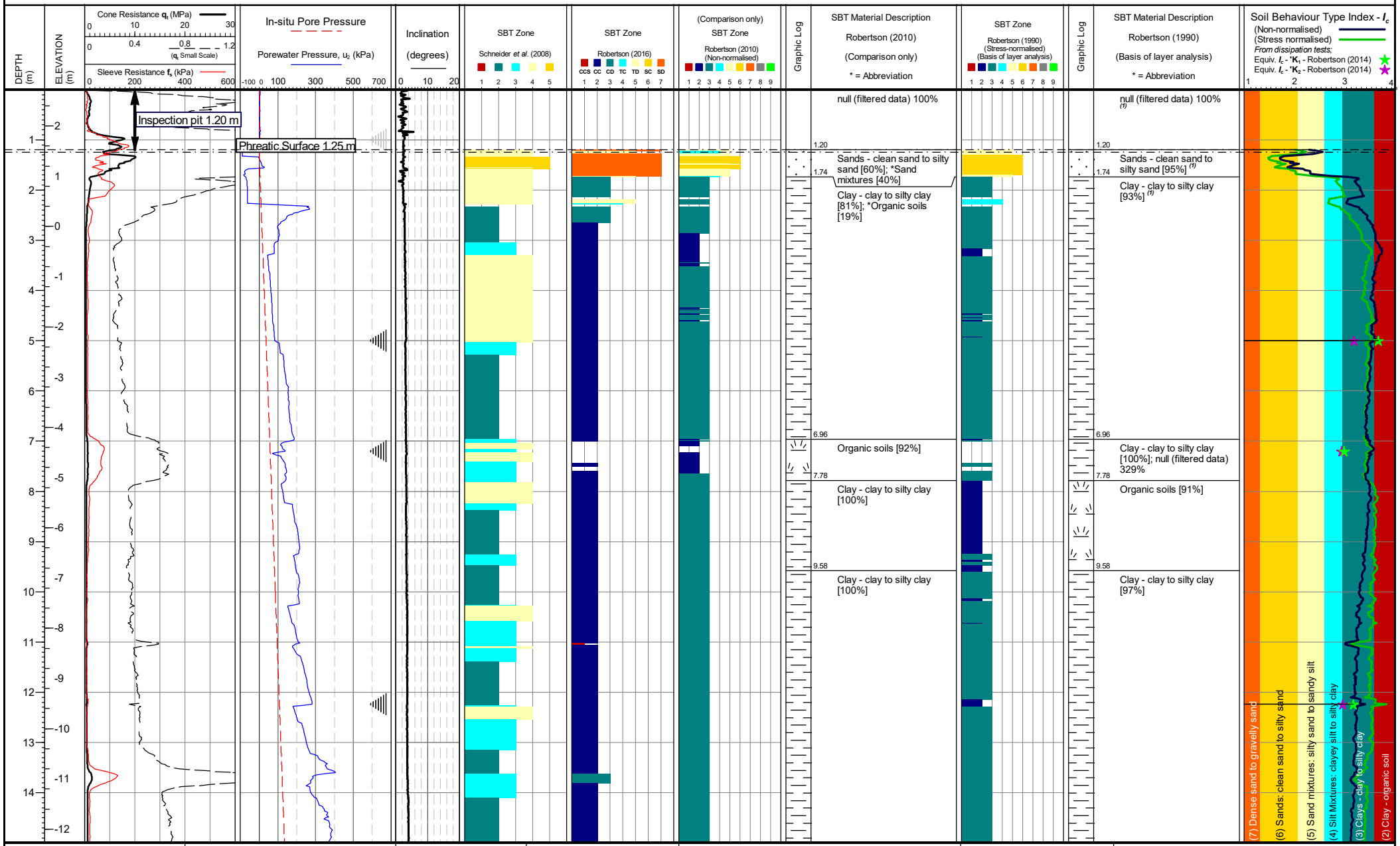
Internal QA Diss.
Dissipation Test

TEST ID: CPT101

Project: TILBURY

Client: SOIL ENGINEERING

Lankelma Project Ref: 25-32-29428-1



Cone area (mm2):
ConeID: S15-CFIPTTM250.2116
Location: Essex, UK
Rig Used: UK3
Date of test: 08/05/2025 10:29:14

Remarks: *Phreatic surface origin: Average measured piezometric elevation from other location(s)

Coordinates: 566334.083, 175912.213
Elevation: 2.724

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I_c clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
3 - Clays - clay to silty clay
4 - Silt mixtures - clayey silt to silty clay
5 - Sand mixtures - silty sand to sandy silt
6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

Internal QA Diss.
Dissipation Test

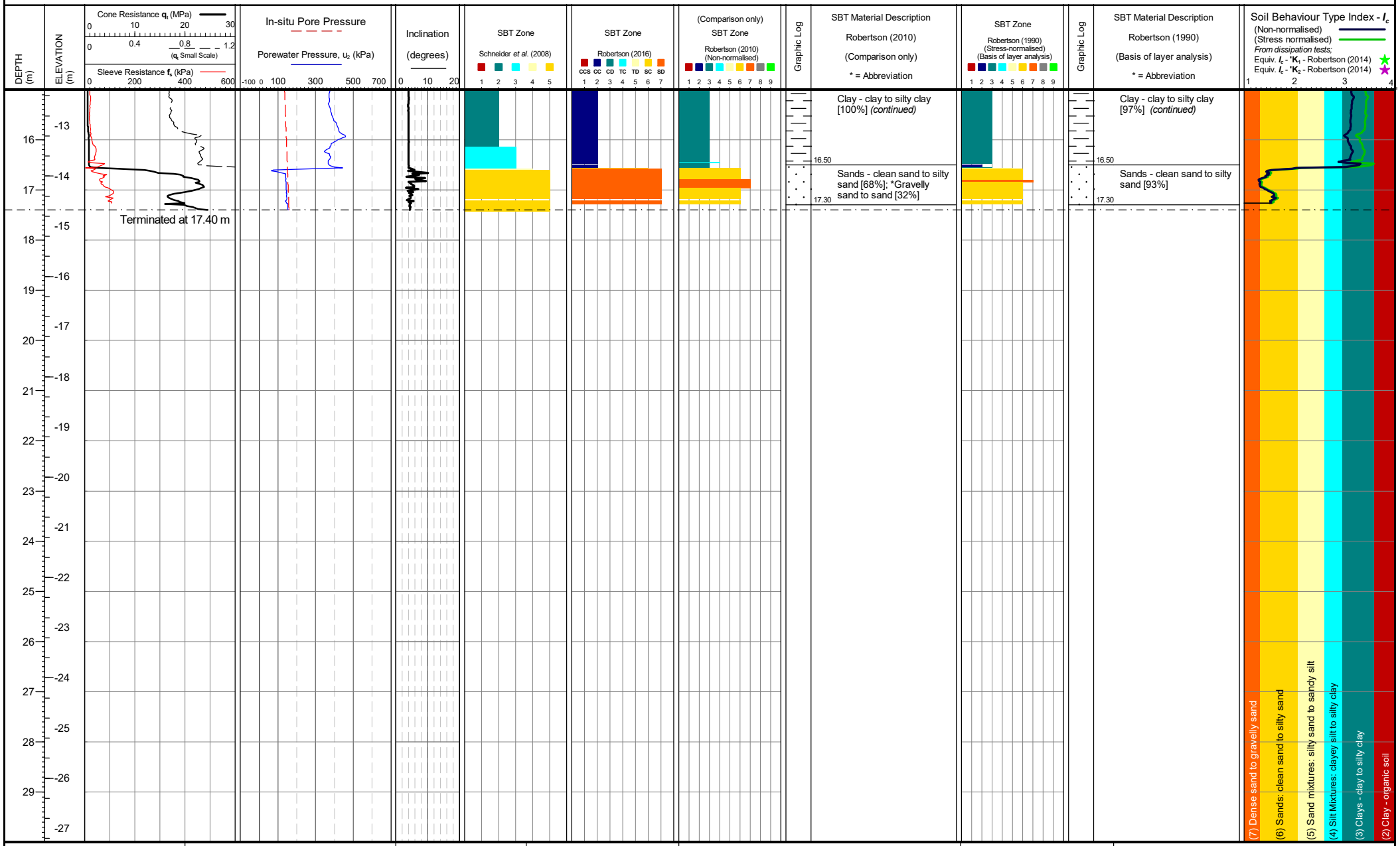
TEST ID: CPT102

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING

Lankelma Project Ref: 25-32-29428-1



Cone area (mm2):
ConeID: S15-CFIPTTM250.2116
Location: Essex, UK
Rig Used: UK3
Date of test: 08/05/2025 10:29:14

Remarks: *Phreatic surface origin: Average measured piezometric elevation from other location(s)

Coordinates: 566334.083, 175912.213
Elevation: 2.724

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I_c clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
3 - Clays - clay to silty clay
4 - Silt mixtures - clayey silt to silty clay
5 - Sand mixtures - silty sand to sandy silt
6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

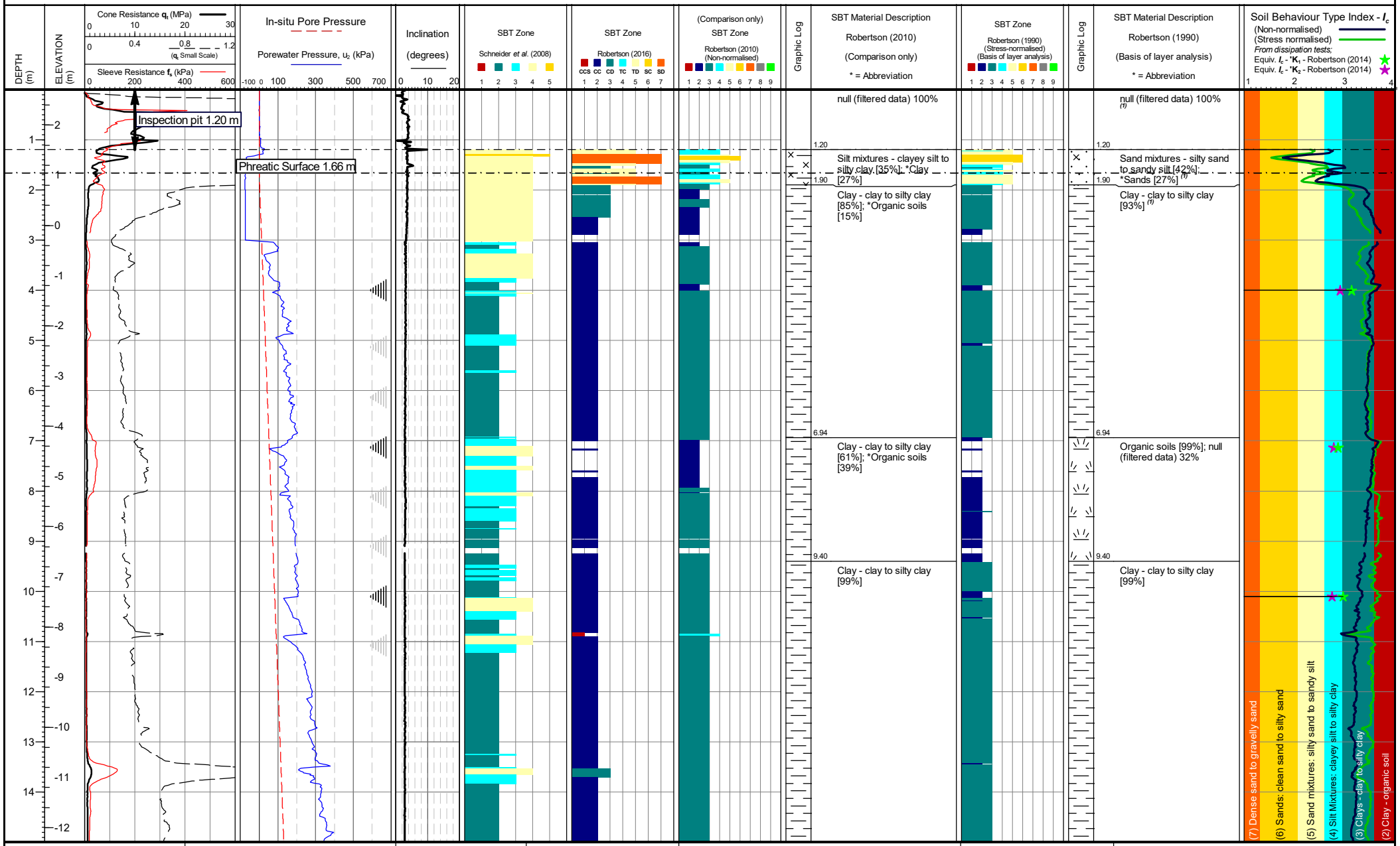
Internal QA Diss.
Dissipation Test

TEST ID: CPT102

Project: TILBURY

Client: SOIL ENGINEERING

Lankelma Project Ref: 25-32-29428-1



Cone area (mm2):
ConeID: S15-CFIPTTM250.2116
Location: Essex, UK
Rig Used: UK3
Date of test: 06/05/2025 10:00:36

Remarks: *Phreatic surface origin: Average measured piezometric depth at this location, approx. +- 0.4 mbgl

Coordinates: 566316.646, 175907.221
Elevation: 2.709

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I_c clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
3 - Clays - clay to silty clay
4 - Silt mixtures - clayey silt to silty clay
5 - Sand mixtures - silty sand to sandy silt
6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

Internal QA Diss.
Dissipation Test

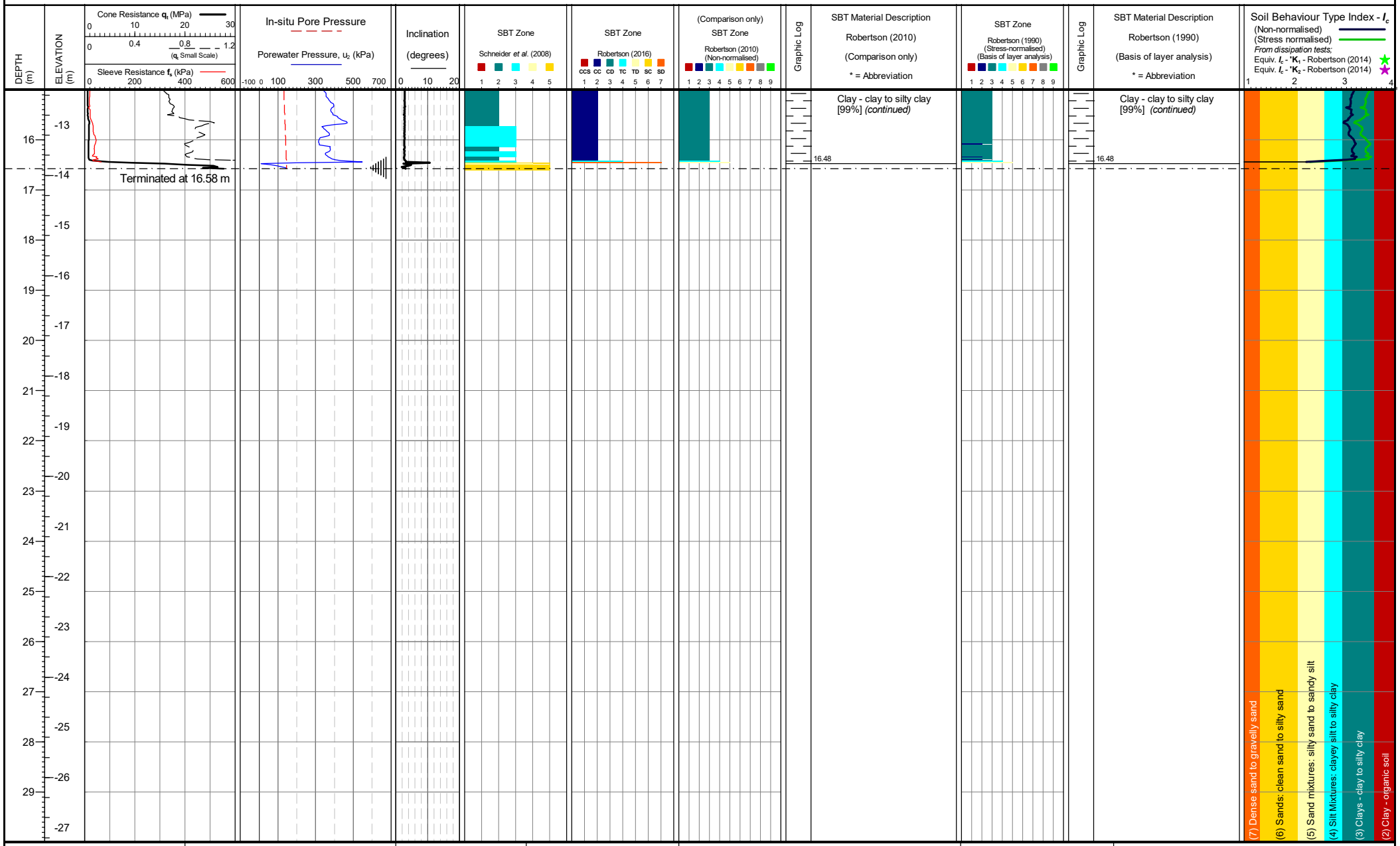
TEST ID: CPT103

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING

Lankelma Project Ref: 25-32-29428-1



Cone area (mm2):
ConeID: S15-CFIPTTM250.2116
Location: Essex, UK
Rig Used: UK3
Date of test: 06/05/2025 10:00:36

Remarks: *Phreatic surface origin: Average measured piezometric depth at this location, approx. +- 0.4 mbgl

Coordinates: 566316.646, 175907.221
Elevation: 2.709

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I_c clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
3 - Clays - clay to silty clay
4 - Silt mixtures - clayey silt to silty clay
5 - Sand mixtures - silty sand to sandy silt
6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

Internal QA Diss. Dissipation Test

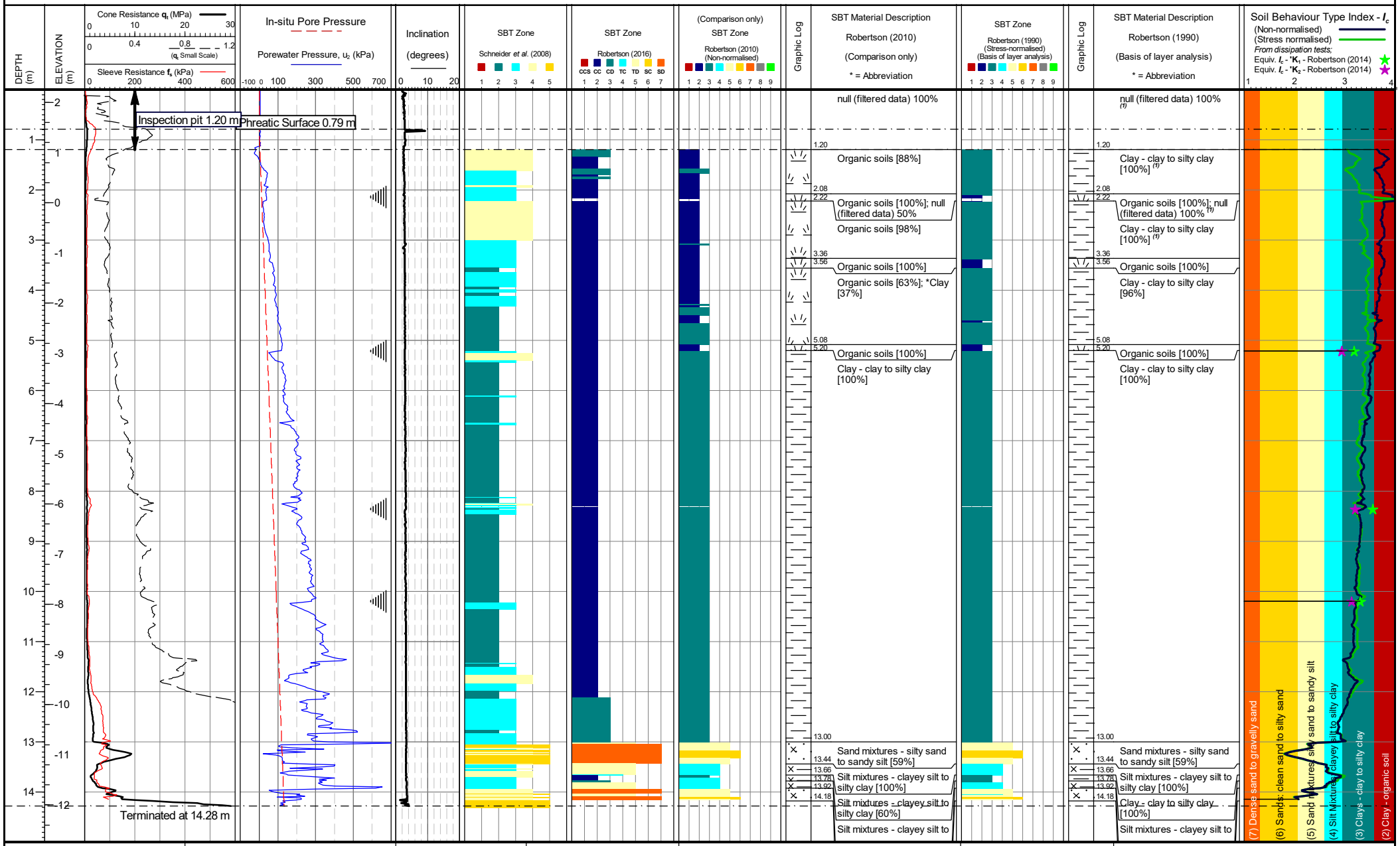
TEST ID: CPT103

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING

Lankelma Project Ref: 25-32-29428-1



Cone area (mm2):
ConeID: S15-CFIPTTM250.2116
Location: Essex, UK
Rig Used: UK3
Date of test: 14/05/2025 10:26:20

Remarks: *Phreatic surface origin: Average measured piezometric elevation from other location(s)

Coordinates: 567408.732, 174141.855
Elevation: 2.256

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I_c clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
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7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

Internal QA Diss.
Dissipation Test

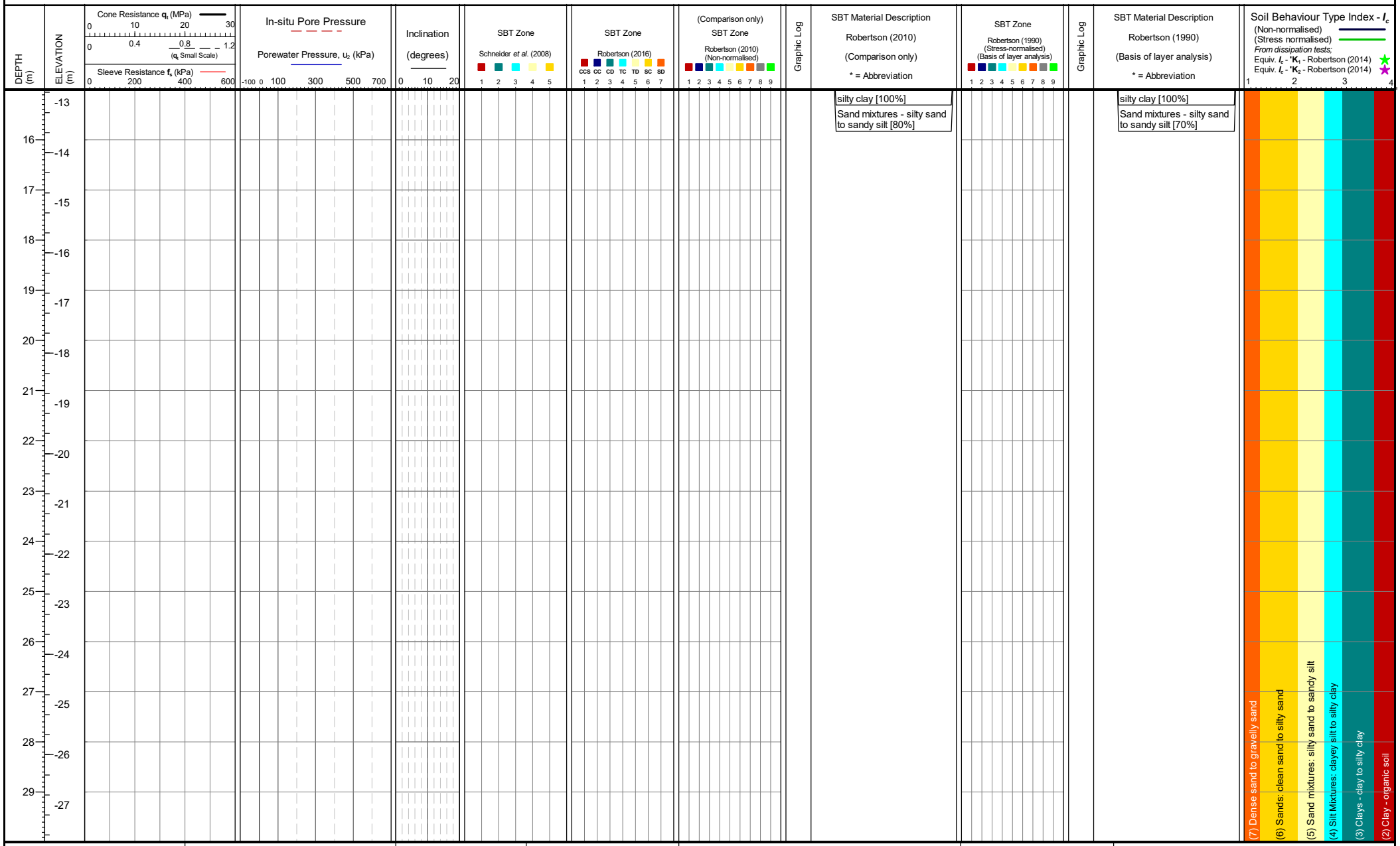
TEST ID: CPT104

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING

Lankelma Project Ref: 25-32-29428-1



Cone area (mm2):
ConeID: S15-CFIPTTM250.2116
Location: Essex, UK
Rig Used: UK3
Date of test: 14/05/2025 10:26:20

Remarks: *Phreatic surface origin: Average measured piezometric elevation from other location(s)

Coordinates: 567408.732, 174141.855
Elevation: 2.256

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I_c clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
3 - Clays - clay to silty clay
4 - Silt mixtures - clayey silt to silty clay
5 - Sand mixtures - silty sand to sandy silt
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8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

[1] 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

Internal QA Diss.
Dissipation Test

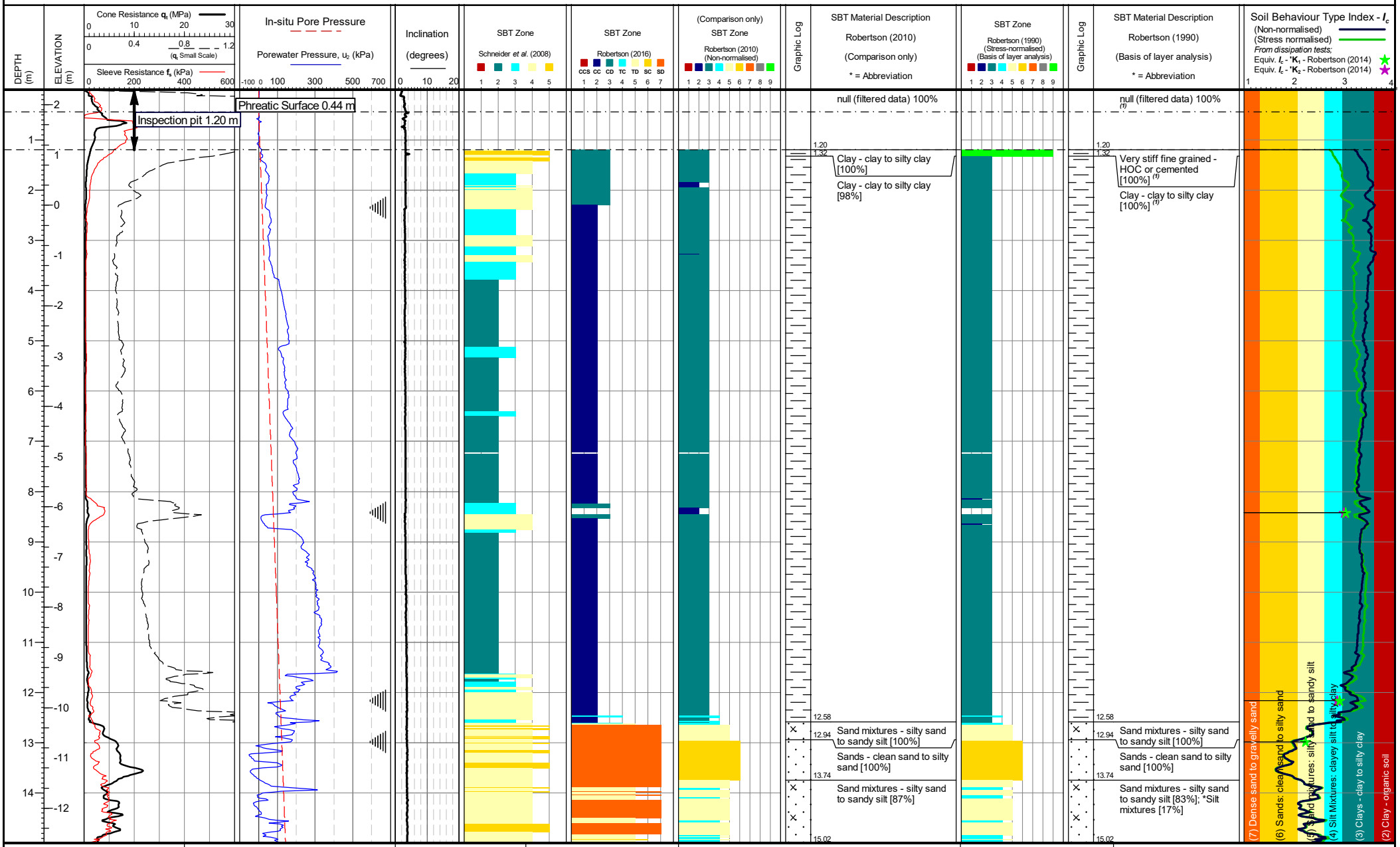
TEST ID: CPT104

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING

Lankelma Project Ref: 25-32-29428-1



Cone area (mm2):
ConeID: S15-CFIPTTM250.2116
Location: Essex, UK
Rig Used: UK3
Date of test: 15/05/2025 10:07:33

Remarks: *Phreatic surface origin: Average measured piezometric depth at this location, approx. +- 0.4 mbgl

Coordinates: 567426.41, 174081.075
Elevation: 2.301

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I_c clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
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5 - Sand mixtures - silty sand to sandy silt
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7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

Internal QA Diss.
Dissipation Test

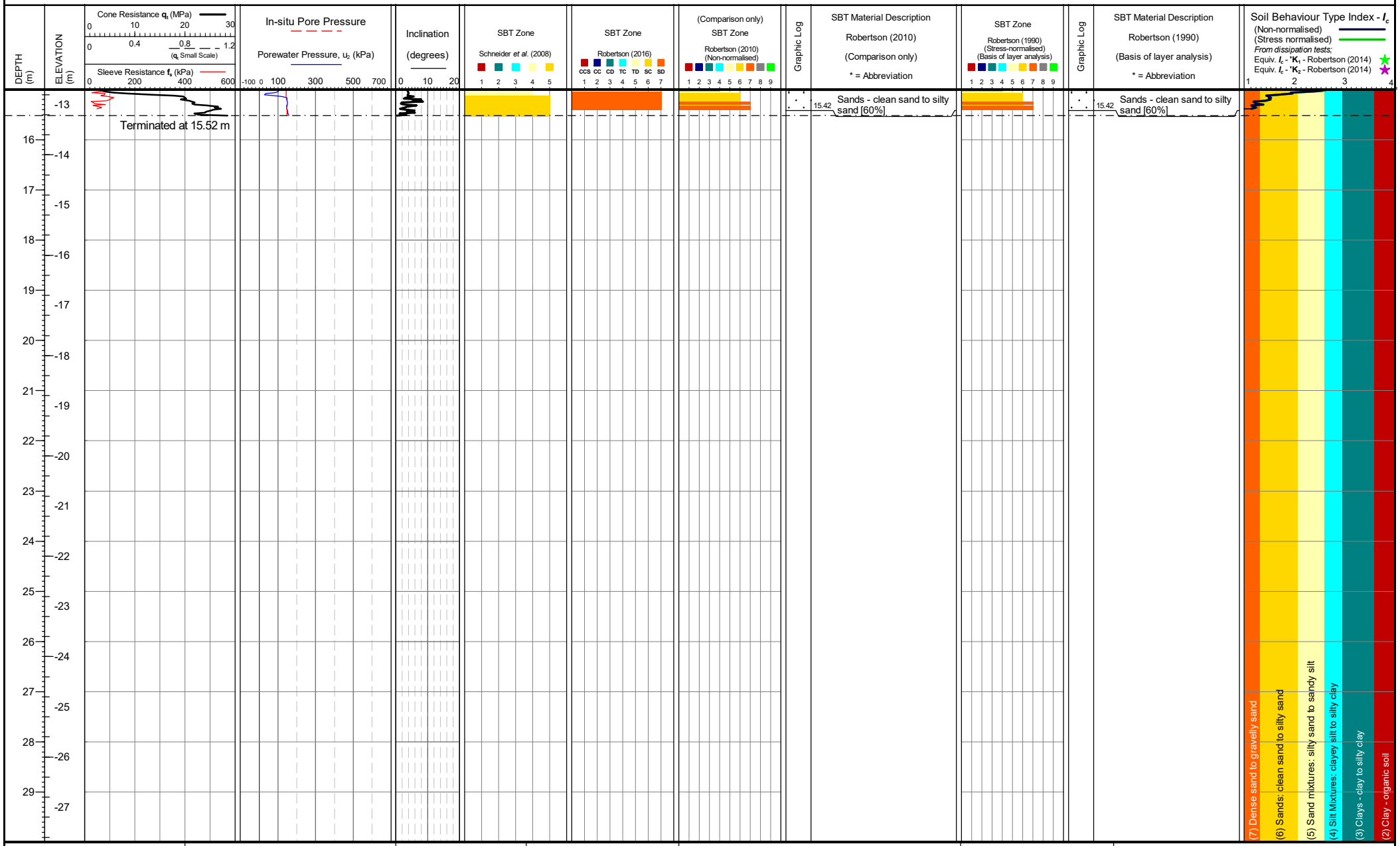
TEST ID: CPT105

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING

Lankelma Project Ref: 25-32-29428-1



Cone area (mm2):
ConeID: S15-CFIPTTM250.2116
Location: Essex, UK
Rig Used: UK3
Date of test: 15/05/2025 10:07:33

Remarks: *Phreatic surface origin: Average measured piezometric depth at this location, approx. +- 0.4 mbgl

Coordinates: 567426.41, 174081.075
Elevation: 2.301

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I_c clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
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5 - Sand mixtures - silty sand to sandy silt
6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

Internal QA Diss.
Dissipation Test

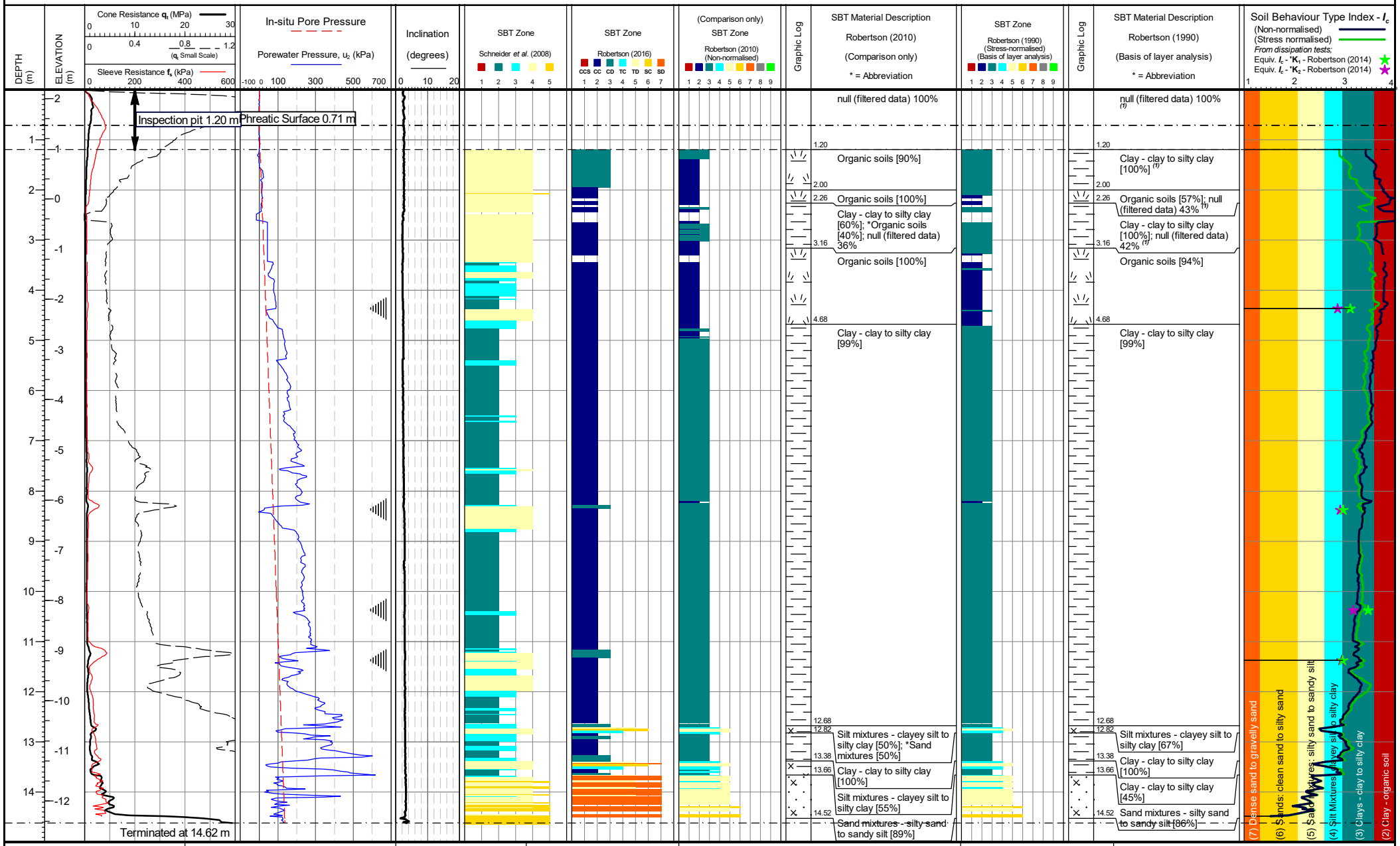
TEST ID: CPT105

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING

Lankelma Project Ref: 25-32-29428-1



Cone area (mm2):
ConeID: S15-CFIPTTM250.2116
Location: Essex, UK
Rig Used: UK3
Date of test: 13/05/2025 09:45:35

Remarks: *Phreatic surface origin: Average measured piezometric elevation from other location(s)

Coordinates: 567428.311, 174166.814
Elevation: 2.179

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I_c clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
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7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

Internal QA Diss.
Dissipation Test

TEST ID: CPT106

APPENDIX E PARAMETER RESULTS 1 – S_U, M_V, OCR, SBT, I_C

Undrained shear strength

Coefficient of volume change

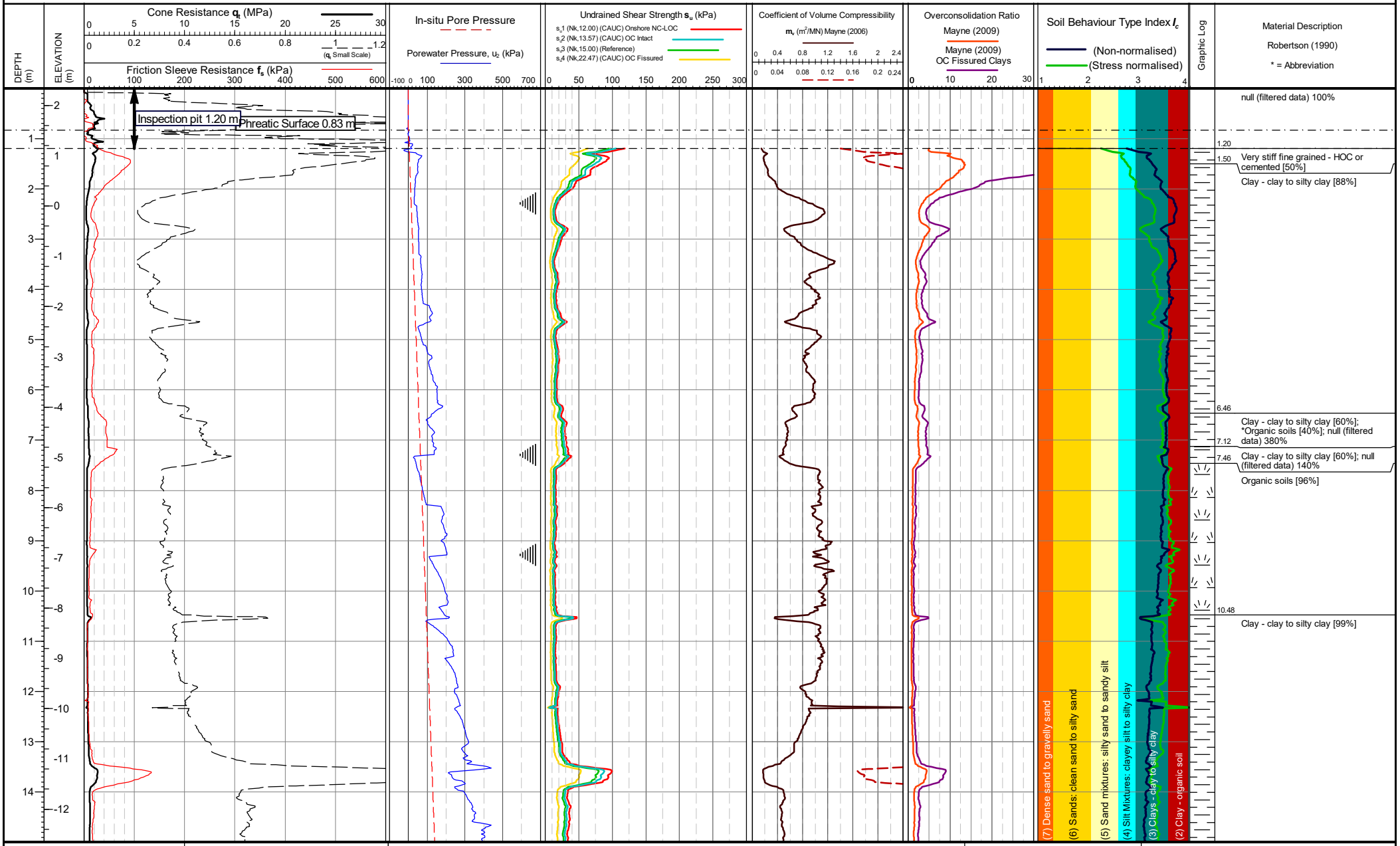
Overconsolidation ratio

Robertson 1990 SBT descriptions & SBT index I_c

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING



Material Description
Robertson (1990)
* = Abbreviation

null (filtered data) 100%

1.20

1.50 Very stiff fine grained - HOC or cemented [50%]

Clay - clay to silty clay [88%]

6.46

Clay - clay to silty clay [60%]; *Organic soils [40%]; null (filtered data) 380%

7.12

7.46 Clay - clay to silty clay [60%]; null (filtered data) 140%

Organic soils [96%]

10.48

Clay - clay to silty clay [99%]

Cone area (mm2):
ConeID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Rig Used: UK3
Date of test: 07/05/2025 08:47:52

Location: Essex, UK
Coordinates: 566299.724, 175912.182
Elevation: 2.341
Coordinate system:

Remarks: *Phreatic surface origin: Piezocone response in drained soils

Termination Remark:
Tip/sleeve load + inclination

Internal QA Diss.
Dissipation Test
Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 18-07-25

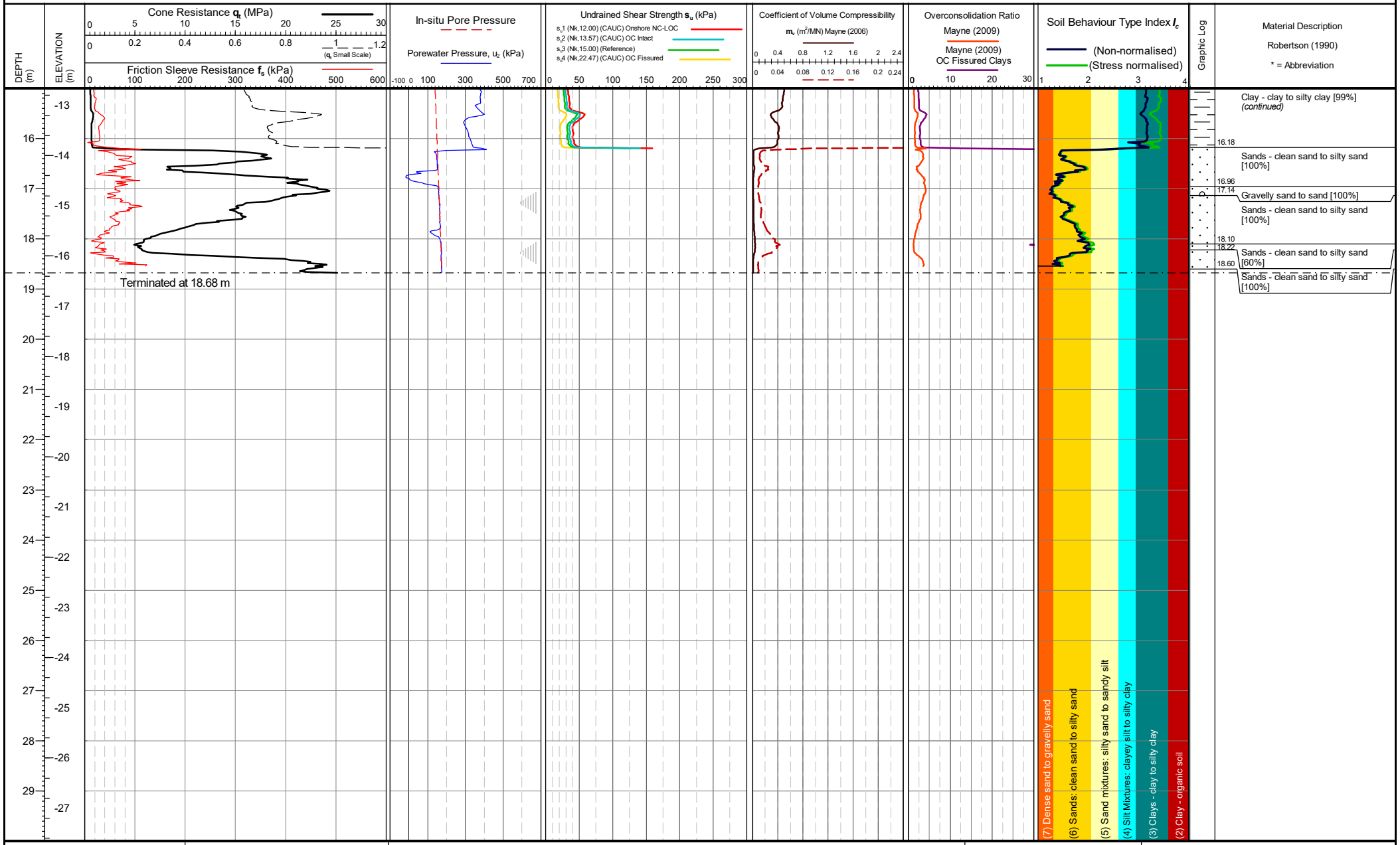
Checked by: Chris Player

Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT101

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
ConeID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Rig Used: UK3
Date of test: 07/05/2025 08:47:52

Location: Essex, UK
Coordinates: 566299.724, 175912.182
Elevation: 2.341
Coordinate system:

Remarks: *Phreatic surface origin: Piezocone response in drained soils

Termination Remark:
Tip/sleeve load + inclination

Internal QA Diss.
Dissipation Test
Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 18-07-25

Checked by: Chris Player

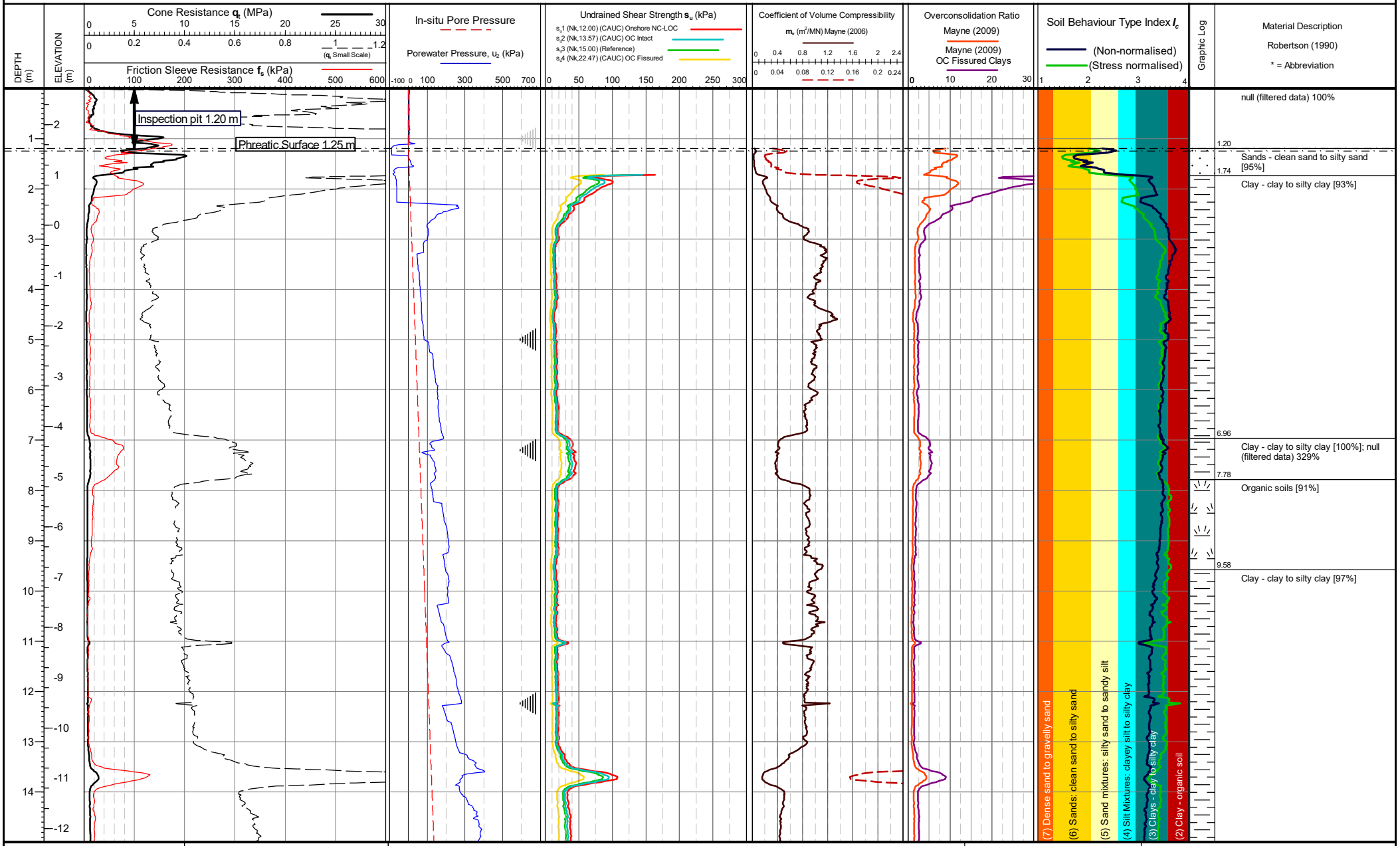
Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT101

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
ConeID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Rig Used: UK3
Date of test: 08/05/2025 10:29:14

Location: Essex, UK
Coordinates: 566334.083, 175912.213
Elevation: 2.724
Coordinate system:

Remarks: *Phreatic surface origin: Average measured piezometric elevation from other location(s)

Termination Remark:
Lateral support at depth

Internal QA Diss.
Dissipation Test
Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 18-07-25

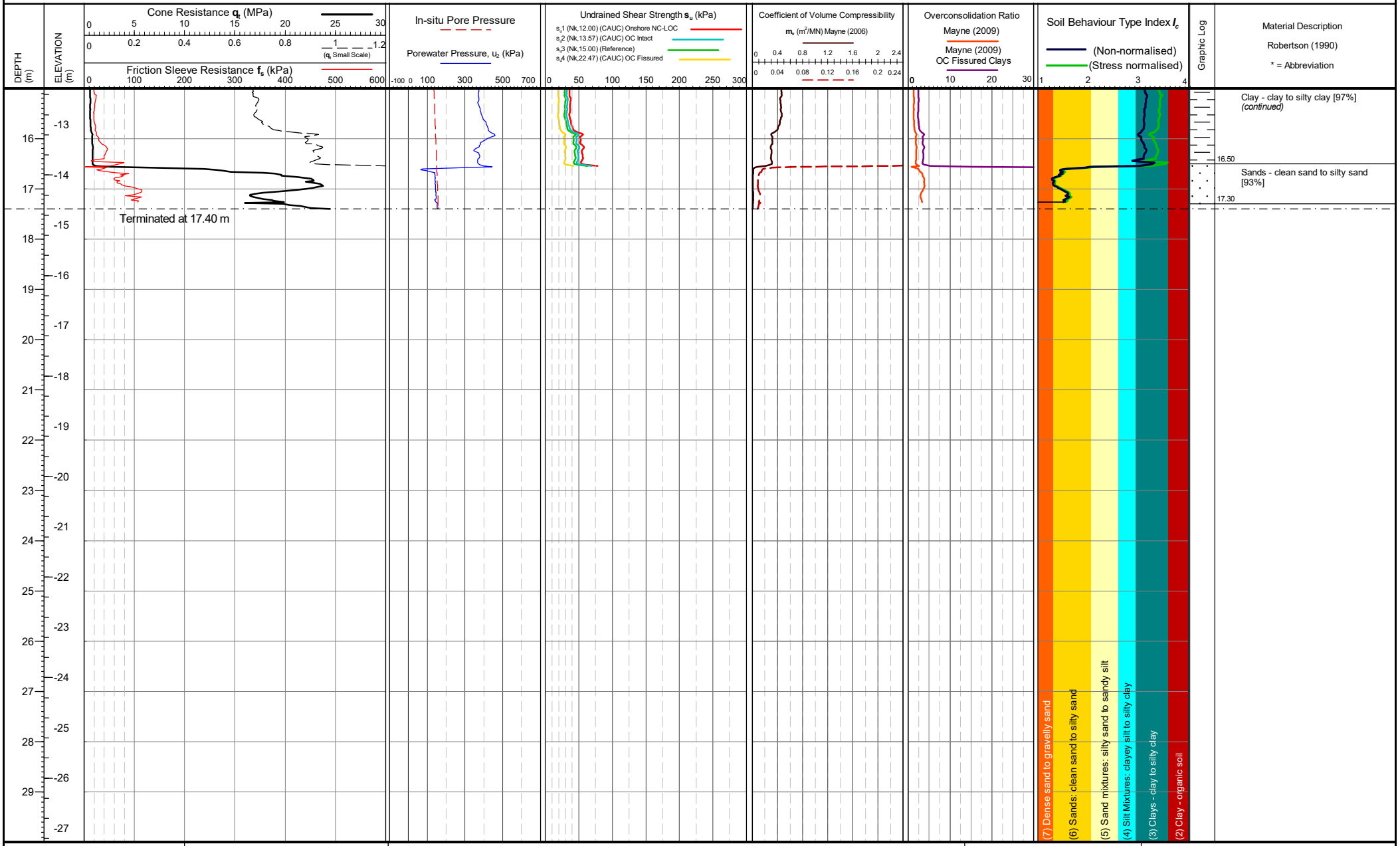
Checked by: Chris Player

Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT102

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
ConeID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Rig Used: UK3
Date of test: 08/05/2025 10:29:14

Location: Essex, UK
Coordinates: 566334.083, 175912.213
Elevation: 2.724
Coordinate system:

Remarks: *Phreatic surface origin: Average measured piezometric elevation from other location(s)

Termination Remark:
Lateral support at depth

Internal QA Diss.
Dissipation Test
Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 18-07-25

Checked by: Chris Player

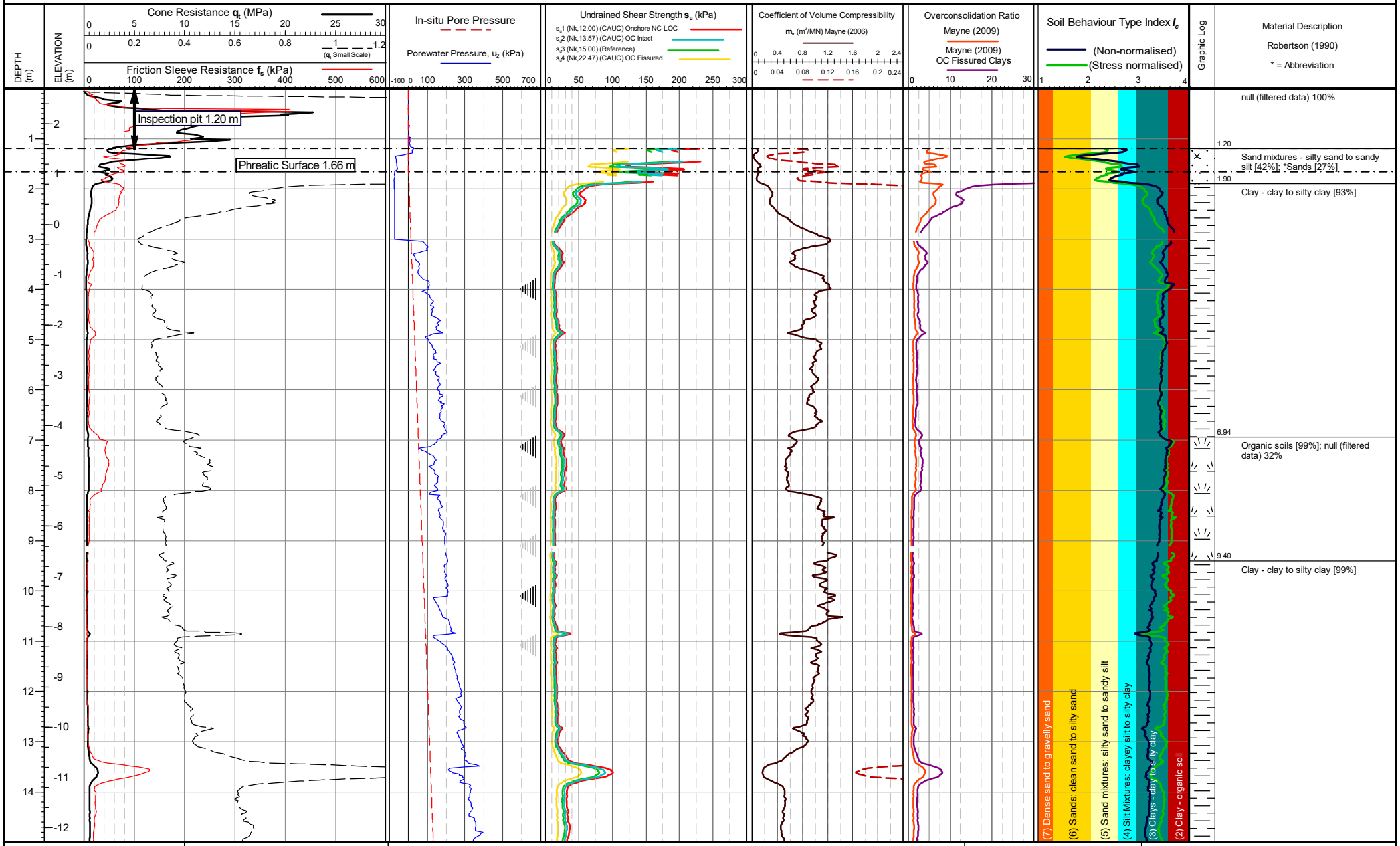
Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT102

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
ConeID: S15-CFIPTTM250.2116
Operator: Riley Trevelyan
Rig Used: UK3
Date of test: 06/05/2025 10:00:36

Location: Essex, UK
Coordinates: 566316.646, 175907.221
Elevation: 2.709
Coordinate system:

Remarks: *Phreatic surface origin: Average measured piezometric depth at this location, approx. +- 0.4 mbgl

Termination Remark:
Lateral support at depth

Internal QA Diss.
Dissipation Test
Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 18-07-25

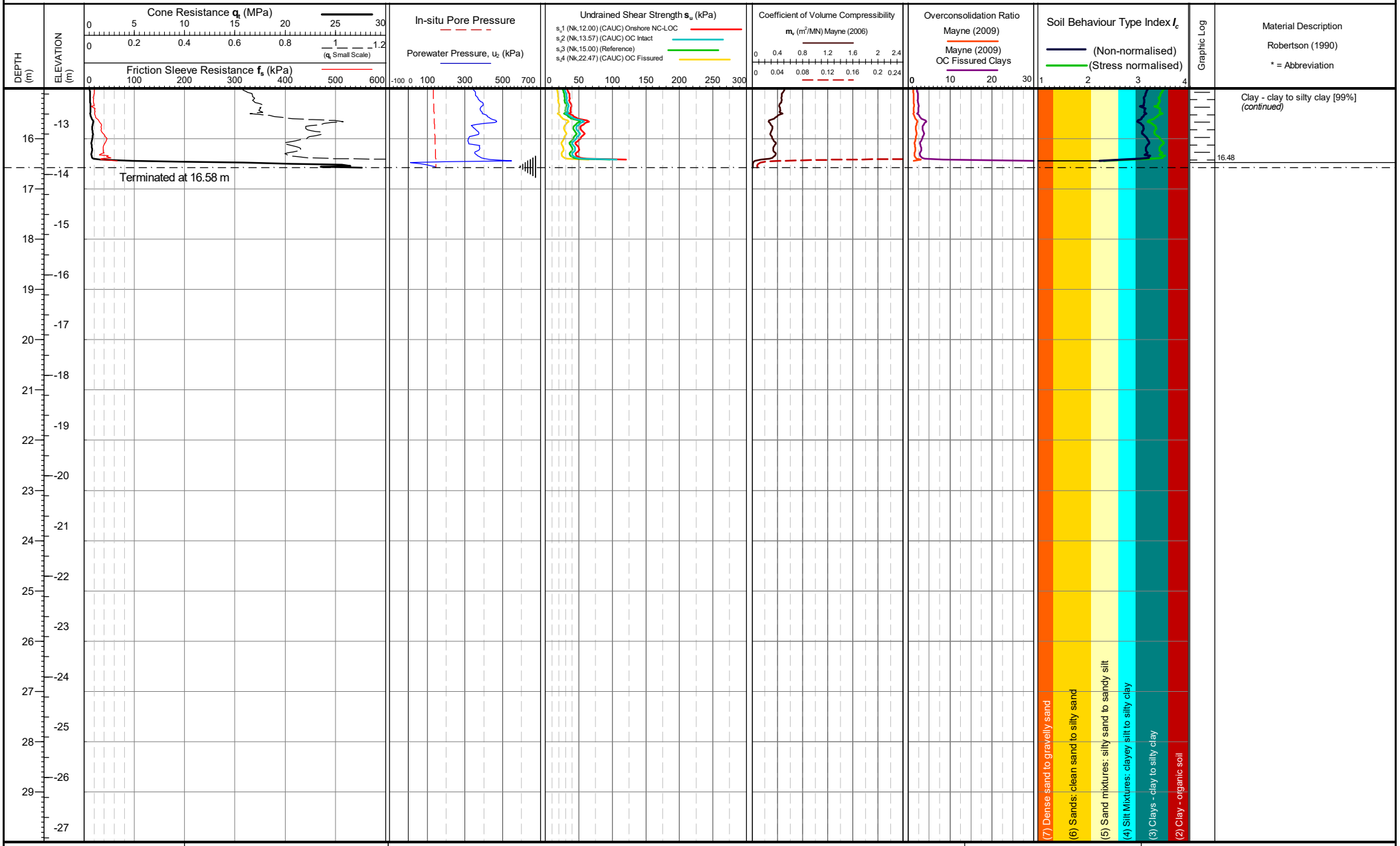
Checked by: Chris Player

Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT103

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
ConeID: S15-CFIPTTM250.2116
Operator: Riley Trevelyan
Rig Used: UK3
Date of test: 06/05/2025 10:00:36

Location: Essex, UK
Coordinates: 566316.646, 175907.221
Elevation: 2.709
Coordinate system:

Remarks: *Phreatic surface origin: Average measured piezometric depth at this location, approx. +- 0.4 mbgl

Termination Remark:
Lateral support at depth

Internal QA Diss.
Dissipation Test
Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 18-07-25

Checked by: Chris Player

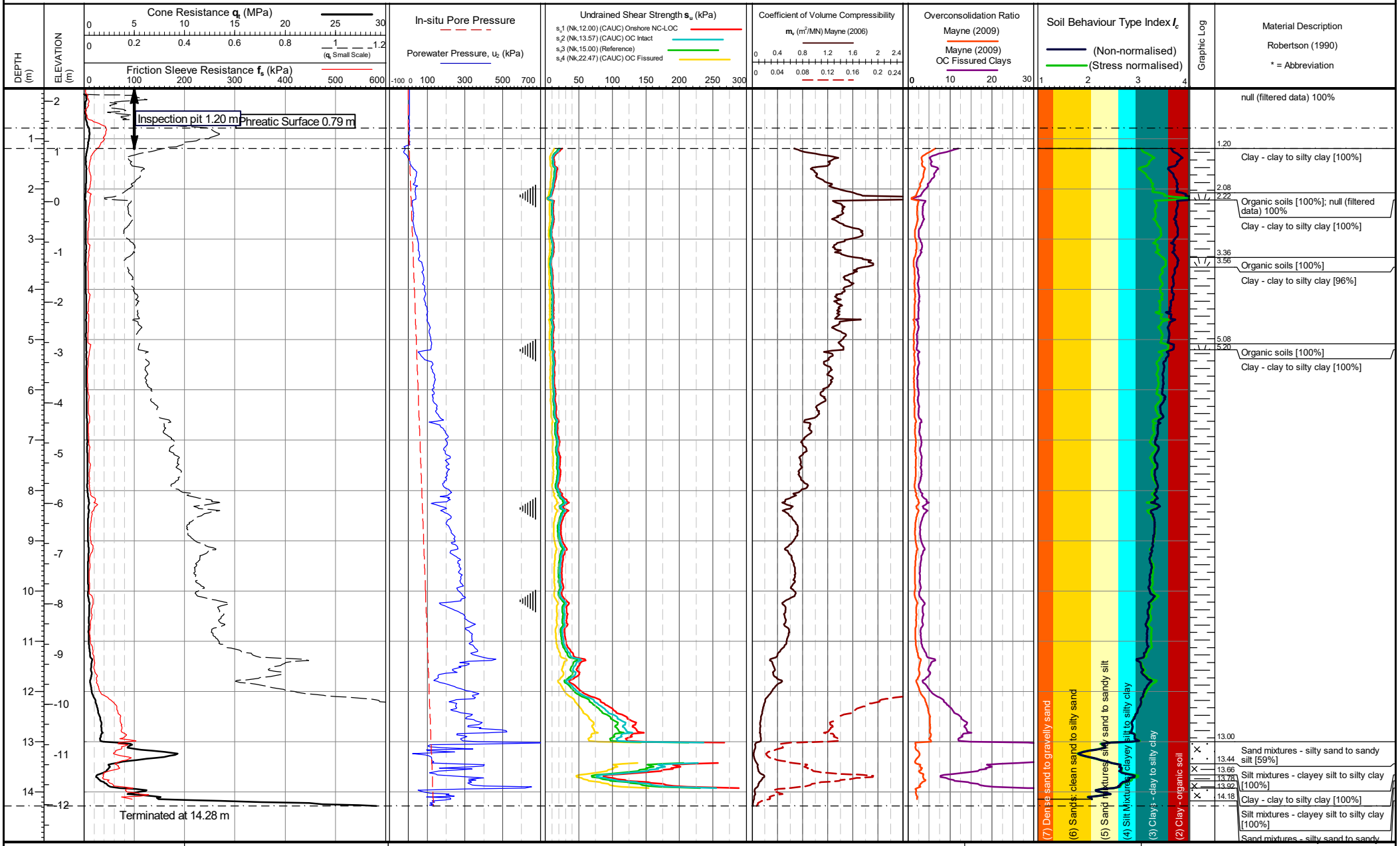
Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT103

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
ConeID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Rig Used: UK3
Date of test: 14/05/2025 10:26:20

Location: Essex, UK
Coordinates: 567408.732, 174141.855
Elevation: 2.256
Coordinate system:

Remarks: *Phreatic surface origin: Average measured piezometric elevation from other location(s)

Termination Remark:
Lateral support at depth

Internal QA Diss.
Dissipation Test
Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 18-07-25

Lankelma Project Ref: 25-32-29428-1

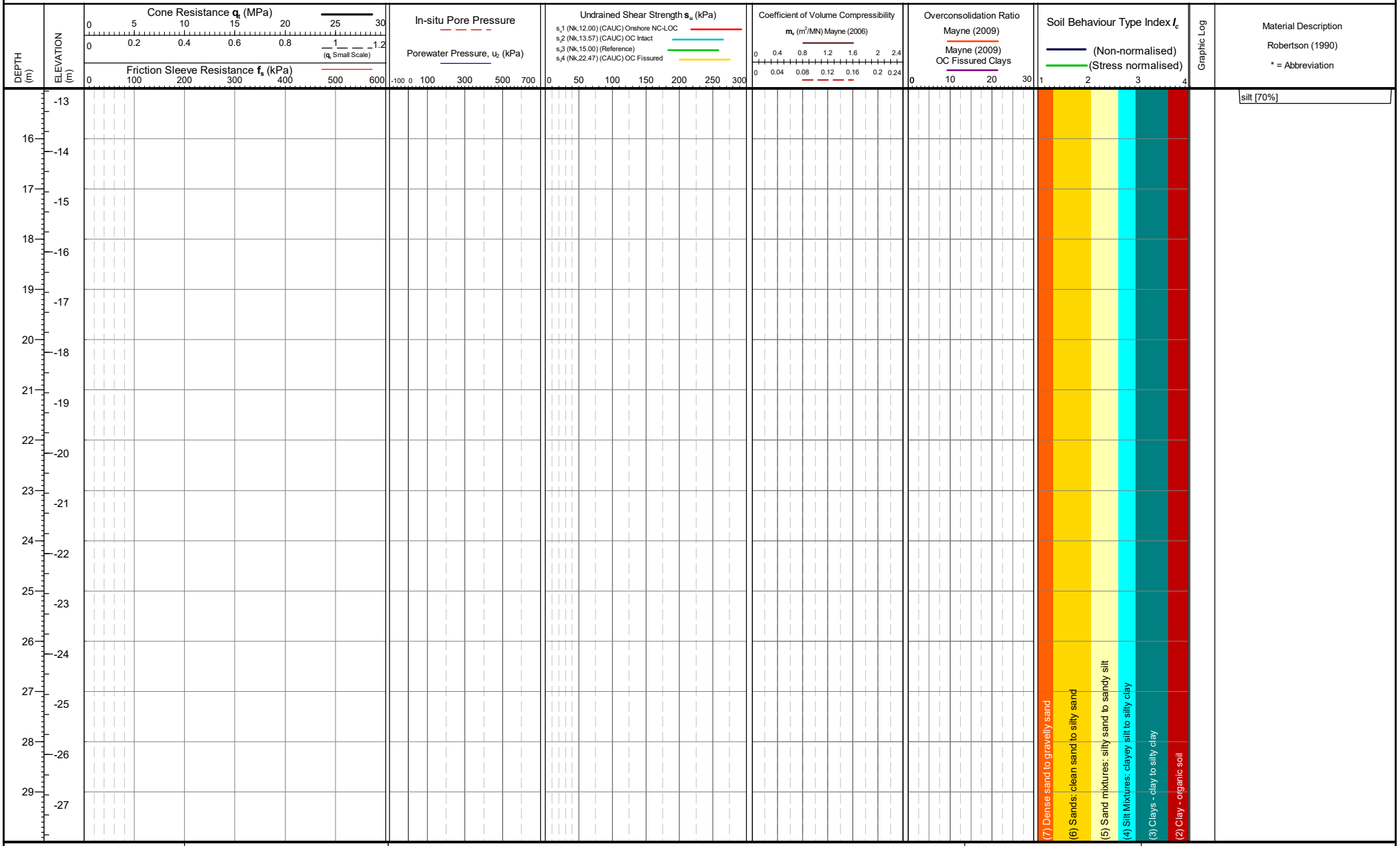
Checked by:
Chris Player

TEST ID: CPT104

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
ConeID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Rig Used: UK3
Date of test: 14/05/2025 10:26:20

Location: Essex, UK
Coordinates: 567408.732, 174141.855
Elevation: 2.256
Coordinate system:

Remarks: *Phreatic surface origin: Average measured piezometric elevation from other location(s)

Termination Remark:
Lateral support at depth

Internal QA Diss.
Dissipation Test
Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

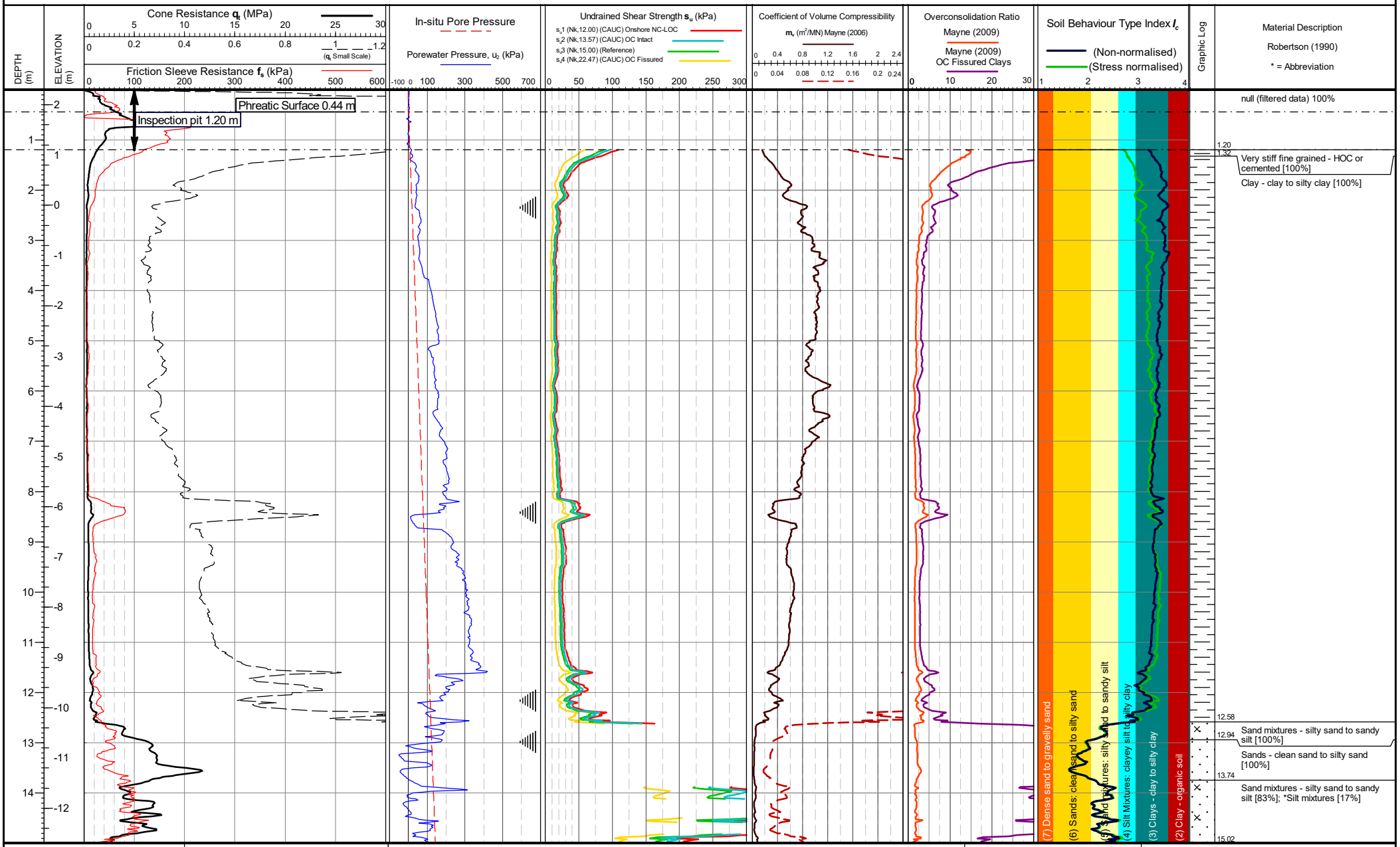
Date of plot: 18-07-25
Checked by: Chris Player

Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT104

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
ConeID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Rig Used: UK3
Date of test: 15/05/2025 10:07:33

Location: Essex, UK
Coordinates: 567426.41, 174081.075
Elevation: 2.301
Coordinate system:

Remarks: *Phreatic surface origin: Average measured piezometric depth at this location, approx. +- 0.4 mbgl

Termination Remark:
Lateral support at depth

Internal QA Diss.
Dissipation Test
Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 18-07-25

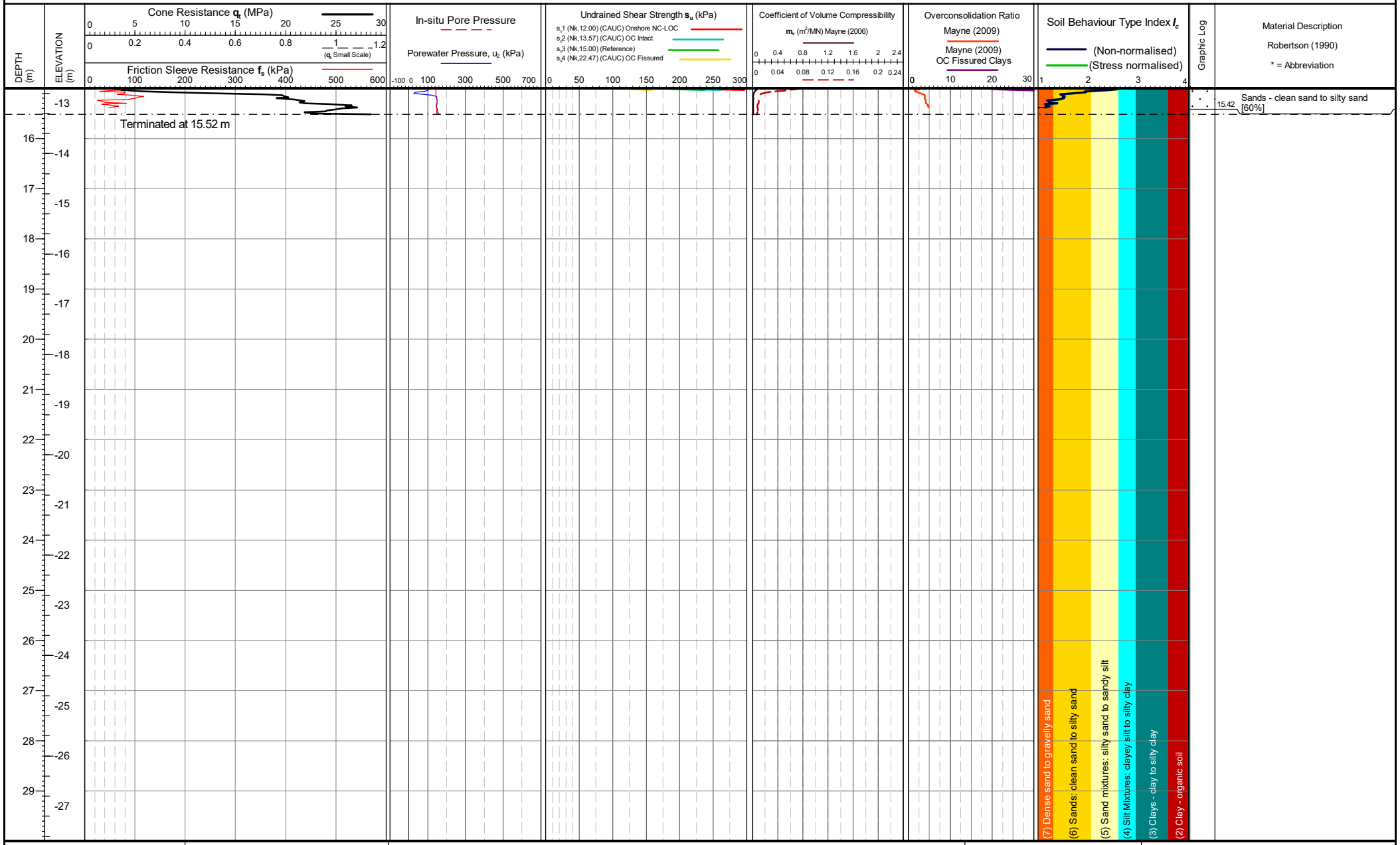
Checked by: Chris Player

Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT105

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
ConeID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Rig Used: UK3
Date of test: 15/05/2025 10:07:33

Location: Essex, UK
Coordinates: 567426.41, 174081.075
Elevation: 2.301
Coordinate system:

Remarks: *Phreatic surface origin: Average measured piezometric depth at this location, approx. +- 0.4 mbgl

Termination Remark:
Lateral support at depth

Internal QA Diss.
Dissipation Test
Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 18-07-25

Checked by: Chris Player

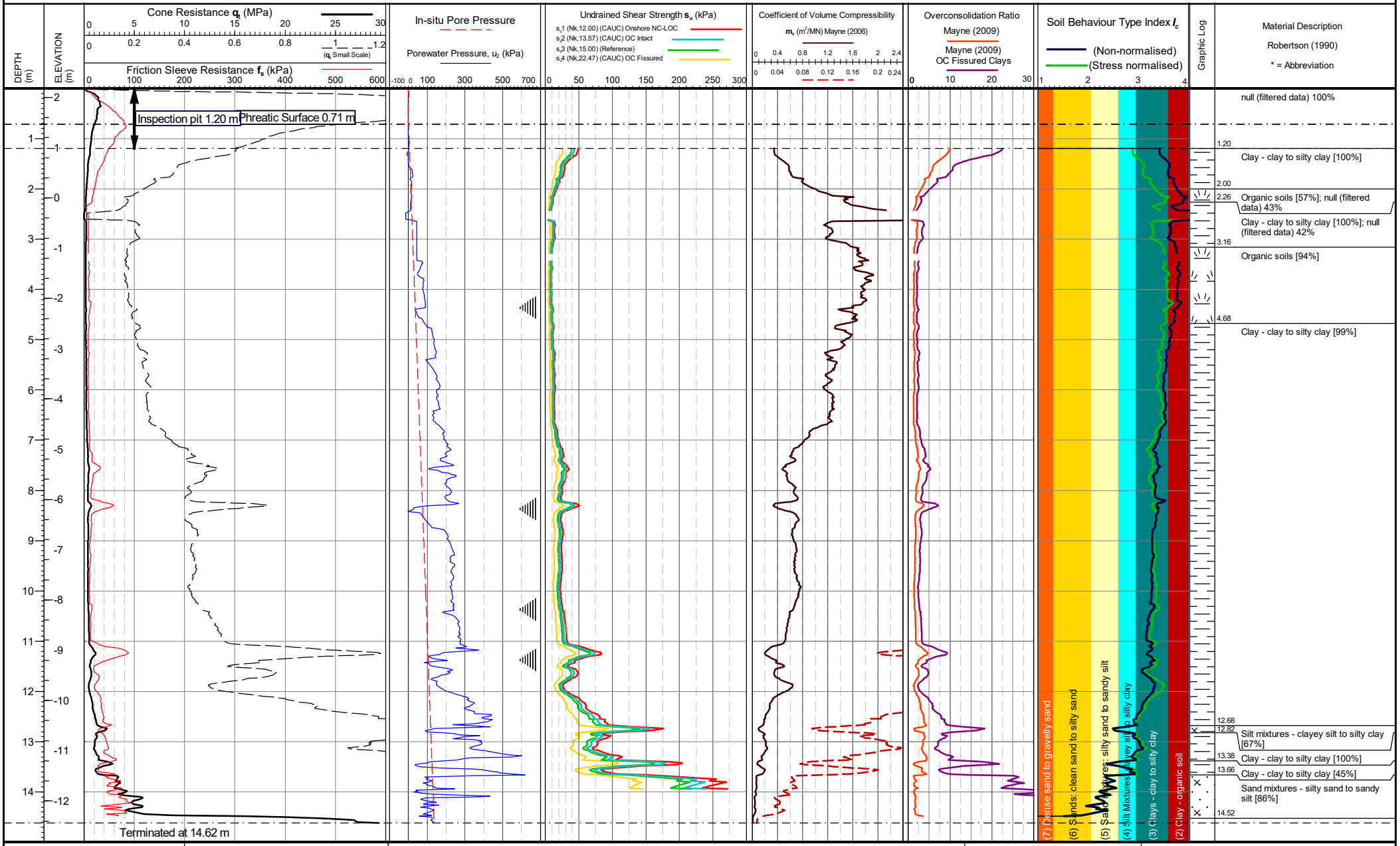
Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT105

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
ConeID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Rig Used: UK3
Date of test: 13/05/2025 09:45:35

Location: Essex, UK
Coordinates: 567428.311, 174166.814
Elevation: 2.179
Coordinate system:

Remarks: *Phreatic surface origin: Average measured piezometric elevation from other location(s)

Termination Remark:
Lateral support at depth

Internal QA Diss.
Dissipation Test
Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 18-07-25

Checked by: Chris Player

Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT106

APPENDIX F PARAMETER RESULTS 2 – SPT N60, PHI, D_R, E, I_C

Equivalent SPT N60

Peak friction angle

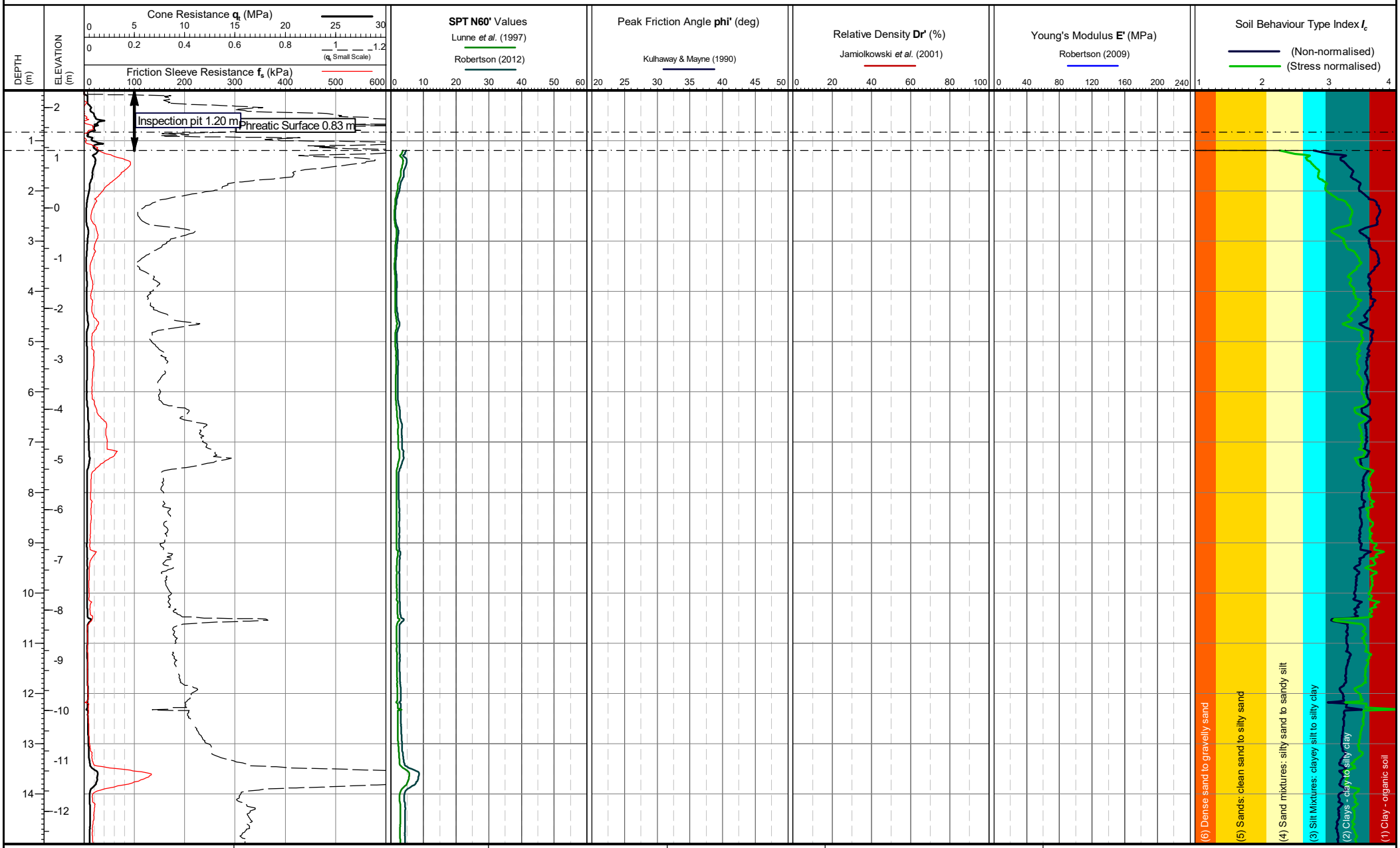
Relative density

Young's modulus

SBT index I_c

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Date of test: 07/05/2025 08:47:52

Location: Essex, UK
Coordinates: 566299.724, 175912.182
Elevation: 2.341
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

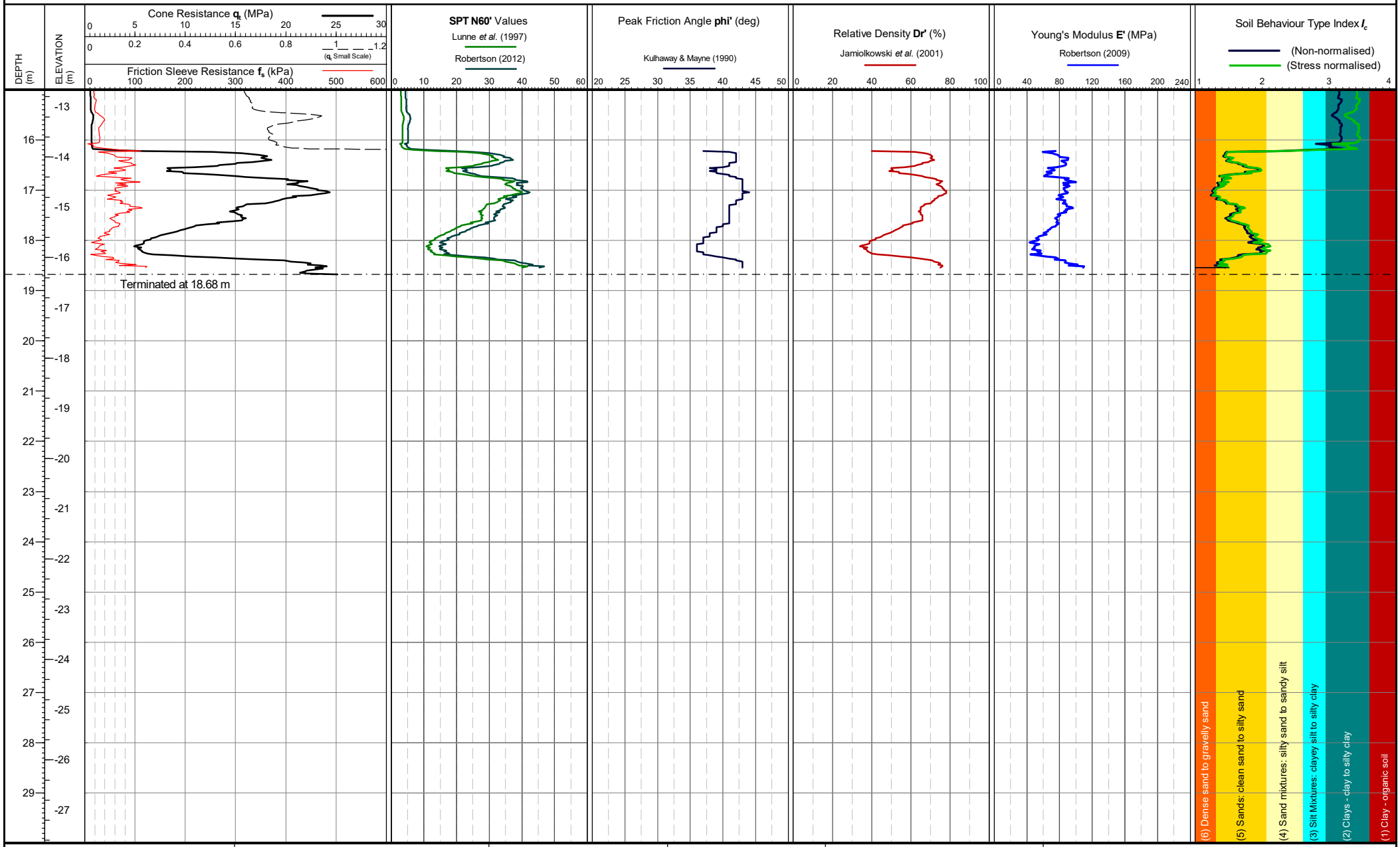
Date of plot: 18-07-25
Checked by: Chris Player

Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT101

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Date of test: 07/05/2025 08:47:52

Location: Essex, UK
Coordinates: 566299.724, 175912.182
Elevation: 2.341
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

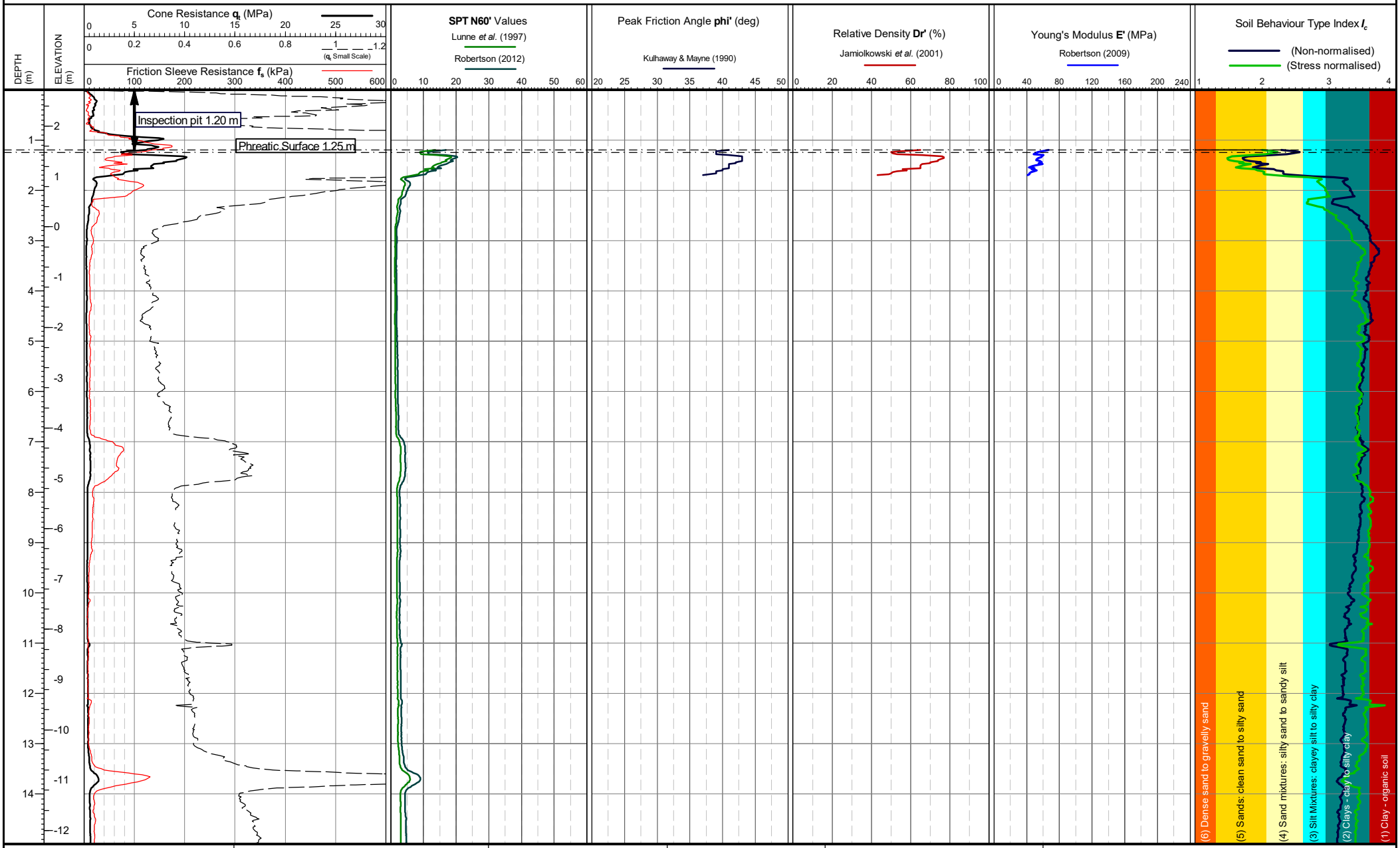
Date of plot: 18-07-25
Checked by: Chris Player

Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT101

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Date of test: 08/05/2025 10:29:14

Location: Essex, UK
Coordinates: 566334.083, 175912.213
Elevation: 2.724
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 18-07-25
Checked by: Chris Player

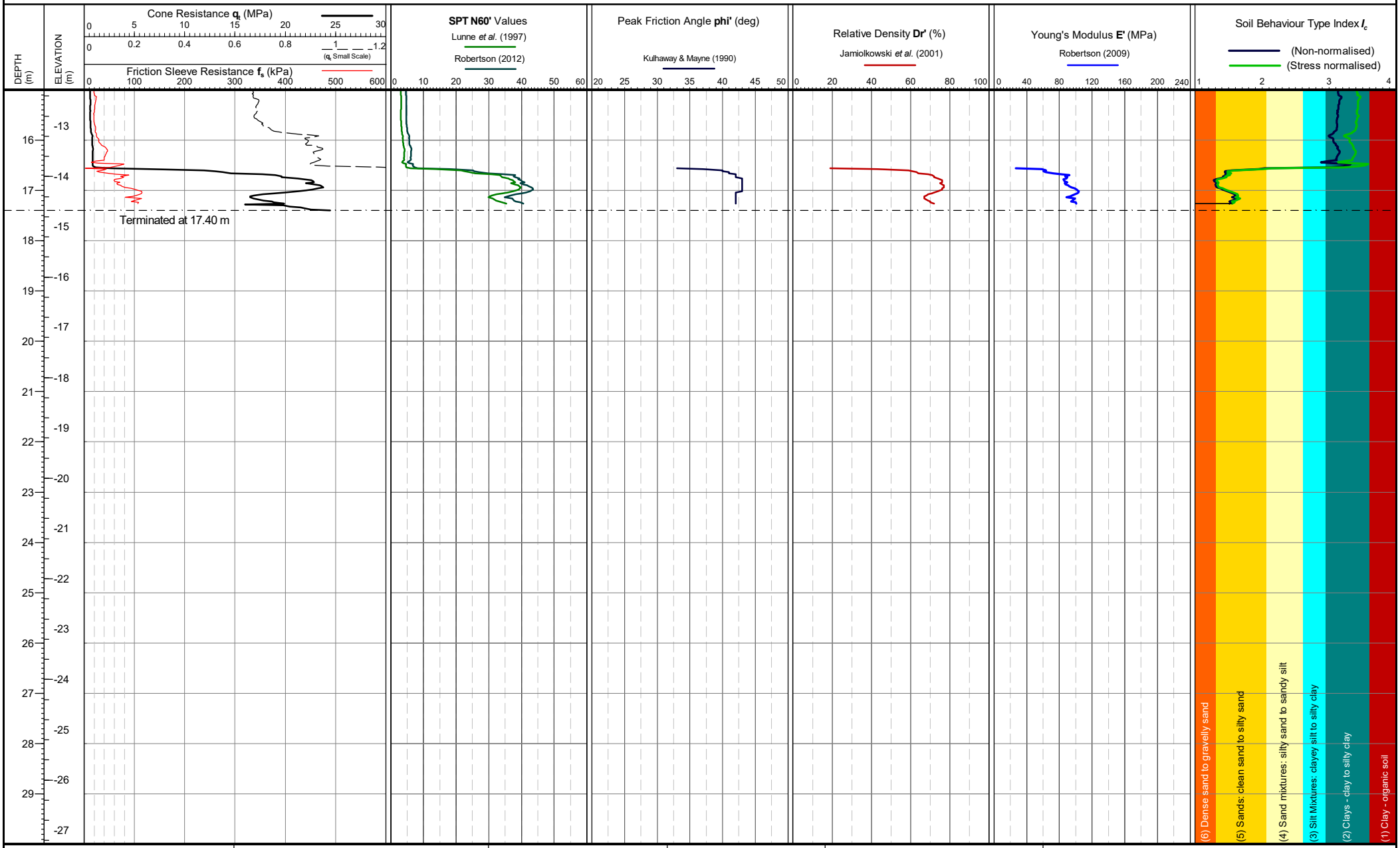
Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT102

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Date of test: 08/05/2025 10:29:14

Location: Essex, UK
Coordinates: 566334.083, 175912.213
Elevation: 2.724
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 18-07-25
Checked by: Chris Player

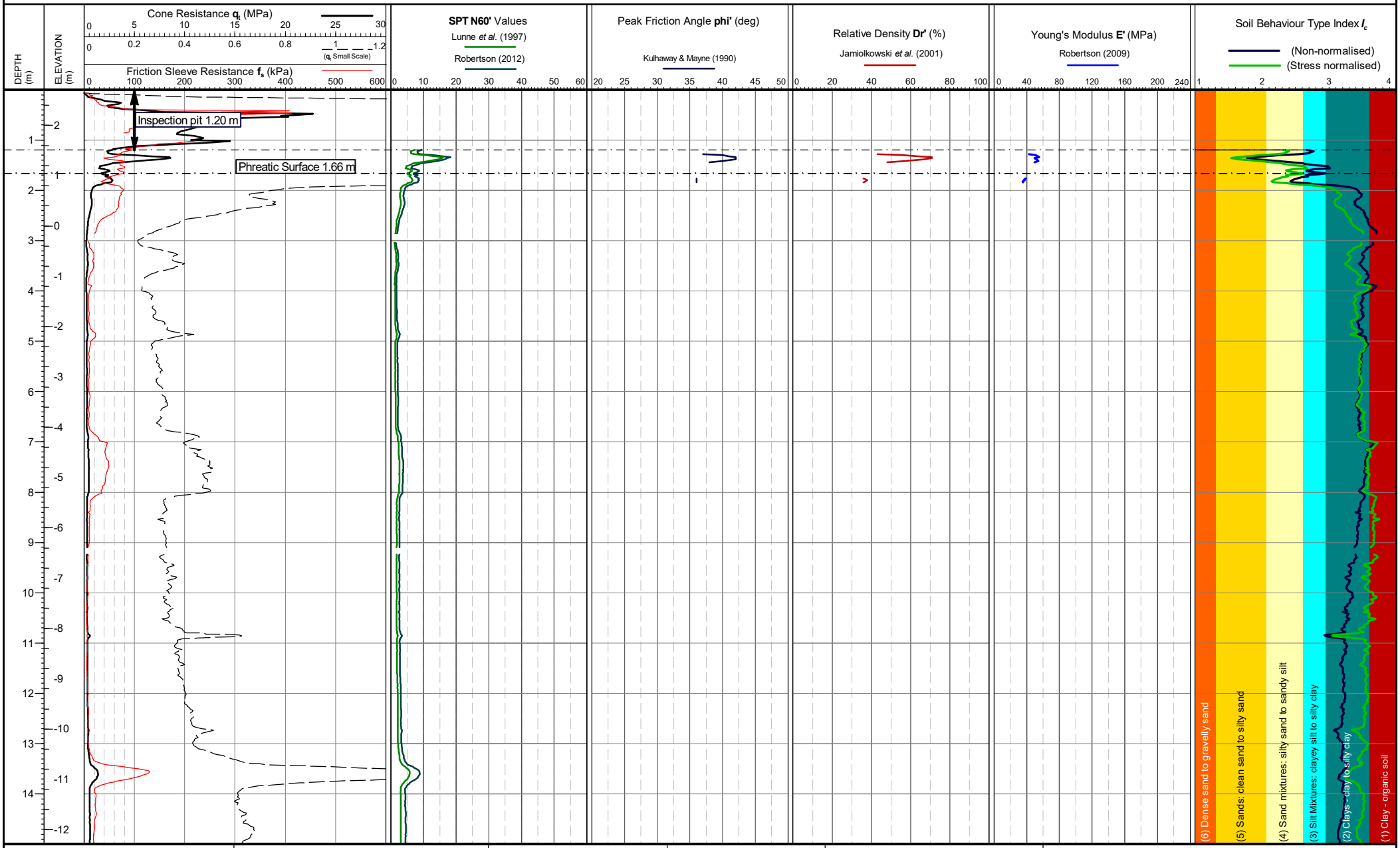
Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT102

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2116
Operator: Riley Trevelyan
Date of test: 06/05/2025 10:00:36

Location: Essex, UK
Coordinates: 566316.646, 175907.221
Elevation: 2.709
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 18-07-25

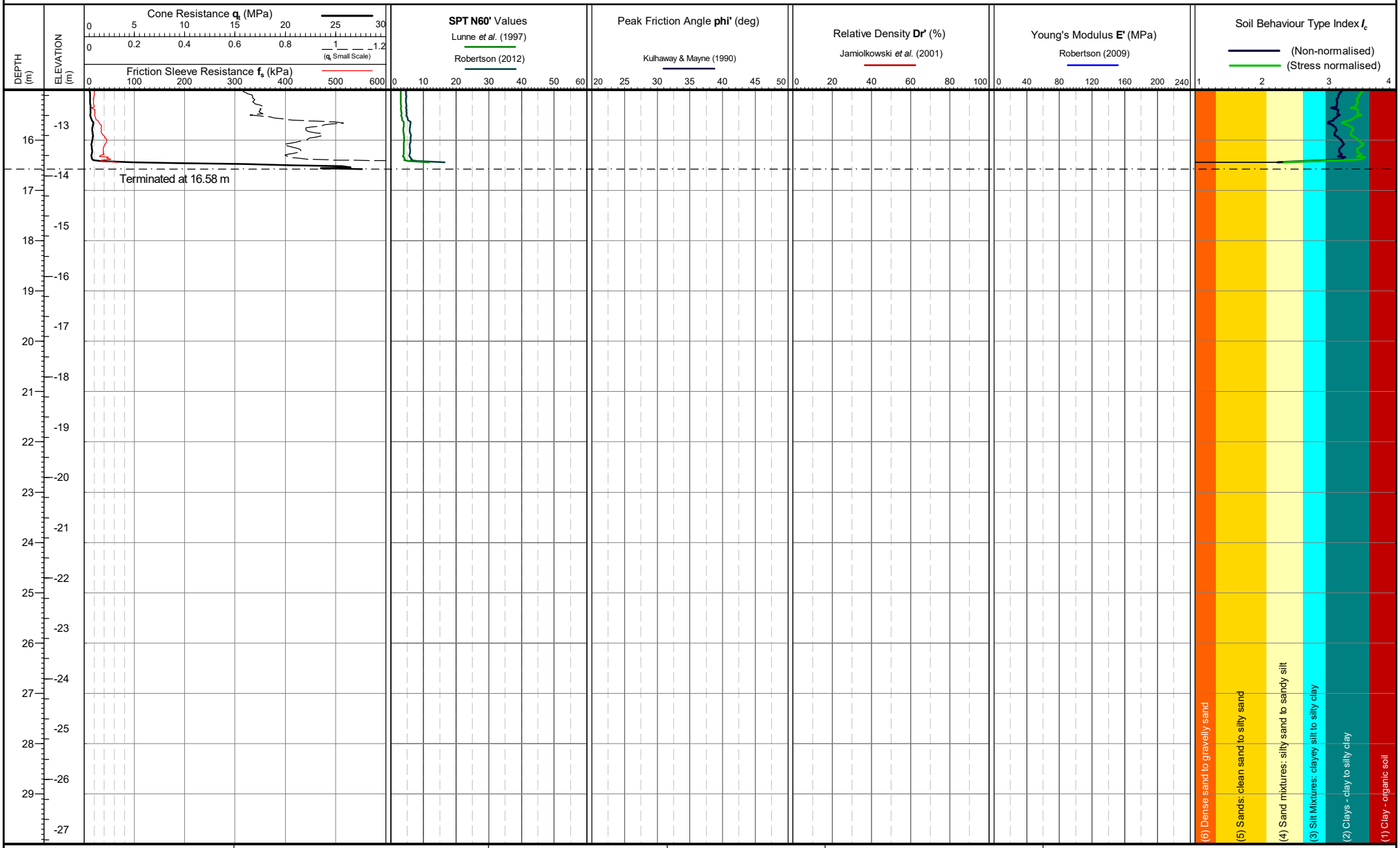
Checked by: Chris Player

Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT103

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2116
Operator: Riley Trevelyan
Date of test: 06/05/2025 10:00:36

Location: Essex, UK
Coordinates: 566316.646, 175907.221
Elevation: 2.709
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 18-07-25
Checked by: Chris Player

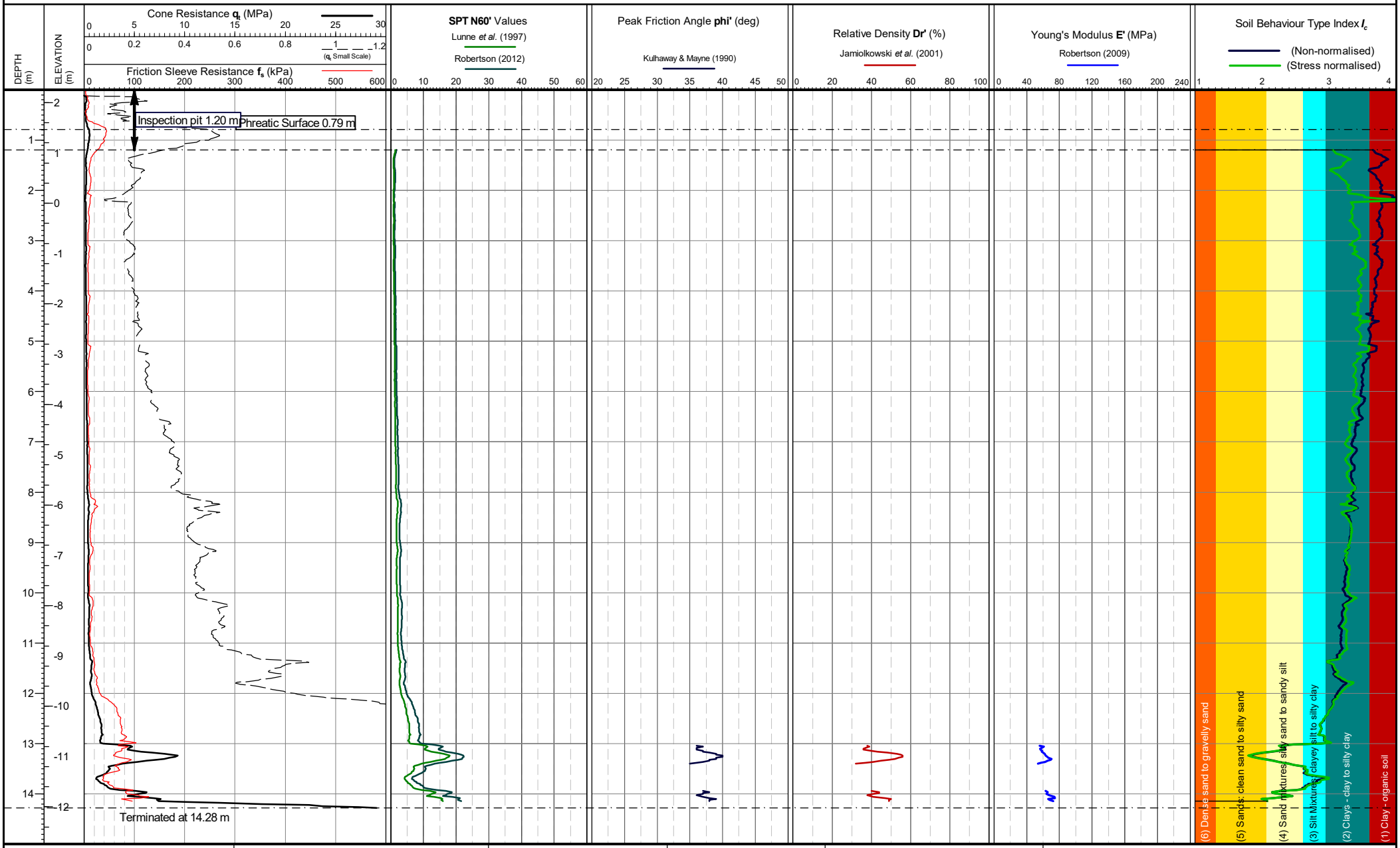
Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT103

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Date of test: 14/05/2025 10:26:20

Location: Essex, UK
Coordinates: 567408.732, 174141.855
Elevation: 2.256
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 18-07-25

Checked by: Chris Player

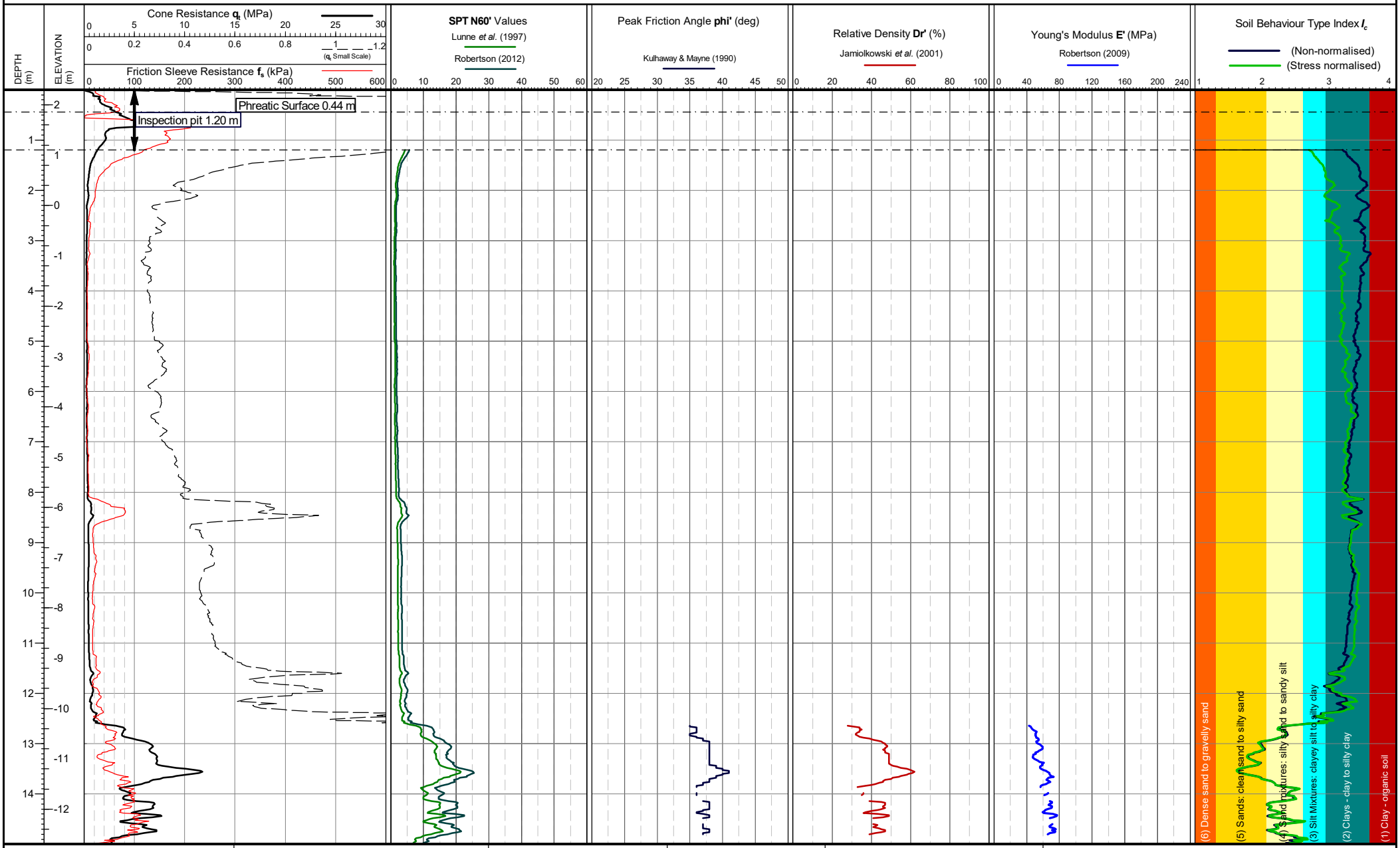
Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT104

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Date of test: 15/05/2025 10:07:33

Location: Essex, UK
Coordinates: 567426.41, 174081.075
Elevation: 2.301
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

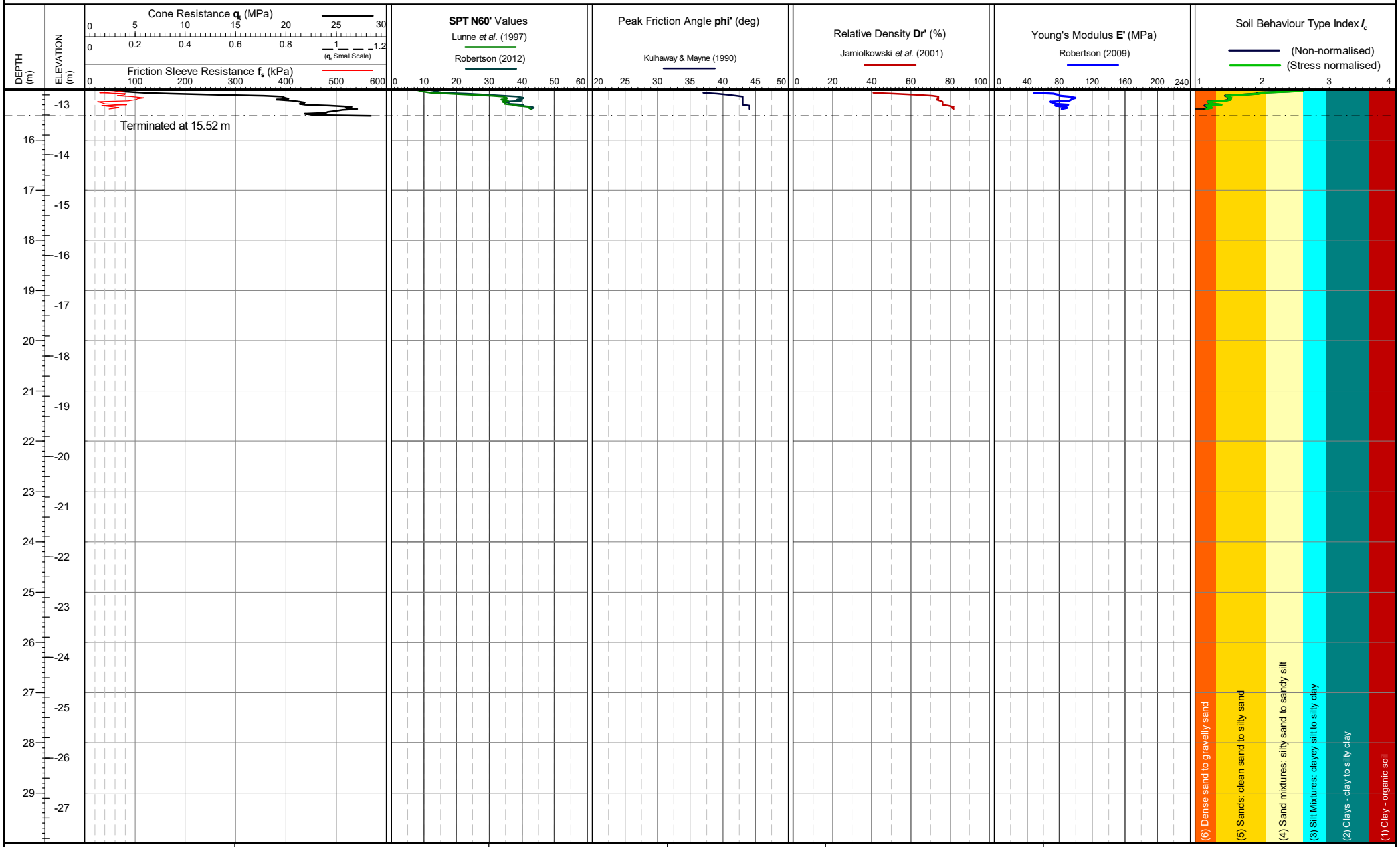
Date of plot: 18-07-25
Checked by: Chris Player

Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT105

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Date of test: 15/05/2025 10:07:33

Location: Essex, UK
Coordinates: 567426.41, 174081.075
Elevation: 2.301
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

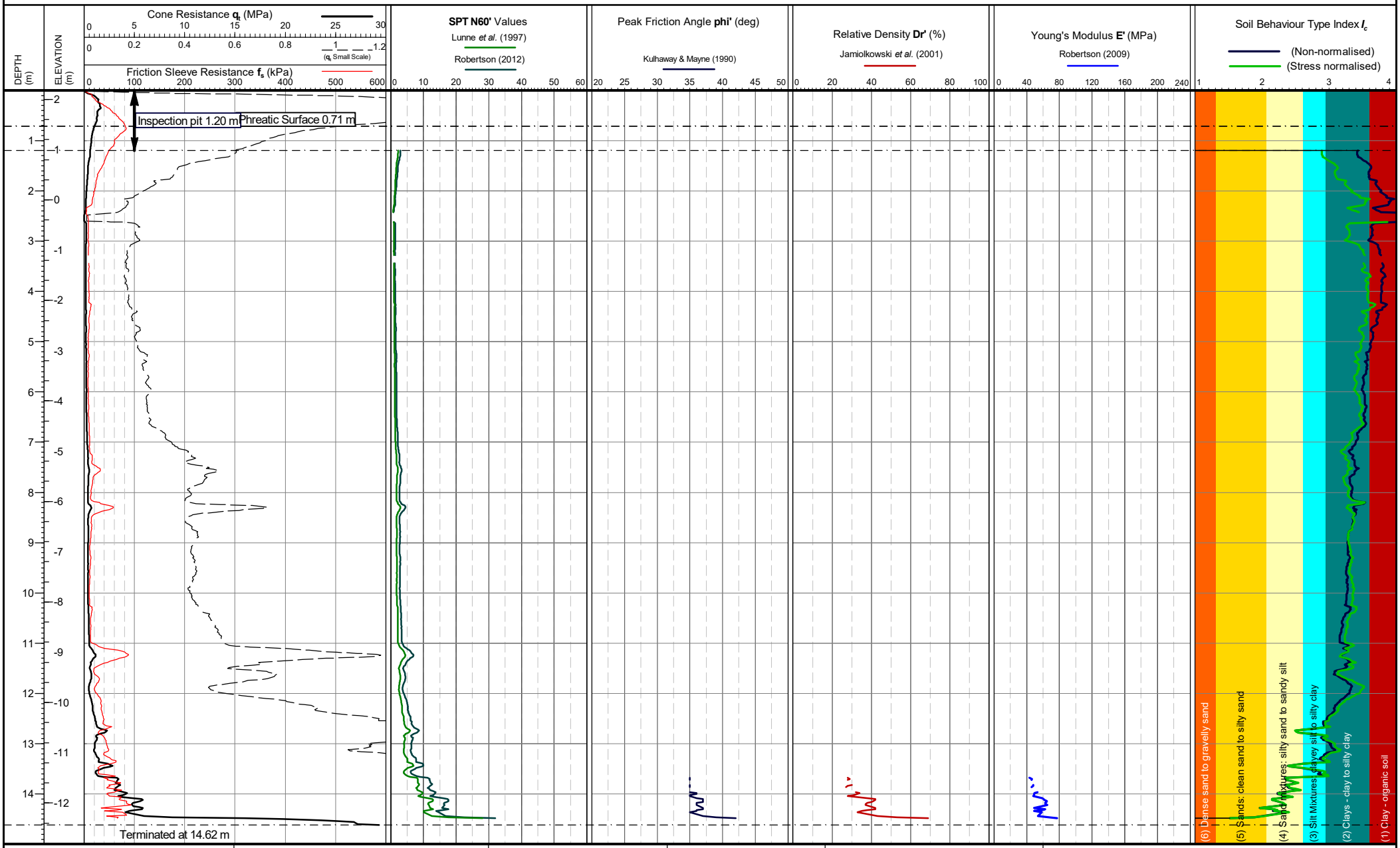
Date of plot: 18-07-25
Checked by: Chris Player

Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT105

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Date of test: 13/05/2025 09:45:35

Location: Essex, UK
Coordinates: 567428.311, 174166.814
Elevation: 2.179
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 18-07-25
Checked by: Chris Player

Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT106

APPENDIX G INTERPRETED DISSIPATION TEST RESULTS

Permeability

Coefficient of consolidation

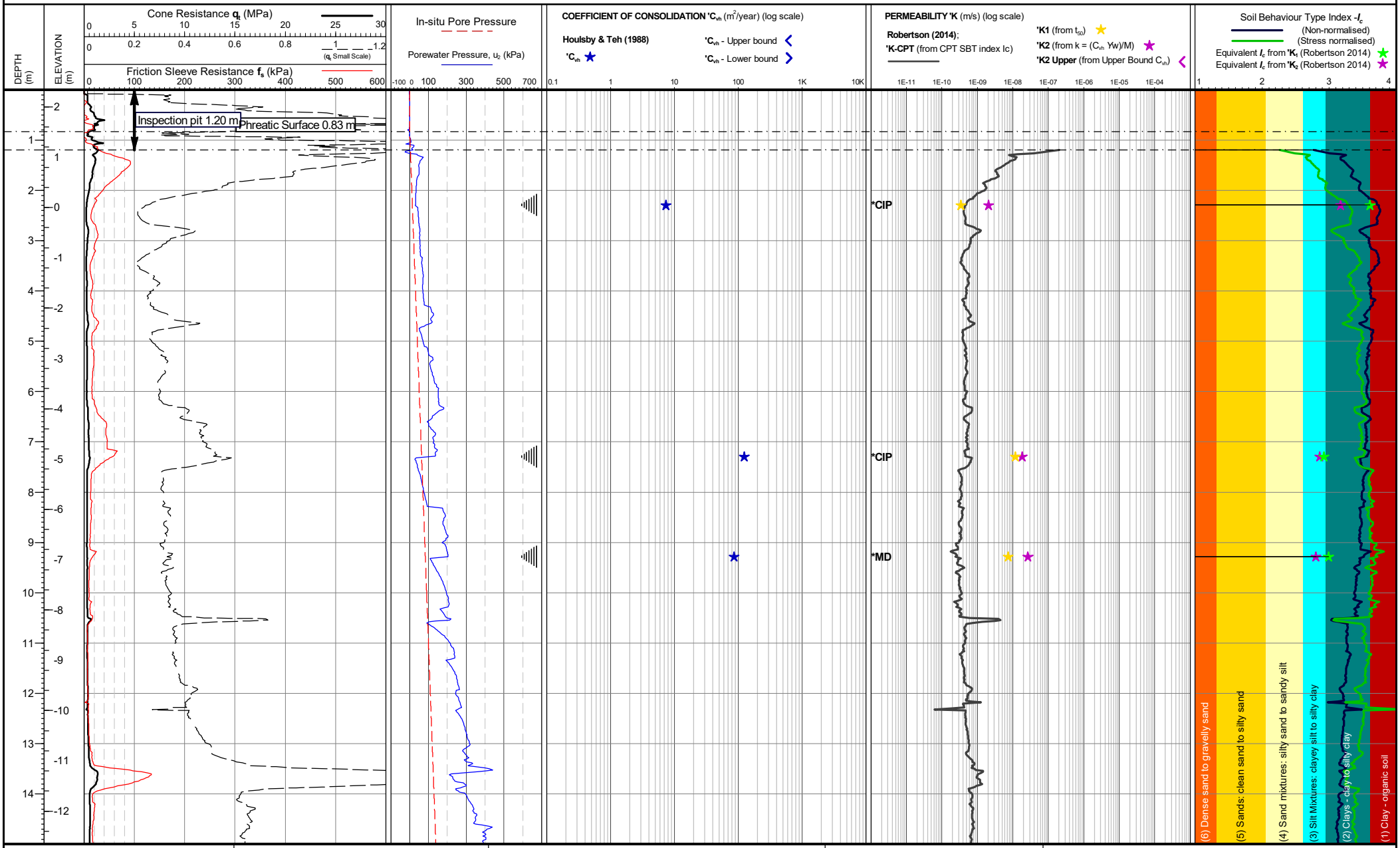
SBT index (I_c) derived from permeability

Plots are provided for all locations. Interpreted values are only provided for specified dissipation tests or QC dissipation data deemed to be suitable for interpretation.

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Date of test: 07/05/2025 08:47:52

Location: Essex, UK
Coordinates: 566299.724, 175912.182
Elevation: 2.341
Coordinate system:

*Abbreviations:
NEP: No excess pore pressures generated
ID: Insufficient test duration
UR: Uncharacteristic response
DR: Drained or partially drained response
A: Estimated/measured in-situ pore pressure corresponds to artesian conditions.
PUS: Potentially unsaturated soil.
MD: Monotonic decay.
IEP: Insufficient excess pressure generated.
LBI: Lower bound interpretation.
DT: Disrupted test.
NI: No interpretation.
u_0: Reached equilibrium pressure u_0

Date of plot: 18-07-25
Checked by: Chris Player

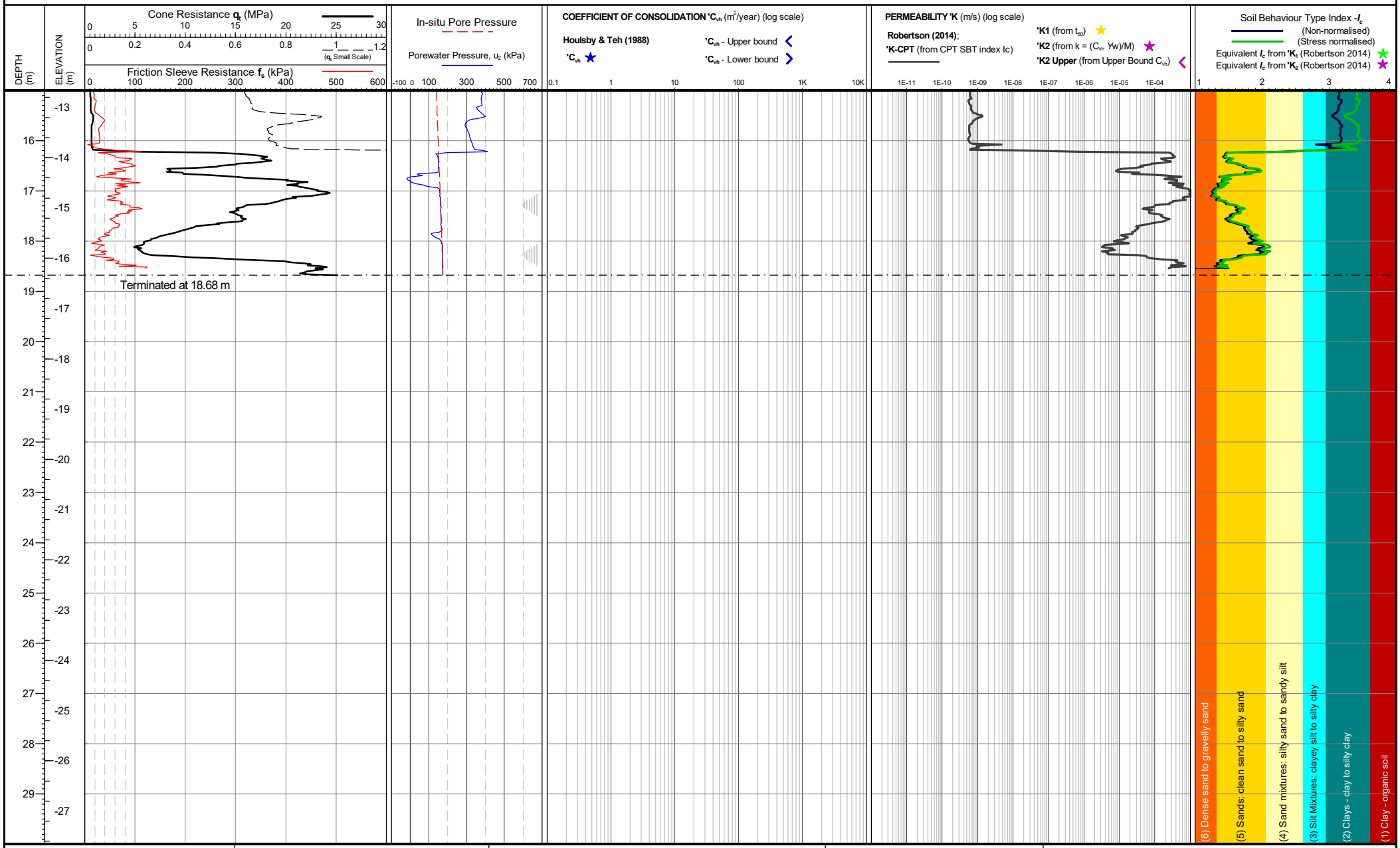
Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT101

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Date of test: 07/05/2025 08:47:52

Location: Essex, UK
Coordinates: 566299.724, 175912.182
Elevation: 2.341
Coordinate system:

*Abbreviations:
NEP: No excess pore pressures generated
ID: Insufficient test duration
UR: Uncharacteristic response
DR: Drained or partially drained response
A: Estimated/measured in-situ pore pressure corresponds to artesian conditions.
PUS: Potentially unsaturated soil.
MD: Monotonic decay.
IEP: Insufficient excess pressure generated.
LBI: Lower bound interpretation.
DT: Disrupted test.
NI: No interpretation.
u_0: Reached equilibrium pressure u_0

Date of plot: 18-07-25
Checked by: Chris Player

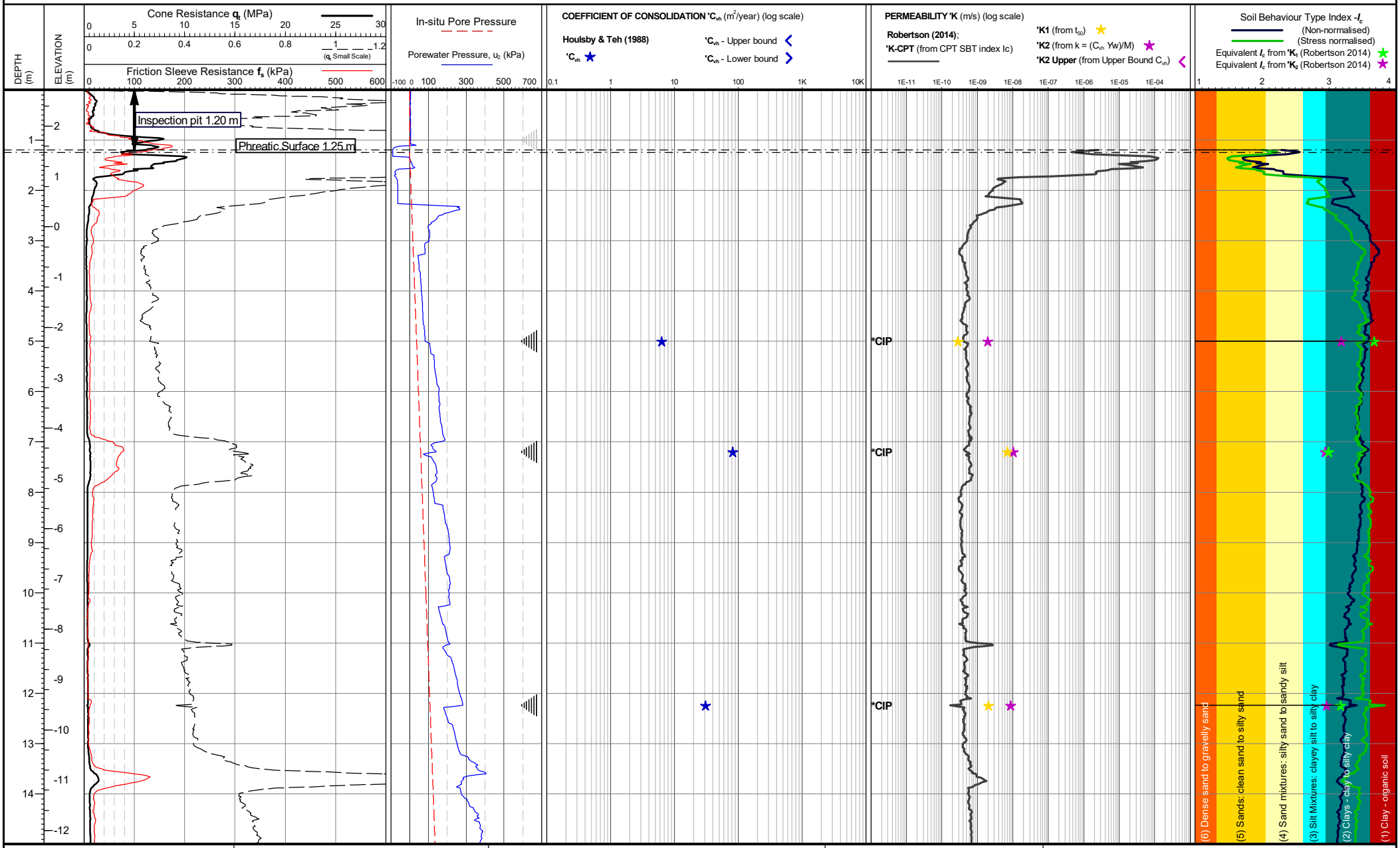
Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT101

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Date of test: 08/05/2025 10:29:14

Location: Essex, UK
Coordinates: 566334.083, 175912.213
Elevation: 2.724
Coordinate system:

*Abbreviations:
NEP: No excess pore pressures generated
ID: Insufficient test duration
UR: Uncharacteristic response
DR: Drained or partially drained response
A: Estimated/measured in-situ pore pressure corresponds to artesian conditions.
PUS: Potentially unsaturated soil.
MD: Monotonic decay.
IEP: Insufficient excess pressure generated.
LBI: Lower bound interpretation.
DT: Disrupted test.
NI: No interpretation.
u_0: Reached equilibrium pressure u_0

Date of plot: 18-07-25
Checked by: Chris Player

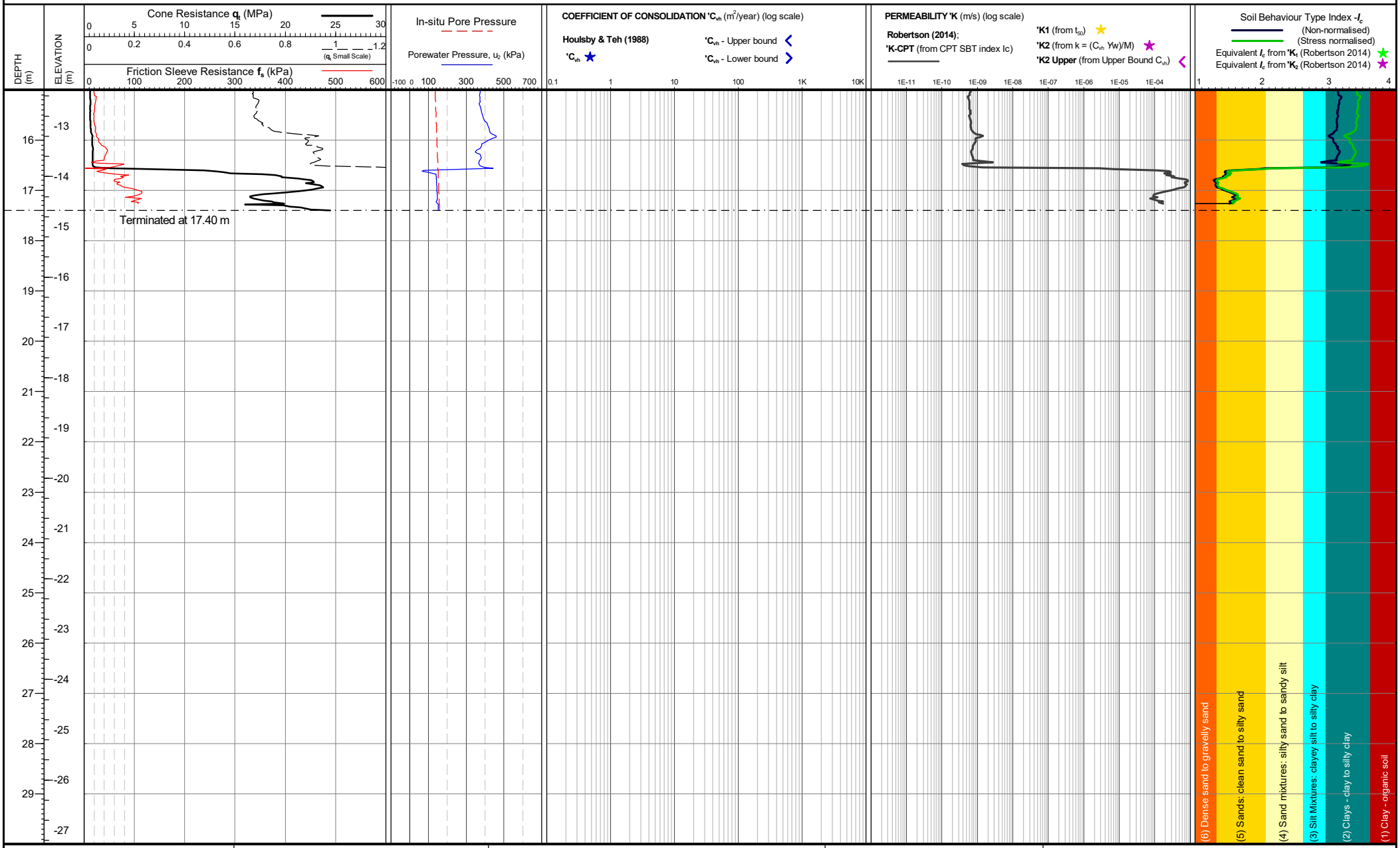
Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT102

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Date of test: 08/05/2025 10:29:14

Location: Essex, UK
Coordinates: 566334.083, 175912.213
Elevation: 2.724
Coordinate system:

*Abbreviations:
NEP: No excess pore pressures generated
ID: Insufficient test duration
UR: Uncharacteristic response
DR: Drained or partially drained response
A: Estimated/measured in-situ pore pressure corresponds to artesian conditions.
PUS: Potentially unsaturated soil.
MD: Monotonic decay.
IEP: Insufficient excess pressure generated.
LBI: Lower bound interpretation.
DT: Disrupted test.
NI: No interpretation.
u_0: Reached equilibrium pressure u_0

Date of plot: 18-07-25
Checked by: Chris Player

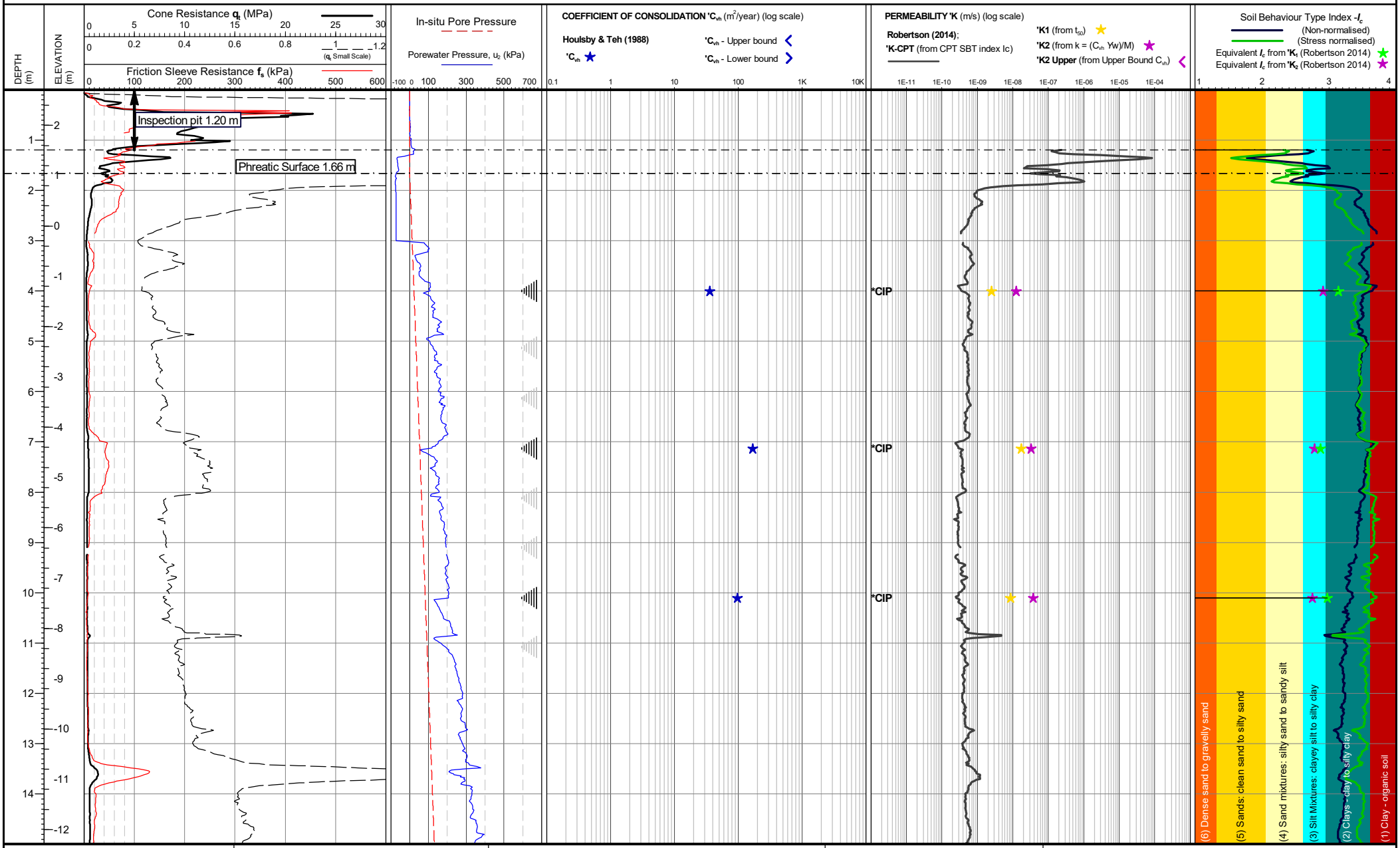
Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT102

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2116
Operator: Riley Trevelyan
Date of test: 06/05/2025 10:00:36

Location: Essex, UK
Coordinates: 566316.646, 175907.221
Elevation: 2.709
Coordinate system:

*Abbreviations:
NEP: No excess pore pressures generated
ID: Insufficient test duration
UR: Uncharacteristic response
DR: Drained or partially drained response
A: Estimated/measured in-situ pore pressure corresponds to artesian conditions.
PUS: Potentially unsaturated soil.
MD: Monotonic decay.
IEP: Insufficient excess pressure generated.
LBI: Lower bound interpretation.
DT: Disrupted test.
NI: No interpretation.
u_0: Reached equilibrium pressure u_0

Date of plot: 18-07-25
Checked by: Chris Player

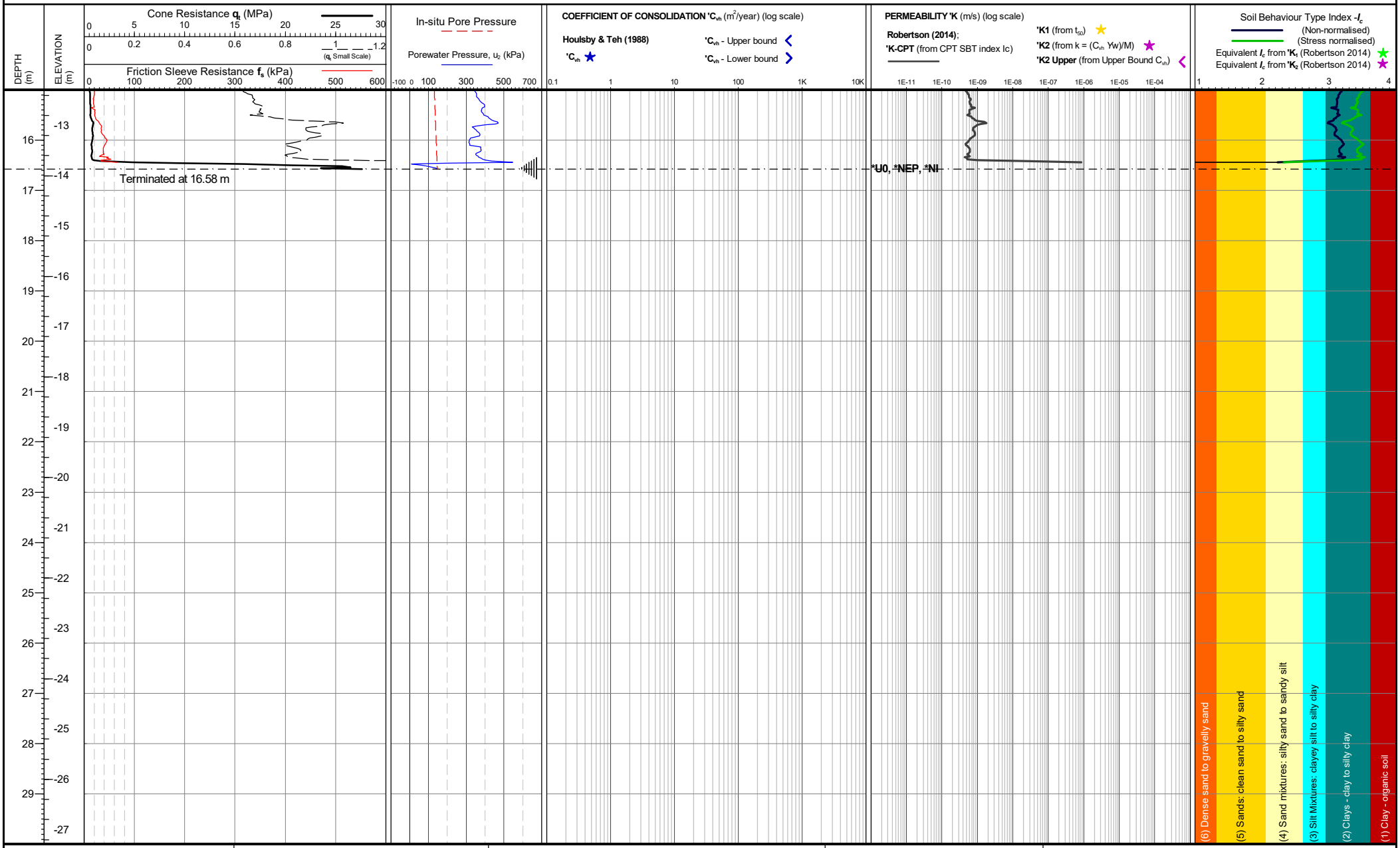
Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT103

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2116
Operator: Riley Trevelyan
Date of test: 06/05/2025 10:00:36

Location: Essex, UK
Coordinates: 566316.646, 175907.221
Elevation: 2.709
Coordinate system:

*Abbreviations:
NEP: No excess pore pressures generated
ID: Insufficient test duration
UR: Uncharacteristic response
DR: Drained or partially drained response
A: Estimated/measured in-situ pore pressure corresponds to artesian conditions.
PUS: Potentially unsaturated soil.
MD: Monotonic decay.
IEP: Insufficient excess pressure generated.
LBI: Lower bound interpretation.
DT: Disrupted test.
NI: No interpretation.
u_0: Reached equilibrium pressure u_0

Date of plot: 18-07-25
Checked by: Chris Player

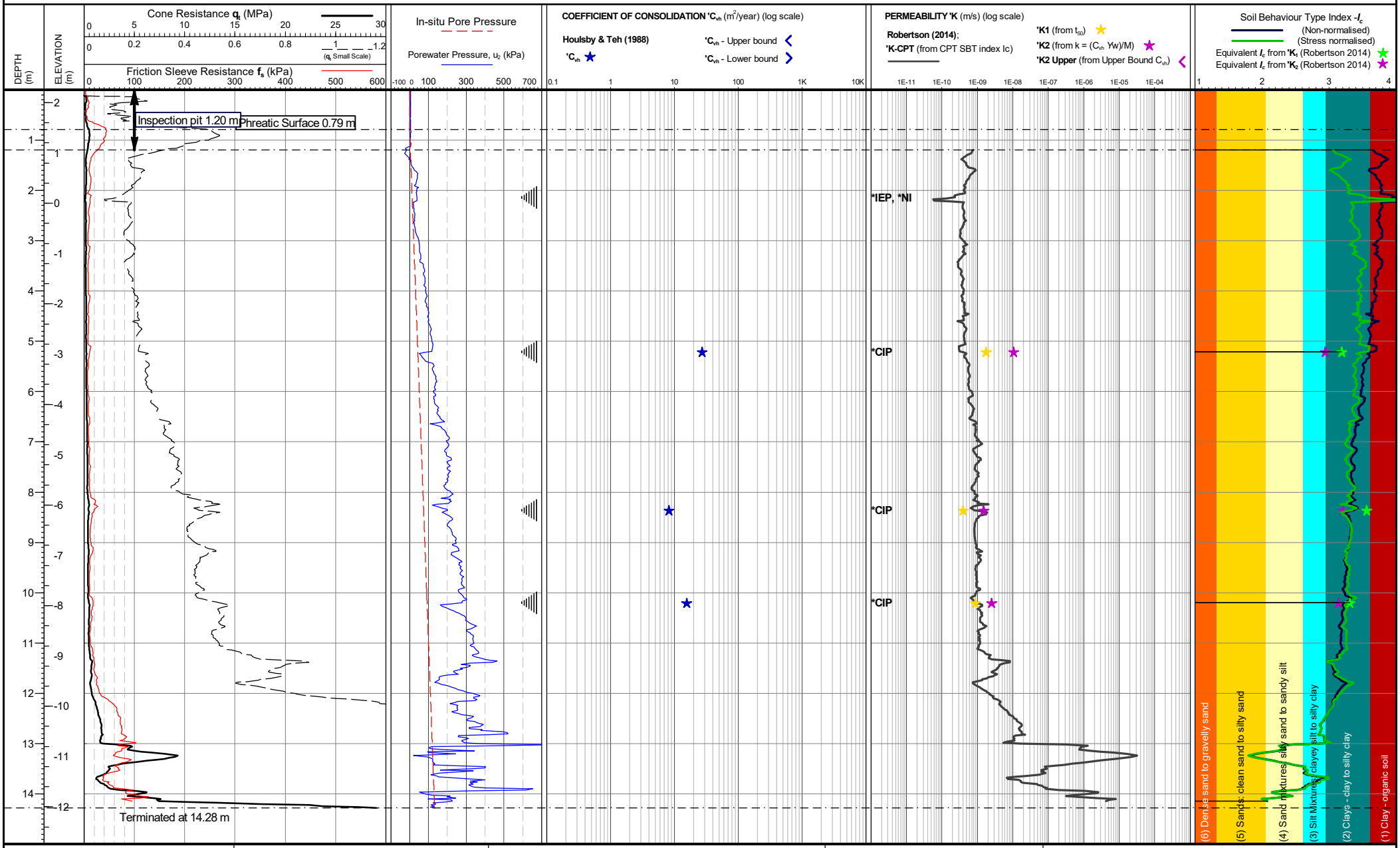
Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT103

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Date of test: 14/05/2025 10:26:20

Location: Essex, UK
Coordinates: 567408.732, 174141.855
Elevation: 2.256
Coordinate system:

*Abbreviations:
NEP: No excess pore pressures generated
ID: Insufficient test duration
UR: Uncharacteristic response
DR: Drained or partially drained response
A: Estimated/measured in-situ pore pressure corresponds to artesian conditions.
PUS: Potentially unsaturated soil.
MD: Monotonic decay.
IEP: Insufficient excess pressure generated.
LBI: Lower bound interpretation.
DT: Disrupted test.
NI: No interpretation.
u_0: Reached equilibrium pressure u_0

Date of plot: 18-07-25
Checked by: Chris Player

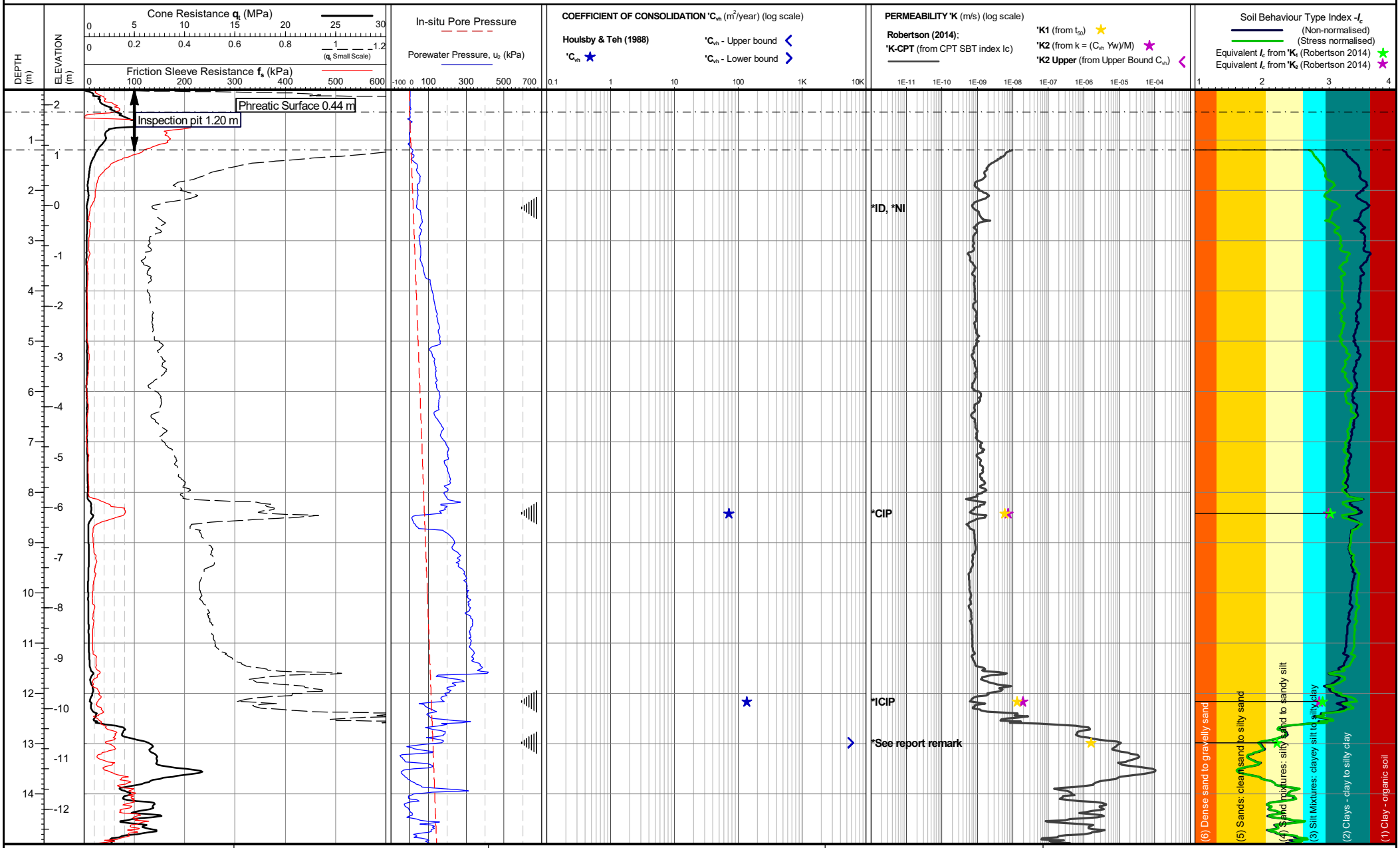
Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT104

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Date of test: 15/05/2025 10:07:33

Location: Essex, UK
Coordinates: 567426.41, 174081.075
Elevation: 2.301
Coordinate system:

*Abbreviations:
NEP: No excess pore pressures generated
ID: Insufficient test duration
UR: Uncharacteristic response
DR: Drained or partially drained response
A: Estimated/measured in-situ pore pressure corresponds to artesian conditions.
PUS: Potentially unsaturated soil.
MD: Monotonic decay.
IEP: Insufficient excess pressure generated.
LBI: Lower bound interpretation.
DT: Disrupted test.
NI: No interpretation.
u_0: Reached equilibrium pressure u_0

Date of plot: 18-07-25
Checked by: Chris Player

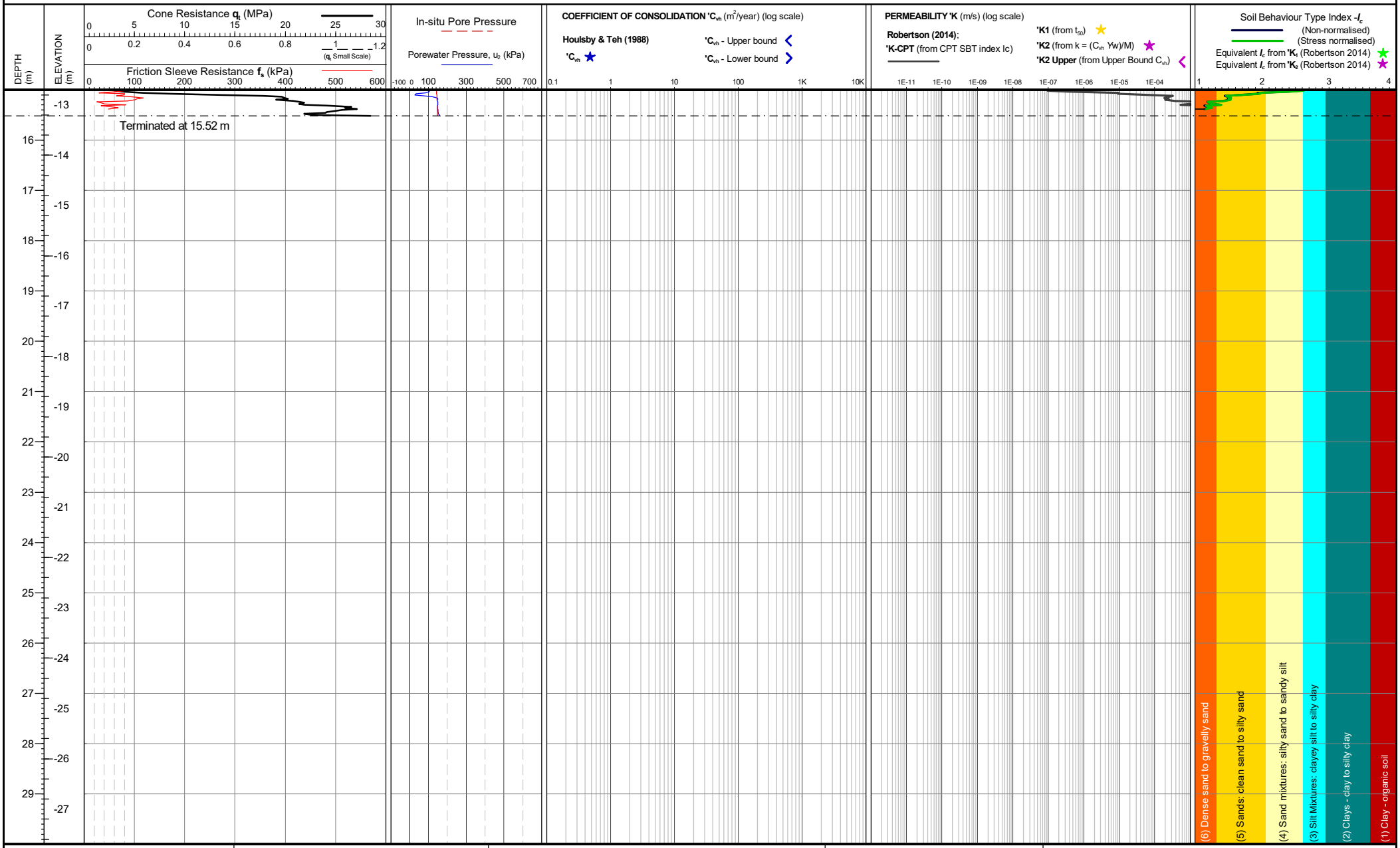
Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT105

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Date of test: 15/05/2025 10:07:33

Location: Essex, UK
Coordinates: 567426.41, 174081.075
Elevation: 2.301
Coordinate system:

*Abbreviations:
NEP: No excess pore pressures generated
ID: Insufficient test duration
UR: Uncharacteristic response
DR: Drained or partially drained response
A: Estimated/measured in-situ pore pressure corresponds to artesian conditions.
PUS: Potentially unsaturated soil.
MD: Monotonic decay.
IEP: Insufficient excess pressure generated.
LBI: Lower bound interpretation.
DT: Disrupted test.
NI: No interpretation.
u_0: Reached equilibrium pressure u_0

Date of plot: 18-07-25
Checked by: Chris Player

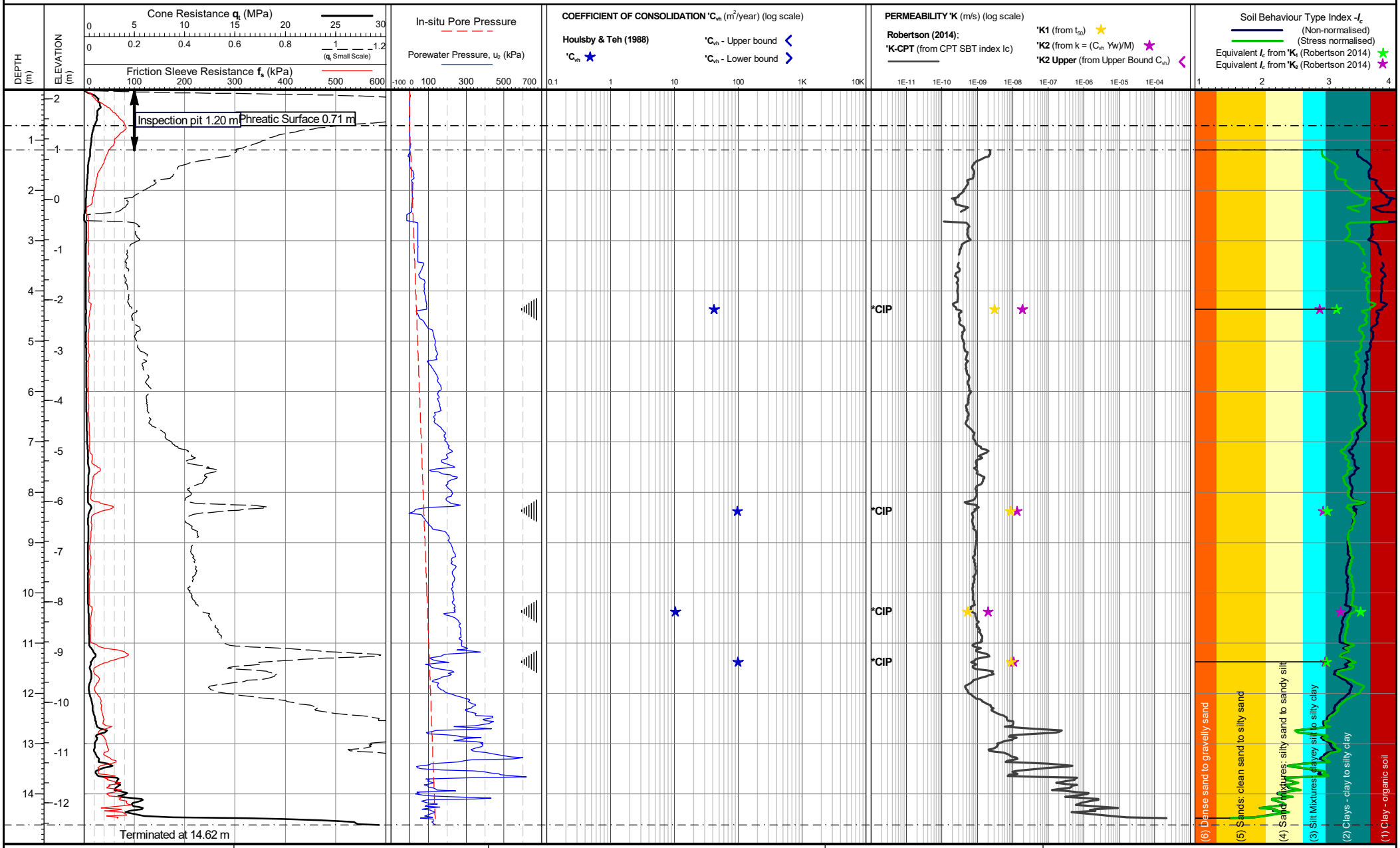
Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT105

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Date of test: 13/05/2025 09:45:35

Location: Essex, UK
Coordinates: 567428.311, 174166.814
Elevation: 2.179
Coordinate system:

*Abbreviations:
NEP: No excess pore pressures generated
ID: Insufficient test duration
UR: Uncharacteristic response
DR: Drained or partially drained response
A: Estimated/measured in-situ pore pressure corresponds to artesian conditions.
PUS: Potentially unsaturated soil.
MD: Monotonic decay.
IEP: Insufficient excess pressure generated.
LBI: Lower bound interpretation.
DT: Disrupted test.
NI: No interpretation.
u_0: Reached equilibrium pressure u_0

Date of plot: 18-07-25
Checked by: Chris Player

Lankelma Project Ref: 25-32-29428-1

TEST ID: CPT106

APPENDIX H DISSIPATION TEST CURVES & GRAPHICAL ANALYSIS

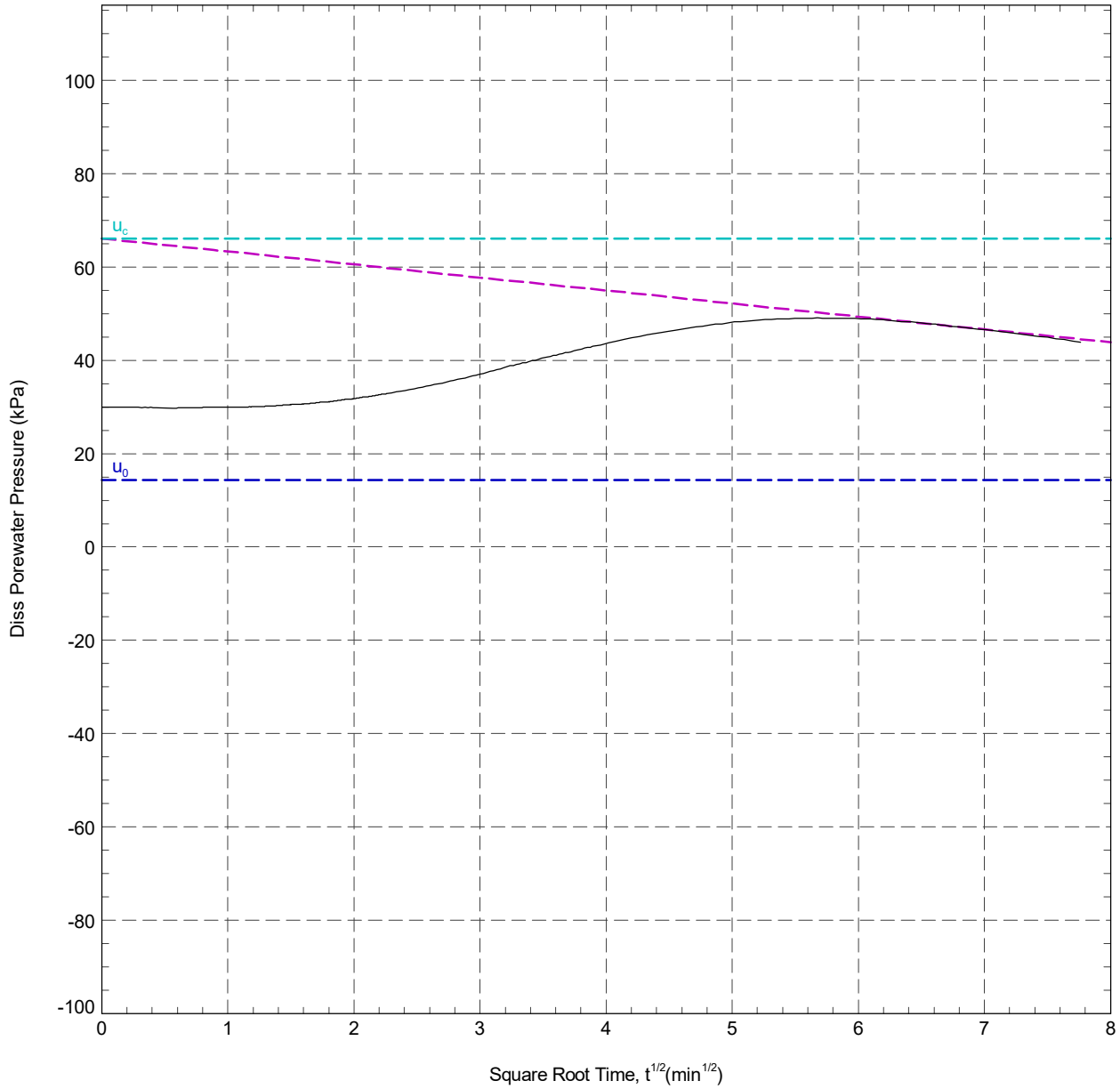
DISSIPATION TEST

LANKELMA

Test ID

CPT101 - 2.29 m

CLIENT : SOIL ENGINEERING	EASTING : 566299.7 m	SHEET : 1 OF 1
PROJECT : TILBURY	NORTHING : 175912.2 m	DATE : 07/05/25
LOCATION : Essex, UK	COORD. SYS. :	
PROJECT No. : 25-32-29428-1	ELEVATION : 2.34 m	



In Situ Pore Pressure, u_0:	14.32
Corrected Initial Pore Pressure, u_c (back extrapolated from linear decay):	66.10
Interpreted Degree Dissipation:	43.1 %
Time for 43.1% Dissipation, $t_{43.1}$:	60.27 min

RIG	: UK3_
CONE ID	: S15-CFIPTTM250.2116
OPERATOR	: Tom Freeland

REMARK

*CIP

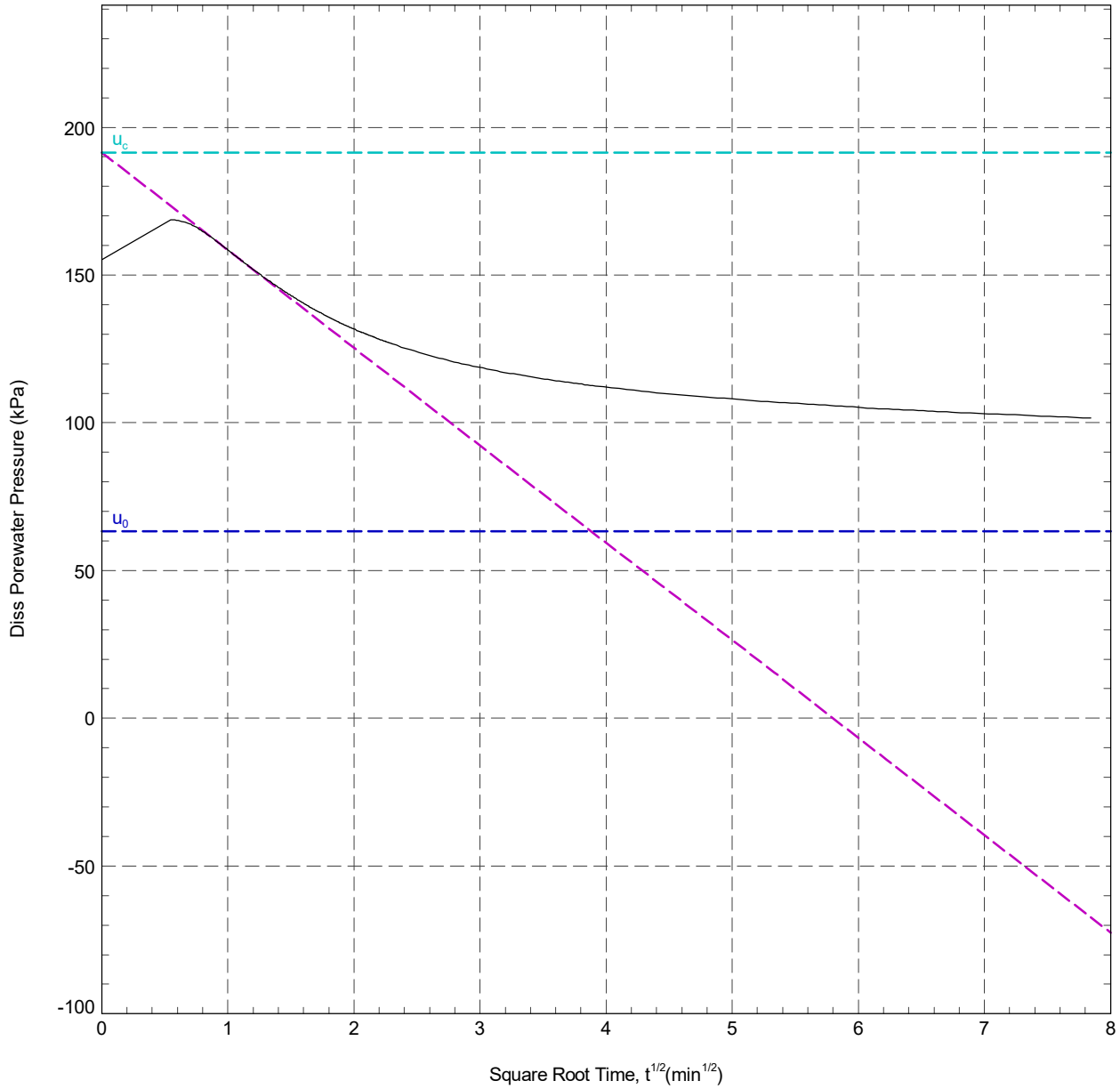
DISSIPATION TEST

LANKELMA

Test ID

CPT101 - 7.29 m

CLIENT : SOIL ENGINEERING	EASTING : 566299.7 m	SHEET : 1 OF 1
PROJECT : TILBURY	NORTHING : 175912.2 m	DATE : 07/05/25
LOCATION : Essex, UK	COORD. SYS. :	
PROJECT No. : 25-32-29428-1	ELEVATION : 2.34 m	



In Situ Pore Pressure, u_0: 63.37
Corrected Initial Pore Pressure, u_c
(back extrapolated from linear decay): 191.40
Interpreted Degree Dissipation: 50 %
Time for 50% Dissipation, t_{50}: 5.10 min

RIG : UK3_	REMARK
CONE ID : S15-CFIPTTM250.2116	*CIP
OPERATOR : Tom Freeland	

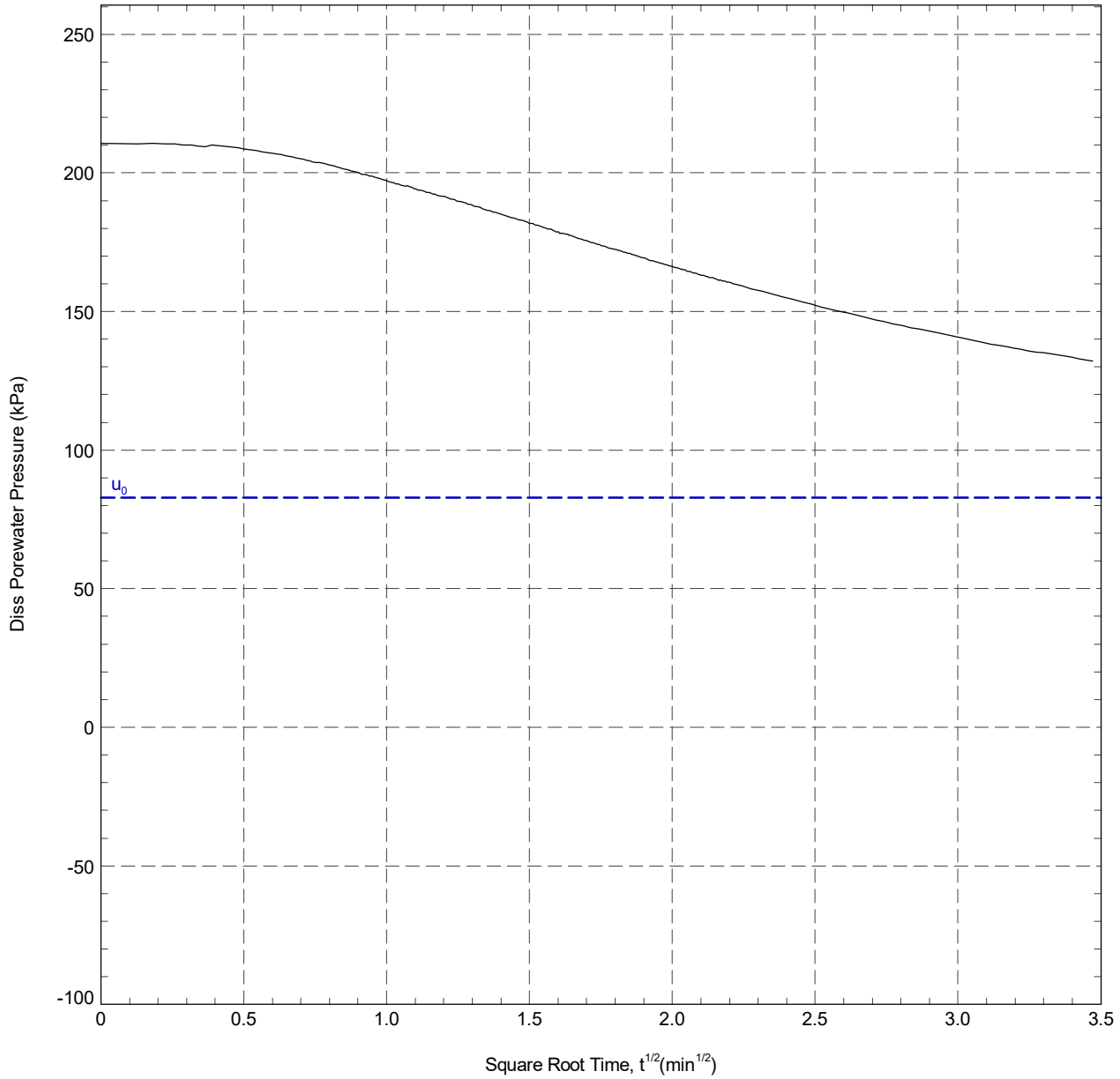
DISSIPATION TEST

LANKELMA

Test ID

CPT101 - 9.28 m

CLIENT : SOIL ENGINEERING	EASTING : 566299.7 m	SHEET : 1 OF 1
PROJECT : TILBURY	NORTHING : 175912.2 m	DATE : 07/05/25
LOCATION : Essex, UK	COORD. SYS. :	
PROJECT No. : 25-32-29428-1	ELEVATION : 2.34 m	



In Situ Pore Pressure, u_0:	82.89
Interpreted Degree Dissipation:	50 %
Time for 50% Dissipation, t_{50}:	7.35 min

RIG : UK3_	REMARK
CONE ID : S15-CFIPTTM250.2116	*MD
OPERATOR : Tom Freeland	

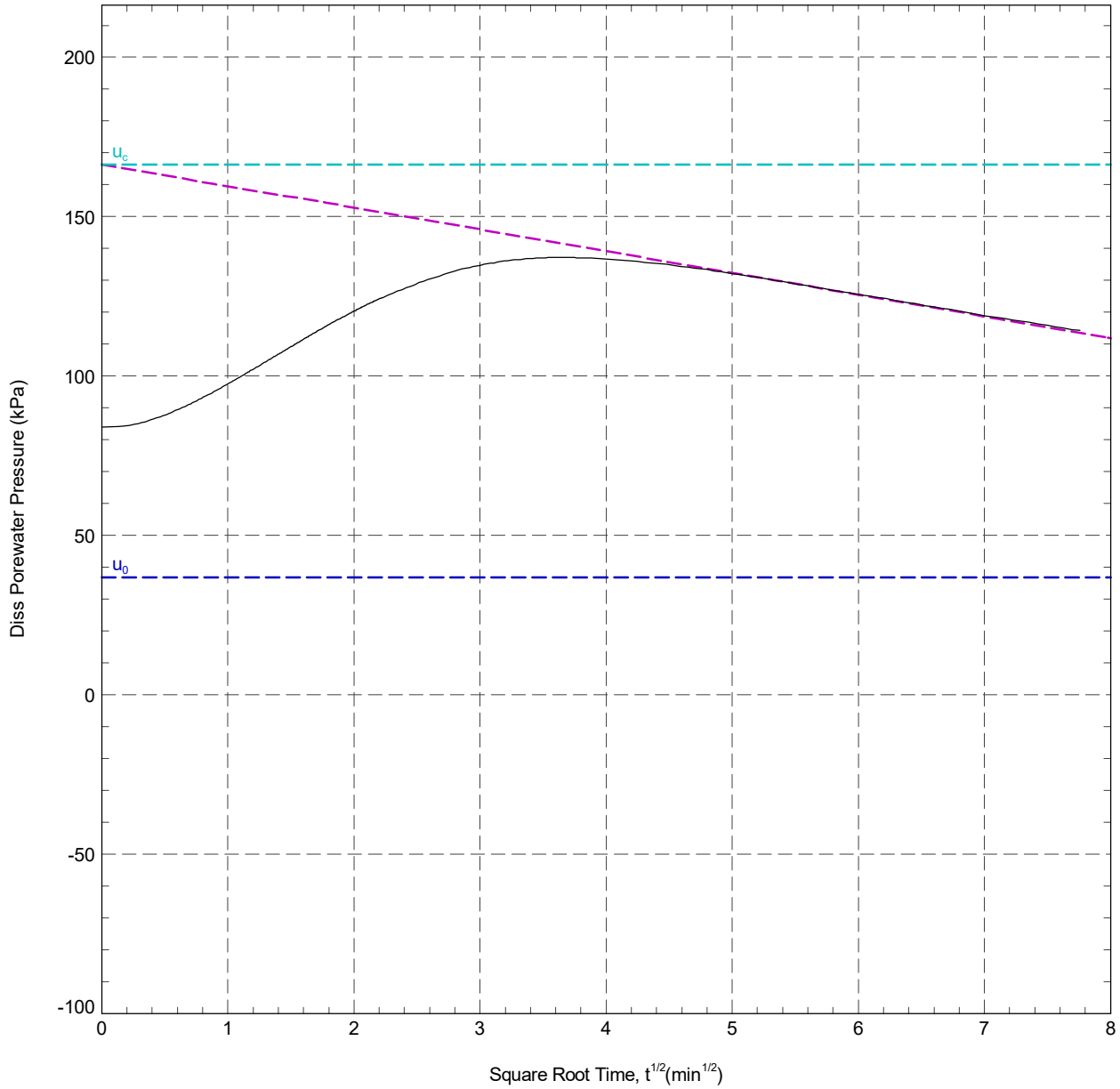
DISSIPATION TEST

LANKELMA

Test ID

CPT102 - 5.00 m

CLIENT : SOIL ENGINEERING	EASTING : 566334.1 m	SHEET : 1 OF 1
PROJECT : TILBURY	NORTHING : 175912.2 m	DATE : 08/05/25
LOCATION : Essex, UK	COORD. SYS. :	
PROJECT No. : 25-32-29428-1	ELEVATION : 2.72 m	



In Situ Pore Pressure, u_0:	36.79
Corrected Initial Pore Pressure, u_c (back extrapolated from linear decay):	166.40
Interpreted Degree Dissipation:	40.2 %
Time for 40.2% Dissipation, $t_{40.2}$:	60.20 min

RIG : UK3_	REMARK
CONE ID : S15-CFIPTTM250.2116	*CIP
OPERATOR : Tom Freeland	

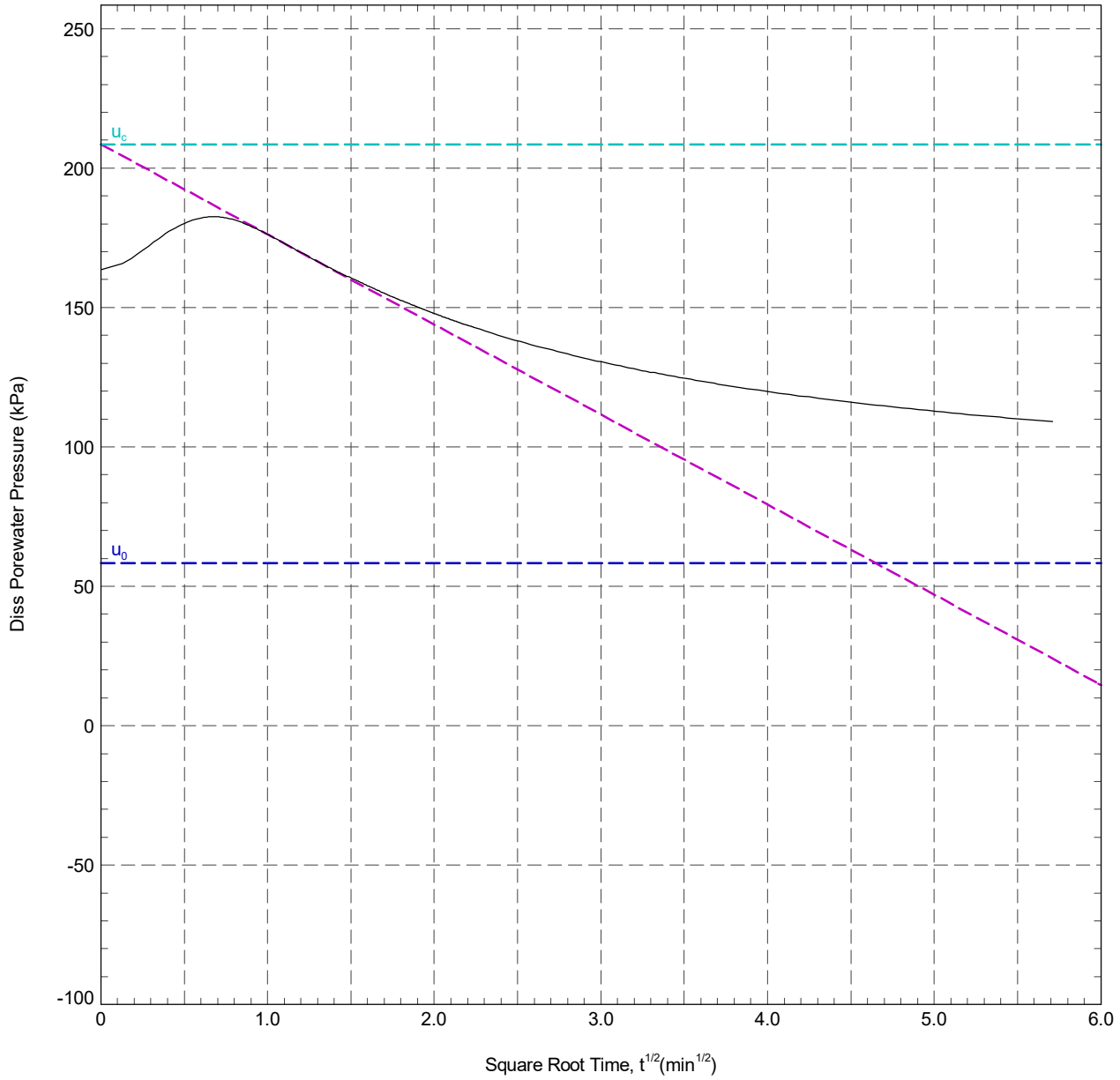
DISSIPATION TEST

LANKELMA

Test ID

CPT102 - 7.20 m

CLIENT : SOIL ENGINEERING	EASTING : 566334.1 m	SHEET : 1 OF 1
PROJECT : TILBURY	NORTHING : 175912.2 m	DATE : 08/05/25
LOCATION : Essex, UK	COORD. SYS. :	
PROJECT No. : 25-32-29428-1	ELEVATION : 2.72 m	



In Situ Pore Pressure, u_0:	58.37
Corrected Initial Pore Pressure, u_c (back extrapolated from linear decay):	208.50
Interpreted Degree Dissipation:	50 %
Time for 50% Dissipation, t_{50}:	7.68 min

RIG	: UK3_
CONE ID	: S15-CFIPTTM250.2116
OPERATOR	: Tom Freeland

REMARK

*CIP

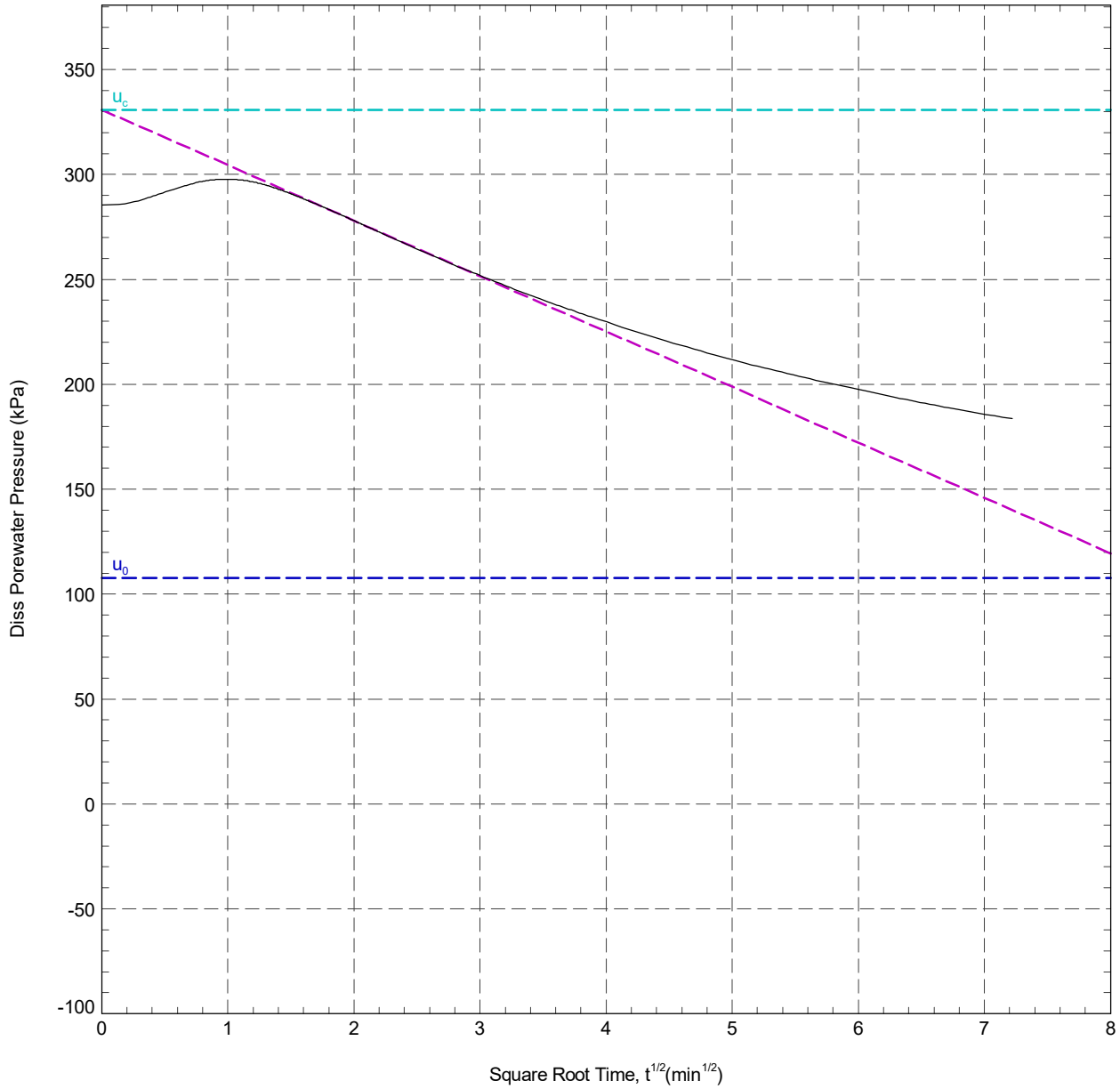
DISSIPATION TEST

LANKELMA

Test ID

CPT102 - 12.24 m

CLIENT : SOIL ENGINEERING	EASTING : 566334.1 m	SHEET : 1 OF 1
PROJECT : TILBURY	NORTHING : 175912.2 m	DATE : 08/05/25
LOCATION : Essex, UK	COORD. SYS. :	
PROJECT No. : 25-32-29428-1	ELEVATION : 2.72 m	



In Situ Pore Pressure, u_0:	107.81
Corrected Initial Pore Pressure, u_c (back extrapolated from linear decay):	330.80
Interpreted Degree Dissipation:	50 %
Time for 50% Dissipation, t_{50}:	20.55 min

RIG : UK3_	REMARK
CONE ID : S15-CFIPTTM250.2116	*CIP
OPERATOR : Tom Freeland	

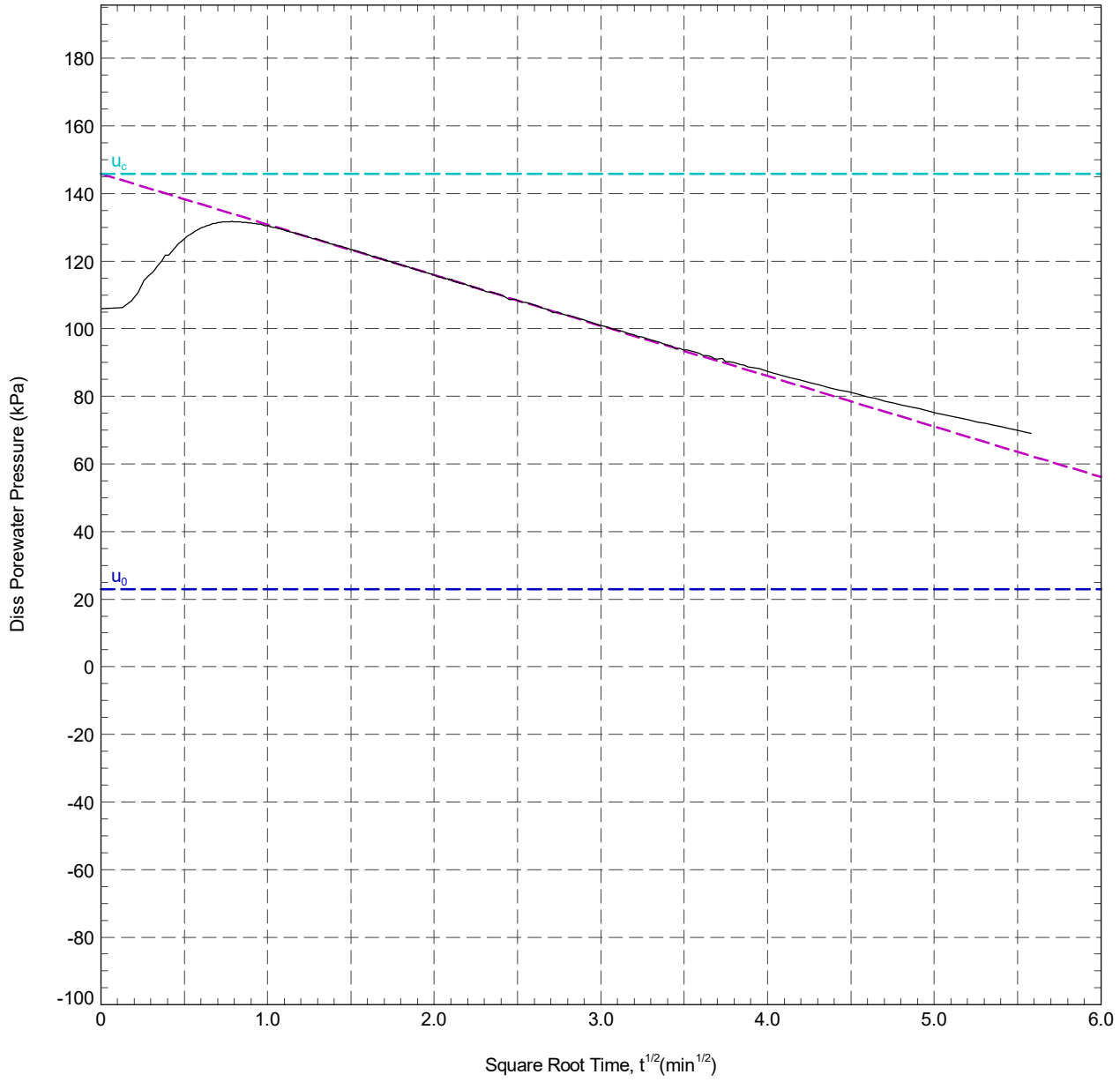
DISSIPATION TEST

LANKELMA

Test ID

CPT103 - 4.00 m

CLIENT : SOIL ENGINEERING	EASTING : 566316.6 m	SHEET : 1 OF 1
PROJECT : TILBURY	NORTHING : 175907.2 m	DATE : 06/05/25
LOCATION : Essex, UK	COORD. SYS. :	
PROJECT No. : 25-32-29428-1	ELEVATION : 2.71 m	



In Situ Pore Pressure, u_0:	22.96
Corrected Initial Pore Pressure, u_c (back extrapolated from linear decay):	145.80
Interpreted Degree Dissipation:	50 %
Time for 50% Dissipation, t_{50}:	17.58 min

RIG : UK3_	REMARK
CONE ID : S15-CFIPTTM250.2116	*CIP
OPERATOR : Riley Trevelyan	

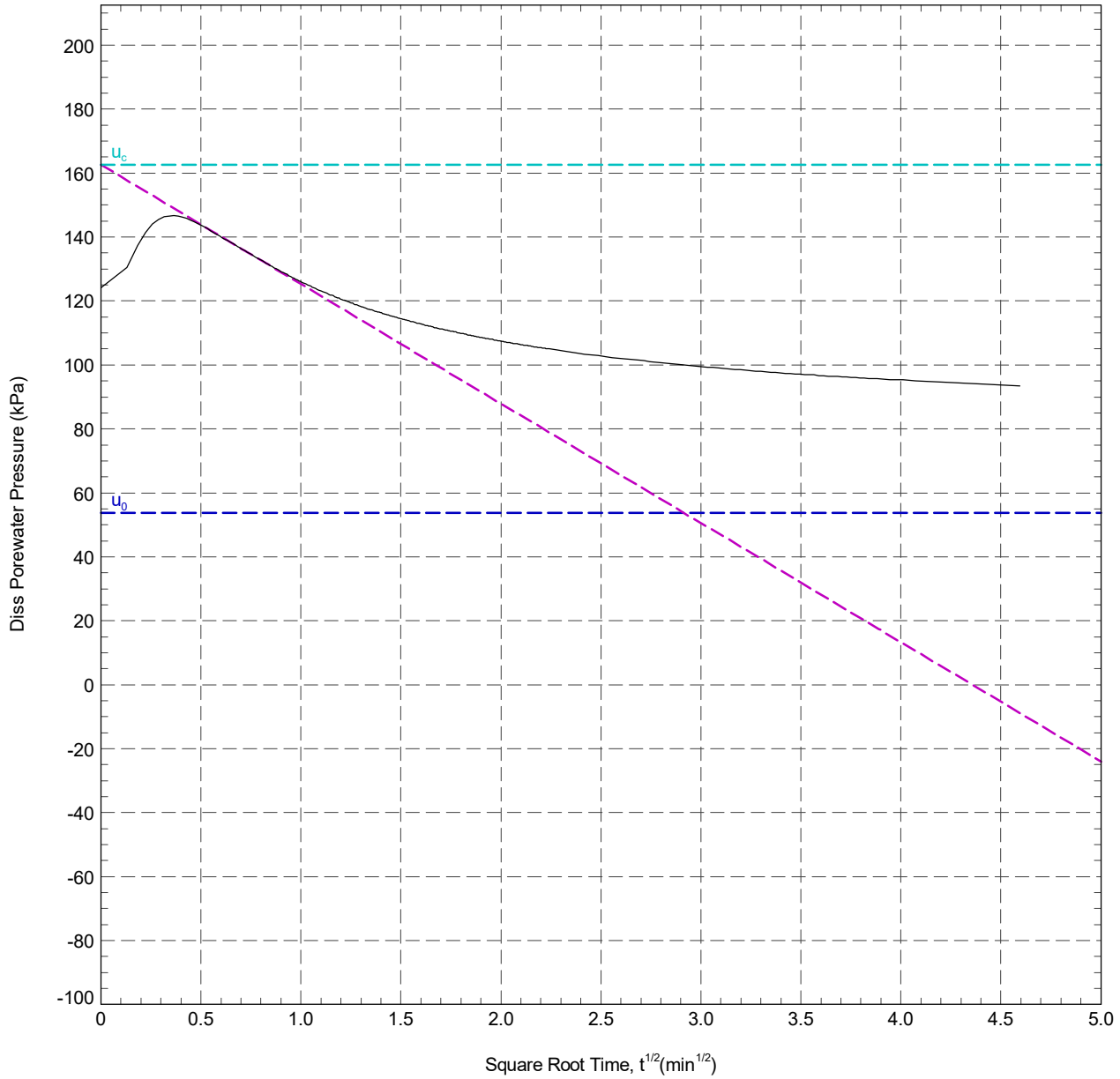
DISSIPATION TEST

LANKELMA

Test ID

CPT103 - 7.13 m

CLIENT : SOIL ENGINEERING	EASTING : 566316.6 m	SHEET : 1 OF 1
PROJECT : TILBURY	NORTHING : 175907.2 m	DATE : 06/05/25
LOCATION : Essex, UK	COORD. SYS. :	
PROJECT No. : 25-32-29428-1	ELEVATION : 2.71 m	



In Situ Pore Pressure, u_0:	53.66
Corrected Initial Pore Pressure, u_c (back extrapolated from linear decay):	162.60
Interpreted Degree Dissipation:	50 %
Time for 50% Dissipation, t_{50}:	3.75 min

RIG : UK3_	REMARK
CONE ID : S15-CFIPTTM250.2116	*CIP
OPERATOR : Riley Trevelyan	

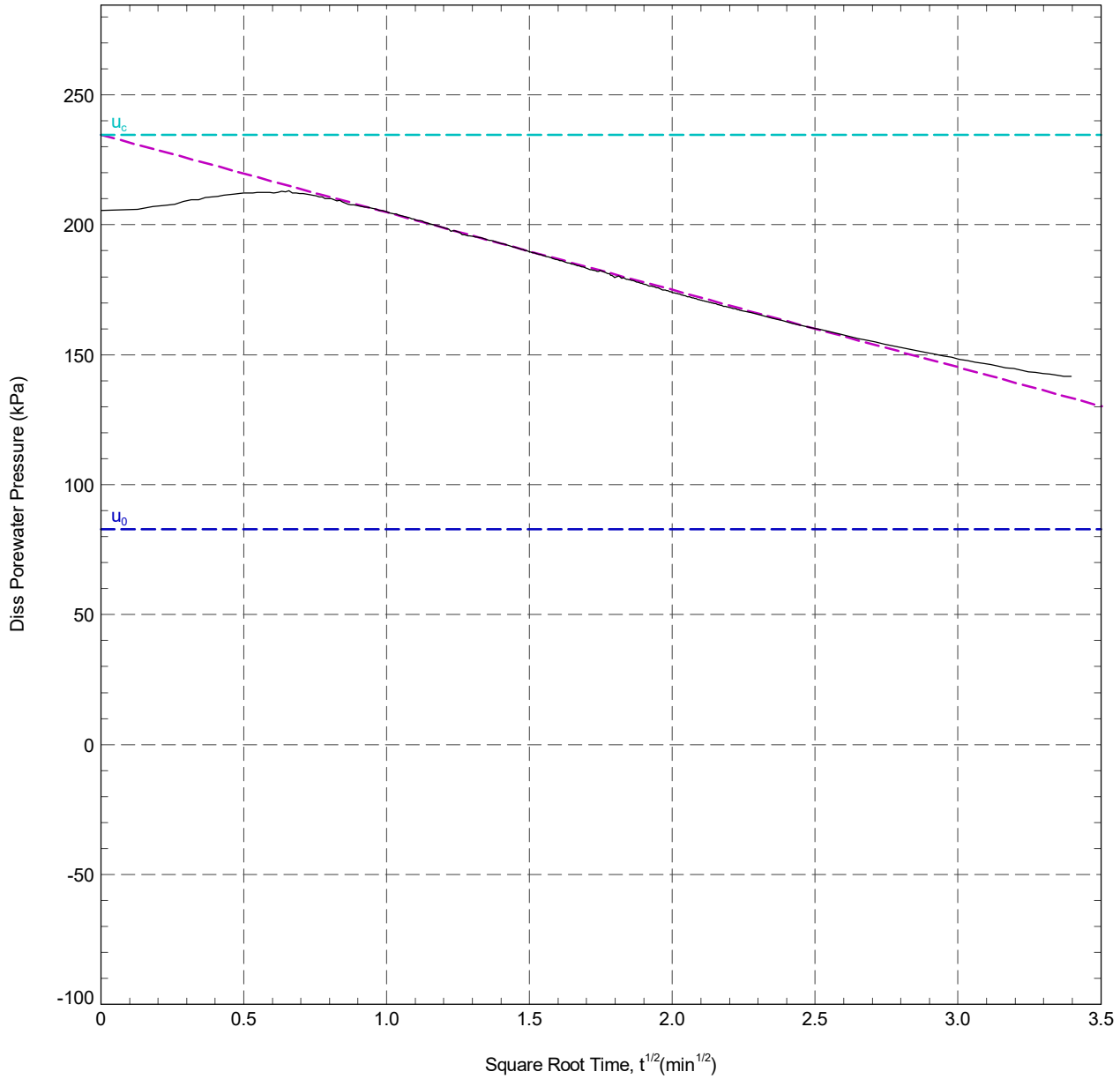
DISSIPATION TEST

LANKELMA

Test ID

CPT103 - 10.10 m

CLIENT : SOIL ENGINEERING	EASTING : 566316.6 m	SHEET : 1 OF 1
PROJECT : TILBURY	NORTHING : 175907.2 m	DATE : 06/05/25
LOCATION : Essex, UK	COORD. SYS. :	
PROJECT No. : 25-32-29428-1	ELEVATION : 2.71 m	



In Situ Pore Pressure, u_0:	82.80
Corrected Initial Pore Pressure, u_c (back extrapolated from linear decay):	234.60
Interpreted Degree Dissipation:	50 %
Time for 50% Dissipation, t_{50}:	6.52 min

RIG : UK3_	REMARK
CONE ID : S15-CFIPTTM250.2116	*CIP
OPERATOR : Riley Trevelyan	

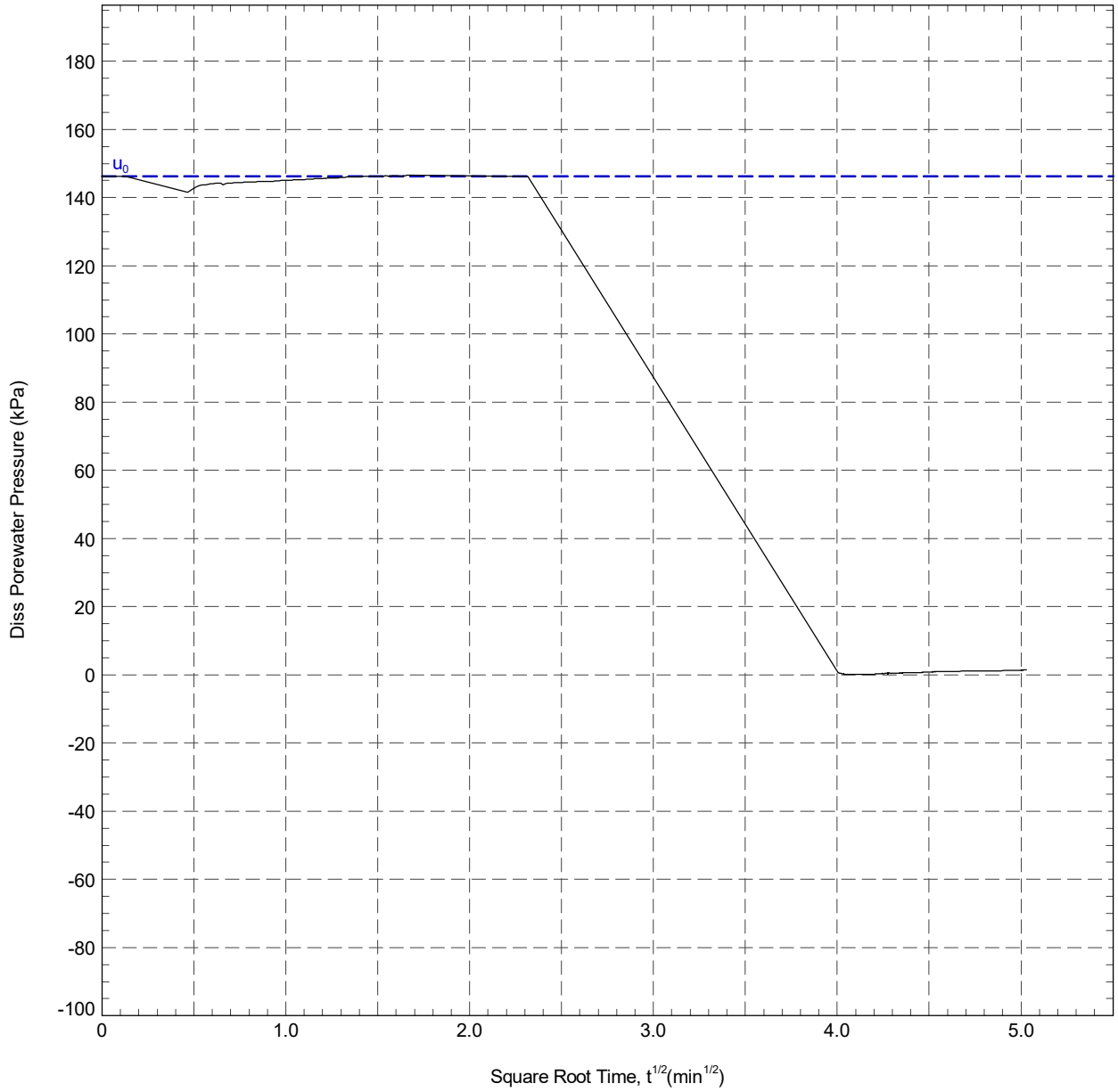
DISSIPATION TEST

LANKELMA

Test ID

CPT103 - 16.56 m

CLIENT : SOIL ENGINEERING	EASTING : 566316.6 m	SHEET : 1 OF 1
PROJECT : TILBURY	NORTHING : 175907.2 m	DATE : 06/05/25
LOCATION : Essex, UK	COORD. SYS. :	
PROJECT No. : 25-32-29428-1	ELEVATION : 2.71 m	



In Situ Pore Pressure, u_0: 146.20

RIG : UK3_	REMARK
CONE ID : S15-CFIPTTM250.2116	*U0, *NEP, *NI
OPERATOR : Riley Trevelyan	

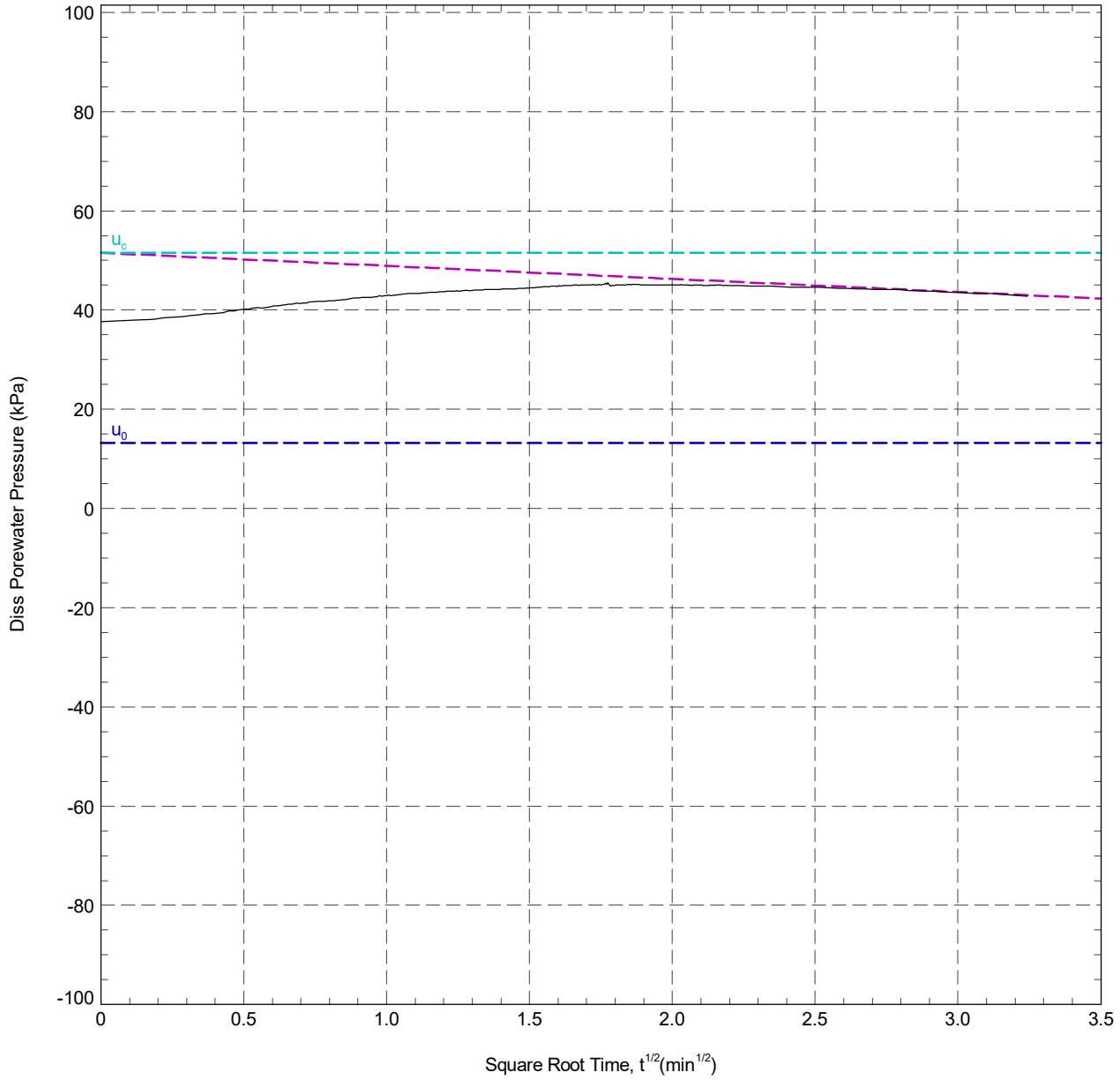
DISSIPATION TEST

LANKELMA

Test ID

CPT104 - 2.14 m

CLIENT : SOIL ENGINEERING	EASTING : 567408.7 m	SHEET : 1 OF 1
PROJECT : TILBURY	NORTHING : 174141.9 m	DATE : 14/05/25
LOCATION : Essex, UK	COORD. SYS. :	
PROJECT No. : 25-32-29428-1	ELEVATION : 2.26 m	



In Situ Pore Pressure, u_0: 13.24

Corrected Initial Pore Pressure, u_c
(back extrapolated from linear decay): 51.50

RIG : UK3_		REMARK
CONE ID : S15-CFIPTTM250.2116		*IEP, *NI
OPERATOR : Tom Freeland		

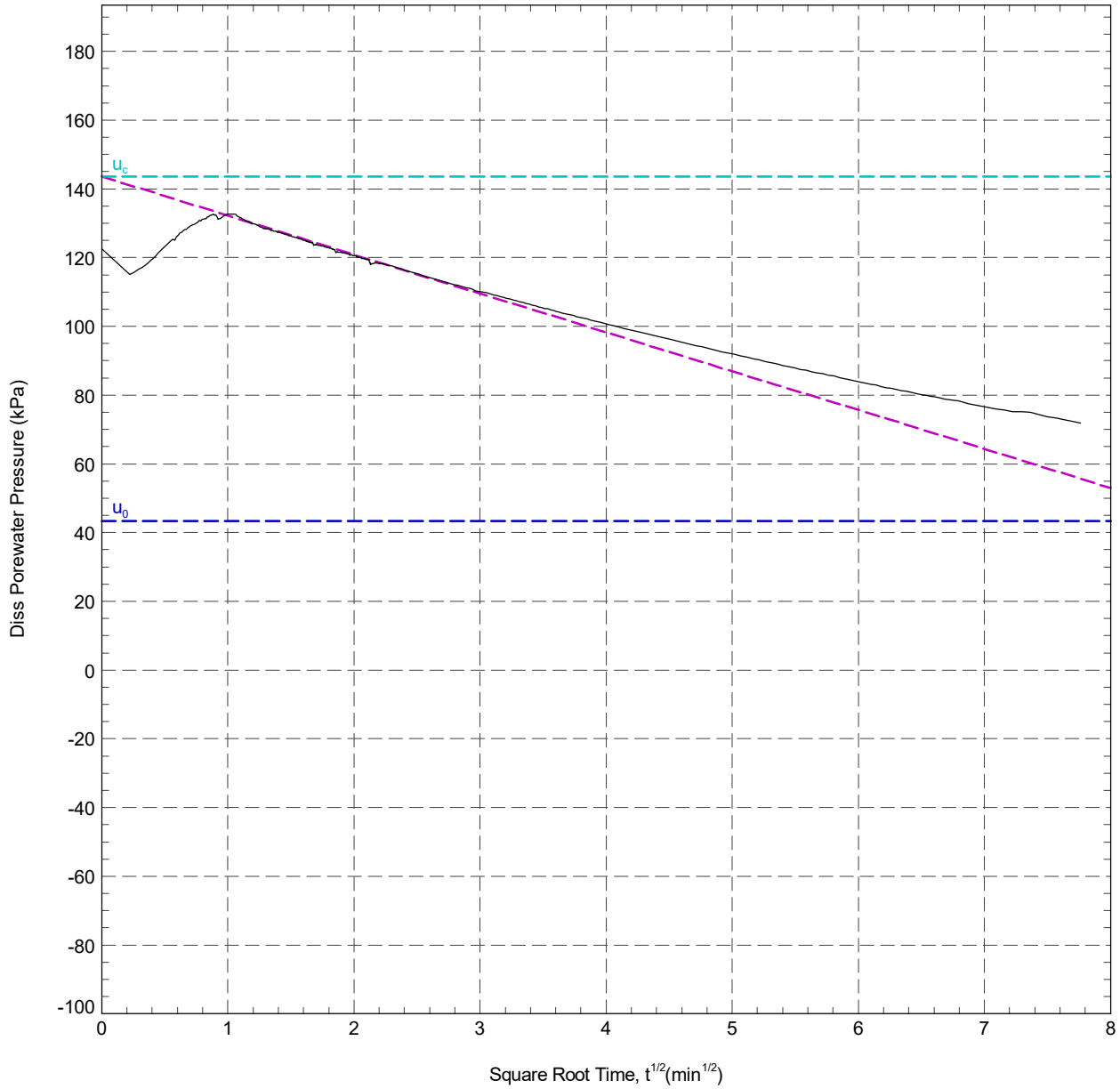
DISSIPATION TEST

LANKELMA

Test ID

CPT104 - 5.21 m

CLIENT : SOIL ENGINEERING	EASTING : 567408.7 m	SHEET : 1 OF 1
PROJECT : TILBURY	NORTHING : 174141.9 m	DATE : 14/05/25
LOCATION : Essex, UK	COORD. SYS. :	
PROJECT No. : 25-32-29428-1	ELEVATION : 2.26 m	



In Situ Pore Pressure, u_0:	43.36
Corrected Initial Pore Pressure, u_c (back extrapolated from linear decay):	143.50
Interpreted Degree Dissipation:	50 %
Time for 50% Dissipation, t_{50}:	23.18 min

RIG : UK3_	REMARK
CONE ID : S15-CFIPTTM250.2116	*CIP
OPERATOR : Tom Freeland	

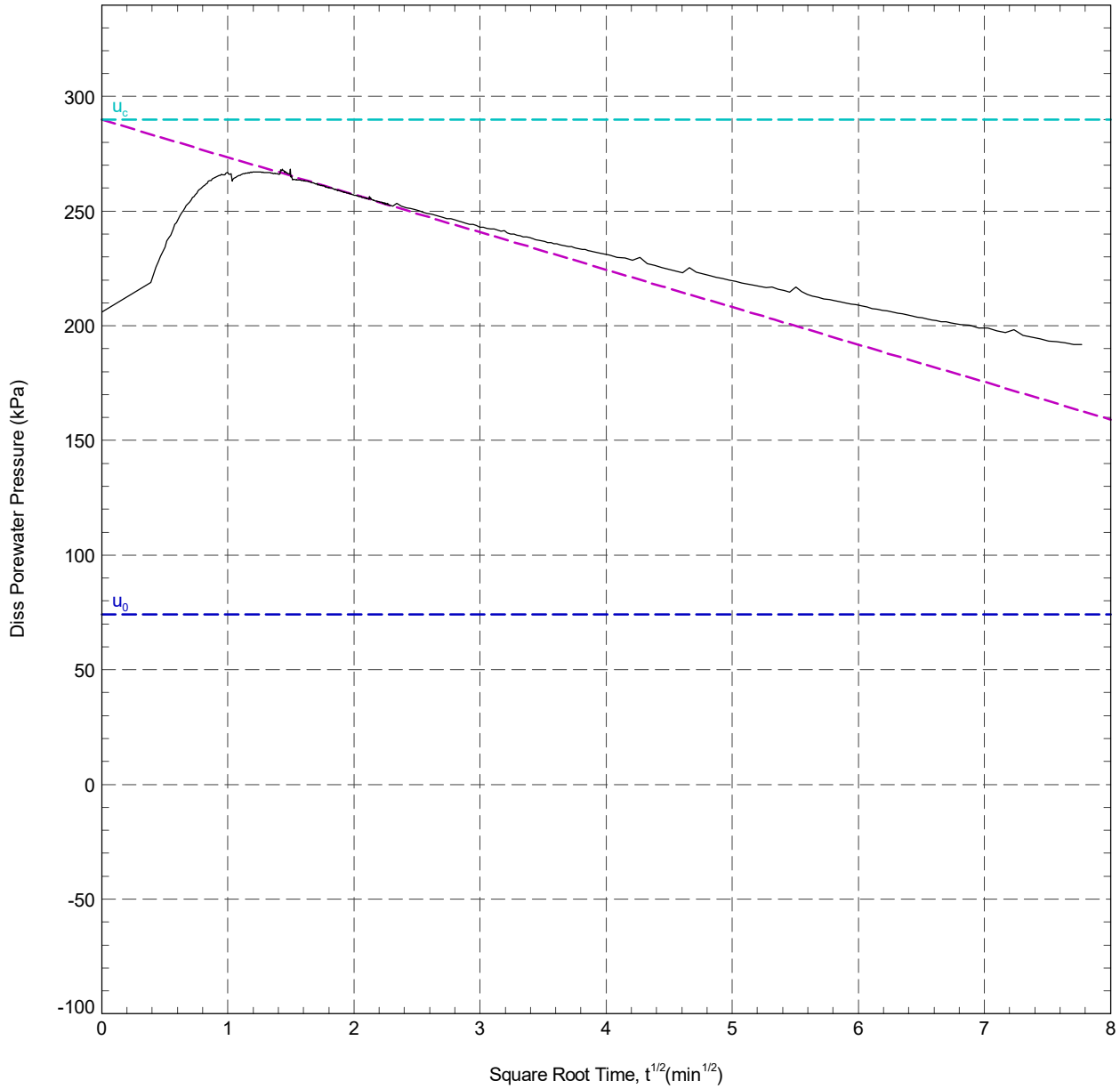
DISSIPATION TEST

LANKELMA

Test ID

CPT104 - 8.36 m

CLIENT : SOIL ENGINEERING	EASTING : 567408.7 m	SHEET : 1 OF 1
PROJECT : TILBURY	NORTHING : 174141.9 m	DATE : 14/05/25
LOCATION : Essex, UK	COORD. SYS. :	
PROJECT No. : 25-32-29428-1	ELEVATION : 2.26 m	



In Situ Pore Pressure, u_0:	74.26
Corrected Initial Pore Pressure, u_c (back extrapolated from linear decay):	289.90
Interpreted Degree Dissipation:	45.4 %
Time for 45.4% Dissipation, $t_{45.4}$:	60.40 min

RIG	: UK3_
CONE ID	: S15-CFIPTTM250.2116
OPERATOR	: Tom Freeland

REMARK

*CIP

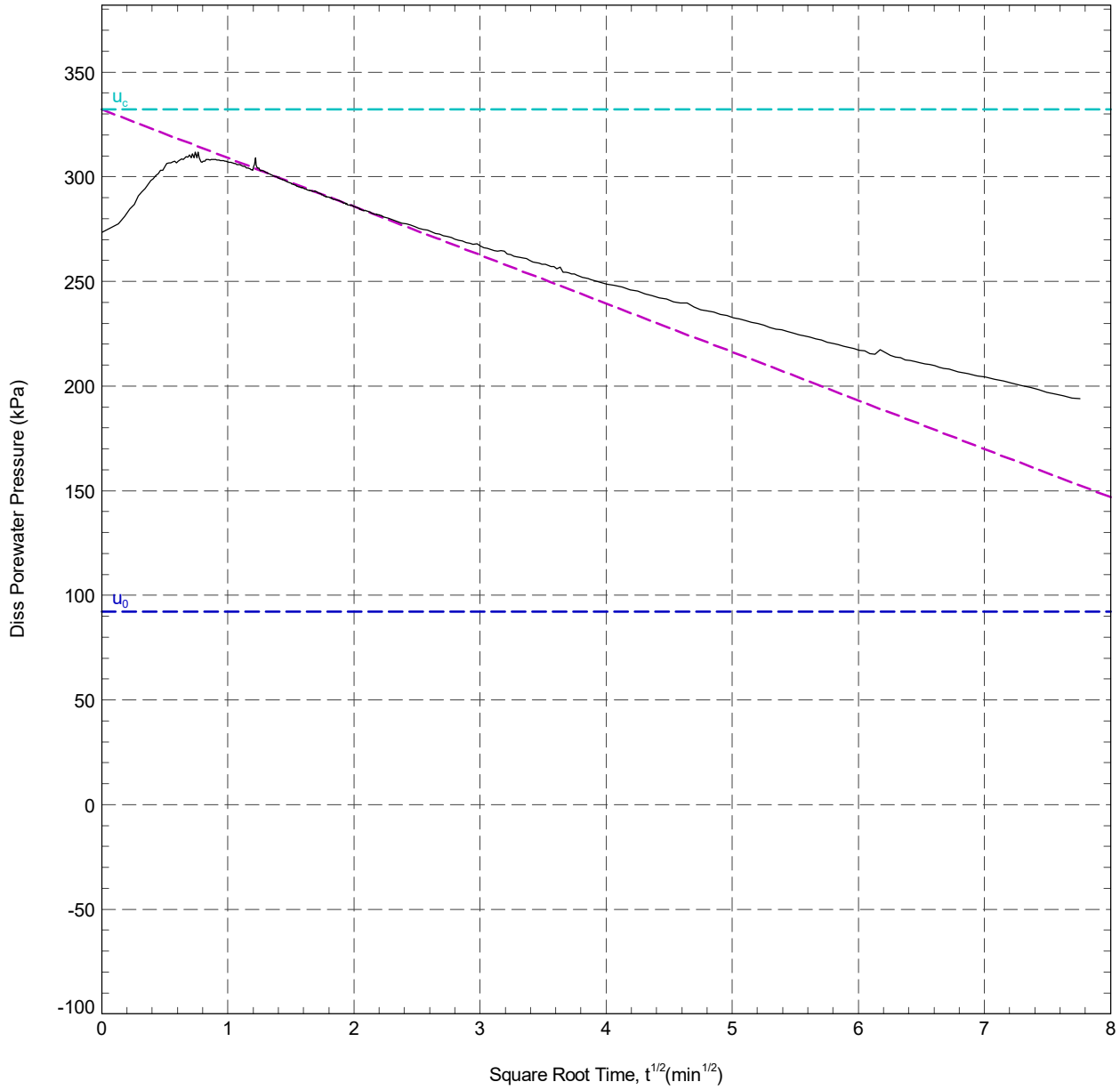
DISSIPATION TEST

LANKELMA

Test ID

CPT104 - 10.20 m

CLIENT : SOIL ENGINEERING	EASTING : 567408.7 m	SHEET : 1 OF 1
PROJECT : TILBURY	NORTHING : 174141.9 m	DATE : 14/05/25
LOCATION : Essex, UK	COORD. SYS. :	
PROJECT No. : 25-32-29428-1	ELEVATION : 2.26 m	



In Situ Pore Pressure, u_0:	92.31
Corrected Initial Pore Pressure, u_c (back extrapolated from linear decay):	332.10
Interpreted Degree Dissipation:	50 %
Time for 50% Dissipation, t_{50}:	40.62 min

RIG : UK3_	REMARK
CONE ID : S15-CFIPTTM250.2116	*CIP
OPERATOR : Tom Freeland	

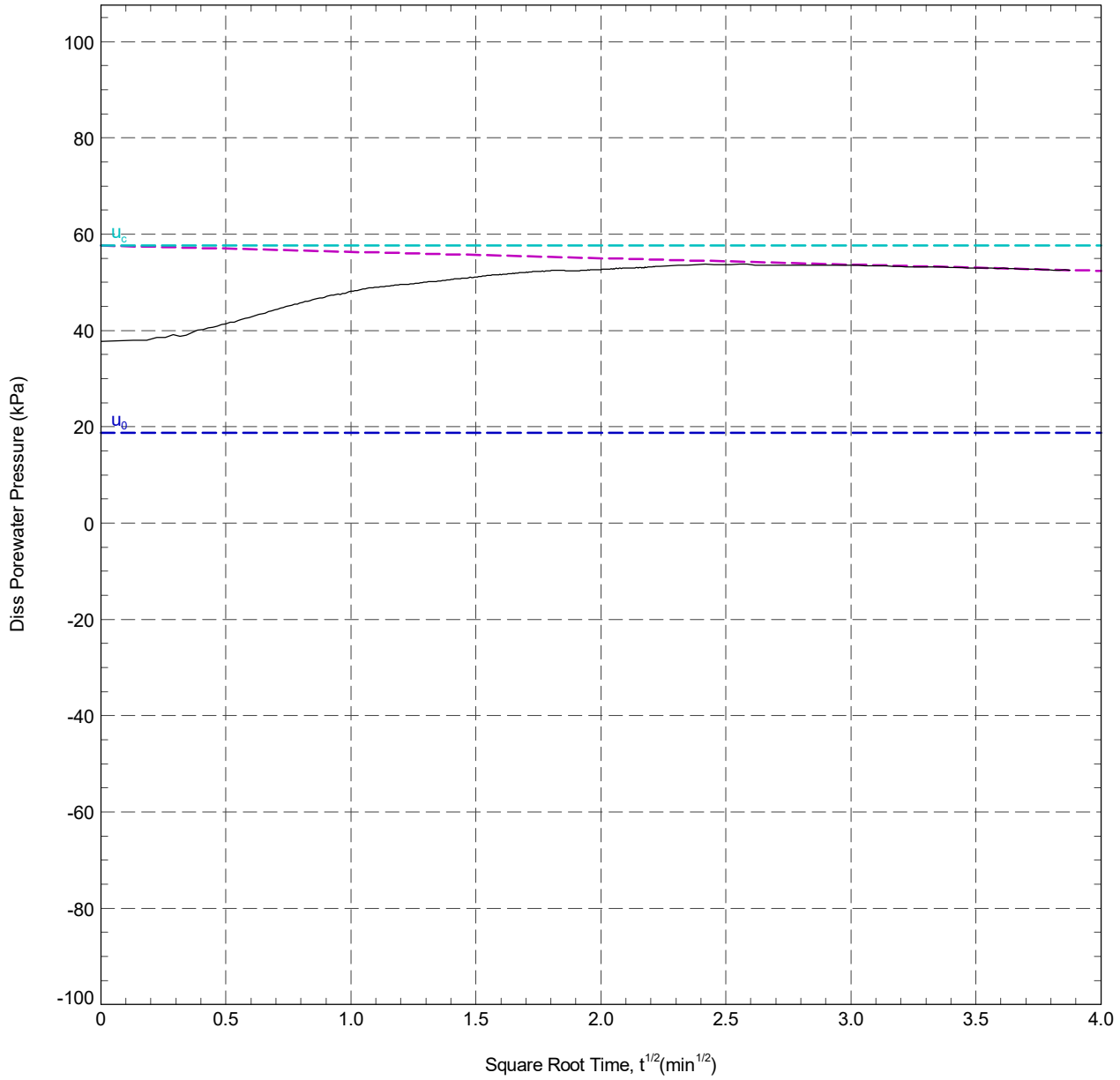
DISSIPATION TEST

LANKELMA

Test ID

CPT105 - 2.35 m

CLIENT : SOIL ENGINEERING	EASTING : 567426.4 m	SHEET : 1 OF 1
PROJECT : TILBURY	NORTHING : 174081.1 m	DATE : 15/05/25
LOCATION : Essex, UK	COORD. SYS. :	
PROJECT No. : 25-32-29428-1	ELEVATION : 2.30 m	



In Situ Pore Pressure, u_0: 18.74

Corrected Initial Pore Pressure, u_c
(back extrapolated from linear decay): 57.60

RIG : UK3_	REMARK
CONE ID : S15-CFIPTTM250.2116	*ID, *NI
OPERATOR : Tom Freeland	

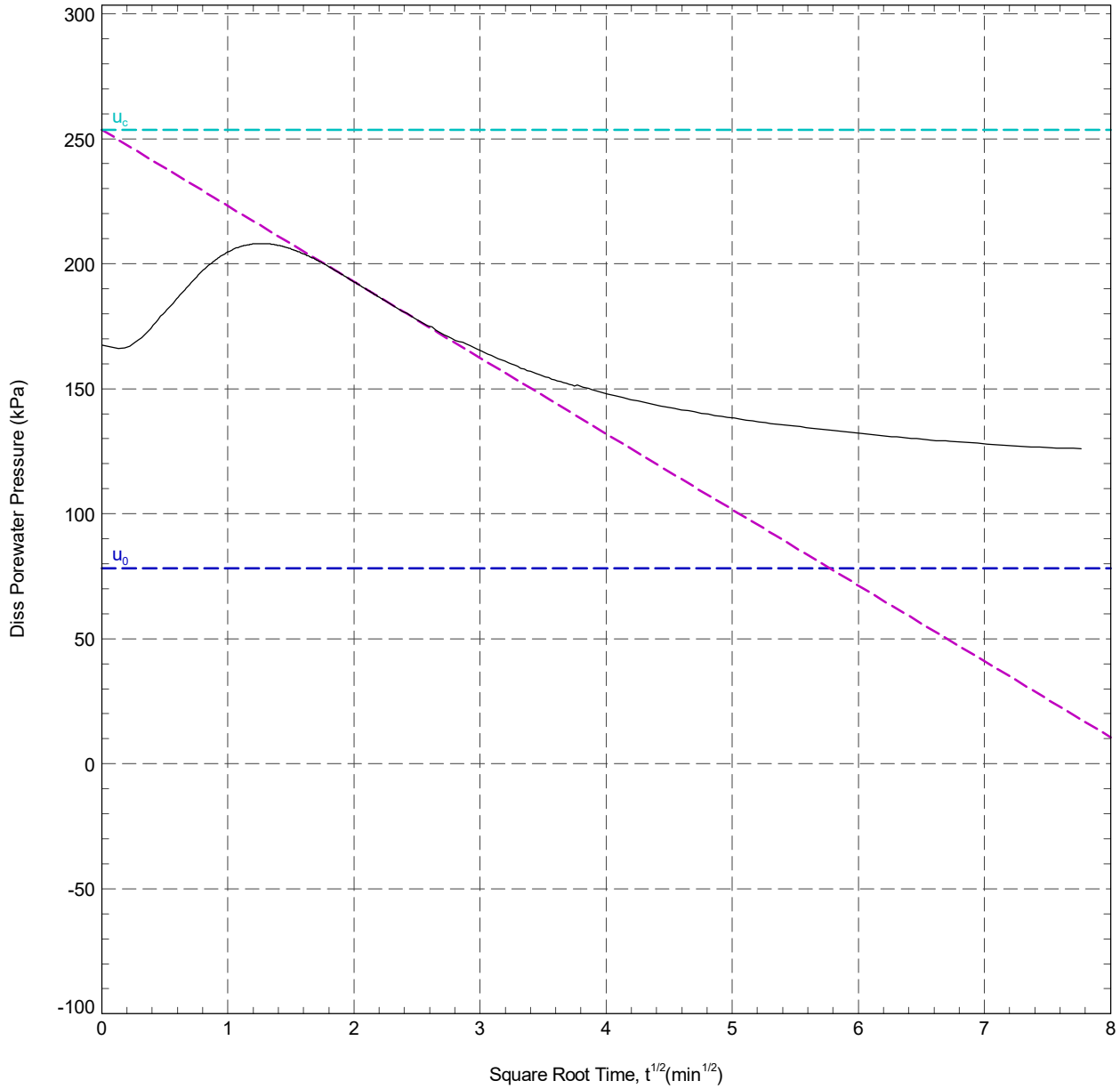
DISSIPATION TEST

LANKELMA

Test ID

CPT105 - 8.42 m

CLIENT : SOIL ENGINEERING	EASTING : 567426.4 m	SHEET : 1 OF 1
PROJECT : TILBURY	NORTHING : 174081.1 m	DATE : 15/05/25
LOCATION : Essex, UK	COORD. SYS. :	
PROJECT No. : 25-32-29428-1	ELEVATION : 2.30 m	



In Situ Pore Pressure, u_0:	78.28
Corrected Initial Pore Pressure, u_c (back extrapolated from linear decay):	253.50
Interpreted Degree Dissipation:	50 %
Time for 50% Dissipation, t_{50}:	8.87 min

RIG : UK3_	REMARK
CONE ID : S15-CFIPTTM250.2116	*CIP
OPERATOR : Tom Freeland	

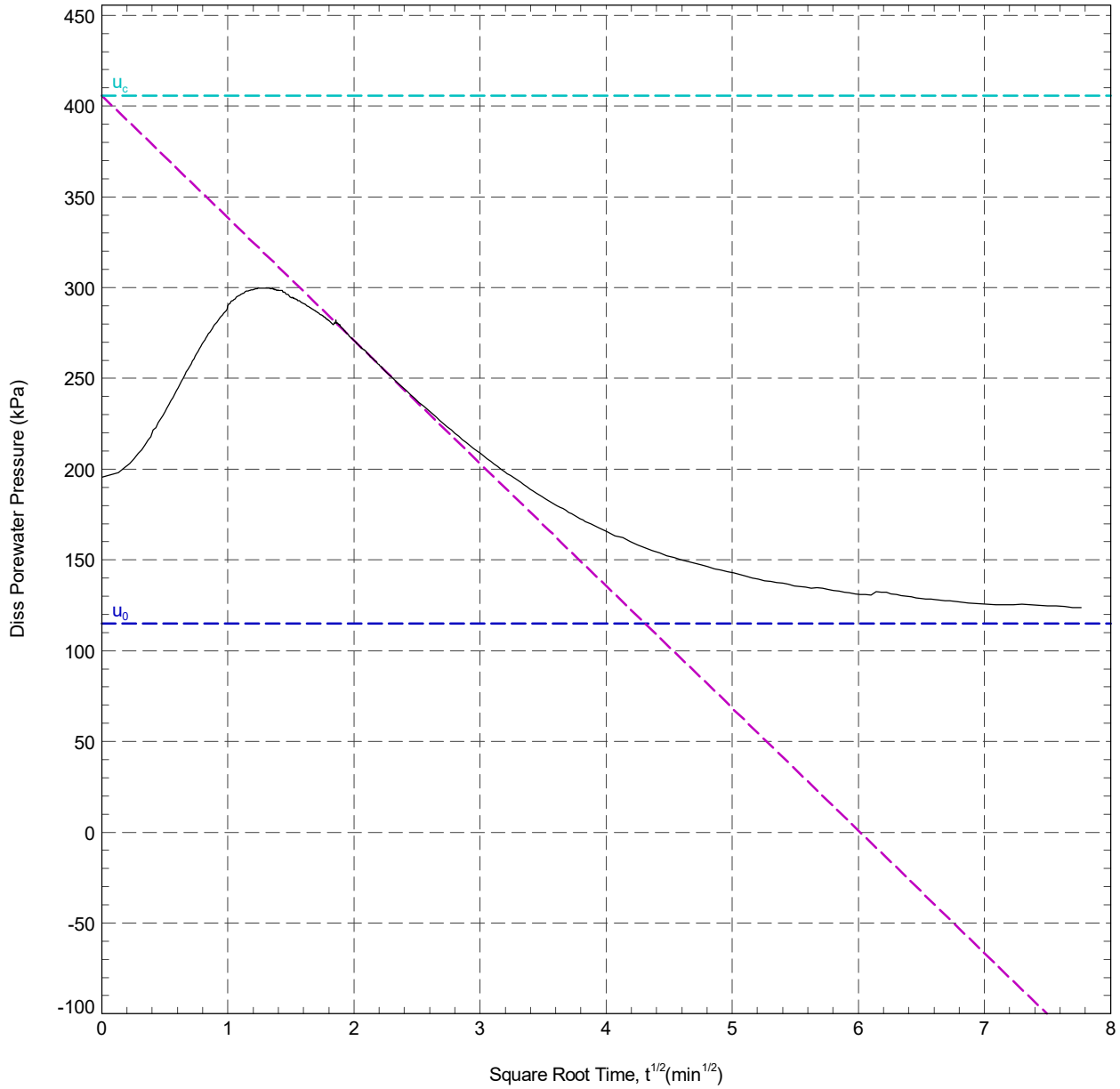
DISSIPATION TEST

LANKELMA

Test ID

CPT105 - 12.16 m

CLIENT : SOIL ENGINEERING	EASTING : 567426.4 m	SHEET : 1 OF 1
PROJECT : TILBURY	NORTHING : 174081.1 m	DATE : 15/05/25
LOCATION : Essex, UK	COORD. SYS. :	
PROJECT No. : 25-32-29428-1	ELEVATION : 2.30 m	



In Situ Pore Pressure, u_0:	114.97
Corrected Initial Pore Pressure, u_c (back extrapolated from linear decay):	405.70
Interpreted Degree Dissipation:	50 %
Time for 50% Dissipation, t_{50}:	4.65 min

RIG : UK3_	REMARK
CONE ID : S15-CFIPTTM250.2116	*ICIP
OPERATOR : Tom Freeland	

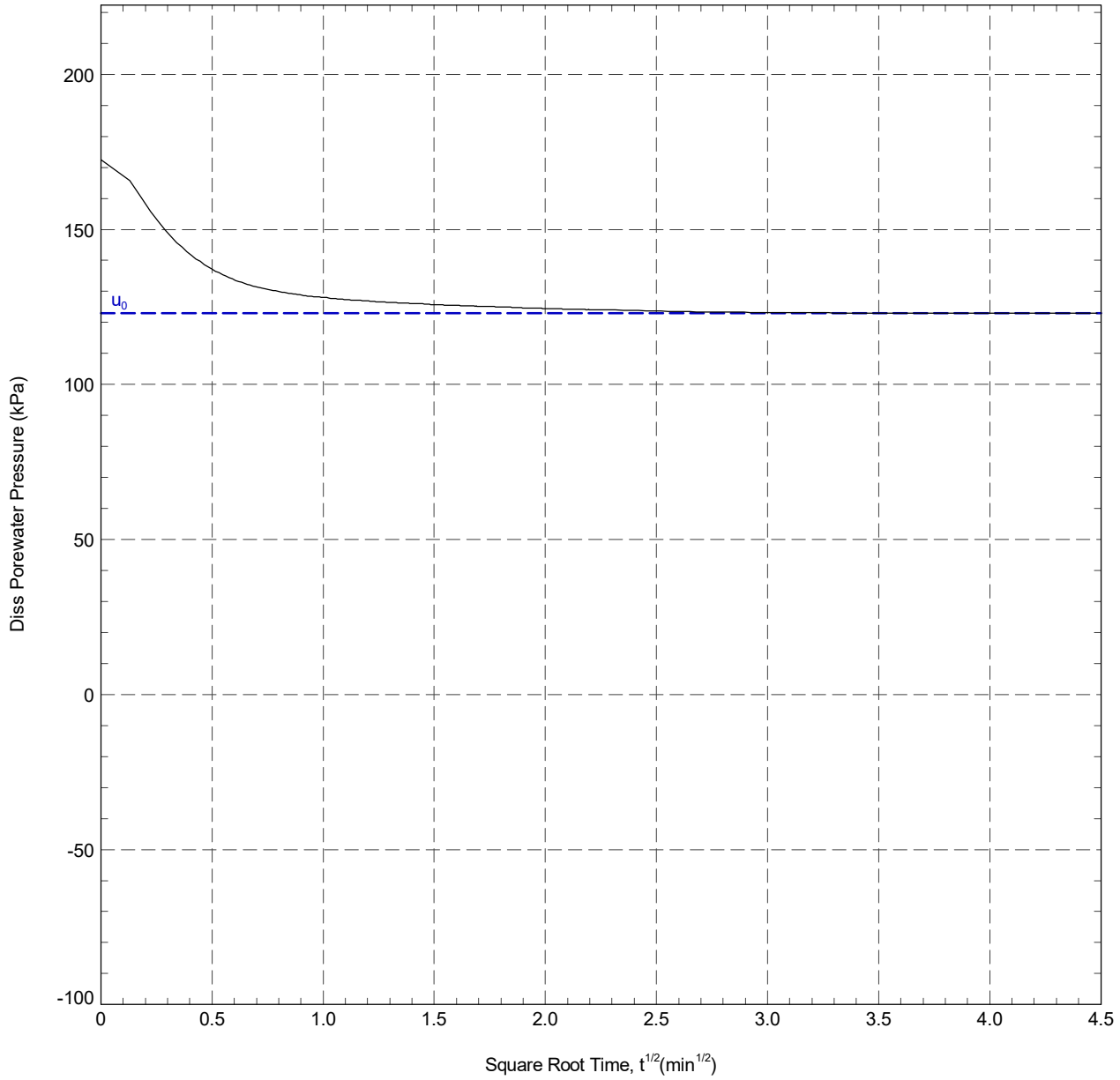
DISSIPATION TEST

LANKELMA

Test ID

CPT105 - 12.98 m

CLIENT : SOIL ENGINEERING	EASTING : 567426.4 m	SHEET : 1 OF 1
PROJECT : TILBURY	NORTHING : 174081.1 m	DATE : 15/05/25
LOCATION : Essex, UK	COORD. SYS. :	
PROJECT No. : 25-32-29428-1	ELEVATION : 2.30 m	



In Situ Pore Pressure, u_0: 123.00
Interpreted Degree Dissipation: 50 %
Time for 50% Dissipation, t_{50}: 0.10 min

RIG : UK3_	REMARK
CONE ID : S15-CFIPTTM250.2116	*PC, *LBI, *U0, *MD
OPERATOR : Tom Freeland	

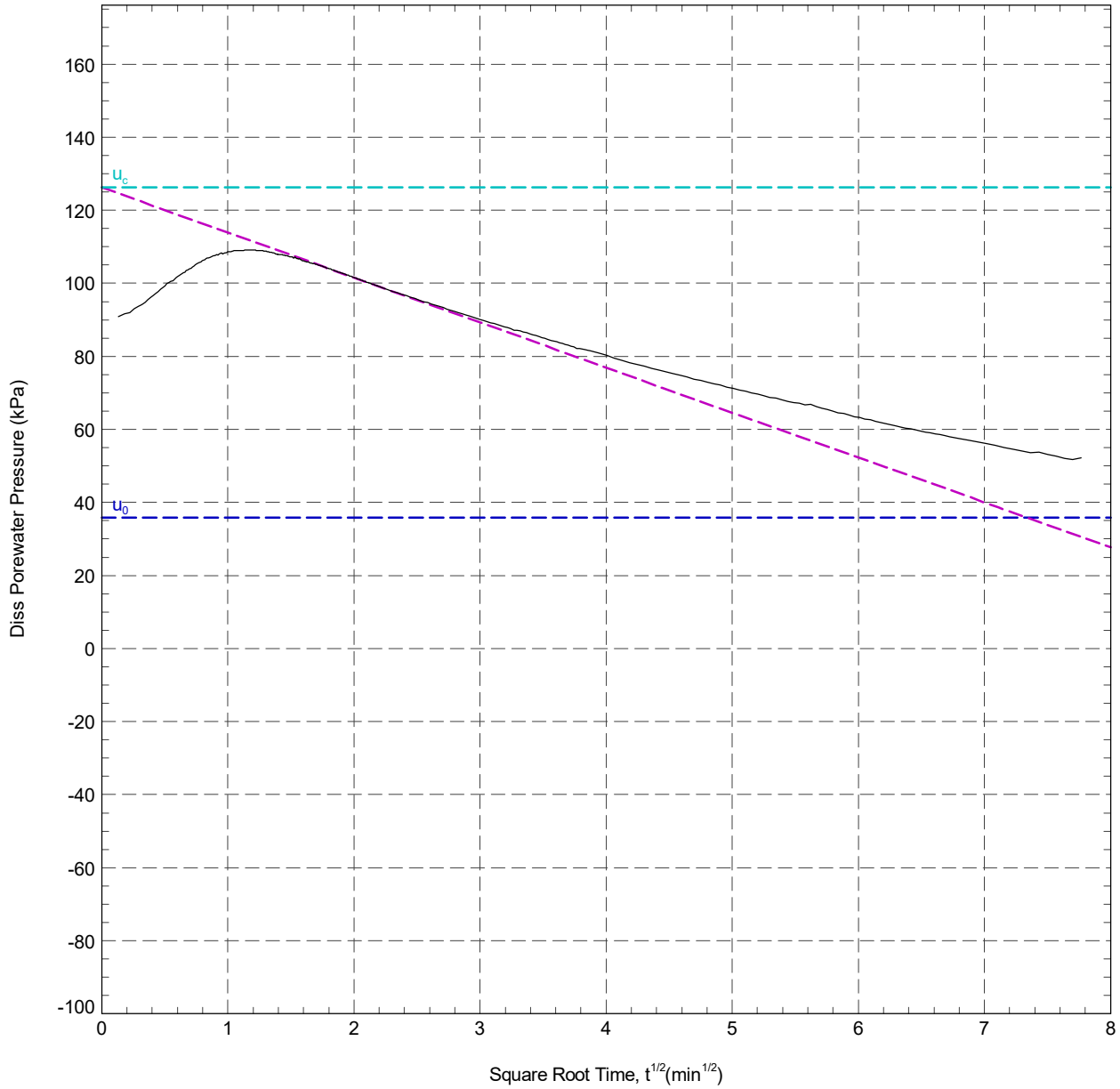
DISSIPATION TEST

LANKELMA

Test ID

CPT106 - 4.36 m

CLIENT : SOIL ENGINEERING	EASTING : 567428.3 m	SHEET : 1 OF 1
PROJECT : TILBURY	NORTHING : 174166.8 m	DATE : 13/05/25
LOCATION : Essex, UK	COORD. SYS. :	
PROJECT No. : 25-32-29428-1	ELEVATION : 2.18 m	



In Situ Pore Pressure, u_0:	35.81
Corrected Initial Pore Pressure, u_c (back extrapolated from linear decay):	126.20
Interpreted Degree Dissipation:	50 %
Time for 50% Dissipation, t_{50}:	15.02 min

RIG : UK3_	REMARK
CONE ID : S15-CFIPTTM250.2116	*CIP
OPERATOR : Tom Freeland	

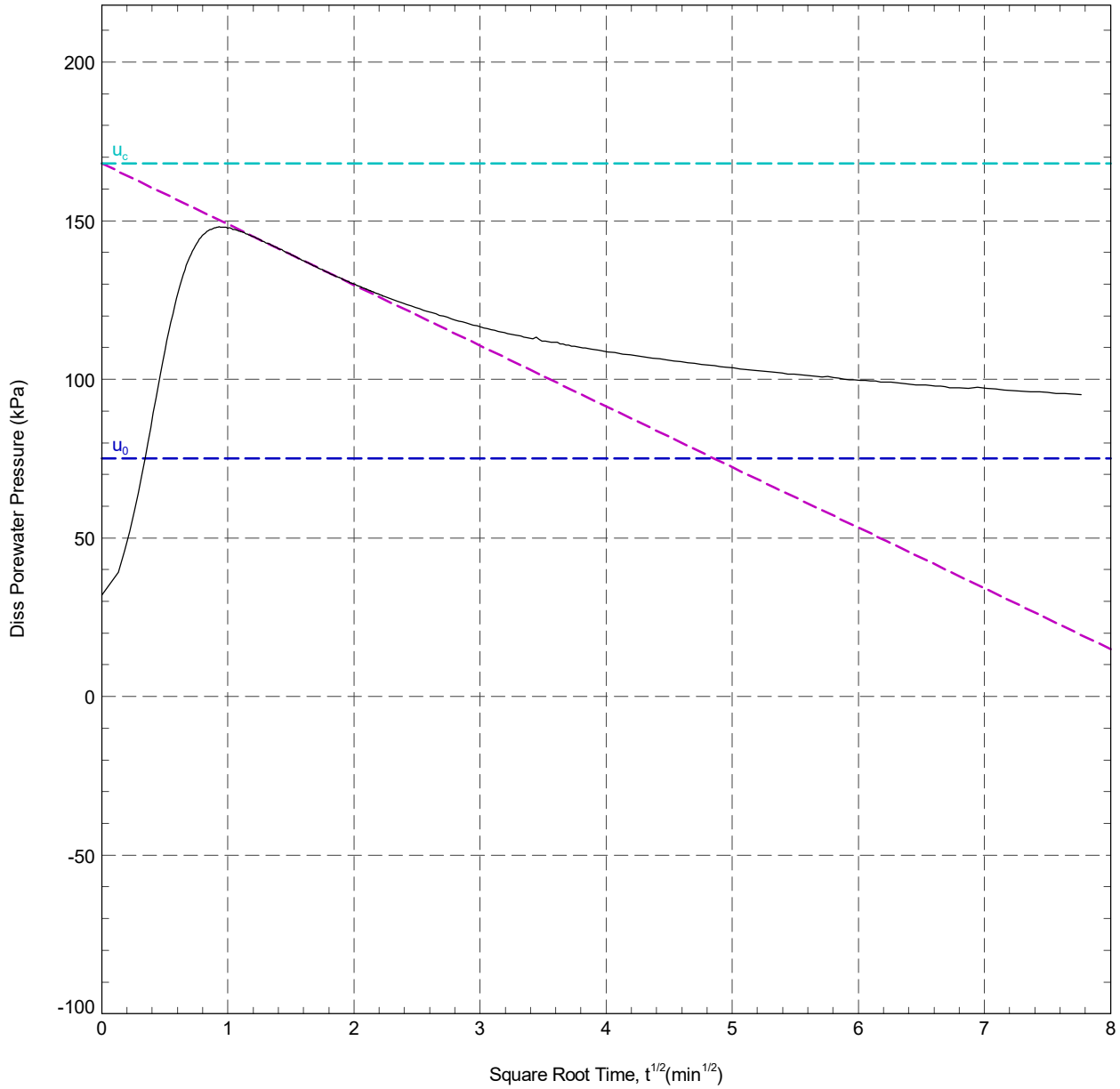
DISSIPATION TEST

LANKELMA

Test ID

CPT106 - 8.37 m

CLIENT : SOIL ENGINEERING	EASTING : 567428.3 m	SHEET : 1 OF 1
PROJECT : TILBURY	NORTHING : 174166.8 m	DATE : 13/05/25
LOCATION : Essex, UK	COORD. SYS. :	
PROJECT No. : 25-32-29428-1	ELEVATION : 2.18 m	



In Situ Pore Pressure, u_0:	75.14
Corrected Initial Pore Pressure, u_c (back extrapolated from linear decay):	168.00
Interpreted Degree Dissipation:	50 %
Time for 50% Dissipation, t_{50}:	6.52 min

RIG : UK3_	REMARK
CONE ID : S15-CFIPTTM250.2116	*CIP
OPERATOR : Tom Freeland	

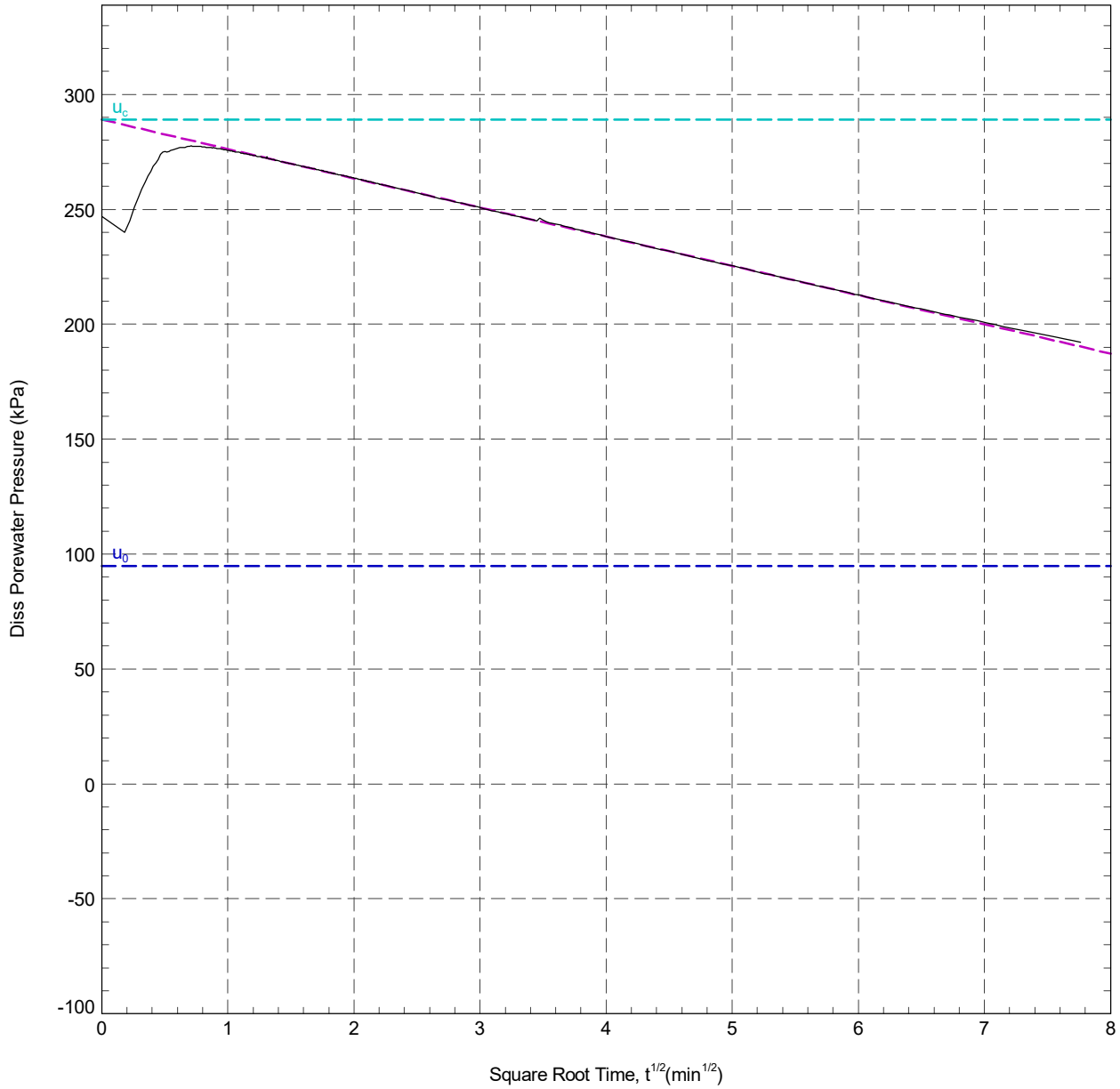
DISSIPATION TEST

LANKELMA

Test ID

CPT106 - 10.37 m

CLIENT : SOIL ENGINEERING	EASTING : 567428.3 m	SHEET : 1 OF 1
PROJECT : TILBURY	NORTHING : 174166.8 m	DATE : 13/05/25
LOCATION : Essex, UK	COORD. SYS. :	
PROJECT No. : 25-32-29428-1	ELEVATION : 2.18 m	



In Situ Pore Pressure, u_0:	94.76
Corrected Initial Pore Pressure, u_c (back extrapolated from linear decay):	288.90
Interpreted Degree Dissipation:	49.9 %
Time for 49.9% Dissipation, $t_{49.9}$:	60.27 min

RIG	: UK3_
CONE ID	: S15-CFIPTTM250.2116
OPERATOR	: Tom Freeland

REMARK

*CIP

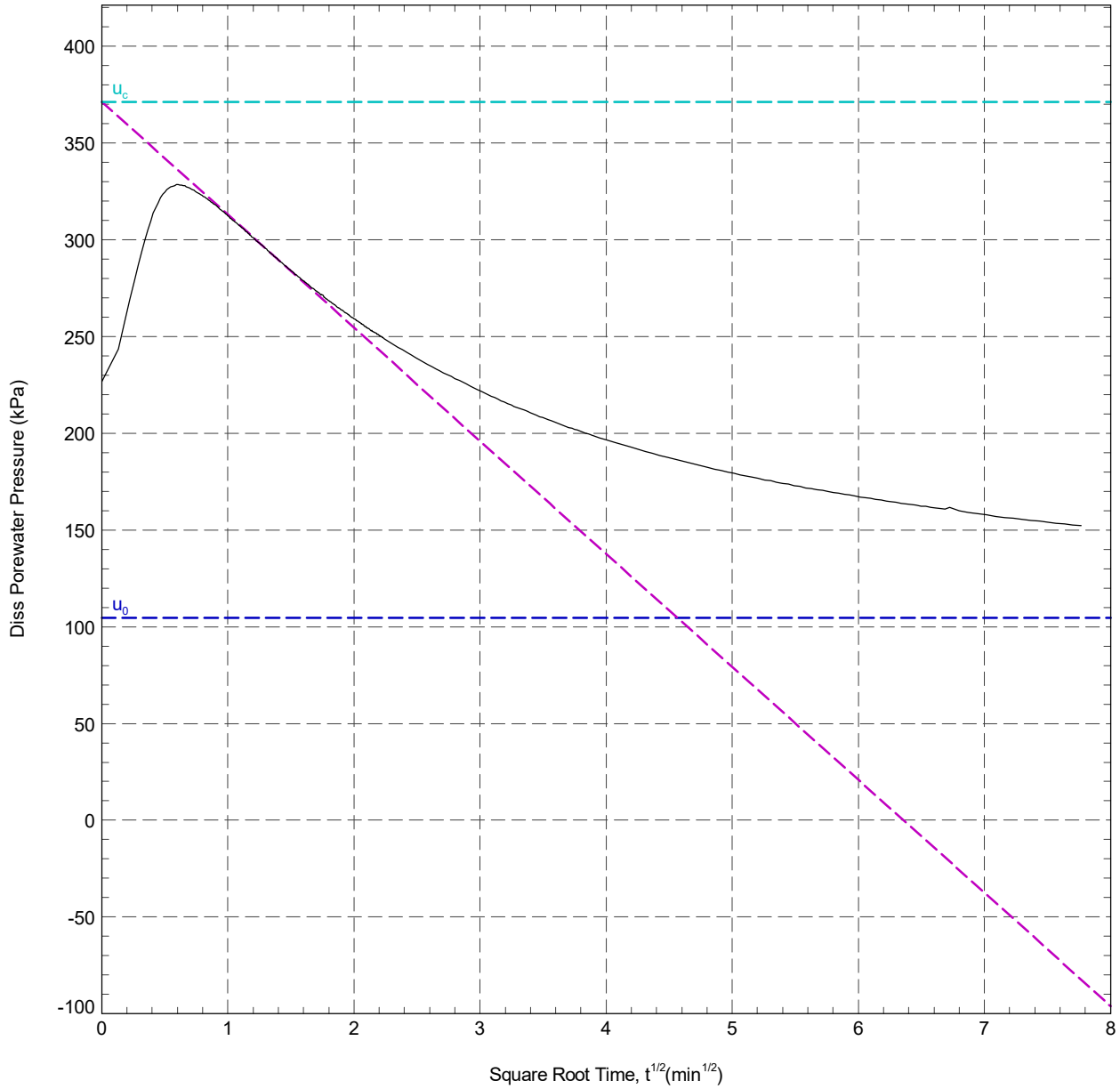
DISSIPATION TEST

LANKELMA

Test ID

CPT106 - 11.37 m

CLIENT : SOIL ENGINEERING	EASTING : 567428.3 m	SHEET : 1 OF 1
PROJECT : TILBURY	NORTHING : 174166.8 m	DATE : 13/05/25
LOCATION : Essex, UK	COORD. SYS. :	
PROJECT No. : 25-32-29428-1	ELEVATION : 2.18 m	



In Situ Pore Pressure, u_0:	104.57
Corrected Initial Pore Pressure, u_c (back extrapolated from linear decay):	371.30
Interpreted Degree Dissipation:	50 %
Time for 50% Dissipation, t_{50}:	6.35 min

RIG : UK3_	REMARK
CONE ID : S15-CFIPTTM250.2116	*CIP
OPERATOR : Tom Freeland	

APPENDIX I SEISMIC TEST RESULTS 1 – V_S, G_0

Small strain shear modulus

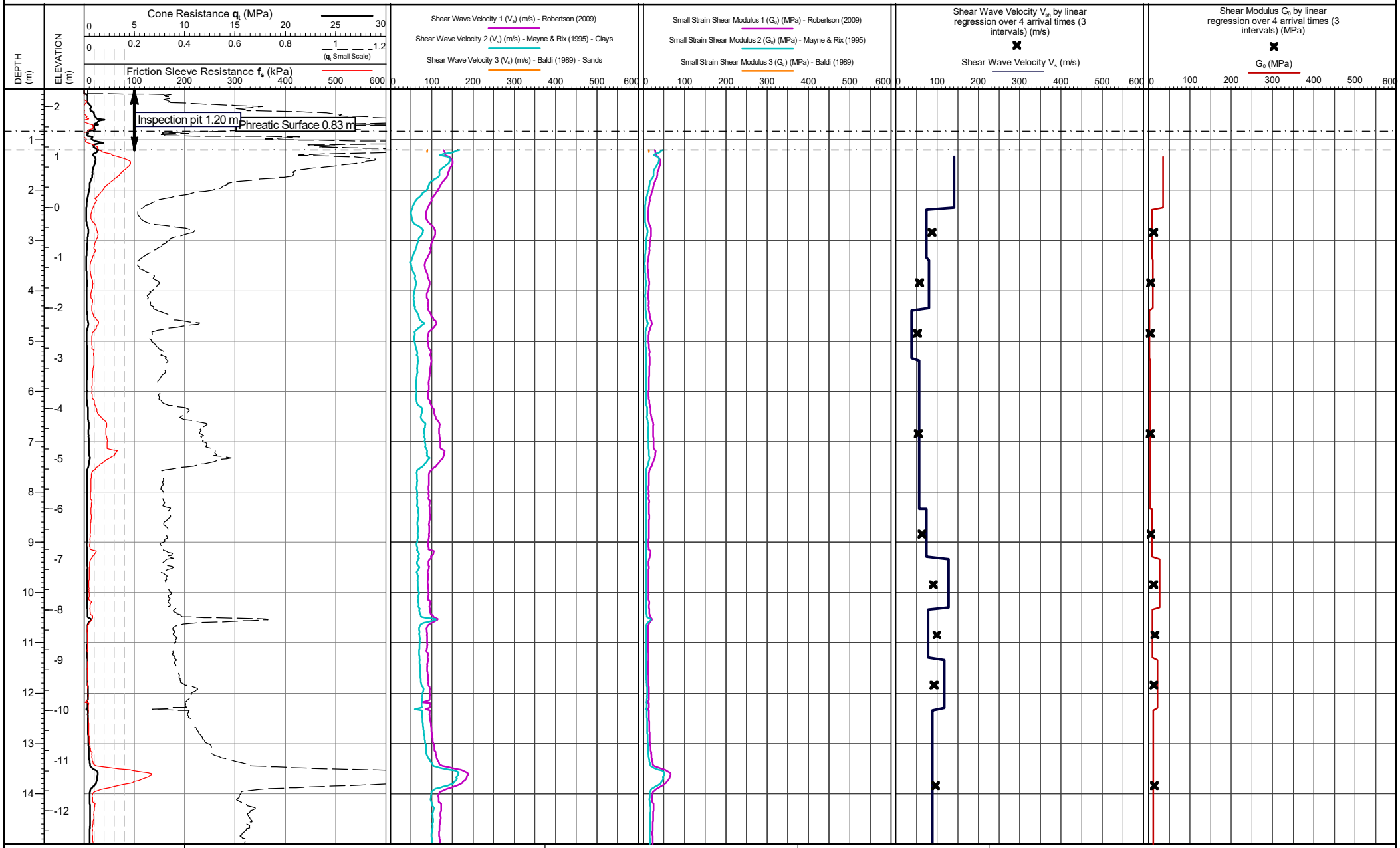
Shear wave velocity

Plots are provided for all seismic locations

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING

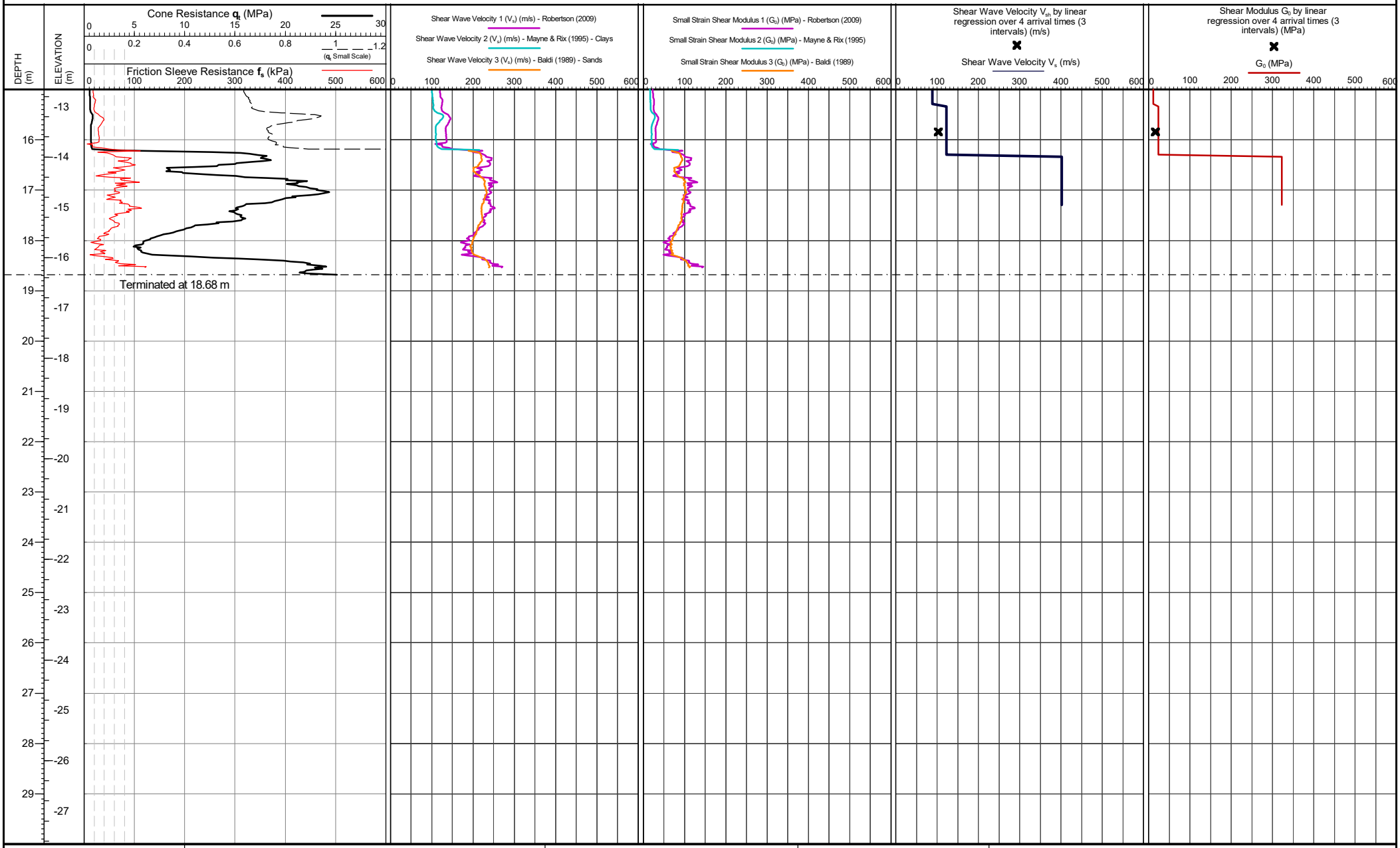


Cone area (mm2):	Location: Essex, UK	Remarks:	Date of plot: 21-07-25	**TEST ID: CPT101**
Cone ID: S15-CFIPTTM250.2116	Coordinates: 566299.724, 175912.182		Checked by: Chris Player	
Operator: Tom Freeland	Elevation: 2.341			Page 1 of 2
Date of test: 07/05/2025 08:47:52	Coordinate system:			

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING

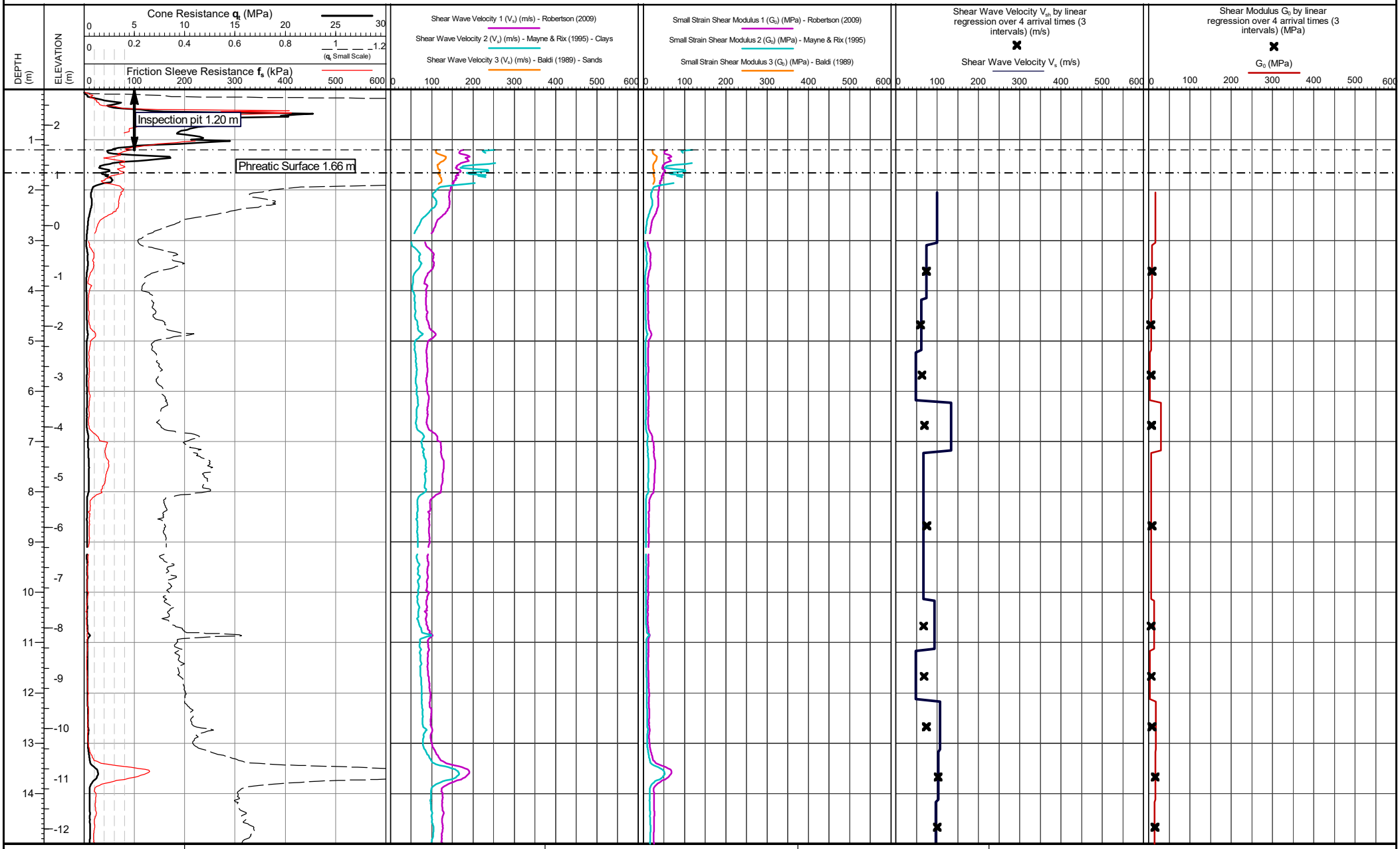


Cone area (mm2):	Location: Essex, UK	Remarks:	Date of plot: 21-07-25	**TEST ID: CPT101**
Cone ID: S15-CFIPTTM250.2116	Coordinates: 566299.724, 175912.182		Checked by: Chris Player	Page 2 of 2
Operator: Tom Freeland	Elevation: 2.341			
Date of test: 07/05/2025 08:47:52	Coordinate system:			

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING

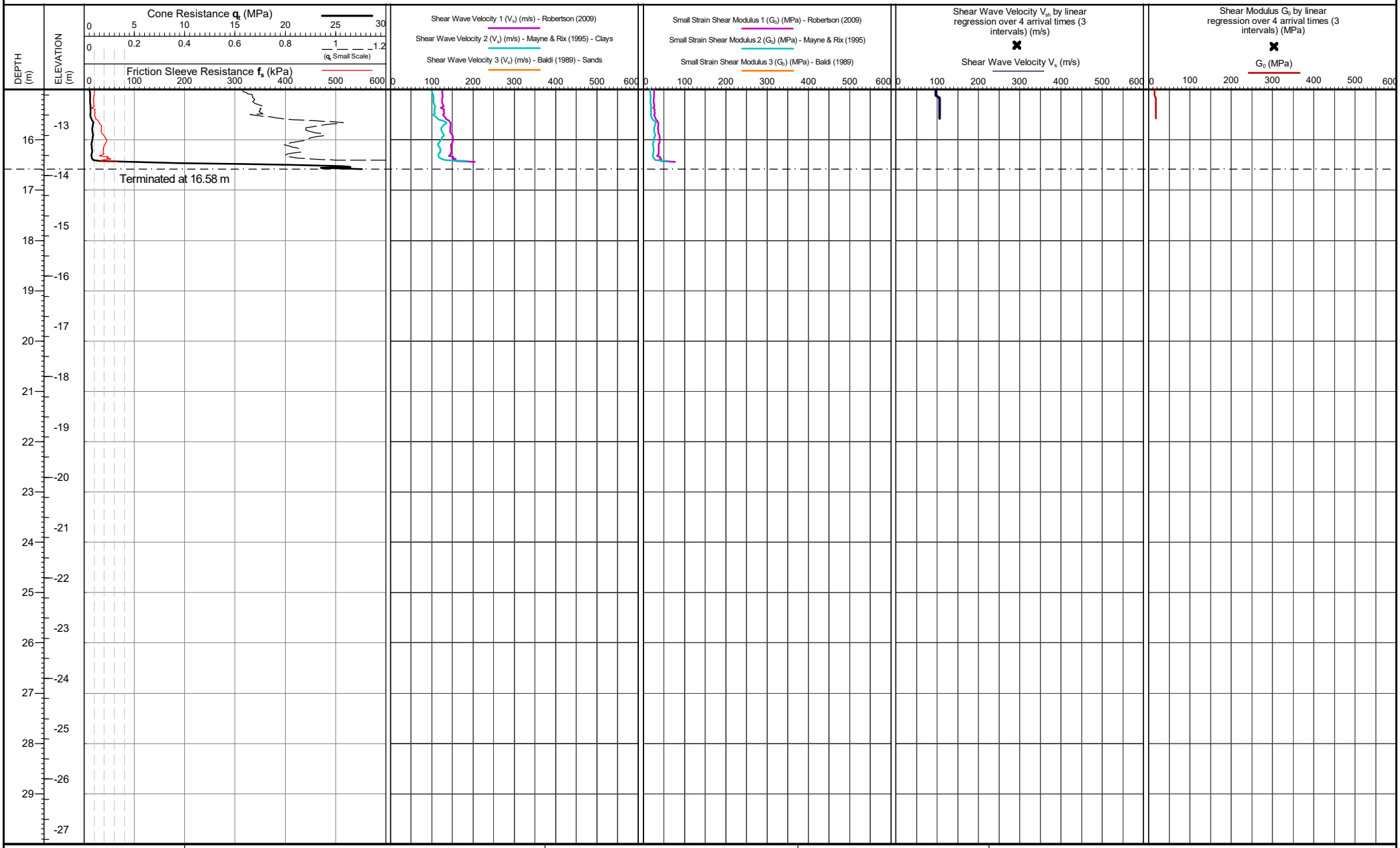


Cone area (mm2):	Location: Essex, UK	Remarks:	Date of plot: 21-07-25	**TEST ID: CPT103**
Cone ID: S15-CFIPTTM250.2116	Coordinates: 566316.646, 175907.221		Checked by: Chris Player	
Operator: Riley Trevelyan	Elevation: 2.709			Page 1 of 2
Date of test: 06/05/2025 10:00:36	Coordinate system:			

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING

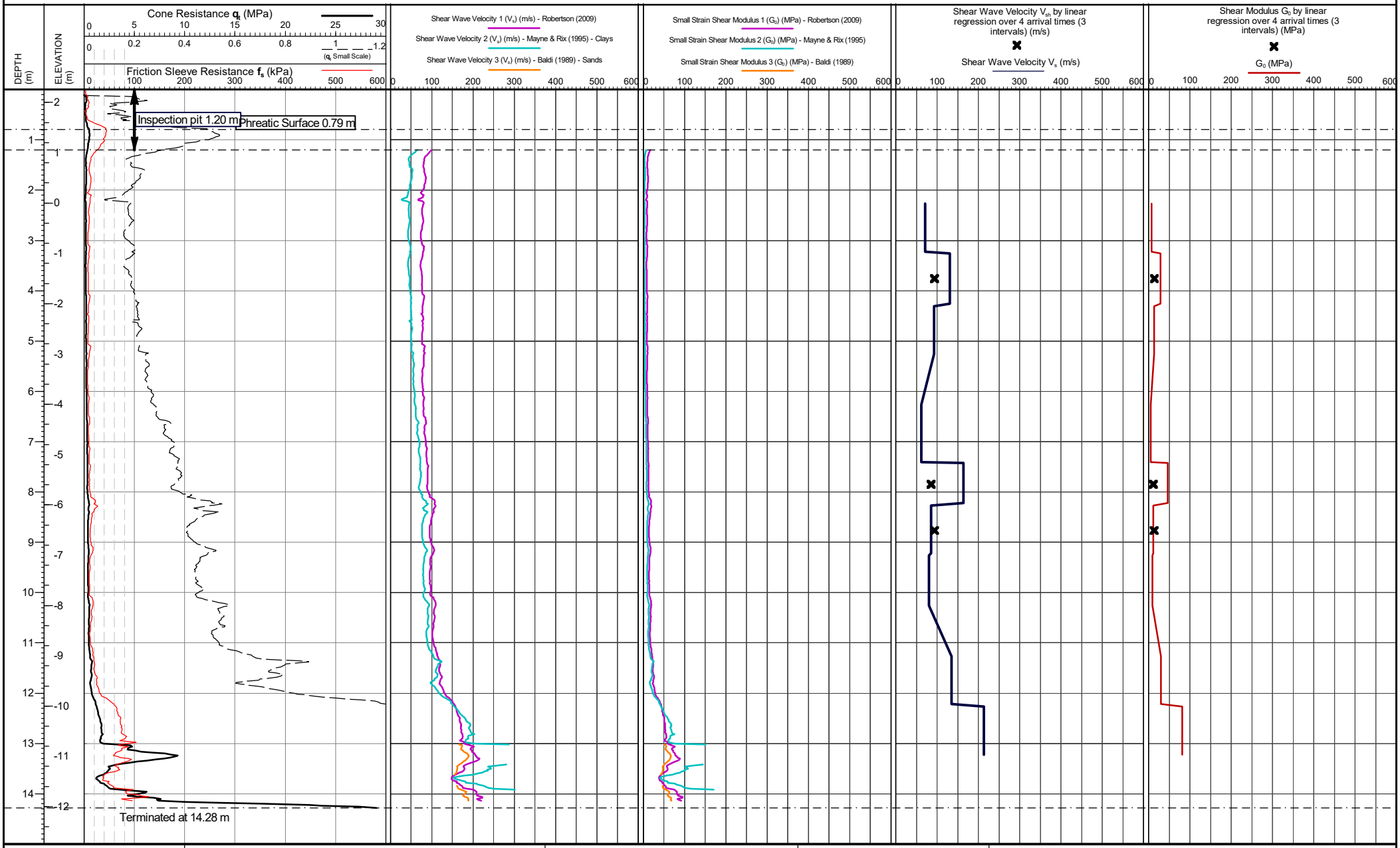


Cone area (mm2):	Location: Essex, UK	Remarks:	Date of plot: 21-07-25	**TEST ID: CPT103**
Cone ID: S15-CFIPTTM250.2116	Coordinates: 566316.646, 175907.221		Checked by: Chris Player	Page 2 of 2
Operator: Riley Trevelyan	Elevation: 2.709			
Date of test: 06/05/2025 10:00:36	Coordinate system:			

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2116
Operator: Tom Freeland
Date of test: 14/05/2025 10:26:20

Location: Essex, UK
Coordinates: 567408.732, 174141.855
Elevation: 2.256
Coordinate system:

Remarks:

Date of plot:
21-07-25

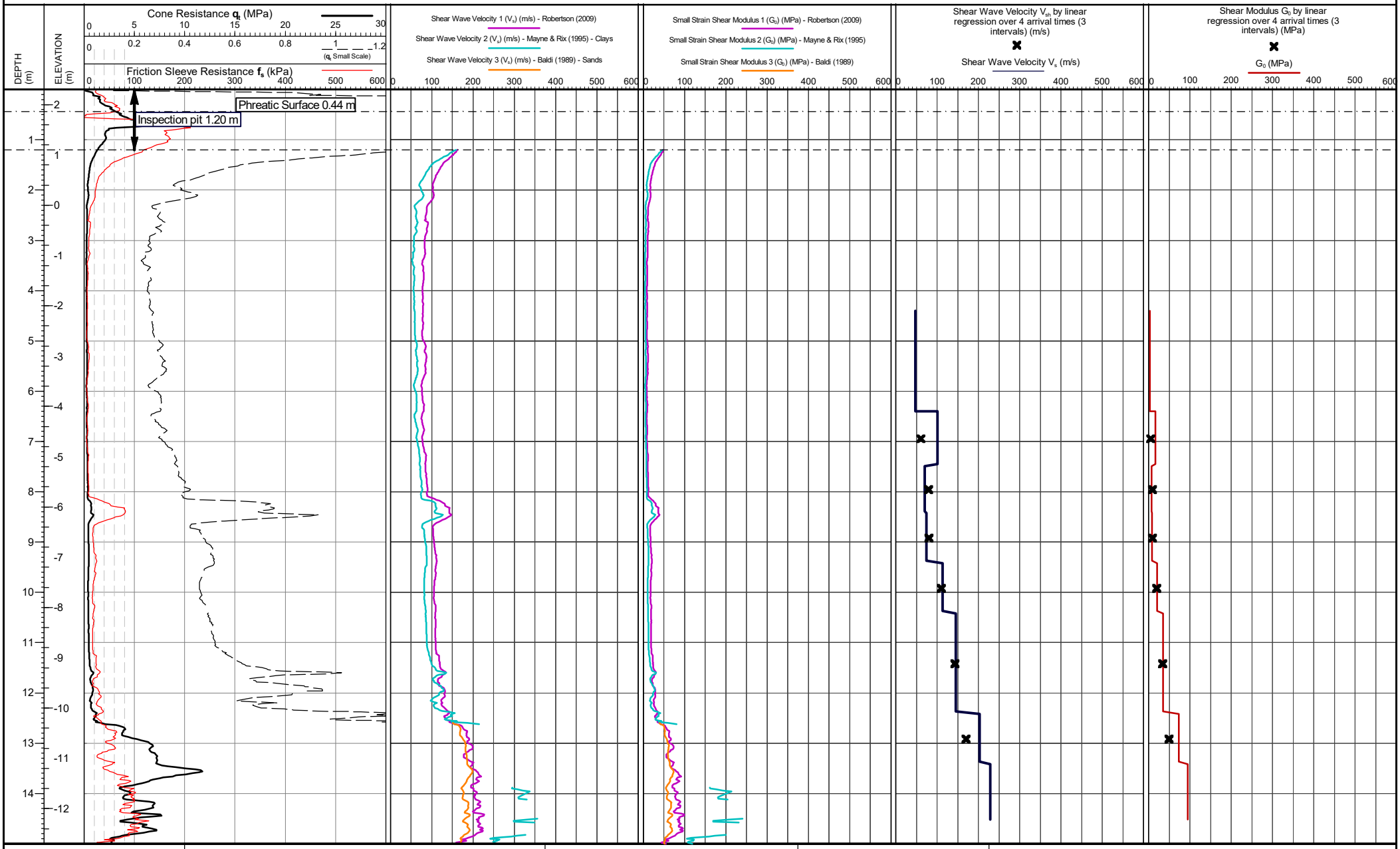
Checked by:
Chris Player

TEST ID: CPT104

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING

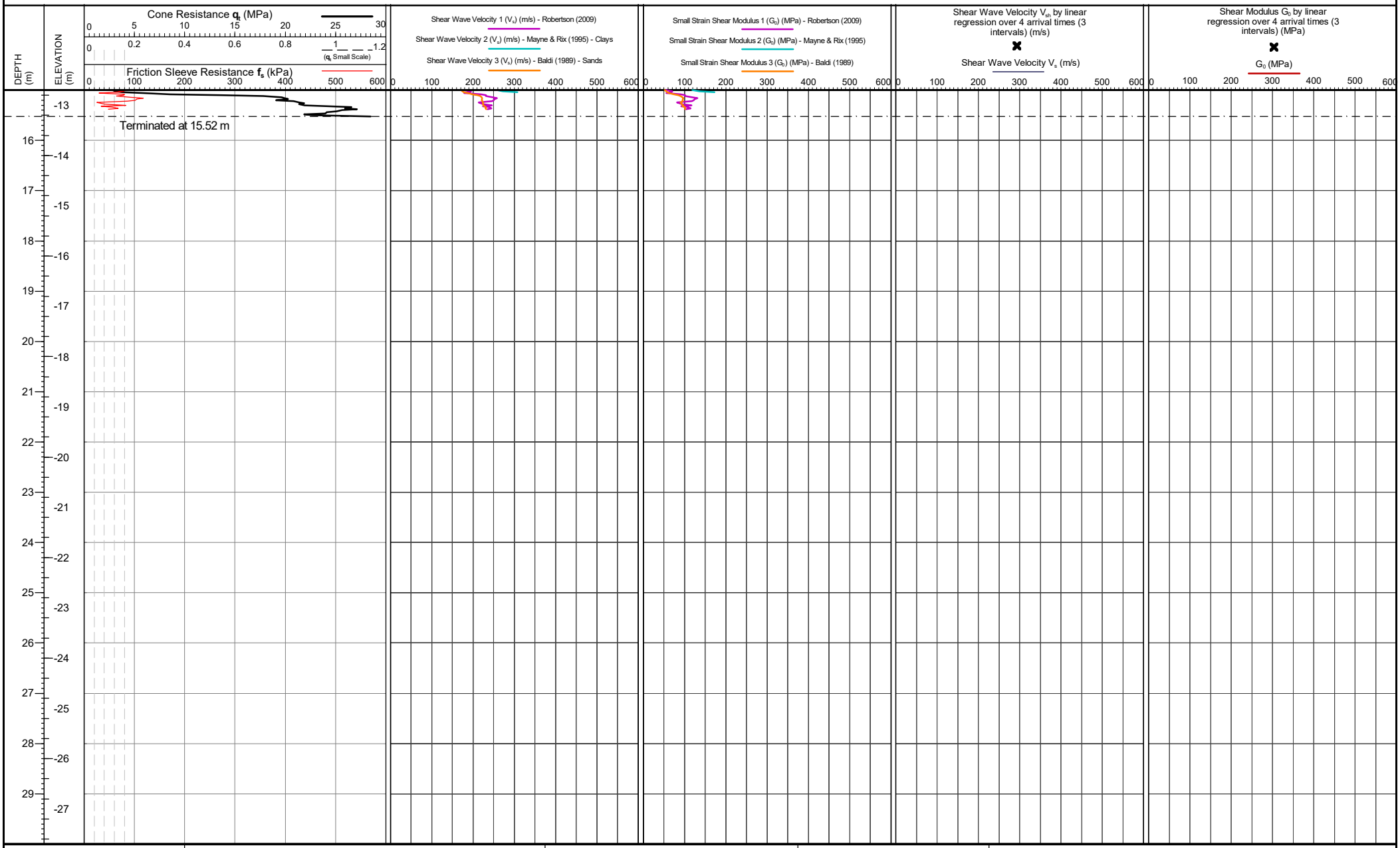


Cone area (mm2):	Location: Essex, UK	Remarks:	Date of plot: 21-07-25	**TEST ID: CPT105**
Cone ID: S15-CFIPTTM250.2116	Coordinates: 567426.41, 174081.075		Checked by: Chris Player	Page 1 of 2
Operator: Tom Freeland	Elevation: 2.301			
Date of test: 15/05/2025 10:07:33	Coordinate system:			

LANKELMA

Project: TILBURY

Client: SOIL ENGINEERING

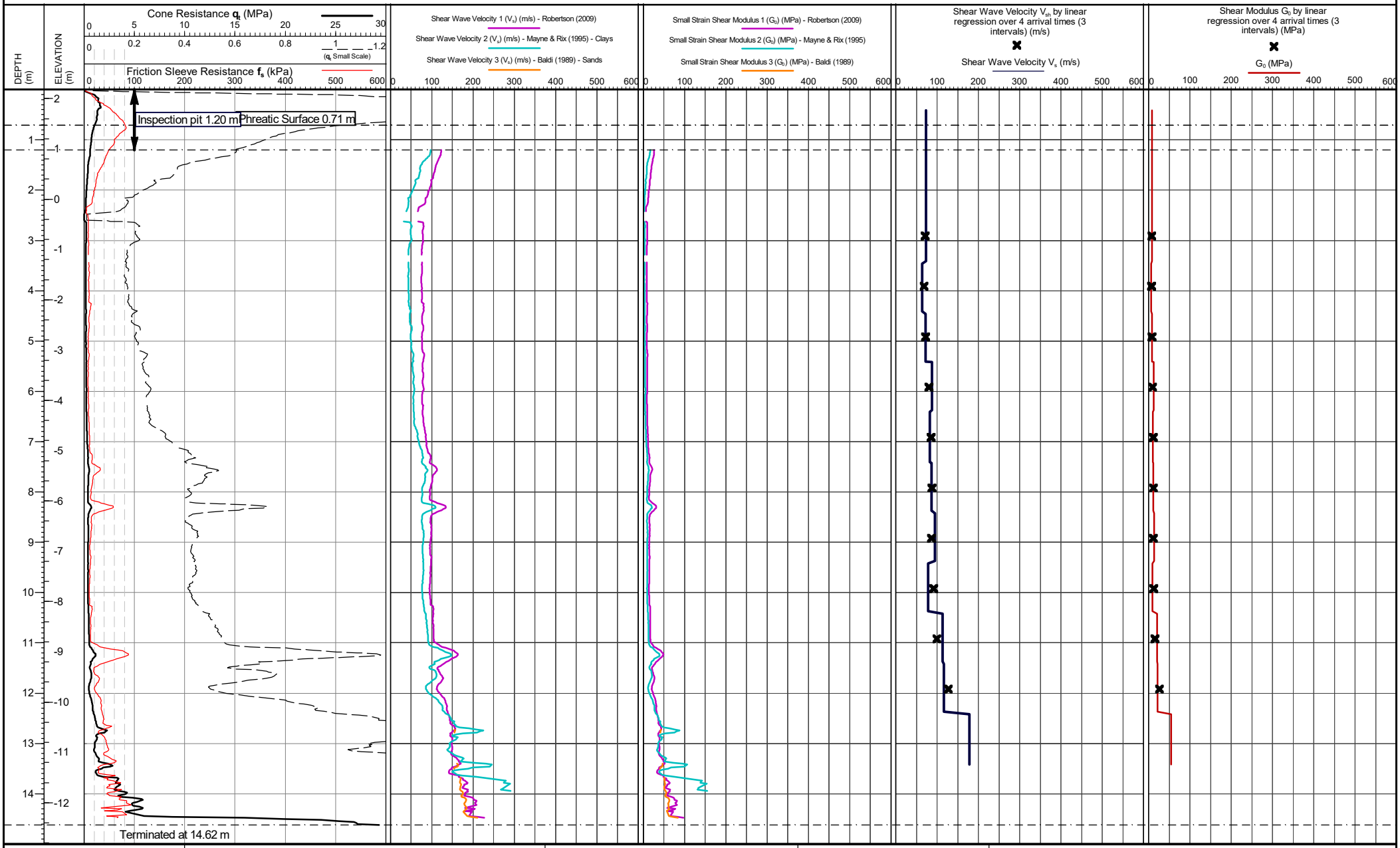


Cone area (mm2):	Location: Essex, UK	Remarks:	Date of plot: 21-07-25	**TEST ID: CPT105**
Cone ID: S15-CFIPTTM250.2116	Coordinates: 567426.41, 174081.075		Checked by: Chris Player	Page 2 of 2
Operator: Tom Freeland	Elevation: 2.301			
Date of test: 15/05/2025 10:07:33	Coordinate system:			

LANKELMA

Project: TILBURY

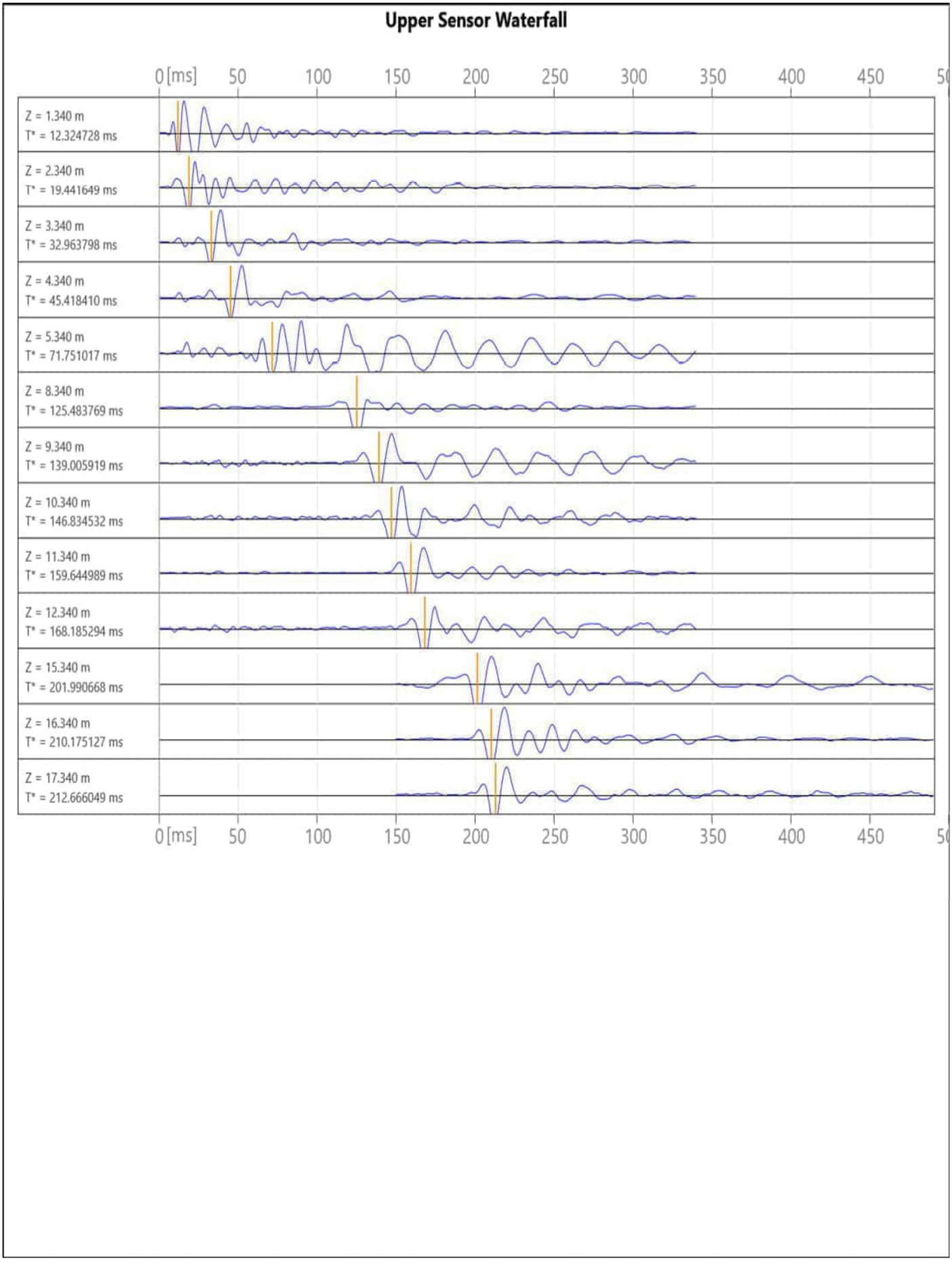
Client: SOIL ENGINEERING

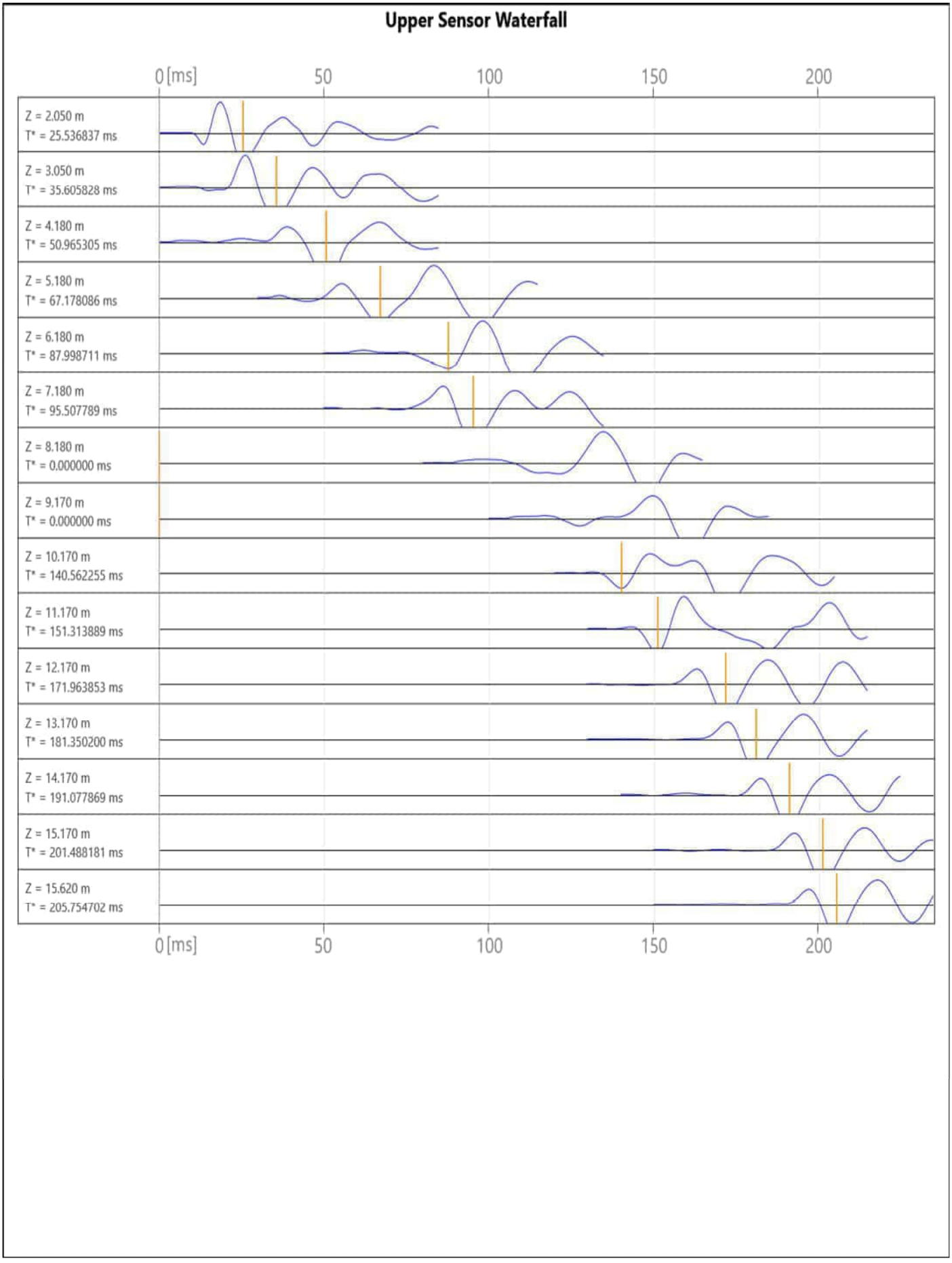


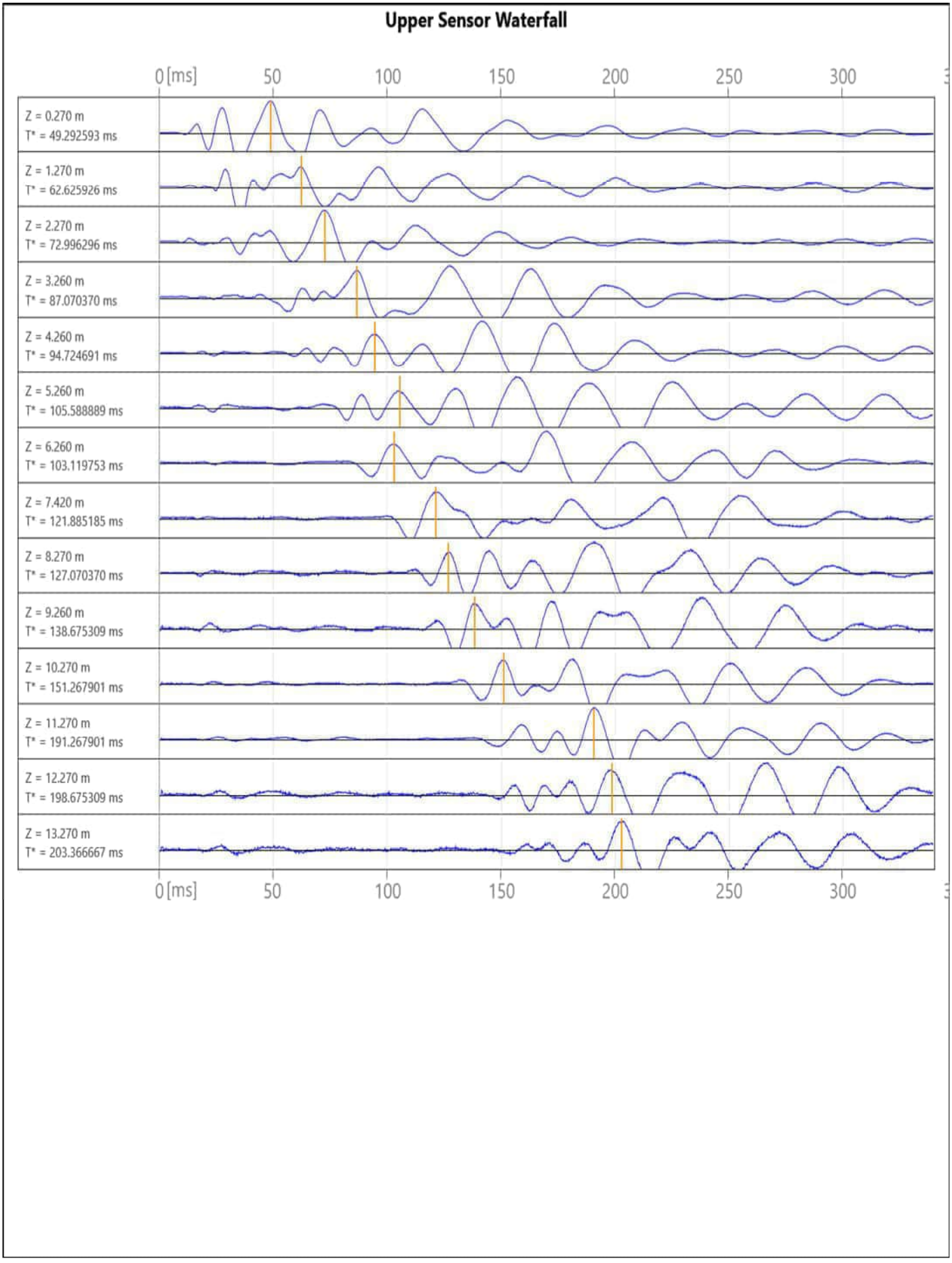
Cone area (mm2):	Location: Essex, UK	Remarks:	Date of plot: 21-07-25	**TEST ID: CPT106**
Cone ID: S15-CFIPTTM250.2116	Coordinates: 567428.311, 174166.814		Checked by: Chris Player	Page 1 of 1
Operator: Tom Freeland	Elevation: 2.179			
Date of test: 13/05/2025 09:45:35	Coordinate system:			

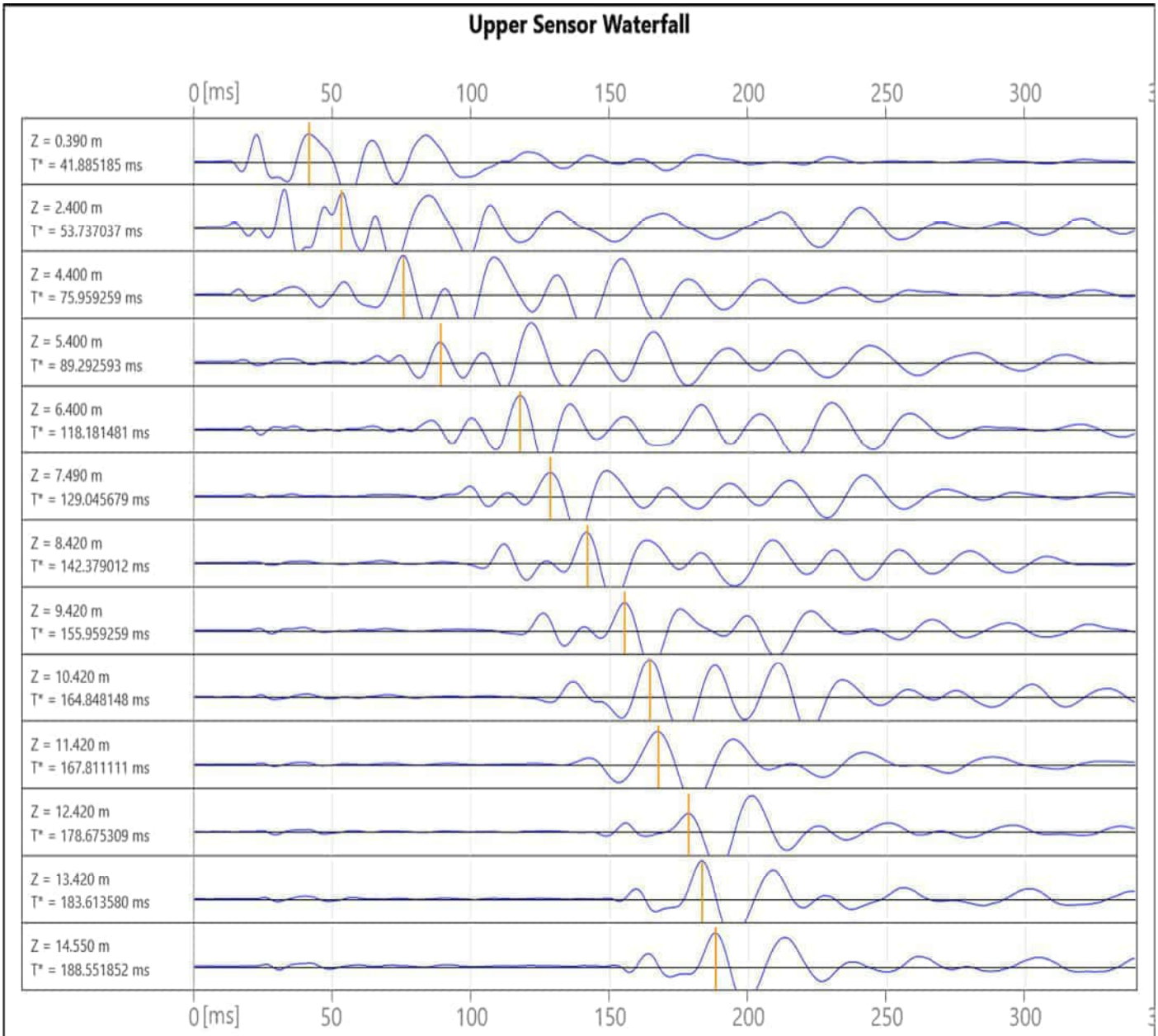
APPENDIX J SEISMOGRAMS

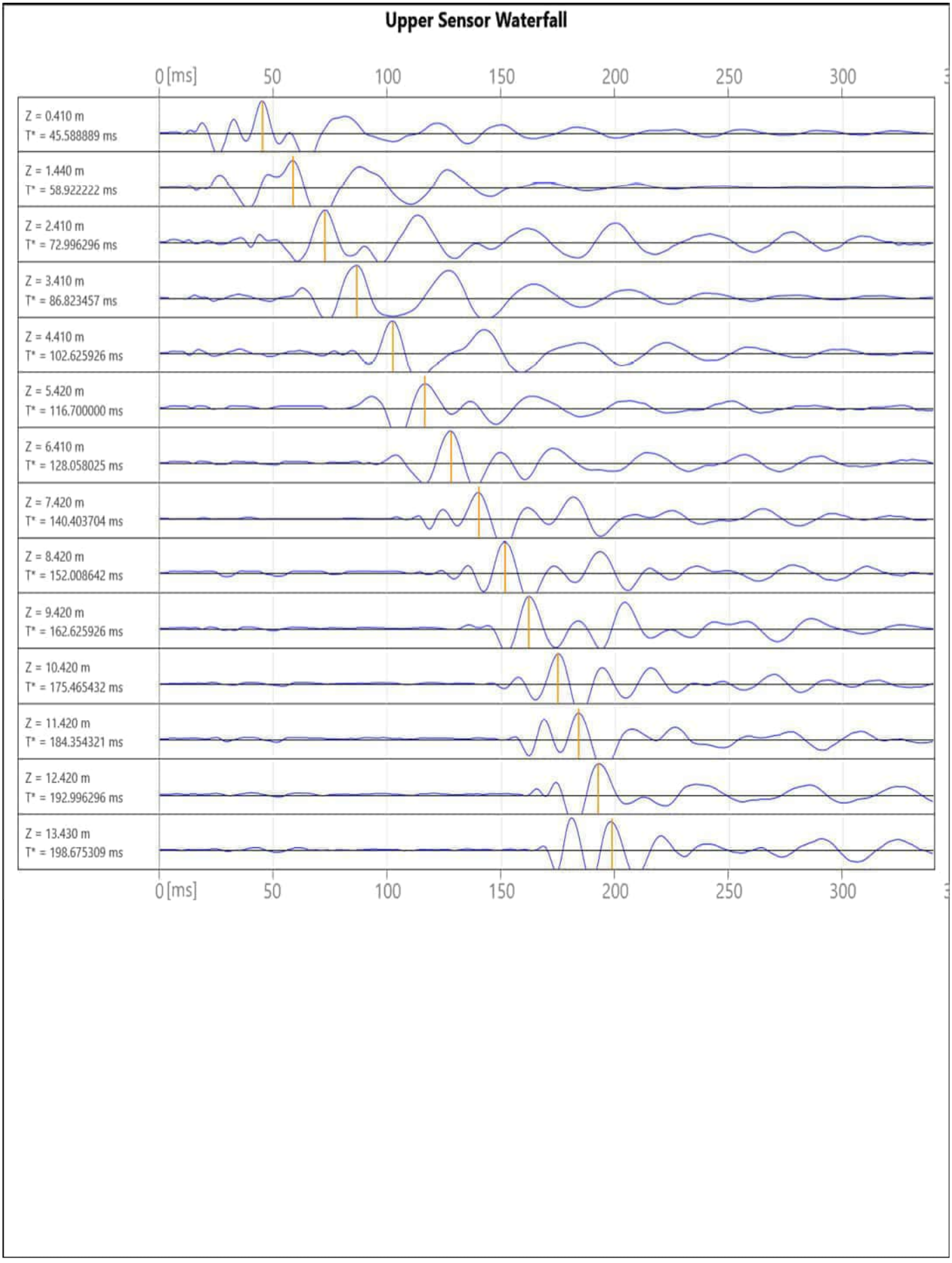
Plots are provided for all seismic locations


Upper Sensor Waterfall
0 [ms]
50
100
150
200
250
300
350
400
450
Z = 1.340 m
T* = 12.324728 ms
Z = 2.340 m
T* = 19.441649 ms
Z = 3.340 m
T* = 32.963798 ms
Z = 4.340 m
T* = 45.418410 ms
Z = 5.340 m
T* = 71.751017 ms
Z = 8.340 m
T* = 125.483769 ms
Z = 9.340 m
T* = 139.005919 ms
Z = 10.340 m
T* = 146.834532 ms
Z = 11.340 m
T* = 159.644989 ms
Z = 12.340 m
T* = 168.185294 ms
Z = 15.340 m
T* = 201.990668 ms
Z = 16.340 m
T* = 210.175127 ms
Z = 17.340 m
T* = 212.666049 ms


Upper Sensor Waterfall
0 [ms]
50
100
150
200
Z = 2.050 m
T* = 25.536837 ms
Z = 3.050 m
T* = 35.605828 ms
Z = 4.180 m
T* = 50.965305 ms
Z = 5.180 m
T* = 67.178086 ms
Z = 6.180 m
T* = 87.998711 ms
Z = 7.180 m
T* = 95.507789 ms
Z = 8.180 m
T* = 0.000000 ms
Z = 9.170 m
T* = 0.000000 ms
Z = 10.170 m
T* = 140.562255 ms
Z = 11.170 m
T* = 151.313889 ms
Z = 12.170 m
T* = 171.963853 ms
Z = 13.170 m
T* = 181.350200 ms
Z = 14.170 m
T* = 191.077869 ms
Z = 15.170 m
T* = 201.488181 ms
Z = 15.620 m
T* = 205.754702 ms
0 [ms]
50
100
150
200


Upper Sensor Waterfall
0 [ms]
50
100
150
200
250
300
Z = 0.270 m
T* = 49.292593 ms
Z = 1.270 m
T* = 62.625926 ms
Z = 2.270 m
T* = 72.996296 ms
Z = 3.260 m
T* = 87.070370 ms
Z = 4.260 m
T* = 94.724691 ms
Z = 5.260 m
T* = 105.588889 ms
Z = 6.260 m
T* = 103.119753 ms
Z = 7.420 m
T* = 121.885185 ms
Z = 8.270 m
T* = 127.070370 ms
Z = 9.260 m
T* = 138.675309 ms
Z = 10.270 m
T* = 151.267901 ms
Z = 11.270 m
T* = 191.267901 ms
Z = 12.270 m
T* = 198.675309 ms
Z = 13.270 m
T* = 203.366667 ms


Upper Sensor Waterfall
0 [ms]
50
100
150
200
250
300
Z = 0.390 m
T* = 41.885185 ms
Z = 2.400 m
T* = 53.737037 ms
Z = 4.400 m
T* = 75.959259 ms
Z = 5.400 m
T* = 89.292593 ms
Z = 6.400 m
T* = 118.181481 ms
Z = 7.490 m
T* = 129.045679 ms
Z = 8.420 m
T* = 142.379012 ms
Z = 9.420 m
T* = 155.959259 ms
Z = 10.420 m
T* = 164.848148 ms
Z = 11.420 m
T* = 167.811111 ms
Z = 12.420 m
T* = 178.675309 ms
Z = 13.420 m
T* = 183.613580 ms
Z = 14.550 m
T* = 188.551852 ms


Upper Sensor Waterfall
0 [ms]
50
100
150
200
250
300
Z = 0.410 m
T* = 45.588889 ms
Z = 1.440 m
T* = 58.922222 ms
Z = 2.410 m
T* = 72.996296 ms
Z = 3.410 m
T* = 86.823457 ms
Z = 4.410 m
T* = 102.625926 ms
Z = 5.420 m
T* = 116.700000 ms
Z = 6.410 m
T* = 128.058025 ms
Z = 7.420 m
T* = 140.403704 ms
Z = 8.420 m
T* = 152.008642 ms
Z = 9.420 m
T* = 162.625926 ms
Z = 10.420 m
T* = 175.465432 ms
Z = 11.420 m
T* = 184.354321 ms
Z = 12.420 m
T* = 192.996296 ms
Z = 13.430 m
T* = 198.675309 ms

APPENDIX K UXO CLEARANCE CERTIFICATE

EOD Contracts Ltd
26-28 Kempton Road
Keytec 7 Business Park
Pershore
WR10 2TA

Telephone: +44 (0) 1386 578 405
Email Shane.Meaker@eodcontractsltd.com
Reference: **ECL/25/25201**
Tuesday, 27TH May 2025

CLEARANCE CERTIFICATE FOR TILBURY AND GRAVESEND 30 APRIL 01 MAY – 16 MAY 2025

1 LIMITATIONS

1.1 Detection of a UXB is dependent on a sufficient magnetic susceptibility contrast between the UXB and its host materials. Significant degradation of the casing of such a device or highly magnetic soils may prevent detection under certain circumstances.

1.2 The radius of detection (from each test MagCone) for a particular type of UXB is dependent on a number of parameters including the sensor system used, the size and orientation of the UXB and the level of ambient magnetic noise (geological and man-made) on the site. High levels of noise may prevent detection in certain areas (see method statement).

1.3 Where a clearance radius is provided this is based on the expected MagCone response for a 50kg UXB. Larger devices (>250kg) will have a correspondingly larger clearance radius.

2 UXB PENETRATION DEPTH

2.1 Unless otherwise stated, the depth achieved is that considered sufficient to clear the CPT location for UXB for the logged depth plus one (1) meter only.

3 LOCATION

3.1 The Test Positions were located and marked up by the client's onsite contractor/ surveyor.

4 SURVEY

4.1 The duration of the survey was over 12 Days.

4.2 A total of 20 tests completed (including retests) using 20 ton Truck CPT Rig.

5 CLEARED POSITIONS

5.1 The position shown on the Table in **Appendix 1** are deemed clear of UXO to 1.5m radius unless otherwise stated and 1m to recorded depth (as per appendix 1 below).

6 CONCLUSION

6.1 The positions (see map/google earth below) as per client marking out were covered by a Mag/cone.

7 RECOMMENDATION

7.1 Further intrusive works can continue on **cleared tested positions** as defined in Appendix 1.



SA Meaker
EOD Contracts Ltd

Appendix 1

CPT TESTING – Tilbury
SUMMARY OF MAGCONE UNEXPLODED ORDNANCE (UXO) SURVEY

TEST NUMBER	DATE PROBED	TEST Position	STATUS	NOTES / CPT TEST POSITIONS UK3, Magnetometer DM15-11(200).01		
1.	01/05/2025	BH102	clear	19.1	Lateral support at depth	
2.	01/05/2025	BH107	clear	6.25	Target depth	
3.	01/05/2025	BH108	clear	6.25	Target depth	
4.	01/05/2025	BH104	clear	6.26	Target depth	
5.	02/05/2025	BH106	clear	6.26	Target depth	
6.	02/05/2025	BH110	clear	17.08	Lateral support at depth	
7.	02/05/2025	BH101	clear	1.4	Tonnage + inclination	
8.	02/05/2025	BH103	clear	19.78	Sudden inclination	
9.	02/05/2025	CPT103	clear	1	Acquisition error	
10.	06/05/2025	CPT103	clear	3	Data error	
11.	06/05/2025	CPT103	clear	16.57	Lateral support at depth	
12.	07/05/2025	CPT101	clear	18.7	Tip/sleeve load + inclination	
13.	08/05/2025	CPT102	clear	17.45	Lateral support at depth	
14.	09/05/2025	BH101	clear	16.05	Target depth	
15.	13/05/2025	CPT106	clear	3.4	Acquisition error	
16.	13/05/2025	CPT106	clear	14.65	Lateral support at depth	
17.	14/05/2025	CPT-104	clear	14.29	Lateral support at depth	
18.	15/05/2025	CPT-105	clear	15.54	Lateral support at depth	
19.	16/05/2025	BH-305	clear	7.19	Target depth	
20.	16/05/2025	BH-306	clear 1m onwards	7.44	Target depth	

KEY	
clear	clear of UXB.
clear 1m onwards	Disturbance of magnetic field to depth shown due to artificial ground but otherwise clear
obstruction	Buried obstruction needs removing, or change location, then re-test.
obstruction	Buried obstruction, location re-probed.

low risk 2.3m	Low risk anomaly at depth shown. Unlikely to be UXB, and clear below.
suspected existing pile	Disturbance of magnetic field at depth of 0-6m, clear below.
anomaly x metres	Significant magnetic anomaly at depth shown.

K Mobile (information purposes only)

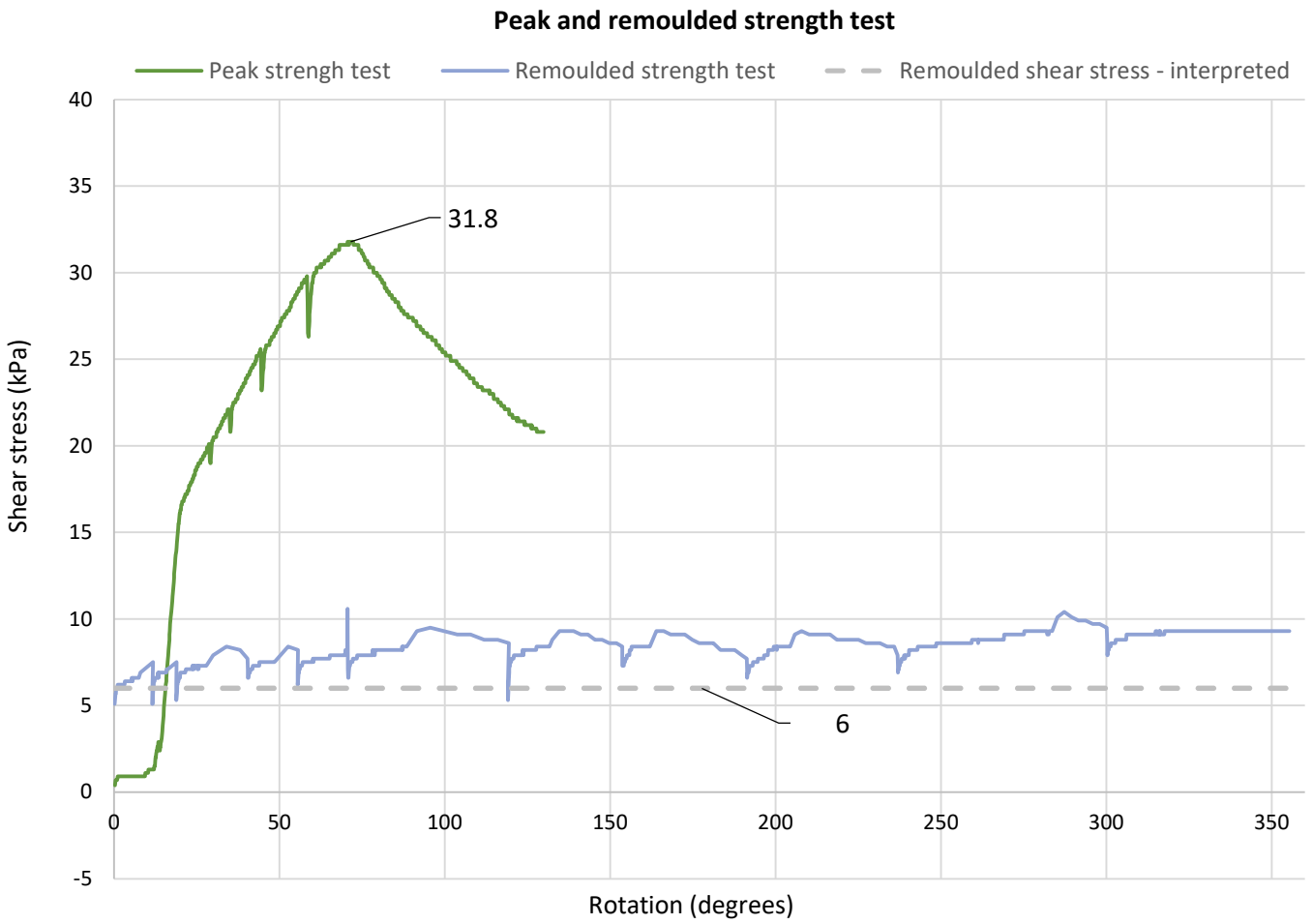
APPENDIX L SHEAR VANE INTERPRETATION RESULTS

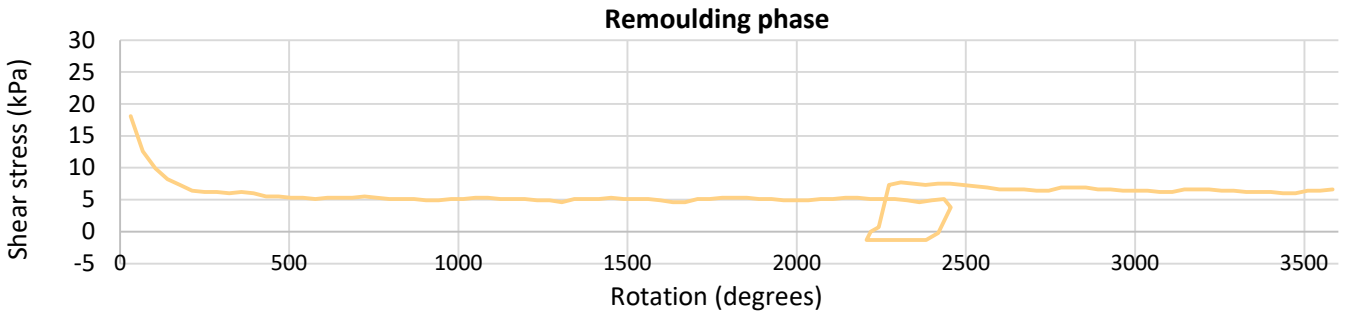
Plots are provided for all shear vane locations

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Shear Vane Test Results Sheet

TILBURY





Location ID: **BH101 VANE** **Depth:** **4.03 m**

Operator: TFL
Vane size: 50 x 100 mm
ISO test type: 'UX'
Rotation rate: 0.1 °/s
Applied zero (digital): 7
Sensor drift: 0 kPa
System friction change: 3.1 kPa (clean/dirty difference)

Su_vane: 31.8 kPa
Sur_vane: 6 kPa
Sensitivity: 5.3

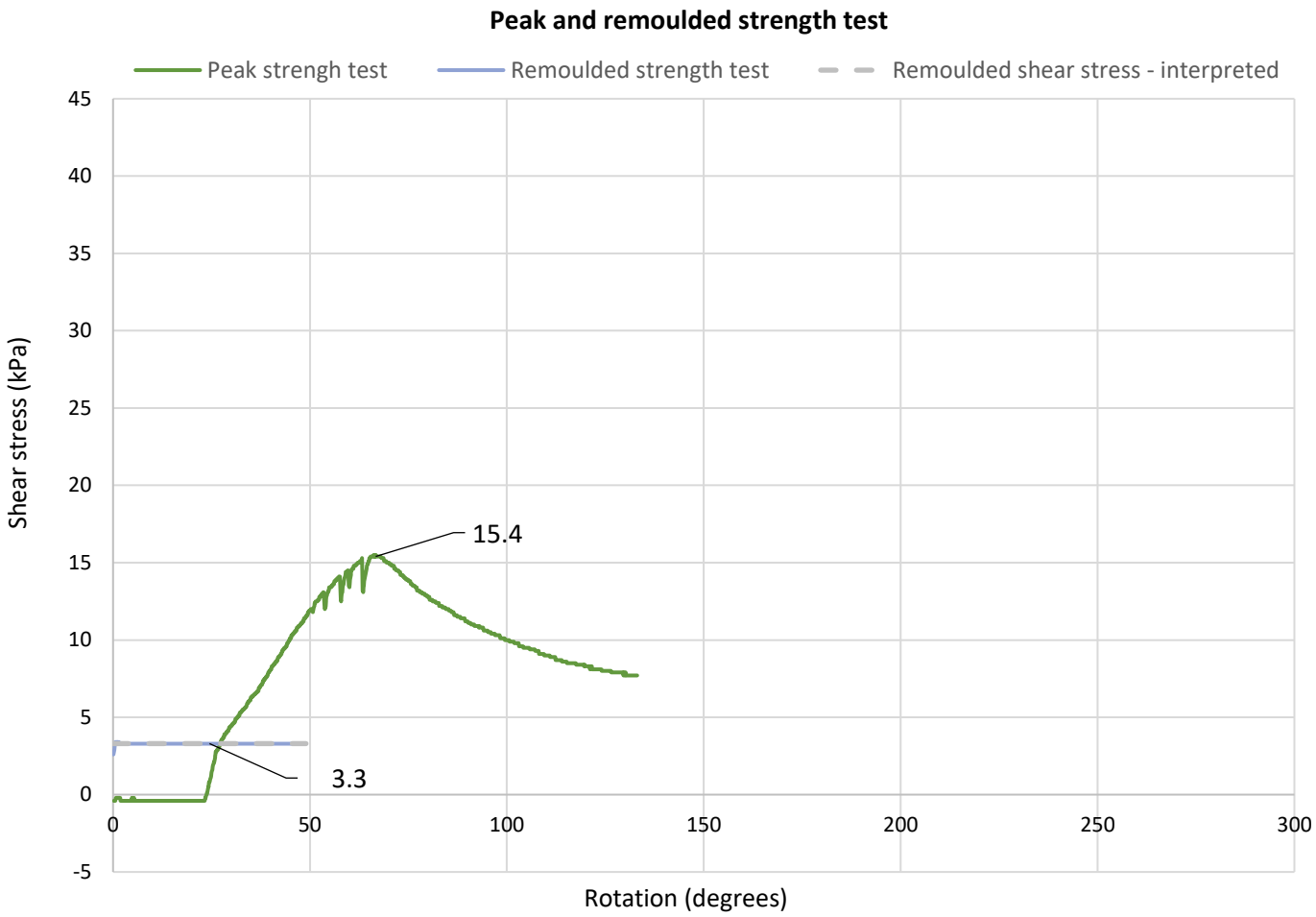
Remarks:

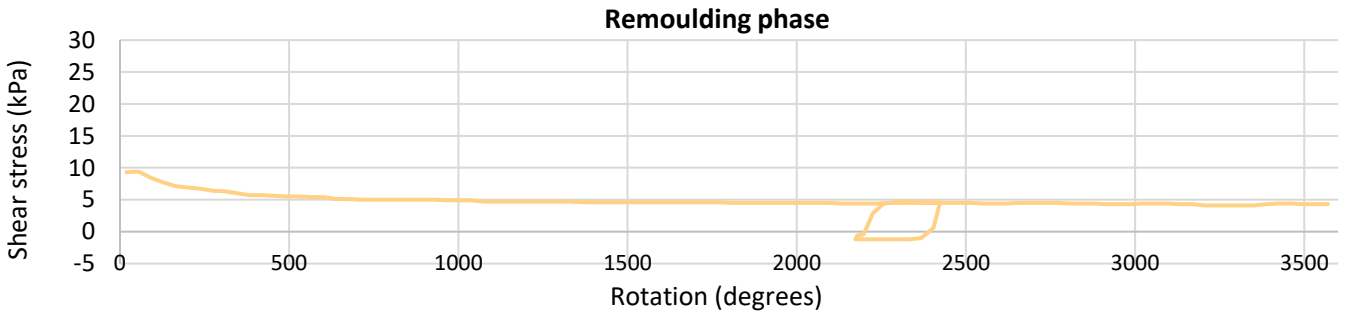
Remoulded measurements higher than those recorded during remoulding phase. The remoulding response is relatively uniform, and the difference is not thought to be associated with non-stationarity of the vane axis and torque response due to vane eccentricity, or continuing drainage. Remoulded strength taken from lowest value recorded during remoulding stage.

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Shear Vane Test Results Sheet

TILBURY





Location ID: **BH107 VANE** **Depth:** **3.04 m**

Remarks:

Remoulding terminated at 50 degrees due to good uniformity of remoulding response

Operator: TF

Vane size: 60 x 120 mm

ISO test type: 'UX'

Rotation rate: 0.1 °/s

Applied zero (digital): 11

Sensor drift: -0.1 kPa

System friction change: 1 kPa (clean/dirty difference)

Su_vane: 15.4 kPa

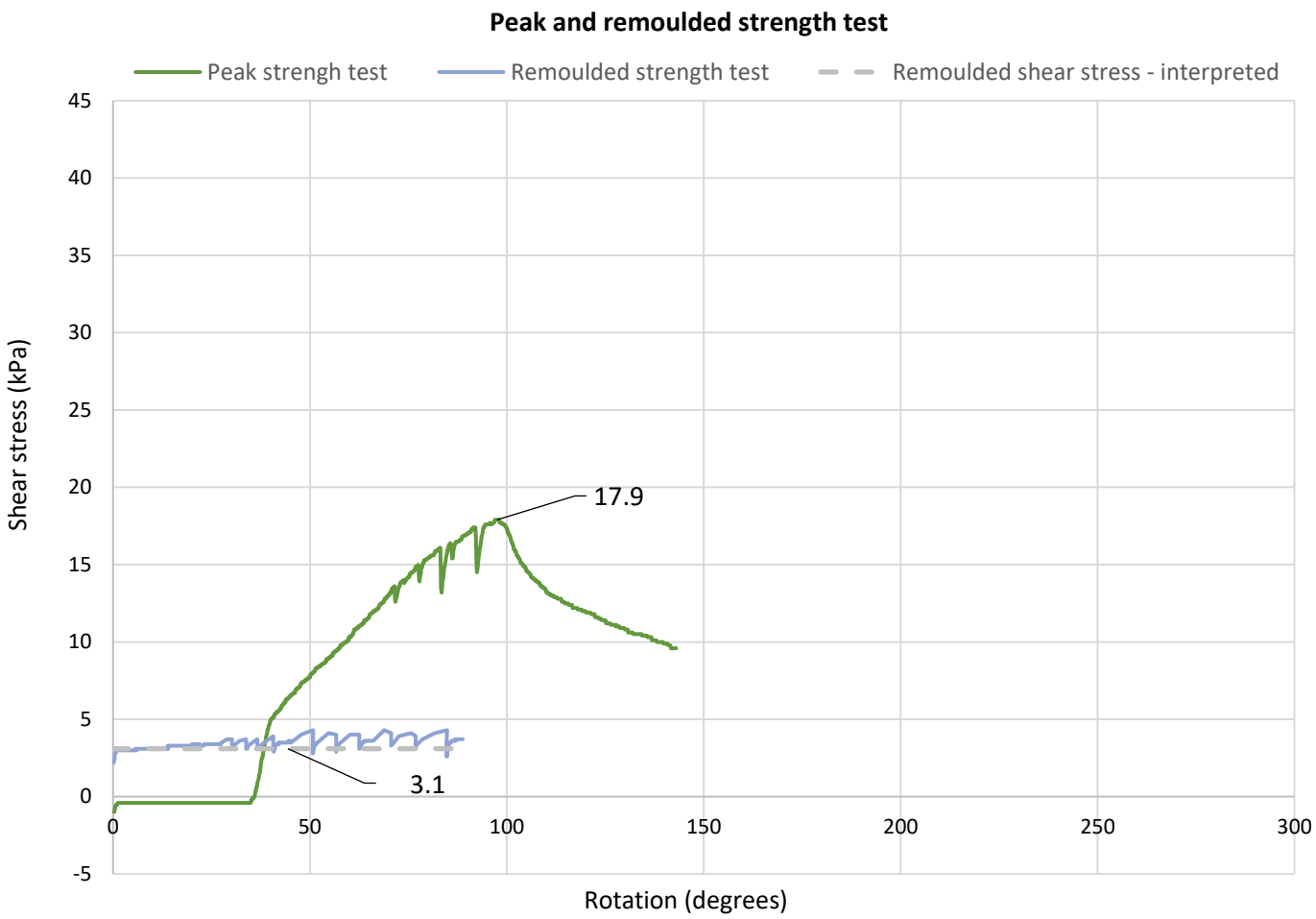
Sur_vane: 3.3 kPa

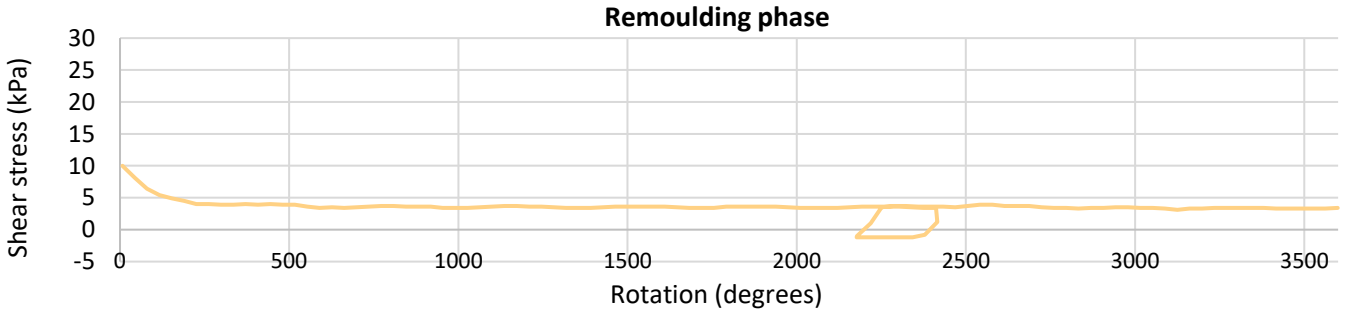
Sensitivity: 4.7

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Shear Vane Test Results Sheet

TILBURY





Location ID: **BH107 VANE** **Depth:** **5 m**

Operator: TF
Vane size: 60 x 120 mm
ISO test type: 'UX'
Rotation rate: 0.1 °/s
Applied zero (digital): 11
Sensor drift: -0.1 kPa
System friction change: 1 kPa (clean/dirty difference)

Su_vane: 17.9 kPa
Sur_vane: 3.1 kPa
Sensitivity: 5.8

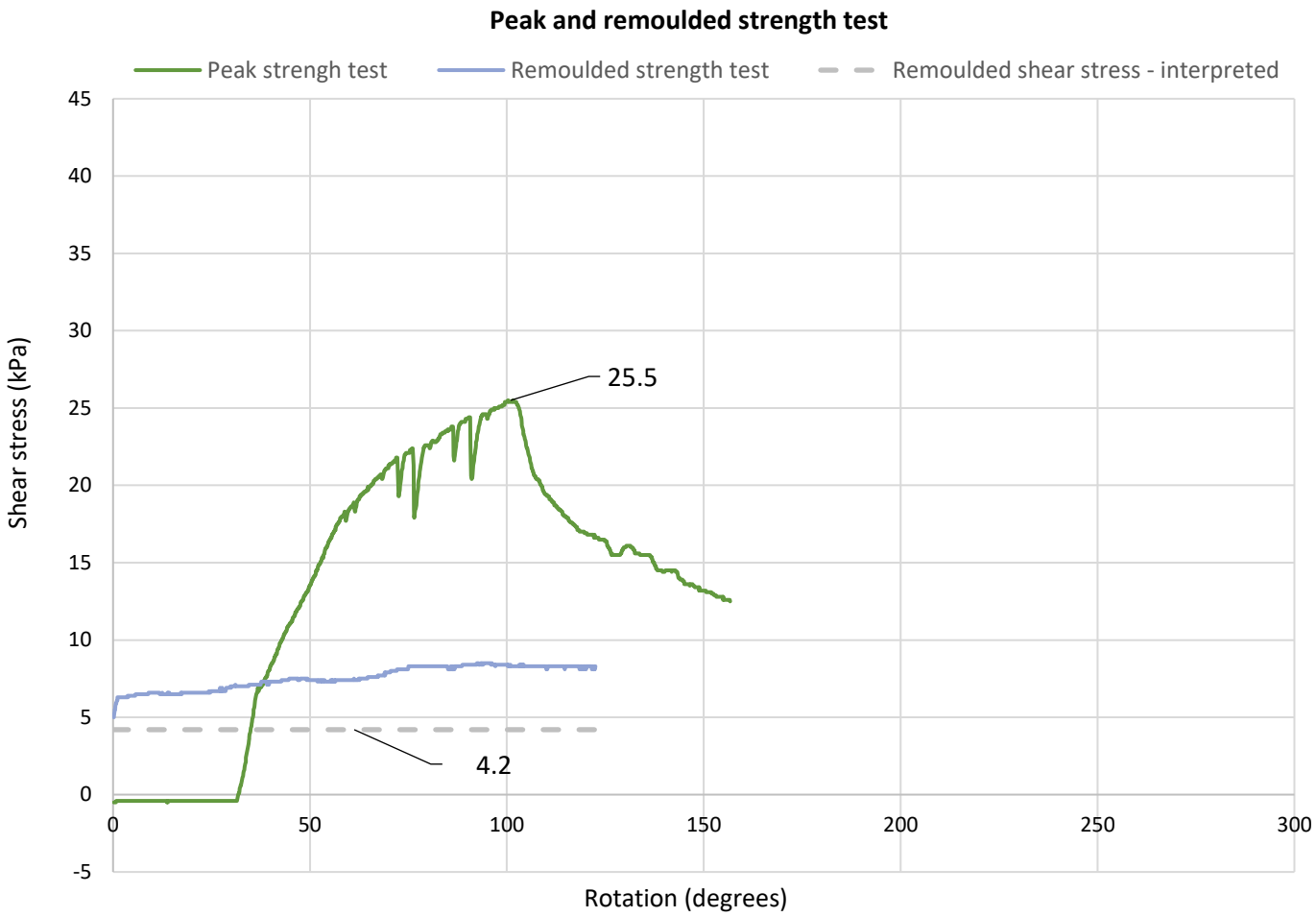
Remarks:

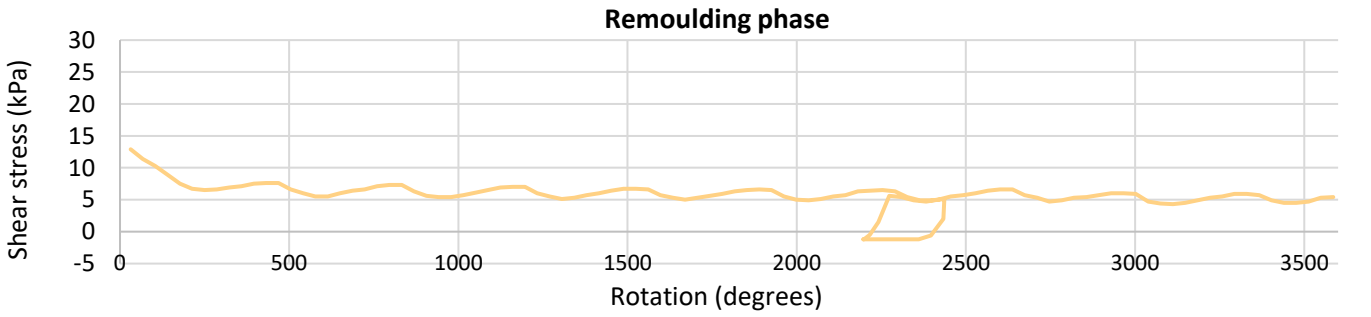
Remoulding terminated at 90 degrees due to good uniformity of remoulding response.

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Shear Vane Test Results Sheet

TILBURY





Location ID: **BH107 VANE** **Depth:** **7 m**

Operator: TF
Vane size: 60 x 120 mm
ISO test type: 'UX'
Rotation rate: 0.1 °/s
Applied zero (digital): 11
Sensor drift: 0.3 kPa
System friction change: 1 kPa (clean/dirty difference)

Su_vane: 25.5 kPa
Sur_vane: 4.2 kPa
Sensitivity: 6.1

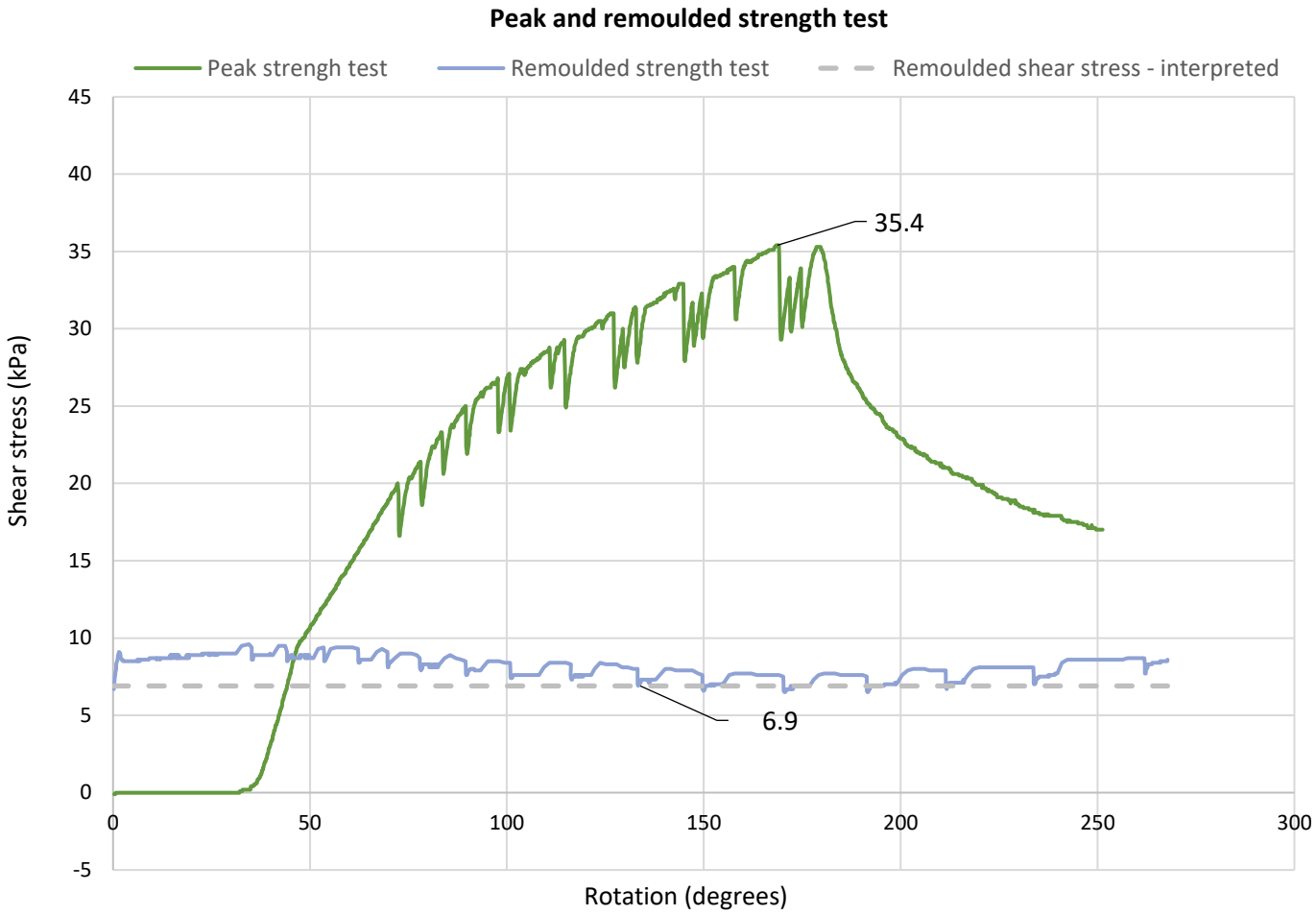
Remarks:

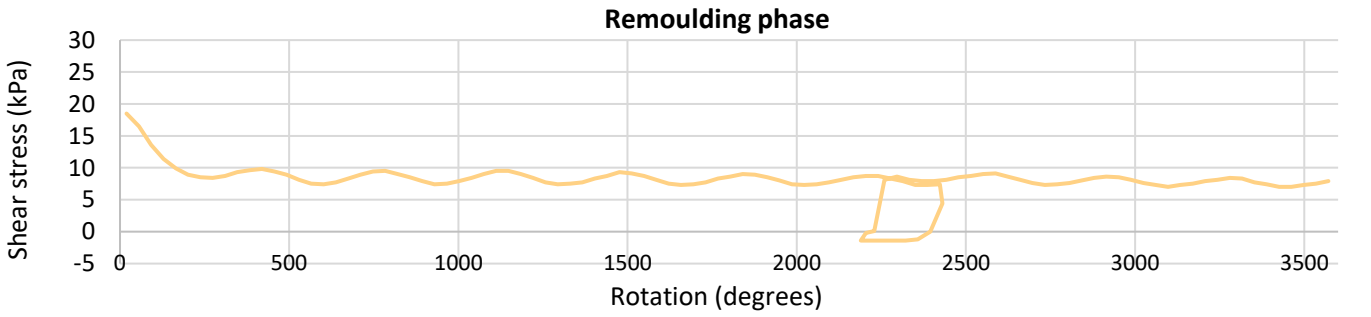
Remoulded strength taken from minimum value recoded during remoulding.

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Shear Vane Test Results Sheet

TILBURY





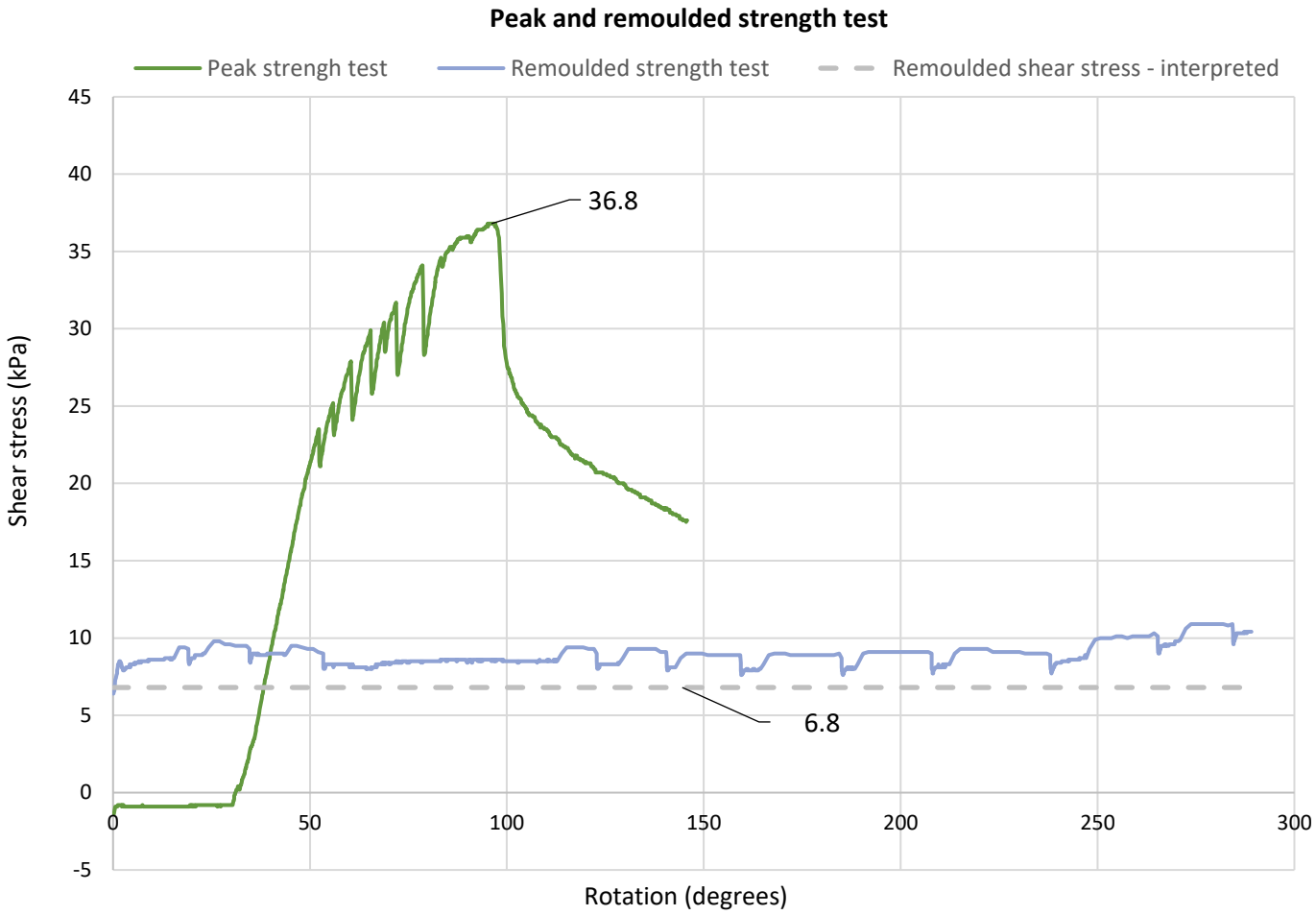
Location ID: **BH107 VANE** **Depth:** **9 m** **Remarks:**

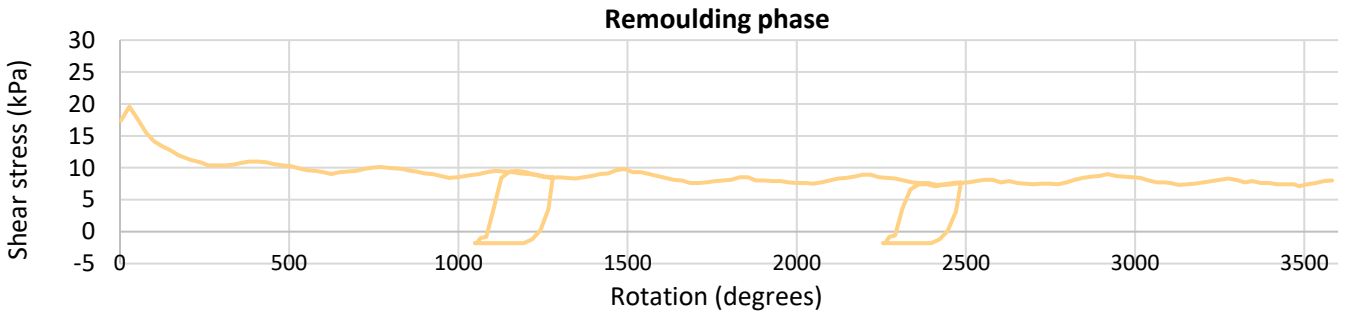
Operator:	TF	**Su_vane:**	35.4 kPa
Vane size:	60 x 120 mm	**Sur_vane:**	6.9 kPa
ISO test type:	'UX'	**Sensitivity:**	5.1
Rotation rate:	0.1 °/s		
Applied zero (digital):	12		
Sensor drift:	0.1 kPa		
System friction change:	1 kPa (clean/dirty difference)		

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Shear Vane Test Results Sheet

TILBURY





Location ID: **BH107 VANE** **Depth:** **11 m**

Operator: TF
Vane size: 60 x 120 mm
ISO test type: 'UX'
Rotation rate: 0.1 °/s
Applied zero (digital): 15
Sensor drift: -0.3 kPa
System friction change: 1.9 kPa (clean/dirty difference)

Su_vane: 36.8 kPa
Sur_vane: 6.8 kPa
Sensitivity: 5.4

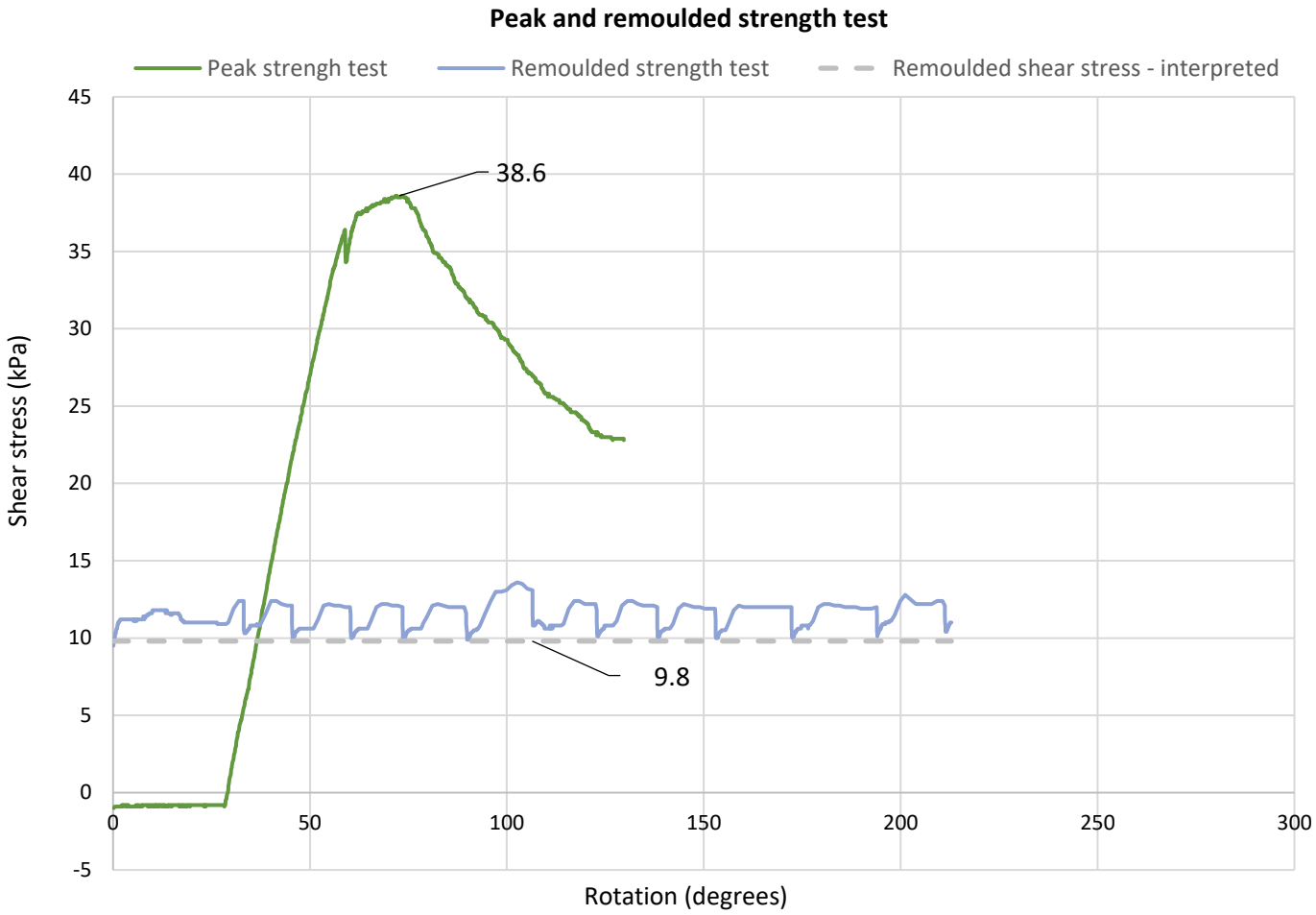
Remarks:

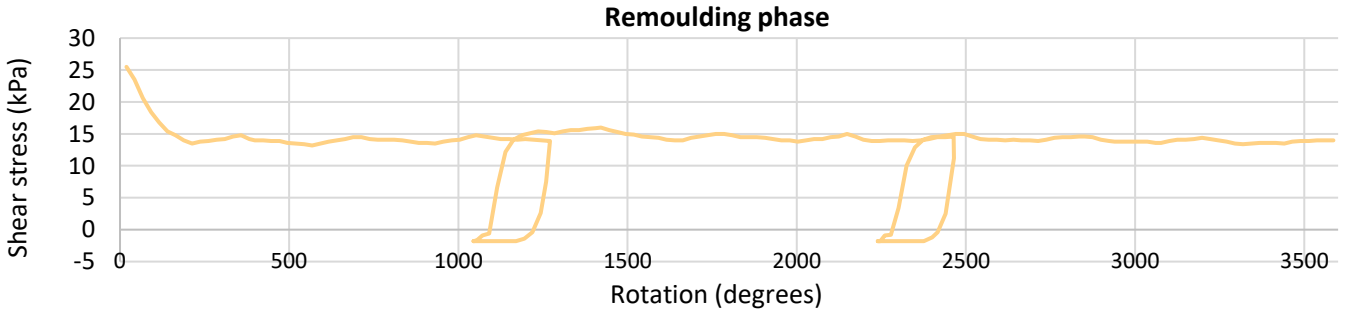
Remoulded measurements slightly higher than those recorded during remoulding phase. The remoulding response is relatively uniform, and the difference is not thought to be associated with non-stationarity of the vane axis and torque response due to vane eccentricity, or continuing drainage. Remoulded strength taken from lowest value recorded during remoulding stage.

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Shear Vane Test Results Sheet

TILBURY





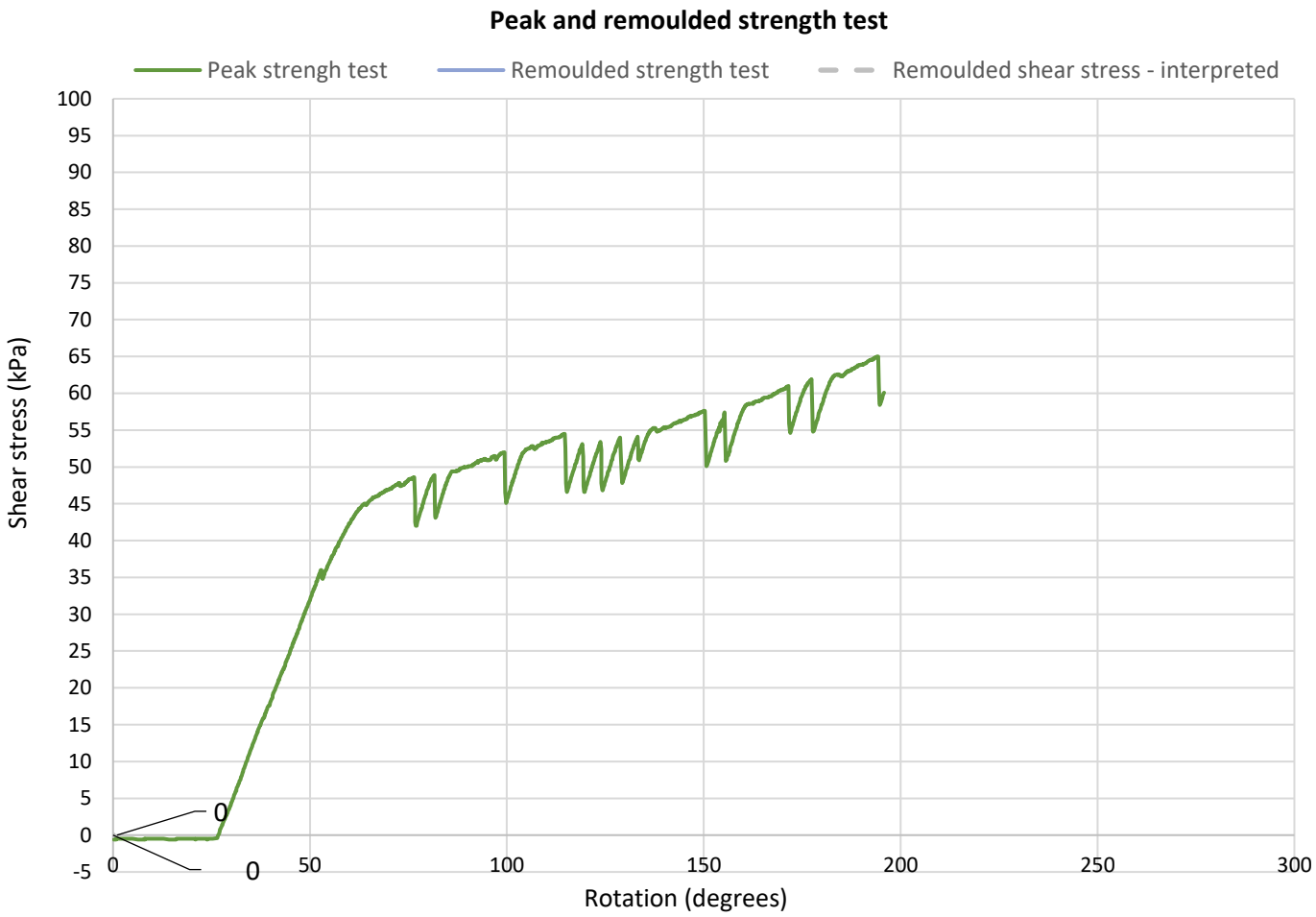
Location ID: **BH107 VANE** **Depth:** **12 m** **Remarks:**

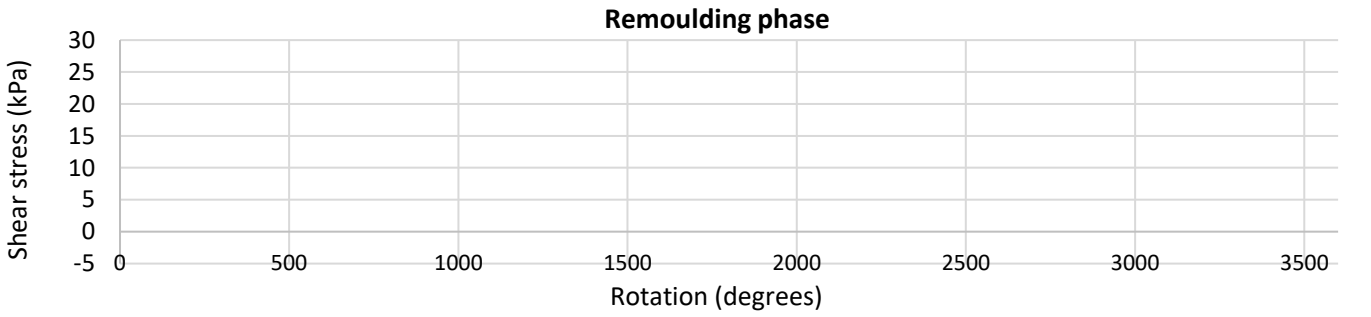
Operator:	TF	**Su_vane:**	38.6 kPa
Vane size:	60 x 120 mm	**Sur_vane:**	9.8 kPa
ISO test type:	'UX'	**Sensitivity:**	3.9
Rotation rate:	0.1 °/s		
Applied zero (digital):	15		
Sensor drift:	-0.1 kPa		
System friction change:	1.9 kPa (clean/dirty difference)		

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Shear Vane Test Results Sheet

TILBURY





Location ID: **BH107 VANE** **Depth:** **13 m**

Remarks:

No peak stress observed, assumed sand/drained.

Operator: TF

Vane size: 60 x 120 mm

ISO test type: 'UX'

Rotation rate: 0.1 °/s

Applied zero (digital): 15

Sensor drift: 0 kPa

System friction change: 1.9 kPa (clean/dirty difference)

Su_vane:

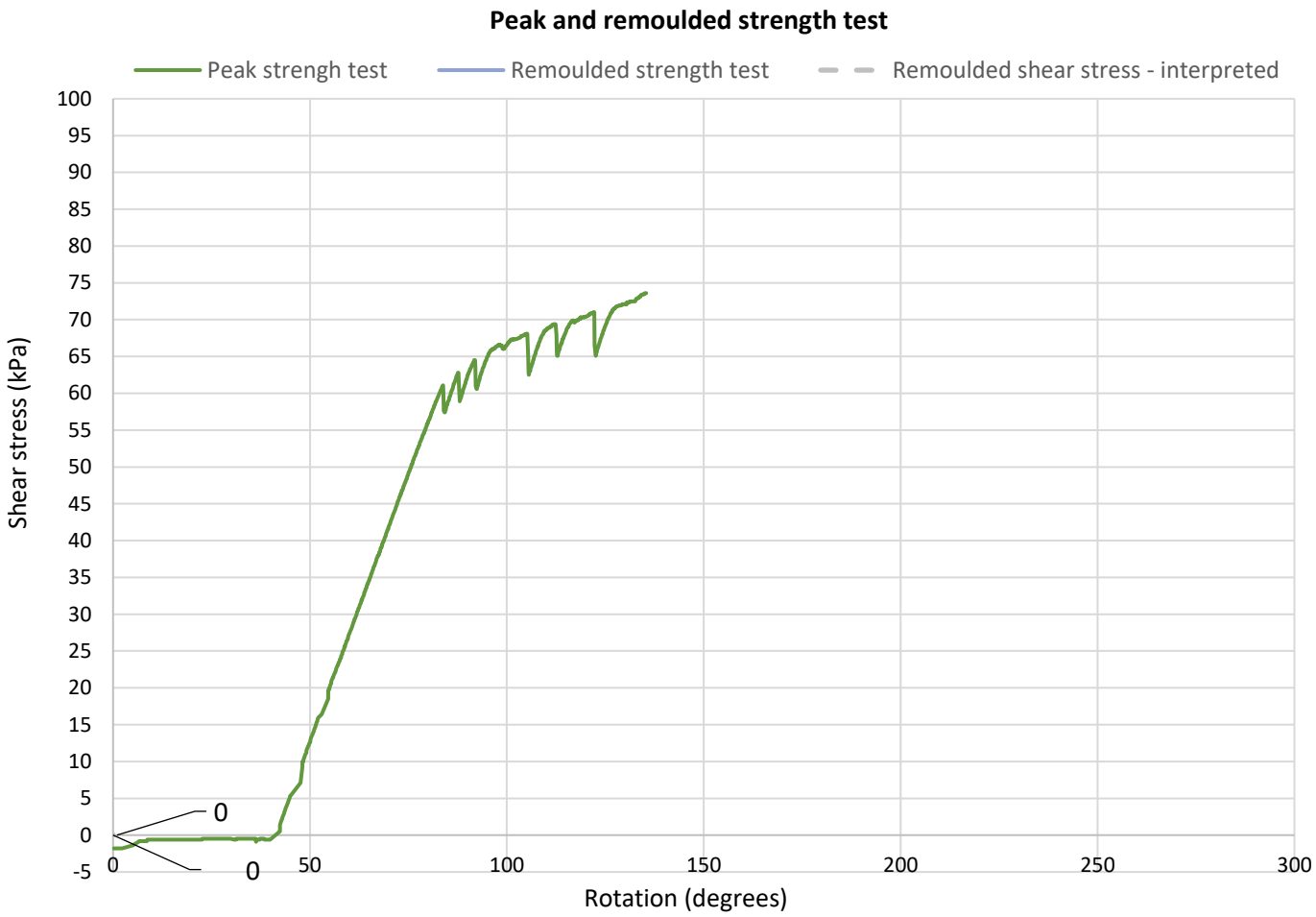
Sur_vane:

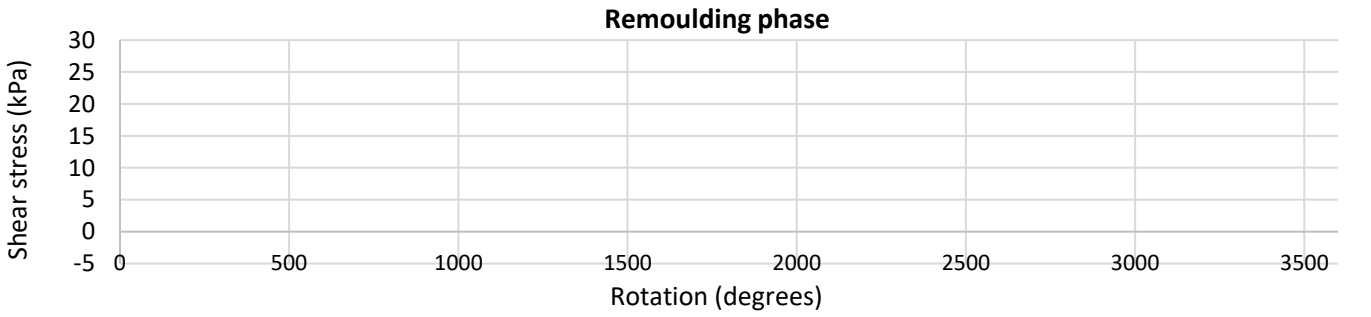
Sensitivity:

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Shear Vane Test Results Sheet

TILBURY





Location ID: **BH107 VANE** **Depth:** **13.3 m**

Remarks:

Re-test of 13 m test. No peak stress observed, assumed sand/drained.

Operator: TF

Vane size: 60 x 120 mm

ISO test type: 'UX'

Rotation rate: 0.1 °/s

Applied zero (digital): 15

Sensor drift: 0.8 kPa

System friction change: 1.9 kPa (clean/dirty difference)

Su_vane:

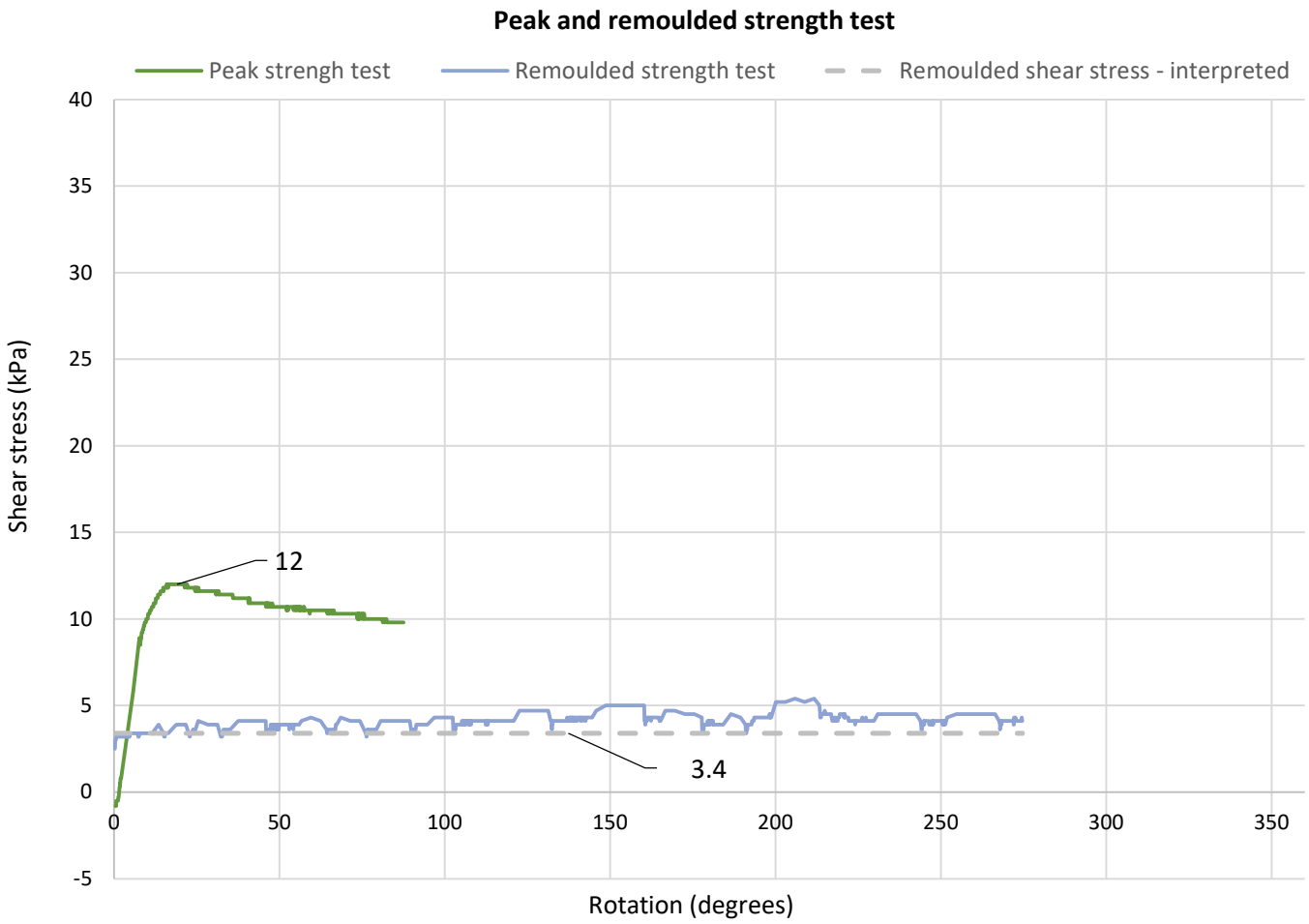
Sur_vane:

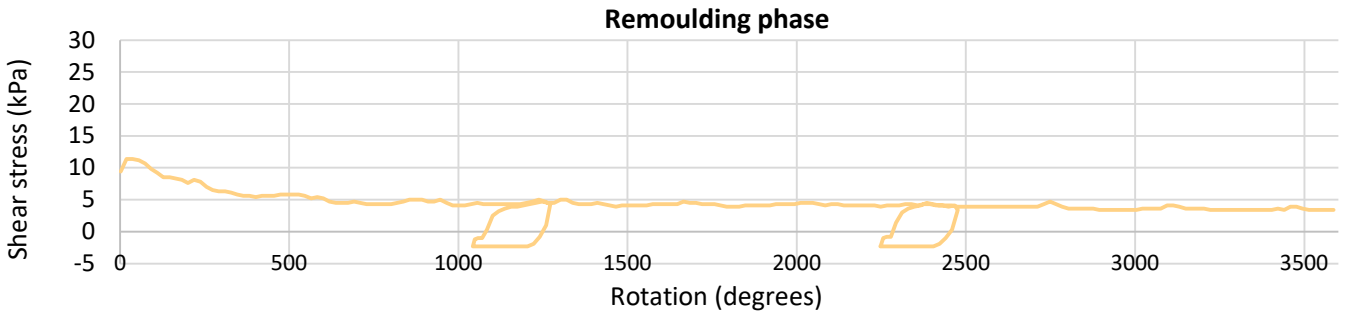
Sensitivity:

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Shear Vane Test Results Sheet

TILBURY





Location ID: **BH110 VANE** **Depth:** **4 m**

Remarks:

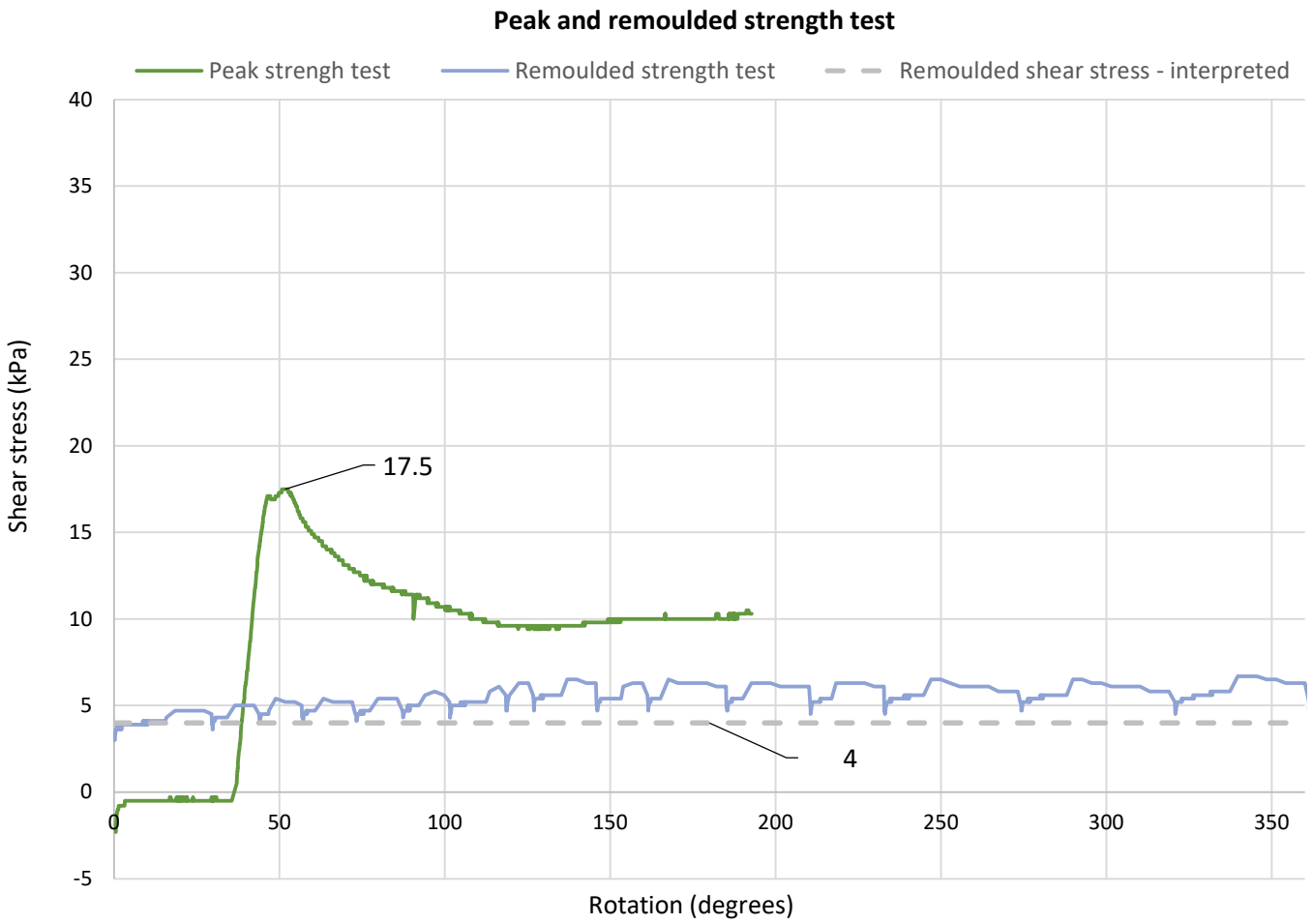
No initial slip coupling rotation due to motor placement

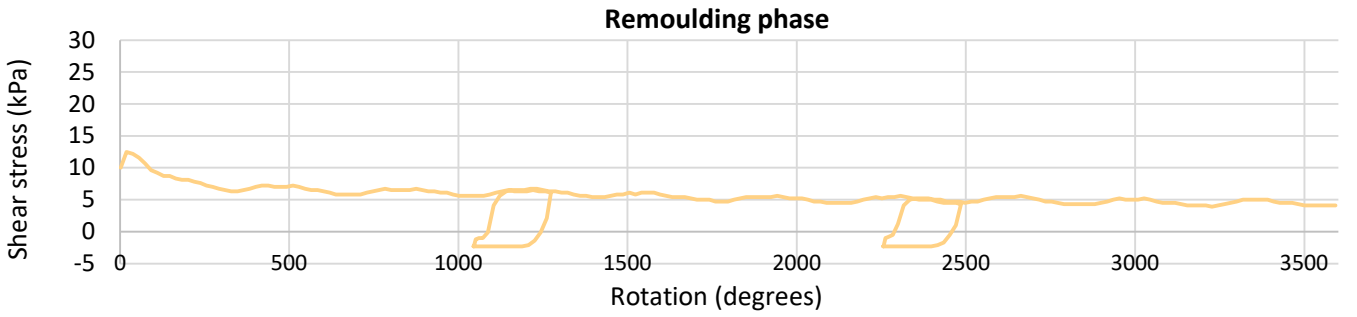
Operator:	TF	**Su_vane:**	12 kPa
Vane size:	50 x 100 mm	**Sur_vane:**	3.4 kPa
ISO test type:	'UX'	**Sensitivity:**	3.5
Rotation rate:	0.1 °/s		
Applied zero (digital):	11.5		
Sensor drift:	-0.9 kPa		
System friction change:	0.7 kPa (clean/dirty difference)		

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Shear Vane Test Results Sheet

TILBURY





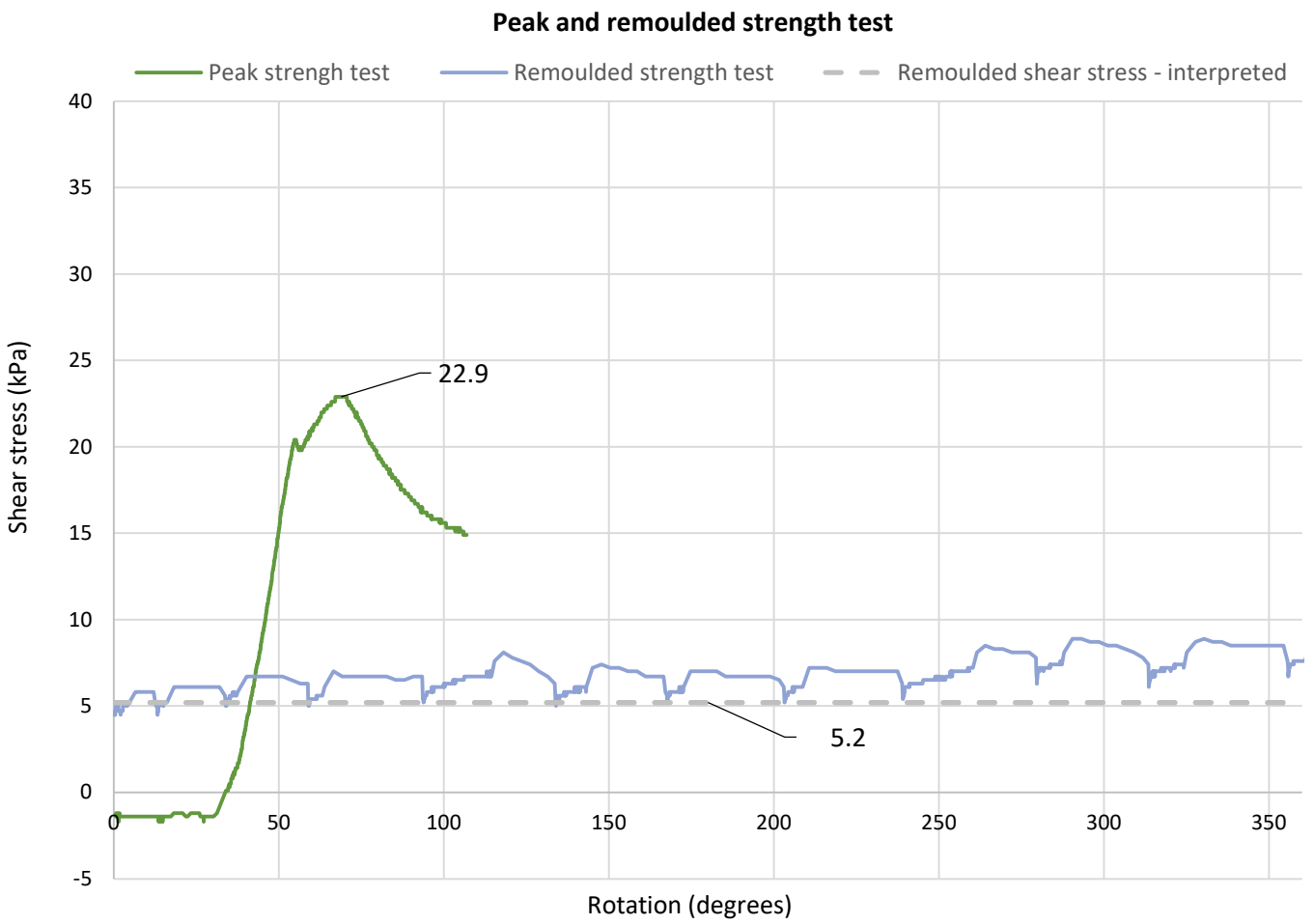
Location ID: **BH110 VANE** **Depth:** **6 m** **Remarks:**

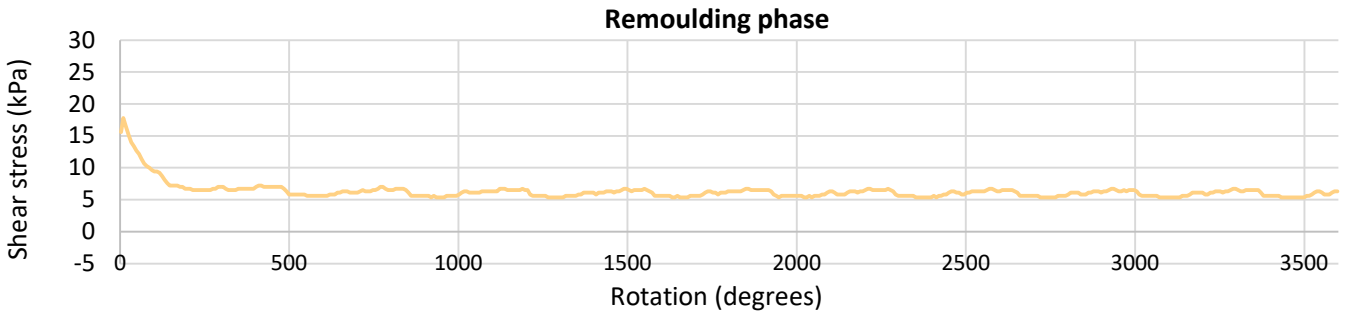
Operator:	TF	**Su_vane:**	17.5 kPa
Vane size:	50 x 100 mm	**Sur_vane:**	4 kPa
ISO test type:	'UX'	**Sensitivity:**	4.4
Rotation rate:	0.1 °/s		
Applied zero (digital):	11.5		
Sensor drift:	0.4 kPa		
System friction change:	0.7 kPa (clean/dirty difference)		

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Shear Vane Test Results Sheet

TILBURY





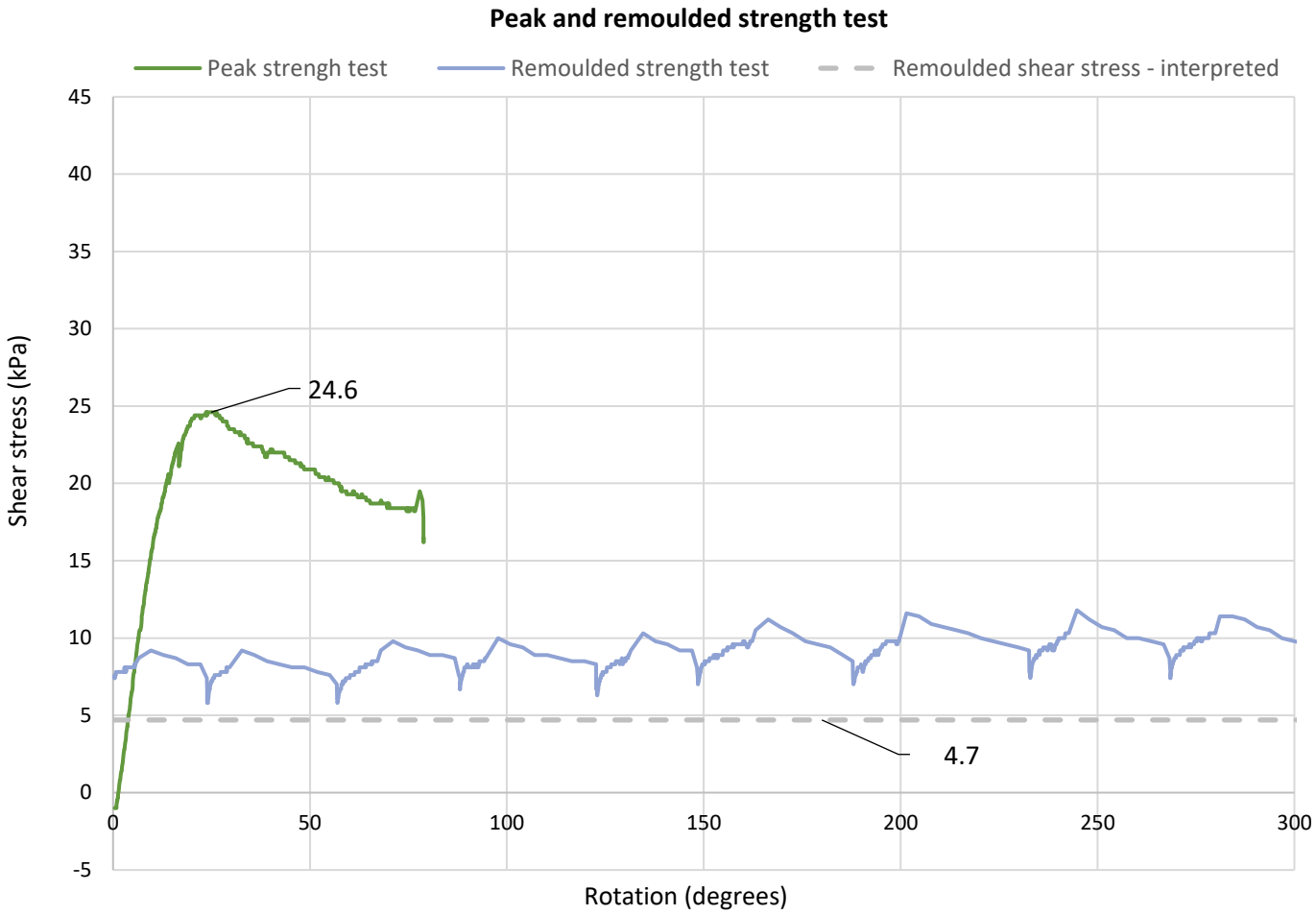
Location ID: **BH110 VANE** **Depth:** **9 m** **Remarks:**

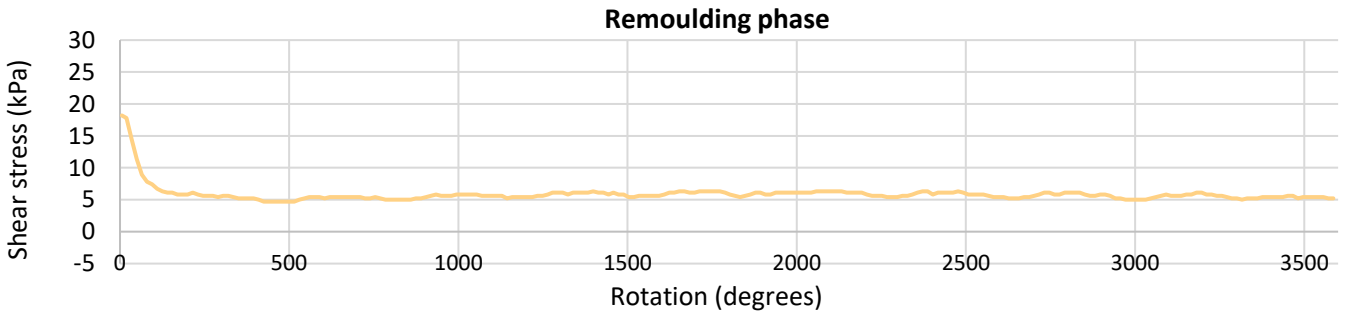
Operator:	TF	**Su_vane:**	22.9 kPa
Vane size:	50 x 100 mm	**Sur_vane:**	5.2 kPa
ISO test type:	'UX'	**Sensitivity:**	4.4
Rotation rate:	0.1 °/s		
Applied zero (digital):	11.5		
Sensor drift:	0 kPa		
System friction change:	0.7 kPa (clean/dirty difference)		

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Shear Vane Test Results Sheet

TILBURY





Location ID: **BH110 VANE** **Depth:** **11 m**

Operator: TF
Vane size: 50 x 100 mm
ISO test type: 'UX'
Rotation rate: 0.1 °/s
Applied zero (digital): 11.5
Sensor drift: 0.4 kPa
System friction change: 0.7 kPa (clean/dirty difference)

Su_vane: 24.6 kPa
Sur_vane: 4.7 kPa
Sensitivity: 5.2

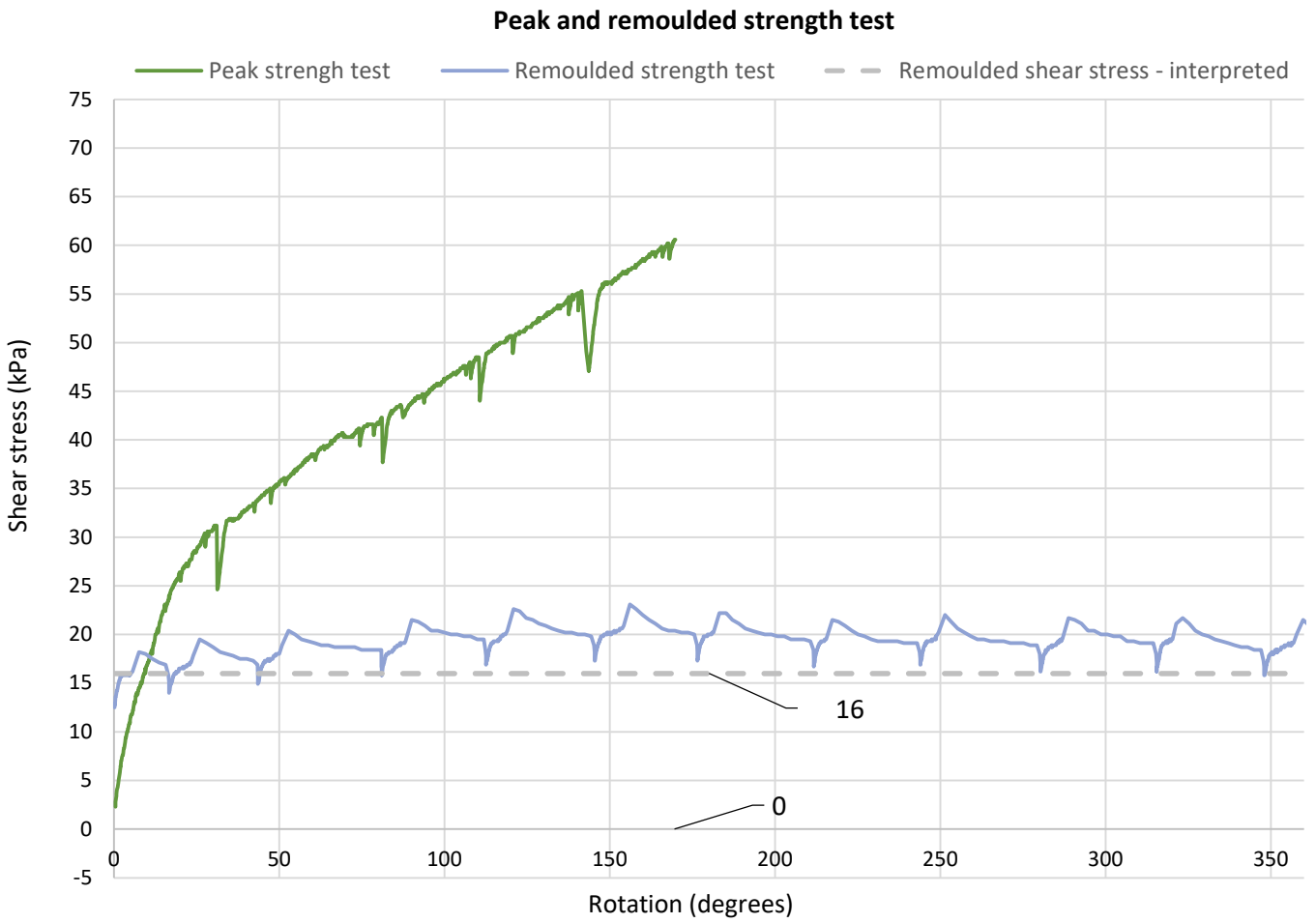
Remarks:

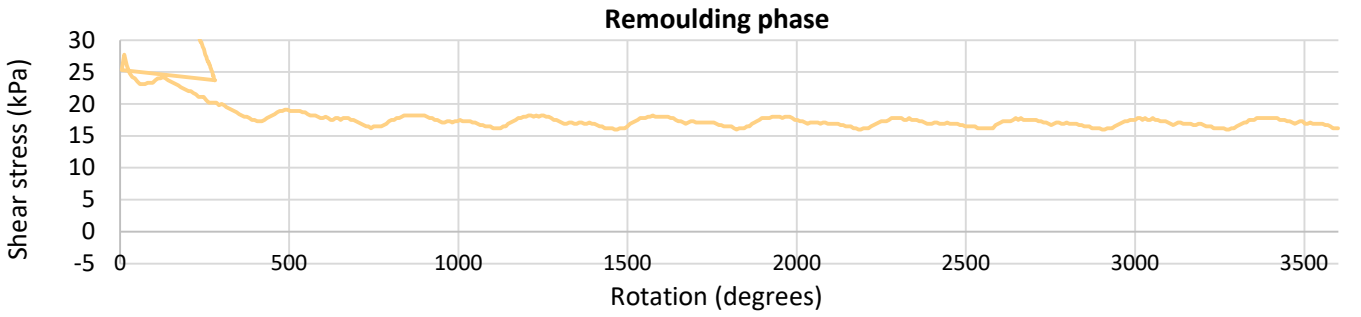
Remoulded measurements higher than those recorded during remoulding phase. The remoulding response is uniform, and the difference is not thought to be associated with non-stationarity of the vane axis and torque response due to vane eccentricity, or continuing drainage. Remoulded strength taken from lowest value recorded during remoulding stage. Remoulded response appears to rise significantly with each measurement attempt (e.g. 312 to 324 degrees).

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Shear Vane Test Results Sheet

TILBURY





Location ID: **BH110 VANE** **Depth:** **13 m**

Operator:	TF	**Su_vane:**	
Vane size:	50 x 100 mm	**Sur_vane:**	16 kPa
ISO test type:	'UX'	**Sensitivity:**	
Rotation rate:	0.1 °/s		
Applied zero (digital):	11.5		
Sensor drift:	0 kPa		
System friction change:	0.7 kPa (clean/dirty difference)		

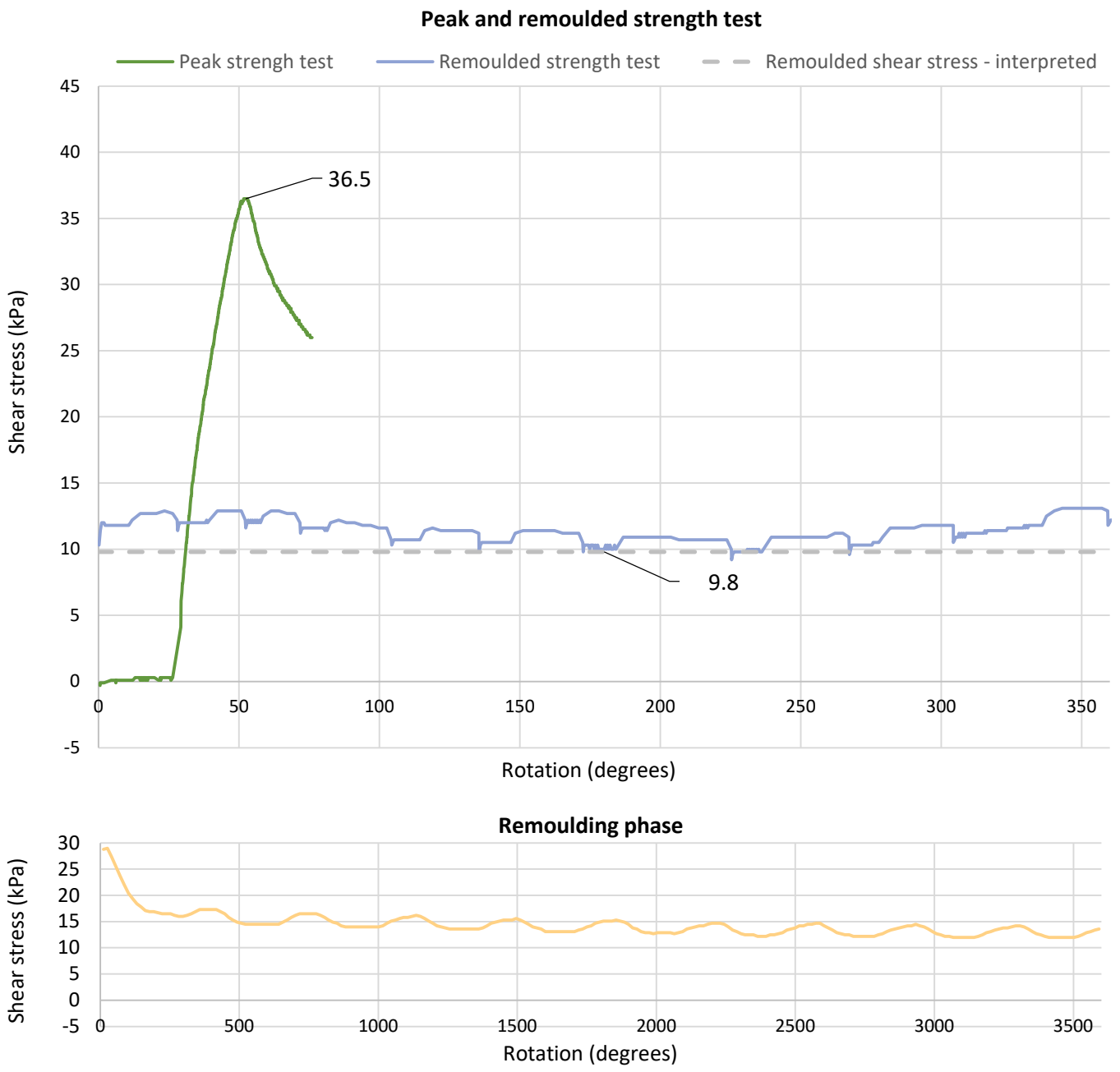
Remarks:

No peak ovserved after 170 degrees rotation and displayed increase in stress usually associated with drainage. Remould phase indicated failure after an additional 155 degrees rotation. Likely peat/organic layer indicated by local CPT tests undertaken at approx 0.4 m higher elevation.

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Shear Vane Test Results Sheet

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Location ID: **BH110 VANE** **Depth:** **13.86**

Remarks:

Test undertaken to compensate for unintentional material (assumed organic/peat) encountered at 13 m.

Operator: TF

Vane size: 50 x 100 mm

ISO test type: 'UX'

Rotation rate: 0.1 °/s

Applied zero (digital): 11.5

Sensor drift: -0.2 kPa

System friction change: 0.7 kPa (clean/dirty difference)

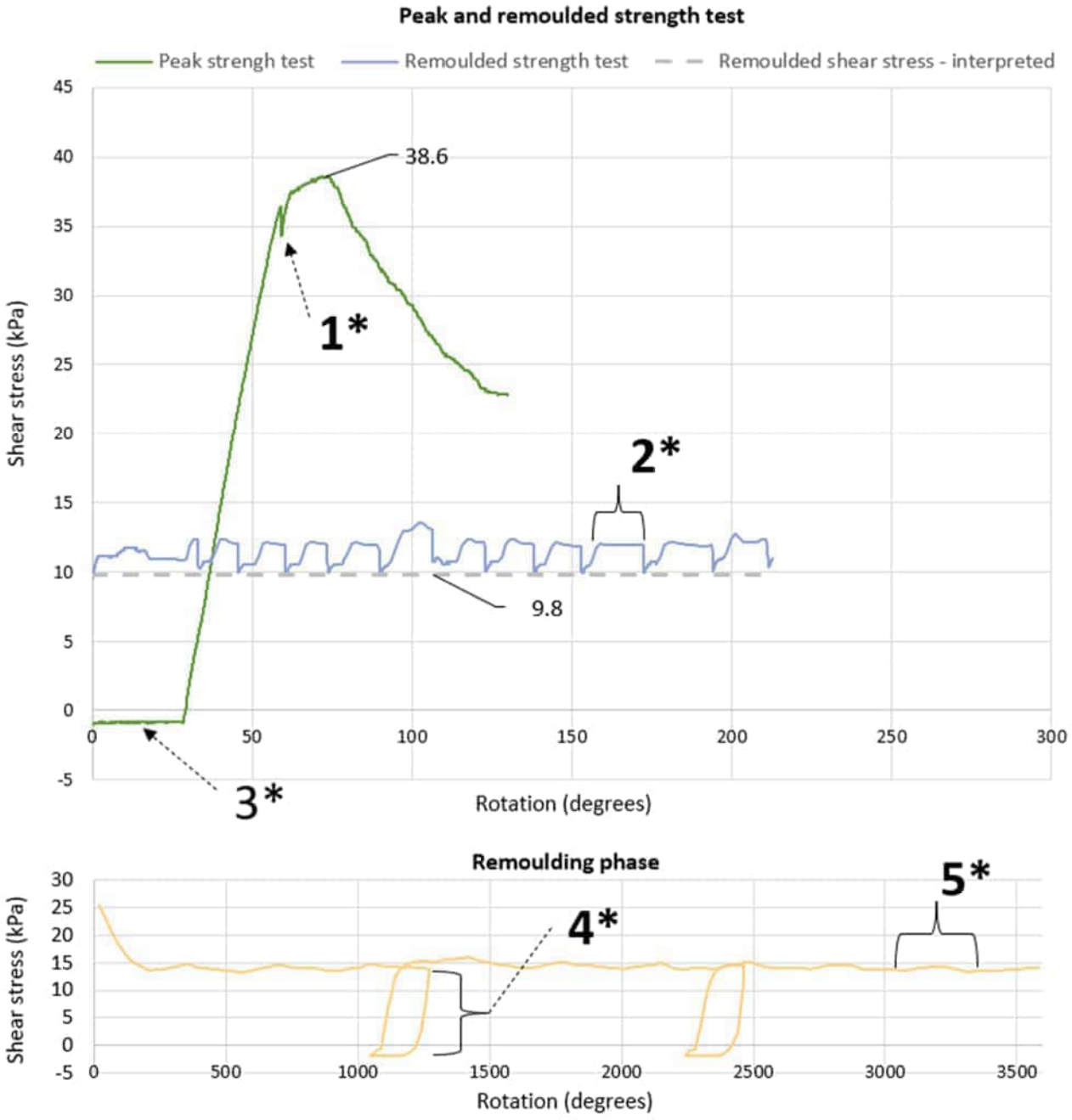
Su_vane: 36.5 kPa

Sur_vane: 9.8 kPa

Sensitivity: 3.7

APPENDIX M SHEAR VANE PLOT WITH FEATURE/ARTEFACT ANNOTATION

Example test data graphical output with feature/artefact annotation.



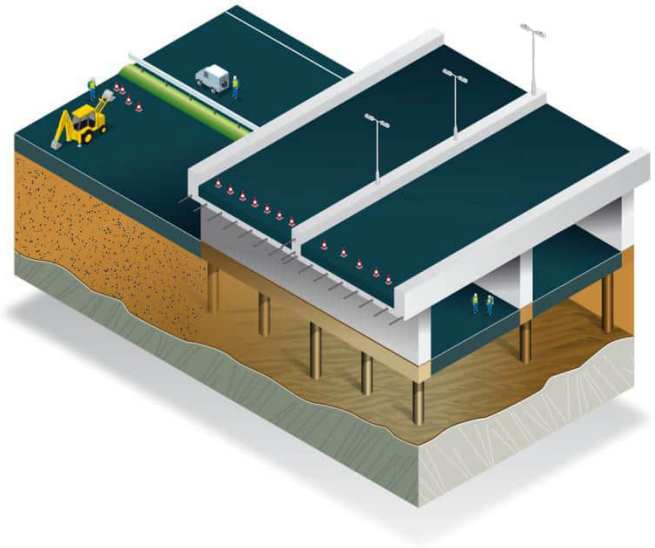
NOTES:

1) Downward spike caused by rod join tightening at higher applied torque. This is usually the top adaptor which is added after vane insertion and not tightened excessively to avoid accidental movement of the vane.
2) Each step up to next drop represents ~5 deg/s rotation 'fast forward' to cover 360° rotation at regular intervals. The lower measurements between these are obtained at standard rate. This can be ignored but can also give useful information on rate effects/sensitivity. The initial drop is often quite pronounced and is believed to be a transient torque imbalance associated with rotational

inertia when dropping to the lower rotation rate, or latency in the motor control during transition to a lower speed.

3) Initial (up to) 25° is the slip coupling rotation to confirm friction between inner rods and the protective casing and centralisers. The slip coupling is located above the vane shaft at base of inner rods and does not capture the small additional friction measured by 'free air' response of the dirty vane (as recovered), therefore the slip coupling value is usually slightly negative after application of the 'dirty' zero value obtained after recovery.
4) Periodic motor reversal. Can be ignored but useful for confirming slip coupling friction on inner rods.
5) Variation with wavelength ~360° caused by eccentricity of vane (van not rotating perfectly around axis). The amplitude of this tends to increase as the soil become stiffer, where the vane shaft stiffness becomes smaller relative to the soil stiffness and the ‘rudder’ effect of the vane is magnified. It can be assumed that the peak torque is affected by at least the same amplitude as the variation seen during remoulding.
   The remoulded test data will typically show the same level of variation (amplitude) over 360 degrees, and the value closest to the minimum is generally taken at the remoulded shear strength.

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engineering

Title: Geophysical Survey to Map Soil Resistivity
Client: SEGL
Site: Tilbury and Gravesend
Ref: P14695-24-R1-C
Date: 29 August 2025

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1. Introduction

Zetica Ltd was commissioned by SEGL (the Client) to carry out geophysical surveys at 2 no. locations on the north and south banks of the River Thames near Tilbury and Gravesend, respectively (the Sites).

The objective of the survey was to measure the electrical resistivity of the subsurface for electrical earth grounding design.

The survey was undertaken over two phases covering a total of 10 no. day shifts between 9th June and 9th August 2025 and utilised the Wenner electrical resistivity sounding method. Results from the first phase of work have been previously presented in Zetica Report P14695-24-R1-A. This report presents the combined survey results from Phase 1 and subsequent Phase 2 works.

1.1. Site Description

The northern Site is located ~2 km east of the centre of Tilbury while the southern Site is located ~2.5 km east of the centre of Gravesend (Figure 1).

Surface elevations at the Tilbury Site varied between 2.2 m and 9.5 m above Ordnance datum (AOD) and between 1.7 m and 2.9 m AOD at the Gravesend Site.

Surface cover varied between aggregate, reinforced concrete, and short grass at the Tilbury Site while the majority of the Gravesend Site was covered by short grass. Above ground obstacles included, public roads, watercourses, fences and a firing range. Typical site conditions at the time of the survey are shown in Figure 2.

Overhead powerlines crossed the Site north to south at Tilbury and north-west to south-east at Gravesend.

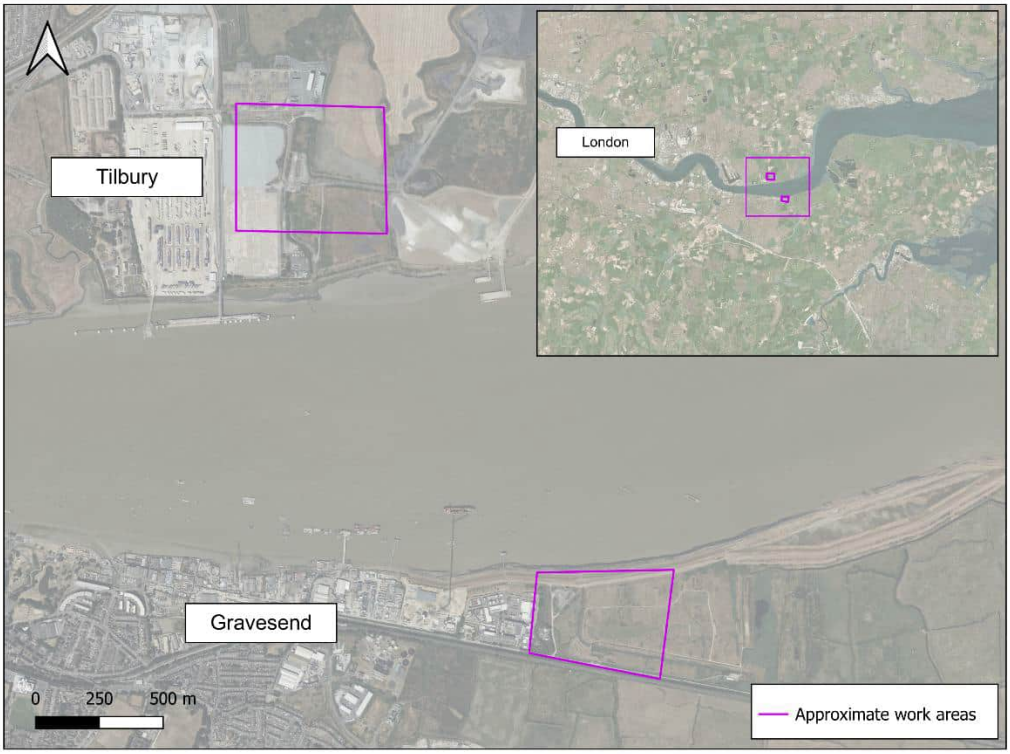


Figure 1: Approximate Site locations. Source: Bing Maps.



Figure 2: Site photos showing typical site conditions at the time of the survey.

2. Methodology

The Wenner electrical resistivity sounding method measures the apparent electrical resistivity of the ground using an array of 4 no. equally spaced electrodes. A resistivity meter is used to inject a current into the ground using the outer pair of electrodes and the resulting potential difference is measured using the inner pair of electrodes. An apparent resistivity is calculated from the injected current and measured potential difference.

2 no. different resistivity meters were deployed during the survey, namely a Campus Tigre resistivity meter and a Syscal Junior resistivity meter. There was no significant difference in the results produced by either system. An example setup of the equipment is shown in Figure 3.

The common spacing between the 4 no. electrodes is known as the 'a-spacing'. Measured resistivities are assigned to greater depths with increasing a-spacings. Typical electrical resistivities for the expected subsurface materials are listed in Table 1.

Electrodes were hammered into the ground to a depth no greater than $1/10^{th}$ of the a-spacing. Where hardstanding was encountered, holes were drilled through the hardstanding before inserting the electrodes.

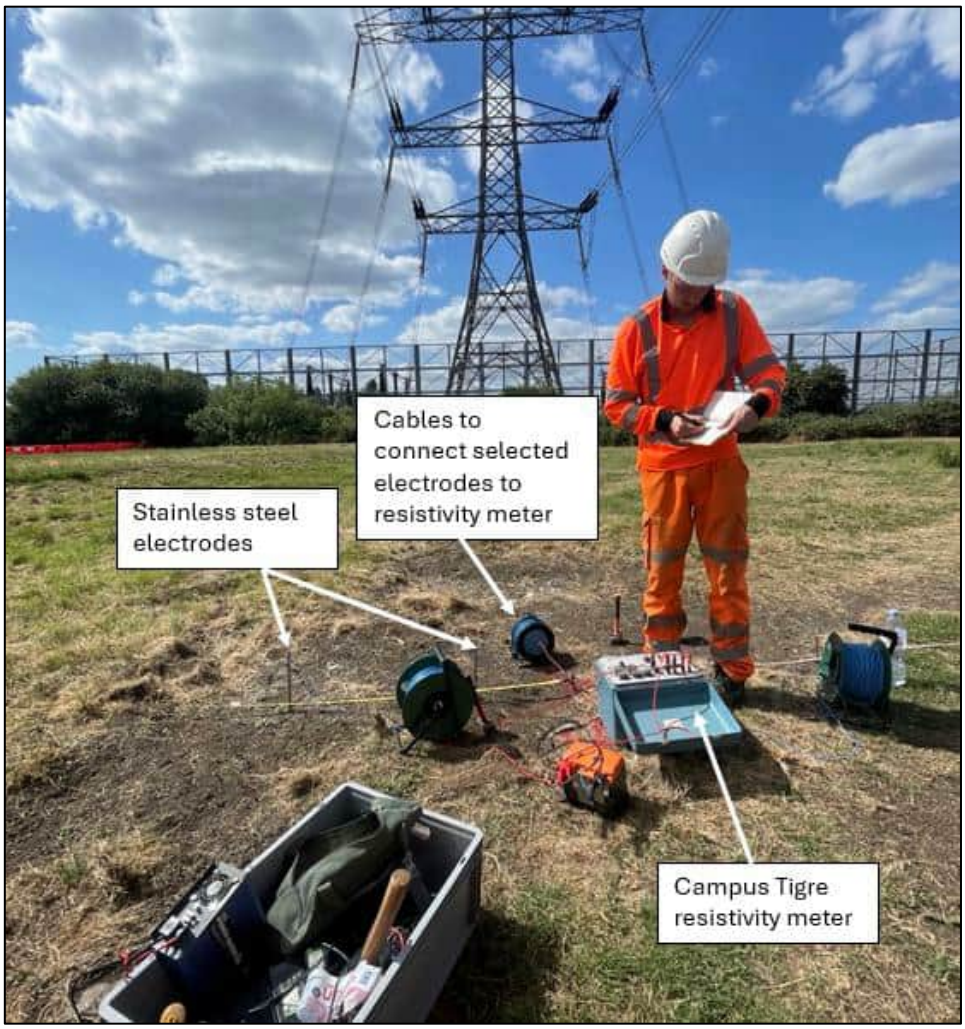


Figure 3: Photo showing the equipment setup with the Campus Tigre resistivity meter.

Rock / soil / material type	*Electrical Resistivity Range (Ω.m)*
Water (fresh)	*20 – 100*
Water (saline)	*<10*
Topsoil	*50 – 100*
Dry Sand	*100 – 300*
Wet Sand	*5 – 100*
Gravel	*100 – 1400*
Sand & gravel	*30 – 250*
Clay	*5 – 200*
Chalk	*30 – 100*

Table 1: Typical resistivity ranges of common material types.

2.1. Survey Lines

Data were acquired along 7 no. survey lines, 3 no. at the Tilbury Site and 4 no. at the Gravesend Site (Figure 4). Survey line B at the Tilbury Site could not be surveyed due to restricted access.

Start and end points for each survey line were provided by the Client as well as individual electrode locations. The start and end points of each line are listed in Table 2.

The mid-point of each line is the location of the respective resistivity sounding (Table 3). The a-spacings used for each Wenner sounding are listed in Table 4.

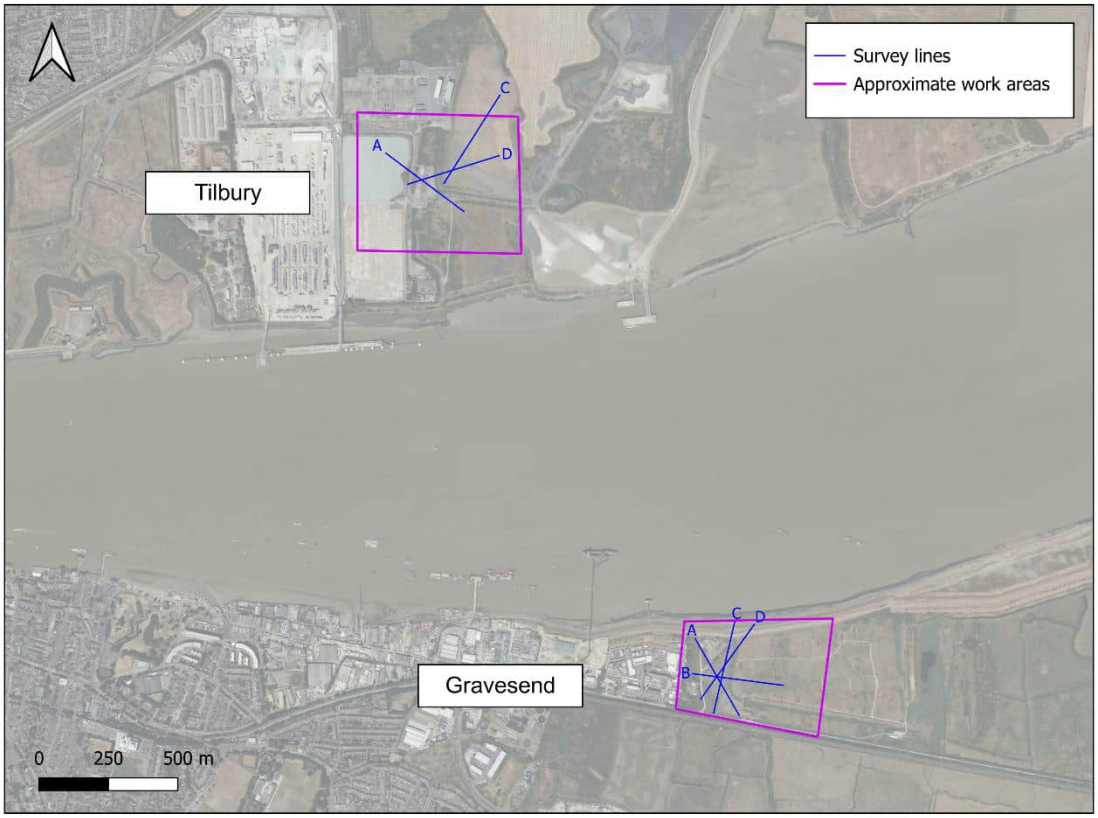


Figure 4: Survey line locations.

Sounding	Surveyed Line Length (m)	Client Provided Start Coordinates		Client Provided End Coordinates	
		Easting	Northing	Easting	Northing
Gravesend Line A	318	567345.2	174263.1	567512.6	173992.7
Gravesend Line B	330	566212.1	176036.3	566409.9	175717.7
Gravesend Line C*	324	567485.0	174327.0	567420.0	173998.0
Gravesend Line D	330	567372.4	174047.5	567556.3	174321.4
Tilbury Line A	330	566172.9	175969.7	566461.1	175769.3
Tilbury Line B**					
Tilbury Line C	375	566577.1	176190.8	566386.5	175868.7
Tilbury Line D	345	566581.9	175974.2	566256.1	175860.8

Table 2: Survey line locations in OSGB coordinate system.

** Coordinates only provided to the nearest metre*

*** Line was inaccessible at the time of the survey*

Sounding	Coordinates	
	Easting	Northing
Gravesend Line A	567428.9	174127.9
Gravesend Line B	567504.0	174121.7
Gravesend Line C	567452.9	174162.4
Gravesend Line D	567464.4	174184.4
Tilbury Line A	566317.0	175869.8
Tilbury Line B		
Tilbury Line C	566481.6	176029.5
Tilbury Line D	566419.0	175917.5

Table 3: Sounding locations in OSGB coordinate system.

Sounding	a-spacings aquired (m)	No. of resistivity recordings
Gravesend Line A	0.3, 0.5, 0.8, 1, 2, 3, 4, 5, 7, 8.5, 10, 15, 20, 25, 35, 45, 60, 85, 100, 106	20
Gravesend Line B	0.3, 0.5, 0.8, 1, 2, 3, 4, 5, 7, 8.5, 10, 15, 23, 29, 35, 45, 69, 86, 100, 110	20
Gravesend Line C	0.3, 0.5, 0.8, 1, 2, 3, 4, 5, 7, 8.5, 10, 15, 20, 25, 35, 45, 60, 85, 100, 108	20
Gravesend Line D	0.3, 0.5, 0.8, 1, 2, 3, 4, 5, 7, 10, 15, 18, 25, 35, 45, 60, 85, 100, 110	19
Tilbury Line A	0.3, 0.5, 0.8, 1, 2, 3, 4, 5, 7, 10, 15, 20, 25, 35, 50, 60, 85, 100, 110	19
Tilbury Line B		
Tilbury Line C	0.3, 0.5, 0.8, 1, 2, 3, 4, 5, 7, 10, 15, 20, 25, 35, 45, 60, 85, 100, 110, 125	20
Tilbury Line D	0.3, 0.5, 0.8, 1, 2, 3, 4, 5, 7, 10, 15, 20, 25, 35, 50, 60, 85, 99, 110, 115	20

Table 4: Acquired a-spacings for each survey line.

2.2. Survey Limitations

The following clarifies some of the limitations relevant to the survey.

- Data are represented by a localised 1D sounding which may not be representative of the ground conditions across the Site.
- Recorded resistivities may be adversely affected by nearby utility services, if present, and lateral changes in ground composition away from the sounding location.

3. Data Processing

A minimum of 3 no. readings were taken for each a-spacing. The number of readings taken was increased if outliers were observed in the field. These readings, minus the outliers, were averaged to give the Wenner resistance (R_W). R_W is then converted to apparent resistivity (ρ_w) using the relationship:

$$\rho_w = 2\pi a R_w$$

Where “a” is the a-spacing of the test.

4. Results

The results discussed in this report are also presented in spreadsheet format in *P14695-24-XLS01-C SEGL Engineering Tilbury-Gravesend Wenner Resistivities.xlsx.*

4.1. Resistivity Soundings: Tilbury Site

The calculated apparent electrical resistivities for the Tilbury Site are show in Figure 5.

Apparent resistivities across the 3 no. lines range between ~1.5 Ω.m and ~183 Ω.m.

Apparent resistivities for all lines follow a similar trend of relatively high resistivities at small a-spacings decreasing until an a-spacing of 3 m and thereafter remaining relatively uniform. This is interpreted as potentially dry and/or arenaceous near surface materials overlying clay rich and/or water saturated materials at depth.

Spikes in resistivity are recorded at a = 35 m and a = 85 m on Line A, and a = 2 m on Line D. These spikes are unlikely to be related to geological change and are interpreted as potential interference from the resistive hardstanding, utilities or instrument errors.

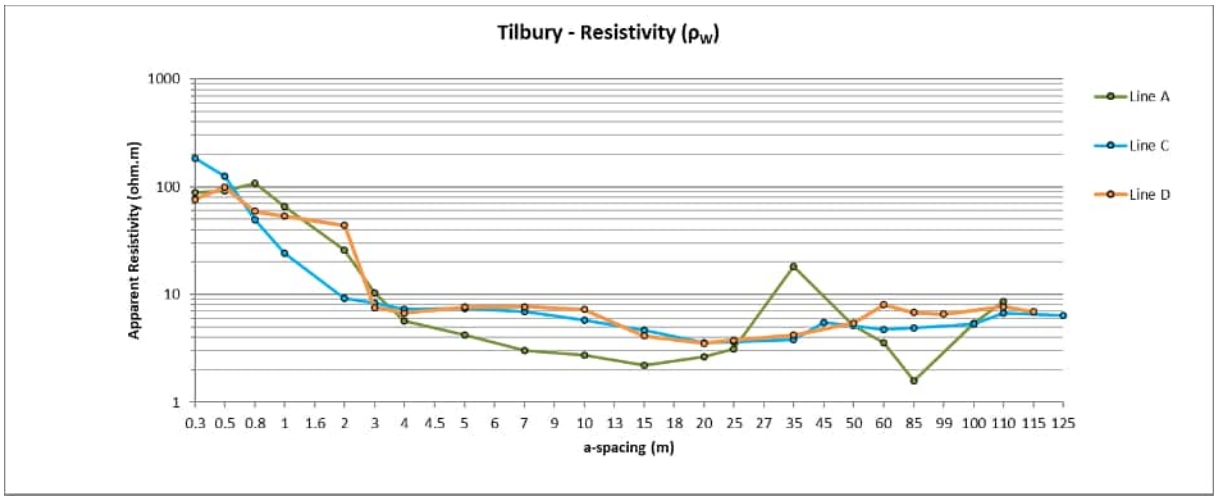


Figure 5: Plot of 1D resistivity soundings for the Tilbury Site.

4.2. Resistivity Soundings: Gravesend Site

The calculated apparent resistivities for the Gravesend Site are shown in Figure 6.

Apparent resistivities across the 4 no. lines range between ~1.3 Ω.m and ~369 Ω.m.

Higher apparent resistivities are recorded for Lines B and C at small a-spacings and likely indicate localised drier near surface materials with lower clay content compared with Lines A and D.

At greater a-spacings (>7 m), recorded resistivities generally show excellent agreement between all lines, gradually increasing from ~1.5 Ω.m to ~13 Ω.m.

Spikes in resistivity are recorded at a = 100 m for Line A and a = 35 m and 60 m for Line D. These spikes in resistivity are likely associated with instrument noise or signal interference.

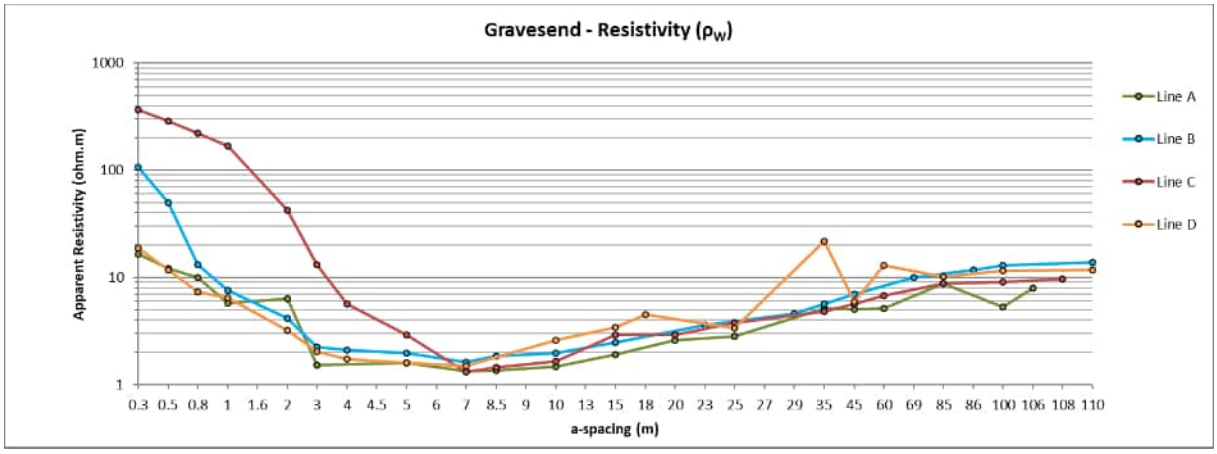


Figure 6: Plot of 1D resistivity soundings for the Gravesend Site.

5. Summary

Apparent resistivities at the Tilbury Site ranged between ~2.0 Ω.m and ~183 Ω.m. Apparent resistivities for the 3 no. lines follow a similar trend of initially high apparent resistivities within the near surface (small a-spacings) overlaying moderate to low resistivities at depth (larger a-spacings). This is interpreted as potentially dry and/or arenaceous near surface materials overlying more clay rich and/or water saturated materials at depth.

Apparent resistivities at the Gravesend Site ranged between ~1.3 Ω.m and ~369 Ω.m. Significantly higher resistivities were recorded for Lines B and C than Lines A and D at small a-spacings and are interpreted as representing localised drier/arenaceous materials within the near surface at those locations. At a-spacings greater than 7 m, the 4 no. lines showed consistent results with apparent resistivities increasing from ~1.5 Ω.m to ~13 Ω.m.

Zetica welcomes the opportunity to further review the results of this geophysical survey if additional ground truthing information becomes available.

Appendix A Notes

1. This report has been prepared in relation to the specific requirement of the contract or commission. The report should not be used by third parties without prior consultation with Zetica Ltd. Any advice, recommendations, or statements within the report should be addressed only in the context of the report as a whole.
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5. By their nature, exploratory points, such as boreholes or trial pits, can only provide information on a relatively limited area or volume of a Property. In general, the conditions encountered may vary between exploratory points.
6. It should be noted that the detection performance is dependent on a measurable physical contrast between the item for detection and host materials. Where significant noise is present sufficient detection may not be possible.
7. Interpretation relies largely on experience of similar conditions. Site-specific conditions can create variations that may not be detectable by non-intrusive investigation techniques. It should be noted that the detail of an interpretation might vary from that identified by later intrusive investigation, although the general identification of a feature should not vary.
8. The report has been written in Line with relevant guidance and legislation in use at the time of report compilation. Subsequent improvement in techniques, changes in legislation, or changes in Site conditions, may render parts of this report obsolete. After a significant period (i.e. a year) it may be prudent to discuss the report and findings with us.

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Grain to Tilbury Tunnel GI - Ground Investigation

Results of pressuremeter tests carried out by Cambridge Insitu Ltd

Project reference:	TB8754
Client:	Soil Engineering
Cambridge Insitu reference:	CIR1609/25
Report date:	July 2025
Version:	1.0

VOLUME 1 of 2
Text report with a summary of the results

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Initial calibration (HPD95 'Wally') Arm 3 only	Peter Allen	Cambridge Insitu Ltd
Initial calibration (HPD95 'Lilith')	Peter Allen	Cambridge Insitu Ltd
Field work	Peter Allen / Simon Baxter / Stuart Pearce	Cambridge Insitu Ltd
Preliminary analysis	Stuart Pearce	Cambridge Insitu Ltd
Final analysis	Robert Whittle	Cambridge Insitu Ltd
Final reporting	Robert Whittle	Cambridge Insitu Ltd

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Grain to Tilbury Tunnel GI

Ground Investigation - Pressuremeter Testing

1 INTRODUCTION

Cambridge Insitu Ltd (CIL) was contracted by Soil Engineering Ltd to provide pressuremeter testing services as part of the ground investigation for the Grain to Tilbury Tunnel GI. The site is being evaluated as part of National Grid's proposed electricity infrastructure upgrades. Testing was undertaken to determine representative values for the engineering properties of the ground, in particular insitu strength and stiffness. Mott MacDonald instructed the testing.

Two 95mm diameter High-Pressure Dilatometers (HPD) named 'Wally' and 'Lilith' were used to carry out the pressuremeter tests. This type of pressuremeter is inserted into pre-bored pockets nominally 101mm in diameter and between 1.5 metres and 2.0 metres long. Soil Engineering Ltd provided the drilling support for the pressuremeter operations. The material for all tests was chalk, varying from structureless to very weakly structured. Flint was present throughout and is probably the reason why core recovery at the T6-101 core barrel size was often poor.

Twenty-seven tests were attempted at four locations with the fieldwork taking place between 15th of May and 23rd of June 2025. Two of these tests ended prematurely; BH108 Test 2 was ended by a membrane rupture. BH101 Test 1 achieved the maximum working displacement of the HPD before encountering the borehole wall, indicating that the cored pocket was grossly oversize. No analysable data was recorded for this test.

This report is concerned solely with the presentation of the pressuremeter results. Any preliminary results issued during the course of the fieldwork are now superseded by the data in this report.

1.1 Instrumentation

1.1.1 95mm High Pressure Dilatometer (HPD95)

The 95mm diameter Cambridge High Pressure Dilatometer was developed to carry out a pressuremeter test in rock but it may also be used in stiff soil. The instrument requires a 99-101mm diameter pocket, in this instance made by coring with a T6-101 barrel. This kind of pressuremeter test is referred to as pre-bored and leads to the ground seeing stress relief before the test itself commences. Figure 1.1 refers to this disturbance as 'overcut', and any data within this zone (including unload/reload cycles) are affected and should not be used.

The central part of the probe is covered by an elastic membrane, locally reinforced at the extremities. This arrangement resists axial extrusion and allows a relatively thin membrane to be used because the membrane is not required to fill the clearance at the membrane ends. The membrane is covered by a thin stainless-steel sheath made up of 18 strips that due to its appearance when expanded is known as a 'Chinese Lantern' or CHL.

Once at the intended depth, pressure is applied down an umbilical hose/cable to the inner surface of the membrane. This pressure causes the membrane to load the borehole wall and carry out a cavity expansion test. Measurements of displacement and pressure on the inner surface of the membrane are made directly in the probe. The resolution is high enough to provide data for shear modulus up to 20GPa. The instrument contains all the signal conditioning electronics, so the final output of the probe is digital data in RS232 format for direct connection to the USB port of a personal computer.

The displacement is measured by six sensors evenly positioned behind the centre of the expanding membrane. Because the probe is a loose fit to the cavity in the ground, the output from a single arm is almost meaningless. The centre of the probe is the reference for all measured displacements and is free to translate in relation to the cavity. It is normal, therefore, to take the average radial displacement as representing the movement of the cavity wall. However, it is possible to take the mean of opposing sensors and in principle displacement data can be obtained from three axes separated by 120°.

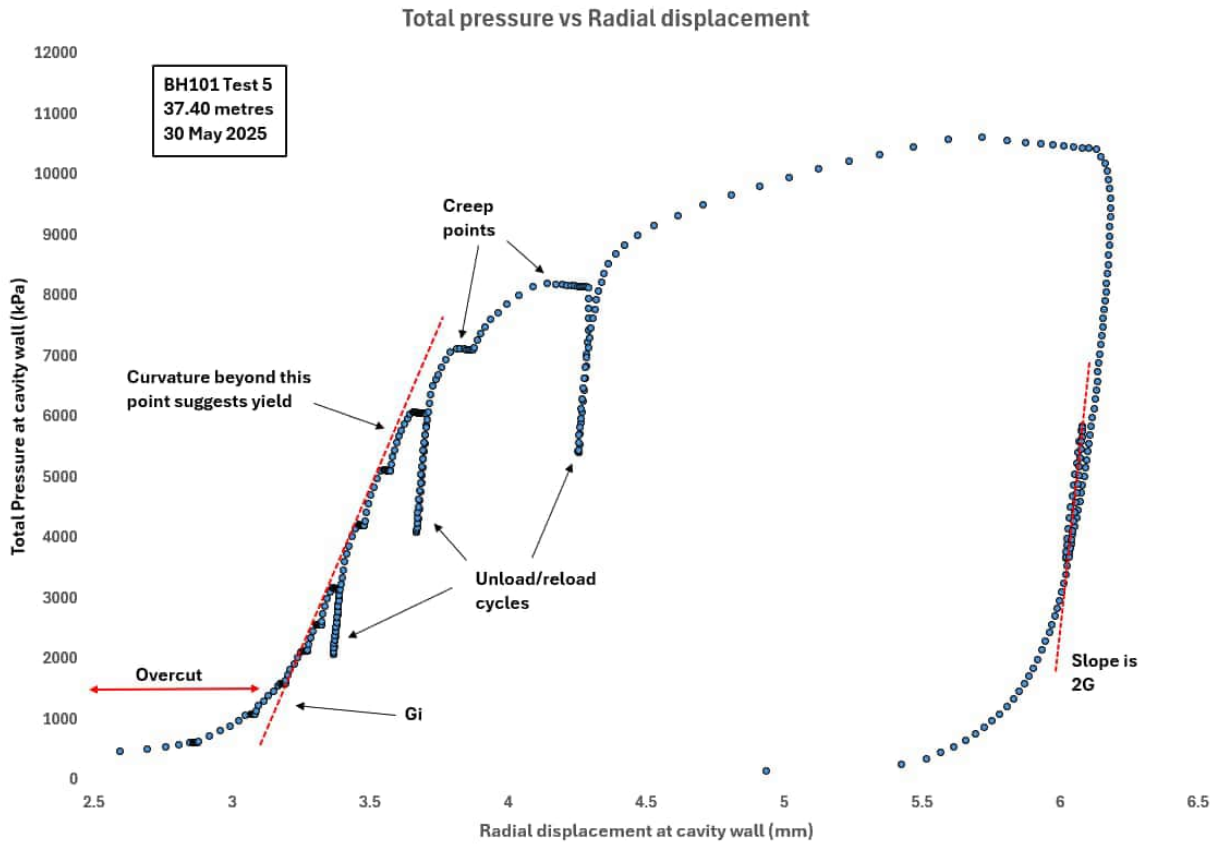


Figure 1.1 Annotated field curve

The pressure capability is 20MPa/200bars in normal use. The displacement capability is 20mm or the equivalent of 42% shear strain. Maximum pressure and maximum displacement do not occur in the same test. The probes used for this contract are known as 'Wally' and 'Lilith' and output a line of data every 10 seconds. A typical test episode from the start of placement to recovery of the probe takes about 2.5 hours.

1.1.2 Compliance calibration

When measuring the displacements of the cavity wall, the stiffness of the ground is in parallel with the stiffness of the measurement system, and in very stiff ground (such as rock) this can be a significant source of error. Whenever a membrane is replaced a calibration for the instrument compliance is carried out using average displacement data. This is sufficient for standard test analysis in the typical material tested for this contract.

1.2 Analysis

The pressuremeter loading curve can be solved directly using mathematical expressions for the expansion of a cylindrical cavity. The solution conventionally is quoted in terms of strength and stiffness parameters for the material, typically shear modulus, shear strength or friction angle as appropriate, and the insitu lateral stress. The success of this method is dependent on the validity of

the necessary assumptions made about the nature of the ground and the geometry of the cavity expansion configuration.

Appendix A gives brief details of the analyses that have been applied.

1.2.1 Assumptions

1.2.1.1 If the material is a soil, it is assumed that at the test level, the material is homogeneous with isotropic properties behaving as a continuum and is fully saturated. These assumptions are unlikely to be valid for rock.

1.2.1.2 An assumption about the instrument is that the length to diameter ratio of the expanding section is large enough for end effects to be negligible allowing the test to be modelled as a plane strain expansion.

1.2.1.3 The pressuremeter test gives data for the total radial stress and radial displacements of the cavity wall. The displacements are a direct function of the hoop strain. To solve the boundary problem represented by a cavity expansion it is necessary also to know the radial strain and circumferential stress. The radial strain is directly related to the measured displacements if the expansion is a constant volume deformation (undrained or elastic). If the expansion is drained, then a more complex solution is required; shear and volumetric strains are derived using assumptions about the dilatant behaviour of the material**.**

1.2.1.4 It is assumed that the cavity expands as a circle and hence the results have been obtained by analysing the curve derived from the average of all displacement followers as this gives the best representation of a circular expansion. This is primarily an assumption about the post-yield response – if the ground is behaving elastically then under some circumstances it may be possible to examine the expansion at multiple axes.

1.2.2 Shear stiffness

Plausible and consistent data for shear modulus have been obtained from the unload/reload cycles and several cycles were incorporated into each test (see Figure 1.1). The simplest approach is to assume linear elasticity so that the slope of a chord through the cycle is directly proportional to the shear modulus (G_{ur}).

In principle, the slope of the initial loading is also a source of modulus data. This part of the curve is significantly influenced by disturbance resulting from the pocket formation and subsequent unloading of the cavity wall. Values for modulus from this part of the test are designated G_i . In a pre-bored test, the ratio G_i/G_{ur} is an approximate indication of the degree of disturbance. Values for G_i are given in Volume 2 of this report but are not included in the summary tables of this volume (Part 3) as they are not considered representative of the true shear stiffness.

All measured modulus parameters are shear modulus G. They can be converted to Young's modulus E - if the material is isotropic then the relationship $E = 2G(1+\nu)$ can be used where ν is Poisson's ratio. We have applied 0.3 as this is a common choice.

Stiffness is stress and potentially strain dependent (Figure 1.2) and values for modulus can be related to the current mean effective stress at the cavity wall. The modulus obtained from the first valid cycle in each test (cycle 2 in figure 1.1) is the best representation of stiffness at the insitu state that avoids combining multiple parameters.

The strain dependency of stiffness is evaluated using the procedure proposed by Bolton & Whittle (1999). Non-linearity is expressed as a power law with a constant term and an exponent (see figure 1.2). Stiffness is plotted over an arbitrary range of 10^{-4} to 10^{-2} shear strain. This would be appropriate for an over consolidated clay but is too great for chalk. In addition to the power law the experimental data from the cycles are also examined using Palmer (1972). These are the points plotted in figure 1.2. Inevitably these show noise, but the trend is clear. It is also apparent that the 10^{-2} limit is an over-estimate for this material, with the points separating from the power law curves between 0.1% and 0.2% shear strain. The tests indicate a strain dependency sufficiently clearly to justify a non-linear interpretation, and the results for all cycles are presented in Table 3.3.

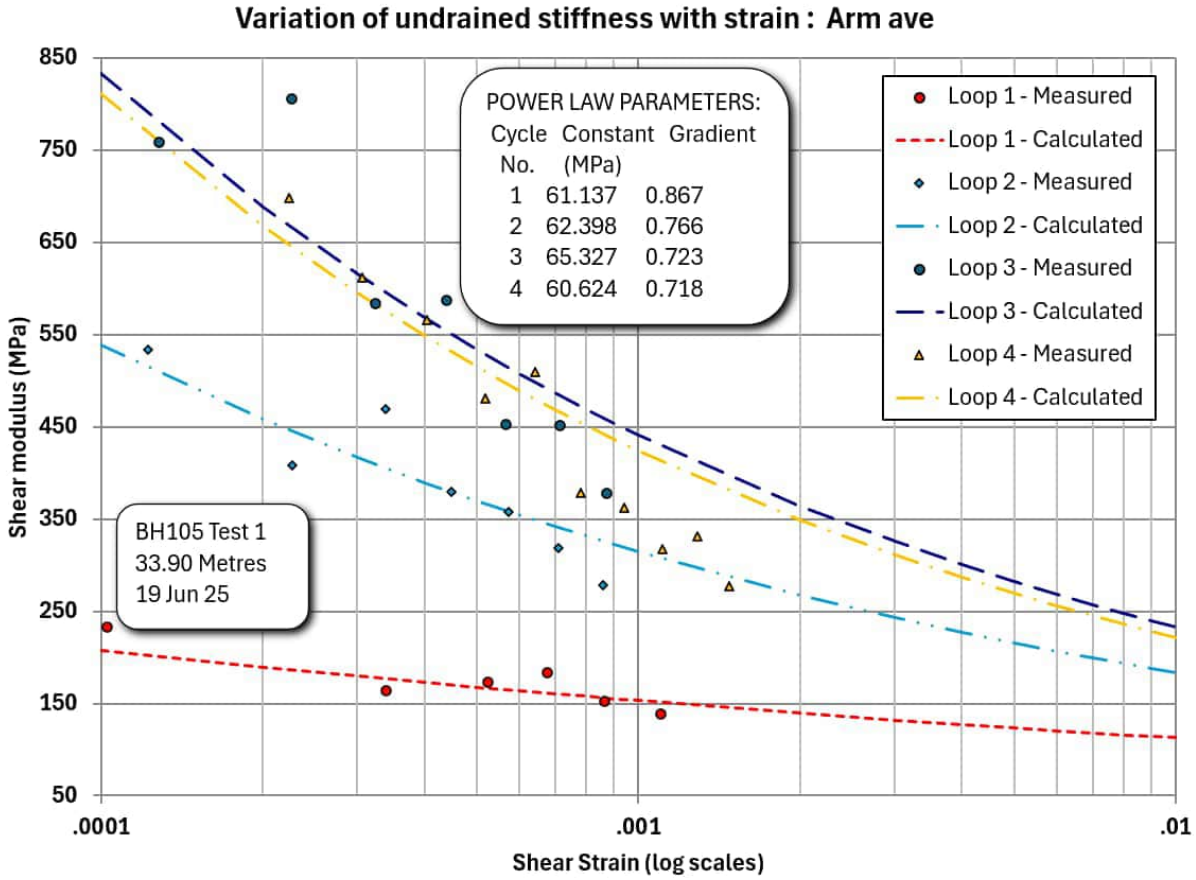


Figure 1.2 Shear modulus against shear strain

We have considered the stress dependency in three ways:

1. Ignored it, just used the first (valid) cycle as being close enough to the insitu stress state to be representative.
2. Back calculated the stiffness properties at yield from the curve modelling results.
3. Applied a modified version of the procedure suggested by Bellotti et al (1989).

Part 3 has plots of shear modulus at 0.1% shear strain plotted for all three methods. 0.1% is about the shear strain at which chalk first yields. Our preference is for the curve modelling results because this represents the best fit data to the entire test curve. We have given a wider interpretation of shear modulus using these values in Table 3.4.

Note that all shear modulus parameters are G_{hh}. Hughes and Whittle (2023) give some guidance on how this relates to shear modulus in the vertical direction, G_{vh}, but because the coefficient of earth pressure at rest, k_o, is only occasionally greater than 1 we expect our results to be similar.

1.2.3 Pore water pressure and overburden stress

At the time of reporting there are no installation data available for deciding the ambient pore water pressure when the pressuremeter test was carried out. For accurate analysis of drained data, knowing the ambient condition is essential so that our measurements of total stress can be converted to effective stress. However, even if ground water was present, the total pressures reached in the tests are generally too high for this to be a serious source of uncertainty. The test itself does give an indication of the ambient pore water pressure (see figure 1.1) from the stress at which the membrane loses contact with the borehole wall. For all tests this stress appears to be greater than zero.

For three locations we have used water levels recorded on site by the drilling operation. The exception is BH105, where we have preferred a higher water table based on the membrane collapsing pressures.

The total vertical stress is calculated from an assumed unit weight, 20kN/m^3.

1.2.4 Cavity reference pressure

We have given estimates for the cavity reference pressure p_o. If the material shows yield (see figure 1.1) then a modified version of the procedure suggested by Marsland & Randolph (1977) is used to make an initial estimate for p_o.

The displacement ordinate of the selected p_o is used to identify the origin that permits displacements to be expressed as circumferential strain at the cavity wall. It is not possible to observe p_o directly due to the disturbance caused by pocket creation and subsequent relaxation.

The early unload/reload cycles can be helpful in the initial assessment of principal stress boundaries. If an unload/reload cycle is similar in form to later cycles, then it follows that the stress at which the cycle was initiated is above all the primary stress boundaries (σ_h, σ_H, and σ_v.).

All tests show some plastic behaviour, allowing the measured field data to be compared with a computed response (so called “curve modelling”) based on the analysed parameters. We have used a modified version of the solution for drained cavity expansion tests proposed by Carter et al (1986). The modified version introduces non-linearity in the sub-yield response. The primary purpose of the modelling approach is to identify p_o.

Assuming p_o.is the insitu horizontal stress σ_{ho}, it is possible to use our estimates for the overburden stress and and the assumed ambient pore water pressure to estimate k_o, the coefficient of earth pressure at rest. The results are scattered but for the most part are plausible.

1.2.5 Drained Strength

We have assumed that, following Hughes et al (1977), the gradient of the response in log-log space is a function of the peak angle of internal friction ϕ' and dilation ψ. There is an analogous procedure for cavity contraction data (Withers et al, 1989), however this tends to give ϕ_{cv}, the constant volume friction angle. This is convenient as ϕ_{cv} is required in order to convert gradients into friction angles.

The chalk has some cohesion, which cannot be independently determined by analysis, only from modelling. We have quoted results for drained cohesion without any great confidence in the values produced.

1.3 Layout of the report

Although it is necessary to make judgments when analysing data, this remains a factual report. The parameters derived represent what seems a reasonable choice having applied a particular analysis. Other choices are possible.

This report is in two volumes. Volume 1 summarises the significant results and provides explanatory text. The appendix of Volume 1 gives a brief guide to the analyses used. Volume 2 contains the test data, before and after analysis, predominantly in graphical form, and with minimal explanation. There

is a small amount of repetition between the two volumes so that each can be used independently of the other.

There are additional resources available on-line provided by Cambridge Insitu Ltd that give further information about the following:

- Instrumentation
- Calibration procedures
- An explanation of how to convert a data line from volts to engineering units
- Analysis procedures

These may be accessed using this link: http://tinyurl.com/caminsitu-resources

1.4 Notation

The data collection system employed in the field uses a limited keyboard that restricts the options for describing a test. In particular it stores tests in the form S* T** where ** must be a number. The 'S', which may be modified, is intended to refer to the borehole and the 'T' refers to the individual test, so a typical test reference is B101T01 – the first test in BH101.

This limitation does not apply to analysed data, which uses different software.

Calibration tests to evaluate membrane stiffness and system compliance are reported in a similar manner but using a test number that cannot be confused with an actual test.

1.5 Units

Pressure is quoted throughout in kPa. Displacements are quoted in millimetres which in turn are eventually converted to percent cavity strain. Depths are given as metres below ground level (mBGL) from our measurements. Part 3 includes some plots of the data plotted against elevation.

1.6 General References

There are three published sources that provide the calculations and explanations for the analyses used:

MAIR, R.J. and WOOD, D.M. (1987)
Pressuremeter Testing. Methods and Interpretation. Construction Industry Research and Information Association Project 335. Publ. Butterworths, London. ISBN 0-408-02434-8

CLARKE, B.G (1994)
Pressuremeters in Geotechnical Design. Publ. Taylor & Francis Ltd, ISBN: 9780751400410

HUGHES, John and WHITTLE, Robert (2023)
High Resolution Pressuremeters and Geotechnical Engineering. The Measurement of Small Things. Publ. Taylor & Francis Ltd, ISBN: 9781032060941

The first two references address a wide range of pressuremeter models, the last of these is specific to the type of pressuremeter used for this contract.

1.7 Specific References

The following are analyses mentioned in the introductory text:

BELLOTTI, R., GHIONNA, V., JAMIOLKOWSKI, M., ROBERTSON, P. and PETERSON, R. (1989)
Interpretation of moduli from self-boring pressuremeter tests in sand. *Géotechnique* **39** (2), pp.269 - 292.

BOLTON M.D. and WHITTLE R.W. (1999)
A non-linear elastic/perfectly plastic analysis for plane strain undrained expansion tests. Géotechnique **49** (1), pp 133-141.

CARTER, J.P., BOOKER, J.R. and YEUNG S.K. (1986)
Cavity expansion in cohesive frictional soil, Géotechnique, **36**(3), pp 349 - 358.

HUGHES, J.M.O., WROTH, C.P. and WINDLE, D. (1977)
Pressuremeter tests in sands, *Géotechnique*, **27**(4): pp 455 - 477.

MARSLAND, A. and RANDOLPH, M.F. (1977)
Comparison of the Results from Pressuremeter Tests and Large Insitu Plate Tests in London Clay. Géotechnique 27 No. 2 pp 217-243.

PALMER, A.C. (1972)
Undrained plane-strain expansion of a cylindrical cavity in clay: a simple interpretation of the pressuremeter test, Géotechnique **22** (3), pp 451 - 457.

WITHERS, N.J., HOWIE, J., HUGHES, J.M.O. and ROBERTSON, P.K. (1989)
Performance and Analysis of Cone Pressuremeter Tests in Sands. Géotechnique **39**(3): pp 433-454.

2 DETAILS OF WORK CARRIED OUT

Table 2.1 below details the pressuremeter testing carried out. Table 2.2 provides background information about the tests and probe used. Table 2.3 is given data for coordinates and levels.

Table 2.1 Sequence of work

Test	Internal ref.	Depth (mBGL)	Date *dd/mm/yyyy*	Max Pressure (kPa)	Material	Assumed test path	Notes
BH101 Test 1	B101T01	19.50	28/05/2025	207	Chalk/Flint	Drained	O/s pocket, no results
BH101 Test 2	B101T02	24.90	28/05/2025	1354	Chalk/Flint	Drained	
BH101 Test 3	B101T03	29.30	29/05/2025	4120	Chalk/Flint	Drained	
BH101 Test 4	B101T04	33.20	29/05/2025	9538	Chalk/Flint	Drained	
BH101 Test 5	B101T05	37.40	30/05/2025	10,504	Chalk/Flint	Drained	
BH101 Test 6	B101T06	41.40	02/06/2025	8197	Chalk/Flint	Drained	
BH101 Test 7	B101T07	45.20	02/06/2025	9871	Chalk/Flint	Drained	
BH102 Test 1	B102T01	27.40	15/05/2025	1103	Chalk/Flint	Drained	
BH102 Test 2	B102T02	30.40	15/05/2025	5329	Chalk/Flint	Drained	
BH102 Test 3	B102T03	33.40	15/05/2025	8301	Chalk/Flint	Drained	
BH102 Test 4	B102T04	35.90	16/05/2025	9066	Chalk/Flint	Drained	
BH102 Test 5	B102T05	38.70	16/05/2025	8724	Chalk/Flint	Drained	
BH102 Test 6	B102T05	41.70	19/05/2025	8252	Chalk/Flint	Drained	
BH102 Test 7	B102T05	44.65	19/05/2025	8989	Chalk/Flint	Drained	
BH105 Test 1	B105T01	33.90	19/06/2025	3754	Chalk/Flint	Drained	
BH105 Test 2	B105T02	38.15	20/06/2025	6316	Chalk/Flint	Drained	
BH105 Test 3	B105T03	42.40	20/06/2025	5500	Chalk/Flint	Drained	
BH105 Test 4	B105T04	46.20	23/06/2025	11633	Chalk/Flint	Drained	
BH105 Test 5	B105T05	50.35	23/06/2025	7986	Chalk/Flint	Drained	
BH108 Test 1	B108T01	24.30	10/06/2025	2470	Chalk/Flint	Drained	
BH108 Test 2	B108T02	26.10	10/06/2025	3021	Chalk/Flint	Drained	Membrane rupture
BH108 Test 3	B108T03	27.90	10/06/2025	2286	Chalk/Flint	Drained	
BH108 Test 4	B108T04	32.20	11/06/2025	3242	Chalk/Flint	Drained	
BH108 Test 5	B108T05	34.20	11/06/2025	1175	Chalk/Flint	Drained	
BH108 Test 6	B108T06	36.40	11/06/2025	3343	Chalk/Flint	Drained	
BH108 Test 7	B108T07	40.30	12/06/2025	4190	Chalk/Flint	Drained	
BH108 Test 8	B108T08	42.40	12/06/2025	4483	Chalk/Flint	Drained	

Notes for Table 2.1:

1. **Depth** is given as metres in drilled length to the centre of the measuring section. The HPD membrane is 0.60 long, hence the affected zone is ± 0.30m of the quoted test centre.
2. **Max Pressure** is the maximum pressure reached by the end of loading.
3. **Material** - is as reported on site.

Table 2.2 Probe details and calibrations

Test	Probe	Operator	Transducer calibration	Membrane stiffness	System compliance
BH101 Test 1	HPD 95 “Wally”	PA	05/03/2025 *	P2205T25	P2205T25
BH101 Test 2	HPD 95 “Wally”	PA	05/03/2025 *	P2205T25	P2205T25
BH101 Test 3	HPD 95 “Wally”	PA	05/03/2025 *	P2205T25	P2205T25
BH101 Test 4	HPD 95 “Wally”	PA	05/03/2025 *	P2205T25	P2205T25
BH101 Test 5	HPD 95 “Wally”	PA	05/03/2025 *	P2205T25	P2205T25
BH101 Test 6	HPD 95 “Wally”	PA	05/03/2025 *	P2205T25	P2205T25
BH101 Test 7	HPD 95 “Wally”	PA	05/03/2025 *	P2205T25	P2205T25
BH102 Test 1	HPD 95 “Wally”	PA	05/03/2025 *	P1305T25	P1305T25
BH102 Test 2	HPD 95 “Wally”	PA	05/03/2025 *	P1305T25	P1305T25
BH102 Test 3	HPD 95 “Wally”	PA	05/03/2025 *	P1305T25	P1305T25
BH102 Test 4	HPD 95 “Wally”	PA	05/03/2025 *	P1305T25	P1305T25
BH102 Test 5	HPD 95 “Wally”	PA	05/03/2025 *	P1305T25	P1305T25
BH102 Test 6	HPD 95 “Wally”	PA	05/03/2025 *	P1305T25	P1305T25
BH102 Test 7	HPD 95 “Wally”	PA	05/03/2025 *	P1305T25	P1305T25
BH105 Test 1	HPD 95 “Lilith”	SDP	23/05/2025	P2305T25	P2305T25
BH105 Test 2	HPD 95 “Lilith”	SDP	23/05/2025	P2305T25	P2305T25
BH105 Test 3	HPD 95 “Lilith”	SDP	23/05/2025	P2305T25	P2305T25
BH105 Test 4	HPD 95 “Lilith”	SDP	23/05/2025	P2305T25	P2305T25
BH105 Test 5	HPD 95 “Wally”	SDP	05/03/2025 *	S1006T26	S1006T26
BH108 Test 1	HPD 95 “Wally”	SDB	05/03/2025 *	P0306T25	P0306T25
BH108 Test 2	HPD 95 “Wally”	SDB	05/03/2025 *	P0306T25	P0306T25
BH108 Test 3	HPD 95 “Lilith”	SDB	23/05/2025	P2305T25	P2305T25
BH108 Test 4	HPD 95 “Lilith”	SDB	23/05/2025	P2305T25	P2305T25
BH108 Test 5	HPD 95 “Lilith”	SDB	23/05/2025	P2305T25	P2305T25
BH108 Test 6	HPD 95 “Lilith”	SDB	23/05/2025	P2305T25	P2305T25
BH108 Test 7	HPD 95 “Lilith”	SDB	23/05/2025	P2305T25	P2305T25
BH108 Test 8	HPD 95 “Lilith”	SDB	23/05/2025	P2305T25	P2305T25

Notes for Table 2.2:

1. **Probe** – Two 95mm diameter High Pressure Dilatometers (HPD95) known as “Wally” and “Lilith” were used on this contract.
2. **Operator** – PA is Peter Allen, SDP is Stuart Pearce and SDB is Simon Baxter, all are employees of Cambridge Insitu Ltd.
3. The pressuremeter has a transducer calibration, referenced by date. There are also additional calibrations for membrane stiffness and system compliance.
4. * Arm 3 only replaced and recalibrated 25/04/2025

Table 2.3 Coordinates and levels – given data

LOCATION	EASTING (m)	NORTHING (m)	ELEVATION (mOD)	WATER TABLE (mBGL)
BH101	566285.852	175892.136	2.156	6.8
BH102	566294.050	175858.591	2.378	4.5
BH105	566607.498	175538.416	8.343	9.6
BH108	567435.356	174079.583	2.354	4.31

Notes for Table 2.3:

1. These data are supplied by Soil Engineering.
2. The water levels are taken from the borehole logs, except for BH105 where observations from the pressuremeter tests have been preferred.

3 SUMMARY OF RESULTS

Table 3.1 details the initial stress state.. Table 3.2 gives results for strength. Table 3.3 gives results for shear modulus, both linear and non-linear. Table 3.4 has 'best estimate/ results for shear modulus with some speculative calculations of the elastic shear modulus.

Table 3.1 Initial stress state

Test	Depth (mBGL)	Elevation (mOD)	Overcut (mm)	u_0 (kPa)	σ_{vo} (kPa)	σ_{ho} (kPa)	k_o
BH101 Test 2	24.90	-22.74	4.21	178	498	350	0.54
BH101 Test 3	29.30	-27.14	4.85	221	586	527	0.84
BH101 Test 4	33.20	-31.04	3.88	259	664	976	1.77
BH101 Test 5	37.40	-35.24	3.29	300	748	1002	1.57
BH101 Test 6	41.40	-39.24	2.93	339	828	876	1.10
BH101 Test 7	45.20	-43.04	3.15	377	904	1147	1.46
BH102 Test 1	27.40	-25.02	4.71	225	548	353	0.40
BH102 Test 2	30.40	-28.02	4.07	254	608	659	1.14
BH102 Test 3	33.40	-31.02	3.92	284	668	1233	2.47
BH102 Test 4	35.90	-33.52	3.82	308	718	897	1.44
BH102 Test 5	38.70	-36.32	4.32	336	774	956	1.42
BH102 Test 6	41.70	-39.32	4.67	365	834	785	0.90
BH102 Test 7	44.65	-42.27	3.26	394	893	1062	1.34
BH105 Test 1	33.90	-25.56	3.41	238	678	459	0.50
BH105 Test 2	38.15	-29.81	5.84	308	763	932	1.37
BH105 Test 3	42.40	-34.06	6.13	349	848	933	1.17
BH105 Test 4	46.20	-37.86	3.35	387	924	1353	1.80
BH105 Test 5	50.35	-42.01	5.18	427	1007	1400	1.68
BH108 Test 1	24.30	-21.95	8.61	196	486	288	0.32
BH108 Test 2	26.10	-23.75	5.65	214	522	482	0.87
BH108 Test 3	27.90	-25.55	4.15	231	558	514	0.87
BH108 Test 4	32.20	-29.85	6.86	274	644	663	1.05
BH108 Test 5	34.20	-31.85	10.73	293	684	417	0.32
BH108 Test 6	36.40	-34.05	2.69	315	728	775	1.11
BH108 Test 7	40.30	-37.95	2.76	353	806	826	1.04
BH108 Test 8	42.40	-40.05	3.05	374	848	932	1.18

Notes for Table 3.1

1. **Depth** is the distance below ground level to the centre of the pressuremeter membrane.
2. **Overcut** is the difference between the at rest radius of the probe and the cavity. Values less than 2.5mm are nominally the same as the core barrel OD. Larger values indicate excessive stress relief.
3. $\mathbf{u_o}$ is ambient pore water pressure.
4. $\boldsymbol{\sigma_{vo}}$ is our approximate judgment of the overburden stress assuming a unit weight of 23kN/m^3.
5. $\boldsymbol{\sigma_{ho}}$ is our best estimate of the insitu lateral stress.
6. $\mathbf{k_o}$is the best estimate coefficient of earth pressure at rest combining the results in the previous columns.

Table 3.2 Parameters for strength

Test	Depth (mBGL)	Elevation (mOD)	ϕ' (deg)	Ψ (deg)	ϕ_{cv} (deg)	c′ (kPa)	τ_f (kPa)
BH101 Test 2	24.90	-22.74	27.0	2.2	25.0	2	106
BH101 Test 3	29.30	-27.14	33.1	7.1	27.0	54	241
BH101 Test 4	33.20	-31.04	47.1	17.1	34.0	147	750
BH101 Test 5	37.40	-35.24	37.0	3.7	34.0	374	804
BH101 Test 6	41.40	-39.24	35.2	1.4	34.0	46	389
BH101 Test 7	45.20	-43.04	34.0	0.0	34.0	170	621
BH102 Test 1	27.40	-25.02	40.0	14.4	28.0	9	106
BH102 Test 2	30.40	-28.02	37.7	4.5	34.0	28	312
BH102 Test 3	33.40	-31.02	46.5	16.2	34.0	177	888
BH102 Test 4	35.90	-33.52	39.0	6.2	34.0	92	519
BH102 Test 5	38.70	-36.32	39.9	6.2	35.0	54	539
BH102 Test 6	41.70	-39.32	38.1	3.9	35.0	50	355
BH102 Test 7	44.65	-42.27	39.0	5.0	35.0	146	629
BH105 Test 1	33.90	-25.56	36.4	5.3	32.0	25	192
BH105 Test 2	38.15	-29.81	35.5	0.6	35.0	208	691
BH105 Test 3	42.40	-34.06	37.6	4.4	34.0	206	628
BH105 Test 4	46.20	-37.86	46.0	14.4	35.0	340	1396
BH105 Test 5	50.35	-42.01	43.9	11.5	35.0	297	1167
BH108 Test 1	24.30	-21.95	35.9	4.7	32.0	16	78
BH108 Test 2	26.10	-23.75	39.0	5.0	35.0	20	228
BH108 Test 3	27.90	-25.55	34.5	6.4	29.0	14	202
BH108 Test 4	32.20	-29.85	35.3	6.2	30.0	31	285
BH108 Test 5	34.20	-31.85	33.0	12.3	22.0	14	82
BH108 Test 6	36.40	-34.05	31.9	-0.1	32.0	65	340
BH108 Test 7	40.30	-37.95	32.6	0.7	32.0	64	377
BH108 Test 8	42.40	-40.05	37.3	6.5	32.0	66	472

Notes for Table 3.2

1. $\boldsymbol{\phi'}$ is the peak angle of internal friction (Hughes et al, 1977).
2. $\boldsymbol{\Psi}$ is the corresponding angle of dilation (Hughes et al, 1977).
3. $\boldsymbol{\phi_{cv}}$ is the assumed constant volume friction angle (Withers et al, 1989).
4. $\boldsymbol{c'}$ is drained cohesion.
5. τ_f is shear stress at first yield.

Table 3.3 Linear and Non-linear shear modulus and Young's modulus

							Plane shear strain			Invariant strain		
Test name	Depth mBGL	Loop No.	G_{ur} MPa	E MPa	Constant α MPa	Exponent β	$G_{s_{0.01\%}}$ MPa	$G_{s_{0.1\%}}$ MPa	$G_{s_{1\%}}$ MPa	$E_{s_{0.01\%}}$ MPa	$E_{s_{0.1\%}}$ MPa	$E_{s_{1\%}}$ MPa
BH101												
2	24.90	1	113	294	38.654	0.861	139	101	73	335	243	177
		2	150	390	59.696	0.887	169	130	100	413	318	245
		3	92	239	8.854	0.645	233	103	45	498	220	97
3	29.30	1	331	861	93.712	0.840	409	283	196	974	674	466
		2	537	1397	126.110	0.824	638	425	284	1506	1004	669
		3	620	1612	235.502	0.873	759	566	423	1839	1373	1025
		4	449	1168	56.513	0.705	855	434	220	1891	959	486
4	33.20	1	538	1398	153.214	0.841	663	460	319	1579	1095	759
		2	919	2388	272.373	0.840	1189	823	569	2831	1959	1355
		3	1218	3167	327.985	0.820	1721	1137	751	4054	2678	1770
		4	1150	2989	210.471	0.764	1850	1074	624	4225	2454	1425
5	37.40	1	1157	3007	812.797	0.956	1219	1101	995	3094	2795	2526
		2	1361	3539	449.430	0.854	1724	1232	880	4138	2957	2113
		3	1379	3584	271.646	0.797	1762	1104	692	4098	2568	1609
		4	1056	2745	321.980	0.816	1753	1148	751	4120	2697	1766
6	41.40	1	935	2431	875.620	0.992	943	925	908	2440	2395	2352
		2	1200	3119	488.759	0.889	1359	1052	815	3323	2574	1993
		3	1225	3185	311.369	0.842	1334	927	645	3181	2211	1537
		4	879	2286	178.383	0.766	1539	898	524	3520	2054	1198
7	45.20	1	1061	2760	914.912	0.978	1120	1065	1012	2878	2736	2601
		2	1013	2634	429.093	0.875	1357	1018	763	3294	2470	1852
		3	1179	3064	263.378	0.820	1382	913	603	3255	2151	1421
		4	941	2446	85.904	0.658	2005	912	415	4319	1965	894
BH102												
1	27.40	1	82	214	19.959	0.807	118	76	49	276	177	114
		2	116	301	34.427	0.833	160	109	74	380	259	176
		3	46	120	4.670	0.626	146	62	26	310	131	55
2	30.40	1	429	1115	402.229	0.987	453	440	427	1170	1136	1102
		2	772	2008	287.046	0.875	908	681	510	2203	1652	1239
		3	1008	2620	243.357	0.818	1301	856	563	3061	2013	1324
		4	809	2103	72.130	0.672	1480	695	327	3212	1510	709
3	33.40	1	508	1322	160.774	0.874	513	384	287	1245	931	697
		2	1078	2802	421.876	0.893	1130	883	691	2771	2166	1693
		3	1423	3700	630.100	0.899	1597	1266	1003	3929	3114	2468
		4	1357	3527	427.832	0.840	1868	1292	894	4447	3077	2129
4	35.90	1	1001	2602	349.152	0.866	1200	881	647	2897	2128	1563
		2	1164	3027	506.125	0.880	1528	1159	880	3721	2822	2141
		3	1270	3301	320.265	0.809	1860	1198	772	4354	2805	1807
		4	1095	2846	202.691	0.761	1832	1056	609	4176	2409	1389
5	38.70	1	1426	3708	416.941	0.848	1691	1191	840	4044	2850	2008
		2	1567	4075	281.952	0.776	2219	1325	791	5102	3046	1818
		3	1509	3924	226.182	0.752	2221	1254	709	5038	2846	1608
		4	1410	3667	231.158	0.755	2208	1256	714	5017	2854	1623
6	41.70	1	1233	3207	323.694	0.838	1439	991	683	3423	2358	1624
		2	1442	3750	480.547	0.853	1861	1327	946	4463	3182	2268
		3	1398	3636	285.806	0.795	1888	1178	735	4387	2736	1707
		4	1111	2890	238.500	0.783	1760	1068	648	4062	2464	1495
7	44.65	1	1233	3205	490.498	0.890	1351	1049	814	3307	2567	1992
		2	1533	3985	393.628	0.823	2009	1337	889	4741	3154	2098
		3	1507	3918	348.843	0.807	2064	1323	848	4826	3094	1984
		4	1234	3207	175.591	0.726	2190	1165	620	4899	2607	1387
BH105												
1	33.90	1	168	437	51.363	0.846	212	149	104	507	356	249
		2	393	1021	66.002	0.772	539	319	189	1236	731	433

							Plane shear strain			Invariant strain		
Test name	Depth mBGL	Loop No.	G_{ur} MPa	E MPa	Constant α MPa	Exponent β	$G_{s0.01\%}$ MPa	$G_{s0.1\%}$ MPa	$G_{s1\%}$ MPa	$E_{s0.01\%}$ MPa	$E_{s0.1\%}$ MPa	$E_{s1\%}$ MPa
		3	571	1485	73.620	0.737	830	453	247	1867	1019	556
		4	418	1087	37.718	0.662	848	390	179	1832	841	386
2	38.15	1	181	471	108.397	0.936	195	169	146	491	423	365
		2	541	1408	180.464	0.864	632	462	338	1524	1114	815
		3	760	1975	152.405	0.791	1045	646	399	2422	1497	925
		4	910	2366	219.554	0.805	1323	844	539	3090	1972	1259
		5	814	2117	122.539	0.737	1381	754	411	3108	1696	926
3	42.40	1	162	422	137.964	0.979	167	160	152	430	410	391
		2	341	886	166.928	0.909	386	313	254	955	774	628
		3	470	1223	137.975	0.837	619	425	292	1472	1011	695
		4	715	1858	161.357	0.806	963	616	394	2252	1440	921
		5	570	1481	119.693	0.763	1062	615	357	2424	1404	814
4	46.20	1	599	1557	185.094	0.859	678	490	354	1632	1180	853
		2	1146	2980	304.827	0.838	1355	933	643	3224	2220	1529
		3	1401	3643	343.061	0.822	1768	1173	779	4168	2766	1836
		4	1498	3894	351.942	0.805	2121	1354	864	4954	3162	2018
		5	1367	3553	152.779	0.693	2583	1274	628	5673	2798	1380
5	50.35	1	794	2065	220.834	0.841	955	662	459	2276	1578	1094
		2	1291	3356	389.355	0.840	1700	1176	813	4047	2800	1937
		3	1225	3185	211.559	0.757	1983	1134	648	4513	2579	1474
BH108												
1	24.30	1	141	367	47.652	0.858	176	127	92	424	306	220
		2	252	654	58.571	0.813	328	213	139	769	500	325
		3	293	761	59.386	0.800	375	236	149	873	551	347
		4	185	481	33.454	0.733	391	212	114	878	475	257
2	26.10	1	209	543	45.403	0.790	314	194	119	728	449	277
		2	251	653	47.075	0.767	403	235	138	921	538	315
		3	287	746	53.040	0.770	441	260	153	1011	595	351
3	27.90	1	105	272	64.444	0.931	122	104	89	305	260	222
		2	257	668	54.798	0.799	349	220	138	812	511	322
		3	321	835	63.122	0.787	449	275	168	1038	636	389
		4	146	379	5.979	0.521	493	164	54	985	327	108
4	32.20	1	95	248	65.292	0.942	111	97	85	281	245	215
		2	310	807	146.120	0.899	370	294	233	911	722	572
5	34.20	3	452	1174	115.578	0.825	579	387	259	1368	914	611
		4	232	602	27.744	0.676	548	260	123	1194	566	268
		1	96	250	56.402	0.942	96	84	74	242	212	186
		2	111	290	22.022	0.759	203	116	67	462	265	152
6	36.40	1	208	541	120.361	0.931	227	194	165	569	485	414
		2	381	990	101.288	0.823	517	344	229	1220	812	540
		3	458	1192	114.883	0.813	643	418	272	1509	981	638
		4	305	793	43.959	0.713	618	319	165	1373	709	366
7	40.30	1	260	677	62.628	0.813	351	228	148	822	535	348
		2	414	1077	109.171	0.824	552	368	246	1303	869	580
		3	501	1303	72.078	0.747	741	414	231	1677	936	523
		4	361	939	63.437	0.735	728	396	215	1637	889	483
8	42.40	1	244	634	104.725	0.888	294	227	175	718	555	429
		2	411	1069	110.585	0.823	565	376	250	1332	886	589
		3	502	1304	98.390	0.780	746	450	271	1720	1036	624
		4	378	983	70.260	0.756	665	379	216	1512	862	491

Notes for Table 3.3

a. G_{ur} is modulus obtained by taking the slope of the chord bisecting a cycle of unloading and reloading. This can only be the shear modulus if the material response is linear elastic. Some tests gave a non-linear response.

b. E is the Youngs modulus calculated from the linear shear modulus (G_{ur}) assuming a Poisson's ratio ν of 0.3:- $E=2G(1+\nu)$
c. Due to the non-linear characteristics of the soil, secant shear modulus is here given by a power law of the form $G_s = \alpha\gamma^{\beta-1}$ where α and β are discovered from a plot of reloading data on log scales. If the response is linear elastic then $\beta = 1$ and α would be identical to G_{ur}, quoted in the first column.
d. Secant shear modulus parameters are given at three plane shear strain levels, γ of $10^{-4}/10^{-3}/10^{-2}$, but any value of shear strain can be used down to 10^{-4}. All these modulus values are G_{hh}. 10^{-2} is approximately the shear strain at which the over-consolidated clay will yield, and so is too high for this material.
e. For comparison purposes, values for secant Young's modulus E_s at three invariant strain values are given. These are derived from the following relationship: $E_s = 2\alpha(1+v)\left(\gamma_a\sqrt{3}\right)^{\beta-1}$ where v is Poisson's ratio and here is an arbitrary 0.3. The $\sqrt{3}$ term converts axial or invariant shear strain to plane shear strain, so that α and β can be used directly.
f. Some modulus values are considered suspect, as the displacement at which they are initiated is significantly negative of the assumed origin. These are highlighted.
g. The last cycle for each test is taken on the final contraction phase of the test, except where the membrane ruptures (BH108 Test 2).

Table 3.4 'Best estimate' shear modulus parameters

Test	Depth (mBGL)	Elevation (mOD)	Constant α MPa	Exponent β	$G_{s_{0.01\%}}$ MPa	$G_{s_{0.1\%}}$ MPa	$G_{s_{1\%}}$ MPa	Gy MPa	G_{50} MPa	G_{max} MPa
BH101 Test 2	24.90	-22.74	4.152	0.645	109	48	21	31	46	148
BH101 Test 3	29.30	-27.14	61.333	0.824	310	207	138	200	232	674
BH101 Test 4	33.20	-31.04	111.032	0.764	976	567	329	520	644	1924
BH101 Test 5	37.40	-35.24	407.641	0.854	1564	1118	799	1182	1331	3813
BH101 Test 6	41.40	-39.24	338.001	0.842	1448	1007	700	1203	1371	3946
BH101 Test 7	45.20	-43.04	432.959	0.875	1369	1027	770	1103	1218	3459
BH102 Test 1	27.40	-25.02	10.383	0.807	61	39	25	31	37	107
BH102 Test 2	30.40	-28.02	159.618	0.818	853	561	369	640	746	2172
BH102 Test 3	33.40	-31.02	343.661	0.893	921	720	563	702	763	2151
BH102 Test 4	35.90	-33.52	280.567	0.809	1629	1050	676	1239	1460	4266
BH102 Test 5	38.70	-36.32	317.555	0.776	2499	1492	891	2002	2445	7262
BH102 Test 6	41.70	-39.32	391.486	0.795	2587	1613	1006	2383	2849	8383
BH102 Test 7	44.65	-42.27	397.076	0.807	2349	1506	966	1856	2191	6409
BH105 Test 1	33.90	-25.56	33.663	0.737	379	207	113	213	273	827
BH105 Test 2	38.15	-29.81	64.897	0.737	732	399	218	328	420	1275
BH105 Test 3	42.40	-34.06	77.828	0.806	465	297	190	248	293	859
BH105 Test 4	46.20	-37.86	102.619	0.693	1735	856	422	689	936	2915
BH105 Test 5	50.35	-42.01	107.158	0.757	1005	574	328	457	571	1713
BH108 Test 1	24.30	-21.95	40.604	0.800	256	162	102	194	230	676
BH108 Test 2	26.10	-23.75	21.253	0.767	182	106	62	84	104	310
BH108 Test 3	27.90	-25.55	18.406	0.787	131	80	49	62	75	222
BH108 Test 4	32.20	-29.85	34.574	0.825	173	116	77	96	111	322
BH108 Test 5	34.20	-31.85	25.691	0.942	44	38	34	37	38	106
BH108 Test 6	36.40	-34.05	58.007	0.813	325	211	137	189	222	647
BH108 Test 7	40.30	-37.95	38.760	0.747	398	223	124	186	235	710
BH108 Test 8	42.40	-40.05	63.232	0.780	480	289	174	252	306	907

Notes for Table 3.4:

a. This table gives 'best choice' parameters deduced from unload/reload cycle data and processed through curve modelling.
b. β and α have the meanings defined in Table 3.3.
c. G_s is secant shear modulus for a specified value of plane shear strain. The results are presented at three strain levels, all within the resolution of the measured unload/reload data.
d. G_y is the shear modulus when the material is on the point of first yielding.
e. G_{50} is shear modulus when 50% of the available strength has been mobilised. Refer to Table 3.2 for the strength estimates.
f. G_{max} is a speculative calculation for the elastic shear modulus, being $\mathrm{G_{max}} = \mathrm{G_y}.\mathrm{EXP}(1/\beta)$.

Figure 3.1 Cavity reference pressure vs Elevation

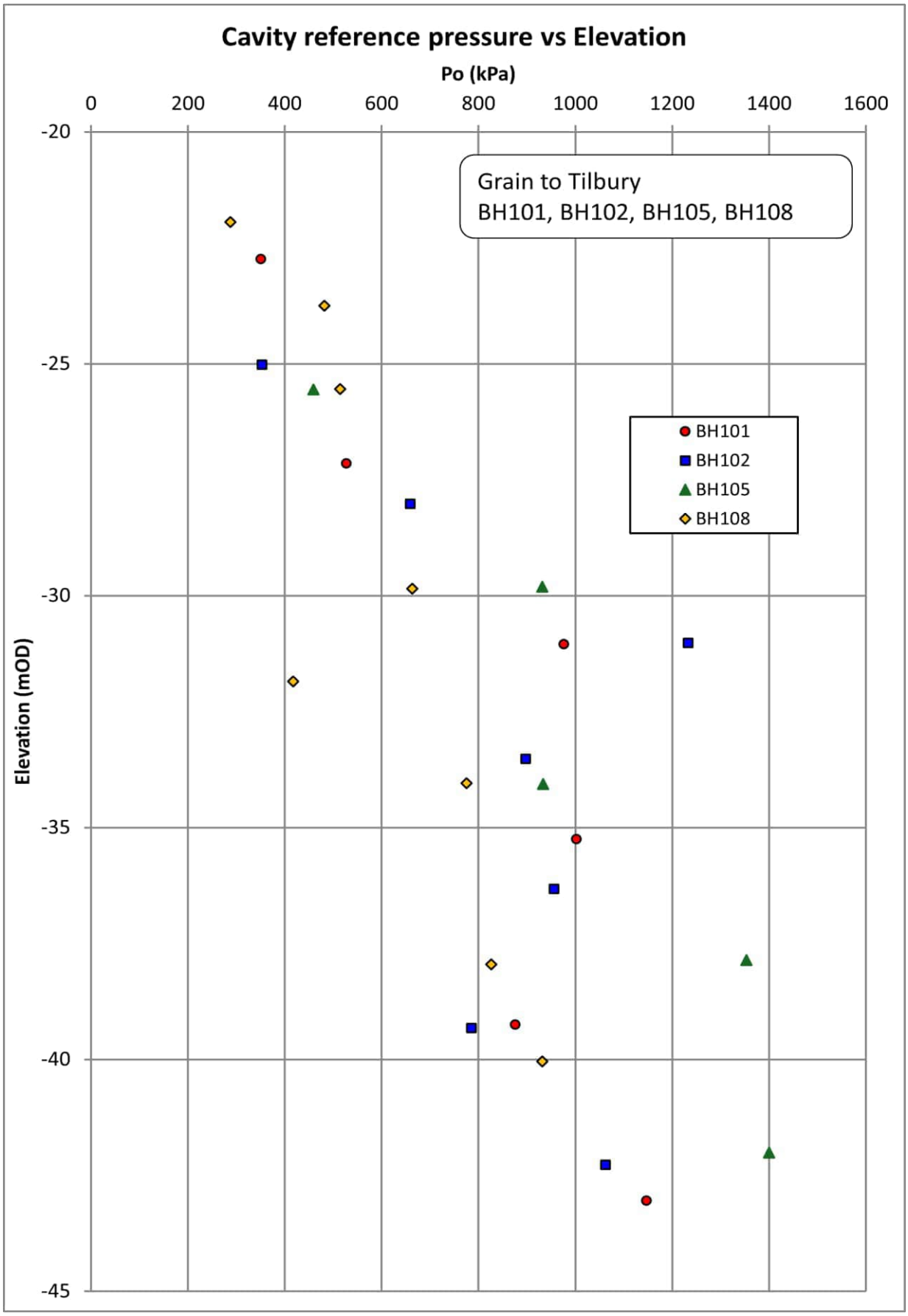


Figure 3.2 Coefficient of earth pressure at rest vs Elevation

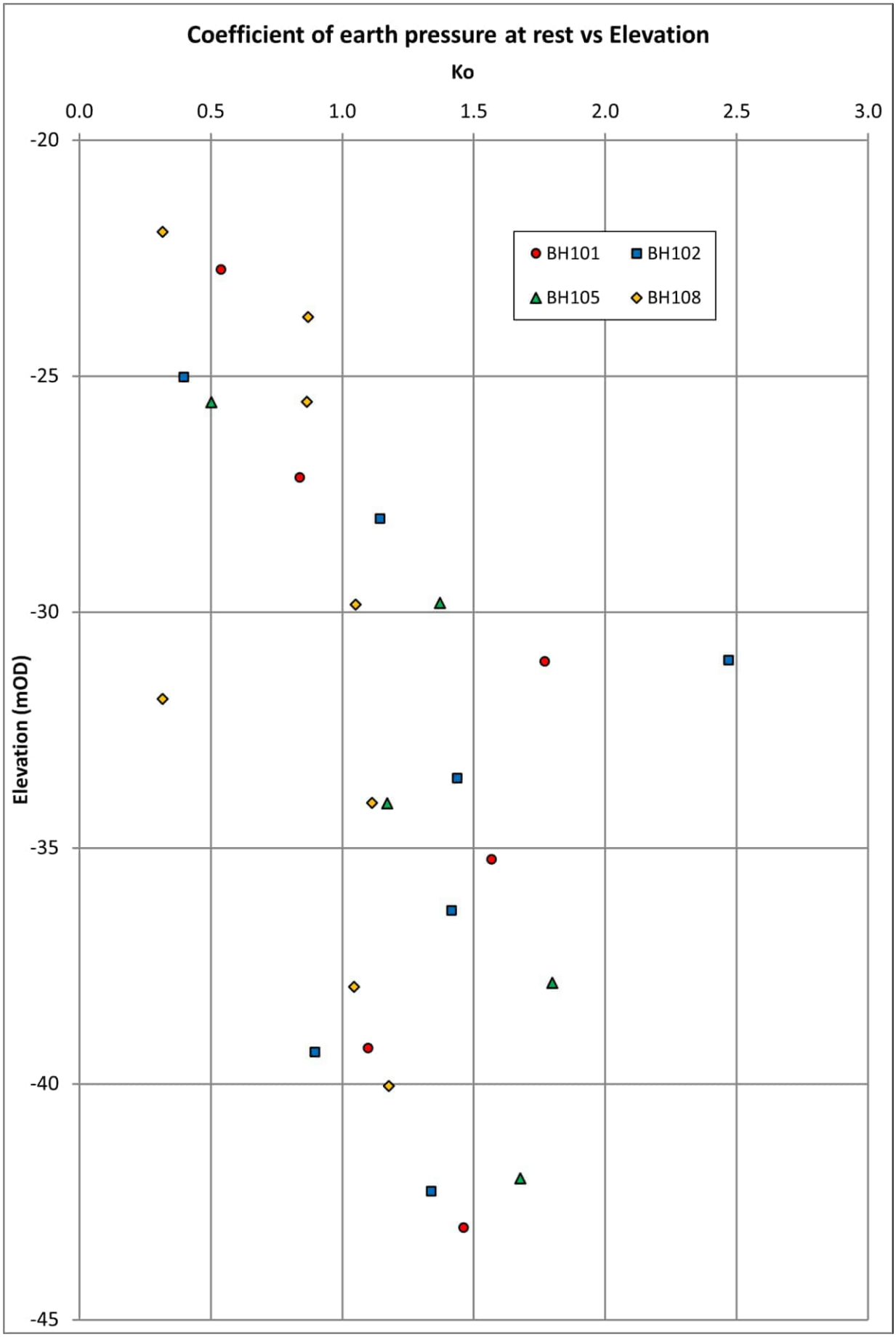


Figure 3.3 Shear stress at first yield vs Elevation

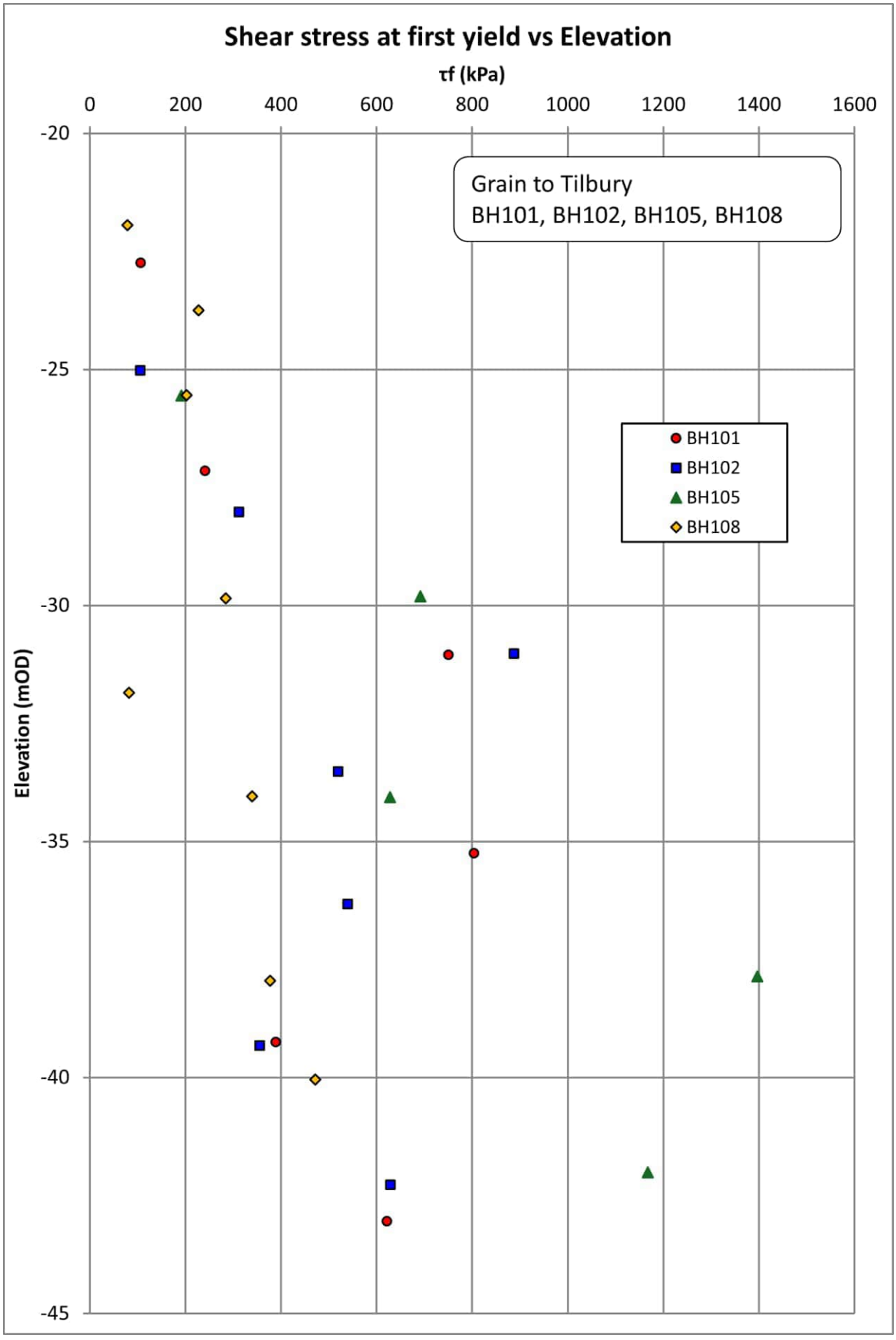


Figure 3.4 Shear modulus at yield vs Elevation

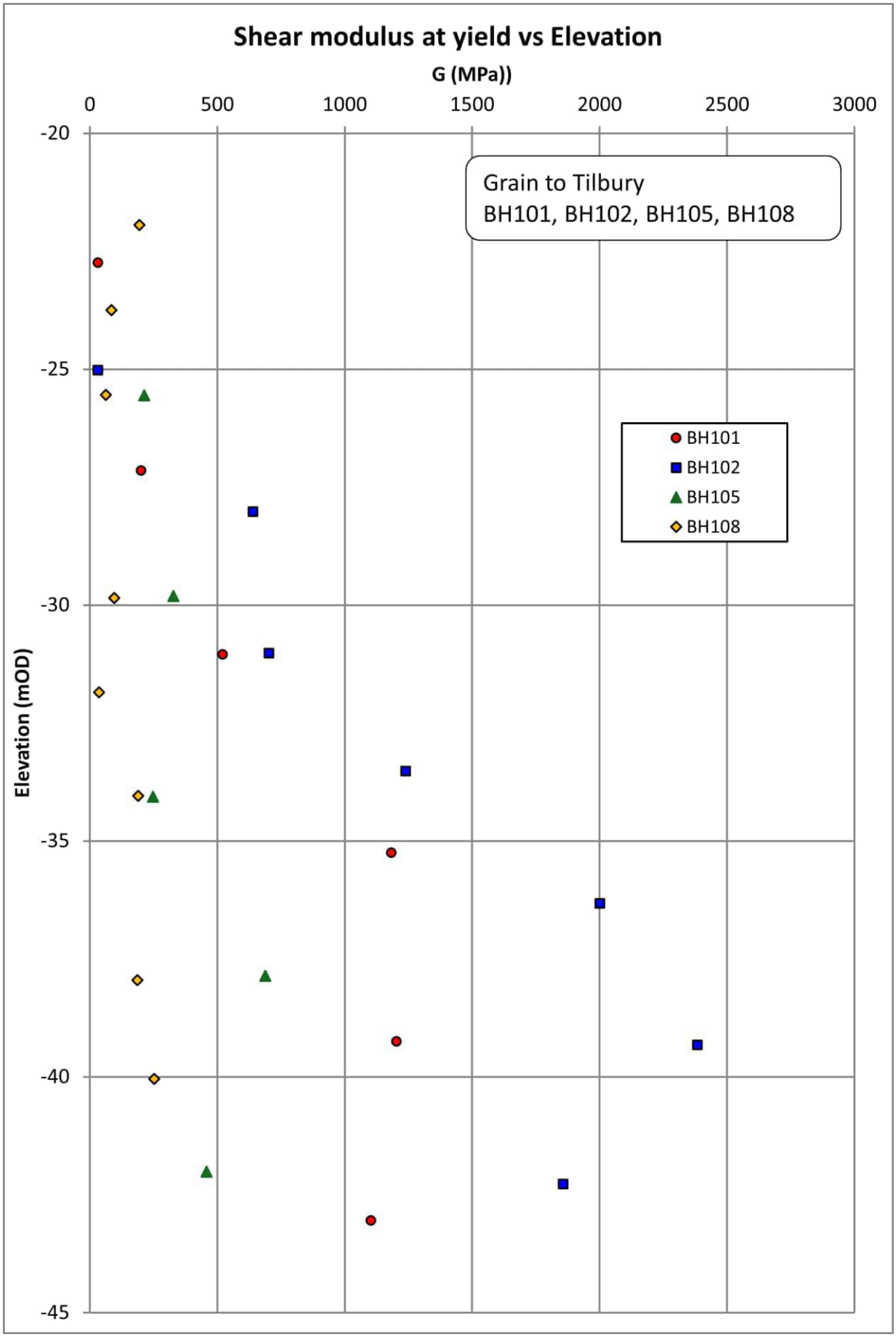


Figure 3.5 Shear modulus at 0.1% shear strain (BH101) vs Elevation

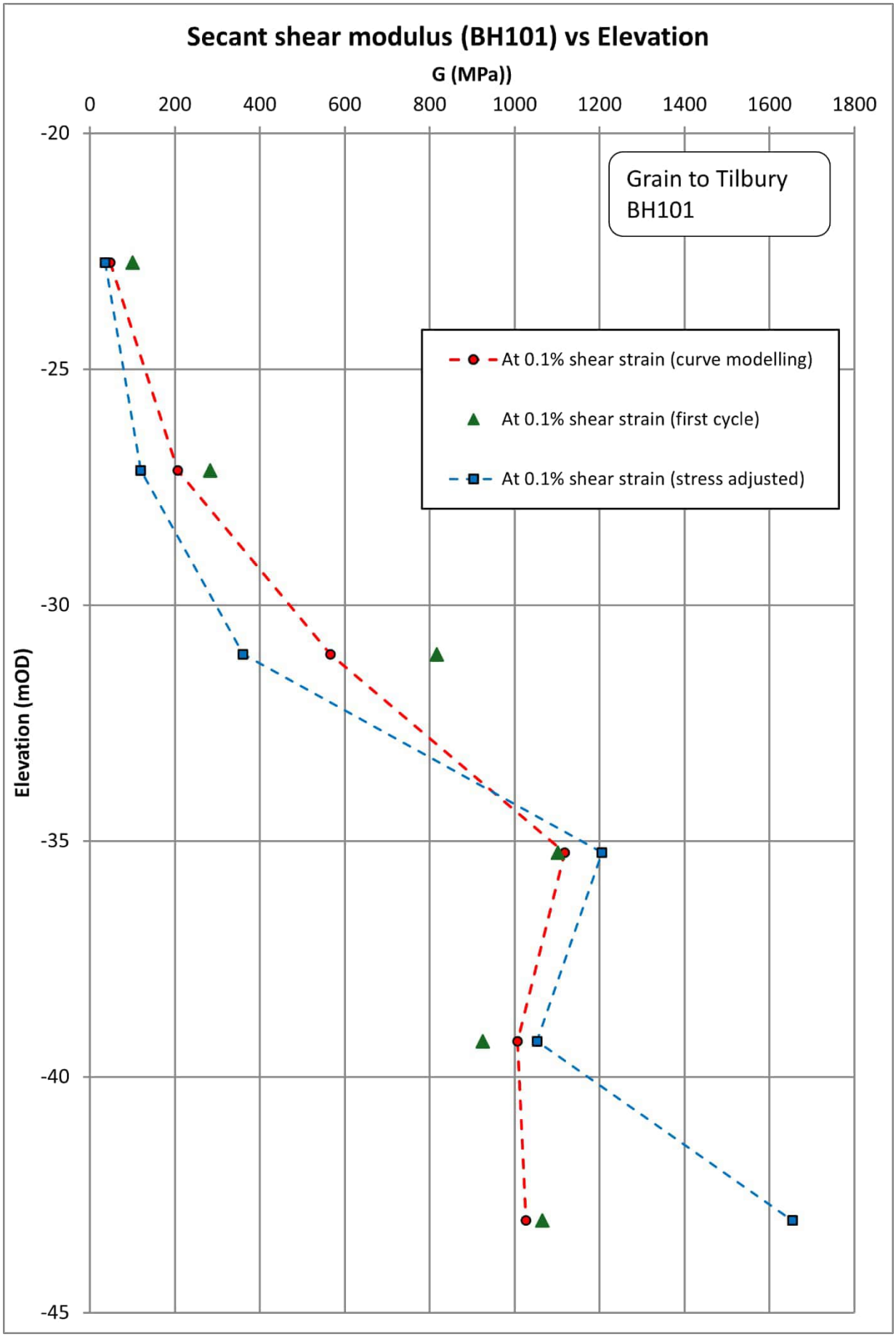


Figure 3.6 Shear modulus at 0.1% shear strain (BH102) vs Elevation

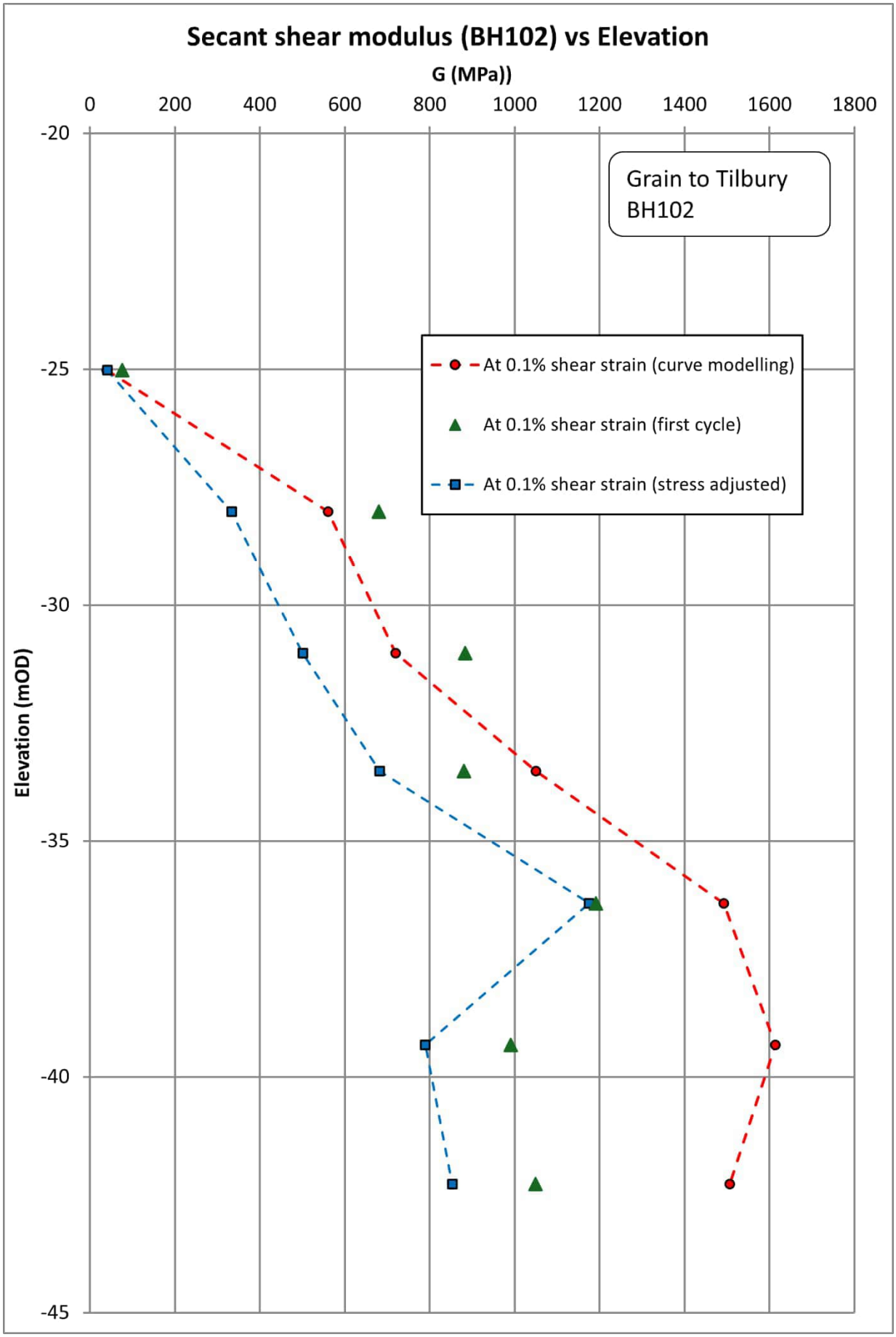


Figure 3.7 Shear modulus at 0.1% shear strain (BH105) vs Elevation

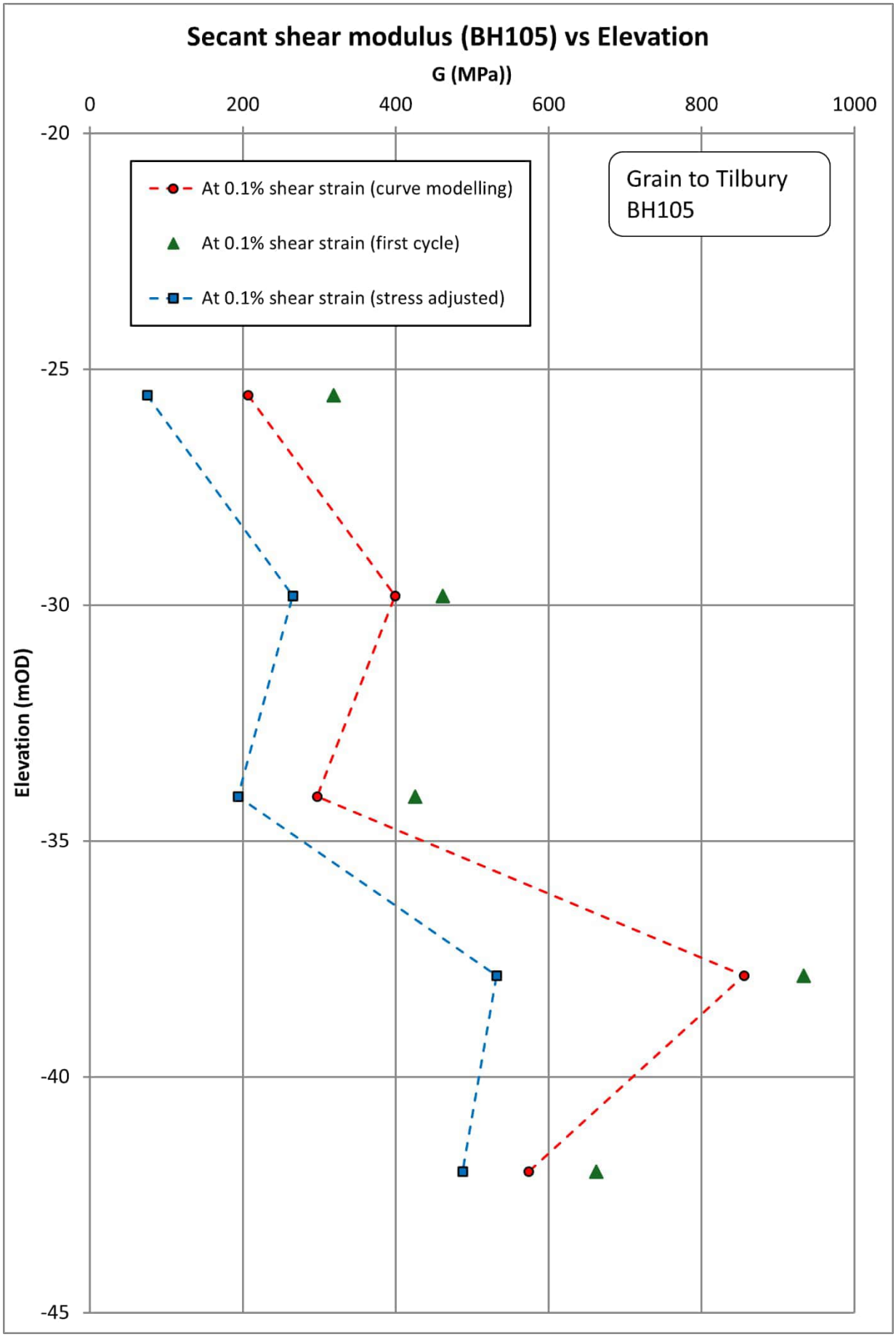
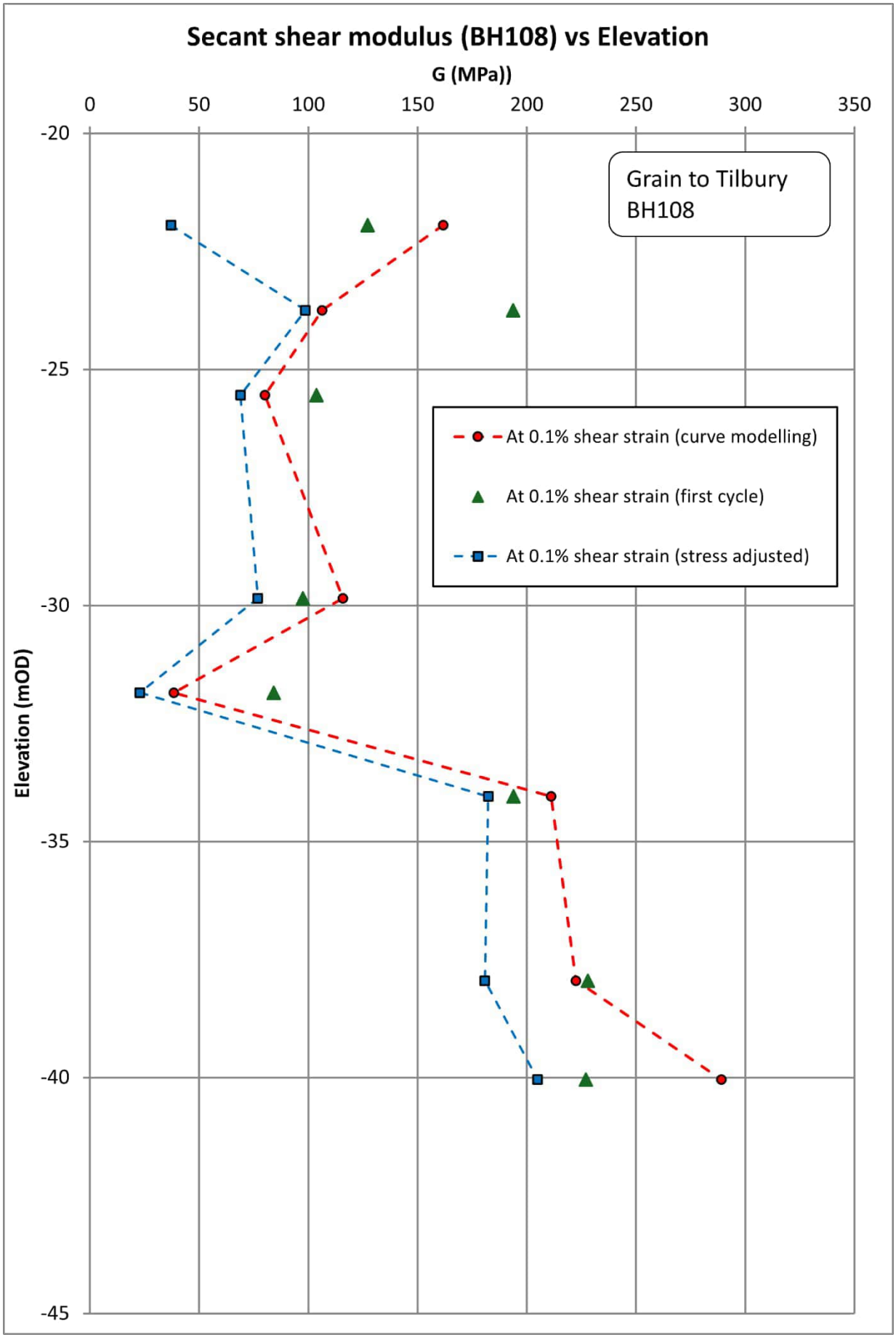
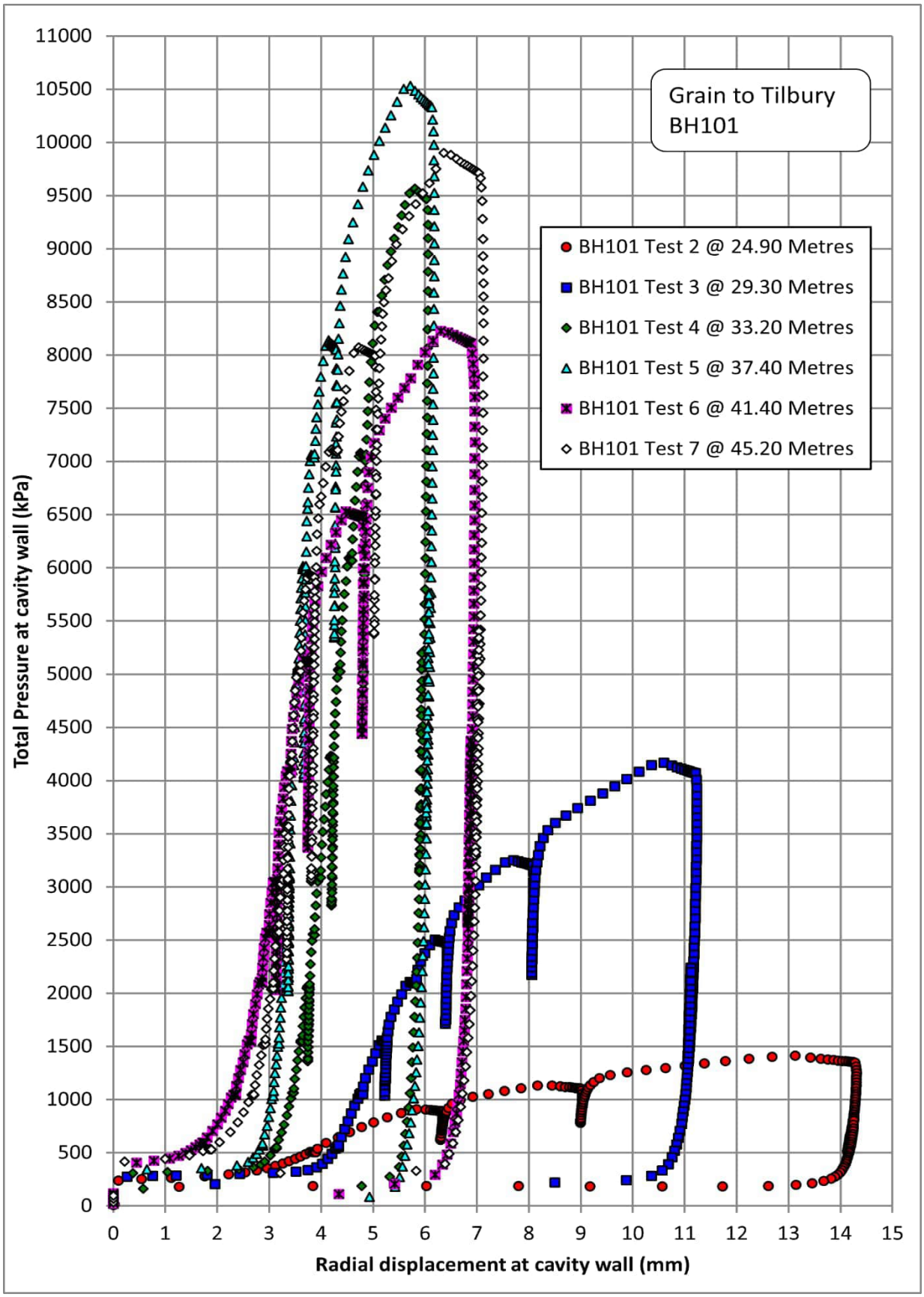


Figure 3.8 Shear modulus at 0.1% shear strain (BH108) vs Elevation

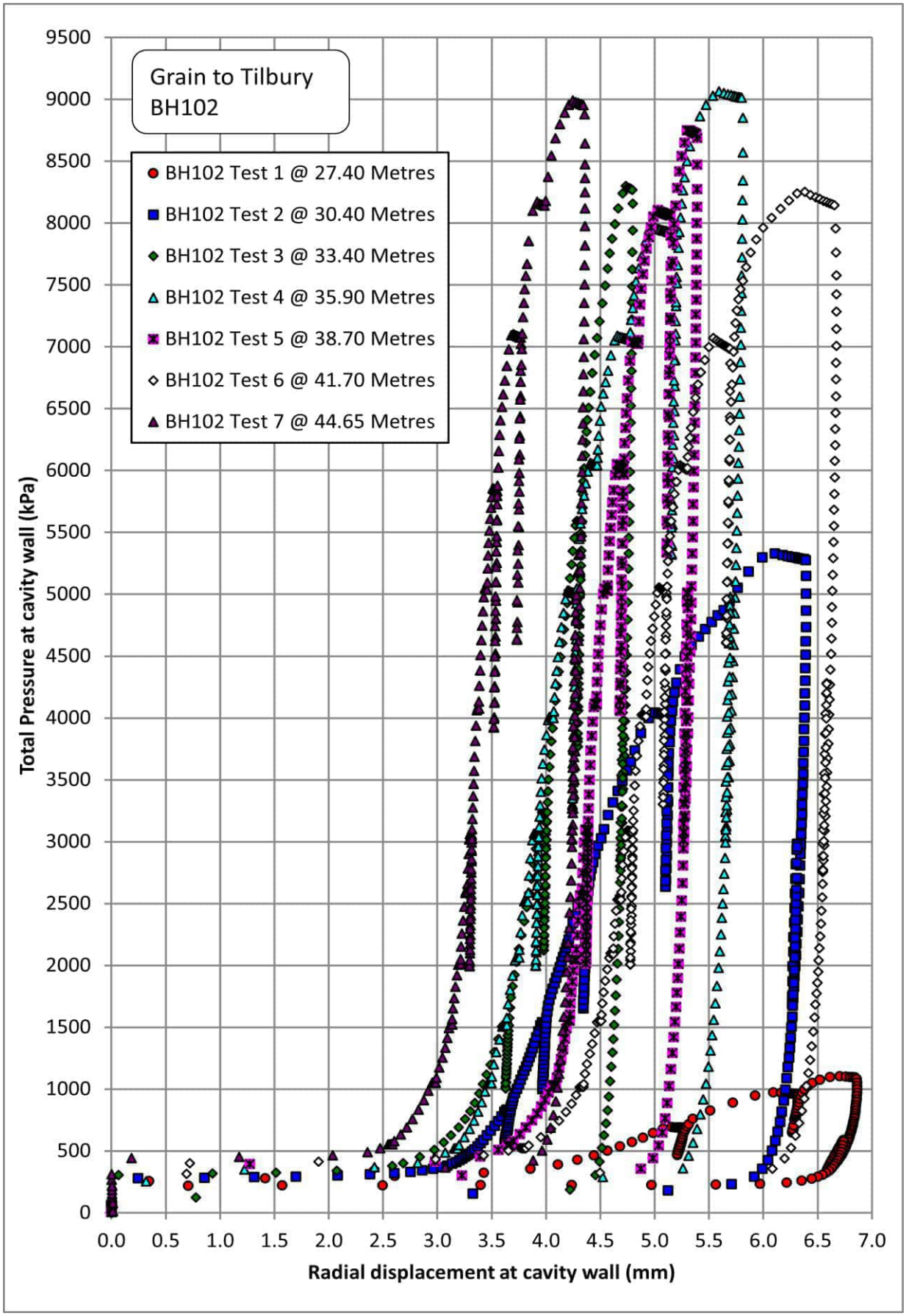


4 FIELD CURVES

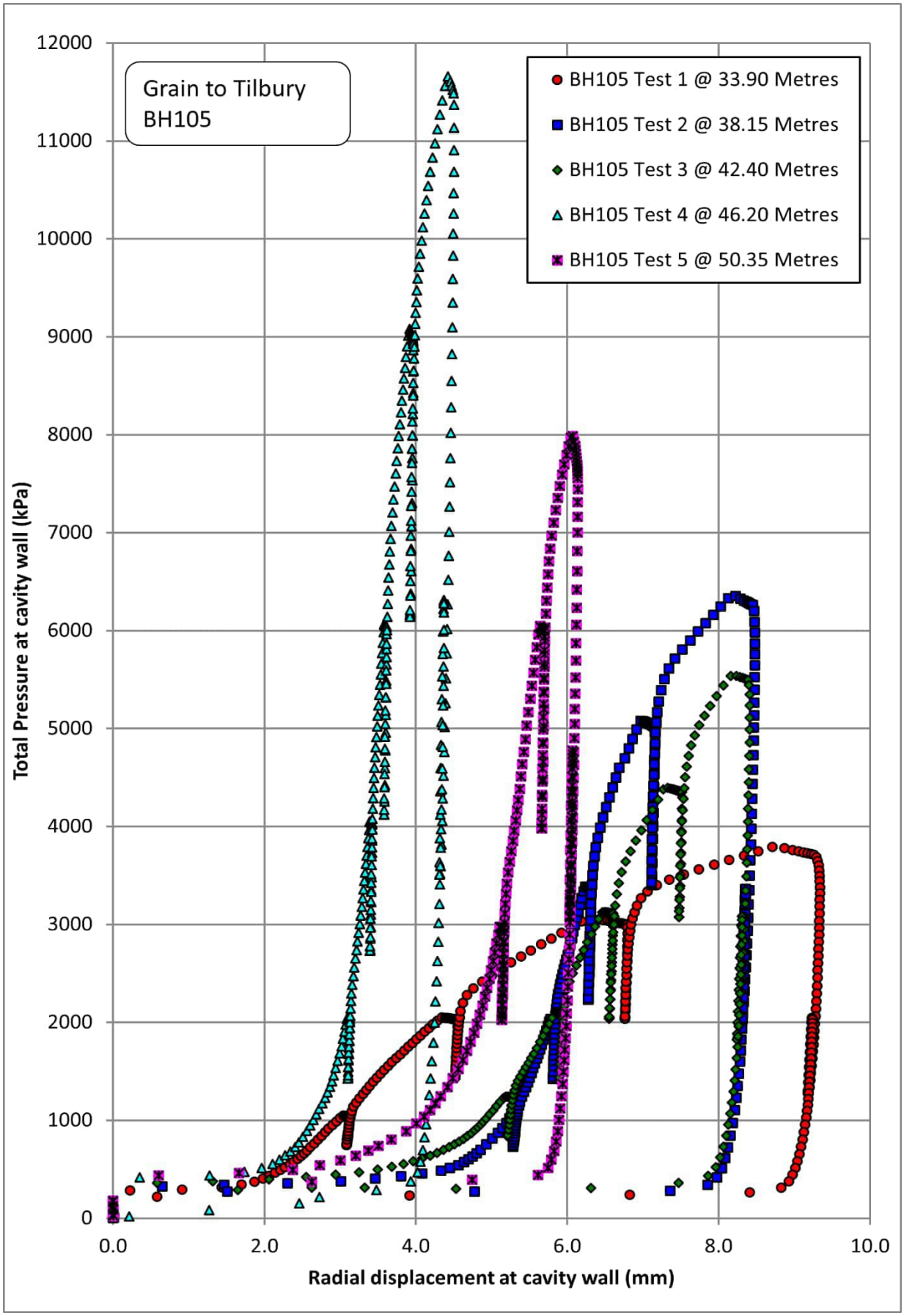
4.1 Combined field curves, BH101



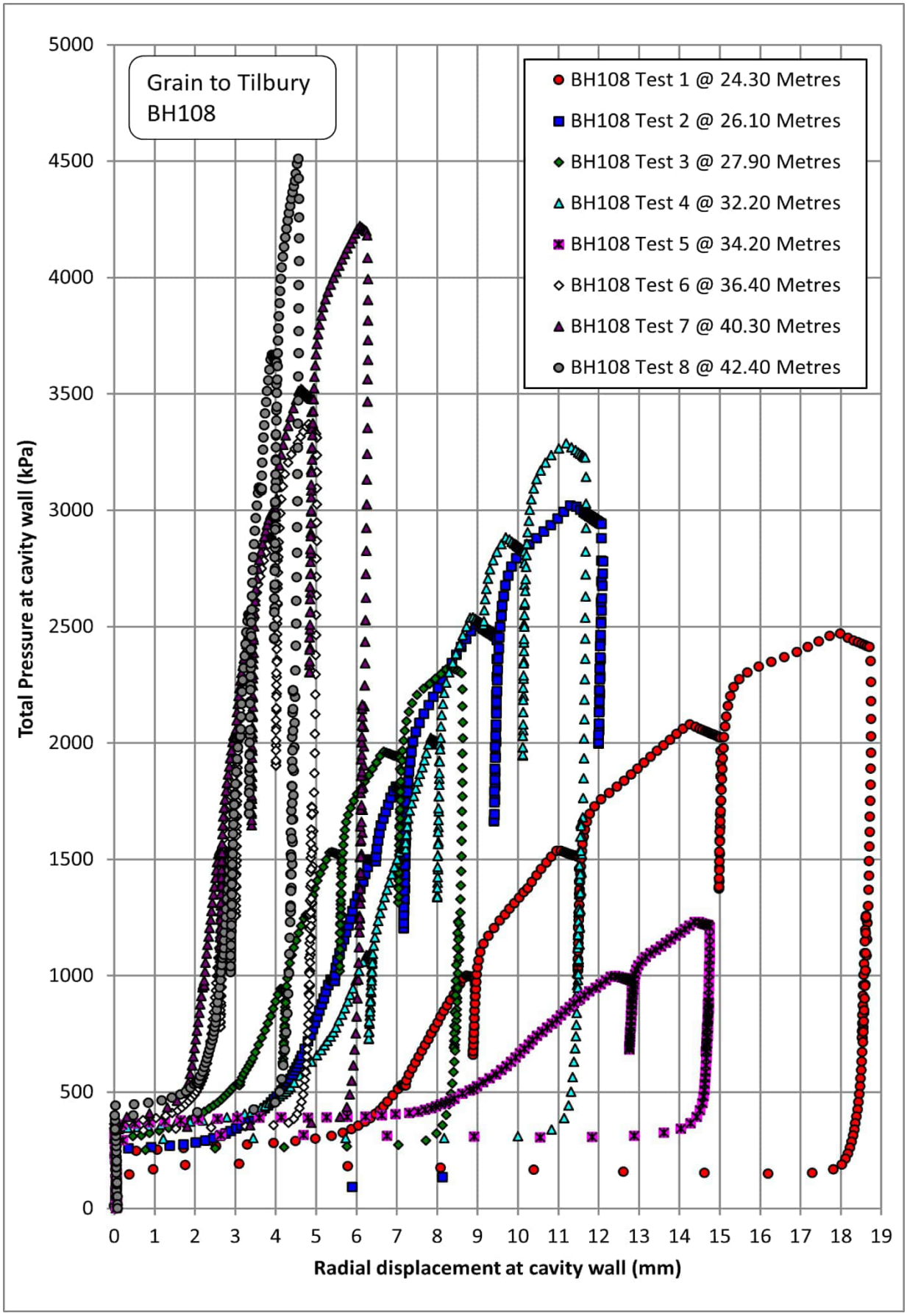
4.2 Combined field curves, BH102



4.3 Combined field curves, BH105



4.4 Combined field curves, BH108



APPENDIX A ANALYSIS OVERVIEW

This appendix gives details of the equations used to derive the results of pressuremeter tests on this contract. For all of these, the primary source is Hughes and Whittle (2023)[1].

A.1 The Analysis program WINSITU

We use (and supply to others) software for analysing a pressuremeter test. The program is called **WINSITU** and runs under all versions of Windows©. It has been in use since 2004, but earlier versions for other operating systems date back to 1985.

To use the program the user must first read in a text file of test data in engineering units. The program needs to know the type of instrument being used, and the user may choose to enter additional background information about the test.

The next task is to identify for the program the nature of the individual data points. Broadly, the options are these:

- a point can be part of the expansion curve
- or part of a reload loop
- or part of the contraction curve
- or none of the above. This might mean a 'rogue' data point, but it is more likely to be true of parts of the loading where the expansion was slowed prior to taking an unload/reload cycle. Data points recorded at this time are neither part of the expansion nor part of a cycle, and should be identified as such.

There is a quick on-screen routine for marking the points. Once marked, they appear in different colours. Most of the analyses use a limited set of the available data - for example the Gibson & Anderson analysis for undrained shear strength uses only points on the expansion curve.

The program implements all the standard analyses mainly in a graphical form. There are significant changes of gradient in the pressure/strain curve denoting critical soil parameters. The user of the program is provided with on-screen tools to mark these breakpoints or to obtain the slope of the loading curve. The tools can be visualised as rulers, whose position is stored by the program in the file of test data. The evidence for any derived parameter is a screen dump of the appropriate analysis that shows the position of any rulers set by the user and quotes the parameter obtained. Even when the user declines to make a choice it is good practice to provide the screen dump as evidence of why a choice is difficult.

The results for a test appear as a summary sheet of derived parameters followed by a number of plots showing the application of the various procedures.

Occasionally analyses are required that are not included in the WINSITU program, and also it is sometimes necessary to read a number of analysis files to summarise results. In such instances commonly available spreadsheet software is used to implement the new analysis or table. Inevitably in such circumstances there is some risk of human error affecting the conversions. WINSITU has export facilities and wherever possible is used as the data source for the spreadsheet.

[1] **HUGHES, John and WHITTLE, Robert (2023)**
High Resolution Pressuremeters and Geotechnical Engineering. The Measurement of Small Things. Publ. Taylor & Francis Ltd, ISBN: 9781032060941

A.2 EQUATIONS FOR MODULUS

Shear modulus G, where τ is shear stress and γ is shear strain:

$$G = \delta\tau/\delta\gamma \quad \text{Equ.[1]}$$

G in terms of cavity strain ε_c and cavity pressure p_c:

$$2G = \delta P_c / \delta\varepsilon_c \quad \text{Equ.[2]}$$

This is valid for a linear elastic response and a small strain alteration.

Linear elastic Young's modulus E in terms of G, where *v* is Poisson's ratio:

$$E = 2(1+v)G \quad \text{Equ.[3]}$$

Non-linear secant shear modulus G_s:

$$G_s = \alpha\gamma^{\beta-1} \quad \text{Equ.[4]}$$

where α is the shear stress constant and β is the exponent of linearity obtained from fitting the reloading response in shear stress/shear strain space with a power function. γ is plane shear strain.

Non-linear secant Young's modulus E'_s using invariant shear strain γ_α:

$$E'_s = 2\alpha[1+v][\sqrt{3}\gamma_\alpha]^{\beta-1} \quad \text{Equ.[5]}$$

Multiplying by √3 converts γ_α to γ assuming no volumetric strains are involved.

Non-linear tangential shear modulus G_t:

$$G_t = \alpha\beta\gamma^{\beta-1} \quad \text{Equ.[6]}$$

Plane shear strain at failure, undrained case, c_u is undrained shear strength:

$$\gamma_f = [c_u/\alpha]^{1/\beta} \quad \text{Equ.[7]}$$

Secant shear modulus at failure, in terms of stress:

$$G_s = \alpha[c_u/\alpha]^{(\beta-1)/\beta} \quad \text{Equ.[8]}$$

For secant shear modulus at mobilised stress levels less than failure, introduce *n* where $0 < n \leq 1$

$$G_n = \alpha[nc_u/\alpha]^{(\beta-1)/\beta} \quad \text{Equ.[9]}$$

For the special case of G_{50} at half of the ultimate shear strength:

$$G_{50} = \alpha[c_u/2\alpha]^{(\beta-1)/\beta} \quad \text{Equ.[10]}$$

Note: substitute τ_f for c_u in the case of drained tests in Equ.[7] *to* Equ.[10].

A.3 MODELLING the DRAINED TEST

A.3.1 Notation

r	is current cavity radius. r_o is the initial radius of the cavity.
R	Radius of the elastic/plastic boundary
ε_c	is current cavity strain, measured by the pressuremeter and is $(r - r_o)/r$.
ε_v	Is volumetric strain
ε_t	is tangential strain and is $(r_o - r)/r_o$
ε_{ip}	is circumferential yield strain when expanding
ε_{ipu}	is circumferential yield strain when contracting
ε_{mx}	is the maximum cavity strain at the end of loading
p'_c	is effective pressure at the cavity wall and is measured by the pressuremeter
p'_o	is effective cavity reference pressure (total reference pressure when prime is omitted).
p'_f	Radial stress at the cavity wall at first yield
p'_{fu}	Radial stress at the cavity wall when yielding in contraction
p'_{mx}	is the maximum effective cavity pressure at the end of loading
p'_{lim}	Effective limit pressure
e	Void ratio
G	is shear modulus, G_s is secant shear modulus, G_t is tangential shear modulus.
G_{load}	Shear modulus at first yield, G_{unload} is shear modulus at yield in contraction
G_{base}	Constant of the stiffness stress dependency relationship
K_a	is $(1 - \sin\phi')/(1 + \sin\phi')$
K_a^{cv}	is $(1 - \sin\phi'_{cv})/(1 + \sin\phi'_{cv})$
K_p^{cv}	is $(1 + \sin\phi'_{cv})/(1 - \sin\phi'_{cv}) = 1/K_a^{cv}$
S, (S_{ul})	Slope of the loading (unloading) response when the field data are plotted on log – log scales.
v	is Poisson's ratio
ϕ'	is angle of shearing resistance. ϕ'_{cv} is the friction angle when the material is shearing at constant volume.
ψ	is dilation angle.
c'	is drained cohesion
σ	is stress, suffix r for radial stress, θ for circumferential stress
σ'_{av}	Mean effective stress
M	is $\frac{(1+sin\psi)}{(1-sin\psi)}$
N	is $\frac{(1+sin\phi)}{(1-sin\phi)}$
τ	is shear stress

γ	Shear strain
α	Shear stress constant (Bolton & Whittle, 1999). α_{ref} denotes α at a particular σ'_{av}. α_r and α_{ru} are radial stress constants for loading and unloading respectively.
β	Exponent of non-linearity (Bolton & Whittle, 1999)
J	Exponent of stress dependency (Janbu, 1963)
A	$\frac{NM+1}{N+1} = \frac{1+\sin\phi'\sin\psi}{1-\sin\psi}$
B	$\frac{NM-N}{N+1} = \frac{\sin\psi\,(1+\sin\phi')}{1-\sin\psi}$
χ	is given by $[(1-\nu) - \nu\,(M+N) + (1-\nu)MN] / MN$
Z	is $2\chi MN/(N+M)$
D	is $M(2+Z)/(M+1)$
F	is $-ZN/(N-1)$
H	is $1-D-F$

A.3.2 Using strain as input and finding the cavity pressure

	Stage	Effective stress	Stop condition
[A]	"Elastic" expansion	$p'_c = p'_0 + \alpha_r(\varepsilon_c)^\beta$	$p'_c = p'_f = p'_o + \left(\frac{(p'_o\sin\phi' + c'\cos\phi')}{\beta(1+\sin\phi') - \sin\phi'}\right)$
[B]	Plastic expansion	$p'_c = (p'_f + c'\cot\phi')\left[\frac{\varepsilon_c}{\varepsilon_{ip}(1+\sin\psi)} + \left(\frac{\sin\psi}{(1+\sin\psi)}\right)\right]^S - c'\cot\phi'$	
[C]	End of expansion	$p'_c = p'_{mx}$	$\varepsilon_c = \varepsilon_{mx}$
[D]	"Elastic" contraction	$p'_c = p'_{mx} - \alpha_{ru}(\varepsilon_{mx} - \varepsilon_c)^\beta$	$p'_c = p'_{fu} = p'_{mx} - \left(\frac{2(p'_{mx}\sin\phi' - c'\cos\phi')}{\beta(1-\sin\phi') + 2\sin\phi'}\right)$
[F]	Plastic contraction	$p'_c = (p'_{fu} + c'\cot\phi')\left[A\left(\frac{\varepsilon_{mx}-\varepsilon_c}{\varepsilon_{ipu}}\right) - B\right]^{s_{ul}} - c'\cot\phi'$	

Note that if cohesion is zero, stage [B] above becomes the Hughes et al (1976) solution for a drained cavity expansion in a purely frictional material. Stage [F] becomes the Withers et al (1989) solution for drained cavity contraction in a purely frictional material.

A.3.3 Using pressure as input and finding the cavity strain

	Stage	Cavity strain	Stop condition
[A]	"Elastic" expansion:	$\varepsilon_c = \left(\frac{p'_c - p'_o}{\alpha_r}\right)^{\frac{1}{\beta}}$	$p'_c = p'_f = p'_o + \left(\frac{(p'_o \sin\phi' + c'\cos\phi')}{\beta(1+\sin\phi') - \sin\phi'}\right)$
[B]	Plastic expansion	$\varepsilon_c = \varepsilon_{ip}(1+\sin\psi)\left[\left(\frac{p'_c + c'\cot\phi'}{p'_f + c'\cot\phi'}\right)^{\frac{1}{s}} - \left(\frac{\sin\psi}{(1+\sin\psi)}\right)\right]$	
[C]	End of expansion	$p'_c = p'_{mx}$	$\varepsilon_c = \varepsilon_{mx}$
[D]	"Elastic" contraction	$\varepsilon_c = \varepsilon_{mx} - \left(\frac{p'_{mx} - p'_c}{\alpha_{ru}}\right)^{\frac{1}{\beta}}$	$p'_c = p'_{fu} = p'_{mx} - \left(\frac{2(p'_{mx}\sin\phi' - c'\cos\phi')}{\beta(1-\sin\phi') + 2\sin\phi'}\right)$
[E]	Plastic contraction	$\varepsilon_c = \varepsilon_{mx} - \left(\frac{\varepsilon_{ipu}}{A}\right)\left[\left(\frac{p'_c + c'\cot\phi'}{p'_{fu} + c'\cot\phi'}\right)^{1/s_{ul}} + B\right]$	

A.3.4 Carter, Booker and Yeung (1986)

One advantage of assuming the pressure and deriving the strain is the possibility of replacing the plastic expansion equation with the more exact solution of Carter et al, 1986. This is given below together with the modifications for a non-linear response prior to first yield.

Carter et al (1986)

$$\varepsilon_C = \varepsilon_{ip}\left[D\left(\frac{p'_c + c'\cot\phi'}{p'_f + c'\cot\phi'}\right)^{\frac{1}{s}} + F\left(\frac{p'_c + c'\cot\phi'}{p'_f + c'\cot\phi'}\right) + H\right] \quad \text{Equ.[11]}$$

where

$$p'_f = p'_o + p'_o\sin\phi' + c'\cos\phi'$$

$$\varepsilon_{ip} = \frac{p'_f - p'_o}{2G}$$

$$D = M(2+Z)/(M+1)$$

$$F = -ZN/(N-1)$$

$$Z = 2\chi MN/(N+M)$$

$$H = 1 - D - F$$

$$\chi = [(1-\nu) - \nu(M+N) + (1-\nu)MN] / MN$$

This may be modified for non-linearity by replacing p'_f and ε_{ip} with the following:

$$p'_f = p'_o + \left[\frac{p'_o\sin\phi' + c'\cos\phi'}{\beta(1+\sin\phi') - \sin\phi'}\right].. \quad \text{Equ.[12]}$$

$$\varepsilon_{ip} = \left(\frac{p'_f - p'_o}{\alpha_r}\right)^{\frac{1}{\beta}} \quad \text{Equ.[13]}$$

Grain to Tilbury Tunnel GI - Ground Investigation

Results of pressuremeter tests carried out by Cambridge Insitu

Project reference:	TB8754
Client:	Soil Engineering
Cambridge Insitu reference:	CIR1609/25
Report date:	July 2025
Version:	1.0

VOLUME 2 of 2

Data for all tests and calibrations

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Volume 2 Details of work carried out

Table 1.1 below details the pressuremeter testing carried out. Table 1.2 provides background information about the tests and probe used. Table 1.3 is given data for coordinates and levels.

Table 1.1 Sequence of work

Test	Internal ref.	Depth (mBGL)	Date *dd/mm/yyyy*	Max Pressure (kPa)	Material	Notes
BH101 Test 1	B101T01	19.50	28/05/2025	207	Chalk/Flint	O/s pocket, no results
BH101 Test 2	B101T02	24.90	28/05/2025	1411	Chalk/Flint	
BH101 Test 3	B101T03	29.30	29/05/2025	4167	Chalk/Flint	
BH101 Test 4	B101T04	33.20	29/05/2025	9565	Chalk/Flint	
BH101 Test 5	B101T05	37.40	30/05/2025	10531	Chalk/Flint	
BH101 Test 6	B101T06	41.40	02/06/2025	8226	Chalk/Flint	
BH101 Test 7	B101T07	45.20	02/06/2025	9901	Chalk/Flint	
BH102 Test 1	B102T01	27.40	15/05/2025	1103	Chalk/Flint	
BH102 Test 2	B102T02	30.40	15/05/2025	5330	Chalk/Flint	
BH102 Test 3	B102T03	33.40	15/05/2025	8301	Chalk/Flint	
BH102 Test 4	B102T04	35.90	16/05/2025	9066	Chalk/Flint	
BH102 Test 5	B102T05	38.70	16/05/2025	8749	Chalk/Flint	
BH102 Test 6	B102T05	41.70	19/05/2025	8252	Chalk/Flint	
BH102 Test 7	B102T05	44.65	19/05/2025	8991	Chalk/Flint	
BH105 Test 1	B105T01	33.90	19/06/2025	3793	Chalk/Flint	
BH105 Test 2	B105T02	38.15	20/06/2025	6354	Chalk/Flint	
BH105 Test 3	B105T03	42.40	20/06/2025	5538	Chalk/Flint	
BH105 Test 4	B105T04	46.20	23/06/2025	11660	Chalk/Flint	
BH105 Test 5	B105T05	50.35	23/06/2025	7986	Chalk/Flint	
BH108 Test 1	B108T01	24.30	10/06/2025	2471	Chalk/Flint	
BH108 Test 2	B108T02	26.10	10/06/2025	3021	Chalk/Flint	Membrane rupture
BH108 Test 3	B108T03	27.90	10/06/2025	2324	Chalk/Flint	
BH108 Test 4	B108T04	32.20	11/06/2025	3288	Chalk/Flint	
BH108 Test 5	B108T05	34.20	11/06/2025	1231	Chalk/Flint	
BH108 Test 6	B108T06	36.40	11/06/2025	3371	Chalk/Flint	
BH108 Test 7	B108T07	40.30	12/06/2025	4222	Chalk/Flint	
BH108 Test 8	B108T08	42.40	12/06/2025	4510	Chalk/Flint	

Notes for Table 1.1:

1. **Depth** is given as metres in drilled length to the centre of the measuring section below seabed. The HPD membrane is 0.60 long, hence the affected zone is ± 0.30m of the quoted test centre.
2. **Max Pressure** is the maximum pressure reached by the end of loading.
3. **Material** - is as reported on site.

Table 1.2 Probe details and calibrations

Test	Probe	Operator	Transducer calibration	Membrane stiffness	System compliance
BH101 Test 1	HPD 95 “Wally”	PA	05/03/2025 *	P2205T25	P2205T25
BH101 Test 2	HPD 95 “Wally”	PA	05/03/2025 *	P2205T25	P2205T25
BH101 Test 3	HPD 95 “Wally”	PA	05/03/2025 *	P2205T25	P2205T25
BH101 Test 4	HPD 95 “Wally”	PA	05/03/2025 *	P2205T25	P2205T25
BH101 Test 5	HPD 95 “Wally”	PA	05/03/2025 *	P2205T25	P2205T25
BH101 Test 6	HPD 95 “Wally”	PA	05/03/2025 *	P2205T25	P2205T25
BH101 Test 7	HPD 95 “Wally”	PA	05/03/2025 *	P2205T25	P2205T25
BH102 Test 1	HPD 95 “Wally”	PA	05/03/2025 *	P1305T25	P1305T25
BH102 Test 2	HPD 95 “Wally”	PA	05/03/2025 *	P1305T25	P1305T25
BH102 Test 3	HPD 95 “Wally”	PA	05/03/2025 *	P1305T25	P1305T25
BH102 Test 4	HPD 95 “Wally”	PA	05/03/2025 *	P1305T25	P1305T25
BH102 Test 5	HPD 95 “Wally”	PA	05/03/2025 *	P1305T25	P1305T25
BH102 Test 6	HPD 95 “Wally”	PA	05/03/2025 *	P1305T25	P1305T25
BH102 Test 7	HPD 95 “Wally”	PA	05/03/2025 *	P1305T25	P1305T25
BH105 Test 1	HPD 95 “Lilith”	SDP	23/05/2025	P2305T25	P2305T25
BH105 Test 2	HPD 95 “Lilith”	SDP	23/05/2025	P2305T25	P2305T25
BH105 Test 3	HPD 95 “Lilith”	SDP	23/05/2025	P2305T25	P2305T25
BH105 Test 4	HPD 95 “Lilith”	SDP	23/05/2025	P2305T25	P2305T25
BH105 Test 5	HPD 95 “Wally”	SDP	05/03/2025 *	S1006T26	S1006T26
BH108 Test 1	HPD 95 “Wally”	SDB	05/03/2025 *	P0306T25	P0306T25
BH108 Test 2	HPD 95 “Wally”	SDB	05/03/2025 *	P0306T25	P0306T25
BH108 Test 3	HPD 95 “Lilith”	SDB	23/05/2025	P2305T25	P2305T25
BH108 Test 4	HPD 95 “Lilith”	SDB	23/05/2025	P2305T25	P2305T25
BH108 Test 5	HPD 95 “Lilith”	SDB	23/05/2025	P2305T25	P2305T25
BH108 Test 6	HPD 95 “Lilith”	SDB	23/05/2025	P2305T25	P2305T25
BH108 Test 7	HPD 95 “Lilith”	SDB	23/05/2025	P2305T25	P2305T25
BH108 Test 8	HPD 95 “Lilith”	SDB	23/05/2025	P2305T25	P2305T25

Notes for Table 1.2:

1. **Probe** – Two 95mm diameter High Pressure Dilatometers (HPD95) known as “Wally” and “Lilith” were used on this contract.
2. **Operator** – PA is Peter Allen, SDP is Stuart Pearce and SDB is Simon Baxter, all are employees of Cambridge Insitu Ltd.
3. The pressuremeter has a transducer calibration, referenced by date. There are also additional calibrations for membrane stiffness and system compliance.
4. * Arm 3 replaced and recalibrated 25/04/2025

Table 1.3 Coordinates and levels – given data

LOCATION	EASTING (m)	NORTHING (m)	ELEVATION (mOD)	WATER TABLE (mBGL)
BH101	566285.852	175892.136	2.156	6.8
BH102	566294.050	175858.591	2.378	4.5
BH105	566607.498	175538.416	8.343	9.6
BH108	567435.356	174079.583	2.354	4.31

Notes for Table 1.3:

1. These data are supplied by Soil Engineering.
2. The water levels are taken from the borehole logs, except for BH105 where observations from the pressuremeter tests have been preferred.

The remainder of this volume is laid out as follows:

- There is a plot of all the field curves on the same axes.
- Then the individual results and plots showing the derivation of the results are given (the page order is given below).
- The volume finishes with a section containing the calibration data for the probe deployed.

Presentation order of plots from the analysis program WINSITU:

1. A Results Summary Sheet
2. A plot of total pressure against cavity strain, using the output from the average of all displacement followers.
3. A plot of Total pressure/Radial displacement showing the slope identified as the initial shear modulus. If the test shows plastic development then yield and iterated cavity reference pressure are indicated.
4. A log-log plot of cavity strain against effective radial stress, using expansion data, quoting the gradient (Hughes et al, 1976). This gradient can be used to determine peak friction angle and dilation.
5. A log-log plot of cavity strain against effective radial stress, using contraction data, quoting the gradient (Withers et al, 1989). This gradient can be used to determine peak friction angle and dilation.
6. Plots on axes of Radial displacement/Total Pressure showing enlarged views of unload/reload cycles and quoting shear modulus G.
7. If the cycles show a non-linear response, then plots on axes of Ln[shear strain]/Ln[radial stress] showing loop reloading paths and quoting the gradient and intercept for each loop.
8. If the cycles show a non-linear response, then a plot on axes of secant shear modulus/Log[Shear strain] showing the decay of stiffness against strain curves derived from fitting a power law function to reloading data, all cycles. Individual data points obtained from applying Palmer (1972) directly to reloading data are also shown.
9. A plot of cavity strain against total pressure showing the experimental data compared to a modelled trend derived using a modified version of the Carter el al (1986) solution for drained cavity expansion tests.

Plots taken from the data collection software package WINLOG:

1. On axes of Radial Displacement/Total Pressure showing all displacement sensors.
2. On axes of Radial Displacement/Total Pressure showing average displacement.
3. On axes of Radial Displacement/Total Pressure showing opposing arm pairs.
4. On axes of Radial Displacement/Total Pressure showing the mean trend of even numbered and odd numbered arms.

Because the information presented here comes from a variety of sources it is not possible to number the pages in a coherent manner.

Winsitu colour coding

Plots from the analysis program WINSITU use a colour coding scheme to distinguish between different kinds of data. The options are these:

Data description	Colour
On the loading path	Red
On the unloading path	Blue
To be ignored	Grey
Loop unloading	Yellow
Loop reloading	Magenta
Creep hold	Dark green
Creep end	Light green

When a particular plot displays one colour only then this is arbitrary, and the colour has no significance. When more than one colour is shown then the meaning is indicated above.

Figure 1 Combined field curves from BH101

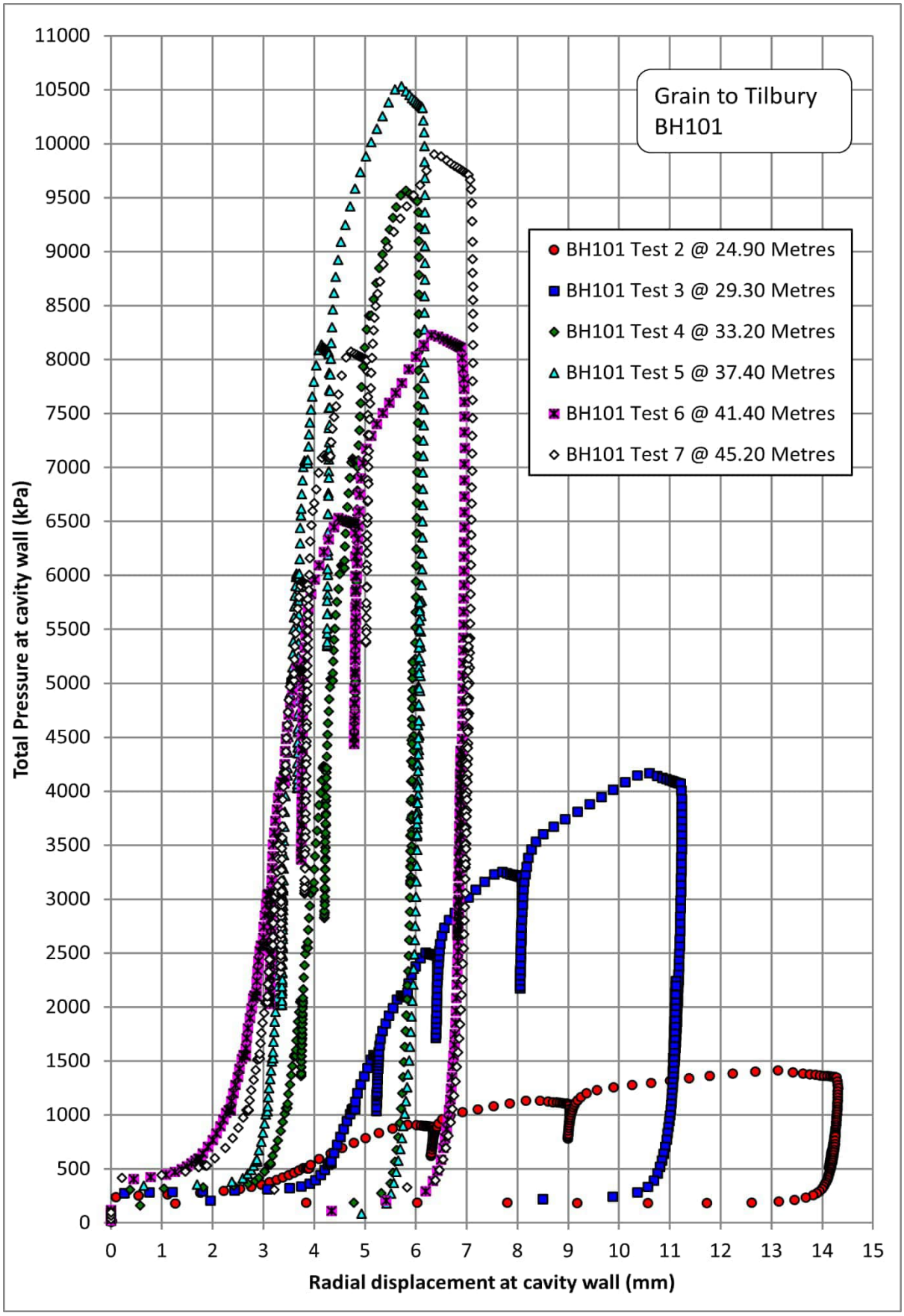


Figure 2 Combined field curves from BH102

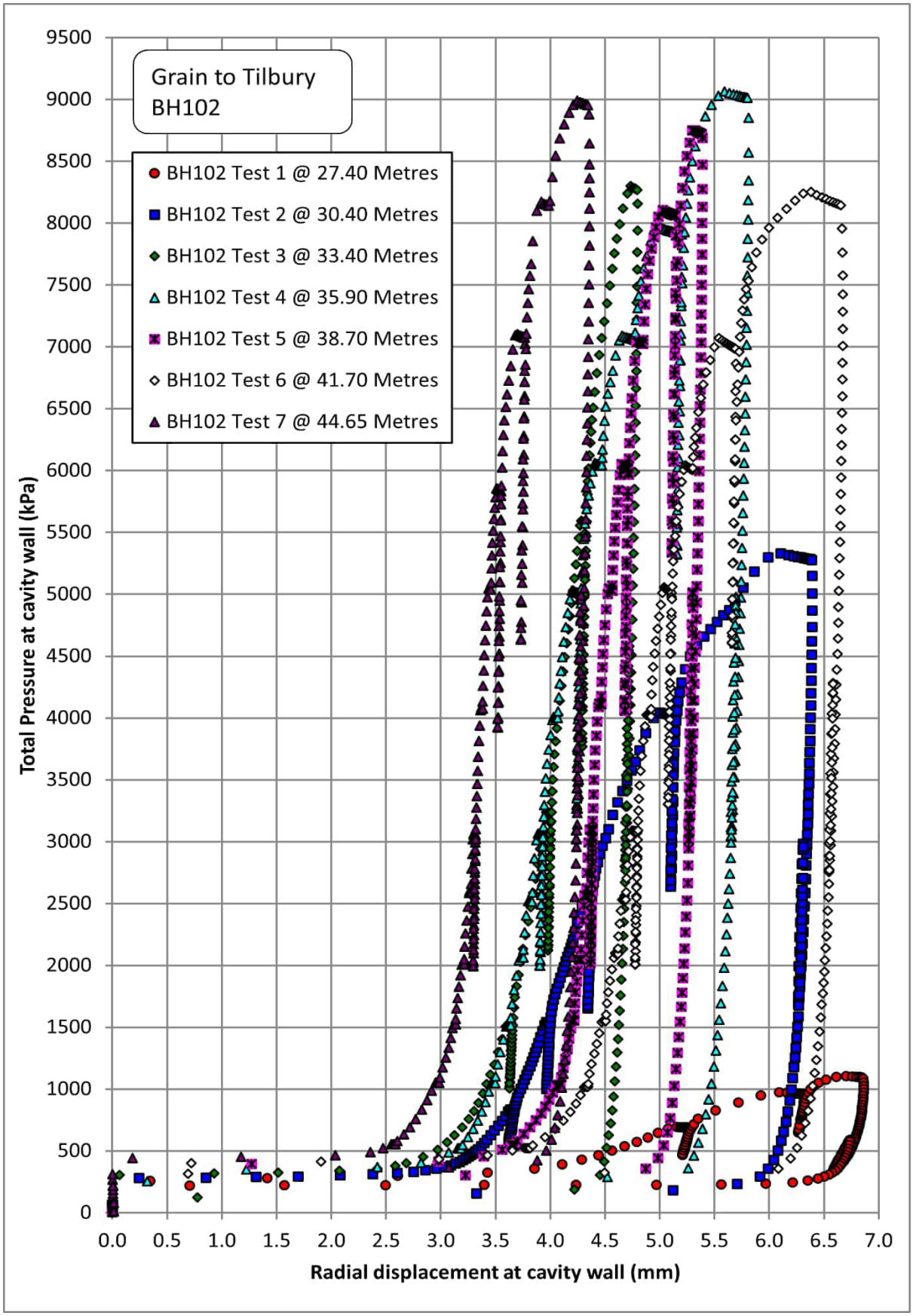


Figure 3 Combined field curves from BH105

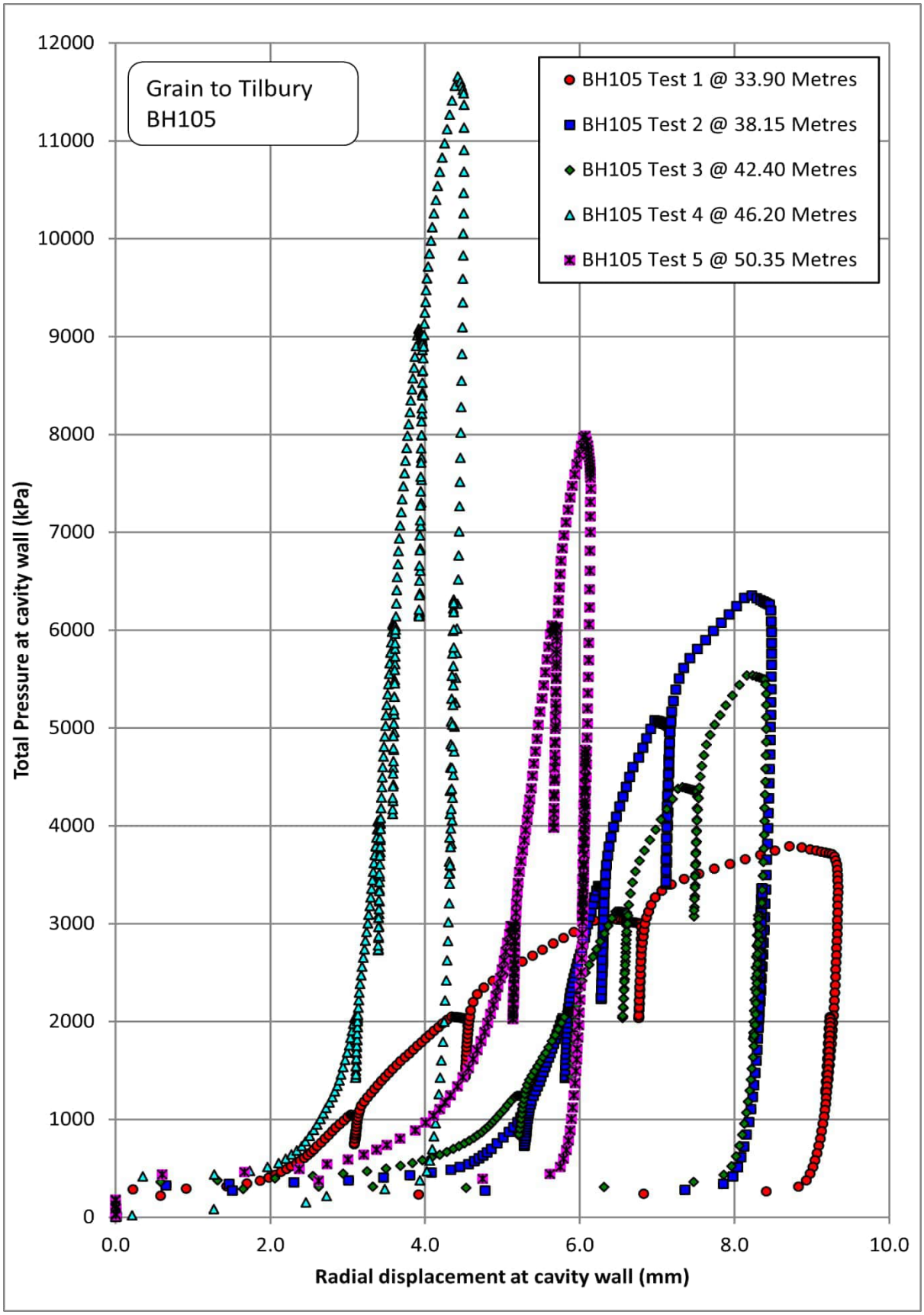
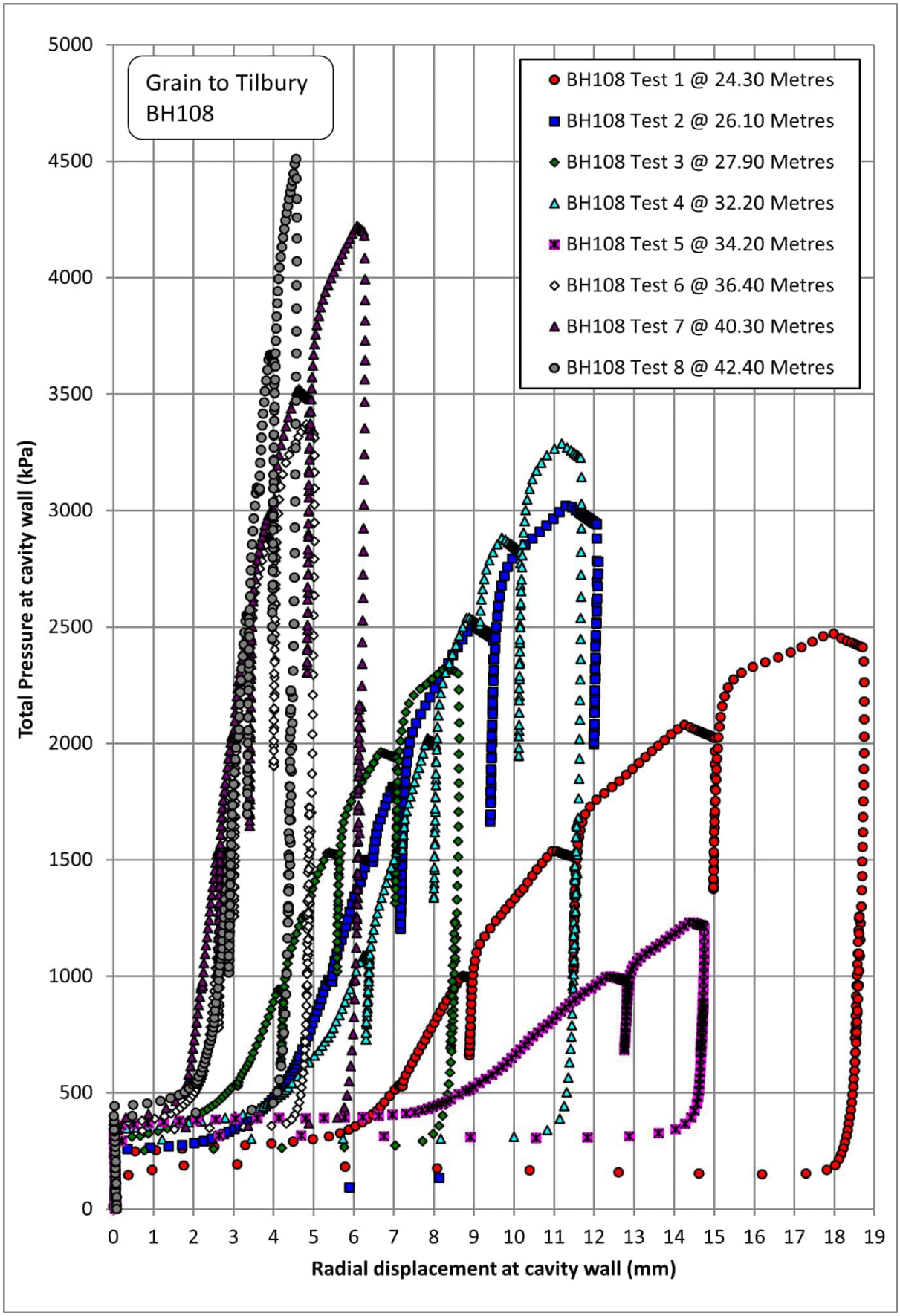


Figure 4 Combined field curves from BH108

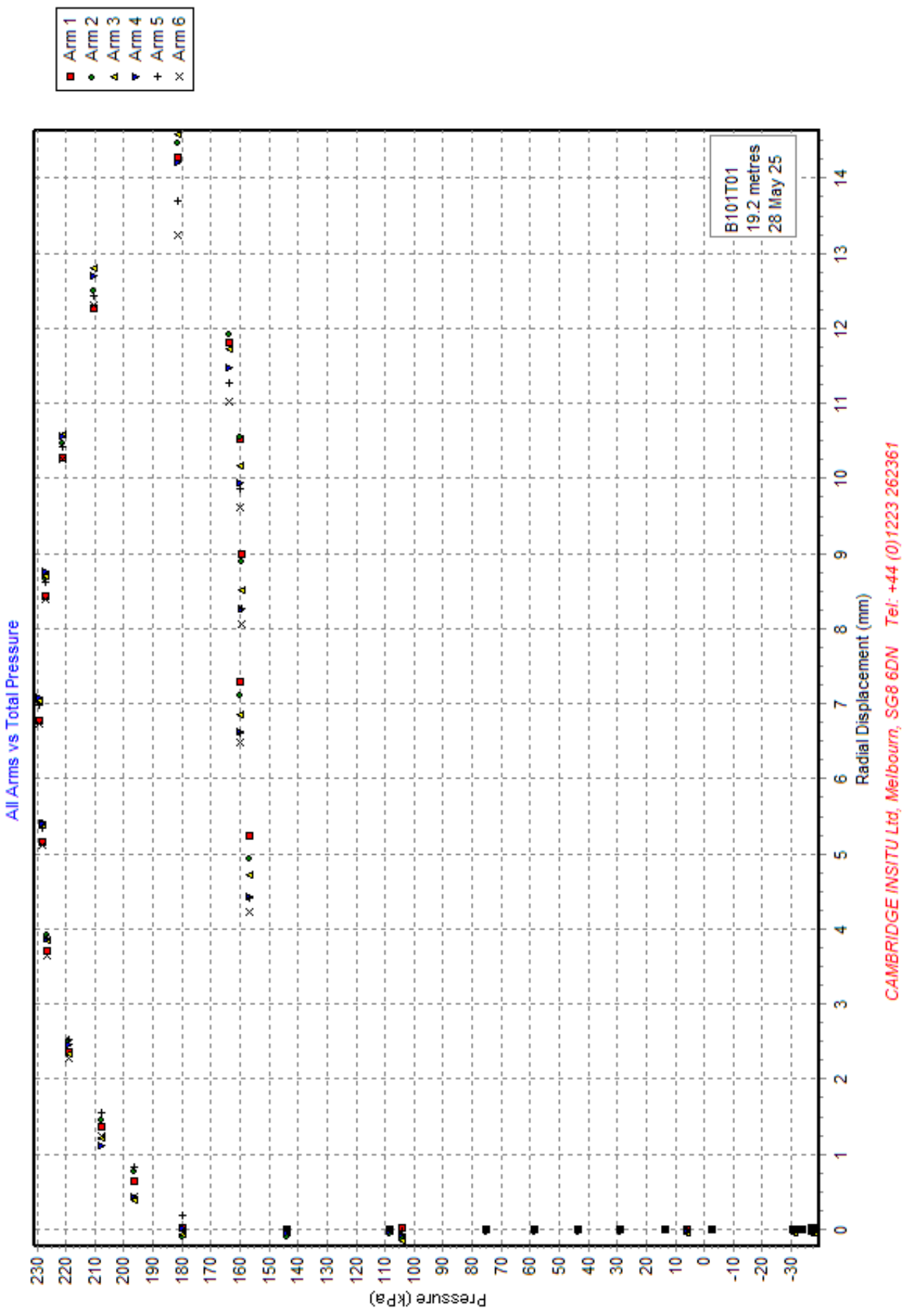


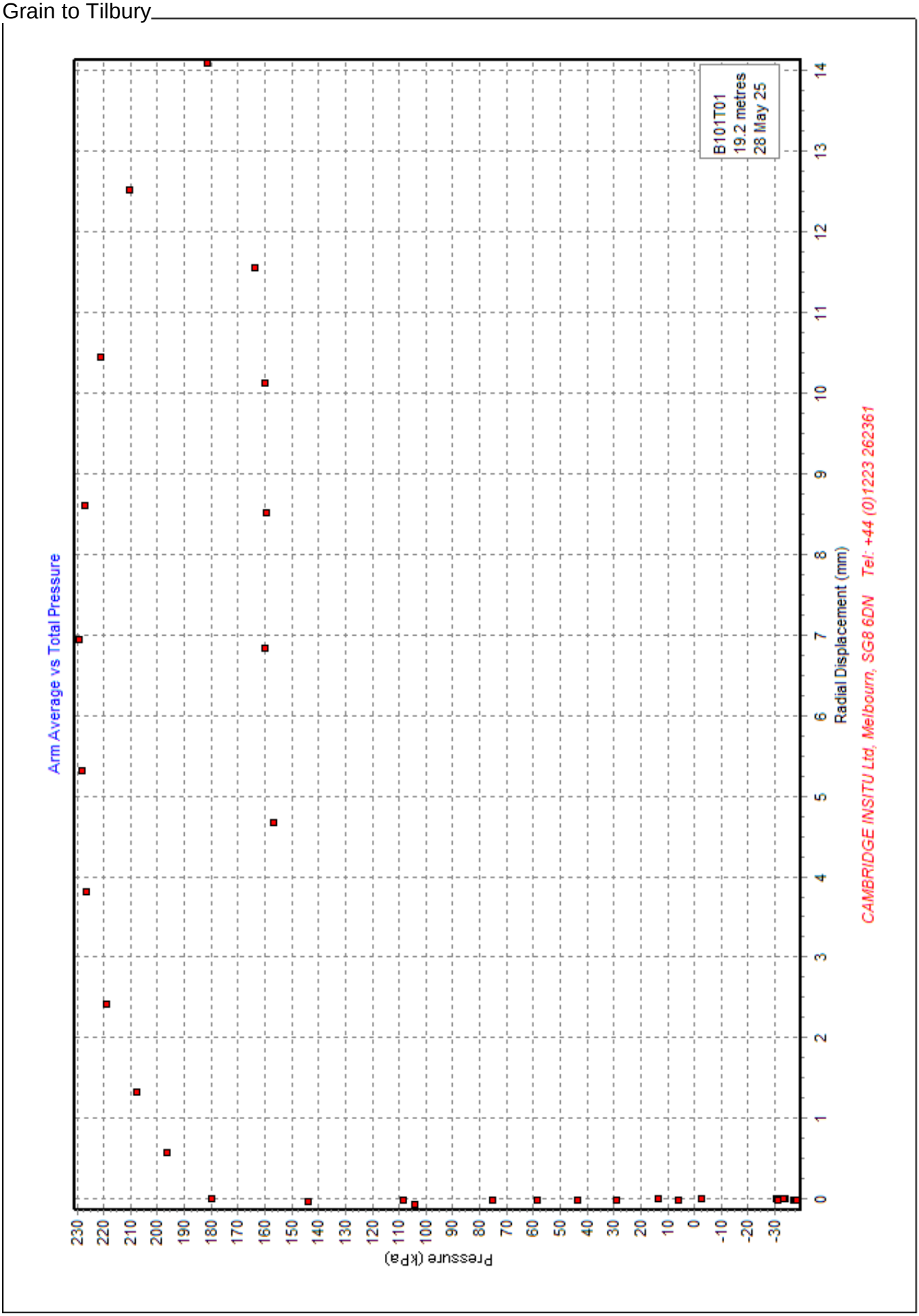
TEST DATA

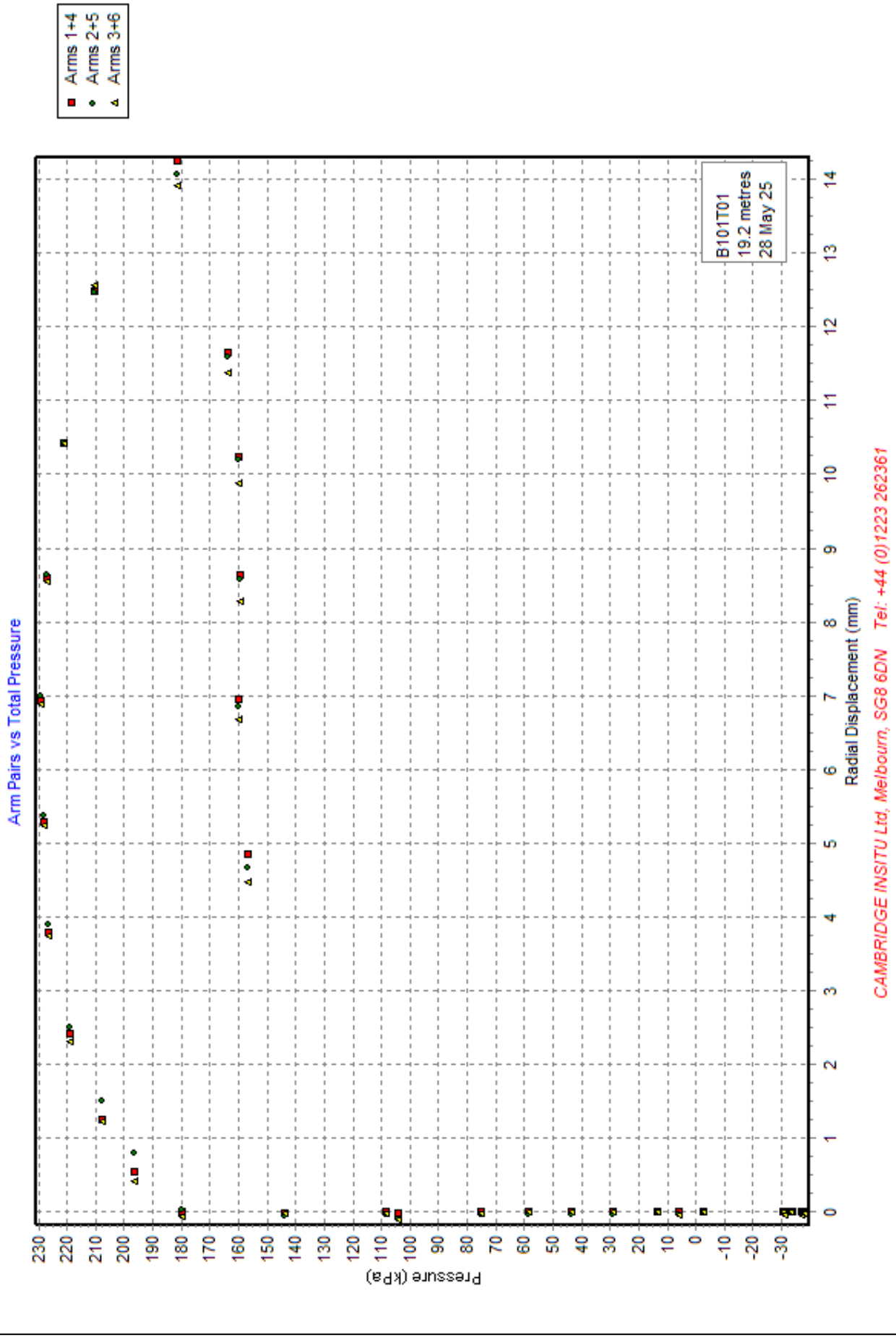
(TAKEN FROM WINSITU and WINLOG FILES)

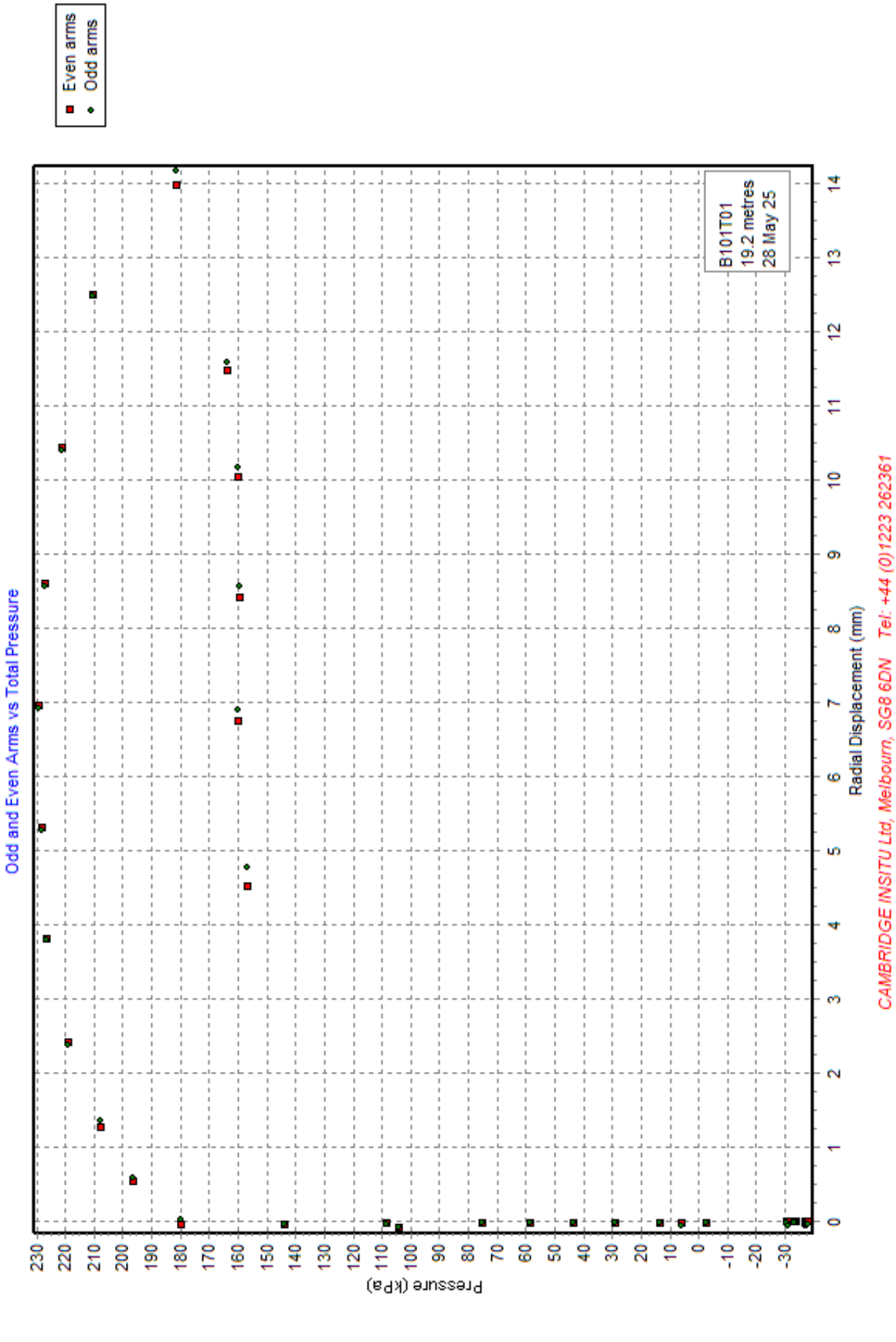
Test	Internal Ref.	Depth (mBGL)	Date
BH101 Test 1**	B101T01	19.50	28/05/2025
BH101 Test 2	B101T02	24.90	28/05/2025
BH101 Test 3	B101T03	29.30	29/05/2025
BH101 Test 4	B101T04	33.20	29/05/2025
BH101 Test 5	B101T05	37.40	30/05/2025
BH101 Test 6	B101T06	41.40	02/06/2025
BH101 Test 7	B101T07	45.20	02/06/2025
BH102 Test 1	B102T01	27.40	15/05/2025
BH102 Test 2	B102T02	30.40	15/05/2025
BH102 Test 3	B102T03	33.40	15/05/2025
BH102 Test 4	B102T04	35.90	16/05/2025
BH102 Test 5	B102T05	38.70	16/05/2025
BH102 Test 6	B102T05	41.70	19/05/2025
BH102 Test 7	B102T05	44.65	19/05/2025
BH105 Test 1	B105T01	33.90	19/06/2025
BH105 Test 2	B105T02	38.15	20/06/2025
BH105 Test 3	B105T03	42.40	20/06/2025
BH105 Test 4	B105T04	46.20	23/06/2025
BH105 Test 5	B105T05	50.35	23/06/2025
BH108 Test 1	B108T01	24.30	10/06/2025
BH108 Test 2	B108T02	26.10	10/06/2025
BH108 Test 3	B108T03	27.90	10/06/2025
BH108 Test 4	B108T04	32.20	11/06/2025
BH108 Test 5	B108T05	34.20	11/06/2025
BH108 Test 6	B108T06	36.40	11/06/2025
BH108 Test 7	B108T07	40.30	12/06/2025
BH108 Test 8	B108T08	42.40	12/06/2025

****Logging plots only**


All Arms vs Total Pressure
Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
B101T01
19.2 metres
28 May 25
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arm Average vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
B101T01
19.2 metres
28 May 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arm Pairs vs Total Pressure
Arms 1+4
Arms 2+5
Arms 3+6
B101T01
19.2 metres
28 May 25
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
Odd and Even Arms vs Total Pressure
B101T01
19.2 metres
28 May 25
Radial Displacement (mm)
Pressure (kPa)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to Tilbury
BH101 Test 2 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Grain to Tilbury
Borehole : BH101
Test name : BH101 Test 2
Test date : 28 May 25
Test depth : 24.90 Metres
Water table : 6.8 Metres
Ambient PWP : 179.0 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDP/RW on 17 Jul 25

Remarks: No Recovery

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=4.21"
Po from Marsland & Randolph (kPa) : "Arm ave=399.7"
Best estimate of Po (kPa) : "Arm ave=350.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=789.3"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 25.0
Angle of internal friction (°) : "Arm ave=27.0"
Dilation angle (°) : "Arm ave=2.2"
Gradient of log-log plot : "Arm ave=0.324"

[Withers et al 1989]
Angle of internal friction (°) : "Arm ave=24.0"
Dilation angle (°) : "Arm ave=-1.1"
Gradient of log-log plot : "Arm ave=-1.406"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=6.1"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	112.9	4.009	712	0.223	252
Arm ave	2	149.9	9.108	877	0.187	280
Arm ave	3	92.1	18.959	654	0.357	329

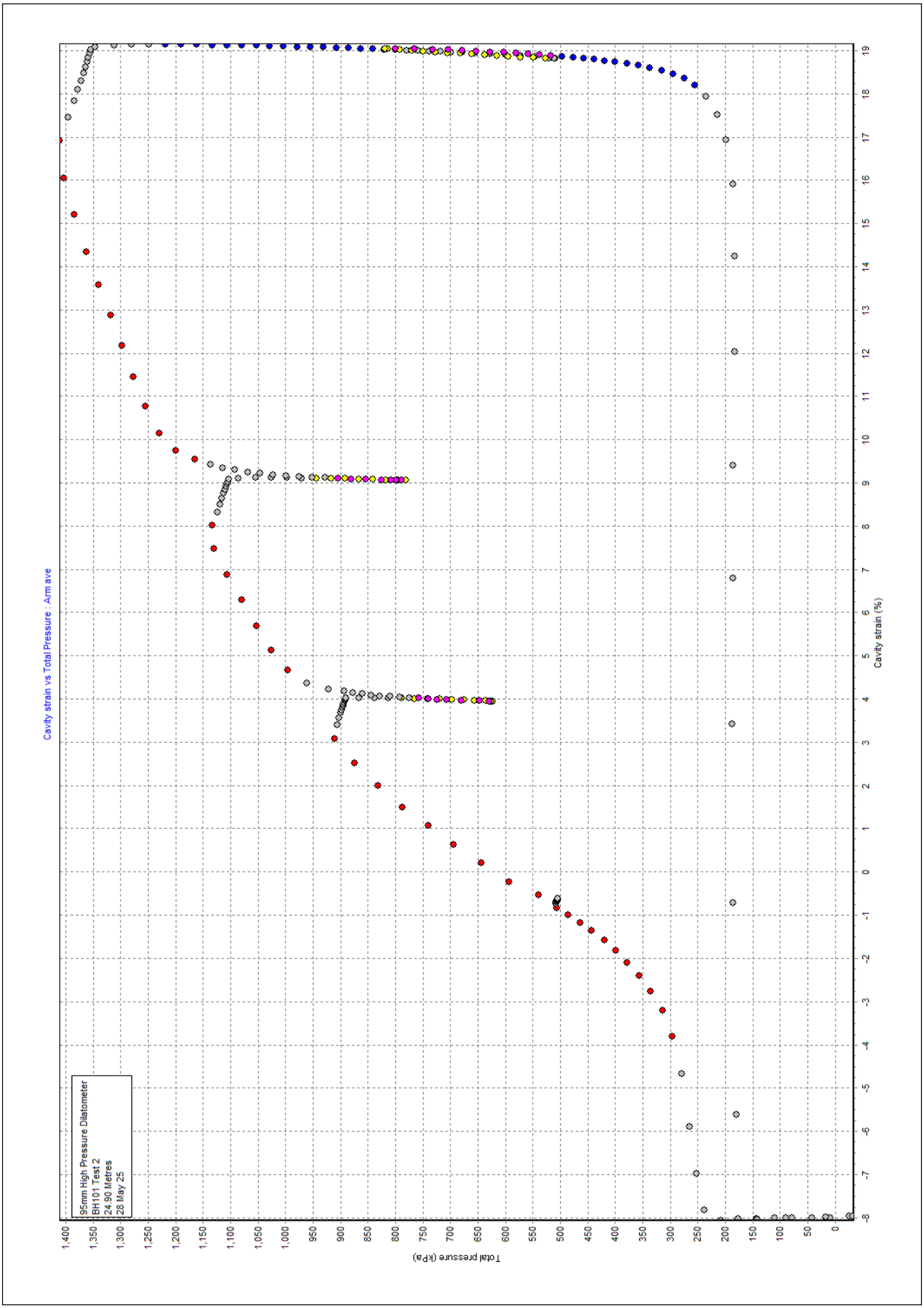
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

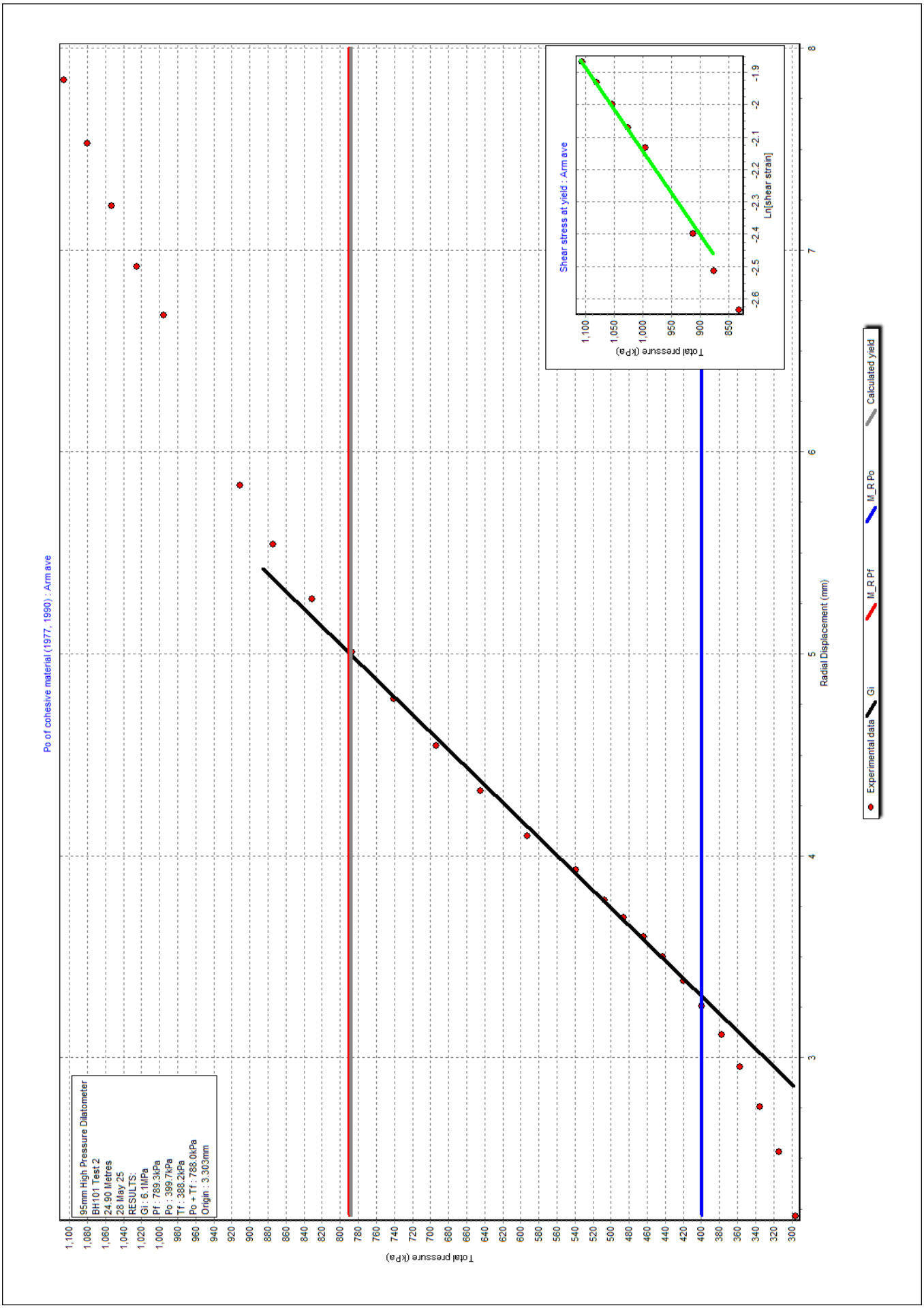
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	44.915	38.654	0.861
Arm ave	2	67.336	59.696	0.887
Arm ave	3	13.718	8.854	0.645

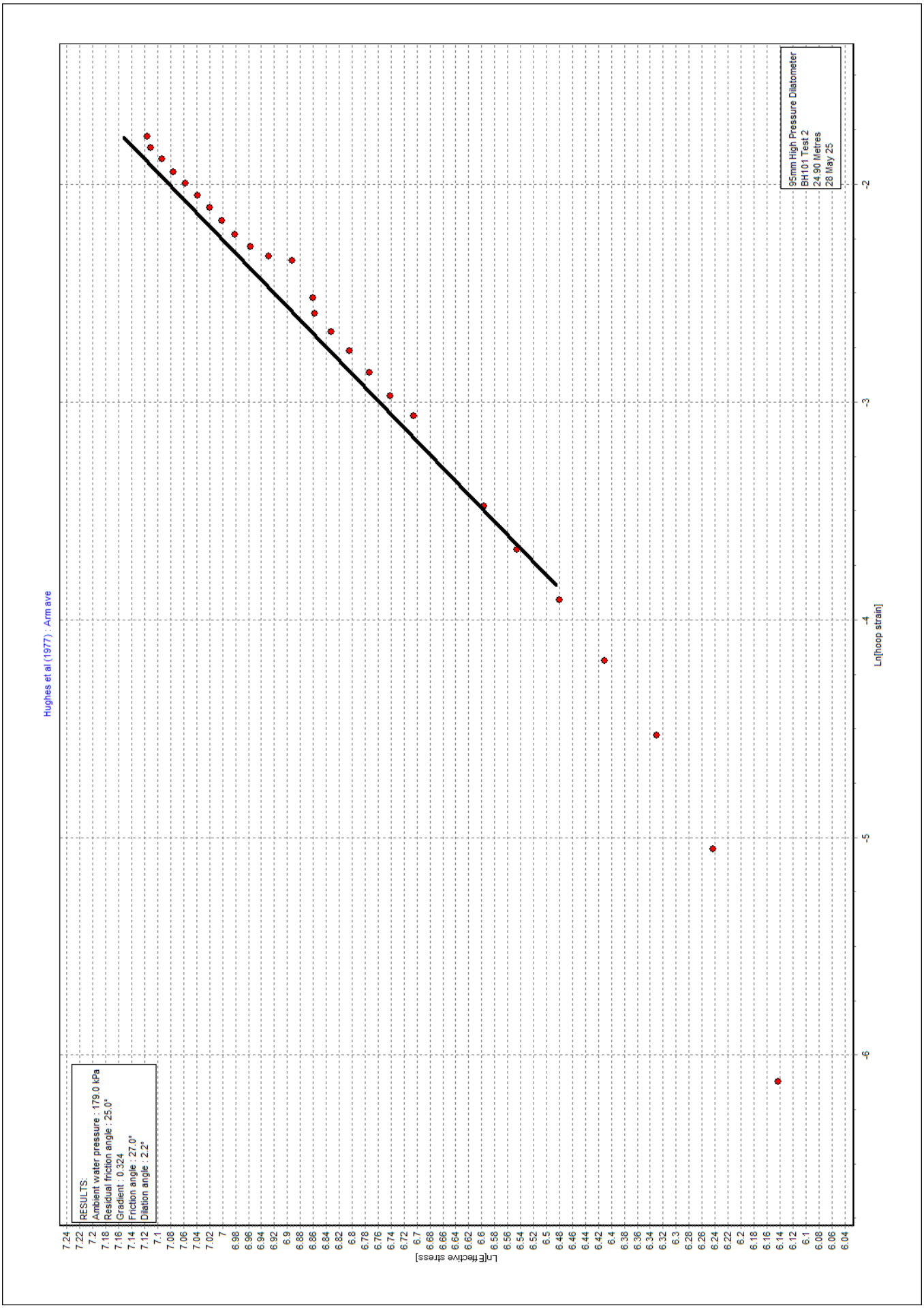
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 4.21
Po (kPa) : 350
Cohesion (kPa) : 2
Angle of peak friction (deg) : 27.0
Angle of peak dilation (deg) : 2.2
Total yield stress (kPa) : 514
Total limit stress (kPa) : 2013
G at first yield (MPa) : 31.3

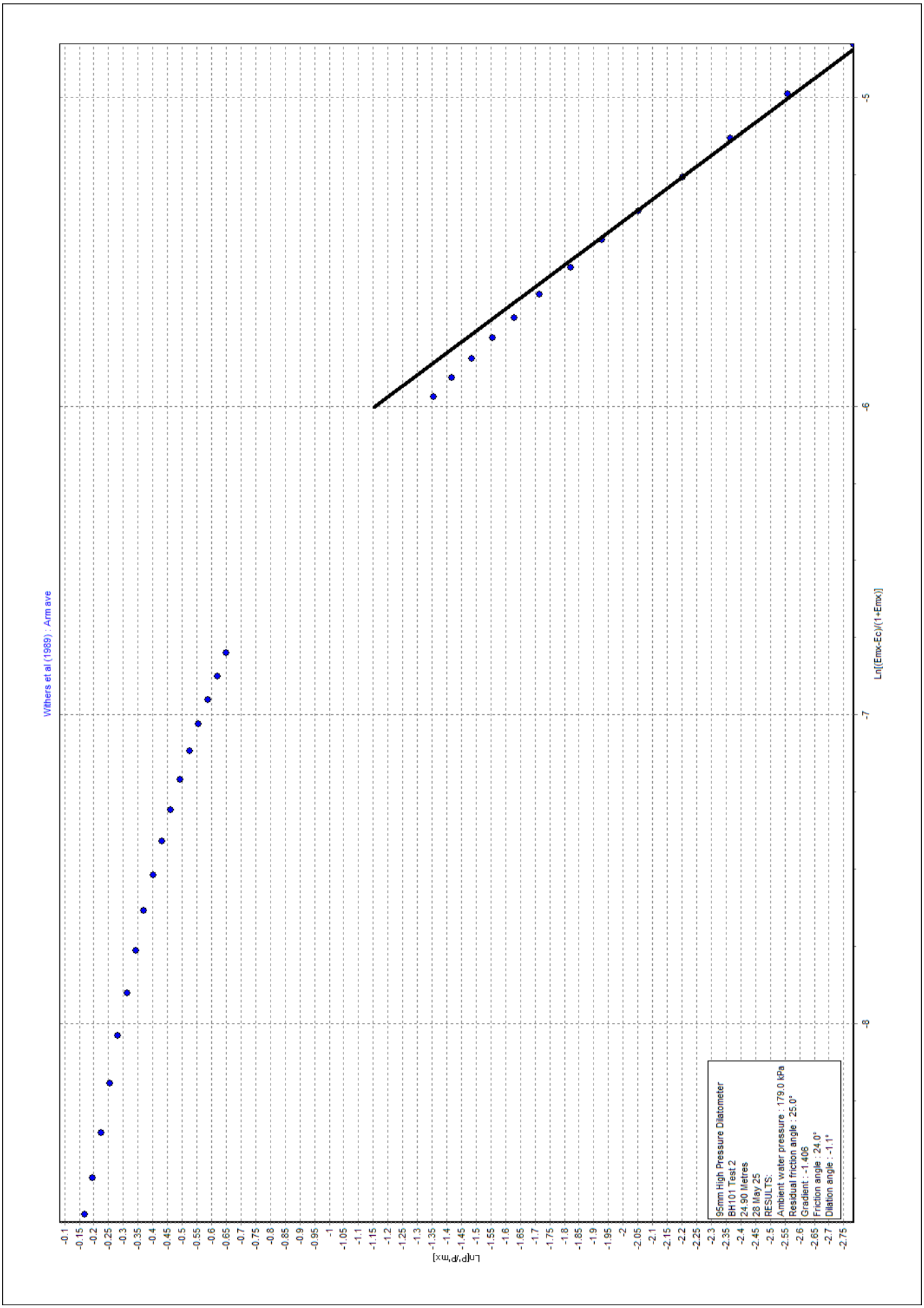
Grain to Tilbury
BH101 Test 2 - SUMMARY OF RESULTS

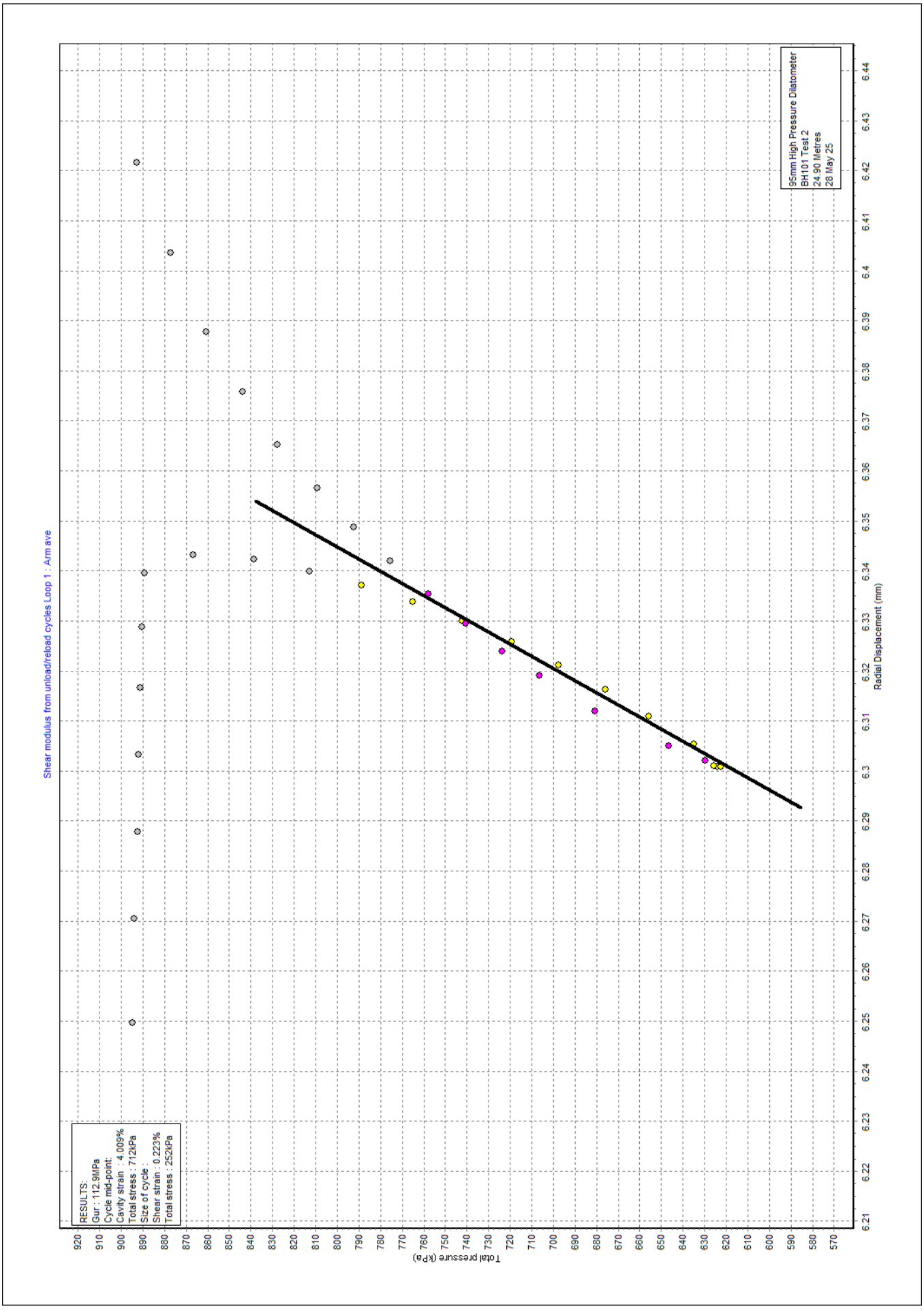
Non-linear exponent	:	0.645
Janbu exponent	:	0.596
Correlation	:	0.094
Ambient pore water pressure (kPa)	:	179
Residual friction angle (deg)	:	25.0
Poisson's ratio	:	0.20

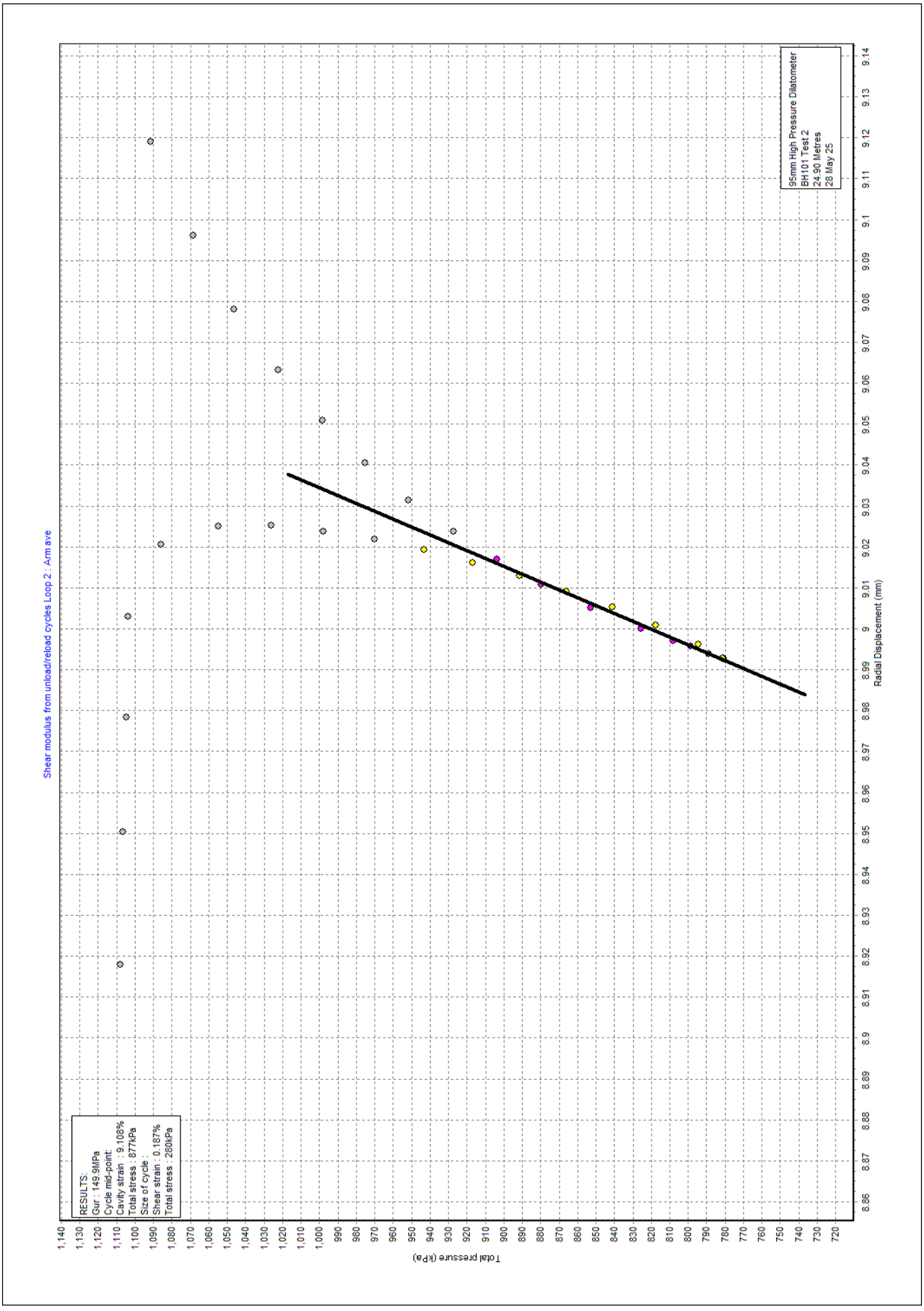

Cavity strain vs Total Pressure : Arm ave
95mm High Pressure Dilatometer
BH101 Test 2
24.90 Metres
28 May 25
Total pressure (kPa)
Cavity strain (%)

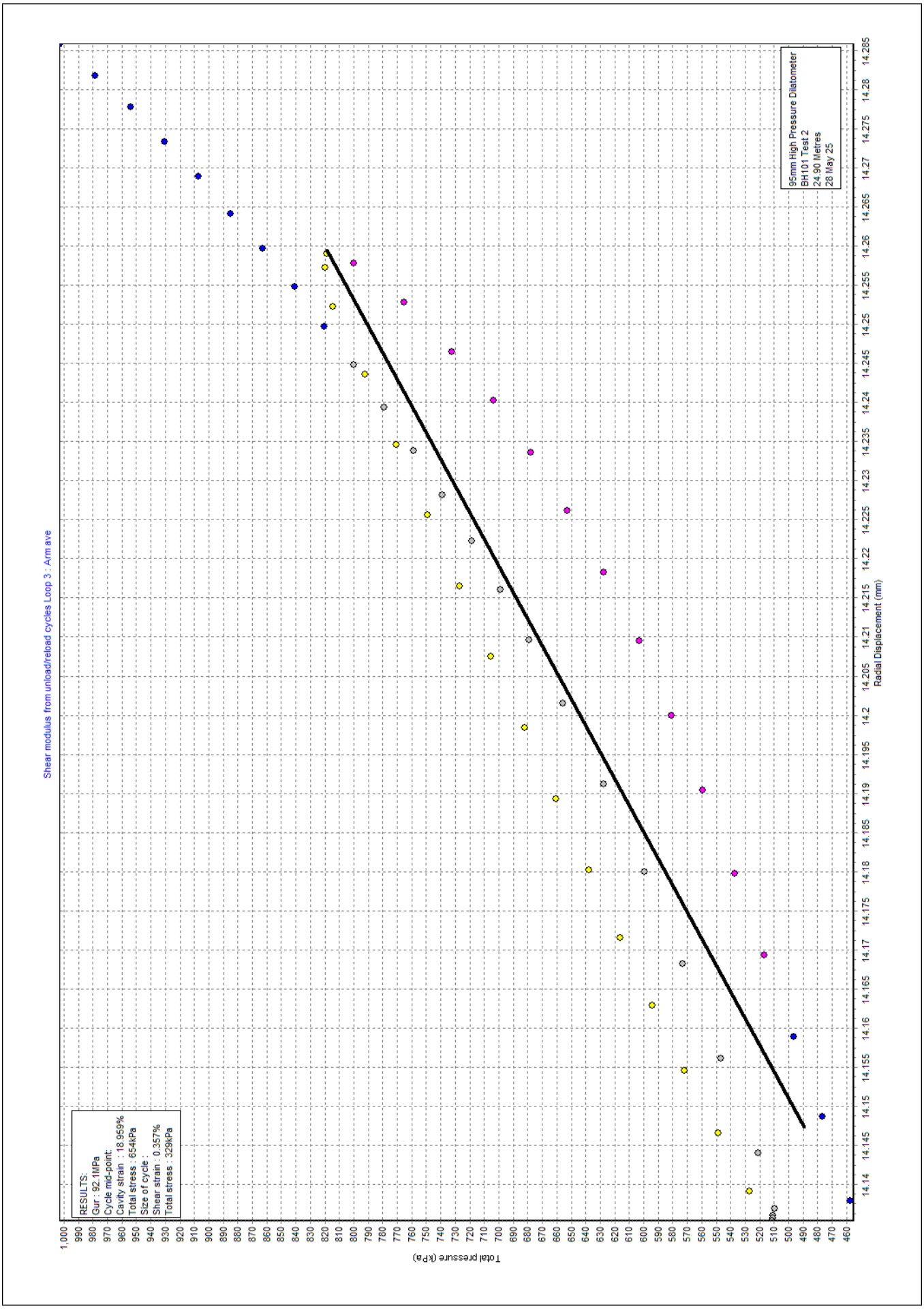

Po of cohesive material (1977, 1990) : Arm ave
Total pressure (kPa)
Radial Displacement (mm)
95mm High Pressure Dilatometer
BH101 Test 2
24.90 Metres
28 May 25
RESULTS:
Gi : 6.1MPa
Pf : 789.3kPa
Po : 399.7kPa
Tf : 388.2kPa
Po + Tf : 788.0kPa
Origin : 3.303mm
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Shear stress at yield : Arm ave
Total pressure (kPa)
Ln[shear strain]

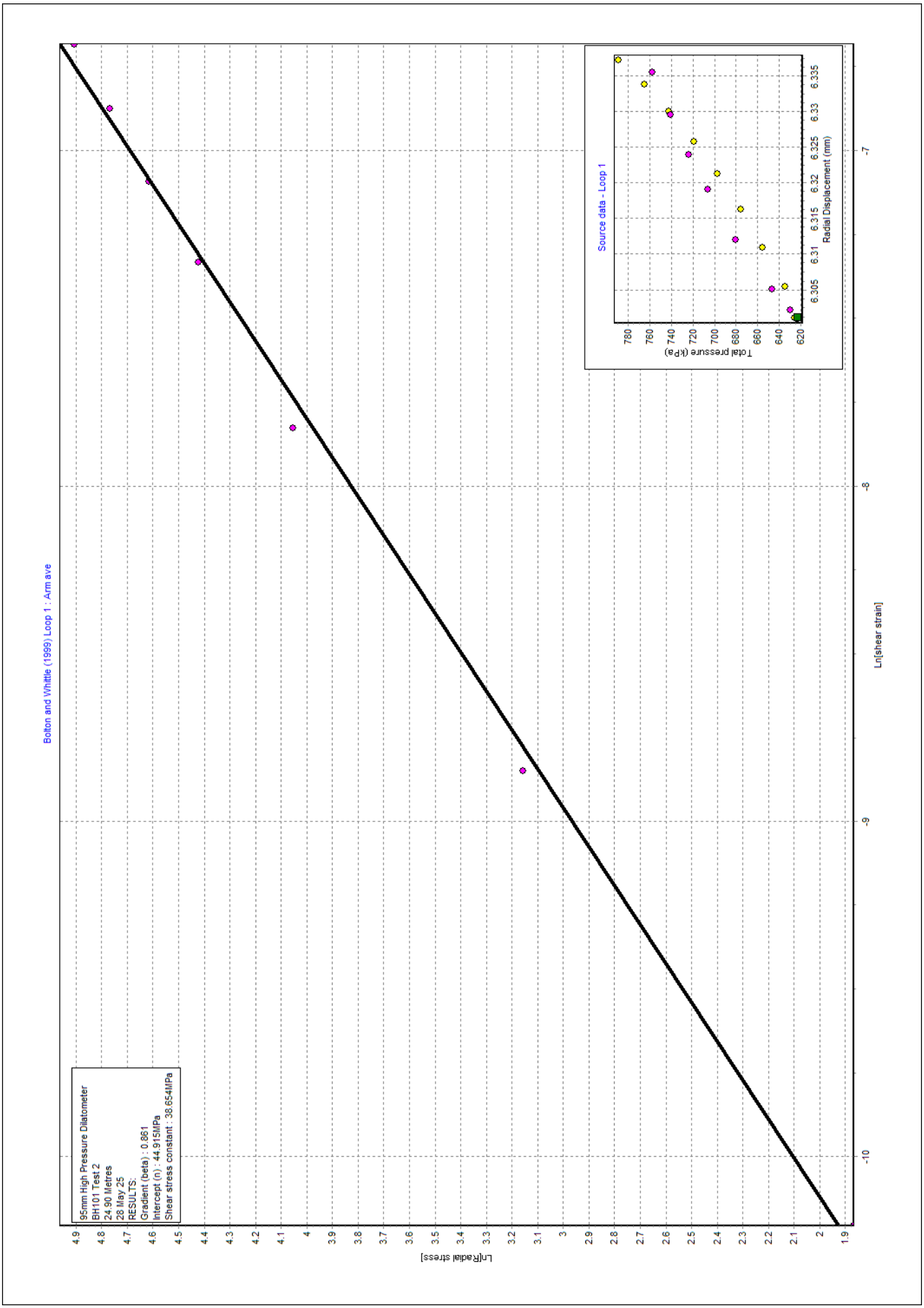

Hughes et al (1977) : Arm ave
RESULTS:
Ambient water pressure : 179.0 kPa
Residual friction angle : 25.0°
Gradient : 0.324
Friction angle : 27.0°
Dilation angle : 2.2°
95mm High Pressure Dilatometer
BH101 Test 2
24.90 Metres
28 May 25
Ln[E effective stress]
Ln[hoop strain]

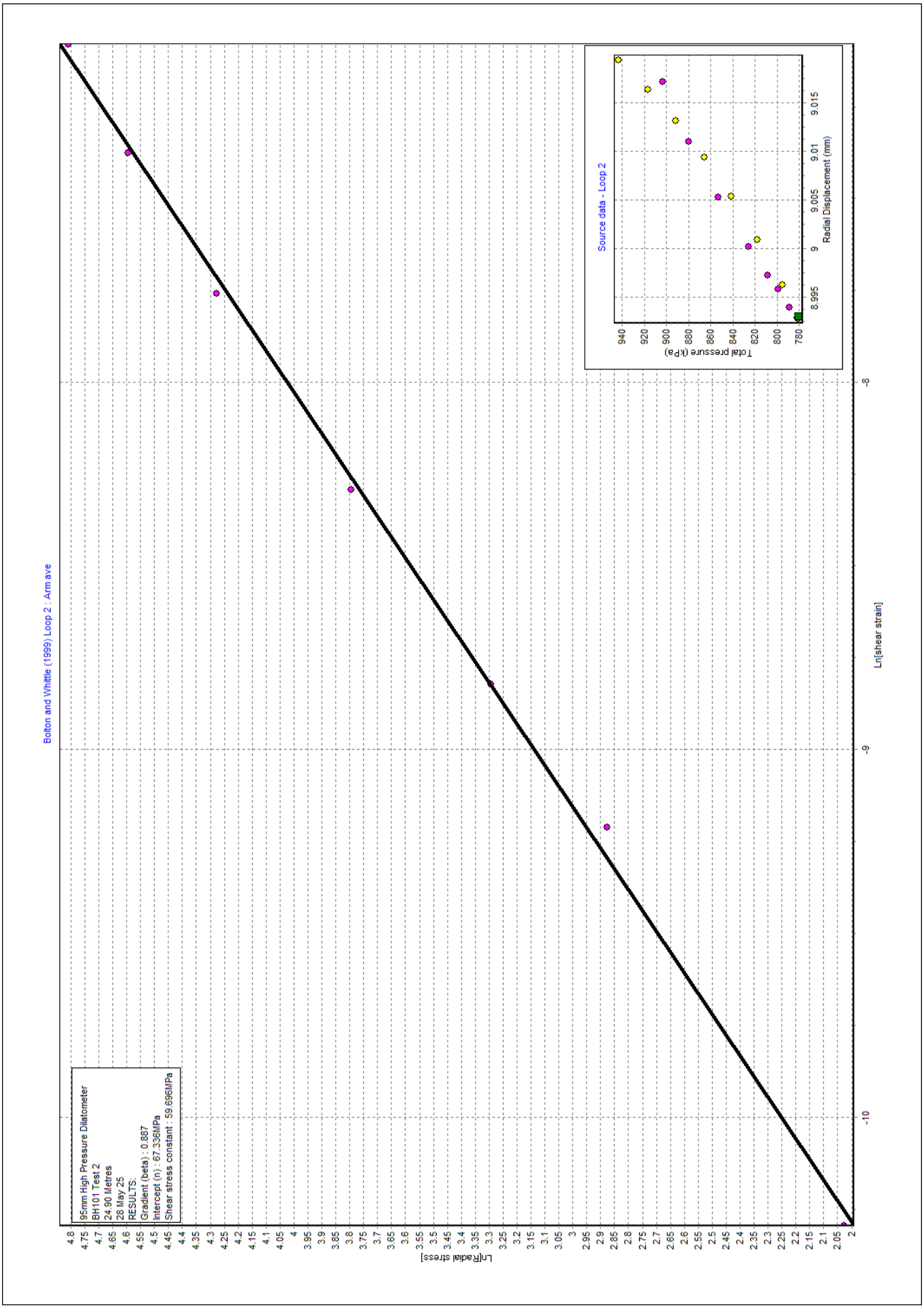

Withers et al (1989) : Arm ave
Ln[(Emx-Ec)/(1+Emx)]
Ln[P'/P'mx]
95mm High Pressure Dilatometer
BH101 Test 2
24.90 Metres
28 May 25
RESULTS:
Ambient water pressure : 179.0 kPa
Residual friction angle : 25.0°
Gradient : -1.406
Friction angle : 24.0°
Dilation angle : -1.1°

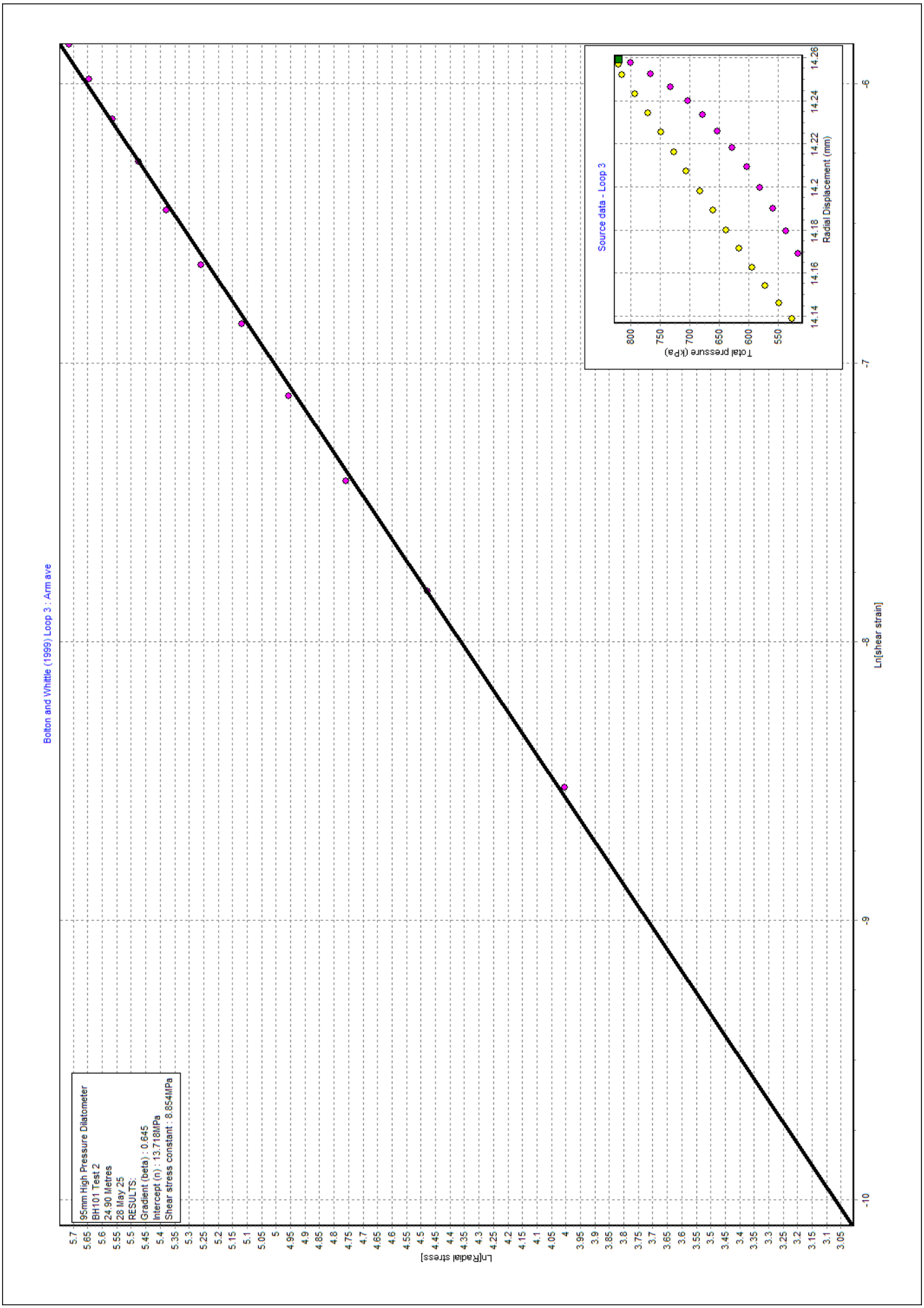

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 112.9MPa
Cycle mid-point:
Cavity strain : 4.009%
Total stress : 712kPa
Size of cycle :
Shear strain : 0.223%
Total stress : 252kPa
95mm High Pressure Dilatometer
BH101 Test 2
24.90 Metres
28 May 25
Total pressure (kPa)
Radial Displacement (mm)

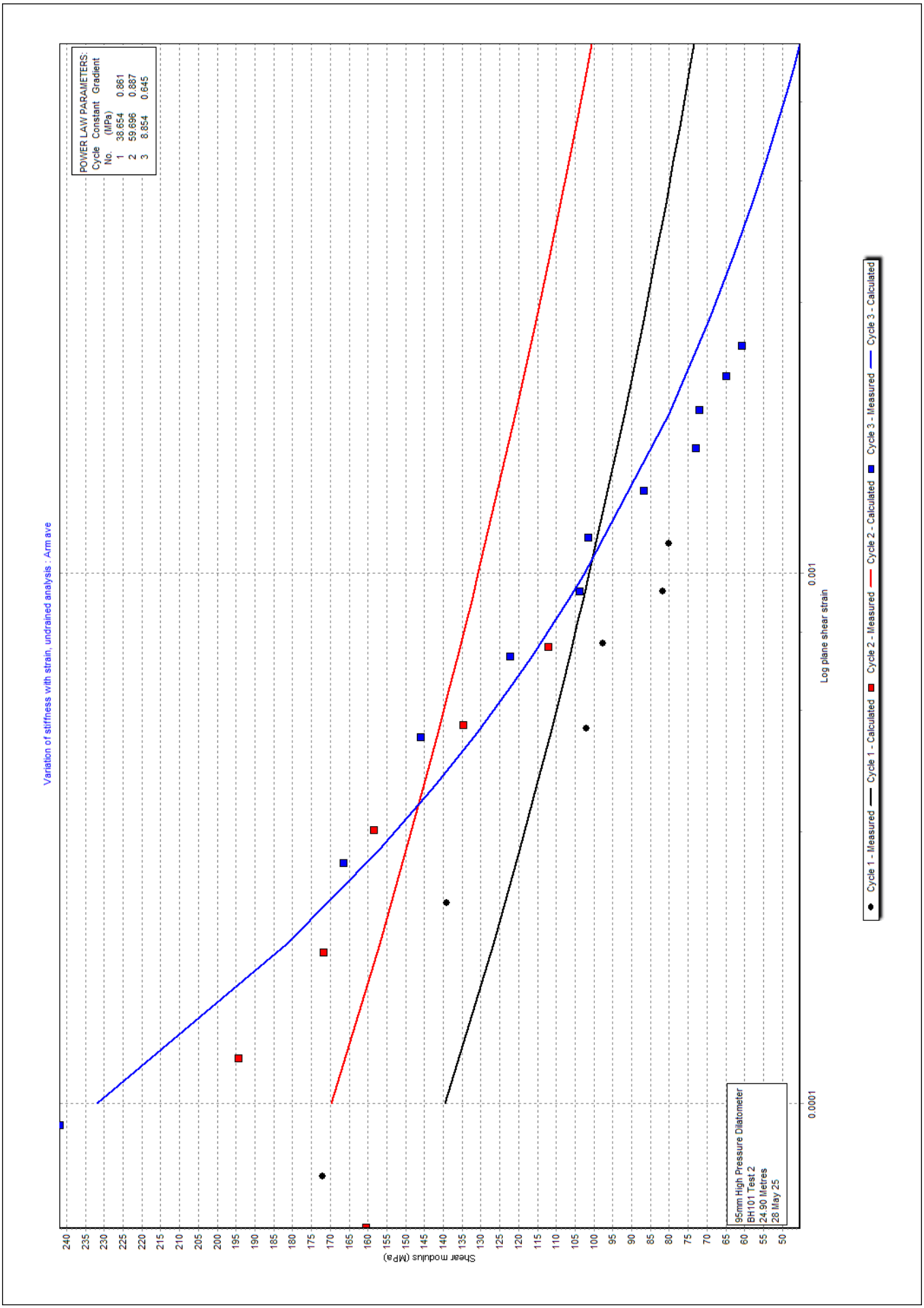

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 149.9MPa
Cycle mid-point:
Cavity strain : 9.108%
Total stress : 877kPa
Size of cycle :
Shear strain : 0.187%
Total stress : 280kPa
95mm High Pressure Dilatometer
BH101 Test 2
24.90 Metres
28 May 25
Total pressure (kPa)
Radial Displacement (mm)

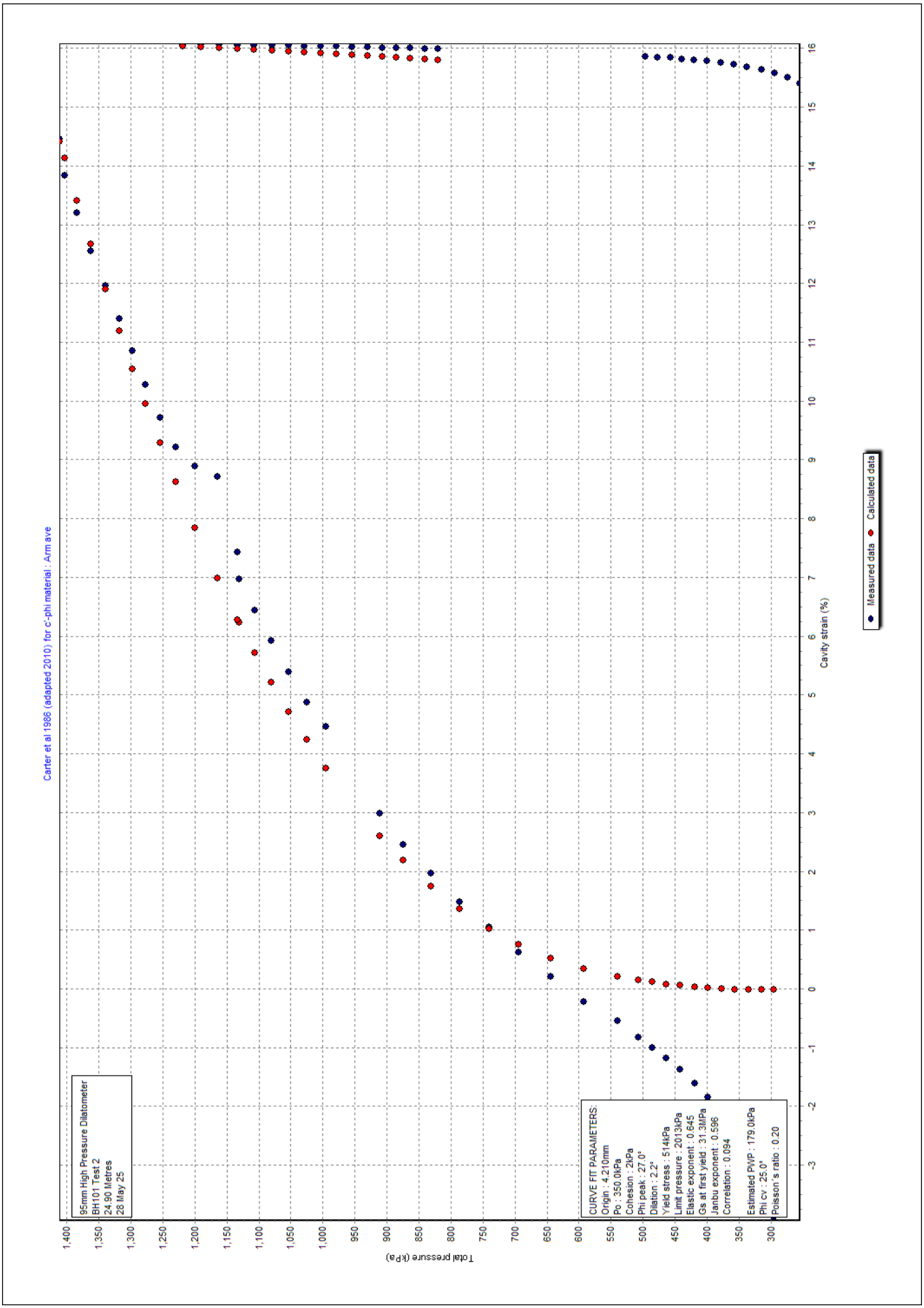

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 92.1MPa
Cycle mid-point:
Cavity strain : 18.959%
Total stress : 854kPa
Size of cycle :
Shear strain : 0.357%
Total stress : 329kPa
95mm High Pressure Dilatometer
BH101 Test 2
24.90 Metres
28 May 25
Radial Displacement (mm)
Total pressure (kPa)

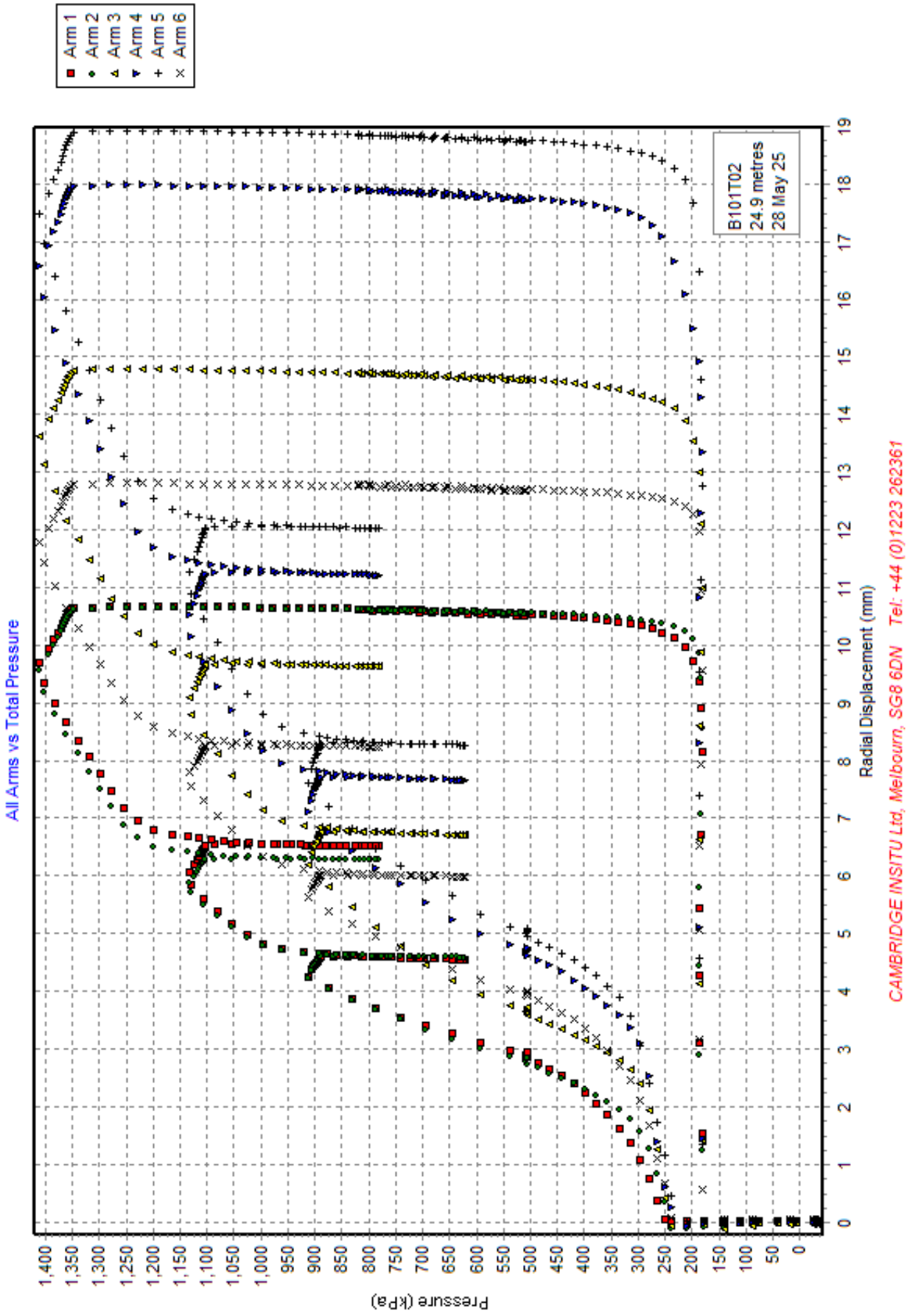

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH101 Test 2
24.90 Metres
28 May 25
RESULTS:
Gradient (beta) : 0.861
Intercept (n) : 44.915MPa
Shear stress constant : 38.654MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

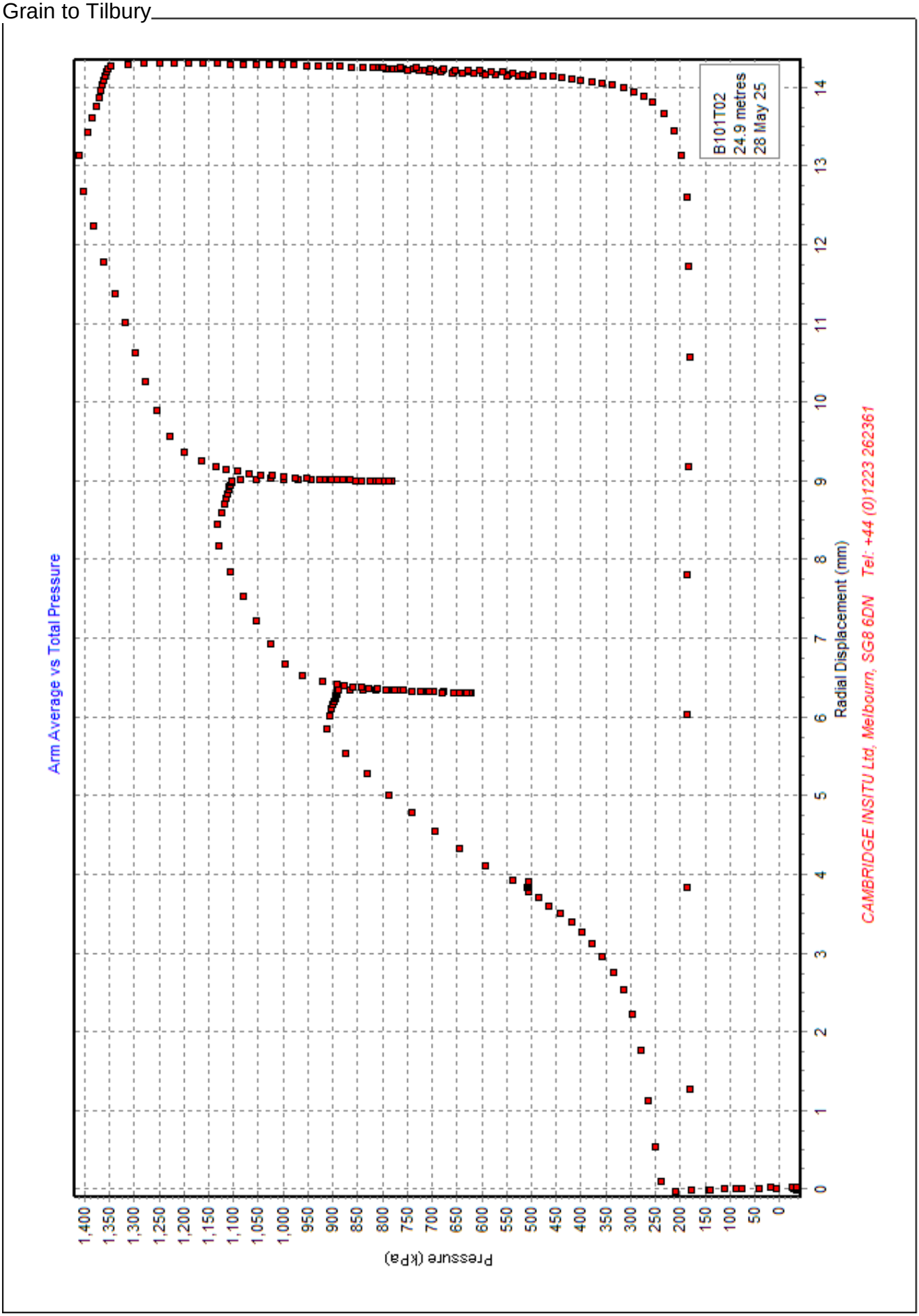

95mm High Pressure Dilatometer
BH101 Test 2
24.90 Metres
28 May 25
RESULTS:
Gradient (beta) : 0.887
Intercept (n) : 67.336MPa
Shear stress constant : 59.696MPa
Bolton and Whittle (1999) Loop 2 : Arm ave
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

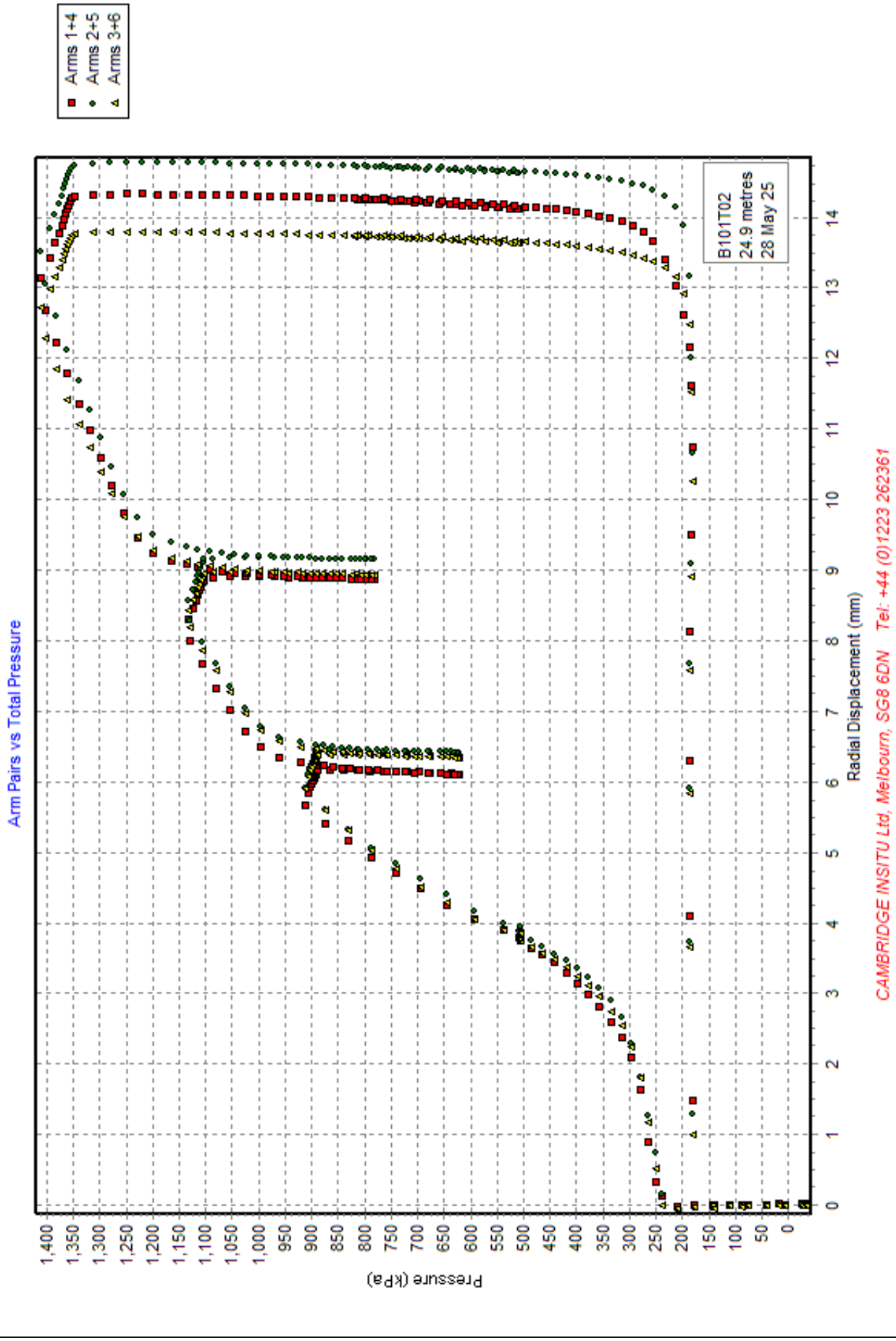

Bolton and Whittle (1999) Loop 3 : Arm ave
95mm High Pressure Dilatometer
BH101 Test 2
24.90 Metres
28 May 25
RESULTS:
Gradient (beta) : 0.645
Intercept (n) : 13.718MPa
Shear stress constant : 8.854MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)

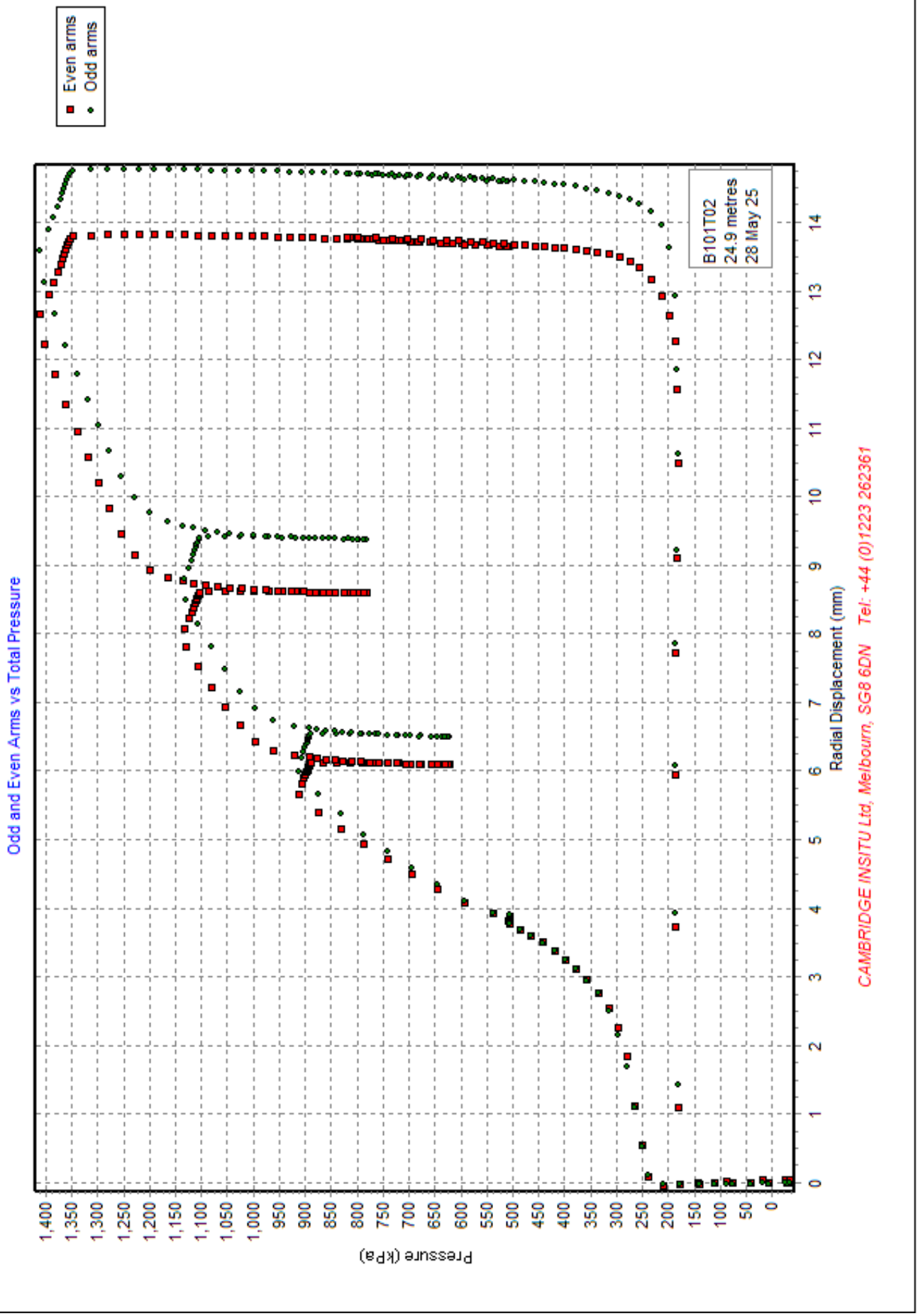

Variation of stiffness with strain, undrained analysis : Arm ave
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 38.654 0.861
2 59.696 0.887
3 8.854 0.645
Shear modulus (MPa)
Log plane shear strain
0.0001
0.001
95mm High Pressure Dilatometer
BH101 Test 2
24.90 Metres
28 May 25
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated


Carter et al 1986 (adapted 2010) for c-phi material : Arm ave
95mm High Pressure Dilatometer
BH101 Test 2
24.90 Metres
28 May 25
CURVE FIT PARAMETERS:
Origin : 4.210mm
Po : 350.0kPa
Cohesion : 2kPa
Phi peak : 27.0°
Dilation : 2.2°
Yield stress : 514kPa
Limit pressure : 2013kPa
Elastic exponent : 0.645
Gs at first yield : 31.3MPa
Janbu exponent : 0.596
Correlation : 0.094
Estimated PWP : 179.0kPa
Phi cv : 25.0°
Poisson's ratio : 0.20
Measured data
Calculated data
Total pressure (kPa)
Cavity strain (%)


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
B101T02
24.9 metres
28 May 25
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arm Average vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
B101T02
24.9 metres
28 May 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arms 1+4
Arms 2+5
Arms 3+6
B101T02
24.9 metres
28 May 25
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
B101T02
24.9 metres
28 May 25
Odd and Even Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to Tilbury
BH101 Test 3 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Grain to Tilbury
Borehole : BH101
Test name : BH101 Test 3
Test date : 29 May 25
Test depth : 29.30 Metres
Water table : 6.8 Metres
Ambient PWP : 220.7 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDP/RW on 17 Jul 25

Remarks: Zero Recovery

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=4.85"
Po from Marsland & Randolph (kPa) : "Arm ave=522.6"
Best estimate of Po (kPa) : "Arm ave=527.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=1802.4"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 27.0
Angle of internal friction (°) : "Arm ave=33.1"
Dilation angle (°) : "Arm ave=7.1"
Gradient of log-log plot : "Arm ave=0.397"

[Withers et al 1989]
Angle of internal friction (°) : "Arm ave=31.1"
Dilation angle (°) : "Arm ave=4.6"
Gradient of log-log plot : "Arm ave=-1.881"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=33.4"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	331.1	0.723	1194	0.097	323
Arm ave	2	537.4	2.918	1900	0.080	430
Arm ave	3	620.1	6.032	2470	0.099	615
Arm ave	4	449.1	11.705	1795	0.207	929

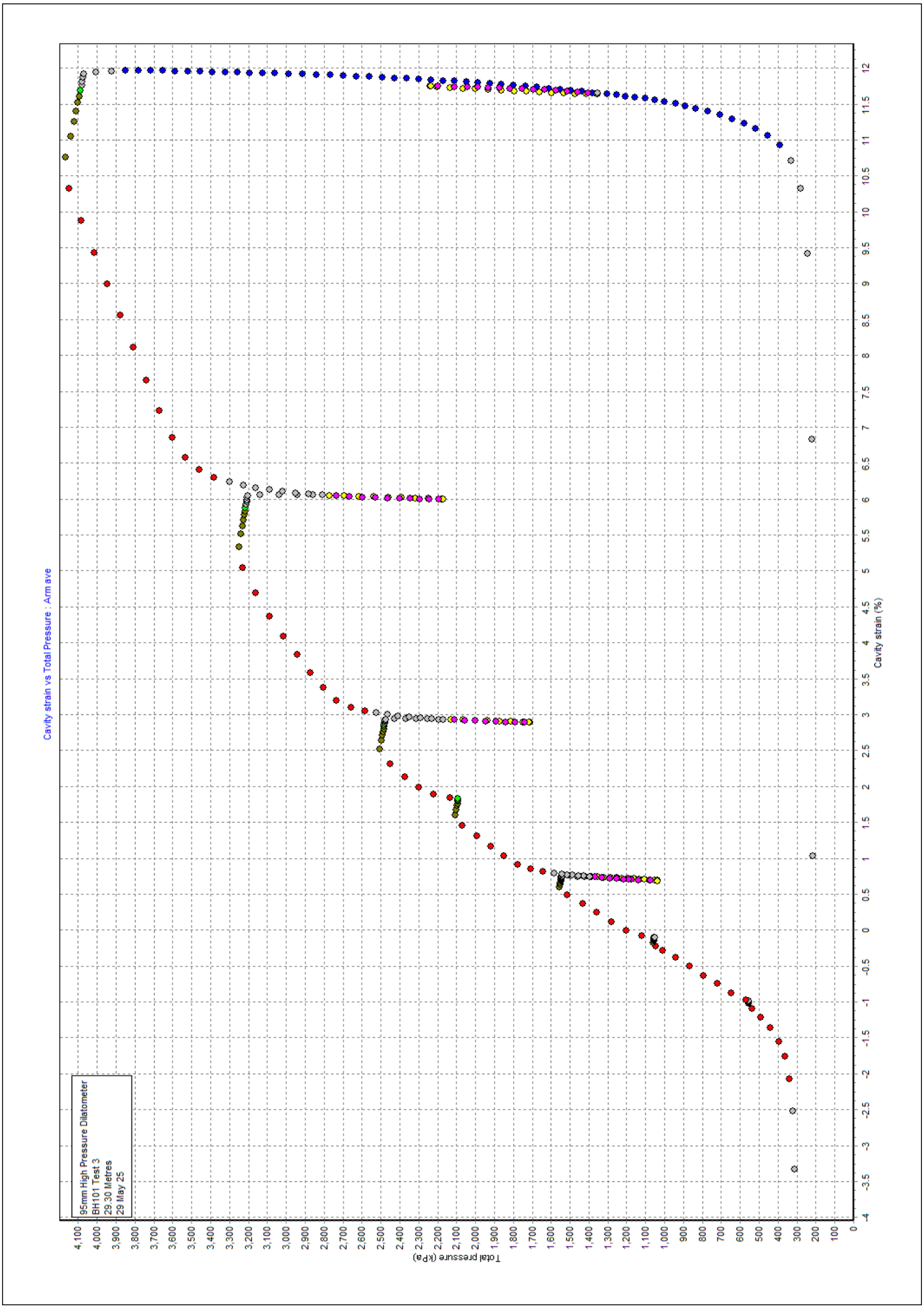
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

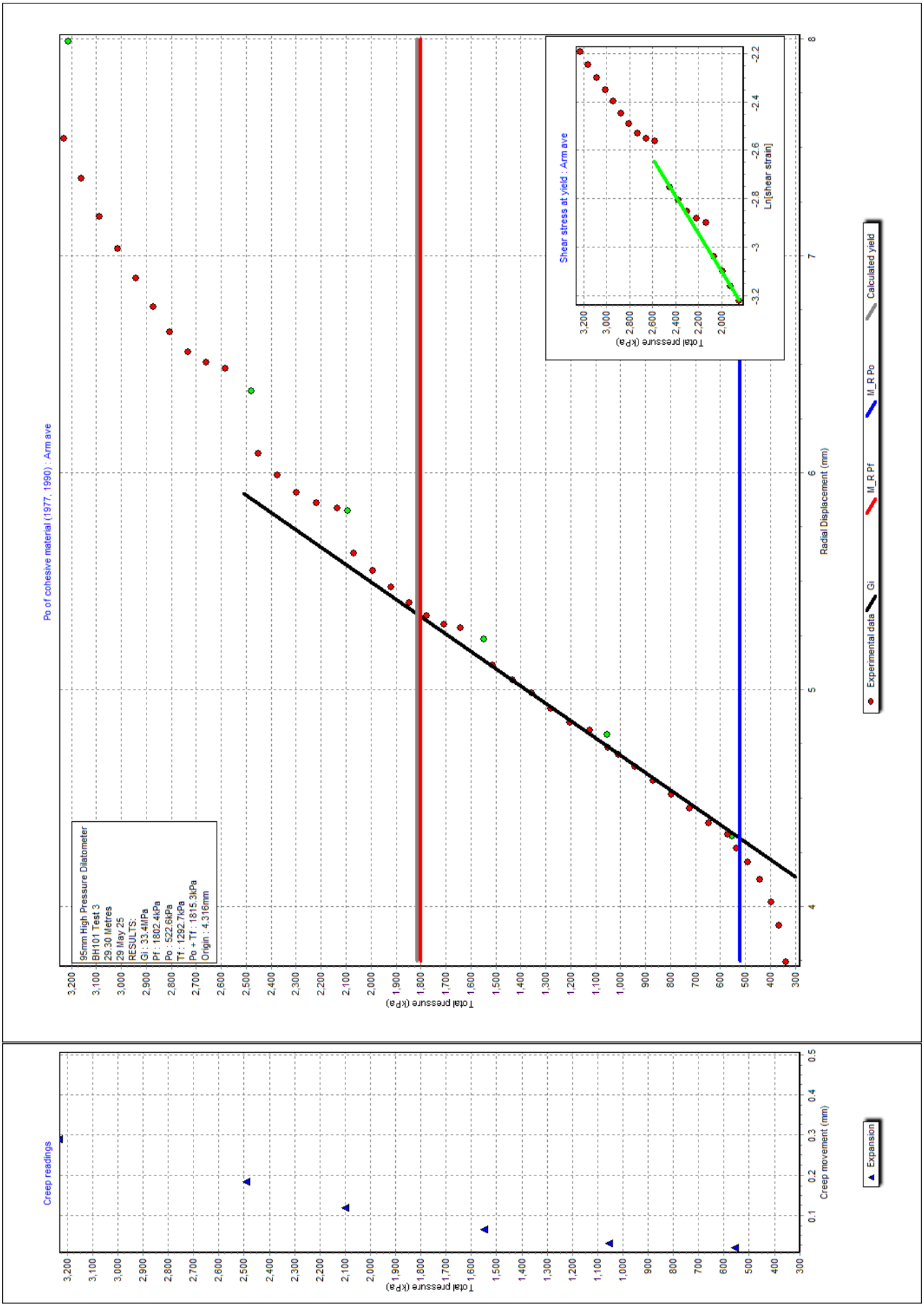
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	111.593	93.712	0.840
Arm ave	2	153.043	126.110	0.824
Arm ave	3	269.767	235.502	0.873
Arm ave	4	80.159	56.513	0.705

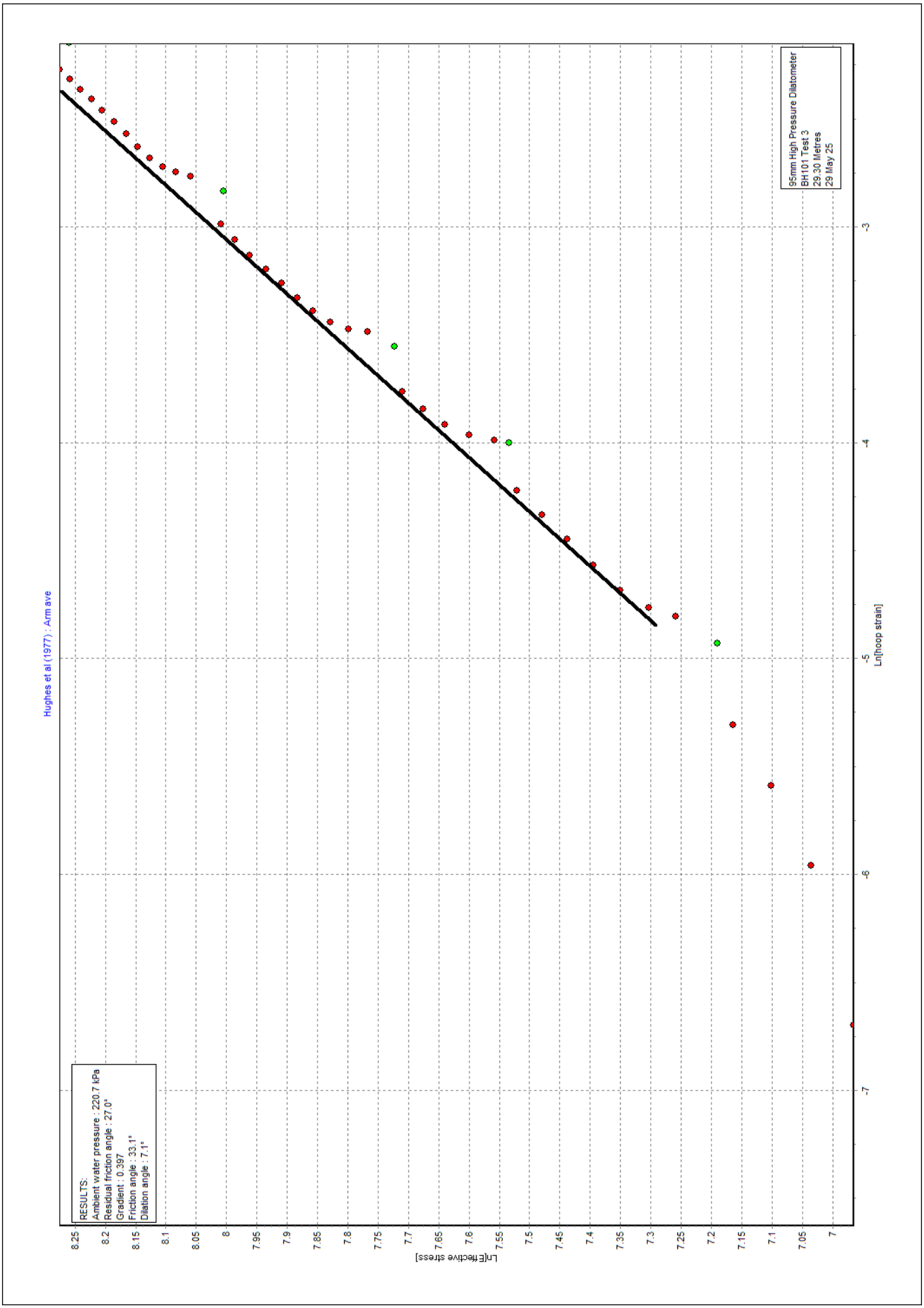
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 4.85
Po (kPa) : 527
Cohesion (kPa) : 54
Angle of peak friction (deg) : 33.1
Angle of peak dilation (deg) : 7.1
Total yield stress (kPa) : 819

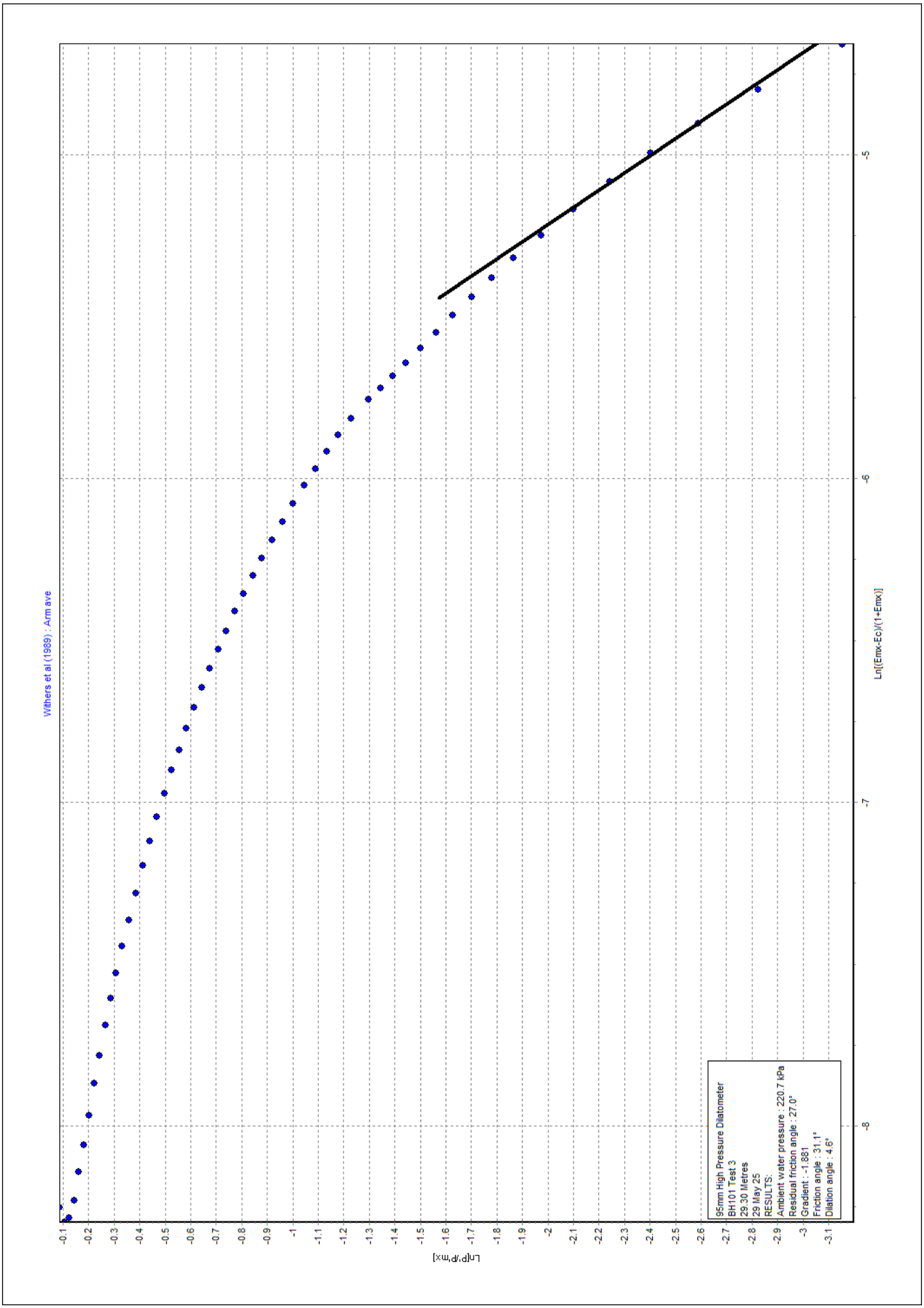
Grain to Tilbury
BH101 Test 3 - SUMMARY OF RESULTS

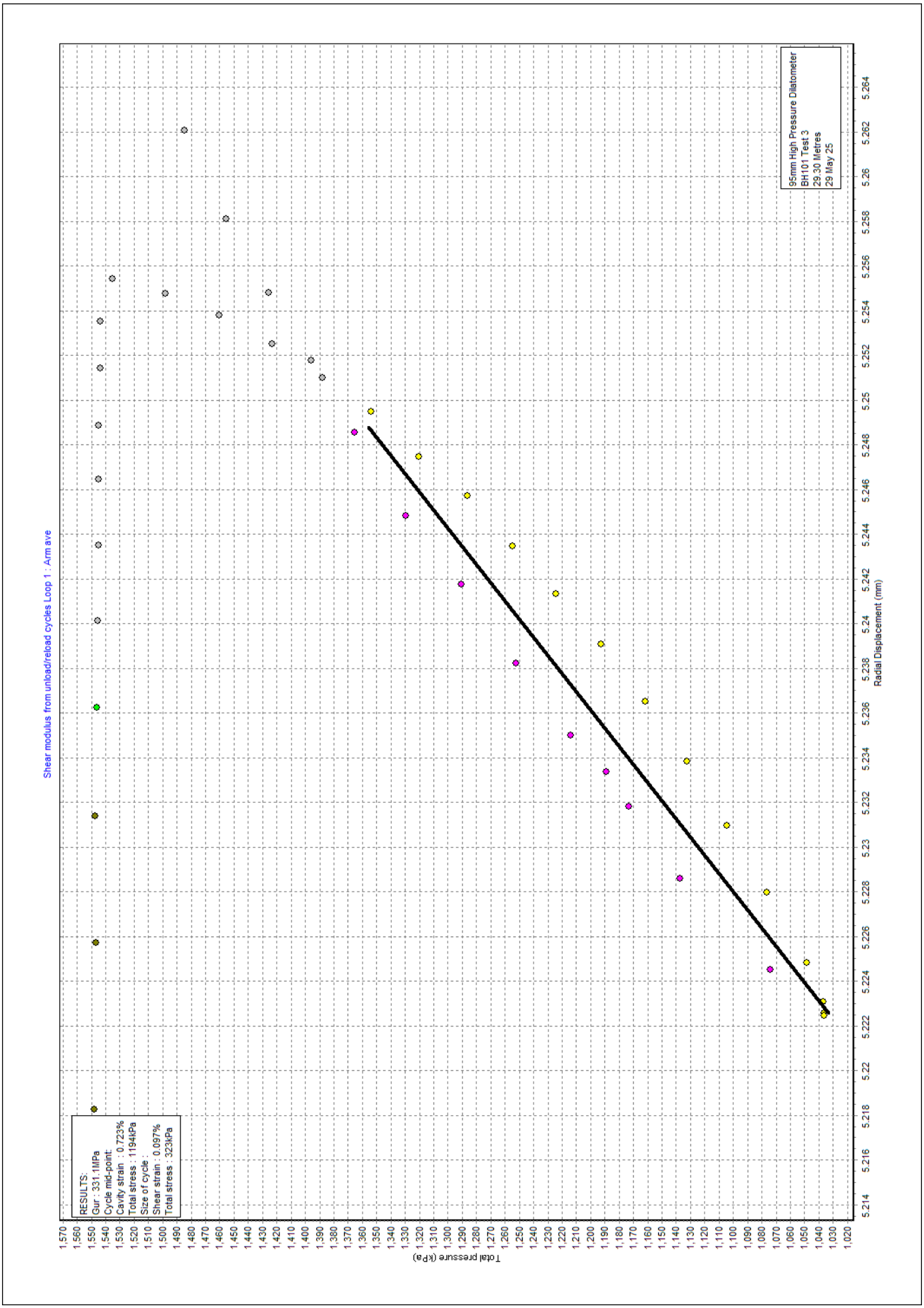
Total limit stress (kPa)	:	8104
G at first yield (MPa)	:	200.3
Non-linear exponent	:	0.824
Janbu exponent	:	0.464
Correlation	:	0.591
Ambient pore water pressure (kPa)	:	221
Residual friction angle (deg)	:	27.0
Poisson's ratio	:	0.20

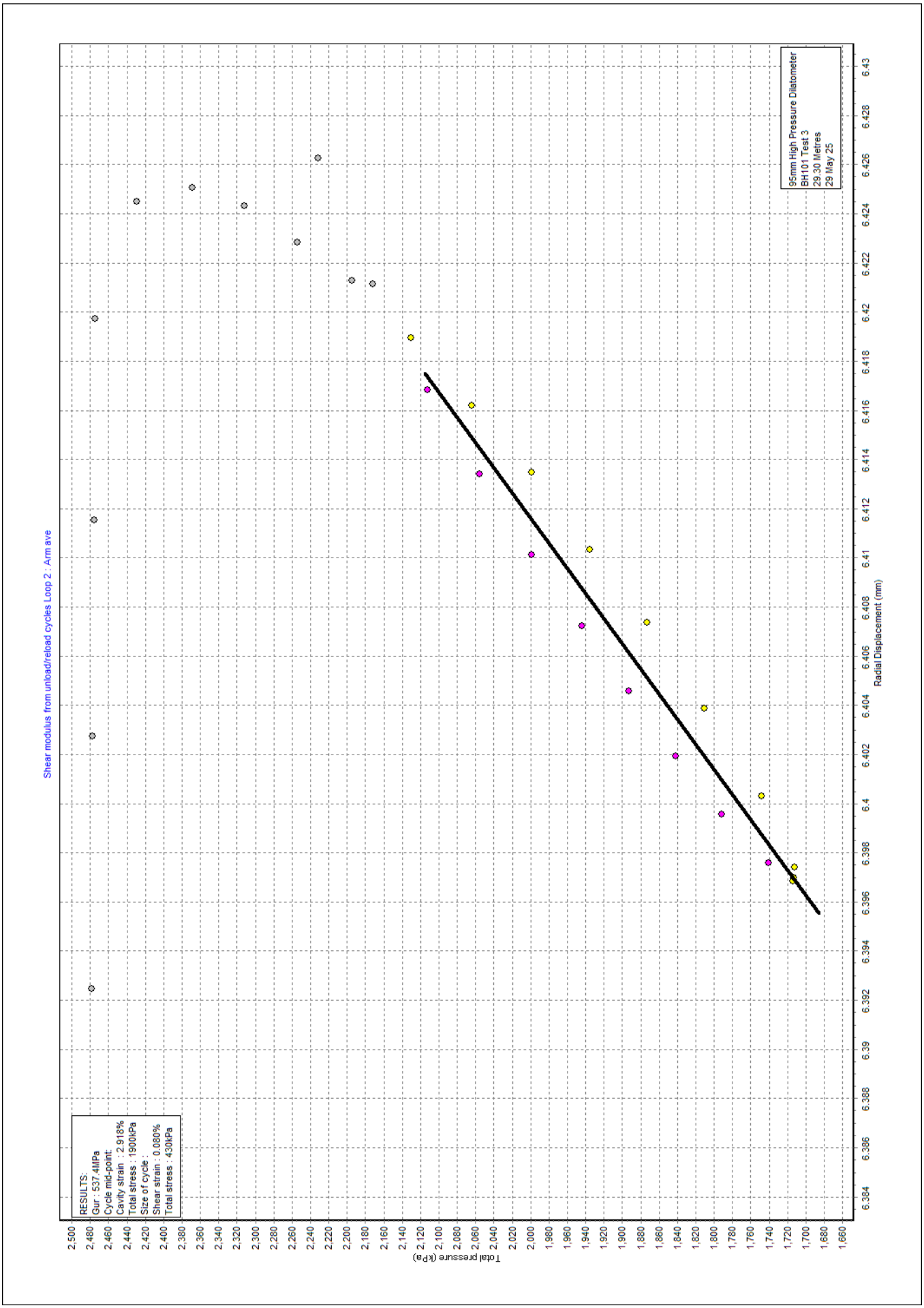

Cavity strain vs Total Pressure : Arm ave
95mm High Pressure Dilatometer
BH101 Test 3
29.30 Metres
29 May 25
Total pressure (kPa)
Cavity strain (%)

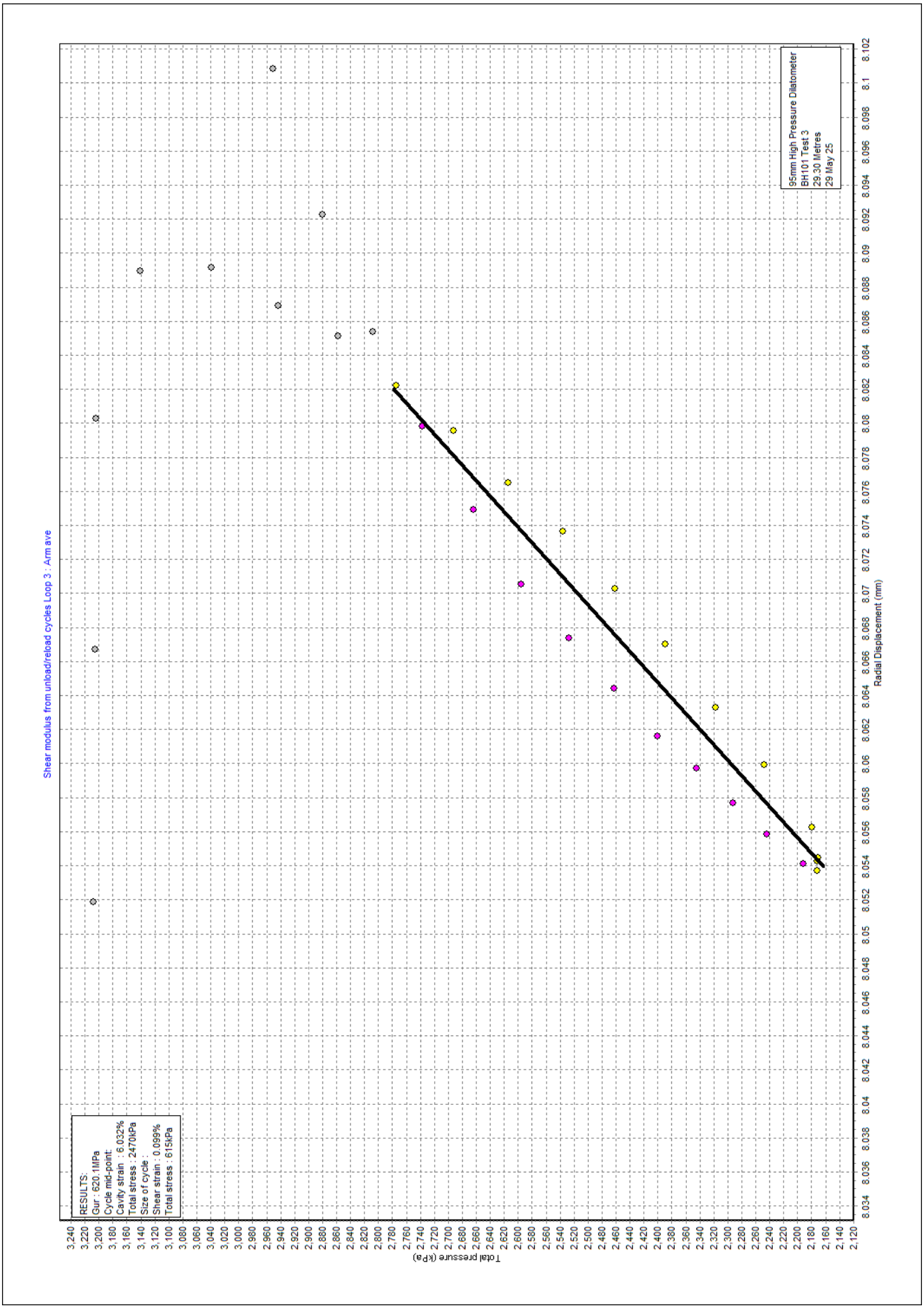

Po of cohesive material (1977, 1990) : Arm ave
95mm High Pressure Dilatometer
BH101 Test 3
29.30 Metres
29 May 25
RESULTS:
Gi : 33.4MPa
Pf : 1802.4kPa
Po : 522.6kPa
Tf : 1292.7kPa
Po + Tf : 1815.3kPa
Origin : 4.316mm
Total pressure (kPa)
Radial Displacement (mm)
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Shear stress at yield : Arm ave
Total pressure (kPa)
Ln[shear strain]
Creep readings
Total pressure (kPa)
Creep movement (mm)
Expansion

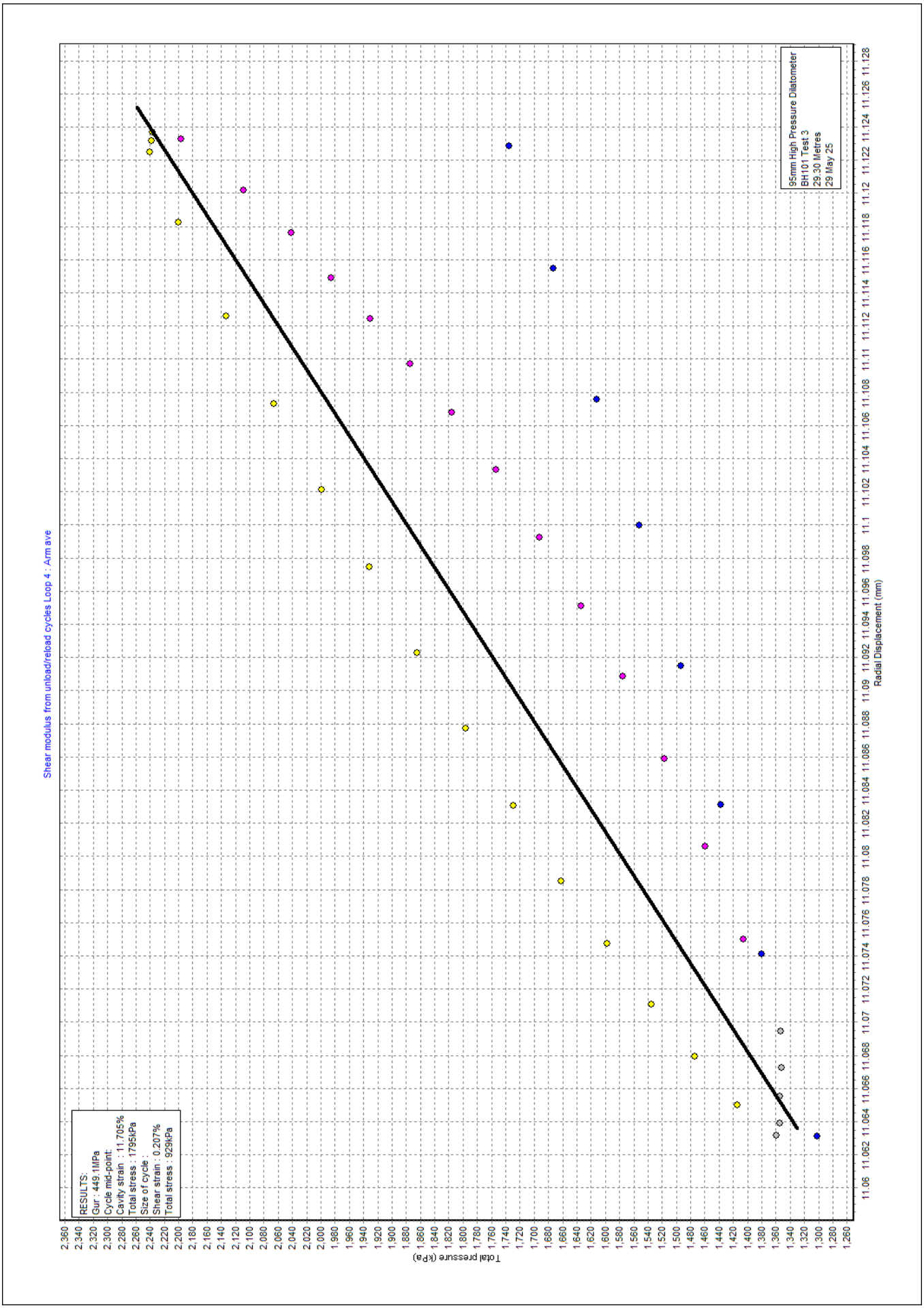

95mm High Pressure Dilatometer
BH101 Test 3
29.30 Metres
29 May 25
RESULTS:
Ambient water pressure : 220.7 kPa
Residual friction angle : 27.0°
Gradient : 0.397
Friction angle : 33.1°
Dilation angle : 7.1°
Hughes et al (1977) : Arm ave
Ln[Effective stress]
Ln[hoop strain]

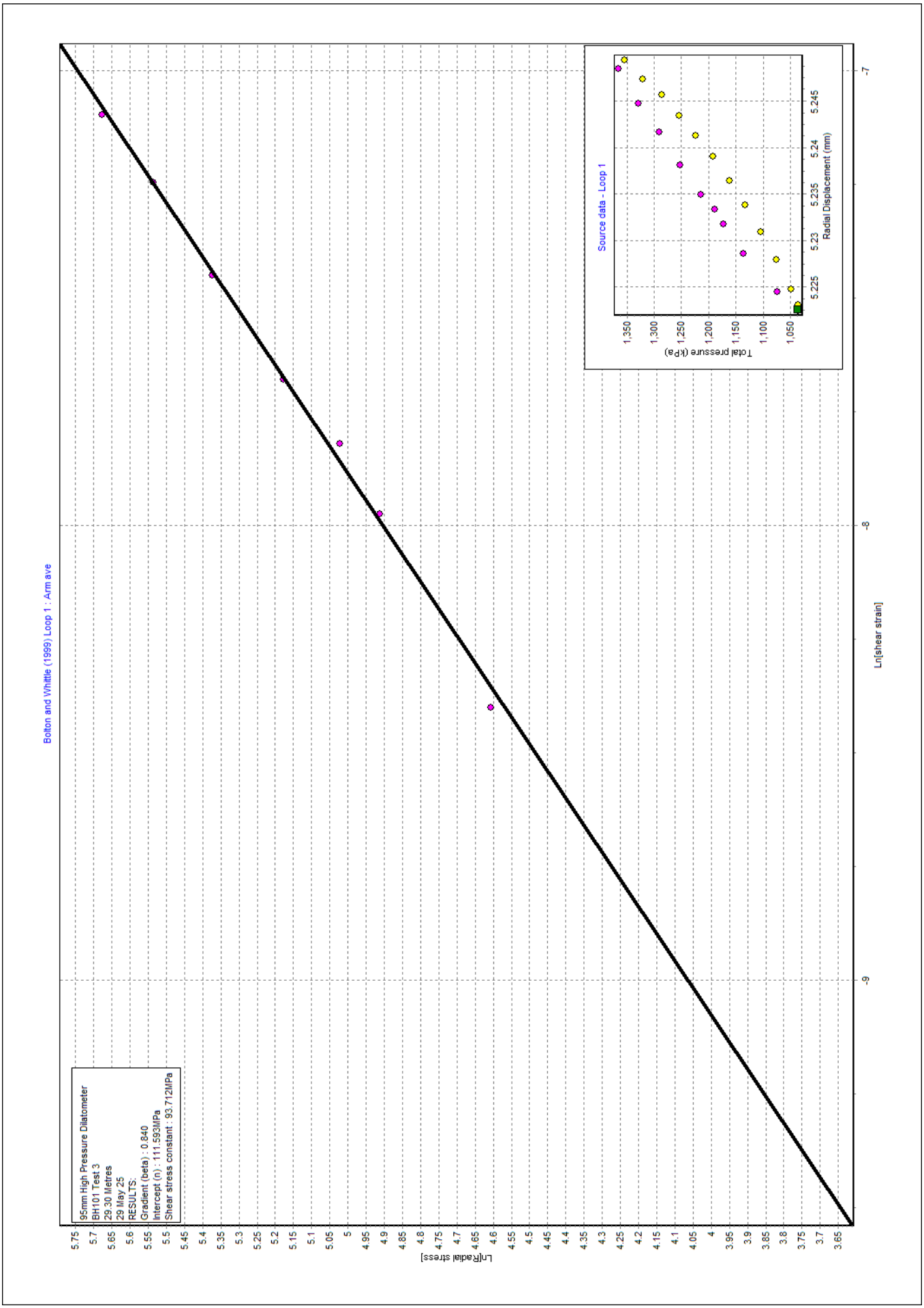

Withers et al (1989) : Arm ave
Ln[(Emx-Ec)/(1+Emx)]
Ln[P'/P'mx]
95mm High Pressure Dilatometer
BH101 Test 3
29.30 Metres
29 May 25
RESULTS:
Ambient water pressure : 220.7 kPa
Residual friction angle : 27.0°
Gradient : -1.881
Friction angle : 31.1°
Dilation angle : 4.6°

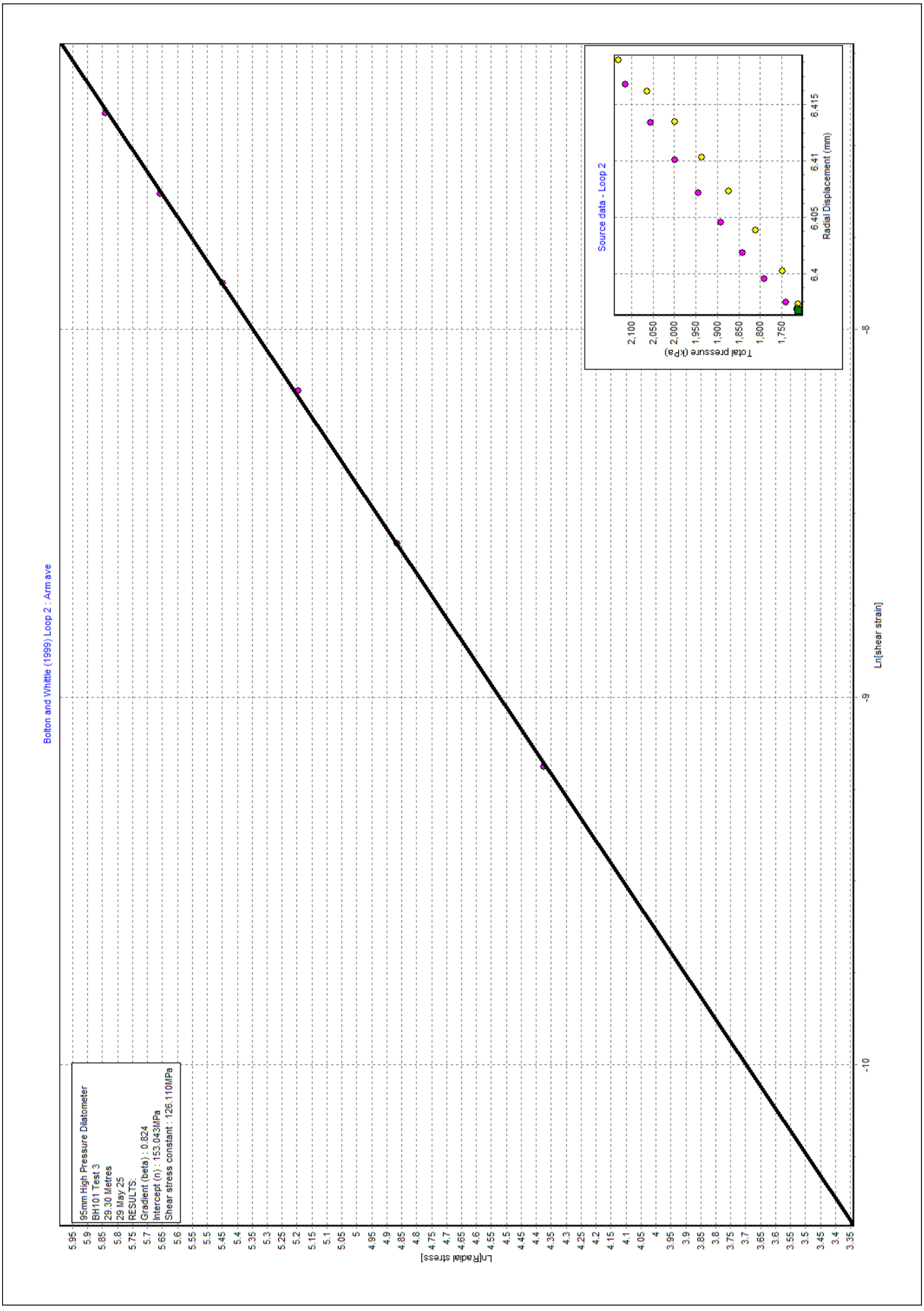

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 331.1MPa
Cycle mid-point:
Cavity strain : 0.723%
Total stress : 1194kPa
Size of cycle :
Shear strain : 0.097%
Total stress : 323kPa
95mm High Pressure Dilatometer
BH101 Test 3
29.30 Metres
29 May 25
Radial Displacement (mm)
Total pressure (kPa)

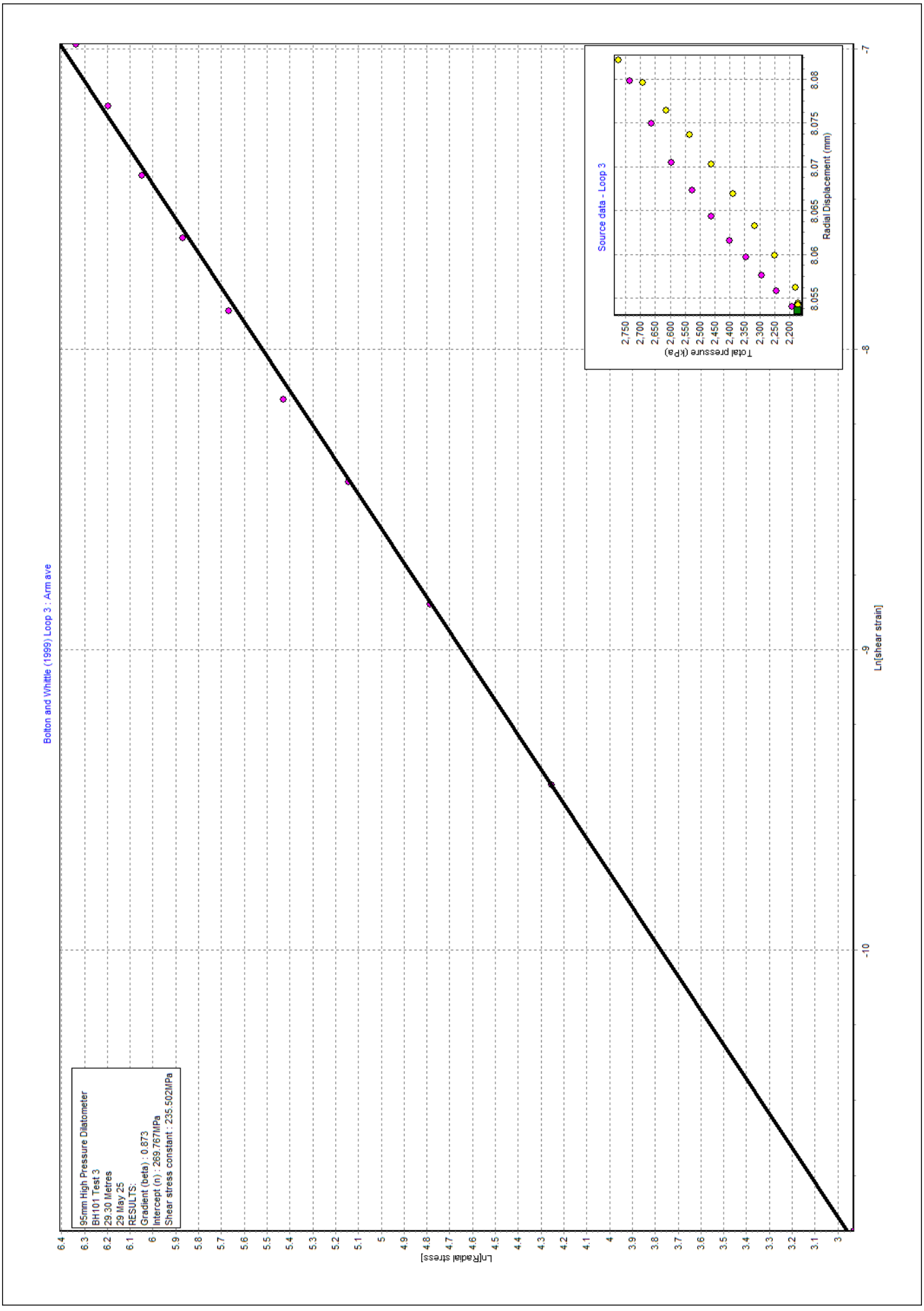

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 537.4MPa
Cycle mid-point:
Cavity strain : 2.918%
Total stress : 1900kPa
Size of cycle :
Shear strain : 0.080%
Total stress : 430kPa
95mm High Pressure Dilatometer
BH101 Test 3
29.30 Metres
29 May 25
Total pressure (kPa)
Radial Displacement (mm)

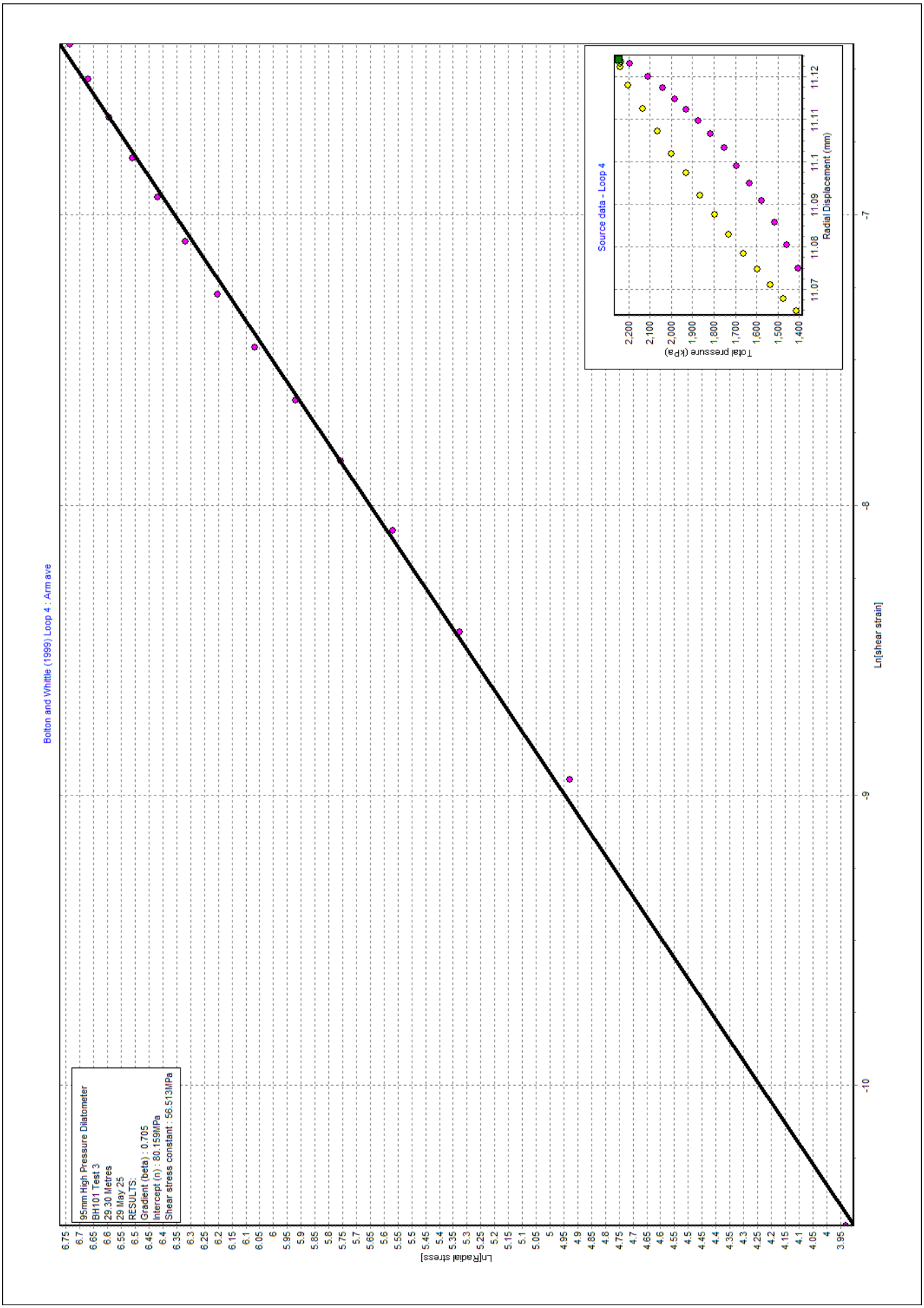

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 620.1MPa
Cycle mid-point:
Cavity strain : 6.032%
Total stress : 2470kPa
Size of cycle :
Shear strain : 0.099%
Total stress : 615kPa
95mm High Pressure Dilatometer
BH101 Test 3
29.30 Metres
29 May 25
Total pressure (kPa)
Radial Displacement (mm)

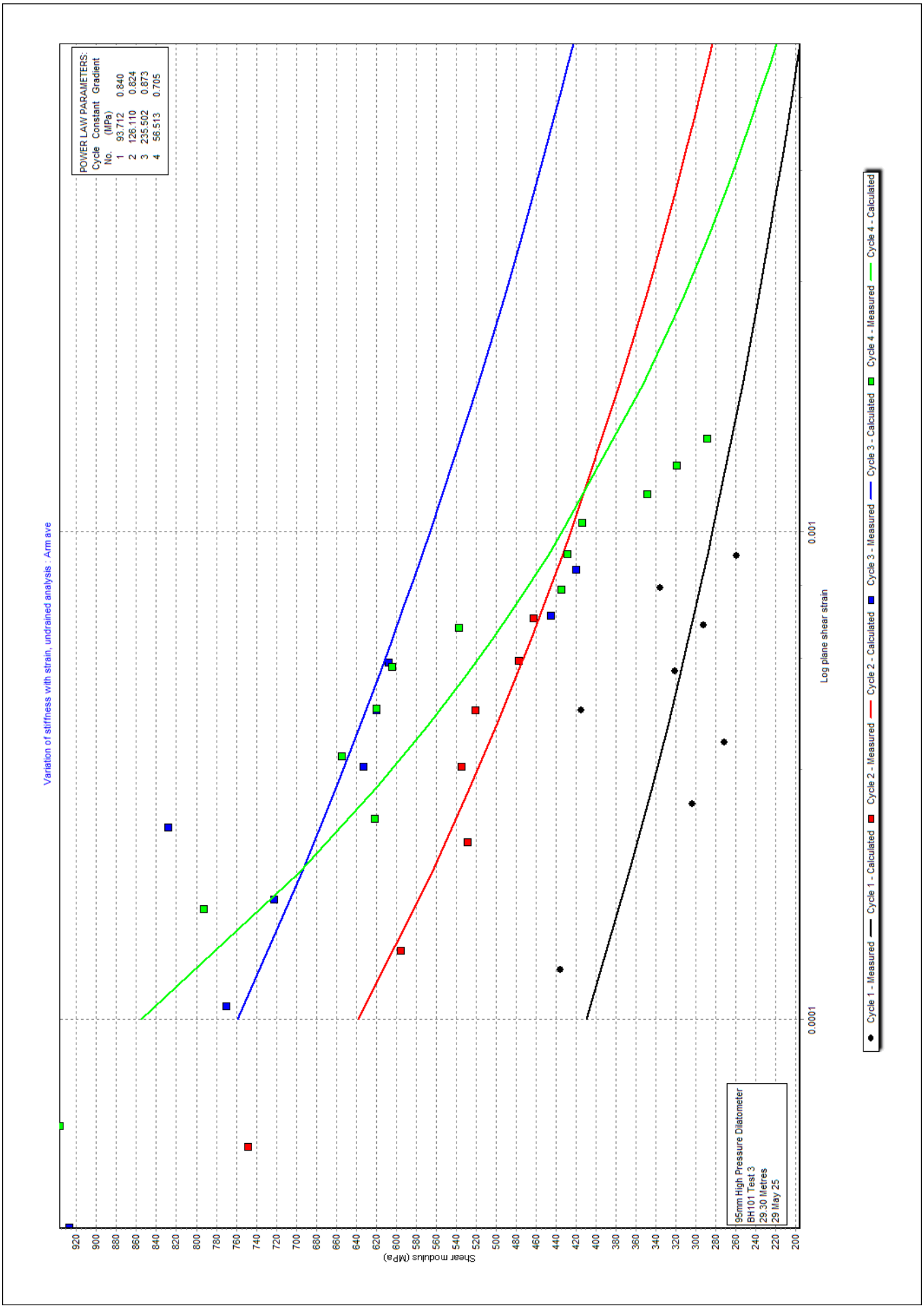

Shear modulus from unload/reload cycles Loop 4 : Arm ave
Total pressure (kPa)
Radial Displacement (mm)
95mm High Pressure Dilatometer
BH101 Test 3
29.30 Metres
29 May 25
RESULTS:
Gur : 449.1MPa
Cycle mid-point:
Cavity strain : 11.705%
Total stress : 1795kPa
Size of cycle :
Shear strain : 0.207%
Total stress : 929kPa

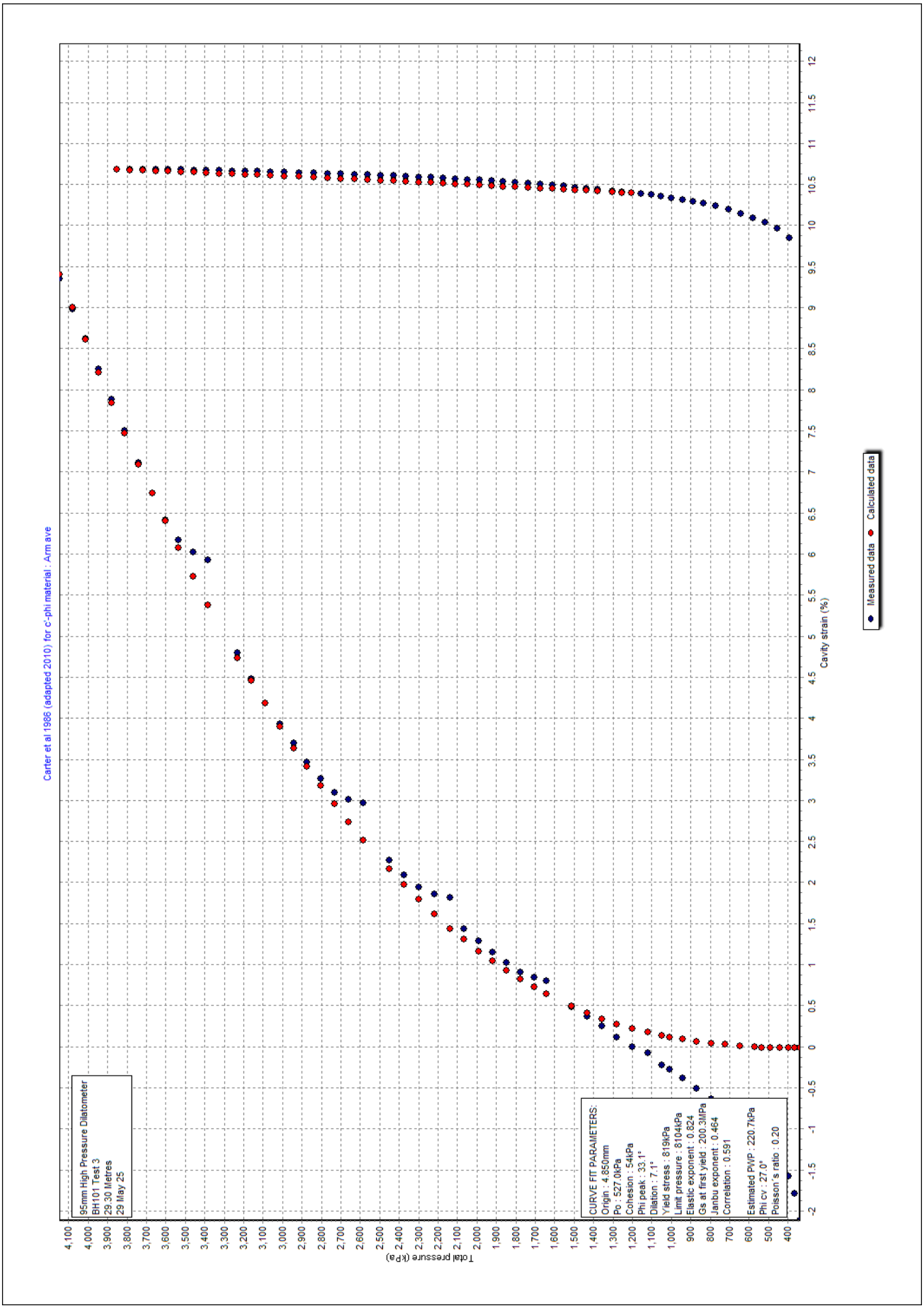

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH101 Test 3
29.30 Metres
29 May 25
RESULTS:
Gradient (beta) : 0.840
Intercept (n) : 111.593MPa
Shear stress constant : 93.712MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

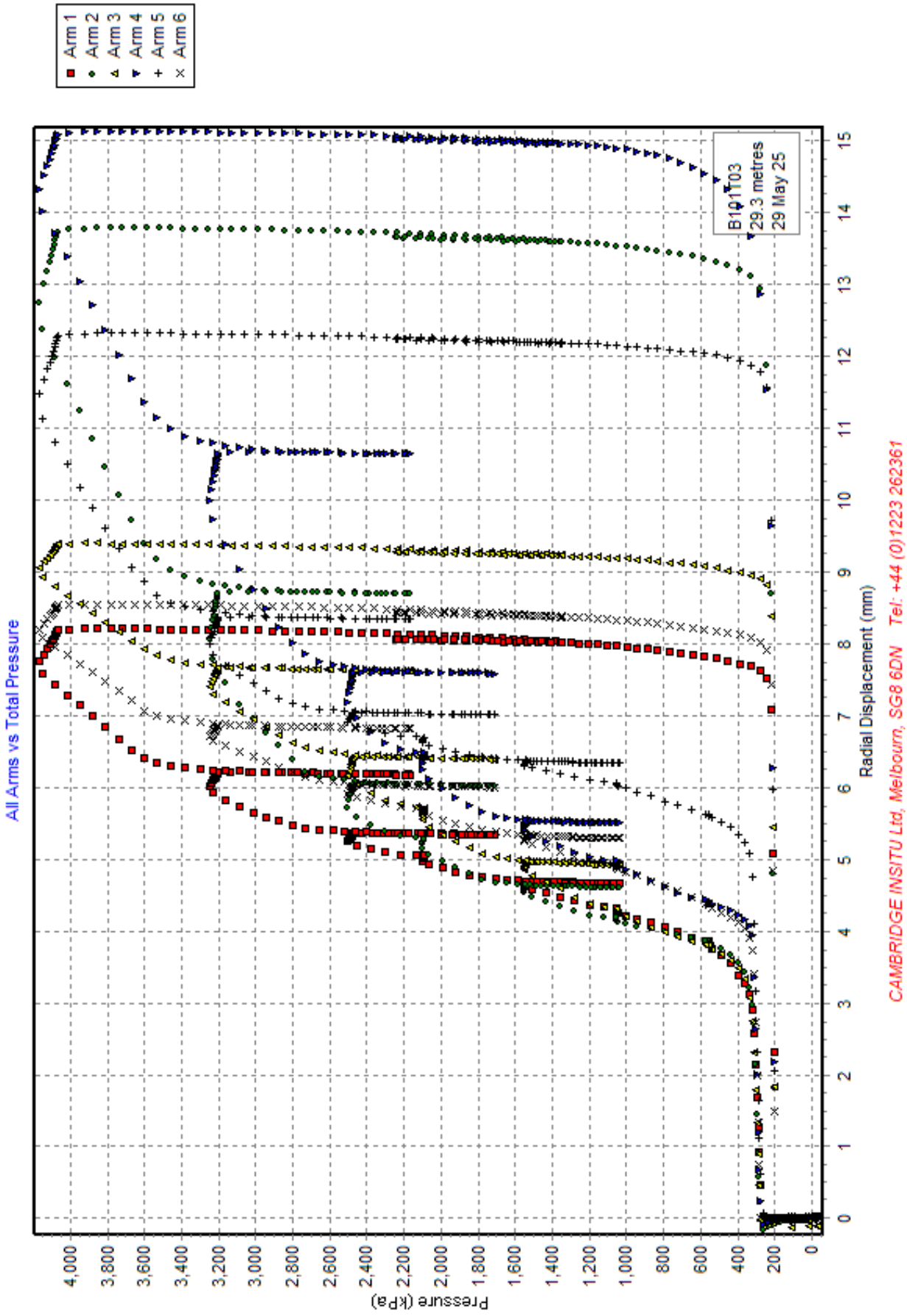

95mm High Pressure Dilatometer
BH101 Test 3
29.30 Metres
29 May 25
RESULTS:
Gradient (beta) : 0.824
Intercept (n) : 153.043MPa
Shear stress constant : 126.110MPa
Bolton and Whittle (1999) Loop 2 : Arm ave
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

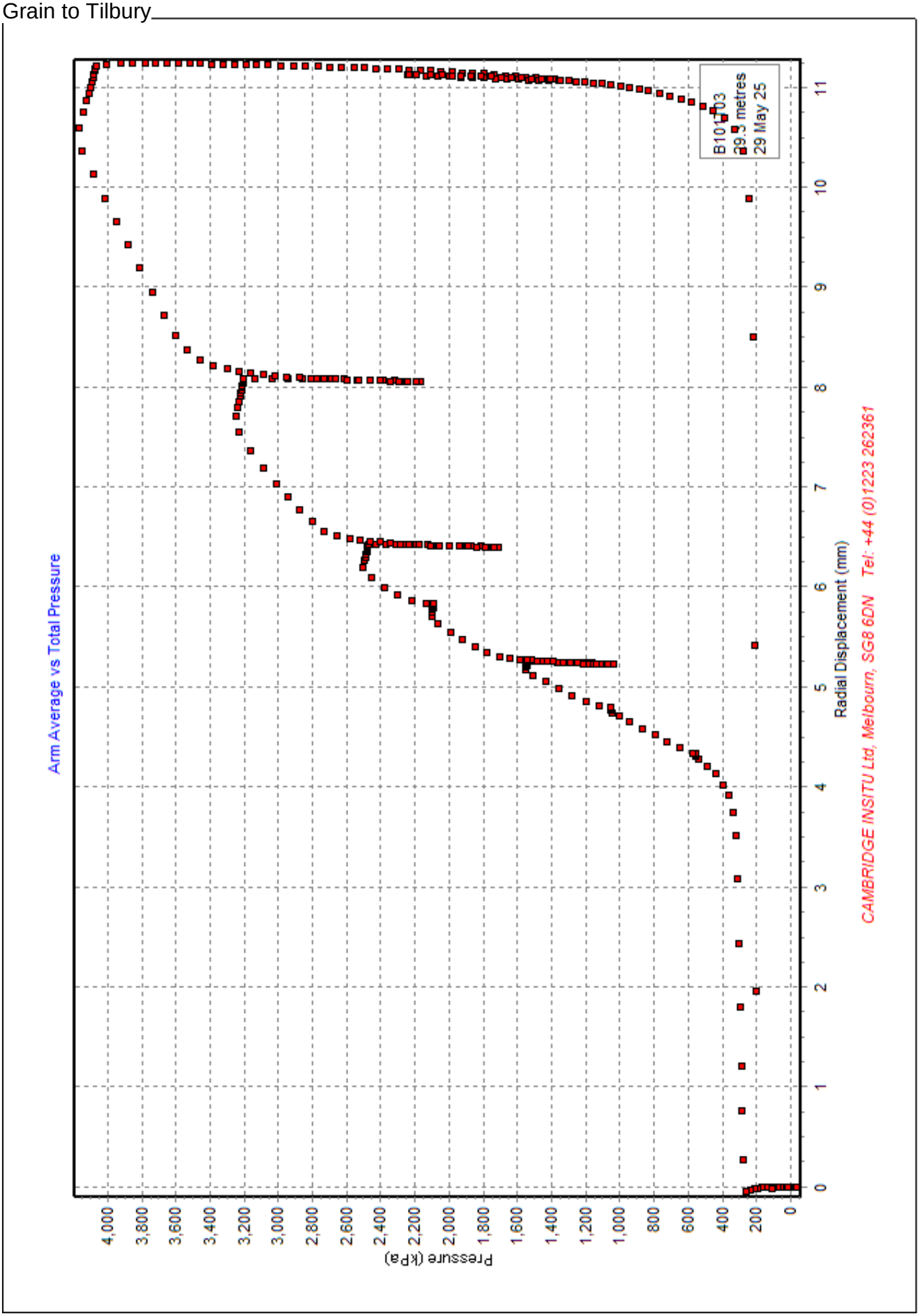

Bolton and Whittle (1999) Loop 3 : Arm ave
95mm High Pressure Dilatometer
BH101 Test 3
29.30 Metres
29 May 25
RESULTS:
Gradient (beta) : 0.873
Intercept (n) : 269.767MPa
Shear stress constant : 235.502MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)

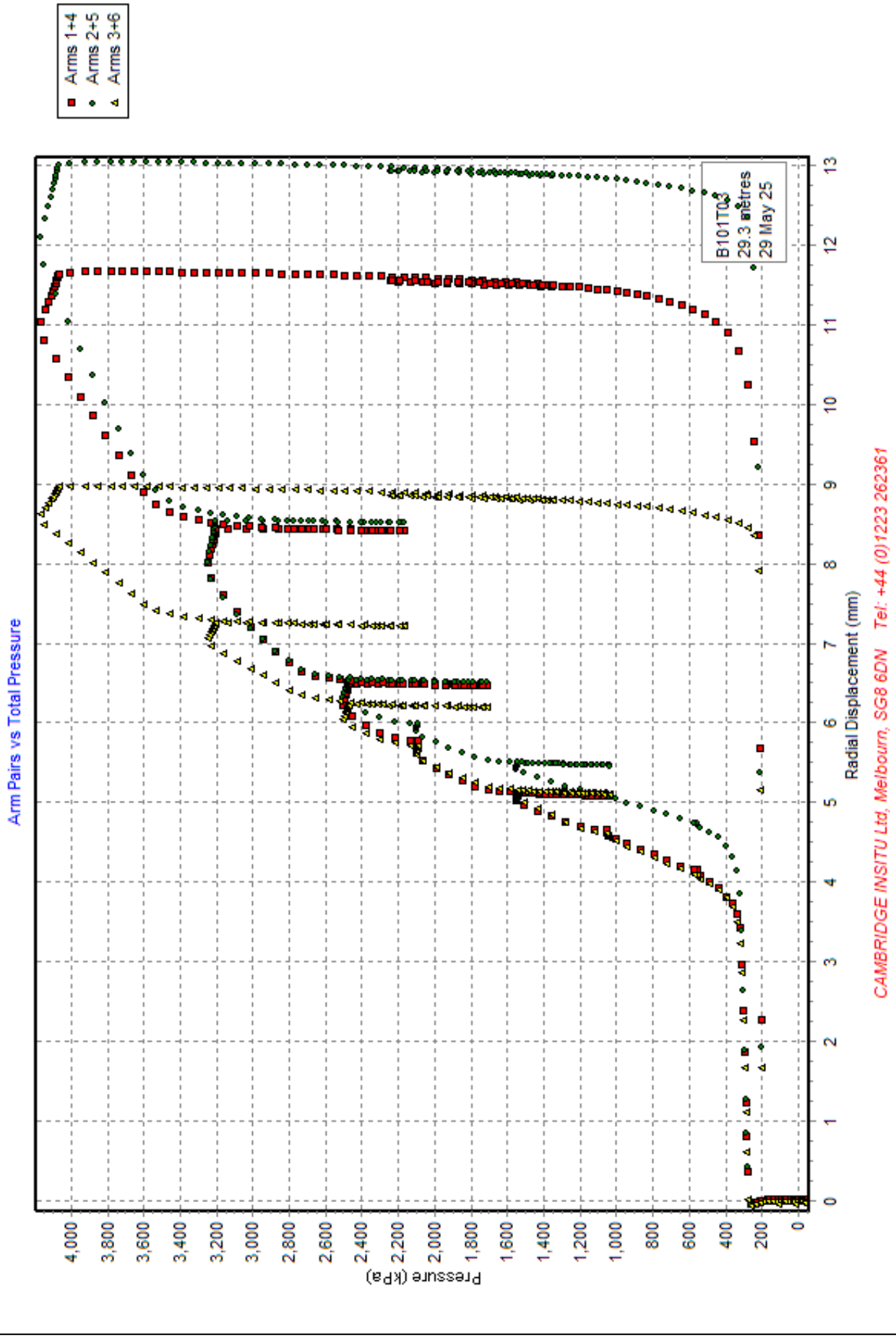

Bolton and Whittle (1999) Loop 4 : Arm ave
95mm High Pressure Dilatometer
BH101 Test 3
29.30 Metres
29 May 25
RESULTS:
Gradient (beta) : 0.705
Intercept (n) : 80.159MPa
Shear stress constant : 56.513MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 4
Total pressure (kPa)
Radial Displacement (mm)

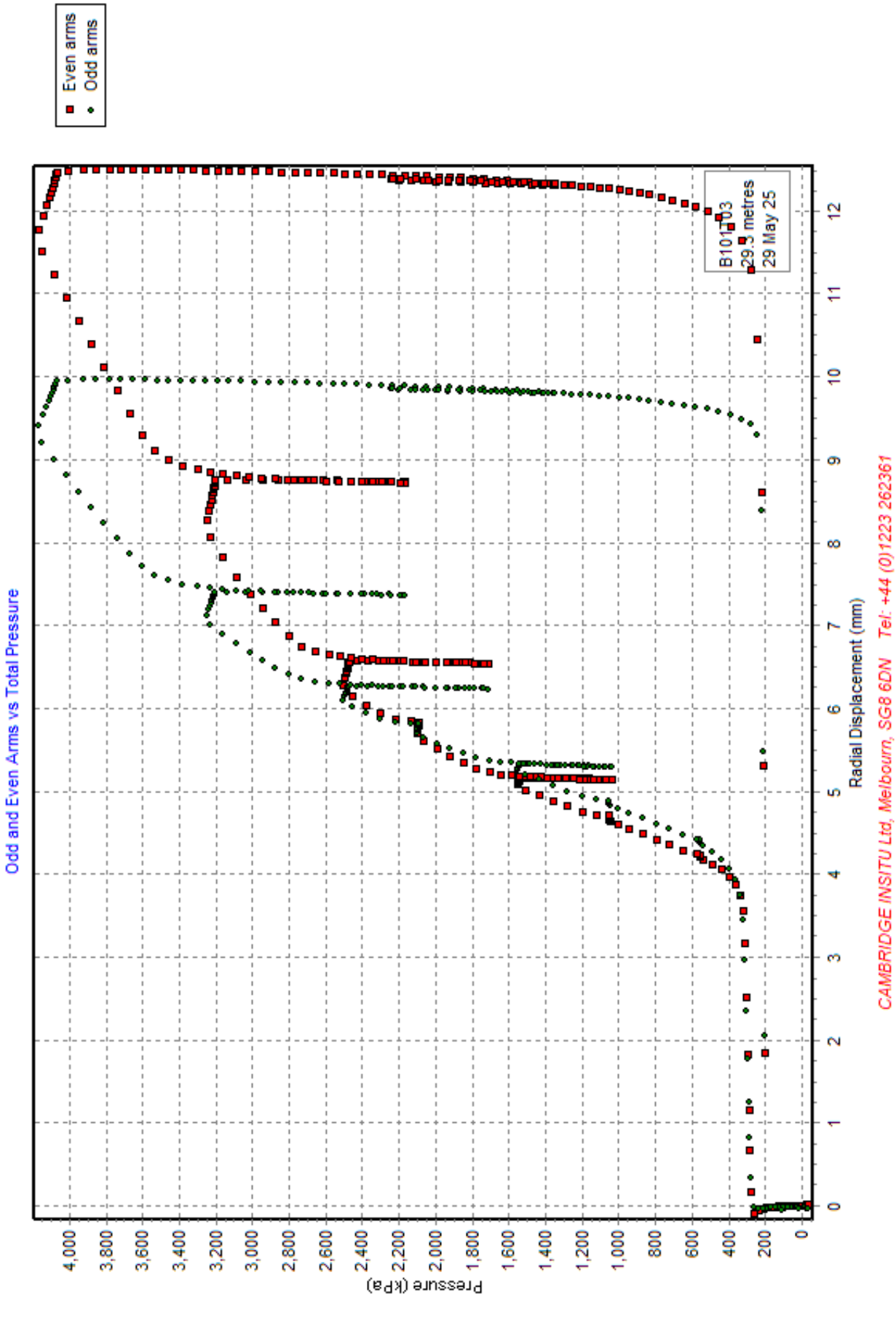

Variation of stiffness with strain, undrained analysis : Arm ave
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 93.712 0.840
2 126.110 0.824
3 235.502 0.873
4 56.513 0.705
Shear modulus (MPa)
Log plane shear strain
0.0001
0.001
95mm High Pressure Dilatometer
BH101 Test 3
29.30 Metres
29 May 25
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
Cycle 4 - Measured
Cycle 4 - Calculated


Carter et al 1986 (adapted 2010) for c'-phi material : Arm ave
95mm High Pressure Dilatometer
BH101 Test 3
29.30 Metres
29 May 25
CURVE FIT PARAMETERS:
Origin : 4.850mm
Po : 527.0kPa
Cohesion : 54kPa
Phi peak : 33.1°
Dilation : 7.1°
Yield stress : 819kPa
Limit pressure : 8104kPa
Elastic exponent : 0.824
Gs at first yield : 200.3MPa
Janbu exponent : 0.464
Correlation : 0.591
Estimated PWP : 220.7kPa
Phi cv : 27.0°
Poisson's ratio : 0.20
Total pressure (kPa)
Cavity strain (%)
Measured data
Calculated data


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
B101T03
29.3 metres
29 May 25
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arm Average vs Total Pressure
Pressure (kPa)
4,000
3,800
3,600
3,400
3,200
3,000
2,800
2,600
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Radial Displacement (mm)
0
1
2
3
4
5
6
7
8
9
10
11
B101/03
29.3 metres
29 May 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arms 1+4
Arms 2+5
Arms 3+6
B101T03
29.3 metres
29 May 25
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
B101103
29.3 metres
29 May 25
Odd and Even Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to Tilbury
BH101 Test 4 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Grain to Tilbury
Borehole : BH101
Test name : BH101 Test 4
Test date : 29 May 25
Test depth : 33.20 Metres
Water table : 6.8 Metres
Ambient PWP : 320.0 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDP/RW on 17 Jul 25

Remarks: Small amount of flint present. Structure breaking down towards end of test.

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=3.88"
Po from Marsland & Randolph (kPa) : "Arm ave=1013.9"
Best estimate of Po (kPa) : "Arm ave=976.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=3601.4"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 34.0
Angle of internal friction (°) : "Arm ave=47.1"
Dilation angle (°) : "Arm ave=17.1"
Gradient of log-log plot : "Arm ave=0.547"

[Withers et al 1989]
Angle of internal friction (°) : "Arm ave=36.7"
Dilation angle (°) : "Arm ave=3.3"
Gradient of log-log plot : "Arm ave=-2.705"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=158.2"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	537.6	-0.236	1628	0.106	569
Arm ave	2	918.5	0.647	3387	0.123	1130
Arm ave	3	1218.2	1.807	5644	0.154	1872
Arm ave	4	1149.7	3.887	4142	0.180	2070

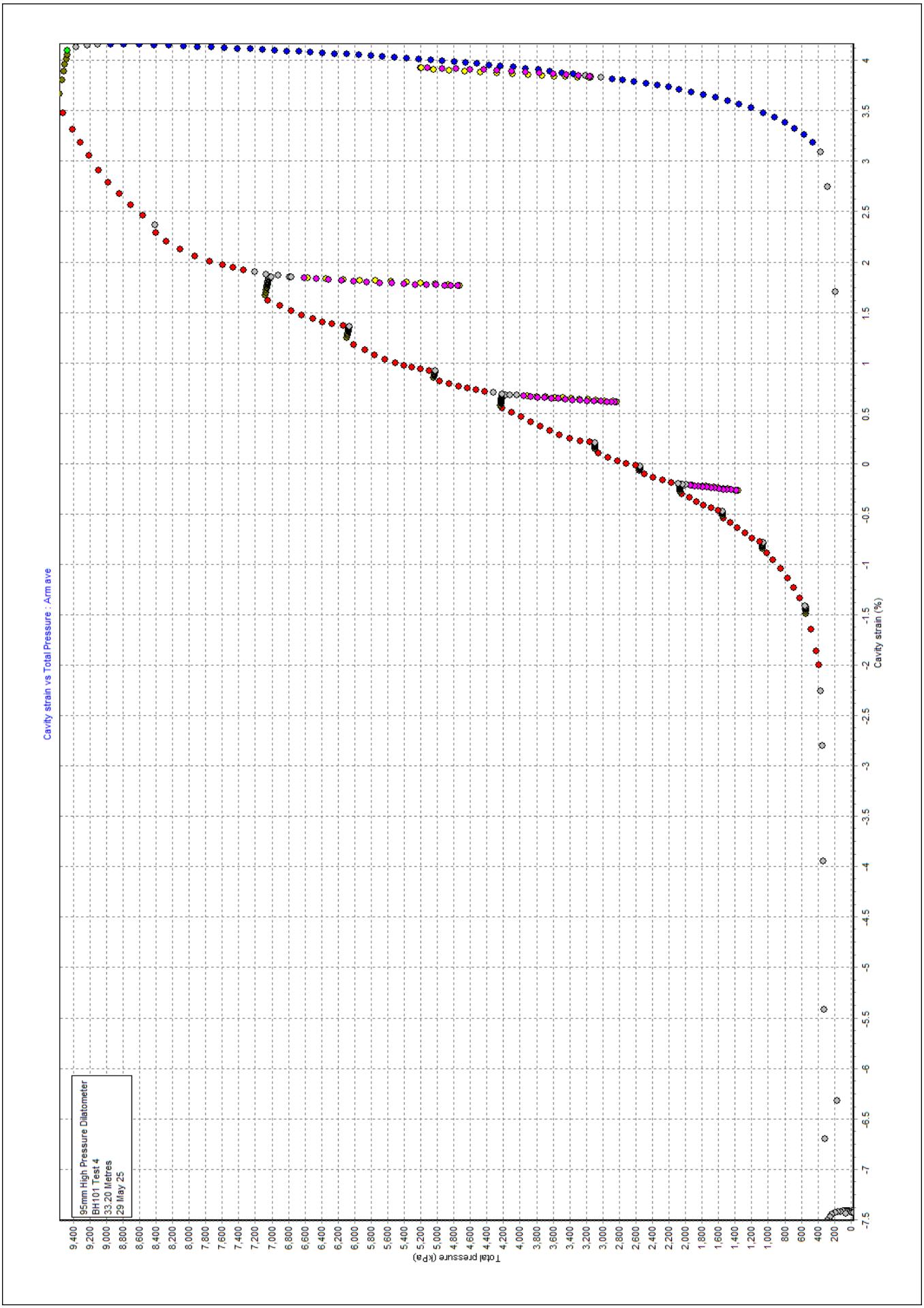
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

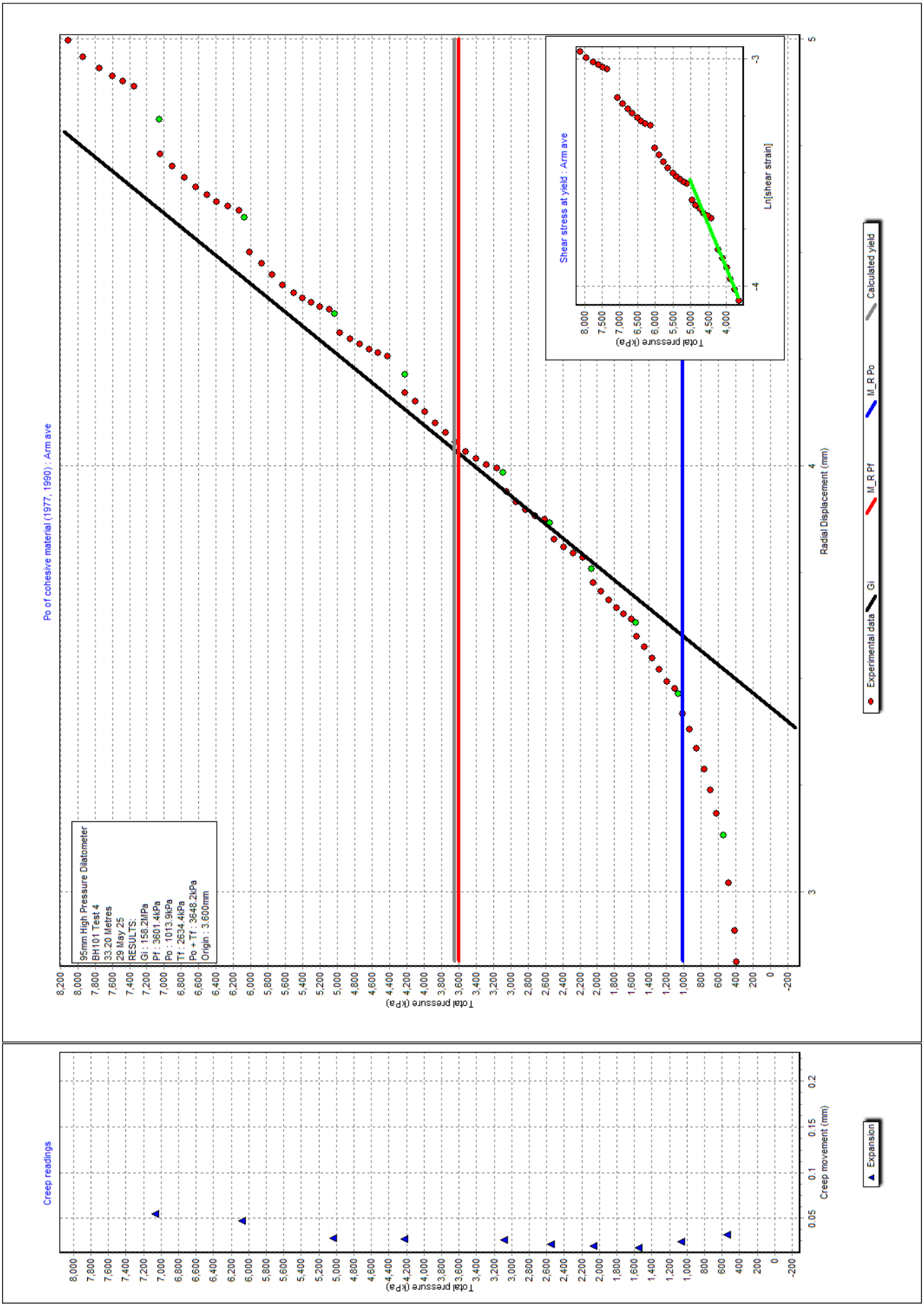
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	182.096	153.214	0.841
Arm ave	2	324.260	272.373	0.840
Arm ave	3	400.141	327.985	0.820
Arm ave	4	275.500	210.471	0.764

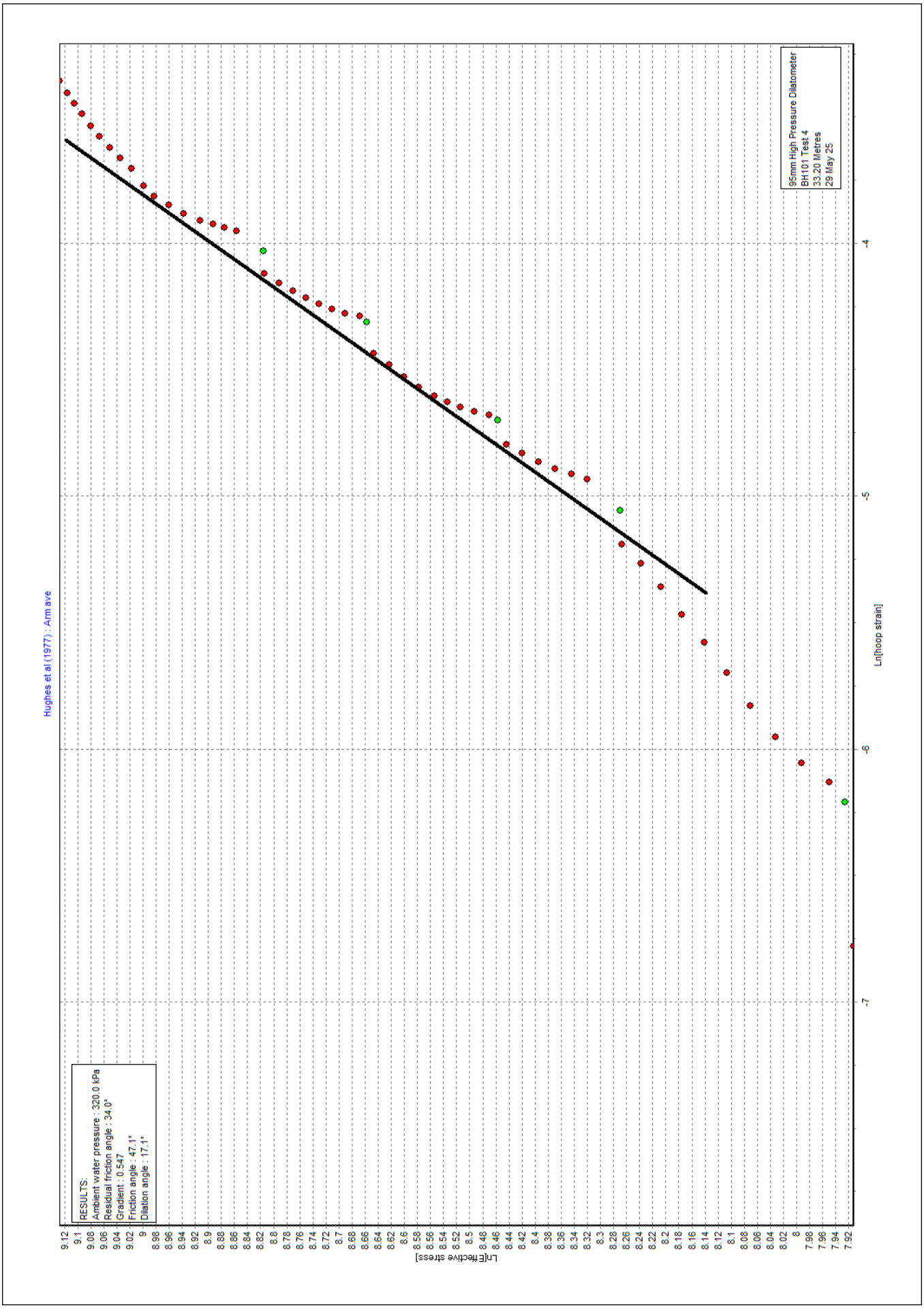
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 3.88
Po (kPa) : 976
Cohesion (kPa) : 147
Angle of peak friction (deg) : 47.1
Angle of peak dilation (deg) : 17.1

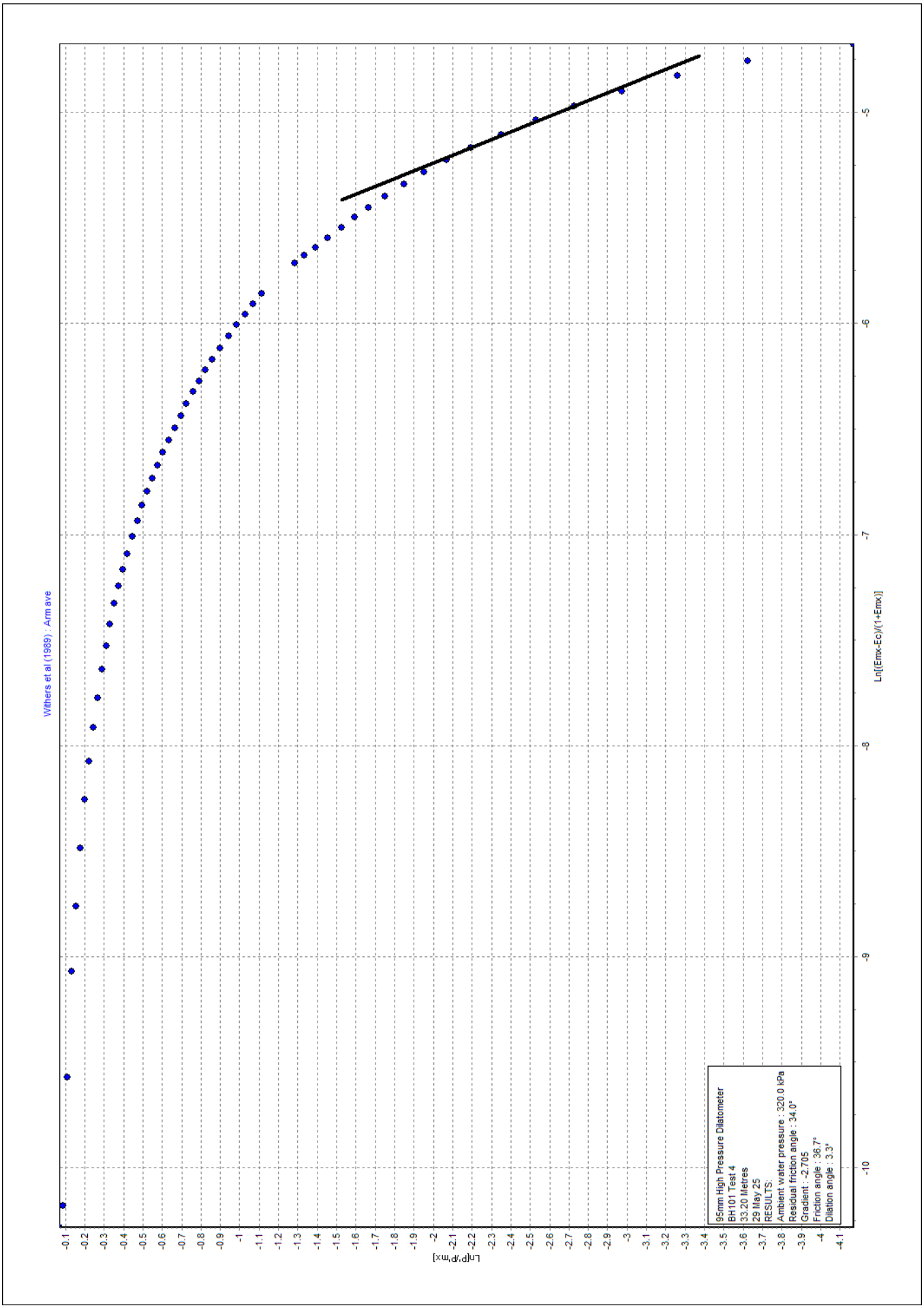
Grain to Tilbury
BH101 Test 4 - SUMMARY OF RESULTS

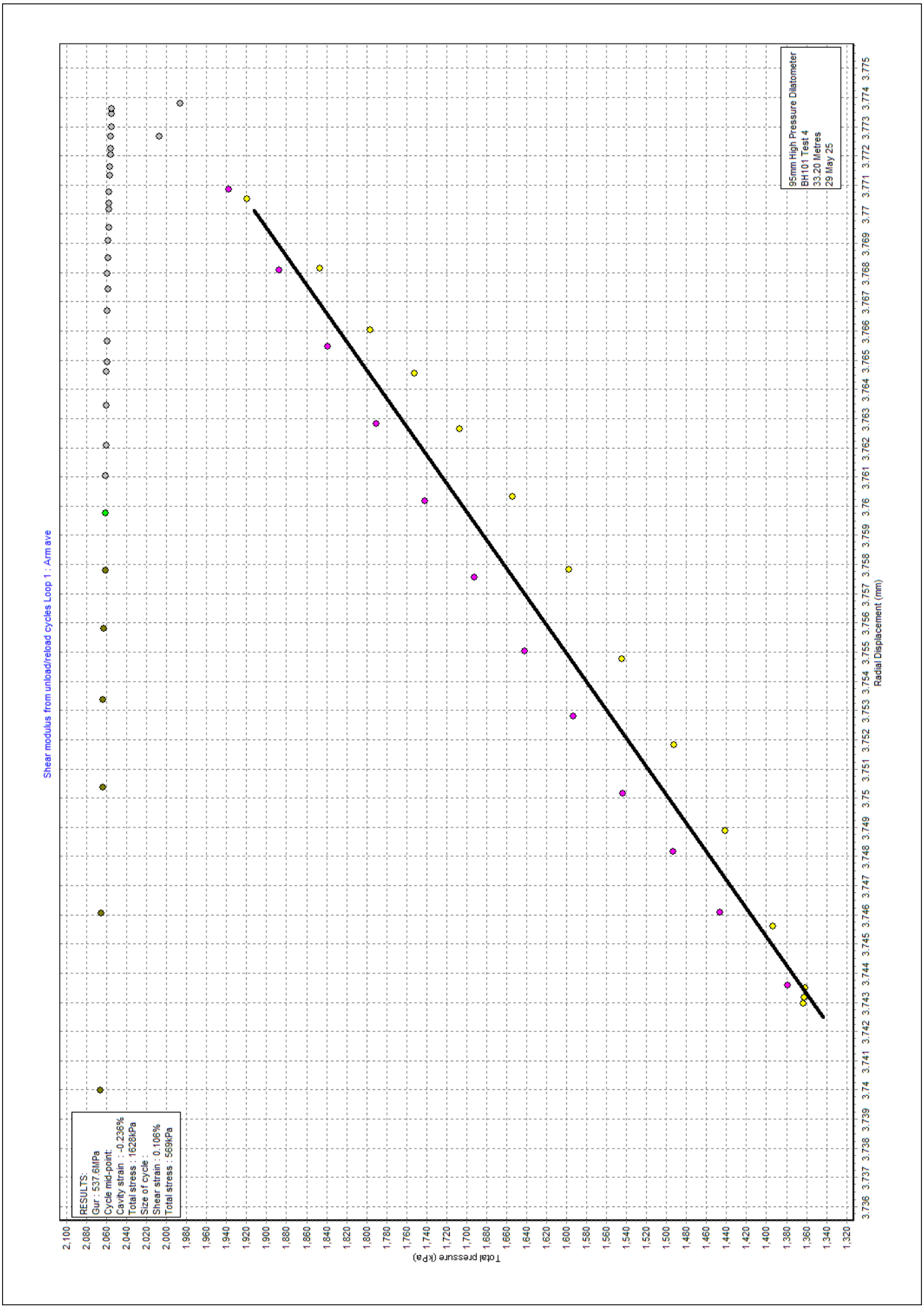
Total yield stress (kPa)	:	1958
Total limit stress (kPa)	:	44056
G at first yield (MPa)	:	519.8
Non-linear exponent	:	0.764
Janbu exponent	:	0.307
Correlation	:	0.678
Ambient pore water pressure (kPa)	:	320
Residual friction angle (deg)	:	34.0
Poisson's ratio	:	0.20

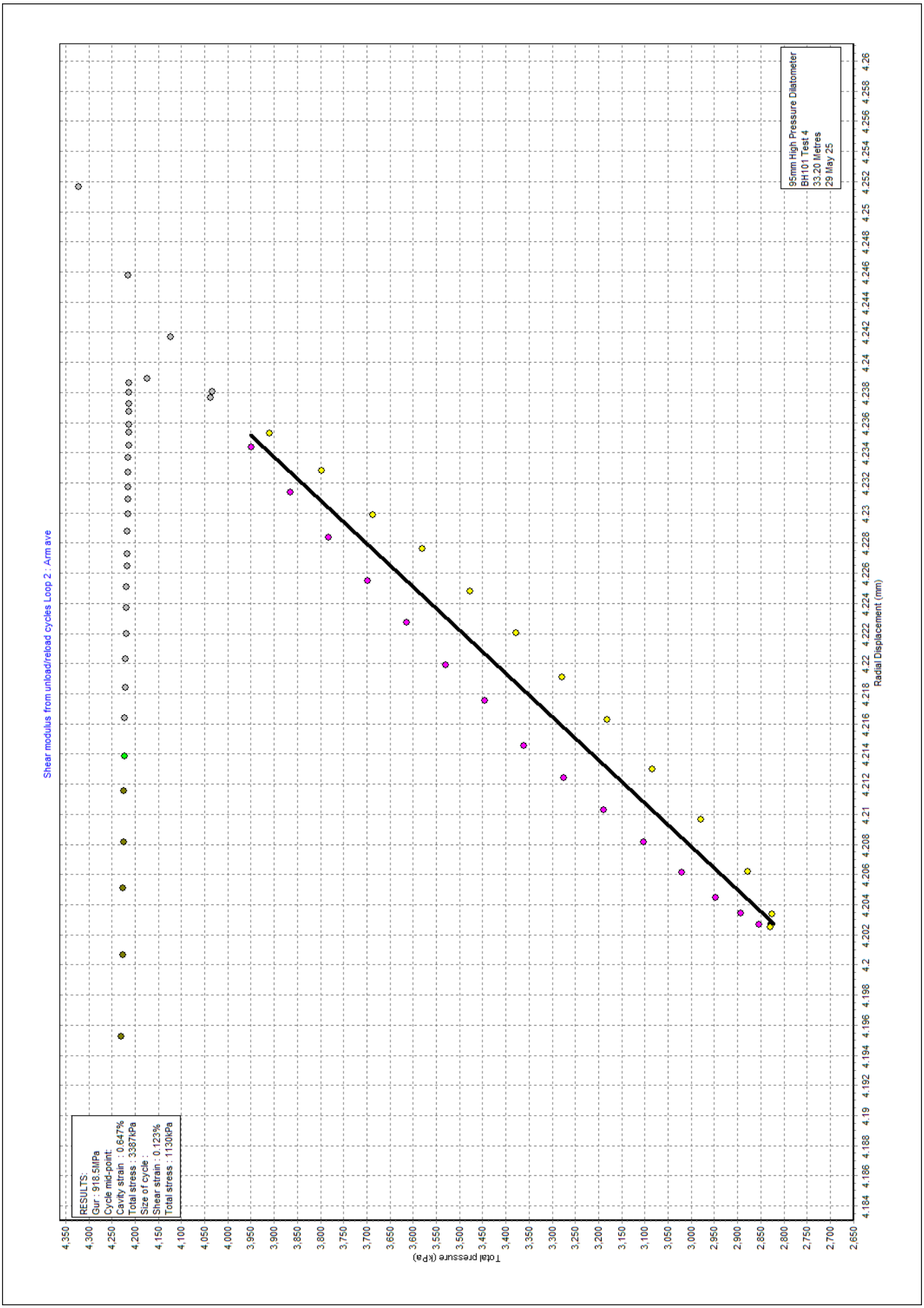

Cavity strain vs Total Pressure : Arm ave
95mm High Pressure Dilatometer
BH101 Test 4
33.20 Metres
29 May 25
Total pressure (kPa)
Cavity strain (%)

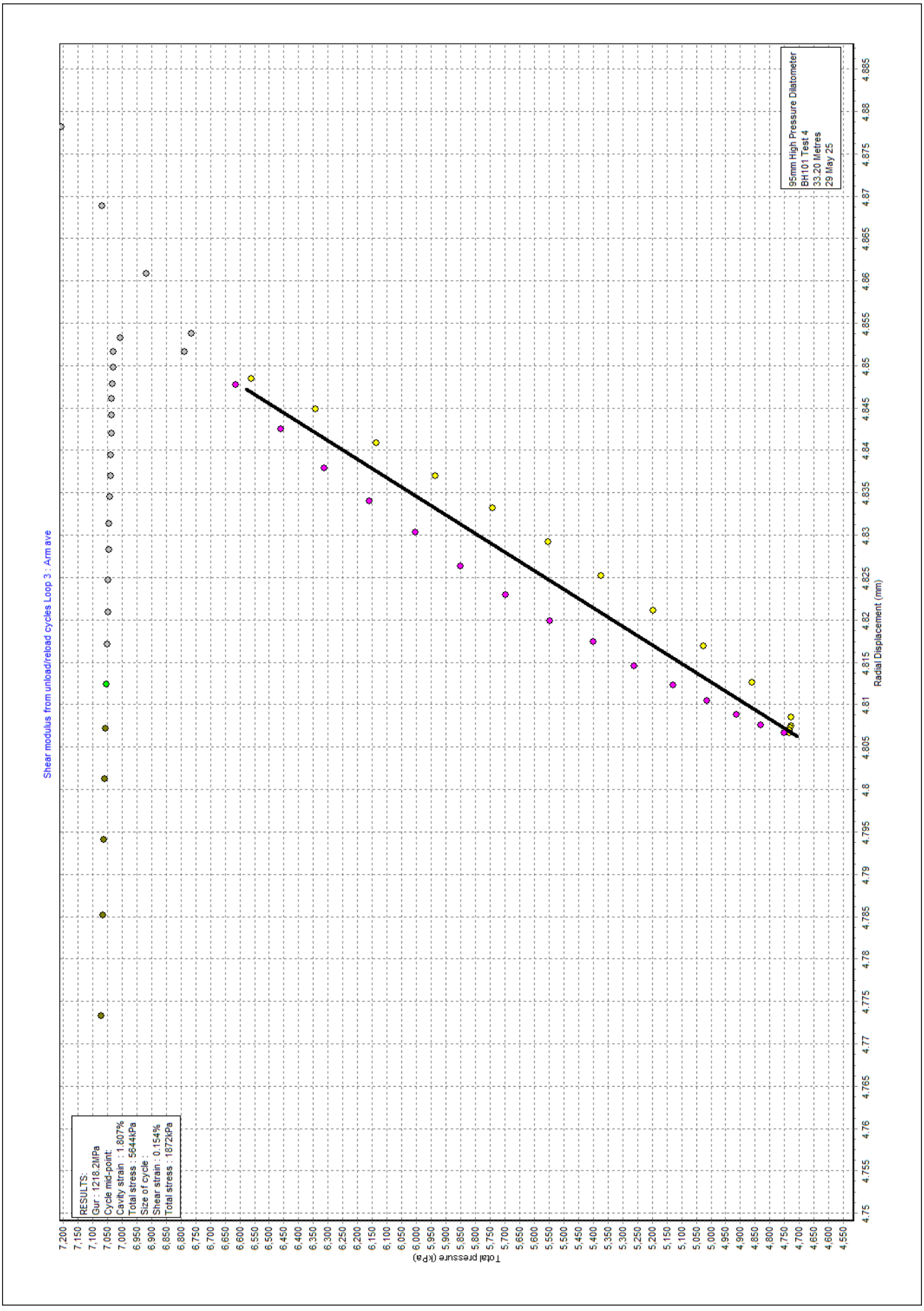

Po of cohesive material (1977, 1990) : Arm ave
95mm High Pressure Dilatometer
BH101 Test 4
33.20 Metres
29 May 25
RESULTS:
Gi : 158.2MPa
Pf : 3601.4kPa
Po : 1013.9kPa
Tf : 2634.4kPa
Po + Tf : 3648.2kPa
Origin : 3.600mm
Total pressure (kPa)
Radial Displacement (mm)
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Shear stress at yield : Arm ave
Ln[shear strain]
Creep readings
Creep movement (mm)
Expansion

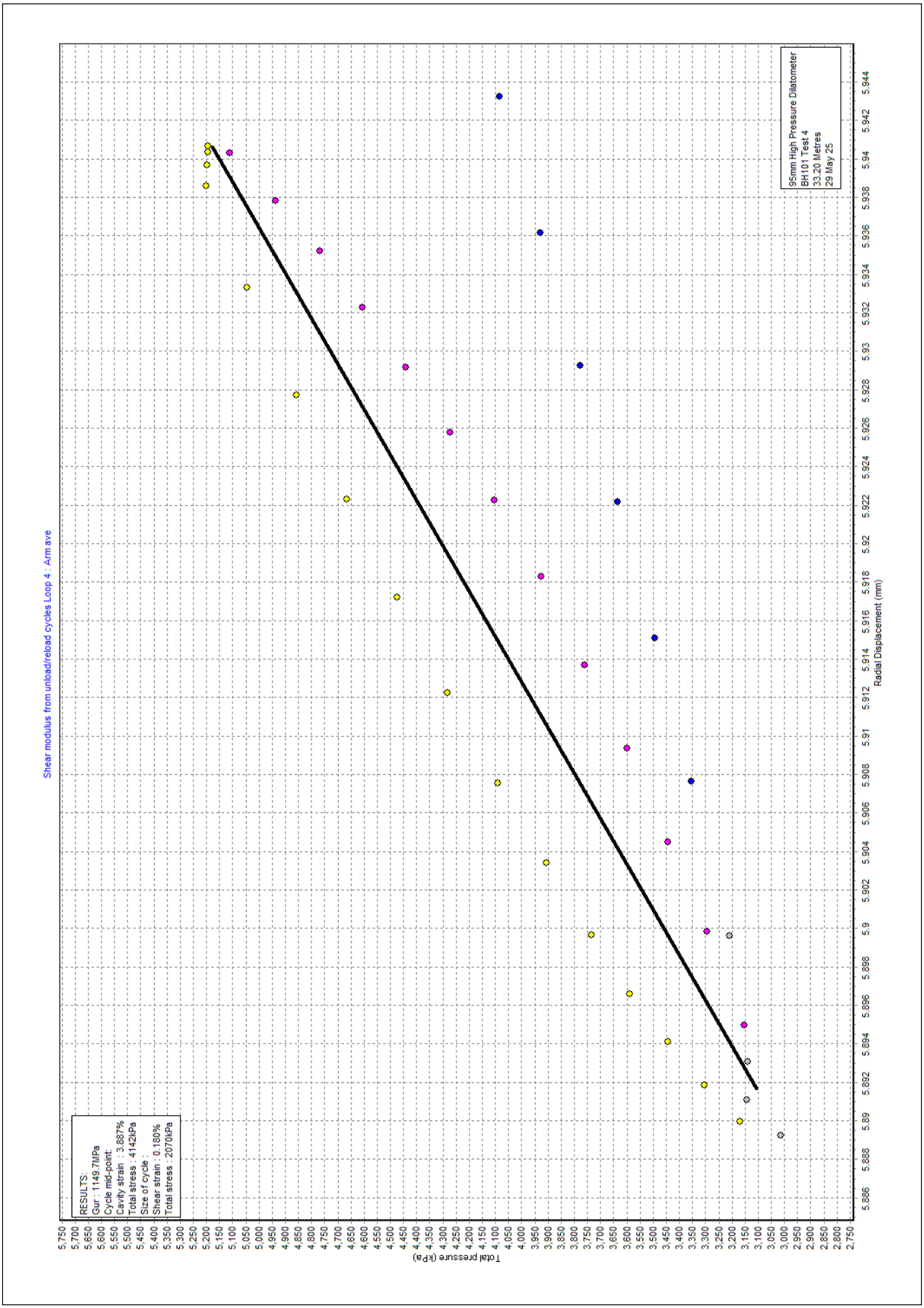

Hughes et al (1977) : Arm ave
RESULTS:
Ambient water pressure : 320.0 kPa
Residual friction angle : 34.0°
Gradient : 0.547
Friction angle : 47.1°
Dilation angle : 17.1°
95mm High Pressure Dilatometer
BH101 Test 4
33.20 Metres
29 May 25
Ln[effective stress]
Ln[hoop strain]

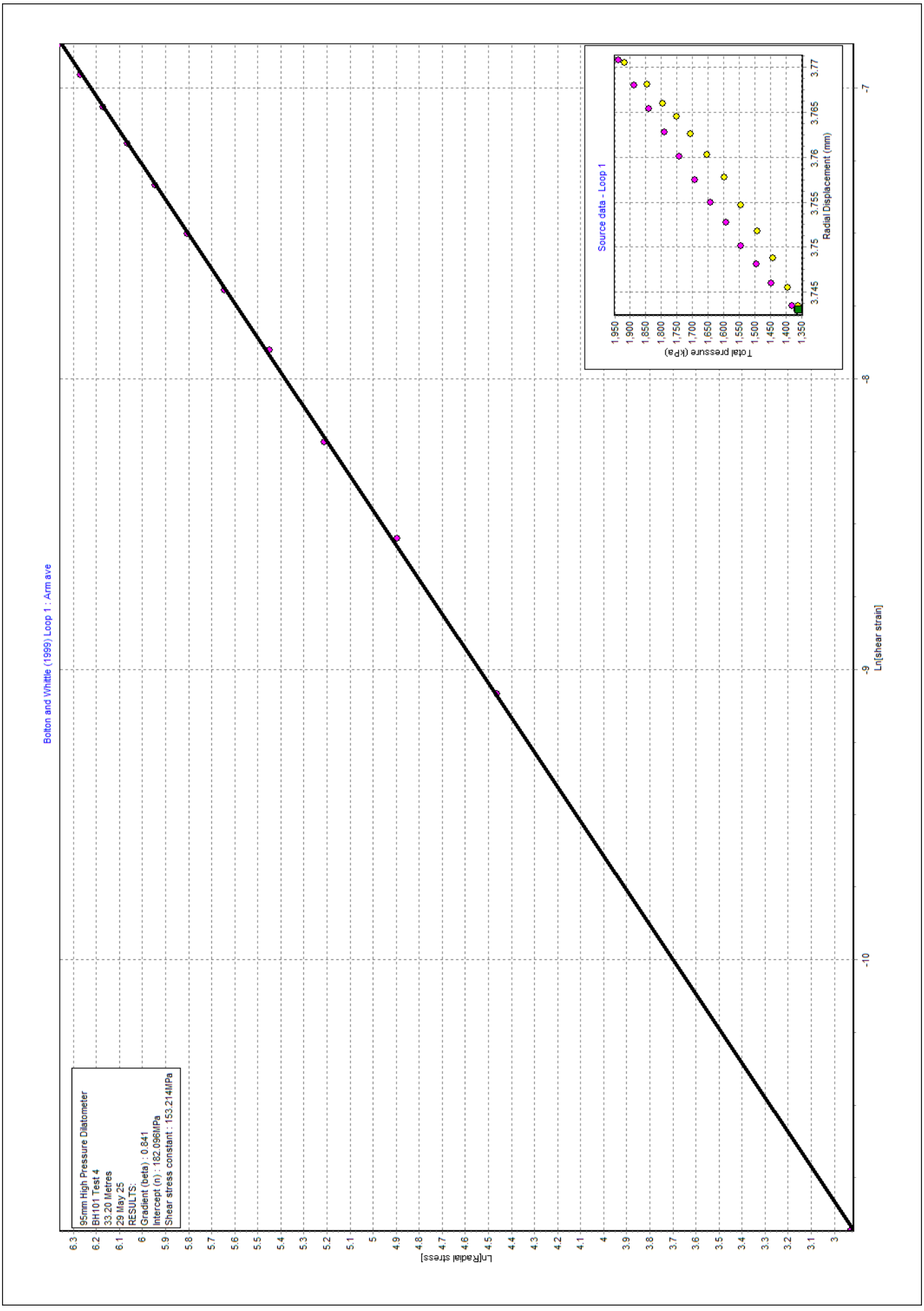

Withers et al (1989) : Arm ave
Ln[(Emx-Ec)/(1+Emx)]
Ln[P'/P'mx]
95mm High Pressure Dilatometer
BH101 Test 4
33.20 Metres
29 May 25
RESULTS:
Ambient water pressure : 320.0 kPa
Residual friction angle : 34.0°
Gradient : -2.705
Friction angle : 36.7°
Dilation angle : 3.3°

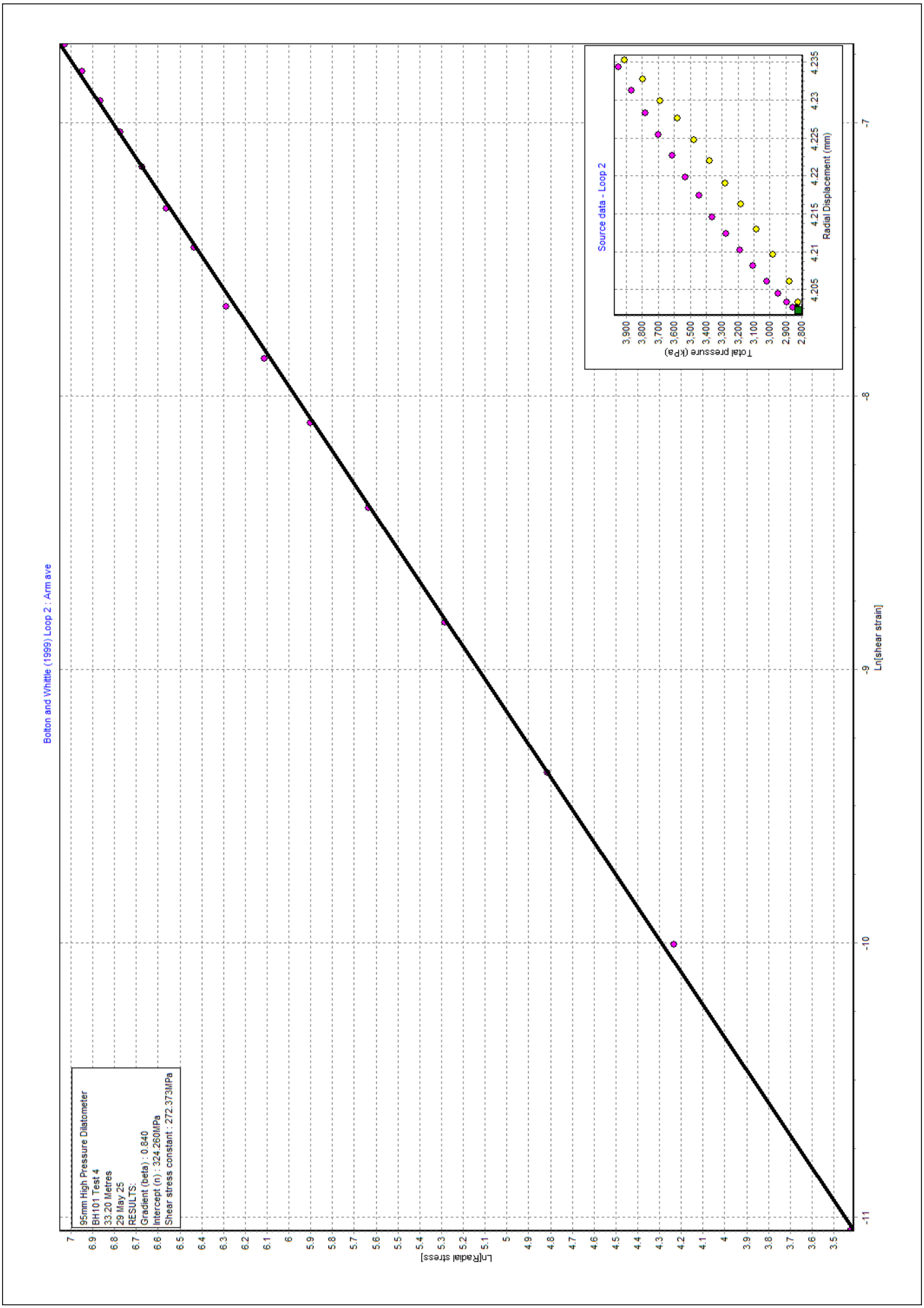

Shear modulus from unload/reload cycles Loop 1 : Arm ave
Total pressure (kPa)
Radial Displacement (mm)
RESULTS:
Gur : 537.6MPa
Cycle mid-point:
Cavity strain : -0.236%
Total stress : 1628kPa
Size of cycle :
Shear strain : 0.106%
Total stress : 569kPa
95mm High Pressure Dilatometer
BH101 Test 4
33.20 Metres
29 May 25

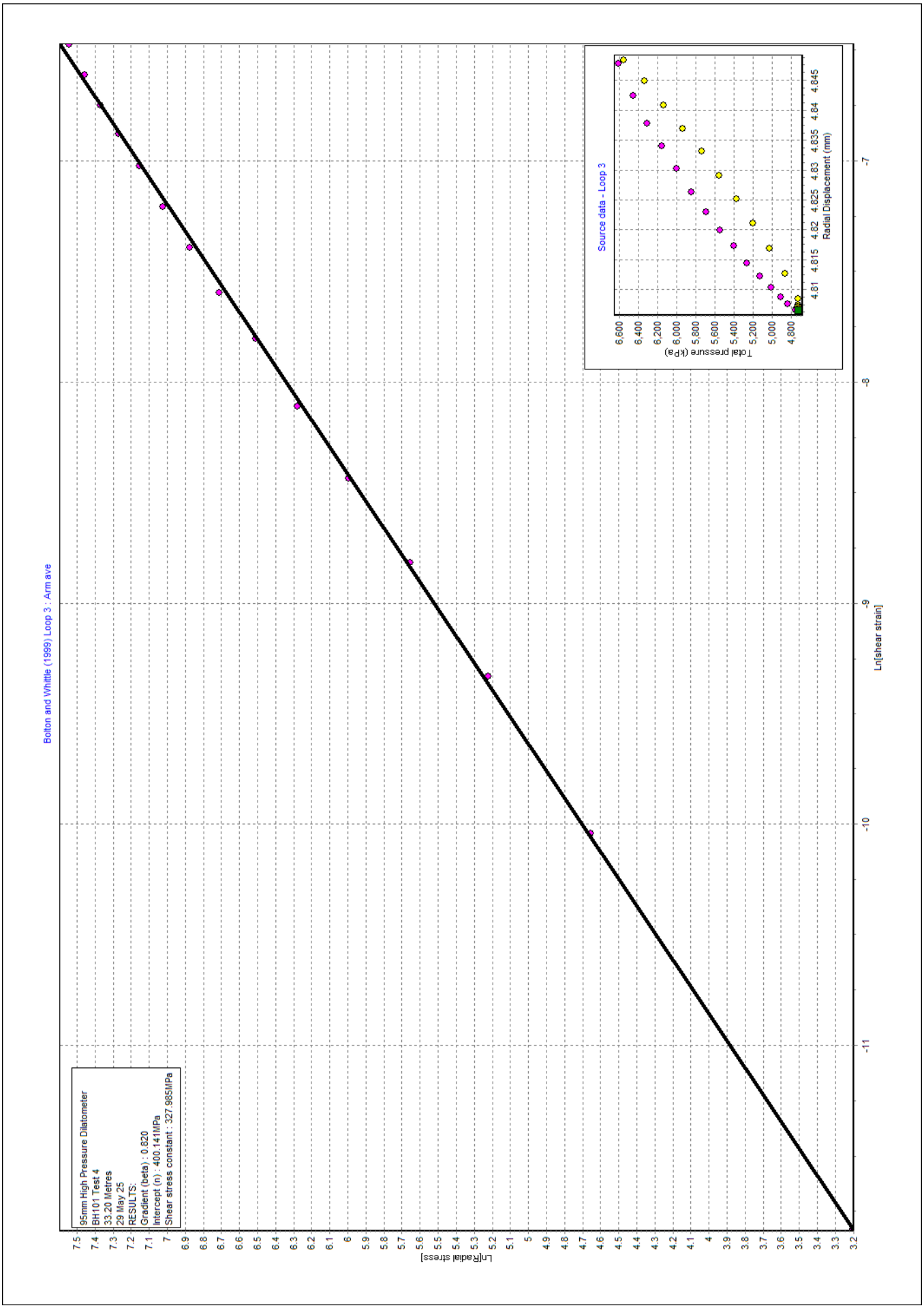

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 918.5MPa
Cycle mid-point:
Cavity strain : 0.647%
Total stress : 3387kPa
Size of cycle :
Shear strain : 0.123%
Total stress : 1130kPa
95mm High Pressure Dilatometer
BH101 Test 4
33.20 Metres
29 May 25
Total pressure (kPa)
Radial Displacement (mm)

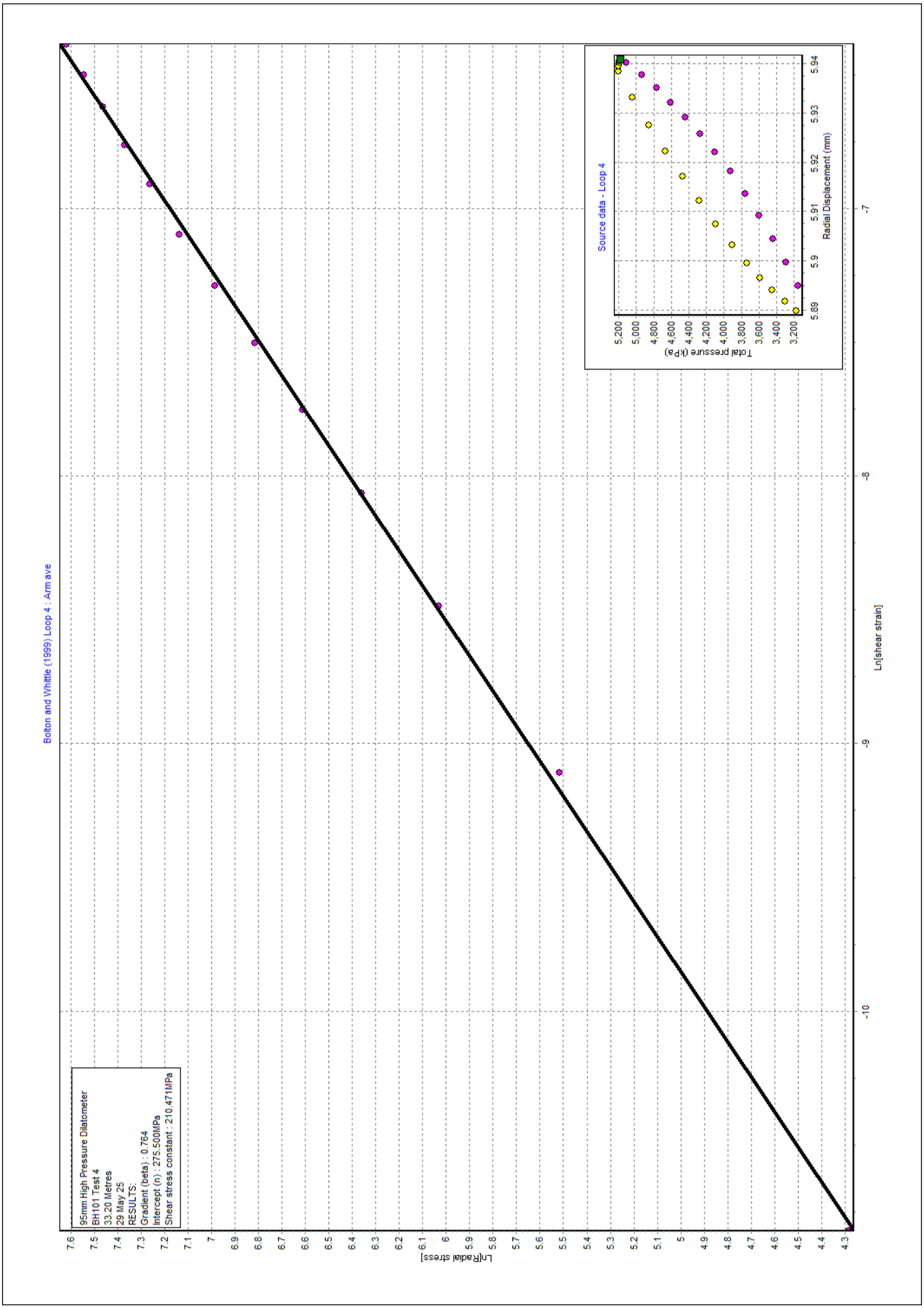

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 1218.2MPa
Cycle mid-point:
Cavity strain : 1.807%
Total stress : 5644kPa
Size of cycle :
Shear strain : 0.154%
Total stress : 1872kPa
95mm High Pressure Dilatometer
BH101 Test 4
33.20 Metres
29 May 25
Radial Displacement (mm)
Total pressure (kPa)

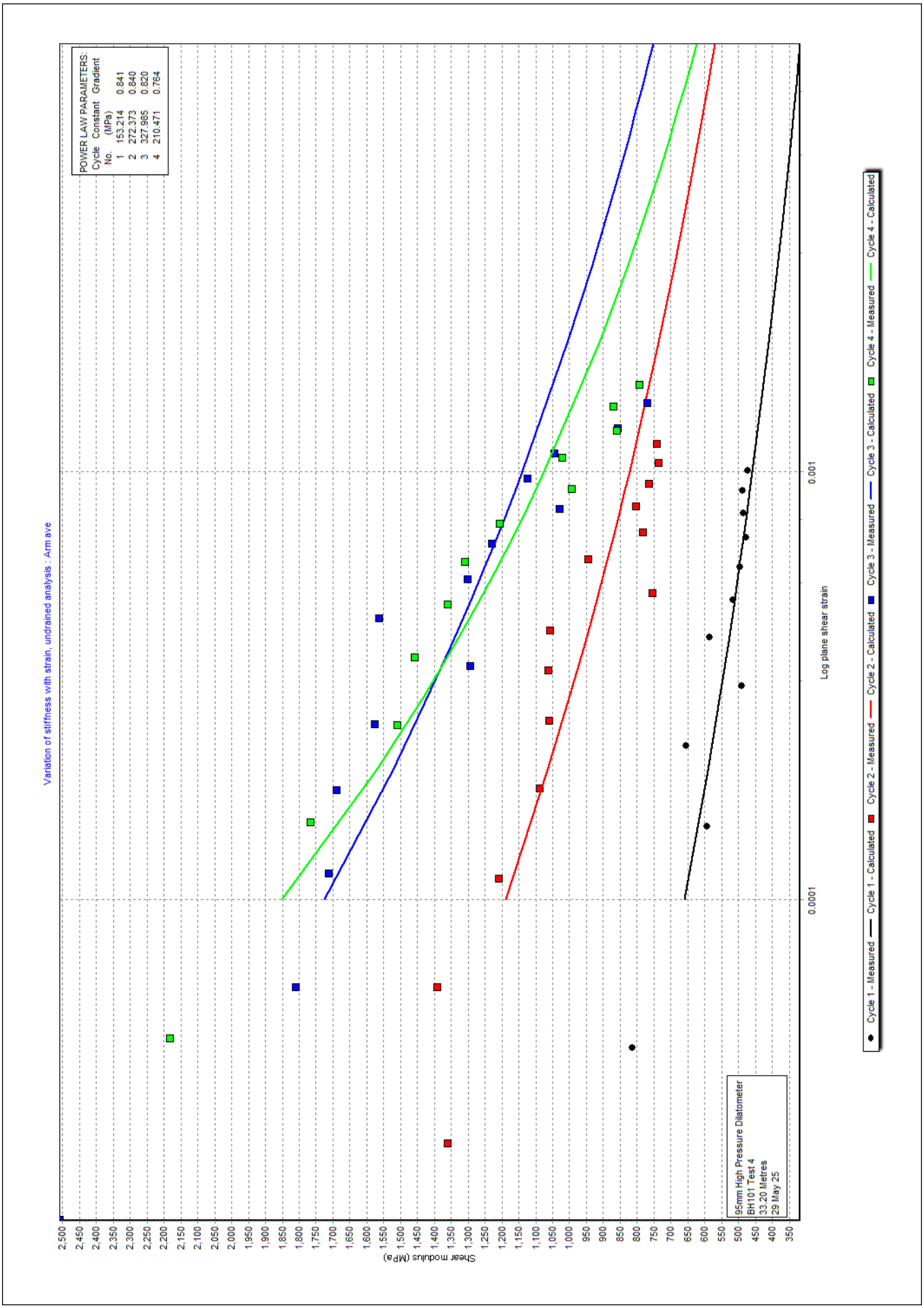

Shear modulus from unload/reload cycles Loop 4 : Arm ave
RESULTS:
Gur : 1149.7MPa
Cycle mid-point:
Cavity strain : 3.887%
Total stress : 4142kPa
Size of cycle :
Shear strain : 0.180%
Total stress : 2070kPa
95mm High Pressure Dilatometer
BH101 Test 4
33.20 Metres
29 May 25
Total pressure (kPa)
Radial Displacement (mm)

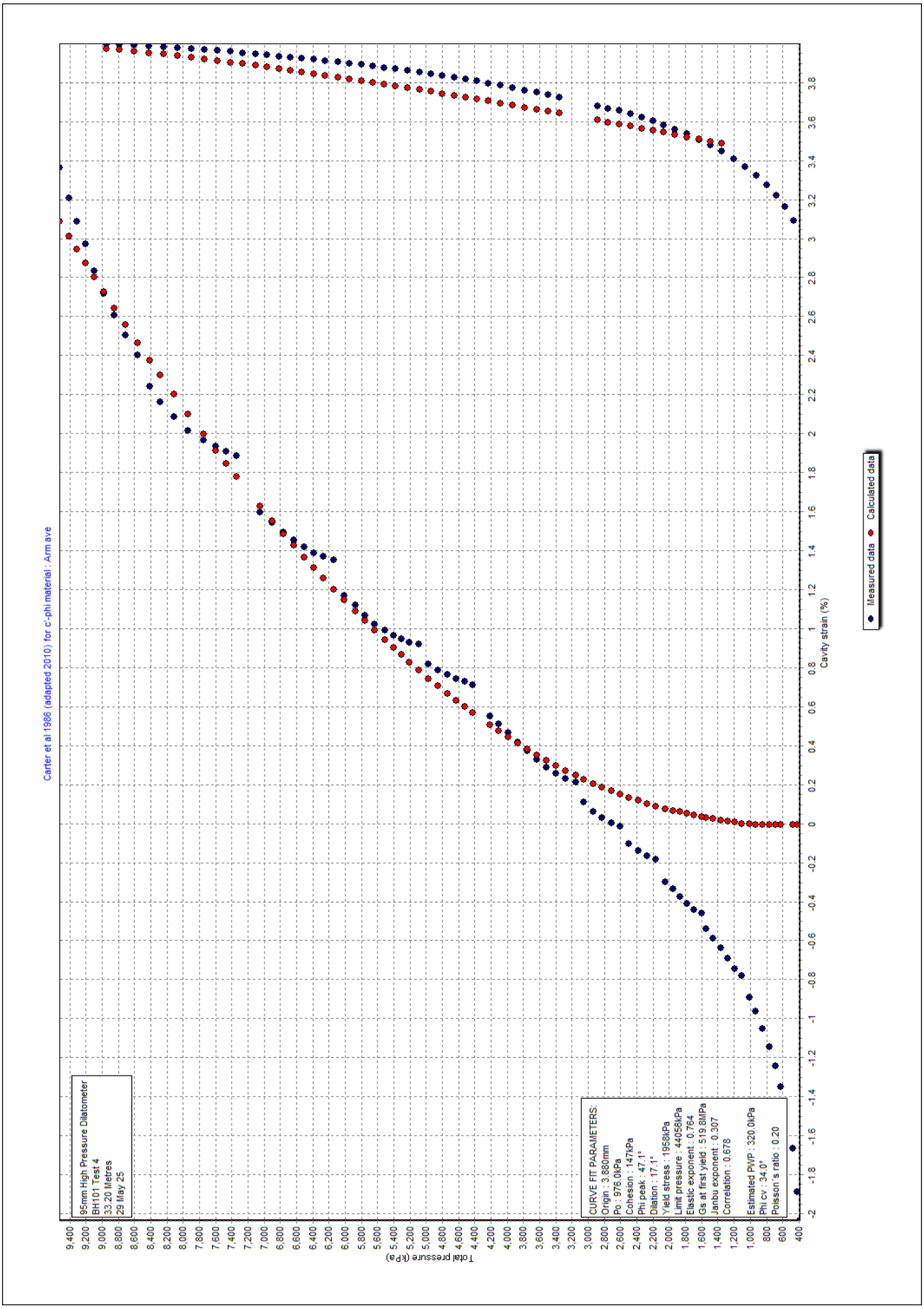

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH101 Test 4
33.20 Metres
29 May 25
RESULTS:
Gradient (beta) : 0.841
Intercept (n) : 182.096kPa
Shear stress constant : 153.214kPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

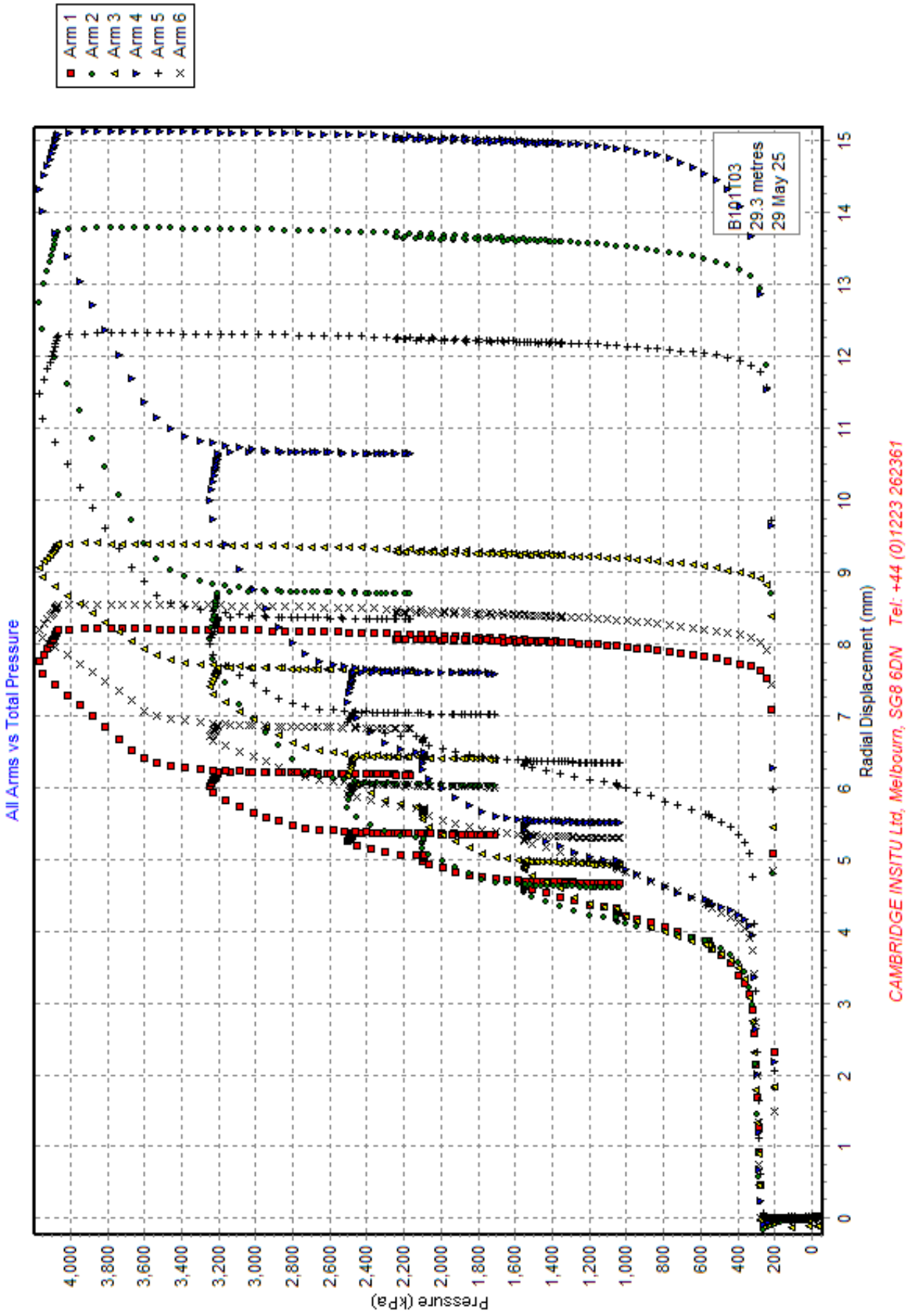

Bolton and Whittle (1999) Loop 2 : Arm ave
95mm High Pressure Dilatometer
BH101 Test 4
33.20 Metres
29 May 25
RESULTS:
Gradient (beta) : 0.840
Intercept (n) : 324.260MPa
Shear stress constant : 272.373MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

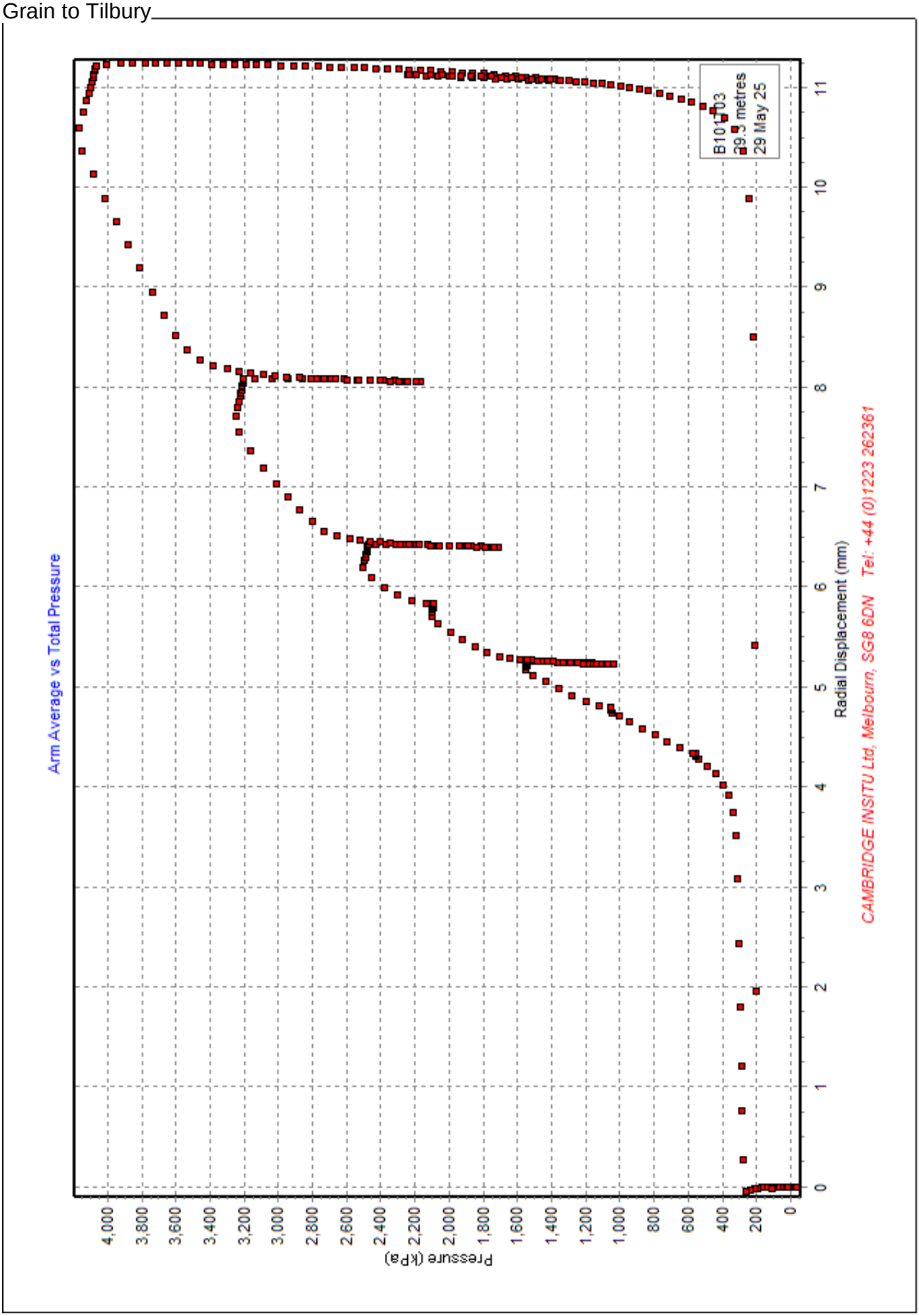

Bolton and Whittle (1999) Loop 3 : Arm ave
95mm High Pressure Dilatometer
BH101 Test 4
33.20 Metres
29 May 25
RESULTS:
Gradient (beta) : 0.820
Intercept (n) : 400.141MPa
Shear stress constant : 327.985MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)

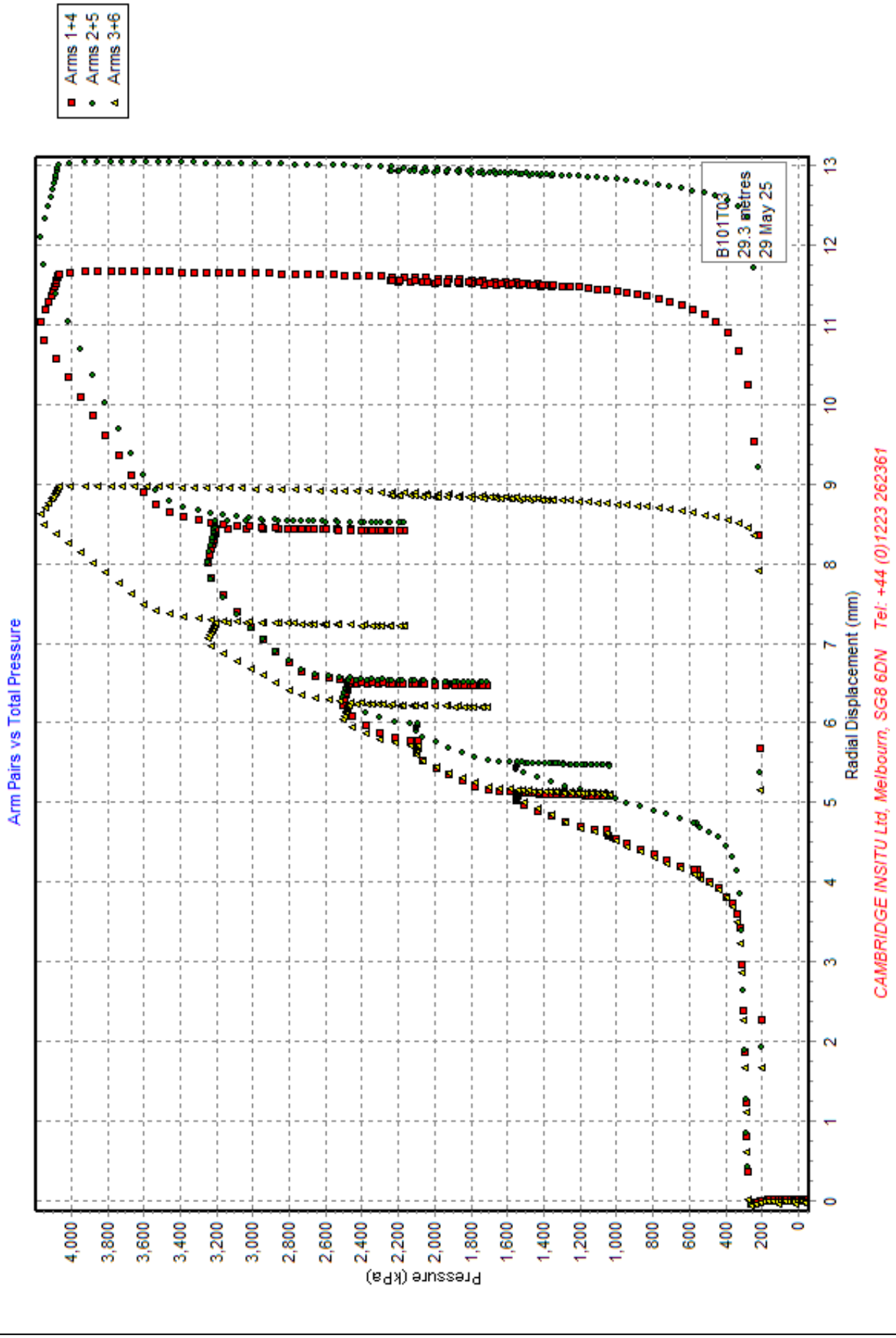

95mm High Pressure Dilatometer
BH101 Test 4
33.20 Metres
29 May 25
RESULTS:
Gradient (beta) : 0.764
Intercept (n) : 275.500MPa
Shear stress constant : 210.471MPa
Bolton and Whittle (1999) Loop 4 : Arm ave
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 4
Total pressure (kPa)
Radial Displacement (mm)

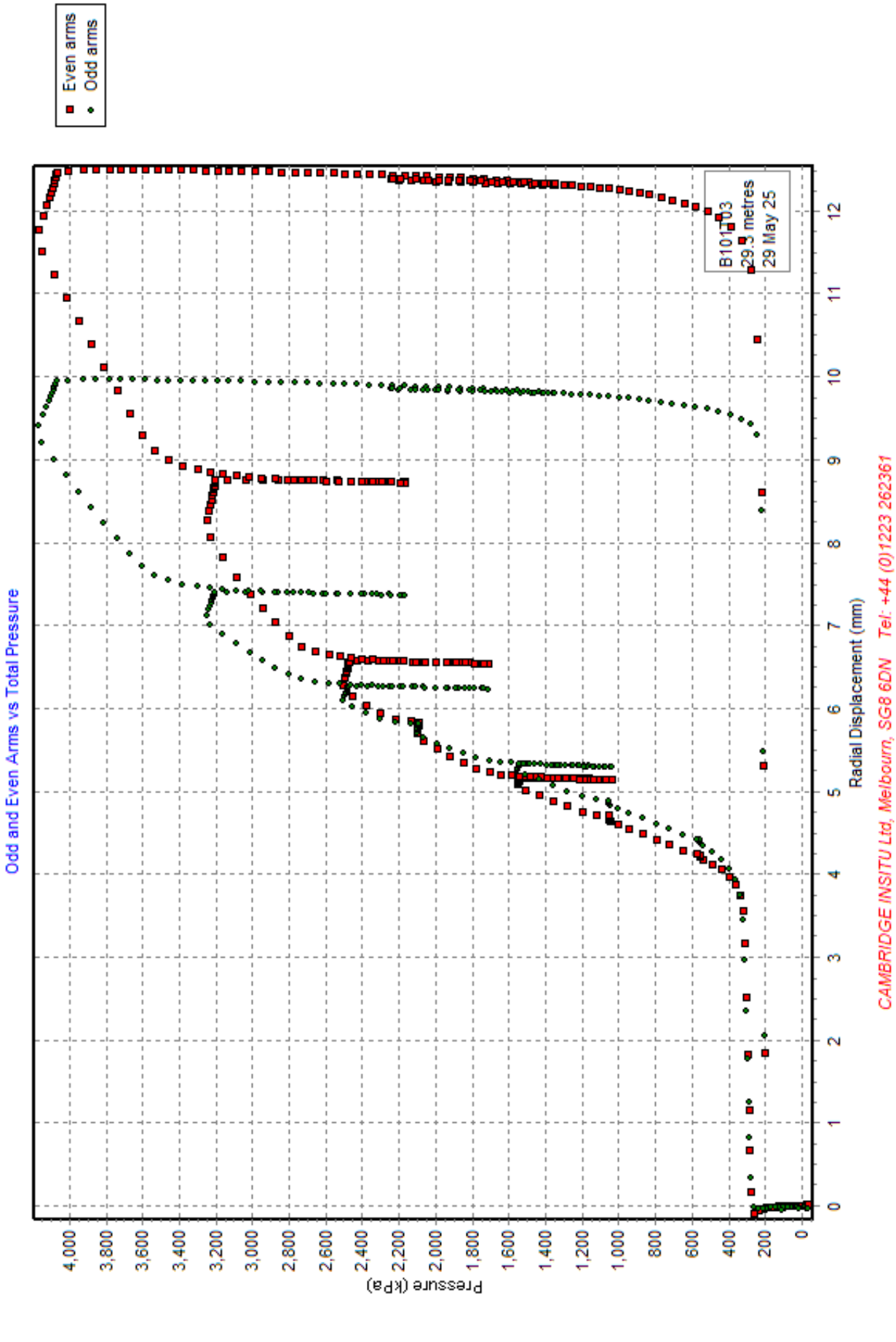

Variation of stiffness with strain, undrained analysis : Arm ave
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 153.214 0.841
2 272.373 0.840
3 327.985 0.820
4 210.471 0.764
Shear modulus (MPa)
Log plane shear strain
0.0001
0.001
95mm High Pressure Dilatometer
BH101 Test 4
33.20 Metres
29 May 25
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
Cycle 4 - Measured
Cycle 4 - Calculated

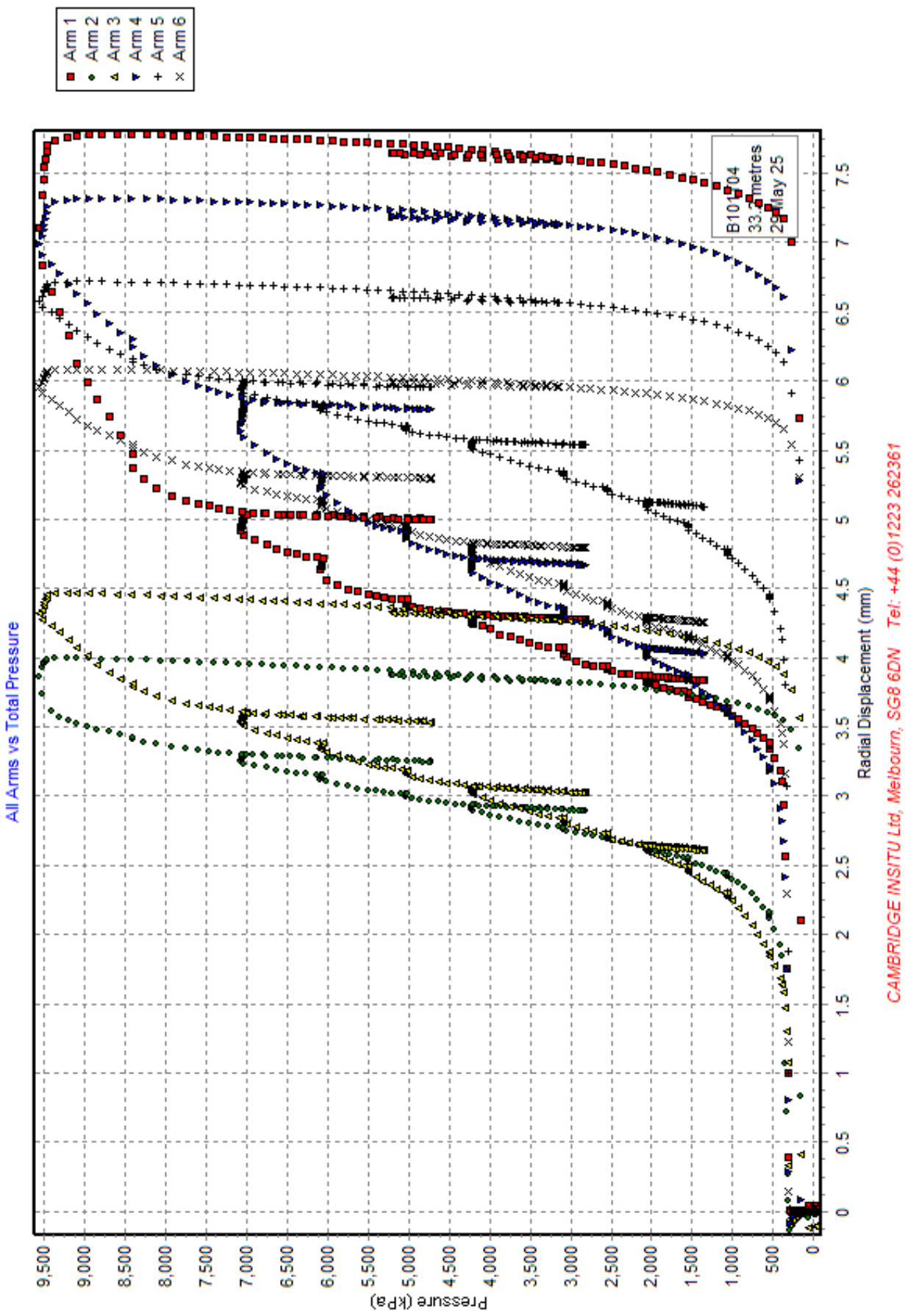

Carter et al 1986 (adapted 2010) for c-phi material : Arm ave
95mm High Pressure Dilatometer
BH101 Test 4
33.20 Metres
29 May 25
CURVE FIT PARAMETERS:
Origin : 3.880mm
Po : 976.0kPa
Cohesion : 147kPa
Phi peak : 47.1°
Dilation : 17.1°
Yield stress : 1958kPa
Limit pressure : 44056kPa
Elastic exponent : 0.764
Gs at first yield : 519.8MPa
Janbu exponent : 0.307
Correlation : 0.678
Estimated PWP : 320.0kPa
Phi cv : 34.0°
Poisson's ratio : 0.20
Measured data
Calculated data
Total pressure (kPa)
Cavity strain (%)

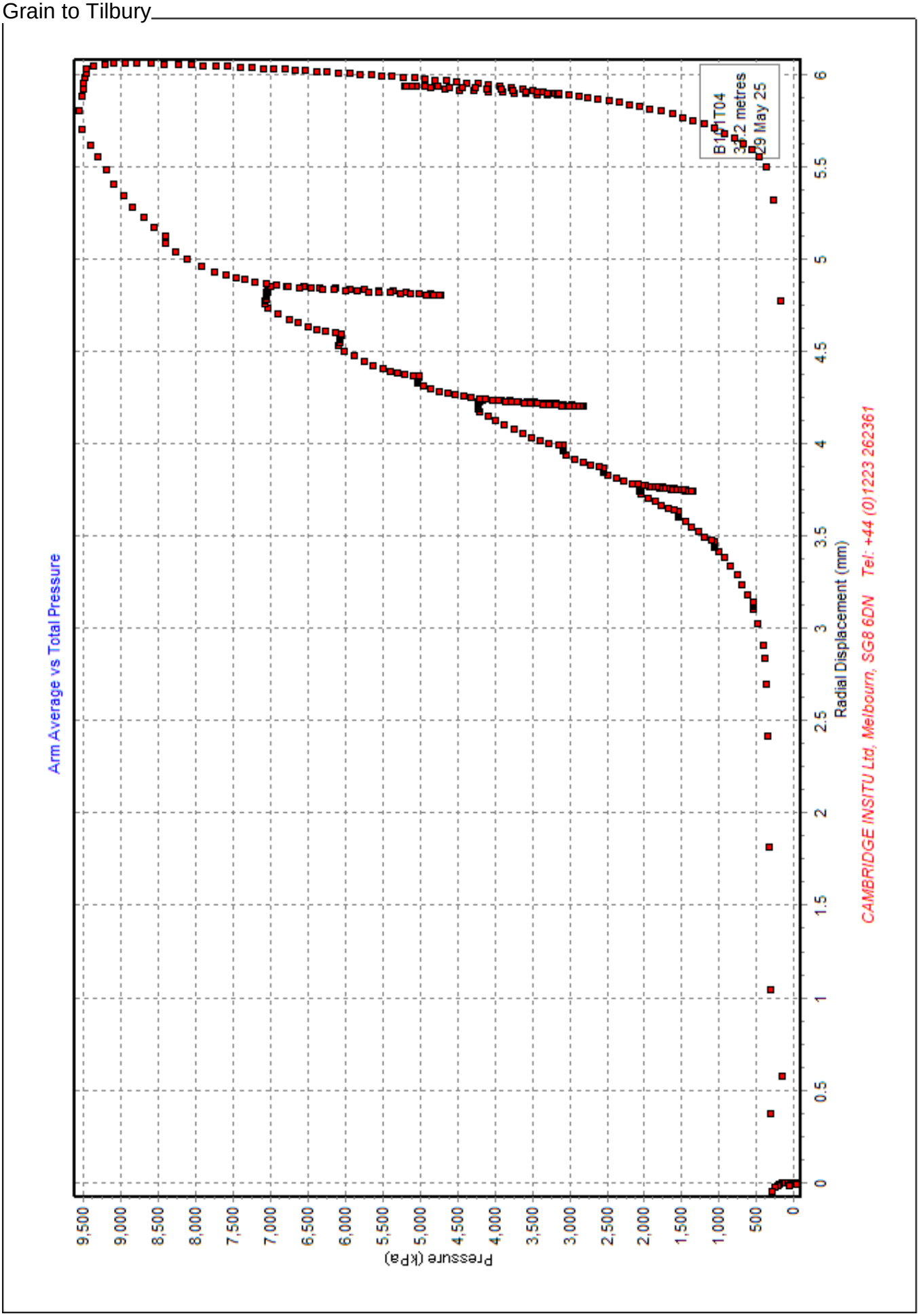

Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
B101T03
29.3 metres
29 May 25
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
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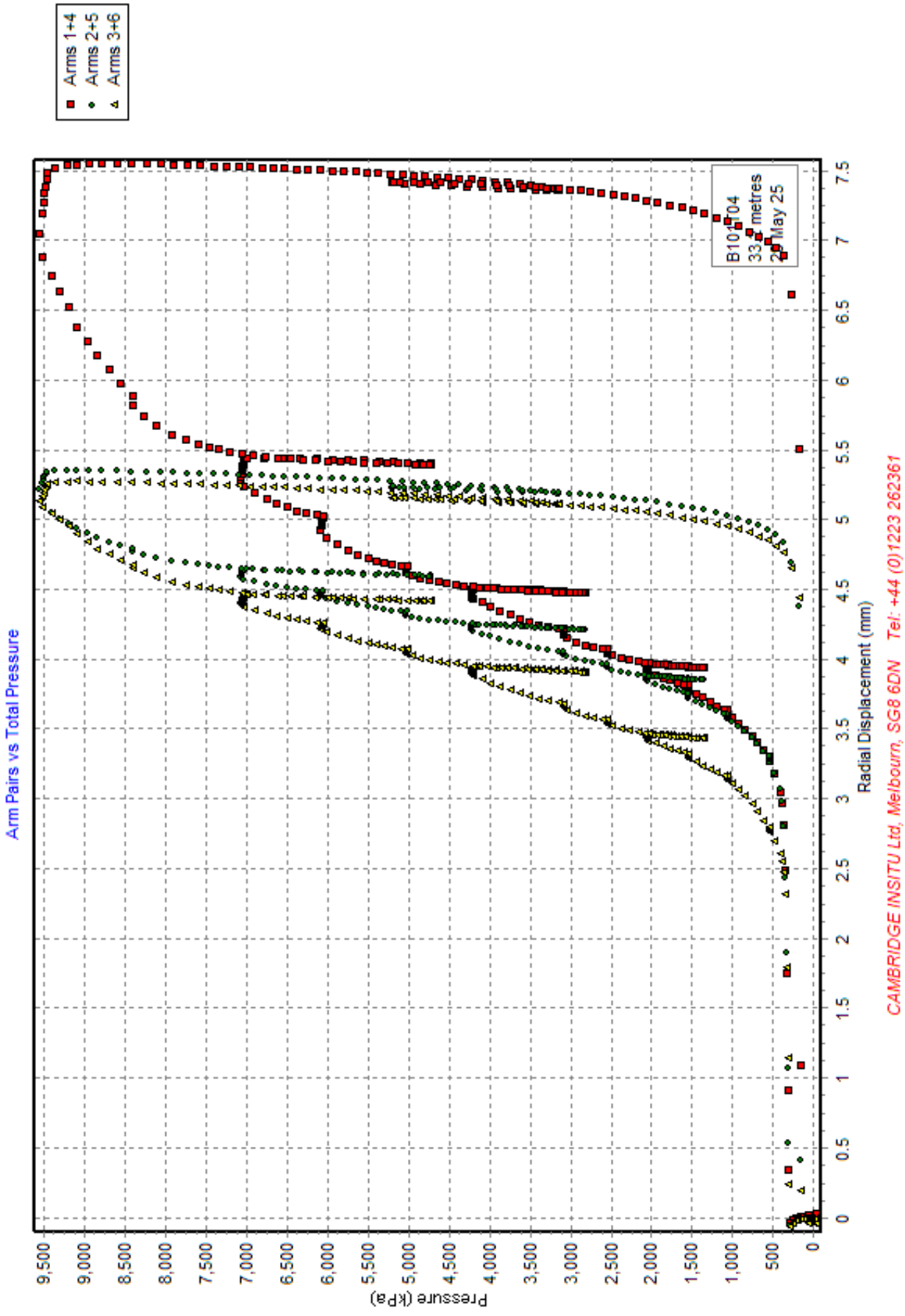

Arm Average vs Total Pressure
Pressure (kPa)
4,000
3,800
3,600
3,400
3,200
3,000
2,800
2,600
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Radial Displacement (mm)
0
1
2
3
4
5
6
7
8
9
10
11
B101/03
29.3 metres
29 May 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

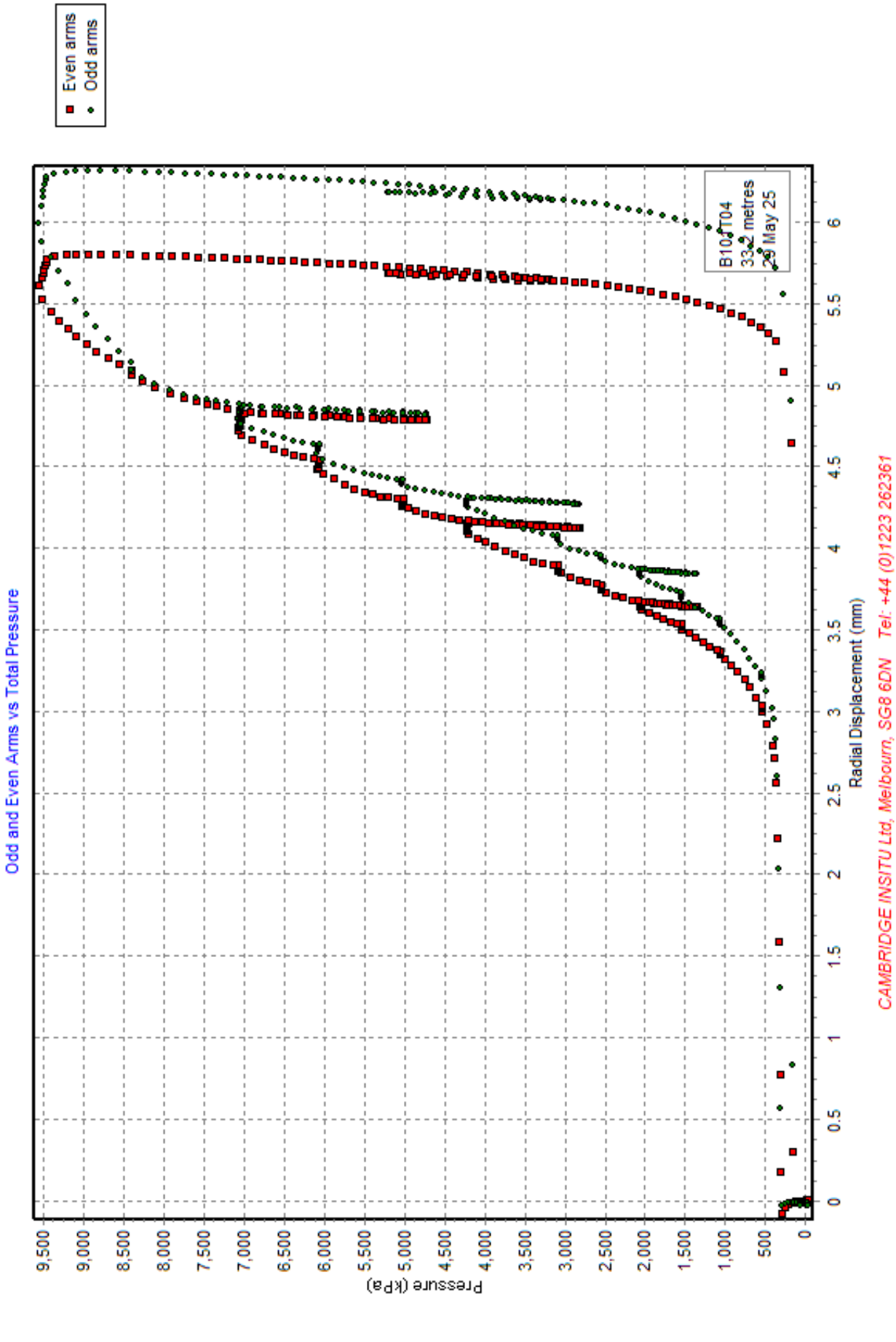

Arms 1+4
Arms 2+5
Arms 3+6
B101T03
29.3 metres
29 May 25
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
B101103
29.3 metres
29 May 25
Odd and Even Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
B101004
33.2metres
29May 25
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arm Average vs Total Pressure
Pressure (kPa)
9,500
9,000
8,500
8,000
7,500
7,000
6,500
6,000
5,500
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Radial Displacement (mm)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
B1 T04
3.2 metres
29 May 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arms 1+4
Arms 2+5
Arms 3+6
B104
33.4 metres
25 May 25
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
B104T04
33.2 metres
29 May 25
Odd and Even Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to Tilbury
BH101 Test 5 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Grain to Tilbury
Borehole : BH101
Test name : BH101 Test 5
Test date : 30 May 25
Test depth : 37.40 Metres
Water table : 6.8 Metres
Ambient PWP : 300.2 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDP/RW on 17 Jul 25

Remarks: Structure breaks down at 2% cavity strain

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=3.29"
Po from Marsland & Randolph (kPa) : "Arm ave=1019.0"
Best estimate of Po (kPa) : "Arm ave=1002.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=5303.8"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 34.0
Angle of internal friction (°) : "Arm ave=37.0"
Dilation angle (°) : "Arm ave=3.7"
Gradient of log-log plot : "Arm ave=0.400"

[Withers et al 1989]
Angle of internal friction (°) : "Arm ave=39.9"
Dilation angle (°) : "Arm ave=7.3"
Gradient of log-log plot : "Arm ave=-2.881"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=267.2"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	1156.5	0.163	2381	0.065	749
Arm ave	2	1361.3	0.761	4819	0.118	1602
Arm ave	3	1378.6	1.887	6079	0.105	1445
Arm ave	4	1055.9	5.329	4599	0.221	2334

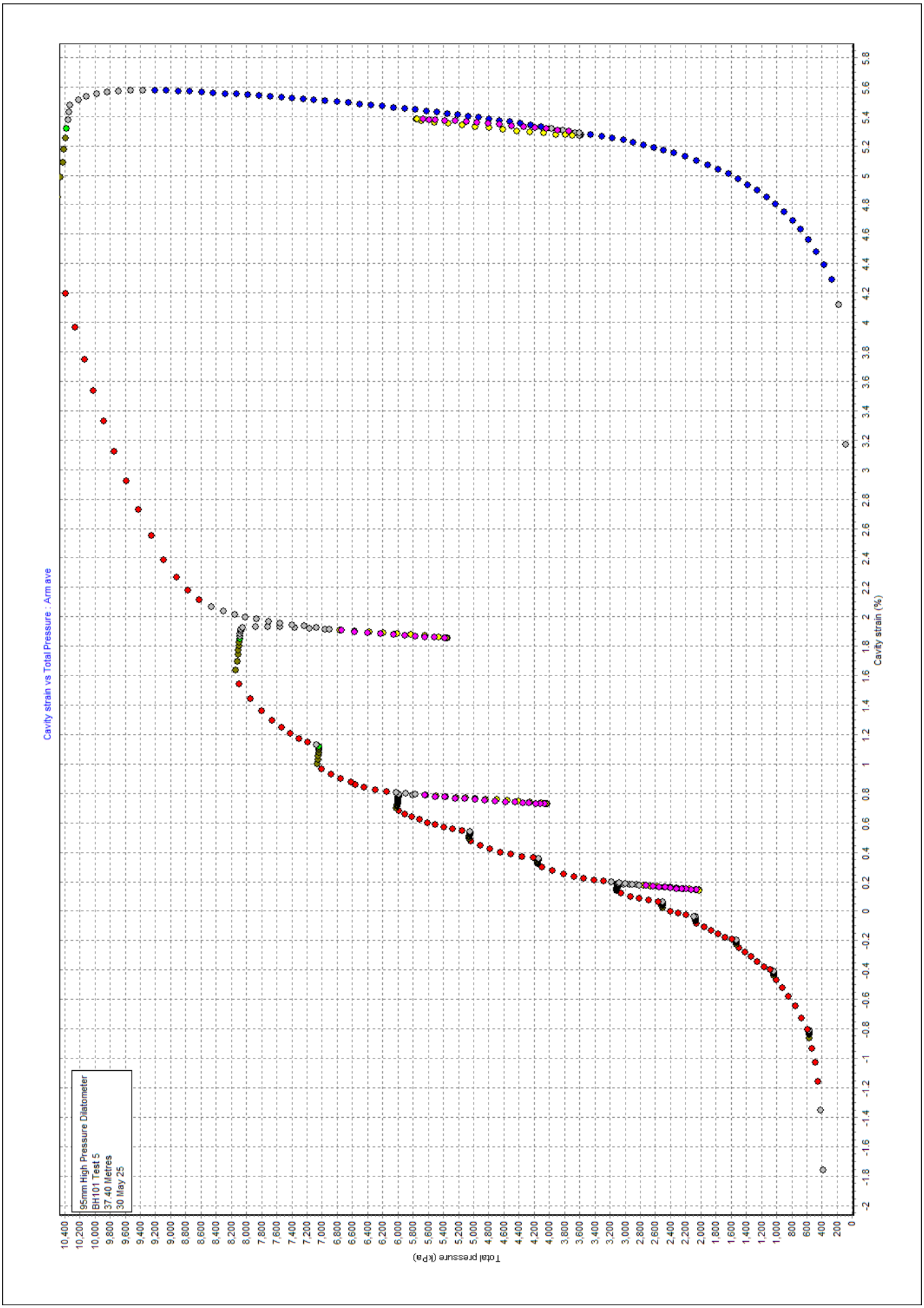
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

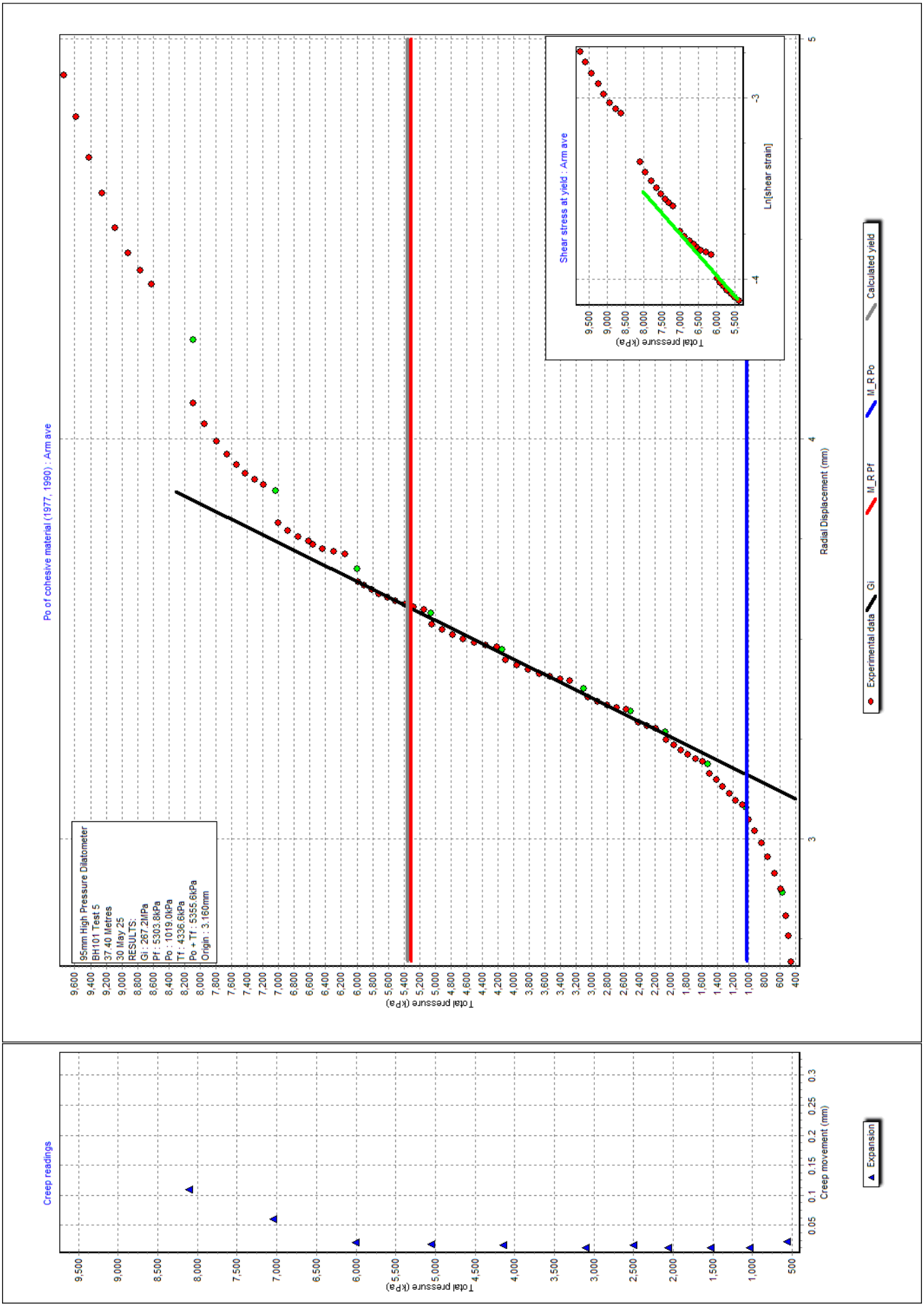
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	850.402	812.797	0.956
Arm ave	2	526.040	449.430	0.854
Arm ave	3	340.843	271.646	0.797
Arm ave	4	394.363	321.980	0.816

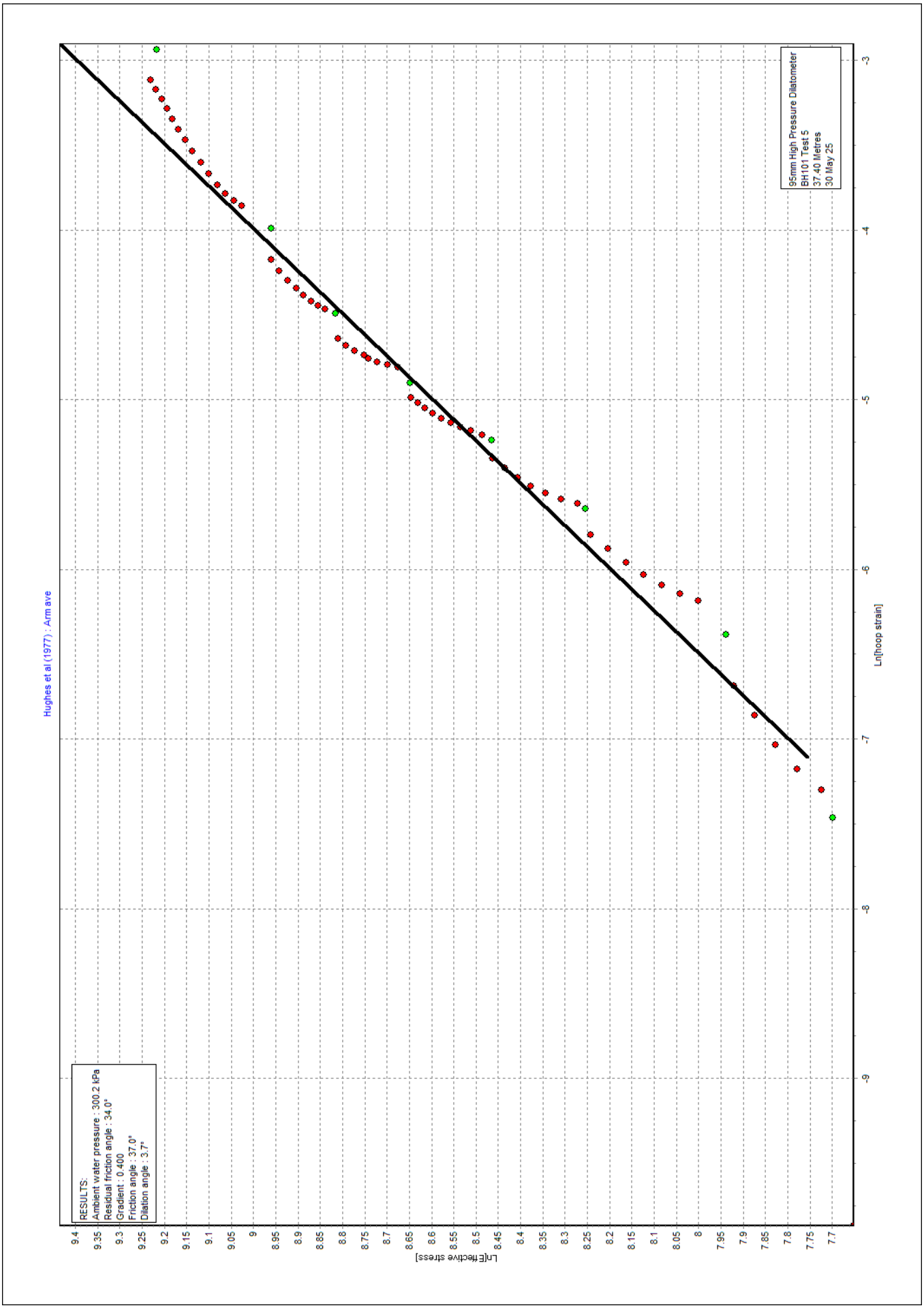
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 3.29
Po (kPa) : 1002
Cohesion (kPa) : 374
Angle of peak friction (deg) : 37.0
Angle of peak dilation (deg) : 3.7
Total yield stress (kPa) : 1943

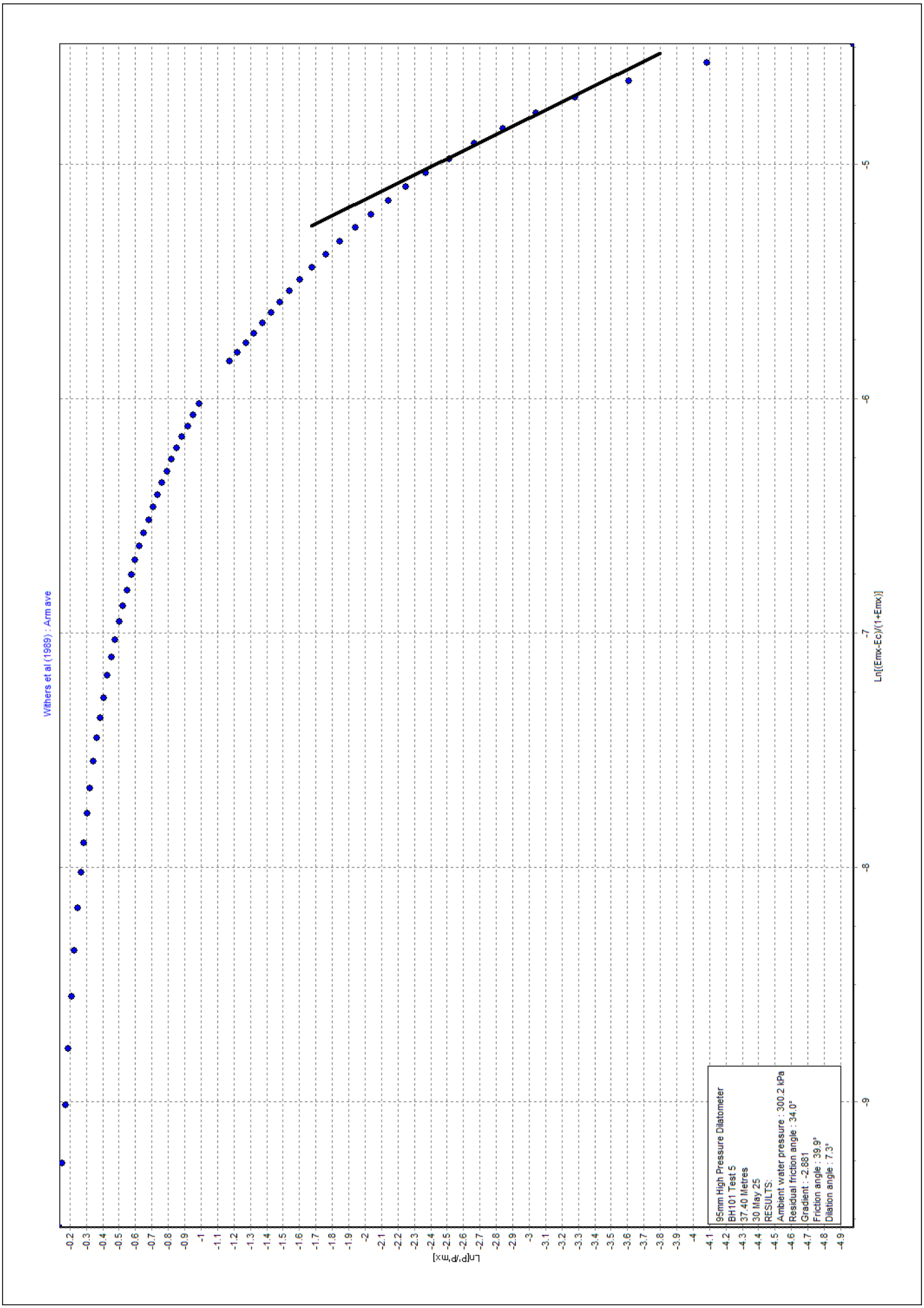
Grain to Tilbury
BH101 Test 5 - SUMMARY OF RESULTS

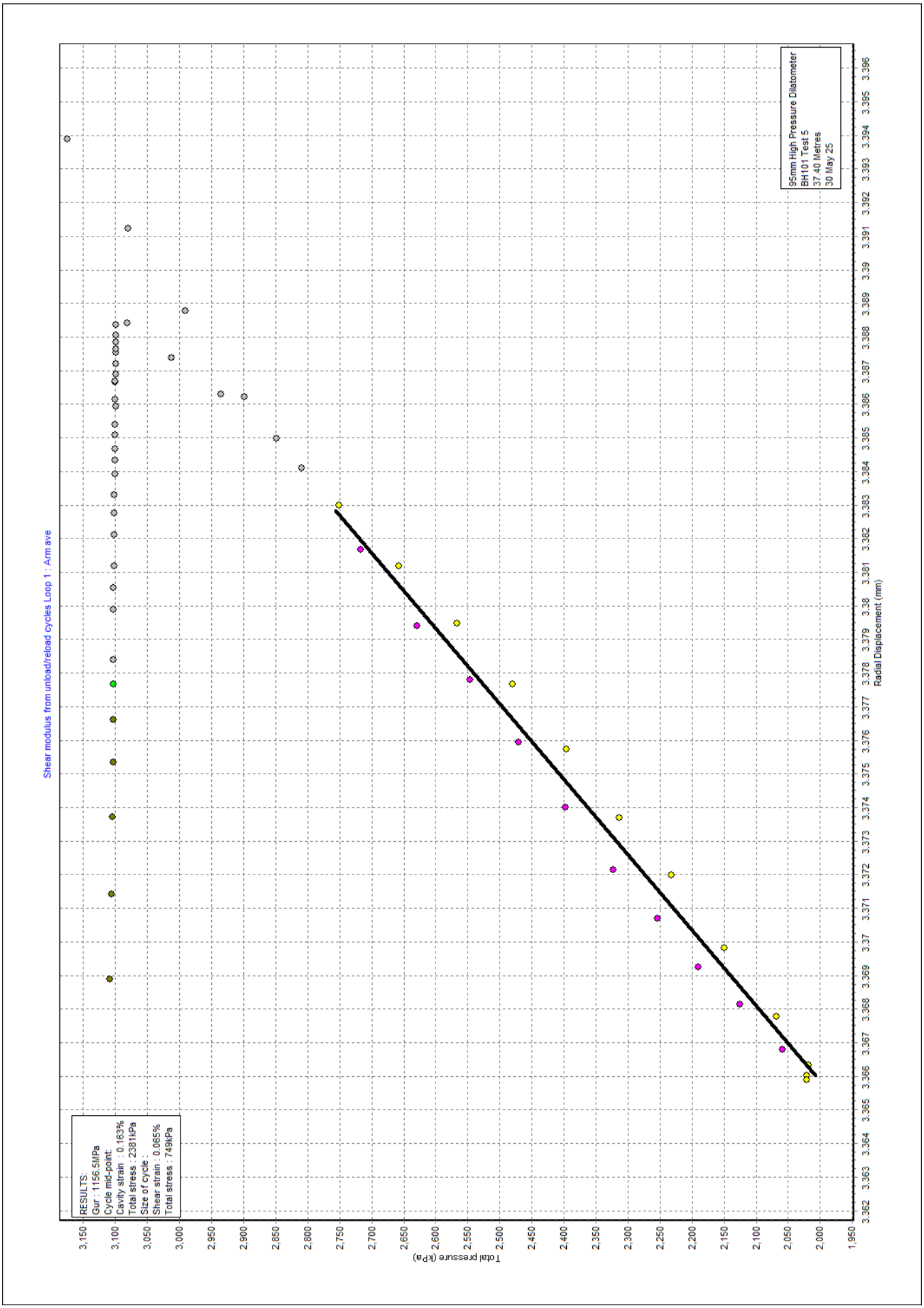
Total limit stress (kPa)	:	32128
G at first yield (MPa)	:	1182.4
Non-linear exponent	:	0.854
Janbu exponent	:	0.062
Correlation	:	0.340
Ambient pore water pressure (kPa)	:	300
Residual friction angle (deg)	:	34.0
Poisson's ratio	:	0.20

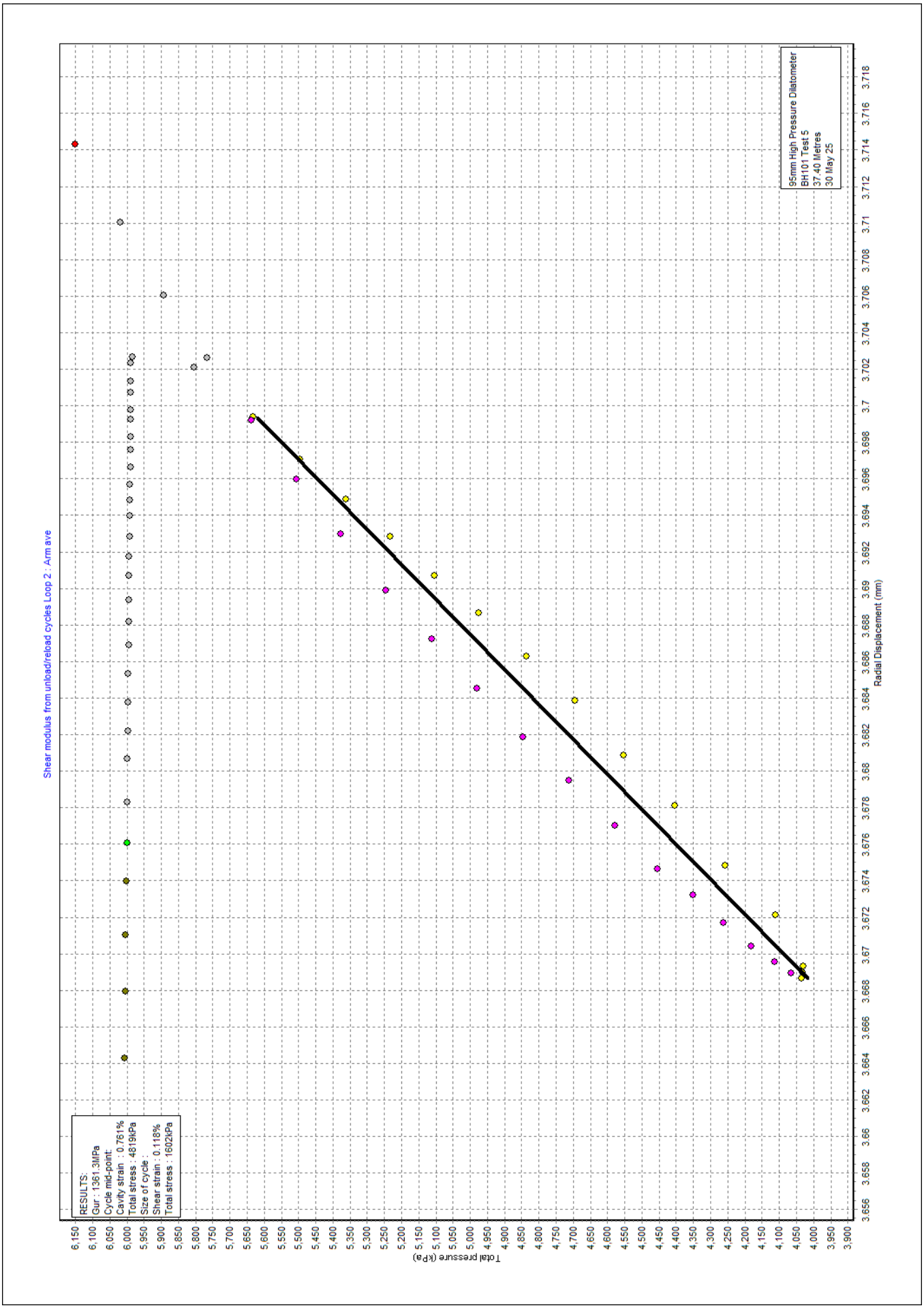

Cavity strain vs Total Pressure : Arm ave
95mm High Pressure Dilatometer
BH101 Test 5
37.40 Metres
30 May 25
Total pressure (kPa)
Cavity strain (%)

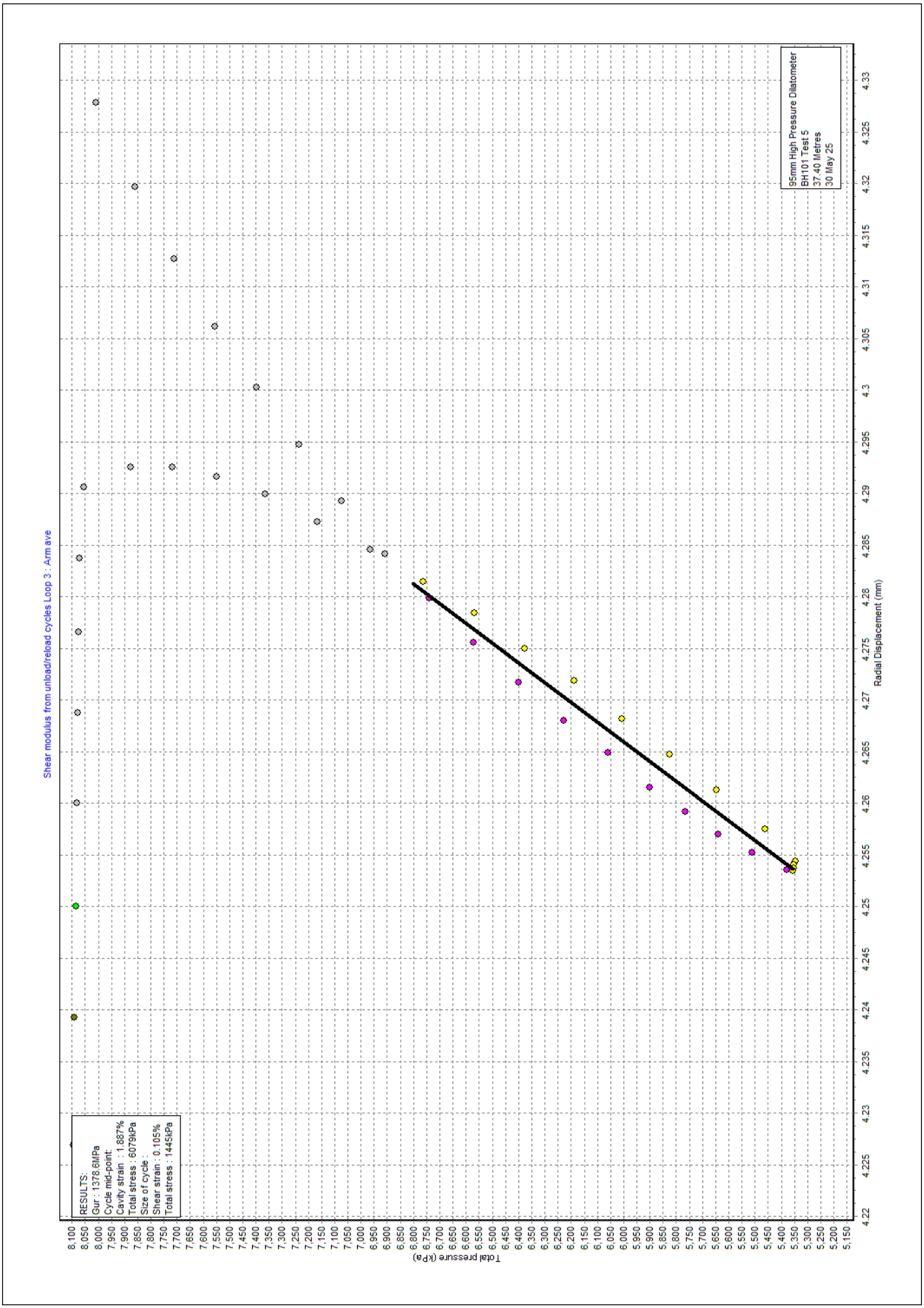

Po of cohesive material (1977, 1990) : Arm ave
95mm High Pressure Dilatometer
BH101 Test 5
37.40 Metres
30 May 25
RESULTS:
Gi : 267.2MPa
Pf : 5303.8kPa
Po : 1019.0kPa
Tf : 4336.6kPa
Po + Tf : 5355.6kPa
Origin : 3.160mm
Total pressure (kPa)
Radial Displacement (mm)
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Shear stress at yield : Arm ave
Ln[shear strain]
Creep readings
Creep movement (mm)
Expansion

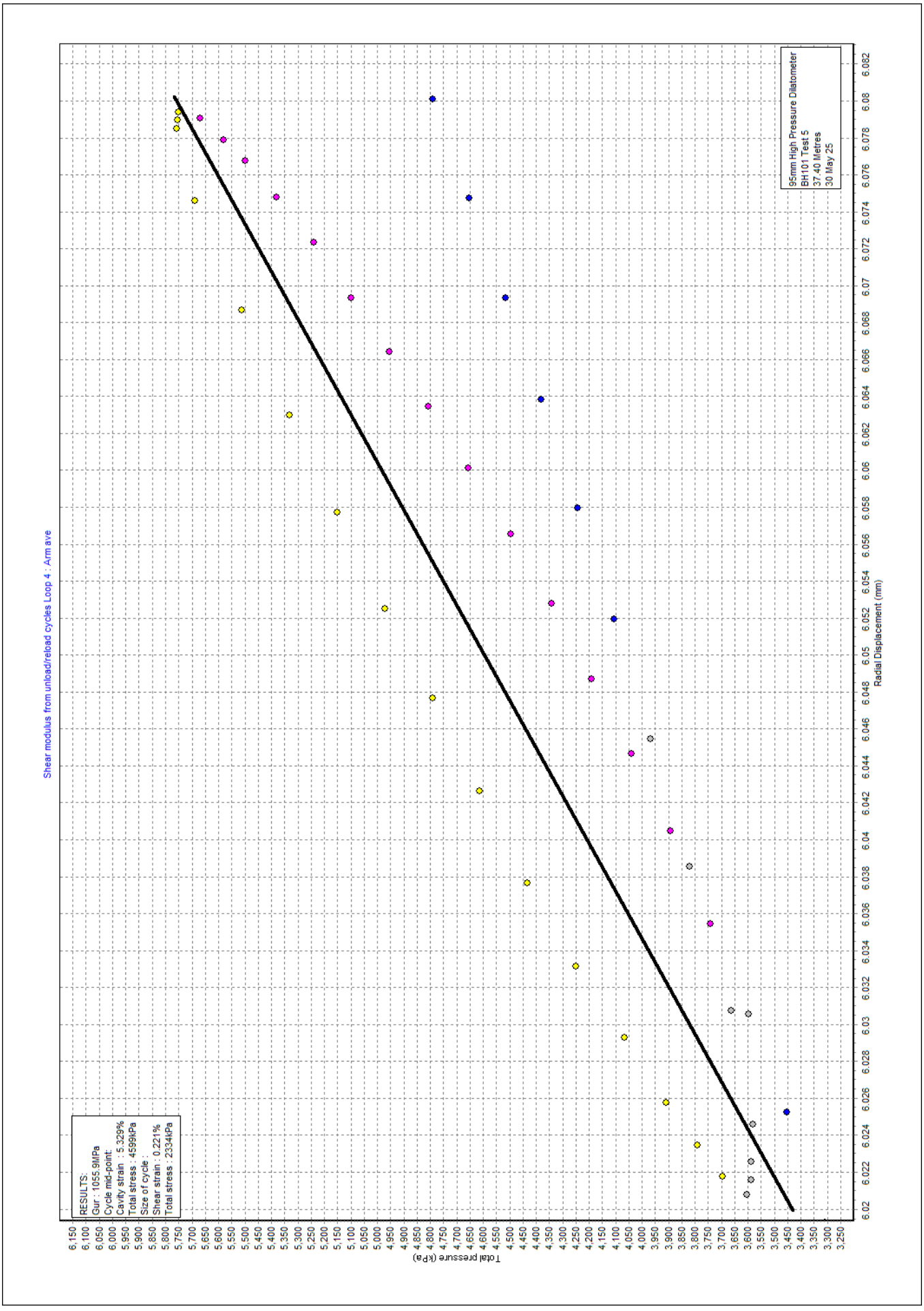

Hughes et al (1977) : Arm ave
RESULTS:
Ambient water pressure : 300.2 kPa
Residual friction angle : 34.0°
Gradient : 0.400
Friction angle : 37.0°
Dilation angle : 3.7°
95mm High Pressure Dilatometer
BH101 Test 5
37.40 Metres
30 May 25
Ln[effective stress]
Ln[hoop strain]

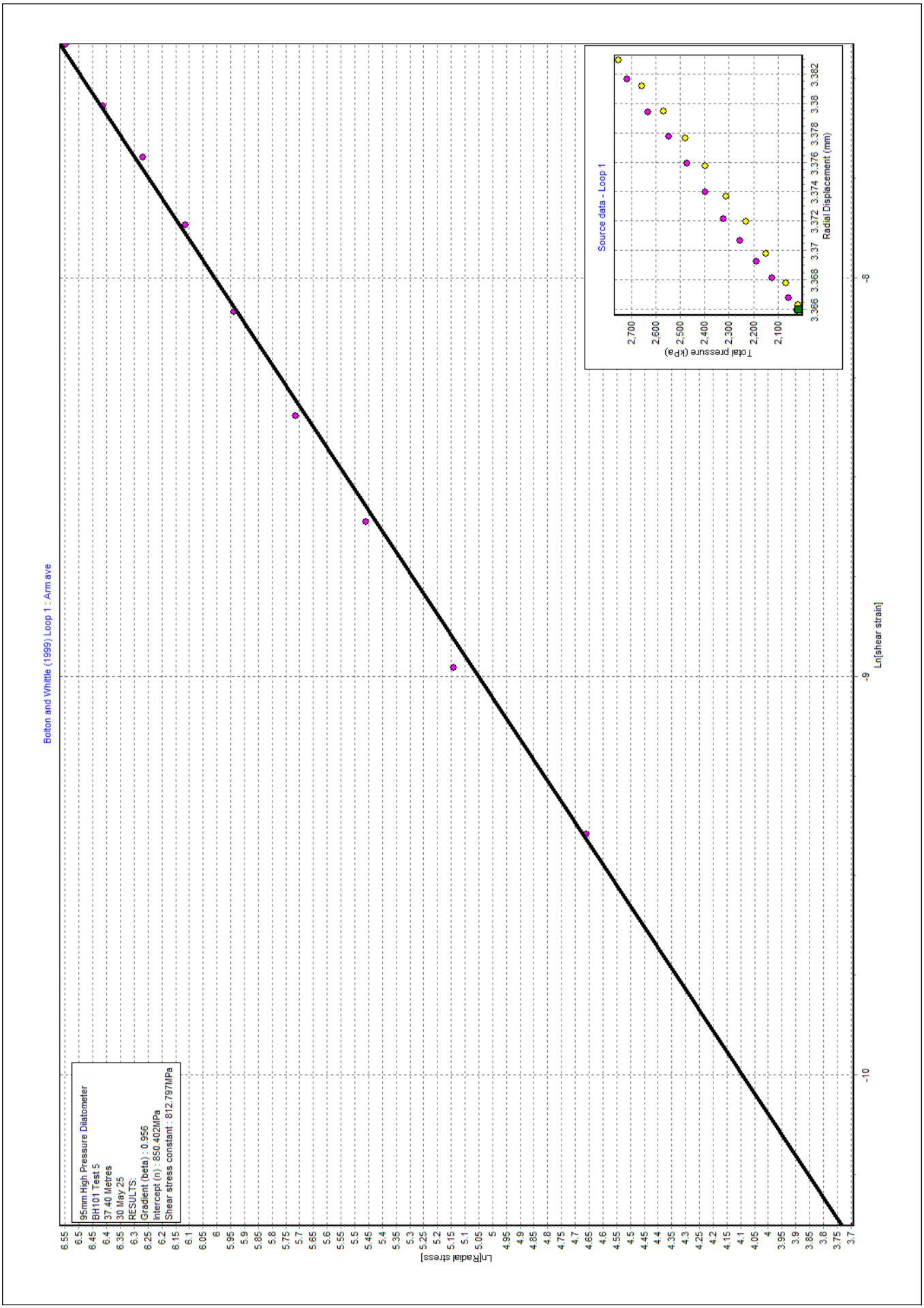

Withers et al (1989) : Arm ave
Ln[(Emx-Ec)/(1+Emx)]
Ln[P'/P'mx]
95mm High Pressure Dilatometer
BH101 Test 5
37.40 Metres
30 May 25
RESULTS:
Ambient water pressure : 300.2 kPa
Residual friction angle : 34.0°
Gradient : -2.881
Friction angle : 39.9°
Dilation angle : 7.3°

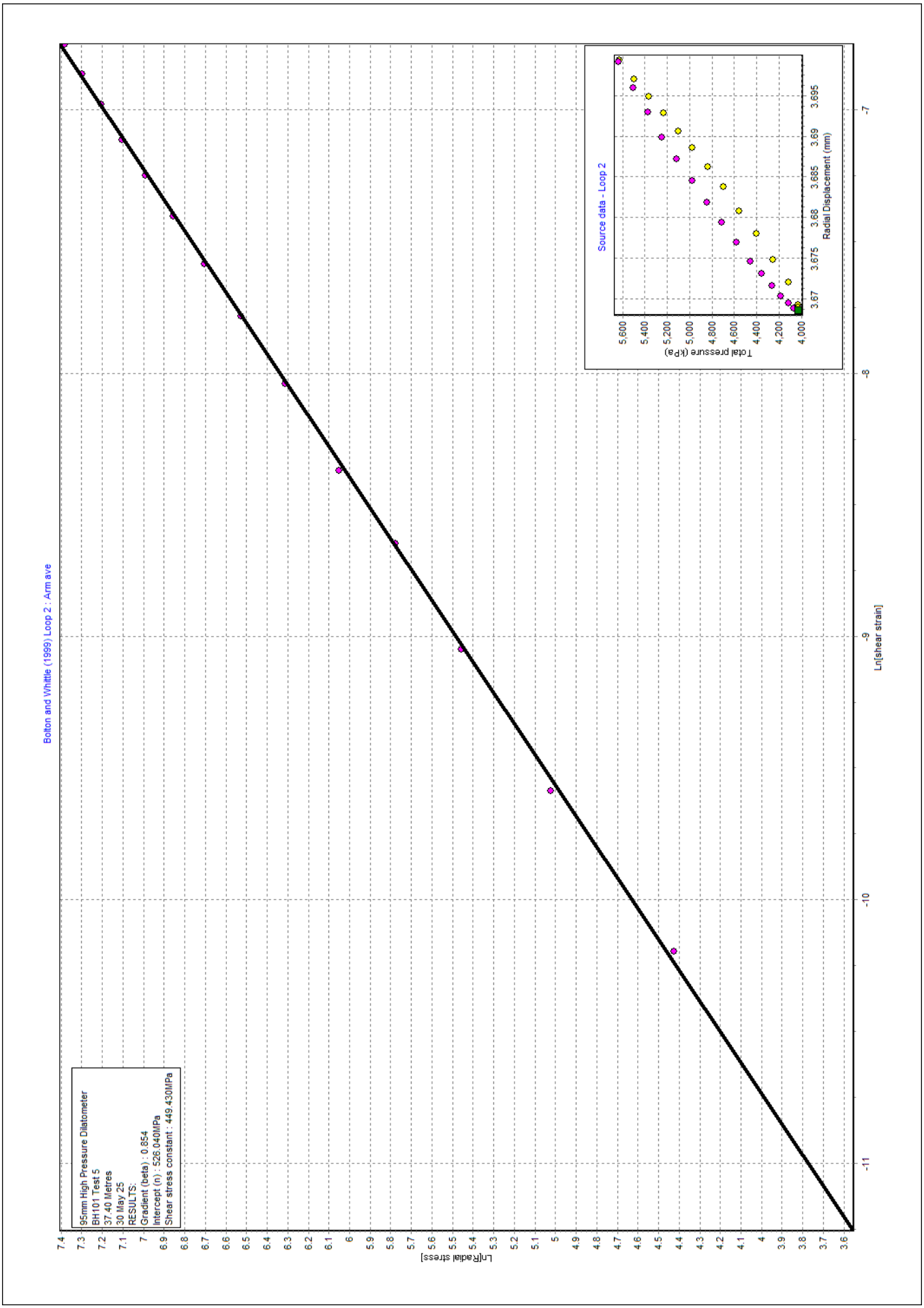

Shear modulus from unload/reload cycles Loop 1 : Arm ave
Total pressure (kPa)
Radial Displacement (mm)
95mm High Pressure Dilatometer
BH101 Test 5
37.40 Metres
30 May 25
RESULTS:
Gur : 1156.5MPa
Cycle mid-point:
Cavity strain : 0.163%
Total stress : 2381kPa
Size of cycle :
Shear strain : 0.065%
Total stress : 749kPa

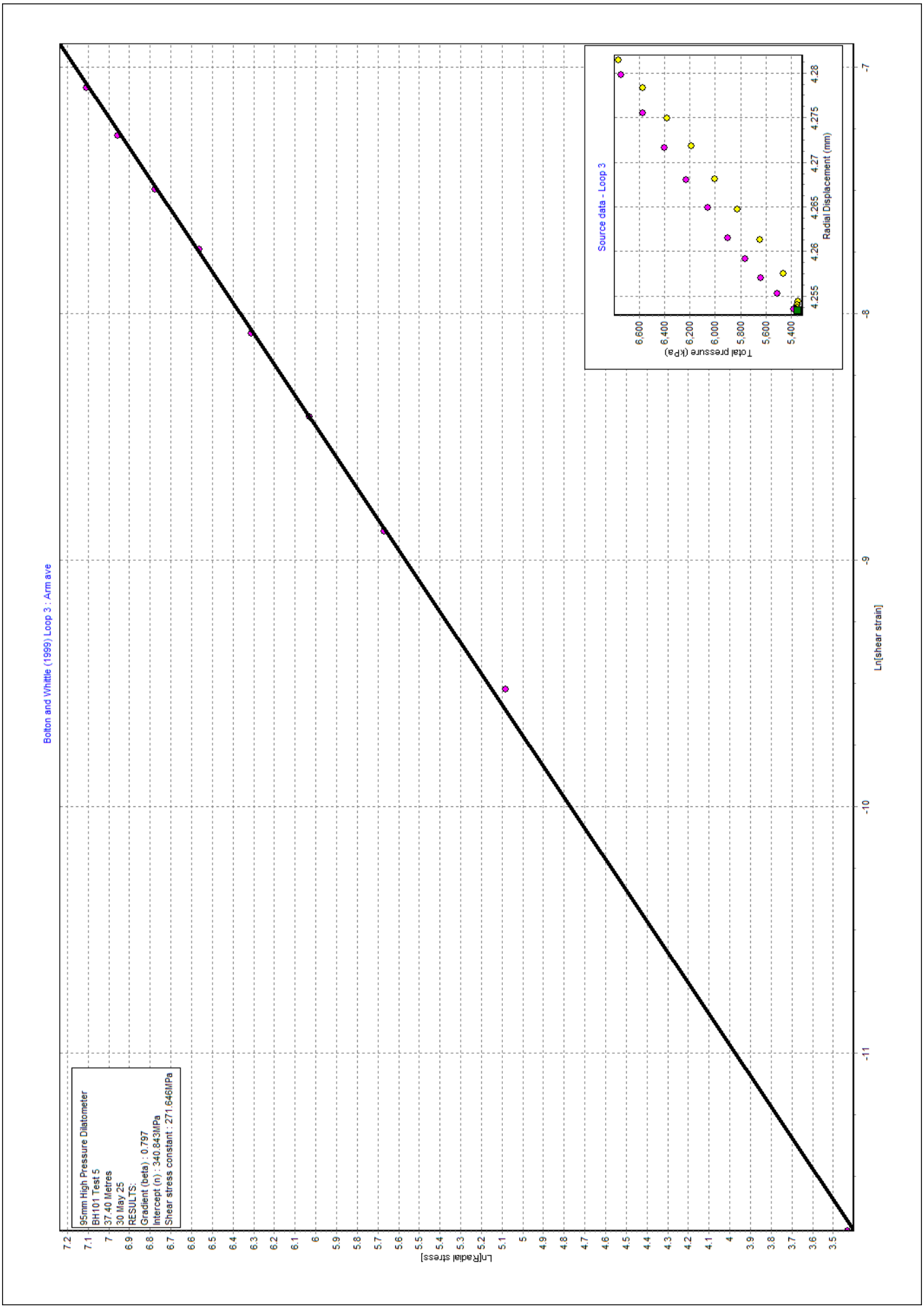

Shear modulus from unload/reload cycles Loop 2 : Arm ave
Total pressure (kPa)
Radial Displacement (mm)
95mm High Pressure Dilatometer
BH101 Test 5
37.40 Metres
30 May 25
RESULTS:
Gur : 1361.3MPa
Cycle mid-point:
Cavity strain : 0.761%
Total stress : 4819kPa
Size of cycle :
Shear strain : 0.118%
Total stress : 1602kPa

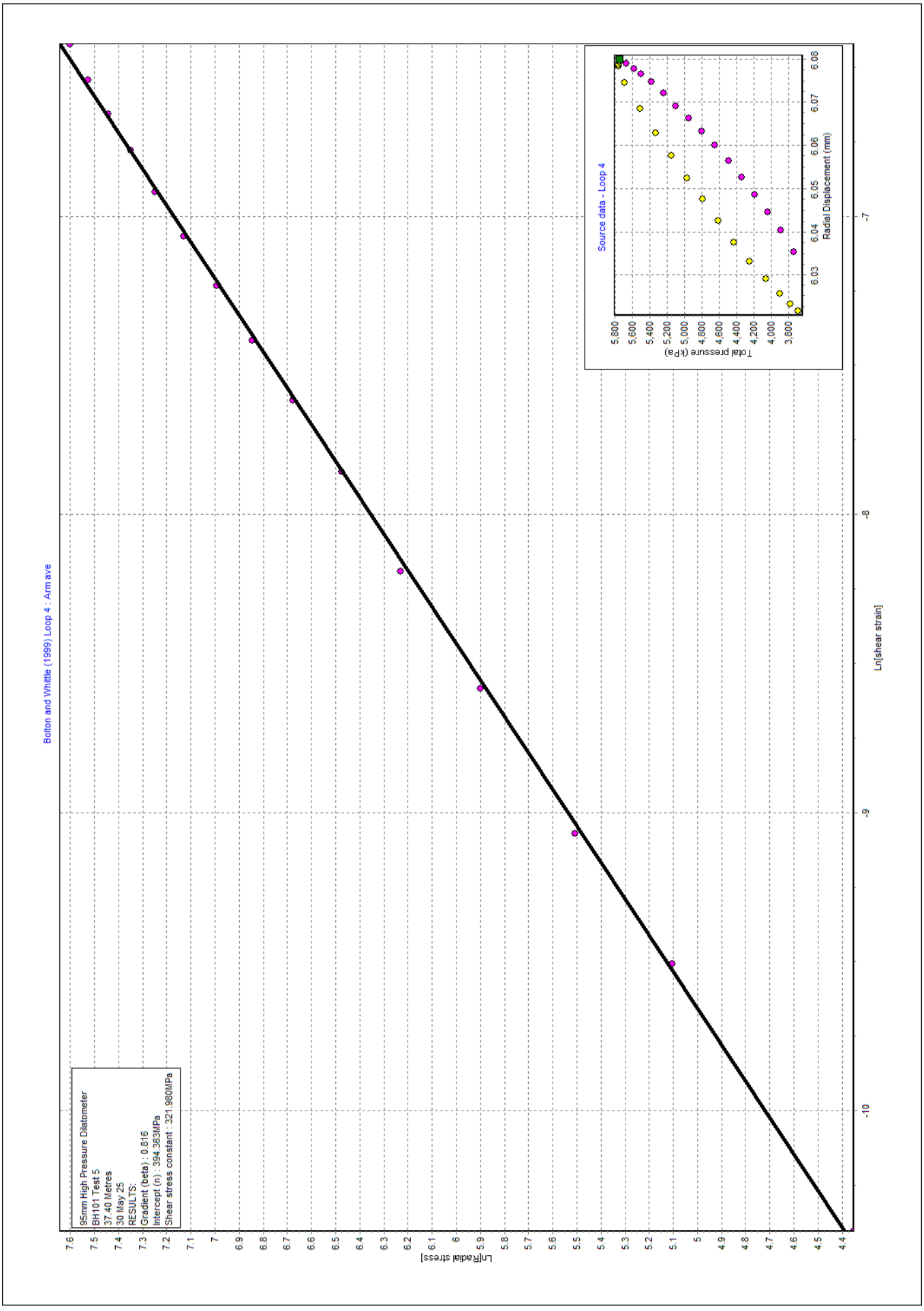

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 1378.6MPa
Cycle mid-point:
Cavity strain : 1.887%
Total stress : 6079kPa
Size of cycle :
Shear strain : 0.105%
Total stress : 1445kPa
95mm High Pressure Dilatometer
BH101 Test 5
37.40 Metres
30 May 25
Total pressure (kPa)
Radial Displacement (mm)

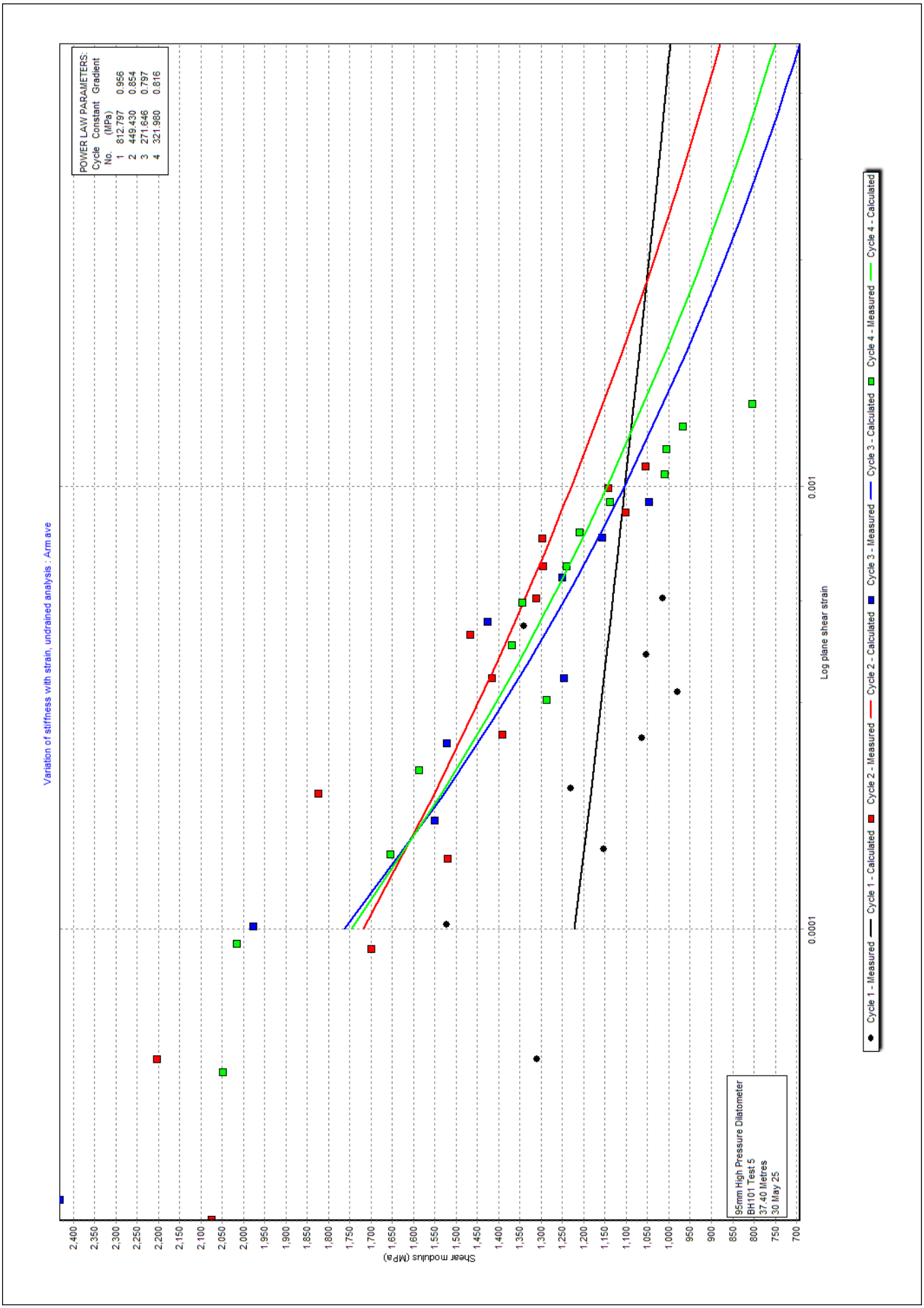

Shear modulus from unload/reload cycles Loop 4 : Arm ave
Total pressure (kPa)
Radial Displacement (mm)
95mm High Pressure Dilatometer
BH101 Test 5
37.40 Metres
30 May 25
RESULTS:
Gur : 1055.9MPa
Cycle mid-point:
Cavity strain : 5.329%
Total stress : 4599kPa
Size of cycle :
Shear strain : 0.221%
Total stress : 2334kPa

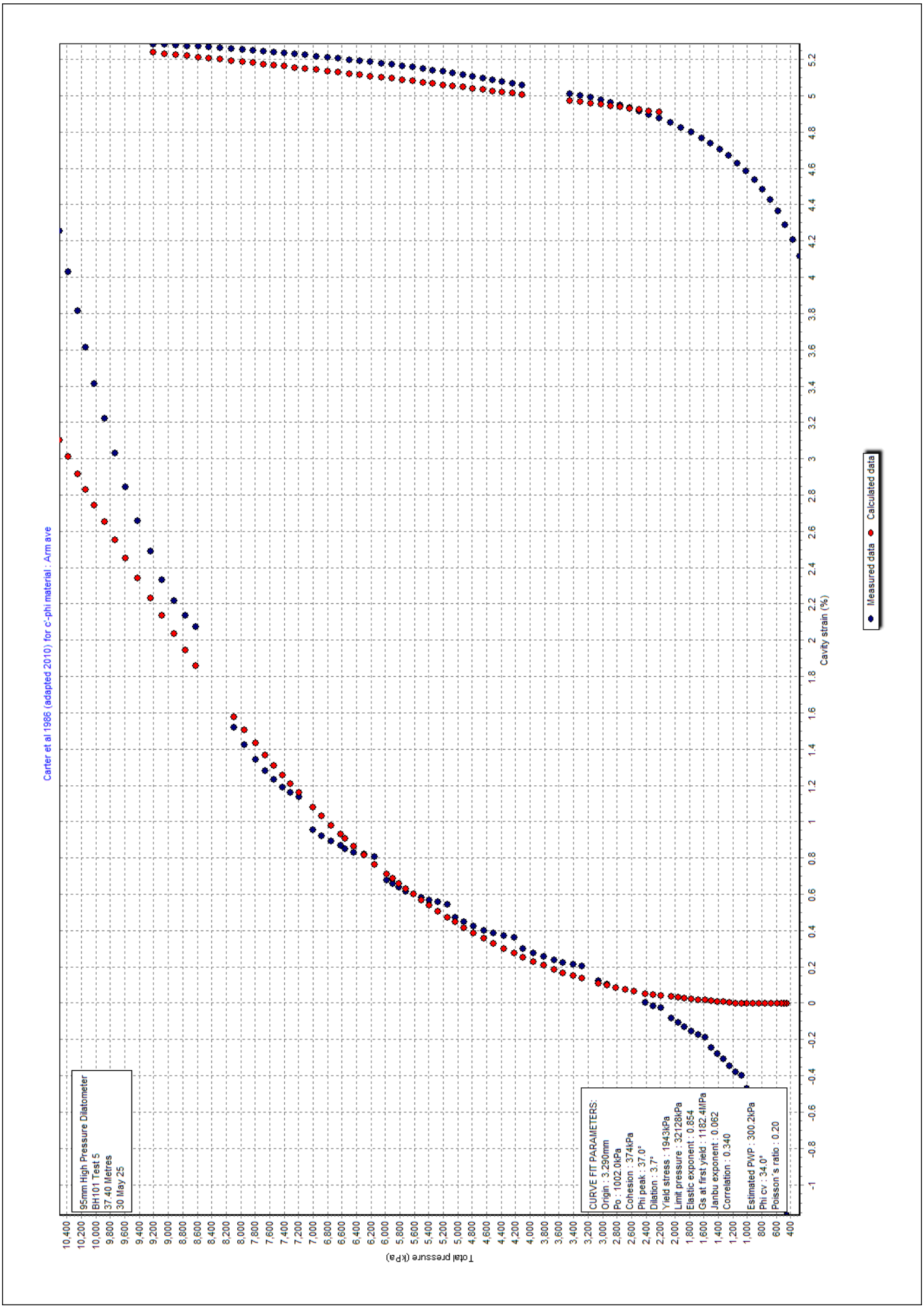

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH101 Test 5
37.40 Metres
30 May 25
RESULTS:
Gradient (beta) : 0.956
Intercept (n) : 850.402MPa
Shear stress constant : 812.797MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

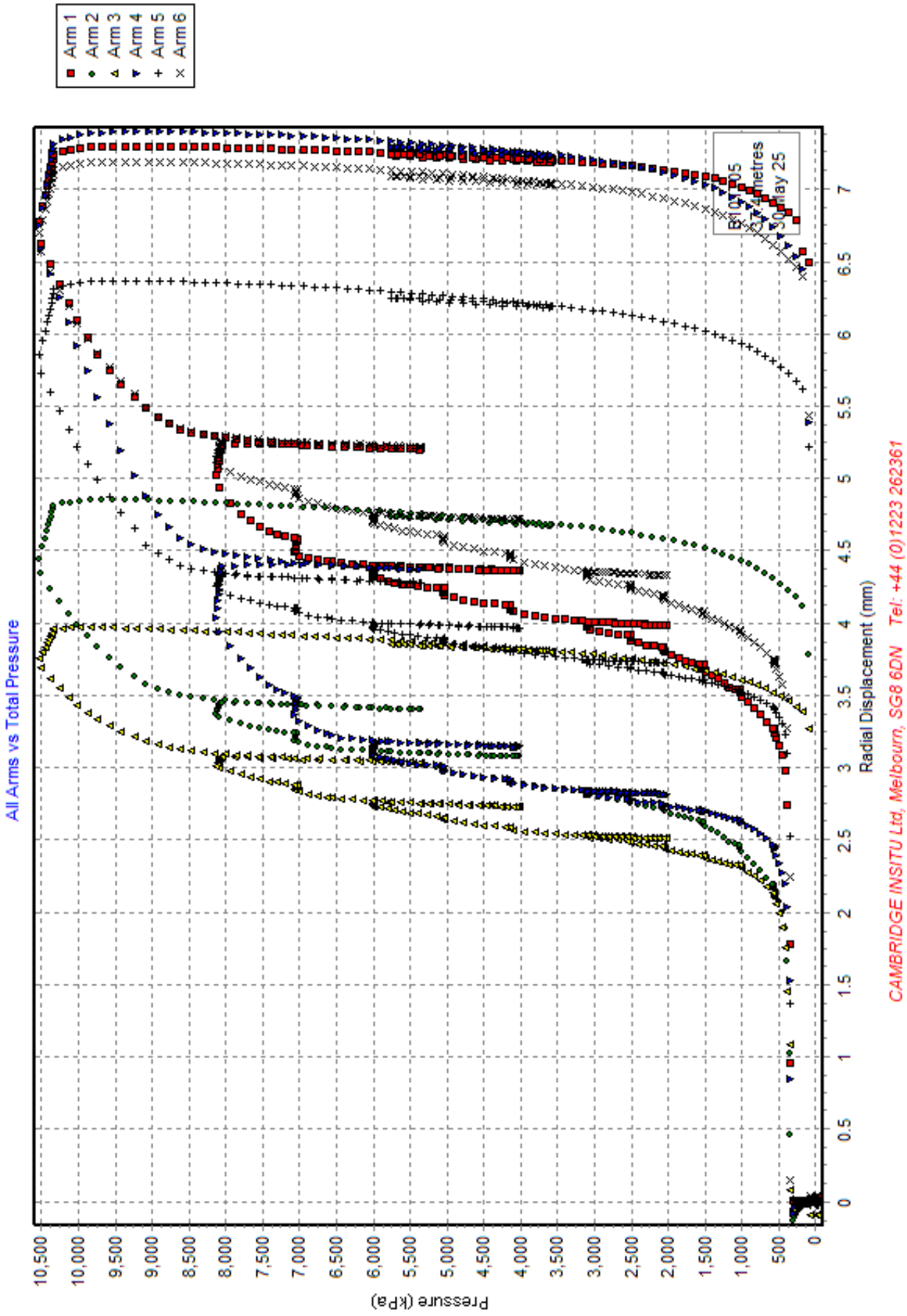

Bolton and Whittle (1999) Loop 2 : Arm ave
95mm High Pressure Dilatometer
BH101 Test 5
37.40 Metres
30 May 25
RESULTS:
Gradient (beta) : 0.854
Intercept (n) : 526.040MPa
Shear stress constant : 449.430MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

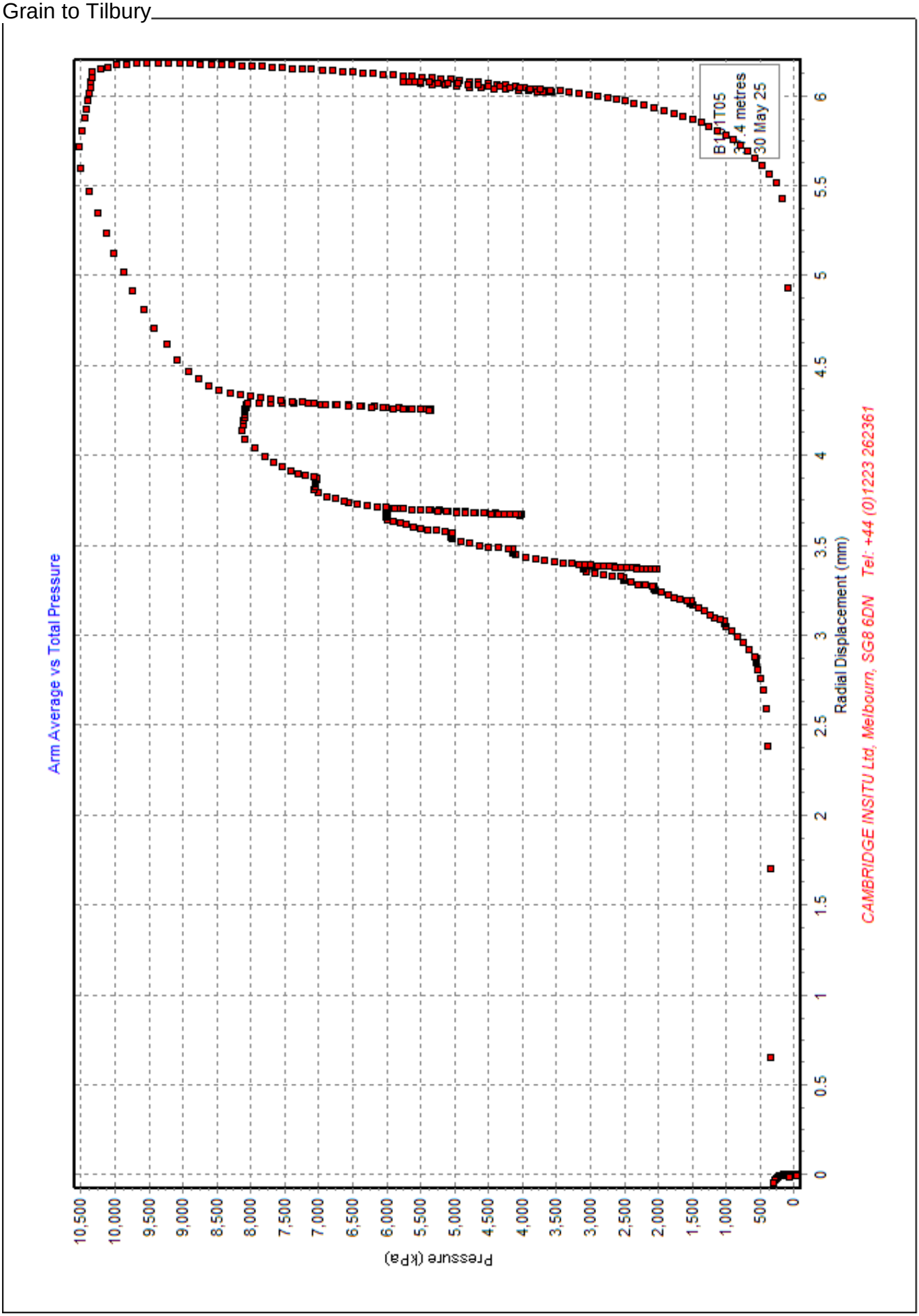

Bolton and Whittle (1999) Loop 3 : Arm ave
95mm High Pressure Dilatometer
BH101 Test 5
37.40 Metres
30 May 25
RESULTS:
Gradient (beta) : 0.797
Intercept (n) : 340.843MPa
Shear stress constant : 271.646MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)

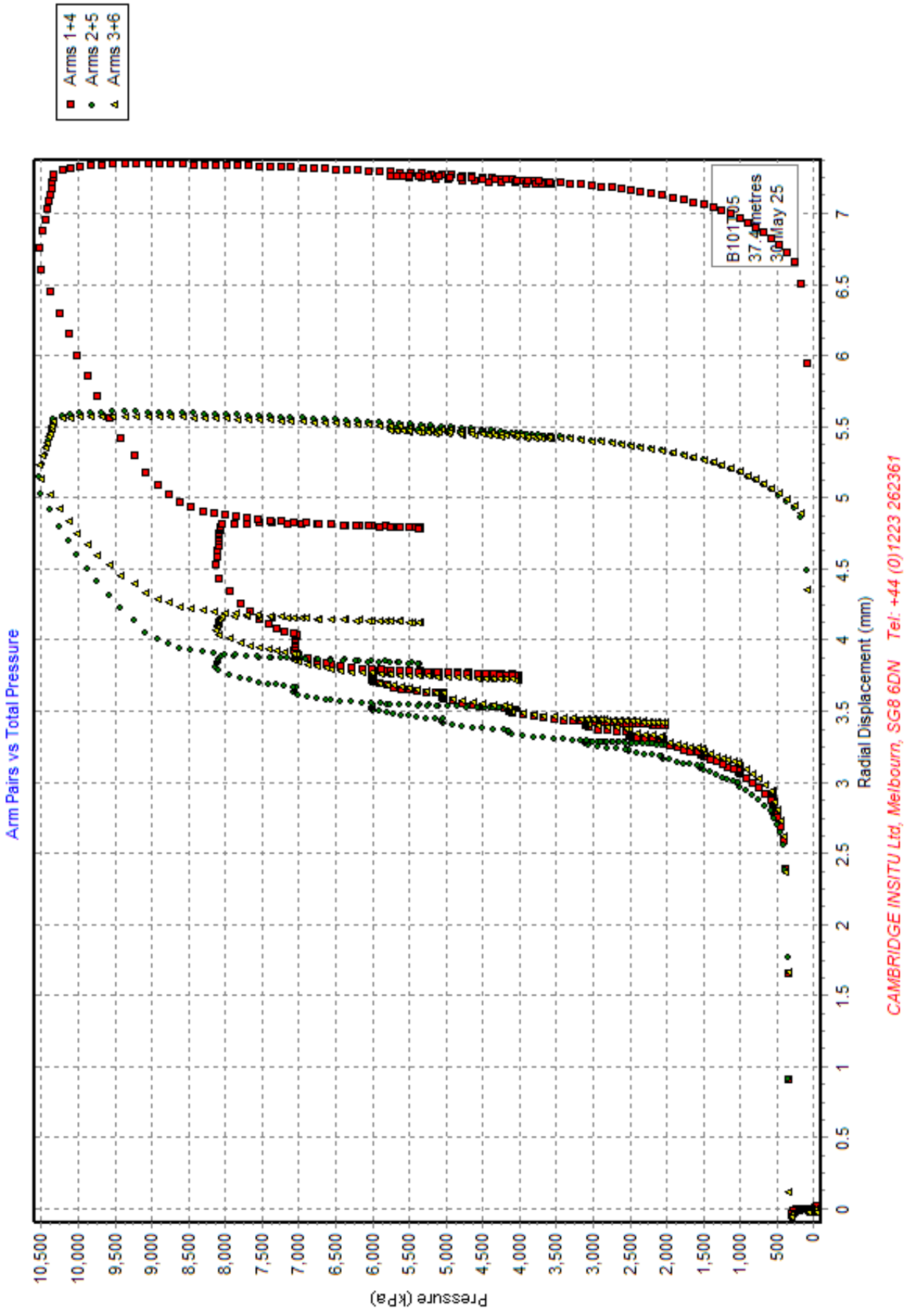

Bolton and Whittle (1999) Loop 4 : Arm ave
95mm High Pressure Dilatometer
BH101 Test 5
37.40 Metres
30 May 25
RESULTS:
Gradient (beta) : 0.816
Intercept (n) : 394.363MPa
Shear stress constant : 321.980MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 4
Total pressure (kPa)
Radial Displacement (mm)

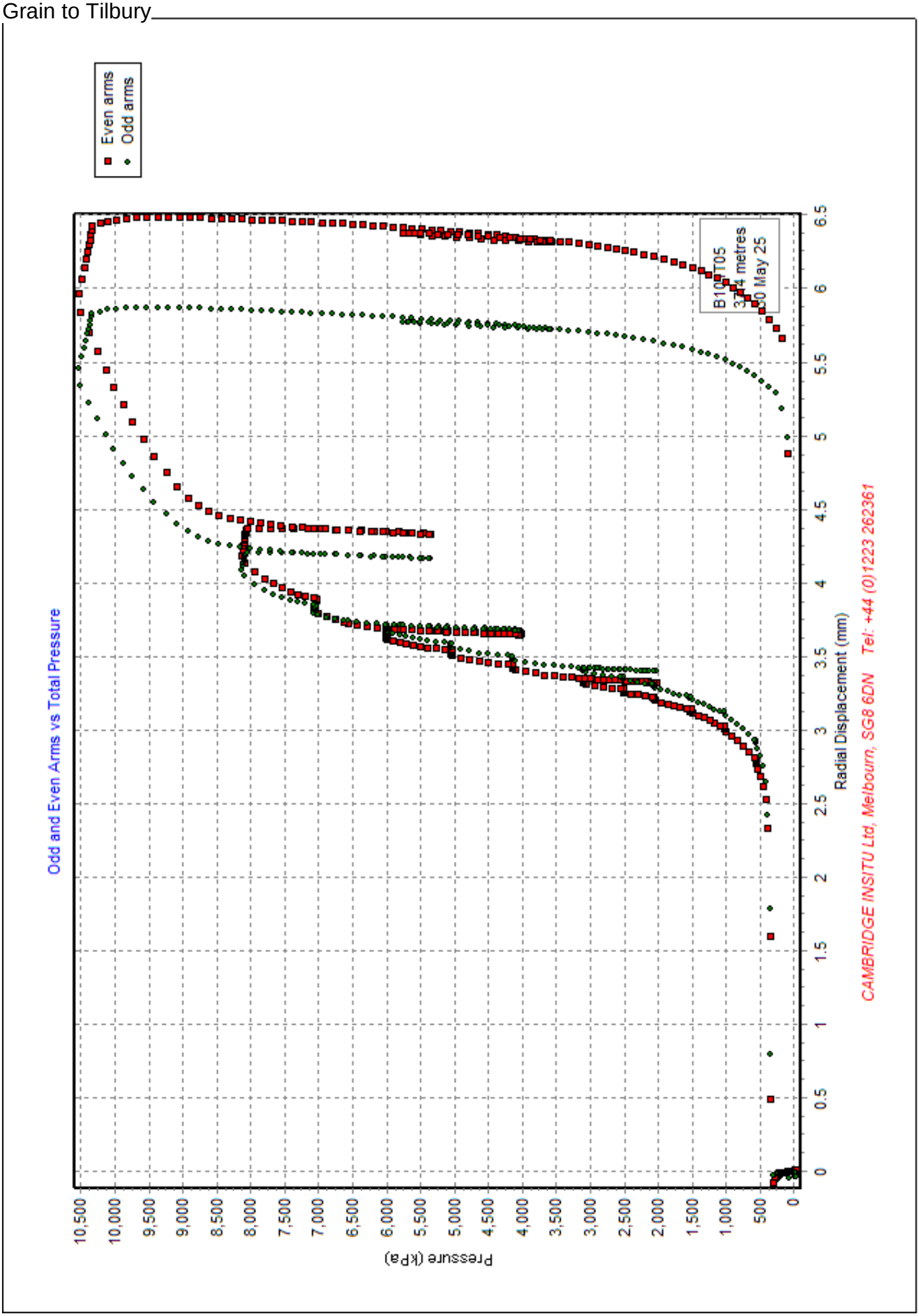

Variation of stiffness with strain, undrained analysis : Arm ave
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 812.797 0.956
2 449.430 0.854
3 271.646 0.797
4 321.980 0.816
Shear modulus (MPa)
Log plane shear strain
0.0001
0.001
95mm High Pressure Dilatometer
BH101 Test 5
37.40 Metres
30 May 25
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
Cycle 4 - Measured
Cycle 4 - Calculated


Carter et al 1986 (adapted 2010) for c-phi material : Arm ave
95mm High Pressure Dilatometer
BH101 Test 5
37.40 Metres
30 May 25
CURVE FIT PARAMETERS:
Origin : 3.290mm
Po : 1002.0kPa
Cohesion : 374kPa
Phi peak : 37.0°
Dilation : 3.7°
Yield stress : 1943kPa
Limit pressure : 32128kPa
Elastic exponent : 0.854
Gs at first yield : 1182.4MPa
Janbu exponent : 0.062
Correlation : 0.340
Estimated PWP : 300.2kPa
Phi cv : 34.0°
Poisson's ratio : 0.20
Measured data
Calculated data
Total pressure (kPa)
Cavity strain (%)


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
BH05
CP 4 metres
30 May 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arm Average vs Total Pressure
B1/T05
3.4 metres
30 May 25
Radial Displacement (mm)
Pressure (kPa)
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Arms 1+4
Arms 2+5
Arms 3+6
B101705
37.4 metres
30 May 25
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
B10T05
3.4 metres
30 May 25
Odd and Even Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to Tilbury
BH101 Test 6 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Grain to Tilbury
Borehole : BH101
Test name : BH101 Test 6
Test date : 2 Jun 25
Test depth : 41.40 Metres
Water table : 6.8 Metres
Ambient PWP : 339.4 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDP/RW on 17 Jul 25

Remarks:

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=2.93"
Po from Marsland & Randolph (kPa) : "Arm ave=1285.0"
Best estimate of Po (kPa) : "Arm ave=876.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=4033.7"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 34.0
Angle of internal friction (°) : "Arm ave=35.2"
Dilation angle (°) : "Arm ave=1.4"
Gradient of log-log plot : "Arm ave=0.374"

[Withers et al 1989]
Angle of internal friction (°) : "Arm ave=29.5"
Dilation angle (°) : "Arm ave=-5.3"
Gradient of log-log plot : "Arm ave=-2.221"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=119.4"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	935.1	0.405	2343	0.068	636
Arm ave	2	1199.7	1.608	3816	0.073	877
Arm ave	3	1225.0	3.643	5118	0.111	1360
Arm ave	4	879.1	7.637	3483	0.205	1801

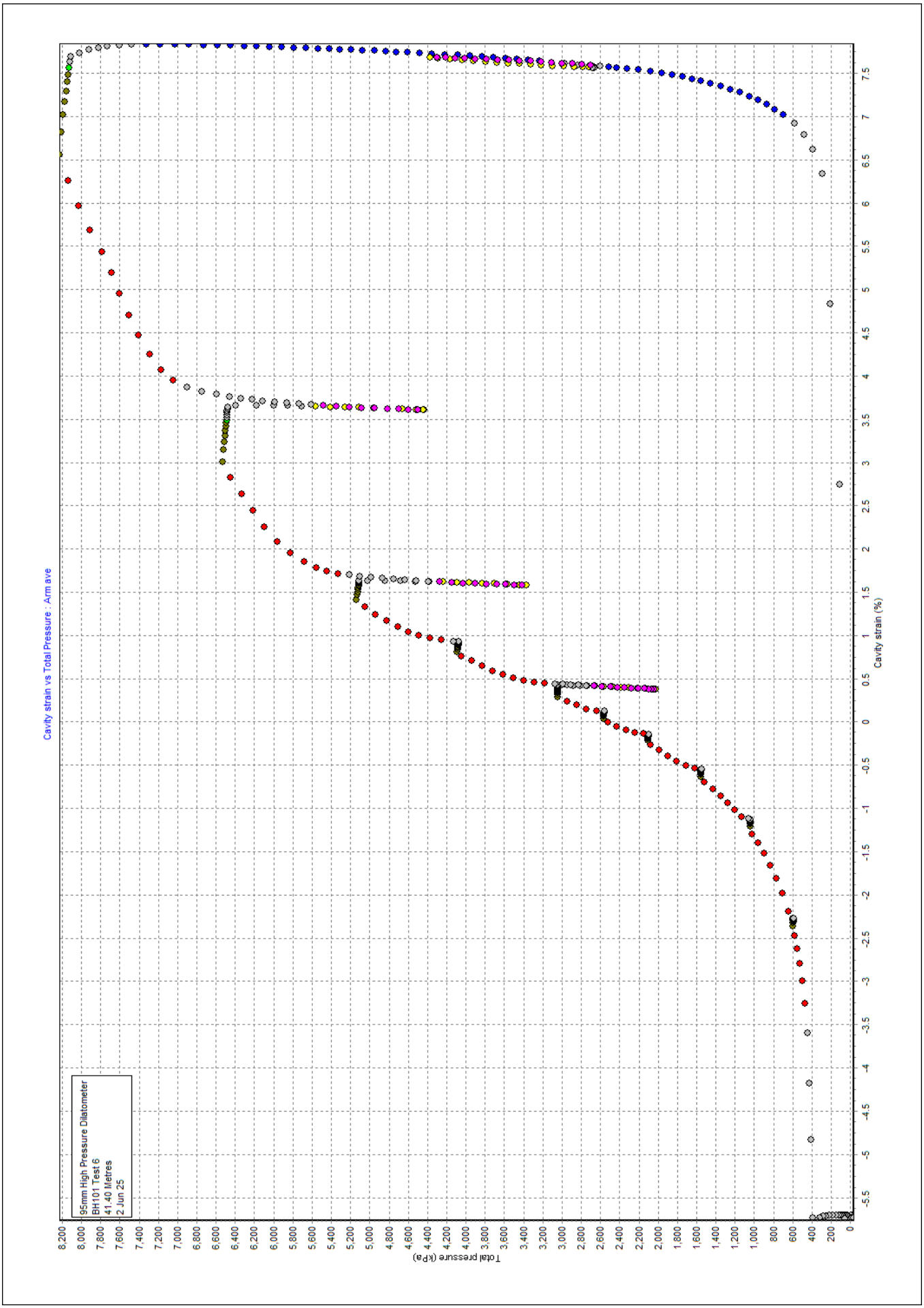
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

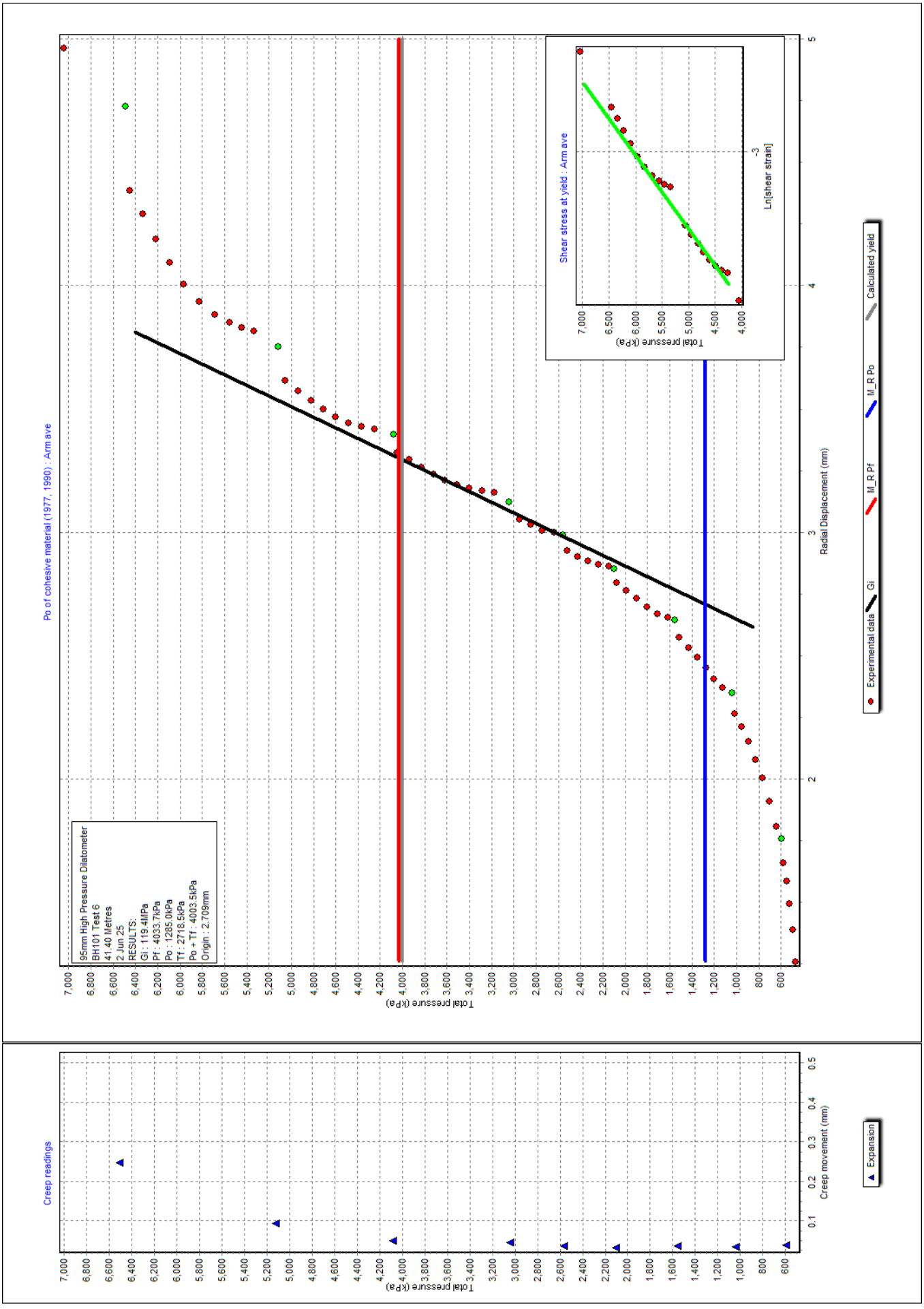
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	882.836	875.620	0.992
Arm ave	2	549.952	488.759	0.889
Arm ave	3	369.966	311.369	0.842
Arm ave	4	233.009	178.383	0.766

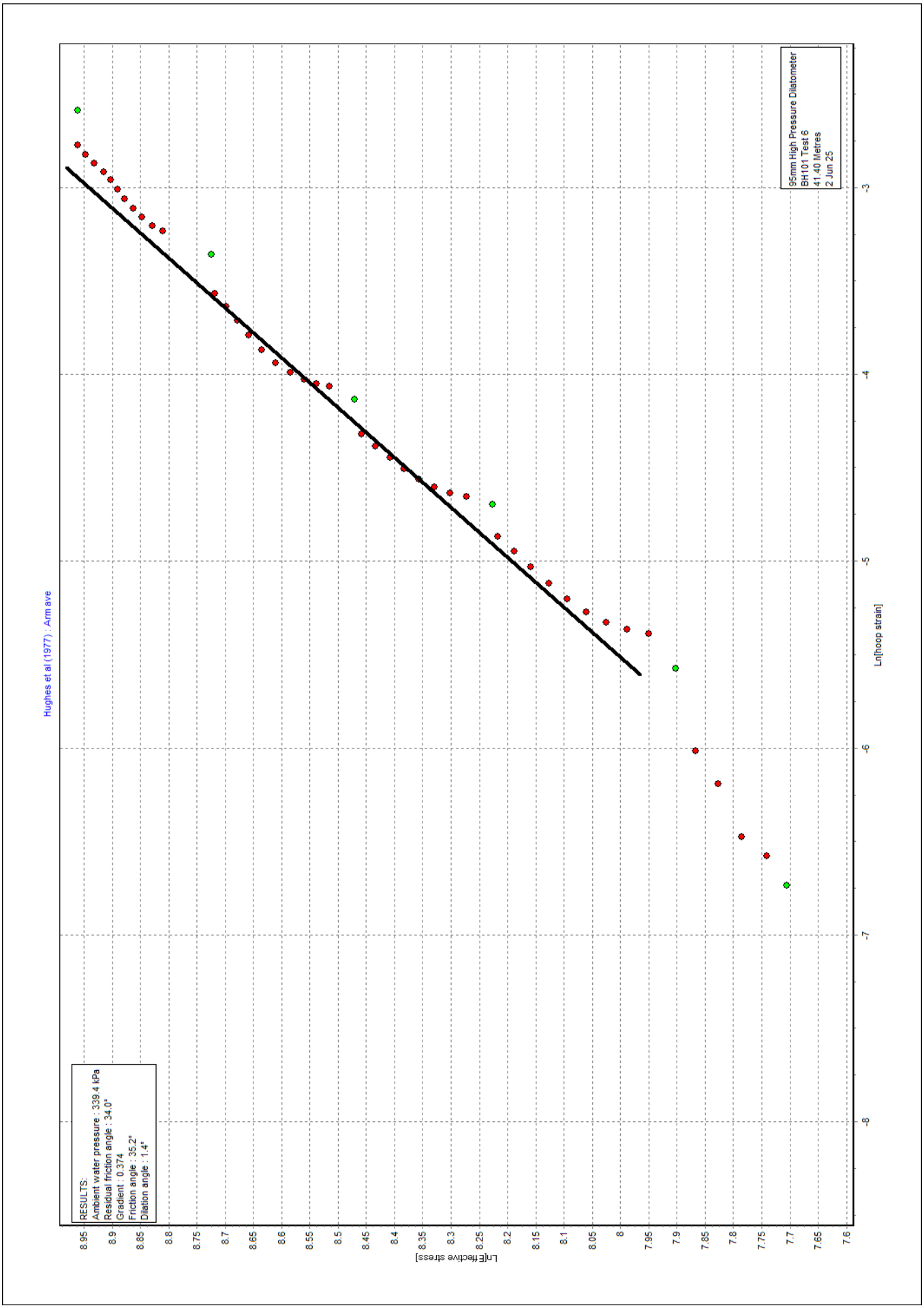
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 2.93
Po (kPa) : 876
Cohesion (kPa) : 46
Angle of peak friction (deg) : 35.2
Angle of peak dilation (deg) : 1.4
Total yield stress (kPa) : 1338

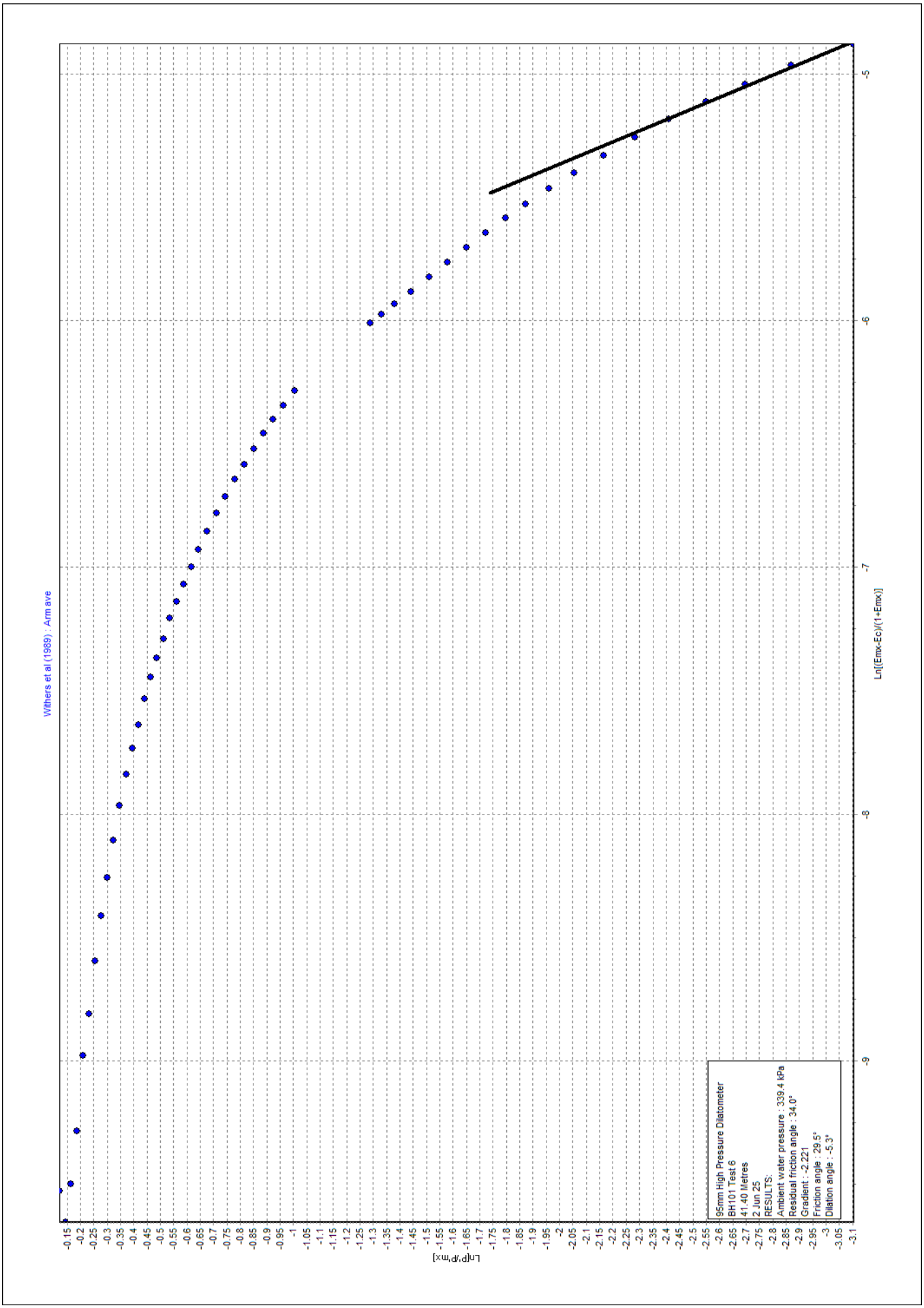
Grain to Tilbury
BH101 Test 6 - SUMMARY OF RESULTS

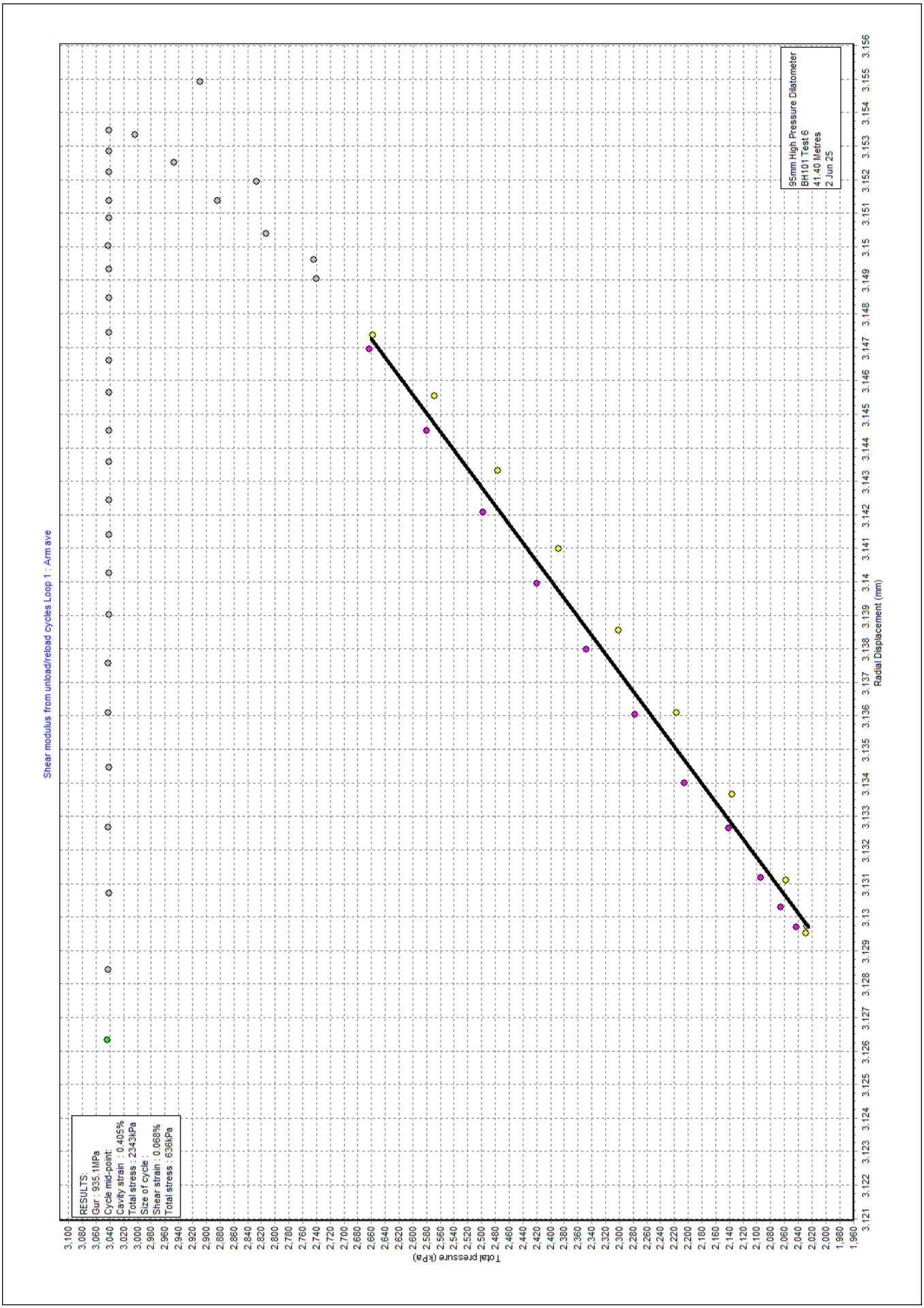
Total limit stress (kPa)	:	18294
G at first yield (MPa)	:	1203.4
Non-linear exponent	:	0.842
Janbu exponent	:	-0.041
Correlation	:	0.074
Ambient pore water pressure (kPa)	:	339
Residual friction angle (deg)	:	34.0
Poisson's ratio	:	0.20

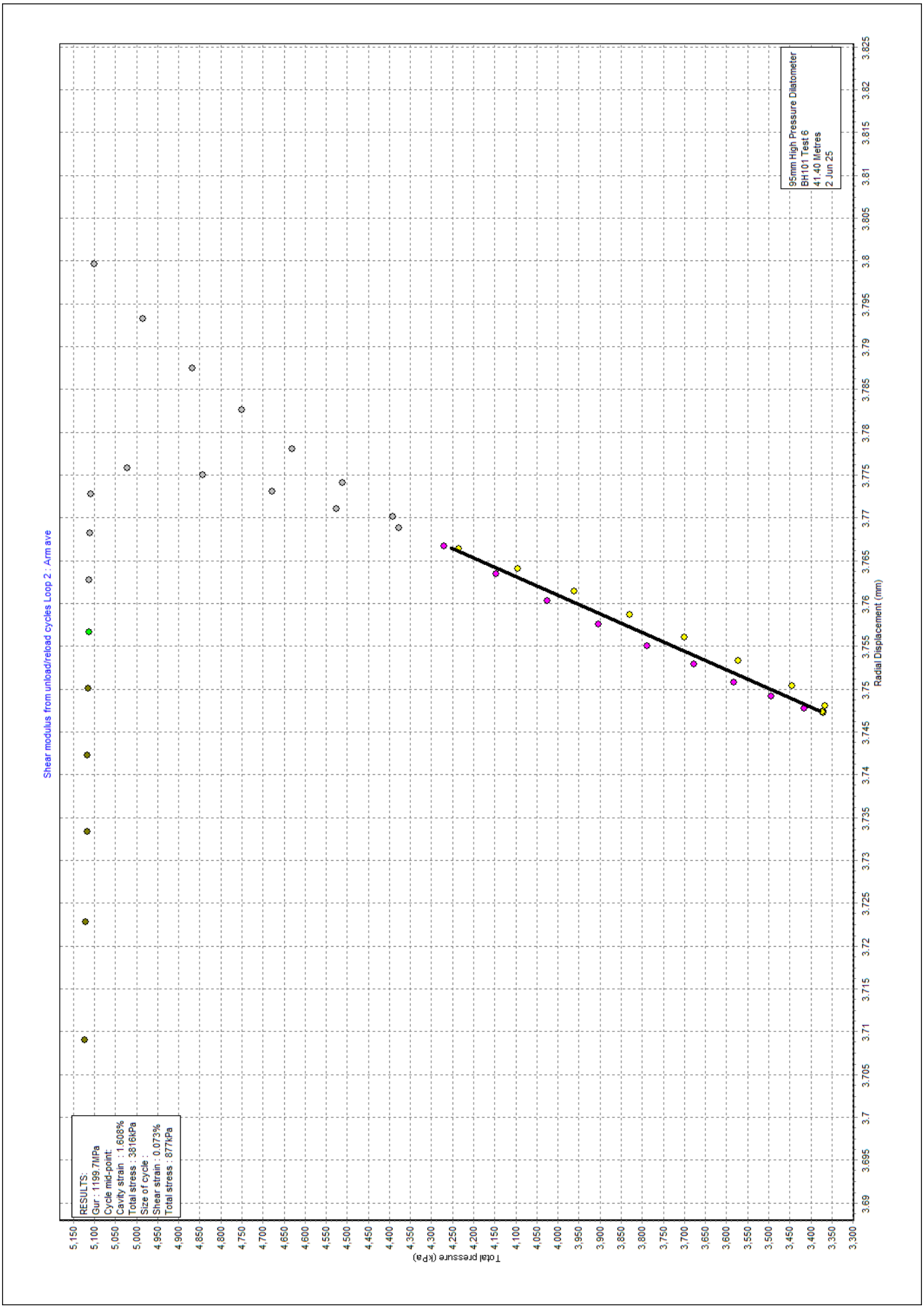

Cavity strain vs Total Pressure : Arm ave
95mm High Pressure Dilatometer
BH101 Test 6
41.40 Metres
2 Jun 25
Total pressure (kPa)
Cavity strain (%)

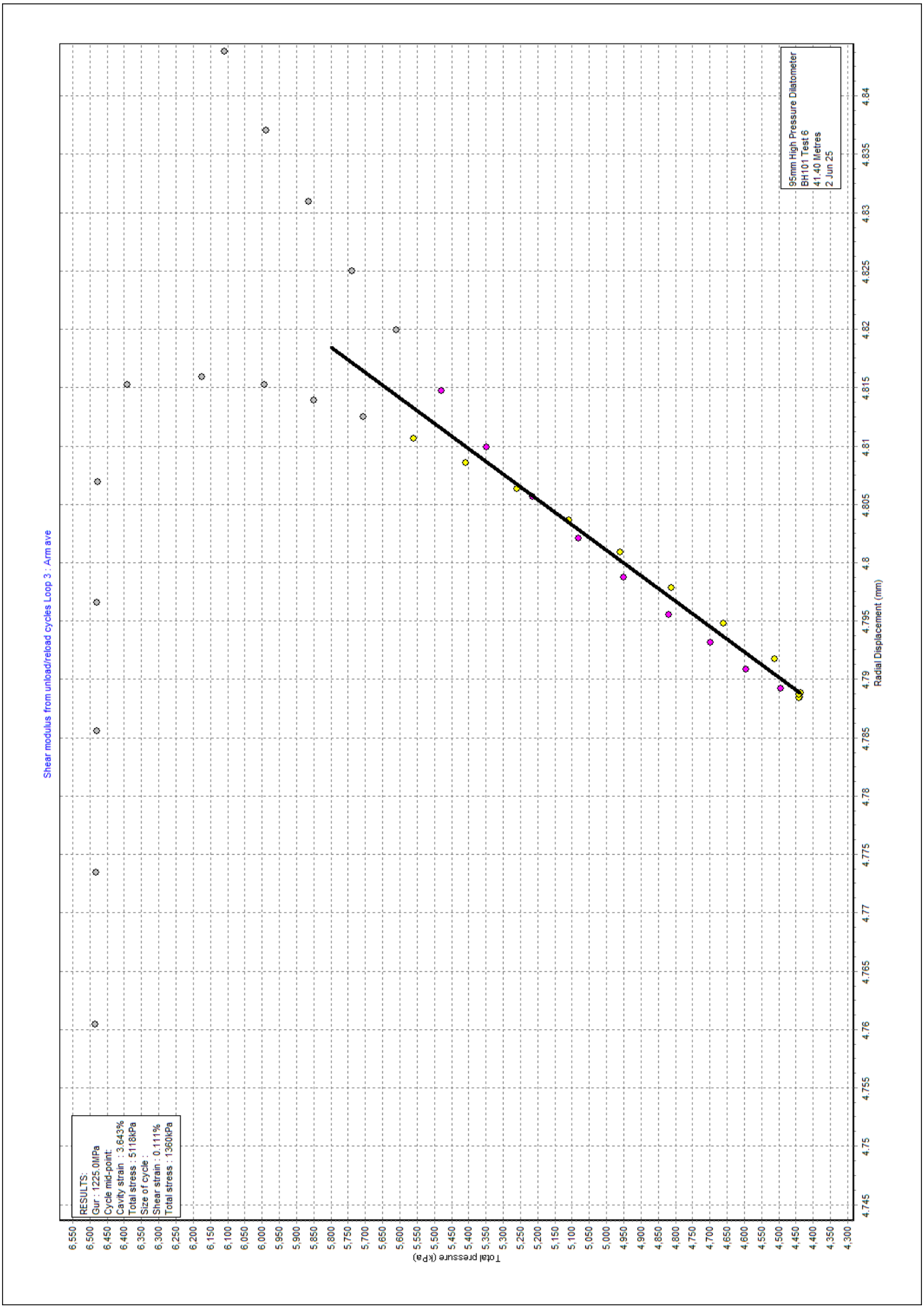

Po of cohesive material (1977, 1990) : Arm ave
95mm High Pressure Dilatometer
BH101 Test 6
41.40 Metres
2 Jun 25
RESULTS:
Gi : 119.4MPa
Pf : 4033.7kPa
Po : 1285.0kPa
Tf : 2718.5kPa
Po + Tf : 4003.5kPa
Origin : 2.709mm
Total pressure (kPa)
Radial Displacement (mm)
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Shear stress at yield : Arm ave
Ln[shear strain]
Creep readings
Creep movement (mm)
Expansion

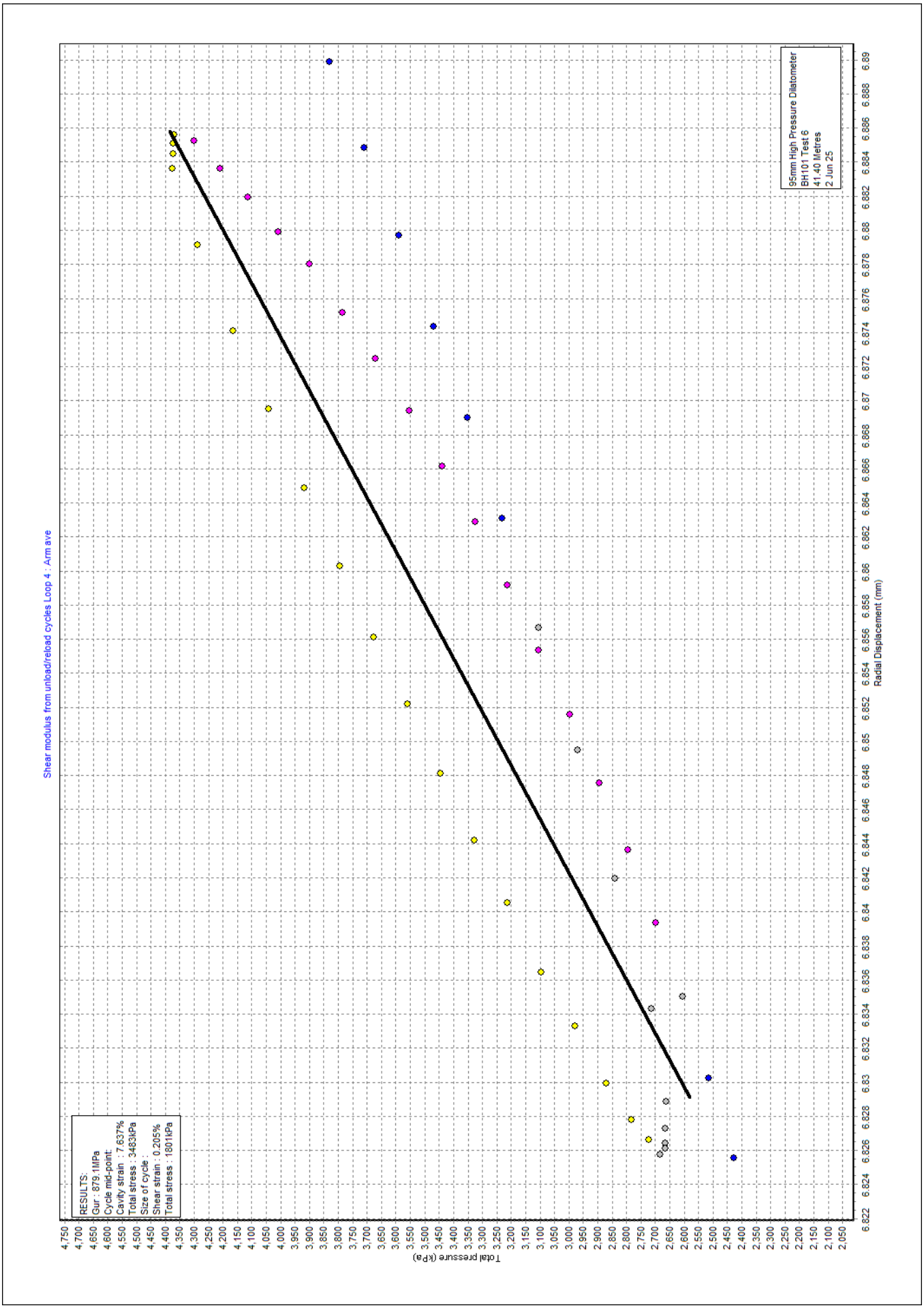

95mm High Pressure Dilatometer
BH101 Test 6
41.40 Metres
2 Jun 25
RESULTS:
Ambient water pressure : 339.4 kPa
Residual friction angle : 34.0°
Gradient : 0.374
Friction angle : 35.2°
Dilation angle : 1.4°
Hughes et al (1977) : Arm ave
Ln[E effective stress]
Ln[hoop strain]

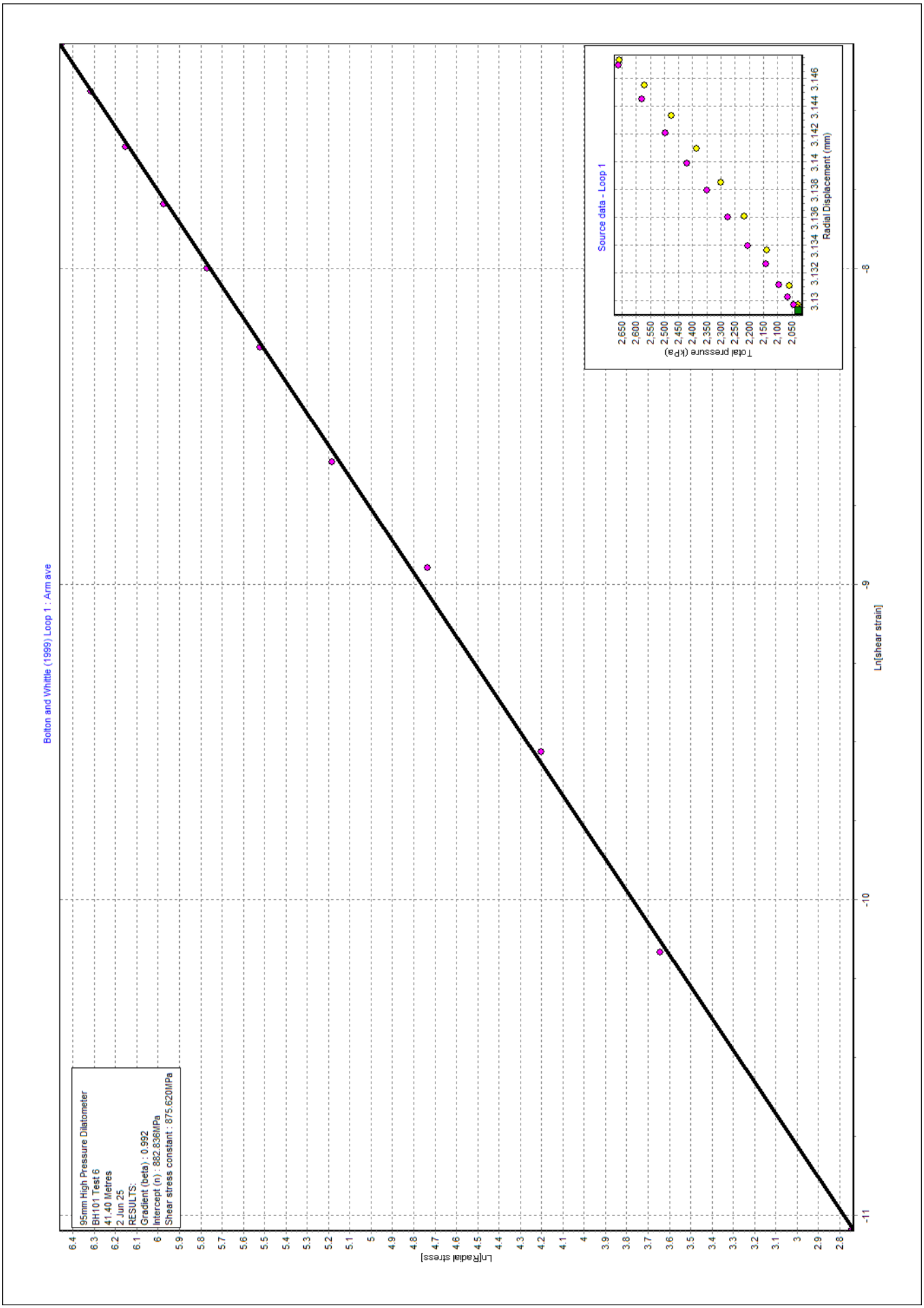

Withers et al (1989) : Arm ave
Ln[(Emx-Ec)/(1+Emx)]
Ln[P'/P'mx]
95mm High Pressure Dilatometer
BH101 Test 6
41.40 Metres
2 Jun 25
RESULTS:
Ambient water pressure : 339.4 kPa
Residual friction angle : 34.0°
Gradient : -2.221
Friction angle : 29.5°
Dilation angle : -5.3°

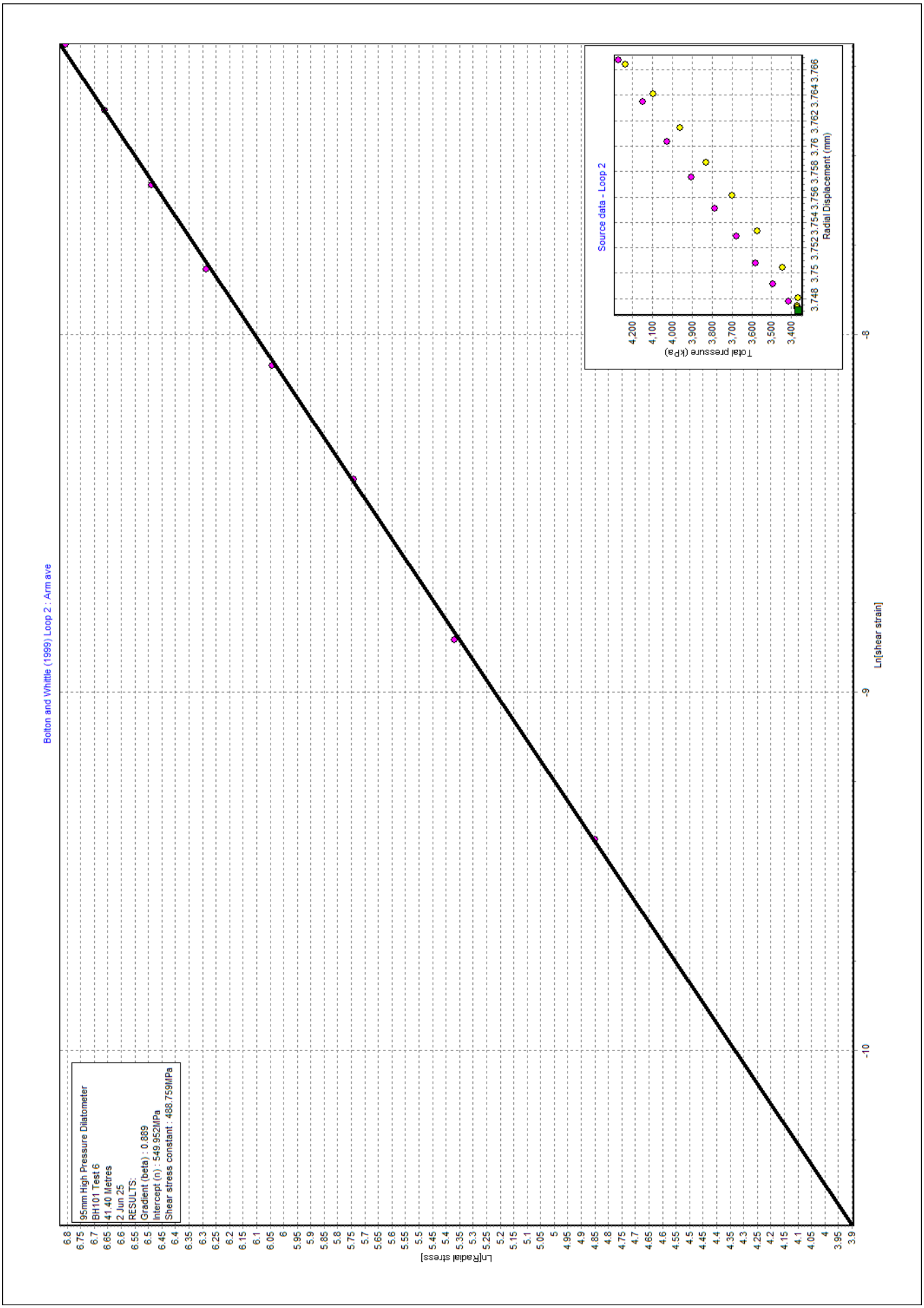

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 935.1MPa
Cycle mid-point:
Cavity strain : 0.405%
Total stress : 2343kPa
Size of cycle :
Shear strain : 0.068%
Total stress : 636kPa
95mm High Pressure Dilatometer
BH101 Test 6
41.40 Metres
2 Jun 25
Radial Displacement (mm)
Total pressure (kPa)

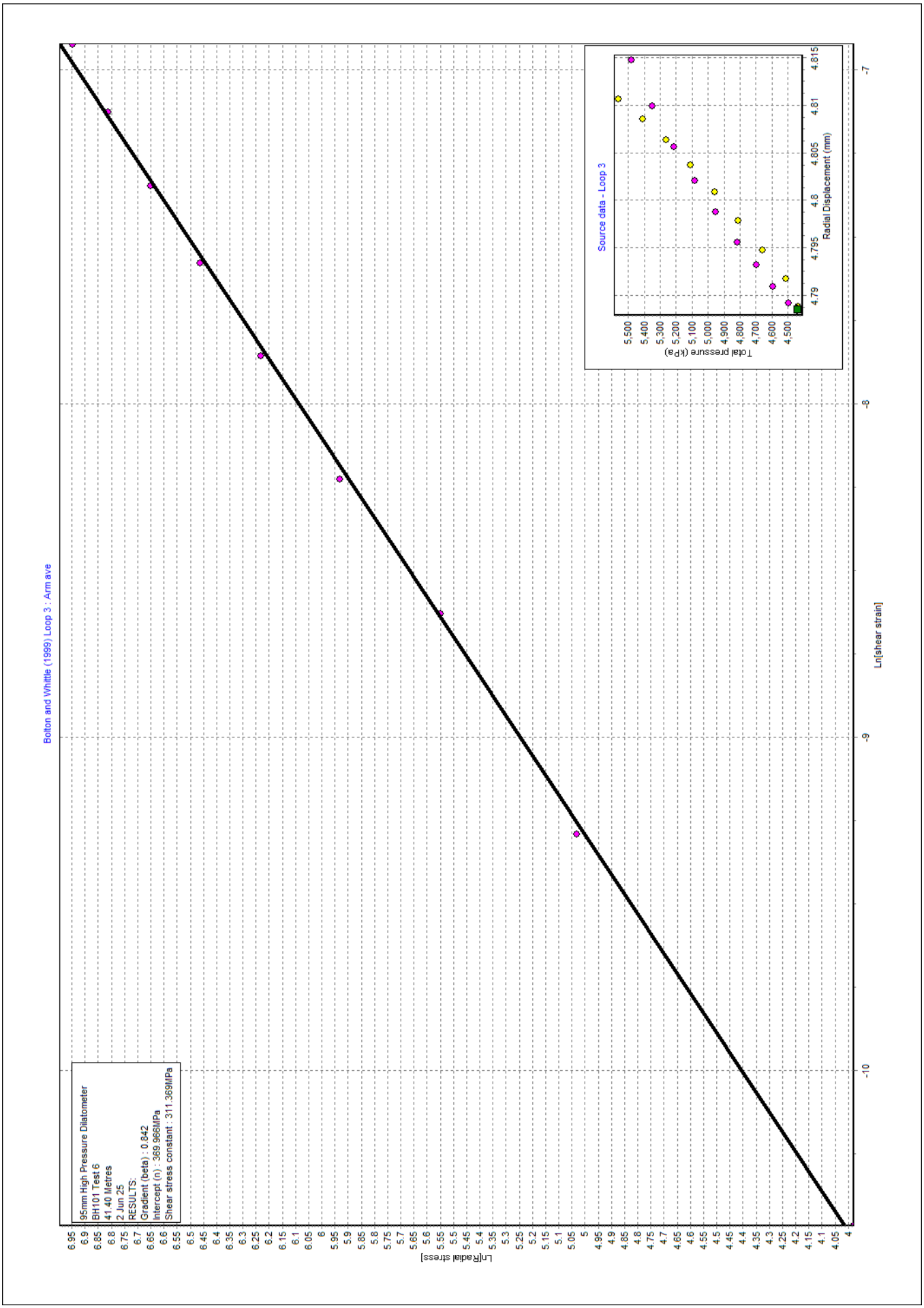

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 1199.7MPa
Cycle mid-point:
Cavity strain : 1.608%
Total stress : 3816kPa
Size of cycle :
Shear strain : 0.073%
Total stress : 877kPa
95mm High Pressure Dilatometer
BH101 Test 6
41.40 Metres
2 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

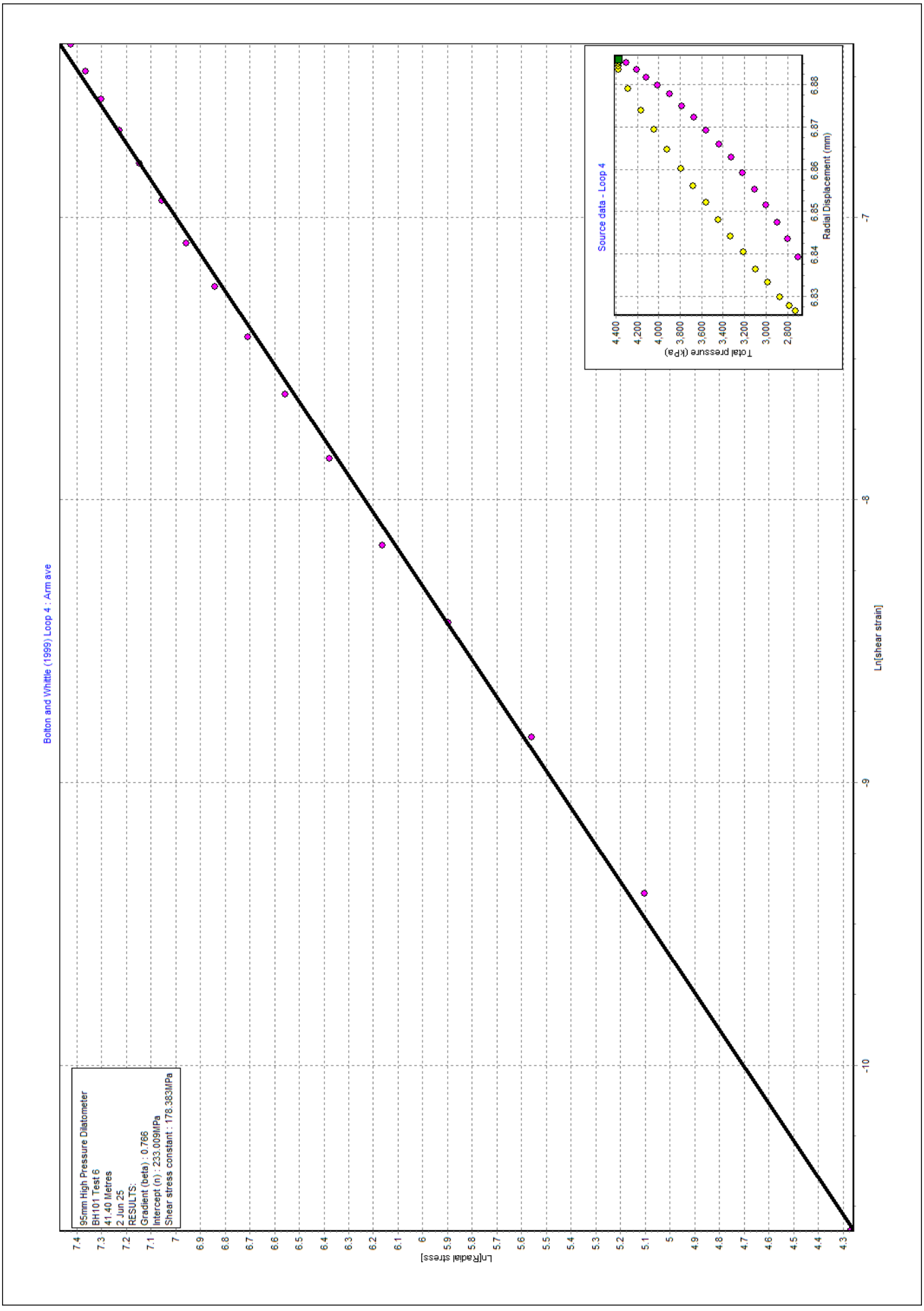

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 1225.0MPa
Cycle mid-point:
Cavity strain : 3.643%
Total stress : 5118kPa
Size of cycle :
Shear strain : 0.111%
Total stress : 1360kPa
95mm High Pressure Dilatometer
BH101 Test 6
41.40 Metres
2 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

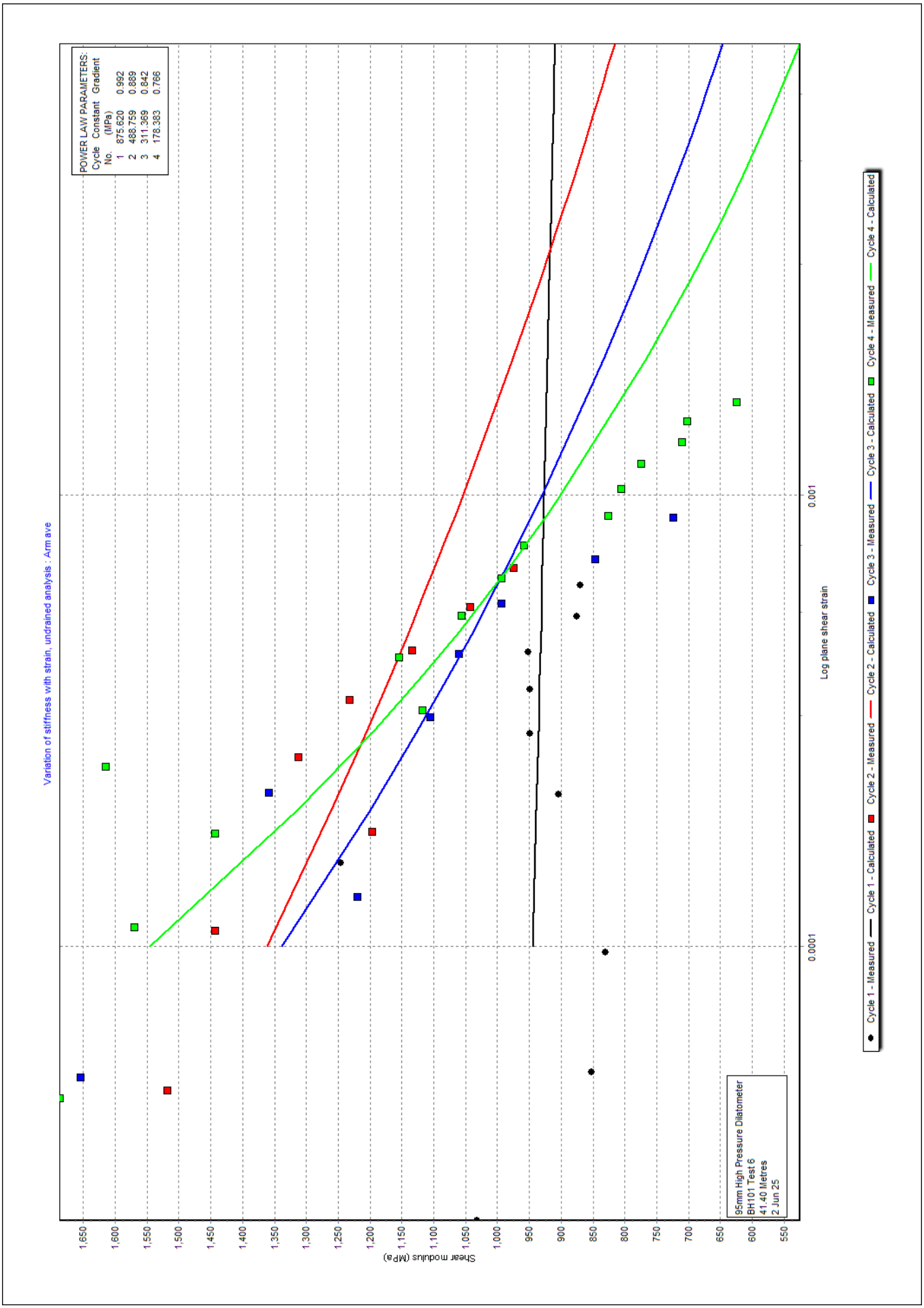

Shear modulus from unload/reload cycles Loop 4 : Arm ave
RESULTS:
Gur : 879.1MPa
Cycle mid-point:
Cavity strain : 7.637%
Total stress : 3483kPa
Size of cycle :
Shear strain : 0.205%
Total stress : 1801kPa
95mm High Pressure Dilatometer
BH101 Test 6
41.40 Metres
2 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

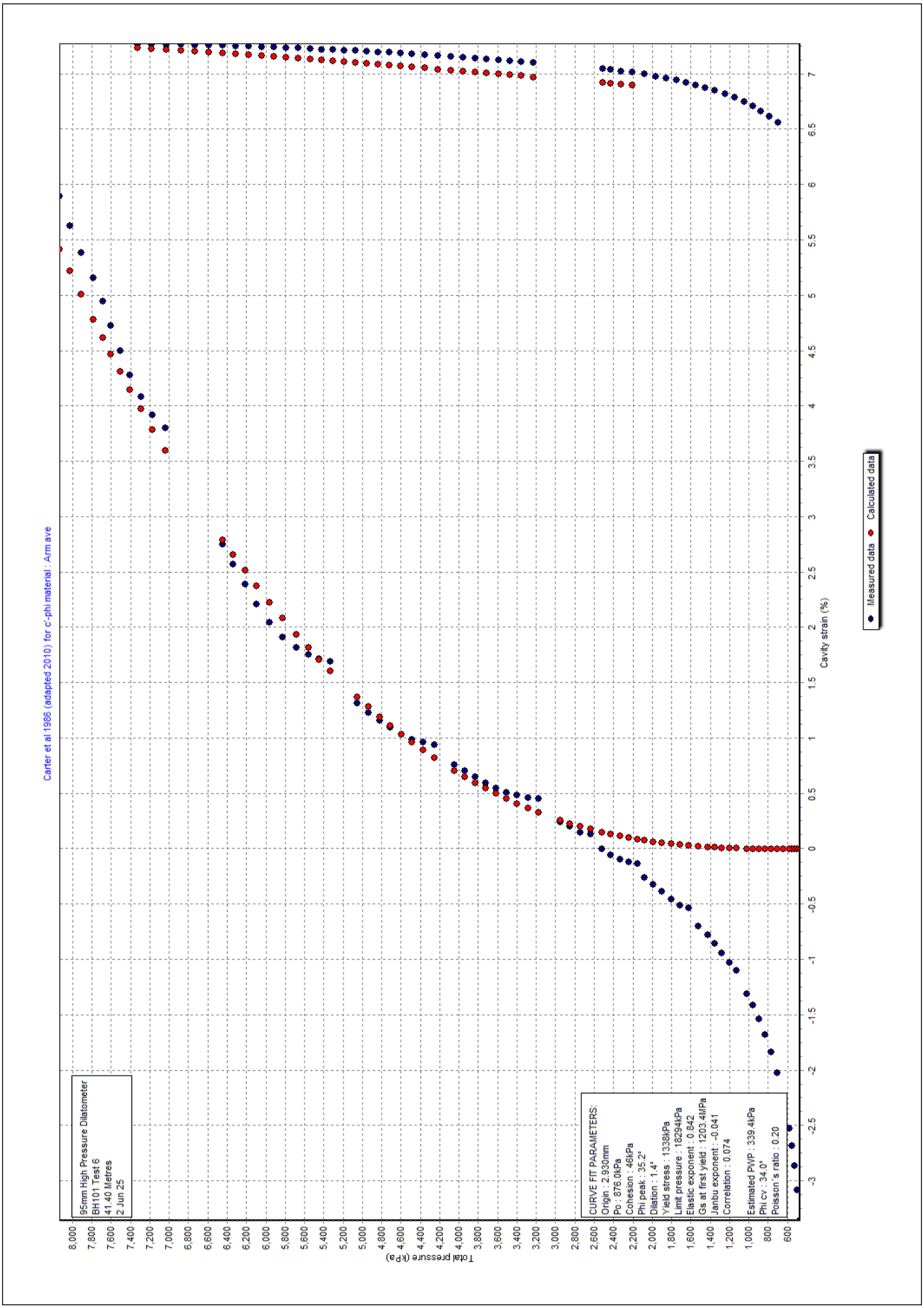

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH101 Test 6
41.40 Metres
2 Jun 25
RESULTS:
Gradient (beta) : 0.992
Intercept (n) : 882.836MPa
Shear stress constant : 875.620MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

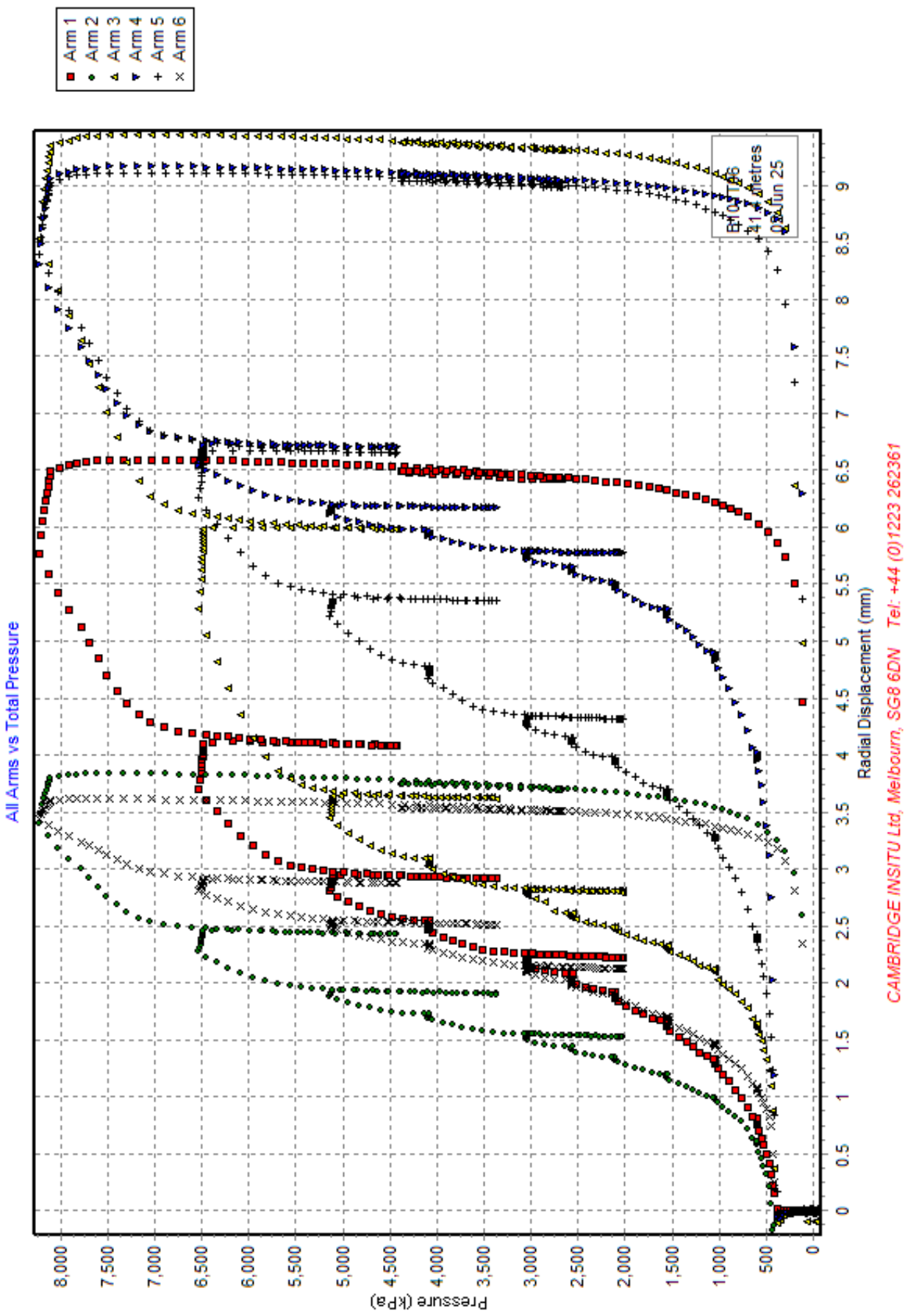

Bolton and Whittle (1999) Loop 2 : Arm ave
95mm High Pressure Dilatometer
BH101 Test 6
41.40 Metres
2 Jun 25
RESULTS:
Gradient (beta) : 0.889
Intercept (n) : 549.952MPa
Shear stress constant : 488.759MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

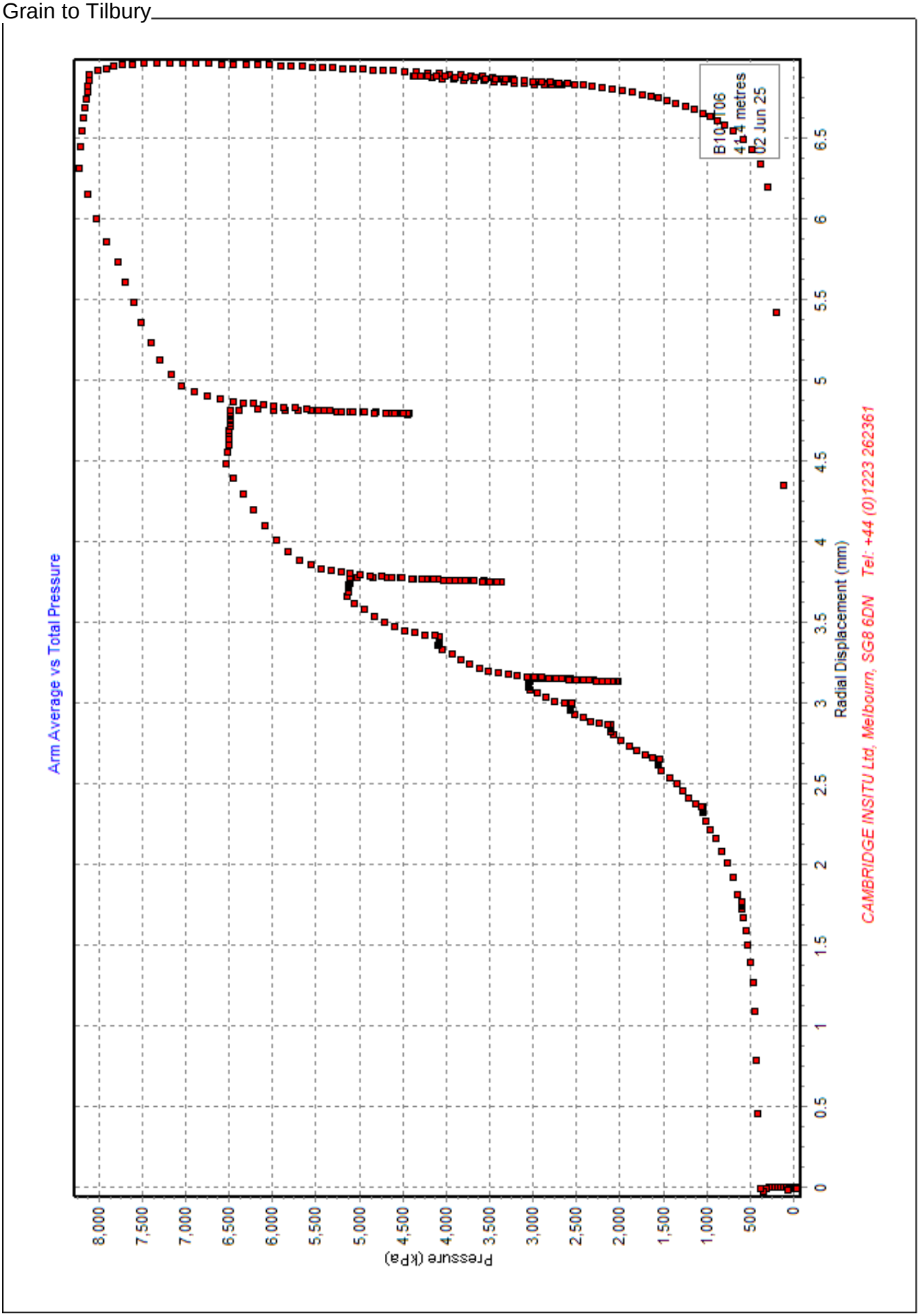

Bolton and Whittle (1999) Loop 3 : Arm ave
95mm High Pressure Dilatometer
BH101 Test 6
41.40 Metres
2 Jun 25
RESULTS:
Gradient (beta) : 0.842
Intercept (n) : 369.966MPa
Shear stress constant : 311.369MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)

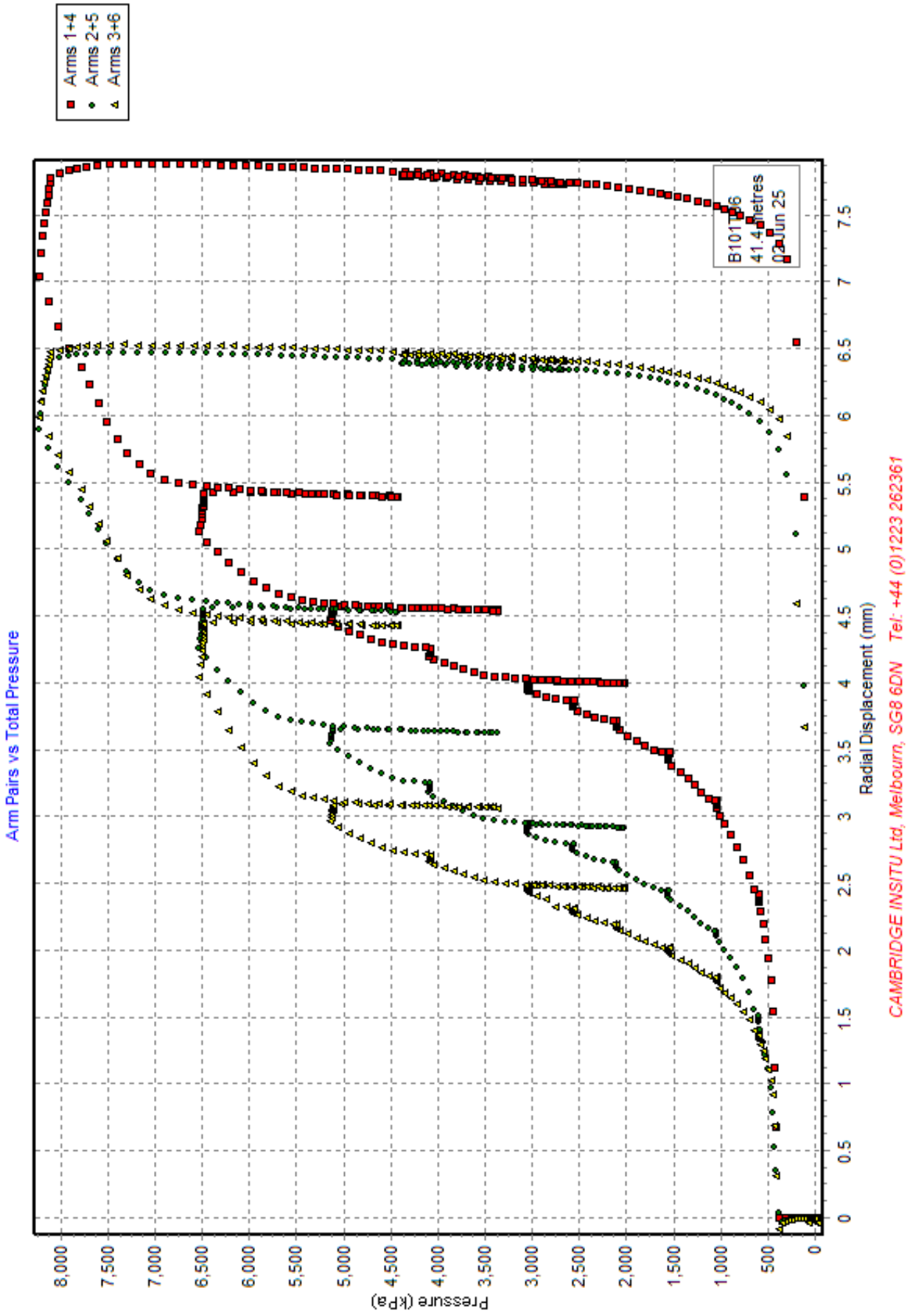

95mm High Pressure Dilatometer
BH101 Test 6
41.40 Metres
2 Jun 25
RESULTS:
Gradient (beta) : 0.766
Intercept (n) : 233.009MPa
Shear stress constant : 178.383MPa
Bolton and Whittle (1999) Loop 4 : Arm ave
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 4
Total pressure (kPa)
Radial Displacement (mm)

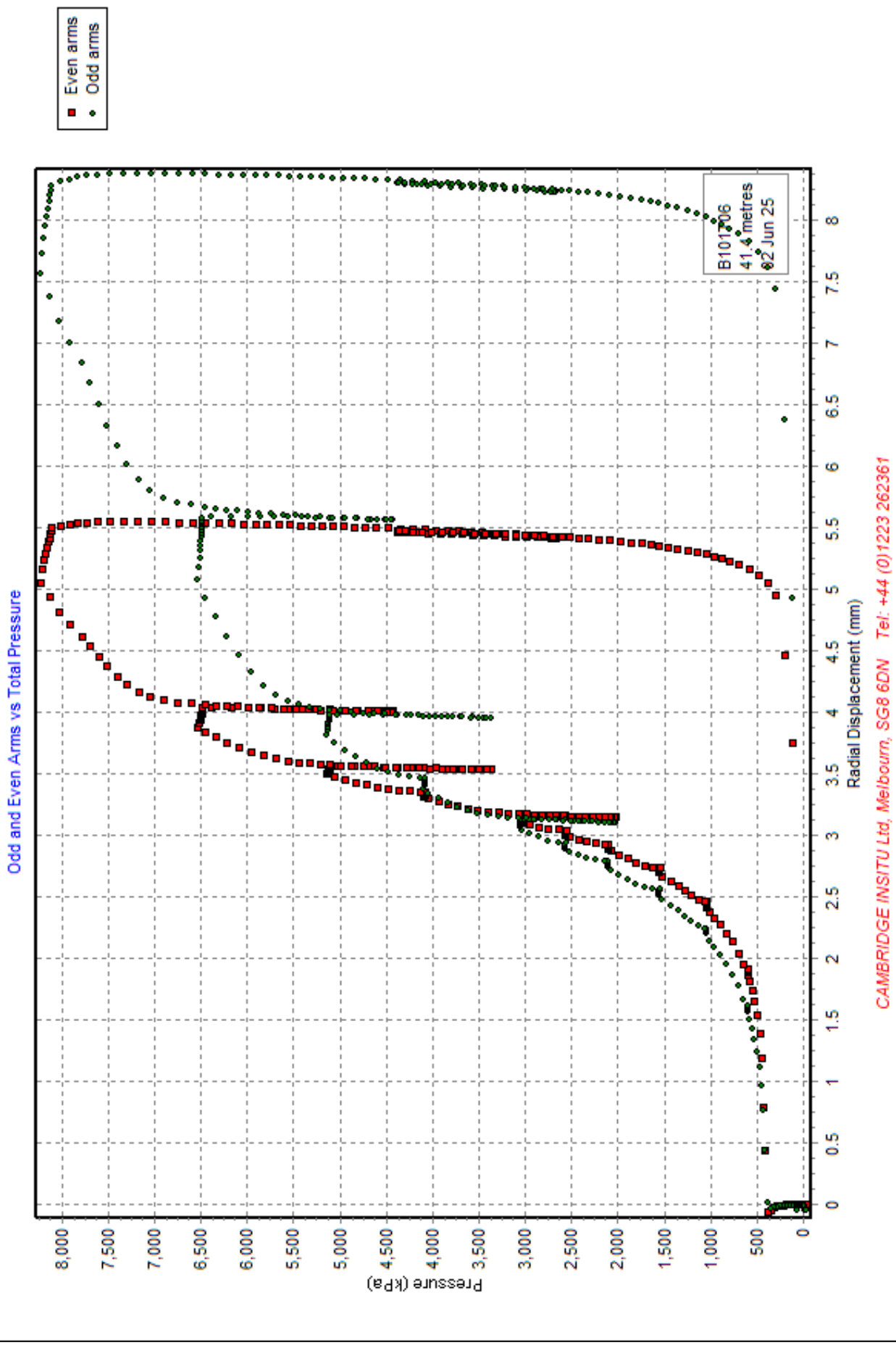

Variation of stiffness with strain, undrained analysis : Arm ave
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 875.620 0.992
2 488.759 0.889
3 311.369 0.842
4 178.383 0.766
Shear modulus (MPa)
Log plane shear strain
0.0001
0.001
95mm High Pressure Dilatometer
BH101 Test 6
41.40 Metres
2 Jun 25
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
Cycle 4 - Measured
Cycle 4 - Calculated


Carter et al 1986 (adapted 2010) for c-phi material : Arm ave
95mm High Pressure Dilatometer
BH101 Test 6
41.40 Metres
2 Jun 25
CURVE FIT PARAMETERS:
Origin : 2.930mm
Po : 876.0kPa
Cohesion : 46kPa
Phi peak : 35.2°
Dilation : 1.4°
Yield stress : 1338kPa
Limit pressure : 18294kPa
Elastic exponent : 0.842
Gs at first yield : 1203.4MPa
Janbu exponent : -0.041
Correlation : 0.074
Estimated PWP : 339.4kPa
Phi cv : 34.0°
Poisson's ratio : 0.20
Measured data
Calculated data
Total pressure (kPa)
Cavity strain (%)


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
BH01T26
41.4 Metres
08 Jun 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


B106
414 metres
02 Jun 25
Arm Average vs Total Pressure
Radial Displacement (mm)
Pressure (kPa)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arms 1+4
Arms 2+5
Arms 3+6
B101 06
41.4 metres
02 Jun 25
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
B101706
41.4 metres
02 Jun 25
Odd and Even Arms vs Total Pressure
Radial Displacement (mm)
Pressure (kPa)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to Tilbury
BH101 Test 7 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Grain to Tilbury
Borehole : BH101
Test name : BH101 Test 7
Test date : 2 Jun 25
Test depth : 45.20 Metres
Water table : 6.8 Metres
Ambient PWP : 376.7 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDP/RW on 18 Jul 25

Remarks: Structure breaking down at about 2.5% cavity strain

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=3.15"
Po from Marsland & Randolph (kPa) : "Arm ave=1422.7"
Best estimate of Po (kPa) : "Arm ave=1147.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=4328.8"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 34.0
Angle of internal friction (°) : "Arm ave=34.0"
Dilation angle (°) : "Arm ave=0.0"
Gradient of log-log plot : "Arm ave=0.358"

[Withers et al 1989]
Angle of internal friction (°) : "Arm ave=34.3"
Dilation angle (°) : "Arm ave=0.4"
Gradient of log-log plot : "Arm ave=-2.559"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=172.4"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	1061.4	0.384	2744	0.082	867
Arm ave	2	1012.9	1.340	4171	0.221	2246
Arm ave	3	1178.5	3.677	6574	0.206	2433
Arm ave	4	940.6	7.465	4353	0.223	2099

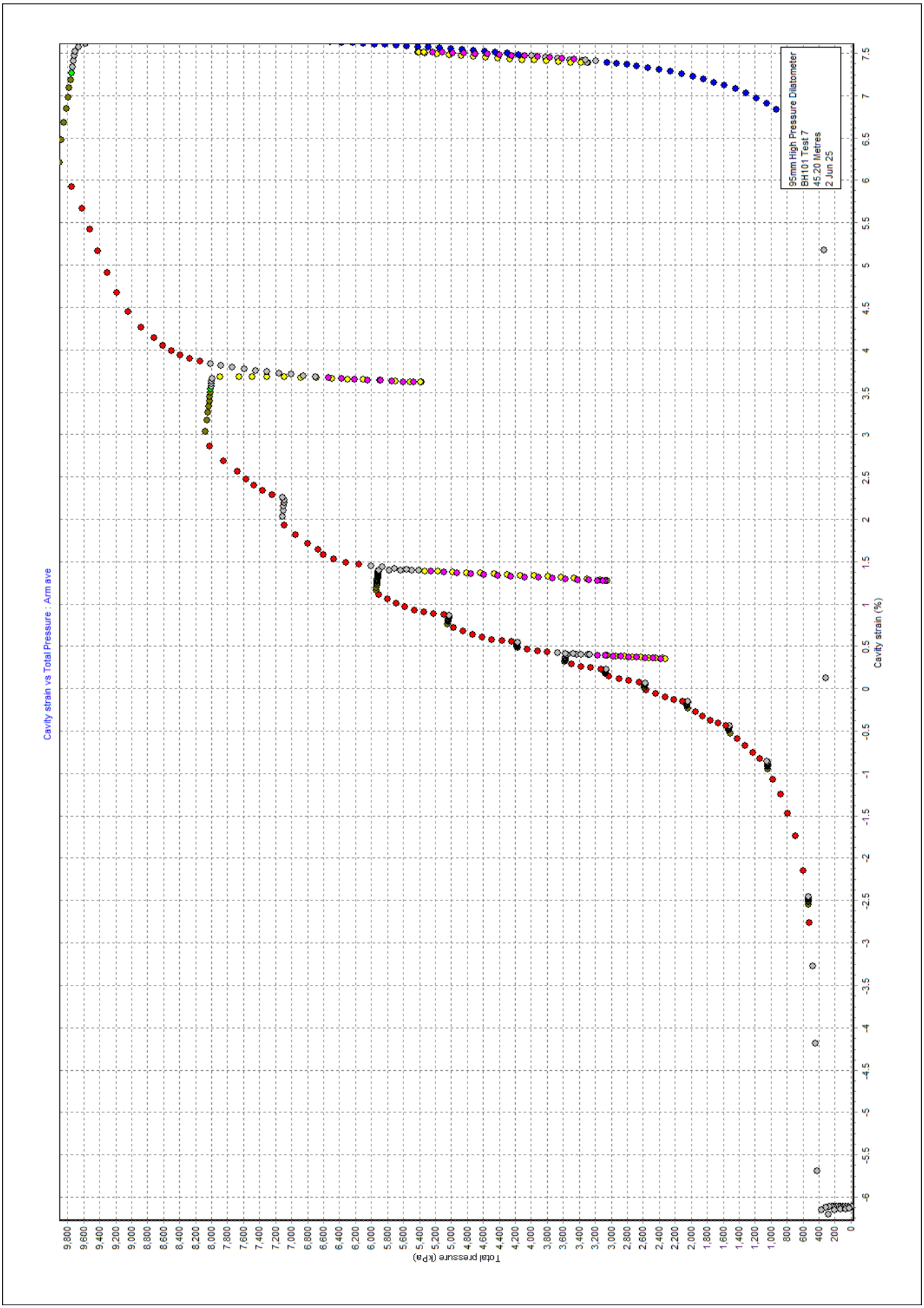
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

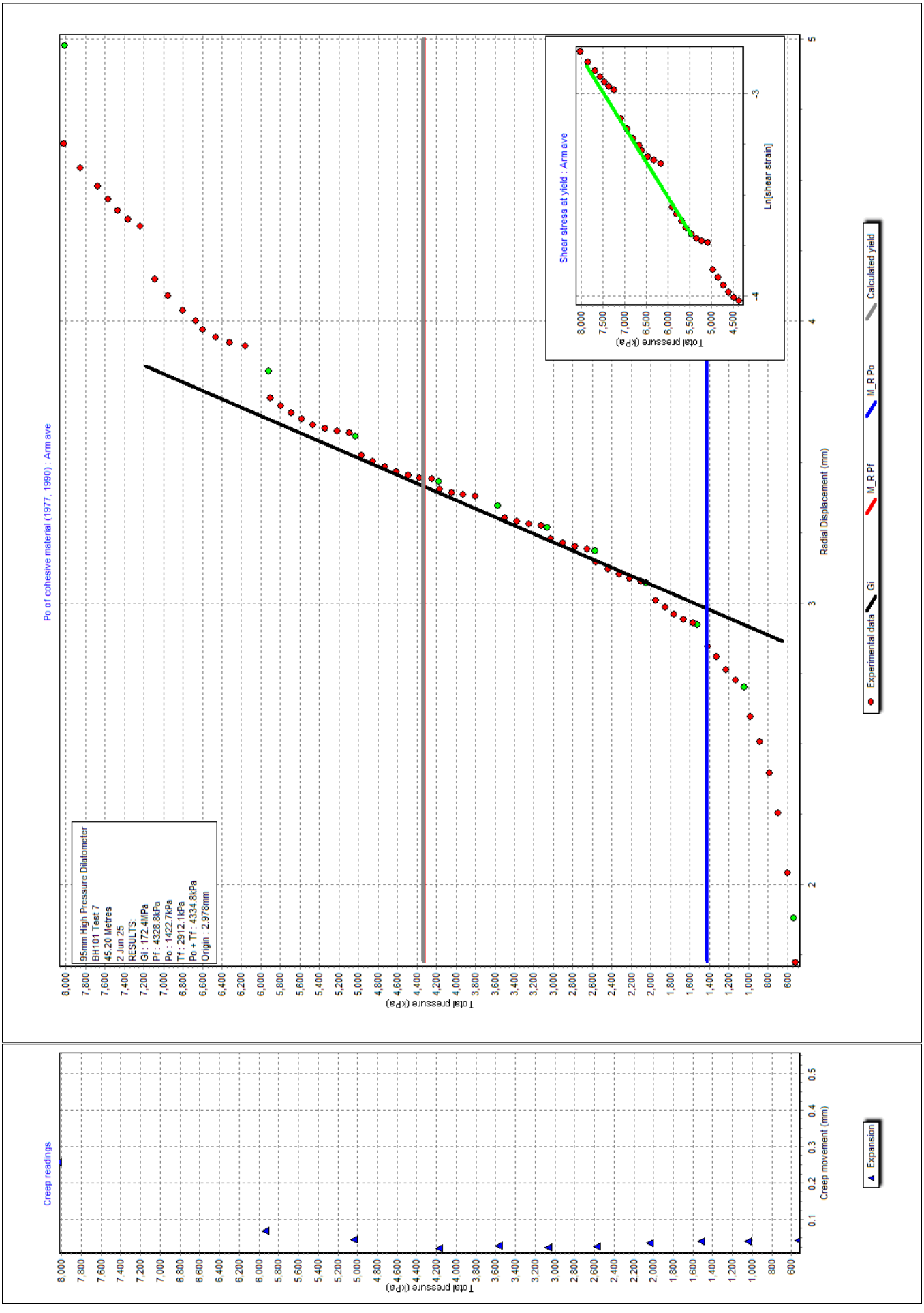
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	935.438	914.912	0.978
Arm ave	2	490.409	429.093	0.875
Arm ave	3	321.259	263.378	0.820
Arm ave	4	130.596	85.904	0.658

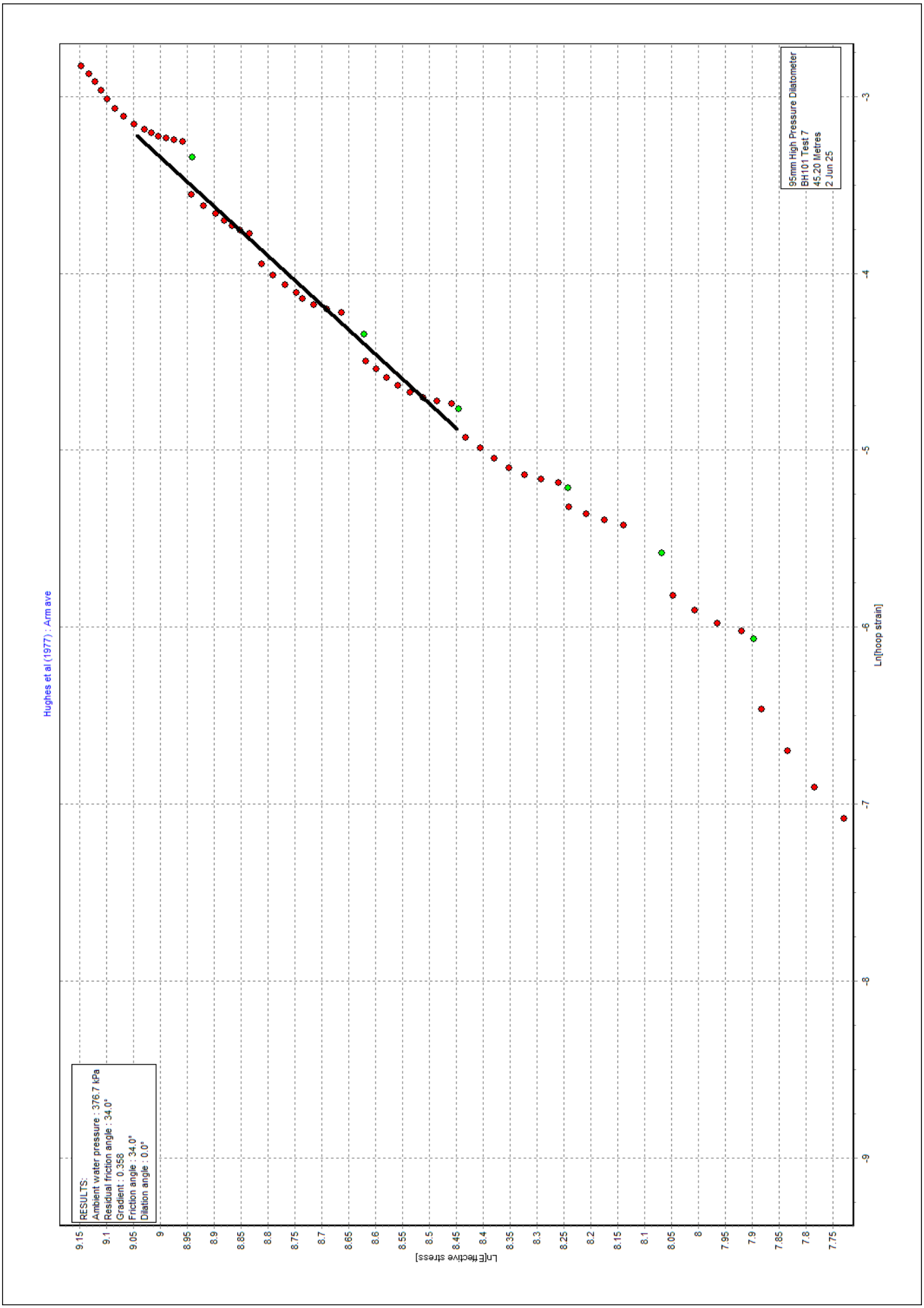
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 3.15
Po (kPa) : 1147
Cohesion (kPa) : 170
Angle of peak friction (deg) : 34.0
Angle of peak dilation (deg) : 0.0
Total yield stress (kPa) : 1857

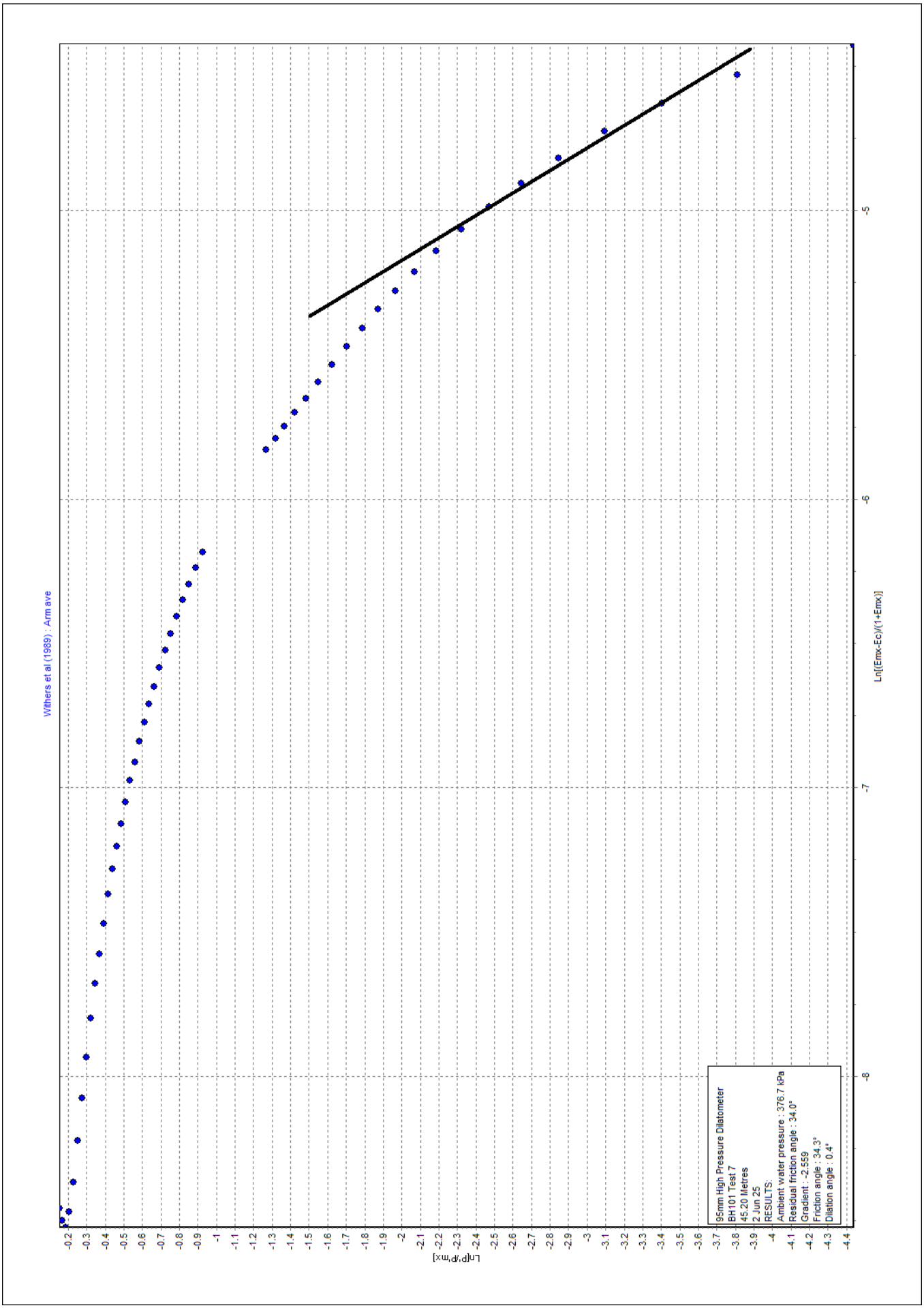
Grain to Tilbury
BH101 Test 7 - SUMMARY OF RESULTS

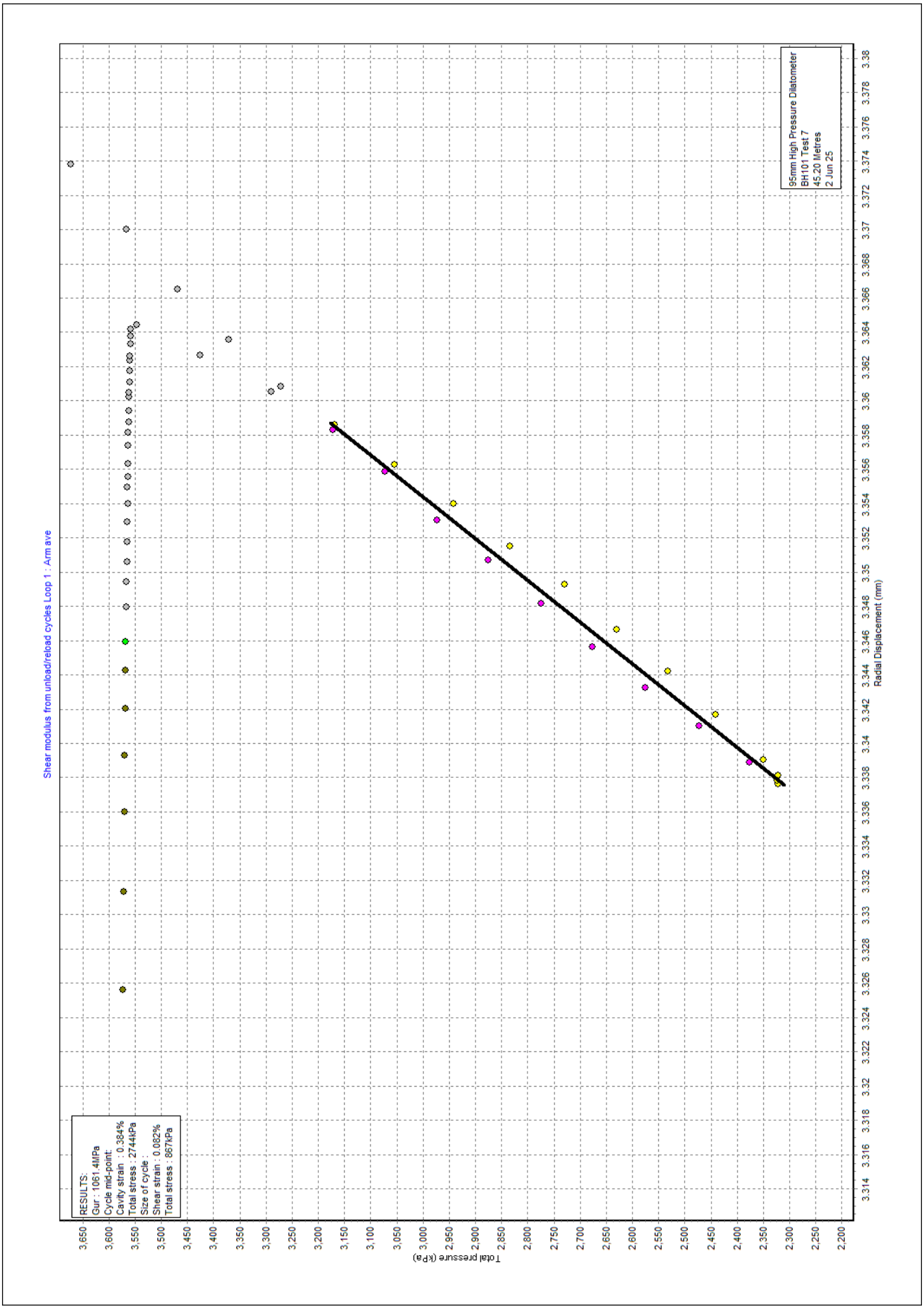
Total limit stress (kPa)	:	21522
G at first yield (MPa)	:	1103.1
Non-linear exponent	:	0.875
Janbu exponent	:	-0.006
Correlation	:	0.005
Ambient pore water pressure (kPa)	:	377
Residual friction angle (deg)	:	34.0
Poisson's ratio	:	0.20

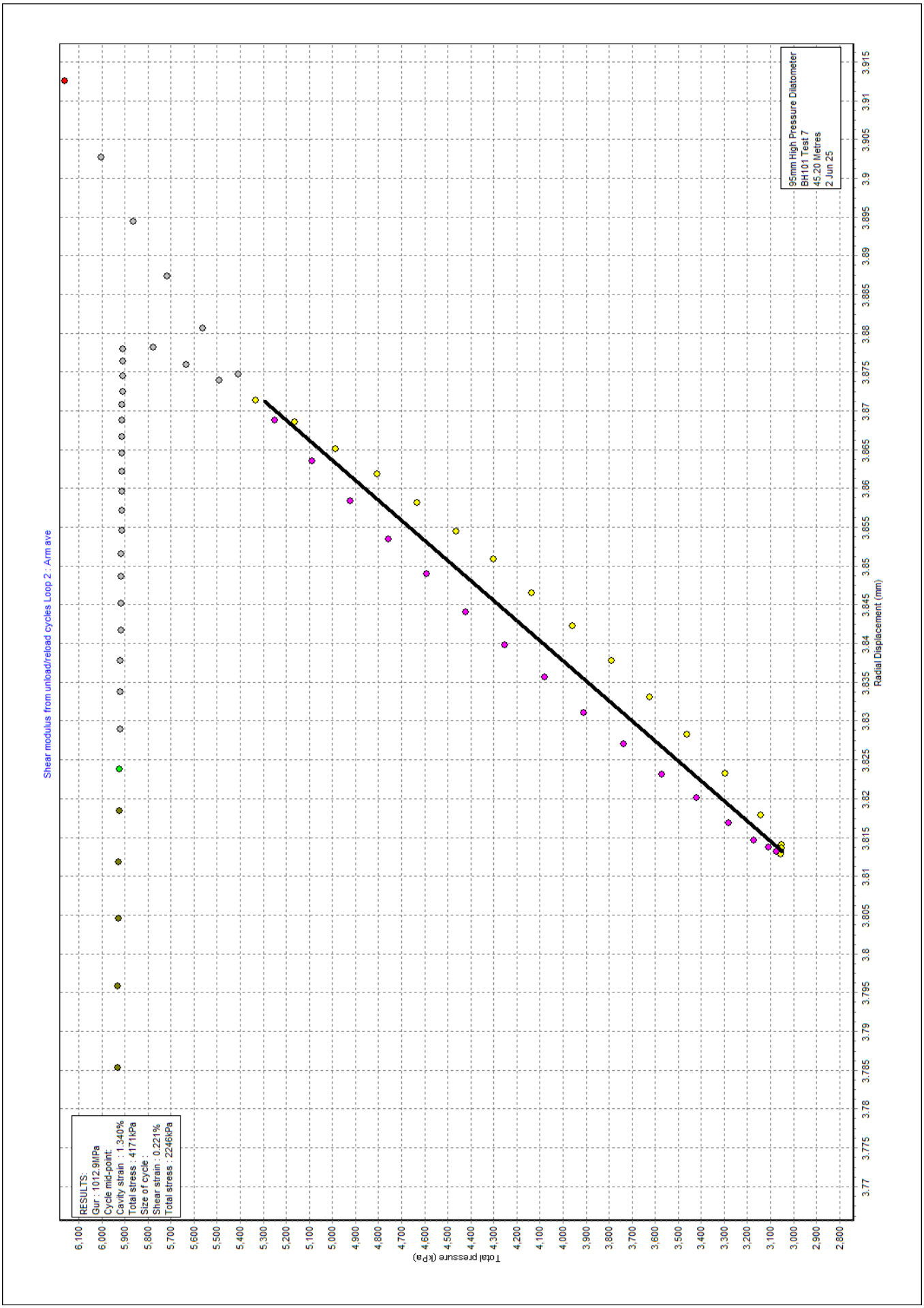

95mm High Pressure Dilatometer
BH101 Test 7
45.20 Metres
2 Jun 25
Cavity strain vs Total Pressure : Arm ave
Cavity strain (%)
Total pressure (kPa)

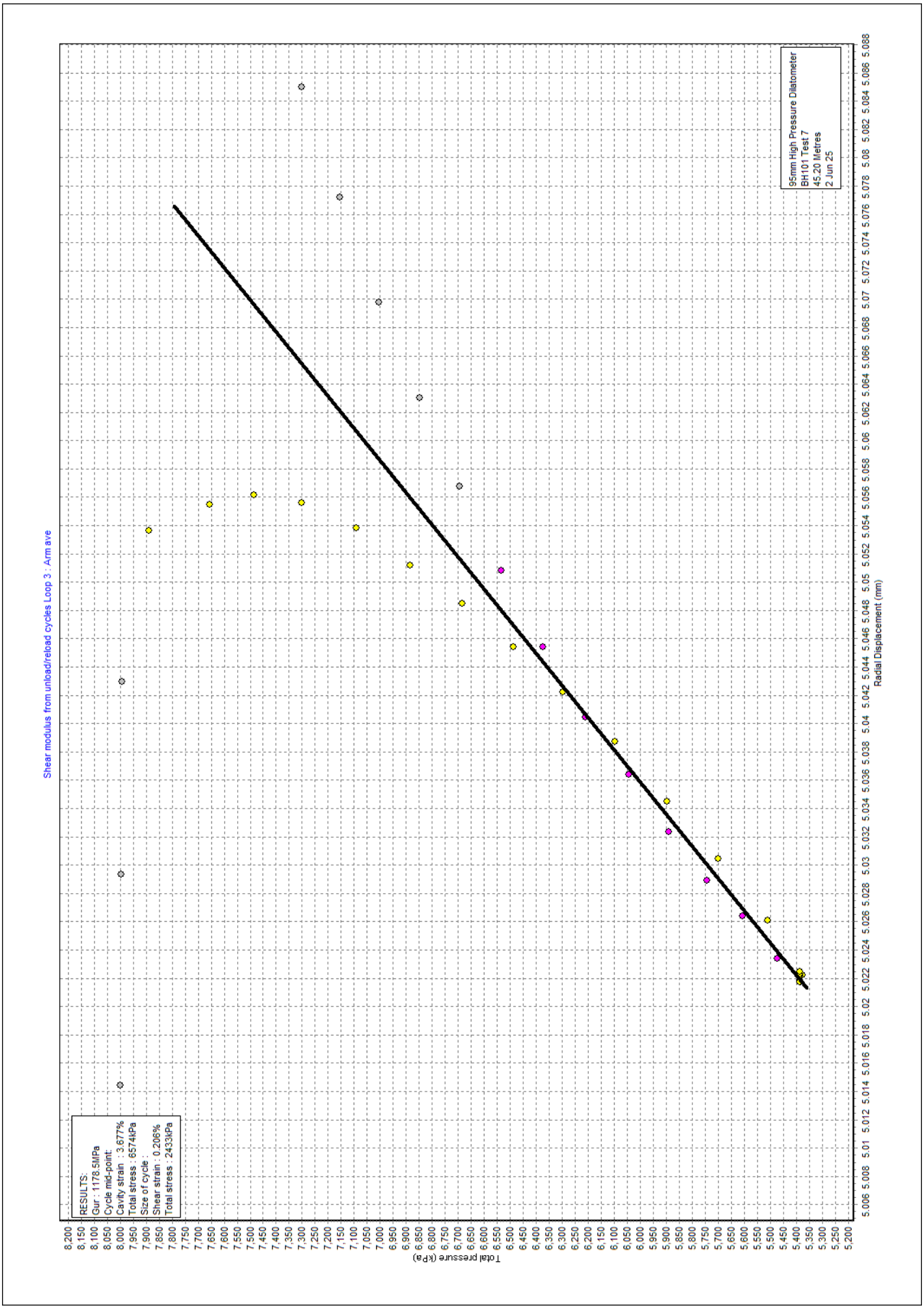

Po of cohesive material (1977, 1990) : Arm ave
95mm High Pressure Dilatometer
BH101 Test 7
45.20 Metres
2 Jun 25
RESULTS:
Gi : 172.4MPa
Pf : 4328.8kPa
Po : 1422.7kPa
Tf : 2912.1kPa
Po + Tf : 4334.8kPa
Origin : 2.978mm
Total pressure (kPa)
Radial Displacement (mm)
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Shear stress at yield : Arm ave
Ln[shear strain]
Creep readings
Creep movement (mm)
Expansion

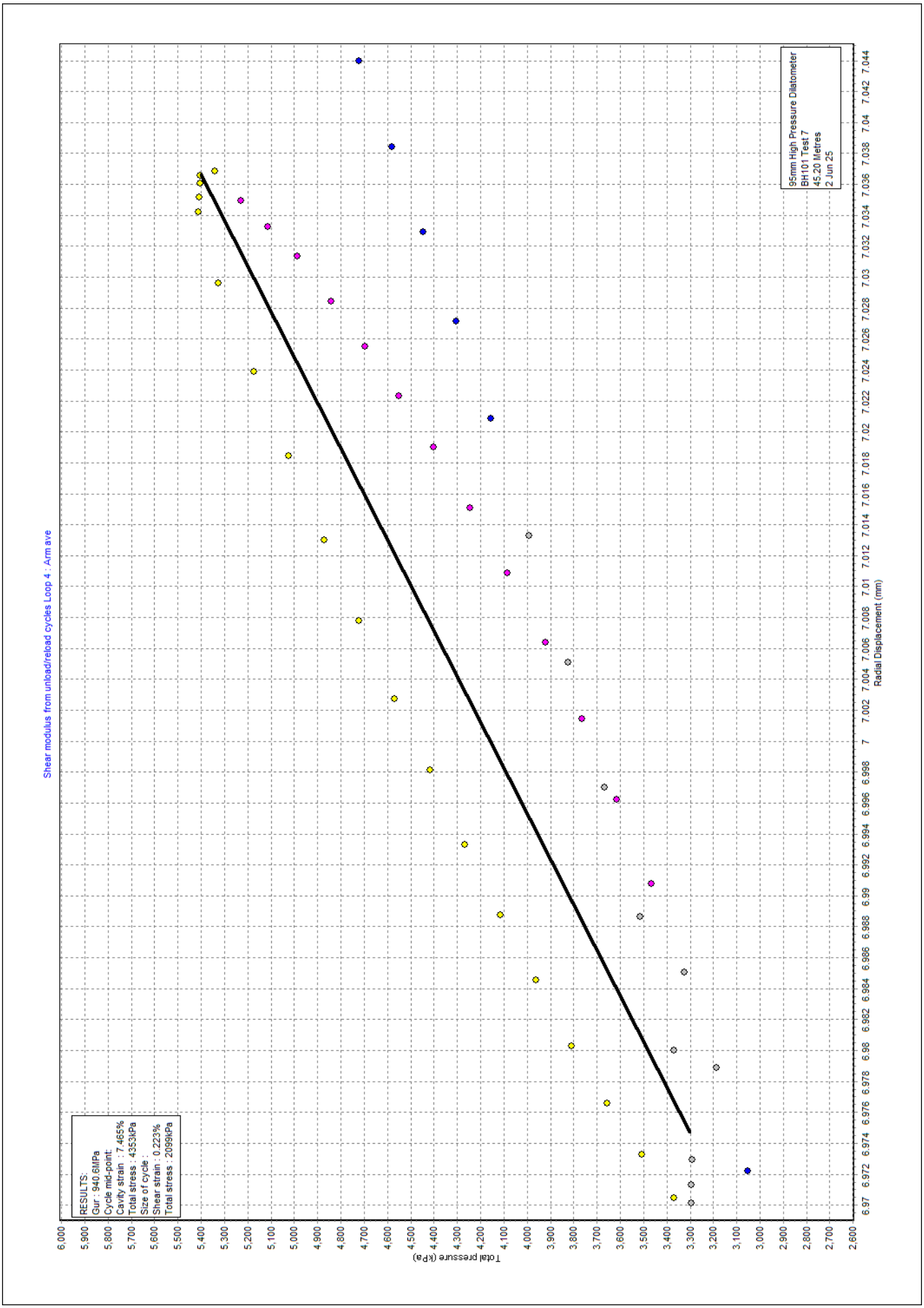

Hughes et al (1977) : Arm ave
RESULTS:
Ambient water pressure : 376.7 kPa
Residual friction angle : 34.0°
Gradient : 0.358
Friction angle : 34.0°
Dilation angle : 0.0°
95mm High Pressure Dilatometer
BH101 Test 7
45.20 Metres
2 Jun 25
Ln[E fective stress]
Ln[hoop strain]

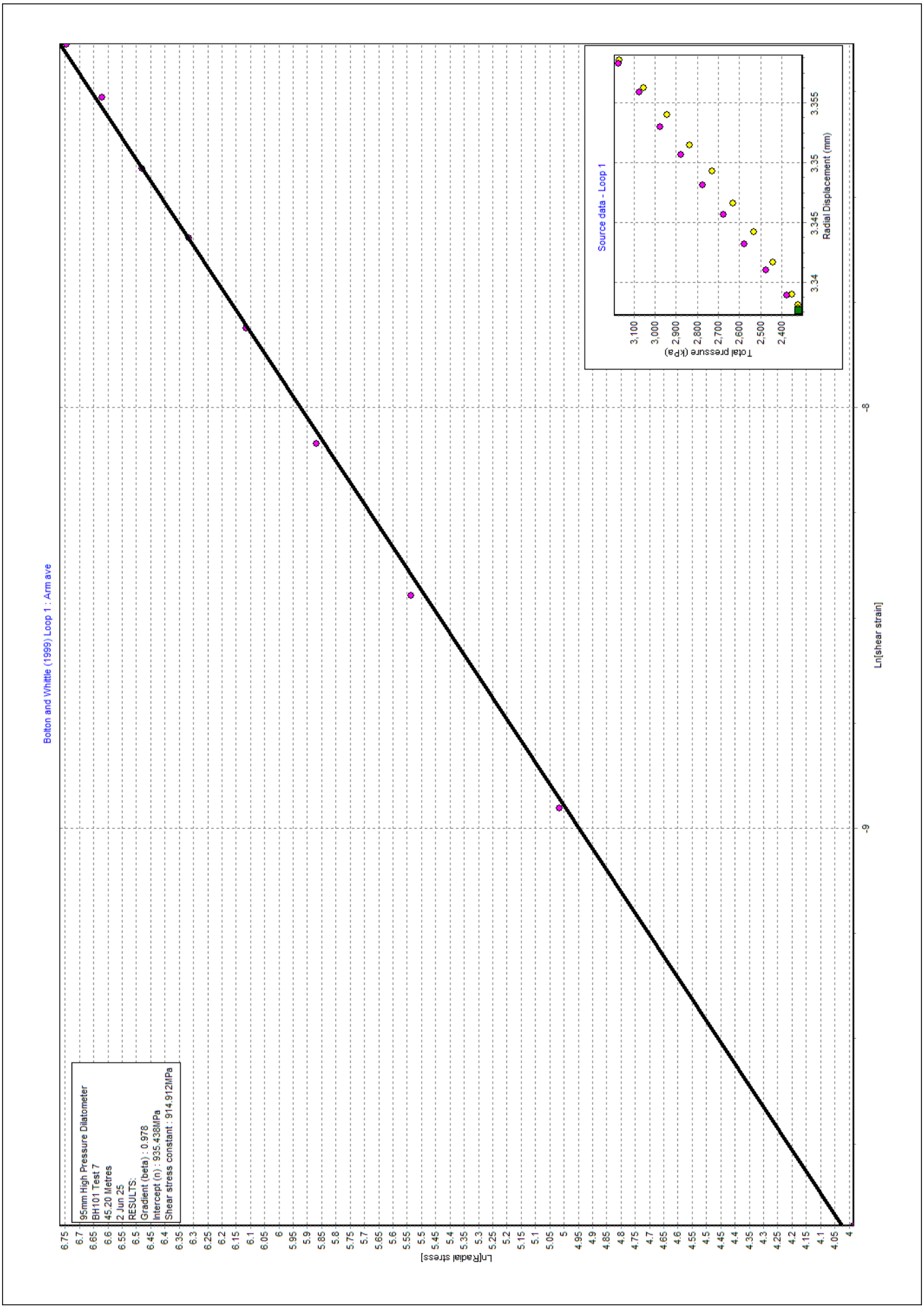

Withers et al (1989) : Arm ave
Ln[(Emx-Ec)/(1+Emx)]
Ln[P'/P'mx]
95mm High Pressure Dilatometer
BH101 Test 7
45.20 Metres
2 Jun 25
RESULTS:
Ambient water pressure : 376.7 kPa
Residual friction angle : 34.0°
Gradient : -2.559
Friction angle : 34.3°
Dilation angle : 0.4°

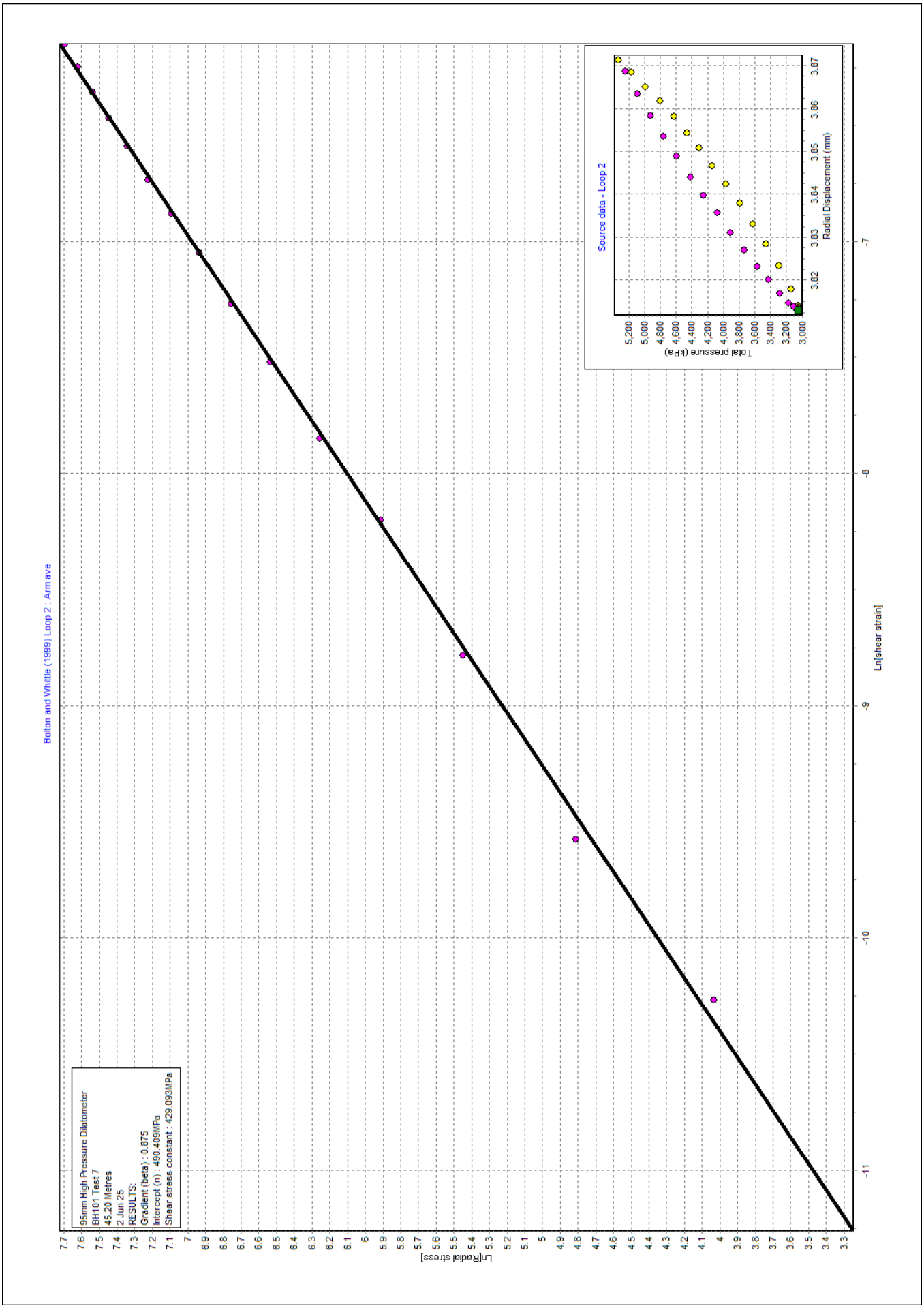

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 1061.4MPa
Cycle mid-point:
Cavity strain : 0.384%
Total stress : 2744kPa
Size of cycle :
Shear strain : 0.082%
Total stress : 867kPa
95mm High Pressure Dilatometer
BH101 Test 7
45.20 Metres
2 Jun 25
Radial Displacement (mm)
Total pressure (kPa)

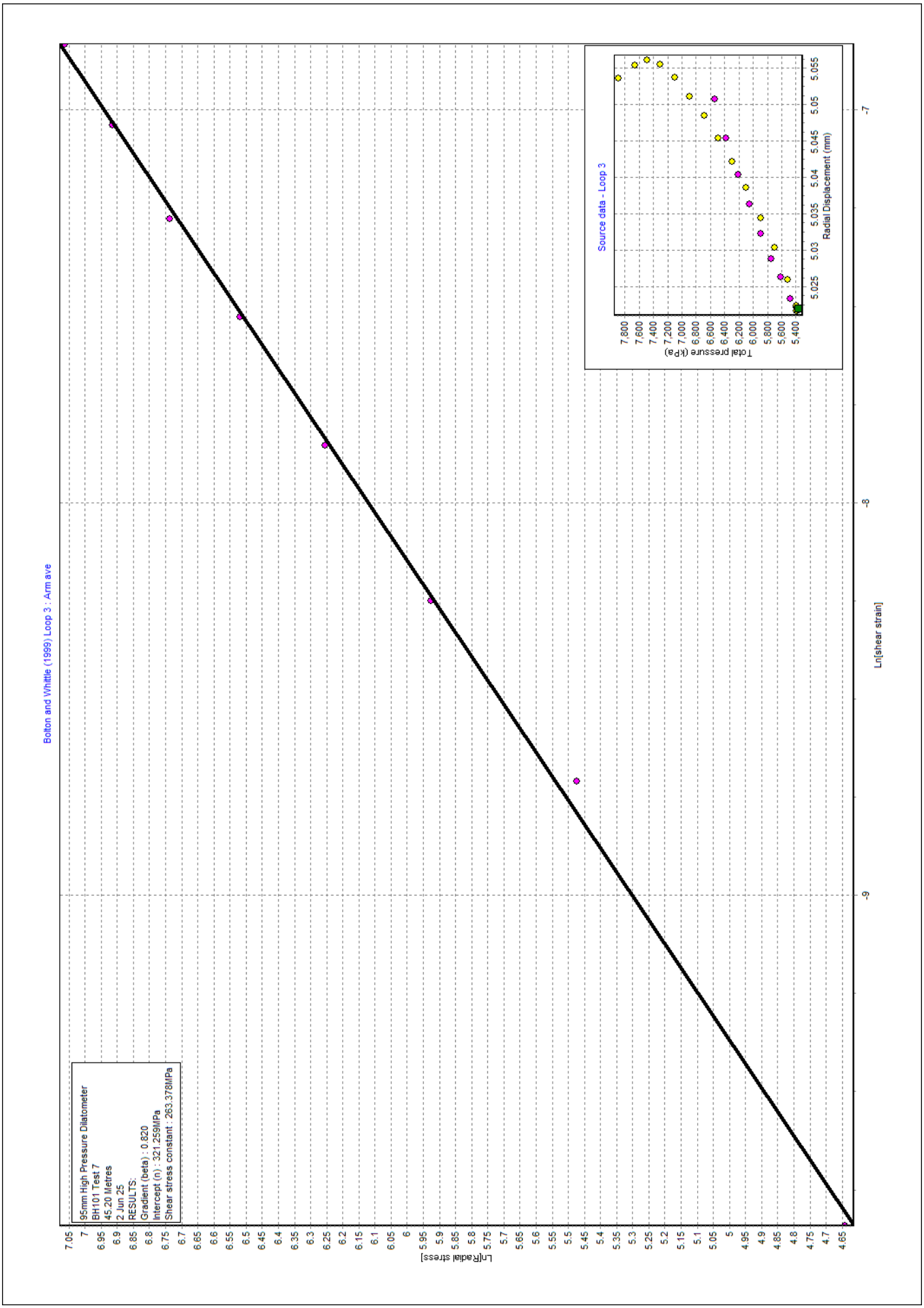

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 1012.9MPa
Cycle mid-point:
Cavity strain : 1.340%
Total stress : 4171kPa
Size of cycle :
Shear strain : 0.221%
Total stress : 2246kPa
95mm High Pressure Dilatometer
BH101 Test 7
45.20 Metres
2 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

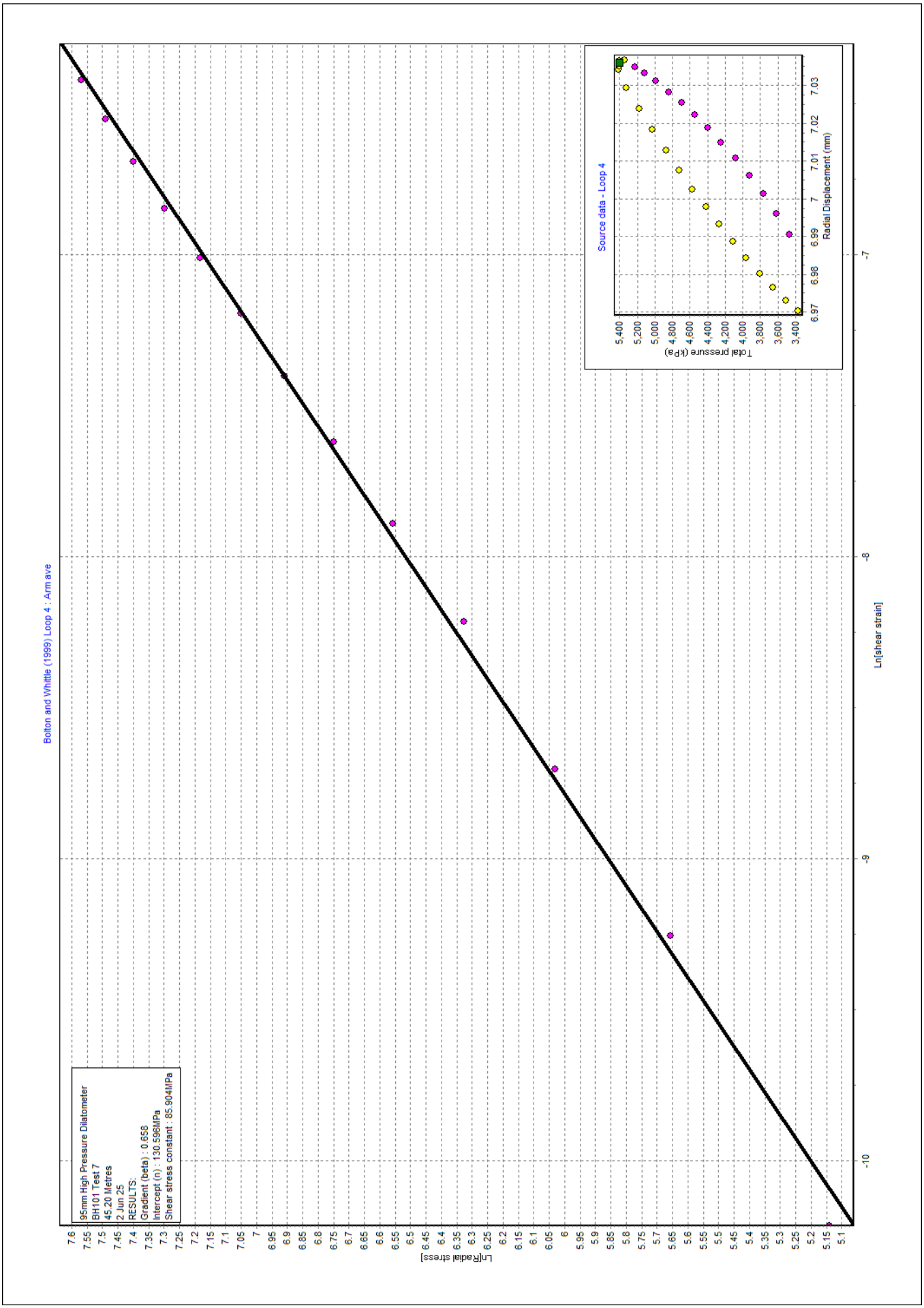

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 1178.5MPa
Cycle mid-point:
Cavity strain : 3.677%
Total stress : 6574kPa
Size of cycle :
Shear strain : 0.206%
Total stress : 2433kPa
95mm High Pressure Dilatometer
BH101 Test 7
45.20 Metres
2 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

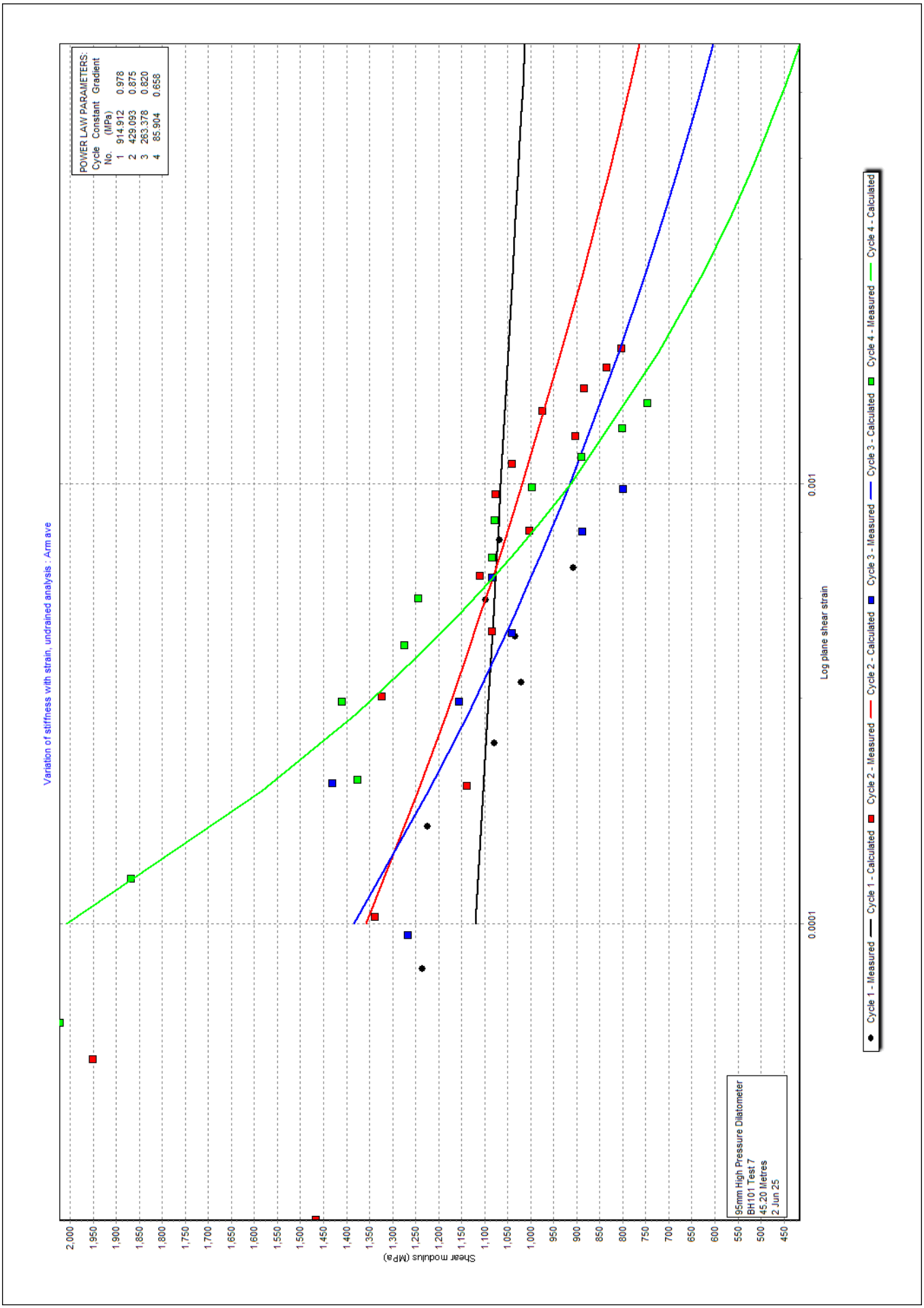

Shear modulus from unload/reload cycles Loop 4 : Arm ave
Total pressure (kPa)
Radial Displacement (mm)
95mm High Pressure Dilatometer
BH101 Test 7
45.20 Metres
2 Jun 25
RESULTS:
Gur : 940.6MPa
Cycle mid-point:
Cavity strain : 7.465%
Total stress : 4353kPa
Size of cycle :
Shear strain : 0.223%
Total stress : 2099kPa

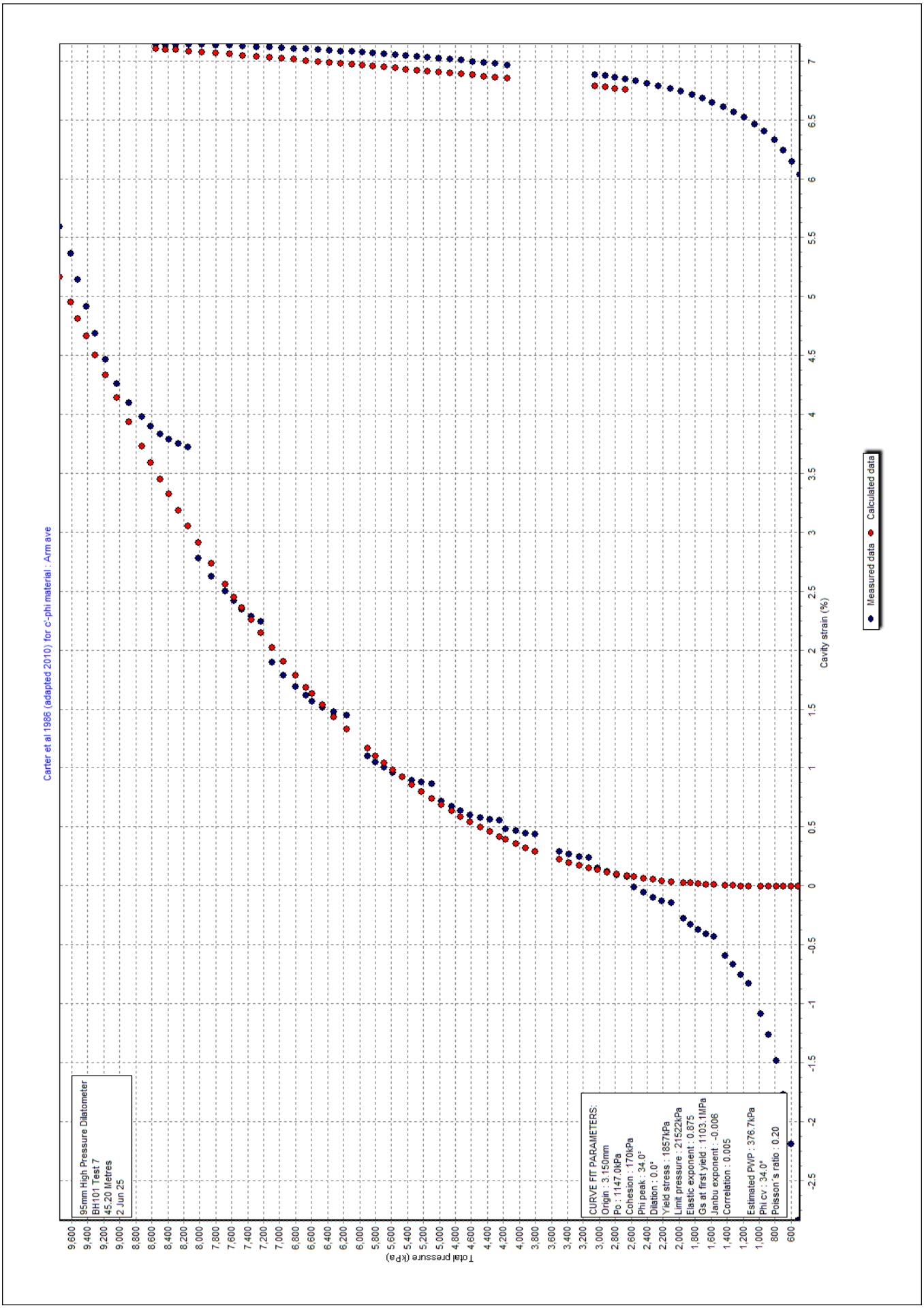

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH101 Test 7
45.20 Metres
2 Jun 25
RESULTS:
Gradient (beta) : 0.978
Intercept (n) : 935.438MPa
Shear stress constant : 914.912MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

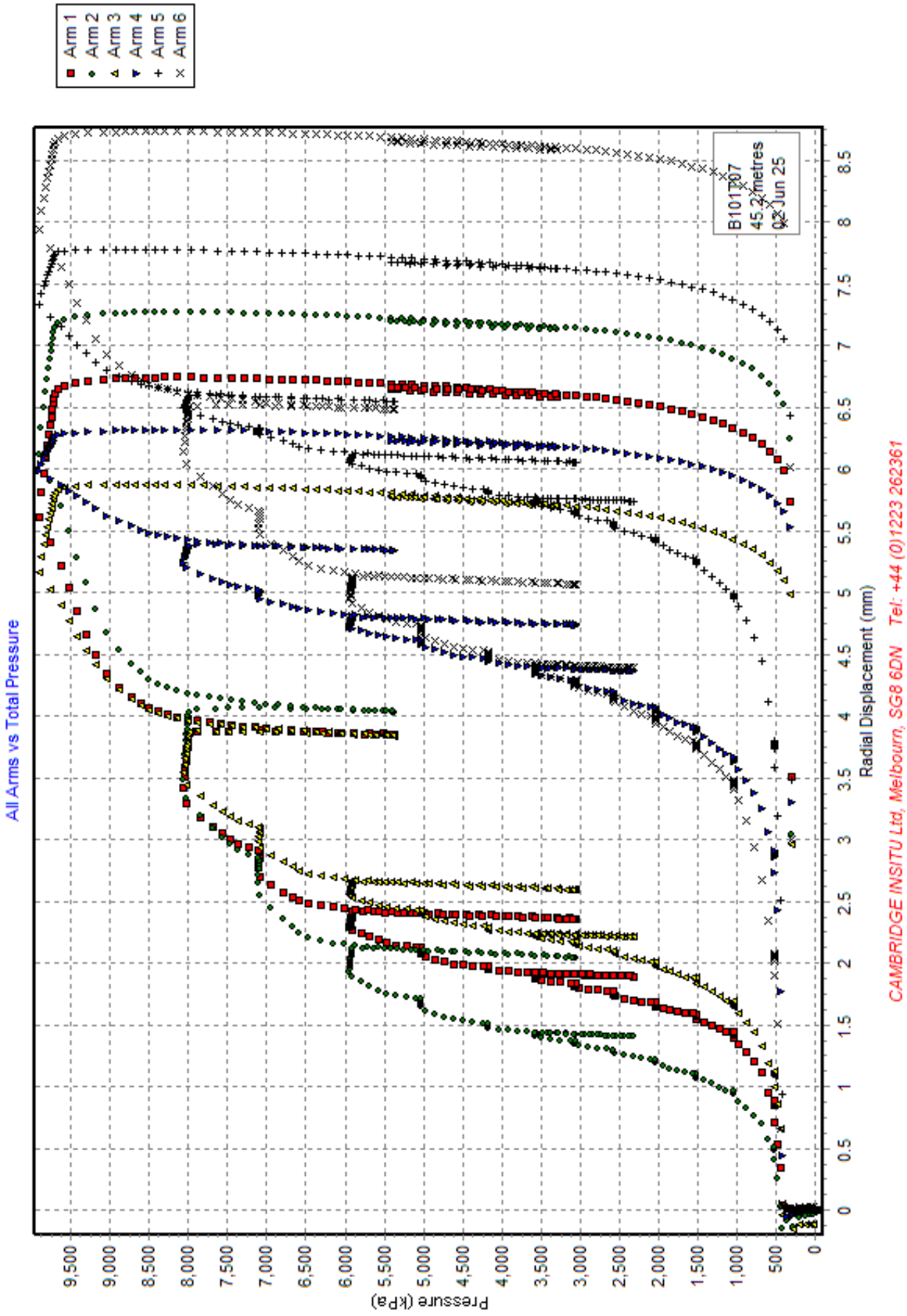

Bolton and Whittle (1999) Loop 2 : Arm ave
95mm High Pressure Dilatometer
BH101 Test 7
45.20 Metres
2 Jun 25
RESULTS:
Gradient (beta) : 0.875
Intercept (n) : 490.409MPa
Shear stress constant : 429.093MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

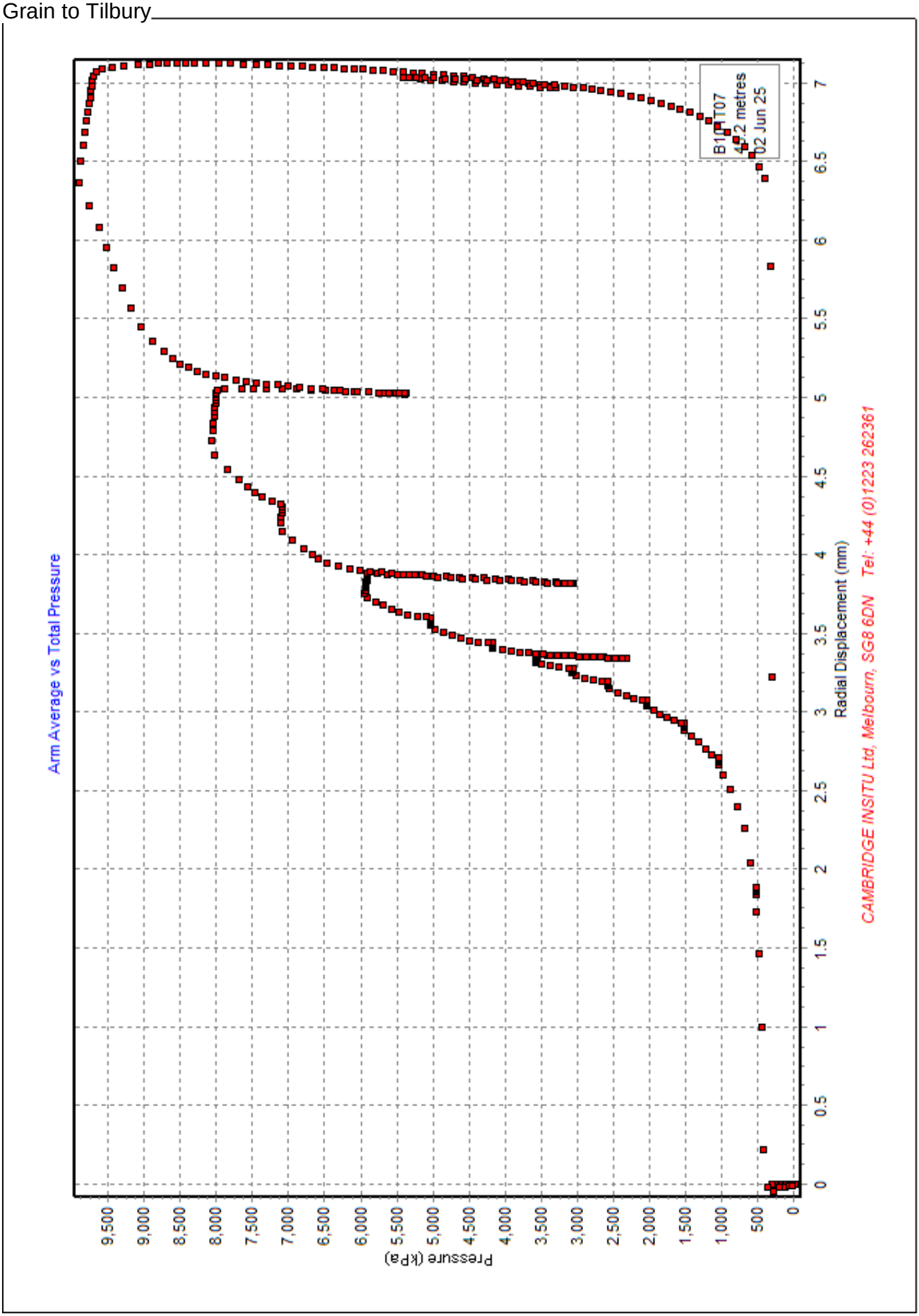

Bolton and Whittle (1999) Loop 3 : Arm ave
95mm High Pressure Dilatometer
BH101 Test 7
45.20 Metres
2 Jun 25
RESULTS:
Gradient (beta) : 0.820
Intercept (n) : 321.259MPa
Shear stress constant : 263.378MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)

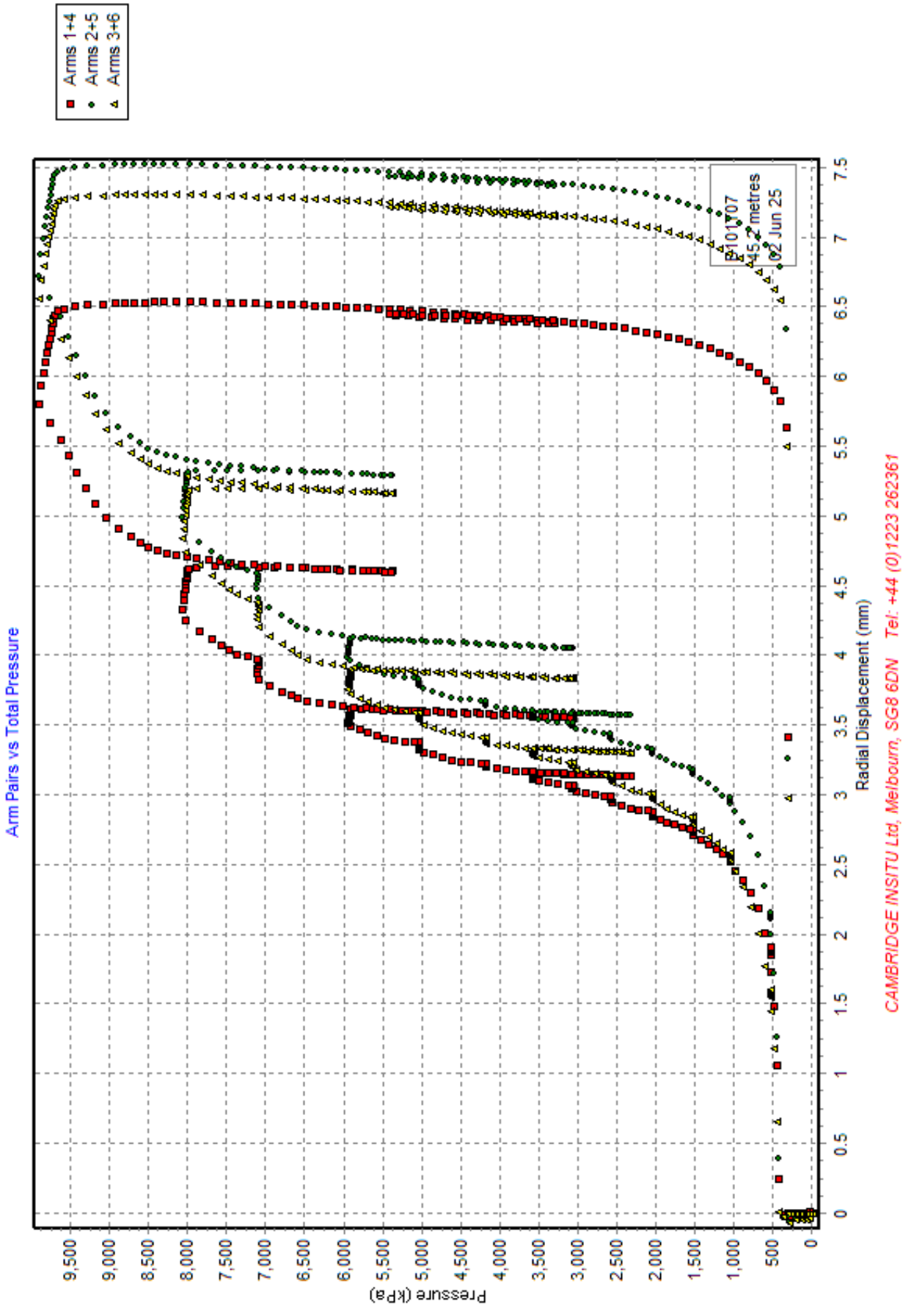

Bolton and Whittle (1999) Loop 4 : Arm ave
95mm High Pressure Dilatometer
BH101 Test 7
45.20 Metres
2 Jun 25
RESULTS:
Gradient (beta) : 0.658
Intercept (n) : 130.596MPa
Shear stress constant : 85.904MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 4
Total pressure (kPa)
Radial Displacement (mm)

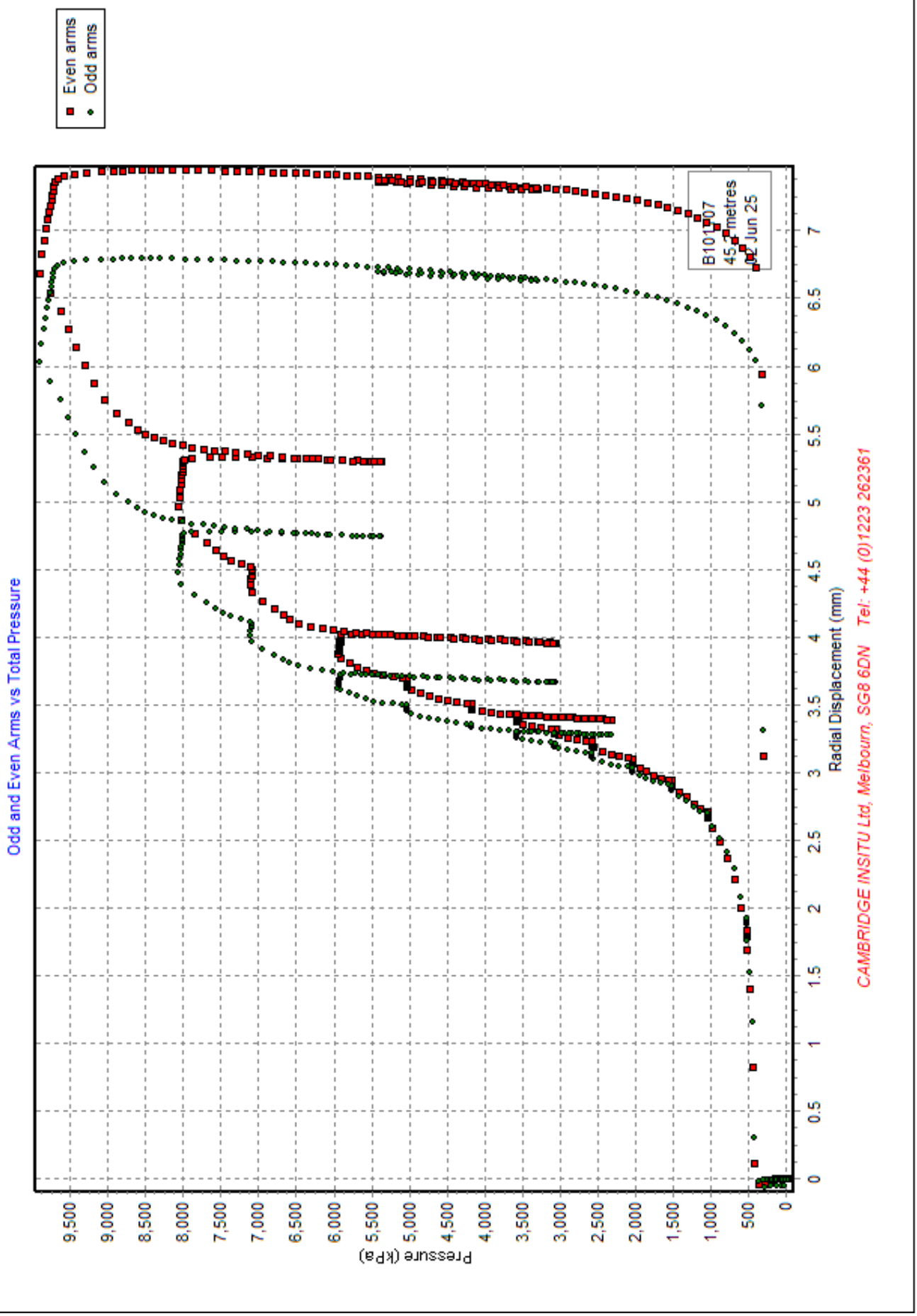

POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 914.912 0.978
2 429.093 0.875
3 263.378 0.820
4 85.904 0.658
Variation of stiffness with strain, undrained analysis : Arm ave
Shear modulus (MPa)
Log plane shear strain
0.0001
0.001
95mm High Pressure Dilatometer
BH101 Test 7
45.20 Metres
2 Jun 25
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
Cycle 4 - Measured
Cycle 4 - Calculated


Carter et al 1986 (adapted 2010) for c-phi material : Arm ave
95mm High Pressure Dilatometer
BH101 Test 7
45.20 Metres
2 Jun 25
CURVE FIT PARAMETERS:
Origin : 3.150mm
Po : 1147.0kPa
Cohesion : 170kPa
Phi peak : 34.0°
Dilation : 0.0°
Yield stress : 1857kPa
Limit pressure : 21522kPa
Elastic exponent : 0.875
Gs at first yield : 1103.1MPa
Janbu exponent : -0.006
Correlation : 0.005
Estimated PWP : 376.7kPa
Phi cv : 34.0°
Poisson's ratio : 0.20
Measured data
Calculated data
Total pressure (kPa)
Cavity strain (%)


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
B101107
45.4 metres
02 Jun 25
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


B1 T07
4.2 metres
02 Jun 25
Arm Average vs Total Pressure
Radial Displacement (mm)
Pressure (kPa)
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Arms 1+4
Arms 2+5
Arms 3+6
B101707
45.2 metres
02 Jun 25
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
B101 07
45.2 metres
02 Jun 25
Odd and Even Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to TIlbury
BH102 Test 1 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Grain to Tilbury
Borehole : BH102
Test name : BH102 Test 1
Test date : 15 May 25
Test depth : 27.40 Metres
Water table : 4.5 Metres
Ambient PWP : 224.6 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDP/RW on 24 May 25

Remarks: Completely structureless chalk

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=4.71"
Po from Marsland & Randolph (kPa) : "Arm ave=459.0"
Best estimate of Po (kPa) : "Arm ave=353.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=959.4"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 28.0
Angle of internal friction (°) : "Arm ave=40.0"
Dilation angle (°) : "Arm ave=14.4"
Gradient of log-log plot : "Arm ave=0.488"

[Withers et al 1989]
Angle of internal friction (°) : "Arm ave=28.4"
Dilation angle (°) : "Arm ave=0.5"
Gradient of log-log plot : "Arm ave=-1.795"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=8.8"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	82.4	0.979	541	0.174	144
Arm ave	2	115.7	2.964	736	0.151	175
Arm ave	3	46.2	3.677	463	0.521	241

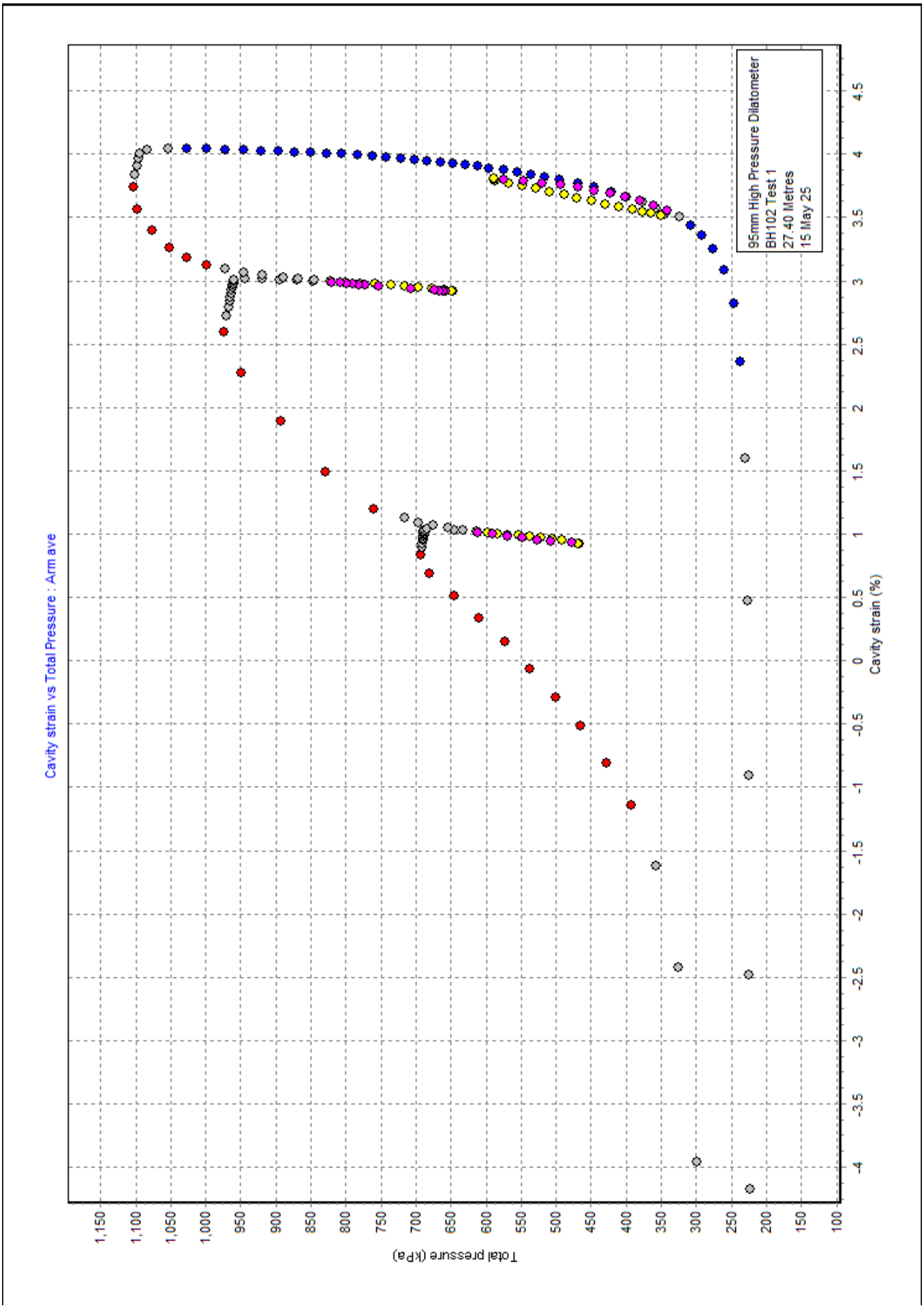
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

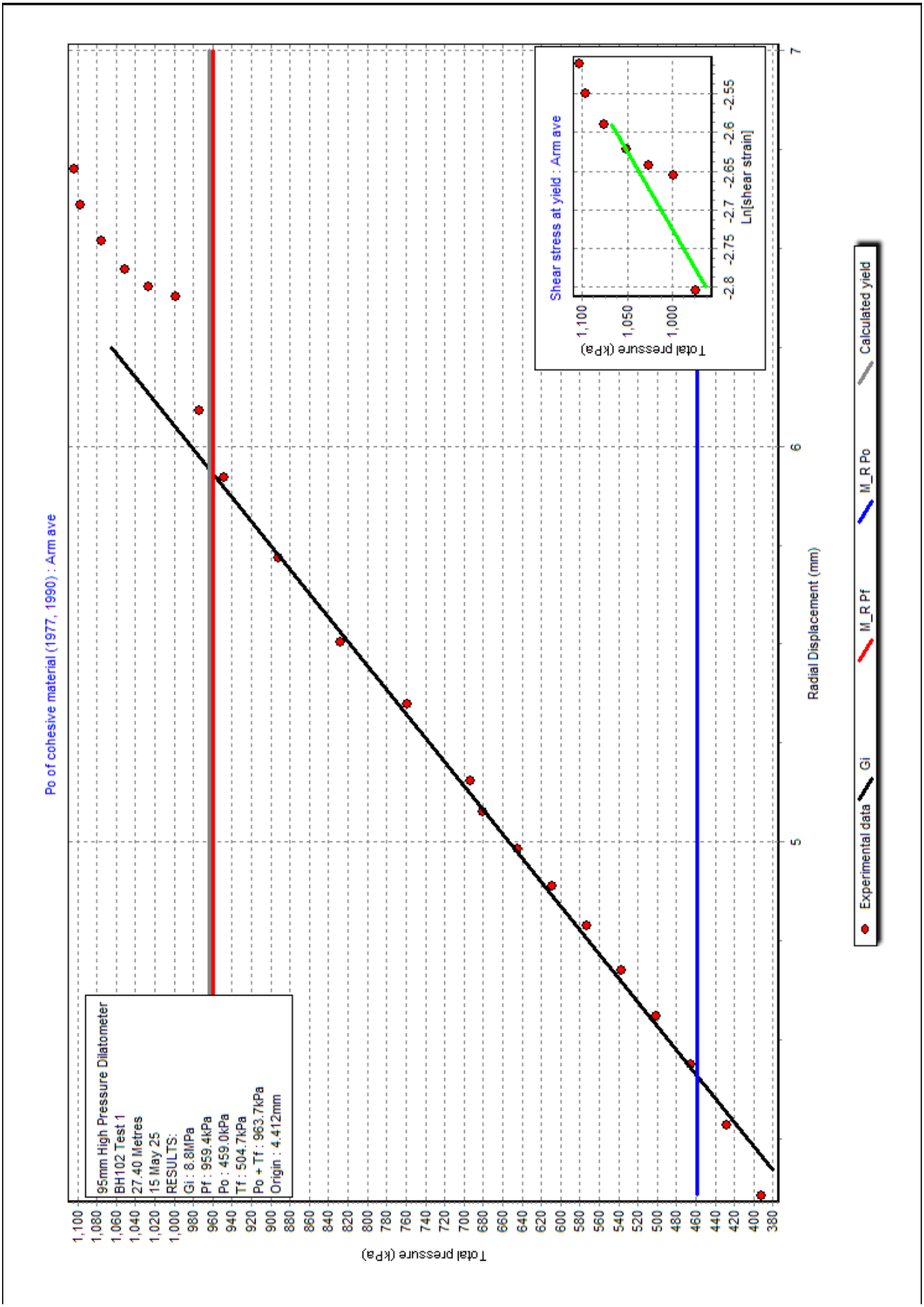
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	24.744	19.959	0.807
Arm ave	2	41.318	34.427	0.833
Arm ave	3	7.458	4.670	0.626

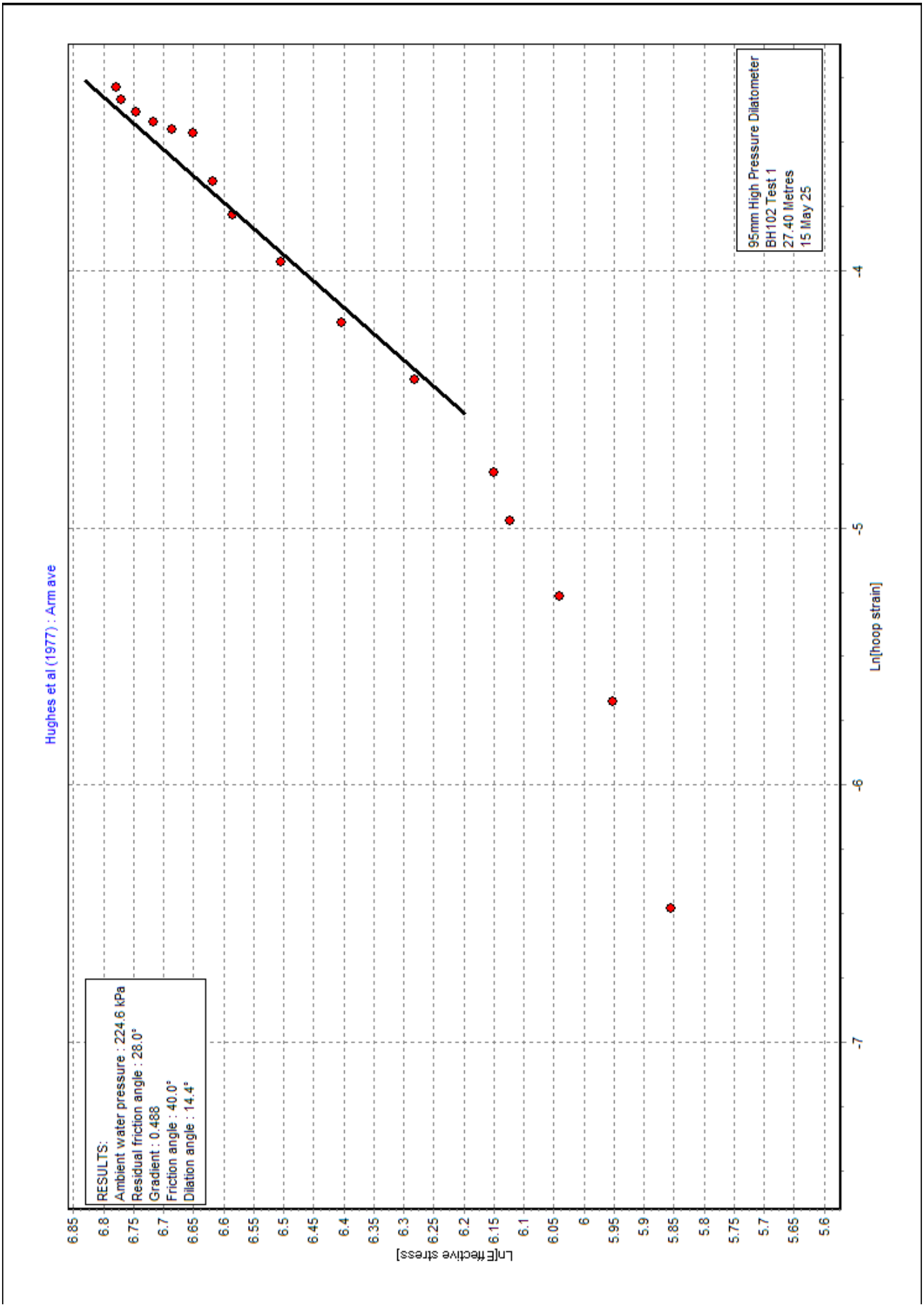
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 4.71
Po (kPa) : 353
Cohesion (kPa) : 9
Angle of peak friction (deg) : 40.0
Angle of peak dilation (deg) : 14.4
Total yield stress (kPa) : 484
Total limit stress (kPa) : 3436
G at first yield (MPa) : 31.1

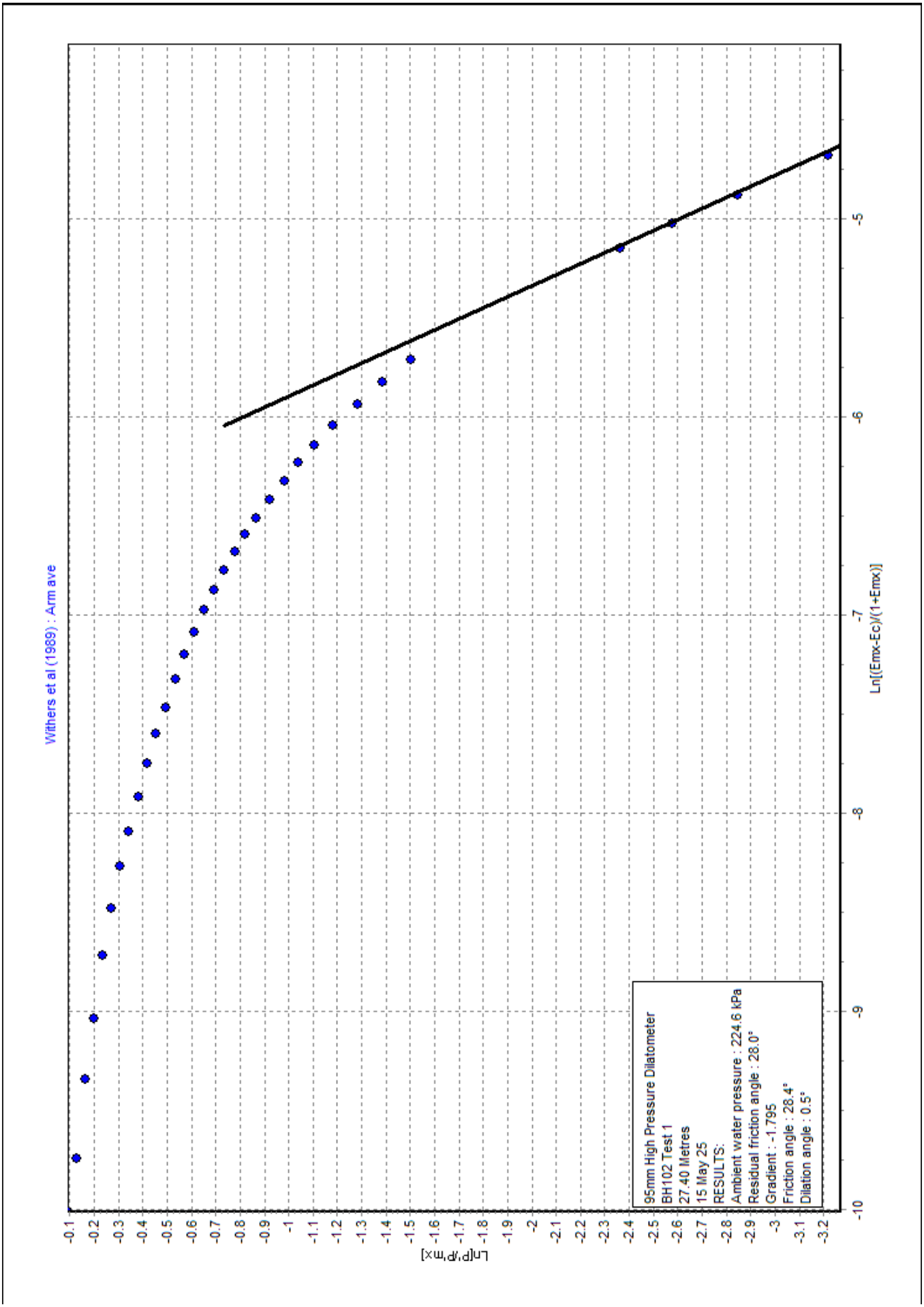
Grain to TIlbury
BH102 Test 1 - SUMMARY OF RESULTS

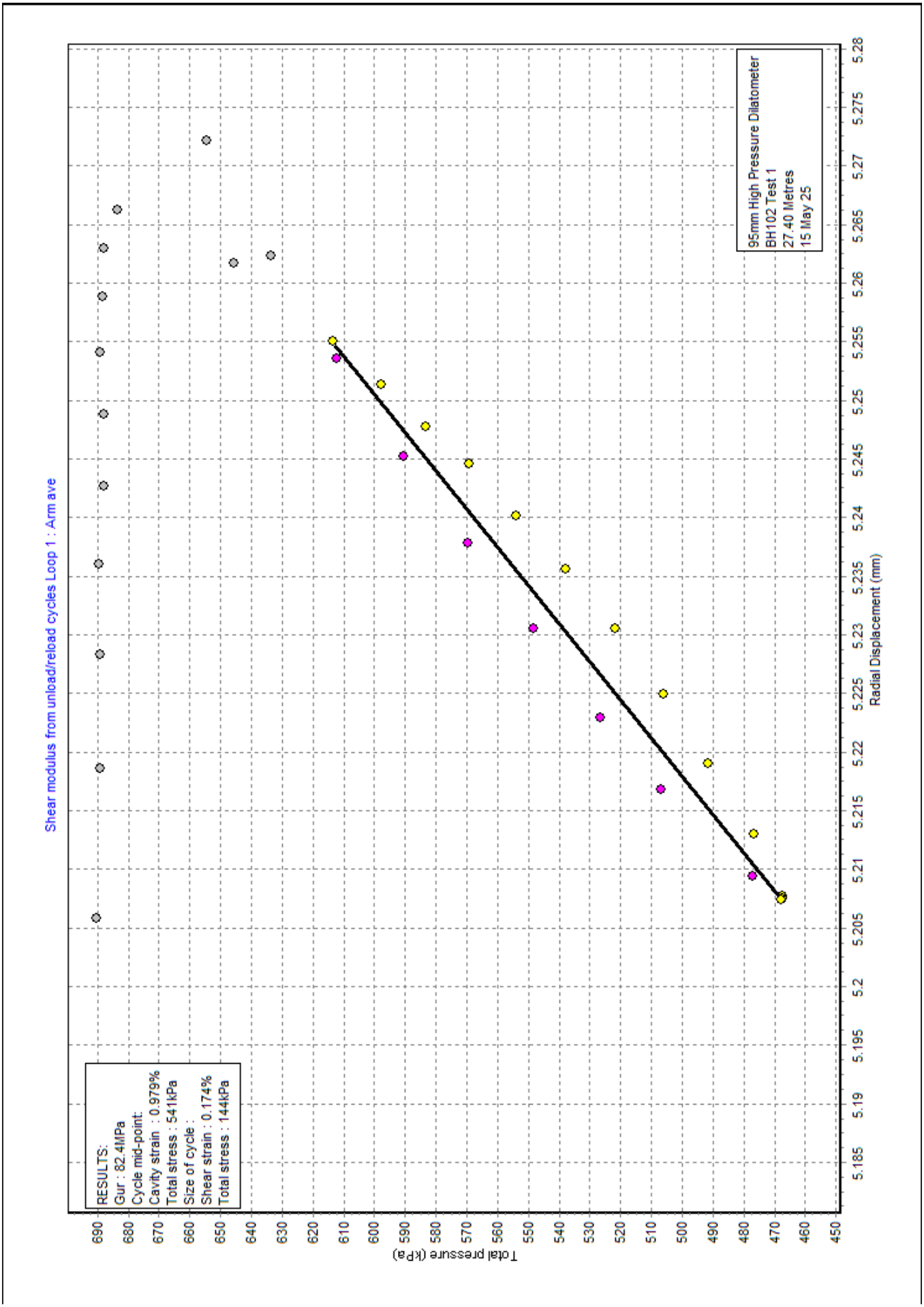
Non-linear exponent	:	0.807
Janbu exponent	:	0.836
Correlation	:	0.234
Ambient pore water pressure (kPa)	:	225
Residual friction angle (deg)	:	28.0
Poisson's ratio	:	0.20

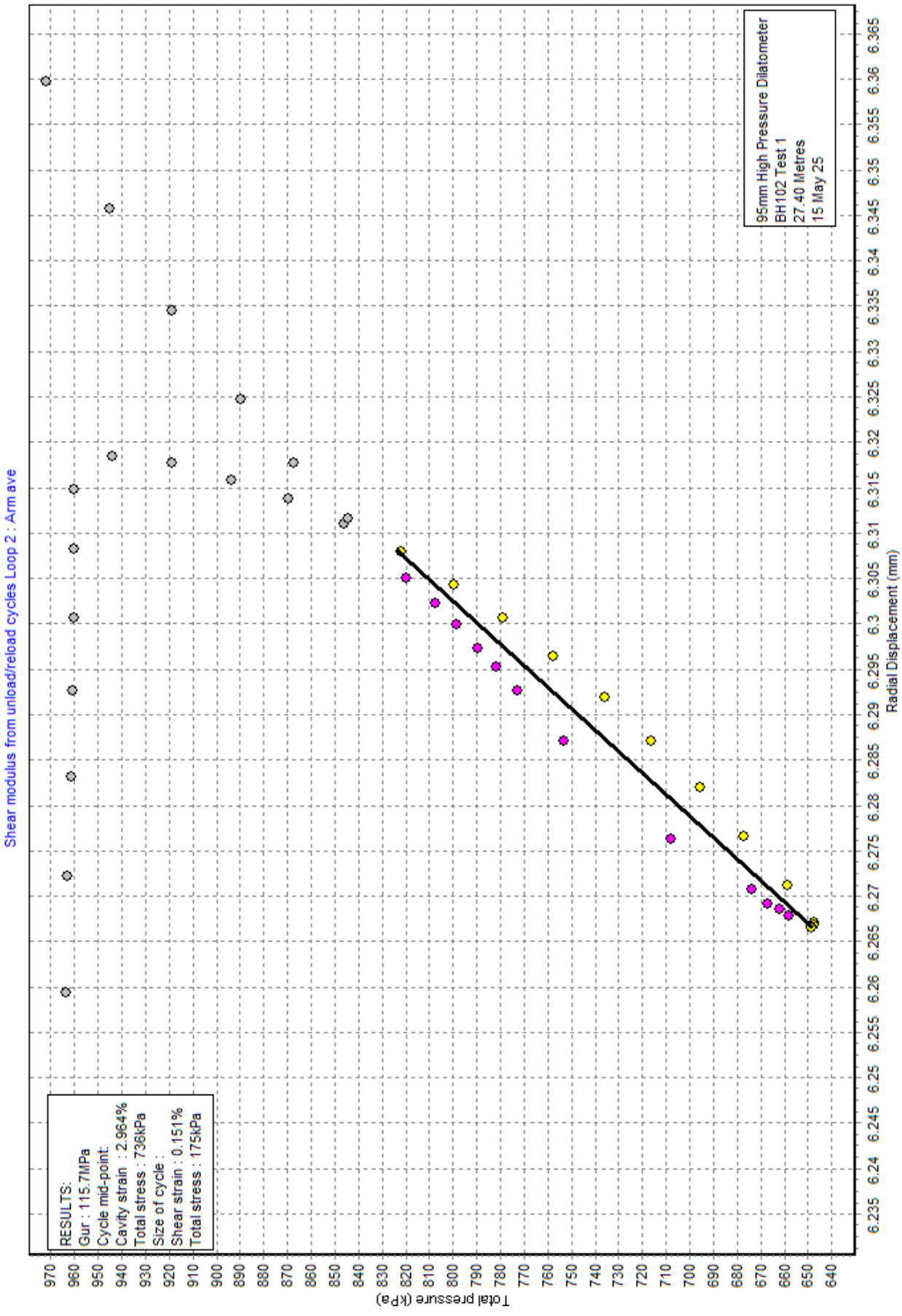

Cavity strain vs Total Pressure : Arm ave
95mm High Pressure Dilatometer
BH102 Test 1
27.40 Metres
15 May 25
Total pressure (kPa)
Cavity strain (%)
1,150
1,100
1,050
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4

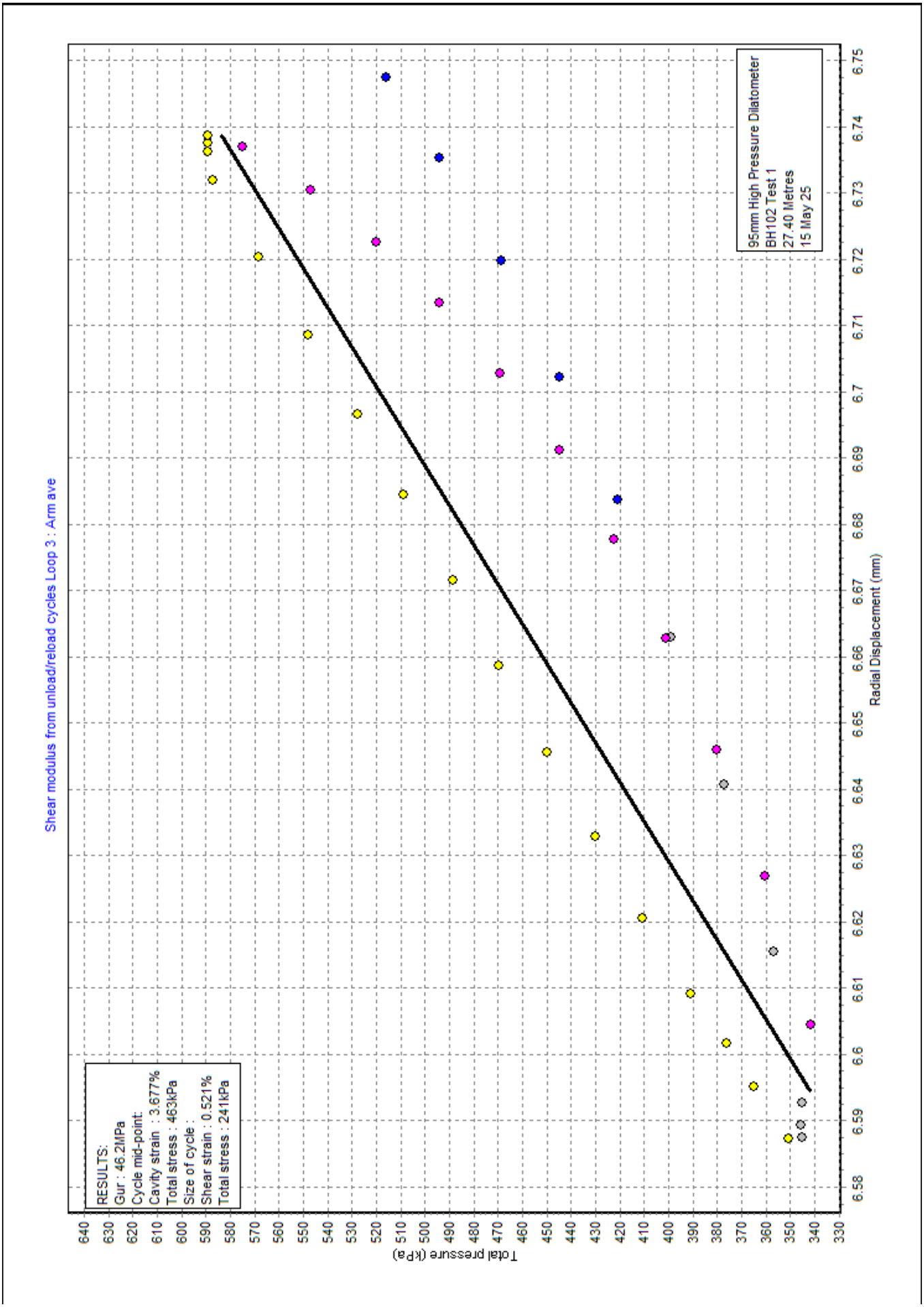

Po of cohesive material (1977, 1990) : Arm ave
95mm High Pressure Dilatometer
BH102 Test 1
27.40 Metres
15 May 25
RESULTS:
Gi : 8.8MPa
Pf : 959.4kPa
Po : 459.0kPa
Tf : 504.7kPa
Po + Tf : 963.7kPa
Origin : 4.412mm
Total pressure (kPa)
Radial Displacement (mm)
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Shear stress at yield : Arm ave
Total pressure (kPa)
Ln[shear strain]

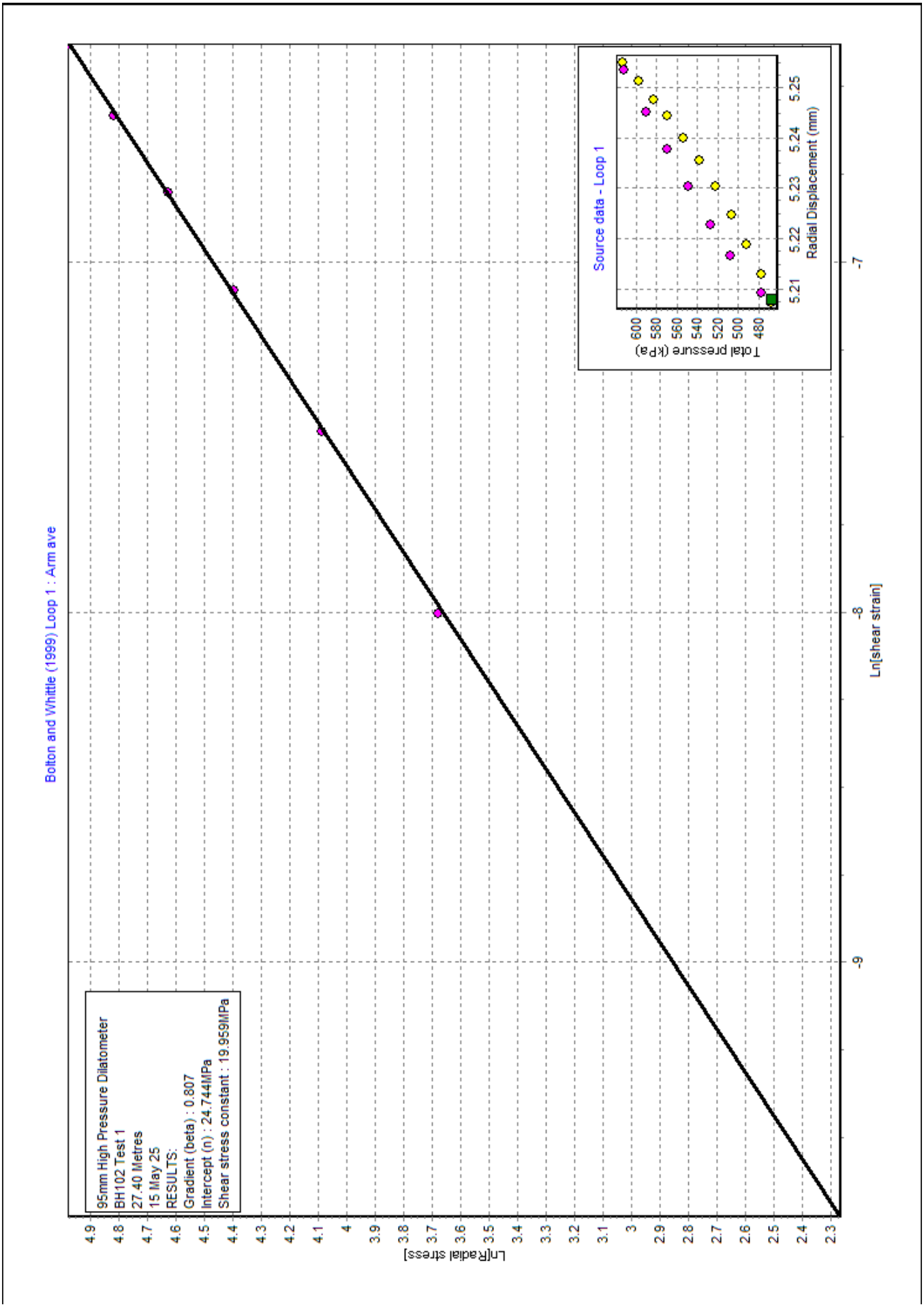

Hughes et al (1977) : Arm ave
RESULTS:
Ambient water pressure : 224.6 kPa
Residual friction angle : 28.0°
Gradient : 0.488
Friction angle : 40.0°
Dilation angle : 14.4°
95mm High Pressure Dilatometer
BH102 Test 1
27.40 Metres
15 May 25
Ln[Effective stress]
Ln[hoop strain]
6.85
6.8
6.75
6.7
6.65
6.6
6.55
6.5
6.45
6.4
6.35
6.3
6.25
6.2
6.15
6.1
6.05
6
5.95
5.9
5.85
5.8
5.75
5.7
5.65
5.6
-4
-5
-6
-7

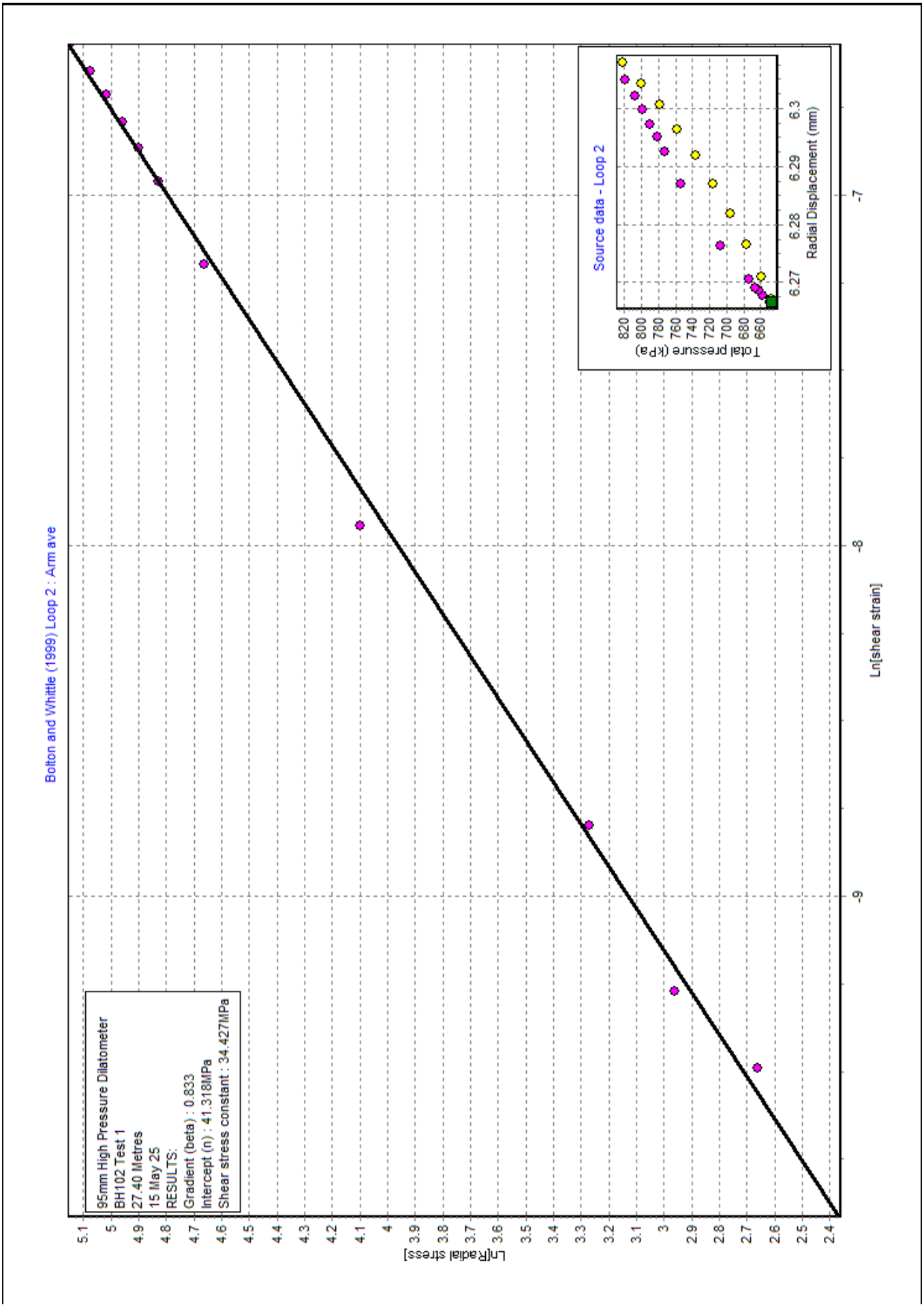

Withers et al (1989) : Arm ave
Ln[P'/P'mx]
Ln[(Emx-Ec)/(1+Emx)]
95mm High Pressure Dilatometer
BH102 Test 1
27.40 Metres
15 May 25
RESULTS:
Ambient water pressure : 224.6 kPa
Residual friction angle : 28.0°
Gradient : -1.795
Friction angle : 28.4°
Dilation angle : 0.5°

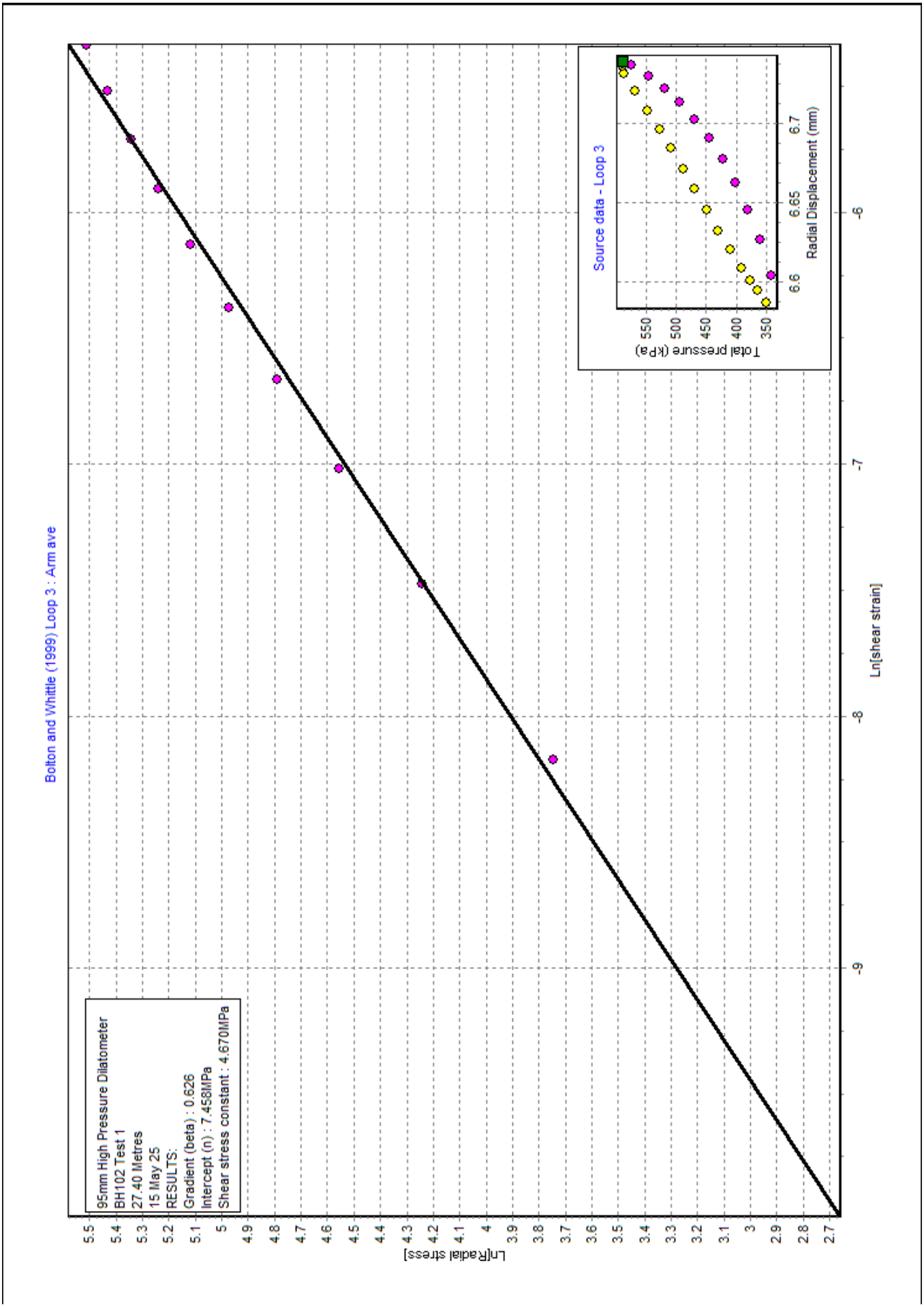

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 82.4MPa
Cycle mid-point:
Cavity strain : 0.979%
Total stress : 541kPa
Size of cycle :
Shear strain : 0.174%
Total stress : 144kPa
95mm High Pressure Dilatometer
BH102 Test 1
27.40 Metres
15 May 25
Total pressure (kPa)
Radial Displacement (mm)

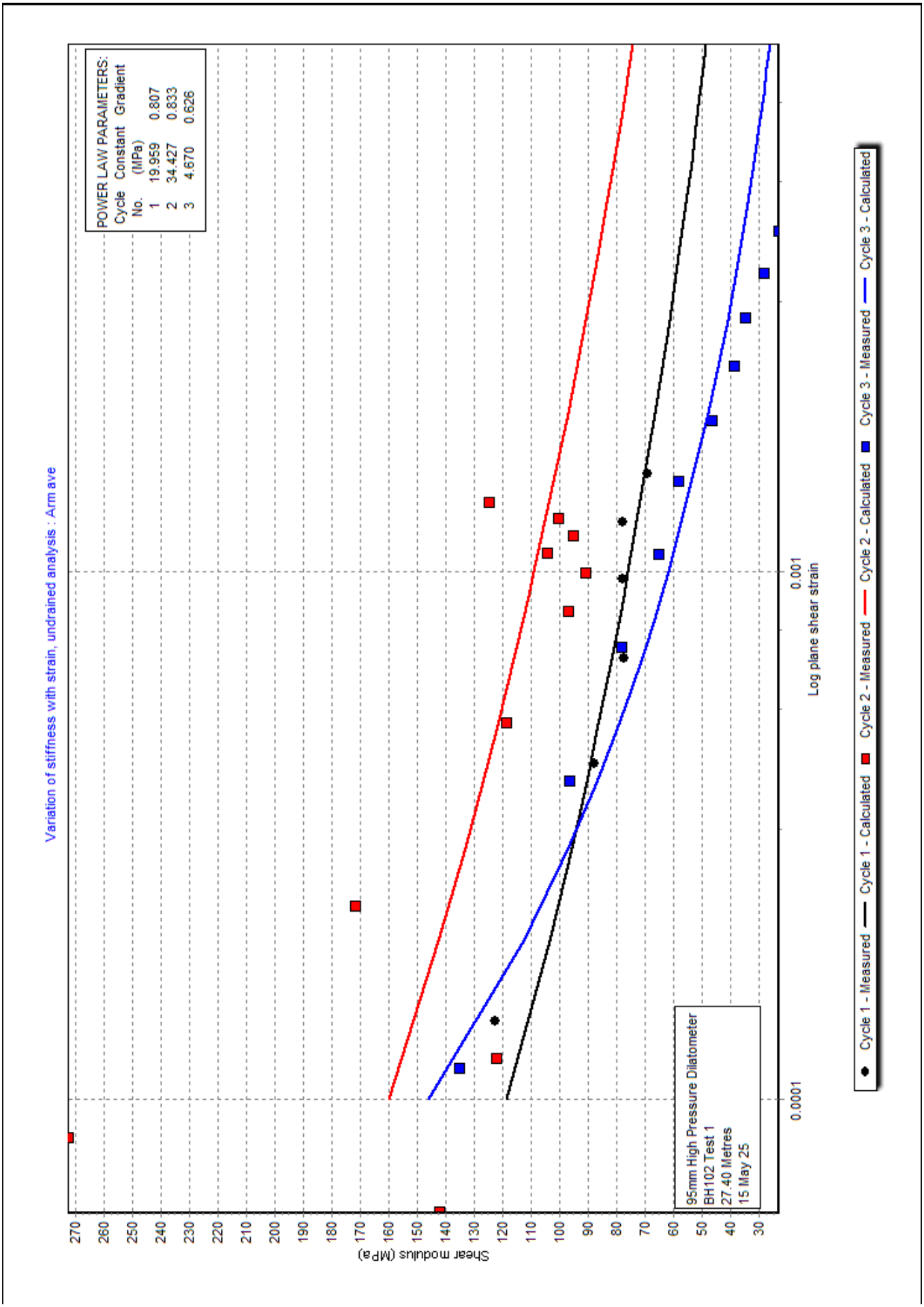

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 115.7MPa
Cycle mid-point:
Cavity strain : 2.964%
Total stress : 736kPa
Size of cycle :
Shear strain : 0.151%
Total stress : 175kPa
95mm High Pressure Dilatometer
BH102 Test 1
27.40 Metres
15 May 25
Total pressure (kPa)
Radial Displacement (mm)

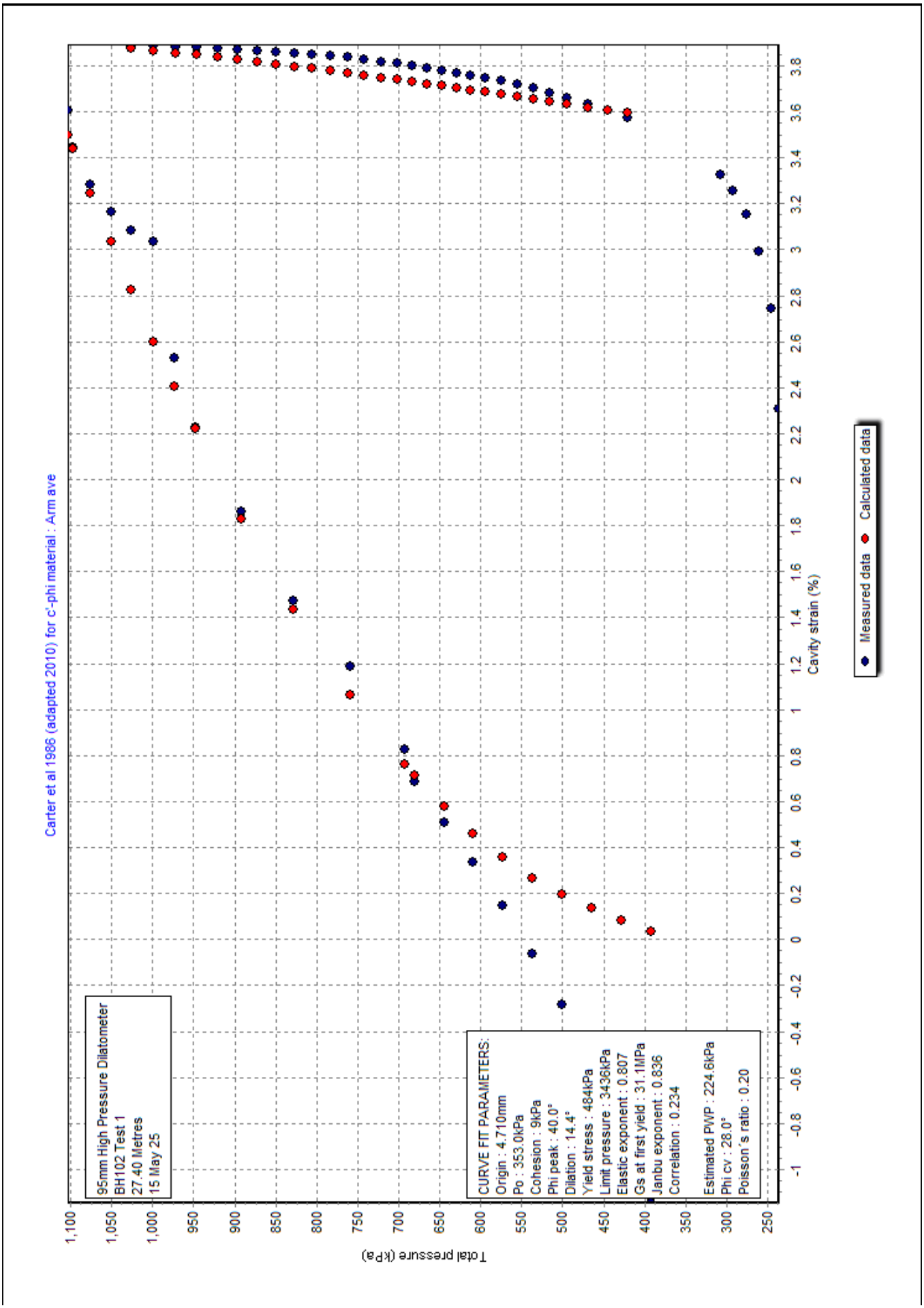

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 46.2MPa
Cycle mid-point:
Cavity strain : 3.677%
Total stress : 463kPa
Size of cycle :
Shear strain : 0.521%
Total stress : 241kPa
95mm High Pressure Dilatometer
BH102 Test 1
27.40 Metres
15 May 25
Total pressure (kPa)
Radial Displacement (mm)

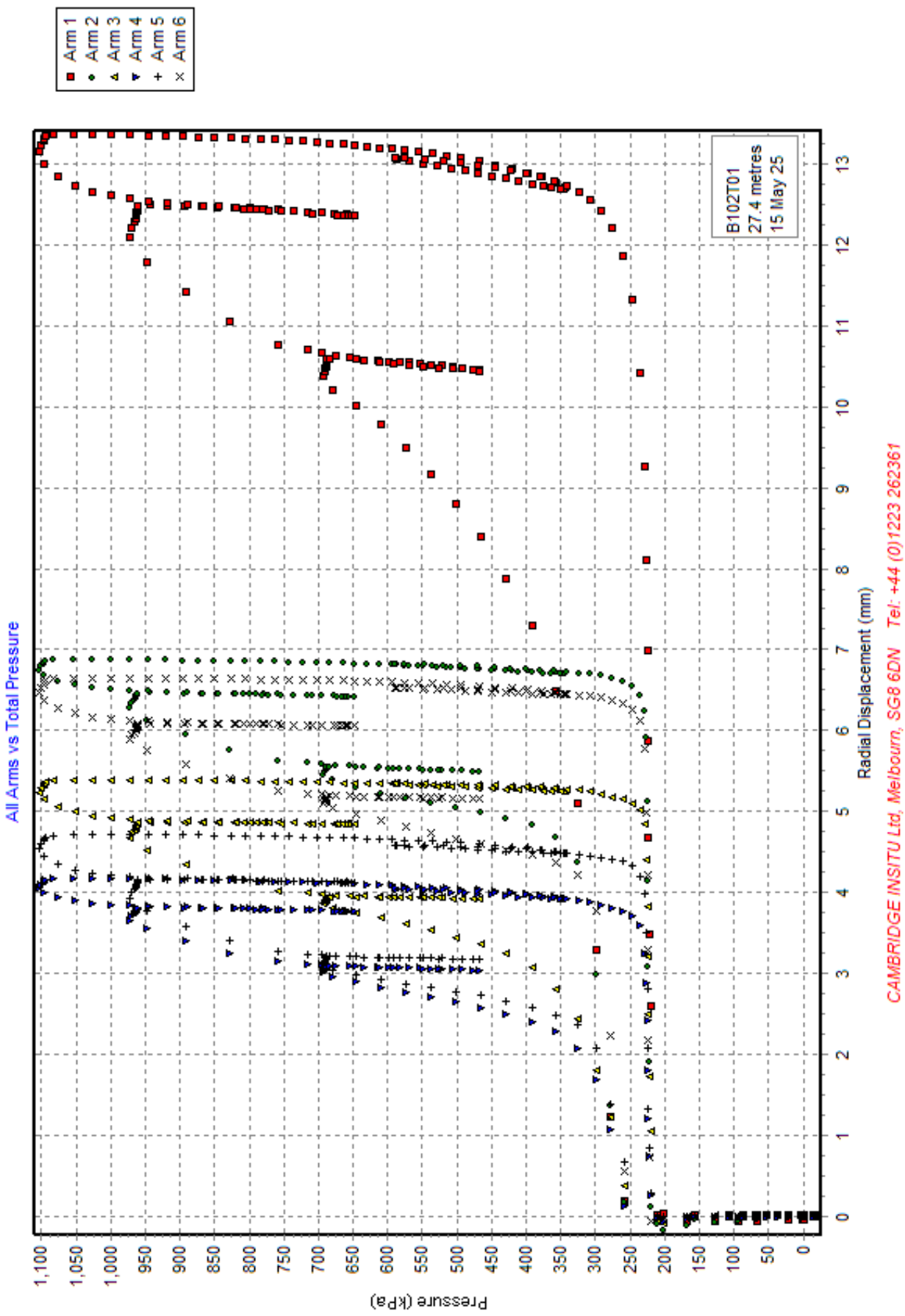

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 1
27.40 Metres
15 May 25
RESULTS:
Gradient (beta) : 0.807
Intercept (n) : 24.744MPa
Shear stress constant : 19.959MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

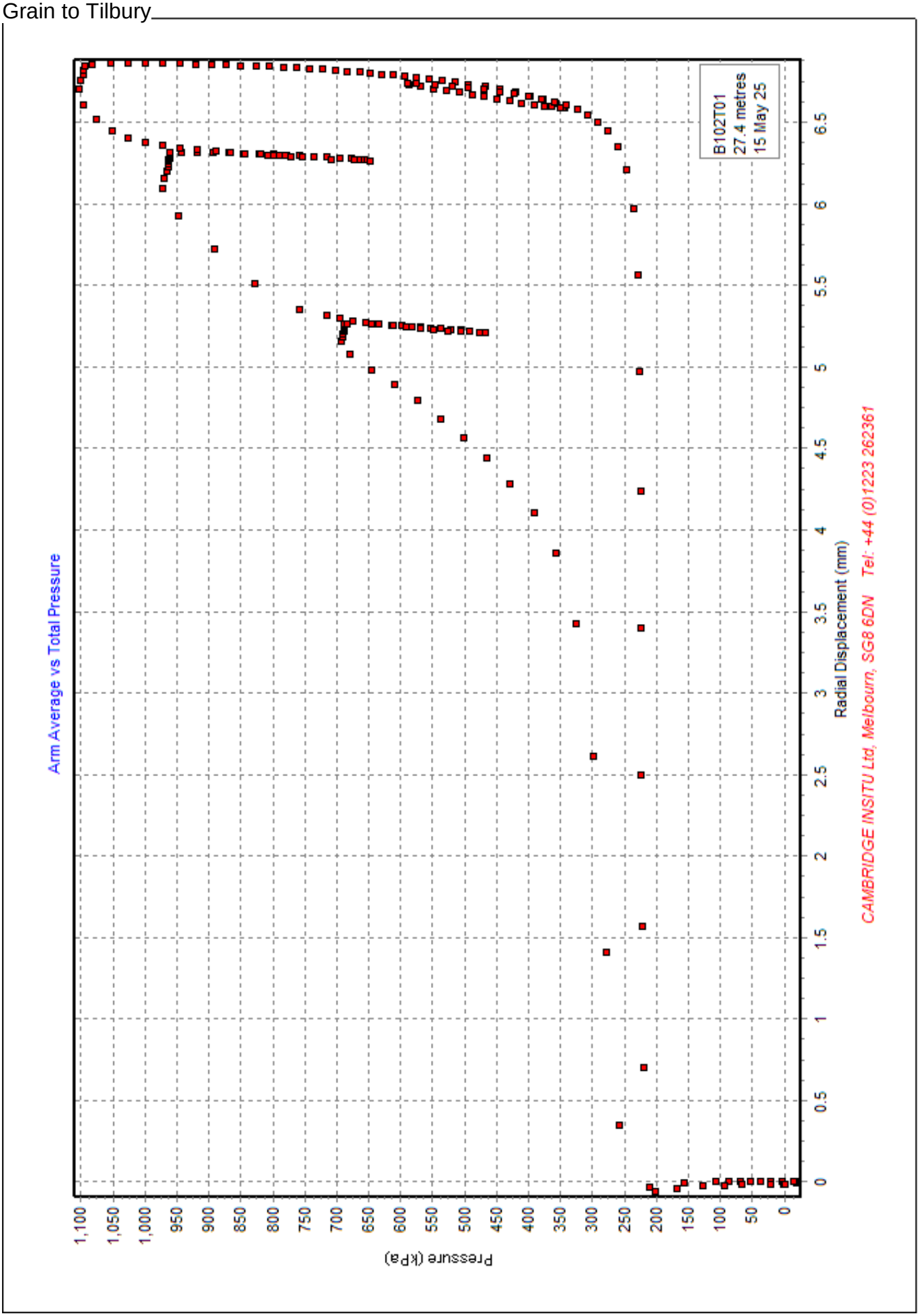

Bolton and Whittle (1999) Loop 2 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 1
27.40 Metres
15 May 25
RESULTS:
Gradient (beta) : 0.833
Intercept (n) : 41.318MPa
Shear stress constant : 34.427MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

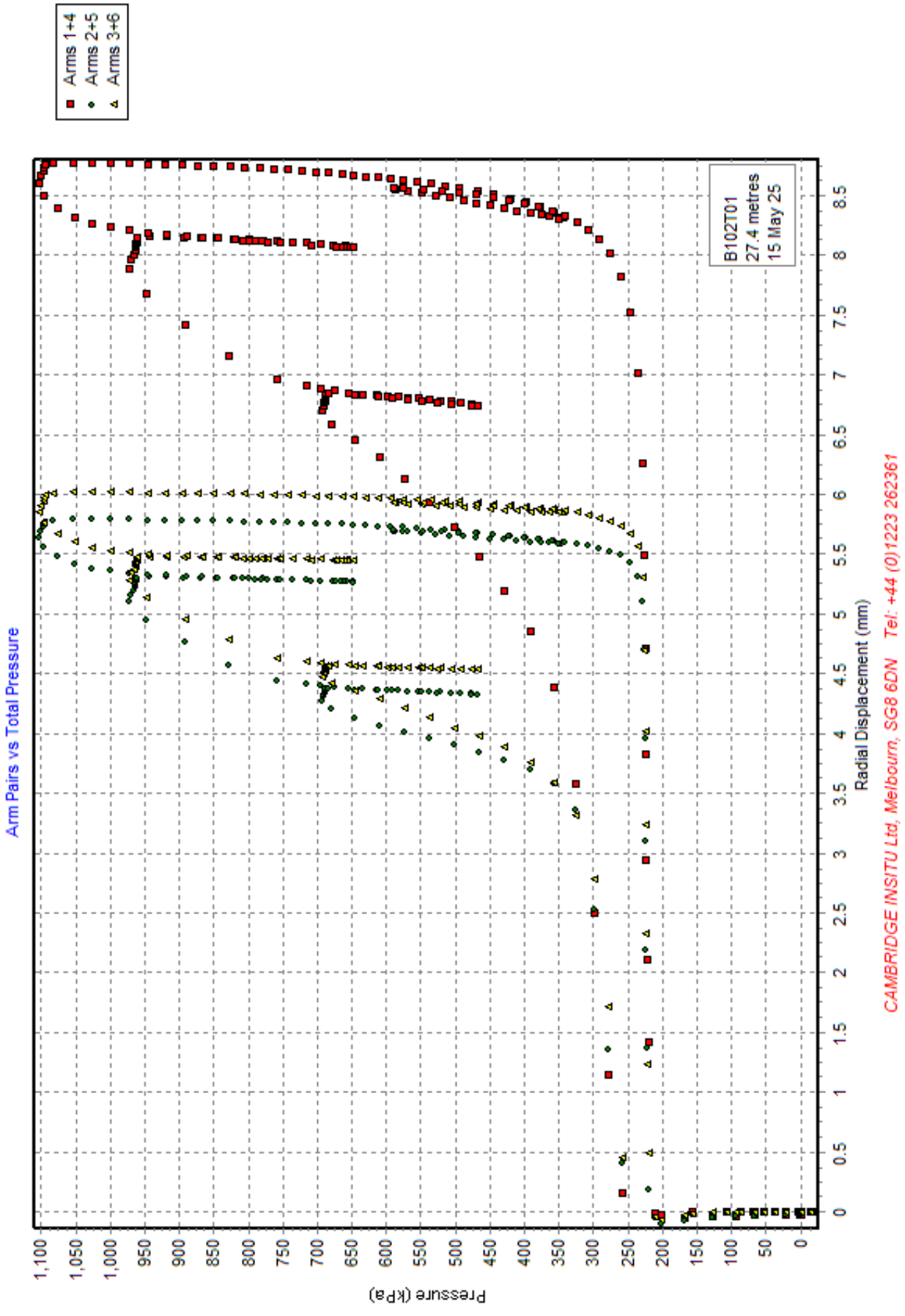

Bolton and Whittle (1999) Loop 3 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 1
27.40 Metres
15 May 25
RESULTS:
Gradient (beta) : 0.626
Intercept (n) : 7.458MPa
Shear stress constant : 4.670MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)

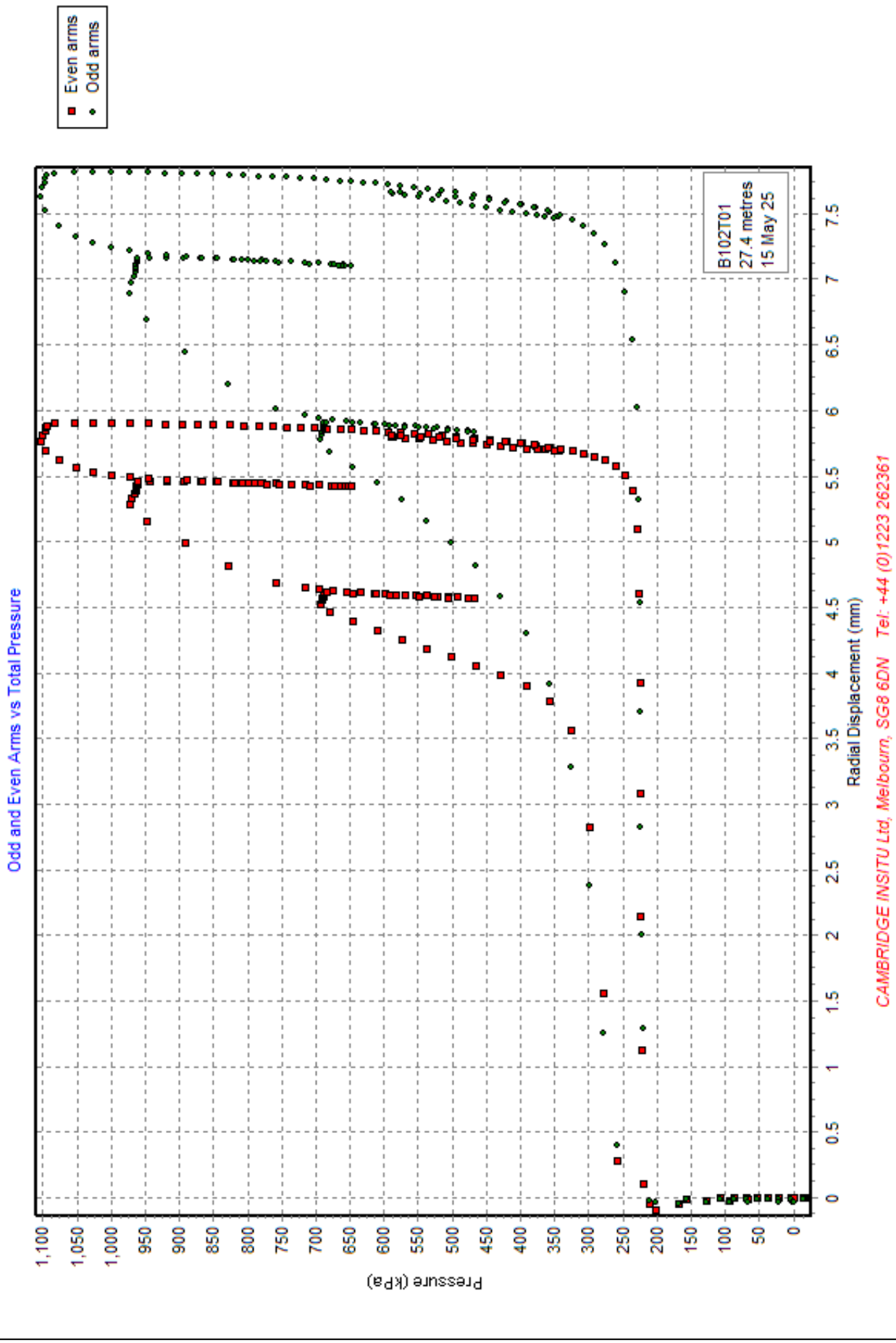

Variation of stiffness with strain, undrained analysis : Arm ave
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 19.959 0.807
2 34.427 0.833
3 4.670 0.626
95mm High Pressure Dilatometer
BH102 Test 1
27.40 Metres
15 May 25
Shear modulus (MPa)
Log plane shear strain
0.0001
0.001
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated


Carter et al 1986 (adapted 2010) for c'-phi material : Arm ave
95mm High Pressure Dilatometer
BH102 Test 1
27.40 Metres
15 May 25
CURVE FIT PARAMETERS:
Origin : 4.710mm
Po : 353.0kPa
Cohesion : 9kPa
Phi peak : 40.0°
Dilation : 14.4°
Yield stress : 484kPa
Limit pressure : 3436kPa
Elastic exponent : 0.807
Gs at first yield : 31.1MPa
Janbu exponent : 0.836
Correlation : 0.234
Estimated PWP : 224.6kPa
Phi cv : 28.0°
Poisson's ratio : 0.20
Total pressure (kPa)
Cavity strain (%)
Measured data
Calculated data


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
B102T01
27.4 metres
15 May 25
All Arms vs Total Pressure
Radial Displacement (mm)
Pressure (kPa)
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Arm Average vs Total Pressure
Pressure (kPa)
1,100
1,050
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
Radial Displacement (mm)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
B102T01
27.4 metres
15 May 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arms 1+4
Arms 2+5
Arms 3+6
B102T01
27.4 metres
15 May 25
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
B102T01
27.4 metres
15 May 25
Odd and Even Arms vs Total Pressure
Radial Displacement (mm)
Pressure (kPa)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to TIlbury
BH102 Test 2 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Tilbury
Borehole : BH102
Test name : BH102 Test 2
Test date : 15 May 25
Test depth : 30.40 Metres
Water table : 4.5 Metres
Ambient PWP : 254.1 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDP/RW on 18 Jul 25

Remarks:

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=4.07"
Po from Marsland & Randolph (kPa) : "Arm ave=882.0"
Best estimate of Po (kPa) : "Arm ave=659.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=3096.7"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 34.0
Angle of internal friction (°) : "Arm ave=37.7"
Dilation angle (°) : "Arm ave=4.5"
Gradient of log-log plot : "Arm ave=0.409"

[Withers et al 1989]
Angle of internal friction (°) : "Arm ave=33.8"
Dilation angle (°) : "Arm ave=-0.2"
Gradient of log-log plot : "Arm ave=-2.524"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=71.4"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	428.9	-0.174	1191	0.090	386
Arm ave	2	772.2	0.540	1950	0.078	604
Arm ave	3	1007.6	1.983	3102	0.094	943
Arm ave	4	808.9	4.223	2355	0.154	1248

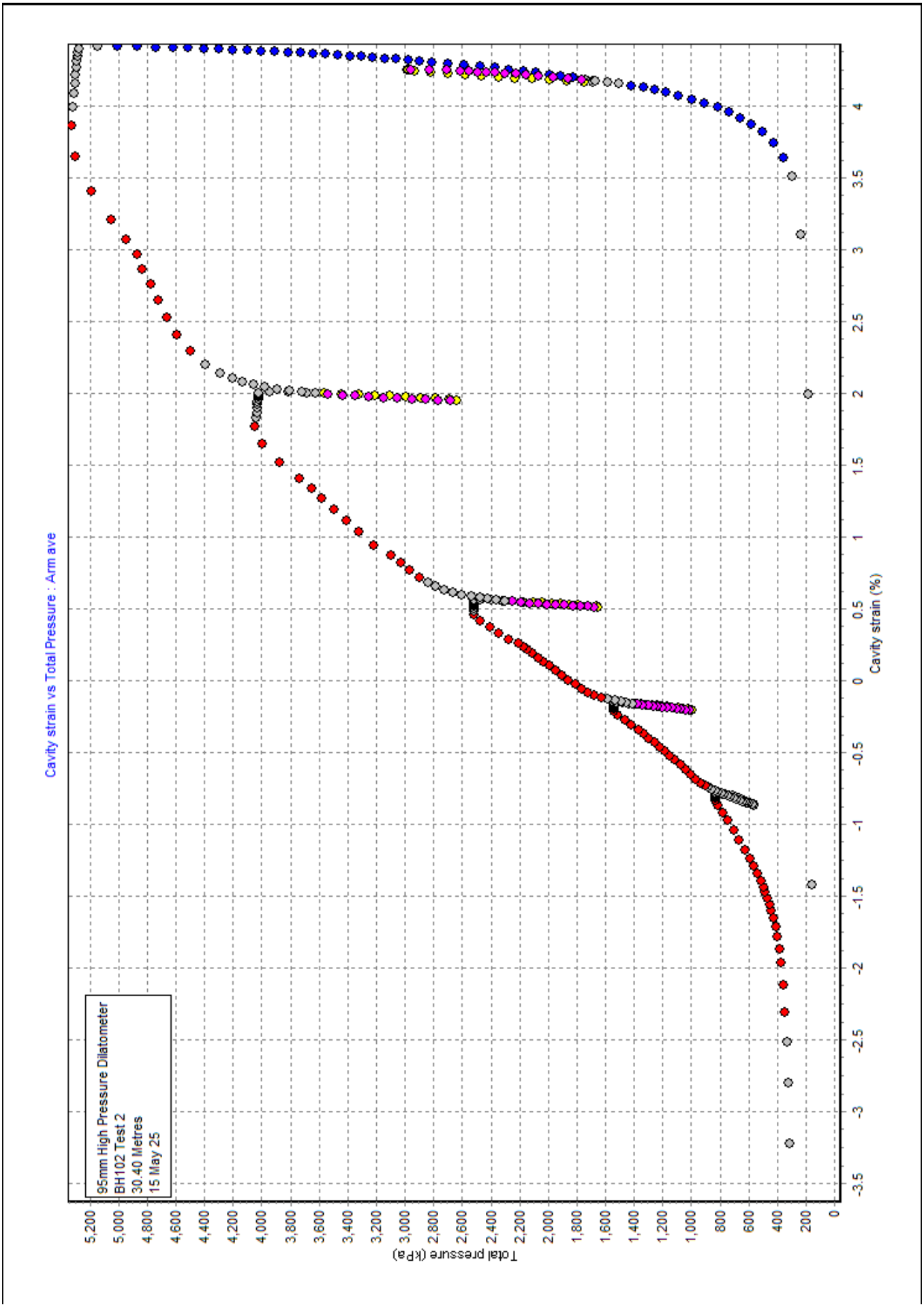
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

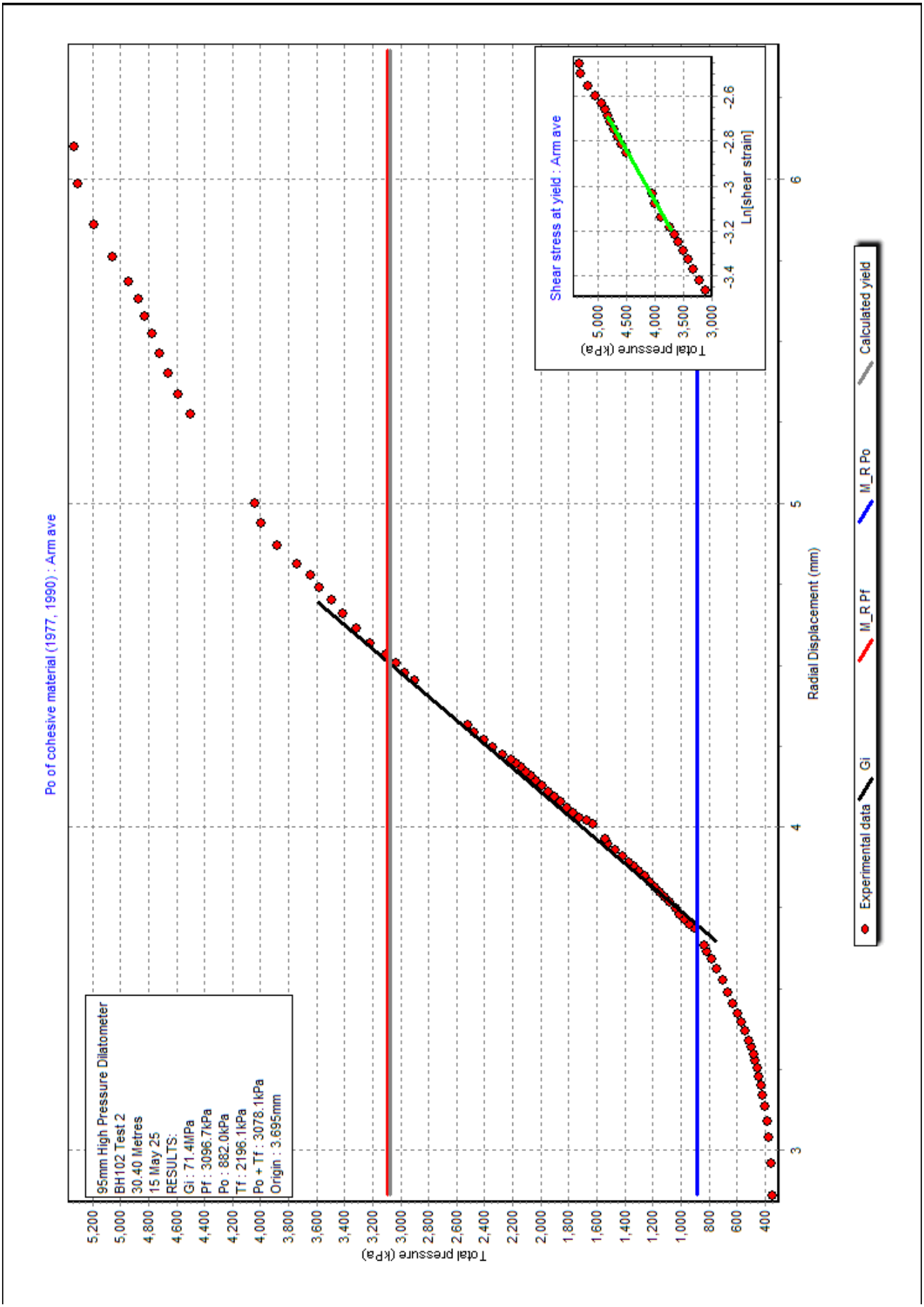
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	407.659	402.229	0.987
Arm ave	2	328.111	287.046	0.875
Arm ave	3	297.334	243.357	0.818
Arm ave	4	107.370	72.130	0.672

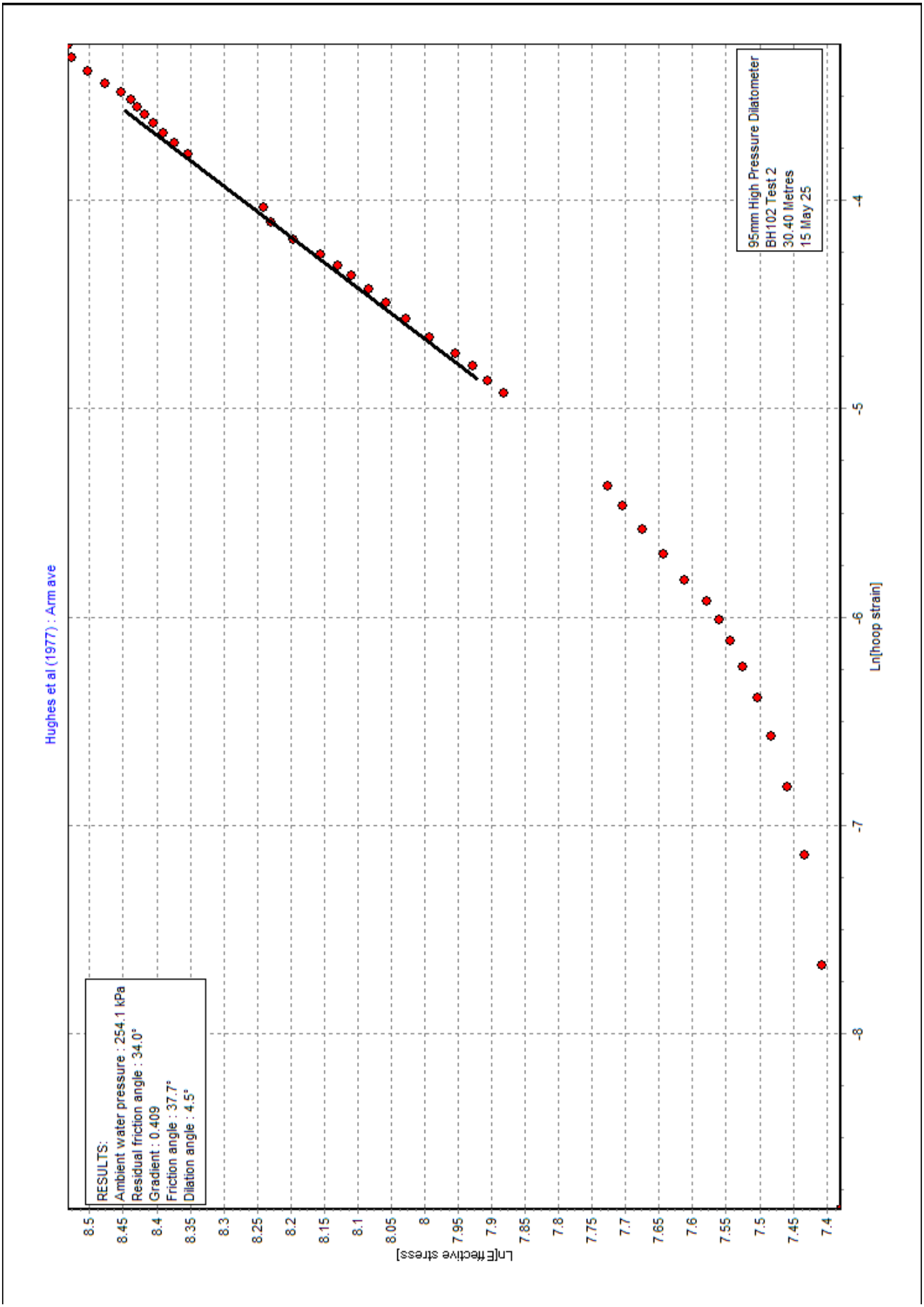
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 4.07
Po (kPa) : 659
Cohesion (kPa) : 28
Angle of peak friction (deg) : 37.7
Angle of peak dilation (deg) : 4.5
Total yield stress (kPa) : 1040

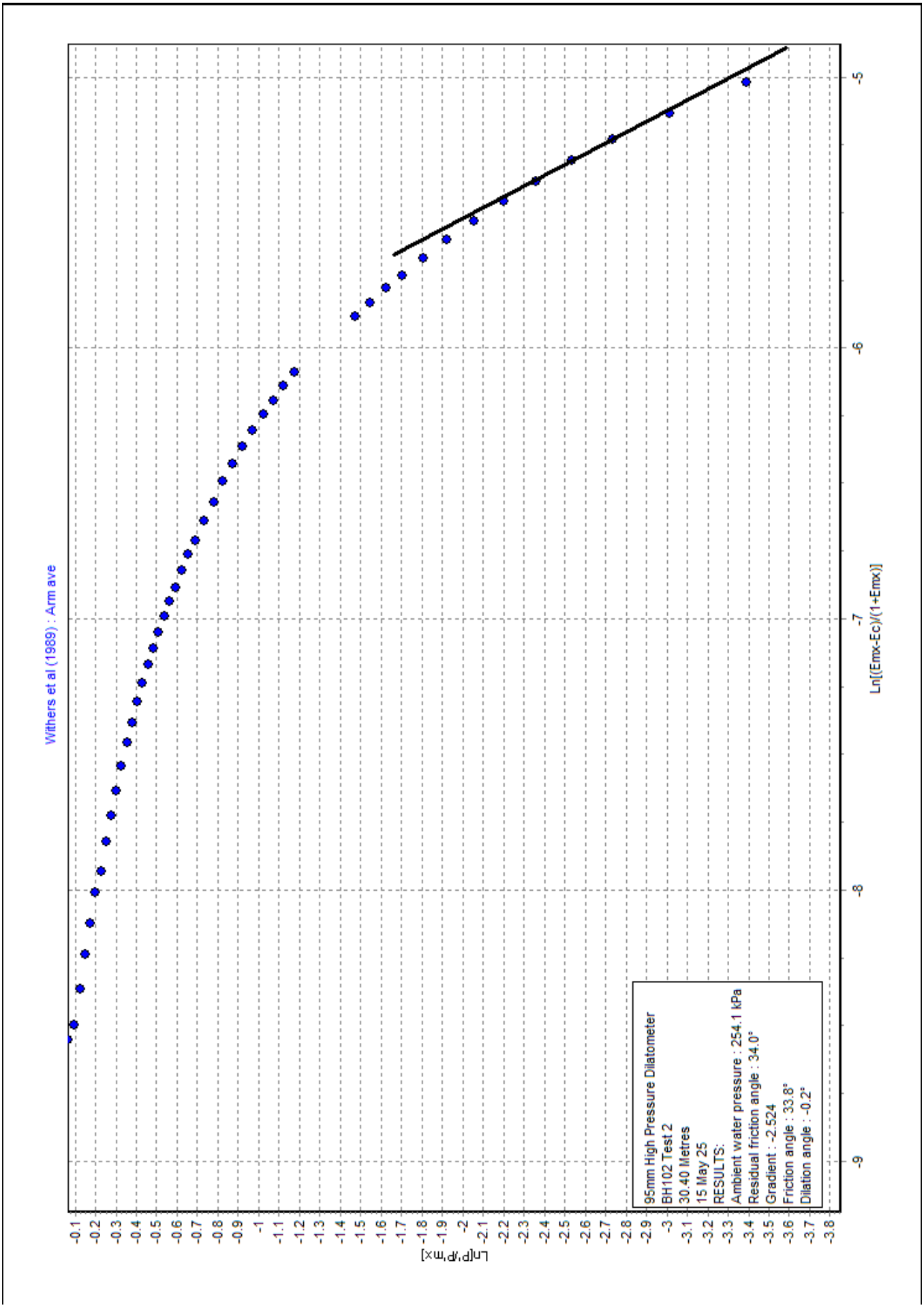
Grain to TIlbury
BH102 Test 2 - SUMMARY OF RESULTS

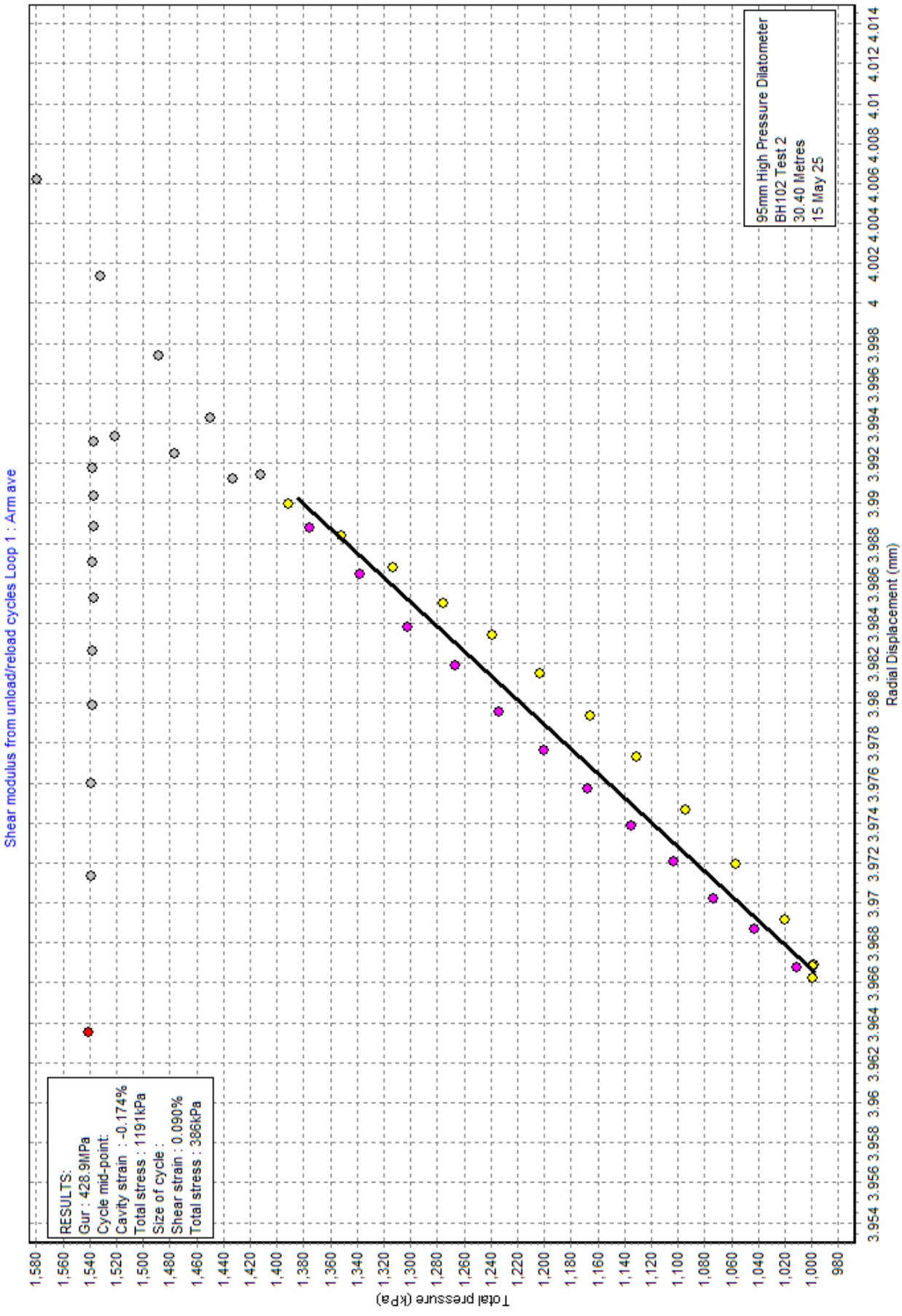
Total limit stress (kPa)	:	15304
G at first yield (MPa)	:	639.6
Non-linear exponent	:	0.818
Janbu exponent	:	0.240
Correlation	:	0.529
Ambient pore water pressure (kPa)	:	254
Residual friction angle (deg)	:	34.0
Poisson's ratio	:	0.20

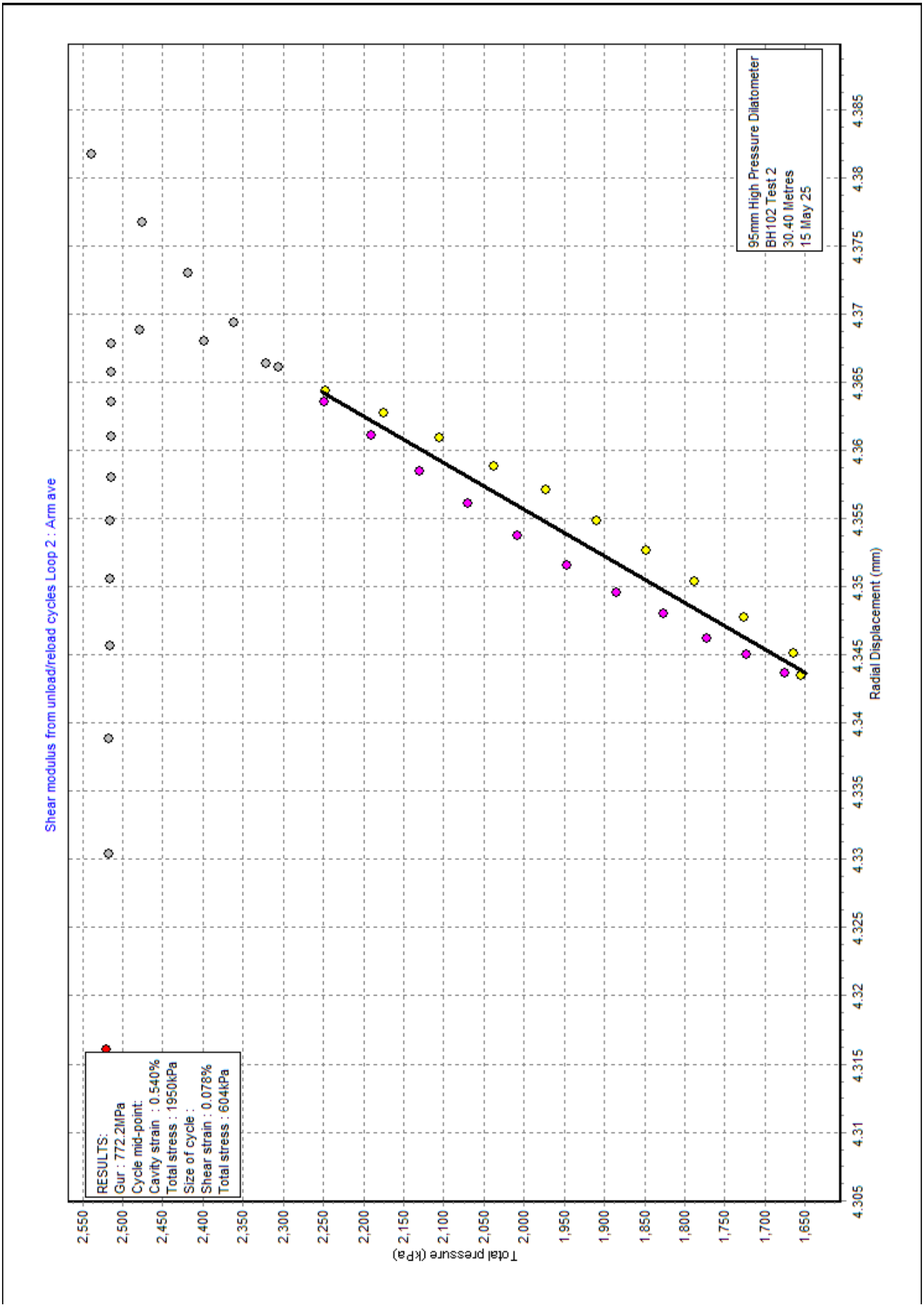

Cavity strain vs Total Pressure : Arm ave
95mm High Pressure Dilatometer
BH102 Test 2
30.40 Metres
15 May 25
Total pressure (kPa)
Cavity strain (%)
5,200
5,000
4,800
4,600
4,400
4,200
4,000
3,800
3,600
3,400
3,200
3,000
2,800
2,600
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5

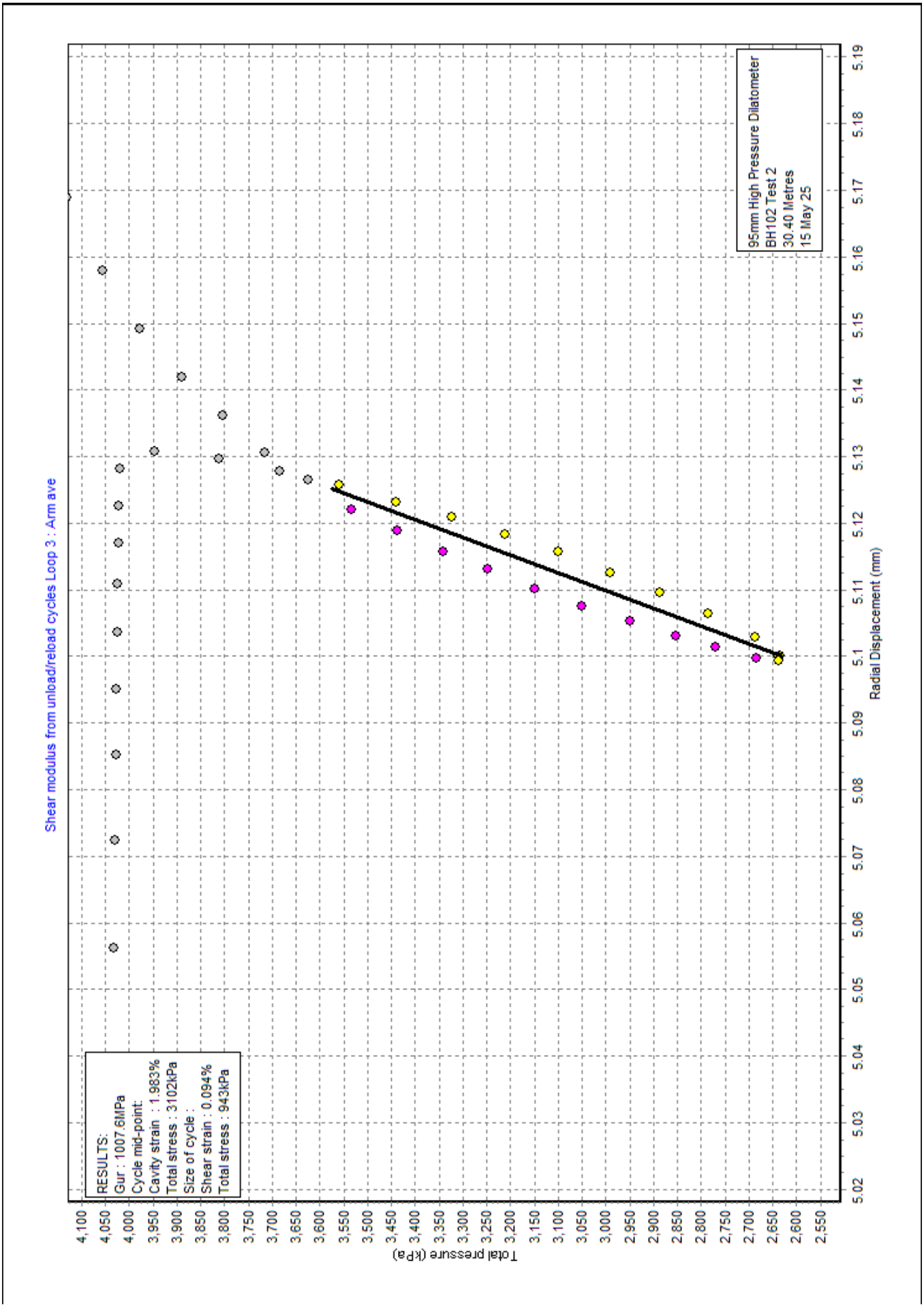

Po of cohesive material (1977, 1990) : Arm ave
95mm High Pressure Dilatometer
BH102 Test 2
30.40 Metres
15 May 25
RESULTS:
Gi : 71.4MPa
Pf : 3096.7kPa
Po : 882.0kPa
Tf : 2196.1kPa
Po + Tf : 3078.1kPa
Origin : 3.695mm
Total pressure (kPa)
Radial Displacement (mm)
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Shear stress at yield : Arm ave
Total pressure (kPa)
Ln[shear strain]

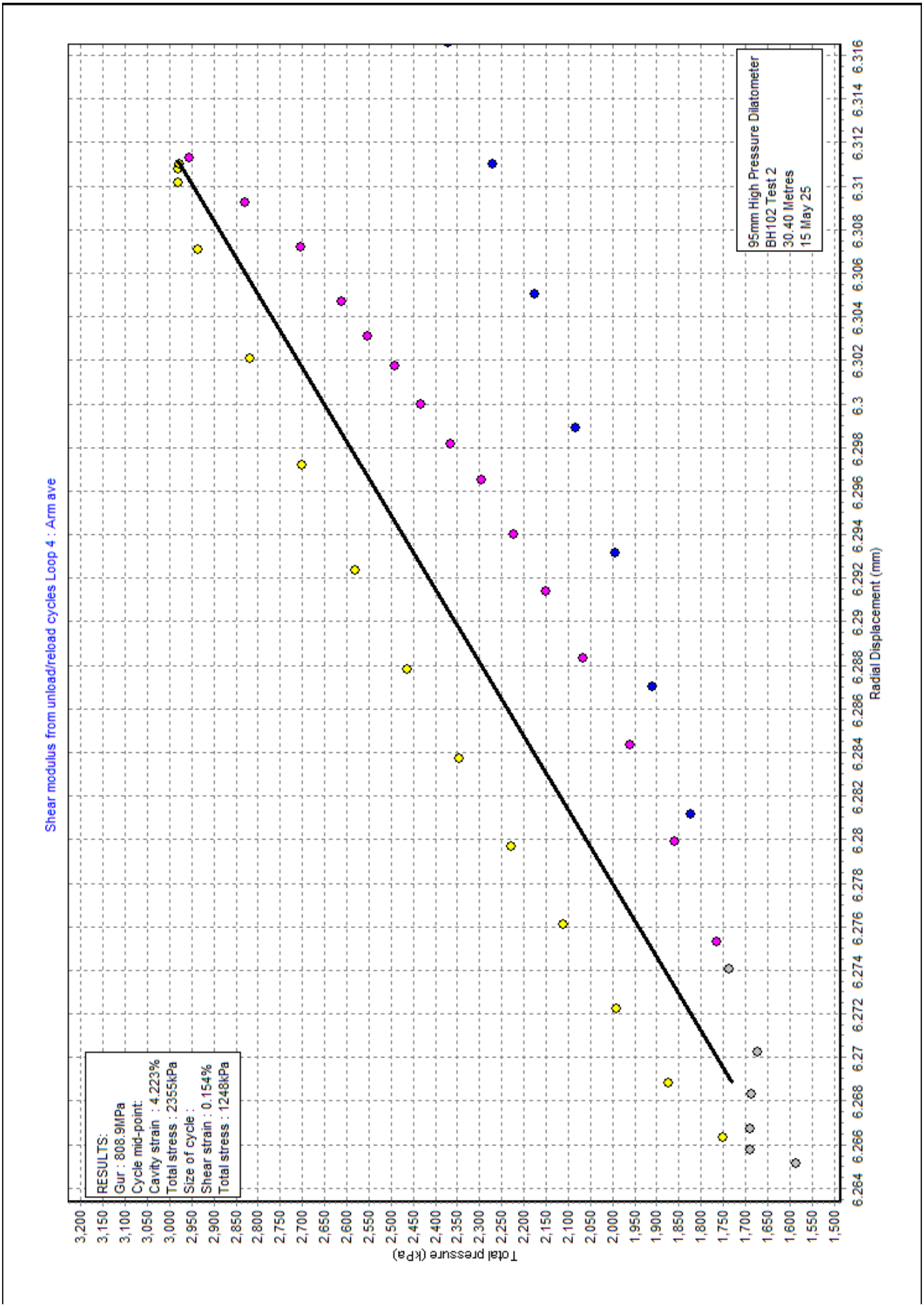

Hughes et al (1977) : Arm ave
RESULTS:
Ambient water pressure : 254.1 kPa
Residual friction angle : 34.0°
Gradient : 0.409
Friction angle : 37.7°
Dilation angle : 4.5°
95mm High Pressure Dilatometer
BH102 Test 2
30.40 Metres
15 May 25
Ln[Effective stress]
Ln[hoop strain]
8.5
8.45
8.4
8.35
8.3
8.25
8.2
8.15
8.1
8.05
8
7.95
7.9
7.85
7.8
7.75
7.7
7.65
7.6
7.55
7.5
7.45
7.4
-4
-5
-6
-7
-8

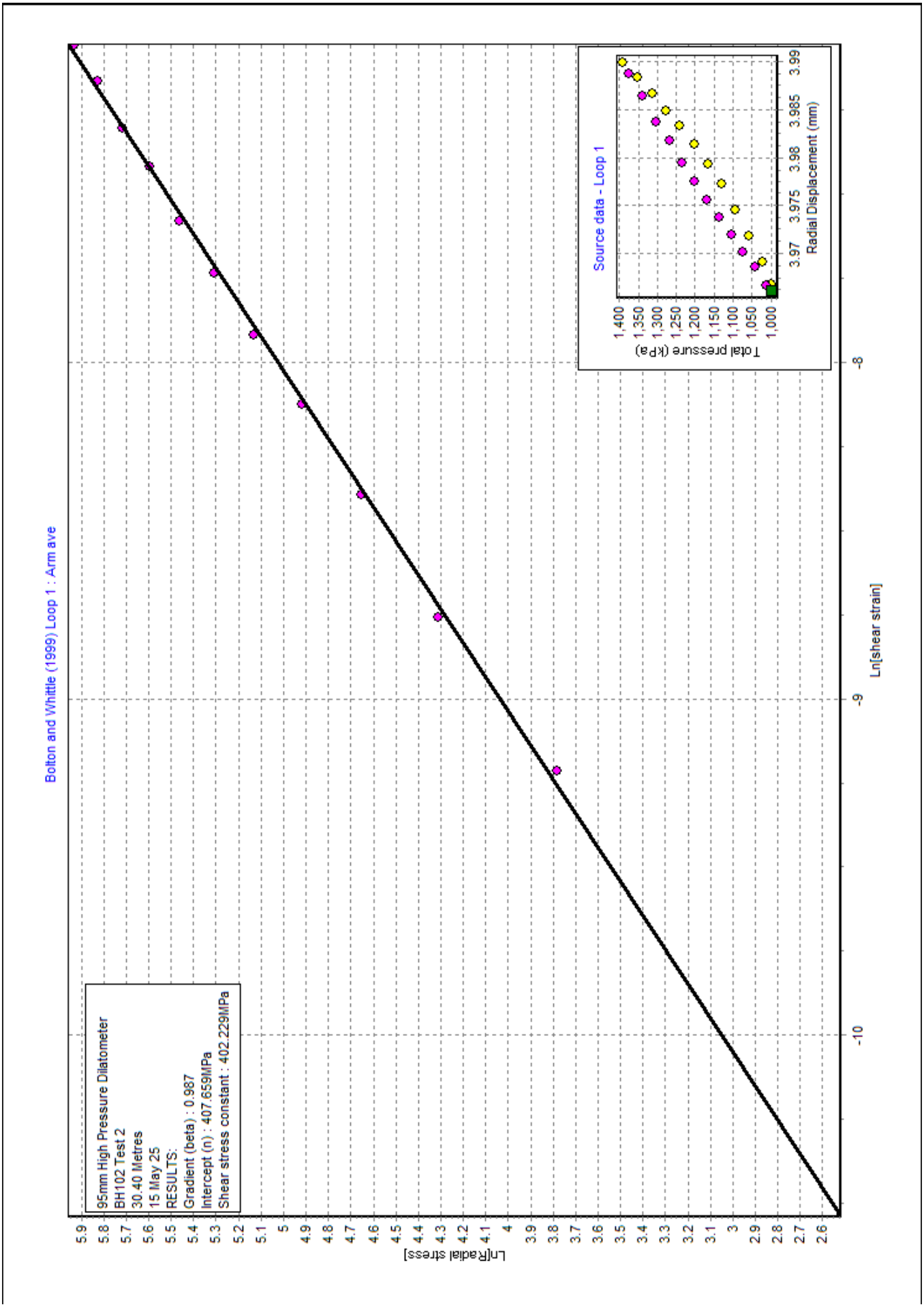

Withers et al (1989) : Arm ave
Ln[P'/P'mx]
Ln[(Emx-Ec)/(1+Emx)]
95mm High Pressure Dilatometer
BH102 Test 2
30.40 Metres
15 May 25
RESULTS:
Ambient water pressure : 254.1 kPa
Residual friction angle : 34.0°
Gradient : -2.524
Friction angle : 33.8°
Dilation angle : -0.2°

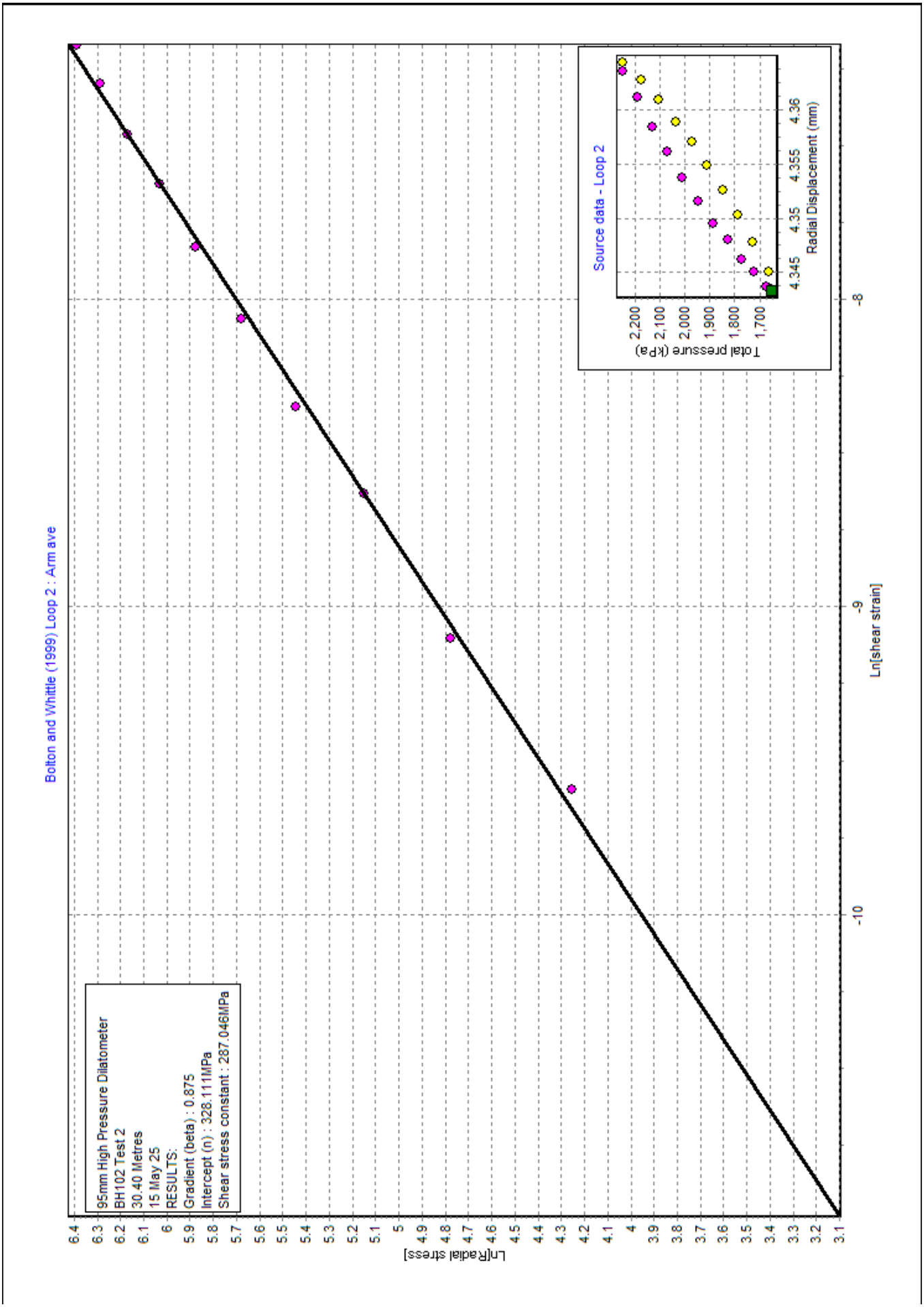

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 428.9MPa
Cycle mid-point:
Cavity strain : -0.174%
Total stress : 1191kPa
Size of cycle :
Shear strain : 0.090%
Total stress : 386kPa
95mm High Pressure Dilatometer
BH102 Test 2
30.40 Metres
15 May 25
Total pressure (kPa)
Radial Displacement (mm)

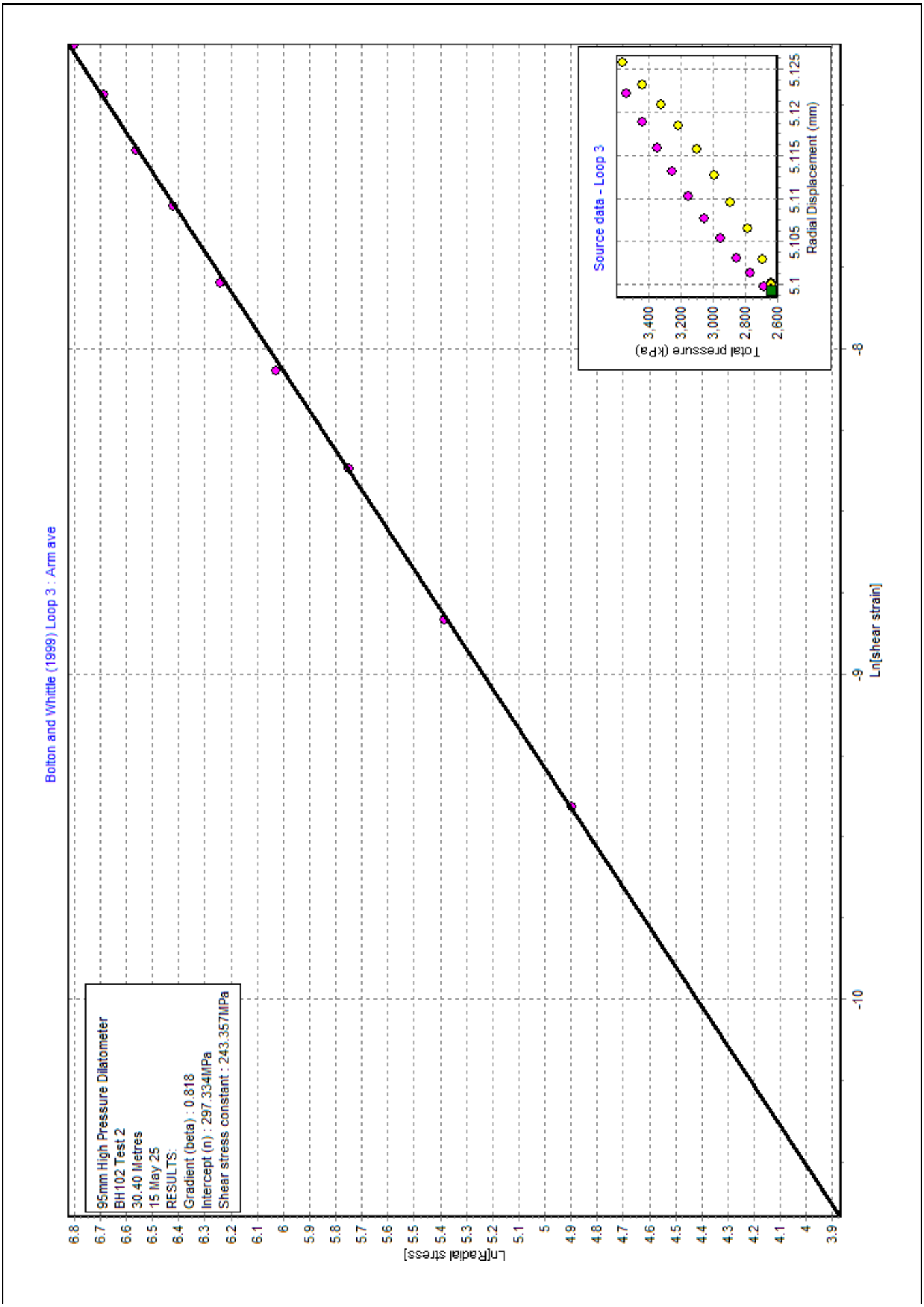

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 772.2MPa
Cycle mid-point:
Cavity strain : 0.540%
Total stress : 1950kPa
Size of cycle :
Shear strain : 0.078%
Total stress : 604kPa
95mm High Pressure Dilatometer
BH102 Test 2
30.40 Metres
15 May 25
Total pressure (kPa)
Radial Displacement (mm)
2,550
2,500
2,450
2,400
2,350
2,300
2,250
2,200
2,150
2,100
2,050
2,000
1,950
1,900
1,850
1,800
1,750
1,700
1,650
4.305
4.31
4.315
4.32
4.325
4.33
4.335
4.34
4.345
4.35
4.355
4.36
4.365
4.37
4.375
4.38
4.385

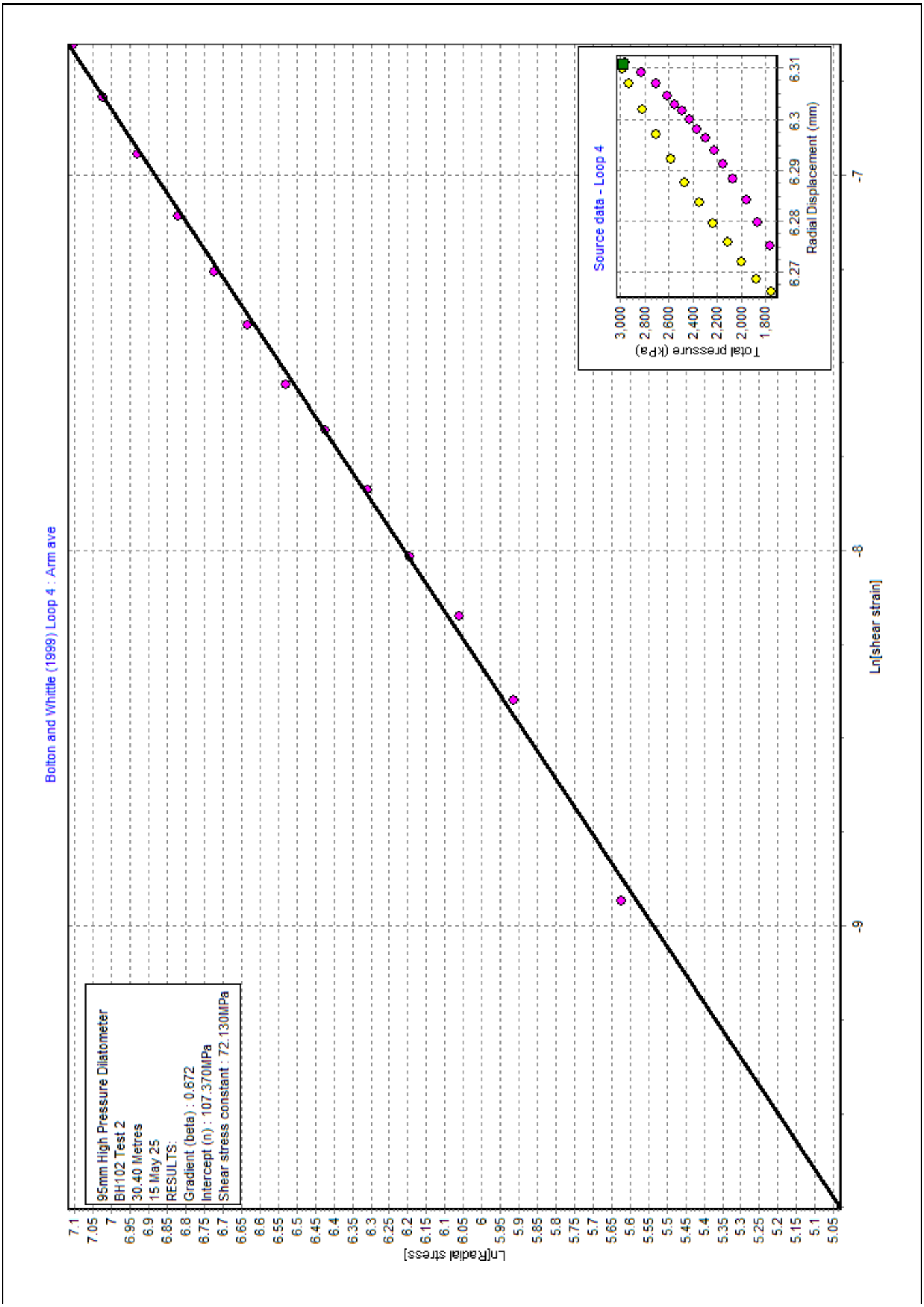

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 1007.6MPa
Cycle mid-point:
Cavity strain : 1.983%
Total stress : 3102kPa
Size of cycle :
Shear strain : 0.094%
Total stress : 943kPa
95mm High Pressure Dilatometer
BH102 Test 2
30.40 Metres
15 May 25
Total pressure (kPa)
Radial Displacement (mm)

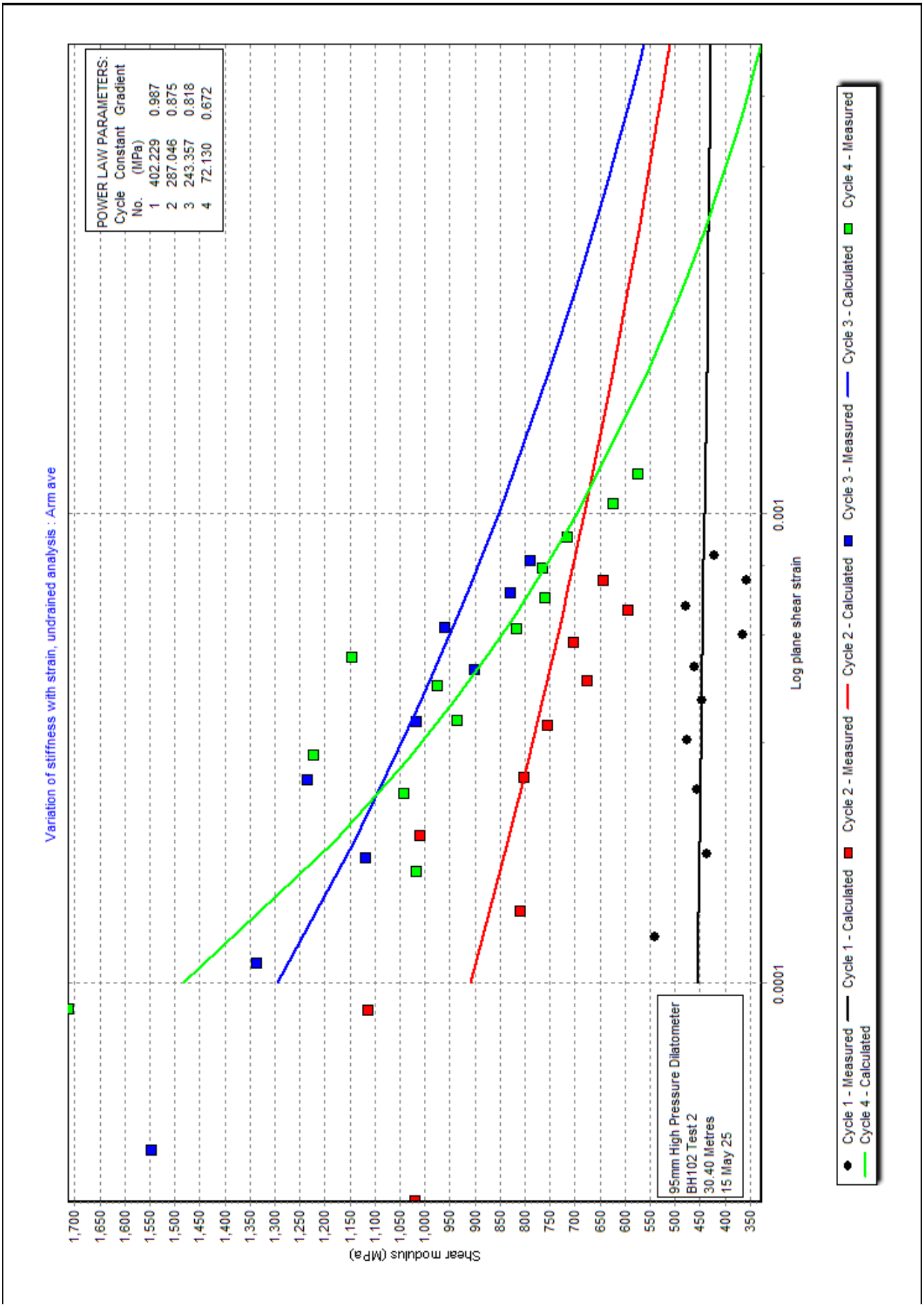

Shear modulus from unload/reload cycles Loop 4 : Arm ave
RESULTS:
Gur : 808.9MPa
Cycle mid-point:
Cavity strain : 4.223%
Total stress : 2355kPa
Size of cycle :
Shear strain : 0.154%
Total stress : 1248kPa
95mm High Pressure Dilatometer
BH102 Test 2
30.40 Metres
15 May 25
Total pressure (kPa)
Radial Displacement (mm)

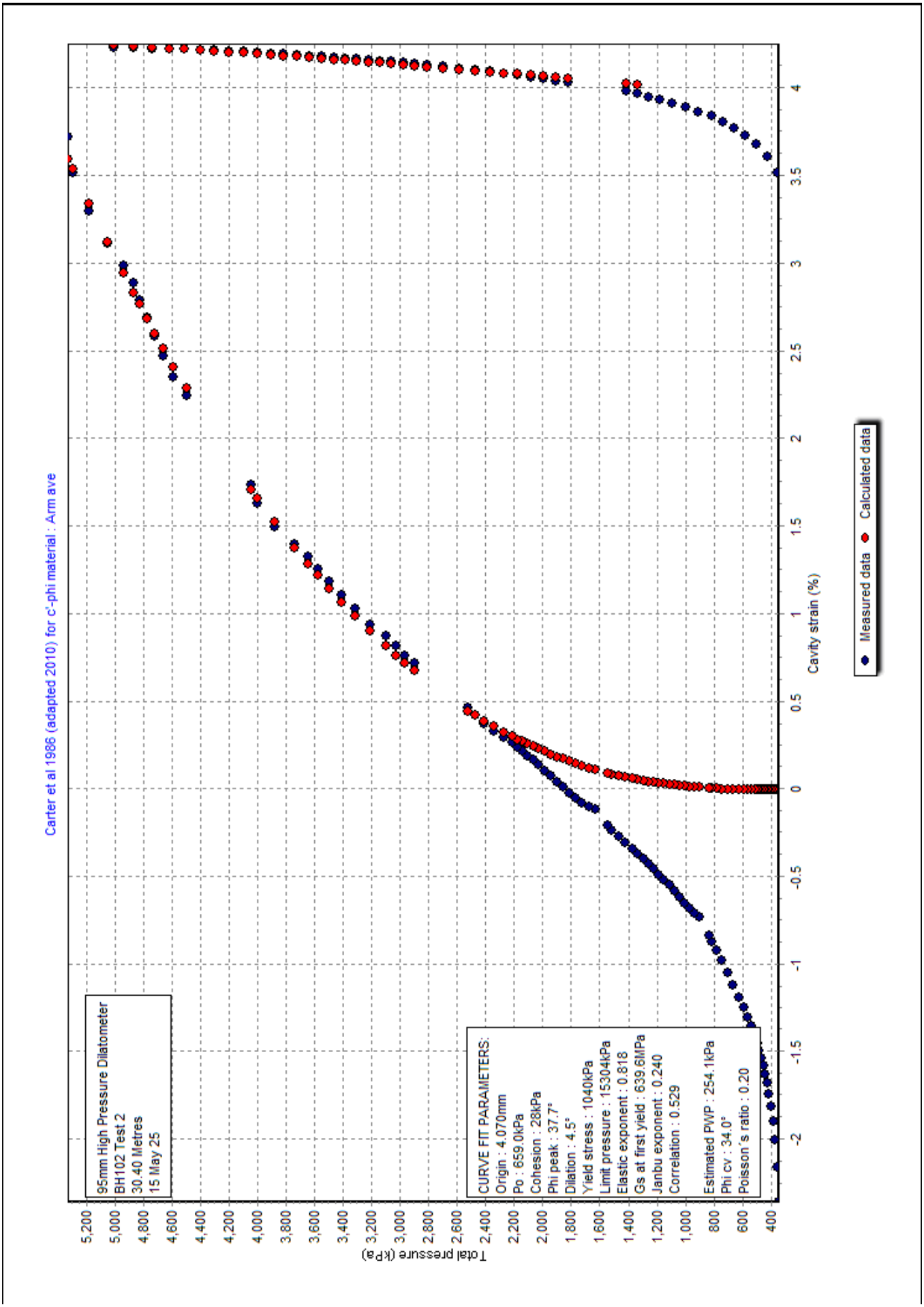

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 2
30.40 Metres
15 May 25
RESULTS:
Gradient (beta) : 0.987
Intercept (n) : 407.659MPa
Shear stress constant : 402.229MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

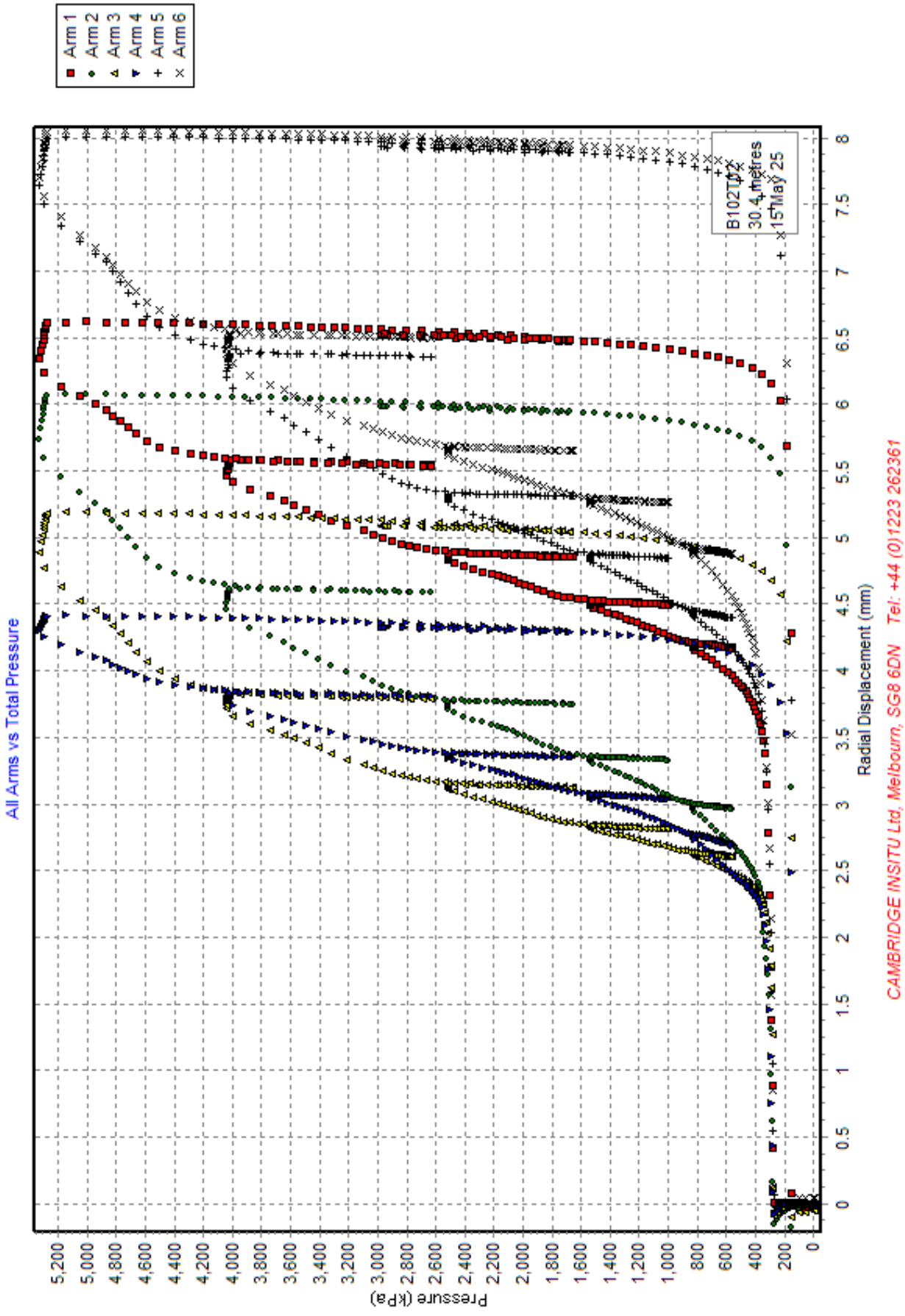

Bolton and Whittle (1999) Loop 2 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 2
30.40 Metres
15 May 25
RESULTS:
Gradient (beta) : 0.875
Intercept (n) : 328.111MPa
Shear stress constant : 287.046MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

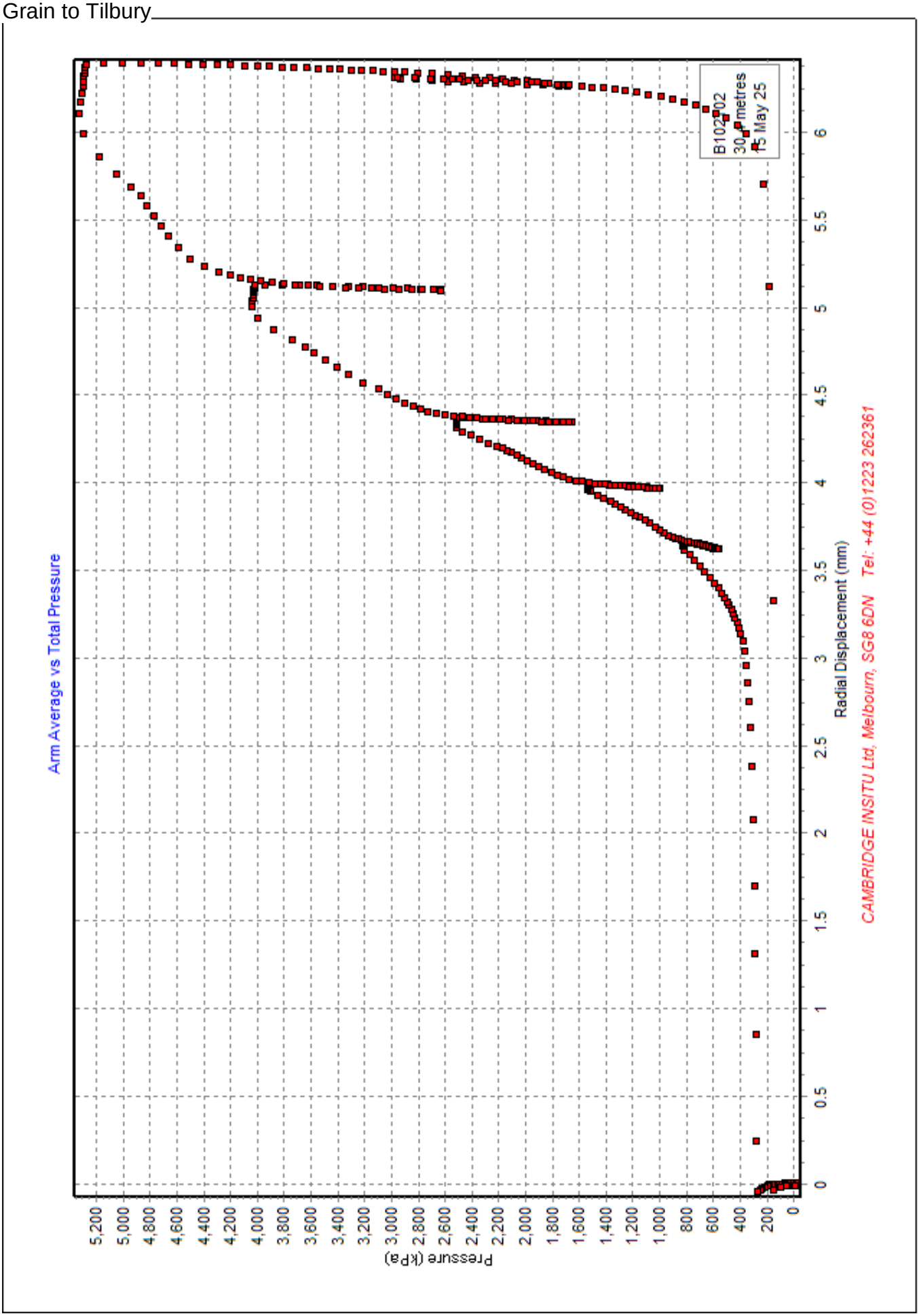

Bolton and Whittle (1999) Loop 3 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 2
30.40 Metres
15 May 25
RESULTS:
Gradient (beta) : 0.818
Intercept (n) : 297.334MPa
Shear stress constant : 243.357MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)

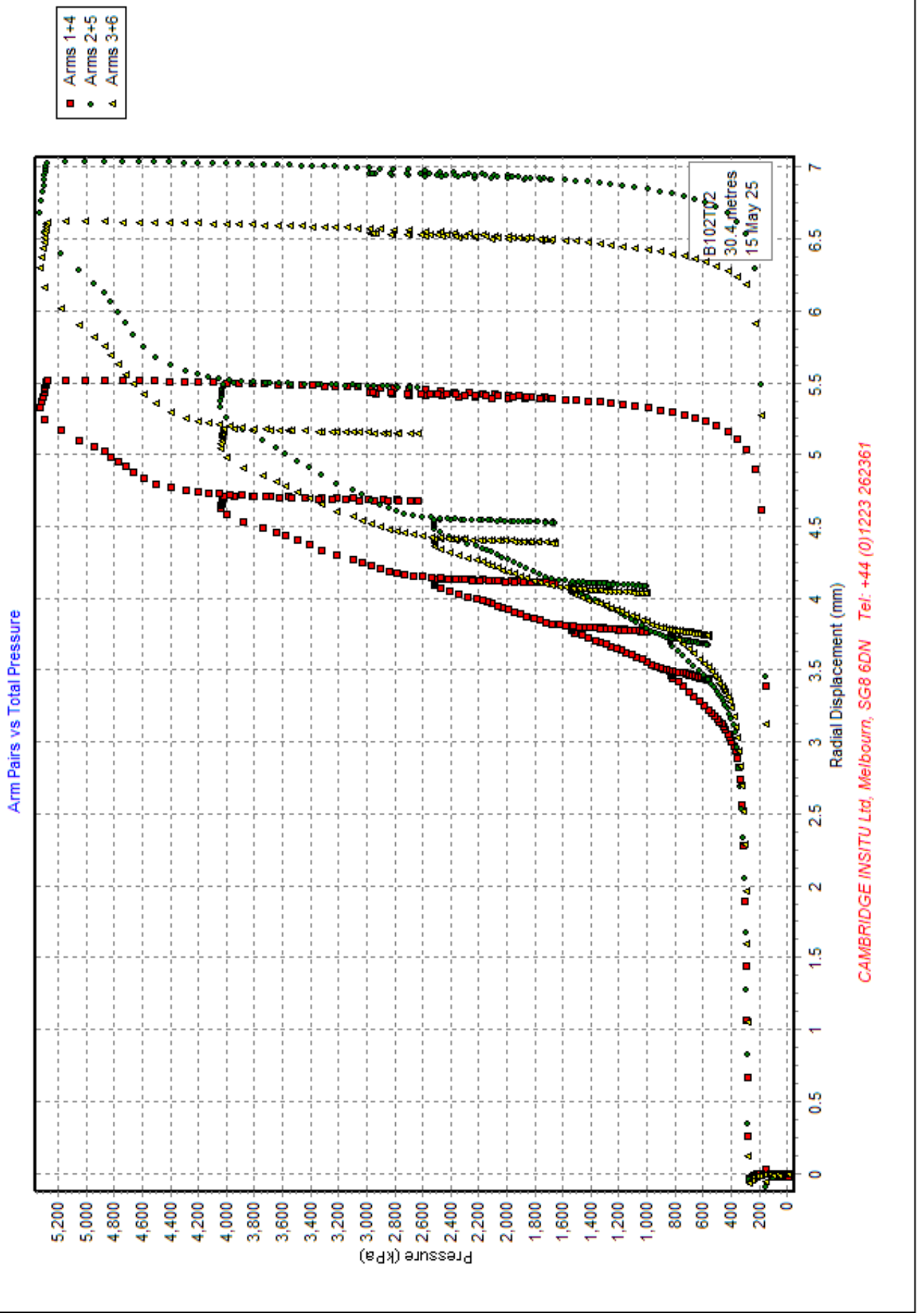

Bolton and Whittle (1999) Loop 4 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 2
30.40 Metres
15 May 25
RESULTS:
Gradient (beta) : 0.672
Intercept (n) : 107.370MPa
Shear stress constant : 72.130MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 4
Total pressure (kPa)
Radial Displacement (mm)

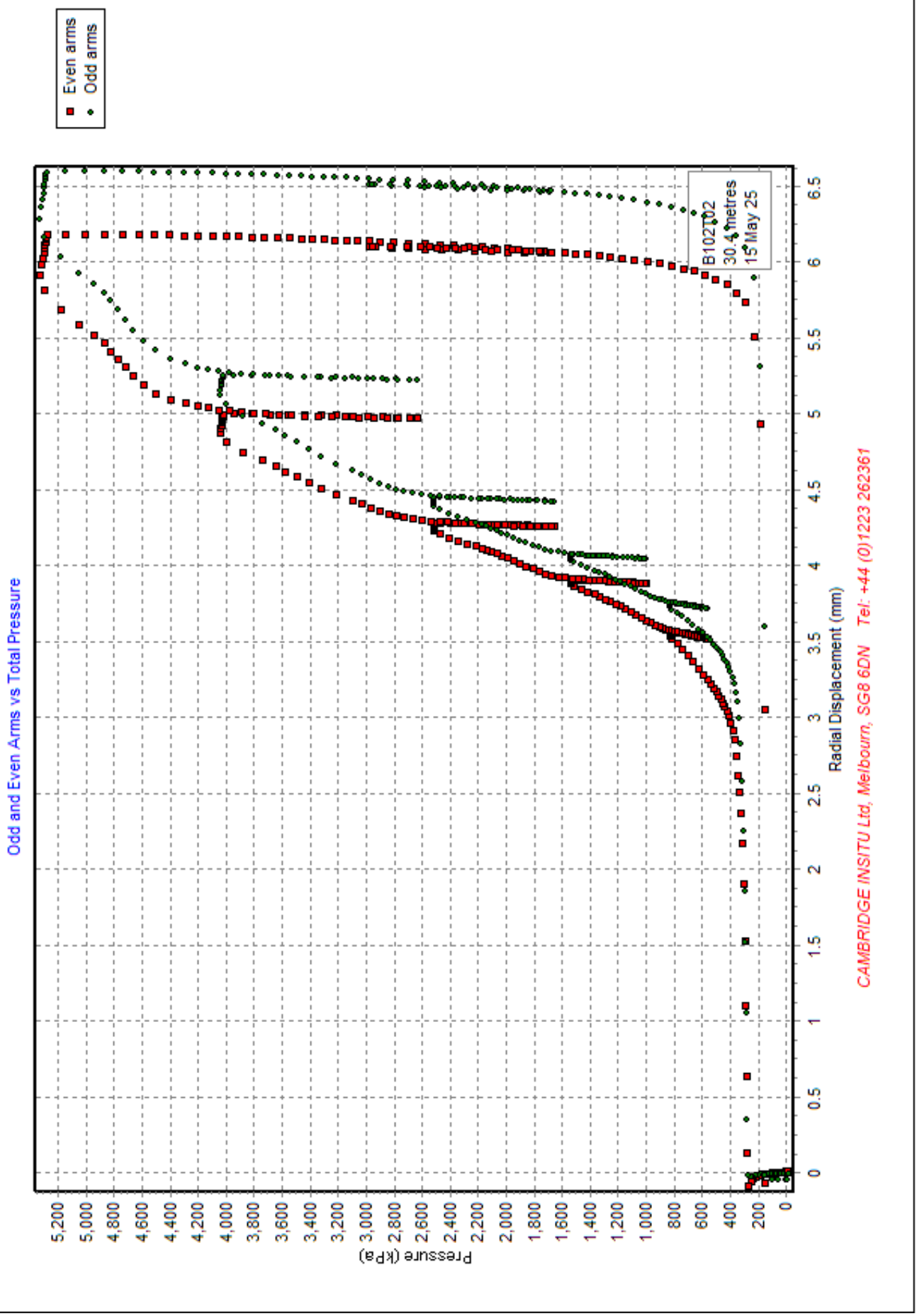

Variation of stiffness with strain, undrained analysis : Arm ave
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 402.229 0.987
2 287.046 0.875
3 243.357 0.818
4 72.130 0.672
95mm High Pressure Dilatometer
BH102 Test 2
30.40 Metres
15 May 25
Shear modulus (MPa)
Log plane shear strain
0.0001
0.001
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
Cycle 4 - Measured
Cycle 4 - Calculated


Carter et al 1986 (adapted 2010) for c'-phi material : Arm ave
95mm High Pressure Dilatometer
BH102 Test 2
30.40 Metres
15 May 25
CURVE FIT PARAMETERS:
Origin : 4.070mm
Po : 659.0kPa
Cohesion : 28kPa
Phi peak : 37.7°
Dilation : 4.5°
Yield stress : 1040kPa
Limit pressure : 15304kPa
Elastic exponent : 0.818
Gs at first yield : 639.6MPa
Janbu exponent : 0.240
Correlation : 0.529
Estimated PWP : 254.1kPa
Phi cv : 34.0°
Poisson's ratio : 0.20
Total pressure (kPa)
Cavity strain (%)
Measured data
Calculated data


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
B102T02
30.4 metres
15 May 25
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


B102 02
30.0 metres
15 May 25
Arm Average vs Total Pressure
Radial Displacement (mm)
Pressure (kPa)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arms 1+4
Arms 2+5
Arms 3+6
B102T02
30.4 metres
15 May 25
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
B102102
30.4 metres
15 May 25
Odd and Even Arms vs Total Pressure
Radial Displacement (mm)
Pressure (kPa)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to TIlbury
BH102 Test 3 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Tilbury
Borehole : BH102
Test name : BH102 Test 3
Test date : 15 May 25
Test depth : 33.40 Metres
Water table : 4.5 Metres
Ambient PWP : 283.5 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDP/RW on 18 Jul 25

Remarks: Flint in pocket

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=3.92"
Po from Marsland & Randolph (kPa) : "Arm ave=3603.3"
Best estimate of Po (kPa) : "Arm ave=1233.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=6791.7"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 34.0
Angle of internal friction (°) : "Arm ave=46.5"
Dilation angle (°) : "Arm ave=16.2"
Gradient of log-log plot : "Arm ave=0.537"

[Withers et al 1989]
Angle of internal friction (°) : "Arm ave=34.5"
Dilation angle (°) : "Arm ave=0.6"
Gradient of log-log plot : "Arm ave=-2.568"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=212.2"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	508.4	-0.540	1177	0.069	352
Arm ave	2	1077.8	0.126	2380	0.049	526
Arm ave	3	1422.9	0.724	4303	0.077	1094
Arm ave	4	1356.6	1.492	3655	0.134	1824

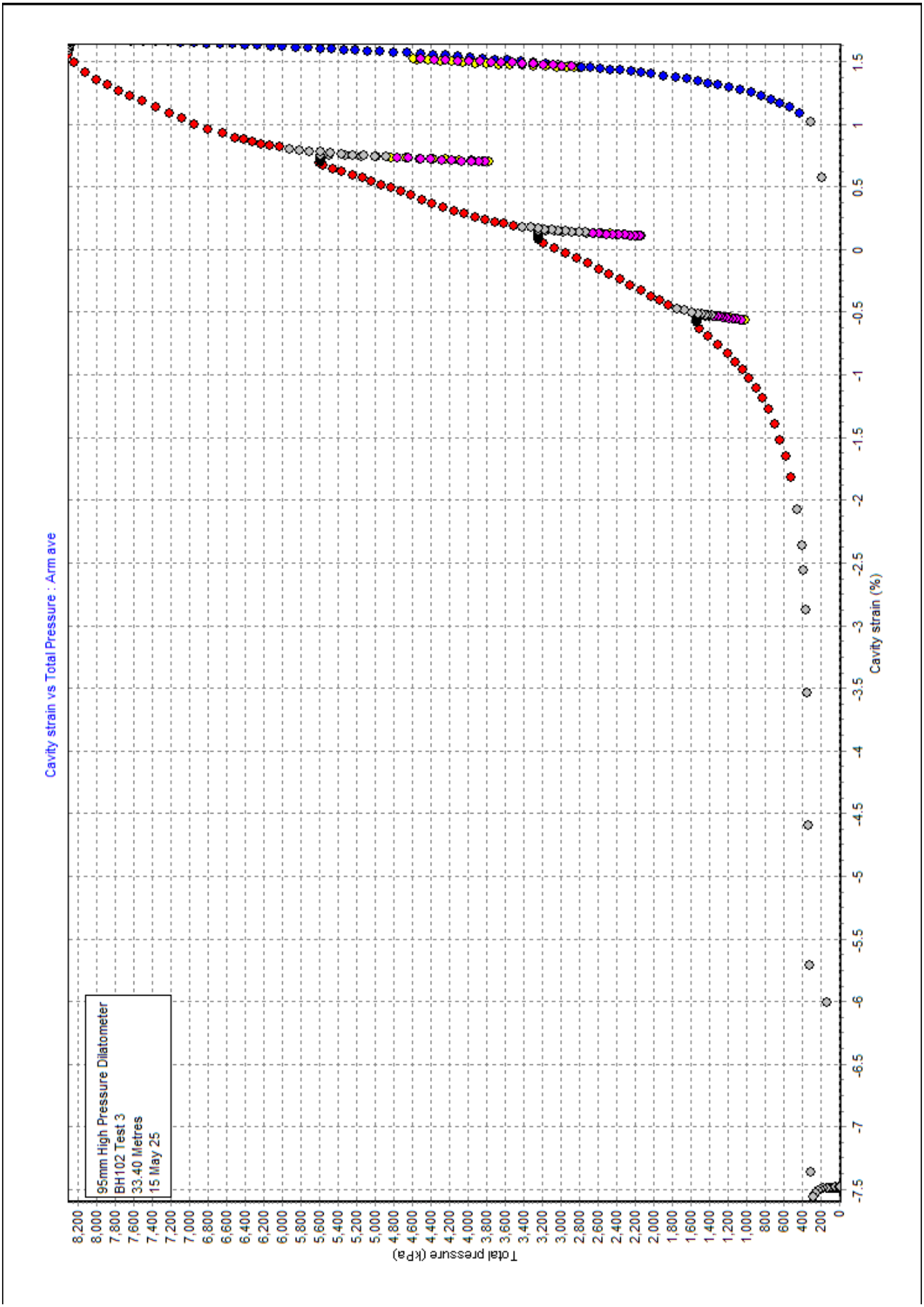
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

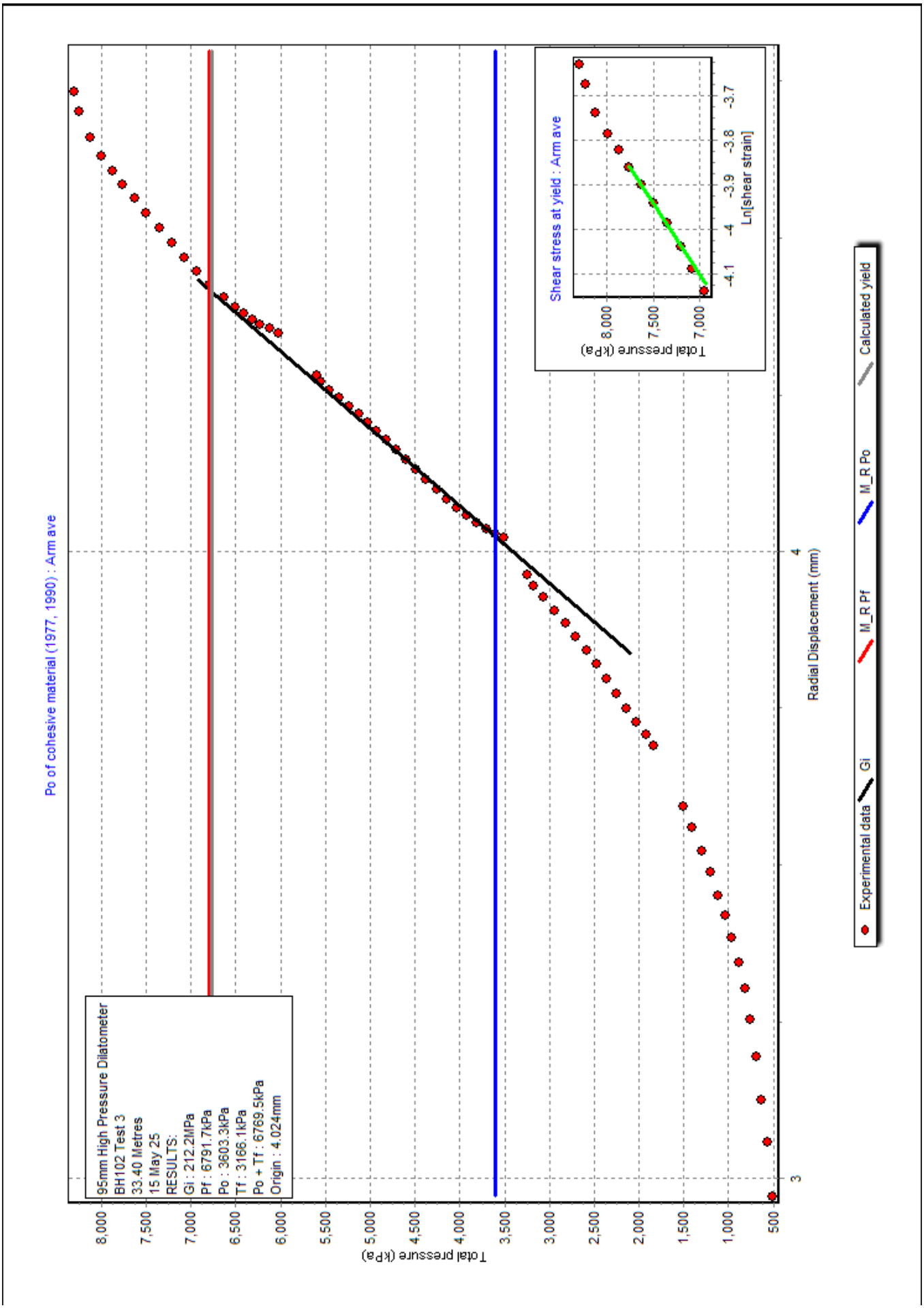
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	183.855	160.774	0.874
Arm ave	2	472.396	421.876	0.893
Arm ave	3	701.143	630.100	0.899
Arm ave	4	509.357	427.832	0.840

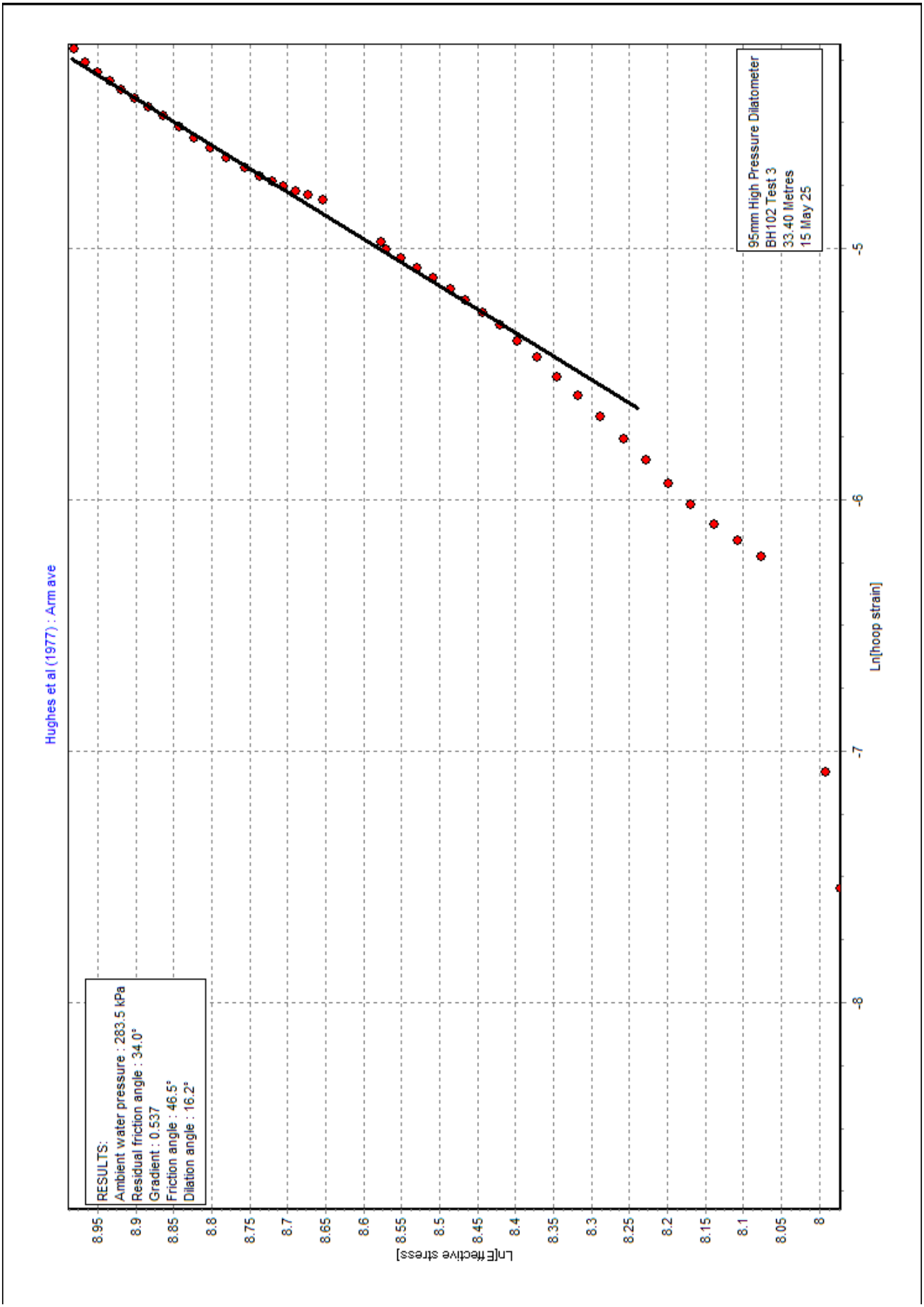
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 3.92
Po (kPa) : 1233
Cohesion (kPa) : 177
Angle of peak friction (deg) : 46.5
Angle of peak dilation (deg) : 16.2
Total yield stress (kPa) : 2227

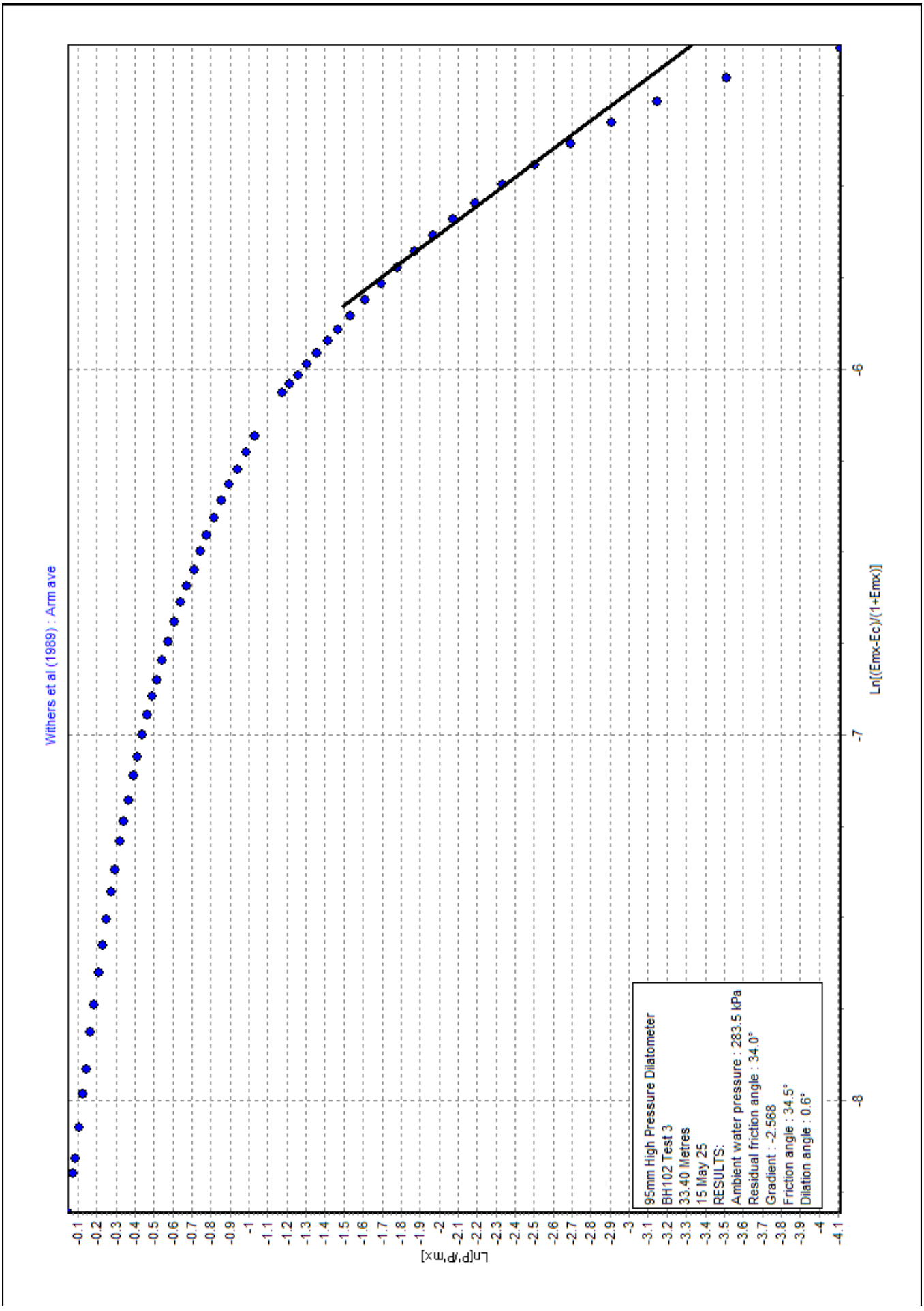
Grain to TIlbury
BH102 Test 3 - SUMMARY OF RESULTS

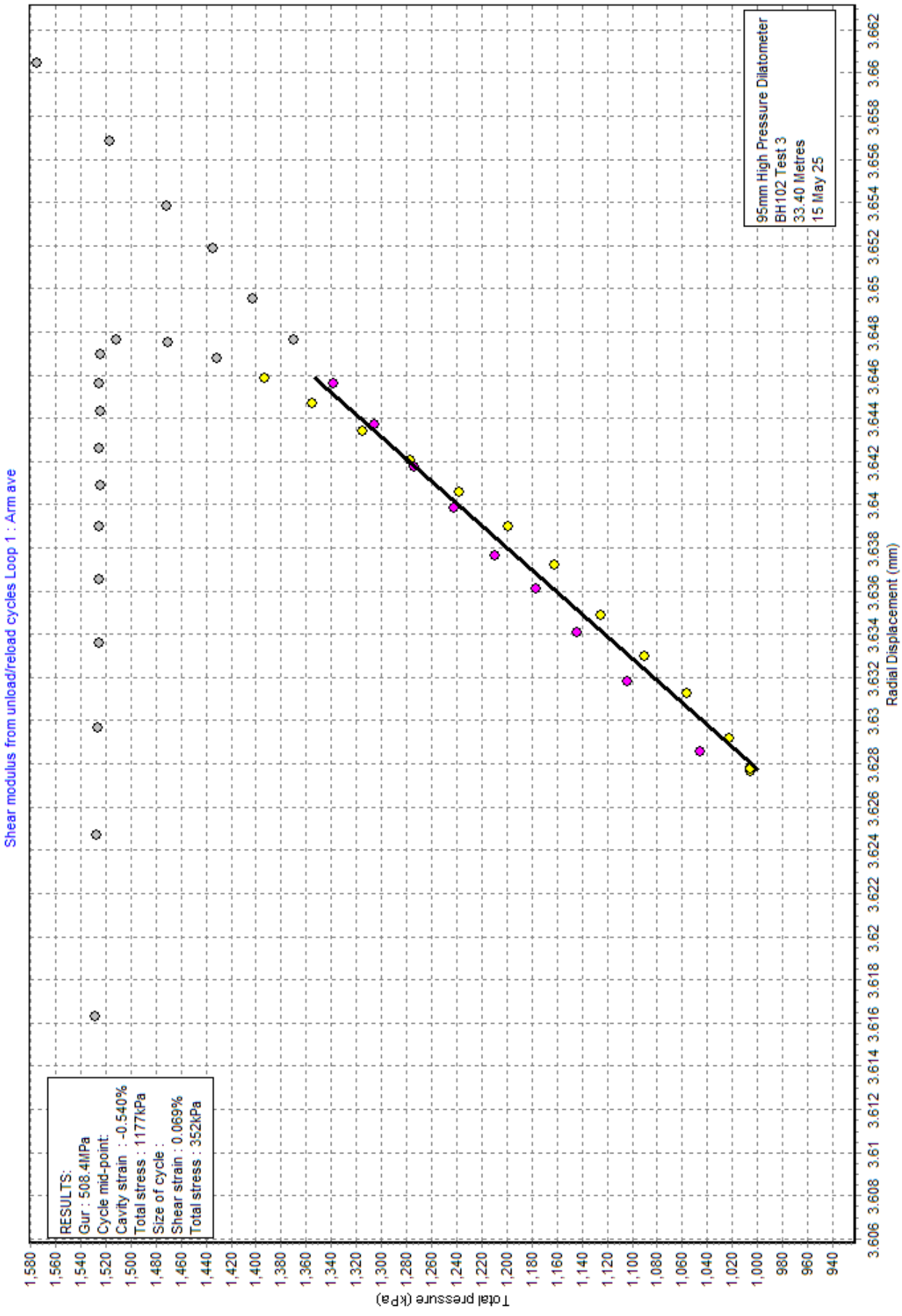
Total limit stress (kPa)	:	53447
G at first yield (MPa)	:	701.8
Non-linear exponent	:	0.893
Janbu exponent	:	0.374
Correlation	:	0.844
Ambient pore water pressure (kPa)	:	284
Residual friction angle (deg)	:	34.0
Poisson's ratio	:	0.20

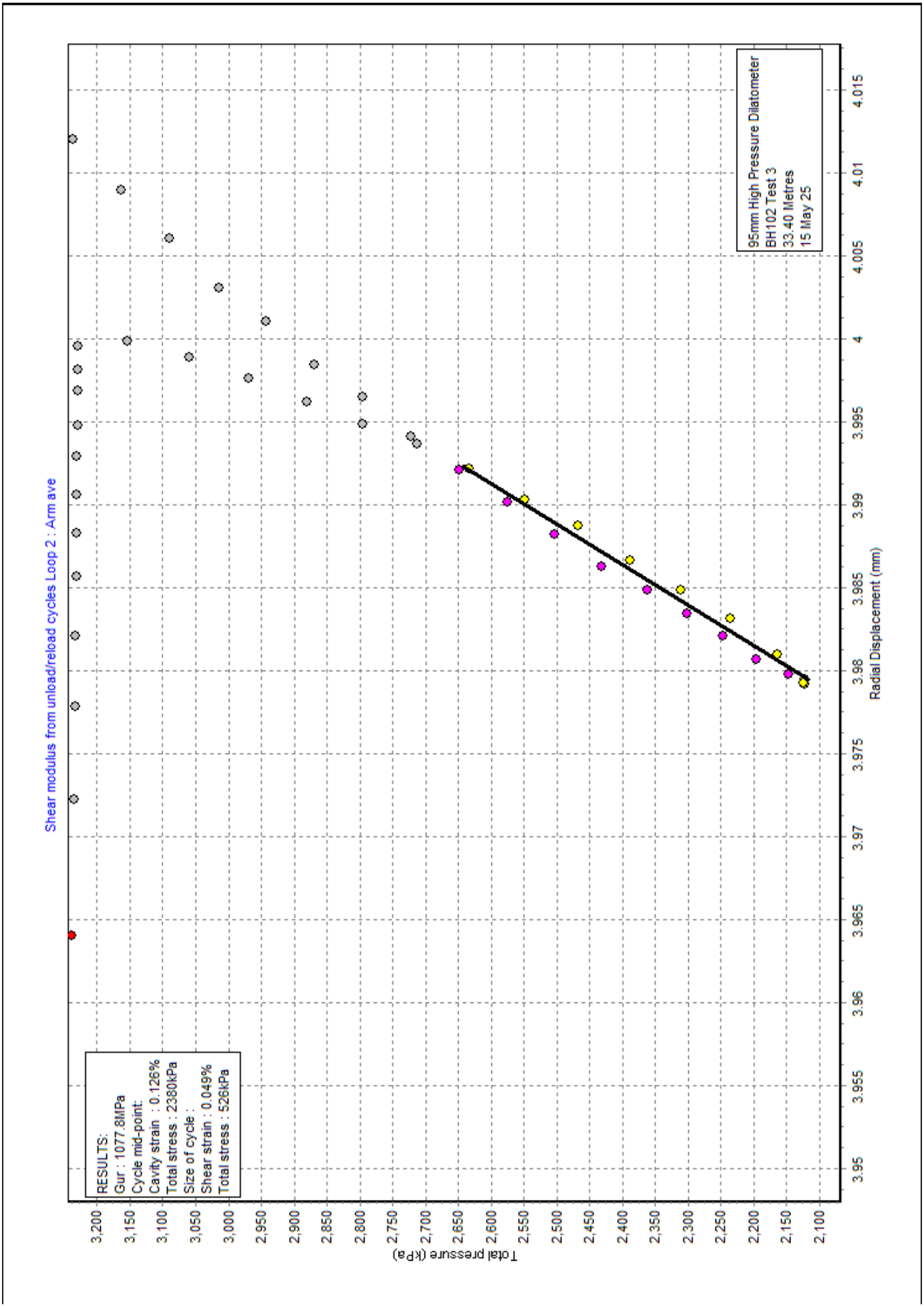

Cavity strain vs Total Pressure : Arm ave
95mm High Pressure Dilatometer
BH102 Test 3
33.40 Metres
15 May 25
Total pressure (kPa)
Cavity strain (%)

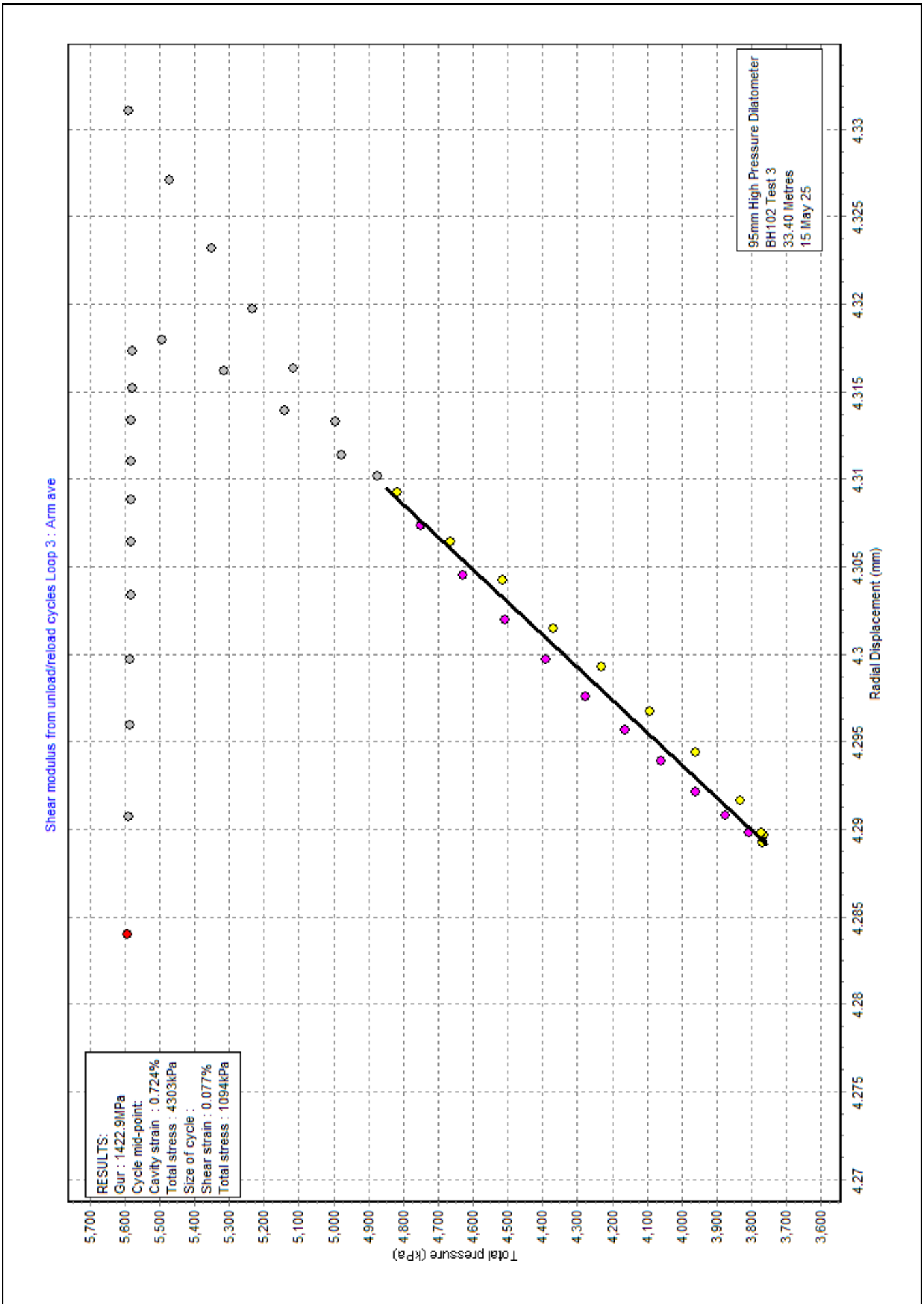

Po of cohesive material (1977, 1990) : Arm ave
95mm High Pressure Dilatometer
BH102 Test 3
33.40 Metres
15 May 25
RESULTS:
Gi : 212.2MPa
Pf : 6791.7kPa
Po : 3603.3kPa
Tf : 3166.1kPa
Po + Tf : 6769.5kPa
Origin : 4.024mm
Total pressure (kPa)
Radial Displacement (mm)
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Shear stress at yield : Arm ave
Ln[shear strain]

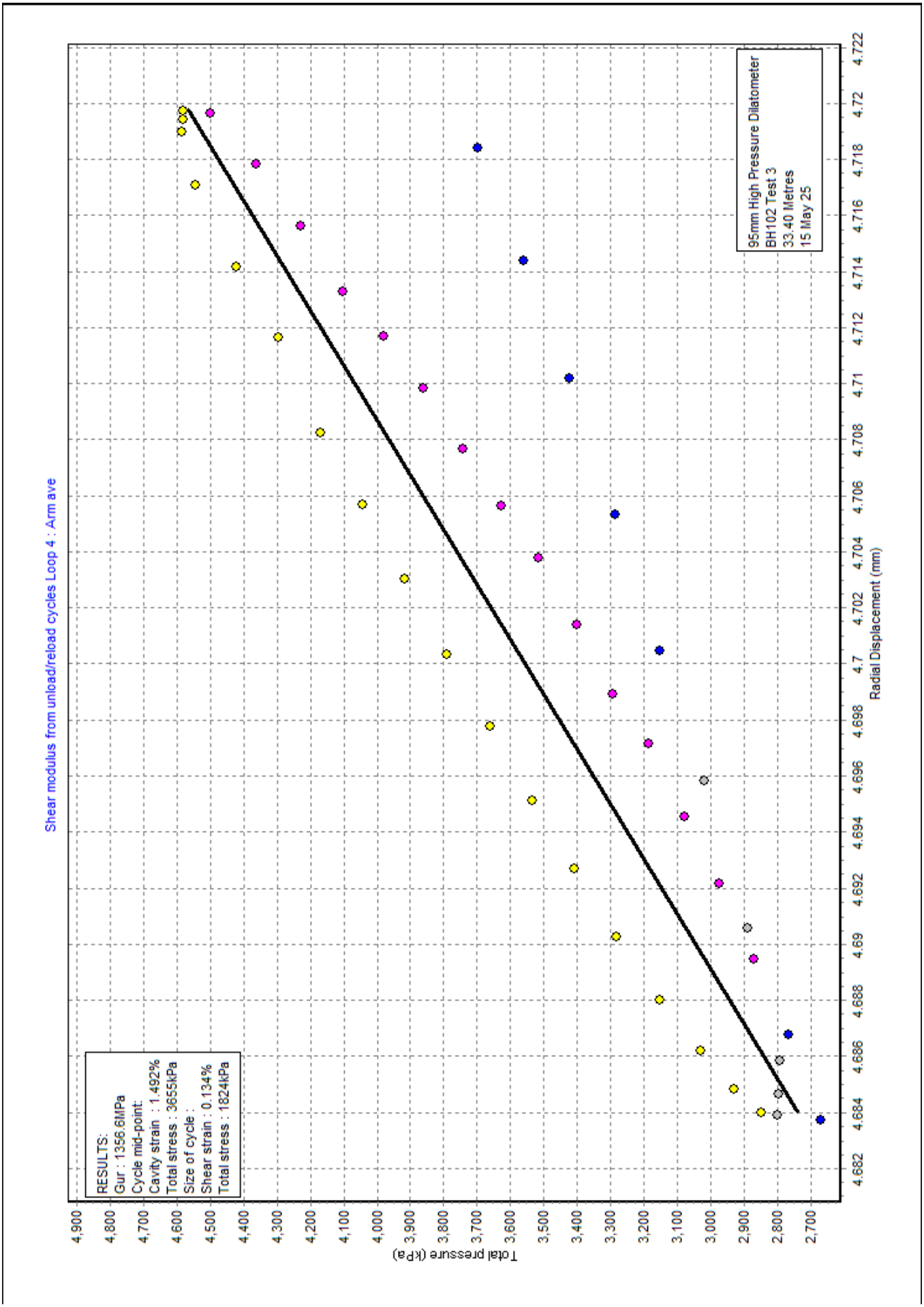

Hughes et al (1977) : Arm ave
RESULTS:
Ambient water pressure : 283.5 kPa
Residual friction angle : 34.0°
Gradient : 0.537
Friction angle : 46.5°
Dilation angle : 16.2°
95mm High Pressure Dilatometer
BH102 Test 3
33.40 Metres
15 May 25
Ln[effective stress]
Ln[hoop strain]
8.95
8.9
8.85
8.8
8.75
8.7
8.65
8.6
8.55
8.5
8.45
8.4
8.35
8.3
8.25
8.2
8.15
8.1
8.05
8
-5
-6
-7
-8

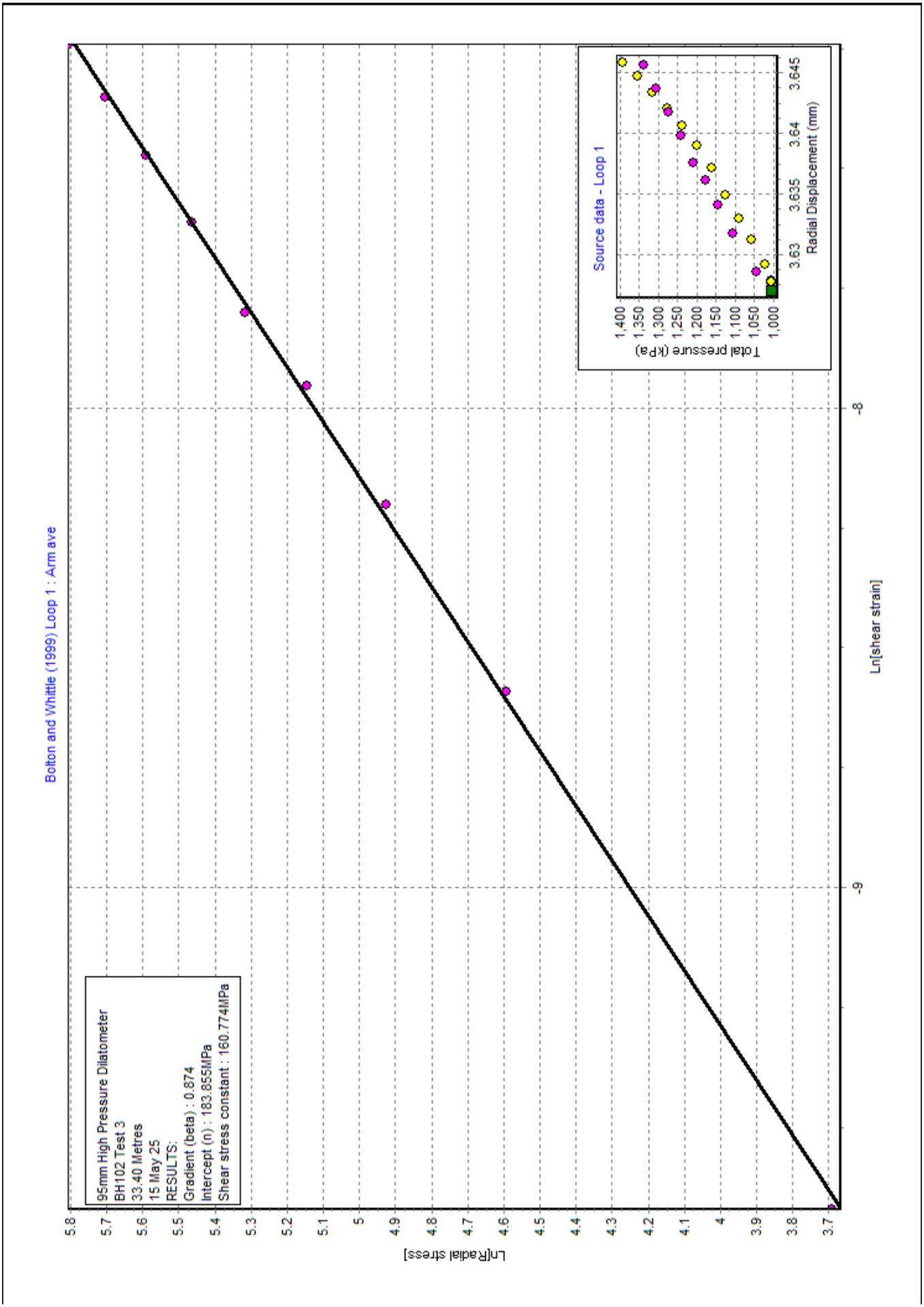

Withers et al (1989) : Arm ave
Ln[(Emx-Ec)/(1+Emx)]
Ln[P'/P'mx]
95mm High Pressure Dilatometer
BH102 Test 3
33.40 Metres
15 May 25
RESULTS:
Ambient water pressure : 283.5 kPa
Residual friction angle : 34.0°
Gradient : -2.568
Friction angle : 34.5°
Dilation angle : 0.6°

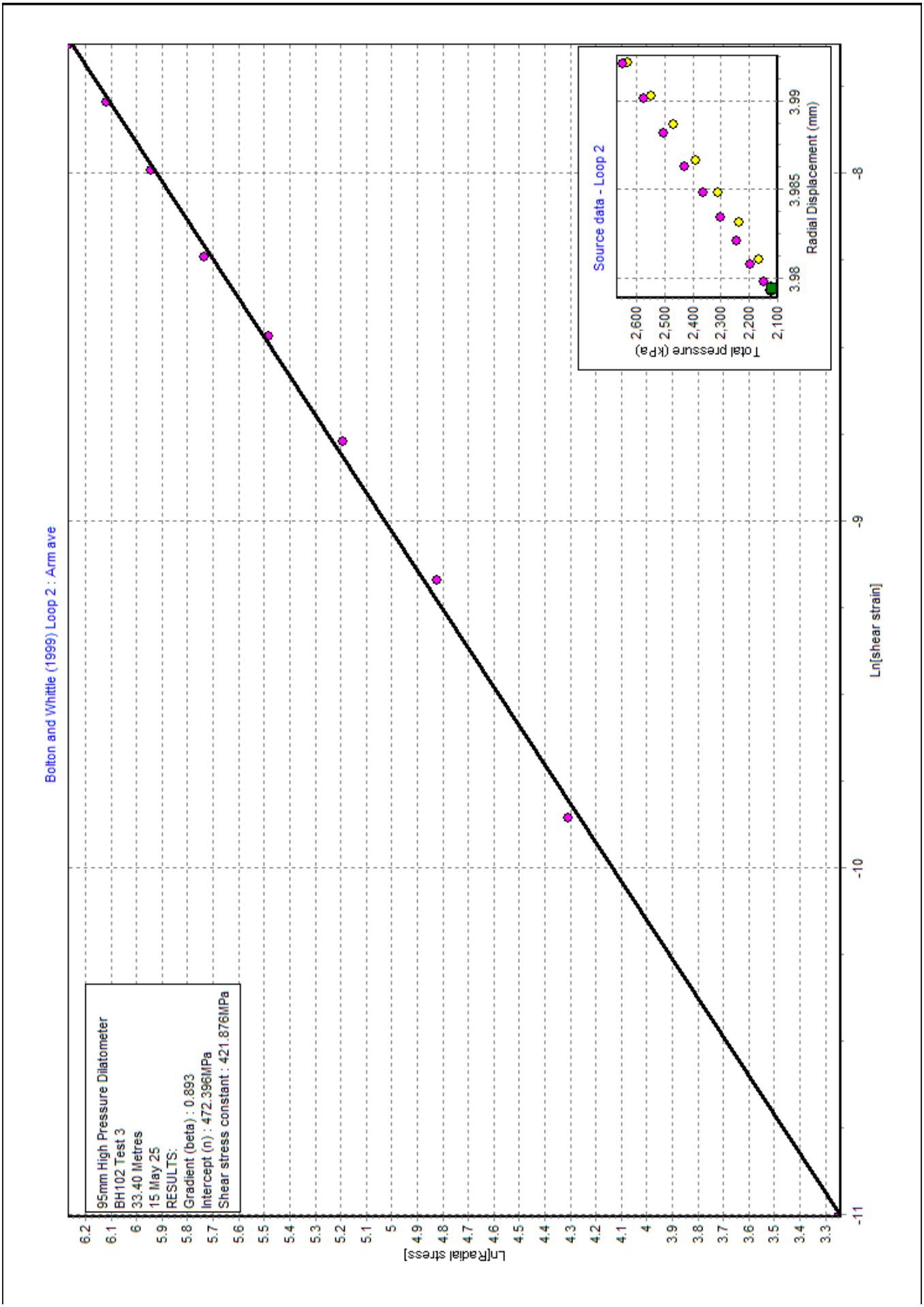

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 508.4MPa
Cycle mid-point:
Cavity strain : -0.540%
Total stress : 1177kPa
Size of cycle :
Shear strain : 0.069%
Total stress : 352kPa
95mm High Pressure Dilatometer
BH102 Test 3
33.40 Metres
15 May 25
Total pressure (kPa)
Radial Displacement (mm)

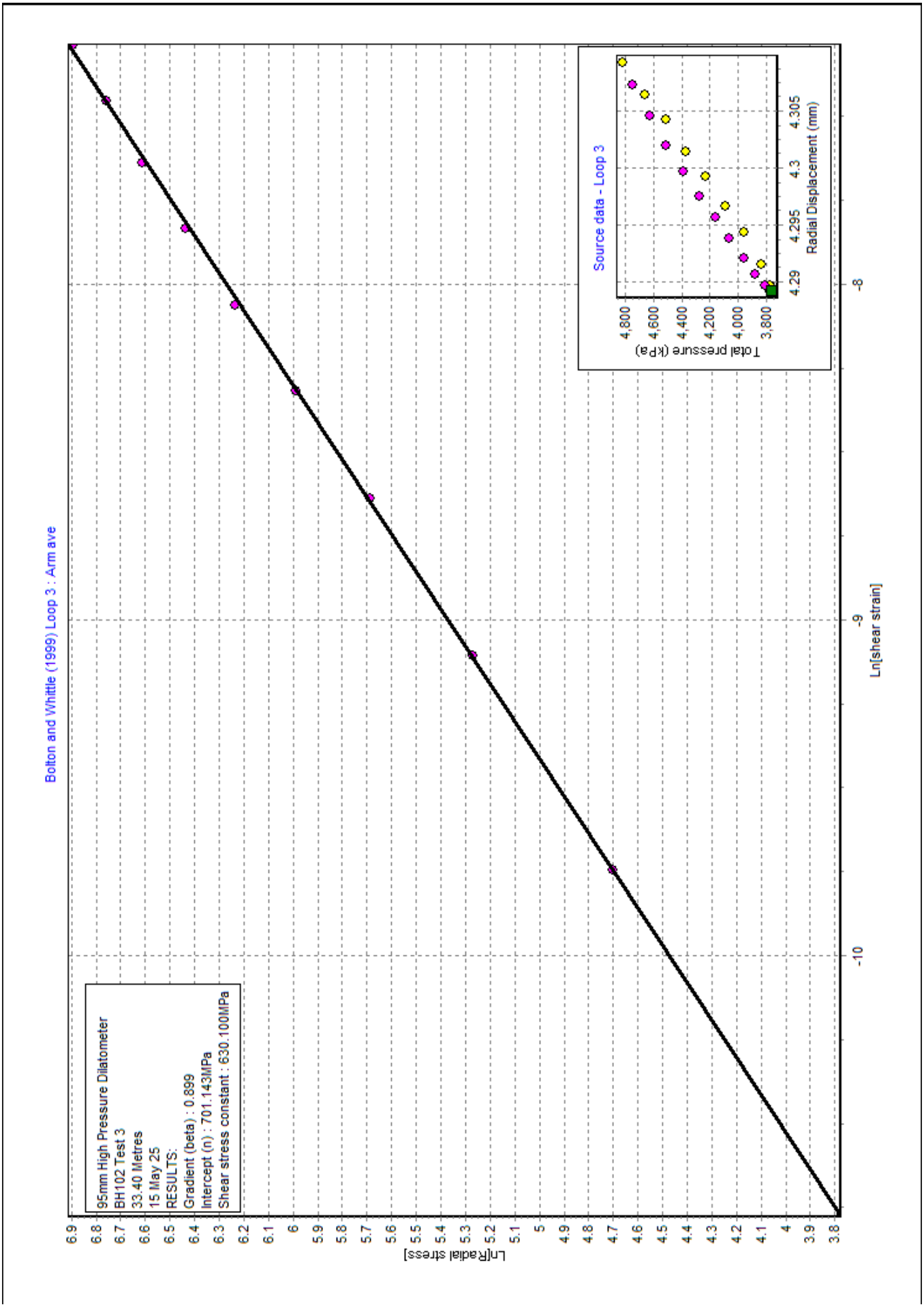

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 1077.8MPa
Cycle mid-point:
Cavity strain : 0.126%
Total stress : 2380kPa
Size of cycle :
Shear strain : 0.049%
Total stress : 526kPa
95mm High Pressure Dilatometer
BH102 Test 3
33.40 Metres
15 May 25
Total pressure (kPa)
Radial Displacement (mm)
3,200
3,150
3,100
3,050
3,000
2,950
2,900
2,850
2,800
2,750
2,700
2,650
2,600
2,550
2,500
2,450
2,400
2,350
2,300
2,250
2,200
2,150
2,100
3.95
3.955
3.96
3.965
3.97
3.975
3.98
3.985
3.99
3.995
4
4.005
4.01
4.015

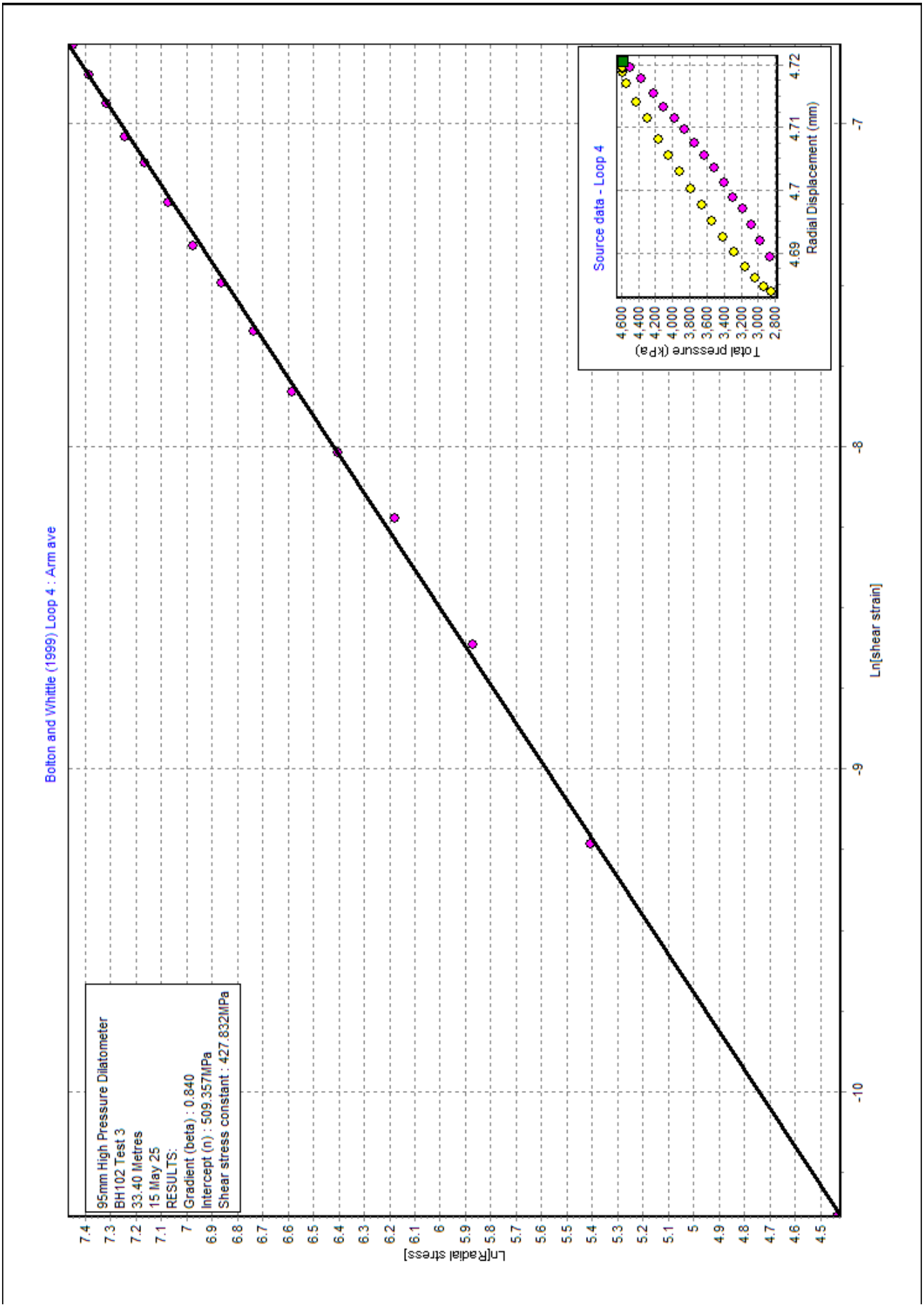

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 1422.9MPa
Cycle mid-point:
Cavity strain : 0.724%
Total stress : 4303kPa
Size of cycle :
Shear strain : 0.077%
Total stress : 1094kPa
95mm High Pressure Dilatometer
BH102 Test 3
33.40 Metres
15 May 25
Total pressure (kPa)
Radial Displacement (mm)
5,700
5,600
5,500
5,400
5,300
5,200
5,100
5,000
4,900
4,800
4,700
4,600
4,500
4,400
4,300
4,200
4,100
4,000
3,900
3,800
3,700
3,600
4.27
4.275
4.28
4.285
4.29
4.295
4.3
4.305
4.31
4.315
4.32
4.325
4.33

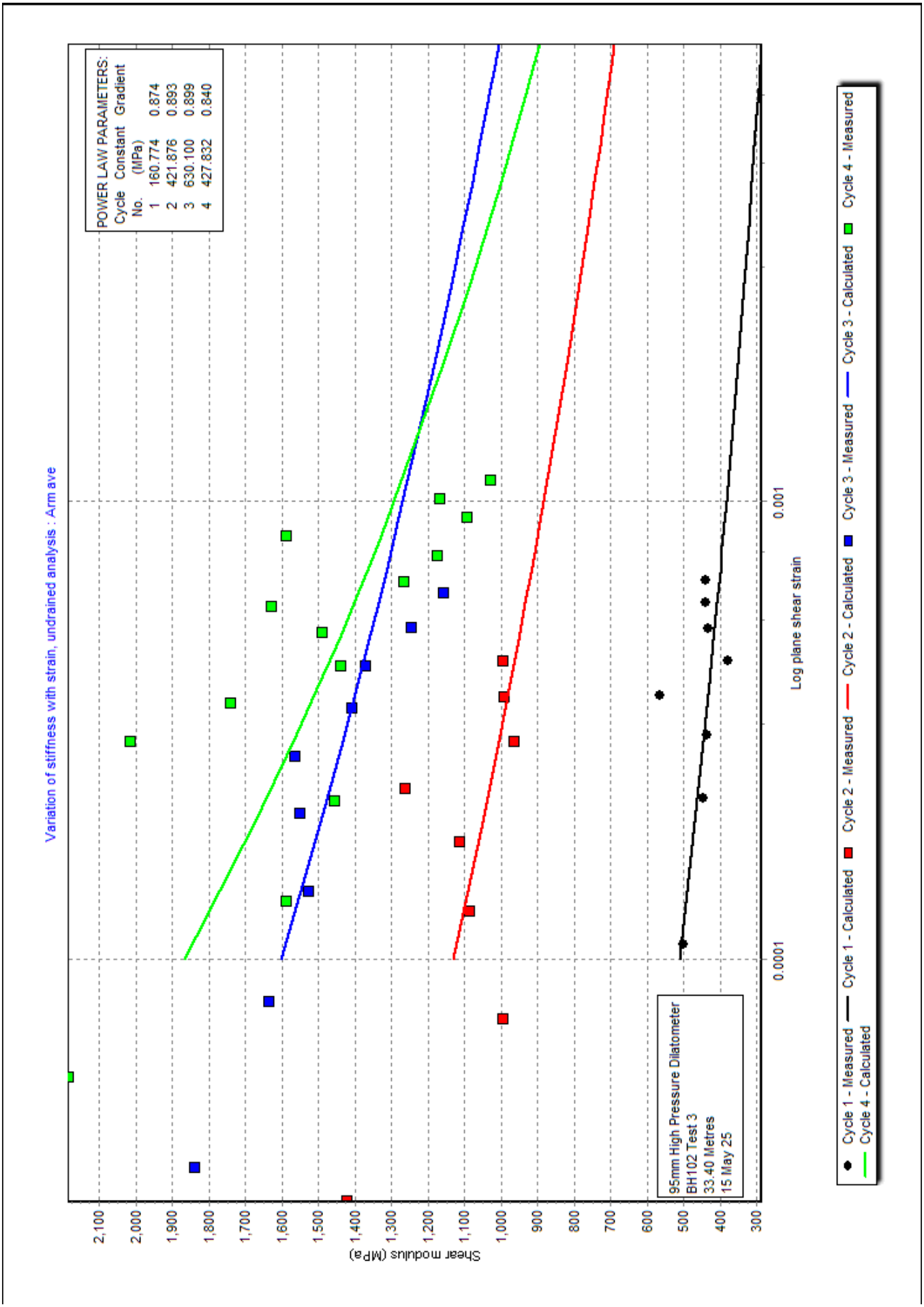

Shear modulus from unload/reload cycles Loop 4 : Arm ave
RESULTS:
Gur : 1356.6MPa
Cycle mid-point:
Cavity strain : 1.492%
Total stress : 3655kPa
Size of cycle :
Shear strain : 0.134%
Total stress : 1824kPa
95mm High Pressure Dilatometer
BH102 Test 3
33.40 Metres
15 May 25
Total pressure (kPa)
Radial Displacement (mm)

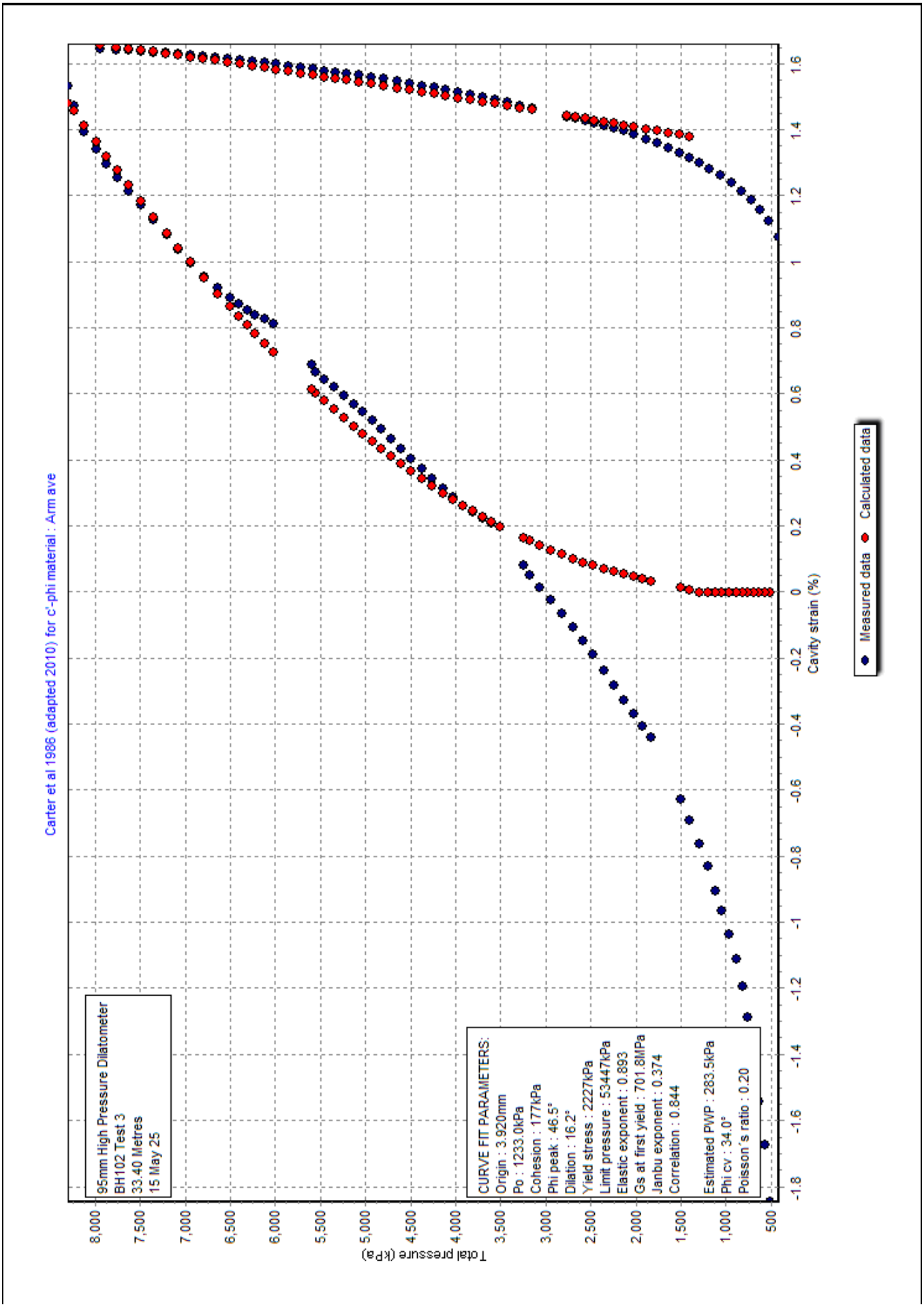

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 3
33.40 Metres
15 May 25
RESULTS:
Gradient (beta) : 0.874
Intercept (n) : 183.855MPa
Shear stress constant : 160.774MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

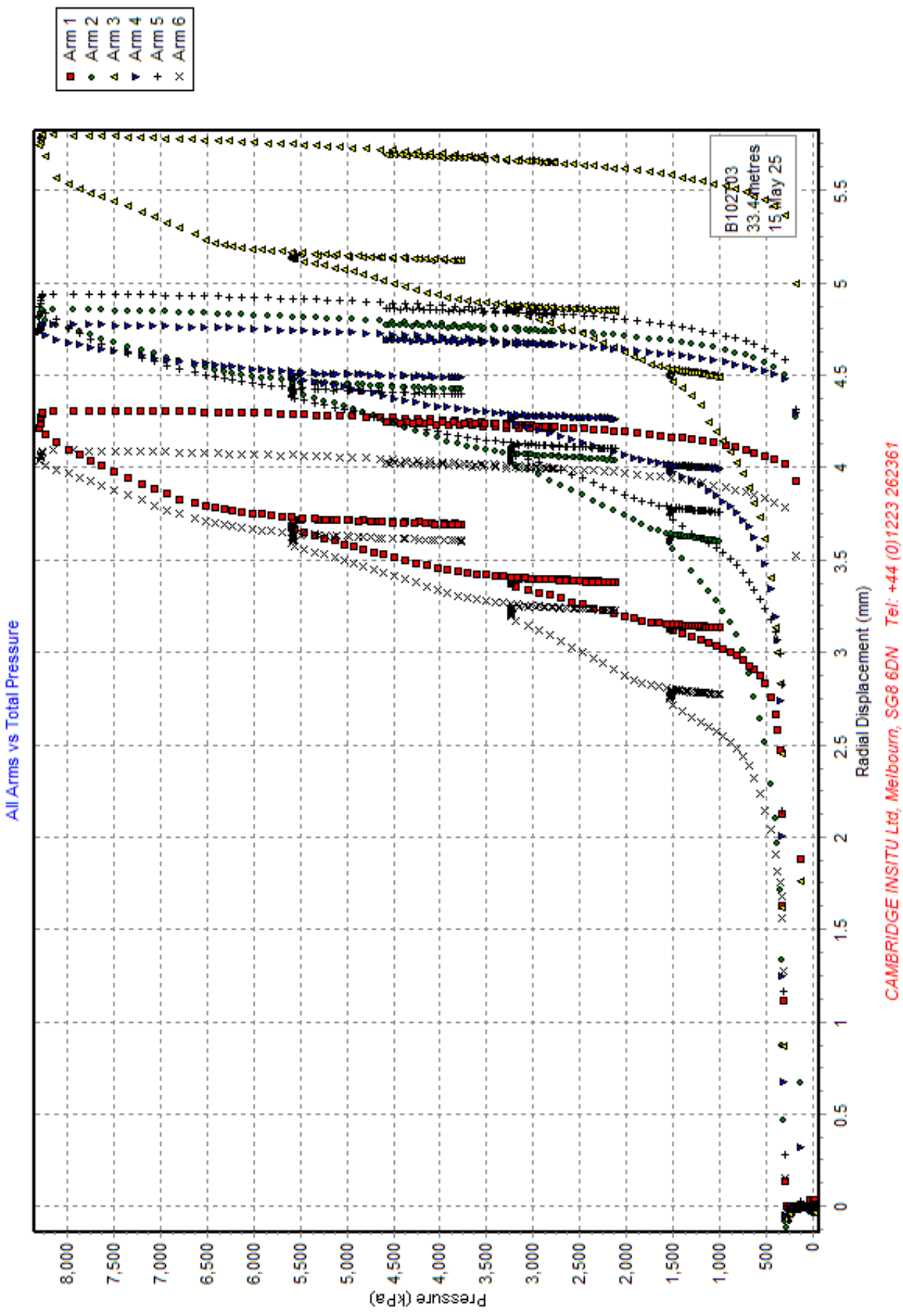

Bolton and Whittle (1999) Loop 2 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 3
33.40 Metres
15 May 25
RESULTS:
Gradient (beta) : 0.893
Intercept (n) : 472.396MPa
Shear stress constant : 421.876MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

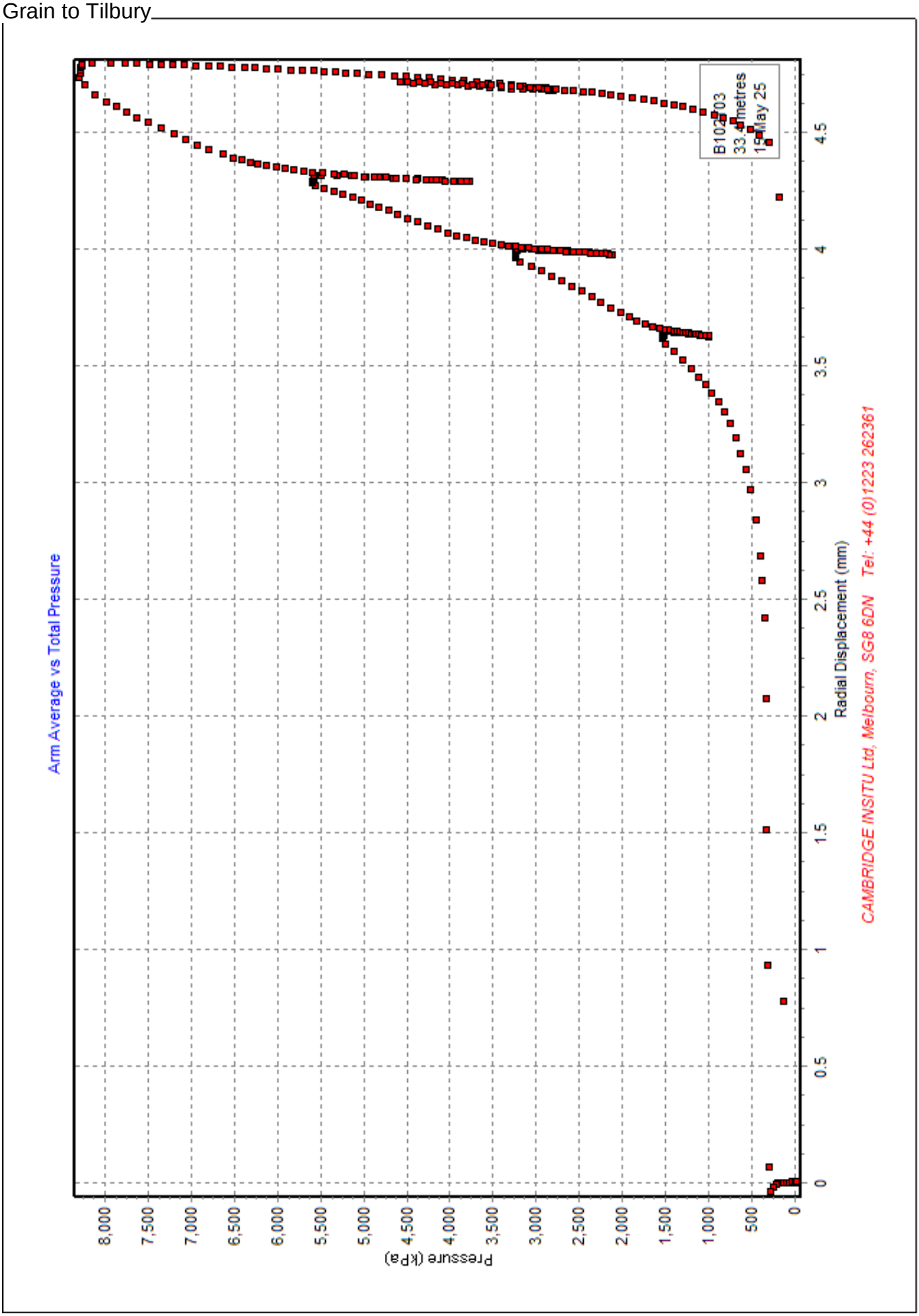

Bolton and Whittle (1999) Loop 3 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 3
33.40 Metres
15 May 25
RESULTS:
Gradient (beta) : 0.899
Intercept (n) : 701.143MPa
Shear stress constant : 630.100MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)

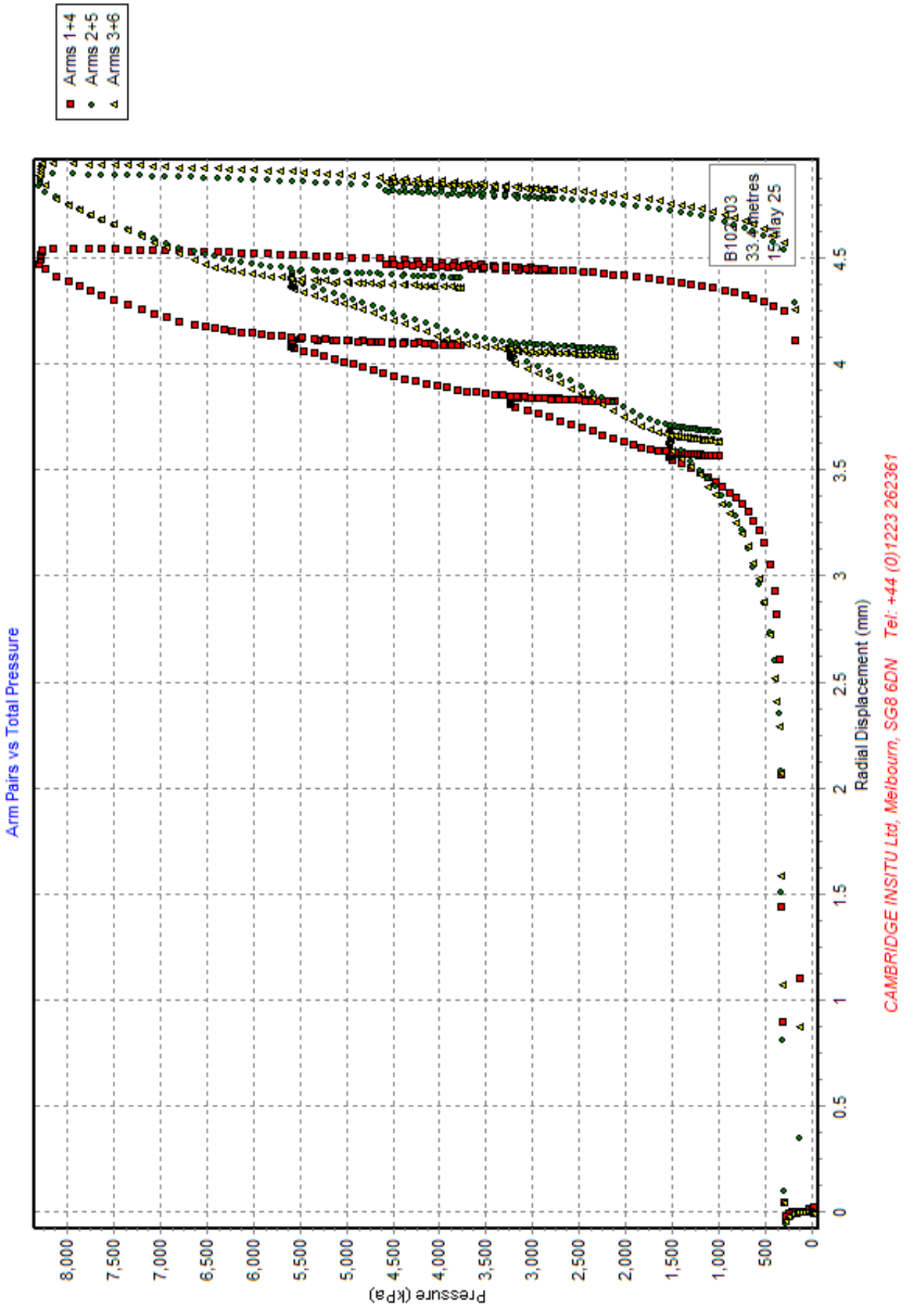

Bolton and Whittle (1999) Loop 4 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 3
33.40 Metres
15 May 25
RESULTS:
Gradient (beta) : 0.840
Intercept (n) : 509.357MPa
Shear stress constant : 427.832MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 4
Total pressure (kPa)
Radial Displacement (mm)

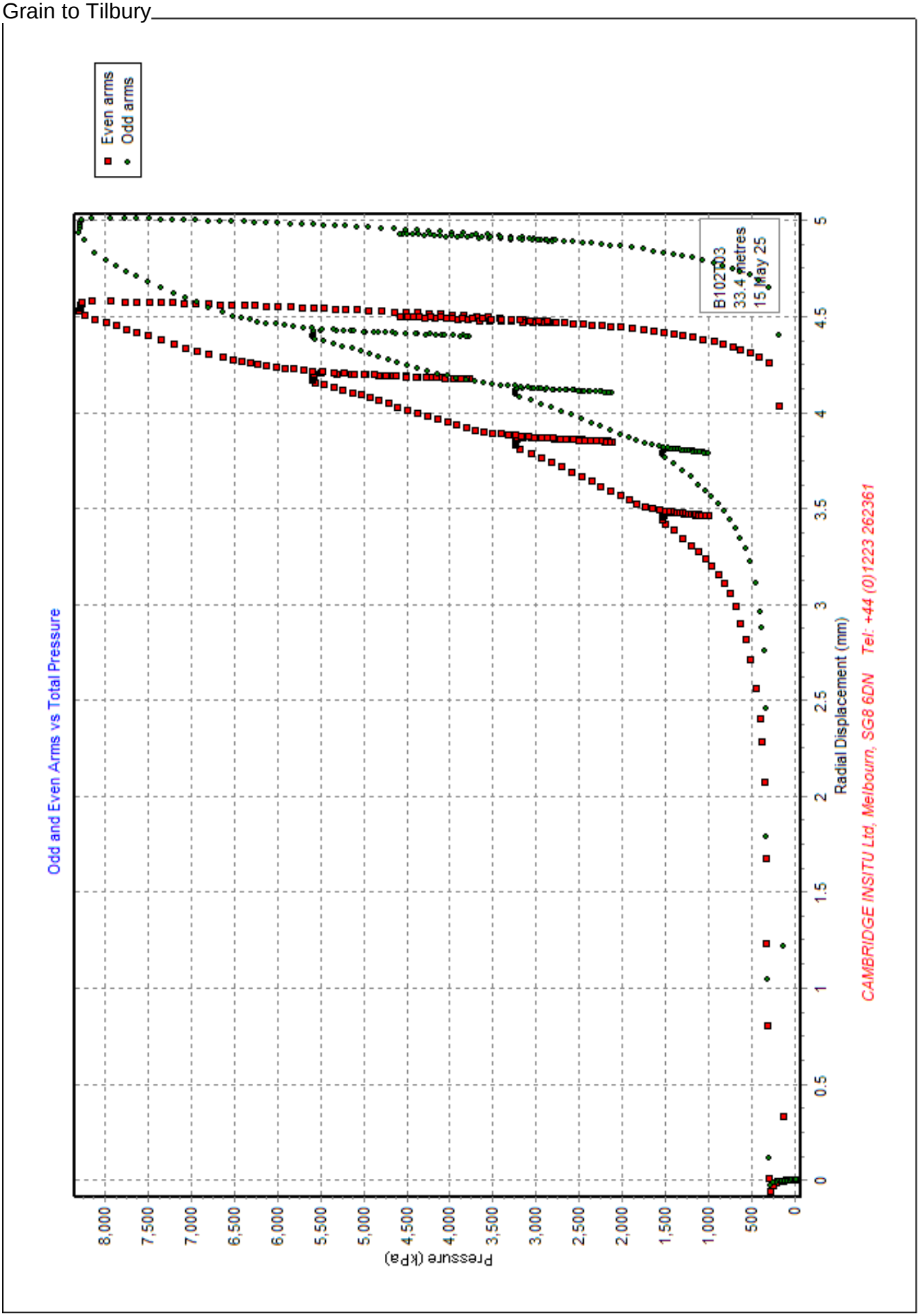

Variation of stiffness with strain, undrained analysis : Arm ave
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 160.774 0.874
2 421.876 0.893
3 630.100 0.899
4 427.832 0.840
95mm High Pressure Dilatometer
BH102 Test 3
33.40 Metres
15 May 25
Shear modulus (MPa)
Log plane shear strain
0.0001
0.001
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
Cycle 4 - Measured
Cycle 4 - Calculated


Carter et al 1986 (adapted 2010) for c'-phi material : Arm ave
95mm High Pressure Dilatometer
BH102 Test 3
33.40 Metres
15 May 25
CURVE FIT PARAMETERS:
Origin : 3.920mm
Po : 1233.0kPa
Cohesion : 177kPa
Phi peak : 46.5°
Dilation : 16.2°
Yield stress : 2227kPa
Limit pressure : 53447kPa
Elastic exponent : 0.893
Gs at first yield : 701.8MPa
Janbu exponent : 0.374
Correlation : 0.844
Estimated PWP : 283.5kPa
Phi cv : 34.0°
Poisson's ratio : 0.20
Total pressure (kPa)
Cavity strain (%)
Measured data
Calculated data


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
B102203
33.4 metres
15 May 25
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arm Average vs Total Pressure
B102/03
33.4metres
19May 25
Radial Displacement (mm)
Pressure (kPa)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arms 1+4
Arms 2+5
Arms 3+6
B102-03
33.4 metres
15 May 25
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
B102103
33.4 metres
15 May 25
Odd and Even Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to TIlbury
BH102 Test 4 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Tilbury
Borehole : BH102
Test name : BH102 Test 4
Test date : 16 May 25
Test depth : 35.90 Metres
Water table : 4.5 Metres
Ambient PWP : 308.0 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDP/RW on 18 Jul 25

Remarks: Flint presant

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=3.82"
Po from Marsland & Randolph (kPa) : "Arm ave=944.1"
Best estimate of Po (kPa) : "Arm ave=897.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=4522.5"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 34.0
Angle of internal friction (°) : "Arm ave=39.0"
Dilation angle (°) : "Arm ave=6.2"
Gradient of log-log plot : "Arm ave=0.428"

[Withers et al 1989]
Angle of internal friction (°) : "Arm ave=40.4"
Dilation angle (°) : "Arm ave=8.1"
Gradient of log-log plot : "Arm ave=-2.909"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=166.9"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	1000.9	0.186	2460	0.091	907
Arm ave	2	1164.3	0.842	4062	0.129	1499
Arm ave	3	1269.8	2.592	6342	0.156	1983
Arm ave	4	1094.5	3.544	4027	0.172	1886

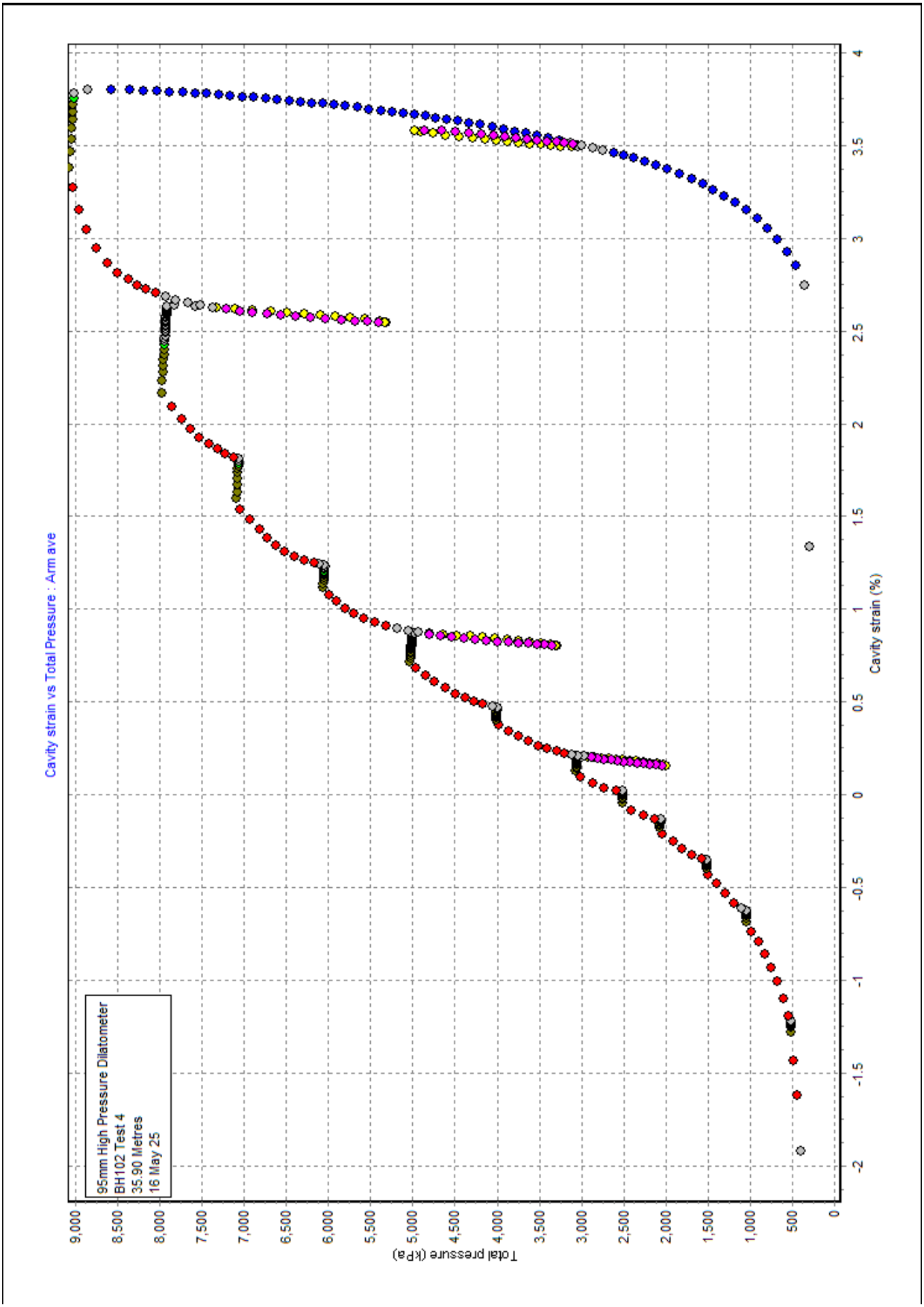
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

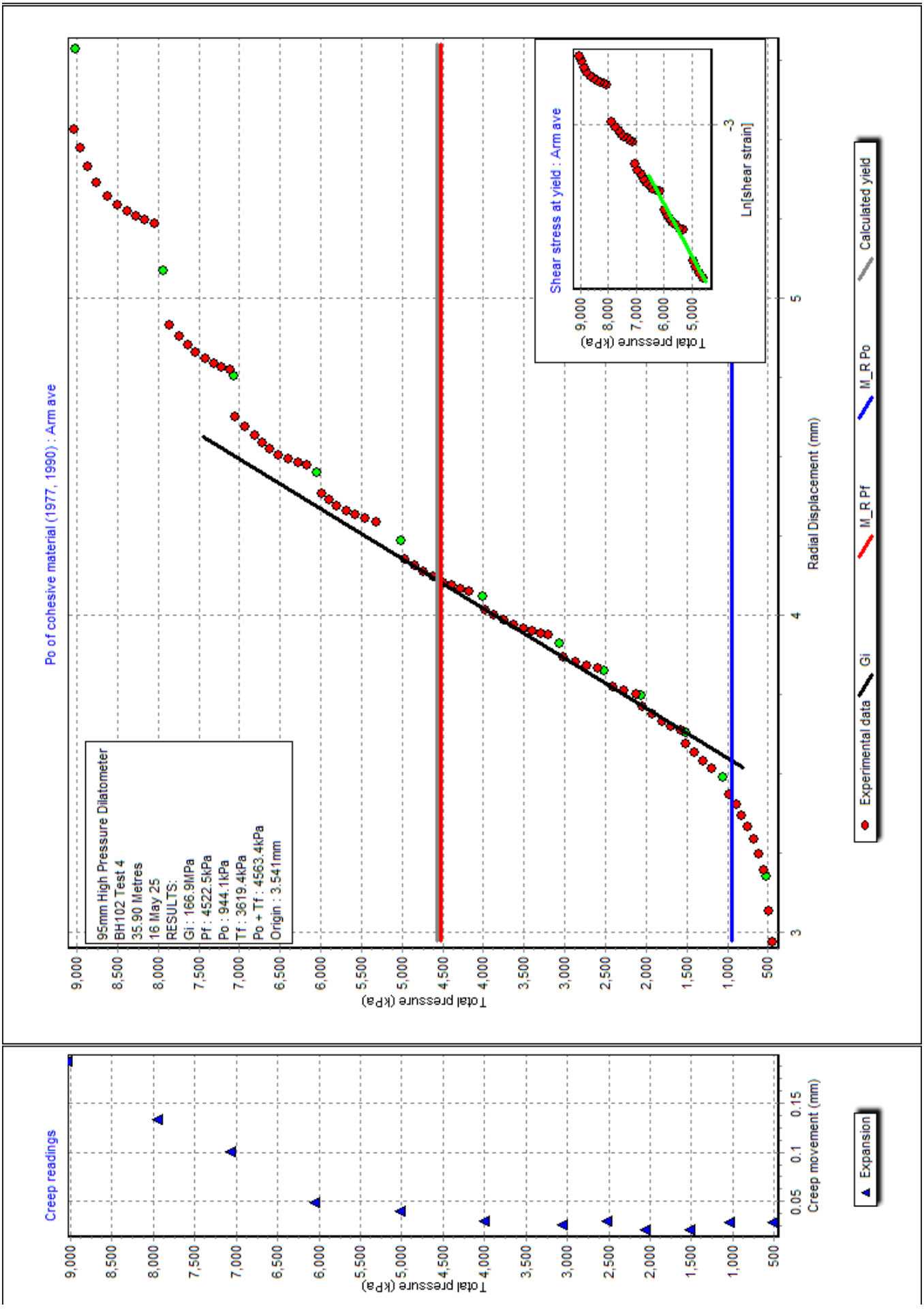
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	403.026	349.152	0.866
Arm ave	2	575.147	506.125	0.880
Arm ave	3	395.735	320.265	0.809
Arm ave	4	266.370	202.691	0.761

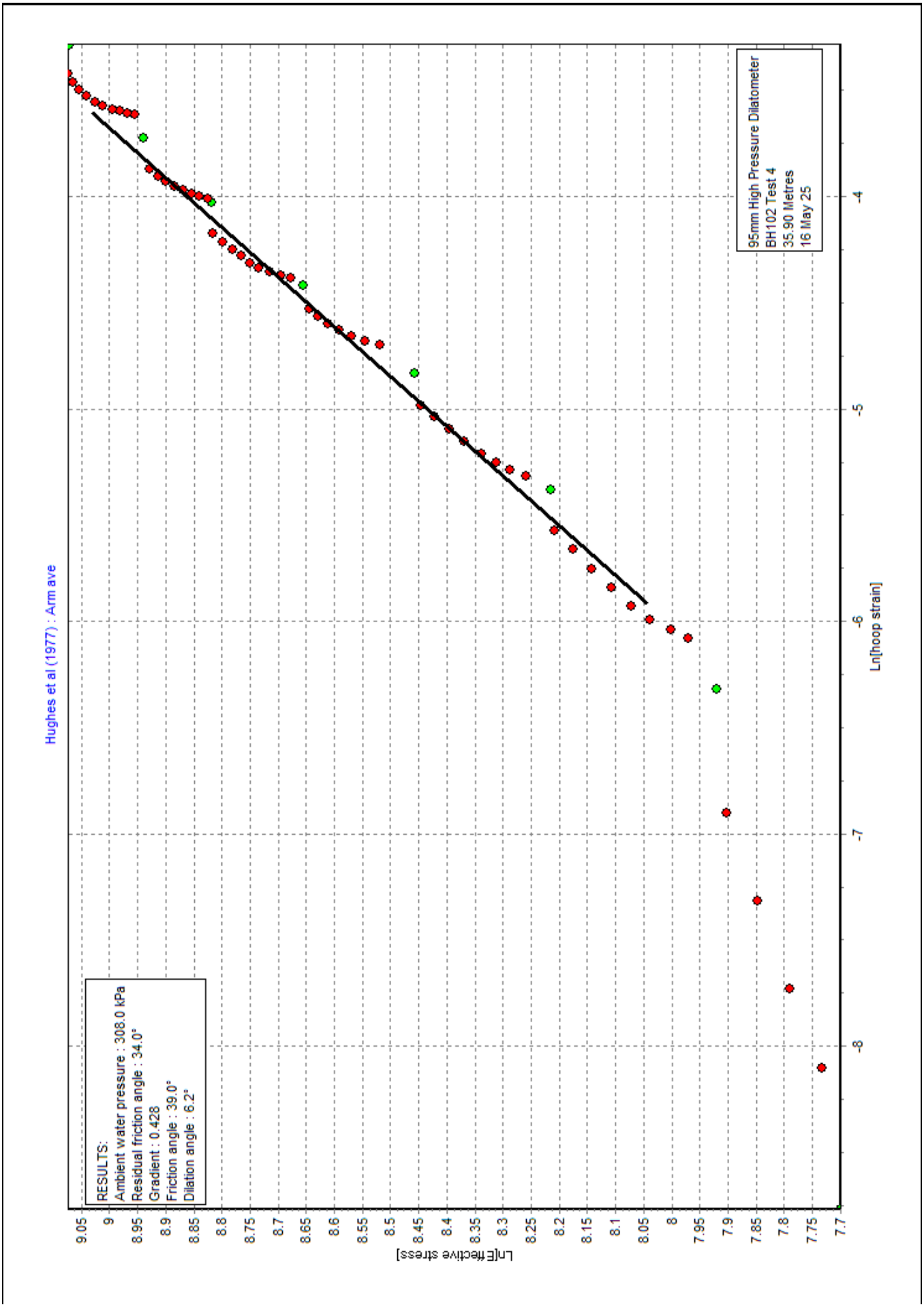
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 3.82
Po (kPa) : 897
Cohesion (kPa) : 92
Angle of peak friction (deg) : 39.0
Angle of peak dilation (deg) : 6.2
Total yield stress (kPa) : 1539

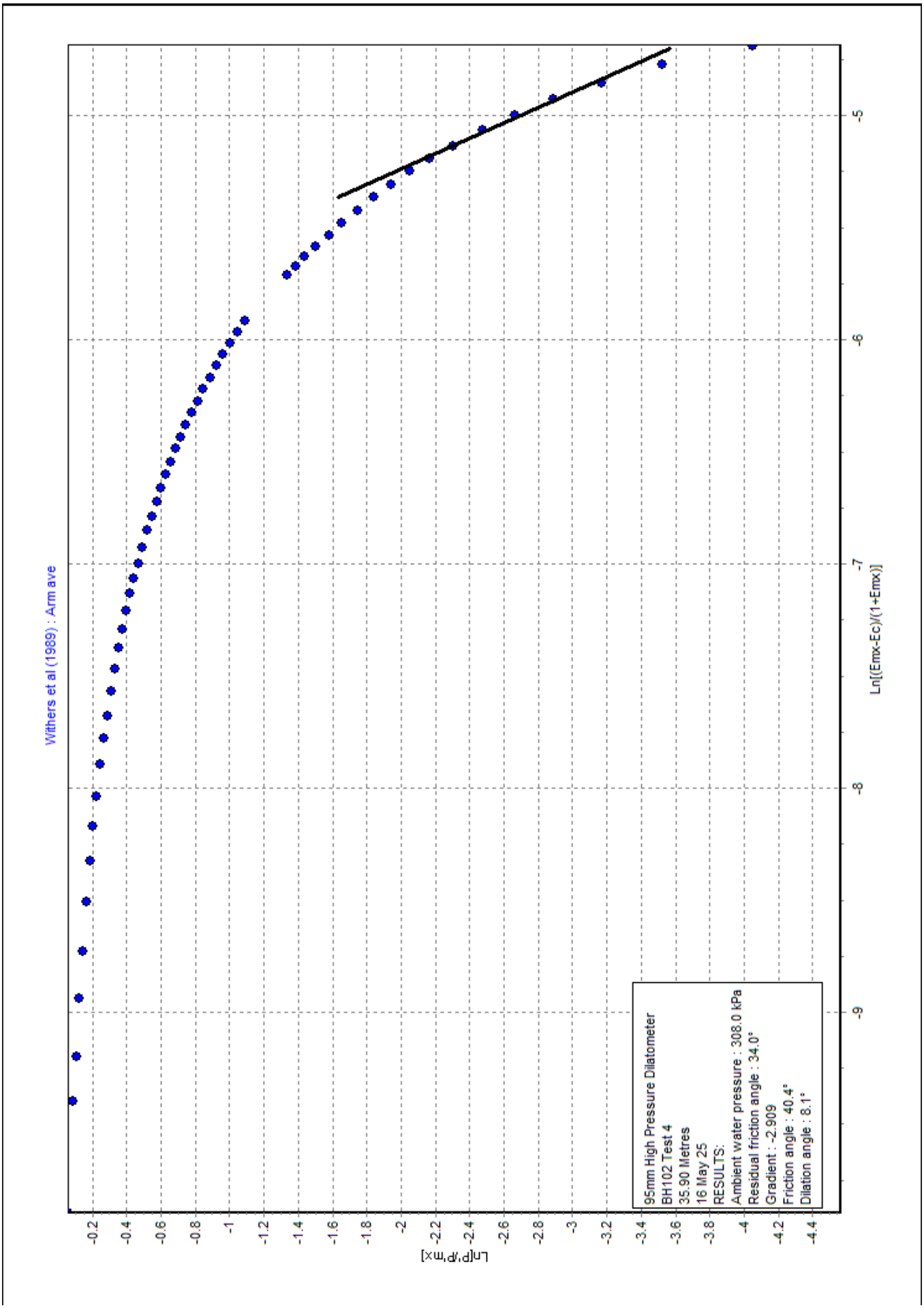
Grain to TIlbury
BH102 Test 4 - SUMMARY OF RESULTS

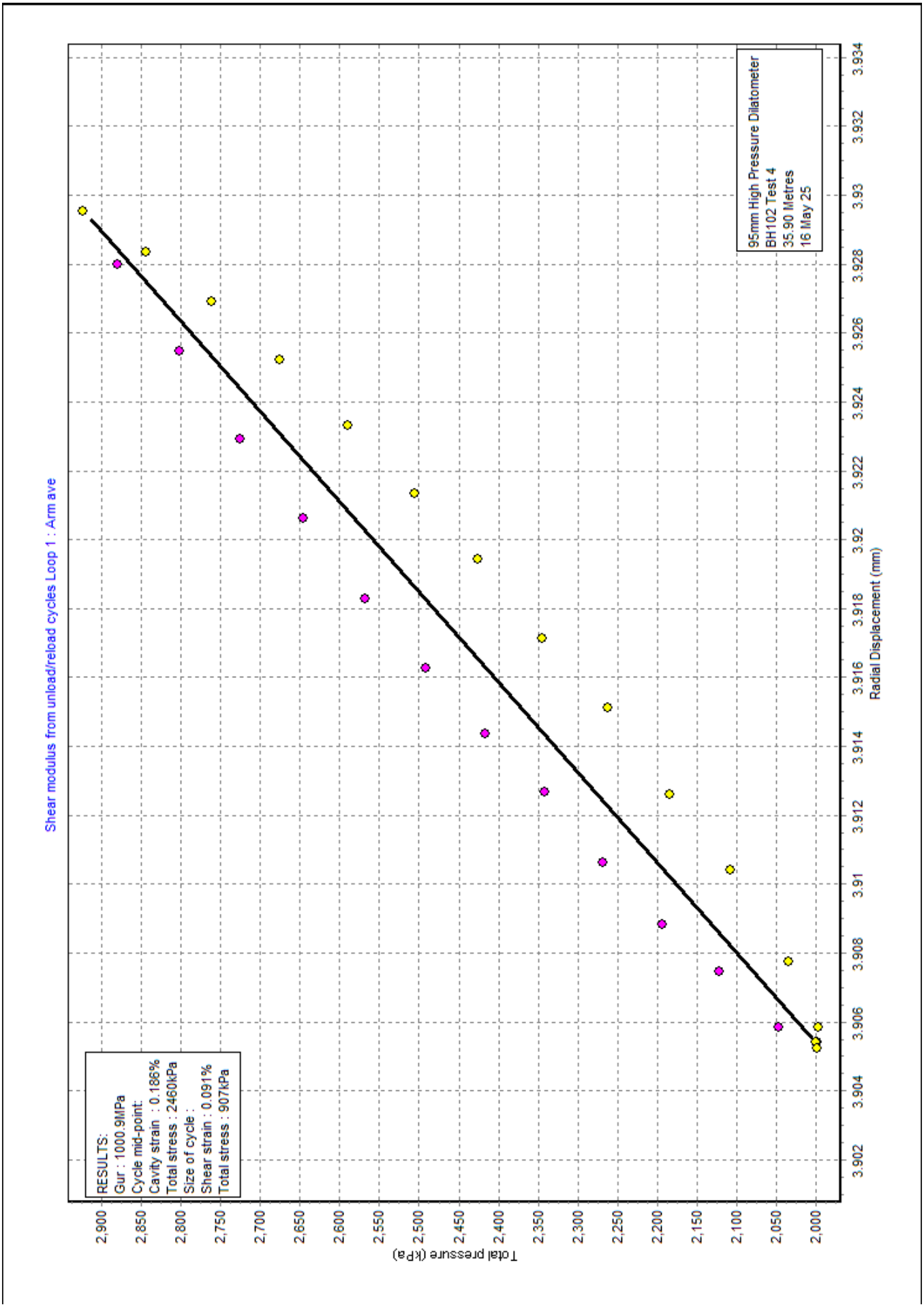
Total limit stress (kPa)	:	30060
G at first yield (MPa)	:	1239.3
Non-linear exponent	:	0.809
Janbu exponent	:	0.064
Correlation	:	0.165
Ambient pore water pressure (kPa)	:	308
Residual friction angle (deg)	:	34.0
Poisson's ratio	:	0.20

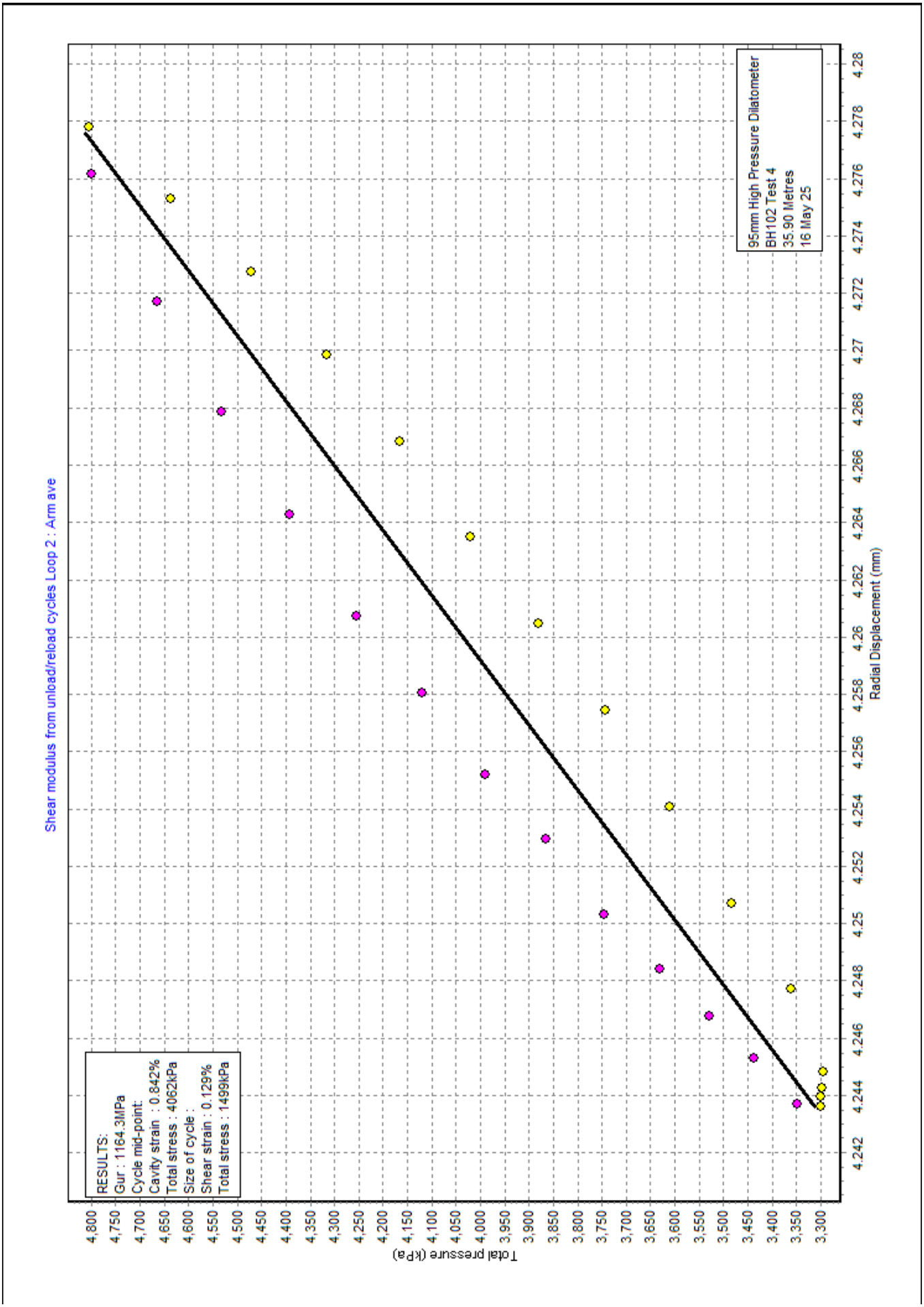

Cavity strain vs Total Pressure : Arm ave
95mm High Pressure Dilatometer
BH102 Test 4
35.90 Metres
16 May 25
Total pressure (kPa)
Cavity strain (%)
9,000
8,500
8,000
7,500
7,000
6,500
6,000
5,500
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2

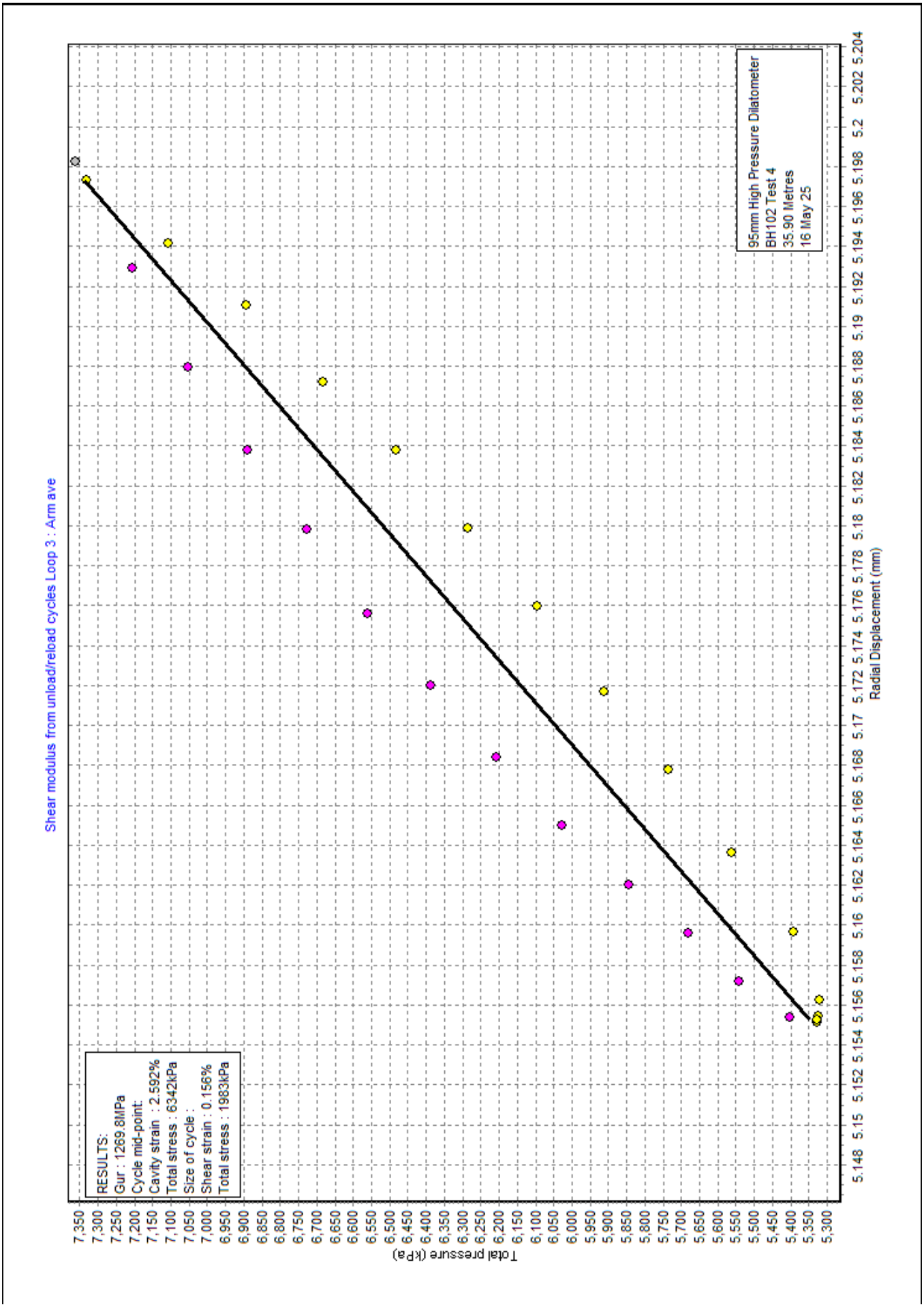

Po of cohesive material (1977, 1990) : Arm ave
95mm High Pressure Dilatometer
BH102 Test 4
35.90 Metres
16 May 25
RESULTS:
Gi : 166.9MPa
Pf : 4522.5kPa
Po : 944.1kPa
Tf : 3619.4kPa
Po + Tf : 4563.4kPa
Origin : 3.541mm
Total pressure (kPa)
Radial Displacement (mm)
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Shear stress at yield : Arm ave
Ln[shear strain]
Creep readings
Creep movement (mm)
Expansion

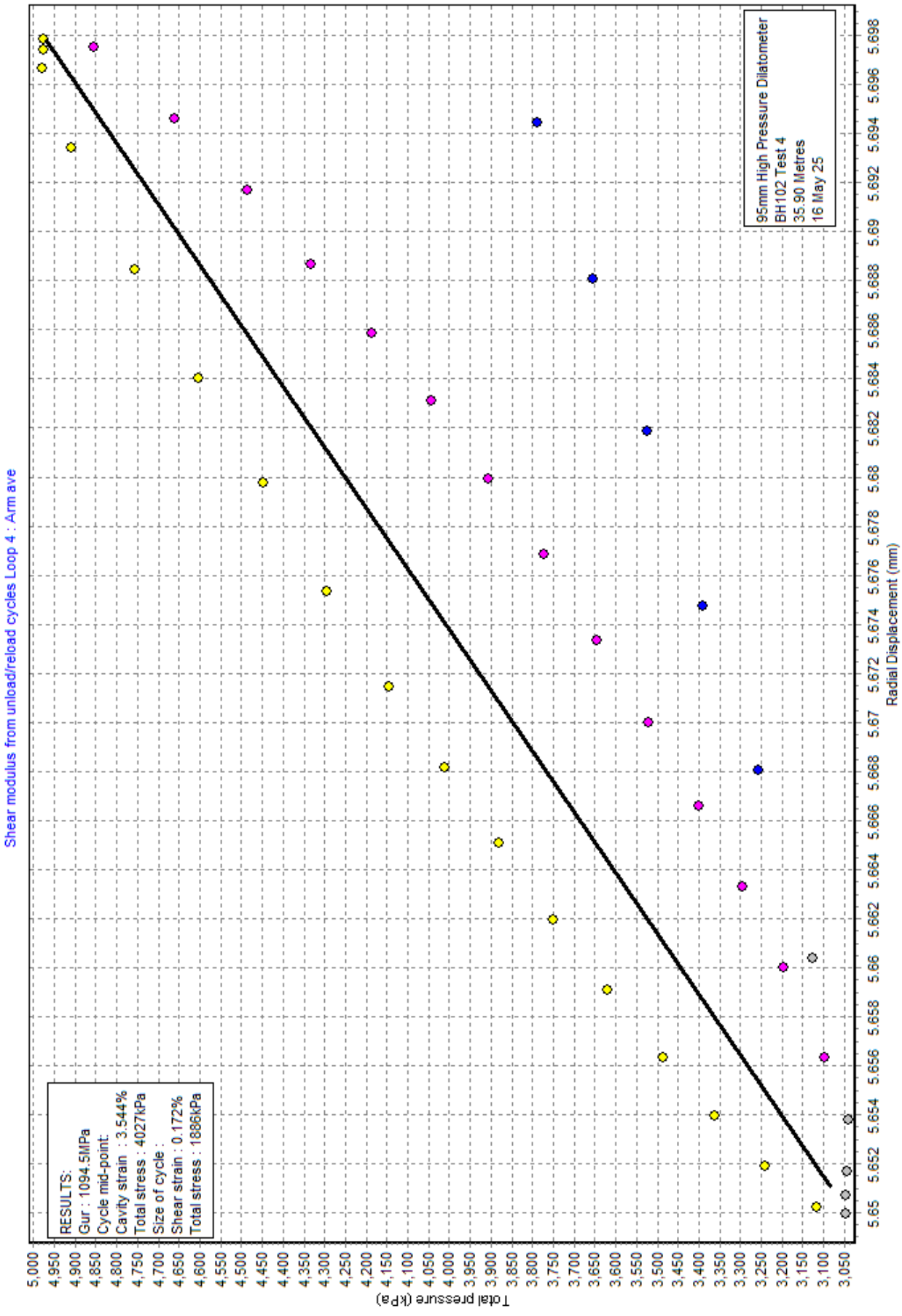

Hughes et al (1977) : Arm ave
RESULTS:
Ambient water pressure : 308.0 kPa
Residual friction angle : 34.0°
Gradient : 0.428
Friction angle : 39.0°
Dilation angle : 6.2°
95mm High Pressure Dilatometer
BH102 Test 4
35.90 Metres
16 May 25
Ln[Effective stress]
Ln[hoop strain]
9.05
9
8.95
8.9
8.85
8.8
8.75
8.7
8.65
8.6
8.55
8.5
8.45
8.4
8.35
8.3
8.25
8.2
8.15
8.1
8.05
8
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7.9
7.85
7.8
7.75
7.7
-4
-5
-6
-7
-8

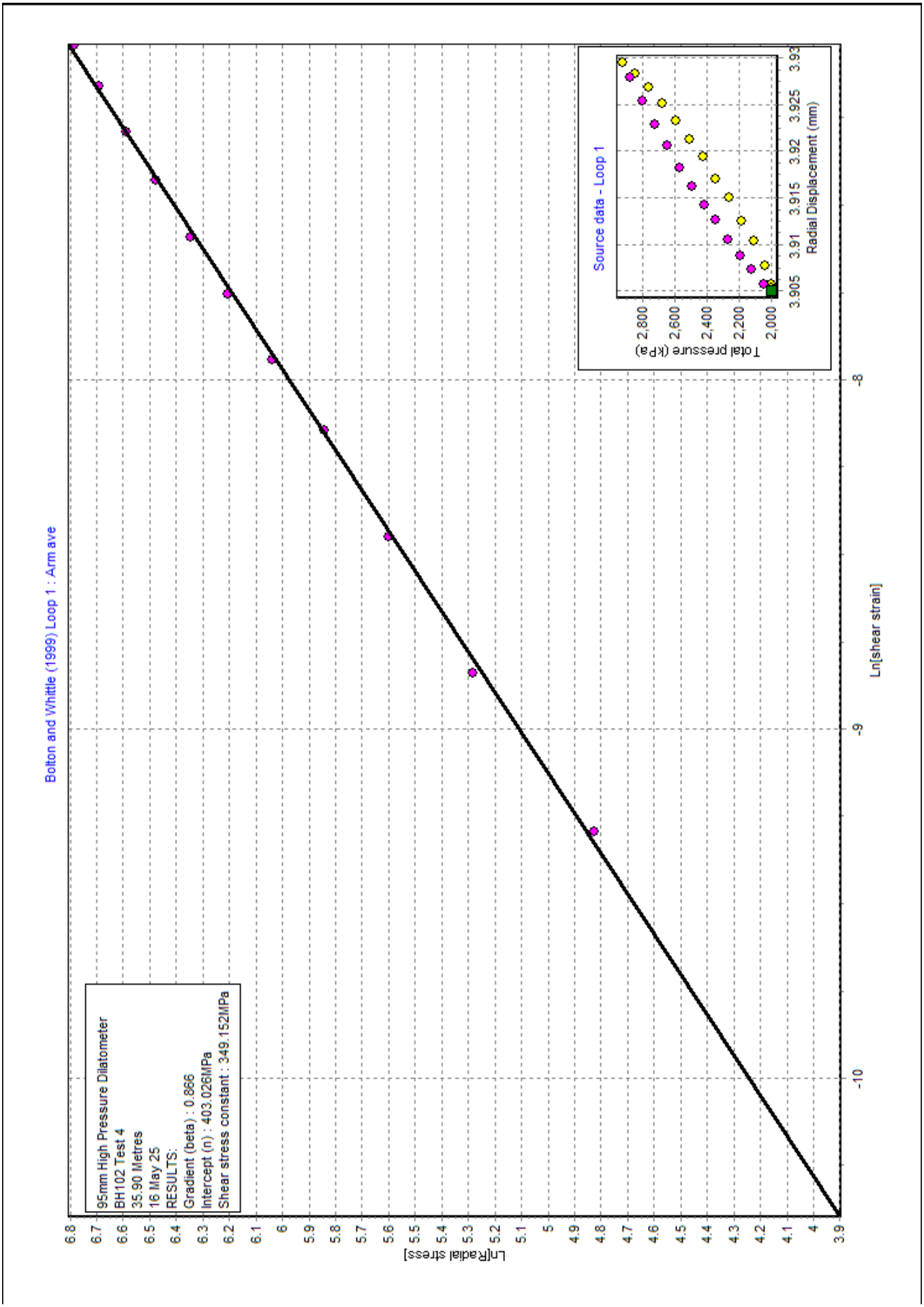

Withers et al (1989) : Arm ave
Ln[(Emx-Ec)/(1+Emx)]
Ln[P'/P'mx]
95mm High Pressure Dilatometer
BH102 Test 4
35.90 Metres
16 May 25
RESULTS:
Ambient water pressure : 308.0 kPa
Residual friction angle : 34.0°
Gradient : -2.909
Friction angle : 40.4°
Dilation angle : 8.1°

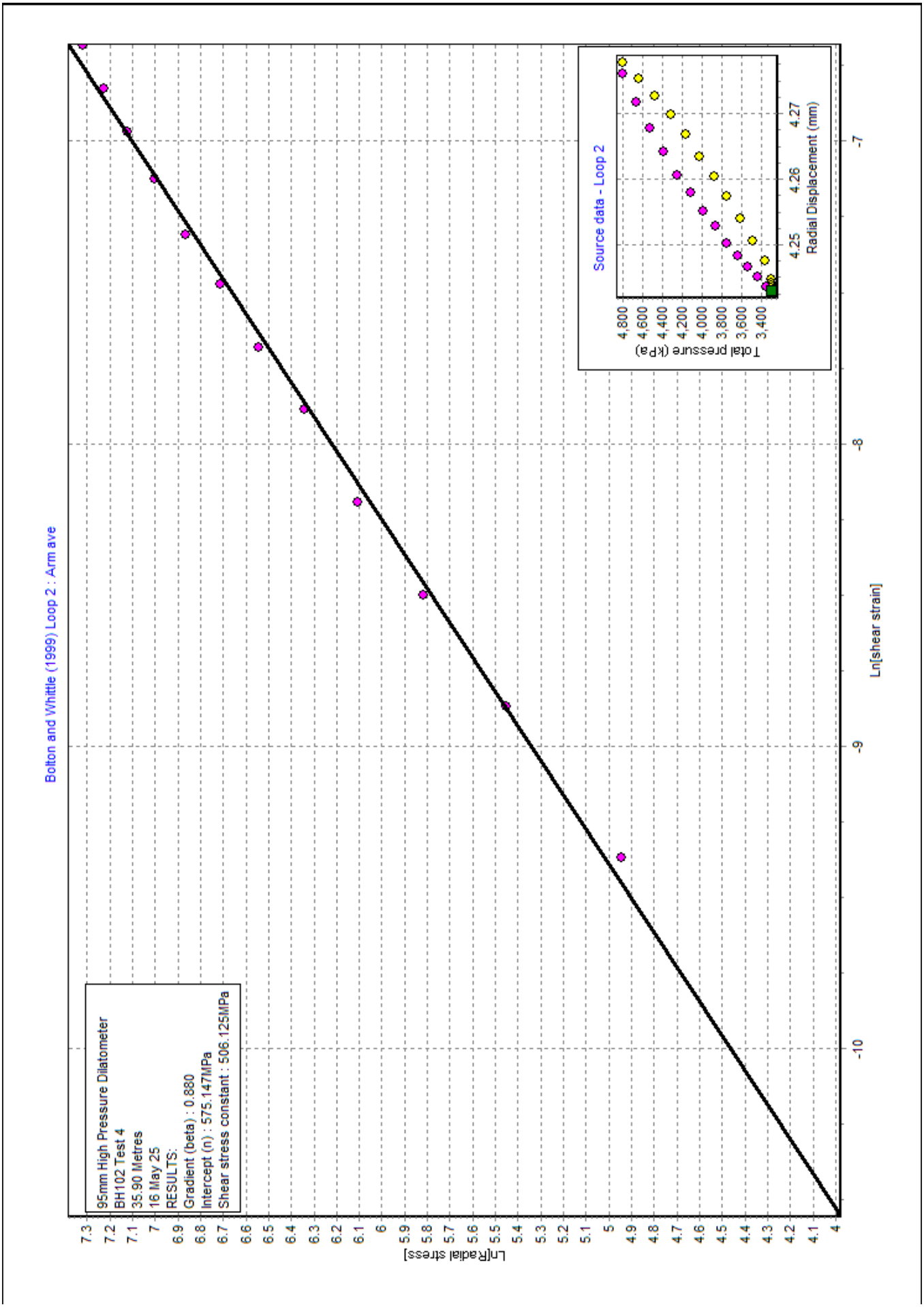

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 1000.9MPa
Cycle mid-point:
Cavity strain : 0.186%
Total stress : 2460kPa
Size of cycle :
Shear strain : 0.091%
Total stress : 907kPa
95mm High Pressure Dilatometer
BH102 Test 4
35.90 Metres
16 May 25
Total pressure (kPa)
Radial Displacement (mm)
2,900
2,850
2,800
2,750
2,700
2,650
2,600
2,550
2,500
2,450
2,400
2,350
2,300
2,250
2,200
2,150
2,100
2,050
2,000
3.902
3.904
3.906
3.908
3.91
3.912
3.914
3.916
3.918
3.92
3.922
3.924
3.926
3.928
3.93
3.932
3.934

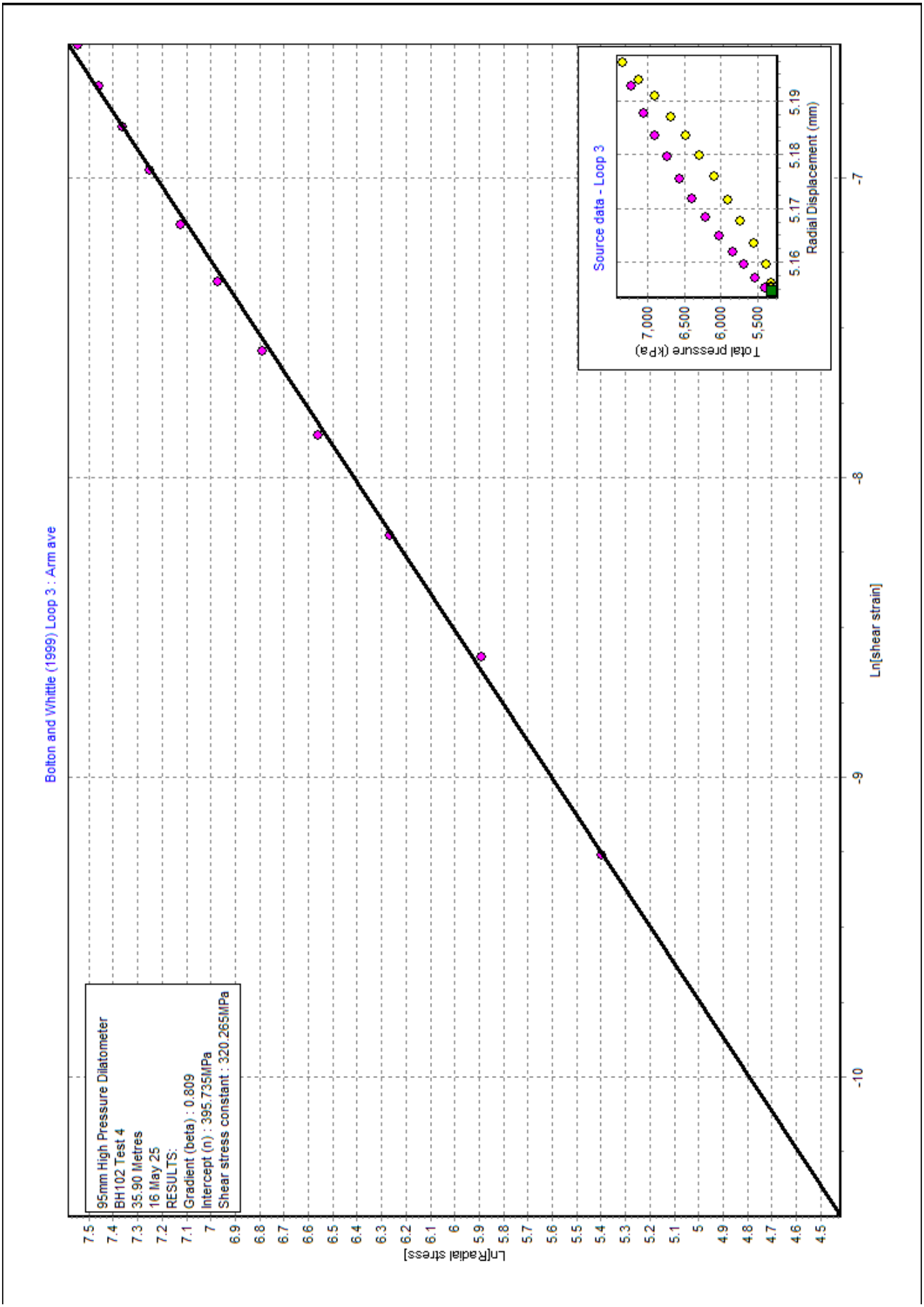

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 1164.3MPa
Cycle mid-point:
Cavity strain : 0.842%
Total stress : 4062kPa
Size of cycle :
Shear strain : 0.129%
Total stress : 1499kPa
95mm High Pressure Dilatometer
BH102 Test 4
35.90 Metres
16 May 25
Total pressure (kPa)
Radial Displacement (mm)

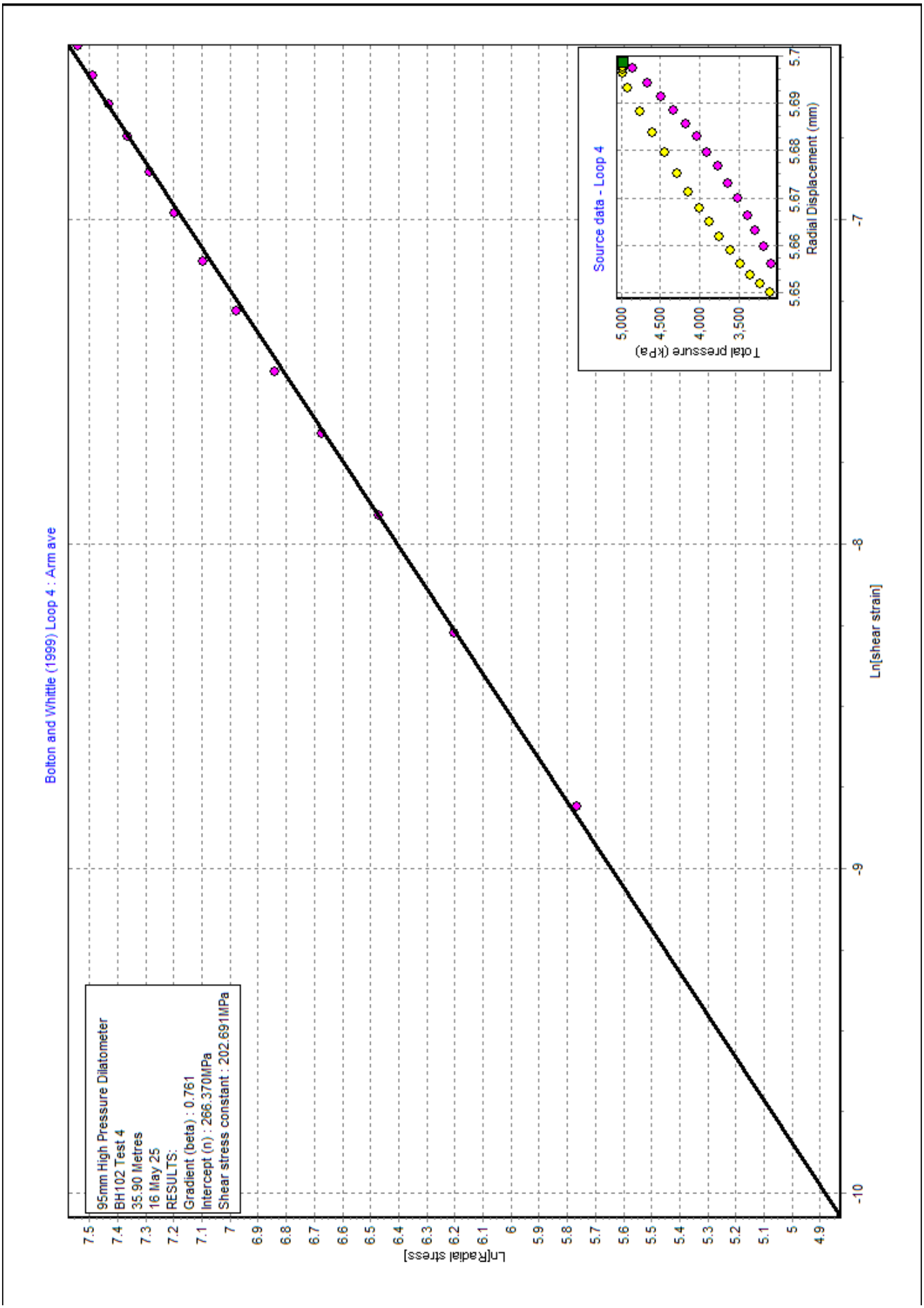

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 1269.8MPa
Cycle mid-point:
Cavity strain : 2.592%
Total stress : 6342kPa
Size of cycle :
Shear strain : 0.156%
Total stress : 1983kPa
95mm High Pressure Dilatometer
BH102 Test 4
35.90 Metres
16 May 25
Total pressure (kPa)
Radial Displacement (mm)

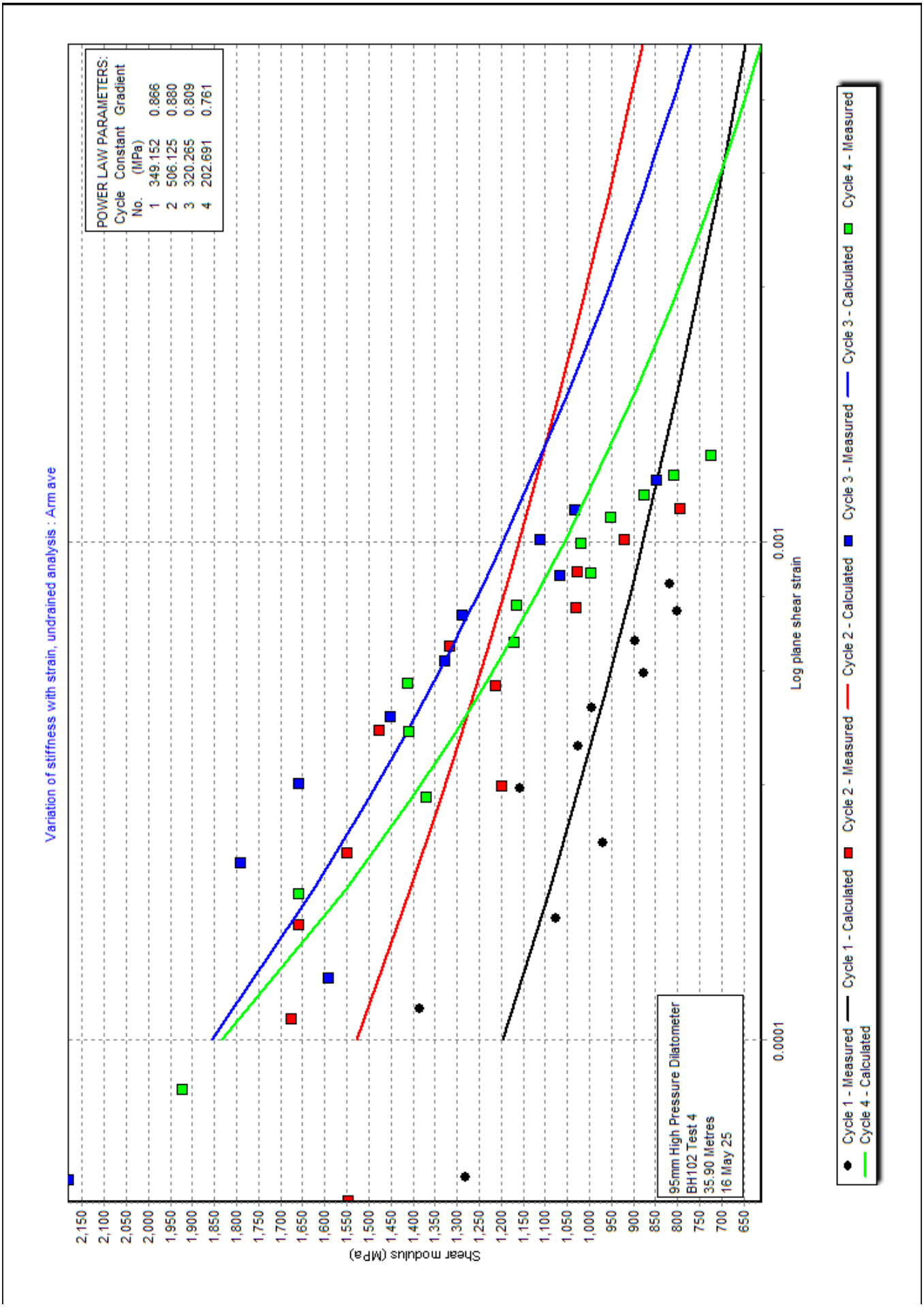

Shear modulus from unload/reload cycles Loop 4 : Arm ave
RESULTS:
Gur : 1094.5MPa
Cycle mid-point:
Cavity strain : 3.544%
Total stress : 4027kPa
Size of cycle :
Shear strain : 0.172%
Total stress : 1886kPa
95mm High Pressure Dilatometer
BH102 Test 4
35.90 Metres
16 May 25
Total pressure (kPa)
Radial Displacement (mm)

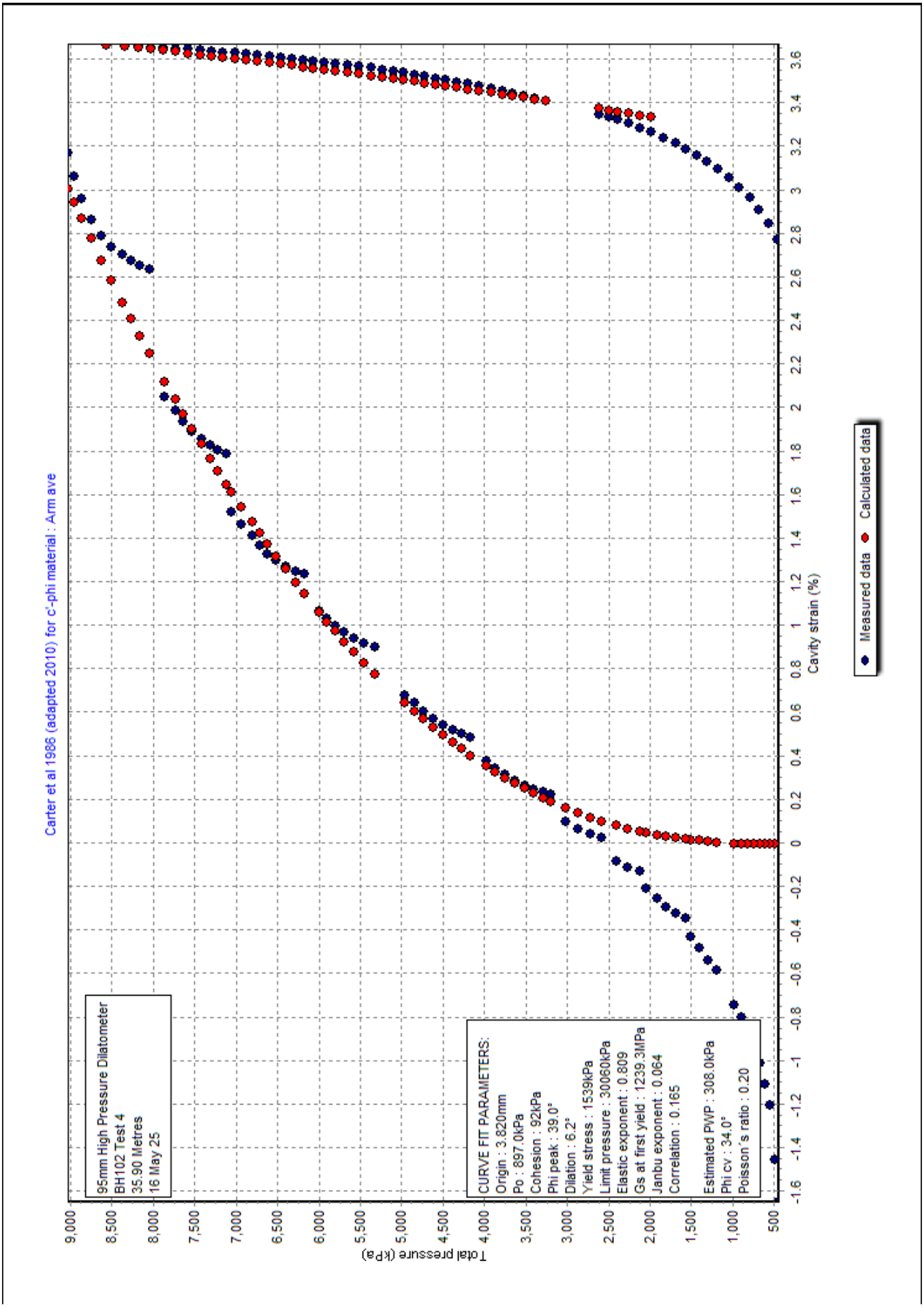

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 4
35.90 Metres
16 May 25
RESULTS:
Gradient (beta) : 0.866
Intercept (n) : 403.026MPa
Shear stress constant : 349.152MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

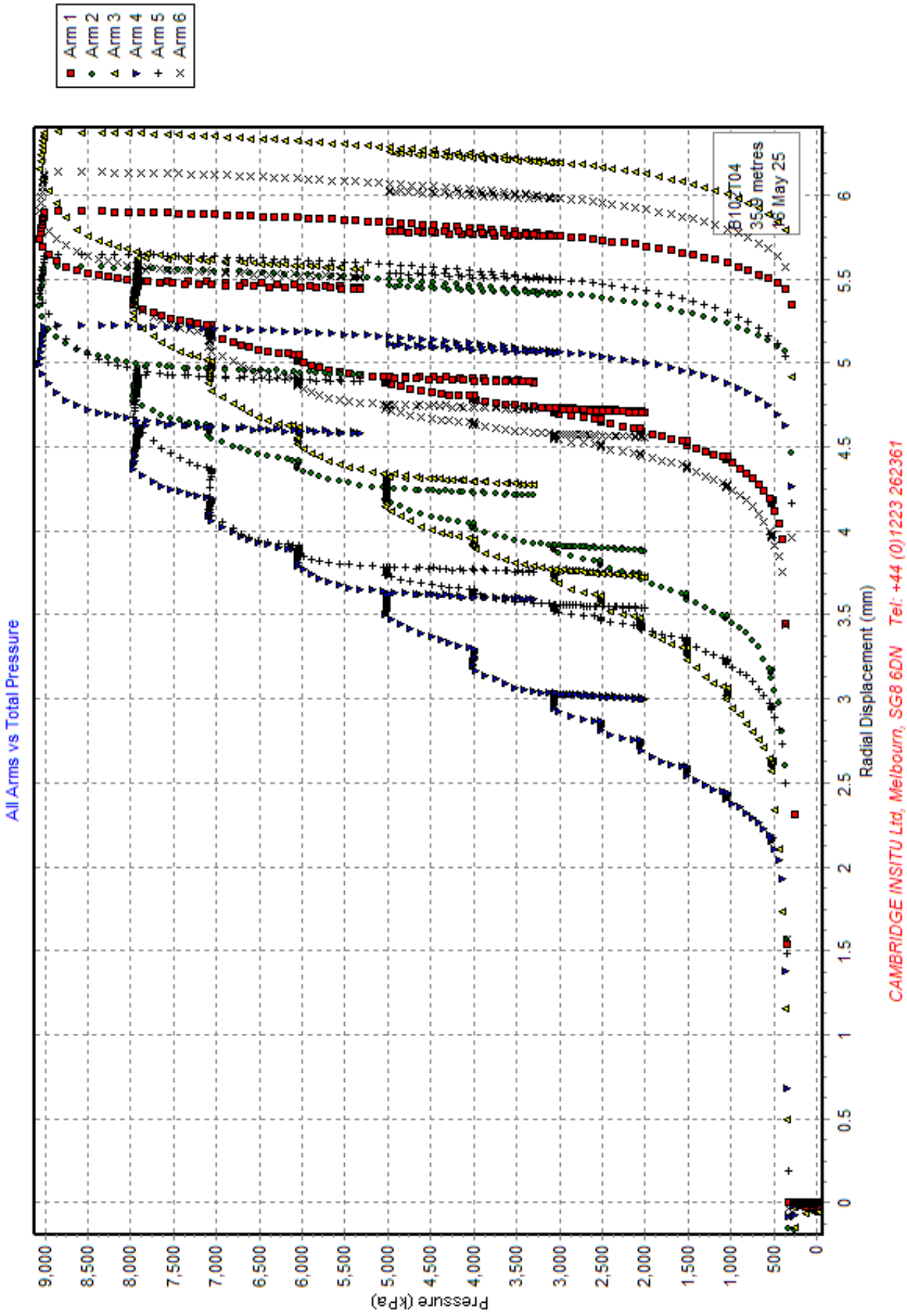

Bolton and Whittle (1999) Loop 2 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 4
35.90 Metres
16 May 25
RESULTS:
Gradient (beta) : 0.880
Intercept (n) : 575.147MPa
Shear stress constant : 506.125MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

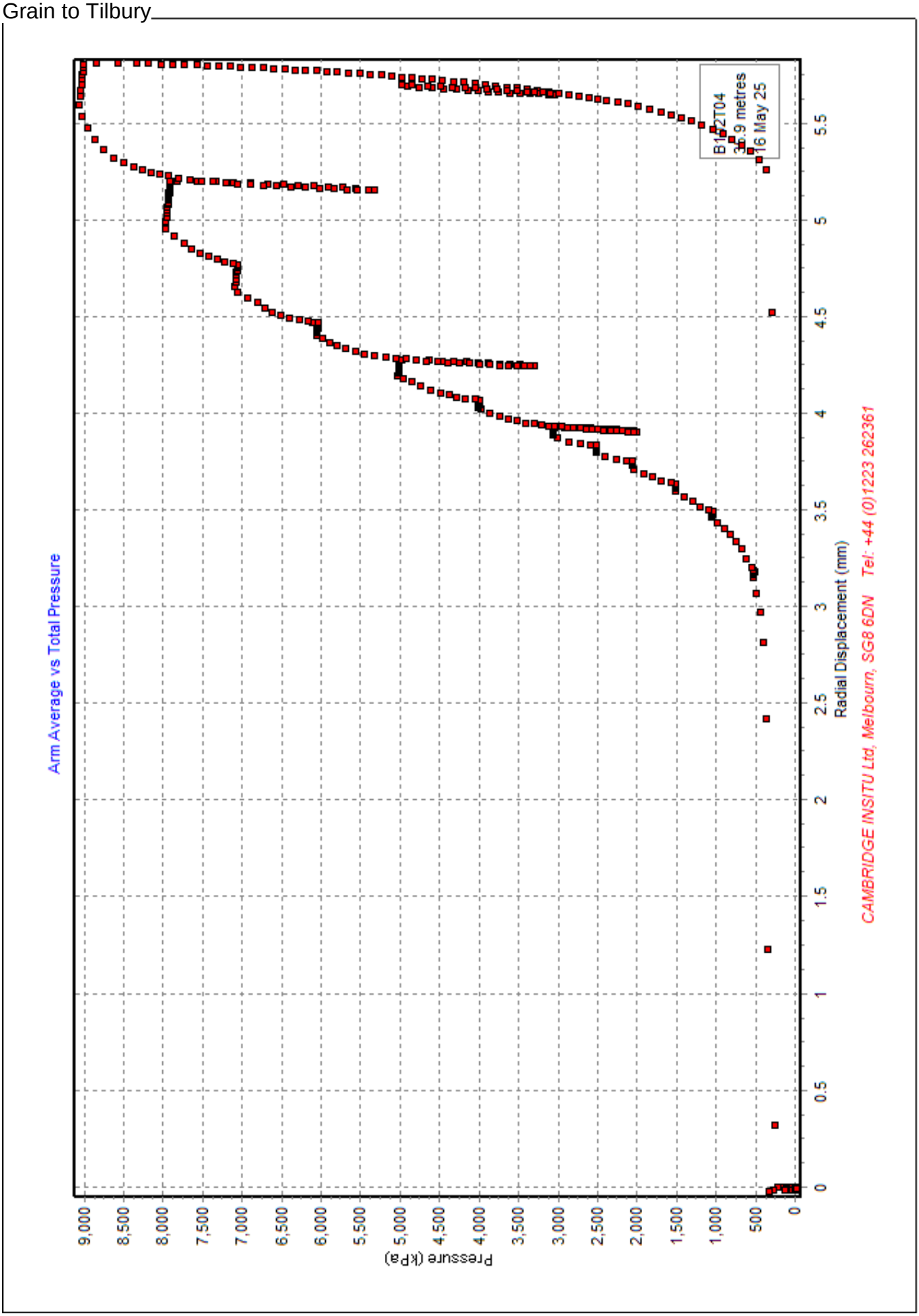

Bolton and Whittle (1999) Loop 3 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 4
35.90 Metres
16 May 25
RESULTS:
Gradient (beta) : 0.809
Intercept (n) : 395.735MPa
Shear stress constant : 320.265MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)

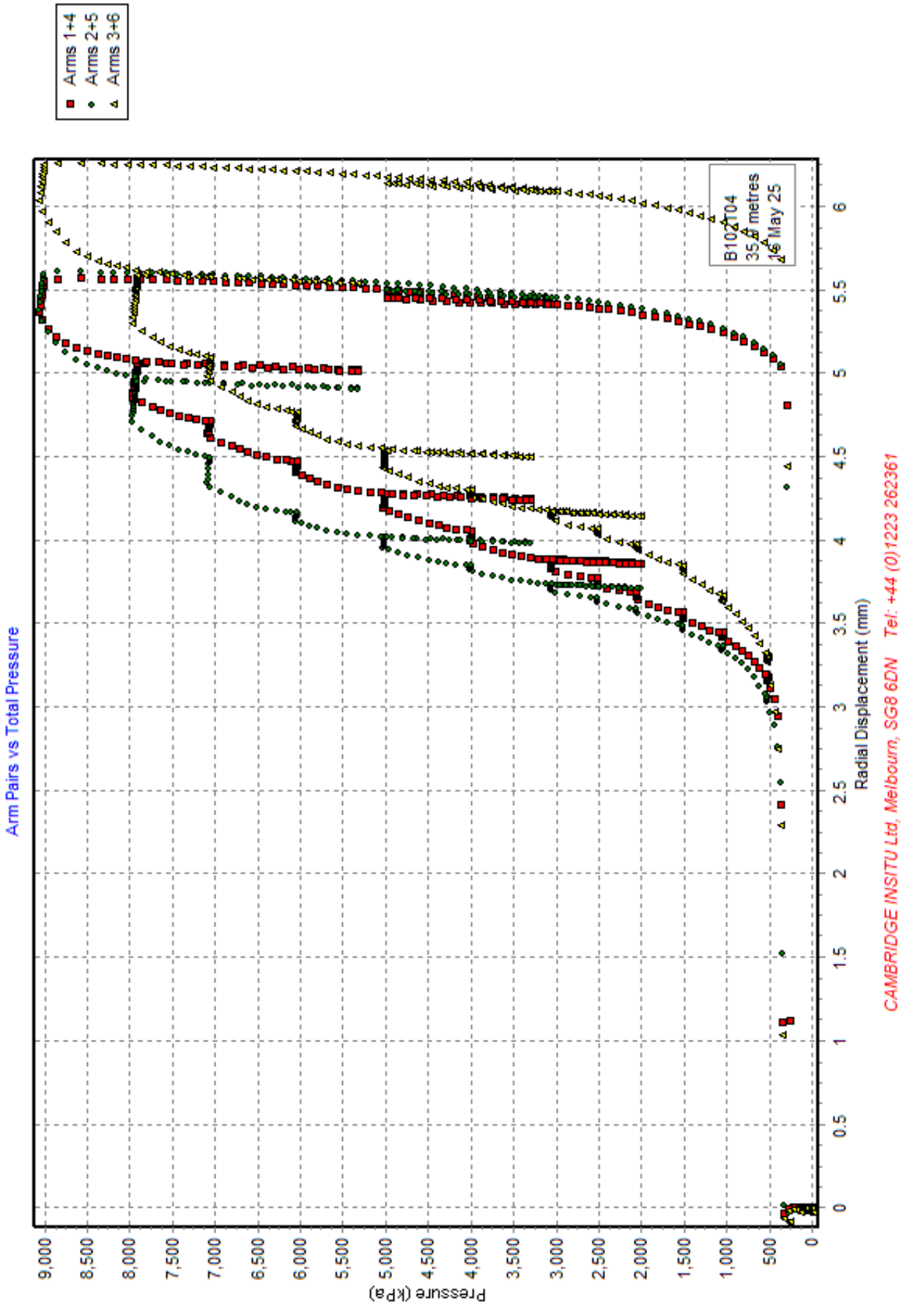

Bolton and Whittle (1999) Loop 4 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 4
35.90 Metres
16 May 25
RESULTS:
Gradient (beta) : 0.761
Intercept (n) : 266.370MPa
Shear stress constant : 202.691MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 4
Total pressure (kPa)
Radial Displacement (mm)

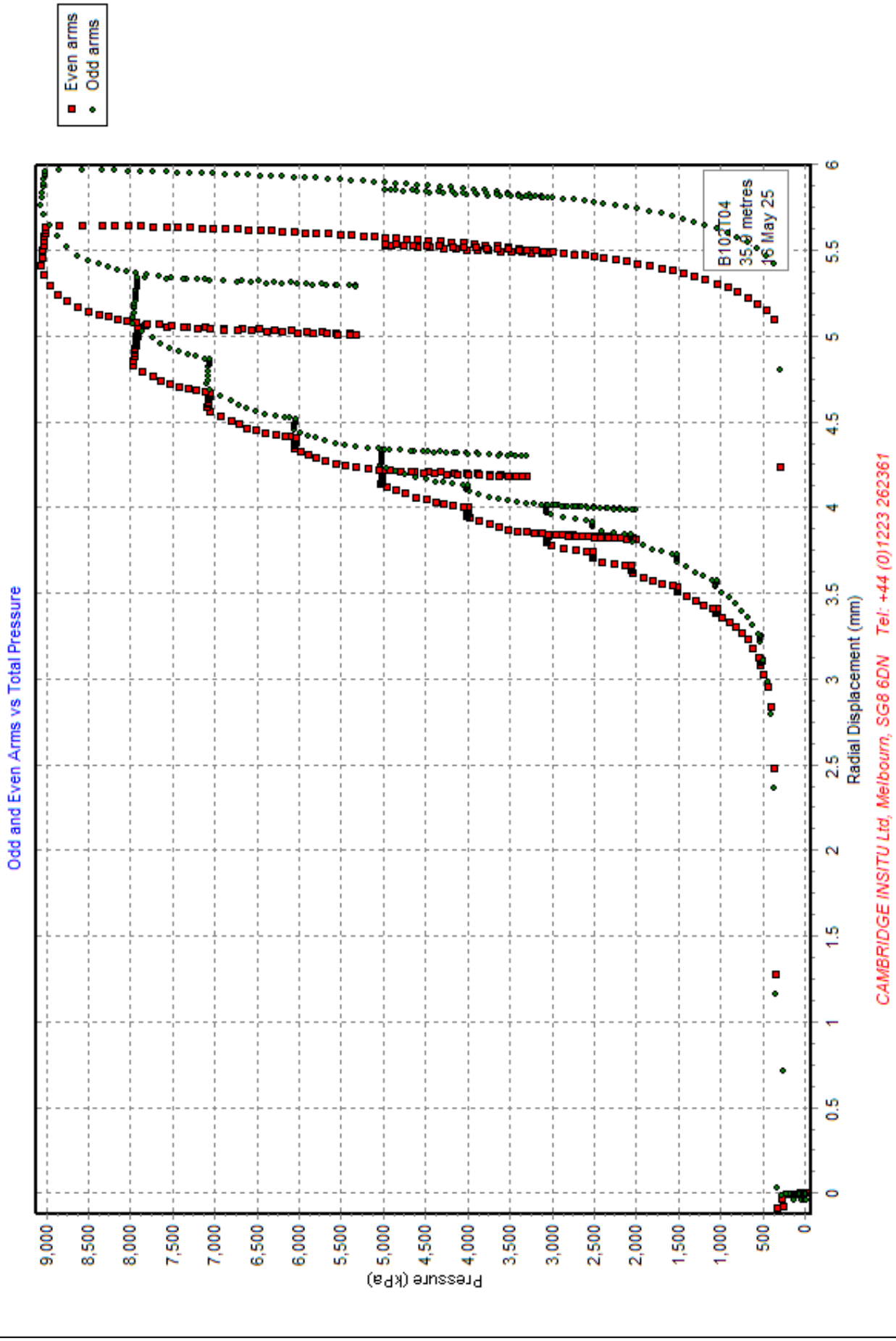

Variation of stiffness with strain, undrained analysis : Arm ave
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 349.152 0.866
2 506.125 0.880
3 320.265 0.809
4 202.691 0.761
95mm High Pressure Dilatometer
BH102 Test 4
35.90 Metres
16 May 25
Shear modulus (MPa)
Log plane shear strain
0.0001
0.001
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
Cycle 4 - Measured
Cycle 4 - Calculated


Carter et al 1986 (adapted 2010) for c'-phi material : Arm ave
95mm High Pressure Dilatometer
BH102 Test 4
35.90 Metres
16 May 25
CURVE FIT PARAMETERS:
Origin : 3.820mm
Po : 897.0kPa
Cohesion : 92kPa
Phi peak : 39.0°
Dilation : 6.2°
Yield stress : 1539kPa
Limit pressure : 30060kPa
Elastic exponent : 0.809
Gs at first yield : 1239.3MPa
Janbu exponent : 0.064
Correlation : 0.165
Estimated PWP : 308.0kPa
Phi cv : 34.0°
Poisson's ratio : 0.20
Measured data
Calculated data
Total pressure (kPa)
Cavity strain (%)


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
B102T04
3549 metres
16 May 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arm Average vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
B1-2T04
3.9 metres
16 May 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arms 1+4
Arms 2+5
Arms 3+6
B102T04
35.4 metres
15 May 25
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
B102T04
35.0 metres
16 May 25
Odd and Even Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to TIlbury
BH102 Test 5 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Tilbury
Borehole : BH102
Test name : BH102 Test 5
Test date : 16 May 25
Test depth : 38.70 Metres
Water table : 4.5 Metres
Ambient PWP : 335.5 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDP/RW on 18 Jul 25

Remarks: Flint Presant

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=4.32"
Po from Marsland & Randolph (kPa) : "Arm ave=1165.1"
Best estimate of Po (kPa) : "Arm ave=956.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=4762.5"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 35.0
Angle of internal friction (°) : "Arm ave=39.9"
Dilation angle (°) : "Arm ave=6.2"
Gradient of log-log plot : "Arm ave=0.433"

[Withers et al 1989]
Angle of internal friction (°) : "Arm ave=35.1"
Dilation angle (°) : "Arm ave=0.1"
Gradient of log-log plot : "Arm ave=-2.696"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=299.2"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	1426.0	0.105	2477	0.064	907
Arm ave	2	1567.4	0.708	4860	0.102	1598
Arm ave	3	1509.1	1.526	6203	0.113	1712
Arm ave	4	1410.3	1.827	4045	0.136	1914

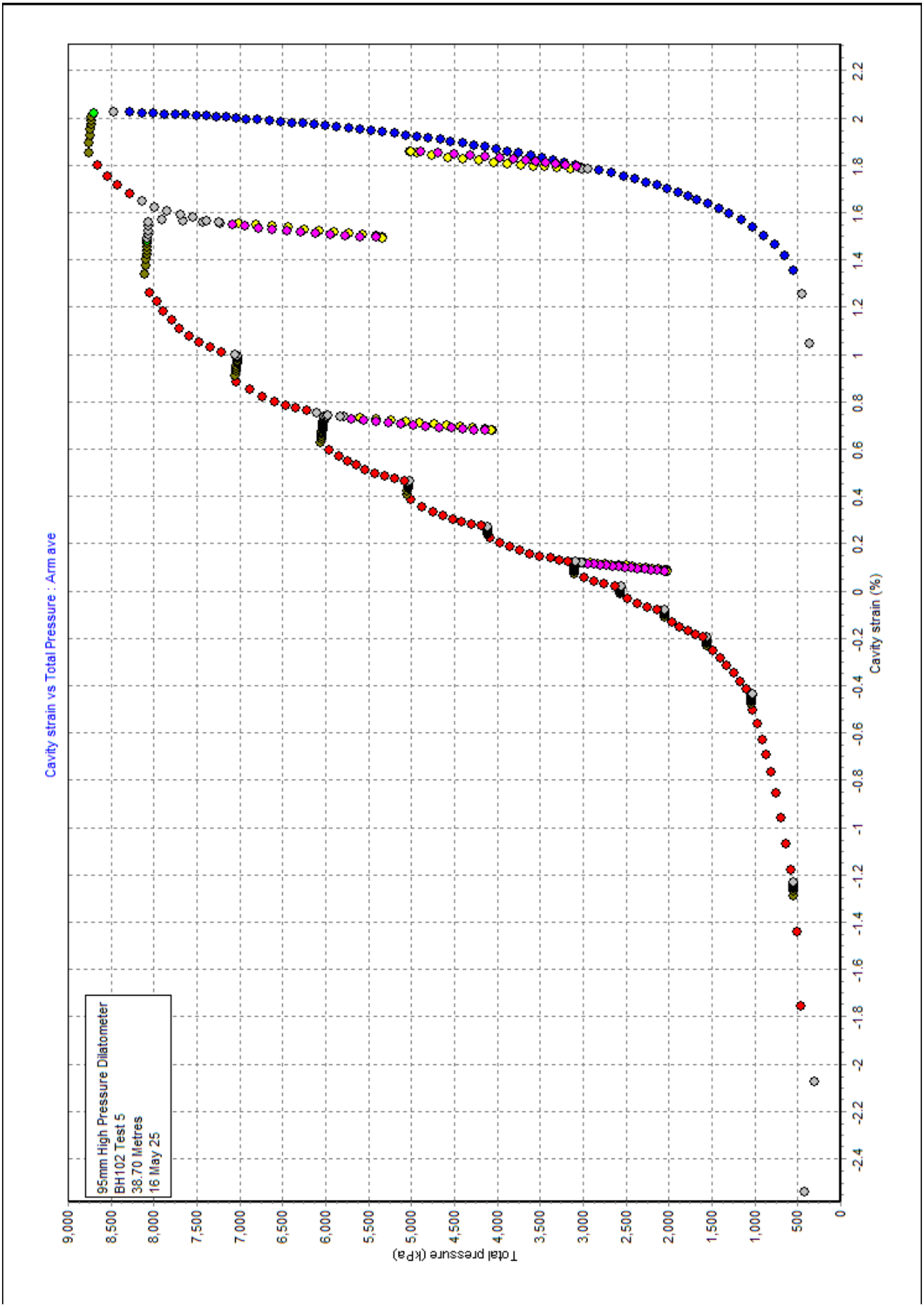
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

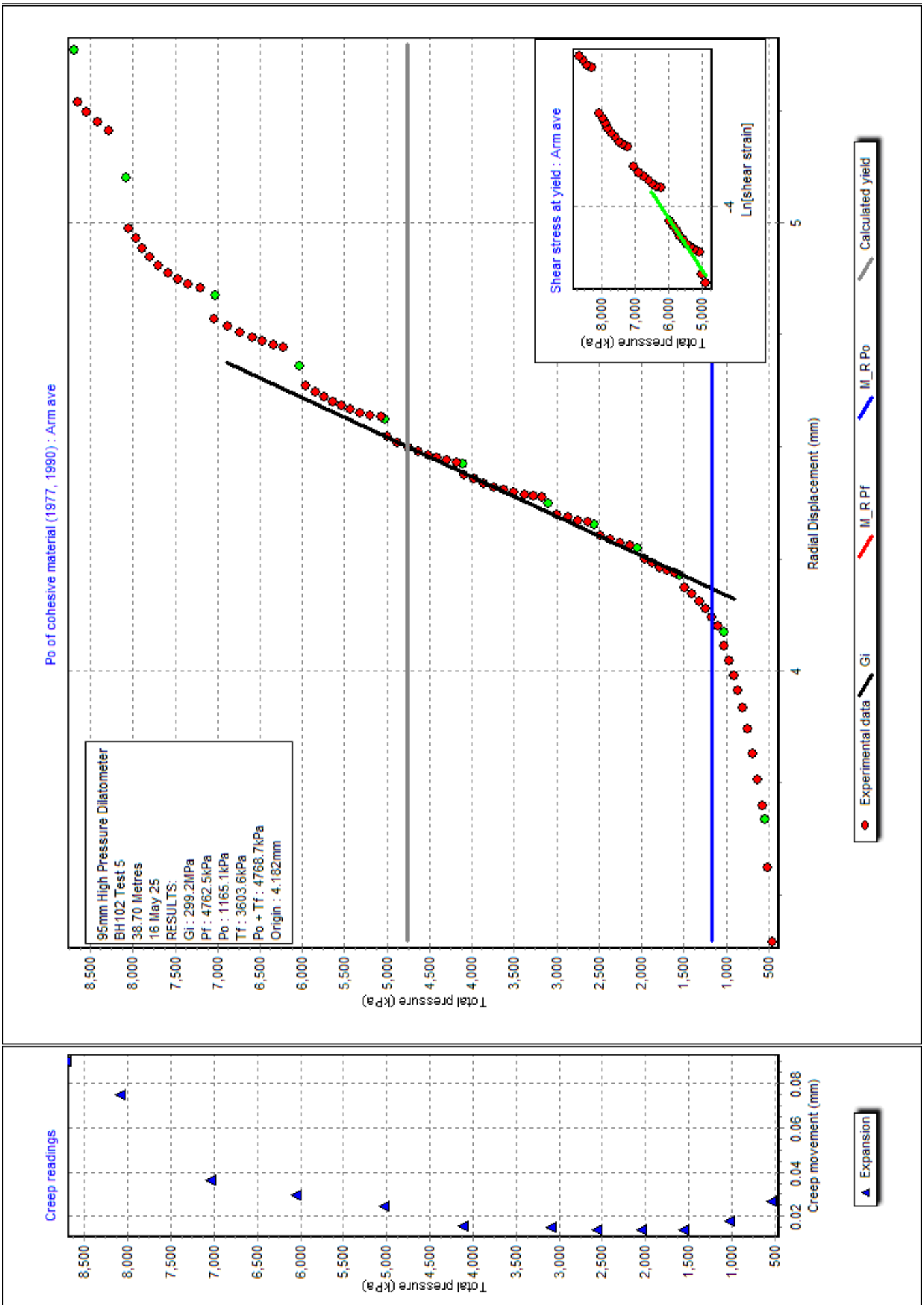
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	491.704	416.941	0.848
Arm ave	2	363.263	281.952	0.776
Arm ave	3	300.828	226.182	0.752
Arm ave	4	306.000	231.158	0.755

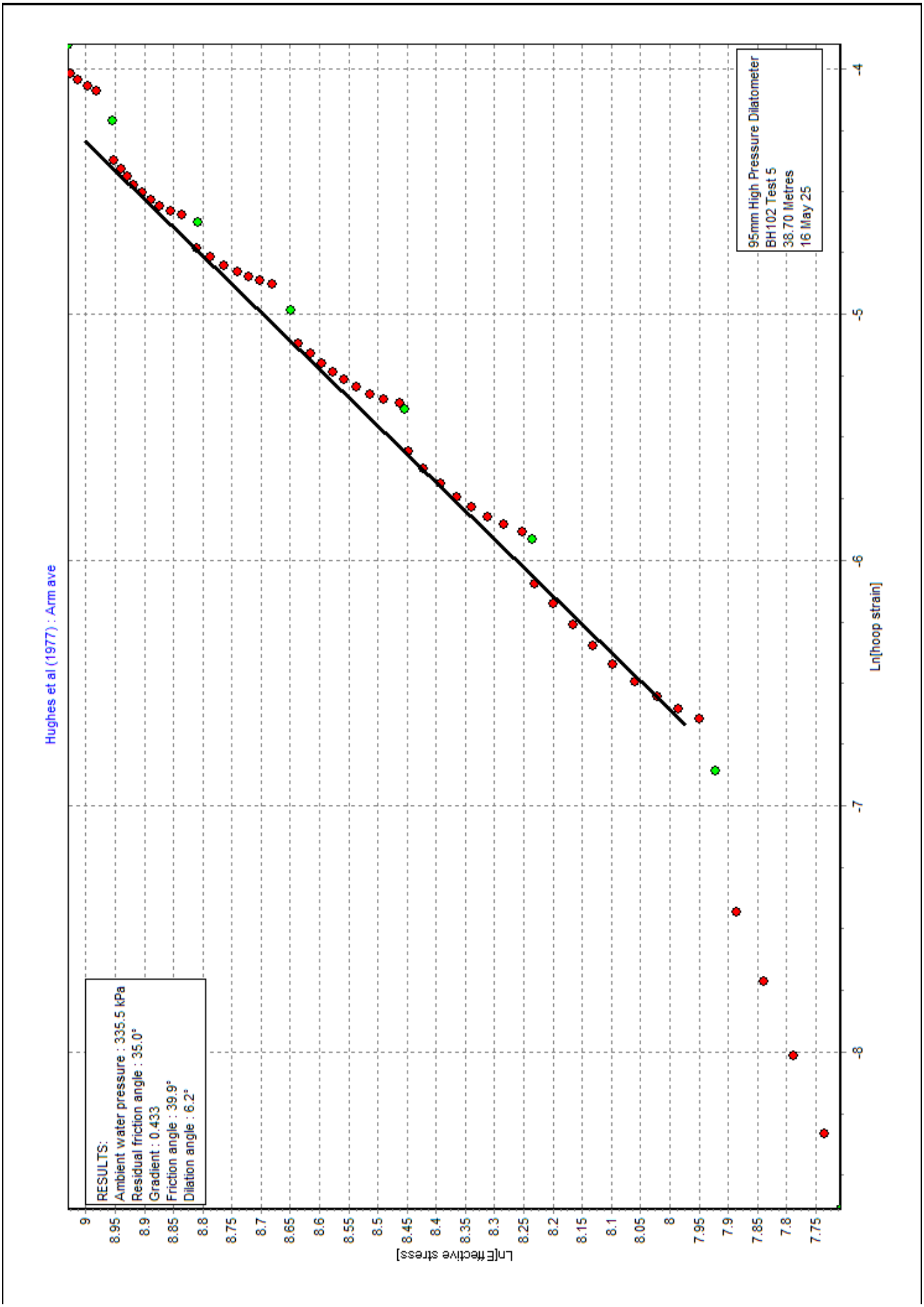
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 4.32
Po (kPa) : 956
Cohesion (kPa) : 54
Angle of peak friction (deg) : 39.9
Angle of peak dilation (deg) : 6.2
Total yield stress (kPa) : 1651

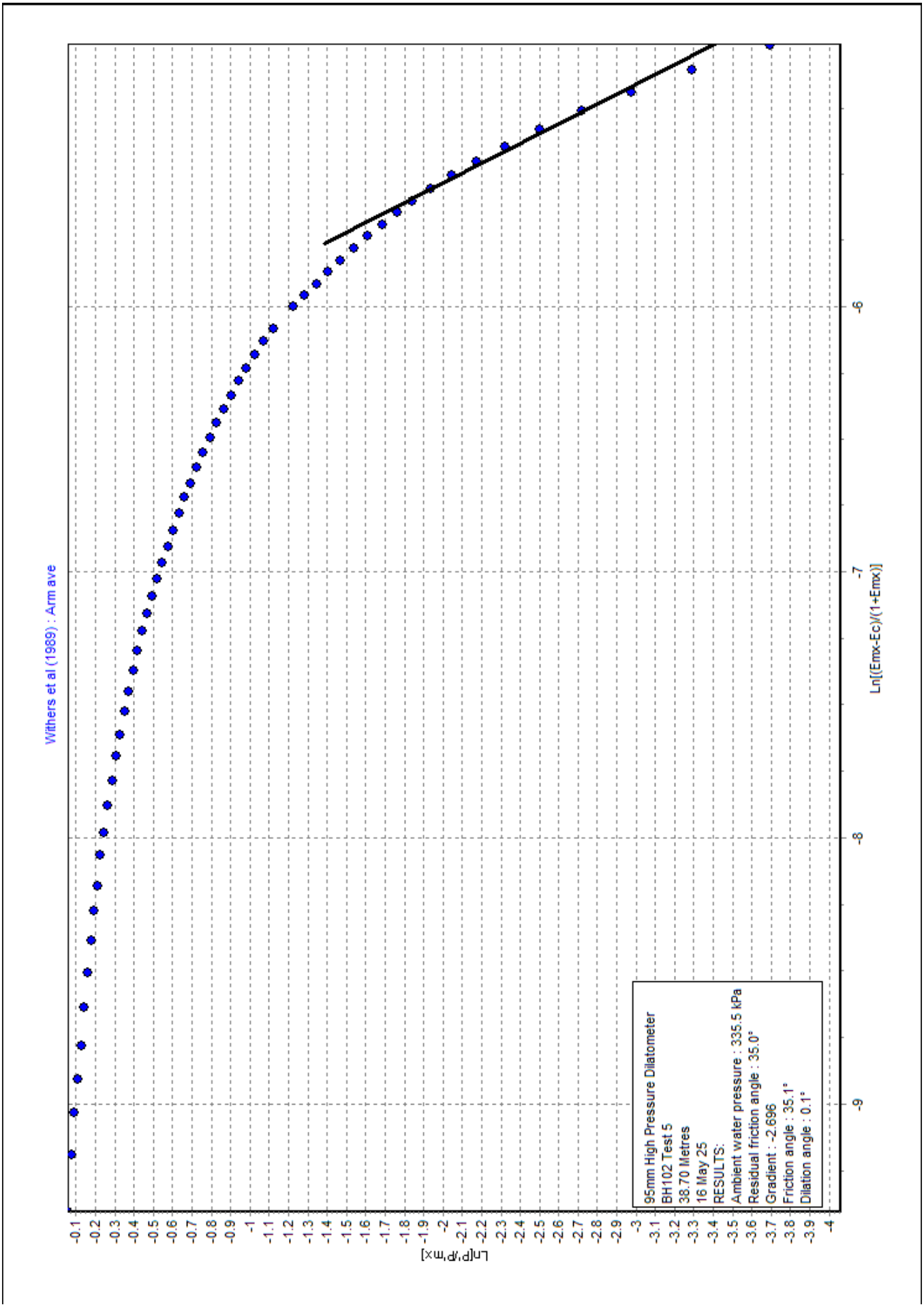
Grain to TIlbury
BH102 Test 5 - SUMMARY OF RESULTS

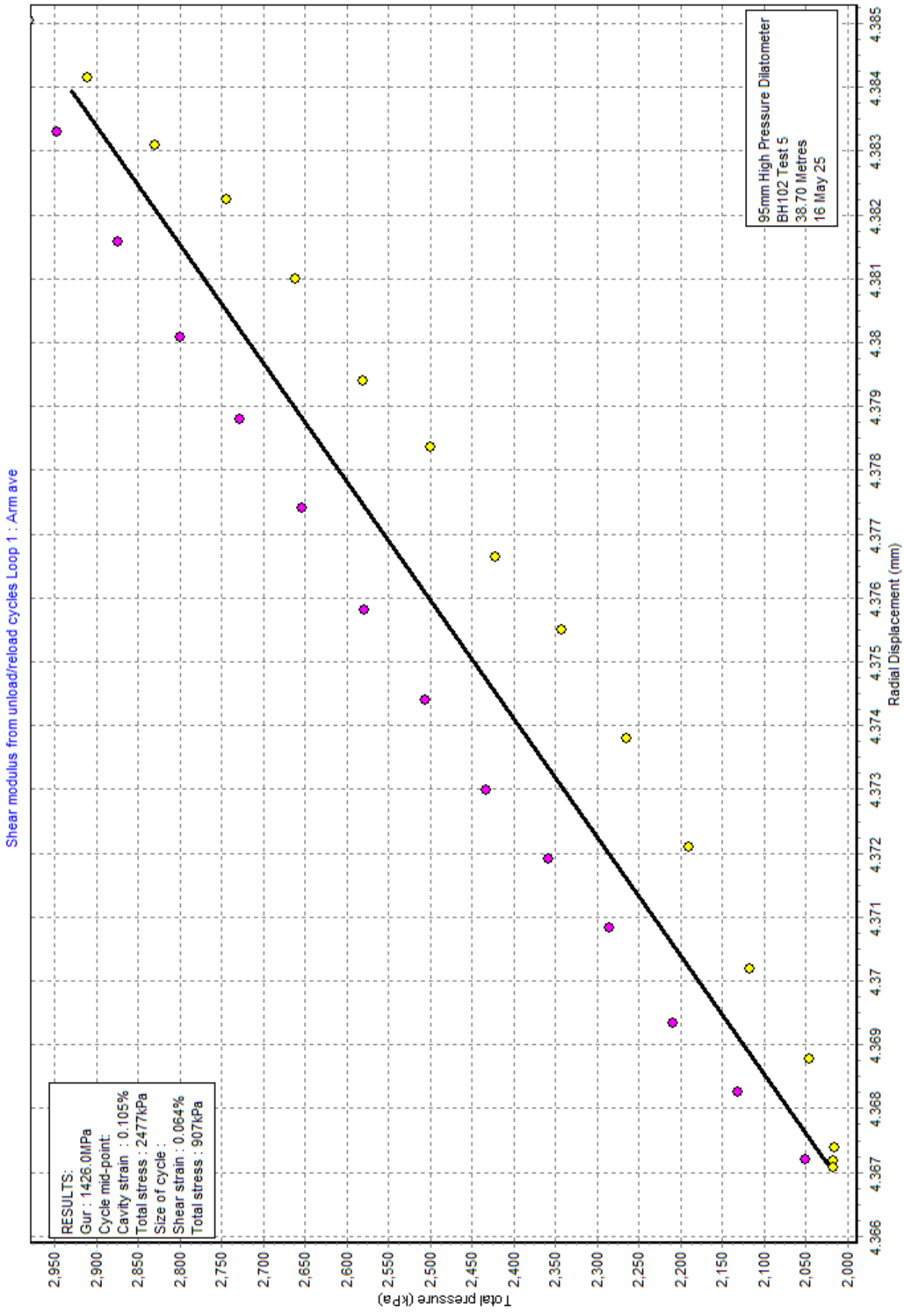
Total limit stress (kPa)	:	38668
G at first yield (MPa)	:	2001.7
Non-linear exponent	:	0.776
Janbu exponent	:	-0.069
Correlation	:	1.008
Ambient pore water pressure (kPa)	:	336
Residual friction angle (deg)	:	35.0
Poisson's ratio	:	0.20

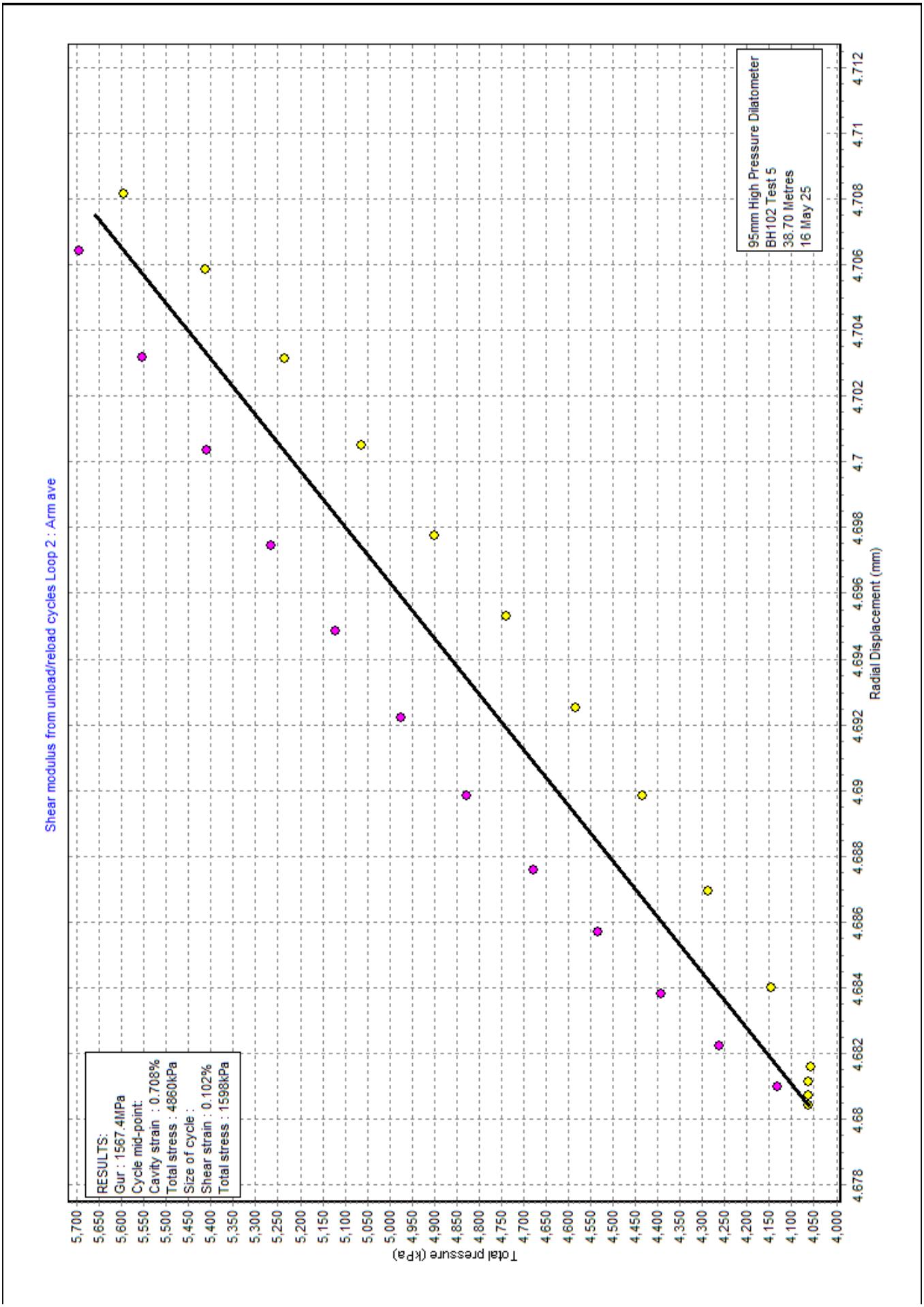

Cavity strain vs Total Pressure : Arm ave
95mm High Pressure Dilatometer
BH102 Test 5
38.70 Metres
16 May 25
Total pressure (kPa)
Cavity strain (%)
9,000
8,500
8,000
7,500
7,000
6,500
6,000
5,500
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-1.8
-2
-2.2
-2.4

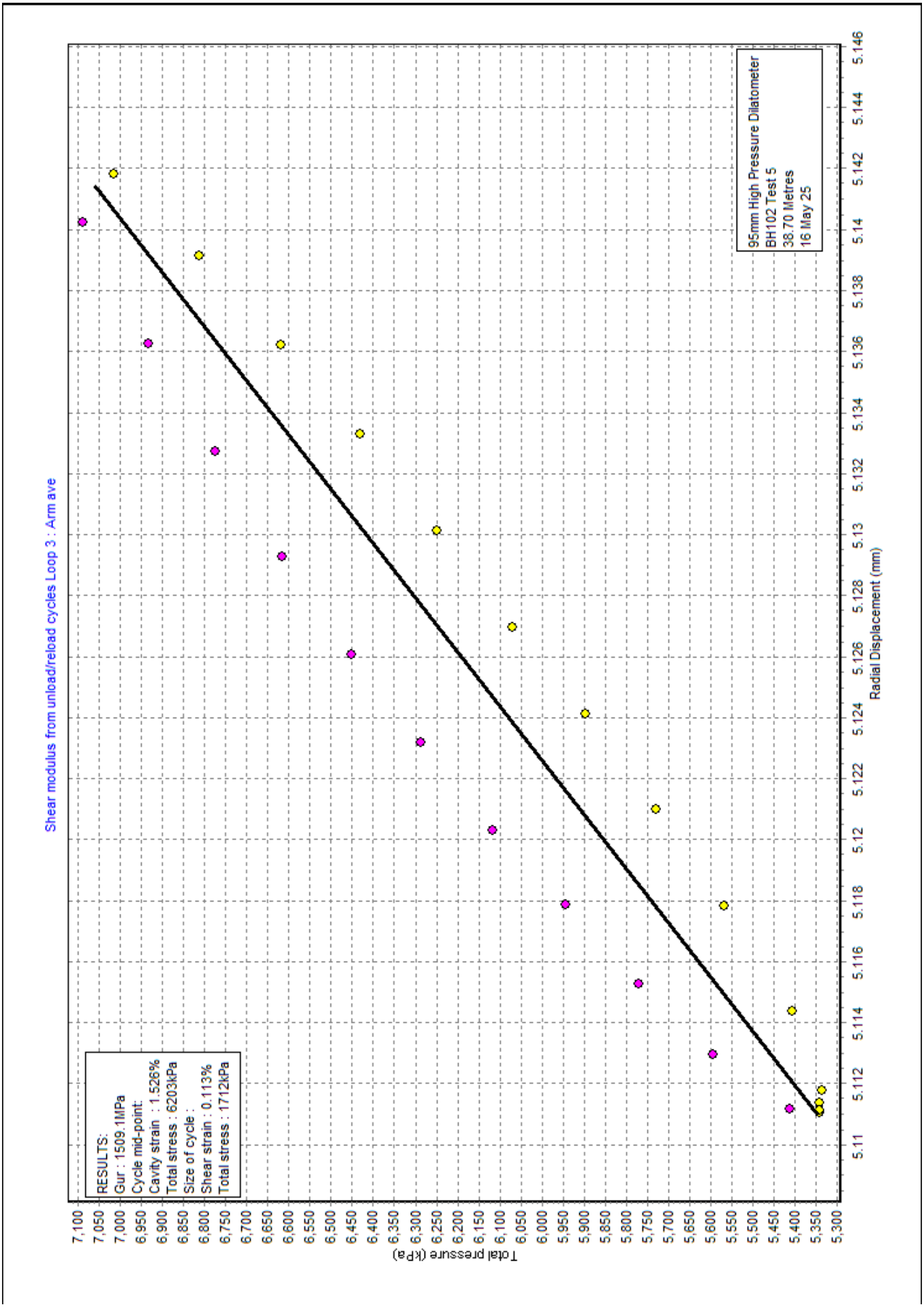

Po of cohesive material (1977, 1990) : Arm ave
95mm High Pressure Dilatometer
BH102 Test 5
38.70 Metres
16 May 25
RESULTS:
Gi : 299.2MPa
Pf : 4762.5kPa
Po : 1165.1kPa
Tf : 3603.6kPa
Po + Tf : 4768.7kPa
Origin : 4.182mm
Total pressure (kPa)
Radial Displacement (mm)
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Shear stress at yield : Arm ave
Ln[shear strain]
Creep readings
Creep movement (mm)
Expansion

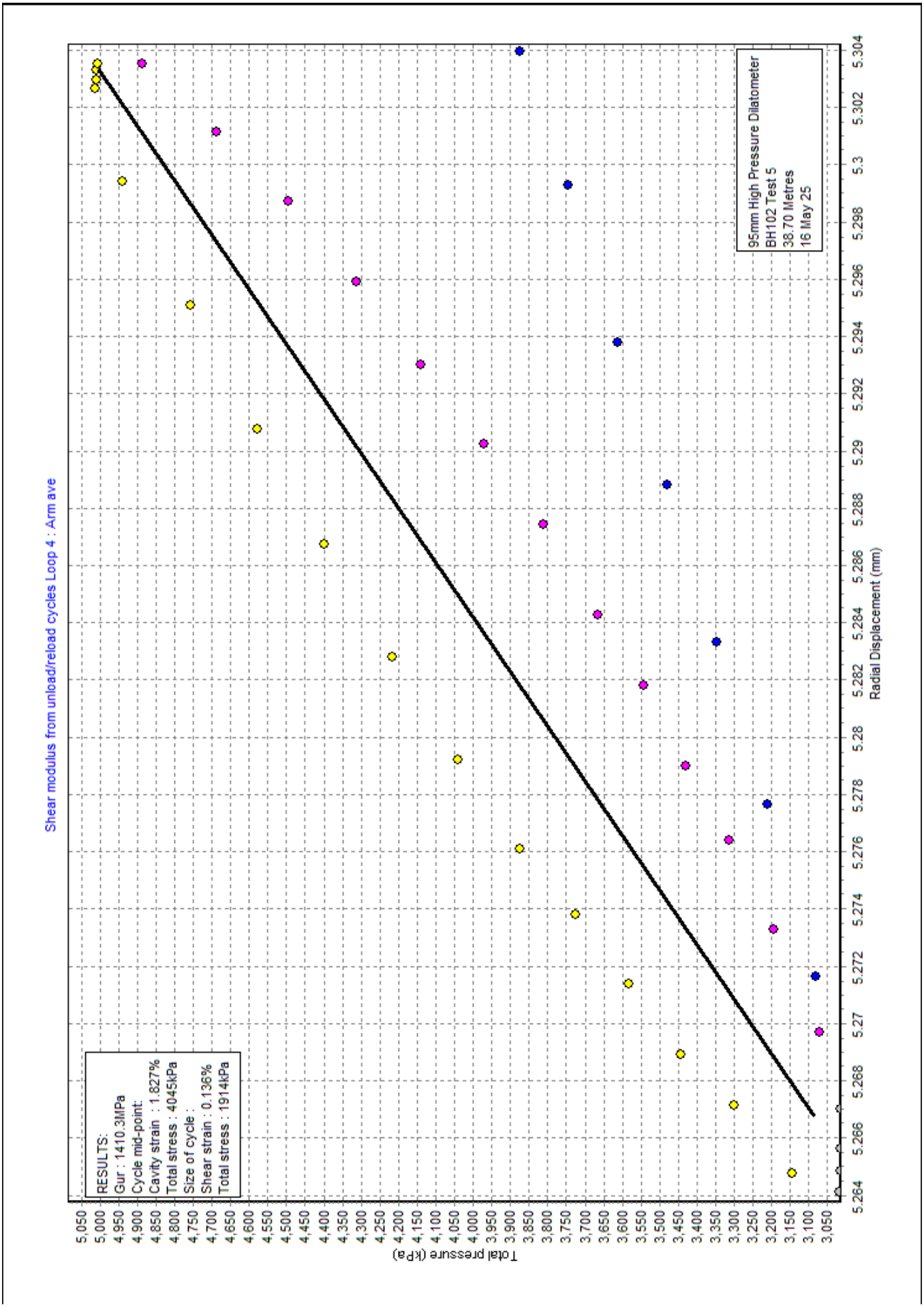

Hughes et al (1977) : Arm ave
RESULTS:
Ambient water pressure : 335.5 kPa
Residual friction angle : 35.0°
Gradient : 0.433
Friction angle : 39.9°
Dilation angle : 6.2°
95mm High Pressure Dilatometer
BH102 Test 5
38.70 Metres
16 May 25
Ln[effective stress]
Ln[hoop strain]
9
8.95
8.9
8.85
8.8
8.75
8.7
8.65
8.6
8.55
8.5
8.45
8.4
8.35
8.3
8.25
8.2
8.15
8.1
8.05
8
7.95
7.9
7.85
7.8
7.75
-4
-5
-6
-7
-8

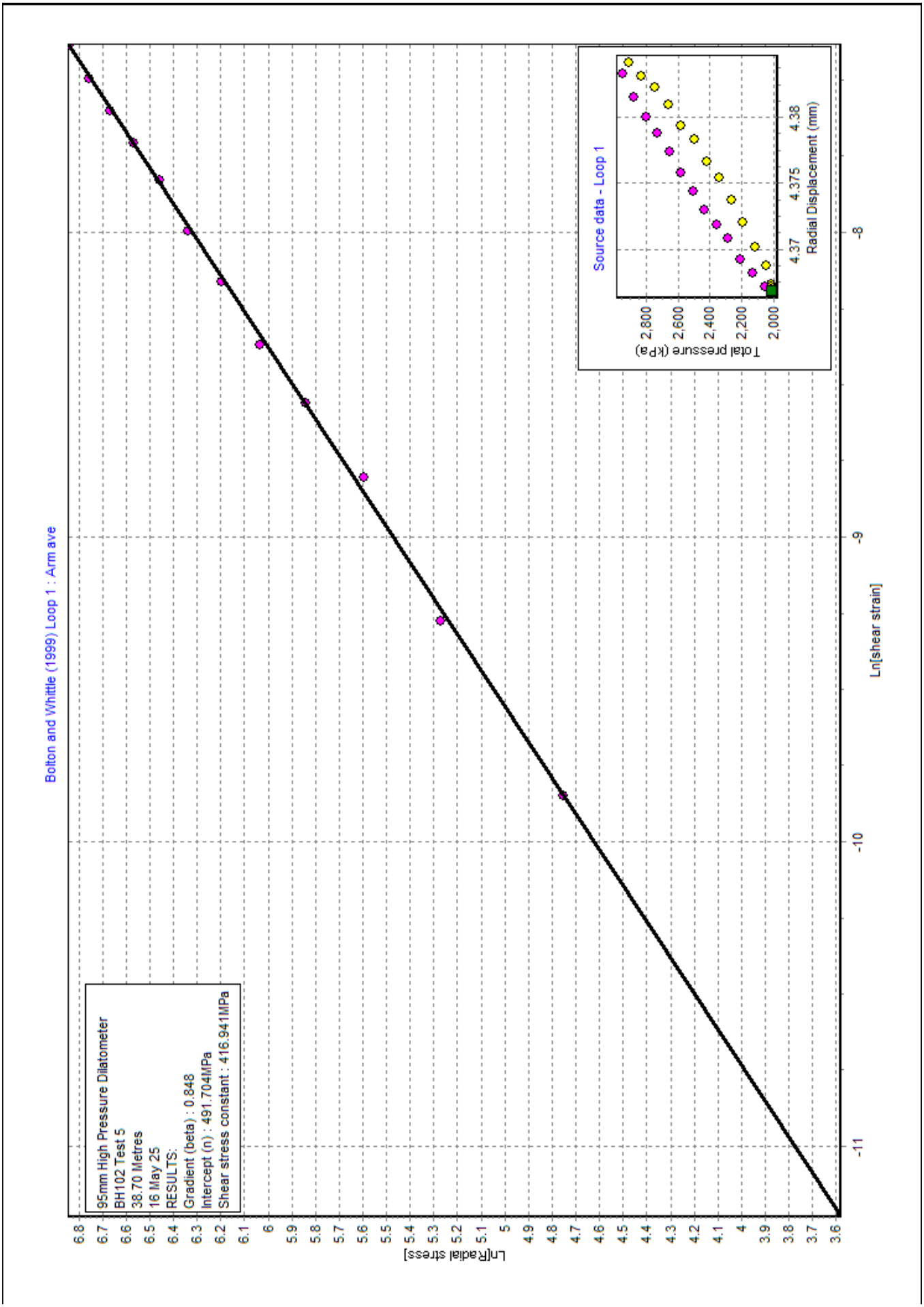

Withers et al (1989) : Arm ave
Ln[(Emx-Ec)/(1+Emx)]
Ln[P'/P'mx]
95mm High Pressure Dilatometer
BH102 Test 5
38.70 Metres
16 May 25
RESULTS:
Ambient water pressure : 335.5 kPa
Residual friction angle : 35.0°
Gradient : -2.696
Friction angle : 35.1°
Dilation angle : 0.1°

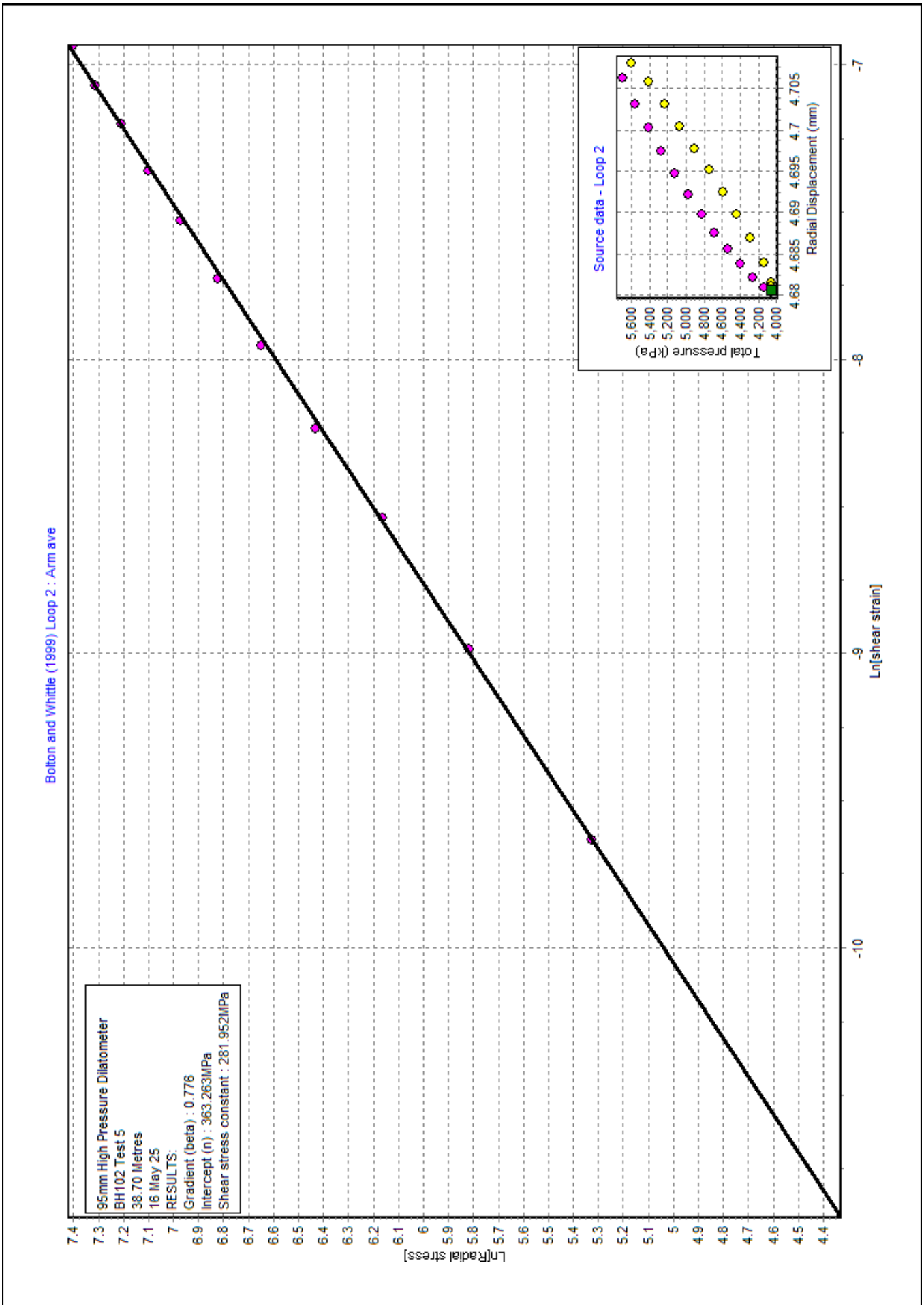

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 1426.0MPa
Cycle mid-point:
Cavity strain : 0.105%
Total stress : 2477kPa
Size of cycle :
Shear strain : 0.064%
Total stress : 907kPa
95mm High Pressure Dilatometer
BH102 Test 5
38.70 Metres
16 May 25
Total pressure (kPa)
Radial Displacement (mm)
2,950
2,900
2,850
2,800
2,750
2,700
2,650
2,600
2,550
2,500
2,450
2,400
2,350
2,300
2,250
2,200
2,150
2,100
2,050
2,000
4.366
4.367
4.368
4.369
4.37
4.371
4.372
4.373
4.374
4.375
4.376
4.377
4.378
4.379
4.38
4.381
4.382
4.383
4.384
4.385

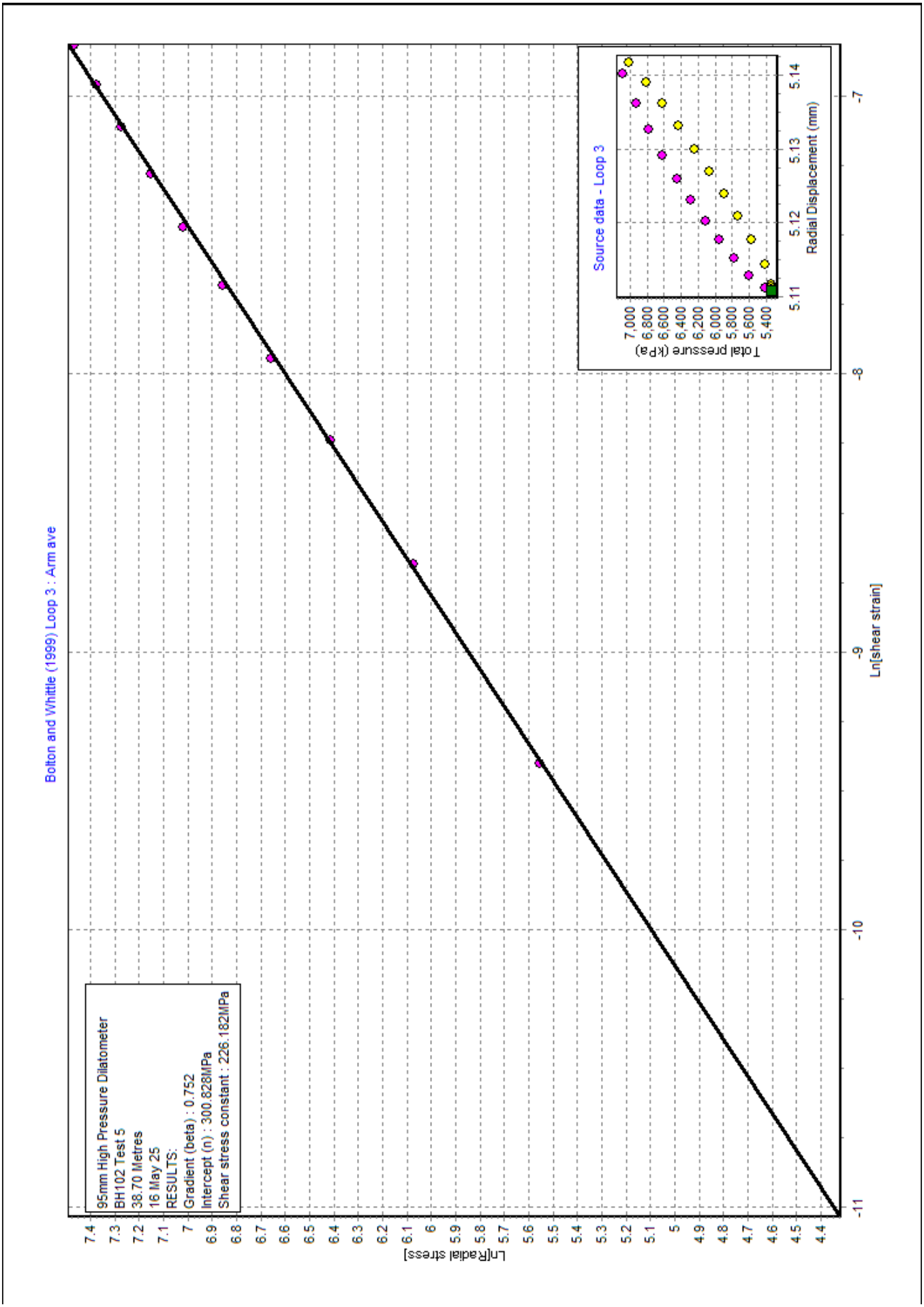

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 1567.4MPa
Cycle mid-point:
Cavity strain : 0.708%
Total stress : 4860kPa
Size of cycle :
Shear strain : 0.102%
Total stress : 1598kPa
95mm High Pressure Dilatometer
BH102 Test 5
38.70 Metres
16 May 25
Total pressure (kPa)
Radial Displacement (mm)

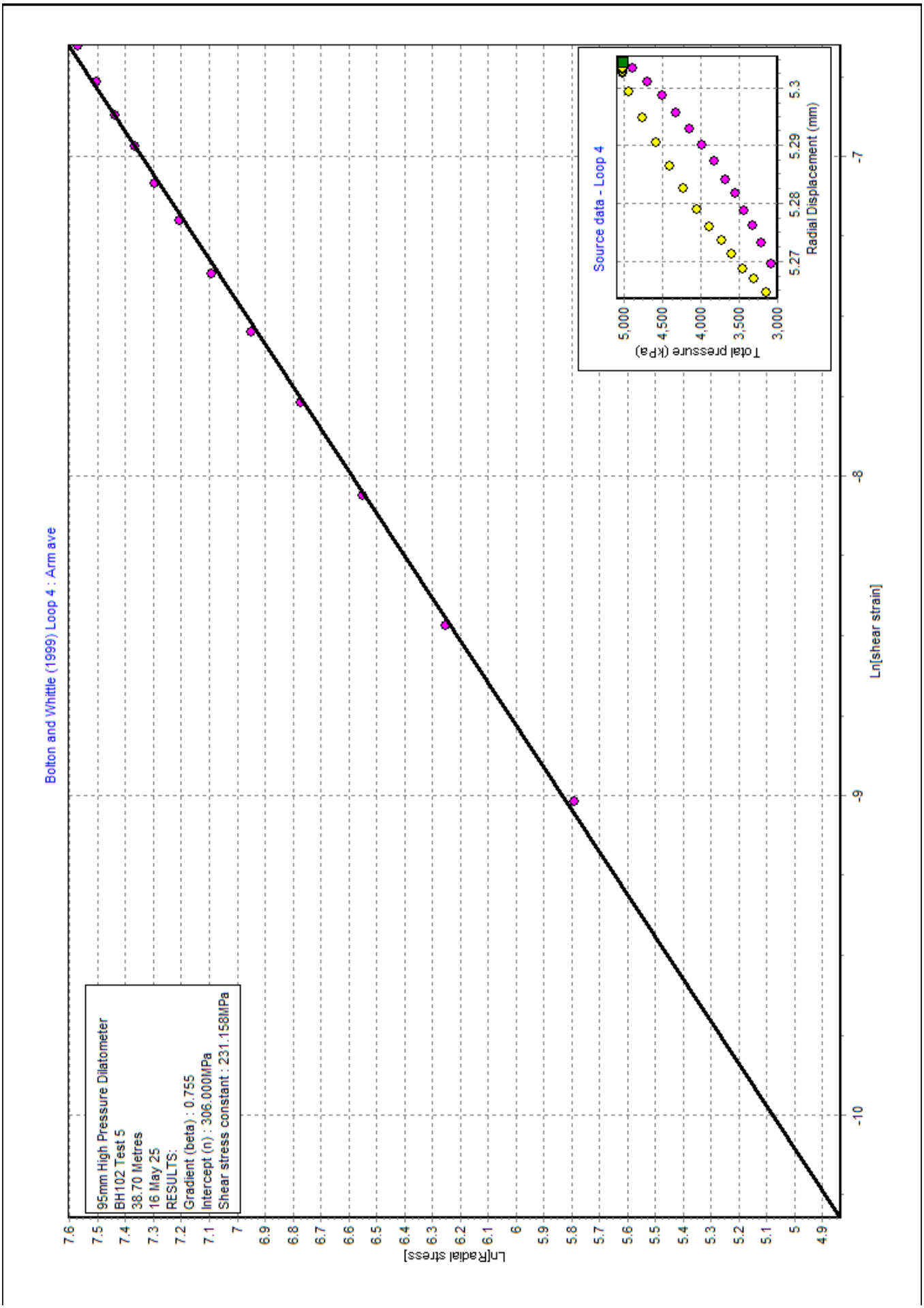

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 1509.1MPa
Cycle mid-point:
Cavity strain : 1.526%
Total stress : 6203kPa
Size of cycle :
Shear strain : 0.113%
Total stress : 1712kPa
95mm High Pressure Dilatometer
BH102 Test 5
38.70 Metres
16 May 25
Total pressure (kPa)
Radial Displacement (mm)

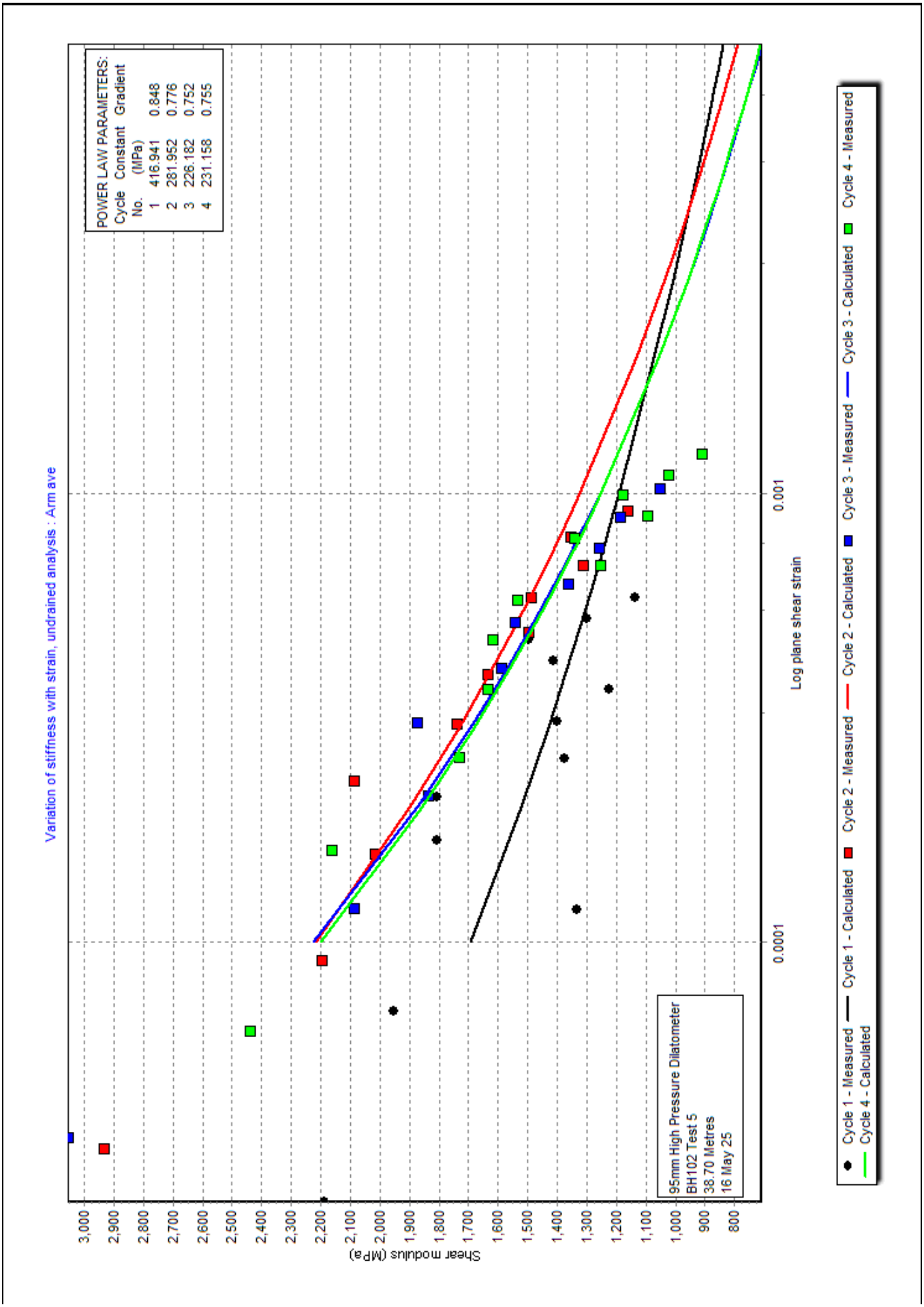

Shear modulus from unload/reload cycles Loop 4 : Arm ave
RESULTS:
Gur : 1410.3MPa
Cycle mid-point:
Cavity strain : 1.827%
Total stress : 4045kPa
Size of cycle :
Shear strain : 0.136%
Total stress : 1914kPa
95mm High Pressure Dilatometer
BH102 Test 5
38.70 Metres
16 May 25
Total pressure (kPa)
Radial Displacement (mm)

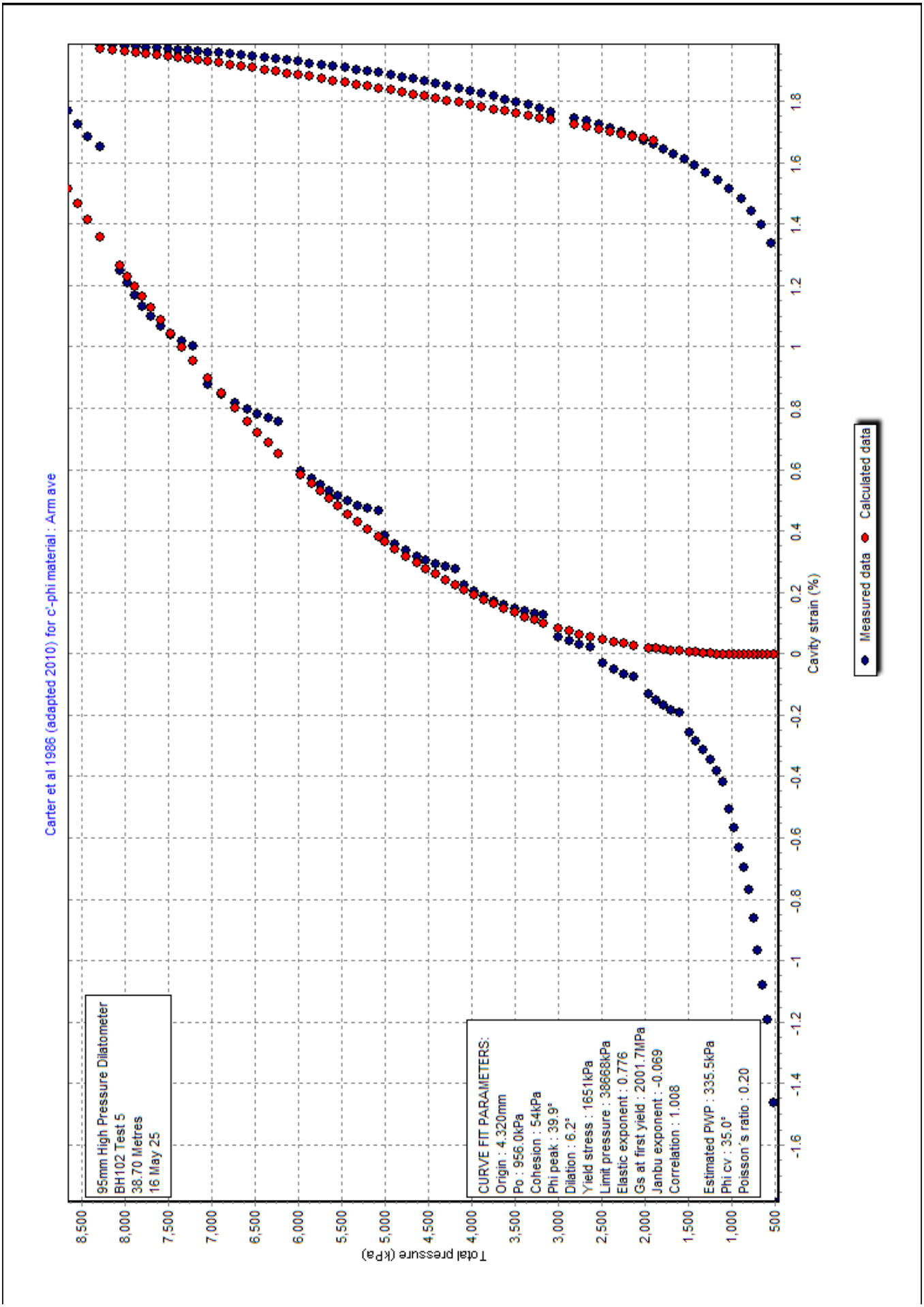

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 5
38.70 Metres
16 May 25
RESULTS:
Gradient (beta) : 0.848
Intercept (n) : 491.704kPa
Shear stress constant : 416.941kPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

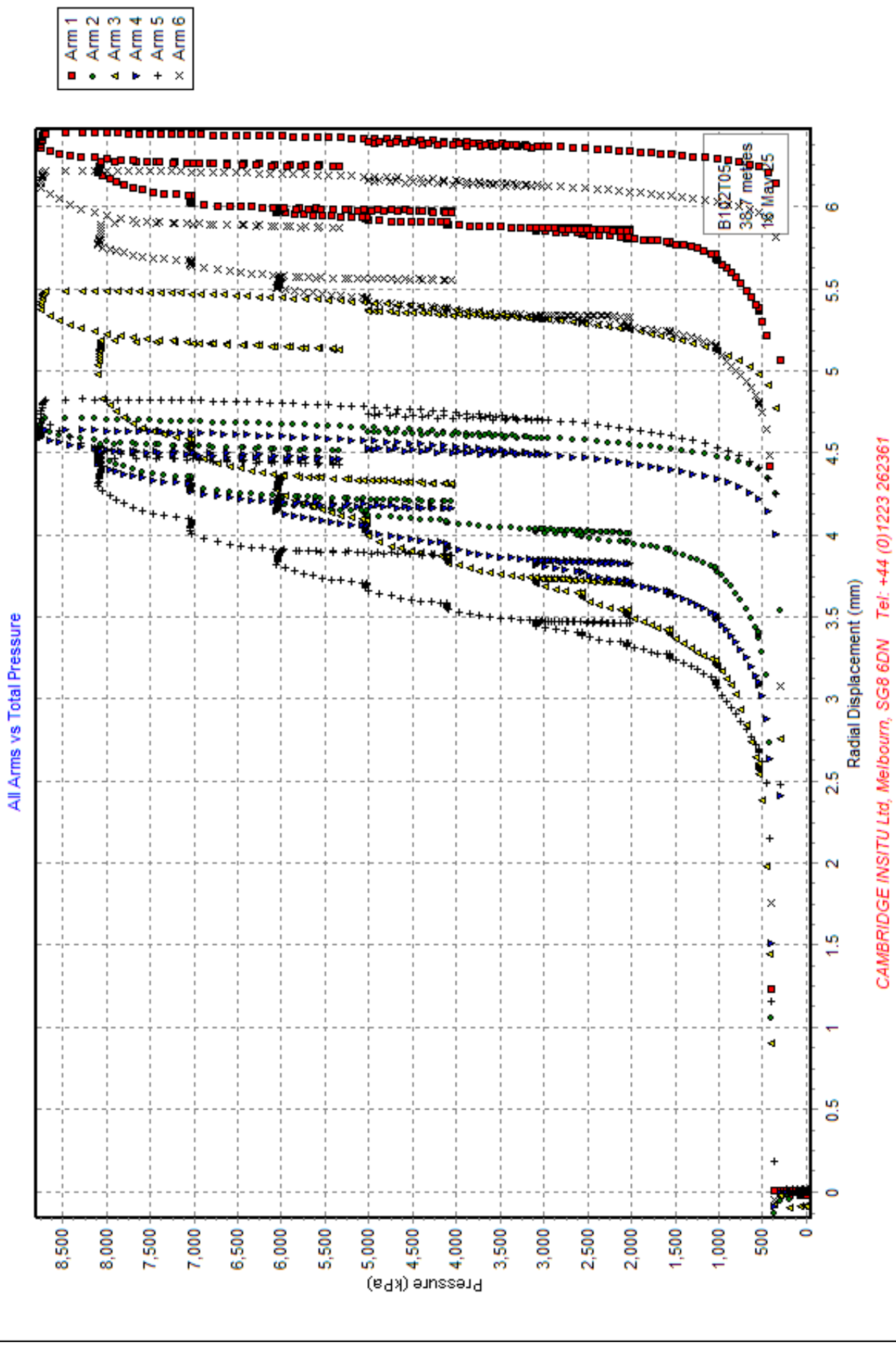

Bolton and Whittle (1999) Loop 2 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 5
38.70 Metres
16 May 25
RESULTS:
Gradient (beta) : 0.776
Intercept (n) : 363.263MPa
Shear stress constant : 281.952MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

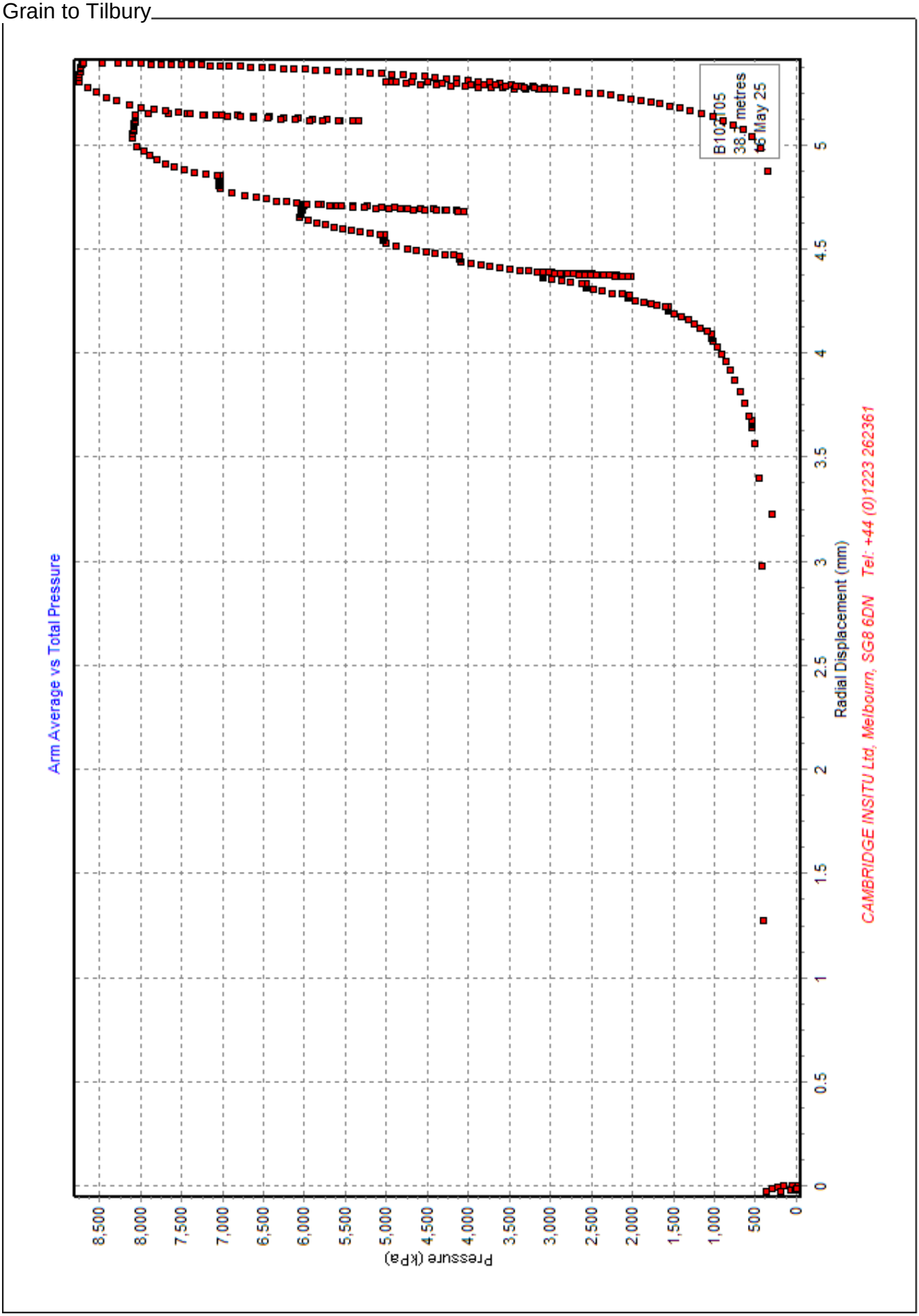

Bolton and Whittle (1999) Loop 3 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 5
38.70 Metres
16 May 25
RESULTS:
Gradient (beta) : 0.752
Intercept (n) : 300.828MPa
Shear stress constant : 226.182MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)

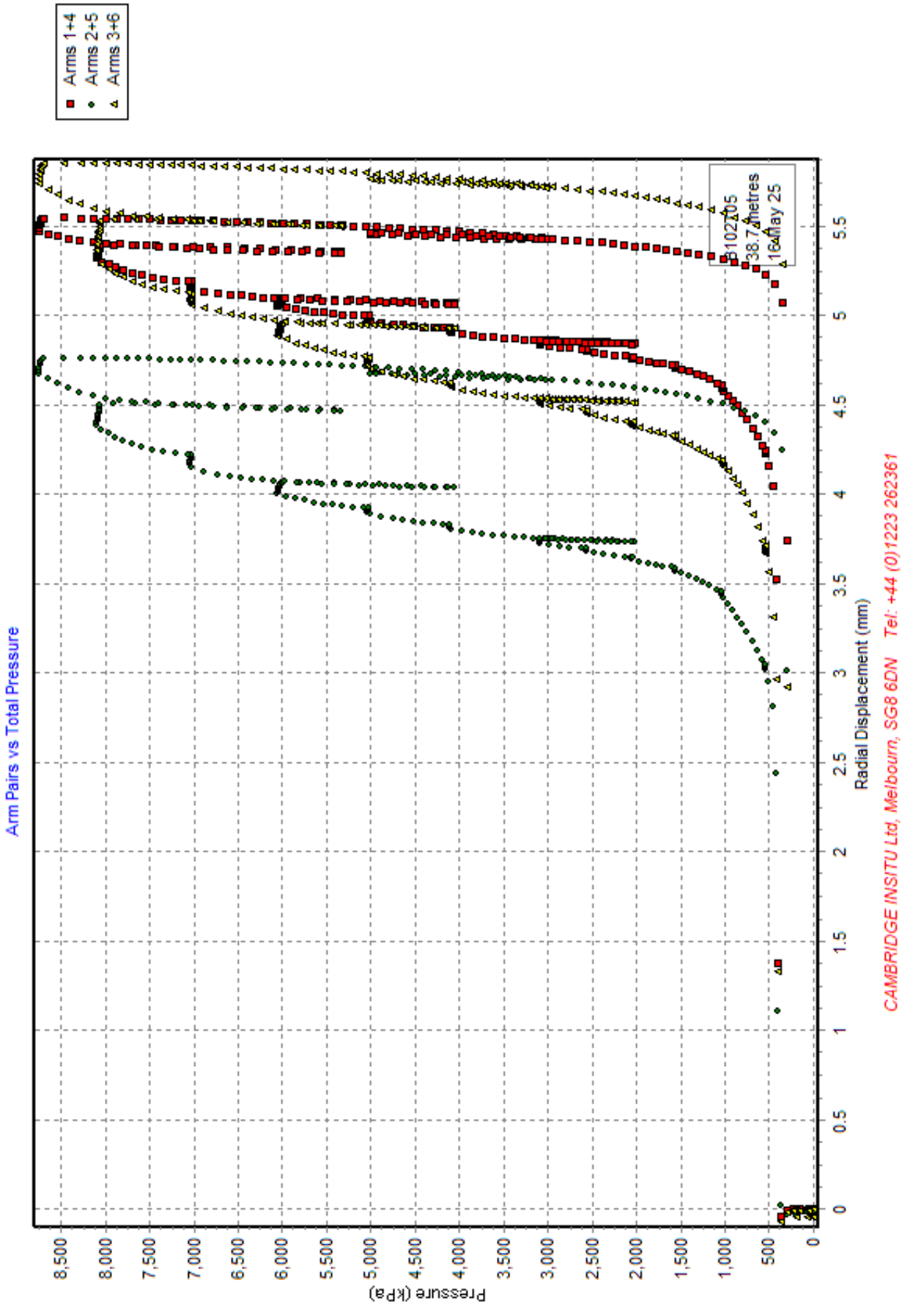

Bolton and Whittle (1999) Loop 4 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 5
38.70 Metres
16 May 25
RESULTS:
Gradient (beta) : 0.755
Intercept (n) : 306.000MPa
Shear stress constant : 231.158MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 4
Total pressure (kPa)
Radial Displacement (mm)

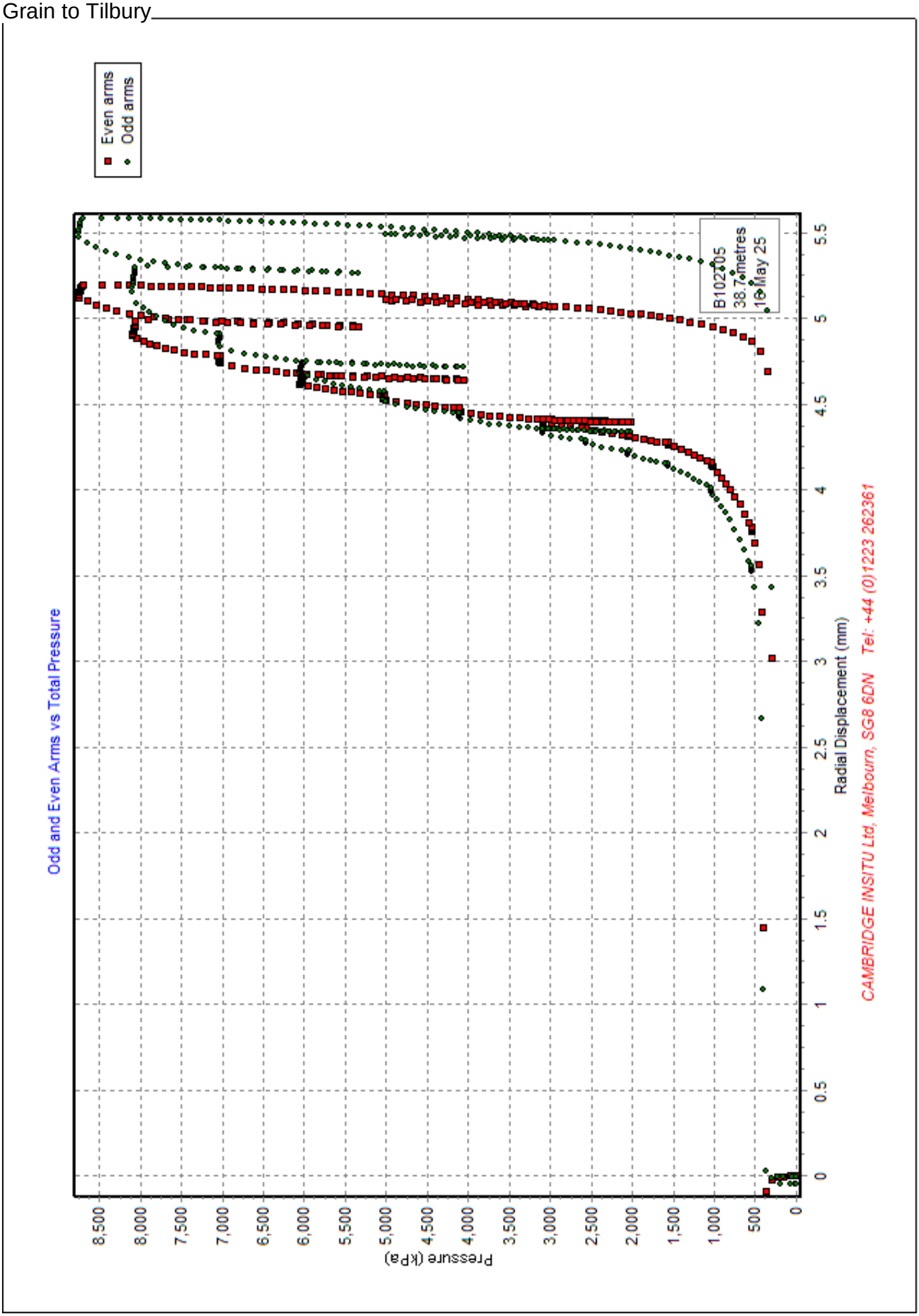

Variation of stiffness with strain, undrained analysis : Arm ave
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 416.941 0.848
2 281.952 0.776
3 226.182 0.752
4 231.158 0.755
95mm High Pressure Dilatometer
BH102 Test 5
38.70 Metres
16 May 25
Shear modulus (MPa)
Log plane shear strain
0.0001
0.001
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
Cycle 4 - Measured
Cycle 4 - Calculated


Carter et al 1986 (adapted 2010) for c'-phi material : Arm ave
95mm High Pressure Dilatometer
BH102 Test 5
38.70 Metres
16 May 25
CURVE FIT PARAMETERS:
Origin : 4.320mm
Po : 956.0kPa
Cohesion : 54kPa
Phi peak : 39.9°
Dilation : 6.2°
Yield stress : 1651kPa
Limit pressure : 38668kPa
Elastic exponent : 0.776
Gs at first yield : 2001.7MPa
Janbu exponent : -0.069
Correlation : 1.008
Estimated PWP : 335.5kPa
Phi cv : 35.0°
Poisson's ratio : 0.20
Total pressure (kPa)
Cavity strain (%)
Measured data
Calculated data


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
B102T05
38.7 metres
16 May 25
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arm Average vs Total Pressure
Pressure (kPa)
8,500
8,000
7,500
7,000
6,500
6,000
5,500
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Radial Displacement (mm)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
B102 105
38.1 metres
15 May 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arms 1+4
Arms 2+5
Arms 3+6
B102-05
38.7 metres
16 May 25
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
B102005
38.7 metres
16 May 25
Odd and Even Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to TIlbury
BH102 Test 6 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Grain to Tilbury
Borehole : BH102
Test name : BH102 Test 6
Test date : 19 May 25
Test depth : 41.70 Metres
Water table : 4.5 Metres
Ambient PWP : 364.9 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDP/RW on 18 Jul 25

Remarks: Flint present. Structural breakdown about 2.5% cavity strain.

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=4.67"
Po from Marsland & Randolph (kPa) : "Arm ave=2019.1"
Best estimate of Po (kPa) : "Arm ave=785.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=5907.9"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 35.0
Angle of internal friction (°) : "Arm ave=38.1"
Dilation angle (°) : "Arm ave=3.9"
Gradient of log-log plot : "Arm ave=0.408"

[Withers et al 1989]
Angle of internal friction (°) : "Arm ave=36.5"
Dilation angle (°) : "Arm ave=1.8"
Gradient of log-log plot : "Arm ave=-2.785"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=178.5"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	1233.4	0.215	2409	0.064	790
Arm ave	2	1442.2	0.793	4003	0.097	1397
Arm ave	3	1398.3	1.888	5355	0.105	1471
Arm ave	4	1111.4	3.565	3573	0.127	1408

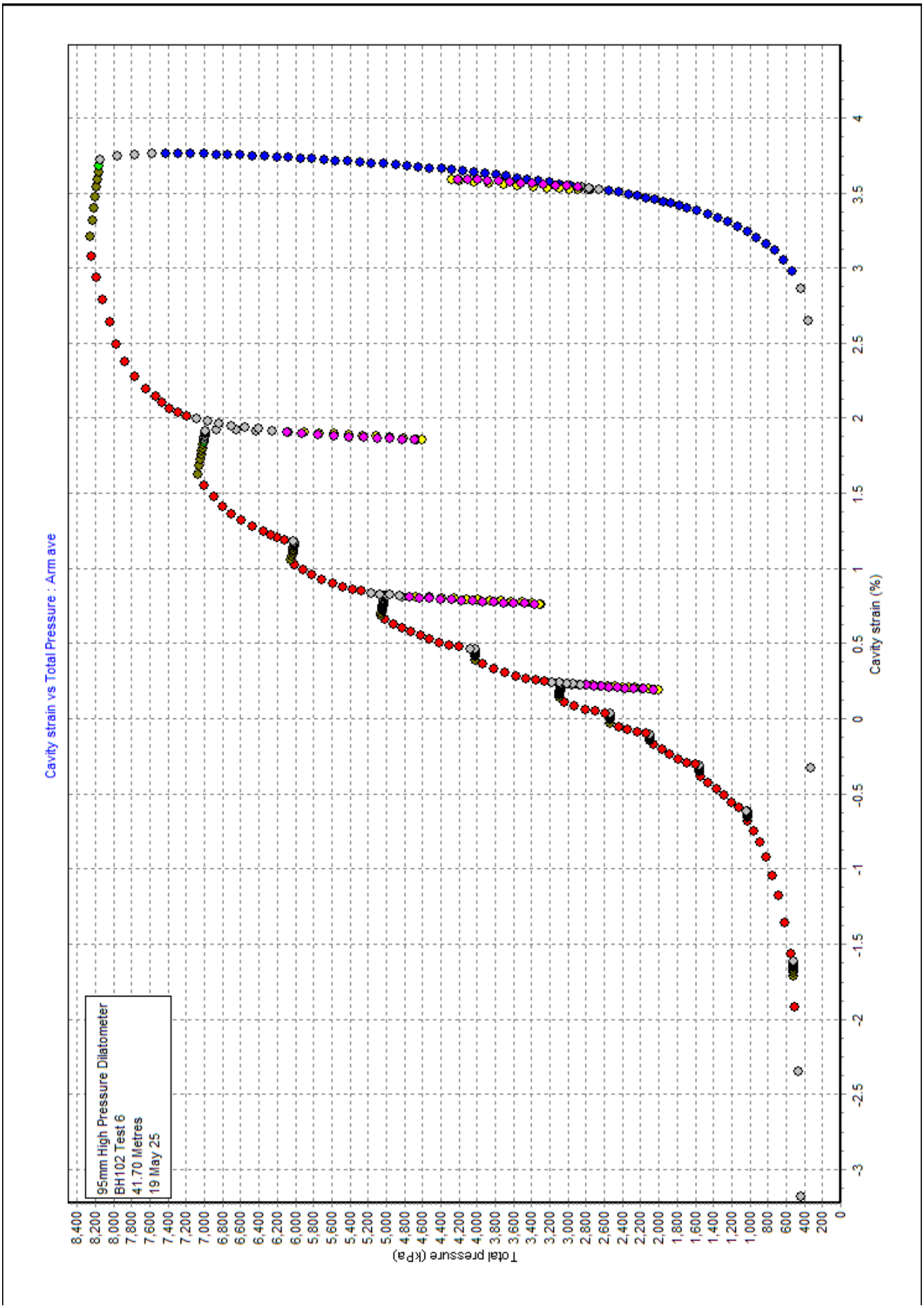
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

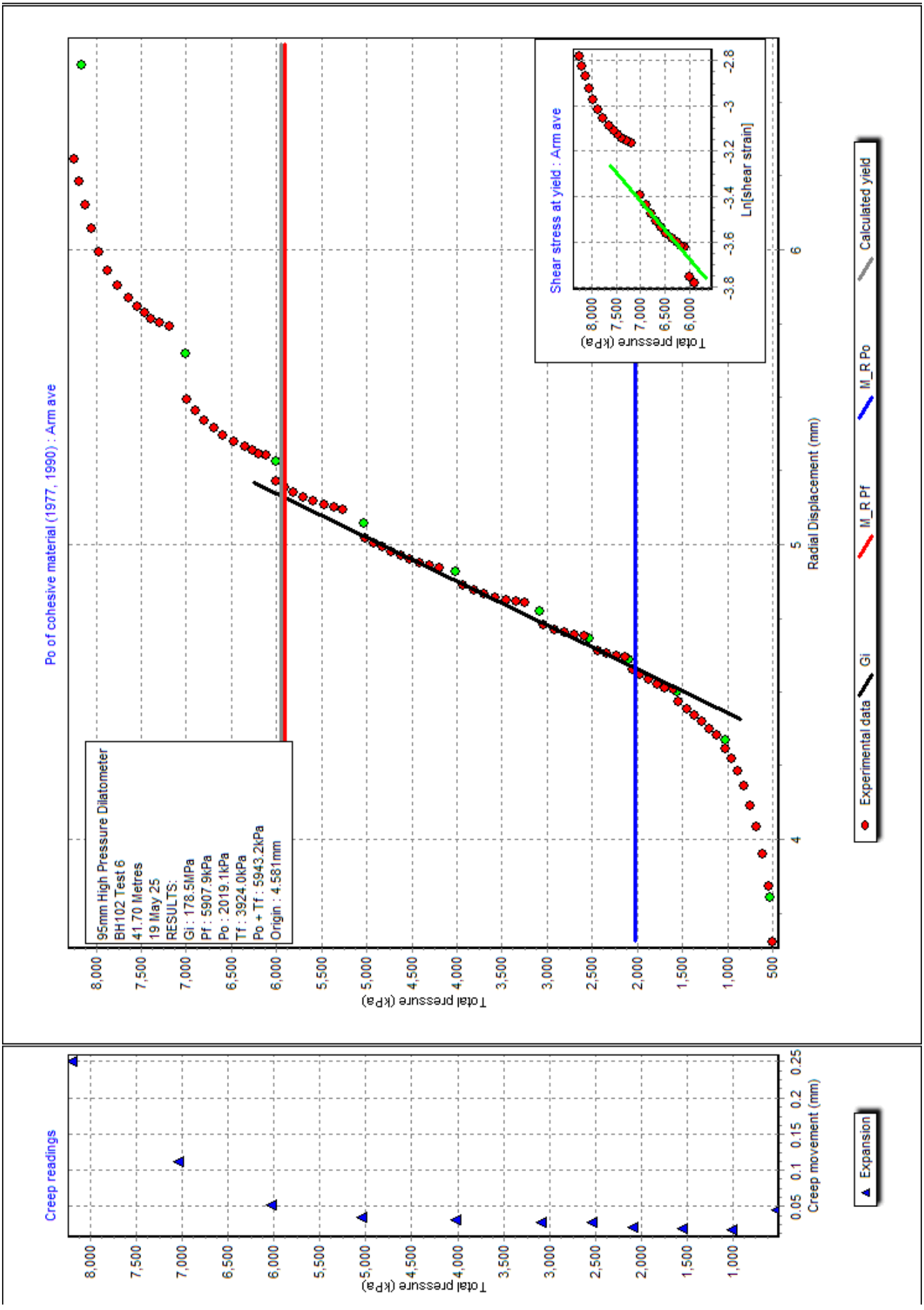
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	386.056	323.694	0.838
Arm ave	2	563.613	480.547	0.853
Arm ave	3	359.341	285.806	0.795
Arm ave	4	304.580	238.500	0.783

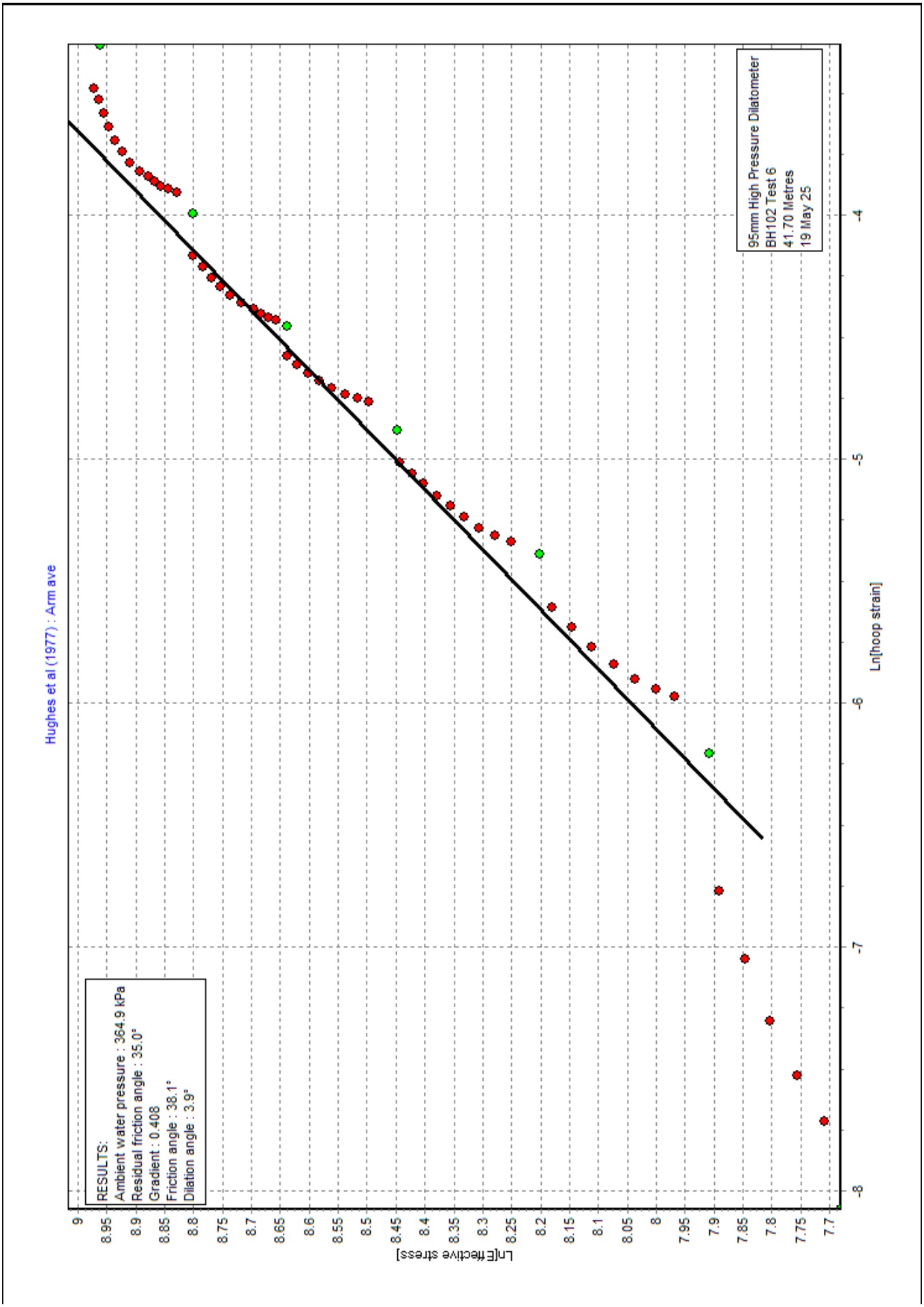
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 4.67
Po (kPa) : 785
Cohesion (kPa) : 50
Angle of peak friction (deg) : 38.1
Angle of peak dilation (deg) : 3.9

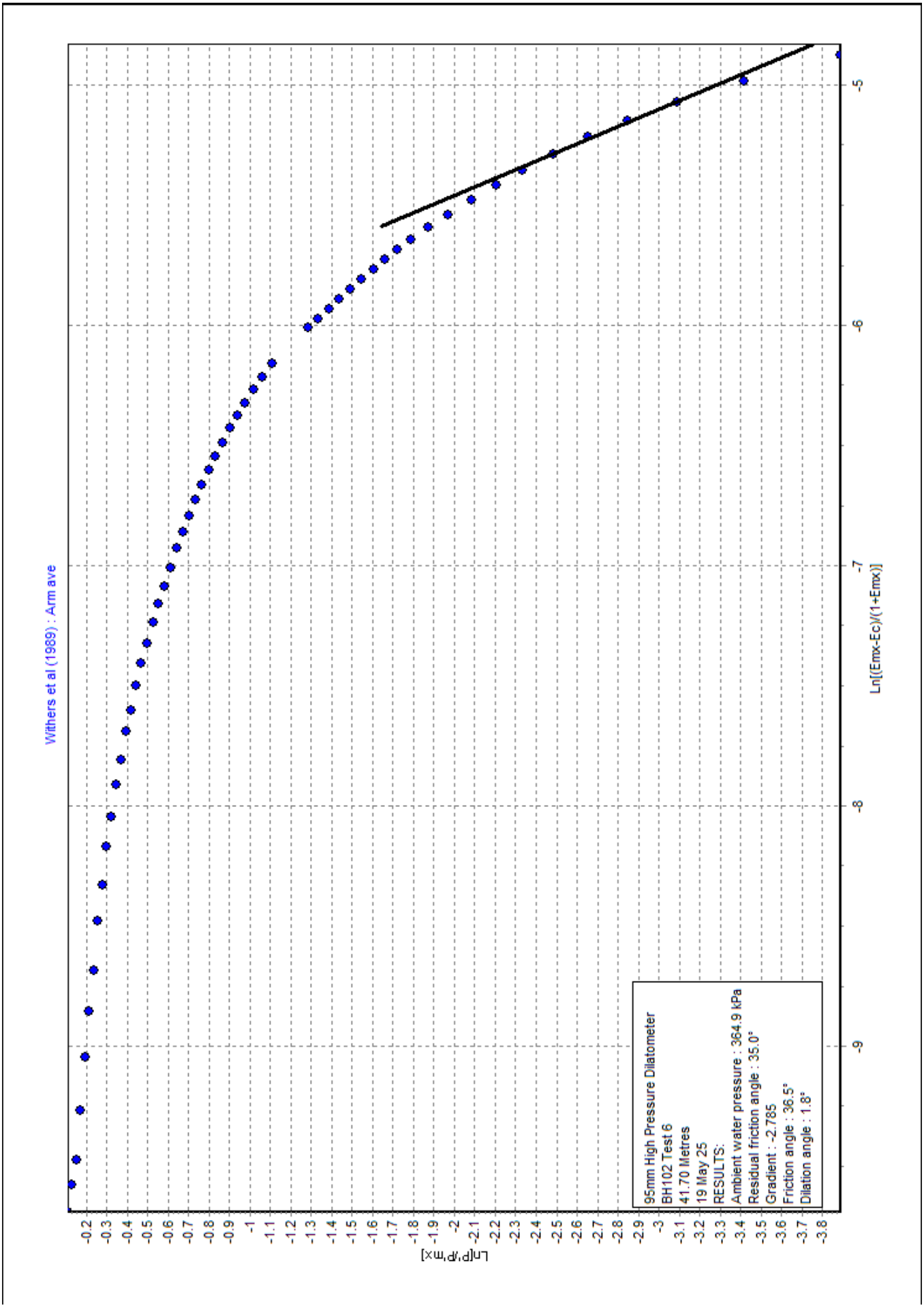
Grain to TIlbury
BH102 Test 6 - SUMMARY OF RESULTS

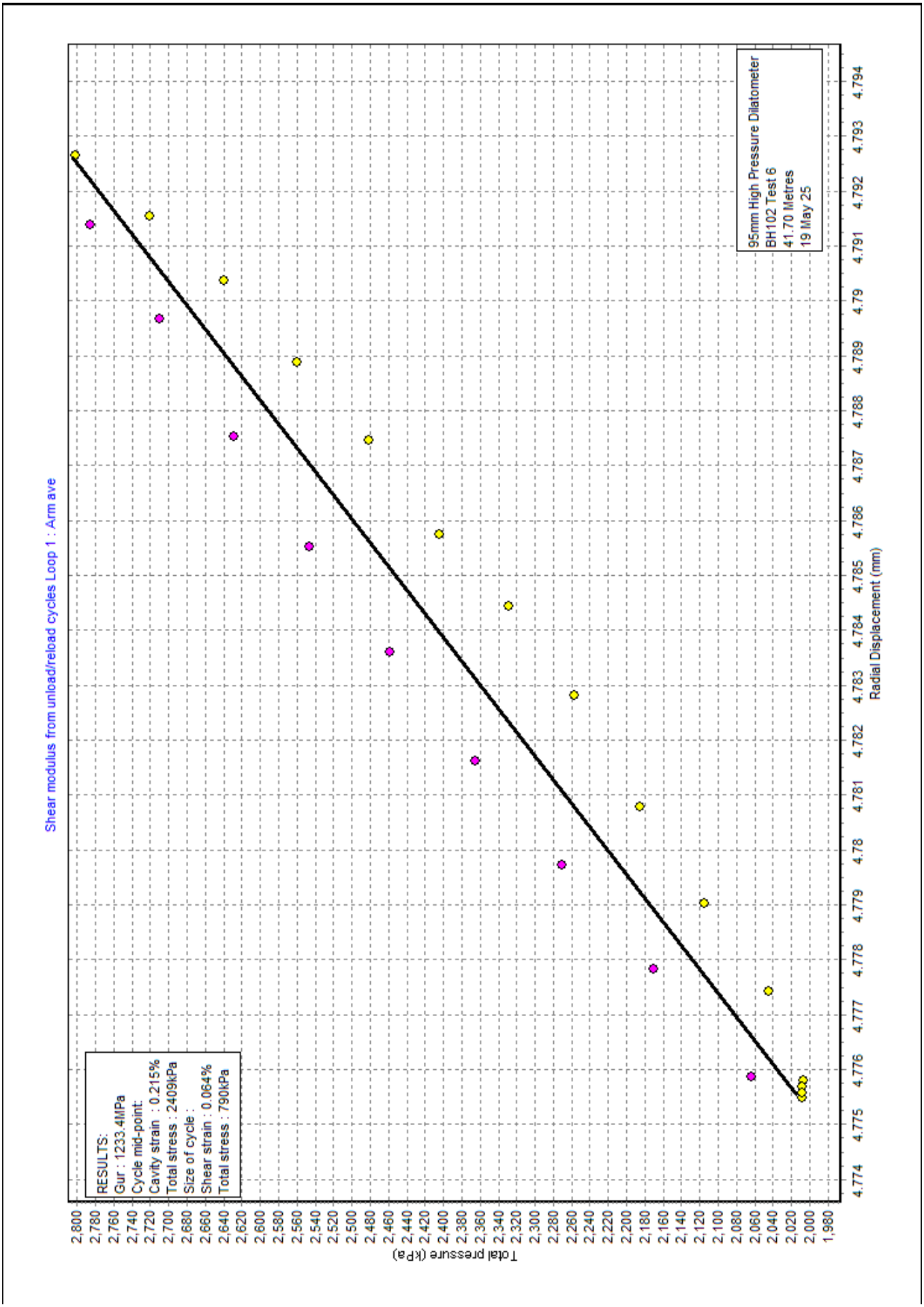
Total yield stress (kPa)	:	1232
Total limit stress (kPa)	:	27719
G at first yield (MPa)	:	2383.1
Non-linear exponent	:	0.795
Janbu exponent	:	-0.138
Correlation	:	0.641
Ambient pore water pressure (kPa)	:	365
Residual friction angle (deg)	:	35.0
Poisson's ratio	:	0.20

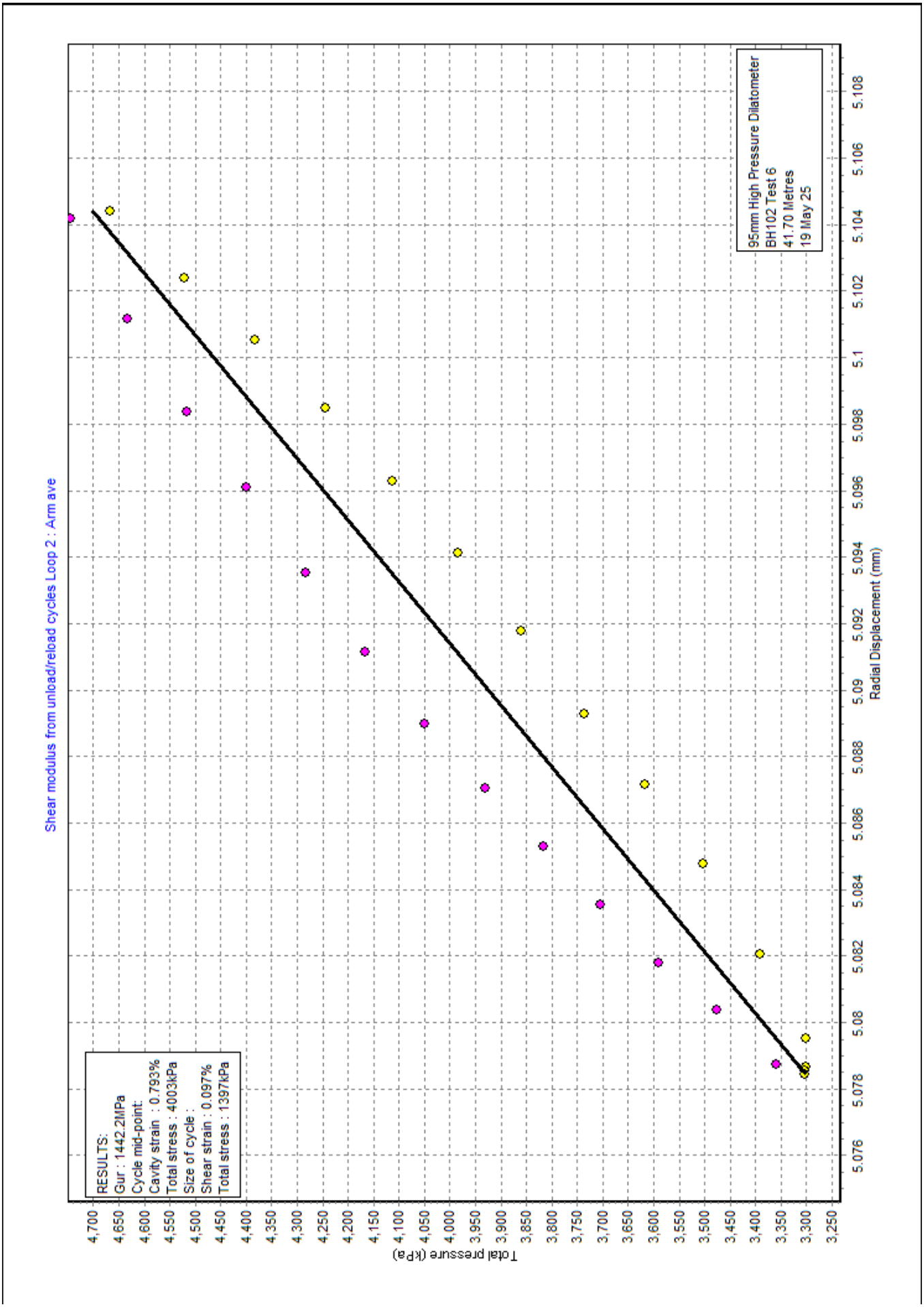

Cavity strain vs Total Pressure : Arm ave
95mm High Pressure Dilatometer
BH102 Test 6
41.70 Metres
19 May 25
Total pressure (kPa)
Cavity strain (%)

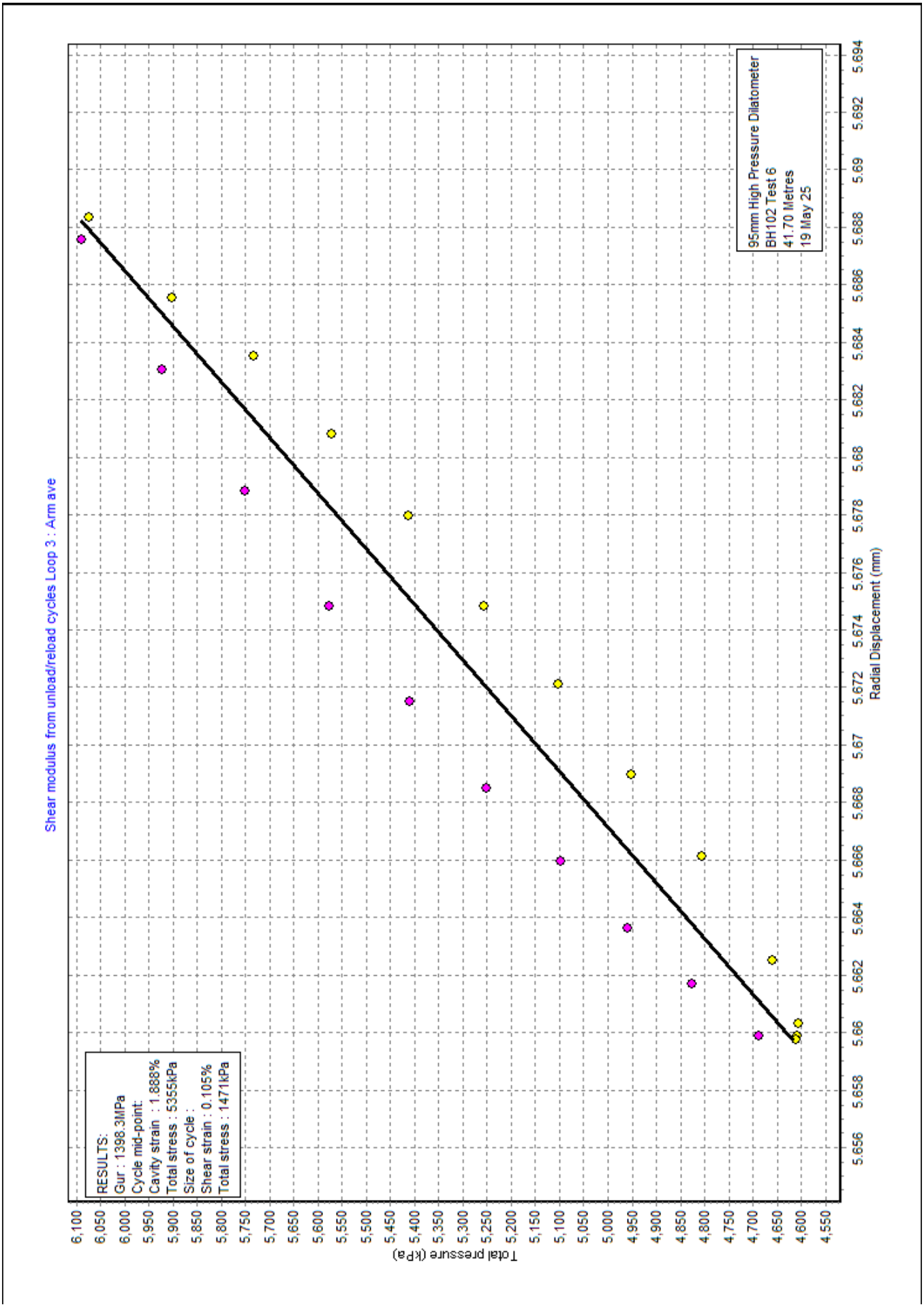

Po of cohesive material (1977, 1990) : Arm ave
95mm High Pressure Dilatometer
BH102 Test 6
41.70 Metres
19 May 25
RESULTS:
Gi : 178.5MPa
Pf : 5907.9kPa
Po : 2019.1kPa
Tf : 3924.0kPa
Po + Tf : 5943.2kPa
Origin : 4.581mm
Total pressure (kPa)
Radial Displacement (mm)
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Shear stress at yield : Arm ave
Ln[shear strain]
Creep readings
Creep movement (mm)
Expansion

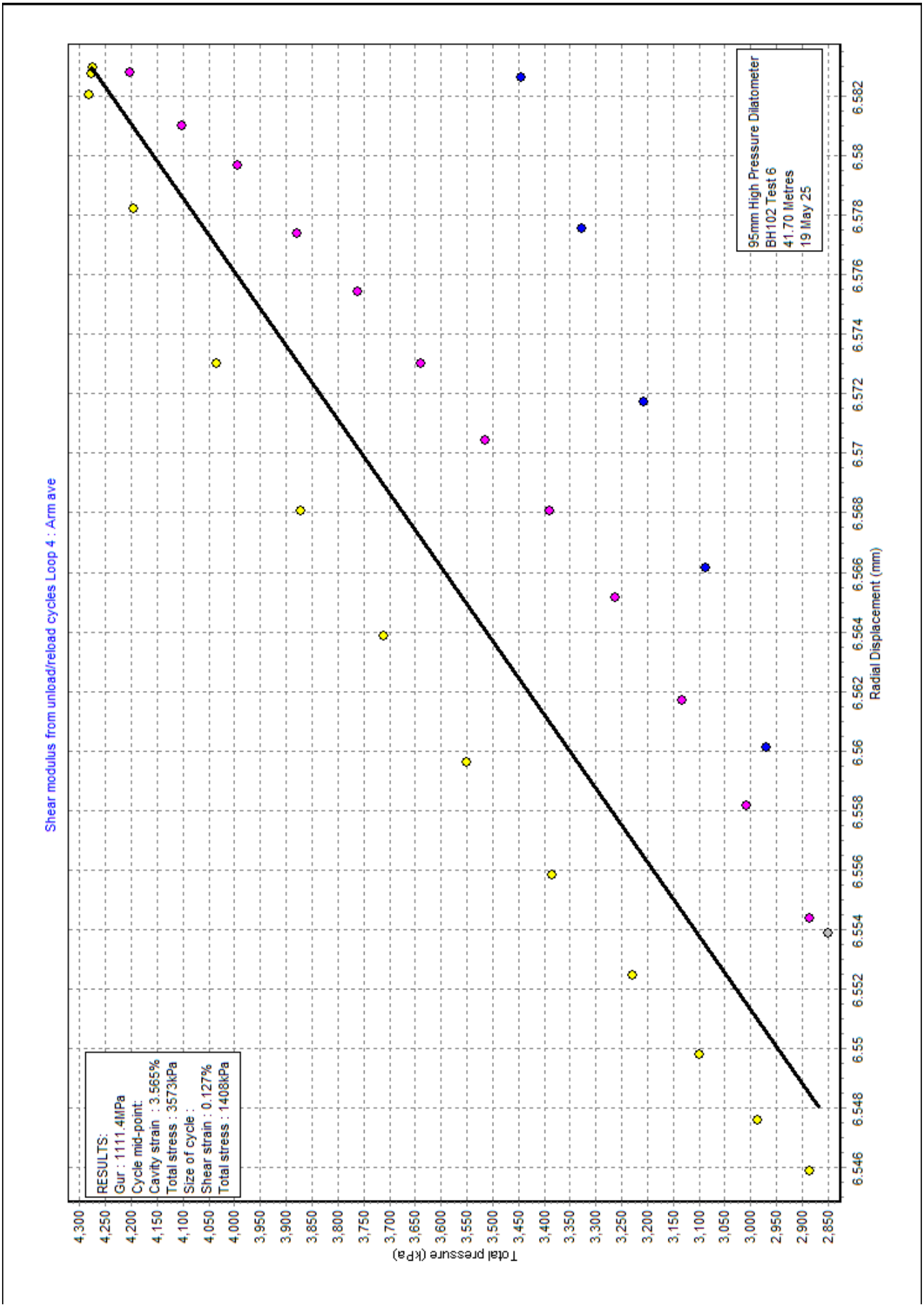

Hughes et al (1977) : Arm ave
RESULTS:
Ambient water pressure : 364.9 kPa
Residual friction angle : 35.0°
Gradient : 0.408
Friction angle : 38.1°
Dilation angle : 3.9°
95mm High Pressure Dilatometer
BH102 Test 6
41.70 Metres
19 May 25
Ln[effective stress]
Ln[hoop strain]
9
8.95
8.9
8.85
8.8
8.75
8.7
8.65
8.6
8.55
8.5
8.45
8.4
8.35
8.3
8.25
8.2
8.15
8.1
8.05
8
7.95
7.9
7.85
7.8
7.75
7.7
-4
-5
-6
-7
-8

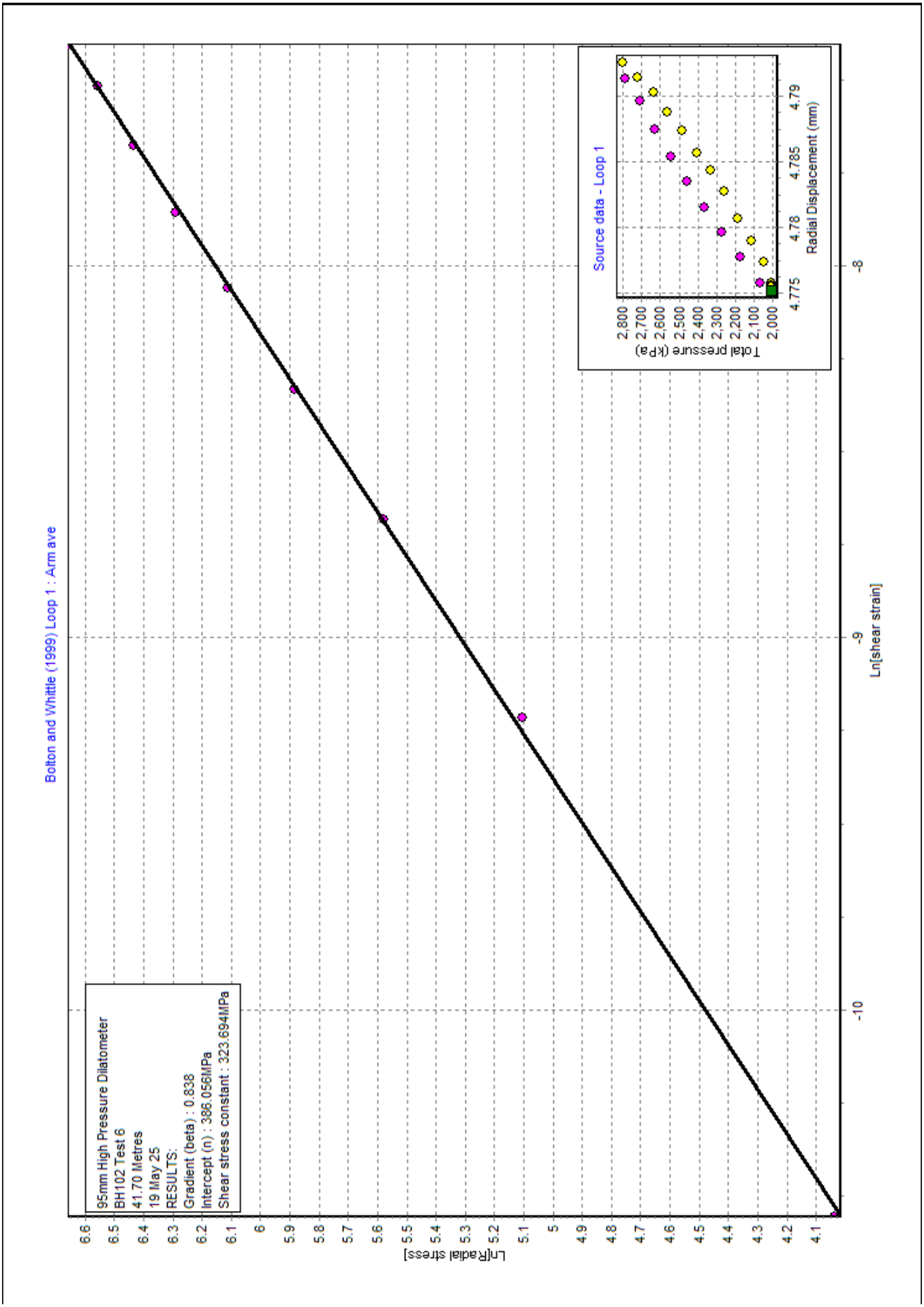

Withers et al (1989) : Arm ave
Ln[(Emx-Ec)/(1+Emx)]
Ln[P'/P'mx]
95mm High Pressure Dilatometer
BH102 Test 6
41.70 Metres
19 May 25
RESULTS:
Ambient water pressure : 364.9 kPa
Residual friction angle : 35.0°
Gradient : -2.785
Friction angle : 36.5°
Dilation angle : 1.8°

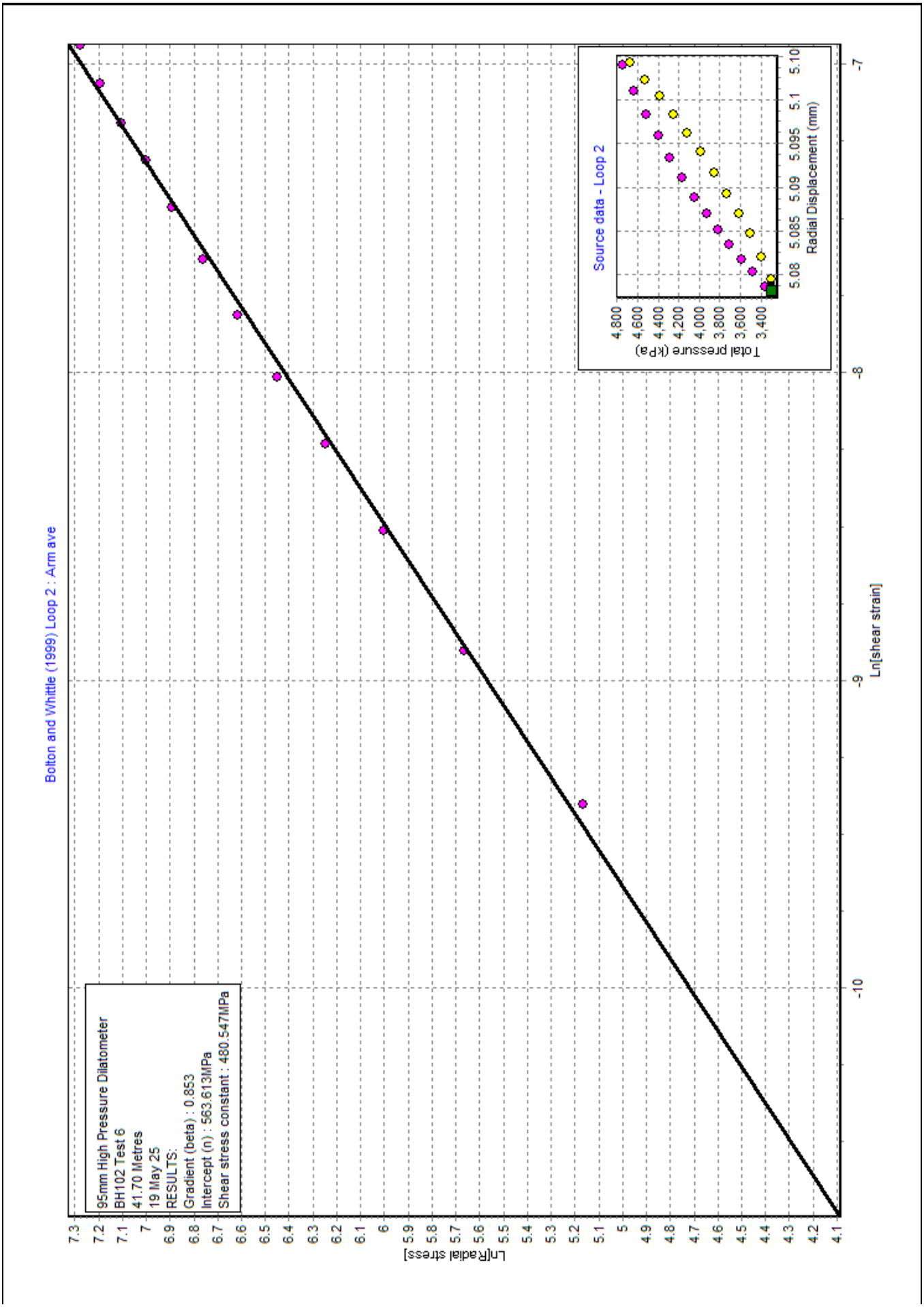

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 1233.4MPa
Cycle mid-point:
Cavity strain : 0.215%
Total stress : 2409kPa
Size of cycle :
Shear strain : 0.064%
Total stress : 790kPa
95mm High Pressure Dilatometer
BH102 Test 6
41.70 Metres
19 May 25
Total pressure (kPa)
Radial Displacement (mm)

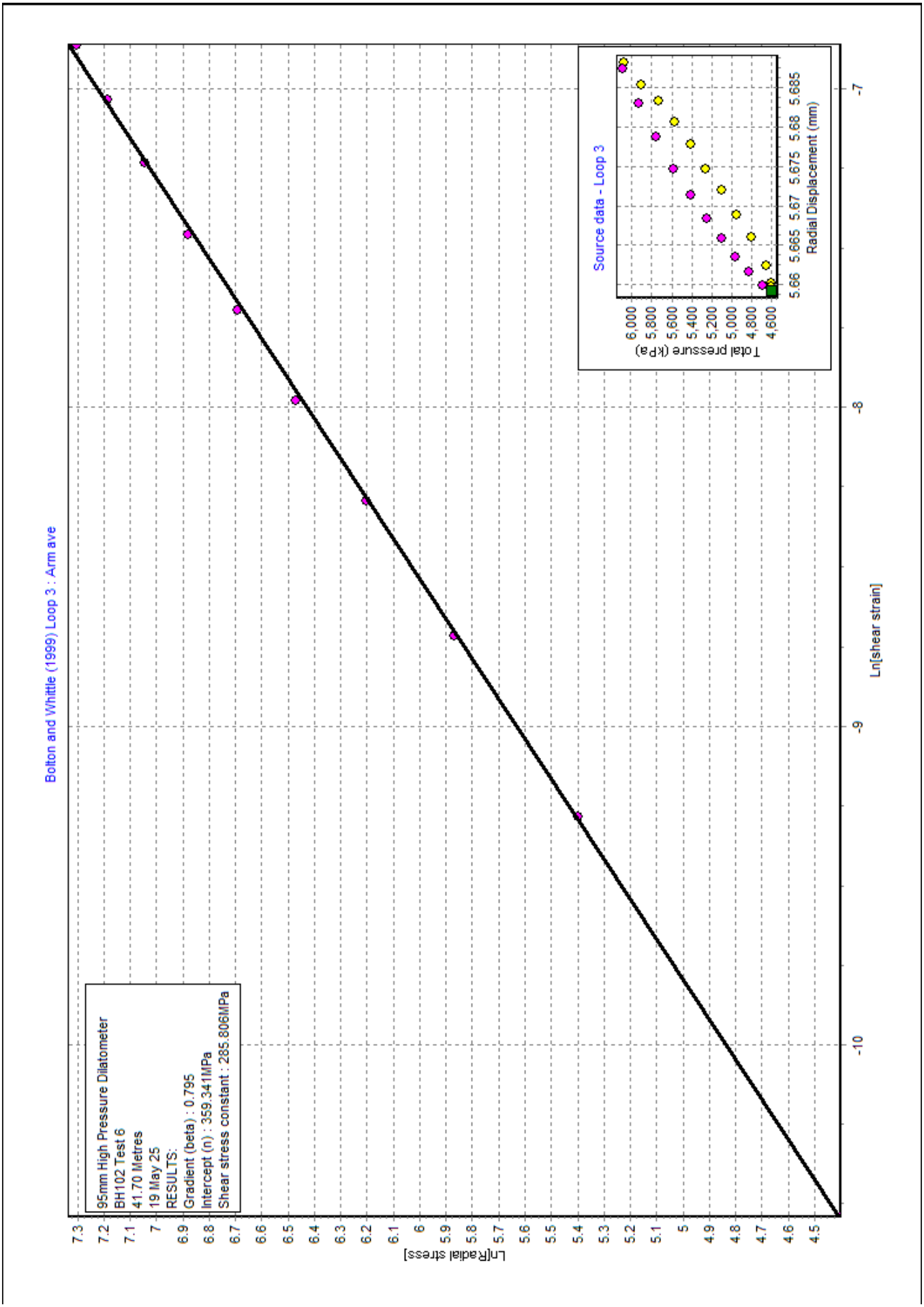

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 1442.2MPa
Cycle mid-point:
Cavity strain : 0.793%
Total stress : 4003kPa
Size of cycle :
Shear strain : 0.097%
Total stress : 1397kPa
95mm High Pressure Dilatometer
BH102 Test 6
41.70 Metres
19 May 25
Total pressure (kPa)
Radial Displacement (mm)
4,700
4,650
4,600
4,550
4,500
4,450
4,400
4,350
4,300
4,250
4,200
4,150
4,100
4,050
4,000
3,950
3,900
3,850
3,800
3,750
3,700
3,650
3,600
3,550
3,500
3,450
3,400
3,350
3,300
3,250
5.076
5.078
5.08
5.082
5.084
5.086
5.088
5.09
5.092
5.094
5.096
5.098
5.1
5.102
5.104
5.106
5.108

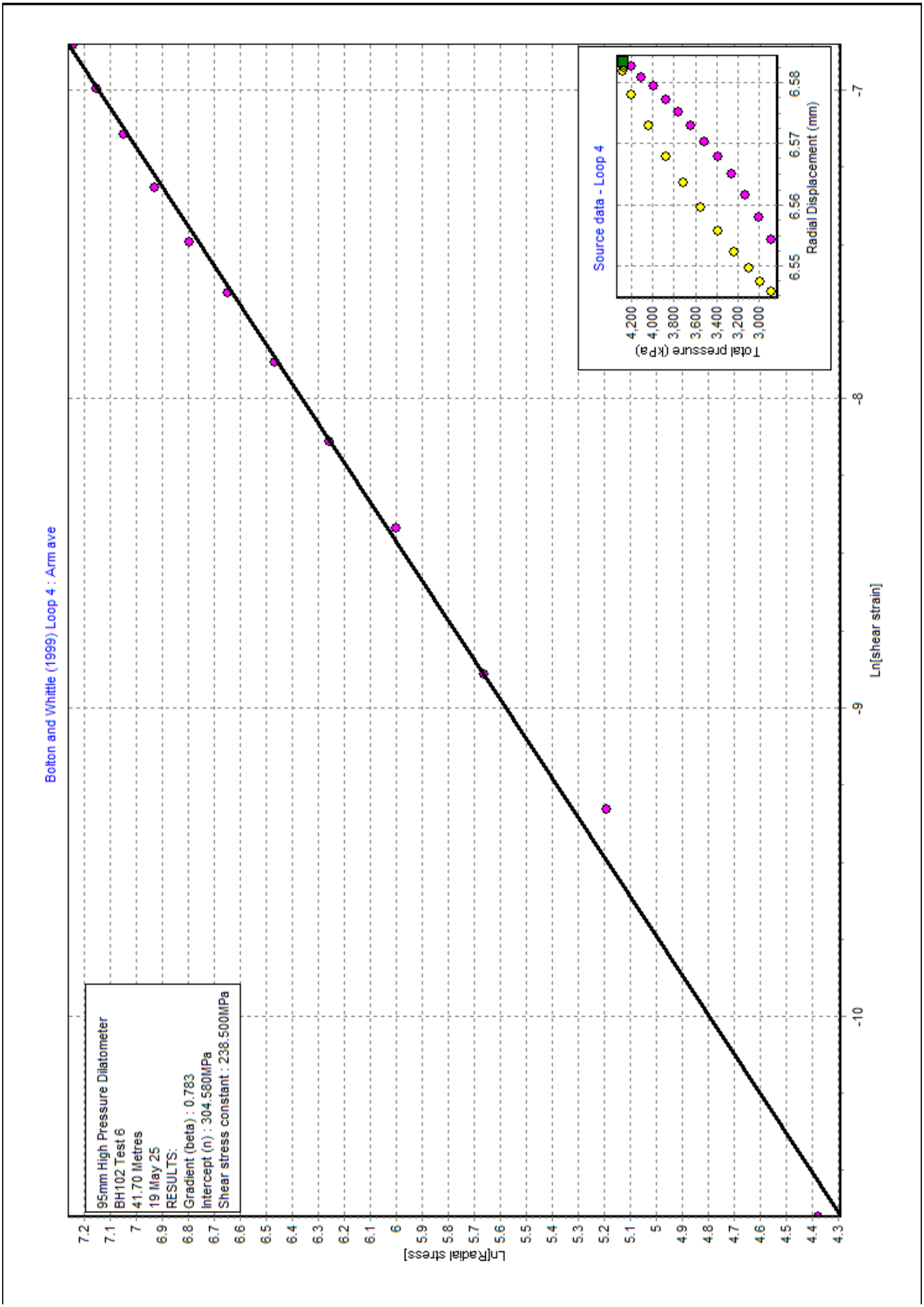

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 1398.3MPa
Cycle mid-point:
Cavity strain : 1.888%
Total stress : 5355kPa
Size of cycle :
Shear strain : 0.105%
Total stress : 1471kPa
95mm High Pressure Dilatometer
BH102 Test 6
41.70 Metres
19 May 25
Total pressure (kPa)
Radial Displacement (mm)

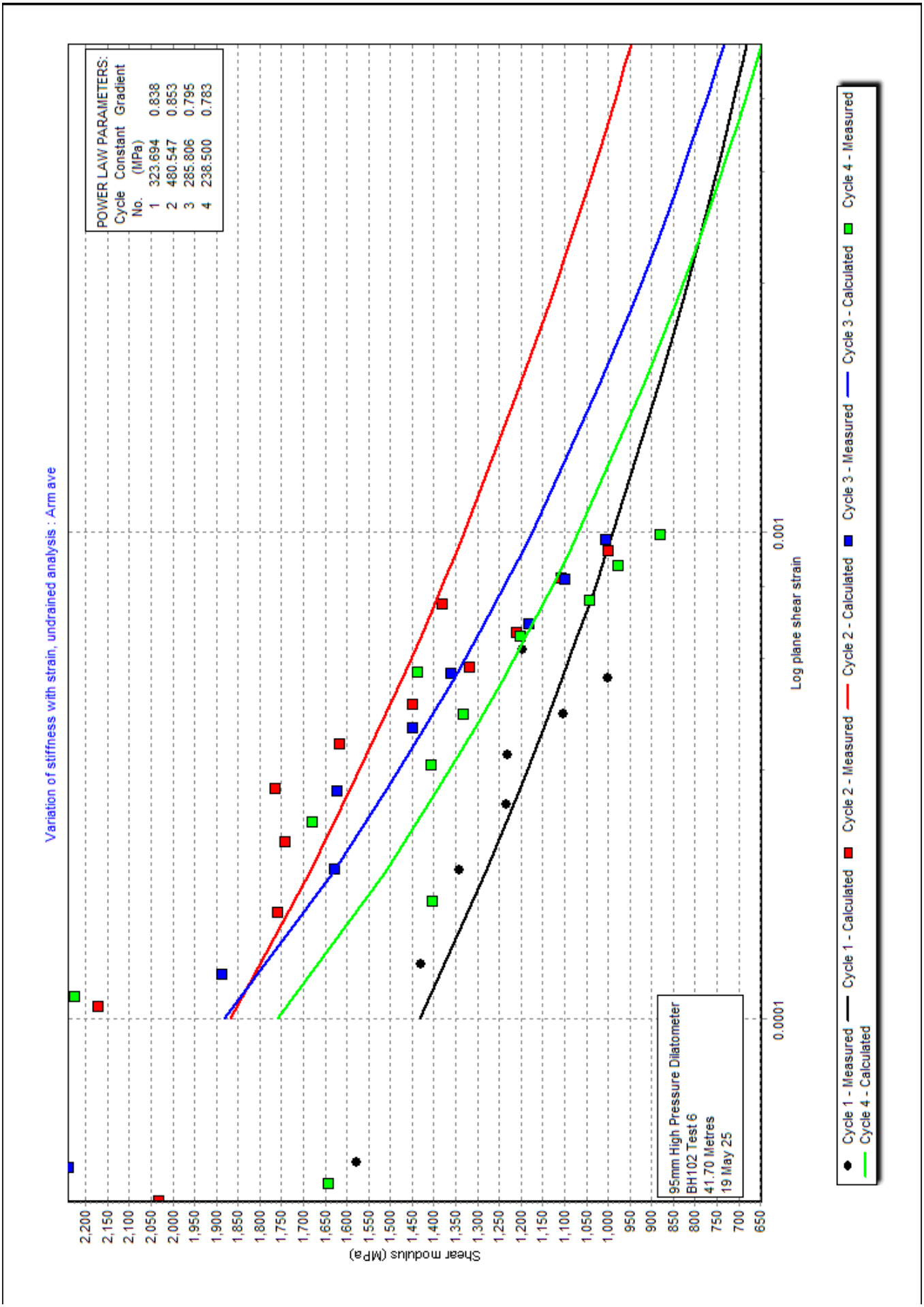

Shear modulus from unload/reload cycles Loop 4 : Arm ave
RESULTS:
Gur : 1111.4MPa
Cycle mid-point:
Cavity strain : 3.565%
Total stress : 3573kPa
Size of cycle :
Shear strain : 0.127%
Total stress : 1408kPa
95mm High Pressure Dilatometer
BH102 Test 6
41.70 Metres
19 May 25
Total pressure (kPa)
Radial Displacement (mm)

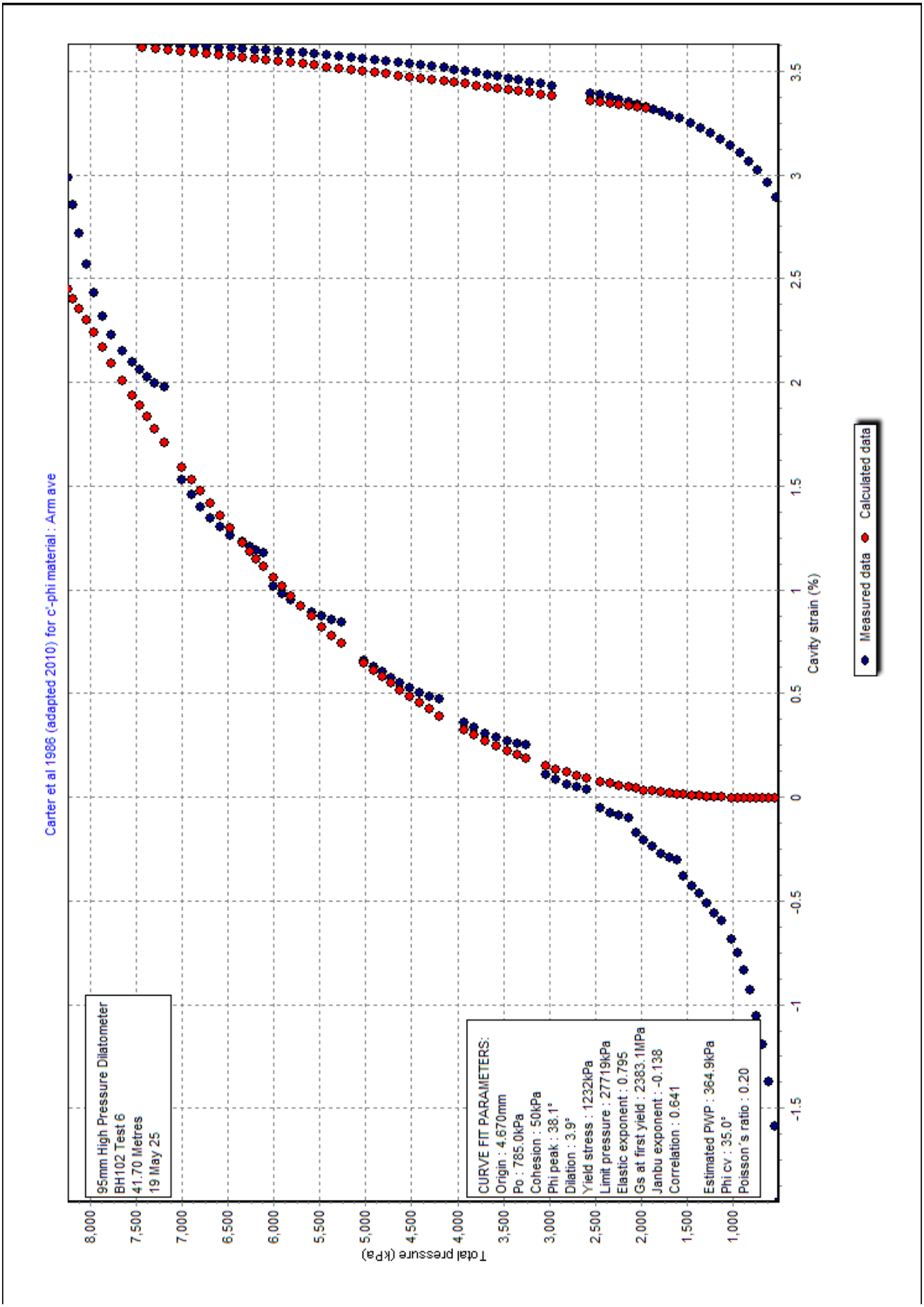

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 6
41.70 Metres
19 May 25
RESULTS:
Gradient (beta) : 0.838
Intercept (n) : 386.056MPa
Shear stress constant : 323.694MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

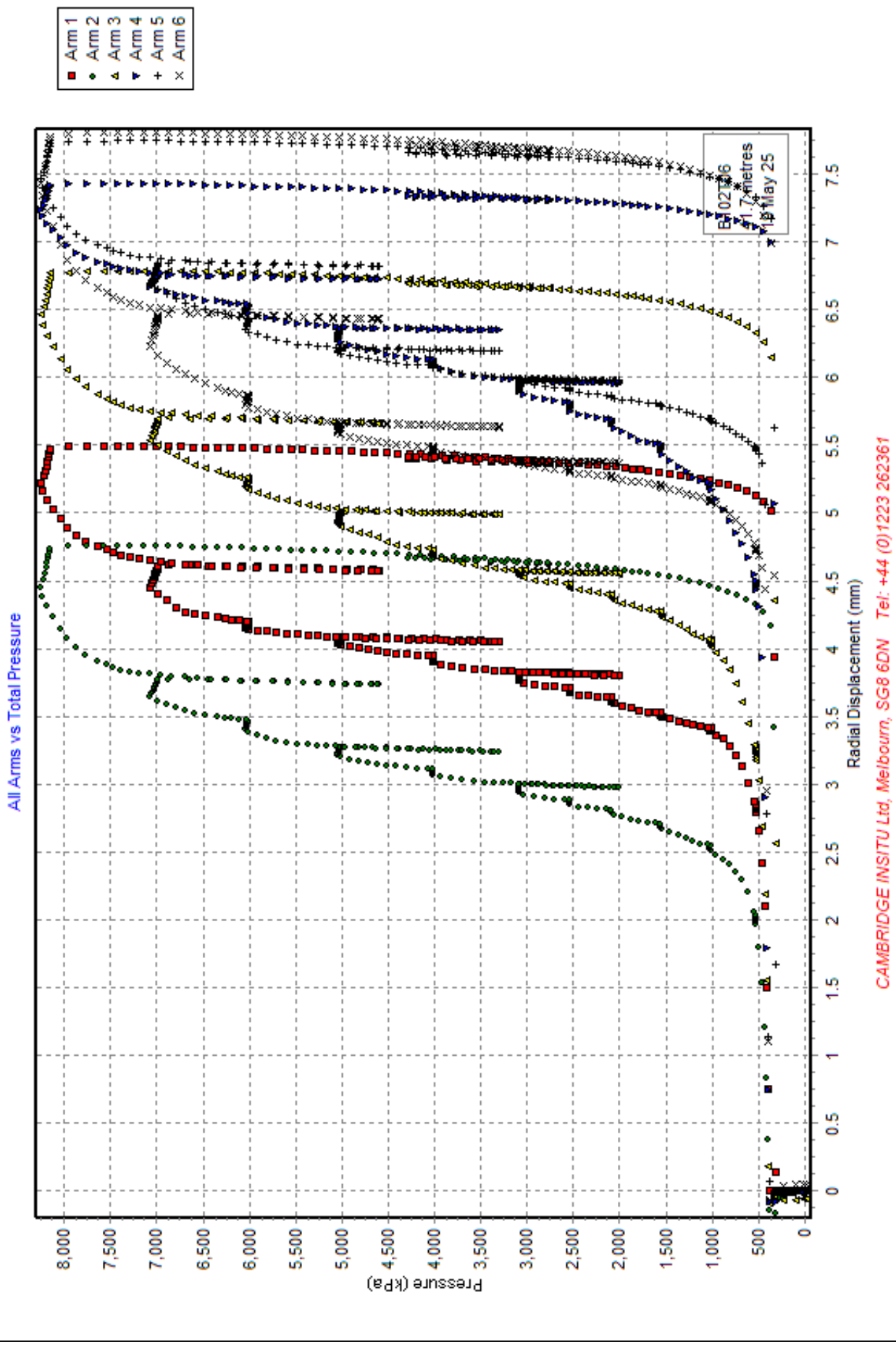

Bolton and Whittle (1999) Loop 2 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 6
41.70 Metres
19 May 25
RESULTS:
Gradient (beta) : 0.853
Intercept (n) : 563.613MPa
Shear stress constant : 480.547MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

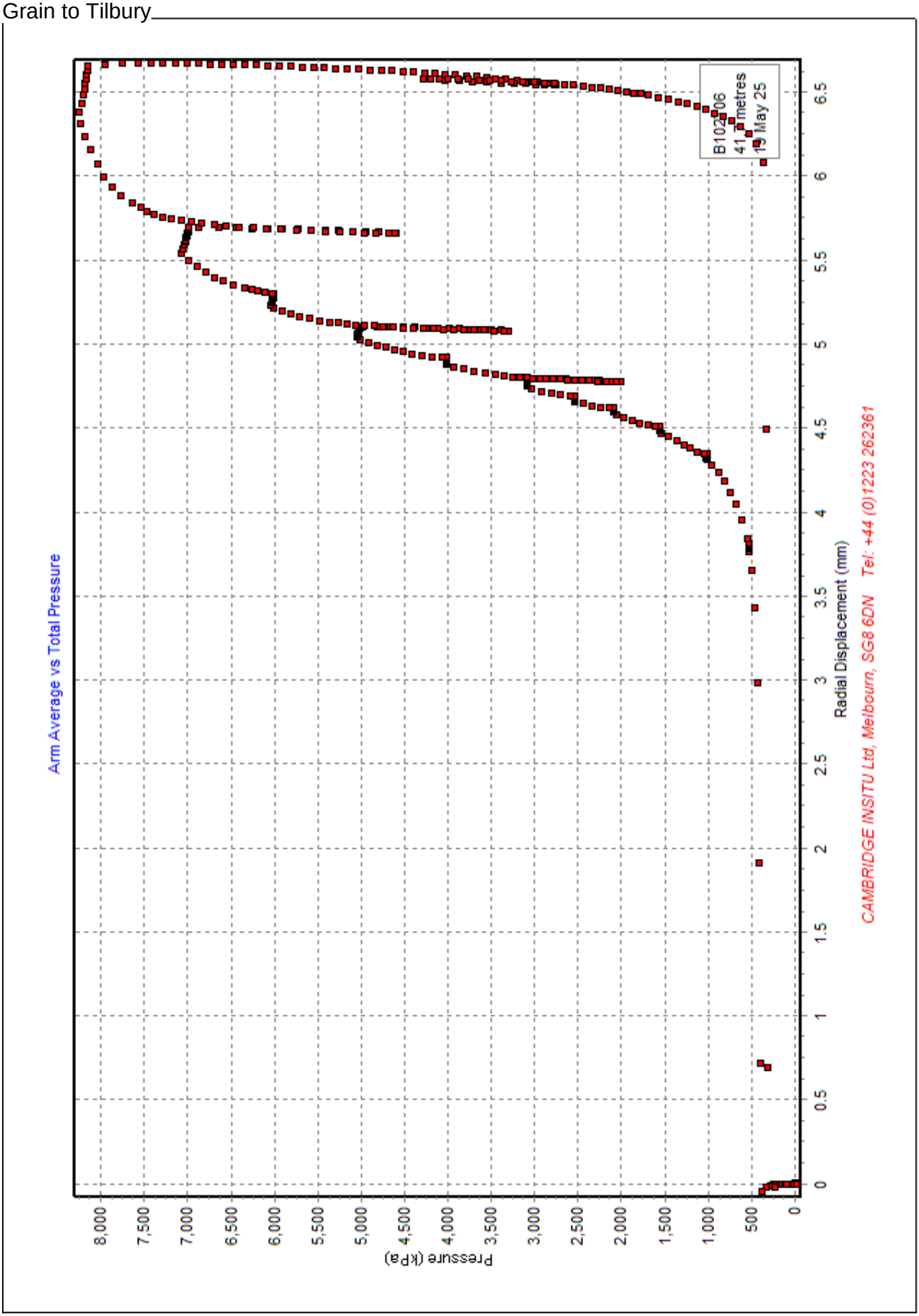

Bolton and Whittle (1999) Loop 3 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 6
41.70 Metres
19 May 25
RESULTS:
Gradient (beta) : 0.795
Intercept (n) : 359.341MPa
Shear stress constant : 285.806MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)

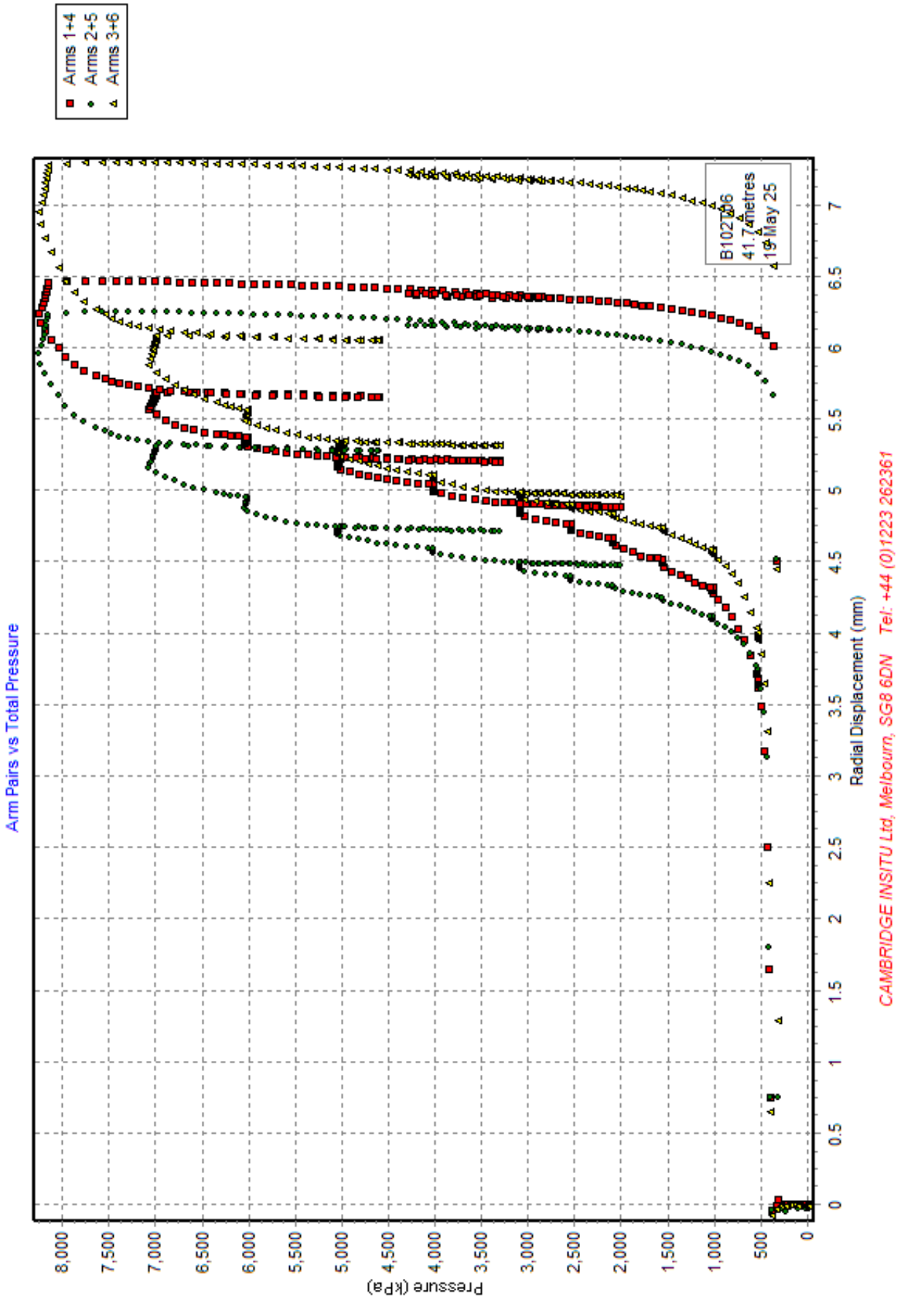

Bolton and Whittle (1999) Loop 4 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 6
41.70 Metres
19 May 25
RESULTS:
Gradient (beta) : 0.783
Intercept (n) : 304.580MPa
Shear stress constant : 238.500MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 4
Total pressure (kPa)
Radial Displacement (mm)

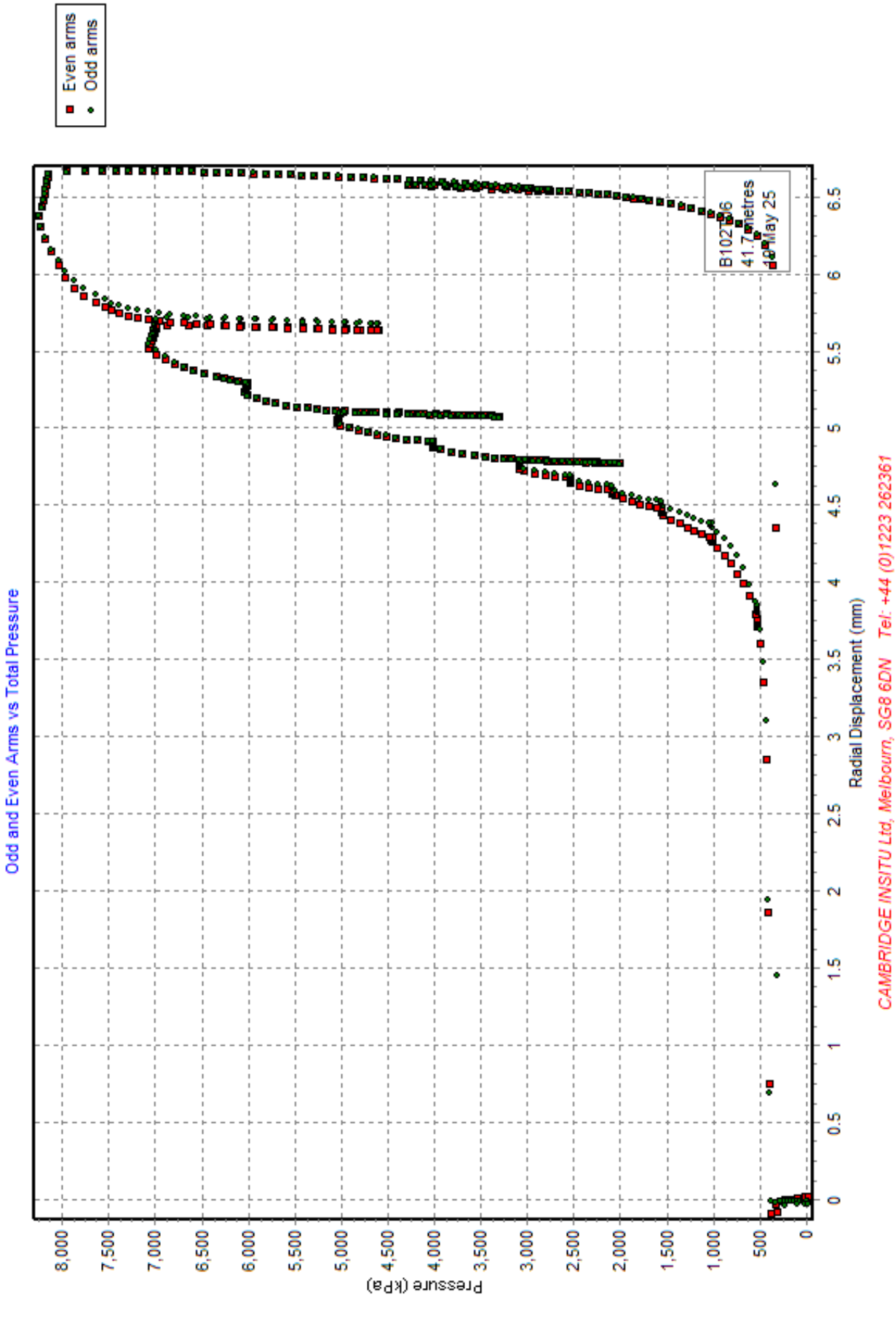

Variation of stiffness with strain, undrained analysis : Arm ave
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 323.694 0.838
2 480.547 0.853
3 285.806 0.795
4 238.500 0.783
Shear modulus (MPa)
Log plane shear strain
0.0001
0.001
95mm High Pressure Dilatometer
BH102 Test 6
41.70 Metres
19 May 25
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
Cycle 4 - Measured
Cycle 4 - Calculated


Carter et al 1986 (adapted 2010) for c'-phi material : Arm ave
95mm High Pressure Dilatometer
BH102 Test 6
41.70 Metres
19 May 25
CURVE FIT PARAMETERS:
Origin : 4.670mm
Po : 785.0kPa
Cohesion : 50kPa
Phi peak : 38.1°
Dilation : 3.9°
Yield stress : 1232kPa
Limit pressure : 27719kPa
Elastic exponent : 0.795
Gs at first yield : 2383.1MPa
Janbu exponent : -0.138
Correlation : 0.641
Estimated PWP : 364.9kPa
Phi cv : 35.0°
Poisson's ratio : 0.20
Total pressure (kPa)
Cavity strain (%)
Measured data
Calculated data


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arm Average vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
B102106
41.7 metres
19 May 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arms 1+4
Arms 2+5
Arms 3+6
B102206
41.7 metres
19 May 25
Arm Pairs vs Total Pressure
Pressure (kPa)
8,000
7,500
7,000
6,500
6,000
5,500
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Radial Displacement (mm)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
B102
41.7 metres
May 25
Odd and Even Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to TIlbury
BH102 Test 7 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Grain to Tilbury
Borehole : BH102
Test name : BH102 Test 7
Test date : 19 May 25
Test depth : 44.65 Metres
Water table : 4.5 Metres
Ambient PWP : 393.9 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDP/RW on 18 Jul 25

Remarks: Flint present

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=3.26"
Po from Marsland & Randolph (kPa) : "Arm ave=1418.9"
Best estimate of Po (kPa) : "Arm ave=1062.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=4512.3"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 35.0
Angle of internal friction (°) : "Arm ave=39.0"
Dilation angle (°) : "Arm ave=5.0"
Gradient of log-log plot : "Arm ave=0.420"

[Withers et al 1989]
Angle of internal friction (°) : "Arm ave=36.6"
Dilation angle (°) : "Arm ave=2.0"
Gradient of log-log plot : "Arm ave=-2.796"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=395.0"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	1232.5	0.088	2426	0.069	853
Arm ave	2	1532.6	0.531	4775	0.109	1668
Arm ave	3	1507.0	0.943	5626	0.130	1965
Arm ave	4	1233.6	1.929	3999	0.150	1849

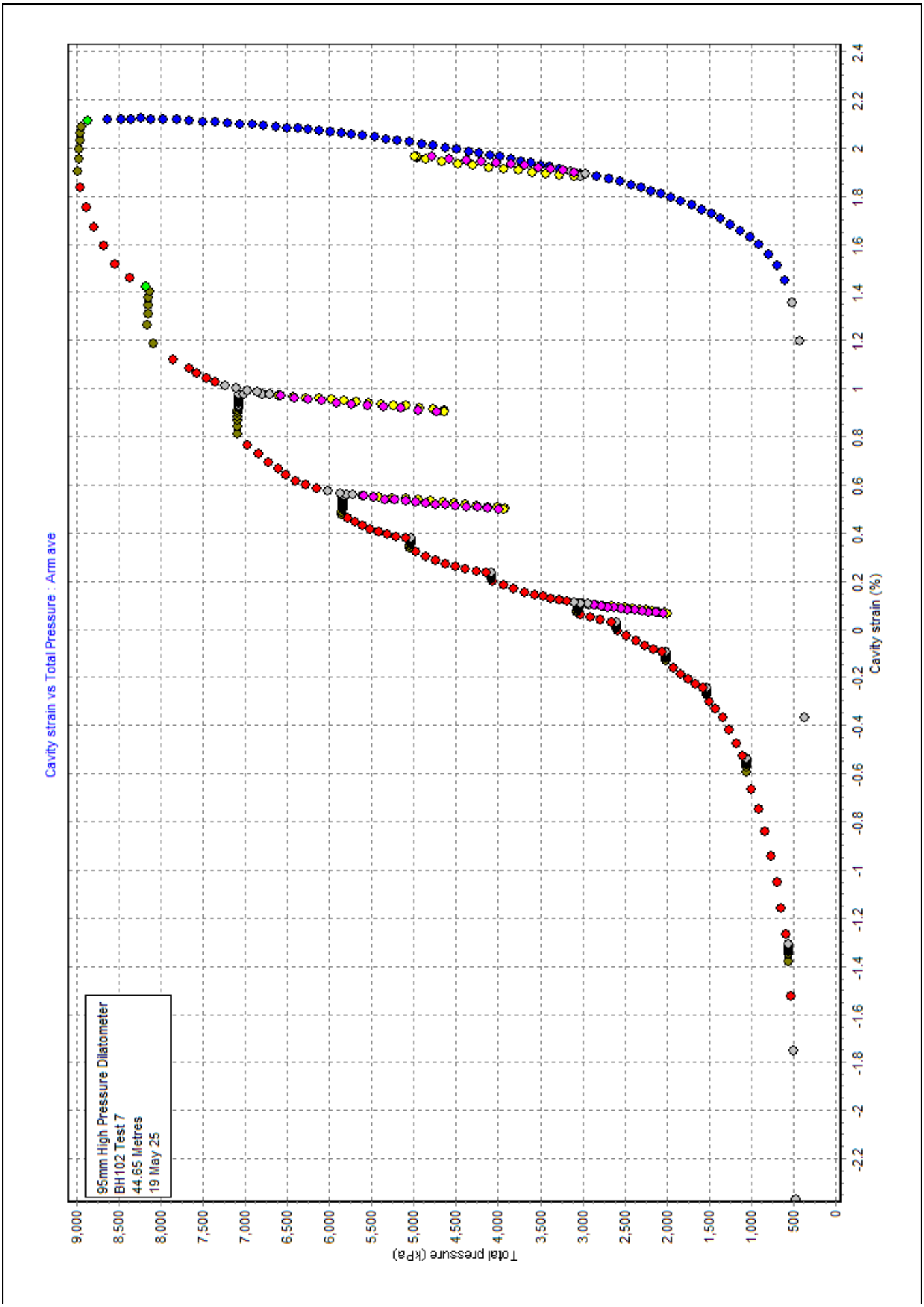
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

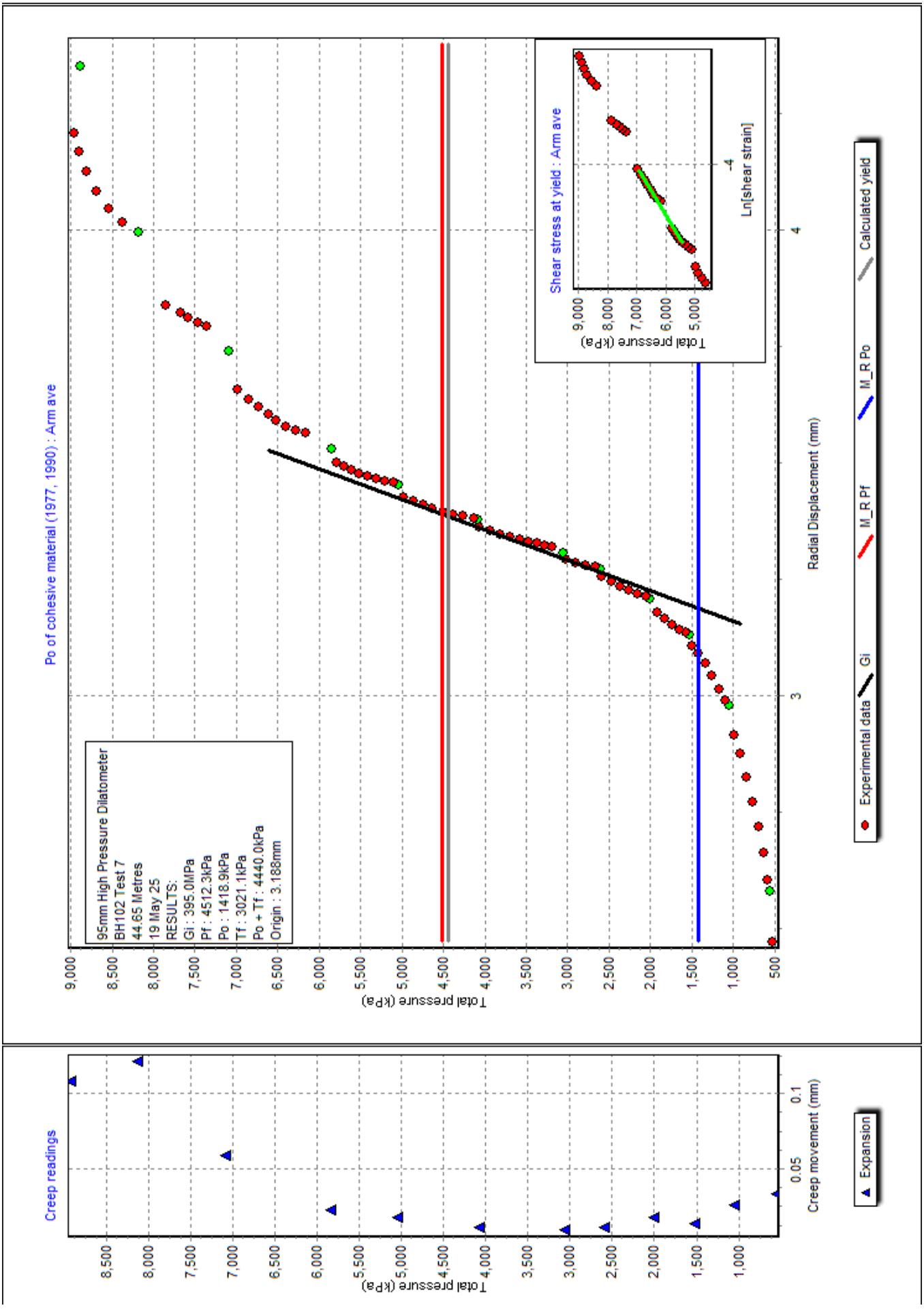
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	551.344	490.498	0.890
Arm ave	2	478.024	393.628	0.823
Arm ave	3	432.410	348.843	0.807
Arm ave	4	241.738	175.591	0.726

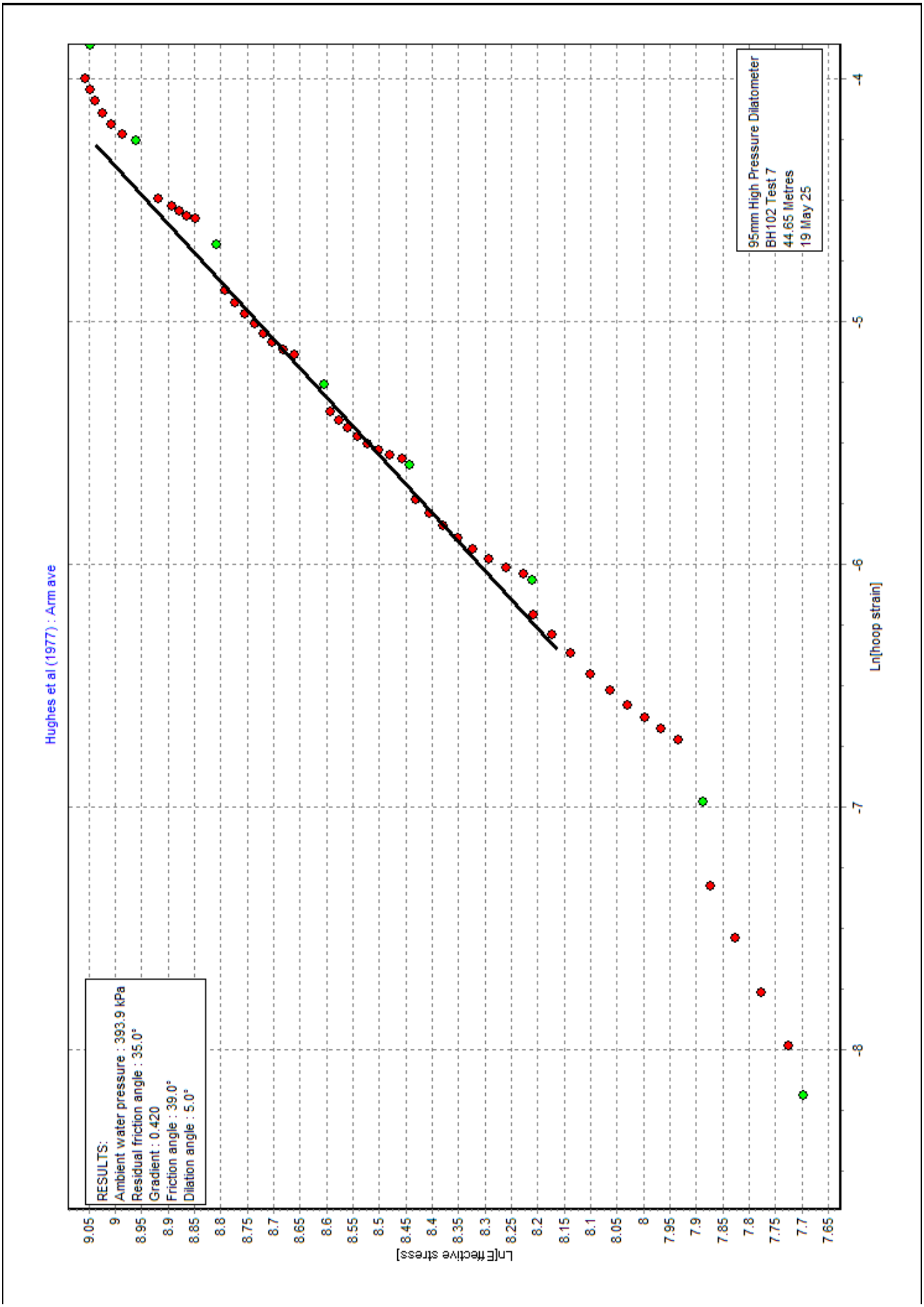
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 3.26
Po (kPa) : 1062
Cohesion (kPa) : 146
Angle of peak friction (deg) : 39.0
Angle of peak dilation (deg) : 5.0
Total yield stress (kPa) : 1841

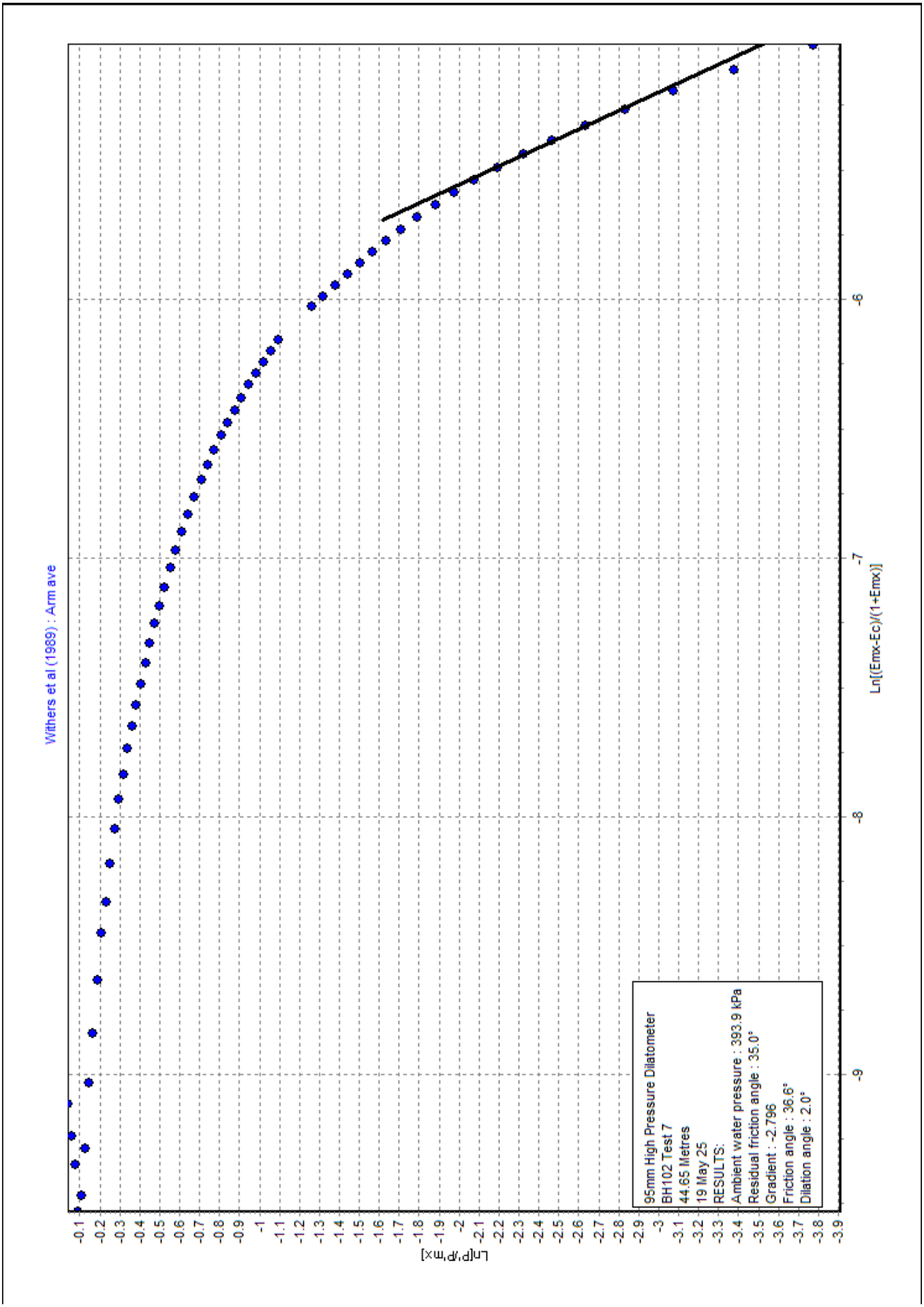
Grain to TIlbury
BH102 Test 7 - SUMMARY OF RESULTS

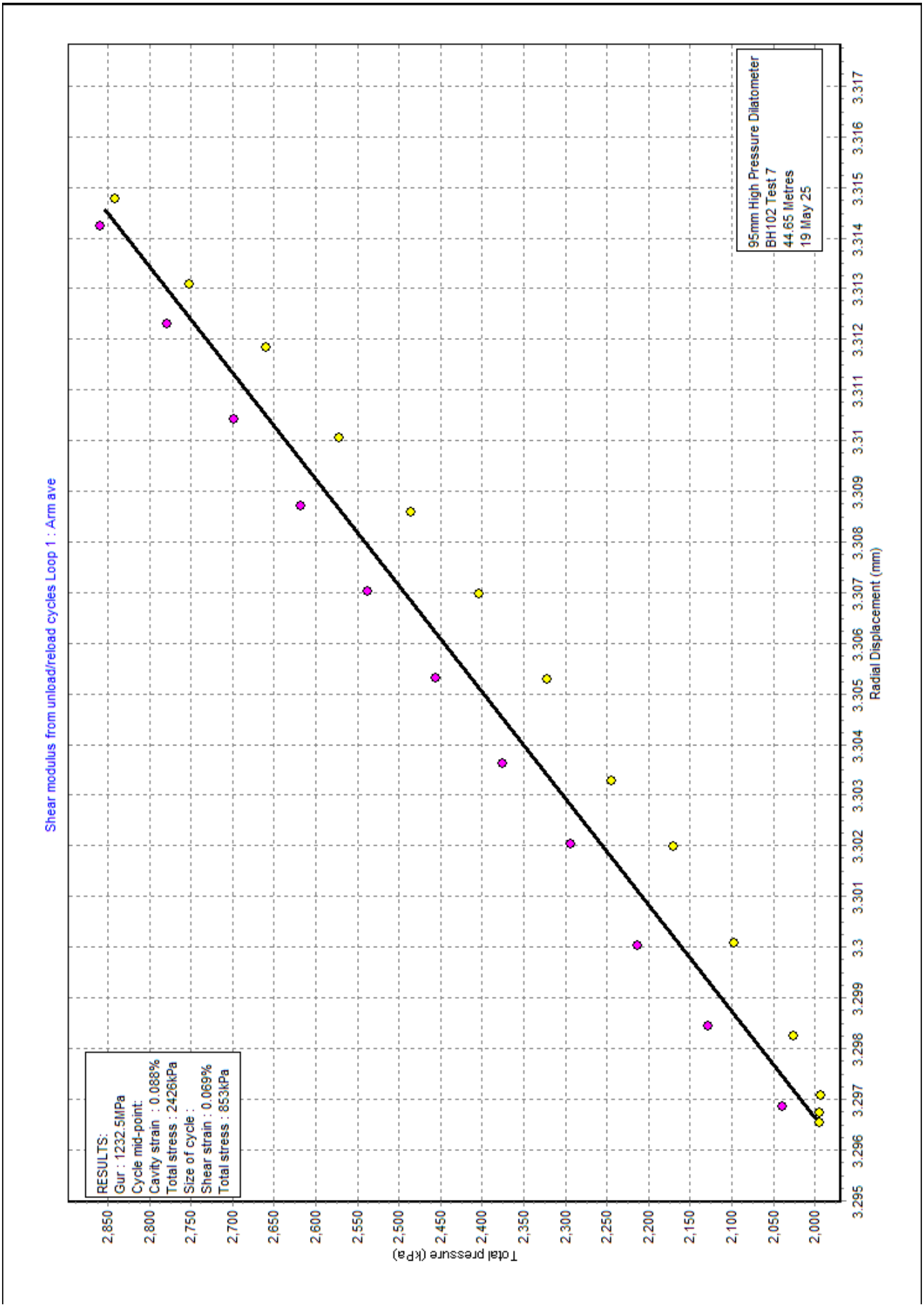
Total limit stress (kPa)	:	37688
G at first yield (MPa)	:	1856.2
Non-linear exponent	:	0.807
Janbu exponent	:	-0.072
Correlation	:	0.649
Ambient pore water pressure (kPa)	:	394
Residual friction angle (deg)	:	35.0
Poisson's ratio	:	0.20

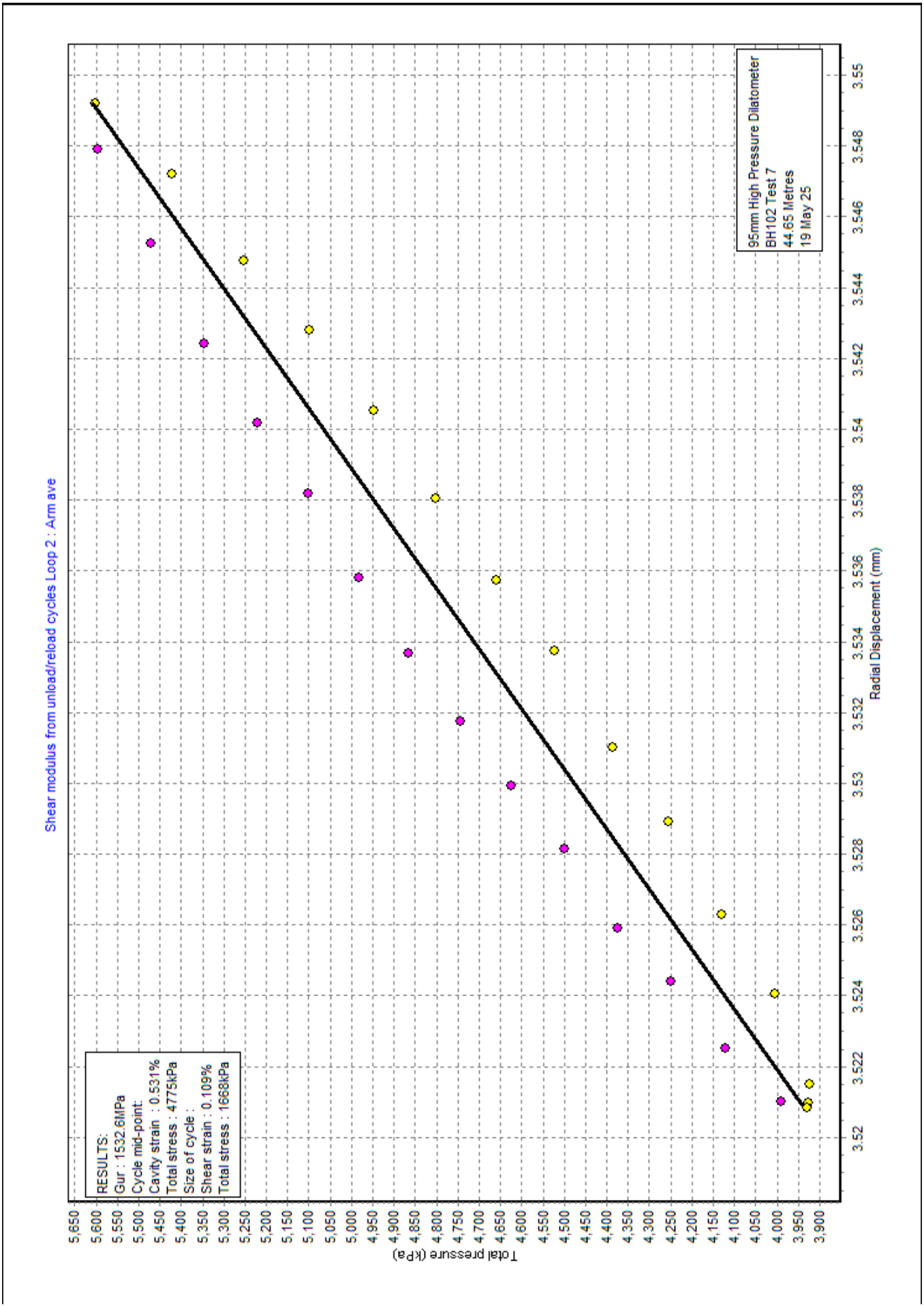

Cavity strain vs Total Pressure : Arm ave
95mm High Pressure Dilatometer
BH102 Test 7
44.65 Metres
19 May 25
Total pressure (kPa)
Cavity strain (%)
9,000
8,500
8,000
7,500
7,000
6,500
6,000
5,500
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-1.8
-2
-2.2

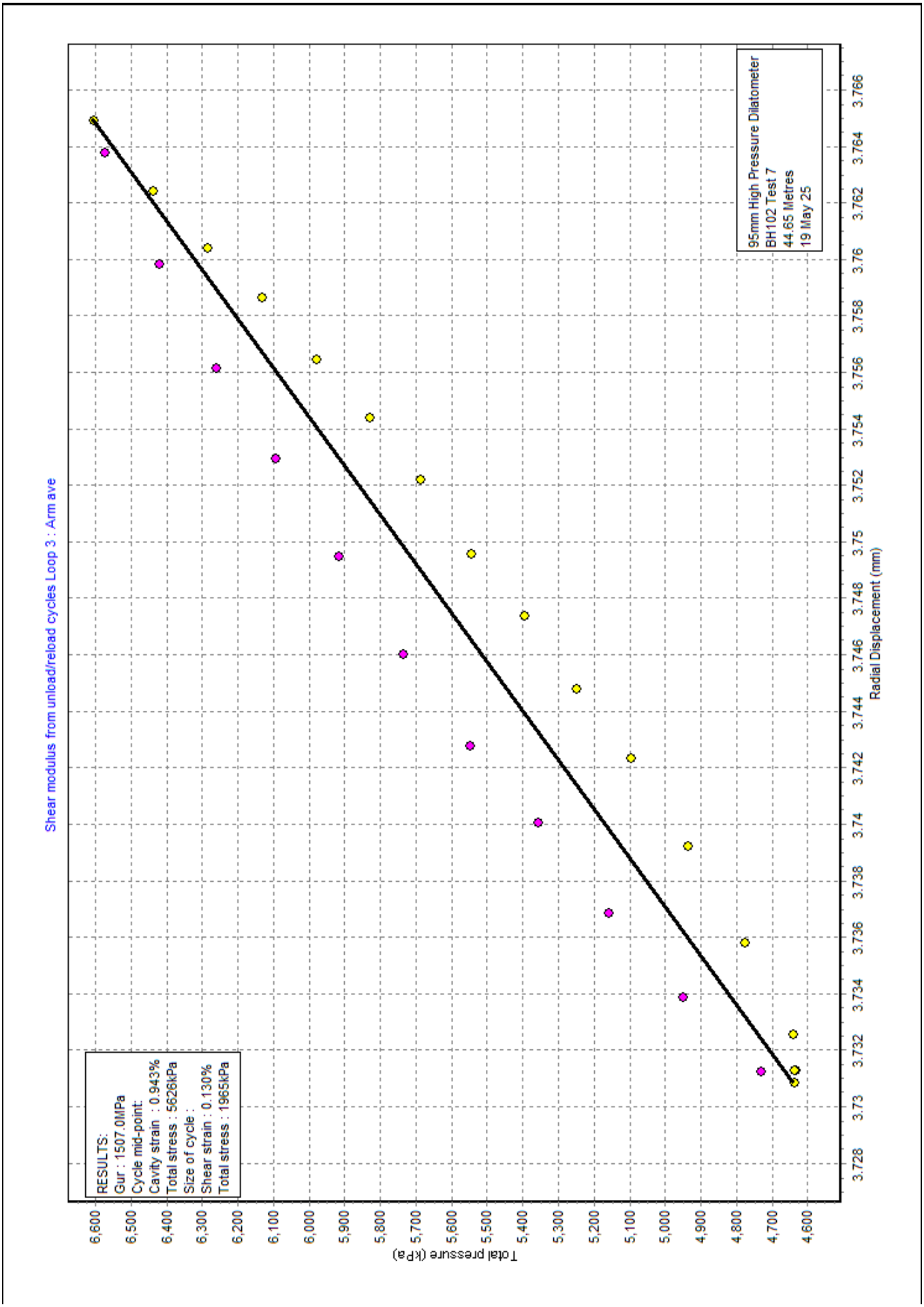

Po of cohesive material (1977, 1990) : Arm ave
95mm High Pressure Dilatometer
BH102 Test 7
44.65 Metres
19 May 25
RESULTS:
Gi : 395.0MPa
Pf : 4512.3kPa
Po : 1418.9kPa
Tf : 3021.1kPa
Po + Tf : 4440.0kPa
Origin : 3.188mm
Total pressure (kPa)
Radial Displacement (mm)
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Shear stress at yield : Arm ave
Ln[shear strain]
Creep readings
Creep movement (mm)
Expansion

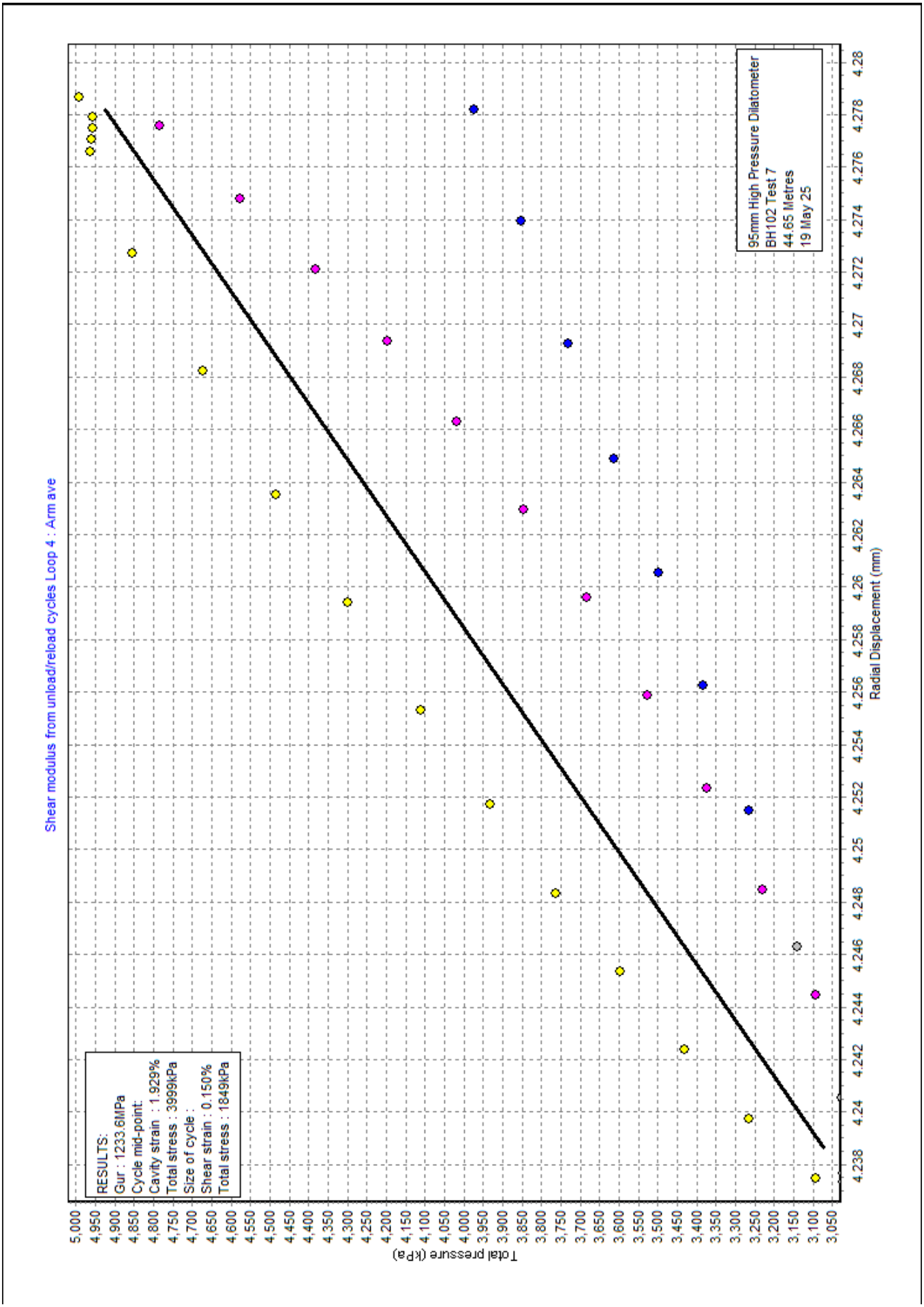

Hughes et al (1977) : Arm ave
RESULTS:
Ambient water pressure : 393.9 kPa
Residual friction angle : 35.0°
Gradient : 0.420
Friction angle : 39.0°
Dilation angle : 5.0°
95mm High Pressure Dilatometer
BH102 Test 7
44.65 Metres
19 May 25
Ln[Effective stress]
Ln[hoop strain]
9.05
9
8.95
8.9
8.85
8.8
8.75
8.7
8.65
8.6
8.55
8.5
8.45
8.4
8.35
8.3
8.25
8.2
8.15
8.1
8.05
8
7.95
7.9
7.85
7.8
7.75
7.7
7.65
-4
-5
-6
-7
-8

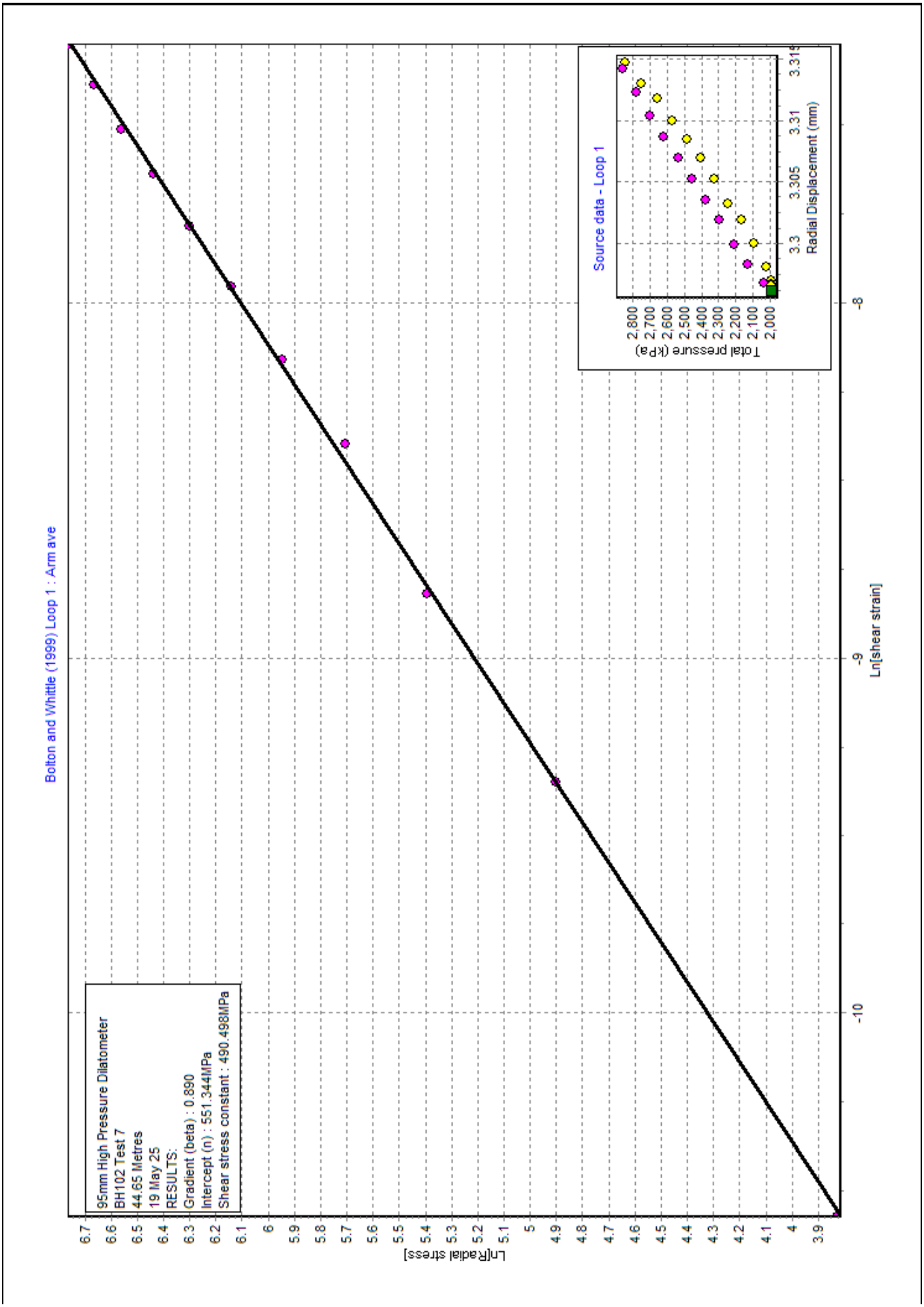

Withers et al (1989) : Arm ave
Ln[P'/P'mx]
Ln[(Emx-Ec)/(1+Emx)]
95mm High Pressure Dilatometer
BH102 Test 7
44.65 Metres
19 May 25
RESULTS:
Ambient water pressure : 393.9 kPa
Residual friction angle : 35.0°
Gradient : -2.796
Friction angle : 36.6°
Dilation angle : 2.0°

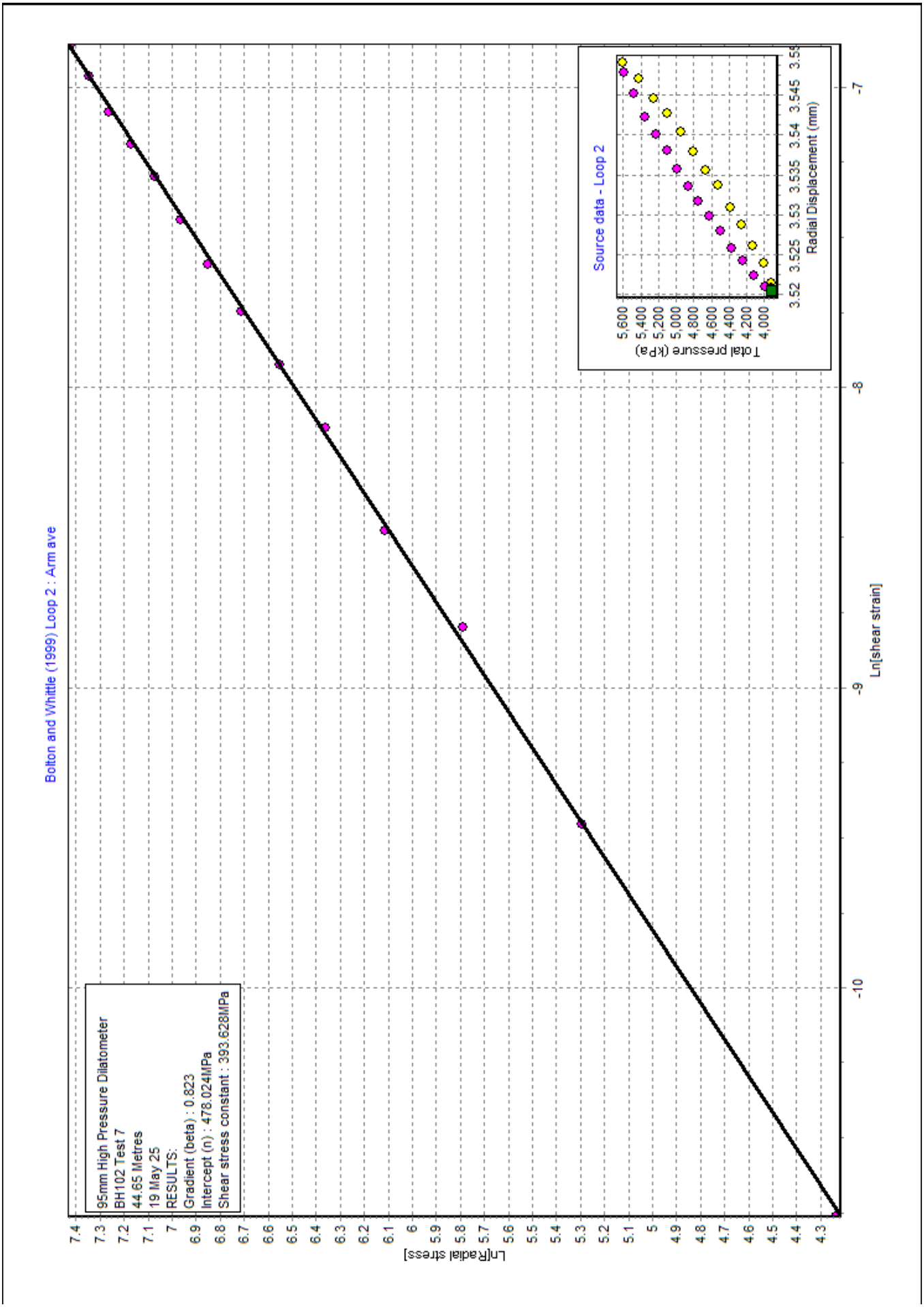

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 1232.5MPa
Cycle mid-point:
Cavity strain : 0.088%
Total stress : 2426kPa
Size of cycle :
Shear strain : 0.069%
Total stress : 853kPa
95mm High Pressure Dilatometer
BH102 Test 7
44.65 Metres
19 May 25
Total pressure (kPa)
Radial Displacement (mm)
2,850
2,800
2,750
2,700
2,650
2,600
2,550
2,500
2,450
2,400
2,350
2,300
2,250
2,200
2,150
2,100
2,050
2,000
3.295
3.296
3.297
3.298
3.299
3.3
3.301
3.302
3.303
3.304
3.305
3.306
3.307
3.308
3.309
3.31
3.311
3.312
3.313
3.314
3.315
3.316
3.317

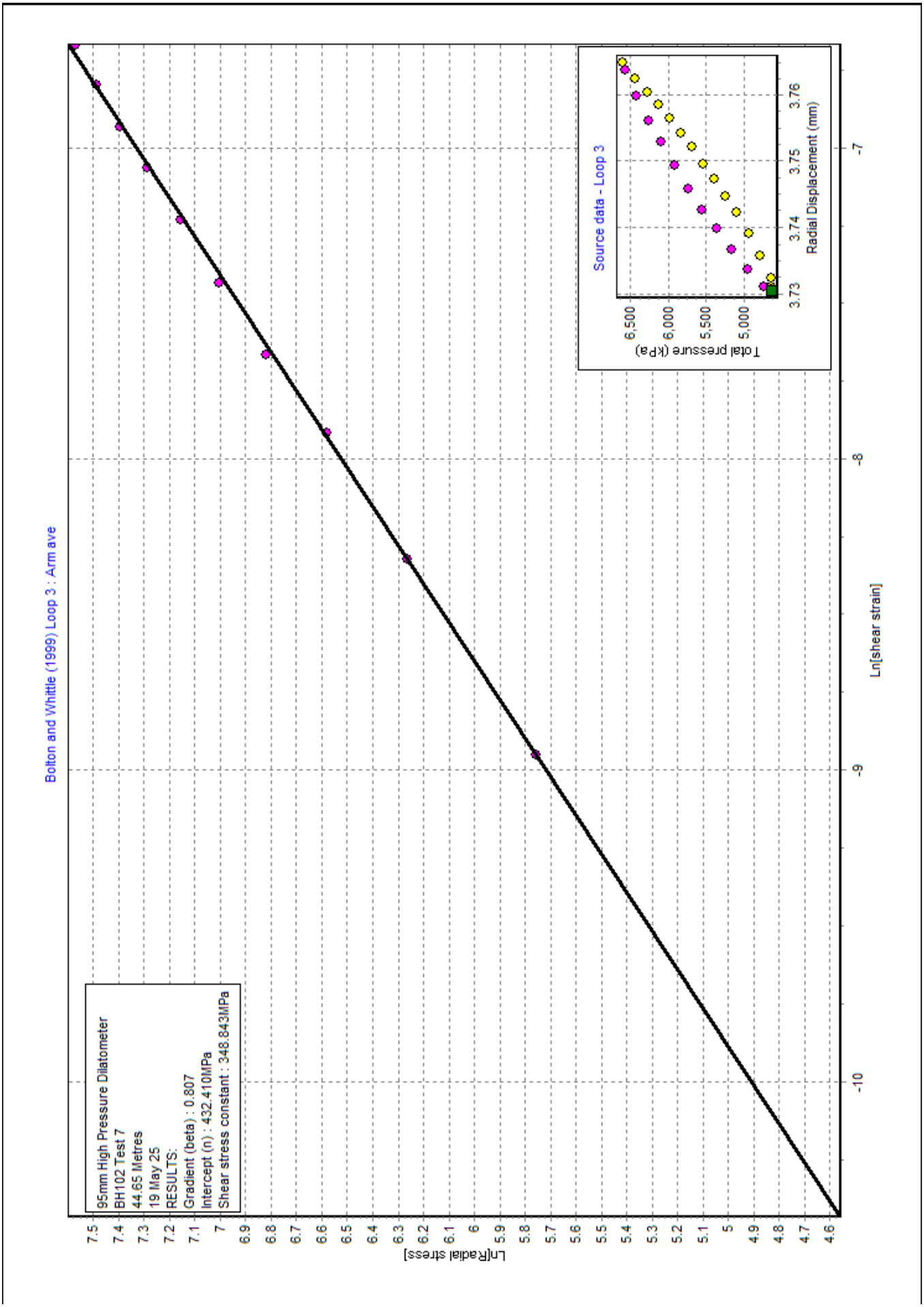

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 1532.6MPa
Cycle mid-point:
Cavity strain : 0.531%
Total stress : 4775kPa
Size of cycle :
Shear strain : 0.109%
Total stress : 1668kPa
95mm High Pressure Dilatometer
BH102 Test 7
44.65 Metres
19 May 25
Total pressure (kPa)
Radial Displacement (mm)

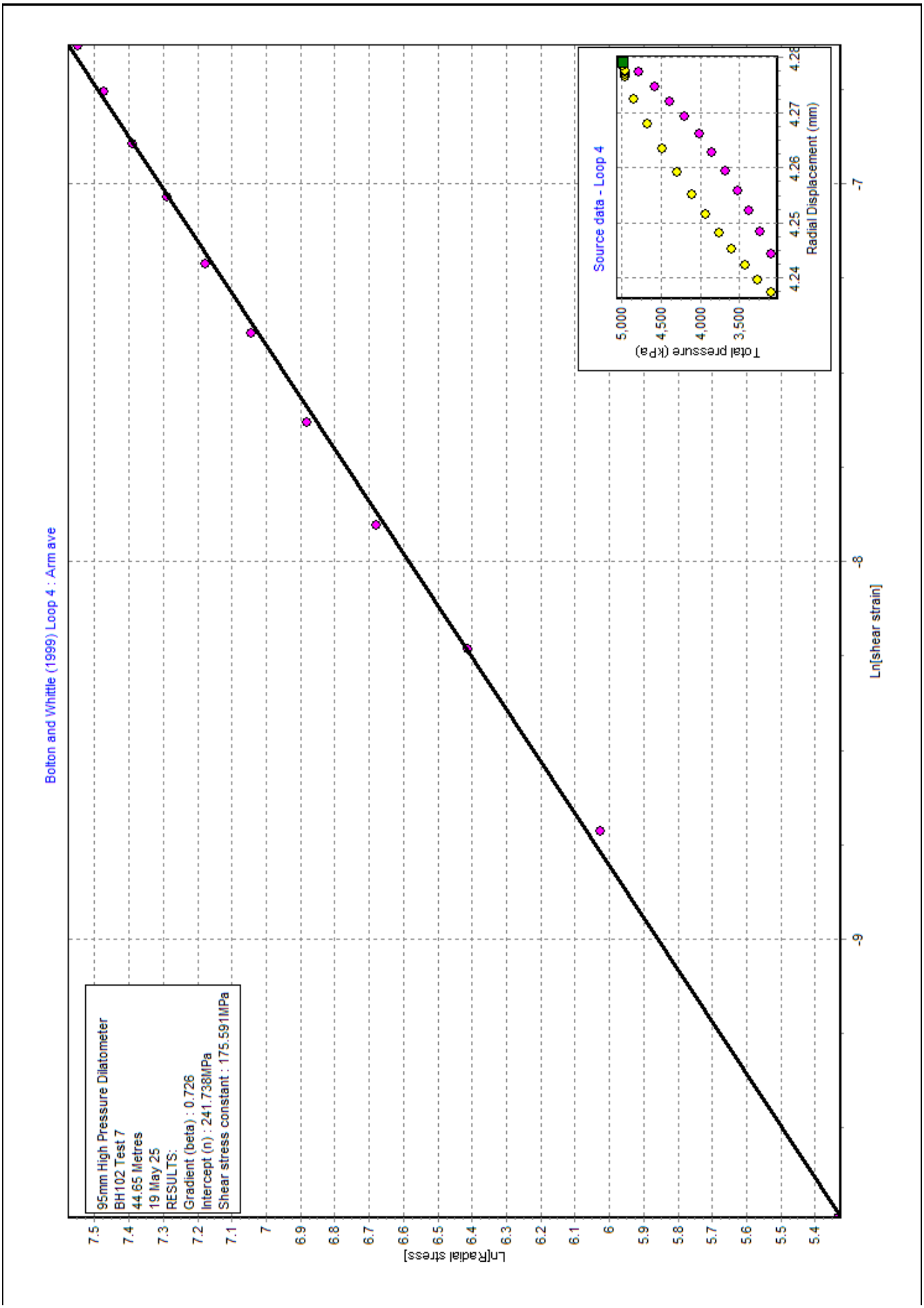

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 1507.0MPa
Cycle mid-point:
Cavity strain : 0.943%
Total stress : 5626kPa
Size of cycle :
Shear strain : 0.130%
Total stress : 1965kPa
95mm High Pressure Dilatometer
BH102 Test 7
44.65 Metres
19 May 25
Total pressure (kPa)
6,600
6,500
6,400
6,300
6,200
6,100
6,000
5,900
5,800
5,700
5,600
5,500
5,400
5,300
5,200
5,100
5,000
4,900
4,800
4,700
4,600
Radial Displacement (mm)
3.728
3.73
3.732
3.734
3.736
3.738
3.74
3.742
3.744
3.746
3.748
3.75
3.752
3.754
3.756
3.758
3.76
3.762
3.764
3.766

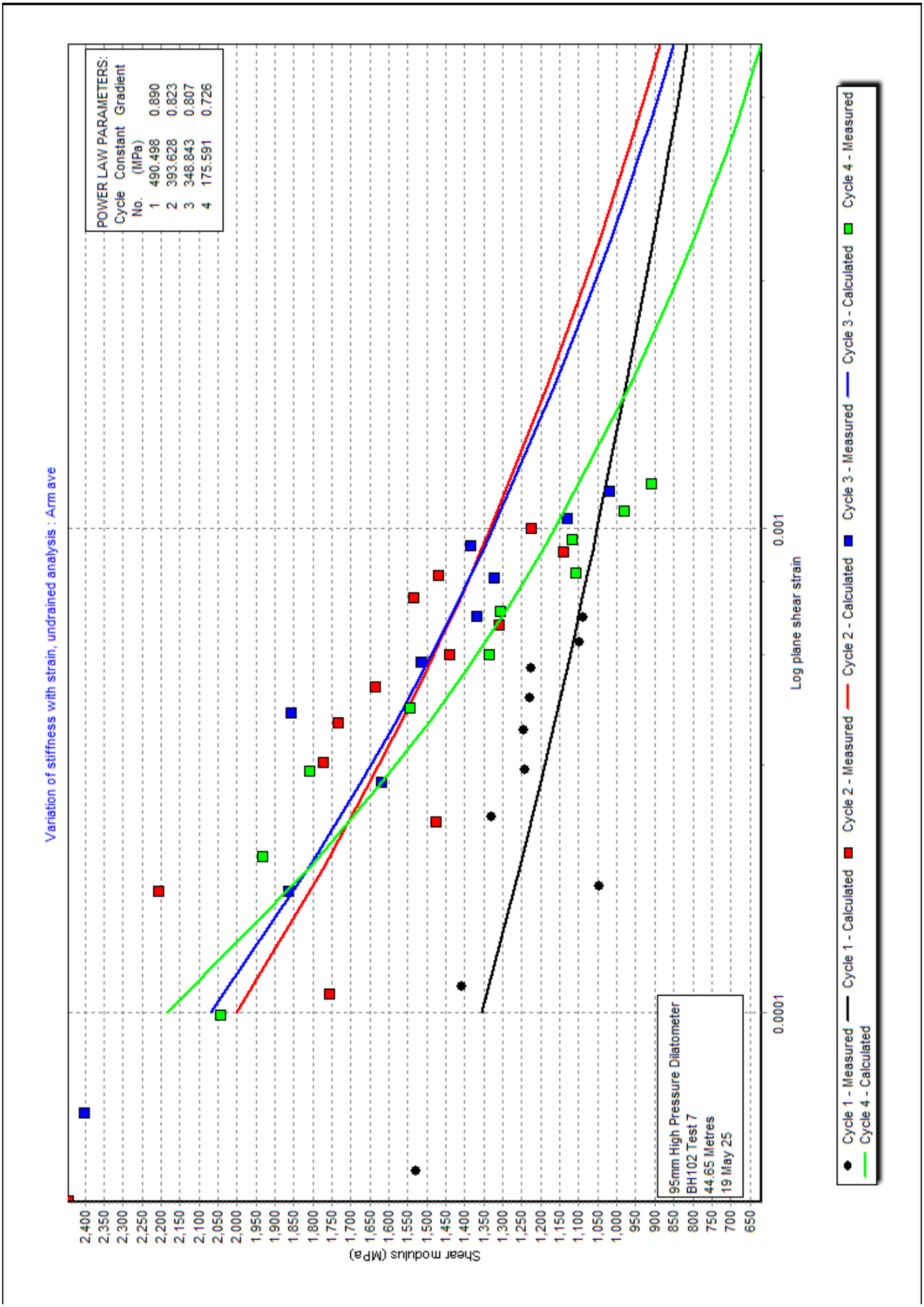

Shear modulus from unload/reload cycles Loop 4 : Arm ave
RESULTS:
Gur : 1233.6MPa
Cycle mid-point:
Cavity strain : 1.929%
Total stress : 3999kPa
Size of cycle :
Shear strain : 0.150%
Total stress : 1849kPa
95mm High Pressure Dilatometer
BH102 Test 7
44.65 Metres
19 May 25
Total pressure (kPa)
Radial Displacement (mm)

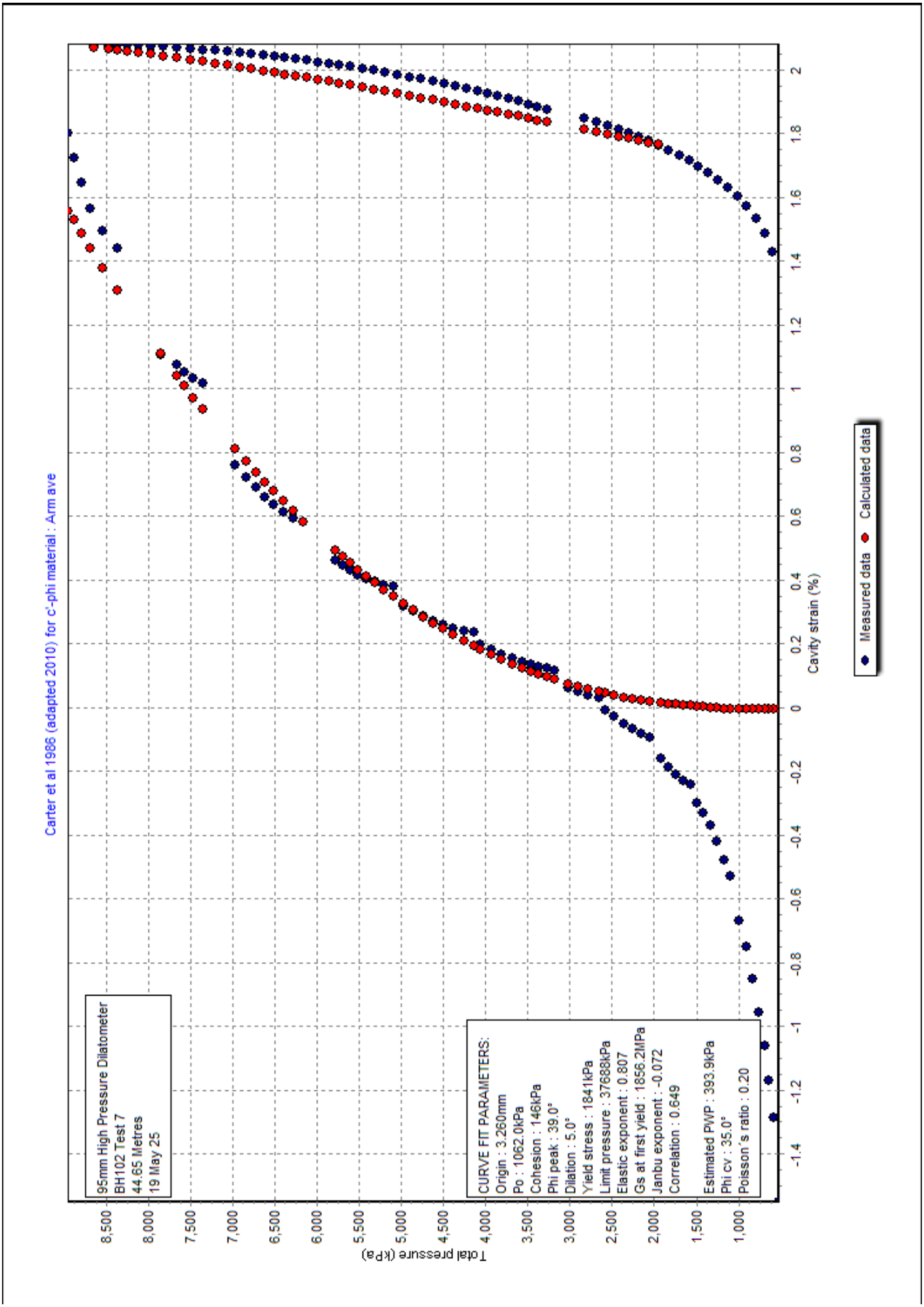

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 7
44.65 Metres
19 May 25
RESULTS:
Gradient (beta) : 0.890
Intercept (n) : 551.344MPa
Shear stress constant : 490.498MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

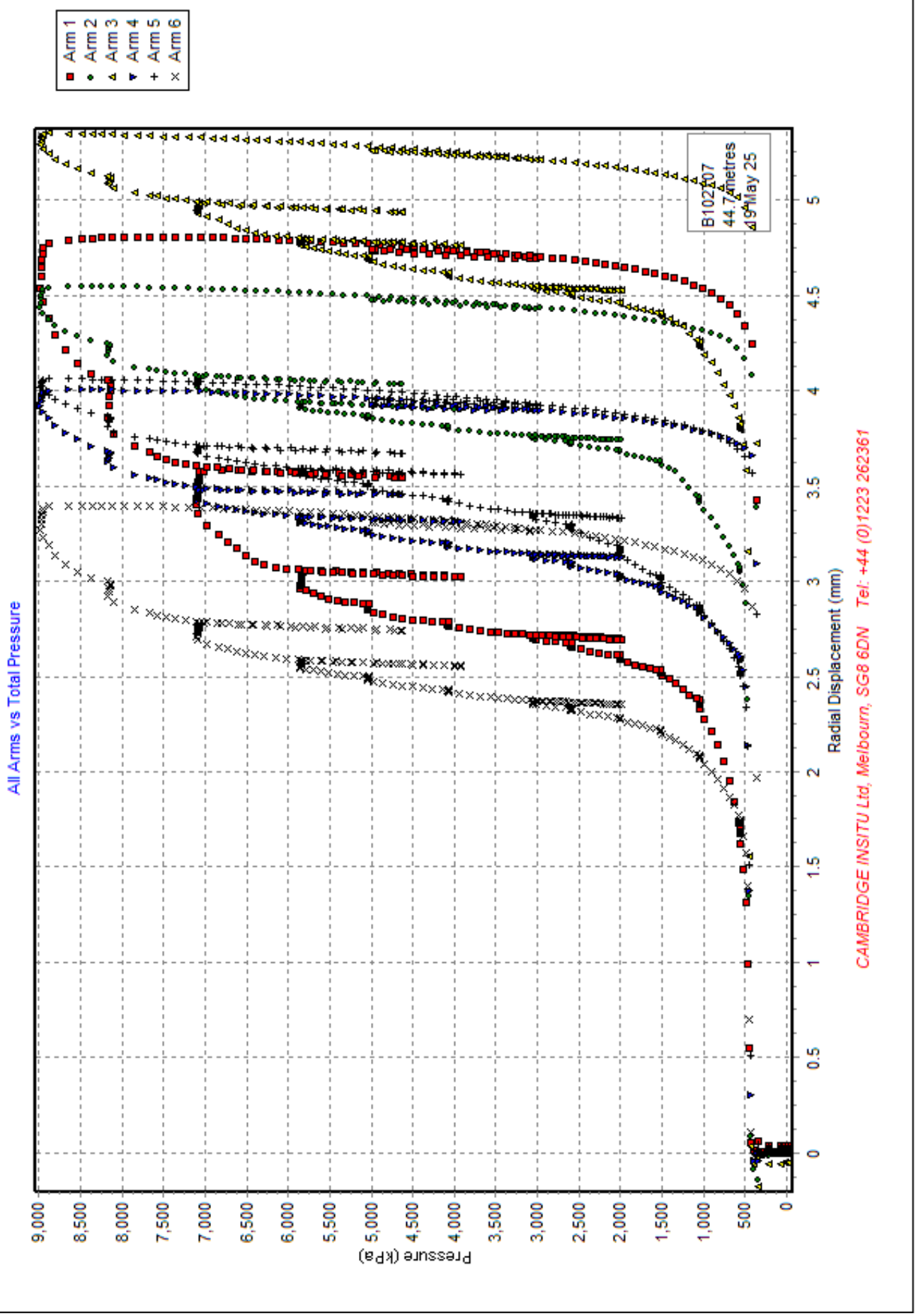

Bolton and Whittle (1999) Loop 2 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 7
44.65 Metres
19 May 25
RESULTS:
Gradient (beta) : 0.823
Intercept (n) : 478.024MPa
Shear stress constant : 393.628MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

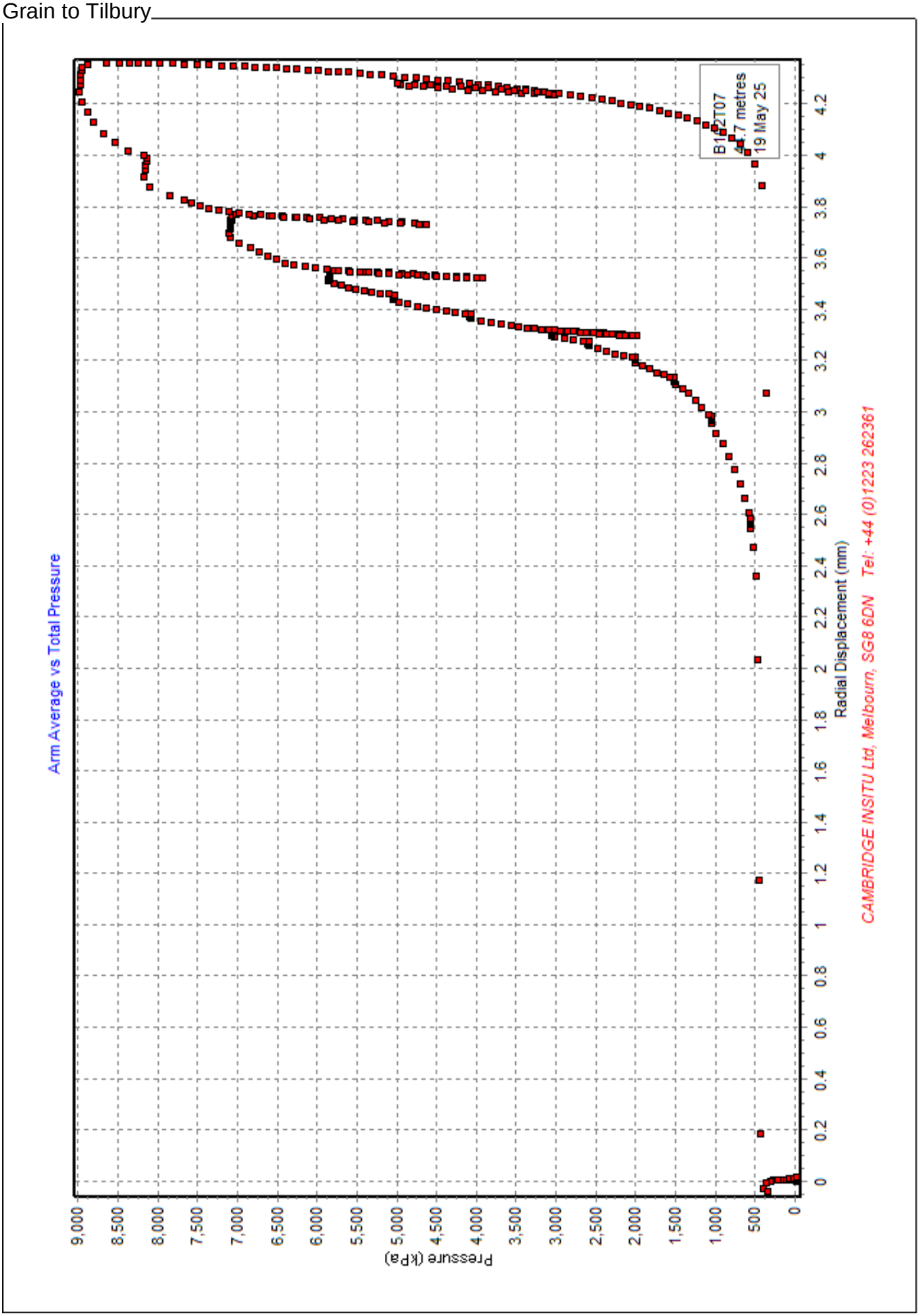

Bolton and Whittle (1999) Loop 3 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 7
44.65 Metres
19 May 25
RESULTS:
Gradient (beta) : 0.807
Intercept (n) : 432.410MPa
Shear stress constant : 348.843MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)

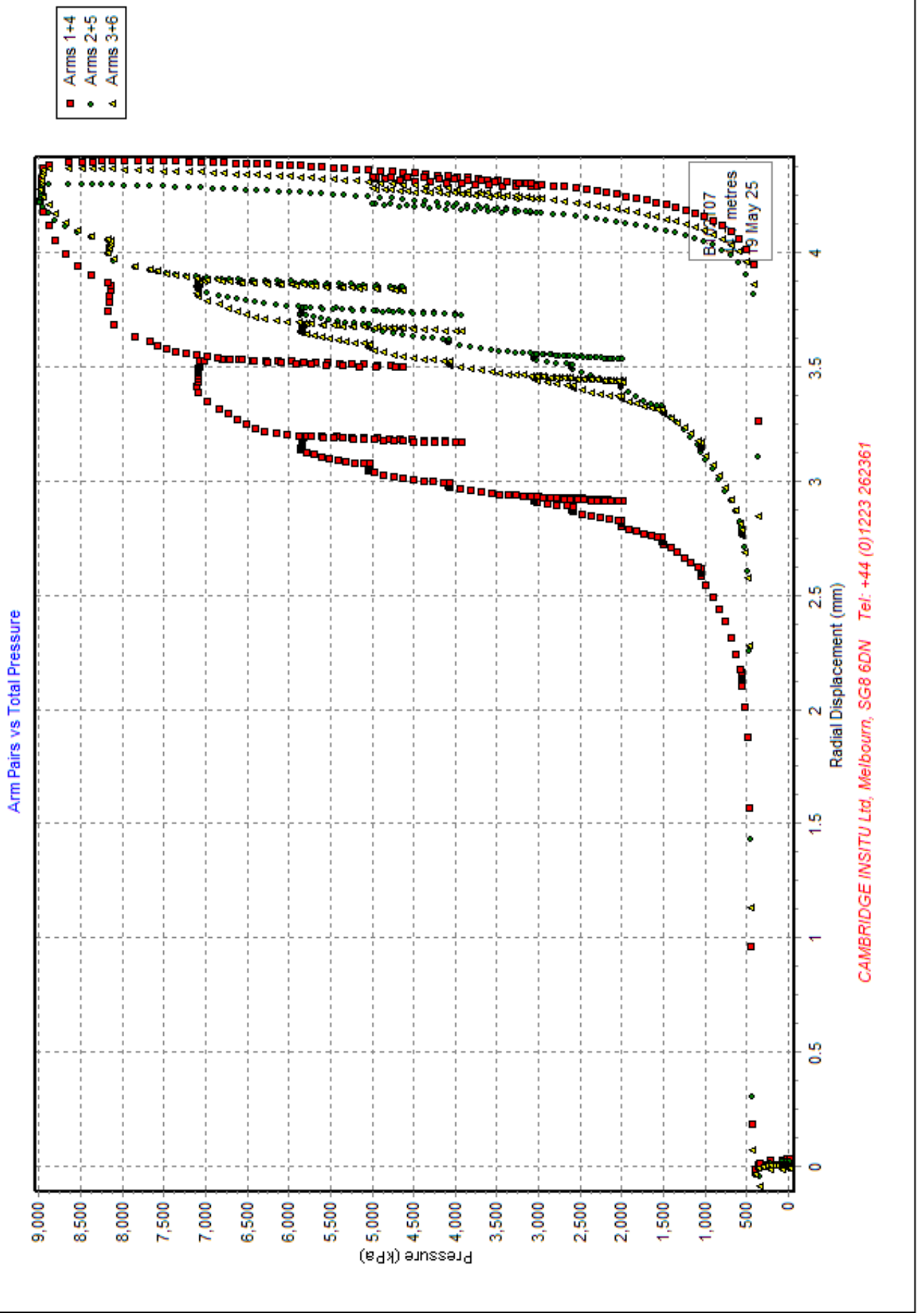

Bolton and Whittle (1999) Loop 4 : Arm ave
95mm High Pressure Dilatometer
BH102 Test 7
44.65 Metres
19 May 25
RESULTS:
Gradient (beta) : 0.726
Intercept (n) : 241.738MPa
Shear stress constant : 175.591MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 4
Total pressure (kPa)
Radial Displacement (mm)

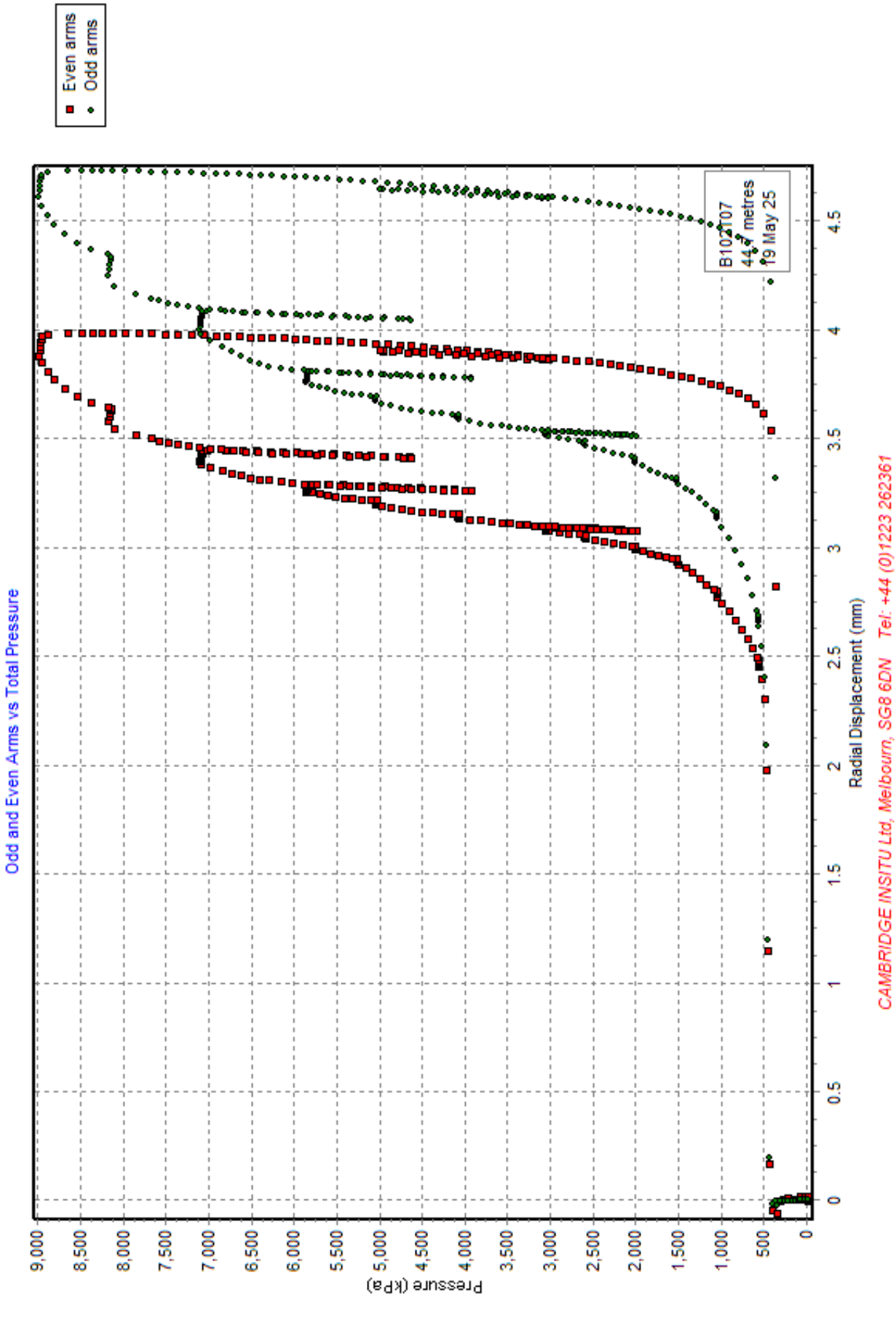

Variation of stiffness with strain, undrained analysis : Arm ave
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 490.498 0.890
2 393.628 0.823
3 348.843 0.807
4 175.591 0.726
95mm High Pressure Dilatometer
BH102 Test 7
44.65 Metres
19 May 25
Shear modulus (MPa)
Log plane shear strain
0.0001
0.001
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
Cycle 4 - Measured
Cycle 4 - Calculated


Carter et al 1986 (adapted 2010) for c'-phi material : Arm ave
95mm High Pressure Dilatometer
BH102 Test 7
44.65 Metres
19 May 25
CURVE FIT PARAMETERS:
Origin : 3.260mm
Po : 1062.0kPa
Cohesion : 146kPa
Phi peak : 39.0°
Dilation : 5.0°
Yield stress : 1841kPa
Limit pressure : 37688kPa
Elastic exponent : 0.807
Gs at first yield : 1856.2MPa
Janbu exponent : -0.072
Correlation : 0.649
Estimated PWP : 393.9kPa
Phi cv : 35.0°
Poisson's ratio : 0.20
Total pressure (kPa)
Cavity strain (%)
Measured data
Calculated data


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
B102407
44.7 metres
19 May 25
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arm Average vs Total Pressure
Pressure (kPa)
9,000
8,500
8,000
7,500
7,000
6,500
6,000
5,500
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Radial Displacement (mm)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
4.2
B1 2T07
4.7 metres
19 May 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arms 1+4
Arms 2+5
Arms 3+6
BH107
metres
19 May 25
Arm Pairs vs Total Pressure
Pressure (kPa)
9,000
8,500
8,000
7,500
7,000
6,500
6,000
5,500
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Radial Displacement (mm)
0
0.5
1
1.5
2
2.5
3
3.5
4
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
B102107
44.7 metres
19 May 25
Odd and Even Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to TIlbury
BH105 Test 1 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Grain to Tilbury
Borehole : BH105
Test name : BH105 Test 1
Test date : 19 Jun 25
Test depth : 33.90 Metres
Water table : 9.6 Metres
Ambient PWP : 238.4 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDP/RW on 21 Jul 25

Remarks:

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=3.41"
Po from Marsland & Randolph (kPa) : "Arm ave=466.2"
Best estimate of Po (kPa) : "Arm ave=459.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=1631.6"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 32.0
Angle of internal friction (°) : "Arm ave=36.4"
Dilation angle (°) : "Arm ave=5.3"
Gradient of log-log plot : "Arm ave=0.407"

[Withers et al 1989]
Angle of internal friction (°) : "Arm ave=30.4"
Dilation angle (°) : "Arm ave=-1.9"
Gradient of log-log plot : "Arm ave=-2.152"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=23.0"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	168.0	-0.592	852	0.132	221
Arm ave	2	392.7	2.165	1633	0.104	410
Arm ave	3	571.2	6.488	2332	0.103	587
Arm ave	4	417.9	11.176	1652	0.197	824

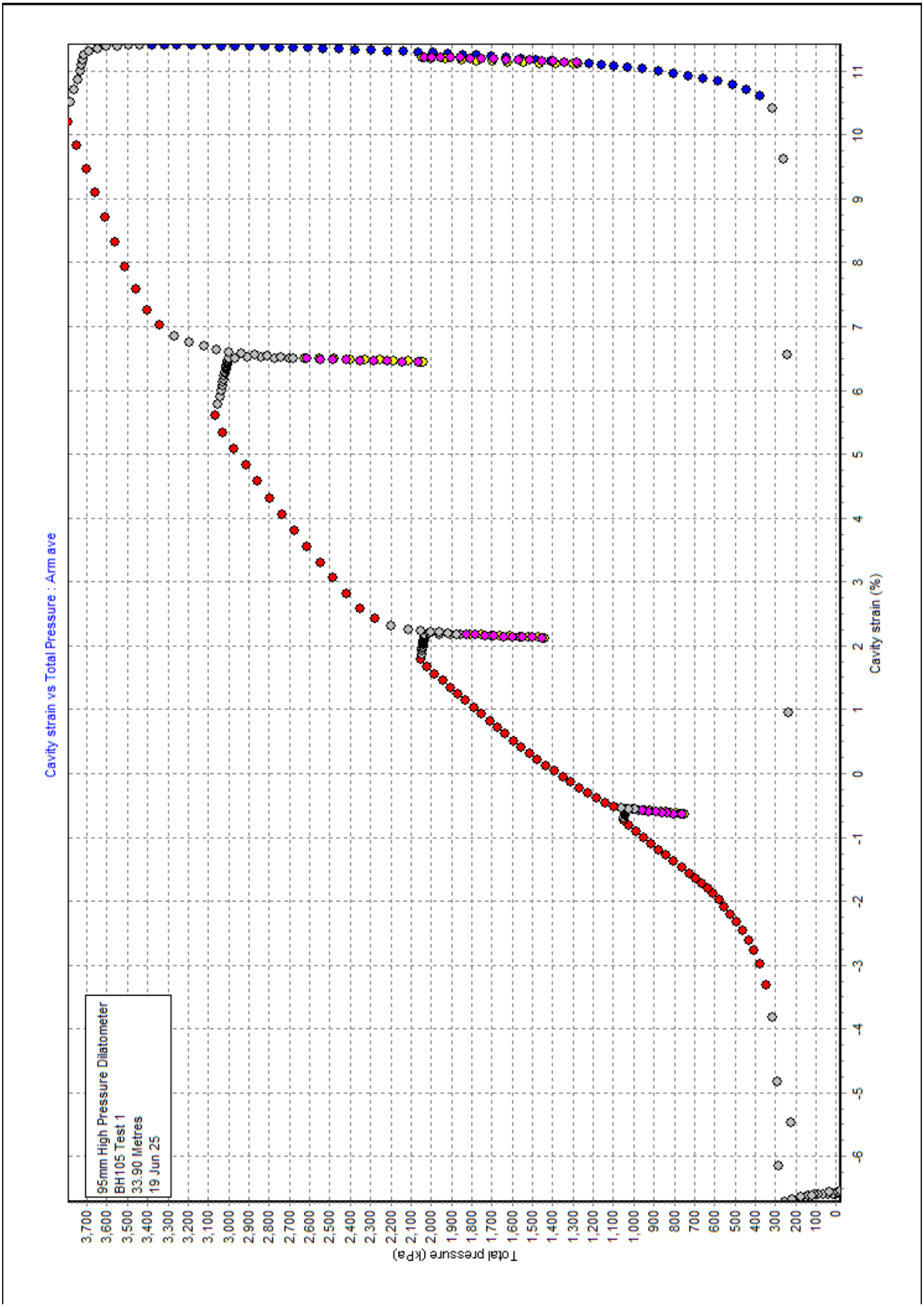
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

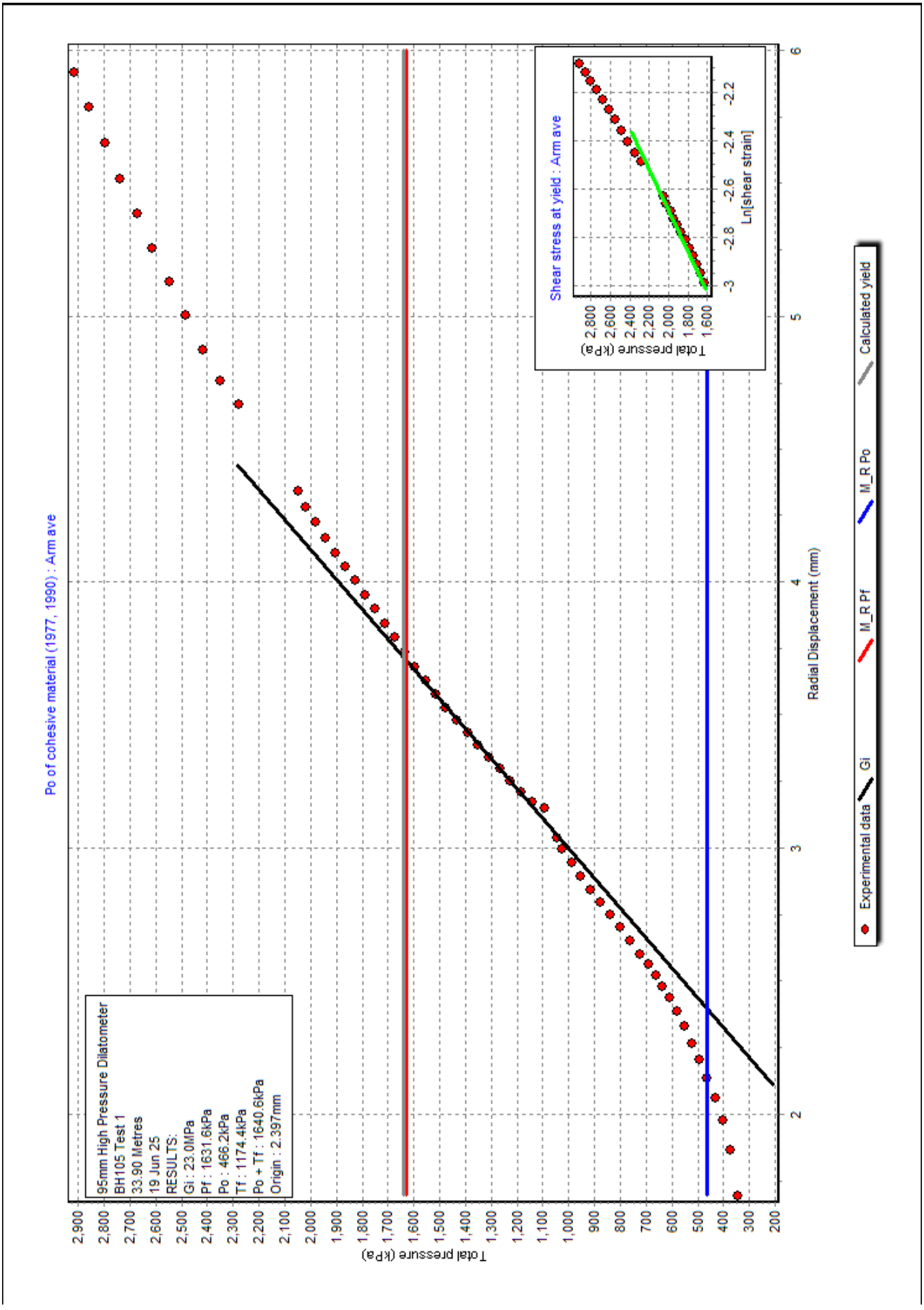
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	60.718	51.363	0.846
Arm ave	2	85.480	66.002	0.772
Arm ave	3	99.926	73.620	0.737
Arm ave	4	56.965	37.718	0.662

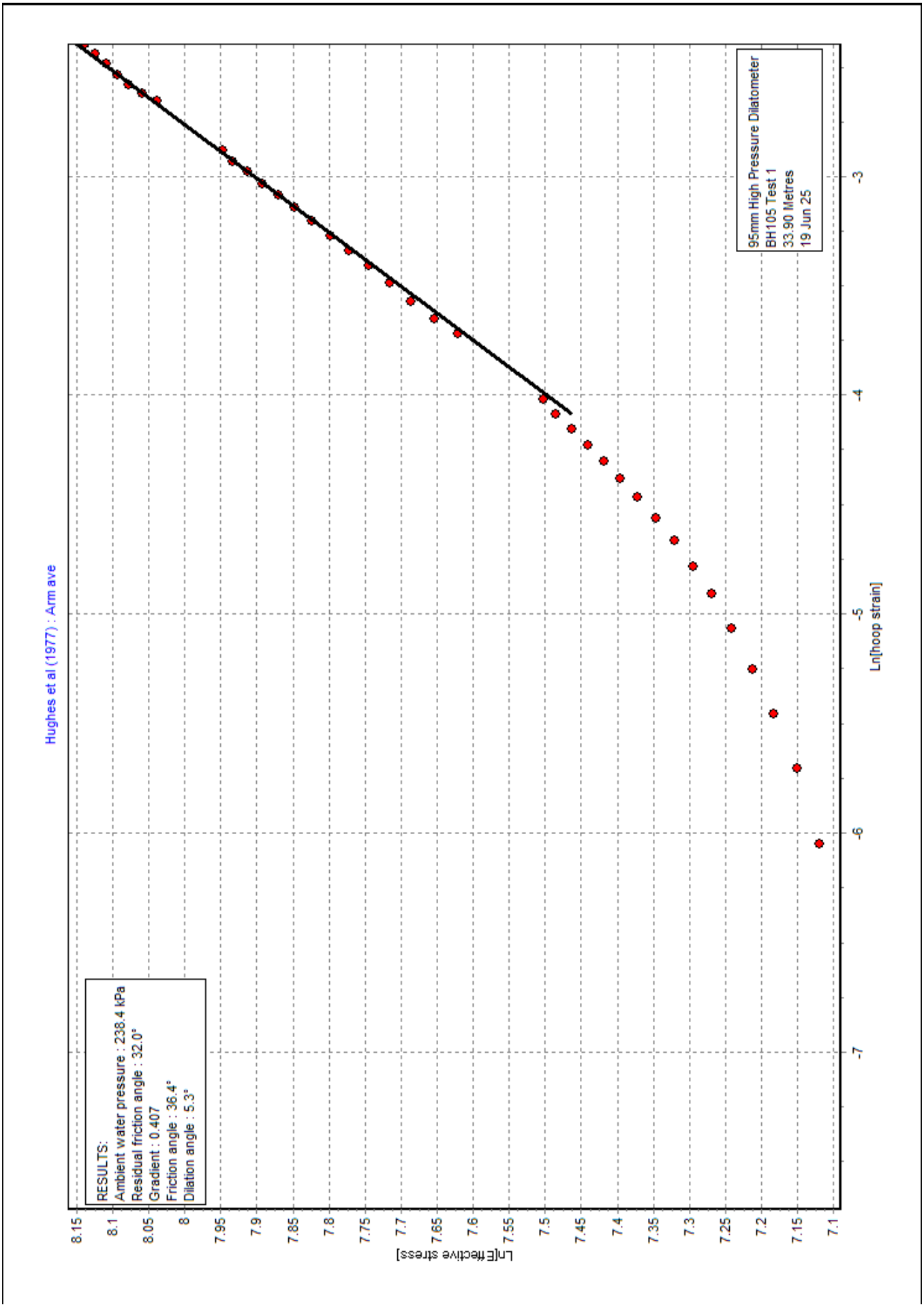
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 3.41
Po (kPa) : 459
Cohesion (kPa) : 25
Angle of peak friction (deg) : 36.4
Angle of peak dilation (deg) : 5.3
Total yield stress (kPa) : 719

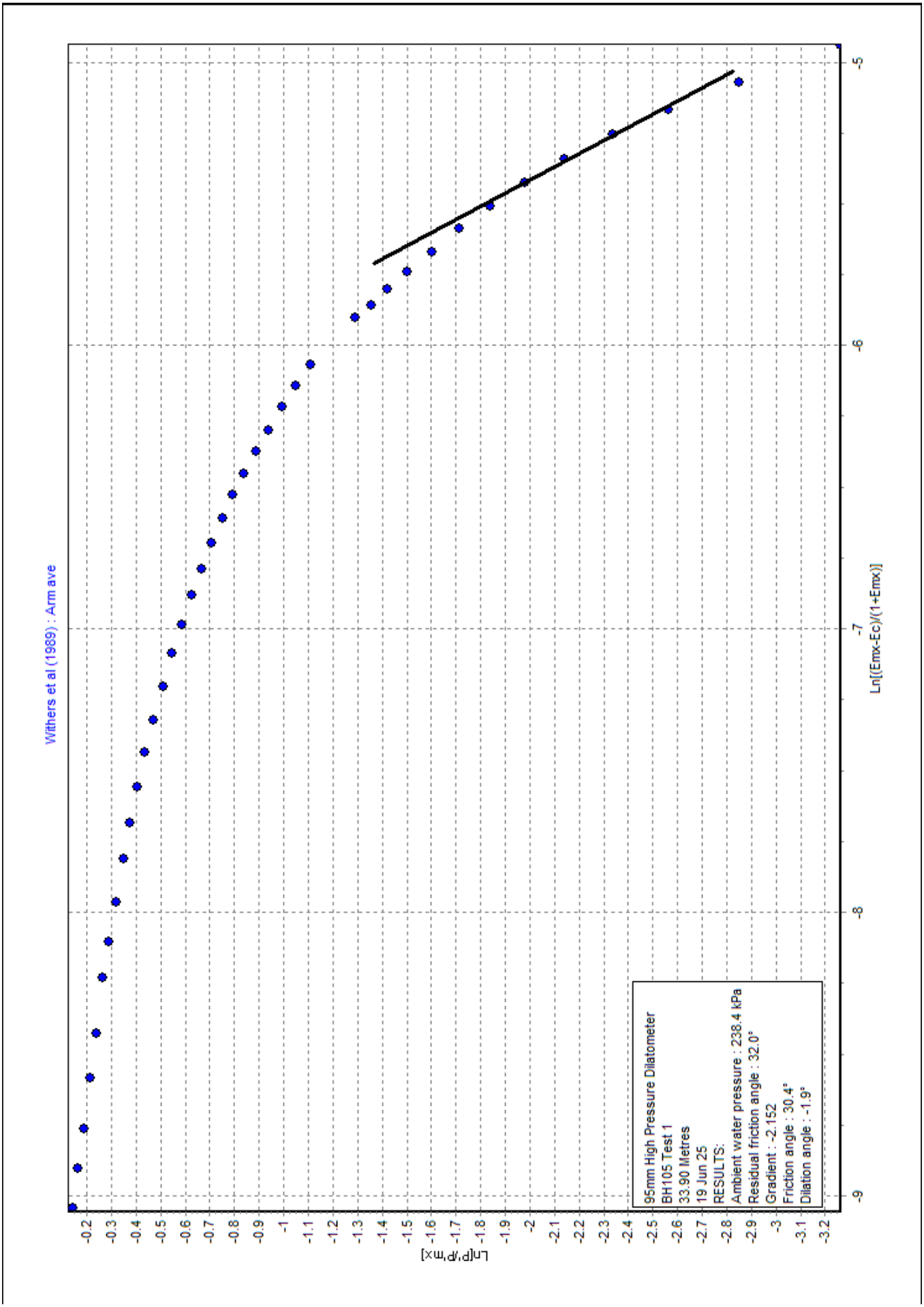
Grain to TIlbury
BH105 Test 1 - SUMMARY OF RESULTS

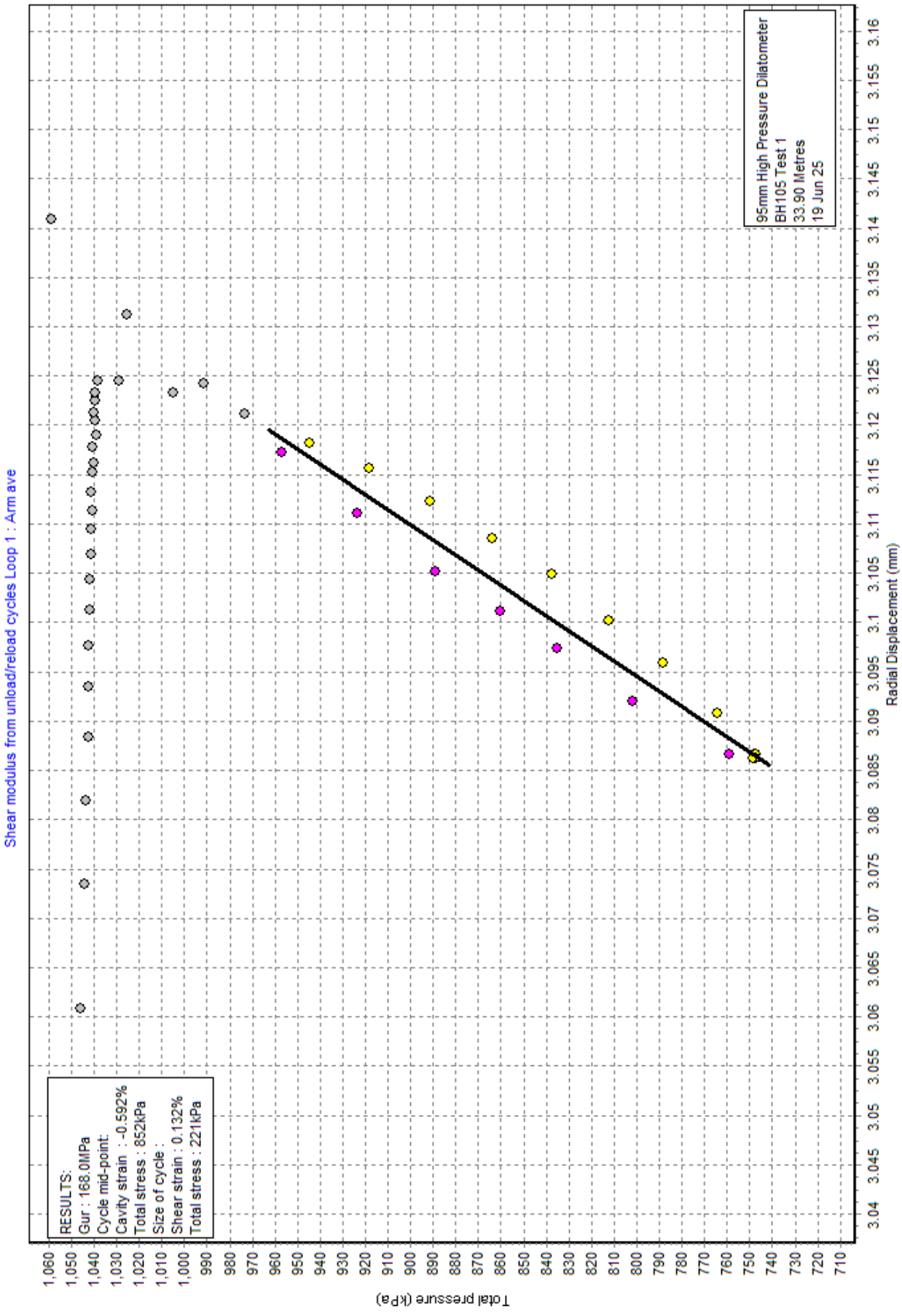
Total limit stress (kPa)	:	7450
G at first yield (MPa)	:	212.9
Non-linear exponent	:	0.737
Janbu exponent	:	0.377
Correlation	:	0.533
Ambient pore water pressure (kPa)	:	238
Residual friction angle (deg)	:	32.0
Poisson's ratio	:	0.20

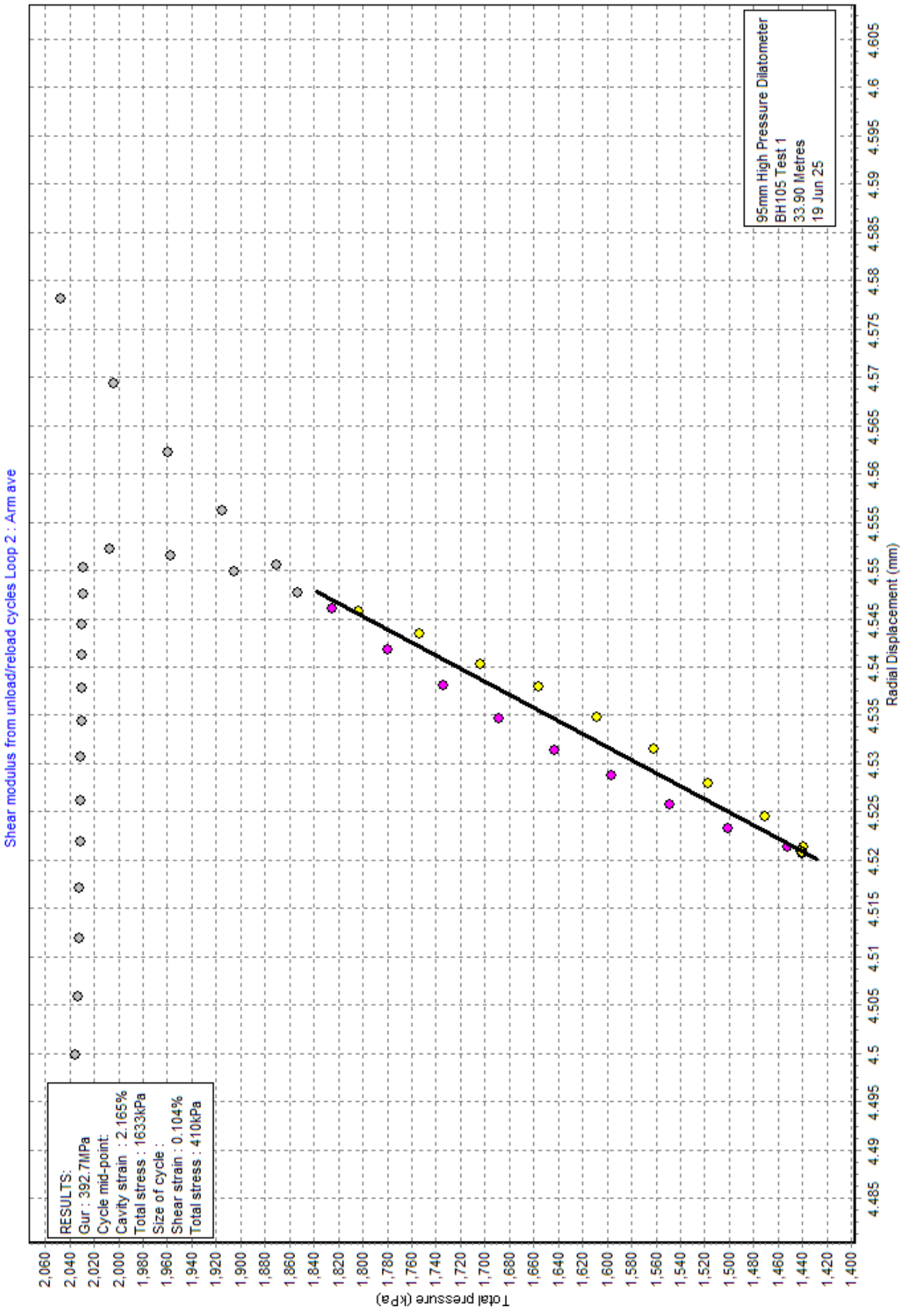

Cavity strain vs Total Pressure : Arm ave
95mm High Pressure Dilatometer
BH105 Test 1
33.90 Metres
19 Jun 25
Total pressure (kPa)
Cavity strain (%)

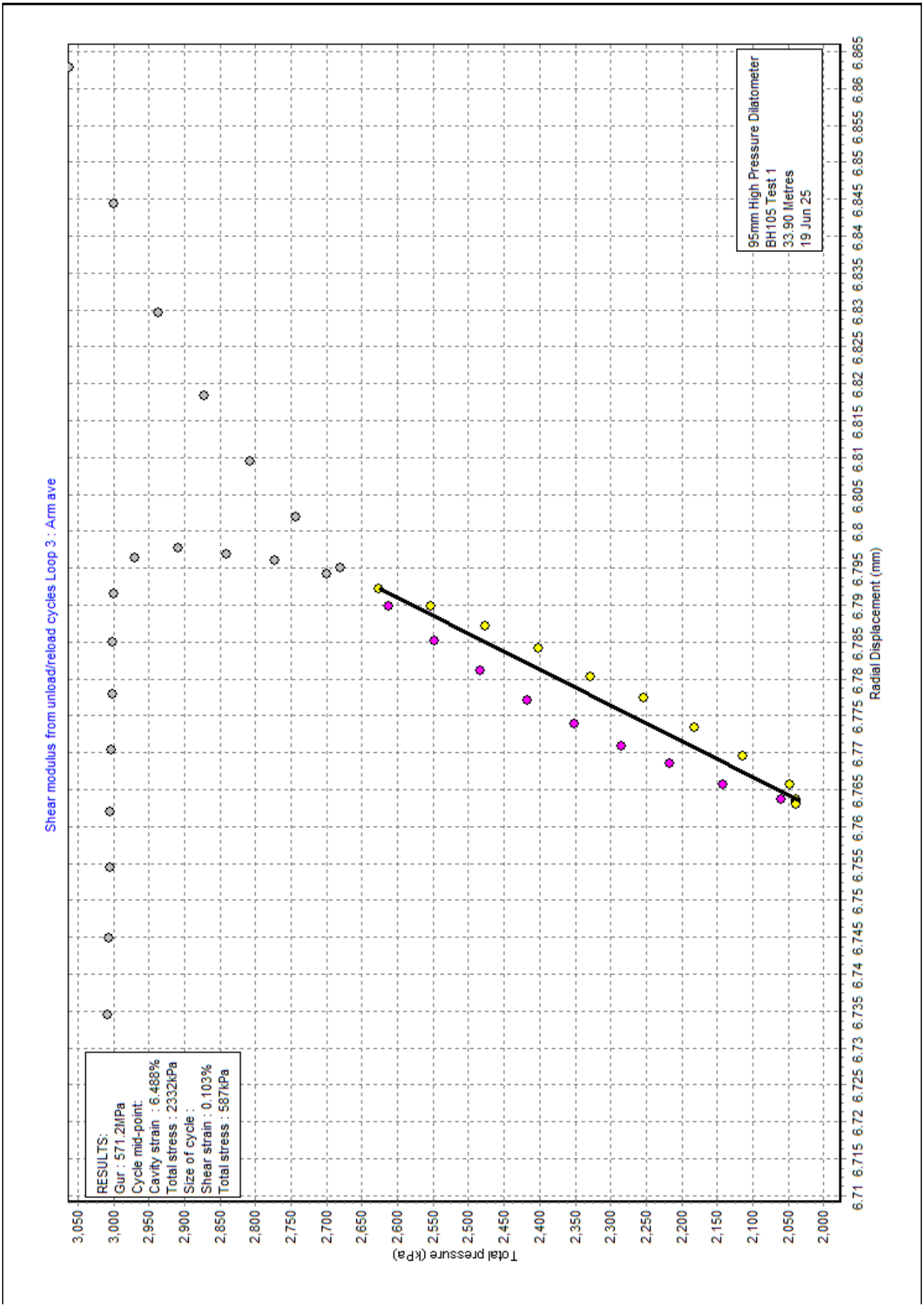

Po of cohesive material (1977, 1990) : Arm ave
95mm High Pressure Dilatometer
BH105 Test 1
33.90 Metres
19 Jun 25
RESULTS:
Gi : 23.0MPa
Pf : 1631.6kPa
Po : 466.2kPa
Tf : 1174.4kPa
Po + Tf : 1640.6kPa
Origin : 2.397mm
Total pressure (kPa)
Radial Displacement (mm)
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Shear stress at yield : Arm ave
Total pressure (kPa)
Ln[shear strain]

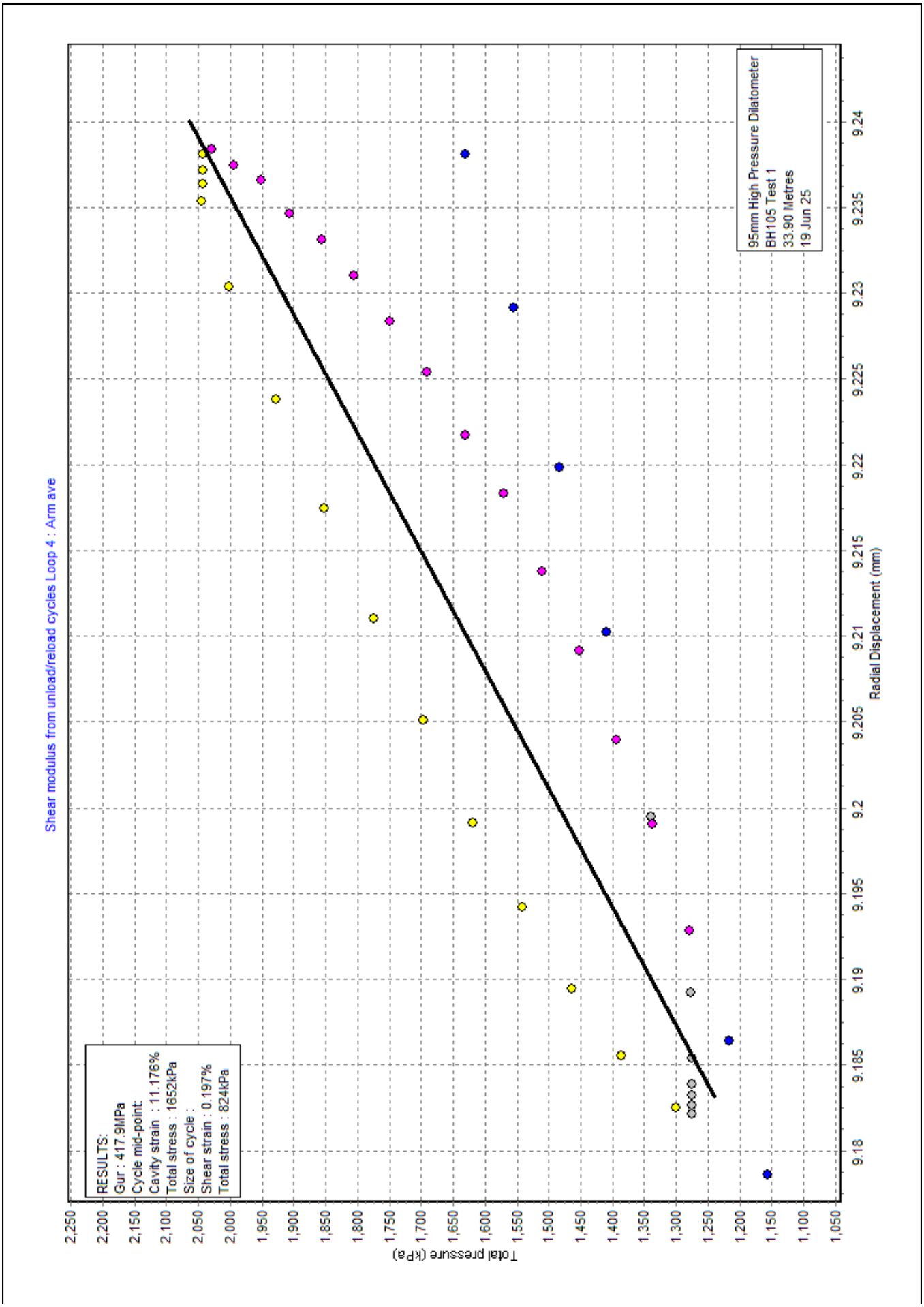

Hughes et al (1977) : Arm ave
RESULTS:
Ambient water pressure : 238.4 kPa
Residual friction angle : 32.0°
Gradient : 0.407
Friction angle : 36.4°
Dilation angle : 5.3°
95mm High Pressure Dilatometer
BH105 Test 1
33.90 Metres
19 Jun 25
Ln[Effective stress]
Ln[hoop strain]
8.15
8.1
8.05
8
7.95
7.9
7.85
7.8
7.75
7.7
7.65
7.6
7.55
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
-3
-4
-5
-6
-7

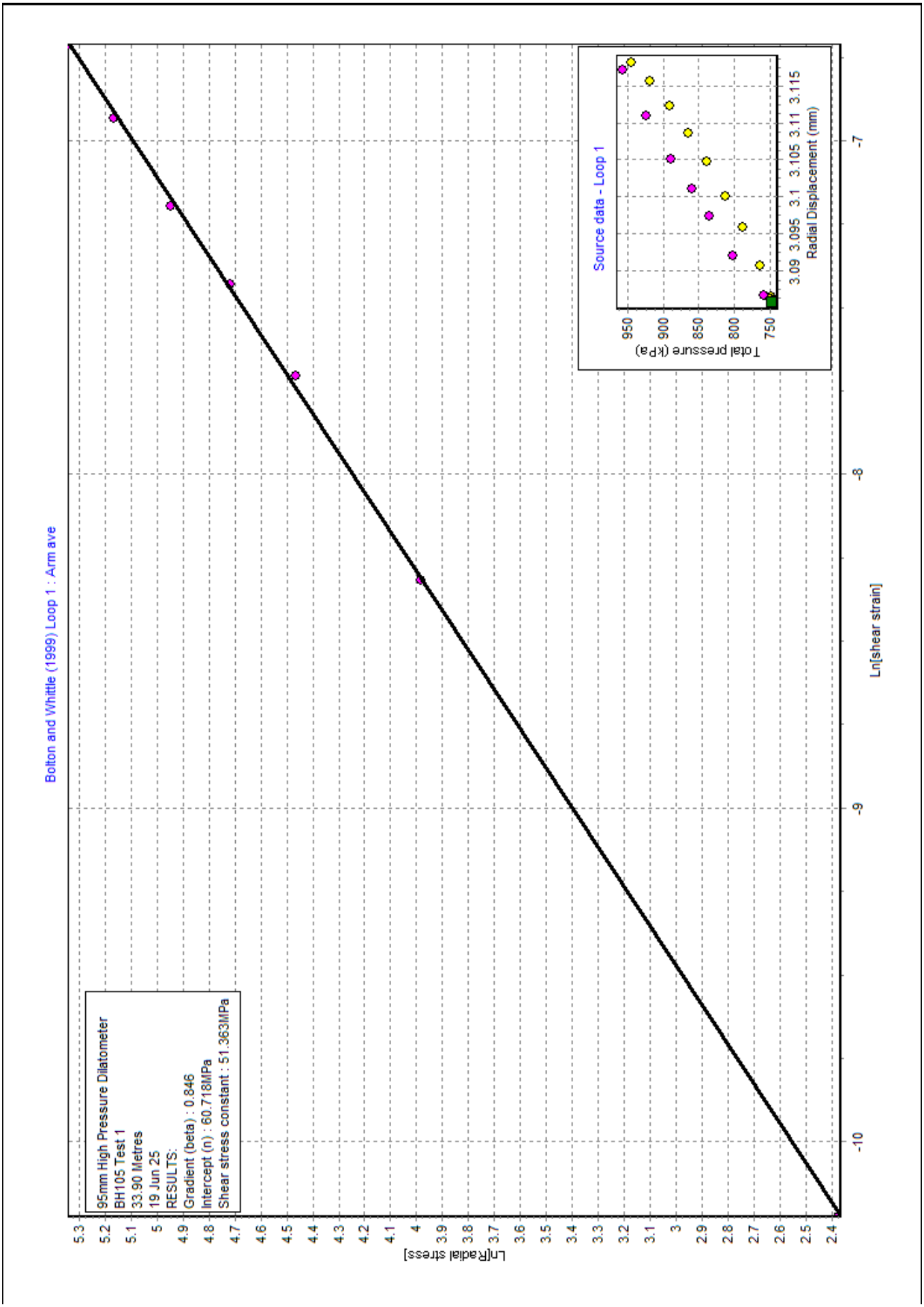

Withers et al (1989) : Arm ave
Ln[(Emx-Ec)/(1+Emx)]
Ln[P'/P'mx]
95mm High Pressure Dilatometer
BH105 Test 1
33.90 Metres
19 Jun 25
RESULTS:
Ambient water pressure : 238.4 kPa
Residual friction angle : 32.0°
Gradient : -2.152
Friction angle : 30.4°
Dilation angle : -1.9°

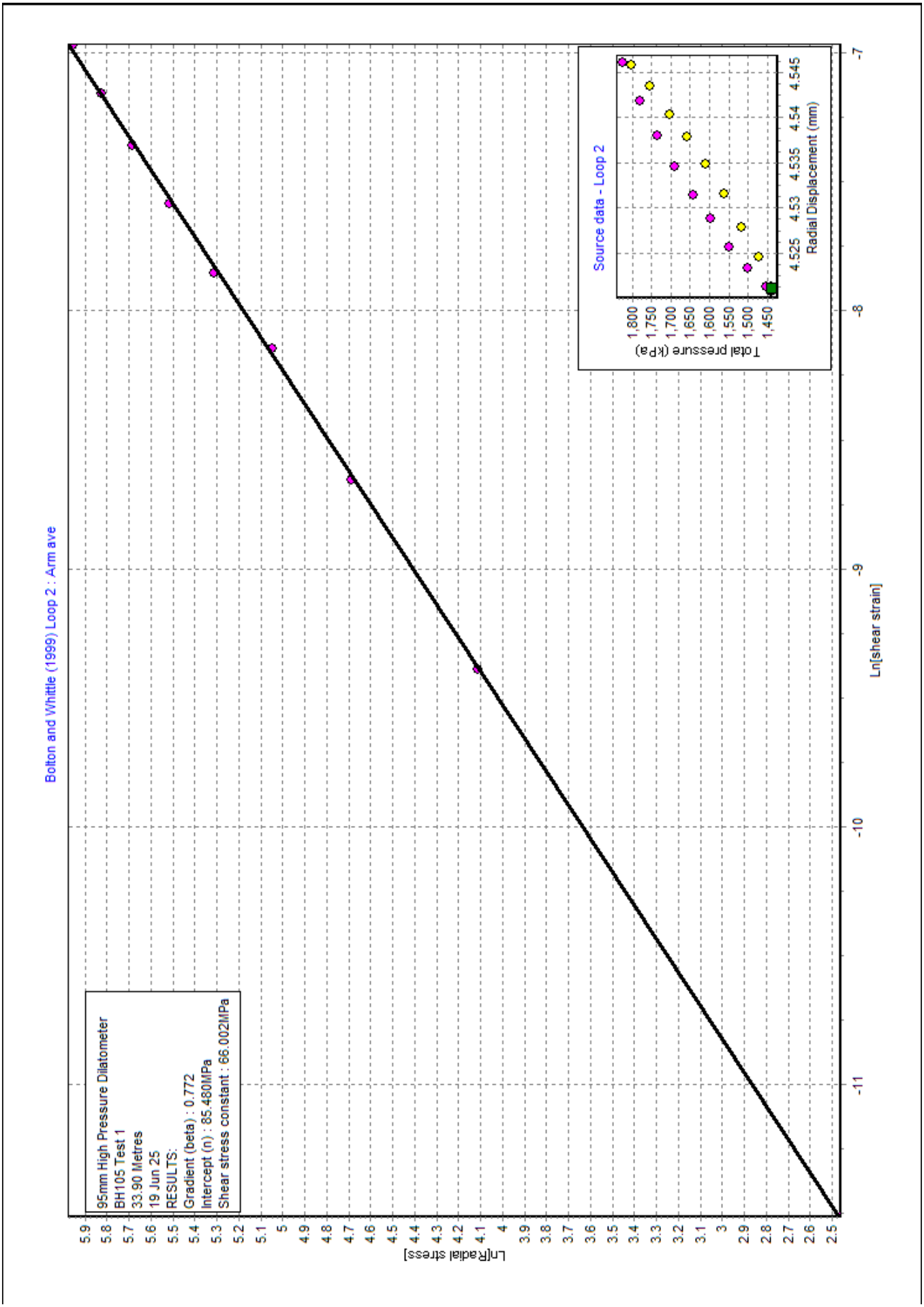

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 168.0MPa
Cycle mid-point:
Cavity strain : -0.592%
Total stress : 852kPa
Size of cycle :
Shear strain : 0.132%
Total stress : 221kPa
95mm High Pressure Dilatometer
BH105 Test 1
33.90 Metres
19 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

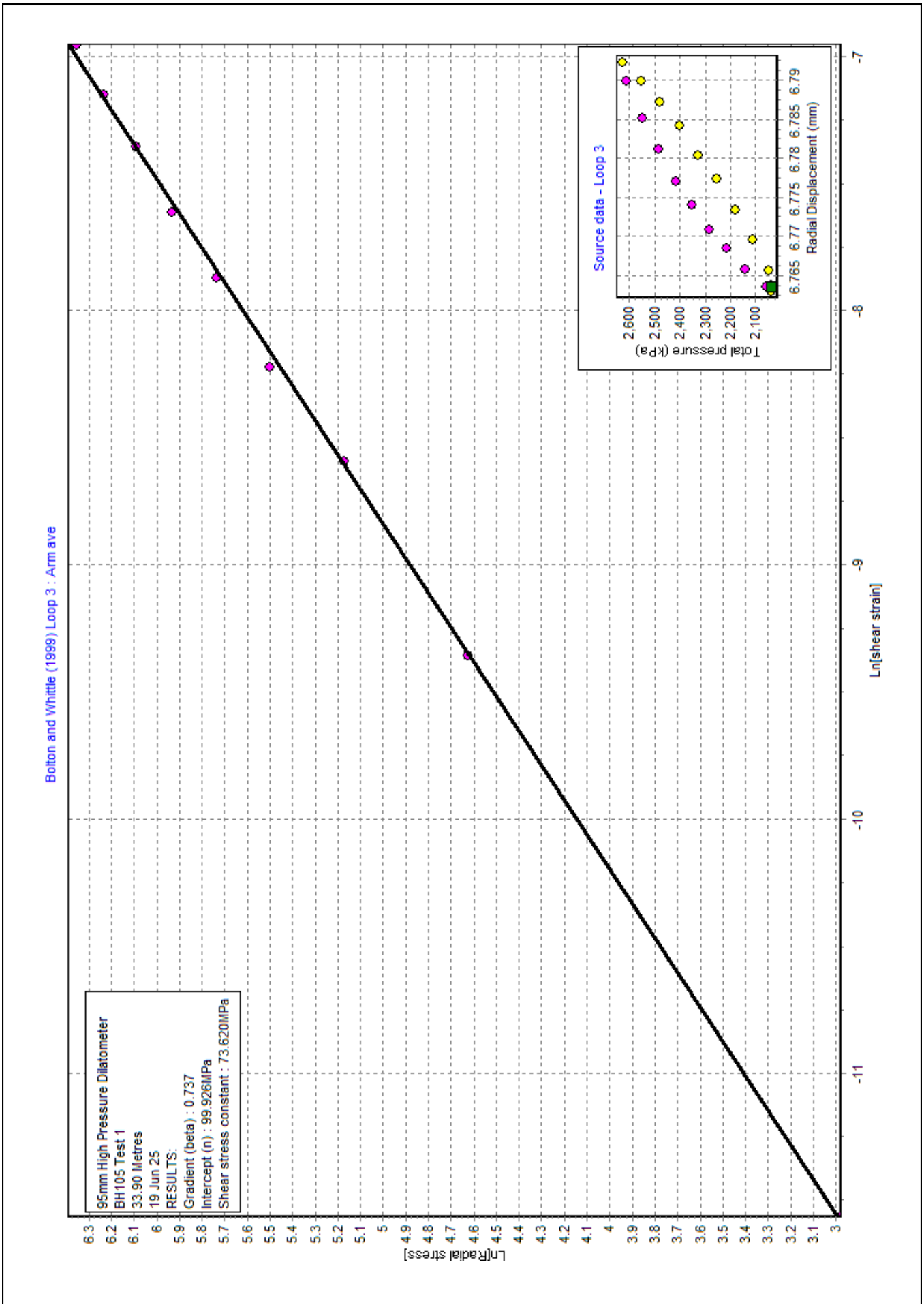

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 392.7MPa
Cycle mid-point:
Cavity strain : 2.165%
Total stress : 1633kPa
Size of cycle :
Shear strain : 0.104%
Total stress : 410kPa
95mm High Pressure Dilatometer
BH105 Test 1
33.90 Metres
19 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

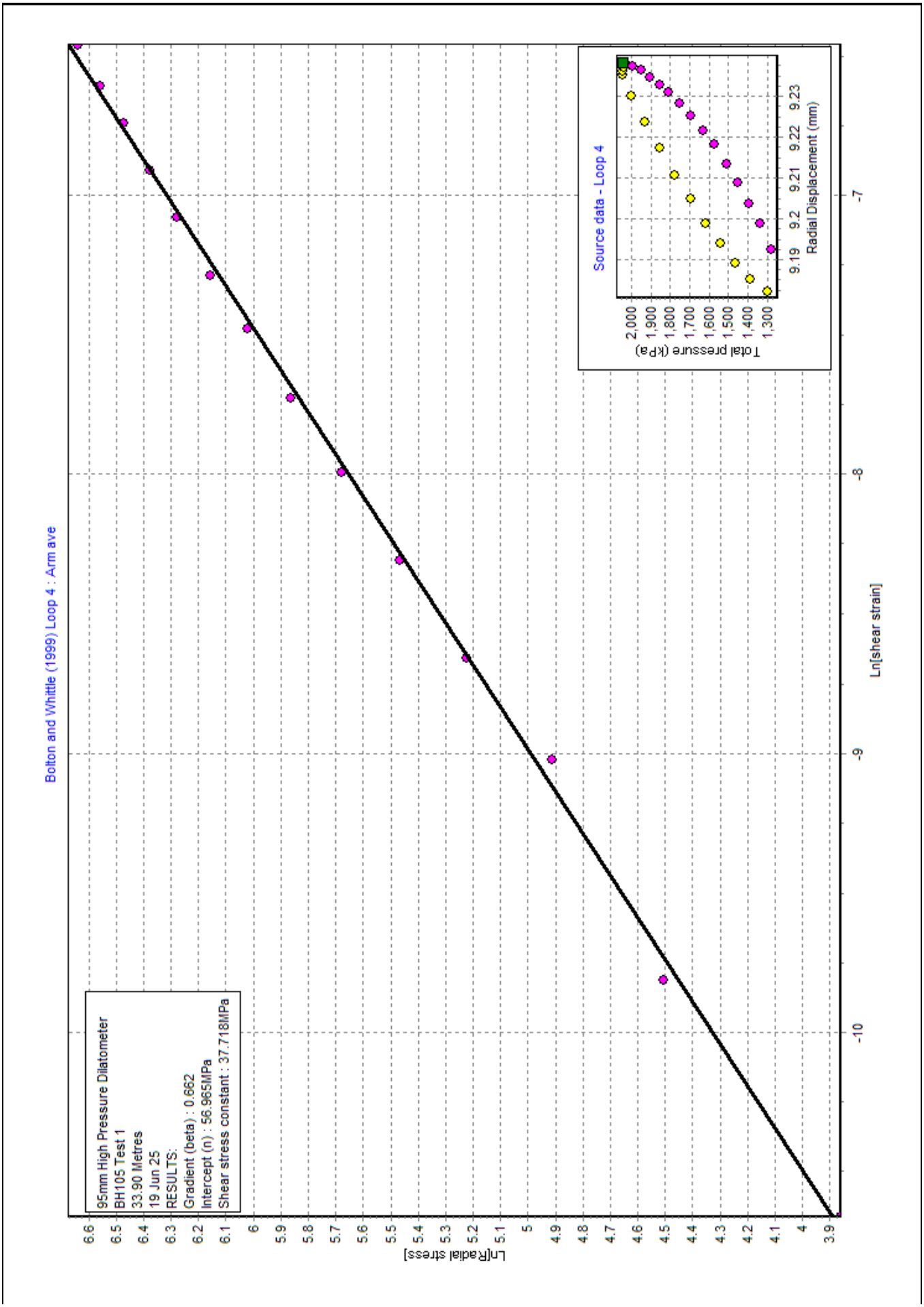

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 571.2MPa
Cycle mid-point:
Cavity strain : 6.488%
Total stress : 2332kPa
Size of cycle :
Shear strain : 0.103%
Total stress : 587kPa
95mm High Pressure Dilatometer
BH105 Test 1
33.90 Metres
19 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

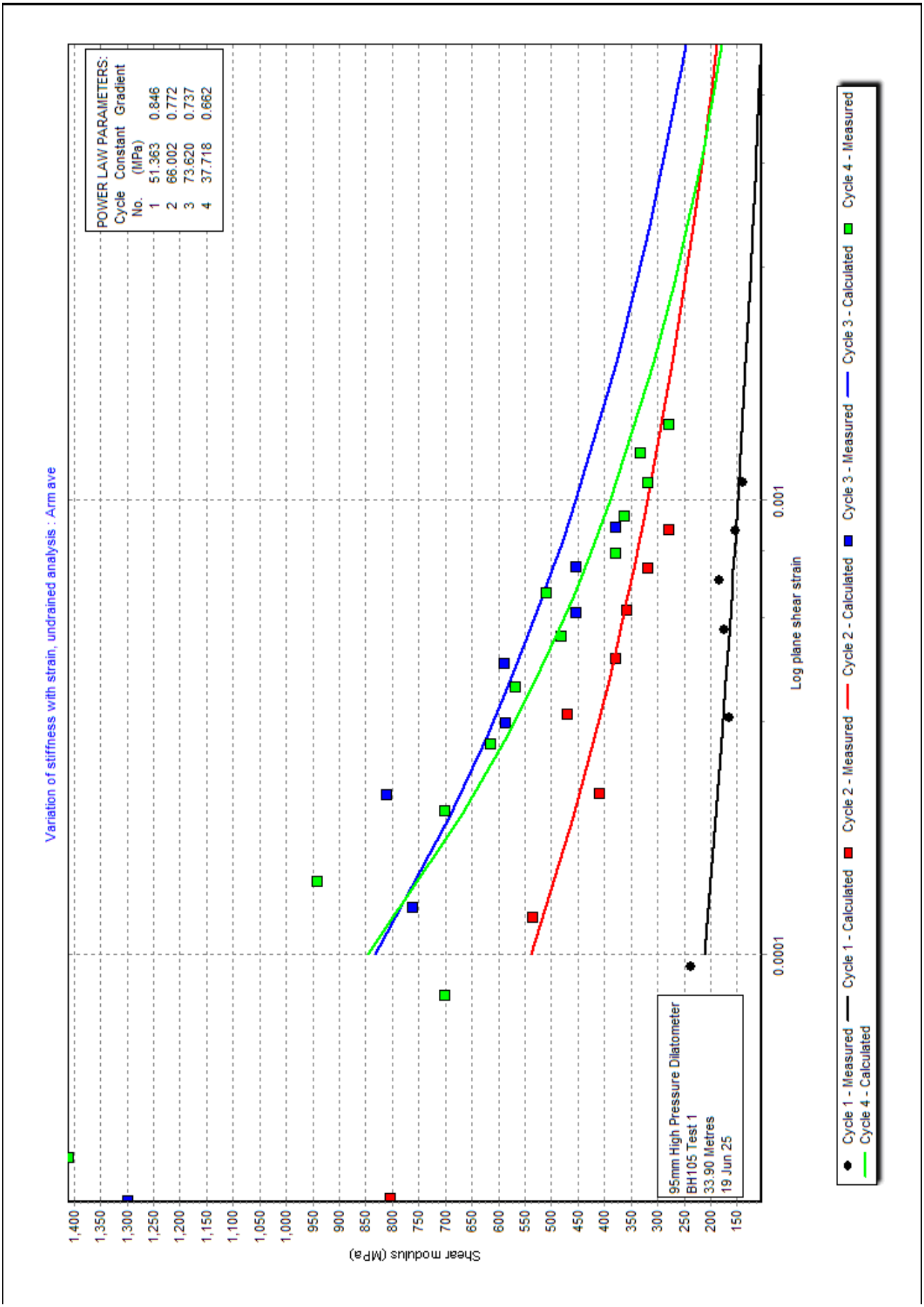

Shear modulus from unload/reload cycles Loop 4 : Arm ave
RESULTS:
Gur : 417.9MPa
Cycle mid-point:
Cavity strain : 11.176%
Total stress : 1652kPa
Size of cycle :
Shear strain : 0.197%
Total stress : 824kPa
95mm High Pressure Dilatometer
BH105 Test 1
33.90 Metres
19 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

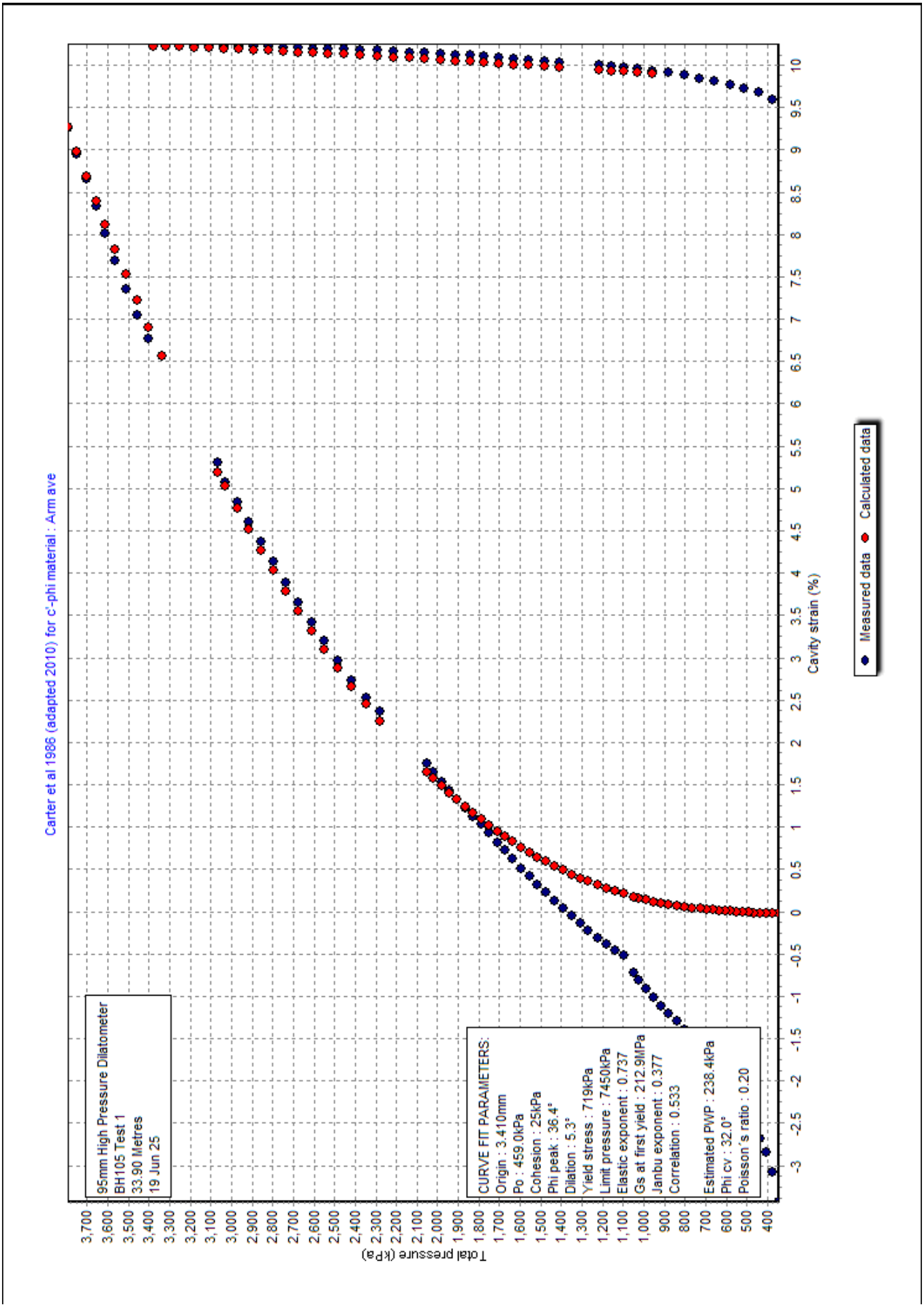

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH105 Test 1
33.90 Metres
19 Jun 25
RESULTS:
Gradient (beta) : 0.846
Intercept (n) : 60.718MPa
Shear stress constant : 51.363MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

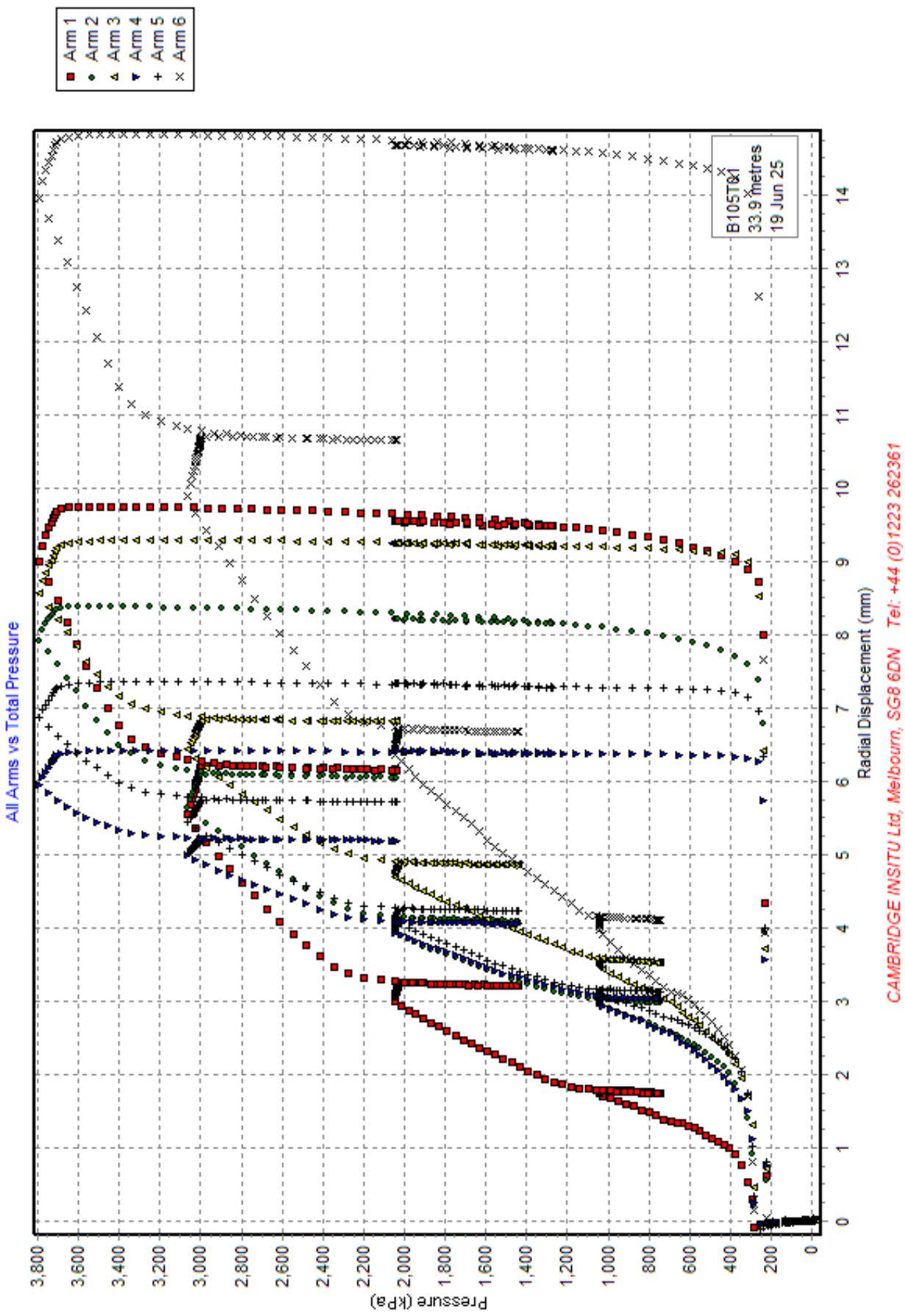

Bolton and Whittle (1999) Loop 2 : Arm ave
95mm High Pressure Dilatometer
BH105 Test 1
33.90 Metres
19 Jun 25
RESULTS:
Gradient (beta) : 0.772
Intercept (n) : 85.480MPa
Shear stress constant : 66.002MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

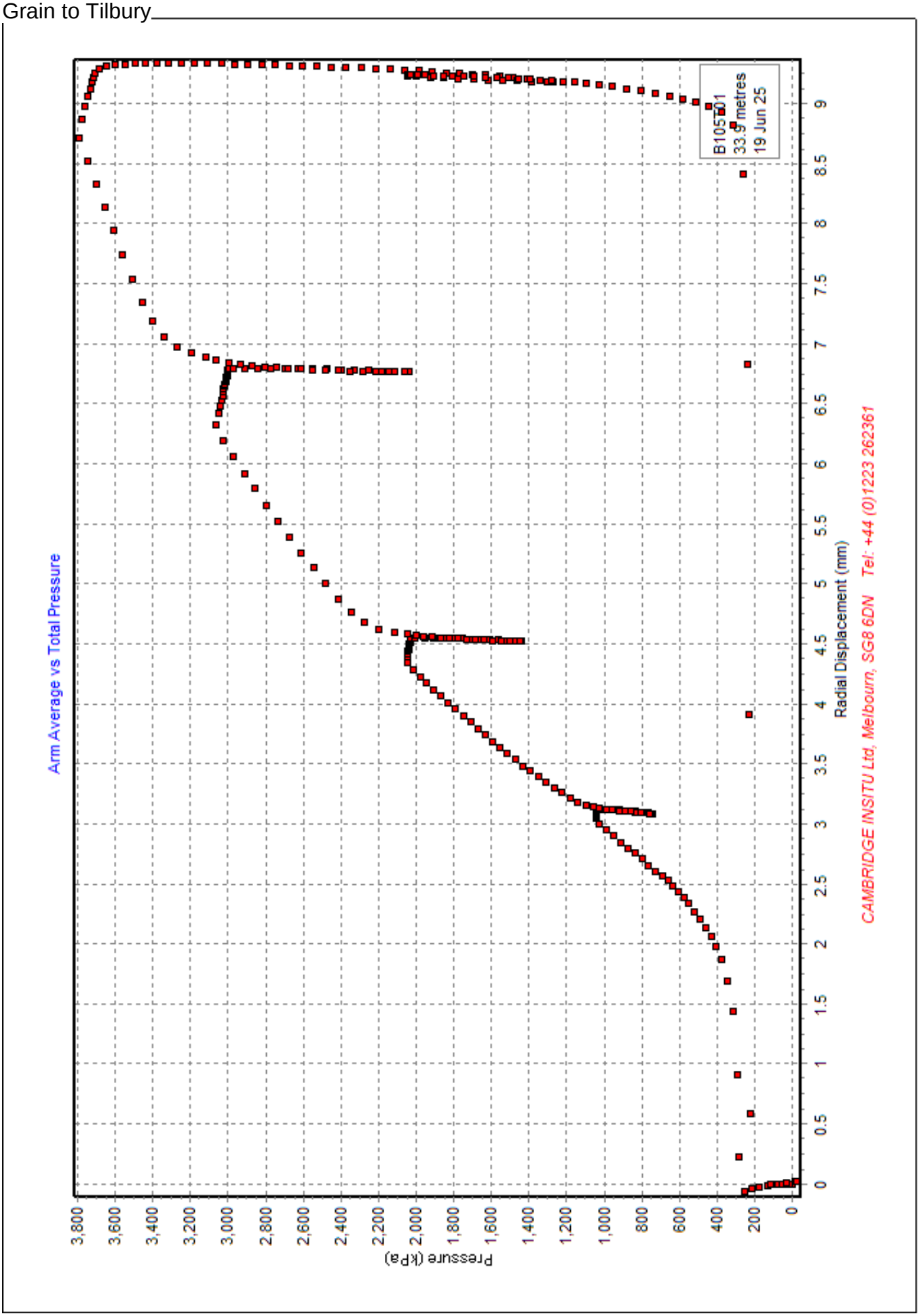

Bolton and Whittle (1999) Loop 3 : Arm ave
95mm High Pressure Dilatometer
BH105 Test 1
33.90 Metres
19 Jun 25
RESULTS:
Gradient (beta) : 0.737
Intercept (n) : 99.926MPa
Shear stress constant : 73.620MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)

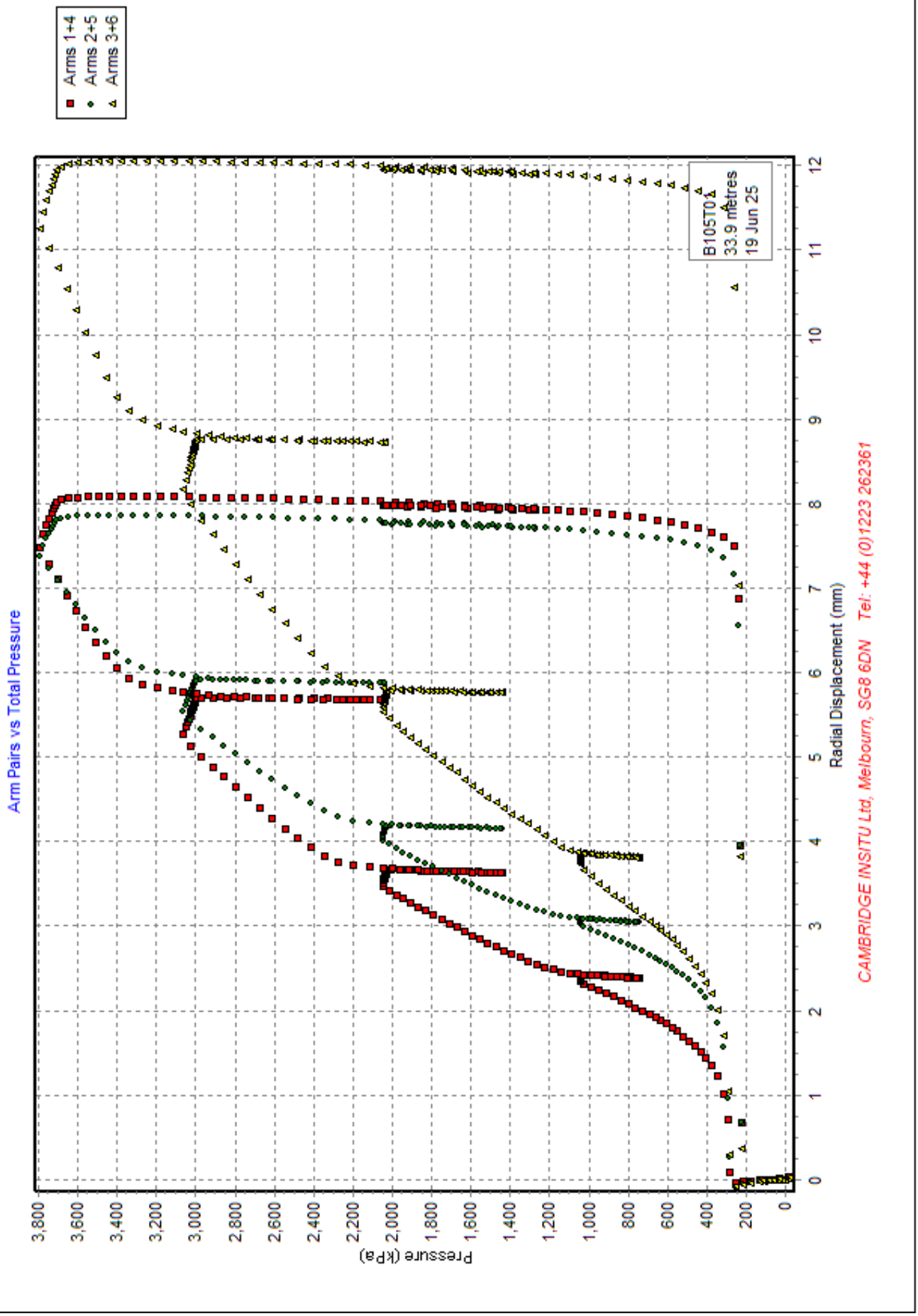

Bolton and Whittle (1999) Loop 4 : Arm ave
95mm High Pressure Dilatometer
BH105 Test 1
33.90 Metres
19 Jun 25
RESULTS:
Gradient (beta) : 0.662
Intercept (n) : 56.965MPa
Shear stress constant : 37.718MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 4
Total pressure (kPa)
Radial Displacement (mm)

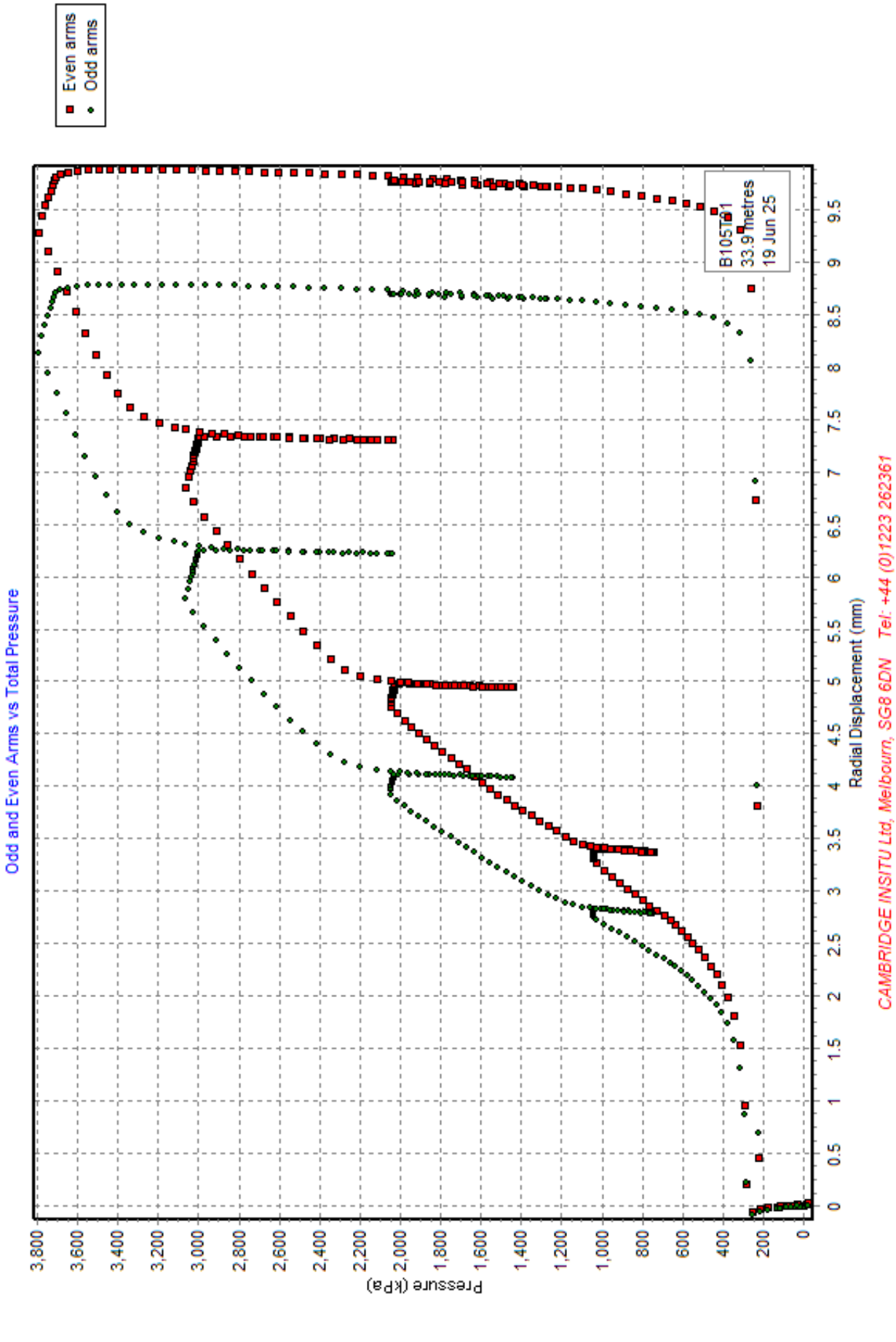

Variation of stiffness with strain, undrained analysis : Arm ave
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 51.363 0.846
2 66.002 0.772
3 73.620 0.737
4 37.718 0.662
95mm High Pressure Dilatometer
BH105 Test 1
33.90 Metres
19 Jun 25
Shear modulus (MPa)
Log plane shear strain
0.0001
0.001
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
Cycle 4 - Measured
Cycle 4 - Calculated


Carter et al 1986 (adapted 2010) for c'-phi material : Arm ave
95mm High Pressure Dilatometer
BH105 Test 1
33.90 Metres
19 Jun 25
CURVE FIT PARAMETERS:
Origin : 3.410mm
Po : 459.0kPa
Cohesion : 25kPa
Phi peak : 36.4°
Dilation : 5.3°
Yield stress : 719kPa
Limit pressure : 7450kPa
Elastic exponent : 0.737
Gs at first yield : 212.9MPa
Janbu exponent : 0.377
Correlation : 0.533
Estimated PWP : 238.4kPa
Phi cv : 32.0°
Poisson's ratio : 0.20
Total pressure (kPa)
Cavity strain (%)
Measured data
Calculated data


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
B105T&I
33.9 metres
19 Jun 25
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arm Average vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
B105501
33.9 metres
19 Jun 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arms 1+4
Arms 2+5
Arms 3+6
B105T04
33.9 metres
19 Jun 25
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
B105T01
33.9 metres
19 Jun 25
Odd and Even Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to TIlbury
BH105 Test 2 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Grain to Tilbury
Borehole : BH105
Test name : BH105 Test 2
Test date : 20 Jun 25
Test depth : 38.15 Metres
Water table : 9.6 Metres
Ambient PWP : 280.1 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDP/RW on 21 Jul 25

Remarks:

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=5.84"
Po from Marsland & Randolph (kPa) : "Arm ave=1103.3"
Best estimate of Po (kPa) : "Arm ave=932.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=3759.1"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 35.0
Angle of internal friction (°) : "Arm ave=35.5"
Dilation angle (°) : "Arm ave=0.6"
Gradient of log-log plot : "Arm ave=0.371"

[Withers et al 1989]
Angle of internal friction (°) : "Arm ave=35.2"
Dilation angle (°) : "Arm ave=0.2"
Gradient of log-log plot : "Arm ave=-2.703"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=84.6"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	181.3	-0.995	837	0.116	211
Arm ave	2	541.4	-0.030	1635	0.077	417
Arm ave	3	759.7	0.837	2666	0.111	846
Arm ave	4	910.1	2.380	4061	0.152	1388
Arm ave	5	814.4	4.585	2657	0.172	1400

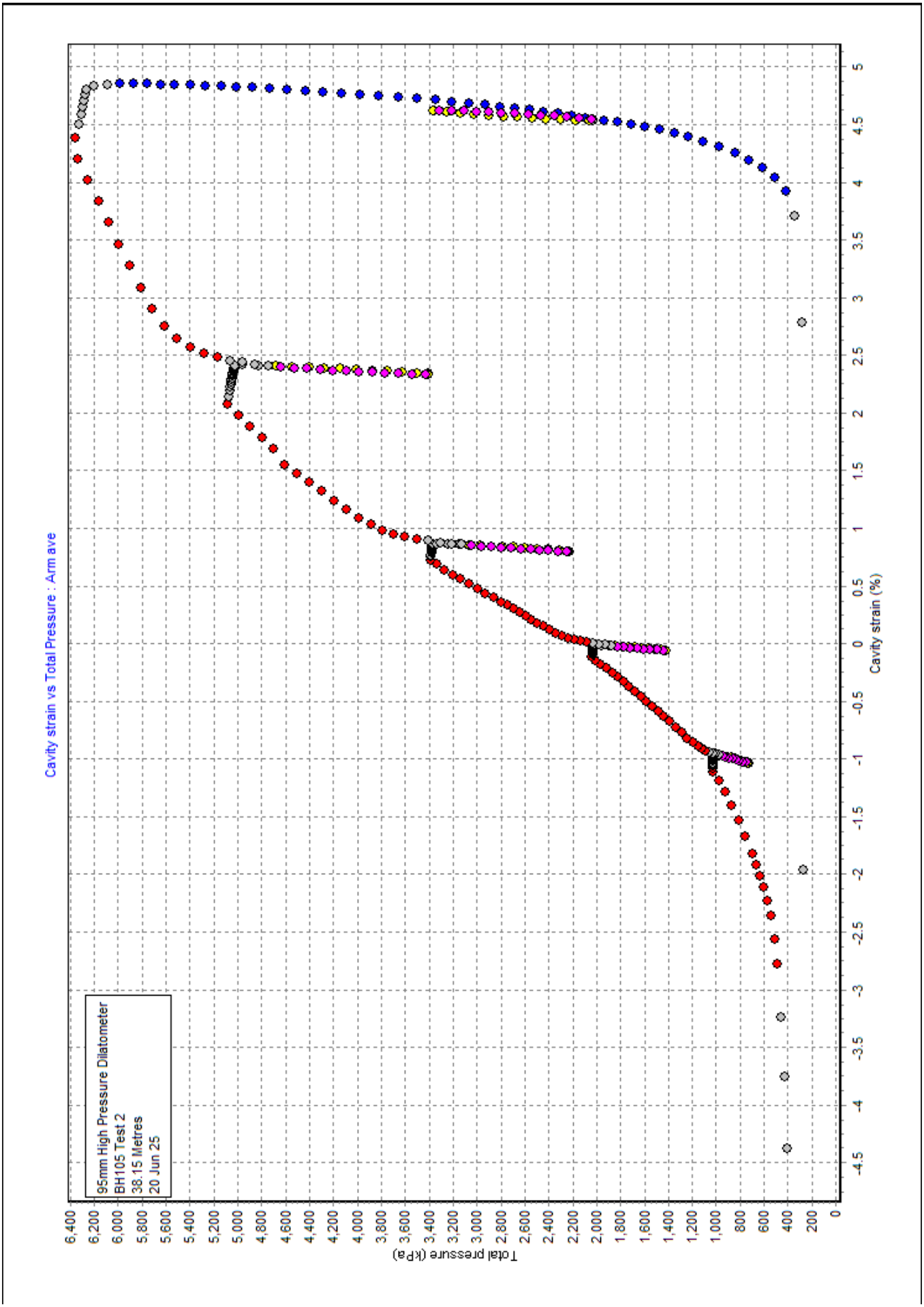
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

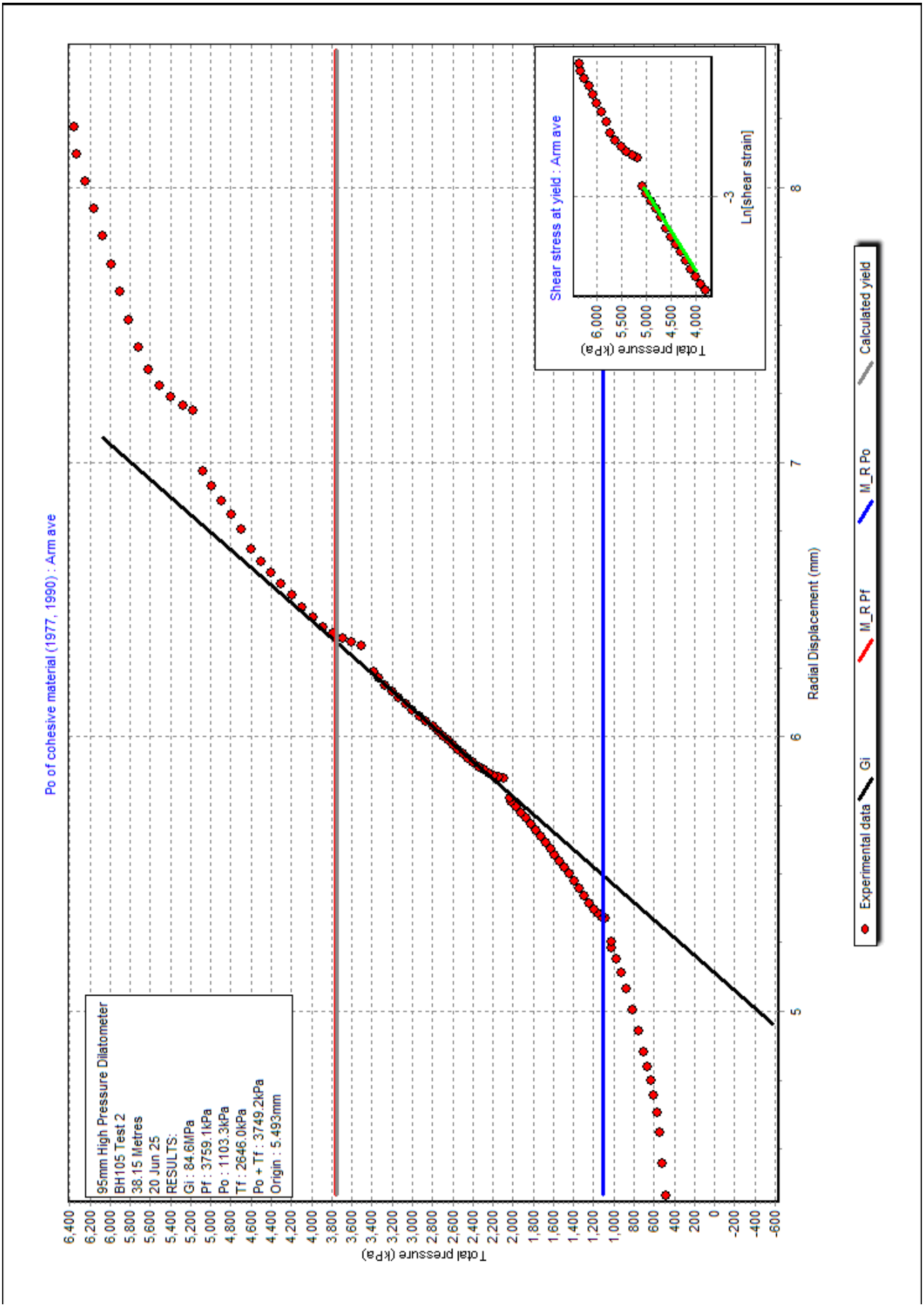
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	115.866	108.397	0.936
Arm ave	2	208.806	180.464	0.864
Arm ave	3	192.620	152.405	0.791
Arm ave	4	272.729	219.554	0.805
Arm ave	5	166.270	122.539	0.737

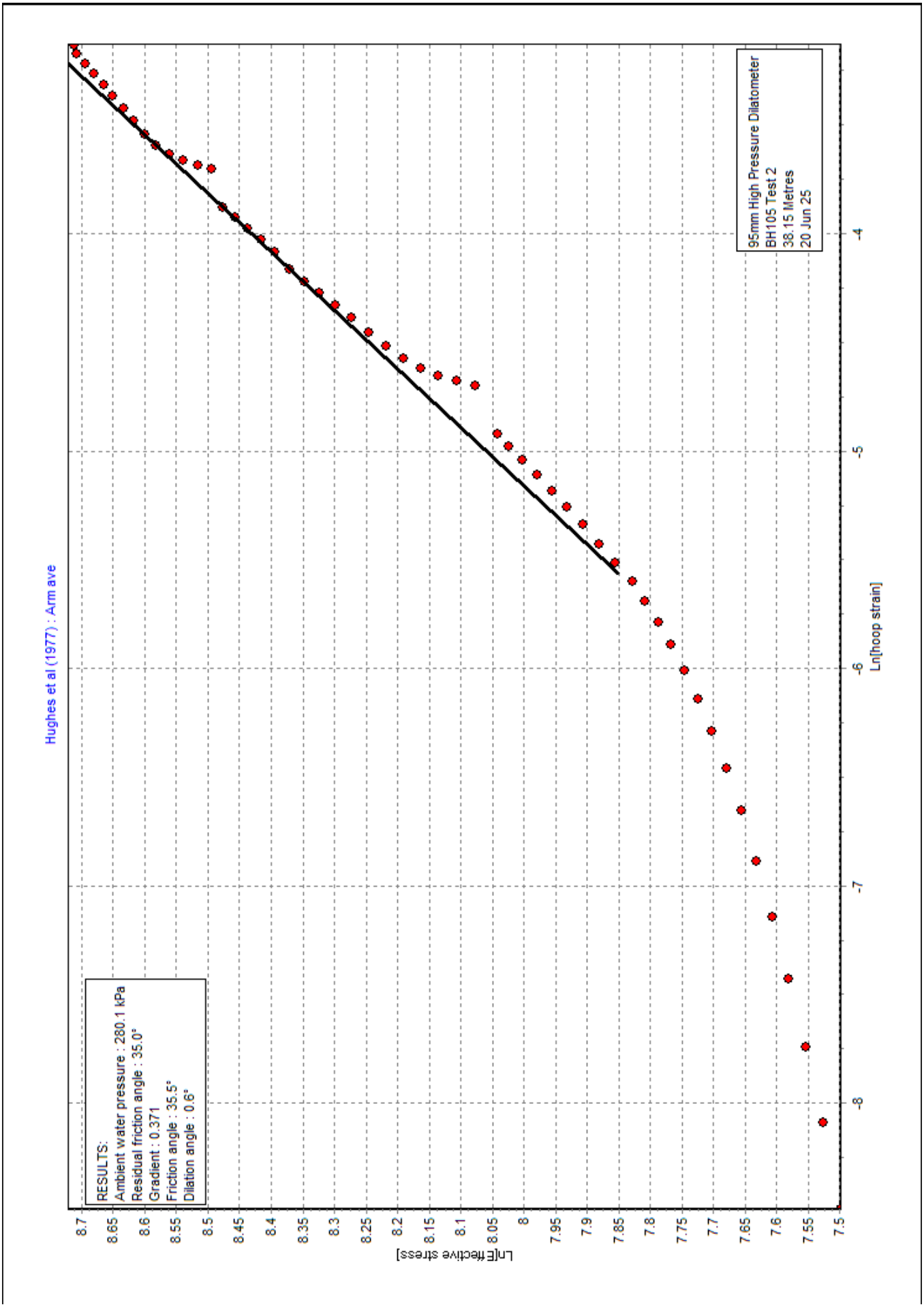
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 5.84
Po (kPa) : 932
Cohesion (kPa) : 208
Angle of peak friction (deg) : 35.5

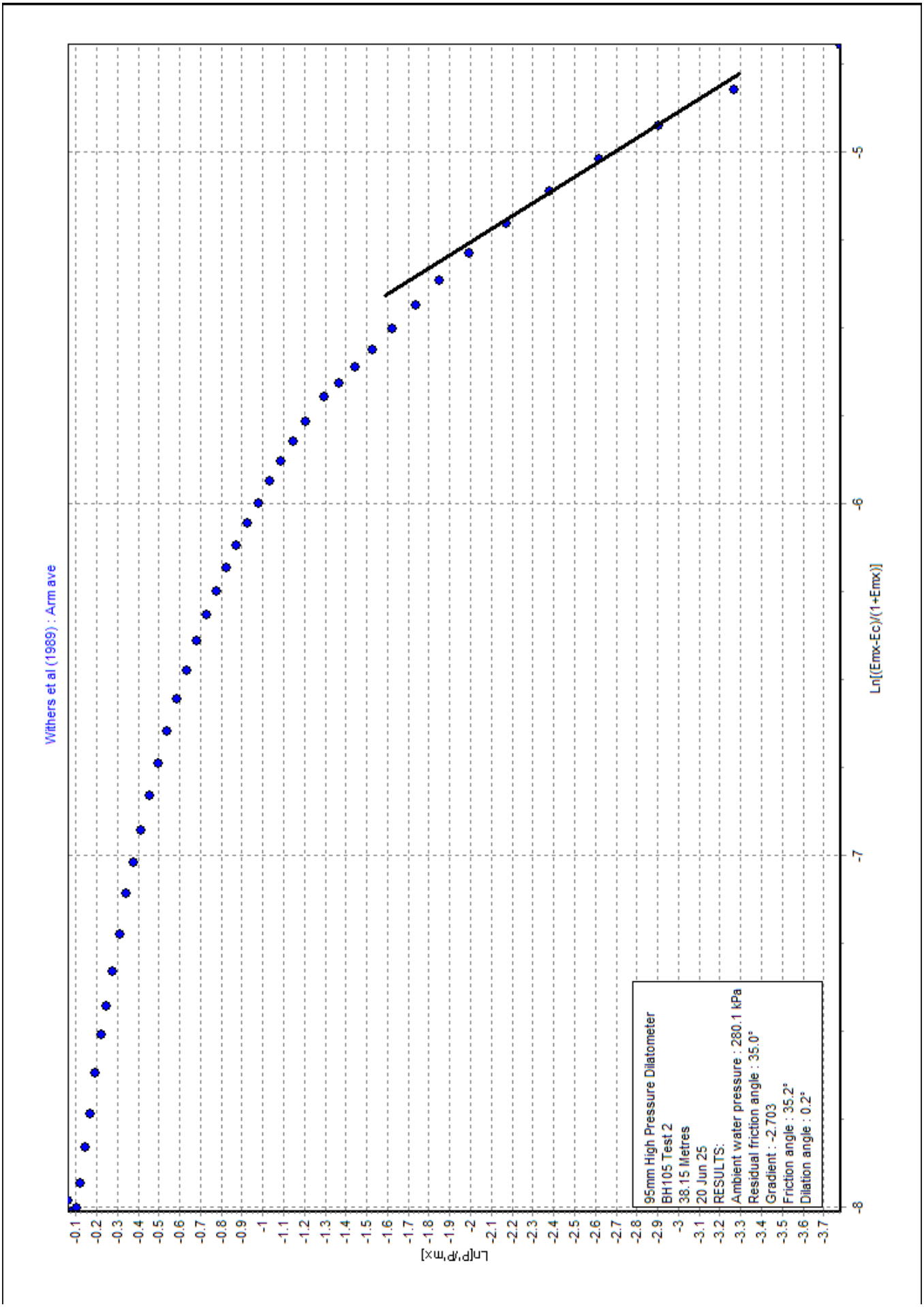
Grain to TIlbury
BH105 Test 2 - SUMMARY OF RESULTS

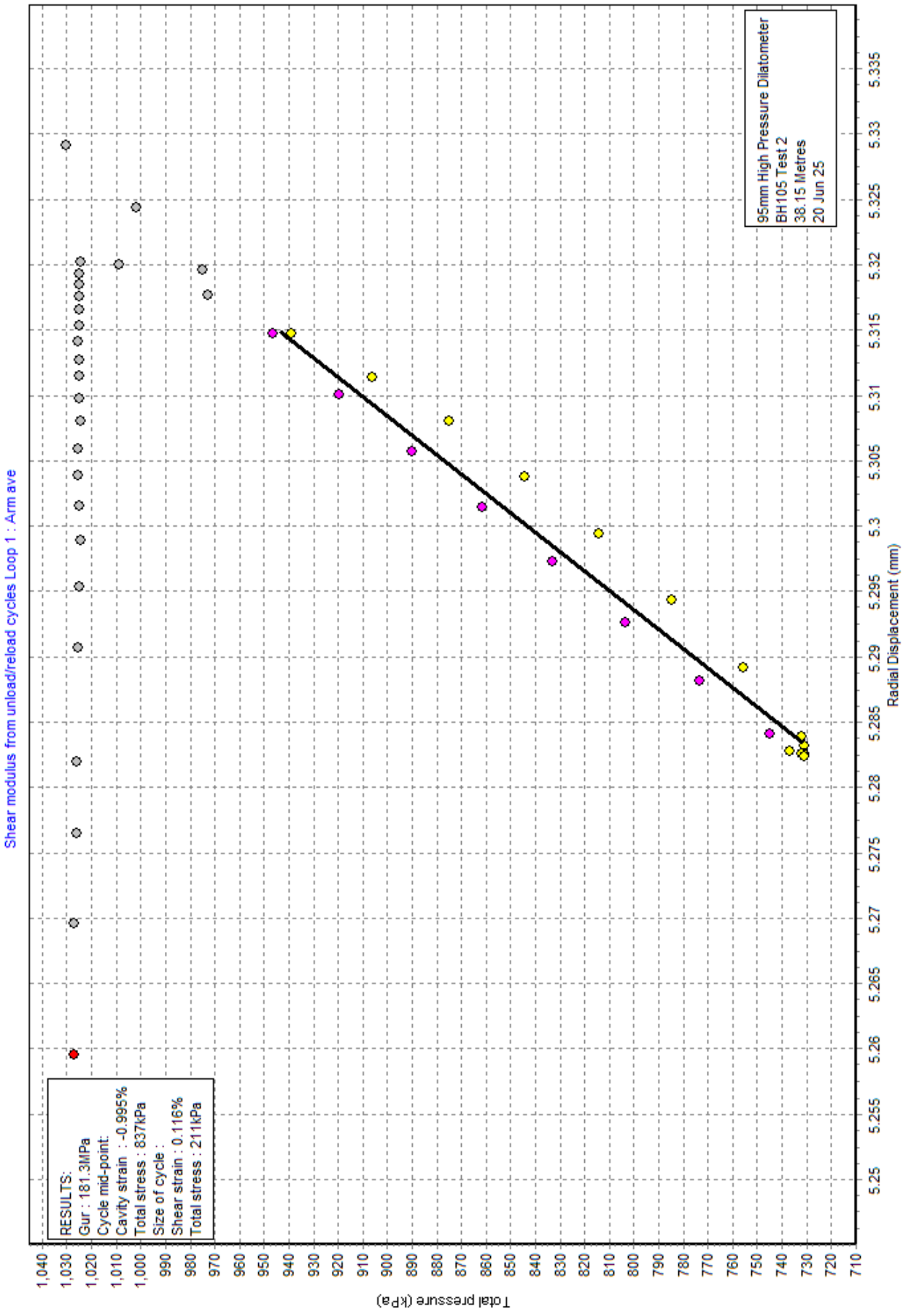
Angle of peak dilation (deg)	:	0.6
Total yield stress (kPa)	:	1870
Total limit stress (kPa)	:	15595
G at first yield (MPa)	:	328.2
Non-linear exponent	:	0.737
Janbu exponent	:	0.364
Correlation	:	0.798
Ambient pore water pressure (kPa)	:	280
Residual friction angle (deg)	:	35.0
Poisson's ratio	:	0.20

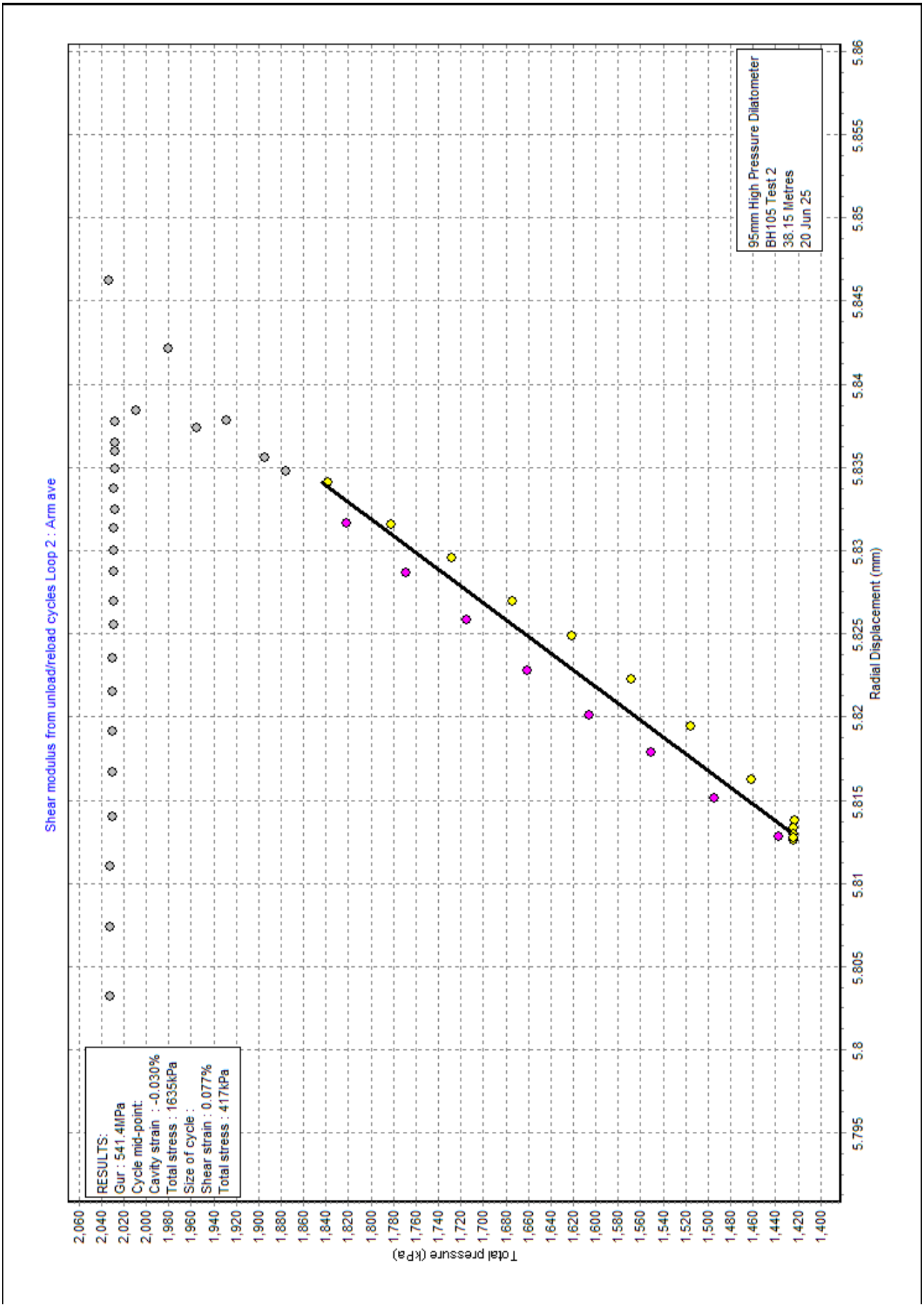

Cavity strain vs Total Pressure : Arm ave
95mm High Pressure Dilatometer
BH105 Test 2
38.15 Metres
20 Jun 25
Total pressure (kPa)
Cavity strain (%)

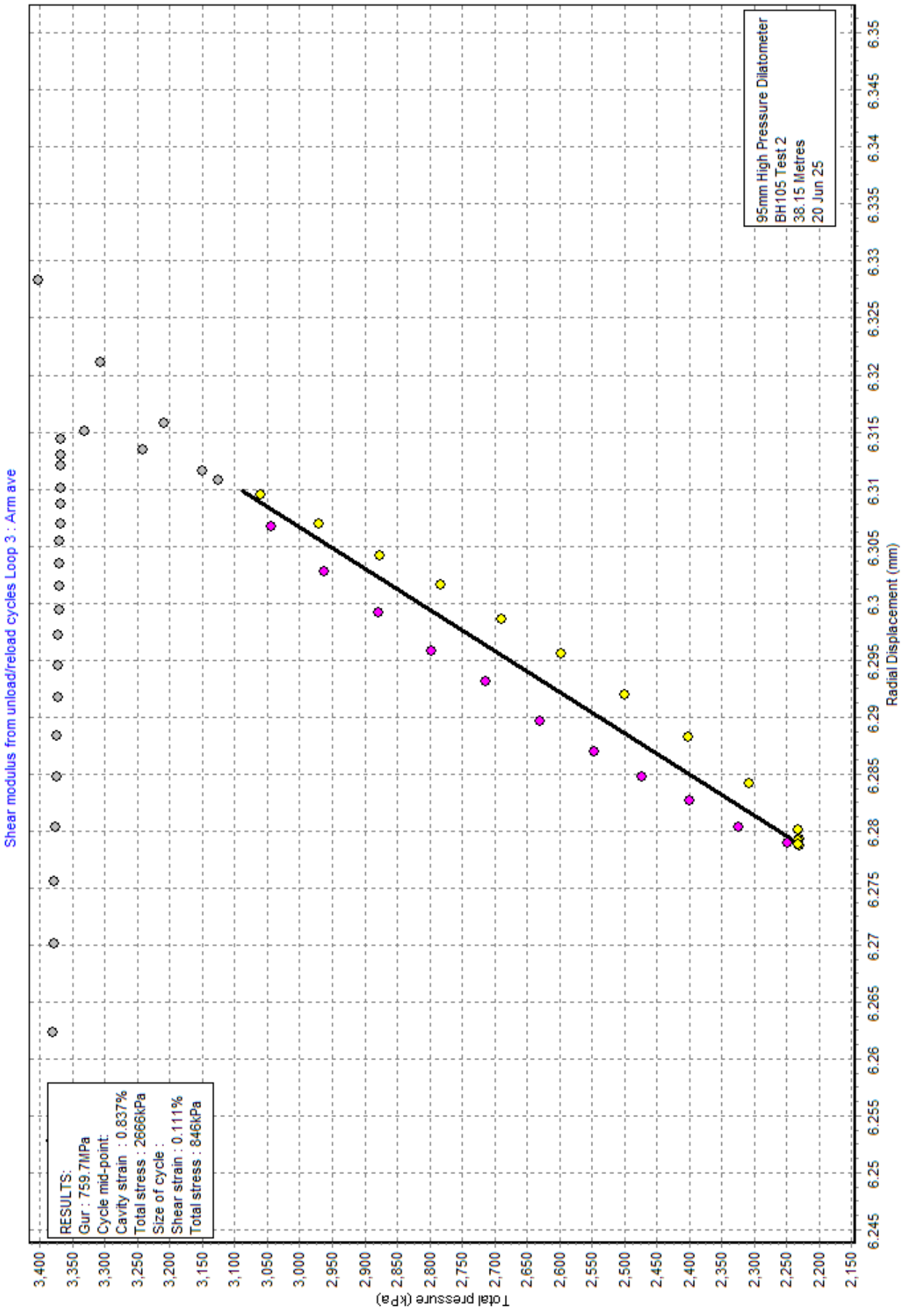

Po of cohesive material (1977, 1990) : Arm ave
95mm High Pressure Dilatometer
BH105 Test 2
38.15 Metres
20 Jun 25
RESULTS:
Gi : 84.6MPa
Pf : 3759.1kPa
Po : 1103.3kPa
Tf : 2646.0kPa
Po + Tf : 3749.2kPa
Origin : 5.493mm
Total pressure (kPa)
Radial Displacement (mm)
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Shear stress at yield : Arm ave
Total pressure (kPa)
Ln[shear strain]

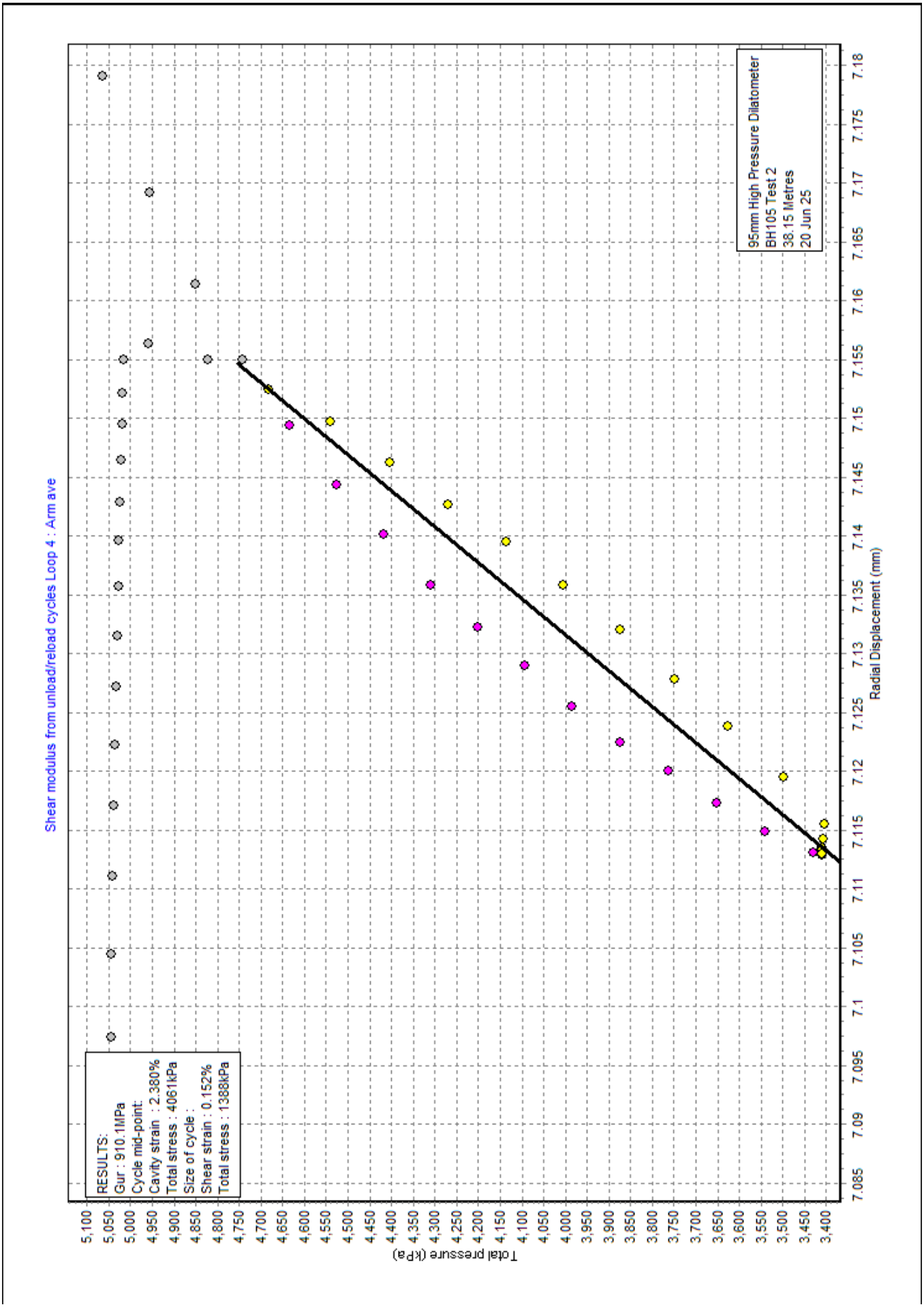

Hughes et al (1977) : Arm ave
RESULTS:
Ambient water pressure : 280.1 kPa
Residual friction angle : 35.0°
Gradient : 0.371
Friction angle : 35.5°
Dilation angle : 0.6°
95mm High Pressure Dilatometer
BH105 Test 2
38.15 Metres
20 Jun 25
Ln[Effective stress]
Ln[hoop strain]
8.7
8.65
8.6
8.55
8.5
8.45
8.4
8.35
8.3
8.25
8.2
8.15
8.1
8.05
8
7.95
7.9
7.85
7.8
7.75
7.7
7.65
7.6
7.55
7.5
-4
-5
-6
-7
-8

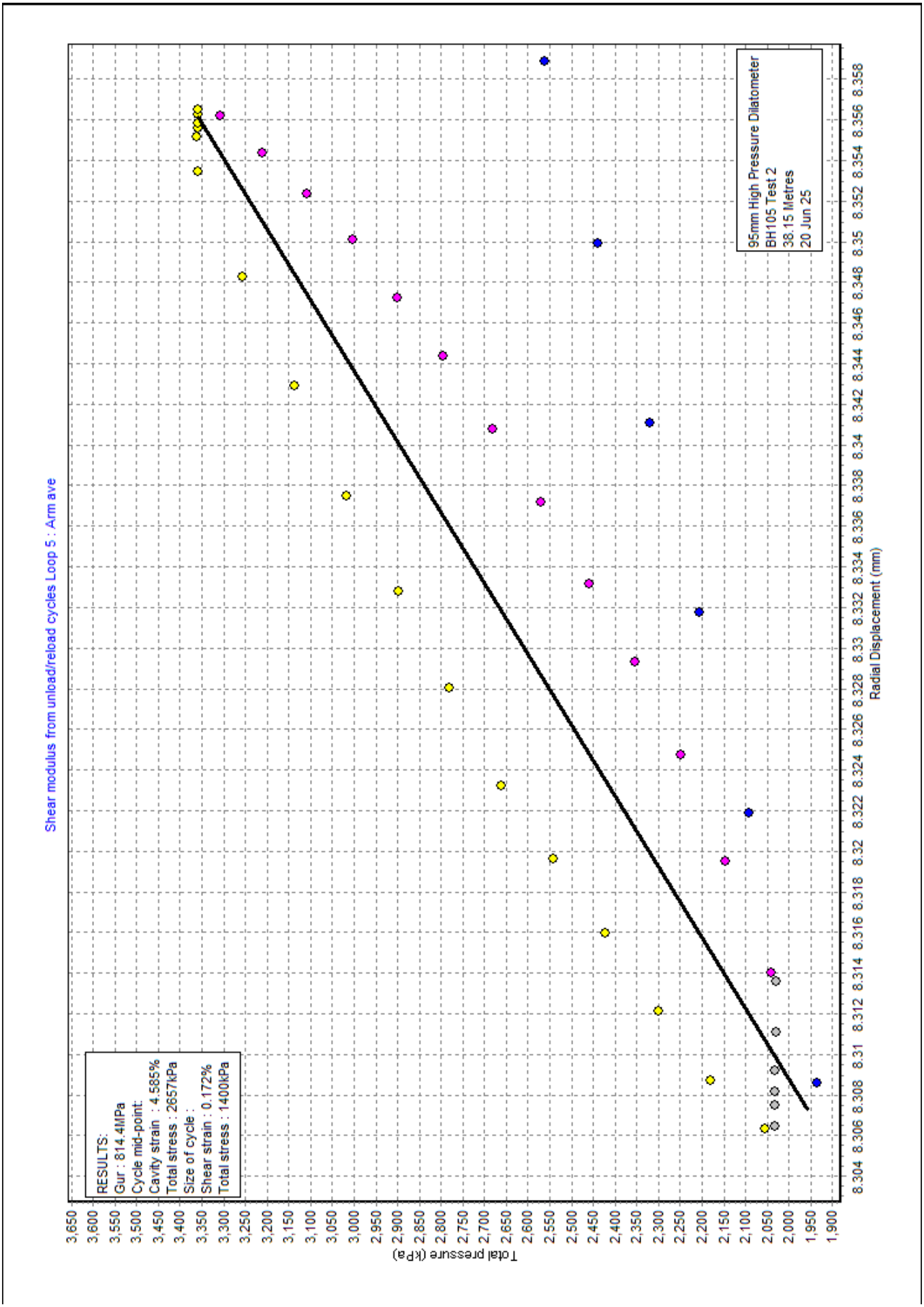

Withers et al (1989) : Arm ave
Ln[(Emx-Ec)/(1+Emx)]
Ln[P'/P'mx]
95mm High Pressure Dilatometer
BH105 Test 2
38.15 Metres
20 Jun 25
RESULTS:
Ambient water pressure : 280.1 kPa
Residual friction angle : 35.0°
Gradient : -2.703
Friction angle : 35.2°
Dilation angle : 0.2°

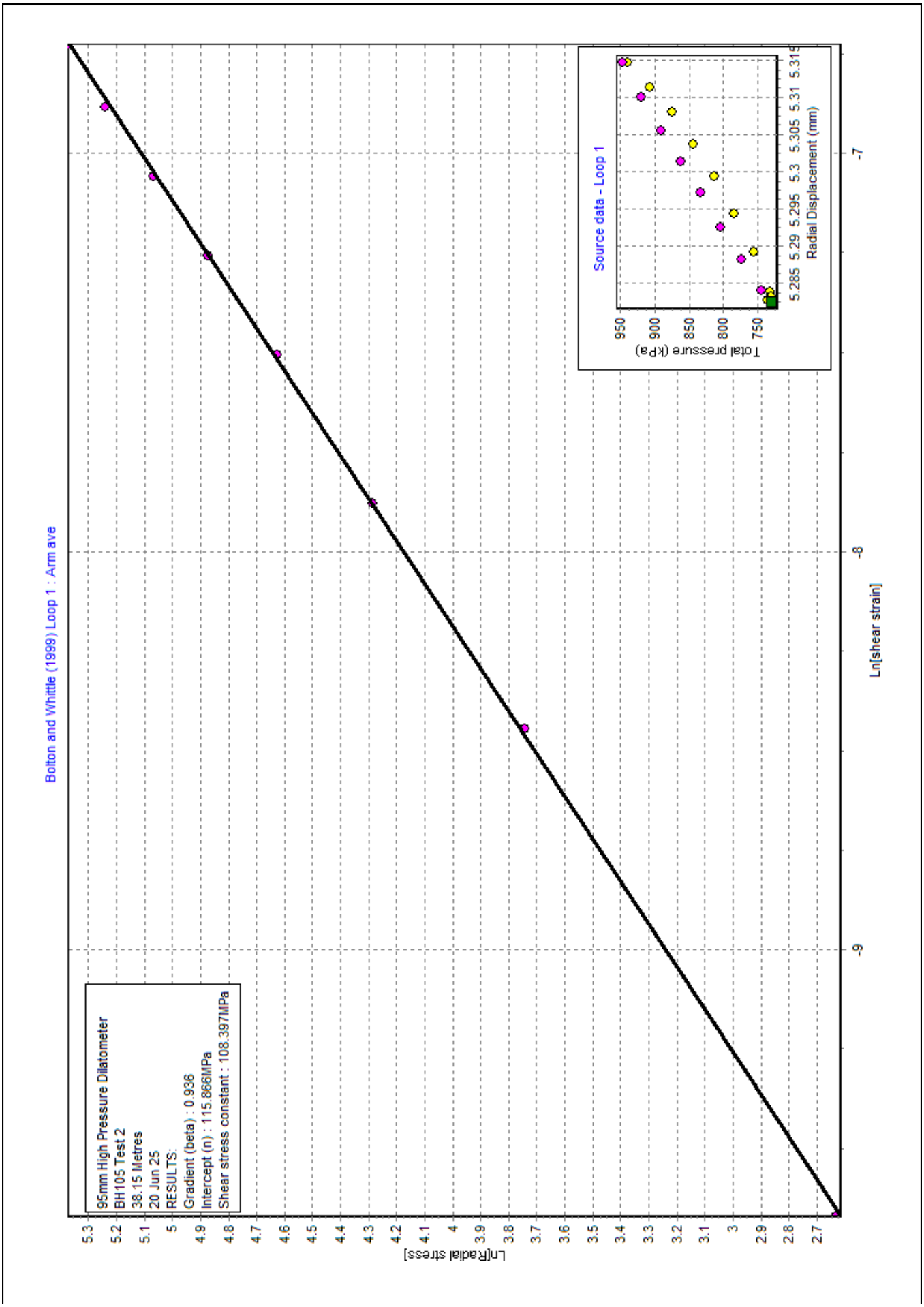

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 181.3MPa
Cycle mid-point:
Cavity strain : -0.995%
Total stress : 837kPa
Size of cycle :
Shear strain : 0.116%
Total stress : 211kPa
95mm High Pressure Dilatometer
BH105 Test 2
38.15 Metres
20 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

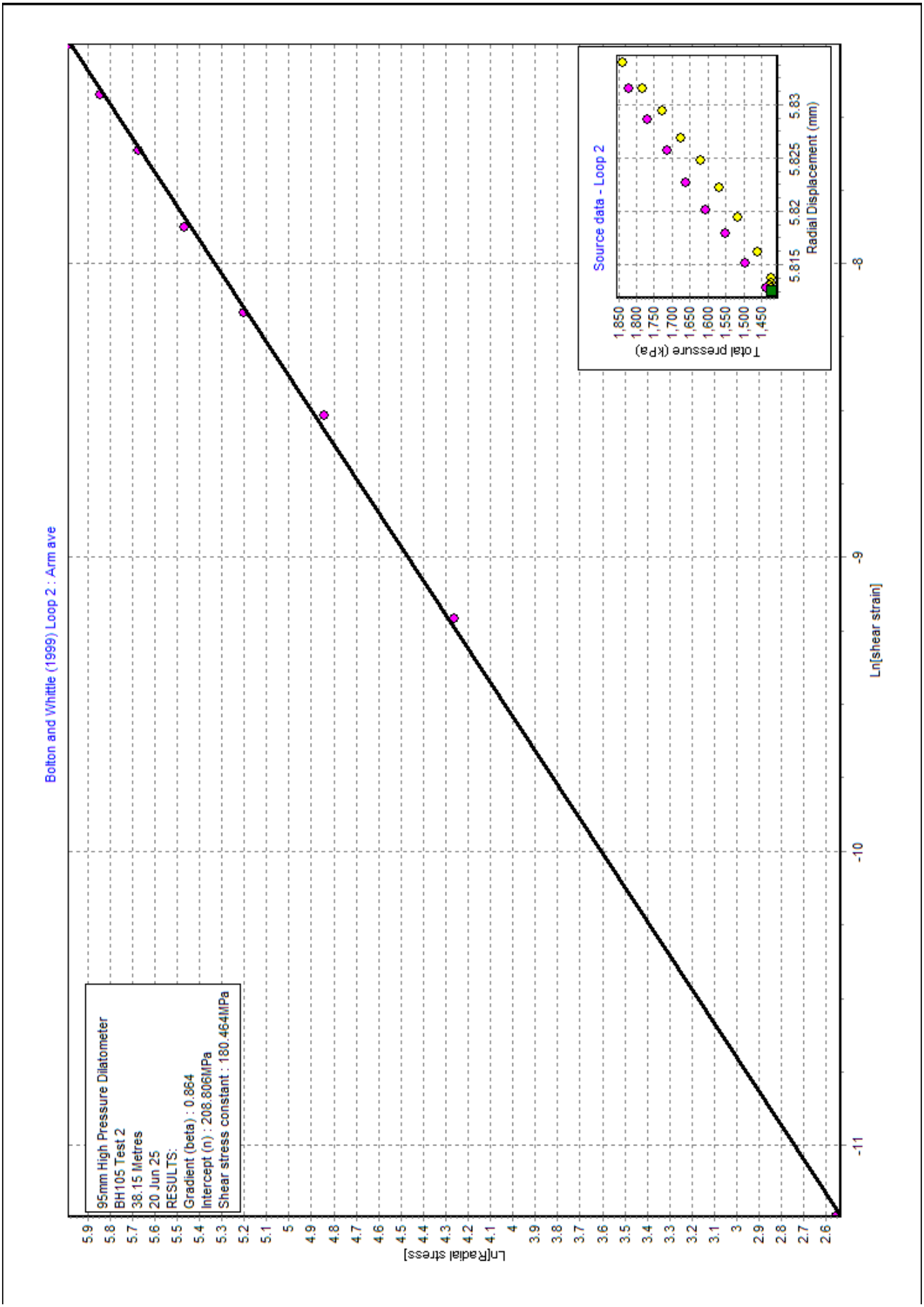

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 541.4MPa
Cycle mid-point:
Cavity strain : -0.030%
Total stress : 1635kPa
Size of cycle :
Shear strain : 0.077%
Total stress : 417kPa
95mm High Pressure Dilatometer
BH105 Test 2
38.15 Metres
20 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

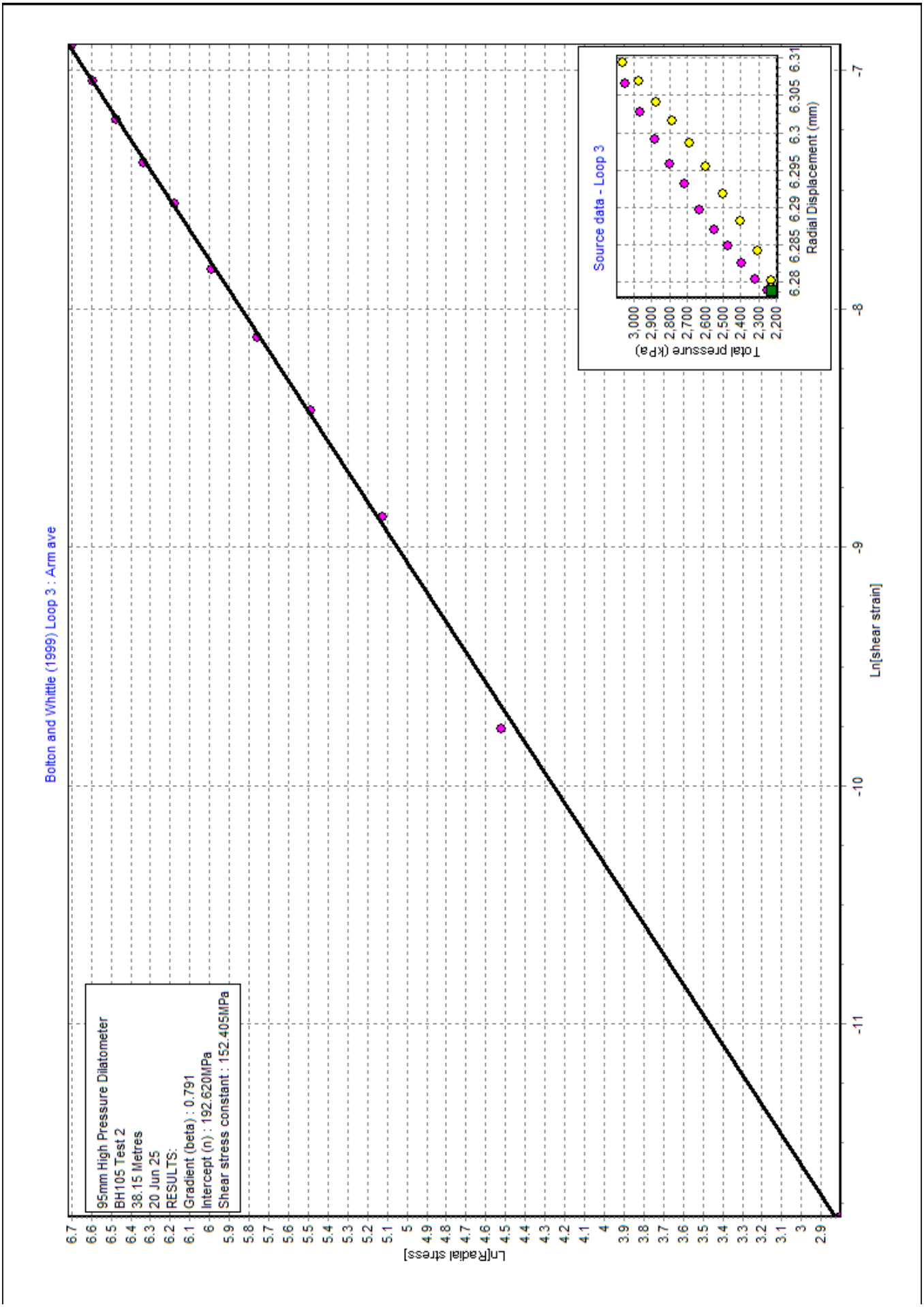

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 759.7MPa
Cycle mid-point:
Cavity strain : 0.837%
Total stress : 2666kPa
Size of cycle :
Shear strain : 0.111%
Total stress : 846kPa
95mm High Pressure Dilatometer
BH105 Test 2
38.15 Metres
20 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

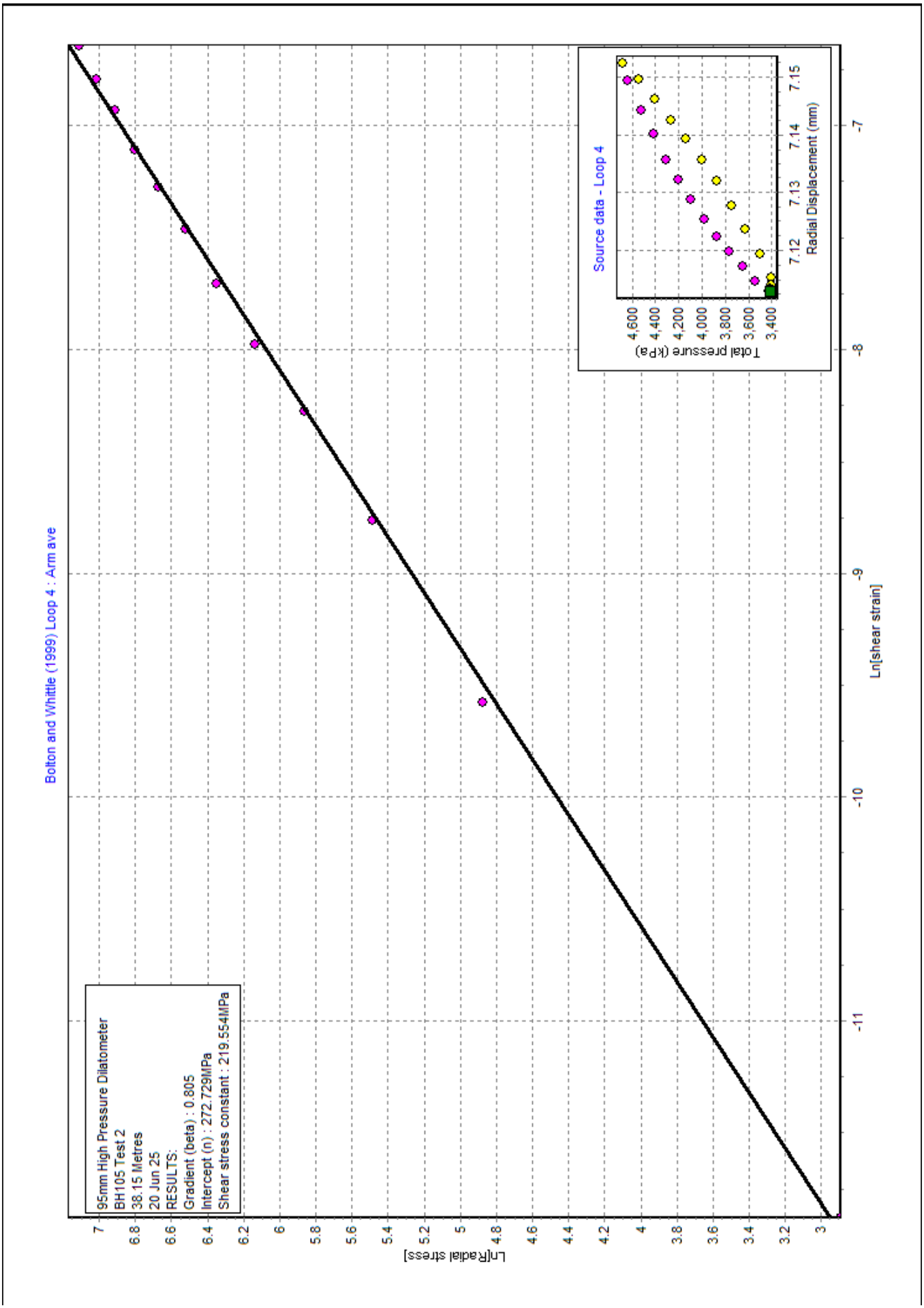

Shear modulus from unload/reload cycles Loop 4 : Arm ave
RESULTS:
Gur : 910.1MPa
Cycle mid-point:
Cavity strain : 2.380%
Total stress : 4061kPa
Size of cycle :
Shear strain : 0.152%
Total stress : 1388kPa
95mm High Pressure Dilatometer
BH105 Test 2
38.15 Metres
20 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

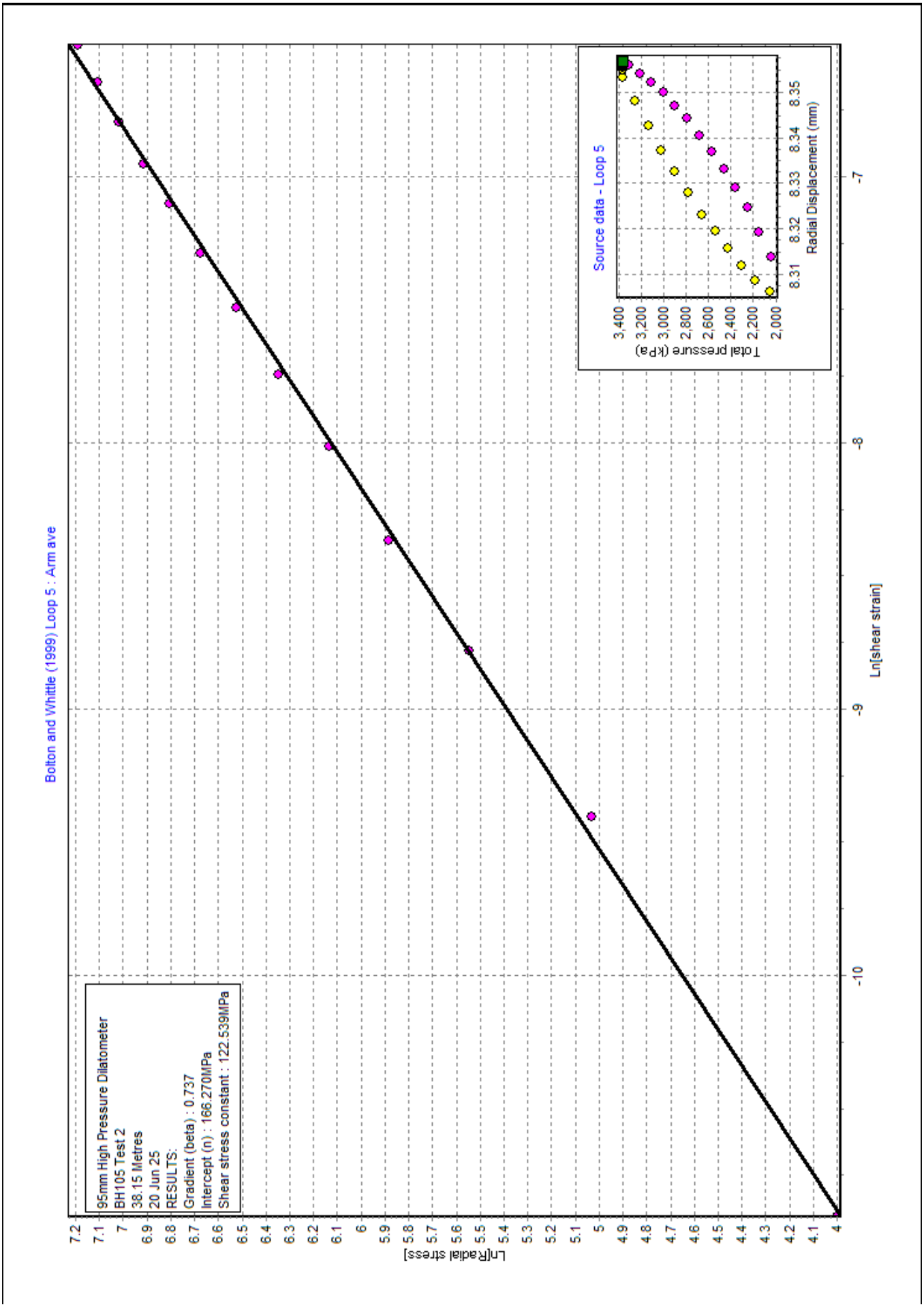

Shear modulus from unload/reload cycles Loop 5 : Arm ave
RESULTS:
Gur : 814.4MPa
Cycle mid-point:
Cavity strain : 4.585%
Total stress : 2657kPa
Size of cycle :
Shear strain : 0.172%
Total stress : 1400kPa
95mm High Pressure Dilatometer
BH105 Test 2
38.15 Metres
20 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

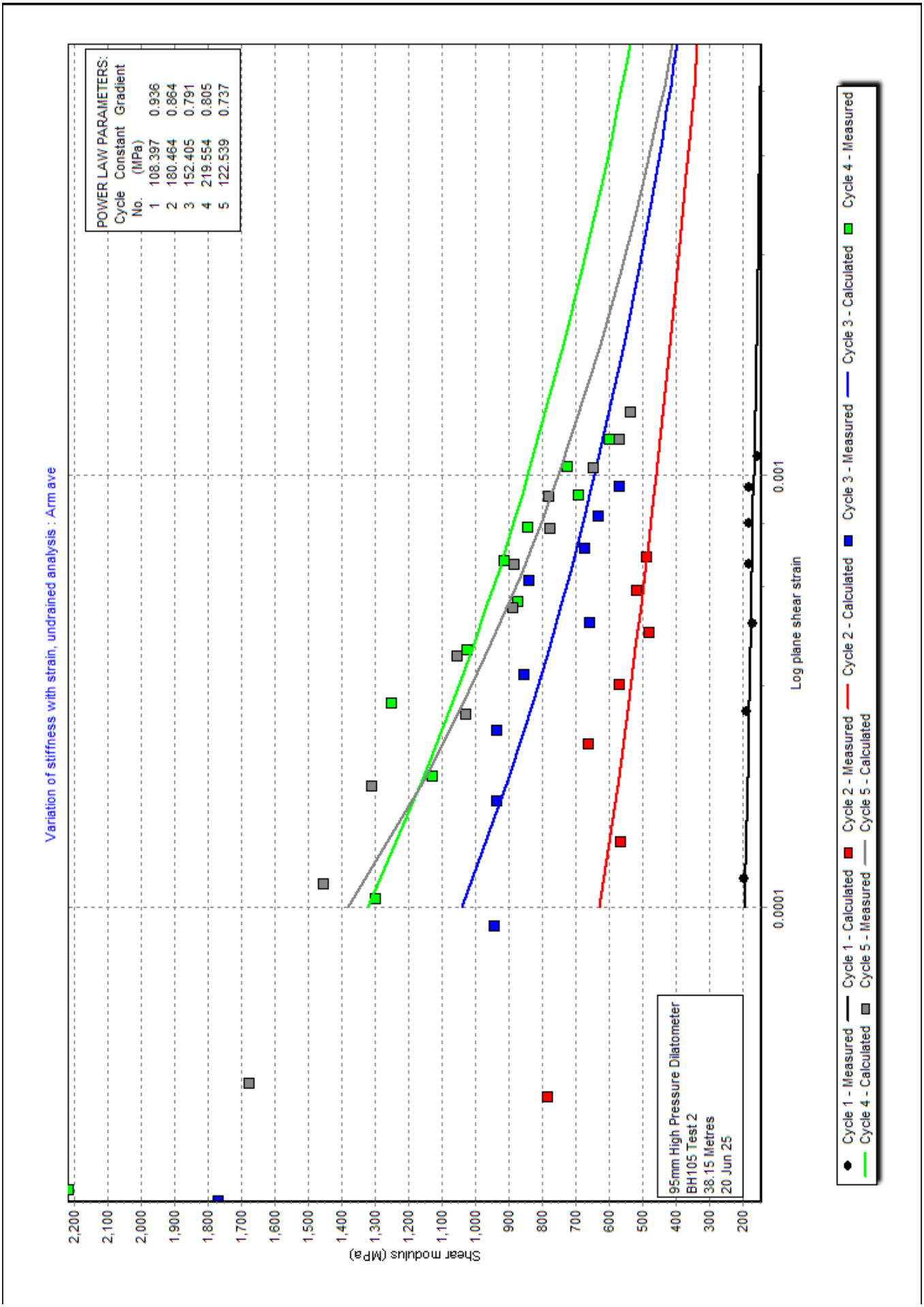

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH105 Test 2
38.15 Metres
20 Jun 25
RESULTS:
Gradient (beta) : 0.936
Intercept (n) : 115.866MPa
Shear stress constant : 108.397MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

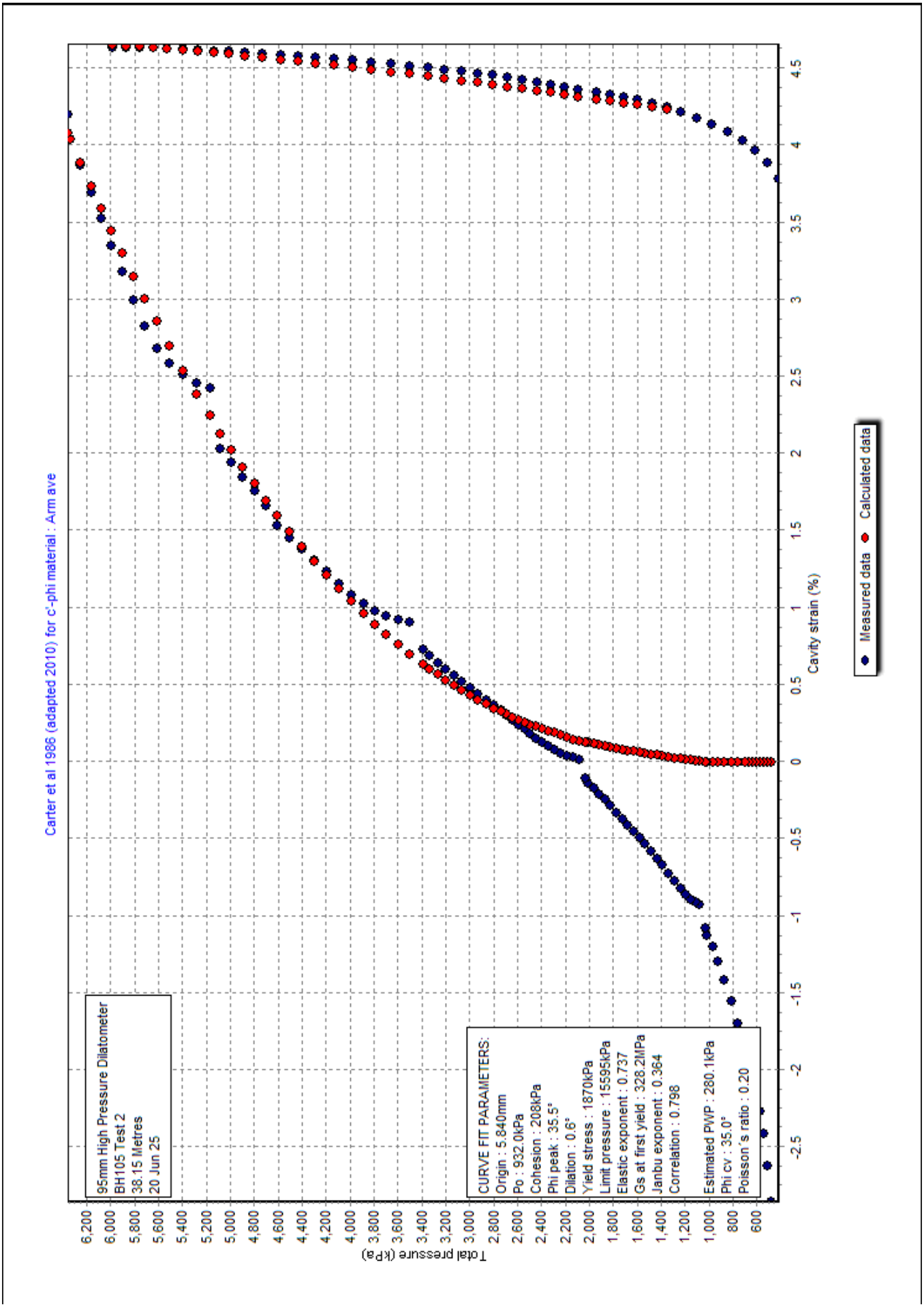

Bolton and Whittle (1999) Loop 2 : Arm ave
95mm High Pressure Dilatometer
BH105 Test 2
38.15 Metres
20 Jun 25
RESULTS:
Gradient (beta) : 0.864
Intercept (n) : 208.806MPa
Shear stress constant : 180.464MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

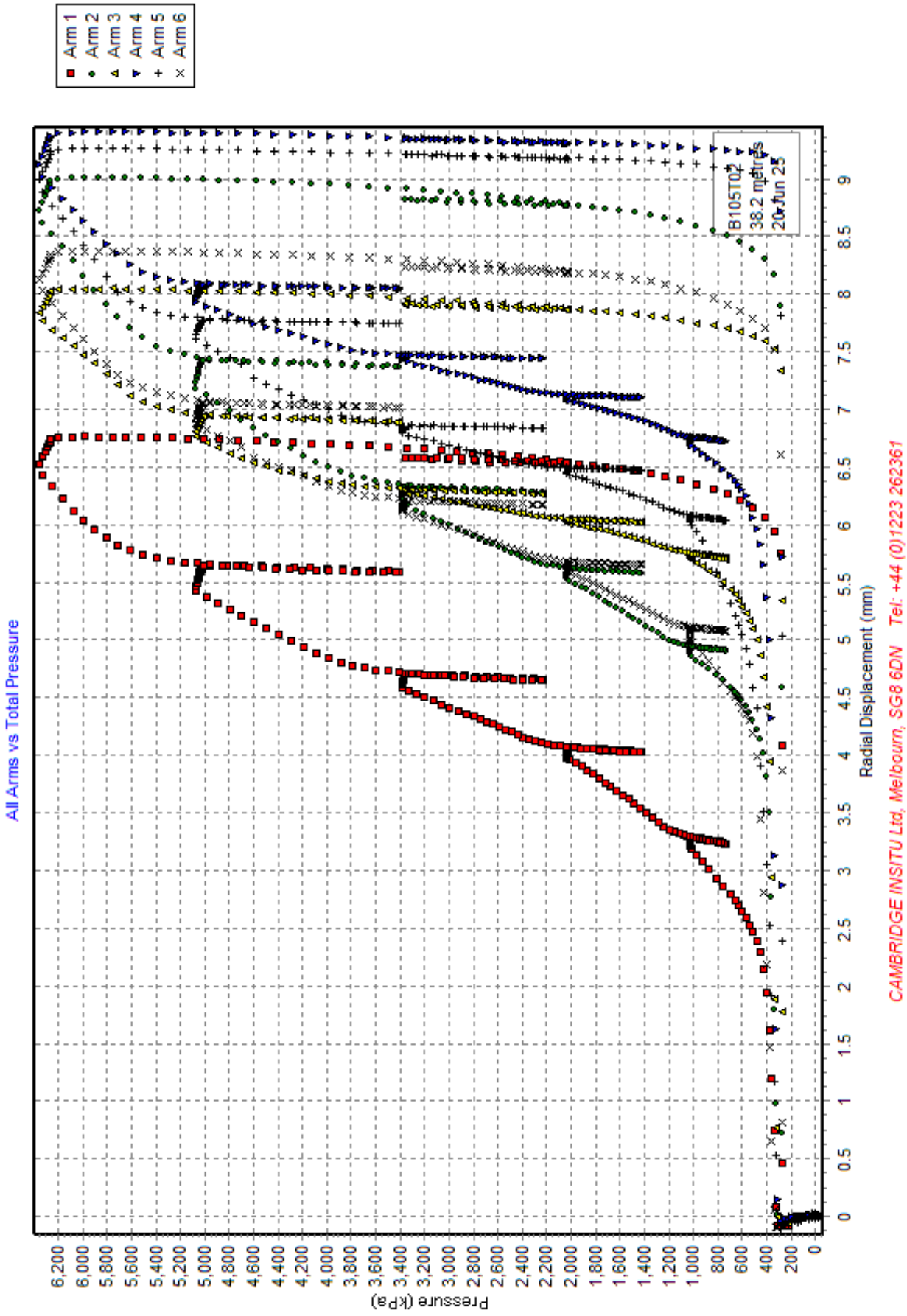

Bolton and Whittle (1999) Loop 3 : Arm ave
95mm High Pressure Dilatometer
BH105 Test 2
38.15 Metres
20 Jun 25
RESULTS:
Gradient (beta) : 0.791
Intercept (n) : 192.620MPa
Shear stress constant : 152.405MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)

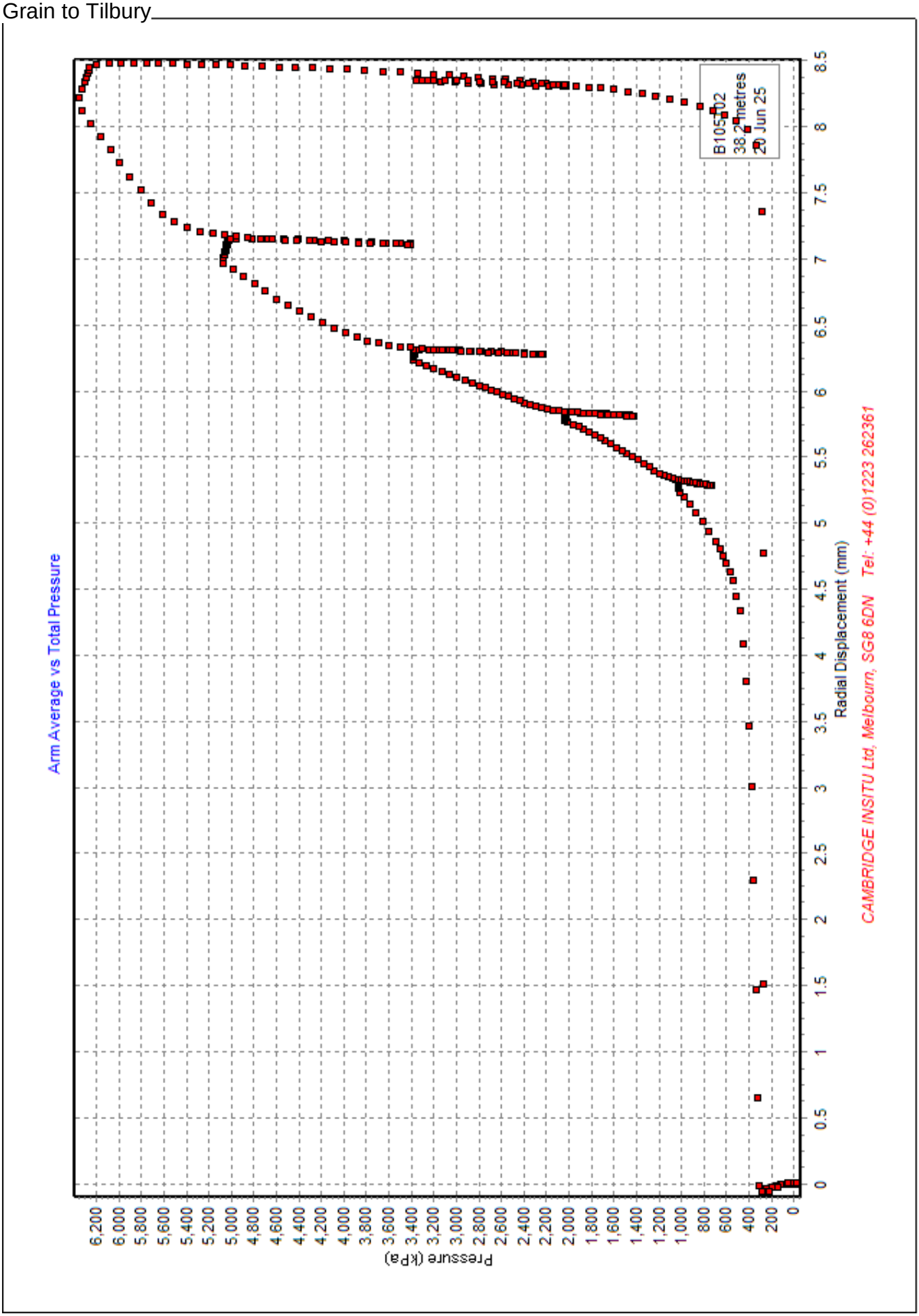

Bolton and Whittle (1999) Loop 4 : Arm ave
95mm High Pressure Dilatometer
BH105 Test 2
38.15 Metres
20 Jun 25
RESULTS:
Gradient (beta) : 0.805
Intercept (n) : 272.729MPa
Shear stress constant : 219.554MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 4
Total pressure (kPa)
Radial Displacement (mm)

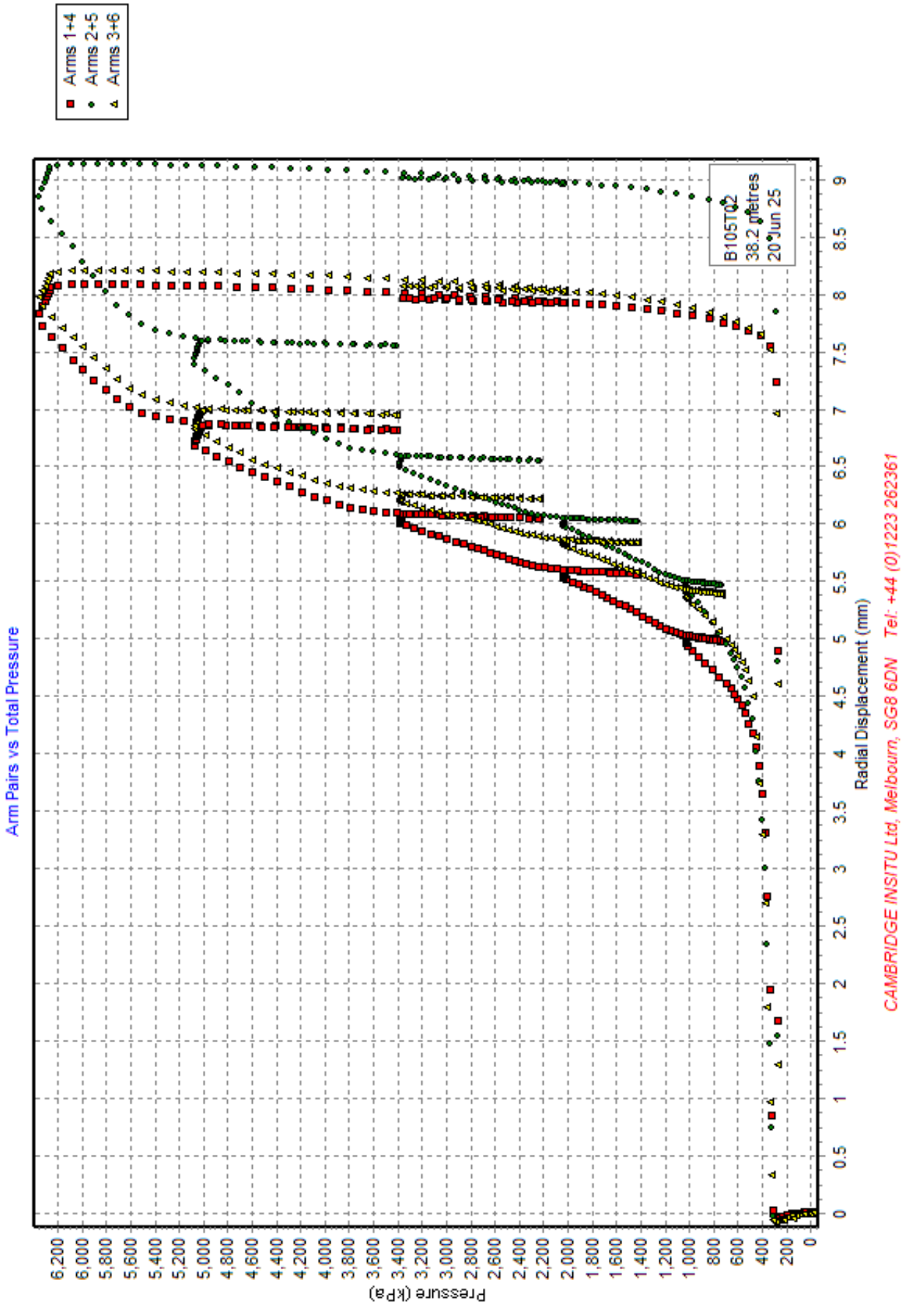

Bolton and Whittle (1999) Loop 5 : Arm ave
95mm High Pressure Dilatometer
BH105 Test 2
38.15 Metres
20 Jun 25
RESULTS:
Gradient (beta) : 0.737
Intercept (n) : 166.270MPa
Shear stress constant : 122.539MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 5
Total pressure (kPa)
Radial Displacement (mm)

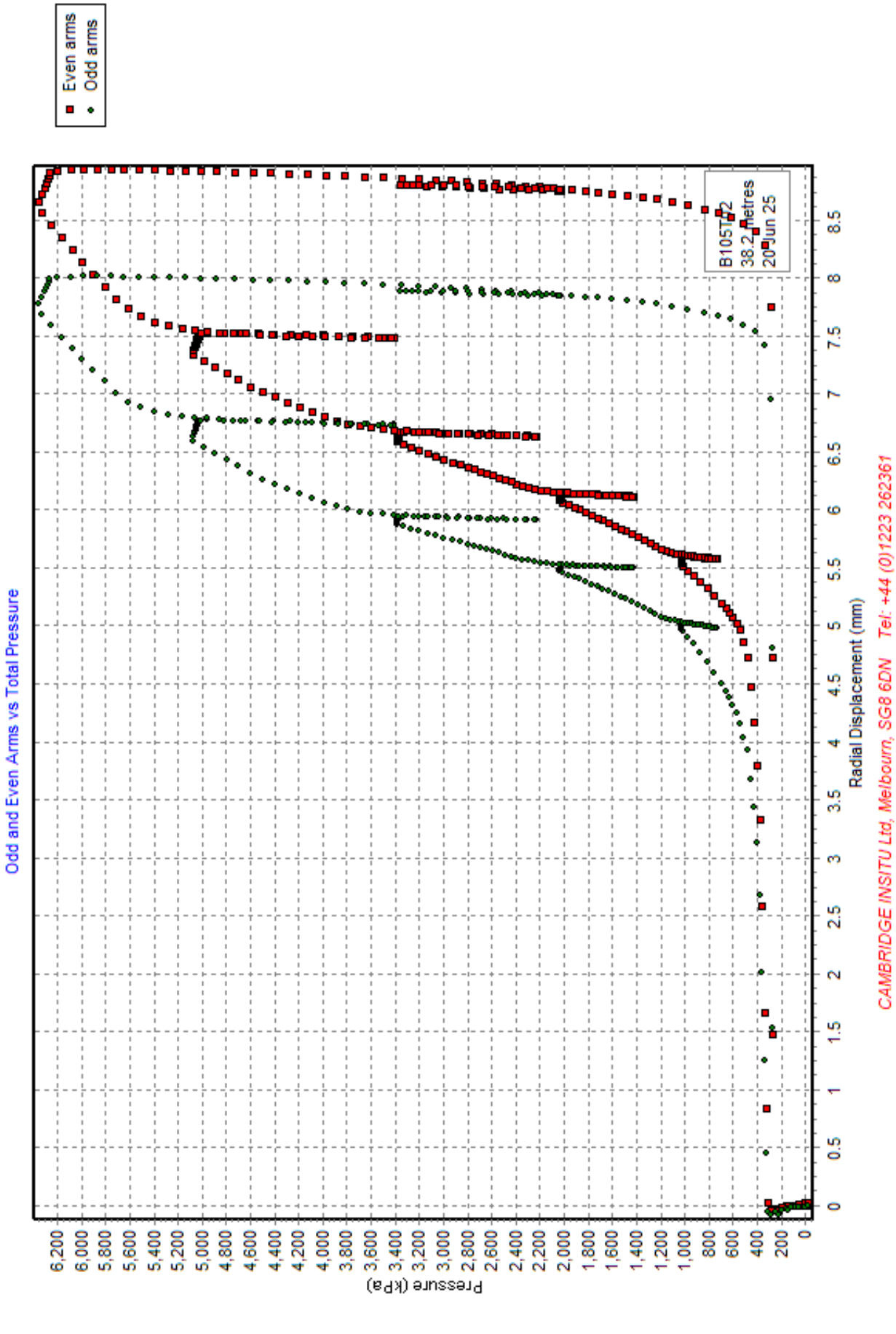

Variation of stiffness with strain, undrained analysis : Arm ave
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 108.397 0.936
2 180.464 0.864
3 152.405 0.791
4 219.554 0.805
5 122.539 0.737
95mm High Pressure Dilatometer
BH105 Test 2
38.15 Metres
20 Jun 25
Shear modulus (MPa)
Log plane shear strain
0.0001
0.001
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
Cycle 4 - Measured
Cycle 4 - Calculated
Cycle 5 - Measured
Cycle 5 - Calculated


Carter et al 1986 (adapted 2010) for c'-phi material : Arm ave
95mm High Pressure Dilatometer
BH105 Test 2
38.15 Metres
20 Jun 25
CURVE FIT PARAMETERS:
Origin : 5.840mm
Po : 932.0kPa
Cohesion : 208kPa
Phi peak : 35.5°
Dilation : 0.6°
Yield stress : 1870kPa
Limit pressure : 15595kPa
Elastic exponent : 0.737
Gs at first yield : 328.2MPa
Janbu exponent : 0.364
Correlation : 0.798
Estimated PWP : 280.1kPa
Phi cv : 35.0°
Poisson's ratio : 0.20
Total pressure (kPa)
Cavity strain (%)
Measured data
Calculated data


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
All Arms vs Total Pressure
B105T02
38.2 metres
20 Jun 25
Pressure (kPa)
Radial Displacement (mm)
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Arm Average vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
B105-02
38.2 metres
20 Jun 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arms 1+4
Arms 2+5
Arms 3+6
B105T02
38.2 metres
20 Jun 25
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
B105T2
38.2 metres
20th Jun 25
Odd and Even Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to TIlbury
BH105 Test 3 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Grain to Tilbury
Borehole : BH105
Test name : BH105 Test 3
Test date : 20 Jun 25
Test depth : 42.40 Metres
Water table : 9.6 Metres
Ambient PWP : 321.8 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDP/RW on 21 Jul 25

Remarks:

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=6.13"
Po from Marsland & Randolph (kPa) : "Arm ave=1009.2"
Best estimate of Po (kPa) : "Arm ave=933.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=3762.7"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 34.0
Angle of internal friction (°) : "Arm ave=37.6"
Dilation angle (°) : "Arm ave=4.4"
Gradient of log-log plot : "Arm ave=0.408"

[Withers et al 1989]
Angle of internal friction (°) : "Arm ave=34.2"
Dilation angle (°) : "Arm ave=0.2"
Gradient of log-log plot : "Arm ave=-2.548"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=47.5"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	162.3	-1.641	946	0.141	228
Arm ave	2	340.6	-0.402	1619	0.133	453
Arm ave	3	470.2	0.819	2427	0.160	753
Arm ave	4	714.8	2.499	3519	0.124	887
Arm ave	5	569.8	3.938	2438	0.212	1207

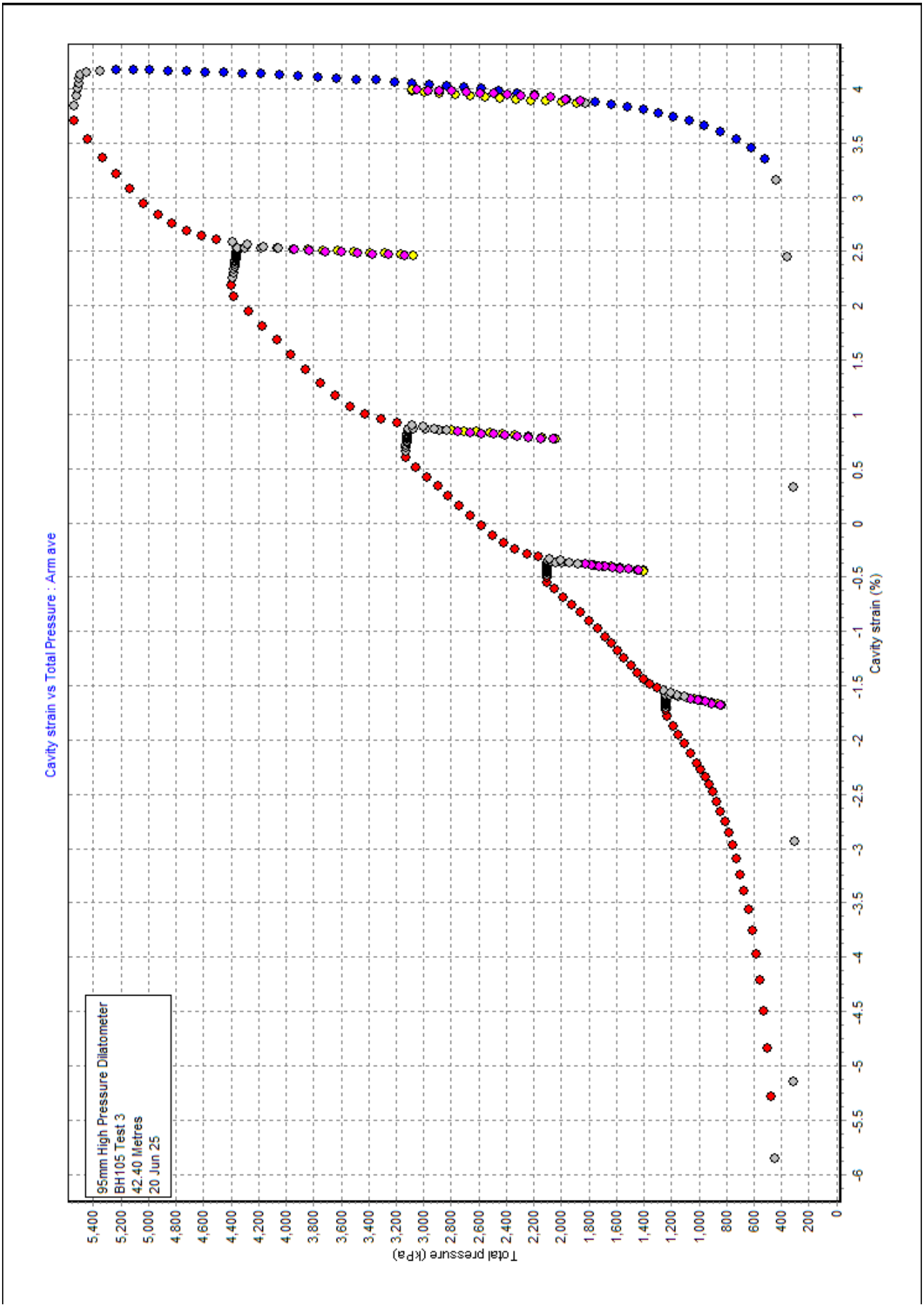
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

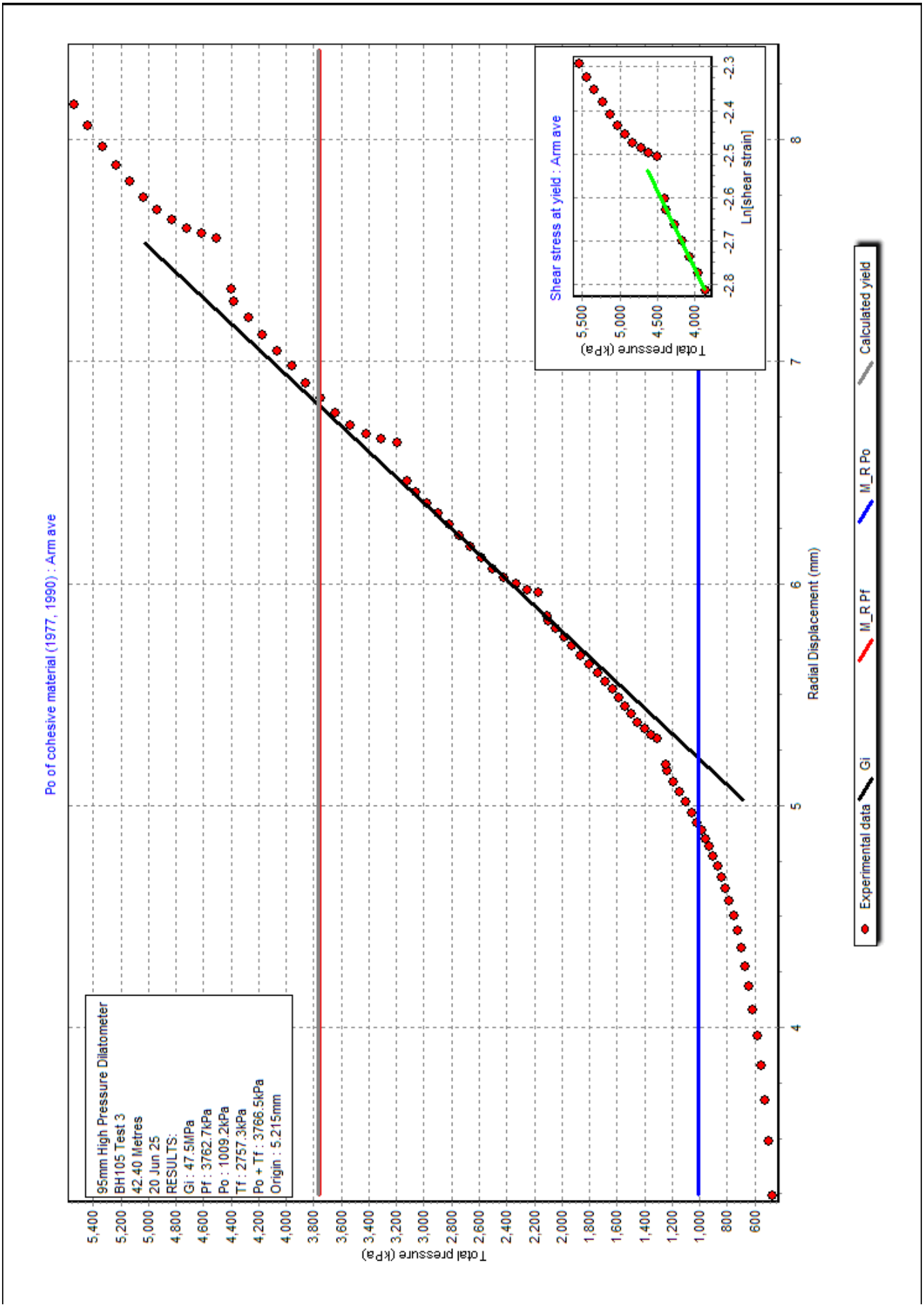
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	140.967	137.964	0.979
Arm ave	2	183.650	166.928	0.909
Arm ave	3	164.848	137.975	0.837
Arm ave	4	200.188	161.357	0.806
Arm ave	5	156.840	119.693	0.763

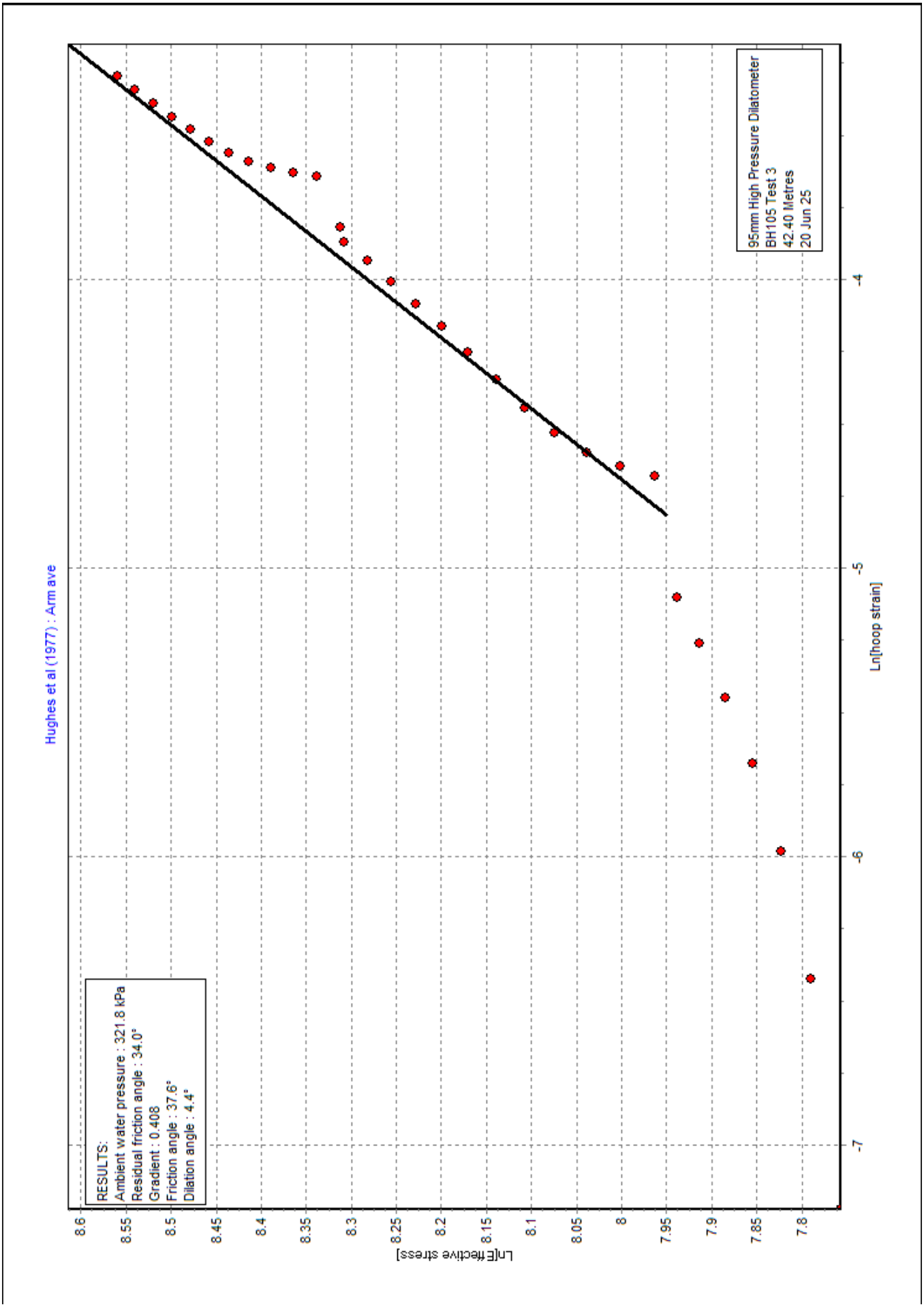
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 6.13
Po (kPa) : 933
Cohesion (kPa) : 206
Angle of peak friction (deg) : 37.6

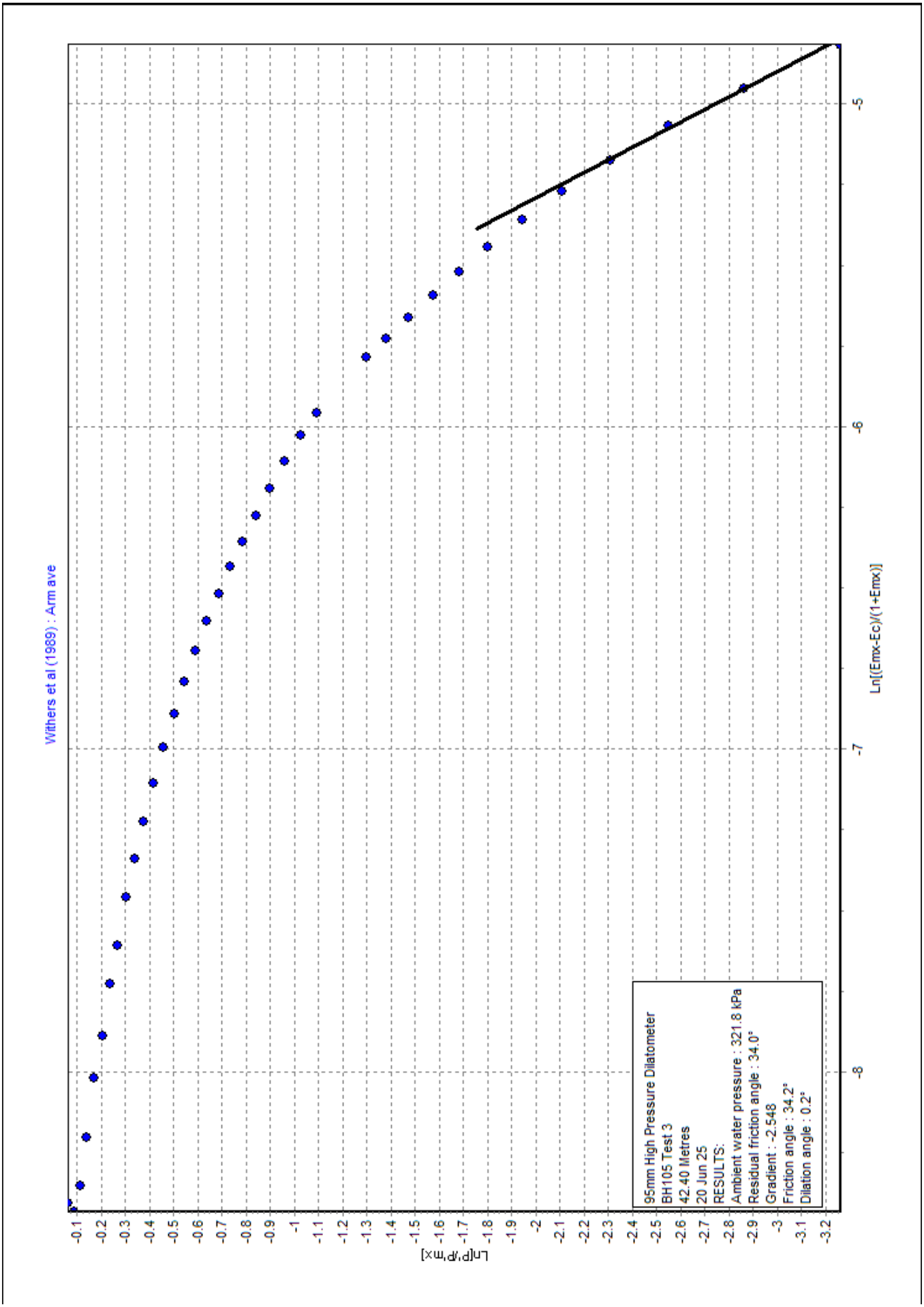
Grain to TIlbury
BH105 Test 3 - SUMMARY OF RESULTS

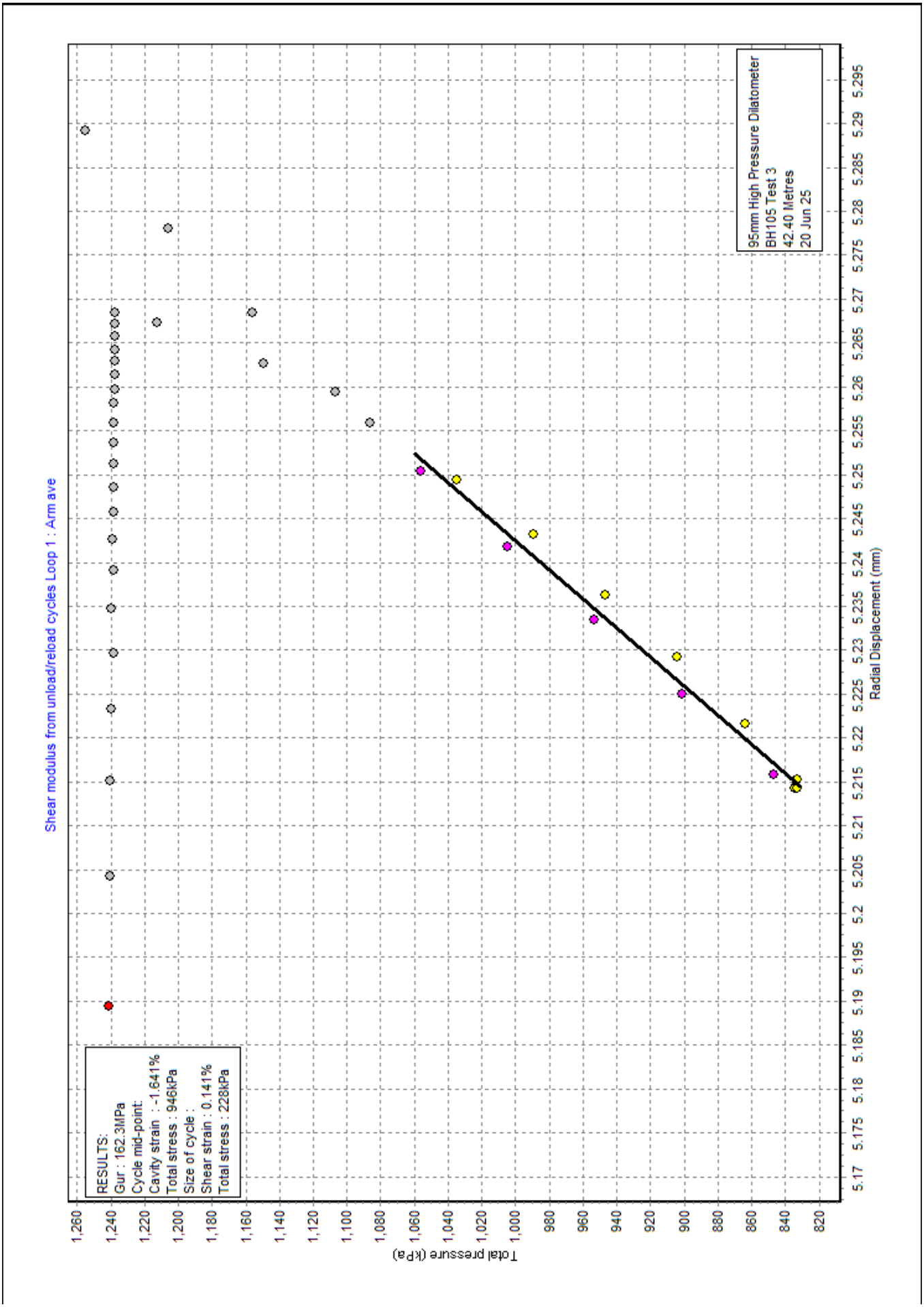
Angle of peak dilation (deg)	:	4.4
Total yield stress (kPa)	:	1712
Total limit stress (kPa)	:	15525
G at first yield (MPa)	:	248.3
Non-linear exponent	:	0.806
Janbu exponent	:	0.529
Correlation	:	0.922
Ambient pore water pressure (kPa)	:	322
Residual friction angle (deg)	:	34.0
Poisson's ratio	:	0.20

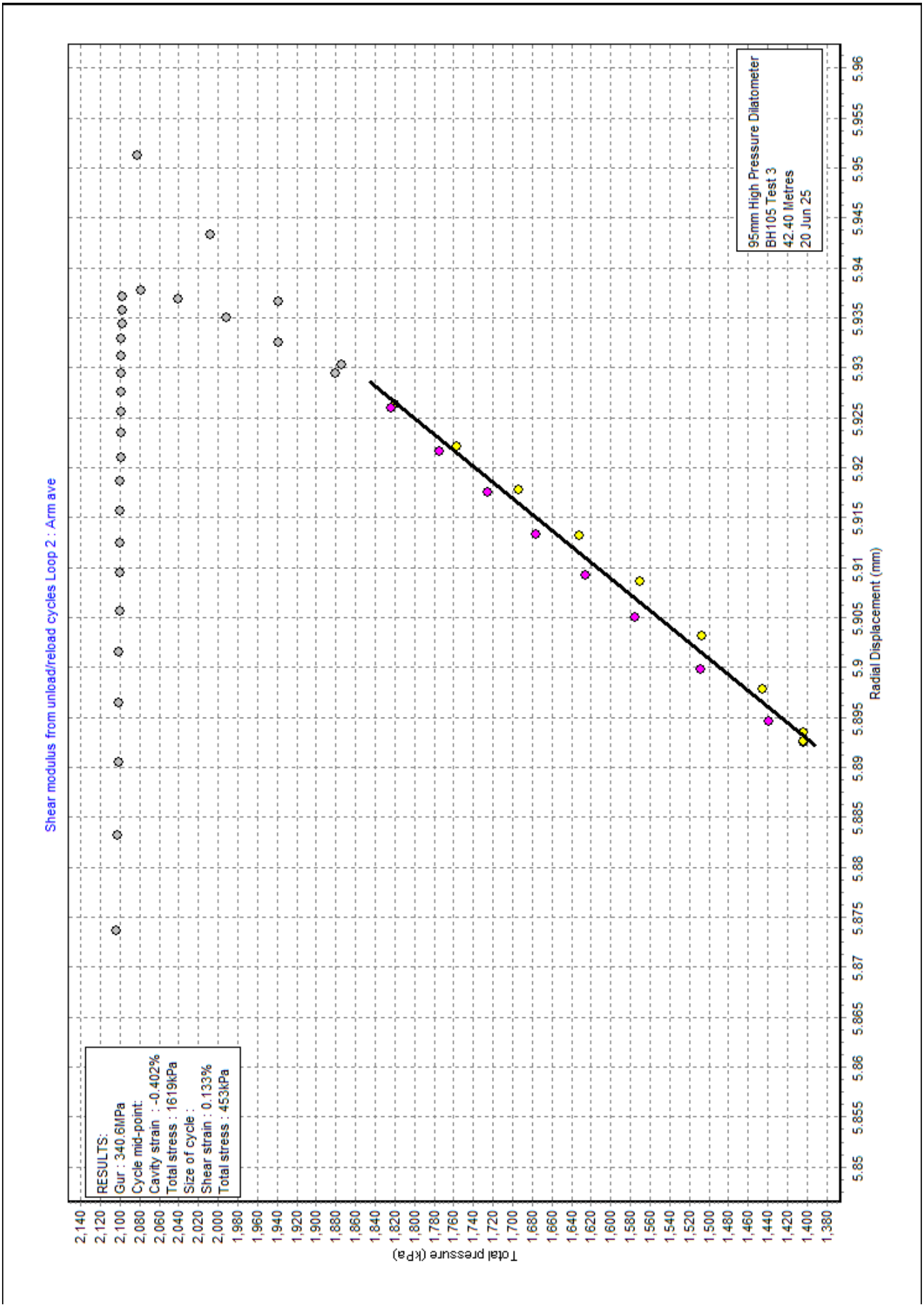

Cavity strain vs Total Pressure : Arm ave
95mm High Pressure Dilatometer
BH105 Test 3
42.40 Metres
20 Jun 25
Total pressure (kPa)
Cavity strain (%)

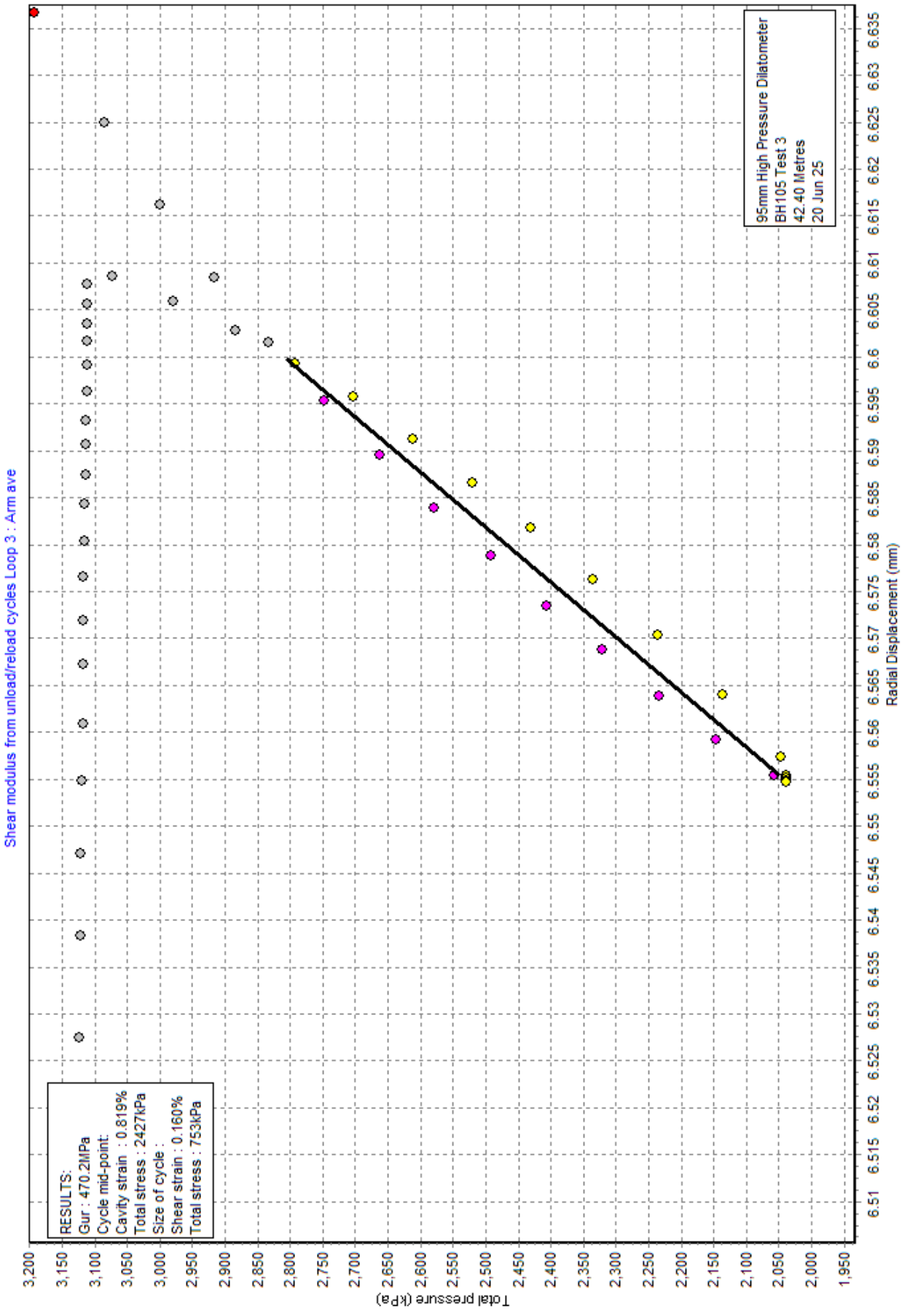

Po of cohesive material (1977, 1990) : Arm ave
95mm High Pressure Dilatometer
BH105 Test 3
42.40 Metres
20 Jun 25
RESULTS:
Gi : 47.5MPa
Pf : 3762.7kPa
Po : 1009.2kPa
Tf : 2757.3kPa
Po + Tf : 3766.5kPa
Origin : 5.215mm
Total pressure (kPa)
Radial Displacement (mm)
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Shear stress at yield : Arm ave
Total pressure (kPa)
Ln[shear strain]

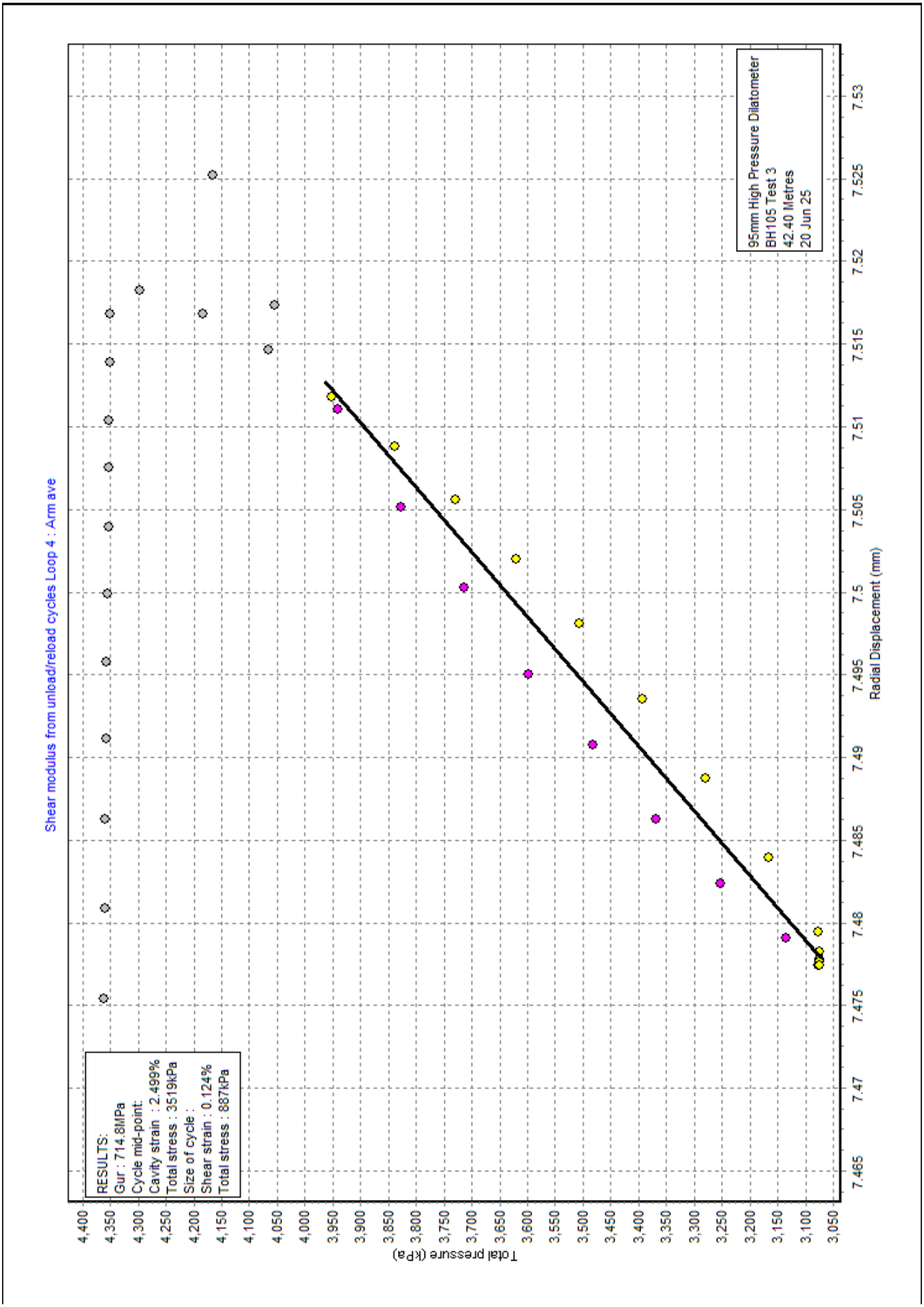

Hughes et al (1977) : Arm ave
RESULTS:
Ambient water pressure : 321.8 kPa
Residual friction angle : 34.0°
Gradient : 0.408
Friction angle : 37.6°
Dilation angle : 4.4°
95mm High Pressure Dilatometer
BH105 Test 3
42.40 Metres
20 Jun 25
Ln[effective stress]
Ln[hoop strain]
8.6
8.55
8.5
8.45
8.4
8.35
8.3
8.25
8.2
8.15
8.1
8.05
8
7.95
7.9
7.85
7.8
-4
-5
-6
-7

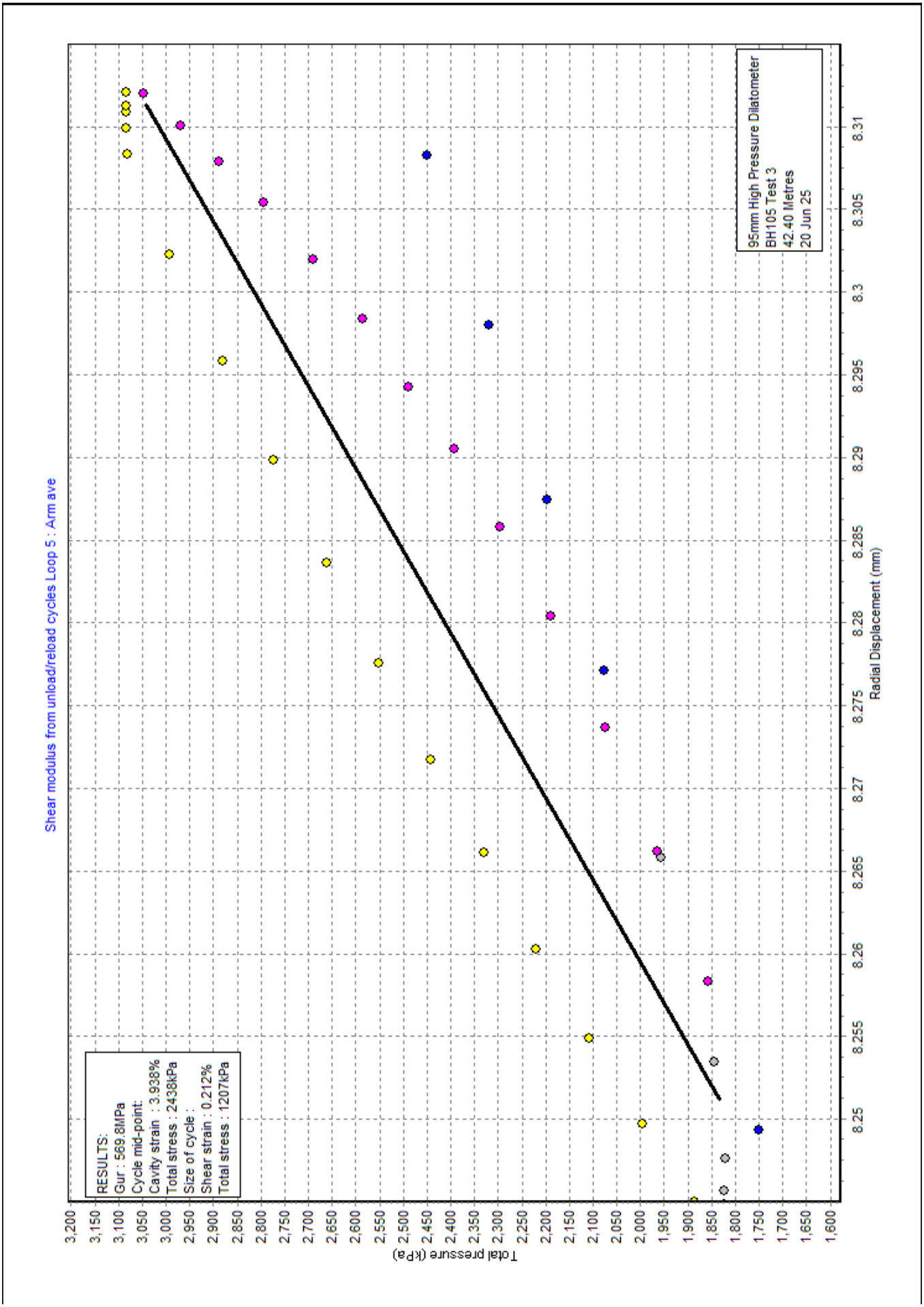

Withers et al (1989) : Arm ave
Ln[P'/P'lim x]
Ln[(Emx-Ec)/(1+Emx)]
95mm High Pressure Dilatometer
BH105 Test 3
42.40 Metres
20 Jun 25
RESULTS:
Ambient water pressure : 321.8 kPa
Residual friction angle : 34.0°
Gradient : -2.548
Friction angle : 34.2°
Dilation angle : 0.2°

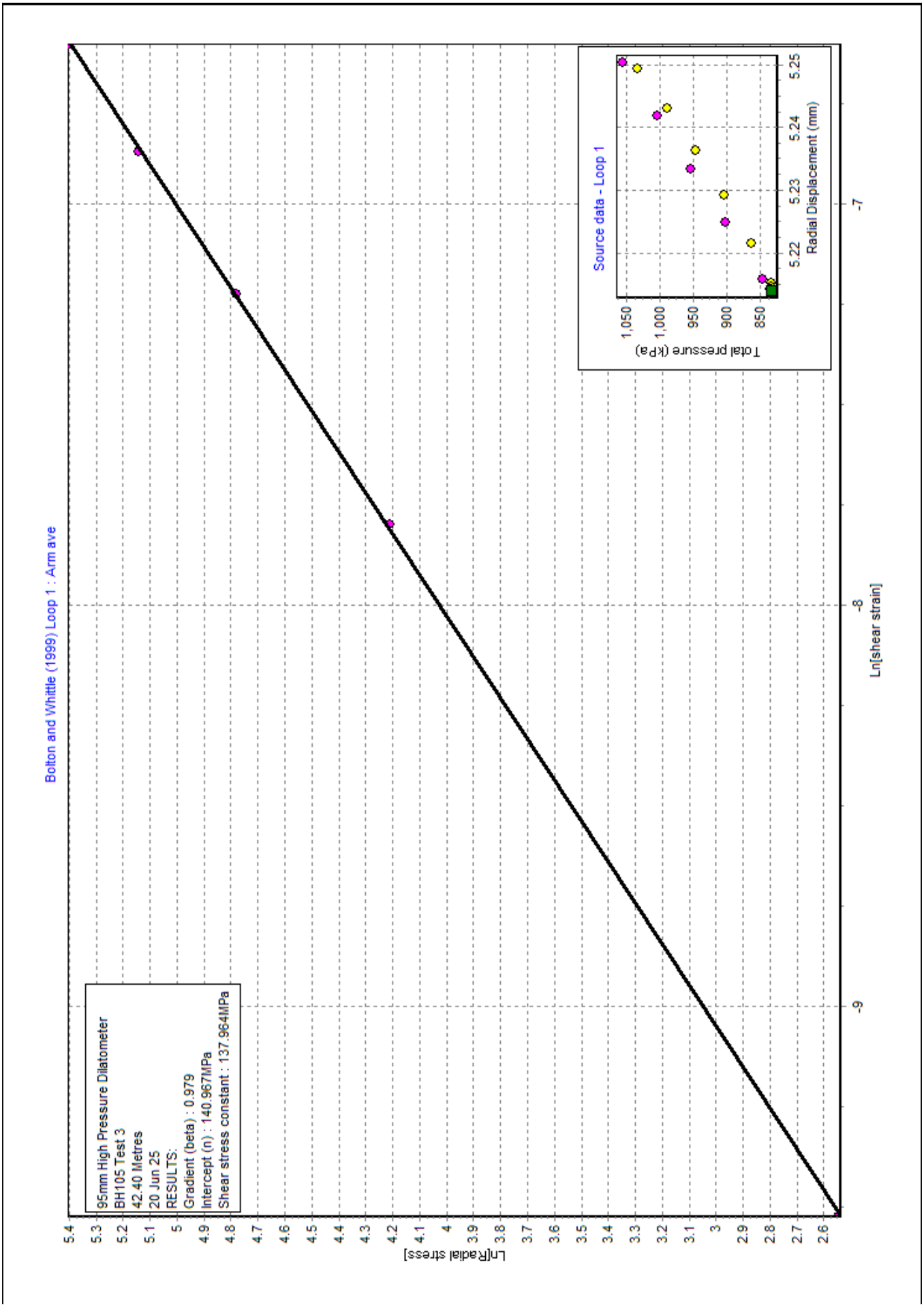

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 162.3MPa
Cycle mid-point:
Cavity strain : -1.641%
Total stress : 946kPa
Size of cycle :
Shear strain : 0.141%
Total stress : 228kPa
95mm High Pressure Dilatometer
BH105 Test 3
42.40 Metres
20 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

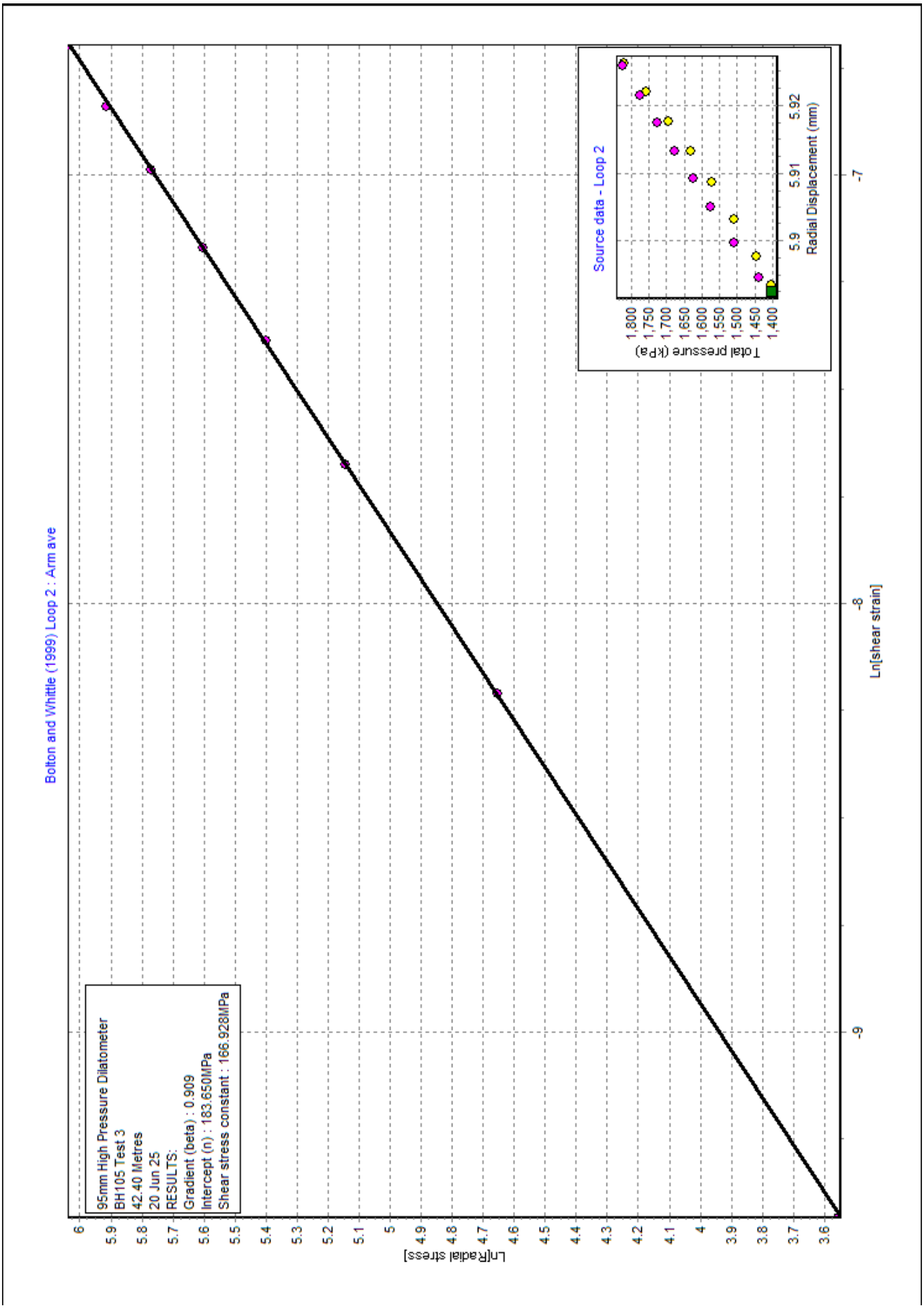

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 340.6MPa
Cycle mid-point:
Cavity strain : -0.402%
Total stress : 1619kPa
Size of cycle :
Shear strain : 0.133%
Total stress : 453kPa
95mm High Pressure Dilatometer
BH105 Test 3
42.40 Metres
20 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

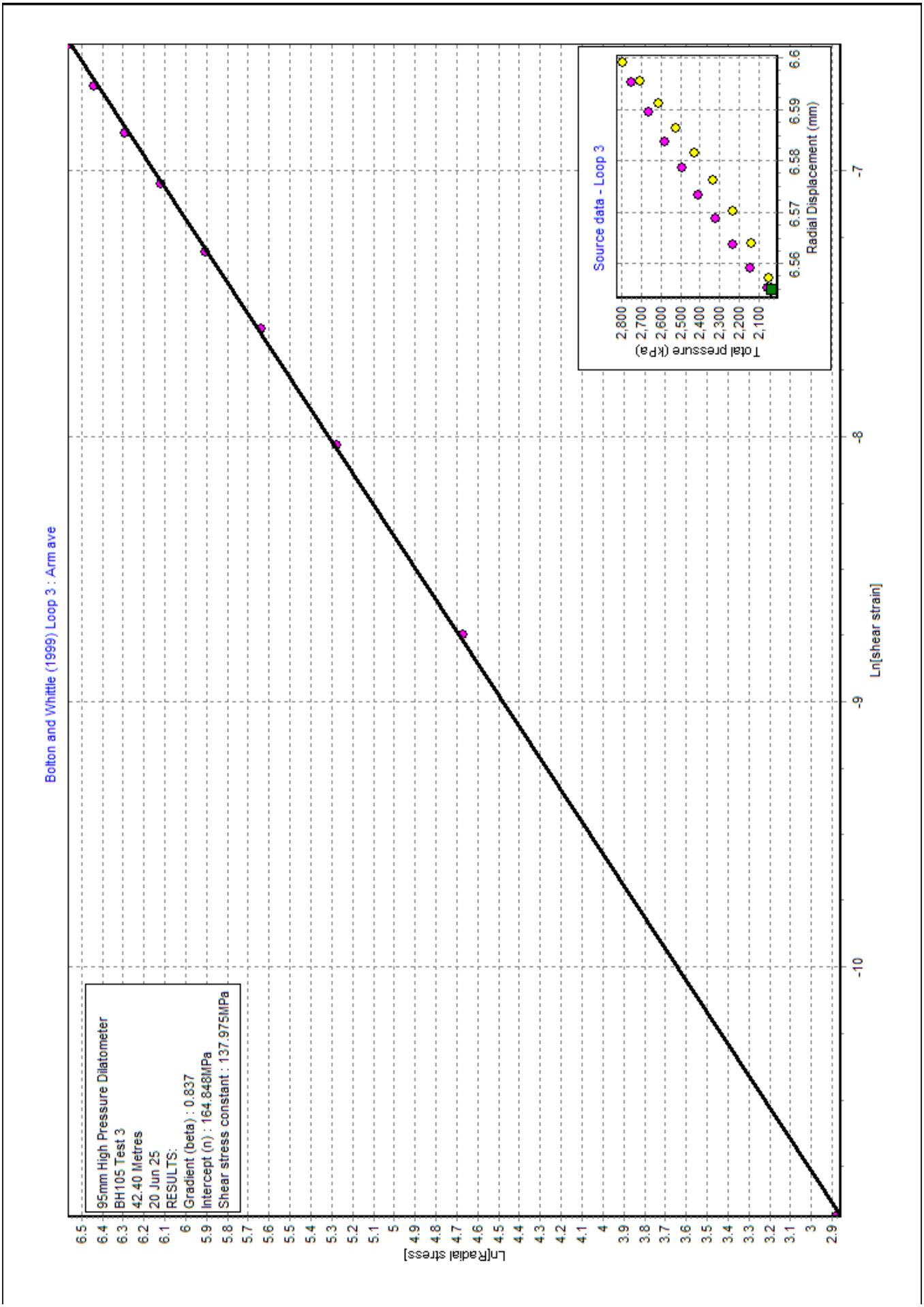

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 470.2MPa
Cycle mid-point:
Cavity strain : 0.819%
Total stress : 2427kPa
Size of cycle :
Shear strain : 0.160%
Total stress : 753kPa
95mm High Pressure Dilatometer
BH105 Test 3
42.40 Metres
20 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

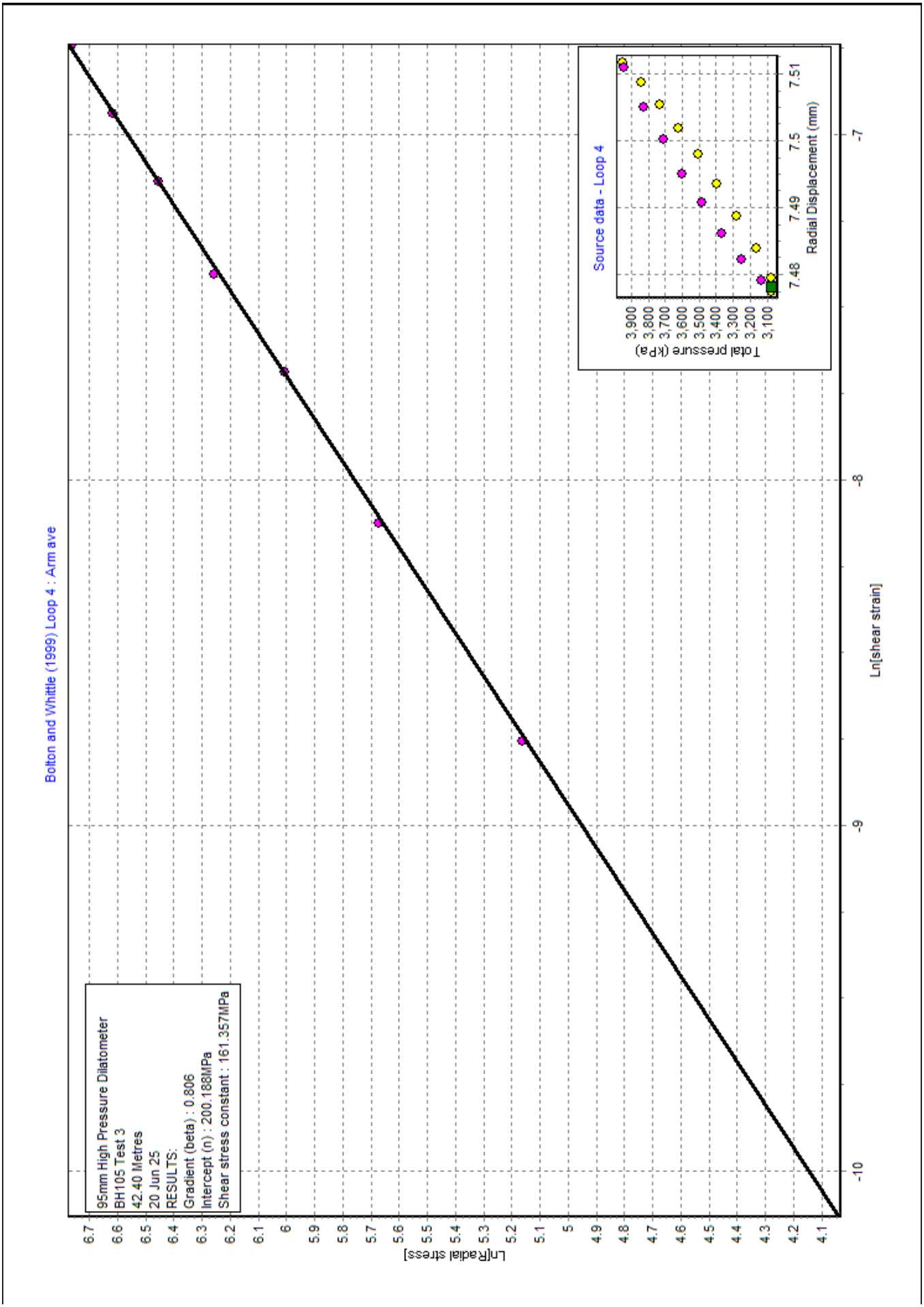

Shear modulus from unload/reload cycles Loop 4 : Arm ave
RESULTS:
Gur : 714.8MPa
Cycle mid-point:
Cavity strain : 2.499%
Total stress : 3519kPa
Size of cycle :
Shear strain : 0.124%
Total stress : 887kPa
95mm High Pressure Dilatometer
BH105 Test 3
42.40 Metres
20 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

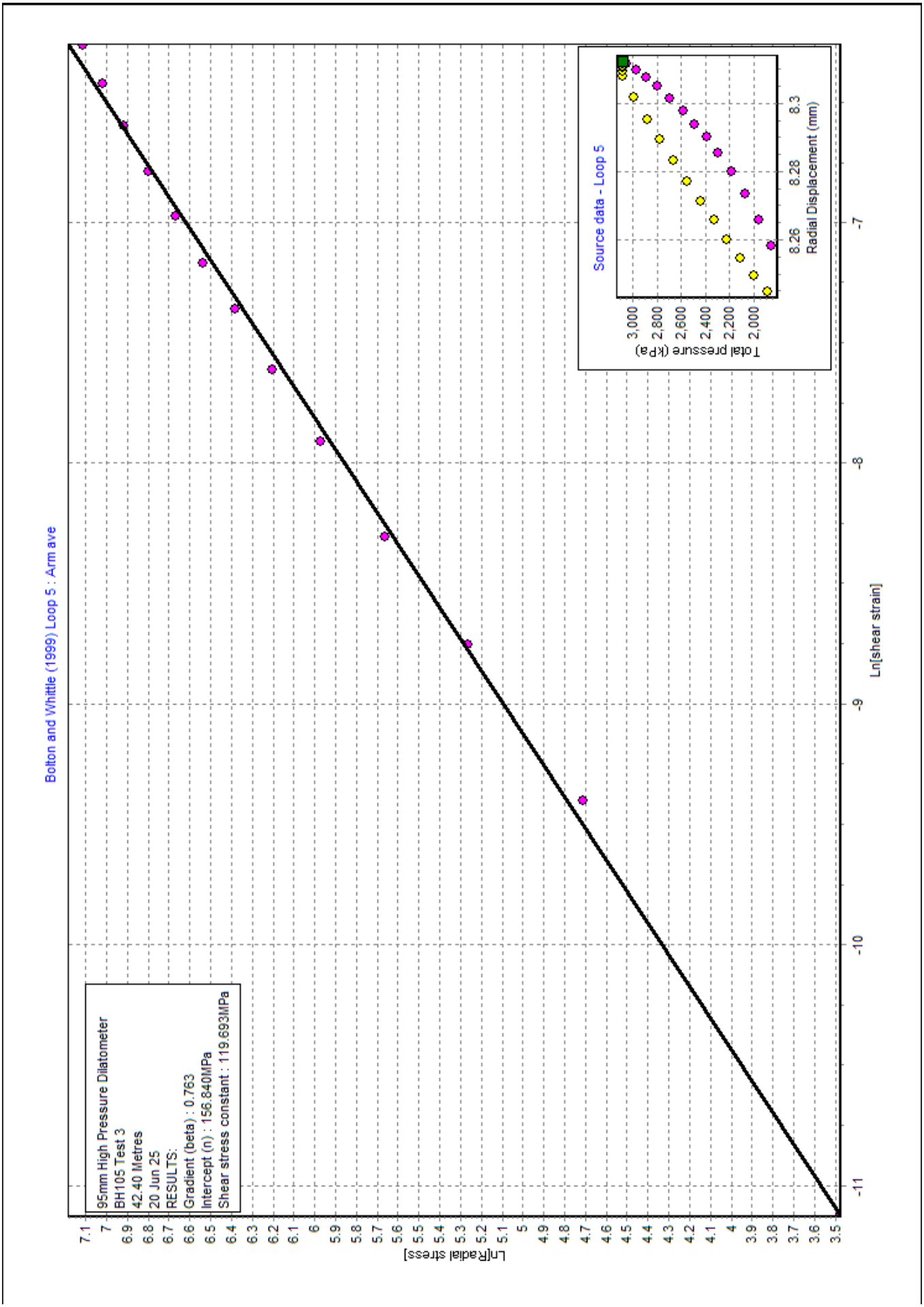

Shear modulus from unload/reload cycles Loop 5 : Arm ave
RESULTS:
Gur : 569.8MPa
Cycle mid-point:
Cavity strain : 3.938%
Total stress : 2438kPa
Size of cycle :
Shear strain : 0.212%
Total stress : 1207kPa
95mm High Pressure Dilatometer
BH105 Test 3
42.40 Metres
20 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

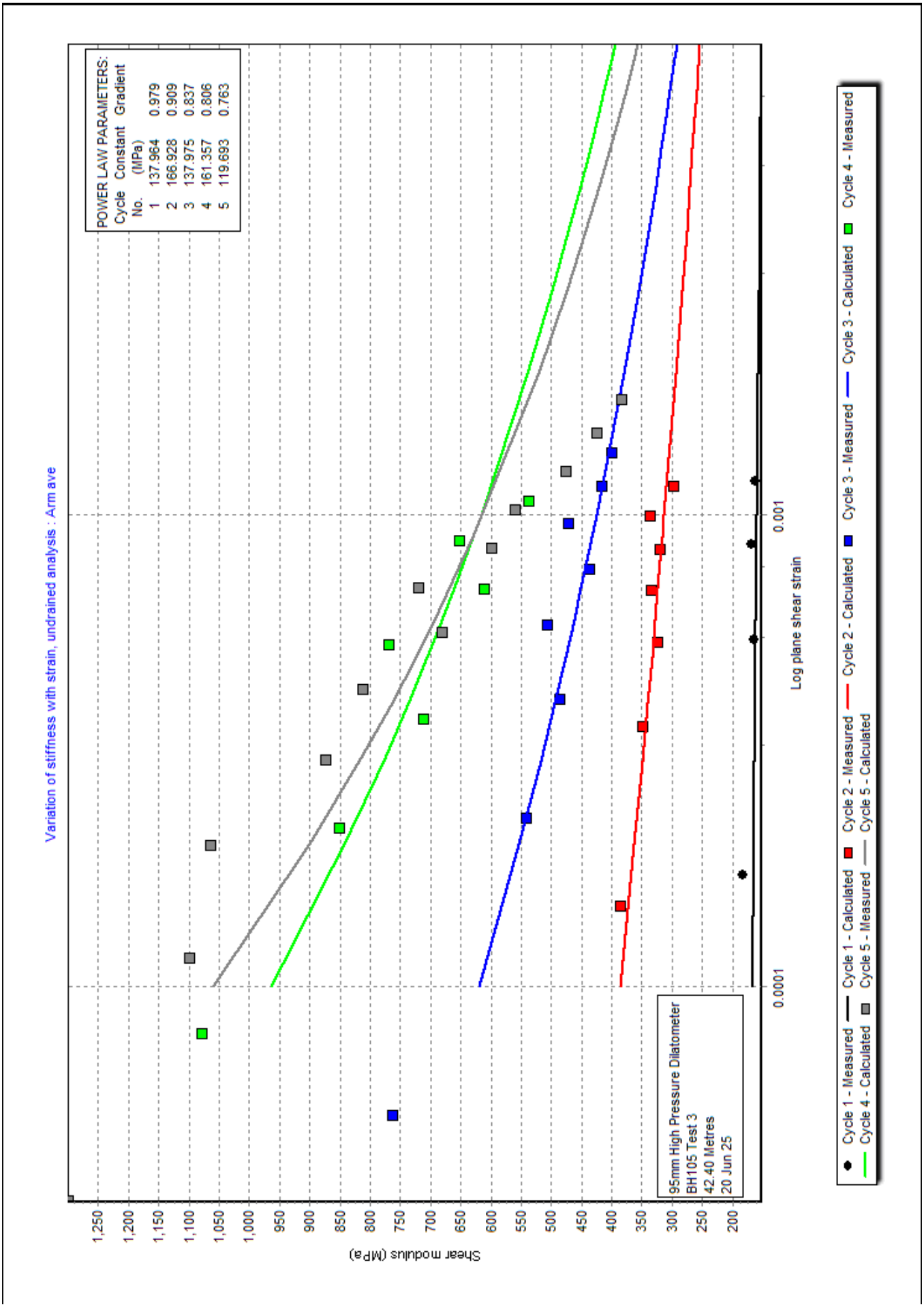

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH105 Test 3
42.40 Metres
20 Jun 25
RESULTS:
Gradient (beta) : 0.979
Intercept (n) : 140.967MPa
Shear stress constant : 137.964MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

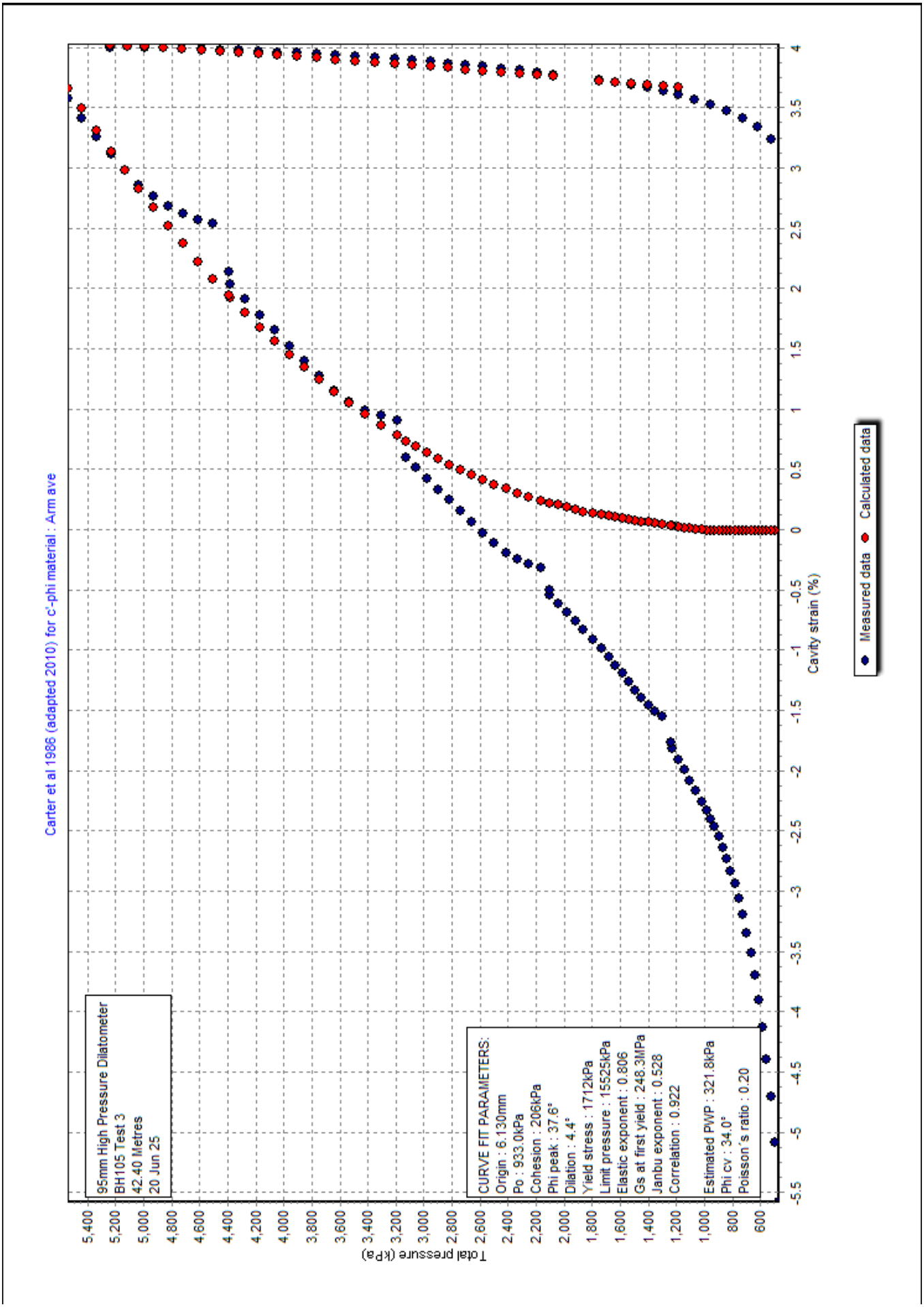

Bolton and Whittle (1999) Loop 2 : Arm ave
95mm High Pressure Dilatometer
BH105 Test 3
42.40 Metres
20 Jun 25
RESULTS:
Gradient (beta) : 0.909
Intercept (n) : 183.650MPa
Shear stress constant : 166.928MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

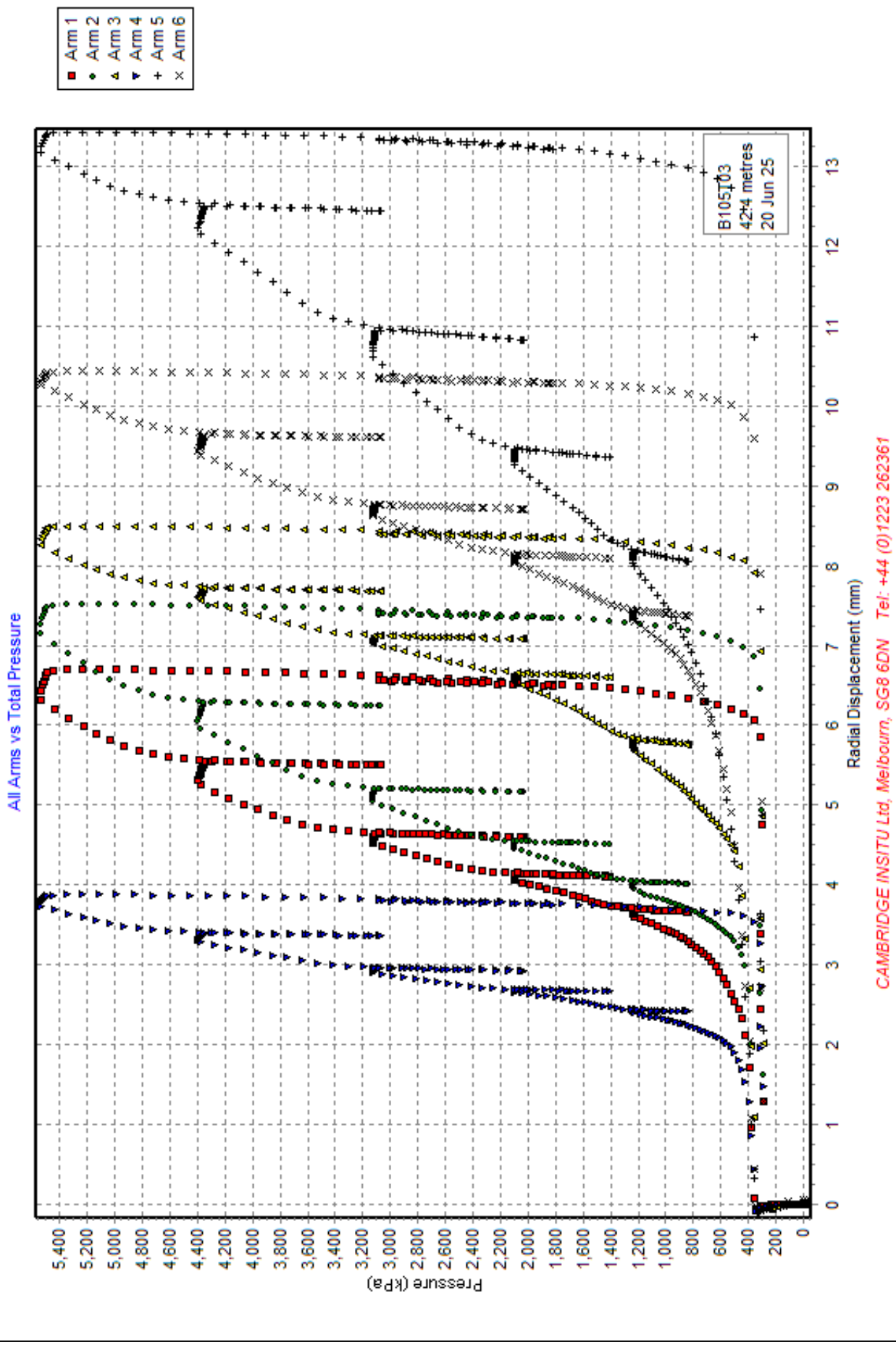

Bolton and Whittle (1999) Loop 3 : Arm ave
95mm High Pressure Dilatometer
BH105 Test 3
42.40 Metres
20 Jun 25
RESULTS:
Gradient (beta) : 0.837
Intercept (n) : 164.848MPa
Shear stress constant : 137.975MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)

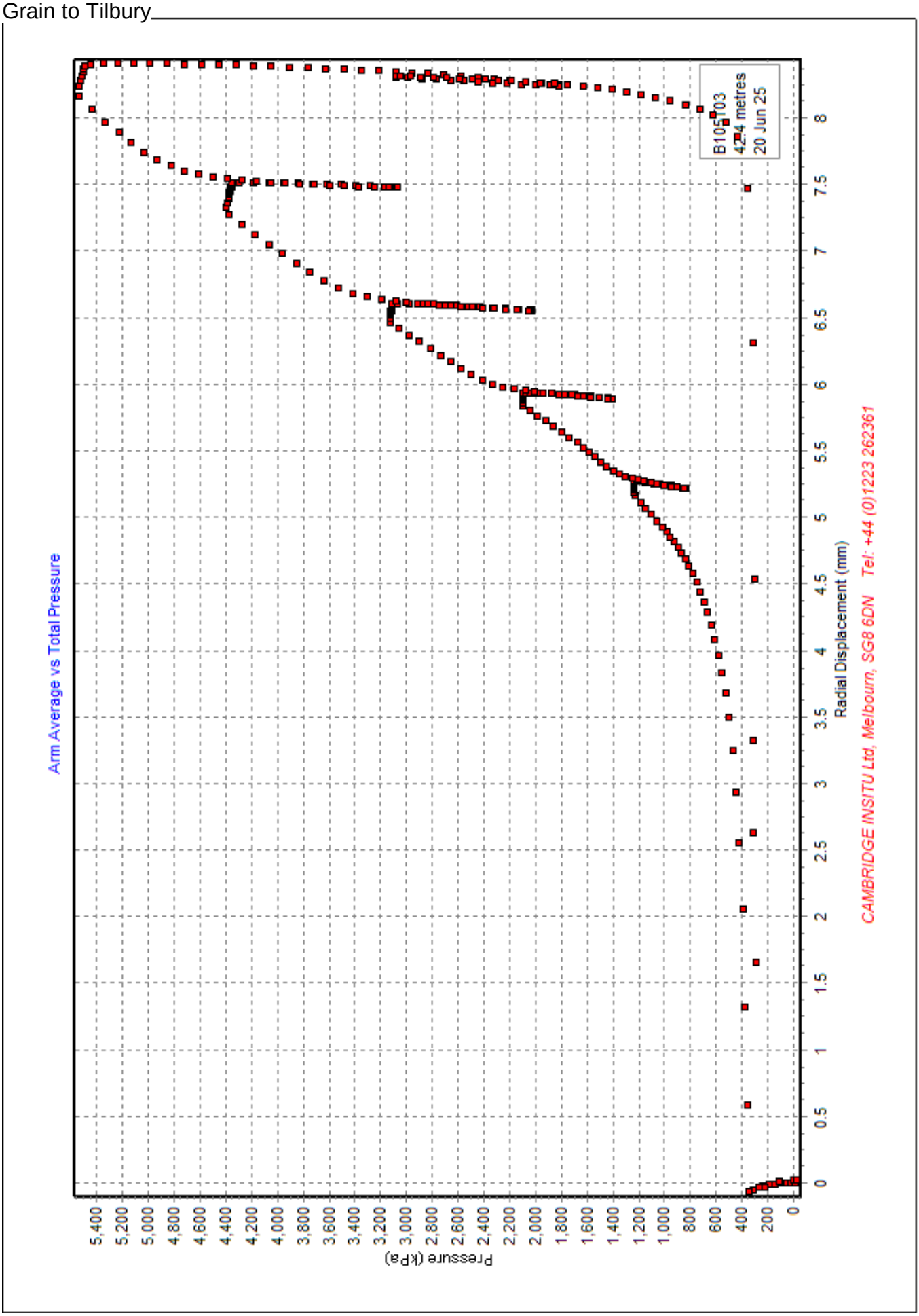

Bolton and Whittle (1999) Loop 4 : Arm ave
95mm High Pressure Dilatometer
BH105 Test 3
42.40 Metres
20 Jun 25
RESULTS:
Gradient (beta) : 0.806
Intercept (n) : 200.188MPa
Shear stress constant : 161.357MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 4
Total pressure (kPa)
Radial Displacement (mm)

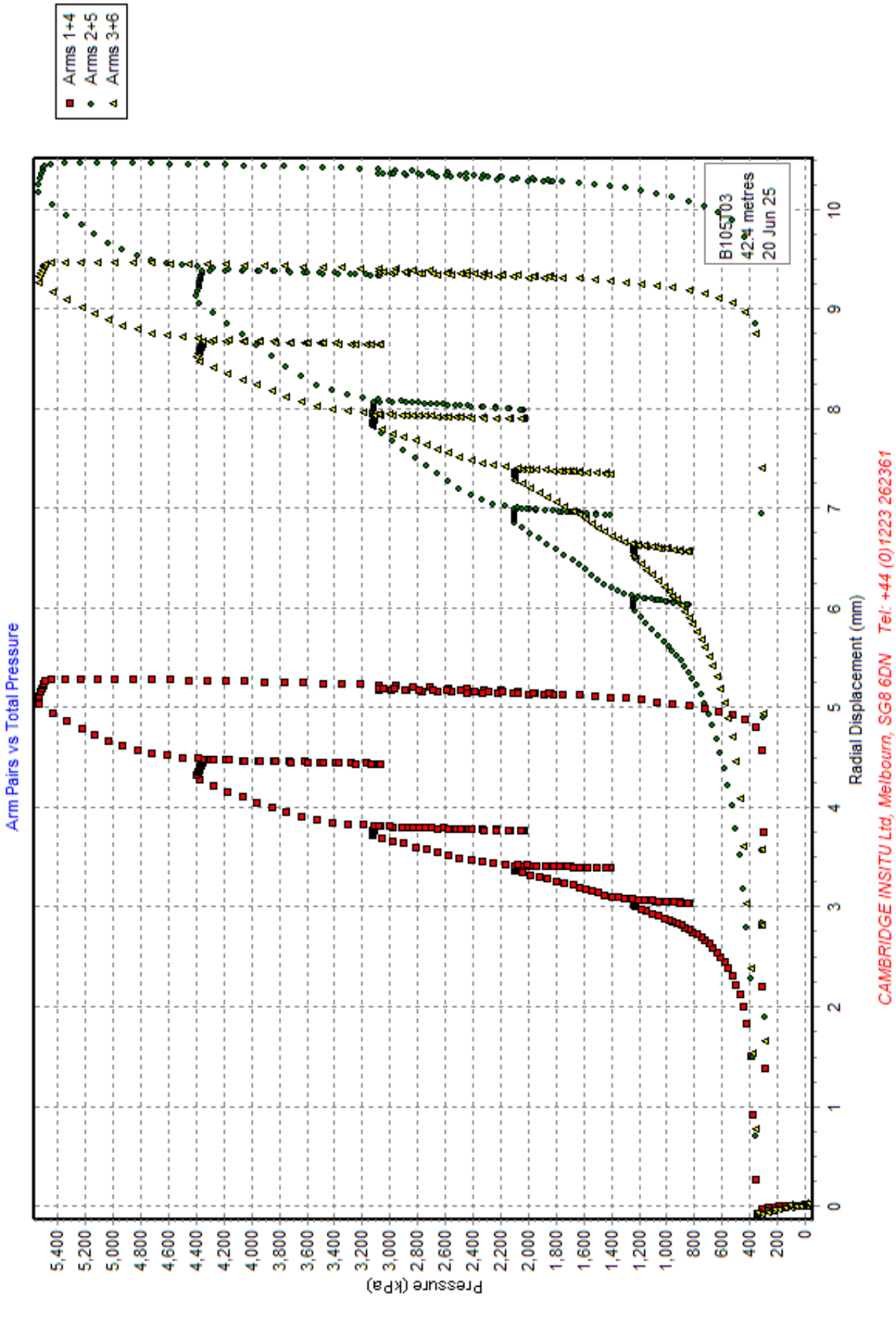

Bolton and Whittle (1999) Loop 5 : Arm ave
95mm High Pressure Dilatometer
BH105 Test 3
42.40 Metres
20 Jun 25
RESULTS:
Gradient (beta) : 0.763
Intercept (n) : 156.840MPa
Shear stress constant : 119.693MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 5
Total pressure (kPa)
Radial Displacement (mm)

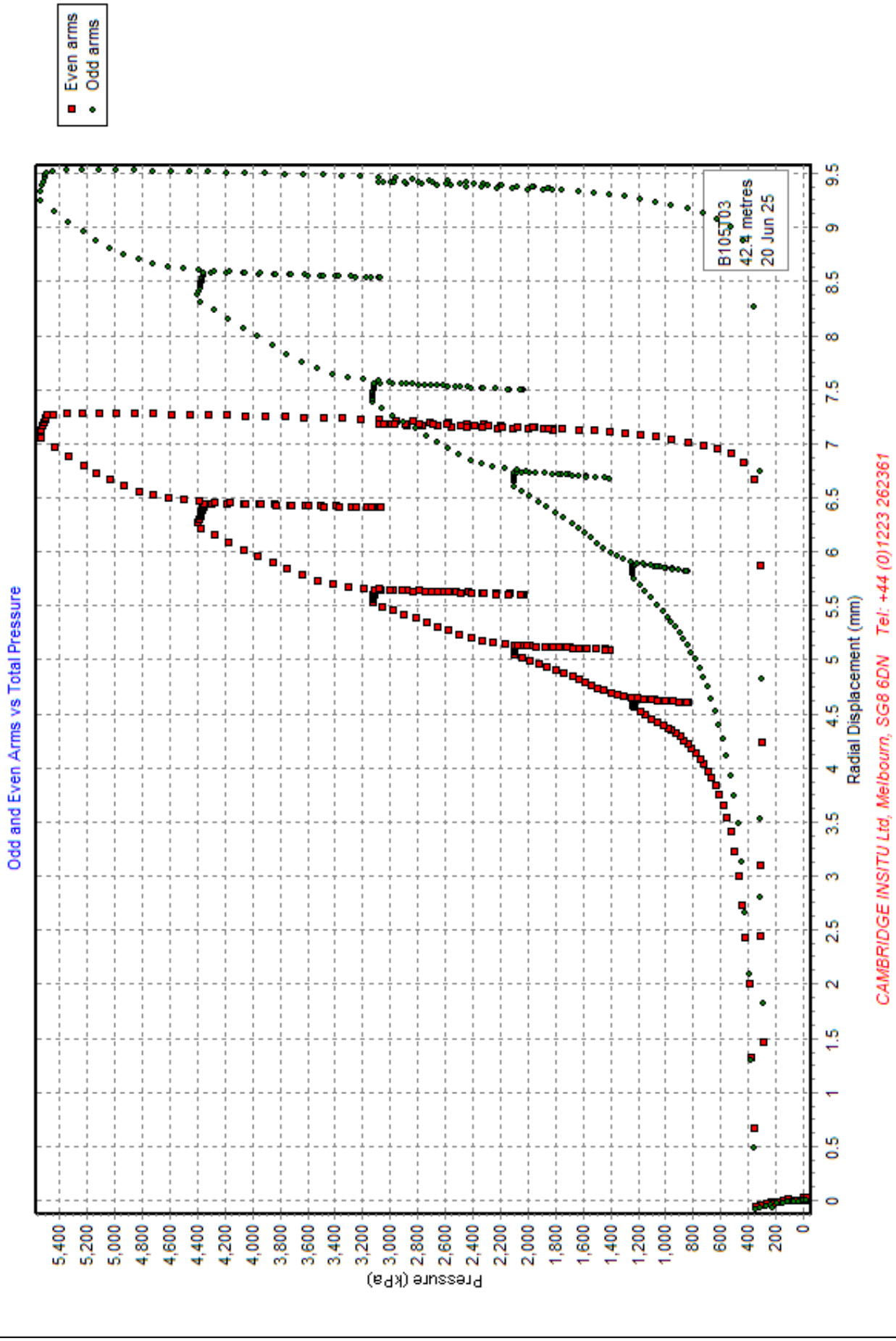

Variation of stiffness with strain, undrained analysis : Arm ave
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 137.964 0.979
2 166.928 0.909
3 137.975 0.837
4 161.357 0.806
5 119.693 0.763
Shear modulus (MPa)
1,250
1,200
1,150
1,100
1,050
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
0.0001
0.001
Log plane shear strain
95mm High Pressure Dilatometer
BH105 Test 3
42.40 Metres
20 Jun 25
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
Cycle 4 - Measured
Cycle 4 - Calculated
Cycle 5 - Measured
Cycle 5 - Calculated


Carter et al 1986 (adapted 2010) for c'-phi material : Arm ave
95mm High Pressure Dilatometer
BH105 Test 3
42.40 Metres
20 Jun 25
CURVE FIT PARAMETERS:
Origin : 6.130mm
Po : 933.0kPa
Cohesion : 206kPa
Phi peak : 37.6°
Dilation : 4.4°
Yield stress : 1712kPa
Limit pressure : 15525kPa
Elastic exponent : 0.806
Gs at first yield : 248.3MPa
Janbu exponent : 0.528
Correlation : 0.922
Estimated PWP : 321.8kPa
Phi cv : 34.0°
Poisson's ratio : 0.20
Total pressure (kPa)
Cavity strain (%)
Measured data
Calculated data


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
B105103
42.4 metres
20 Jun 25
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


B105103
4.4 metres
20 Jun 25
Arm Average vs Total Pressure
Radial Displacement (mm)
Pressure (kPa)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arms 1+4
Arms 2+5
Arms 3+6
B105703
42.4 metres
20 Jun 25
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
B105/03
42.4 metres
20 Jun 25
Odd and Even Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to TIlbury
BH105 Test 4 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Grain to Tilbury
Borehole : BH105
Test name : BH105 Test 4
Test date : 23 Jun 25
Test depth : 46.20 Metres
Water table : 9.6 Metres
Ambient PWP : 359.0 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDP/RW on 21 Jul 25

Remarks:

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=3.35"
Po from Marsland & Randolph (kPa) : "Arm ave=1445.5"
Best estimate of Po (kPa) : "Arm ave=1353.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=6799.0"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 35.0
Angle of internal friction (°) : "Arm ave=46.0"
Dilation angle (°) : "Arm ave=14.4"
Gradient of log-log plot : "Arm ave=0.522"

[Withers et al 1989]
Angle of internal friction (°) : "Arm ave=36.4"
Dilation angle (°) : "Arm ave=1.8"
Gradient of log-log plot : "Arm ave=-2.784"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=312.5"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	598.8	-0.457	1654	0.076	454
Arm ave	2	1146.0	0.111	3253	0.096	1106
Arm ave	3	1401.3	0.477	4937	0.126	1768
Arm ave	4	1497.7	1.145	7252	0.157	2358
Arm ave	5	1366.7	1.921	4900	0.206	2821

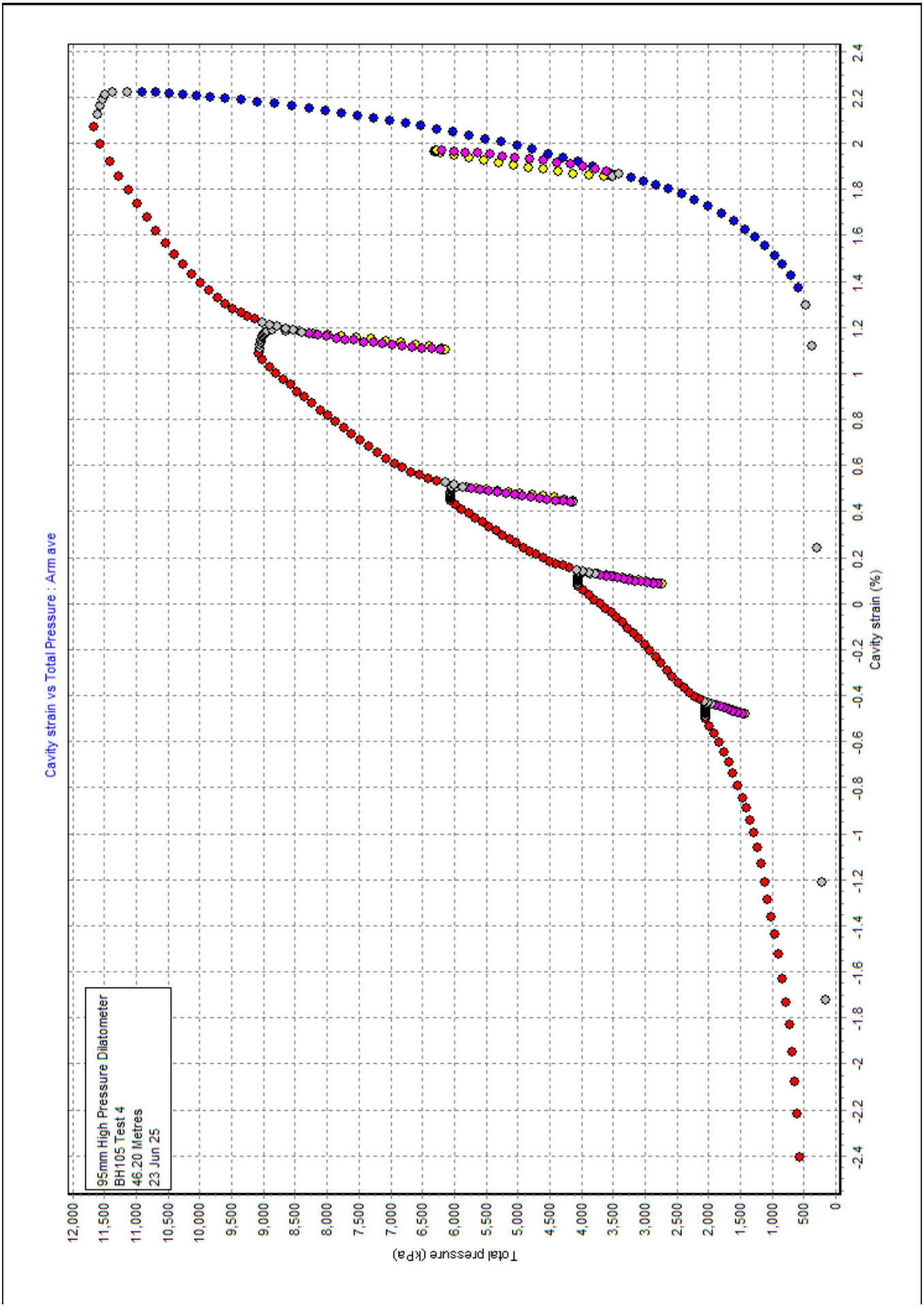
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

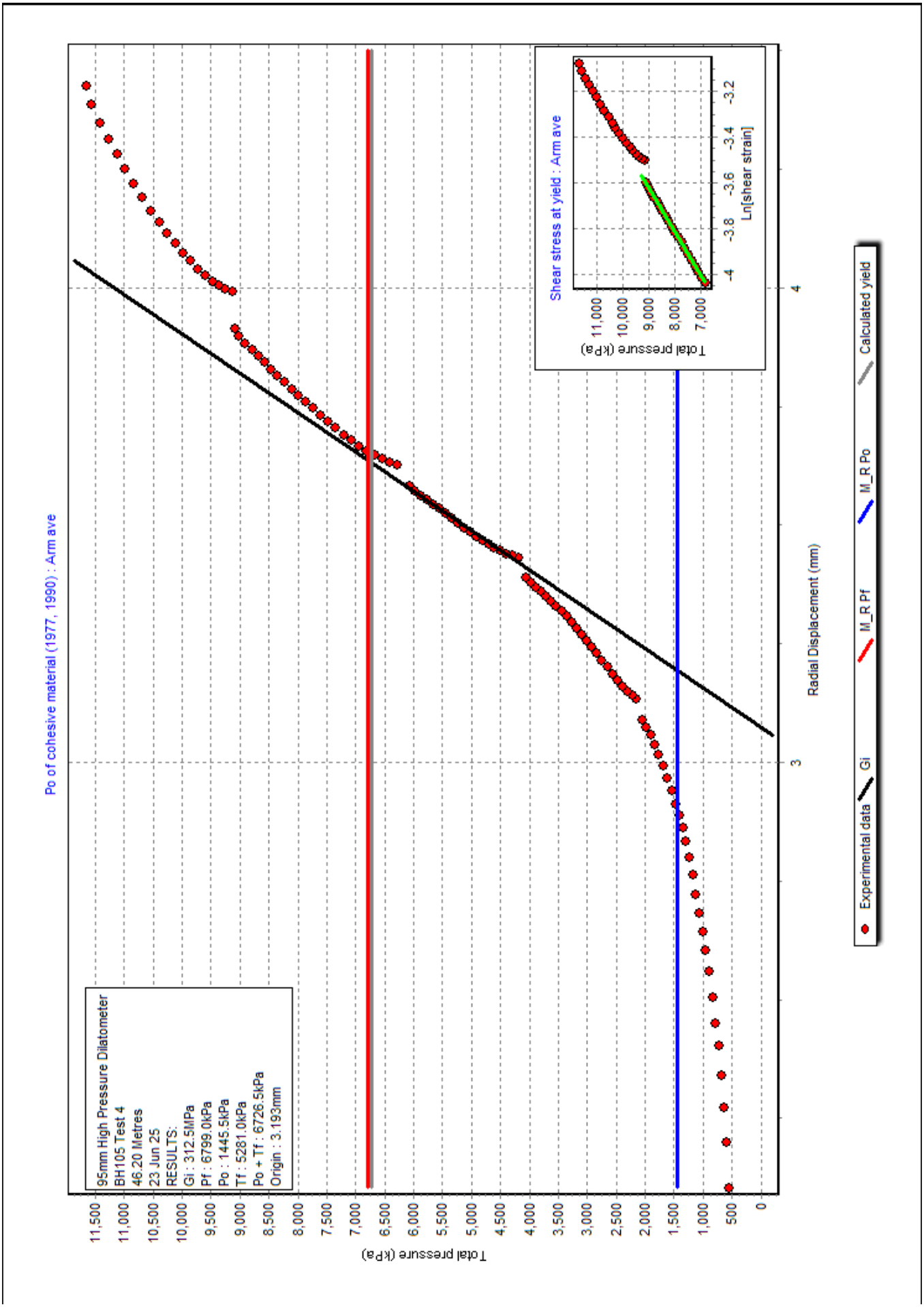
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	215.514	185.094	0.859
Arm ave	2	363.829	304.827	0.838
Arm ave	3	417.501	343.061	0.822
Arm ave	4	437.032	351.942	0.805
Arm ave	5	220.604	152.779	0.693

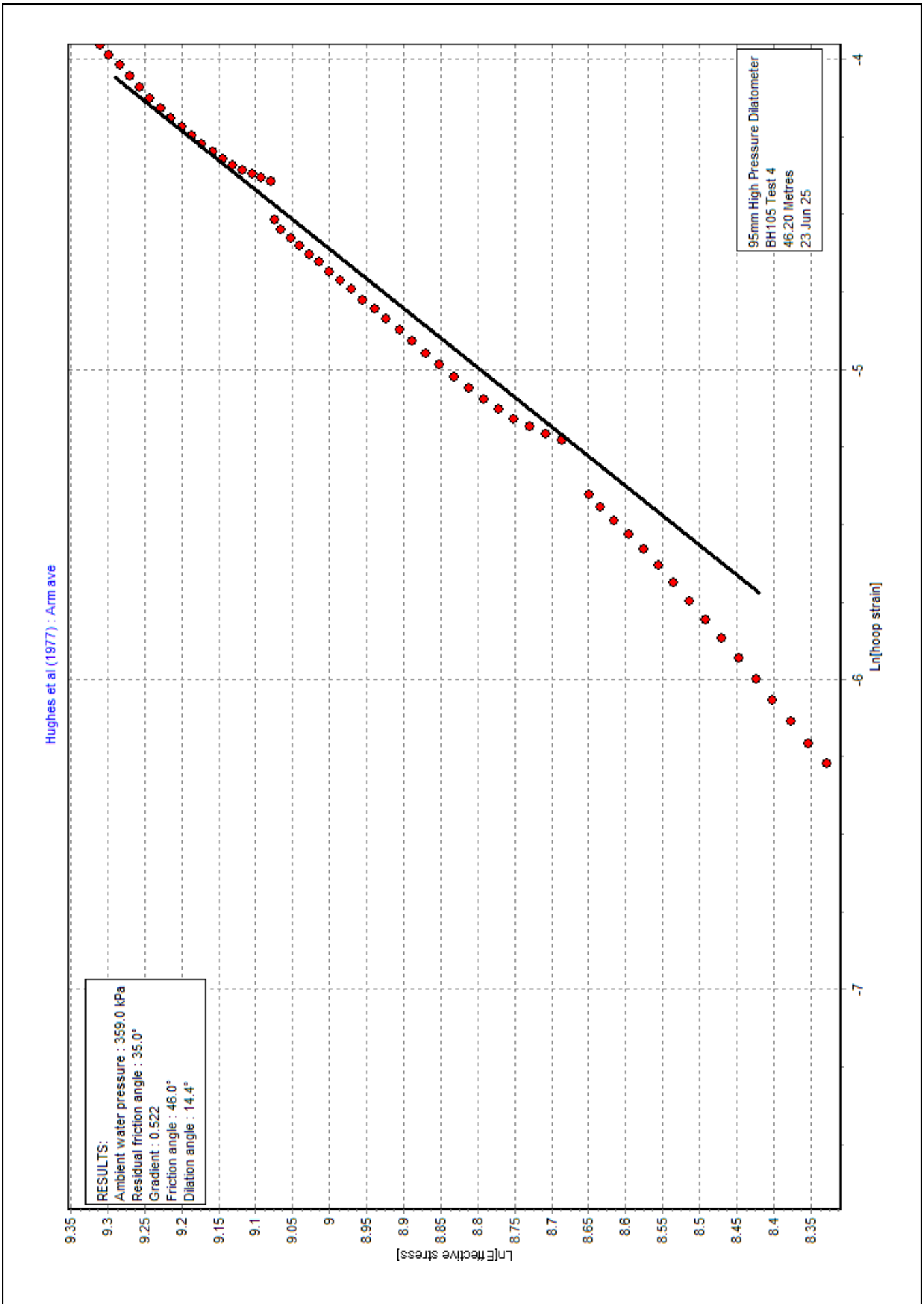
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 3.35
Po (kPa) : 1353
Cohesion (kPa) : 340
Angle of peak friction (deg) : 46.0

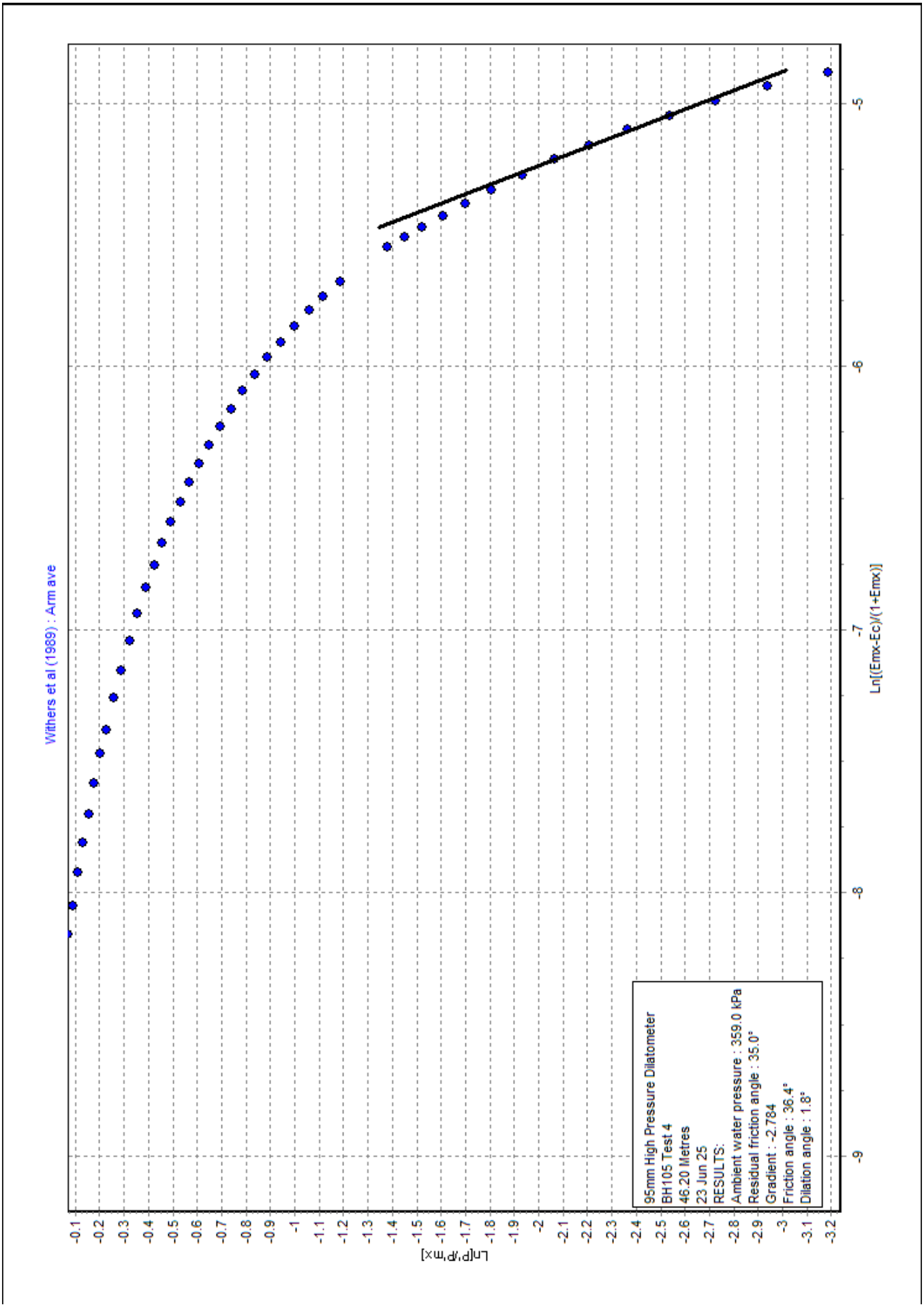
Grain to TIlbury
BH105 Test 4 - SUMMARY OF RESULTS

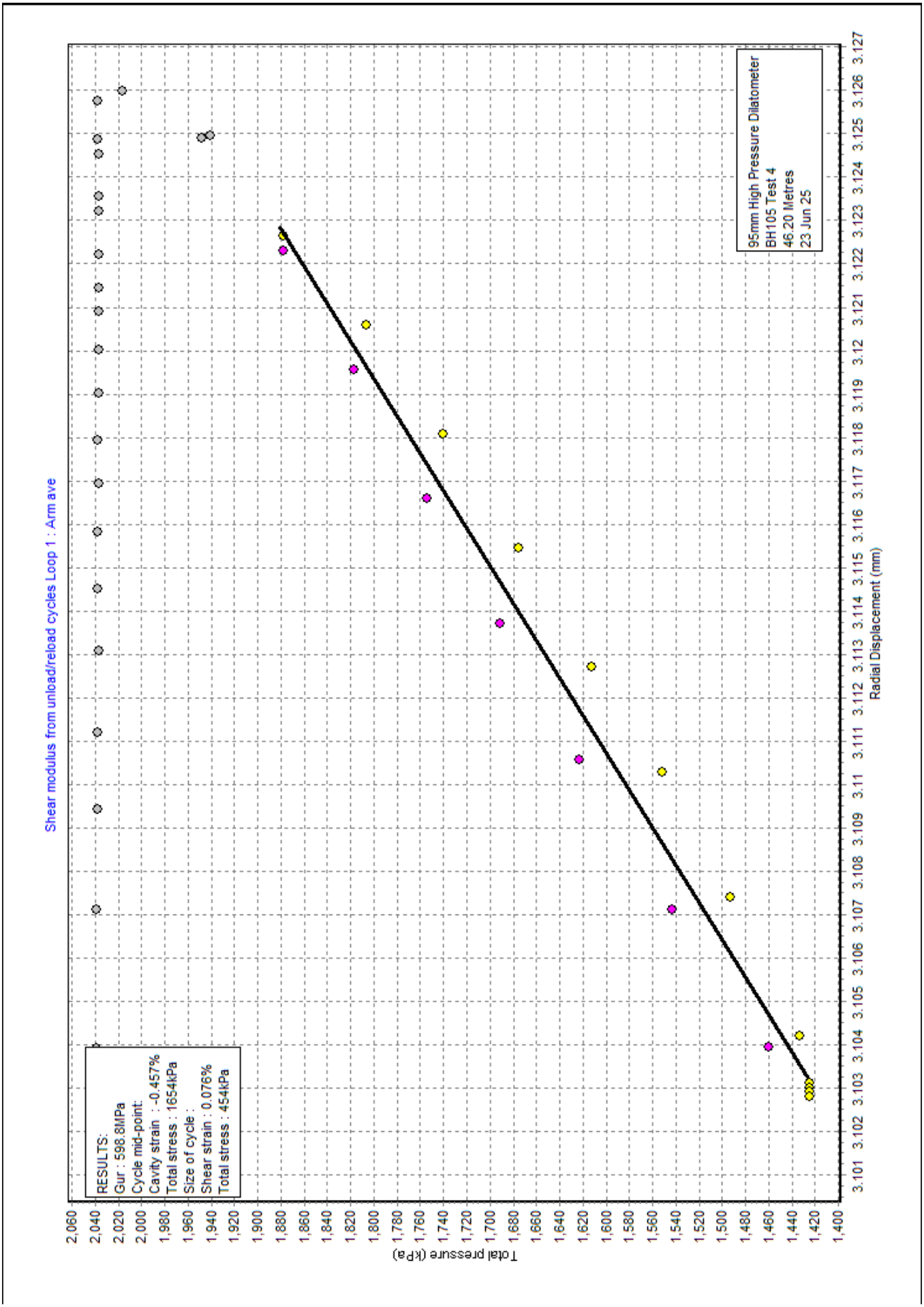
Angle of peak dilation (deg)	:	14.4
Total yield stress (kPa)	:	3368
Total limit stress (kPa)	:	61163
G at first yield (MPa)	:	688.6
Non-linear exponent	:	0.693
Janbu exponent	:	0.213
Correlation	:	0.572
Ambient pore water pressure (kPa)	:	359
Residual friction angle (deg)	:	35.0
Poisson's ratio	:	0.20

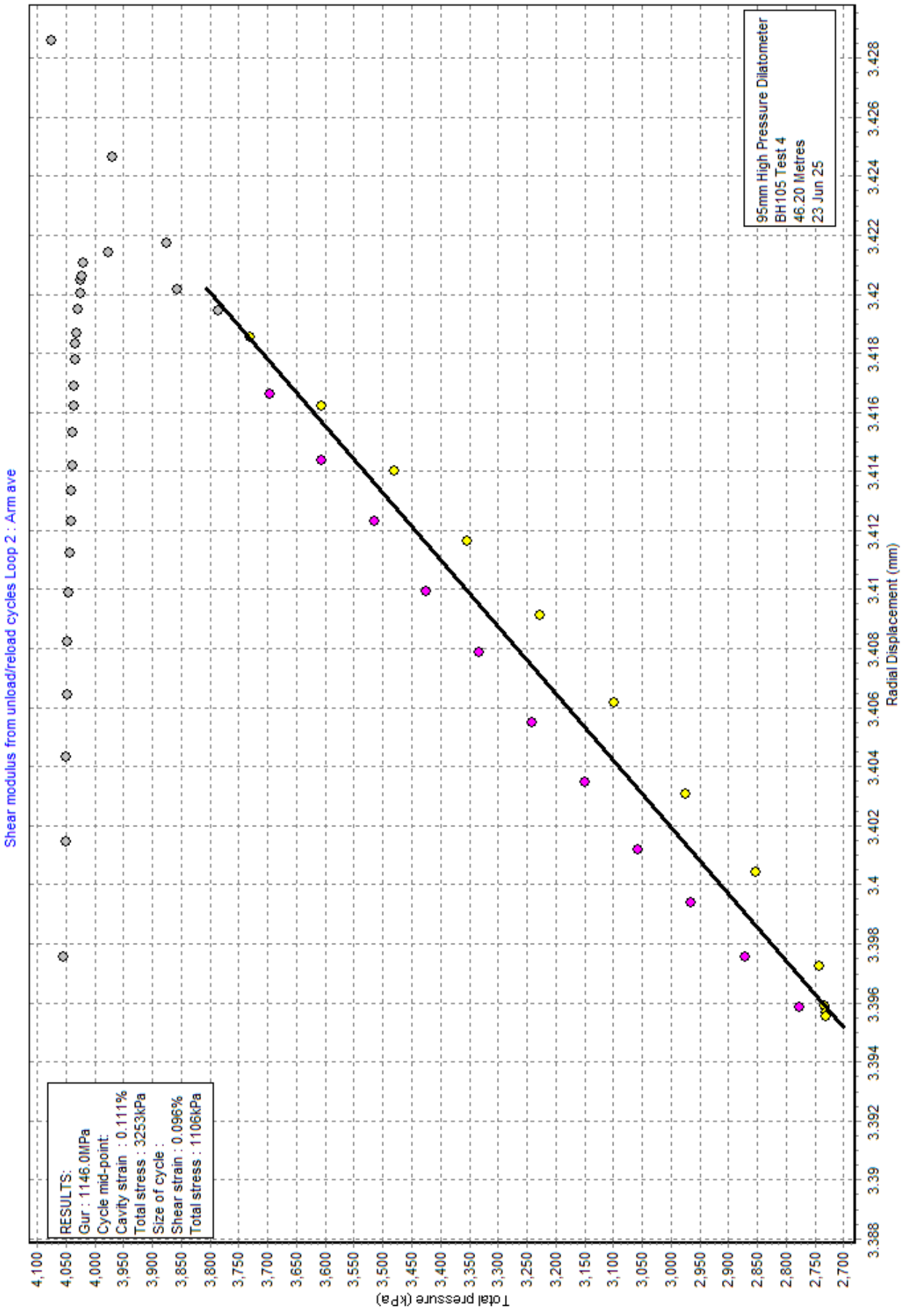

Cavity strain vs Total Pressure : Arm ave
95mm High Pressure Dilatometer
BH105 Test 4
46.20 Metres
23 Jun 25
Total pressure (kPa)
Cavity strain (%)
12,000
11,500
11,000
10,500
10,000
9,500
9,000
8,500
8,000
7,500
7,000
6,500
6,000
5,500
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-1.8
-2
-2.2
-2.4

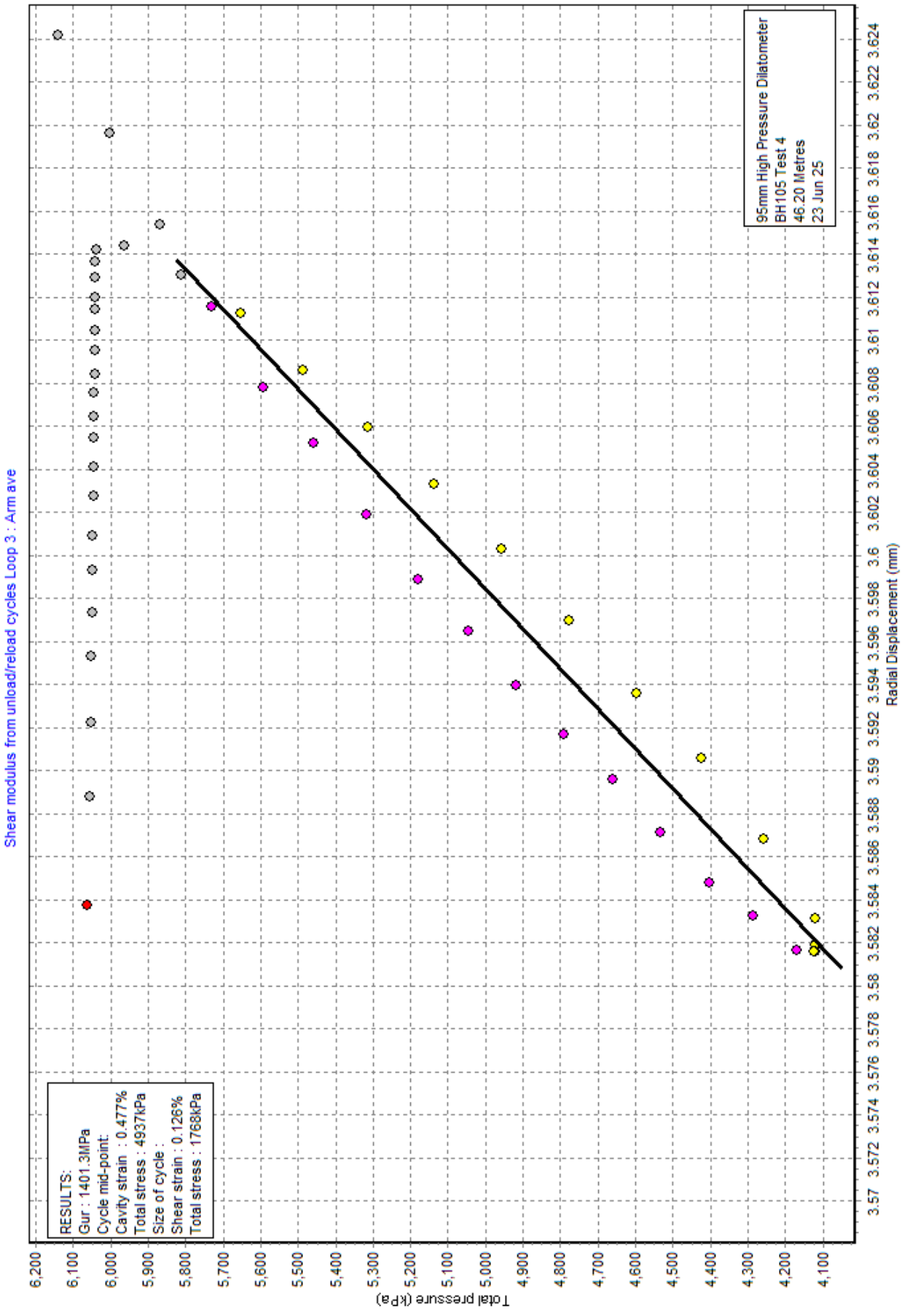

Po of cohesive material (1977, 1990) : Arm ave
95mm High Pressure Dilatometer
BH105 Test 4
46.20 Metres
23 Jun 25
RESULTS:
Gi : 312.5MPa
Pf : 6799.0kPa
Po : 1445.5kPa
Tf : 5281.0kPa
Po + Tf : 6726.5kPa
Origin : 3.193mm
Total pressure (kPa)
Radial Displacement (mm)
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Shear stress at yield : Arm ave
Total pressure (kPa)
Ln[shear strain]

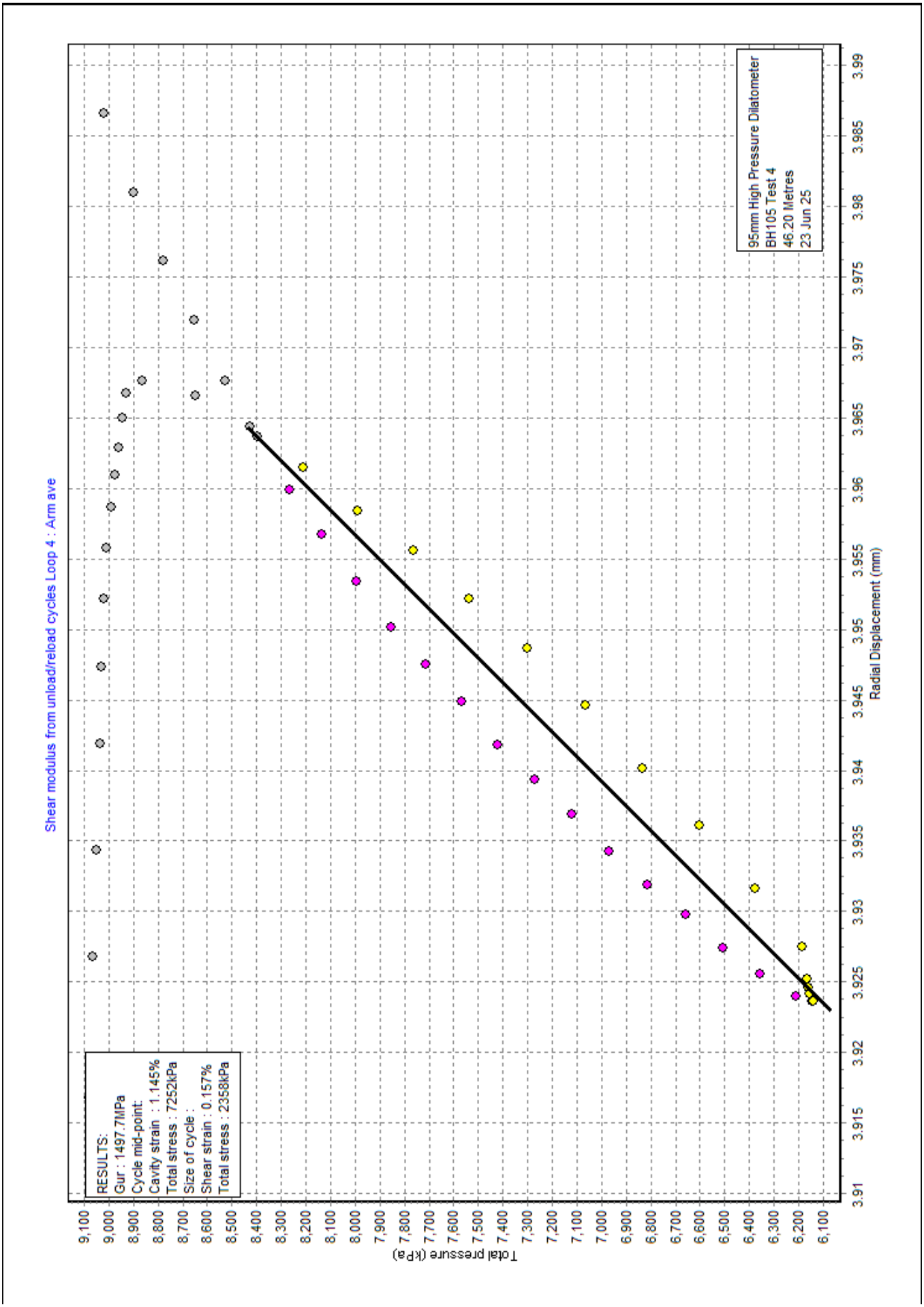

Hughes et al (1977) : Arm ave
RESULTS:
Ambient water pressure : 359.0 kPa
Residual friction angle : 35.0°
Gradient : 0.522
Friction angle : 46.0°
Dilation angle : 14.4°
95mm High Pressure Dilatometer
BH105 Test 4
46.20 Metres
23 Jun 25
Ln[Effective stress]
Ln[hoop strain]
9.35
9.3
9.25
9.2
9.15
9.1
9.05
9
8.95
8.9
8.85
8.8
8.75
8.7
8.65
8.6
8.55
8.5
8.45
8.4
8.35
-4
-5
-6
-7

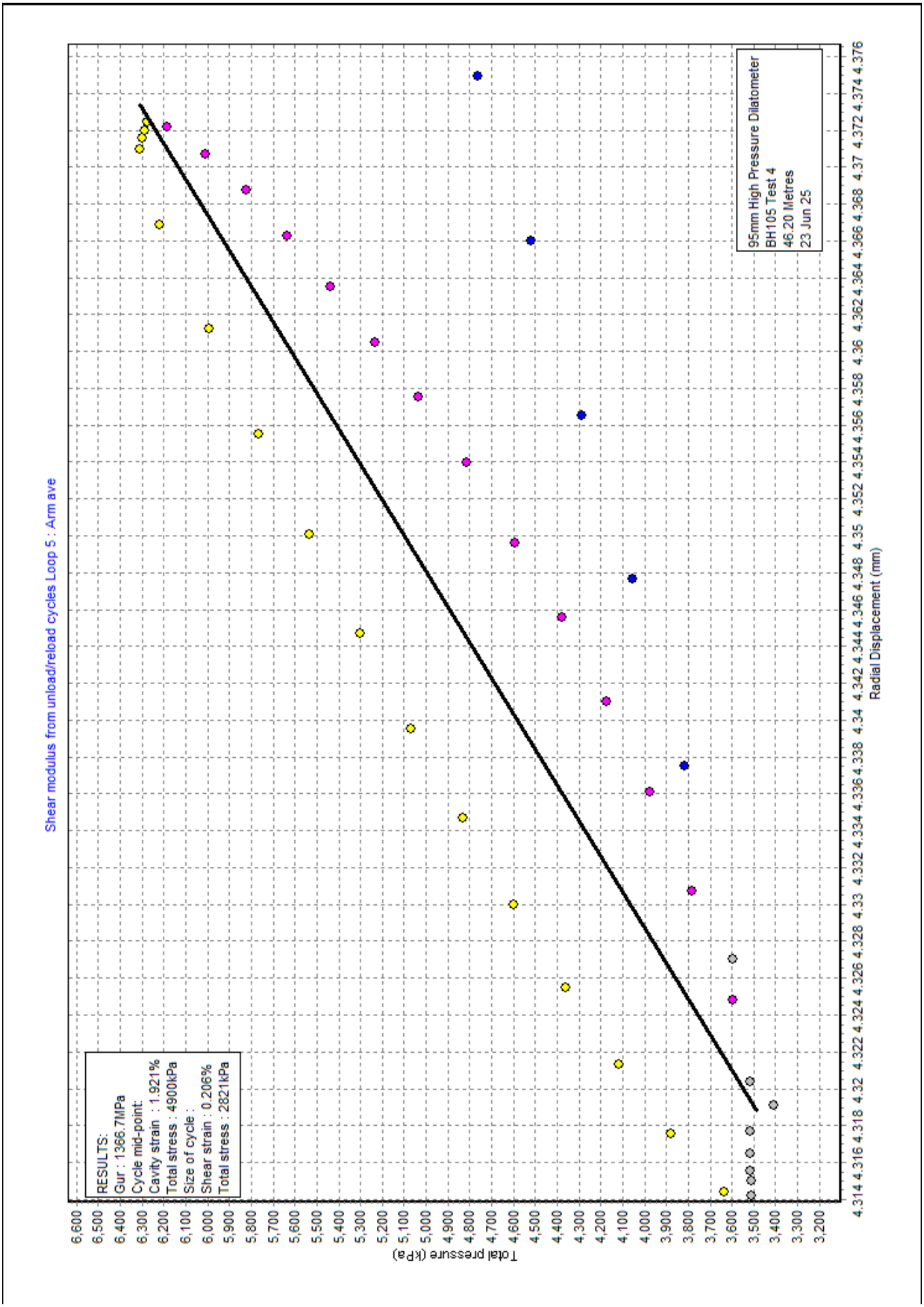

Withers et al (1989) : Arm ave
Ln[(Emx-Ec)/(1+Emx)]
Ln[P'/P'mx]
95mm High Pressure Dilatometer
BH105 Test 4
46.20 Metres
23 Jun 25
RESULTS:
Ambient water pressure : 359.0 kPa
Residual friction angle : 35.0°
Gradient : -2.784
Friction angle : 36.4°
Dilation angle : 1.8°

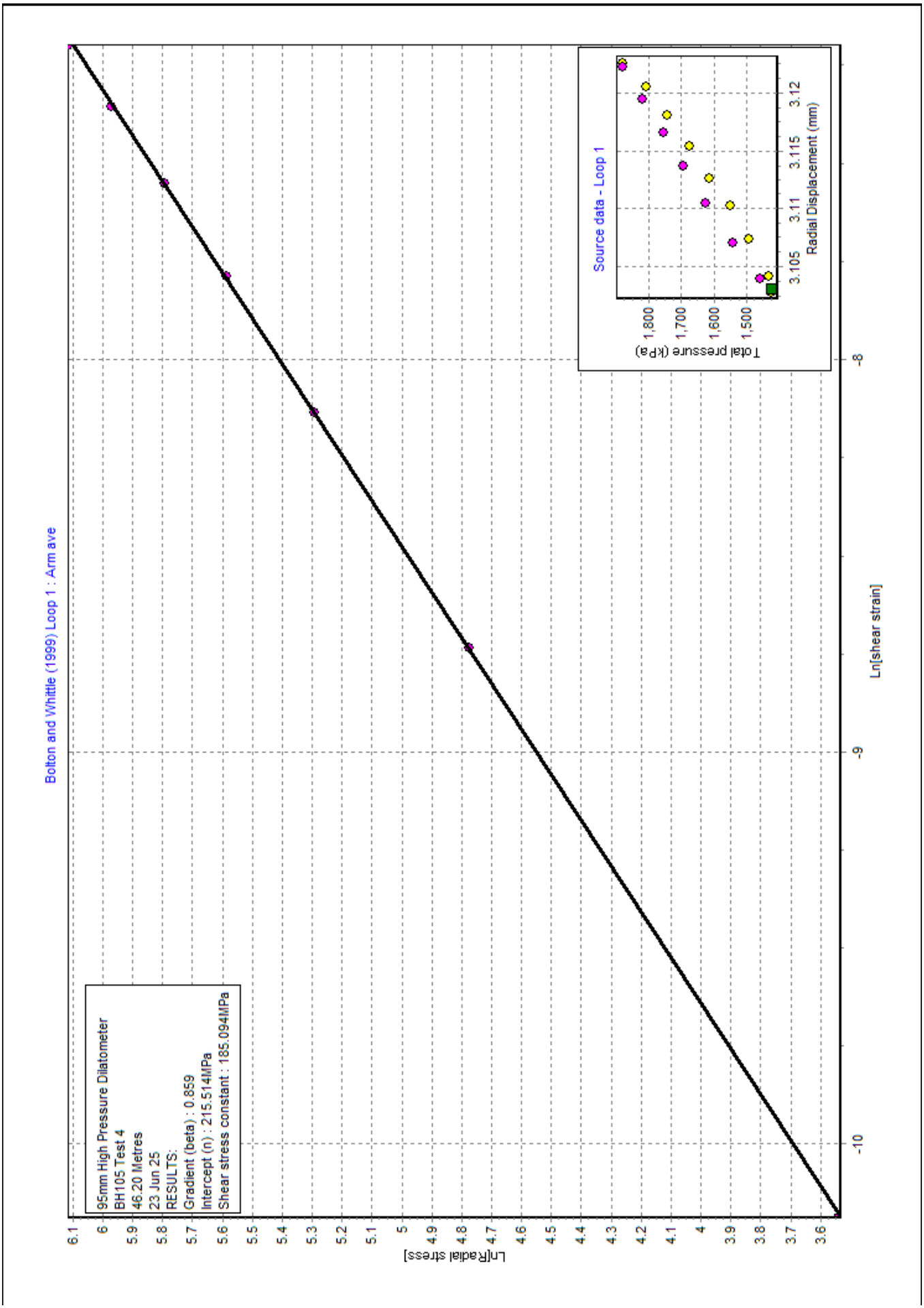

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 598.8MPa
Cycle mid-point:
Cavity strain : -0.457%
Total stress : 1654kPa
Size of cycle :
Shear strain : 0.076%
Total stress : 454kPa
95mm High Pressure Dilatometer
BH105 Test 4
46.20 Metres
23 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

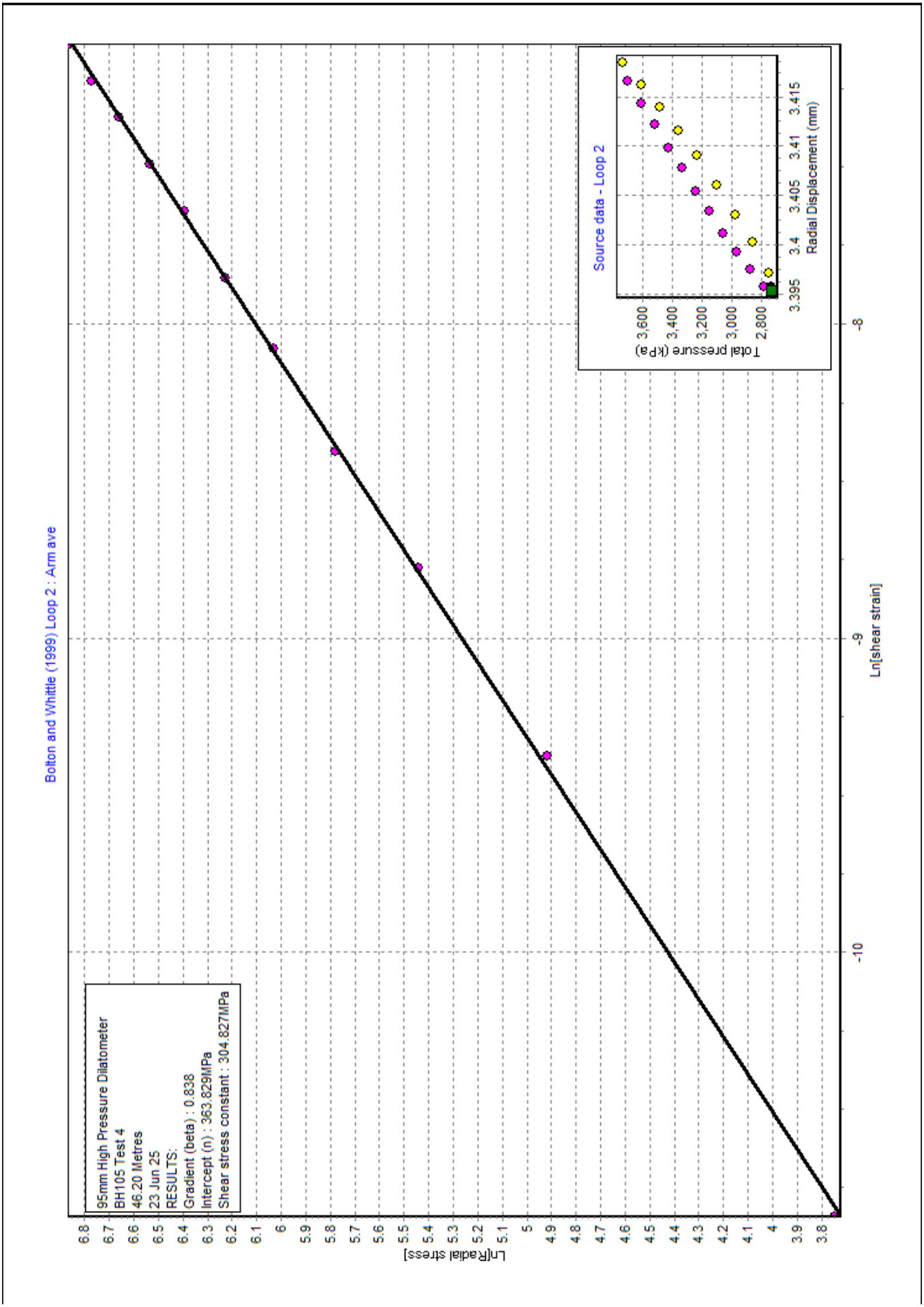

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 1146.0MPa
Cycle mid-point:
Cavity strain : 0.111%
Total stress : 3253kPa
Size of cycle :
Shear strain : 0.096%
Total stress : 1106kPa
95mm High Pressure Dilatometer
BH105 Test 4
46.20 Metres
23 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

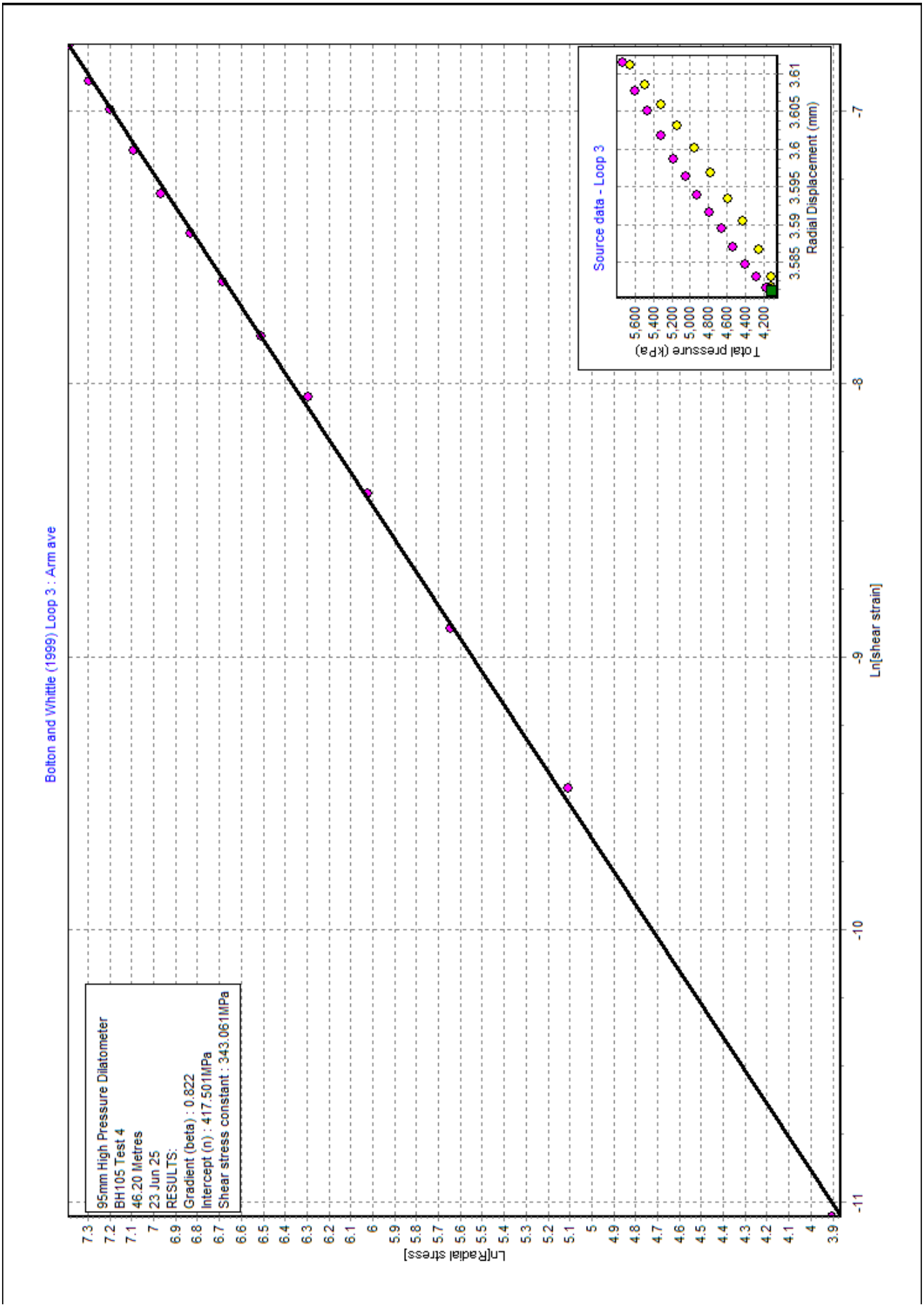

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 1401.3MPa
Cycle mid-point:
Cavity strain : 0.477%
Total stress : 4937kPa
Size of cycle :
Shear strain : 0.126%
Total stress : 1768kPa
95mm High Pressure Dilatometer
BH105 Test 4
46.20 Metres
23 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

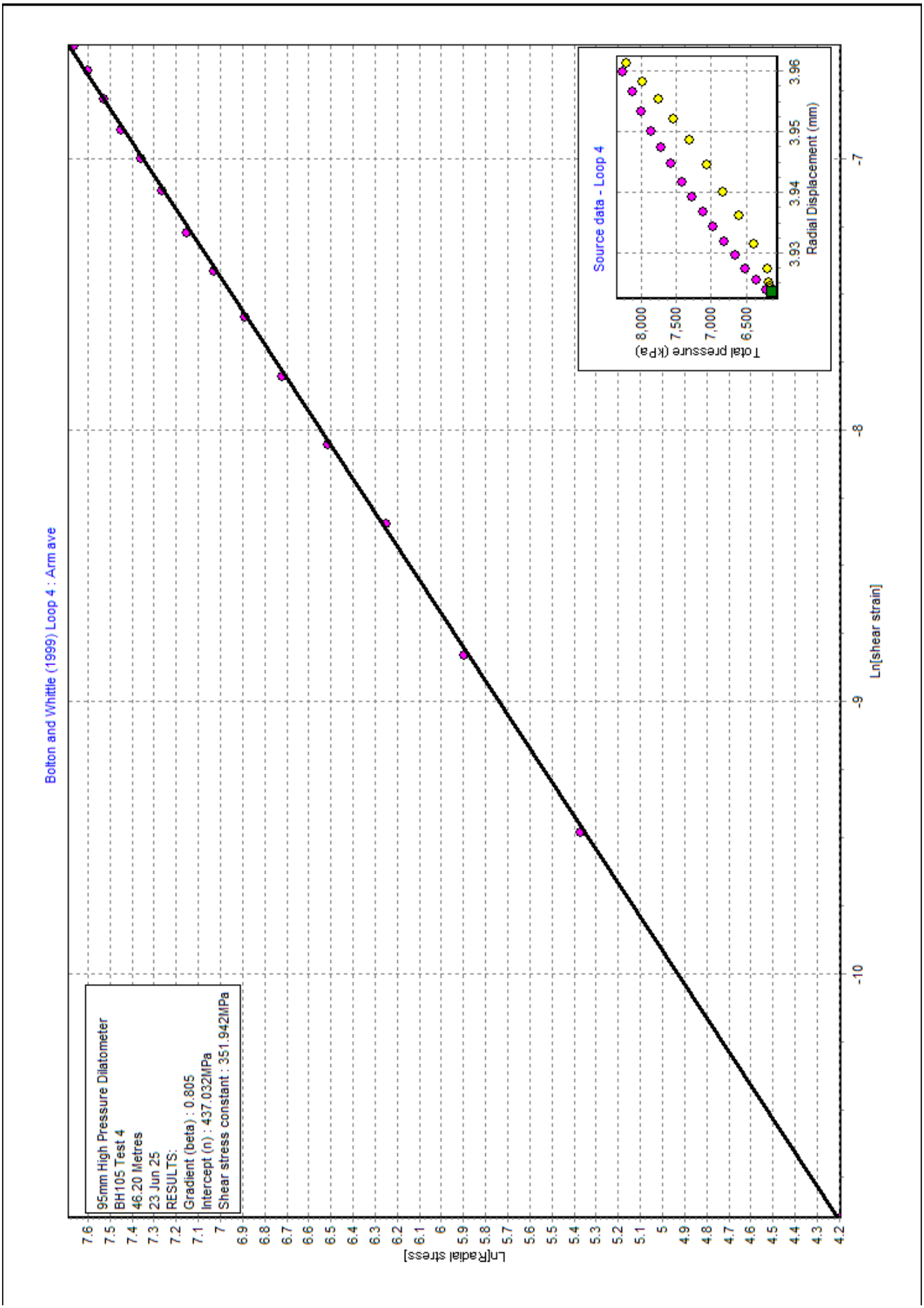

Shear modulus from unload/reload cycles Loop 4 : Arm ave
RESULTS:
Gur : 1497.7MPa
Cycle mid-point:
Cavity strain : 1.145%
Total stress : 7252kPa
Size of cycle :
Shear strain : 0.157%
Total stress : 2358kPa
95mm High Pressure Dilatometer
BH105 Test 4
46.20 Metres
23 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

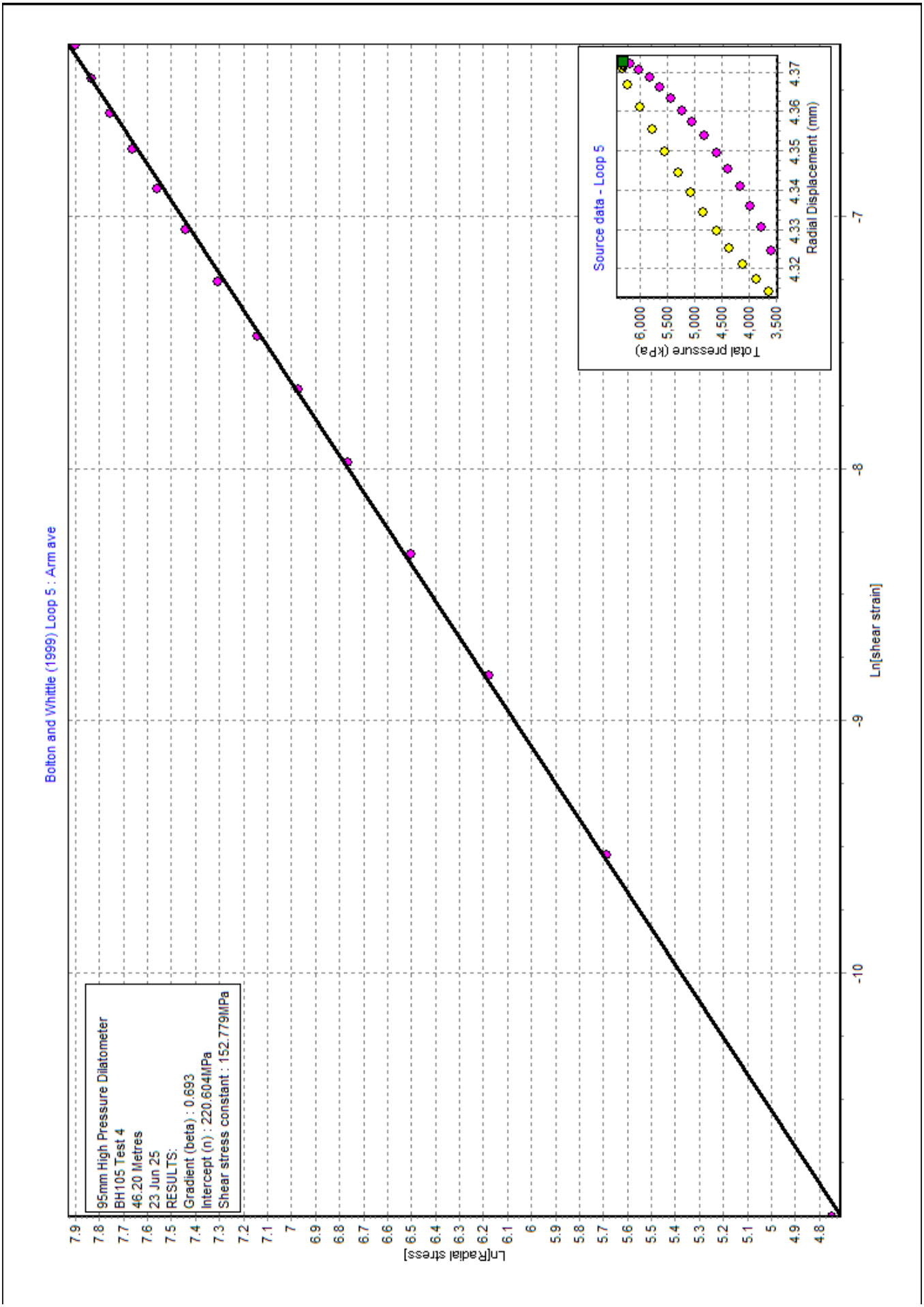

Shear modulus from unload/reload cycles Loop 5 : Arm ave
RESULTS:
Gur : 1366.7MPa
Cycle mid-point:
Cavity strain : 1.921%
Total stress : 4900kPa
Size of cycle :
Shear strain : 0.206%
Total stress : 2821kPa
95mm High Pressure Dilatometer
BH105 Test 4
46.20 Metres
23 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

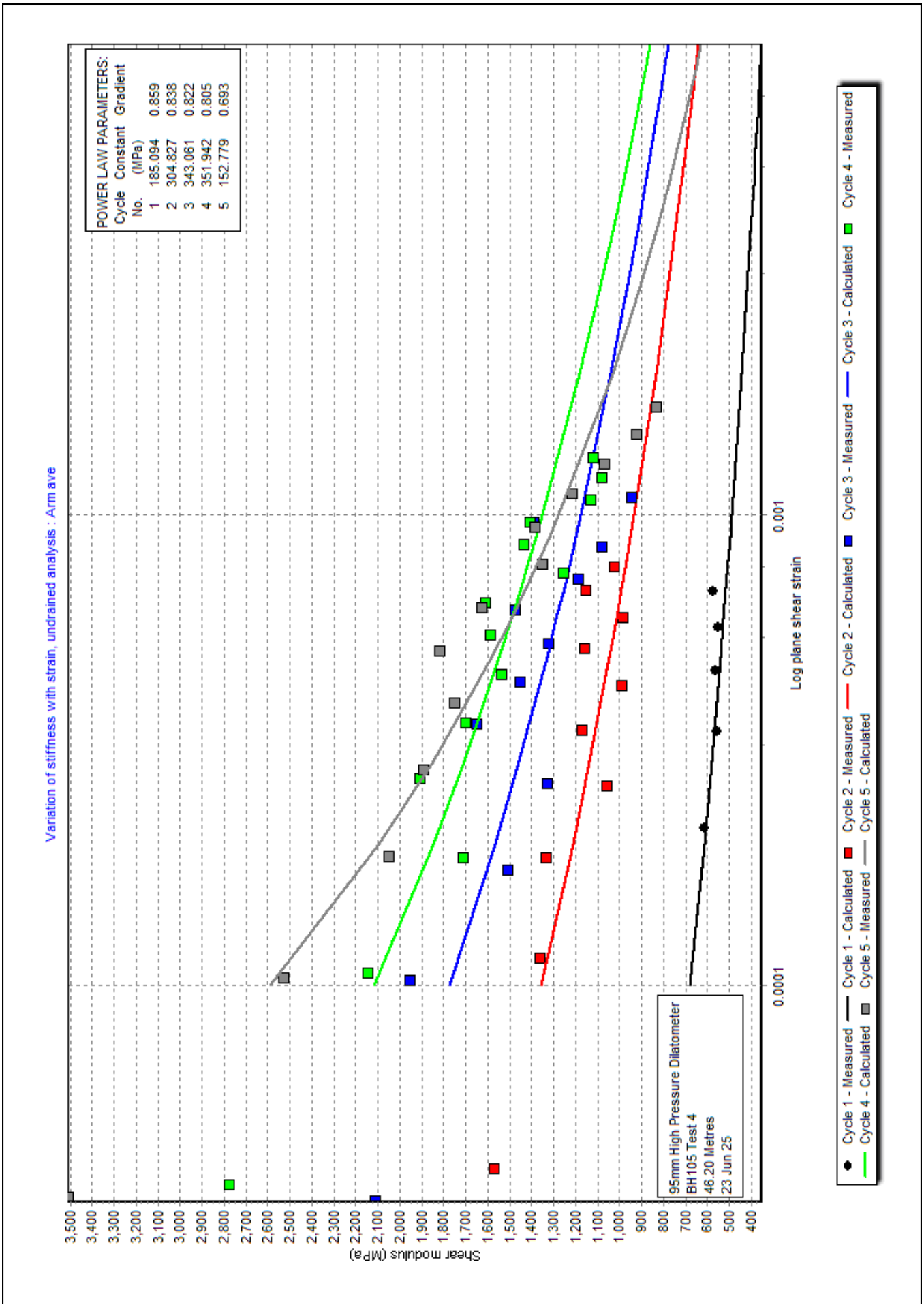

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH105 Test 4
46.20 Metres
23 Jun 25
RESULTS:
Gradient (beta) : 0.859
Intercept (n) : 215.514MPa
Shear stress constant : 185.094MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

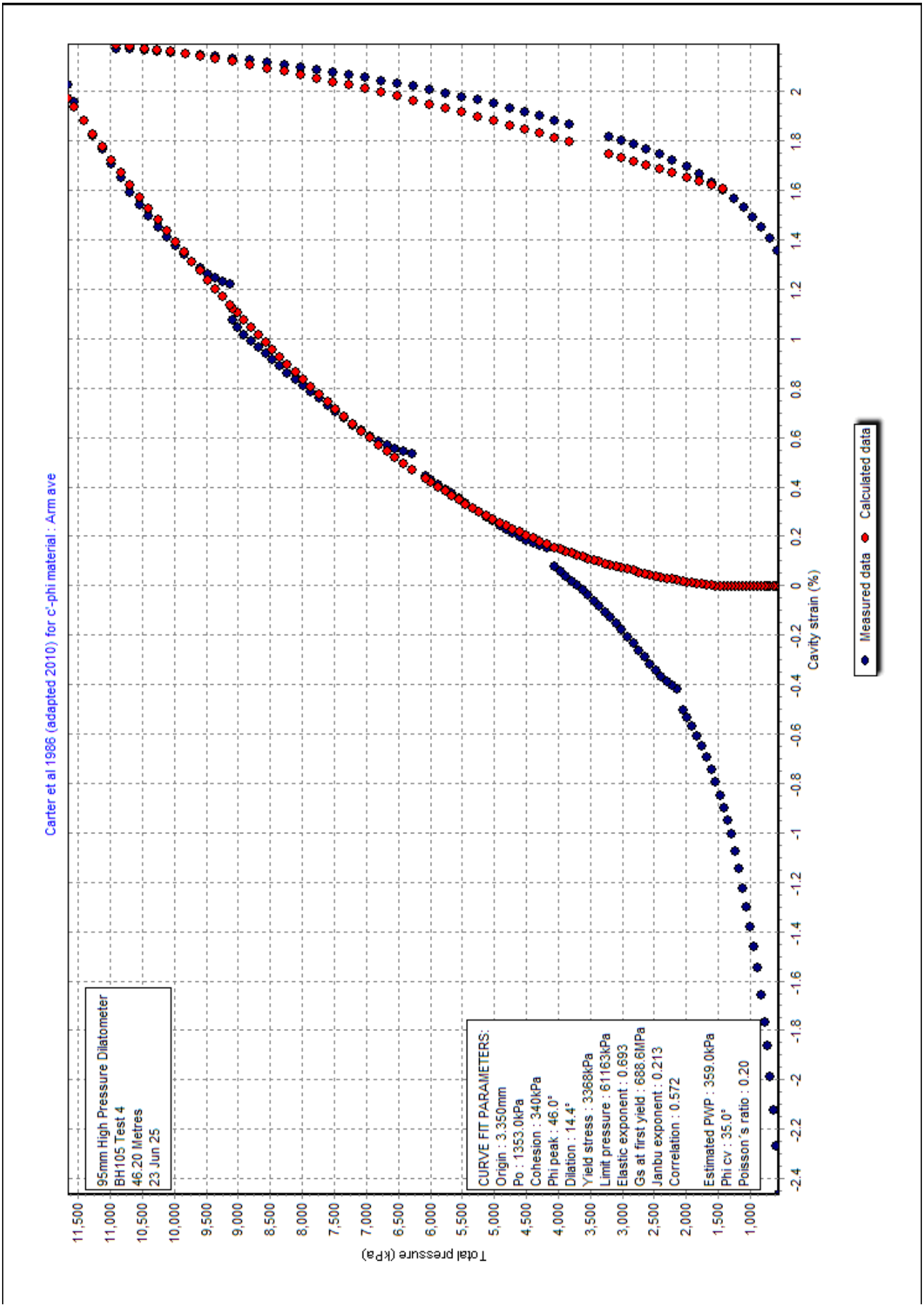

Bolton and Whittle (1999) Loop 2 : Arm ave
95mm High Pressure Dilatometer
BH105 Test 4
46.20 Metres
23 Jun 25
RESULTS:
Gradient (beta) : 0.838
Intercept (n) : 363.829MPa
Shear stress constant : 304.827MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

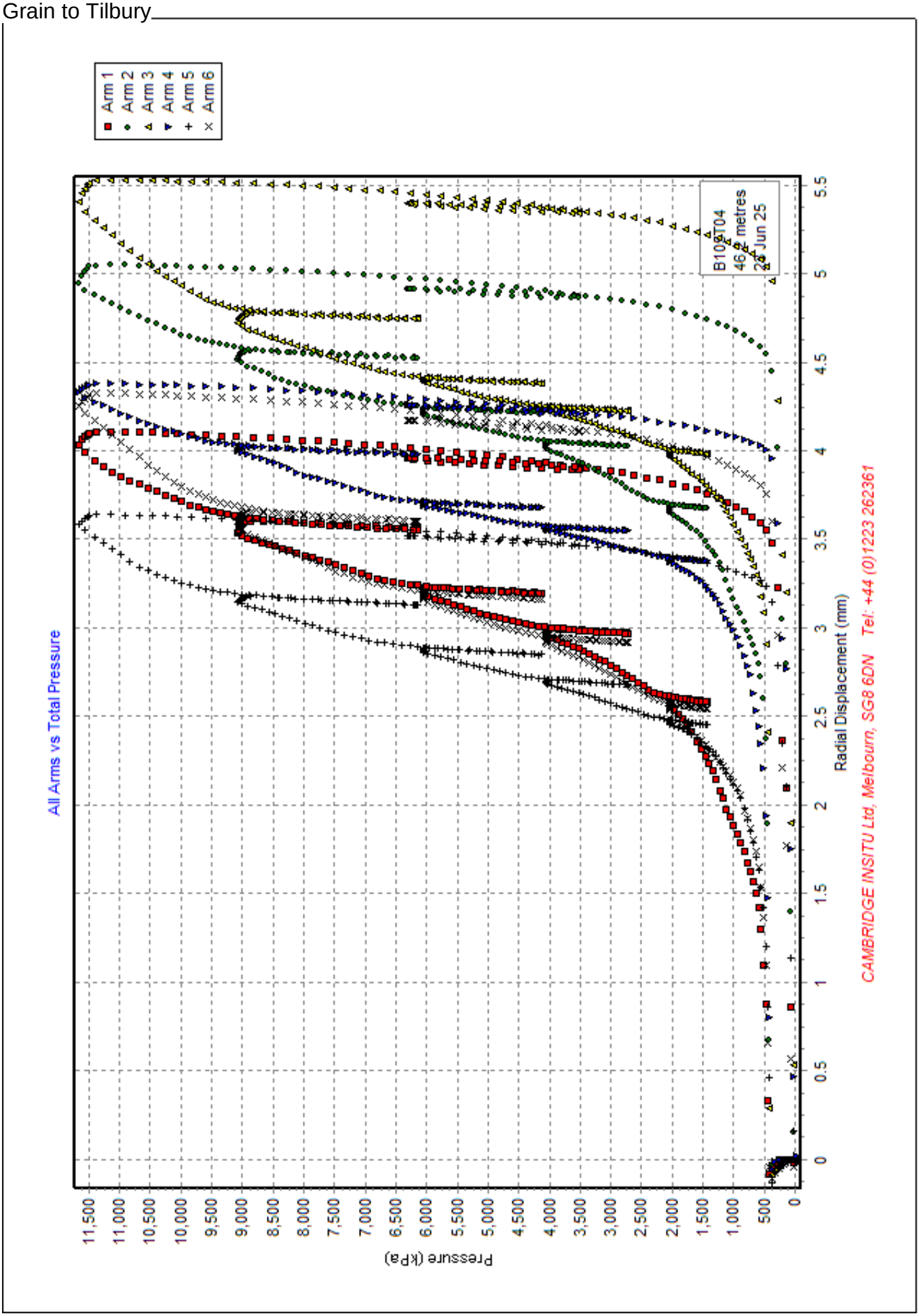

Bolton and Whittle (1999) Loop 3 : Arm ave
95mm High Pressure Dilatometer
BH105 Test 4
46.20 Metres
23 Jun 25
RESULTS:
Gradient (beta) : 0.822
Intercept (n) : 417.501MPa
Shear stress constant : 343.061MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)

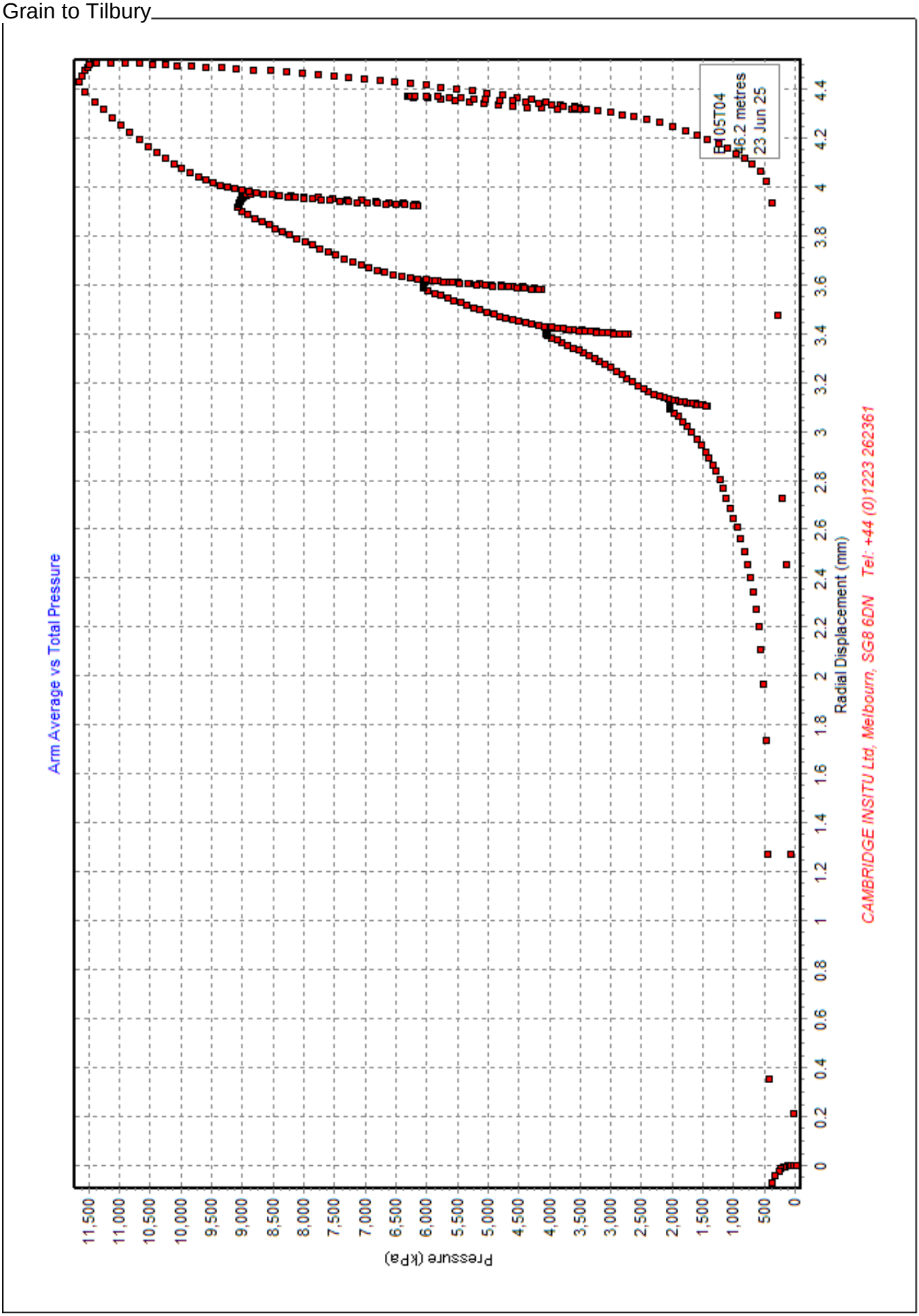

Bolton and Whittle (1999) Loop 4 : Arm ave
95mm High Pressure Dilatometer
BH105 Test 4
46.20 Metres
23 Jun 25
RESULTS:
Gradient (beta) : 0.805
Intercept (n) : 437.032MPa
Shear stress constant : 351.942MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 4
Total pressure (kPa)
Radial Displacement (mm)

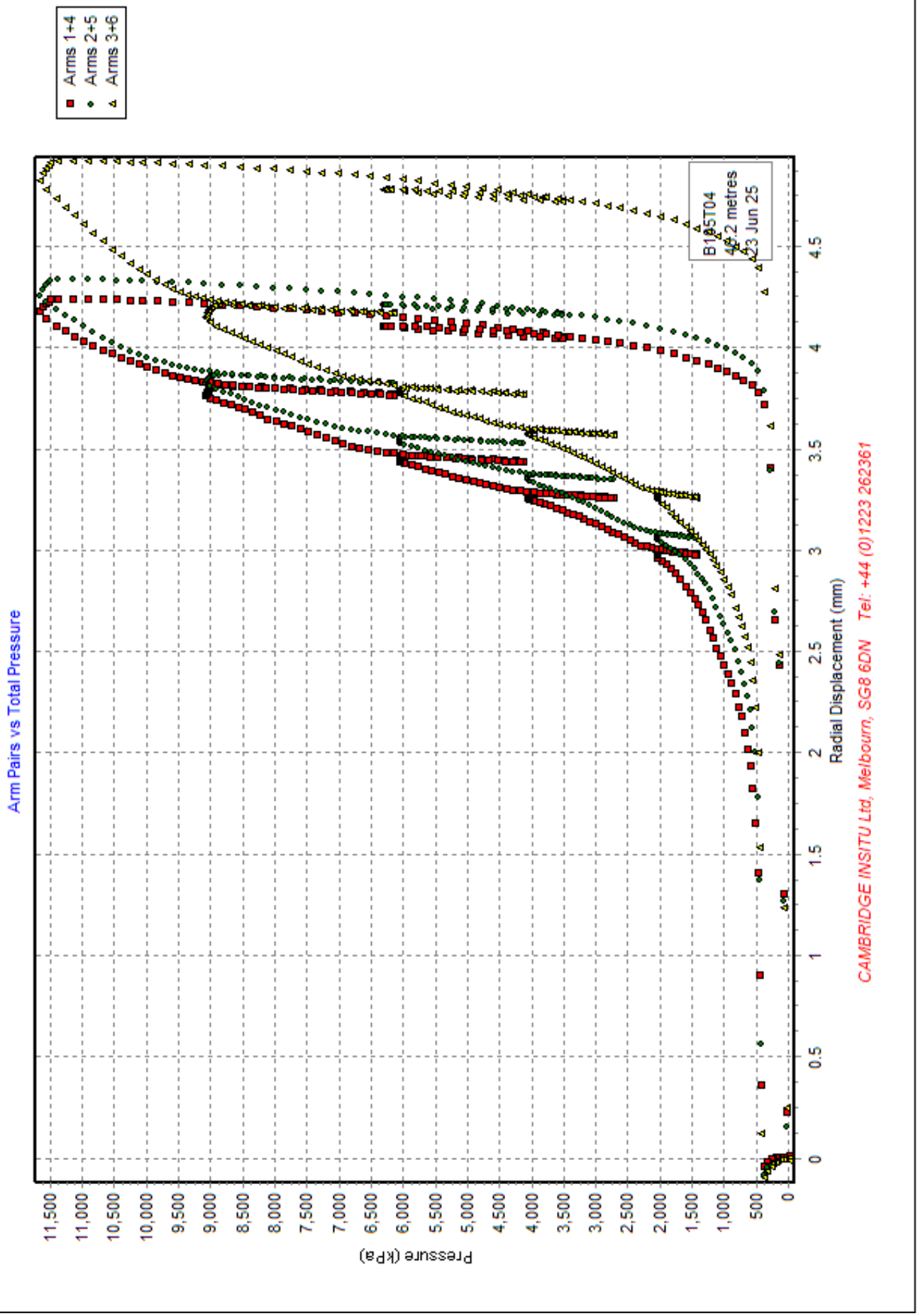

Bolton and Whittle (1999) Loop 5 : Arm ave
95mm High Pressure Dilatometer
BH105 Test 4
46.20 Metres
23 Jun 25
RESULTS:
Gradient (beta) : 0.693
Intercept (n) : 220.604MPa
Shear stress constant : 152.779MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 5
Total pressure (kPa)
Radial Displacement (mm)

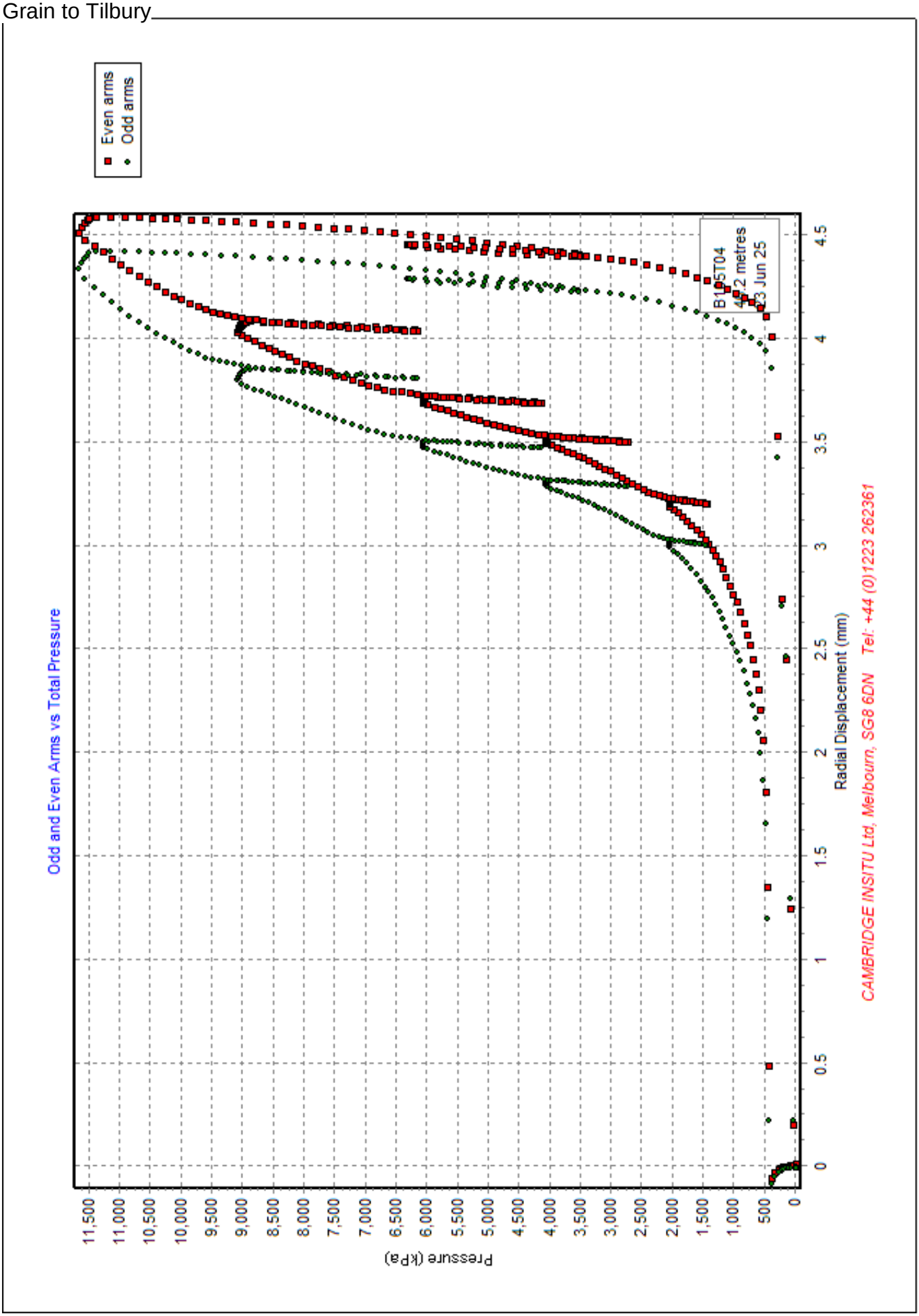

Variation of stiffness with strain, undrained analysis : Arm ave
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 185.094 0.859
2 304.827 0.838
3 343.061 0.822
4 351.942 0.805
5 152.779 0.693
95mm High Pressure Dilatometer
BH105 Test 4
46.20 Metres
23 Jun 25
Shear modulus (MPa)
Log plane shear strain
0.0001
0.001
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
Cycle 4 - Measured
Cycle 4 - Calculated
Cycle 5 - Measured
Cycle 5 - Calculated


Carter et al 1986 (adapted 2010) for c'-phi material : Arm ave
95mm High Pressure Dilatometer
BH105 Test 4
46.20 Metres
23 Jun 25
CURVE FIT PARAMETERS:
Origin : 3.350mm
Po : 1353.0kPa
Cohesion : 340kPa
Phi peak : 46.0°
Dilation : 14.4°
Yield stress : 3368kPa
Limit pressure : 61163kPa
Elastic exponent : 0.693
Gs at first yield : 688.6MPa
Janbu exponent : 0.213
Correlation : 0.572
Estimated PWP : 359.0kPa
Phi cv : 35.0°
Poisson's ratio : 0.20
Total pressure (kPa)
Cavity strain (%)
Measured data
Calculated data


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
B108T04
46.2 metres
24 Jun 25
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arm Average vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
BH05T04
16.2 metres
23 Jun 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arms 1+4
Arms 2+5
Arms 3+6
B105T04
40.2 metres
23 Jun 25
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
B105T04
4.2 metres
23 Jun 25
Odd and Even Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to TIlbury
BH105 Test 5 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Grain to Tilbury
Borehole : BH105
Test name : BH105 Test 5
Test date : 23 Jun 25
Test depth : 50.35 Metres
Water table : 9.6 Metres
Ambient PWP : 399.8 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDP/RW on 21 Jul 25

Remarks: Large decrease in pressure at pressure hold 8MPa.

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=5.18"
Po from Marsland & Randolph (kPa) : "Arm ave=1401.6"
Best estimate of Po (kPa) : "Arm ave=1400.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=5491.1"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 35.0
Angle of internal friction (°) : "Arm ave=43.9"
Dilation angle (°) : "Arm ave=11.5"
Gradient of log-log plot : "Arm ave=0.491"

[Withers et al 1989]
Angle of internal friction (°) : "Arm ave=35.1"
Dilation angle (°) : "Arm ave=0.1"
Gradient of log-log plot : "Arm ave=-2.697"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=179.5"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	794.4	-0.059	2363	0.087	692
Arm ave	2	1290.8	0.933	4771	0.120	1555
Arm ave	3	1225.1	1.627	3922	0.134	1647

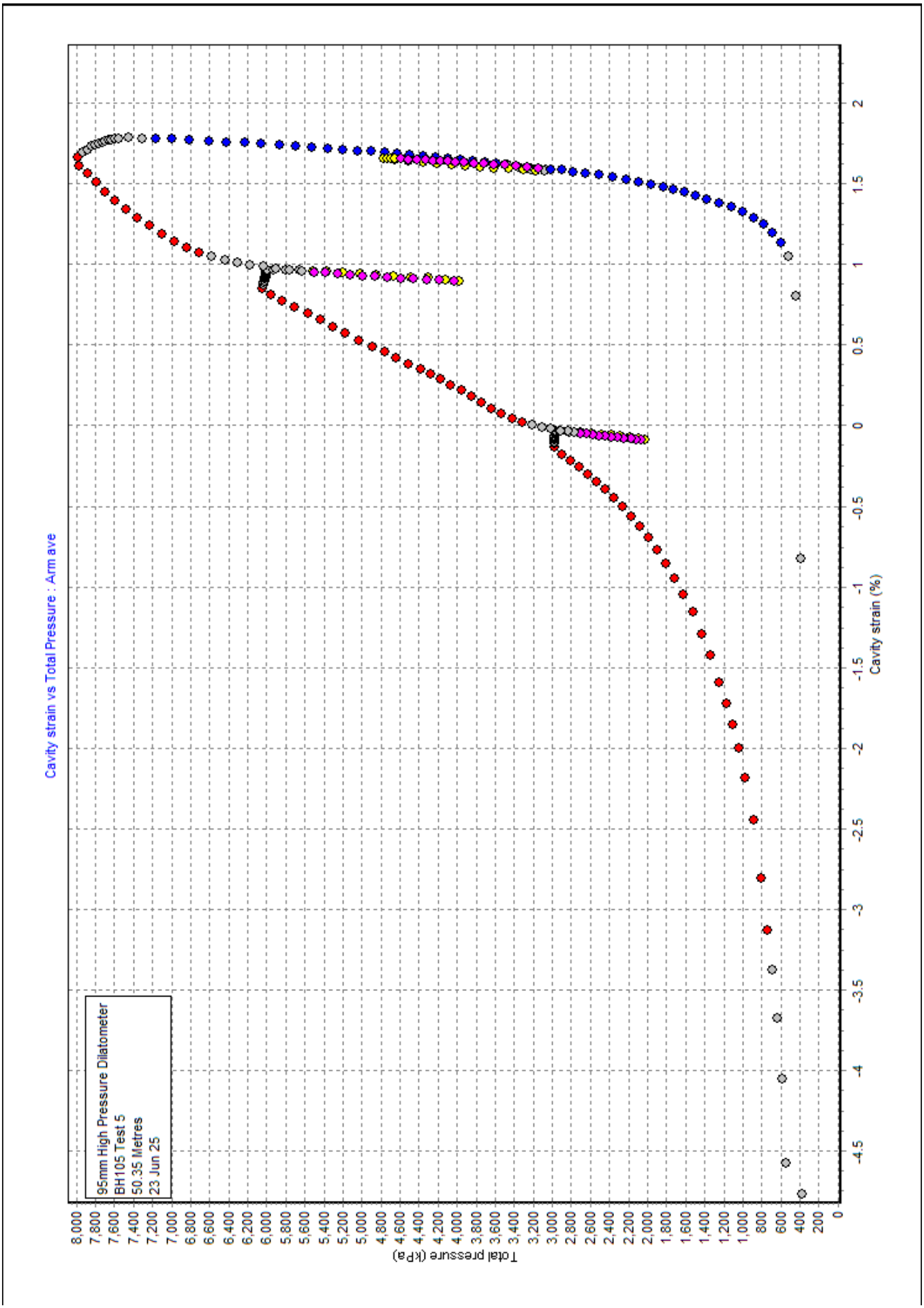
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

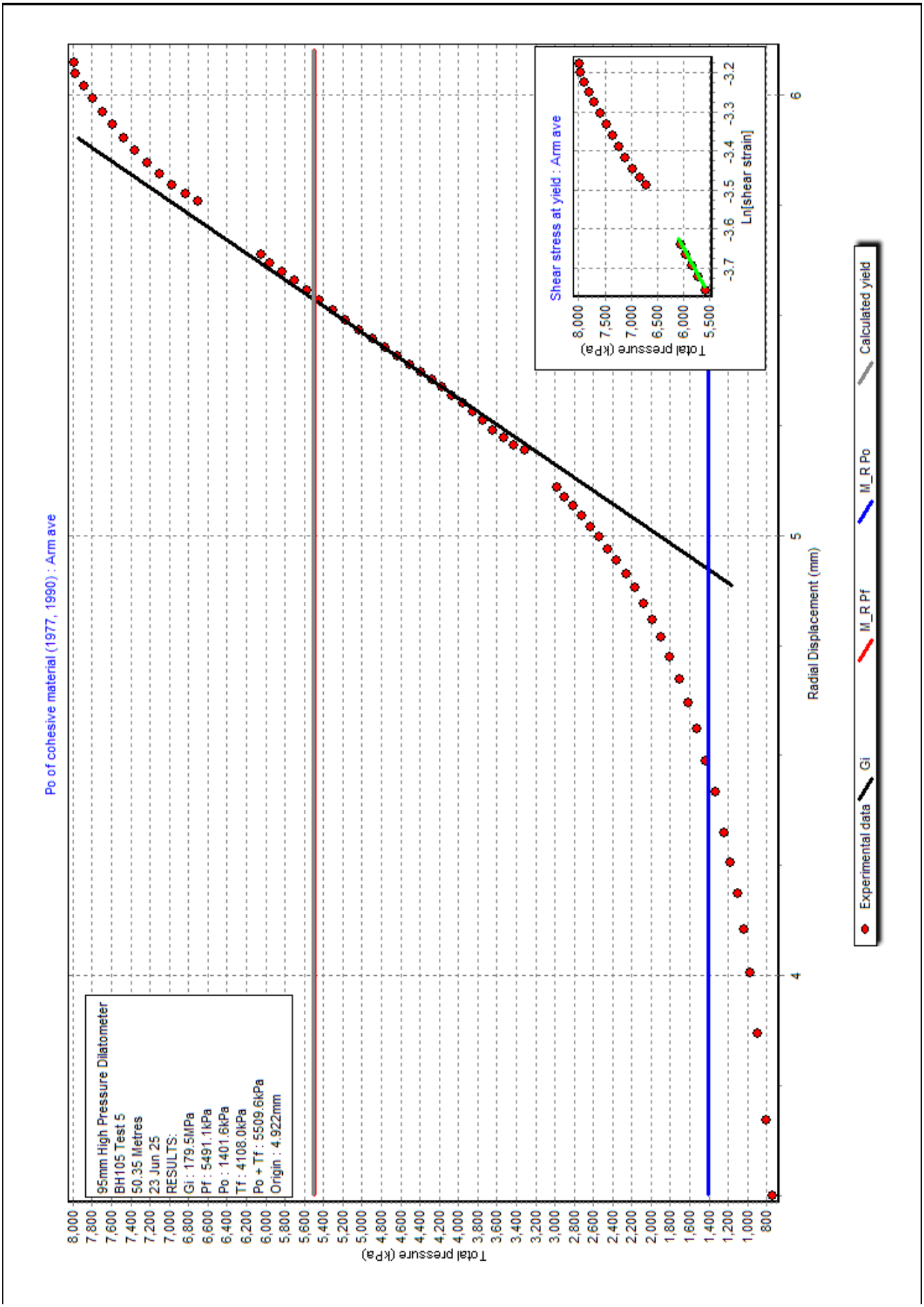
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	262.655	220.834	0.841
Arm ave	2	463.388	389.355	0.840
Arm ave	3	279.649	211.559	0.757

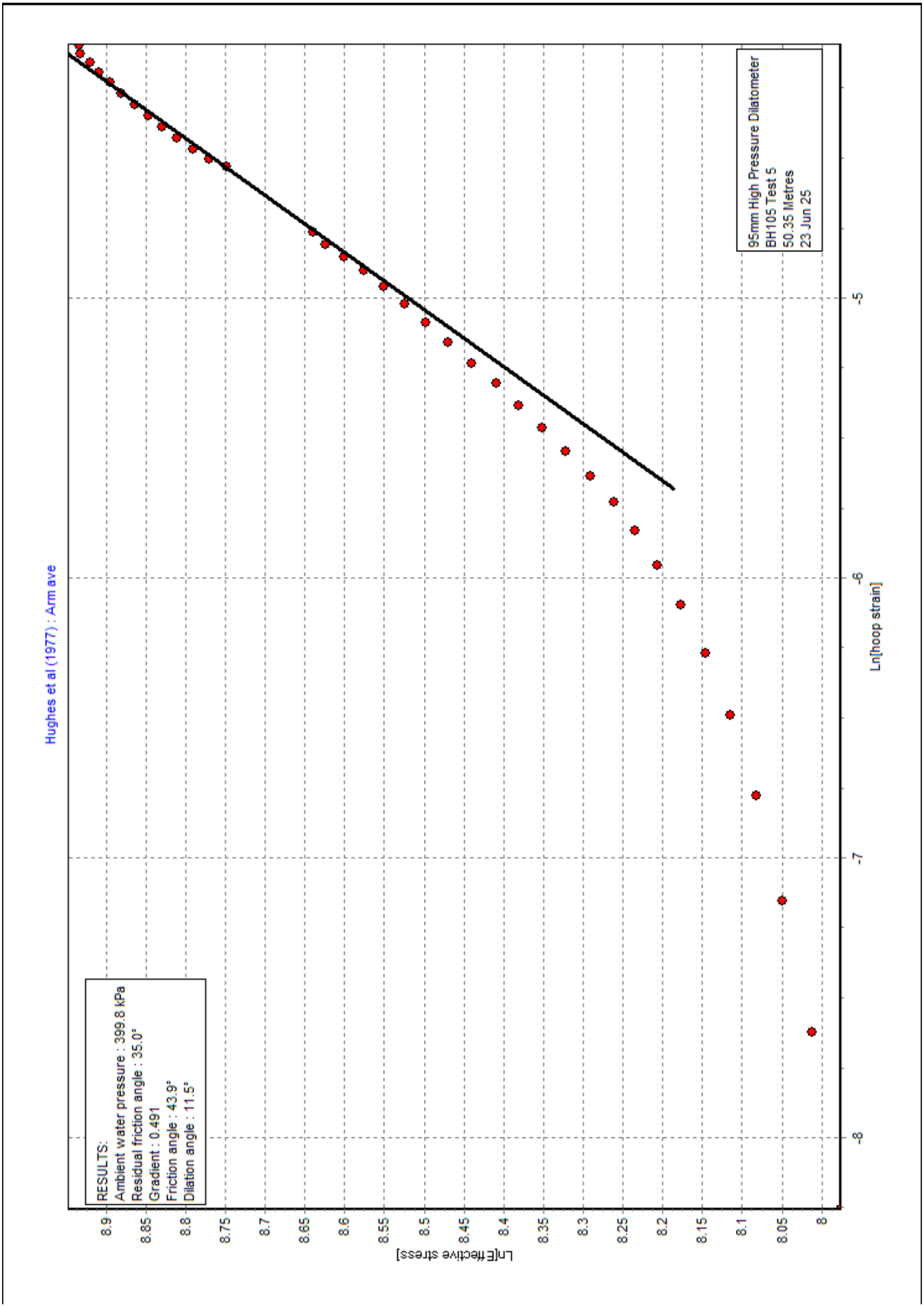
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 5.18
Po (kPa) : 1400
Cohesion (kPa) : 297
Angle of peak friction (deg) : 43.9
Angle of peak dilation (deg) : 11.5
Total yield stress (kPa) : 2942
Total limit stress (kPa) : 40087
G at first yield (MPa) : 457.2

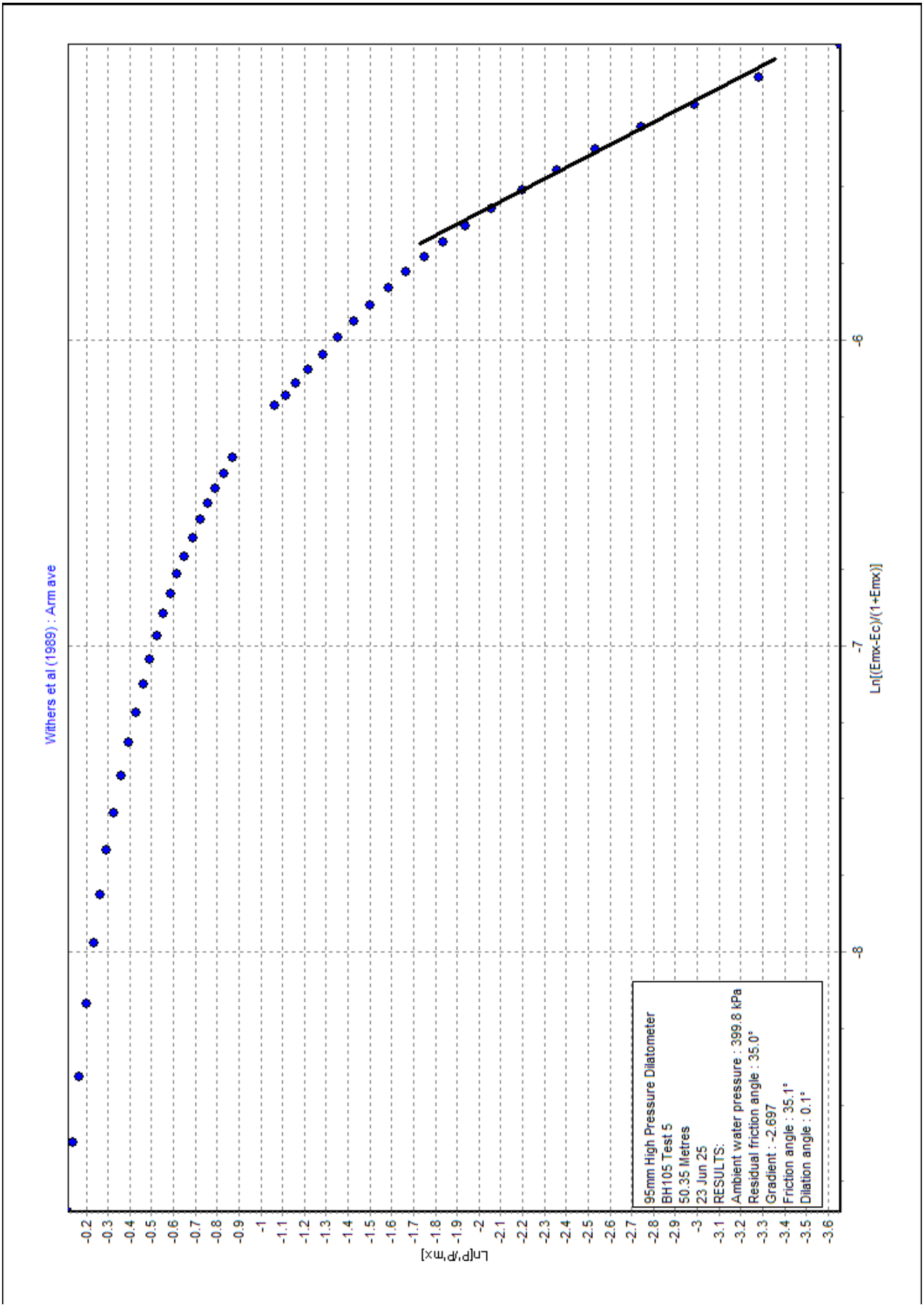
Grain to TIlbury
BH105 Test 5 - SUMMARY OF RESULTS

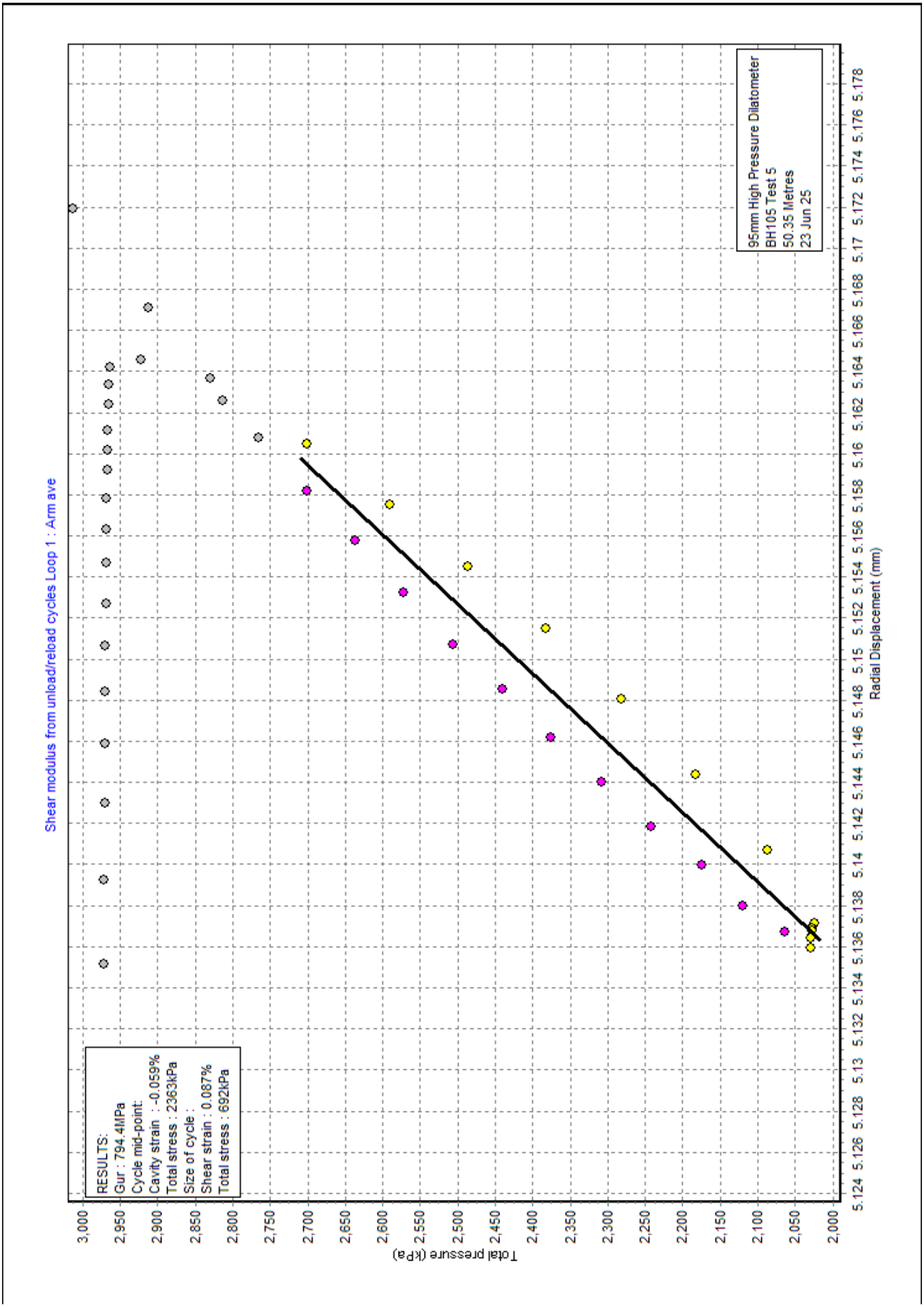
Non-linear exponent	:	0.757
Janbu exponent	:	0.462
Correlation	:	0.808
Ambient pore water pressure (kPa)	:	400
Residual friction angle (deg)	:	35.0
Poisson's ratio	:	0.20

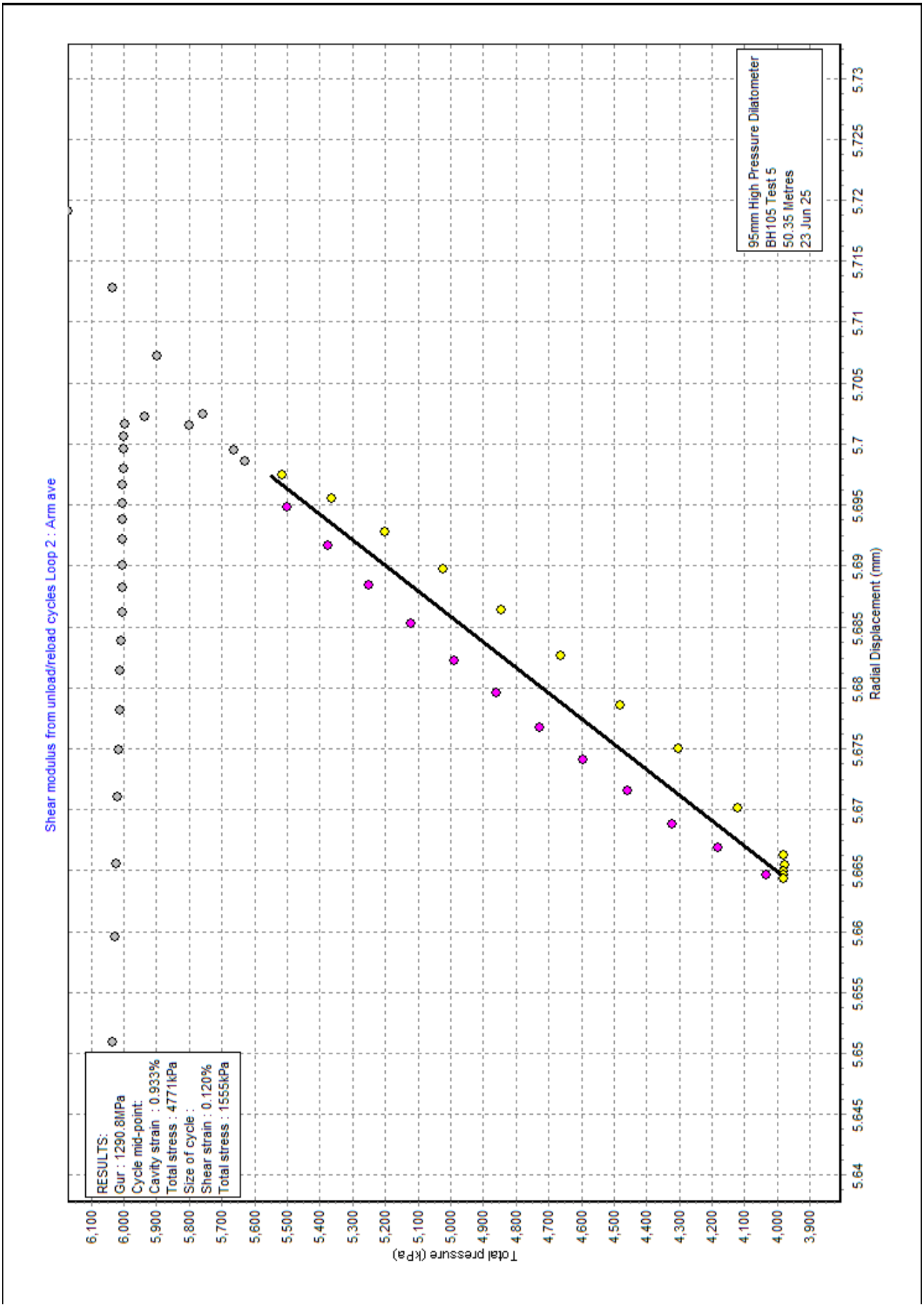

Cavity strain vs Total Pressure : Arm ave
95mm High Pressure Dilatometer
BH105 Test 5
50.35 Metres
23 Jun 25
Total pressure (kPa)
Cavity strain (%)

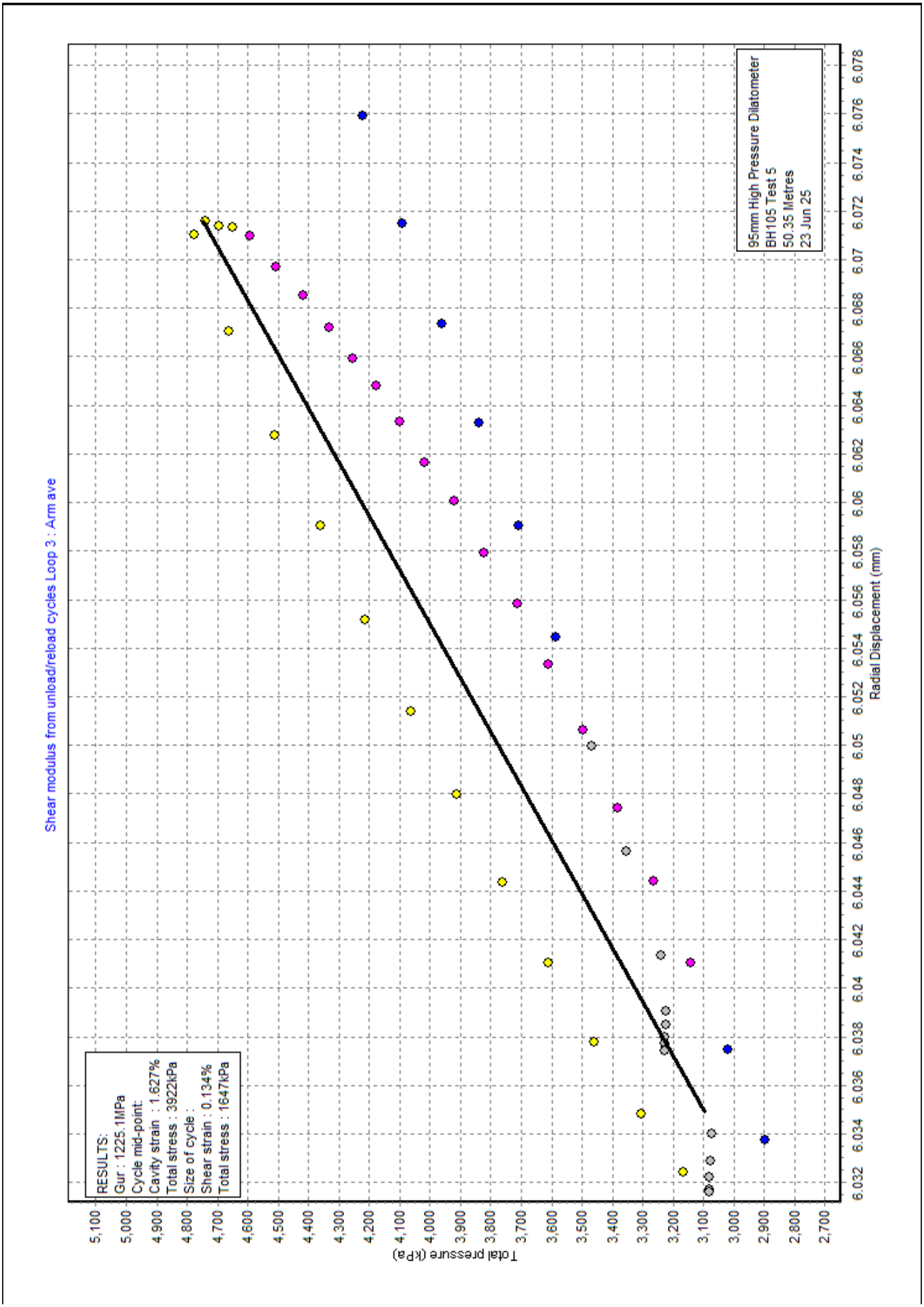

Po of cohesive material (1977, 1990) : Arm ave
95mm High Pressure Dilatometer
BH105 Test 5
50.35 Metres
23 Jun 25
RESULTS:
Gi : 179.5MPa
Pf : 5491.1kPa
Po : 1401.6kPa
Tf : 4108.0kPa
Po + Tf : 5509.6kPa
Origin : 4.922mm
Total pressure (kPa)
Radial Displacement (mm)
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Shear stress at yield : Arm ave
Total pressure (kPa)
Ln[shear strain]

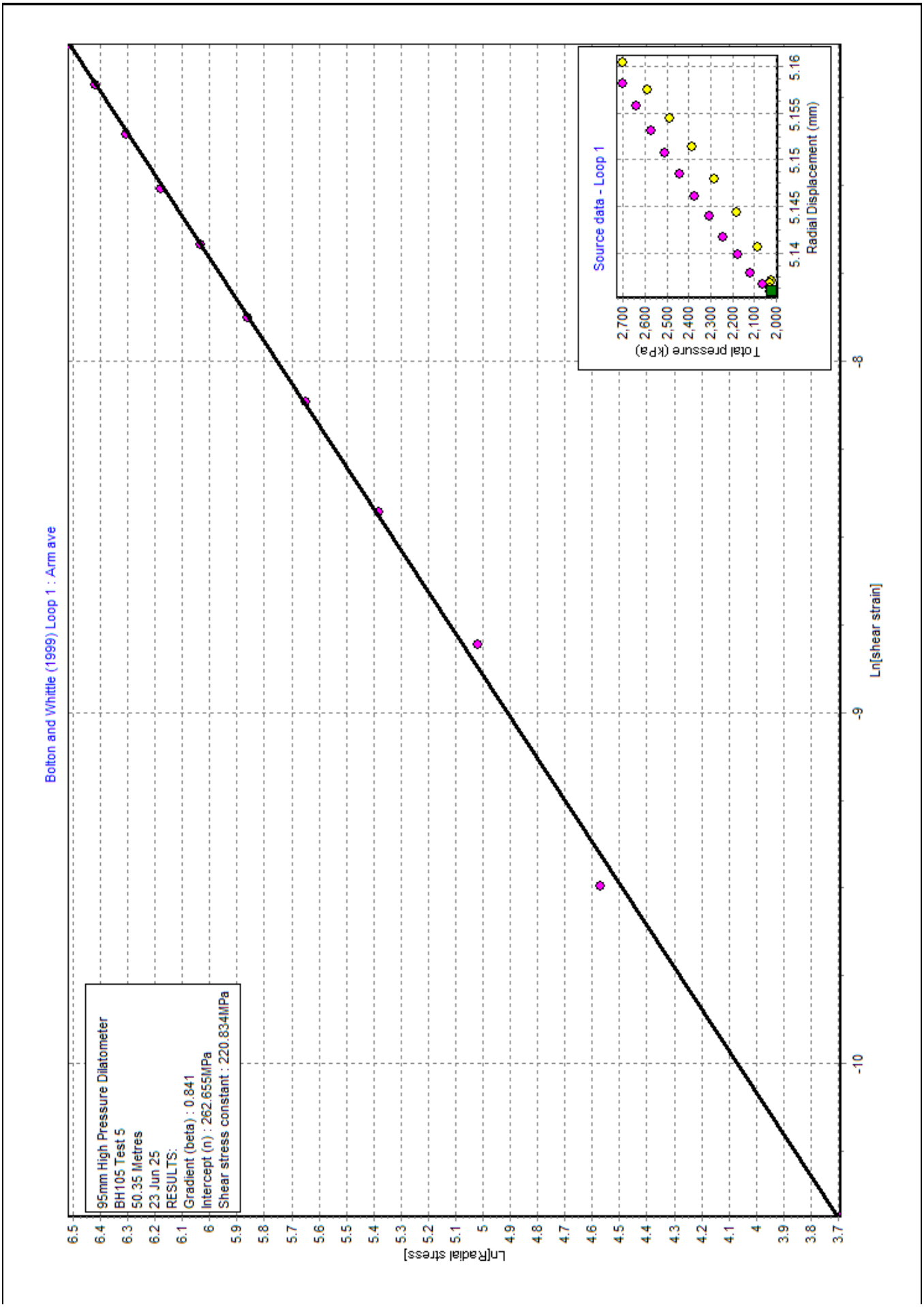

Hughes et al (1977) : Arm ave
RESULTS:
Ambient water pressure : 399.8 kPa
Residual friction angle : 35.0°
Gradient : 0.491
Friction angle : 43.9°
Dilation angle : 11.5°
95mm High Pressure Dilatometer
BH105 Test 5
50.35 Metres
23 Jun 25
Ln[effective stress]
Ln[hoop strain]
8.9
8.85
8.8
8.75
8.7
8.65
8.6
8.55
8.5
8.45
8.4
8.35
8.3
8.25
8.2
8.15
8.1
8.05
8
-5
-6
-7
-8

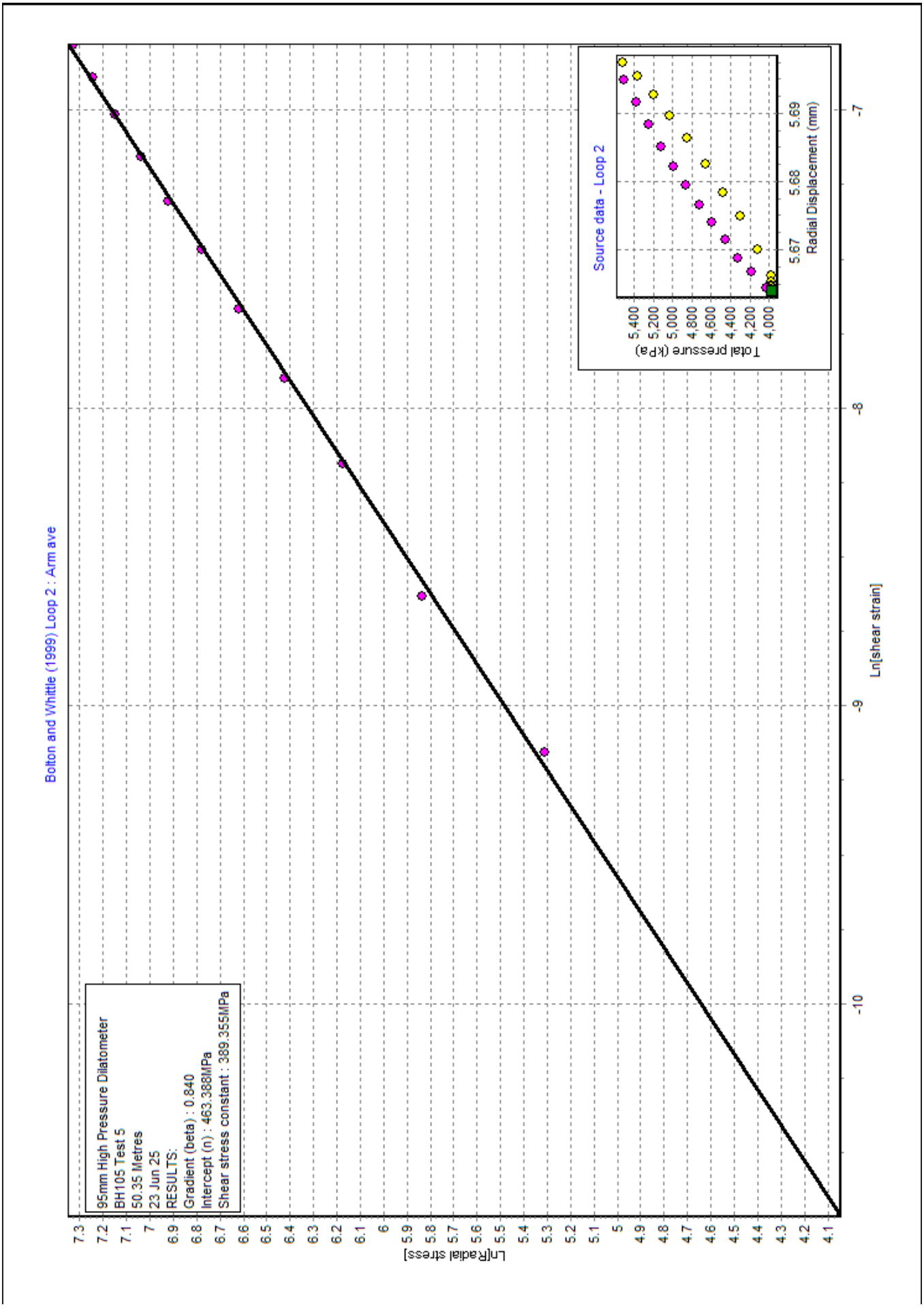

Withers et al (1989) : Arm ave
Ln[(Emx-Ec)/(1+Emx)]
Ln[P'/P'mx]
95mm High Pressure Dilatometer
BH105 Test 5
50.35 Metres
23 Jun 25
RESULTS:
Ambient water pressure : 399.8 kPa
Residual friction angle : 35.0°
Gradient : -2.697
Friction angle : 35.1°
Dilation angle : 0.1°

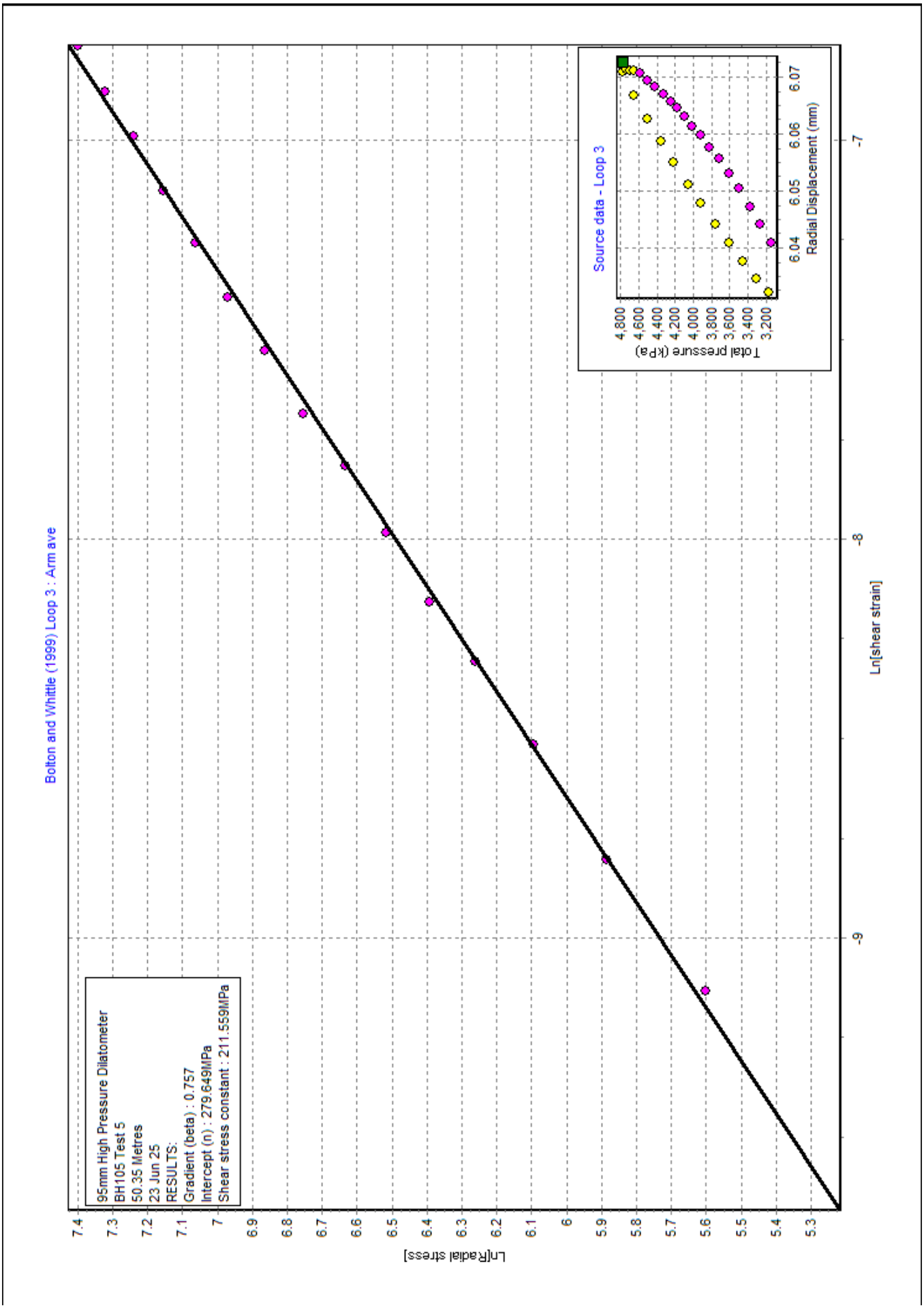

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 794.4MPa
Cycle mid-point:
Cavity strain : -0.059%
Total stress : 2363kPa
Size of cycle :
Shear strain : 0.087%
Total stress : 692kPa
95mm High Pressure Dilatometer
BH105 Test 5
50.35 Metres
23 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

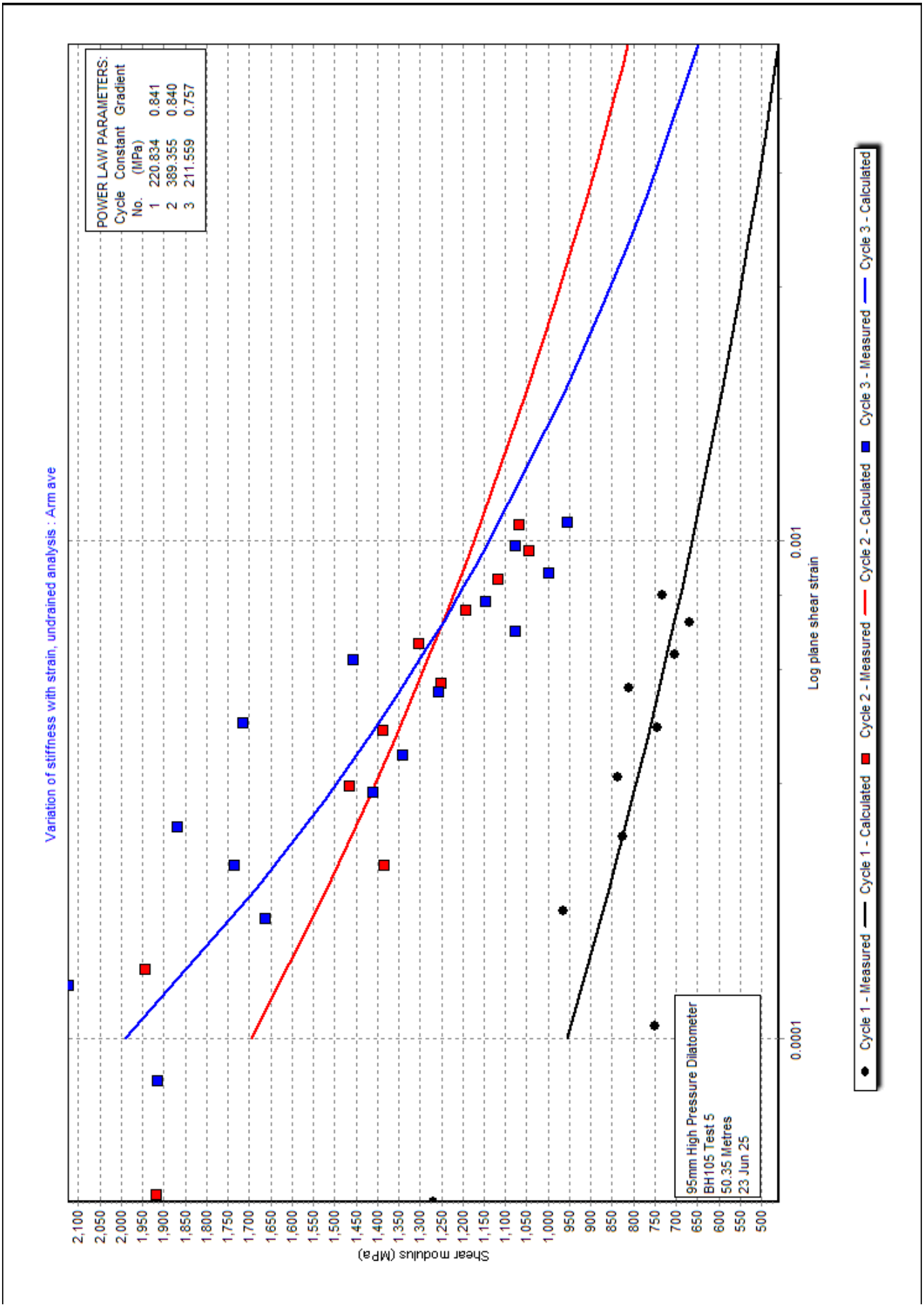

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 1290.8MPa
Cycle mid-point:
Cavity strain : 0.933%
Total stress : 4771kPa
Size of cycle :
Shear strain : 0.120%
Total stress : 1555kPa
95mm High Pressure Dilatometer
BH105 Test 5
50.35 Metres
23 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

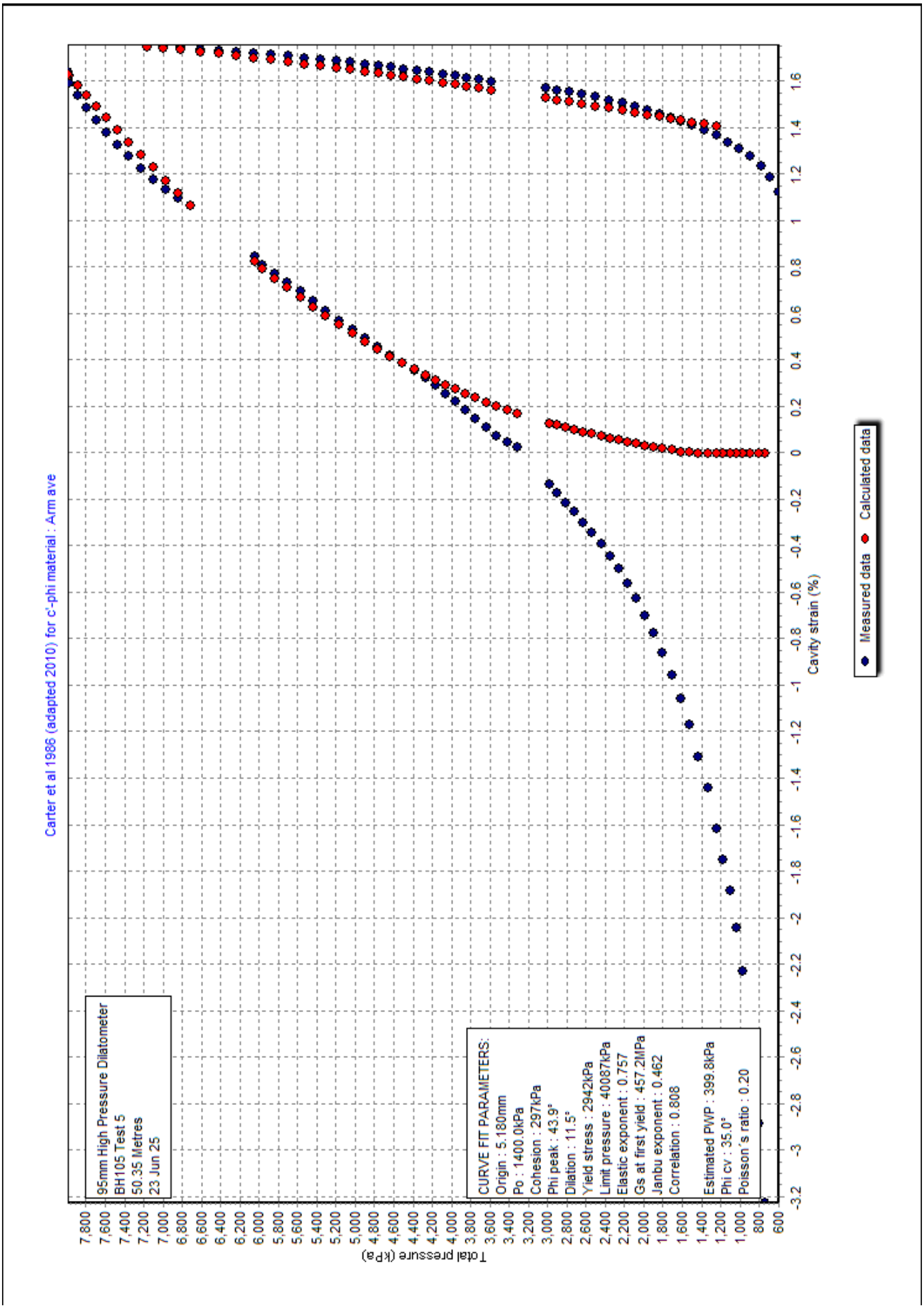

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 1225.1MPa
Cycle mid-point:
Cavity strain : 1.627%
Total stress : 3922kPa
Size of cycle :
Shear strain : 0.134%
Total stress : 1647kPa
95mm High Pressure Dilatometer
BH105 Test 5
50.35 Metres
23 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

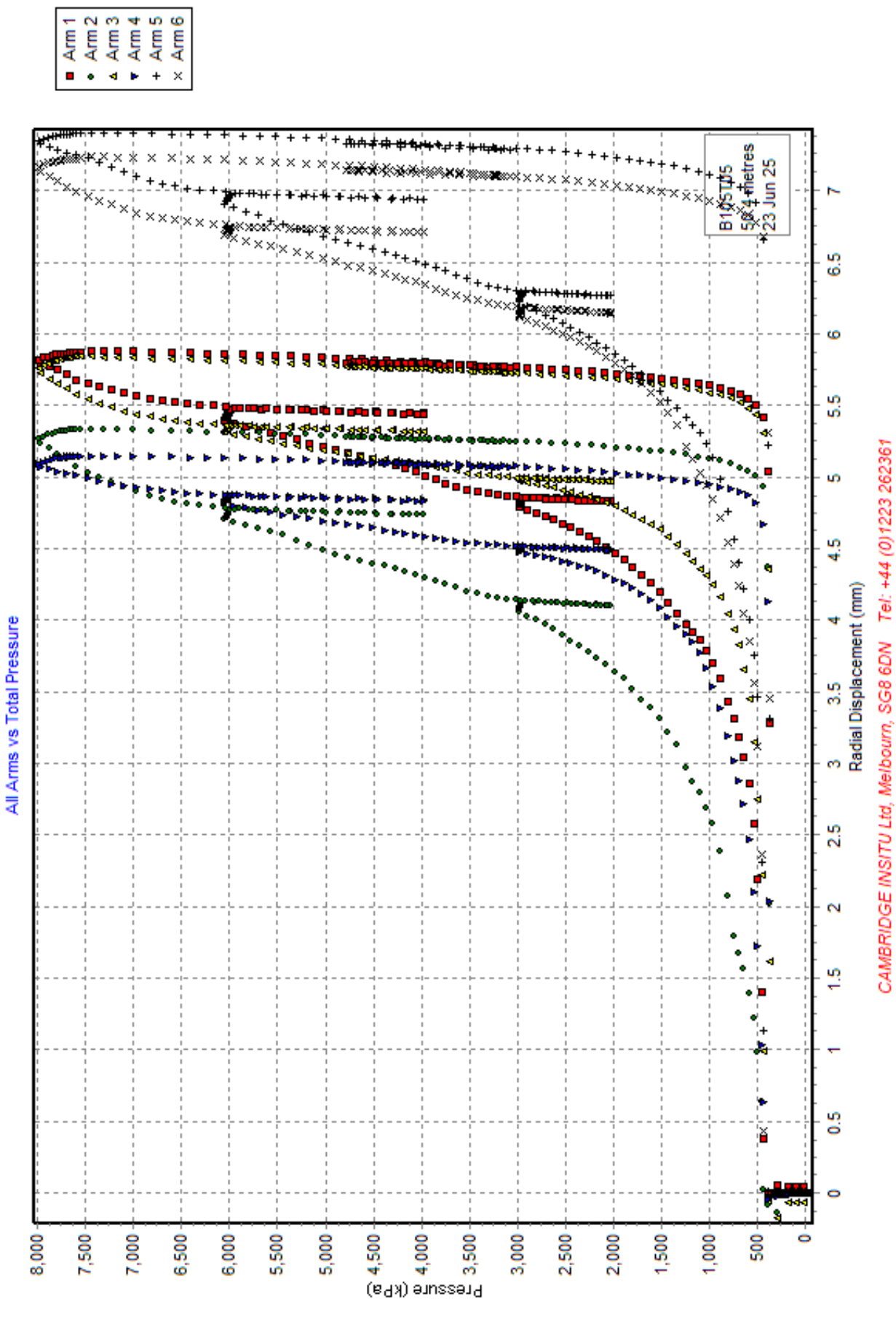

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH105 Test 5
50.35 Metres
23 Jun 25
RESULTS:
Gradient (beta) : 0.841
Intercept (n) : 262.655MPa
Shear stress constant : 220.834MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

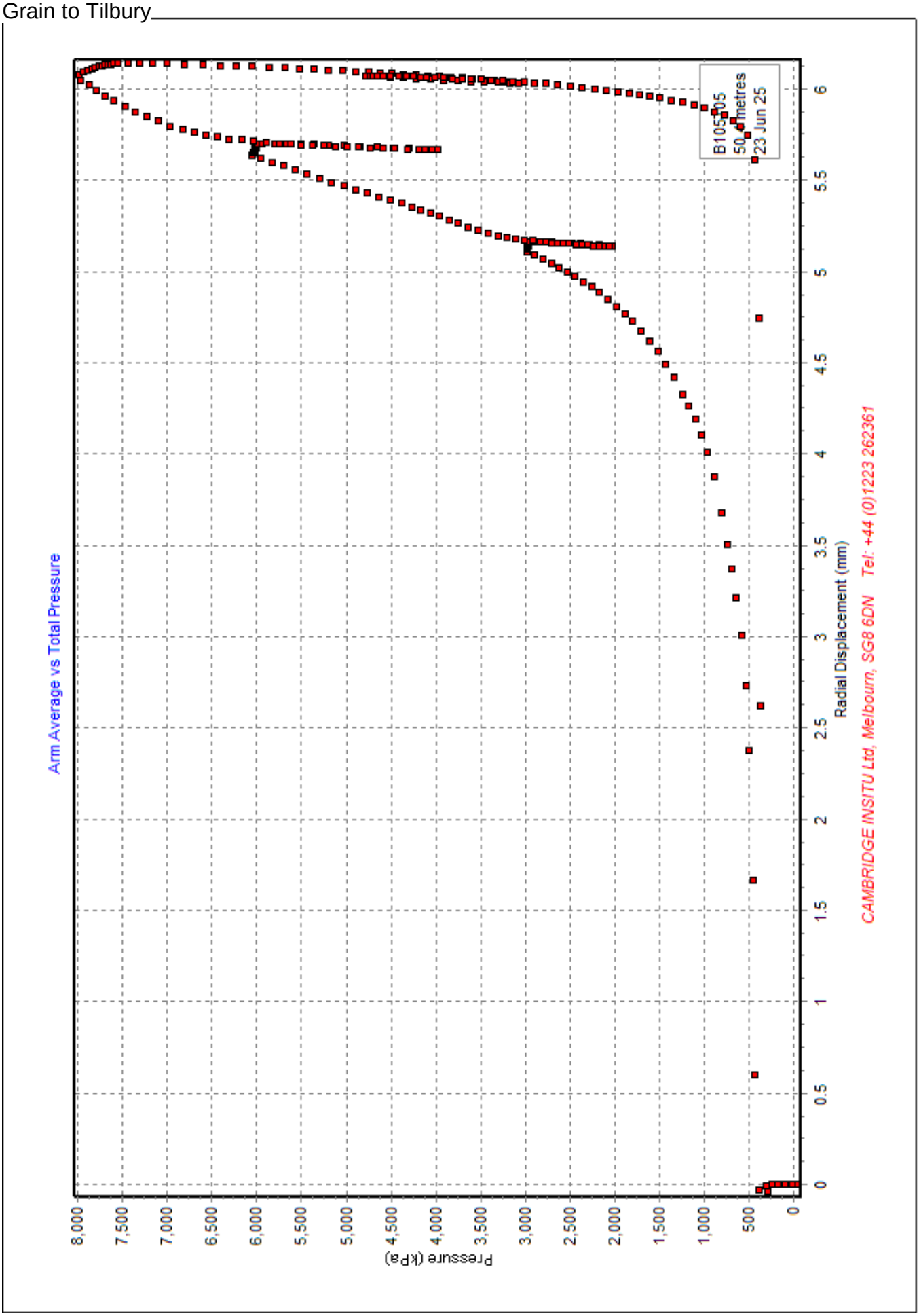

Bolton and Whittle (1999) Loop 2 : Arm ave
95mm High Pressure Dilatometer
BH105 Test 5
50.35 Metres
23 Jun 25
RESULTS:
Gradient (beta) : 0.840
Intercept (n) : 463.388MPa
Shear stress constant : 389.355MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

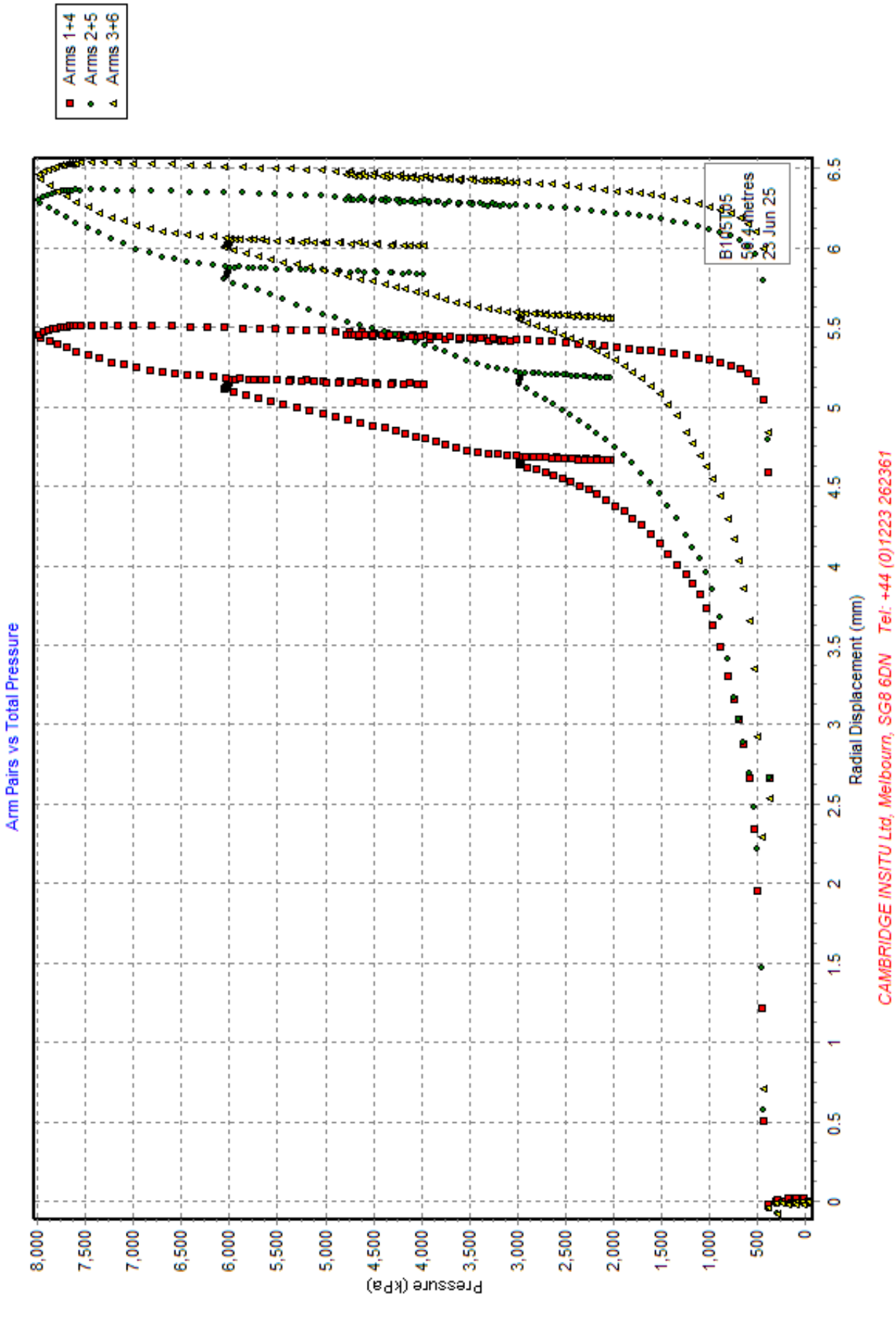

Bolton and Whittle (1999) Loop 3 : Arm ave
95mm High Pressure Dilatometer
BH105 Test 5
50.35 Metres
23 Jun 25
RESULTS:
Gradient (beta) : 0.757
Intercept (n) : 279.649MPa
Shear stress constant : 211.559MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)

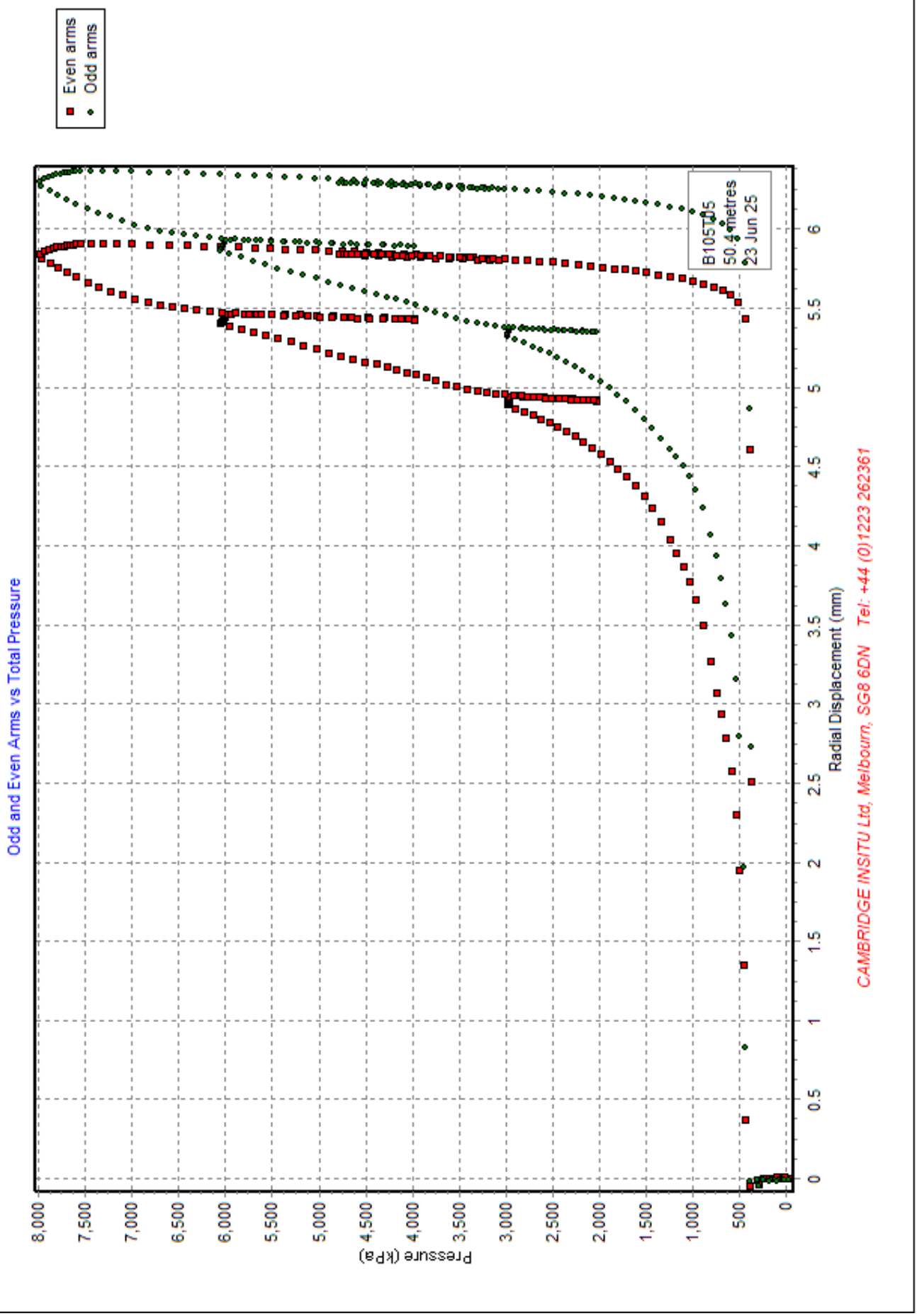

Variation of stiffness with strain, undrained analysis : Arm ave
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 220.834 0.841
2 389.355 0.840
3 211.559 0.757
95mm High Pressure Dilatometer
BH105 Test 5
50.35 Metres
23 Jun 25
Shear modulus (MPa)
Log plane shear strain
0.0001
0.001
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated


Carter et al 1986 (adapted 2010) for c'-phi material : Arm ave
95mm High Pressure Dilatometer
BH105 Test 5
50.35 Metres
23 Jun 25
CURVE FIT PARAMETERS:
Origin : 5.180mm
Po : 1400.0kPa
Cohesion : 297kPa
Phi peak : 43.9°
Dilation : 11.5°
Yield stress : 2942kPa
Limit pressure : 40087kPa
Elastic exponent : 0.757
Gs at first yield : 457.2MPa
Janbu exponent : 0.462
Correlation : 0.808
Estimated PWP : 399.8kPa
Phi cv : 35.0°
Poisson's ratio : 0.20
Total pressure (kPa)
Cavity strain (%)
Measured data
Calculated data


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
8,000
7,500
7,000
6,500
6,000
5,500
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
23 Jun 25
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Arm Average vs Total Pressure
Pressure (kPa)
8,000
7,500
7,000
6,500
6,000
5,500
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Radial Displacement (mm)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
B105005
50 metres
23 Jun 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arms 1+4
Arms 2+5
Arms 3+6
B105105
50.44metres
25 Jun 25
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
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Even arms
Odd arms
B105T05
50.4 metres
23 Jun 25
Odd and Even Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to TIlbury
BH108 Test 1 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Grain to Tilbury
Borehole : BH108
Test name : BH108 Test 1
Test date : 10 Jun 25
Test depth : 24.30 Metres
Water table : 4.31 Metres
Ambient PWP : 196.1 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDB/SDP on 3 Jul 25

Remarks:

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=8.61"
Po from Marsland & Randolph (kPa) : "Arm ave=459.0"
Best estimate of Po (kPa) : "Arm ave=288.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=868.5"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 32.0
Angle of internal friction (°) : "Arm ave=35.9"
Dilation angle (°) : "Arm ave=4.7"
Gradient of log-log plot : "Arm ave=0.400"

[Withers et al 1989]
Angle of internal friction (°) : "Arm ave=31.8"
Dilation angle (°) : "Arm ave=-0.3"
Gradient of log-log plot : "Arm ave=-2.241"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=9.6"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	141.2	0.527	773	0.157	221
Arm ave	2	251.5	5.053	1150	0.098	245
Arm ave	3	292.5	11.181	1520	0.099	290
Arm ave	4	184.9	17.457	1006	0.267	495

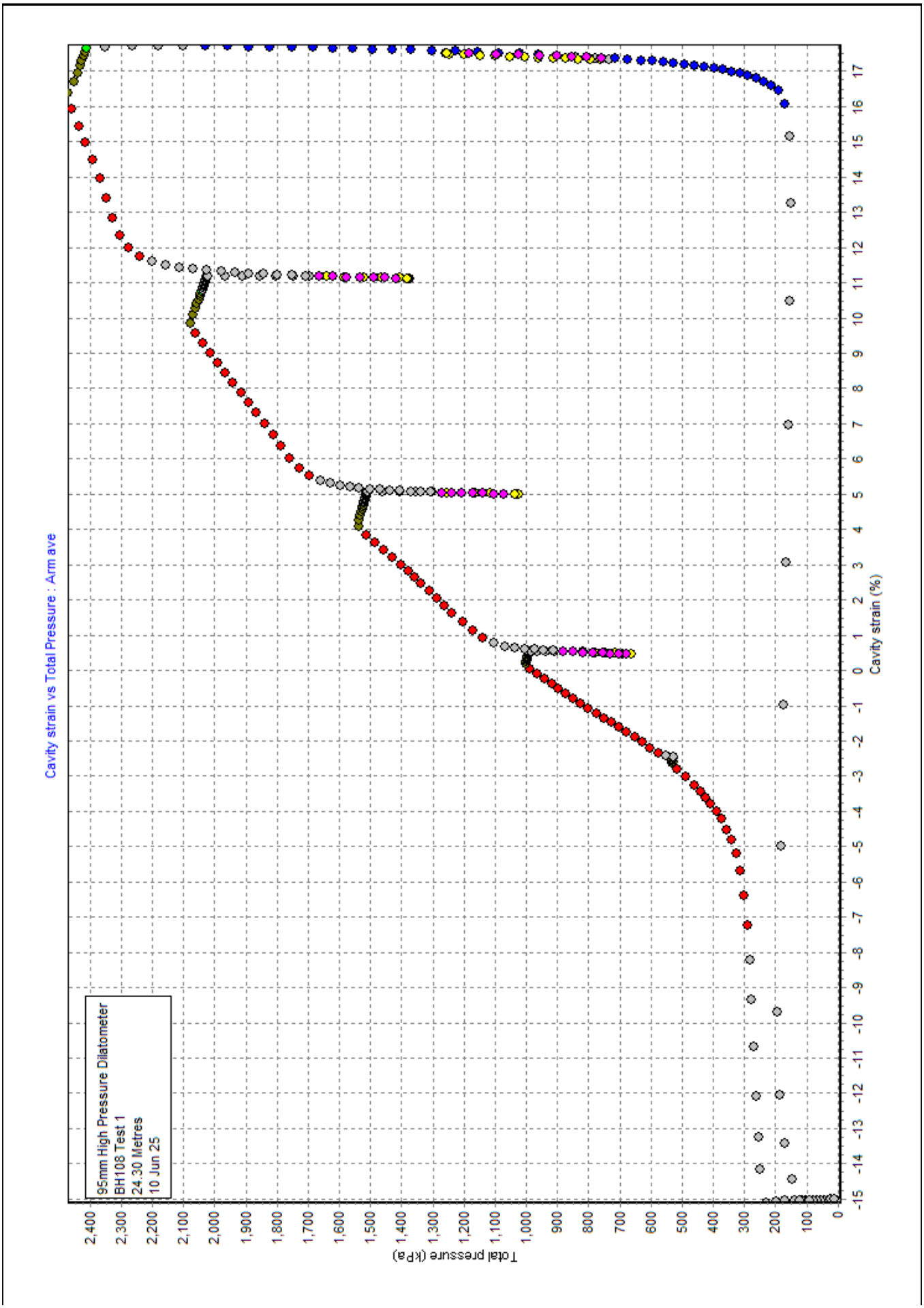
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

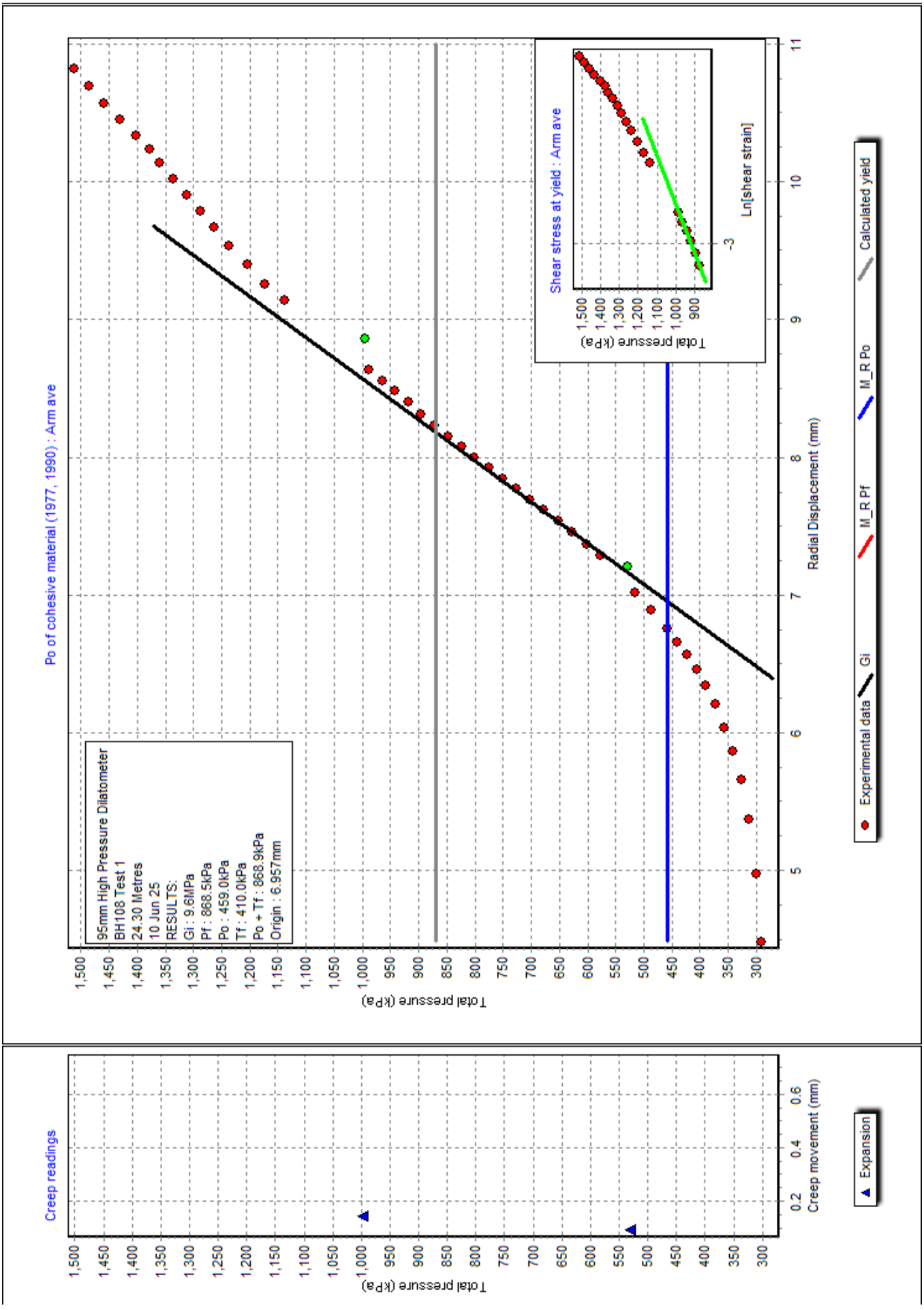
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	55.548	47.652	0.858
Arm ave	2	72.063	58.571	0.813
Arm ave	3	74.221	59.386	0.800
Arm ave	4	45.658	33.454	0.733

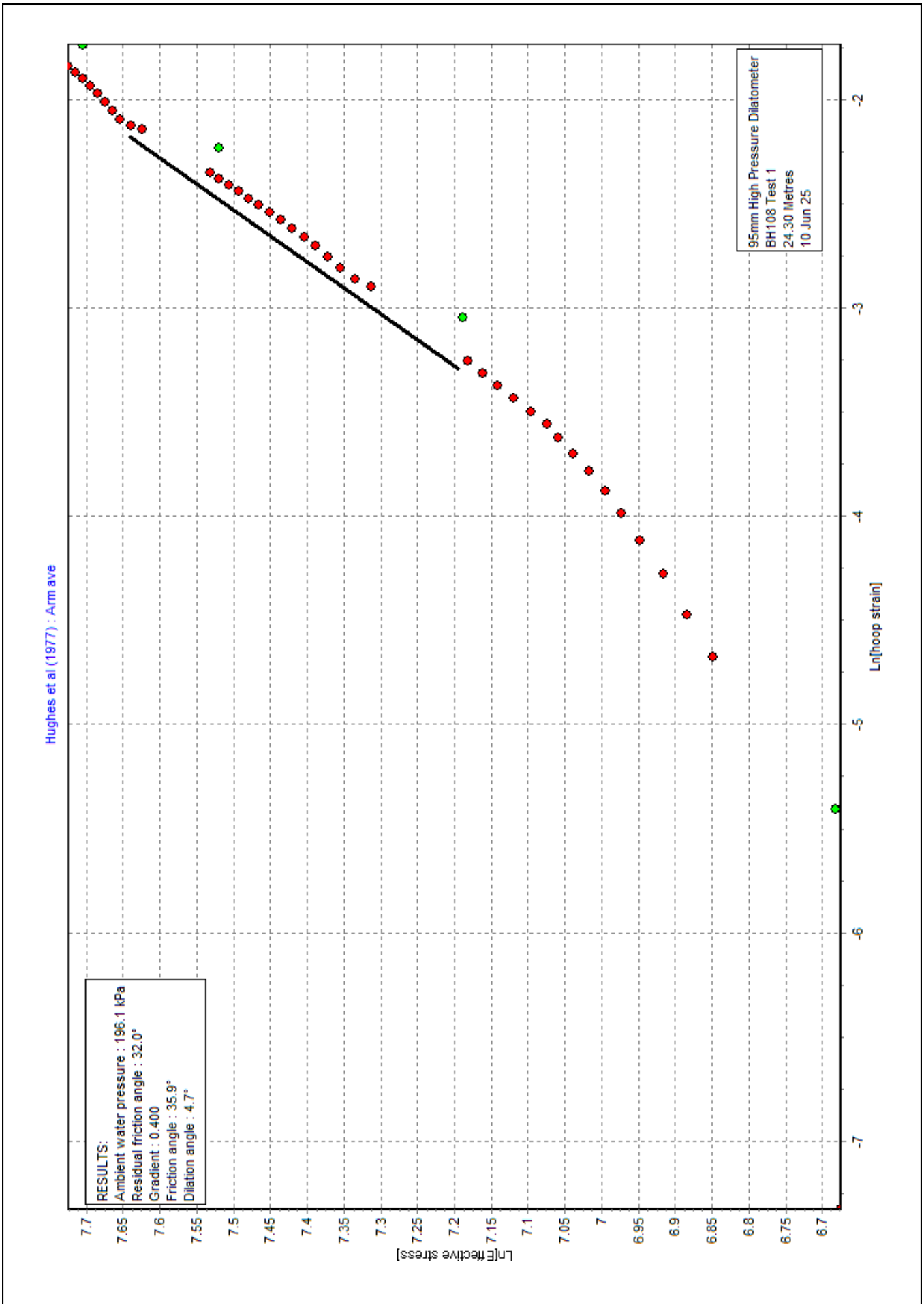
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 8.61
Po (kPa) : 288
Cohesion (kPa) : 16
Angle of peak friction (deg) : 35.9
Angle of peak dilation (deg) : 4.7
Total yield stress (kPa) : 386

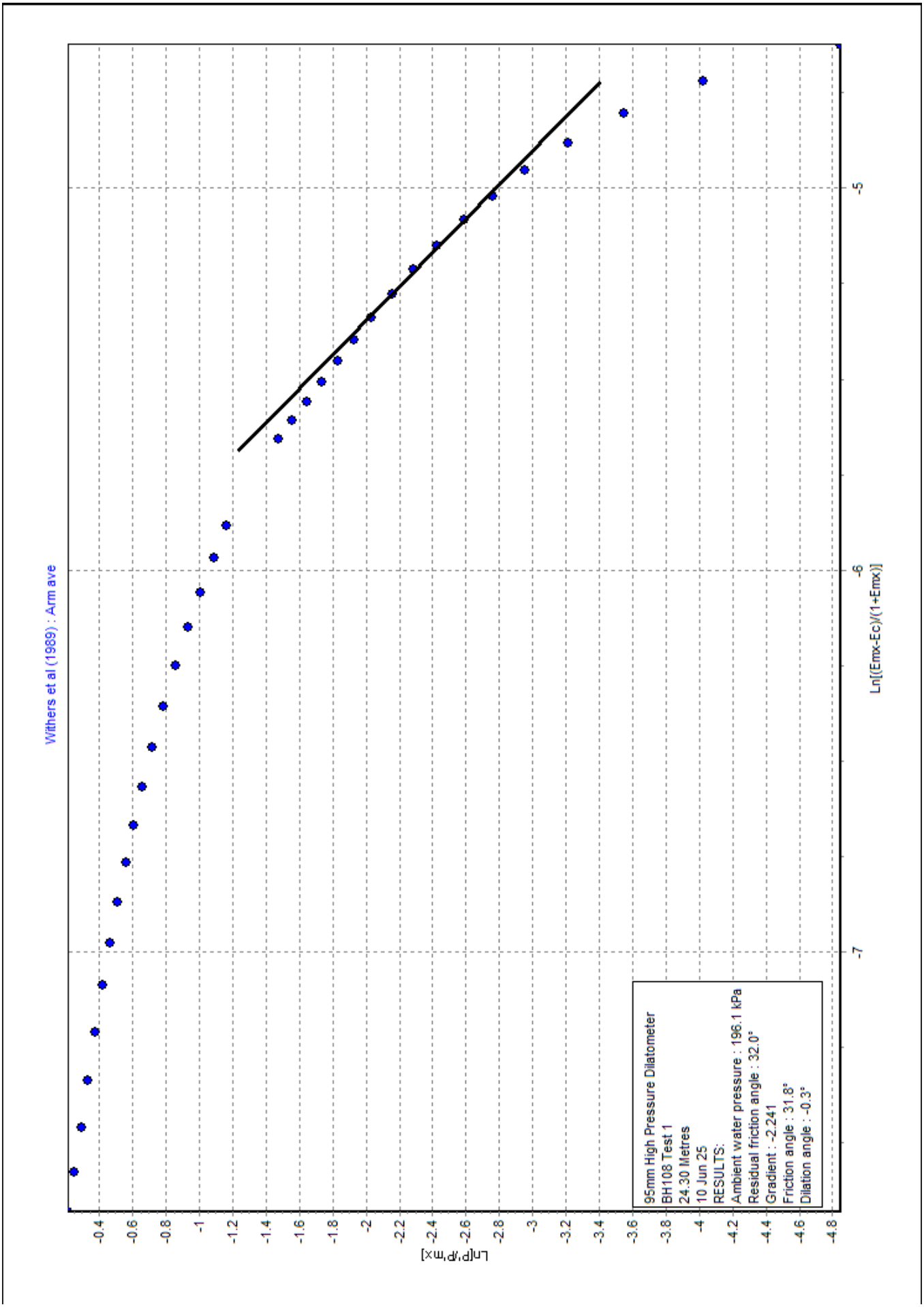
Grain to TIlbury
BH108 Test 1 - SUMMARY OF RESULTS

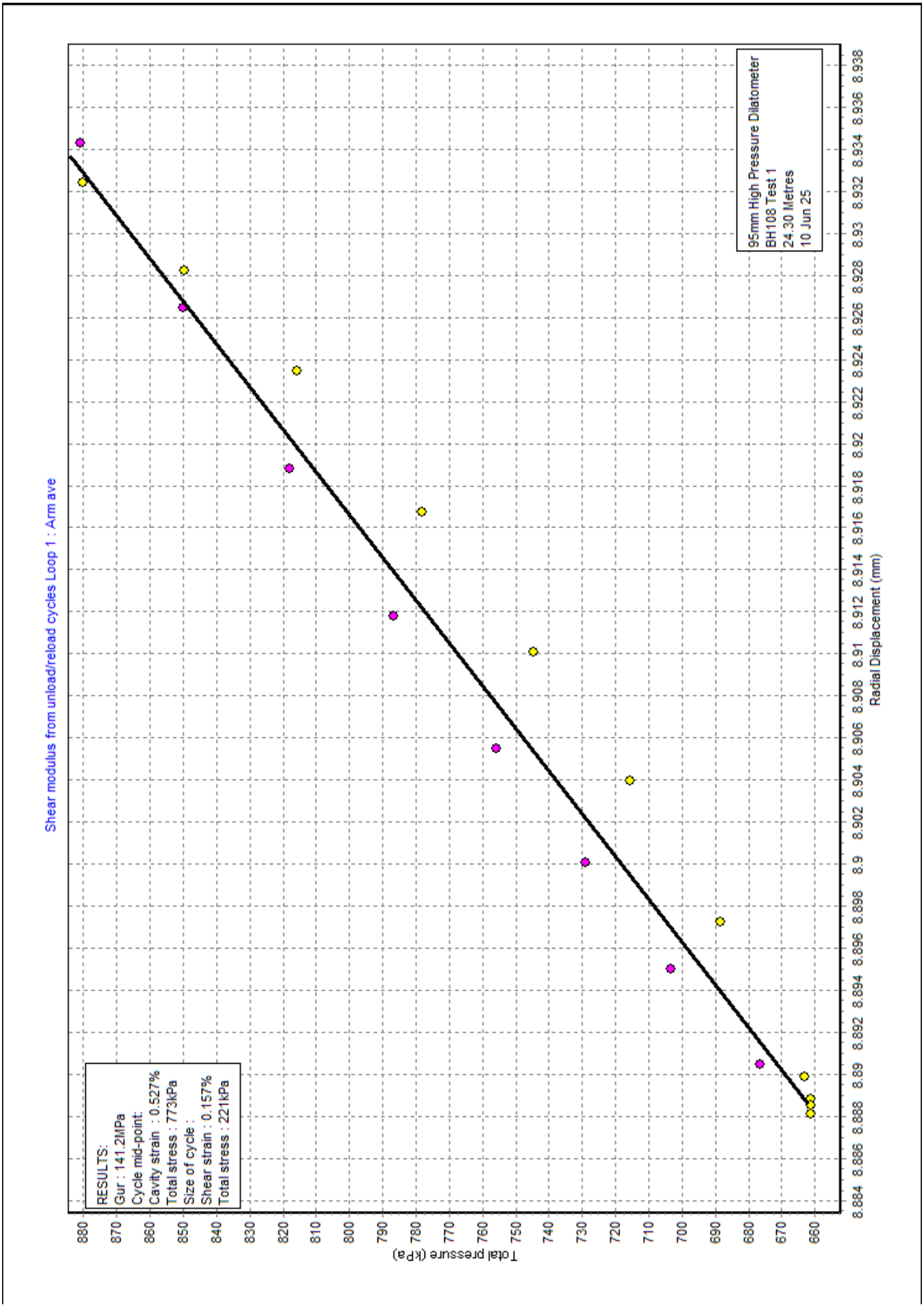
Total limit stress (kPa)	:	4103
G at first yield (MPa)	:	193.7
Non-linear exponent	:	0.800
Janbu exponent	:	0.149
Correlation	:	0.478
Ambient pore water pressure (kPa)	:	196
Residual friction angle (deg)	:	32.0
Poisson's ratio	:	0.20

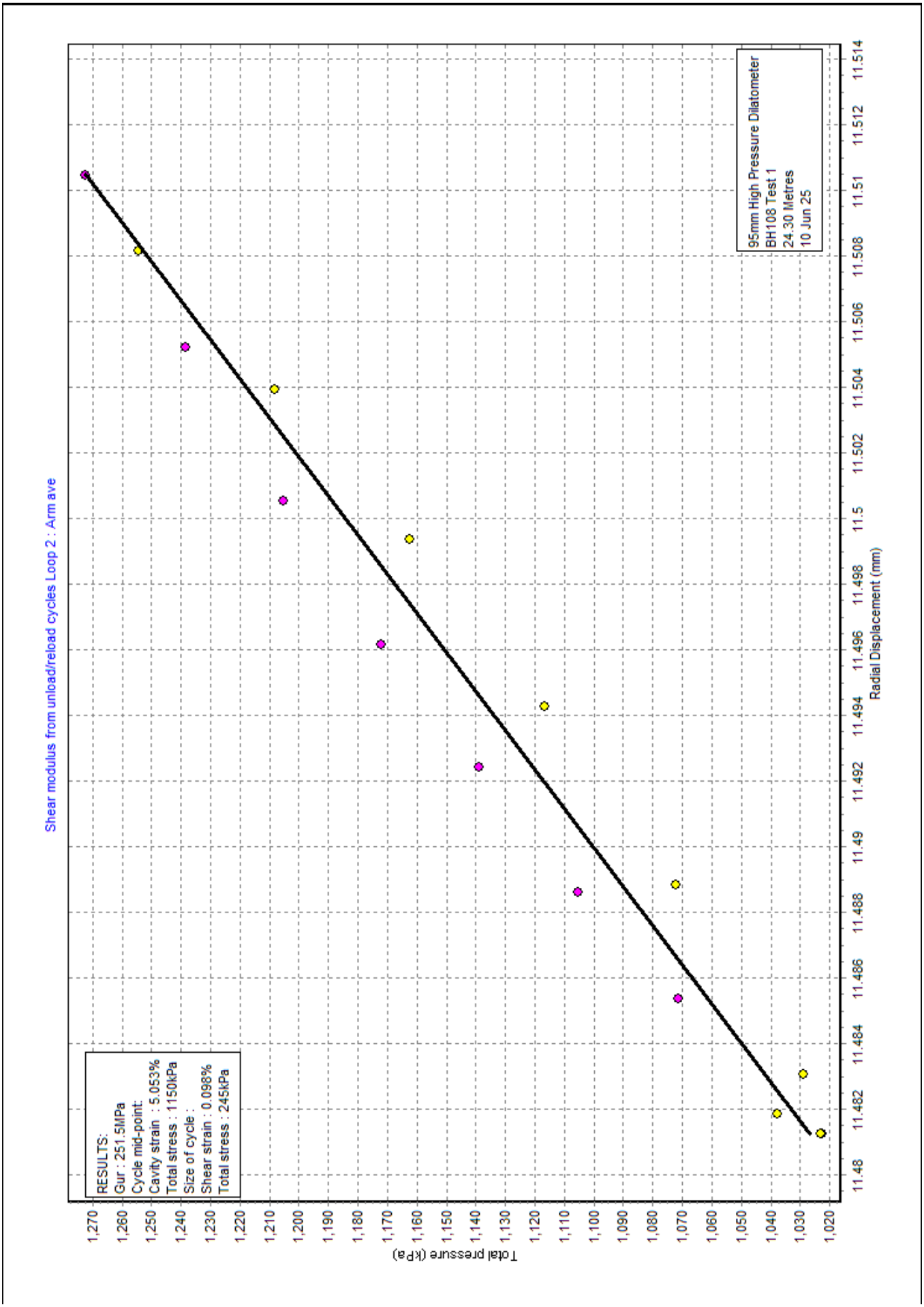

Cavity strain vs Total Pressure : Arm ave
95mm High Pressure Dilatometer
BH108 Test 1
24.30 Metres
10 Jun 25
Total pressure (kPa)
Cavity strain (%)

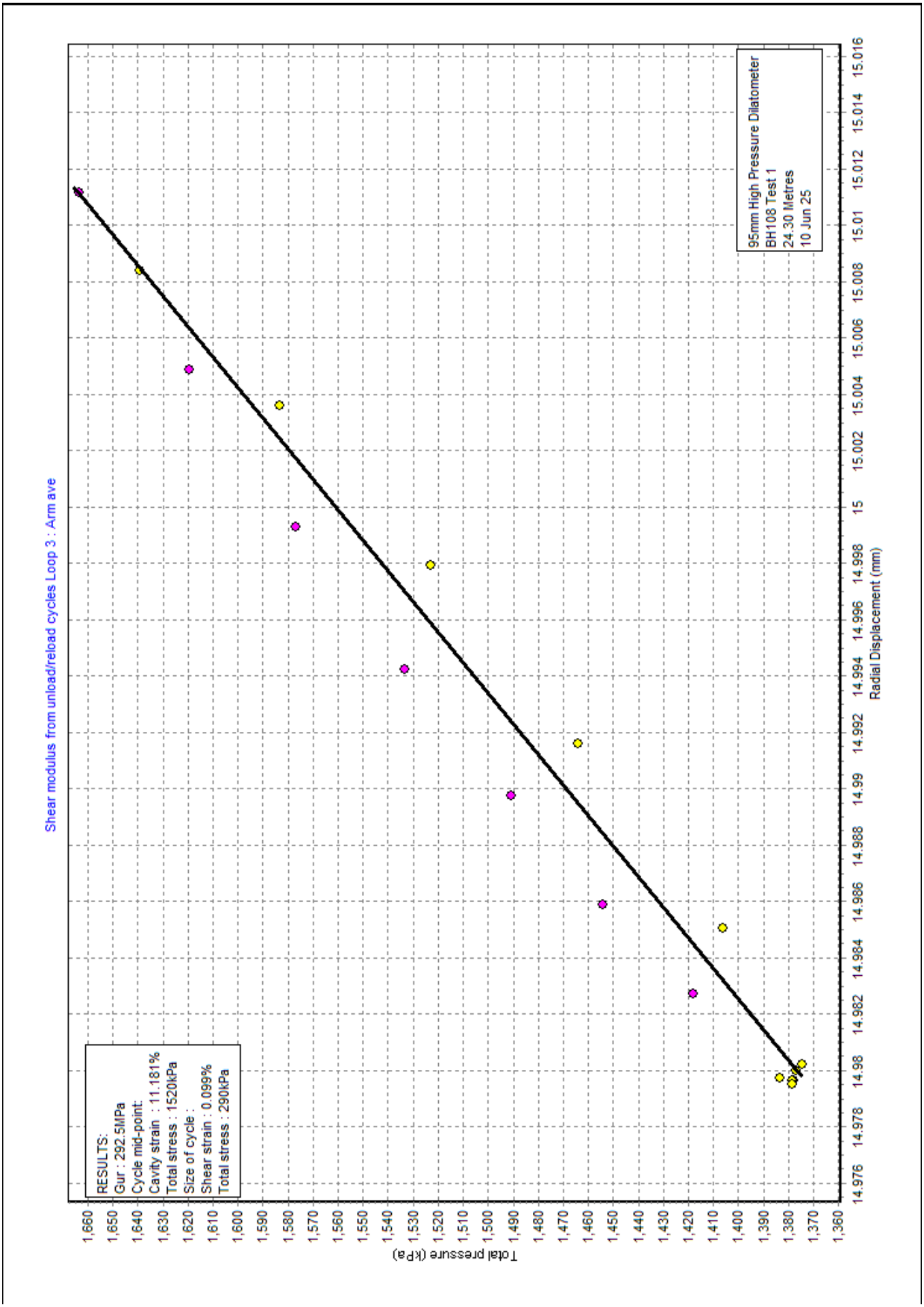

Po of cohesive material (1977, 1990) : Arm ave
95mm High Pressure Dilatometer
BH108 Test 1
24.30 Metres
10 Jun 25
RESULTS:
Gi : 9.6MPa
Pf : 868.5kPa
Po : 459.0kPa
Tf : 410.0kPa
Po + Tf : 868.9kPa
Origin : 6.957mm
Total pressure (kPa)
Radial Displacement (mm)
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Shear stress at yield : Arm ave
Total pressure (kPa)
Ln[shear strain]
Creep readings
Total pressure (kPa)
Creep movement (mm)
Expansion

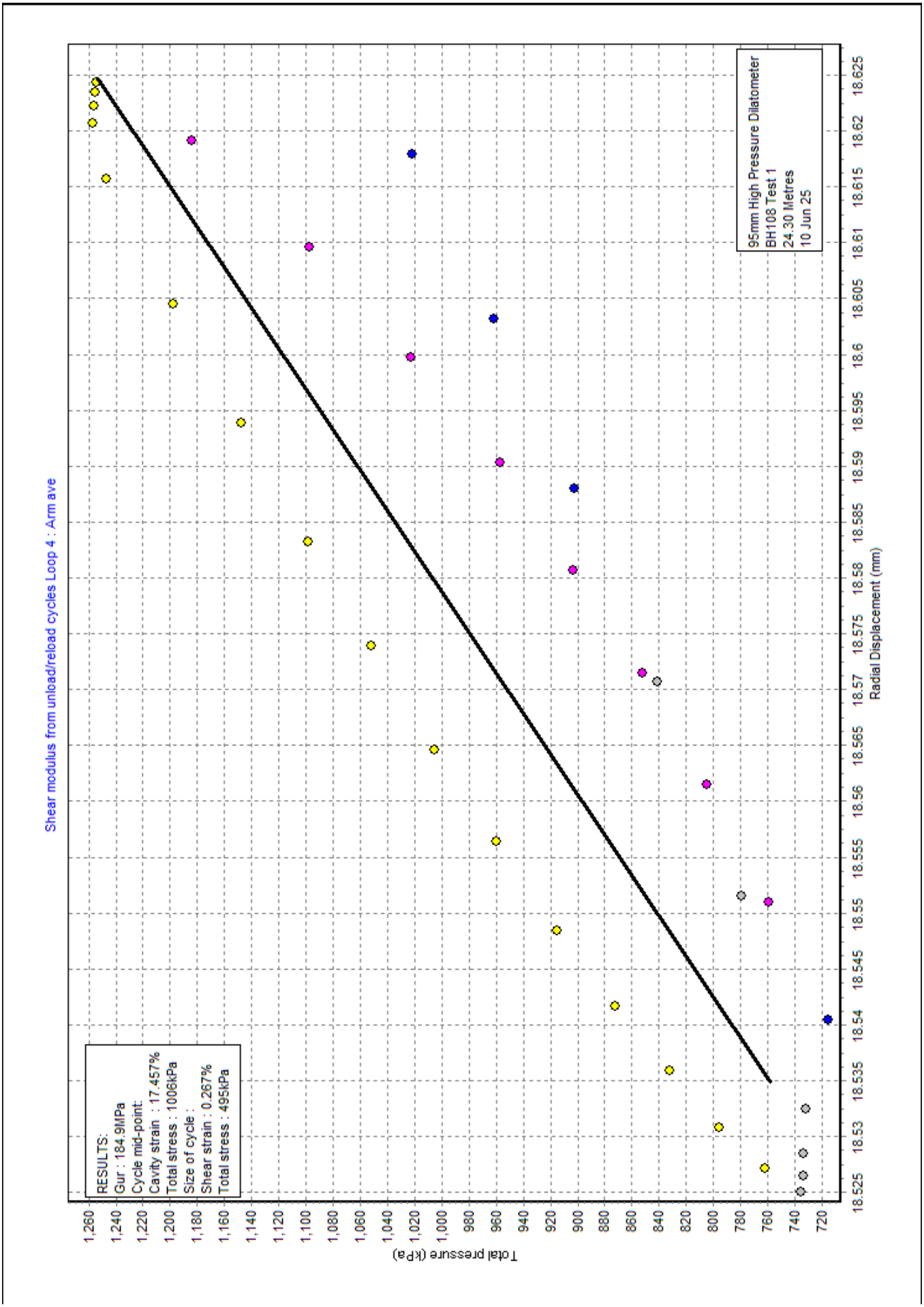

Hughes et al (1977) : Arm ave
RESULTS:
Ambient water pressure : 196.1 kPa
Residual friction angle : 32.0°
Gradient : 0.400
Friction angle : 35.9°
Dilation angle : 4.7°
95mm High Pressure Dilatometer
BH108 Test 1
24.30 Metres
10 Jun 25
Ln[Effective stress]
Ln[hoop strain]
7.7
7.65
7.6
7.55
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
6.75
6.7
-2
-3
-4
-5
-6
-7

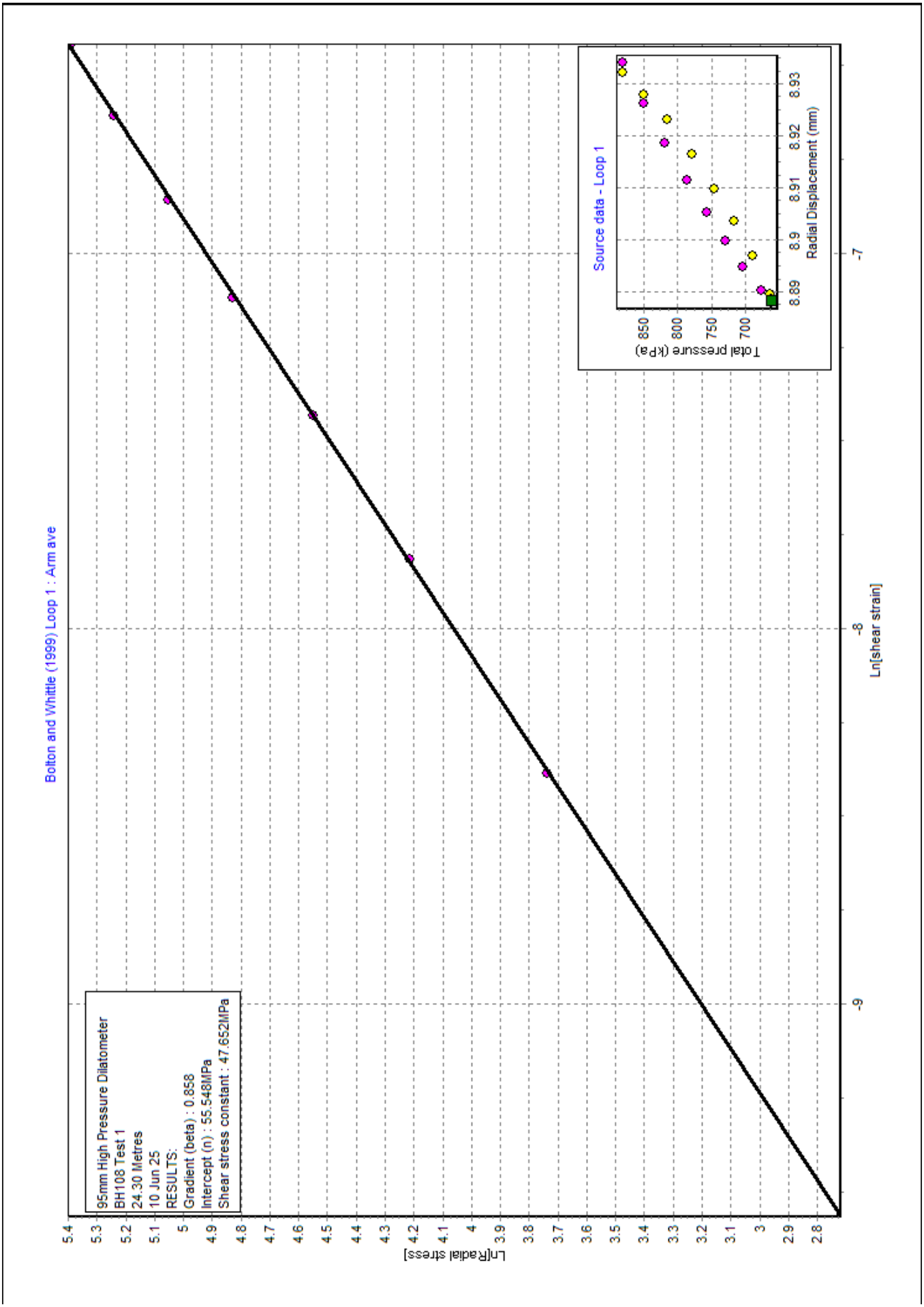

Withers et al (1989) : Arm ave
Ln[(Emx-Ec)/(1+Emx)]
Ln[P'/P'mx]
95mm High Pressure Dilatometer
BH108 Test 1
24.30 Metres
10 Jun 25
RESULTS:
Ambient water pressure : 196.1 kPa
Residual friction angle : 32.0°
Gradient : -2.241
Friction angle : 31.8°
Dilation angle : -0.3°

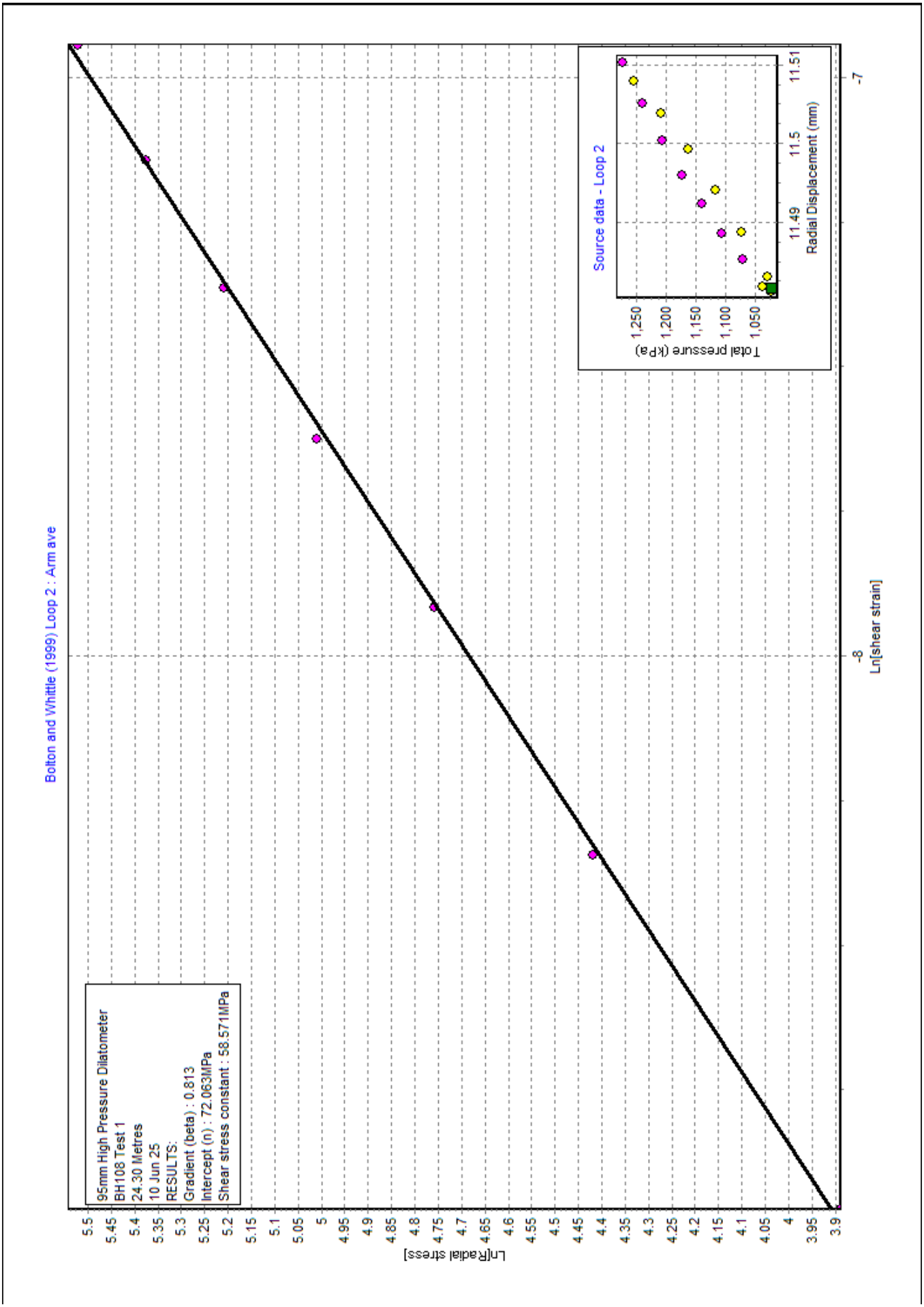

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 141.2MPa
Cycle mid-point:
Cavity strain : 0.527%
Total stress : 773kPa
Size of cycle :
Shear strain : 0.157%
Total stress : 221kPa
95mm High Pressure Dilatometer
BH108 Test 1
24.30 Metres
10 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

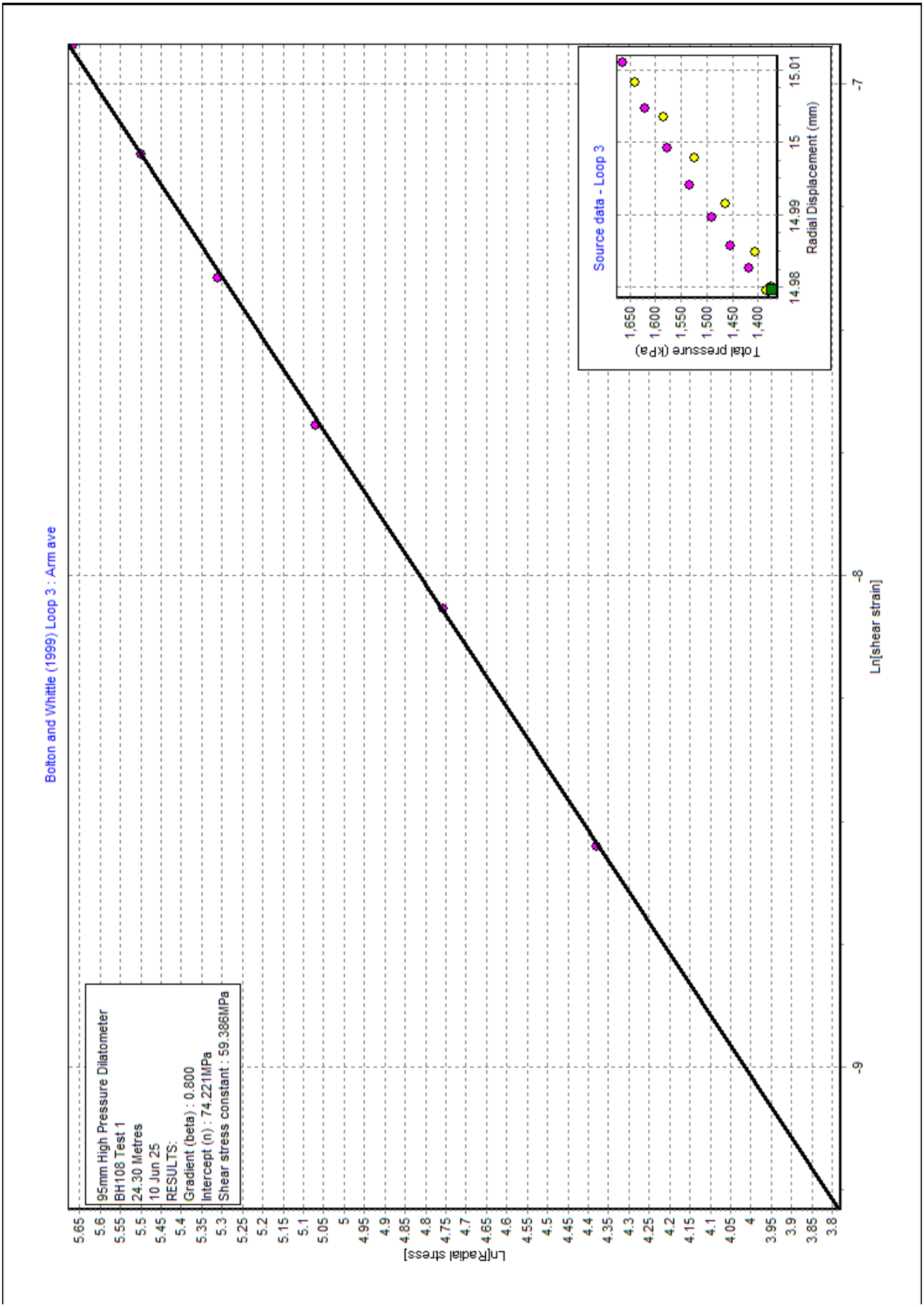

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 251.5MPa
Cycle mid-point:
Cavity strain : 5.053%
Total stress : 1150kPa
Size of cycle :
Shear strain : 0.098%
Total stress : 245kPa
95mm High Pressure Dilatometer
BH108 Test 1
24.30 Metres
10 Jun 25
Total pressure (kPa)
Radial Displacement (mm)
1,270
1,260
1,250
1,240
1,230
1,220
1,210
1,200
1,190
1,180
1,170
1,160
1,150
1,140
1,130
1,120
1,110
1,100
1,090
1,080
1,070
1,060
1,050
1,040
1,030
1,020
11.48
11.482
11.484
11.486
11.488
11.49
11.492
11.494
11.496
11.498
11.5
11.502
11.504
11.506
11.508
11.51
11.512
11.514

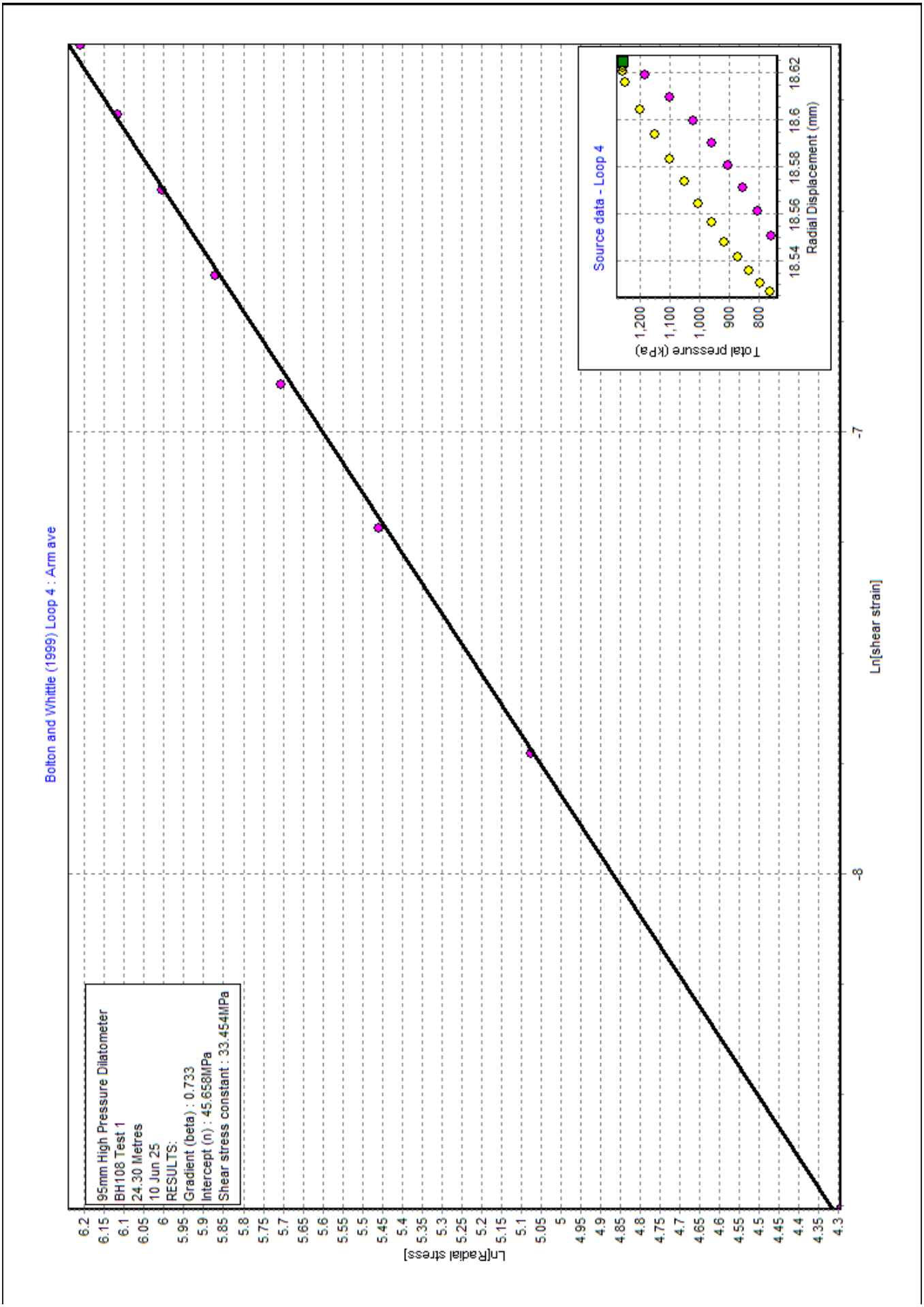

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 292.5MPa
Cycle mid-point:
Cavity strain : 11.181%
Total stress : 1520kPa
Size of cycle :
Shear strain : 0.099%
Total stress : 290kPa
95mm High Pressure Dilatometer
BH108 Test 1
24.30 Metres
10 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

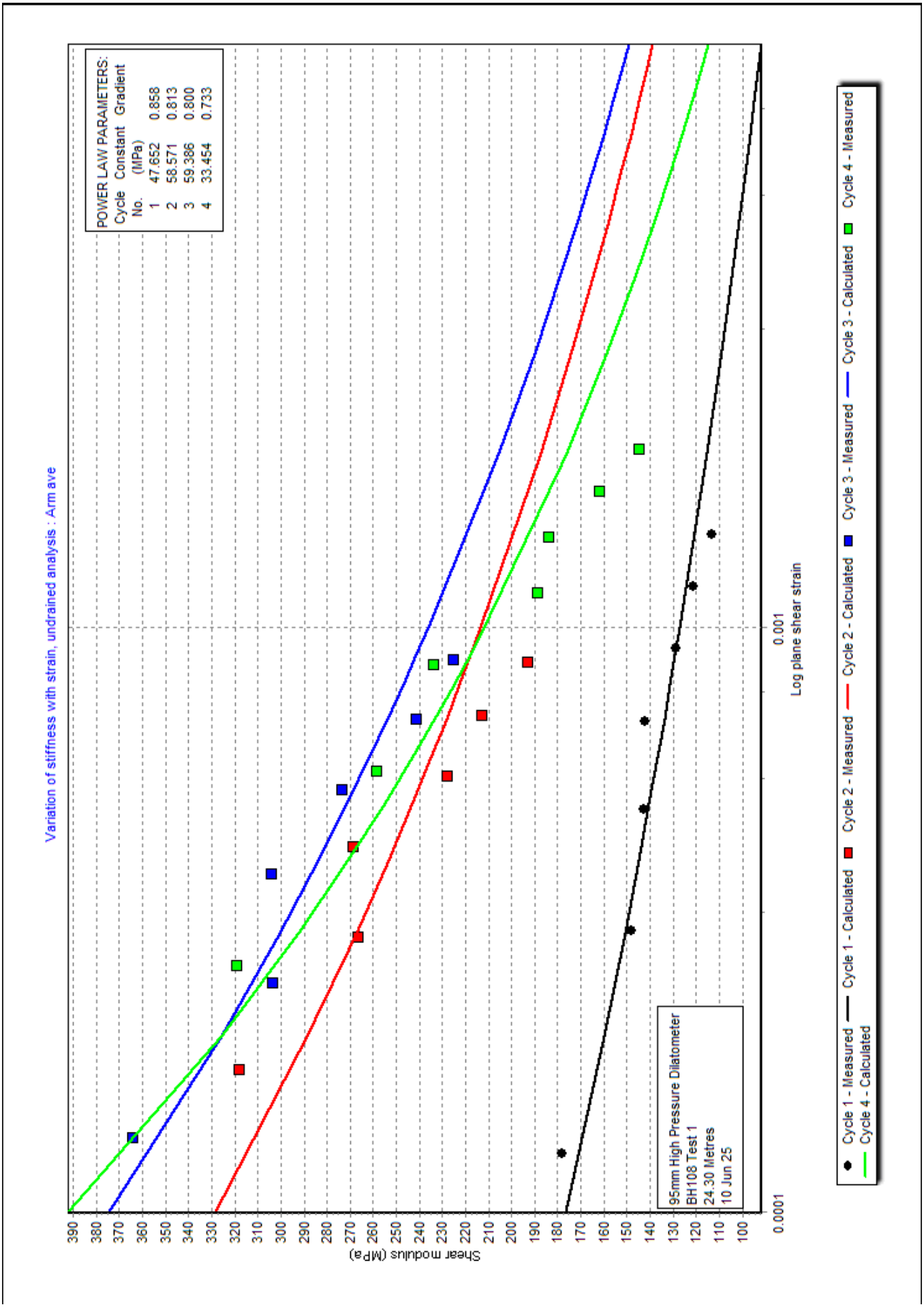

Shear modulus from unload/reload cycles Loop 4 : Arm ave
RESULTS:
Gur : 184.9MPa
Cycle mid-point:
Cavity strain : 17.457%
Total stress : 1006kPa
Size of cycle :
Shear strain : 0.267%
Total stress : 495kPa
95mm High Pressure Dilatometer
BH108 Test 1
24.30 Metres
10 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

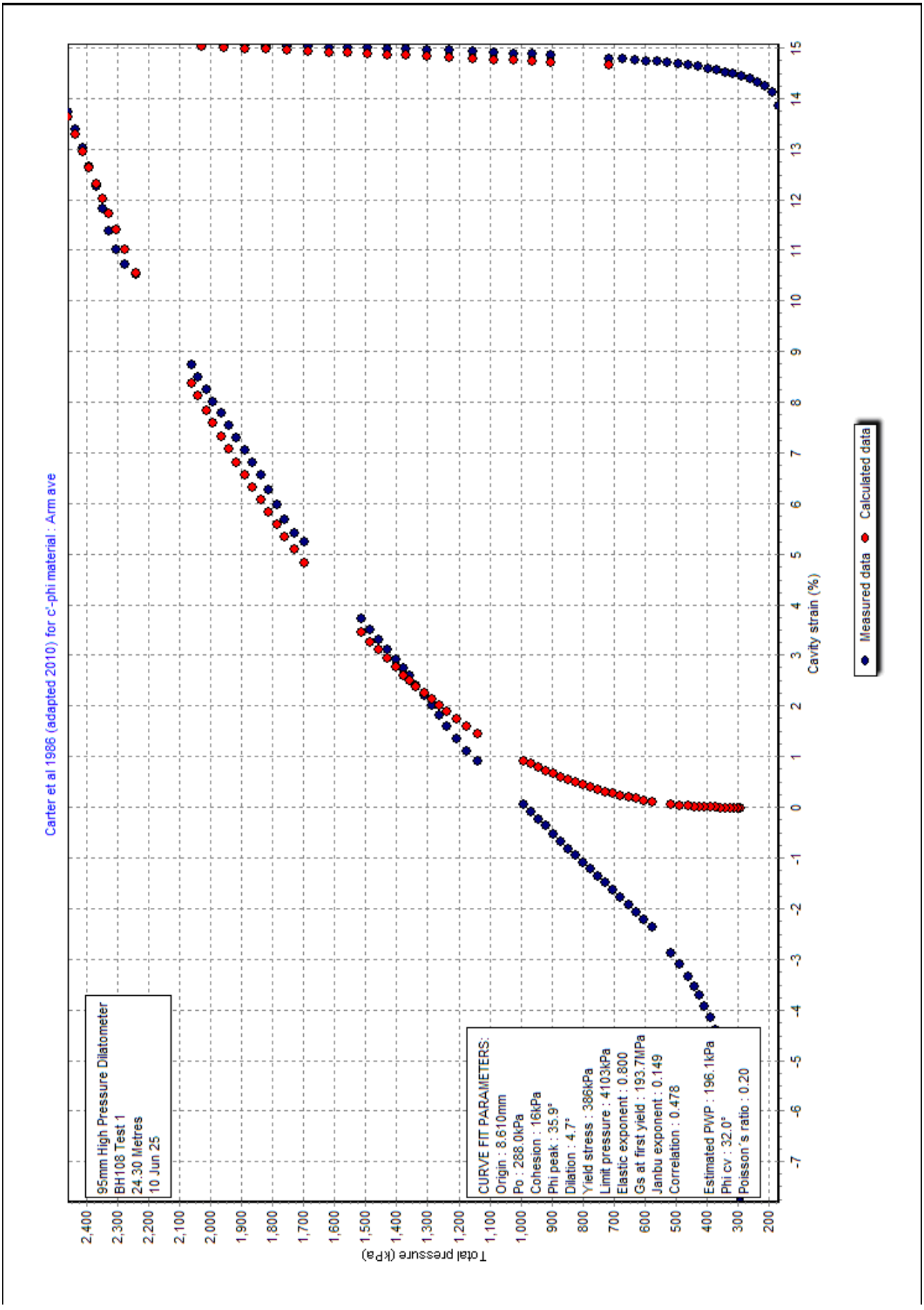

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 1
24.30 Metres
10 Jun 25
RESULTS:
Gradient (beta) : 0.858
Intercept (n) : 55.548MPa
Shear stress constant : 47.652MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

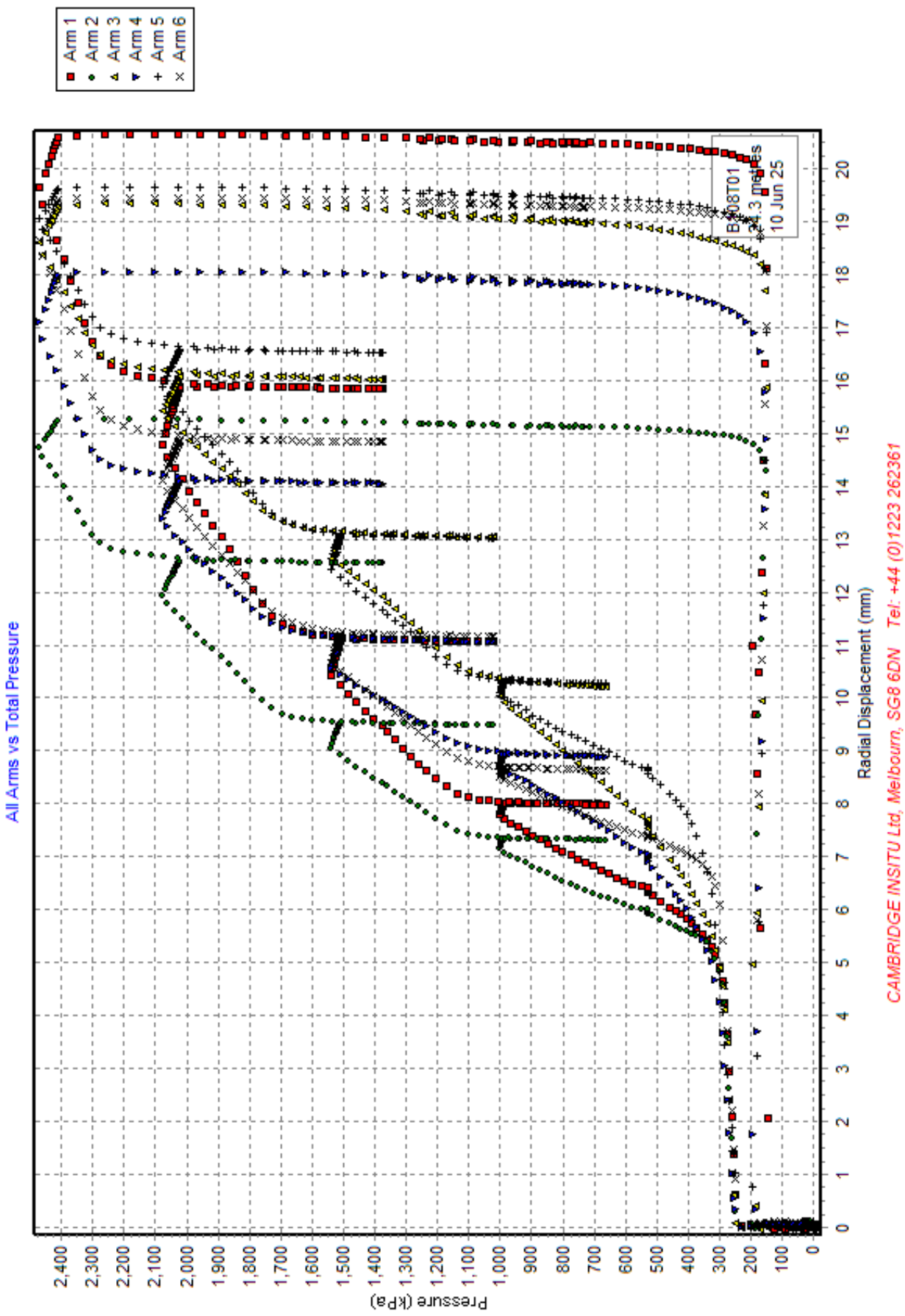

Bolton and Whittle (1999) Loop 2 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 1
24.30 Metres
10 Jun 25
RESULTS:
Gradient (beta) : 0.813
Intercept (n) : 72.063MPa
Shear stress constant : 58.571MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

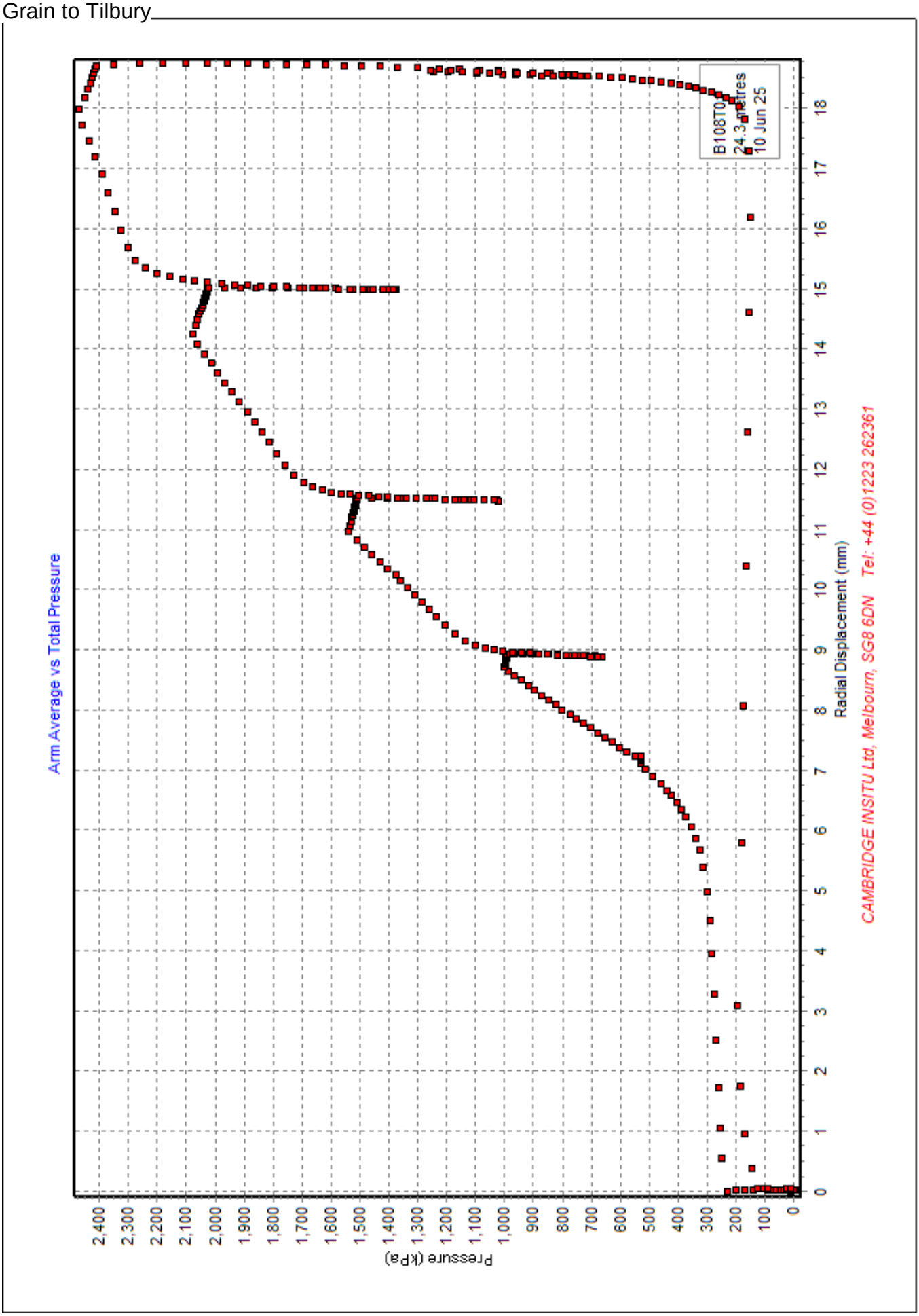

Bolton and Whittle (1999) Loop 3 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 1
24.30 Metres
10 Jun 25
RESULTS:
Gradient (beta) : 0.800
Intercept (n) : 74.221MPa
Shear stress constant : 59.386MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)

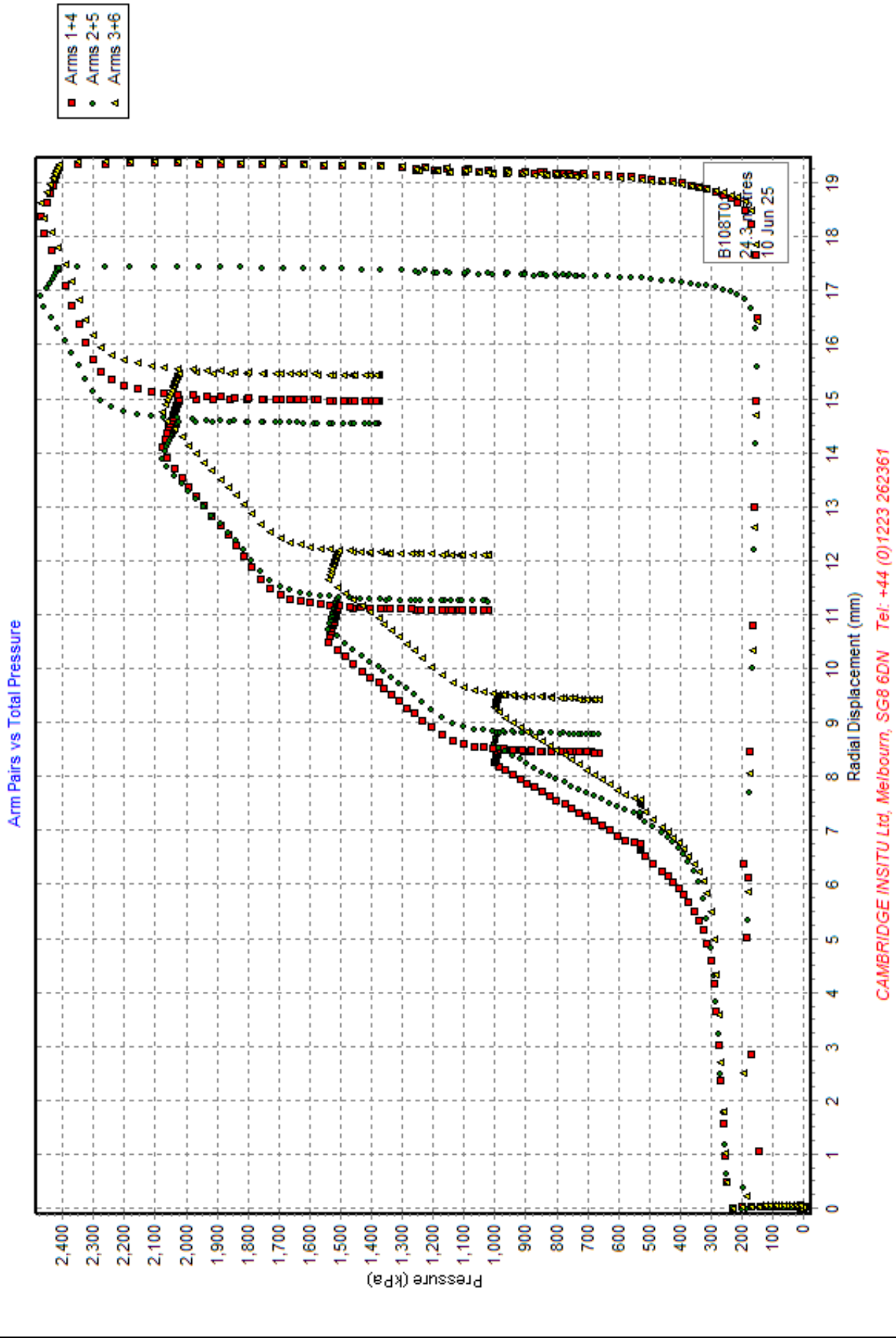

Bolton and Whittle (1999) Loop 4 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 1
24.30 Metres
10 Jun 25
RESULTS:
Gradient (beta) : 0.733
Intercept (n) : 45.658MPa
Shear stress constant : 33.454MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 4
Total pressure (kPa)
Radial Displacement (mm)

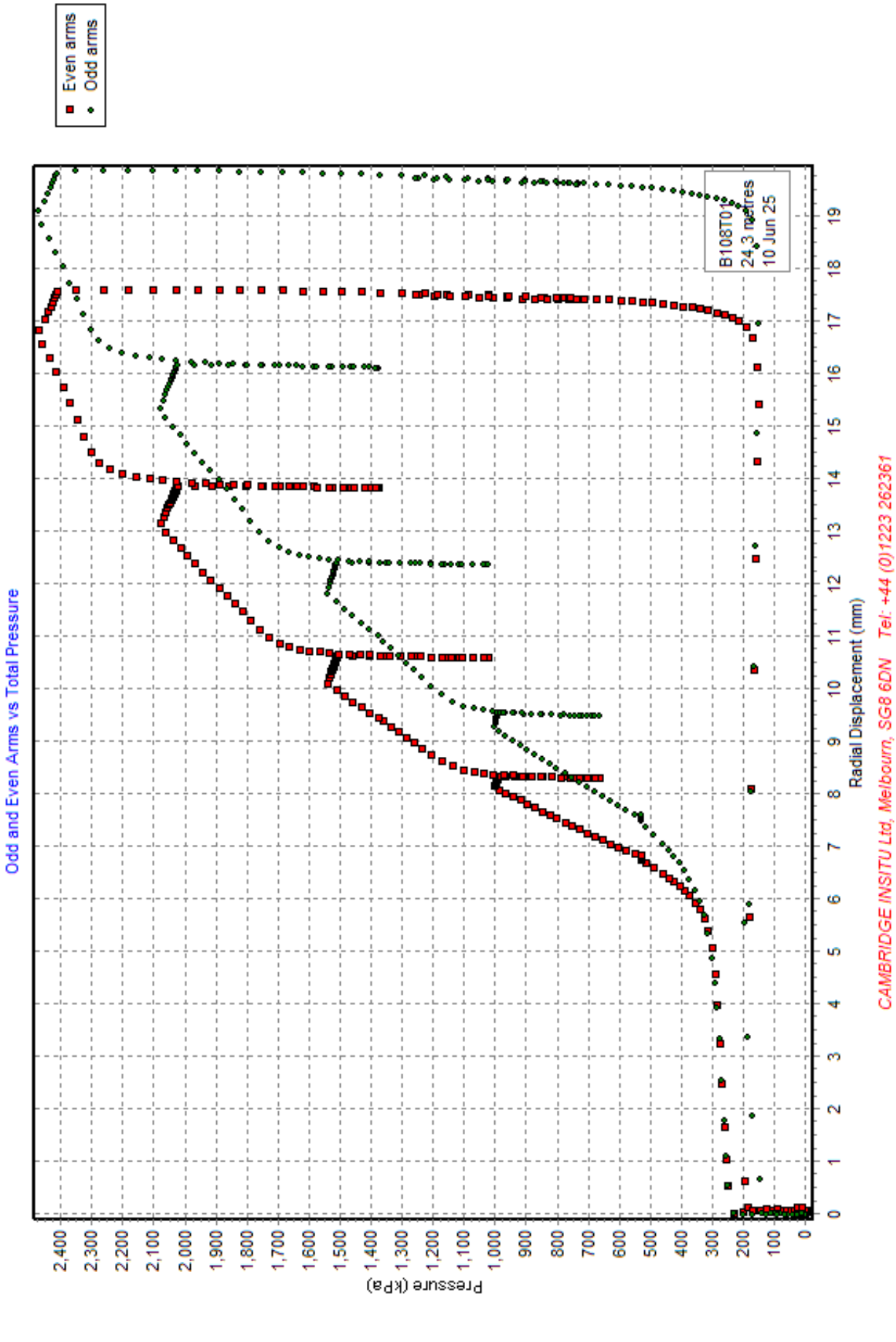

Variation of stiffness with strain, undrained analysis : Arm ave
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 47.652 0.858
2 58.571 0.813
3 59.386 0.800
4 33.454 0.733
Shear modulus (MPa)
Log plane shear strain
95mm High Pressure Dilatometer
BH108 Test 1
24.30 Metres
10 Jun 25
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
Cycle 4 - Measured
Cycle 4 - Calculated


Carter et al 1986 (adapted 2010) for c'-phi material : Arm ave
95mm High Pressure Dilatometer
BH108 Test 1
24.30 Metres
10 Jun 25
CURVE FIT PARAMETERS:
Origin : 8.610mm
Po : 288.0kPa
Cohesion : 16kPa
Phi peak : 35.9°
Dilation : 4.7°
Yield stress : 386kPa
Limit pressure : 4103kPa
Elastic exponent : 0.800
Gs at first yield : 193.7MPa
Janbu exponent : 0.149
Correlation : 0.478
Estimated PWP : 196.1kPa
Phi cv : 32.0°
Poisson's ratio : 0.20
Total pressure (kPa)
Cavity strain (%)
Measured data
Calculated data


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
10 Jun 25
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Arm Average vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
B108T0
24.3 metres
10 Jun 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arms 1+4
Arms 2+5
Arms 3+6
B108T0
24.3 metres
10 Jun 25
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
Odd and Even Arms vs Total Pressure
B108T01
24.3 metres
10 Jun 25
Radial Displacement (mm)
Pressure (kPa)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to TIlbury
BH108 Test 2 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Grain to Tilbury
Borehole : BH108
Test name : BH108 Test 2
Test date : 10 Jun 25
Test depth : 26.10 Metres
Water table : 4.3 Metres
Ambient PWP : 213.9 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDB/SDP/RW on 3 Jul 25

Remarks: Test ended by membrane rupturing.

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=5.65"
Po from Marsland & Randolph (kPa) : "Arm ave=643.8"
Best estimate of Po (kPa) : "Arm ave=482.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=1810.8"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 35.0
Angle of internal friction (°) : "Arm ave=39.0"
Dilation angle (°) : "Arm ave=5.0"
Gradient of log-log plot : "Arm ave=0.420"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=14.0"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	209.0	2.846	1388	0.175	365
Arm ave	2	251.2	6.997	1902	0.188	473
Arm ave	3	286.8	11.779	2259	0.185	532

[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

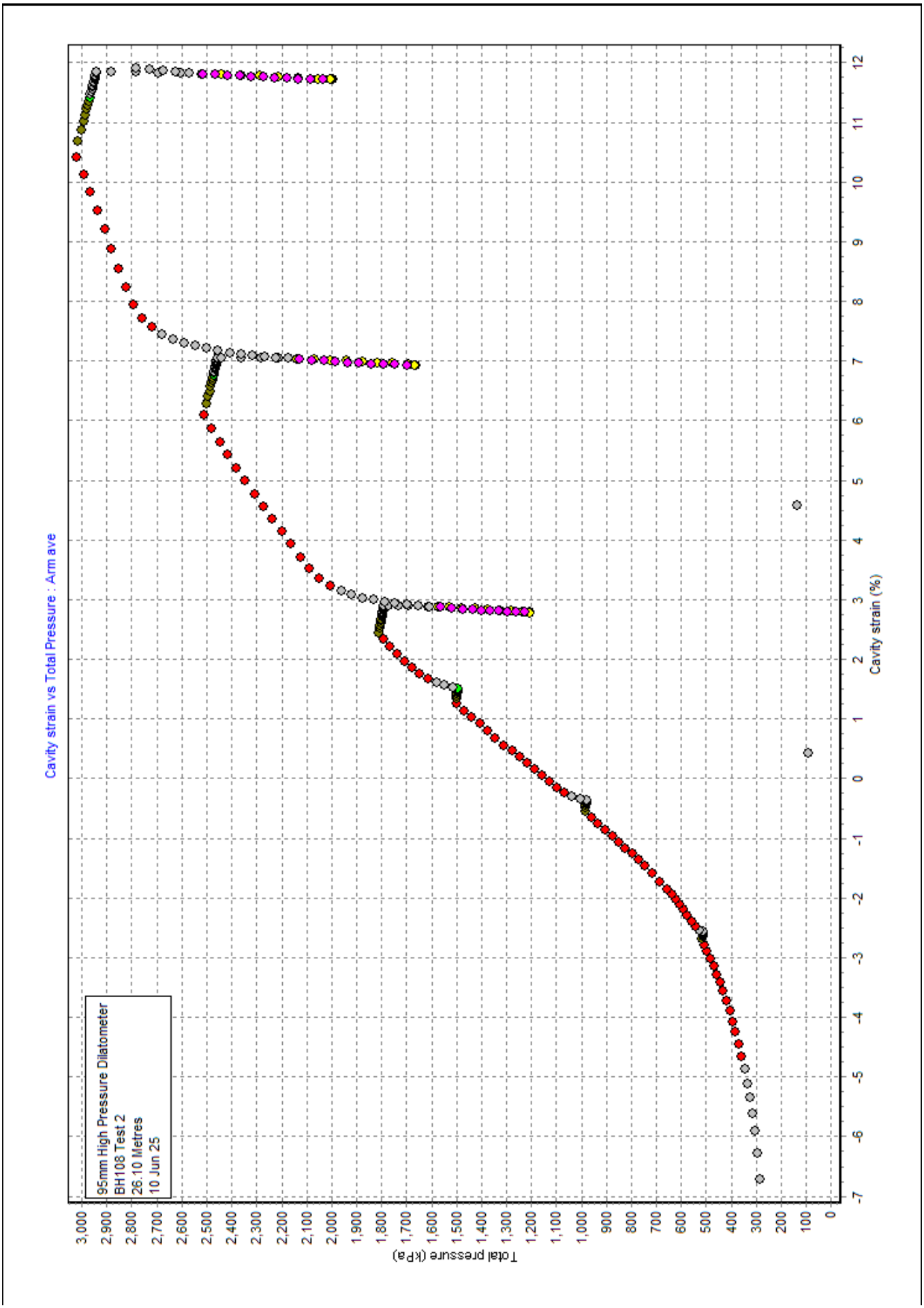
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	57.488	45.403	0.790
Arm ave	2	61.368	47.075	0.767
Arm ave	3	68.892	53.040	0.770

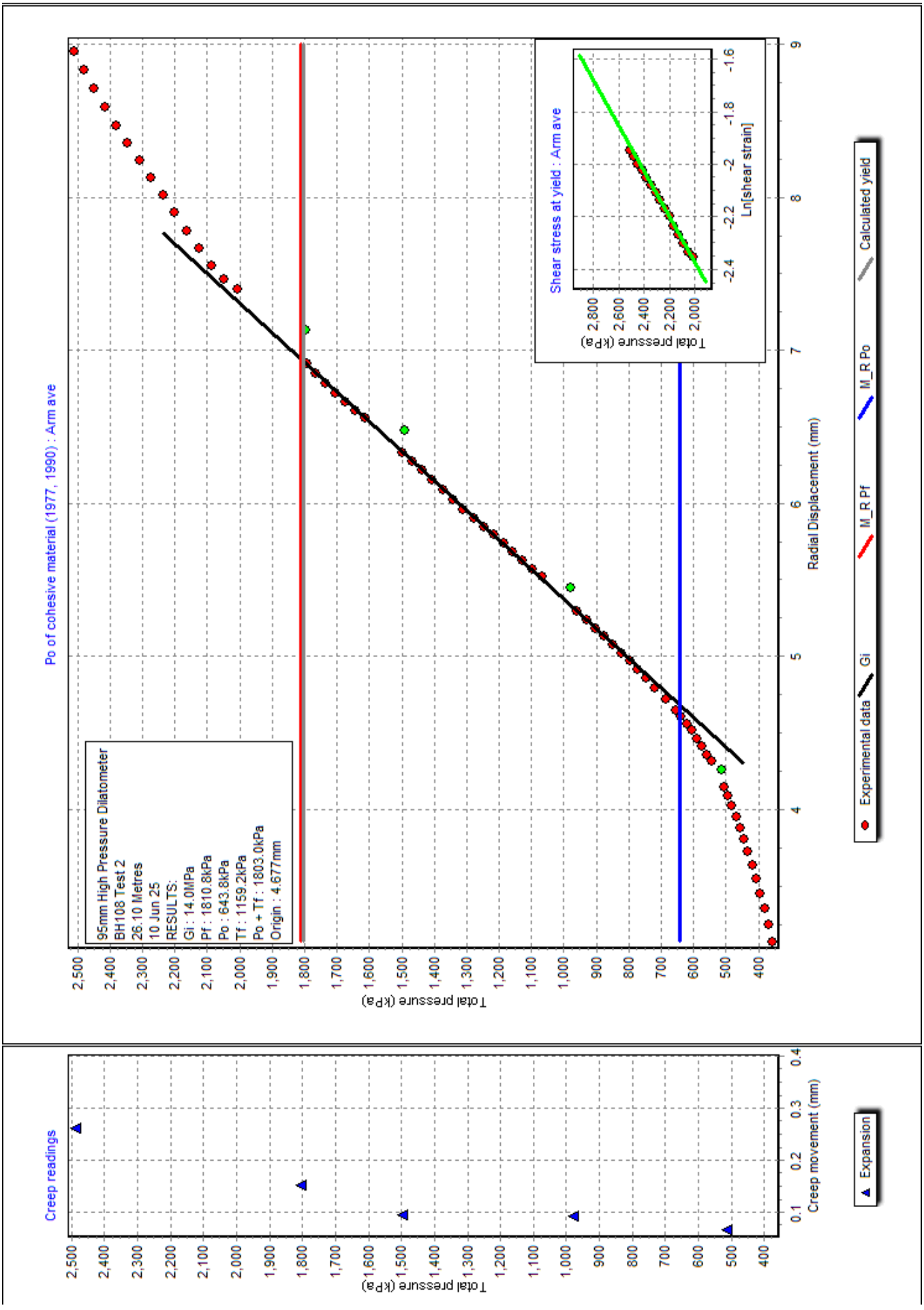
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 5.65
Po (kPa) : 482
Cohesion (kPa) : 20
Angle of peak friction (deg) : 39.0
Angle of peak dilation (deg) : 5.0
Total yield stress (kPa) : 779
Total limit stress (kPa) : 5905
G at first yield (MPa) : 84.3
Non-linear exponent : 0.767
Janbu exponent : 0.481
Correlation : 1.000

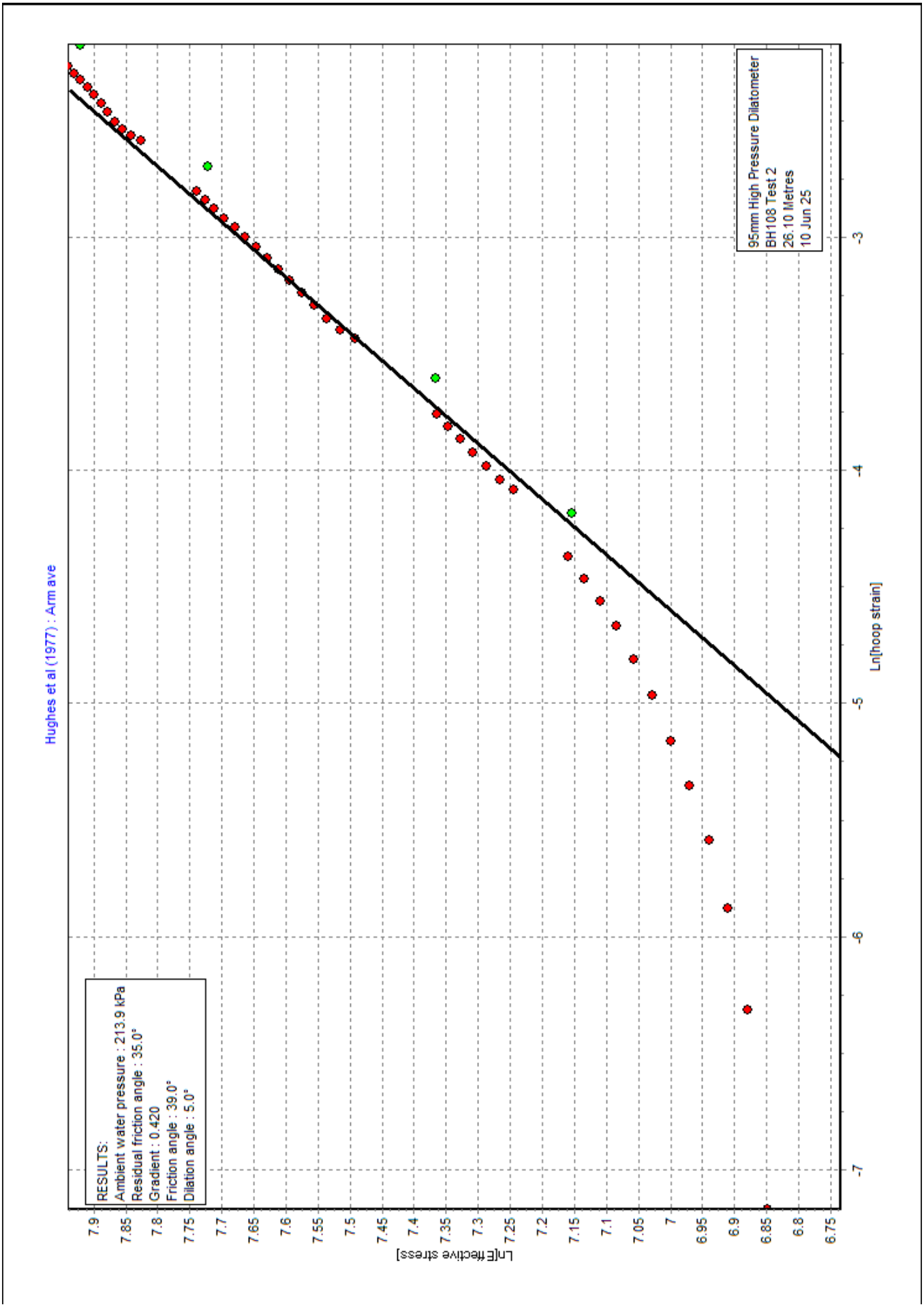
Ambient pore water pressure (kPa) : 214

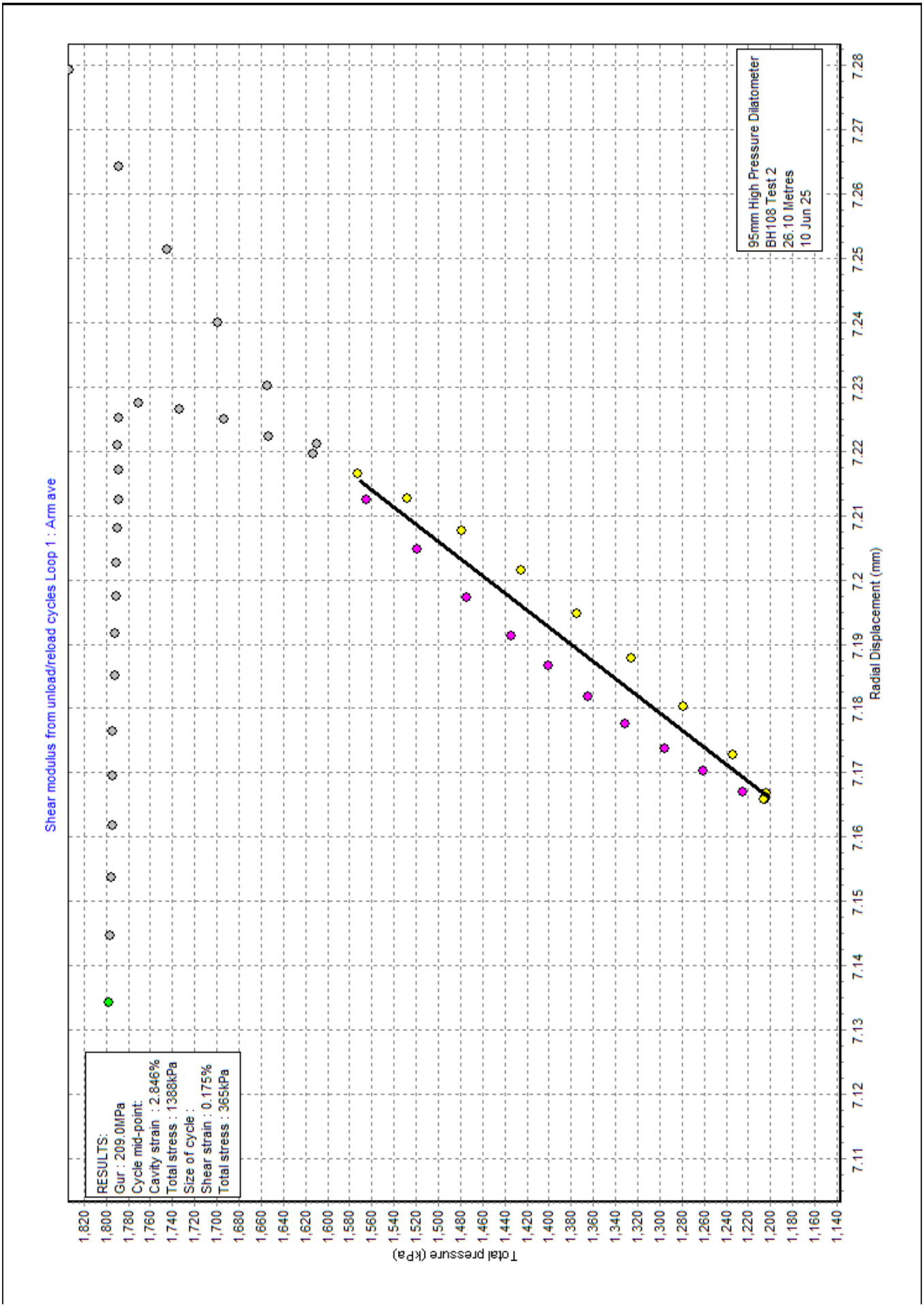
Grain to TIlbury
BH108 Test 2 - SUMMARY OF RESULTS

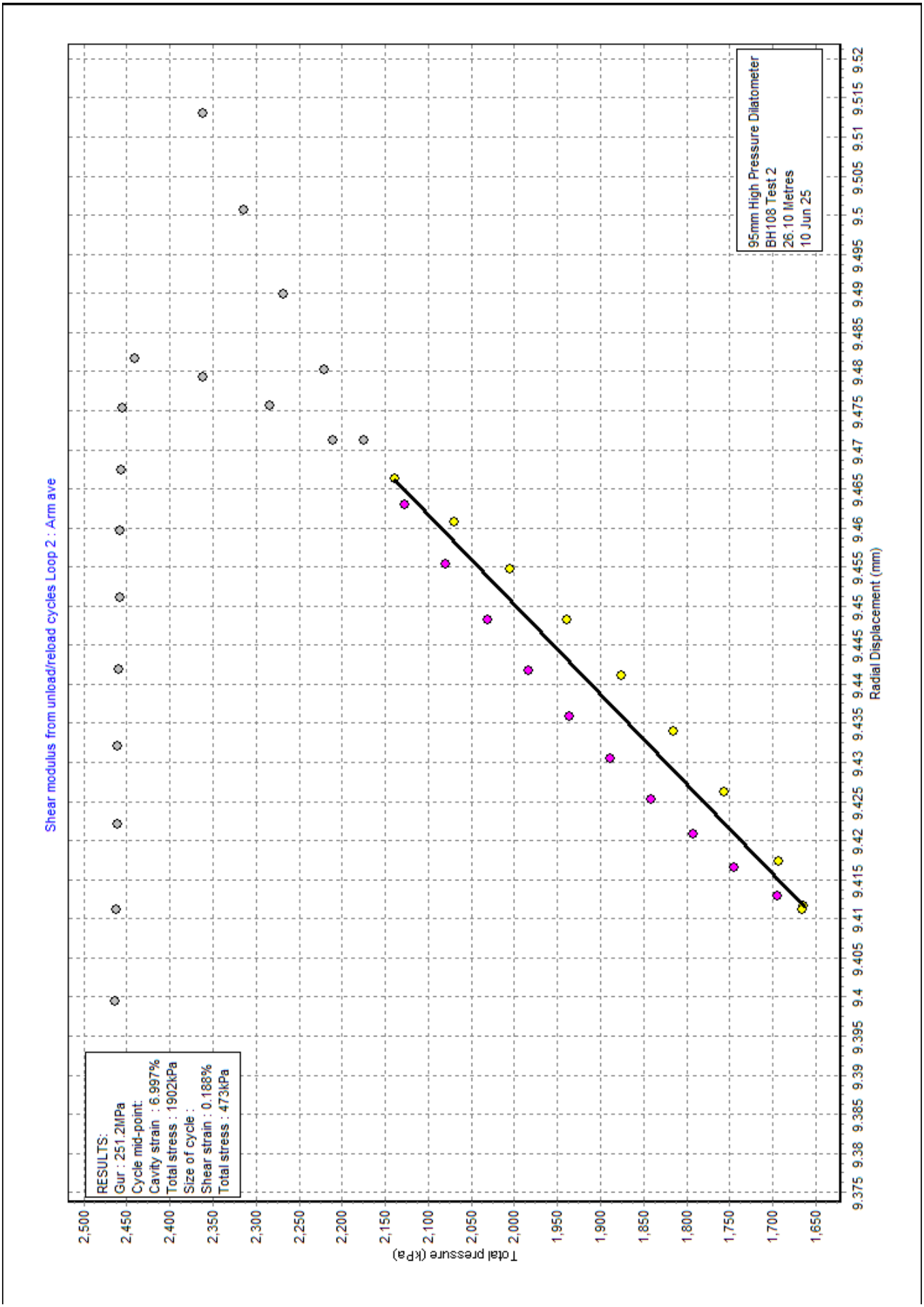
Residual friction angle (deg)	:	35.0
Poisson's ratio	:	0.20

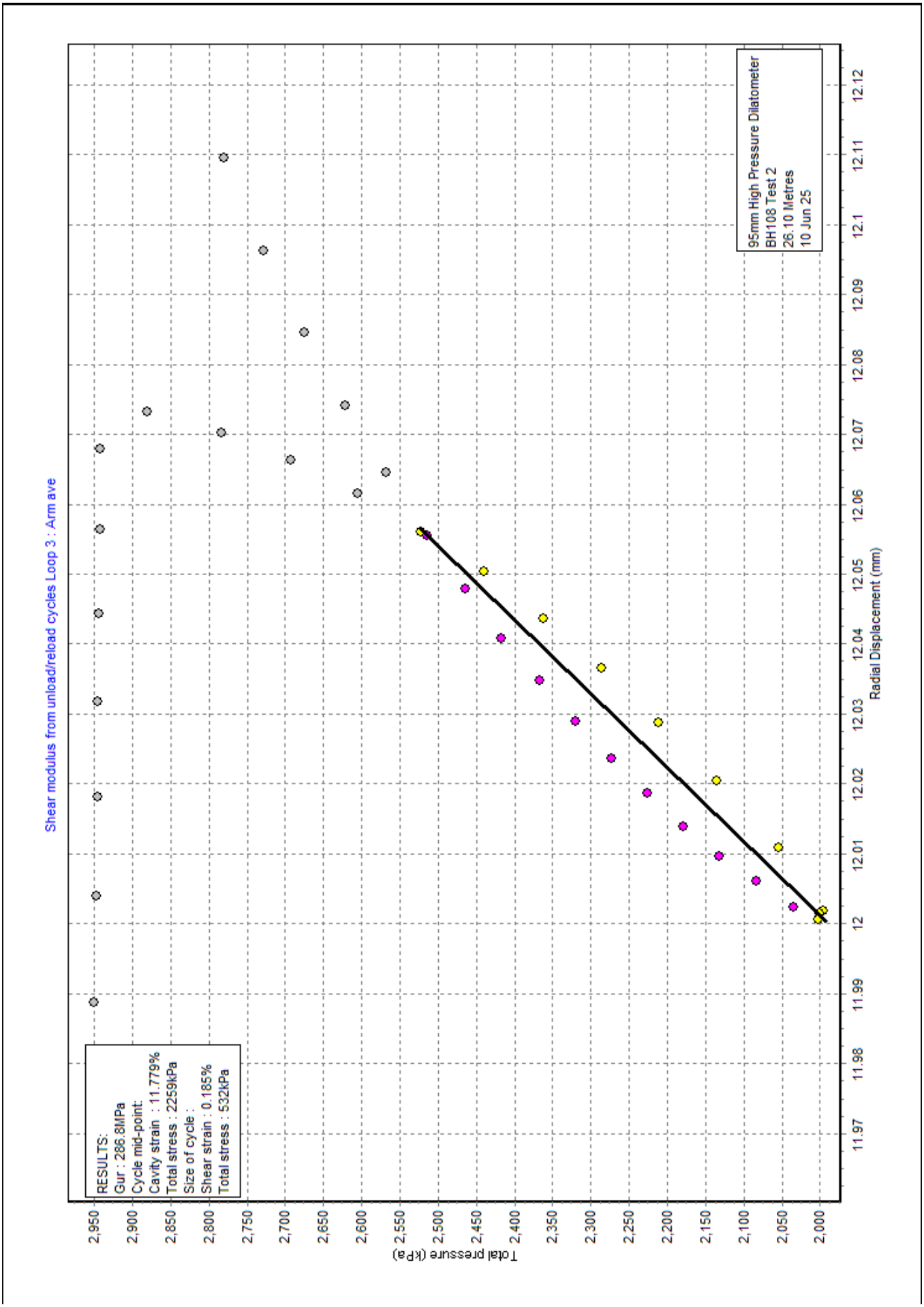

Cavity strain vs Total Pressure : Arm ave
95mm High Pressure Dilatometer
BH108 Test 2
26.10 Metres
10 Jun 25
Total pressure (kPa)
Cavity strain (%)

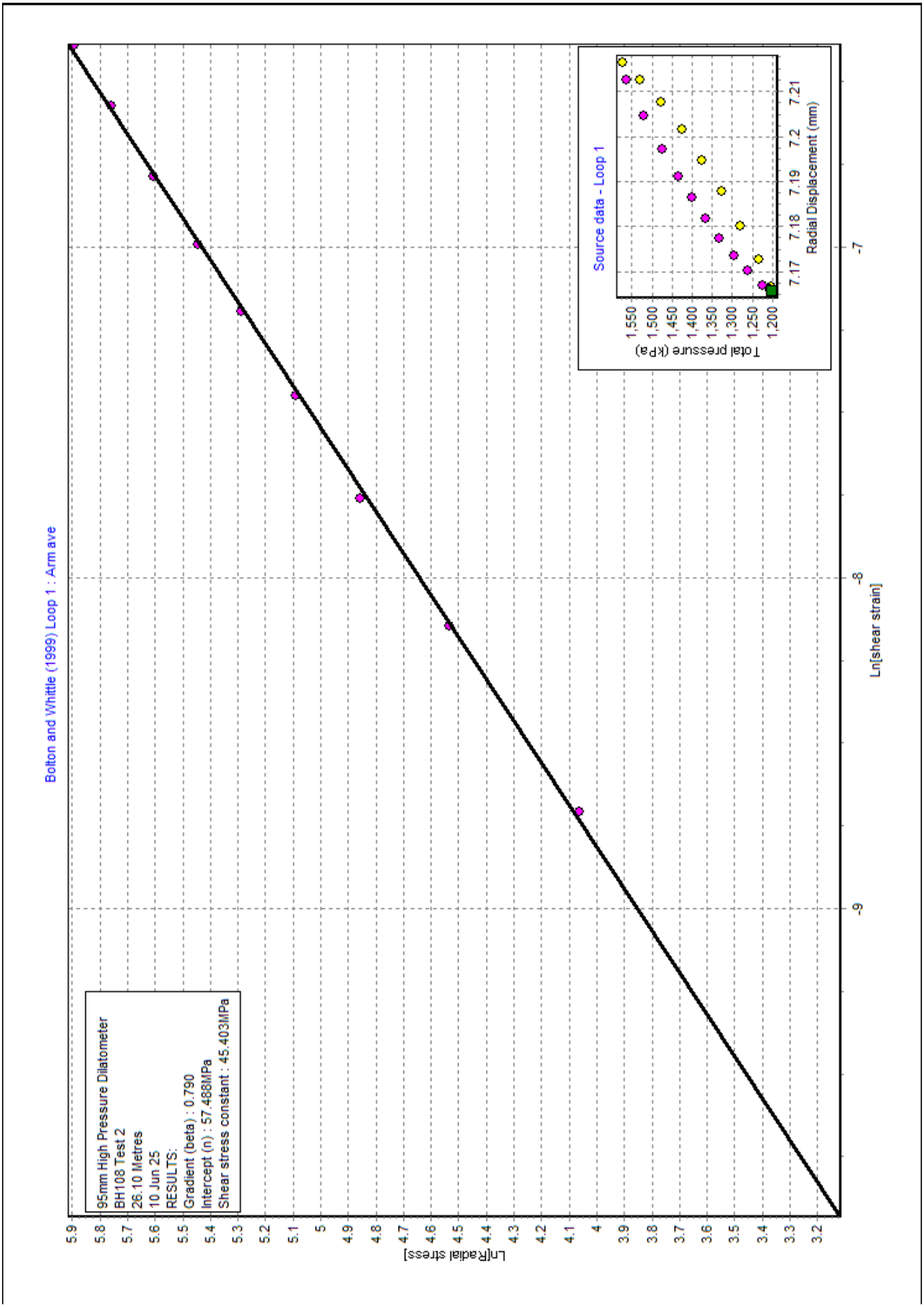

Po of cohesive material (1977, 1990) : Arm ave
95mm High Pressure Dilatometer
BH108 Test 2
26.10 Metres
10 Jun 25
RESULTS:
Gi : 14.0MPa
Pf : 1810.8kPa
Po : 643.8kPa
Tf : 1159.2kPa
Po + Tf : 1803.0kPa
Origin : 4.677mm
Total pressure (kPa)
Radial Displacement (mm)
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Shear stress at yield : Arm ave
Total pressure (kPa)
Ln[shear strain]
Creep readings
Total pressure (kPa)
Creep movement (mm)
Expansion

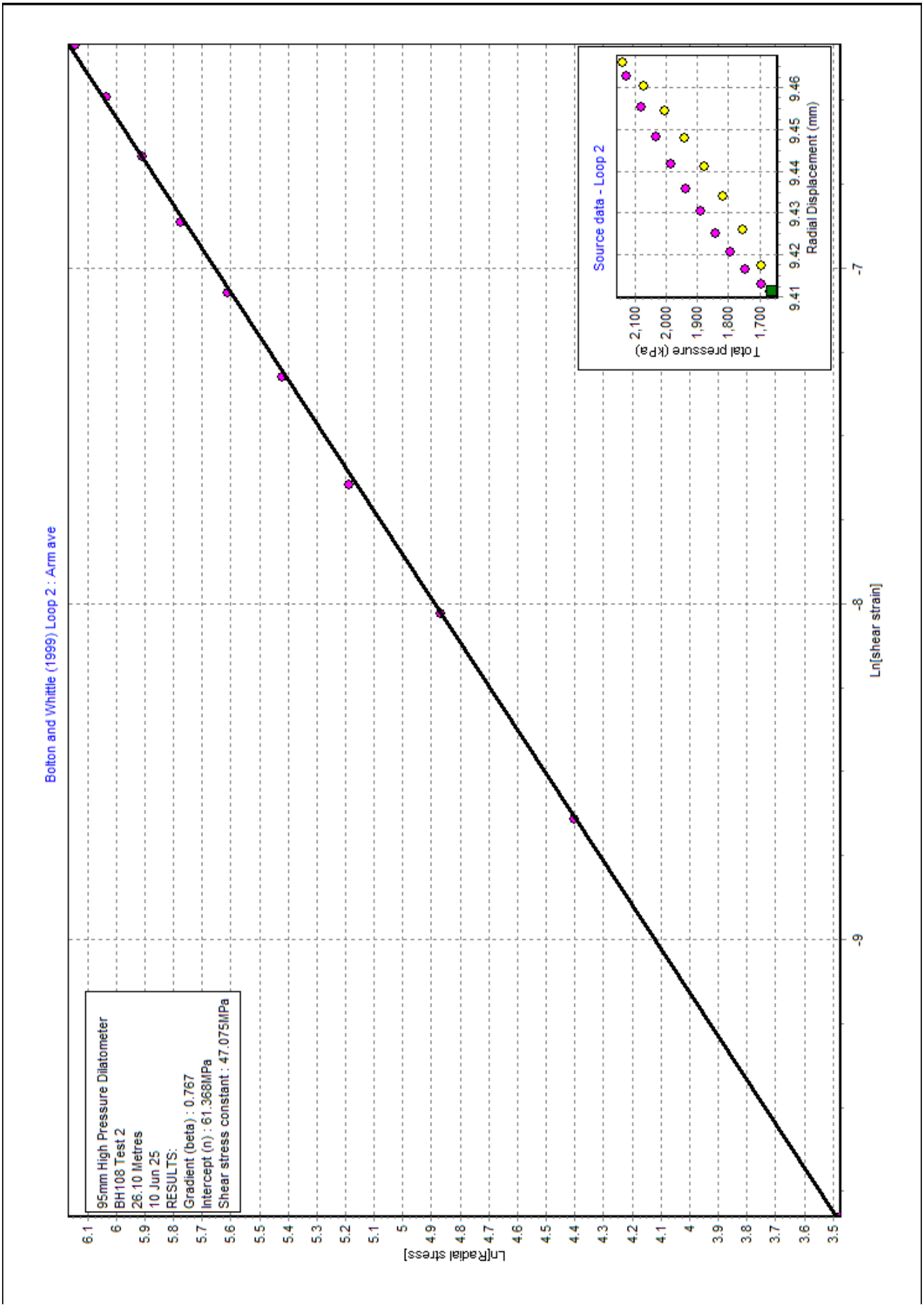

Hughes et al (1977) : Arm ave
RESULTS:
Ambient water pressure : 213.9 kPa
Residual friction angle : 35.0°
Gradient : 0.420
Friction angle : 39.0°
Dilation angle : 5.0°
95mm High Pressure Dilatometer
BH108 Test 2
26.10 Metres
10 Jun 25
Ln[Effective stress]
Ln[hoop strain]
7.9
7.85
7.8
7.75
7.7
7.65
7.6
7.55
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
6.75
-3
-4
-5
-6
-7

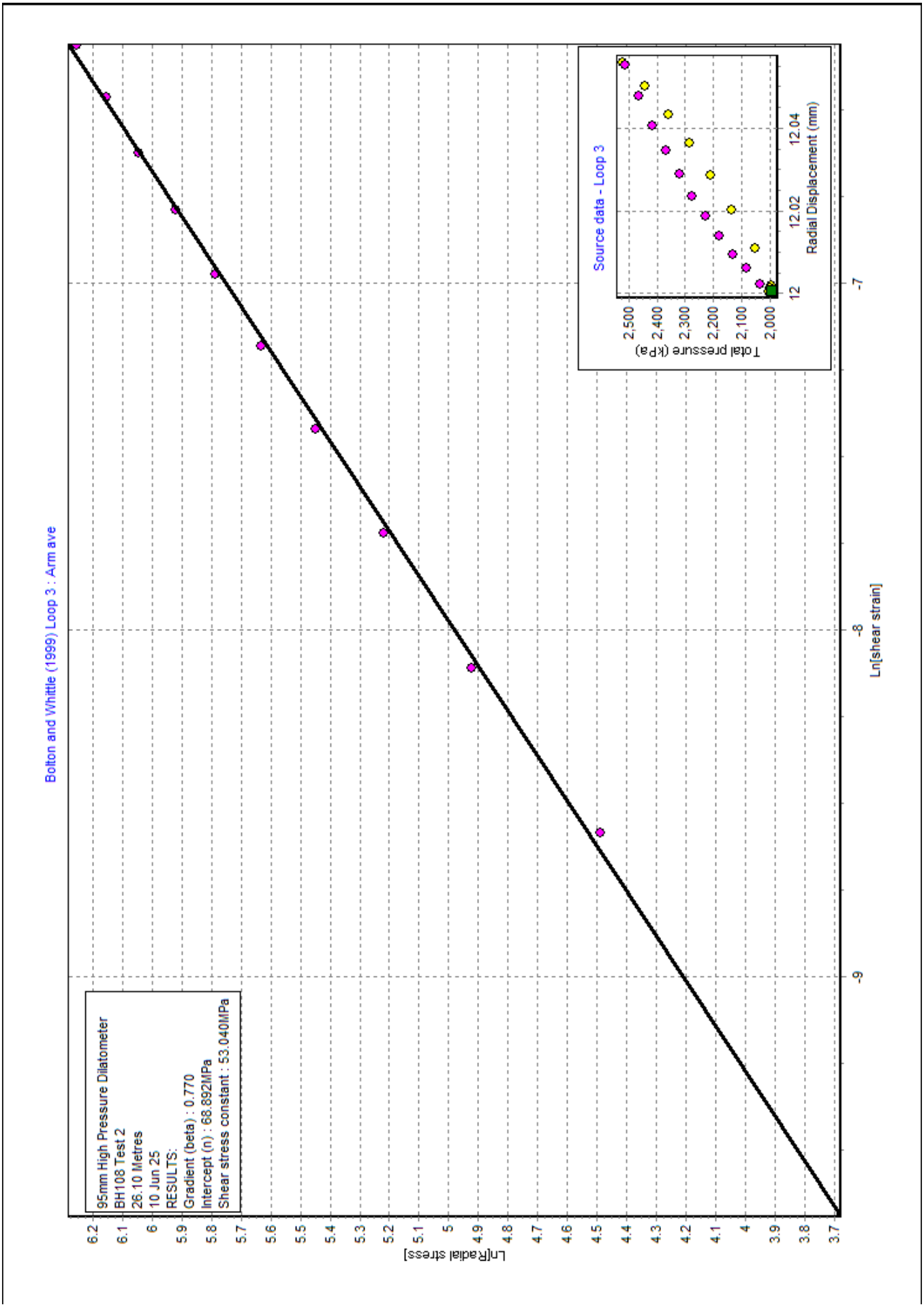

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 209.0MPa
Cycle mid-point:
Cavity strain : 2.846%
Total stress : 1388kPa
Size of cycle :
Shear strain : 0.175%
Total stress : 365kPa
95mm High Pressure Dilatometer
BH108 Test 2
26.10 Metres
10 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

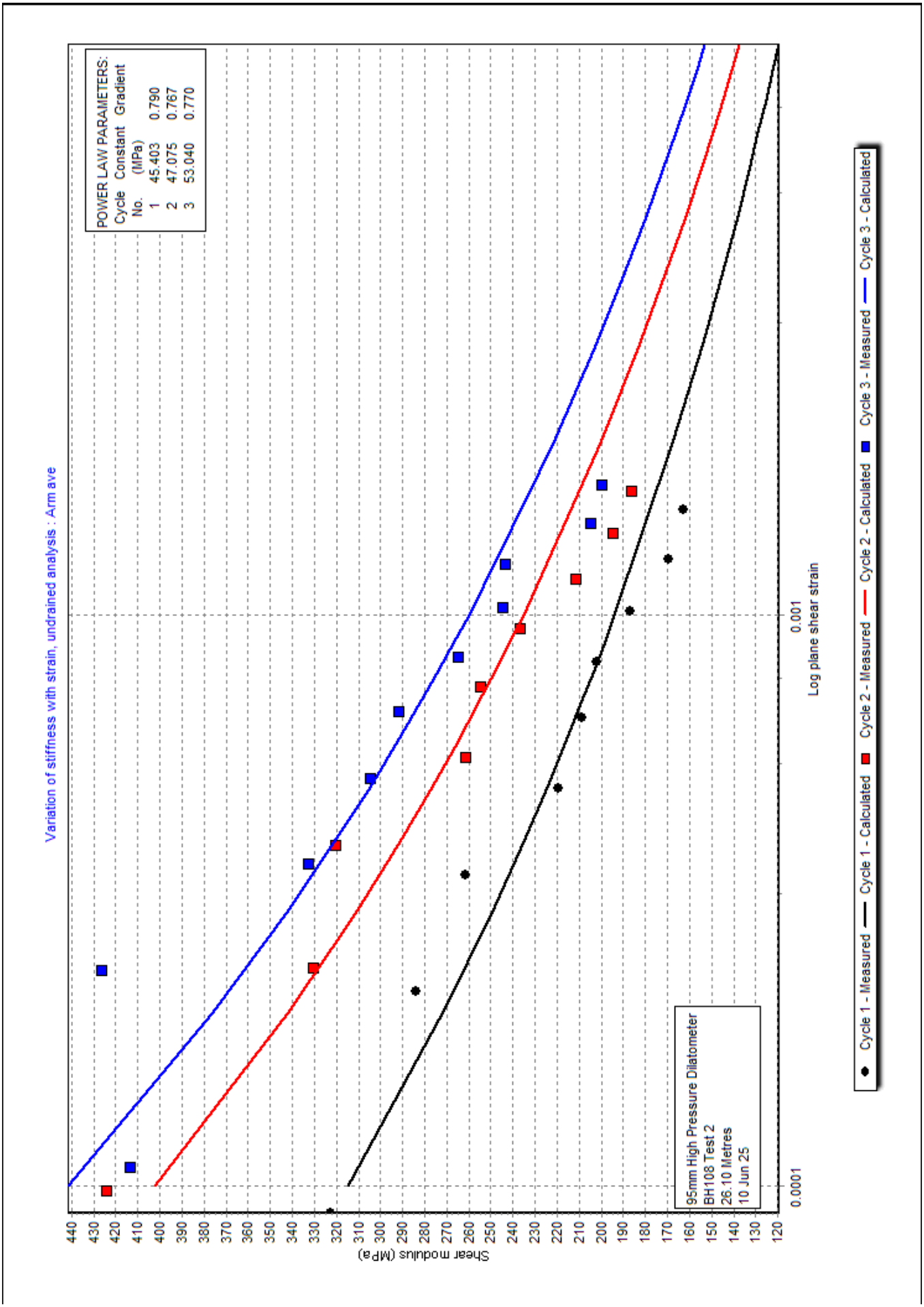

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 251.2MPa
Cycle mid-point:
Cavity strain : 6.997%
Total stress : 1902kPa
Size of cycle :
Shear strain : 0.188%
Total stress : 473kPa
95mm High Pressure Dilatometer
BH108 Test 2
26.10 Metres
10 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

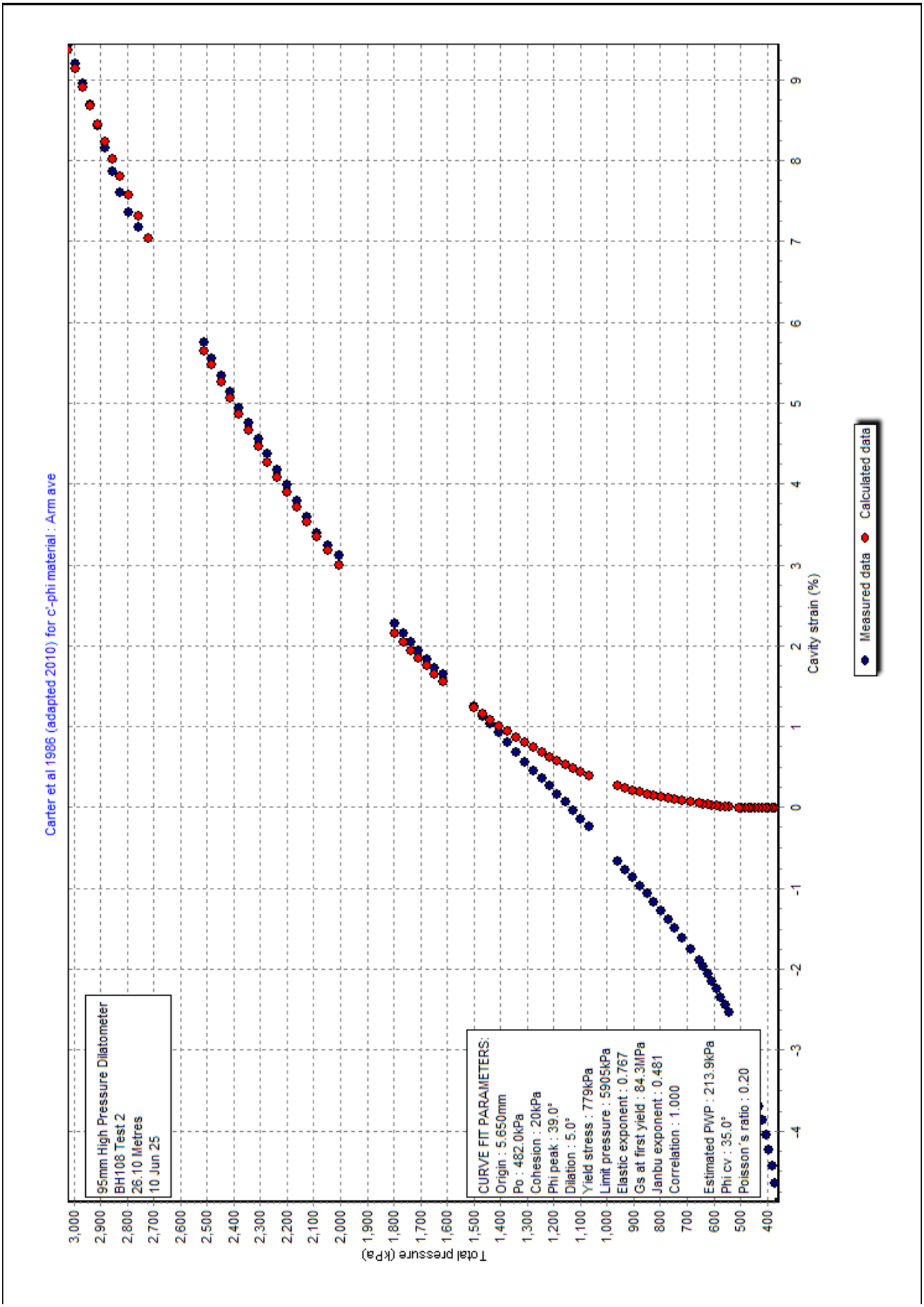

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 286.8MPa
Cycle mid-point:
Cavity strain : 11.779%
Total stress : 2259kPa
Size of cycle :
Shear strain : 0.185%
Total stress : 532kPa
95mm High Pressure Dilatometer
BH108 Test 2
26.10 Metres
10 Jun 25
Total pressure (kPa)
Radial Displacement (mm)
2,950
2,900
2,850
2,800
2,750
2,700
2,650
2,600
2,550
2,500
2,450
2,400
2,350
2,300
2,250
2,200
2,150
2,100
2,050
2,000
11.97
11.98
11.99
12
12.01
12.02
12.03
12.04
12.05
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12.07
12.08
12.09
12.1
12.11
12.12

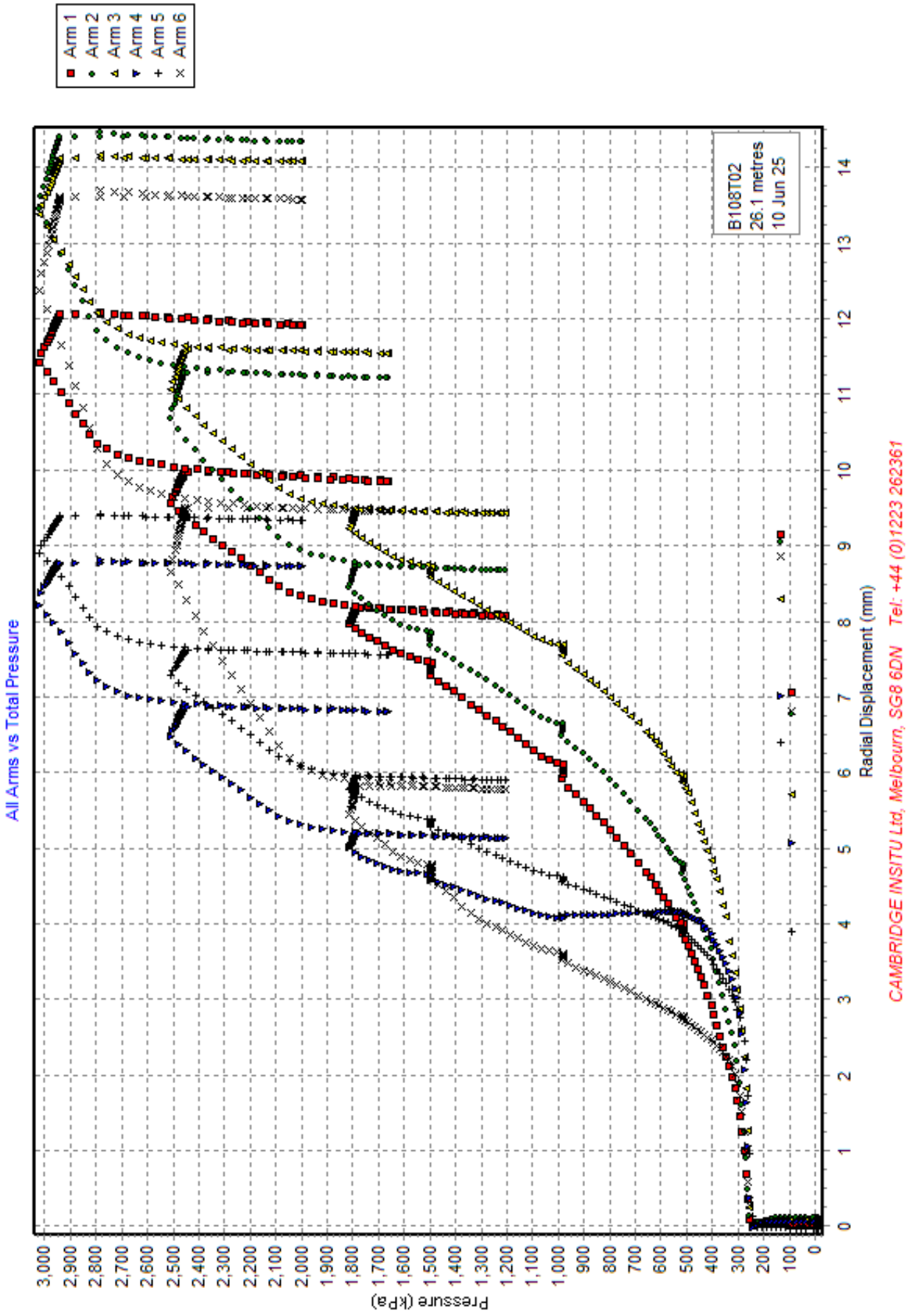

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 2
26.10 Metres
10 Jun 25
RESULTS:
Gradient (beta) : 0.790
Intercept (n) : 57.488MPa
Shear stress constant : 45.403MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

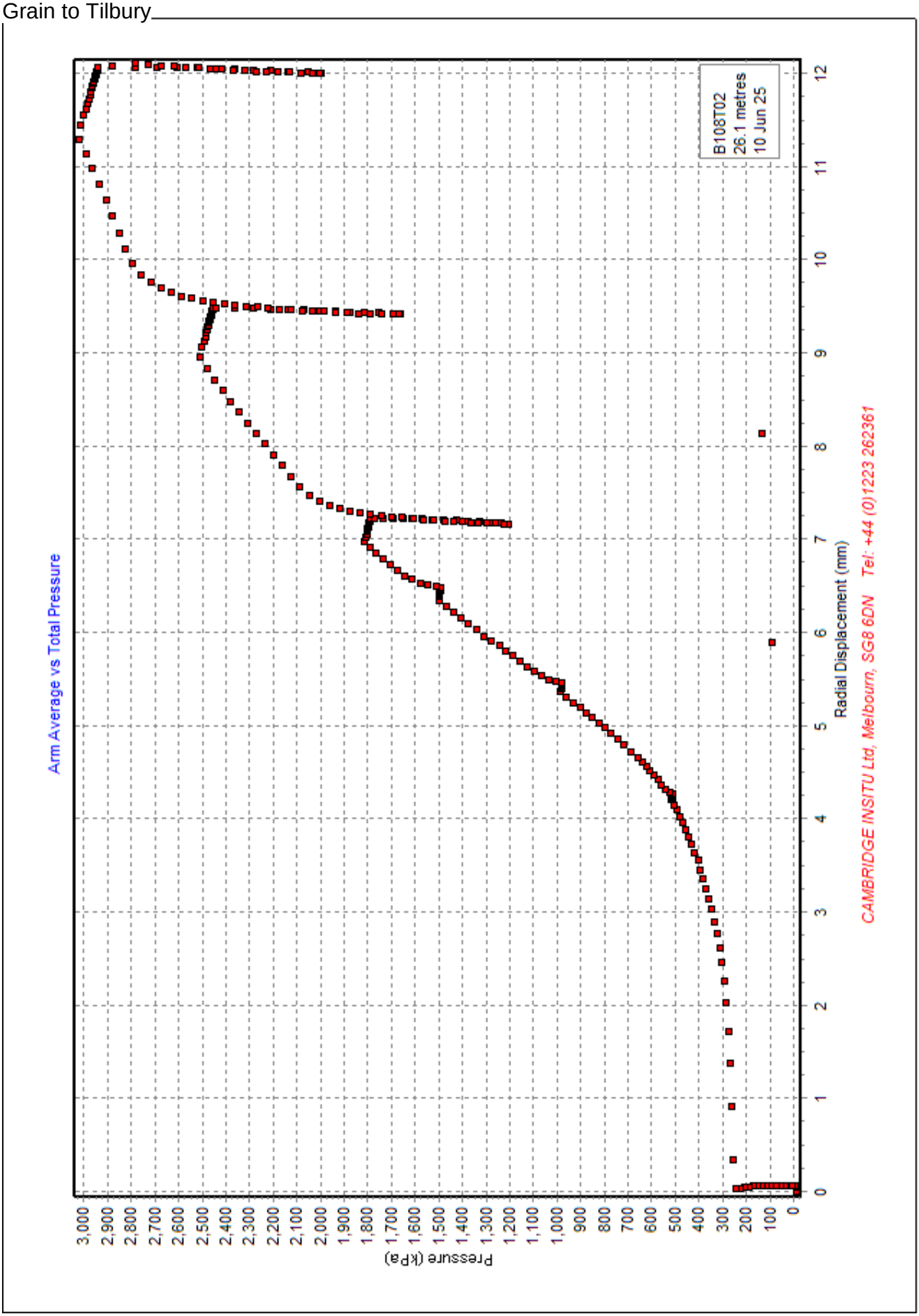

Bolton and Whittle (1999) Loop 2 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 2
26.10 Metres
10 Jun 25
RESULTS:
Gradient (beta) : 0.767
Intercept (n) : 61.368MPa
Shear stress constant : 47.075MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

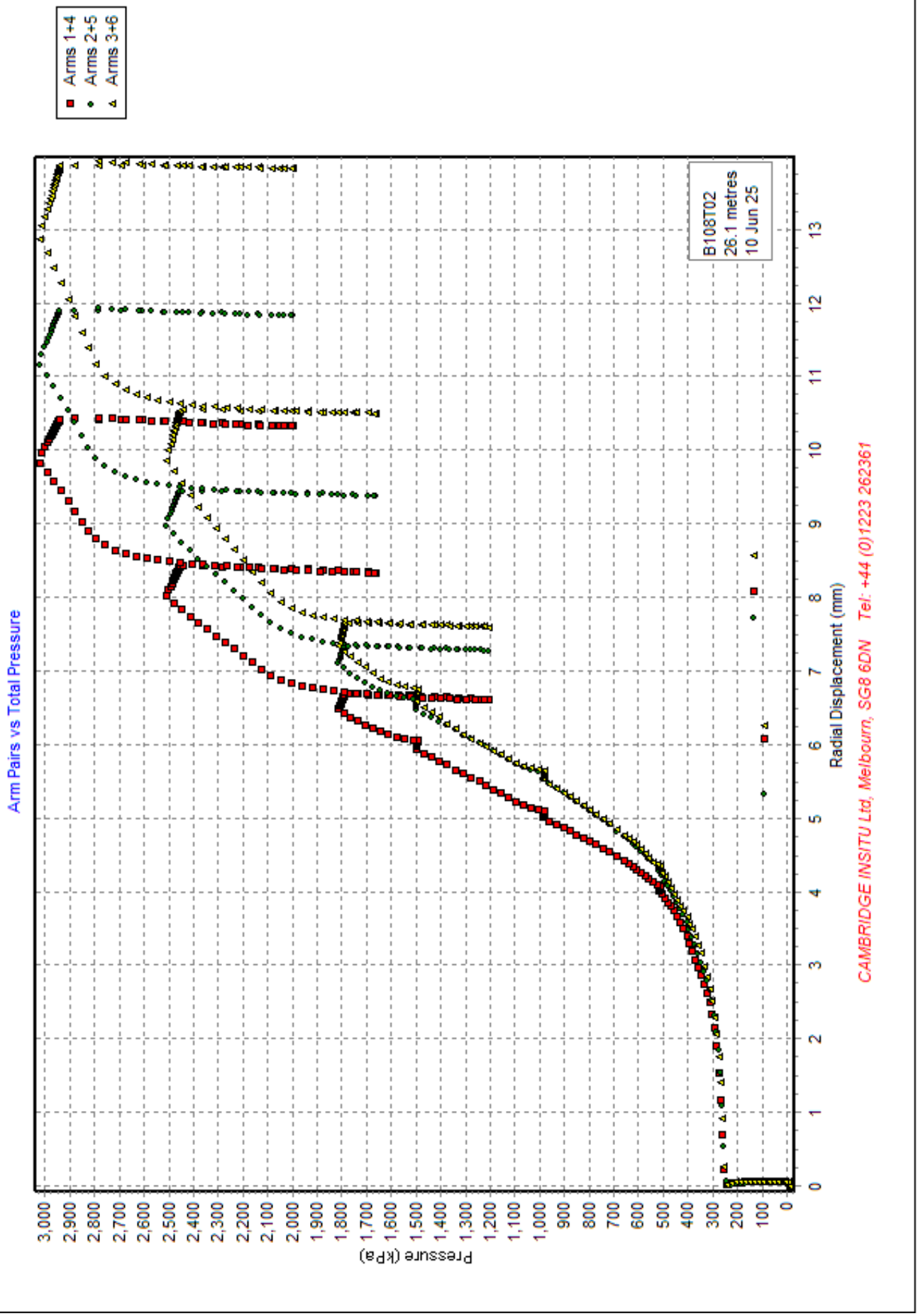

Bolton and Whittle (1999) Loop 3 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 2
26.10 Metres
10 Jun 25
RESULTS:
Gradient (beta) : 0.770
Intercept (n) : 68.892MPa
Shear stress constant : 53.040MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)

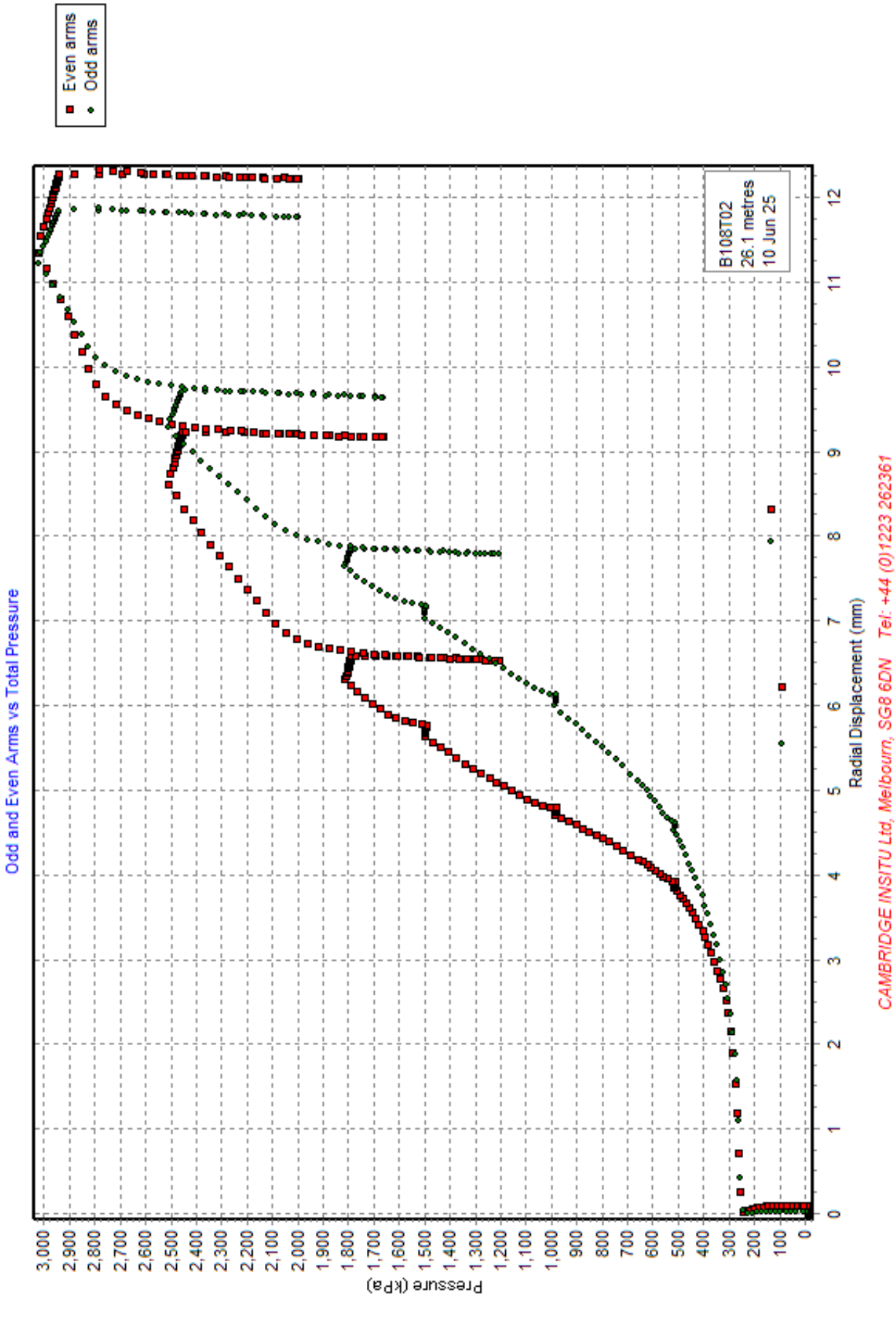

Variation of stiffness with strain, undrained analysis : Arm ave
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 45.403 0.790
2 47.075 0.767
3 53.040 0.770
Shear modulus (MPa)
Log plane shear strain
0.0001
0.001
95mm High Pressure Dilatometer
BH108 Test 2
26.10 Metres
10 Jun 25
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated


Carter et al 1986 (adapted 2010) for c'-phi material : Arm ave
95mm High Pressure Dilatometer
BH108 Test 2
26.10 Metres
10 Jun 25
CURVE FIT PARAMETERS:
Origin : 5.650mm
Po : 482.0kPa
Cohesion : 20kPa
Phi peak : 39.0°
Dilation : 5.0°
Yield stress : 779kPa
Limit pressure : 5905kPa
Elastic exponent : 0.767
Gs at first yield : 84.3MPa
Janbu exponent : 0.481
Correlation : 1.000
Estimated PWP : 213.9kPa
Phi cv : 35.0°
Poisson's ratio : 0.20
Total pressure (kPa)
Cavity strain (%)
Measured data
Calculated data


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
B108T02
26.1 metres
10 Jun 25
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arm Average vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
B108T02
26.1 metres
10 Jun 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arms 1+4
Arms 2+5
Arms 3+6
B108T02
26.1 metres
10 Jun 25
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
B108T02
26.1 metres
10 Jun 25
Odd and Even Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to TIlbury
BH108 Test 3 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Grain to Tilbury
Borehole : BH108
Test name : BH108 Test 3
Test date : 10 Jun 25
Test depth : 27.90 Metres
Water table : 4.3 Metres
Ambient PWP : 231.5 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDB/SDP/RW on 20 Jul 25

Remarks: Switched to Lilith HPD after burst in T2.

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=4.15"
Po from Marsland & Randolph (kPa) : "Arm ave=492.6"
Best estimate of Po (kPa) : "Arm ave=514.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=1451.9"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 29.0
Angle of internal friction (°) : "Arm ave=34.5"
Dilation angle (°) : "Arm ave=6.4"
Gradient of log-log plot : "Arm ave=0.402"

[Withers et al 1989]
Angle of internal friction (°) : "Arm ave=20.7"
Dilation angle (°) : "Arm ave=-9.1"
Gradient of log-log plot : "Arm ave=-1.341"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=13.5"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	104.6	0.106	733	0.217	227
Arm ave	2	257.0	2.751	1178	0.126	323
Arm ave	3	321.2	5.523	1481	0.102	327
Arm ave	4	145.8	8.217	943	0.371	542

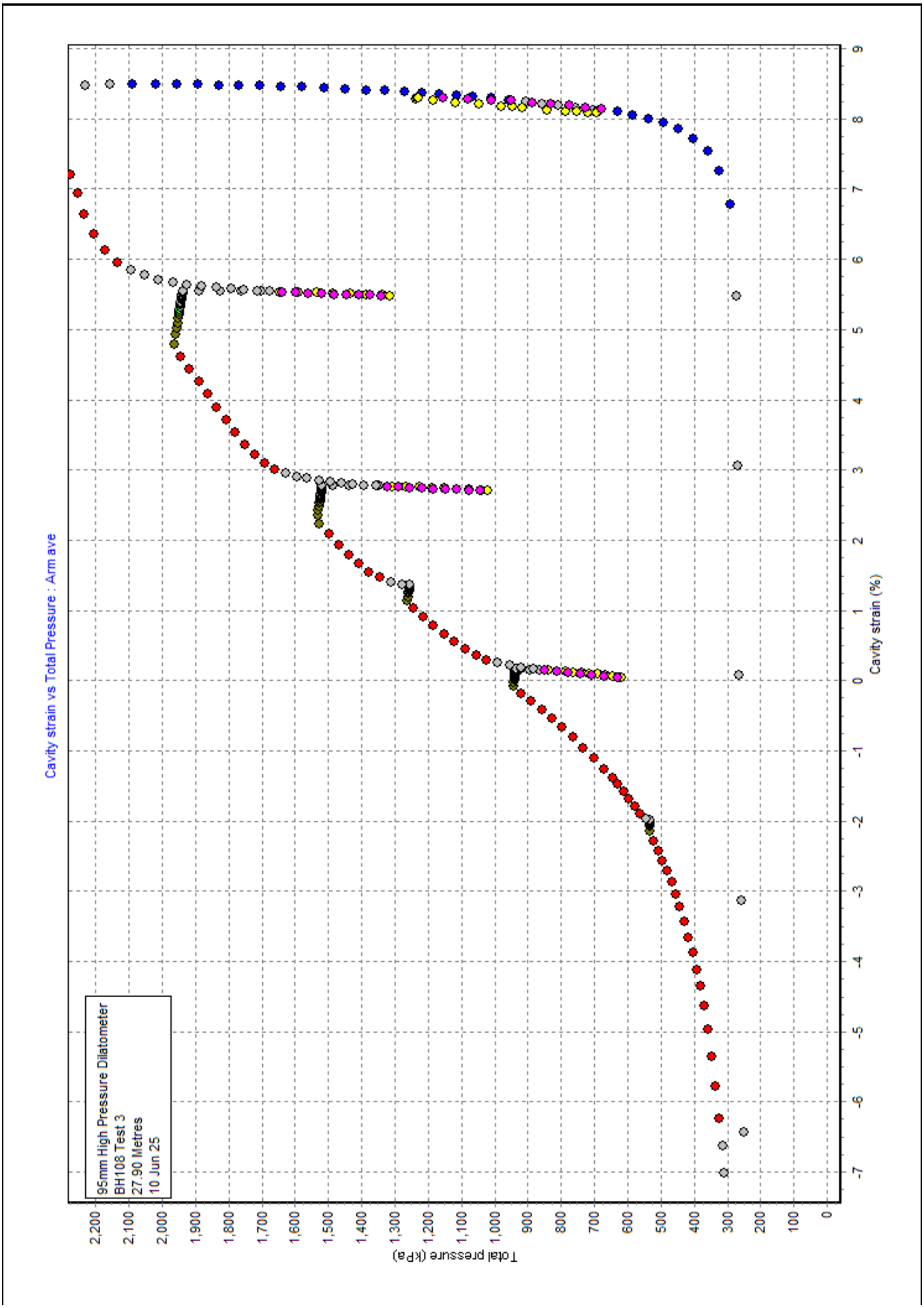
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

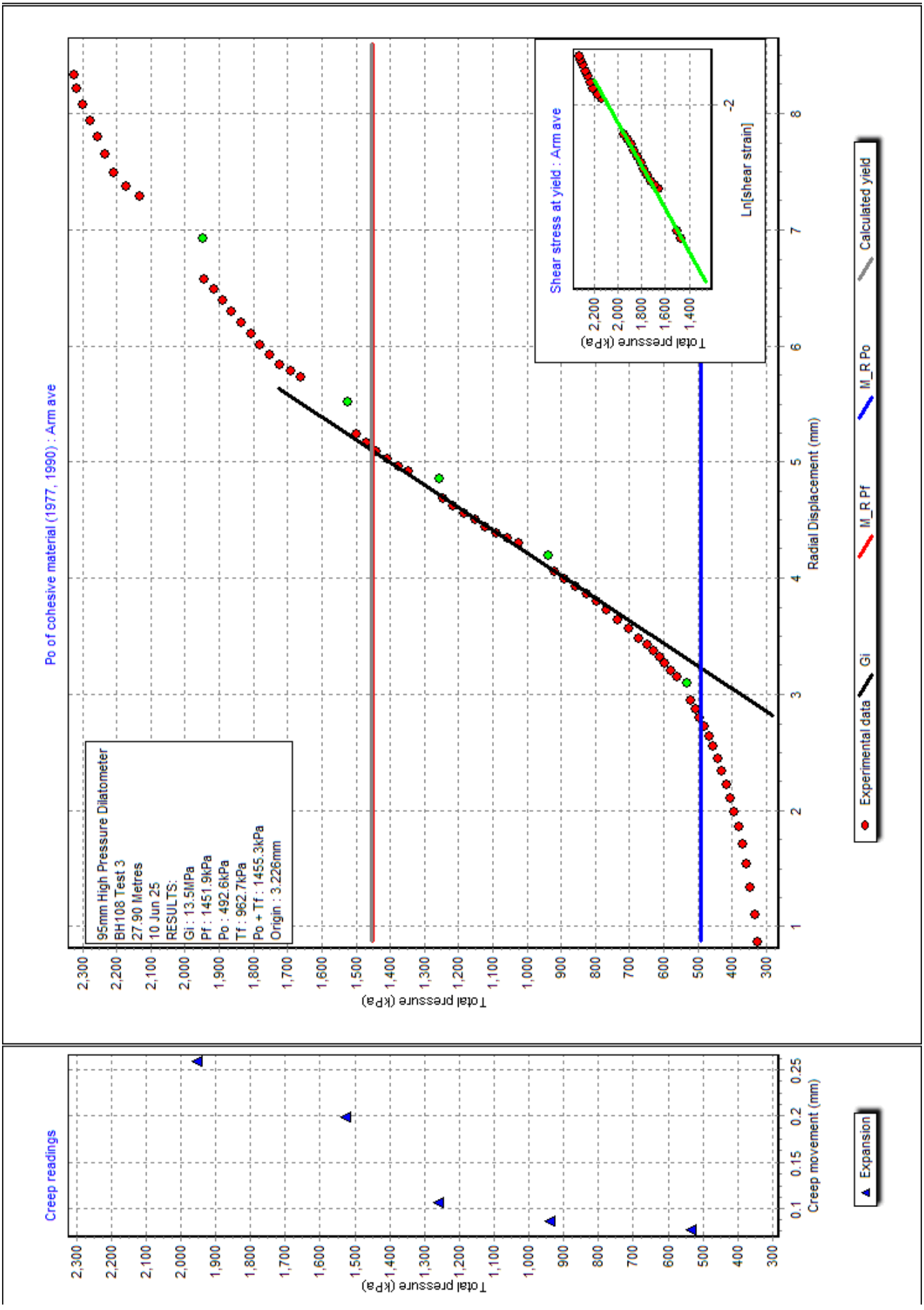
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	69.257	64.444	0.931
Arm ave	2	68.598	54.798	0.799
Arm ave	3	80.256	63.122	0.787
Arm ave	4	11.472	5.979	0.521

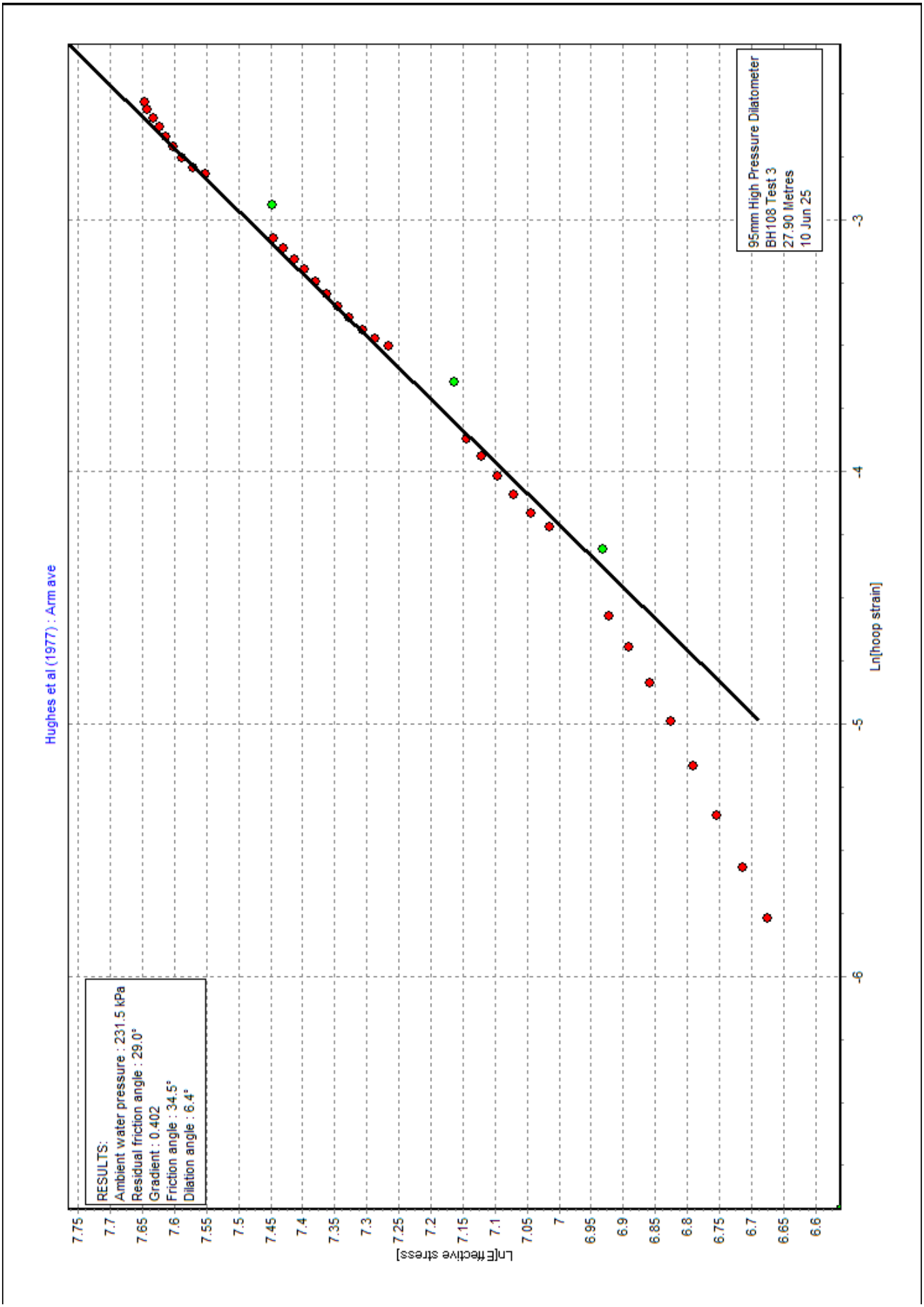
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 4.15
Po (kPa) : 514
Cohesion (kPa) : 14
Angle of peak friction (deg) : 34.5
Angle of peak dilation (deg) : 6.4
Total yield stress (kPa) : 771

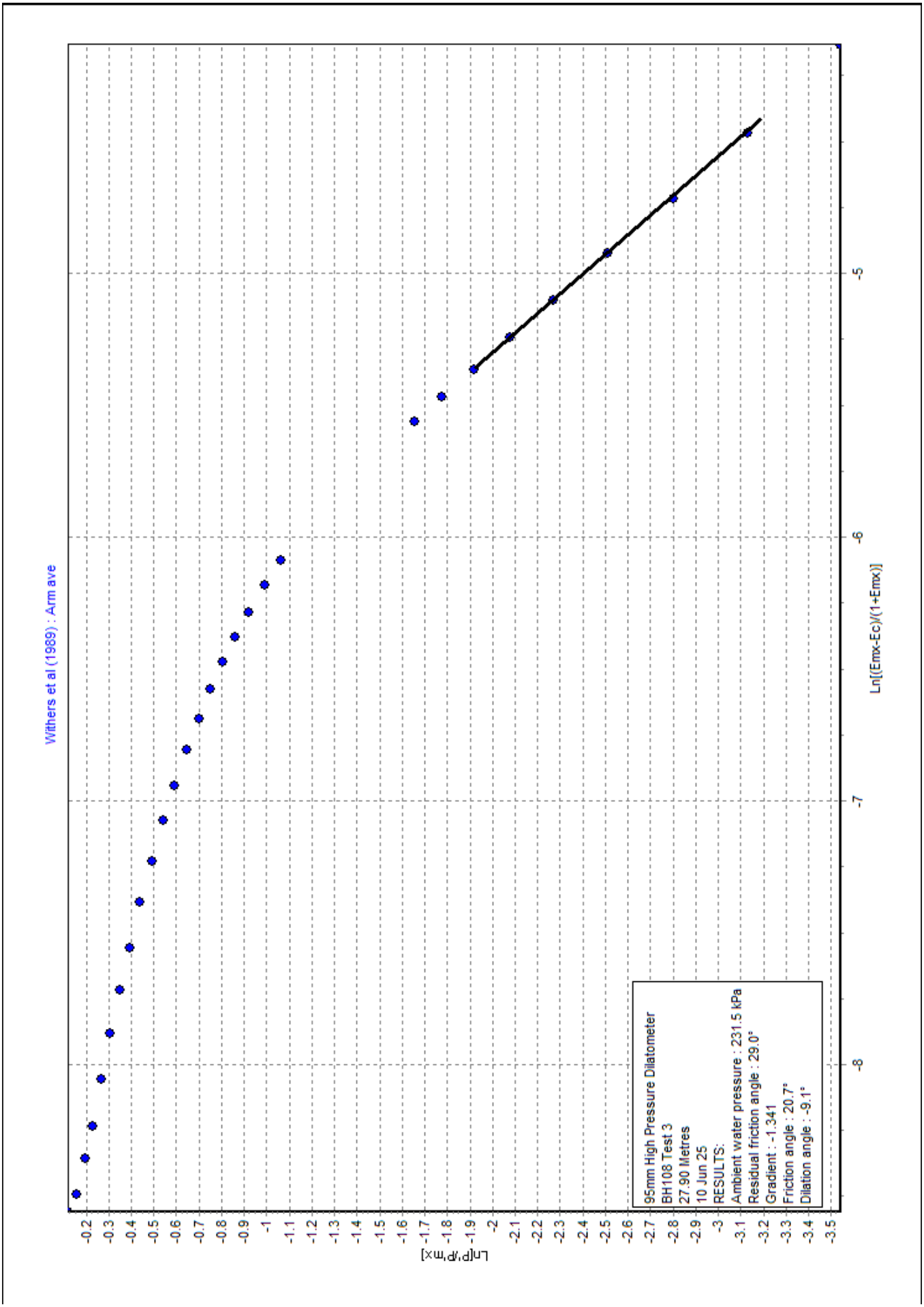
Grain to TIlbury
BH108 Test 3 - SUMMARY OF RESULTS

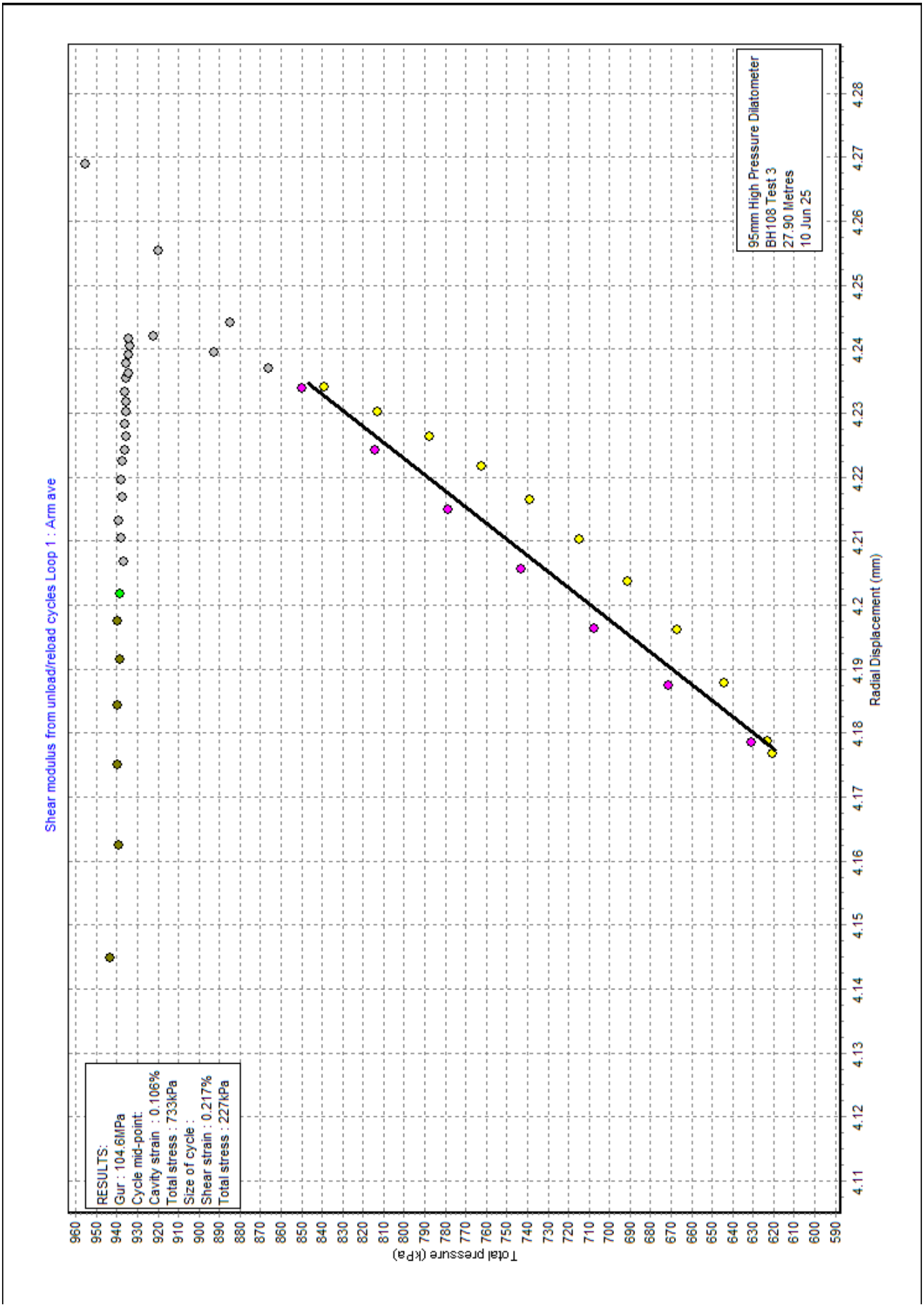
Total limit stress (kPa)	:	4772
G at first yield (MPa)	:	62.4
Non-linear exponent	:	0.787
Janbu exponent	:	0.908
Correlation	:	0.996
Ambient pore water pressure (kPa)	:	232
Residual friction angle (deg)	:	29.0
Poisson's ratio	:	0.20

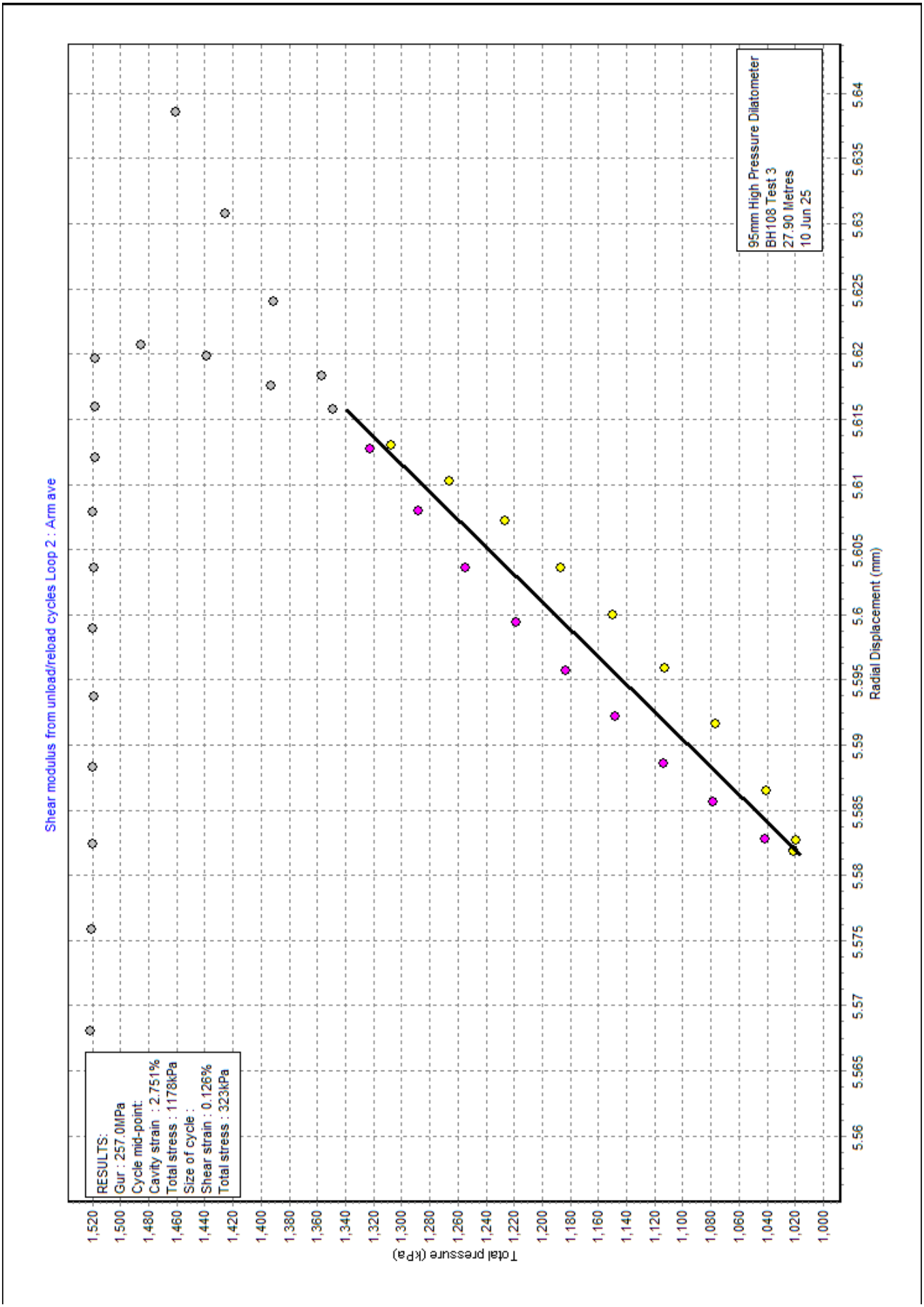

Cavity strain vs Total Pressure : Arm ave
95mm High Pressure Dilatometer
BH108 Test 3
27.90 Metres
10 Jun 25
Total pressure (kPa)
Cavity strain (%)
2,200
2,100
2,000
1,900
1,800
1,700
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
9
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
-7

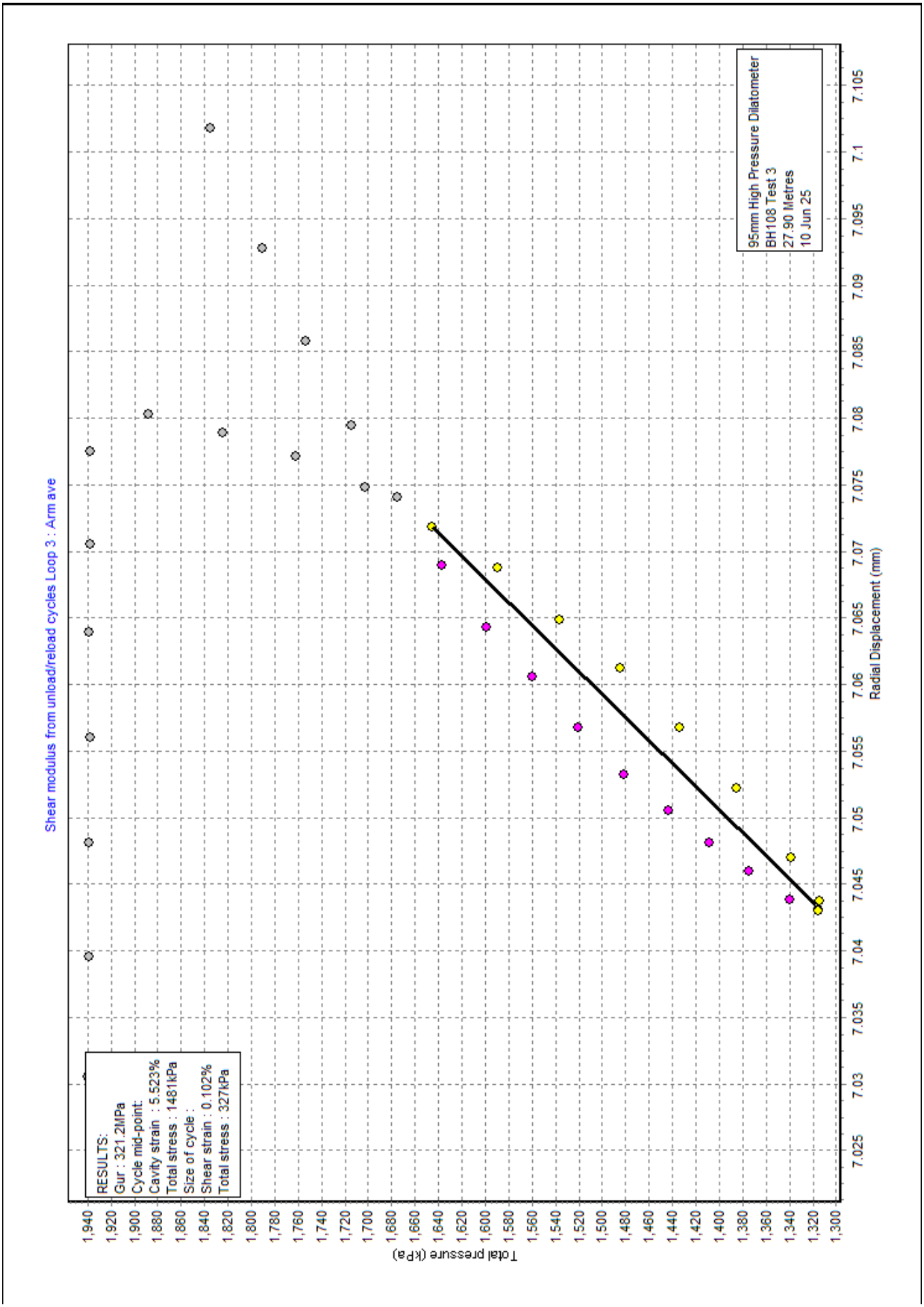

Po of cohesive material (1977, 1990) : Arm ave
95mm High Pressure Dilatometer
BH108 Test 3
27.90 Metres
10 Jun 25
RESULTS:
Gi : 13.5MPa
Pf : 1451.9kPa
Po : 492.6kPa
Tf : 962.7kPa
Po + Tf : 1455.3kPa
Origin : 3.226mm
Total pressure (kPa)
Radial Displacement (mm)
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Shear stress at yield : Arm ave
Ln[shear strain]
Creep readings
Creep movement (mm)
Expansion

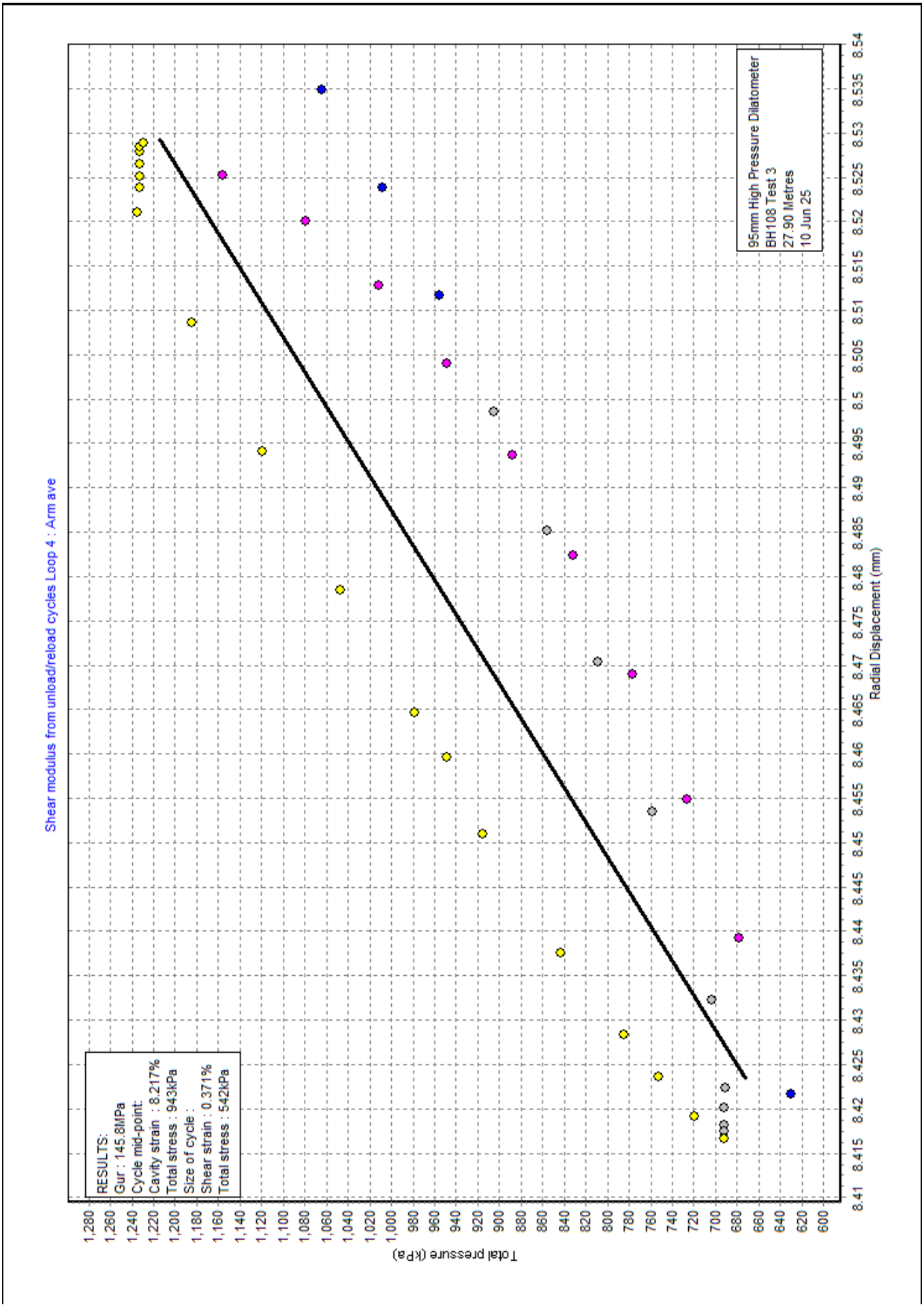

Hughes et al (1977) : Arm ave
RESULTS:
Ambient water pressure : 231.5 kPa
Residual friction angle : 29.0°
Gradient : 0.402
Friction angle : 34.5°
Dilation angle : 6.4°
95mm High Pressure Dilatometer
BH108 Test 3
27.90 Metres
10 Jun 25
Ln[effective stress]
Ln[hoop strain]
7.75
7.7
7.65
7.6
7.55
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
6.75
6.7
6.65
6.6
-3
-4
-5
-6

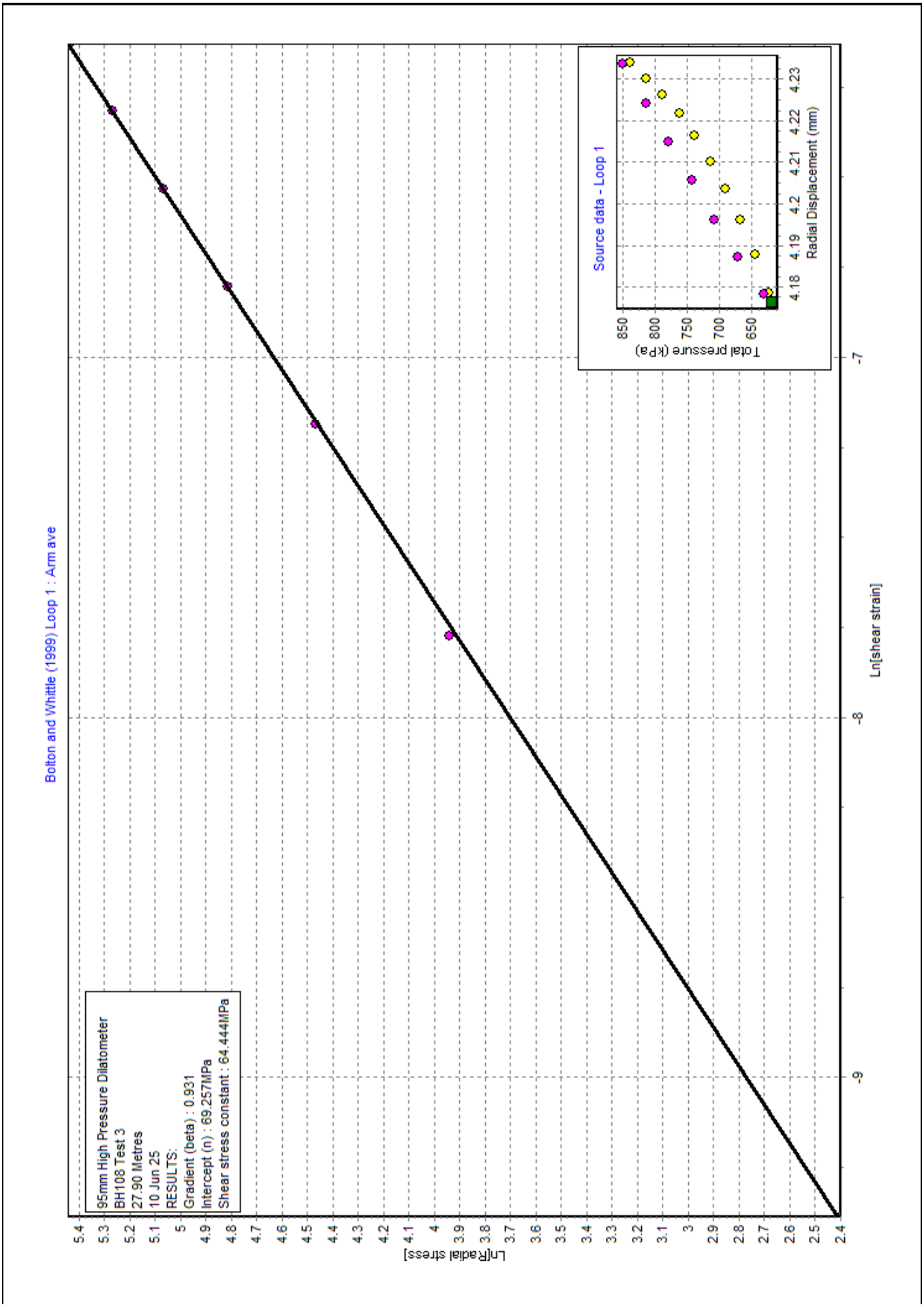

Withers et al (1989) : Arm ave
Ln[(Emx-Ec)/(1+Emx)]
Ln[P'/P'mx]
95mm High Pressure Dilatometer
BH108 Test 3
27.90 Metres
10 Jun 25
RESULTS:
Ambient water pressure : 231.5 kPa
Residual friction angle : 29.0°
Gradient : -1.341
Friction angle : 20.7°
Dilation angle : -9.1°

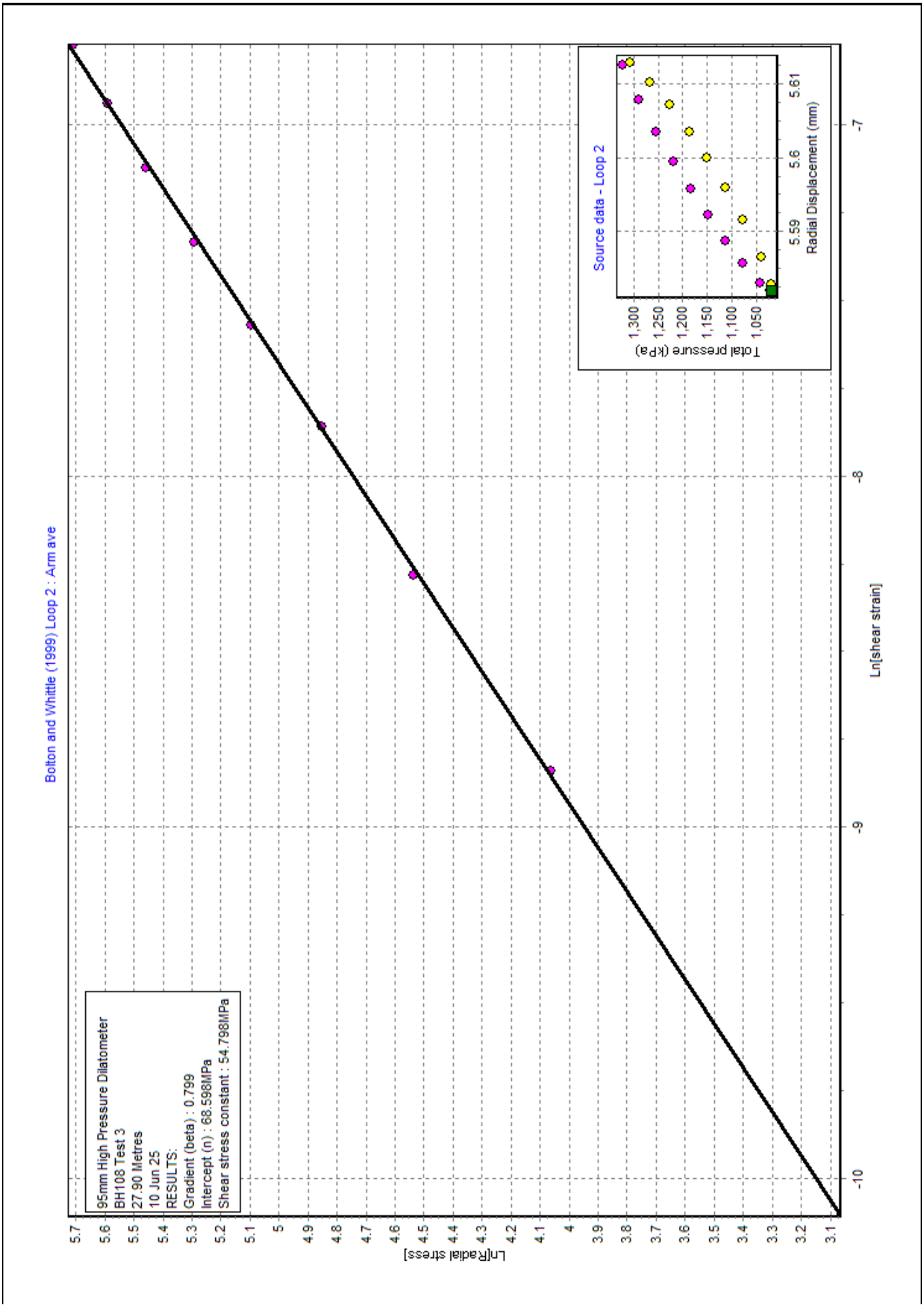

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 104.6MPa
Cycle mid-point:
Cavity strain : 0.106%
Total stress : 733kPa
Size of cycle :
Shear strain : 0.217%
Total stress : 227kPa
95mm High Pressure Dilatometer
BH108 Test 3
27.90 Metres
10 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

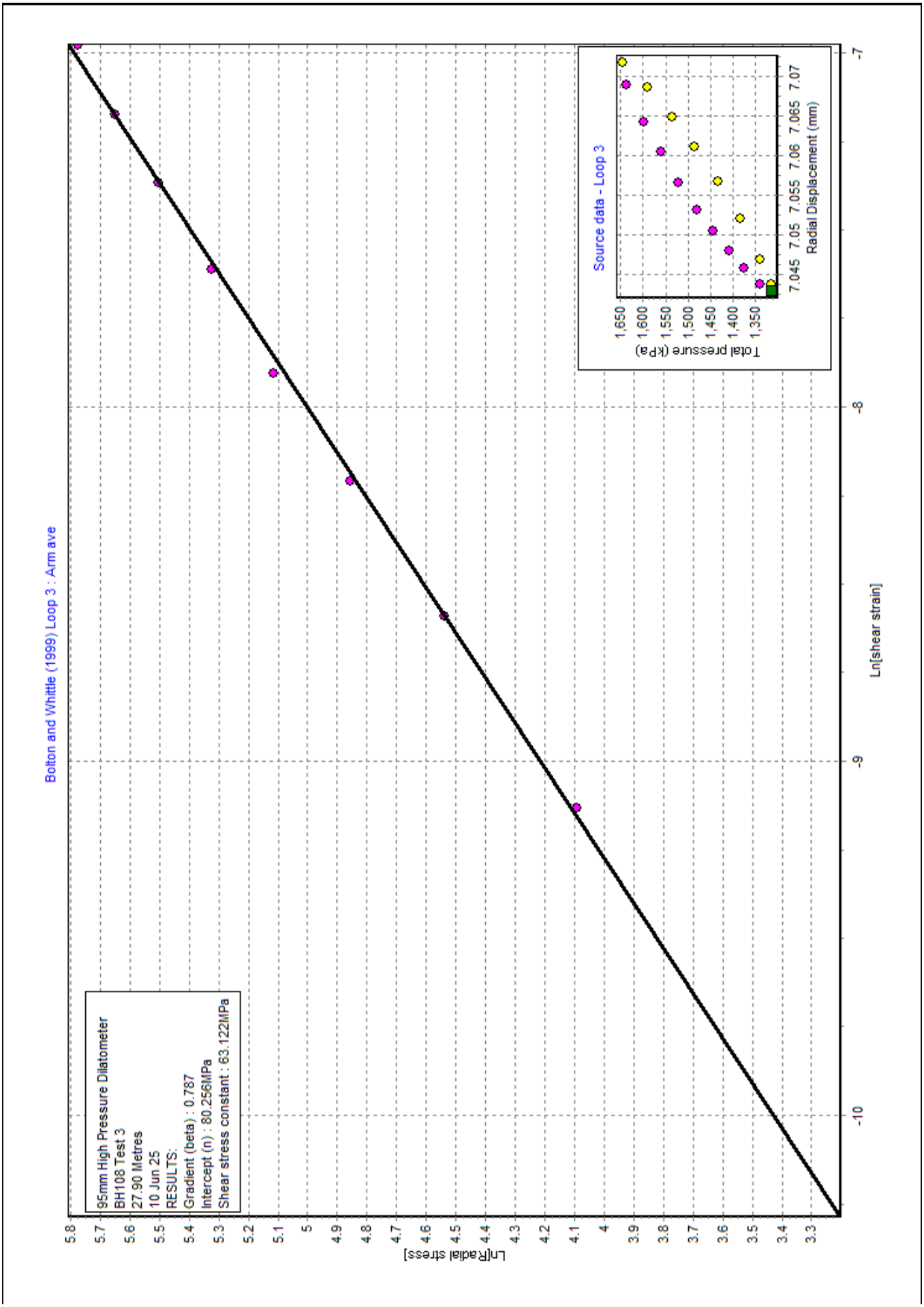

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 257.0MPa
Cycle mid-point:
Cavity strain : 2.751%
Total stress : 1178kPa
Size of cycle :
Shear strain : 0.126%
Total stress : 323kPa
95mm High Pressure Dilatometer
BH108 Test 3
27.90 Metres
10 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

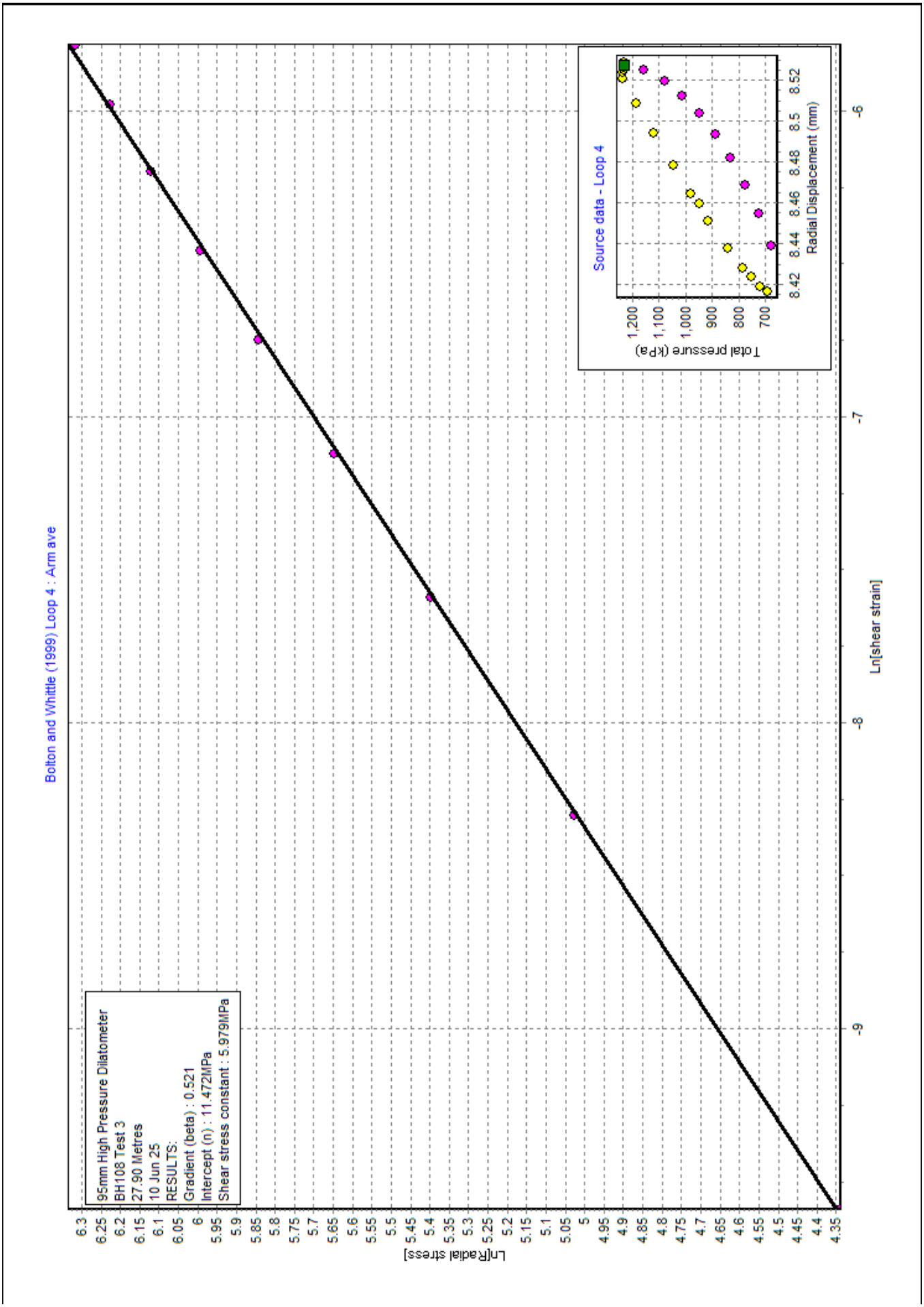

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 321.2MPa
Cycle mid-point:
Cavity strain : 5.523%
Total stress : 1481kPa
Size of cycle :
Shear strain : 0.102%
Total stress : 327kPa
95mm High Pressure Dilatometer
BH108 Test 3
27.90 Metres
10 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

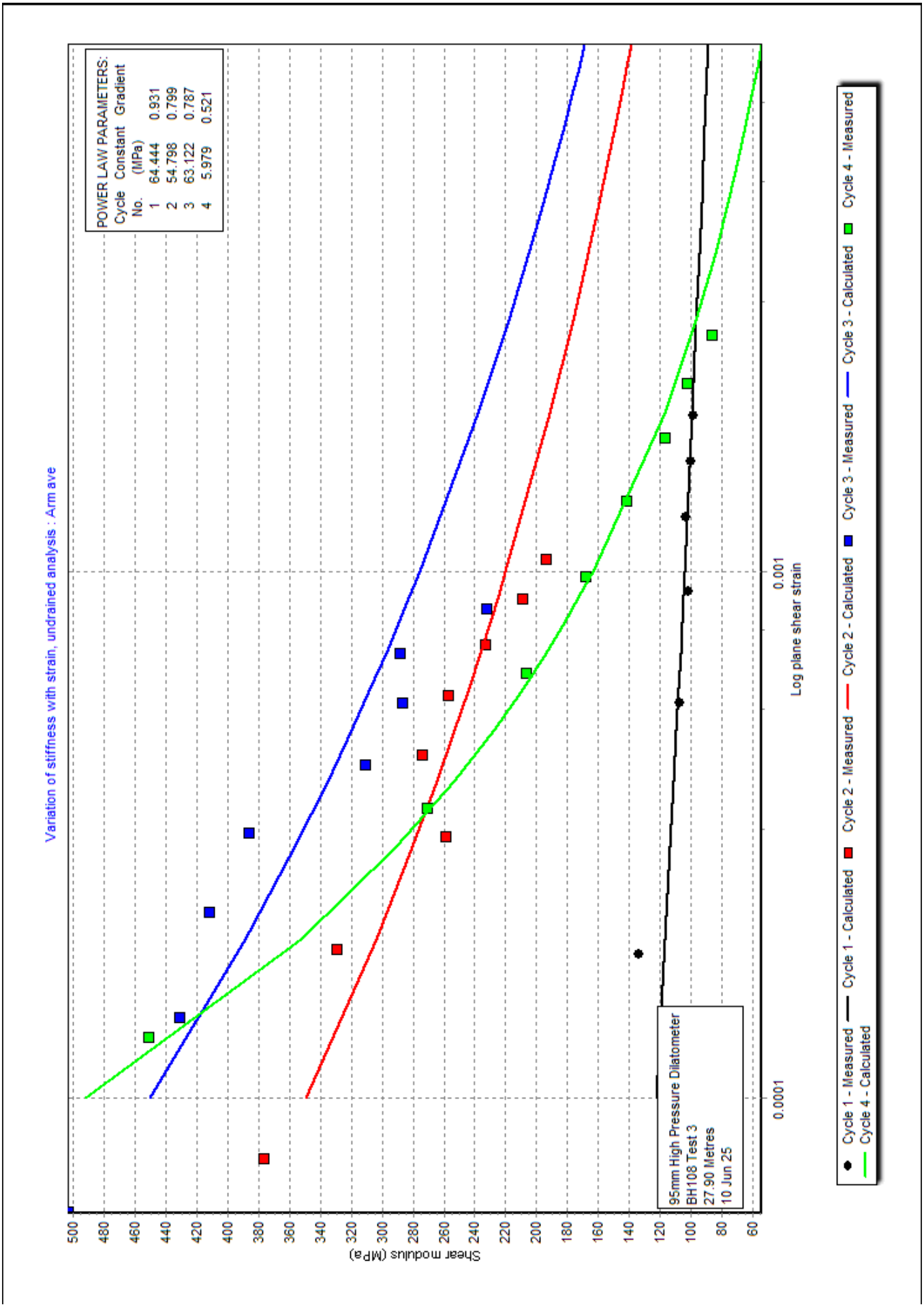

Shear modulus from unload/reload cycles Loop 4 : Arm ave
RESULTS:
Gur : 145.8MPa
Cycle mid-point:
Cavity strain : 8.217%
Total stress : 943kPa
Size of cycle :
Shear strain : 0.371%
Total stress : 542kPa
95mm High Pressure Dilatometer
BH108 Test 3
27.90 Metres
10 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

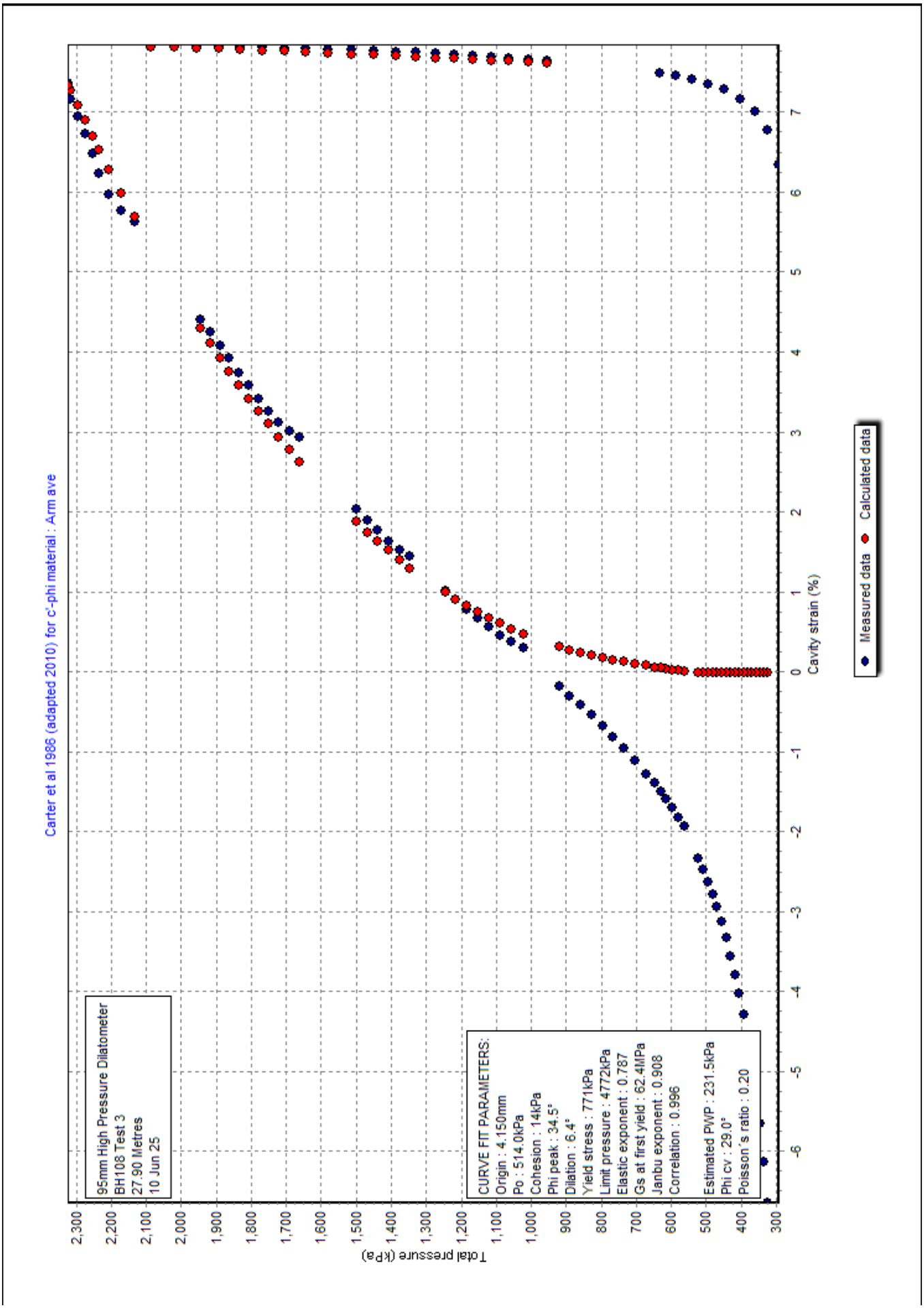

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 3
27.90 Metres
10 Jun 25
RESULTS:
Gradient (beta) : 0.931
Intercept (n) : 69.257MPa
Shear stress constant : 64.444MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

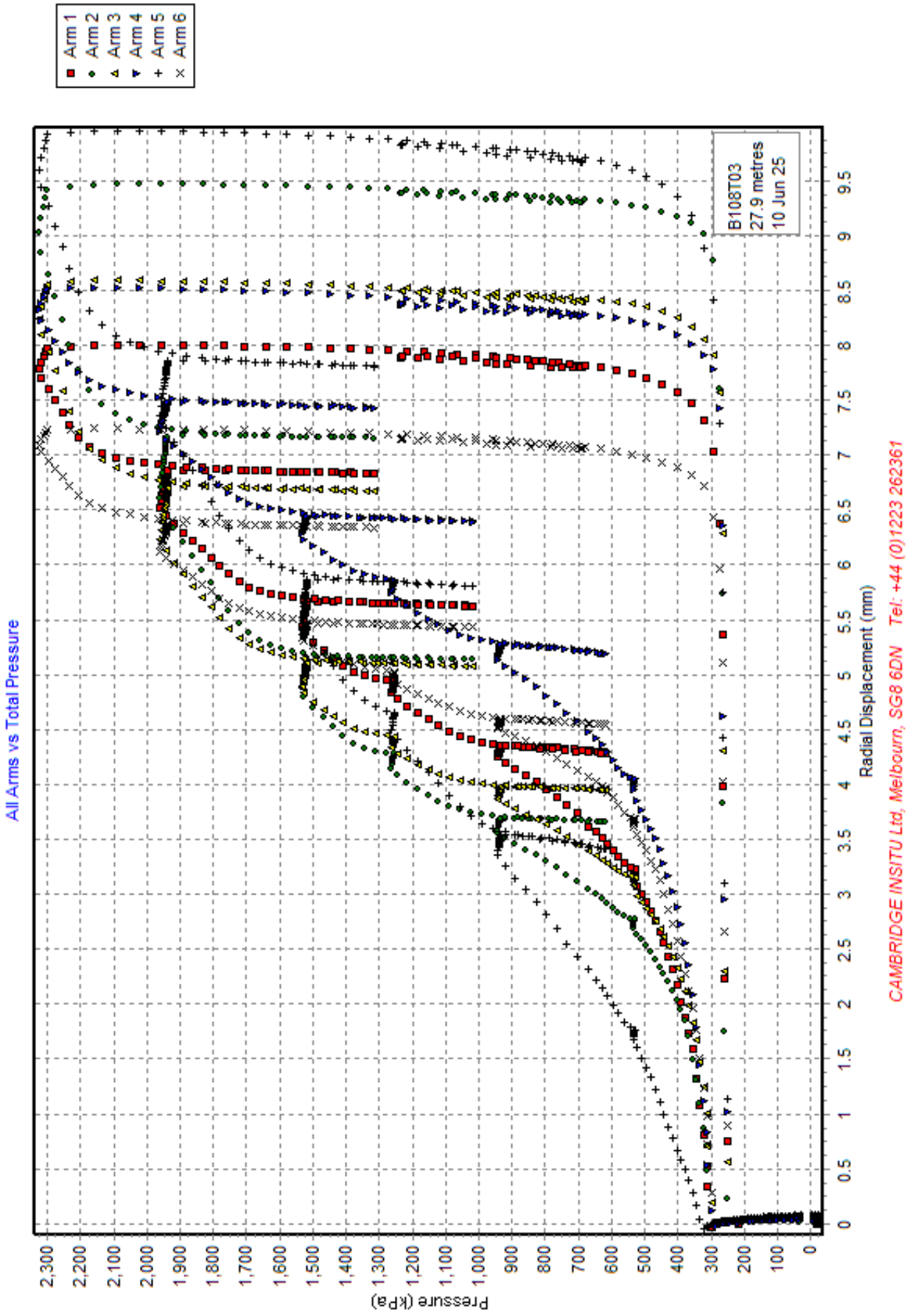

Bolton and Whittle (1999) Loop 2 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 3
27.90 Metres
10 Jun 25
RESULTS:
Gradient (beta) : 0.799
Intercept (n) : 68.598MPa
Shear stress constant : 54.798MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

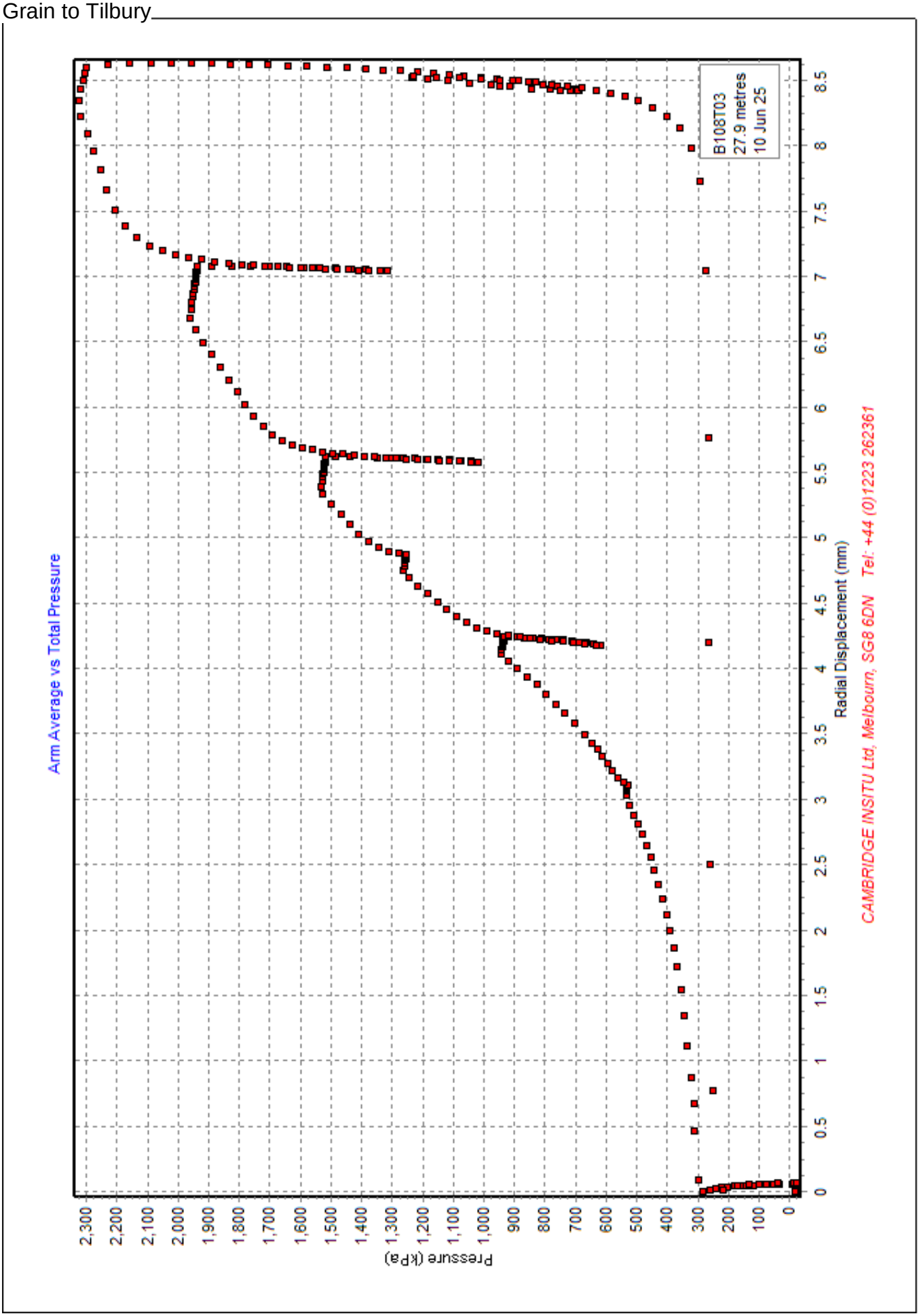

Bolton and Whittle (1999) Loop 3 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 3
27.90 Metres
10 Jun 25
RESULTS:
Gradient (beta) : 0.787
Intercept (n) : 80.256MPa
Shear stress constant : 63.122MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)

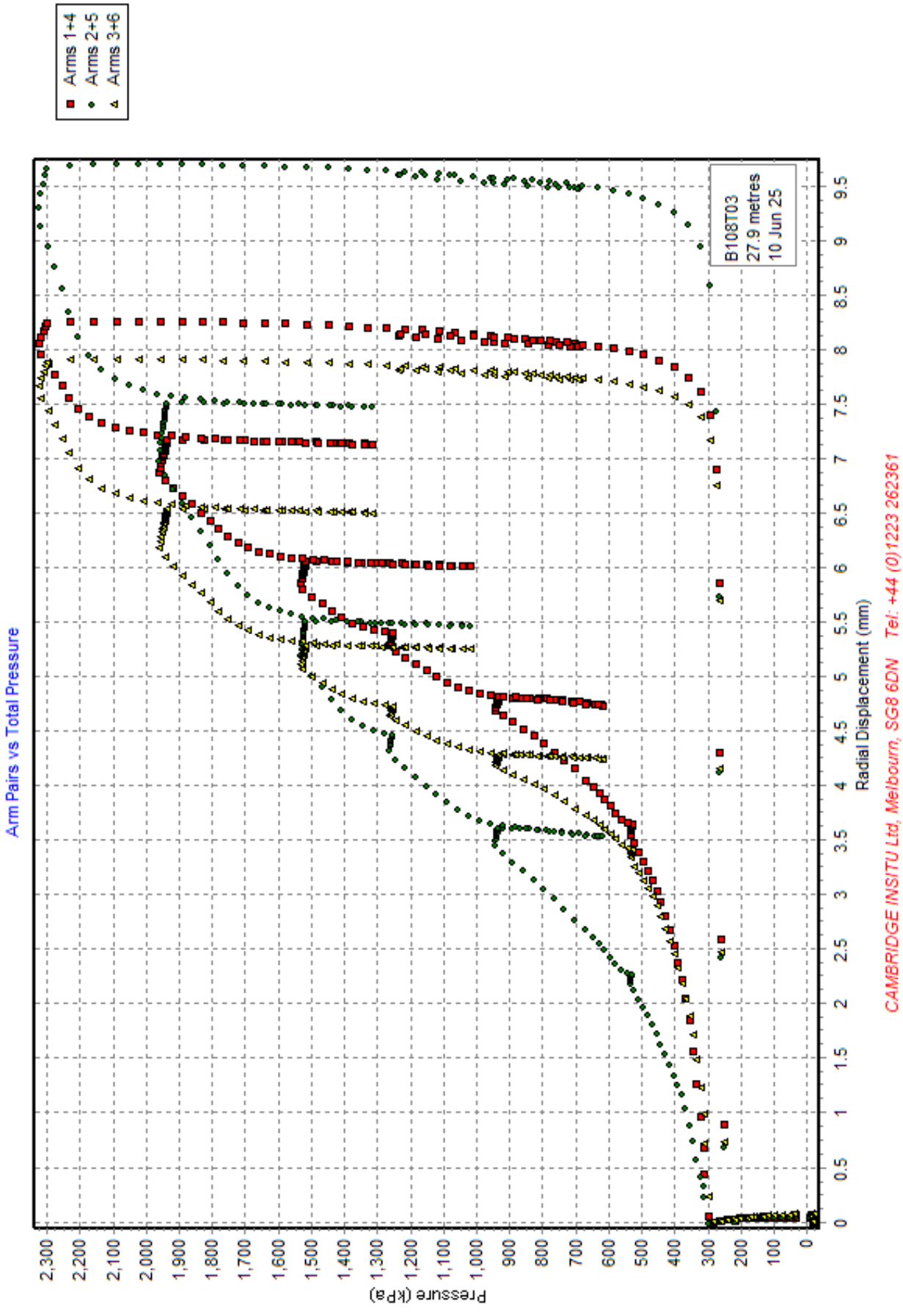

Bolton and Whittle (1999) Loop 4 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 3
27.90 Metres
10 Jun 25
RESULTS:
Gradient (beta) : 0.521
Intercept (n) : 11.472MPa
Shear stress constant : 5.979MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 4
Total pressure (kPa)
Radial Displacement (mm)

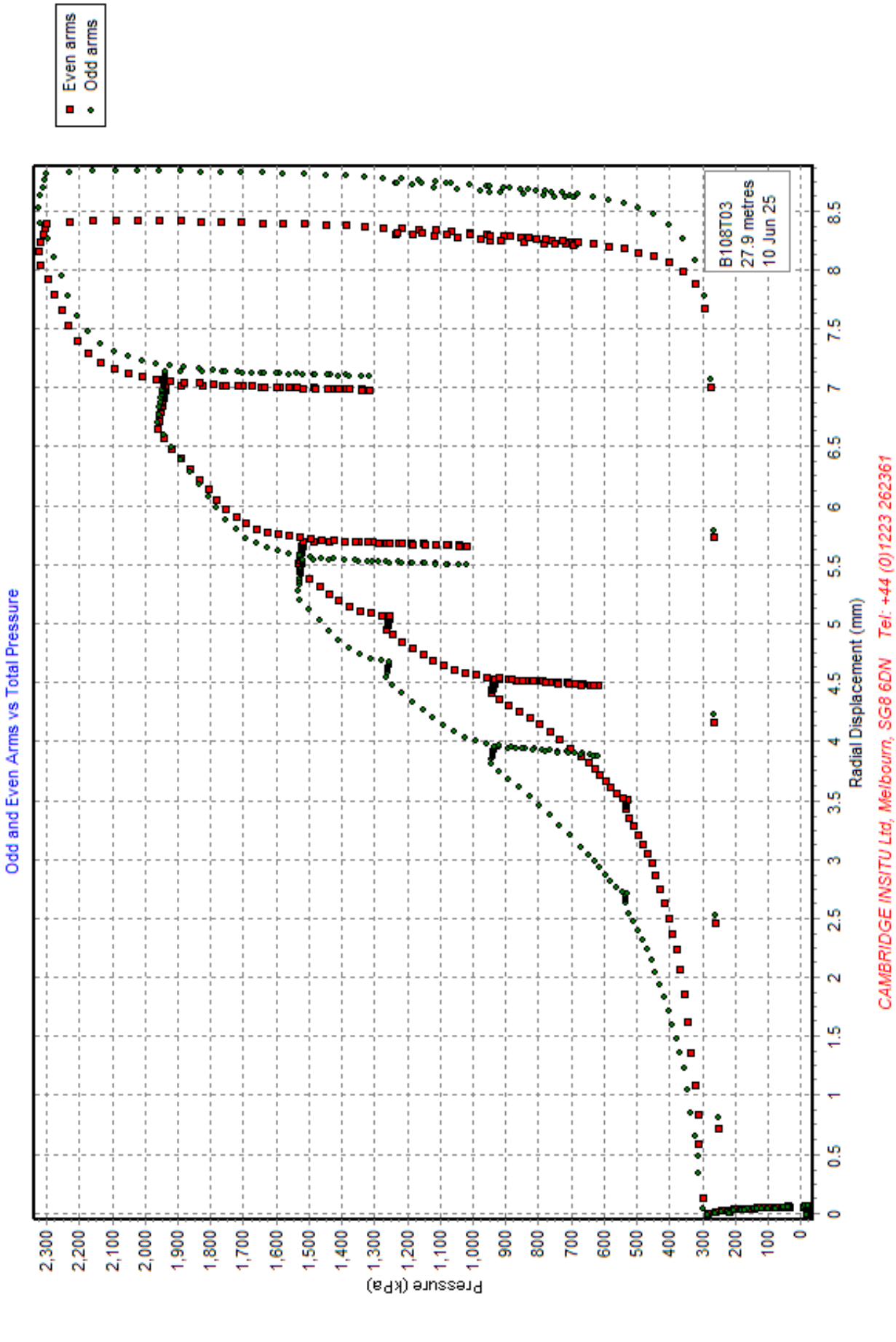

Variation of stiffness with strain, undrained analysis : Arm ave
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 64.444 0.931
2 54.798 0.799
3 63.122 0.787
4 5.979 0.521
95mm High Pressure Dilatometer
BH108 Test 3
27.90 Metres
10 Jun 25
Shear modulus (MPa)
Log plane shear strain
0.0001
0.001
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
Cycle 4 - Measured
Cycle 4 - Calculated


Carter et al 1986 (adapted 2010) for c'-phi material : Arm ave
95mm High Pressure Dilatometer
BH108 Test 3
27.90 Metres
10 Jun 25
CURVE FIT PARAMETERS:
Origin : 4.150mm
Po : 514.0kPa
Cohesion : 14kPa
Phi peak : 34.5°
Dilation : 6.4°
Yield stress : 771kPa
Limit pressure : 4772kPa
Elastic exponent : 0.787
Gs at first yield : 62.4MPa
Janbu exponent : 0.908
Correlation : 0.996
Estimated PWP : 231.5kPa
Phi cv : 29.0°
Poisson's ratio : 0.20
Total pressure (kPa)
Cavity strain (%)
Measured data
Calculated data


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
B108T03
27.9 metres
10 Jun 25
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arm Average vs Total Pressure
B108T03
27.9 metres
10 Jun 25
Radial Displacement (mm)
Pressure (kPa)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arms 1+4
Arms 2+5
Arms 3+6
B108T03
27.9 metres
10 Jun 25
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
B108T03
27.9 metres
10 Jun 25
Odd and Even Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to TIlbury
BH108 Test 4 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Grain to Tilbury
Borehole : BH108
Test name : BH108 Test 4
Test date : 11 Jun 25
Test depth : 32.20 Metres
Water table : 4.3 Metres
Ambient PWP : 273.7 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDB/SDP/RW on 20 Jul 25

Remarks:

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=6.86"
Po from Marsland & Randolph (kPa) : "Arm ave=797.6"
Best estimate of Po (kPa) : "Arm ave=663.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=2175.4"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 30.0
Angle of internal friction (°) : "Arm ave=35.3"
Dilation angle (°) : "Arm ave=6.2"
Gradient of log-log plot : "Arm ave=0.406"

[Withers et al 1989]
Angle of internal friction (°) : "Arm ave=31.6"
Dilation angle (°) : "Arm ave=1.8"
Gradient of log-log plot : "Arm ave=-2.093"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=17.6"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	95.3	-0.942	856	0.272	259
Arm ave	2	310.3	2.102	1561	0.141	437
Arm ave	3	451.6	5.918	2193	0.106	481
Arm ave	4	231.5	8.406	1257	0.320	741

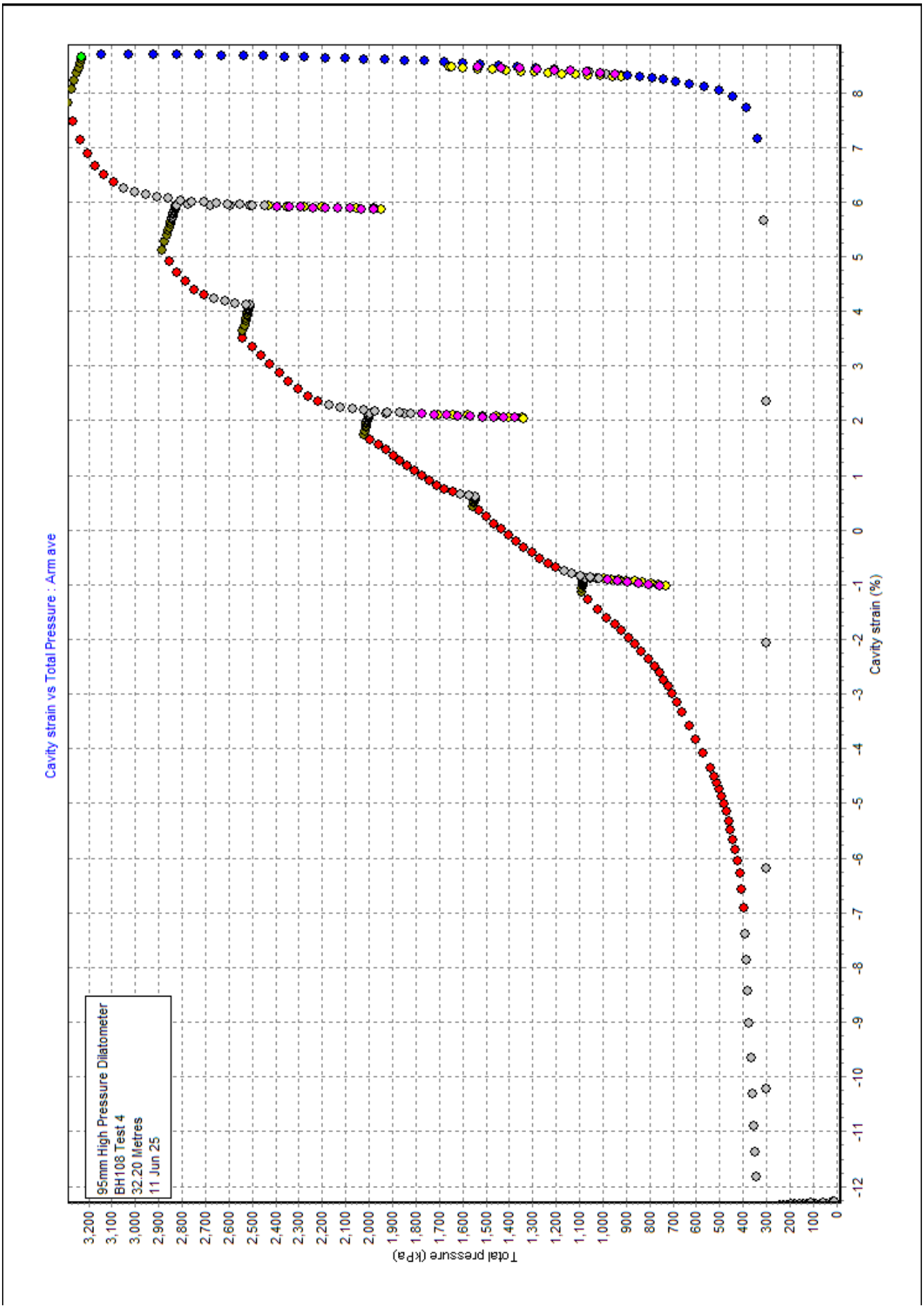
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

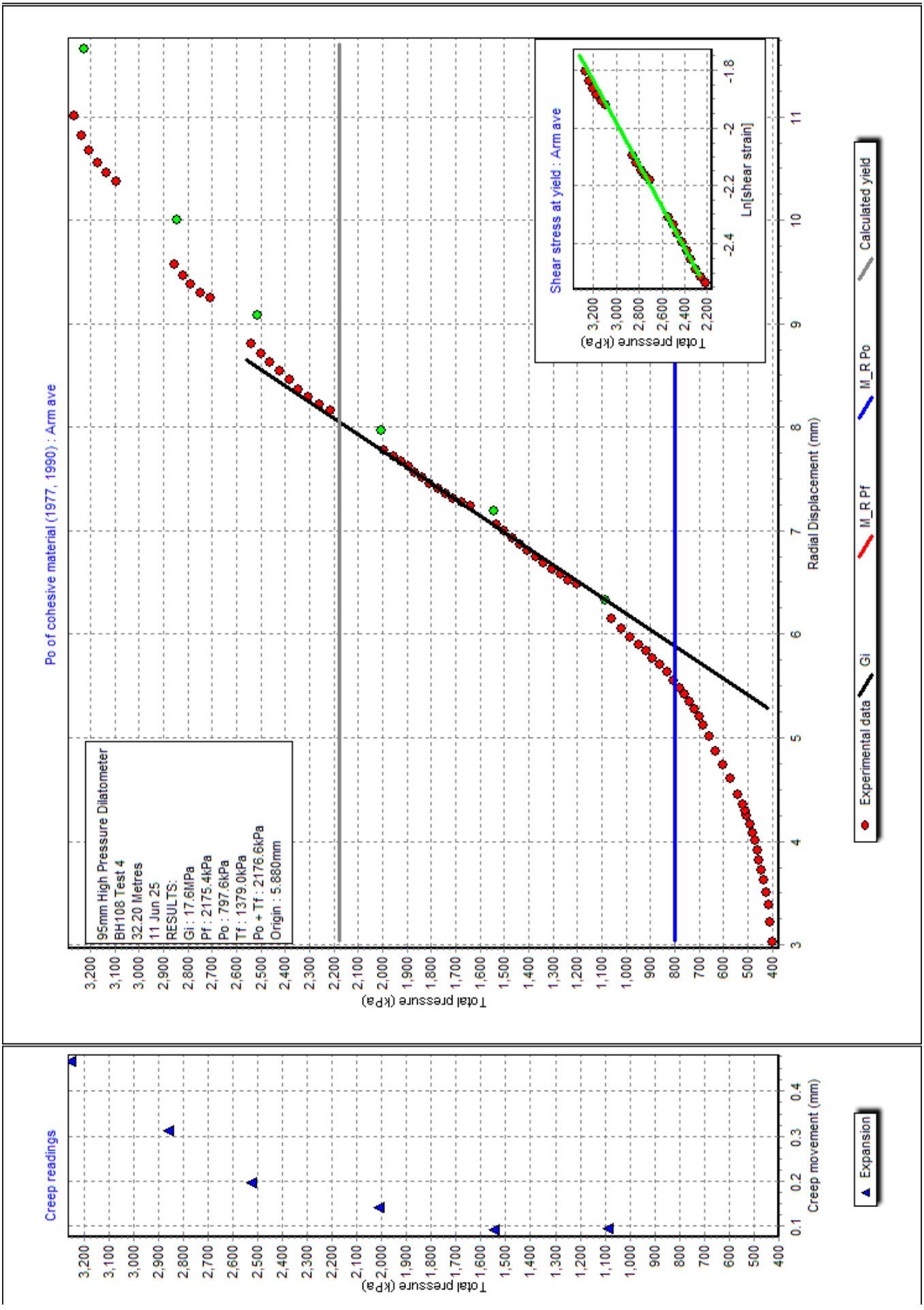
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	69.314	65.292	0.942
Arm ave	2	162.523	146.120	0.899
Arm ave	3	140.173	115.578	0.825
Arm ave	4	41.070	27.744	0.676

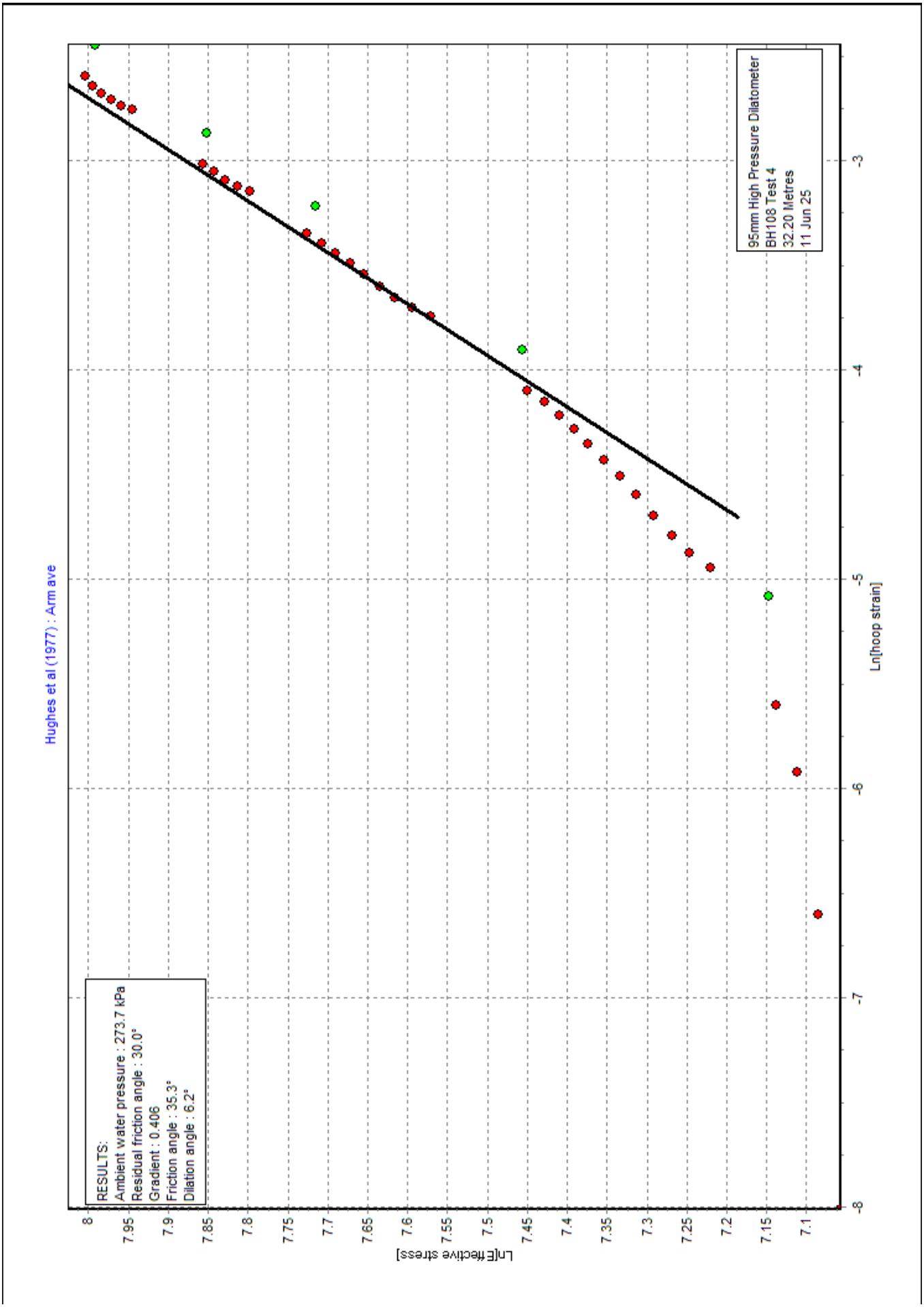
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 6.86
Po (kPa) : 663
Cohesion (kPa) : 31
Angle of peak friction (deg) : 35.3
Angle of peak dilation (deg) : 6.2
Total yield stress (kPa) : 1008

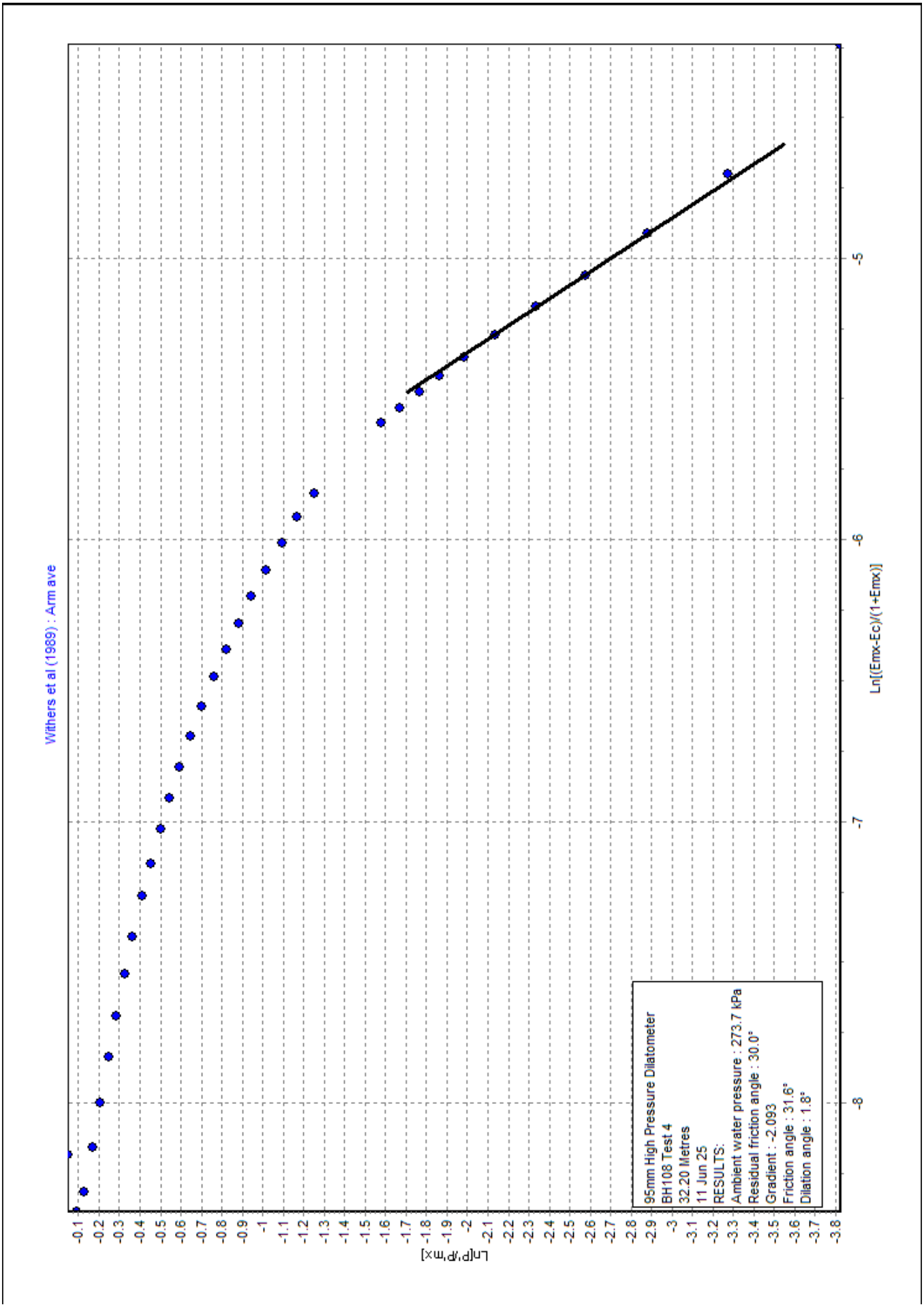
Grain to TIlbury
BH108 Test 4 - SUMMARY OF RESULTS

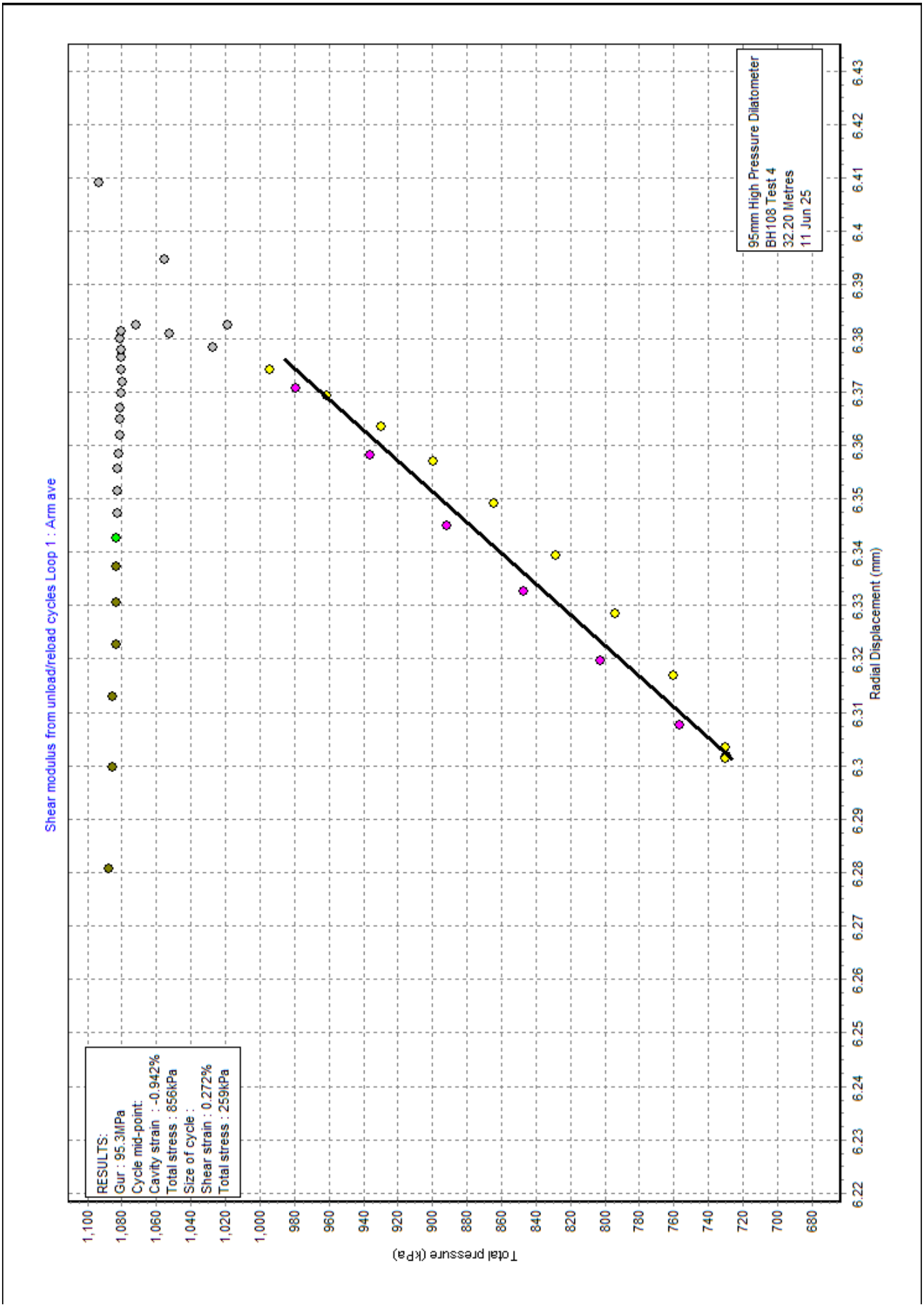
Total limit stress (kPa)	:	6924
G at first yield (MPa)	:	95.7
Non-linear exponent	:	0.825
Janbu exponent	:	0.840
Correlation	:	0.707
Ambient pore water pressure (kPa)	:	274
Residual friction angle (deg)	:	30.0
Poisson's ratio	:	0.20

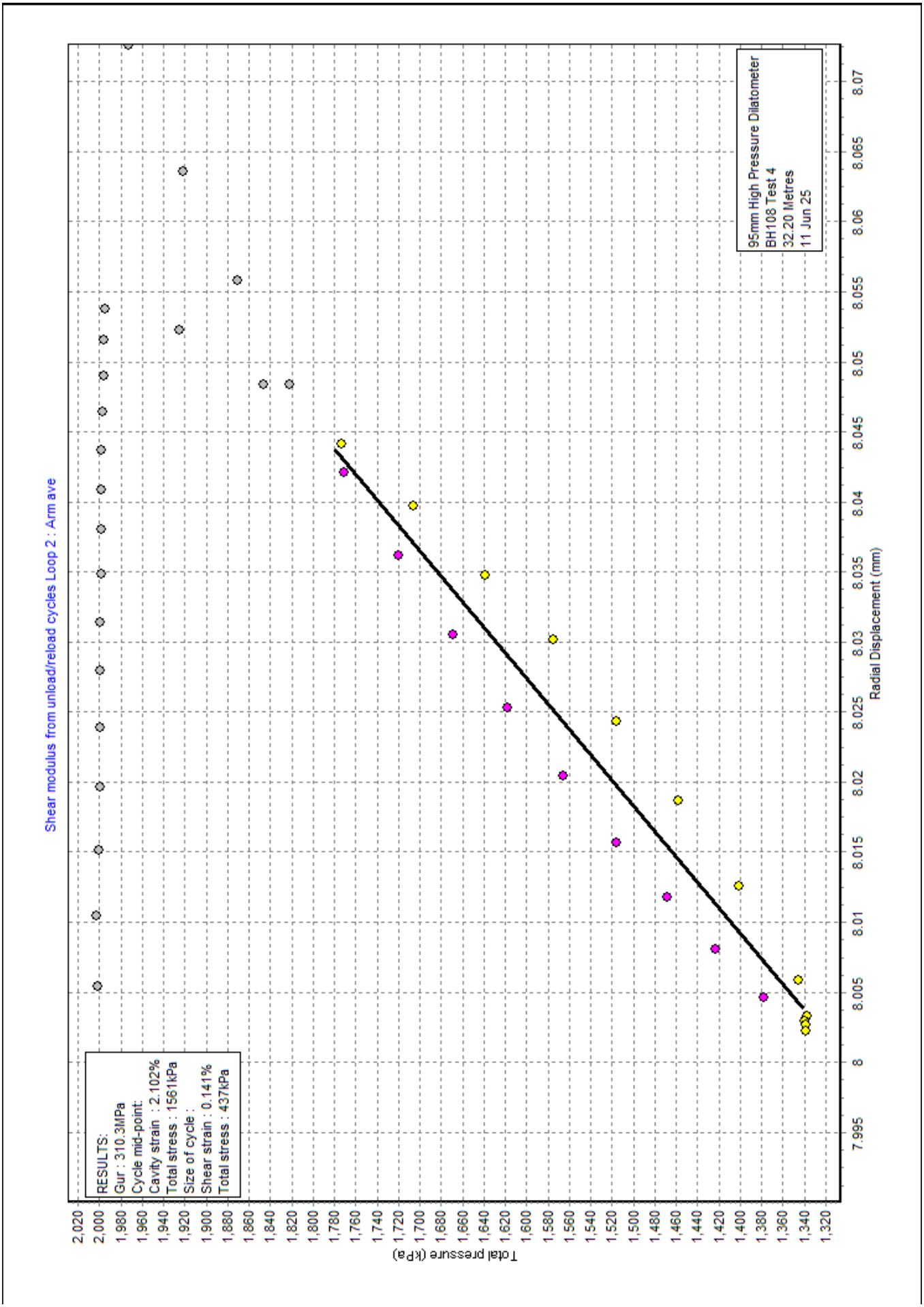

Cavity strain vs Total Pressure : Arm ave
95mm High Pressure Dilatometer
BH108 Test 4
32.20 Metres
11 Jun 25
Total pressure (kPa)
Cavity strain (%)

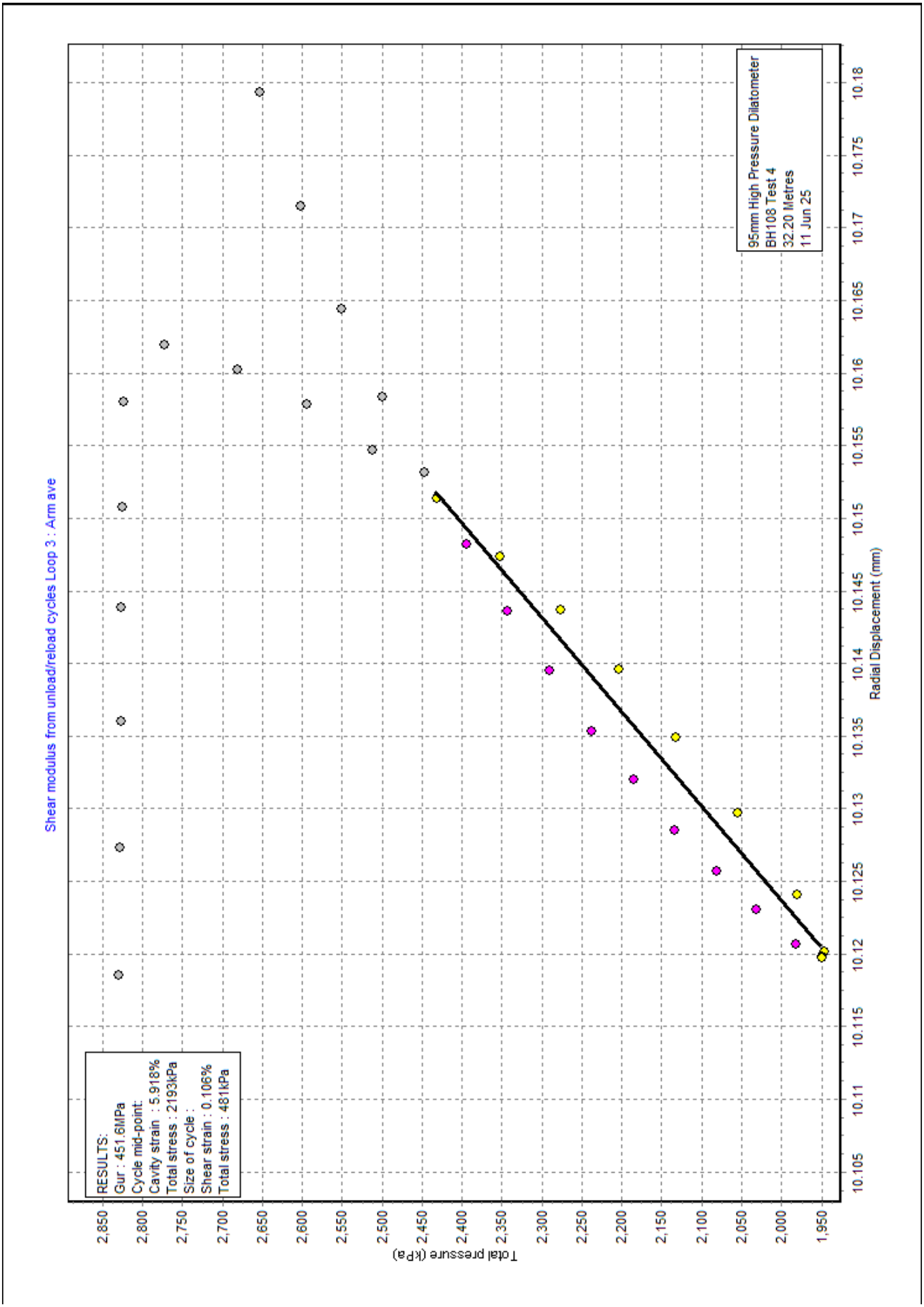

Po of cohesive material (1977, 1990) : Arm ave
95mm High Pressure Dilatometer
BH108 Test 4
32.20 Metres
11 Jun 25
RESULTS:
Gi : 17.6MPa
Pf : 2175.4kPa
Po : 797.6kPa
Tf : 1379.0kPa
Po + Tf : 2176.6kPa
Origin : 5.880mm
Shear stress at yield : Arm ave
Total pressure (kPa)
Ln[shear strain]
Radial Displacement (mm)
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Creep readings
Creep movement (mm)
Expansion

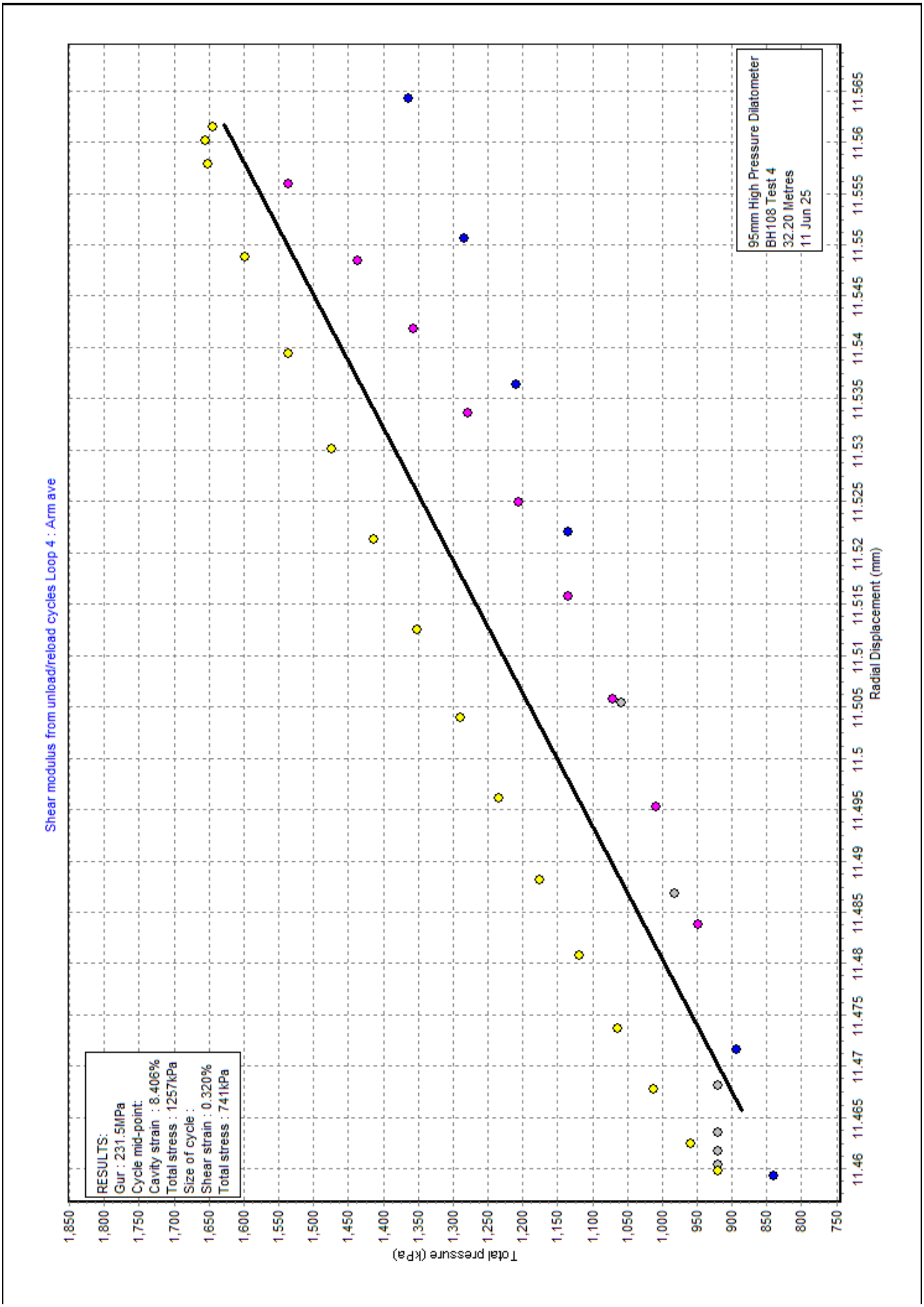

Hughes et al (1977) : Arm ave
95mm High Pressure Dilatometer
BH108 Test 4
32.20 Metres
11 Jun 25
RESULTS:
Ambient water pressure : 273.7 kPa
Residual friction angle : 30.0°
Gradient : 0.406
Friction angle : 35.3°
Dilation angle : 6.2°
Ln[Effective stress]
Ln[hoop strain]
8
7.95
7.9
7.85
7.8
7.75
7.7
7.65
7.6
7.55
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
-3
-4
-5
-6
-7
-8

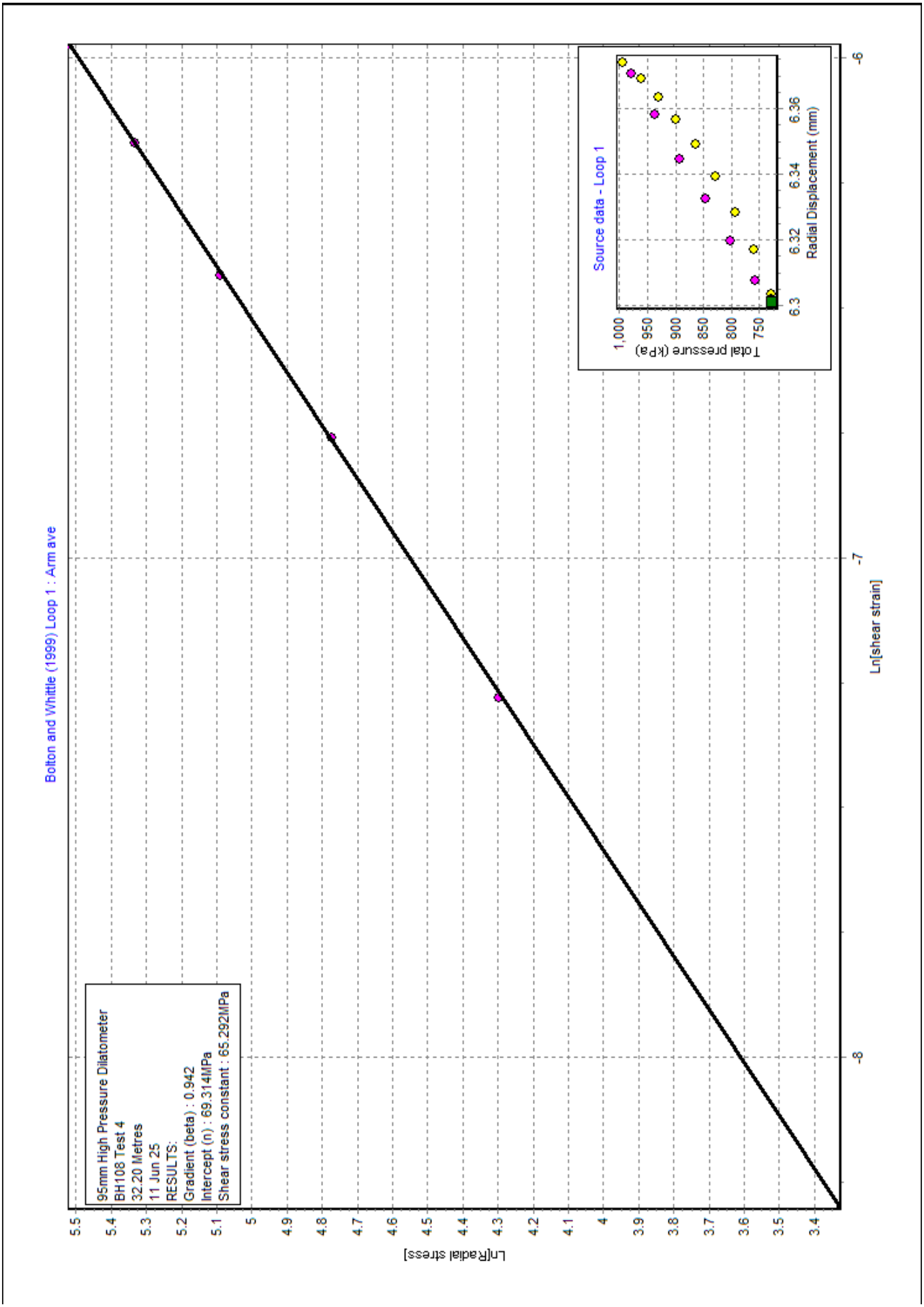

Withers et al (1989) : Arm ave
Ln[(Emx-Ec)/(1+Emx)]
Ln[P'/P'mx]
95mm High Pressure Dilatometer
BH108 Test 4
32.20 Metres
11 Jun 25
RESULTS:
Ambient water pressure : 273.7 kPa
Residual friction angle : 30.0°
Gradient : -2.093
Friction angle : 31.6°
Dilation angle : 1.8°

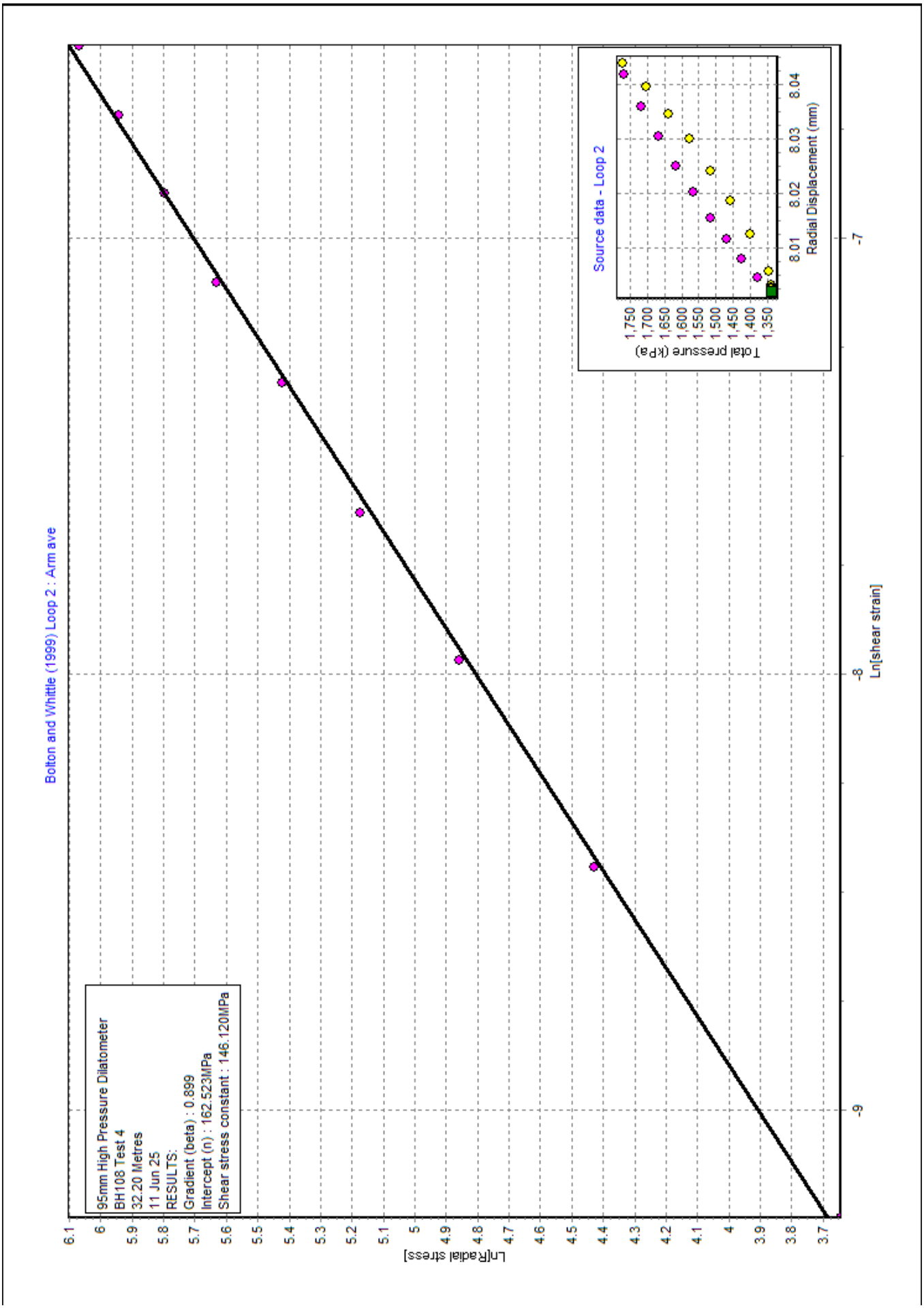

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 95.3MPa
Cycle mid-point:
Cavity strain : -0.942%
Total stress : 856kPa
Size of cycle :
Shear strain : 0.272%
Total stress : 259kPa
95mm High Pressure Dilatometer
BH108 Test 4
32.20 Metres
11 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

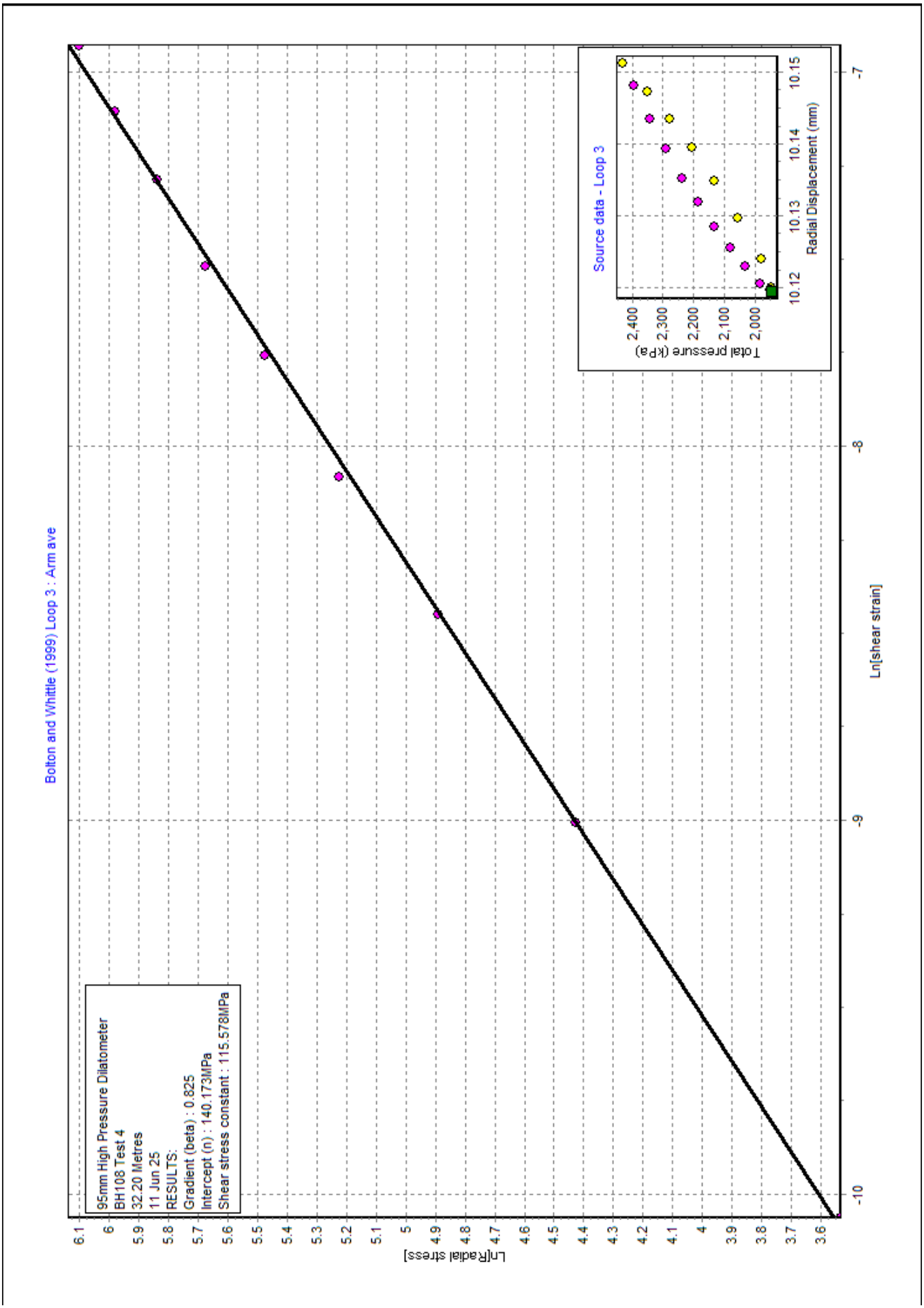

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 310.3MPa
Cycle mid-point:
Cavity strain : 2.102%
Total stress : 1561kPa
Size of cycle :
Shear strain : 0.141%
Total stress : 437kPa
95mm High Pressure Dilatometer
BH108 Test 4
32.20 Metres
11 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

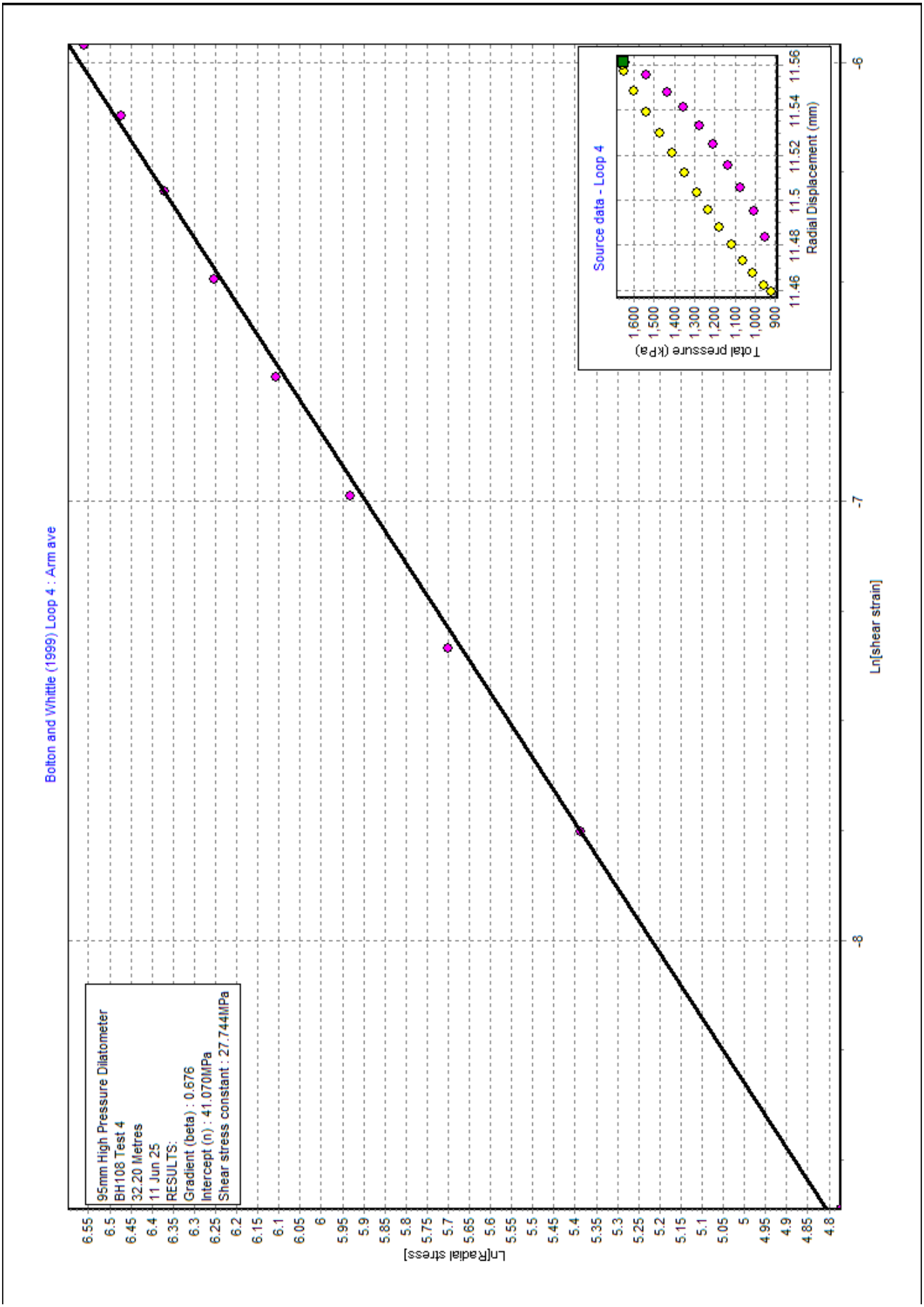

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 451.6MPa
Cycle mid-point:
Cavity strain : 5.918%
Total stress : 2193kPa
Size of cycle :
Shear strain : 0.106%
Total stress : 481kPa
95mm High Pressure Dilatometer
BH108 Test 4
32.20 Metres
11 Jun 25
Total pressure (kPa)
Radial Displacement (mm)
2,850
2,800
2,750
2,700
2,650
2,600
2,550
2,500
2,450
2,400
2,350
2,300
2,250
2,200
2,150
2,100
2,050
2,000
1,950
10.105
10.11
10.115
10.12
10.125
10.13
10.135
10.14
10.145
10.15
10.155
10.16
10.165
10.17
10.175
10.18

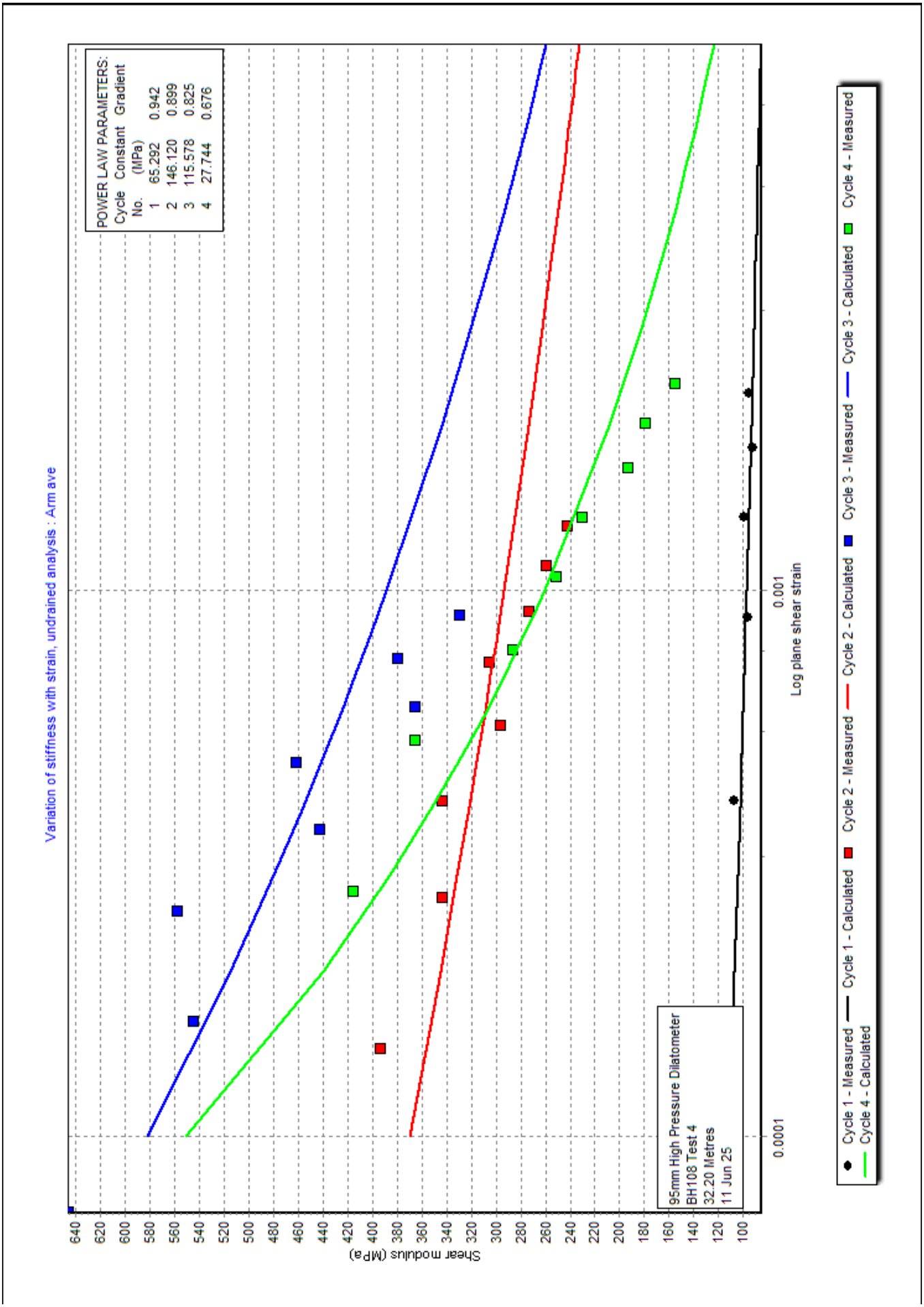

Shear modulus from unload/reload cycles Loop 4 : Arm ave
Total pressure (kPa)
Radial Displacement (mm)
95mm High Pressure Dilatometer
BH108 Test 4
32.20 Metres
11 Jun 25
RESULTS:
Gur : 231.5MPa
Cycle mid-point:
Cavity strain : 8.406%
Total stress : 1257kPa
Size of cycle :
Shear strain : 0.320%
Total stress : 741kPa

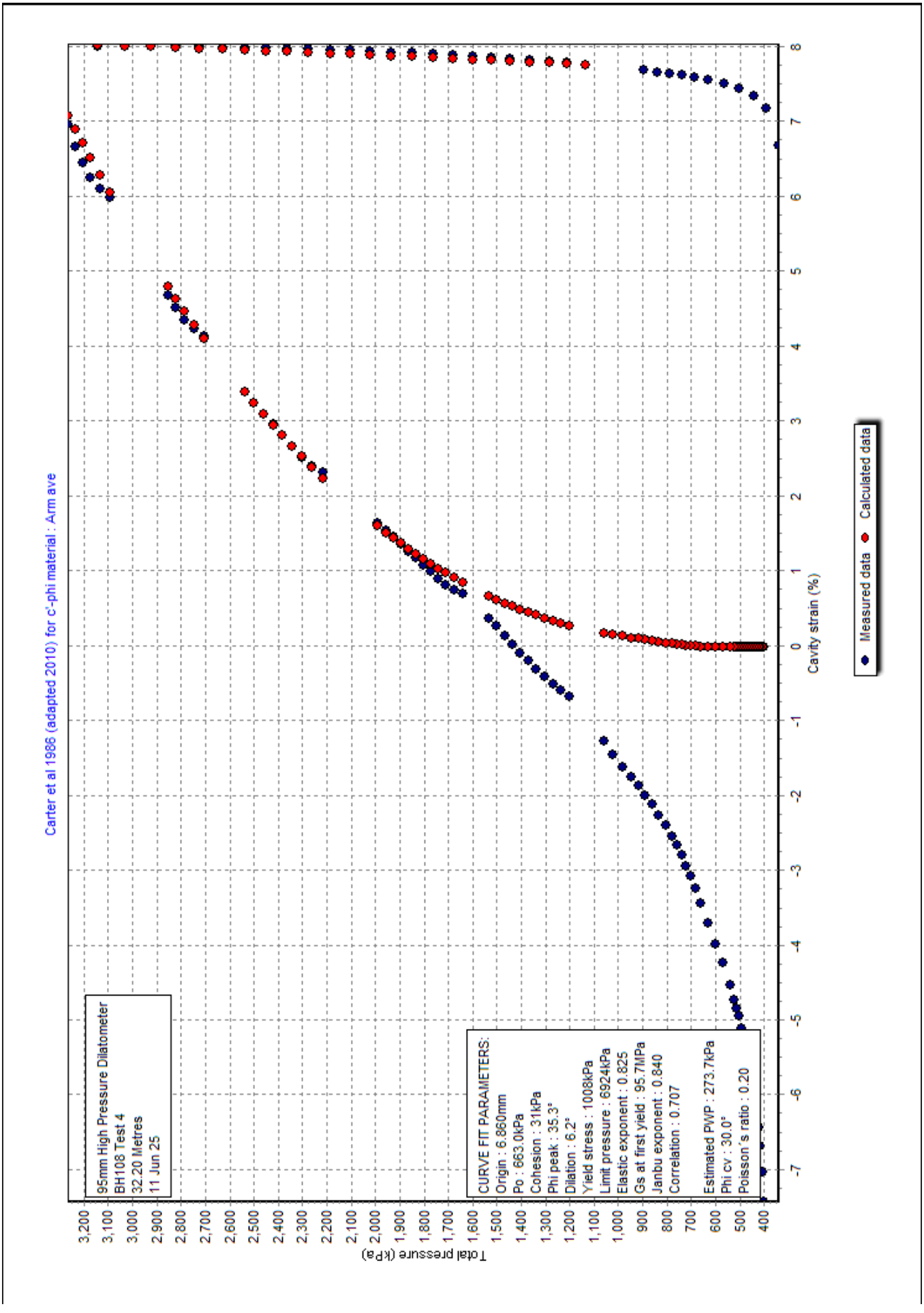

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 4
32.20 Metres
11 Jun 25
RESULTS:
Gradient (beta) : 0.942
Intercept (n) : 69.314MPa
Shear stress constant : 65.292MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

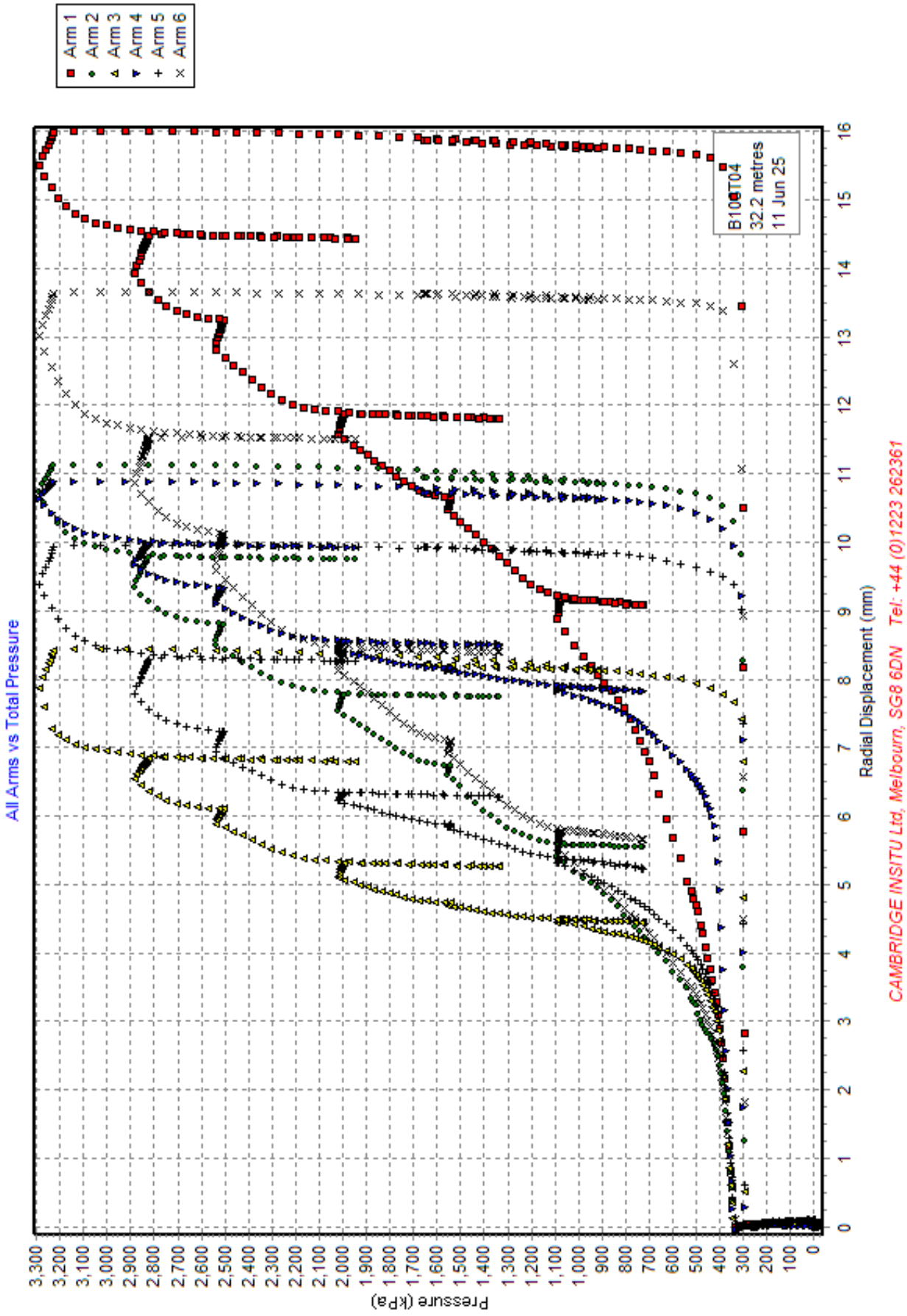

Bolton and Whittle (1999) Loop 2 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 4
32.20 Metres
11 Jun 25
RESULTS:
Gradient (beta) : 0.899
Intercept (n) : 162.523MPa
Shear stress constant : 146.120MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

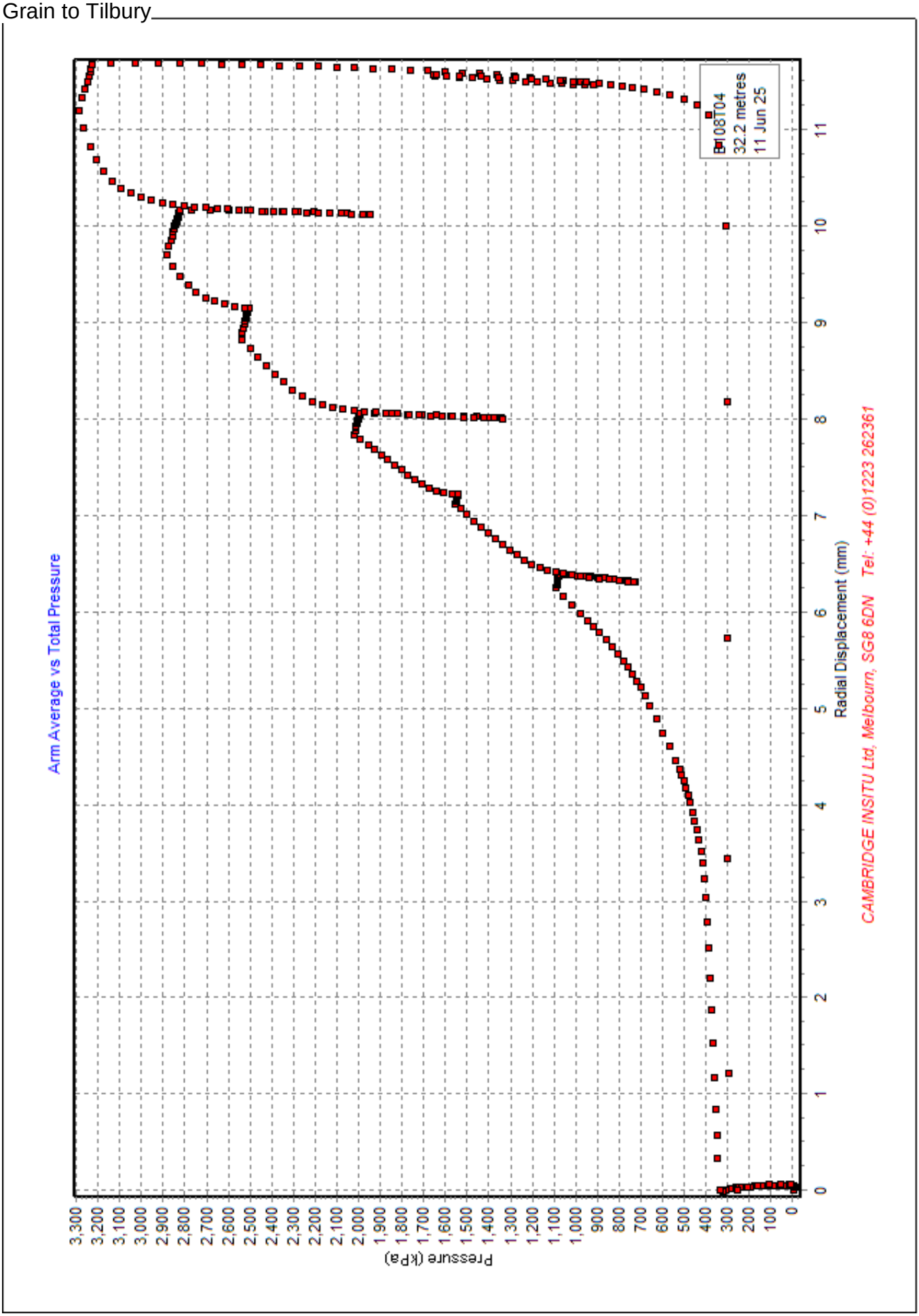

Bolton and Whittle (1999) Loop 3 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 4
32.20 Metres
11 Jun 25
RESULTS:
Gradient (beta) : 0.825
Intercept (n) : 140.173MPa
Shear stress constant : 115.578MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)

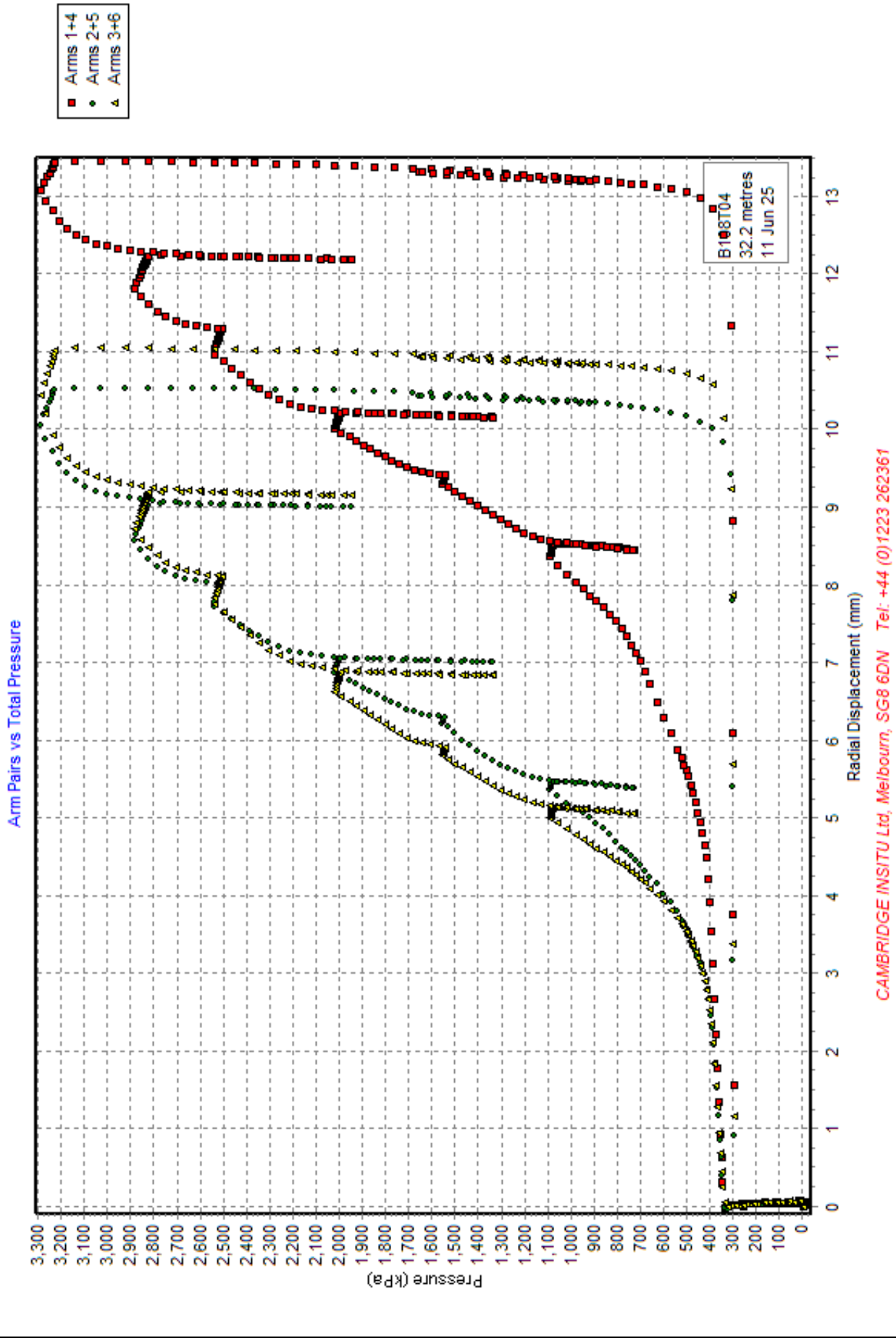

Bolton and Whittle (1999) Loop 4 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 4
32.20 Metres
11 Jun 25
RESULTS:
Gradient (beta) : 0.676
Intercept (n) : 41.070MPa
Shear stress constant : 27.744MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 4
Total pressure (kPa)
Radial Displacement (mm)

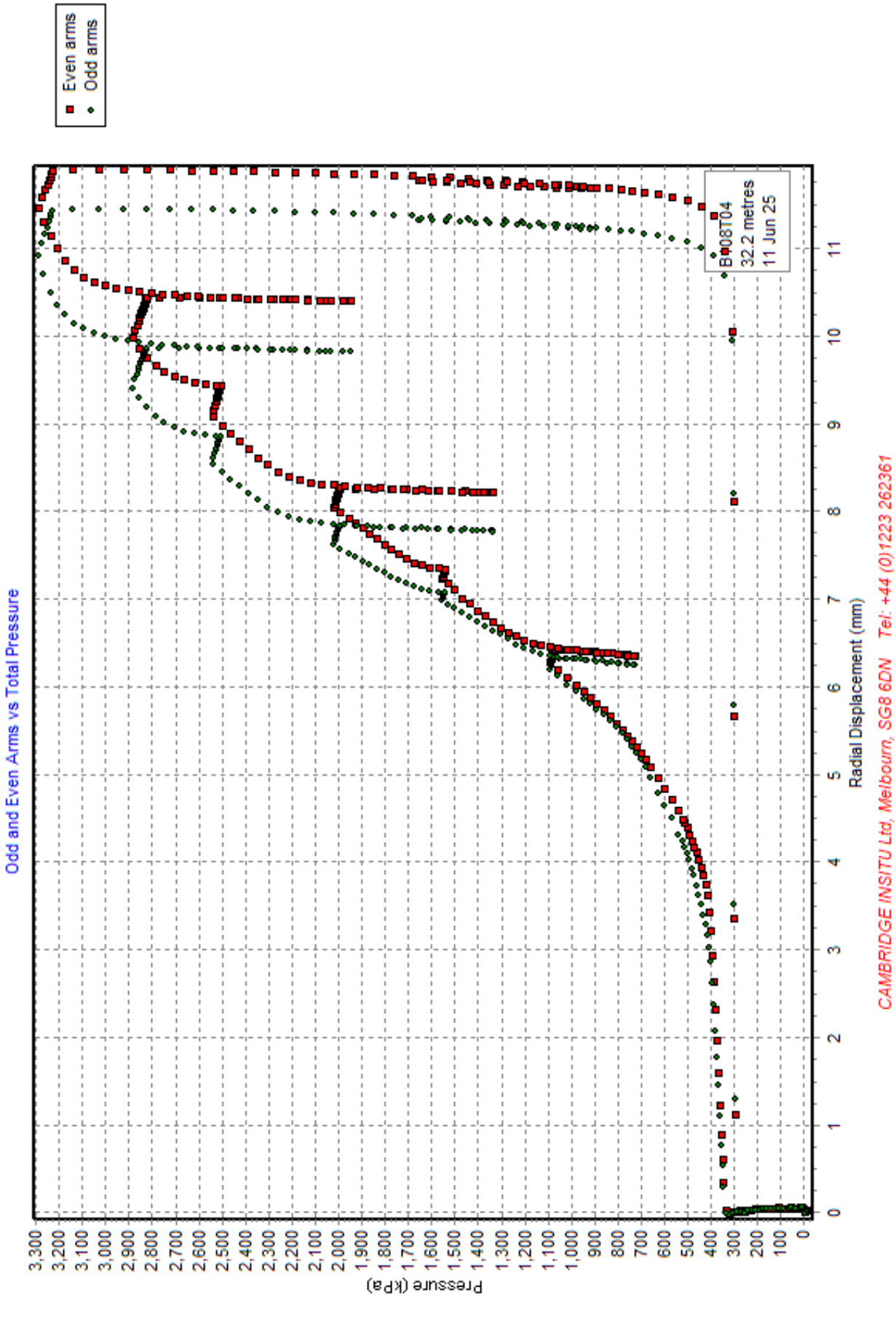

Variation of stiffness with strain, undrained analysis : Arm ave
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 65.292 0.942
2 146.120 0.899
3 115.578 0.825
4 27.744 0.676
95mm High Pressure Dilatometer
BH108 Test 4
32.20 Metres
11 Jun 25
Shear modulus (MPa)
Log plane shear strain
0.0001
0.001
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
Cycle 4 - Measured
Cycle 4 - Calculated


Carter et al 1986 (adapted 2010) for c'-phi material : Arm ave
95mm High Pressure Dilatometer
BH108 Test 4
32.20 Metres
11 Jun 25
CURVE FIT PARAMETERS:
Origin : 6.860mm
Po : 663.0kPa
Cohesion : 31kPa
Phi peak : 35.3°
Dilation : 6.2°
Yield stress : 1008kPa
Limit pressure : 6924kPa
Elastic exponent : 0.825
Gs at first yield : 95.7MPa
Janbu exponent : 0.840
Correlation : 0.707
Estimated PWP : 273.7kPa
Phi cv : 30.0°
Poisson's ratio : 0.20
Total pressure (kPa)
Cavity strain (%)
Measured data
Calculated data


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
B106T04
32.2 metres
11 Jun 25
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arm Average vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
BH108T04
32.2 metres
11 Jun 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arms 1+4
Arms 2+5
Arms 3+6
B108T04
32.2 metres
11 Jun 25
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
Odd and Even Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
B108T04
32.2 metres
11 Jun 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to TIlbury
BH108 Test 5 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Grain to Tilbury
Borehole : BH108
Test name : BH108 Test 5
Test date : 11 Jun 25
Test depth : 34.20 Metres
Water table : 4.3 Metres
Ambient PWP : 293.3 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDB/SDP/RW on 20 Jul 25

Remarks: Oversized pocket. Arm 1 hits limit. Extremely weak material.

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=10.73"
Po from Marsland & Randolph (kPa) : "Arm ave=462.3"
Best estimate of Po (kPa) : "Arm ave=417.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=828.4"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 22.0
Angle of internal friction (°) : "Arm ave=33.0"
Dilation angle (°) : "Arm ave=12.3"
Gradient of log-log plot : "Arm ave=0.428"

[Withers et al 1989]
Angle of internal friction (°) : "Arm ave=20.5"
Dilation angle (°) : "Arm ave=-1.6"
Gradient of log-log plot : "Arm ave=-1.122"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=5.3"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	96.0	3.498	817	0.283	272
Arm ave	2	111.4	6.701	779	0.196	219

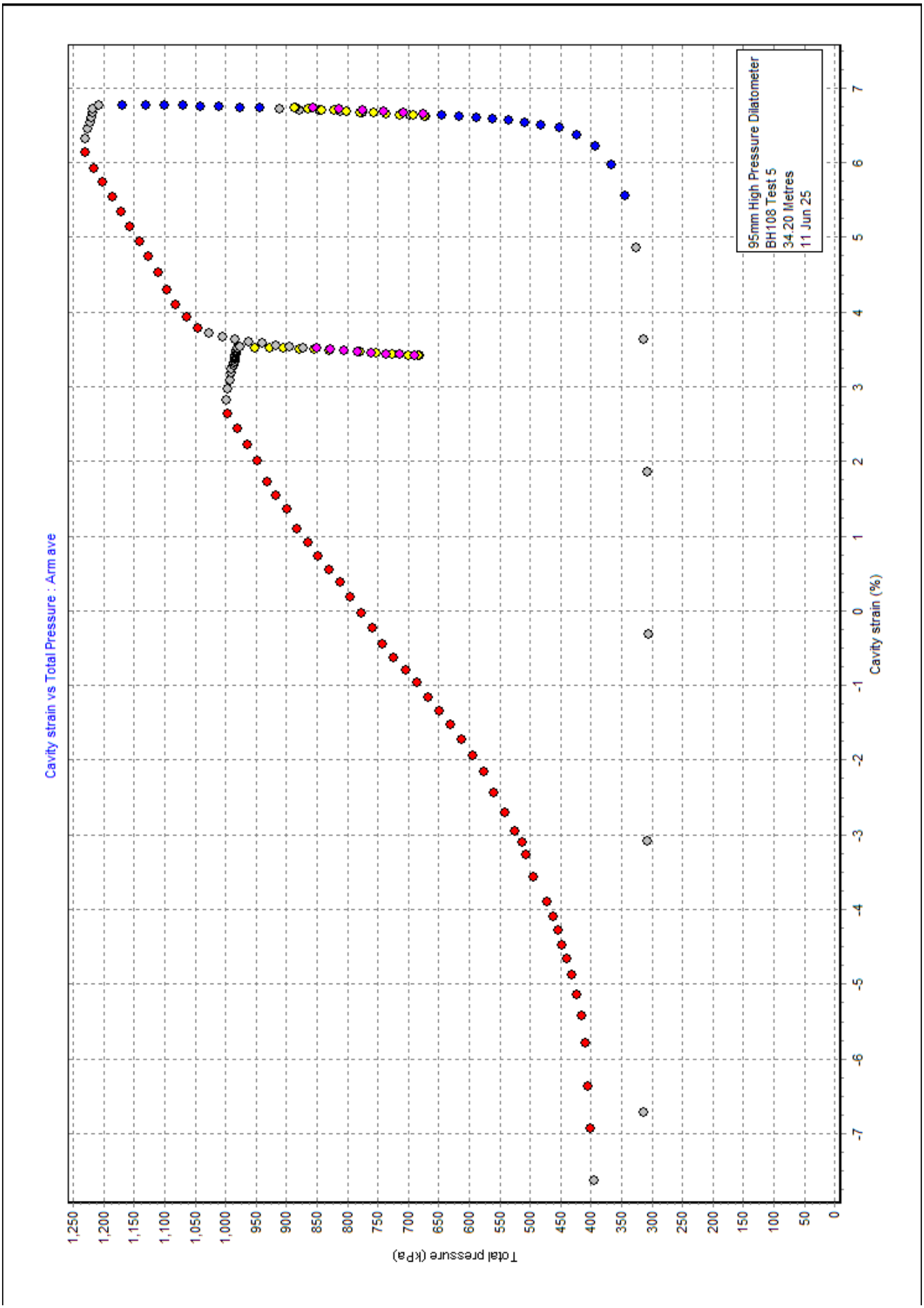
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

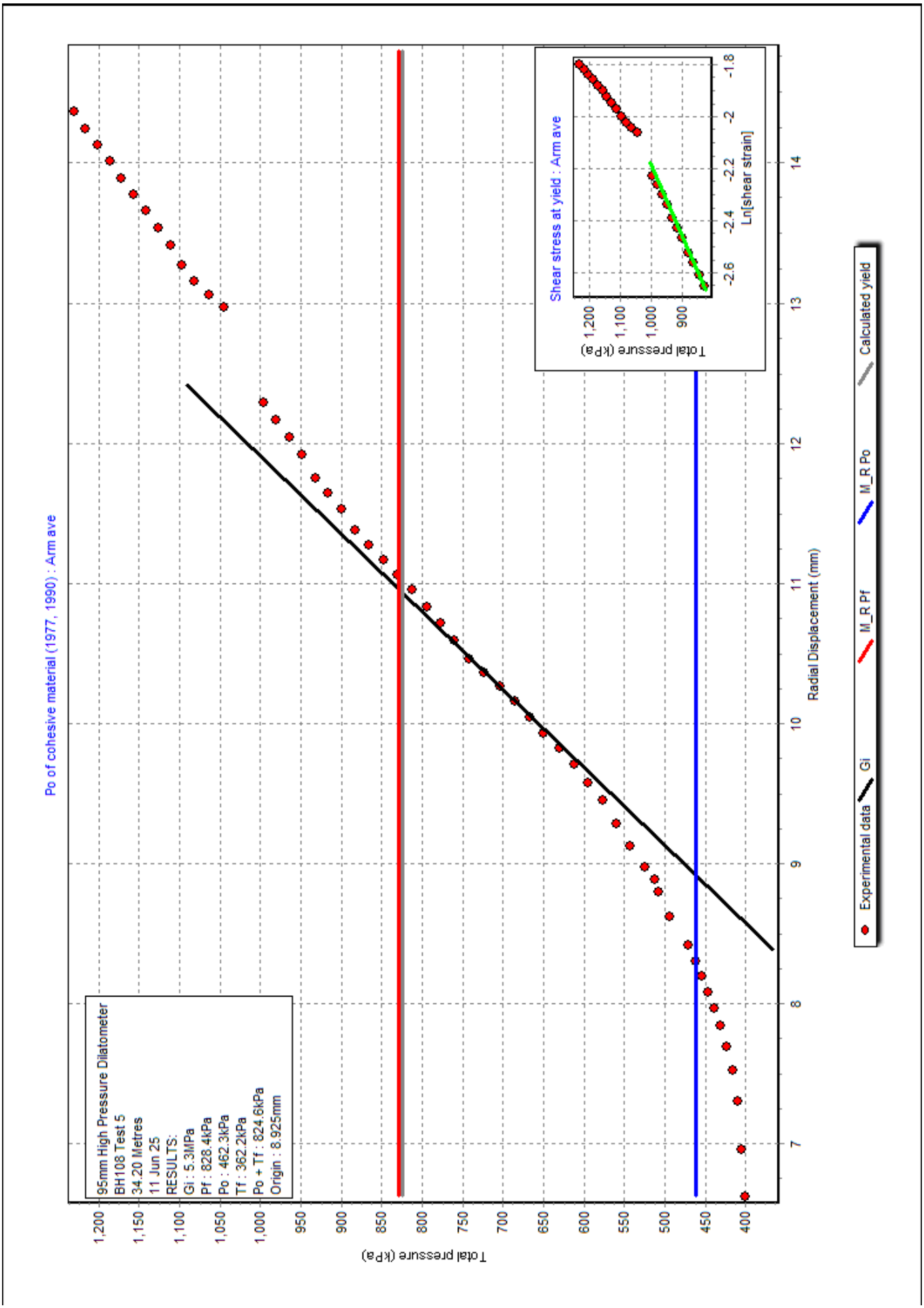
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	59.890	56.402	0.942
Arm ave	2	29.006	22.022	0.759

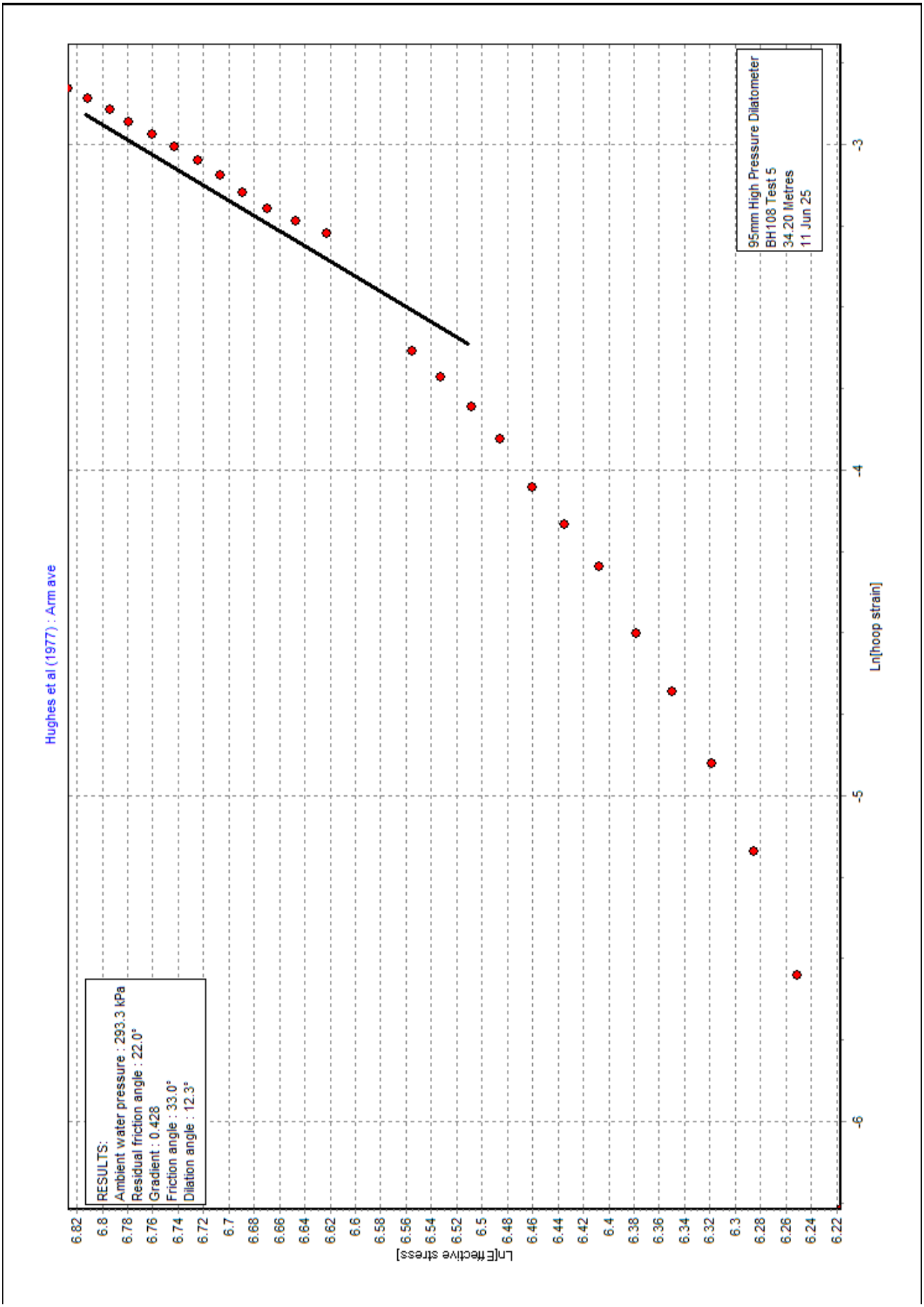
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 10.73
Po (kPa) : 417
Cohesion (kPa) : 14
Angle of peak friction (deg) : 33.0
Angle of peak dilation (deg) : 12.3
Total yield stress (kPa) : 504
Total limit stress (kPa) : 2744
G at first yield (MPa) : 36.6
Non-linear exponent : 0.942

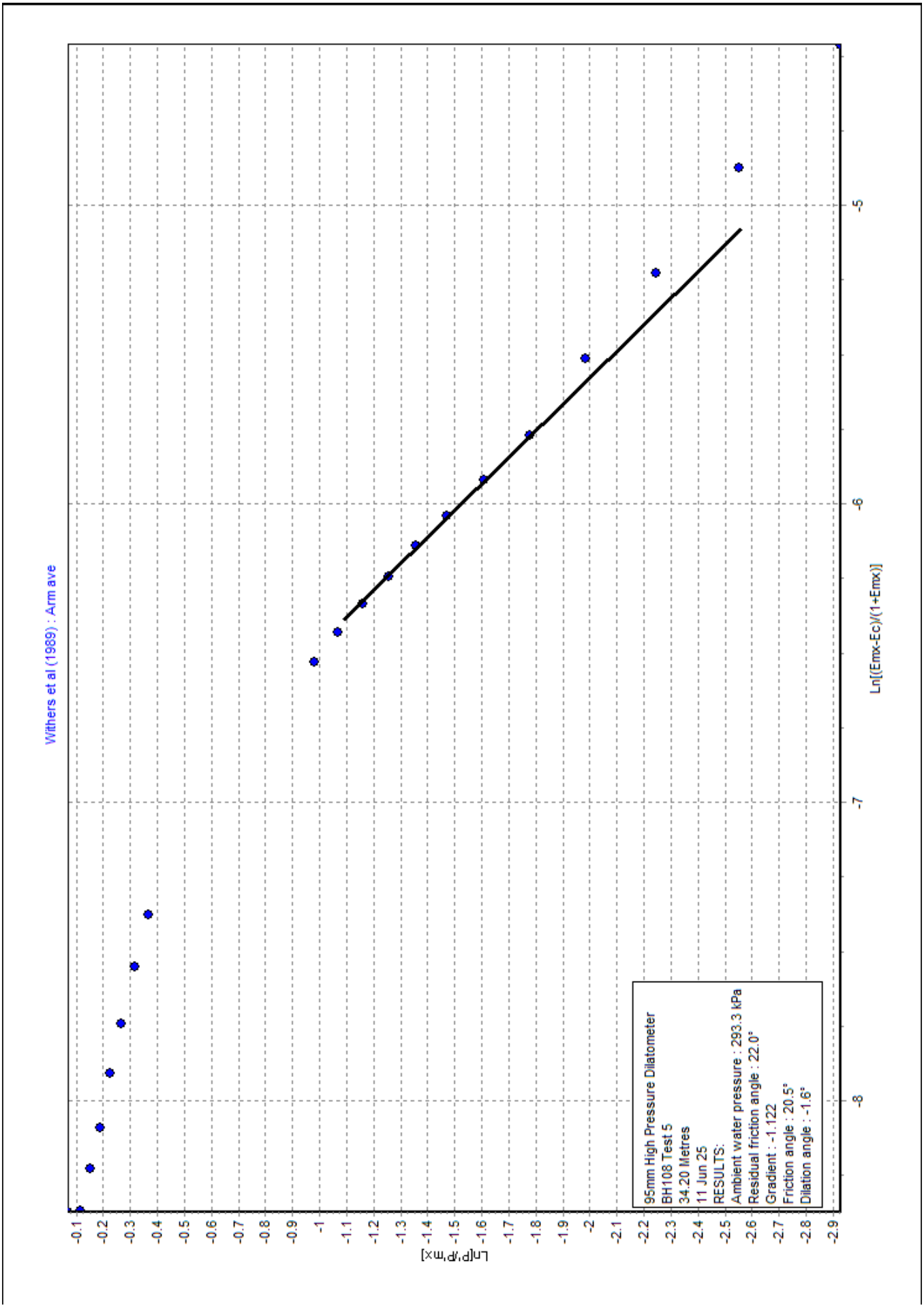
Grain to TIlbury
BH108 Test 5 - SUMMARY OF RESULTS

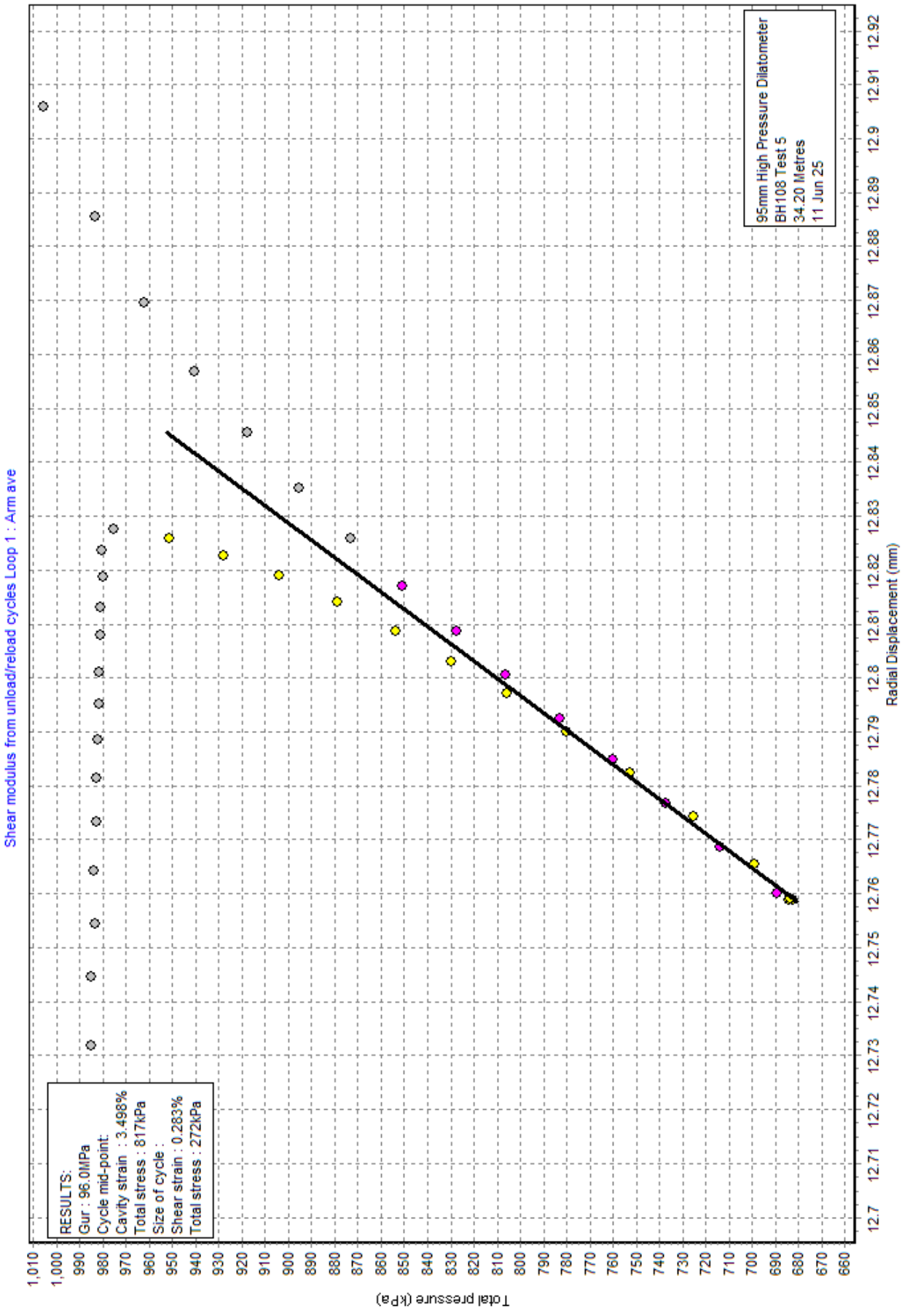
Janbu exponent	:	0.610
Correlation	:	1.000
Ambient pore water pressure (kPa)	:	293
Residual friction angle (deg)	:	22.0
Poisson's ratio	:	0.20

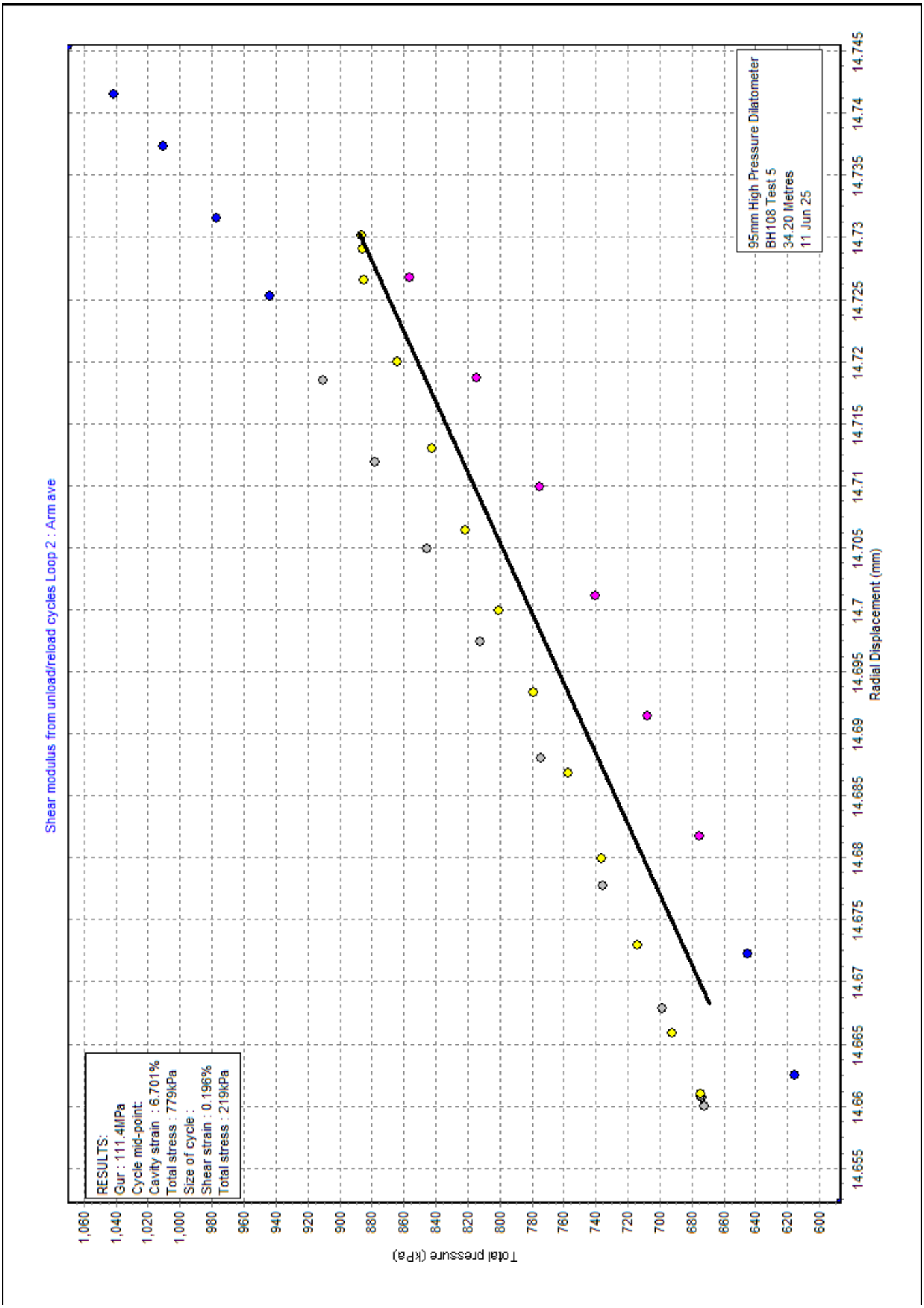

Cavity strain vs Total Pressure : Arm ave
95mm High Pressure Dilatometer
BH108 Test 5
34.20 Metres
11 Jun 25
Total pressure (kPa)
Cavity strain (%)
1,250
1,200
1,150
1,100
1,050
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
7
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
-7

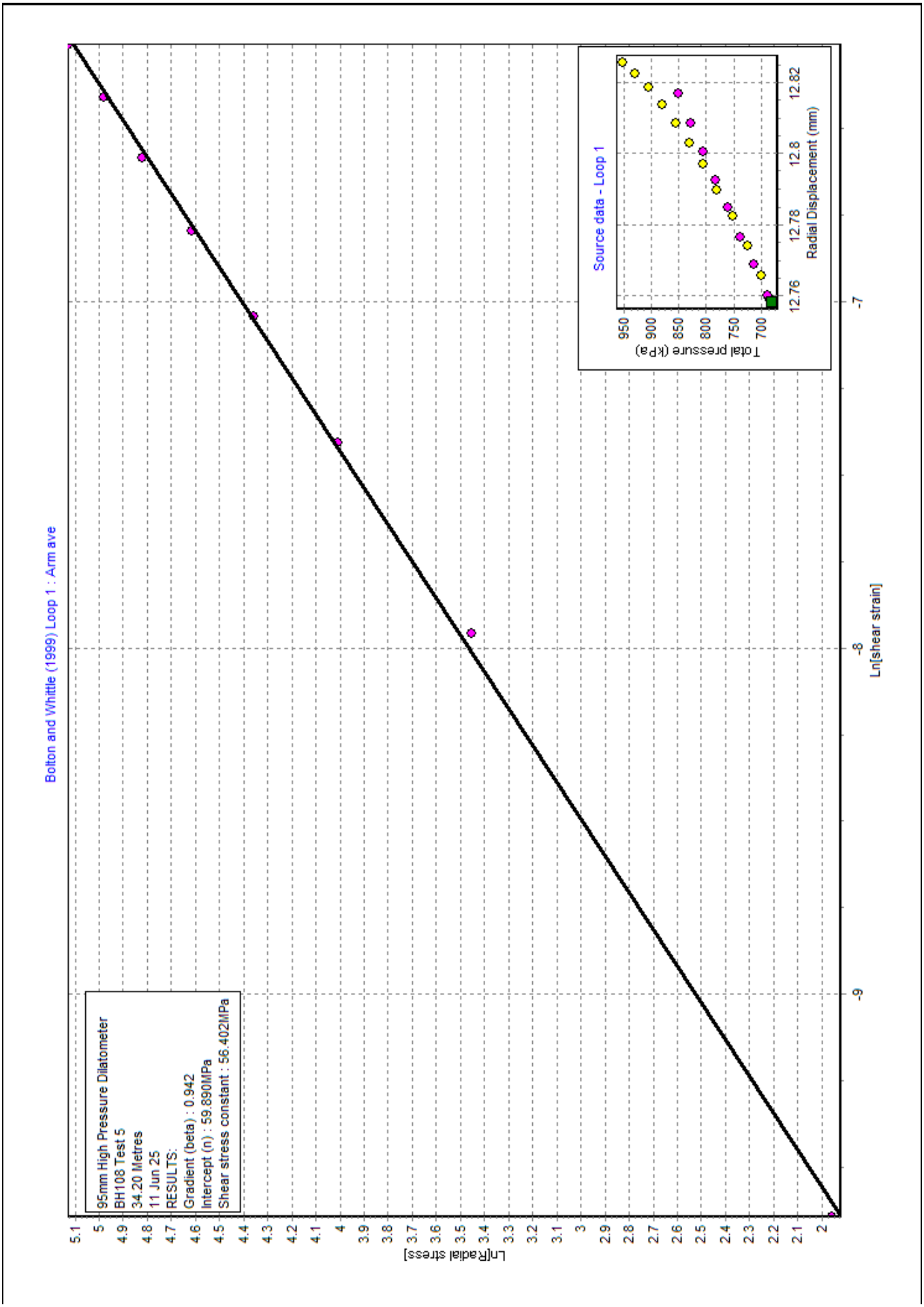

Po of cohesive material (1977, 1990) : Arm ave
95mm High Pressure Dilatometer
BH108 Test 5
34.20 Metres
11 Jun 25
RESULTS:
Gi : 5.3MPa
Pf : 828.4kPa
Po : 462.3kPa
Tf : 362.2kPa
Po + Tf : 824.6kPa
Origin : 8.925mm
Total pressure (kPa)
Radial Displacement (mm)
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Shear stress at yield : Arm ave
Total pressure (kPa)
Ln[shear strain]

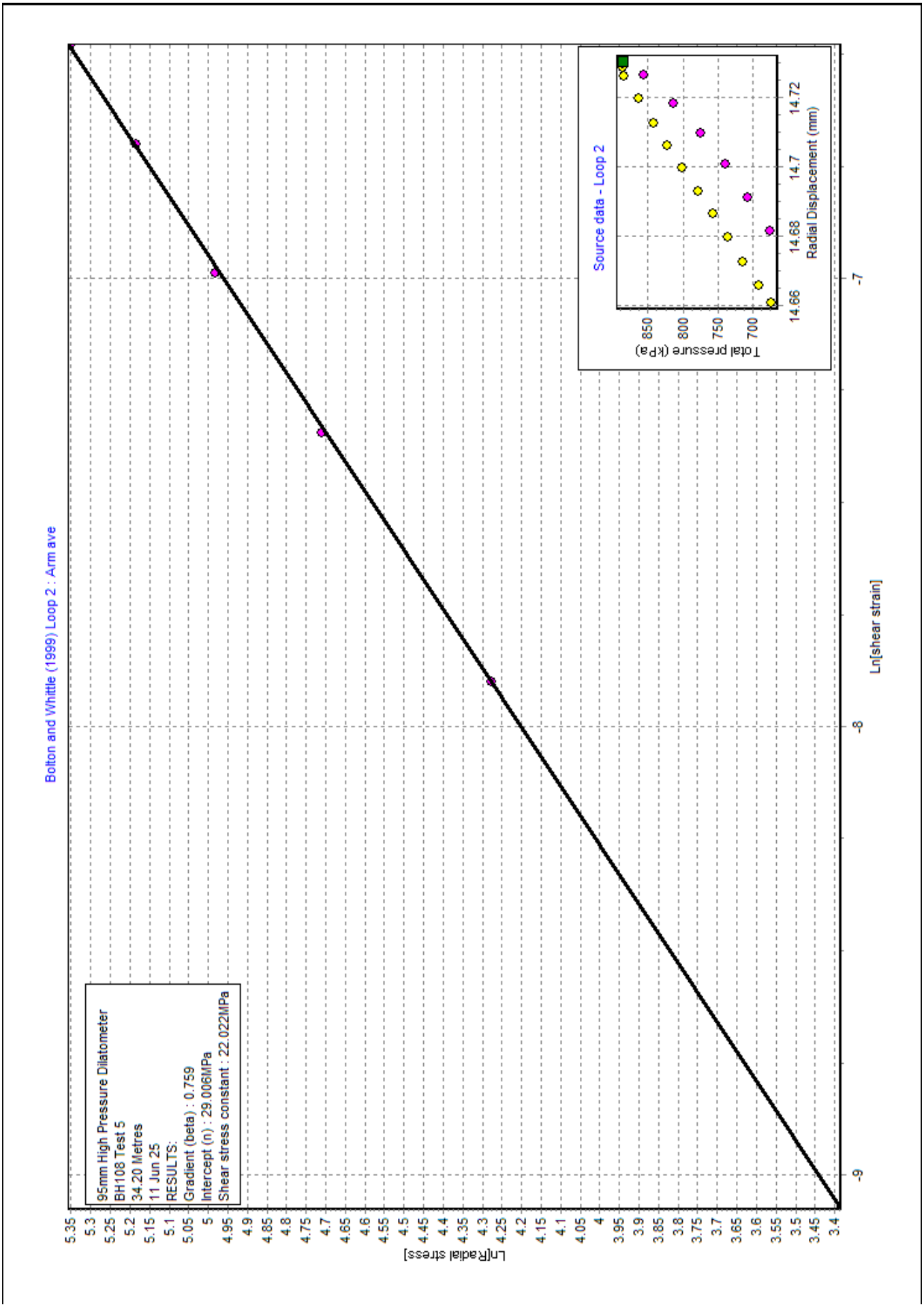

Hughes et al (1977) : Arm ave
RESULTS:
Ambient water pressure : 293.3 kPa
Residual friction angle : 22.0°
Gradient : 0.428
Friction angle : 33.0°
Dilation angle : 12.3°
95mm High Pressure Dilatometer
BH108 Test 5
34.20 Metres
11 Jun 25
Ln[Effective stress]
Ln[hoop strain]
6.82
6.8
6.78
6.76
6.74
6.72
6.7
6.68
6.66
6.64
6.62
6.6
6.58
6.56
6.54
6.52
6.5
6.48
6.46
6.44
6.42
6.4
6.38
6.36
6.34
6.32
6.3
6.28
6.26
6.24
6.22
-3
-4
-5
-6

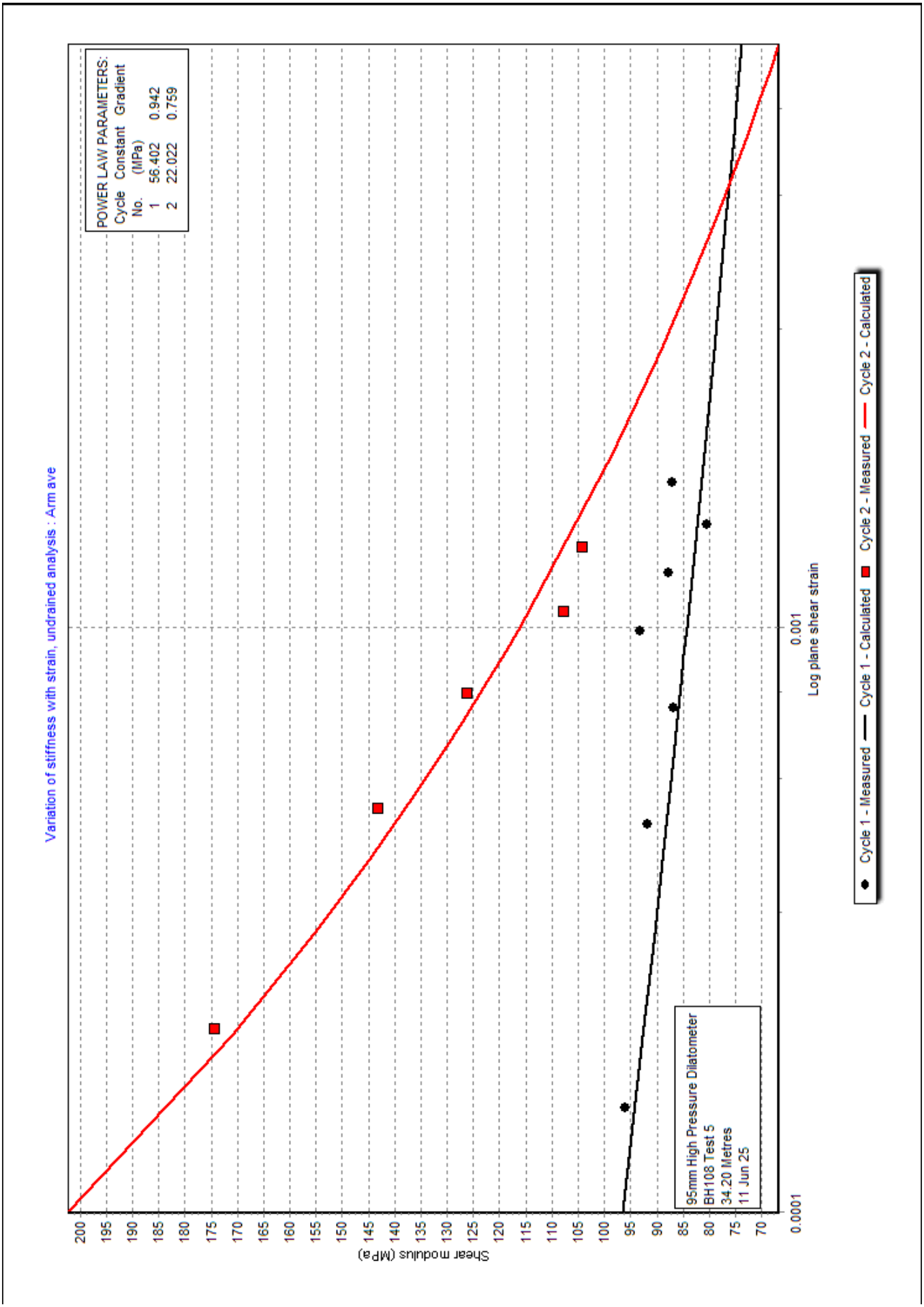

Withers et al (1989) : Arm ave
Ln[(Emx-Ec)/(1+Emx)]
Ln[P'/P'mx]
95mm High Pressure Dilatometer
BH108 Test 5
34.20 Metres
11 Jun 25
RESULTS:
Ambient water pressure : 293.3 kPa
Residual friction angle : 22.0°
Gradient : -1.122
Friction angle : 20.5°
Dilation angle : -1.6°

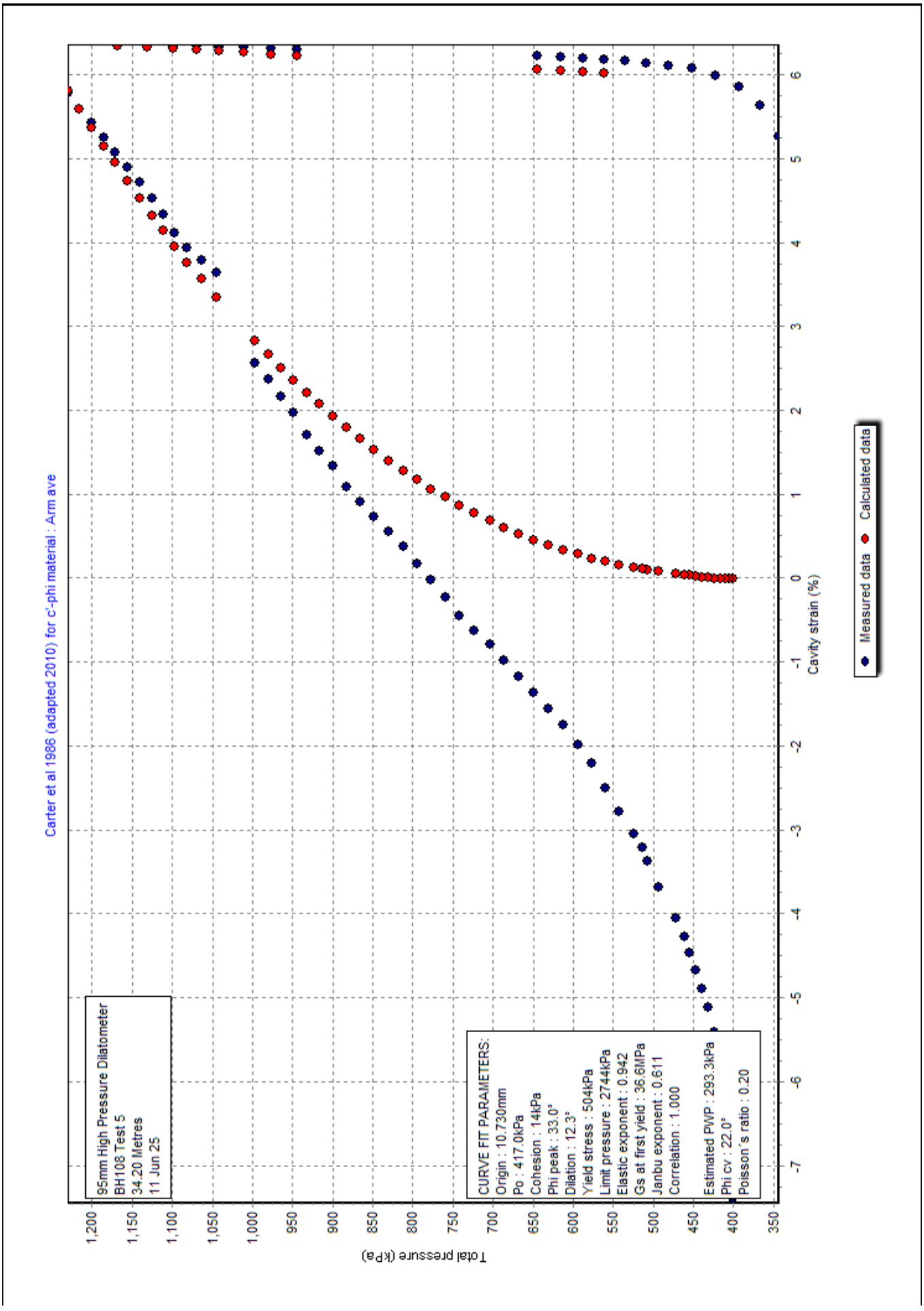

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 96.0MPa
Cycle mid-point:
Cavity strain : 3.498%
Total stress : 817kPa
Size of cycle :
Shear strain : 0.283%
Total stress : 272kPa
95mm High Pressure Dilatometer
BH108 Test 5
34.20 Metres
11 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

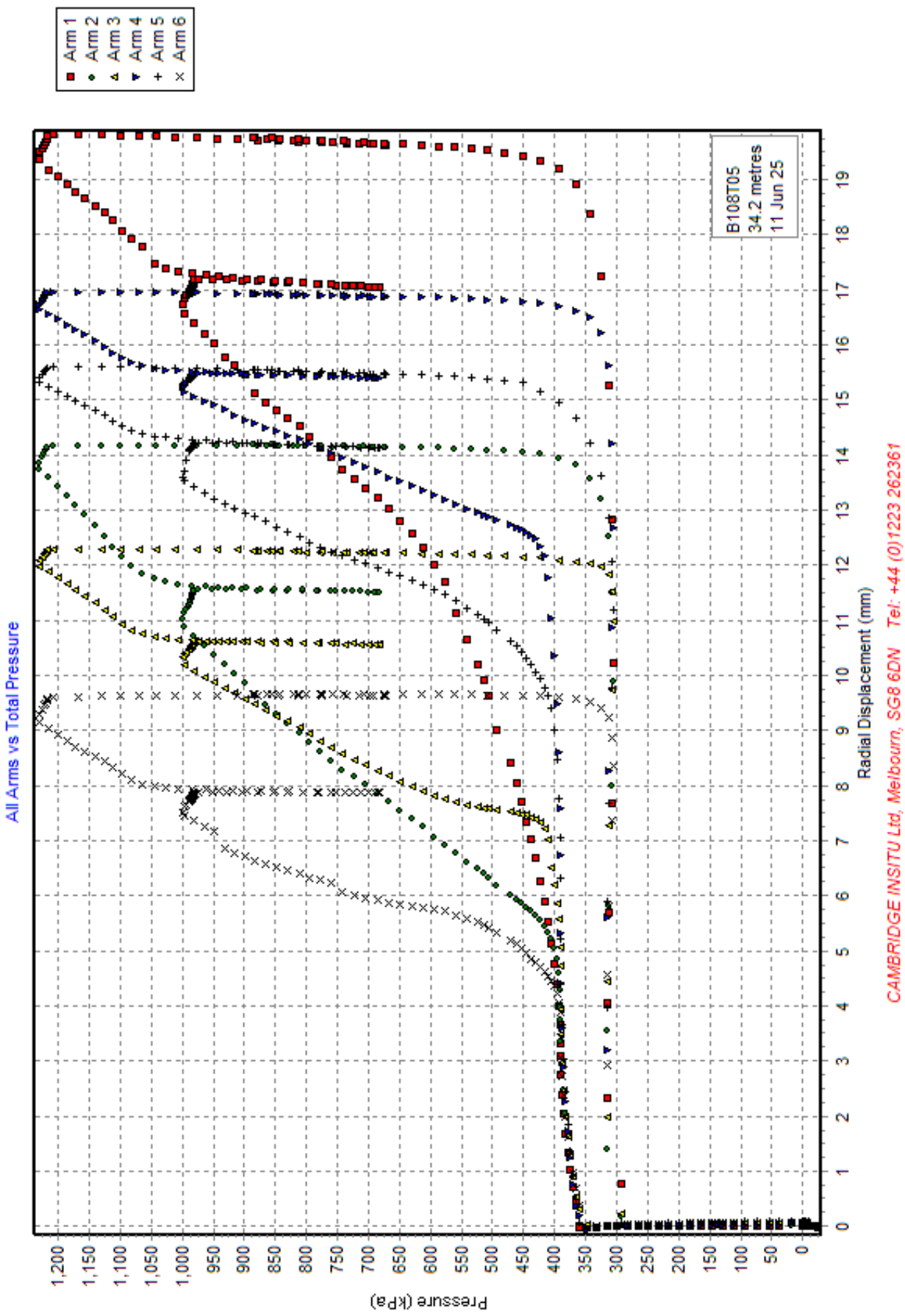

Shear modulus from unload/reload cycles Loop 2 : Arm ave
Total pressure (kPa)
Radial Displacement (mm)
95mm High Pressure Dilatometer
BH108 Test 5
34.20 Metres
11 Jun 25
RESULTS:
Gur : 111.4MPa
Cycle mid-point:
Cavity strain : 6.701%
Total stress : 779kPa
Size of cycle :
Shear strain : 0.196%
Total stress : 219kPa

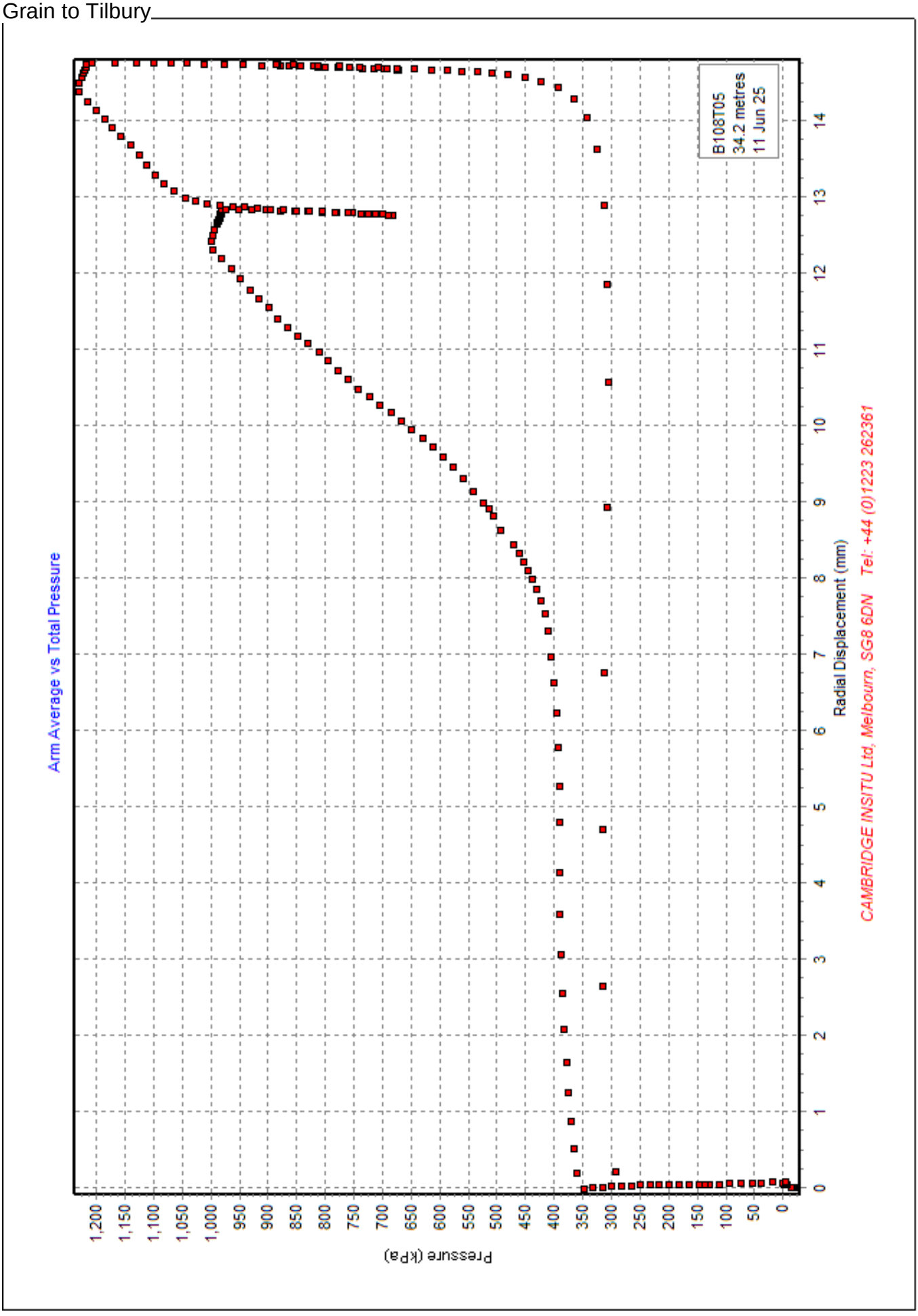

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 5
34.20 Metres
11 Jun 25
RESULTS:
Gradient (beta) : 0.942
Intercept (n) : 59.890MPa
Shear stress constant : 56.402MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

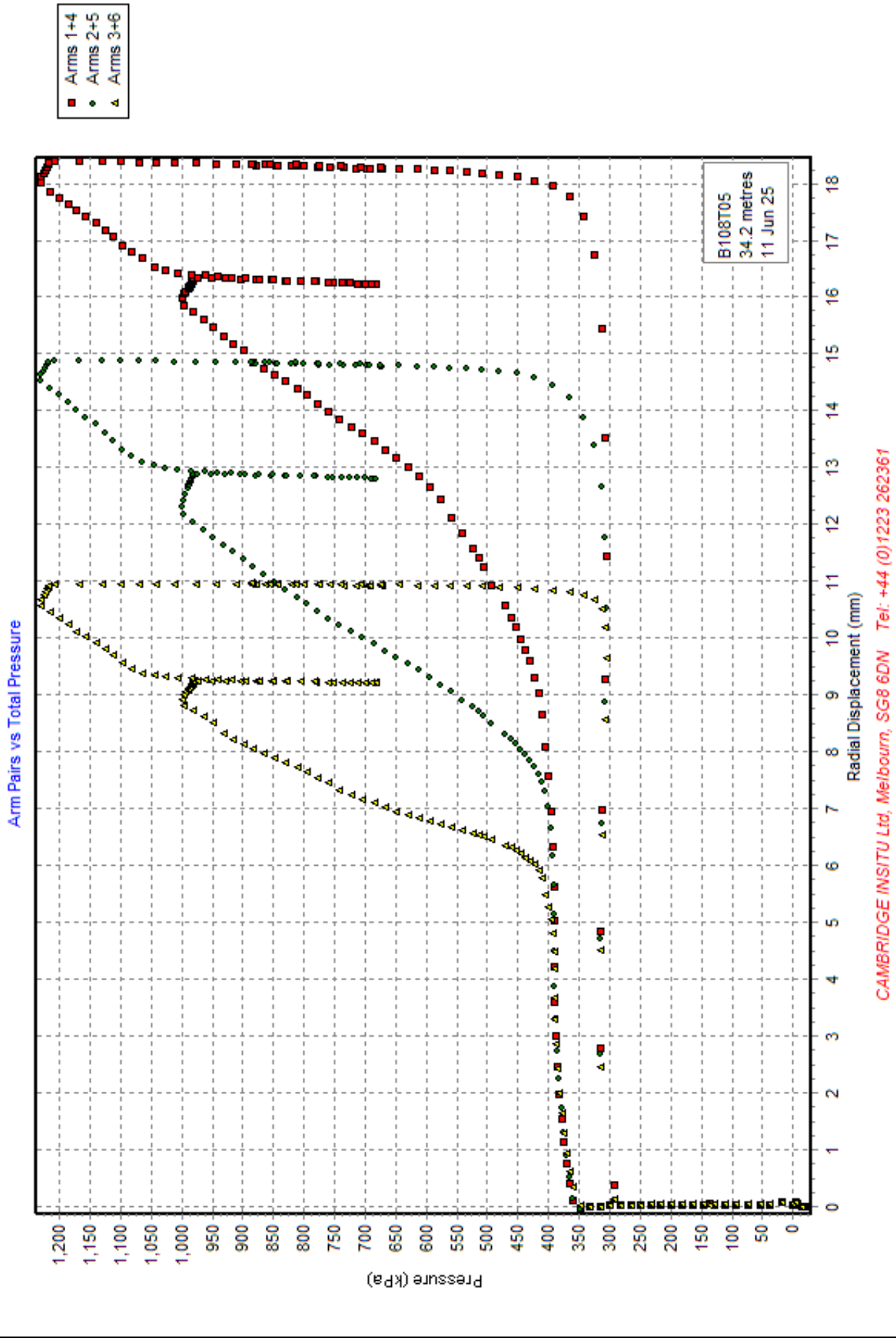

Bolton and Whittle (1999) Loop 2 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 5
34.20 Metres
11 Jun 25
RESULTS:
Gradient (beta) : 0.759
Intercept (n) : 29.006MPa
Shear stress constant : 22.022MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

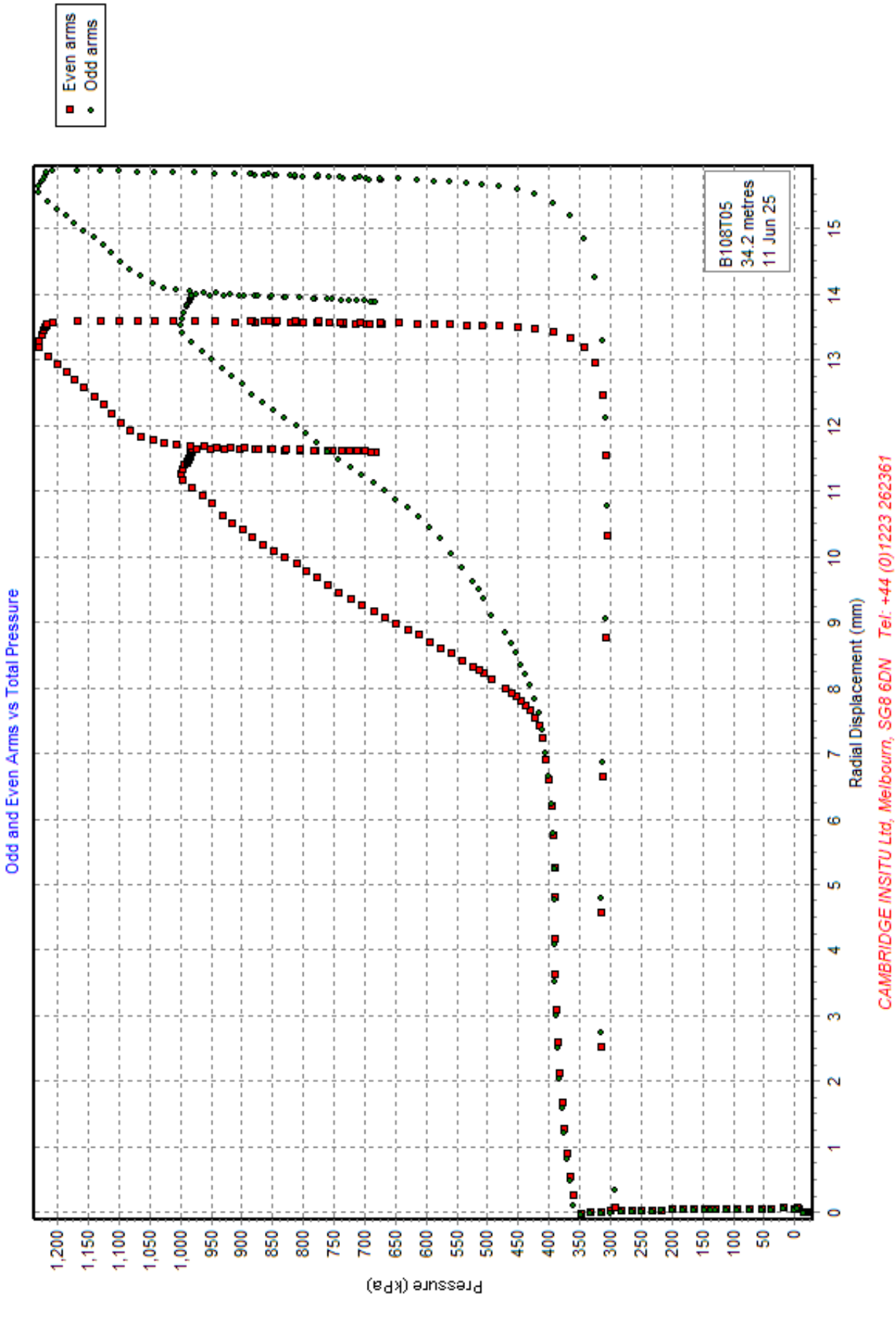

Variation of stiffness with strain, undrained analysis : Arm ave
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 56.402 0.942
2 22.022 0.759
Shear modulus (MPa)
Log plane shear strain
0.0001
0.001
95mm High Pressure Dilatometer
BH108 Test 5
34.20 Metres
11 Jun 25
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated


Carter et al 1986 (adapted 2010) for c'-phi material : Arm ave
95mm High Pressure Dilatometer
BH108 Test 5
34.20 Metres
11 Jun 25
CURVE FIT PARAMETERS:
Origin : 10.730mm
Po : 417.0kPa
Cohesion : 14kPa
Phi peak : 33.0°
Dilation : 12.3°
Yield stress : 504kPa
Limit pressure : 2744kPa
Elastic exponent : 0.942
Gs at first yield : 36.6MPa
Janbu exponent : 0.611
Correlation : 1.000
Estimated PWP : 293.3kPa
Phi cv : 22.0°
Poisson's ratio : 0.20
Total pressure (kPa)
Cavity strain (%)
Measured data
Calculated data


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
B108T05
34.2 metres
11 Jun 25
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
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Arm Average vs Total Pressure
Pressure (kPa)
1,200
1,150
1,100
1,050
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
Radial Displacement (mm)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
B108T05
34.2 metres
11 Jun 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arms 1+4
Arms 2+5
Arms 3+6
B108T05
34.2 metres
11 Jun 25
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
B108T05
34.2 metres
11 Jun 25
Odd and Even Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to TIlbury
BH108 Test 6 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Grain to Tilbury
Borehole : BH108
Test name : BH108 Test 6
Test date : 11 Jun 25
Test depth : 36.40 Metres
Water table : 4.31 Metres
Ambient PWP : 314.8 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDB/SDP/RW on 20 Jul 25

Remarks:

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=2.69"
Po from Marsland & Randolph (kPa) : "Arm ave=918.1"
Best estimate of Po (kPa) : "Arm ave=775.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=1887.4"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 32.0
Angle of internal friction (°) : "Arm ave=31.9"
Dilation angle (°) : "Arm ave=-0.1"
Gradient of log-log plot : "Arm ave=0.345"

[Withers et al 1989]
Angle of internal friction (°) : "Arm ave=31.8"
Dilation angle (°) : "Arm ave=-0.2"
Gradient of log-log plot : "Arm ave=-2.243"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=61.6"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	208.1	-0.079	948	0.167	347
Arm ave	2	380.8	0.659	1543	0.148	565
Arm ave	3	458.3	2.600	2219	0.138	635
Arm ave	4	305.0	4.240	1308	0.275	839

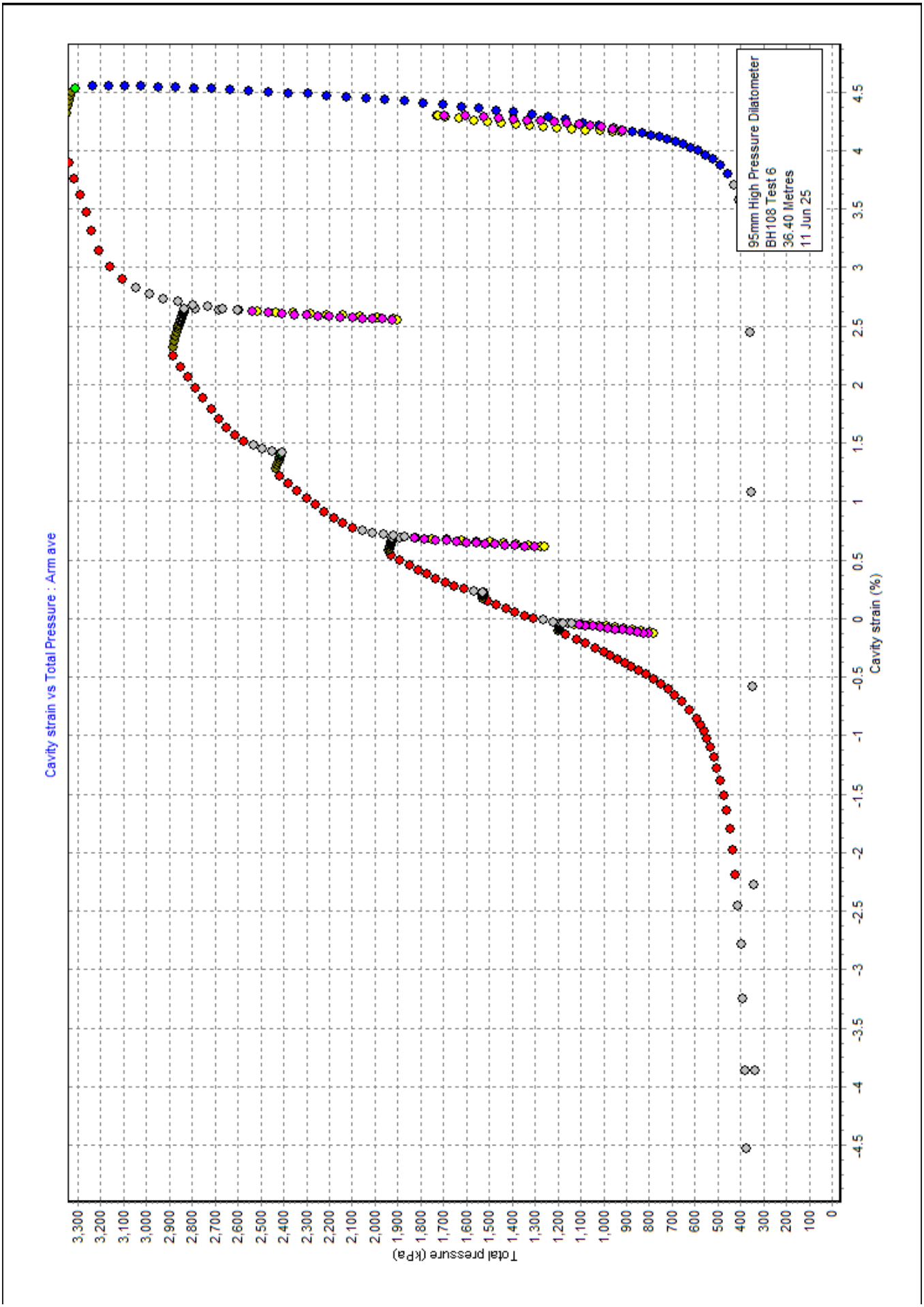
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

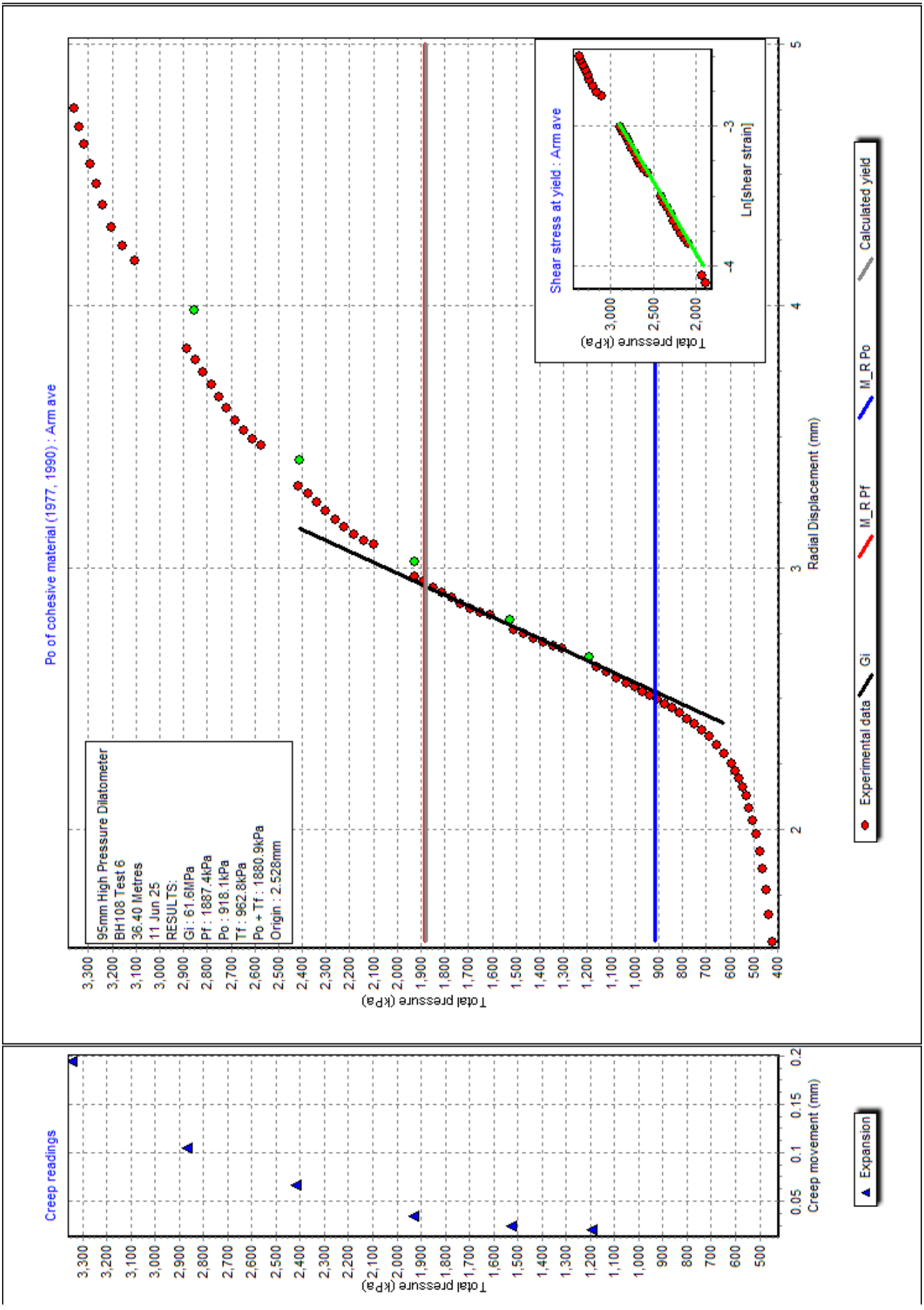
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	129.245	120.361	0.931
Arm ave	2	123.108	101.288	0.823
Arm ave	3	141.254	114.883	0.813
Arm ave	4	61.672	43.959	0.713

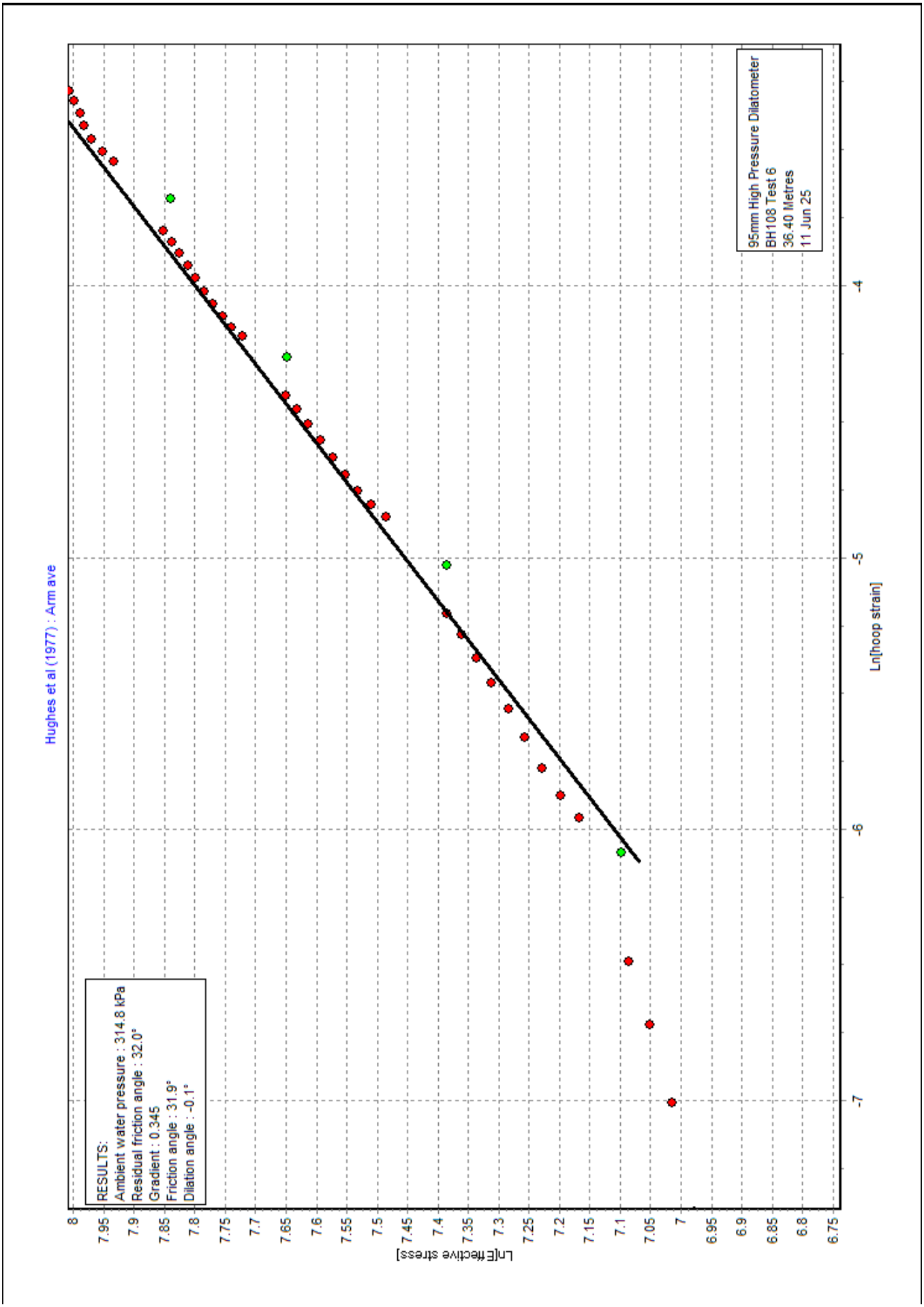
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 2.69
Po (kPa) : 775
Cohesion (kPa) : 65
Angle of peak friction (deg) : 31.9
Angle of peak dilation (deg) : -0.1
Total yield stress (kPa) : 1193

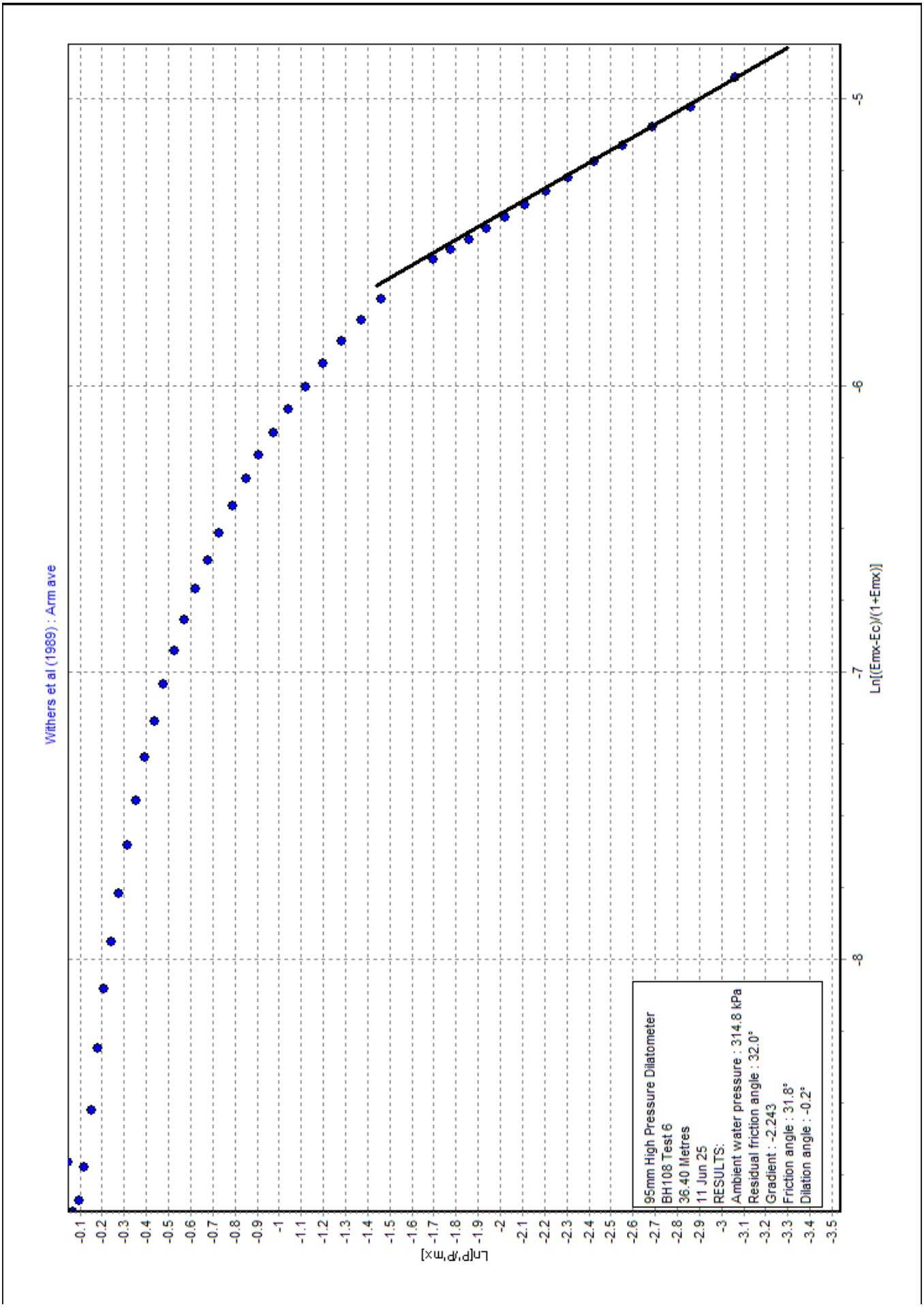
Grain to TIlbury
BH108 Test 6 - SUMMARY OF RESULTS

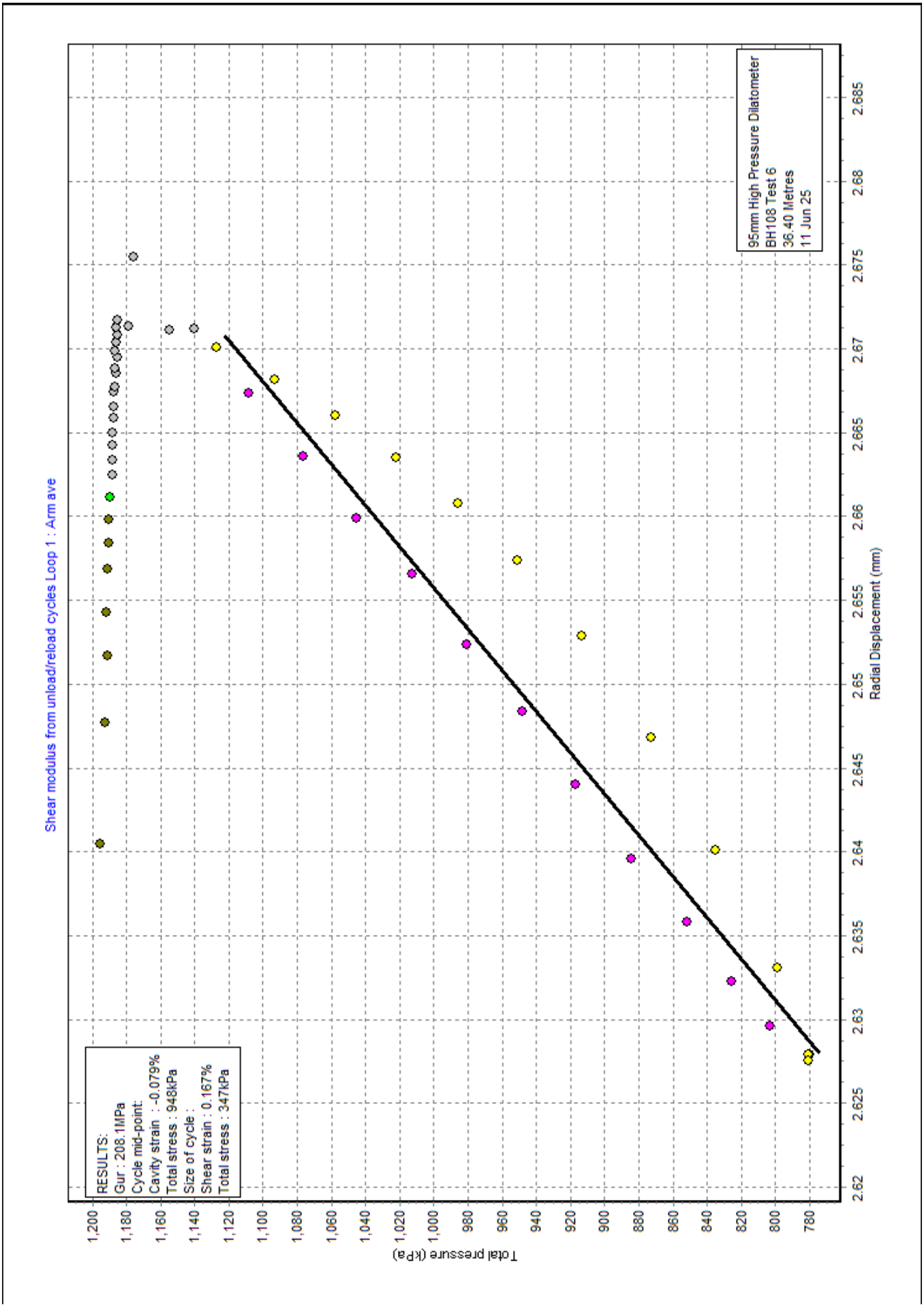
Total limit stress (kPa)	:	7633
G at first yield (MPa)	:	189.2
Non-linear exponent	:	0.813
Janbu exponent	:	0.536
Correlation	:	0.796
Ambient pore water pressure (kPa)	:	315
Residual friction angle (deg)	:	32.0
Poisson's ratio	:	0.20

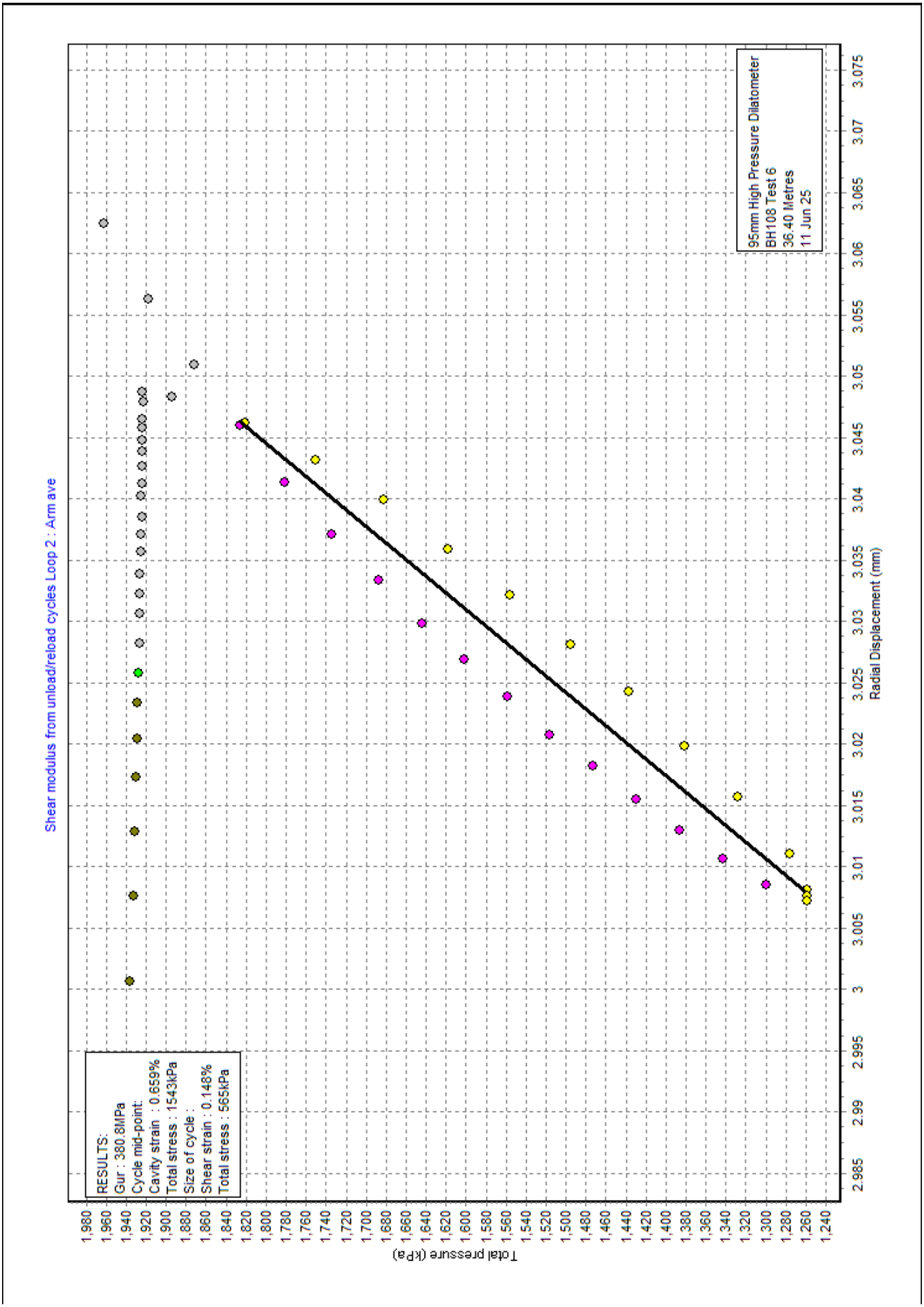

Cavity strain vs Total Pressure : Arm ave
95mm High Pressure Dilatometer
BH108 Test 6
36.40 Metres
11 Jun 25
Total pressure (kPa)
Cavity strain (%)

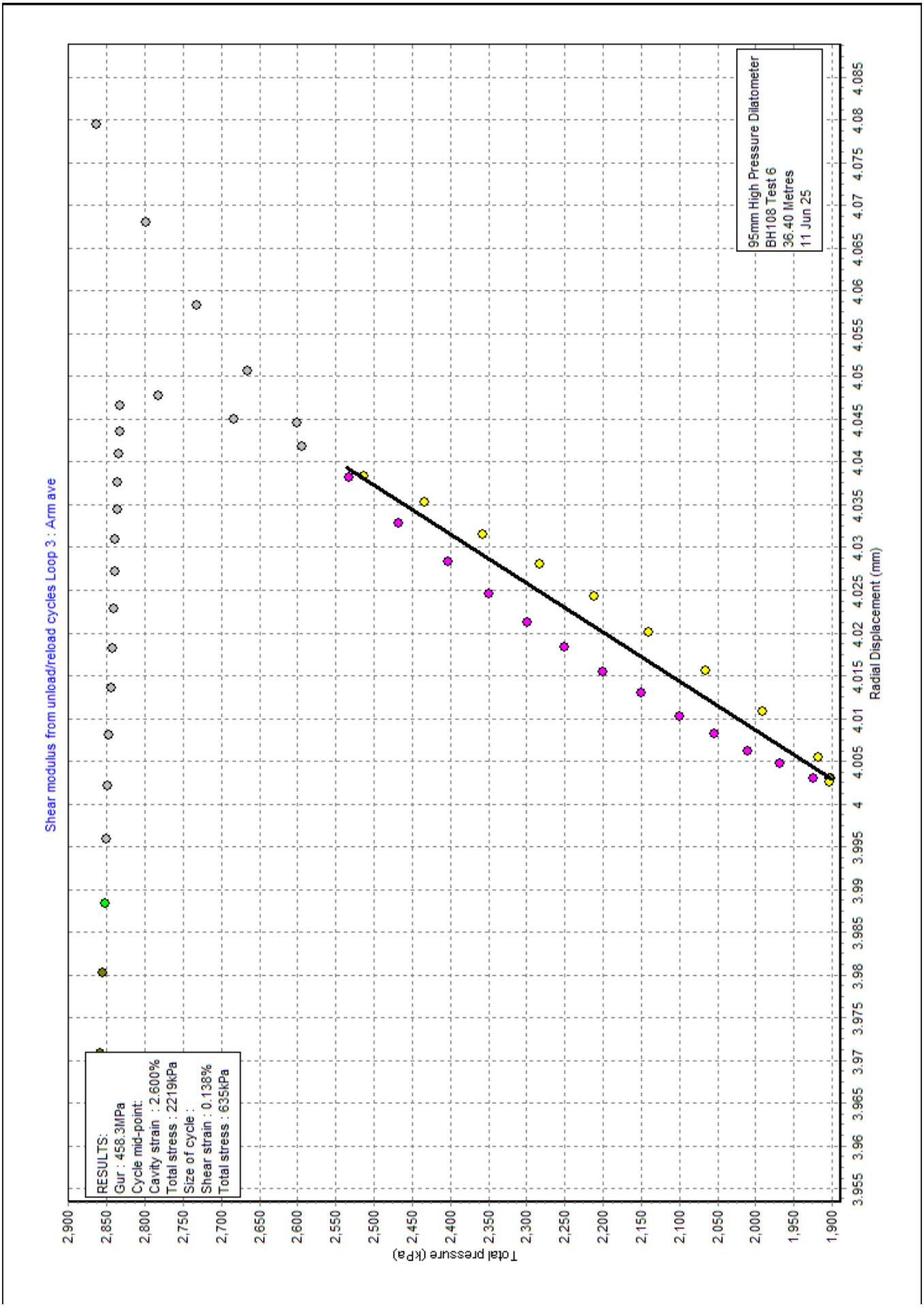

Po of cohesive material (1977, 1990) : Arm ave
95mm High Pressure Dilatometer
BH108 Test 6
36.40 Metres
11 Jun 25
RESULTS:
Gi : 61.6MPa
Pf : 1887.4kPa
Po : 918.1kPa
Tf : 962.8kPa
Po + Tf : 1880.9kPa
Origin : 2.528mm
Total pressure (kPa)
Radial Displacement (mm)
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Shear stress at yield : Arm ave
Total pressure (kPa)
Ln[shear strain]
Creep readings
Total pressure (kPa)
Creep movement (mm)
Expansion

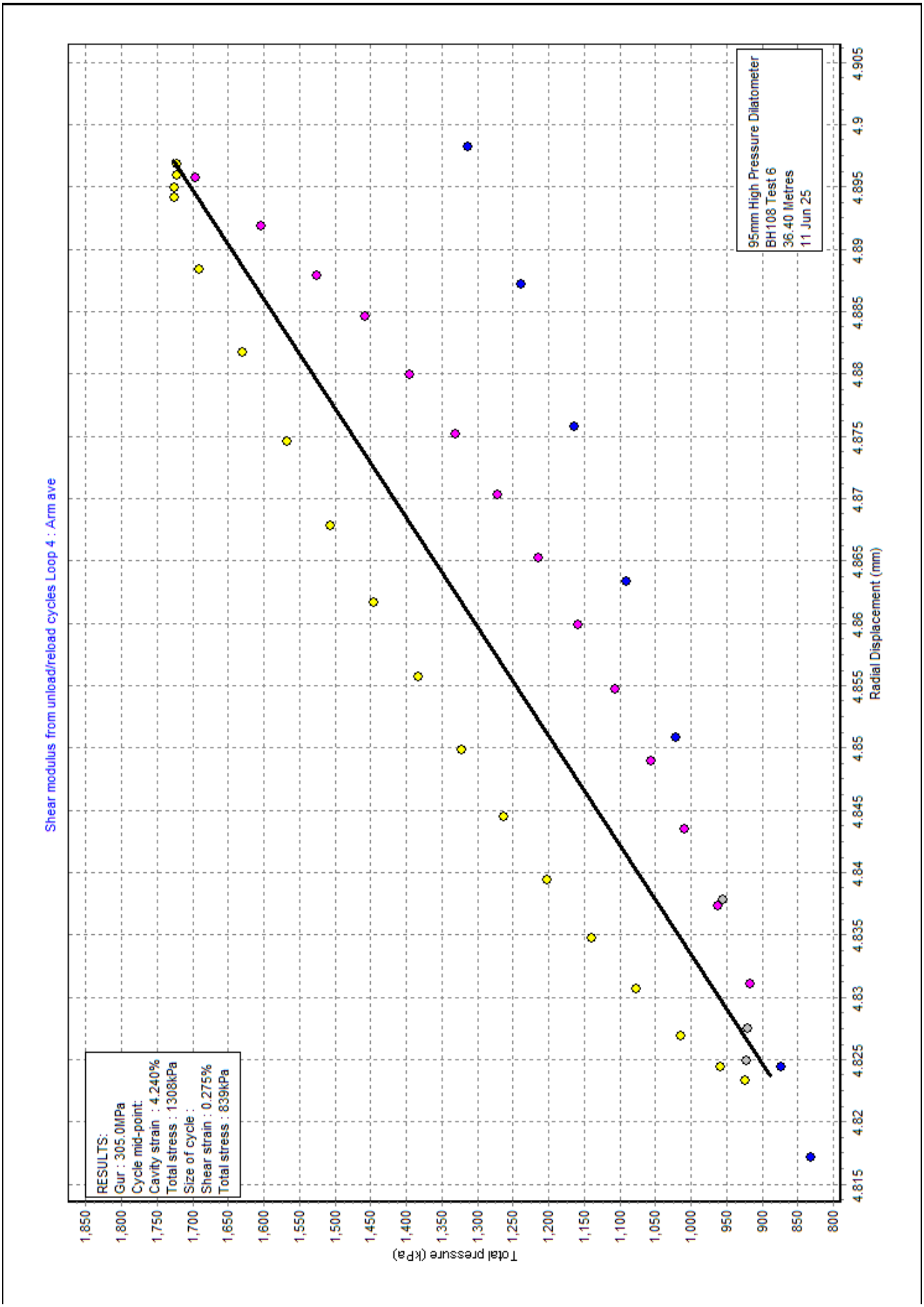

Hughes et al (1977) : Arm ave
RESULTS:
Ambient water pressure : 314.8 kPa
Residual friction angle : 32.0°
Gradient : 0.345
Friction angle : 31.9°
Dilation angle : -0.1°
95mm High Pressure Dilatometer
BH108 Test 6
36.40 Metres
11 Jun 25
Ln[Effective stress]
Ln[hoop strain]
8
7.95
7.9
7.85
7.8
7.75
7.7
7.65
7.6
7.55
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
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7.05
7
6.95
6.9
6.85
6.8
6.75
-4
-5
-6
-7

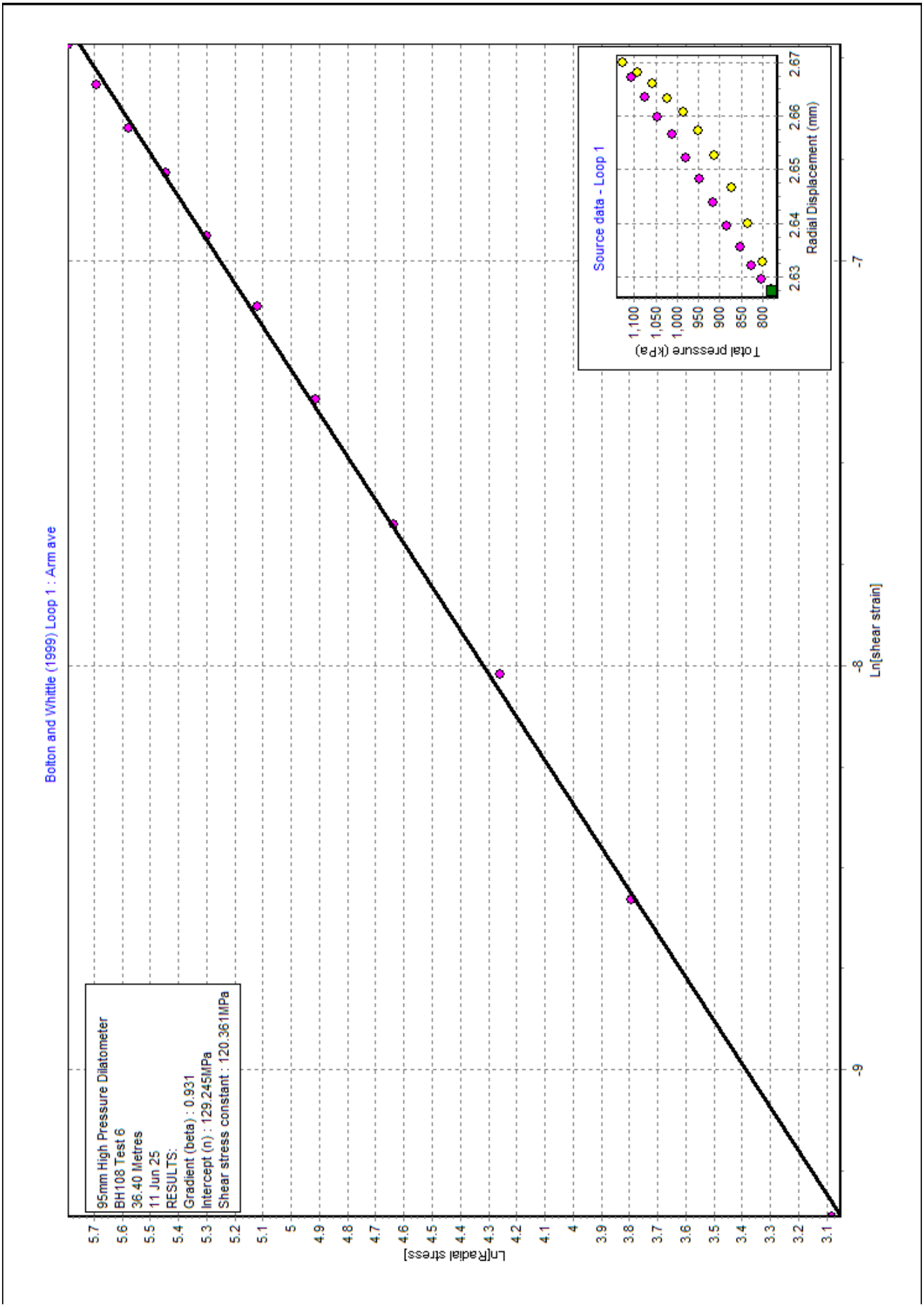

Withers et al (1989) : Arm ave
Ln[(Emx-Ec)/(1+Emx)]
Ln[P'/P'mx]
95mm High Pressure Dilatometer
BH108 Test 6
36.40 Metres
11 Jun 25
RESULTS:
Ambient water pressure : 314.8 kPa
Residual friction angle : 32.0°
Gradient : -2.243
Friction angle : 31.8°
Dilation angle : -0.2°

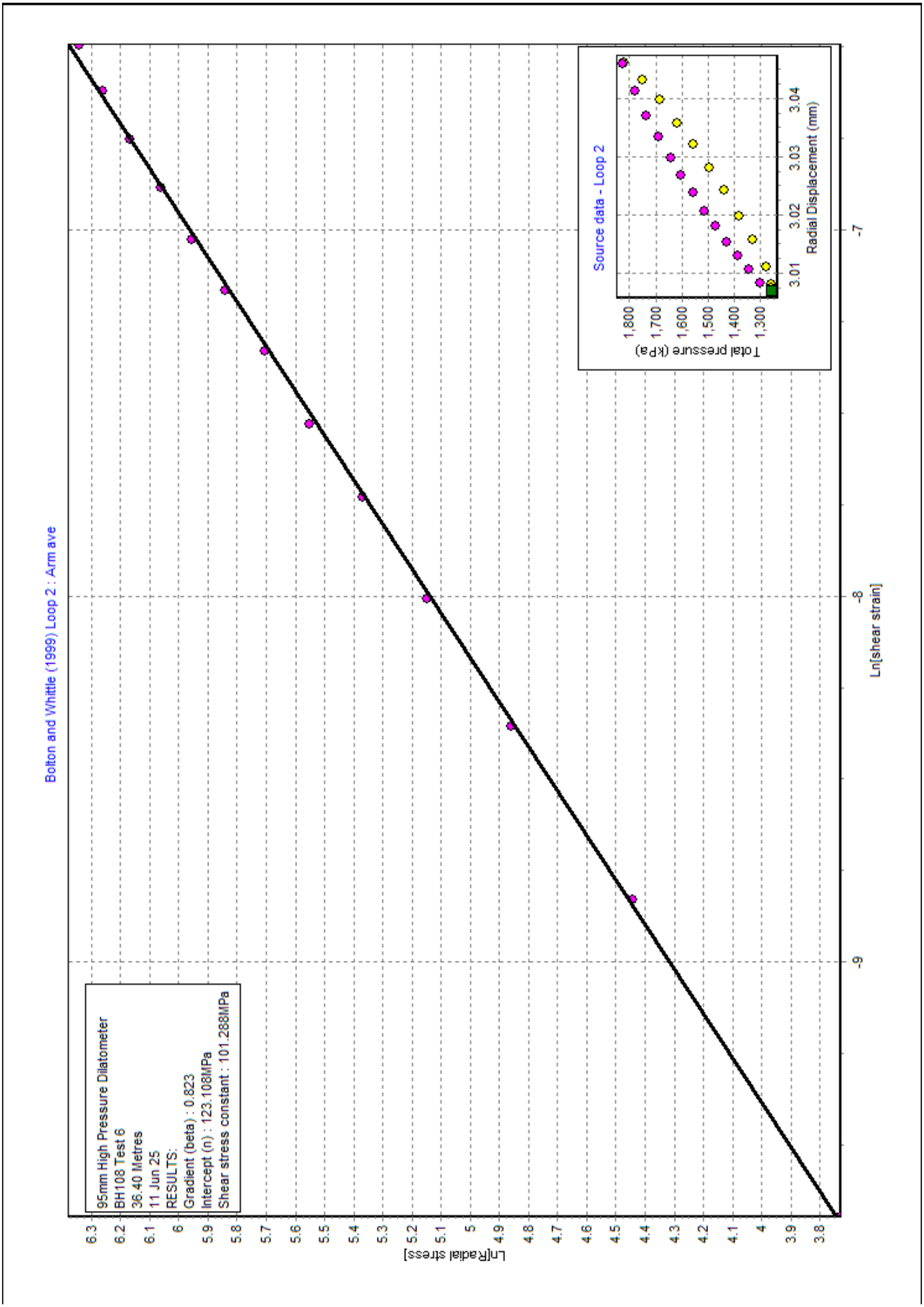

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 208.1MPa
Cycle mid-point:
Cavity strain : -0.079%
Total stress : 948kPa
Size of cycle :
Shear strain : 0.167%
Total stress : 347kPa
95mm High Pressure Dilatometer
BH108 Test 6
36.40 Metres
11 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

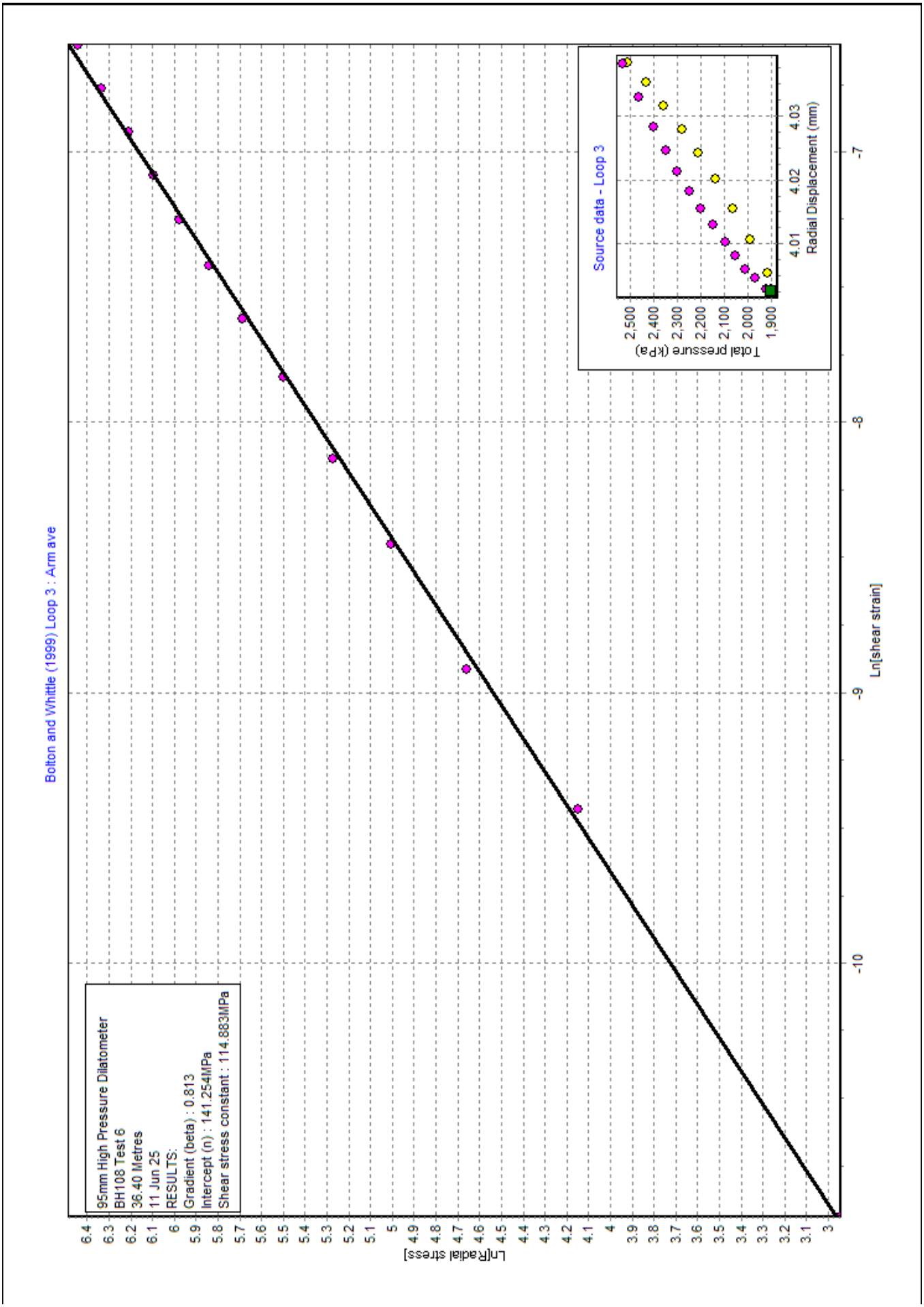

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 380.8MPa
Cycle mid-point:
Cavity strain : 0.659%
Total stress : 1543kPa
Size of cycle :
Shear strain : 0.148%
Total stress : 565kPa
95mm High Pressure Dilatometer
BH108 Test 6
36.40 Metres
11 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

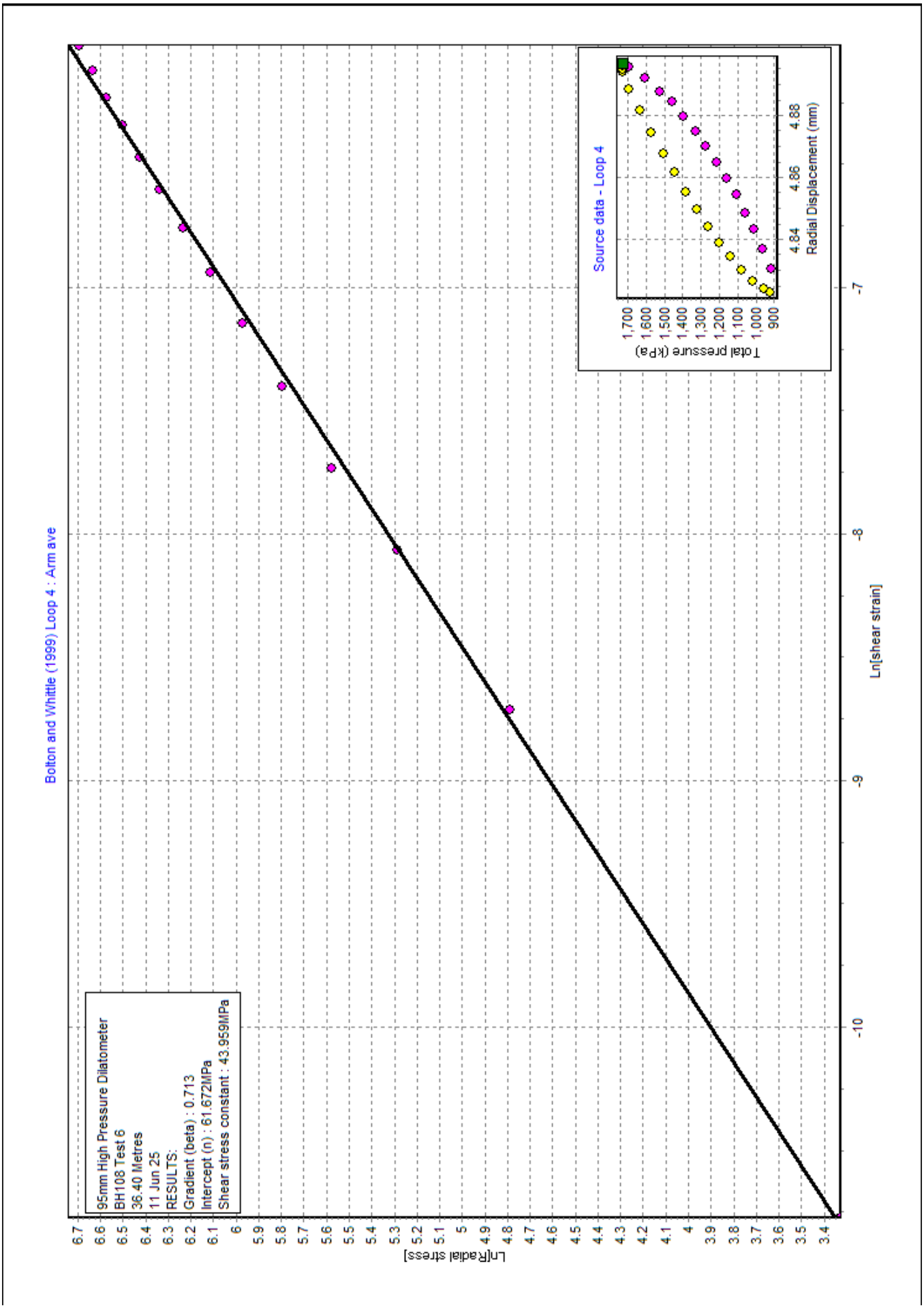

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 458.3MPa
Cycle mid-point:
Cavity strain : 2.600%
Total stress : 2219kPa
Size of cycle :
Shear strain : 0.138%
Total stress : 635kPa
95mm High Pressure Dilatometer
BH108 Test 6
36.40 Metres
11 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

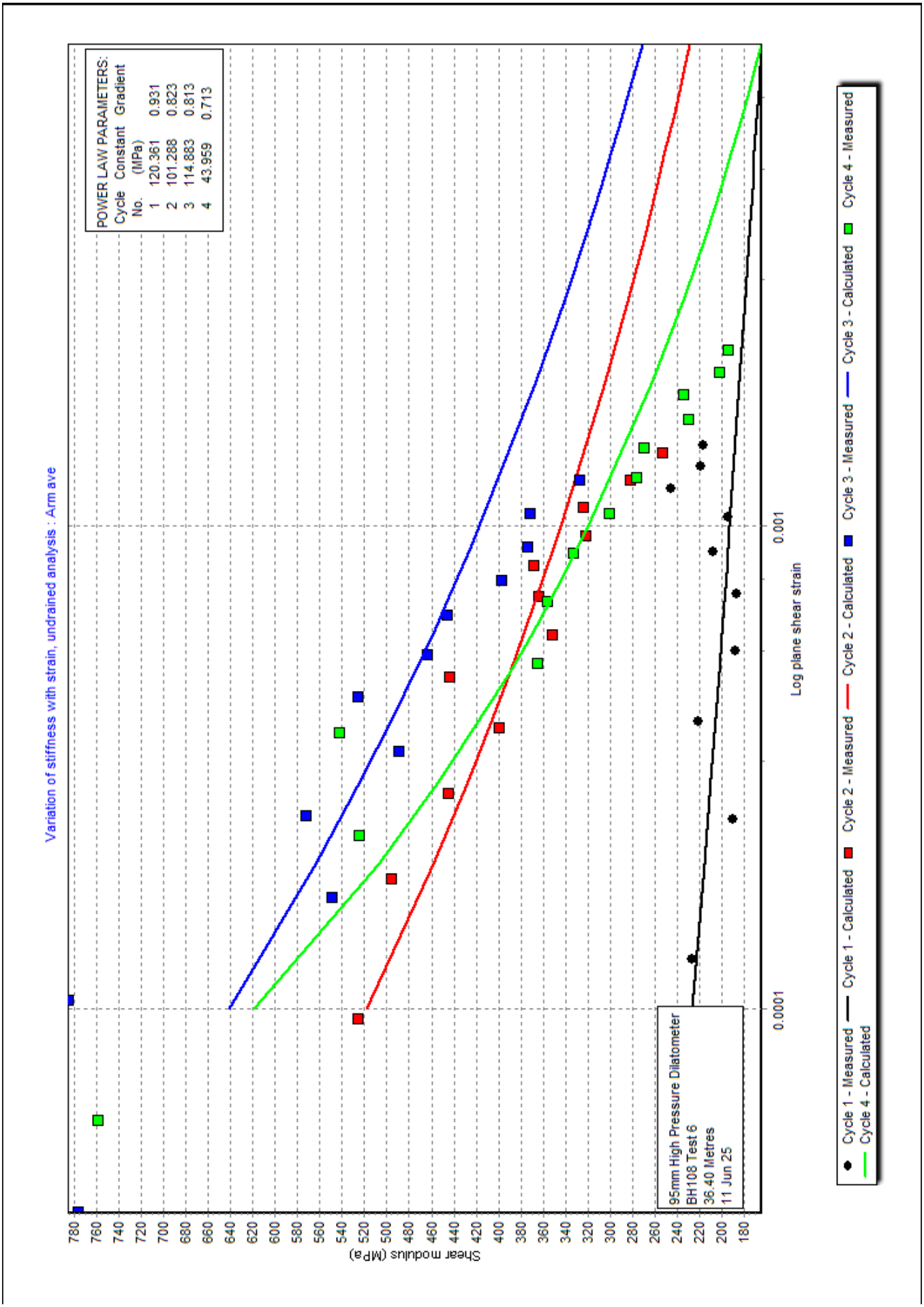

Shear modulus from unload/reload cycles Loop 4 : Arm ave
RESULTS:
Gur : 305.0MPa
Cycle mid-point:
Cavity strain : 4.240%
Total stress : 1308kPa
Size of cycle :
Shear strain : 0.275%
Total stress : 839kPa
95mm High Pressure Dilatometer
BH108 Test 6
36.40 Metres
11 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

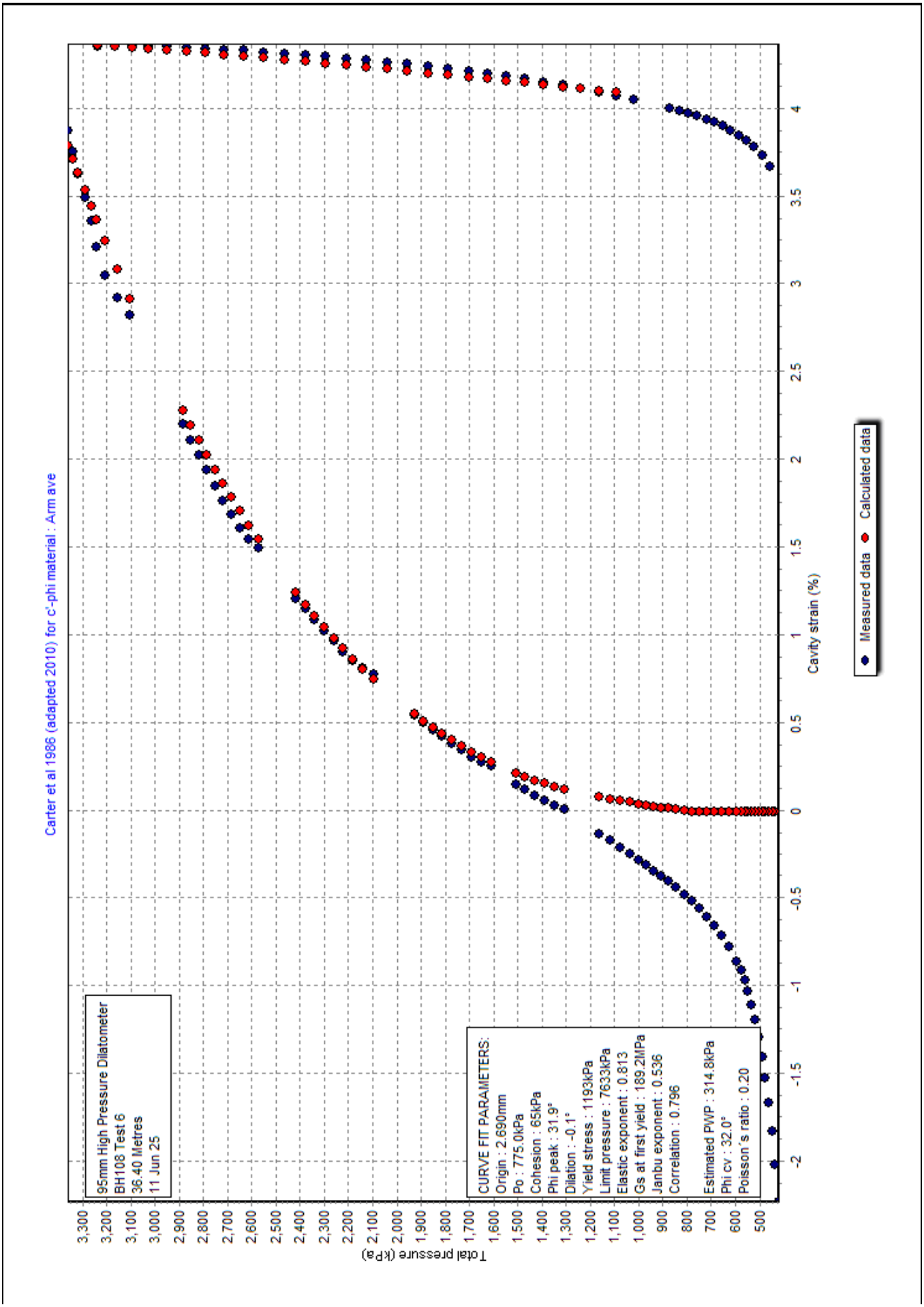

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 6
36.40 Metres
11 Jun 25
RESULTS:
Gradient (beta) : 0.931
Intercept (n) : 129.245MPa
Shear stress constant : 120.361MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

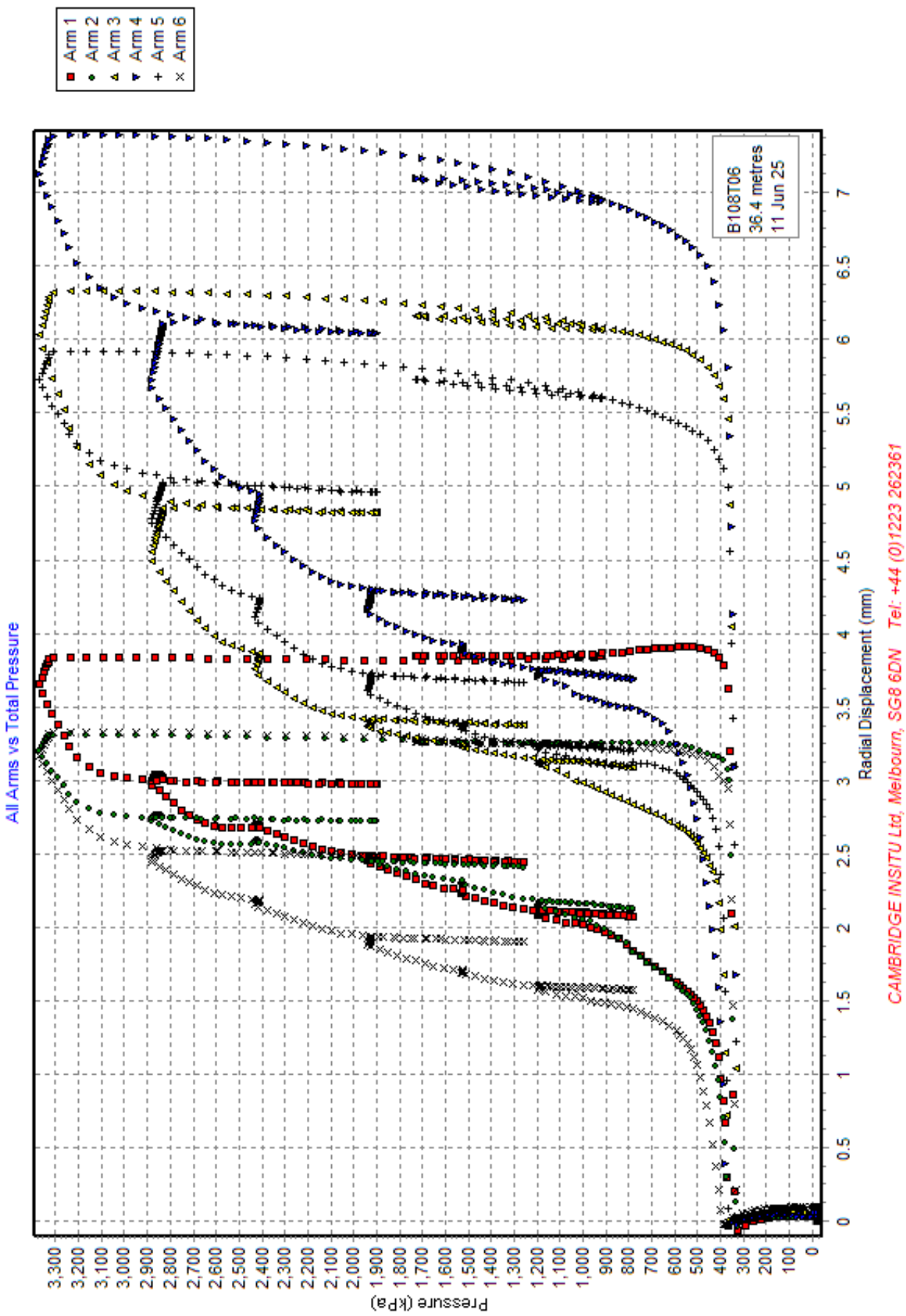

Bolton and Whittle (1999) Loop 2 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 6
36.40 Metres
11 Jun 25
RESULTS:
Gradient (beta) : 0.823
Intercept (n) : 123.108MPa
Shear stress constant : 101.288MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

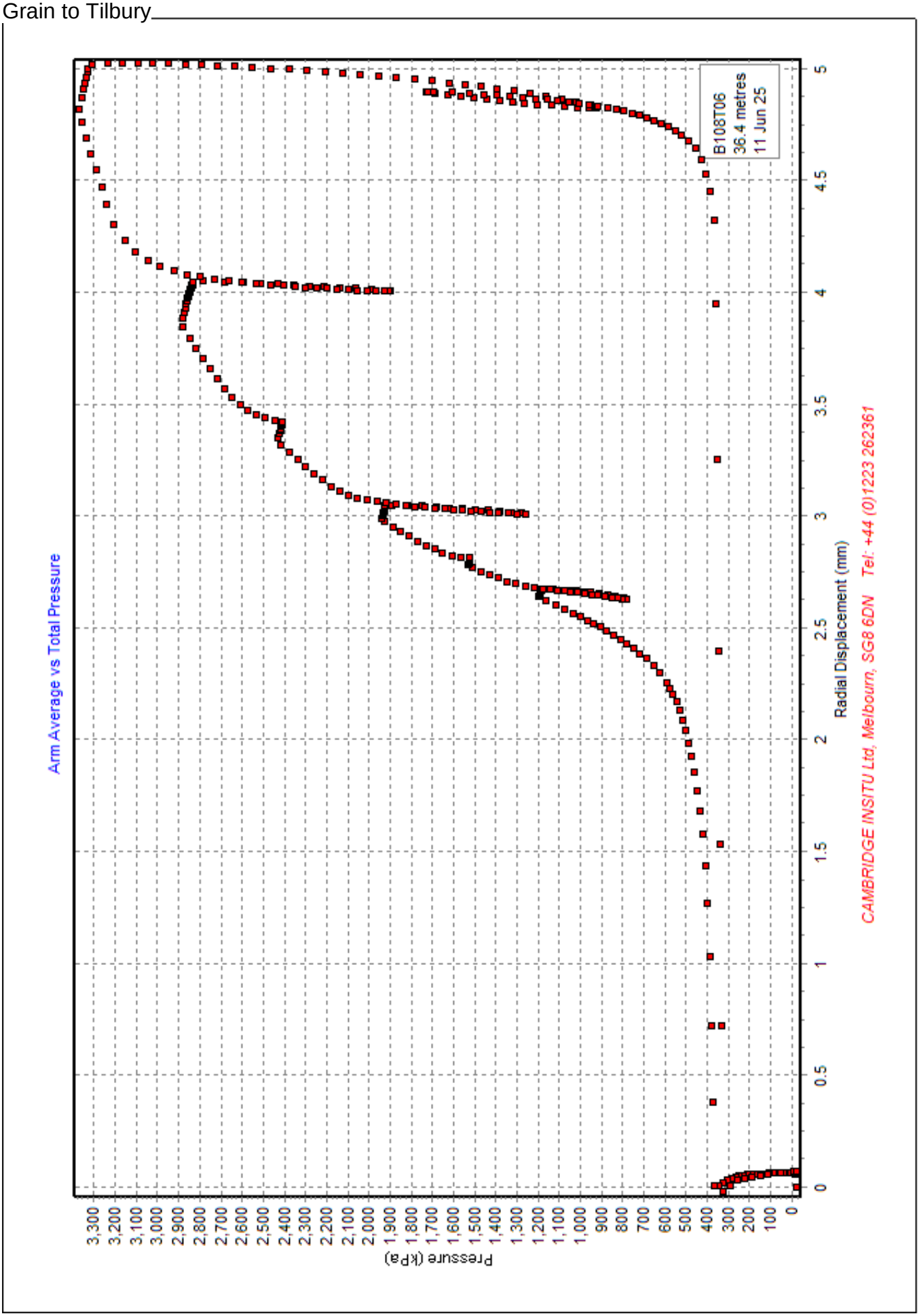

Bolton and Whittle (1999) Loop 3 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 6
36.40 Metres
11 Jun 25
RESULTS:
Gradient (beta) : 0.813
Intercept (n) : 141.254MPa
Shear stress constant : 114.883MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)

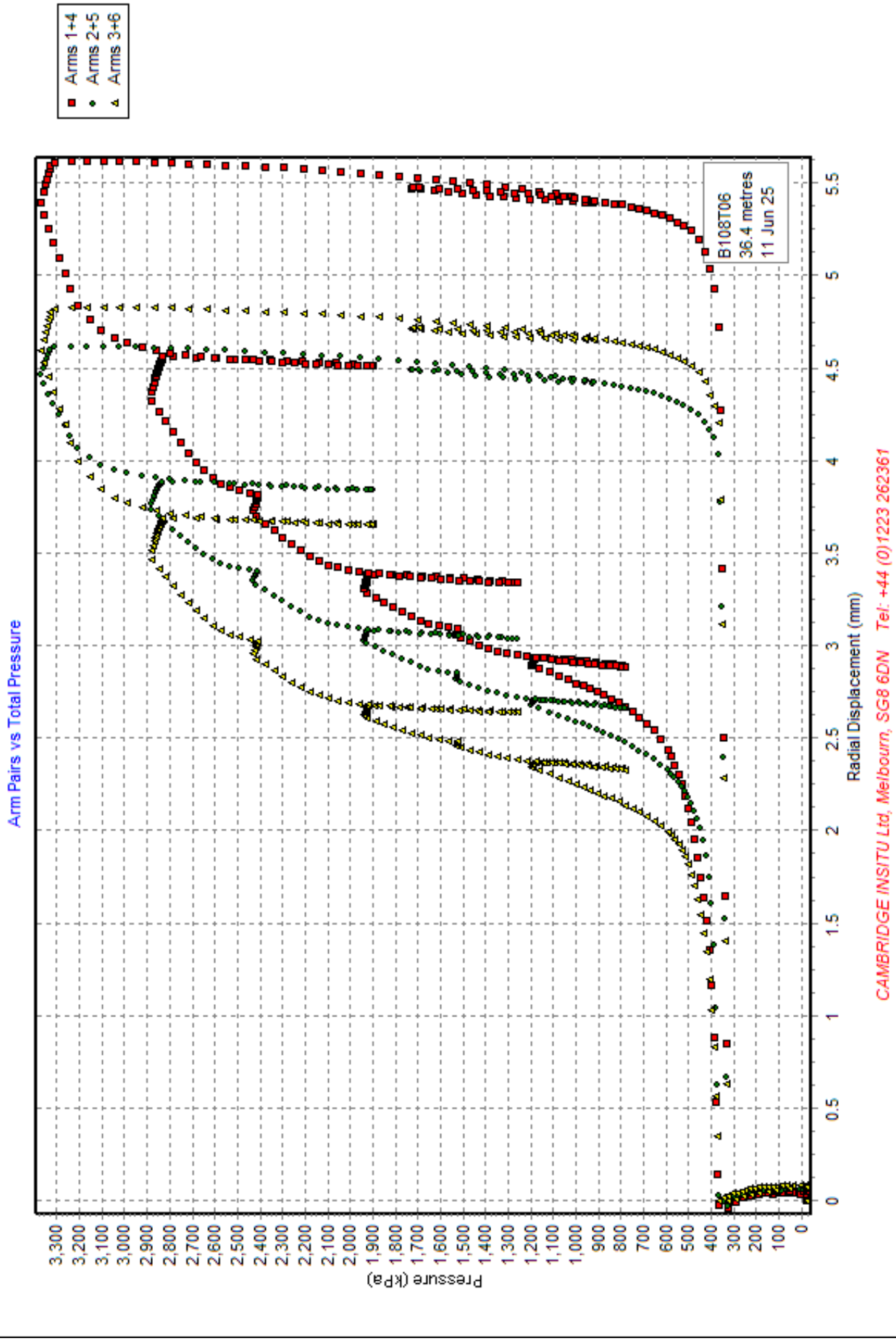

Bolton and Whittle (1999) Loop 4 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 6
36.40 Metres
11 Jun 25
RESULTS:
Gradient (beta) : 0.713
Intercept (n) : 61.672MPa
Shear stress constant : 43.959MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 4
Total pressure (kPa)
Radial Displacement (mm)

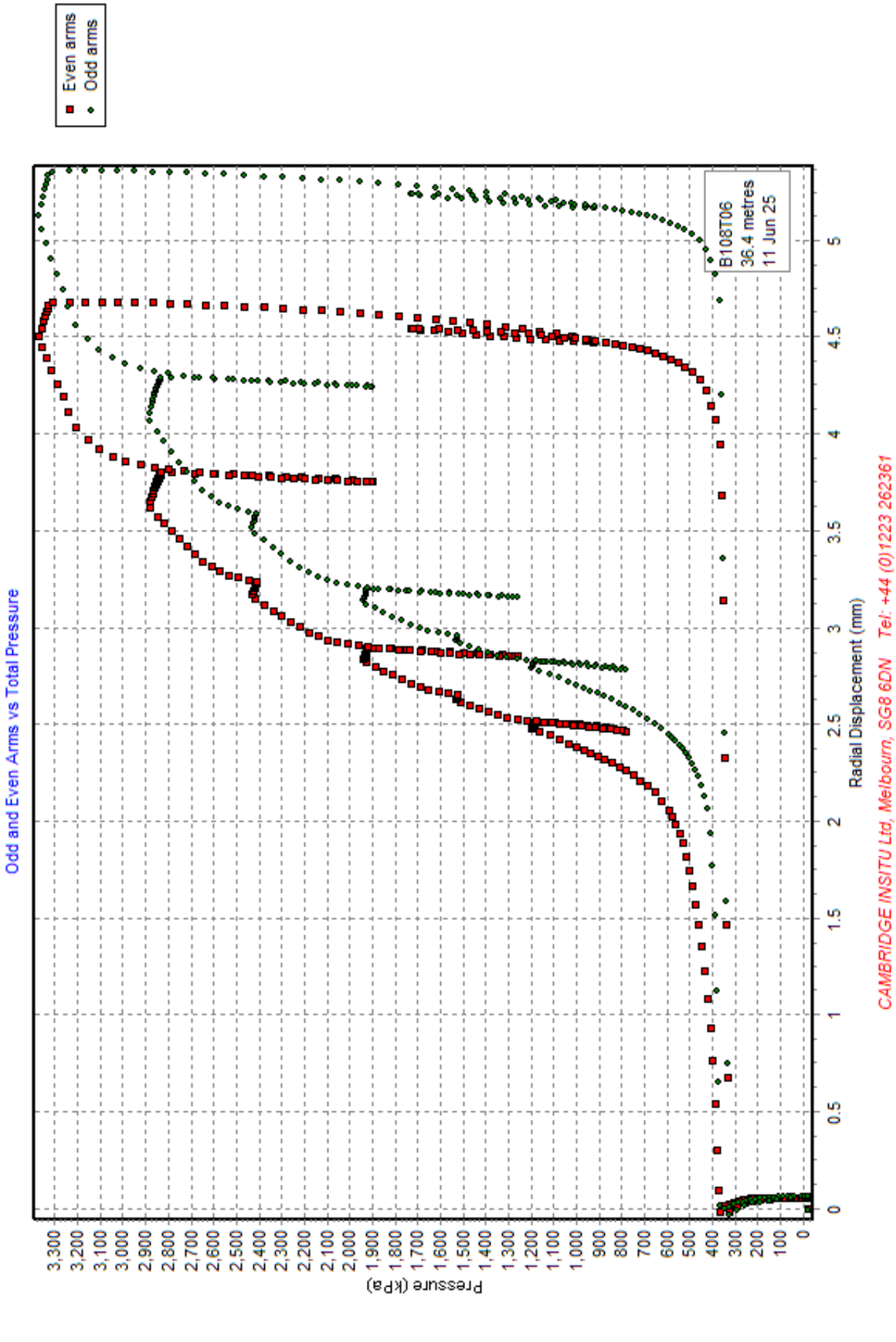

Variation of stiffness with strain, undrained analysis : Arm ave
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 120.361 0.931
2 101.288 0.823
3 114.883 0.813
4 43.959 0.713
95mm High Pressure Dilatometer
BH108 Test 6
36.40 Metres
11 Jun 25
Shear modulus (MPa)
Log plane shear strain
0.0001
0.001
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
Cycle 4 - Measured
Cycle 4 - Calculated


Carter et al 1986 (adapted 2010) for c'-phi material : Arm ave
95mm High Pressure Dilatometer
BH108 Test 6
36.40 Metres
11 Jun 25
CURVE FIT PARAMETERS:
Origin : 2.690mm
Po : 775.0kPa
Cohesion : 65kPa
Phi peak : 31.9°
Dilation : -0.1°
Yield stress : 1193kPa
Limit pressure : 7633kPa
Elastic exponent : 0.813
Gs at first yield : 189.2MPa
Janbu exponent : 0.536
Correlation : 0.796
Estimated PWP : 314.8kPa
Phi cv : 32.0°
Poisson's ratio : 0.20
Total pressure (kPa)
Cavity strain (%)
Measured data
Calculated data


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
B108T06
36.4 metres
11 Jun 25
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arm Average vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
B108T06
36.4 metres
11 Jun 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arms 1+4
Arms 2+5
Arms 3+6
B108T06
36.4 metres
11 Jun 25
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
B108T06
36.4 metres
11 Jun 25
Odd and Even Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to TIlbury
BH108 Test 7 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Grain to Tilbury
Borehole : BH108
Test name : BH108 Test 7
Test date : 12 Jun 25
Test depth : 40.30 Metres
Water table : 4.31 Metres
Ambient PWP : 353.1 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDB/SDP/RW on 20 Jul 25

Remarks:

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=2.76"
Po from Marsland & Randolph (kPa) : "Arm ave=934.7"
Best estimate of Po (kPa) : "Arm ave=826.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=1735.5"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 32.0
Angle of internal friction (°) : "Arm ave=32.6"
Dilation angle (°) : "Arm ave=0.7"
Gradient of log-log plot : "Arm ave=0.354"

[Withers et al 1989]
Angle of internal friction (°) : "Arm ave=31.8"
Dilation angle (°) : "Arm ave=-0.2"
Gradient of log-log plot : "Arm ave=-2.243"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=38.9"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	260.2	-0.254	1176	0.156	408
Arm ave	2	414.4	1.283	1933	0.147	609
Arm ave	3	501.0	4.092	2656	0.141	706
Arm ave	4	361.0	6.532	1688	0.277	1000

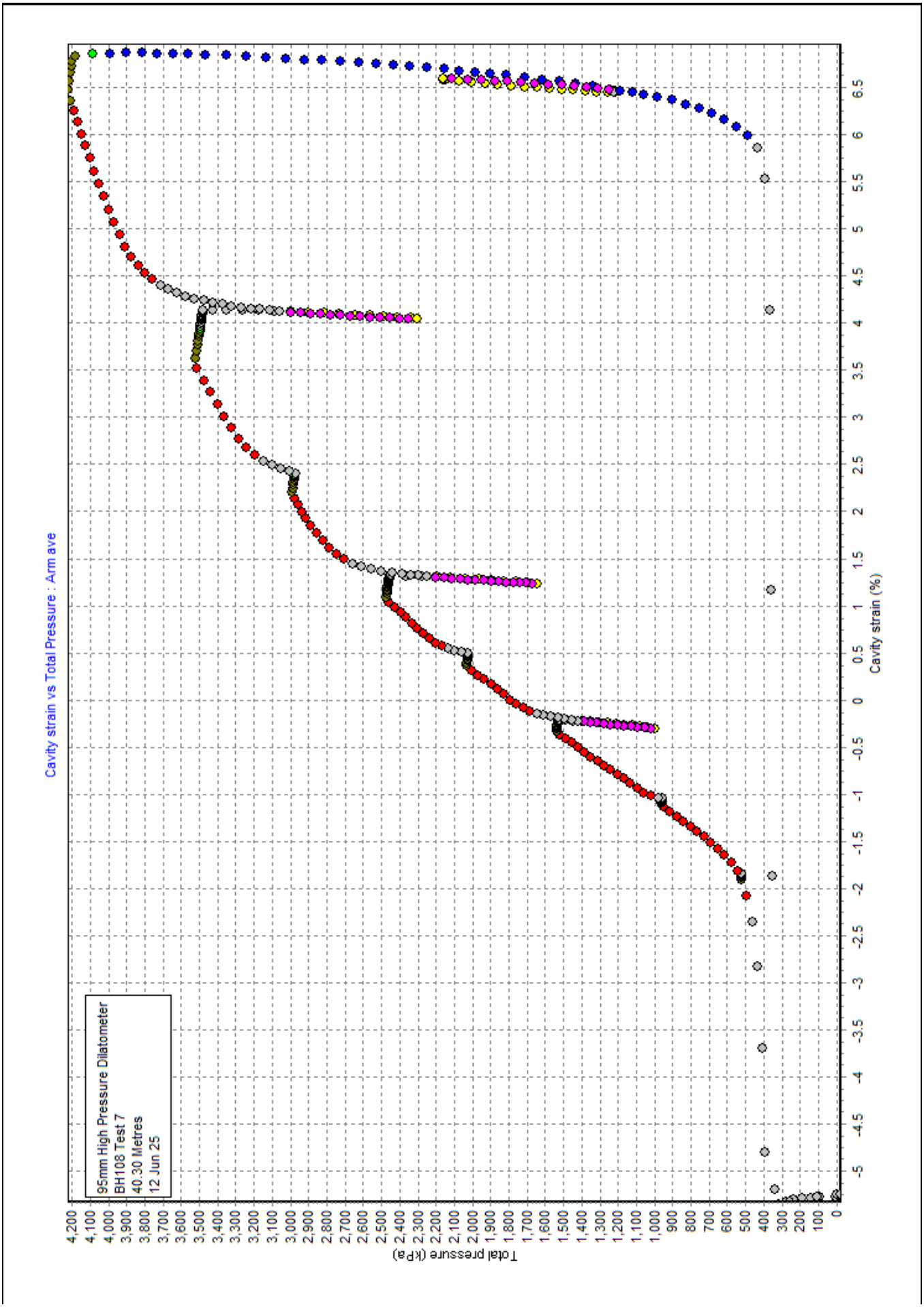
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

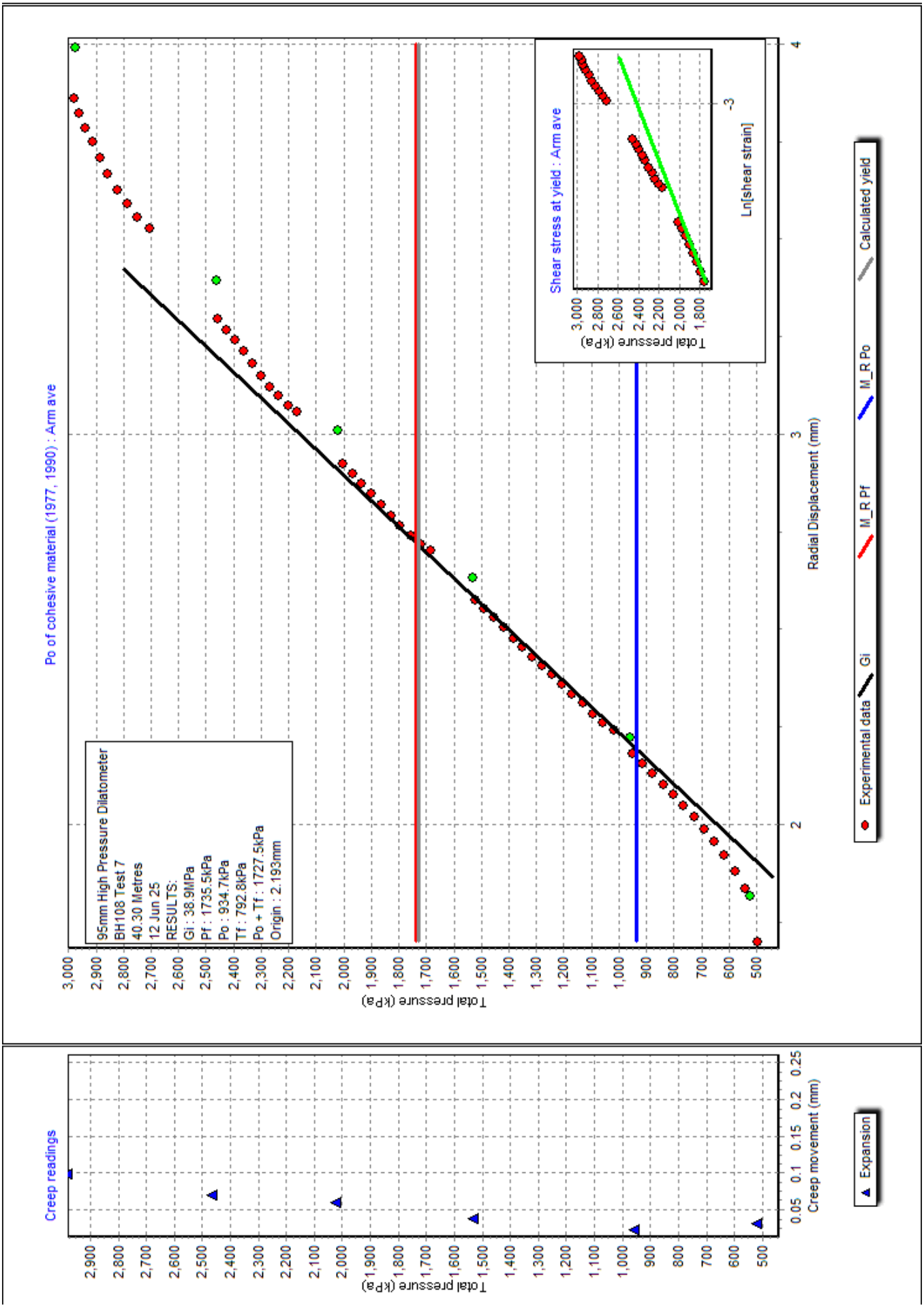
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	77.035	62.628	0.813
Arm ave	2	132.422	109.171	0.824
Arm ave	3	96.554	72.078	0.747
Arm ave	4	86.312	63.437	0.735

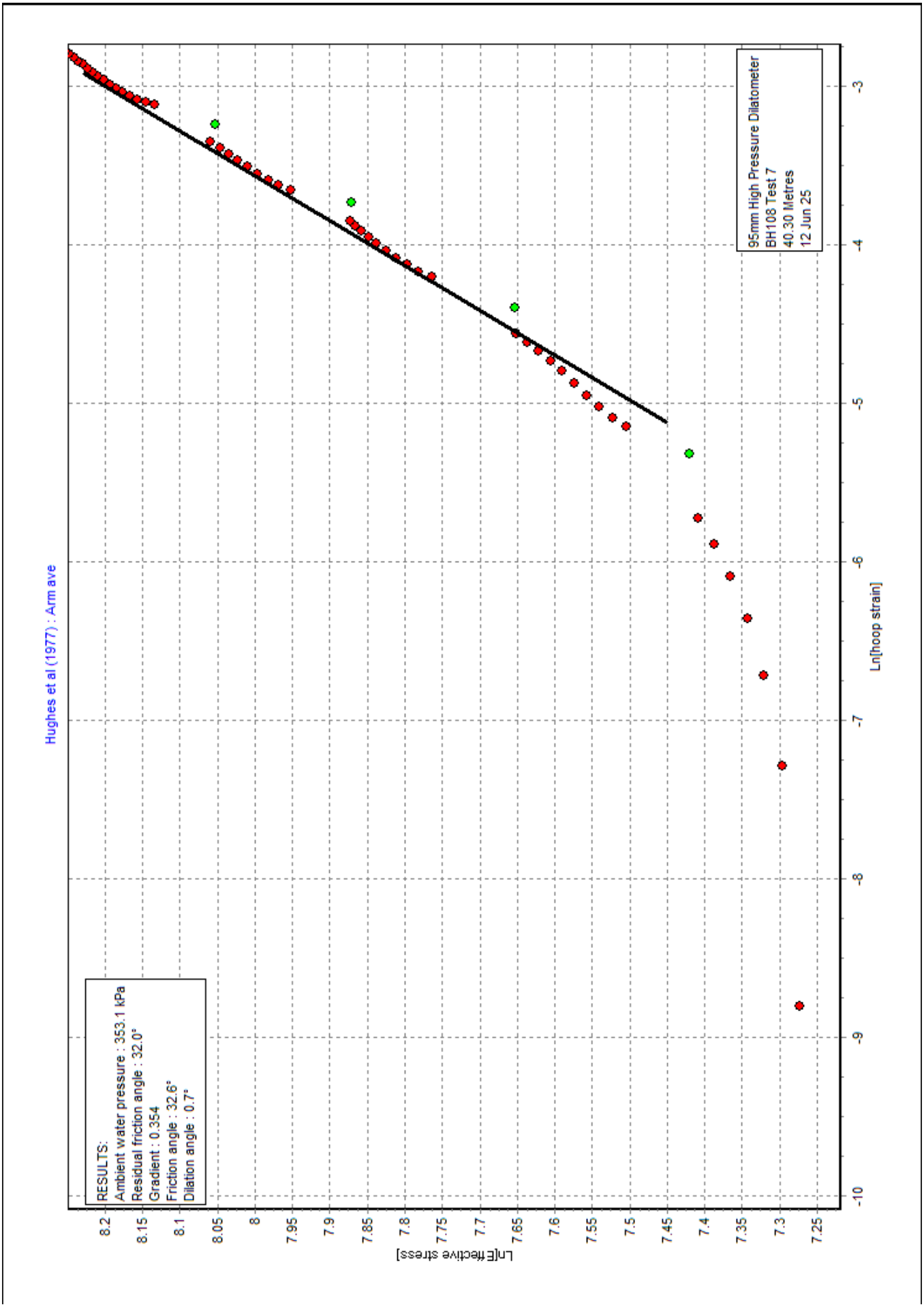
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 2.76
Po (kPa) : 826
Cohesion (kPa) : 64
Angle of peak friction (deg) : 32.6
Angle of peak dilation (deg) : 0.7
Total yield stress (kPa) : 1331

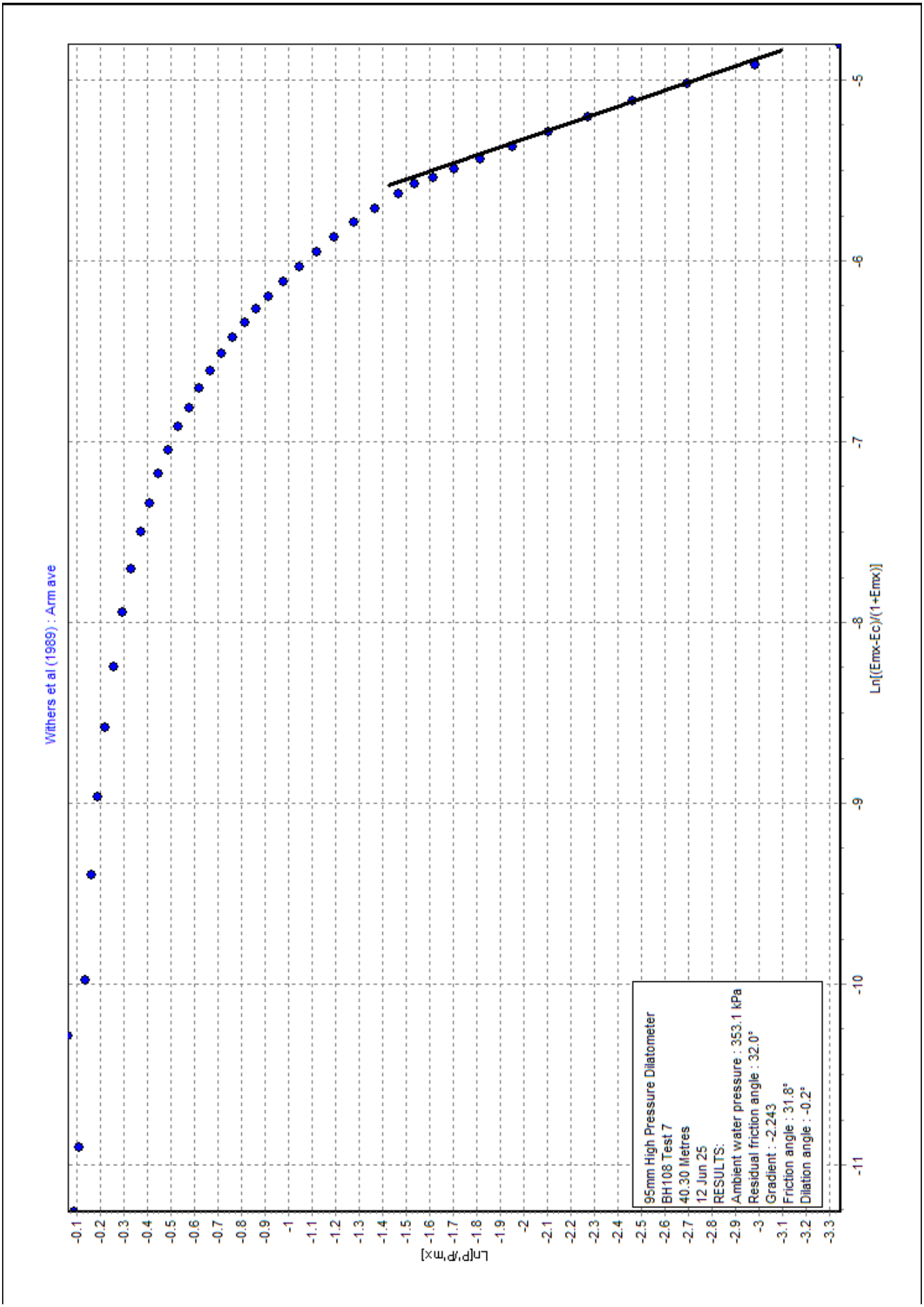
Grain to TIlbury
BH108 Test 7 - SUMMARY OF RESULTS

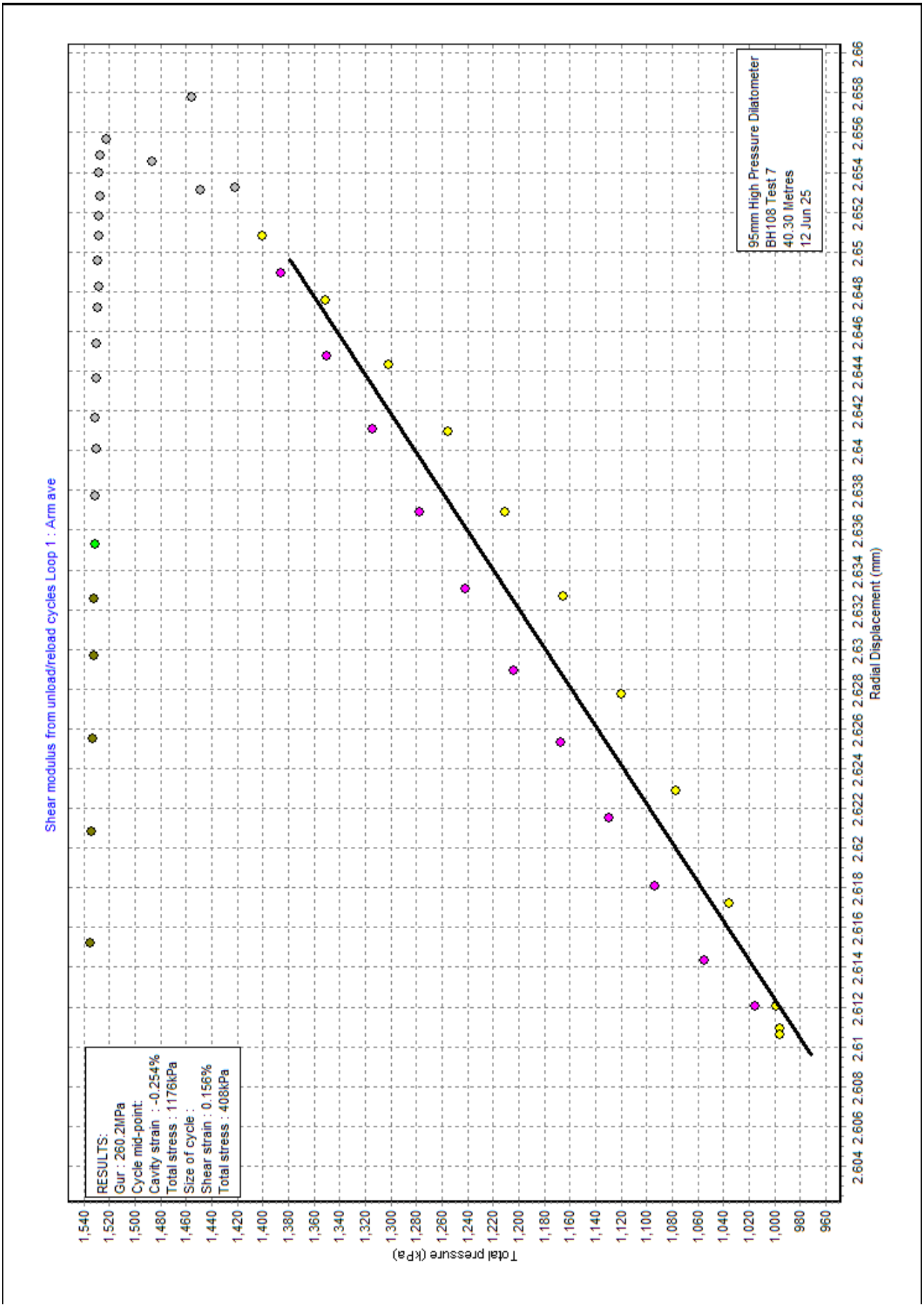
Total limit stress (kPa)	:	8463
G at first yield (MPa)	:	186.1
Non-linear exponent	:	0.747
Janbu exponent	:	0.427
Correlation	:	0.793
Ambient pore water pressure (kPa)	:	353
Residual friction angle (deg)	:	32.0
Poisson's ratio	:	0.20

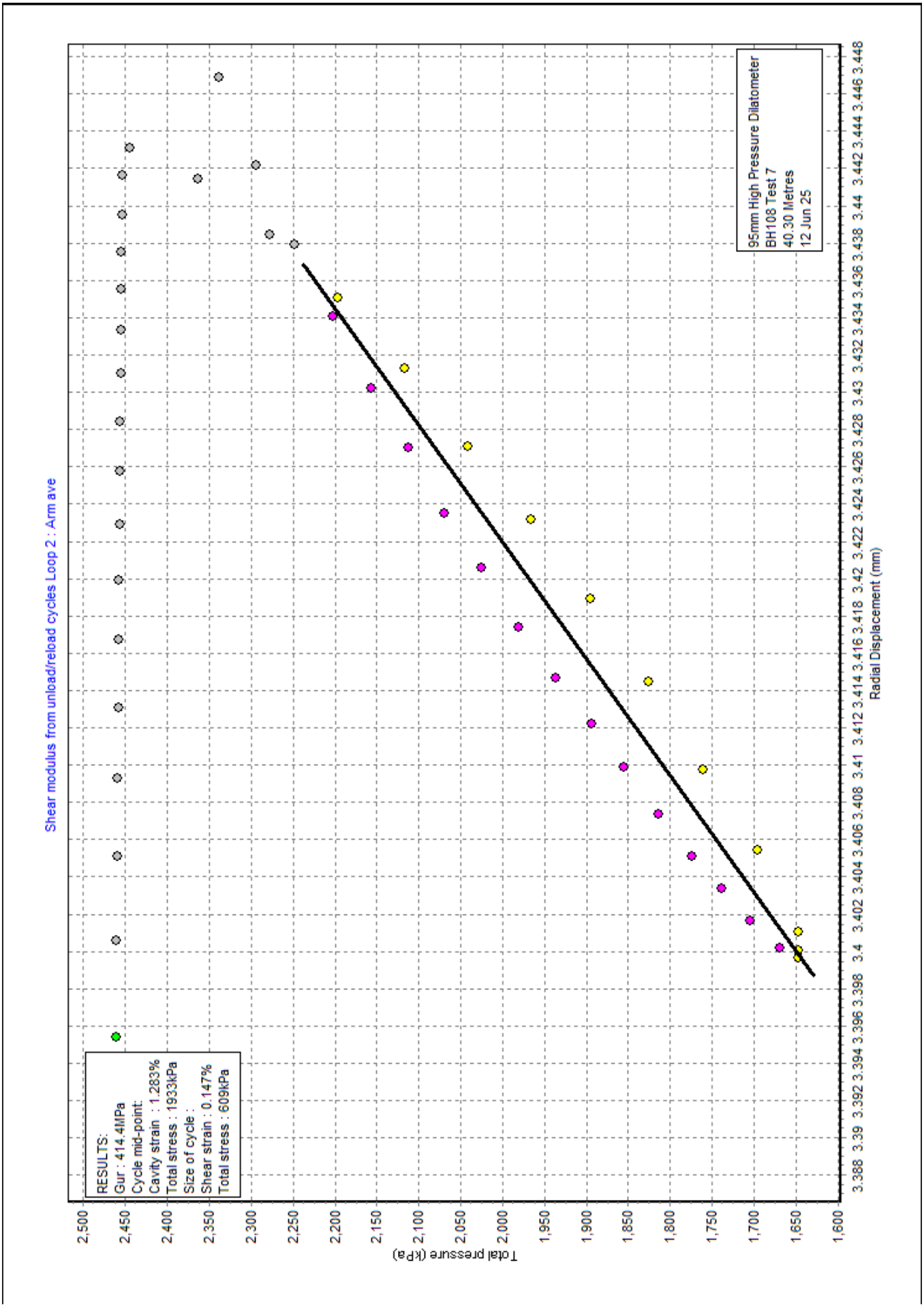

Cavity strain vs Total Pressure : Arm ave
95mm High Pressure Dilatometer
BH108 Test 7
40.30 Metres
12 Jun 25
Total pressure (kPa)
Cavity strain (%)

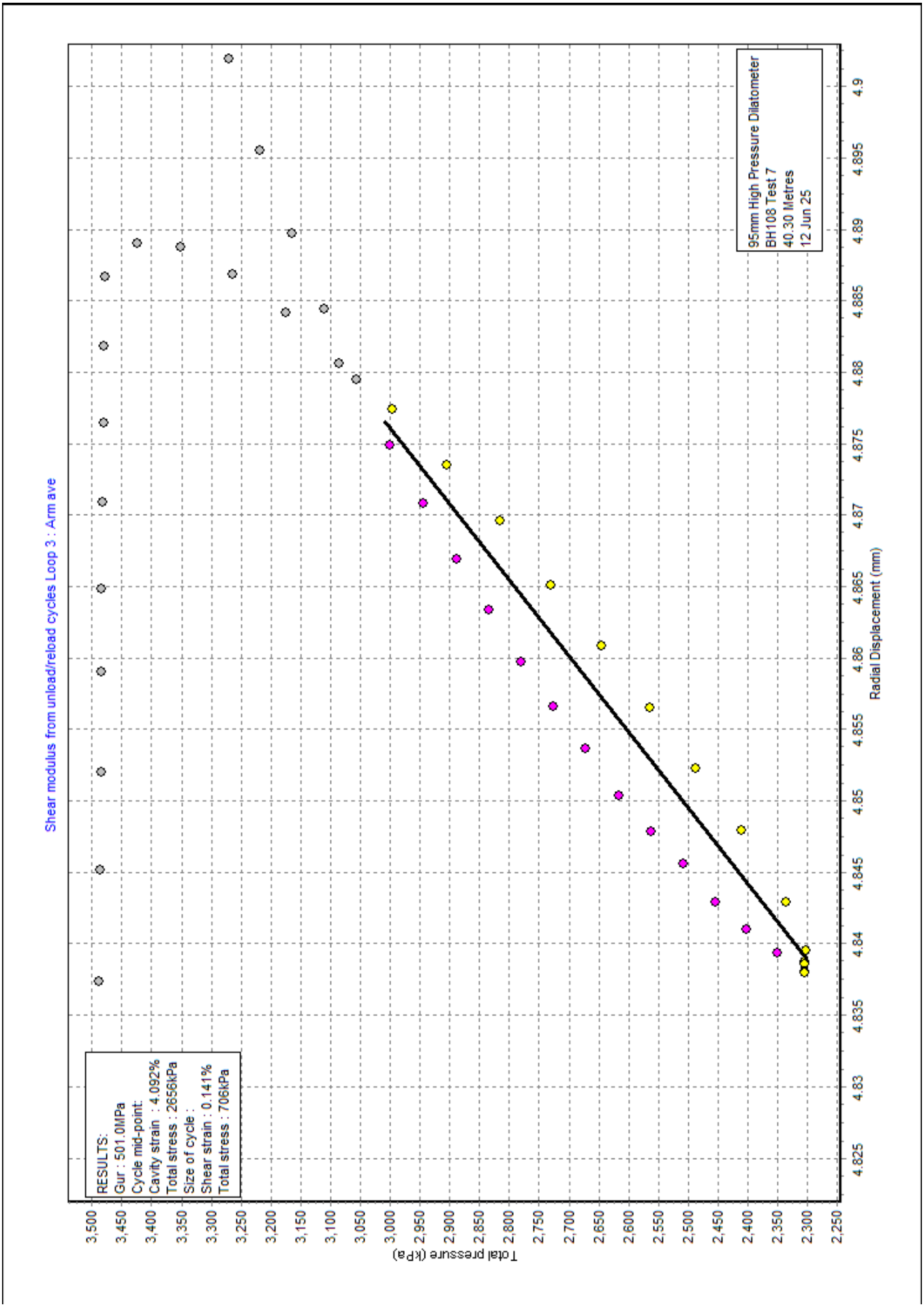

Po of cohesive material (1977, 1990) : Arm ave
95mm High Pressure Dilatometer
BH108 Test 7
40.30 Metres
12 Jun 25
RESULTS:
Gi : 38.9MPa
Pf : 1735.5kPa
Po : 934.7kPa
Tf : 792.8kPa
Po + Tf : 1727.5kPa
Origin : 2.193mm
Total pressure (kPa)
Radial Displacement (mm)
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Shear stress at yield : Arm ave
Total pressure (kPa)
Ln[shear strain]
Creep readings
Total pressure (kPa)
Creep movement (mm)
Expansion

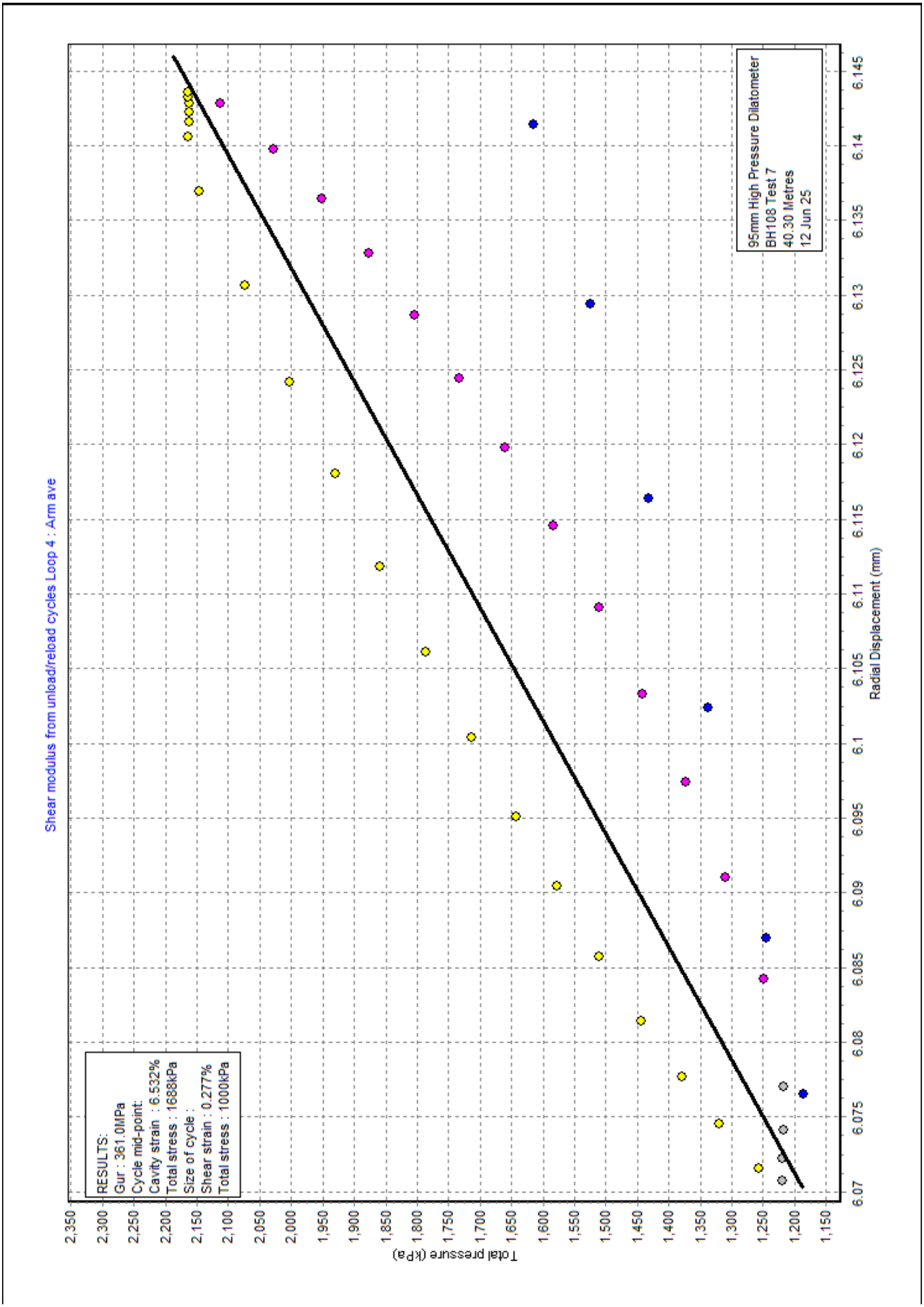

Hughes et al (1977) : Arm ave
RESULTS:
Ambient water pressure : 353.1 kPa
Residual friction angle : 32.0°
Gradient : 0.354
Friction angle : 32.6°
Dilation angle : 0.7°
95mm High Pressure Dilatometer
BH108 Test 7
40.30 Metres
12 Jun 25
Ln[Effective stress]
Ln[hoop strain]
8.2
8.15
8.1
8.05
8
7.95
7.9
7.85
7.8
7.75
7.7
7.65
7.6
7.55
7.5
7.45
7.4
7.35
7.3
7.25
-3
-4
-5
-6
-7
-8
-9
-10

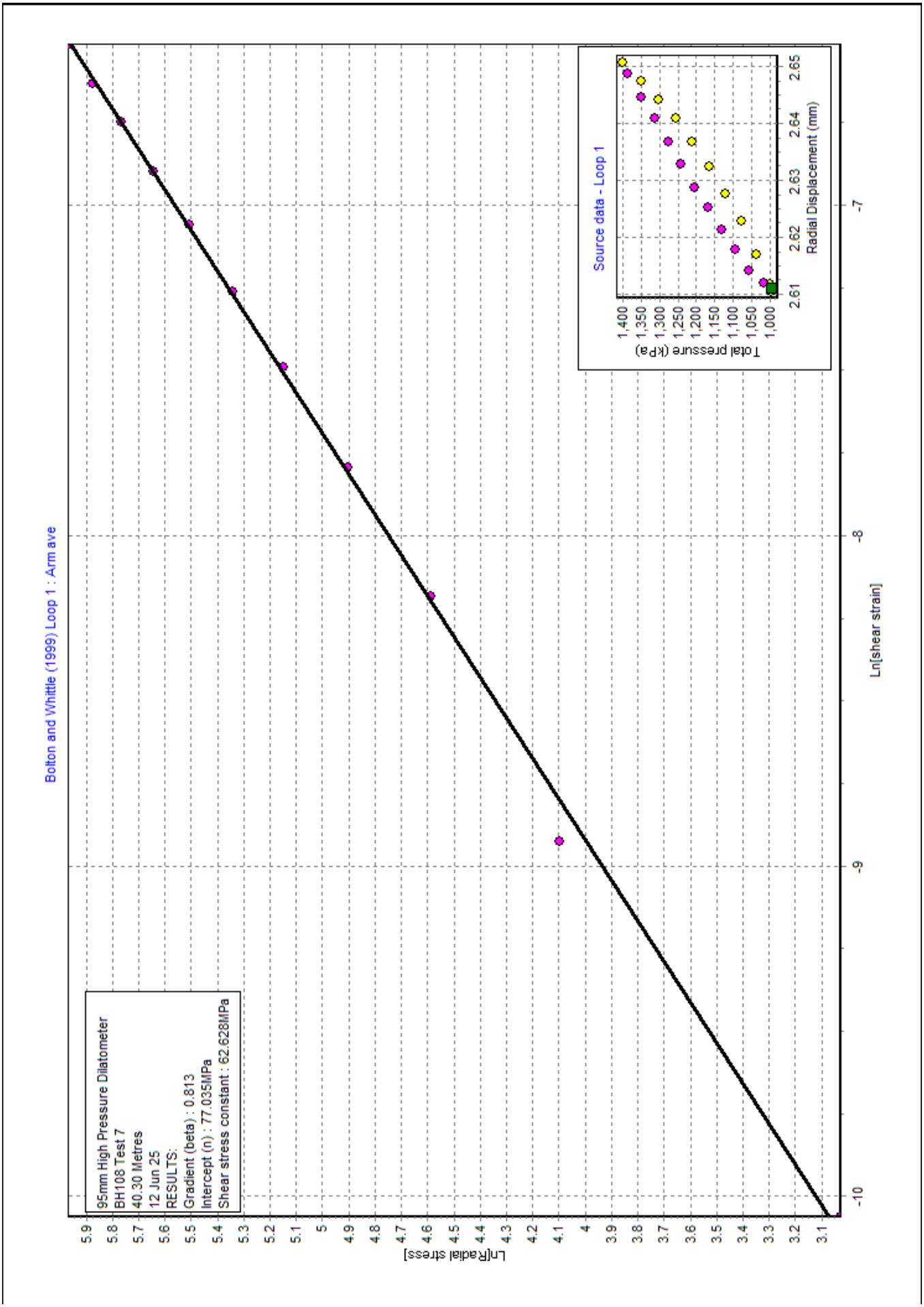

Withers et al (1989) : Arm ave
Ln[P'/P'mx]
Ln[(Emx-Ec)/(1+Emx)]
95mm High Pressure Dilatometer
BH108 Test 7
40.30 Metres
12 Jun 25
RESULTS:
Ambient water pressure : 353.1 kPa
Residual friction angle : 32.0°
Gradient : -2.243
Friction angle : 31.8°
Dilation angle : -0.2°

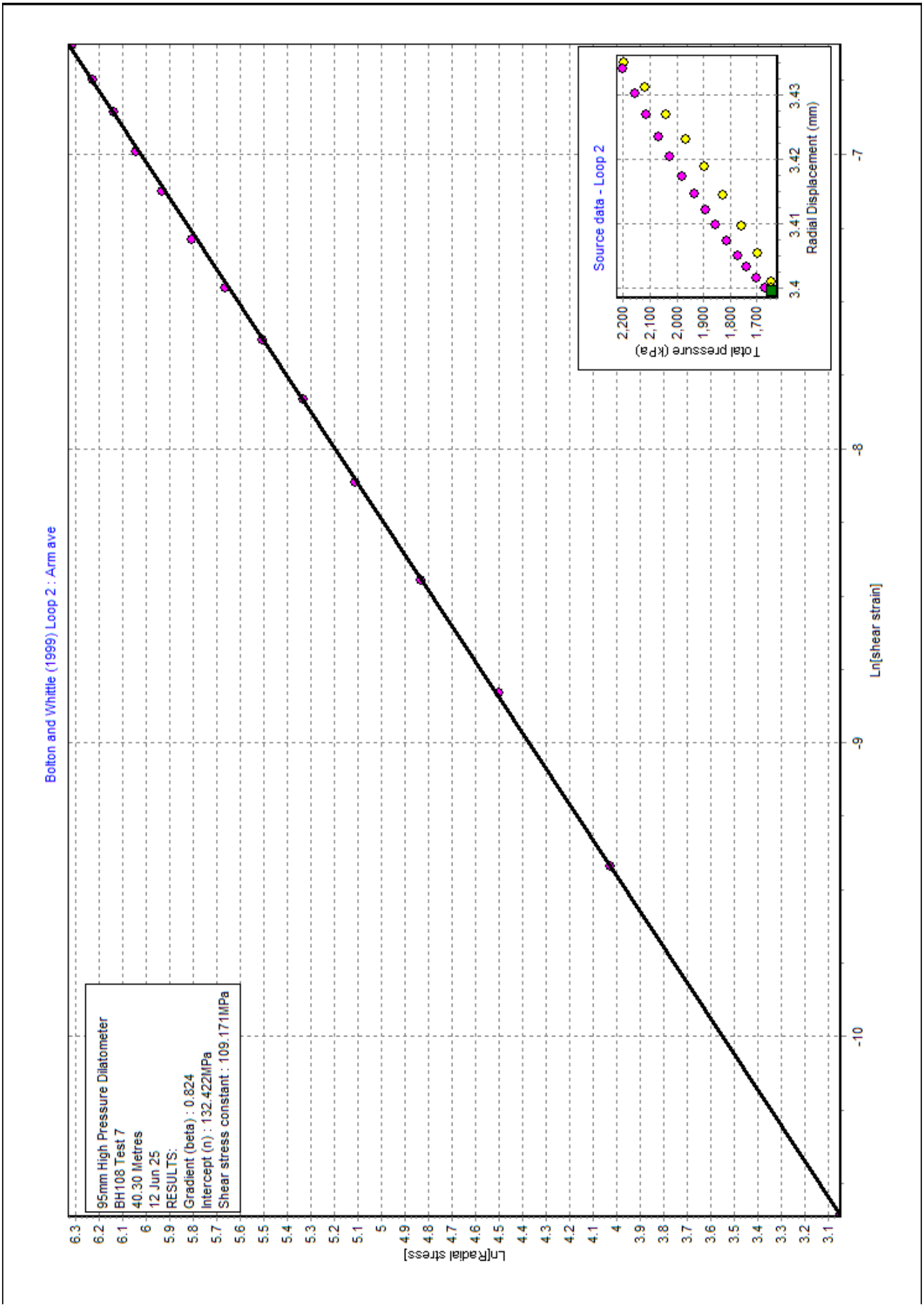

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 260.2MPa
Cycle mid-point:
Cavity strain : -0.254%
Total stress : 1176kPa
Size of cycle :
Shear strain : 0.156%
Total stress : 408kPa
95mm High Pressure Dilatometer
BH108 Test 7
40.30 Metres
12 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

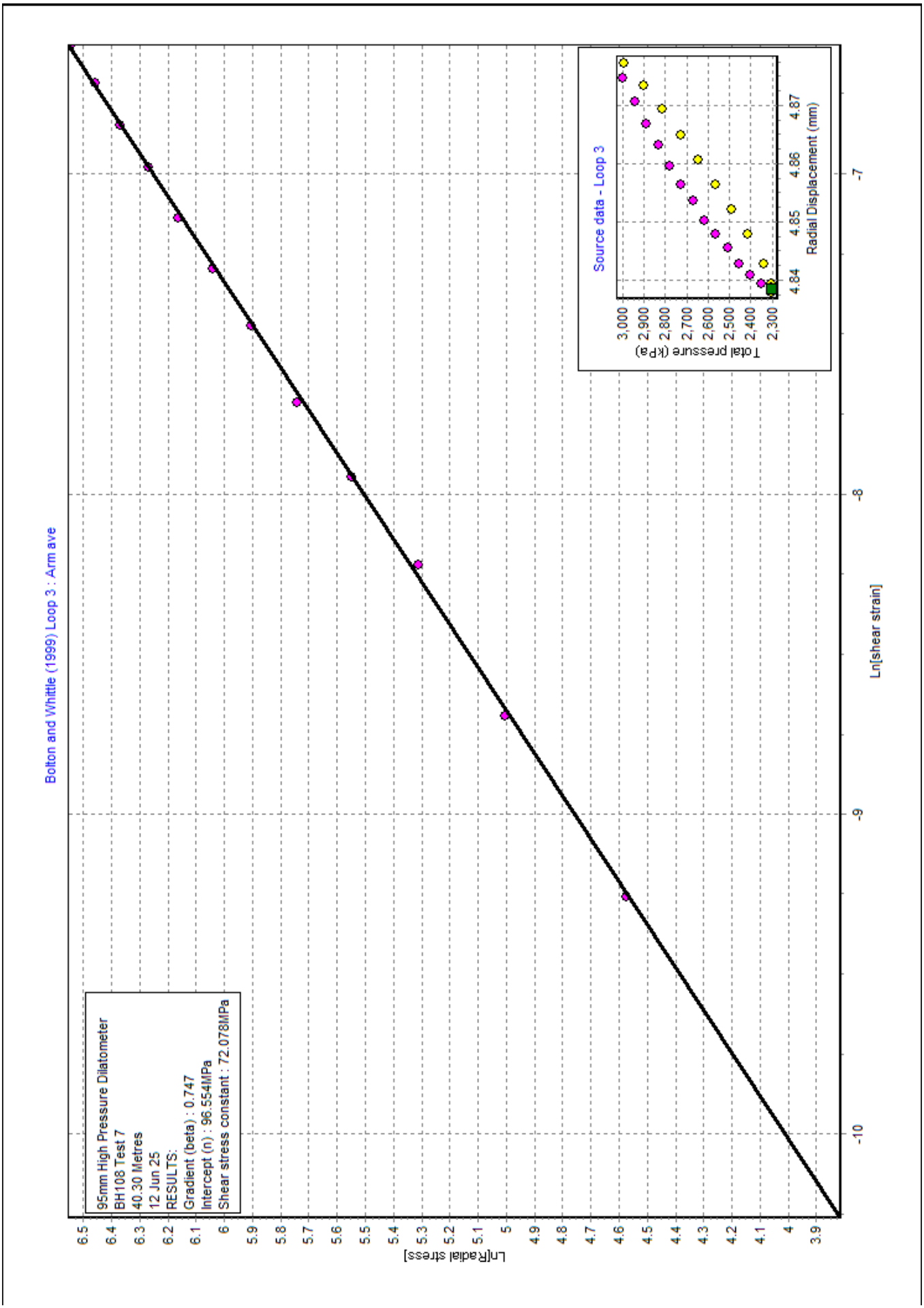

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 414.4MPa
Cycle mid-point:
Cavity strain : 1.283%
Total stress : 1933kPa
Size of cycle :
Shear strain : 0.147%
Total stress : 609kPa
95mm High Pressure Dilatometer
BH108 Test 7
40.30 Metres
12 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

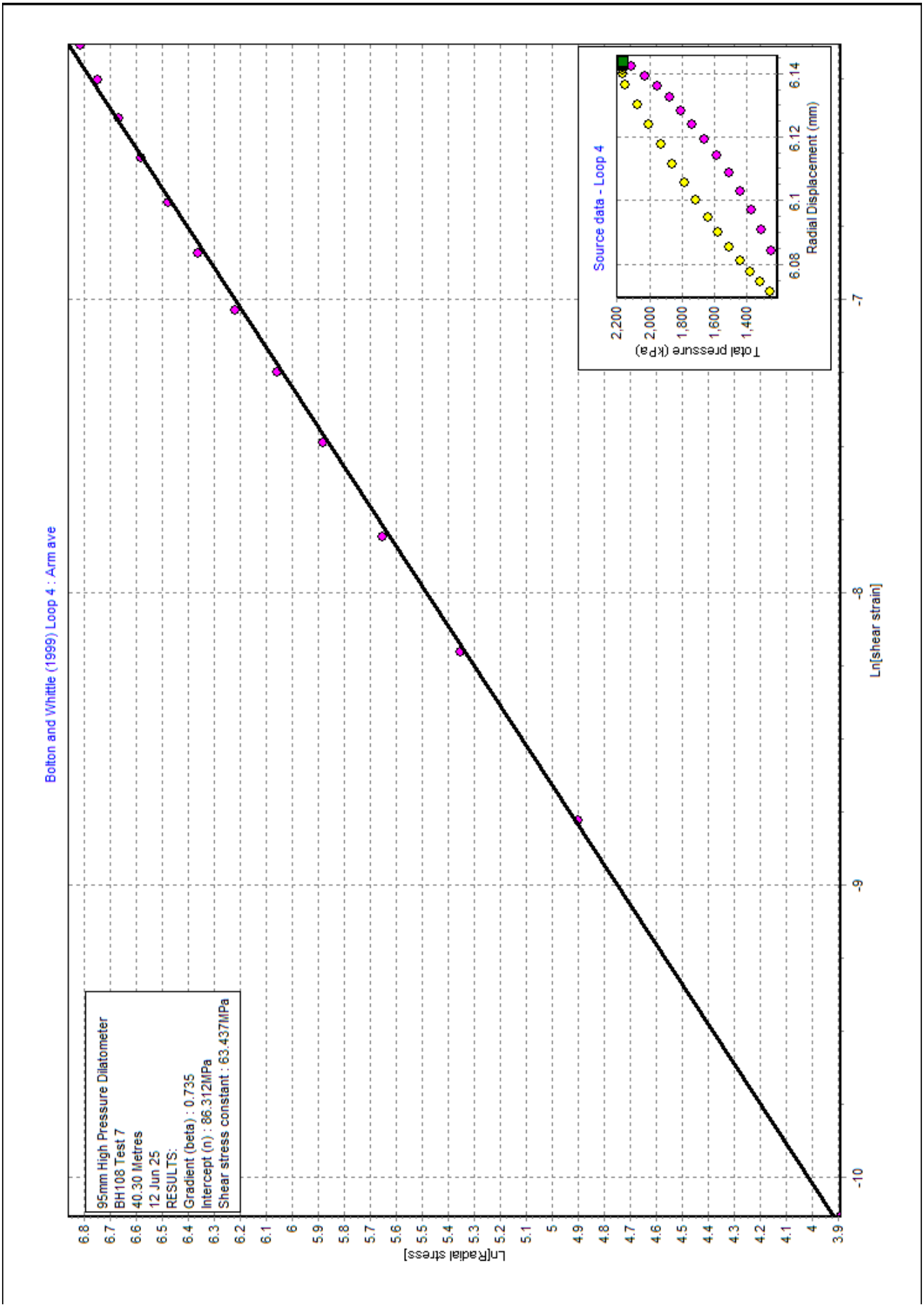

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 501.0MPa
Cycle mid-point:
Cavity strain : 4.092%
Total stress : 2656kPa
Size of cycle :
Shear strain : 0.141%
Total stress : 706kPa
95mm High Pressure Dilatometer
BH108 Test 7
40.30 Metres
12 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

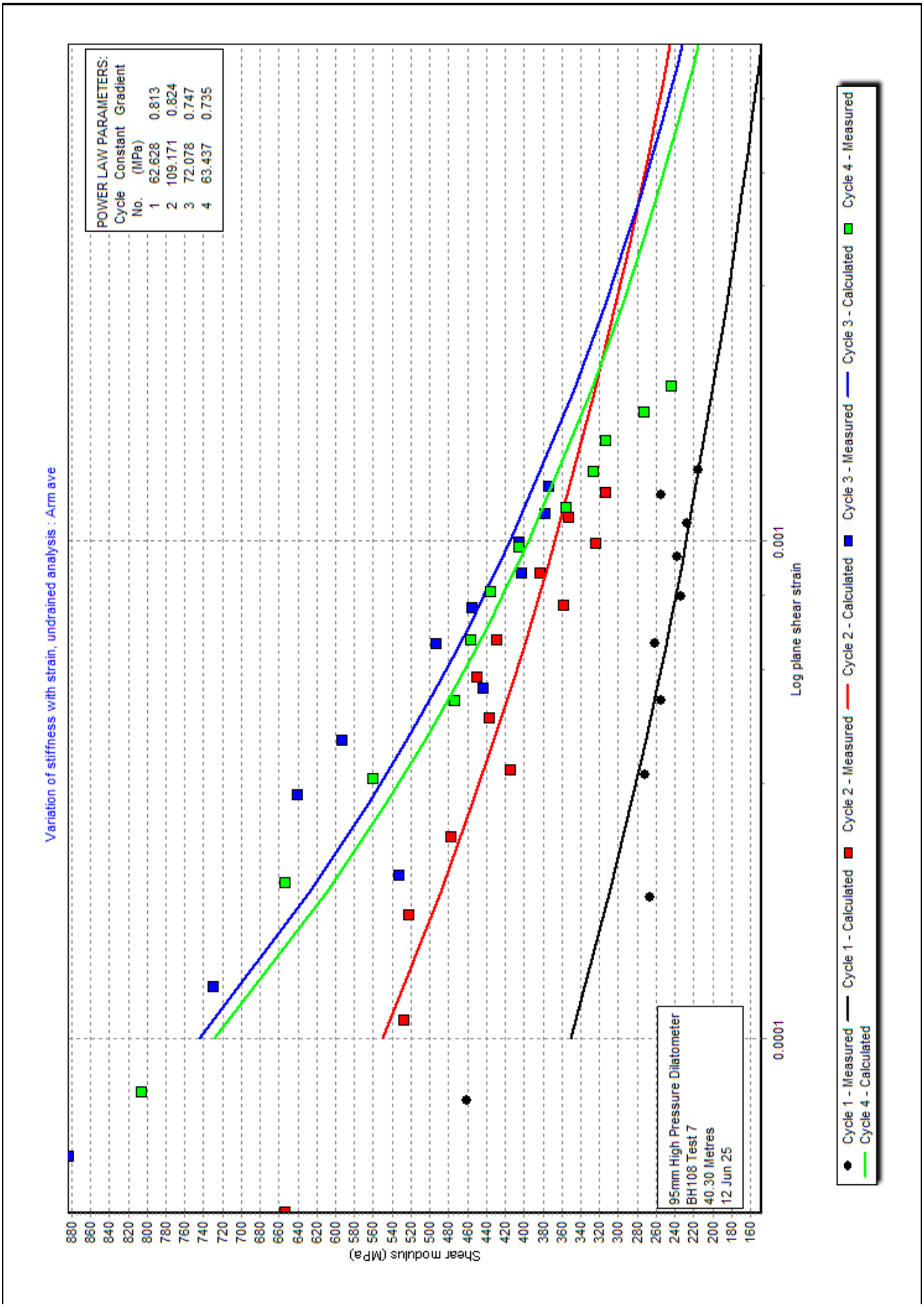

Shear modulus from unload/reload cycles Loop 4 : Arm ave
RESULTS:
Gur : 361.0MPa
Cycle mid-point:
Cavity strain : 6.532%
Total stress : 1688kPa
Size of cycle :
Shear strain : 0.277%
Total stress : 1000kPa
95mm High Pressure Dilatometer
BH108 Test 7
40.30 Metres
12 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

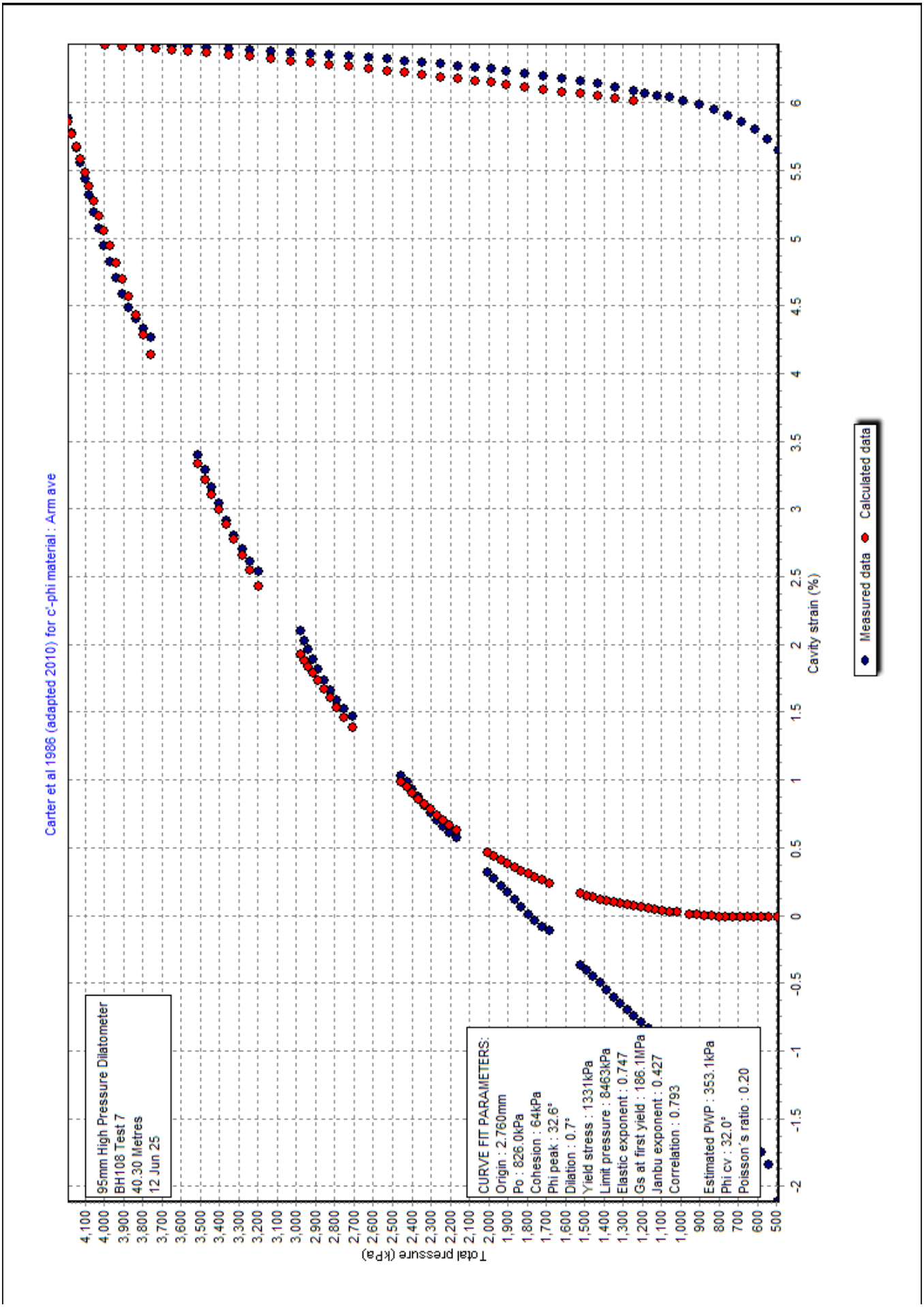

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 7
40.30 Metres
12 Jun 25
RESULTS:
Gradient (beta) : 0.813
Intercept (n) : 77.035MPa
Shear stress constant : 62.628MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

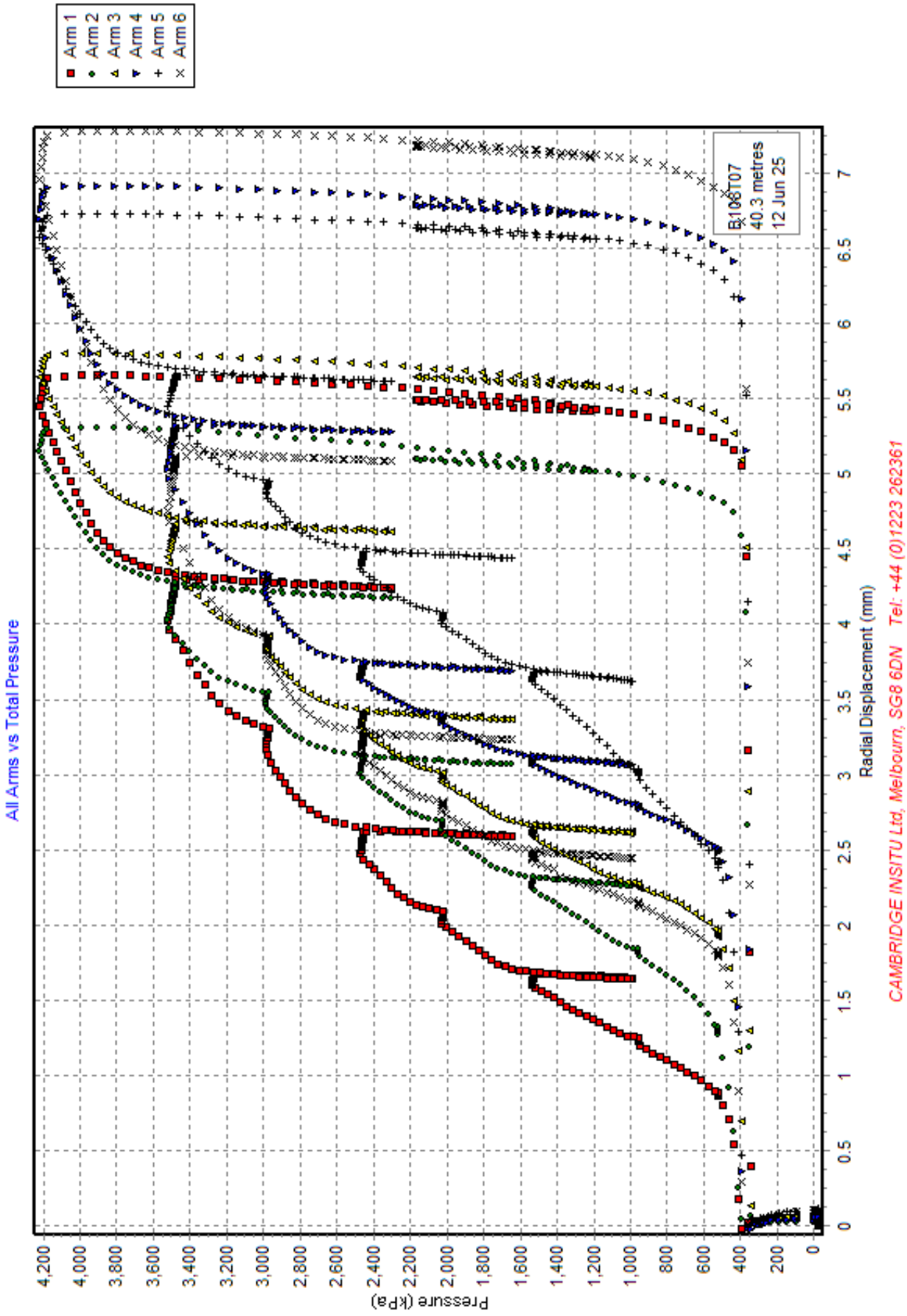

Bolton and Whittle (1999) Loop 2 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 7
40.30 Metres
12 Jun 25
RESULTS:
Gradient (beta) : 0.824
Intercept (n) : 132.422MPa
Shear stress constant : 109.171MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

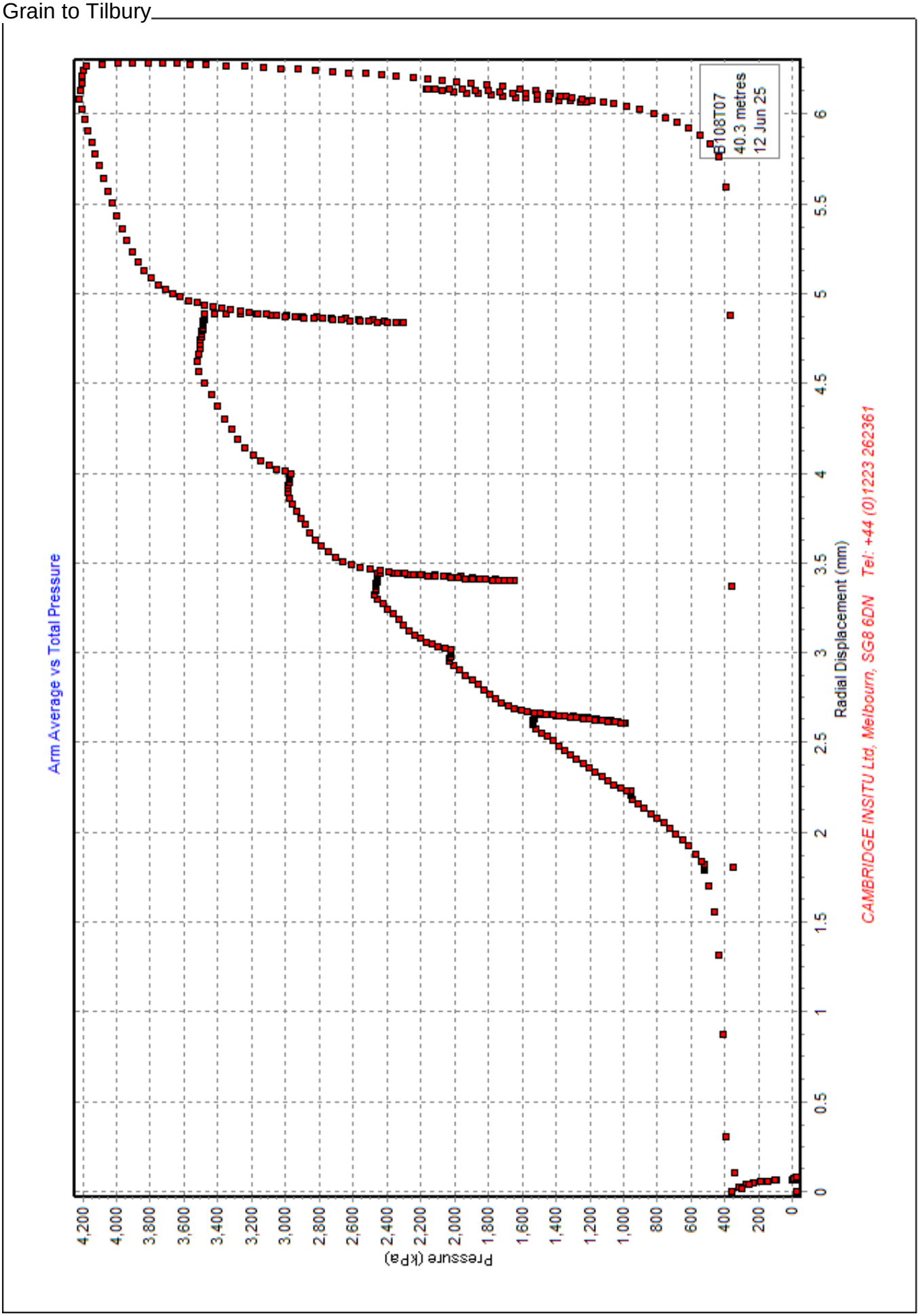

Bolton and Whittle (1999) Loop 3 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 7
40.30 Metres
12 Jun 25
RESULTS:
Gradient (beta) : 0.747
Intercept (n) : 96.554MPa
Shear stress constant : 72.078MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)

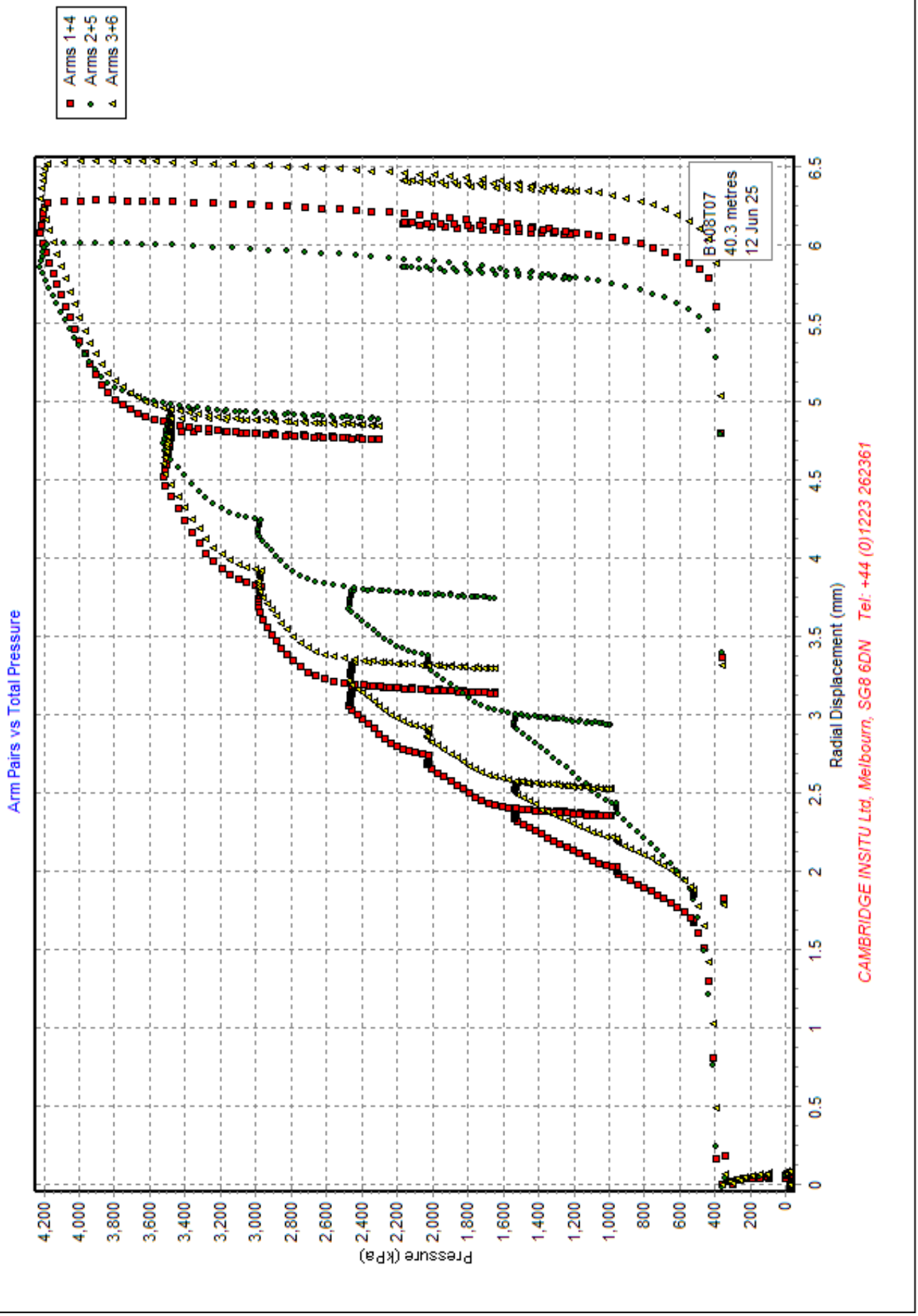

Bolton and Whittle (1999) Loop 4 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 7
40.30 Metres
12 Jun 25
RESULTS:
Gradient (beta) : 0.735
Intercept (n) : 86.312MPa
Shear stress constant : 63.437MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 4
Total pressure (kPa)
Radial Displacement (mm)

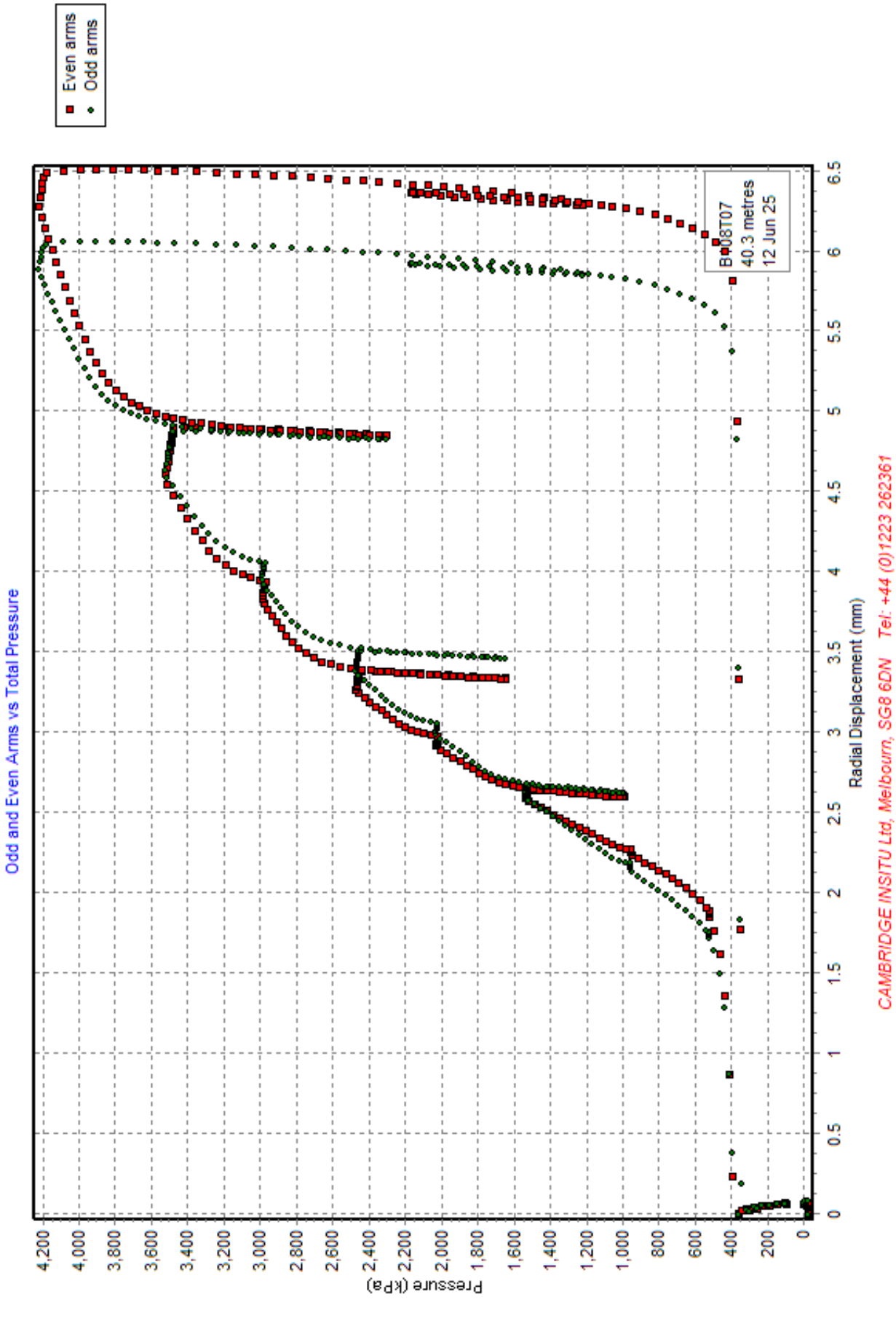

Variation of stiffness with strain, undrained analysis : Arm ave
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 62.628 0.813
2 109.171 0.824
3 72.078 0.747
4 63.437 0.735
95mm High Pressure Dilatometer
BH108 Test 7
40.30 Metres
12 Jun 25
Shear modulus (MPa)
Log plane shear strain
0.0001
0.001
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
Cycle 4 - Measured
Cycle 4 - Calculated


Carter et al 1986 (adapted 2010) for c'-phi material : Arm ave
95mm High Pressure Dilatometer
BH108 Test 7
40.30 Metres
12 Jun 25
CURVE FIT PARAMETERS:
Origin : 2.760mm
Po : 826.0kPa
Cohesion : 64kPa
Phi peak : 32.6°
Dilation : 0.7°
Yield stress : 1331kPa
Limit pressure : 8463kPa
Elastic exponent : 0.747
Gs at first yield : 186.1MPa
Janbu exponent : 0.427
Correlation : 0.793
Estimated PWP : 353.1kPa
Phi cv : 32.0°
Poisson's ratio : 0.20
Total pressure (kPa)
Cavity strain (%)
Measured data
Calculated data


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
All Arms vs Total Pressure
B106T07
40.3 metres
12 Jun 25
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arm Average vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
61108T07
40.3 metres
12 Jun 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arms 1+4
Arms 2+5
Arms 3+6
B408T07
40.3 metres
12 Jun 25
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
Odd and Even Arms vs Total Pressure
B108T07
40.3 metres
12 Jun 25
Radial Displacement (mm)
Pressure (kPa)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Grain to TIlbury
BH108 Test 8 - SUMMARY OF RESULTS
[File made with WinSitu]

[DETAILS OF TEST]
Project : TB8754
Site : Grain to Tilbury
Borehole : BH108
Test name : BH108 Test 8
Test date : 12 Jun 25
Test depth : 42.40 Metres
Water table : 4.31 Metres
Ambient PWP : 373.7 kPa
Material : Chalk
Probe : 95mm High Pressure Dilatometer
Diameter : 97.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by SDB/SDP/RW on 20 Jul 25

Remarks: Arms started to go backwards, so stopped test to preserve unloading. Close to potential burst again.

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=3.05"
Po from Marsland & Randolph (kPa) : "Arm ave=1015.2"
Best estimate of Po (kPa) : "Arm ave=932.0"

[UNDRAINED STRENGTH PARAMETERS]
Undrained yield stress (kPa) : "Arm ave=2443.7"

[DRAINED ANALYSIS OF SANDS]
[Hughes et al 1977]
Constant volume friction angle (°) : 32.0
Angle of internal friction (°) : "Arm ave=37.3"
Dilation angle (°) : "Arm ave=6.5"
Gradient of log-log plot : "Arm ave=0.420"

[Withers et al 1989]
Angle of internal friction (°) : "Arm ave=32.8"
Dilation angle (°) : "Arm ave=1.0"
Gradient of log-log plot : "Arm ave=-2.306"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=62.8"

Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	244.0	-0.294	1207	0.157	382
Arm ave	2	411.2	0.605	2021	0.157	646
Arm ave	3	501.6	1.821	2891	0.176	883
Arm ave	4	378.0	2.613	1733	0.273	1035

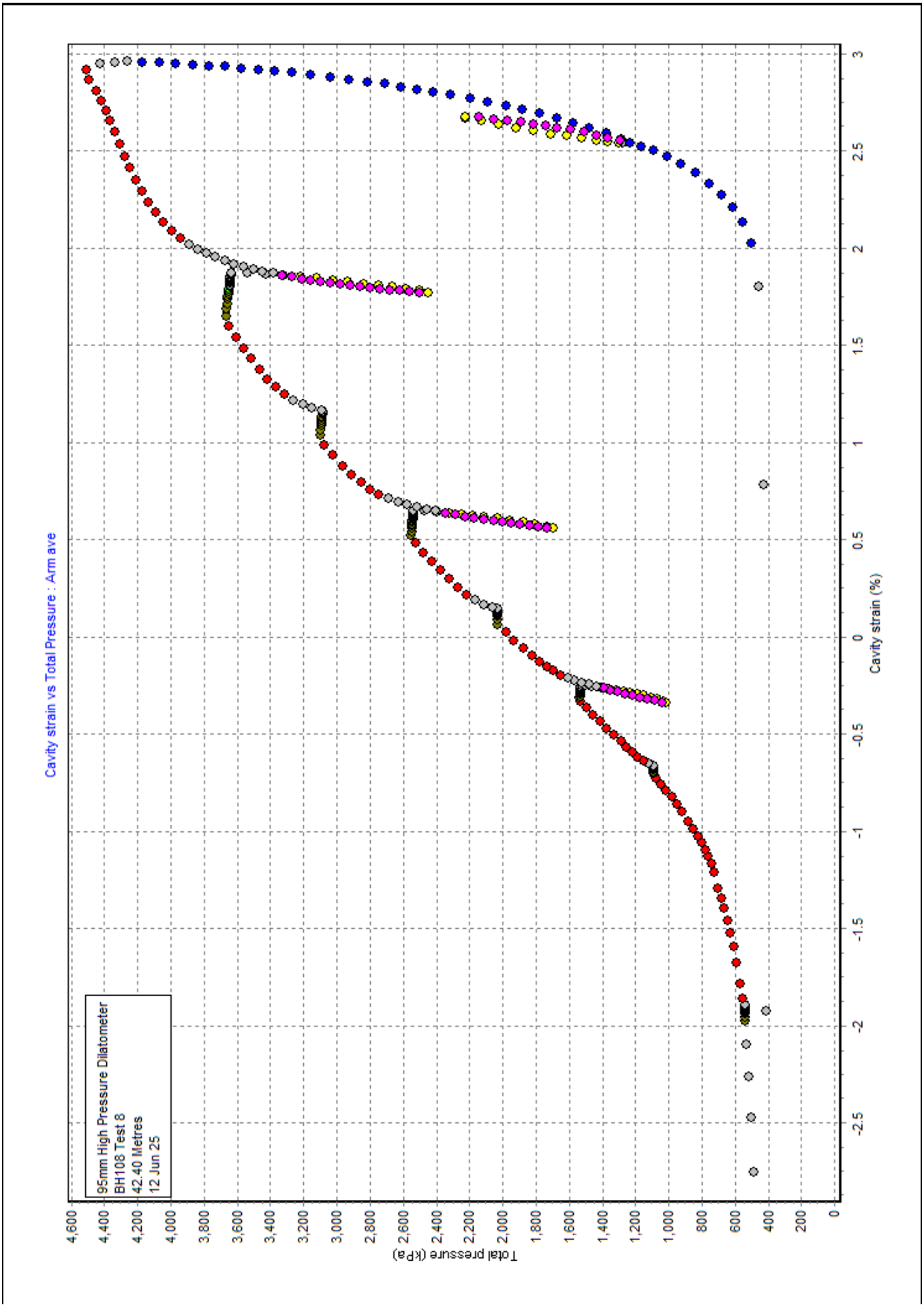
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

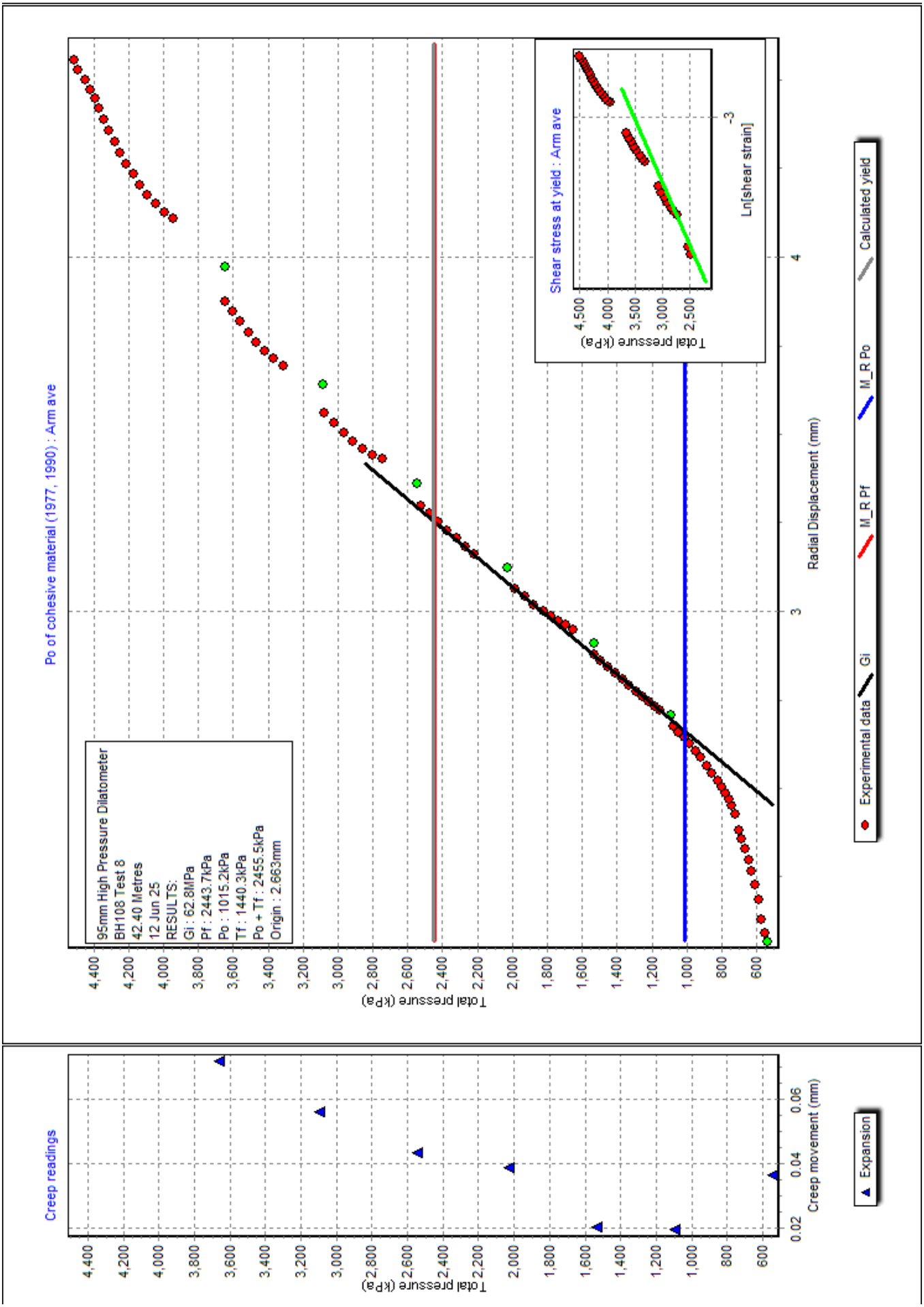
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	117.950	104.725	0.888
Arm ave	2	134.316	110.585	0.823
Arm ave	3	126.201	98.390	0.780
Arm ave	4	92.979	70.260	0.756

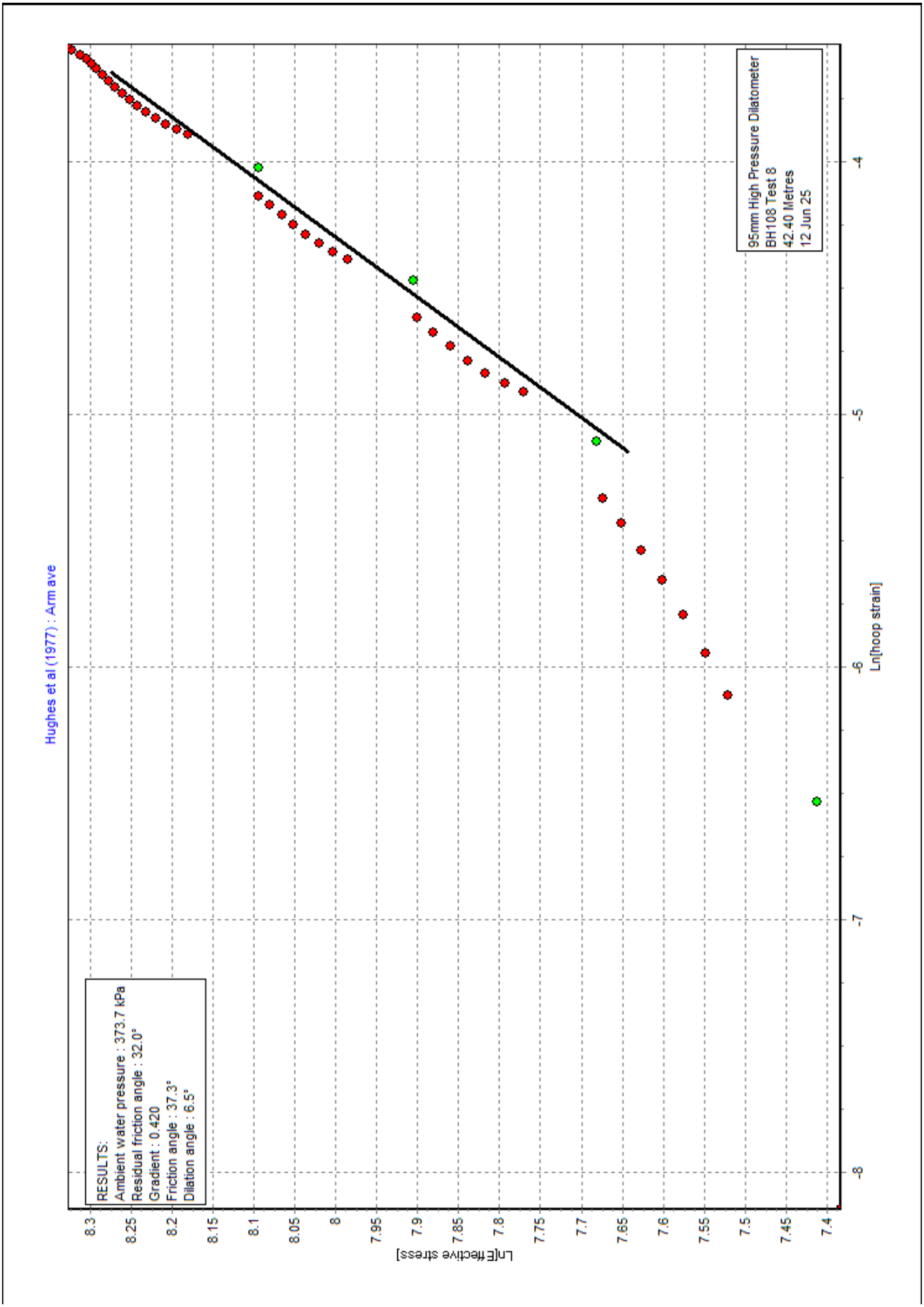
[PARAMETERS USED FOR DRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 3.05
Po (kPa) : 932
Cohesion (kPa) : 66
Angle of peak friction (deg) : 37.3
Angle of peak dilation (deg) : 6.5

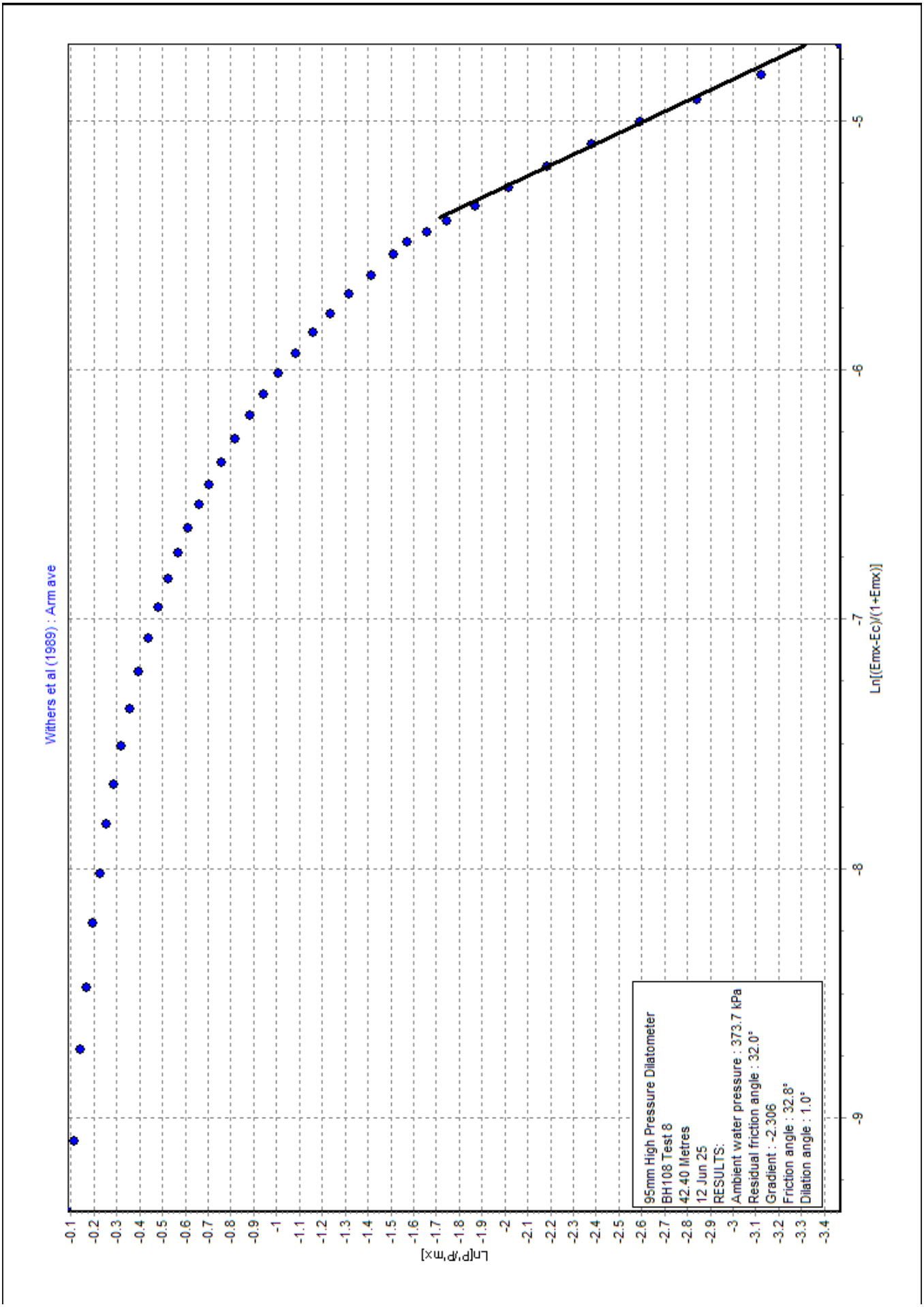
Grain to TIlbury
BH108 Test 8 - SUMMARY OF RESULTS

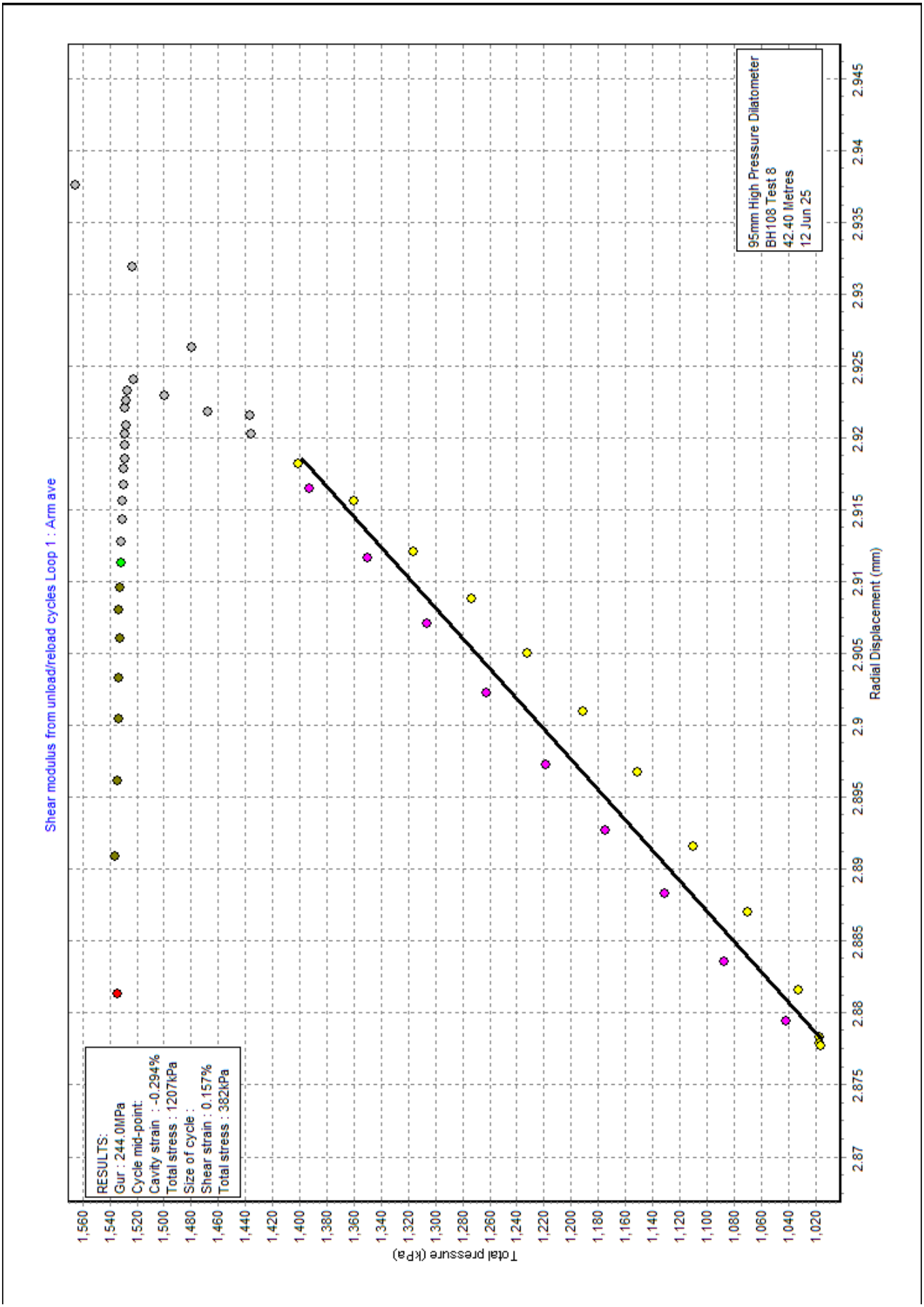
Total yield stress (kPa)	:	1537
Total limit stress (kPa)	:	14315
G at first yield (MPa)	:	251.7
Non-linear exponent	:	0.780
Janbu exponent	:	0.344
Correlation	:	0.757
Ambient pore water pressure (kPa)	:	374
Residual friction angle (deg)	:	32.0
Poisson's ratio	:	0.20

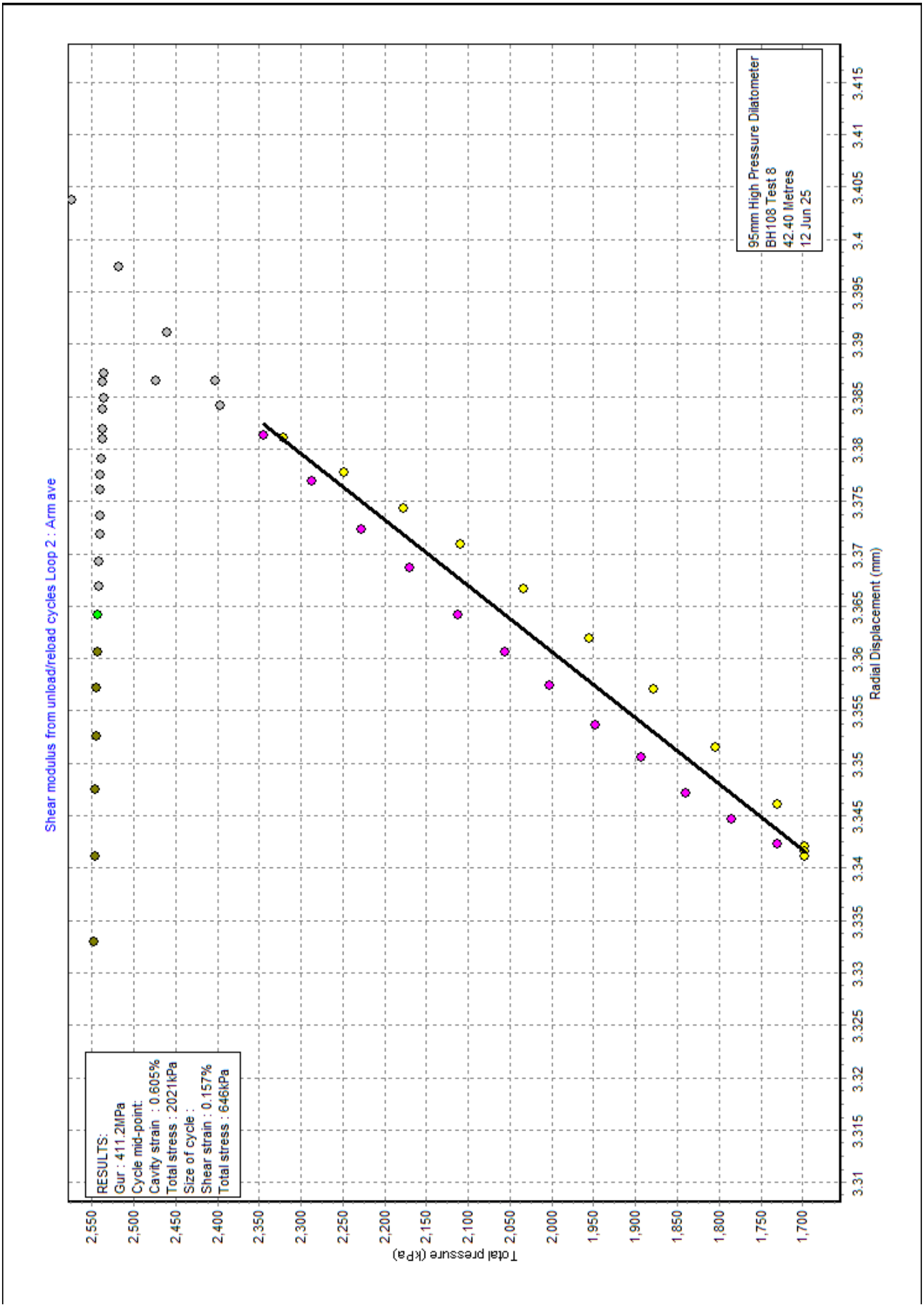

Cavity strain vs Total Pressure : Arm ave
95mm High Pressure Dilatometer
BH108 Test 8
42.40 Metres
12 Jun 25
Total pressure (kPa)
Cavity strain (%)
4,600
4,400
4,200
4,000
3,800
3,600
3,400
3,200
3,000
2,800
2,600
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5

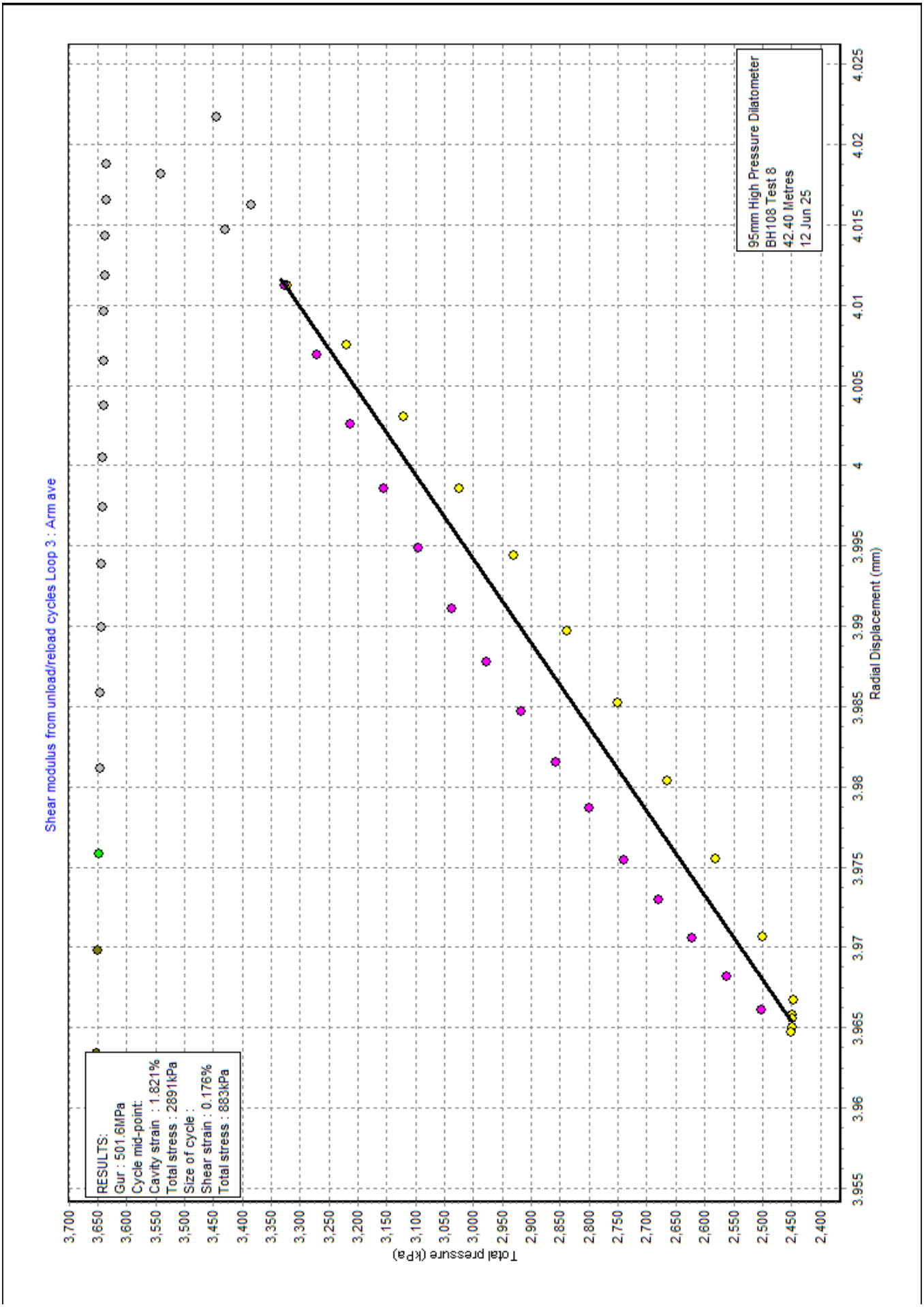

Po of cohesive material (1977, 1990) : Arm ave
95mm High Pressure Dilatometer
BH108 Test 8
42.40 Metres
12 Jun 25
RESULTS:
Gi : 62.8MPa
Pf : 2443.7kPa
Po : 1015.2kPa
Tf : 1440.3kPa
Po + Tf : 2455.5kPa
Origin : 2.663mm
Total pressure (kPa)
Radial Displacement (mm)
Experimental data
Gi
M_R Pf
M_R Po
Calculated yield
Shear stress at yield : Arm ave
Ln[shear strain]
Creep readings
Creep movement (mm)
Expansion

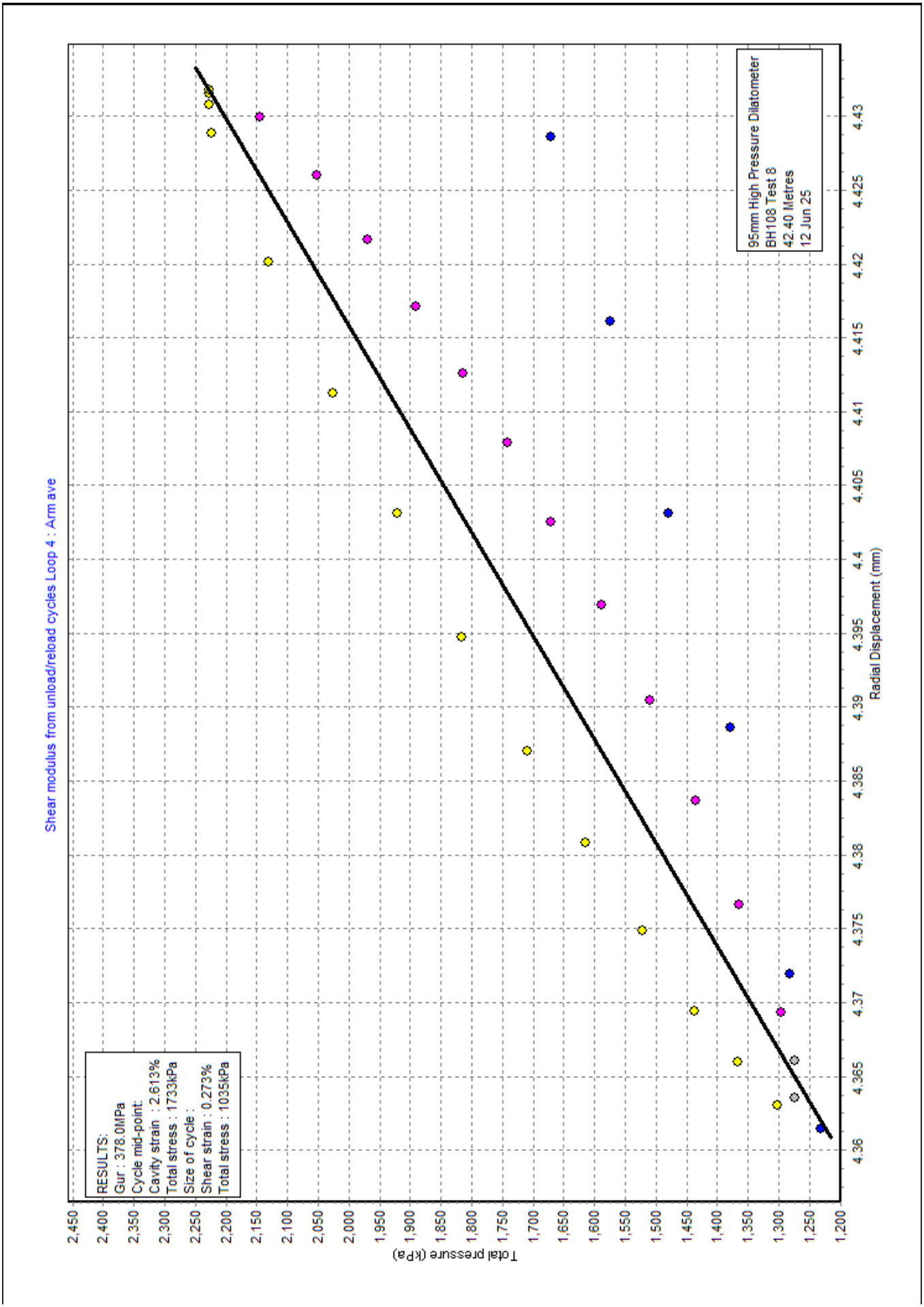

Hughes et al (1977) : Arm ave
RESULTS:
Ambient water pressure : 373.7 kPa
Residual friction angle : 32.0°
Gradient : 0.420
Friction angle : 37.3°
Dilation angle : 6.5°
95mm High Pressure Dilatometer
BH108 Test 8
42.40 Metres
12 Jun 25
Ln[Effective stress]
Ln[hoop strain]
8.3
8.25
8.2
8.15
8.1
8.05
8
7.95
7.9
7.85
7.8
7.75
7.7
7.65
7.6
7.55
7.5
7.45
7.4
-4
-5
-6
-7
-8

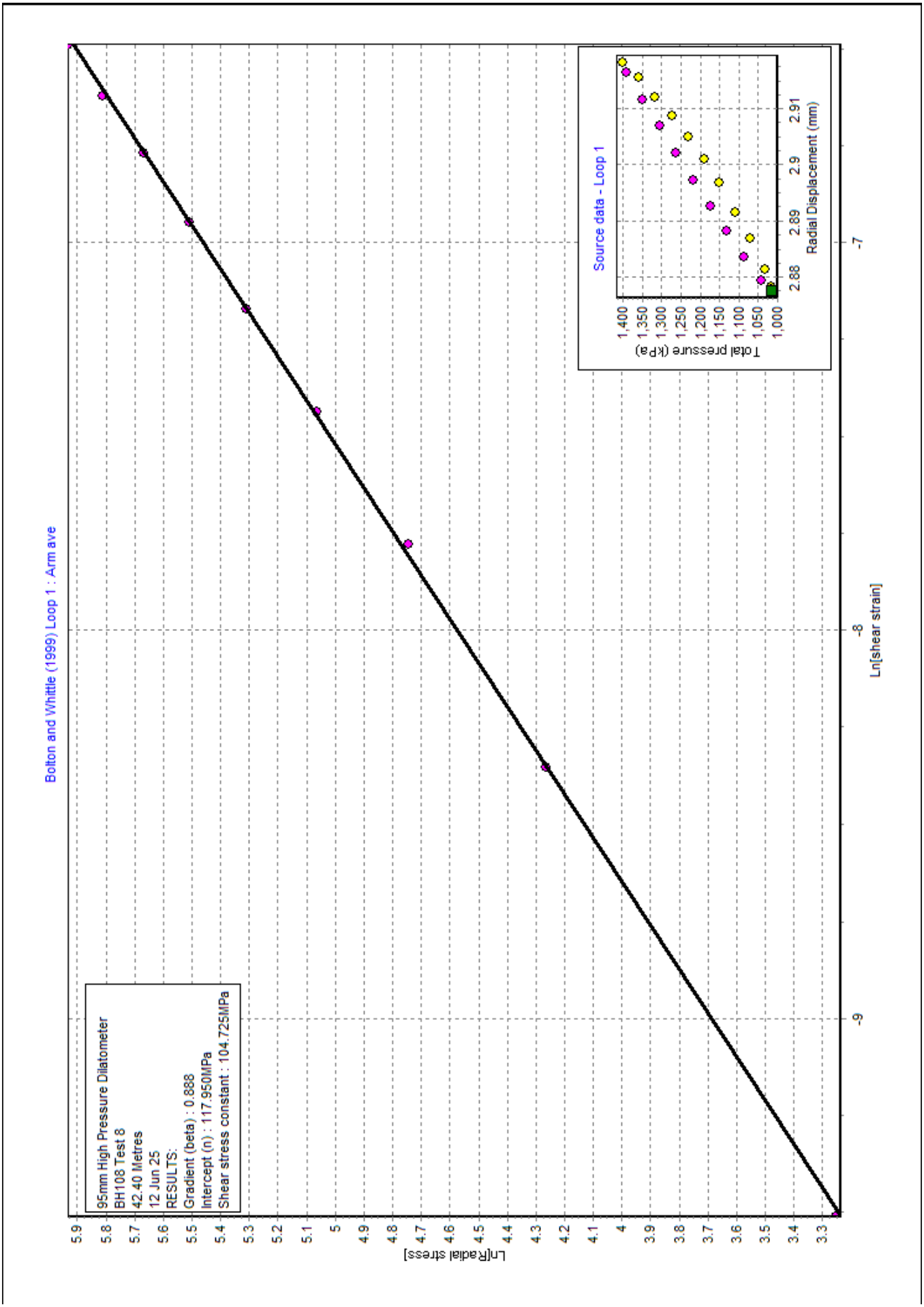

Withers et al (1989) : Arm ave
Ln[(Emx-Ec)/(1+Emx)]
Ln[P'/P'mx]
95mm High Pressure Dilatometer
BH108 Test 8
42.40 Metres
12 Jun 25
RESULTS:
Ambient water pressure : 373.7 kPa
Residual friction angle : 32.0°
Gradient : -2.306
Friction angle : 32.8°
Dilation angle : 1.0°

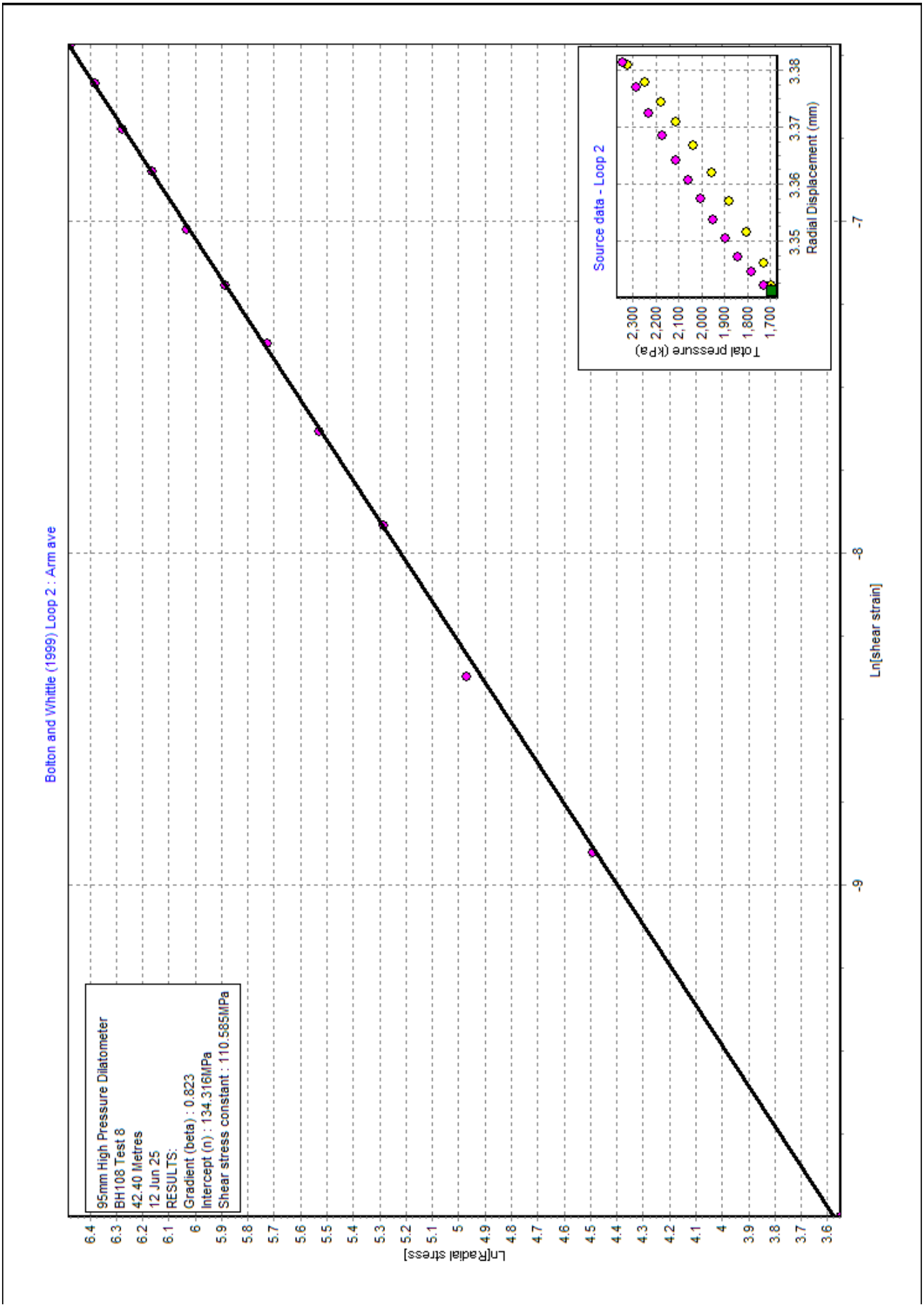

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 244.0MPa
Cycle mid-point:
Cavity strain : -0.294%
Total stress : 1207kPa
Size of cycle :
Shear strain : 0.157%
Total stress : 382kPa
95mm High Pressure Dilatometer
BH108 Test 8
42.40 Metres
12 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

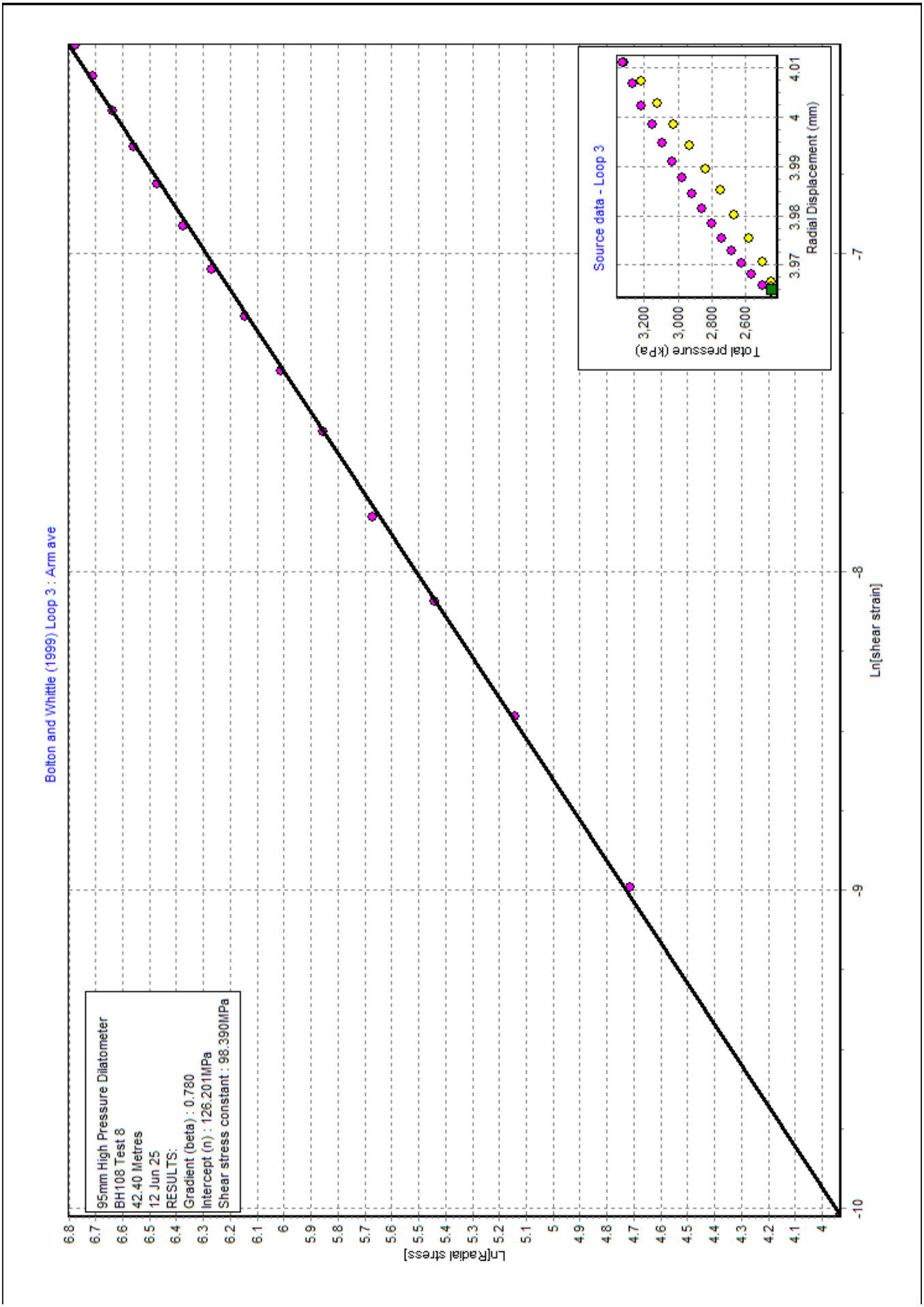

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 411.2MPa
Cycle mid-point:
Cavity strain : 0.605%
Total stress : 2021kPa
Size of cycle :
Shear strain : 0.157%
Total stress : 646kPa
95mm High Pressure Dilatometer
BH108 Test 8
42.40 Metres
12 Jun 25
Total pressure (kPa)
Radial Displacement (mm)
2,550
2,500
2,450
2,400
2,350
2,300
2,250
2,200
2,150
2,100
2,050
2,000
1,950
1,900
1,850
1,800
1,750
1,700
3.31
3.315
3.32
3.325
3.33
3.335
3.34
3.345
3.35
3.355
3.36
3.365
3.37
3.375
3.38
3.385
3.39
3.395
3.4
3.405
3.41
3.415

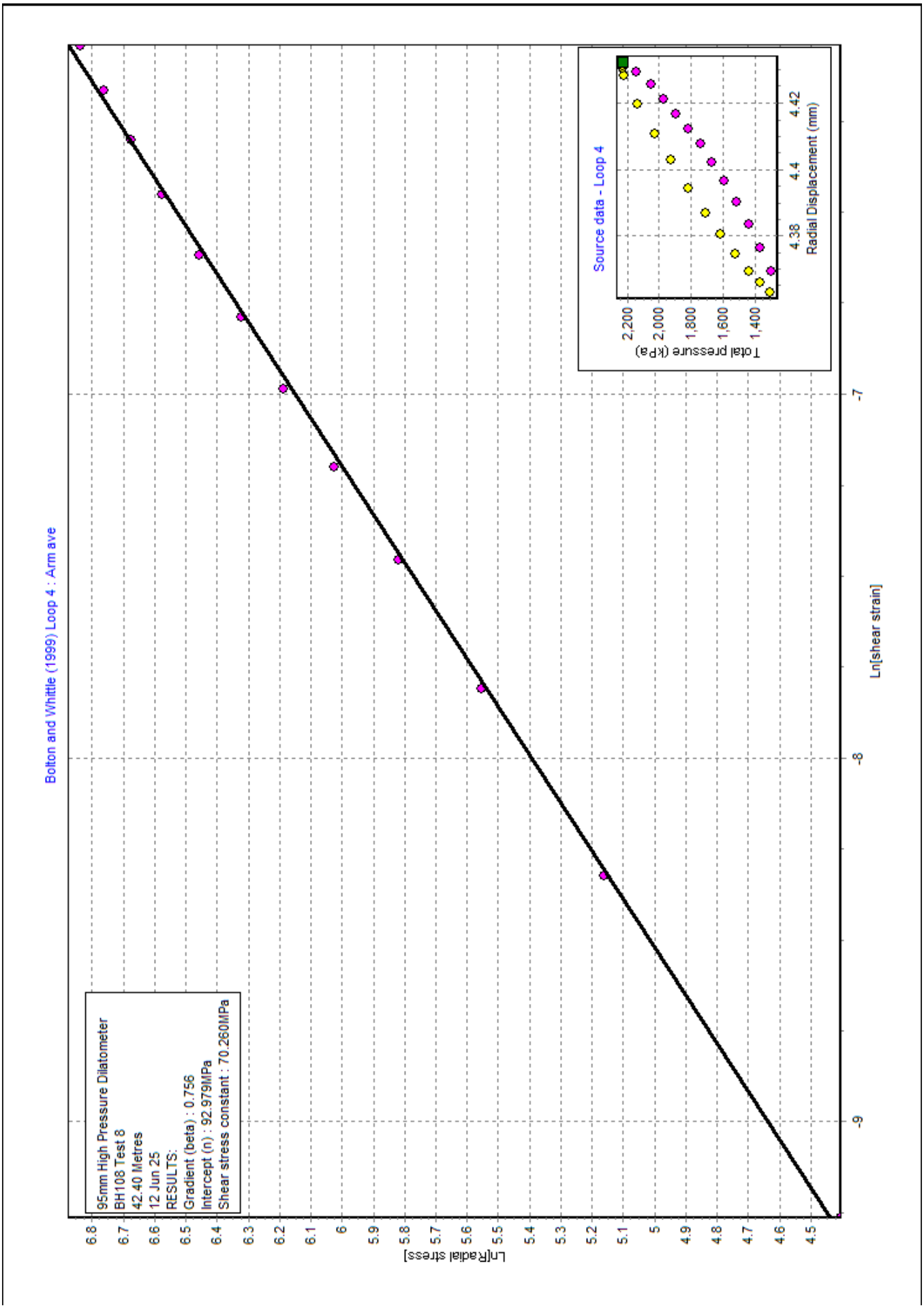

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 501.6MPa
Cycle mid-point:
Cavity strain : 1.821%
Total stress : 2891kPa
Size of cycle :
Shear strain : 0.176%
Total stress : 883kPa
95mm High Pressure Dilatometer
BH108 Test 8
42.40 Metres
12 Jun 25
Total pressure (kPa)
Radial Displacement (mm)

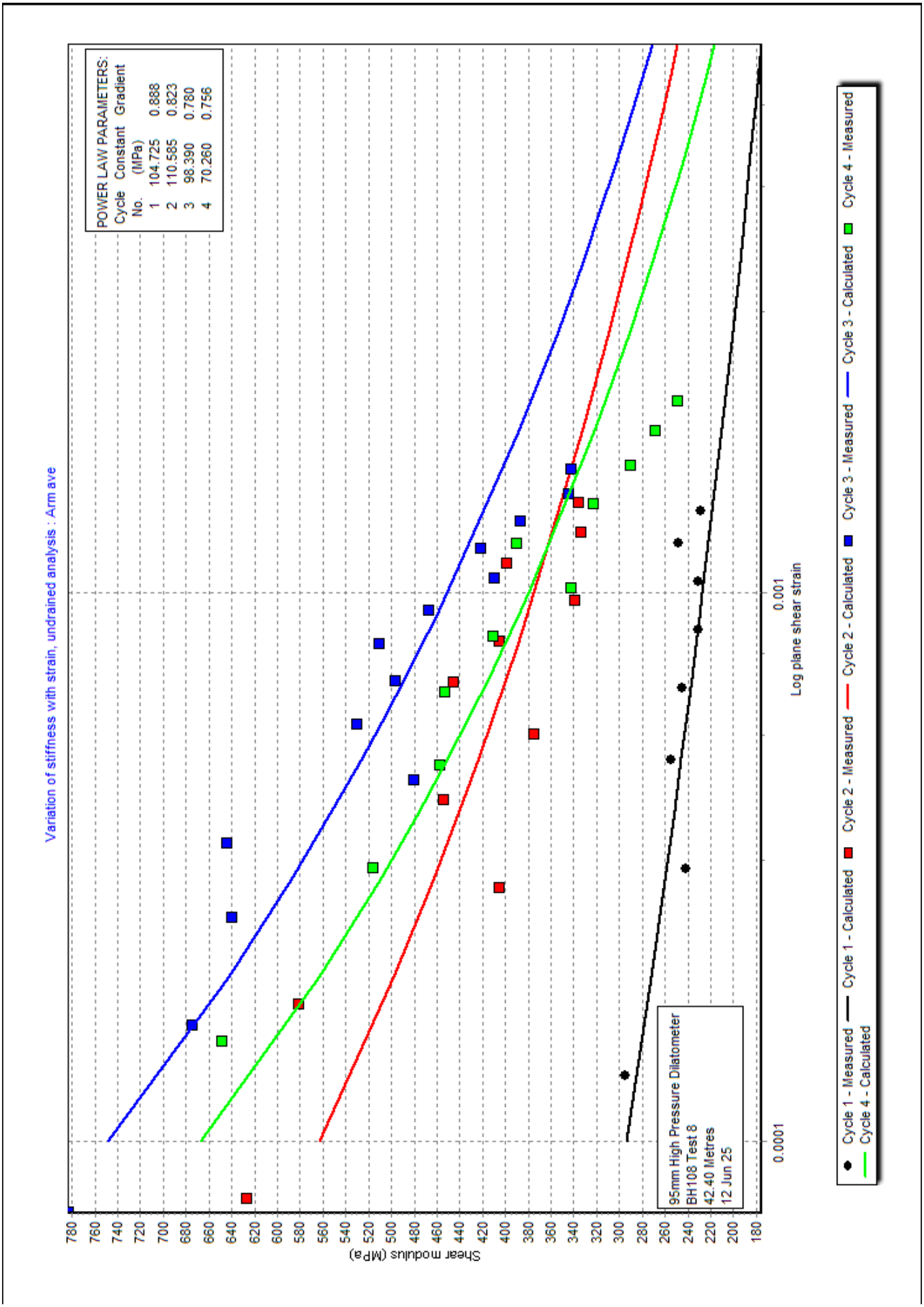

Shear modulus from unload/reload cycles Loop 4 : Arm ave
RESULTS:
Gur : 378.0MPa
Cycle mid-point:
Cavity strain : 2.613%
Total stress : 1733kPa
Size of cycle :
Shear strain : 0.273%
Total stress : 1035kPa
95mm High Pressure Dilatometer
BH108 Test 8
42.40 Metres
12 Jun 25
Total pressure (kPa)
Radial Displacement (mm)
2,450
2,400
2,350
2,300
2,250
2,200
2,150
2,100
2,050
2,000
1,950
1,900
1,850
1,800
1,750
1,700
1,650
1,600
1,550
1,500
1,450
1,400
1,350
1,300
1,250
1,200
4.36
4.365
4.37
4.375
4.38
4.385
4.39
4.395
4.4
4.405
4.41
4.415
4.42
4.425
4.43

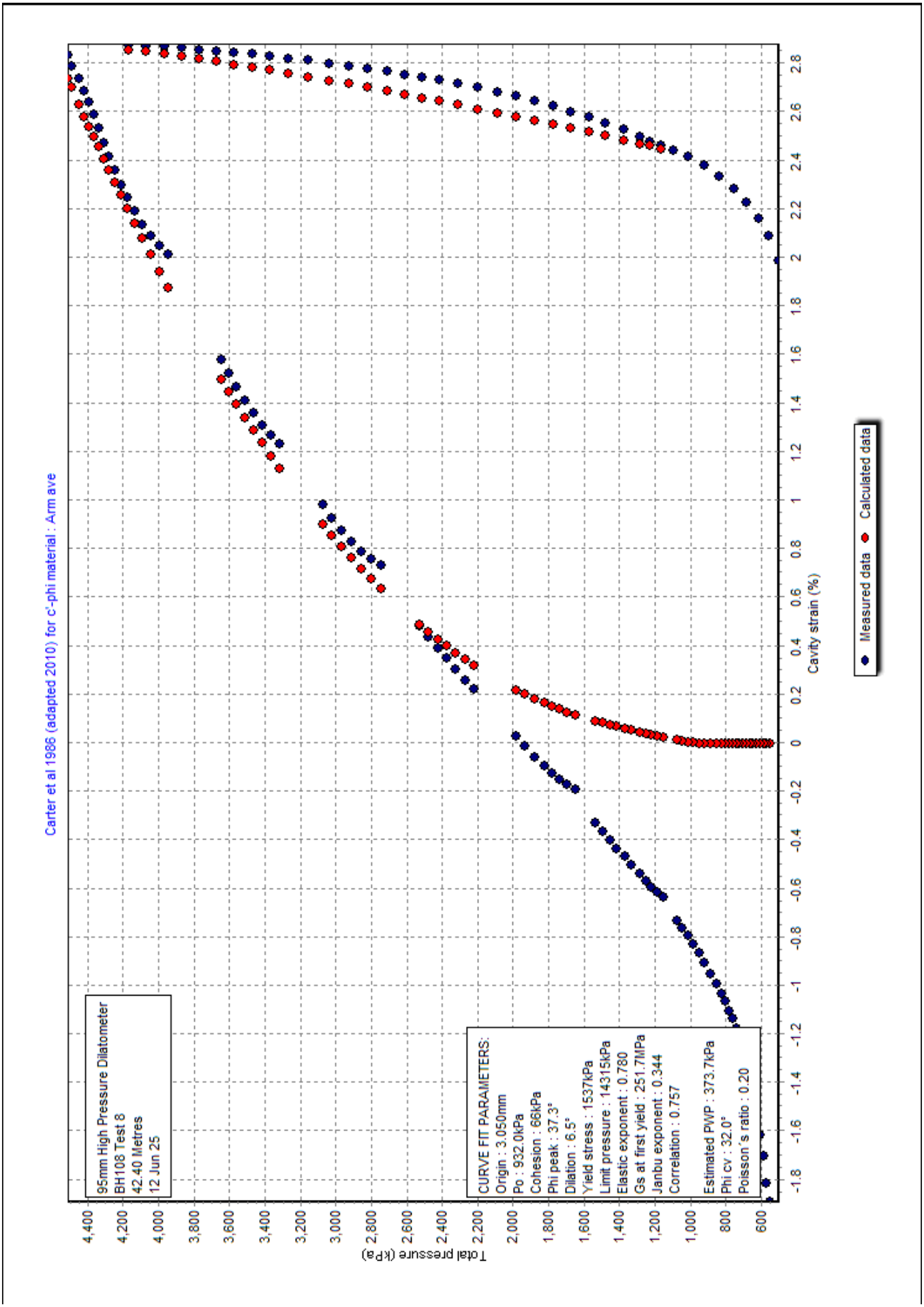

Bolton and Whittle (1999) Loop 1 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 8
42.40 Metres
12 Jun 25
RESULTS:
Gradient (beta) : 0.888
Intercept (n) : 117.950MPa
Shear stress constant : 104.725MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

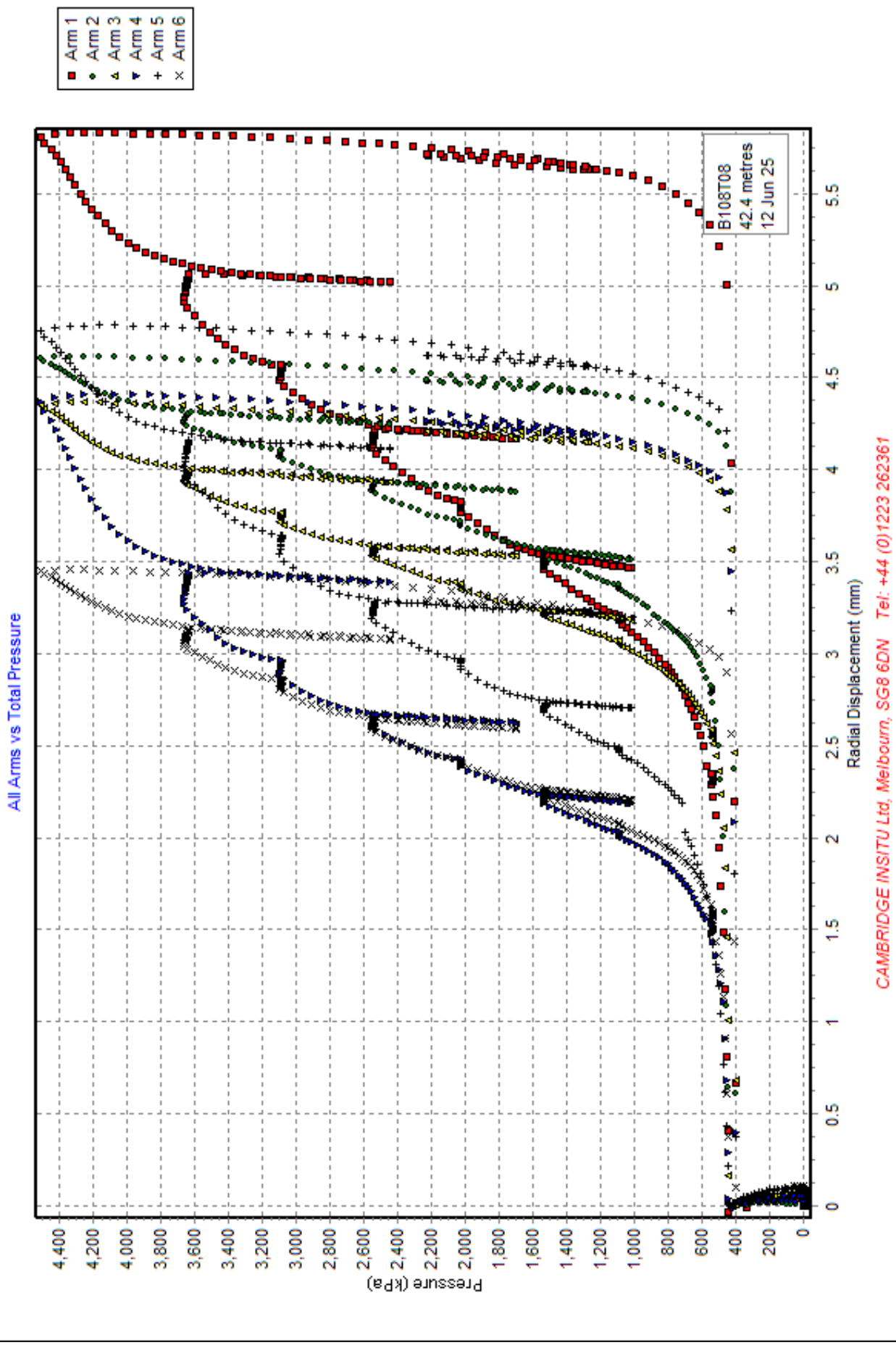

Bolton and Whittle (1999) Loop 2 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 8
42.40 Metres
12 Jun 25
RESULTS:
Gradient (beta) : 0.823
Intercept (n) : 134.316MPa
Shear stress constant : 110.585MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

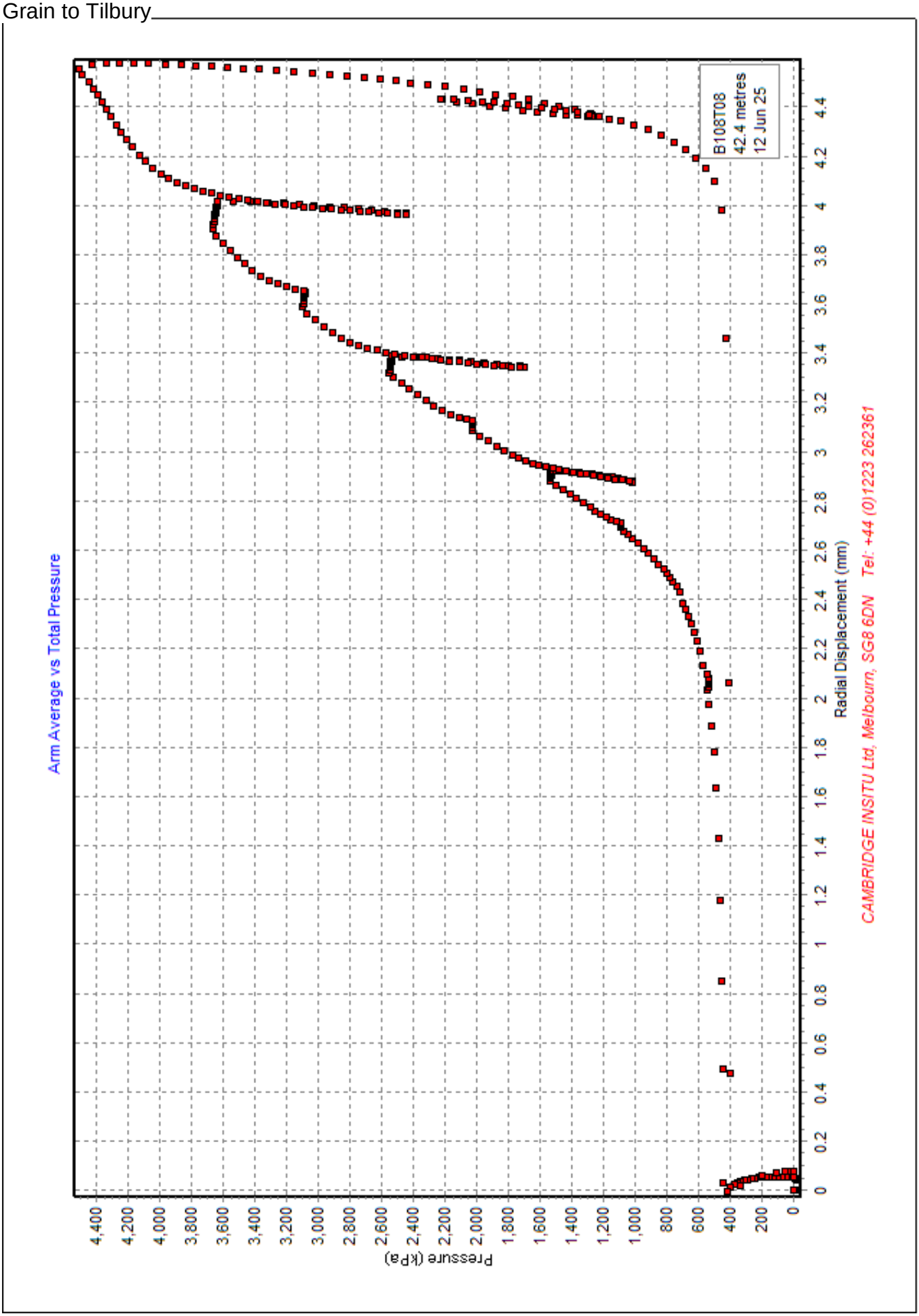

Bolton and Whittle (1999) Loop 3 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 8
42.40 Metres
12 Jun 25
RESULTS:
Gradient (beta) : 0.780
Intercept (n) : 126.201MPa
Shear stress constant : 98.390MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)

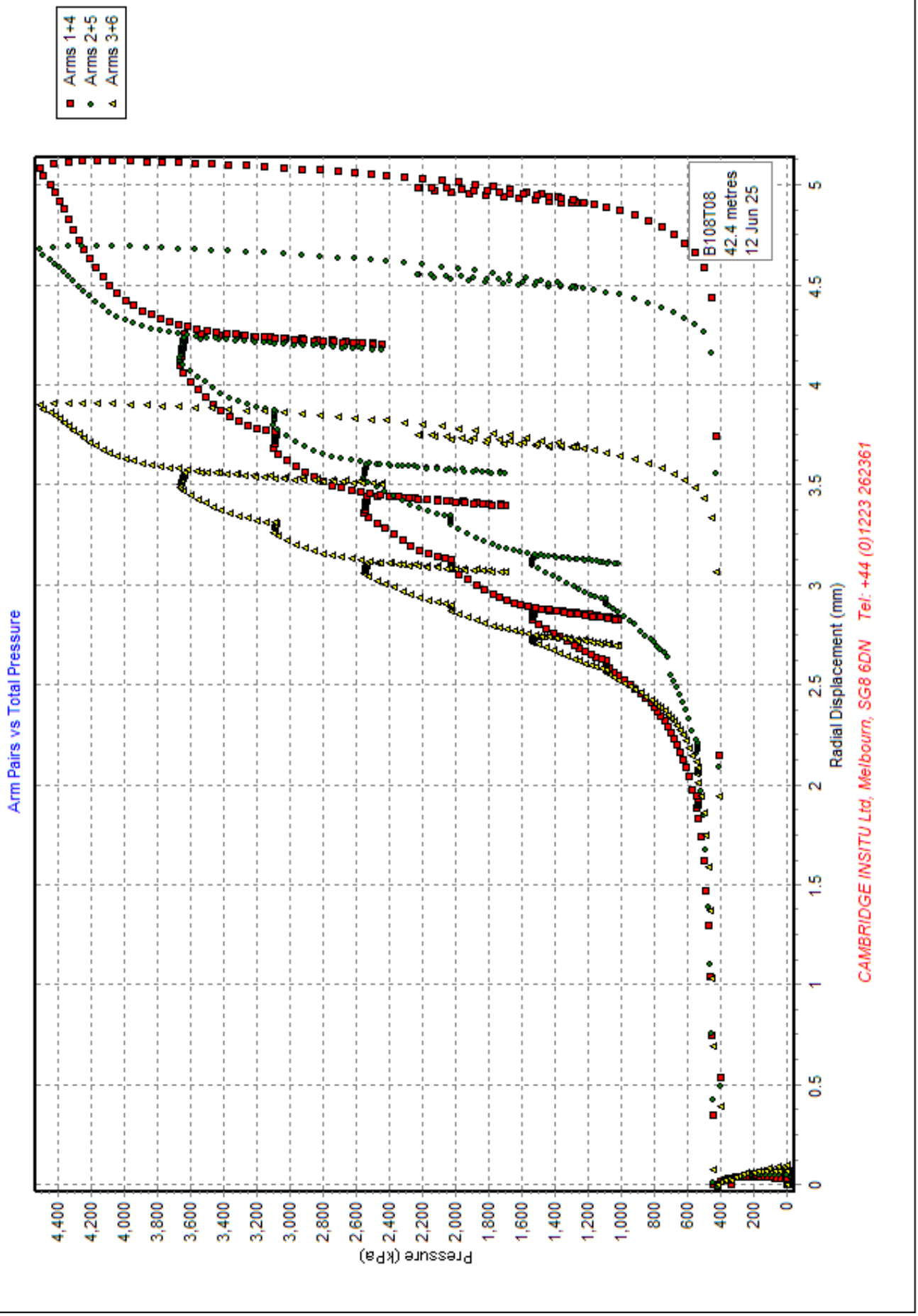

Bolton and Whittle (1999) Loop 4 : Arm ave
95mm High Pressure Dilatometer
BH108 Test 8
42.40 Metres
12 Jun 25
RESULTS:
Gradient (beta) : 0.756
Intercept (n) : 92.979MPa
Shear stress constant : 70.260MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 4
Total pressure (kPa)
Radial Displacement (mm)

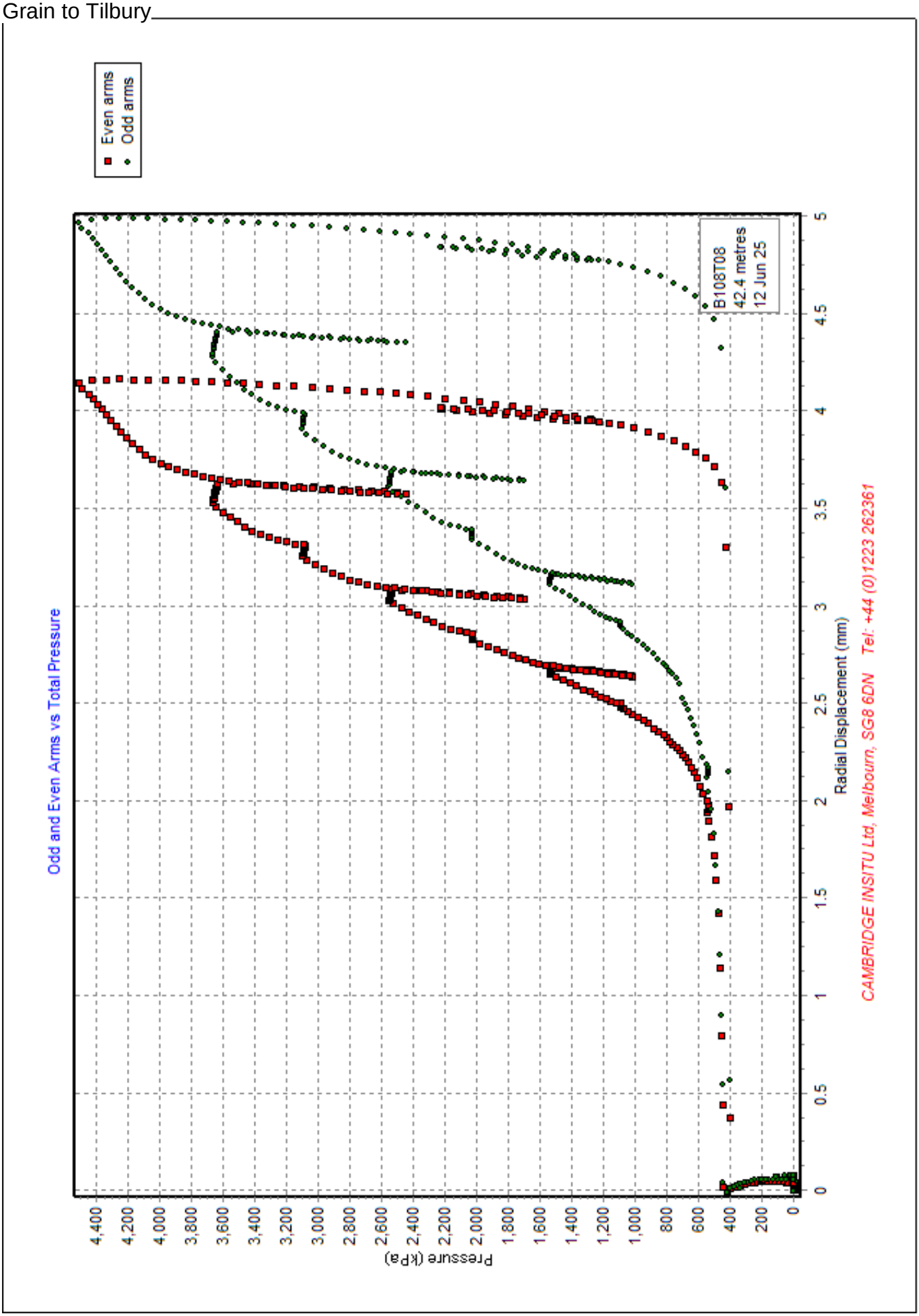

Variation of stiffness with strain, undrained analysis : Arm ave
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 104.725 0.888
2 110.585 0.823
3 98.390 0.780
4 70.260 0.756
95mm High Pressure Dilatometer
BH108 Test 8
42.40 Metres
12 Jun 25
Shear modulus (MPa)
Log plane shear strain
0.0001
0.001
Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
Cycle 4 - Measured
Cycle 4 - Calculated


Carter et al 1986 (adapted 2010) for c'-phi material : Arm ave
95mm High Pressure Dilatometer
BH108 Test 8
42.40 Metres
12 Jun 25
CURVE FIT PARAMETERS:
Origin : 3.050mm
Po : 932.0kPa
Cohesion : 66kPa
Phi peak : 37.3°
Dilation : 6.5°
Yield stress : 1537kPa
Limit pressure : 14315kPa
Elastic exponent : 0.780
Gs at first yield : 251.7MPa
Janbu exponent : 0.344
Correlation : 0.757
Estimated PWP : 373.7kPa
Phi cv : 32.0°
Poisson's ratio : 0.20
Total pressure (kPa)
Cavity strain (%)
Measured data
Calculated data


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
B108T08
42.4 metres
12 Jun 25
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
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Arm Average vs Total Pressure
B108T08
42.4 metres
12 Jun 25
Pressure (kPa)
Radial Displacement (mm)
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Arms 1+4
Arms 2+5
Arms 3+6
B108T08
42.4 metres
12 Jun 25
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Even arms
Odd arms
B108T08
42.4 metres
12 Jun 25
Odd and Even Arms vs Total Pressure
Radial Displacement (mm)
Pressure (kPa)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

CALIBRATION DATA

(TAKEN FROM WINLOG & EXCEL FILES)

Included:

TEST NAME	DATE *dd/mm/yyyy*	PROBE	REMARKS
Transducers	05/03/2025	HPD95 “Wally”	Full calibration
Transducers	25/04/2025	HPD95 “Wally”	Arm 3 transducer only
P1305T25	13/05/2025	HPD95 “Wally”	System compliance
P1305T25	13/05/2025	HPD95 “Wally”	Membrane calibration
P2205T25	22/05/2025	HPD95 “Wally”	System compliance
P2205T25	22/05/2025	HPD95 “Wally”	Membrane stiffness slope
P2205T25	22/05/2025	HPD95 “Wally”	Membrane stiffness zero
P0306T25	03/06/2025	HPD95 “Wally”	System compliance
P0306T25	03/06/2025	HPD95 “Wally”	Membrane calibration
S1006T25	10/06/2025	HPD95 “Wally”	System compliance
S1005T25	10/06/2025	HPD95 “Wally”	Membrane stiffness slope
S1005T25	10/06/2025	HPD95 “Wally”	Membrane stiffness zero
Transducers	23/05/2025	HPD95 “Lilith”	Full calibration
P2305T25	23/05/2025	HPD95 “Lilith”	System compliance
P2305T25	23/05/2025	HPD95 “Lilith”	Membrane stiffness slope
P2305T25	23/05/2025	HPD95 “Lilith”	Membrane stiffness zero

Calibration Date	Operator	Instrument Type	Serial Number	Instrument Name
05/03/2025	SDB + KGC	HPD	160208	Wally

Notes: Full cals used for Grain to Tilbury

Arm Springs

mm	Arm 1	Linearity	Hysteresis	Arm 2	Linearity	Hysteresis	Arm 3	Linearity	Hysteresis	Arm 4	Linearity	Hysteresis	Arm 5	Linearity	Hysteresis	Arm 6	Linearity	Hysteresis
	(mV)	(%)	(%)	(mV)	(%)	(%)	(mV)	(%)	(%)	(mV)	(%)	(%)	(mV)	(%)	(%)	(mV)	(%)	(%)
0	-2133.2	103.5	0.08	-2756.7	103.3	0.03	-2449.5	103.5	0.02	-2102.4	103.1	-0.05	-2332.3	103.1	0.07	-2067.7	105.4	0.04
2	-1832	102.3	0.16	-2470.7	102.1	-0.03	-2146.9	102.5	0.12	-1813.8	102.5	-0.01	-2045.8	102.1	0.07	-1804.4	103.4	-0.01
4	-1534.1	101.5	0.19	-2188.0	101.5	-0.06	-1847.2	101.5	0.18	-1526.8	101.5	0.00	-1762.2	101.3	0.05	-1546.0	102.2	-0.08
6	-1238.5	100.8	0.21	-1907.1	100.5	-0.09	-1550.5	100.8	0.22	-1242.6	100.8	0.01	-1480.9	100.7	0.03	-1290.7	100.7	-0.13
8	-944.9	99.8	0.25	-1628.9	99.9	-0.12	-1255.6	99.9	0.24	-960.5	100.3	0.00	-1201.2	100.0	0.01	-1039.1	99.9	-0.18
10	-654.2	99.3	0.24	-1352.4	99.5	-0.13	-963.5	99.2	0.24	-679.8	99.4	0.00	-923.5	99.1	0.00	-789.5	98.8	-0.20
12	-365	97.8	0.21	-1077.1	97.9	-0.15	-673.4	98.8	0.23	-401.4	98.8	0.01	-648.1	99.2	-0.02	-542.5	97.9	-0.20
14	-80.3	98.3	0.06	-806.0	98.6	-0.23	-384.5	98.2	0.20	-124.7	97.7	0.02	-372.6	97.8	-0.03	-297.9	97.0	-0.22
16	205.8	98.1	0.00	-533.2	98.2	-0.20	-97.2	98.0	0.15	148.8	97.5	-0.05	-100.8	98.2	-0.11	-55.6	97.8	-0.28
18	491.4	98.1	-0.07	-261.4	98.1	-0.16	189.3	97.6	0.10	421.8	98.2	-0.10	171.9	98.1	-0.01	188.8	97.4	-0.10
20	777	-97.4		10.1	-96.5		474.8	-98.6		696.8	-97.2		444.5	-98.0		432.2	-96.4	
18	493.3	-98.7		-257.0	-97.8		186.5	-98.5		424.7	-98.0		172.3	-97.2		191.3	-96.0	
16	205.9	-98.9		-527.7	-98.2		-101.6	-98.7		150.3	-98.4		-97.8	-98.7		-48.7	-97.5	
14	-82.1	-99.3		-799.5	-98.8		-390.3	-99.1		-125.2	-98.8		-371.9	-99.2		-292.4	-98.1	
12	-371.1	-99.6		-1073.0	-99.6		-680.1	-99.3		-401.7	-99.4		-647.6	-99.3		-537.5	-98.8	
10	-661.2	-100.0		-1348.8	-100.0		-970.5	-99.9		-679.9	-100.3		-923.4	-100.1		-784.5	-100.1	
8	-952.2	-100.4		-1625.5	-100.9		-1262.6	-100.7		-960.6	-100.8		-1201.5	-100.9		-1034.6	-101.2	
6	-1244.6	-101.3		-1904.7	-101.7		-1557.0	-101.0		-1242.9	-101.4		-1481.7	-101.4		-1287.5	-102.6	
4	-1539.6	-102.0		-2186.3	-102.4		-1852.4	-101.9		-1526.8	-102.4		-1763.5	-102.3		-1544.0	-104.1	
2	-1836.6	-102.6		-2469.8	-103.9		-2150.3	-102.5		-1813.4	-102.7		-2047.7	-103.1		-1804.2	-105.8	
0	-2135.4			-2757.4			-2450.1			-2100.9			-2334.2			-2068.6		
Intercept	**-2121.2 mV**			**-2742.8 mV**			**-2436.9 mV**			**-2088.6 mV**			**-2320.4 mV**			**-2048.2 mV**		
Slope	**145.6 mV/mm**			**138.4 mV/mm**			**146.2 mV/mm**			**140.0 mV/mm**			**138.9 mV/mm**			**124.9 mV/mm**		

Pressure Cells

Gauge Zero Offset: **0.0**

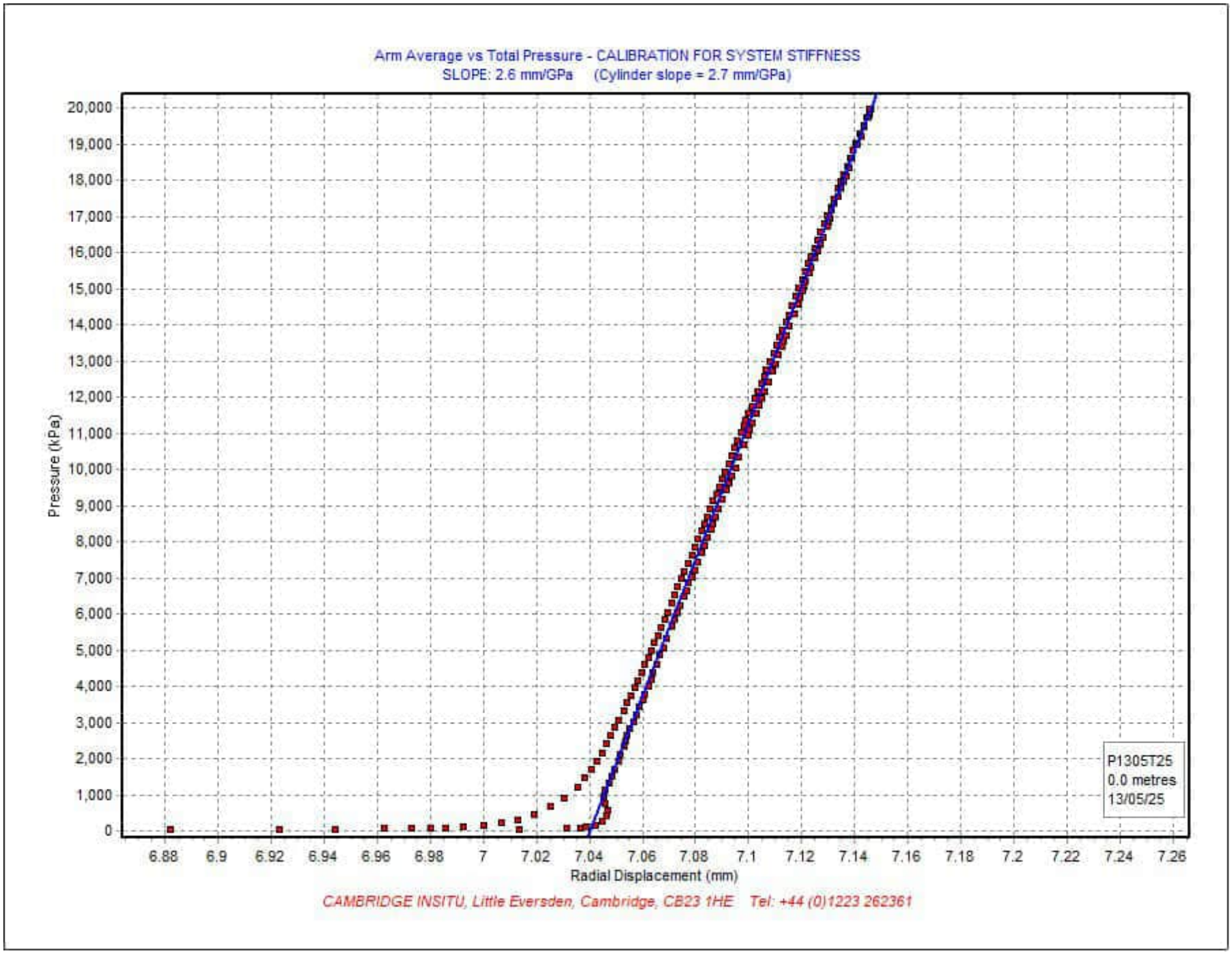
Bars	TPC A	Linearity	Hysteresis	TPC B	Linearity	Hysteresis
	(mV)	(%)	(%)	(mV)	(%)	(%)
0.0	-978.7	99.8	-0.13	-2203.5	100.1	-0.12
20.0	-763.2	99.5	-0.19	-1985.4	99.5	-0.13
40.0	-548.4	99.7	-0.25	-1768.6	100.1	-0.18
60.0	-333.2	100.0	-0.27	-1550.6	100.1	-0.21
80.0	-117.4	99.9	-0.25	-1332.5	99.8	-0.17
100.0	98.3	100.1	-0.30	-1115.0	100.0	-0.23
120.0	314.4	100.4	-0.15	-897.2	100.3	-0.17
140.0	531.1	100.5	-0.25	-678.6	100.3	-0.17
160.0	748.0	100.2	-0.13	-460.0	100.3	-0.09
180.0	964.3	100.6	-0.11	-241.5	99.7	-0.02
200.0	1181.5	99.6		-24.4	99.5	
180.0	966.6	100.0		-241.1	99.6	
160.0	750.8	99.2		-458.0	99.6	
140.0	536.6	101.4		-674.9	100.4	
120.0	317.7	98.6		-893.6	99.3	
100.0	104.8	100.5		-1110.0	100.5	
80.0	-112.1	99.7		-1328.9	99.7	
60.0	-327.3	99.9		-1546.0	100.3	
40.0	-543.0	100.1		-1764.6	100.0	
20.0	-759.1	100.4		-1982.5	100.3	
0.0	-975.8			-2200.9		
Intercept	-977.6 mV			-2202.0 mV		
Slope	10.792 mV/Bars			10.892 mV/Bars		
Slope	107.9 mV/MPa			108.9 mV/MPa		

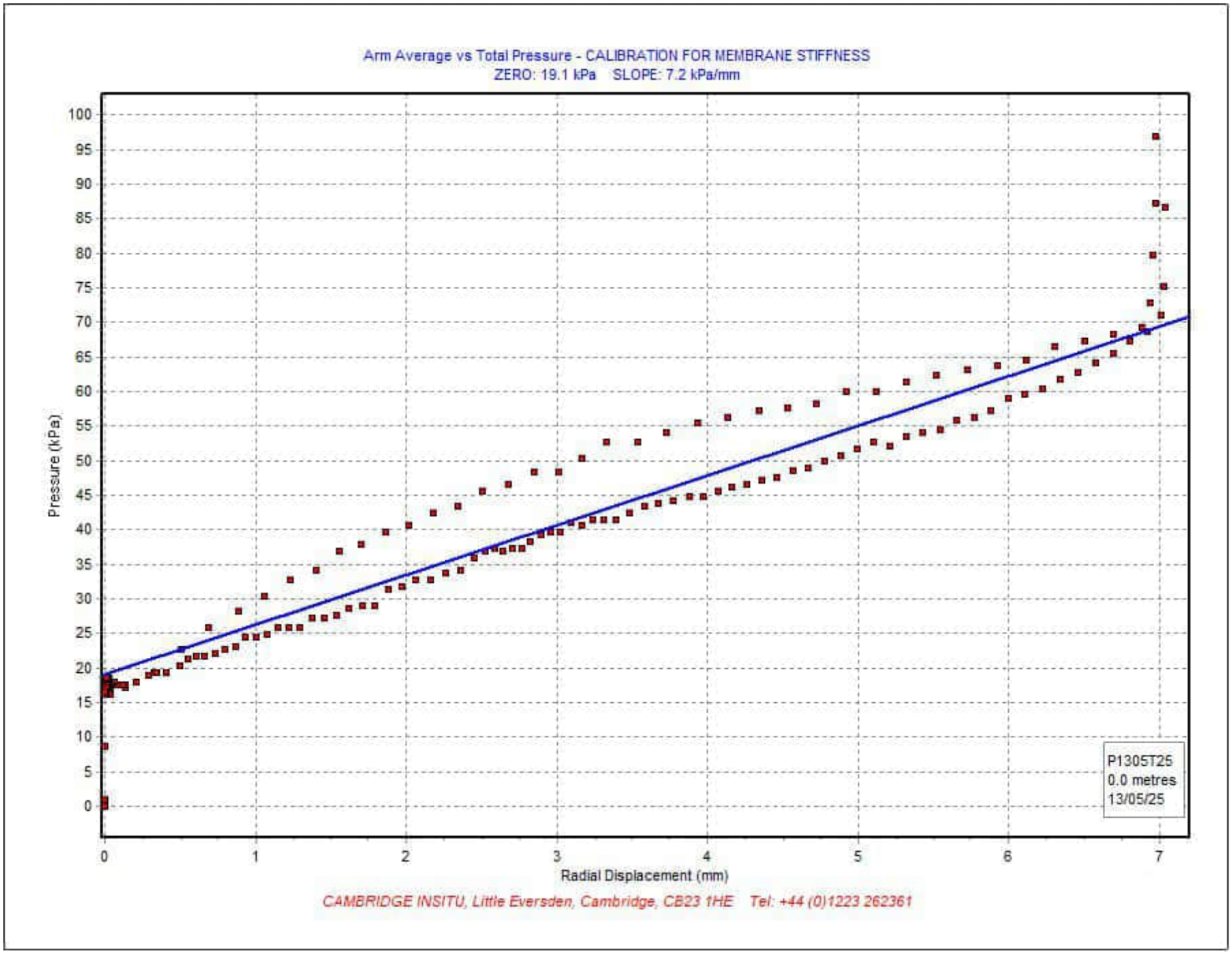
Calibration Date	Operator	Instrument Type	Serial Number	Instrument Name
25/04/2025	PA	HPD	160208	Wally

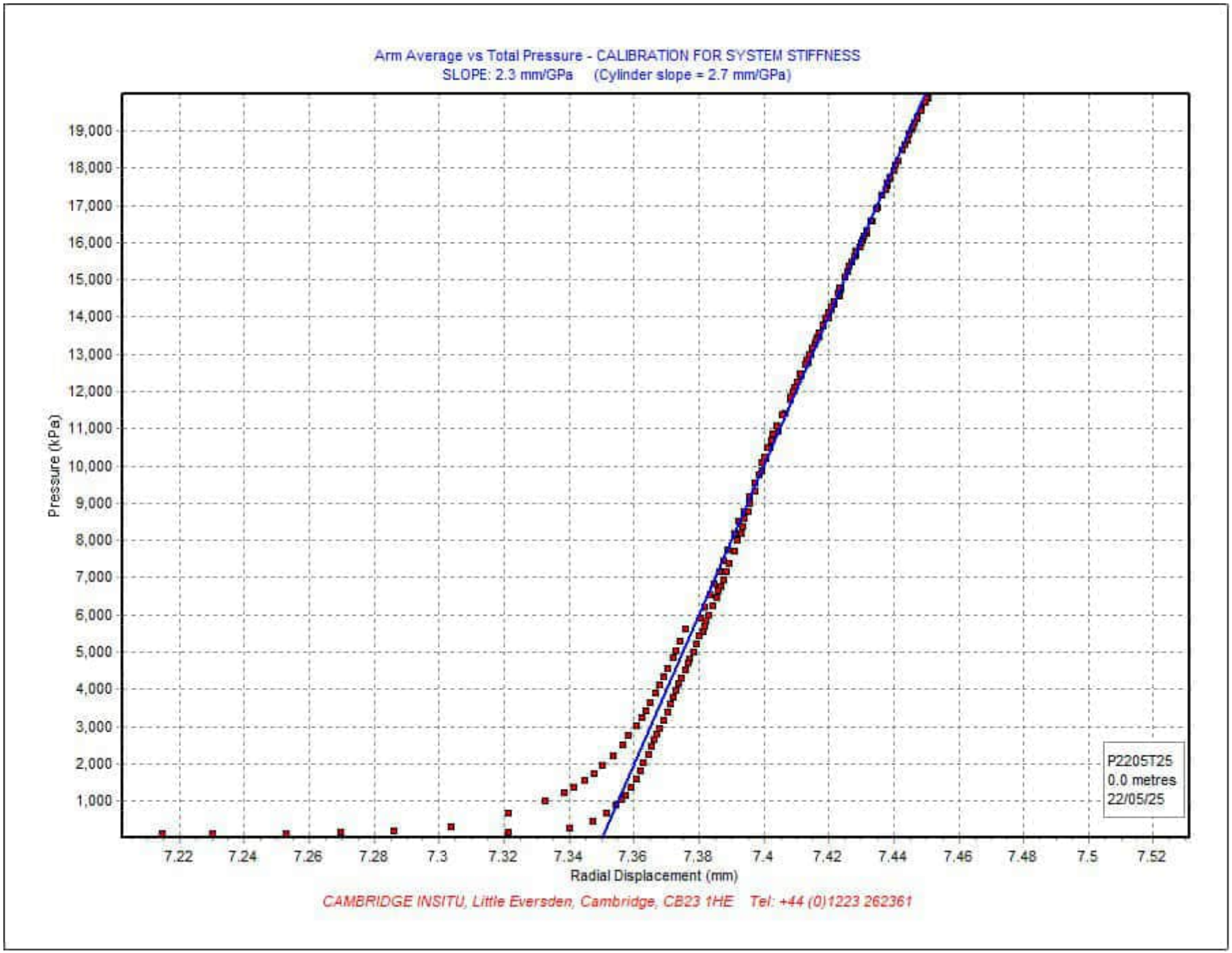
Notes: Replaced & Calibrated Arm 3. Use all other cals from 05/03/2025.

Arm Springs

mm	Arm 1	Linearity	Hysteresis	Arm 2	Linearity	Hysteresis	Arm 3	Linearity	Hysteresis	Arm 4	Linearity	Hysteresis	Arm 5	Linearity	Hysteresis	Arm 6	Linearity	Hysteresis
	(mV)	(%)	(%)	(mV)	(%)	(%)	(mV)	(%)	(%)	(mV)	(%)	(%)	(mV)	(%)	(%)	(mV)	(%)	(%)
0		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	-2471.8	102.0	0.02		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!
2		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	-2173.7	102.8	0.14		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!
4		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	-1873.5	101.5	0.24		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!
6		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	-1576.9	101.2	0.24		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!
8		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	-1281.3	99.9	0.26		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!
10		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	-989.5	99.5	0.28		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!
12		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	-698.7	98.6	0.27		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!
14		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	-410.5	98.5	0.23		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!
16		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	-122.8	98.1	0.18		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!
18		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	163.7	95.2	0.11		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!
20		#DIV/0!			#DIV/0!		441.8	-96.3			#DIV/0!			#DIV/0!			#DIV/0!	
18		#DIV/0!			#DIV/0!		160.5	-98.7			#DIV/0!			#DIV/0!			#DIV/0!	
16		#DIV/0!			#DIV/0!		-127.9	-99.1			#DIV/0!			#DIV/0!			#DIV/0!	
14		#DIV/0!			#DIV/0!		-417.3	-99.0			#DIV/0!			#DIV/0!			#DIV/0!	
12		#DIV/0!			#DIV/0!		-706.5	-99.6			#DIV/0!			#DIV/0!			#DIV/0!	
10		#DIV/0!			#DIV/0!		-997.6	-99.7			#DIV/0!			#DIV/0!			#DIV/0!	
8		#DIV/0!			#DIV/0!		-1289.0	-100.9			#DIV/0!			#DIV/0!			#DIV/0!	
6		#DIV/0!			#DIV/0!		-1583.8	-101.6			#DIV/0!			#DIV/0!			#DIV/0!	
4		#DIV/0!			#DIV/0!		-1880.5	-101.8			#DIV/0!			#DIV/0!			#DIV/0!	
2		#DIV/0!			#DIV/0!		-2177.9	-100.8			#DIV/0!			#DIV/0!			#DIV/0!	
0							-2472.5											
Intercept	**#DIV/0!**	**mV**		**#DIV/0!**	**mV**		**-2461.9**	**mV**		**#DIV/0!**	**mV**		**#DIV/0!**	**mV**		**#DIV/0!**	**mV**	
Slope	**#DIV/0!**	**mV/mm**		**#DIV/0!**	**mV/mm**		**146.1**	**mV/mm**		**#DIV/0!**	**mV/mm**		**#DIV/0!**	**mV/mm**		**#DIV/0!**	**mV/mm**	

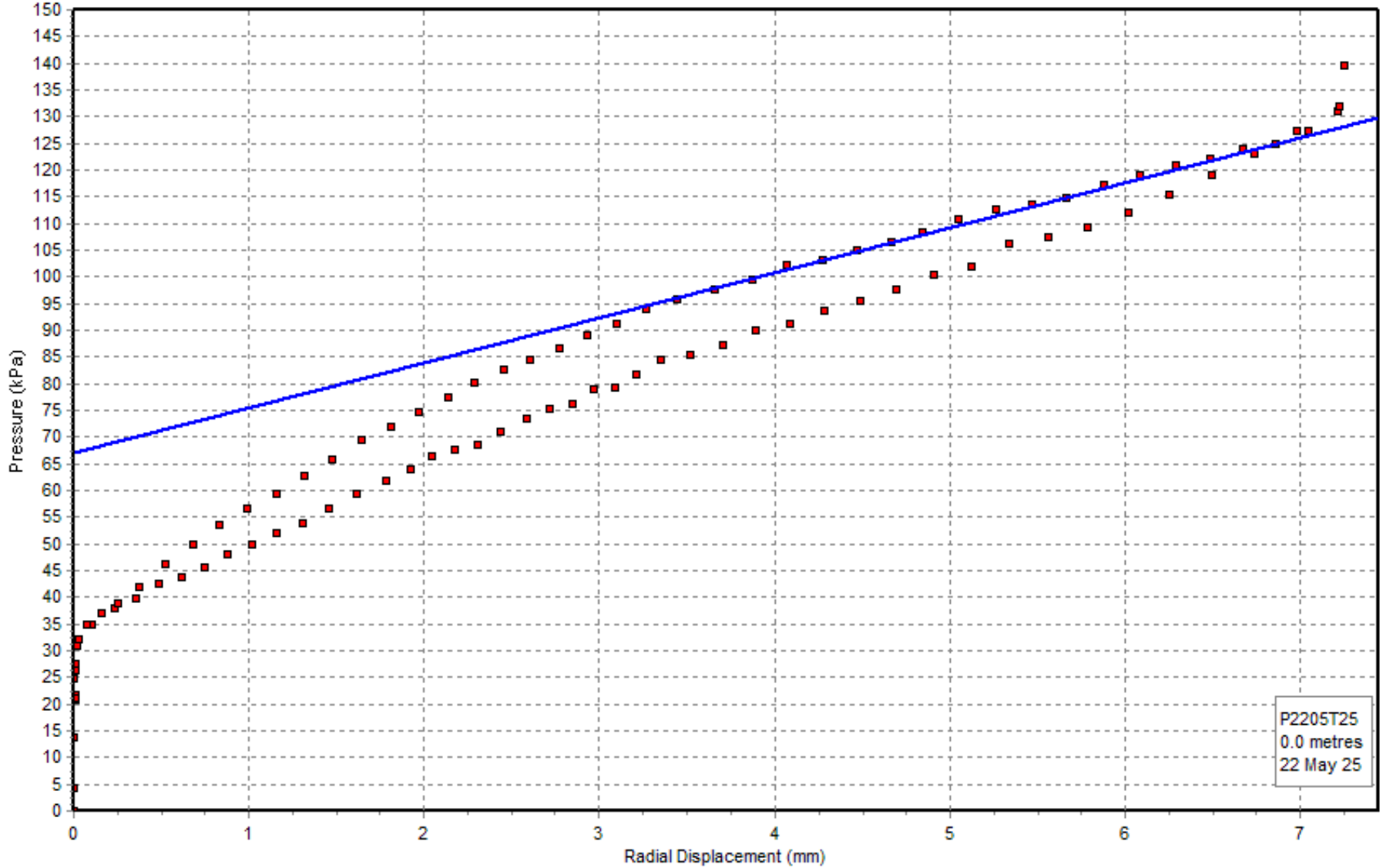

Arm Average vs Total Pressure - CALIBRATION FOR SYSTEM STIFFNESS
SLOPE: 2.6 mm/GPa (Cylinder slope = 2.7 mm/GPa)
Pressure (kPa)
20,000
19,000
18,000
17,000
16,000
15,000
14,000
13,000
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
6.88
6.9
6.92
6.94
6.96
6.98
7
7.02
7.04
7.06
7.08
7.1
7.12
7.14
7.16
7.18
7.2
7.22
7.24
7.26
Radial Displacement (mm)
P1305T25
0.0 metres
13/05/25
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361


Arm Average vs Total Pressure - CALIBRATION FOR MEMBRANE STIFFNESS
ZERO: 19.1 kPa SLOPE: 7.2 kPa/mm
Pressure (kPa)
Radial Displacement (mm)
P1305T25
0.0 metres
13/05/25
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361


Arm Average vs Total Pressure - CALIBRATION FOR SYSTEM STIFFNESS
SLOPE: 2.3 mm/GPa (Cylinder slope = 2.7 mm/GPa)
Pressure (kPa)
19,000
18,000
17,000
16,000
15,000
14,000
13,000
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
7.22
7.24
7.26
7.28
7.3
7.32
7.34
7.36
7.38
7.4
7.42
7.44
7.46
7.48
7.5
7.52
Radial Displacement (mm)
P2205T25
0.0 metres
22/05/25
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361

Arm Average vs Total Pressure - CALIBRATION FOR MEMBRANE STIFFNESS

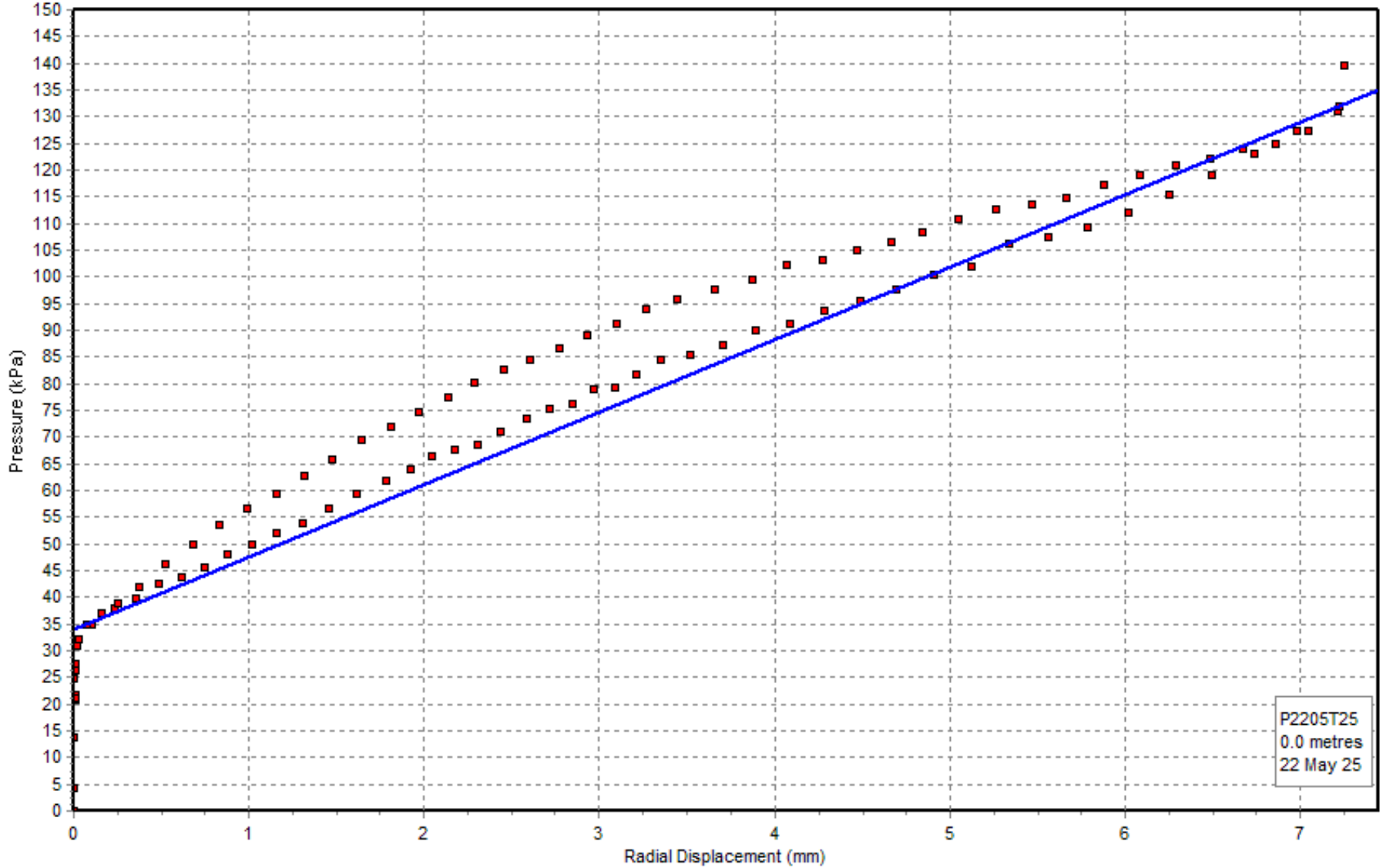
ZERO: 67.1 kPa SLOPE: 8.4 kPa/mm



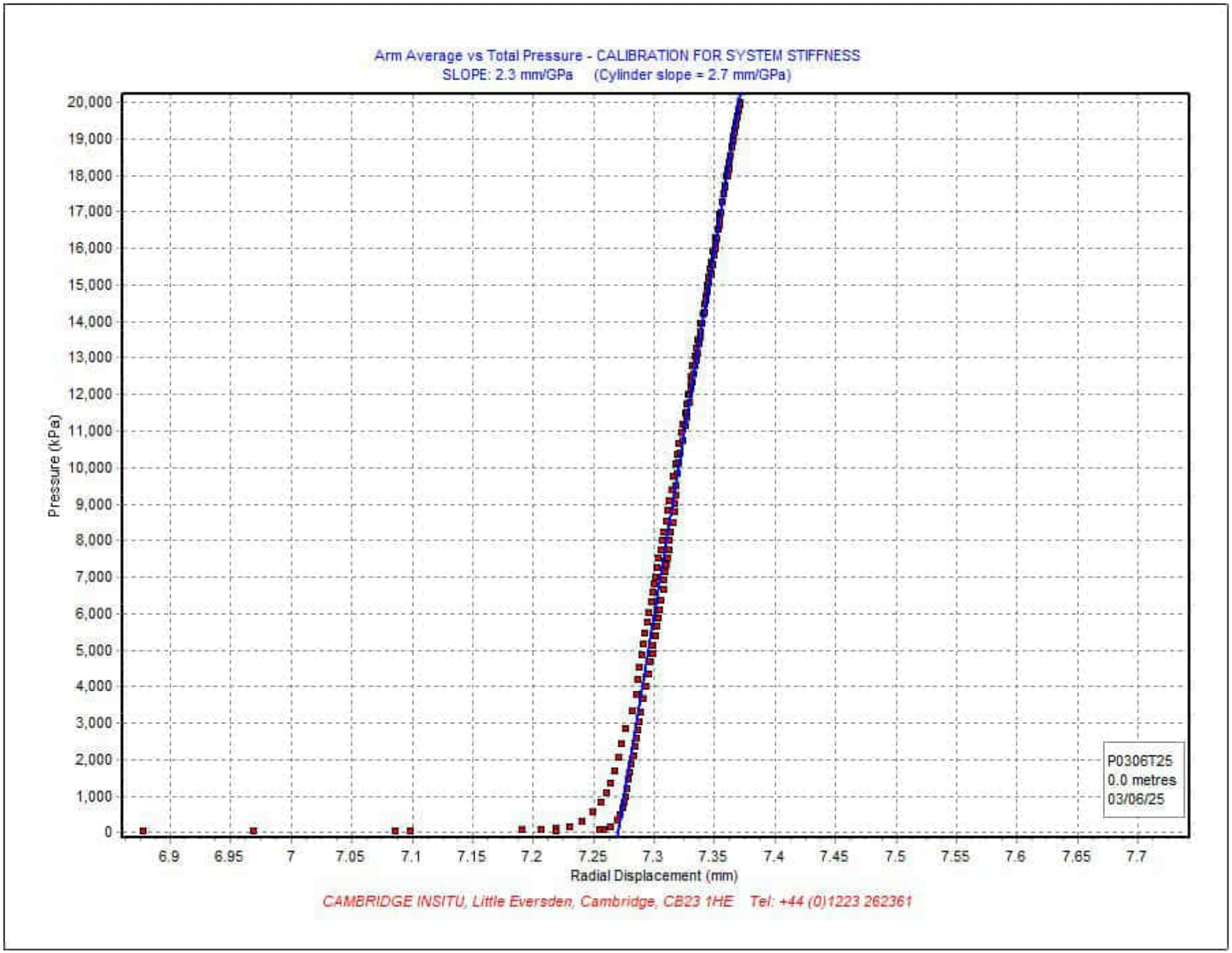
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

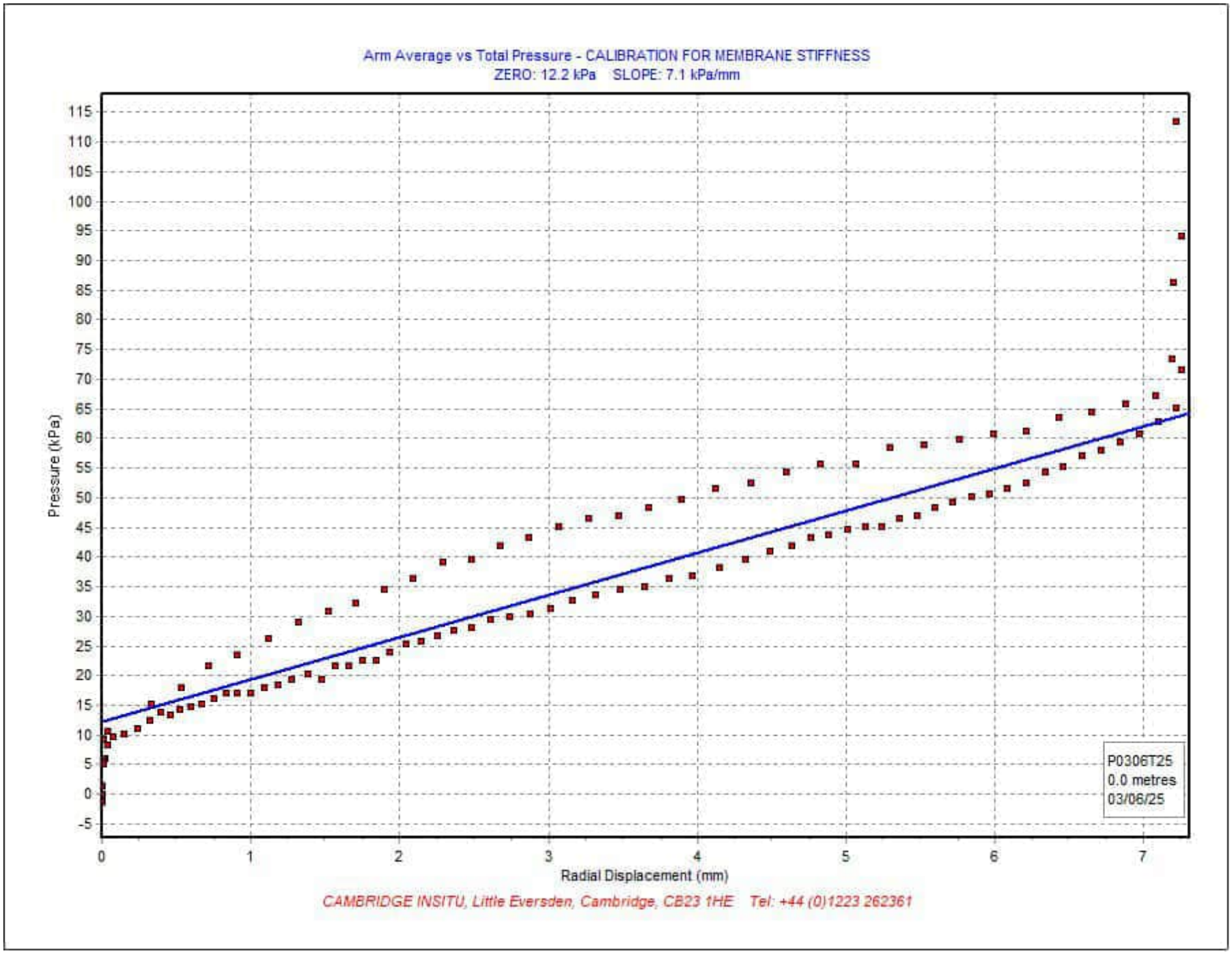
Arm Average vs Total Pressure - CALIBRATION FOR MEMBRANE STIFFNESS

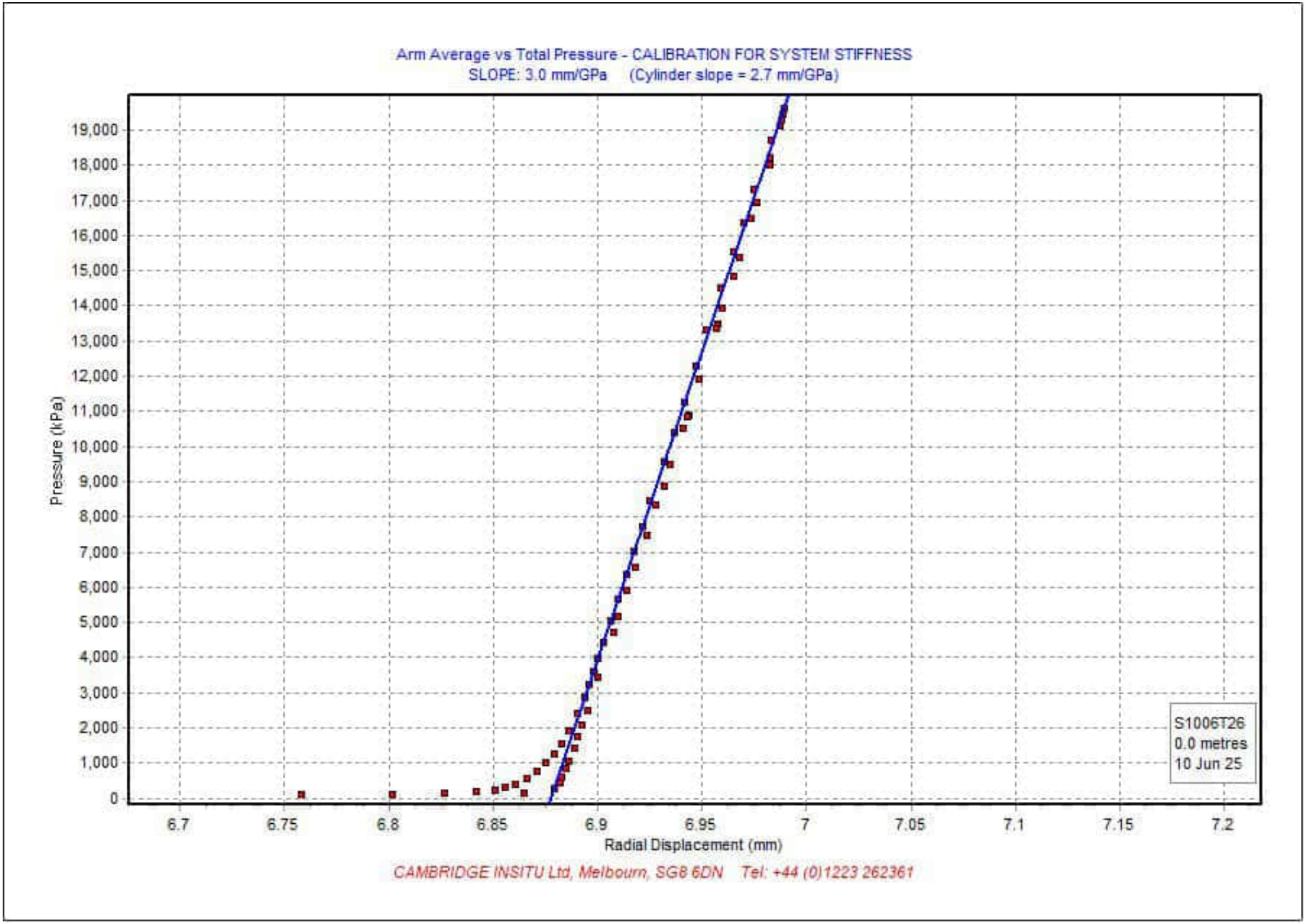
ZERO: 33.9 kPa SLOPE: 13.6 kPa/mm

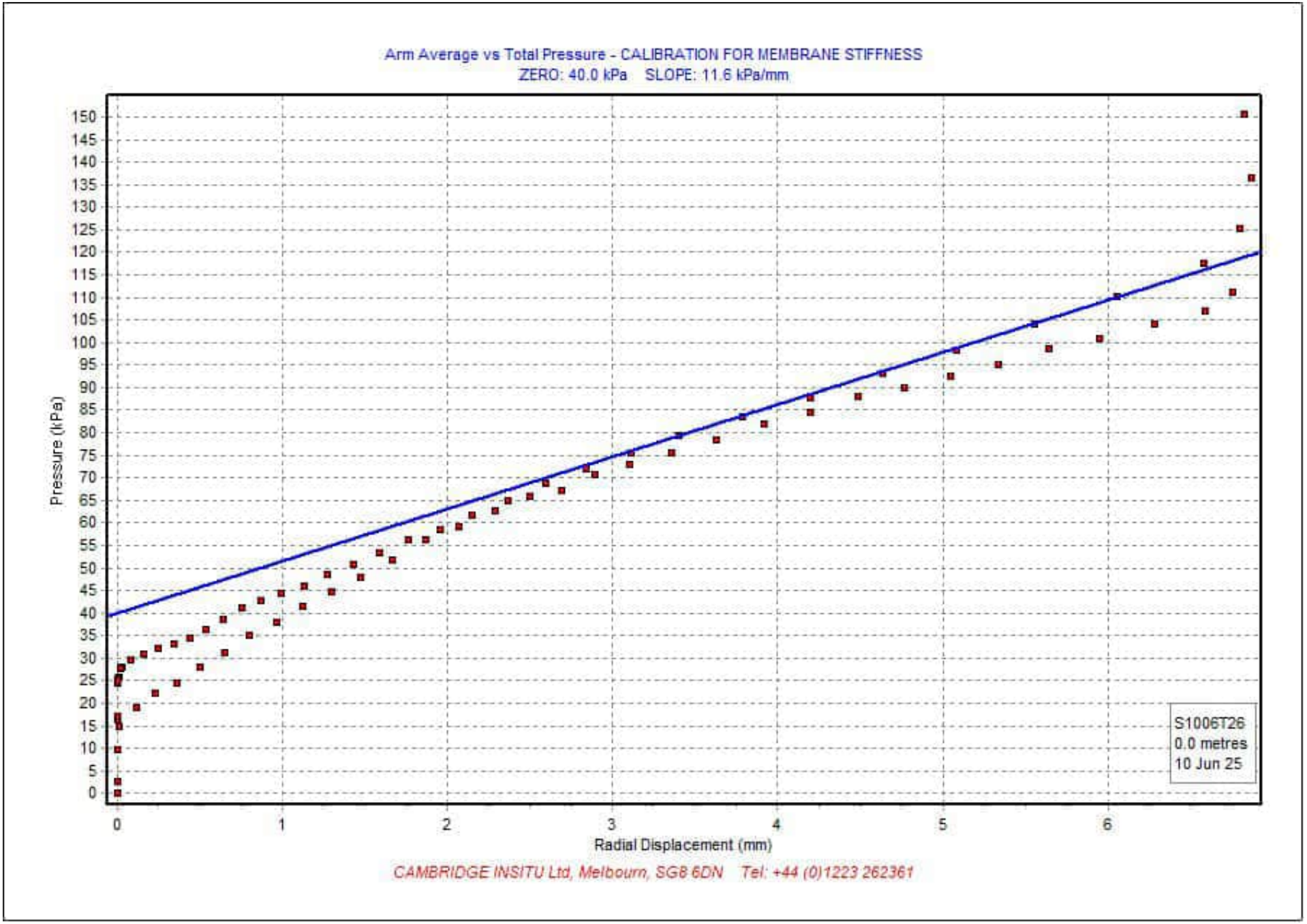


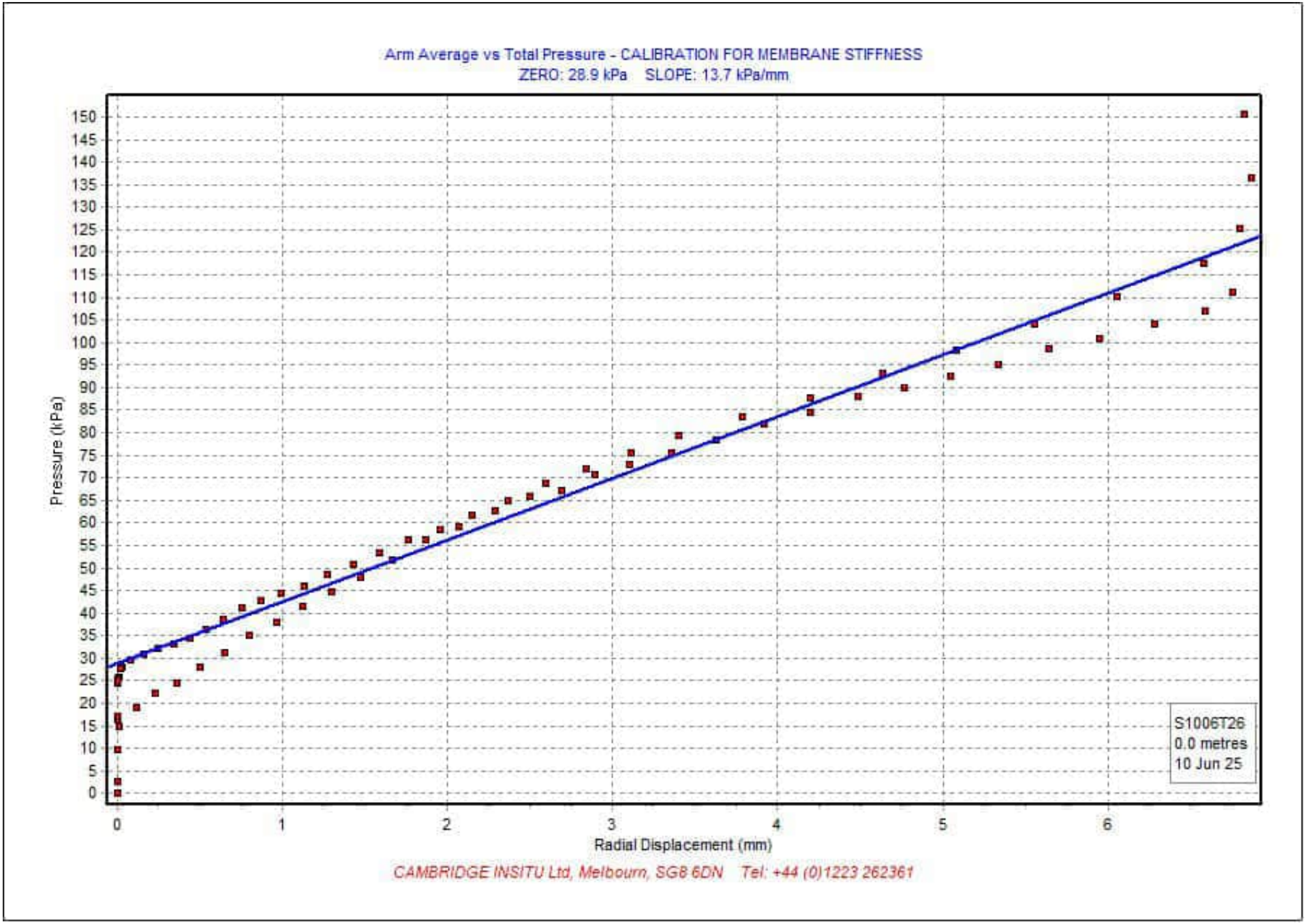
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Arm Average vs Total Pressure - CALIBRATION FOR SYSTEM STIFFNESS
SLOPE: 2.3 mm/GPa (Cylinder slope = 2.7 mm/GPa)
Pressure (kPa)
20,000
19,000
18,000
17,000
16,000
15,000
14,000
13,000
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
6.9
6.95
7
7.05
7.1
7.15
7.2
7.25
7.3
7.35
7.4
7.45
7.5
7.55
7.6
7.65
7.7
Radial Displacement (mm)
P0306T25
0.0 metres
03/06/25
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361


Arm Average vs Total Pressure - CALIBRATION FOR MEMBRANE STIFFNESS
ZERO: 12.2 kPa SLOPE: 7.1 kPa/mm
Pressure (kPa)
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
0
1
2
3
4
5
6
7
Radial Displacement (mm)
P0306T25
0.0 metres
03/06/25
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361


Arm Average vs Total Pressure - CALIBRATION FOR SYSTEM STIFFNESS
SLOPE: 3.0 mm/GPa (Cylinder slope = 2.7 mm/GPa)
Pressure (kPa)
19,000
18,000
17,000
16,000
15,000
14,000
13,000
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
6.7
6.75
6.8
6.85
6.9
6.95
7
7.05
7.1
7.15
7.2
Radial Displacement (mm)
S1006T26
0.0 metres
10 Jun 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arm Average vs Total Pressure - CALIBRATION FOR MEMBRANE STIFFNESS
ZERO: 40.0 kPa SLOPE: 11.6 kPa/mm
Pressure (kPa)
Radial Displacement (mm)
S1006T26
0.0 metres
10 Jun 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arm Average vs Total Pressure - CALIBRATION FOR MEMBRANE STIFFNESS
ZERO: 28.9 kPa SLOPE: 13.7 kPa/mm
Pressure (kPa)
Radial Displacement (mm)
S1006T26
0.0 metres
10 Jun 25
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Calibration Date	Operator	Instrument Type	Serial Number	Instrument Name
23/05/2025	PA	HPD	220826	Lilith

Notes: Full displacement & pressure calibrations

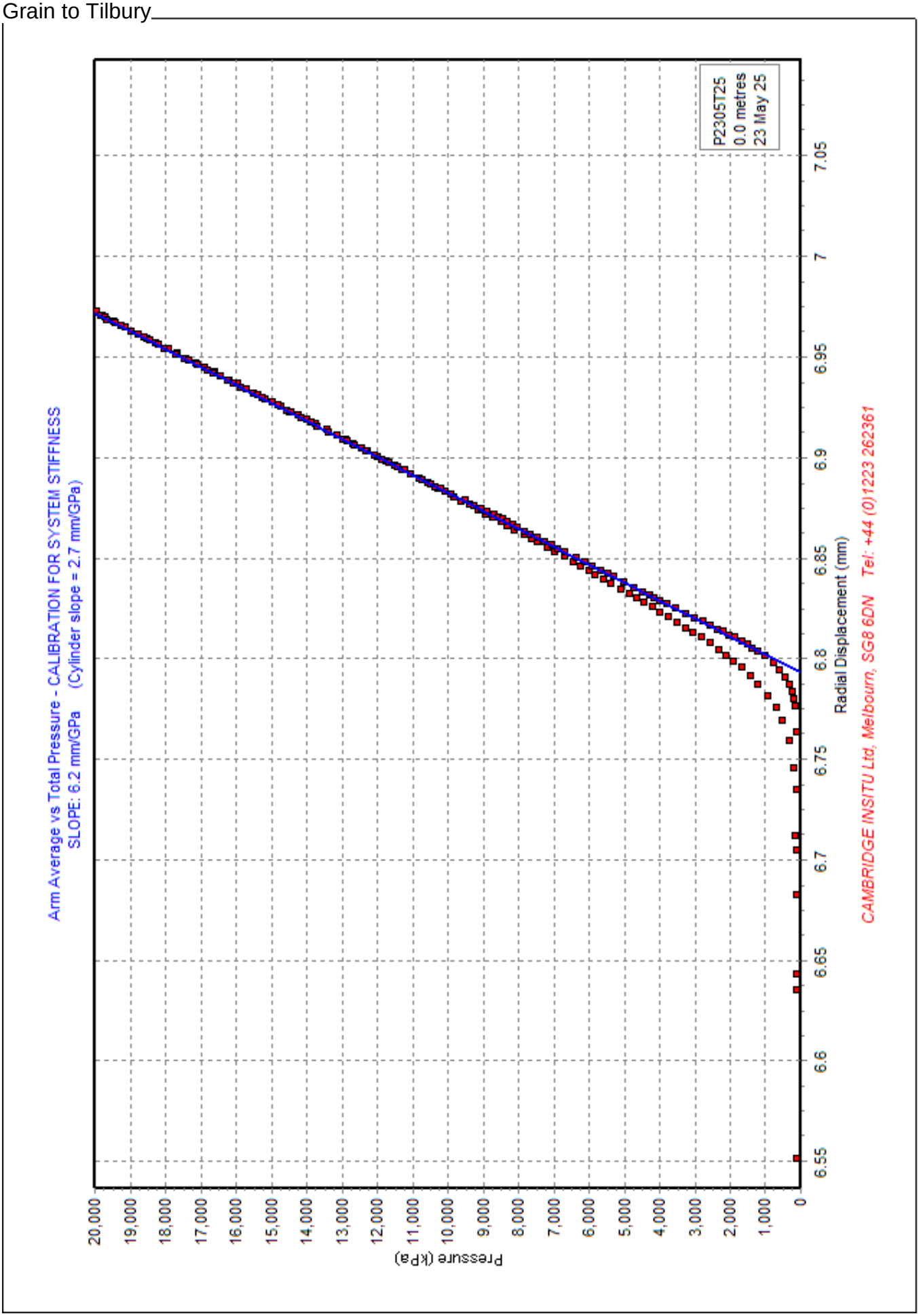
Arm Springs

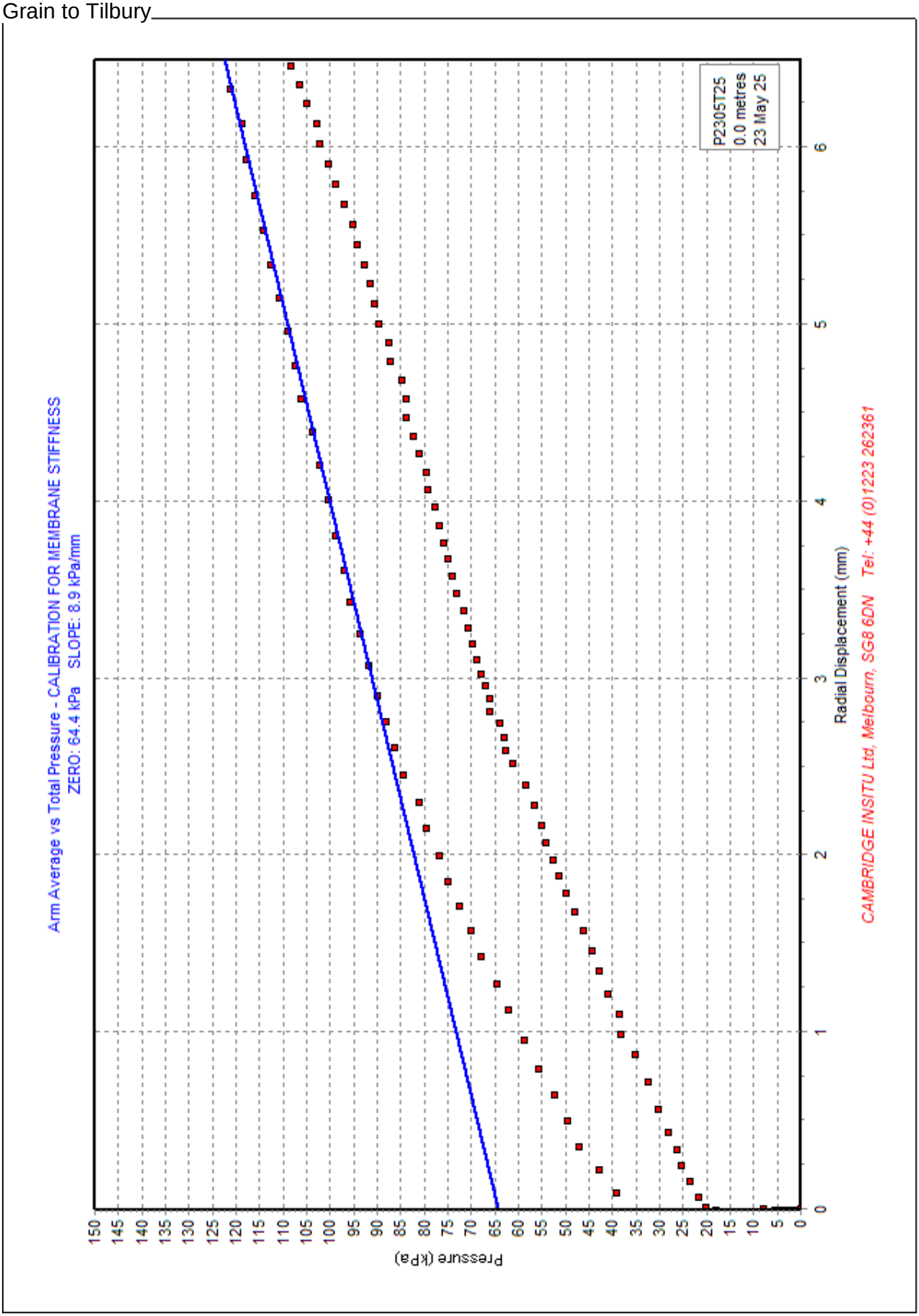
mm	Arm 1	Linearity	Hysteresis	Arm 2	Linearity	Hysteresis	Arm 3	Linearity	Hysteresis	Arm 4	Linearity	Hysteresis	Arm 5	Linearity	Hysteresis	Arm 6	Linearity	Hysteresis
	(mV)	(%)	(%)	(mV)	(%)	(%)	(mV)	(%)	(%)	(mV)	(%)	(%)	(mV)	(%)	(%)	(mV)	(%)	(%)
0	-2585.5	104.5	0.00	-2644.5	102.6	0.03	-2495.9	104.3	0.06	-2677.4	103.5	0.04	-2476.6	105.8	0.08	-2445.9	104.6	0.02
2	-2312.3	103.2	-0.02	-2371.2	102.2	-0.08	-2220.6	102.4	0.02	-2403.3	102.3	-0.01	-2199.5	102.5	0.02	-2171.0	102.7	-0.02
4	-2042.5	102.6	-0.05	-2099.0	101.0	0.07	-1950.4	101.2	0.02	-2132.2	101.1	-0.02	-1931.1	101.6	-0.03	-1901.1	101.7	-0.06
6	-1774.3	101.9	-0.07	-1829.8	101.0	0.06	-1683.3	100.4	0.00	-1864.5	100.6	-0.03	-1665.1	100.5	-0.02	-1633.9	100.6	-0.11
8	-1507.7	101.1	-0.12	-1560.8	100.2	0.05	-1418.3	99.8	-0.02	-1598.1	100.0	-0.06	-1402.0	99.9	-0.08	-1369.6	100.0	-0.15
10	-1243.2	100.9	-0.12	-1293.8	99.5	0.03	-1155.0	99.2	-0.04	-1333.2	99.5	-0.07	-1140.4	99.0	-0.08	-1106.9	99.5	-0.18
12	-979.2	100.3	-0.13	-1028.8	99.1	0.00	-893.2	98.8	-0.08	-1069.6	98.9	-0.08	-881.0	98.6	-0.10	-845.5	98.8	-0.19
14	-716.8	99.1	-0.14	-764.8	98.5	-0.06	-632.4	98.9	-0.08	-807.5	97.3	-0.08	-622.8	98.2	-0.09	-585.8	96.6	-0.19
16	-457.6	99.7	-0.11	-502.3	97.2	0.01	-371.3	96.8	-0.05	-549.8	98.6	-0.10	-365.5	96.3	-0.06	-332.0	97.9	-0.18
18	-196.9	51.2	-0.09	-243.4	97.6	-0.04	-115.8	97.9	-0.06	-288.5	98.2	-0.07	-113.3	98.4	-0.11	-74.7	97.7	-0.12
20	-63.1	-50.3		16.6	-97.2		142.6	-97.4		-28.4	-97.5		144.4	-97.3		182.1	-96.5	
18	-194.7	-99.4		-242.4	-97.6		-114.3	-96.9		-286.6	-98.3		-110.5	-96.7		-71.6	-97.3	
16	-454.7	-98.8		-502.5	-97.8		-369.9	-98.7		-547.1	-97.6		-363.8	-98.0		-327.4	-96.4	
14	-713.2	-100.5		-763.2	-99.7		-630.3	-98.9		-805.5	-98.9		-620.4	-98.5		-580.8	-98.9	
12	-976.0	-101.0		-1028.9	-99.7		-891.2	-99.6		-1067.4	-99.7		-878.4	-99.2		-840.6	-99.6	
10	-1240.2	-101.1		-1294.5	-100.4		-1153.9	-100.0		-1331.4	-100.1		-1138.2	-100.0		-1102.3	-100.2	
8	-1504.7	-102.4		-1562.0	-101.1		-1417.8	-100.6		-1596.6	-100.8		-1400.0	-101.0		-1365.6	-101.0	
6	-1772.6	-102.7		-1831.5	-101.1		-1683.3	-101.4		-1863.6	-101.3		-1664.6	-101.5		-1631.0	-102.2	
4	-2041.3	-103.5		-2100.9	-100.7		-1950.8	-102.4		-2131.8	-102.4		-1930.3	-103.0		-1899.6	-103.1	
2	-2311.9	-104.7		-2369.2	-103.6		-2221.1	-104.8		-2403.1	-104.0		-2200.1	-106.3		-2170.6	-104.9	
0	-2585.6			-2645.2			-2497.6			-2678.5			-2478.6			-2446.4		
Intercept	**-2563.2 mV**			**-2633.7 mV**			**-2481.5 mV**			**-2664.4 mV**			**-2458.4 mV**			**-2428.7 mV**		
Slope	**130.8 mV/mm**			**133.2 mV/mm**			**131.9 mV/mm**			**132.4 mV/mm**			**130.9 mV/mm**			**131.4 mV/mm**		

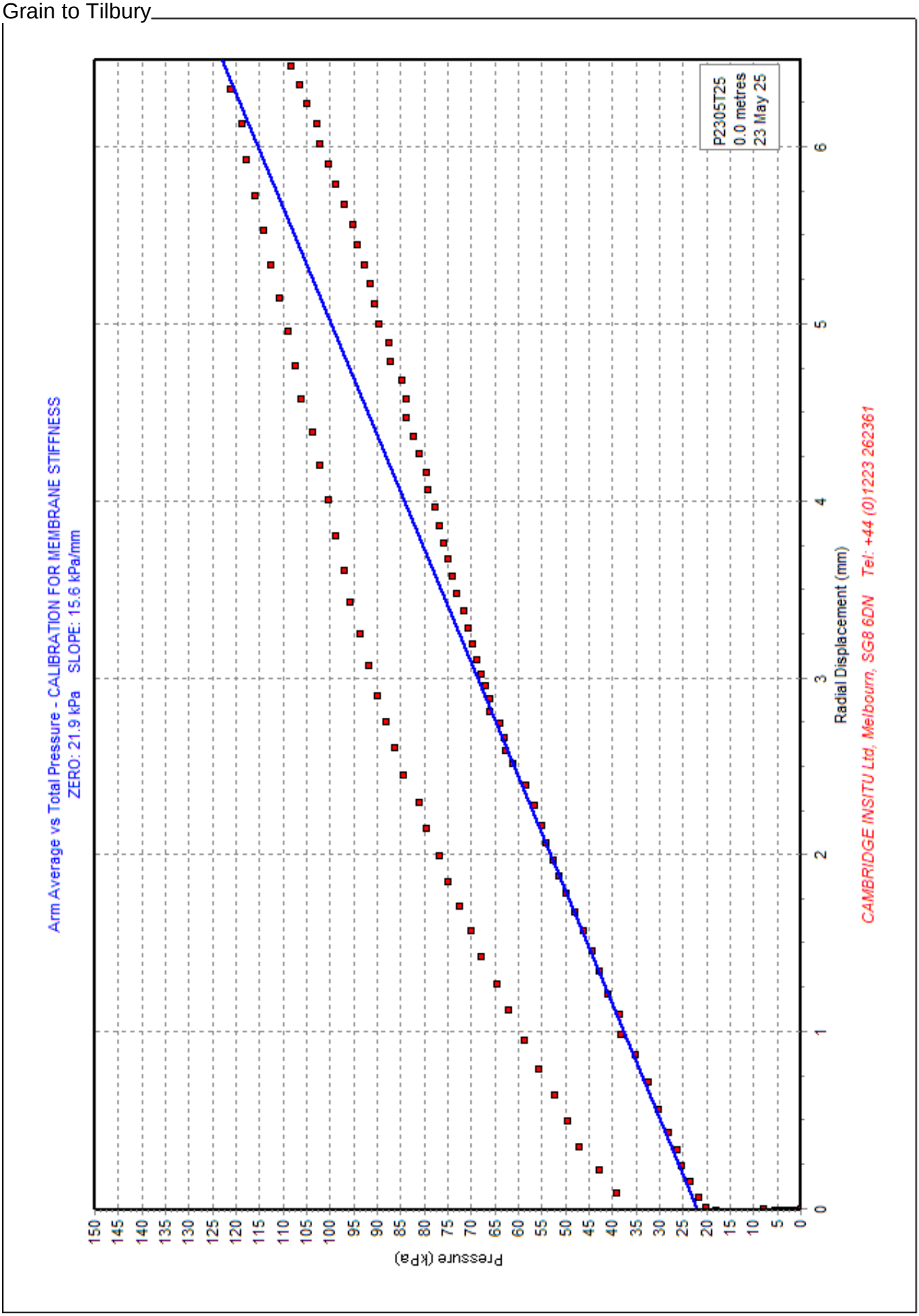
Pressure Cells

Gauge Zero Offset: **0.0**

Bars	TPC A	Linearity	Hysteresis	TPC B	Linearity	Hysteresis
	(mV)	(%)	(%)	(mV)	(%)	(%)
0.0	-2151.9	100.2	-0.03	-2434.8	100.5	-0.10
20.0	-1941.1	100.2	-0.02	-2220.0	99.2	-0.05
40.0	-1730.2	99.4	-0.01	-2008.0	100.3	-0.15
60.0	-1520.9	100.0	-0.10	-1793.6	100.1	-0.14
80.0	-1310.4	99.7	-0.05	-1579.7	100.3	-0.13
100.0	-1100.5	100.3	-0.07	-1365.2	99.7	-0.09
120.0	-889.4	100.3	-0.05	-1152.1	100.0	-0.13
140.0	-678.2	99.9	-0.02	-938.4	100.2	-0.14
160.0	-468.0	100.1	0.00	-724.2	100.1	-0.07
180.0	-257.3	100.3	-0.03	-510.3	100.4	-0.06
200.0	-46.1	100.1		-295.7	99.8	
180.0	-256.7	100.3		-509.0	100.0	
160.0	-467.9	99.7		-722.8	99.5	
140.0	-677.8	100.0		-935.5	100.0	
120.0	-888.3	100.1		-1149.3	100.1	
100.0	-1099.0	99.9		-1363.3	100.0	
80.0	-1309.3	99.5		-1577.0	99.9	
60.0	-1518.8	100.3		-1790.6	100.1	
40.0	-1729.9	100.2		-2004.7	100.2	
20.0	-1940.7	100.0		-2219.0	100.0	
0.0	-2151.2			-2432.7		
Intercept	-2151.5 mV			-2433.5 mV		
Slope	10.524 mV/Bars			10.689 mV/Bars		
Slope	105.2 mV/MPa			106.9 mV/MPa		


Arm Average vs Total Pressure - CALIBRATION FOR SYSTEM STIFFNESS
SLOPE: 6.2 mm/GPa (Cylinder slope = 2.7 mm/GPa)
P2305T25
0.0 metres
23 May 25
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arm Average vs Total Pressure - CALIBRATION FOR MEMBRANE STIFFNESS
ZERO: 64.4 kPa SLOPE: 8.9 kPa/mm
P2305T25
0.0 metres
23 May 25
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361


Arm Average vs Total Pressure - CALIBRATION FOR MEMBRANE STIFFNESS
ZERO: 21.9 kPa SLOPE: 15.6 kPa/mm
P2305T25
0.0 metres
23 May 25
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU Ltd, Melbourn, SG8 6DN Tel: +44 (0)1223 262361

Geotechnical Factual Report:

Grain to Tilbury Tunnel Ground Investigation

Engineer: Soil Engineering

Client: FBJV

Project No.: P1250112

Document Log

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01	2025-07-21	Draft for Review	JH	RC

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Issue Log

01	2025-07-21	J Holt BSc (Hons) FGS	General Manager, In Situ SI

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Whilst every effort has been made to ensure the accuracy of the data supplied and any analysis interpretation derived from it, the possibility exists of variations in the ground conditions spatially adjacent to those test depths specifically covered in this report. No liability can be accepted for any such variations in ground conditions. The contents of this report are not exhaustive and any end-user of this report, and the information contained within it, must satisfy themselves of the appropriateness of the results presented.

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Abbreviations

Pressuremeter Types	
HPD	High pressure dilatometer
SBP	Self boring pressuremeter
DPM	Driven pressuremeter
MPM	Ménard pressuremeter
In situ horizontal stress (σho)	
p_o	Cavity reference pressure
σho (M&R)	In situ horizontal stress from Marsland & Randolph (1977), where $P_{yield} = P_L + s_u$
σho (LO)	In situ horizontal stress from lift off analysis (SBP)
σho (H&W)	In siut horizontal stress from unloading curve (Houlsby & Withers, 1988; DPM)
σho (CM)	In situ horizontal stress from curve modelling (Whittle, 1999; SBP)
Undrained shear strength (kPa)	
Su (loading)	Shear strength from loading curve, via analysis of Gibson & Anderson (1961)
Su (M&R)	Shear strength from analysis of Marsland & Randolph (1977), where $P_{yield} = P_L + s_u$
Su (unloading)	Shear strength from unloading curve, via analysis of Jefferies (1988); SBP & DPM
Su (H&W)	Shear strength from unloading curve, via analysis of Houlsby & Withers (1988); DPM
P_L	Limit pressure via analysis of Gibson & Anderson (1961)
P_L (H&W)	Limit pressure via analysis of Houlsby & Withers (1988); DPM
Shear modulus parameters	
G_i	Initial shear modulus (in MPa) derived from linear section of loading path, prior to material yield
G_{ur}	Shear modulus (in MPa) derived from unload-reload loop
ε_c	Cavity strain range over the unload-reload loop
β	Exponent of elasticity, after analysis of Bolton & Whittle (1999), where 1 is linear elastic
α	Shear stress constant (in MPa), after analysis of Bolton & Whittle (1999)
Pressure	
P_{max}	Maximum test pressure reached
P_{yield}	Pressure at which material yield is assessed, defined at end of linear loading curve
Ménard parameters (MPa)	
E_M	Ménard modulus
p_{LM}	Ménard limit pressure
P_{*LM}	Ménard net limit pressure,
p_{fM}	Ménard creep pressure

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1 Introduction

1.1 Project Information

At the request of Soil Engineering, on behalf of FBJV, In Situ Site Investigation carried out pressuremeter testing at the Grain to Tilbury Tunnel ground investigation site, located in Gravesend, Kent.

This report presents the factual records of the pressuremeter testing carried out on site, together with an interpretation of the test results to derive material parameters.

The fieldwork was carried out from the 1st to 3rd July 2025. Further details relating to the ground investigation, i.e. borehole location and exploratory hole log, are provided in the Soil Engineering report ref. TB8754.

2 Fieldwork

2.1 General

Seven pressuremeter tests were carried out in one borehole, constructed using a rotary drilling rig, operated by Soil Engineering. The tests were carried out using a high pressure dilatometer (HPD). The testing was carried out in general accordance with BS EN ISO 22476-5 (2023).

The test depths were provided to In Situ Site Investigation by Soil Engineering. Coordinates provided on the test reports were provided by Soil Engineering. A summary table of the tests is presented below.

Table 1 Summary of pressuremeter tests.

Borehole ID	Test reference	Date	Test depth (mbgl)	Probe	Operator	Remarks
BH107	T01	01/07/2025	22.80	HPD06 Kylie	A Lewins	Oversize test pocket. Terminated due to the uneven expansion.
	T02	01/07/2025	27.00	HPD06 Kylie	A Lewins	Slightly oversize test pocket. Terminated due to large expansion on arms 2 & 3.
	T03	02/07/2025	30.80	HPD06 Kylie	A Lewins	Terminated due to uneven arm expansion.
	T04	02/07/2025	35.00	HPD06 Kylie	A Lewins	Oversize test pocket. Terminated due to jumps and uneven arm expansion.
	T05	02/07/2025	39.00	HPD06 Kylie	A Lewins	Oversize test pocket. Terminated due to jumps and uneven arm expansion.
	T06	03/07/2025	43.50	HPD06 Kylie	A Lewins	Second attempt within test pocket after initial failed test. Oversize test pocket.
	T07	03/07/2025	47.00	HPD06 Kylie	A Lewins	Oversize test pocket. Terminated due to jumps and uneven expansion.

2.2 High pressure dilatometer

2.2.1 Instrument description

The HPD is a cylindrical 95mm diameter probe which is inserted into a cored 99 to 101mm diameter test pocket, drilled using a T6-H or T6-101 core barrel. The HPD is therefore termed a pre-bored type instrument.

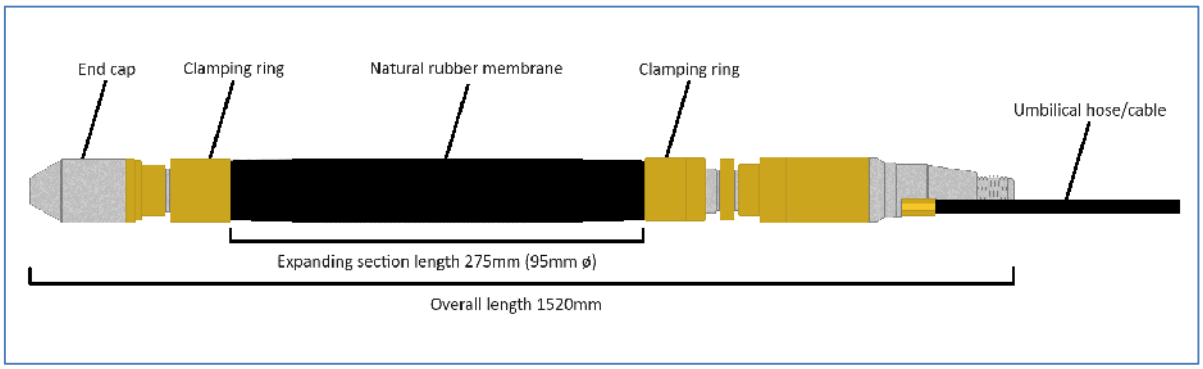


Figure 1 High pressure dilatometer.

The probe, approximately 1.5m in length, has a central section which is covered by a rubber membrane. Pressure applied to the inside of the instrument, via compressed air, forces the membrane to expand against the test pocket wall. The radial displacement of the inside boundary of the membrane is measured at six points equally distributed around the centre of the expanding section, by free moving arms. This displacement, and the pressure necessary to cause the movement, is continuously monitored by transducers contained within the instrument. The HPD is linked to the ground surface via a combined pressure hose and electrical power/communication umbilical cable which connects the instrument to the pressure source and readout unit.

Analogue to digital conversion of the displacement and pressure transducers is carried out within the pressuremeter electronics package. The pressuremeter output comprises a multiplexed signal which connects through the pressuremeter interface unit to the USB port of a laptop computer. Software, supplied by Cambridge Insitu Ltd, is used to record the data, convert the received signals to engineering units (using the pressure and displacement transducer calibrations) and display these in real time on the laptop computer during testing to allow control of the test by the operator. Plotting these readings of displacement against pressure produces a loading curve for the material being tested. A number of mathematical analyses are applied to translate this loading curve into material strength and stiffness parameters.

The testing on this project was undertaken using a single 6-arm probe, manufactured by Cambridge Insitu Ltd. Details of the instrument are provided below. Instrument calibrations were carried out prior to and after the testing program. Corrections measured for membrane stiffness (essentially resistance to inflation in air) were carried out prior to testing in each borehole. Only a single membrane was used during the testing program. The instrument calibration details are presented on each test report.

Table 2 HPD instrument details.

Diameter (mm)	Pressure capacity (MPa)	Displacement measurement	Probe ID
95	20	6 arms at 60° radial separation 3 opposite pairs	HPD06 - Kylie

2.2.2 HPD testing procedure

The boreholes were constructed using a top-drive rotary drilling rig by conventional rotary coring. The flushing medium used during coring was drilling mud. The boreholes were advanced using rotary drilling to approximately 1.0m above the scheduled test depth. A 2.0m long section was then drilled using a T6-101 size core barrel, to provide a test pocket of 101.3mm nominal diameter. The HPD was then lowered into the test pocket as soon as practicably possible using the drill rods, lowered in via the drilling rig winch.

The pressuremeter tests were carried out in a stress-controlled manner using a manually operated gas control box to pressurise the HPD at an appropriate rate for the ground conditions. During the tests a number of unload-reload loops were performed. Before carrying out the loops, a short holding period was maintained to allow reduction of creep on the ground. The loading was continued until either the ground had failed, maximum arm displacement had occurred, or if at lower pressure, expansion around the probe was uneven, such that in the opinion of the operator, continuation of the loading would result in risk of damage to the probe. Upon unloading and deflation of the membrane, the instrument was withdrawn from the tested section and recovered back to the ground surface. The borehole was then advanced to the next specified test depth and the sequence repeated, until the testing program was completed.

3 HPD Test Interpretation

3.1 Introduction

The HPD pressure / cavity strain curve has been analysed to determine various material parameters, as appropriate to the tested material, including:

- cavity reference pressure p_o
- in situ horizontal stress σ_{ho}
- initial shear modulus G_i
- material yield P_{yield}
- unload-reload shear modulus G_{ur}
- undrained shear strength s_u
- limit pressure P_L

The analysis methodologies used have followed industry accepted practice for interpretation of pressuremeter tests (e.g., Clarke, 1996; Mair & Wood, 1987). The nature of the material tested can result in some limitations in the application and appropriateness of the interpretation methods. Any such limitations, if present, are discussed below and should be considered when selecting material parameters for engineering design purposes.

3.2 Tested material

The borehole record was cross referenced with the tests to provide an indication of the geology at the discrete test depths. The encountered ground conditions were predominantly structureless CHALK to very weak low density CHALK. For more detail refer to the Soil Engineering ground investigation report ref. TB8754.

3.3 Test analysis

An example HPD test curve is shown below which helps illustrate the features of the displacement-pressure response used for analysis, from initial membrane inflation, material loading, through to probe deflation and unloading.

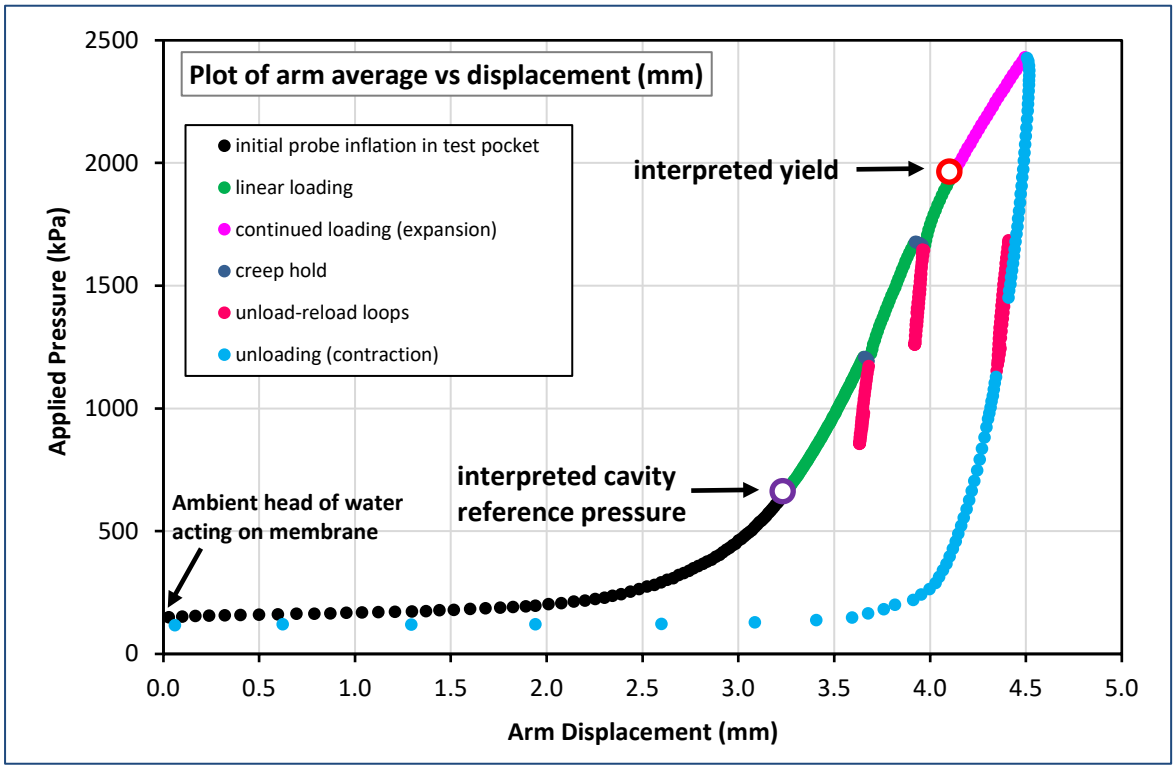


Figure 2 Example HPD test curve.

3.3.1 In situ horizontal stress

The act of drilling into undisturbed ground relieves the in situ horizontal stress, which is then effectively restored when the instrument is inserted into the test pocket and the membrane is initially pressurised. During this initial loading, a linear pressure / displacement response is anticipated as the pressure is increased and then exceeds the cavity reference pressure (p_o). For a test carried out with the HPD, the direct correlation between cavity reference pressure and in situ horizontal stress is problematic and should be treated with caution. This is due to the large potential for disturbance during test pocket formation and subsequent relaxation or stress relief of the ground, following drilling of the open test pocket.

Marsland and Randolph (1977) proposed that in the vicinity of in situ horizontal stress, soil behaves elastically and therefore the initial loading curve is linear. This elastic behaviour will cease when the undrained shear strength of the material in the cavity wall is reached, and hence the pressure / displacement response during further loading will then begin to curve away from linearity. The point at which the loading curve becomes non-linear (or the onset of yield, P_{yield}), represents the in situ horizontal stress plus the undrained shear strength at this point:

- $P_{yield} = \sigma_{ho} + s_u$.

3.3.2 Shear modulus

A pressuremeter test, in an elastic, perfectly plastic material, imparts a pure shear failure, hence it is normal to report shear modulus in preference to an elastic modulus. Shear modulus is determined from the initial loading curve, and from unload reload loops performed at intervals during the test progression. The relationship used to determine shear modulus (G) is below, where ε_c is the cavity strain range:

- $G = \frac{1}{2}\frac{dp}{d\varepsilon c}$

The initial modulus (G_i), calculated from the slope of the linear loading curve, should be treated with caution due to the almost inevitable disturbance during test pocket formation, with the calculated values from a HPD test being typically lower than that derived from analysis of the unload-reload loops.

Hysteresis is generally evident in unload-reload loops and it is possible to determine a secant shear modulus from the reloading portion of a loop. A high degree of consistency is often possible when plotting secant shear modulus results from individual tests. This may be further extended to a series of tests in a geological formation by normalising via in situ horizontal stress or undrained shear strength. The various plots for both initial loading shear modulus (G_i) and the shear modulus derived from unload reload loops (G_{ur}) are presented graphically in the test results.

Individual unload reload loops can also be analysed to determine small strain stiffness parameters. This is achieved by taking a secant modulus from the base of the loop, to the individual data points on the reloading curve. Plotting the cavity strain range against modulus, gives an indication of how stiffness varies with strain. Further, a Bolton and Whittle (1999) analysis can be performed to investigate the non linear elastic / plastic behaviour.

The secant modulus can be converted to an undrained elastic (Youngs) modulus (E_u) by use of the following relationship:

- $E_u = 2.G(1 + \upsilon)$ where υ = Poisson's ratio

The Poisson's ratio can be either undrained (υ_u) or drained (υ'). For undrained elastic soil (clay) a υ_u value of 0.5 can be taken. For drained conditions in any soil, the value of υ' is typically 0.1 to 0.3. The Poisson's ratio for weak rocks is also generally taken as 0.1 to 0.3, with the difference between drained or undrained behaviour is relatively insignificant (Mair and Wood, 1987).

Plots of calculated secant modulus values at varying shear strain % are provided within the analysis results. It is noted that any user of this analysis should satisfy themselves that it is appropriate to the material tested.

3.3.3 Strength

Undrained shear strength has been determined using Gibson and Anderson (1961) for the loading portion of the test curve. This is a generally accepted method for the determination of strength, and is based on the assumption of an elastic - perfectly plastic material. This assumption may not be valid for rock as the material may behave as a brittle material and fail in tension, or in triaxial compression, depending on the strength of the material and in situ stress conditions.

The analysis of Gibson and Anderson (1961) also provides a Limit Pressure (P_L). This is a limiting pressure defined as the pressure at which the change in volume (ΔV) divided by the current volume (V) is equal to one. While this is not achieved in practice, it can be determined by extrapolation. Note is also made that the definition of P_L is different to that associated with a Ménard Limit Pressure, and the two should not be interchanged.

3.4 Summary of results

Summary tables of the analysis results are presented in Appendix A, followed by the individual analysis plots for all tests. The data is also provided separately in AGS format.

4 References

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Whittle, R.W. (1999) Using non-linear elasticity to obtain the engineering properties of clay. Ground Engineering, 32, No. 5, 30-34.

Appendix A Test Data Analysis

Description	Pages included	Page No.
Pressuremeter Results Summary		
Pressuremeter Analysis Results Summary (Table All Tests)	1	15
Pressuremeter Shear Modulus & Undrained Shear Strength Plot (Figure 1)	1	16
Pressuremeter Cavity Reference Pressure, Yield, Limit & Max Pressure Plot (Figure 2)	1	17
MBH601		
Test 1 – 22.80m	9	18
Test 2 – 27.00m	10	27
Test 3 – 30.80m	10	37
Test 4 – 35.00m	9	47
Test 5 – 39.00m	10	56
Test 6 – 43.50m	10	66
Test 7 – 47.00m	10	76

Pressuremeter Analysis Results Summary

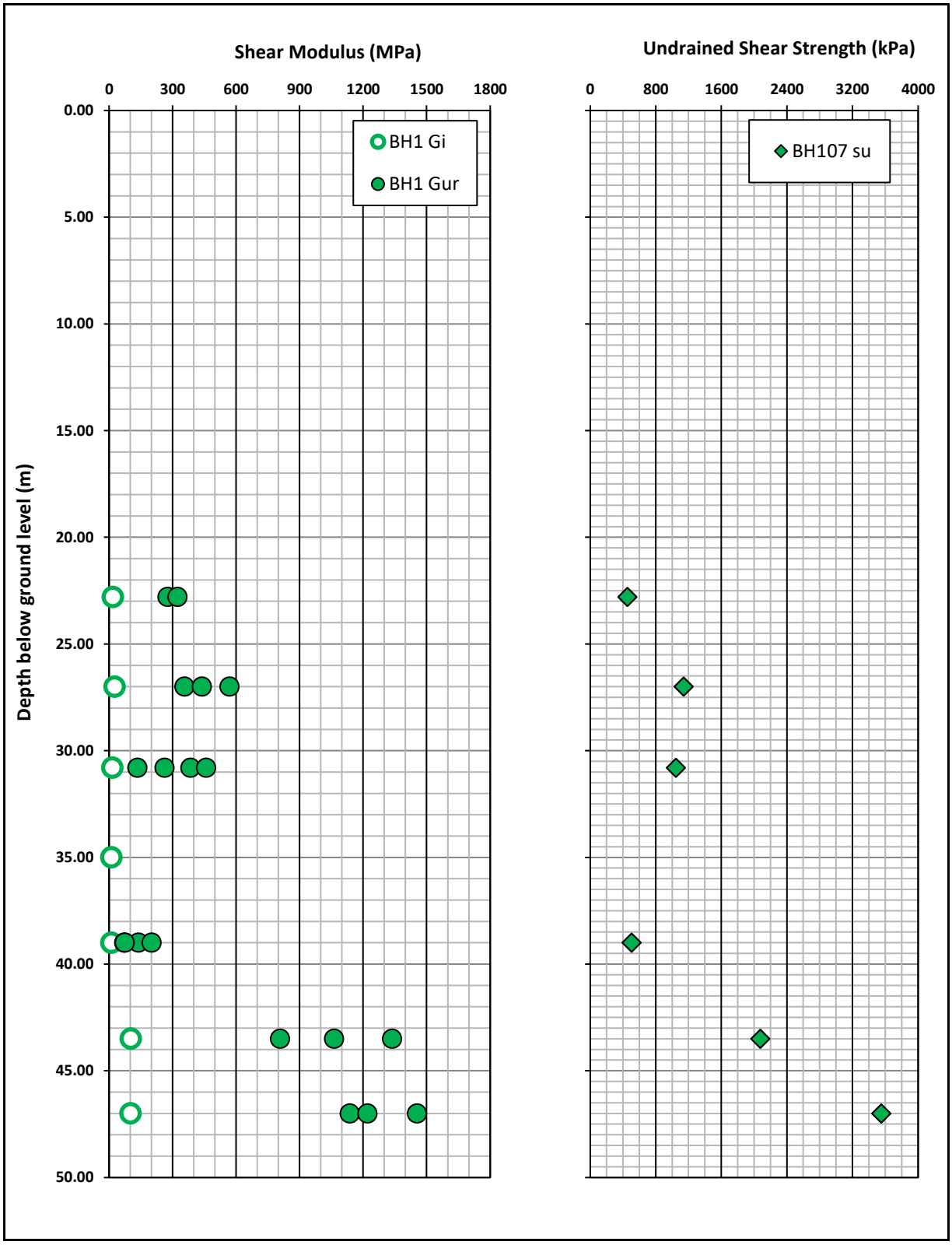
IN SITU SITE INVESTIGATION

Test ID	Depth (m)	Material description from borehole log	Max. test pressure (kPa)	s_{ho} (kPa)	Undrained strength $S_{u\ (M\&R)}$ (kPa)	Undrained strength $S_{u\ (loading)}$ (kPa)	Undrained strength P_L (kPa)	G_i (MPa)	Loop No.	G_{ur} (MPa)	e_c (%)	Non linear stiffness α (MPa)	Non linear stiffness β	Secant shear modulus Shear strain 1%	Secant shear modulus Shear strain 0.1%	Secant shear modulus Shear strain 0.01%	Secant shear modulus Shear strain 0.001%
BH1																	
1	22.80	Assumed zone of core loss: Probable structureless CHALK with flints.	1190	464	454	454	2611	18.8	1	277	0.013	33.166	0.769	96	163	277	471
									2	324	0.025	30.416	0.732	105	194	360	668
2	27.00	Structureless CHALK composed of slightly silty slightly sandy GRAVEL. Clasts are very weak medium density white with rare orange brown staining.	2326	591	1141	1141	5328	26.5	1	357	0.026	59.168	0.795	152	244	391	626
									2	570	0.009	61.058	0.772	175	296	500	846
									3	439	0.043	88.822	0.802	221	348	550	867
3	30.80	Assumed zone of core loss: Probable structureless CHALK with flints.	2648	585	1047	1047	4463	16.9	1	134	0.054	28.213	0.809	68	106	164	255
									2	263	0.042	54.038	0.810	130	201	311	482
									3	385	0.034	65.632	0.798	166	264	420	668
									4	459	0.047	55.571	0.751	175	309	548	972
4	35.00	Very weak low density white CHALK recovered mostly non intact fractures with occasional small and medium rinded nodular flints (<2mm) white cortex).	1165	675	No material yield			11.7	1	77	0.109	29.167	0.868	54	73	98	133
									2	114	0.074	33.808	0.845	69	99	141	202
									3	67	0.168	26.729	0.864	50	68	93	127
5	39.00	Very weak low density white locally stained orange brown CHALK recovered mostly non intact with occasional small to large rinded nodular flints (<2mm) white cortex.	1393	672	507	507	2768	11.6	1	72	0.094	19.539	0.820	45	68	102	155
									2	140	0.065	29.998	0.802	75	118	186	293
									3	201	0.048	37.416	0.800	94	149	237	376
									4	75	0.252	20.343	0.814	48	73	113	173
6	43.50	Assumed zone of core loss: Probable CHALK with flints	4384	1403	2077	2077	11524	103.9	1	808	0.019	150.825	0.813	357	549	844	1298
									2	1337	0.012	181.251	0.808	438	681	1058	1645
									3	1063	0.021	220.080	0.821	503	760	1149	1737
7	47.00	Very weak low density white locally orange brown stained CHALK.	6653	1899	3551	3551	17187	102.7	1	1138	0.023	165.677	0.791	434	703	1139	1844
									2	1454	0.008	Full analysis not possible due to pool loop definition					
									3	1220	0.047	309.247	0.823	699	1050	1578	2371

Project	Grain to Tilbury Tunnel GI	**Table No.**	**BH107**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Shear Modulus & Undrained Shear Strength Plot

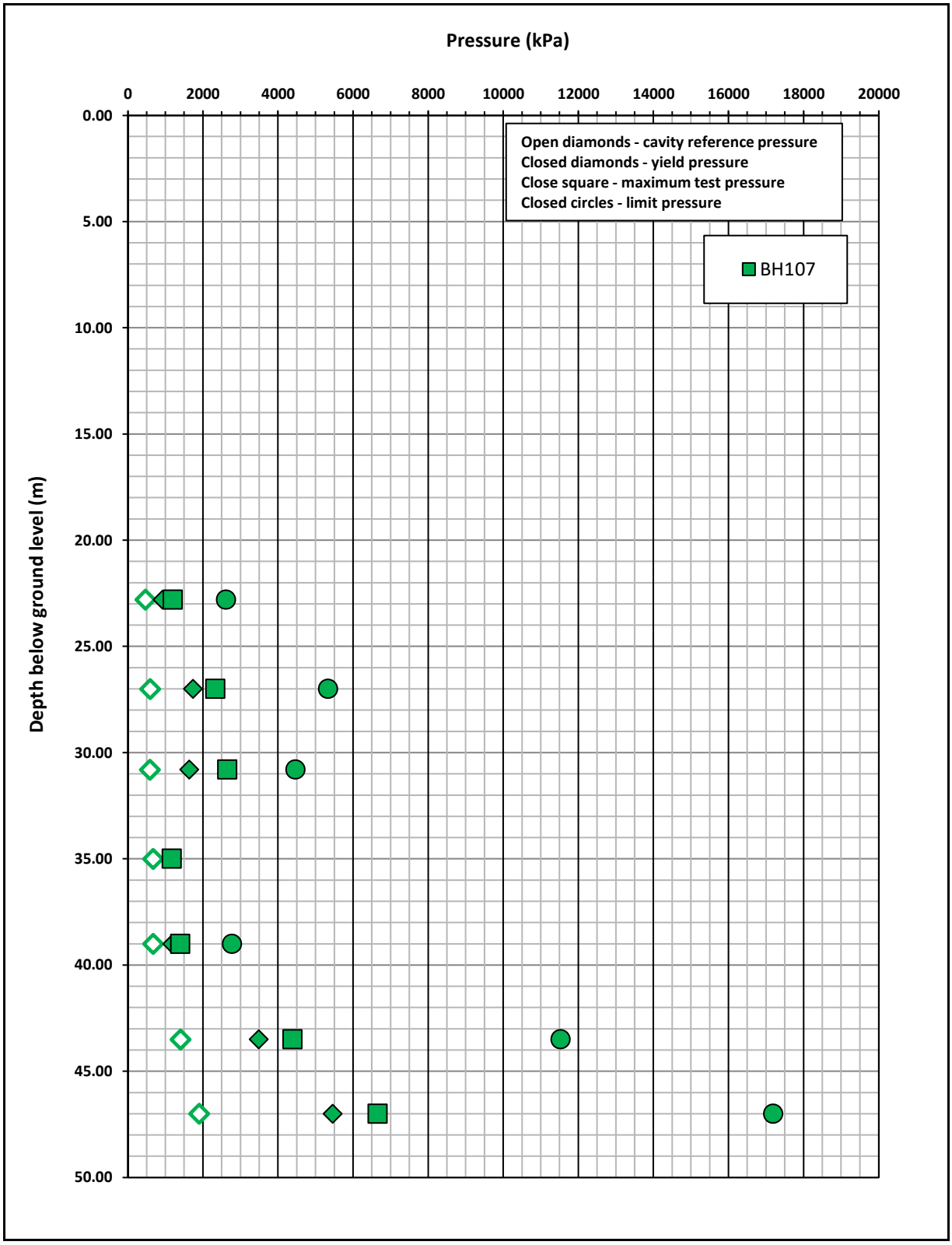
IN SITU SITE INVESTIGATION



Project	Grain to Tilbury Tunnel GI	**Figure No.**	**1**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Cavity Reference Pressure, Yield, Limit & Max Pressure Plot

IN SITU SITE INVESTIGATION

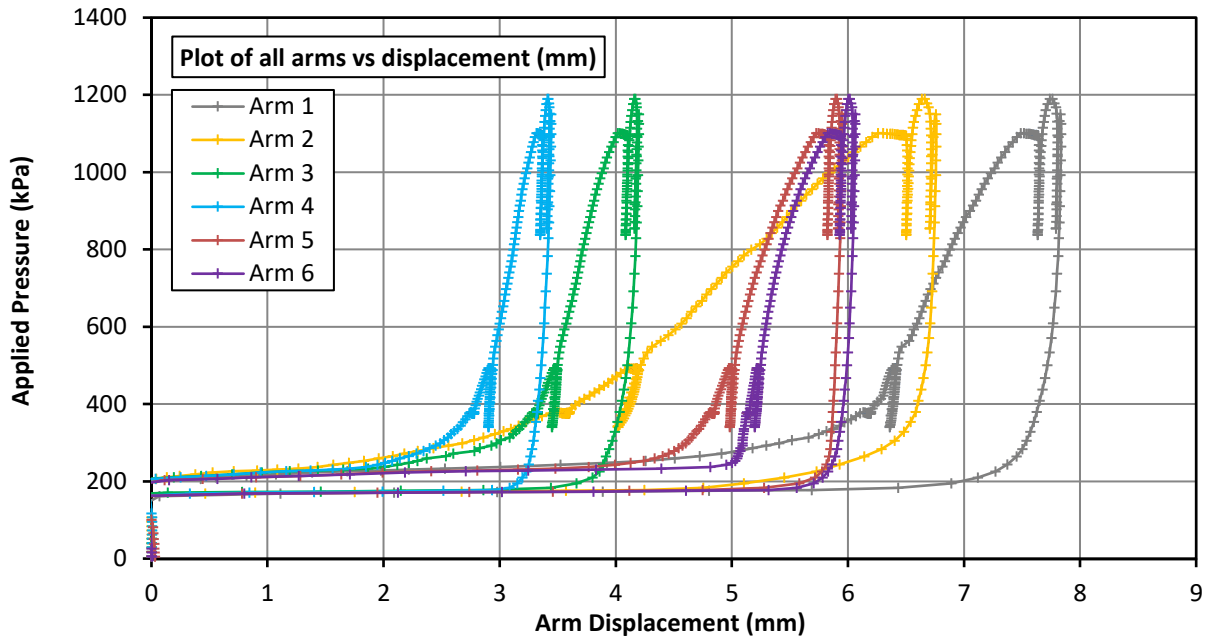


Project	Grain to Tilbury Tunnel GI	**Figure No.**	**2**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Test Overview
High Pressure Dilatometer (HPD)

IN SITU SITE INVESTIGATION

Test Date	01/07/2025	**Test No.**	1
Borehole	BH107	**Test Depth (m)**	22.80
Coordinates (m)	- -	**Elevation (m)**	-



Material description from borehole log:

Assumed zone of core loss: Probable structureless CHALK with flints.

Test pocket conditions:

Total core recovery:	45 %	Test pocket depth range:	
Solid core recovery:	0 %	From: 22.00 m to: 24.00 m	
Rock quality designation:	0 %	Flush: Water	

Test comment:

The test pocket was oversize with arms lifting off at 3.0 to 6.5mm. The po was estimated to be at 395kPa, with the following loading section being relatively short. Material yield was interpreted at 784kPa, with the test taken to a maximum pressure of 1029kPa where it was terminated due to the uneven expansion and risk of membrane burst. The displacement-pressure response shown by the arms was highly variable. with disturbance indicated by arms 1 & 2. Analysis of two unload reload loops provides modulus values of 244 to 272MPa. Derived undrained shear strength analysis provides a value of 389kPa.

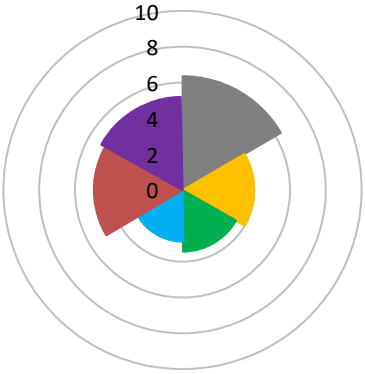
Test details:		**Instrument:**	Kylie (HPD06)		**Operator:**	A Lewins	
			mV	mV/mm		mV	mV/MPa
Drilling method:	Rotary coring	Arm 1:	-2405.6	135.6	TPC A:	-2189.2	104.7
Casing depth:	22.00 m	Arm 2:	-2458.9	135.6	TPC B:	-1952.5	105.7
Water level:	1.50 m	Arm 3:	-2285.5	136.6	Membrane:		
Test time:		Arm 4:	-2388.5	131.4	Stiffness	34.7 kPa	
Start of test:	10:48 hrs	Arm 5:	-2350.2	127.9	Slope	10.0 kPa/mm	
End of test:	11:50 hrs	Arm 6:	-2270.3	135.1	Compliance	1.4 mm/GPa	

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T01 - 01**
Client	FBJV		
Project No.	P1250112		

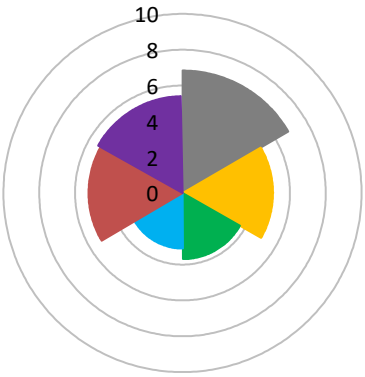
Pressuremeter Test - Membrane Expansion Plan View

IN SITU SITE INVESTIGATION

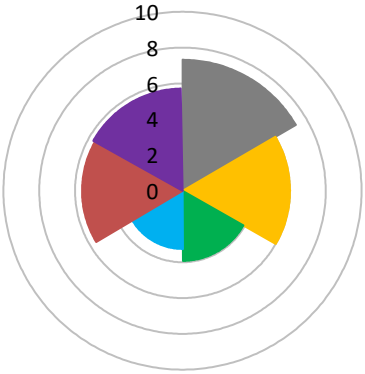
Test Date	01/07/2025	**Test No.**	1
Borehole	BH107	**Test Depth (m)**	22.80



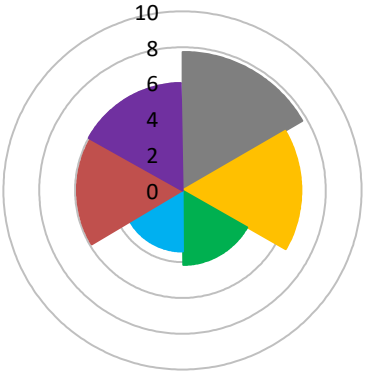
Arm expansion at:	0.0	% cavity strain
Test pressure:	471	kPa
Arm 1 at:	6.4	mm
Arm 2 at:	4.0	mm
Arm 3 at:	3.4	mm
Arm 4 at:	2.9	mm
Arm 5 at:	4.9	mm
Arm 6 at:	5.2	mm



Arm expansion at:	0.8	% cavity strain
Test pressure:	770	kPa
Arm 1 at:	6.8	mm
Arm 2 at:	5.1	mm
Arm 3 at:	3.7	mm
Arm 4 at:	3.1	mm
Arm 5 at:	5.2	mm
Arm 6 at:	5.4	mm



Arm expansion at:	1.6	% cavity strain
Test pressure:	1038	kPa
Arm 1 at:	7.3	mm
Arm 2 at:	6.0	mm
Arm 3 at:	3.9	mm
Arm 4 at:	3.3	mm
Arm 5 at:	5.6	mm
Arm 6 at:	5.7	mm



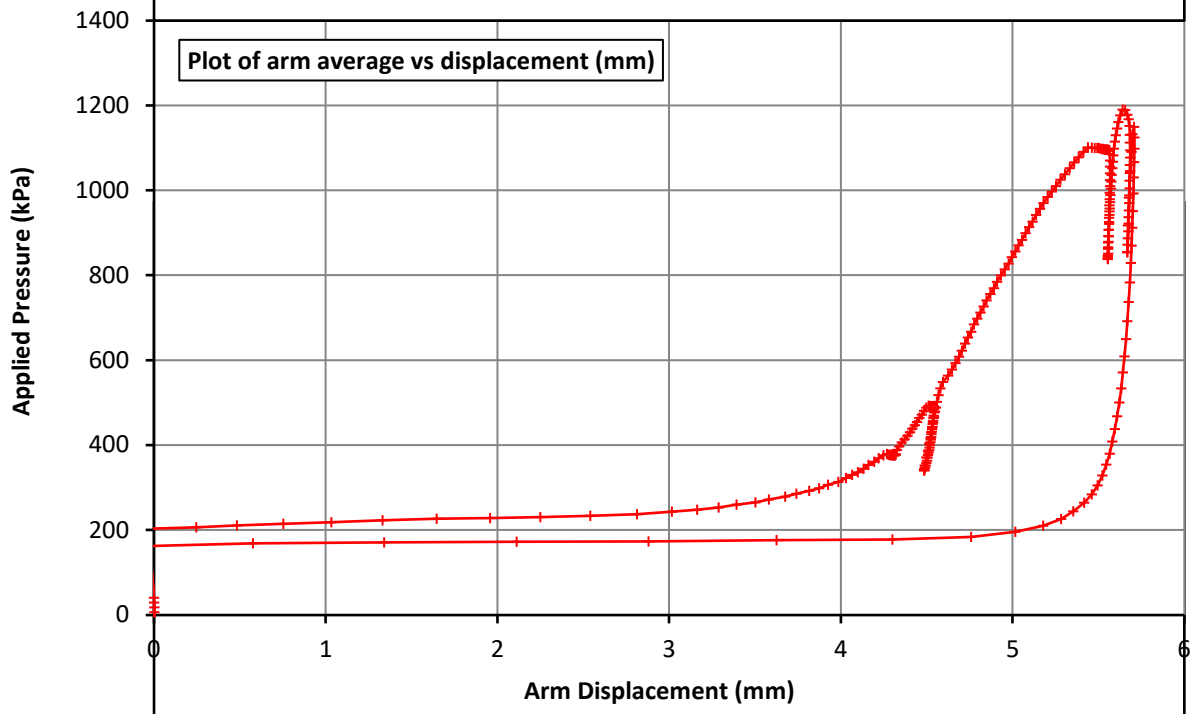
Arm expansion at:	2.2	% cavity strain
Maximum test pressure:	1190	kPa
Arm 1 at:	7.7	mm
Arm 2 at:	6.6	mm
Arm 3 at:	4.2	mm
Arm 4 at:	3.4	mm
Arm 5 at:	5.9	mm
Arm 6 at:	6.0	mm

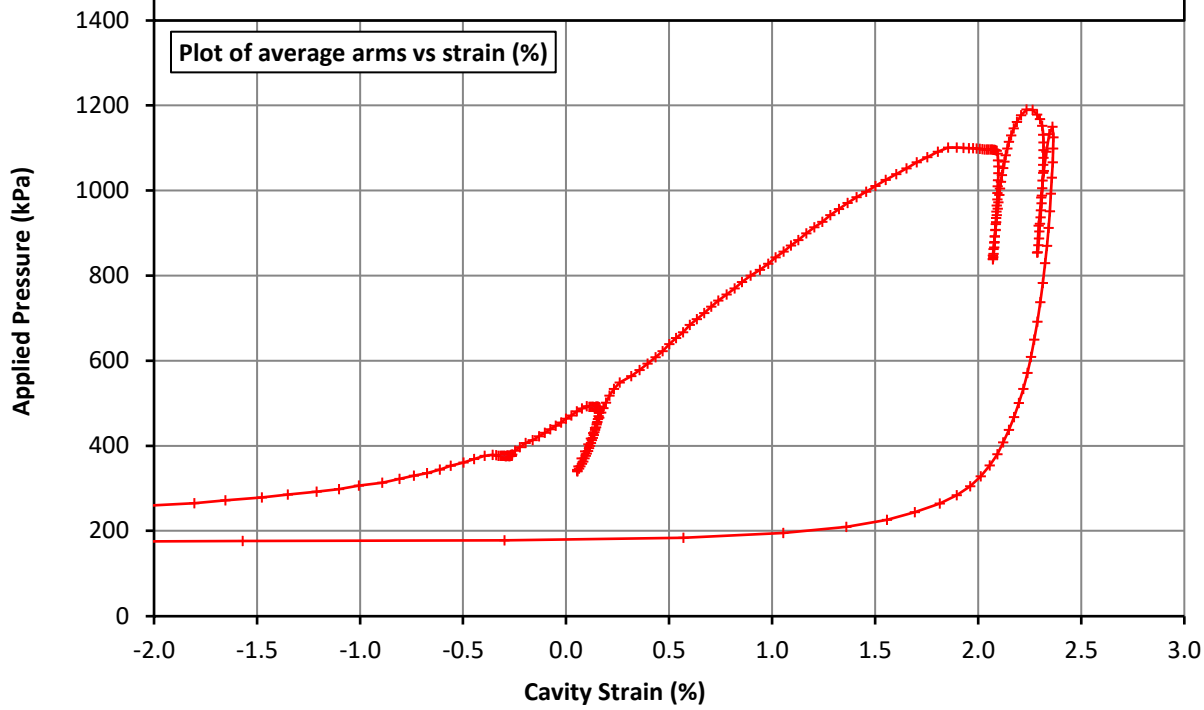
Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T01 - 02**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Test - Average Arm Plots

IN SITU SITE INVESTIGATION

Test Date	01/07/2025	**Test No.**	1
Borehole	BH107	**Test Depth (m)**	22.80



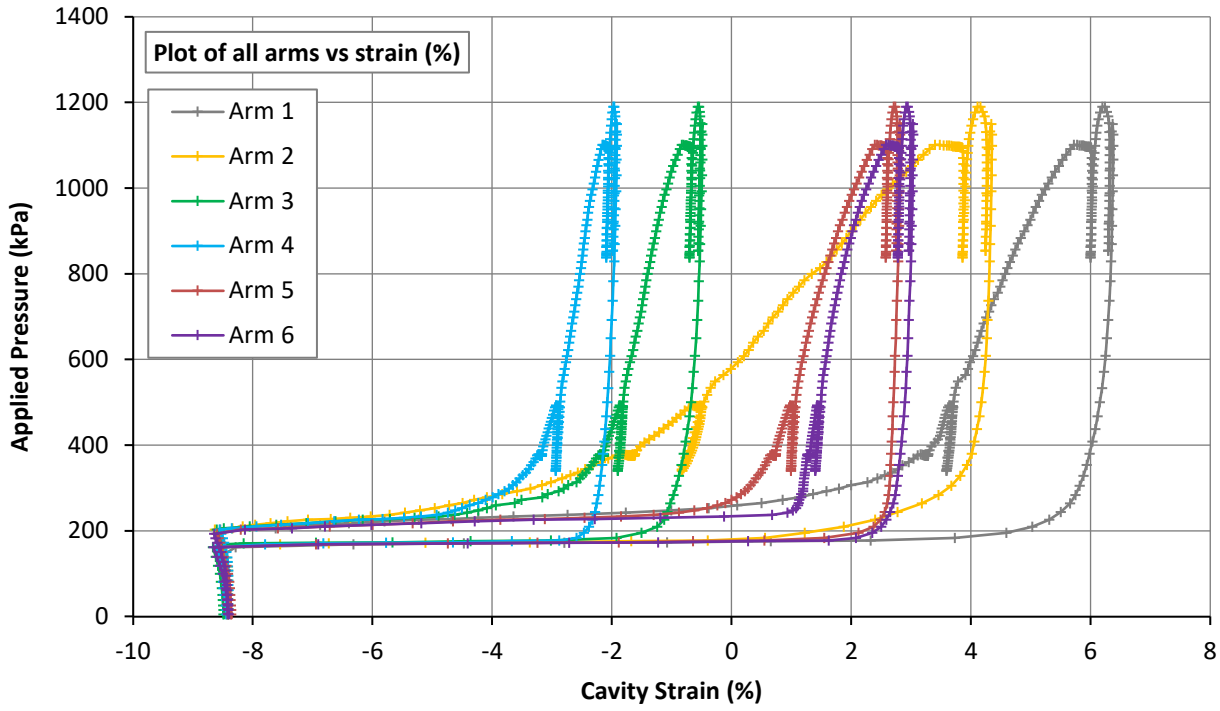


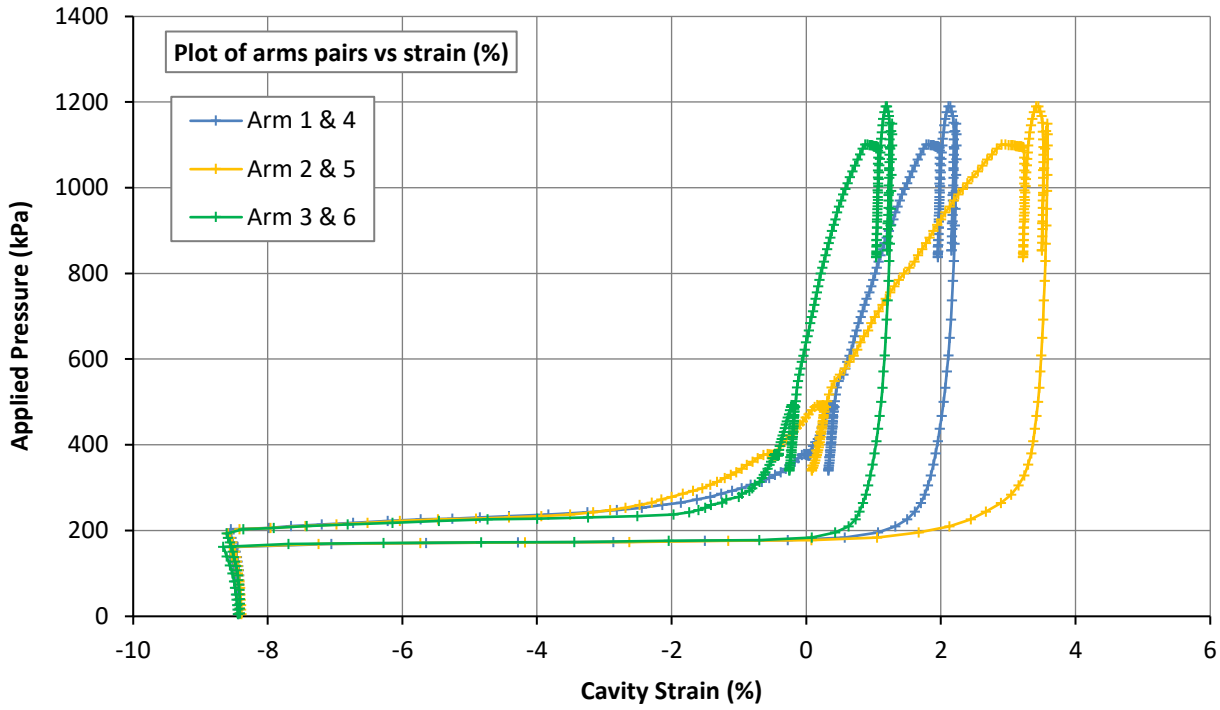
Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T01 - 03**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Test - Arm Displacement vs Strain (%)

IN SITU SITE INVESTIGATION

Test Date	01/07/2025	**Test No.**	1
Borehole	BH107	**Test Depth (m)**	22.80



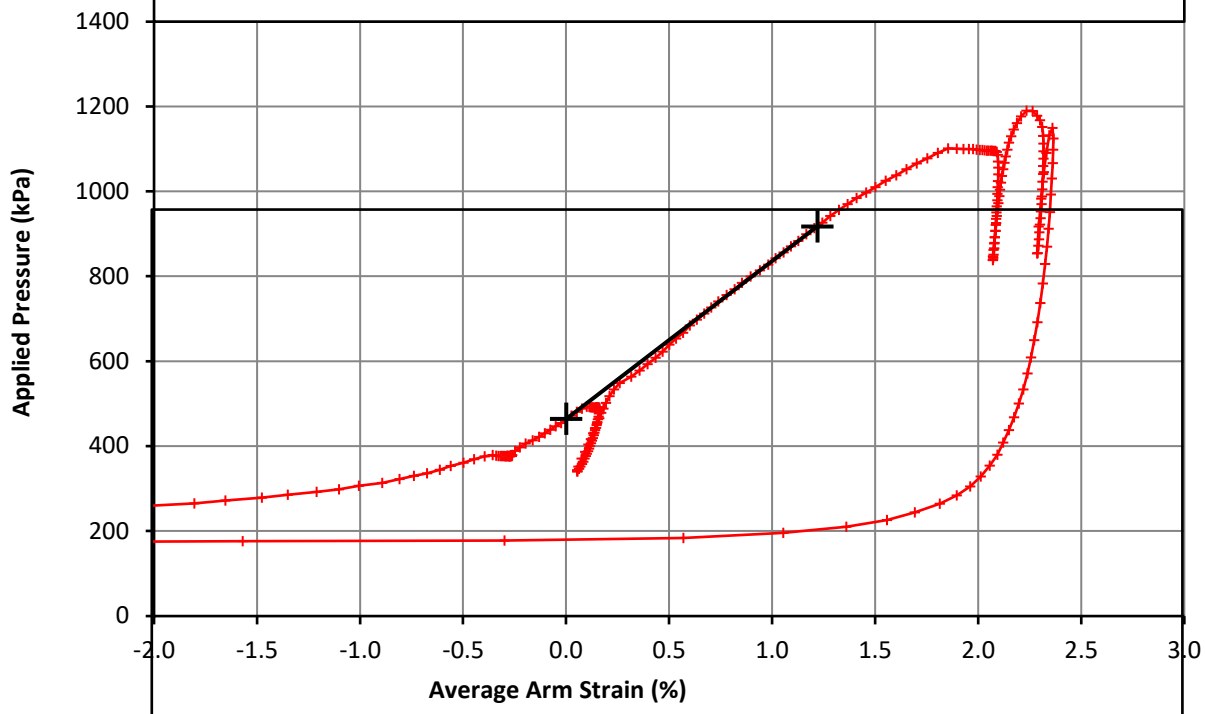


Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T01 - 04**
Client	FBJV		
Project No.	P1250112		

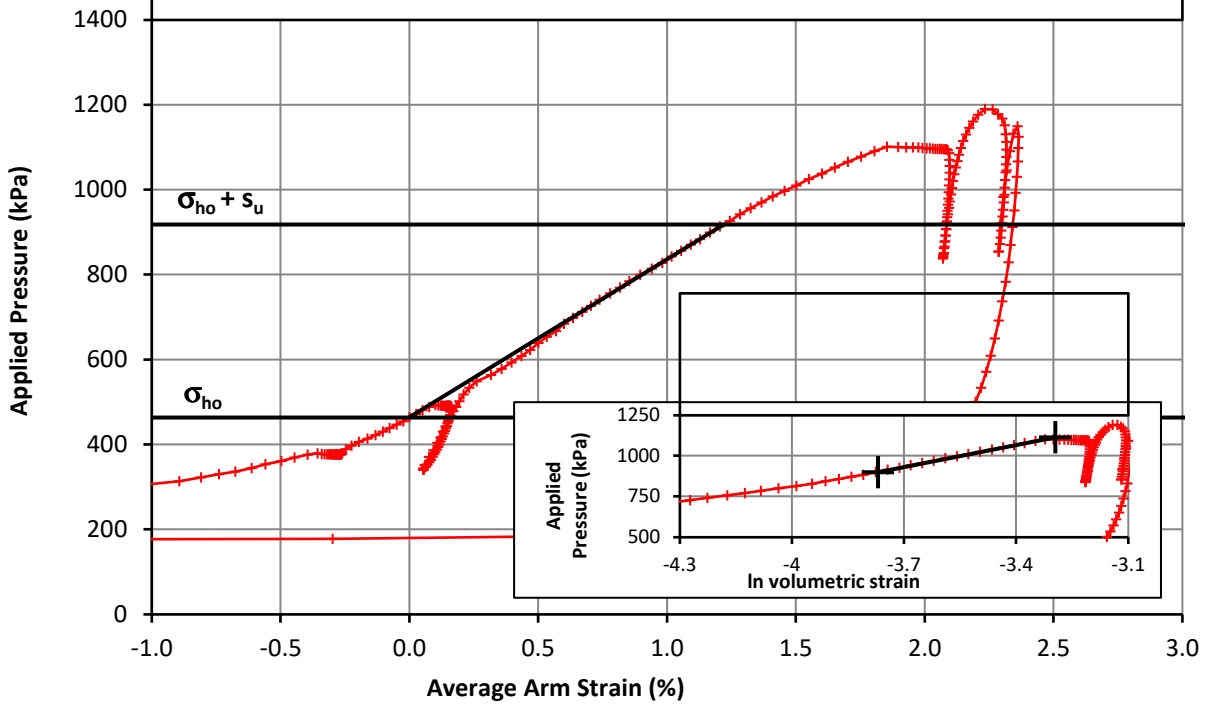
Pressuremeter Analysis - Initial Modulus & In Situ Horizontal Stress

IN SITU SITE INVESTIGATION

Test Date	01/07/2025	**Test No.**	1
Borehole	BH107	**Test Depth (m)**	22.80



Initial Modulus	Shear Modulus	18.8	MPa



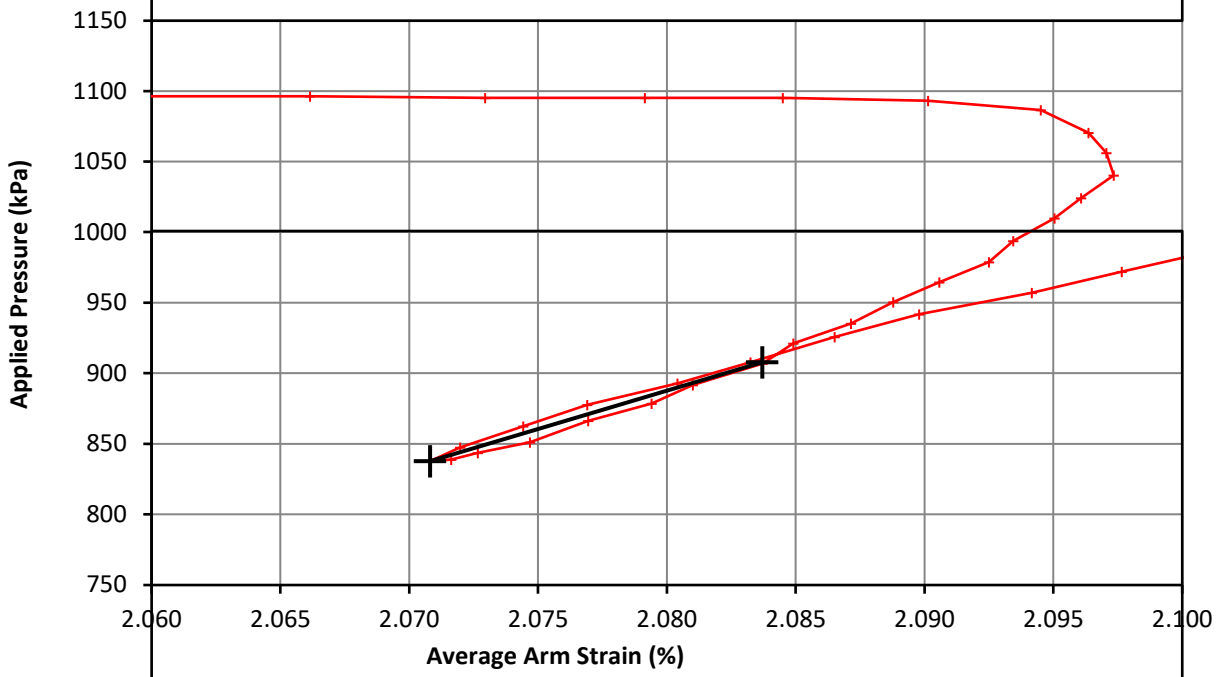
Marsland & Randolph	In situ horizontal stress	464	kPa
	Undrained Strength	454	kPa

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T01 - 05**
Client	FBJV		
Project No.	P1250112		

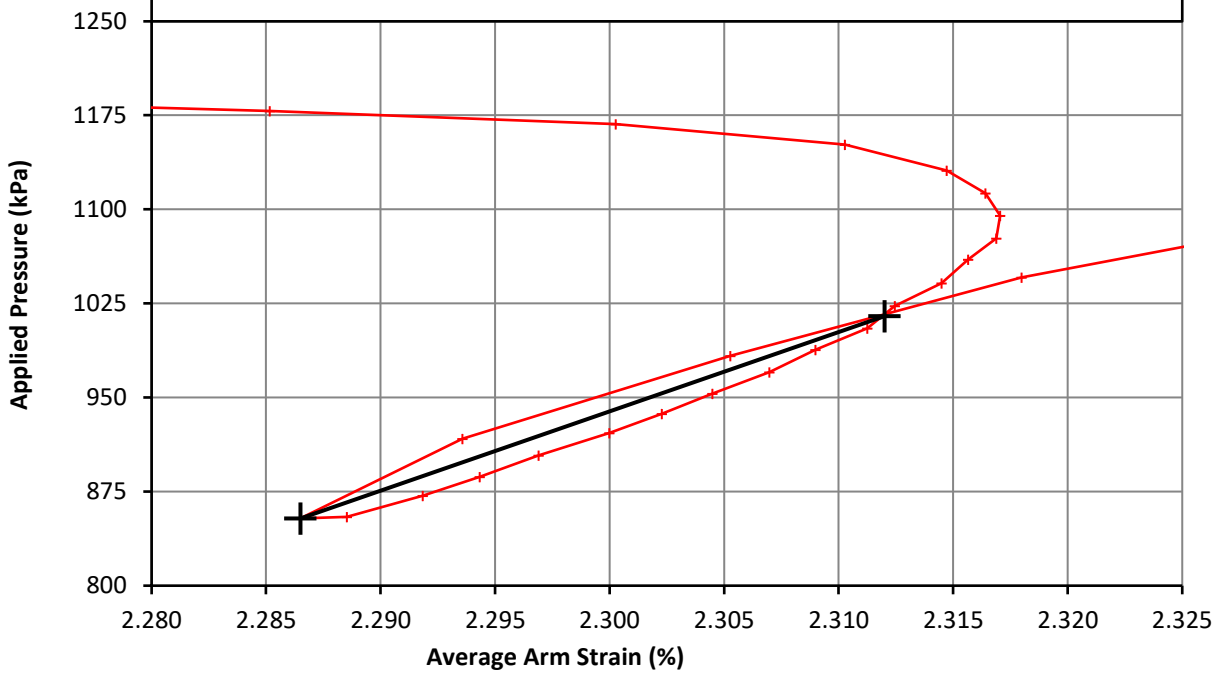
Pressuremeter Analysis - Unload Reload Loop

IN SITU SITE INVESTIGATION

Test Date	01/07/2025	**Test No.**	1
Borehole	BH107	**Test Depth (m)**	22.80



Loop 1	Shear Modulus	277.4	MPa
	Cavity Strain Range	0.013	%



Loop 2	Shear Modulus	323.6	MPa
	Cavity Strain Range	0.025	%

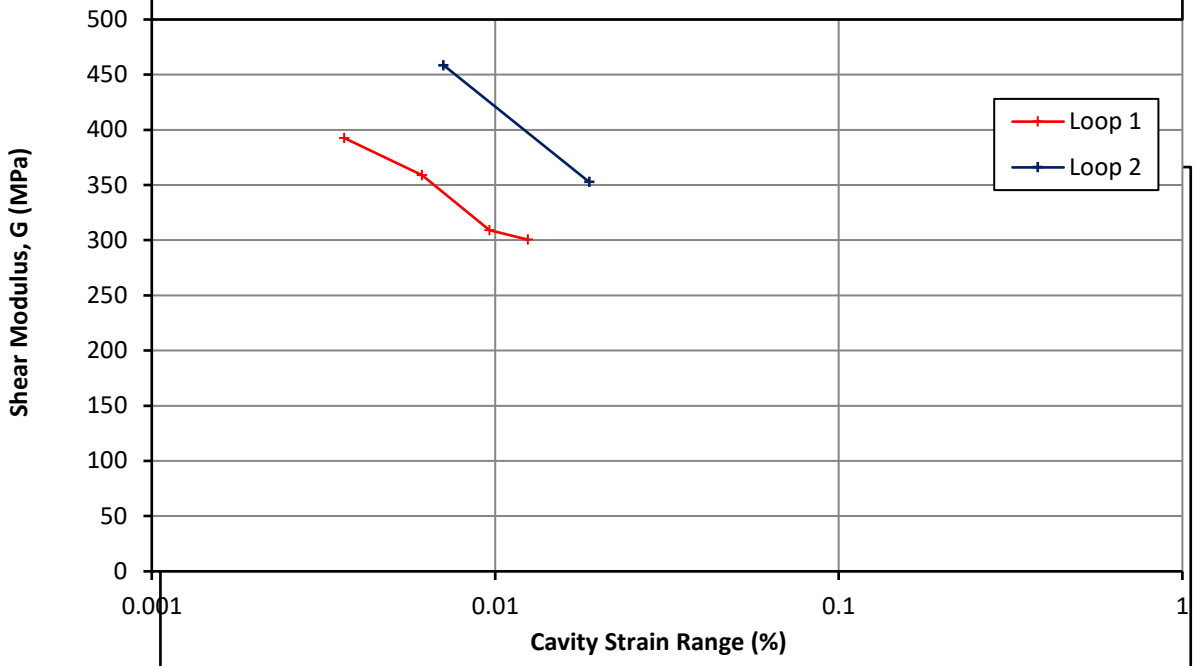
Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T01 - 06**
Client	FBJV		
Project No.	P1250112		

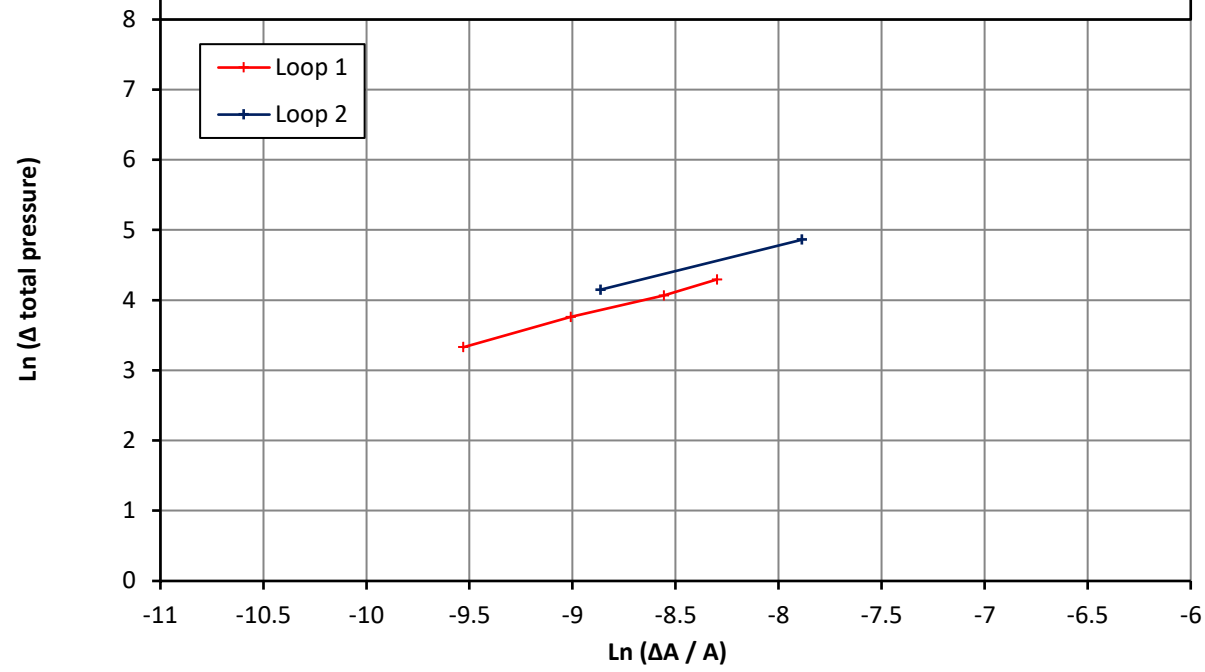
Pressuremeter Analysis

Small Strain Stiffness and Bolton & Whittle (1999)

IN SITU SITE INVESTIGATION

Test Date	01/07/2025	**Test No.**	1
Borehole	BH107	**Test Depth (m)**	22.80





Loop 1		Loop 2	
Gradient(β)	Intercept	Gradient(β)	Intercept
0.769	43.103 (MPa)	0.732	41.569 (MPa)

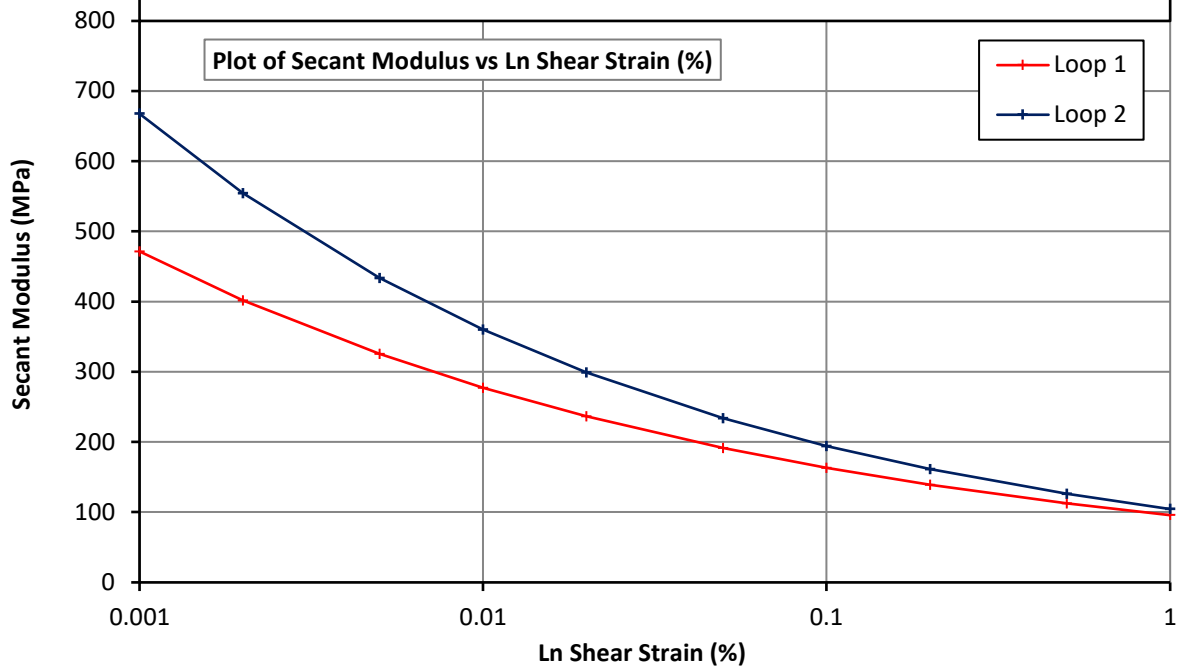
Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T01 - 07**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Analysis

Secant Modulus - Shear Strain (%)

IN SITU SITE INVESTIGATION

Test Date	01/07/2025	**Test No.**	1
Borehole	BH107	**Test Depth (m)**	22.80



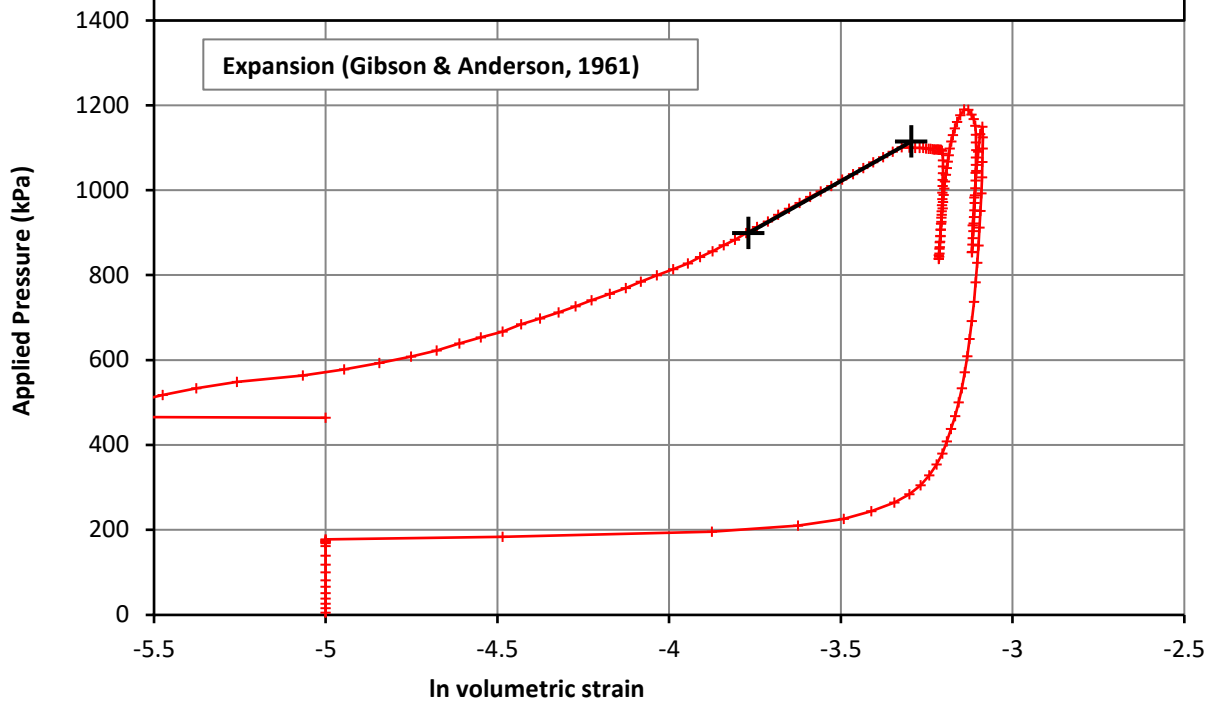
Shear Strain	Loop 1	Loop 2
0.001%	**471**	**668**
0.002%	402	554
0.005%	325	434
0.010%	**277**	**360**
0.020%	236	299
0.050%	191	234
0.100%	**163**	**194**
0.200%	139	161
0.500%	113	126
1.000%	**96**	**105**

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T01 - 08**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Analysis - Undrained Strength

IN SITU SITE INVESTIGATION

Test Date	01/07/2025	**Test No.**	1
Borehole	BH107	**Test Depth (m)**	22.80



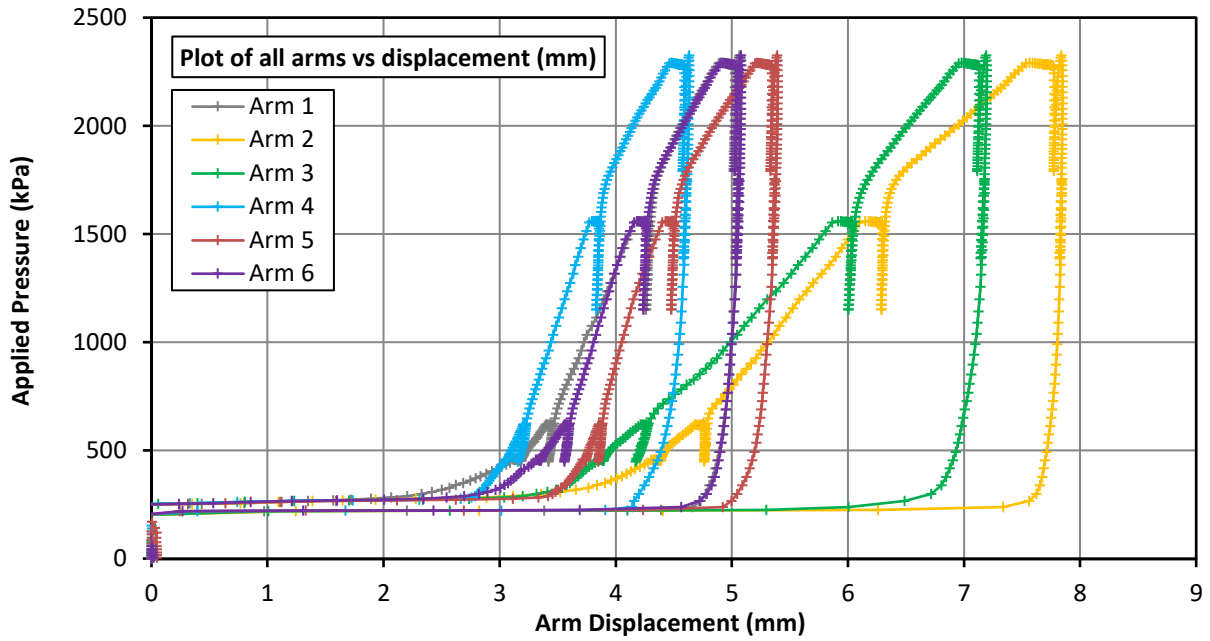
Strength (loading)	Undrained Shear	454	kPa
	Limit Pressure	2611	kPa

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T01 - 9**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Test Overview
High Pressure Dilatometer (HPD)

IN SITU SITE INVESTIGATION

Test Date	01/07/2025	**Test No.**	2
Borehole	BH107	**Test Depth (m)**	27.00
Coordinates (m)	- -	**Elevation (m)**	-



Material description from borehole log:

Structureless CHALK composed of slightly silty slightly sandy GRAVEL. Clasts are very weak medium density white with rare orange brown staining. CIRIA Ungraded.
[SEAFORD CHALK FORMATION]

Test pocket conditions:

Total core recovery:	55 %	Test pocket depth range:	
Solid core recovery:	9 %	From: 26.00 m	to: 28.00 m
Rock quality designation:	0 %	Flush: Water	

Test comment:

The test pocket was slightly oversize with arms lifting off at 3.3 to 4.8mm. The po was estimated to be at 507kPa, with the following loading section being relatively short. Material yield was interpreted at 1531kPa, with the test taken to a maximum pressure of 2023kPa where it was terminated due to excessive expansion on arms 2 & 3. The displacement-pressure response shown by the arms was variable with disturbance indicated by arms 2 & 3. Analysis of three unload reload loops provides modulus values of 303 to 484MPa. Derived undrained shear strength analysis provides a value of 1024kPa.

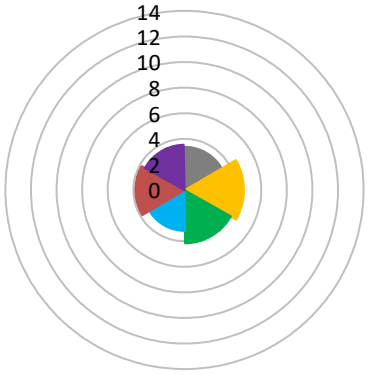
Test details:		**Instrument:**	Kylie (HPD06)		**Operator:**	A Lewins	
			mV	mV/mm		mV	mV/MPa
Drilling method:	Rotary coring	Arm 1:	-2407.5	135.6	TPC A:	-2191.2	104.7
Casing depth:	26.00 m	Arm 2:	-2461.4	135.6	TPC B:	-1951.7	105.7
Water level:	1.50 m	Arm 3:	-2293.5	136.6	Membrane:		
		Arm 4:	-2391.4	131.4	Stiffness	34.7 kPa	
Test time:		Arm 5:	-2349.8	127.9	Slope	10.0 kPa/mm	
Start of test:	14:17 hrs	Arm 6:	-2271.4	135.1	Compliance	1.4 mm/GPa	
End of test:	15:38 hrs						

Project	Gravesend Reach Tunnel	**Figure No.**	**BH107 T02 - 01**
Client	Soil Engineering		
Project No.	P1250112		

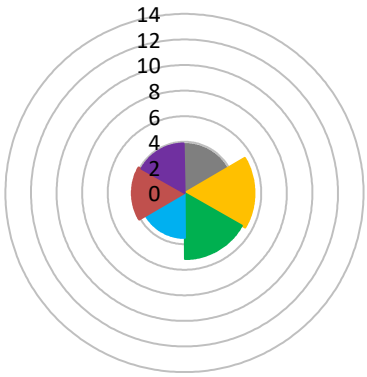
Pressuremeter Test - Membrane Expansion Plan View

IN SITU SITE INVESTIGATION

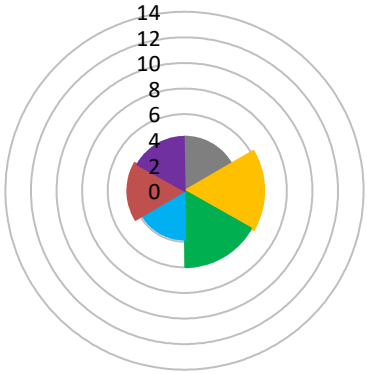
Test Date	01/07/2025	**Test No.**	2
Borehole	BH107	**Test Depth (m)**	27.00



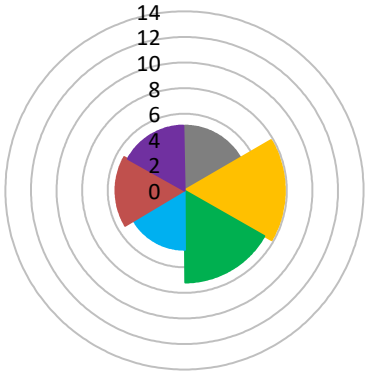
Arm expansion at:	0.0	% cavity strain
Test pressure:	601	kPa
Arm 1 at:	3.4	mm
Arm 2 at:	4.6	mm
Arm 3 at:	4.2	mm
Arm 4 at:	3.2	mm
Arm 5 at:	3.8	mm
Arm 6 at:	3.5	mm



Arm expansion at:	1.0	% cavity strain
Test pressure:	1114	kPa
Arm 1 at:	3.8	mm
Arm 2 at:	5.5	mm
Arm 3 at:	5.2	mm
Arm 4 at:	3.5	mm
Arm 5 at:	4.1	mm
Arm 6 at:	3.9	mm



Arm expansion at:	2.0	% cavity strain
Test pressure:	1557	kPa
Arm 1 at:	4.2	mm
Arm 2 at:	6.2	mm
Arm 3 at:	6.0	mm
Arm 4 at:	3.8	mm
Arm 5 at:	4.5	mm
Arm 6 at:	4.2	mm



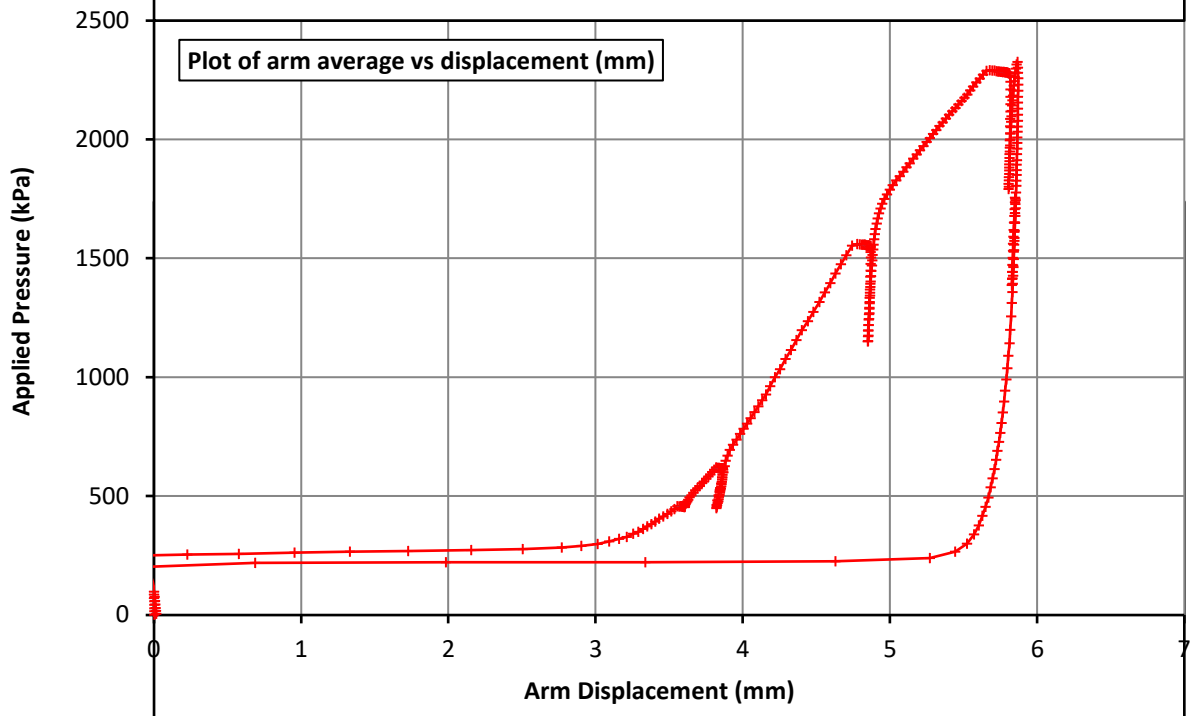
Arm expansion at:	4.0	% cavity strain
Maximum test pressure:	2326	kPa
Arm 1 at:	5.1	mm
Arm 2 at:	7.8	mm
Arm 3 at:	7.2	mm
Arm 4 at:	4.6	mm
Arm 5 at:	5.4	mm
Arm 6 at:	5.1	mm

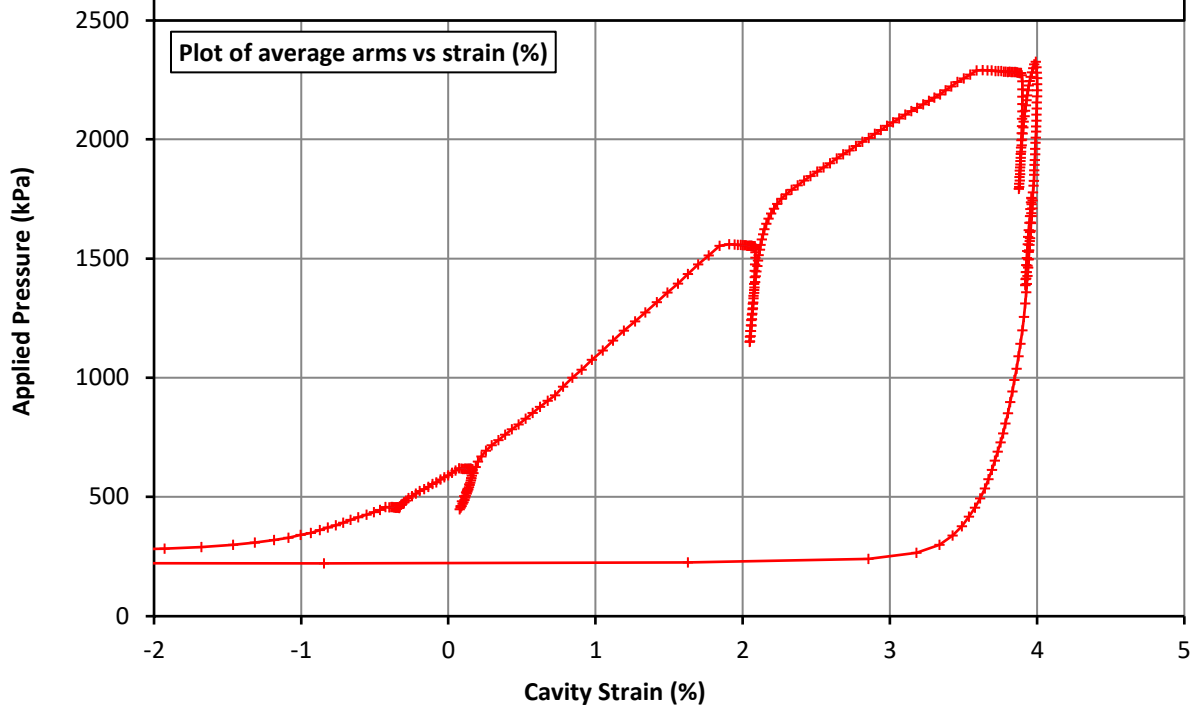
Project	Gravesend Reach Tunnel	**Figure No.**	**BH107 T02 - 02**
Client	Soil Engineering		
Project No.	P1250112		

Pressuremeter Test - Average Arm Plots

IN SITU SITE INVESTIGATION

Test Date	01/07/2025	**Test No.**	2
Borehole	BH107	**Test Depth (m)**	27.00



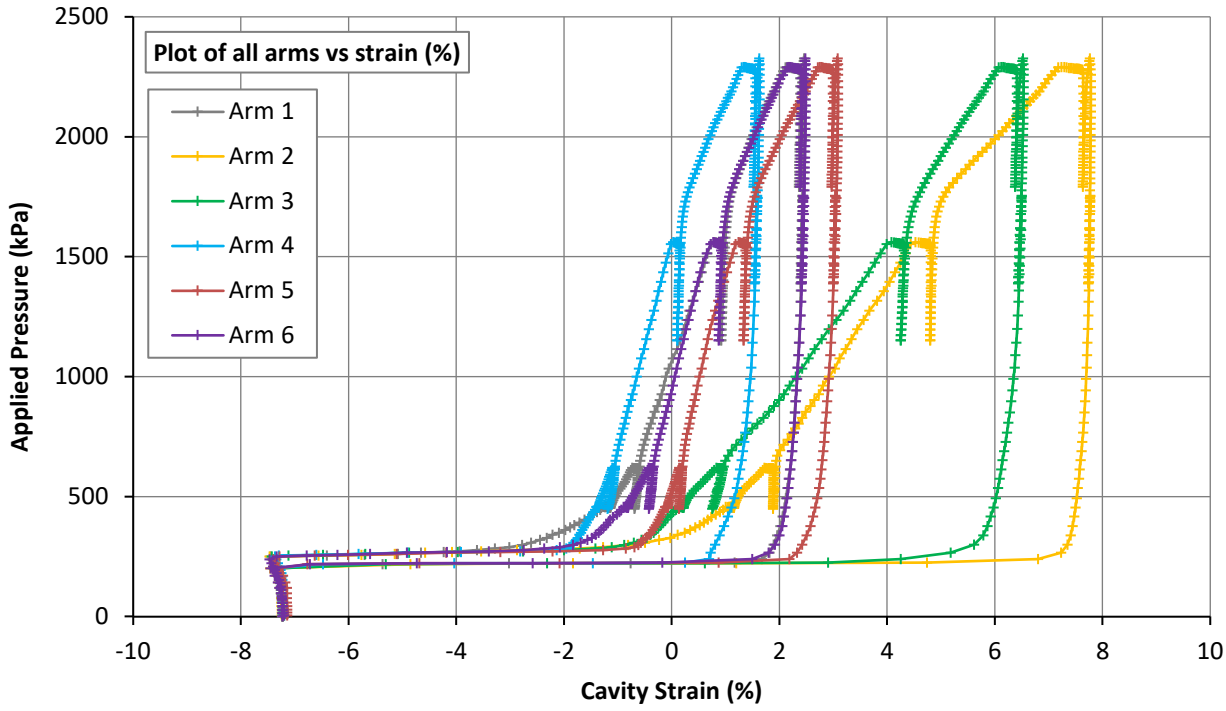


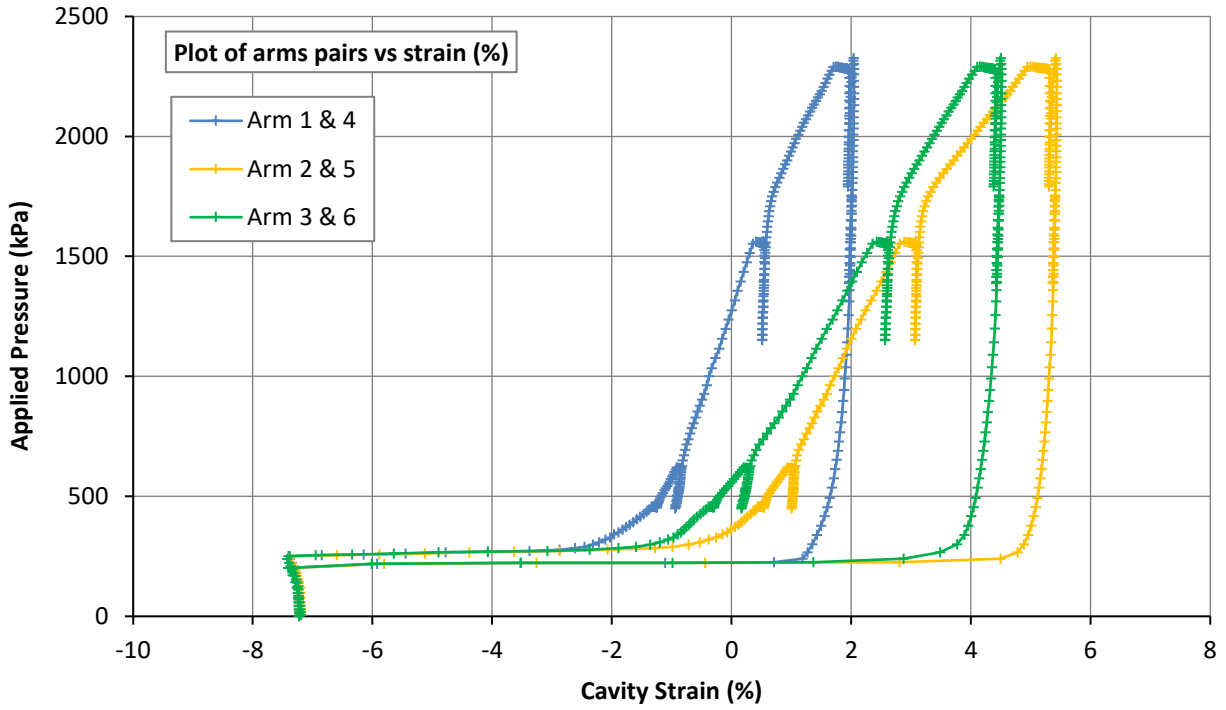
Project	Gravesend Reach Tunnel	**Figure No.**	**BH107 T02 - 03**
Client	Soil Engineering		
Project No.	P1250112		

Pressuremeter Test - Arm Displacement vs Strain (%)

IN SITU SITE INVESTIGATION

Test Date	01/07/2025	**Test No.**	2
Borehole	BH107	**Test Depth (m)**	27.00



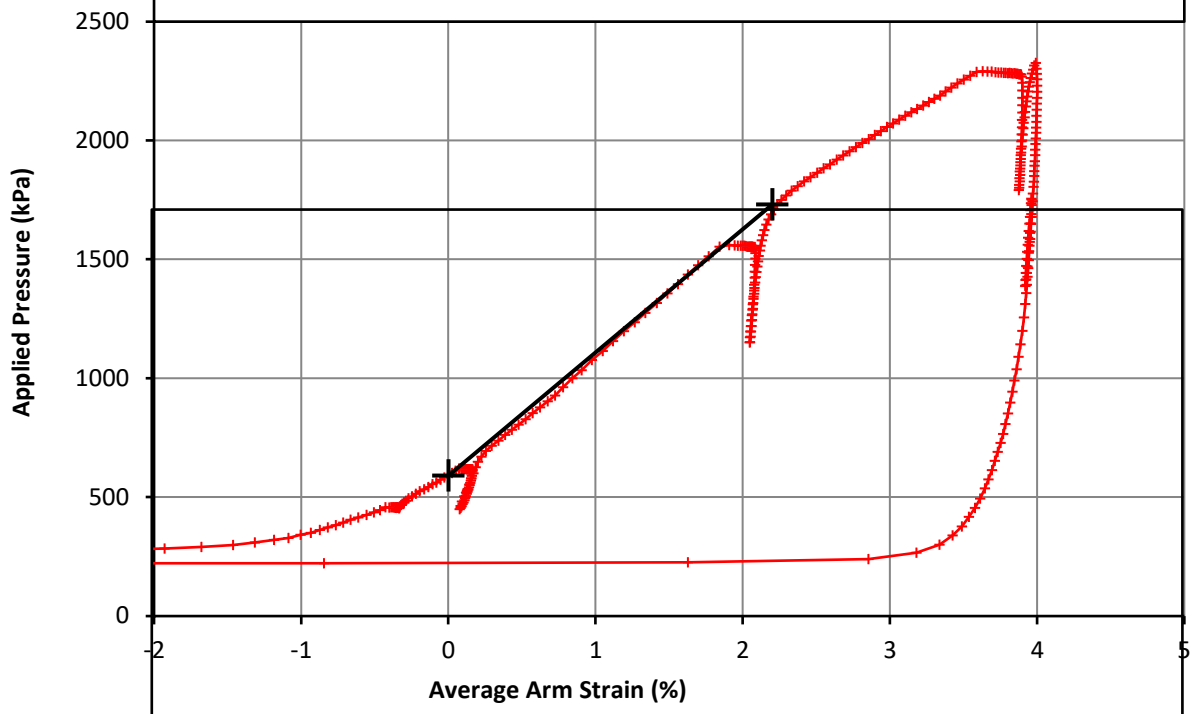


Project	Gravesend Reach Tunnel	**Figure No.**	**BH107 T02 - 04**
Client	Soil Engineering		
Project No.	P1250112		

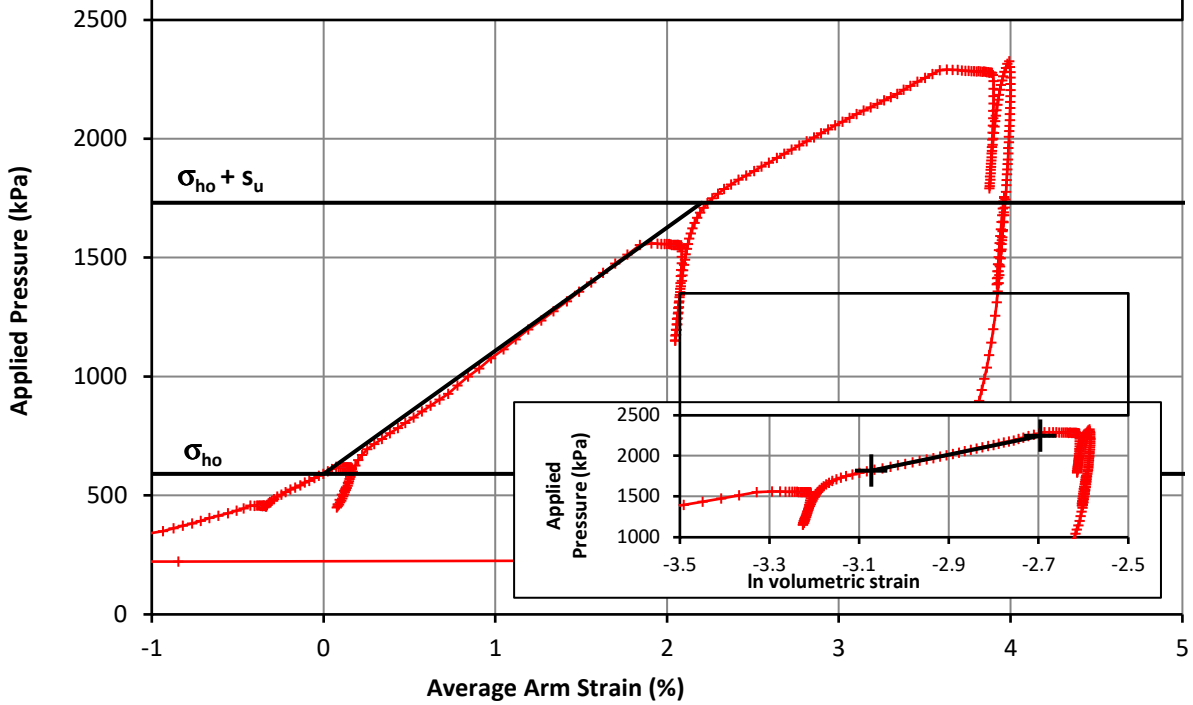
Pressuremeter Analysis - Initial Modulus & In Situ Horizontal Stress

IN SITU SITE INVESTIGATION

Test Date	01/07/2025	**Test No.**	2
Borehole	BH107	**Test Depth (m)**	27.00



Initial Modulus	Shear Modulus	26.5	MPa



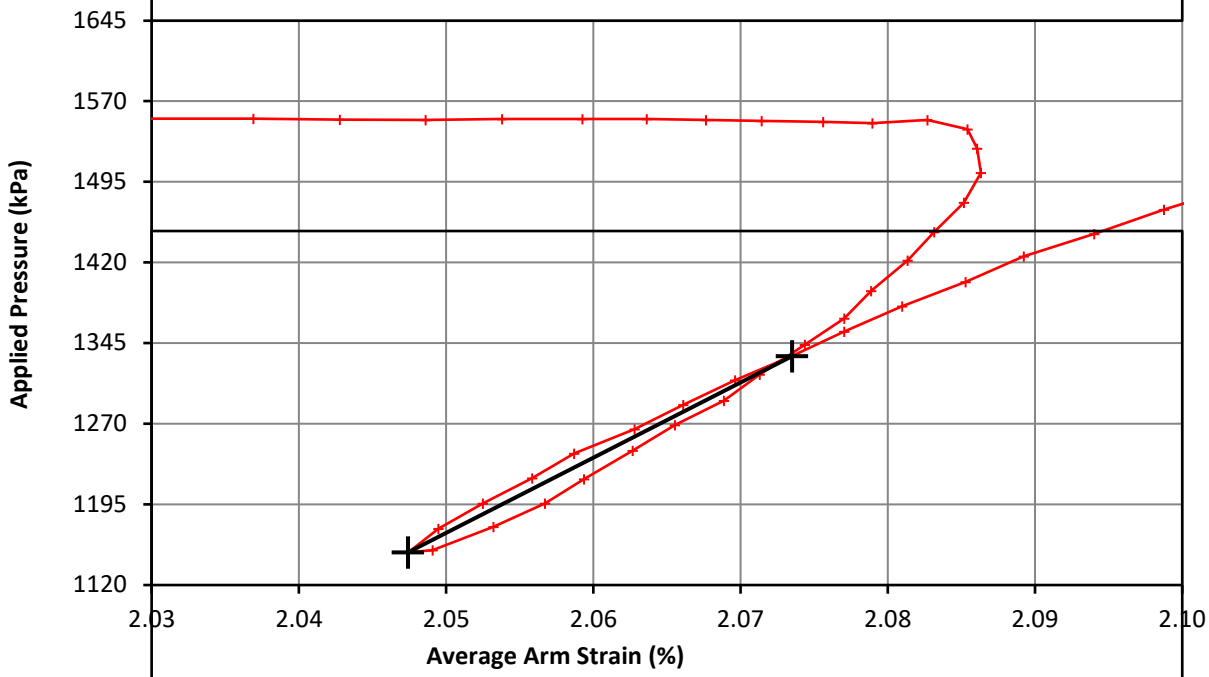
Marsland & Randolph	In situ horizontal stress	591	kPa
	Undrained Strength	1141	kPa

Project	Gravesend Reach Tunnel	**Figure No.**	**BH107 T02 - 05**
Client	Soil Engineering		
Project No.	P1250112		

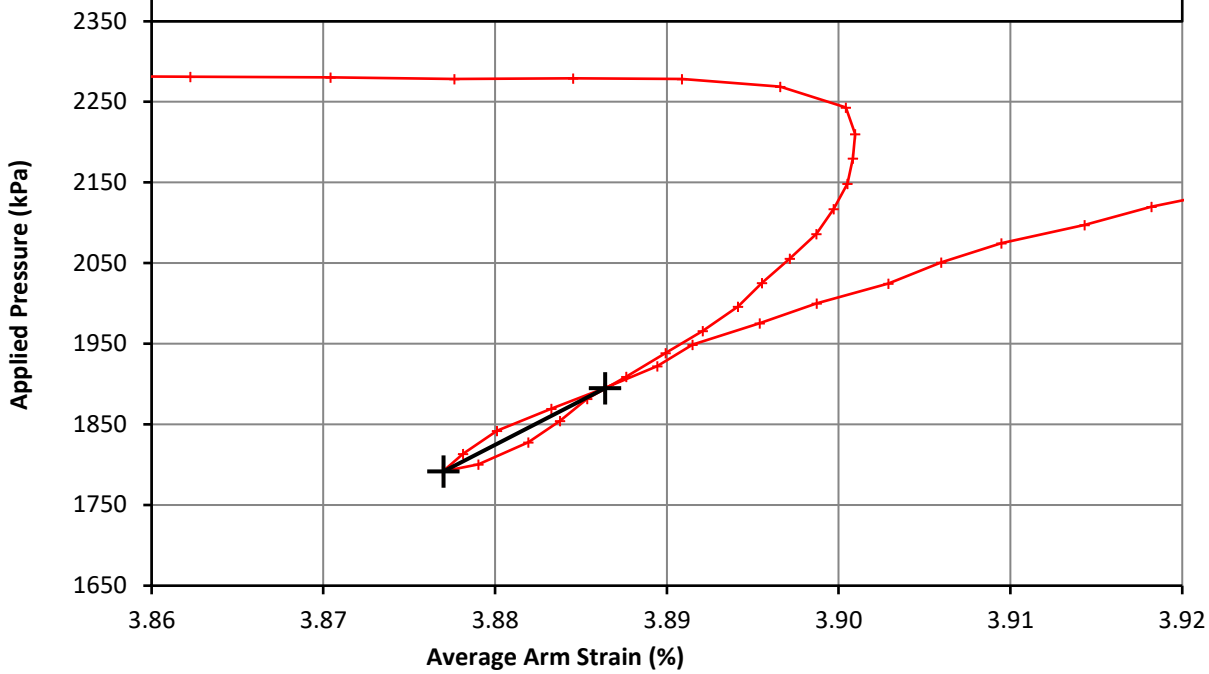
Pressuremeter Analysis - Unload Reload Loop

IN SITU SITE INVESTIGATION

Test Date	01/07/2025	**Test No.**	2
Borehole	BH107	**Test Depth (m)**	27.00



Loop 1	Shear Modulus	356.9	MPa
	Cavity Strain Range	0.026	%



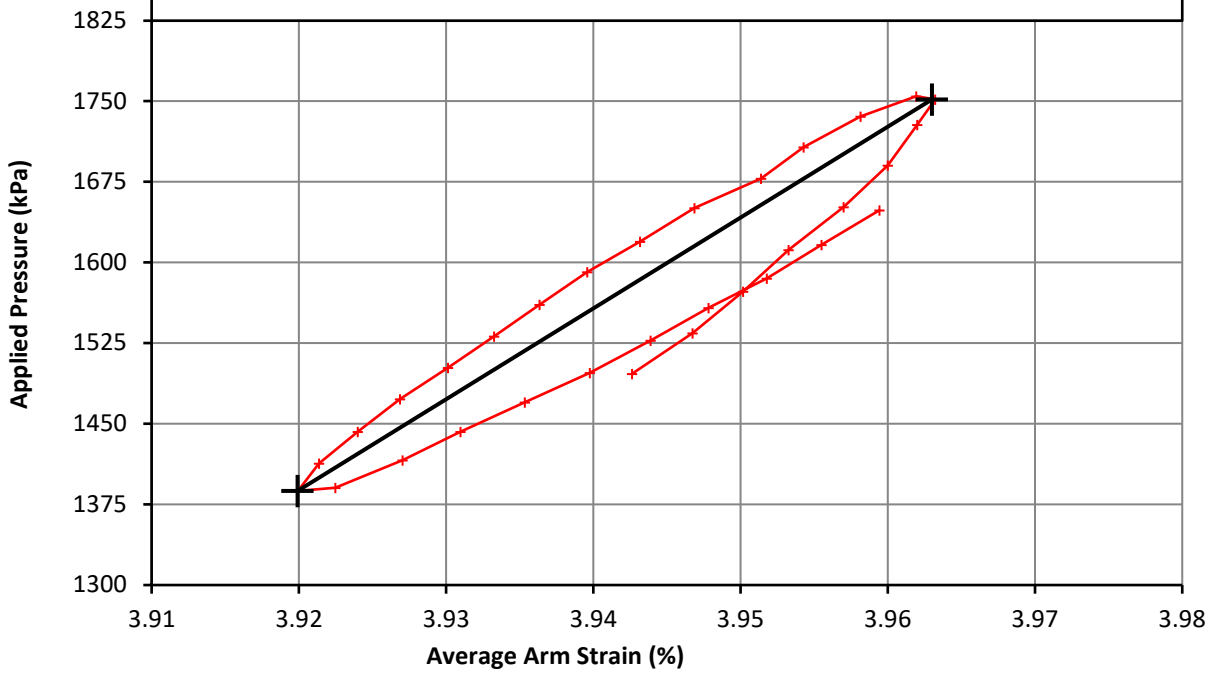
Loop 2	Shear Modulus	569.7	MPa
	Cavity Strain Range	0.009	%

Project	Gravesend Reach Tunnel	**Figure No.**	**BH107 T02 - 06**
Client	Soil Engineering		
Project No.	P1250112		

Pressuremeter Analysis - Unload Reload Loop

IN SITU SITE INVESTIGATION

Test Date	01/07/2025	**Test No.**	2
Borehole	BH107	**Test Depth (m)**	27.00



Loop 3	Shear Modulus	439.0	MPa
	Cavity Strain Range	0.043	%

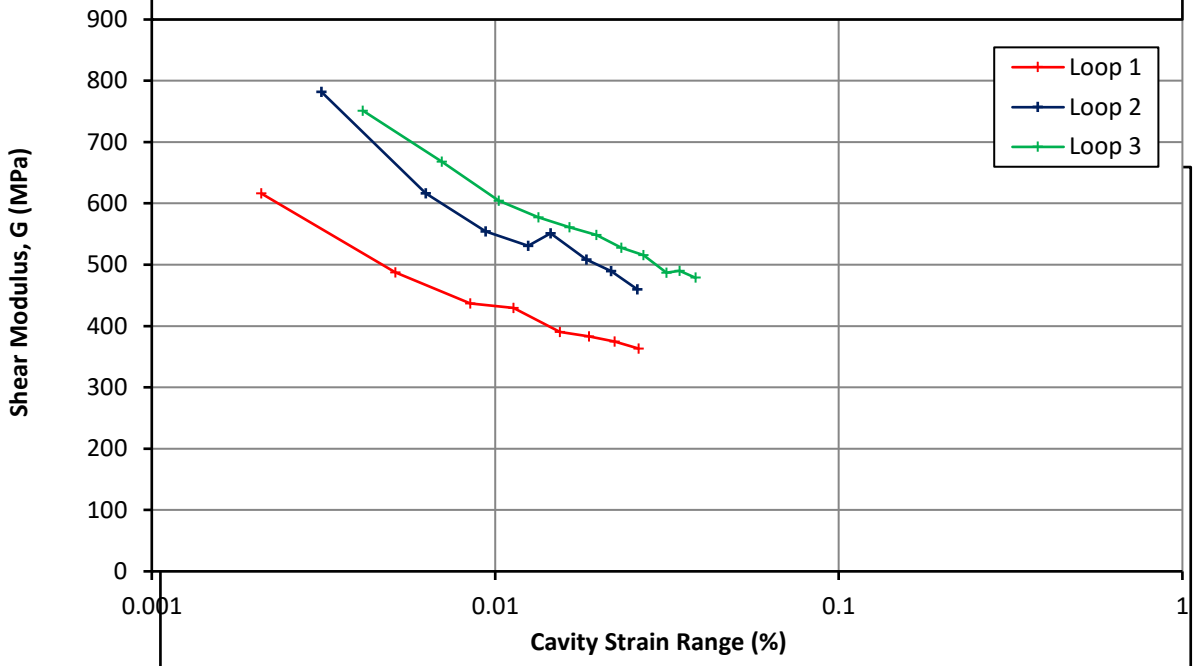
Project	Gravesend Reach Tunnel	**Figure No.**	**BH107 T02 - 07**
Client	Soil Engineering		
Project No.	P1250112		

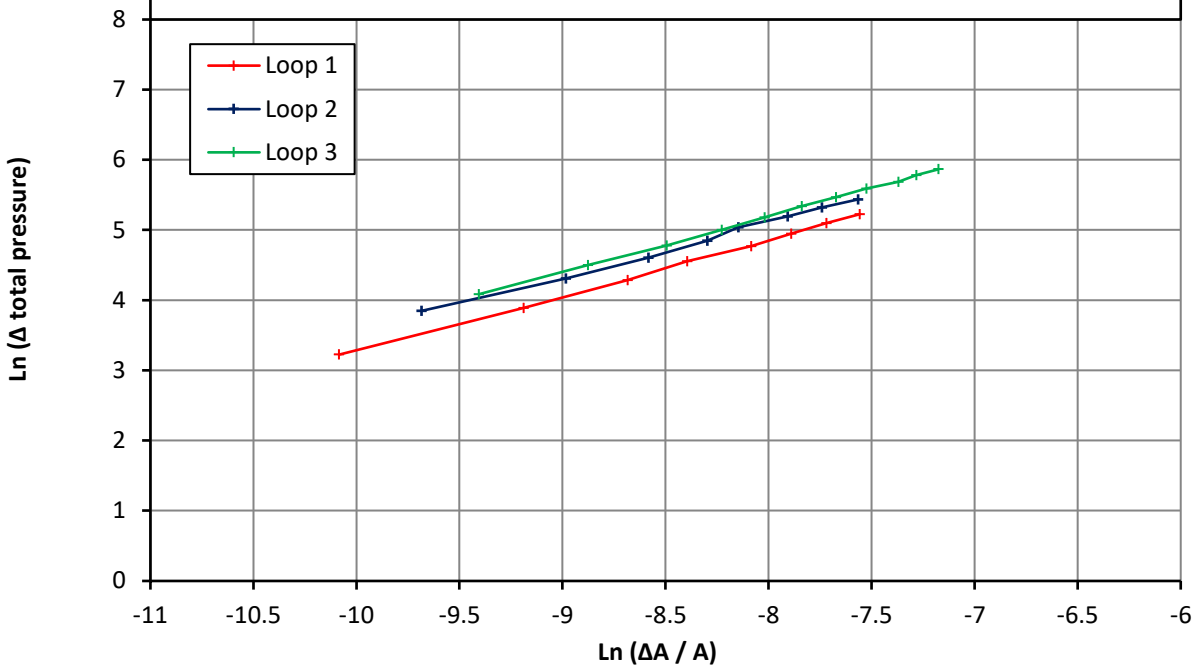
Pressuremeter Analysis

Small Strain Stiffness and Bolton & Whittle (1999)

IN SITU SITE INVESTIGATION

Test Date	01/07/2025	**Test No.**	2
Borehole	BH107	**Test Depth (m)**	27.00





Loop 1		Loop 2		Loop 3	
Gradient(β)	Intercept	Gradient(β)	Intercept	Gradient(β)	Intercept
0.795	74.420 (MPa)	0.772	79.119 (MPa)	0.802	110.735 (MPa)

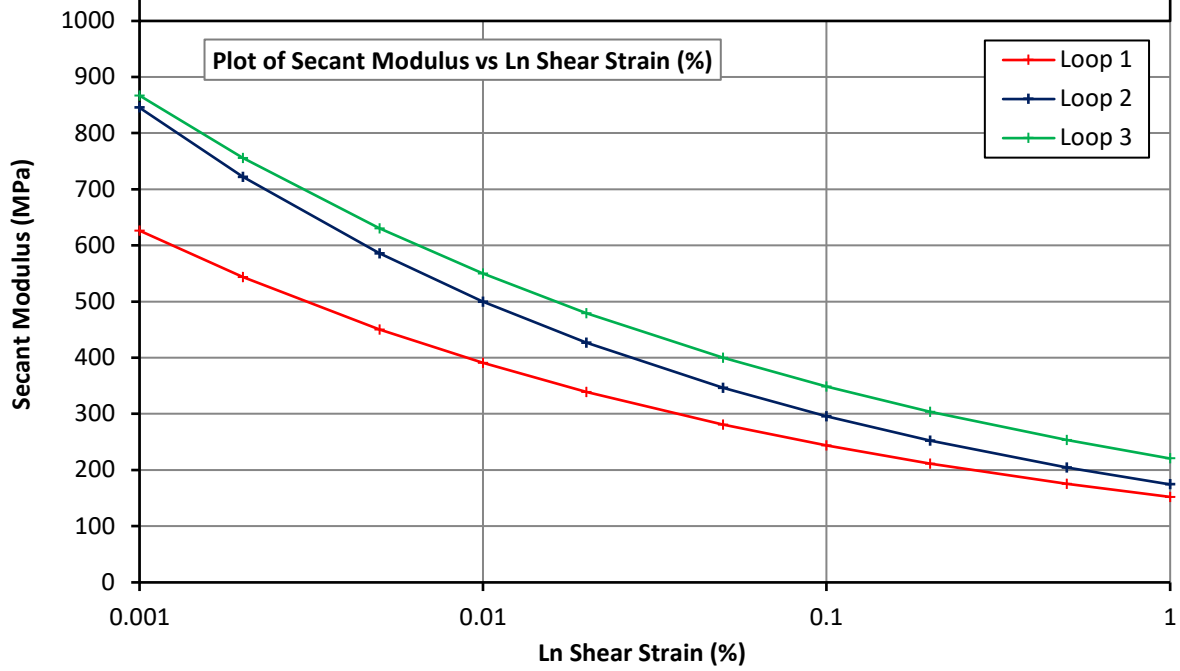
Project	Gravesend Reach Tunnel	**Figure No.**	**BH107 T02 - 08**
Client	Soil Engineering		
Project No.	P1250112		

Pressuremeter Analysis

Secant Modulus - Shear Strain (%)

IN SITU SITE INVESTIGATION

Test Date	01/07/2025	**Test No.**	2
Borehole	BH107	**Test Depth (m)**	27.00



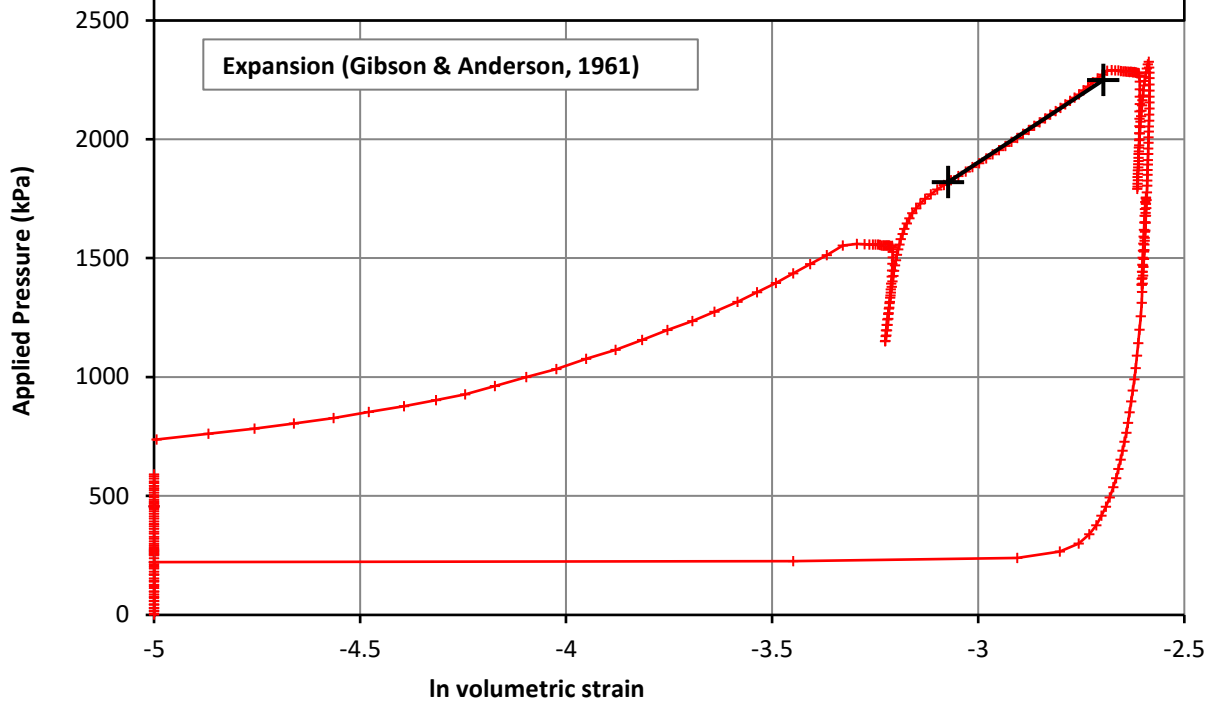
Shear Strain	Loop 1	Loop 2	Loop 3
0.001%	**626**	**846**	**867**
0.002%	543	722	756
0.005%	450	586	630
0.010%	**391**	**500**	**550**
0.020%	339	427	479
0.050%	281	346	400
0.100%	**244**	**296**	**348**
0.200%	211	252	304
0.500%	175	205	253
1.000%	**152**	**175**	**221**

Project	Gravesend Reach Tunnel	**Figure No.**	**BH107 T02 - 09**
Client	Soil Engineering		
Project No.	P1250112		

Pressuremeter Analysis - Undrained Strength

IN SITU SITE INVESTIGATION

Test Date	01/07/2025	**Test No.**	2
Borehole	BH107	**Test Depth (m)**	27.00



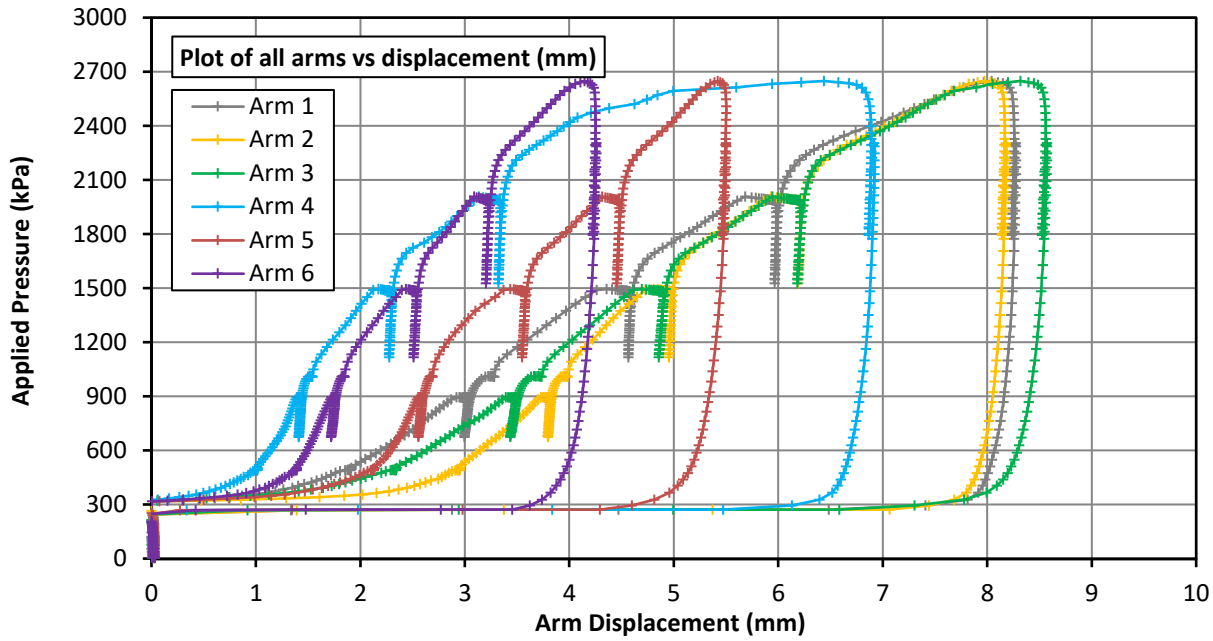
Strength (loading)	Undrained Shear	1141	kPa
	Limit Pressure	5328	kPa

Project	Gravesend Reach Tunnel	**Figure No.**	**BH107 T02 - 10**
Client	Soil Engineering		
Project No.	P1250112		

Pressuremeter Test Overview
High Pressure Dilatometer (HPD)

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	3
Borehole	BH107	**Test Depth (m)**	30.80
Coordinates (m)	- -	**Elevation (m)**	-



Material description from borehole log:

Assumed zone of core loss: Probable CHALK with flints.

Test pocket conditions:

Total core recovery:	43 %	Test pocket depth range:	
Solid core recovery:	3 %	From: 30.00 m	to: 32.00 m
Rock quality designation:	0 %	Flush: Water	

Test comment:

The test pocket was reasonable with arms lifting off at 1.2 to 3.4mm. The po was estimated to be at 548kPa, with the following loading section being relatively short. Material yield was interpreted at 1394kPa, with the test taken to a maximum pressure of 2305kPa, where it was terminated due to uneven arm expansion. The displacement-pressure response shown by the arms was variable with large expansion shown by arms 1, 2, 3 & 4. Analysis of four unload reload loops provides modulus values of 115 to 389MPa. Derived undrained shear strength analysis provides a value of 846kPa.

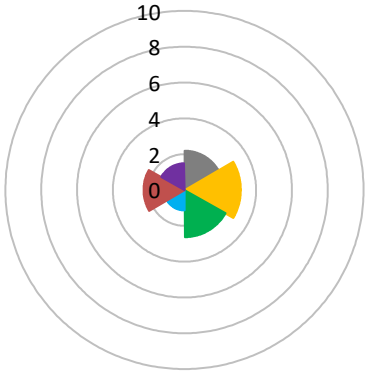
Test details:		**Instrument:**	Kylie (HPD06)		**Operator:**	A Lewins	
			mV	mV/mm		mV	mV/MPa
Drilling method:	Rotary coring	Arm 1:	-2404.5	135.6	TPC A:	-2191.0	104.7
Casing depth:	30.00 m	Arm 2:	-2466.4	135.6	TPC B:	-1954.9	105.7
Water level:	1.50 m	Arm 3:	-2287.6	136.6	Membrane:		
		Arm 4:	-2391.8	131.4	Stiffness	34.7	kPa
Test time:		Arm 5:	-2343.8	127.9	Slope	10.0	kPa/mm
Start of test:	09:05 hrs	Arm 6:	-2270.1	135.1	Compliance	1.4	mm/GPa
End of test:	10:22 hrs						

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T03 - 01**
Client	FBJV		
Project No.	P1250112		

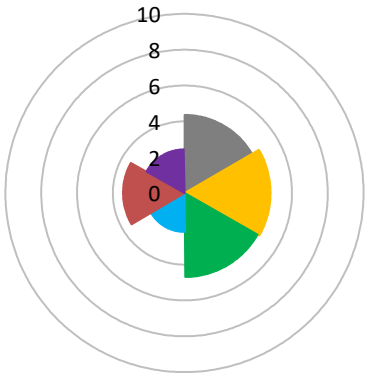
Pressuremeter Test - Membrane Expansion Plan View

IN SITU SITE INVESTIGATION

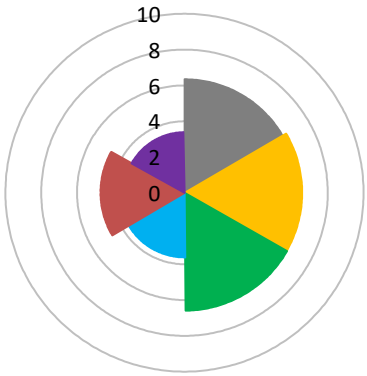
Test Date	02/07/2025	**Test No.**	3
Borehole	BH107	**Test Depth (m)**	30.80



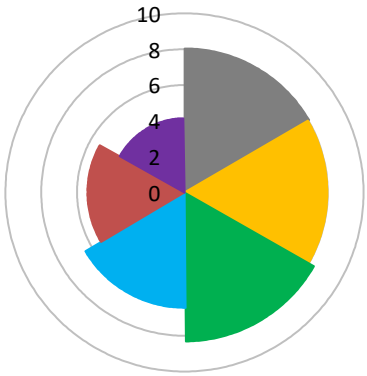
Arm expansion at:	0.1	% cavity strain
Test pressure:	601	kPa
Arm 1 at:	2.2	mm
Arm 2 at:	3.1	mm
Arm 3 at:	2.6	mm
Arm 4 at:	1.1	mm
Arm 5 at:	2.3	mm
Arm 6 at:	1.5	mm



Arm expansion at:	3.0	% cavity strain
Test pressure:	1495	kPa
Arm 1 at:	4.4	mm
Arm 2 at:	4.8	mm
Arm 3 at:	4.7	mm
Arm 4 at:	2.2	mm
Arm 5 at:	3.4	mm
Arm 6 at:	2.4	mm



Arm expansion at:	6.1	% cavity strain
Test pressure:	2267	kPa
Arm 1 at:	6.3	mm
Arm 2 at:	6.6	mm
Arm 3 at:	6.6	mm
Arm 4 at:	3.6	mm
Arm 5 at:	4.7	mm
Arm 6 at:	3.4	mm



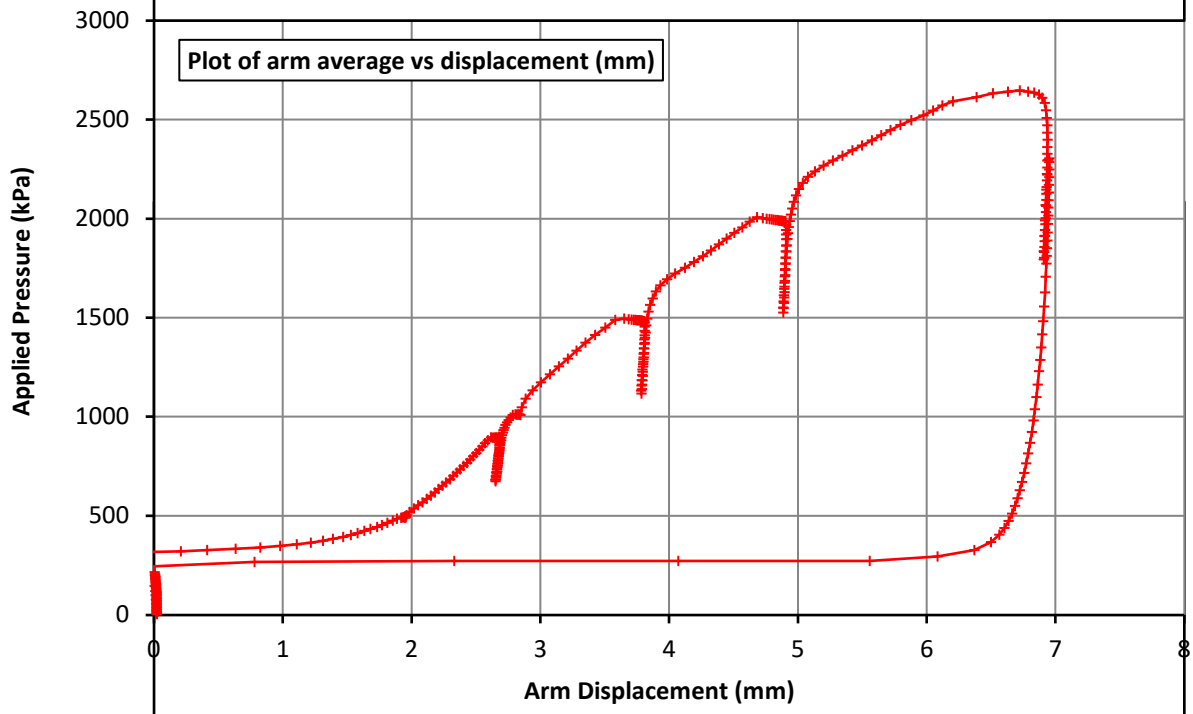
Arm expansion at:	9.1	% cavity strain
Maximum test pressure:	2648	kPa
Arm 1 at:	8.0	mm
Arm 2 at:	8.0	mm
Arm 3 at:	8.3	mm
Arm 4 at:	6.4	mm
Arm 5 at:	5.4	mm
Arm 6 at:	4.1	mm

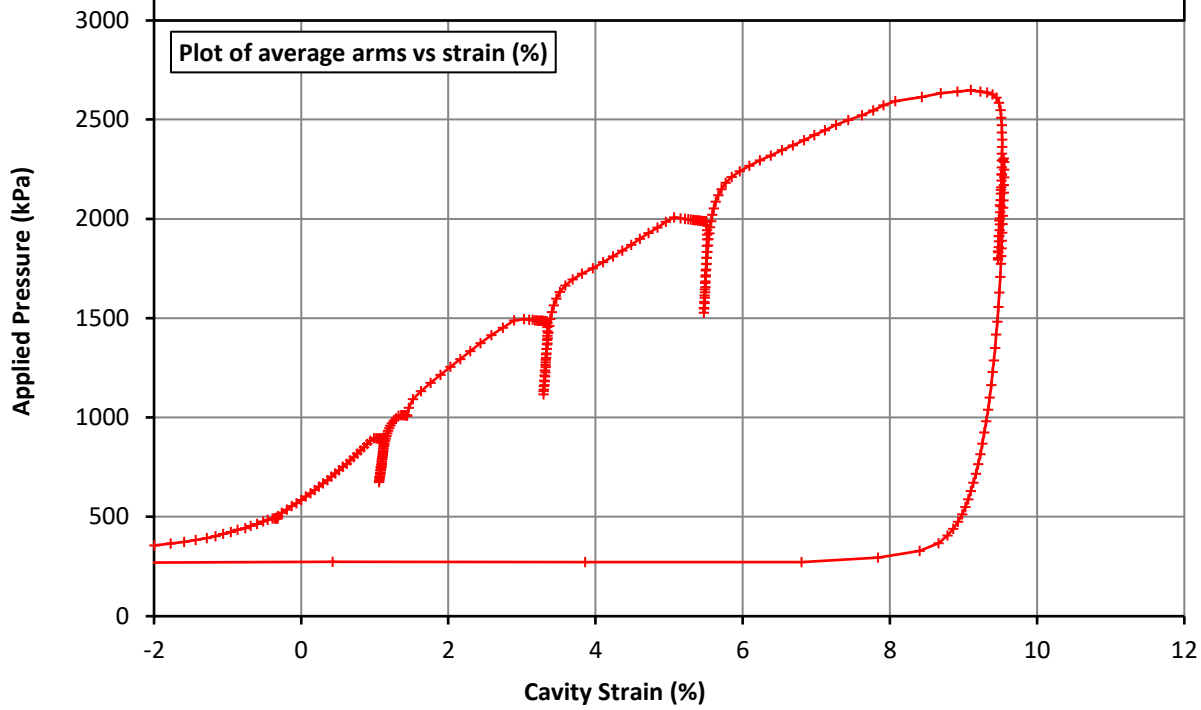
Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T03 - 02**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Test - Average Arm Plots

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	3
Borehole	BH107	**Test Depth (m)**	30.80



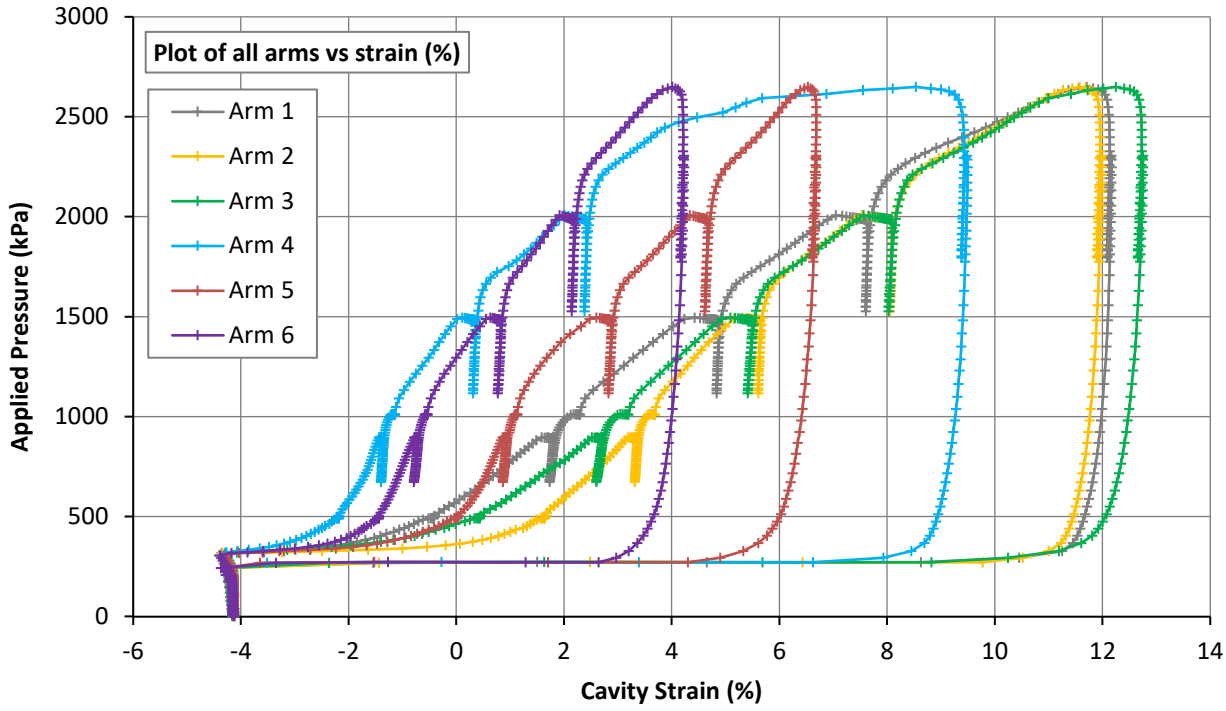


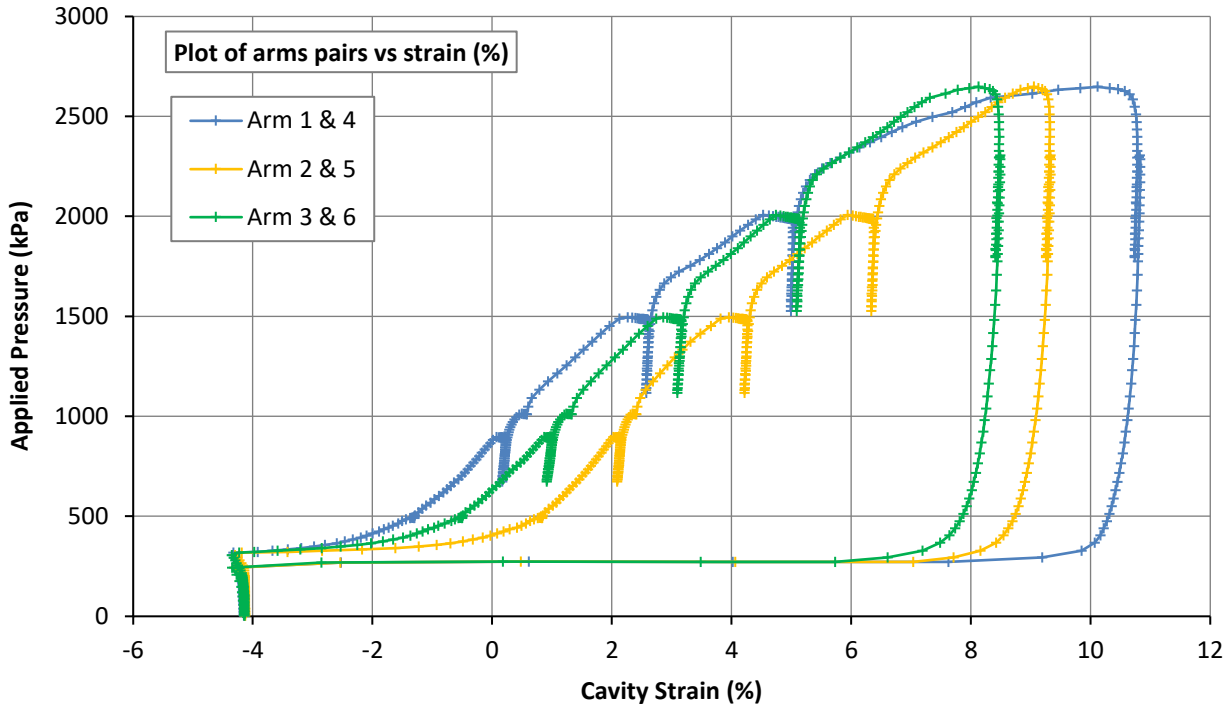
Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T03 - 03**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Test - Arm Displacement vs Strain (%)

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	3
Borehole	BH107	**Test Depth (m)**	30.80



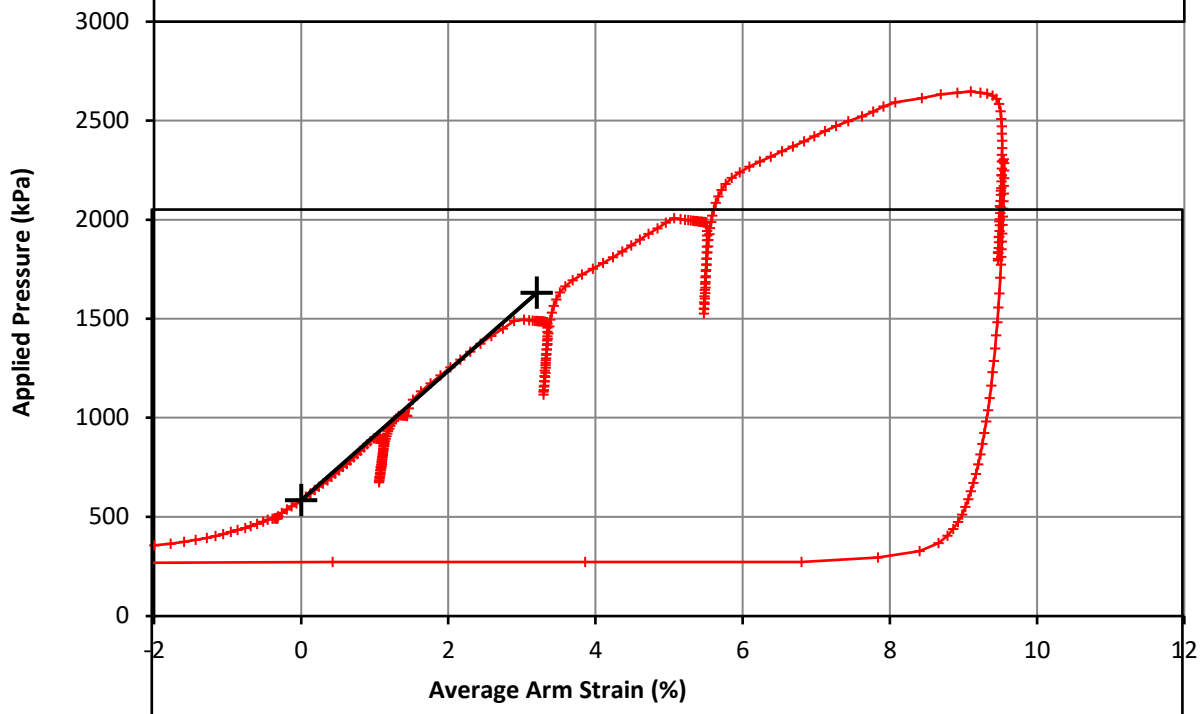


Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T03 - 04**
Client	FBJV		
Project No.	P1250112		

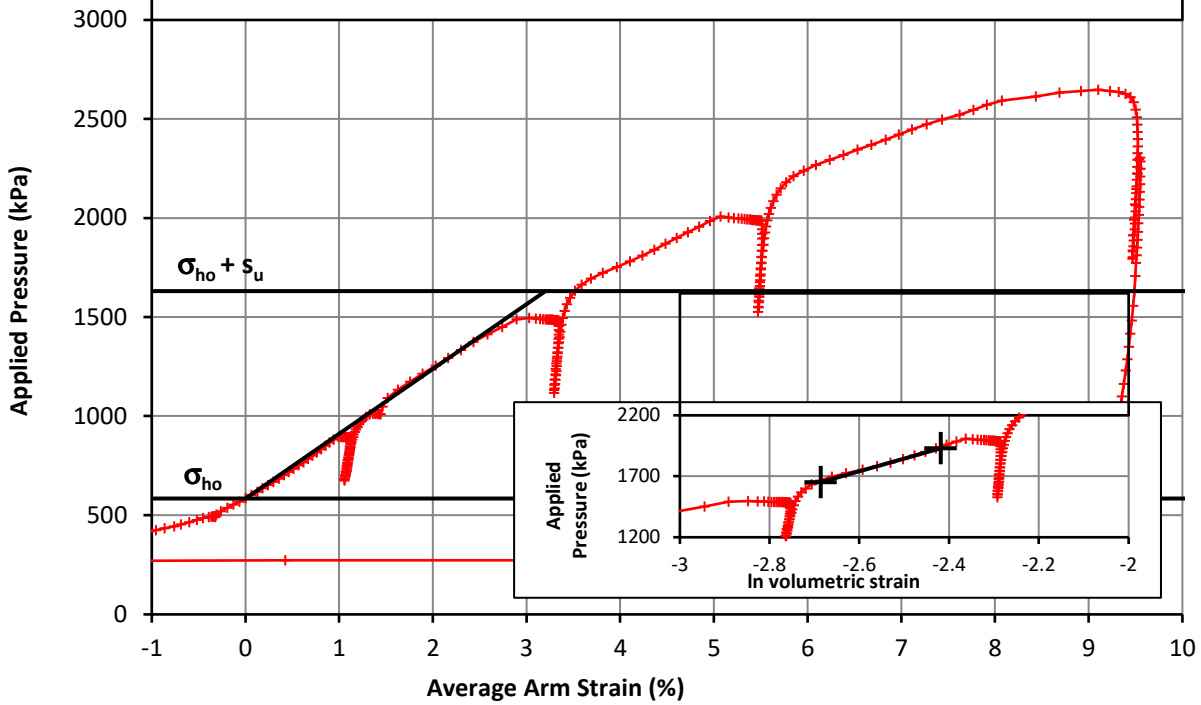
Pressuremeter Analysis - Initial Modulus & In Situ Horizontal Stress

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	3
Borehole	BH107	**Test Depth (m)**	30.80



Initial Modulus	Shear Modulus	16.9	MPa



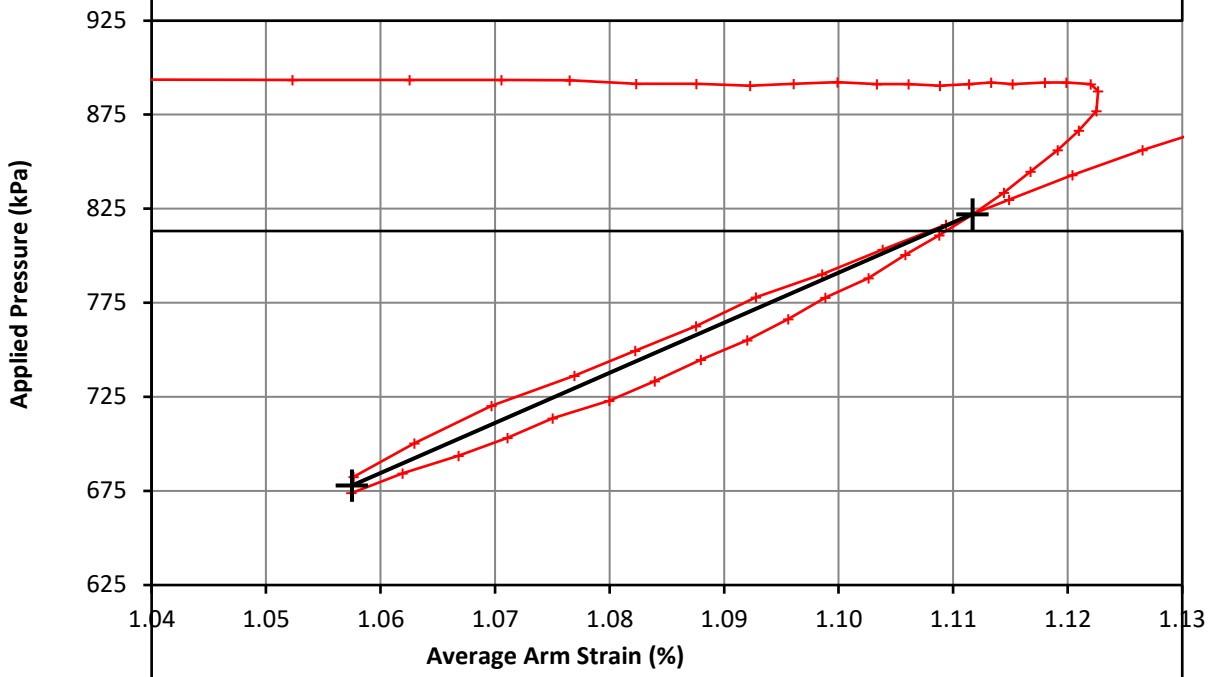
Marsland & Randolph	In situ horizontal stress	585	kPa
	Undrained Strength	1047	kPa

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T03 - 05**
Client	FBJV		
Project No.	P1250112		

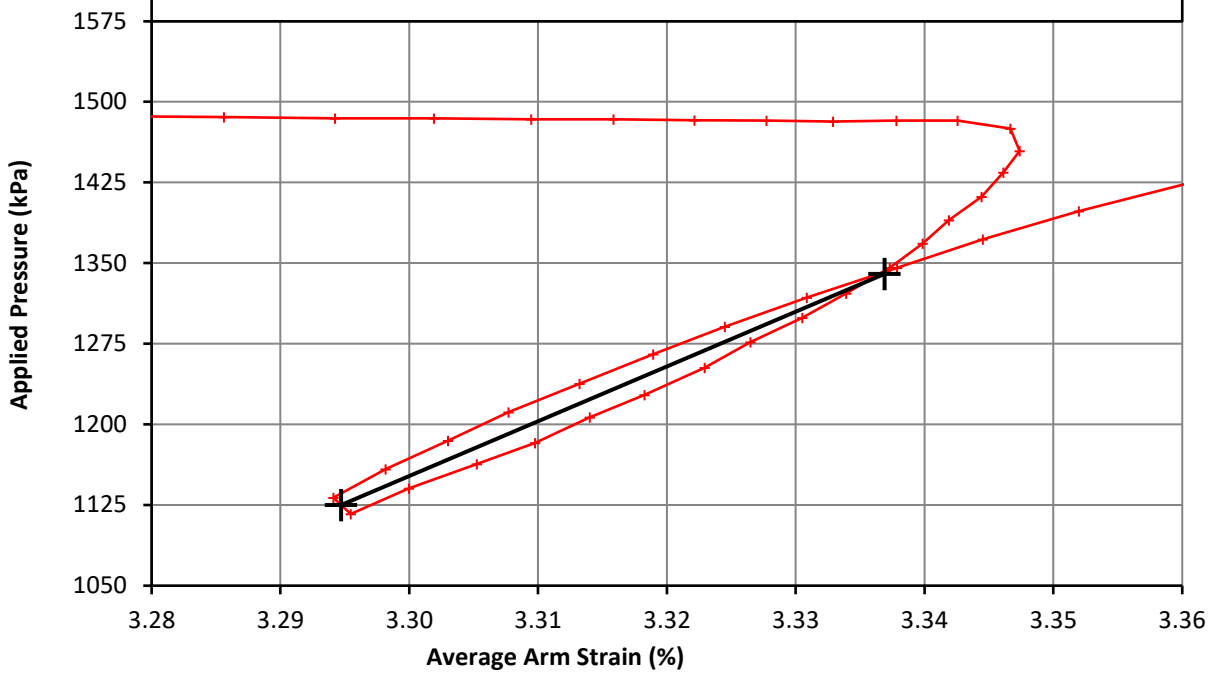
Pressuremeter Analysis - Unload Reload Loop

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	3
Borehole	BH107	**Test Depth (m)**	30.80



Loop 1	Shear Modulus	134.4	MPa
	Cavity Strain Range	0.054	%



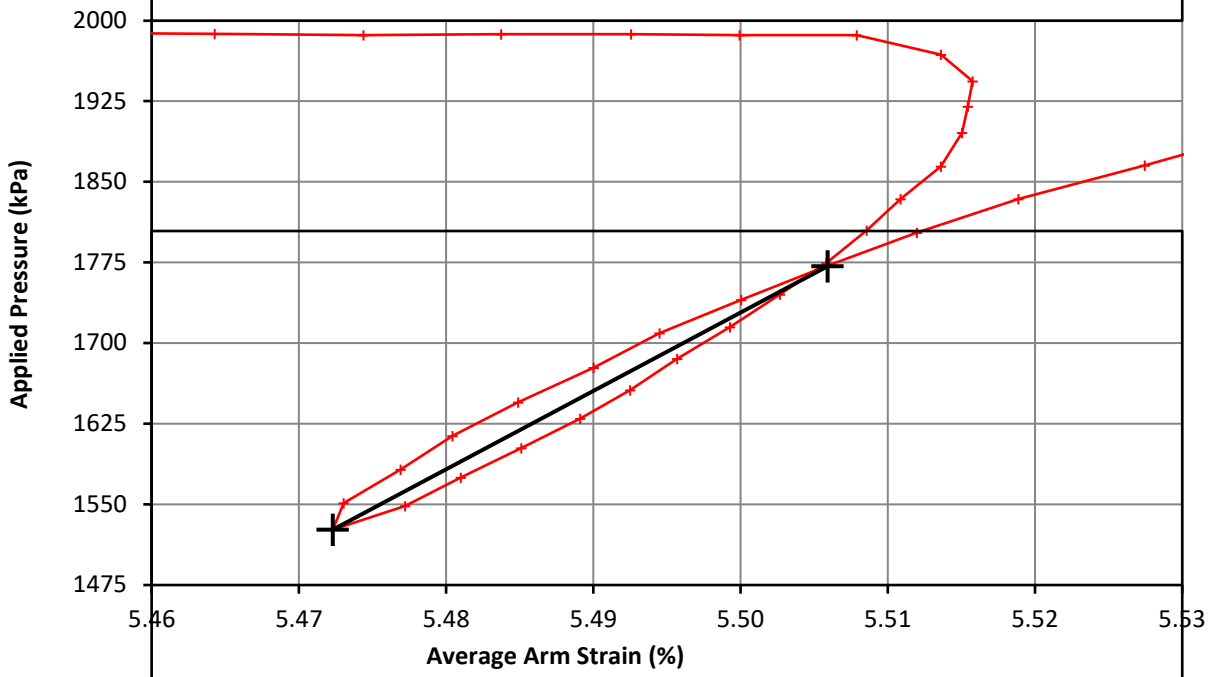
Loop 2	Shear Modulus	263.2	MPa
	Cavity Strain Range	0.042	%

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T03 - 06**
Client	FBJV		
Project No.	P1250112		

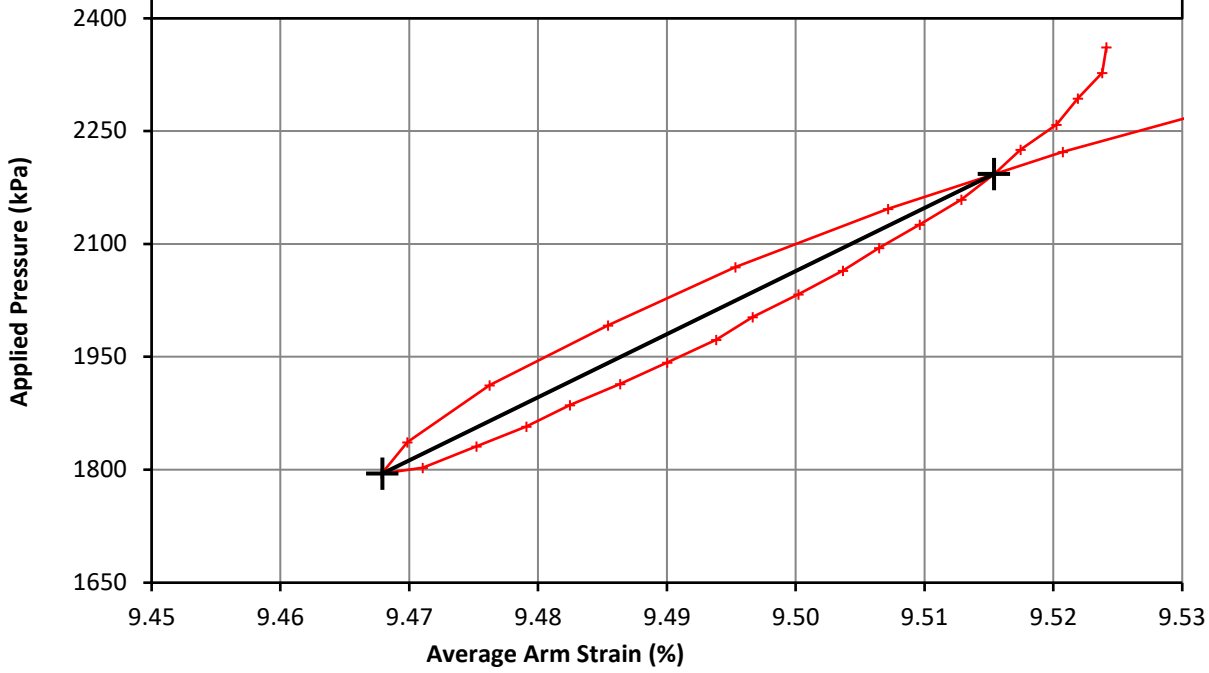
Pressuremeter Analysis - Unload Reload Loop

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	3
Borehole	BH107	**Test Depth (m)**	30.80



Loop 3	Shear Modulus	384.7	MPa
	Cavity Strain Range	0.034	%



Loop 4	Shear Modulus	458.9	MPa
	Cavity Strain Range	0.047	%

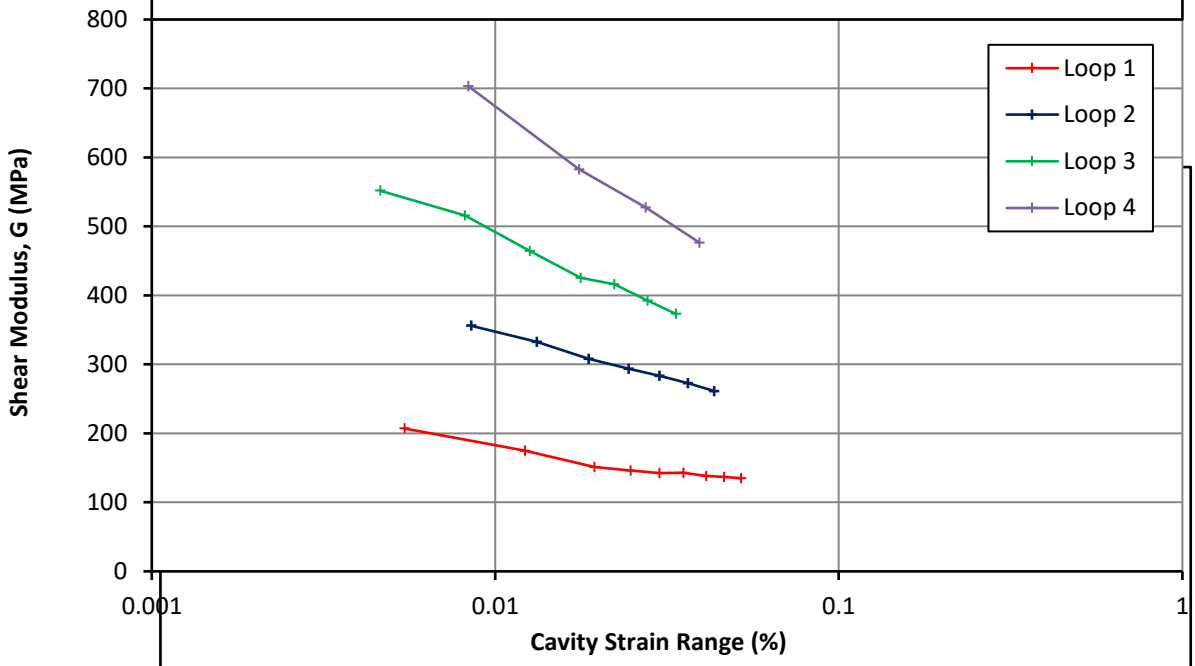
Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T03 - 07**
Client	FBJV		
Project No.	P1250112		

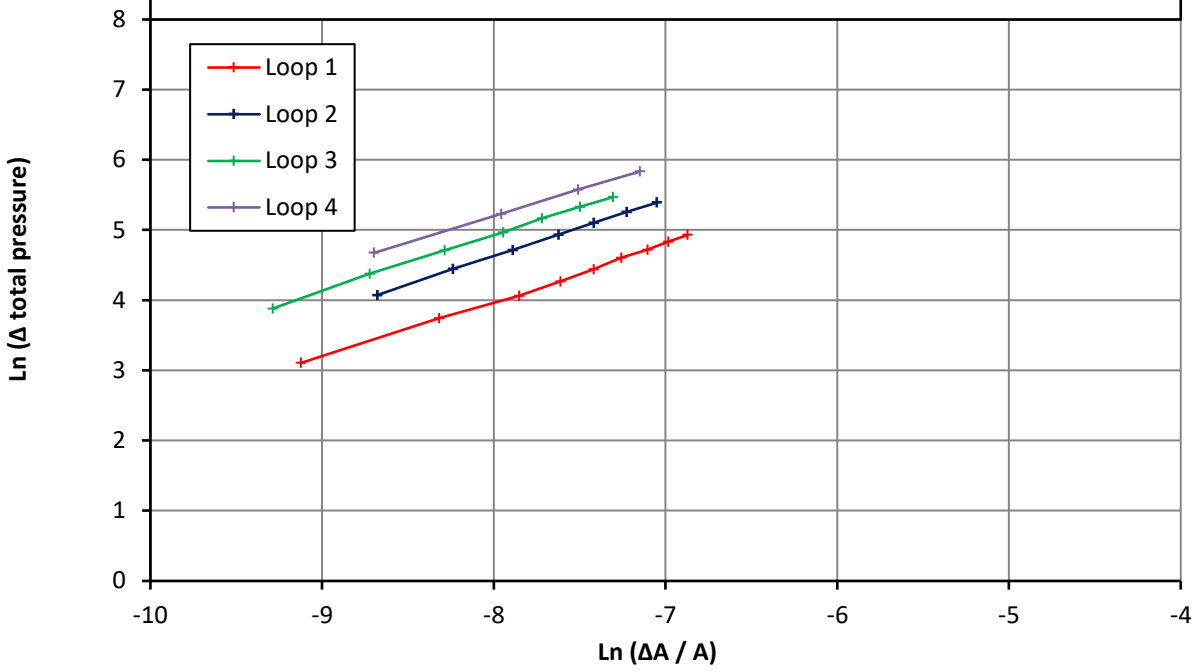
Pressuremeter Analysis

Small Strain Stiffness and Bolton & Whittle (1999)

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	3
Borehole	BH107	**Test Depth (m)**	30.80





Loop 1		Loop 2		Loop 3		Loop 4	
Gradient(β)	Intercept	Gradient(β)	Intercept	Gradient(β)	Intercept	Gradient(β)	Intercept
0.809	34.884 (MPa)	0.810	66.719 (MPa)	0.798	82.199 (MPa)	0.751	73.953 (MPa)

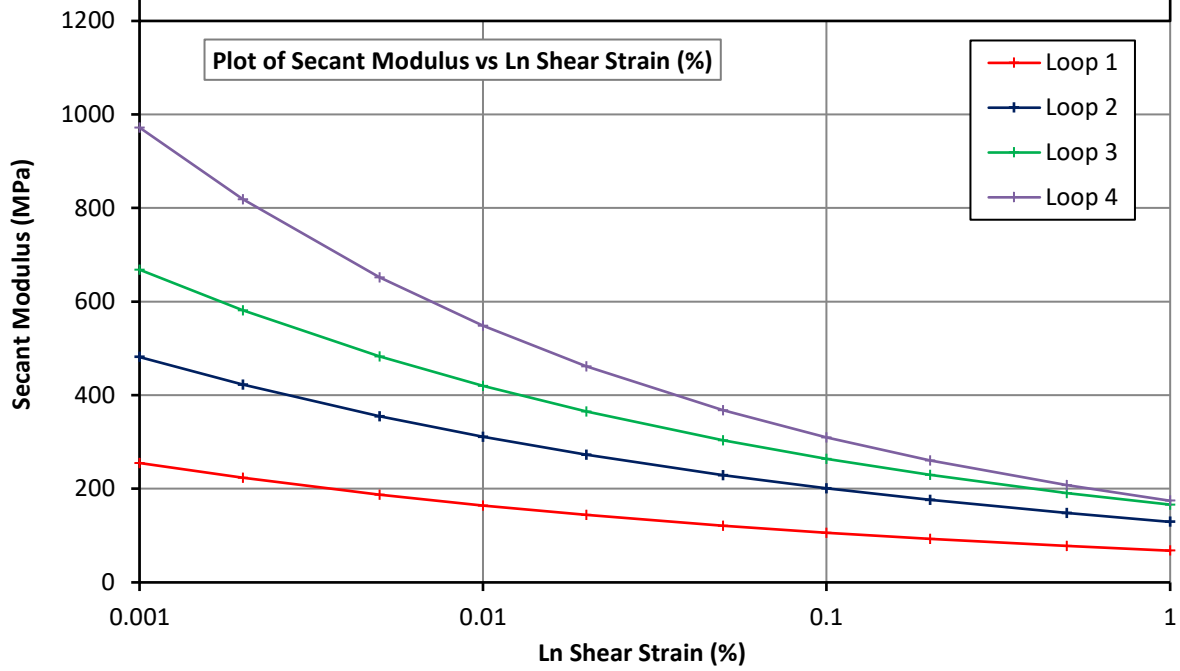
Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T03 - 08**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Analysis

Secant Modulus - Shear Strain (%)

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	3
Borehole	BH107	**Test Depth (m)**	30.80



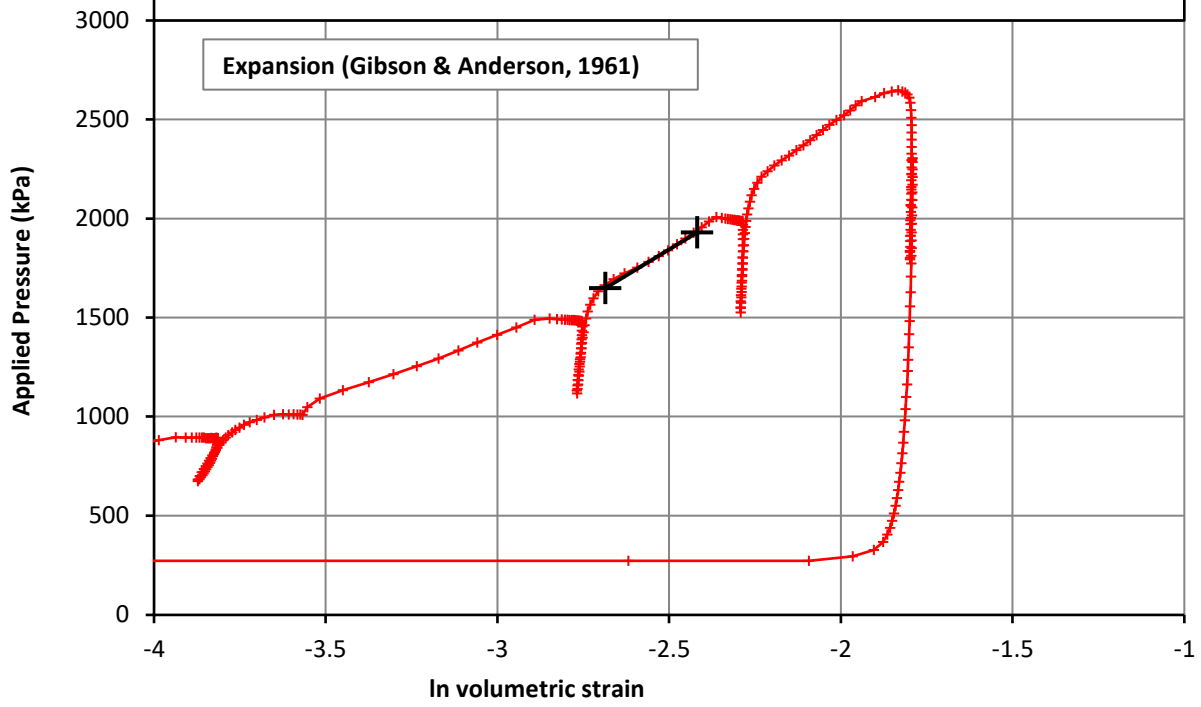
Shear Strain	Loop 1	Loop 2	Loop 3	Loop 4
0.001%	**255**	**482**	**668**	**972**
0.002%	223	422	581	818
0.005%	187	355	483	652
0.010%	**164**	**311**	**420**	**548**
0.020%	144	273	365	462
0.050%	121	229	304	368
0.100%	**106**	**201**	**264**	**309**
0.200%	93	176	230	260
0.500%	78	148	191	207
1.000%	**68**	**130**	**166**	**175**

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T03 - 09**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Analysis - Undrained Strength

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	3
Borehole	BH107	**Test Depth (m)**	30.80



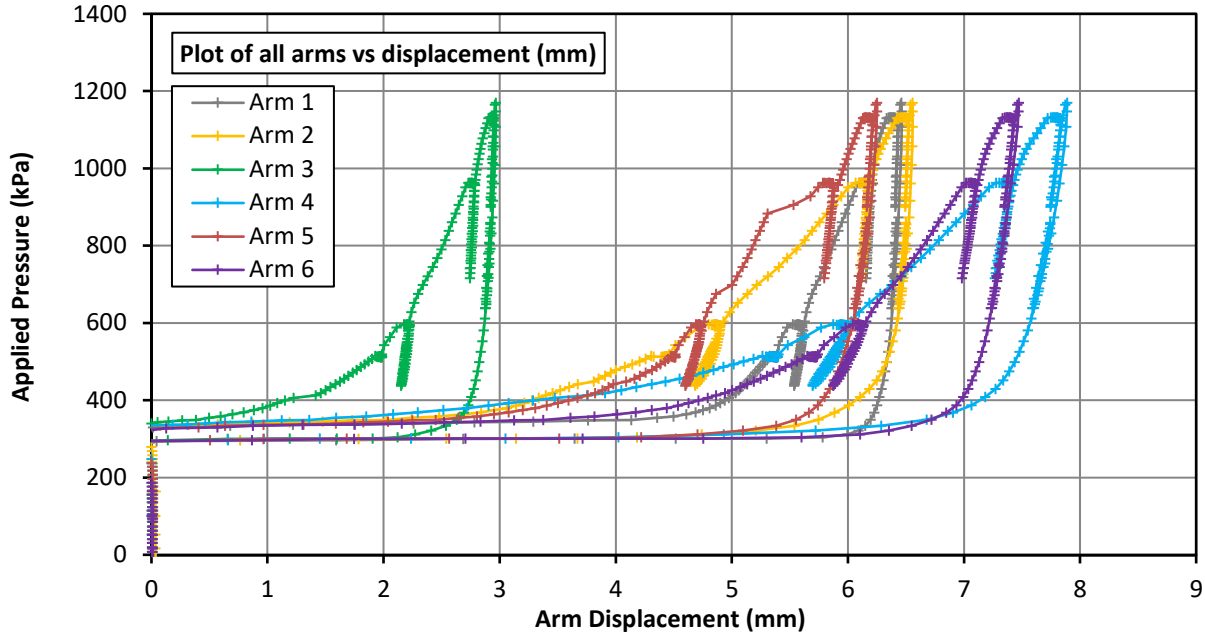
Strength (loading)	Undrained Shear	1047	kPa
	Limit Pressure	4463	kPa

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T03 - 10**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Test Overview
High Pressure Dilatometer (HPD)

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	4
Borehole	BH107	**Test Depth (m)**	35.00
Coordinates (m)	- -	**Elevation (m)**	-



Material description from borehole log:

Very weak low density white CHALK recovered mostly non intact fractures with occasional small and medium rinded nodular flints (<2mm) white cortex). CIRIA Ungraded.
[SEAFORD CHALK FORMATION]

Test pocket conditions:

Total core recovery:	45 %	Test pocket depth range:	
Solid core recovery:	3 %	From: 34.00 m	to: 36.00 m
Rock quality designation:	0 %	Flush:	Water

Test comment:

The test pocket was oversize with arms lifting off at 2.4 to 6.5mm. The po was estimated to be at 560kPa. No material yield was interpreted and the test was taken to a maximum pressure of 1007kPa, where it was terminated due to jumps and uneven arm expansion. Analysis of three unload reload loops provides modulus values of 58 to 99MPa.

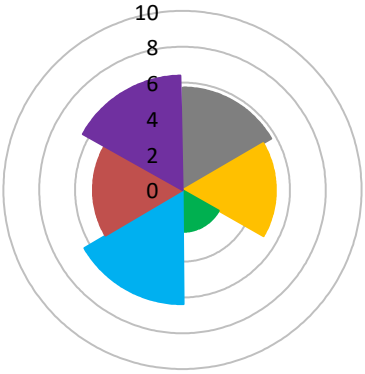
Test details:		**Instrument:**	Kylie (HPD06)		**Operator:**	A Lewins	
			mV	mV/mm		mV	mV/MPa
Drilling method:	Rotary coring						
Casing depth:	34.00 m	Arm 1:	-2403.2	135.6	TPC A:	-2190.2	104.7
Water level:	1.50 m	Arm 2:	-2465.3	135.6	TPC B:	-1954.2	105.7
		Arm 3:	-2286.7	136.6	Membrane:		
Test time:		Arm 4:	-2388.8	131.4	Stiffness	34.7	kPa
Start of test:	12:24 hrs	Arm 5:	-2341.7	127.9	Slope	10.0	kPa/mm
End of test:	13:35 hrs	Arm 6:	-2268.1	125.1	Compliance	1.4	mm/GPa

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T04 - 01**
Client	FBJV		
Project No.	P1250112		

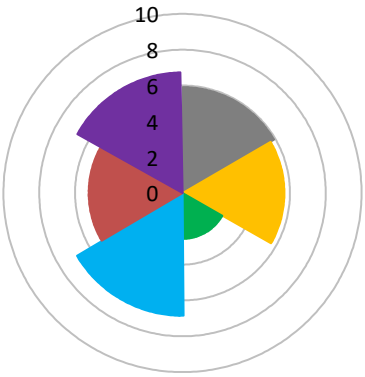
Pressuremeter Test - Membrane Expansion Plan View

IN SITU SITE INVESTIGATION

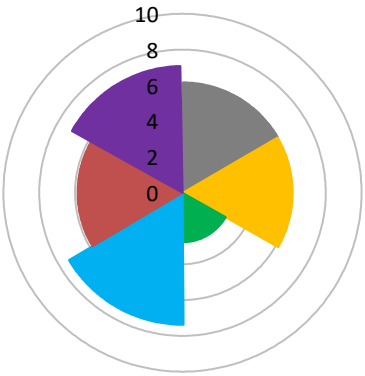
Test Date	02/07/2025	**Test No.**	4
Borehole	BH107	**Test Depth (m)**	35.00



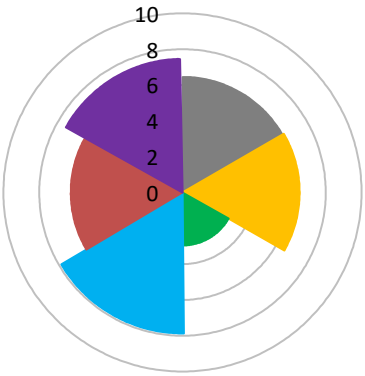
Arm expansion at:	0.1	% cavity strain
Test pressure:	699	kPa
Arm 1 at:	5.7	mm
Arm 2 at:	5.2	mm
Arm 3 at:	2.3	mm
Arm 4 at:	6.4	mm
Arm 5 at:	5.0	mm
Arm 6 at:	6.4	mm



Arm expansion at:	0.8	% cavity strain
Test pressure:	838	kPa
Arm 1 at:	5.9	mm
Arm 2 at:	5.7	mm
Arm 3 at:	2.6	mm
Arm 4 at:	6.9	mm
Arm 5 at:	5.2	mm
Arm 6 at:	6.7	mm



Arm expansion at:	1.5	% cavity strain
Test pressure:	961	kPa
Arm 1 at:	6.2	mm
Arm 2 at:	6.2	mm
Arm 3 at:	2.8	mm
Arm 4 at:	7.4	mm
Arm 5 at:	5.9	mm
Arm 6 at:	7.1	mm



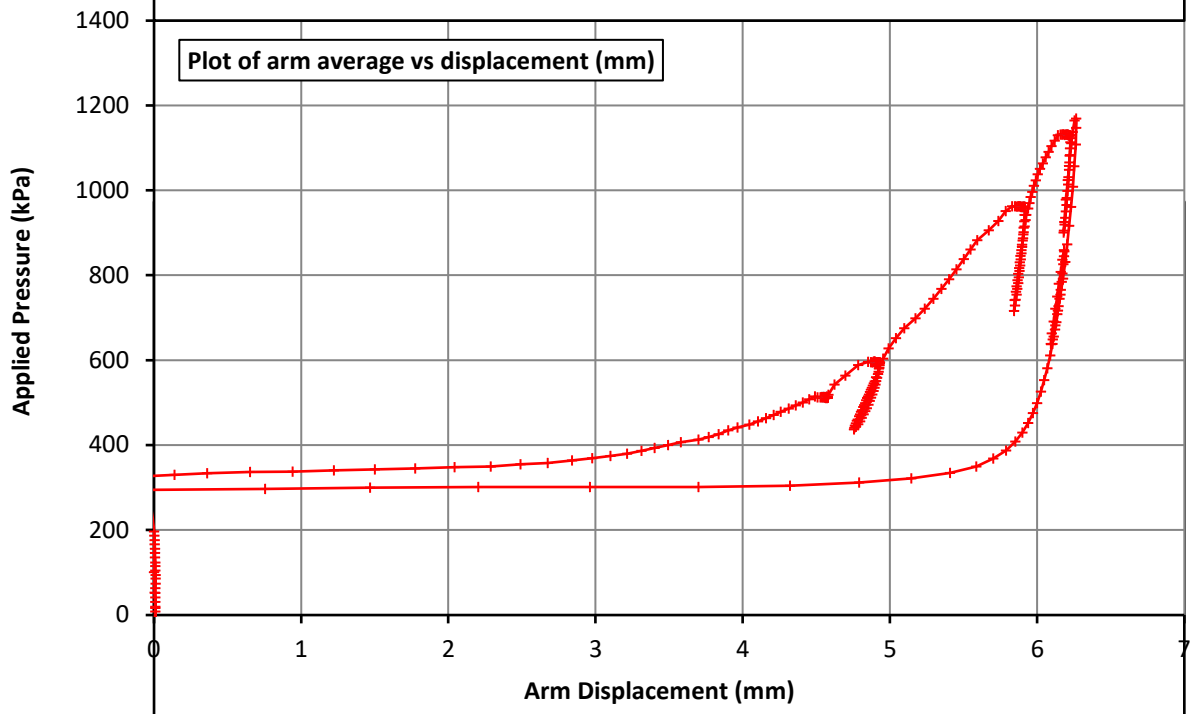
Arm expansion at:	2.2	% cavity strain
Maximum test pressure:	1165	kPa
Arm 1 at:	6.5	mm
Arm 2 at:	6.5	mm
Arm 3 at:	3.0	mm
Arm 4 at:	7.9	mm
Arm 5 at:	6.2	mm
Arm 6 at:	7.5	mm

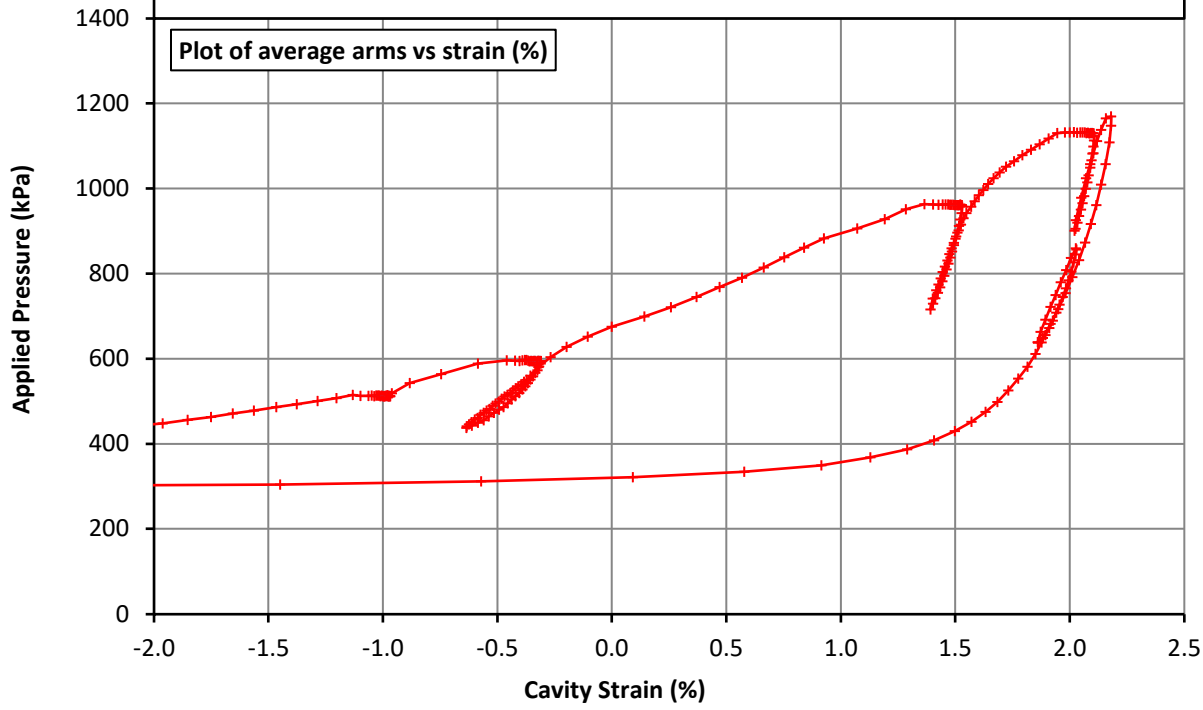
Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T04 - 02**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Test - Average Arm Plots

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	4
Borehole	BH107	**Test Depth (m)**	35.00



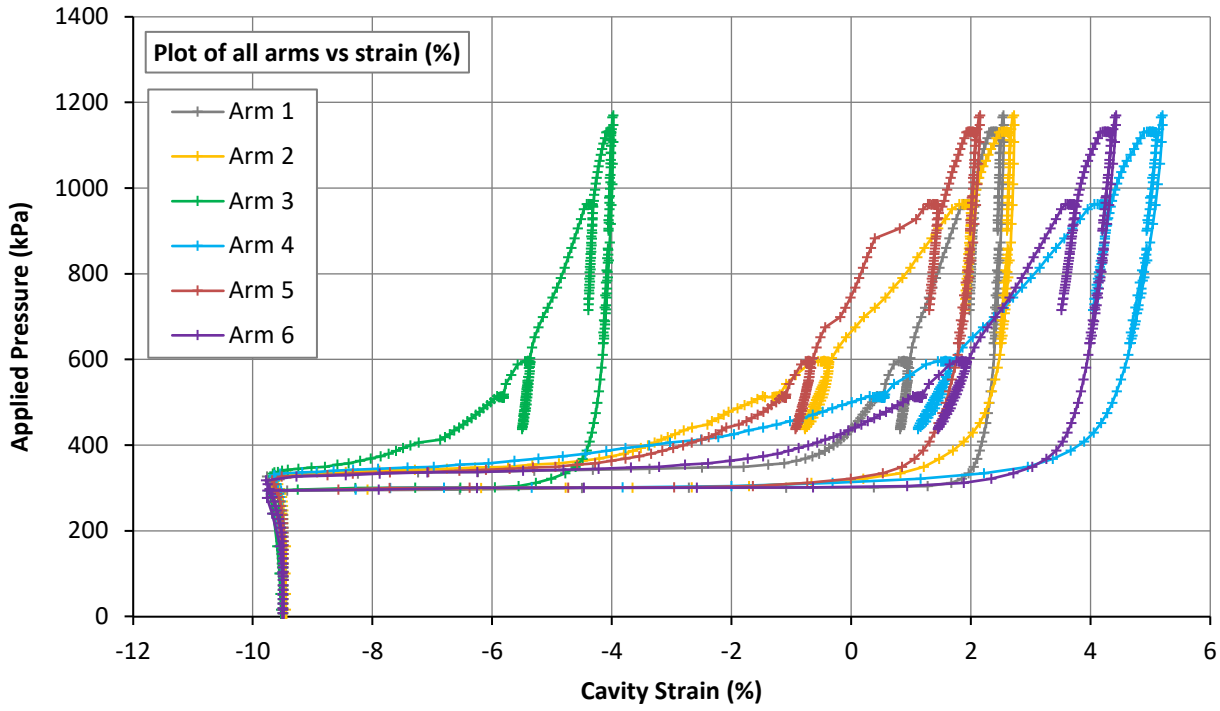


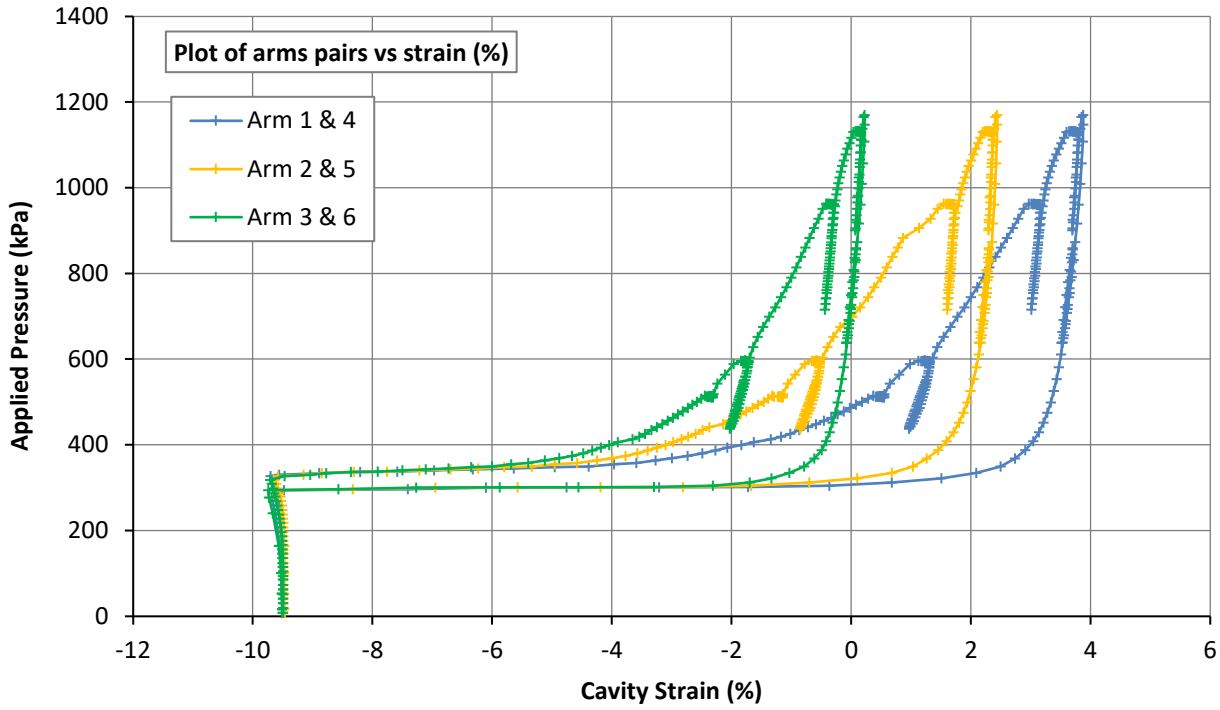
Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T04 - 03**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Test - Arm Displacement vs Strain (%)

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	4
Borehole	BH107	**Test Depth (m)**	35.00



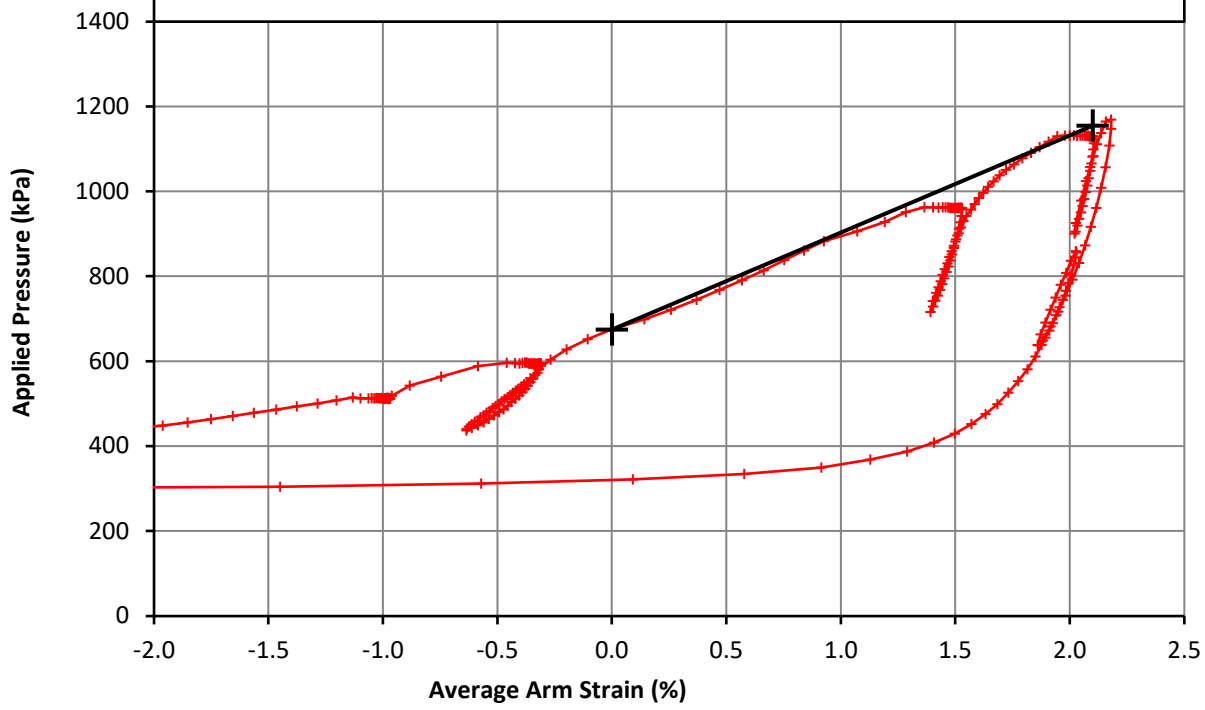


Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T04 - 04**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Analysis - Initial Modulus & In Situ Horizontal Stress

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	4
Borehole	BH107	**Test Depth (m)**	35.00



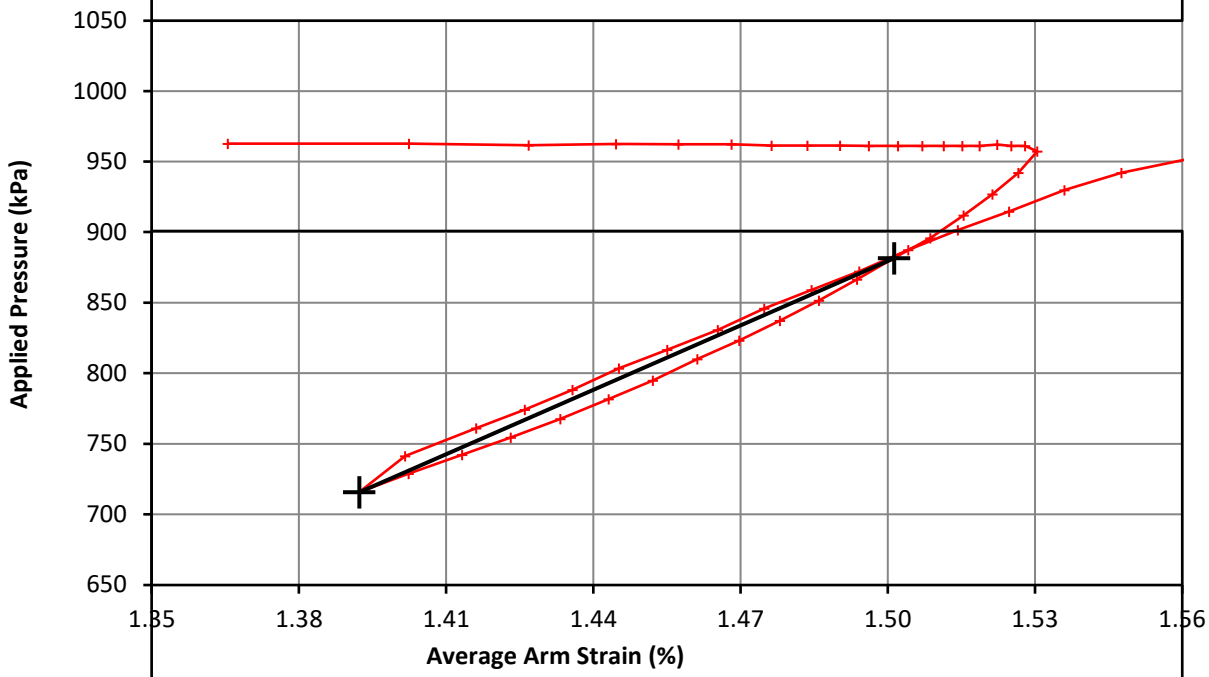
Initial Modulus	Shear Modulus	11.7	MPa
In situ horizontal stress		675	kPa

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T04 - 05**
Client	FBJV		
Project No.	P1250112		

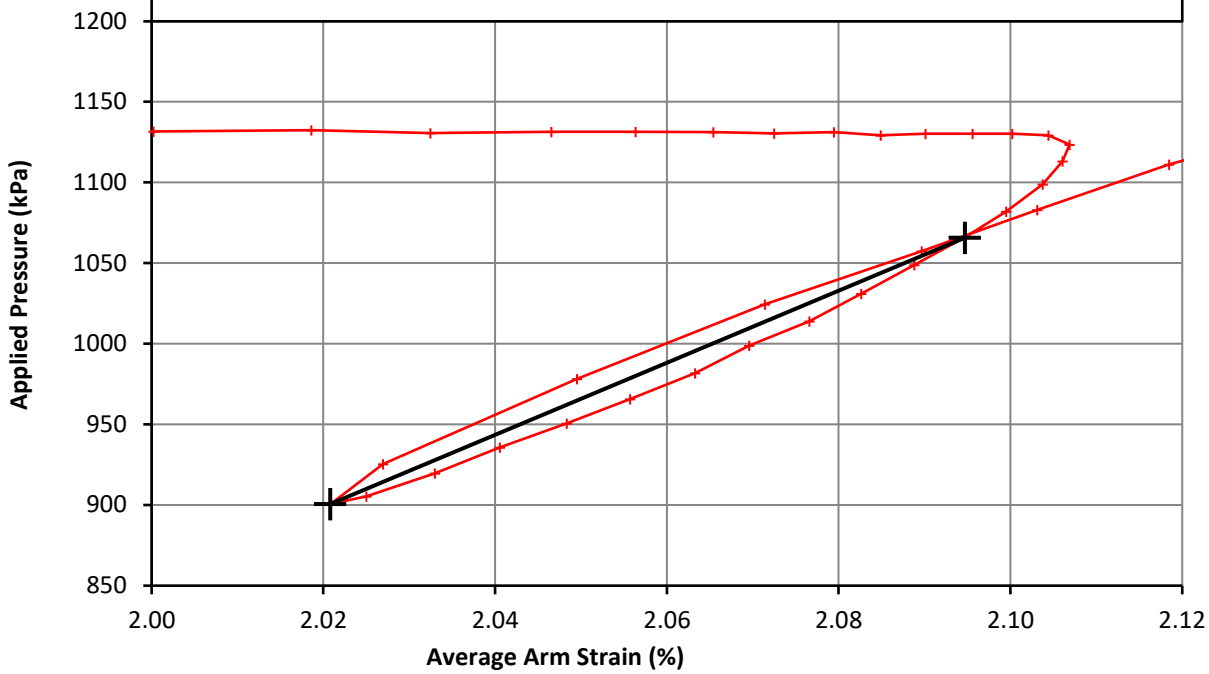
Pressuremeter Analysis - Unload Reload Loop

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	4
Borehole	BH107	**Test Depth (m)**	35.00



Loop 1	Shear Modulus	77.2	MPa
	Cavity Strain Range	0.109	%



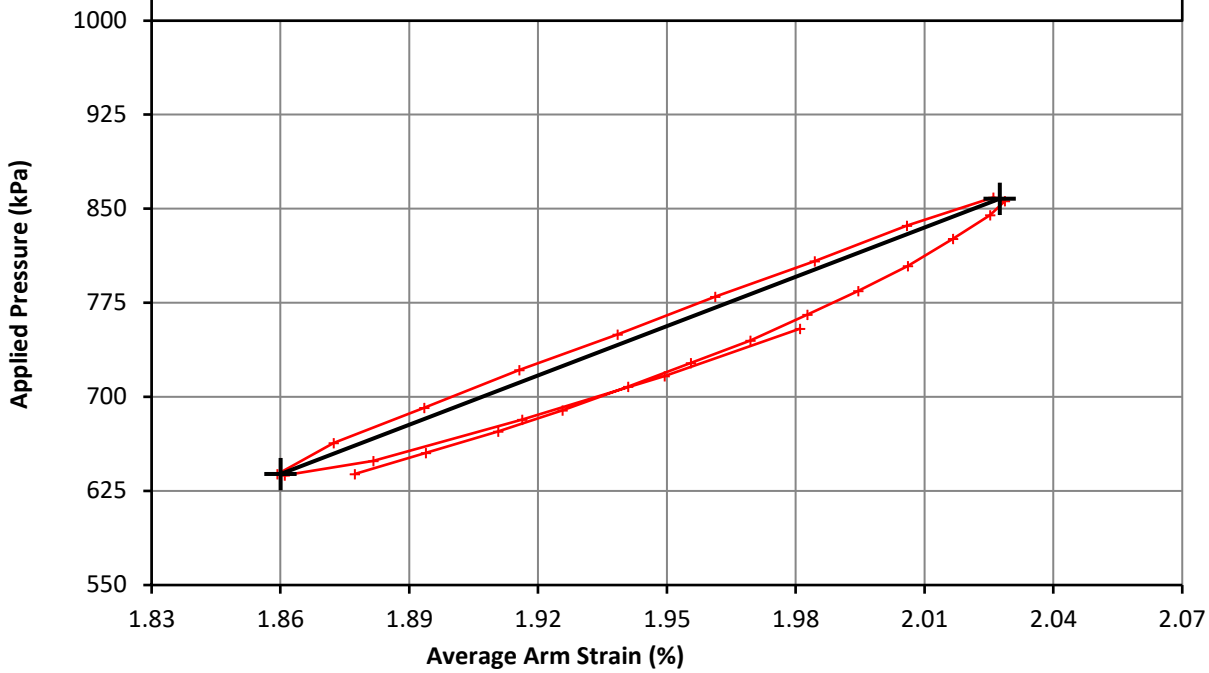
Loop 2	Shear Modulus	114.0	MPa
	Cavity Strain Range	0.074	%

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T04 - 06**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Analysis - Unload Reload Loop

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	4
Borehole	BH107	**Test Depth (m)**	35.00



Loop 3	Shear Modulus	66.8	MPa
	Cavity Strain Range	0.168	%

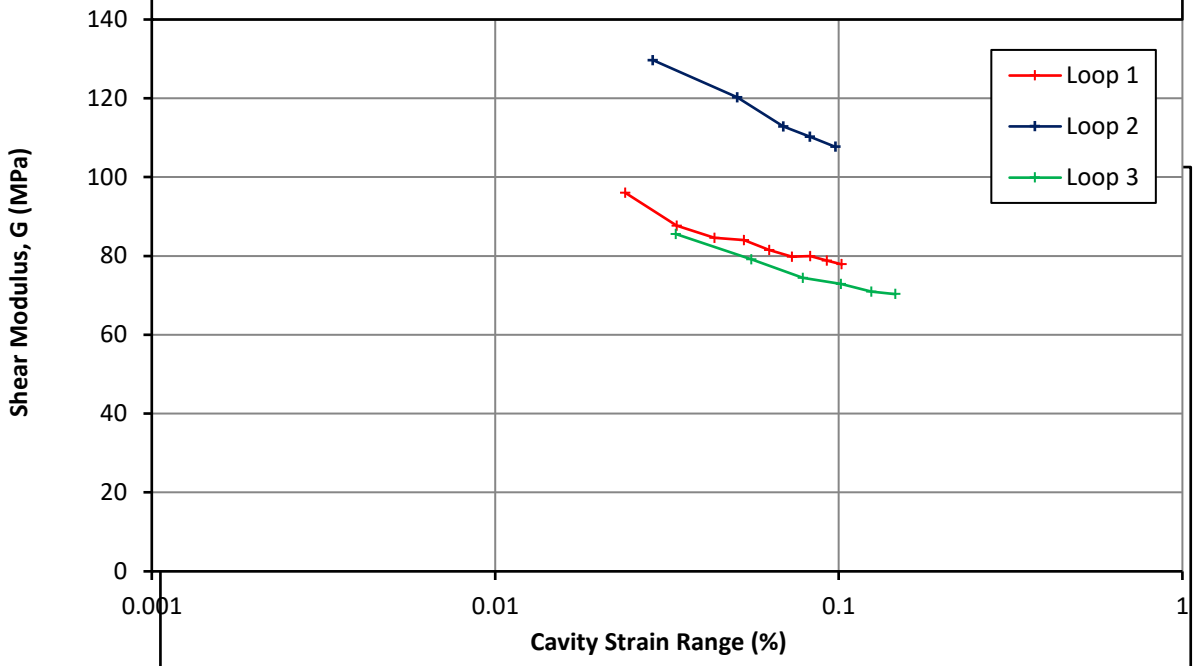
Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T04 - 07**
Client	FBJV		
Project No.	P1250112		

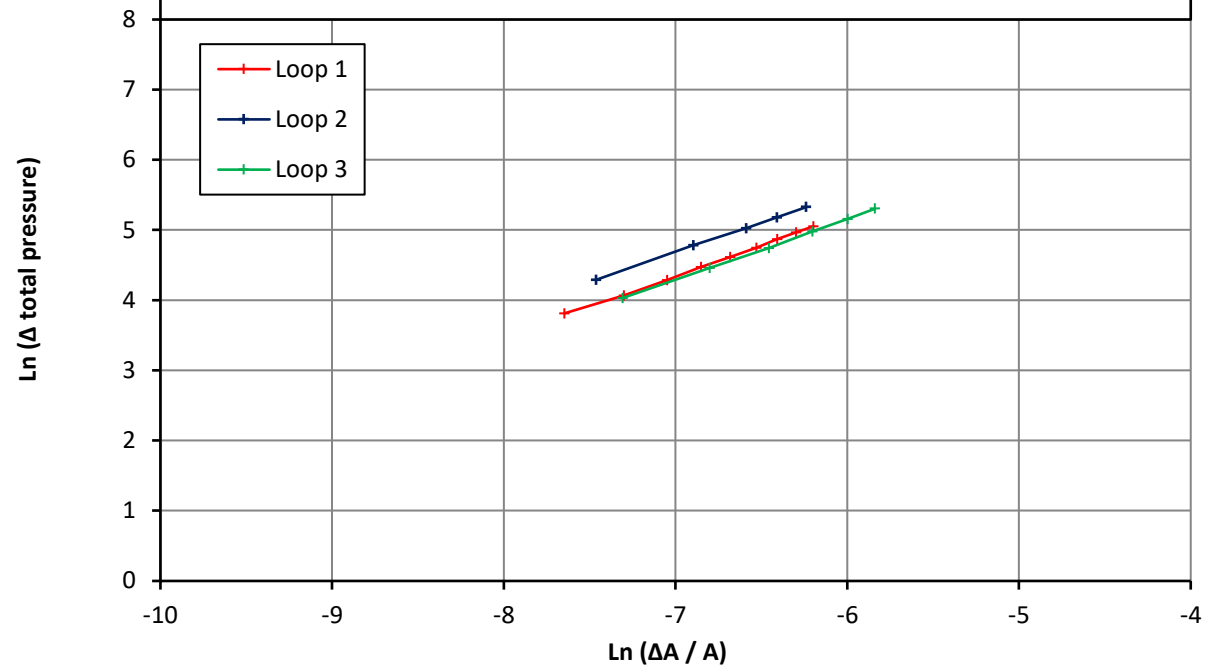
Pressuremeter Analysis

Small Strain Stiffness and Bolton & Whittle (1999)

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	4
Borehole	BH107	**Test Depth (m)**	35.00





Loop 1		Loop 2		Loop 3	
Gradient(β)	Intercept	Gradient(β)	Intercept	Gradient(β)	Intercept
0.868	33.599 (MPa)	0.845	40.024 (MPa)	0.864	30.925 (MPa)

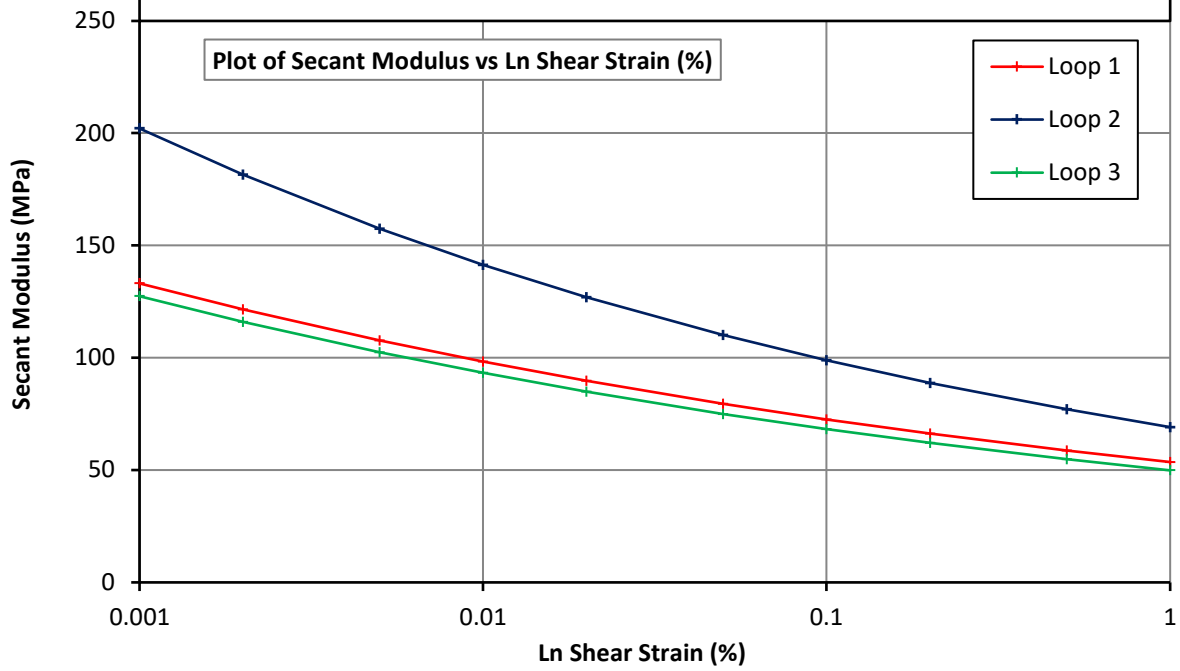
Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T04 - 08**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Analysis

Secant Modulus - Shear Strain (%)

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	4
Borehole	BH107	**Test Depth (m)**	35.00



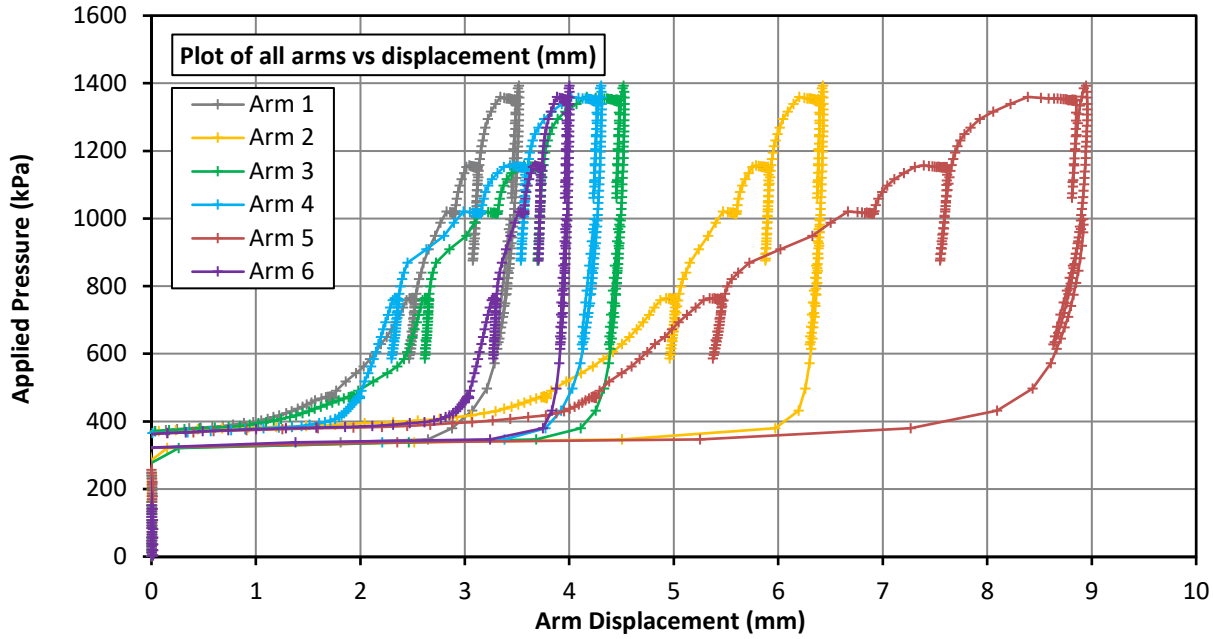
Shear Strain	Loop 1	Loop 2	Loop 3
0.001%	**133**	**202**	**127**
0.002%	122	181	116
0.005%	108	157	102
0.010%	**98**	**141**	**93**
0.020%	90	127	85
0.050%	79	110	75
0.100%	**73**	**99**	**68**
0.200%	66	89	62
0.500%	59	77	55
1.000%	**54**	**69**	**50**

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T04 - 09**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Test Overview
High Pressure Dilatometer (HPD)

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	5
Borehole	BH107	**Test Depth (m)**	39.00
Coordinates (m)	- -	**Elevation (m)**	-



Material description from borehole log:

Very weak low density white locally stained orange brown CHALK recovered mostly non intact with occasional small to large rinded nodular flints (<2mm) white cortex. CIRIA Ungraded.
[SEAFORD CHALK FORMATION]

Test pocket conditions:

Total core recovery:	55 %	Test pocket depth range:	
Solid core recovery:	12 %	From: 38.00 m	to: 40.00 m
Rock quality designation:	0 %	Flush:	Water

Test comment:

The test pocket was oversize with arms lifting off at 2.1 to 5.0mm. The po was estimated to be at 580kPa, with the following loading section being relatively short. Material yield was interpreted at 1050kPa, with the test taken to a maximum pressure of 1208kPa, where it was terminated due to jumps and uneven arm expansion. The displacement-pressure response shown by the arms was highly variable with large expansion on arm 5. Analysis of four unload reload loops provides modulus values of 62 to 175MPa. Derived undrained shear strength analysis provides a value of 470kPa.

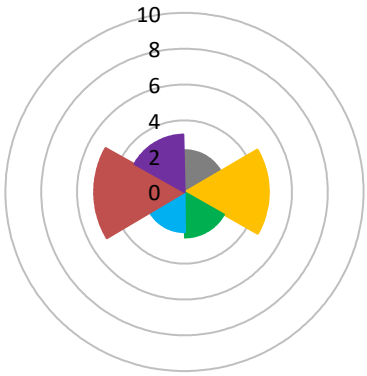
Test details:		**Instrument:**	Kylie (HPD06)		**Operator:**	A Lewins	
			mV	mV/mm		mV	mV/MPa
Drilling method:	Rotary coring	Arm 1:	-2401.3	135.6	TPC A:	-2189.8	104.7
Casing depth:	38.00 m	Arm 2:	-2460.1	135.6	TPC B:	-1953.2	105.7
Water level:	1.50 m	Arm 3:	-2287.7	136.6	Membrane:		
Test time:		Arm 4:	-2387.7	121.4	Stiffness	34.7 kPa	
Start of test:	15:22 hrs	Arm 5:	-2341.7	127.9	Slope	10.0 kPa/mm	
End of test:	16:24 hrs	Arm 6:	-2267.5	135.1	Compliance	1.4 mm/GPa	

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T05 - 01**
Client	Soil Engineering		
Project No.	P1250112		

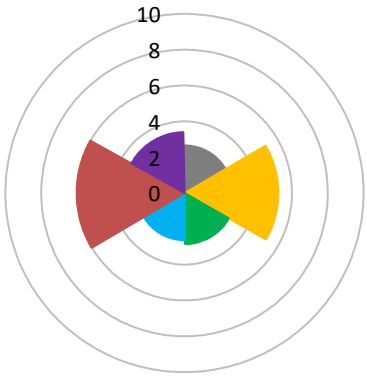
Pressuremeter Test - Membrane Expansion Plan View

IN SITU SITE INVESTIGATION

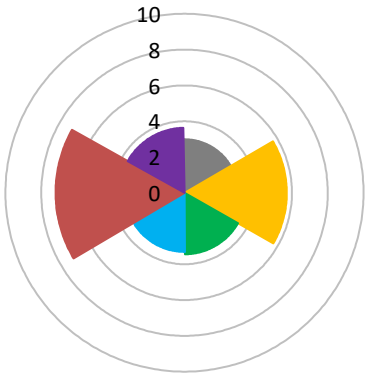
Test Date	02/07/2025	**Test No.**	5
Borehole	BH107	**Test Depth (m)**	39.00



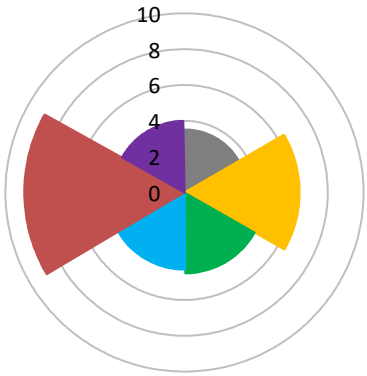
Arm expansion at:	0.1	% cavity strain
Test pressure:	693	kPa
Arm 1 at:	2.3	mm
Arm 2 at:	4.7	mm
Arm 3 at:	2.5	mm
Arm 4 at:	2.2	mm
Arm 5 at:	5.0	mm
Arm 6 at:	3.2	mm



Arm expansion at:	0.9	% cavity strain
Test pressure:	909	kPa
Arm 1 at:	2.7	mm
Arm 2 at:	5.2	mm
Arm 3 at:	2.9	mm
Arm 4 at:	2.6	mm
Arm 5 at:	6.0	mm
Arm 6 at:	3.4	mm



Arm expansion at:	2.1	% cavity strain
Test pressure:	1134	kPa
Arm 1 at:	3.0	mm
Arm 2 at:	5.7	mm
Arm 3 at:	3.4	mm
Arm 4 at:	3.3	mm
Arm 5 at:	7.2	mm
Arm 6 at:	3.6	mm



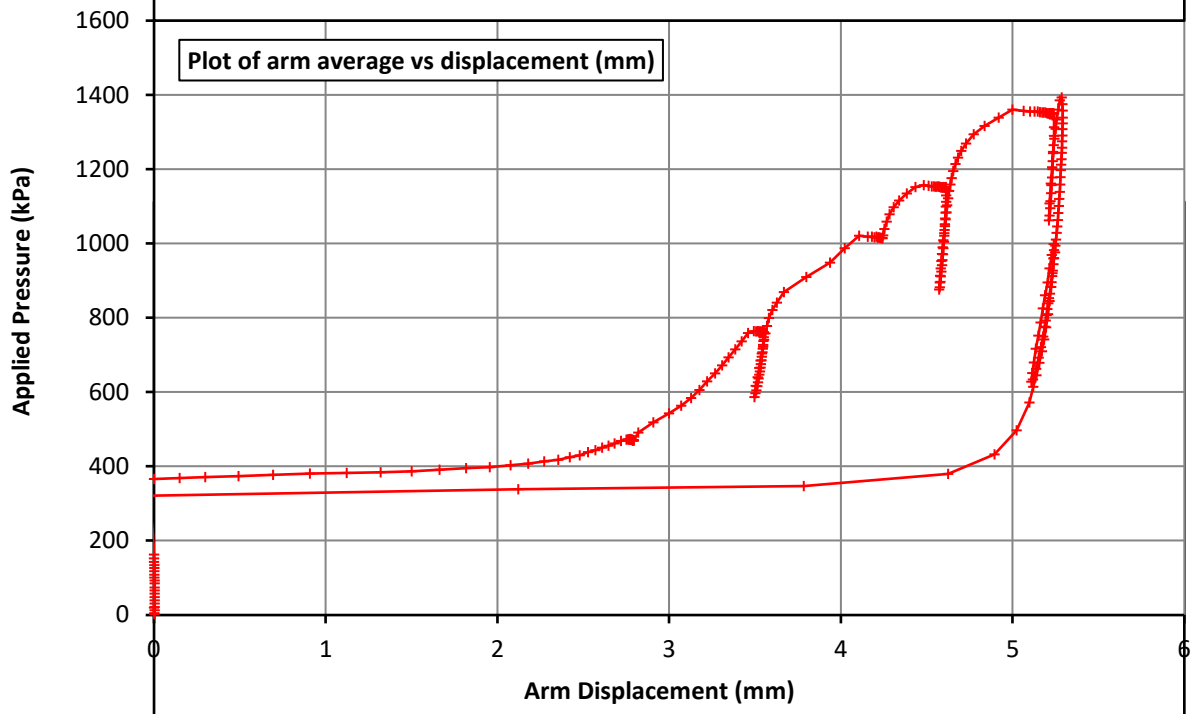
Arm expansion at:	3.8	% cavity strain
Maximum test pressure:	1393	kPa
Arm 1 at:	3.5	mm
Arm 2 at:	6.4	mm
Arm 3 at:	4.5	mm
Arm 4 at:	4.3	mm
Arm 5 at:	8.9	mm
Arm 6 at:	4.0	mm

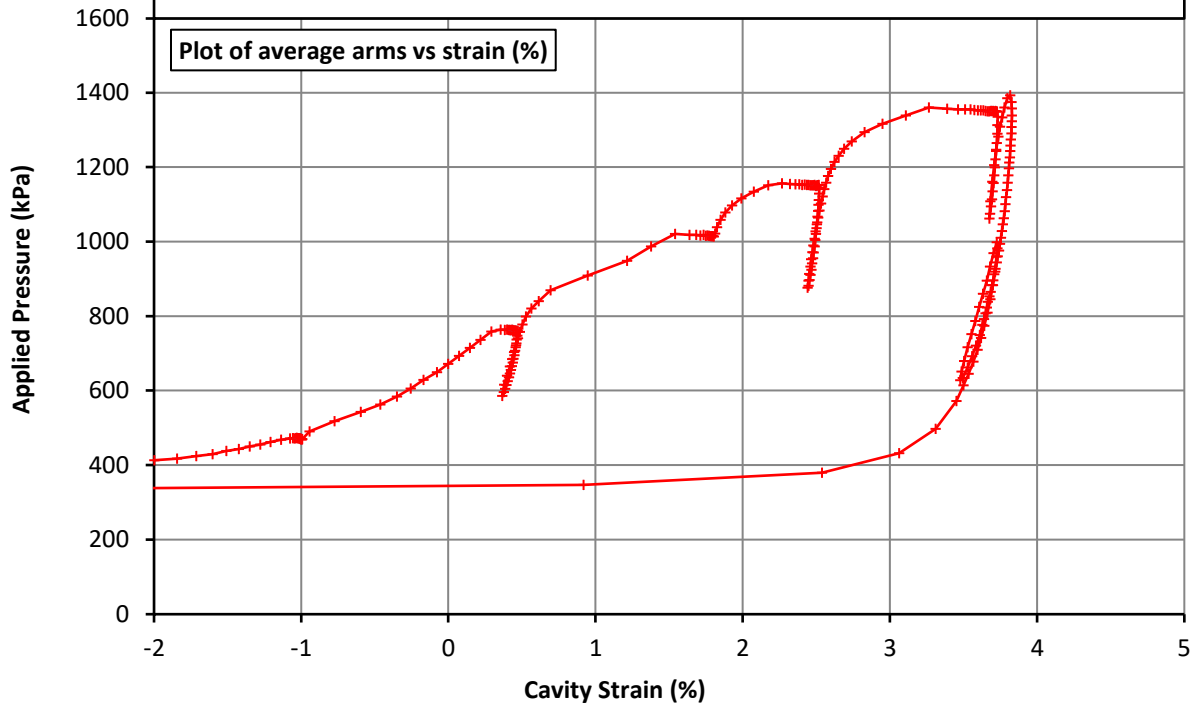
Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T05 - 02**
Client	Soil Engineering		
Project No.	P1250112		

Pressuremeter Test - Average Arm Plots

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	5
Borehole	BH107	**Test Depth (m)**	39.00



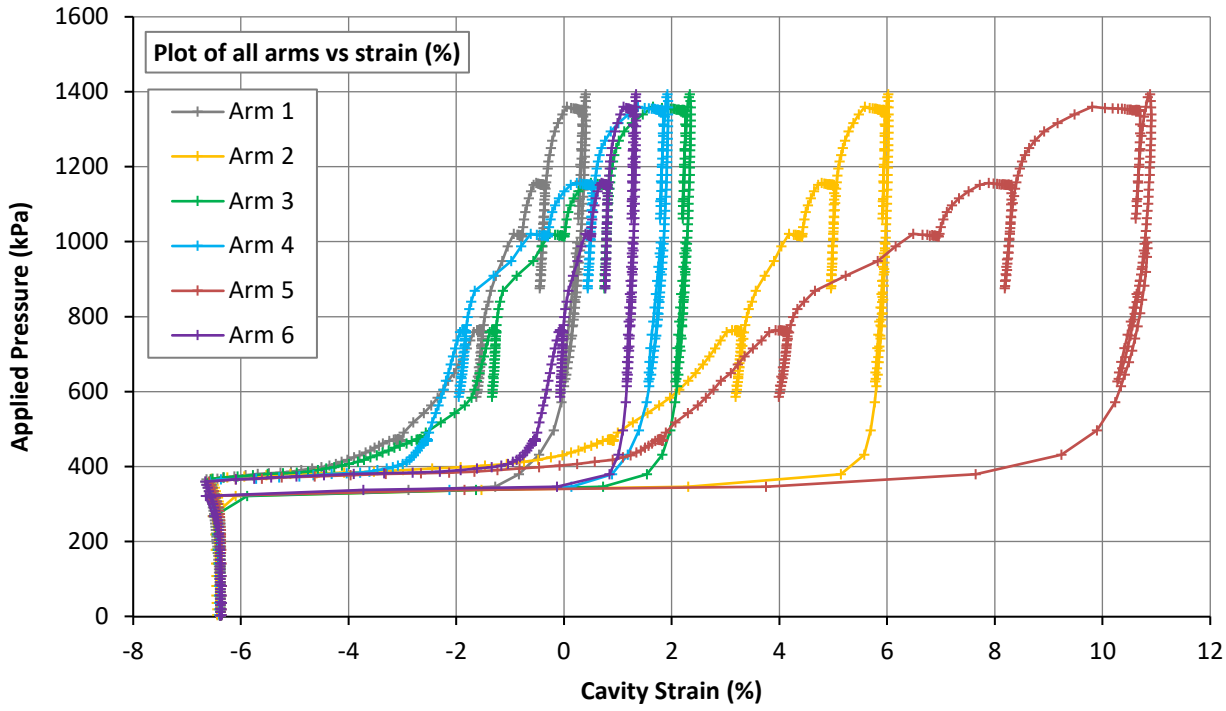


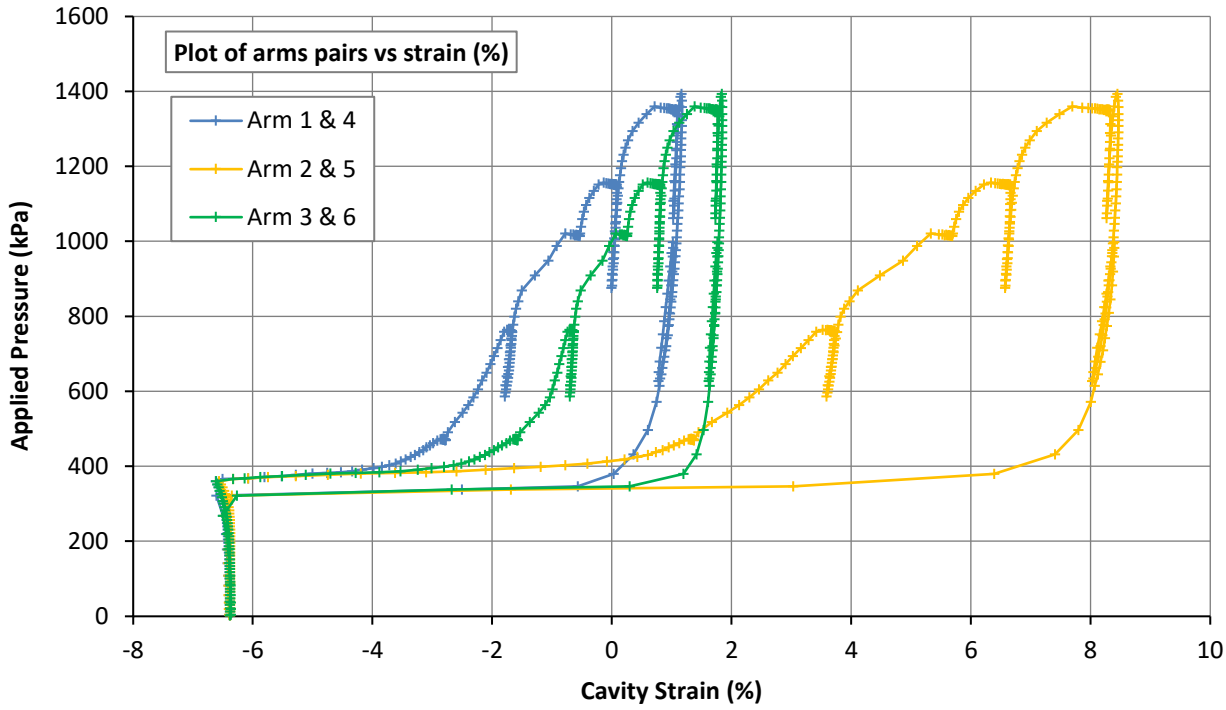
Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T05 - 03**
Client	Soil Engineering		
Project No.	P1250112		

Pressuremeter Test - Arm Displacement vs Strain (%)

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	5
Borehole	BH107	**Test Depth (m)**	39.00



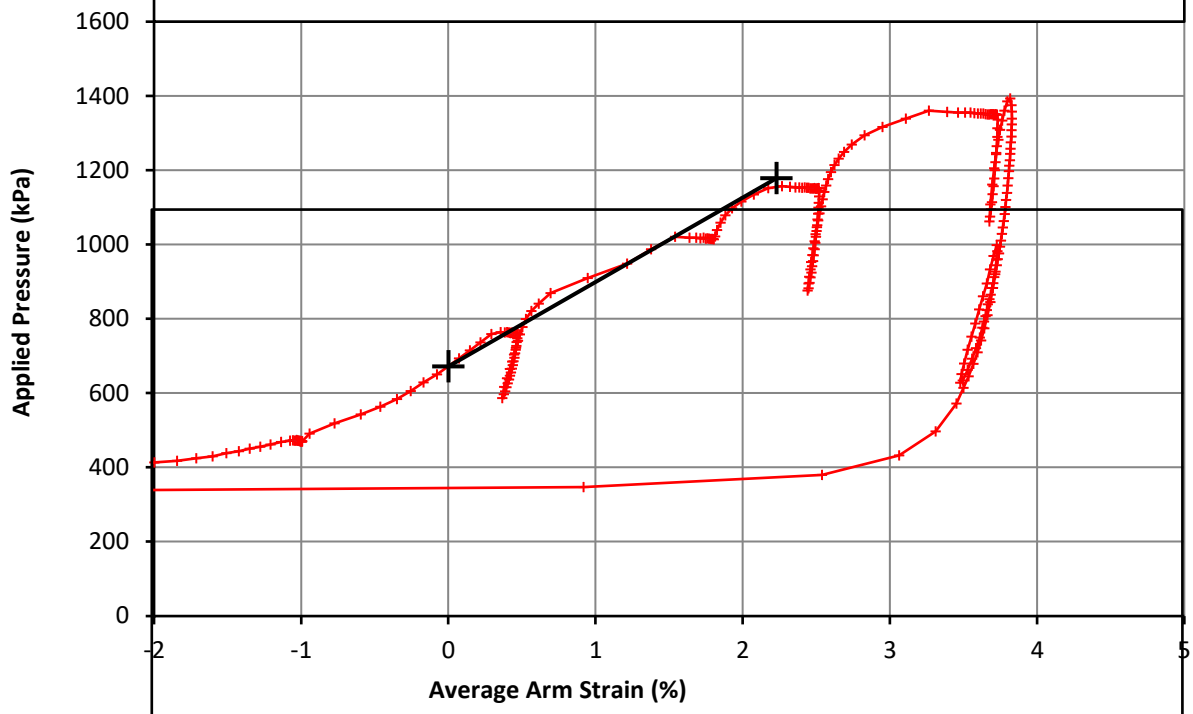


Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T05 - 04**
Client	Soil Engineering		
Project No.	P1250112		

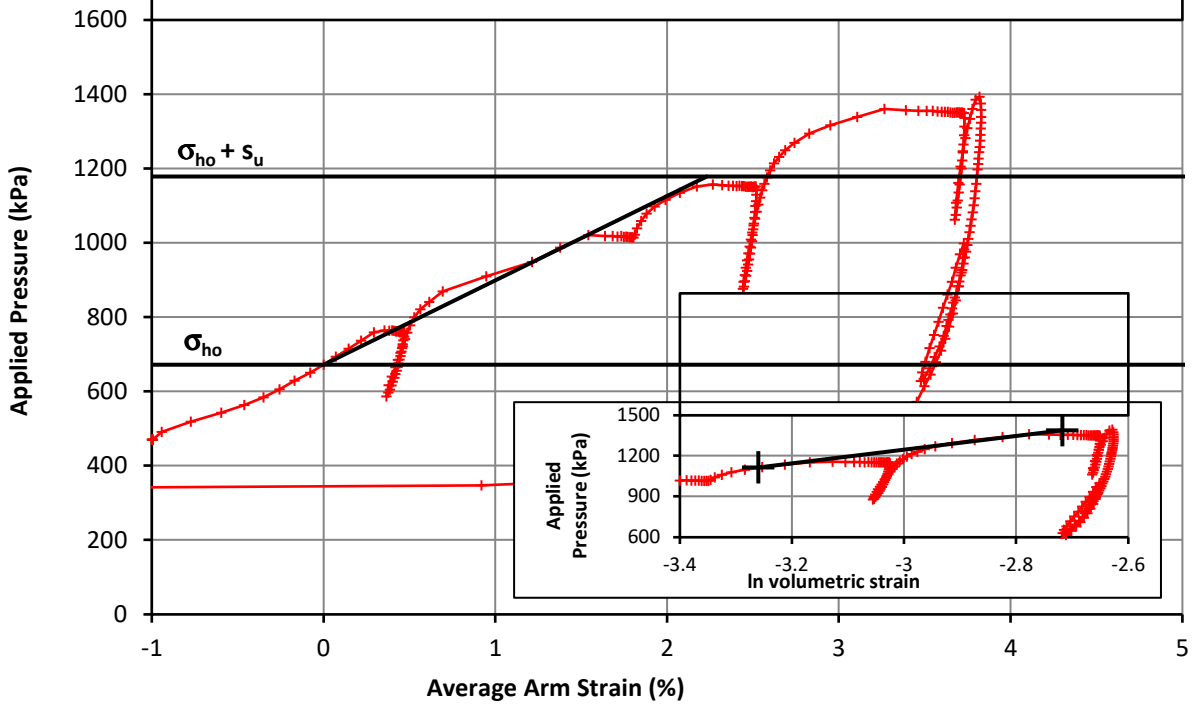
Pressuremeter Analysis - Initial Modulus & In Situ Horizontal Stress

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	5
Borehole	BH107	**Test Depth (m)**	39.00



Initial Modulus	Shear Modulus	11.6	MPa



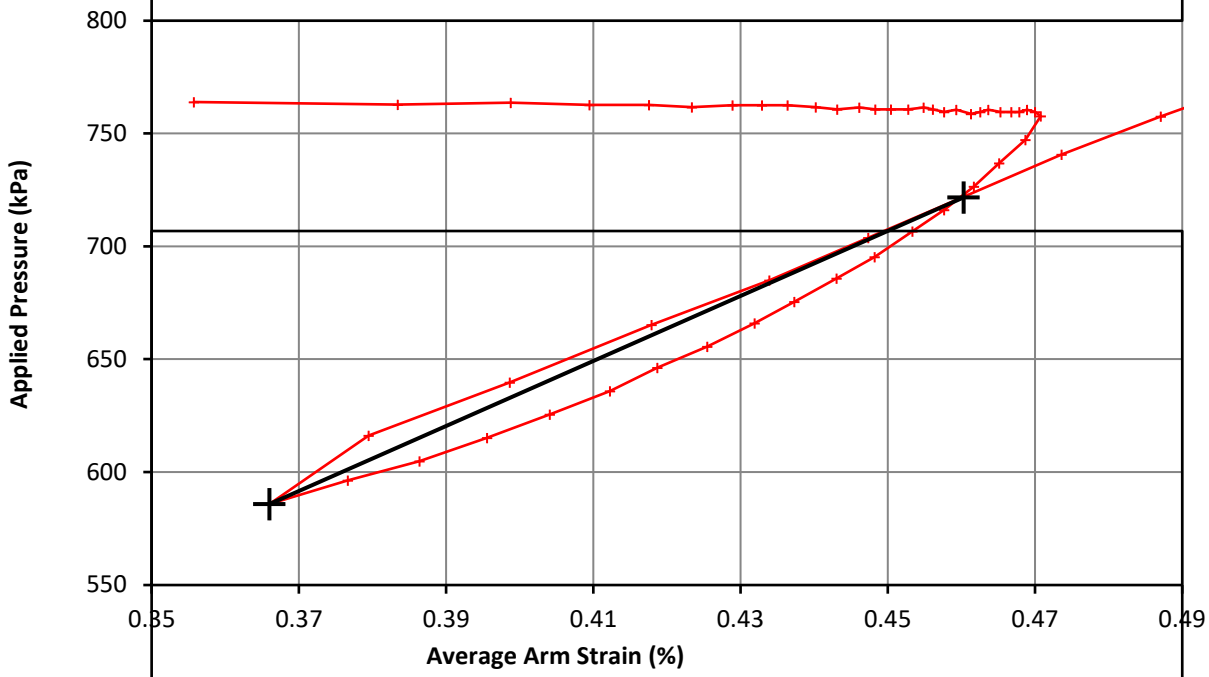
Marsland & Randolph	In situ horizontal stress	672	kPa
	Undrained Strength	507	kPa

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T05 - 05**
Client	Soil Engineering		
Project No.	P1250112		

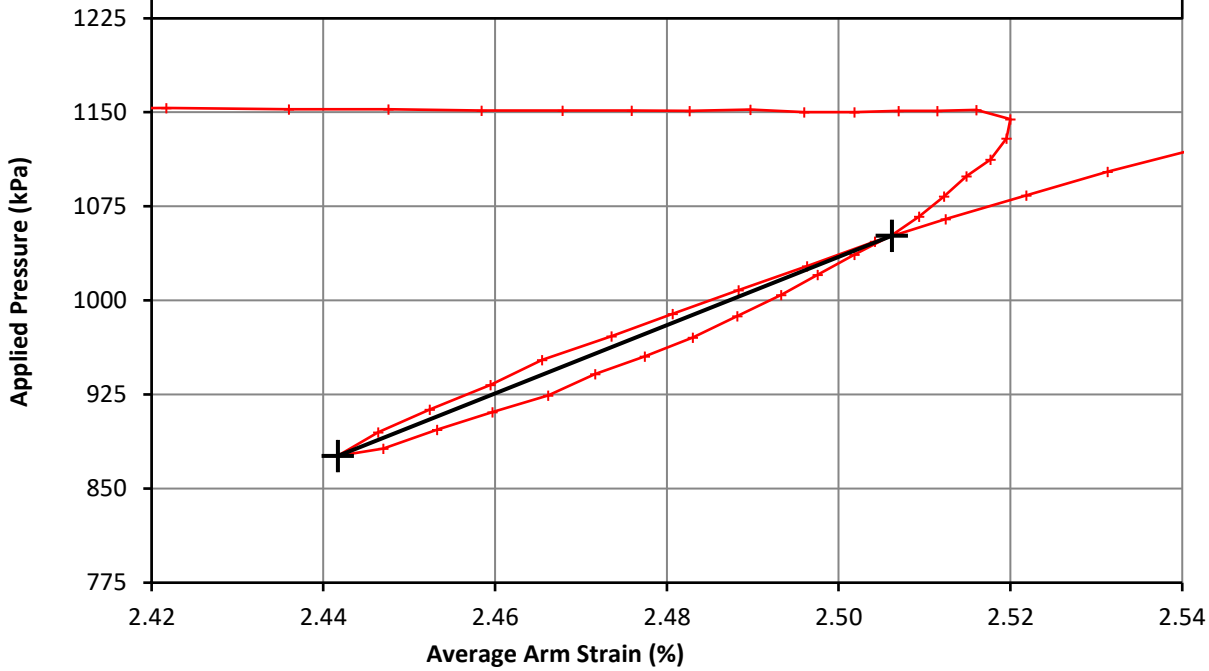
Pressuremeter Analysis - Unload Reload Loop

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	5
Borehole	BH107	**Test Depth (m)**	39.00



Loop 1	Shear Modulus	72.3	MPa
	Cavity Strain Range	0.094	%



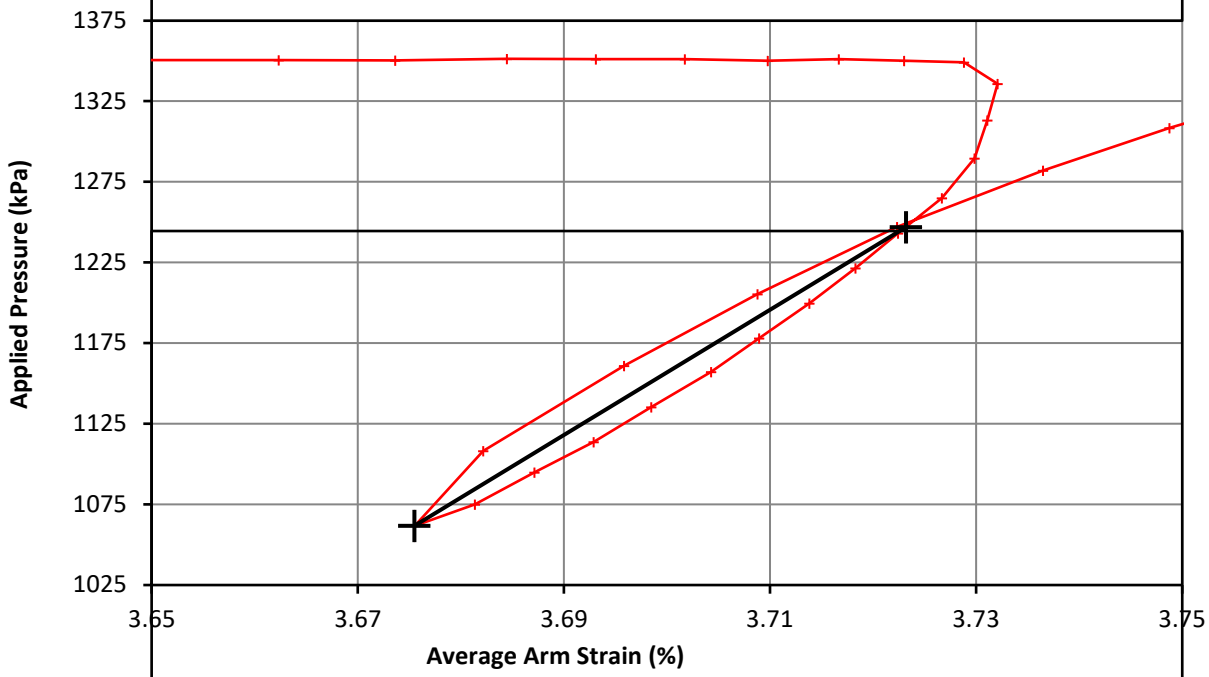
Loop 2	Shear Modulus	139.5	MPa
	Cavity Strain Range	0.065	%

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T05 - 06**
Client	Soil Engineering		
Project No.	P1250112		

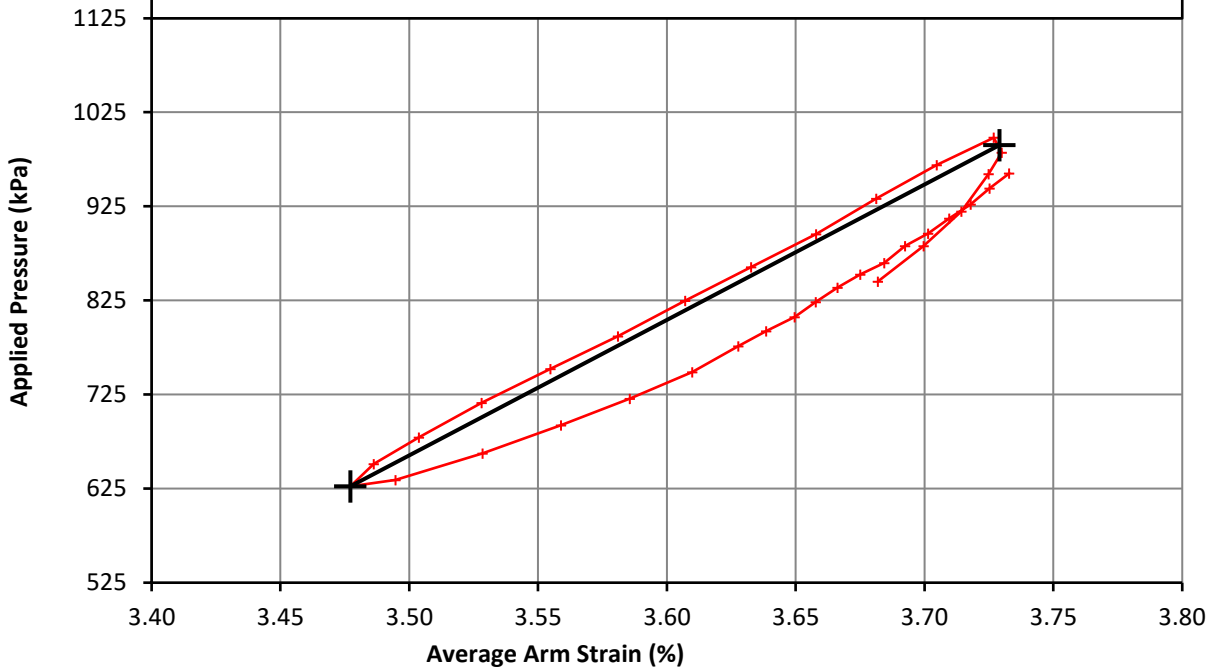
Pressuremeter Analysis - Unload Reload Loop

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	5
Borehole	BH107	**Test Depth (m)**	39.00



Loop 3	Shear Modulus	201.4	MPa
	Cavity Strain Range	0.048	%



Loop 4	Shear Modulus	74.6	MPa
	Cavity Strain Range	0.252	%

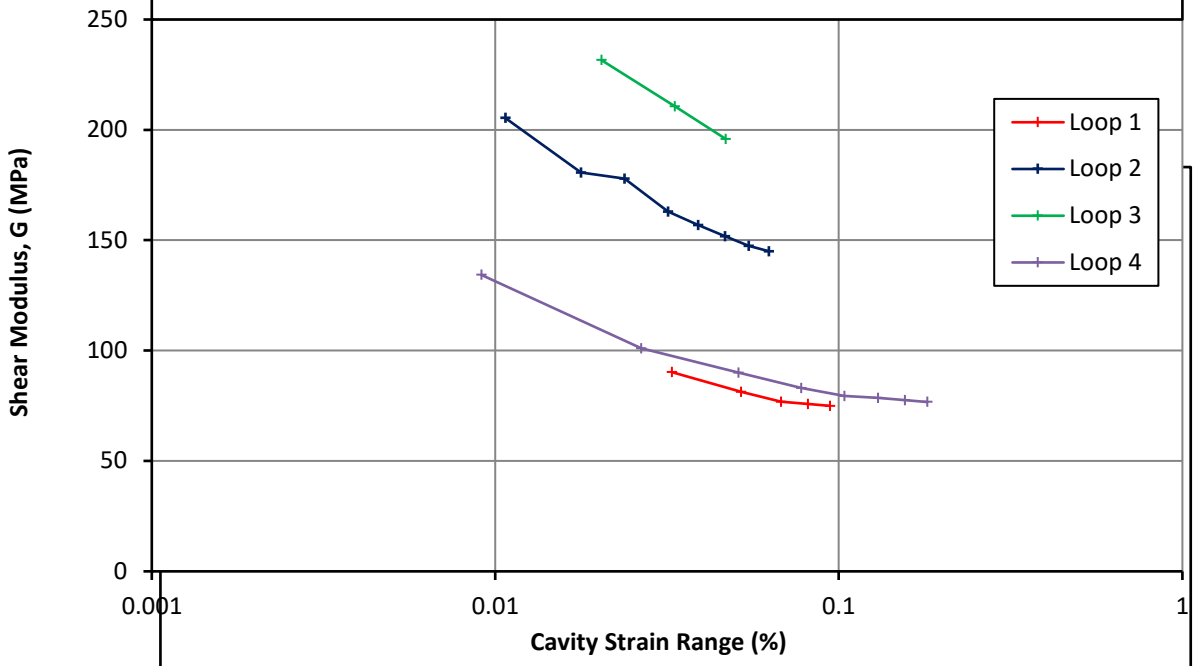
Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T05 - 07**
Client	Soil Engineering		
Project No.	P1250112		

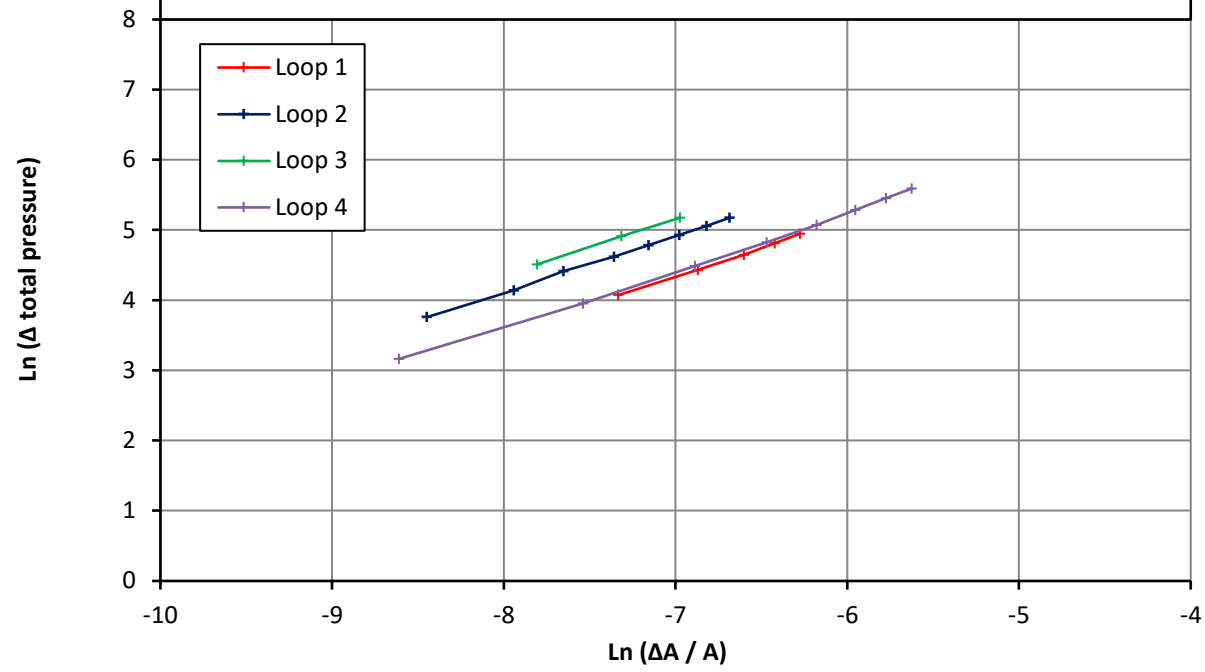
Pressuremeter Analysis

Small Strain Stiffness and Bolton & Whittle (1999)

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	5
Borehole	BH107	**Test Depth (m)**	39.00





Loop 1		Loop 2		Loop 3		Loop 4	
Gradient(β)	Intercept	Gradient(β)	Intercept	Gradient(β)	Intercept	Gradient(β)	Intercept
0.820	23.819 (MPa)	0.802	37.396 (MPa)	0.800	46.794 (MPa)	0.814	24.982 (MPa)

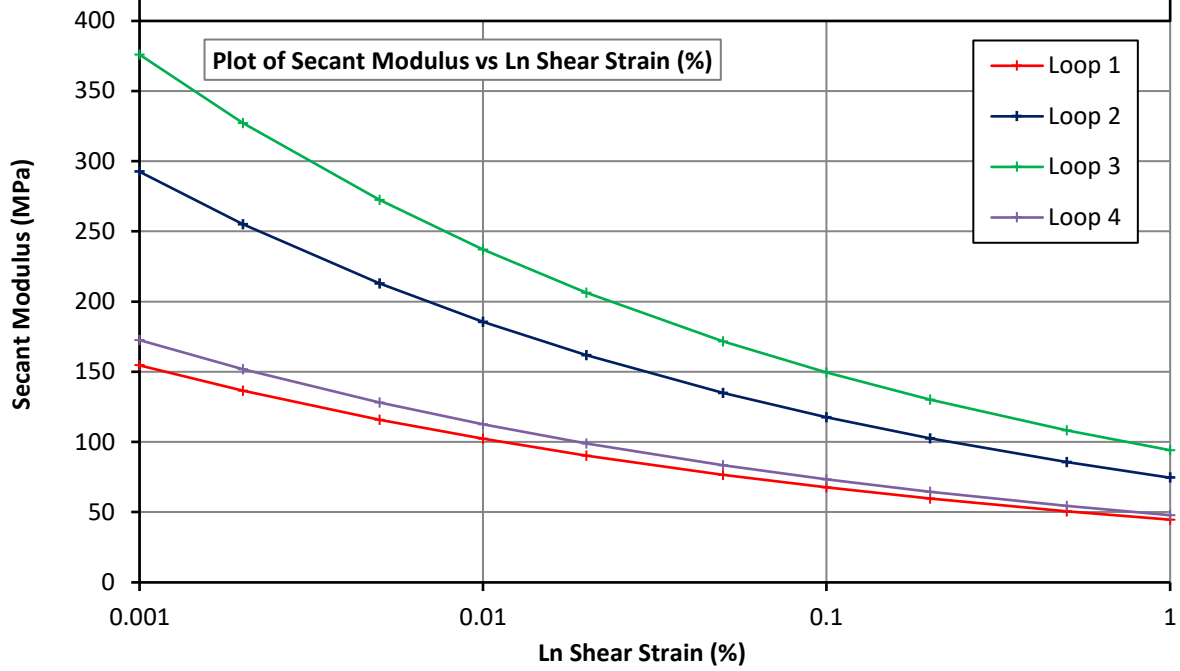
Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T05 - 08**
Client	Soil Engineering		
Project No.	P1250112		

Pressuremeter Analysis

Secant Modulus - Shear Strain (%)

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	5
Borehole	BH107	**Test Depth (m)**	39.00



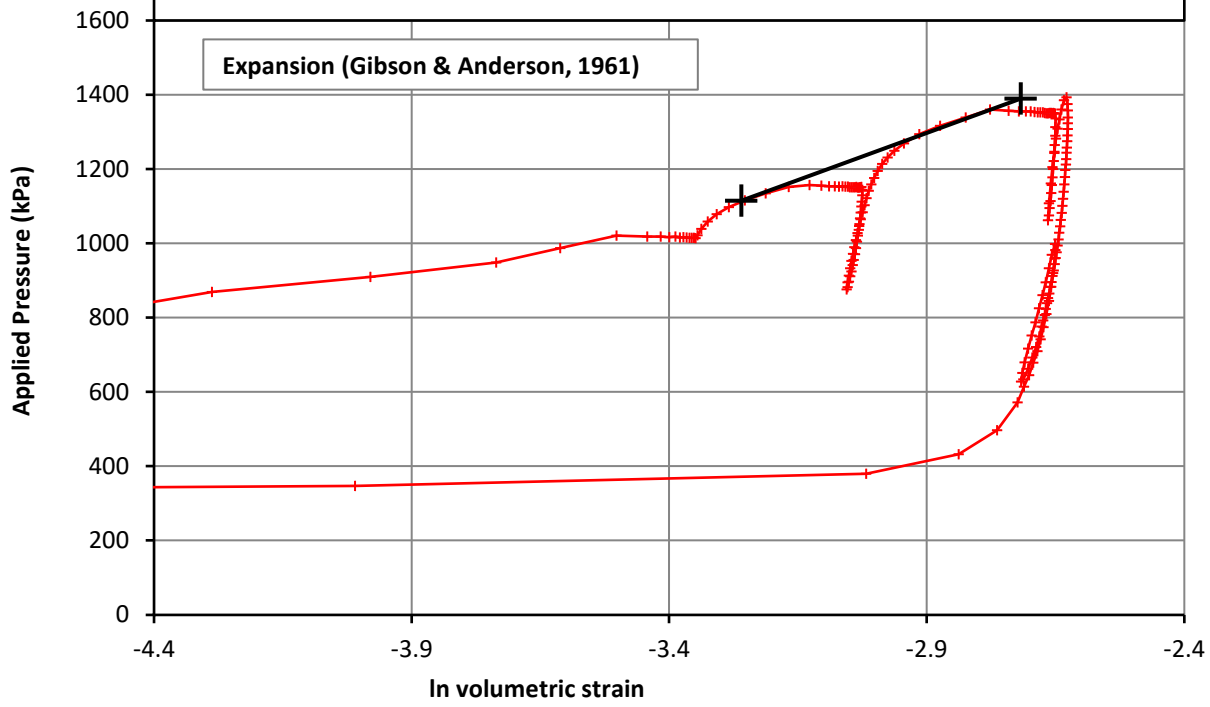
Shear Strain	Loop 1	Loop 2	Loop 3	Loop 4
0.001%	**155**	**293**	**376**	**173**
0.002%	137	255	327	152
0.005%	116	213	272	128
0.010%	**102**	**186**	**237**	**113**
0.020%	90	162	206	99
0.050%	77	135	172	83
0.100%	**68**	**118**	**149**	**73**
0.200%	60	103	130	65
0.500%	51	86	108	54
1.000%	**45**	**75**	**94**	**48**

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T05 - 09**
Client	Soil Engineering		
Project No.	P1250112		

Pressuremeter Analysis - Undrained Strength

IN SITU SITE INVESTIGATION

Test Date	02/07/2025	**Test No.**	5
Borehole	BH107	**Test Depth (m)**	39.00



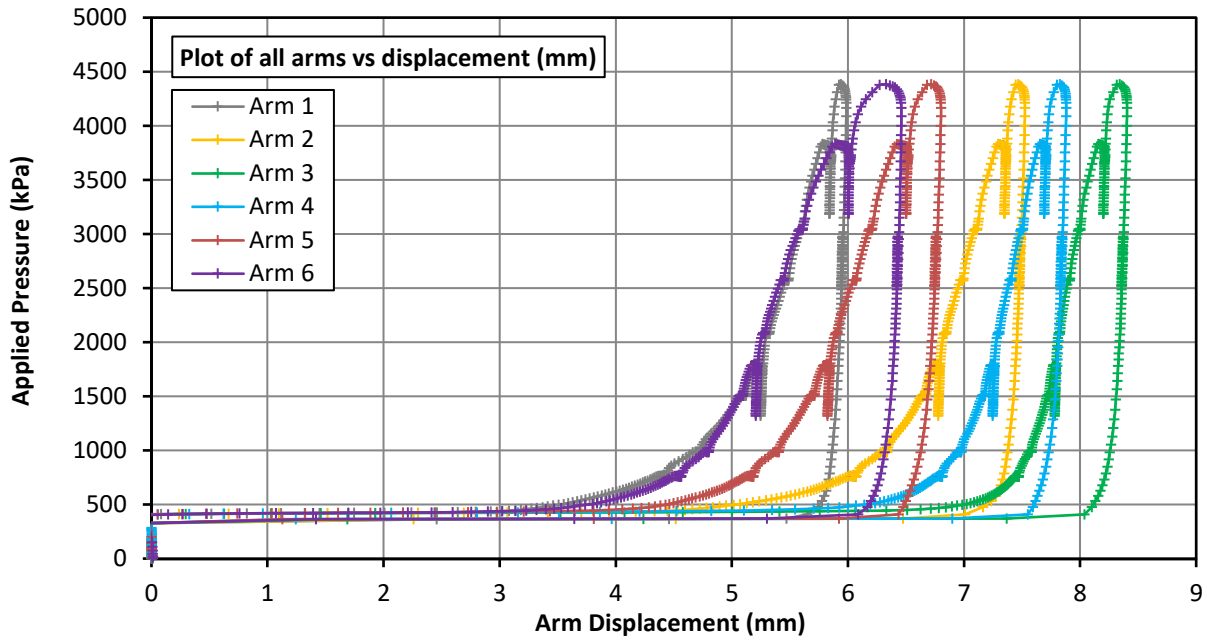
Strength (loading)	Undrained Shear	507	kPa
	Limit Pressure	2768	kPa

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T05 - 10**
Client	Soil Engineering		
Project No.	P1250112		

Pressuremeter Test Overview
High Pressure Dilatometer (HPD)

IN SITU SITE INVESTIGATION

Test Date	03/07/2025	**Test No.**	6
Borehole	BH107	**Test Depth (m)**	43.50
Coordinates (m)	- -	**Elevation (m)**	-



Material description from borehole log:

Assumed zone of core loss: Probable CHALK with flints

Test pocket conditions:

Total core recovery:	20 %	Test pocket depth range:	
Solid core recovery:	5 %	From: 42.00 m	to: 44.00 m
Rock quality designation:	0 %	Flush: Water	

Test comment:

Second attempt within test pocket after initial failed test. The test pocket was oversize with arms lifting off at 5.2 to 7.9mm. The po was estimated to be at 1281kPa, with the following loading section being relatively long. Material yield was interpreted at 3009kPa, with the test taken to a maximum pressure of 3824kPa. The displacement-pressure response shown by the arms was slightly variable. Analysis of three unload reload loops provides modulus values of 676 to 1107MPa. Derived undrained shear strength analysis provides a value of 1728kPa.

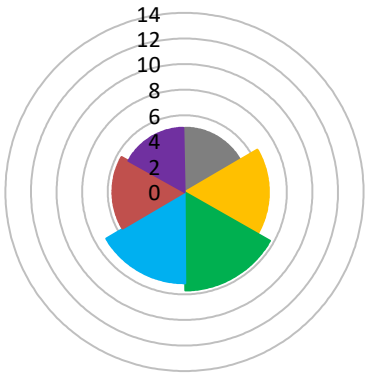
Test details:		**Instrument:**	Kylie (HPD06)		**Operator:**	A Lewins	
			mV	mV/mm		mV	mV/MPa
Drilling method:	Rotary coring	Arm 1:	-2399.4	135.6	TPC A:	-2188.7	104.7
Casing depth:	42.00 m	Arm 2:	-2462.1	135.6	TPC B:	-1953.7	105.7
Water level:	1.50 m	Arm 3:	-2282.0	136.6	Membrane:		
Test time:		Arm 4:	-2386.3	131.4	Stiffness	34.7	kPa
Start of test:	09:50 hrs	Arm 5:	-2338.7	127.9	Slope	10.0	kPa/mm
End of test:	11:20 hrs	Arm 6:	-2264.8	135.1	Compliance	1.4	mm/GPa

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T06 - 01**
Client	FBJV		
Project No.	P1250112		

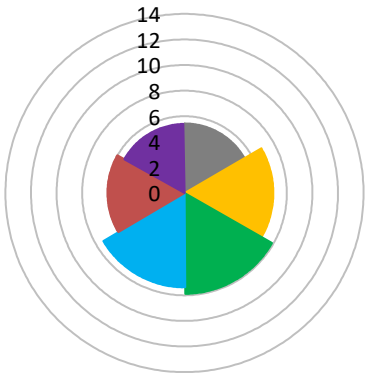
Pressuremeter Test - Membrane Expansion Plan View

IN SITU SITE INVESTIGATION

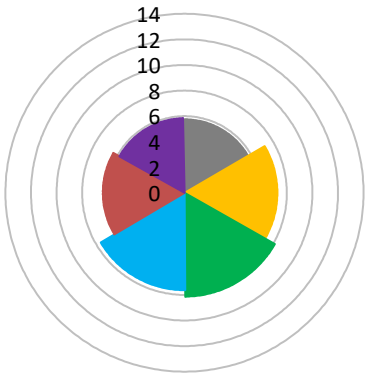
Test Date	03/07/2025	**Test No.**	6
Borehole	BH107	**Test Depth (m)**	43.50



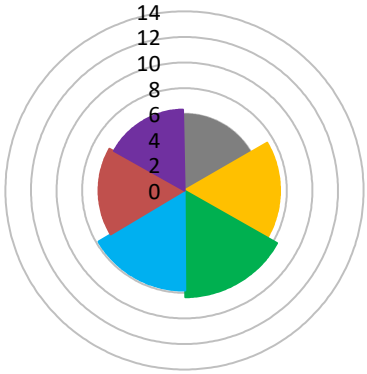
Arm expansion at:	0.0	% cavity strain
Test pressure:	1429	kPa
Arm 1 at:	5.0	mm
Arm 2 at:	6.6	mm
Arm 3 at:	7.7	mm
Arm 4 at:	7.1	mm
Arm 5 at:	5.6	mm
Arm 6 at:	5.0	mm



Arm expansion at:	0.6	% cavity strain
Test pressure:	2495	kPa
Arm 1 at:	5.4	mm
Arm 2 at:	6.9	mm
Arm 3 at:	7.9	mm
Arm 4 at:	7.4	mm
Arm 5 at:	6.0	mm
Arm 6 at:	5.4	mm



Arm expansion at:	1.2	% cavity strain
Test pressure:	3755	kPa
Arm 1 at:	5.8	mm
Arm 2 at:	7.3	mm
Arm 3 at:	8.1	mm
Arm 4 at:	7.6	mm
Arm 5 at:	6.4	mm
Arm 6 at:	5.8	mm



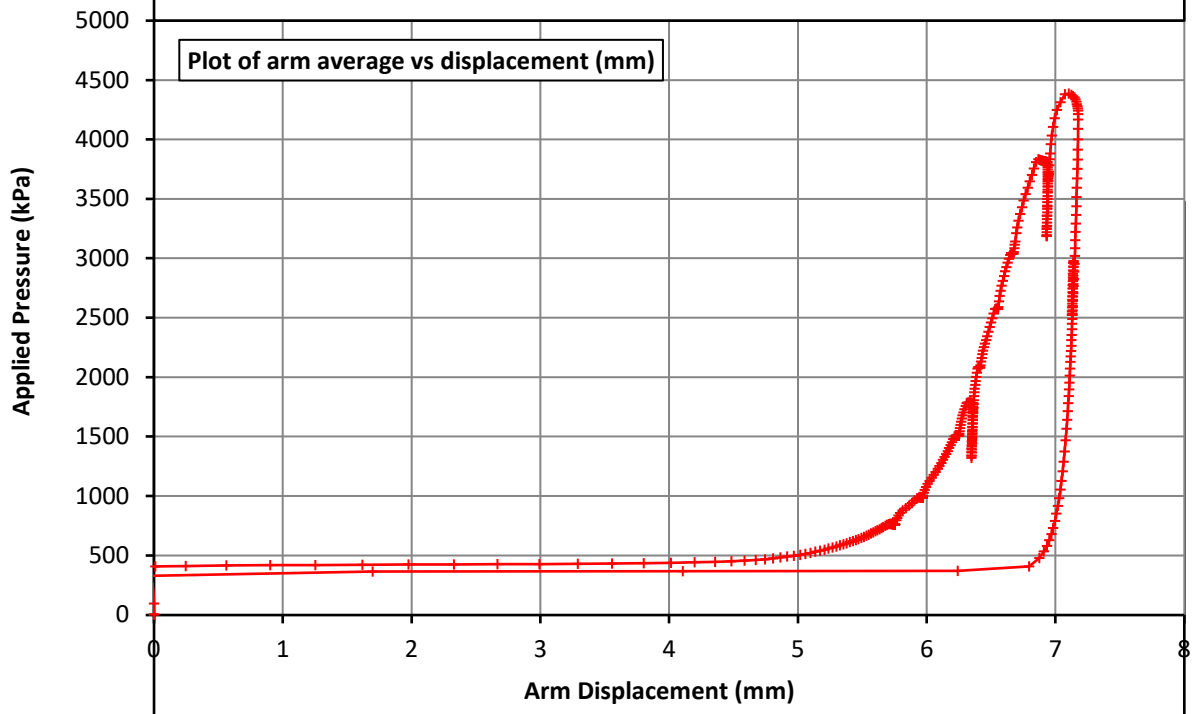
Arm expansion at:	1.7	% cavity strain
Maximum test pressure:	4384	kPa
Arm 1 at:	5.9	mm
Arm 2 at:	7.5	mm
Arm 3 at:	8.3	mm
Arm 4 at:	7.8	mm
Arm 5 at:	6.7	mm
Arm 6 at:	6.3	mm

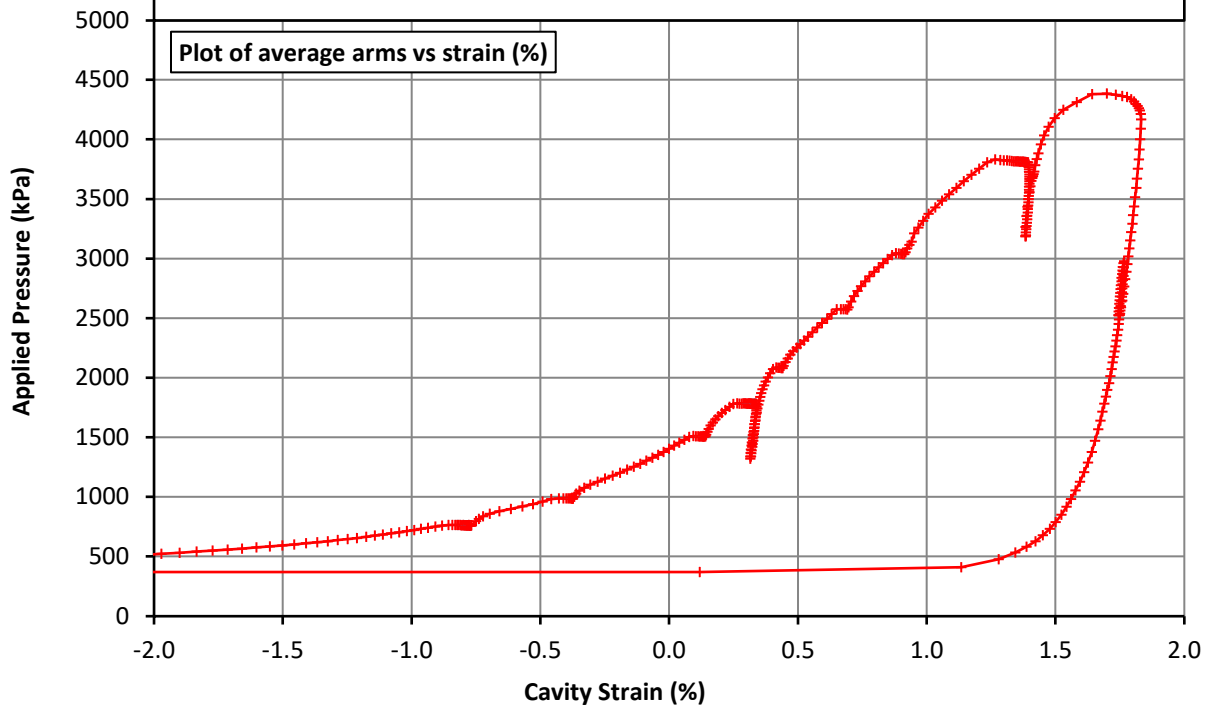
Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T06 - 02**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Test - Average Arm Plots

IN SITU SITE INVESTIGATION

Test Date	03/07/2025	**Test No.**	6
Borehole	BH107	**Test Depth (m)**	43.50



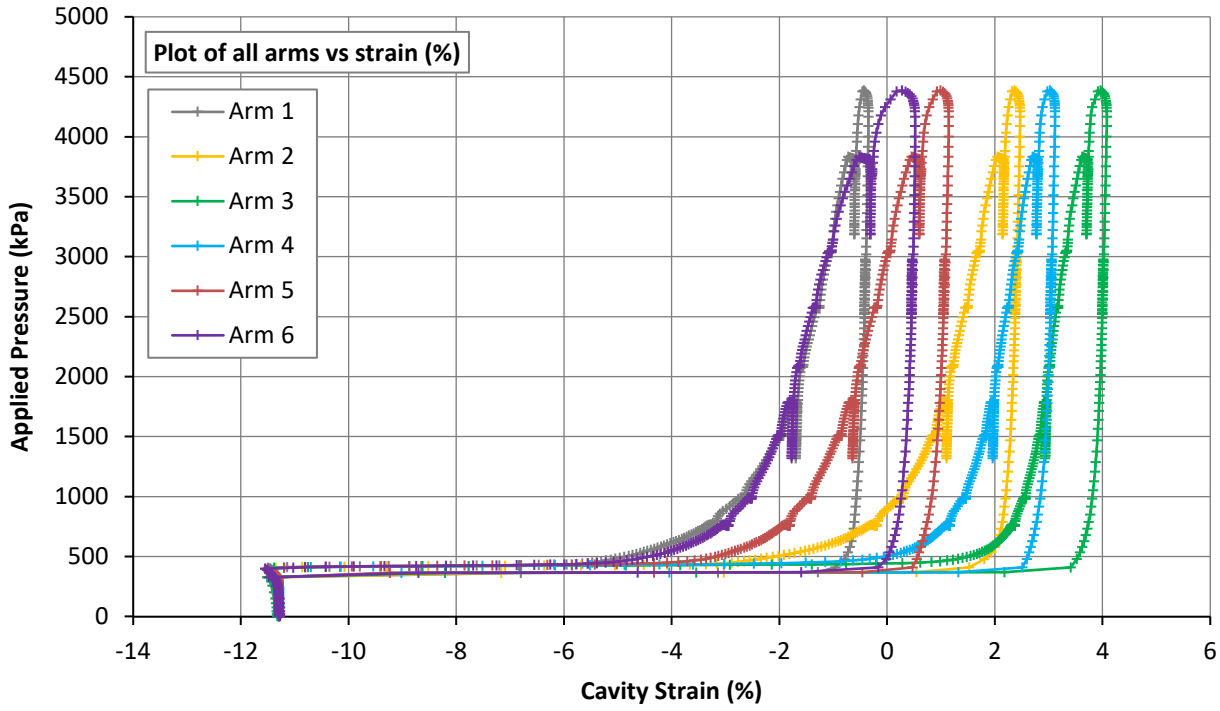


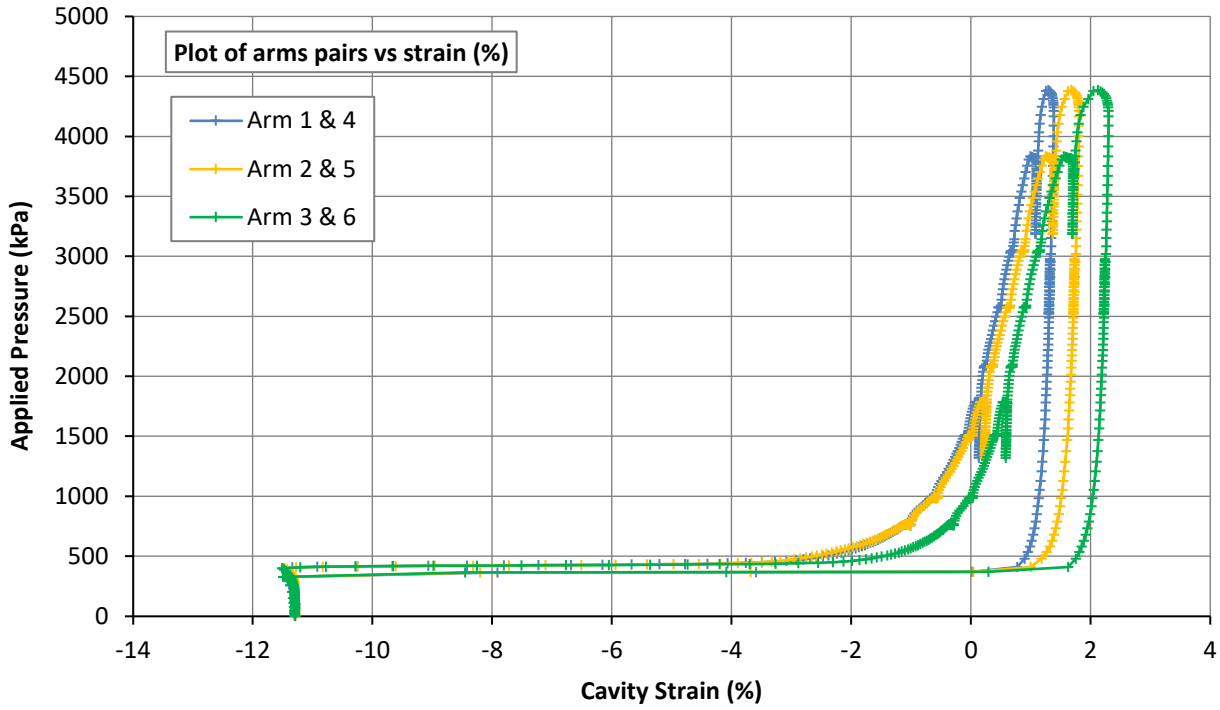
Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T06 - 03**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Test - Arm Displacement vs Strain (%)

IN SITU SITE INVESTIGATION

Test Date	03/07/2025	Test No.	6
Borehole	BH107	Test Depth (m)	43.50



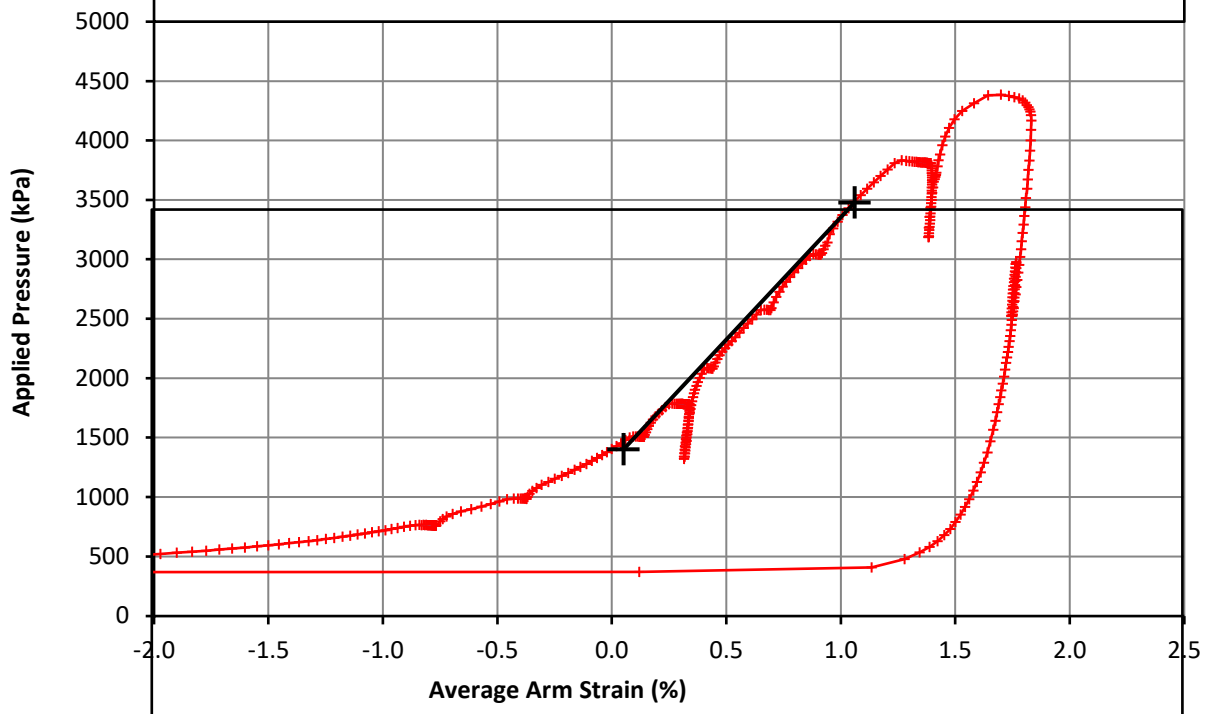


Project	Grain to Tilbury Tunnel GI	Figure No.	BH107 T06 - 04
Client	FBJV		
Project No.	P1250112		

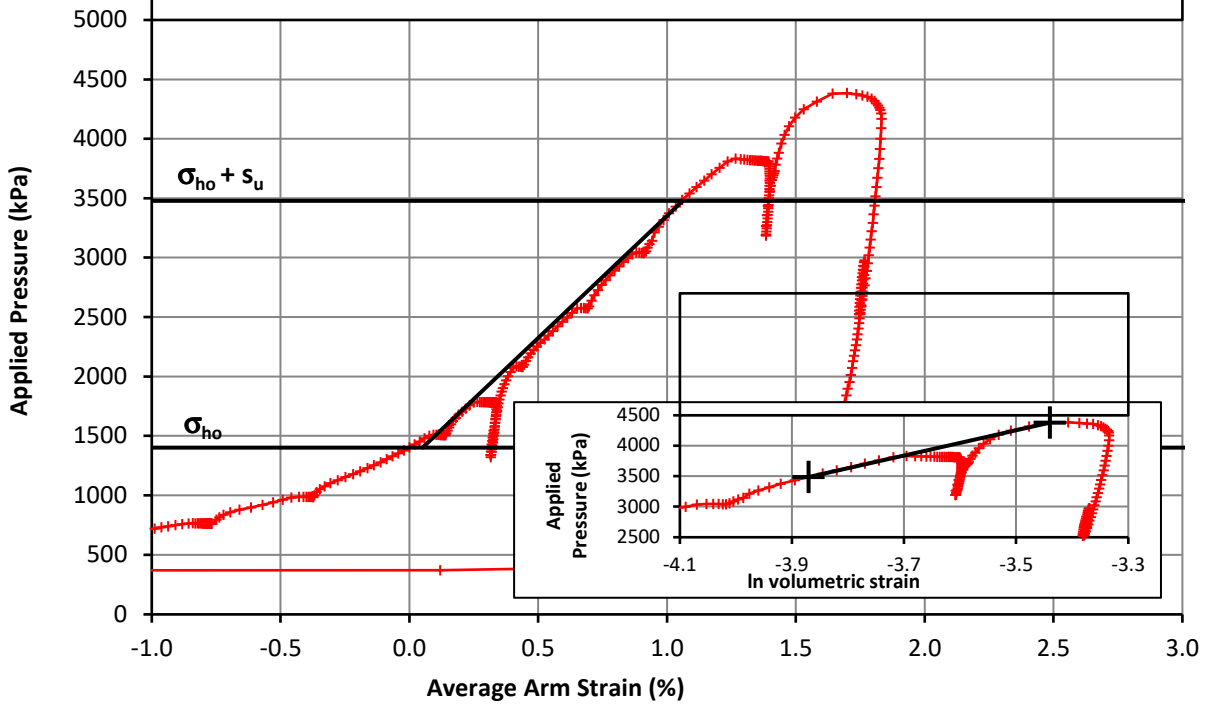
Pressuremeter Analysis - Initial Modulus & In Situ Horizontal Stress

IN SITU SITE INVESTIGATION

Test Date	03/07/2025	**Test No.**	6
Borehole	BH107	**Test Depth (m)**	43.50



Initial Modulus	Shear Modulus	103.9	MPa



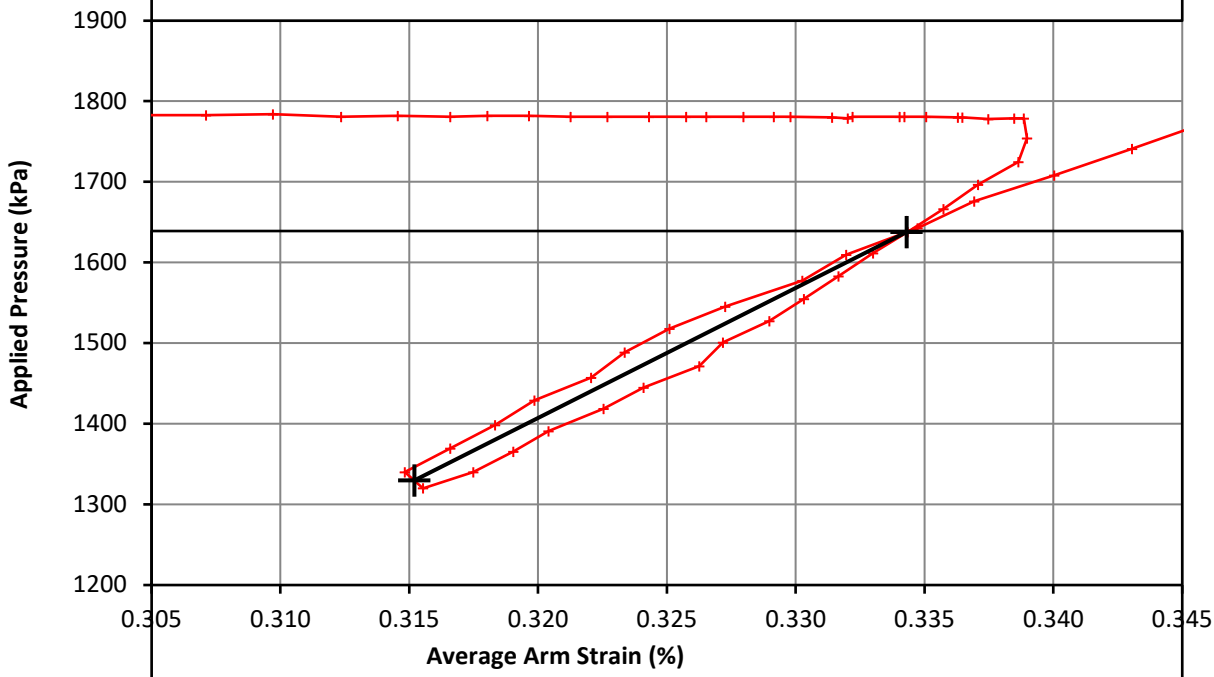
Marsland & Randolph	In situ horizontal stress	1403	kPa
	Undrained Strength	2077	kPa

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T06 - 05**
Client	FBJV		
Project No.	P1250112		

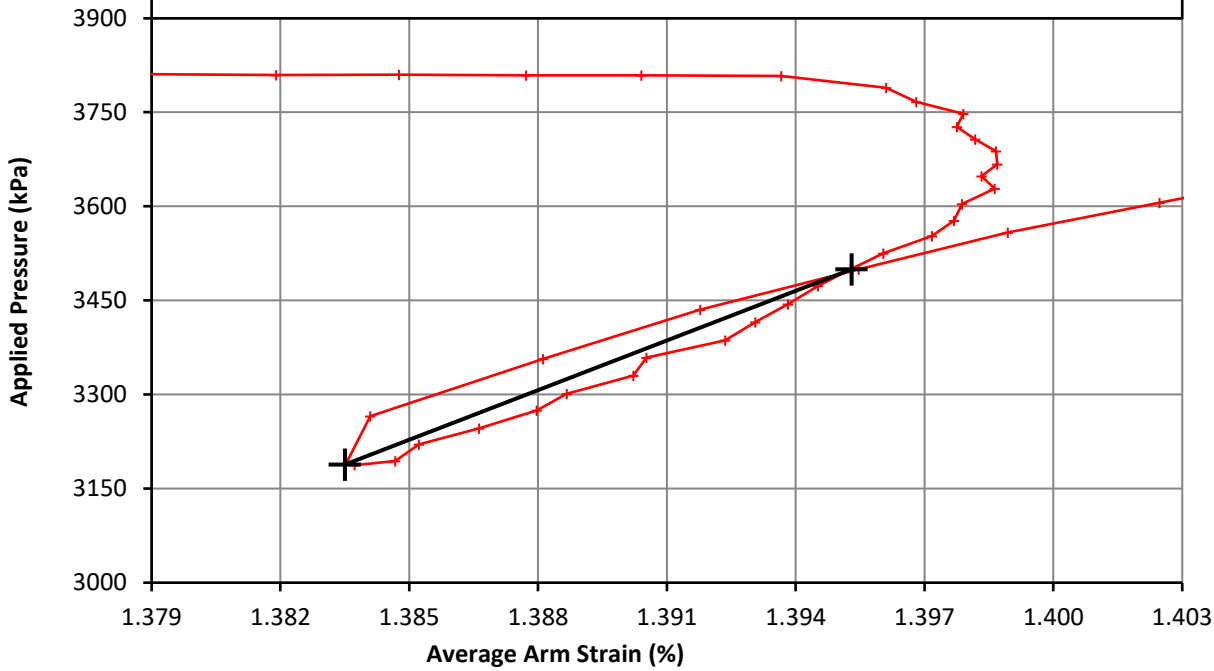
Pressuremeter Analysis - Unload Reload Loop

IN SITU SITE INVESTIGATION

Test Date	03/07/2025	**Test No.**	6
Borehole	BH107	**Test Depth (m)**	43.50



Loop 1	Shear Modulus	808.2	MPa
	Cavity Strain Range	0.019	%



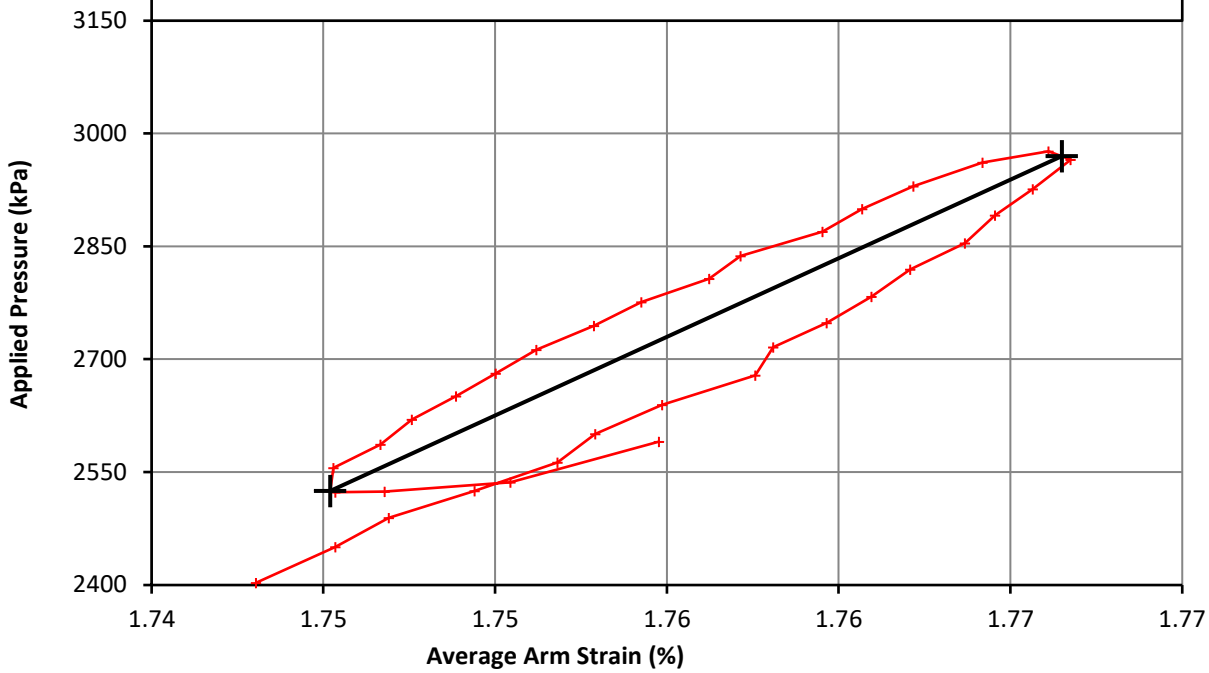
Loop 2	Shear Modulus	1337.0	MPa
	Cavity Strain Range	0.012	%

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T06 - 06**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Analysis - Unload Reload Loop

IN SITU SITE INVESTIGATION

Test Date	03/07/2025	**Test No.**	6
Borehole	BH107	**Test Depth (m)**	43.50



Loop 3	Shear Modulus	1063.1	MPa
	Cavity Strain Range	0.021	%

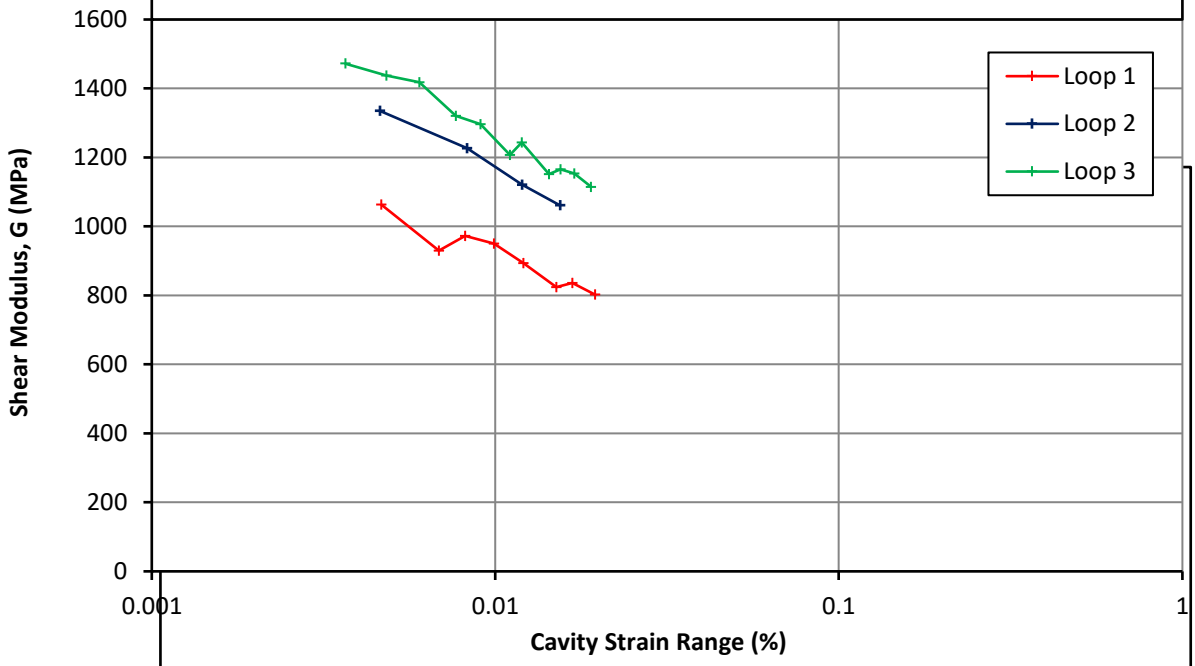
Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T06 - 07**
Client	FBJV		
Project No.	P1250112		

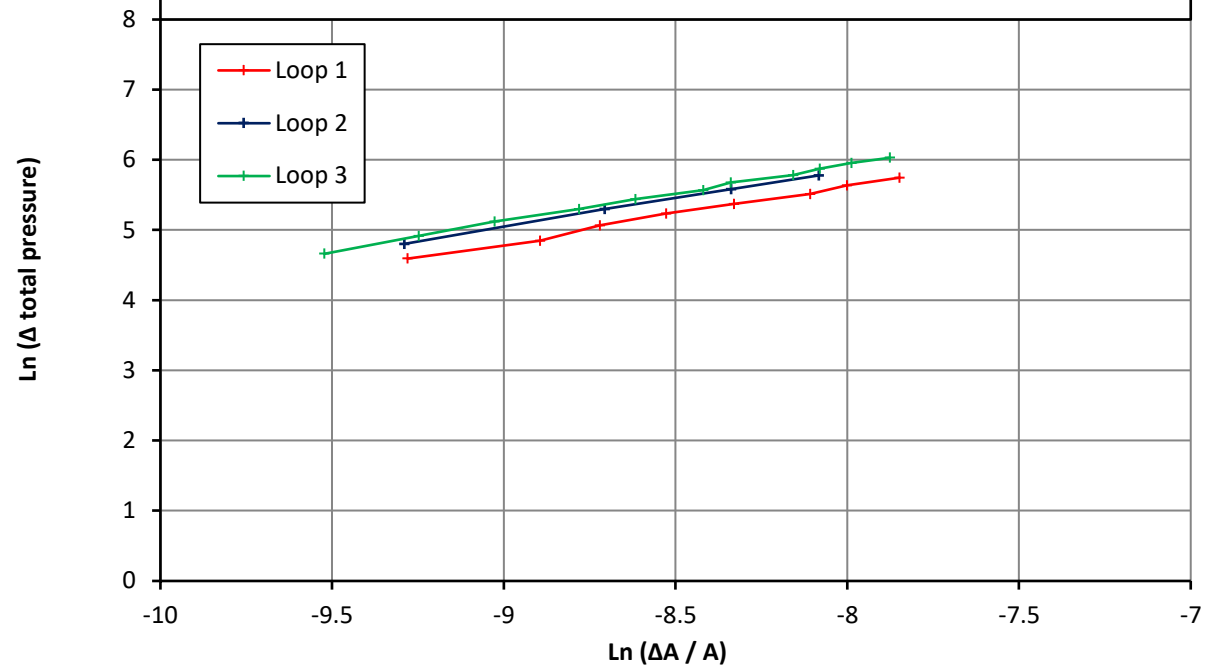
Pressuremeter Analysis

Small Strain Stiffness and Bolton & Whittle (1999)

IN SITU SITE INVESTIGATION

Test Date	03/07/2025	**Test No.**	6
Borehole	BH107	**Test Depth (m)**	43.50





Loop 1		Loop 2		Loop 3	
Gradient(β)	Intercept	Gradient(β)	Intercept	Gradient(β)	Intercept
0.813	185.504 (MPa)	0.808	224.197 (MPa)	0.821	268.201 (MPa)

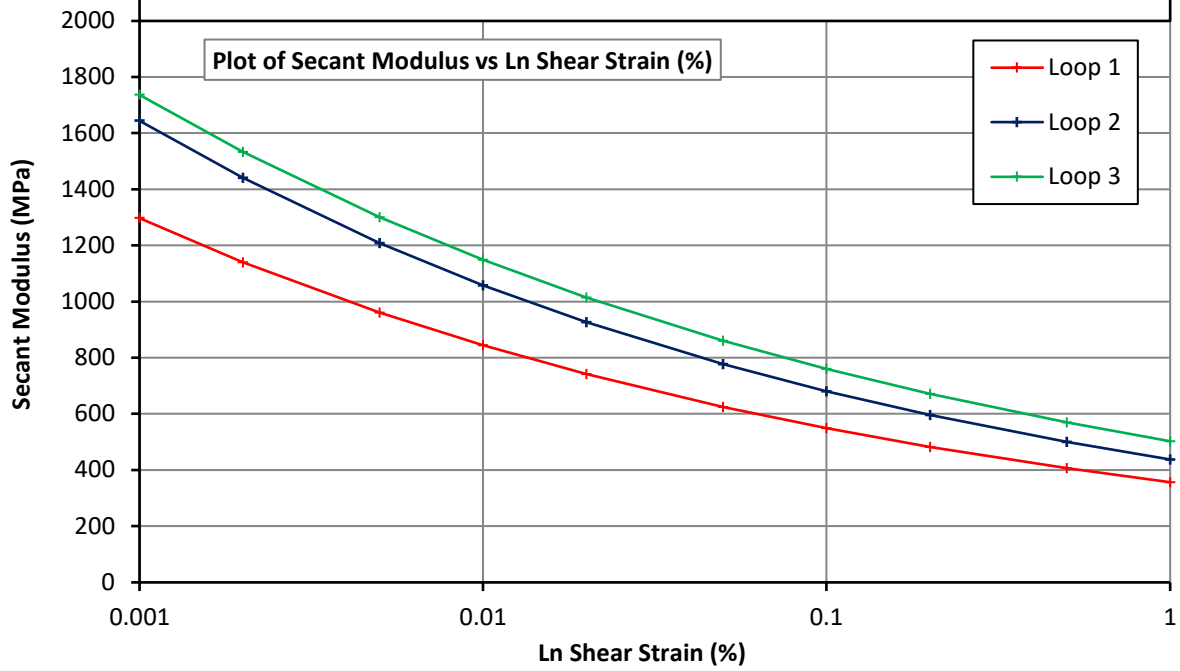
Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T06 - 08**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Analysis

Secant Modulus - Shear Strain (%)

IN SITU SITE INVESTIGATION

Test Date	03/07/2025	**Test No.**	6
Borehole	BH107	**Test Depth (m)**	43.50



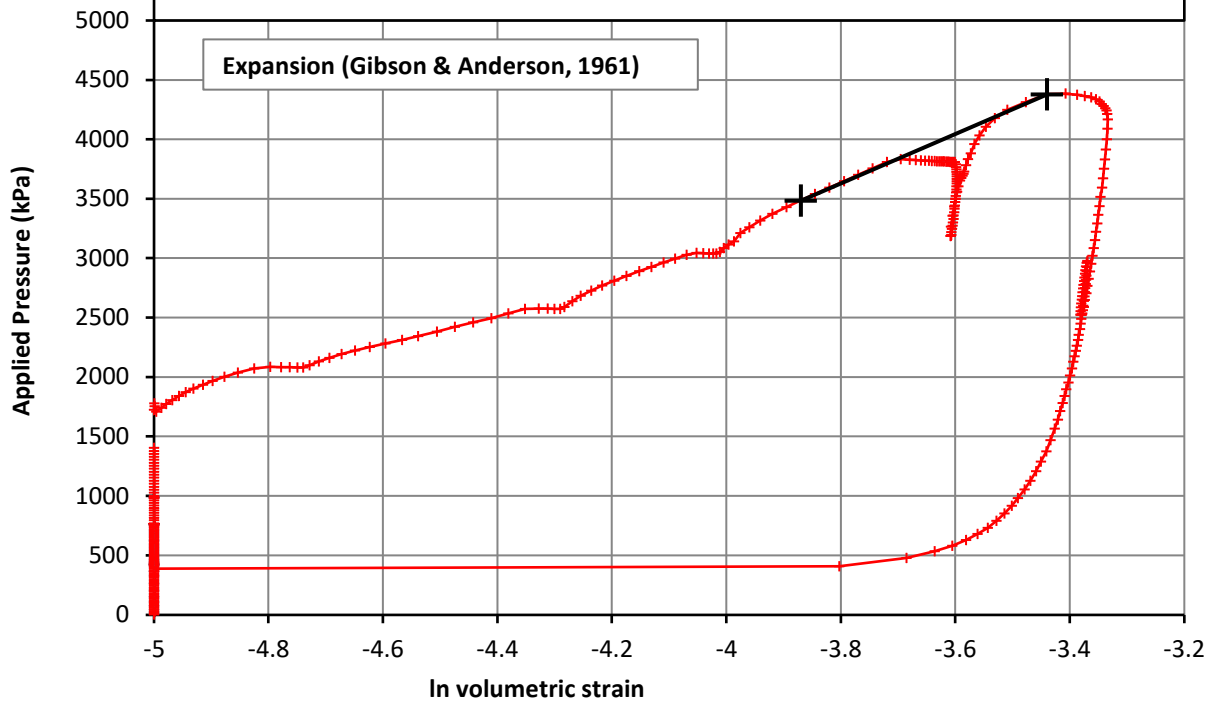
Shear Strain	Loop 1	Loop 2	Loop 3
0.001%	**1298**	**1645**	**1737**
0.002%	1140	1440	1533
0.005%	961	1208	1301
0.010%	**844**	**1058**	**1149**
0.020%	741	926	1014
0.050%	625	777	861
0.100%	**549**	**681**	**760**
0.200%	482	596	671
0.500%	406	500	569
1.000%	**357**	**438**	**503**

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T06 - 09**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Analysis - Undrained Strength

IN SITU SITE INVESTIGATION

Test Date	03/07/2025	**Test No.**	6
Borehole	BH107	**Test Depth (m)**	43.50



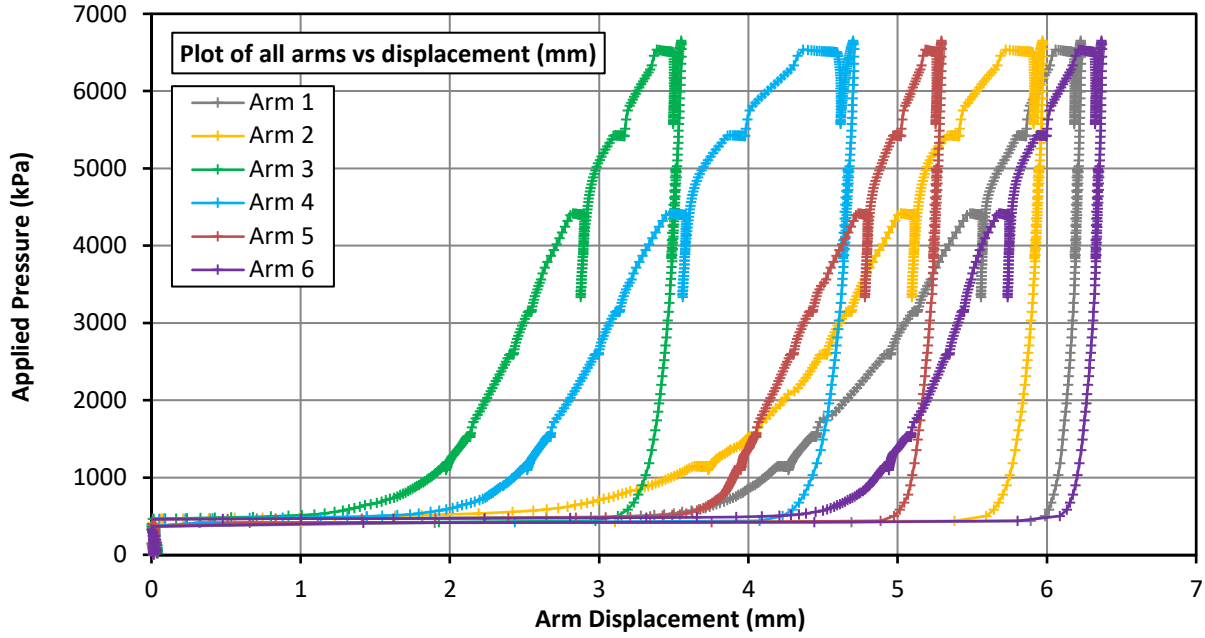
Strength (loading)	Undrained Shear	2077	kPa
	Limit Pressure	11524	kPa

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T06 - 10**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Test Overview
High Pressure Dilatometer (HPD)

IN SITU SITE INVESTIGATION

Test Date	03/07/2025	**Test No.**	7
Borehole	BH107	**Test Depth (m)**	47.00
Coordinates (m)	- -	**Elevation (m)**	-



Material description from borehole log:

Very weak low density white locally orange brown stained CHALK. Discontinuities1) 70-90 degrees medium spaced planar smooth with occasional black staining and rarely orange brown staining. CIRIA Grade A2.
[SEAFORD CHALK FORMATION - CUCKMERE BEDS]

Test pocket conditions:

Total core recovery:	75 %	Test pocket depth range:	
Solid core recovery:	33 %	From: 46.00 m	to: 48.00 m
Rock quality designation:	5 %	Flush: Water	

Test comment:

The test pocket was oversize with arms lifting off at 2.3 to 5.3mm. The po was estimated to be at 1615kPa, with the following loading section being long. Material yield was interpreted at 4818kPa, with the test taken to a maximum pressure of 5814kPa, where it was terminated due to jumps and uneven expansion. The displacement-pressure response shown by the arms was variable. Analysis of three unload reload loops provides modulus values of 966 to 1191MPa. Derived undrained shear strength analysis provides a value of 3203kPa.

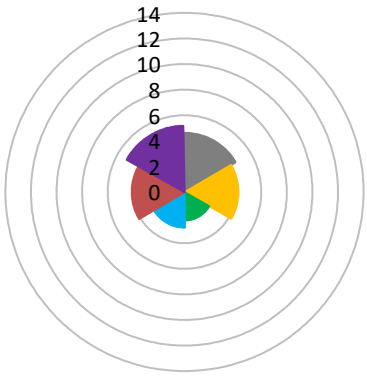
Test details:		**Instrument:** Kylie (HPD06)			**Operator:** A Lewins		
			mV	mV/mm		mV	mV/MPa
Drilling method:	Rotary coring						
Casing depth:	46.00 m	Arm 1:	-2401.6	135.6	TPC A:	-2191.6	104.7
Water level:	1.50 m	Arm 2:	-2467.2	135.6	TPC B:	-1956.0	105.7
		Arm 3:	-2289.0	136.6	Membrane:		
Test time:		Arm 4:	-2390.6	121.4	Stiffness	34.7	kPa
Start of test:	13:16 hrs	Arm 5:	-2343.7	127.9	Slope	10.0	kPa/mm
End of test:	14:18 hrs	Arm 6:	-2268.3	135.1	Compliance	1.4	mm/GPa

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T07 - 01**
Client	FBJV		
Project No.	P1250112		

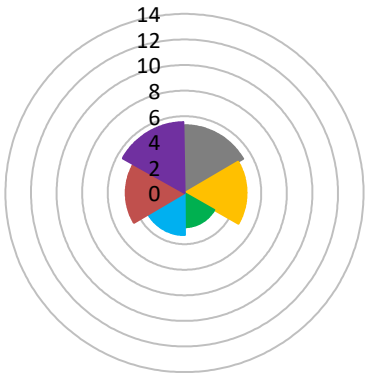
Pressuremeter Test - Membrane Expansion Plan View

IN SITU SITE INVESTIGATION

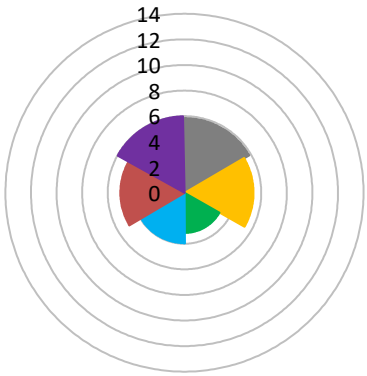
Test Date	03/07/2025	**Test No.**	7
Borehole	BH107	**Test Depth (m)**	47.00



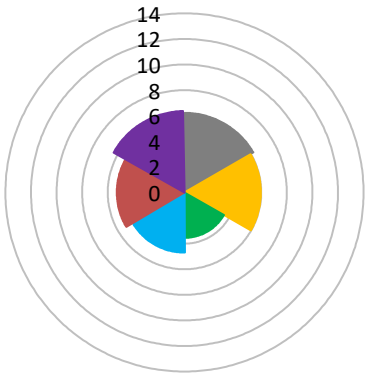
Arm expansion at:	0.0	% cavity strain
Test pressure:	1943	kPa
Arm 1 at:	4.6	mm
Arm 2 at:	4.2	mm
Arm 3 at:	2.2	mm
Arm 4 at:	2.8	mm
Arm 5 at:	4.1	mm
Arm 6 at:	5.2	mm



Arm expansion at:	1.0	% cavity strain
Test pressure:	3868	kPa
Arm 1 at:	5.3	mm
Arm 2 at:	4.9	mm
Arm 3 at:	2.7	mm
Arm 4 at:	3.3	mm
Arm 5 at:	4.6	mm
Arm 6 at:	5.5	mm



Arm expansion at:	2.0	% cavity strain
Test pressure:	5422	kPa
Arm 1 at:	5.8	mm
Arm 2 at:	5.4	mm
Arm 3 at:	3.2	mm
Arm 4 at:	4.0	mm
Arm 5 at:	5.0	mm
Arm 6 at:	6.0	mm



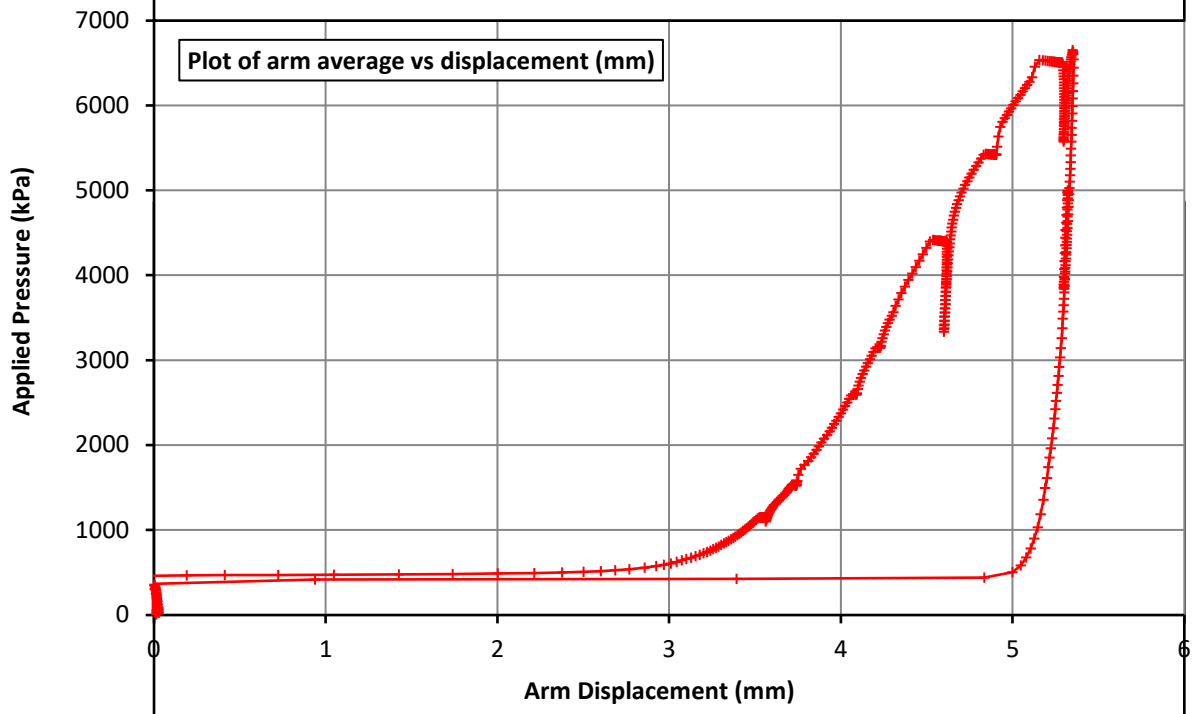
Arm expansion at:	2.9	% cavity strain
Maximum test pressure:	6653	kPa
Arm 1 at:	6.2	mm
Arm 2 at:	6.0	mm
Arm 3 at:	3.5	mm
Arm 4 at:	4.7	mm
Arm 5 at:	5.3	mm
Arm 6 at:	6.4	mm

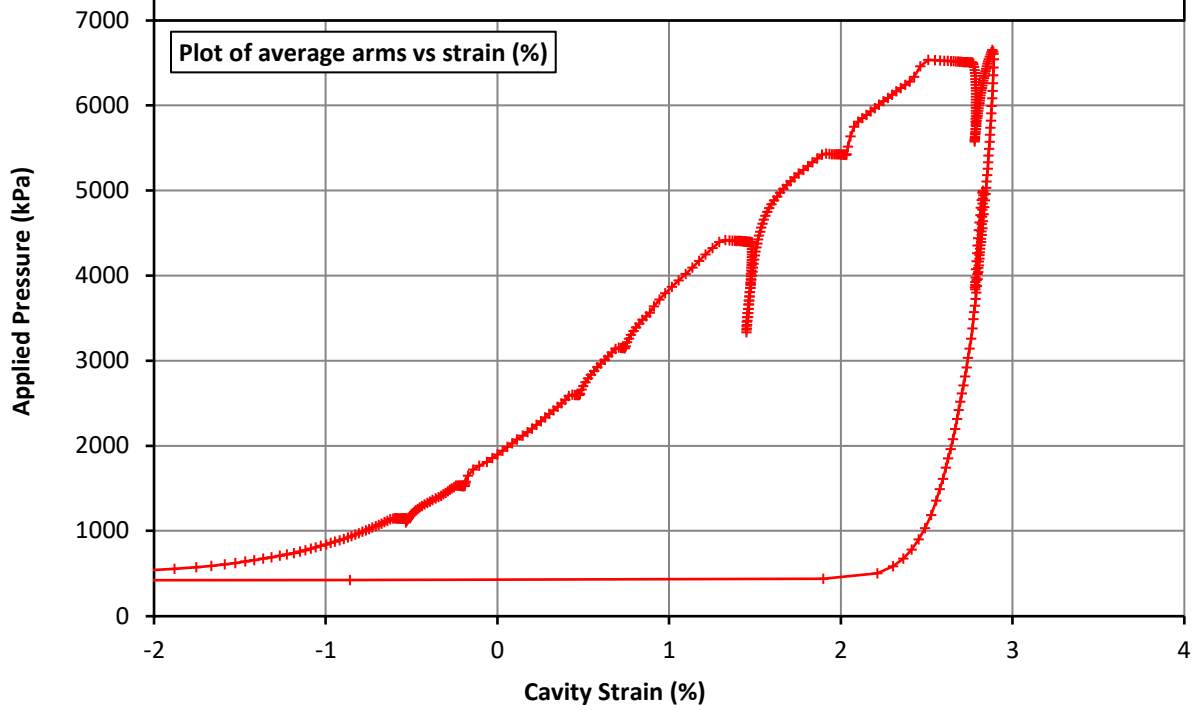
Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T07 - 02**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Test - Average Arm Plots

IN SITU SITE INVESTIGATION

Test Date	03/07/2025	**Test No.**	7
Borehole	BH107	**Test Depth (m)**	47.00



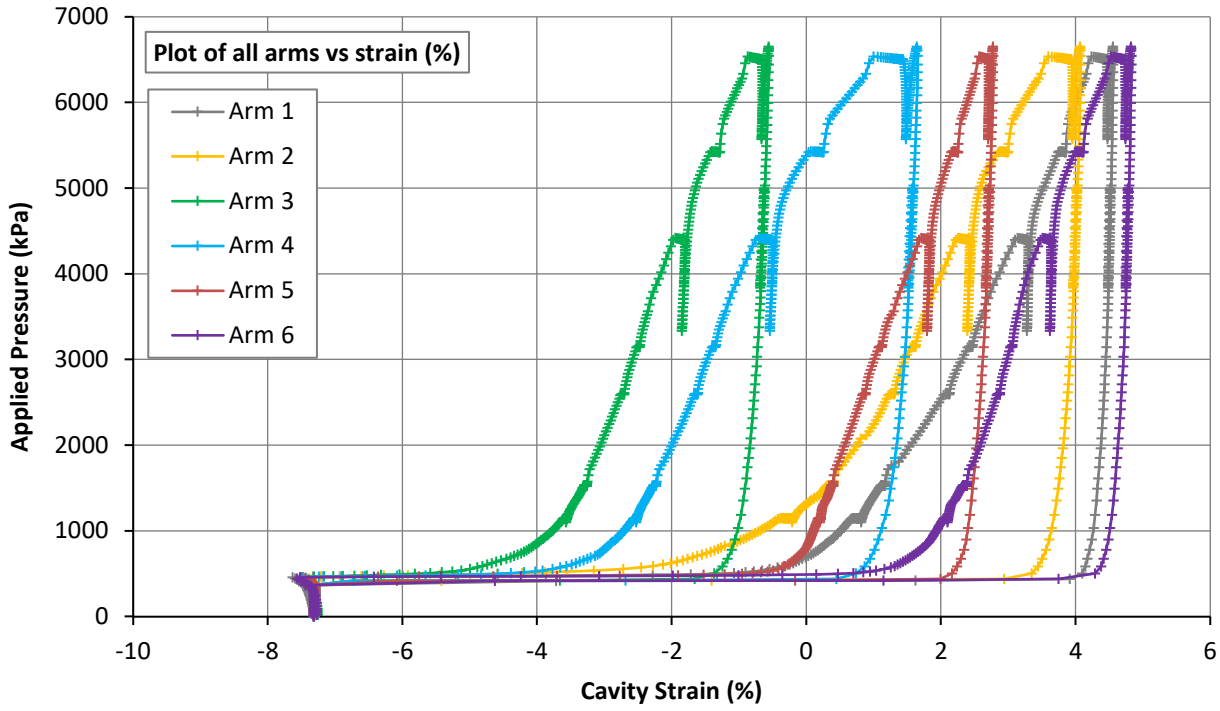


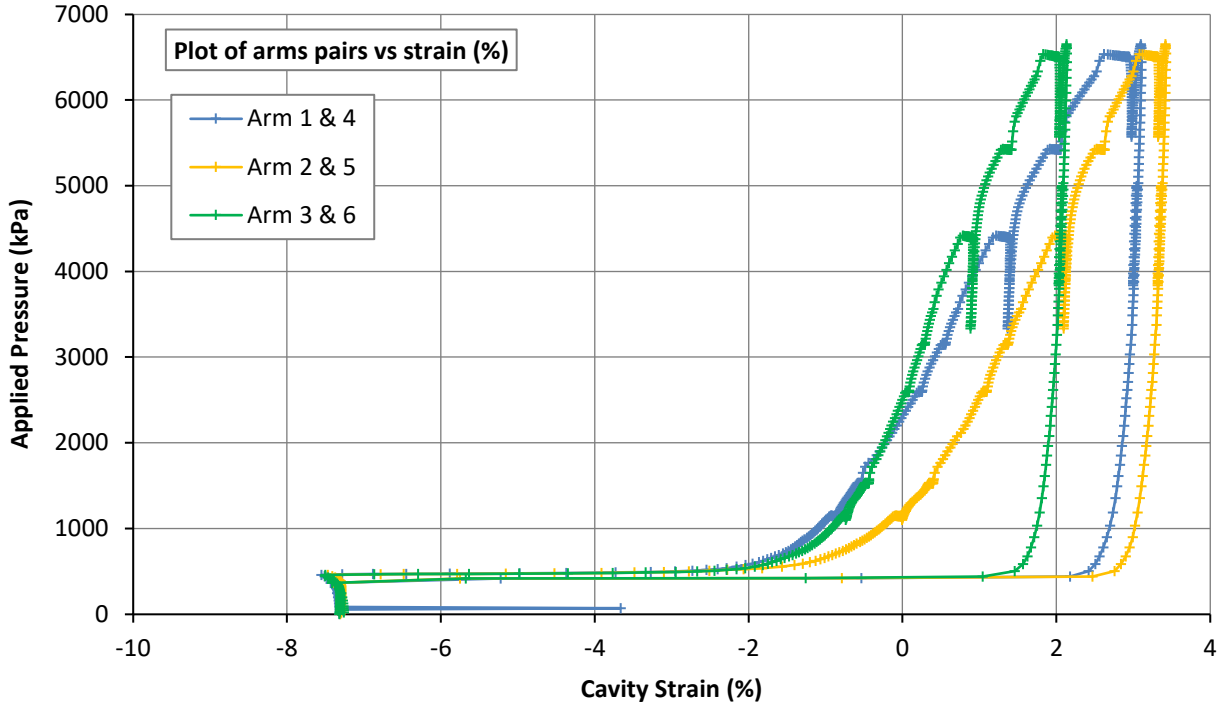
Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T07 - 03**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Test - Arm Displacement vs Strain (%)

IN SITU SITE INVESTIGATION

Test Date	03/07/2025	**Test No.**	7
Borehole	BH107	**Test Depth (m)**	47.00



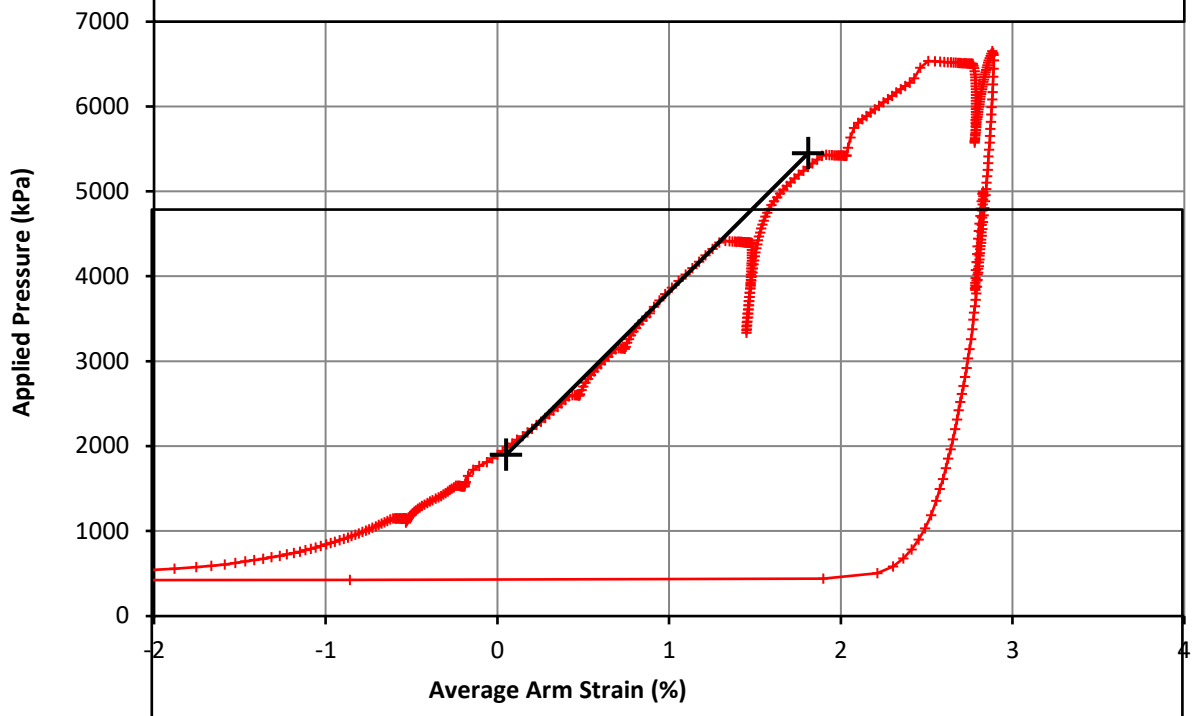


Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T07 - 04**
Client	FBJV		
Project No.	P1250112		

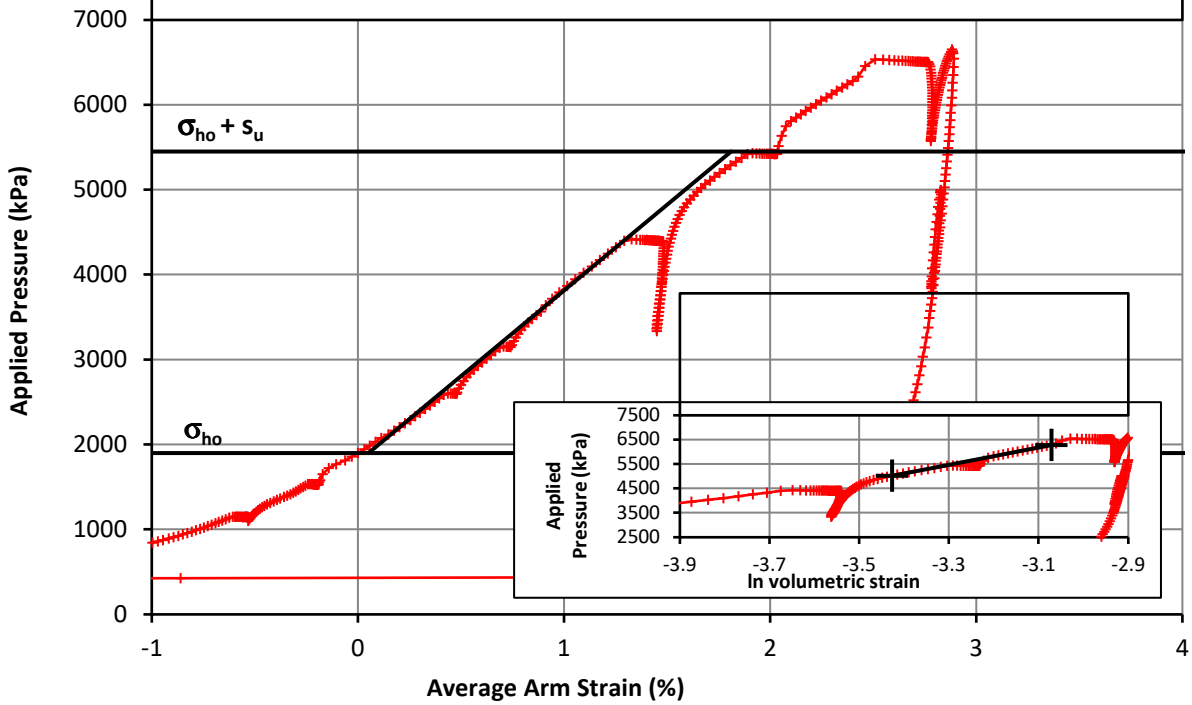
Pressuremeter Analysis - Initial Modulus & In Situ Horizontal Stress

IN SITU SITE INVESTIGATION

Test Date	03/07/2025	**Test No.**	7
Borehole	BH107	**Test Depth (m)**	47.00



Initial Modulus	Shear Modulus	102.7	MPa



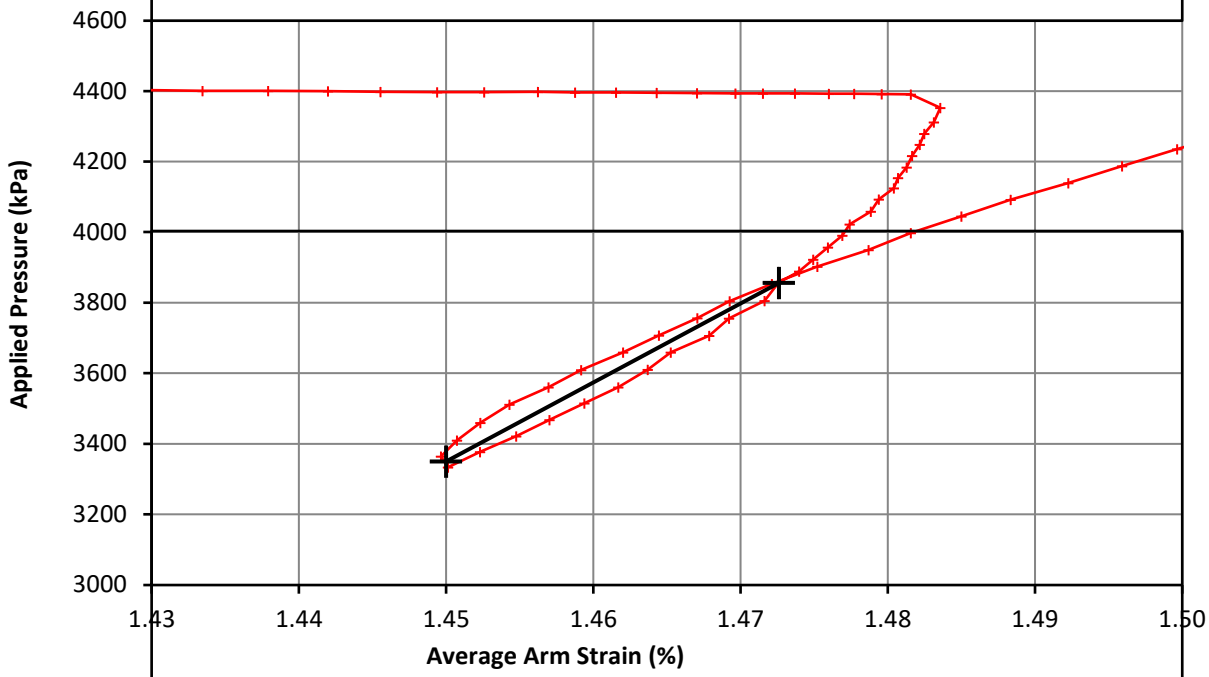
Marsland & Randolph	In situ horizontal stress	1899	kPa
	Undrained Strength	3551	kPa

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T07 - 05**
Client	FBJV		
Project No.	P1250112		

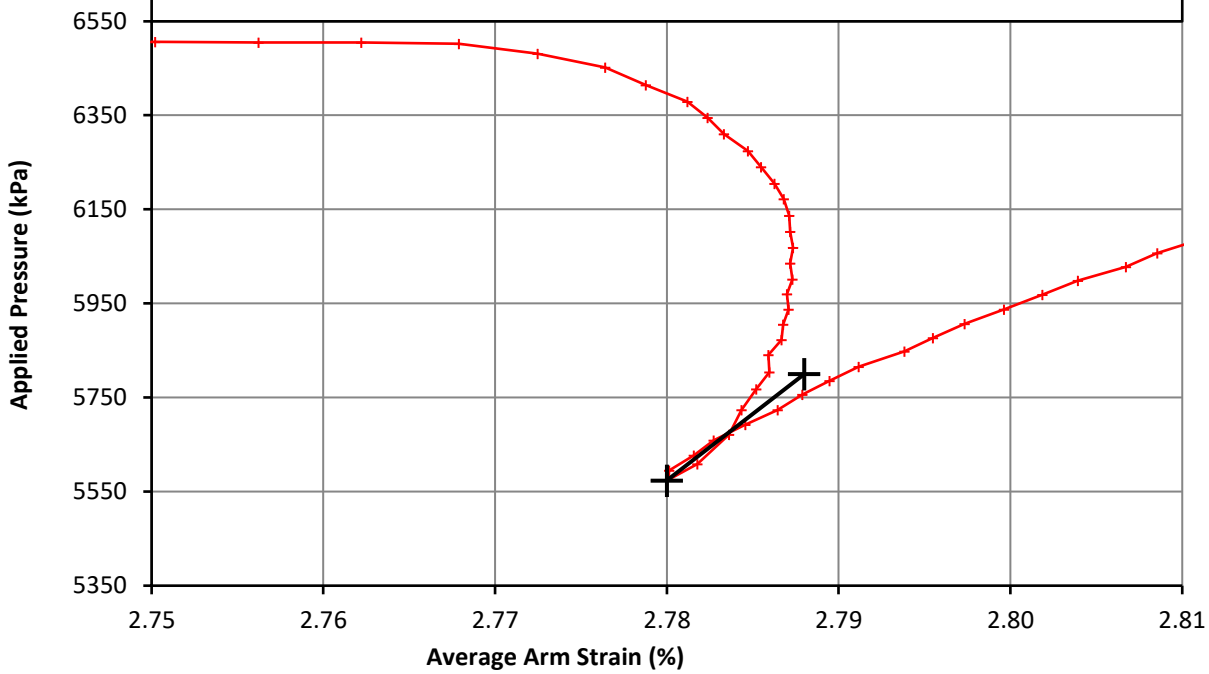
Pressuremeter Analysis - Unload Reload Loop

IN SITU SITE INVESTIGATION

Test Date	03/07/2025	**Test No.**	7
Borehole	BH107	**Test Depth (m)**	47.00



Loop 1	Shear Modulus	1137.8	MPa
	Cavity Strain Range	0.023	%



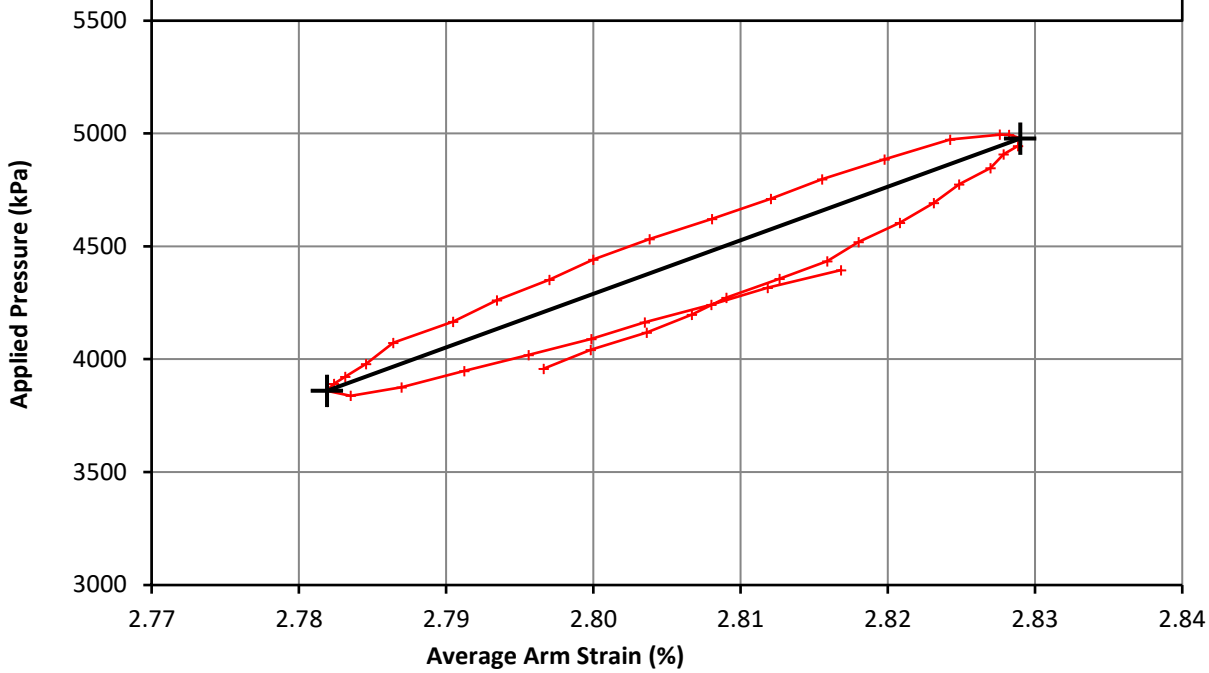
Loop 2	Shear Modulus	1454.5	MPa
	Cavity Strain Range	0.008	%

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T07 - 06**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Analysis - Unload Reload Loop

IN SITU SITE INVESTIGATION

Test Date	03/07/2025	**Test No.**	7
Borehole	BH107	**Test Depth (m)**	47.00



Loop 3	Shear Modulus	1220.4	MPa
	Cavity Strain Range	0.047	%

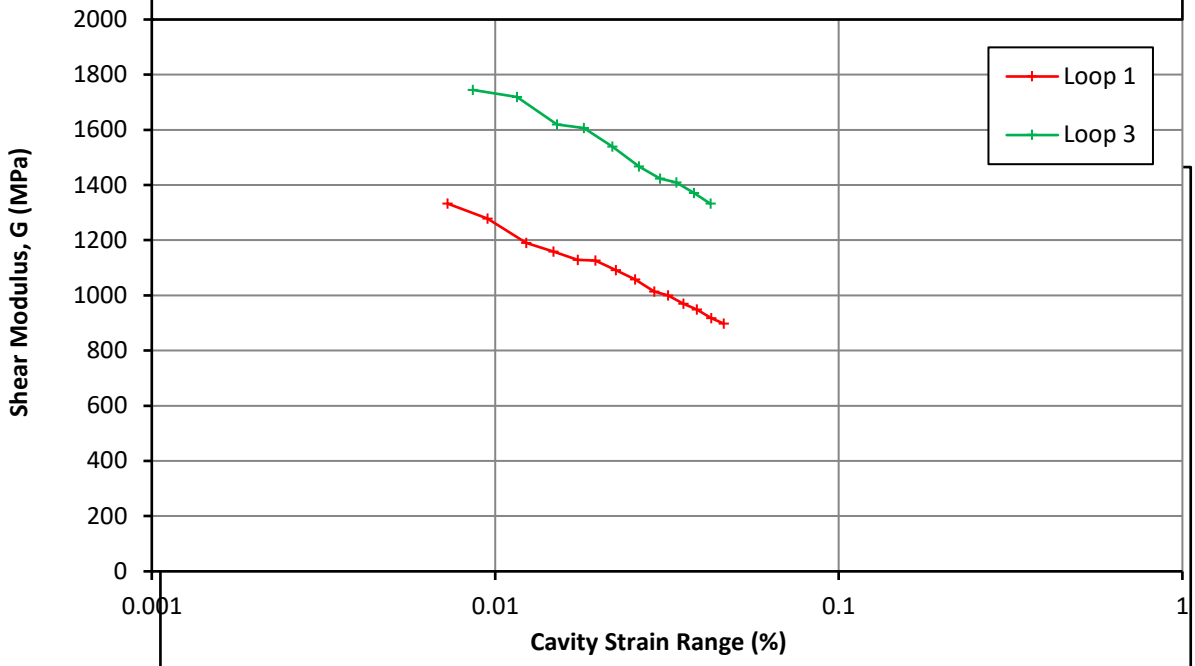
Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T07 - 07**
Client	FBJV		
Project No.	P1250112		

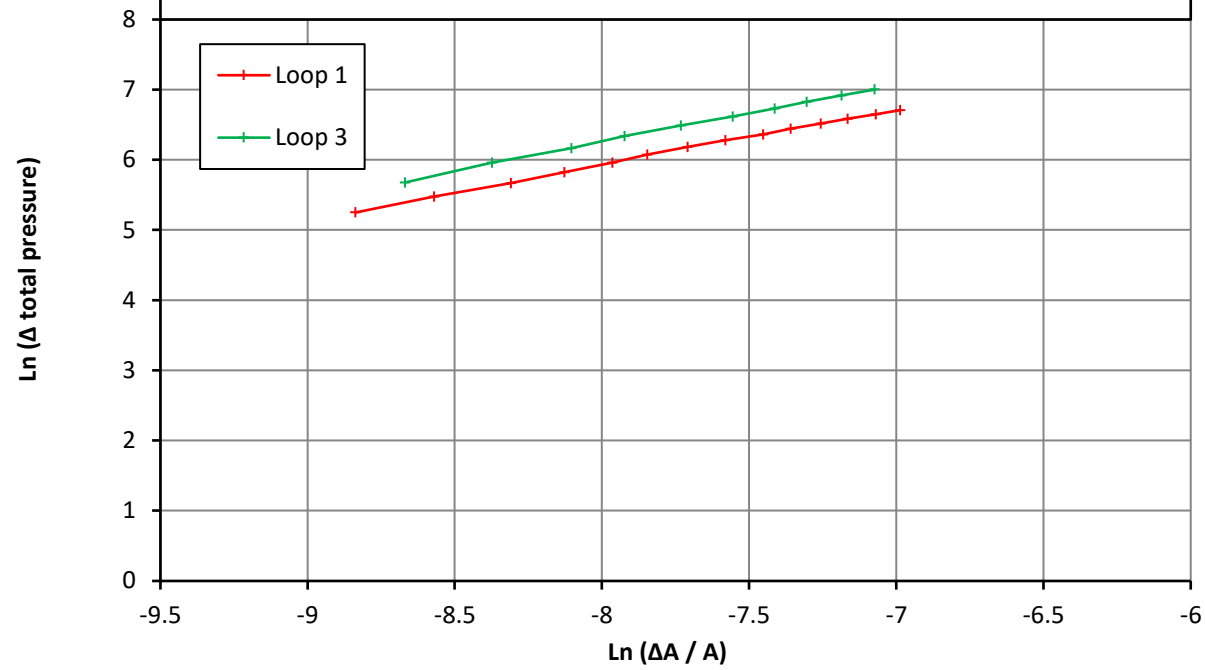
Pressuremeter Analysis

Small Strain Stiffness and Bolton & Whittle (1999)

IN SITU SITE INVESTIGATION

Test Date	03/07/2025	**Test No.**	7
Borehole	BH107	**Test Depth (m)**	47.00





Loop 1	
Gradient(β)	Intercept
0.791	209.530 (MPa)

Loop 3	
Gradient(β)	Intercept
0.823	375.728 (MPa)

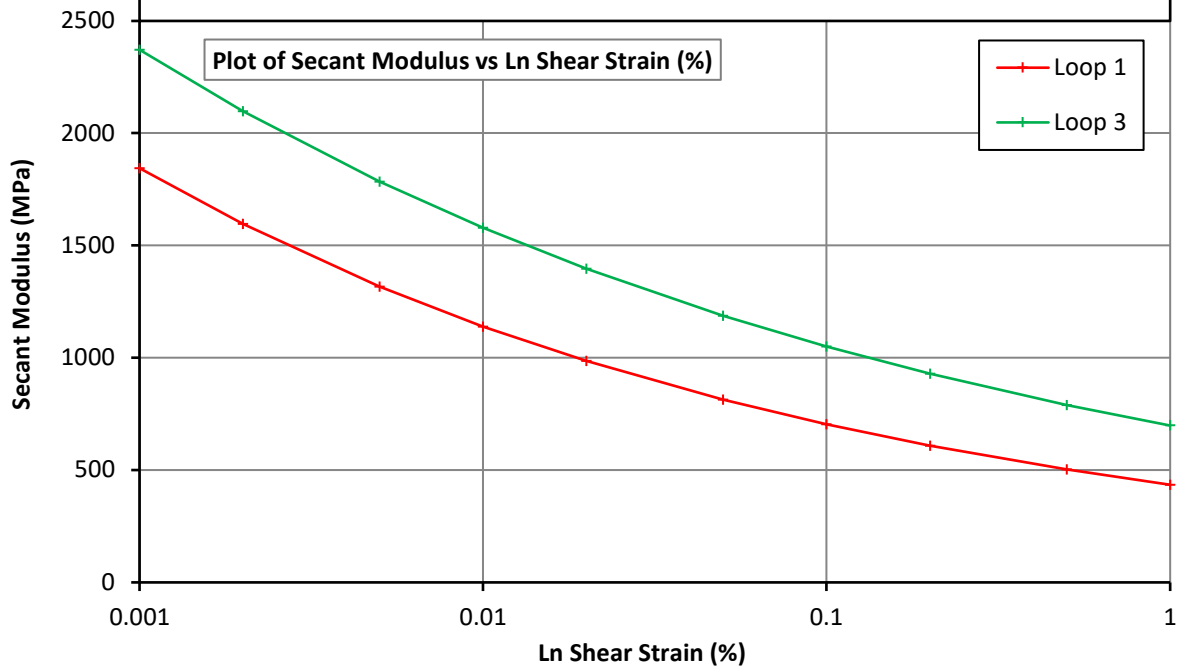
Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T07 - 08**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Analysis

Secant Modulus - Shear Strain (%)

IN SITU SITE INVESTIGATION

Test Date	03/07/2025	**Test No.**	7
Borehole	BH107	**Test Depth (m)**	47.00



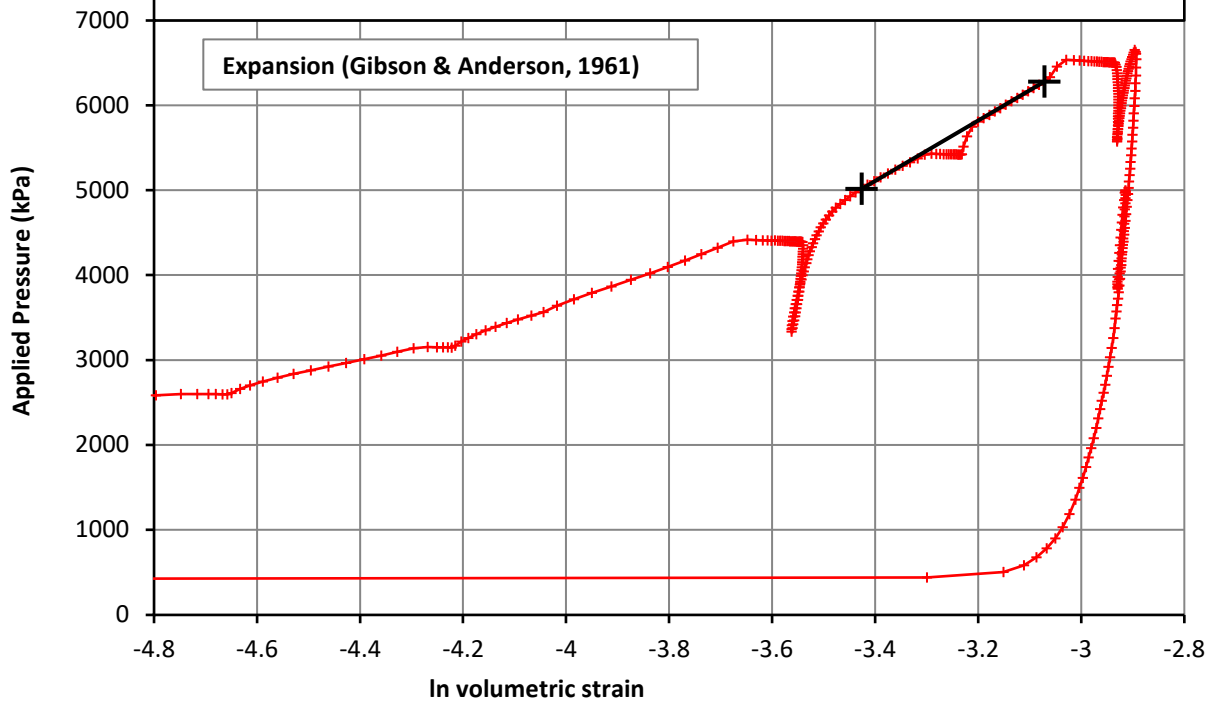
Shear Strain	Loop 1	Loop 3
0.001%	**1844**	**2371**
0.002%	1595	2098
0.005%	1317	1784
0.010%	**1139**	**1578**
0.020%	985	1396
0.050%	813	1187
0.100%	**703**	**1050**
0.200%	608	929
0.500%	502	790
1.000%	**434**	**699**

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T07 - 09**
Client	FBJV		
Project No.	P1250112		

Pressuremeter Analysis - Undrained Strength

IN SITU SITE INVESTIGATION

Test Date	03/07/2025	**Test No.**	7
Borehole	BH107	**Test Depth (m)**	47.00



Strength (loading)	Undrained Shear	3551	kPa
	Limit Pressure	17187	kPa

Project	Grain to Tilbury Tunnel GI	**Figure No.**	**BH107 T07 - 10**
Client	FBJV		
Project No.	P1250112		

Appendix B Calibrations

Description	Pages included	Page No.
HPD Calibration Record		
HPD06 – Kylie	1	88

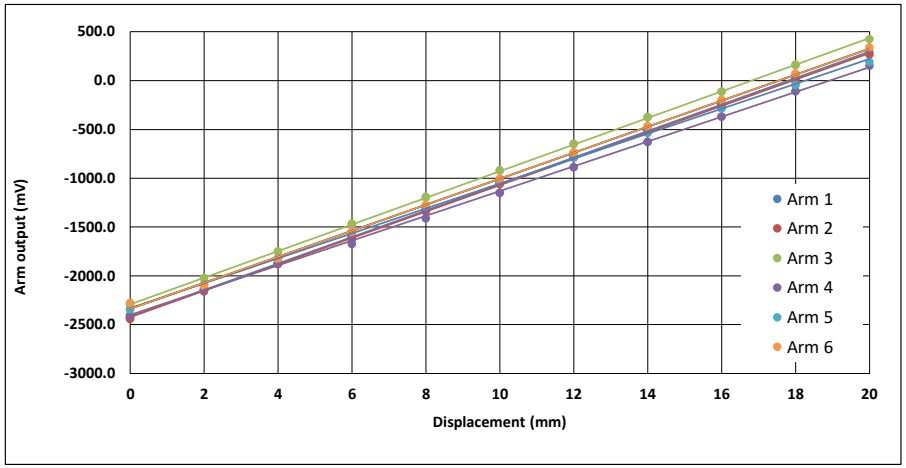
Calibration Record

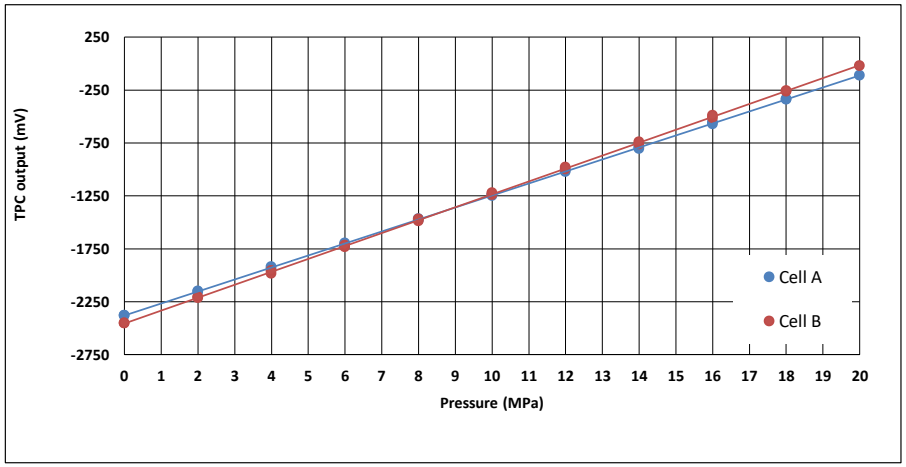
HPD06 - Kylie

IN SITU SITE INVESTIGATION

Arms	07/03/2025					
Displacement	Arm 1	Arm 2	Arm 3	Arm 4	Arm 5	Arm 6
mm	mV	mV	mV	mV	mV	mV
0	-2418.0	-2457.2	-2307.0	-2437.1	-2343.0	-2264.8
2	-2140.9	-2189.0	-2031.9	-2167.8	-2090.9	-2020.2
4	-1861.8	-1901.7	-1750.5	-1899.4	-1820.0	-1741.6
6	-1585.7	-1624.0	-1472.8	-1634.2	-1552.5	-1468.5
8	-1312.1	-1348.3	-1198.0	-1371.1	-1293.1	-1195.9
10	-1043.4	-1077.2	-924.0	-1108.2	-1036.5	-923.6
12	-772.3	-808.4	-649.3	-847.4	-780.1	-653.9
14	-504.0	-542.1	-378.2	-586.7	-562.0	-384.8
16	-236.2	-277.0	-109.6	-326.5	-279.4	-116.5
18	24.9	-15.2	156.1	-69.0	-39.3	152.2
20	289.4	243.9	411.1	191.7	194.8	418.6
18	26.6	-17.2	153.8	-68.9	-38.3	151.2
16	-235.2	-281.8	-112.6	-327.6	-280.1	-116.7
14	-502.8	-547.7	-381.7	-588.0	-525.8	-385.9
12	-772.1	-813.7	-653.8	-848.6	-780.7	-655.7
10	-1043.1	-1083.5	-928.3	-1111.7	-1035.6	-926.7
8	-1315.3	-1356.0	-1202.5	-1372.7	-1292.4	-1198.9
6	-1588.8	-1632.2	-1478.1	-1635.3	-1553.0	-1468.5
4	-1863.0	-1908.9	-1756.3	-1901.5	-1819.1	-1747.3
2	-2141.7	-2185.9	-2034.3	-2170.4	-2091.9	-2020.6
0	-2418.8	-2460.0	-2301.8	-2439.6	-2346.5	-2270.3
Slope (mV/mm)	135.6	135.6	136.6	131.4	127.9	135.1
Zero (mV)	-2406.6	-2447.8	-2298.6	-2428.6	-2330.8	-2279.0

Pressure Cells	07/03/2025	
Pressure	Cell A	Cell B
MPa	mV	mV
0	-2188.6	-1957.8
2	-1984.0	-1751.0
4	-1774.9	-1540.4
6	-1567.9	-1332.3
8	-1357.8	-1115.3
10	-1146.1	-908.4
12	-933.9	-693.3
14	-728.7	-486.2
16	-513.2	-267.5
18	-302.1	-33.1
20	-97.3	153.5
18	-309.1	-62.9
16	-509.4	-261.9
14	-720.2	-474.9
12	-924.0	-680.7
10	-1137.8	-1084.1
8	-1343.5	-1104.3
6	-1554.7	-1317.9
4	-1764.4	-1530.1
2	-1974.7	-1742.9
0	-2187.0	-1956.3
Slope (mV/MPa)	104.7	105.7
Zero (mV)	-2188.1	-1966.3





System Complaince	1.6 mm/Gpa

Calibrated by:	I Musson
Calibrated at:	Rotherham
Checked by:	J Holt
Date:	07/03/2025

SOIL ENGINEERING

SUPPORTING FACTUAL DATA

SECTION A
Exploratory Hole Records and Field Data

GROUNDWATER / GAS MONITORING RESULTS

Project Name	Grain to Tilbury Tunnel GI
Project No.	TB8754
Engineer	Mott MacDonald
Employer	FBJV

SOIL ENGINEERING

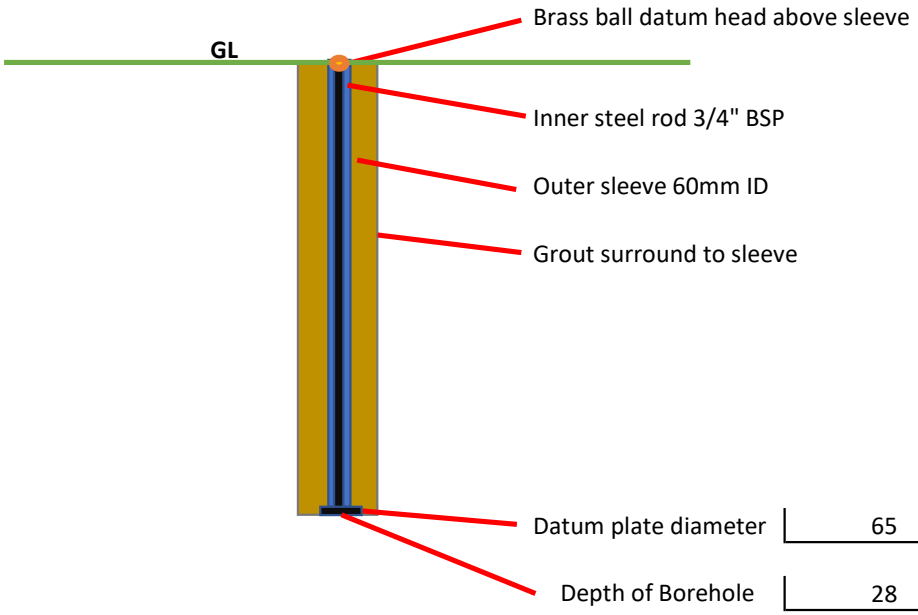
Deep Datum Installation Record

Location ID	BH301	Install Supervisor	Paschalis Staikos
Date of Install	03/07/2025	Lead Driller	Dale Sargeant

Coords:

Easting	566441.322
Northing	175781.639
Level	7.402

Height of datum rod (s)
7.402 m



Datum plate diameter	65	mm
Depth of Borehole	28	mBgl

Install Comments

Grout ratio = 1/0.3/3

Grout volume = 1280

Form V1.1 - PS - 2025-06-10

Project Name	Grain to Tilbury Tunnel GI
Project No.	TB8754
Engineer	Mott MacDonald
Employer	FBJV

SOIL ENGINEERING

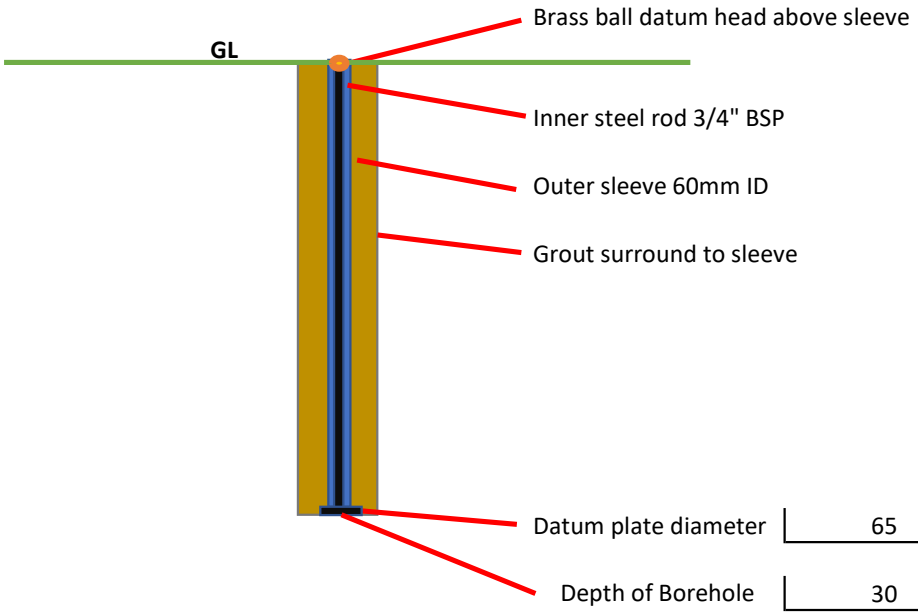
Deep Datum Installation Record

Location ID	BH302	Install Supervisor	Paschalis Staikos
Date of Install	14/07/2025	Lead Driller	Dale Sargeant

Coords:

Easting	566606.405
Northing	175776.429
Level	8.212

Height of datum rod (s)
8.212 m



Datum plate diameter	65	mm
Depth of Borehole	30	mBgl

Install Comments

Grout ratio = 1/0.3/3

Grout volume = 1440

Form V1.1 - PS - 2025-06-10

Project Name	Grain to Tilbury Tunnel GI
Project No.	TB8754
Engineer	Mott MacDonald
Employer	FBJV

SOIL ENGINEERING

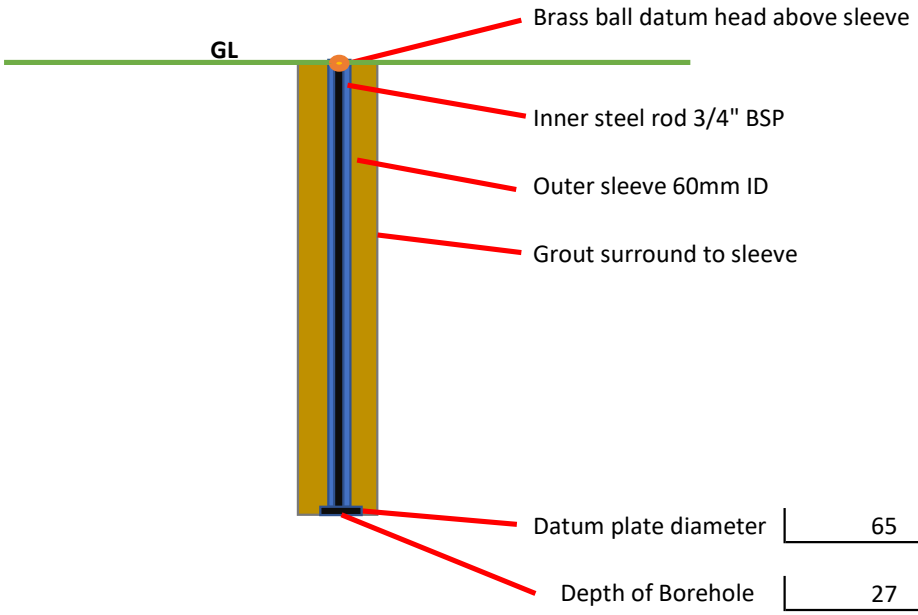
Deep Datum Installation Record

Location ID	BH303	Install Supervisor	Paschalis Staikos
Date of Install	30/06/2025	Lead Driller	Dale Sargeant

Coords:

Easting	566408.665
Northing	175525.029
Level	5.32

Height of datum rod (s)
5.32 m



Datum plate diameter	65	mm
Depth of Borehole	27	mBgl

Install Comments

Grout ratio = 1/0.3/3

Grout volume = 1280

Form V1.1 - PS - 2025-06-10

Project Name	Grain to Tilbury Tunnel GI
Project No.	TB8754
Engineer	Mott MacDonald
Employer	FBJV

SOIL ENGINEERING

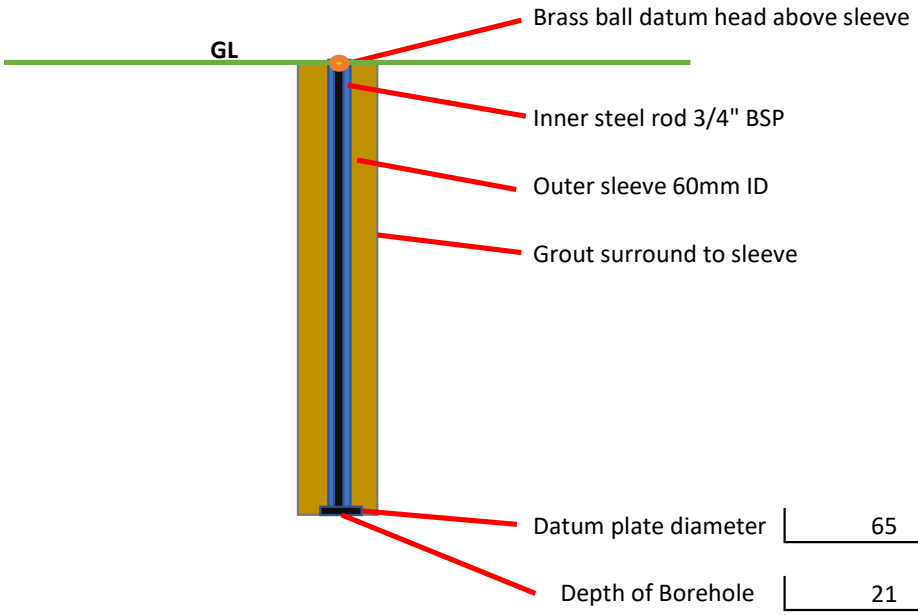
Deep Datum Installation Record

Location ID	BH304	Install Supervisor	Paschalis Staikos
Date of Install	24/06/2025	Lead Driller	Dale Sargeant

Coords:

Easting	567352.785
Northing	174259.483
Level	2.383

Height of datum rod (s)
2.383 m



Datum plate diameter	65	mm
Depth of Borehole	21	mBgl

Install Comments

Grout ratio = 1/0.3/3

Grout volume = 1120

Form V1.1 - PS - 2025-06-10

Project Name	Grain to Tilbury Tunnel GI
Project No.	TB8754
Engineer	Mott MacDonald
Employer	FBJV

SOIL ENGINEERING

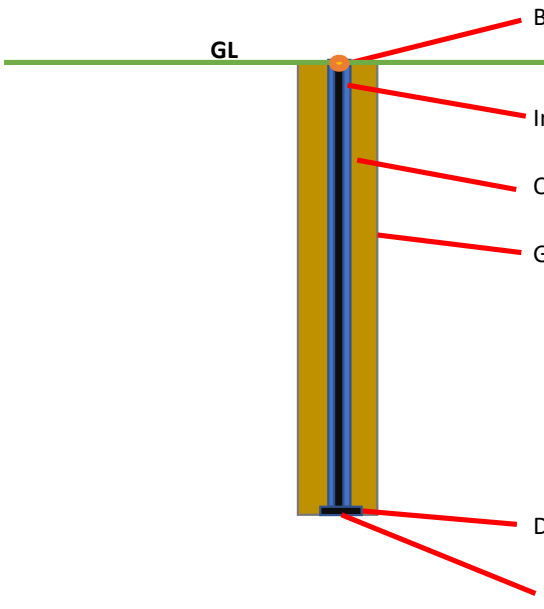
Deep Datum Installation Record

Location ID	BH305	Install Supervisor	Paschalis Staikos
Date of Install	12/06/2025	Lead Driller	Dale Sargeant

Coords:

Easting	567402.083
Northing	174012.693
Level	2.403

Height of datum rod (s)
2.403 m



Brass ball datum head above sleeve

Inner steel rod 3/4" BSP

Outer sleeve 60mm ID

Grout surround to sleeve

Datum plate diameter	65	mm
Depth of Borehole	24	mBgl

Install Comments

Grout ratio = 1/0.3/3

Grout volume = 1200

Form V1.1 - PS - 2025-06-10

Project Name	Grain to Tilbury Tunnel GI
Project No.	TB8754
Engineer	Mott MacDonald
Employer	FBJV

SOIL ENGINEERING

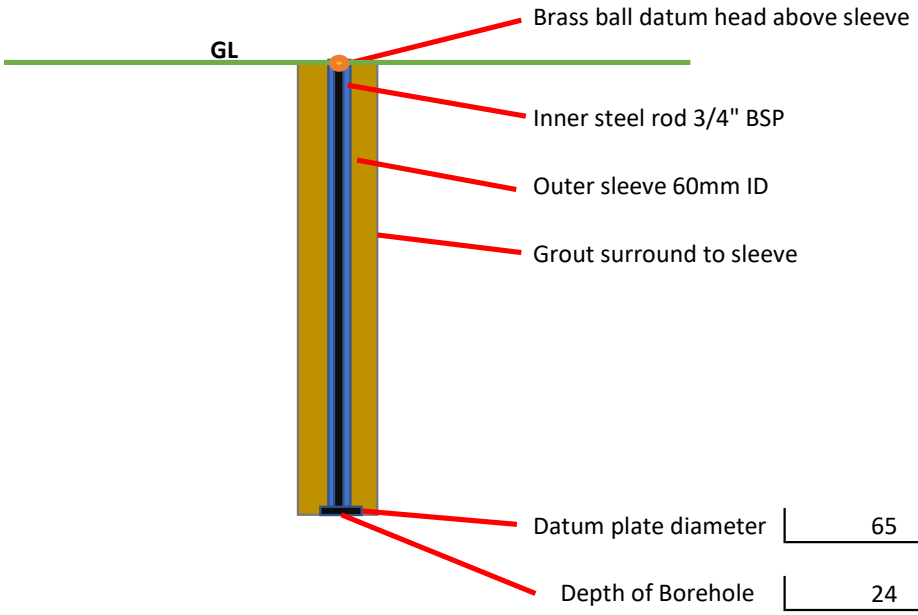
Deep Datum Installation Record

Location ID	BH306	Install Supervisor	Paschalis Staikos
Date of Install	12/06/2025	Lead Driller	Dale Sargeant

Coords:

Easting	567537.151
Northing	173995.66
Level	2.541

Height of datum rod (s)
2.541 m



Datum plate diameter	65	mm
Depth of Borehole	24	mBgl

Install Comments

Grout ratio = 1/0.3/3

Grout volume = 1200

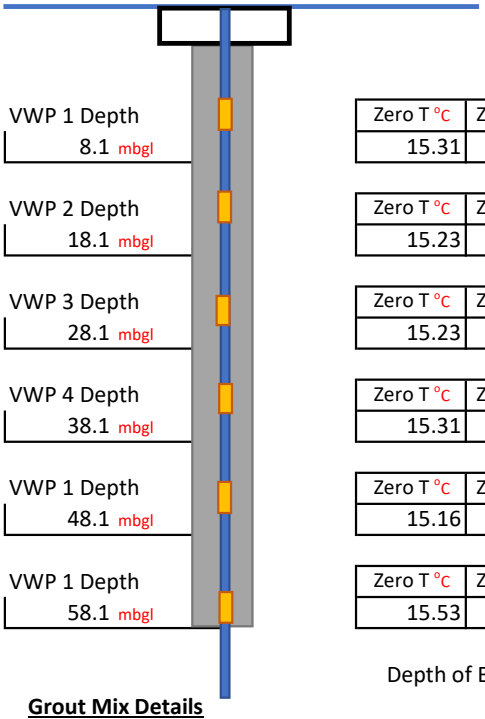
Form V1.1 - PS - 2025-06-10

Project Name	Grain to Tilbury Tunnel GI
Project No.	TB8754
Engineer	Mott MacDonald
Employer	FBJV

SOIL ENGINEERING

Vibrating Wire Piezometer as-builts

Location ID	BH101	Rig Supervisor	Daniel Canneuax
Date of Install	06/06/2025	Lead Driller	Carl Gardner



VWP 1 Depth	Zero T °C	Zero Digits B	Pre T °C	Pre Digits B	Grout T °C	Grout Digits B	Post T °C	Post Digits B
8.1 mbgl	15.31	9179.69	14.3	8581.38	14	8580.2	13.6	8583.7
VWP 2 Depth	Zero T °C	Zero Digits B	Pre T °C	Pre Digits B	Grout T °C	Grout Digits B	Post T °C	Post Digits B
18.1 mbgl	15.23	9928.8	13.61	8419.28	13.3	8418.3	12.9	8422.8
VWP 3 Depth	Zero T °C	Zero Digits B	Pre T °C	Pre Digits B	Grout T °C	Grout Digits B	Post T °C	Post Digits B
28.1 mbgl	15.23	9252.55	13.41	6904.28	13.5	6905.3	13	6907.4
VWP 4 Depth	Zero T °C	Zero Digits B	Pre T °C	Pre Digits B	Grout T °C	Grout Digits B	Post T °C	Post Digits B
38.1 mbgl	15.31	9559.85	13.15	6489.25	14.7	6437.4	13.6	6487.2
VWP 1 Depth	Zero T °C	Zero Digits B	Pre T °C	Pre Digits B	Grout T °C	Grout Digits B	Post T °C	Post Digits B
48.1 mbgl	15.16	9534.51	12.95	5838.99	15.5	5733.6	13.7	5837.1
VWP 1 Depth	Zero T °C	Zero Digits B	Pre T °C	Pre Digits B	Grout T °C	Grout Digits B	Post T °C	Post Digits B
58.1 mbgl	15.53	9783.76	13.08	6503.52	13.2	6544.9	12.9	6547.5

Depth of Borehole 60.5 m

Grout Mix Details

Ratio Used (C|B|W)	1/0.4/6.6
Grout Volume	1760lt

Check List

- ☐ Bore hole depth checked and noted
- ☐ Pipe measured and install depths marked
- ☐ VWP Tips soaked for 12hrs prior to install
- ☐ Photo taken during Installation
- ☐ Tips installed in Tip Up Orientation

Install Comments

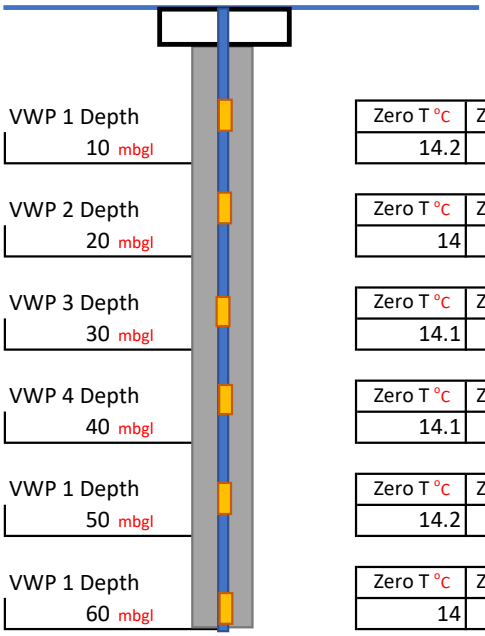
Borehole before installation dipped
at 60.5m
During the installation the pipe with
with the VWP cable and sensors couldn't
move below 58.1m depth.
Agreed with the Employer to install
the VWP at 58.1m

Project Name	Grain to Tilbury Tunnel GI
Project No.	TB8754
Engineer	Mott MacDonald
Employer	FBJV

SOIL ENGINEERING

Vibrating Wire Piezometer as-builts

Location ID	BH104	Rig Supervisor	Emily Cross
Date of Install	18/06/2025	Lead Driller	Pete Smallwood



VWP 1 Depth 10 mbgl

Zero T °C	Zero Digits B	Pre T °C	Pre Digits B	Grout T °C	Grout Digits B	Post T °C	Post Digits B
14.2	8691.2	14.1	7970.5	14.2	7971.5	14.1	7970.5

VWP 2 Depth 20 mbgl

Zero T °C	Zero Digits B	Pre T °C	Pre Digits B	Grout T °C	Grout Digits B	Post T °C	Post Digits B
14	9354.3	14.8	7980.1	14.8	7983.1	14.8	7980.1

VWP 3 Depth 30 mbgl

Zero T °C	Zero Digits B	Pre T °C	Pre Digits B	Grout T °C	Grout Digits B	Post T °C	Post Digits B
14.1	9645.6	17.5	7416.4	17.6	7416.4	17.5	7415.8

VWP 4 Depth 40 mbgl

Zero T °C	Zero Digits B	Pre T °C	Pre Digits B	Grout T °C	Grout Digits B	Post T °C	Post Digits B
14.1	9288.6	14.9	6906.9	14.9	6916.3	14.9	6908.2

VWP 1 Depth 50 mbgl

Zero T °C	Zero Digits B	Pre T °C	Pre Digits B	Grout T °C	Grout Digits B	Post T °C	Post Digits B
14.2	9210.1	15.1	6102.1	15.3	6106.8	15.6	5691.6

VWP 1 Depth 60 mbgl

Zero T °C	Zero Digits B	Pre T °C	Pre Digits B	Grout T °C	Grout Digits B	Post T °C	Post Digits B
14	9387.6	13.1	6607.5	13.1	6609.7	13.1	6608.3

Depth of Borehole 60.5 m

Grout Mix Details

Ratio Used (C|B|W)	1/0.4/6.6
Grout Volume	1440lt

Check List

- ☐ Bore hole depth checked and noted
- ☐ Pipe measured and install depths marked
- ☐ VWP Tips soaked for 12hrs prior to install
- ☐ Photo taken during Installation
- ☐ Tips installed in Tip Up Orientation

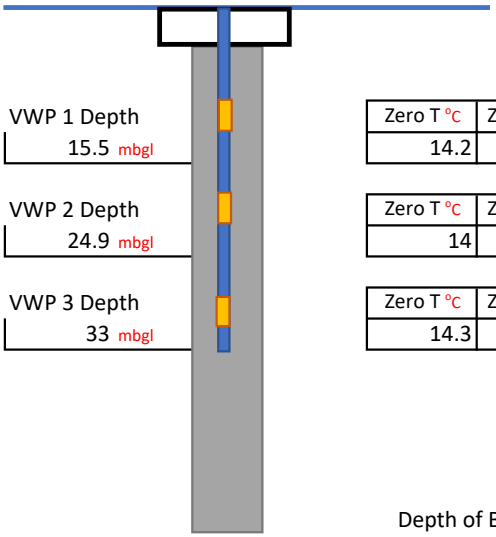
Install Comments

Project Name	Grain to Tilbury Tunnel GI
Project No.	TB8754
Engineer	Mott MacDonald
Employer	FBJV

SOIL ENGINEERING

Vibrating Wire Piezometer as-builts

Location ID	BH105	Rig Supervisor	Emily Cross
Date of Install	26/06/2025	Lead Driller	Pete Smallwood



VWP 1 Depth: 15.5 mbgl

Zero T °C	Zero Digits B	Pre T °C	Pre Digits B	Grout T °C	Grout Digits B	Post T °C	Post Digits B
14.2	9913.1	14.4	9525.8	14.4	9124.6	13.2	8881.6

VWP 2 Depth: 24.9 mbgl

Zero T °C	Zero Digits B	Pre T °C	Pre Digits B	Grout T °C	Grout Digits B	Post T °C	Post Digits B
14	9442.1	13.5	7827.7	13.5	7829.4	12.8	7827.8

VWP 3 Depth: 33 mbgl

Zero T °C	Zero Digits B	Pre T °C	Pre Digits B	Grout T °C	Grout Digits B	Post T °C	Post Digits B
14.3	9489.5	13.9	7523	13.8	7520.2	13	7522.4

Depth of Borehole: 60.5 m

Grout Mix Details

Ratio Used (C|B|W)	1/0.4/6.6
Grout Volume	640lt
Grout volume below installation	1/0.3/5
	880lt

Check List

- ☐ Bore hole depth checked and noted
- ☐ Pipe measured and install depths marked
- ☐ VWP Tips soaked for 12hrs prior to install
- ☐ Photo taken during Installation
- ☐ Tips installed in Tip Up Orientation

Install Comments

SOIL ENGINEERING

SUPPORTING FACTUAL DATA

SECTION B
Laboratory Testing

KEY TO LABORATORY TEST RESULTS AND SUMMARY SHEETS

SECTION B: KEY TO LABORATORY TEST RESULTS AND SUMMARY SHEETS

FIELD IDENTIFICATION

Sample Type	U	Undisturbed sample	D	Small disturbed sample
	UT	Thin wall open drive tube sample	B	Bulk disturbed sample
	P	Piston sample	AMAL	Amalgamated sample
	TW	Thin walled sample	BLK	Block sample
	L	Liner sample	C	Core sample
Test status	Any result in italics indicates a test that is not within the scope of the UKAS accreditation for this laboratory.			

SUMMARY OF LABORATORY SOIL TESTS: INDEX / CLASSIFICATION TESTS

Particle density	p	Small pyknometer method	g	Gas jar method
Plastic index	N/P	Non plastic, although liquid limit will have been determined if requested		
Particle size (PSD)	1	Following value in silt column denotes combined clay and silt fraction		
	p	Following value in clay column denotes sedimentation by pipette, else sedimentation is by hydrometer.		

SUMMARY OF LABORATORY SOIL TESTS: STRENGTH AND PERMEABILITY TESTS

Triaxial	UU	Single stage unconsolidated quick undrained
	UUM	Multi stage unconsolidated quick undrained
	UU3	Set of 3 unconsolidated quick undrained
	CU	Single stage consolidated undrained
	CUM	Multi stage consolidated undrained
	CU3	Set of 3 consolidated undrained
	CD	Single stage consolidated drained
	CDM	Multi stage consolidated drained
	CD3	Set of 3 consolidated drained
		Note that single stage tests are reported assuming phi = 0 for total stress
Consolidation	Oed	One-dimensional oedometer
	mv	Coefficient of compressibility quoted for range p0 to p0 + 100kPa, where determined
Permeability	C	Constant head permeability
Shearbox	SSB	Small shear box
	LSB	Large shear box
	p	Peak value
	r	Residual shear strength
	RS	Ring shear

SOIL ENGINEERING

SECTION B: KEY TO LABORATORY TEST RESULTS AND SUMMARY SHEETS

SUMMARY OF LABORATORY SOIL RE-USE TESTS

MCV	s	MCV value at natural or specified moisture content
	int	Intercept of calibration line in MCV calibration

SUMMARY OF LABORATORY ROCK STRENGTH TESTS

Point Load	Type (combination of)	D	Diametral	A	Axial
		I	Irregular lump	B	Block
		L	Test performed parallel to planes of weakness		
		P	Test performed perpendicular to planes of weakness		
		X	Invalid failure of point load (not broken between points of load application)		

SUMMARY OF LABORATORY ROCK MATERIALS TESTS

Ten% fines	w	Soaked test	d	Dry test

Important note:
Summary sheets are provided for convenience and in no way replace individual test result sheets which shall, without exception, be regarded as the definitive result.

POINT LOAD INDEX RESULT

Point Load	Type (combination of)	D	Diametral	A	Axial
		I	Irregular lump	B	Block
		L	Test performed parallel to planes of weakness		
		P	Test performed perpendicular to planes of weakness		
		X	Invalid failure of point load (not broken between points of load application)		
Dimensions		W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump		
		D	Distance between platens when just in contact with specimen		
		D'	Distance between platens at point of failure		
		De	Equivalent core diameter	Is	P/De^2
		Is(50)	F x Is	F	$(De/50)^{0.45}$

Is(50) point load strength index corrected for a diametral test of core diameter 50mm
For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$
For Diametral tests $De^2 = D \times D'$

SOIL ENGINEERING

SUPPORTING FACTUAL DATA

SECTION B
Laboratory Testing

LABORATORY SOIL TEST DATA SHEETS

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH101
Project No.	TB8754		Sample Depth 3.00m
Engineer	Mott MacDonald		Sample Number 17
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type UT
Description	Grey CLAY.		Specimen Depth 3.03m
			Specimen Number 2

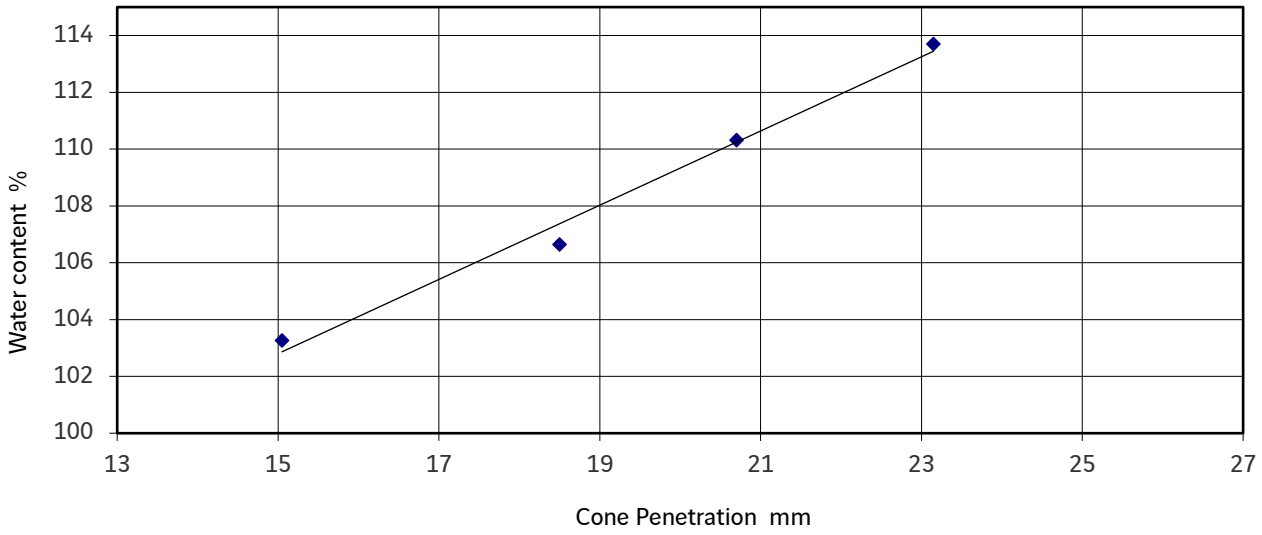
Water content	99.6	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

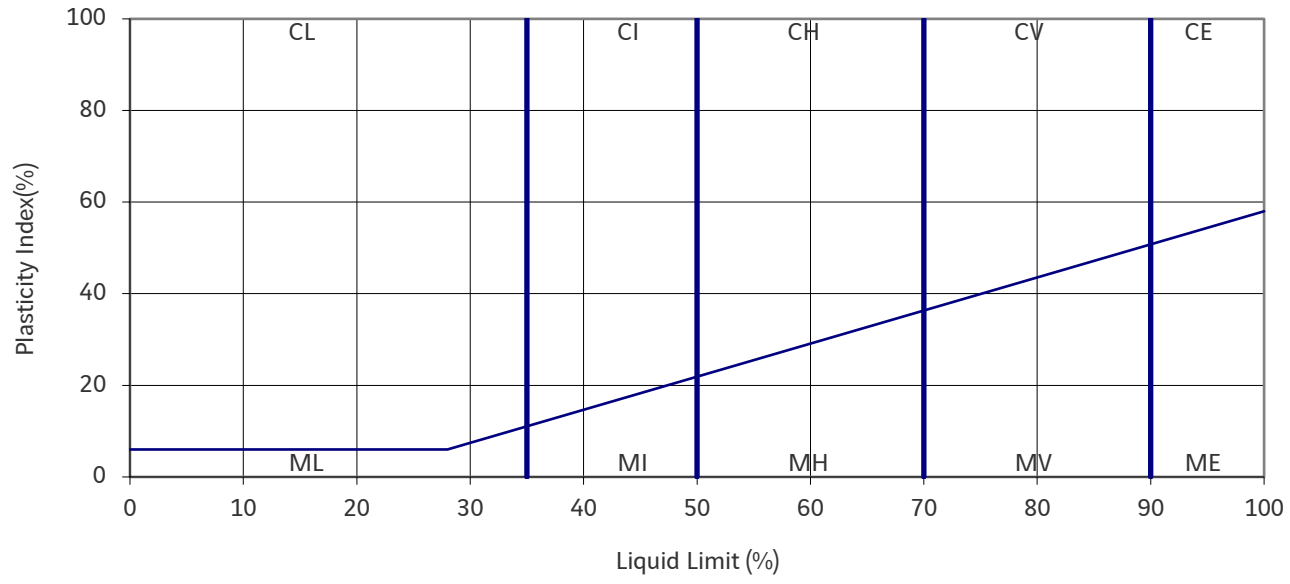
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 22/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH101
Project No.	TB8754		Sample Depth 3.00m
Engineer	Mott MacDonald		Sample Number 17
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type UT
Description	Grey CLAY.		Specimen Depth 3.03m
			Specimen Number 1



As received water content:	99.6%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	110%	Preparation of sample: Natural	
Plastic limit:	33%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	77%		
Water content of soil passing 425µm	99.6%		
Liquidity index:	0.865		

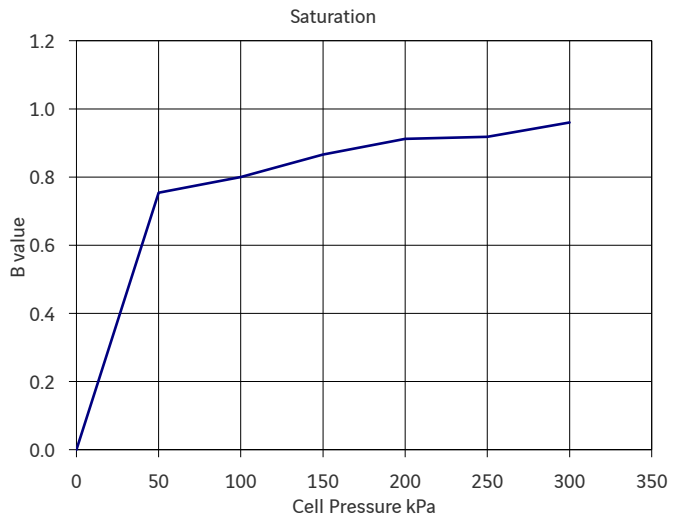


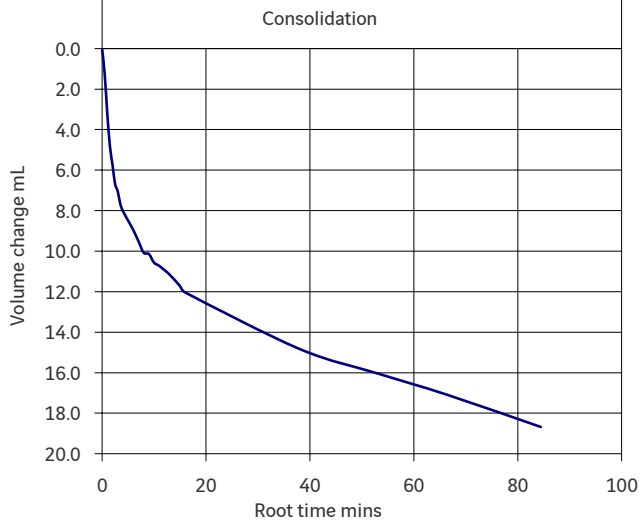
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 24/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH101
Project No.	TB8754		Sample Depth 4.00m
Engineer	Mott MacDonald		Sample Number 20
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Dark grey organic CLAY.		Specimen Depth 4.50m
			Specimen Number 1

SPECIMEN INITIAL DIMENSIONS		
Test number		1
Specimen diameter	mm	100.37
Specimen length	mm	196.00
Density	Mg/m^3	1.50
Moisture content	%	79
Dry density	Mg/m^3	0.84
SATURATION STAGE		
Initial pore water pressure	kPa	-0.6
Saturated pore water pressure	kPa	286
Final cell pressure	kPa	300
B value		0.96
CONSOLIDATION STAGE		
Cell pressure	kPa	325
Back pressure	kPa	300
Effective consolidation pressure	kPa	25
Initial pore water pressure	kPa	310
Final pore water pressure	kPa	300.4
Pore pressure dissipation	%	96.0
c_{vi}	$m^2/year$	0.30
m_{vi}	m^2/MN	1.25
SPECIMEN AFTER CONSOLIDATION		
Density	Mg/m^3	1.53
Moisture content	%	78
Dry density	Mg/m^3	0.86



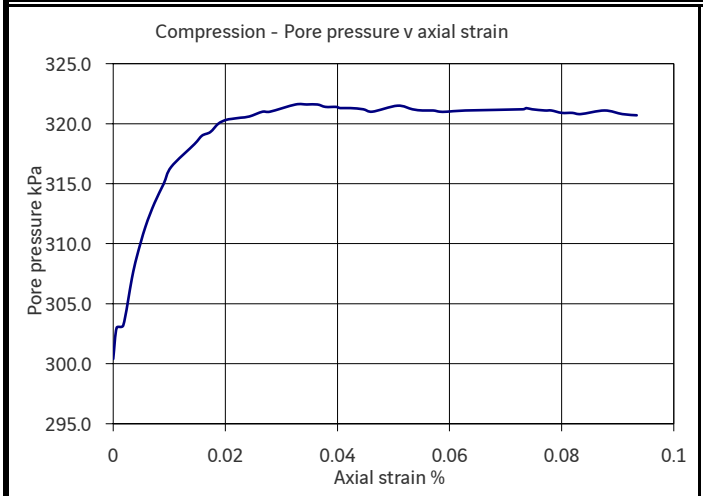


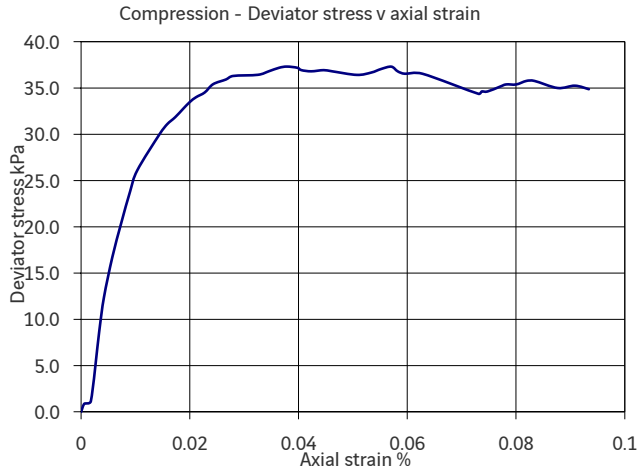
Remarks:
Specimen orientation Vertical
Specimen condition for test UNDISTURBED
Saturation with 50kPa increments with a differential pressure of 10kPa
Drainage from both ends and using a radial filter drain

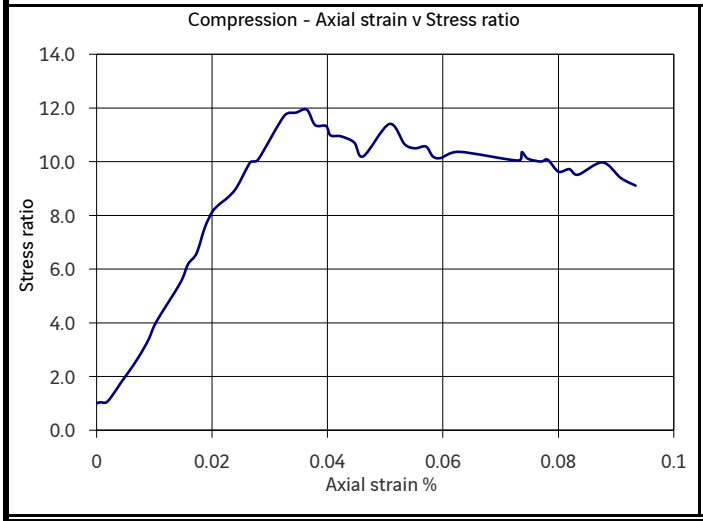
Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 12/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

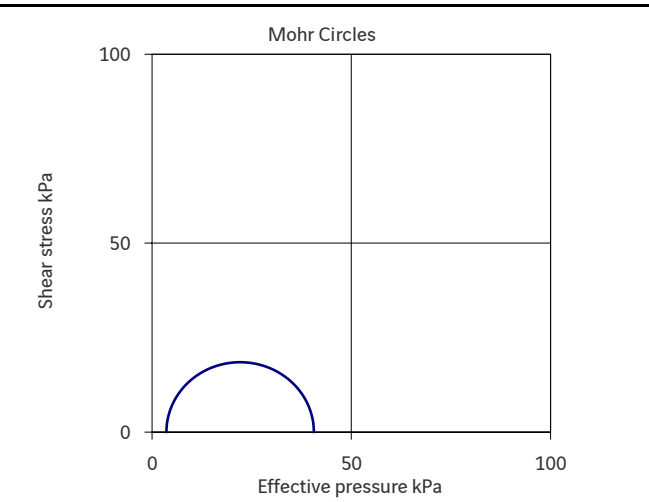
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH101
Project No.	TB8754		Sample Depth 4.00m
Engineer	Mott MacDonald		Sample Number 20
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Dark grey organic CLAY.		Specimen Depth 4.50m
			Specimen Number 1

COMPRESSION STAGE			
Test number			1
Cell pressure		kPa	325
Initial pore water pressure		kPa	300
Effective confining pressure		kPa	25
Failure conditions at			Maximum deviator stress
Axial strain at failure		%	0.0
Maximum deviator stress	σ_1-σ_3	kPa	37
Pore water pressure at failure	σ	kPa	321
Effective major principal stress	σ_1'	kPa	40.91
Effective minor principal stress	σ_3'	kPa	3.60
Effective principal stress ratio			11.36
Membrane correction		kPa	0.01
Filter drain correction		kPa	0.0
Pore pressure coefficient			0.6









Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 12/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

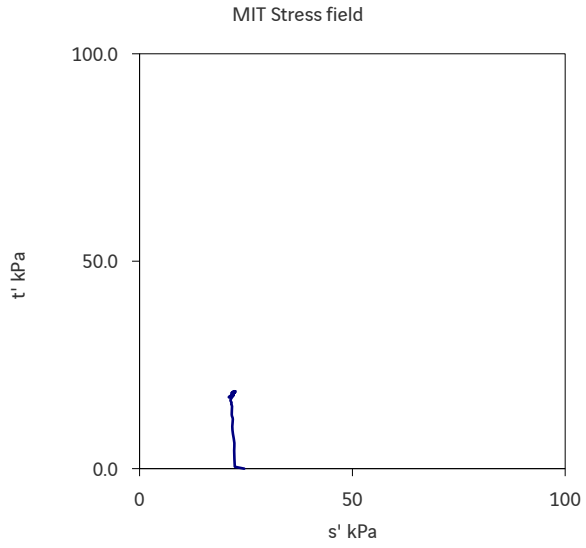
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH101
Project No.	TB8754		Sample Depth 4.00m
Engineer	Mott MacDonald		Sample Number 20
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Dark grey organic CLAY.		Specimen Depth 4.50m
			Specimen Number 1

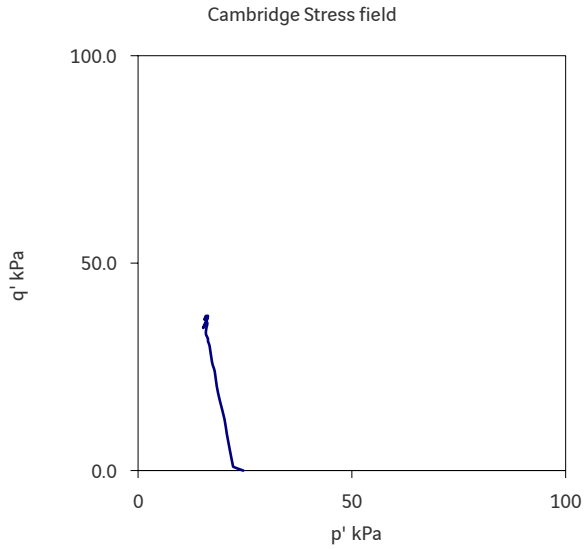
SPECIMEN AFTER TEST

Test number		1	
Mode of failure		Compound 	
Final moisture content	%	78	
Final bulk density	Mg/m^3	1.53	
Final dry density	Mg/m^3	0.86	

ADDITIONAL SPECIMEN DETAILS

Rate of strain	%/hour	0.20	
Failure criterion		Maximum deviator stress	





REMARKS

Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 12/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH101
Project No.	TB8754		Sample Depth 5.00m
Engineer	Mott MacDonald		Sample Number 22
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type UT
Description	Grey CLAY.		Specimen Depth 5.05m
			Specimen Number 2

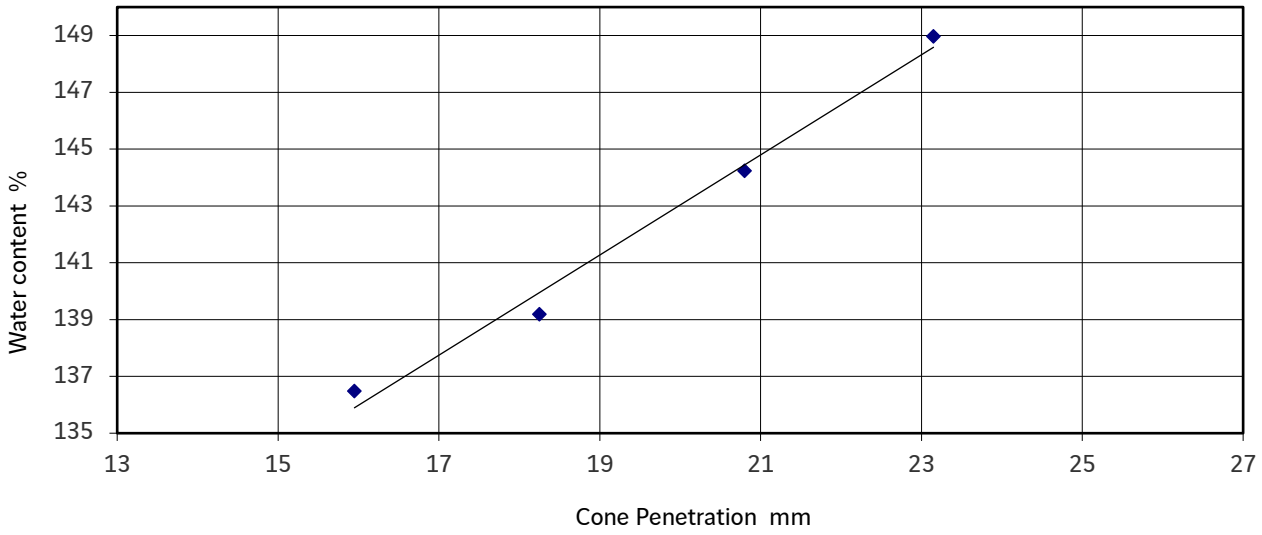
Water content	114	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

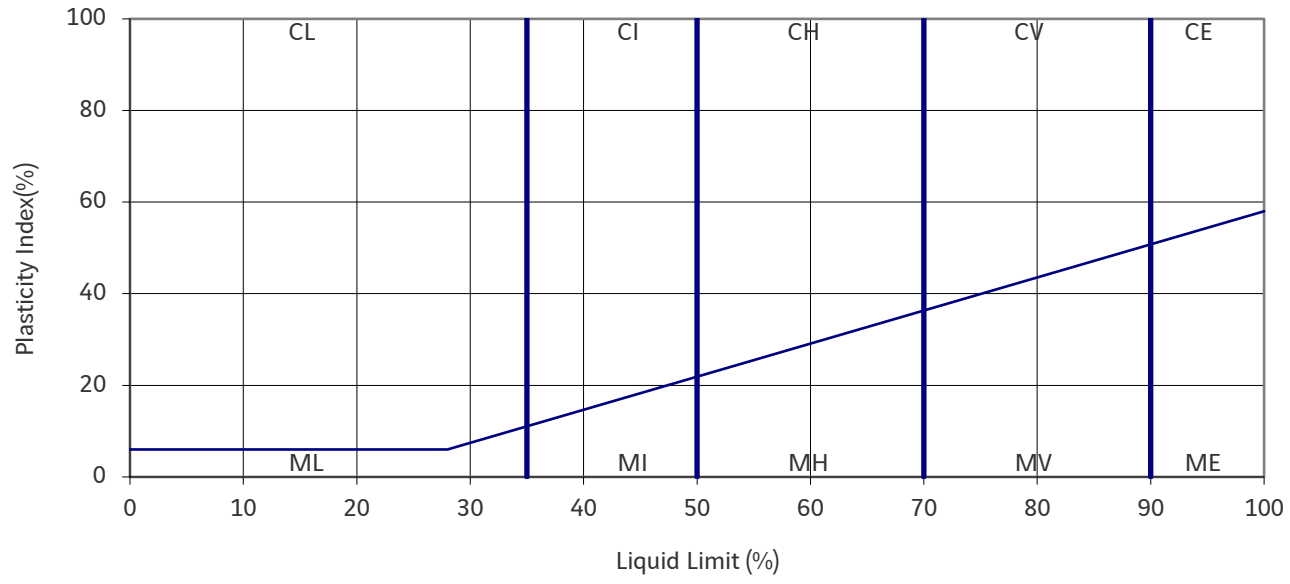
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 22/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH101
Project No.	TB8754		Sample Depth 5.00m
Engineer	Mott MacDonald		Sample Number 22
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type UT
Description	Grey CLAY.		Specimen Depth 5.05m
			Specimen Number 1



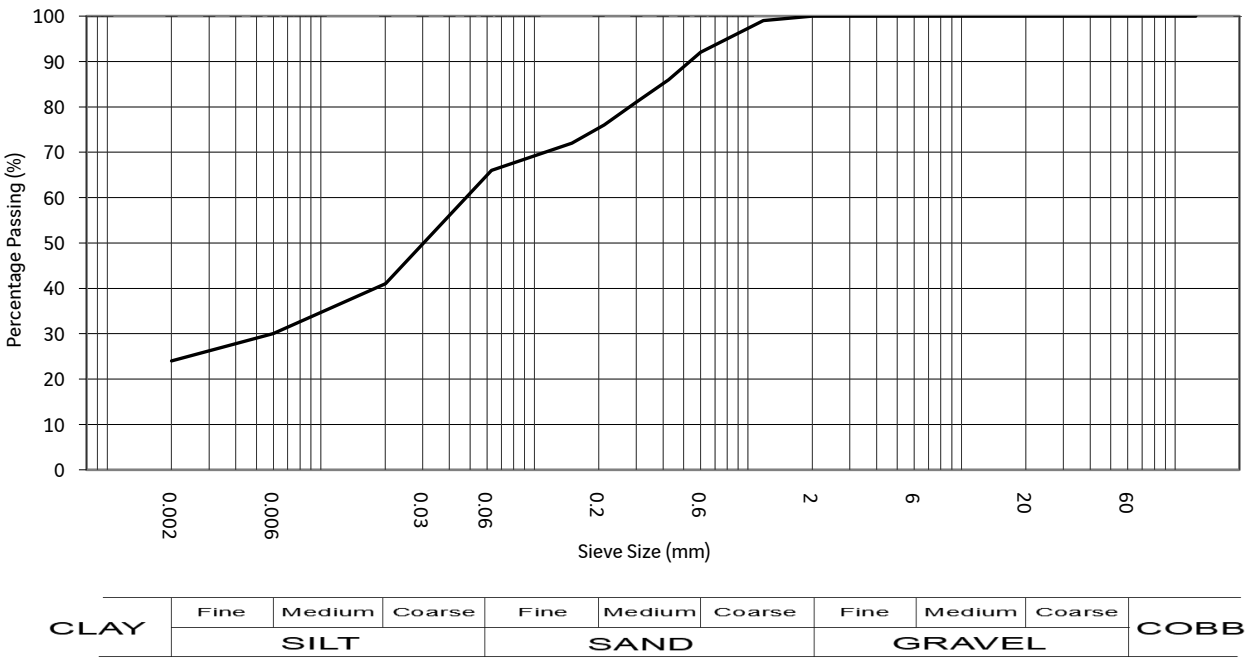
As received water content:	114%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	140%	Preparation of sample: Natural	
Plastic limit:	47%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	93%		
Water content of soil passing 425µm	114%		
Liquidity index:	0.719		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 24/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH101
Project No.	TB8754		Sample Depth 6.00m
Engineer	Mott MacDonald		Sample Number 25
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type P
Description	Dark brown amorphous PEAT.		Specimen Depth 6.70m
			Specimen No. 2



PARTICLE SIZE	%
Clay:	23.9
Silt:	42.6
Sand:	33.5
Gravel:	0.0
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA

Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	100
		10	100
		6.3	100
125.0	100	5	100
90.0	100	3.35	100
75.0	100	2	100
63.0	100	1.18	99
50.0	100	0.6	92
37.5	100	0.425	86
28.0	100	0.3	81
20.0	100	0.212	76
		0.15	72
		0.063	66

SEDIMENTATION DATA

Equivalent particle diameter mm	Cumulative % passing
0.020100	41
0.005990	30
0.002000	24

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:

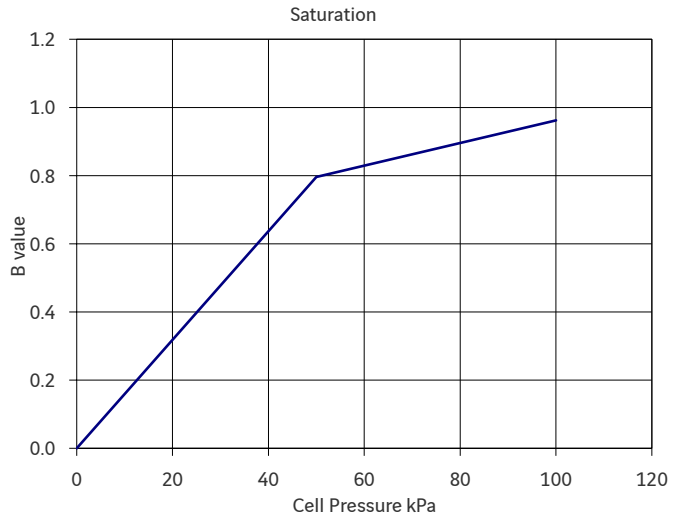
Paul Rodgers

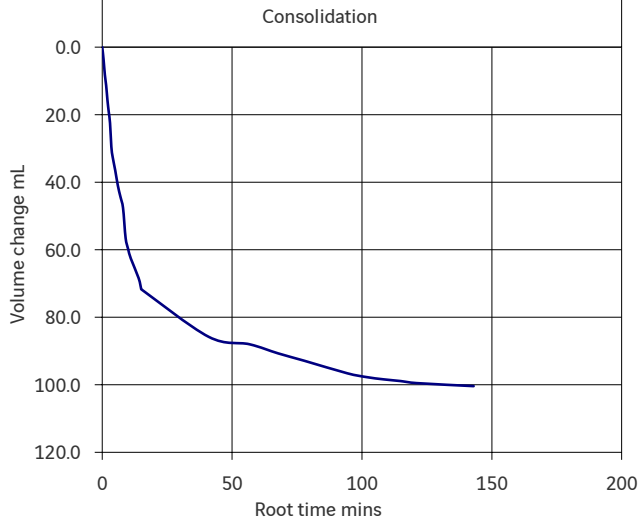
Print date 28/08/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH101
Project No.	TB8754		Sample Depth 6.00m
Engineer	Mott MacDonald		Sample Number 25
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Dark brown plastic amorphous PEAT.		Specimen Depth 6.70m
			Specimen Number 2

SPECIMEN INITIAL DIMENSIONS		
Test number		1
Specimen diameter	mm	101.27
Specimen length	mm	196.70
Density	Mg/m^3	1.09
Moisture content	%	259
Dry density	Mg/m^3	0.30
SATURATION STAGE		
Initial pore water pressure	kPa	1.4
Saturated pore water pressure	kPa	90.4
Final cell pressure	kPa	100
B value		0.962
CONSOLIDATION STAGE		
Cell pressure	kPa	335
Back pressure	kPa	300
Effective consolidation pressure	kPa	35
Initial pore water pressure	kPa	321.9
Final pore water pressure	kPa	301
Pore pressure dissipation	%	95.4
c_{vi}	$m^2/year$	0.37
m_{vi}	m^2/MN	3.03
SPECIMEN AFTER CONSOLIDATION		
Density	Mg/m^3	1.10
Moisture content	%	237
Dry density	Mg/m^3	0.33



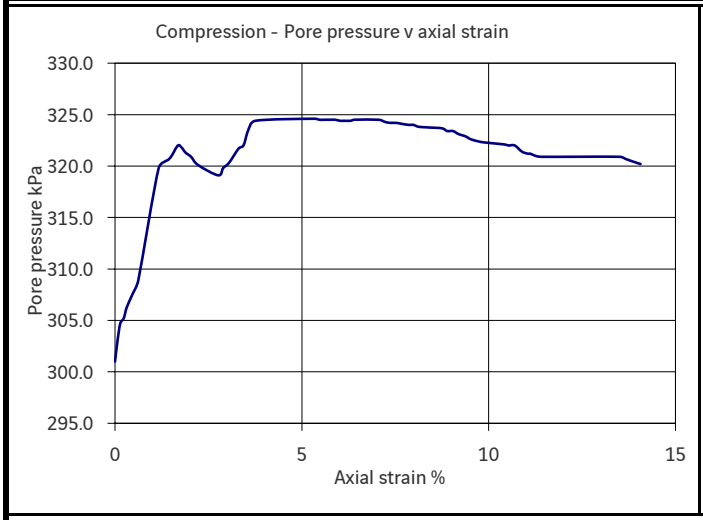


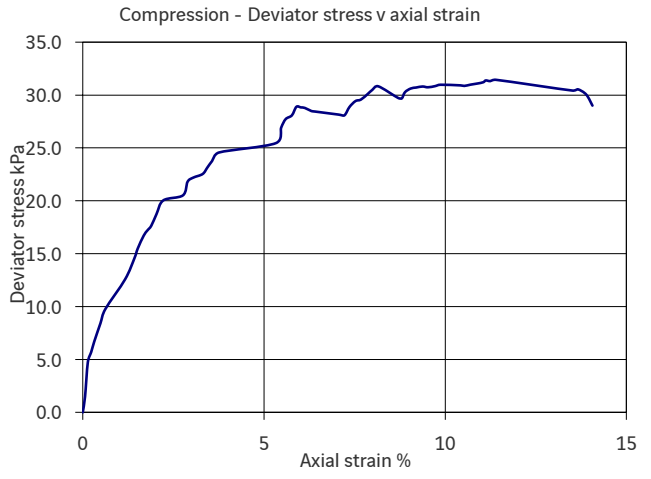
Remarks: Specimen orientation Vertical
Specimen condition for test UNDISTURBED
Saturation with 50kPa increments with a differential pressure of 10kPa
Drainage from both ends and using a radial filter drain

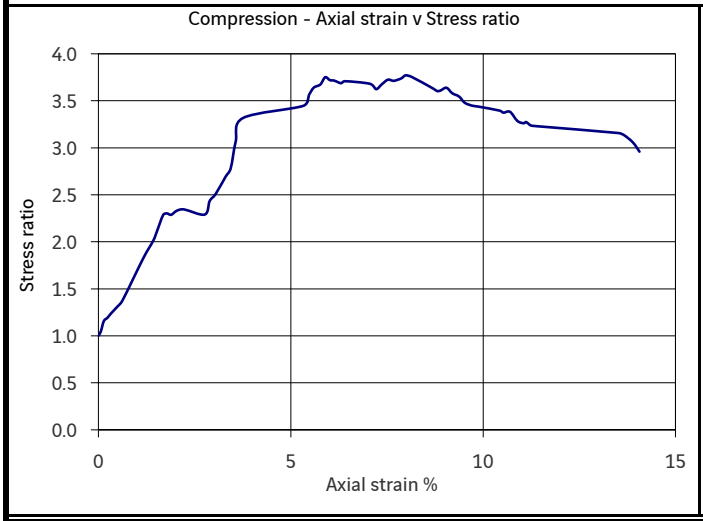
Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 26/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

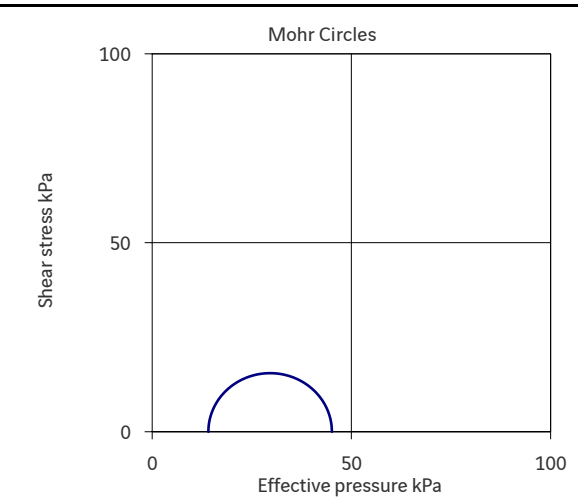
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH101
Project No.	TB8754		Sample Depth 6.00m
Engineer	Mott MacDonald		Sample Number 25
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Dark brown plastic amorphous PEAT.		Specimen Depth 6.70m
			Specimen Number 2

COMPRESSION STAGE			
Test number			1
Cell pressure		kPa	335
Initial pore water pressure		kPa	301
Effective confining pressure		kPa	34
Failure conditions at			Maximum deviator stress
Axial strain at failure		%	11.4
Maximum deviator stress	σ_1-σ_3	kPa	31
Pore water pressure at failure	σ	kPa	321
Effective major principal stress	σ_1'	kPa	45.54
Effective minor principal stress	σ_3'	kPa	14.10
Effective principal stress ratio			3.23
Membrane correction		kPa	1.19
Filter drain correction		kPa	3.5
Pore pressure coefficient			0.6









Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 26/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

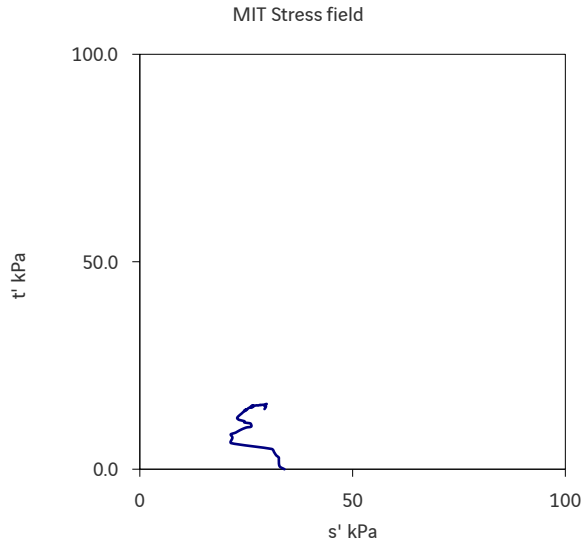
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH101
Project No.	TB8754		Sample Depth 6.00m
Engineer	Mott MacDonald		Sample Number 25
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Dark brown plastic amorphous PEAT.		Specimen Depth 6.70m
			Specimen Number 2

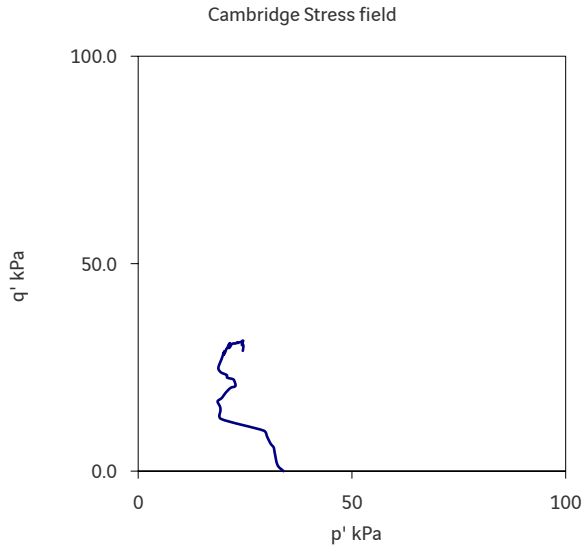
SPECIMEN AFTER TEST

Test number		1	
Mode of failure		Plastic 	
Final moisture content	%	237	
Final bulk density	Mg/m³	1.10	
Final dry density	Mg/m³	0.33	

ADDITIONAL SPECIMEN DETAILS

Rate of strain	%/hour	0.20	
Failure criterion		Maximum deviator stress	





REMARKS

Preliminary	Leeds Laboratory	Results apply to samples as received.	SOIL ENGINEERING
Paul Rodgers		Print date 26/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH101
Project No.	TB8754		Sample Depth 7.00m
Engineer	Mott MacDonald		Sample Number 26
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Dark brown PEAT.		Specimen Depth 7.00m
			Specimen Number 2

Water content	203	%
Oven temperature	50	°C
Is test result assumed to be a natural water content?	Yes	

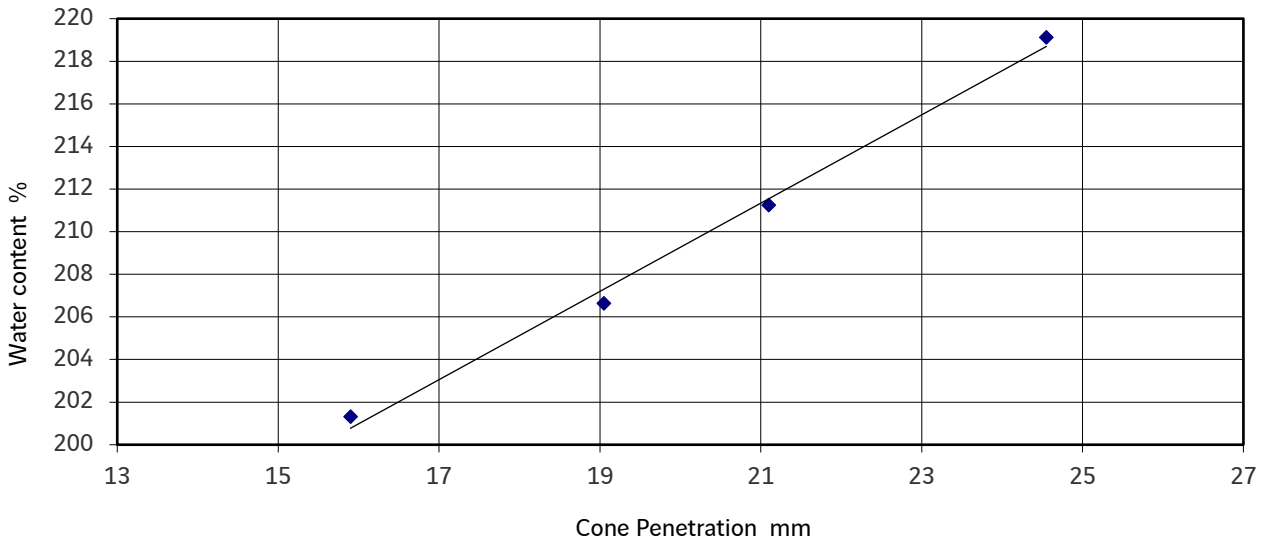
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

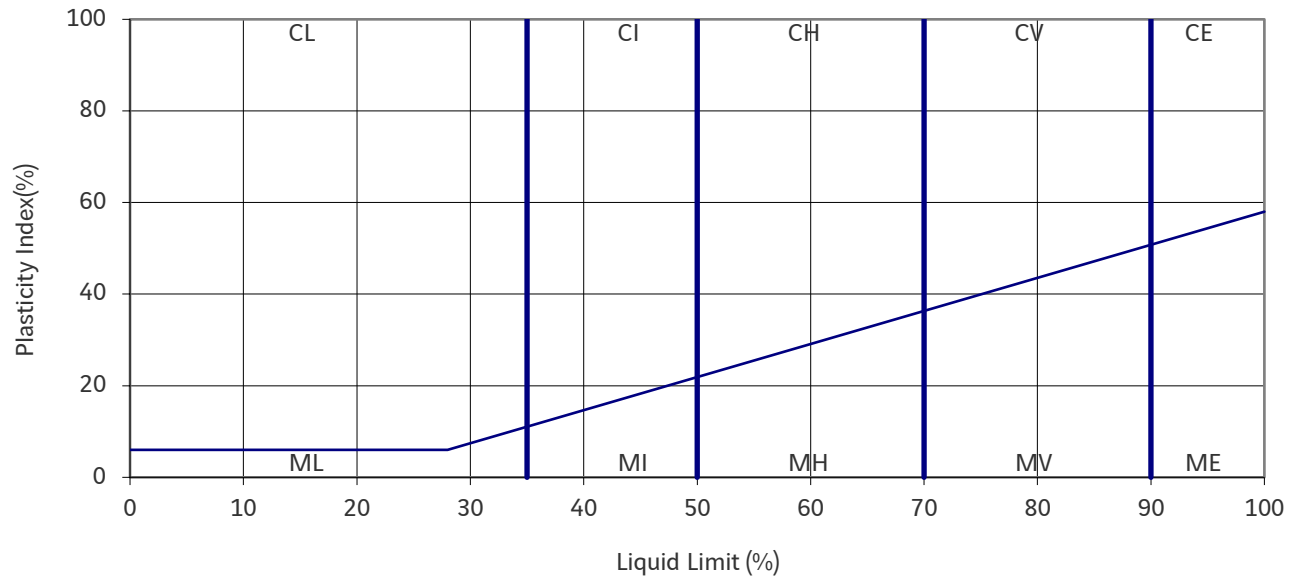
Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 08/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024	

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH101
Project No.	TB8754		Sample Depth 7.00m
Engineer	Mott MacDonald		Sample Number 26
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Dark brown PEAT.		Specimen Depth 7.00m
			Specimen Number 1



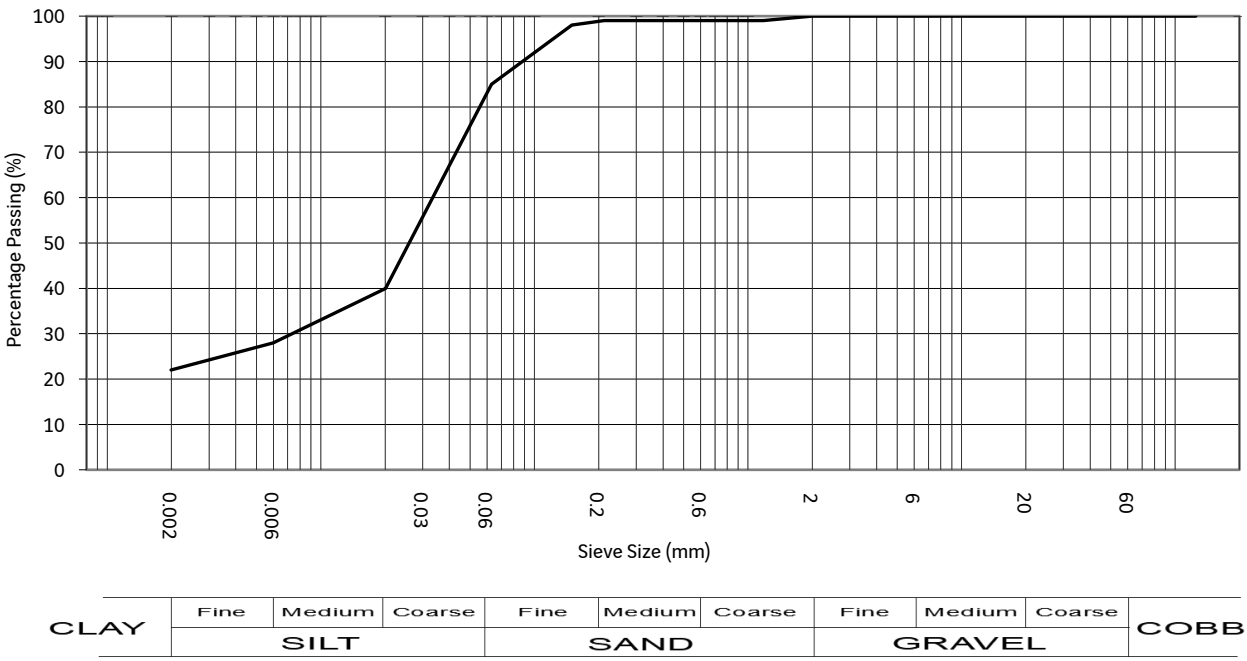
As received water content:	203%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	210%	Preparation of sample: Natural	
Plastic limit:	89%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	120%		
Water content of soil passing 425µm	203%		
Liquidity index:	0.946		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 10/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH101
Project No.	TB8754		Sample Depth 9.00m
Engineer	Mott MacDonald		Sample Number 34
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type B
Description	Grey CLAY.		Specimen Depth 9.00m
			Specimen No. 1



PARTICLE SIZE	%
Clay:	21.8
Silt:	63.5
Sand:	14.5
Gravel:	0.2
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14	100	0.020100	40
		10	100	0.005980	28
		6.3	100	0.001990	22
125.0	100	5	100		
90.0	100	3.35	100		
75.0	100	2	100		
63.0	100	1.18	99		
50.0	100	0.6	99		
37.5	100	0.425	99		
28.0	100	0.3	99		
20.0	100	0.212	99		
		0.15	98		
		0.063	85		

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:

Paul Rodgers

Print date 08/07/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH101
Project No.	TB8754		Sample Depth 9.00m
Engineer	Mott MacDonald		Sample Number 32
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 9.00m
			Specimen Number 2

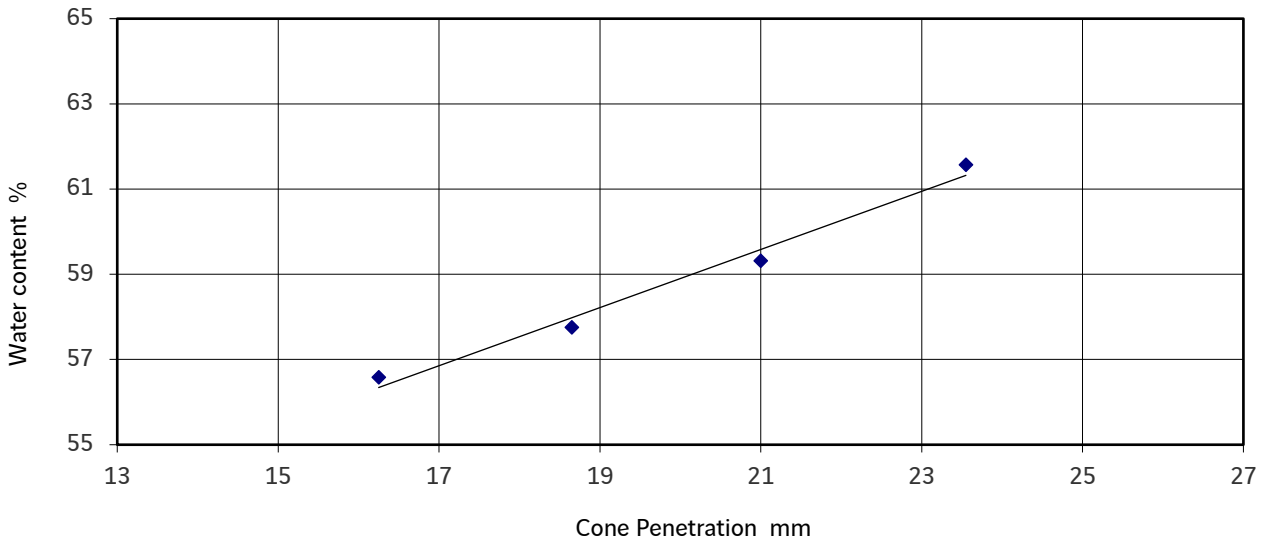
Water content	66.4	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

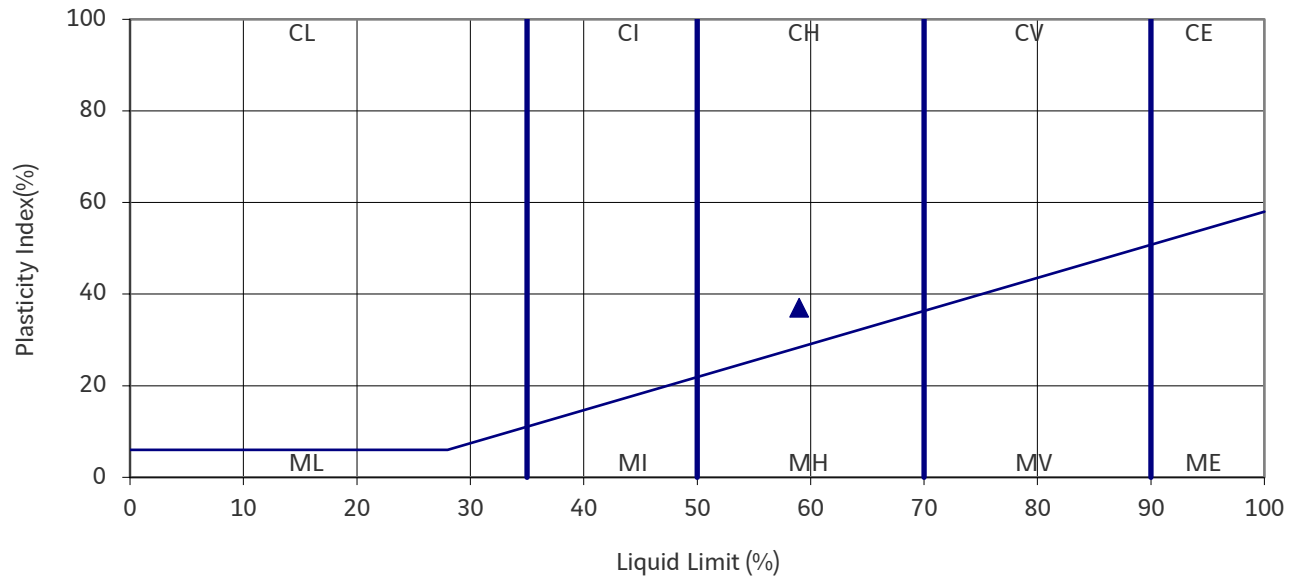
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Steve Harper			Print date 21/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH101
Project No.	TB8754		Sample Depth 9.00m
Engineer	Mott MacDonald		Sample Number 32
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 9.00m
			Specimen Number 1



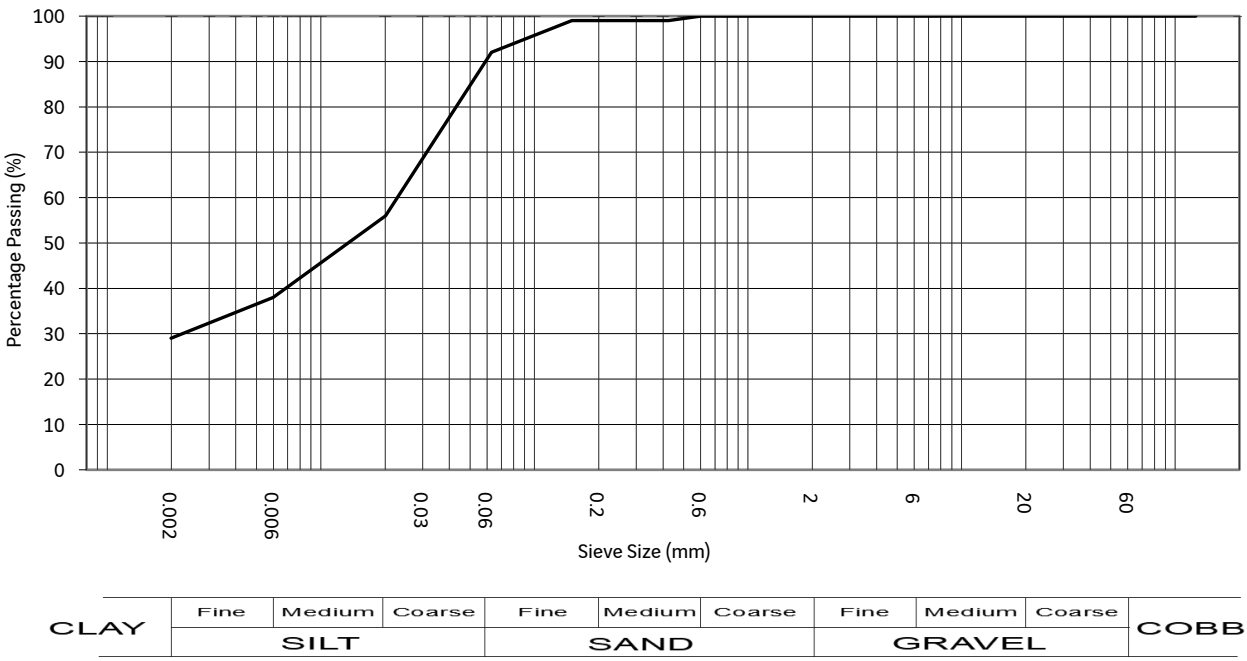
As received water content:	66.4%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	59%	Preparation of sample: Natural	
Plastic limit:	22%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	37%		
Water content of soil passing 425µm	66.4%		
Liquidity index:	1.201		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 21/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH101
Project No.	TB8754		Sample Depth 11.00m
Engineer	Mott MacDonald		Sample Number 38
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type B
Description	Grey CLAY.		Specimen Depth 11.00m
			Specimen No. 1



PARTICLE SIZE	%
Clay:	28.7
Silt:	63.5
Sand:	7.7
Gravel:	0.1
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14	100	0.020100	56
		10	100	0.005980	38
		6.3	100	0.001990	29
125.0	100	5	100		
90.0	100	3.35	100		
75.0	100	2	100		
63.0	100	1.18	100		
50.0	100	0.6	100		
37.5	100	0.425	99		
28.0	100	0.3	99		
20.0	100	0.212	99		
		0.15	99		
		0.063	92		

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:

Paul Rodgers

Print date 08/07/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH101
Project No.	TB8754		Sample Depth 11.00m
Engineer	Mott MacDonald		Sample Number 37
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 11.00m
			Specimen Number 2

Water content	63.6	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

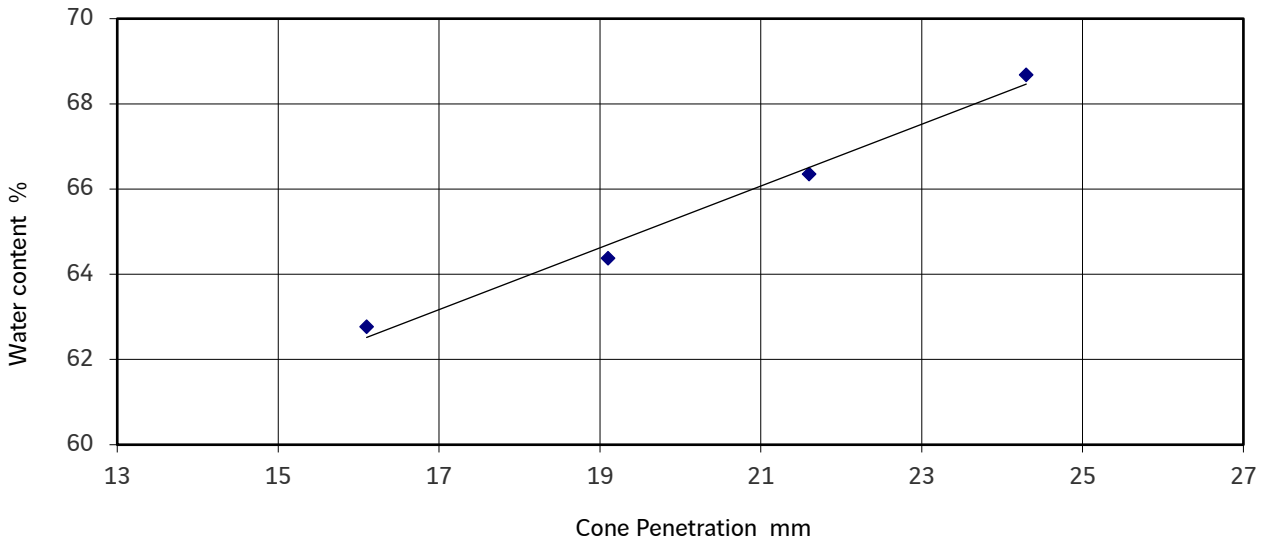
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

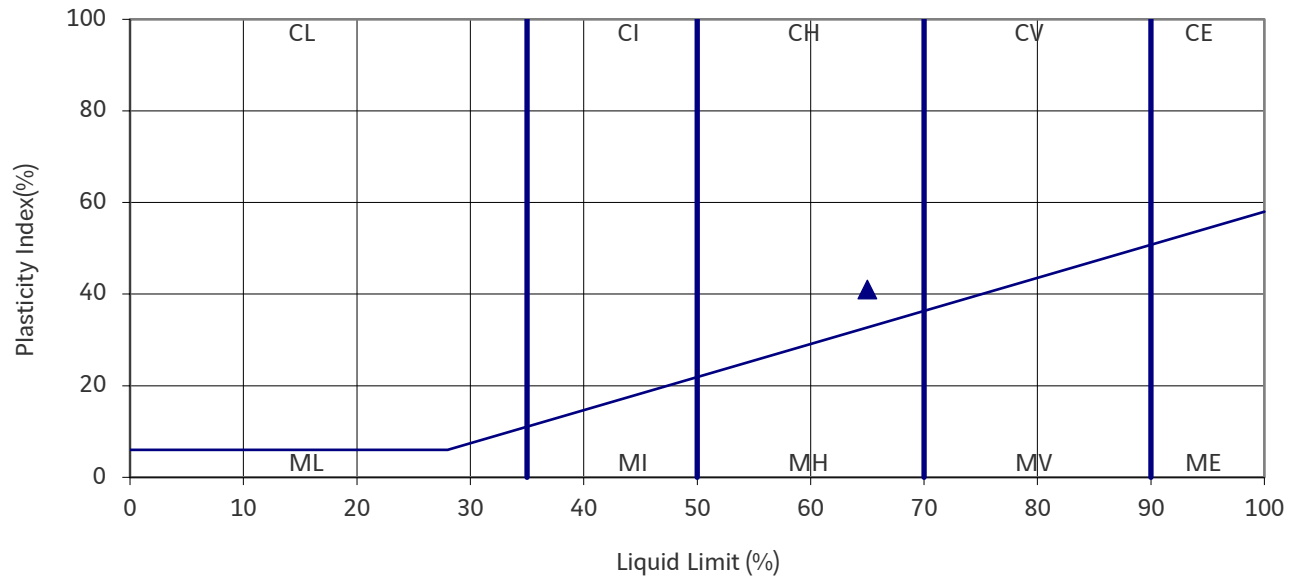
Approved by:	Leeds Laboratory		
Steve Harper		Print date 21/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024	

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH101
Project No.	TB8754		Sample Depth 11.00m
Engineer	Mott MacDonald		Sample Number 37
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 11.00m
			Specimen Number 1



As received water content:	63.6%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	65%	Preparation of sample: Natural	
Plastic limit:	24%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	41%		
Water content of soil passing 425µm	63.6%		
Liquidity index:	0.965		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 21/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH101
Project No.	TB8754		Sample Depth 13.00m
Engineer	Mott MacDonald		Sample Number 41
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type B
Description	Grey SILT.		Specimen Depth 13.00m
			Specimen Number 2

Water content	77.2	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

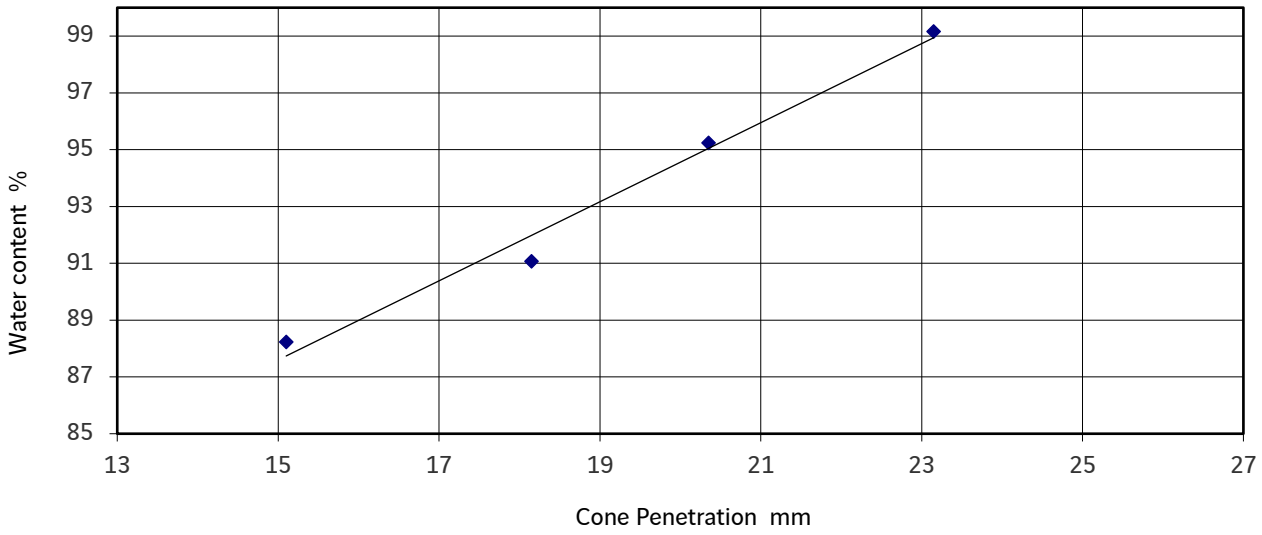
Remarks

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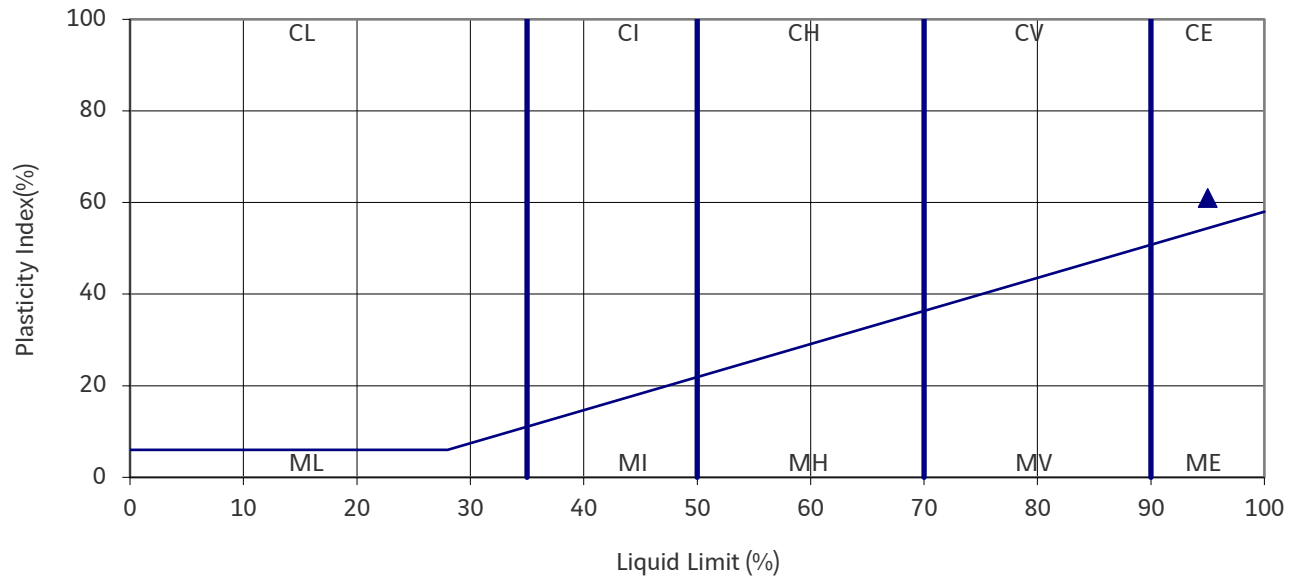
Approved by:	Leeds Laboratory		
Steve Harper		Print date 21/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024	

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH101
Project No.	TB8754		Sample Depth 13.00m
Engineer	Mott MacDonald		Sample Number 41
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type B
Description	Grey SILT.		Specimen Depth 13.00m
			Specimen Number 1



As received water content:	77.2%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	95%	Preparation of sample: Natural	
Plastic limit:	34%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	61%		
Water content of soil passing 425µm	77.2%		
Liquidity index:	0.709		

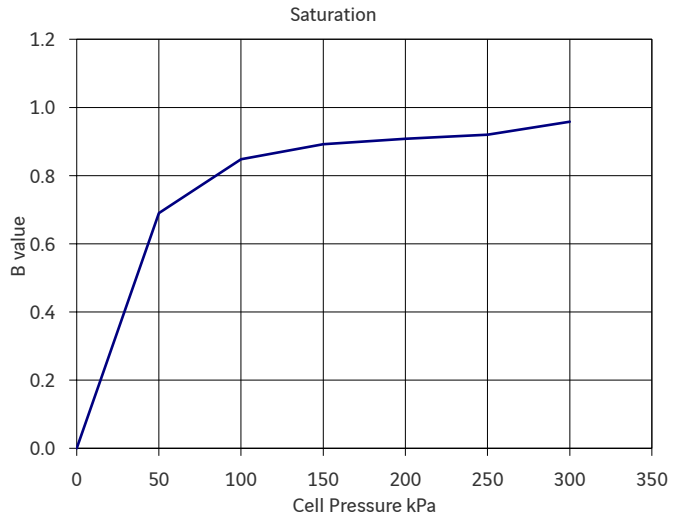


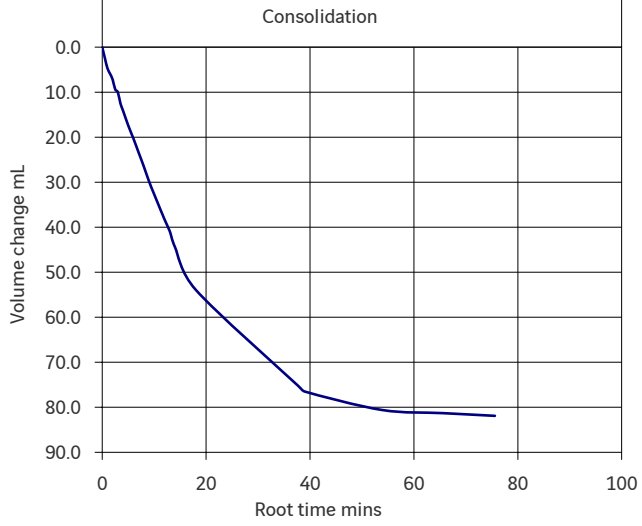
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Approved by:	Leeds Laboratory		
Steve Harper		Print date 21/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH101
Project No.	TB8754		Sample Depth 14.00m
Engineer	Mott MacDonald		Sample Number 43
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with decomposed plant fibres.		Specimen Depth 14.50m
			Specimen Number 1

SPECIMEN INITIAL DIMENSIONS		
Test number		1
Specimen diameter	mm	101.35
Specimen length	mm	196.40
Density	Mg/m^3	1.54
Moisture content	%	73
Dry density	Mg/m^3	0.89
SATURATION STAGE		
Initial pore water pressure	kPa	-1.1
Saturated pore water pressure	kPa	285.6
Final cell pressure	kPa	300
B value		0.958
CONSOLIDATION STAGE		
Cell pressure	kPa	375
Back pressure	kPa	300
Effective consolidation pressure	kPa	75
Initial pore water pressure	kPa	357
Final pore water pressure	kPa	297
Pore pressure dissipation	%	105.3
c_{vi}	$m^2/year$	0.25
m_{vi}	m^2/MN	0.86
SPECIMEN AFTER CONSOLIDATION		
Density	Mg/m^3	1.59
Moisture content	%	69
Dry density	Mg/m^3	0.94



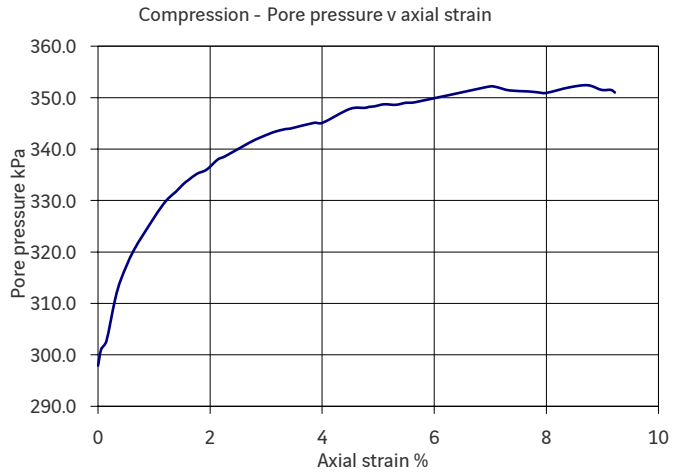


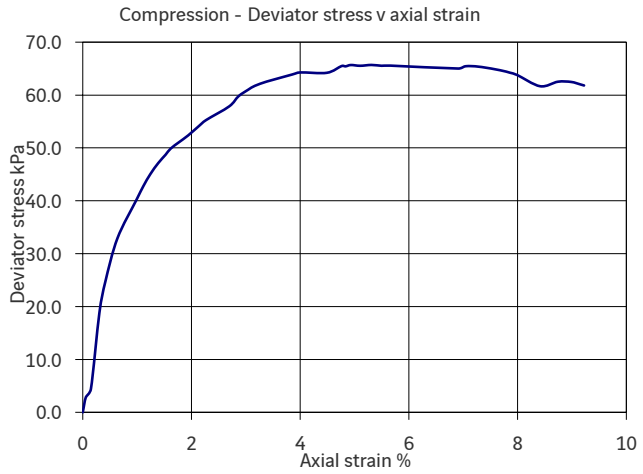
Remarks:
Specimen orientation Vertical
Specimen condition for test UNDISTURBED
Saturation with 50kPa increments with a differential pressure of 10kPa
Drainage from both ends and using a radial filter drain

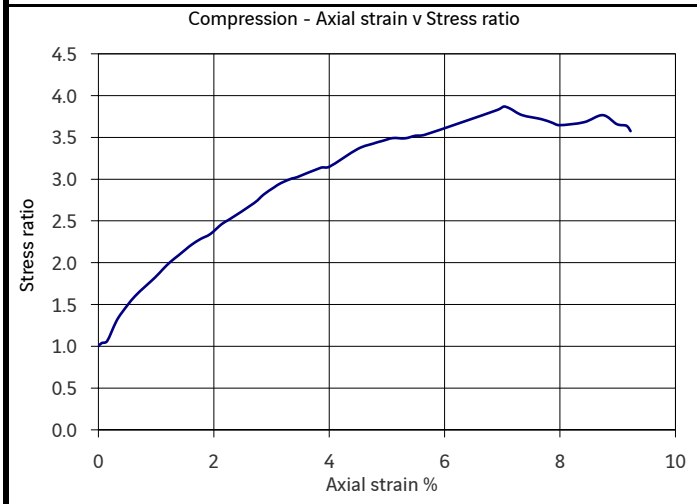
Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 23/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

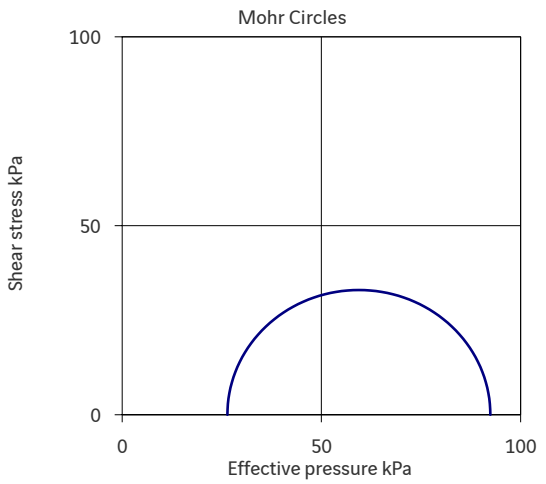
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH101
Project No.	TB8754		Sample Depth 14.00m
Engineer	Mott MacDonald		Sample Number 43
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with decomposed plant fibres.		Specimen Depth 14.50m
			Specimen Number 1

COMPRESSION STAGE			
Test number			1
Cell pressure		kPa	375
Initial pore water pressure		kPa	298
Effective confining pressure		kPa	78
Failure conditions at			Maximum deviator stress
Axial strain at failure		%	5.3
Maximum deviator stress	σ_1-σ_3	kPa	66
Pore water pressure at failure	σ	kPa	349
Effective major principal stress	σ_1'	kPa	92.09
Effective minor principal stress	σ_3'	kPa	26.40
Effective principal stress ratio			3.49
Membrane correction		kPa	0.64
Filter drain correction		kPa	3.5
Pore pressure coefficient			0.8









Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 23/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

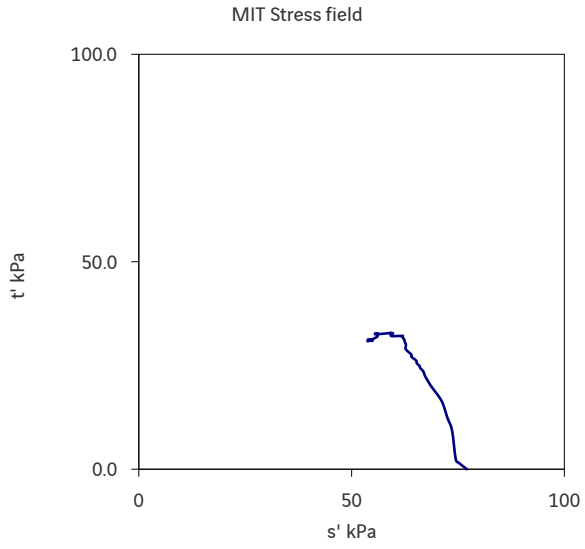
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH101
Project No.	TB8754		Sample Depth 14.00m
Engineer	Mott MacDonald		Sample Number 43
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with decomposed plant fibres.		Specimen Depth 14.50m
			Specimen Number 1

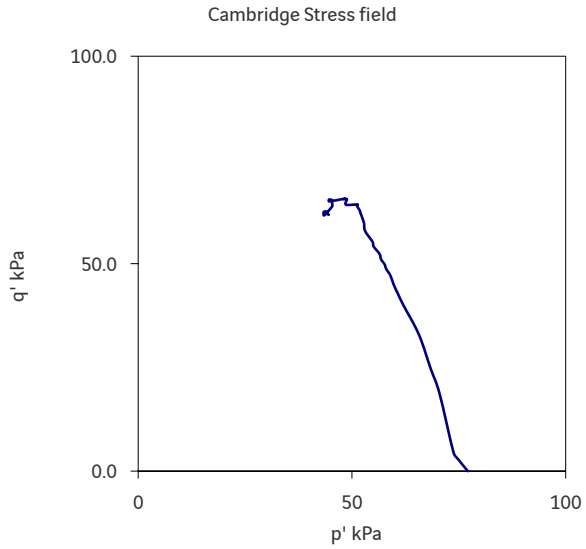
SPECIMEN AFTER TEST

Test number		1	
Mode of failure		Compound 	
Final moisture content	%	69	
Final bulk density	Mg/m^3	1.59	
Final dry density	Mg/m^3	0.94	

ADDITIONAL SPECIMEN DETAILS

Rate of strain	%/hour	0.20	
Failure criterion		Maximum deviator stress	

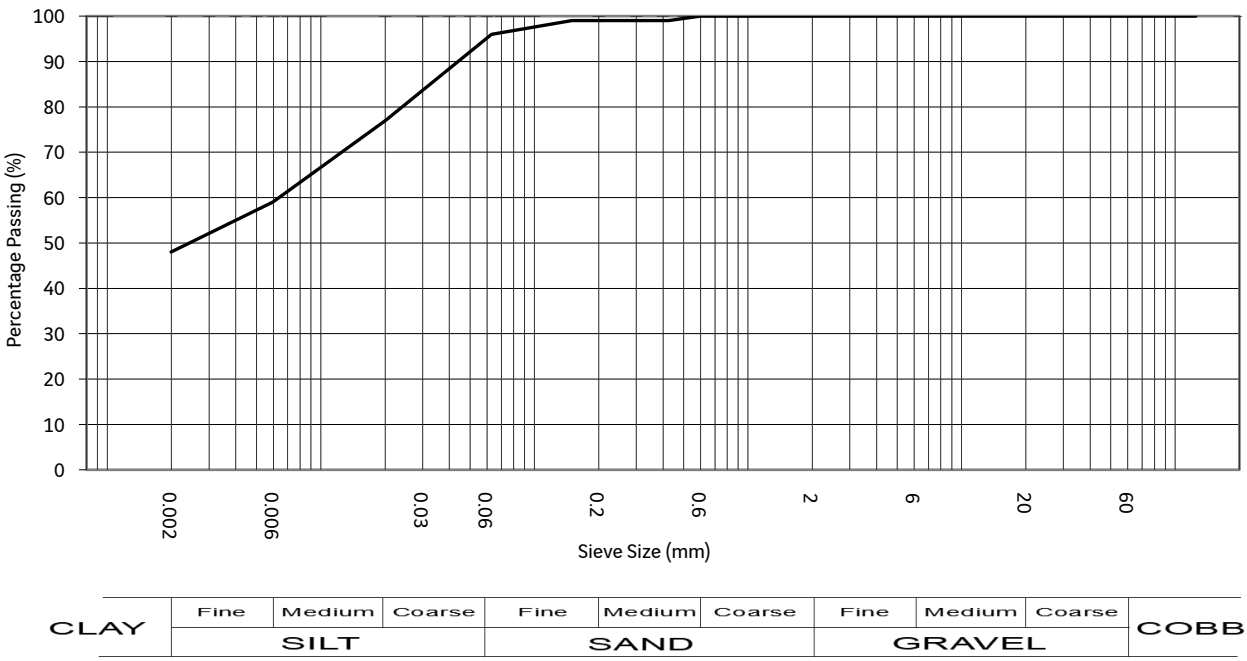




REMARKS

Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 23/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH101
Project No.	TB8754		Sample Depth 15.00m
Engineer	Mott MacDonald		Sample Number 46
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type B
Description	Grey CLAY.		Specimen Depth 15.00m
			Specimen No. 1



PARTICLE SIZE	%
Clay:	47.9
Silt:	47.7
Sand:	4.4
Gravel:	0.0
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA

Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	100
		10	100
		6.3	100
125.0	100	5	100
90.0	100	3.35	100
75.0	100	2	100
63.0	100	1.18	100
50.0	100	0.6	100
37.5	100	0.425	99
28.0	100	0.3	99
20.0	100	0.212	99
		0.15	99
		0.063	96

SEDIMENTATION DATA

Equivalent particle diameter mm	Cumulative % passing
0.020100	77
0.005970	59
0.001990	48

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:

Paul Rodgers

Print date 08/07/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH101
Project No.	TB8754		Sample Depth 15.00m
Engineer	Mott MacDonald		Sample Number 44
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 15.00m
			Specimen Number 2

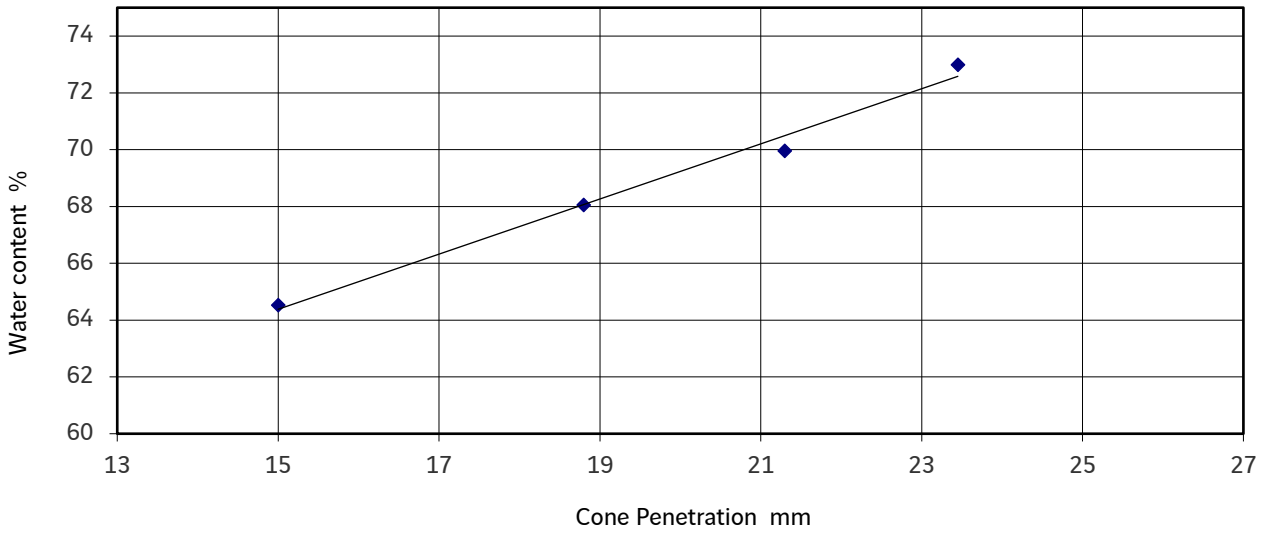
Water content	88.4	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

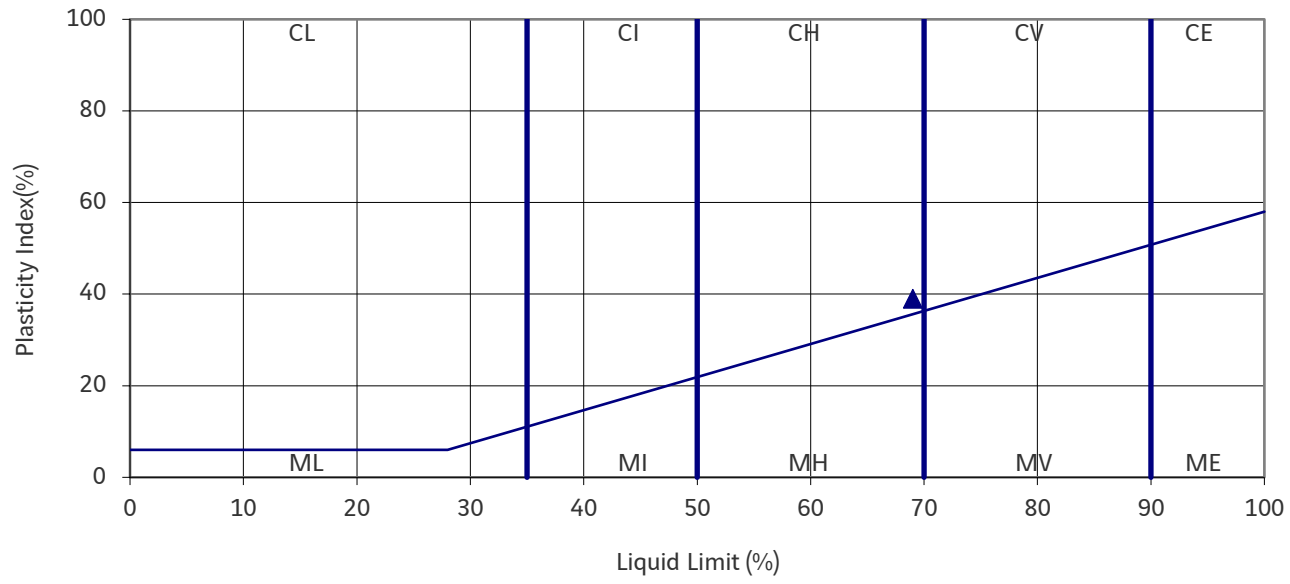
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 01/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH101
Project No.	TB8754		Sample Depth 15.00m
Engineer	Mott MacDonald		Sample Number 44
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 15.00m
			Specimen Number 1



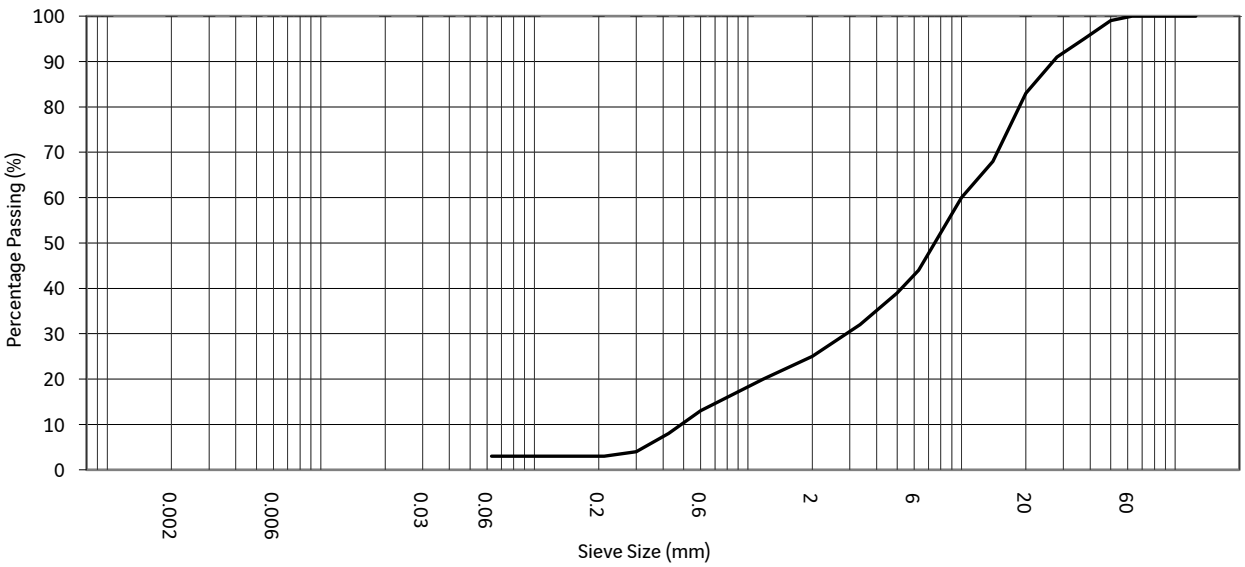
As received water content:	88.4%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	69%	Preparation of sample: Natural	
Plastic limit:	30%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	39%		
Water content of soil passing 425µm	88.4%		
Liquidity index:	1.497		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 01/08/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH101
Project No.	TB8754		Sample Depth 16.50m
Engineer	Mott MacDonald		Sample Number 50
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.2	Sample type B
Description	Brown slightly sandy GRAVEL.		Specimen Depth 16.50m
			Specimen No. 1



PARTICLE SIZE	%
Silt and clay:	2.6
Sand:	22.5
Gravel:	74.9
Cobbles:	0.0

General remarks

Sample size was insufficient to comply with the recommended minimum mass.

WET SIEVE DATA

Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	68
		10	60
		6.3	44
125.0	100	5	39
90.0	100	3.35	32
75.0	100	2	25
63.0	100	1.18	20
50.0	99	0.6	13
37.5	95	0.425	8
28.0	91	0.3	4
20.0	83	0.212	3
		0.15	3
		0.063	3

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:

Paul Rodgers

Print date 08/07/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Particle Density**	Hole ID BH101
Project No.	TB8754		Sample Depth 23.70m
Engineer	Mott MacDonald		Sample Number 55.1
Employer	FBJV	BS 1377-2:2022: Clause 9.1/BS EN ISO 17892-3: 2015: 5.1.4.1	Sample Type CD
Description	White CHALK.		Specimen Depth 23.70m
			Specimen Number 1

Particle Density	2.68	Mg/m^3
Type	Fluid pycnometer	

Remarks

Average pycnometer volume used: 51.5mL

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 11/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH101
Project No.	TB8754		Sample Depth 26.31m
Engineer	Mott MacDonald		Sample Number 57.1
Employer	FBJV	BS 1377-2:2022 Clause 8/BS EN ISO 17892-2:2014 Clause 5.2	Sample Type CS
Description	Off white CHALK.		Specimen Depth 26.31m
			Specimen Number 11

Water Content	25.4	%
Density Type	Immersion density	
Bulk Density	2.00	Mg/m³
Dry Density	1.59	Mg/m³

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 01/10/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Particle Density**	Hole ID BH101
Project No.	TB8754		Sample Depth 27.60m
Engineer	Mott MacDonald		Sample Number 58.1
Employer	FBJV	BS 1377-2:2022: Clause 9.1/BS EN ISO 17892-3: 2015: 5.1.4.1	Sample Type CS
Description	White CHALK.		Specimen Depth 27.60m
			Specimen Number

Particle Density	2.66	Mg/m^3
Type	Fluid pycnometer	

Remarks

Average pycnometer volume used: 51.6mL

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 11/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH101
Project No.	TB8754		Sample Depth 31.21m
Engineer	Mott MacDonald		Sample Number 61.1
Employer	FBJV	BS 1377-2:2022 Clause 8/BS EN ISO 17892-2:2014 Clause 5.2	Sample Type CS
Description	Off white CHALK.		Specimen Depth 31.21m
			Specimen Number 11

Water Content	29.3	%
Density Type	Immersion density	
Bulk Density	1.95	Mg/m³
Dry Density	1.51	Mg/m³

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 01/10/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Particle Density**	Hole ID BH101
Project No.	TB8754		Sample Depth 31.21m
Engineer	Mott MacDonald		Sample Number 61.1
Employer	FBJV	BS 1377-2:2022: Clause 9.1/BS EN ISO 17892-3: 2015: 5.1.4.1	Sample Type CS
Description	White CHALK.		Specimen Depth 31.21m
			Specimen Number

Particle Density	2.66	Mg/m^3
Type	Fluid pycnometer	

Remarks

Average pycnometer volume used: 51.5mL

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 11/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Particle Density**	Hole ID BH101
Project No.	TB8754		Sample Depth 32.77m
Engineer	Mott MacDonald		Sample Number 62.1
Employer	FBJV	BS 1377-2:2022: Clause 9.1/BS EN ISO 17892-3: 2015: 5.1.4.1	Sample Type CS
Description	White CHALK.		Specimen Depth 32.77m
			Specimen Number

Particle Density	2.66	Mg/m^3
Type	Fluid pycnometer	

Remarks

Average pycnometer volume used: 50.9mL

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 11/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH101
Project No.	TB8754		Sample Depth 35.59m
Engineer	Mott MacDonald		Sample Number 64.1
Employer	FBJV	BS 1377-2:2022 Clause 8/BS EN ISO 17892-2:2014: 5.1	Sample Type CS
Description	Off white CHALK.		Specimen Depth 35.59m
			Specimen Number 11

Water Content	23.3	%
Density Type	Linear density	
Bulk Density	2.03	Mg/m^3
Dry Density	1.65	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 01/10/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Particle Density**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Employer	FBJV	BS 1377-2:2022: Clause 9.1/BS EN ISO 17892-3: 2015: 5.1.4.1	

Hole ID	Sample depth m	Sample no.	Sample type	Specimen depth m	Specimen no.	Description	Remarks	Type	Particle Density Mg/m³
BH101	35.59	64.1	CS	35.59	1	White CHALK.	Average pycnometer volume used: 51.8mL	Small Pyk	2.69

Approved by:	Leeds Laboratory	Results apply to samples as received.	SOIL ENGINEERING
Paul Rodgers		Print date 01/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Particle Density**	Hole ID BH101
Project No.	TB8754		Sample Depth 38.73m
Engineer	Mott MacDonald		Sample Number 66.1
Employer	FBJV	BS 1377-2:2022: Clause 9.1/BS EN ISO 17892-3: 2015: 5.1.4.1	Sample Type CS
Description	White CHALK.		Specimen Depth 38.73m
			Specimen Number

Particle Density	2.66	Mg/m^3
Type	Fluid pycnometer	

Remarks

Average pycnometer volume used: 51.5mL

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 11/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Particle Density**	Hole ID BH101
Project No.	TB8754		Sample Depth 43.40m
Engineer	Mott MacDonald		Sample Number 70.1
Employer	FBJV	BS 1377-2:2022: Clause 9.1/BS EN ISO 17892-3: 2015: 5.1.4.1	Sample Type CS
Description	Off white CHALK.		Specimen Depth 43.40m
			Specimen Number

Particle Density	2.66	Mg/m^3
Type	Fluid pycnometer	

Remarks

Average pycnometer volume used: 51.5mL

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 11/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Particle Density**	Hole ID BH101
Project No.	TB8754		Sample Depth 47.17m
Engineer	Mott MacDonald		Sample Number 73.1
Employer	FBJV	BS 1377-2:2022: Clause 9.1/BS EN ISO 17892-3: 2015: 5.1.4.1	Sample Type CS
Description	White CHALK.		Specimen Depth 47.17m
			Specimen Number

Particle Density	2.64	Mg/m^3
Type	Fluid pycnometer	

Remarks

Average pycnometer volume used: 49.7mL

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 11/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH101
Project No.	TB8754		Sample Depth 49.50m
Engineer	Mott MacDonald		Sample Number 74.1
Employer	FBJV	BS 1377-2:2022 Clause 8/BS EN ISO 17892-2:2014 Clause 5.2	Sample Type CS
Description	Off white CHALK.		Specimen Depth 49.50m
			Specimen Number 12

Water Content	26.7	%
Density Type	Immersion density	
Bulk Density	1.94	Mg/m^3
Dry Density	1.53	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 01/10/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH101
Project No.	TB8754		Sample Depth 52.06m
Engineer	Mott MacDonald		Sample Number 76.1
Employer	FBJV	BS 1377-2:2022 Clause 8/BS EN ISO 17892-2:2014 Clause 5.2	Sample Type CS
Description	Off white CHALK.		Specimen Depth 52.06m
			Specimen Number 12

Water Content	25.9	%
Density Type	Immersion density	
Bulk Density	1.89	Mg/m^3
Dry Density	1.50	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 01/10/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH101
Project No.	TB8754		Sample Depth 54.96m
Engineer	Mott MacDonald		Sample Number 78.1
Employer	FBJV	BS 1377-2:2022 Clause 8/BS EN ISO 17892-2:2014 Clause 5.2	Sample Type CS
Description	Off white CHALK.		Specimen Depth 54.96m
			Specimen Number 12

Water Content	27.5	%
Density Type	Immersion density	
Bulk Density	1.96	Mg/m^3
Dry Density	1.54	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 01/10/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH101
Project No.	TB8754		Sample Depth 58.45m
Engineer	Mott MacDonald		Sample Number 80.1
Employer	FBJV	BS 1377-2:2022 Clause 8/BS EN ISO 17892-2:2014 Clause 5.2	Sample Type CS
Description	Off white CHALK.		Specimen Depth 58.45m
			Specimen Number 12

Water Content	23.5	%
Density Type	Immersion density	
Bulk Density	1.90	Mg/m^3
Dry Density	1.54	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 01/10/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH102
Project No.	TB8754		Sample Depth 3.00m
Engineer	Mott MacDonald		Sample Number 16
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey slightly gravelly CLAY.		Specimen Depth 3.00m
			Specimen Number 2

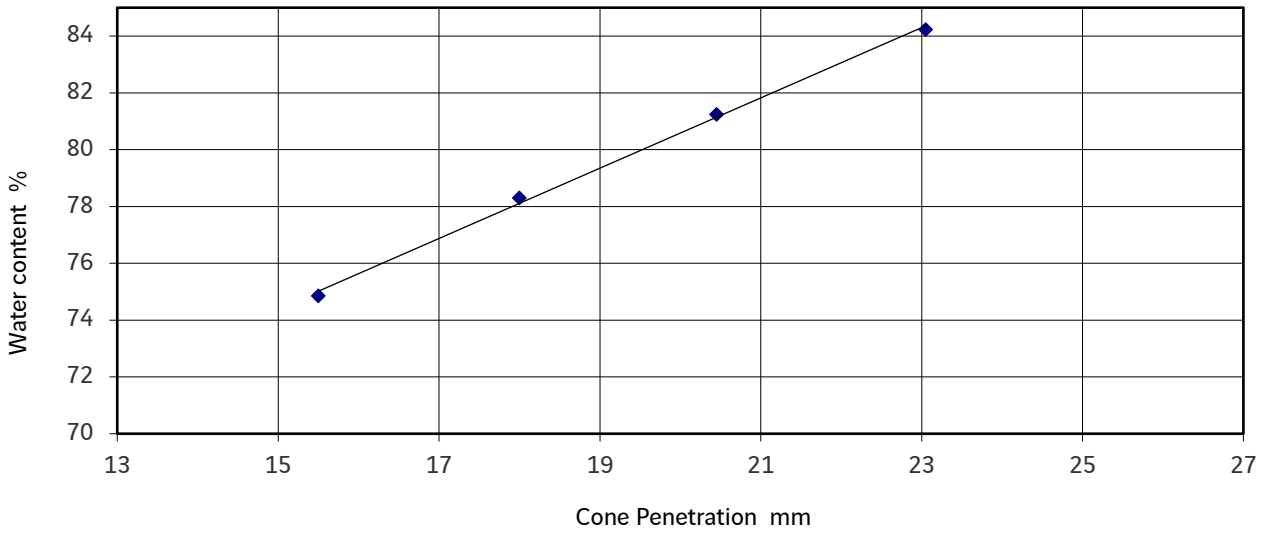
Water content	74.7	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

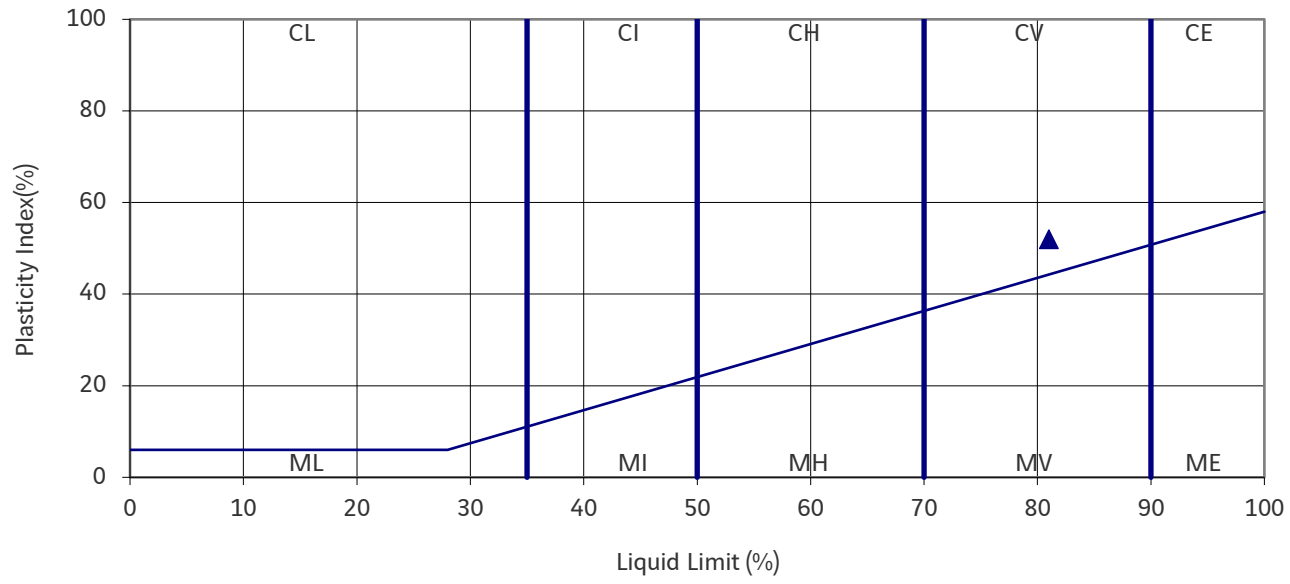
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 21/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH102
Project No.	TB8754		Sample Depth 3.00m
Engineer	Mott MacDonald		Sample Number 16
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey slightly gravelly CLAY.		Specimen Depth 3.00m
			Specimen Number 1



As received water content:	74.7%	Estimated percentage passing 425µm sieve:	95%
Liquid limit:	81%	Preparation of sample: Natural	
Plastic limit:	29%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	52%		
Water content of soil passing 425µm	79.0%		
Liquidity index:	0.962		

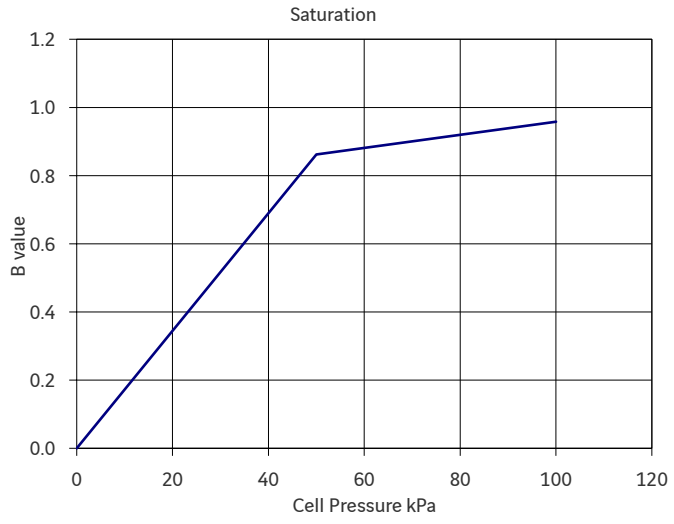


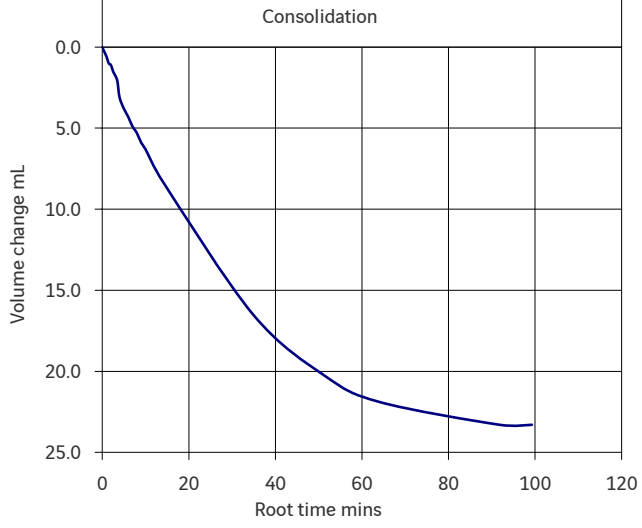
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 21/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH102
Project No.	TB8754		Sample Depth 3.00m
Engineer	Mott MacDonald		Sample Number 17
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with decomposed plant fibres.		Specimen Depth 3.54m
			Specimen Number 2

SPECIMEN INITIAL DIMENSIONS		
Test number		1
Specimen diameter	mm	100.58
Specimen length	mm	195.00
Density	Mg/m^3	1.52
Moisture content	%	98
Dry density	Mg/m^3	0.77
SATURATION STAGE		
Initial pore water pressure	kPa	-1.2
Saturated pore water pressure	kPa	87.8
Final cell pressure	kPa	100
B value		0.958
CONSOLIDATION STAGE		
Cell pressure	kPa	320
Back pressure	kPa	300
Effective consolidation pressure	kPa	20
Initial pore water pressure	kPa	306.4
Final pore water pressure	kPa	298.8
Pore pressure dissipation	%	118.8
c_{vi}	$m^2/year$	2.97
m_{vi}	m^2/MN	1.98
SPECIMEN AFTER CONSOLIDATION		
Density	Mg/m^3	1.53
Moisture content	%	92
Dry density	Mg/m^3	0.80



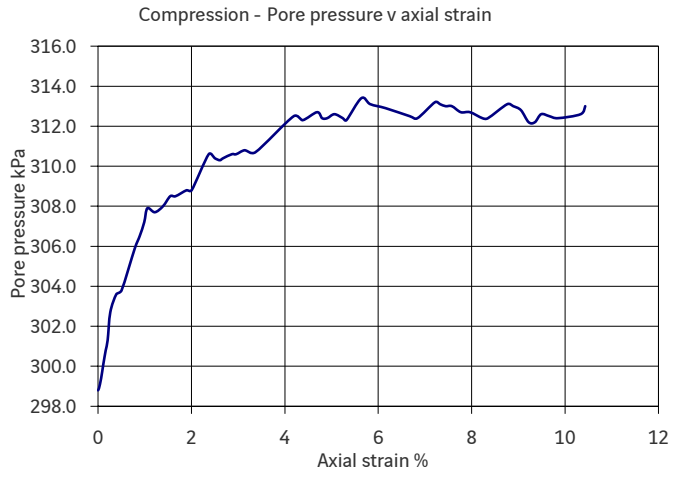


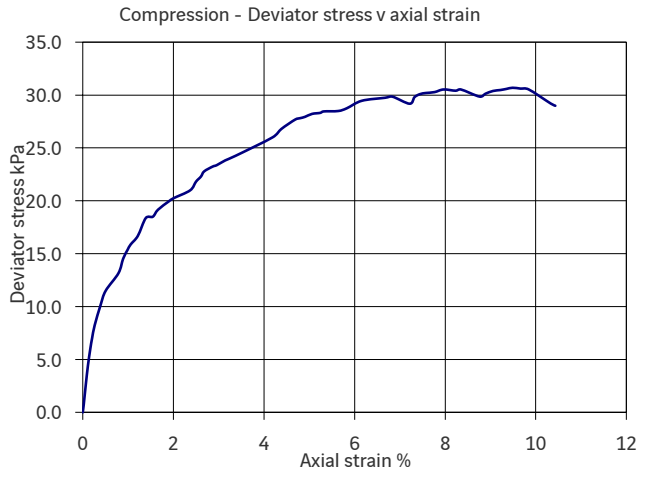
Remarks: Specimen orientation Vertical
Specimen condition for test UNDISTURBED
Saturation with 50kPa increments with a differential pressure of 10kPa
Drainage from both ends

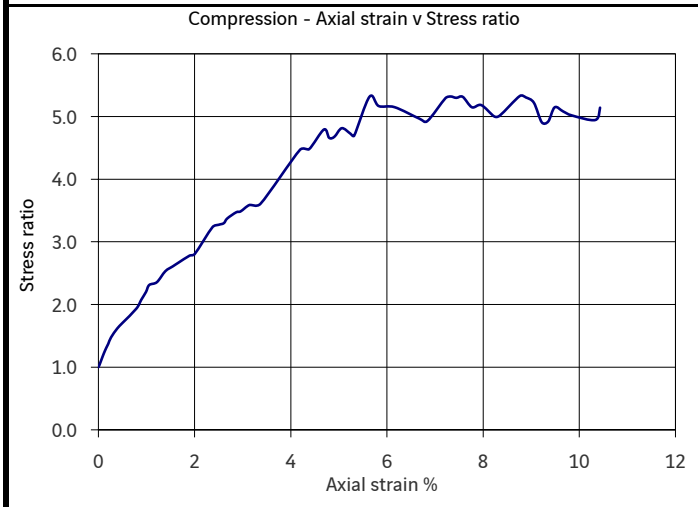
Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 15/08/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

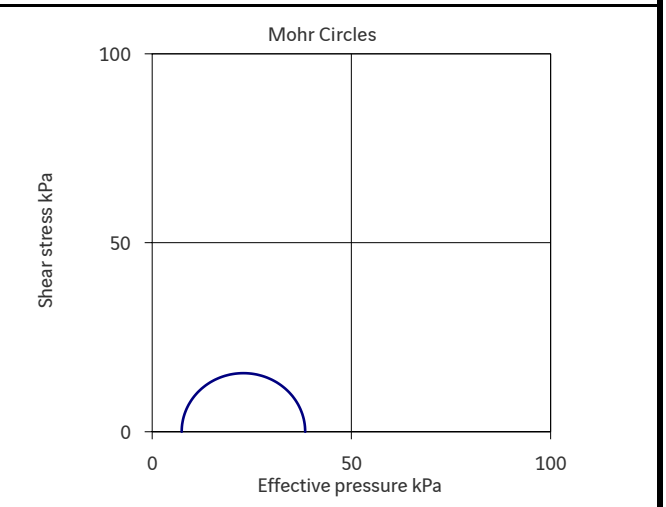
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH102
Project No.	TB8754		Sample Depth 3.00m
Engineer	Mott MacDonald		Sample Number 17
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with decomposed plant fibres.		Specimen Depth 3.54m
			Specimen Number 2

COMPRESSION STAGE			
Test number			1
Cell pressure		kPa	320
Initial pore water pressure		kPa	299
Effective confining pressure		kPa	21
Failure conditions at			Maximum deviator stress
Axial strain at failure		%	9.5
Maximum deviator stress	σ_1-σ_3	kPa	31
Pore water pressure at failure	σ	kPa	313
Effective major principal stress	σ_1'	kPa	38.09
Effective minor principal stress	σ_3'	kPa	7.40
Effective principal stress ratio			5.15
Membrane correction		kPa	1.04
Filter drain correction not applicable		kPa	0.0
Pore pressure coefficient			0.4





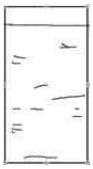




Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 15/08/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

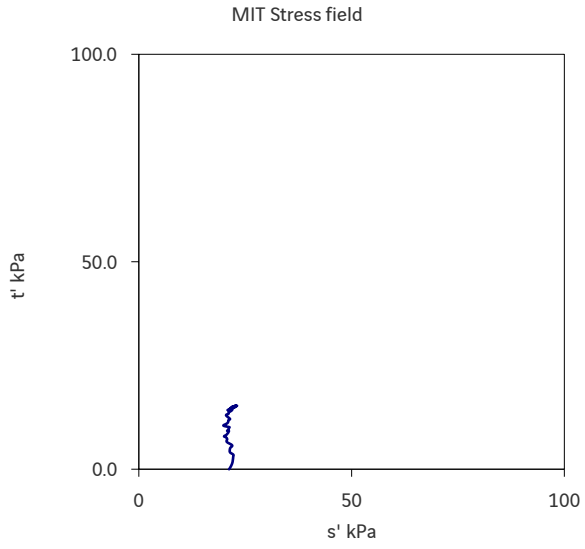
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH102
Project No.	TB8754		Sample Depth 3.00m
Engineer	Mott MacDonald		Sample Number 17
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with decomposed plant fibres.		Specimen Depth 3.54m
			Specimen Number 2

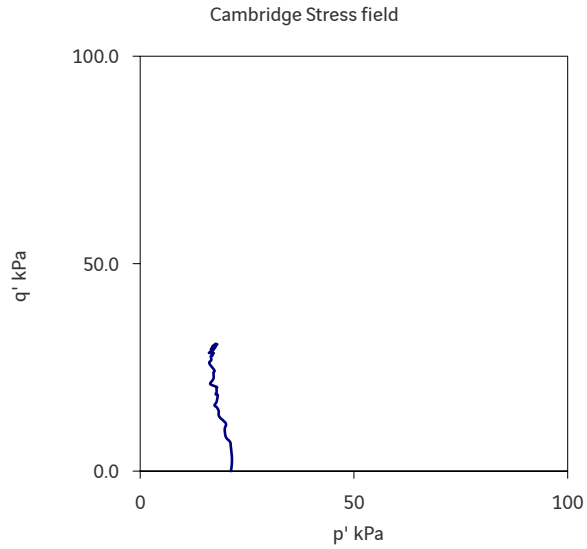
SPECIMEN AFTER TEST

Test number		1	
Mode of failure		Plastic 	
Final moisture content	%	92	
Final bulk density	Mg/m^3	1.53	
Final dry density	Mg/m^3	0.80	

ADDITIONAL SPECIMEN DETAILS

Rate of strain	%/hour	0.19	
Failure criterion		Maximum deviator stress	





REMARKS

Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 15/08/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH102
Project No.	TB8754		Sample Depth 4.00m
Engineer	Mott MacDonald		Sample Number 18
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 4.00m
			Specimen Number 2

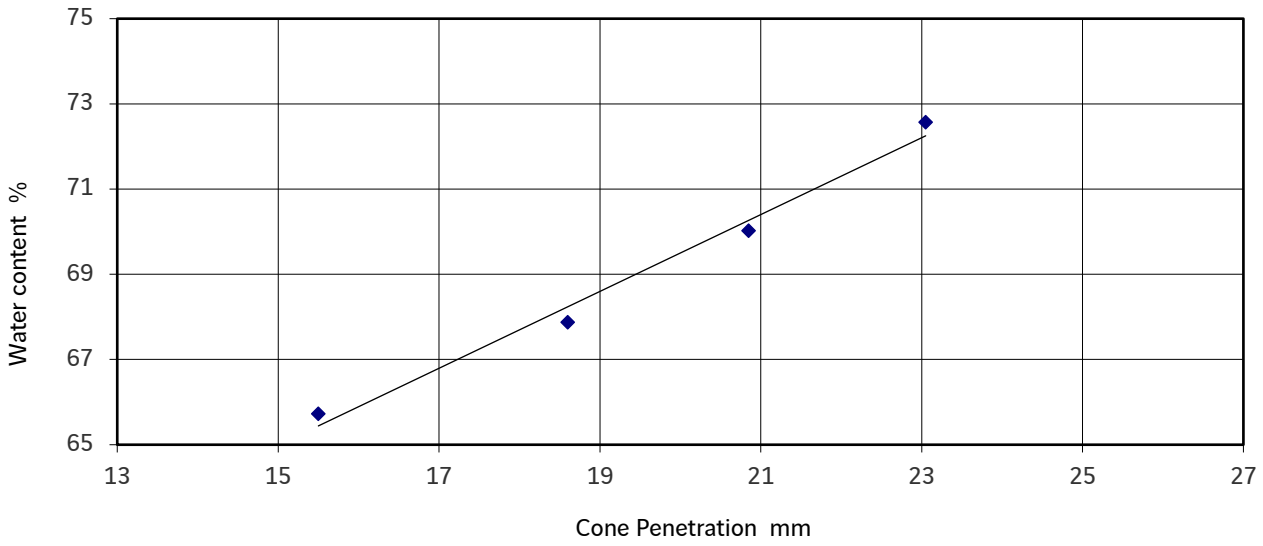
Water content	70.2	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

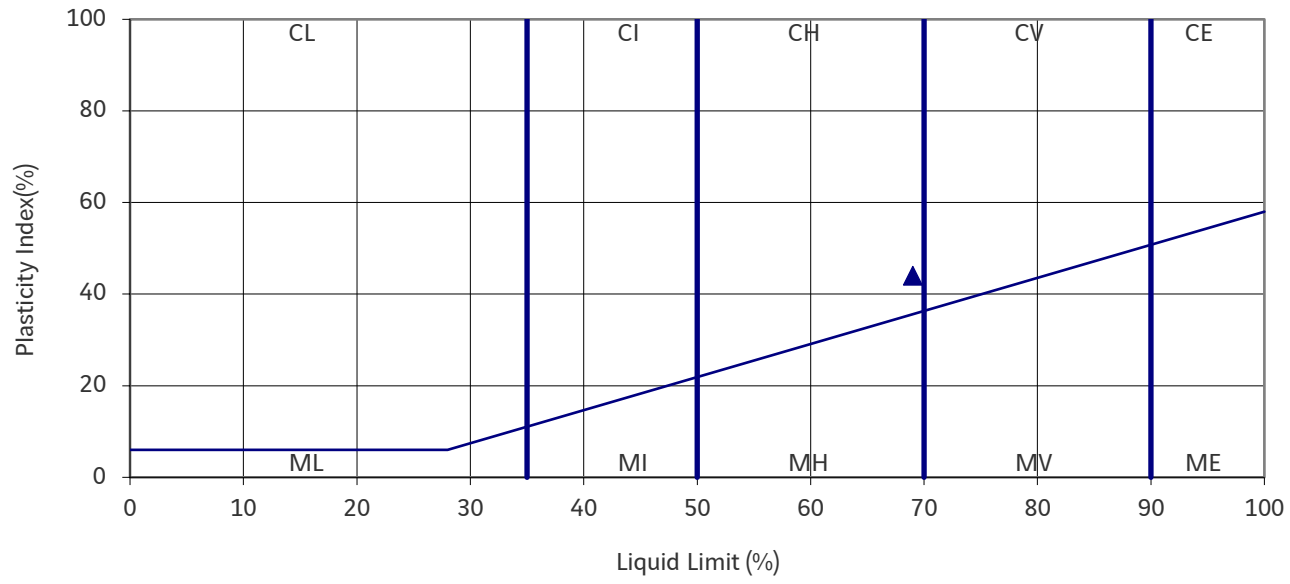
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 21/07/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH102
Project No.	TB8754		Sample Depth 4.00m
Engineer	Mott MacDonald		Sample Number 18
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 4.00m
			Specimen Number 1



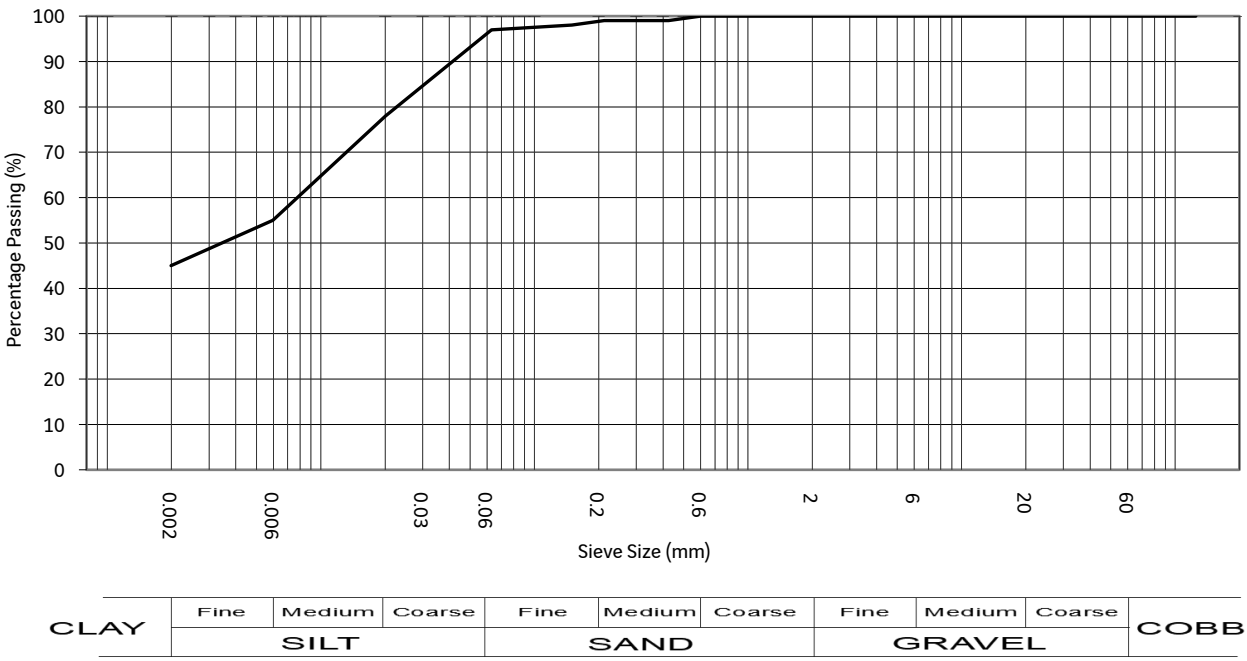
As received water content:	70.2%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	69%	Preparation of sample: Natural	
Plastic limit:	25%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	44%		
Water content of soil passing 425µm	70.2%		
Liquidity index:	1.027		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 21/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH102
Project No.	TB8754		Sample Depth 4.00m
Engineer	Mott MacDonald		Sample Number 19
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type P
Description	Grey CLAY with decomposed plant remains.		Specimen Depth 4.78m
			Specimen No. 2



PARTICLE SIZE	%
Clay:	44.6
Silt:	52.7
Sand:	2.7
Gravel:	0.0
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA

Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	100
		10	100
		6.3	100
125.0	100	5	100
90.0	100	3.35	100
75.0	100	2	100
63.0	100	1.18	100
50.0	100	0.6	100
37.5	100	0.425	99
28.0	100	0.3	99
20.0	100	0.212	99
		0.15	98
		0.063	97

SEDIMENTATION DATA

Equivalent particle diameter mm	Cumulative % passing
0.020100	78
0.005970	55
0.001990	45

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:

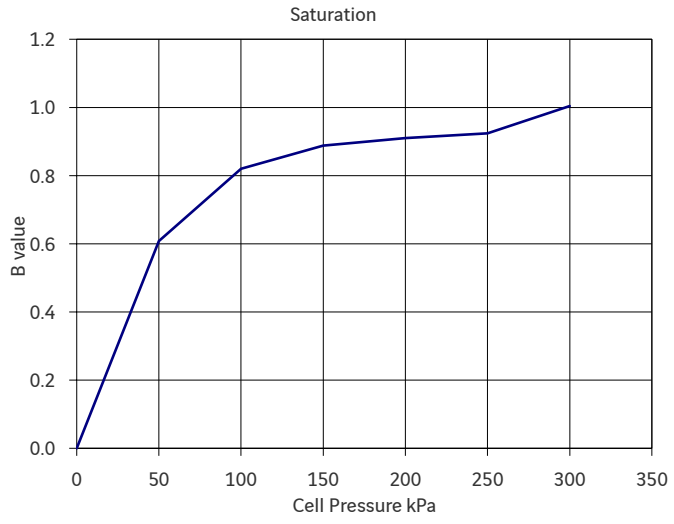
Paul Rodgers

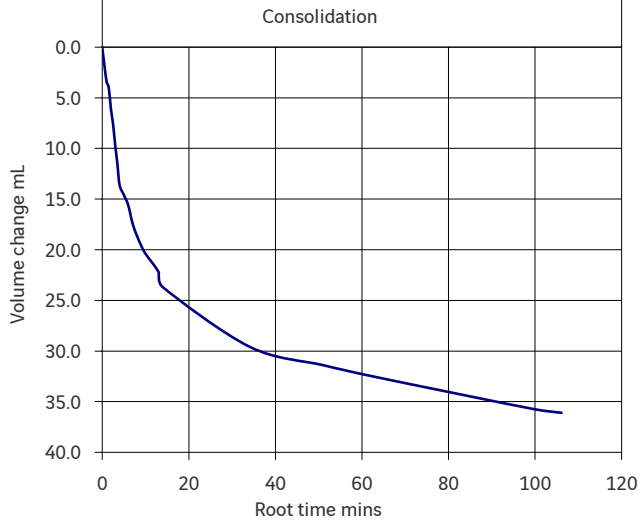
Print date 29/08/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH102
Project No.	TB8754		Sample Depth 4.00m
Engineer	Mott MacDonald		Sample Number 19
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with decomposed plant remains.		Specimen Depth 4.50m
			Specimen Number 1

SPECIMEN INITIAL DIMENSIONS		
Test number		1
Specimen diameter	mm	100.25
Specimen length	mm	196.20
Density	Mg/m^3	1.51
Moisture content	%	80
Dry density	Mg/m^3	0.84
SATURATION STAGE		
Initial pore water pressure	kPa	1.4
Saturated pore water pressure	kPa	283
Final cell pressure	kPa	300
B value		1.004
CONSOLIDATION STAGE		
Cell pressure	kPa	325
Back pressure	kPa	300
Effective consolidation pressure	kPa	25
Initial pore water pressure	kPa	308.1
Final pore water pressure	kPa	297.5
Pore pressure dissipation	%	130.9
c_{vi}	$m^2/year$	0.49
m_{vi}	m^2/MN	2.20
SPECIMEN AFTER CONSOLIDATION		
Density	Mg/m^3	1.54
Moisture content	%	78
Dry density	Mg/m^3	0.86



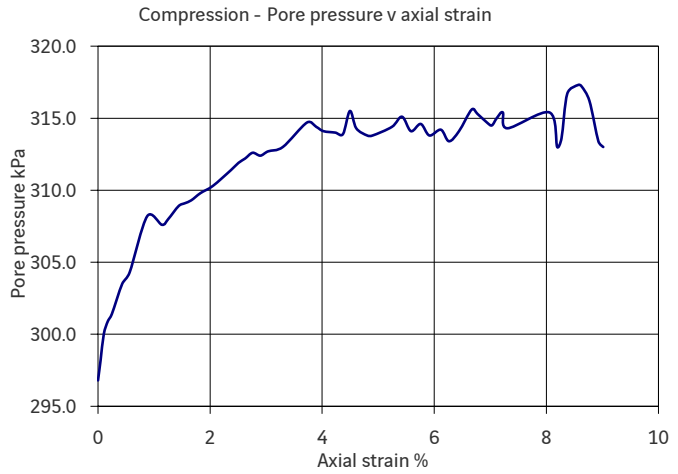


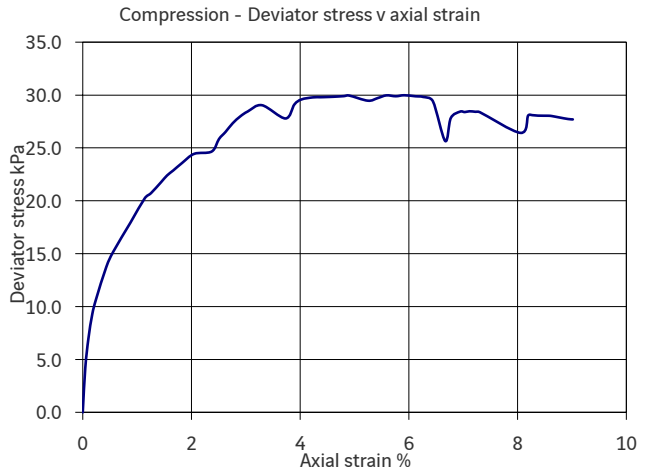
Remarks: Specimen orientation Vertical
Specimen condition for test UNDISTURBED
Saturation with 50kPa increments with a differential pressure of 10kPa
Drainage from both ends and using a radial filter drain

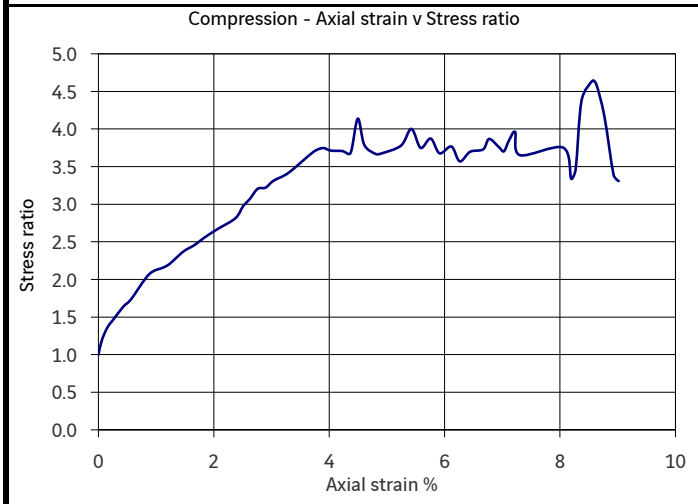
Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 23/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

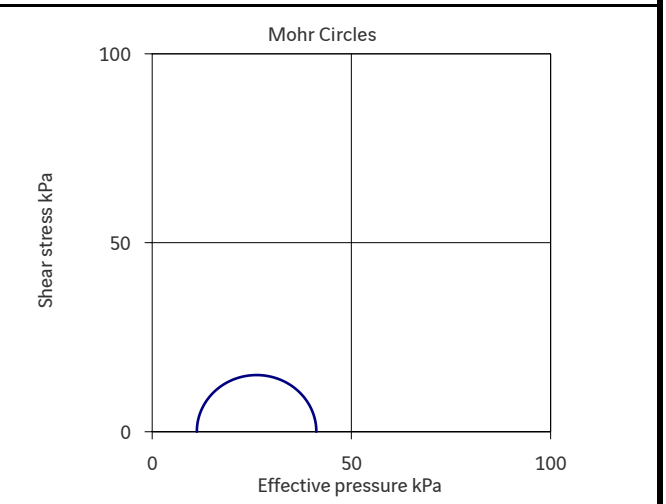
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH102
Project No.	TB8754		Sample Depth 4.00m
Engineer	Mott MacDonald		Sample Number 19
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with decomposed plant remains.		Specimen Depth 4.50m
			Specimen Number 1

COMPRESSION STAGE			
Test number			1
Cell pressure		kPa	325
Initial pore water pressure		kPa	297
Effective confining pressure		kPa	28
Failure conditions at			Maximum deviator stress
Axial strain at failure		%	5.9
Maximum deviator stress	σ_1-σ_3	kPa	30
Pore water pressure at failure	σ	kPa	314
Effective major principal stress	σ_1'	kPa	41.18
Effective minor principal stress	σ_3'	kPa	11.20
Effective principal stress ratio			3.68
Membrane correction		kPa	0.71
Filter drain correction		kPa	3.5
Pore pressure coefficient			0.5









Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 23/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

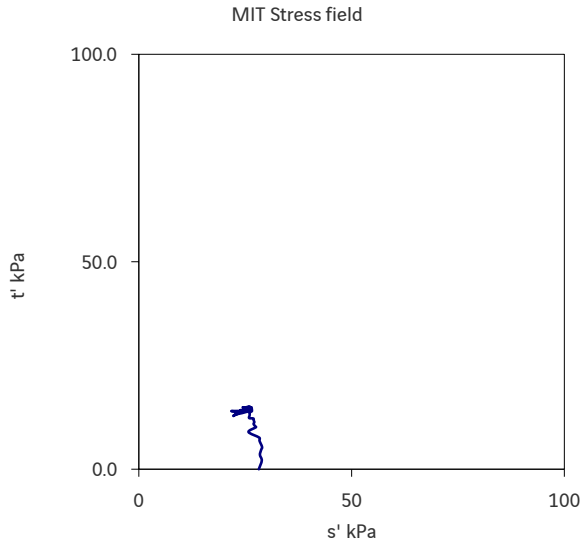
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH102
Project No.	TB8754		Sample Depth 4.00m
Engineer	Mott MacDonald		Sample Number 19
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with decomposed plant remains.		Specimen Depth 4.50m
			Specimen Number 1

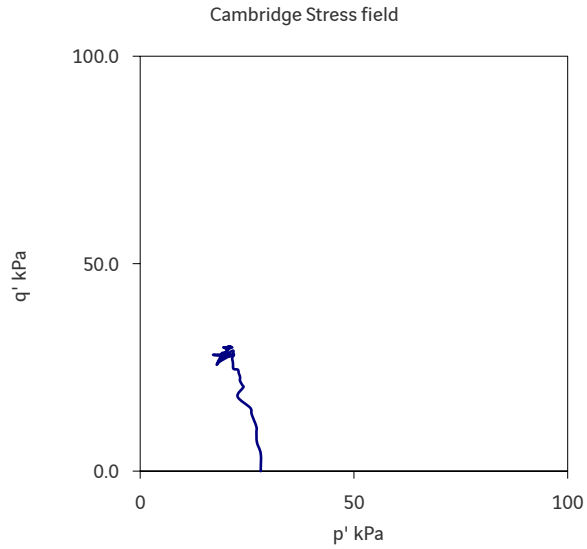
SPECIMEN AFTER TEST

Test number		1	
Mode of failure		Plastic 	
Final moisture content	%	78	
Final bulk density	Mg/m^3	1.54	
Final dry density	Mg/m^3	0.86	

ADDITIONAL SPECIMEN DETAILS

Rate of strain	%/hour	0.20	
Failure criterion		Maximum deviator stress	





REMARKS

Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 23/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH102
Project No.	TB8754		Sample Depth 5.00m
Engineer	Mott MacDonald		Sample Number 20
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 5.00m
			Specimen Number 2

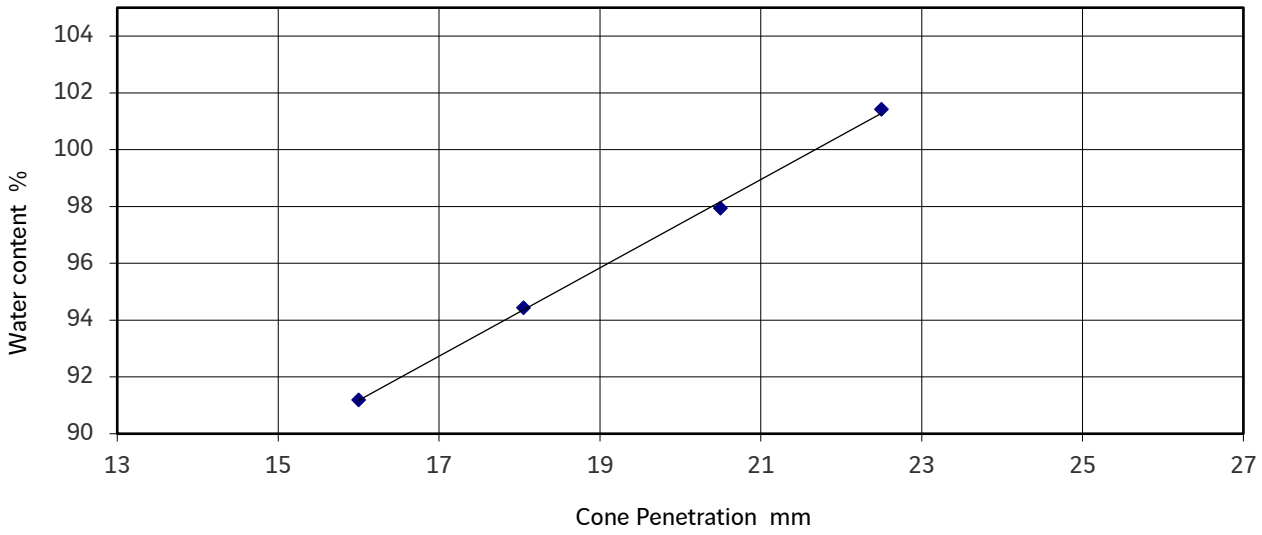
Water content	68.8	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

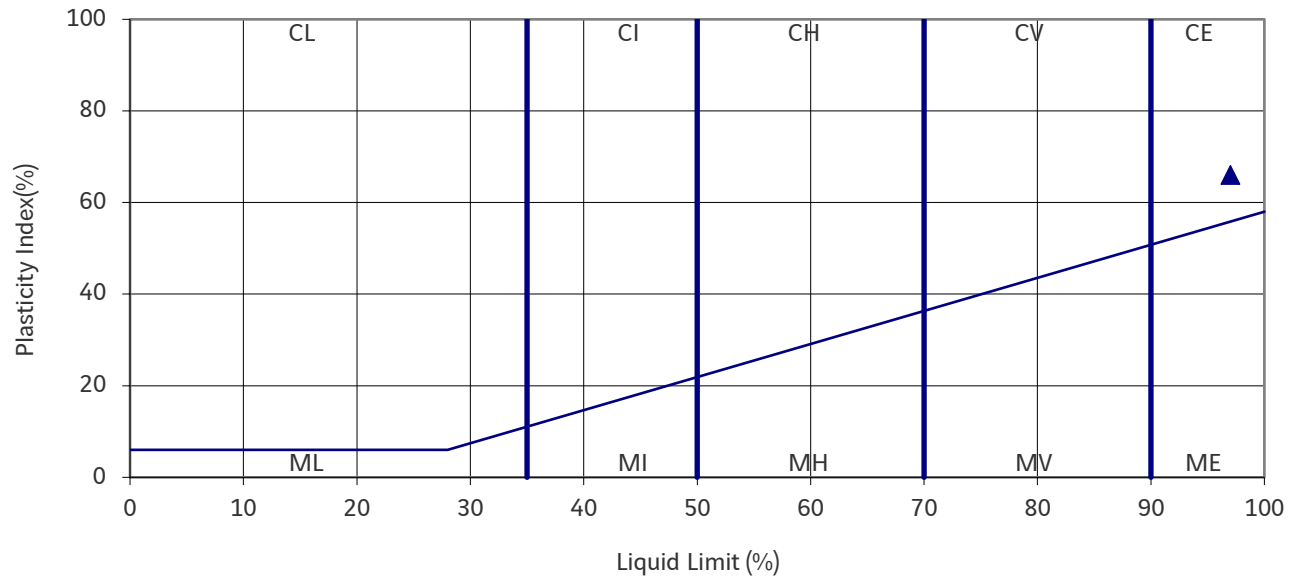
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 03/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH102
Project No.	TB8754		Sample Depth 5.00m
Engineer	Mott MacDonald		Sample Number 20
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 5.00m
			Specimen Number 1



As received water content:	68.8%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	97%	Preparation of sample: Natural	
Plastic limit:	31%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	66%		
Water content of soil passing 425µm	68.8%		
Liquidity index:	0.573		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 03/07/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH102
Project No.	TB8754		Sample Depth 6.00m
Engineer	Mott MacDonald		Sample Number 22
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 6.00m
			Specimen Number 2

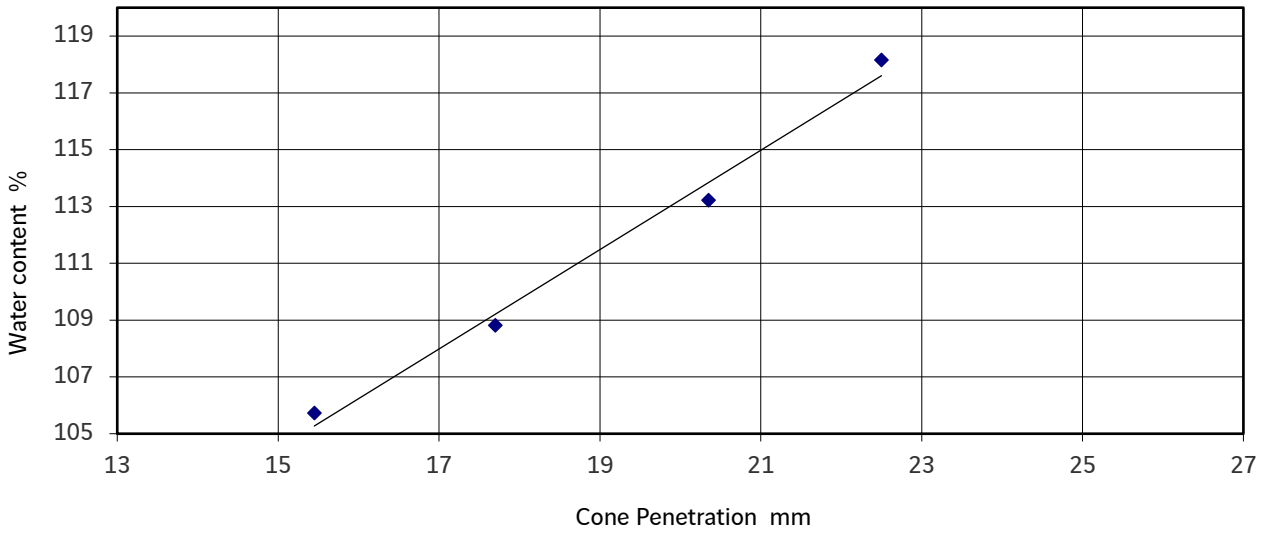
Water content	92.6	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

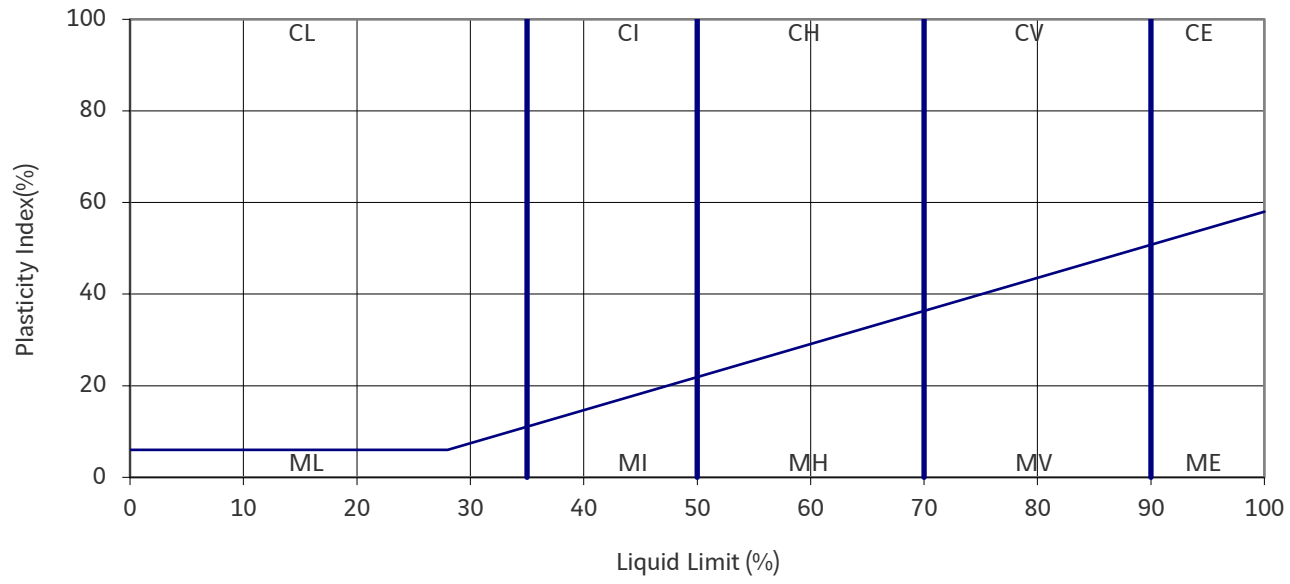
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 04/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH102
Project No.	TB8754		Sample Depth 6.00m
Engineer	Mott MacDonald		Sample Number 22
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 6.00m
			Specimen Number 1



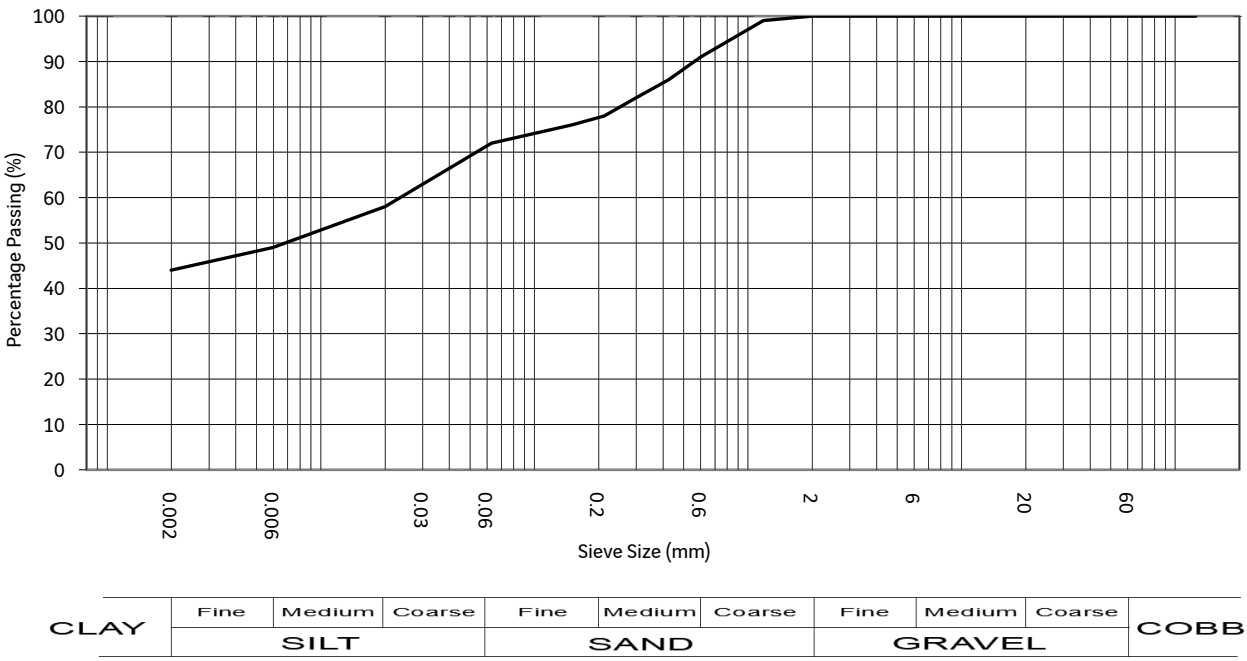
As received water content:	92.6%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	110%	Preparation of sample: Natural	
Plastic limit:	35%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	75%		
Water content of soil passing 425µm	92.6%		
Liquidity index:	0.769		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 08/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH102
Project No.	TB8754		Sample Depth 6.00m
Engineer	Mott MacDonald		Sample Number 23
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type P
Description	Dark brown PEAT.		Specimen Depth 6.00m
			Specimen No. 1



PARTICLE SIZE	%
Clay:	43.9
Silt:	28.4
Sand:	27.7
Gravel:	0.0
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA

Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	100
		10	100
		6.3	100
125.0	100	5	100
90.0	100	3.35	100
75.0	100	2	100
63.0	100	1.18	99
50.0	100	0.6	91
37.5	100	0.425	86
28.0	100	0.3	82
20.0	100	0.212	78
		0.15	76
		0.063	72

SEDIMENTATION DATA

Equivalent particle diameter mm	Cumulative % passing
0.020000	58
0.005970	49
0.001990	44

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:

Paul Rodgers

Print date 21/08/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH102
Project No.	TB8754		Sample Depth 7.00m
Engineer	Mott MacDonald		Sample Number 24
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Dark brown PEAT.		Specimen Depth 7.00m
			Specimen Number 2

Water content	305	%
Oven temperature	50	°C
Is test result assumed to be a natural water content?	Yes	

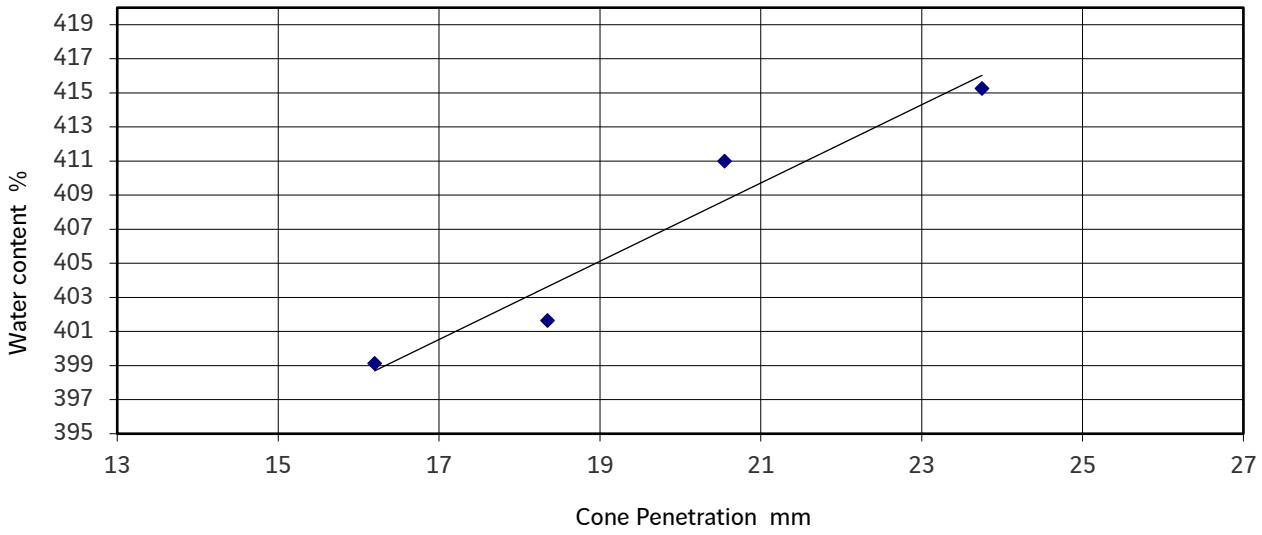
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

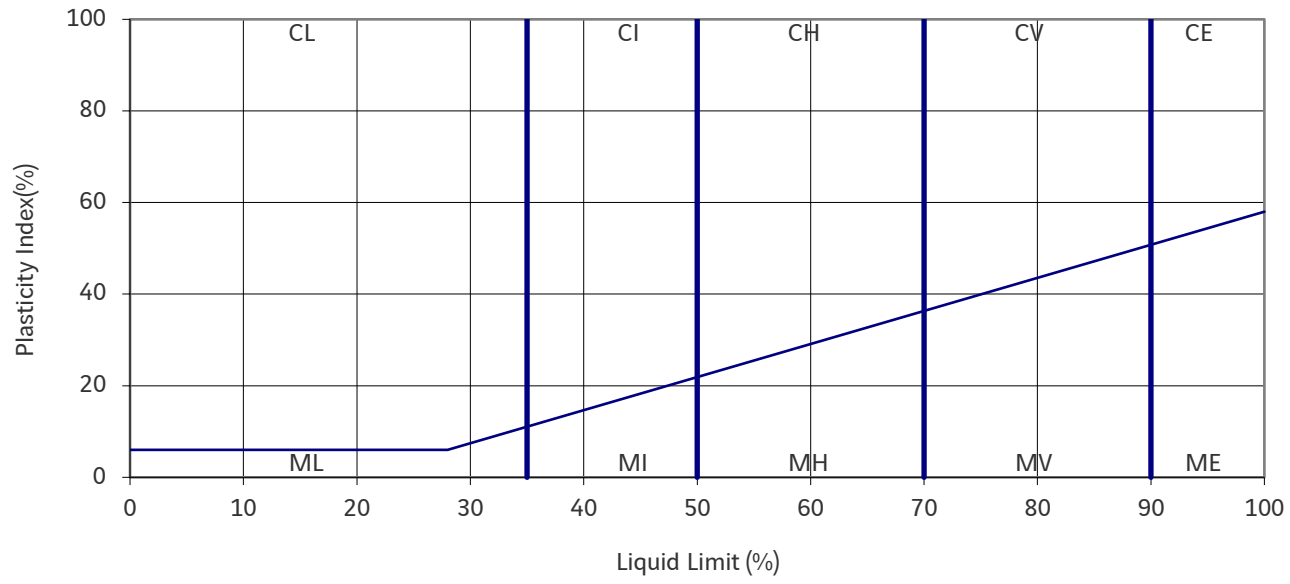
Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 08/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024	

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH102
Project No.	TB8754		Sample Depth 7.00m
Engineer	Mott MacDonald		Sample Number 24
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Dark brown PEAT.		Specimen Depth 7.00m
			Specimen Number 1



As received water content:	305%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	410%	Preparation of sample: Natural	
Plastic limit:	280%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	130%		
Water content of soil passing 425µm	305%		
Liquidity index:	0.191		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 10/07/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH102
Project No.	TB8754		Sample Depth 8.00m
Engineer	Mott MacDonald		Sample Number 26
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 8.00m
			Specimen Number 2

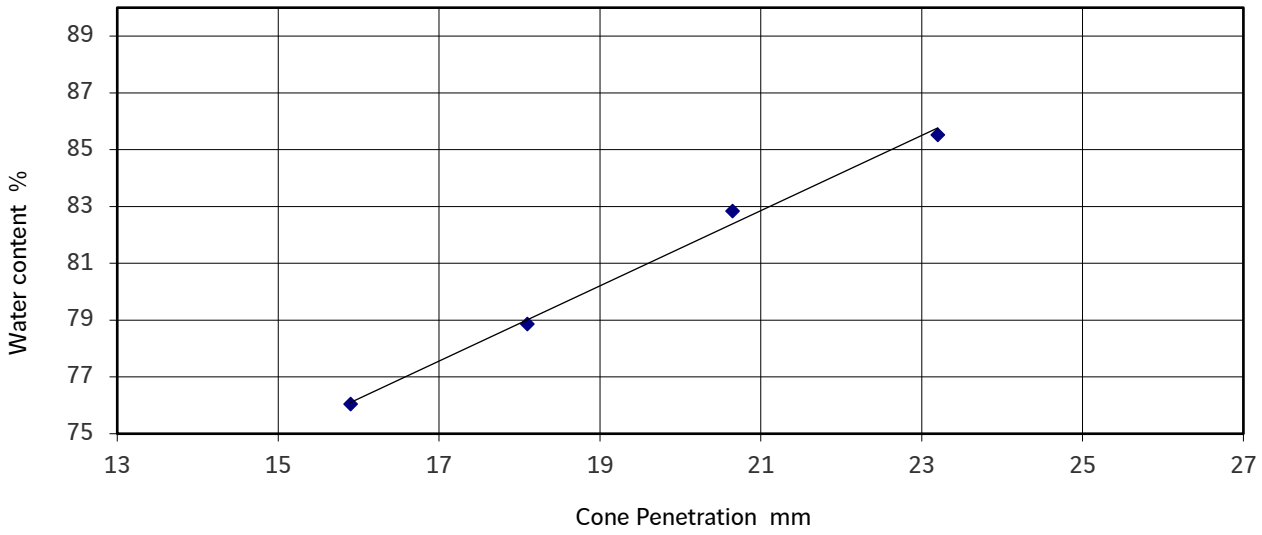
Water content	76.4	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

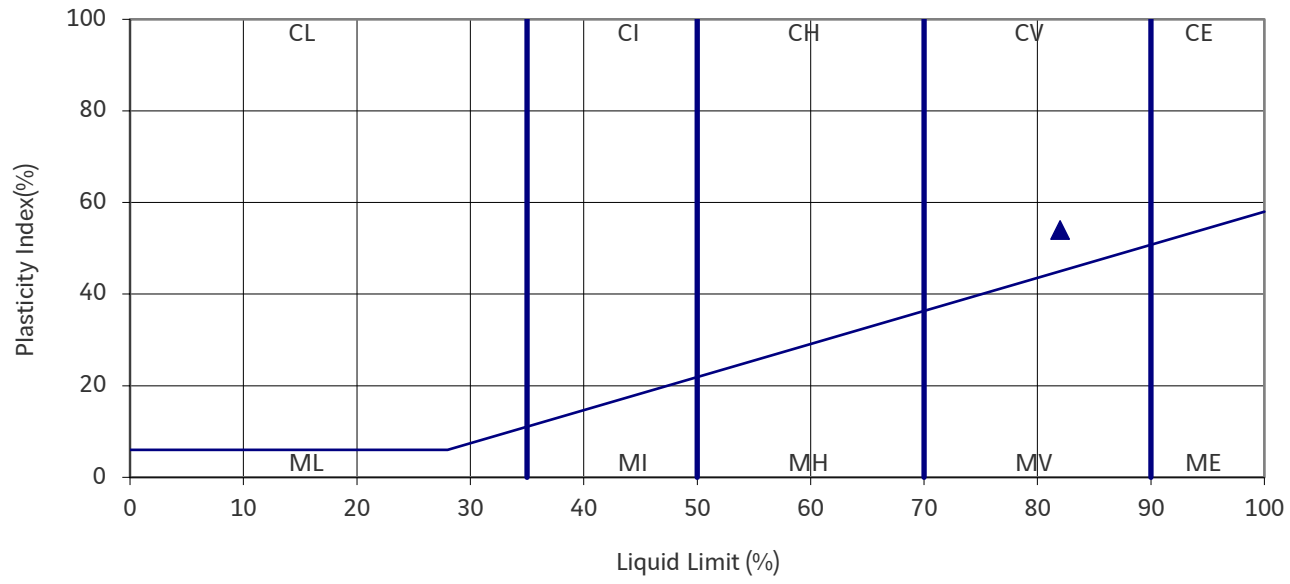
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Steve Harper			Print date 10/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH102
Project No.	TB8754		Sample Depth 8.00m
Engineer	Mott MacDonald		Sample Number 26
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 8.00m
			Specimen Number 1



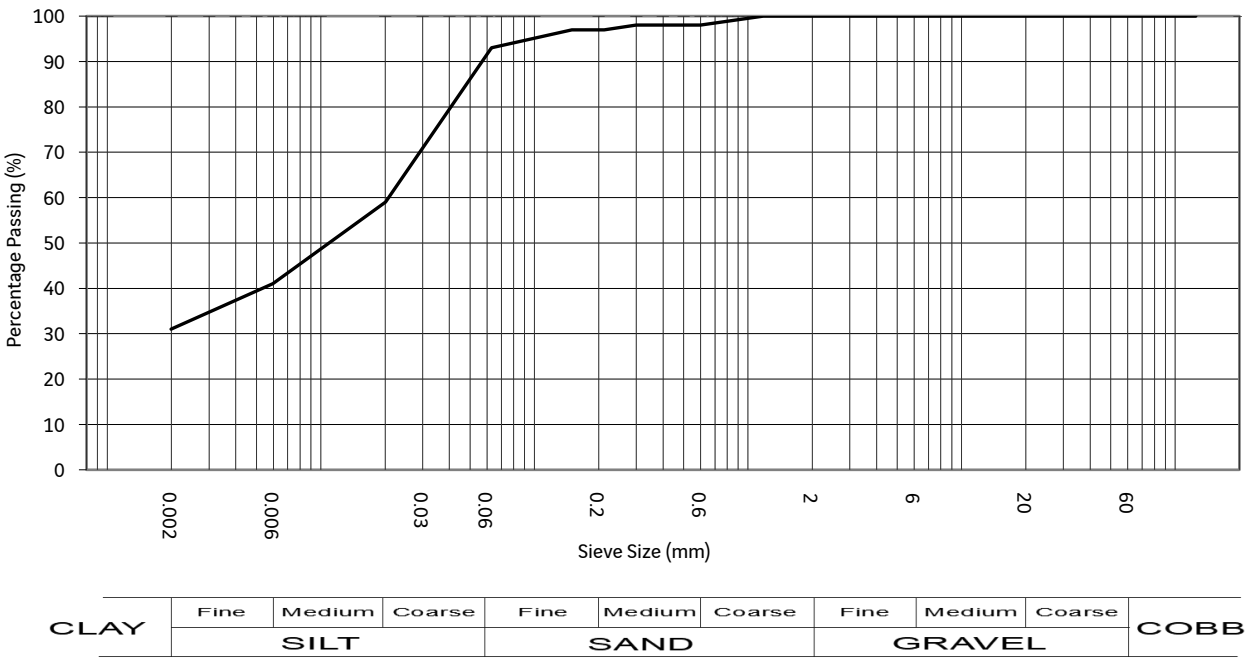
As received water content:	76.4%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	82%	Preparation of sample: Natural	
Plastic limit:	28%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	54%		
Water content of soil passing 425µm	76.4%		
Liquidity index:	0.896		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 10/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH102
Project No.	TB8754		Sample Depth 8.00m
Engineer	Mott MacDonald		Sample Number 27
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type P
Description	Grey CLAY.		Specimen Depth 8.33m
			Specimen No. 1



PARTICLE SIZE	%
Clay:	31.5
Silt:	61.1
Sand:	7.4
Gravel:	0.0
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA

Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	100
		10	100
		6.3	100
125.0	100	5	100
90.0	100	3.35	100
75.0	100	2	100
63.0	100	1.18	100
50.0	100	0.6	98
37.5	100	0.425	98
28.0	100	0.3	98
20.0	100	0.212	97
		0.15	97
		0.063	93

SEDIMENTATION DATA

Equivalent particle diameter mm	Cumulative % passing
0.020100	59
0.005970	41
0.001990	31

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:

Paul Rodgers

Print date 21/08/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH102
Project No.	TB8754		Sample Depth 9.00m
Engineer	Mott MacDonald		Sample Number 28
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 9.00m
			Specimen Number 2

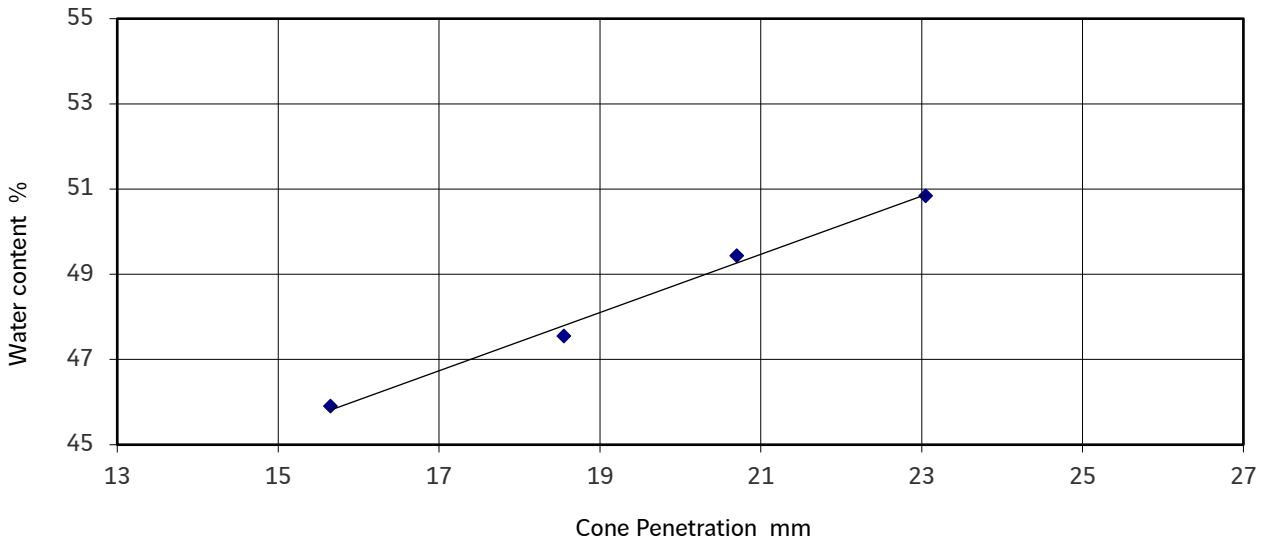
Water content	56.6	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

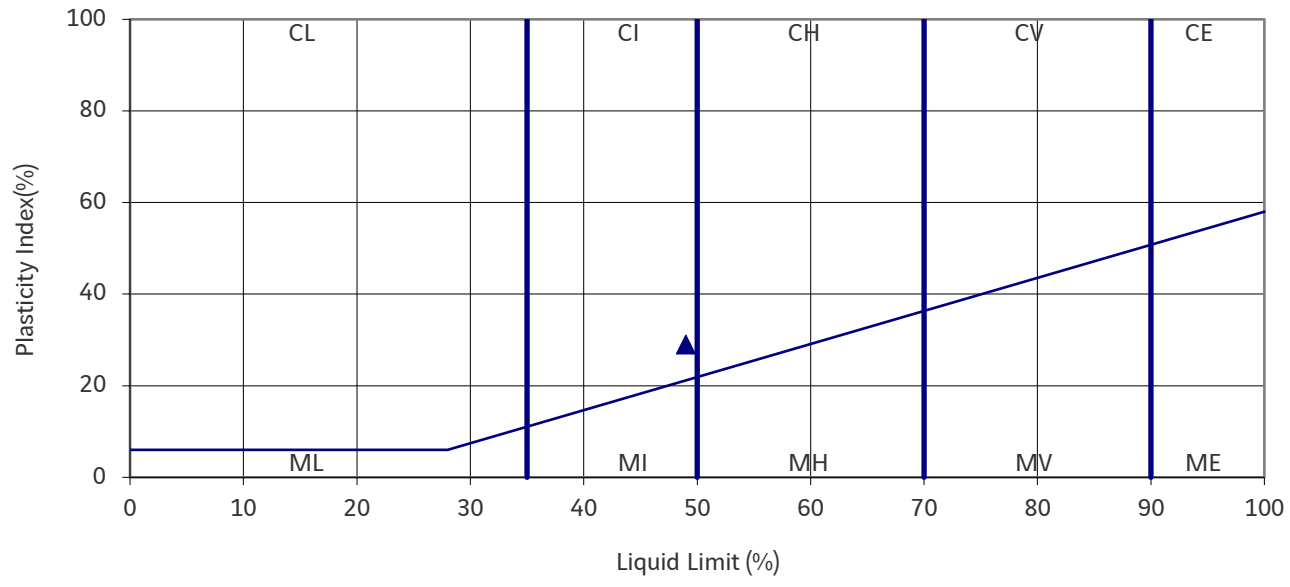
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 04/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH102
Project No.	TB8754		Sample Depth 9.00m
Engineer	Mott MacDonald		Sample Number 28
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 9.00m
			Specimen Number 1



As received water content:	56.6%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	49%	Preparation of sample: Natural	
Plastic limit:	20%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	29%		
Water content of soil passing 425µm	56.6%		
Liquidity index:	1.261		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 08/07/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH102
Project No.	TB8754		Sample Depth 10.00m
Engineer	Mott MacDonald		Sample Number 30
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 10.00m
			Specimen Number 2

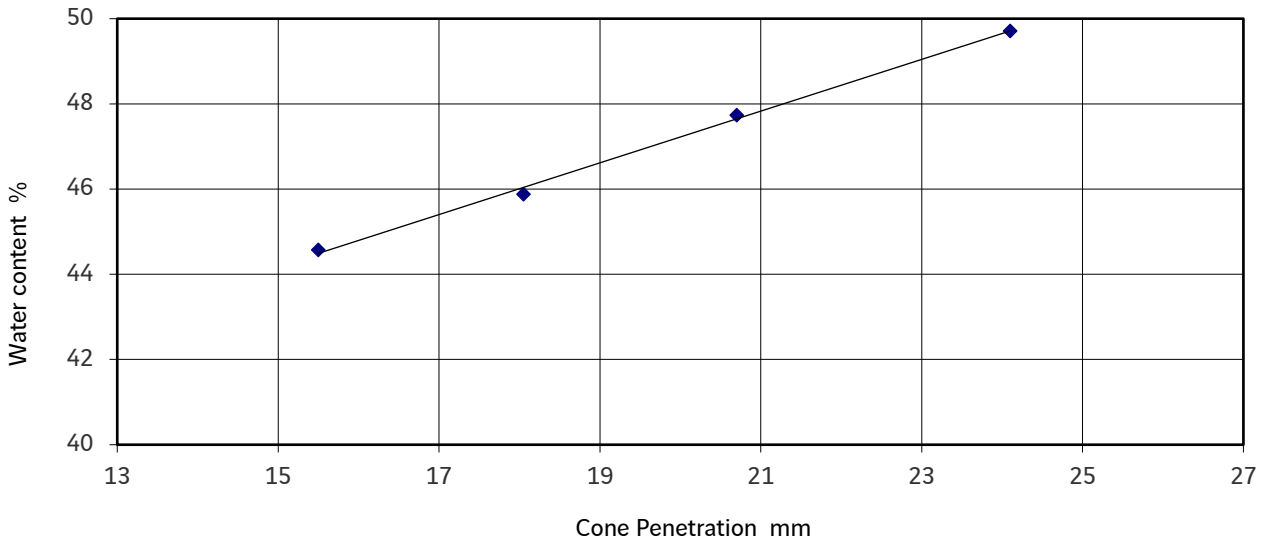
Water content	54.6	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

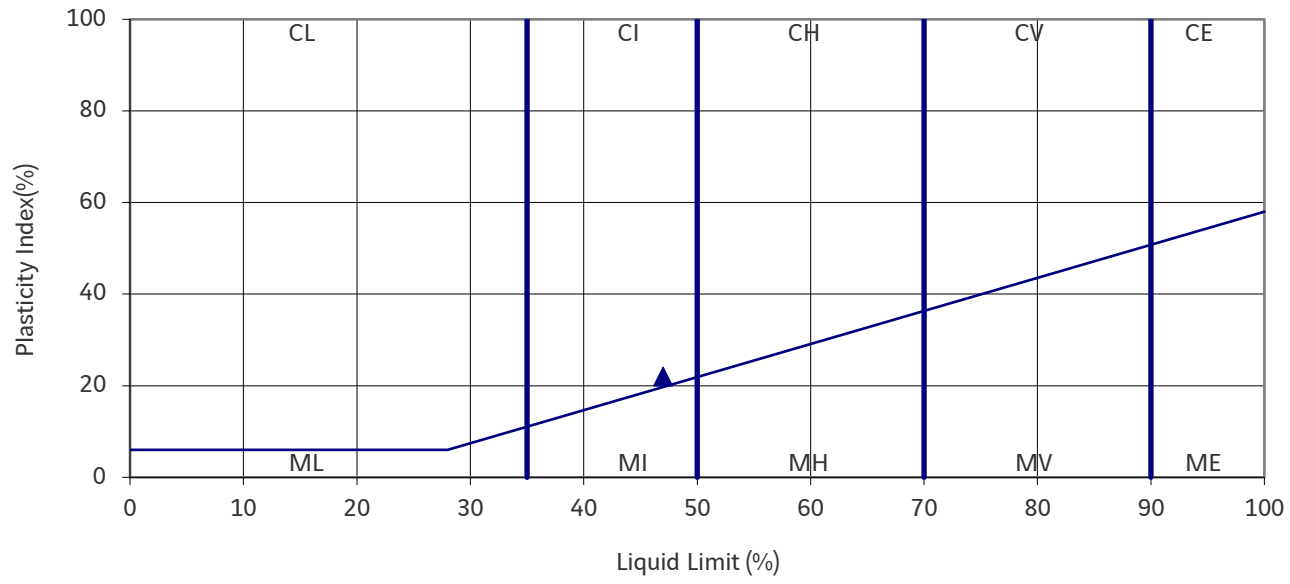
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 08/07/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH102
Project No.	TB8754		Sample Depth 10.00m
Engineer	Mott MacDonald		Sample Number 30
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 10.00m
			Specimen Number 1



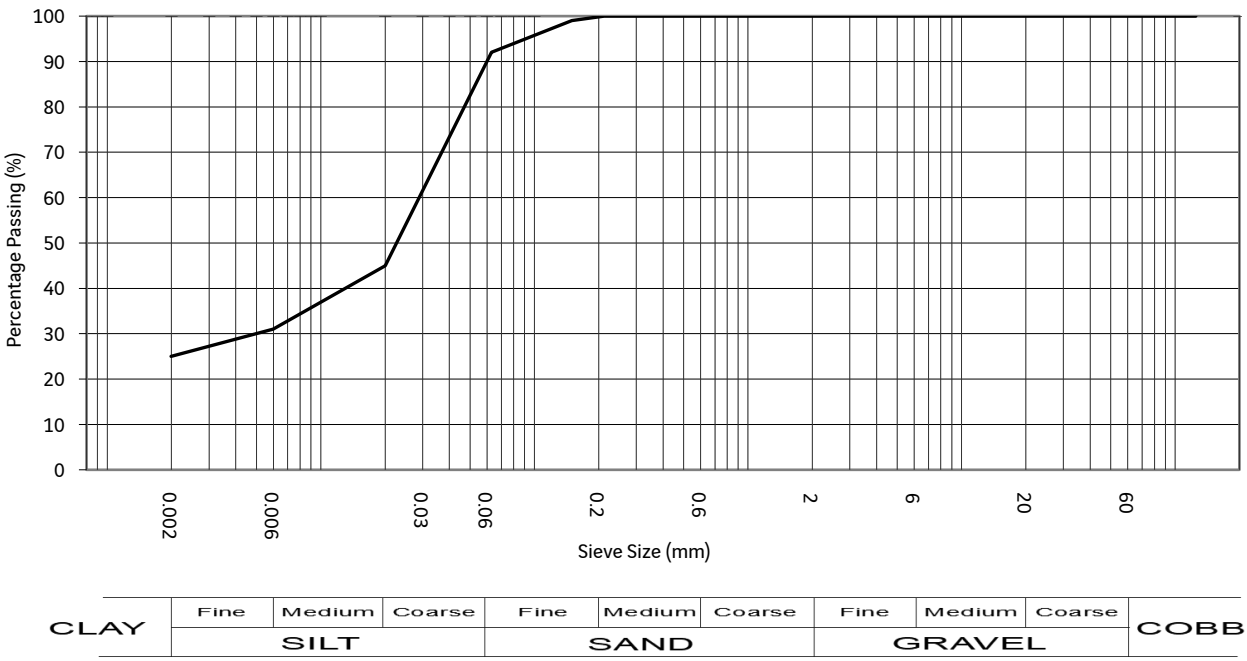
As received water content:	54.6%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	47%	Preparation of sample: Natural	
Plastic limit:	25%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	22%		
Water content of soil passing 425µm	54.6%		
Liquidity index:	1.347		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 10/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH102
Project No.	TB8754		Sample Depth 10.00m
Engineer	Mott MacDonald		Sample Number 31
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type P
Description	Grey CLAY.		Specimen Depth 10.23m
			Specimen No. 1



PARTICLE SIZE	%
Clay:	25.1
Silt:	67.1
Sand:	7.8
Gravel:	0.0
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA

Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	100
		10	100
		6.3	100
125.0	100	5	100
90.0	100	3.35	100
75.0	100	2	100
63.0	100	1.18	100
50.0	100	0.6	100
37.5	100	0.425	100
28.0	100	0.3	100
20.0	100	0.212	100
		0.15	99
		0.063	92

SEDIMENTATION DATA

Equivalent particle diameter mm	Cumulative % passing
0.020000	45
0.005980	31
0.001990	25

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:

Paul Rodgers

Print date 21/08/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH102
Project No.	TB8754		Sample Depth 11.00m
Engineer	Mott MacDonald		Sample Number 32
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 11.00m
			Specimen Number 2

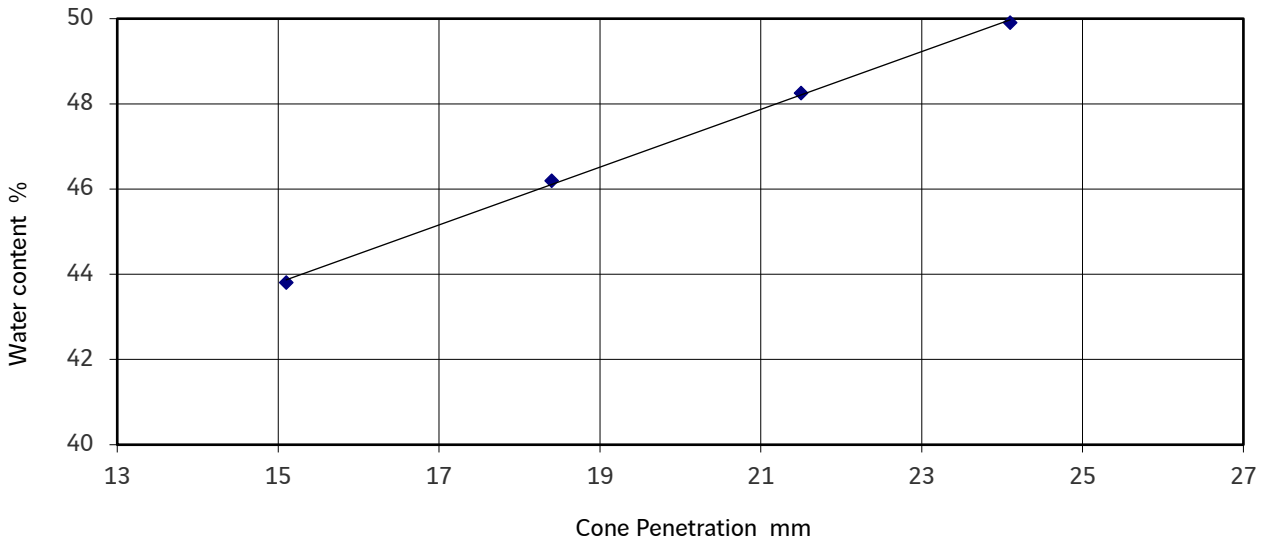
Water content	62.1	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

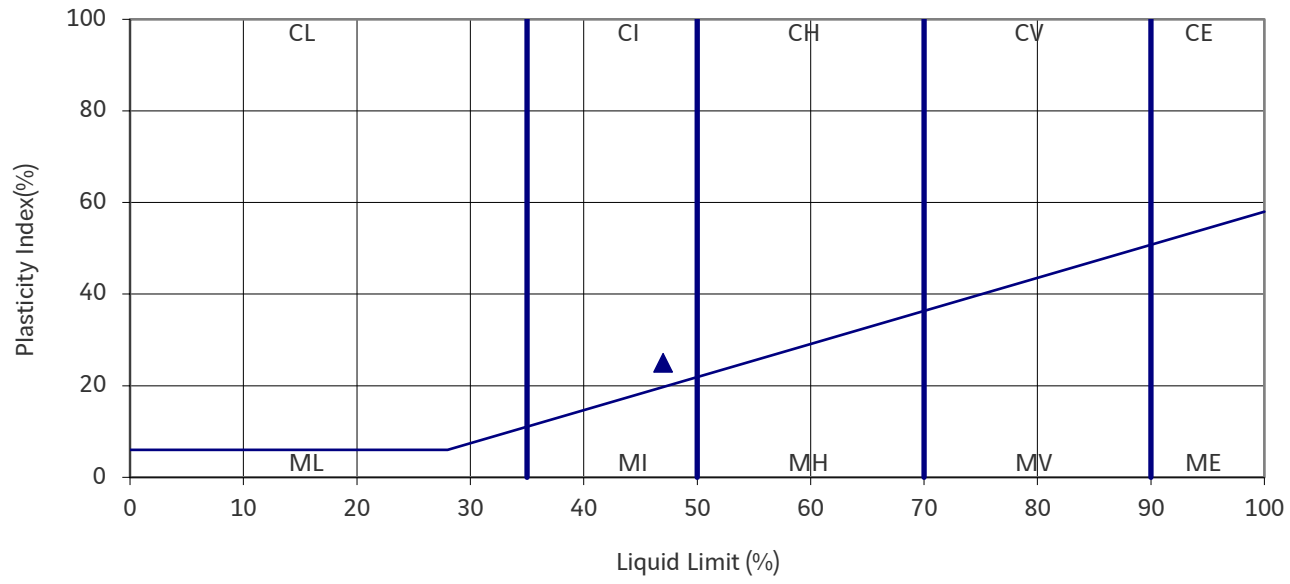
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 08/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH102
Project No.	TB8754		Sample Depth 11.00m
Engineer	Mott MacDonald		Sample Number 32
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 11.00m
			Specimen Number 1



As received water content:	62.1%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	47%	Preparation of sample: Natural	
Plastic limit:	22%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	25%		
Water content of soil passing 425µm	62.1%		
Liquidity index:	1.605		

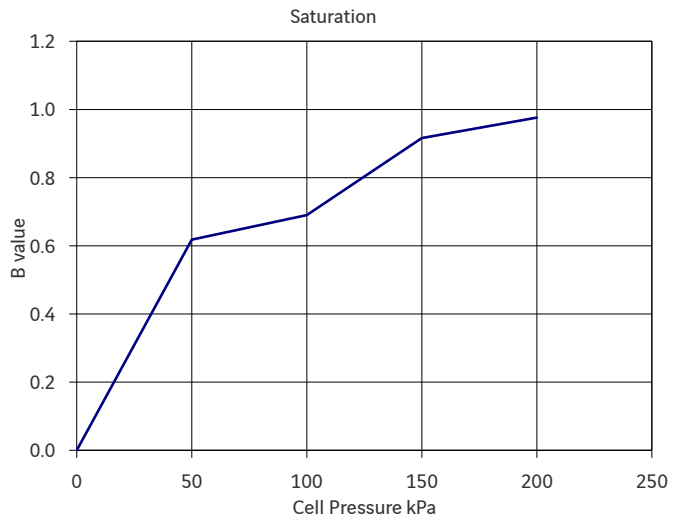


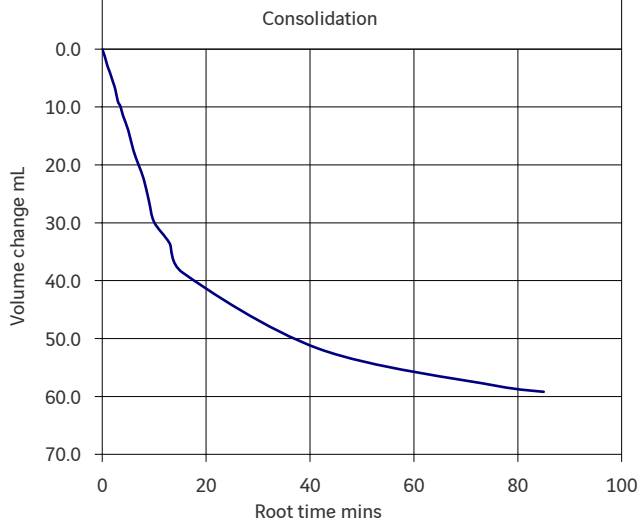
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 10/07/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH102
Project No.	TB8754		Sample Depth 11.00m
Engineer	Mott MacDonald		Sample Number 33
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with decomposed plant fibres.		Specimen Depth 11.54m
			Specimen Number 2

SPECIMEN INITIAL DIMENSIONS		
Test number		1
Specimen diameter	mm	101.23
Specimen length	mm	195.63
Density	Mg/m^3	1.50
Moisture content	%	78
Dry density	Mg/m^3	0.84
SATURATION STAGE		
Initial pore water pressure	kPa	0.2
Saturated pore water pressure	kPa	194.3
Final cell pressure	kPa	200
B value		0.976
CONSOLIDATION STAGE		
Cell pressure	kPa	360
Back pressure	kPa	300
Effective consolidation pressure	kPa	60
Initial pore water pressure	kPa	345.8
Final pore water pressure	kPa	302.5
Pore pressure dissipation	%	94.5
c_{vi}	$m^2/year$	10.50
m_{vi}	m^2/MN	0.87
SPECIMEN AFTER CONSOLIDATION		
Density	Mg/m^3	1.55
Moisture content	%	76
Dry density	Mg/m^3	0.88



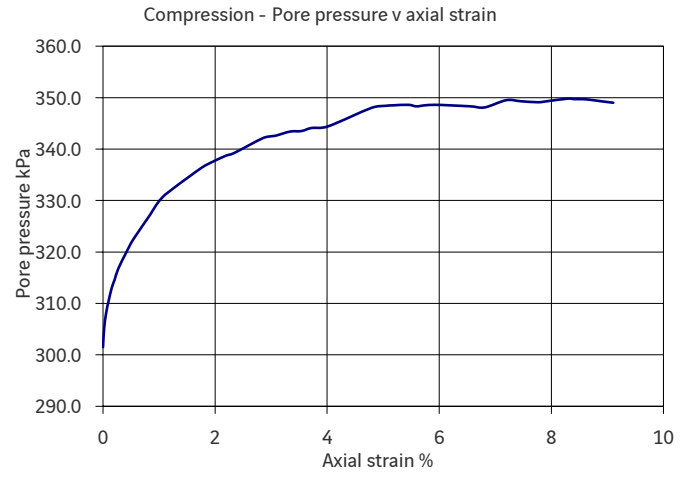


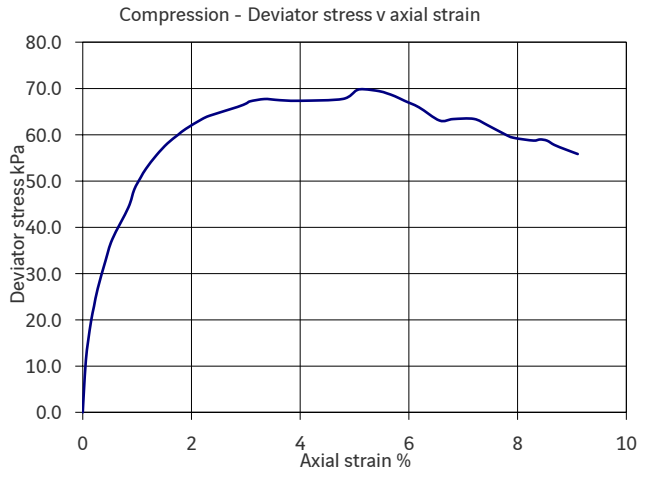
Remarks: Specimen orientation Vertical
Specimen condition for test UNDISTURBED
Saturation with 50kPa increments with a differential pressure of 10kPa
Drainage from both ends

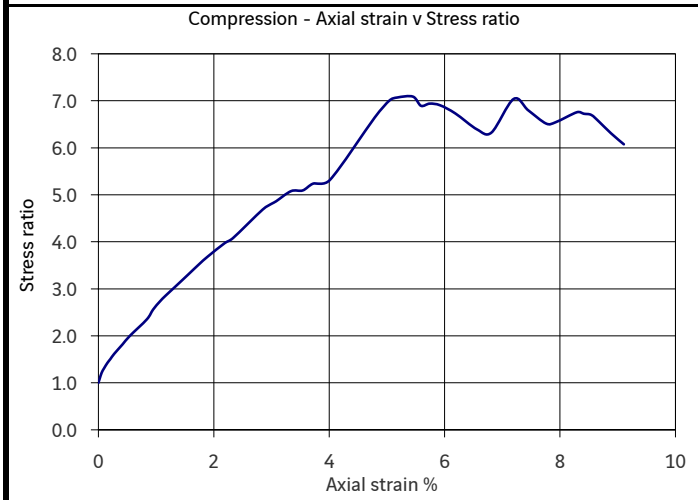
Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 15/08/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

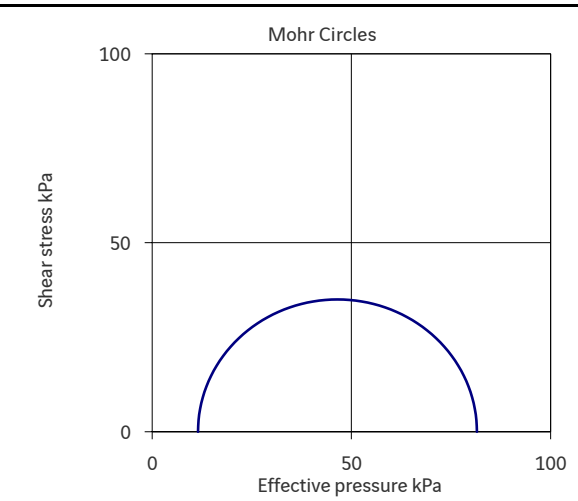
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH102
Project No.	TB8754		Sample Depth 11.00m
Engineer	Mott MacDonald		Sample Number 33
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with decomposed plant fibres.		Specimen Depth 11.54m
			Specimen Number 2

COMPRESSION STAGE			
Test number			1
Cell pressure		kPa	360
Initial pore water pressure		kPa	302
Effective confining pressure		kPa	58
Failure conditions at			Maximum deviator stress
Axial strain at failure		%	5.2
Maximum deviator stress	σ_1-σ_3	kPa	70
Pore water pressure at failure	σ	kPa	349
Effective major principal stress	σ_1'	kPa	81.32
Effective minor principal stress	σ_3'	kPa	11.50
Effective principal stress ratio			7.07
Membrane correction		kPa	0.63
Filter drain correction not applicable		kPa	0.0
Pore pressure coefficient			0.7









Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 15/08/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

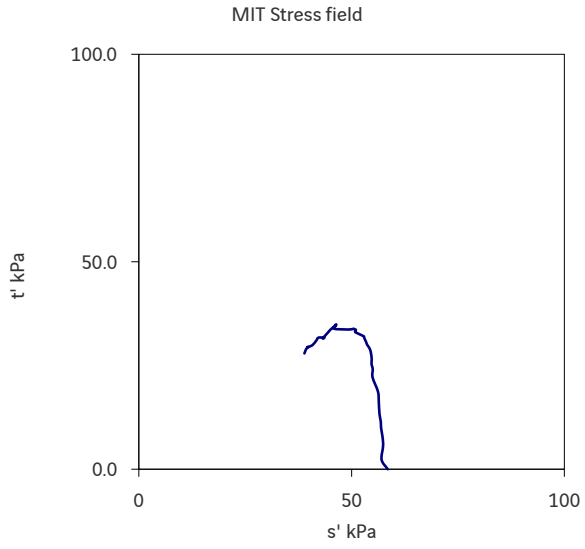
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH102
Project No.	TB8754		Sample Depth 11.00m
Engineer	Mott MacDonald		Sample Number 33
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with decomposed plant fibres.		Specimen Depth 11.54m
			Specimen Number 2

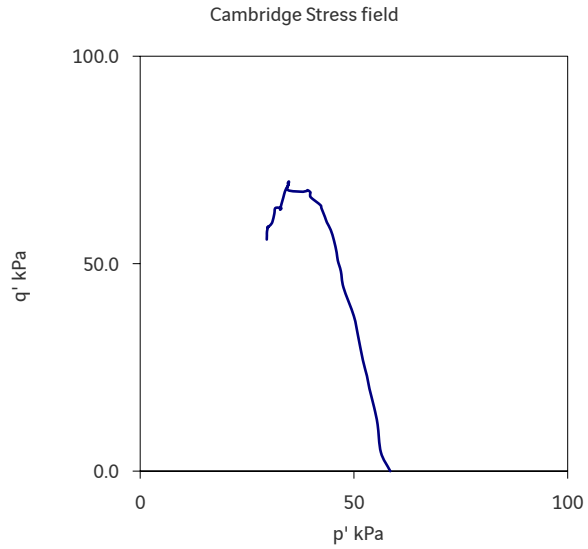
SPECIMEN AFTER TEST

Test number		1	
Mode of failure		Compound 	
Final moisture content	%	76	
Final bulk density	Mg/m^3	1.55	
Final dry density	Mg/m^3	0.88	

ADDITIONAL SPECIMEN DETAILS

Rate of strain	%/hour	0.20	
Failure criterion		Maximum deviator stress	





REMARKS

Preliminary	Leeds Laboratory	Results apply to samples as received.	SOIL ENGINEERING
Paul Rodgers		Print date 15/08/2025	
	Revision No. 3.01	Issue Date 01/05/2024	

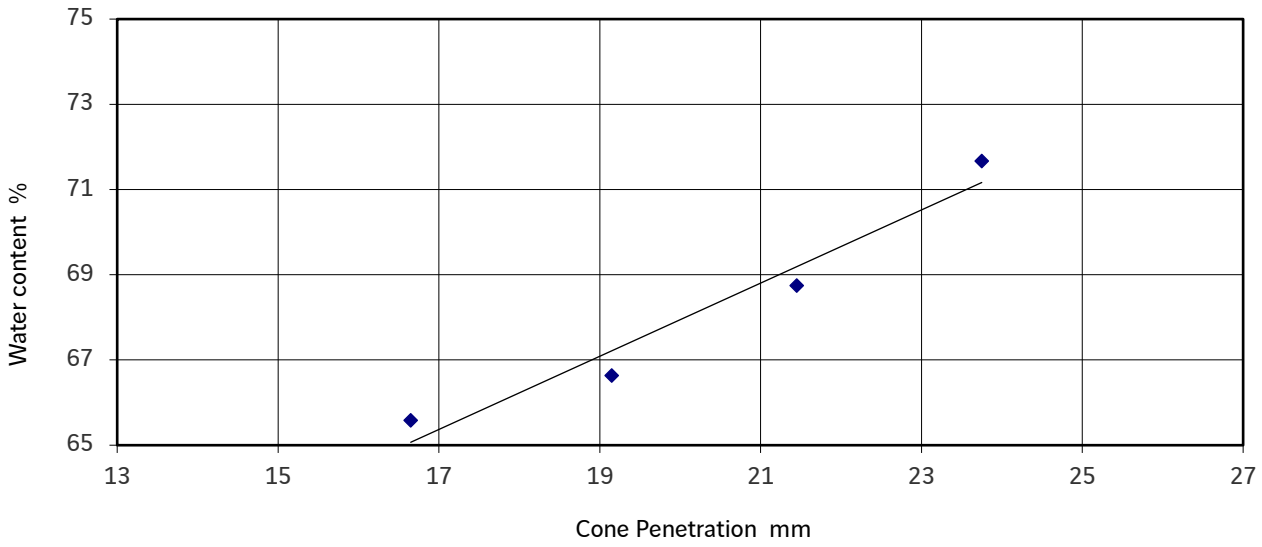
Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH102
Project No.	TB8754		Sample Depth 12.00m
Engineer	Mott MacDonald		Sample Number 34
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 12.00m
			Specimen Number 2

Water content	75.7	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

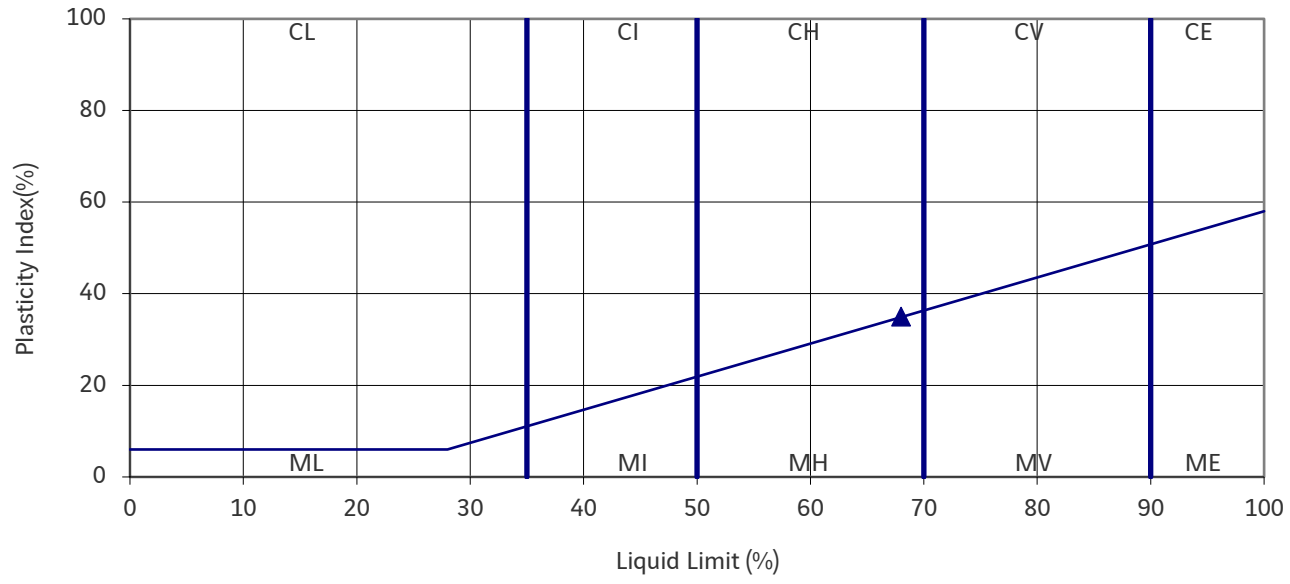
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH102
Project No.	TB8754		Sample Depth 12.00m
Engineer	Mott MacDonald		Sample Number 34
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 12.00m
			Specimen Number 1



As received water content:	75.7%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	68%	Preparation of sample: Natural	
Plastic limit:	33%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	35%		
Water content of soil passing 425µm	75.7%		
Liquidity index:	1.220		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 11/07/2025	
	Revision No. 3.00	Issue Date 19/05/2022	

SOIL ENGINEERING

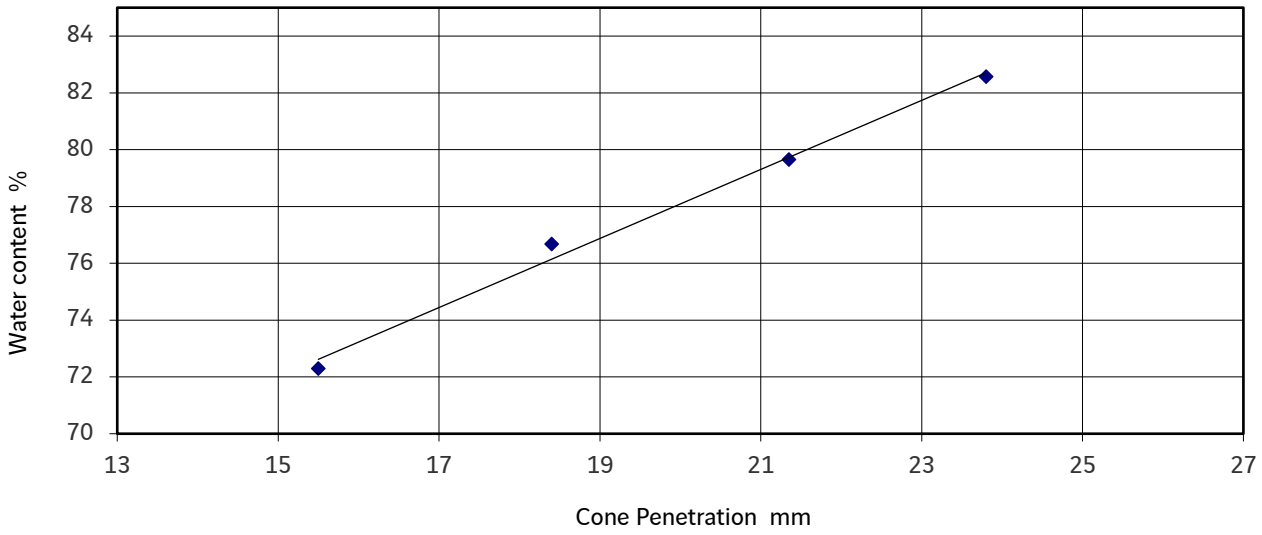
Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH102
Project No.	TB8754		Sample Depth 13.00m
Engineer	Mott MacDonald		Sample Number 36
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey slightly organic CLAY.		Specimen Depth 13.00m
			Specimen Number 2

Water content	71.7	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

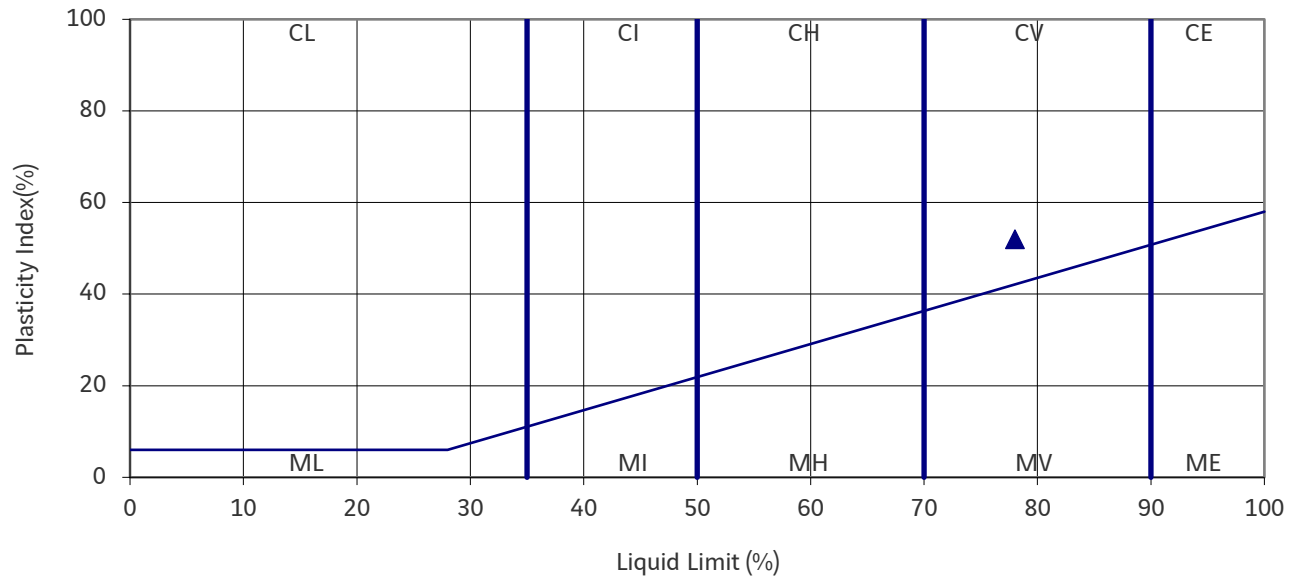
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH102
Project No.	TB8754		Sample Depth 13.00m
Engineer	Mott MacDonald		Sample Number 36
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey slightly organic CLAY.		Specimen Depth 13.00m
			Specimen Number 1



As received water content:	71.7%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	78%	Preparation of sample: Natural	
Plastic limit:	26%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	52%		
Water content of soil passing 425µm	71.7%		
Liquidity index:	0.879		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 10/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH102
Project No.	TB8754		Sample Depth 14.00m
Engineer	Mott MacDonald		Sample Number 38
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 14.00m
			Specimen Number 2

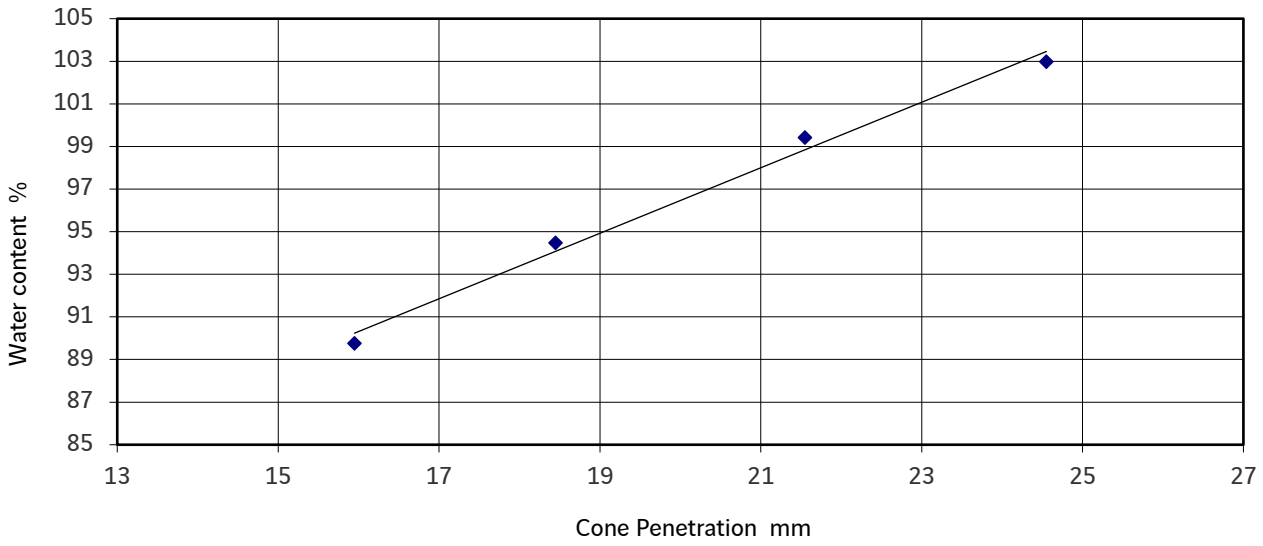
Water content	79.9	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

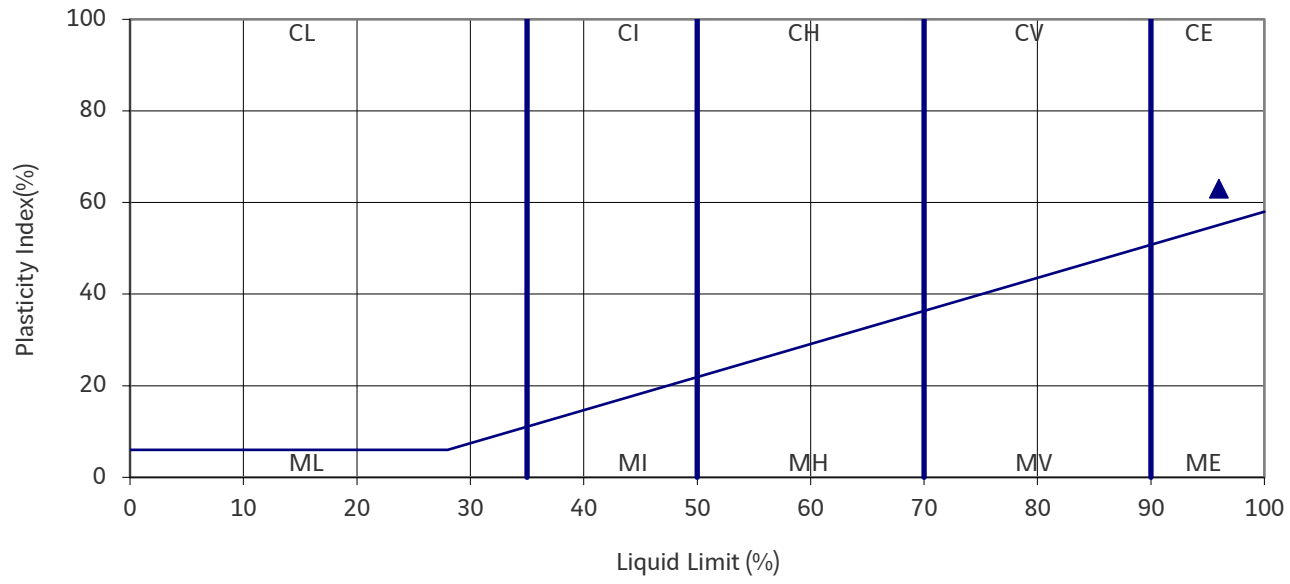
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 08/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH102
Project No.	TB8754		Sample Depth 14.00m
Engineer	Mott MacDonald		Sample Number 38
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 14.00m
			Specimen Number 1



As received water content:	79.9%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	96%	Preparation of sample: Natural	
Plastic limit:	33%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	63%		
Water content of soil passing 425µm	79.9%		
Liquidity index:	0.744		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 10/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH102
Project No.	TB8754		Sample Depth 15.00m
Engineer	Mott MacDonald		Sample Number 40
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 15.00m
			Specimen Number 2

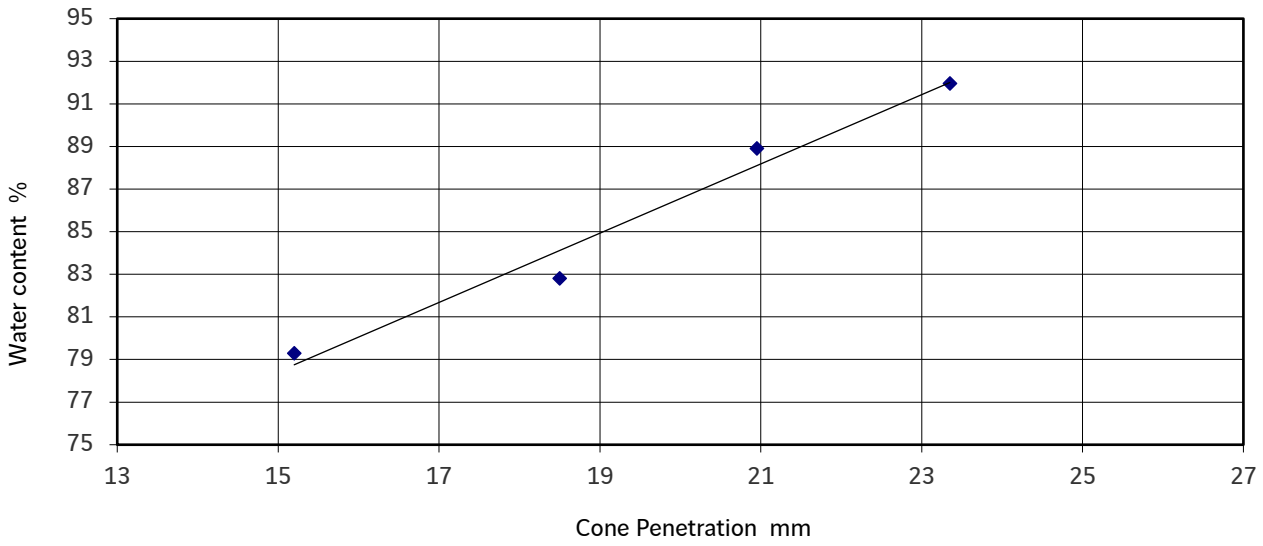
Water content	103	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

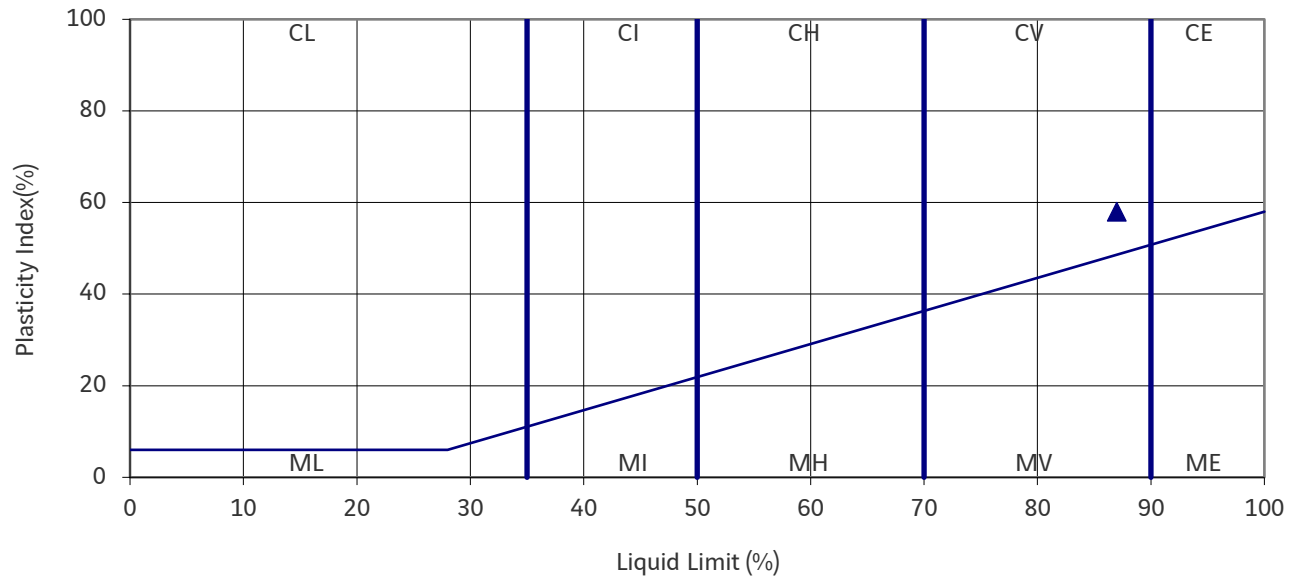
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 08/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH102
Project No.	TB8754		Sample Depth 15.00m
Engineer	Mott MacDonald		Sample Number 40
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 15.00m
			Specimen Number 1



As received water content:	103%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	87%	Preparation of sample: Natural	
Plastic limit:	29%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	58%		
Water content of soil passing 425µm	103%		
Liquidity index:	1.269		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 10/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

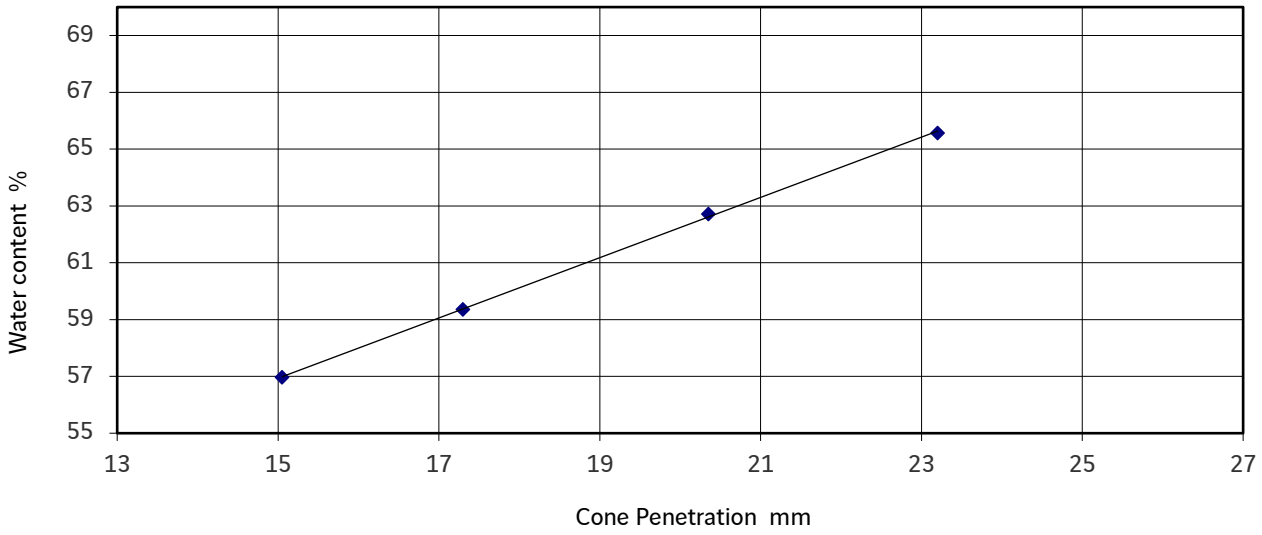
Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH102
Project No.	TB8754		Sample Depth 16.00m
Engineer	Mott MacDonald		Sample Number 42
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey gravelly CLAY.		Specimen Depth 16.00m
			Specimen Number 2

Water content	62.0	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

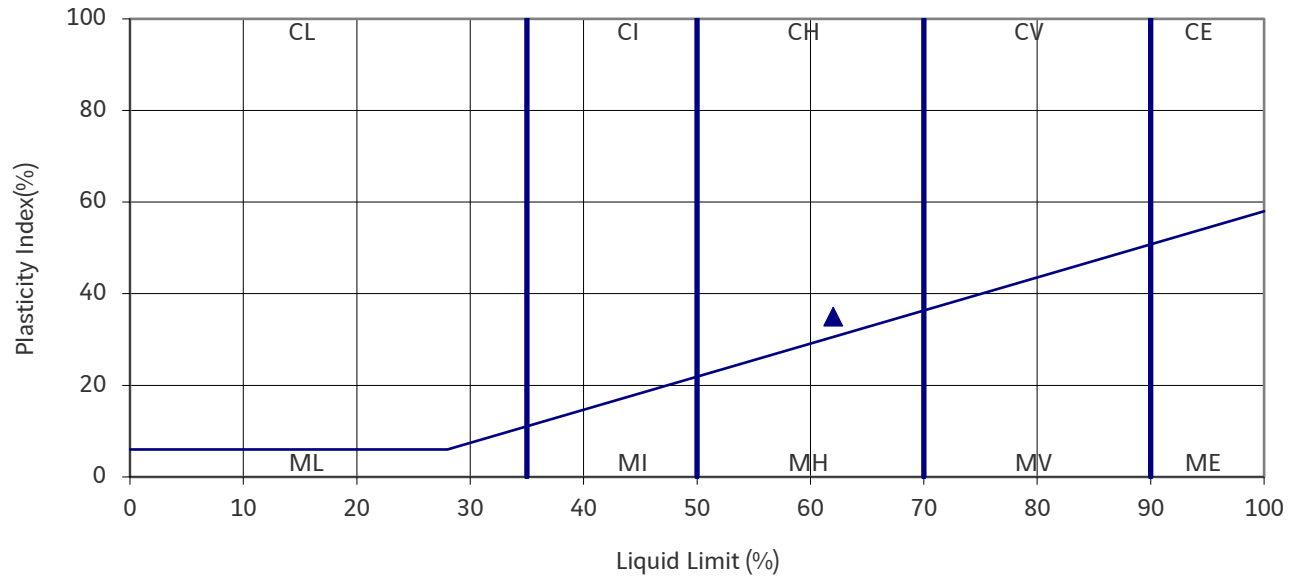
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH102
Project No.	TB8754		Sample Depth 16.00m
Engineer	Mott MacDonald		Sample Number 42
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey gravelly CLAY.		Specimen Depth 16.00m
			Specimen Number 1



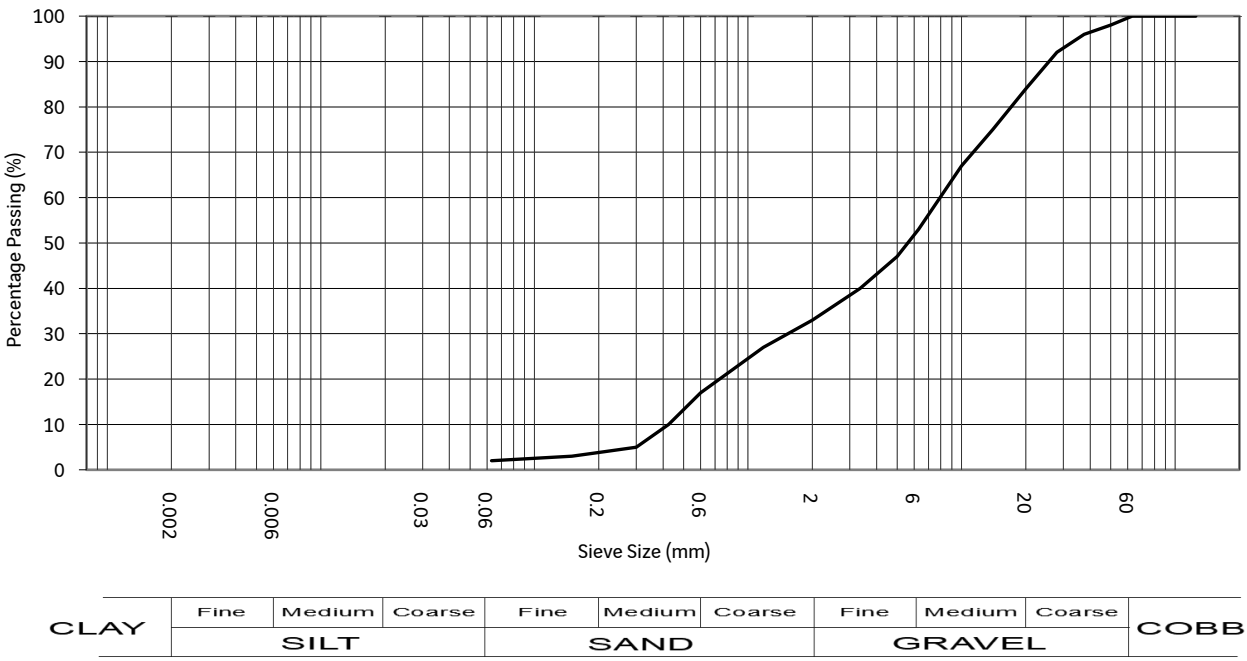
As received water content:	62%	Measured percentage passing 425µm sieve:	70%
Liquid limit:	62%	Preparation of sample: Wet sieve	
Plastic limit:	27%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	35%		
Water content of soil passing 425µm	89.1%		
Liquidity index:	1.776		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 11/07/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH102
Project No.	TB8754		Sample Depth 18.50m
Engineer	Mott MacDonald		Sample Number 47
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.2	Sample type B
Description	Brown slightly sandy GRAVEL.		Specimen Depth 18.50m
			Specimen No. 1



PARTICLE SIZE	%
Silt and clay:	2.4
Sand:	31.0
Gravel:	66.6
Cobbles:	0.0

General remarks

Sample size was insufficient to comply with the recommended minimum mass.

WET SIEVE DATA

Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	75
		10	67
		6.3	53
125.0	100	5	47
90.0	100	3.35	40
75.0	100	2	33
63.0	100	1.18	27
50.0	98	0.6	17
37.5	96	0.425	10
28.0	92	0.3	5
20.0	84	0.212	4
		0.15	3
		0.063	2

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:

Paul Rodgers

Print date 08/07/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH102
Project No.	TB8754		Sample Depth 27.90m
Engineer	Mott MacDonald		Sample Number 102
Employer	FBJV	BS 1377-2:2022 Clause 8/BS EN ISO 17892-2:2014 Clause 5.2	Sample Type CS
Description	Off white CHALK.		Specimen Depth 27.90m
			Specimen Number 1

Water Content	27.9	%
Density Type	Immersion density	
Bulk Density	1.97	Mg/m^3
Dry Density	1.54	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 01/10/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH102
Project No.	TB8754		Sample Depth 33.50m
Engineer	Mott MacDonald		Sample Number 105
Employer	FBJV	BS 1377-2:2022 Clause 8/BS EN ISO 17892-2:2014 Clause 5.2	Sample Type CD
Description	Off white CHALK.		Specimen Depth 33.50m
			Specimen Number 1

Water Content	28.1	%
Density Type	Immersion density	
Bulk Density	1.87	Mg/m^3
Dry Density	1.46	Mg/m^3

Remarks

Deviations from test method

Specimen size is less than $50cm^3$ at $33.57cm^3$

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH102
Project No.	TB8754		Sample Depth 36.15m
Engineer	Mott MacDonald		Sample Number 107
Employer	FBJV	BS 1377-2:2022 Clause 8/BS EN ISO 17892-2:2014 Clause 5.2	Sample Type CS
Description	Off white CHALK.		Specimen Depth 36.15m
			Specimen Number 11

Water Content	22.9	%
Density Type	Immersion density	
Bulk Density	2.05	Mg/m³
Dry Density	1.67	Mg/m³

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 01/10/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH102
Project No.	TB8754		Sample Depth 38.71m
Engineer	Mott MacDonald		Sample Number 109
Employer	FBJV	BS 1377-2:2022 Clause 8/BS EN ISO 17892-2:2014: 5.1	Sample Type CS
Description	Off white CHALK.		Specimen Depth 38.71m
			Specimen Number 1

Water Content	27.4	%
Density Type	Linear density	
Bulk Density	1.97	Mg/m^3
Dry Density	1.55	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 01/10/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH102
Project No.	TB8754		Sample Depth 40.65m
Engineer	Mott MacDonald		Sample Number 110
Employer	FBJV	BS 1377-2:2022 Clause 8/BS EN ISO 17892-2:2014: 5.1	Sample Type CS
Description	Off white CHALK.		Specimen Depth 40.65m
			Specimen Number 11

Water Content	25.0	%
Density Type	Linear density	
Bulk Density	1.96	Mg/m^3
Dry Density	1.57	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 01/10/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH102
Project No.	TB8754		Sample Depth 43.81m
Engineer	Mott MacDonald		Sample Number 112
Employer	FBJV	BS 1377-2:2022 Clause 8/BS EN ISO 17892-2:2014: 5.1	Sample Type CS
Description	Off white CHALK.		Specimen Depth 43.81m
			Specimen Number 1

Water Content	31.3	%
Density Type	Linear density	
Bulk Density	1.90	Mg/m^3
Dry Density	1.45	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 01/10/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH102
Project No.	TB8754		Sample Depth 47.82m
Engineer	Mott MacDonald		Sample Number 114
Employer	FBJV	BS 1377-2:2022 Clause 8/BS EN ISO 17892-2:2014: 5.1	Sample Type CS
Description	Off white CHALK.		Specimen Depth 47.82m
			Specimen Number 11

Water Content	30.3	%
Density Type	Linear density	
Bulk Density	1.87	Mg/m^3
Dry Density	1.44	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 01/10/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH102
Project No.	TB8754		Sample Depth 49.56m
Engineer	Mott MacDonald		Sample Number 115
Employer	FBJV	BS 1377-2:2022 Clause 8/BS EN ISO 17892-2:2014: 5.1	Sample Type CS
Description	Off white CHALK.		Specimen Depth 49.56m
			Specimen Number 11

Water Content	27.2	%
Density Type	Linear density	
Bulk Density	1.95	Mg/m^3
Dry Density	1.54	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 01/10/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH102
Project No.	TB8754		Sample Depth 53.26m
Engineer	Mott MacDonald		Sample Number 117
Employer	FBJV	BS 1377-2:2022 Clause 8/BS EN ISO 17892-2:2014 Clause 5.2	Sample Type CS
Description	Off white CHALK.		Specimen Depth 53.26m
			Specimen Number 11

Water Content	27.8	%
Density Type	Immersion density	
Bulk Density	1.97	Mg/m³
Dry Density	1.54	Mg/m³

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 01/10/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH102
Project No.	TB8754		Sample Depth 54.70m
Engineer	Mott MacDonald		Sample Number 118
Employer	FBJV	BS 1377-2:2022 Clause 8/BS EN ISO 17892-2:2014: 5.1	Sample Type CS
Description	Off white CHALK.		Specimen Depth 54.70m
			Specimen Number 1

Water Content	29.0	%
Density Type	Linear density	
Bulk Density	1.92	Mg/m^3
Dry Density	1.49	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 01/10/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 3.00m
Engineer	Mott MacDonald		Sample Number 20
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 3.73m
			Specimen Number 2

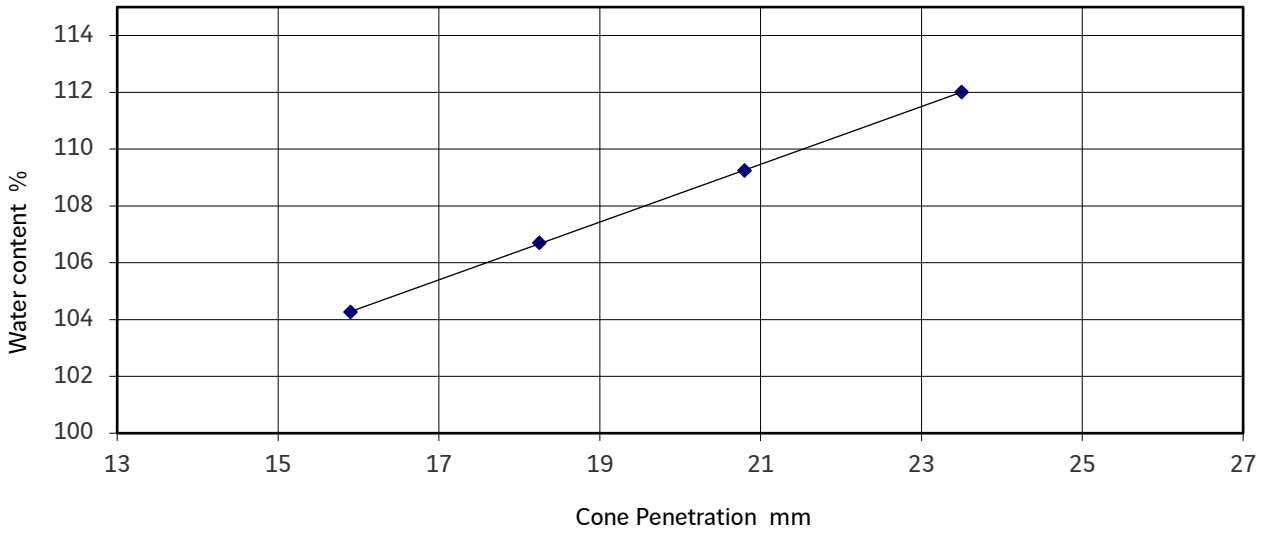
Water content	101	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

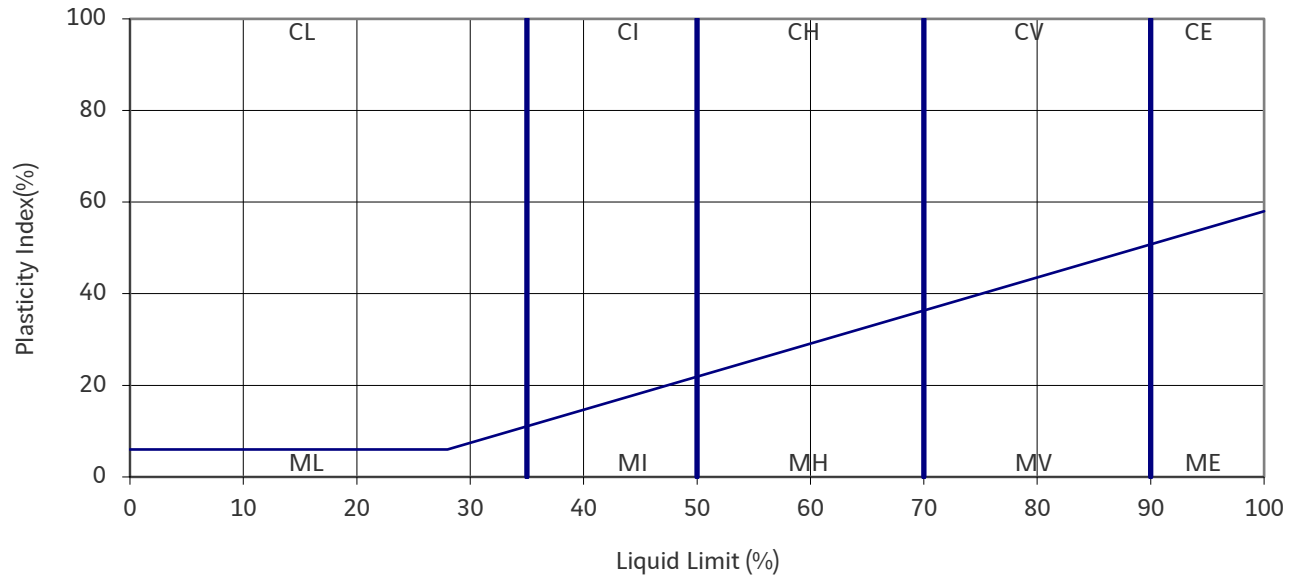
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 22/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH103
Project No.	TB8754		Sample Depth 3.00m
Engineer	Mott MacDonald		Sample Number 20
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 3.73m
			Specimen Number 1



As received water content:	101%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	110%	Preparation of sample: Natural	
Plastic limit:	37%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	73%		
Water content of soil passing 425µm	101%		
Liquidity index:	0.871		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		SOIL ENGINEERING
Paul Rodgers		Print date 24/07/2025	
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 4.00m
Engineer	Mott MacDonald		Sample Number 21
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Light grey CLAY.		Specimen Depth 4.00m
			Specimen Number 2

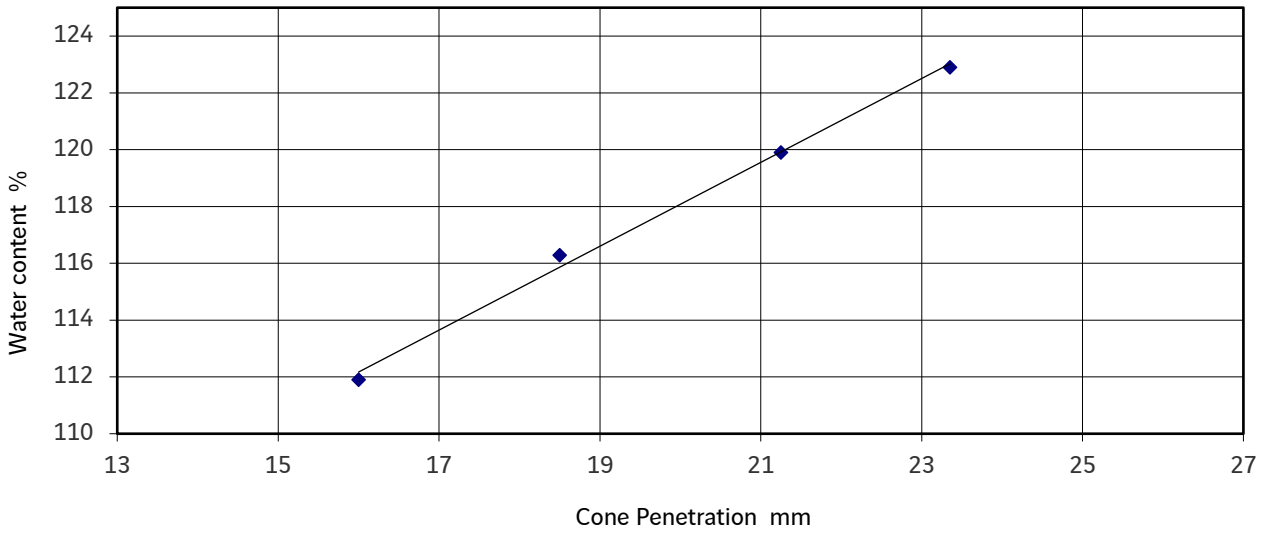
Water content	148	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

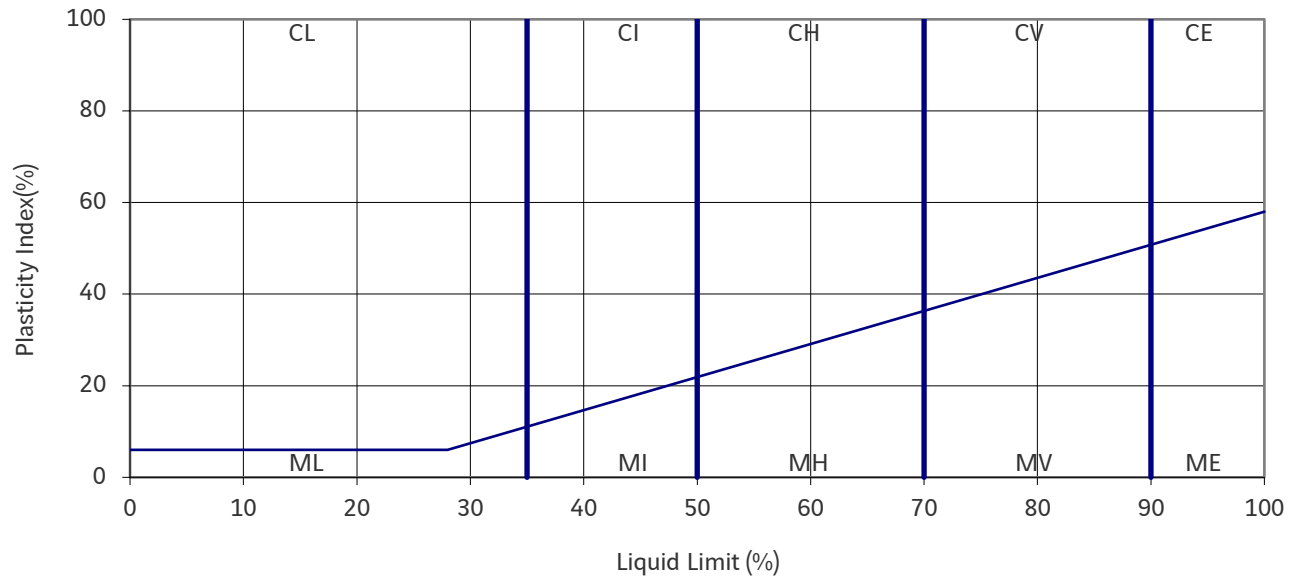
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 04/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH103
Project No.	TB8754		Sample Depth 4.00m
Engineer	Mott MacDonald		Sample Number 21
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Light grey CLAY.		Specimen Depth 4.00m
			Specimen Number 1



As received water content:	148%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	120%	Preparation of sample: Natural	
Plastic limit:	36%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	84%		
Water content of soil passing 425µm	148%		
Liquidity index:	1.329		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 08/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

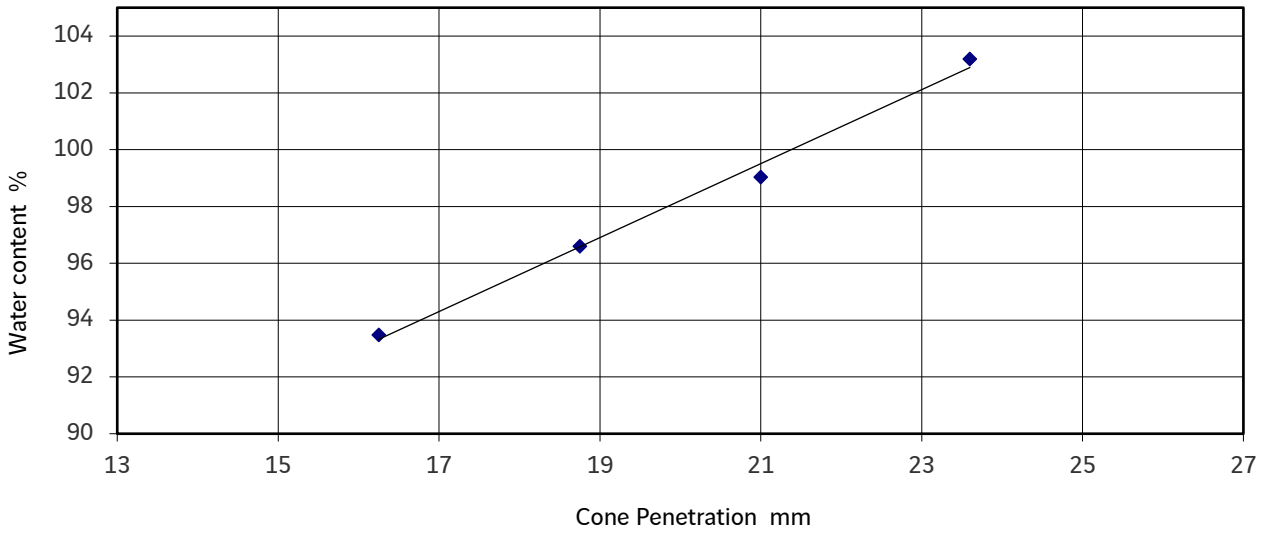
Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 4.00m
Engineer	Mott MacDonald		Sample Number 22
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY with peat.		Specimen Depth 4.54m
			Specimen Number 2

Water content	73.2	%
Oven temperature	50	°C
Is test result assumed to be a natural water content?	Yes	

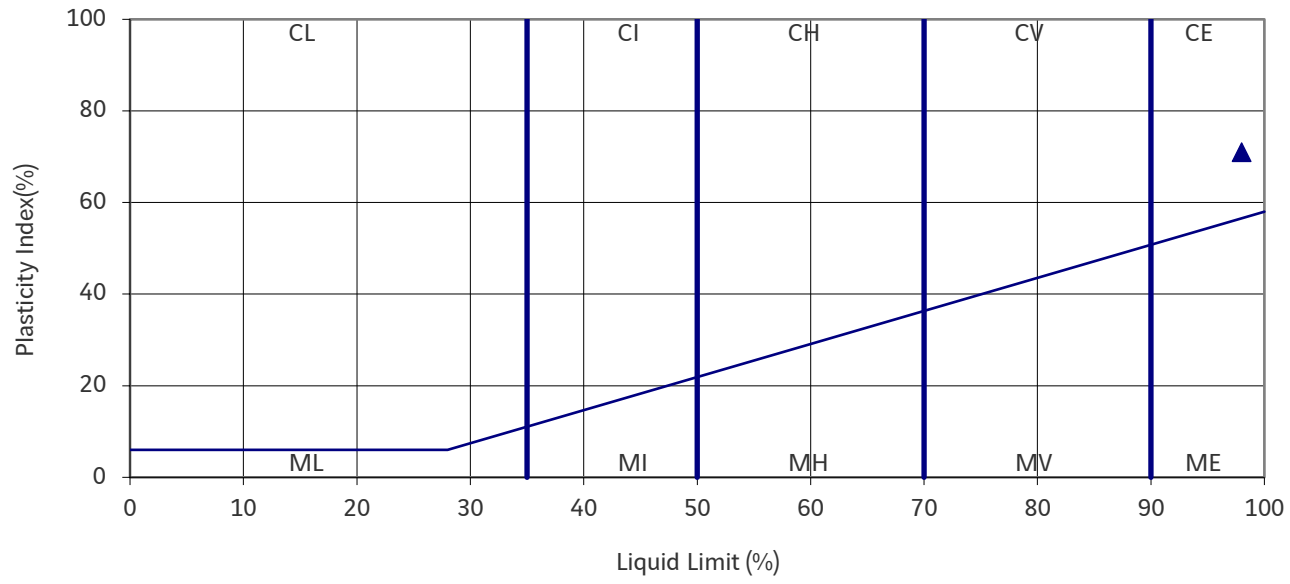
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH103
Project No.	TB8754		Sample Depth 4.00m
Engineer	Mott MacDonald		Sample Number 22
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY with peat.		Specimen Depth 4.54m
			Specimen Number 1



As received water content:	73.2%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	98%	Preparation of sample: Natural	
Plastic limit:	27%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	71%		
Water content of soil passing 425µm	73.2%		
Liquidity index:	0.651		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 21/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 5.00m
Engineer	Mott MacDonald		Sample Number 23
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 5.00m
			Specimen Number 2

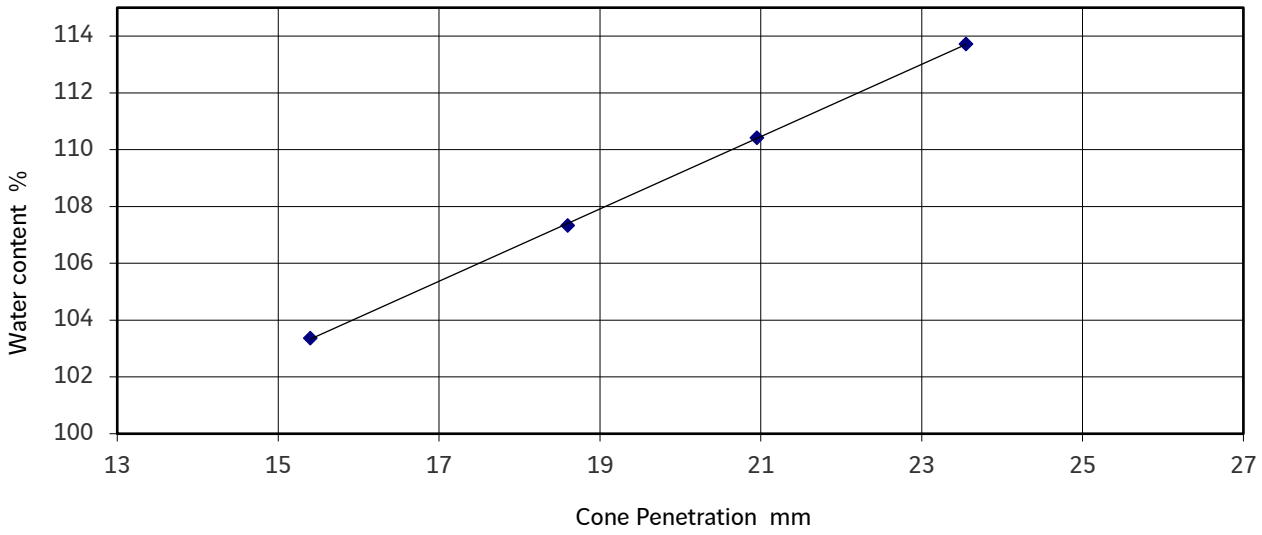
Water content	98.3	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

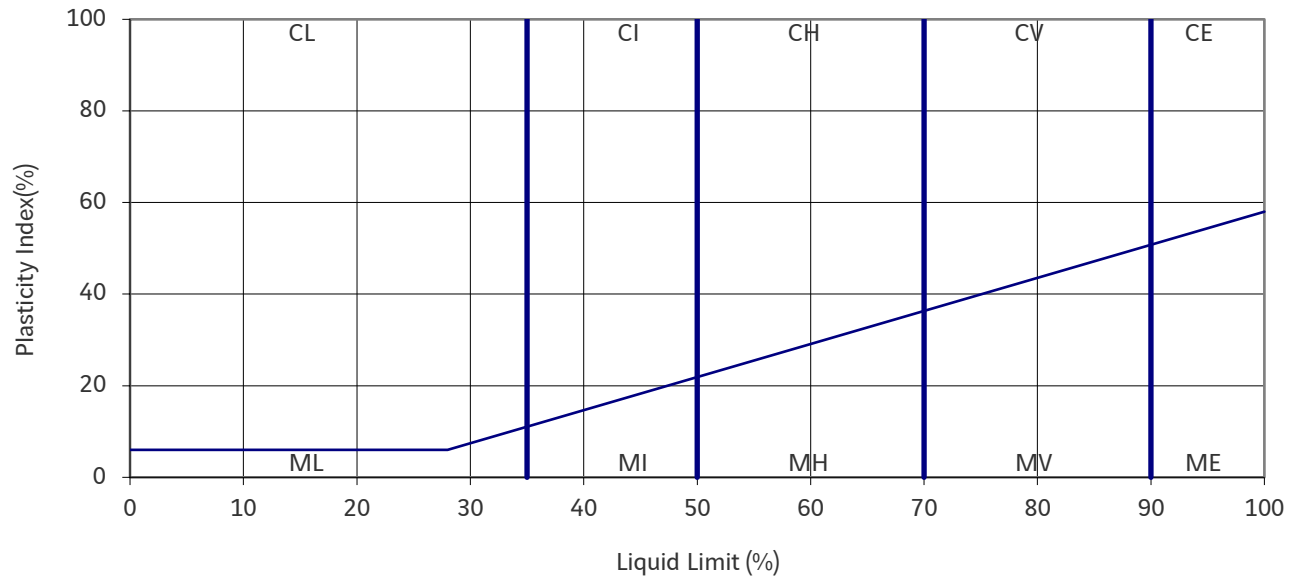
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 03/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH103
Project No.	TB8754		Sample Depth 5.00m
Engineer	Mott MacDonald		Sample Number 23
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 5.00m
			Specimen Number 1



As received water content:	98.3%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	110%	Preparation of sample: Natural	
Plastic limit:	29%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	81%		
Water content of soil passing 425µm	98.3%		
Liquidity index:	0.855		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 03/07/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 5.00m
Engineer	Mott MacDonald		Sample Number 24
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 5.20m
			Specimen Number 3

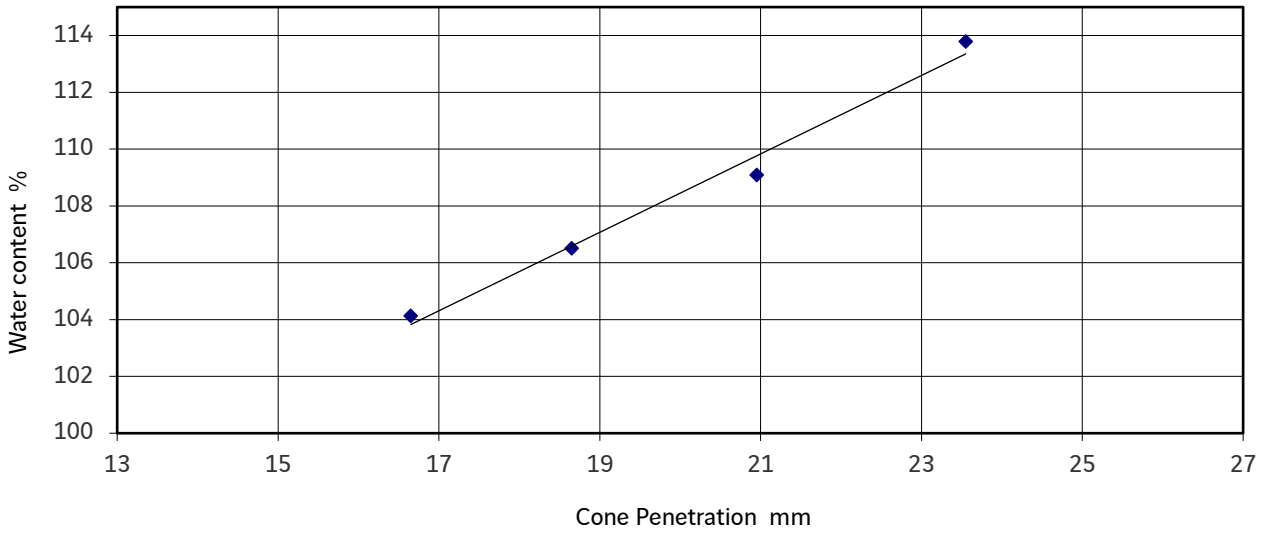
Water content	92.1	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

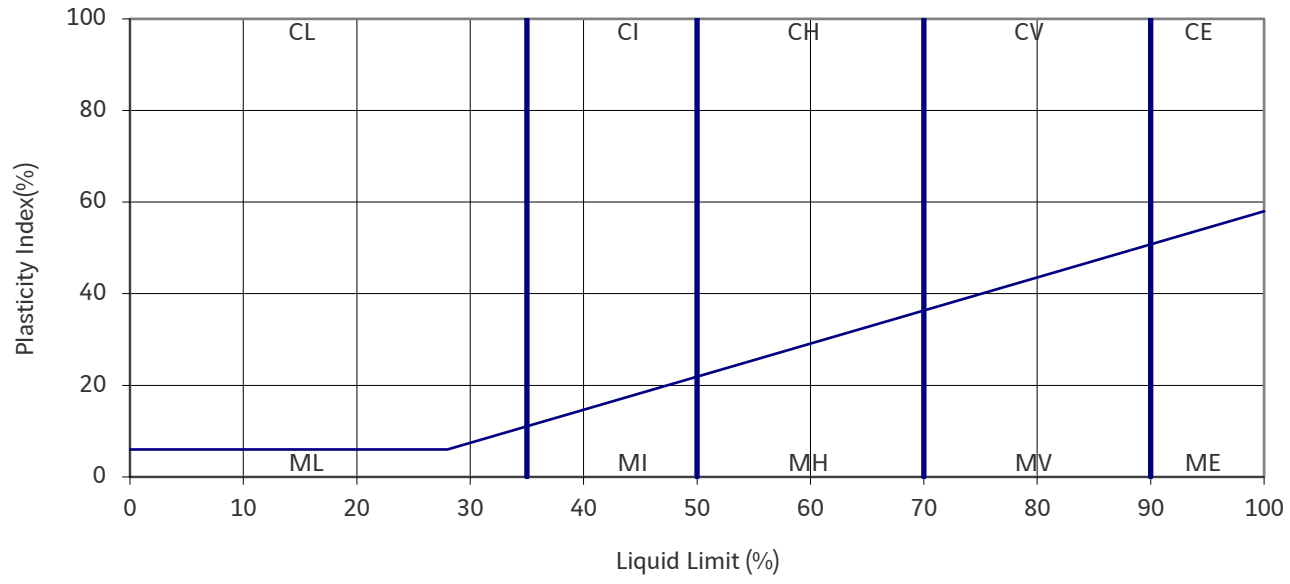
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 22/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH103
Project No.	TB8754		Sample Depth 5.00m
Engineer	Mott MacDonald		Sample Number 24
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 5.20m
			Specimen Number 2



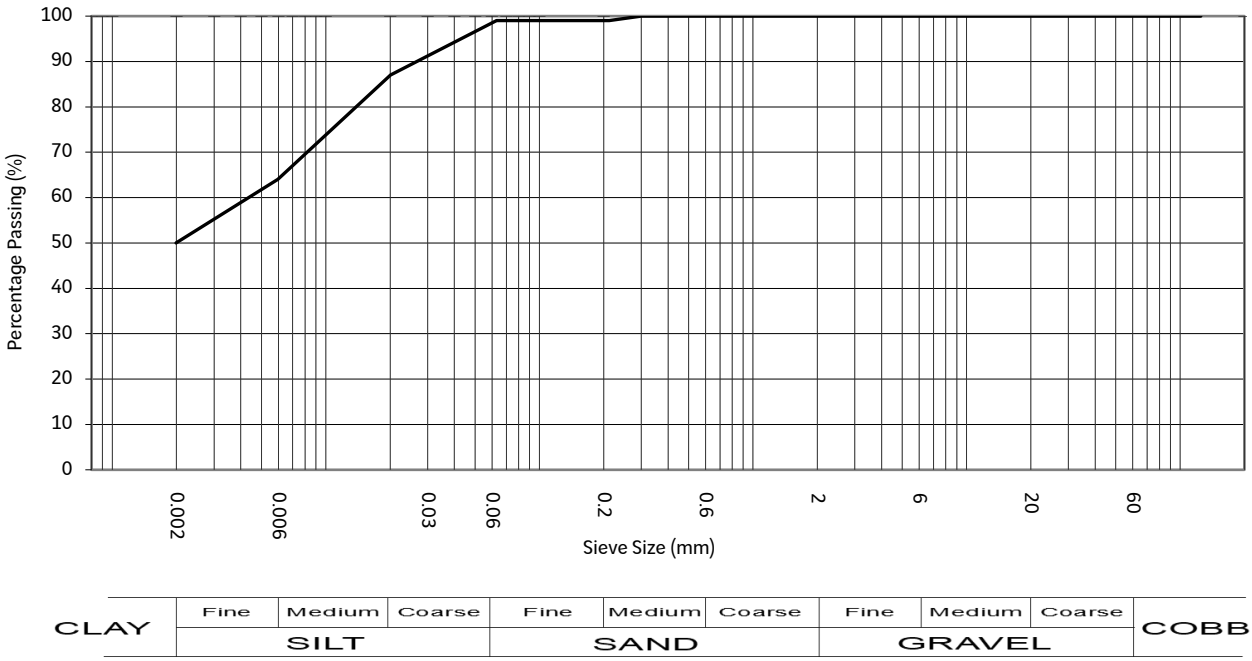
As received water content:	92.1%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	110%	Preparation of sample: Natural	
Plastic limit:	39%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	71%		
Water content of soil passing 425µm	92.1%		
Liquidity index:	0.747		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 24/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH103
Project No.	TB8754		Sample Depth 5.00m
Engineer	Mott MacDonald		Sample Number 24
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type P
Description	Grey CLAY.		Specimen Depth 5.17m
			Specimen No. 1



PARTICLE SIZE	%
Clay:	50.2
Silt:	48.7
Sand:	1.1
Gravel:	0.0
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14	100		
		10	100	0.020100	87
		6.3	100	0.005970	64
125.0	100	5	100	0.001990	50
90.0	100	3.35	100		
75.0	100	2	100		
63.0	100	1.18	100		
50.0	100	0.6	100		
37.5	100	0.425	100		
28.0	100	0.3	100		
20.0	100	0.212	99		
		0.15	99		
		0.063	99		

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

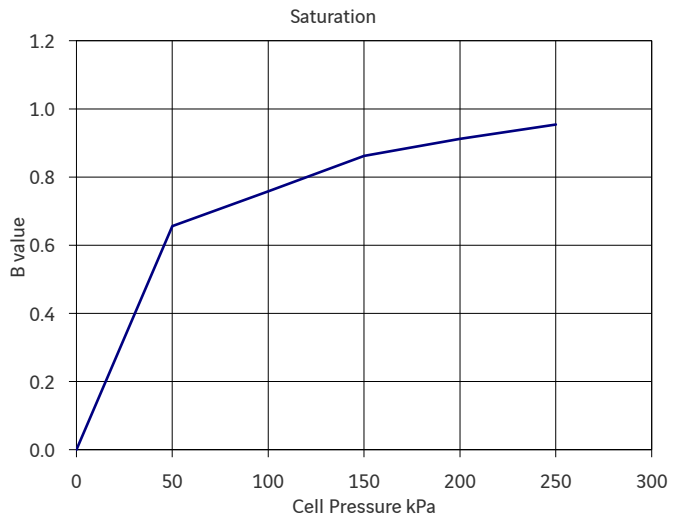
Approved by: Steve Harper

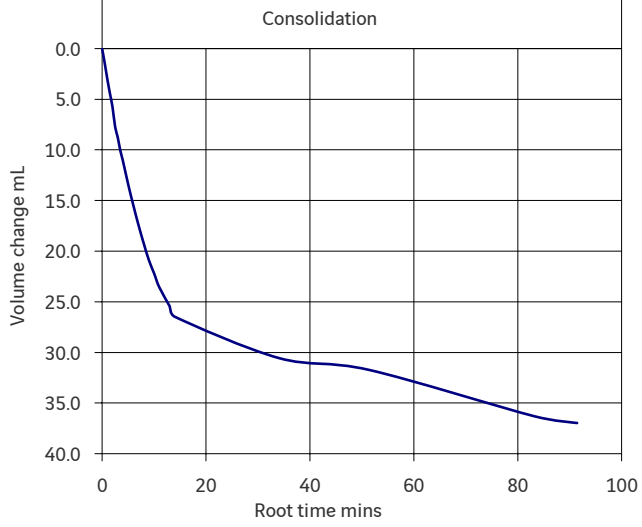
Print date 21/07/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH103
Project No.	TB8754		Sample Depth 5.00m
Engineer	Mott MacDonald		Sample Number 24
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with decomposed plant fibres.		Specimen Depth 5.50m
			Specimen Number 4

SPECIMEN INITIAL DIMENSIONS		
Test number		1
Specimen diameter	mm	101.23
Specimen length	mm	195.60
Density	Mg/m^3	1.49
Moisture content	%	73
Dry density	Mg/m^3	0.86
SATURATION STAGE		
Initial pore water pressure	kPa	-0.8
Saturated pore water pressure	kPa	243
Final cell pressure	kPa	250
B value		0.954
CONSOLIDATION STAGE		
Cell pressure	kPa	330
Back pressure	kPa	300
Effective consolidation pressure	kPa	30
Initial pore water pressure	kPa	328
Final pore water pressure	kPa	301.3
Pore pressure dissipation	%	95.4
c_{vi}	$m^2/year$	0.54
m_{vi}	m^2/MN	0.88
SPECIMEN AFTER CONSOLIDATION		
Density	Mg/m^3	1.54
Moisture content	%	75
Dry density	Mg/m^3	0.88



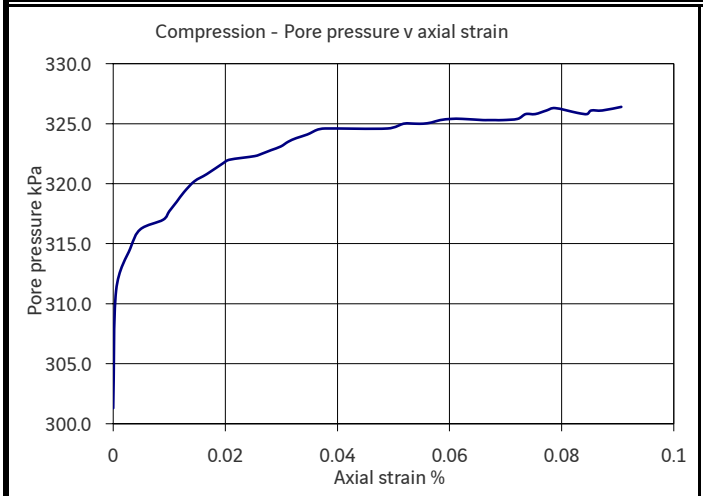


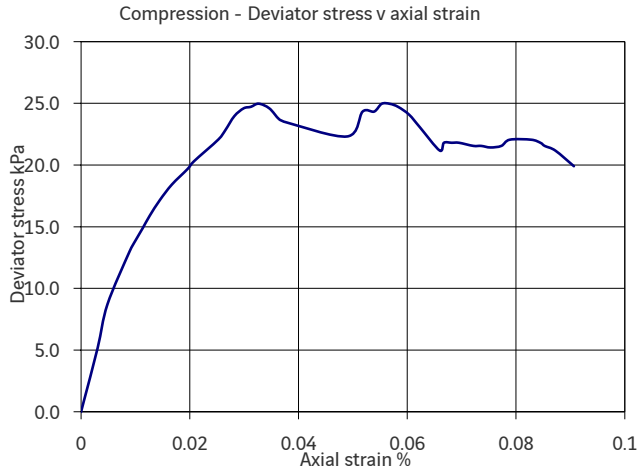
Remarks:
Specimen orientation Vertical
Specimen condition for test UNDISTURBED
Saturation with 50kPa increments with a differential pressure of 10kPa
Drainage from both ends and using a radial filter drain

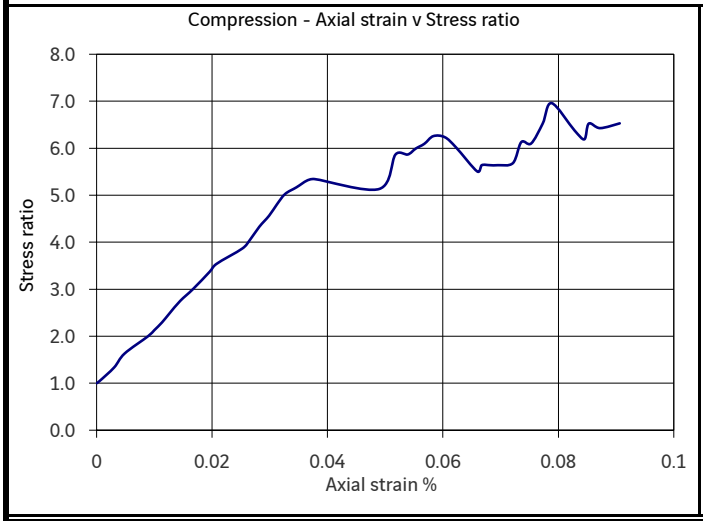
Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 05/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

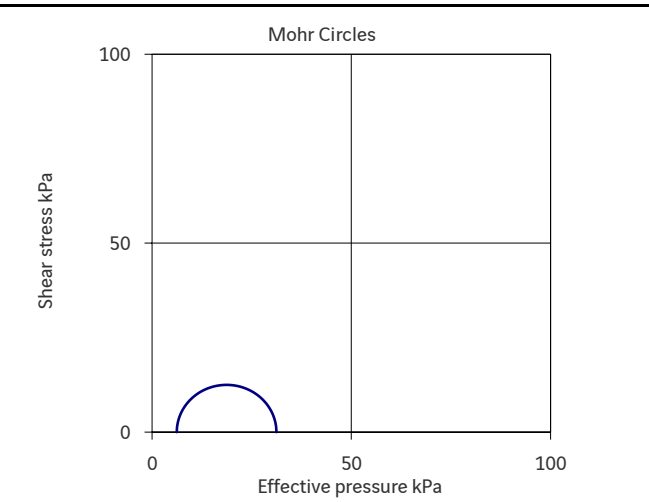
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH103
Project No.	TB8754		Sample Depth 5.00m
Engineer	Mott MacDonald		Sample Number 24
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with decomposed plant fibres.		Specimen Depth 5.50m
			Specimen Number 4

COMPRESSION STAGE			
Test number			1
Cell pressure		kPa	330
Initial pore water pressure		kPa	301
Effective confining pressure		kPa	29
Failure conditions at			Maximum deviator stress
Axial strain at failure		%	0.0
Maximum deviator stress	σ_1-σ_3	kPa	25
Pore water pressure at failure	σ	kPa	324
Effective major principal stress	σ_1'	kPa	31.17
Effective minor principal stress	σ_3'	kPa	6.20
Effective principal stress ratio			5.03
Membrane correction		kPa	0.01
Filter drain correction		kPa	0.0
Pore pressure coefficient			0.9









Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 05/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

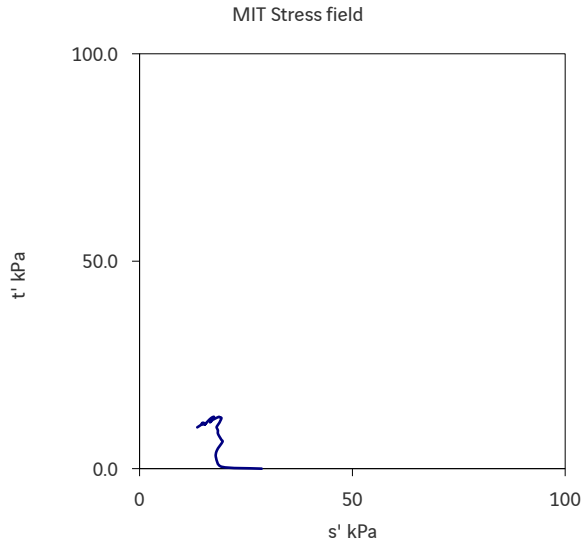
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH103
Project No.	TB8754		Sample Depth 5.00m
Engineer	Mott MacDonald		Sample Number 24
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with decomposed plant fibres.		Specimen Depth 5.50m
			Specimen Number 4

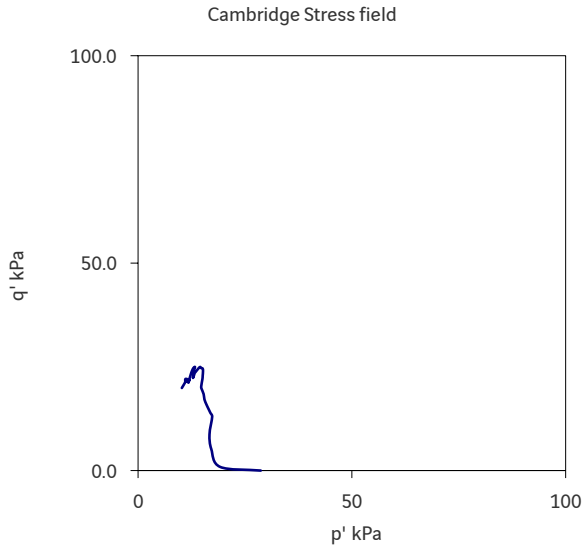
SPECIMEN AFTER TEST

Test number		1	
Mode of failure		Compound 	
Final moisture content	%	75	
Final bulk density	Mg/m^3	1.54	
Final dry density	Mg/m^3	0.88	

ADDITIONAL SPECIMEN DETAILS

Rate of strain	%/hour	0.20	
Failure criterion		Maximum deviator stress	





REMARKS

Preliminary	Leeds Laboratory	Results apply to samples as received.	SOIL ENGINEERING
Paul Rodgers		Print date 05/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 6.00m
Engineer	Mott MacDonald		Sample Number 25
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Light grey CLAY.		Specimen Depth 6.00m
			Specimen Number 2

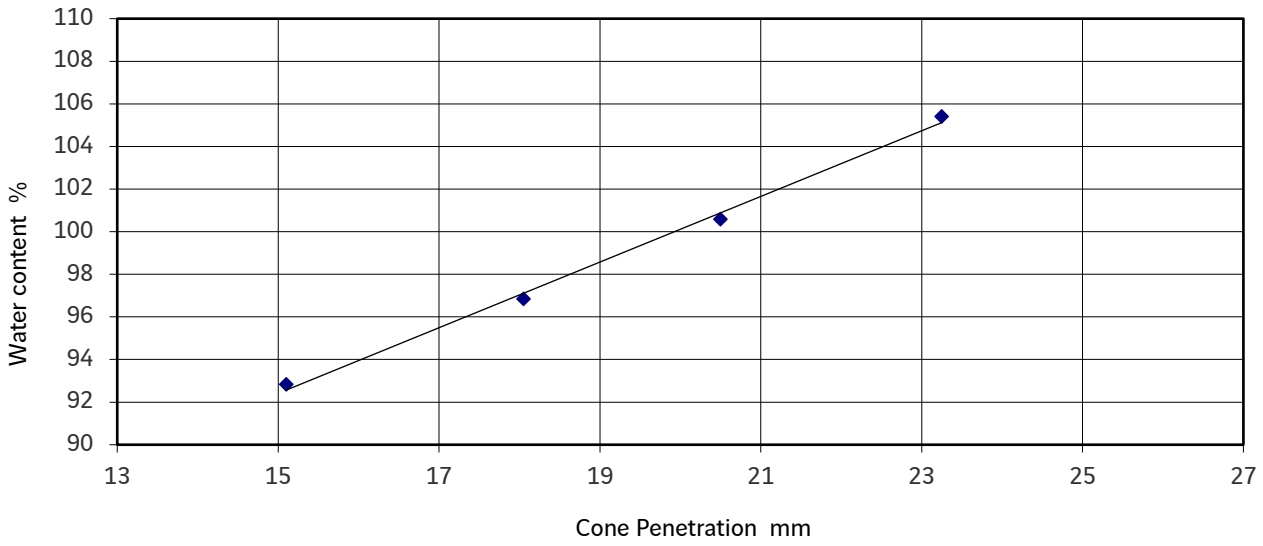
Water content	126	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

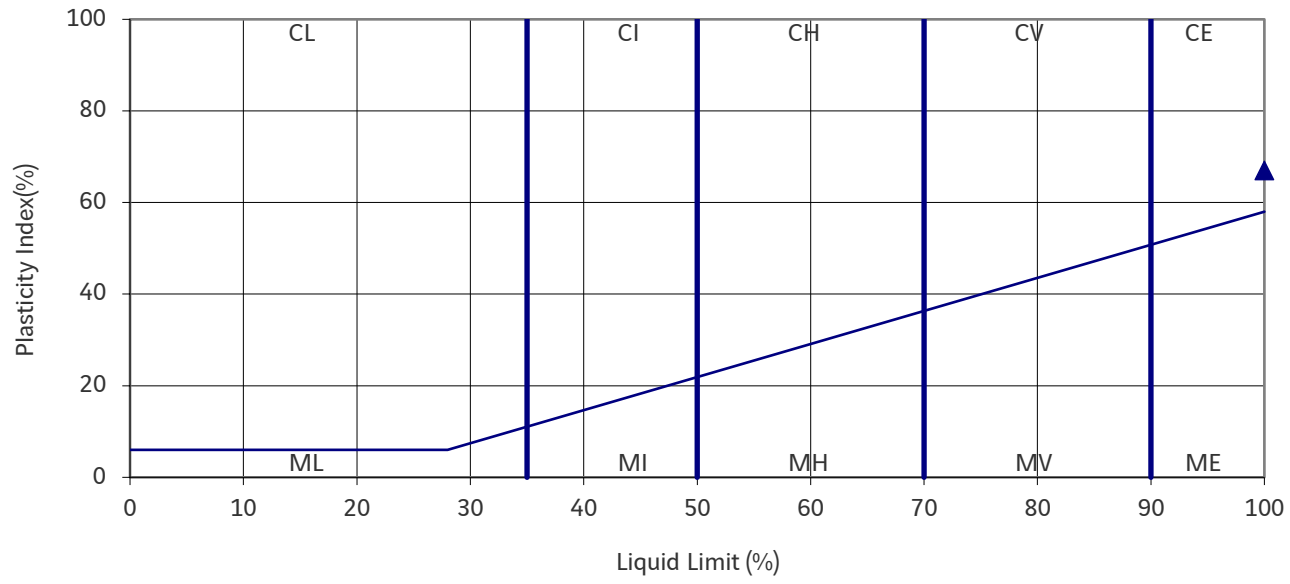
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 04/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH103
Project No.	TB8754		Sample Depth 6.00m
Engineer	Mott MacDonald		Sample Number 25
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Light grey CLAY.		Specimen Depth 6.00m
			Specimen Number 1



As received water content:	126%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	100%	Preparation of sample: Natural	
Plastic limit:	33%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	67%		
Water content of soil passing 425µm	126%		
Liquidity index:	1.384		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 08/07/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 6.00m
Engineer	Mott MacDonald		Sample Number 26
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 6.25m
			Specimen Number 2

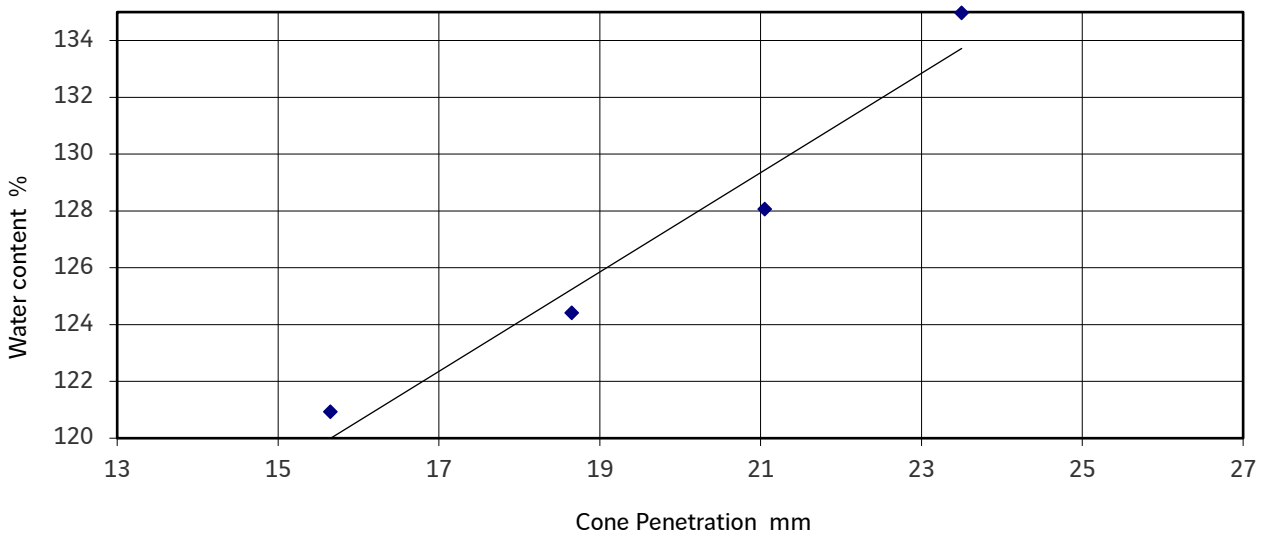
Water content	116	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

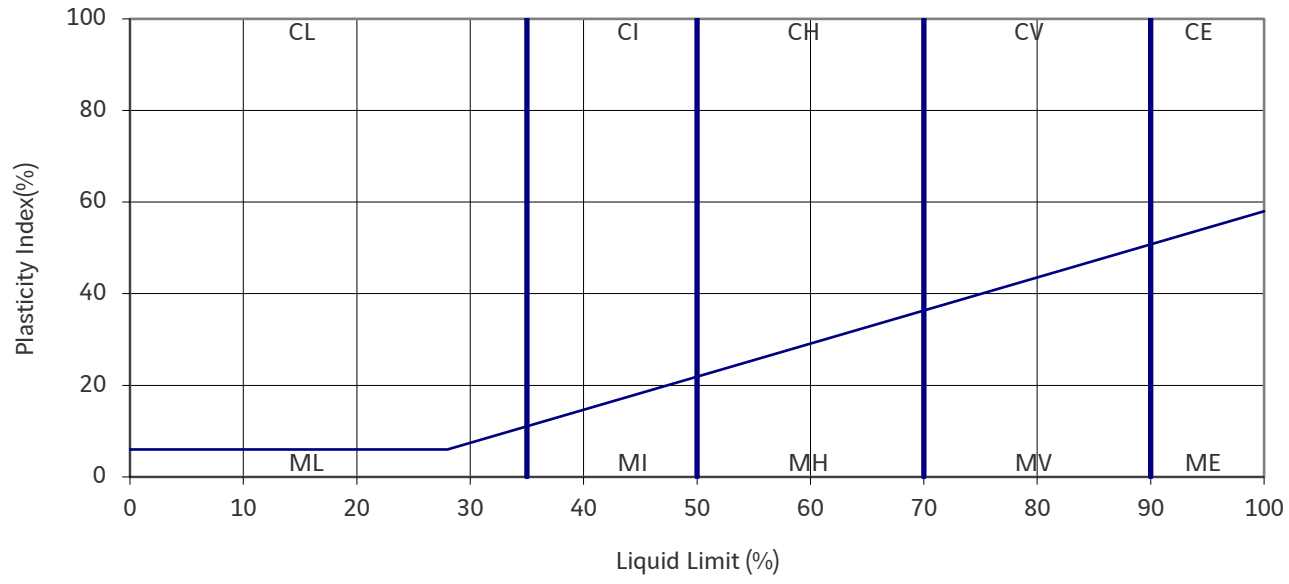
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 22/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH103
Project No.	TB8754		Sample Depth 6.00m
Engineer	Mott MacDonald		Sample Number 26
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 6.25m
			Specimen Number 1



As received water content:	116%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	130%	Preparation of sample: Natural	
Plastic limit:	40%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	90%		
Water content of soil passing 425µm	116%		
Liquidity index:	0.850		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 24/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 7.00m
Engineer	Mott MacDonald		Sample Number 27
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Dark brown grey PEAT.		Specimen Depth 7.00m
			Specimen Number 2

Water content	214	%
Oven temperature	50	°C
Is test result assumed to be a natural water content?	Yes	

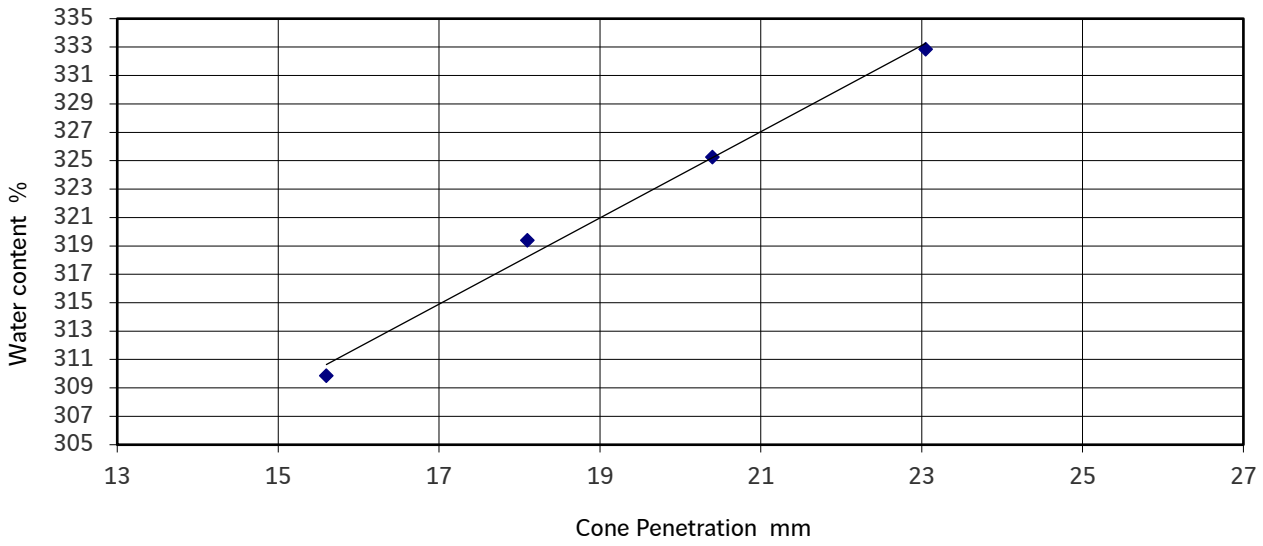
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

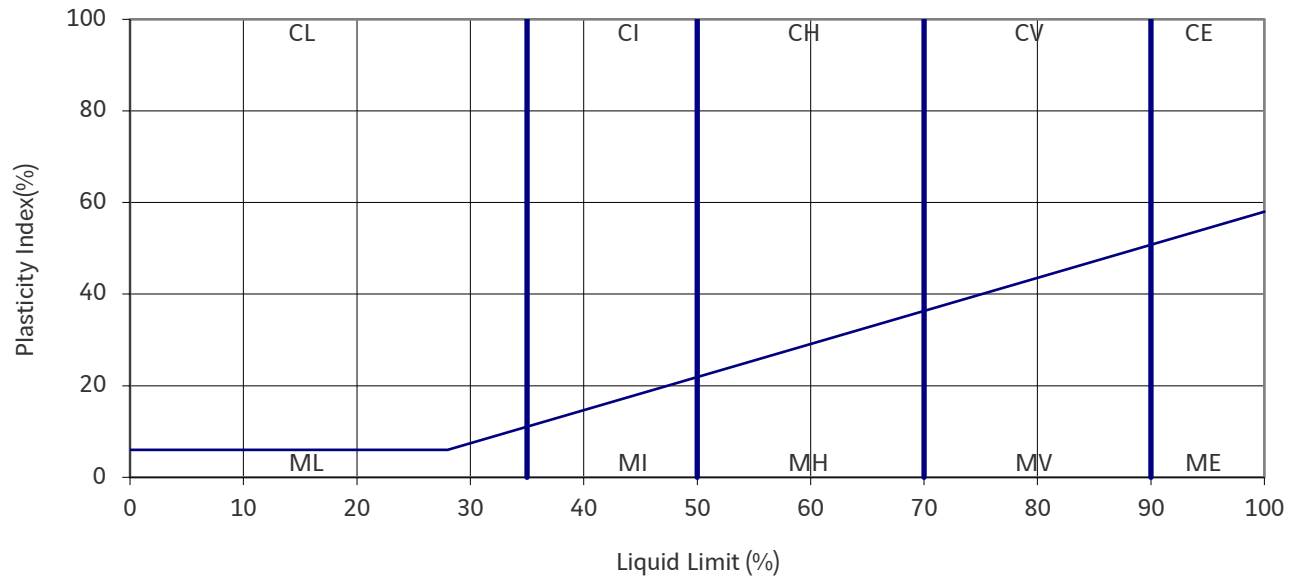
Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 08/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024	

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH103
Project No.	TB8754		Sample Depth 7.00m
Engineer	Mott MacDonald		Sample Number 27
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Dark brown grey PEAT.		Specimen Depth 7.00m
			Specimen Number 1



As received water content:	214%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	320%	Preparation of sample: Natural	
Plastic limit:	160%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	160%		
Water content of soil passing 425µm	214%		
Liquidity index:	0.336		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 10/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 7.00m
Engineer	Mott MacDonald		Sample Number 28
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Dark brown PEAT.		Specimen Depth 7.54m
			Specimen Number 2

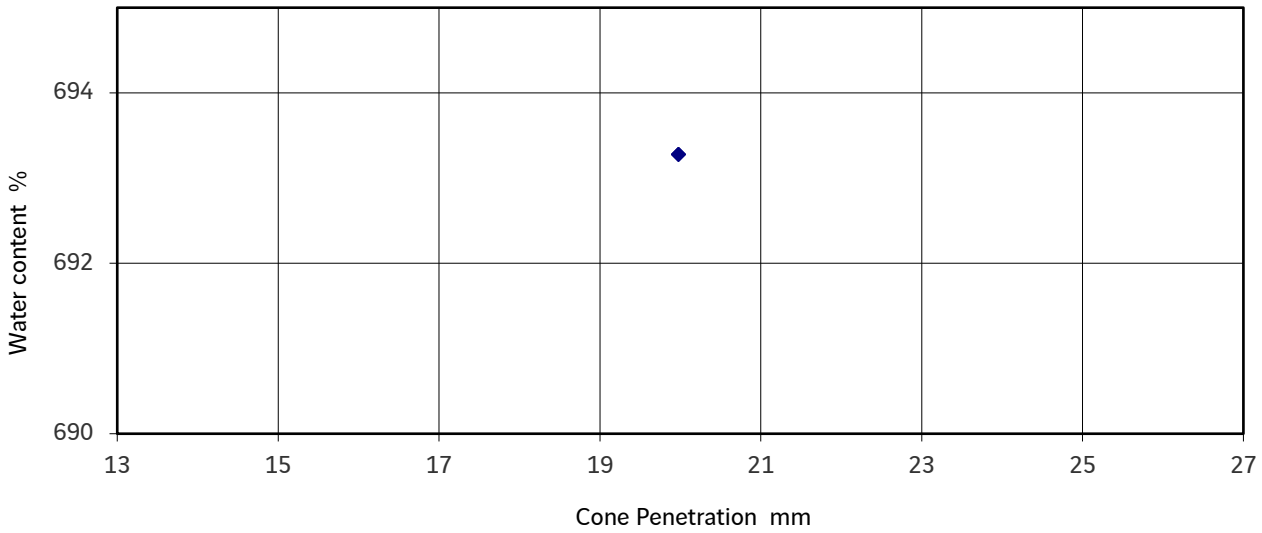
Water content	393	%
Oven temperature	50	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

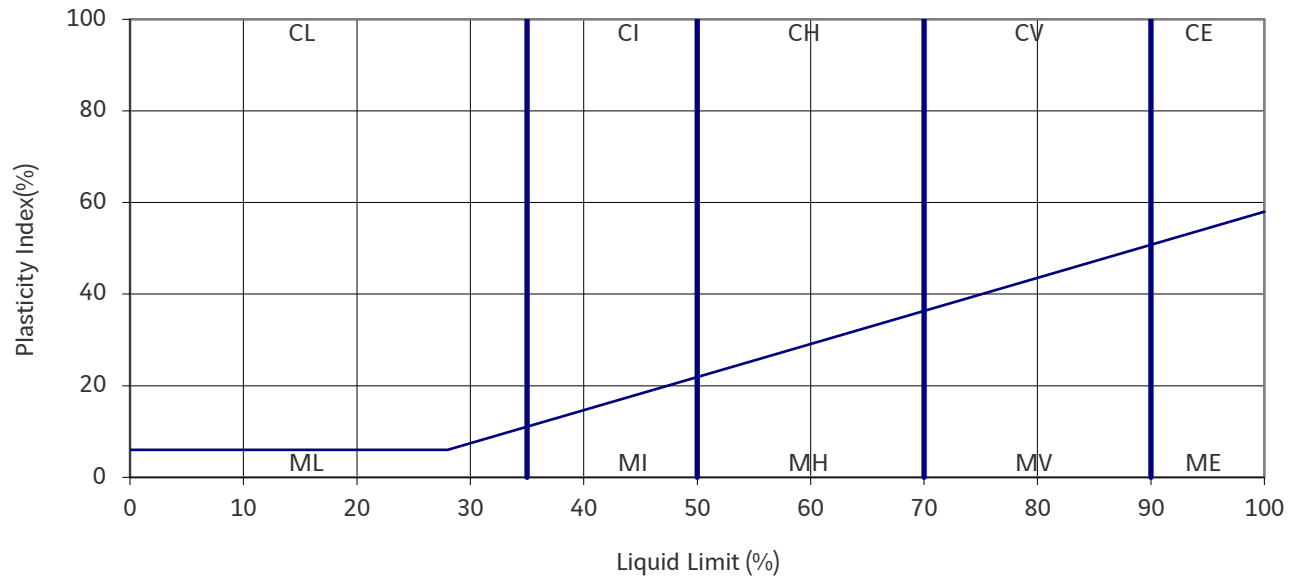
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 21/07/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH103
Project No.	TB8754		Sample Depth 7.00m
Engineer	Mott MacDonald		Sample Number 28
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Dark brown PEAT.		Specimen Depth 7.54m
			Specimen Number 1



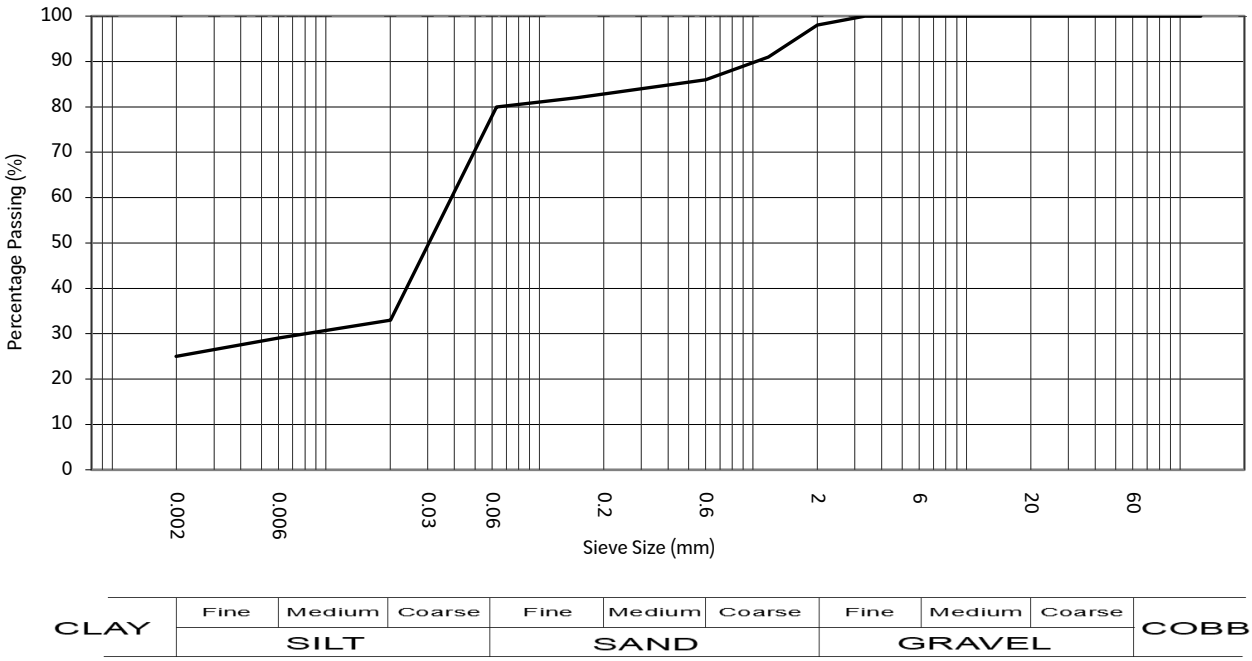
As received water content:	393%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	690%	Preparation of sample: Natural	
Plastic limit:	NP	Remarks:	Test performed with 80g/30deg cone Tested as 1 point Limit Liquid limit due to the sample being peat and it is very difficult to get all four points on a line.
Plasticity index:			
Water content of soil passing 425µm	393%		
Liquidity index:			



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 21/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH103
Project No.	TB8754		Sample Depth 7.00m
Engineer	Mott MacDonald		Sample Number 28
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type P
Description	Dark brown PEAT.		Specimen Depth 7.59m
			Specimen No. 4



PARTICLE SIZE	%
Clay:	25.0
Silt:	55.5
Sand:	17.6
Gravel:	1.9
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14	100		
		10	100	0.020100	33
		6.3	100	0.005980	29
125.0	100	5	100	0.001990	25
90.0	100	3.35	100		
75.0	100	2	98		
63.0	100	1.18	91		
50.0	100	0.6	86		
37.5	100	0.425	85		
28.0	100	0.3	84		
20.0	100	0.212	83		
		0.15	82		
		0.063	80		

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by: Steve Harper

Print date 21/07/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 8.00m
Engineer	Mott MacDonald		Sample Number 29
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Dark brown PEAT.		Specimen Depth 8.00m
			Specimen Number 2

Water content	327	%
Oven temperature	50	°C
Is test result assumed to be a natural water content?	Yes	

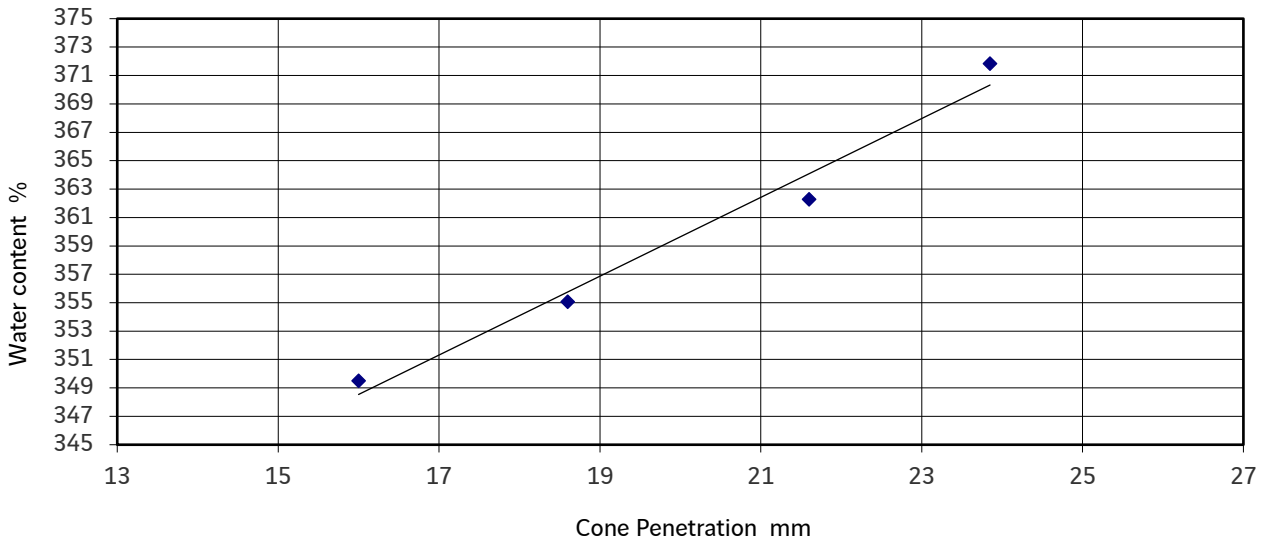
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

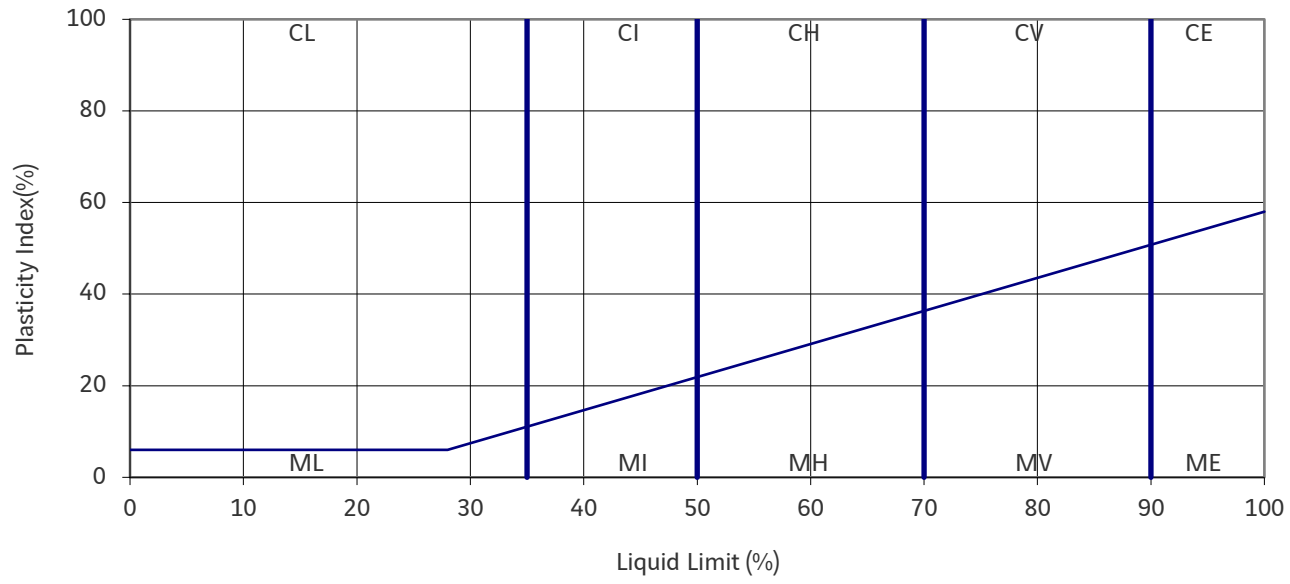
Approved by:	Leeds Laboratory		
Steve Harper		Print date 08/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024	

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH103
Project No.	TB8754		Sample Depth 8.00m
Engineer	Mott MacDonald		Sample Number 29
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Dark brown PEAT.		Specimen Depth 8.00m
			Specimen Number 1



As received water content:	327%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	360%	Preparation of sample: Natural	
Plastic limit:	200%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	160%		
Water content of soil passing 425µm	327%		
Liquidity index:	0.795		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 08/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 8.00m
Engineer	Mott MacDonald		Sample Number 30
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 8.45m
			Specimen Number 2

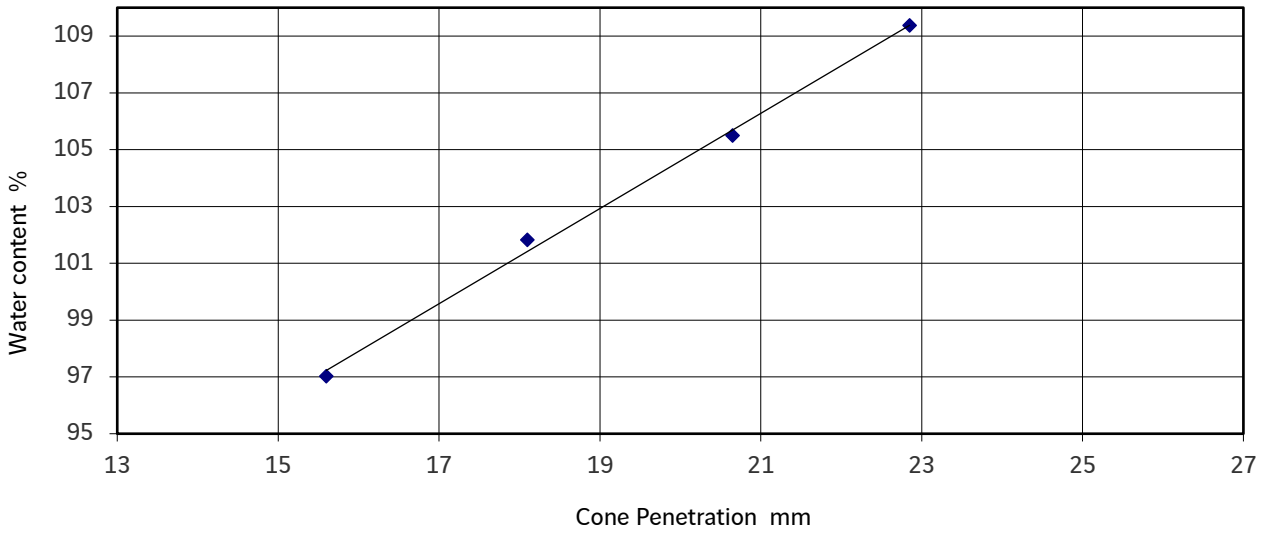
Water content	84.3	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

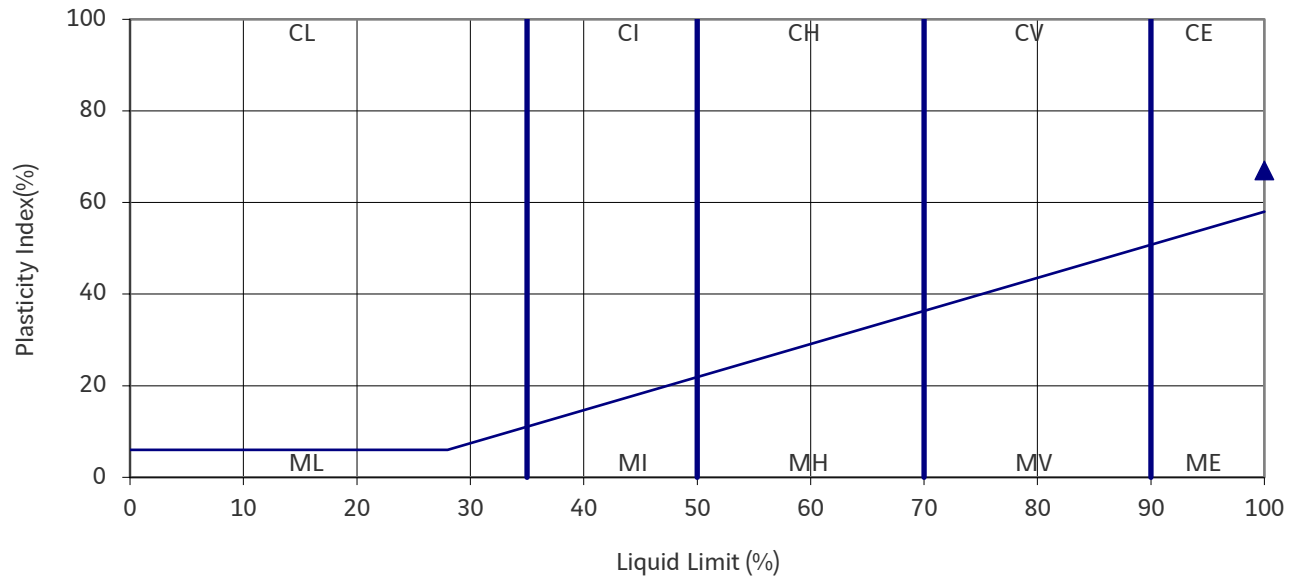
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Steve Harper			Print date 21/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH103
Project No.	TB8754		Sample Depth 8.00m
Engineer	Mott MacDonald		Sample Number 30
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 8.45m
			Specimen Number 1



As received water content:	84.3%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	100%	Preparation of sample: Natural	
Plastic limit:	33%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	67%		
Water content of soil passing 425µm	84.3%		
Liquidity index:	0.766		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 21/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 9.00m
Engineer	Mott MacDonald		Sample Number 31
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 9.00m
			Specimen Number 2

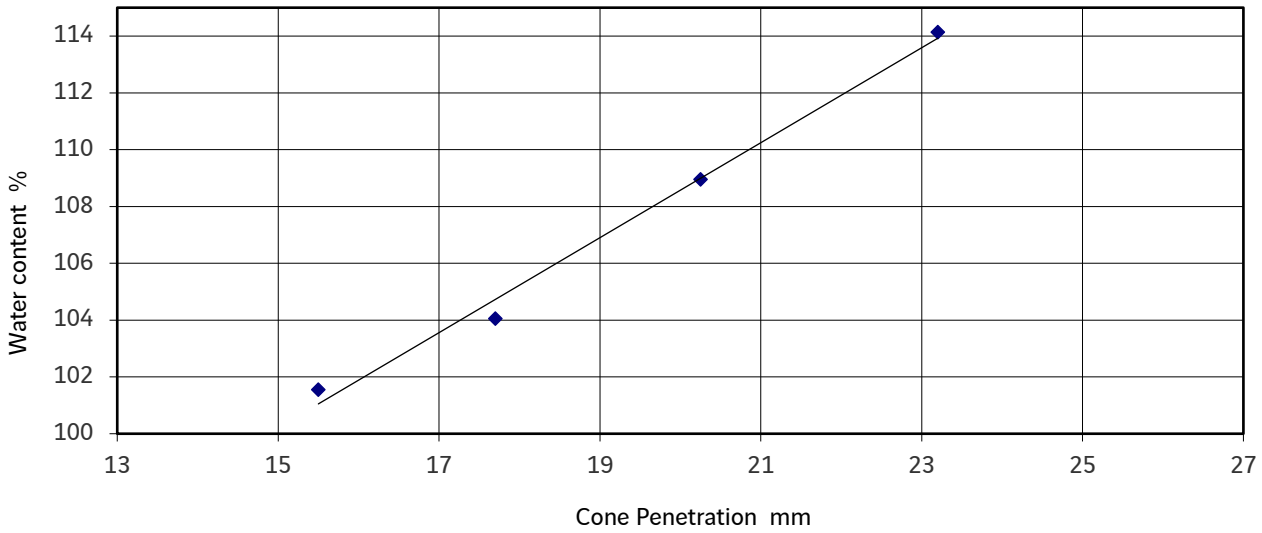
Water content	214	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

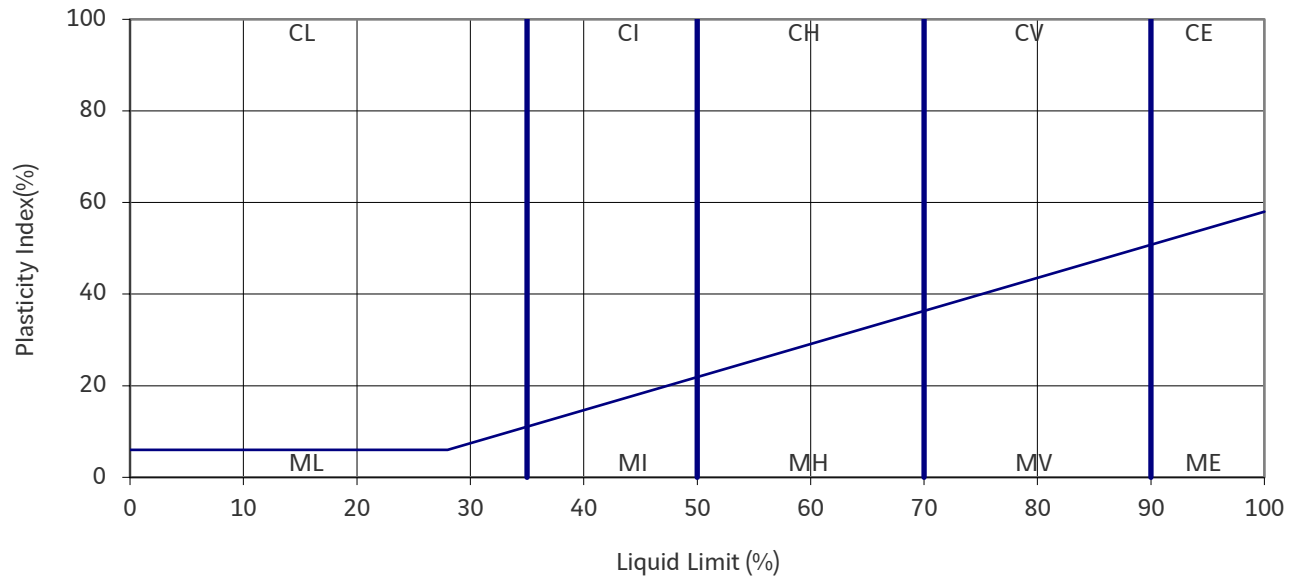
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 08/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH103
Project No.	TB8754		Sample Depth 9.00m
Engineer	Mott MacDonald		Sample Number 31
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 9.00m
			Specimen Number 1



As received water content:	95%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	110%	Preparation of sample: Natural	
Plastic limit:	36%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	74%		
Water content of soil passing 425µm	95.0%		
Liquidity index:	0.798		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 10/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 9.00m
Engineer	Mott MacDonald		Sample Number 32
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Gey CLAY.		Specimen Depth 9.34m
			Specimen Number 2

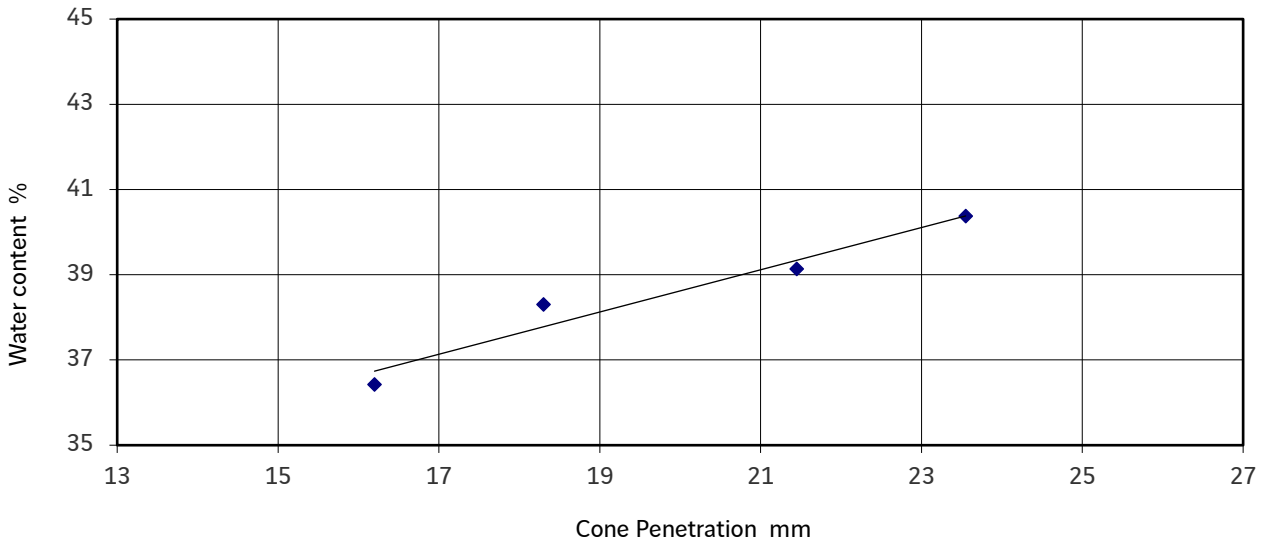
Water content	38.0	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

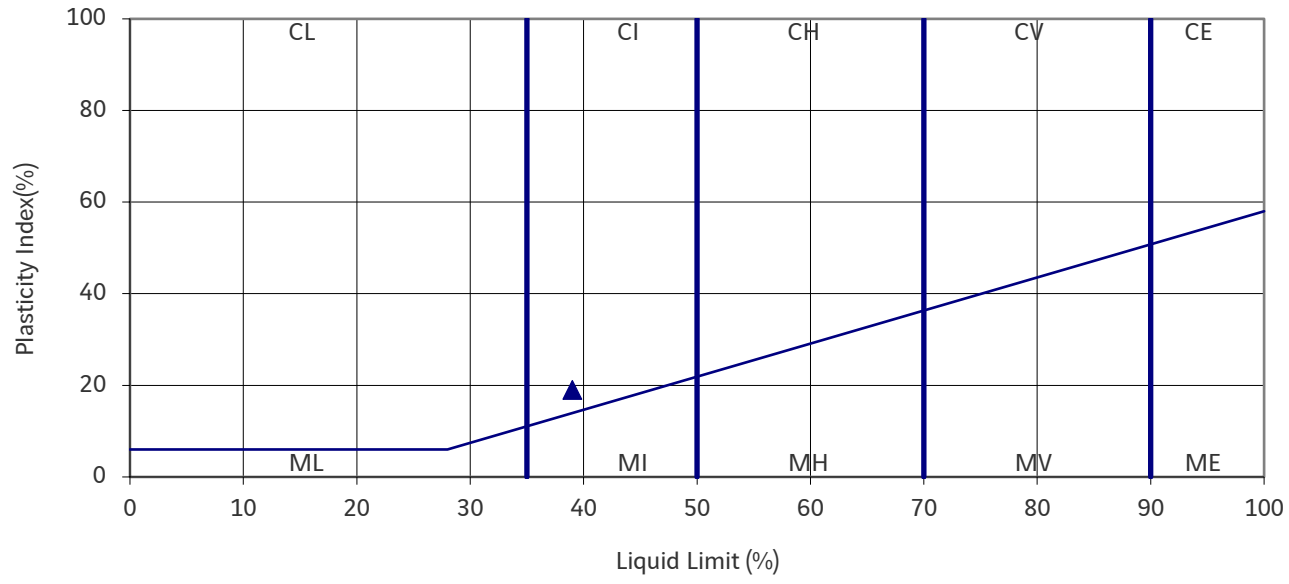
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 22/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH103
Project No.	TB8754		Sample Depth 9.00m
Engineer	Mott MacDonald		Sample Number 32
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 9.34m
			Specimen Number 1



As received water content:	38%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	39%	Preparation of sample: Natural	
Plastic limit:	20%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	19%		
Water content of soil passing 425µm	38.0%		
Liquidity index:	0.950		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 24/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 10.00m
Engineer	Mott MacDonald		Sample Number 33
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 10.00m
			Specimen Number 2

Water content	38.5	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

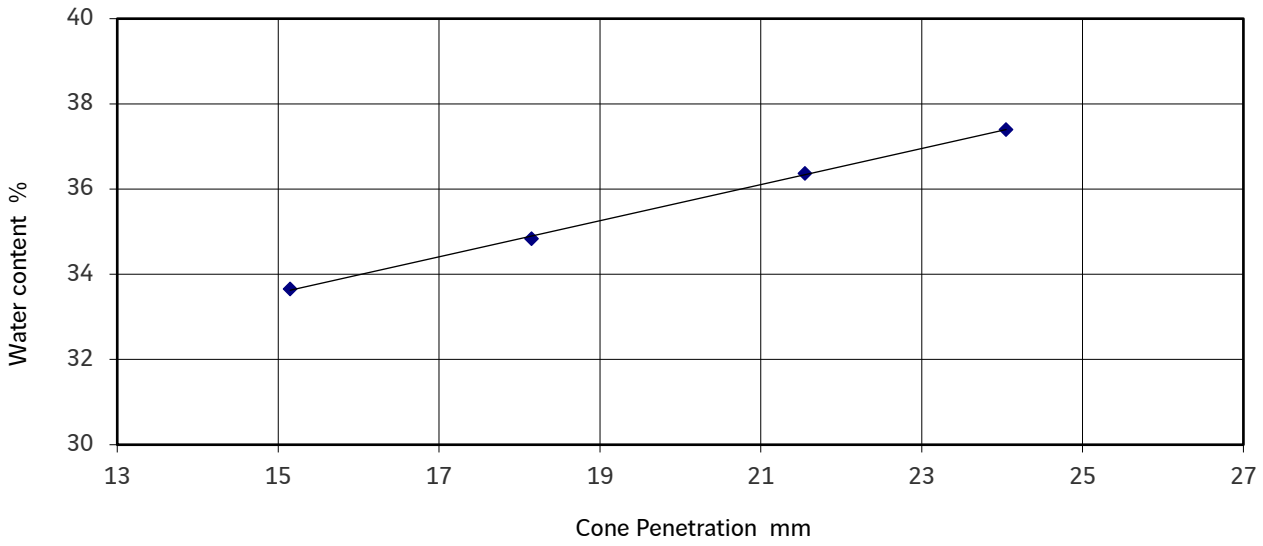
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

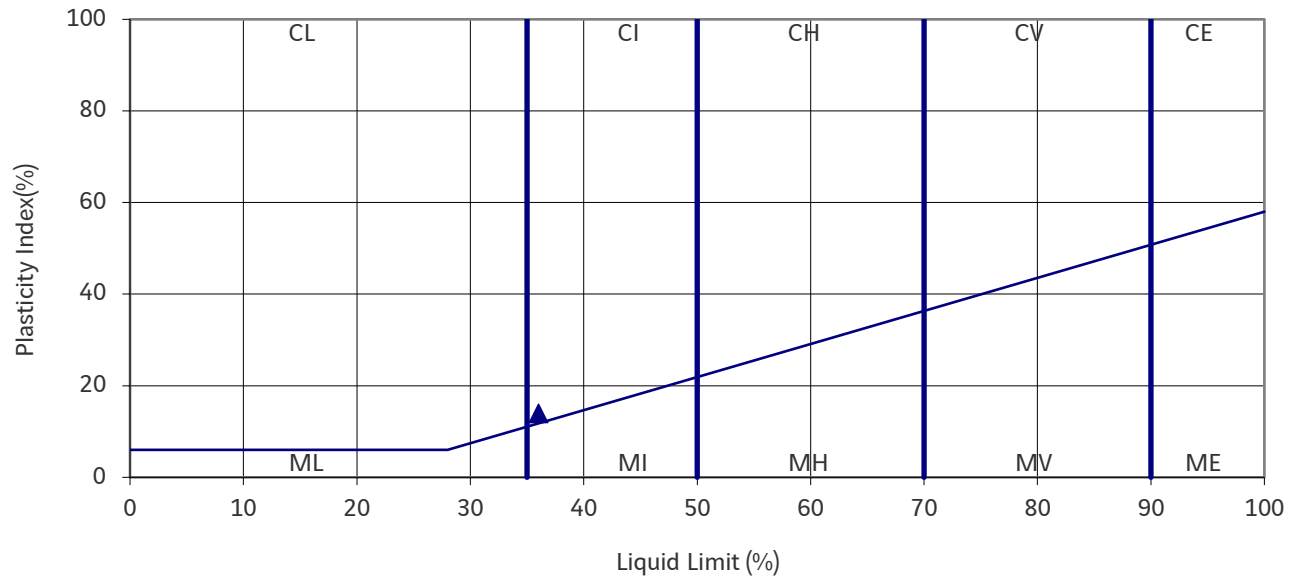
Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 08/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024	

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH103
Project No.	TB8754		Sample Depth 10.00m
Engineer	Mott MacDonald		Sample Number 33
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 10.00m
			Specimen Number 1



As received water content:	38.5%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	36%	Preparation of sample: Natural	
Plastic limit:	22%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	14%		
Water content of soil passing 425µm	38.5%		
Liquidity index:	1.175		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 10/07/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 10.00m
Engineer	Mott MacDonald		Sample Number 34
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey slightly sandy CLAY.		Specimen Depth 10.23m
			Specimen Number 2

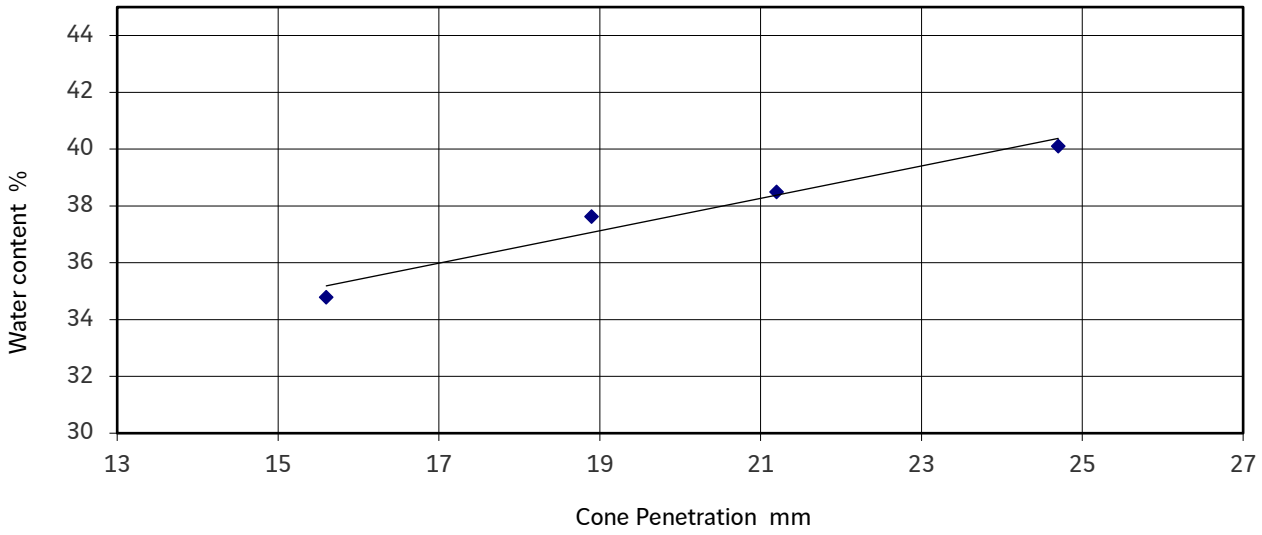
Water content	37.8	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

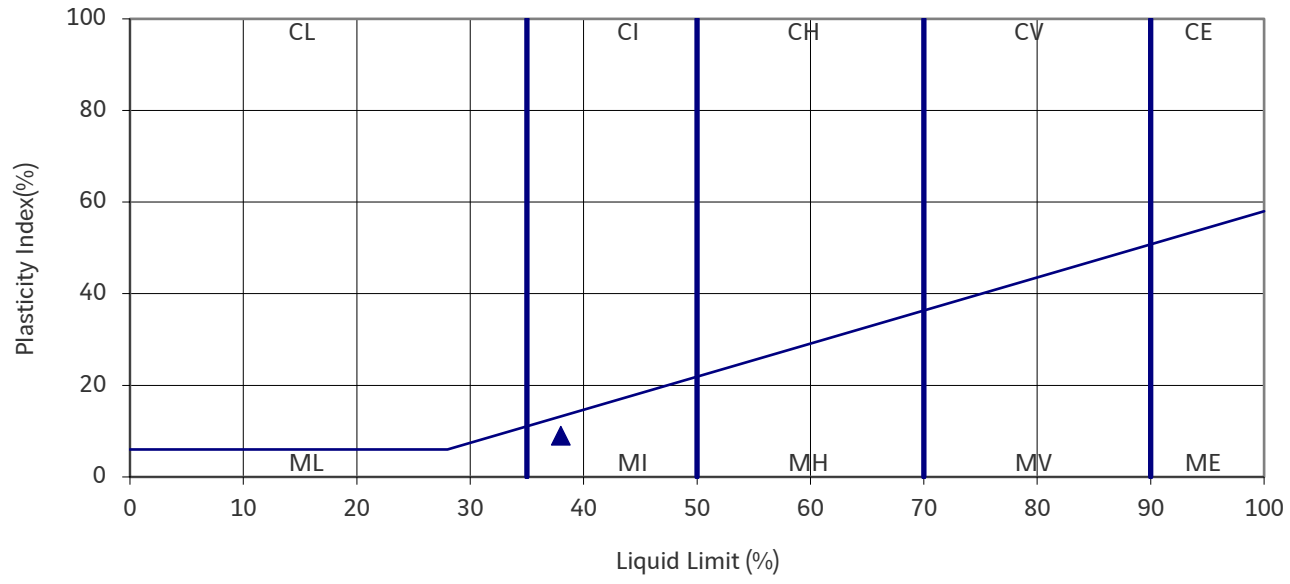
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 24/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH103
Project No.	TB8754		Sample Depth 10.00m
Engineer	Mott MacDonald		Sample Number 34
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey slightly sandy CLAY.		Specimen Depth 10.23m
			Specimen Number 1



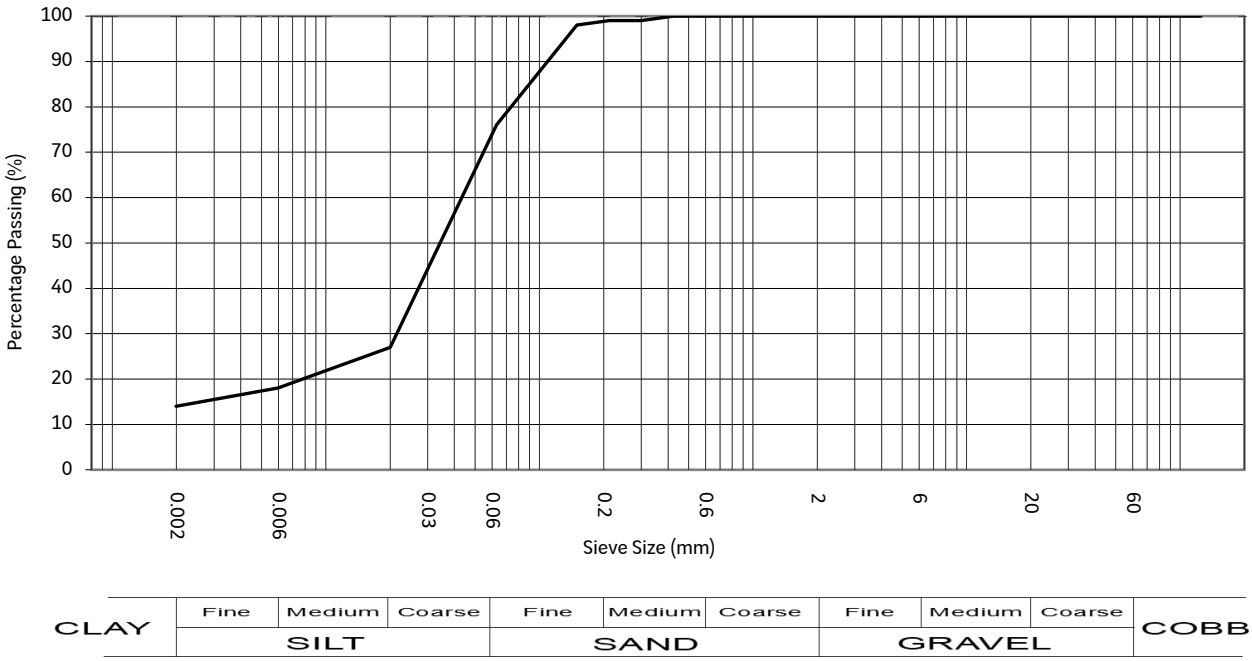
As received water content:	37.8%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	38%	Preparation of sample: Natural	
Plastic limit:	29%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	9%		
Water content of soil passing 425µm	37.8%		
Liquidity index:	0.983		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 24/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH103
Project No.	TB8754		Sample Depth 10.00m
Engineer	Mott MacDonald		Sample Number 34
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type P
Description	Grey slightly sandy CLAY.		Specimen Depth 10.19m
			Specimen No. 3



PARTICLE SIZE	%
Clay:	13.7
Silt:	62.5
Sand:	23.8
Gravel:	0.0
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14	100		
		10	100	0.020000	27
		6.3	100	0.005970	18
125.0	100	5	100	0.001990	14
90.0	100	3.35	100		
75.0	100	2	100		
63.0	100	1.18	100		
50.0	100	0.6	100		
37.5	100	0.425	100		
28.0	100	0.3	99		
20.0	100	0.212	99		
		0.15	98		
		0.063	76		

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:

Steve Harper

Print date 21/07/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 11.00m
Engineer	Mott MacDonald		Sample Number 35
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 11.00m
			Specimen Number 2

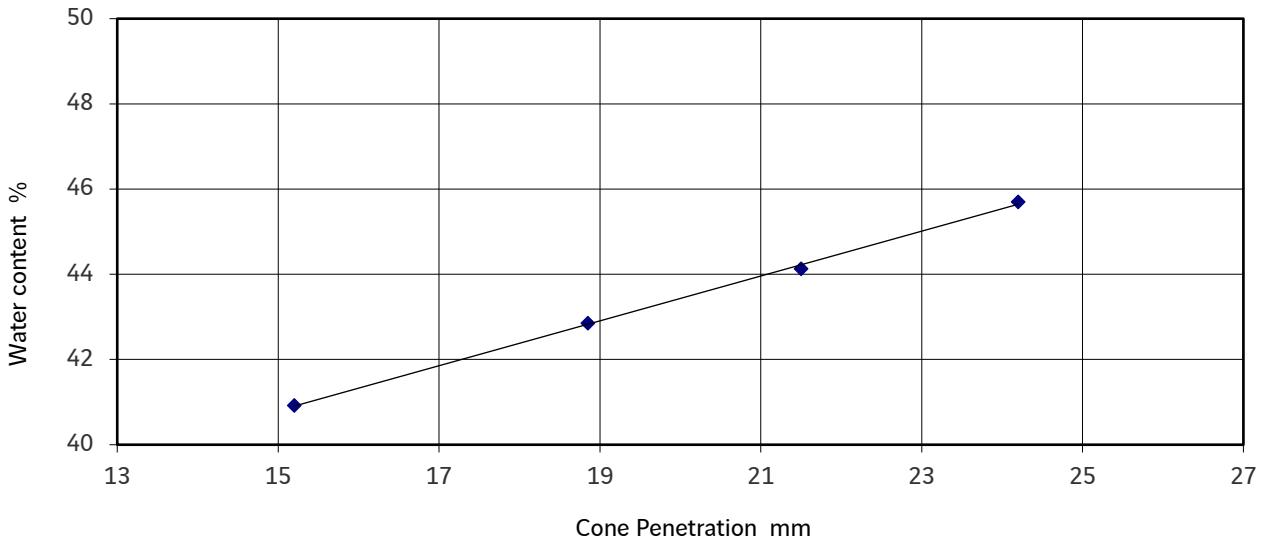
Water content	44.6	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

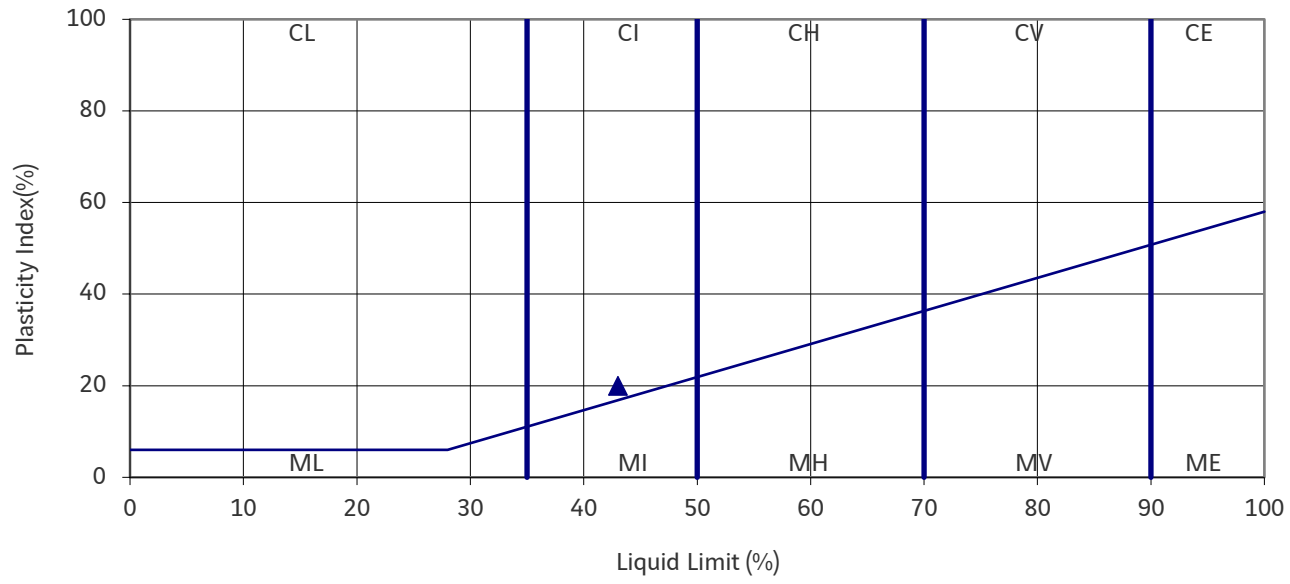
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Steve Harper			Print date 10/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH103
Project No.	TB8754		Sample Depth 11.00m
Engineer	Mott MacDonald		Sample Number 35
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 11.00m
			Specimen Number 1



As received water content:	44.6%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	43%	Preparation of sample: Natural	
Plastic limit:	23%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	20%		
Water content of soil passing 425µm	44.6%		
Liquidity index:	1.078		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 10/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 11.00m
Engineer	Mott MacDonald		Sample Number 36
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Light grey SILT.		Specimen Depth 11.53m
			Specimen Number 2

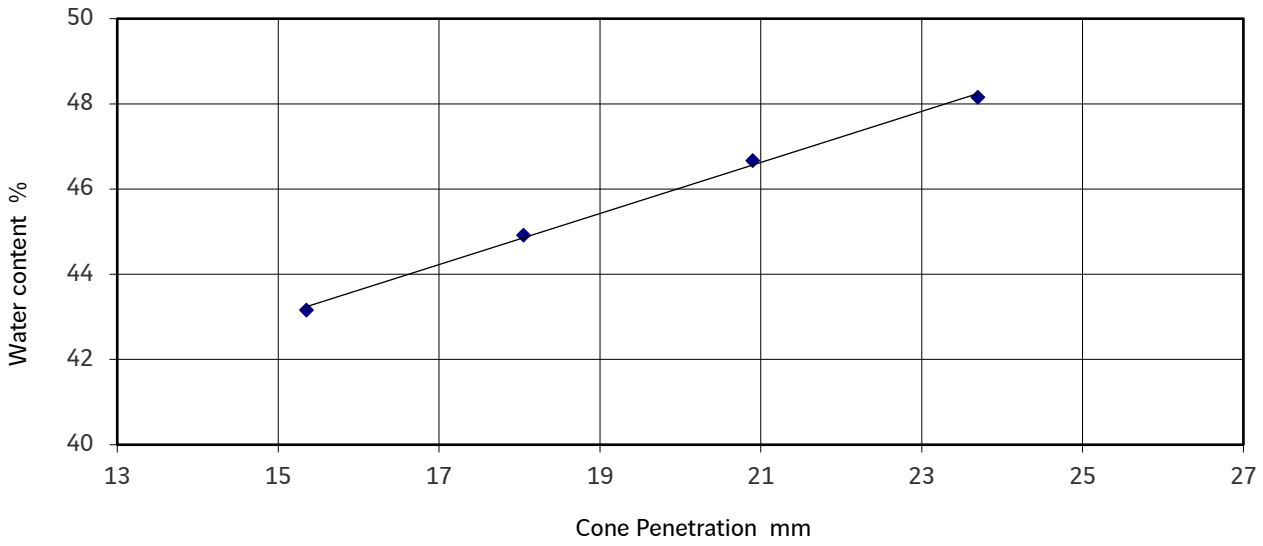
Water content	46.7	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

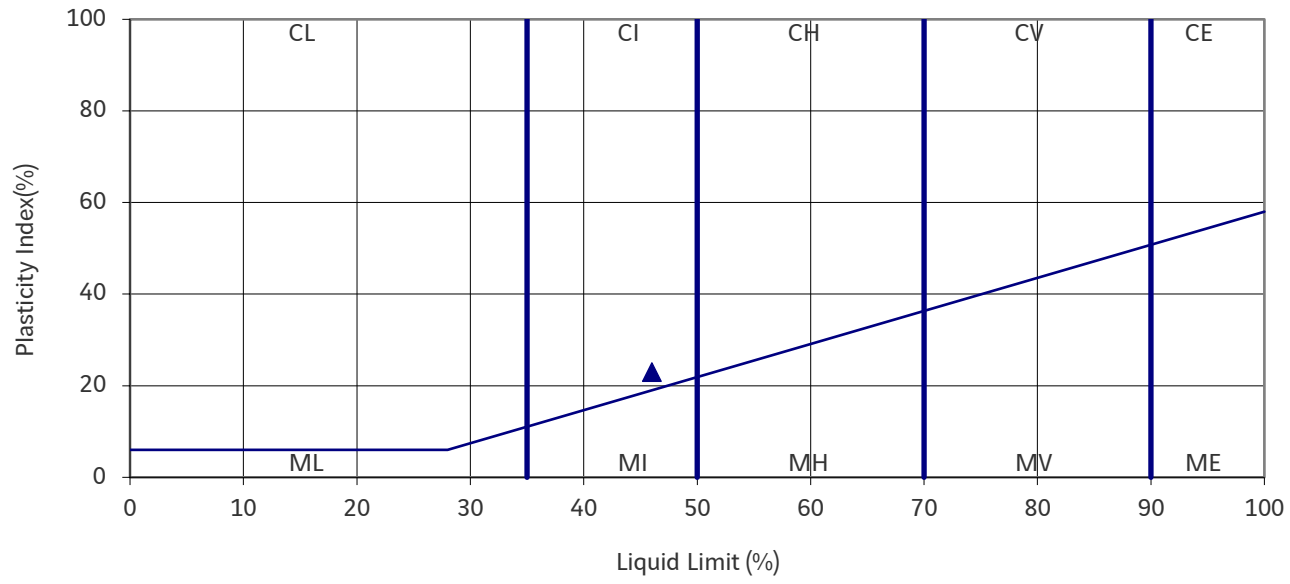
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 21/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH103
Project No.	TB8754		Sample Depth 11.00m
Engineer	Mott MacDonald		Sample Number 36
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Light grey SILT.		Specimen Depth 11.53m
			Specimen Number 1



As received water content:	46.7%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	46%	Preparation of sample: Natural	
Plastic limit:	23%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	23%		
Water content of soil passing 425µm	46.7%		
Liquidity index:	1.031		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 21/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 12.00m
Engineer	Mott MacDonald		Sample Number 37
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 12.00m
			Specimen Number 2

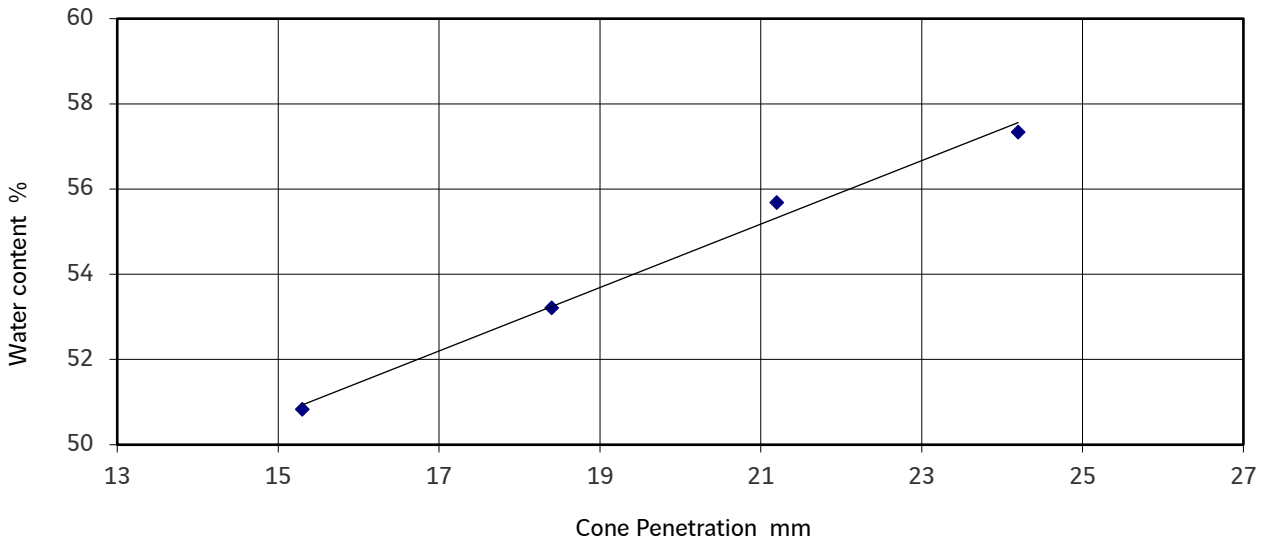
Water content	53.9	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

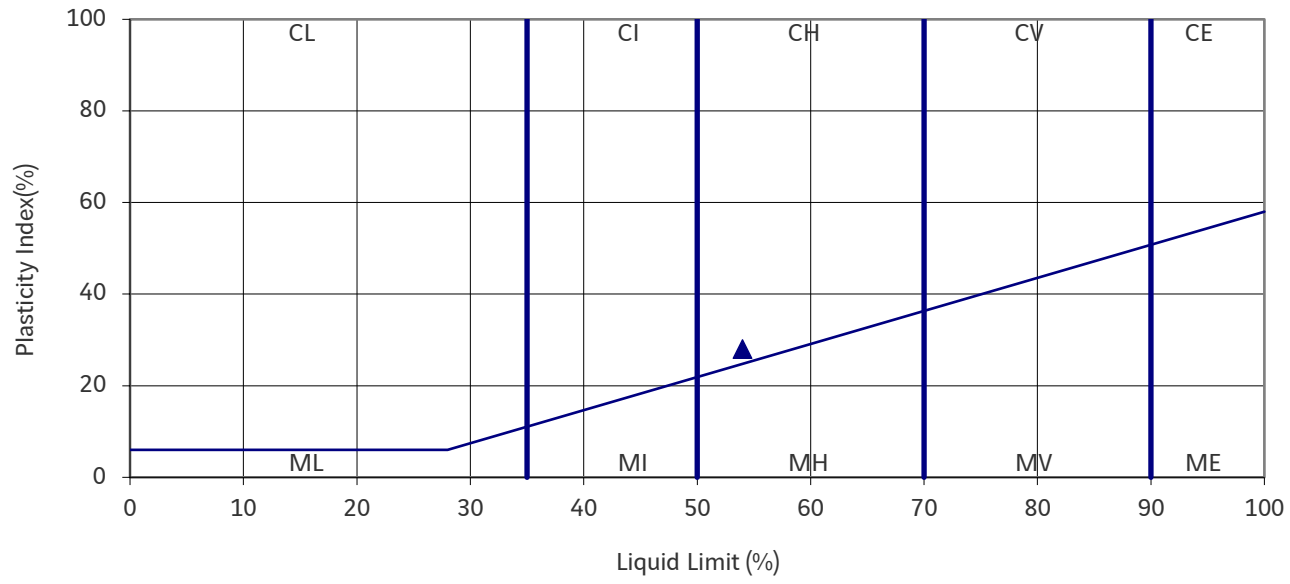
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 08/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH103
Project No.	TB8754		Sample Depth 12.00m
Engineer	Mott MacDonald		Sample Number 37
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 12.00m
			Specimen Number 1



As received water content:	53.9%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	54%	Preparation of sample: Natural	
Plastic limit:	26%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	28%		
Water content of soil passing 425µm	53.9%		
Liquidity index:	0.998		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 10/07/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

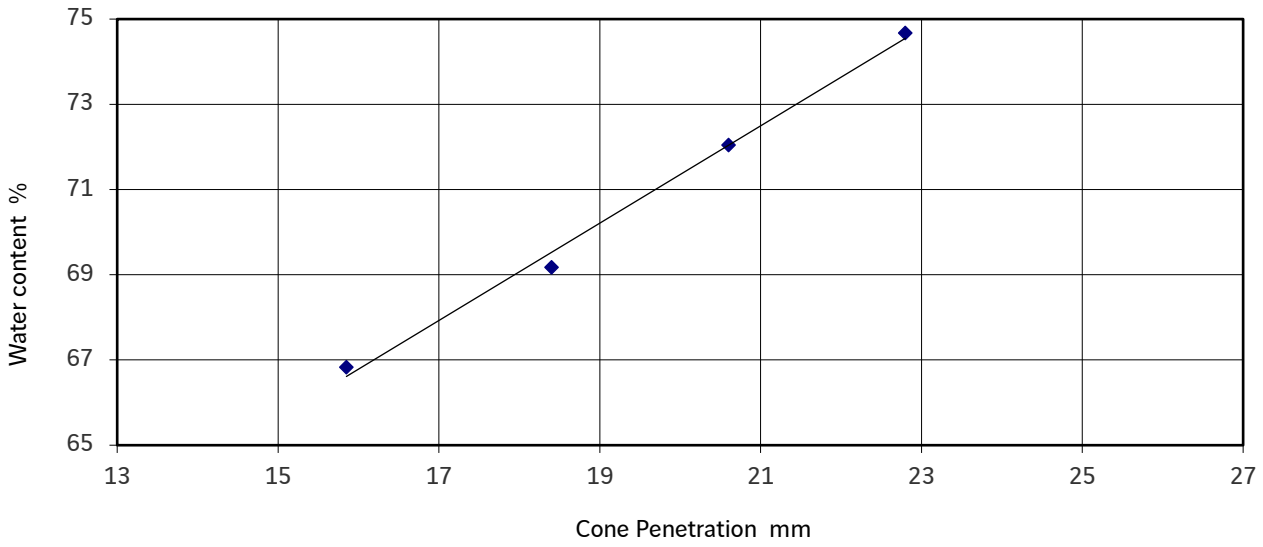
Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 12.00m
Engineer	Mott MacDonald		Sample Number 38
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 12.41m
			Specimen Number 2

Water content	72.0	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

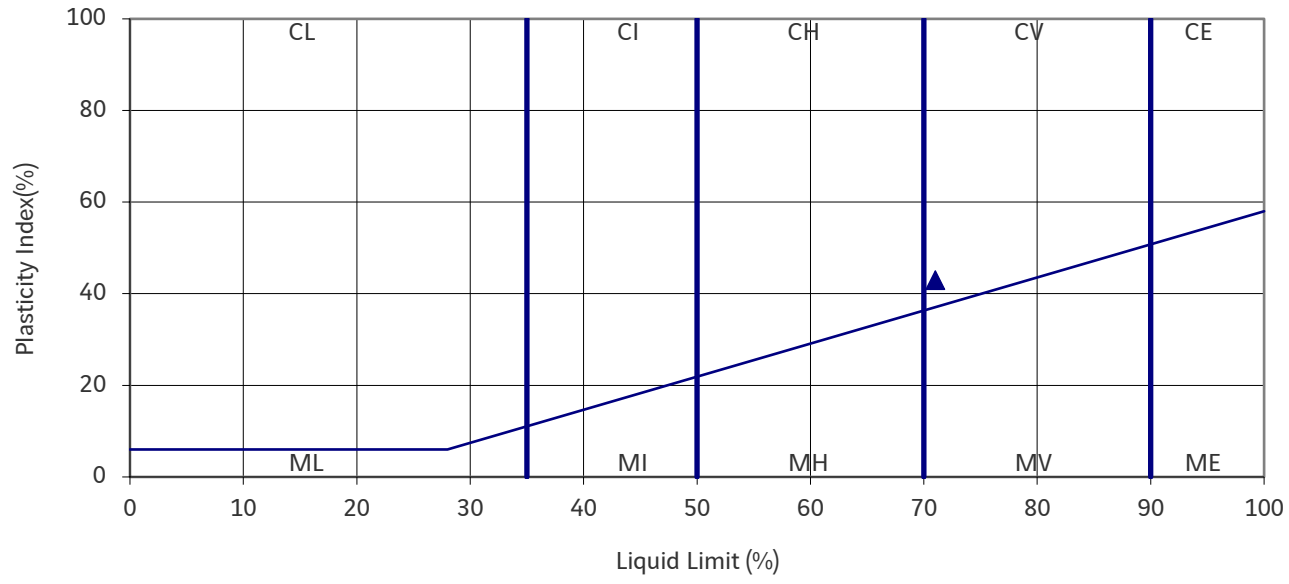
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH103
Project No.	TB8754		Sample Depth 12.00m
Engineer	Mott MacDonald		Sample Number 38
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 12.41m
			Specimen Number 1



As received water content:	72%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	71%	Preparation of sample: Natural	
Plastic limit:	28%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	43%		
Water content of soil passing 425µm	72.0%		
Liquidity index:	1.024		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 24/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 13.00m
Engineer	Mott MacDonald		Sample Number 39
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Dark brown PEAT.		Specimen Depth 13.00m
			Specimen Number 2

Water content	198	%
Oven temperature	50	°C
Is test result assumed to be a natural water content?	Yes	

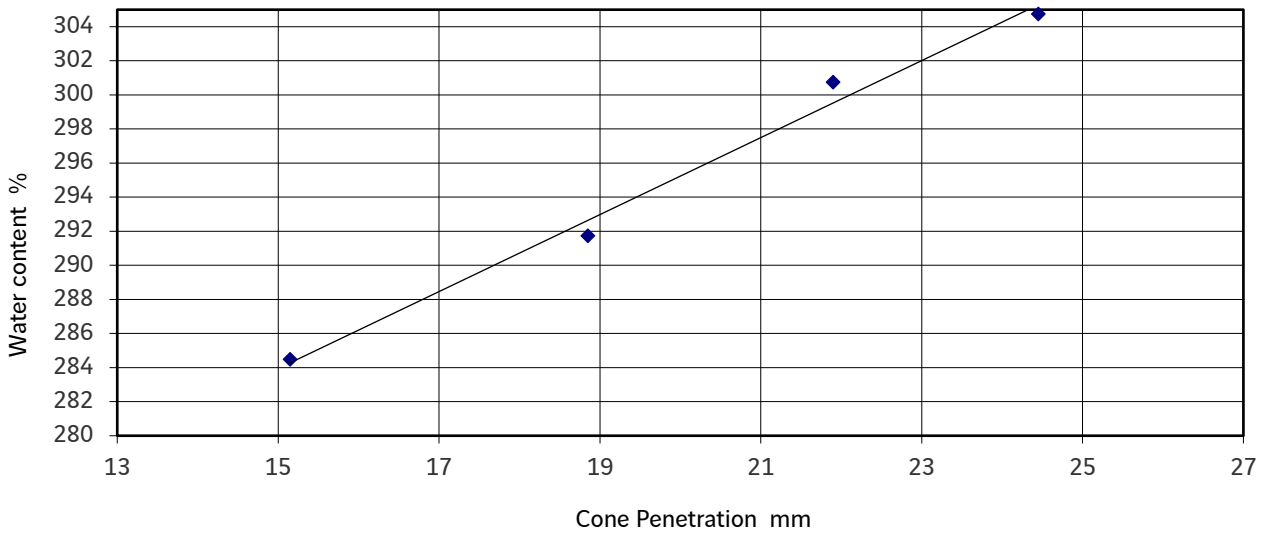
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

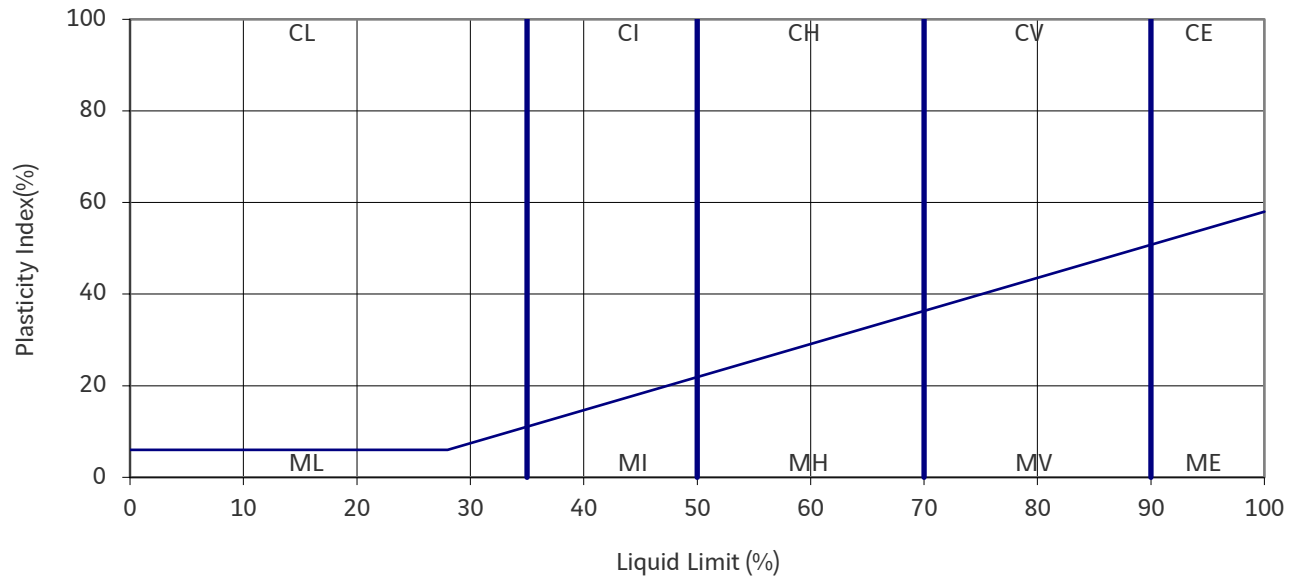
Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 10/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024	

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH103
Project No.	TB8754		Sample Depth 13.00m
Engineer	Mott MacDonald		Sample Number 39
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Dark brown PEAT.		Specimen Depth 13.00m
			Specimen Number 1



As received water content:	198%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	300%	Preparation of sample: Natural	
Plastic limit:	200%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	100%		
Water content of soil passing 425µm	198%		
Liquidity index:	-0.020		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 10/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

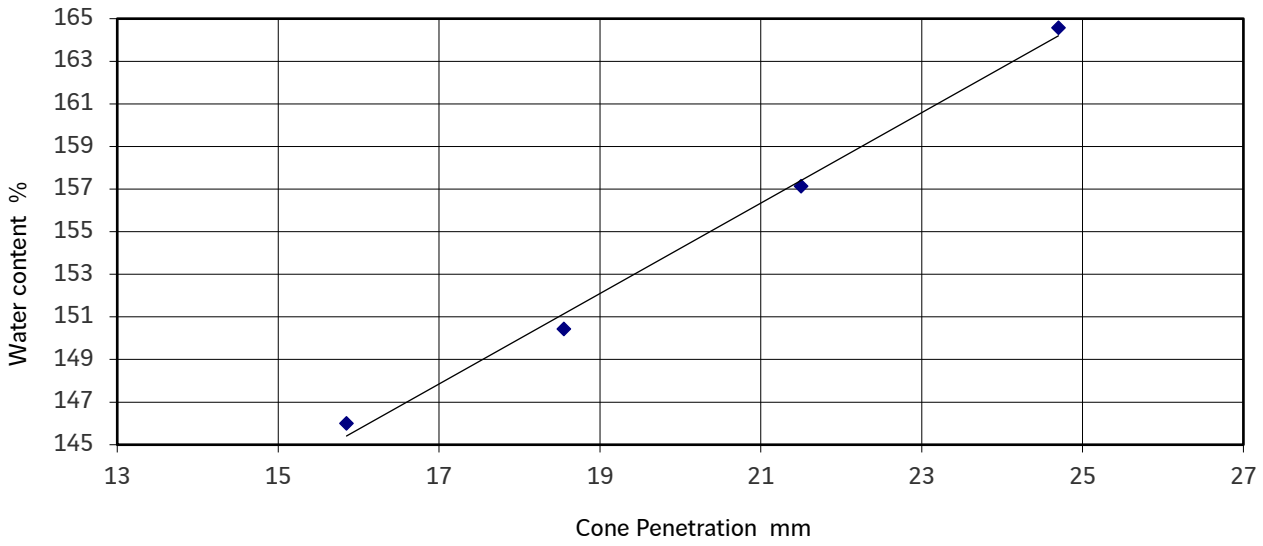
Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 13.00m
Engineer	Mott MacDonald		Sample Number 40
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY with peat.		Specimen Depth 13.54m
			Specimen Number 2

Water content	135	%
Oven temperature	50	°C
Is test result assumed to be a natural water content?	Yes	

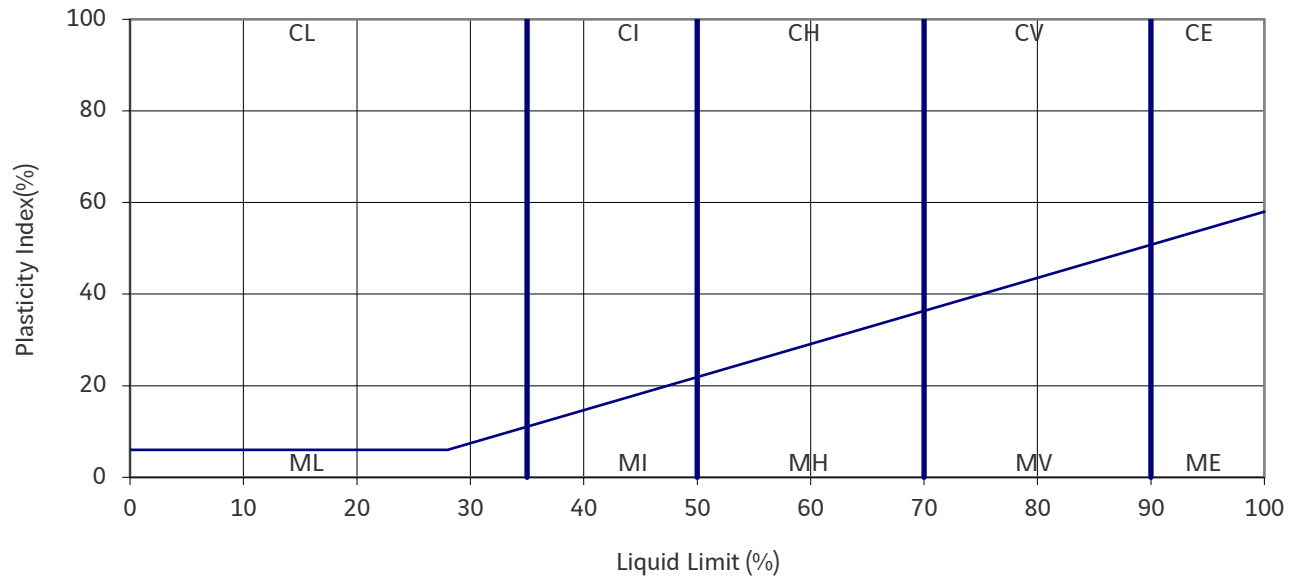
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH103
Project No.	TB8754		Sample Depth 13.00m
Engineer	Mott MacDonald		Sample Number 40
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY with peat.		Specimen Depth 13.54m
			Specimen Number 1



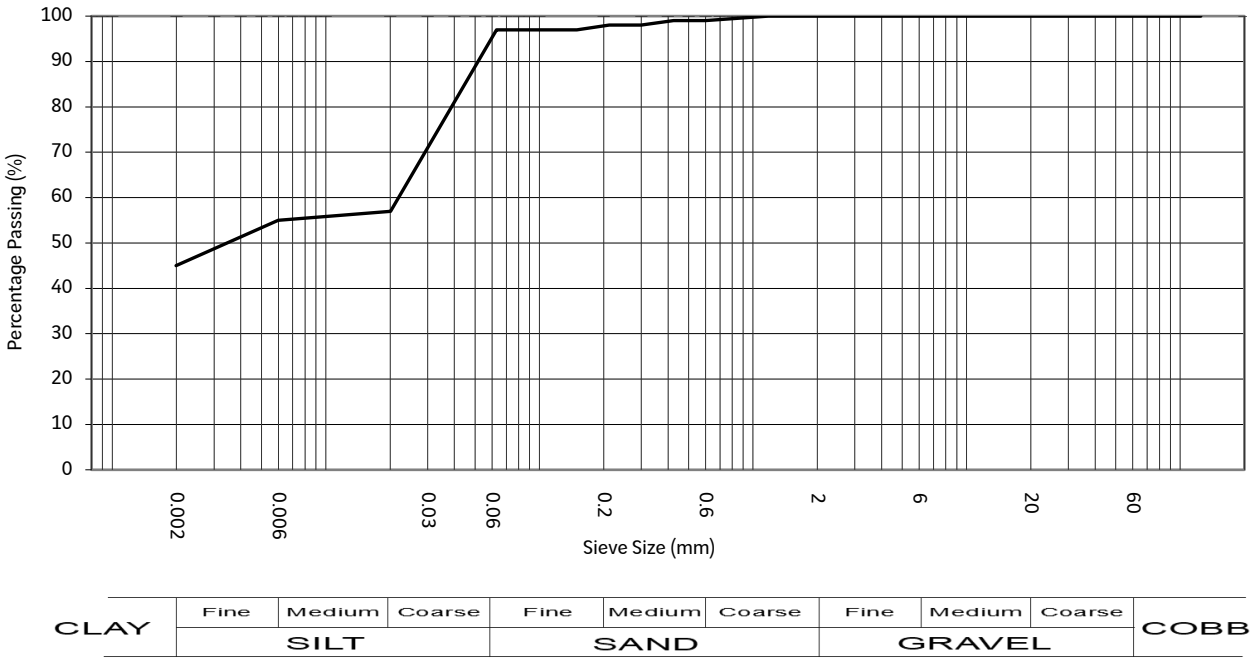
As received water content:	135%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	150%	Preparation of sample: Natural	
Plastic limit:	52%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	98%		
Water content of soil passing 425µm	135%		
Liquidity index:	0.848		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 21/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH103
Project No.	TB8754		Sample Depth 13.00m
Engineer	Mott MacDonald		Sample Number 40
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type P
Description	Grey CLAY with peat.		Specimen Depth 13.59m
			Specimen No. 4



PARTICLE SIZE	%
Clay:	44.8
Silt:	52.2
Sand:	3.0
Gravel:	0.0
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14	100		
		10	100	0.020100	57
		6.3	100	0.005980	55
125.0	100	5	100	0.001990	45
90.0	100	3.35	100		
75.0	100	2	100		
63.0	100	1.18	100		
50.0	100	0.6	99		
37.5	100	0.425	99		
28.0	100	0.3	98		
20.0	100	0.212	98		
		0.15	97		
		0.063	97		

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by: Steve Harper

Print date 21/07/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 14.00m
Engineer	Mott MacDonald		Sample Number 41
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 14.00m
			Specimen Number 2

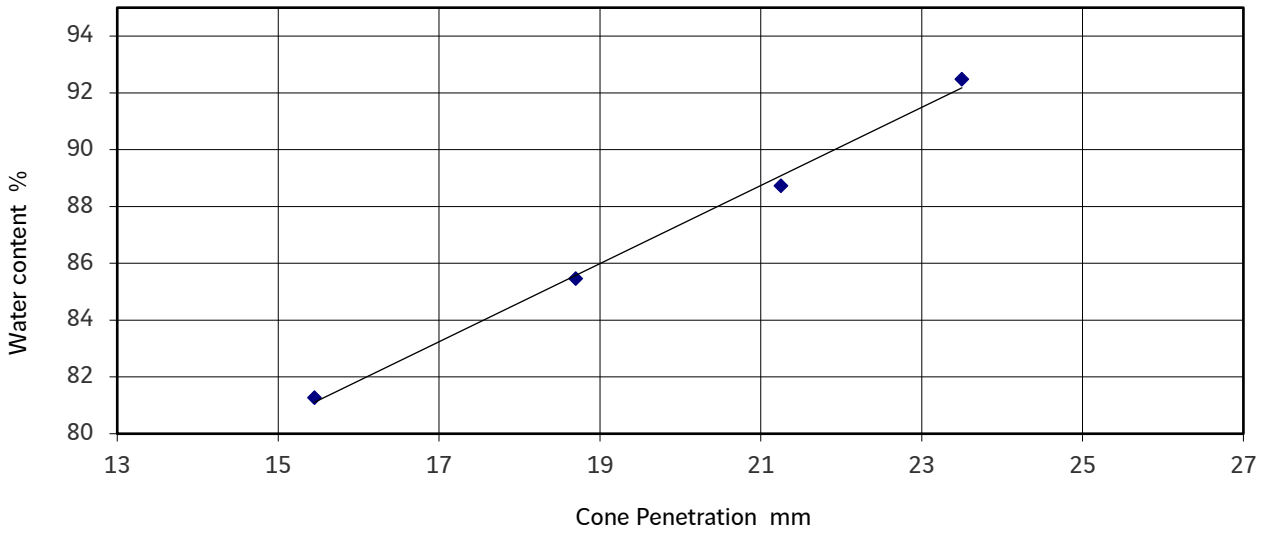
Water content	66.2	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

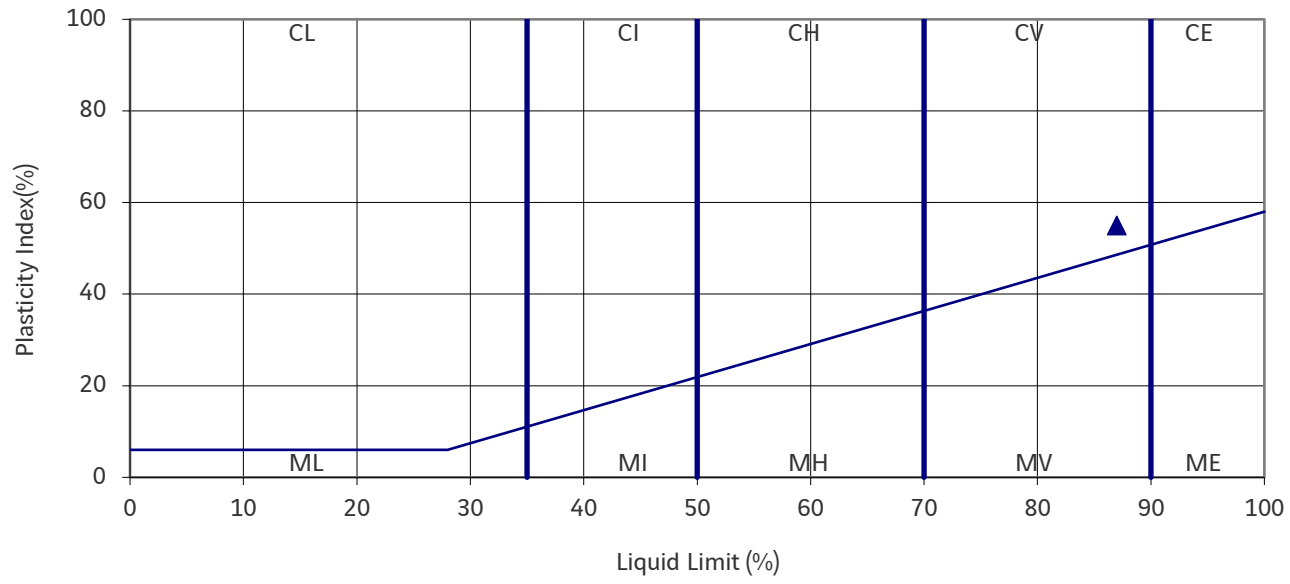
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 10/07/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH103
Project No.	TB8754		Sample Depth 14.00m
Engineer	Mott MacDonald		Sample Number 41
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 14.00m
			Specimen Number 1



As received water content:	66.2%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	87%	Preparation of sample: Natural	
Plastic limit:	32%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	55%		
Water content of soil passing 425µm	66.2%		
Liquidity index:	0.623		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 10/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 14.00m
Engineer	Mott MacDonald		Sample Number 42
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 14.44m
			Specimen Number 2

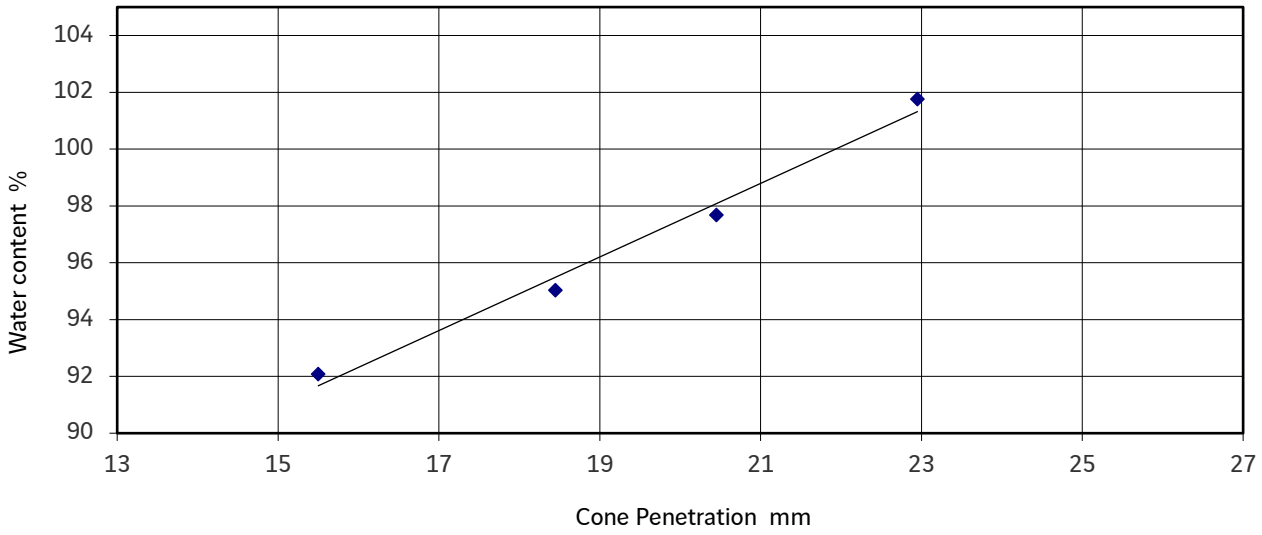
Water content	72.3	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

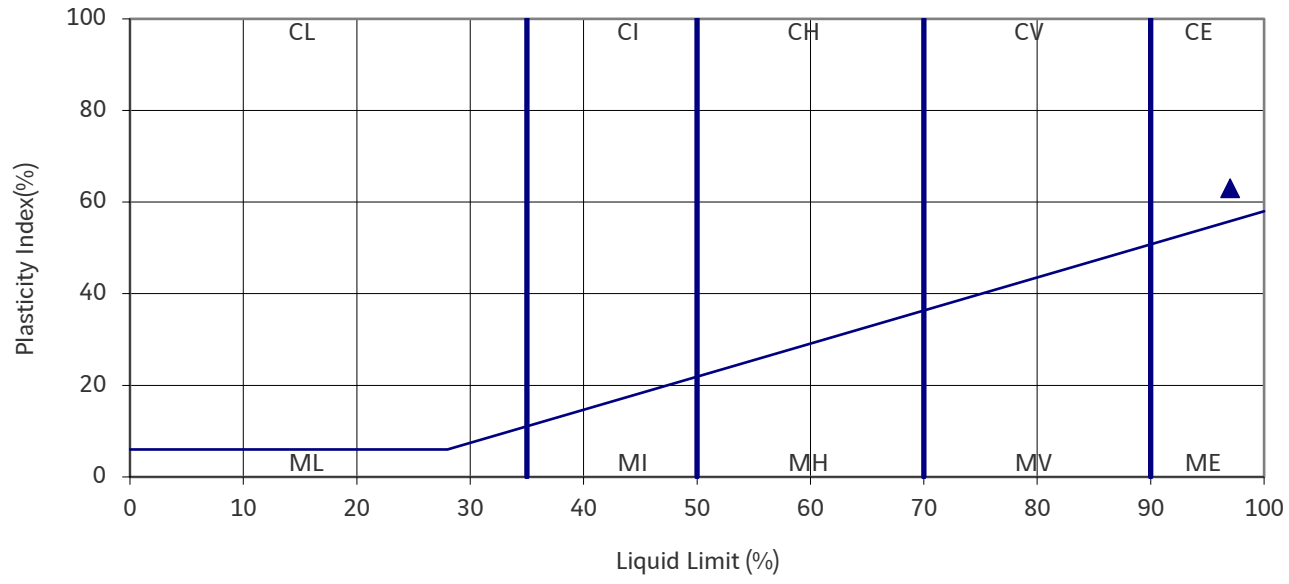
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 22/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH103
Project No.	TB8754		Sample Depth 14.00m
Engineer	Mott MacDonald		Sample Number 42
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 14.44m
			Specimen Number 1



As received water content:	72.3%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	97%	Preparation of sample: Natural	
Plastic limit:	34%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	63%		
Water content of soil passing 425µm	72.3%		
Liquidity index:	0.608		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 24/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 15.00m
Engineer	Mott MacDonald		Sample Number 43
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 15.00m
			Specimen Number 2

Water content	55.2	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

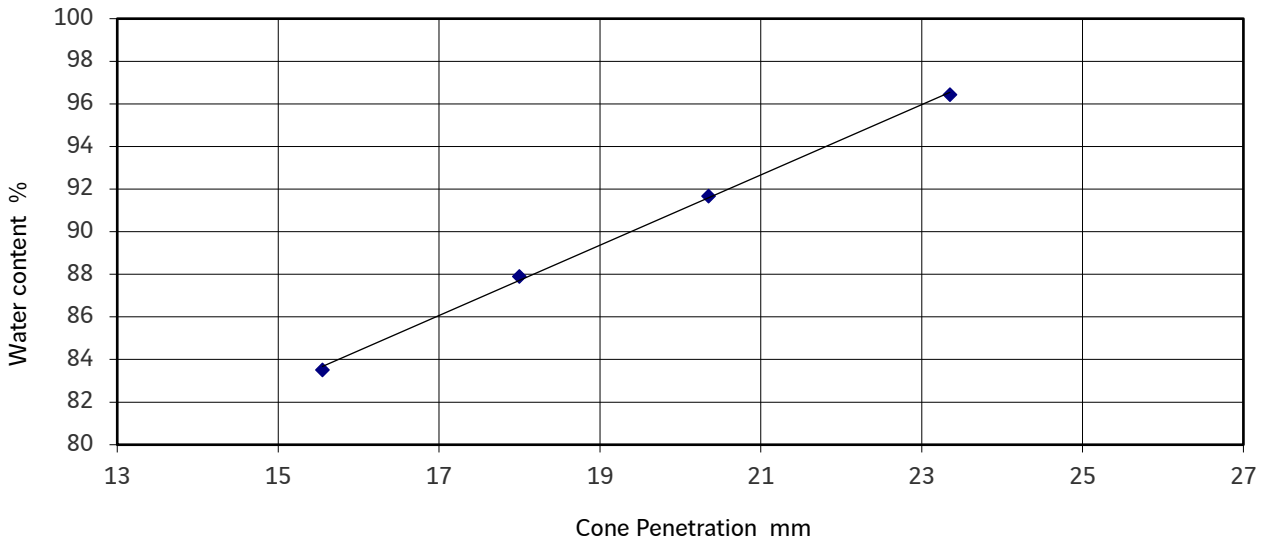
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

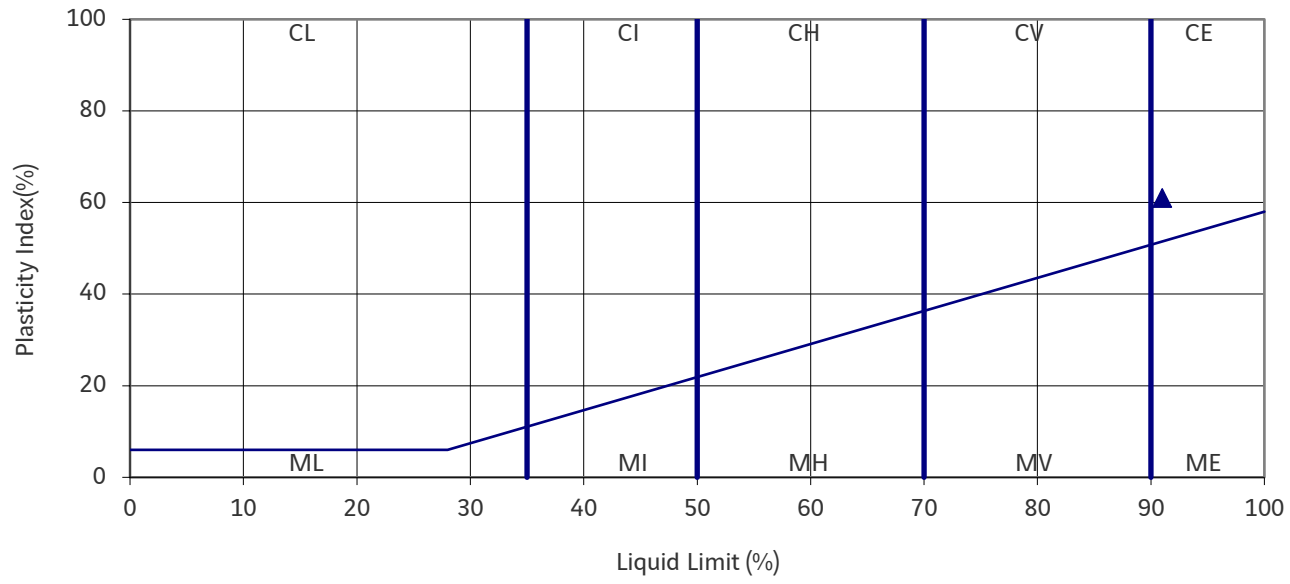
Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 10/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024	

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH103
Project No.	TB8754		Sample Depth 15.00m
Engineer	Mott MacDonald		Sample Number 43
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 15.00m
			Specimen Number 1



As received water content:	55.2%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	91%	Preparation of sample: Natural	
Plastic limit:	30%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	61%		
Water content of soil passing 425µm	55.2%		
Liquidity index:	0.414		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 10/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

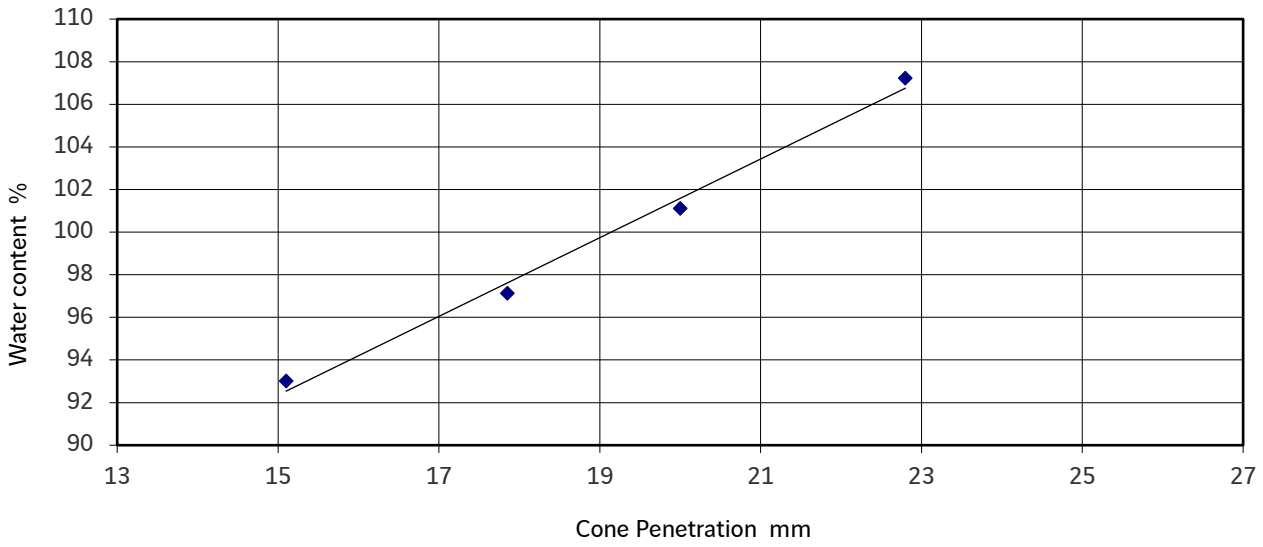
Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 15.00m
Engineer	Mott MacDonald		Sample Number 44
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 15.55m
			Specimen Number 2

Water content	68.5	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

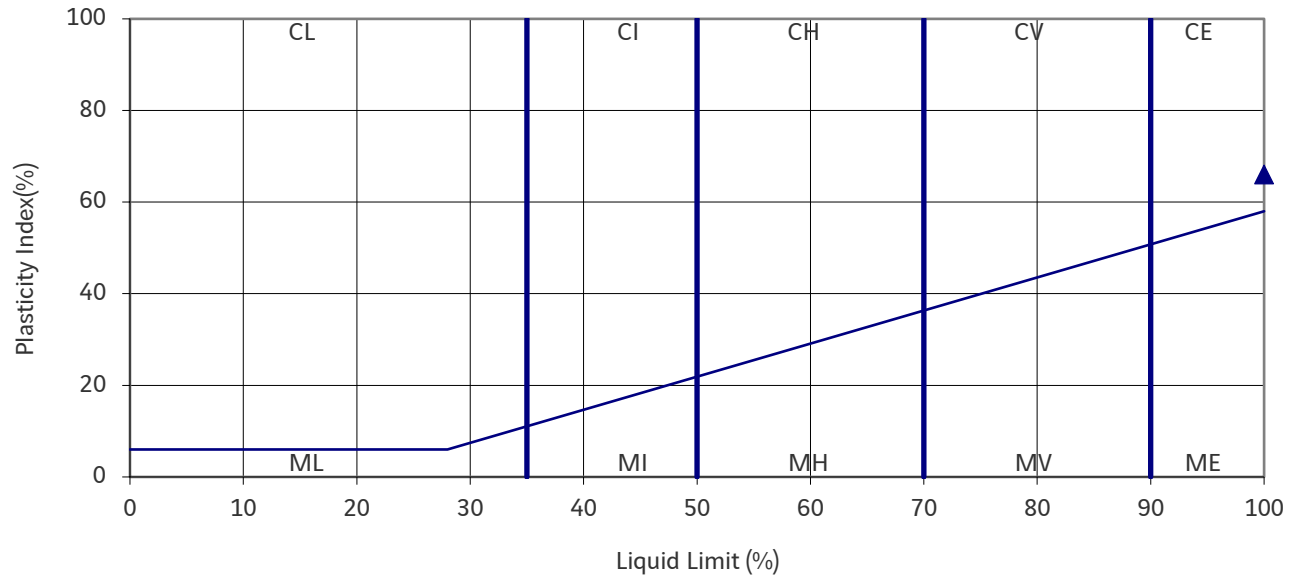
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH103
Project No.	TB8754		Sample Depth 15.00m
Engineer	Mott MacDonald		Sample Number 44
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 15.55m
			Specimen Number 1



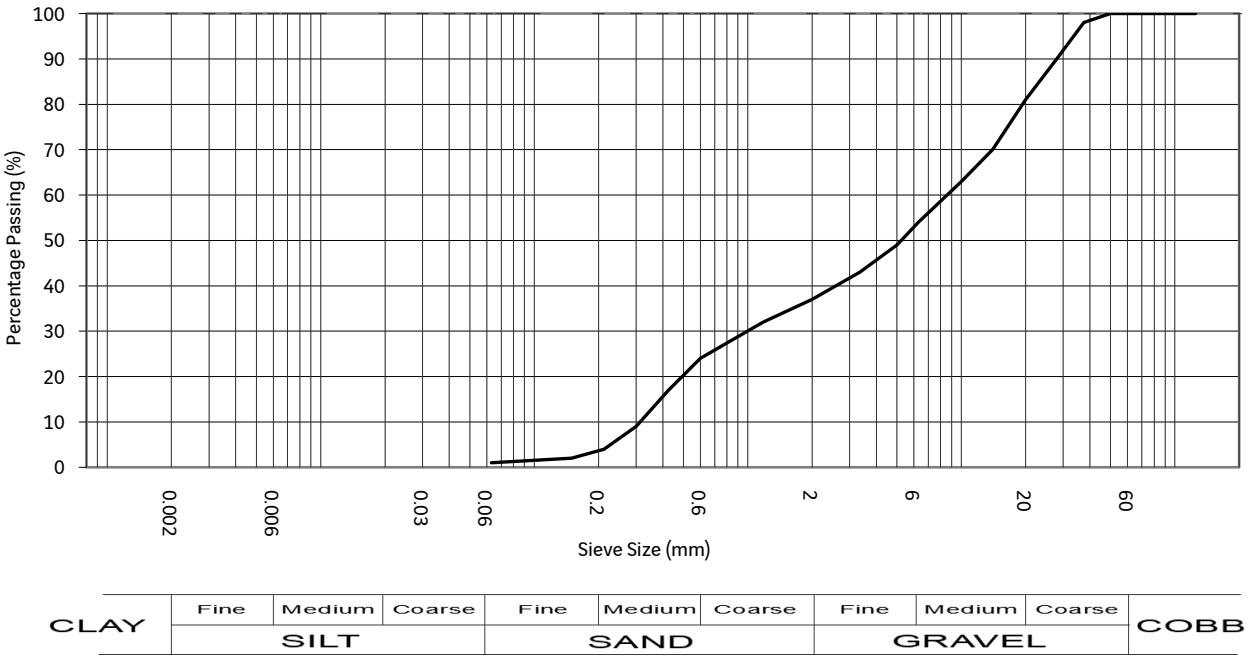
As received water content:	68.5%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	100%	Preparation of sample: Natural	
Plastic limit:	34%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	66%		
Water content of soil passing 425µm	68.5%		
Liquidity index:	0.523		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 11/07/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH103
Project No.	TB8754		Sample Depth 18.50m
Engineer	Mott MacDonald		Sample Number 51
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.2	Sample type B
Description	Brown SAND and GRAVEL.		Specimen Depth 18.50m
			Specimen No. 1



PARTICLE SIZE	%
Silt and clay:	0.7
Sand:	35.8
Gravel:	63.5
Cobbles:	0.0

General remarks

Sample size was insufficient to comply with the recommended minimum mass.

WET SIEVE DATA

Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	70
		10	63
		6.3	54
125.0	100	5	49
90.0	100	3.35	43
75.0	100	2	37
63.0	100	1.18	32
50.0	100	0.6	24
37.5	98	0.425	17
28.0	90	0.3	9
20.0	81	0.212	4
		0.15	2
		0.063	1

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:

Paul Rodgers

Print date 22/07/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 27.18m
Engineer	Mott MacDonald		Sample Number 60.2
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 27.18m
			Specimen Number 12

Water content	26.4	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 06/08/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH103
Project No.	TB8754		Sample Depth 27.18m
Engineer	Mott MacDonald		Sample Number 60.2
Employer	FBJV	BS 1377-2:2022 Clause 8/BS EN ISO 17892-2:2014: 5.1	Sample Type CS
Description	Off white CHALK.		Specimen Depth 27.18m
			Specimen Number 11

Water Content	25.3	%
Density Type	Linear density	
Bulk Density	1.99	Mg/m^3
Dry Density	1.59	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 01/10/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 29.70m
Engineer	Mott MacDonald		Sample Number 62.1
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 29.70m
			Specimen Number 12

Water content	27.1	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 06/08/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH103
Project No.	TB8754		Sample Depth 29.70m
Engineer	Mott MacDonald		Sample Number 62.1
Employer	FBJV	BS 1377-2:2022 Clause 8/BS EN ISO 17892-2:2014 Clause 5.2	Sample Type CS
Description	Off white CHALK.		Specimen Depth 29.70m
			Specimen Number 11

Water Content	28.0	%
Density Type	Immersion density	
Bulk Density	1.95	Mg/m³
Dry Density	1.52	Mg/m³

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 01/10/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 33.25m
Engineer	Mott MacDonald		Sample Number 64.1
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 33.25m
			Specimen Number 12

Water content	22.7	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 06/08/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH103
Project No.	TB8754		Sample Depth 33.25m
Engineer	Mott MacDonald		Sample Number 64.1
Employer	FBJV	BS 1377-2:2022 Clause 8/BS EN ISO 17892-2:2014 Clause 5.2	Sample Type CS
Description	Off white CHALK.		Specimen Depth 33.25m
			Specimen Number 11

Water Content	24.7	%
Density Type	Immersion density	
Bulk Density	2.01	Mg/m^3
Dry Density	1.61	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 34.78m
Engineer	Mott MacDonald		Sample Number 65.2
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 34.78m
			Specimen Number 13

Water content	23.9	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 06/08/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 37.60m
Engineer	Mott MacDonald		Sample Number 67.1
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 37.60m
			Specimen Number 12

Water content	22.9	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 06/08/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 40.15m
Engineer	Mott MacDonald		Sample Number 69.2
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 40.15m
			Specimen Number 12

Water content	26.6	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 06/08/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 44.40m
Engineer	Mott MacDonald		Sample Number 71.2
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 44.40m
			Specimen Number 12

Water content	25.8	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 06/08/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH103
Project No.	TB8754		Sample Depth 47.77m
Engineer	Mott MacDonald		Sample Number 71.1
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 47.77m
			Specimen Number 2

Water content	27.7	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 06/08/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH107
Project No.	TB8754		Sample Depth 2.00m
Engineer	Mott MacDonald		Sample Number 13
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 2.44m
			Specimen Number 2

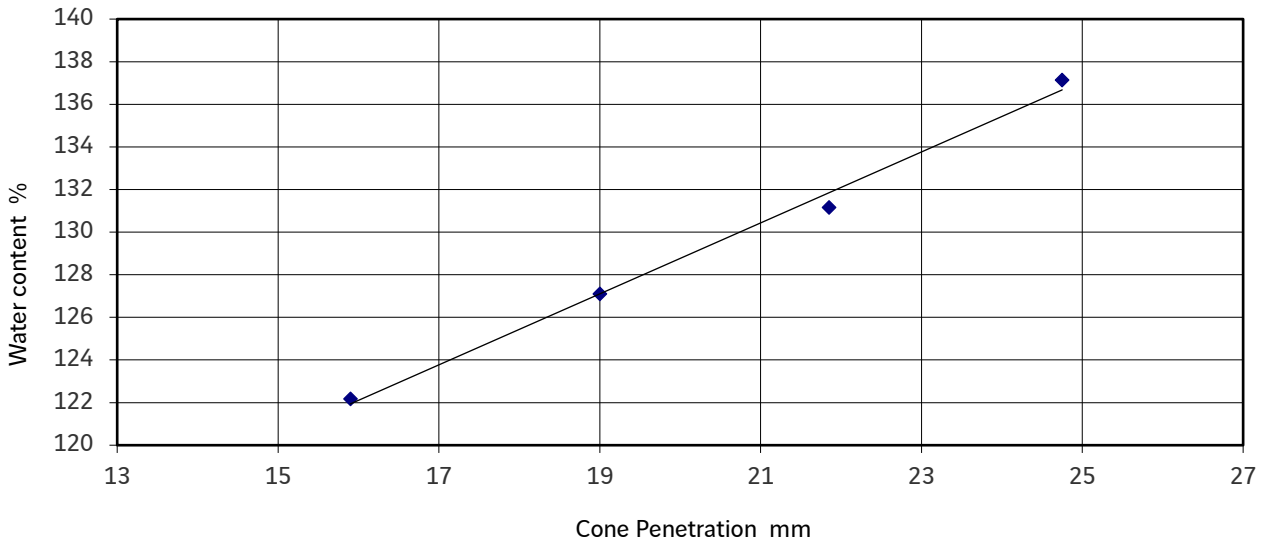
Water content	129	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

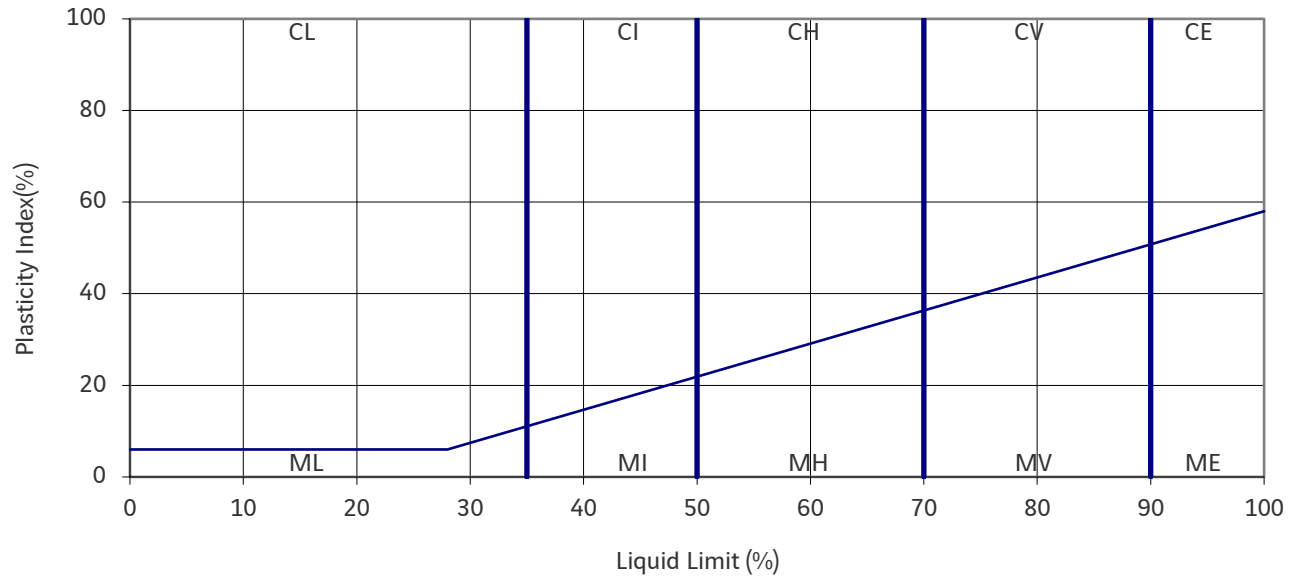
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 24/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH107
Project No.	TB8754		Sample Depth 2.00m
Engineer	Mott MacDonald		Sample Number 13
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 2.44m
			Specimen Number 1



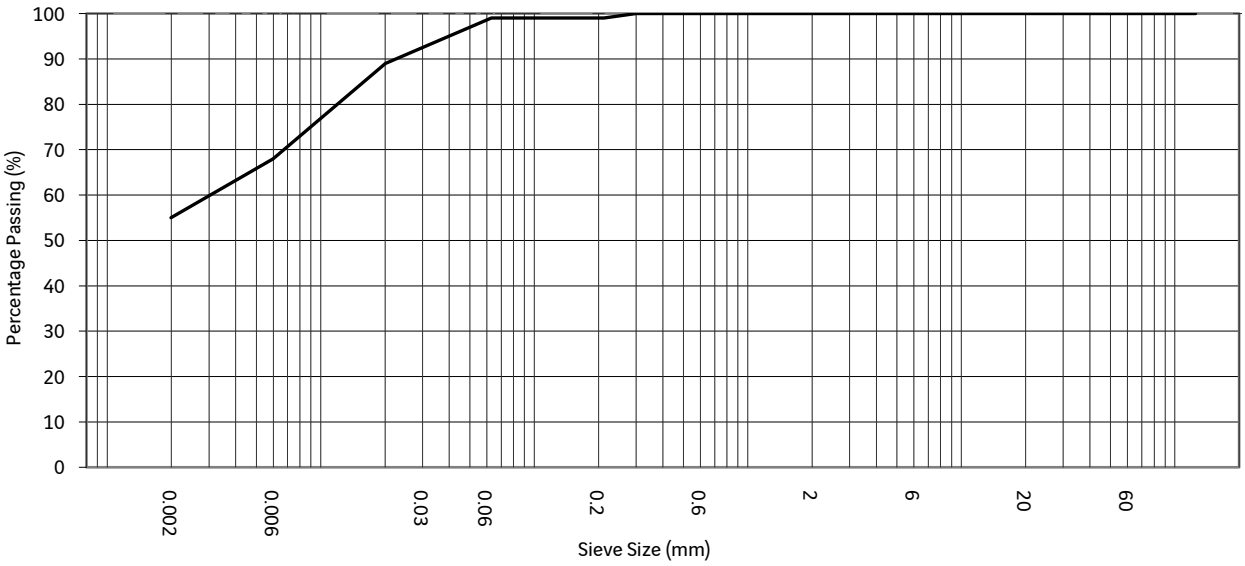
As received water content:	129%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	130%	Preparation of sample: Natural	
Plastic limit:	41%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	89%		
Water content of soil passing 425µm	129%		
Liquidity index:	0.989		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 24/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH107
Project No.	TB8754		Sample Depth 3.00m
Engineer	Mott MacDonald		Sample Number 16
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type B
Description	Greenish grey CLAY.		Specimen Depth 3.00m
			Specimen No. 1



PARTICLE SIZE	%
Clay:	54.8
Silt:	44.0
Sand:	1.2
Gravel:	0.0
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA

Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	100
		10	100
		6.3	100
125.0	100	5	100
90.0	100	3.35	100
75.0	100	2	100
63.0	100	1.18	100
50.0	100	0.6	100
37.5	100	0.425	100
28.0	100	0.3	100
20.0	100	0.212	99
		0.15	99
		0.063	99

SEDIMENTATION DATA

Equivalent particle diameter mm	Cumulative % passing
0.020100	89
0.005990	68
0.001990	55

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:

Paul Rodgers

Print date 31/07/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH107
Project No.	TB8754		Sample Depth 3.00m
Engineer	Mott MacDonald		Sample Number 15
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 3.00m
			Specimen Number 2

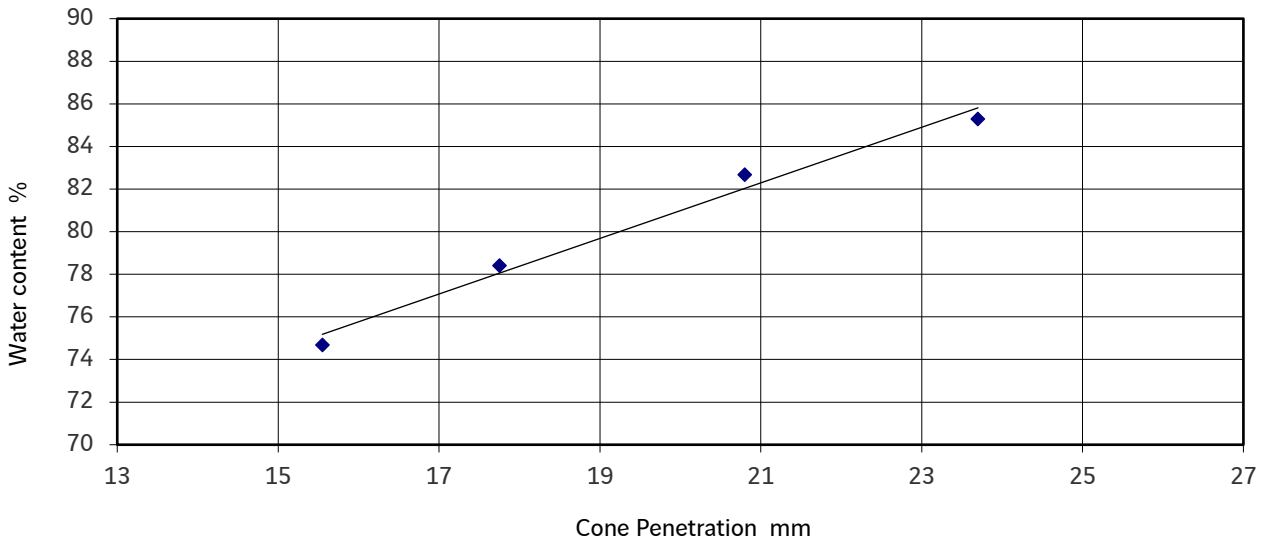
Water content	81.3	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

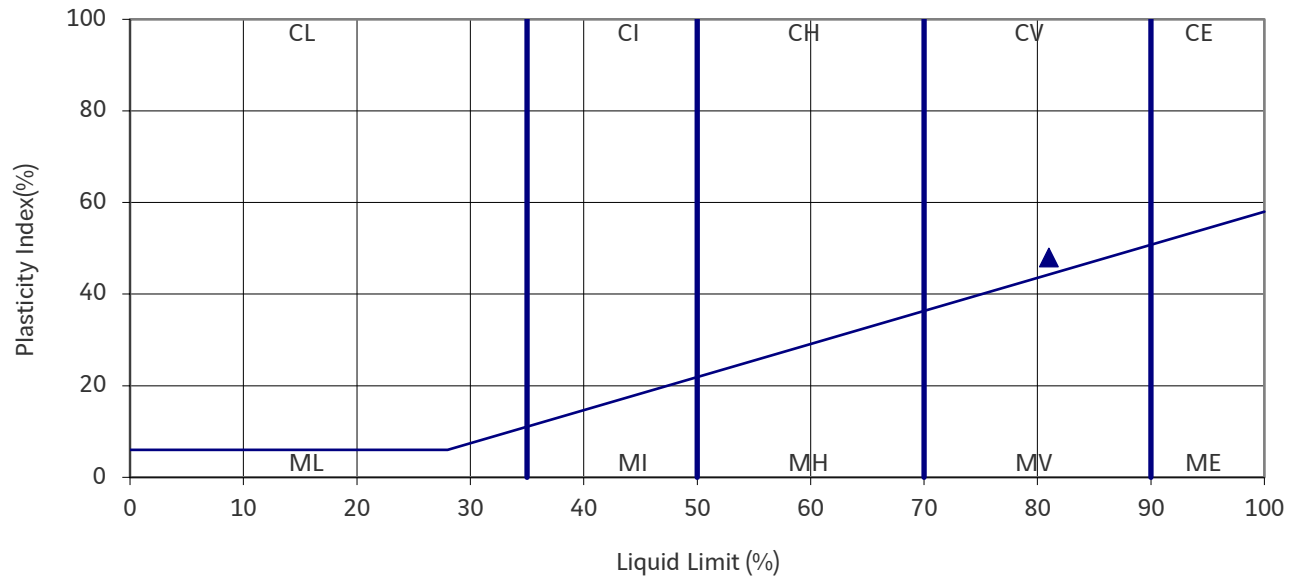
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Steve Harper			Print date 01/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH107
Project No.	TB8754		Sample Depth 3.00m
Engineer	Mott MacDonald		Sample Number 15
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 3.00m
			Specimen Number 1



As received water content:	81.3%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	81%	Preparation of sample: Natural	
Plastic limit:	33%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	48%		
Water content of soil passing 425µm	81.3%		
Liquidity index:	1.007		

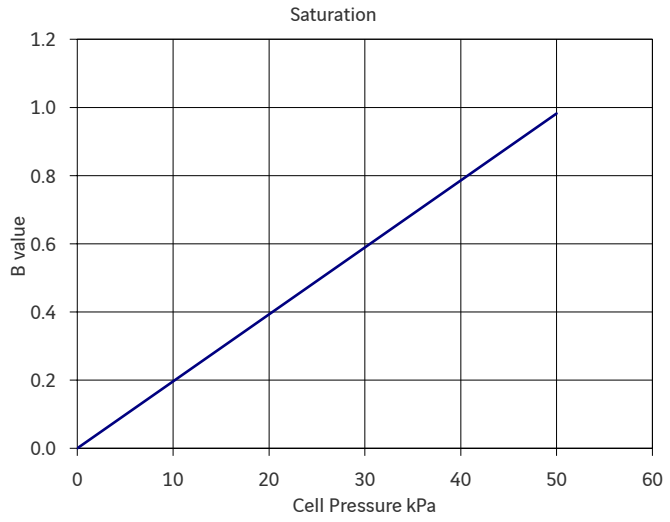


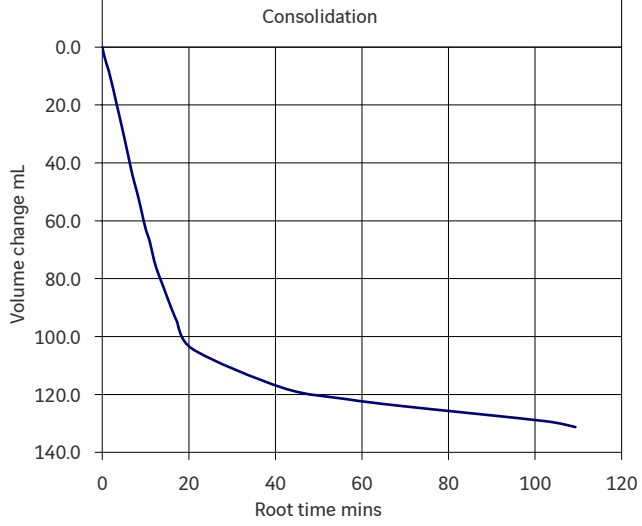
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 01/08/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH107
Project No.	TB8754		Sample Depth 4.00m
Engineer	Mott MacDonald		Sample Number 19
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey slightly organic SILT.		Specimen Depth 4.79m
			Specimen Number 1

SPECIMEN INITIAL DIMENSIONS		
Test number		1
Specimen diameter	mm	102.25
Specimen length	mm	192.00
Density	Mg/m^3	1.59
Moisture content	%	70
Dry density	Mg/m^3	0.93
SATURATION STAGE		
Initial pore water pressure	kPa	1.9
Saturated pore water pressure	kPa	51
Final cell pressure	kPa	50
B value		0.982
CONSOLIDATION STAGE		
Cell pressure	kPa	330
Back pressure	kPa	300
Effective consolidation pressure	kPa	30
Initial pore water pressure	kPa	328.2
Final pore water pressure	kPa	296.2
Pore pressure dissipation	%	113.5
c_{vi}	$m^2/year$	0.41
m_{vi}	m^2/MN	2.60
SPECIMEN AFTER CONSOLIDATION		
Density	Mg/m^3	1.64
Moisture content	%	61
Dry density	Mg/m^3	1.02



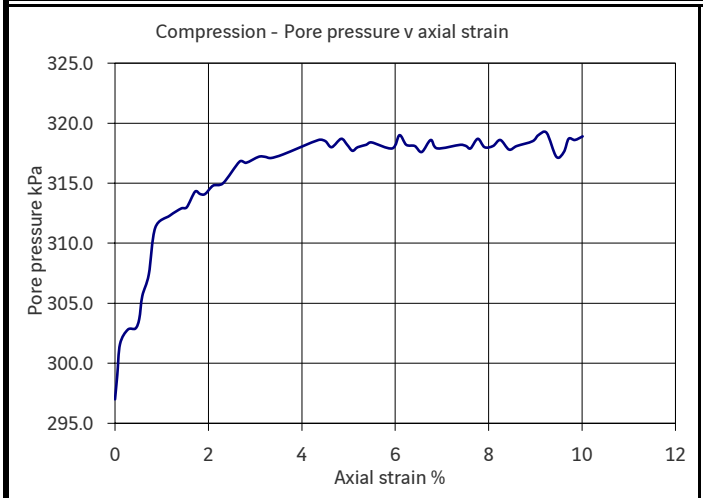


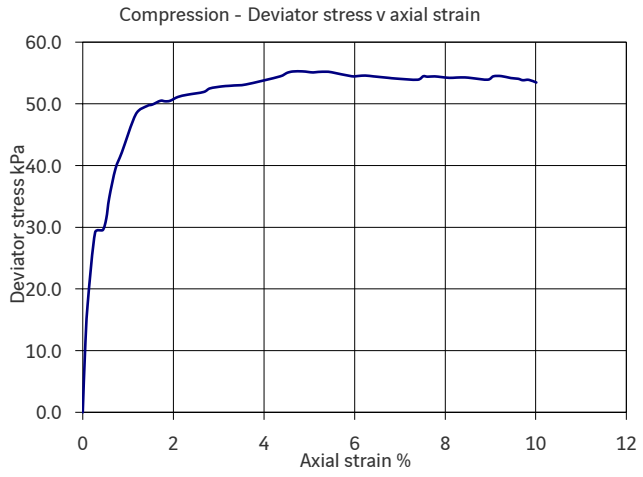
Remarks: Specimen orientation Vertical
Specimen condition for test UNDISTURBED
Saturation with 50kPa increments with a differential pressure of 10kPa
Drainage from both ends and using a radial filter drain

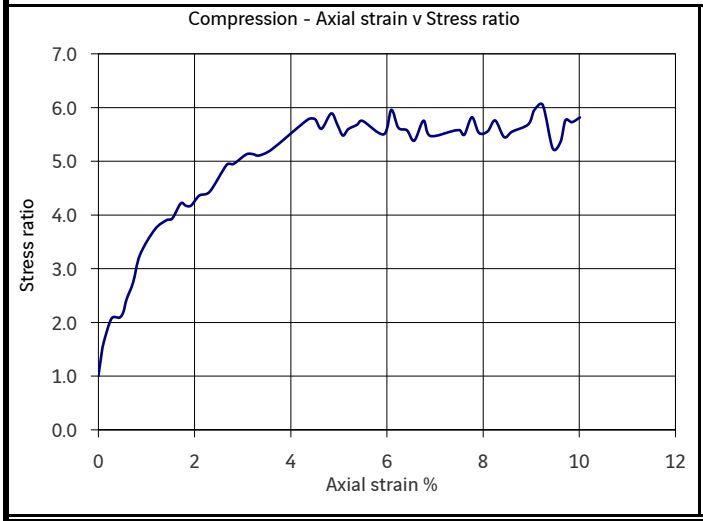
Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 23/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

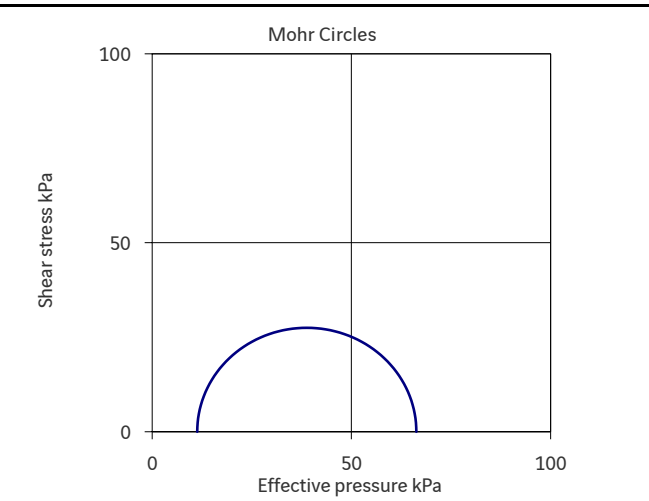
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH107
Project No.	TB8754		Sample Depth 4.00m
Engineer	Mott MacDonald		Sample Number 19
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey slightly organic SILT.		Specimen Depth 4.79m
			Specimen Number 1

COMPRESSION STAGE			
Test number			1
Cell pressure		kPa	330
Initial pore water pressure		kPa	297
Effective confining pressure		kPa	34
Failure conditions at			Maximum deviator stress
Axial strain at failure		%	4.8
Maximum deviator stress	σ_1-σ_3	kPa	55
Pore water pressure at failure	σ	kPa	319
Effective major principal stress	σ_1'	kPa	66.57
Effective minor principal stress	σ_3'	kPa	11.30
Effective principal stress ratio			5.89
Membrane correction		kPa	0.59
Filter drain correction		kPa	3.5
Pore pressure coefficient			0.4









Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 23/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

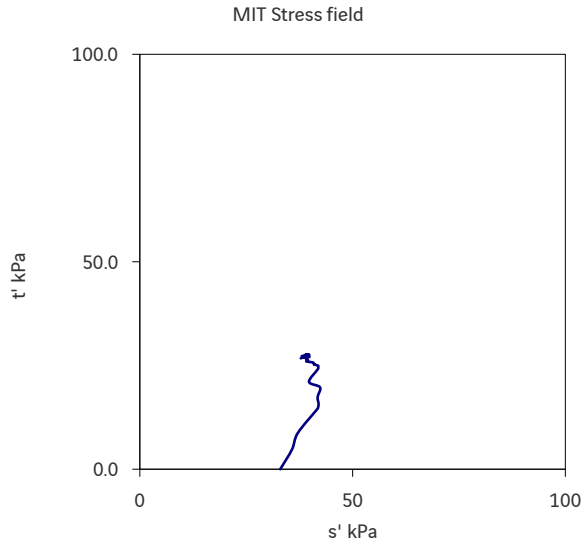
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH107
Project No.	TB8754		Sample Depth 4.00m
Engineer	Mott MacDonald		Sample Number 19
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey slightly organic SILT.		Specimen Depth 4.79m
			Specimen Number 1

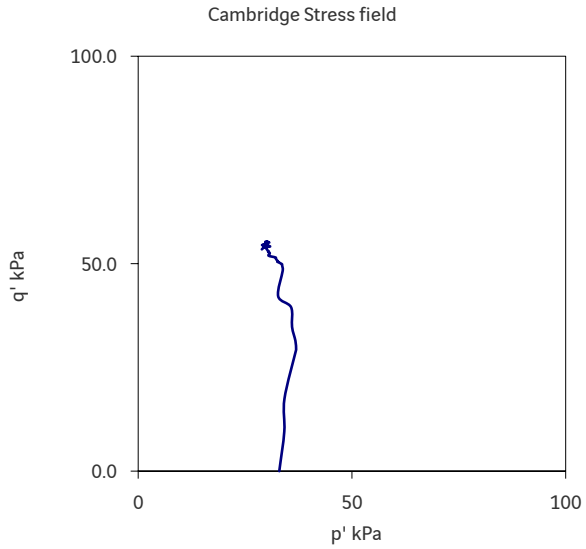
SPECIMEN AFTER TEST

Test number		1	
Mode of failure		Compound 	
Final moisture content	%	61	
Final bulk density	Mg/m^3	1.64	
Final dry density	Mg/m^3	1.02	

ADDITIONAL SPECIMEN DETAILS

Rate of strain	%/hour	0.20	
Failure criterion		Maximum deviator stress	

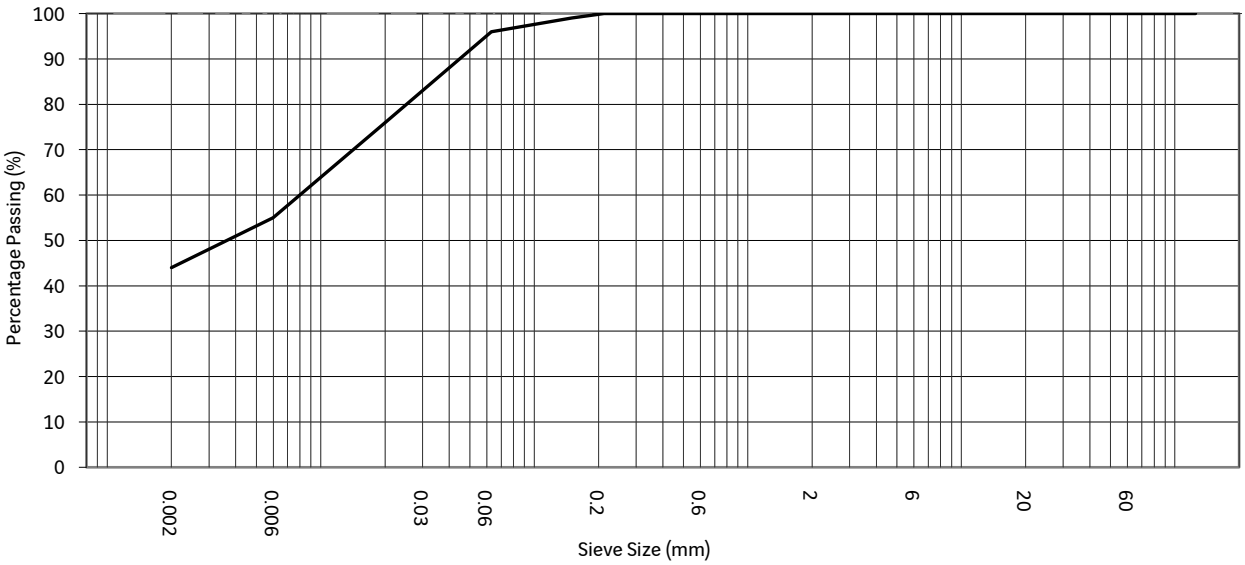




REMARKS

Preliminary	Leeds Laboratory	Results apply to samples as received.	SOIL ENGINEERING
Paul Rodgers		Print date 23/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH107
Project No.	TB8754		Sample Depth 5.00m
Engineer	Mott MacDonald		Sample Number 21
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type B
Description	Greyish brown CLAY		Specimen Depth 5.00m
			Specimen No. 1



PARTICLE SIZE	%
Clay:	44.4
Silt:	51.2
Sand:	4.4
Gravel:	0.0
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA

Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	100
		10	100
		6.3	100
125.0	100	5	100
90.0	100	3.35	100
75.0	100	2	100
63.0	100	1.18	100
50.0	100	0.6	100
37.5	100	0.425	100
28.0	100	0.3	100
20.0	100	0.212	100
		0.15	99
		0.063	96

SEDIMENTATION DATA

Equivalent particle diameter mm	Cumulative % passing
0.020100	76
0.005990	55
0.002000	44

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:

Paul Rodgers

Print date 31/07/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH107
Project No.	TB8754		Sample Depth 5.00m
Engineer	Mott MacDonald		Sample Number 20
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 5.00m
			Specimen Number 2

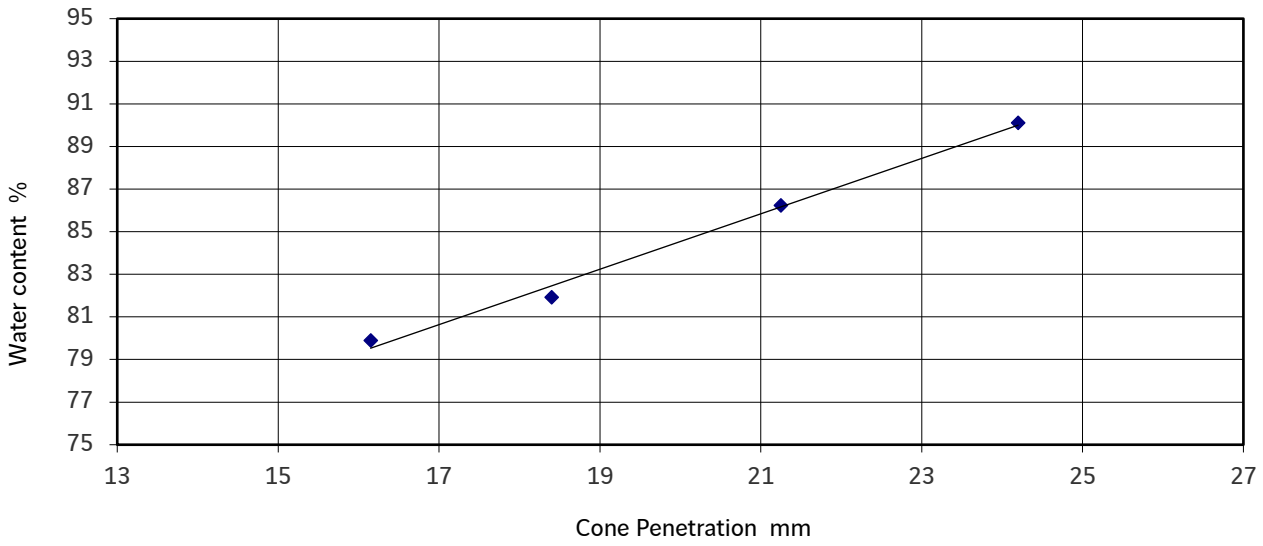
Water content	82.2	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

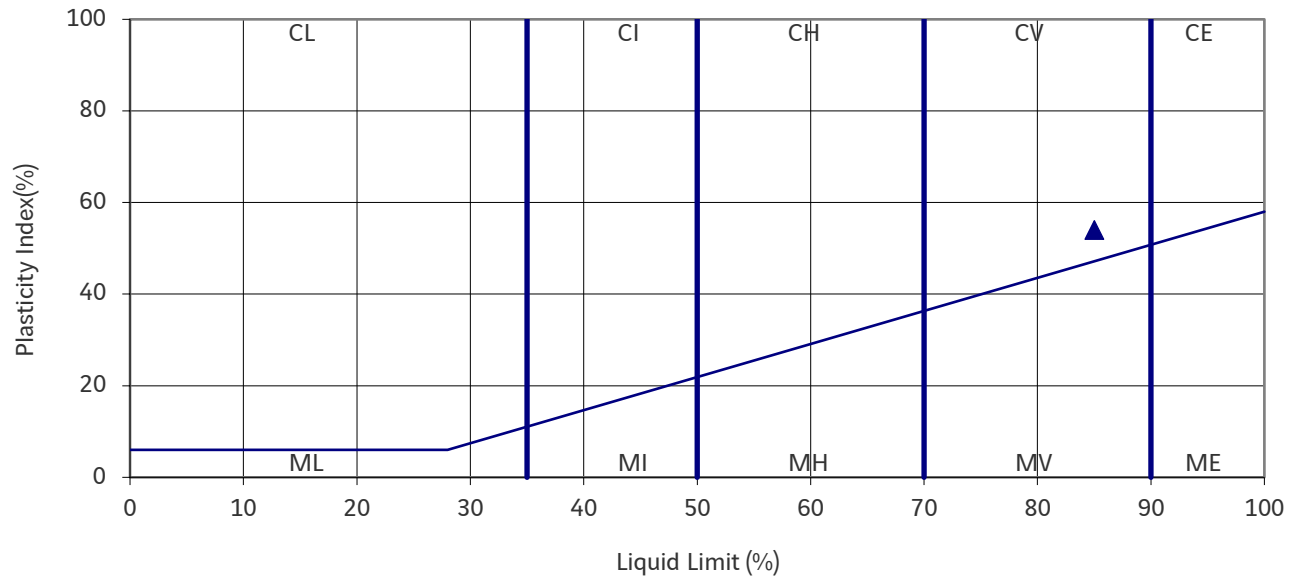
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 11/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH107
Project No.	TB8754		Sample Depth 5.00m
Engineer	Mott MacDonald		Sample Number 20
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 5.00m
			Specimen Number 1



As received water content:	82.2%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	85%	Preparation of sample: Natural	
Plastic limit:	31%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	54%		
Water content of soil passing 425µm	82.2%		
Liquidity index:	0.948		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 13/08/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

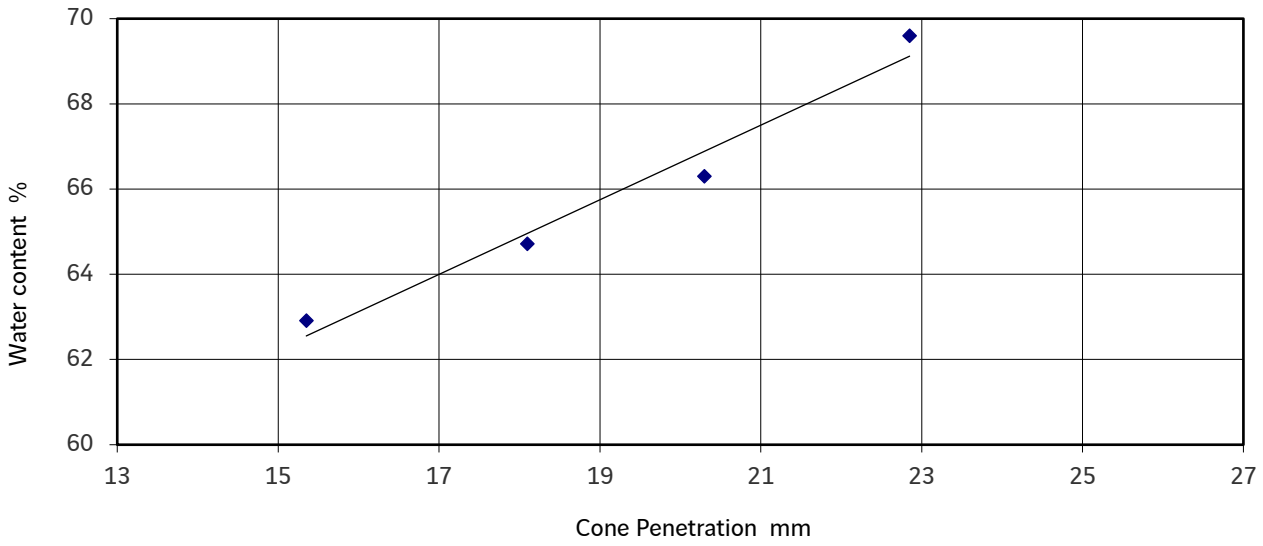
Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH107
Project No.	TB8754		Sample Depth 5.70m
Engineer	Mott MacDonald		Sample Number 22
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Brownish grey CLAY.		Specimen Depth 5.70m
			Specimen Number 2

Water content	72.7	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

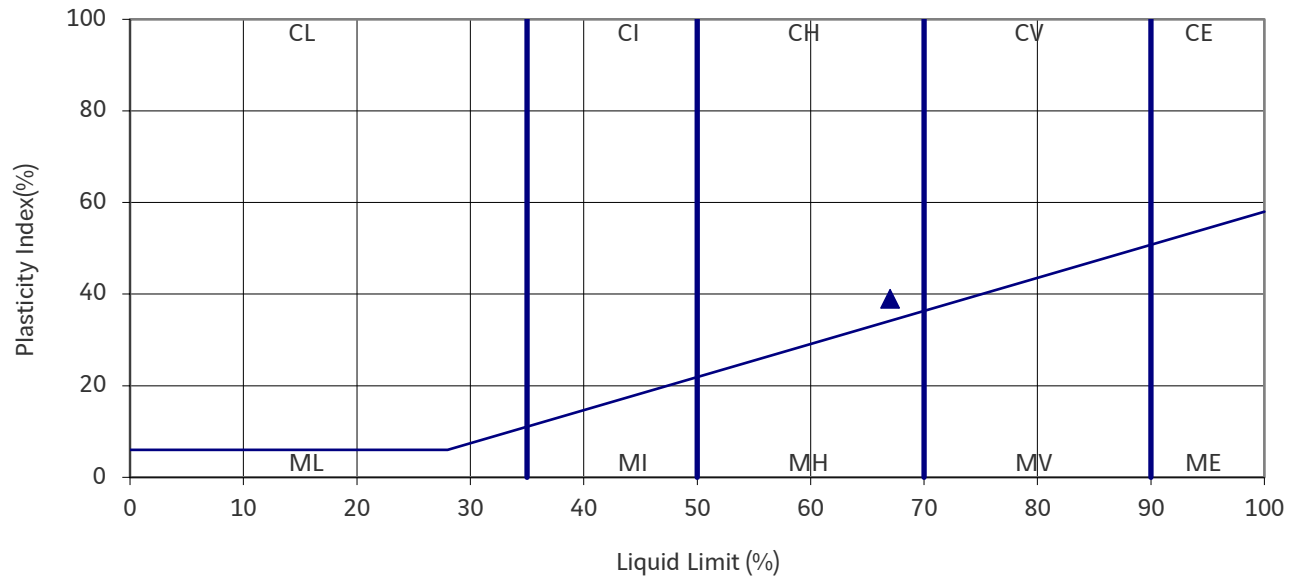
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH107
Project No.	TB8754		Sample Depth 5.70m
Engineer	Mott MacDonald		Sample Number 22
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Brownish grey CLAY.		Specimen Depth 5.70m
			Specimen Number 1



As received water content:	72.7%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	67%	Preparation of sample: Natural	
Plastic limit:	28%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	39%		
Water content of soil passing 425µm	72.7%		
Liquidity index:	1.146		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 13/08/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

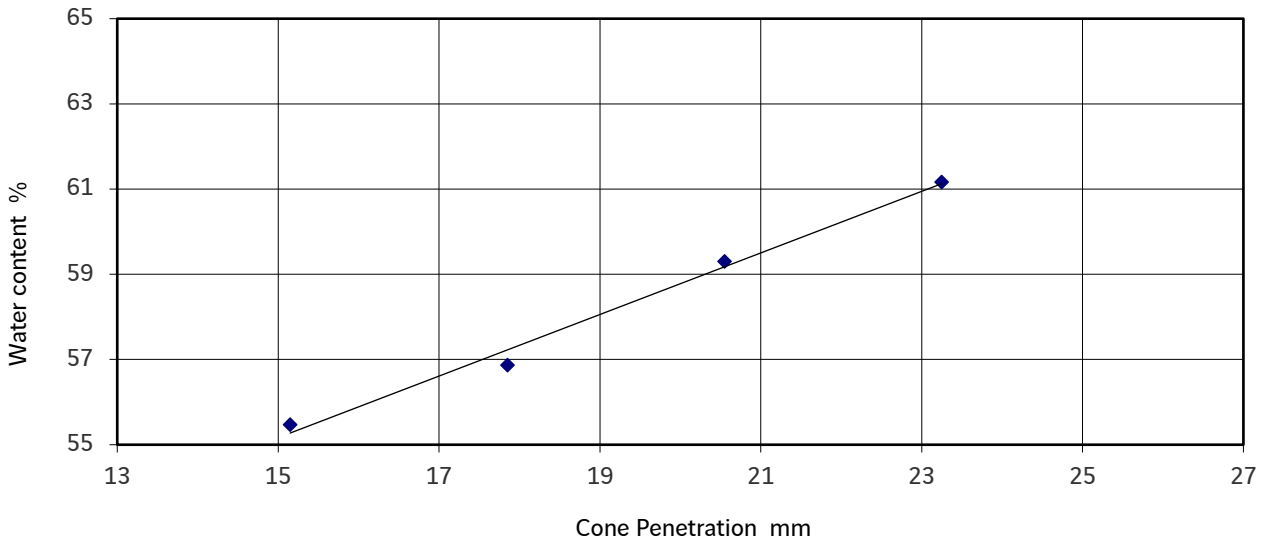
Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH107
Project No.	TB8754		Sample Depth 6.00m
Engineer	Mott MacDonald		Sample Number 24
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 6.44m
			Specimen Number 2

Water content	60.8	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

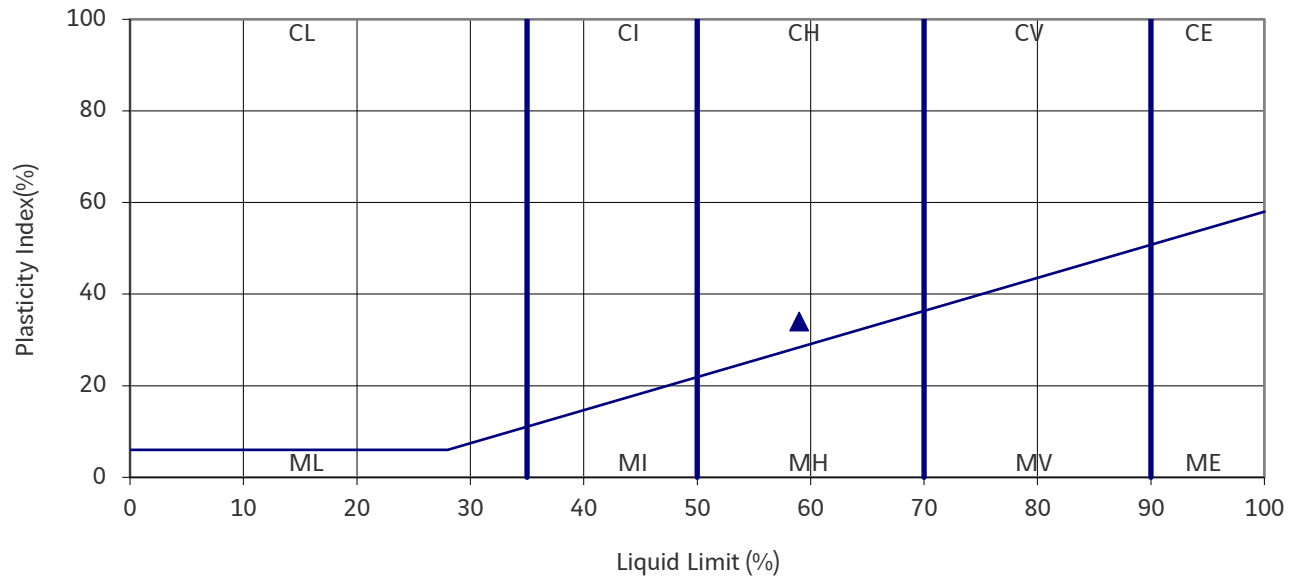
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH107
Project No.	TB8754		Sample Depth 6.00m
Engineer	Mott MacDonald		Sample Number 24
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 6.44m
			Specimen Number 1



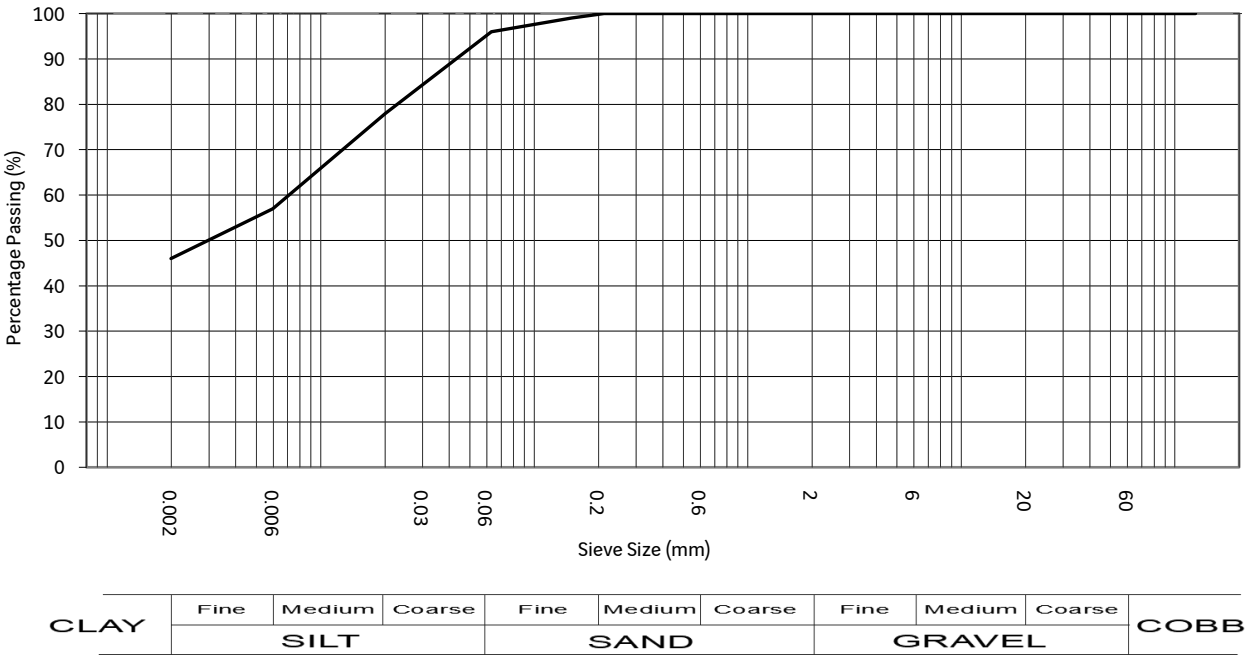
As received water content:	60.8%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	59%	Preparation of sample: Natural	
Plastic limit:	25%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	34%		
Water content of soil passing 425µm	60.8%		
Liquidity index:	1.052		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 21/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH107
Project No.	TB8754		Sample Depth 7.00m
Engineer	Mott MacDonald		Sample Number 27
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type B
Description	Grey CLAY.		Specimen Depth 7.00m
			Specimen No. 1



PARTICLE SIZE	%
Clay:	45.6
Silt:	50.5
Sand:	3.7
Gravel:	0.2
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA

Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	100
		10	100
		6.3	100
125.0	100	5	100
90.0	100	3.35	100
75.0	100	2	100
63.0	100	1.18	100
50.0	100	0.6	100
37.5	100	0.425	100
28.0	100	0.3	100
20.0	100	0.212	100
		0.15	99
		0.063	96

SEDIMENTATION DATA

Equivalent particle diameter mm	Cumulative % passing
0.020100	78
0.005970	57
0.001990	46

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:			
Paul Rodgers		Print date 31/07/2025	SOIL ENGINEERING
	Revision No. 3.07	Issue Date 01/05/2024	

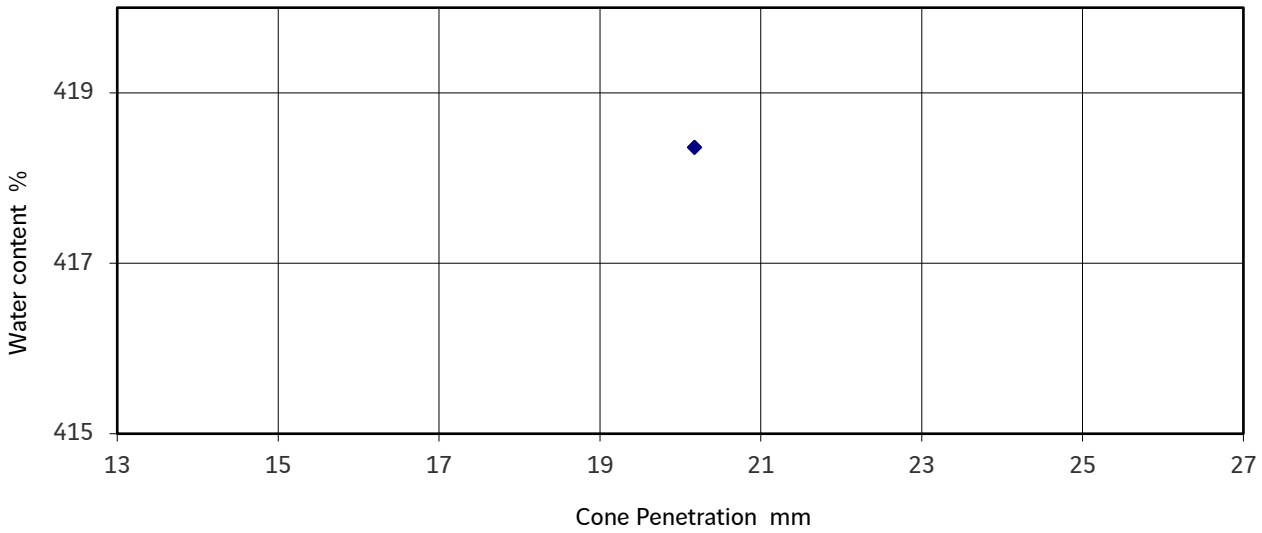
Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH107
Project No.	TB8754		Sample Depth 7.40m
Engineer	Mott MacDonald		Sample Number 28
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Brown slightly clayey PEAT.		Specimen Depth 7.40m
			Specimen Number 2

Water content	218	%
Oven temperature	50	°C
Is test result assumed to be a natural water content?	Yes	

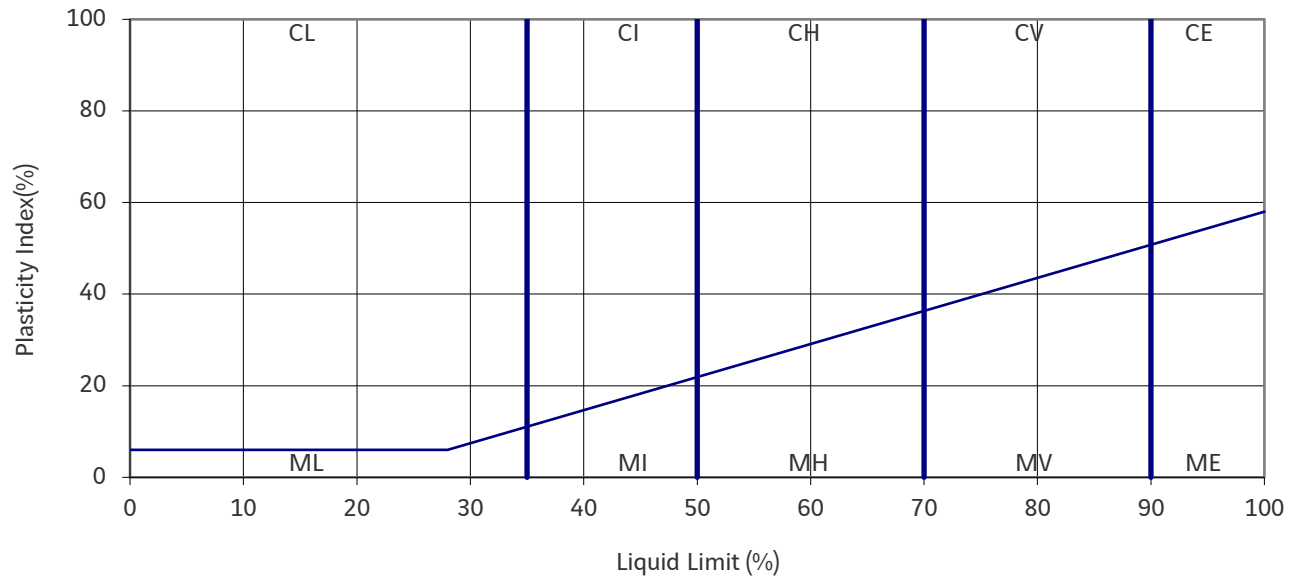
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH107
Project No.	TB8754		Sample Depth 7.40m
Engineer	Mott MacDonald		Sample Number 28
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Brown slightly clayey PEAT.		Specimen Depth 7.40m
			Specimen Number 1



As received water content:	218%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	420%	Preparation of sample: Natural	
Plastic limit:	NP	Remarks:	Test performed with 80g/30deg cone Tested as 1 point Limit Liquid limit due to the sample being peat and it is very difficult to get all four points on a line.
Plasticity index:			
Water content of soil passing 425µm	218%		
Liquidity index:			



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 01/08/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

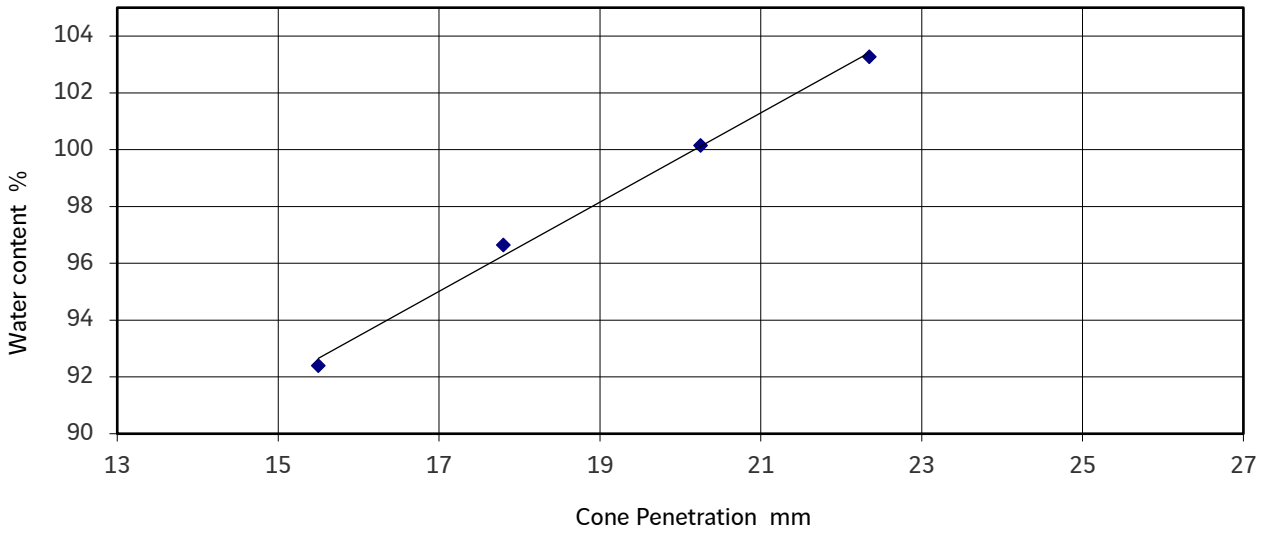
Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH107
Project No.	TB8754		Sample Depth 8.00m
Engineer	Mott MacDonald		Sample Number 30
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 8.43m
			Specimen Number 2

Water content	75.8	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

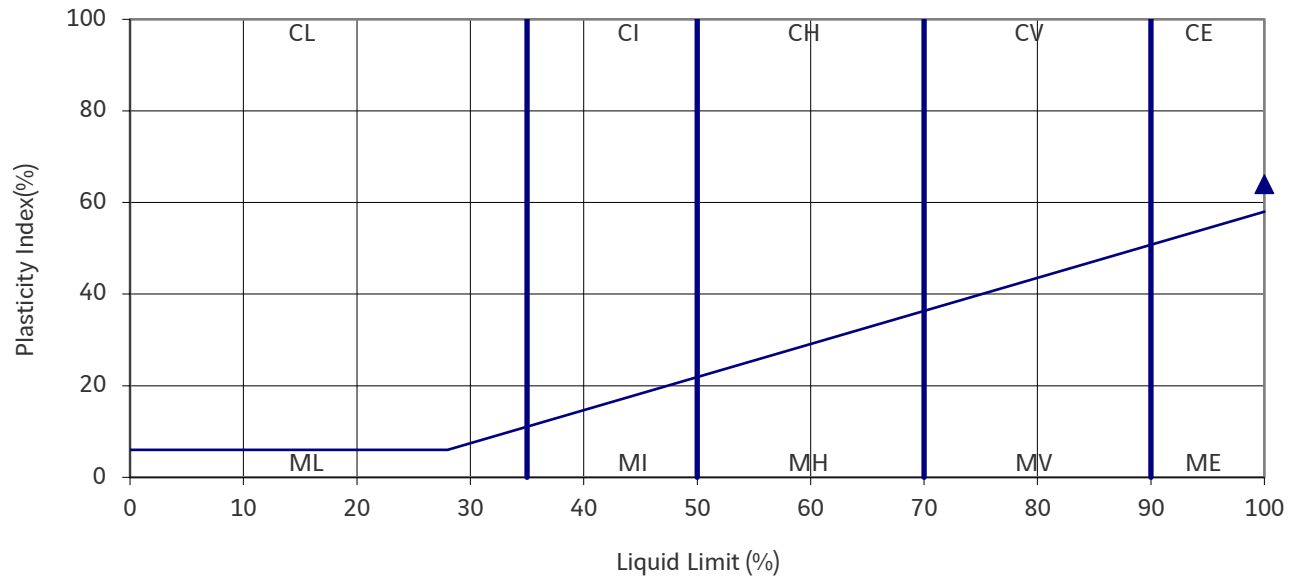
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH107
Project No.	TB8754		Sample Depth 8.00m
Engineer	Mott MacDonald		Sample Number 30
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 8.43m
			Specimen Number 1



As received water content:	75.8%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	100%	Preparation of sample: Natural	
Plastic limit:	36%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	64%		
Water content of soil passing 425µm	75.8%		
Liquidity index:	0.622		

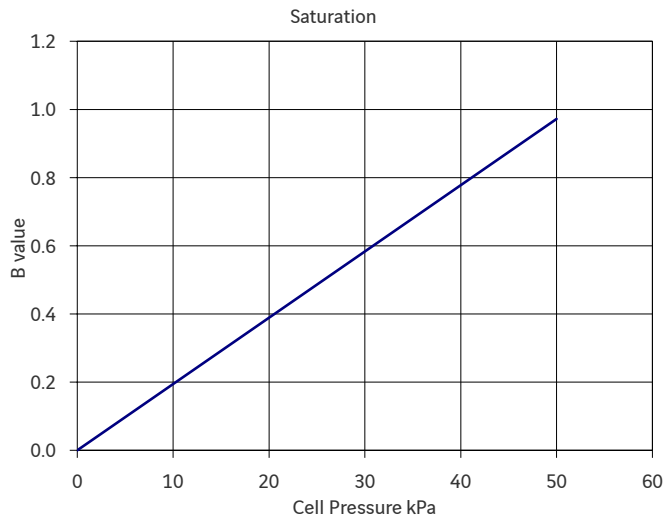


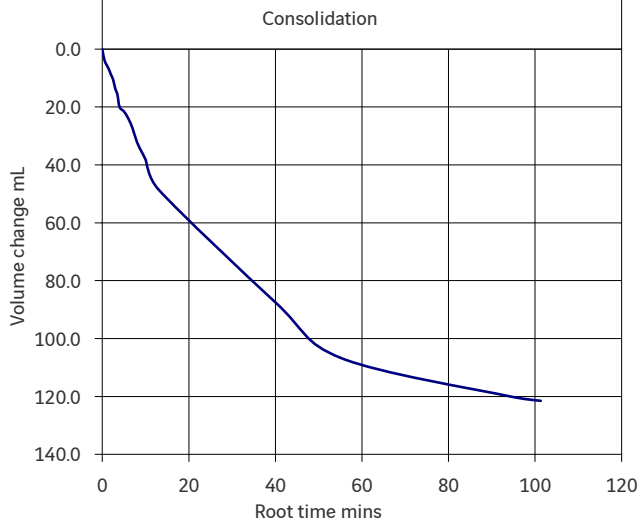
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 21/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH107
Project No.	TB8754		Sample Depth 8.00m
Engineer	Mott MacDonald		Sample Number 30
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with some peat layers.		Specimen Depth 8.54m
			Specimen Number 4

SPECIMEN INITIAL DIMENSIONS		
Test number		1
Specimen diameter	mm	98.95
Specimen length	mm	197.50
Density	Mg/m^3	1.54
Moisture content	%	77
Dry density	Mg/m^3	0.87
SATURATION STAGE		
Initial pore water pressure	kPa	0.6
Saturated pore water pressure	kPa	49.2
Final cell pressure	kPa	50
B value		0.972
CONSOLIDATION STAGE		
Cell pressure	kPa	345
Back pressure	kPa	300
Effective consolidation pressure	kPa	45
Initial pore water pressure	kPa	332.1
Final pore water pressure	kPa	296
Pore pressure dissipation	%	112.5
c_{vi}	$m^2/year$	0.11
m_{vi}	m^2/MN	2.22
SPECIMEN AFTER CONSOLIDATION		
Density	Mg/m^3	1.58
Moisture content	%	68
Dry density	Mg/m^3	0.94



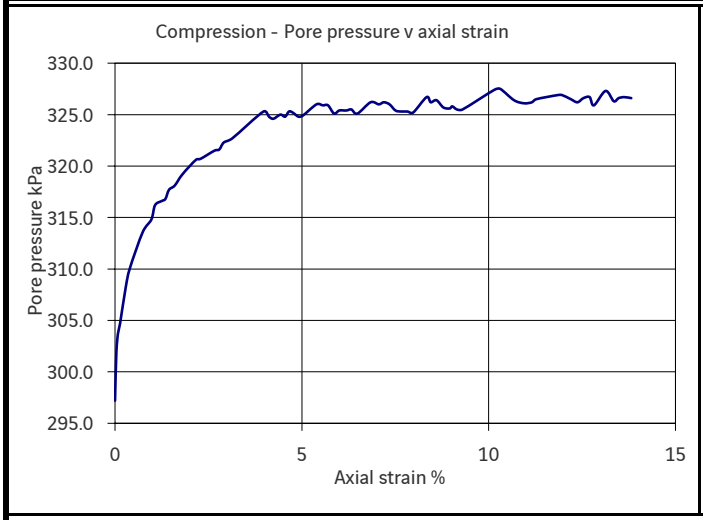


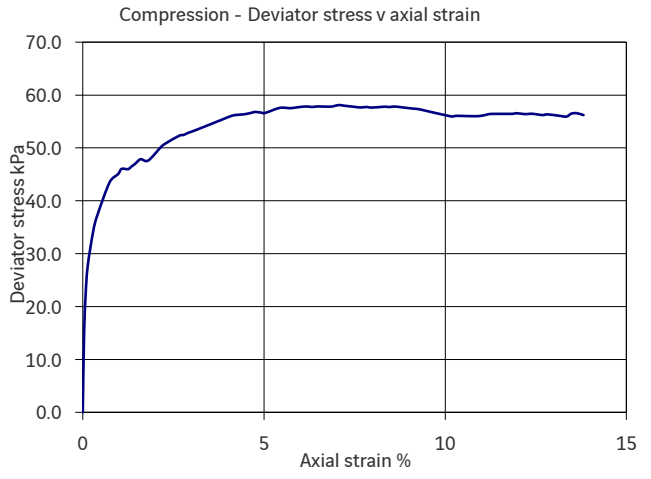
Remarks:
Specimen orientation Vertical
Specimen condition for test UNDISTURBED
Saturation with 50kPa increments with a differential pressure of 10kPa
Drainage from both ends and using a radial filter drain

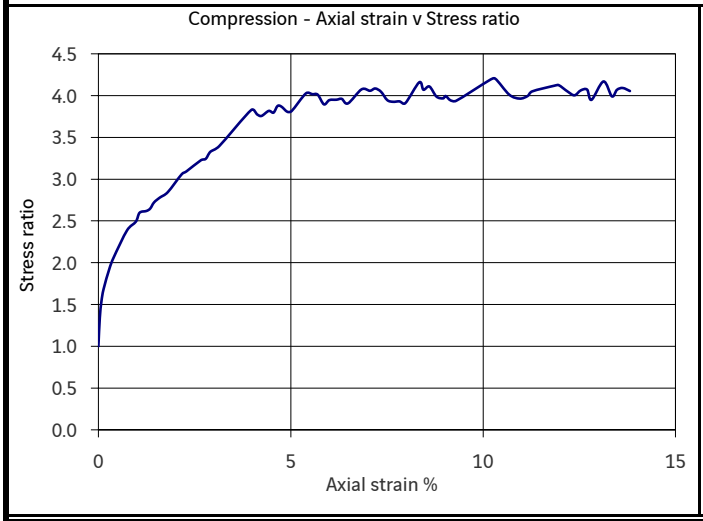
Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 26/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

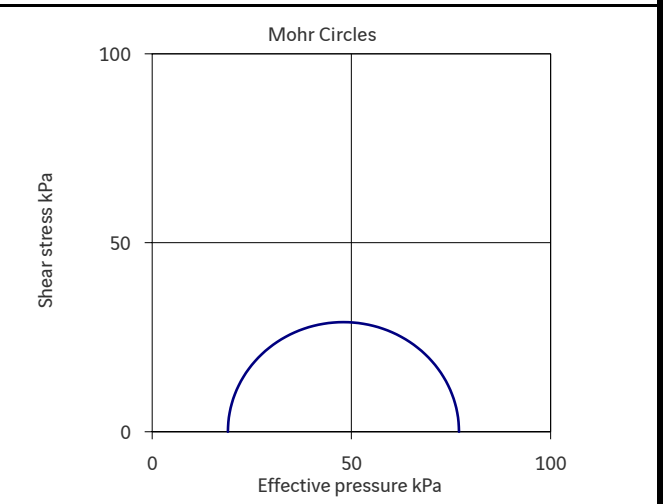
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH107
Project No.	TB8754		Sample Depth 8.00m
Engineer	Mott MacDonald		Sample Number 30
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with some peat layers.		Specimen Depth 8.54m
			Specimen Number 4

COMPRESSION STAGE			
Test number			1
Cell pressure		kPa	345
Initial pore water pressure		kPa	297
Effective confining pressure		kPa	49
Failure conditions at			Maximum deviator stress
Axial strain at failure		%	7.1
Maximum deviator stress	σ_1-σ_3	kPa	58
Pore water pressure at failure	σ	kPa	326
Effective major principal stress	σ_1'	kPa	77.10
Effective minor principal stress	σ_3'	kPa	19.00
Effective principal stress ratio			4.06
Membrane correction		kPa	0.84
Filter drain correction		kPa	3.6
Pore pressure coefficient			0.5









Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 26/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

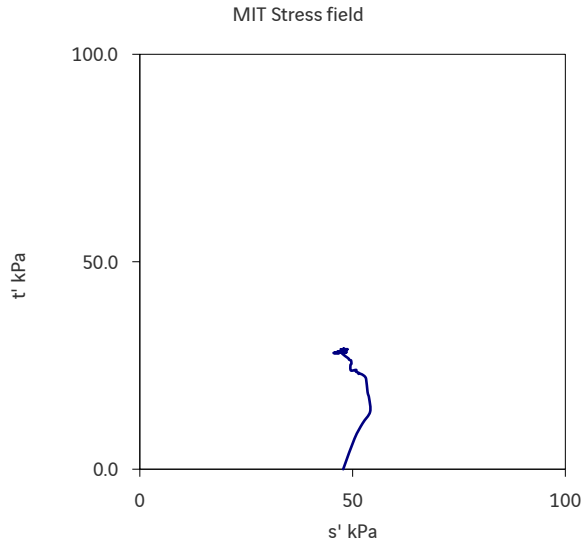
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH107
Project No.	TB8754		Sample Depth 8.00m
Engineer	Mott MacDonald		Sample Number 30
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with some peat layers.		Specimen Depth 8.54m
			Specimen Number 4

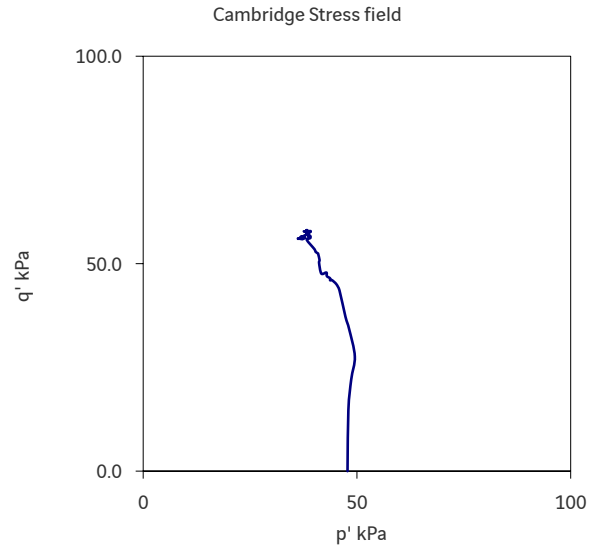
SPECIMEN AFTER TEST

Test number		1	
Mode of failure		Compound 	
Final moisture content	%	68	
Final bulk density	Mg/m³	1.58	
Final dry density	Mg/m³	0.94	

ADDITIONAL SPECIMEN DETAILS

Rate of strain	%/hour	0.19	
Failure criterion		Maximum deviator stress	





REMARKS

Preliminary	Leeds Laboratory	Results apply to samples as received.	SOIL ENGINEERING
Paul Rodgers		Print date 26/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH107
Project No.	TB8754		Sample Depth 9.00m
Engineer	Mott MacDonald		Sample Number 32
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 9.00m
			Specimen Number 1

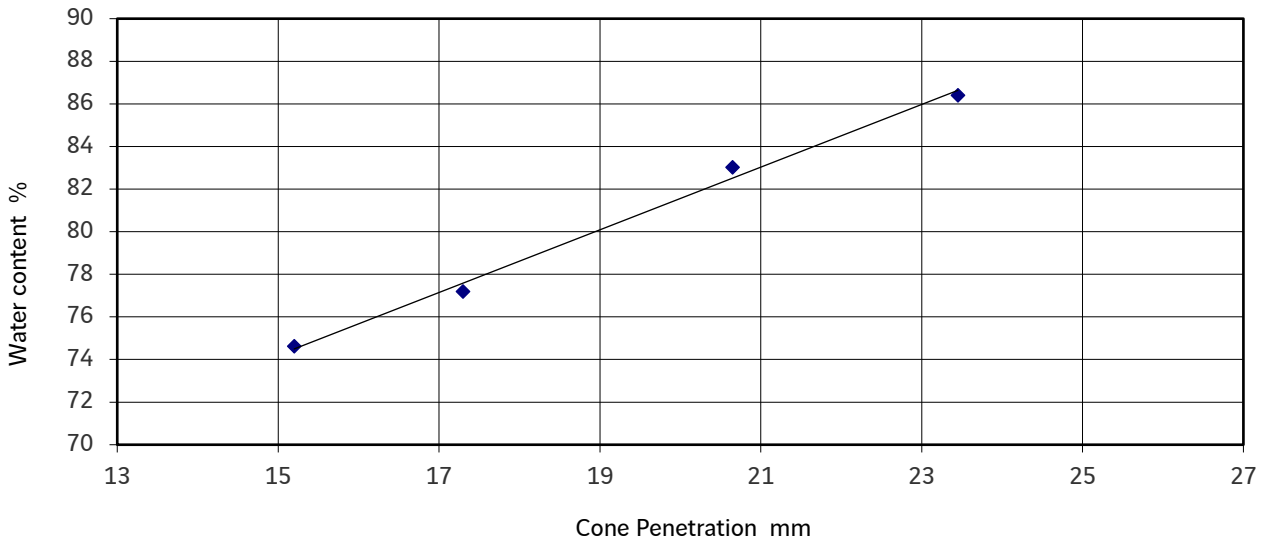
Water content	74.8	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

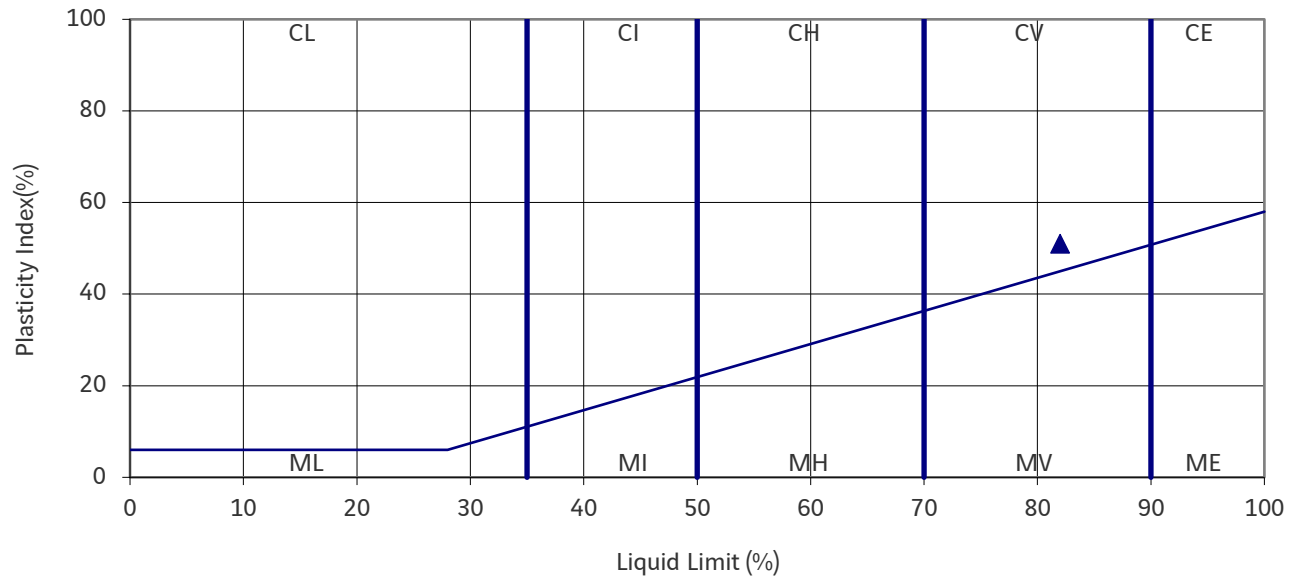
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Steve Harper			Print date 01/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH107
Project No.	TB8754		Sample Depth 9.00m
Engineer	Mott MacDonald		Sample Number 32
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 9.00m
			Specimen Number 3



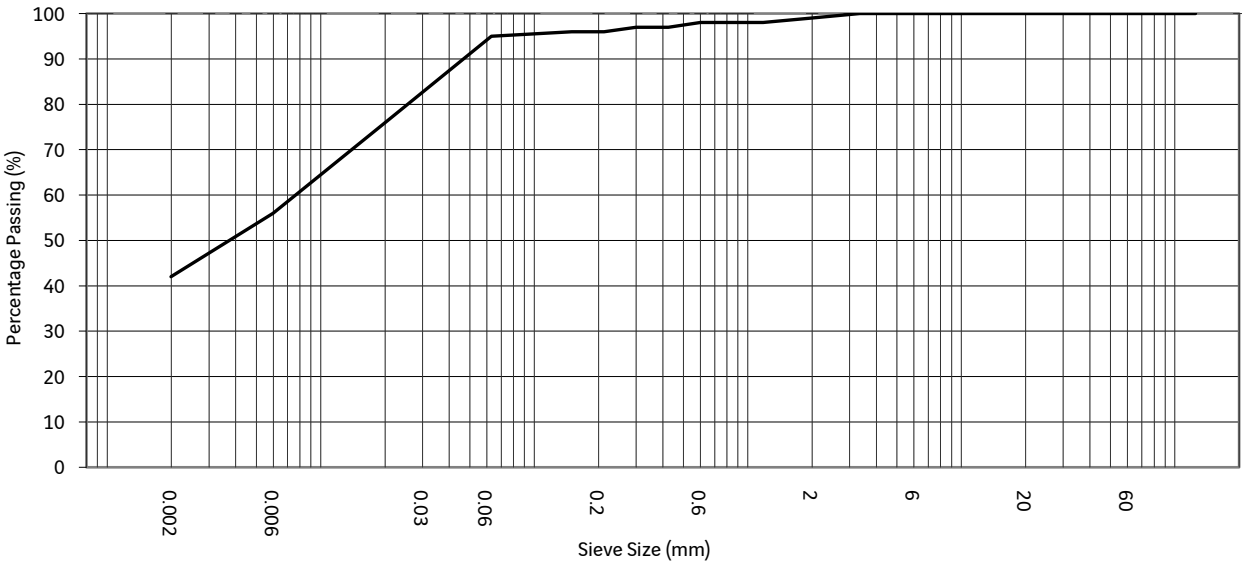
As received water content:	74.8%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	82%	Preparation of sample: Natural	
Plastic limit:	31%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	51%		
Water content of soil passing 425µm	74.8%		
Liquidity index:	0.858		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 01/08/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH107
Project No.	TB8754		Sample Depth 11.00m
Engineer	Mott MacDonald		Sample Number 39
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type B
Description	Dark brown grey organic CLAY.		Specimen Depth 11.00m
			Specimen No. 1



PARTICLE SIZE	%
Clay:	42.3
Silt:	52.2
Sand:	4.6
Gravel:	0.9
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA

Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	100
		10	100
		6.3	100
125.0	100	5	100
90.0	100	3.35	100
75.0	100	2	99
63.0	100	1.18	98
50.0	100	0.6	98
37.5	100	0.425	97
28.0	100	0.3	97
20.0	100	0.212	96
		0.15	96
		0.063	95

SEDIMENTATION DATA

Equivalent particle diameter mm	Cumulative % passing
0.020100	76
0.005980	56
0.001990	42

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:

Paul Rodgers

Print date 31/07/2025

SOIL ENGINEERING

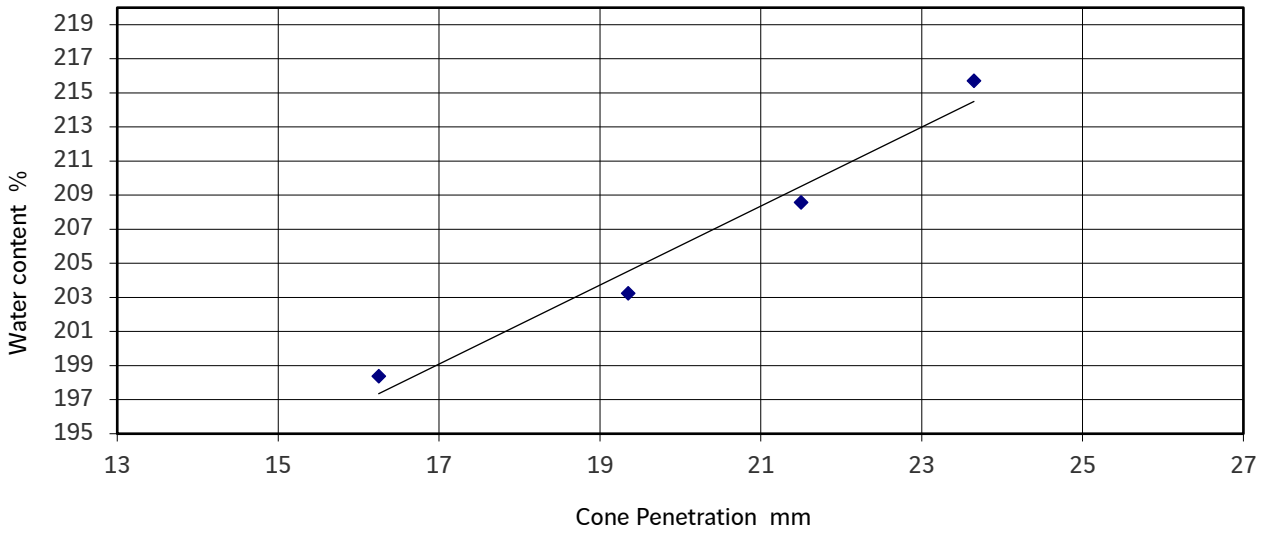
Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH107
Project No.	TB8754		Sample Depth 11.00m
Engineer	Mott MacDonald		Sample Number 37
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey organic CLAY.		Specimen Depth 11.00m
			Specimen Number 2

Water content	165	%
Oven temperature	50	°C
Is test result assumed to be a natural water content?	Yes	

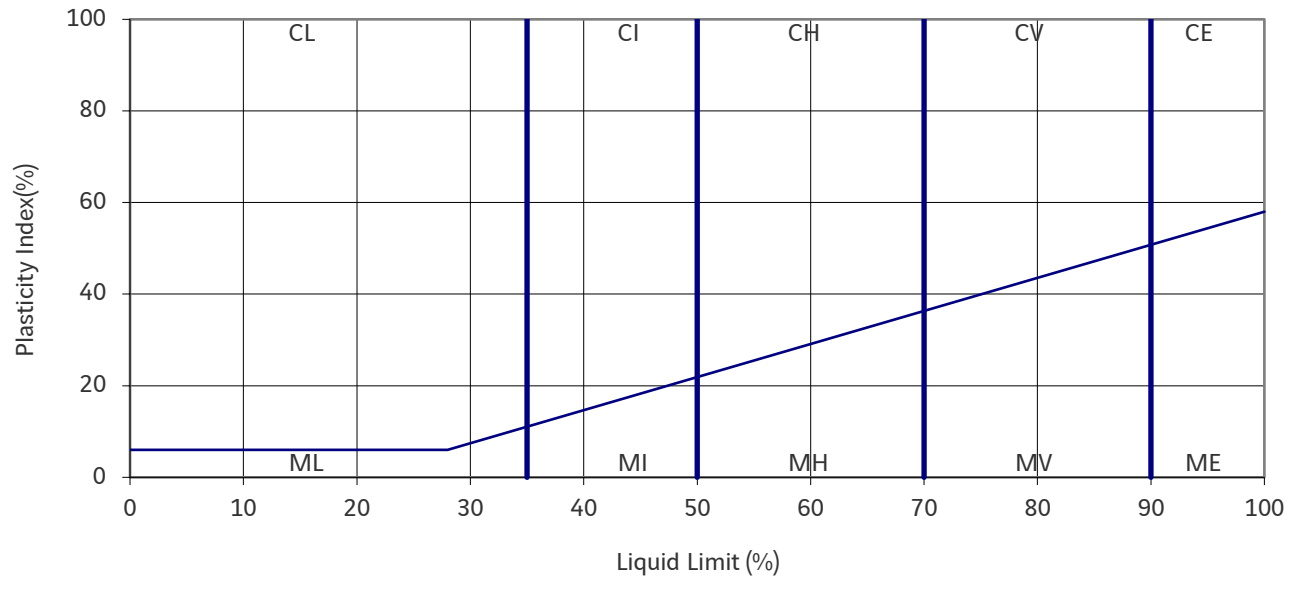
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH107
Project No.	TB8754		Sample Depth 11.00m
Engineer	Mott MacDonald		Sample Number 37
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey organic CLAY.		Specimen Depth 11.00m
			Specimen Number 1



As received water content:	165%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	210%	Preparation of sample: Natural	
Plastic limit:	140%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	70%		
Water content of soil passing 425µm	165%		
Liquidity index:	0.352		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 01/08/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH107
Project No.	TB8754		Sample Depth 11.20m
Engineer	Mott MacDonald		Sample Number 38
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Dark grey organic CLAY.		Specimen Depth 11.20m
			Specimen Number 1

Water content	145	%
Oven temperature	50	°C
Is test result assumed to be a natural water content?	Yes	

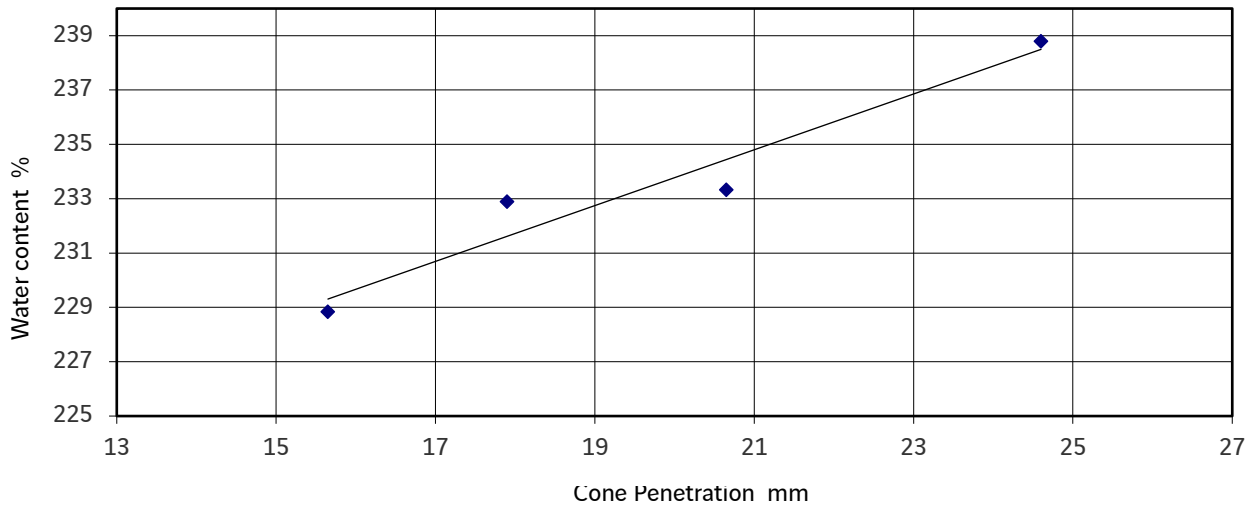
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

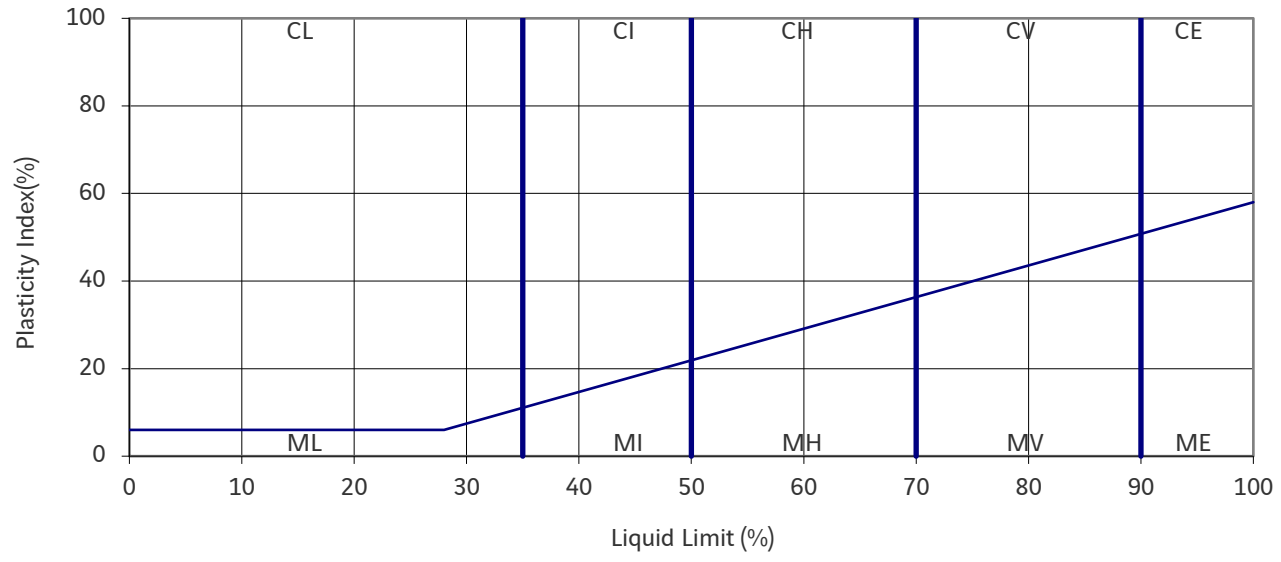
Approved by:	Leeds Laboratory		
Steve Harper		Print date 27/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024	

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH107
Project No.	TB8754		Sample Depth 11.20m
Engineer	Mott MacDonald		Sample Number 38
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Dark grey organic CLAY.		Specimen Depth 11.20m
			Specimen Number 3



As received water content:	145%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	230%	Preparation of sample: Natural	
Plastic limit:	150%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	80%		
Water content of soil passing 425µm	145%		
Liquidity index:	-0.064		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 27/07/2025	
	Revision No. 3.00	Issue Date 19/05/2022	

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH107
Project No.	TB8754		Sample Depth 12.00m
Engineer	Mott MacDonald		Sample Number 43
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey slightly gravelly CLAY.		Specimen Depth 12.62m
			Specimen Number 2

Water content	30.4	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

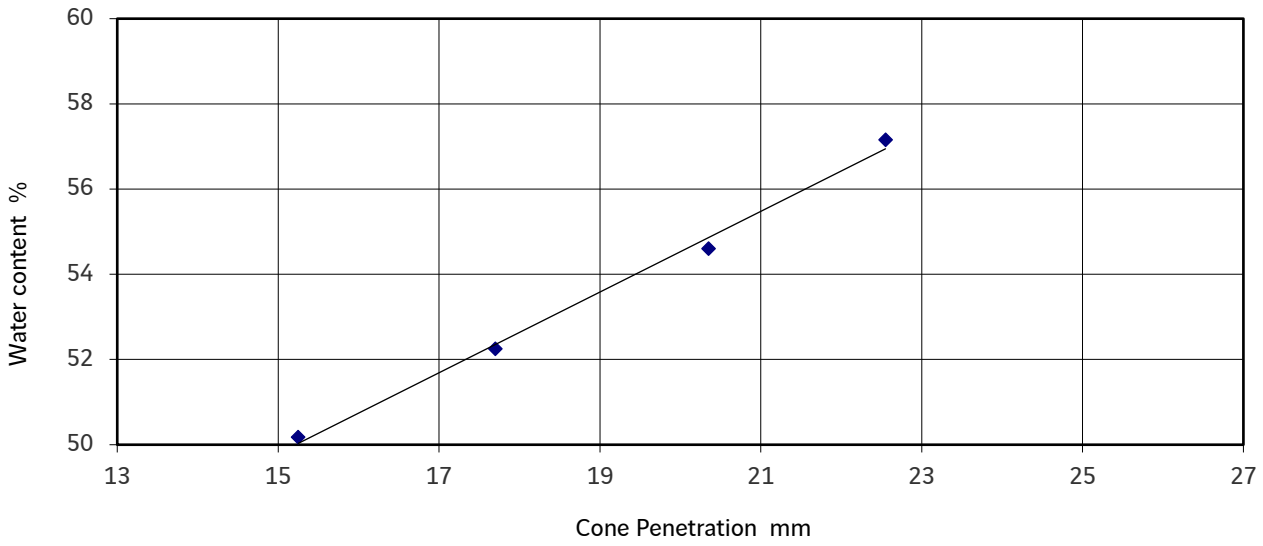
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

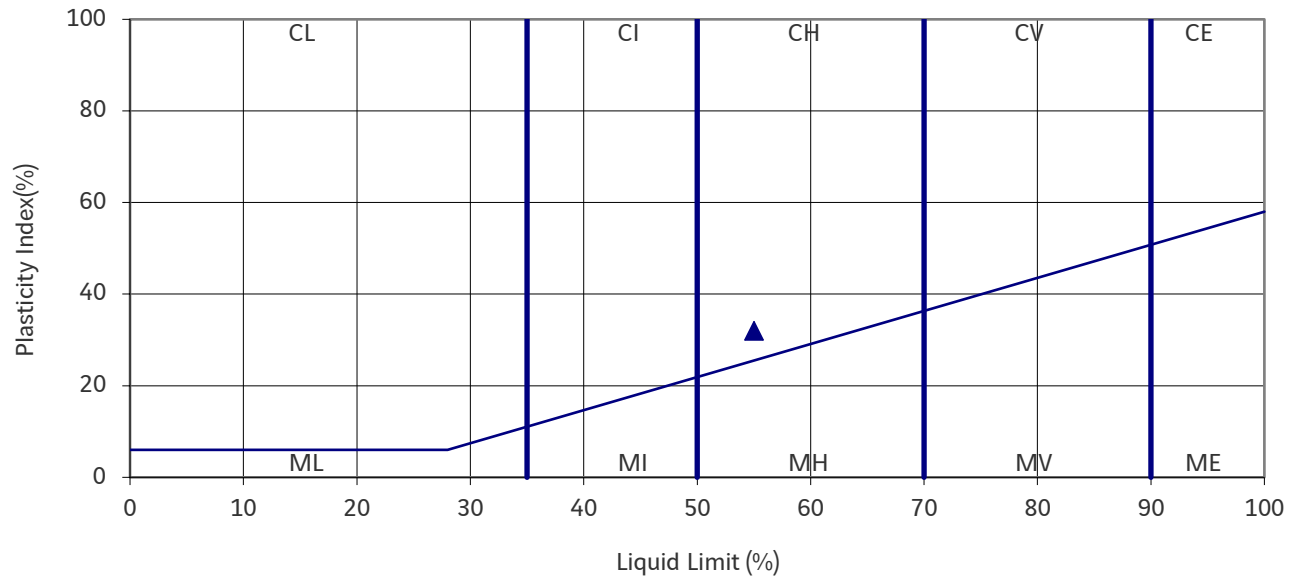
Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 11/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024	

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH107
Project No.	TB8754		Sample Depth 12.00m
Engineer	Mott MacDonald		Sample Number 43
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey slightly gravelly CLAY.		Specimen Depth 12.62m
			Specimen Number 1



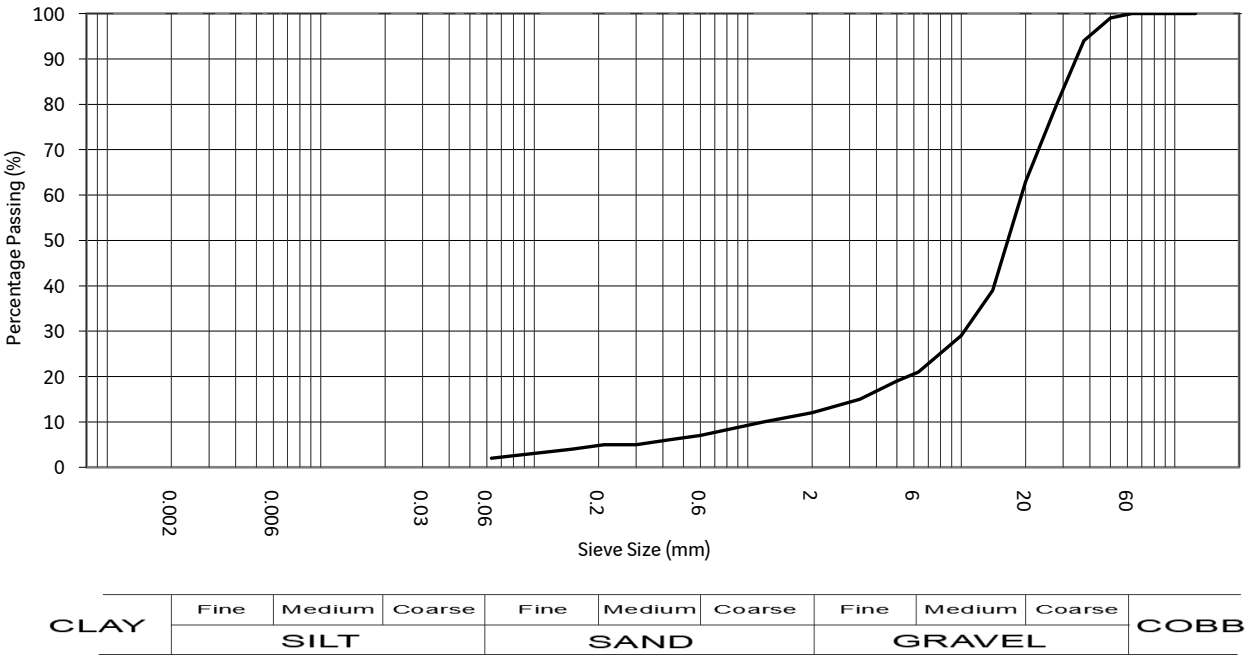
As received water content:	30.4%	Estimated percentage passing 425µm sieve:	88%
Liquid limit:	55%	Preparation of sample: Natural	
Plastic limit:	23%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	32%		
Water content of soil passing 425µm	34.4%		
Liquidity index:	0.356		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 13/08/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH107
Project No.	TB8754		Sample Depth 16.50m
Engineer	Mott MacDonald		Sample Number 55
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.2	Sample type B
Description	Brown slightly sandy GRAVEL.		Specimen Depth 16.50m
			Specimen No. 1



PARTICLE SIZE	%
Silt and clay:	2.2
Sand:	9.6
Gravel:	88.2
Cobbles:	0.0

General remarks

Sample size was insufficient to comply with the recommended minimum mass.

WET SIEVE DATA

Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	39
		10	29
		6.3	21
125.0	100	5	19
90.0	100	3.35	15
75.0	100	2	12
63.0	100	1.18	10
50.0	99	0.6	7
37.5	94	0.425	6
28.0	80	0.3	5
20.0	63	0.212	5
		0.15	4
		0.063	2

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:

Paul Rodgers

Print date 22/07/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH108
Project No.	TB8754		Sample Depth 2.00m
Engineer	Mott MacDonald		Sample Number 14
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Brown CLAY.		Specimen Depth 2.00m
			Specimen Number 2

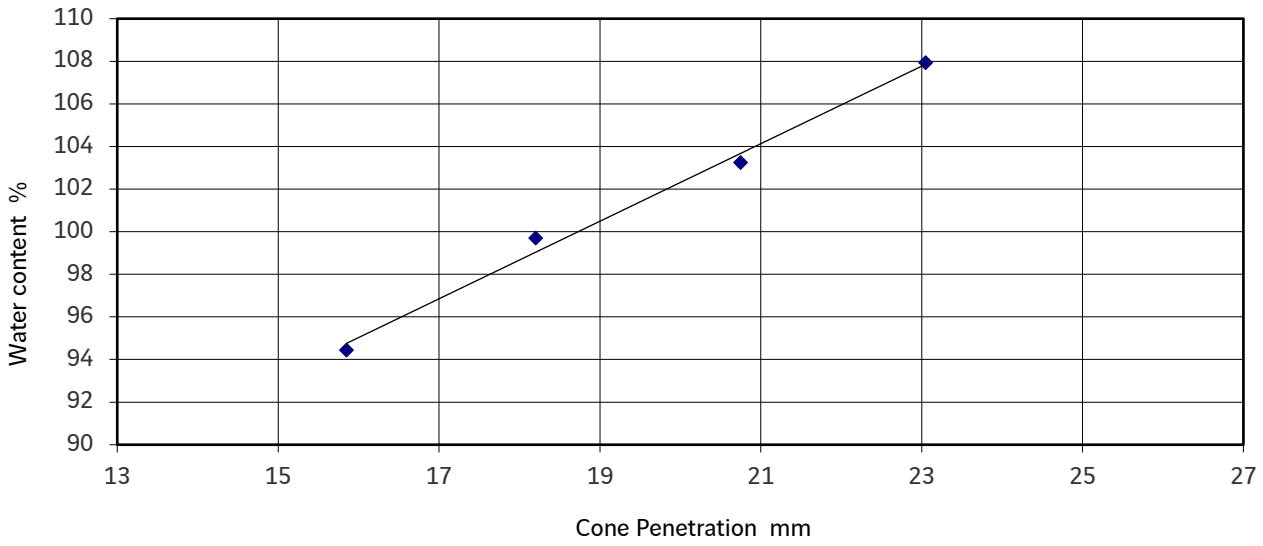
Water content	61.8	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

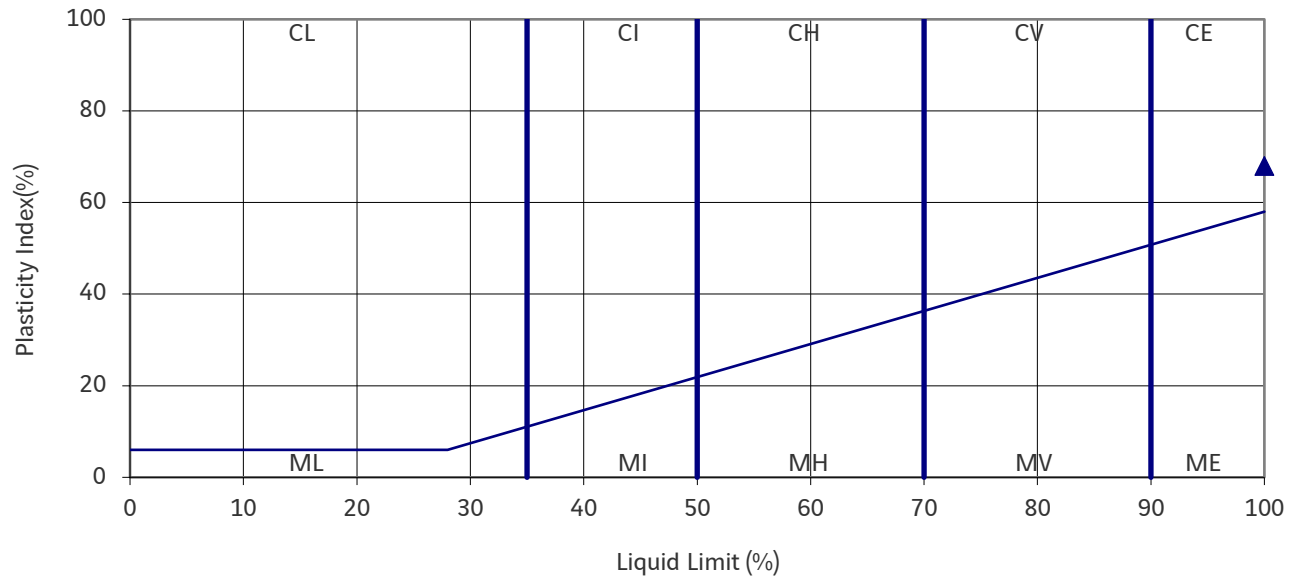
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 23/09/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH108
Project No.	TB8754		Sample Depth 2.00m
Engineer	Mott MacDonald		Sample Number 14
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Brown CLAY.		Specimen Depth 2.00m
			Specimen Number 1



As received water content:	61.8%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	100%	Preparation of sample: Natural	
Plastic limit:	32%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	68%		
Water content of soil passing 425µm	61.8%		
Liquidity index:	0.439		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 01/10/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH108
Project No.	TB8754		Sample Depth 3.00m
Engineer	Mott MacDonald		Sample Number 16
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 3.74m
			Specimen Number 2

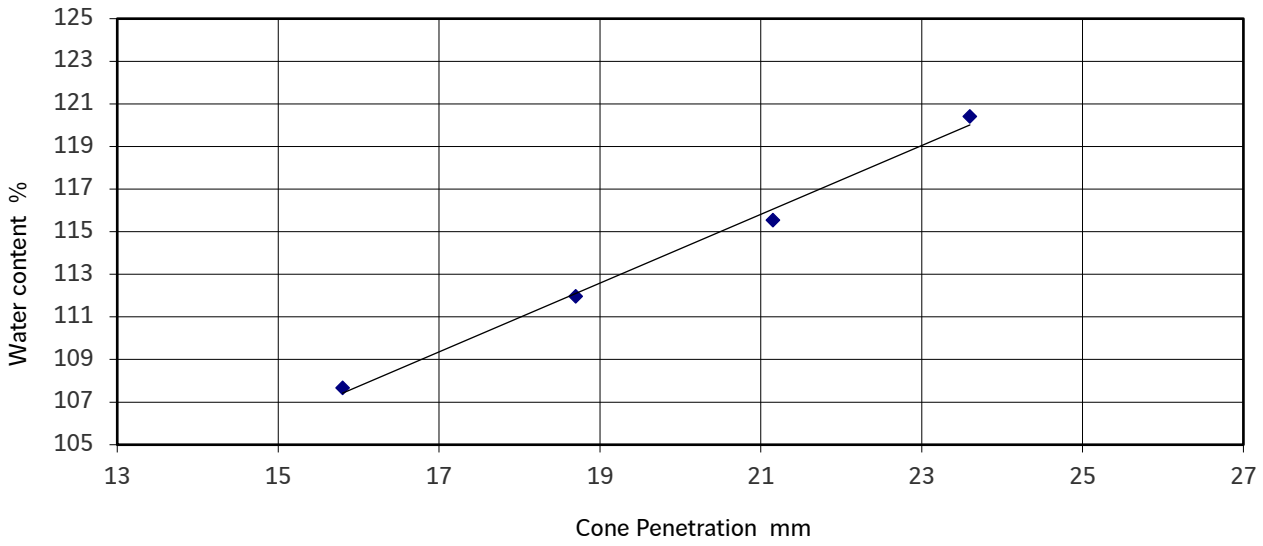
Water content	85.8	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

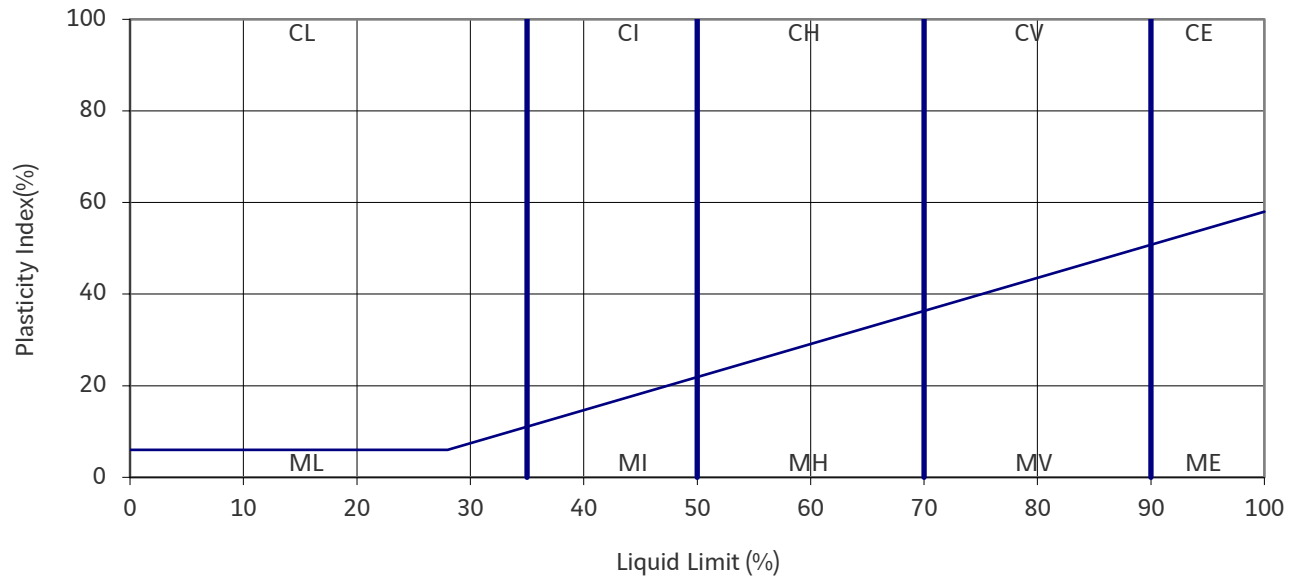
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 23/09/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH108
Project No.	TB8754		Sample Depth 3.00m
Engineer	Mott MacDonald		Sample Number 16
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 3.74m
			Specimen Number 1



As received water content:	85.8%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	110%	Preparation of sample: Natural	
Plastic limit:	36%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	74%		
Water content of soil passing 425µm	85.8%		
Liquidity index:	0.673		

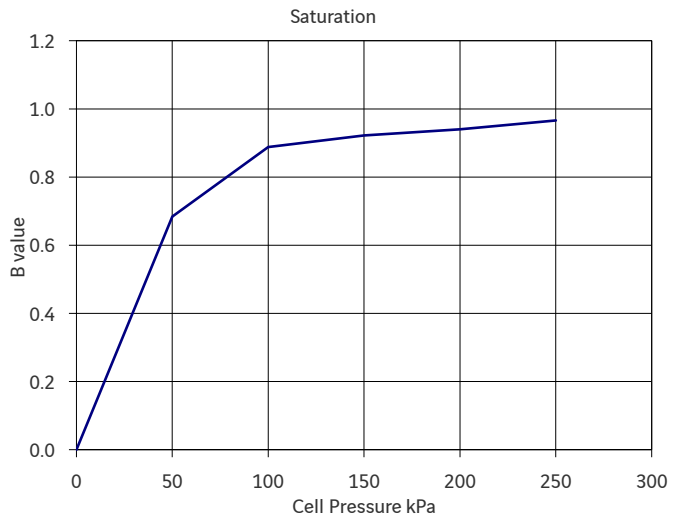


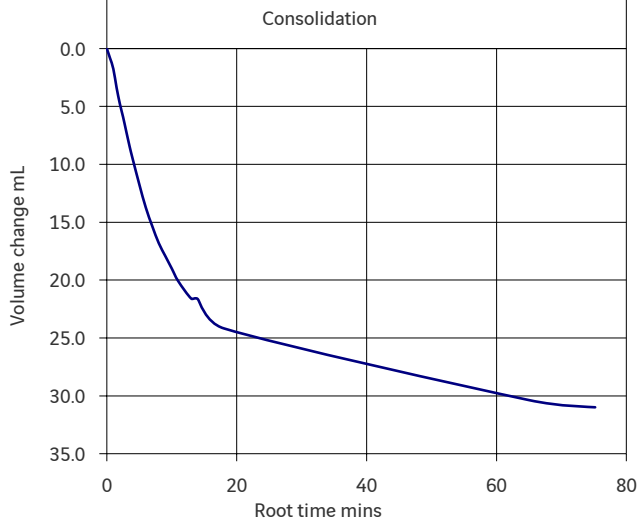
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 01/10/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH108
Project No.	TB8754		Sample Depth 3.00m
Engineer	Mott MacDonald		Sample Number 16
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey organic CLAY.		Specimen Depth 3.53m
			Specimen Number 3

SPECIMEN INITIAL DIMENSIONS		
Test number		1
Specimen diameter	mm	100.58
Specimen length	mm	195.53
Density	Mg/m^3	1.45
Moisture content	%	80
Dry density	Mg/m^3	0.81
SATURATION STAGE		
Initial pore water pressure	kPa	0.6
Saturated pore water pressure	kPa	239.8
Final cell pressure	kPa	250
B value		0.966
CONSOLIDATION STAGE		
Cell pressure	kPa	330
Back pressure	kPa	300
Effective consolidation pressure	kPa	30
Initial pore water pressure	kPa	320.2
Final pore water pressure	kPa	300.8
Pore pressure dissipation	%	96.0
c_{vi}	$m^2/year$	0.53
m_{vi}	m^2/MN	1.03
SPECIMEN AFTER CONSOLIDATION		
Density	Mg/m^3	1.47
Moisture content	%	78
Dry density	Mg/m^3	0.82



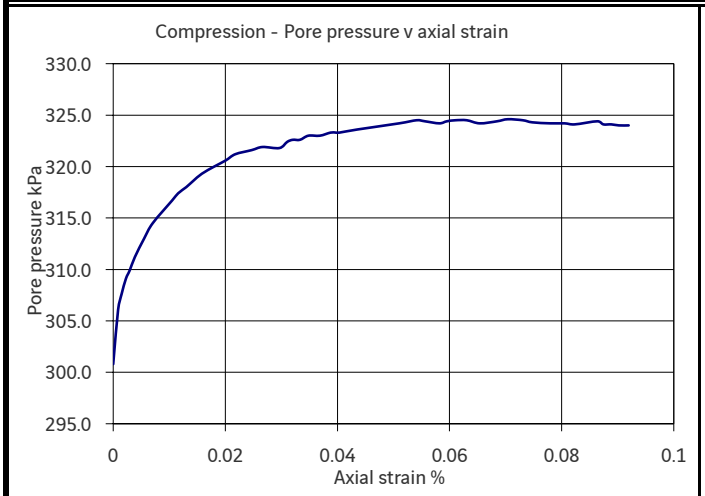


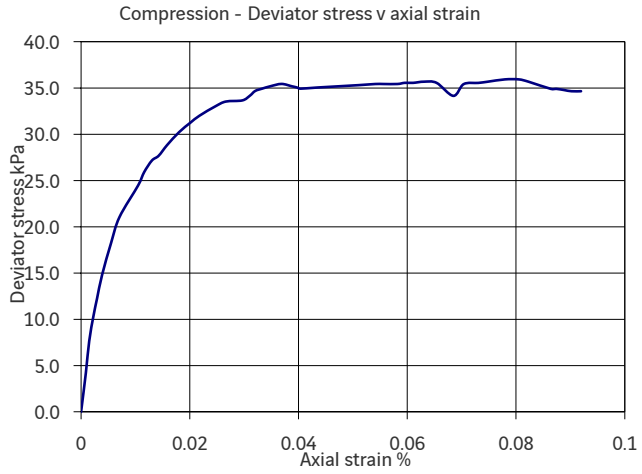
Remarks:
Specimen orientation Vertical
Specimen condition for test UNDISTURBED
Saturation with 50kPa increments with a differential pressure of 10kPa
Drainage from both ends and using a radial filter drain

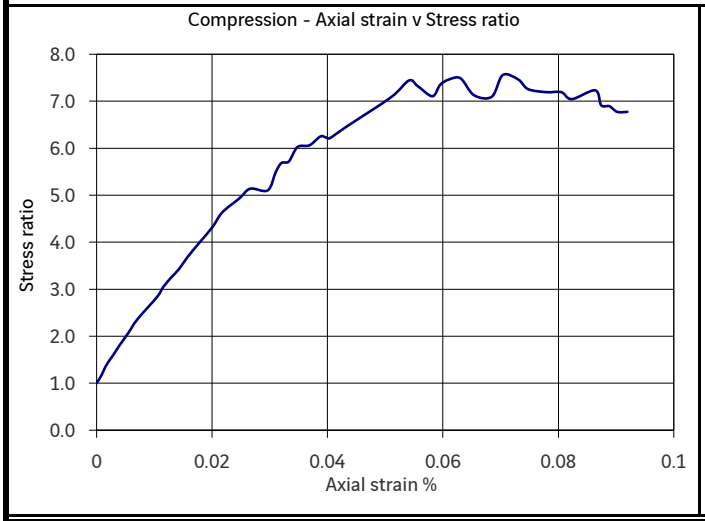
Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 05/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

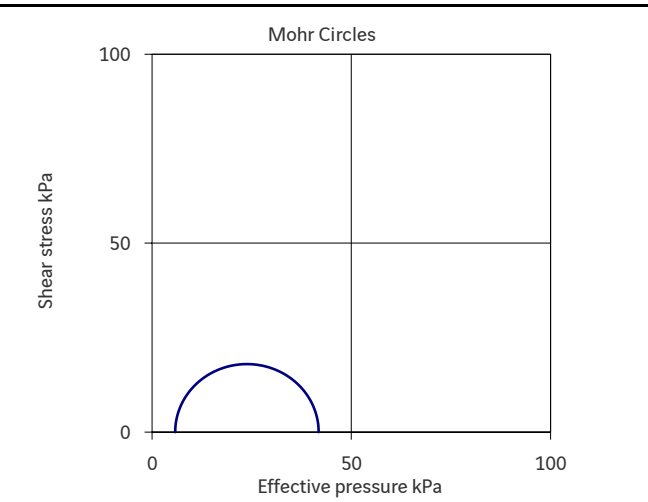
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH108
Project No.	TB8754		Sample Depth 3.00m
Engineer	Mott MacDonald		Sample Number 16
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey organic CLAY.		Specimen Depth 3.53m
			Specimen Number 3

COMPRESSION STAGE			
Test number			1
Cell pressure		kPa	330
Initial pore water pressure		kPa	301
Effective confining pressure		kPa	29
Failure conditions at			Maximum deviator stress
Axial strain at failure		%	0.1
Maximum deviator stress	σ_1-σ_3	kPa	36
Pore water pressure at failure	σ	kPa	324
Effective major principal stress	σ_1'	kPa	41.72
Effective minor principal stress	σ_3'	kPa	5.80
Effective principal stress ratio			7.19
Membrane correction		kPa	0.02
Filter drain correction		kPa	0.0
Pore pressure coefficient			0.7









Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 05/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	

SOIL ENGINEERING

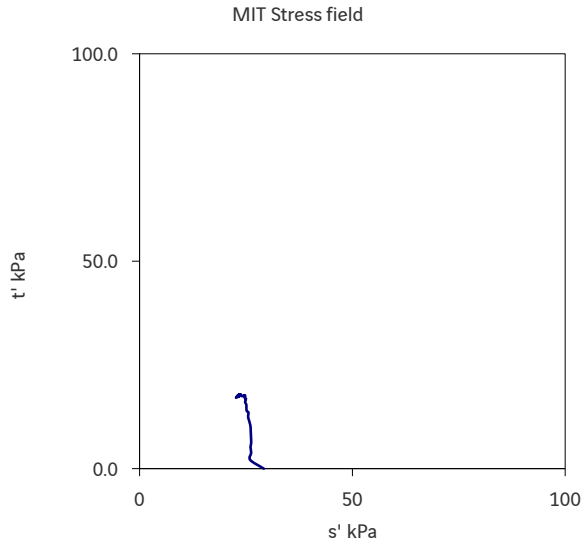
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH108
Project No.	TB8754		Sample Depth 3.00m
Engineer	Mott MacDonald		Sample Number 16
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey organic CLAY.		Specimen Depth 3.53m
			Specimen Number 3

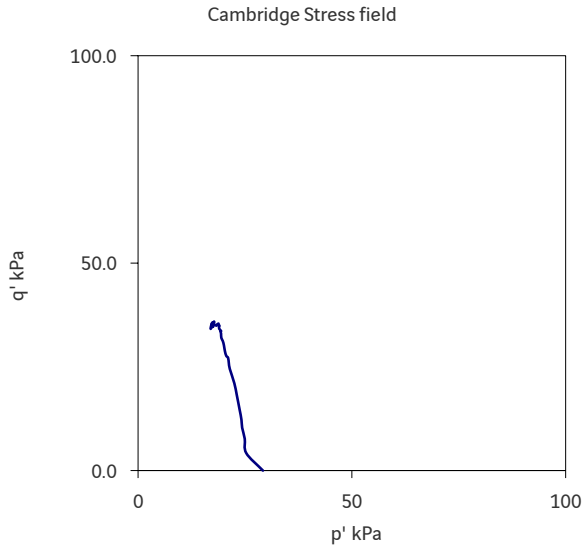
SPECIMEN AFTER TEST

Test number		1	
Mode of failure		Plastic 	
Final moisture content	%	78	
Final bulk density	Mg/m^3	1.47	
Final dry density	Mg/m^3	0.82	

ADDITIONAL SPECIMEN DETAILS

Rate of strain	%/hour	0.20	
Failure criterion		Maximum deviator stress	





REMARKS

Preliminary	Leeds Laboratory	Results apply to samples as received.	SOIL ENGINEERING
Paul Rodgers		Print date 05/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH108
Project No.	TB8754		Sample Depth 4.00m
Engineer	Mott MacDonald		Sample Number 18
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 4.27m
			Specimen Number 2

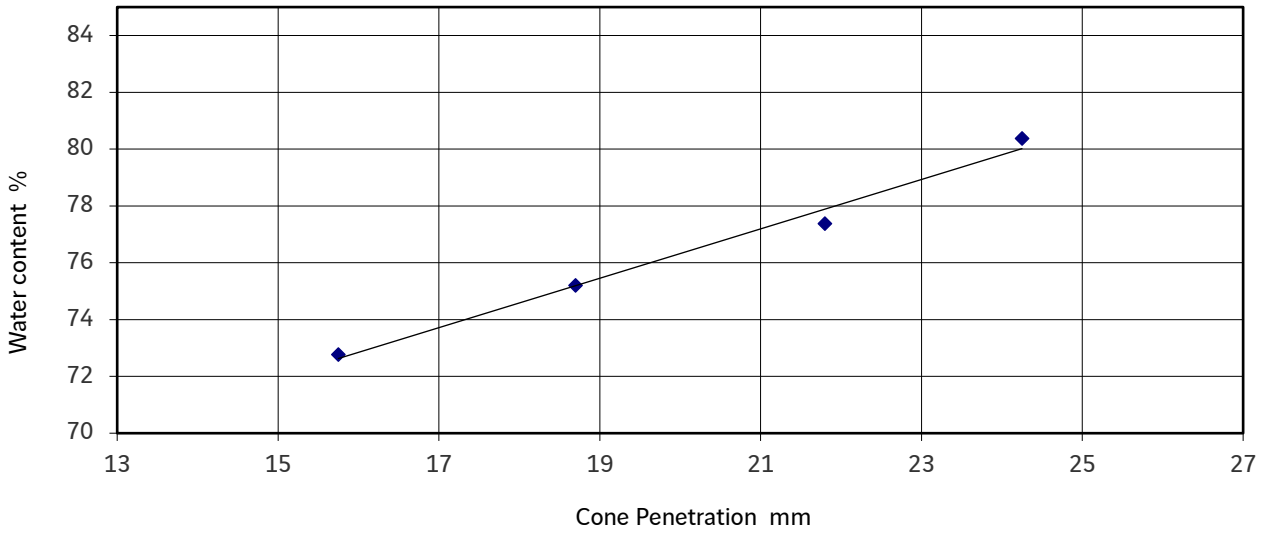
Water content	68.7	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

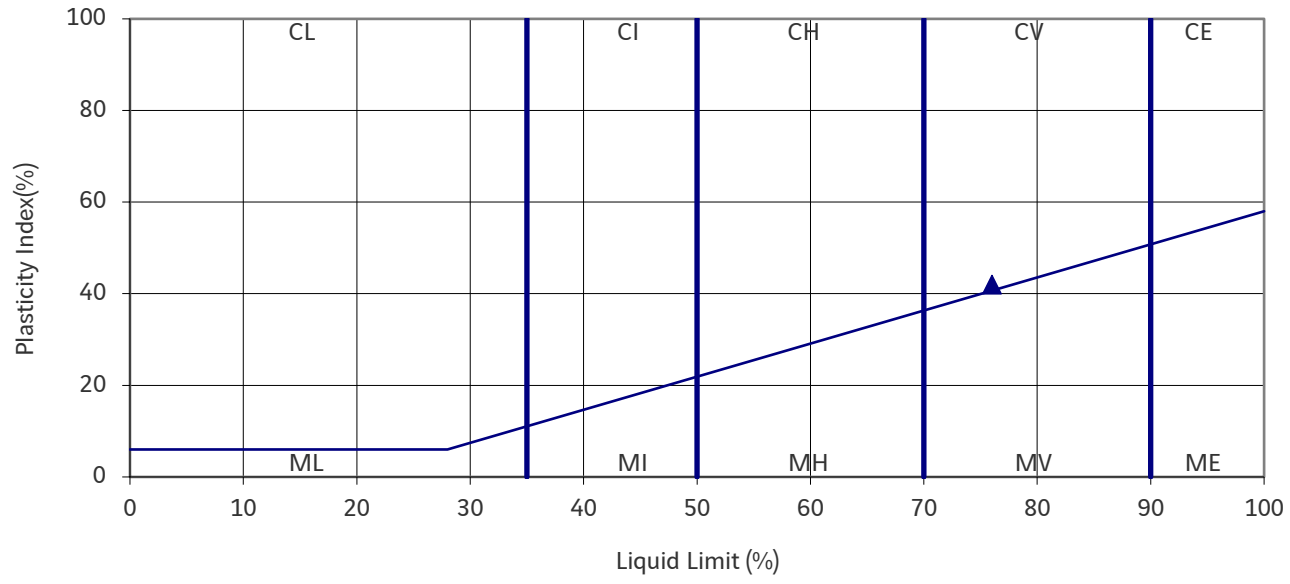
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 22/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH108
Project No.	TB8754		Sample Depth 4.00m
Engineer	Mott MacDonald		Sample Number 18
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 4.27m
			Specimen Number 1



As received water content:	68.7%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	76%	Preparation of sample: Natural	
Plastic limit:	34%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	42%		
Water content of soil passing 425µm	68.7%		
Liquidity index:	0.825		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 24/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

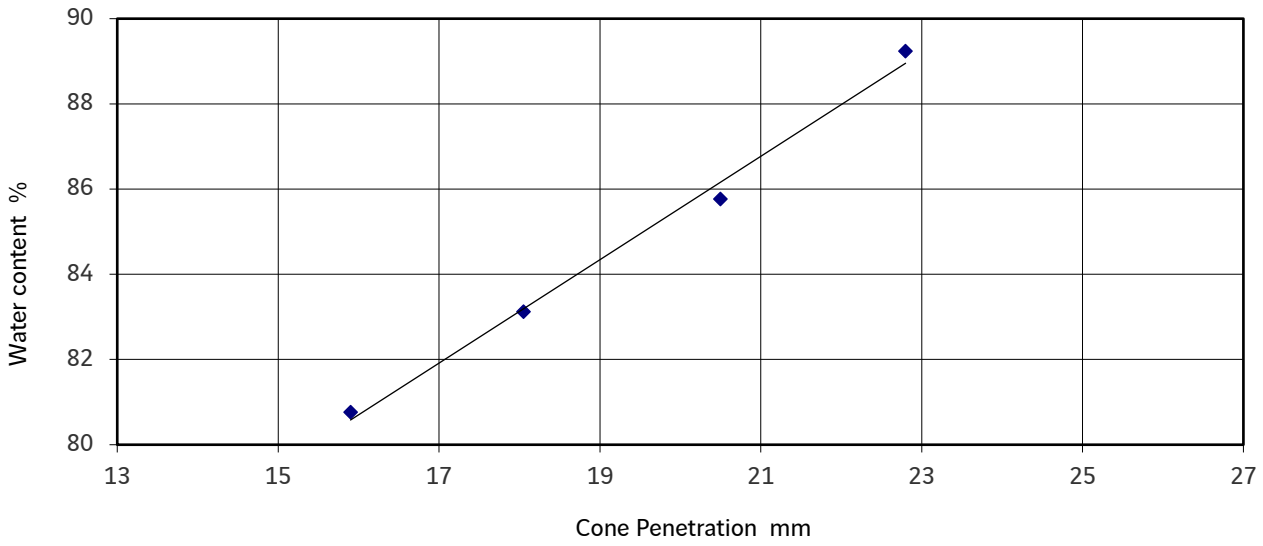
Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH108
Project No.	TB8754		Sample Depth 5.00m
Engineer	Mott MacDonald		Sample Number 20
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 5.72m
			Specimen Number 3

Water content	76.8	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

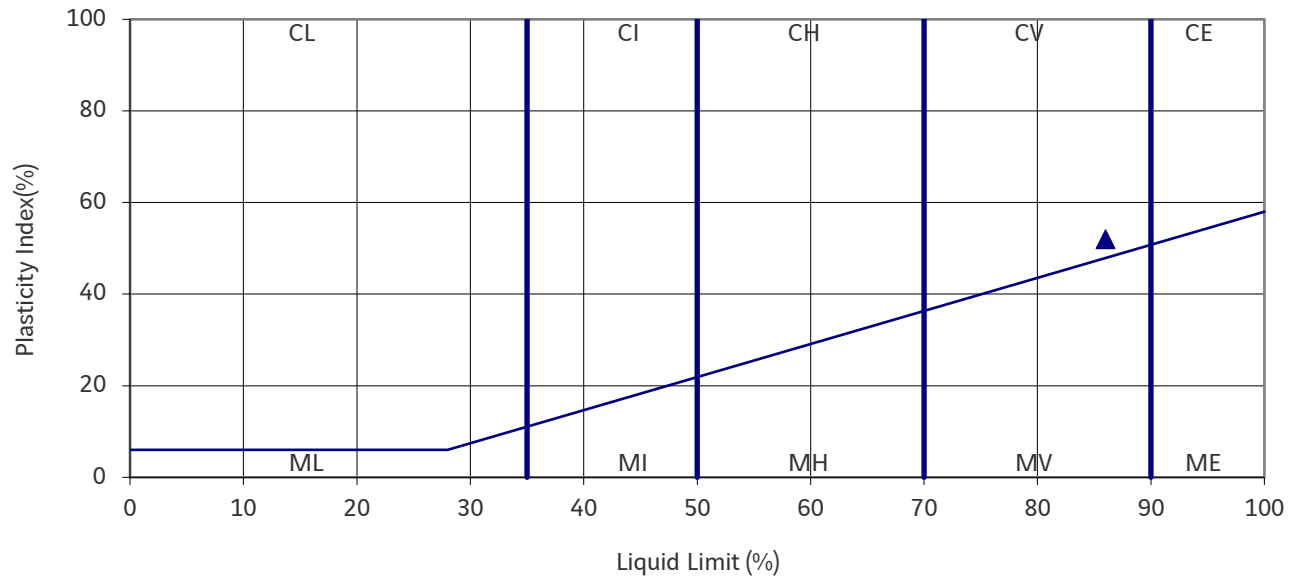
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH108
Project No.	TB8754		Sample Depth 5.00m
Engineer	Mott MacDonald		Sample Number 20
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 5.72m
			Specimen Number 4



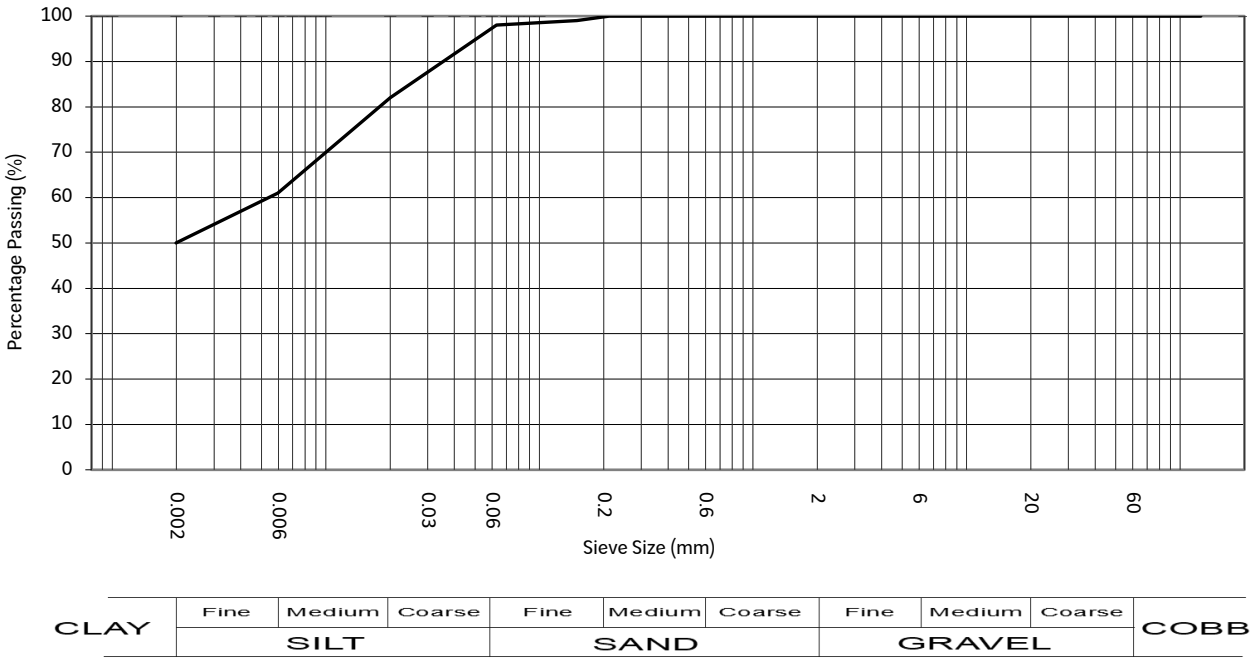
As received water content:	76.8%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	86%	Preparation of sample: Natural	
Plastic limit:	34%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	52%		
Water content of soil passing 425µm	76.8%		
Liquidity index:	0.823		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 21/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH108
Project No.	TB8754		Sample Depth 5.00m
Engineer	Mott MacDonald		Sample Number 20
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type P
Description	Grey CLAY.		Specimen Depth 5.78m
			Specimen No. 2



PARTICLE SIZE	%
Clay:	49.7
Silt:	48.3
Sand:	2.0
Gravel:	0.0
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14	100		
		10	100	0.020000	82
		6.3	100	0.005960	61
125.0	100	5	100	0.001990	50
90.0	100	3.35	100		
75.0	100	2	100		
63.0	100	1.18	100		
50.0	100	0.6	100		
37.5	100	0.425	100		
28.0	100	0.3	100		
20.0	100	0.212	100		
		0.15	99		
		0.063	98		

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:

Steve Harper

Print date 21/07/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH108
Project No.	TB8754		Sample Depth 6.00m
Engineer	Mott MacDonald		Sample Number 21
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Greyish brown CLAY.		Specimen Depth 6.00m
			Specimen Number 2

Water content	70.9	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 05/09/2025	
	Revision No. 1.01	Issue Date 01/05/2024	

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH108
Project No.	TB8754		Sample Depth 6.00m
Engineer	Mott MacDonald		Sample Number 22
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 6.57m
			Specimen Number 2

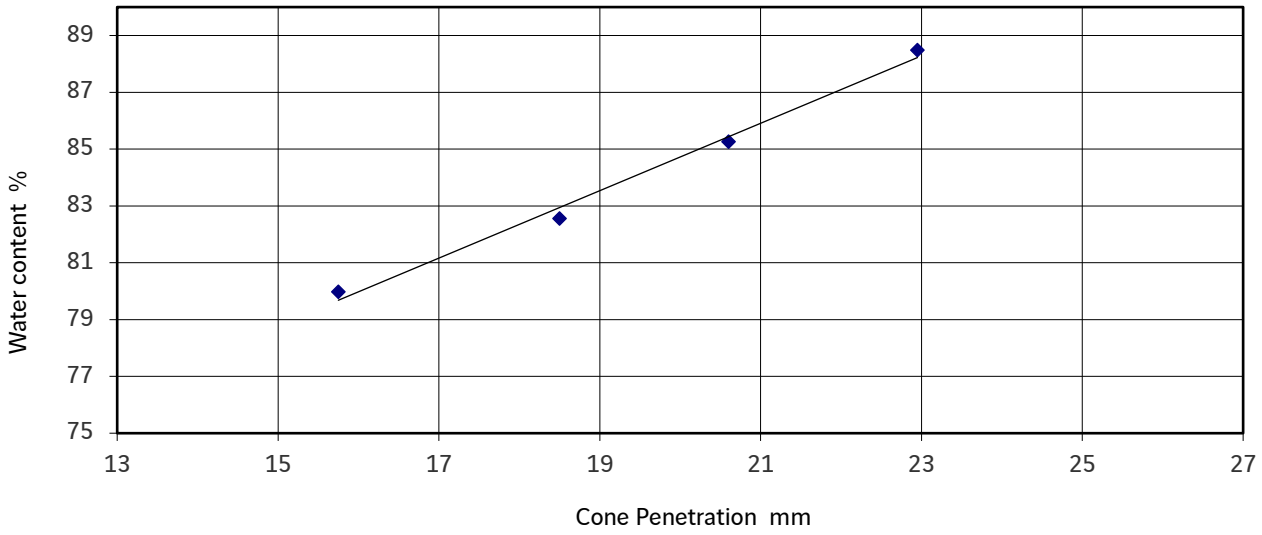
Water content	74.1	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

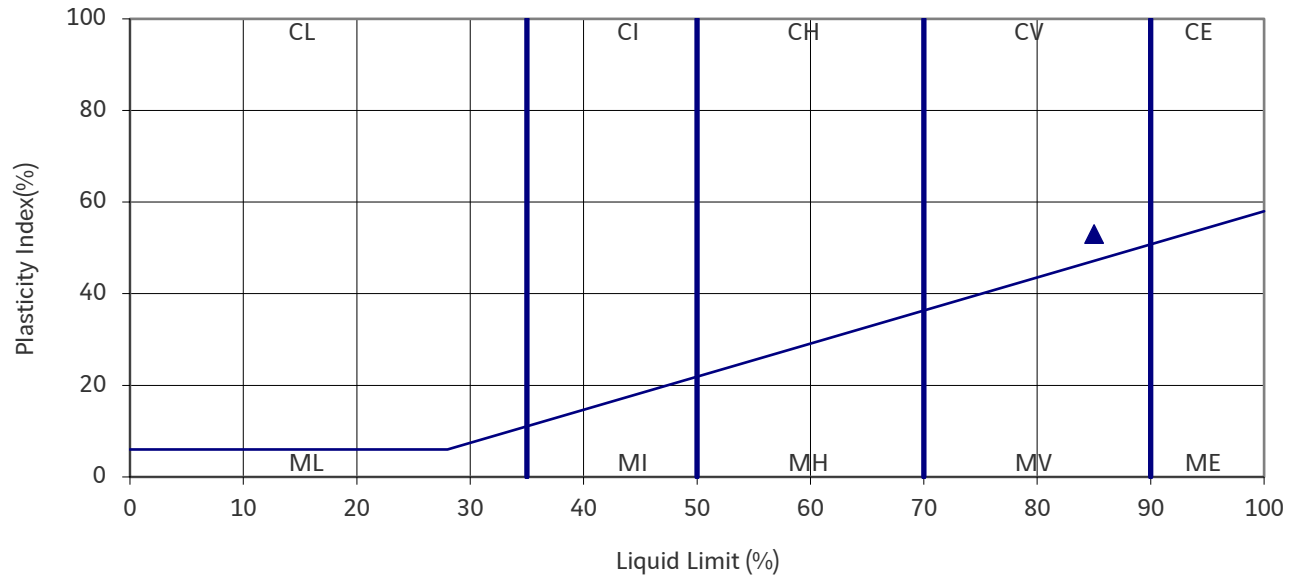
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 22/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH108
Project No.	TB8754		Sample Depth 6.00m
Engineer	Mott MacDonald		Sample Number 22
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 6.57m
			Specimen Number 1



As received water content:	74.1%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	85%	Preparation of sample: Natural	
Plastic limit:	32%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	53%		
Water content of soil passing 425µm	74.1%		
Liquidity index:	0.794		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 24/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH108
Project No.	TB8754		Sample Depth 7.00m
Engineer	Mott MacDonald		Sample Number 24
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 7.94m
			Specimen Number 3

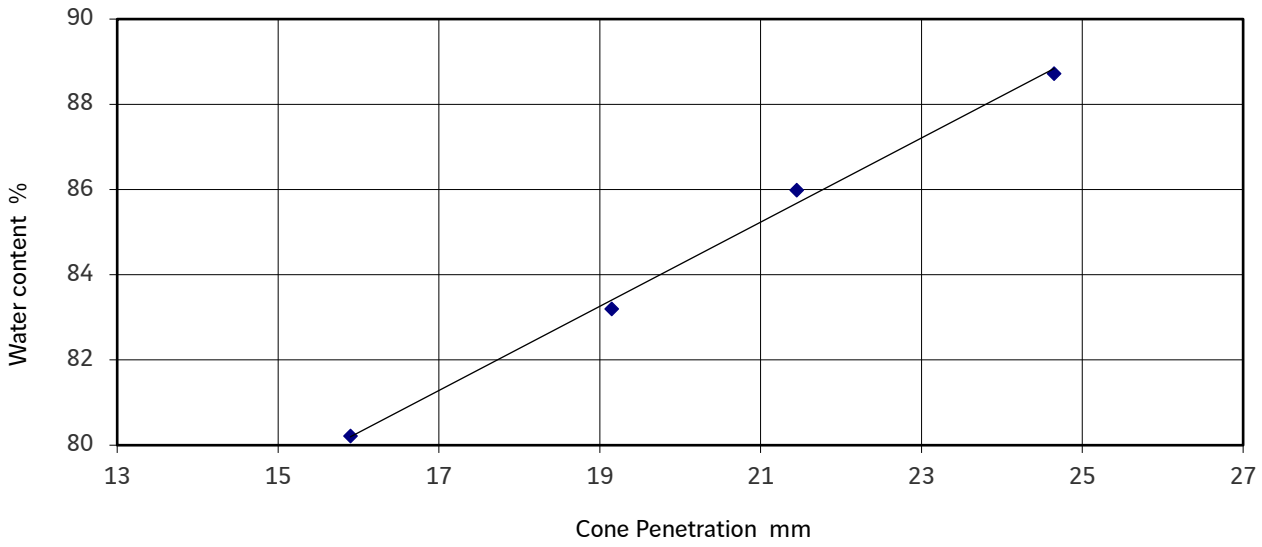
Water content	69.0	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

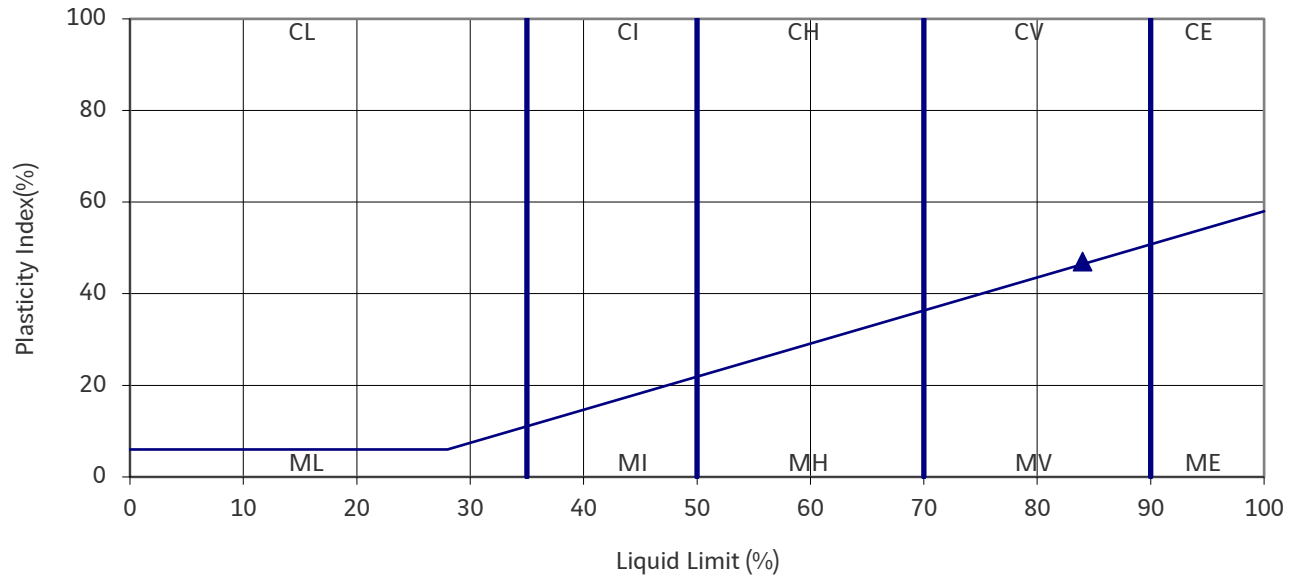
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 22/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH108
Project No.	TB8754		Sample Depth 7.00m
Engineer	Mott MacDonald		Sample Number 24
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 7.94m
			Specimen Number 2



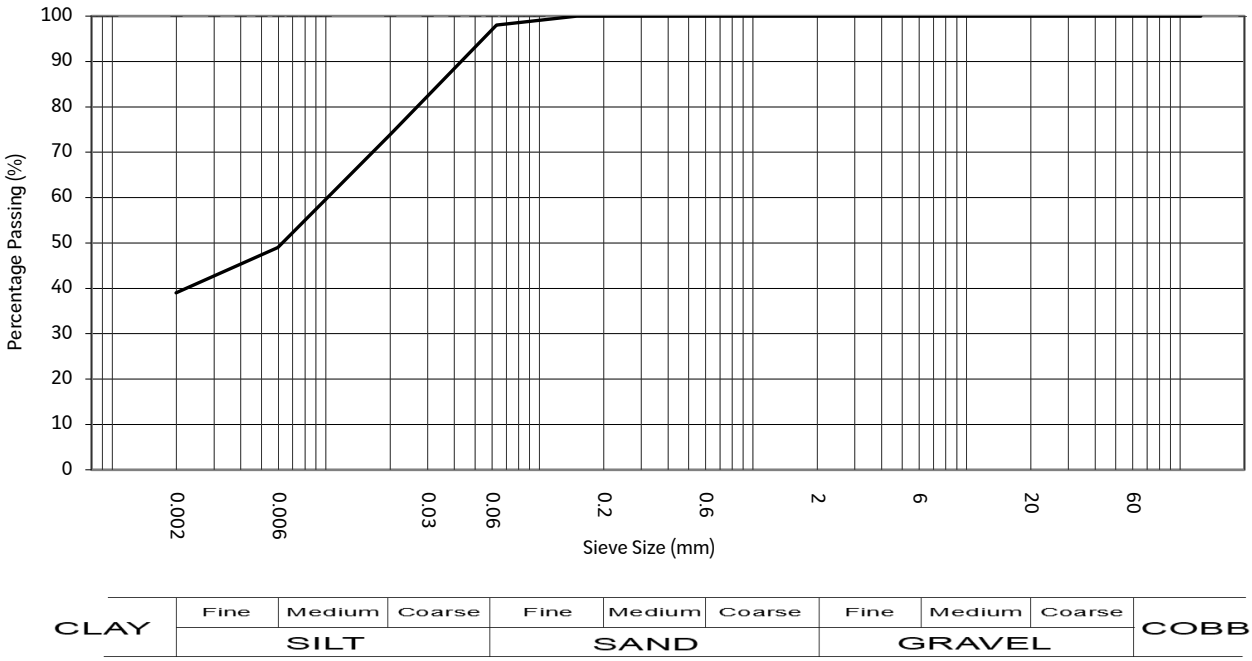
As received water content:	69%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	84%	Preparation of sample: Natural	
Plastic limit:	37%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	47%		
Water content of soil passing 425µm	69.0%		
Liquidity index:	0.681		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 24/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH108
Project No.	TB8754		Sample Depth 7.00m
Engineer	Mott MacDonald		Sample Number 24
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type P
Description	Grey CLAY.		Specimen Depth 7.98m
			Specimen No. 1



PARTICLE SIZE	%
Clay:	39.5
Silt:	58.4
Sand:	2.1
Gravel:	0.0
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14	100		
		10	100	0.020100	74
		6.3	100	0.005970	49
125.0	100	5	100	0.001990	39
90.0	100	3.35	100		
75.0	100	2	100		
63.0	100	1.18	100		
50.0	100	0.6	100		
37.5	100	0.425	100		
28.0	100	0.3	100		
20.0	100	0.212	100		
		0.15	100		
		0.063	98		

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

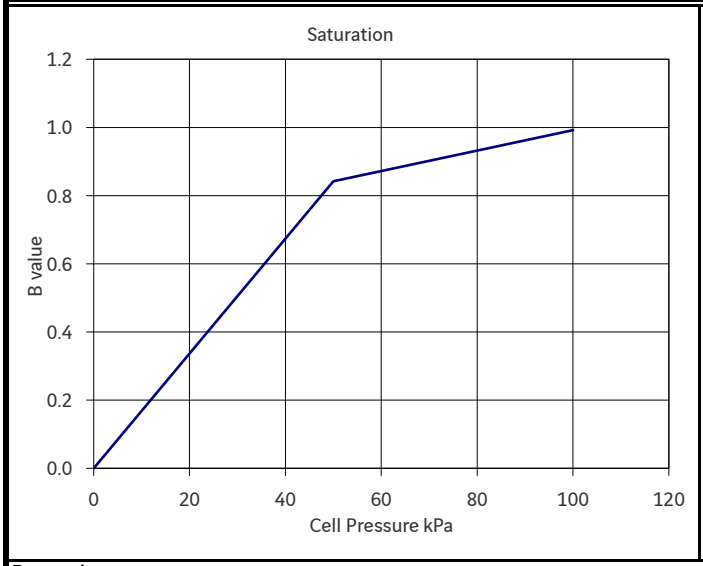
Approved by: Steve Harper

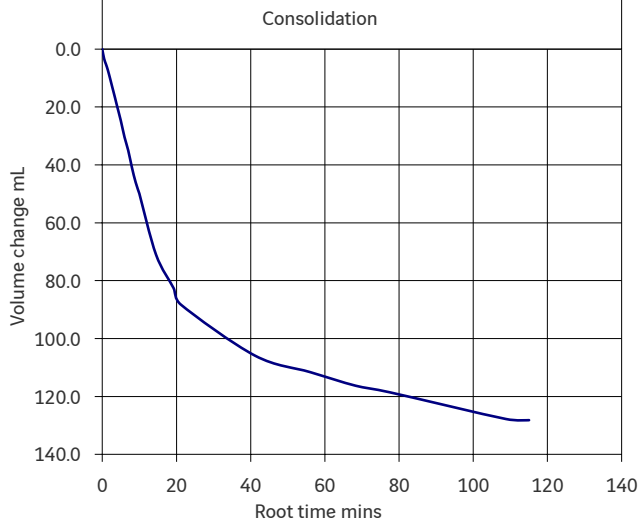
Print date 21/07/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH108
Project No.	TB8754		Sample Depth 7.00m
Engineer	Mott MacDonald		Sample Number 24
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey slightly organic CLAY.		Specimen Depth 7.70m
			Specimen Number 4

SPECIMEN INITIAL DIMENSIONS		
Test number		1
Specimen diameter	mm	100.77
Specimen length	mm	196.00
Density	Mg/m^3	1.61
Moisture content	%	65
Dry density	Mg/m^3	0.97
SATURATION STAGE		
Initial pore water pressure	kPa	-1.2
Saturated pore water pressure	kPa	93.2
Final cell pressure	kPa	100
B value		0.992
CONSOLIDATION STAGE		
Cell pressure	kPa	340
Back pressure	kPa	300
Effective consolidation pressure	kPa	40
Initial pore water pressure	kPa	334
Final pore water pressure	kPa	299.7
Pore pressure dissipation	%	100.9
c_{vi}	$m^2/year$	0.21
m_{vi}	m^2/MN	2.39
SPECIMEN AFTER CONSOLIDATION		
Density	Mg/m^3	1.66
Moisture content	%	57
Dry density	Mg/m^3	1.06



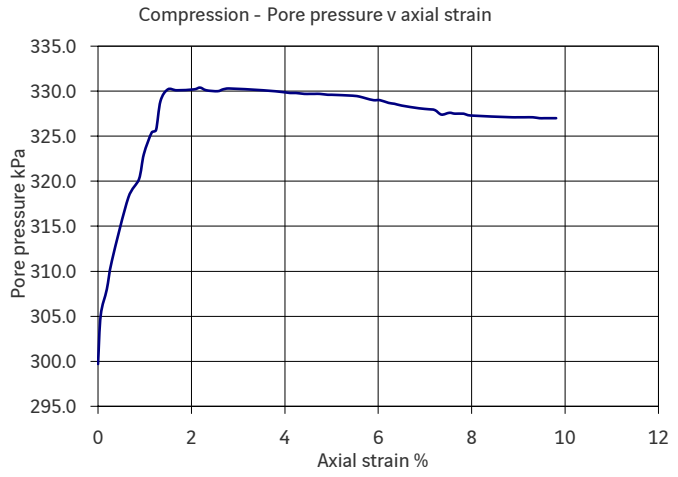


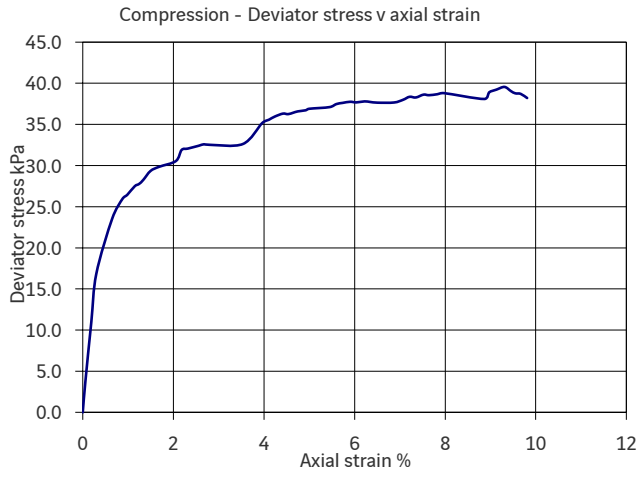
Remarks:
Specimen orientation Vertical
Specimen condition for test UNDISTURBED
Saturation with 50kPa increments with a differential pressure of 10kPa
Drainage from both ends and using a radial filter drain

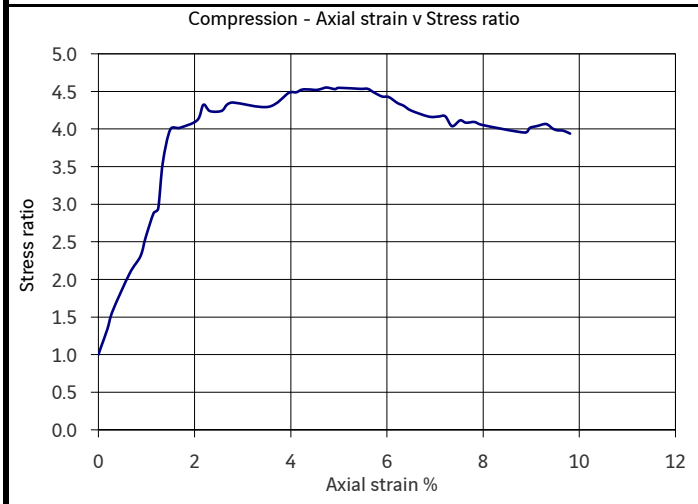
Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 26/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL engineering

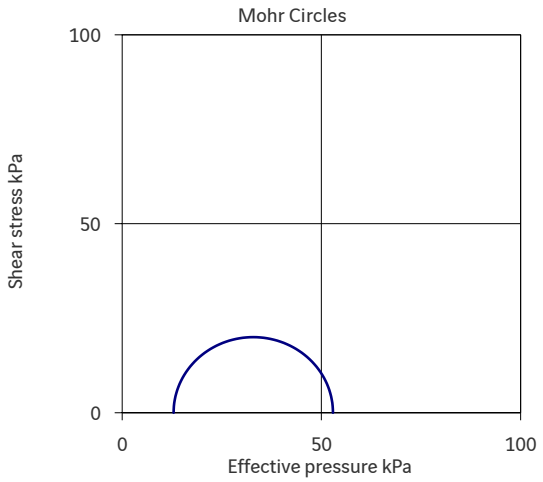
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH108
Project No.	TB8754		Sample Depth 7.00m
Engineer	Mott MacDonald		Sample Number 24
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey slightly organic CLAY.		Specimen Depth 7.70m
			Specimen Number 4

COMPRESSION STAGE			
Test number			1
Cell pressure		kPa	340
Initial pore water pressure		kPa	300
Effective confining pressure		kPa	40
Failure conditions at			Maximum deviator stress
Axial strain at failure		%	9.3
Maximum deviator stress	σ_1-σ_3	kPa	40
Pore water pressure at failure	σ	kPa	327
Effective major principal stress	σ_1'	kPa	52.46
Effective minor principal stress	σ_3'	kPa	12.90
Effective principal stress ratio			4.07
Membrane correction		kPa	1.02
Filter drain correction		kPa	3.5
Pore pressure coefficient			0.7









Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 26/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

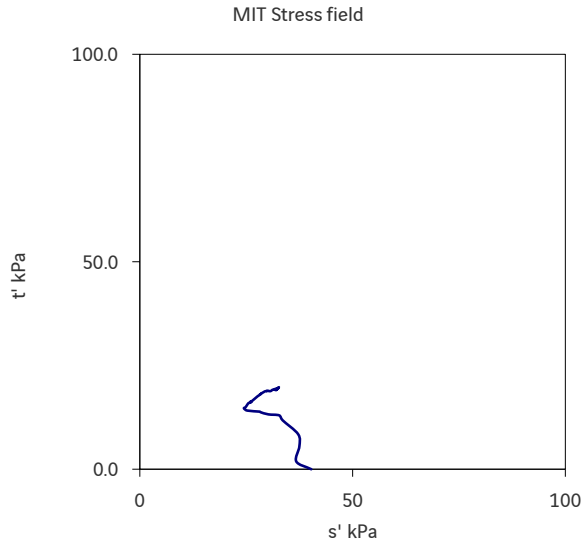
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH108
Project No.	TB8754		Sample Depth 7.00m
Engineer	Mott MacDonald		Sample Number 24
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey slightly organic CLAY.		Specimen Depth 7.70m
			Specimen Number 4

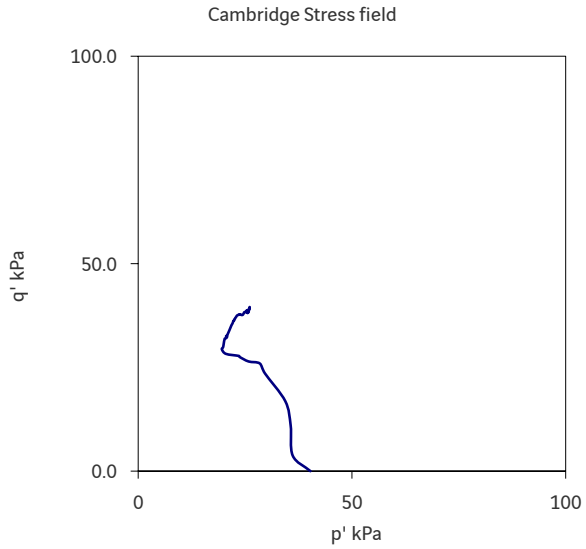
SPECIMEN AFTER TEST

Test number		1	
Mode of failure		Plastic 	
Final moisture content	%	57	
Final bulk density	Mg/m^3	1.66	
Final dry density	Mg/m^3	1.06	

ADDITIONAL SPECIMEN DETAILS

Rate of strain	%/hour	0.20	
Failure criterion		Maximum deviator stress	





REMARKS

Preliminary	Leeds Laboratory	Results apply to samples as received.	SOIL ENGINEERING
Paul Rodgers		Print date 26/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH108
Project No.	TB8754		Sample Depth 8.00m
Engineer	Mott MacDonald		Sample Number 25
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Greyish brown CLAY.		Specimen Depth 8.00m
			Specimen Number 2

Water content	77.9	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 05/09/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH108
Project No.	TB8754		Sample Depth 8.00m
Engineer	Mott MacDonald		Sample Number 26
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 8.54m
			Specimen Number 2

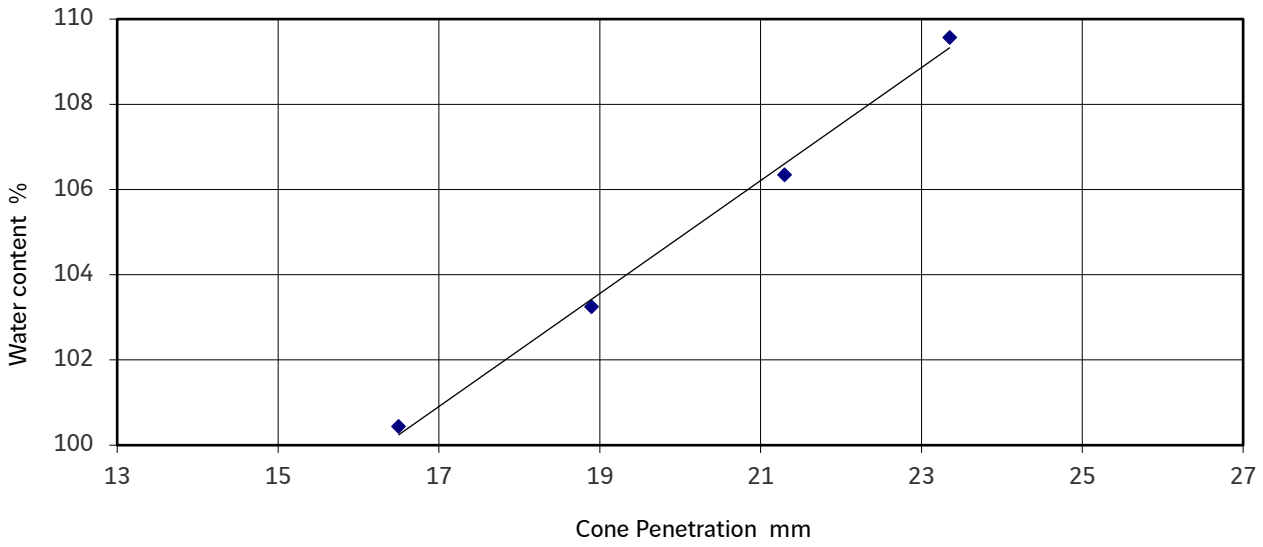
Water content	91.2	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

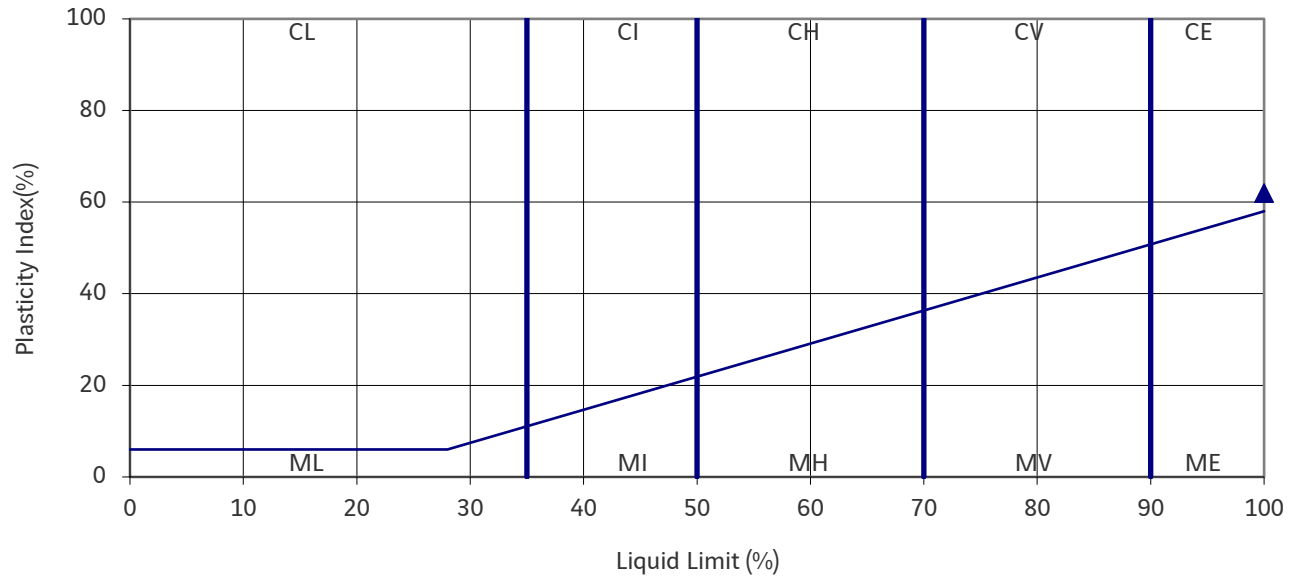
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 03/09/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH108
Project No.	TB8754		Sample Depth 8.00m
Engineer	Mott MacDonald		Sample Number 26
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 8.54m
			Specimen Number 1



As received water content:	91.2%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	100%	Preparation of sample: Natural	
Plastic limit:	38%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	62%		
Water content of soil passing 425µm	91.2%		
Liquidity index:	0.859		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 04/09/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

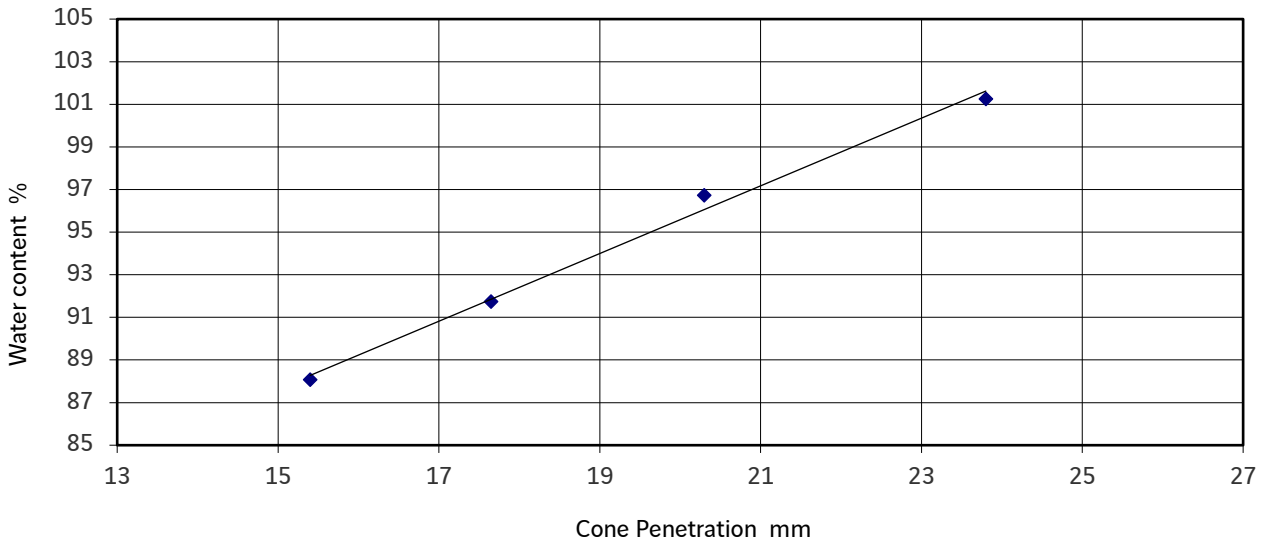
Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH108
Project No.	TB8754		Sample Depth 9.00m
Engineer	Mott MacDonald		Sample Number 28
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 9.76m
			Specimen Number 2

Water content	80.5	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

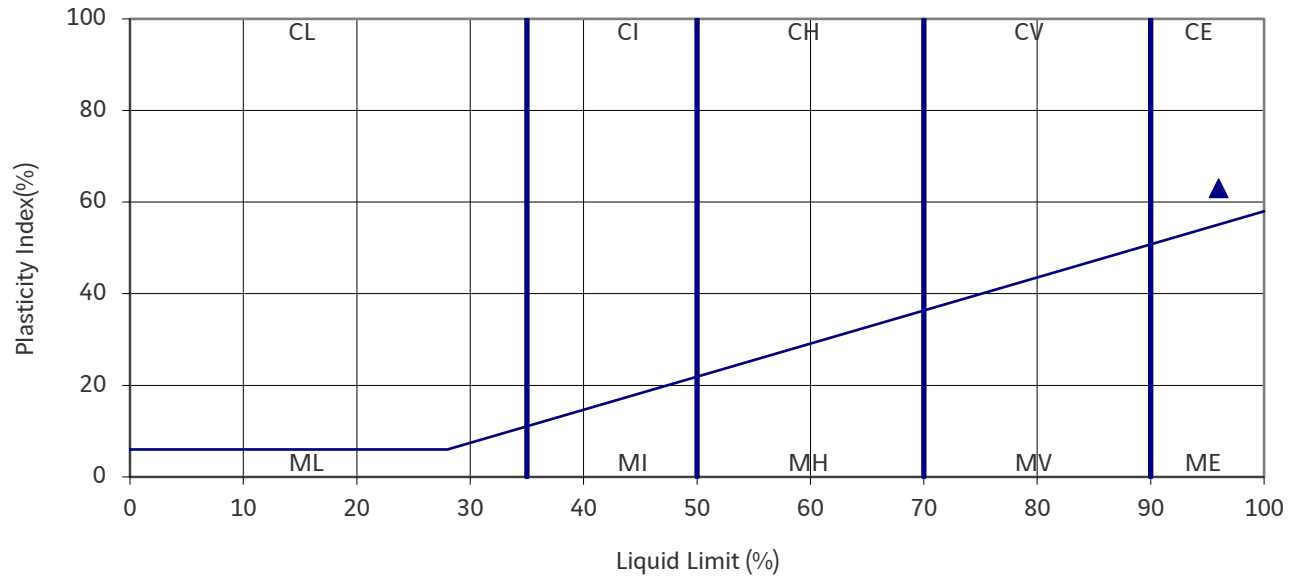
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH108
Project No.	TB8754		Sample Depth 9.00m
Engineer	Mott MacDonald		Sample Number 28
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 9.76m
			Specimen Number 1



As received water content:	80.5%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	96%	Preparation of sample: Natural	
Plastic limit:	33%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	63%		
Water content of soil passing 425µm	80.5%		
Liquidity index:	0.754		

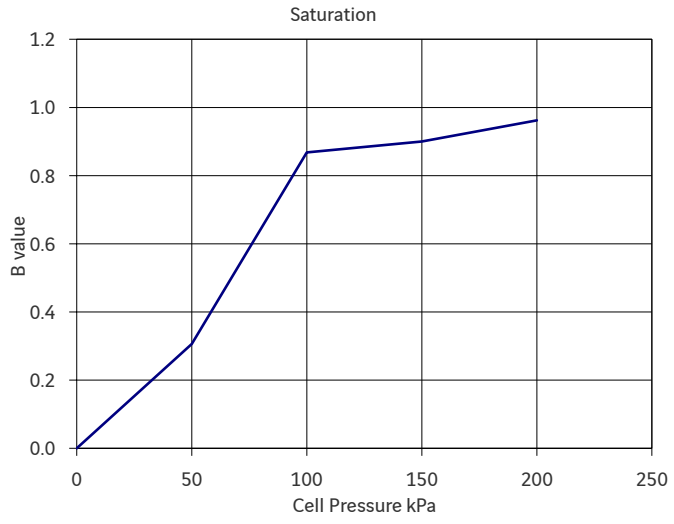


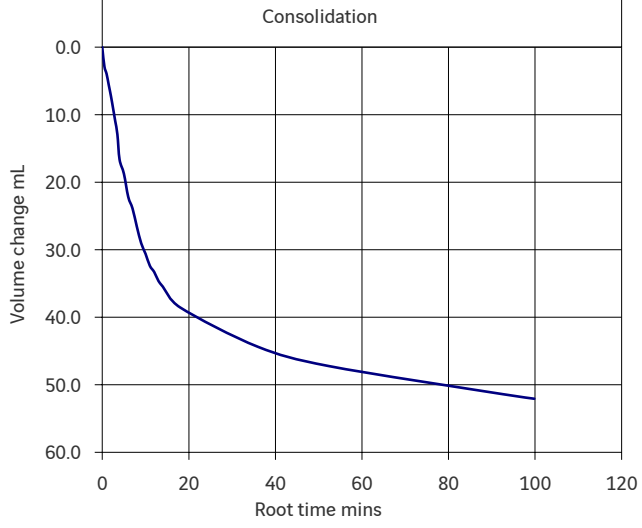
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 04/09/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH108
Project No.	TB8754		Sample Depth 9.00m
Engineer	Mott MacDonald		Sample Number 28
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with strongly decomposed plant remains.		Specimen Depth 9.50m
			Specimen Number 3

SPECIMEN INITIAL DIMENSIONS		
Test number		1
Specimen diameter	mm	100.88
Specimen length	mm	195.77
Density	Mg/m^3	1.52
Moisture content	%	76
Dry density	Mg/m^3	0.86
SATURATION STAGE		
Initial pore water pressure	kPa	0.6
Saturated pore water pressure	kPa	191.9
Final cell pressure	kPa	200
B value		0.962
CONSOLIDATION STAGE		
Cell pressure	kPa	350
Back pressure	kPa	300
Effective consolidation pressure	kPa	50
Initial pore water pressure	kPa	336.2
Final pore water pressure	kPa	301.8
Pore pressure dissipation	%	95.0
c_{vi}	$m^2/year$	0.53
m_{vi}	m^2/MN	0.97
SPECIMEN AFTER CONSOLIDATION		
Density	Mg/m^3	1.56
Moisture content	%	76
Dry density	Mg/m^3	0.89



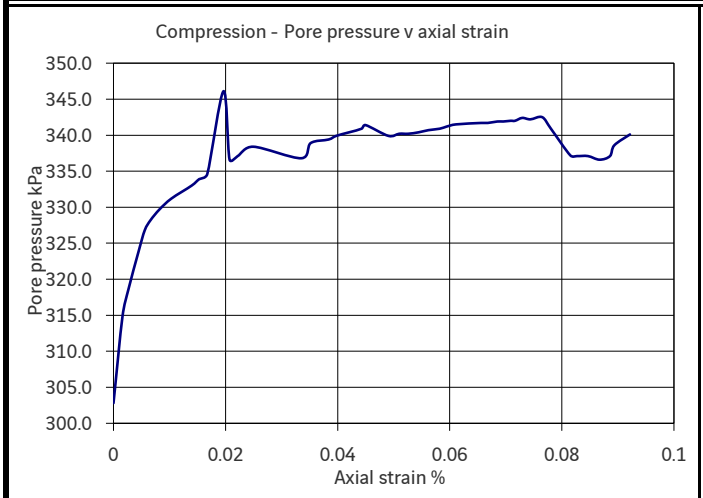


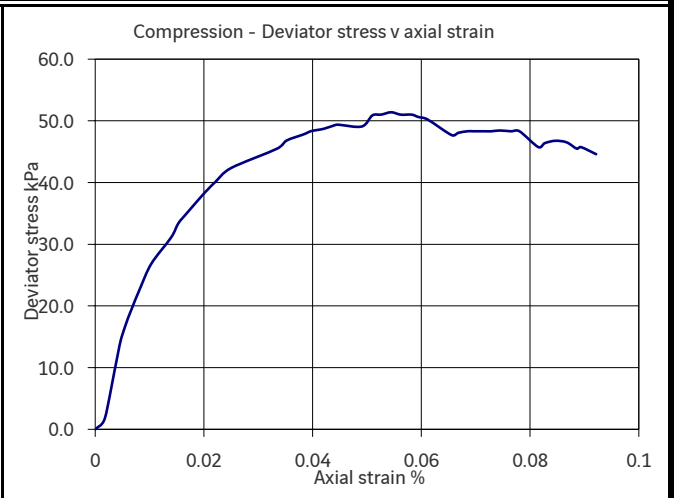
Remarks: Specimen orientation Vertical
Specimen condition for test UNDISTURBED
Saturation with 50kPa increments with a differential pressure of 10kPa
Drainage from both ends and using a radial filter drain

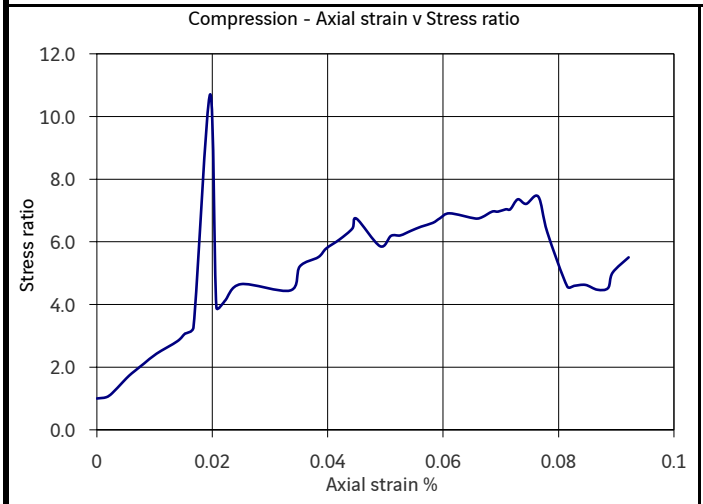
Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 26/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

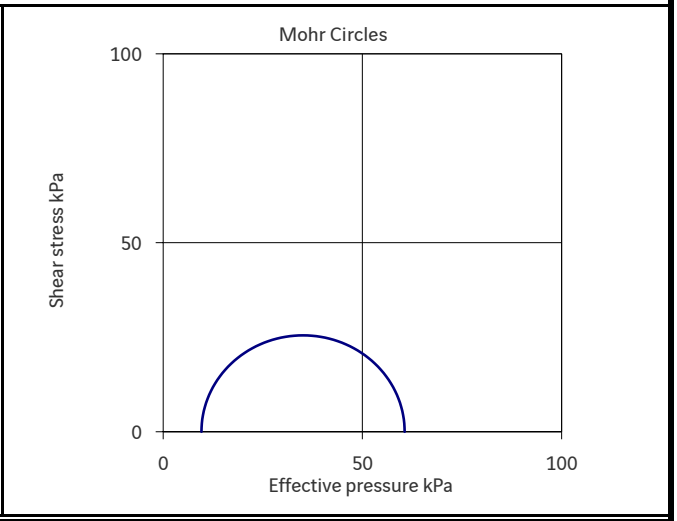
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH108
Project No.	TB8754		Sample Depth 9.00m
Engineer	Mott MacDonald		Sample Number 28
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with strongly decomposed plant remains.		Specimen Depth 9.50m
			Specimen Number 3

COMPRESSION STAGE			
Test number			1
Cell pressure		kPa	350
Initial pore water pressure		kPa	303
Effective confining pressure		kPa	48
Failure conditions at			Maximum deviator stress
Axial strain at failure		%	0.1
Maximum deviator stress	σ_1-σ_3	kPa	51
Pore water pressure at failure	σ	kPa	340
Effective major principal stress	σ_1'	kPa	60.99
Effective minor principal stress	σ_3'	kPa	9.60
Effective principal stress ratio			6.35
Membrane correction		kPa	0.01
Filter drain correction		kPa	0.0
Pore pressure coefficient			0.8









Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 26/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

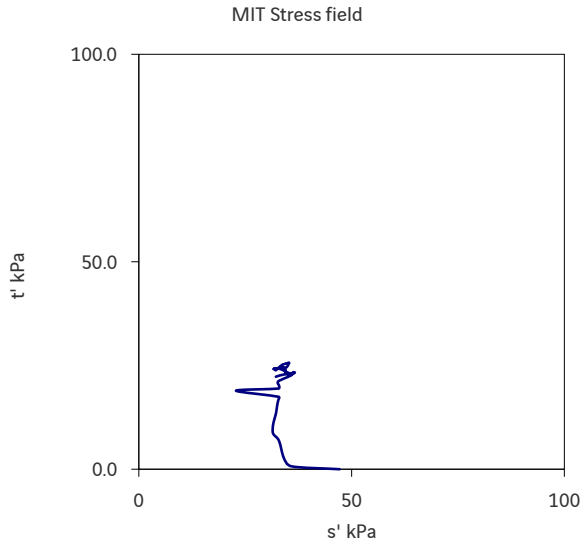
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH108
Project No.	TB8754		Sample Depth 9.00m
Engineer	Mott MacDonald		Sample Number 28
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with strongly decomposed plant remains.		Specimen Depth 9.50m
			Specimen Number 3

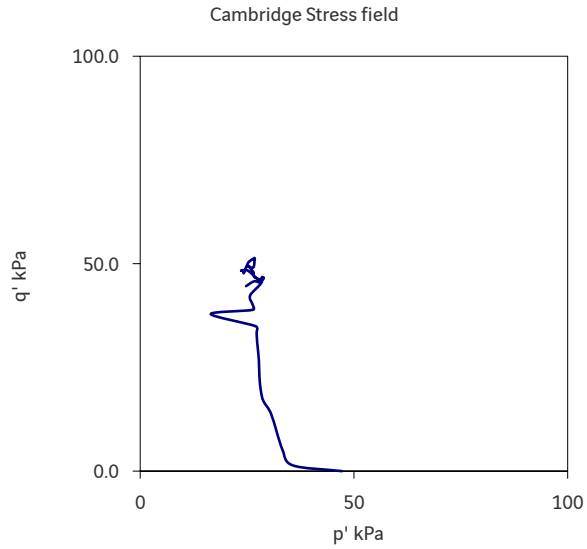
SPECIMEN AFTER TEST

Test number		1	
Mode of failure		Plastic 	
Final moisture content	%	76	
Final bulk density	Mg/m^3	1.56	
Final dry density	Mg/m^3	0.89	

ADDITIONAL SPECIMEN DETAILS

Rate of strain	%/hour	0.20	
Failure criterion		Maximum deviator stress	





REMARKS

Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 26/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH108
Project No.	TB8754		Sample Depth 10.00m
Engineer	Mott MacDonald		Sample Number 29
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 10.00m
			Specimen Number 2

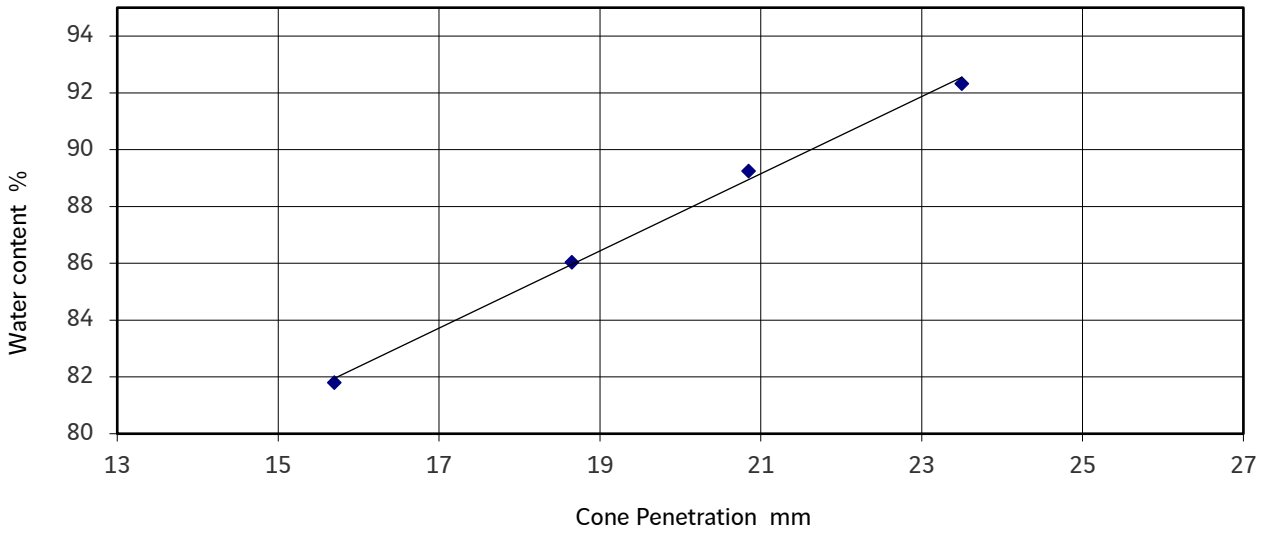
Water content	70.2	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

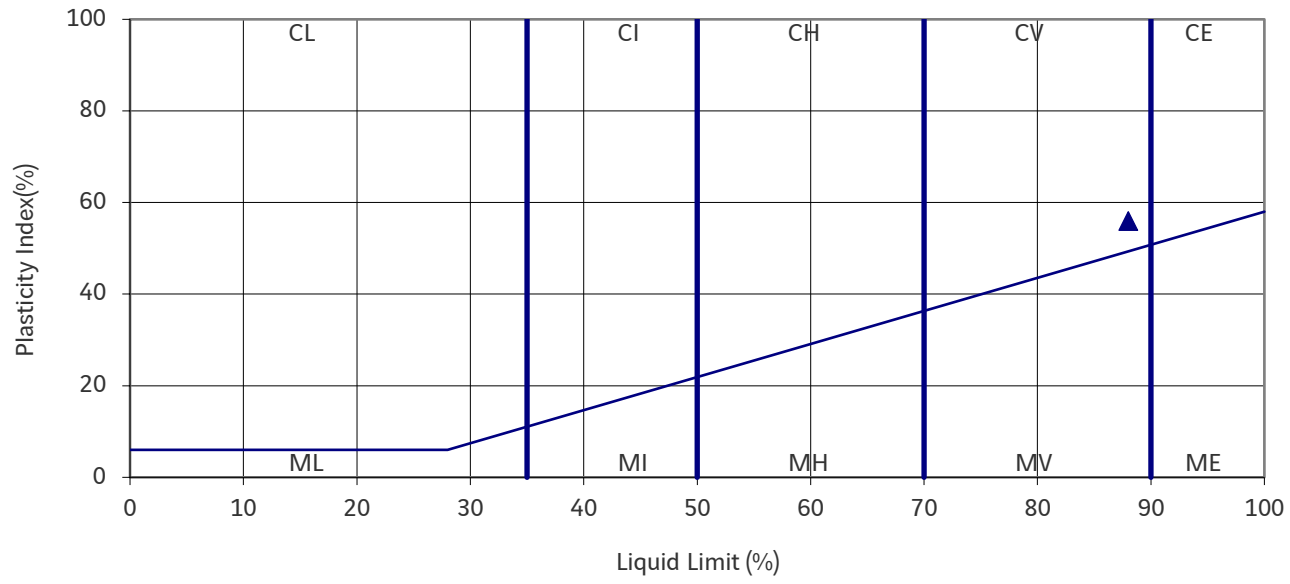
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 21/08/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH108
Project No.	TB8754		Sample Depth 10.00m
Engineer	Mott MacDonald		Sample Number 29
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 10.00m
			Specimen Number 1



As received water content:	70.2%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	88%	Preparation of sample: Natural	
Plastic limit:	32%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	56%		
Water content of soil passing 425µm	70.2%		
Liquidity index:	0.681		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 22/08/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

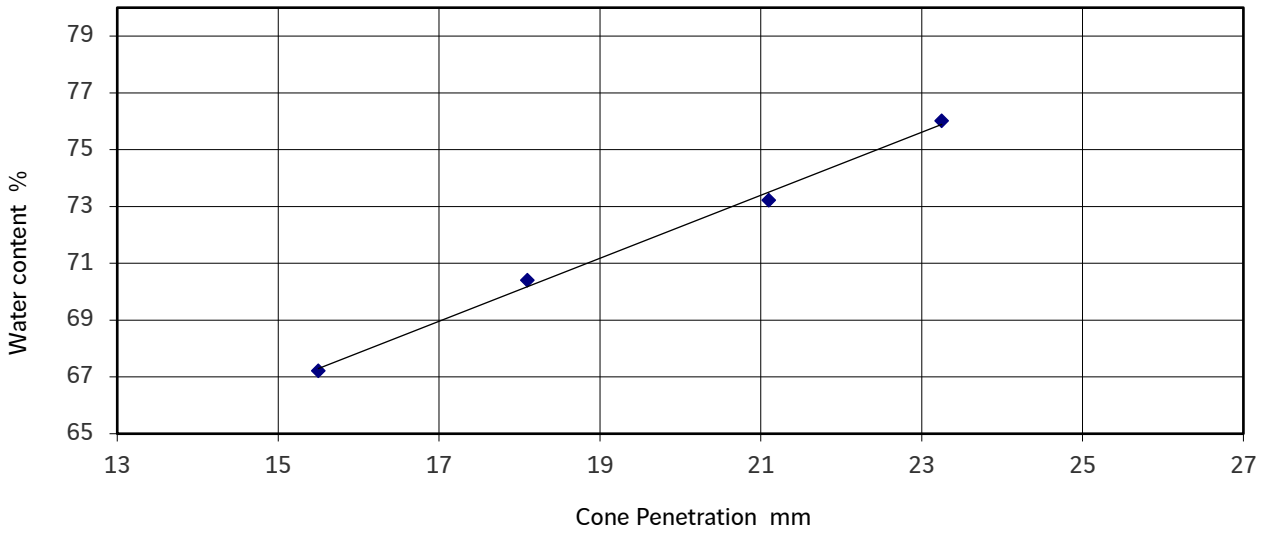
Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH108
Project No.	TB8754		Sample Depth 10.00m
Engineer	Mott MacDonald		Sample Number 30
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 10.40m
			Specimen Number 2

Water content	61.9	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

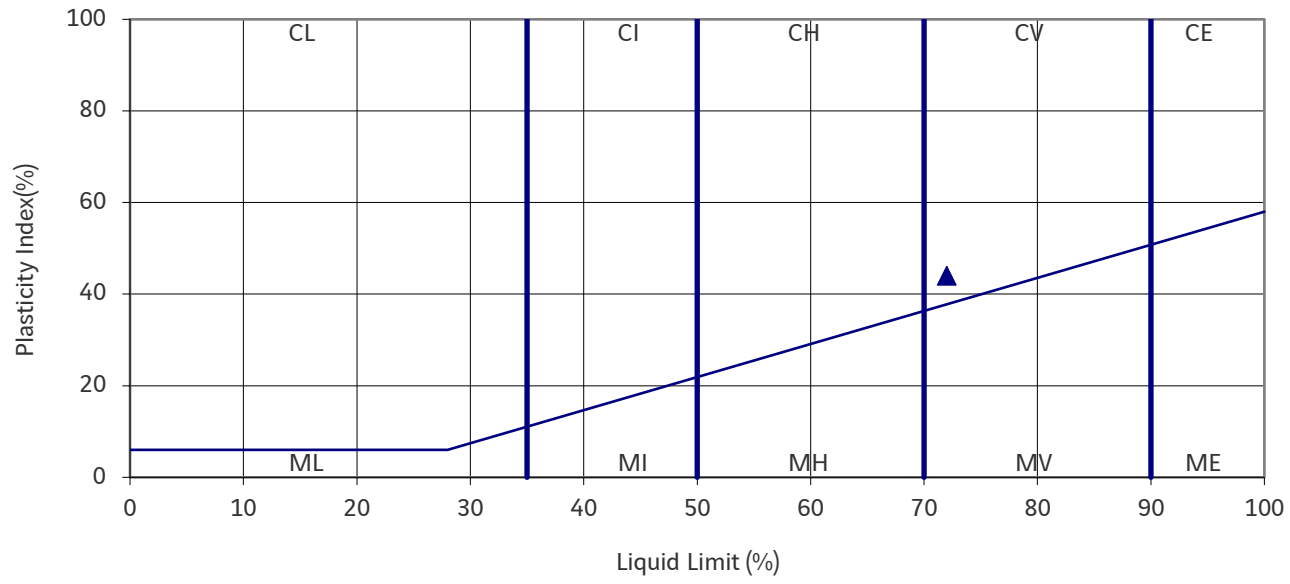
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH108
Project No.	TB8754		Sample Depth 10.00m
Engineer	Mott MacDonald		Sample Number 30
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 10.40m
			Specimen Number 1



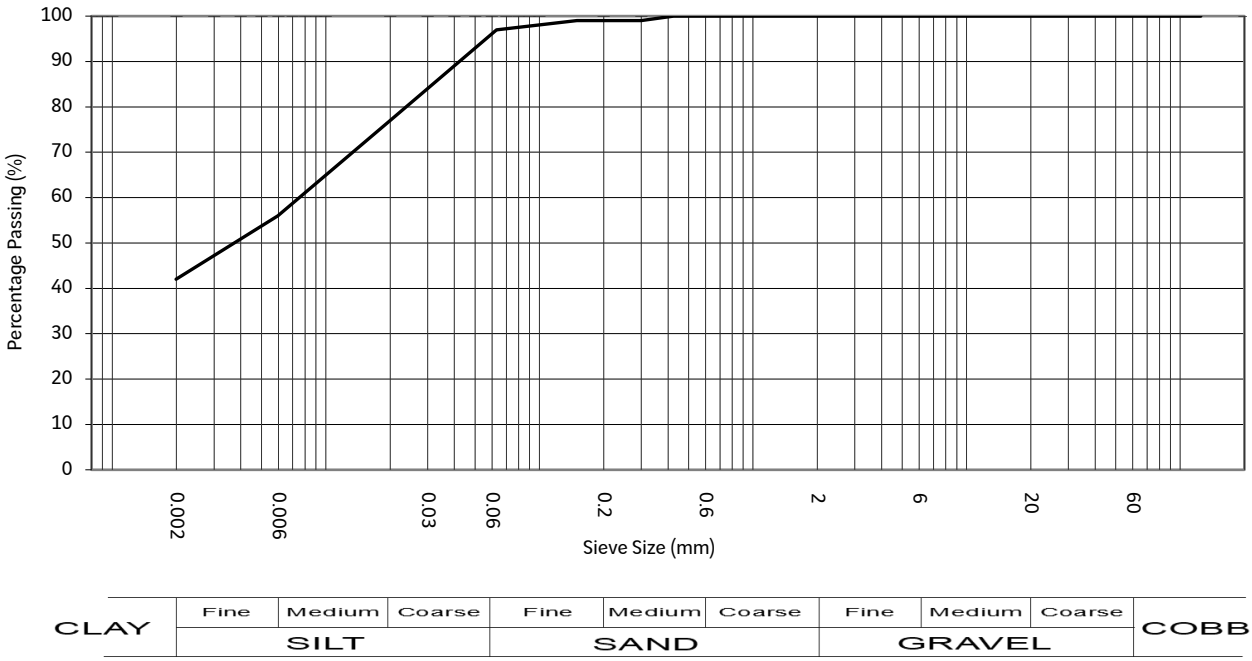
As received water content:	61.9%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	72%	Preparation of sample: Natural	
Plastic limit:	28%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	44%		
Water content of soil passing 425µm	61.9%		
Liquidity index:	0.771		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 21/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH108
Project No.	TB8754		Sample Depth 10.00m
Engineer	Mott MacDonald		Sample Number 30
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type P
Description	Grey CLAY.		Specimen Depth 10.31m
			Specimen No. 3



PARTICLE SIZE	%
Clay:	42.4
Silt:	54.3
Sand:	3.3
Gravel:	0.0
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14	100		
		10	100	0.020000	77
		6.3	100	0.005970	56
125.0	100	5	100	0.001990	42
90.0	100	3.35	100		
75.0	100	2	100		
63.0	100	1.18	100		
50.0	100	0.6	100		
37.5	100	0.425	100		
28.0	100	0.3	99		
20.0	100	0.212	99		
		0.15	99		
		0.063	97		

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:

Steve Harper

Print date 21/07/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH108
Project No.	TB8754		Sample Depth 11.00m
Engineer	Mott MacDonald		Sample Number 32
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 11.40m
			Specimen Number 2

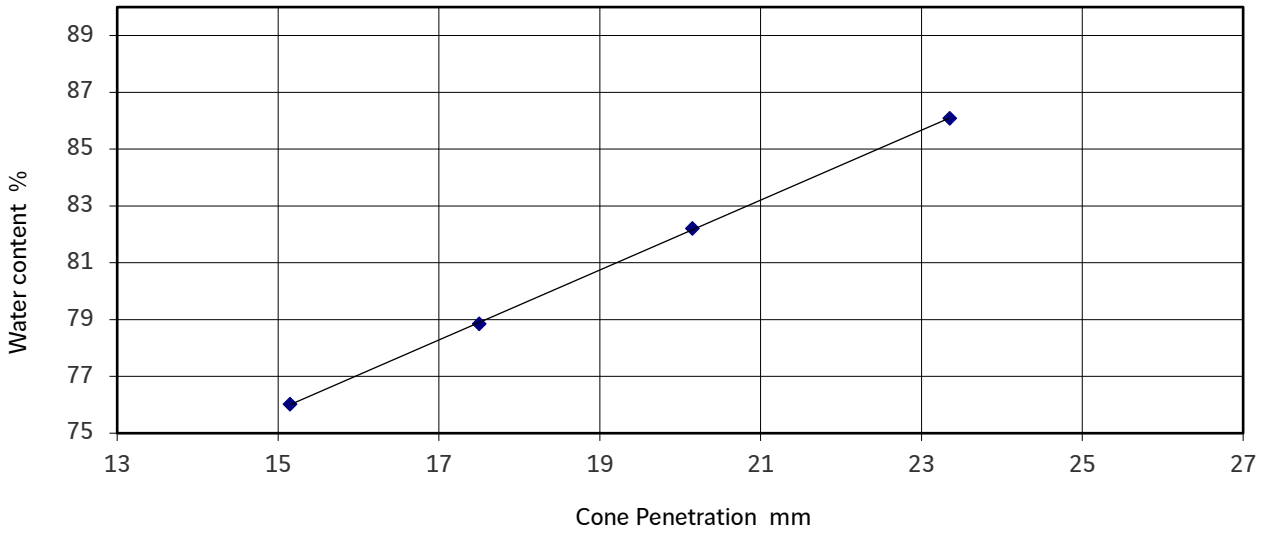
Water content	73.8	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

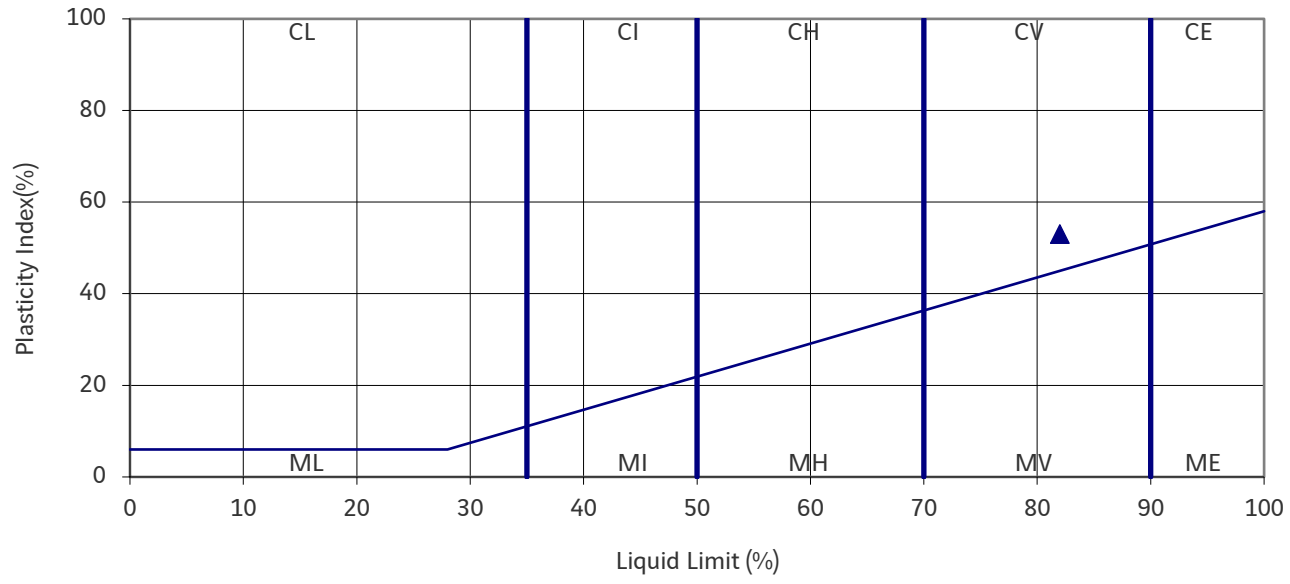
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 22/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH108
Project No.	TB8754		Sample Depth 11.00m
Engineer	Mott MacDonald		Sample Number 32
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 11.40m
			Specimen Number 1



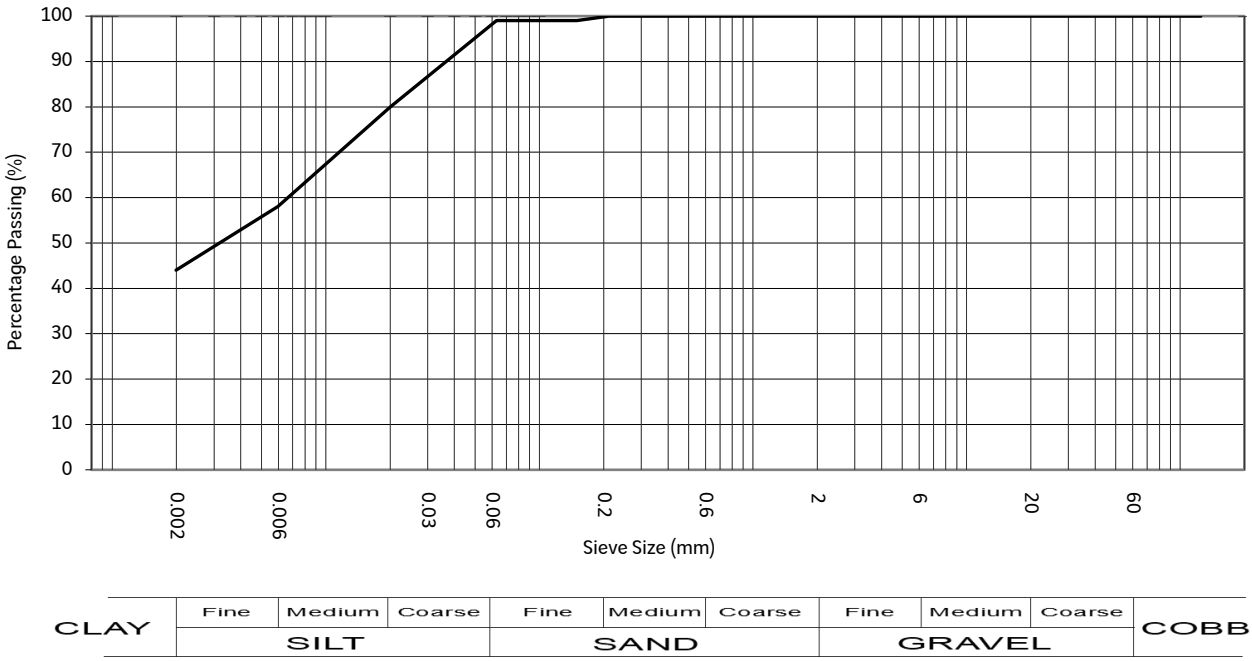
As received water content:	73.8%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	82%	Preparation of sample: Natural	
Plastic limit:	29%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	53%		
Water content of soil passing 425µm	73.8%		
Liquidity index:	0.846		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 24/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH108
Project No.	TB8754		Sample Depth 11.00m
Engineer	Mott MacDonald		Sample Number 32
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type P
Description	Grey CLAY.		Specimen Depth 11.35m
			Specimen No. 3



PARTICLE SIZE	%
Clay:	44.5
Silt:	54.2
Sand:	1.3
Gravel:	0.0
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA

Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	100
		10	100
		6.3	100
125.0	100	5	100
90.0	100	3.35	100
75.0	100	2	100
63.0	100	1.18	100
50.0	100	0.6	100
37.5	100	0.425	100
28.0	100	0.3	100
20.0	100	0.212	100
		0.15	99
		0.063	99

SEDIMENTATION DATA

Equivalent particle diameter mm	Cumulative % passing
0.020000	80
0.005970	58
0.001990	44

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:

Steve Harper

Print date 21/07/2025

SOIL ENGINEERING

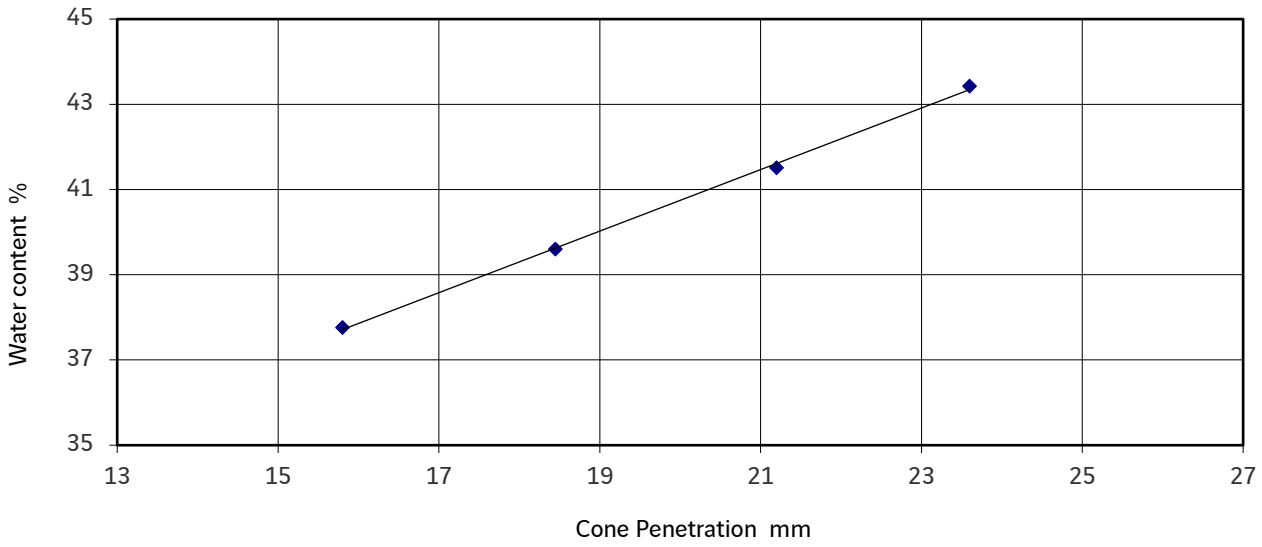
Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH108
Project No.	TB8754		Sample Depth 11.80m
Engineer	Mott MacDonald		Sample Number 33
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Brown CLAY.		Specimen Depth 11.80m
			Specimen Number 2

Water content	26.8	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

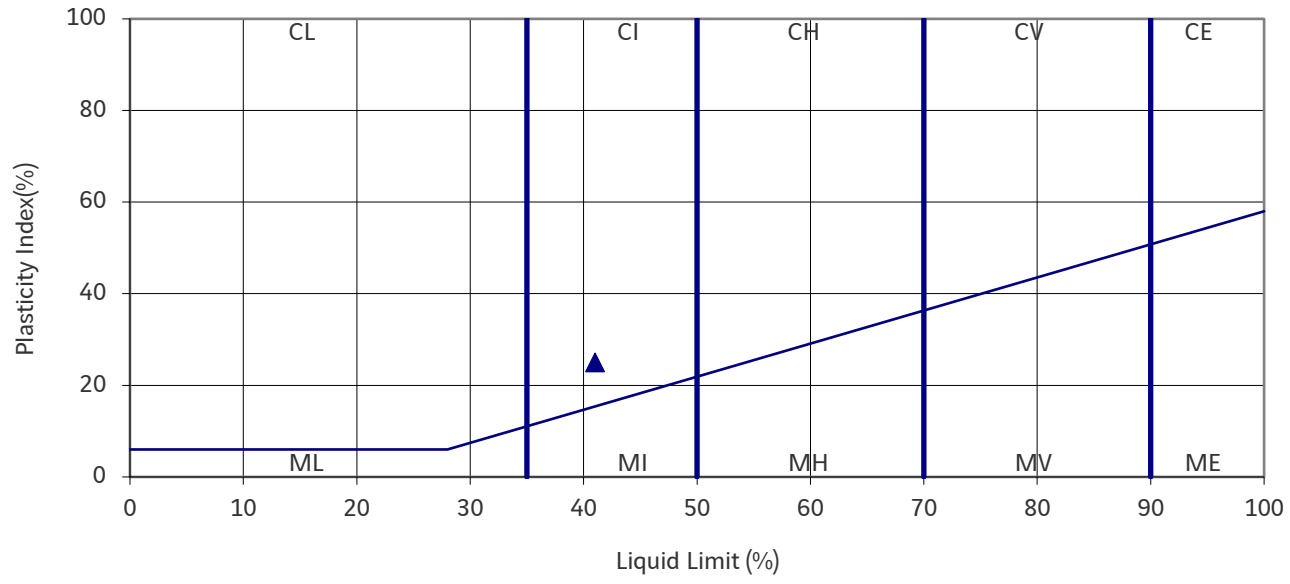
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH108
Project No.	TB8754		Sample Depth 11.80m
Engineer	Mott MacDonald		Sample Number 33
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Brown CLAY.		Specimen Depth 11.80m
			Specimen Number 1



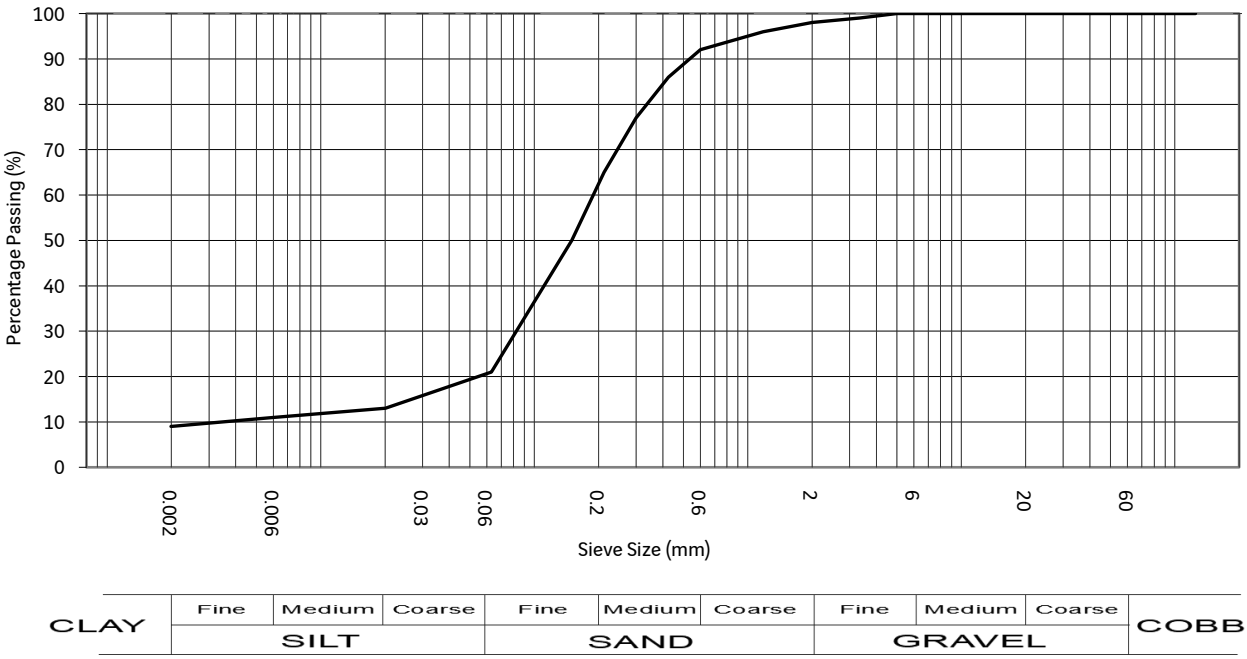
As received water content:	26.8%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	41%	Preparation of sample: Natural	
Plastic limit:	16%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	25%		
Water content of soil passing 425µm	26.8%		
Liquidity index:	0.432		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 04/09/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH108
Project No.	TB8754		Sample Depth 14.30m
Engineer	Mott MacDonald		Sample Number 41
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.2 and 5.4	Sample type B
Description	Brownish grey slightly gravelly clayey SAND.		Specimen Depth 14.30m
			Specimen No. 1



PARTICLE SIZE	%
Clay:	9.1
Silt:	12.2
Sand:	76.6
Gravel:	2.1
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA

Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	100
		10	100
		6.3	100
125.0	100	5	100
90.0	100	3.35	99
75.0	100	2	98
63.0	100	1.18	96
50.0	100	0.6	92
37.5	100	0.425	86
28.0	100	0.3	77
20.0	100	0.212	65
		0.15	50
		0.063	21

SEDIMENTATION DATA

Equivalent particle diameter mm	Cumulative % passing
0.020100	13
0.005970	11
0.001990	9

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:

Paul Rodgers

Print date 31/07/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH109
Project No.	TB8754		Sample Depth 1.20m
Engineer	Mott MacDonald		Sample Number 10
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Brown CLAY.		Specimen Depth 1.20m
			Specimen Number 2

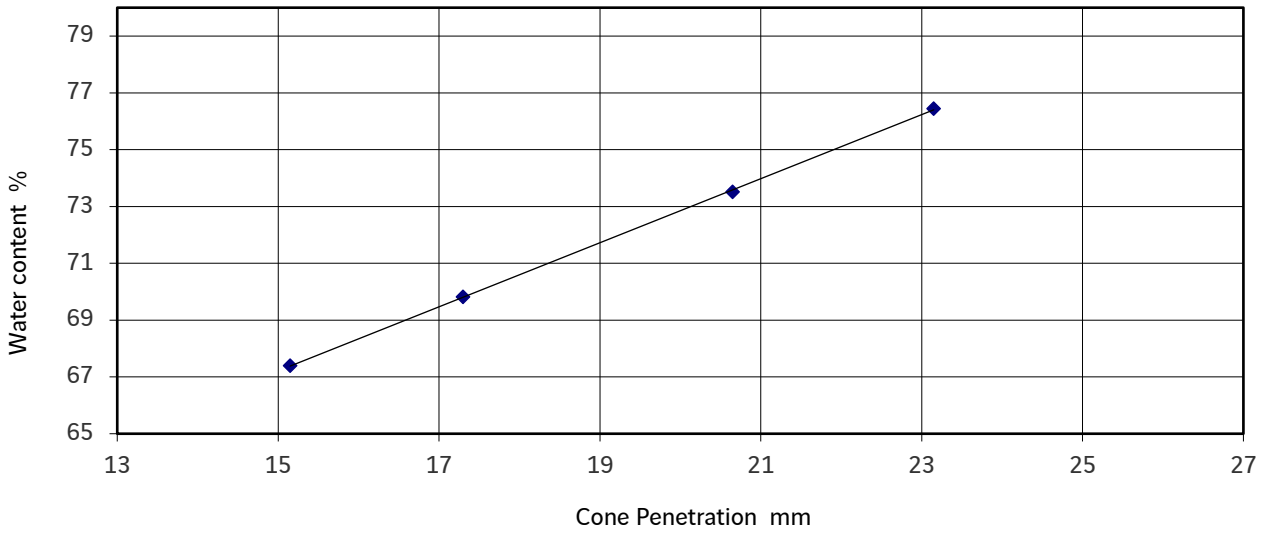
Water content	42.1	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

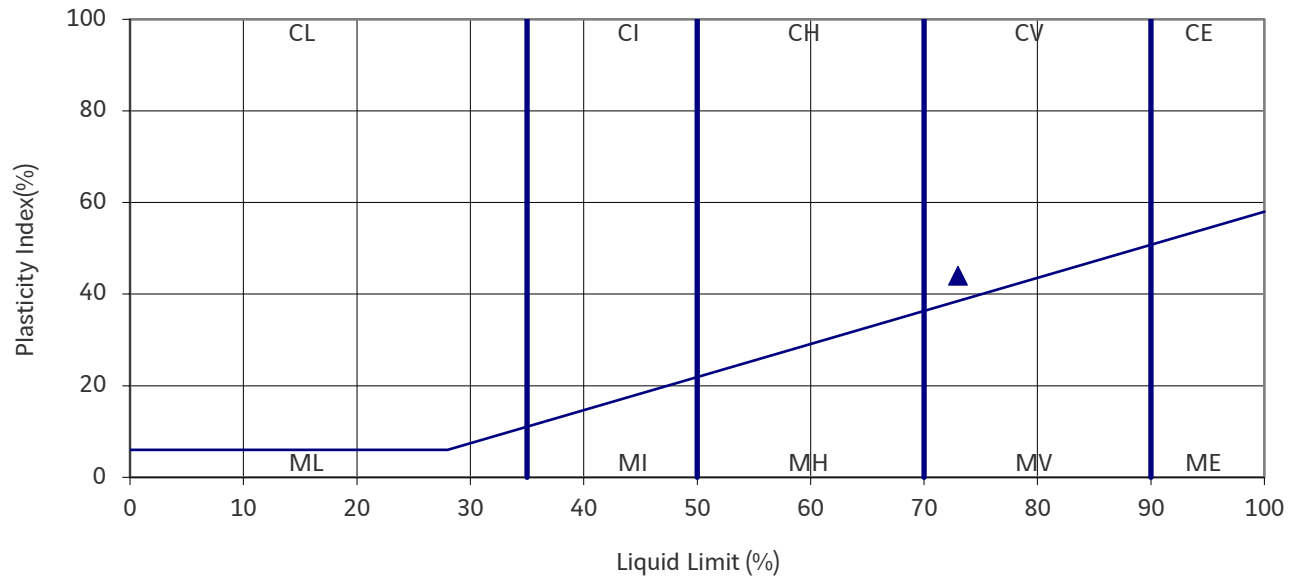
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 23/09/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH109
Project No.	TB8754		Sample Depth 1.20m
Engineer	Mott MacDonald		Sample Number 10
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Brown CLAY.		Specimen Depth 1.20m
			Specimen Number 1



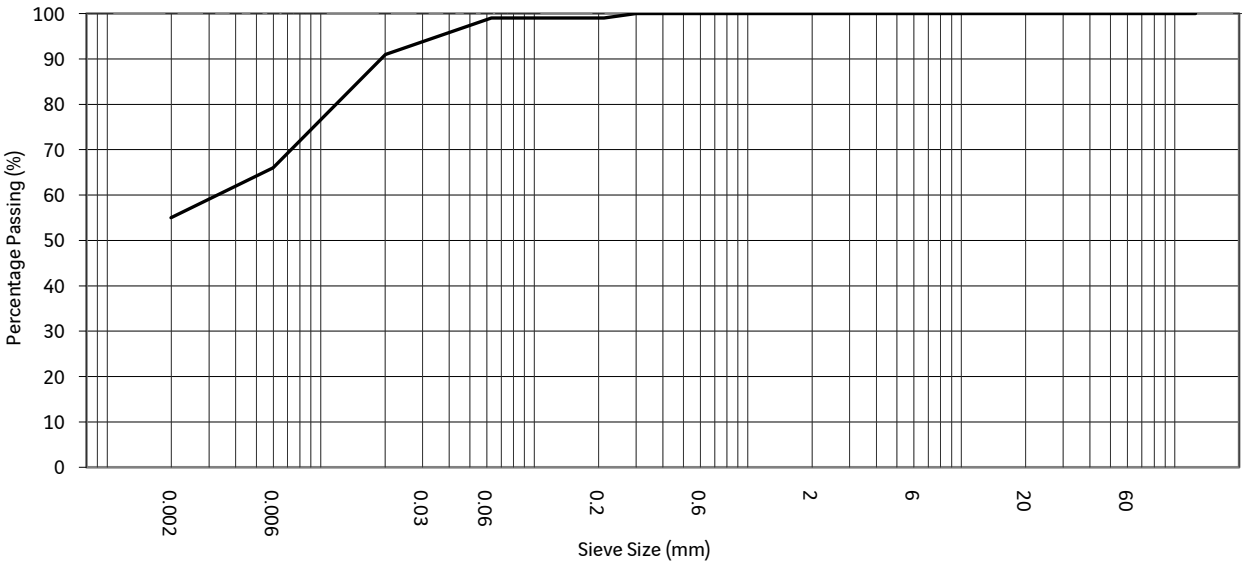
As received water content:	42.1%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	73%	Preparation of sample: Natural	
Plastic limit:	29%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	44%		
Water content of soil passing 425µm	42.1%		
Liquidity index:	0.298		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 01/10/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH109
Project No.	TB8754		Sample Depth 2.20m
Engineer	Mott MacDonald		Sample Number 15
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type B
Description	Brown CLAY.		Specimen Depth 2.20m
			Specimen No. 1



PARTICLE SIZE	%
Clay:	54.6
Silt:	44.2
Sand:	1.2
Gravel:	0.0
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA

Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	100
		10	100
		6.3	100
125.0	100	5	100
90.0	100	3.35	100
75.0	100	2	100
63.0	100	1.18	100
50.0	100	0.6	100
37.5	100	0.425	100
28.0	100	0.3	100
20.0	100	0.212	99
		0.15	99
		0.063	99

SEDIMENTATION DATA

Equivalent particle diameter mm	Cumulative % passing
0.020100	91
0.005980	66
0.001990	55

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:

Paul Rodgers

Print date 31/07/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH109
Project No.	TB8754		Sample Depth 3.00m
Engineer	Mott MacDonald		Sample Number 17
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 3.44m
			Specimen Number 2

Water content	69.6	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

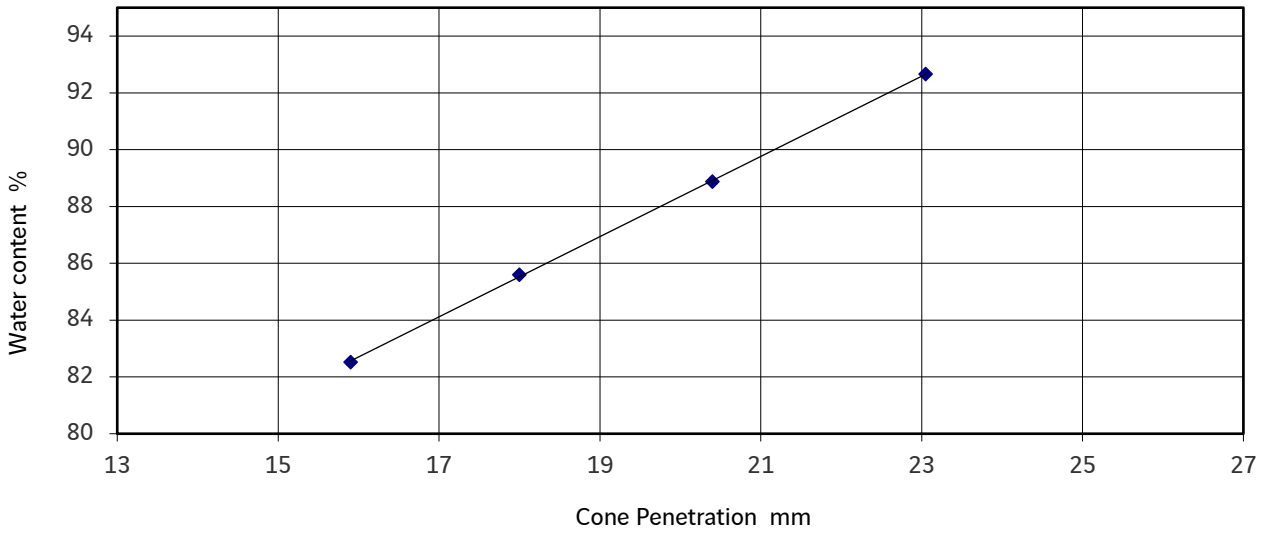
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

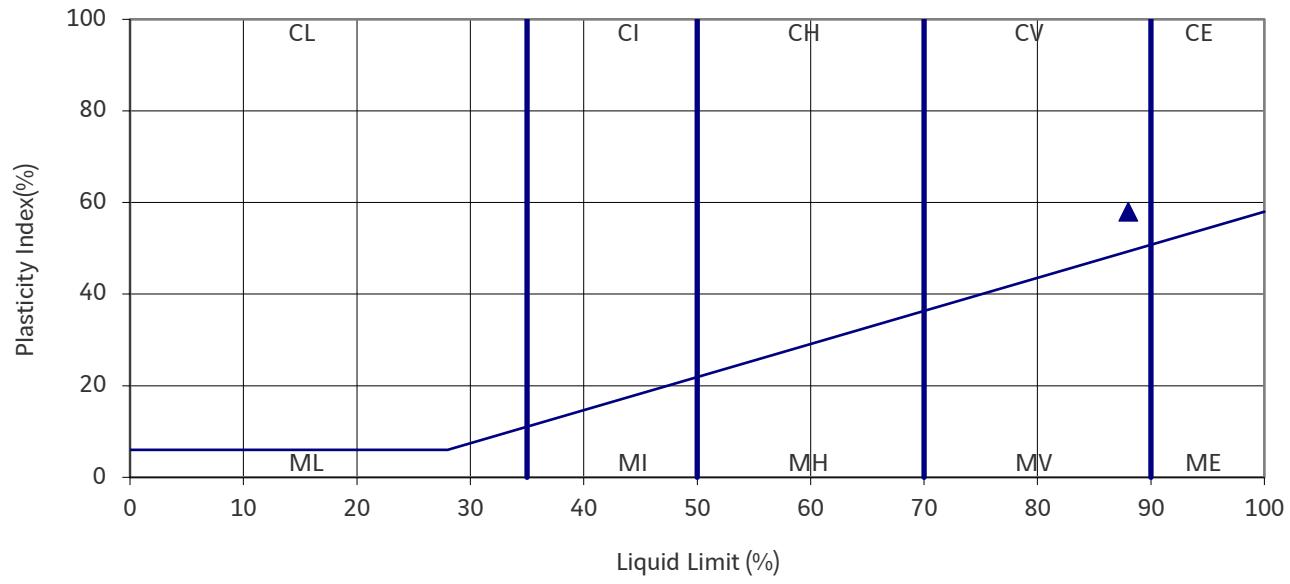
Approved by:	Leeds Laboratory		
Steve Harper		Print date 21/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024	

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH109
Project No.	TB8754		Sample Depth 3.00m
Engineer	Mott MacDonald		Sample Number 17
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 3.44m
			Specimen Number 1



As received water content:	69.6%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	88%	Preparation of sample: Natural	
Plastic limit:	30%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	58%		
Water content of soil passing 425µm	69.6%		
Liquidity index:	0.683		

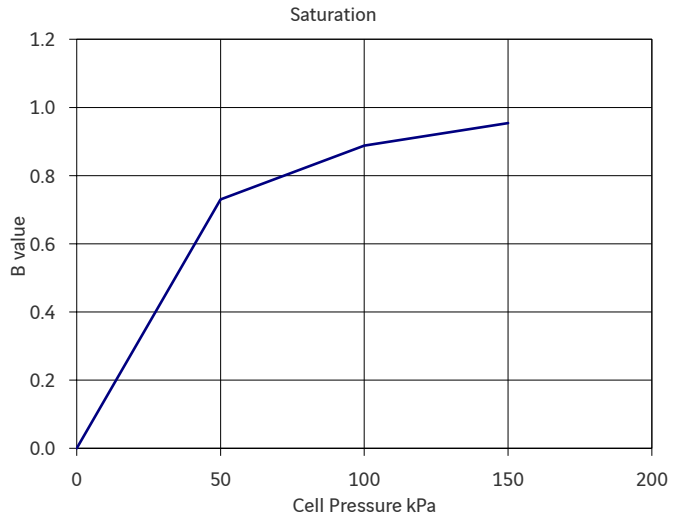


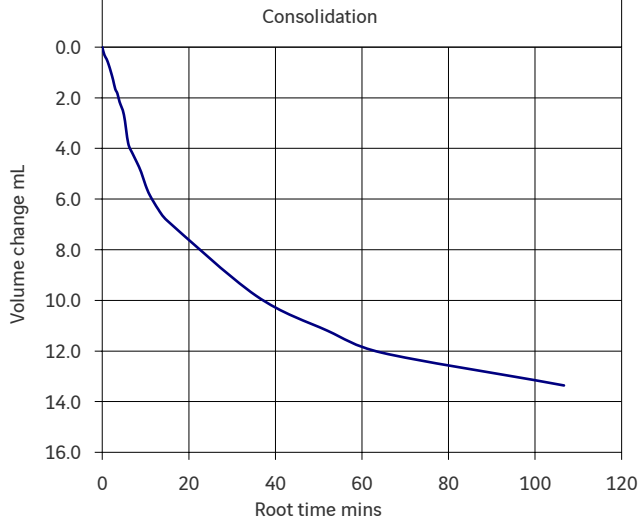
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 21/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH109
Project No.	TB8754		Sample Depth 3.00m
Engineer	Mott MacDonald		Sample Number 17
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with decomposed organic material.		Specimen Depth 3.54m
			Specimen Number 4

SPECIMEN INITIAL DIMENSIONS		
Test number		1
Specimen diameter	mm	100.77
Specimen length	mm	196.37
Density	Mg/m^3	1.57
Moisture content	%	67
Dry density	Mg/m^3	0.94
SATURATION STAGE		
Initial pore water pressure	kPa	-0.8
Saturated pore water pressure	kPa	137.4
Final cell pressure	kPa	150
B value		0.954
CONSOLIDATION STAGE		
Cell pressure	kPa	325
Back pressure	kPa	300
Effective consolidation pressure	kPa	25
Initial pore water pressure	kPa	307.7
Final pore water pressure	kPa	300.3
Pore pressure dissipation	%	96.1
c_{vi}	$m^2/year$	0.27
m_{vi}	m^2/MN	1.15
SPECIMEN AFTER CONSOLIDATION		
Density	Mg/m^3	1.59
Moisture content	%	65
Dry density	Mg/m^3	0.96



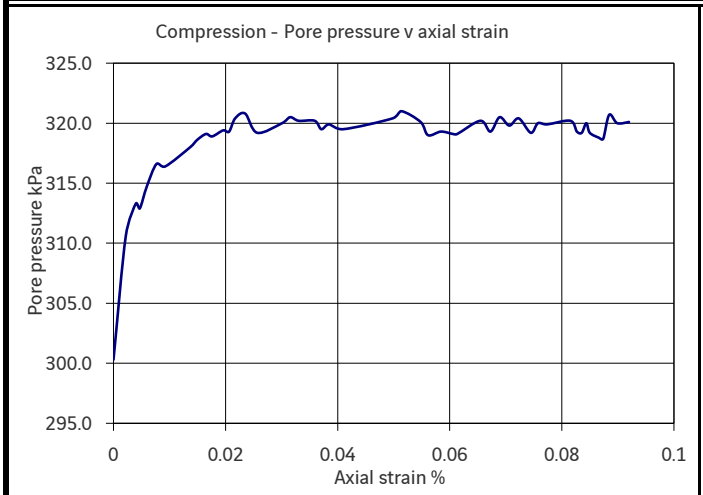


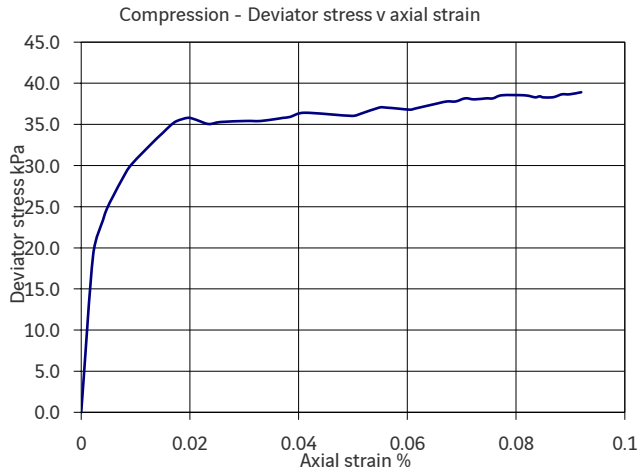
Remarks:
Specimen orientation Vertical
Specimen condition for test UNDISTURBED
Saturation with 50kPa increments with a differential pressure of 10kPa
Drainage from both ends and using a radial filter drain

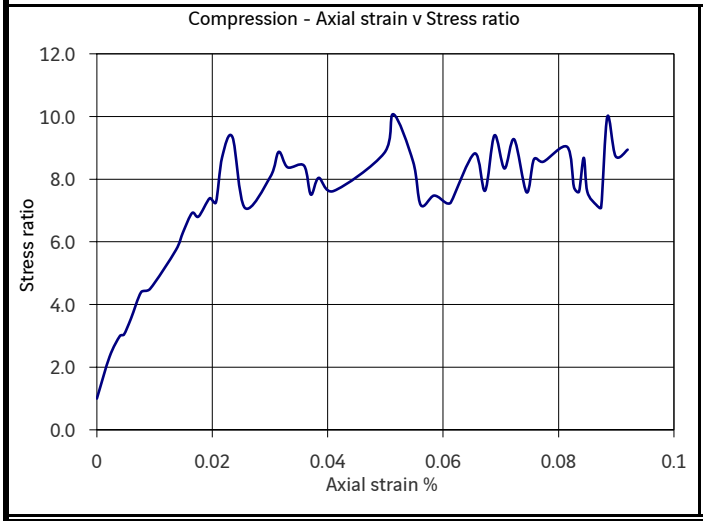
Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 23/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

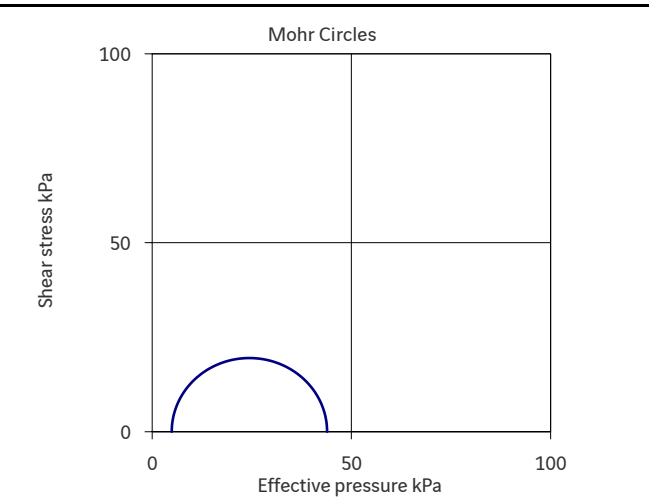
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH109
Project No.	TB8754		Sample Depth 3.00m
Engineer	Mott MacDonald		Sample Number 17
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with decomposed organic material.		Specimen Depth 3.54m
			Specimen Number 4

COMPRESSION STAGE			
Test number			1
Cell pressure		kPa	325
Initial pore water pressure		kPa	300
Effective confining pressure		kPa	25
Failure conditions at			Maximum deviator stress
Axial strain at failure		%	0.1
Maximum deviator stress	σ_1-σ_3	kPa	39
Pore water pressure at failure	σ	kPa	320
Effective major principal stress	σ_1'	kPa	43.81
Effective minor principal stress	σ_3'	kPa	4.90
Effective principal stress ratio			8.94
Membrane correction		kPa	0.02
Filter drain correction		kPa	0.0
Pore pressure coefficient			0.5









Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 23/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

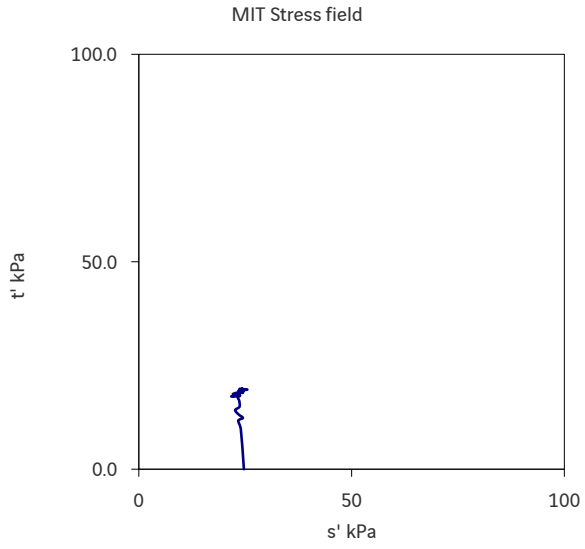
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH109
Project No.	TB8754		Sample Depth 3.00m
Engineer	Mott MacDonald		Sample Number 17
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with decomposed organic material.		Specimen Depth 3.54m
			Specimen Number 4

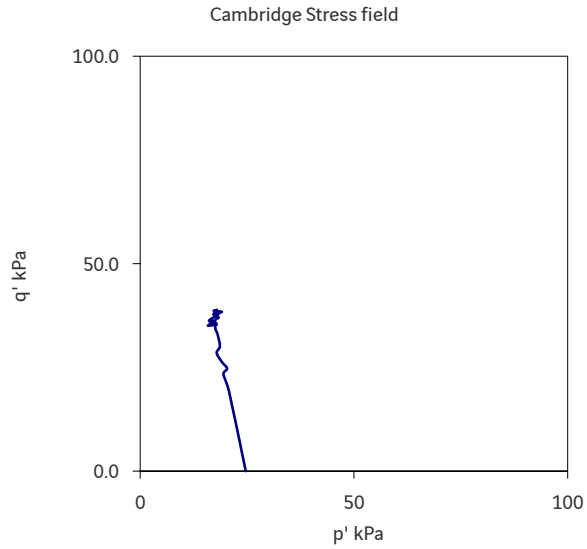
SPECIMEN AFTER TEST

Test number		1	
Mode of failure		Compound 	
Final moisture content	%	65	
Final bulk density	Mg/m^3	1.59	
Final dry density	Mg/m^3	0.96	

ADDITIONAL SPECIMEN DETAILS

Rate of strain	%/hour	0.20	
Failure criterion		Maximum deviator stress	

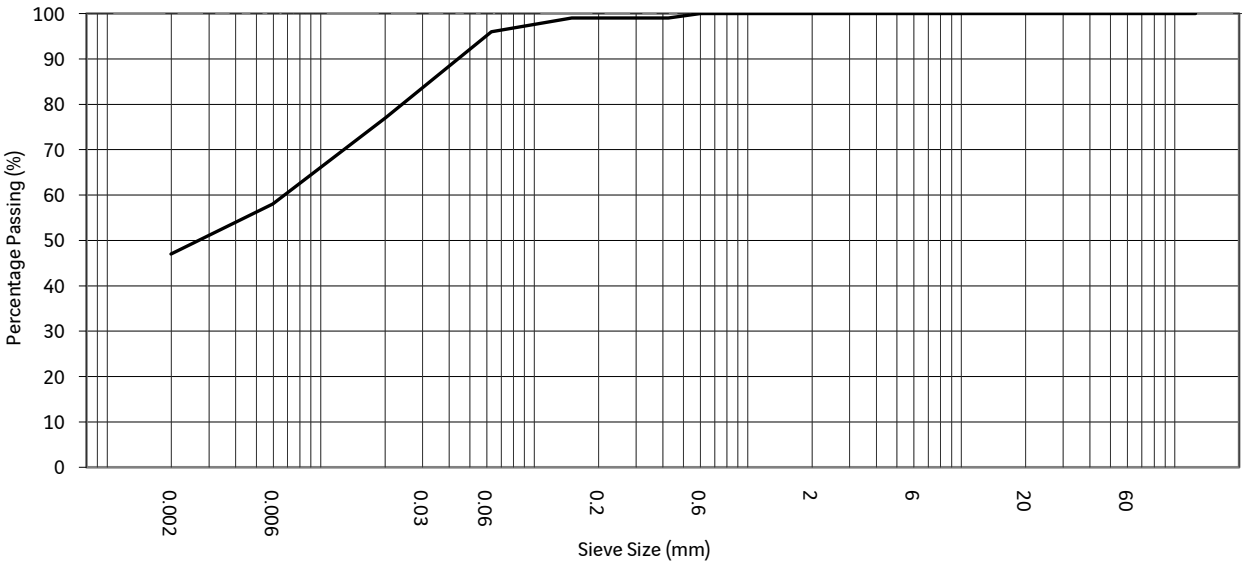




REMARKS

Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 23/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH109
Project No.	TB8754		Sample Depth 4.00m
Engineer	Mott MacDonald		Sample Number 19
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type B
Description	Greenish grey CLAY.		Specimen Depth 4.00m
			Specimen No. 1



PARTICLE SIZE	%
Clay:	47.1
Silt:	48.7
Sand:	3.9
Gravel:	0.3
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA

Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	100
		10	100
		6.3	100
125.0	100	5	100
90.0	100	3.35	100
75.0	100	2	100
63.0	100	1.18	100
50.0	100	0.6	100
37.5	100	0.425	99
28.0	100	0.3	99
20.0	100	0.212	99
		0.15	99
		0.063	96

SEDIMENTATION DATA

Equivalent particle diameter mm	Cumulative % passing
0.020100	77
0.005970	58
0.001990	47

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:			
Paul Rodgers		Print date 31/07/2025	SOIL ENGINEERING
	Revision No. 3.07	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH109
Project No.	TB8754		Sample Depth 4.00m
Engineer	Mott MacDonald		Sample Number 18
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Brown CLAY.		Specimen Depth 4.00m
			Specimen Number 2

Water content	76.4	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 05/09/2025	
	Revision No. 1.01	Issue Date 01/05/2024	

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH109
Project No.	TB8754		Sample Depth 5.00m
Engineer	Mott MacDonald		Sample Number 20
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 5.44m
			Specimen Number 2

Water content	75.2	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

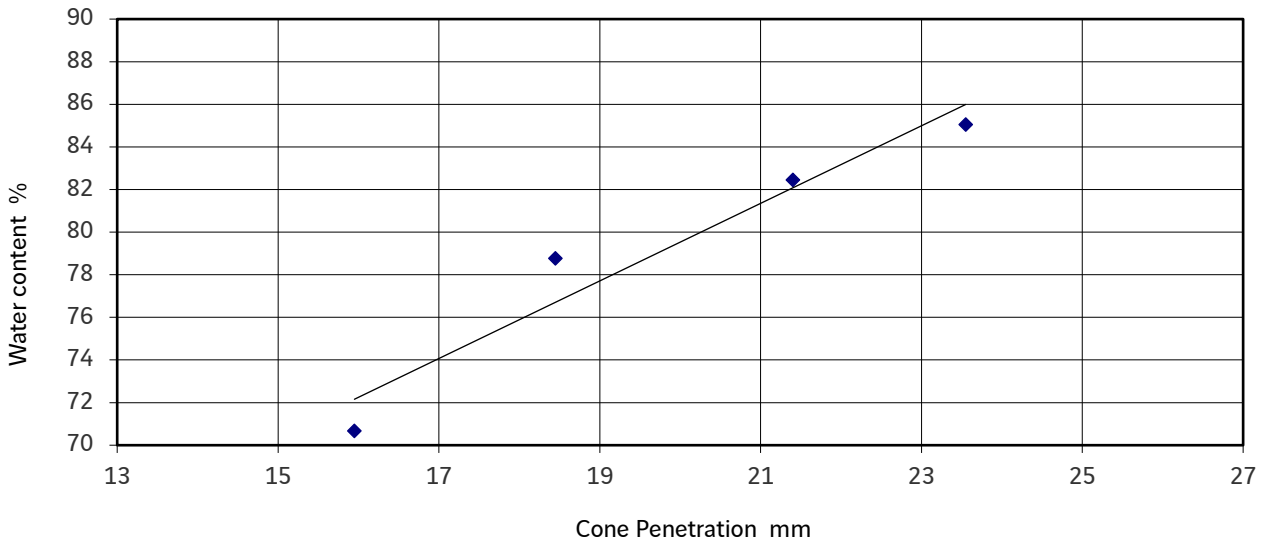
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

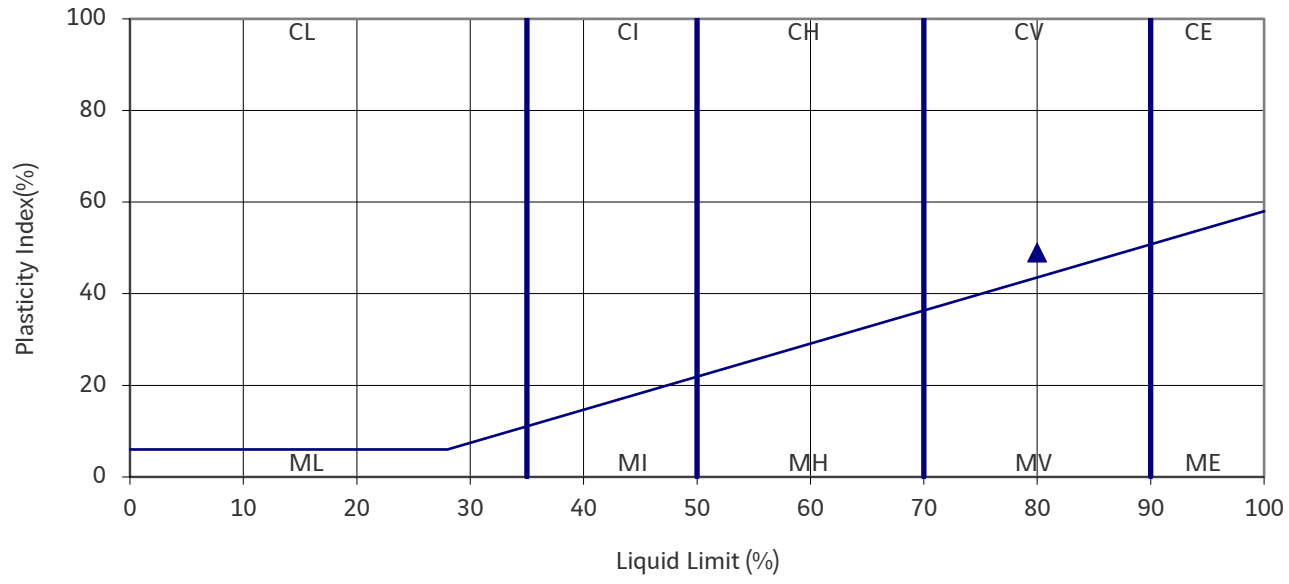
Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 22/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024	

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH109
Project No.	TB8754		Sample Depth 5.00m
Engineer	Mott MacDonald		Sample Number 20
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 5.44m
			Specimen Number 1



As received water content:	75.2%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	80%	Preparation of sample: Natural	
Plastic limit:	31%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	49%		
Water content of soil passing 425µm	75.2%		
Liquidity index:	0.901		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 24/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

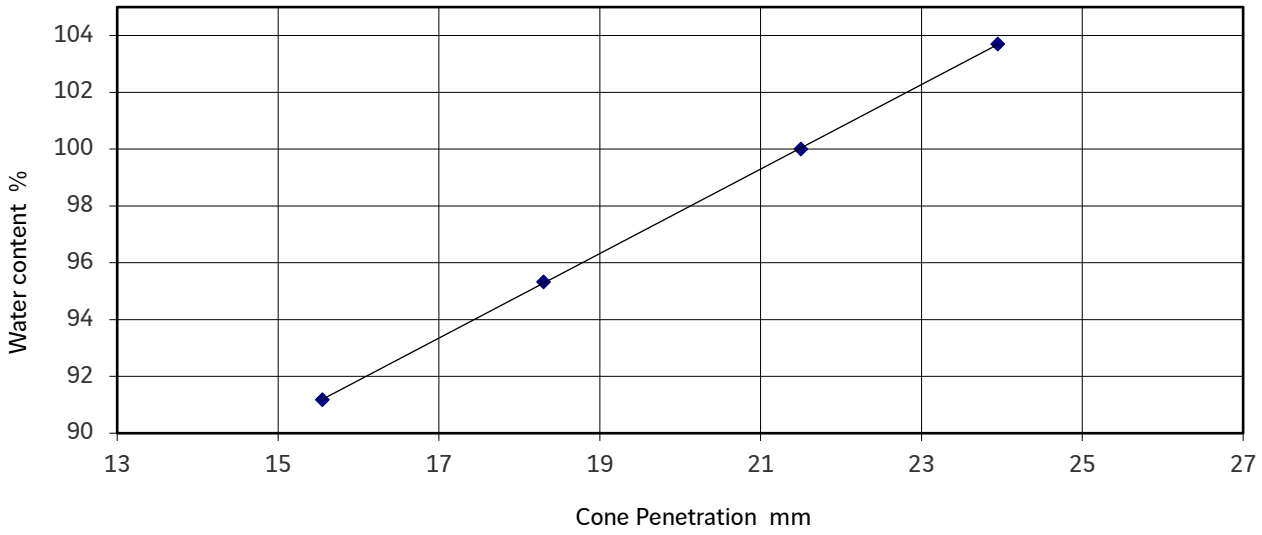
Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH109
Project No.	TB8754		Sample Depth 6.00m
Engineer	Mott MacDonald		Sample Number 21
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey slightly organic CLAY.		Specimen Depth 6.00m
			Specimen Number 2

Water content	84.6	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

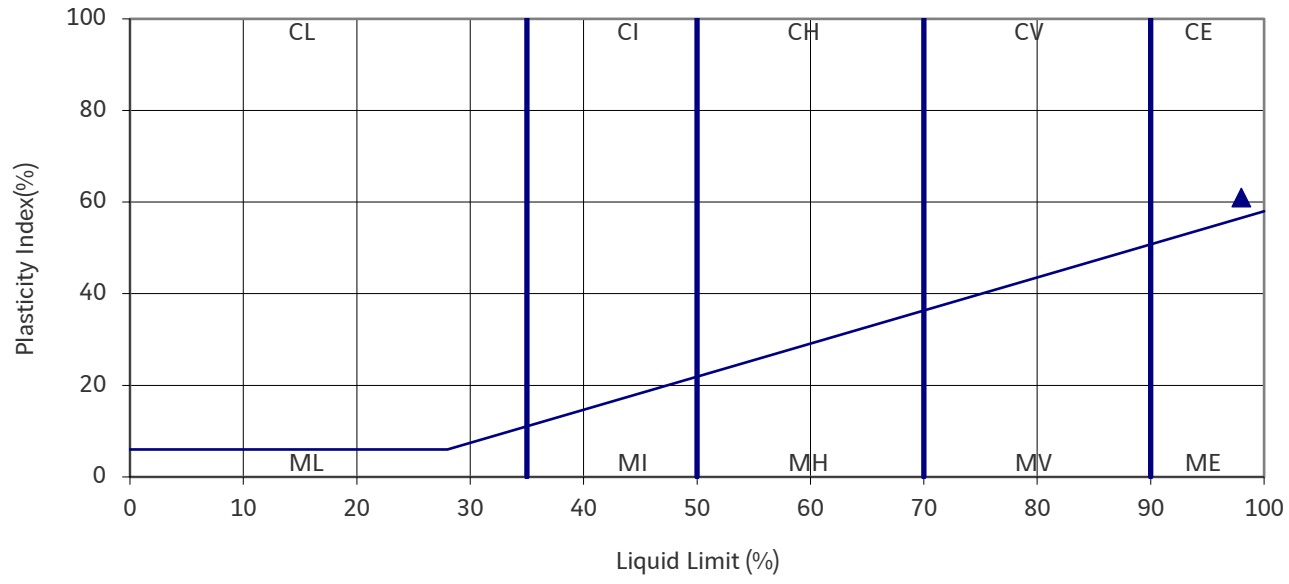
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH109
Project No.	TB8754		Sample Depth 6.00m
Engineer	Mott MacDonald		Sample Number 21
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey slightly organic CLAY.		Specimen Depth 6.00m
			Specimen Number 1



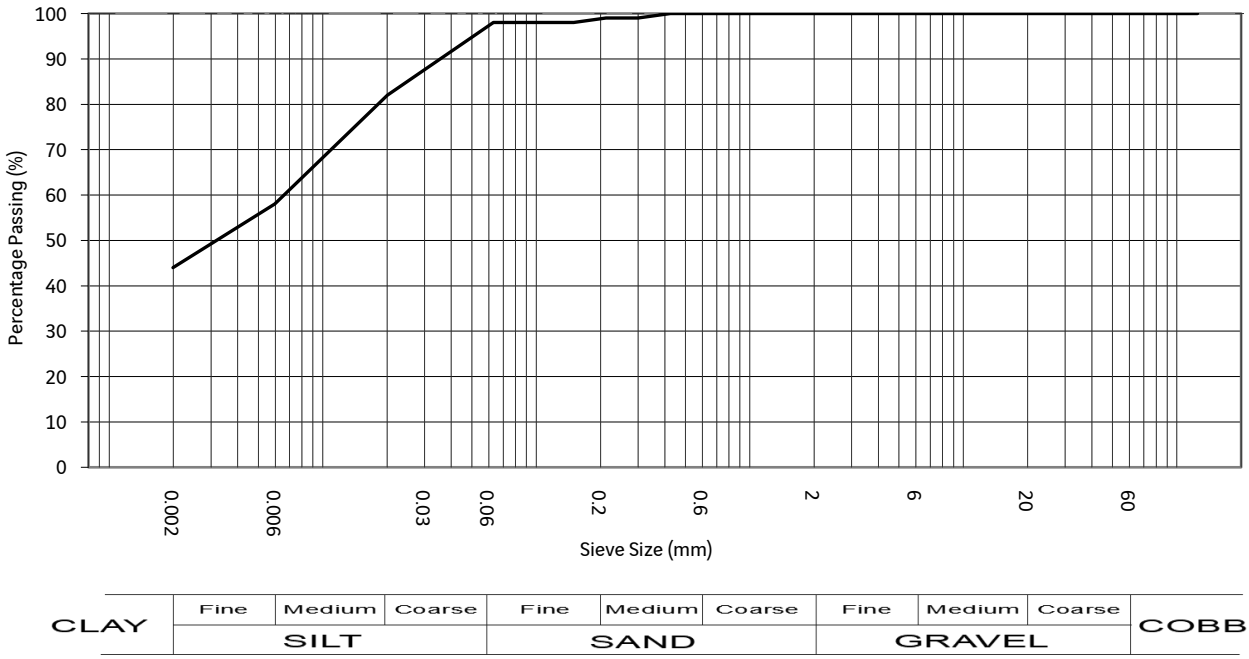
As received water content:	84.6%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	98%	Preparation of sample: Natural	
Plastic limit:	37%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	61%		
Water content of soil passing 425µm	84.6%		
Liquidity index:	0.780		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 04/09/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH109
Project No.	TB8754		Sample Depth 6.00m
Engineer	Mott MacDonald		Sample Number 22
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type P
Description	Grey CLAY.		Specimen Depth 6.30m
			Specimen No. 1



PARTICLE SIZE	%
Clay:	44.5
Silt:	53.0
Sand:	2.5
Gravel:	0.0
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA

Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	100
		10	100
		6.3	100
125.0	100	5	100
90.0	100	3.35	100
75.0	100	2	100
63.0	100	1.18	100
50.0	100	0.6	100
37.5	100	0.425	100
28.0	100	0.3	99
20.0	100	0.212	99
		0.15	98
		0.063	98

SEDIMENTATION DATA

Equivalent particle diameter mm	Cumulative % passing
0.020100	82
0.005970	58
0.001990	44

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:

Paul Rodgers

Print date 22/07/2025

SOIL ENGINEERING

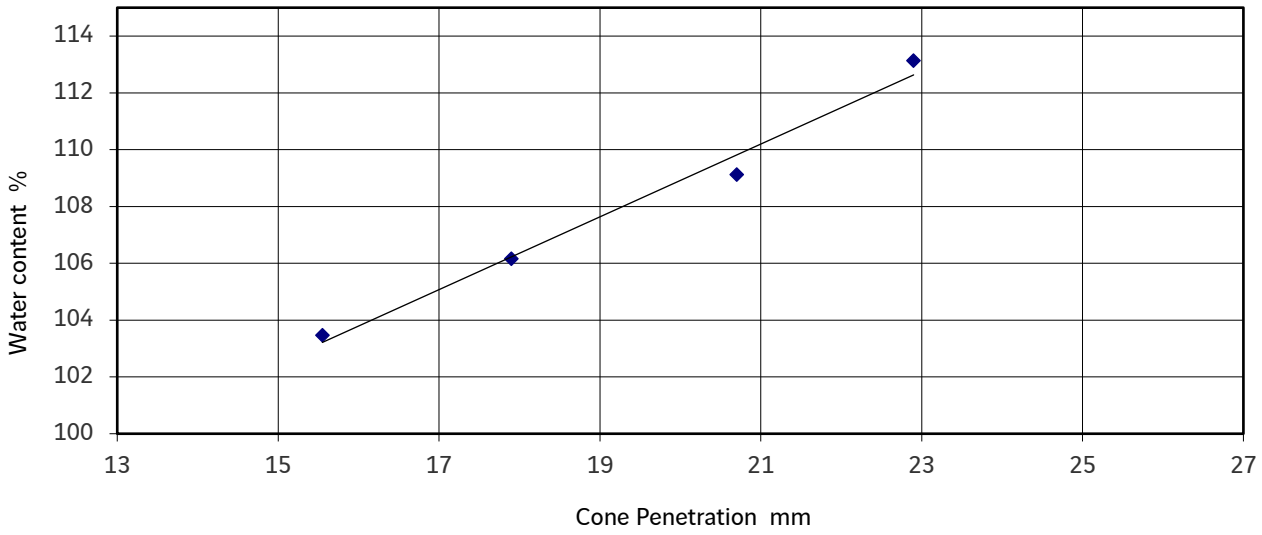
Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH109
Project No.	TB8754		Sample Depth 7.00m
Engineer	Mott MacDonald		Sample Number 23
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Brown CLAY.		Specimen Depth 7.00m
			Specimen Number 2

Water content	92.5	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

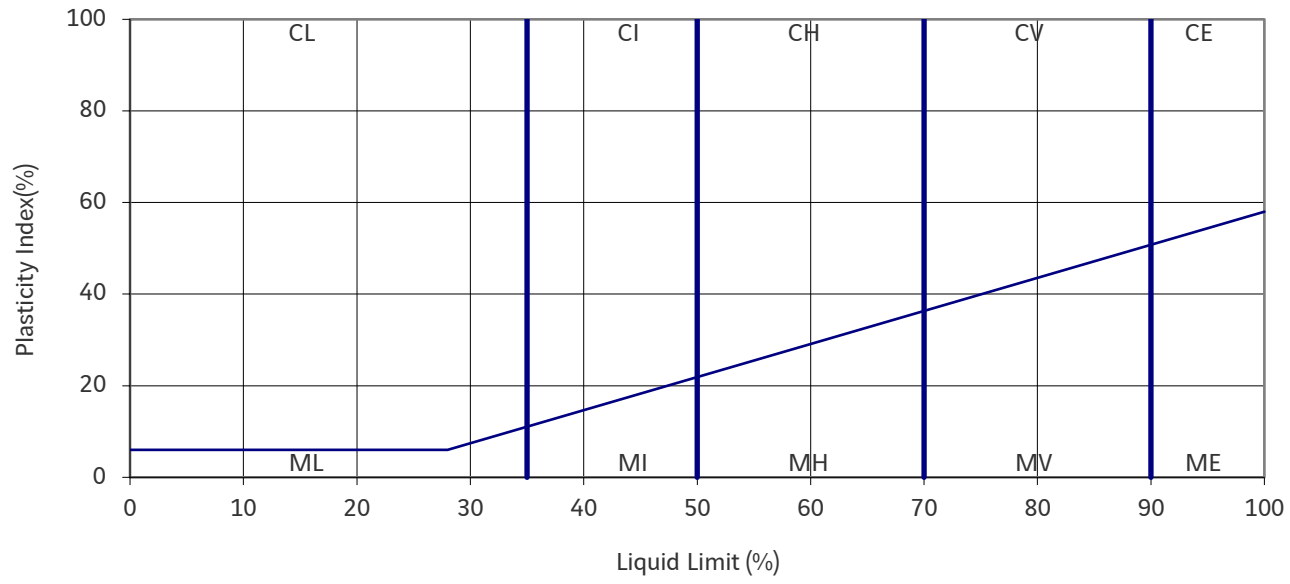
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH109
Project No.	TB8754		Sample Depth 7.00m
Engineer	Mott MacDonald		Sample Number 23
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Brown CLAY.		Specimen Depth 7.00m
			Specimen Number 1



As received water content:	92.5%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	110%	Preparation of sample: Natural	
Plastic limit:	39%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	71%		
Water content of soil passing 425µm	92.5%		
Liquidity index:	0.753		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 01/10/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH109
Project No.	TB8754		Sample Depth 7.70m
Engineer	Mott MacDonald		Sample Number 25
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Dark brown PEAT.		Specimen Depth 7.70m
			Specimen Number 1

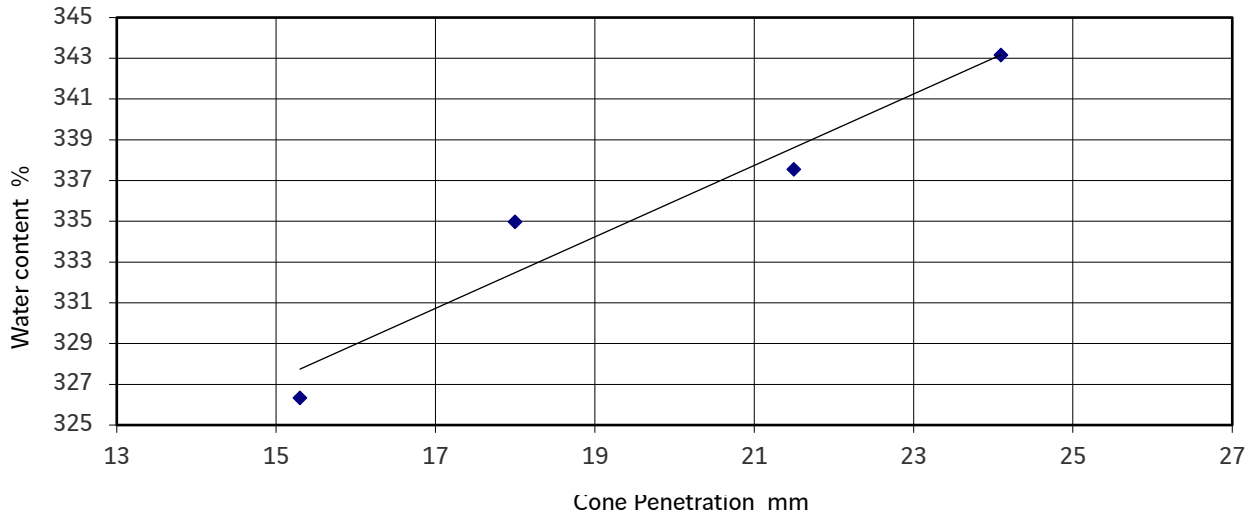
Water content	203	%
Oven temperature	50	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

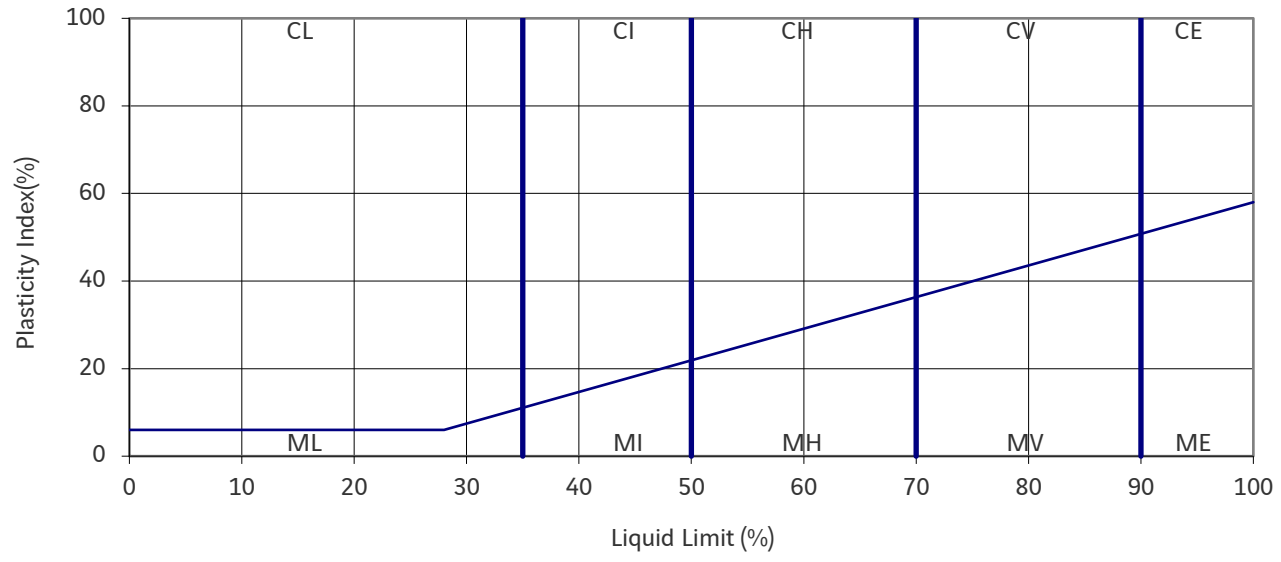
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		SOIL ENGINEERING
Steve Harper		Print date 27/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH109
Project No.	TB8754		Sample Depth 7.70m
Engineer	Mott MacDonald		Sample Number 25
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Dark brown PEAT.		Specimen Depth 7.70m
			Specimen Number 3



As received water content:	203%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	340%	Preparation of sample: Natural	
Plastic limit:	240%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	100%		
Water content of soil passing 425µm	203%		
Liquidity index:	-0.370		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 27/07/2025	
	Revision No. 3.00	Issue Date 19/05/2022	

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH109
Project No.	TB8754		Sample Depth 8.00m
Engineer	Mott MacDonald		Sample Number 27
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 8.24m
			Specimen Number 2

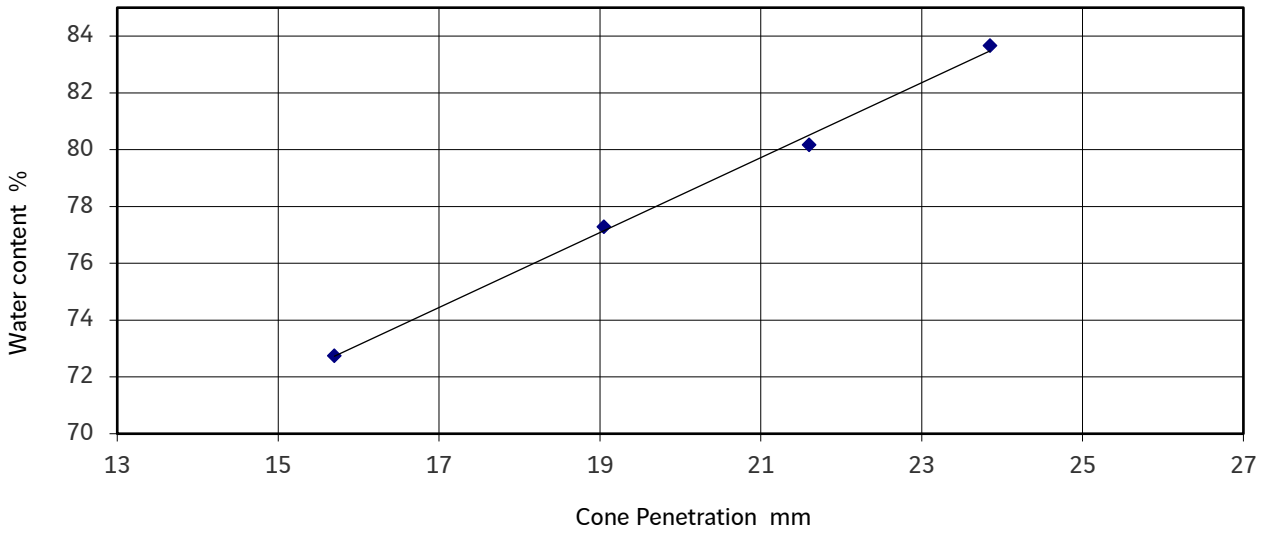
Water content	67.2	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

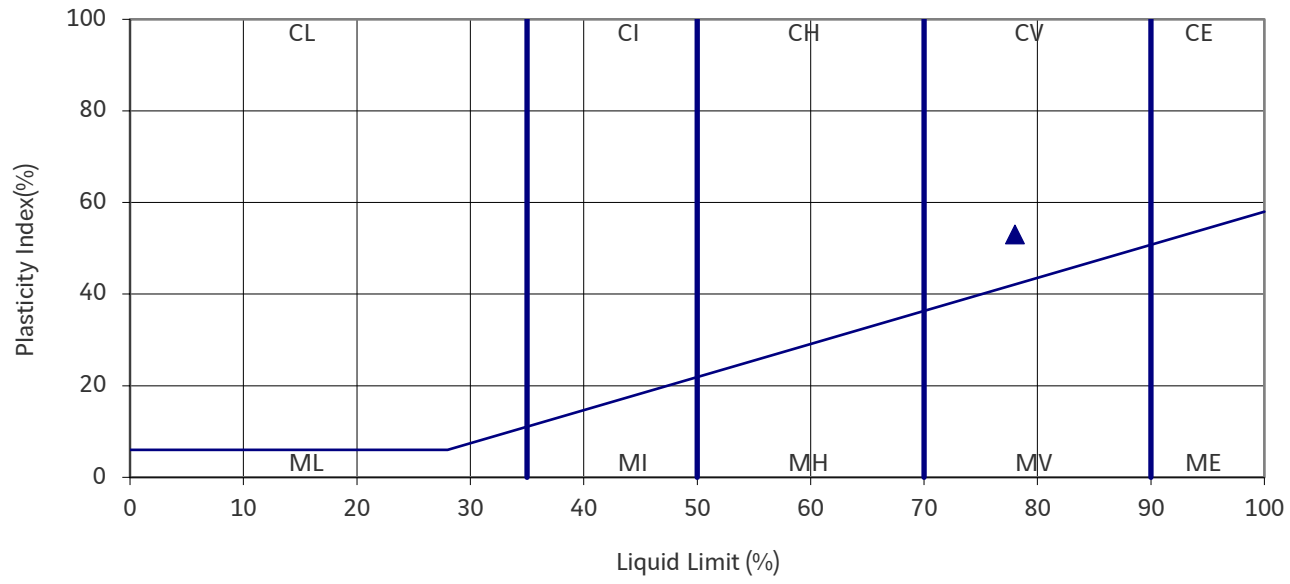
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Steve Harper			Print date 21/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH109
Project No.	TB8754		Sample Depth 8.00m
Engineer	Mott MacDonald		Sample Number 27
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 8.24m
			Specimen Number 1



As received water content:	67.2%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	78%	Preparation of sample: Natural	
Plastic limit:	25%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	53%		
Water content of soil passing 425µm	67.2%		
Liquidity index:	0.797		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 21/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH109
Project No.	TB8754		Sample Depth 9.00m
Engineer	Mott MacDonald		Sample Number 29
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey SILT with decomposed plant remains.		Specimen Depth 9.45m
			Specimen Number 3

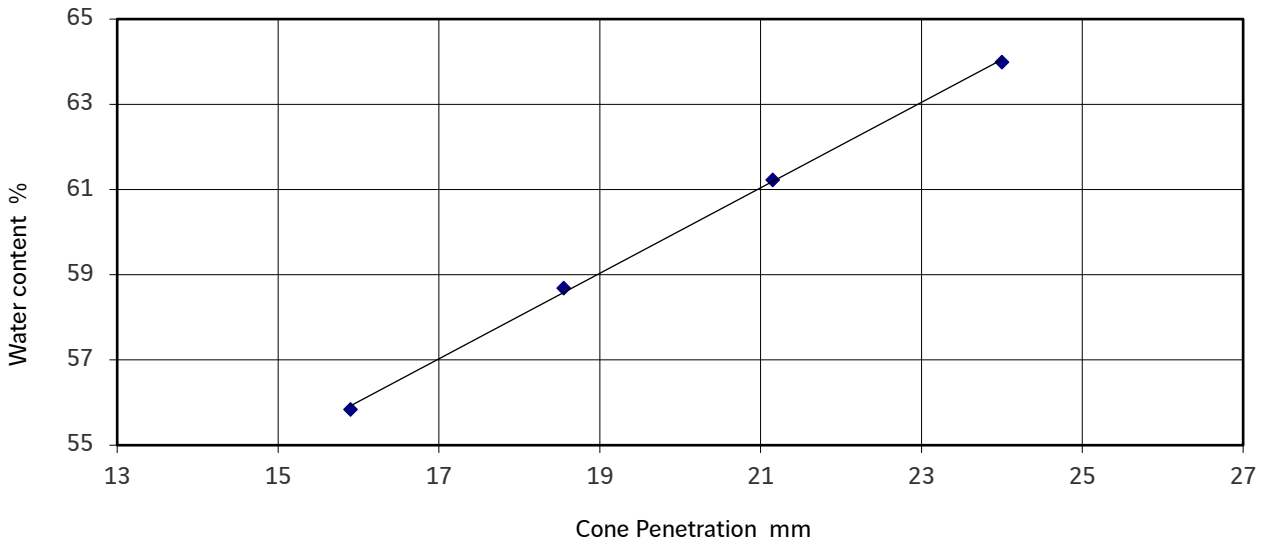
Water content	51.6	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

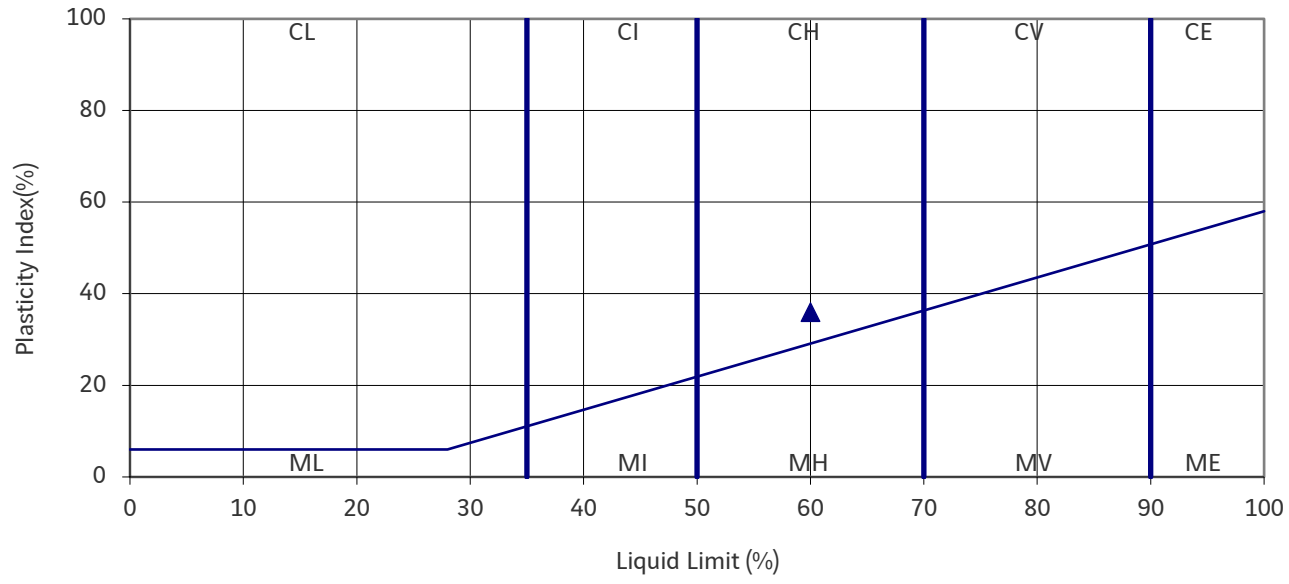
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 03/09/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH109
Project No.	TB8754		Sample Depth 9.00m
Engineer	Mott MacDonald		Sample Number 29
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey SILT with decomposed plant remains.		Specimen Depth 9.45m
			Specimen Number 2



As received water content:	51.6%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	60%	Preparation of sample: Natural	
Plastic limit:	24%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	36%		
Water content of soil passing 425µm	51.6%		
Liquidity index:	0.767		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 04/09/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH109
Project No.	TB8754		Sample Depth 10.00m
Engineer	Mott MacDonald		Sample Number 30
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 10.00m
			Specimen Number 2

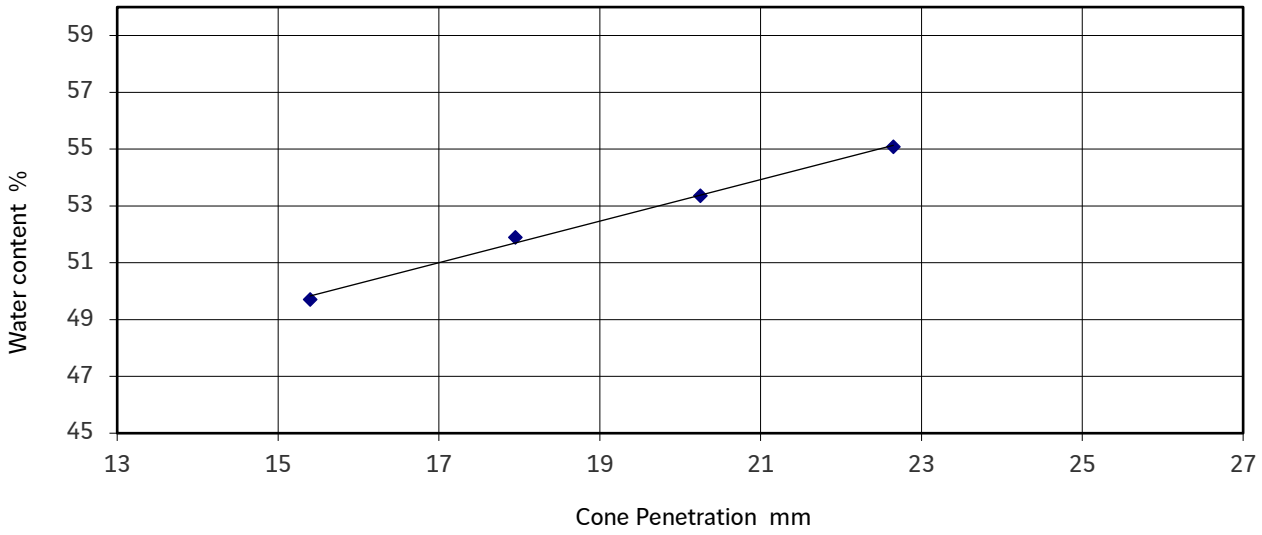
Water content	46.2	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

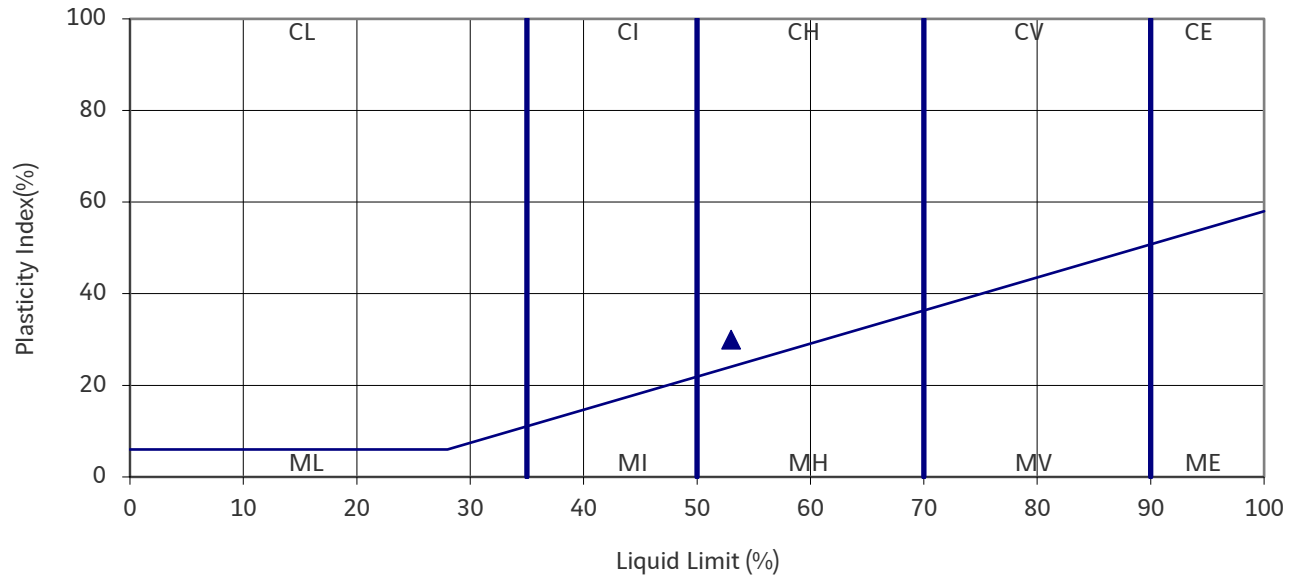
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 03/09/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH109
Project No.	TB8754		Sample Depth 10.00m
Engineer	Mott MacDonald		Sample Number 30
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 10.00m
			Specimen Number 1



As received water content:	46.2%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	53%	Preparation of sample: Natural	
Plastic limit:	23%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	30%		
Water content of soil passing 425µm	46.2%		
Liquidity index:	0.774		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 04/09/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH109
Project No.	TB8754		Sample Depth 10.00m
Engineer	Mott MacDonald		Sample Number 31
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 10.44m
			Specimen Number 2

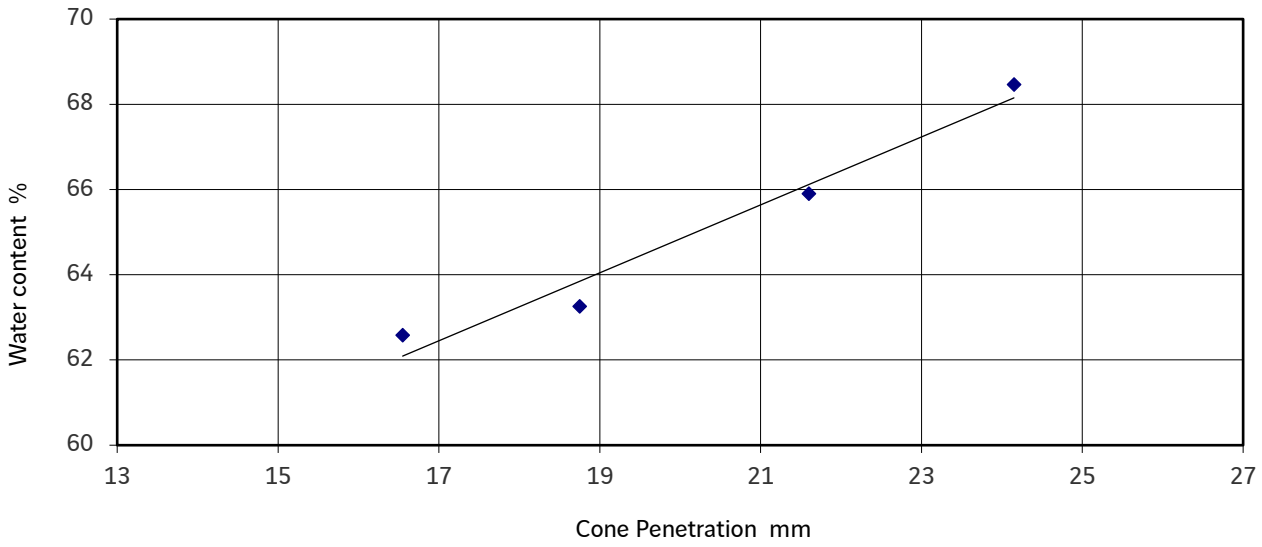
Water content	65.5	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

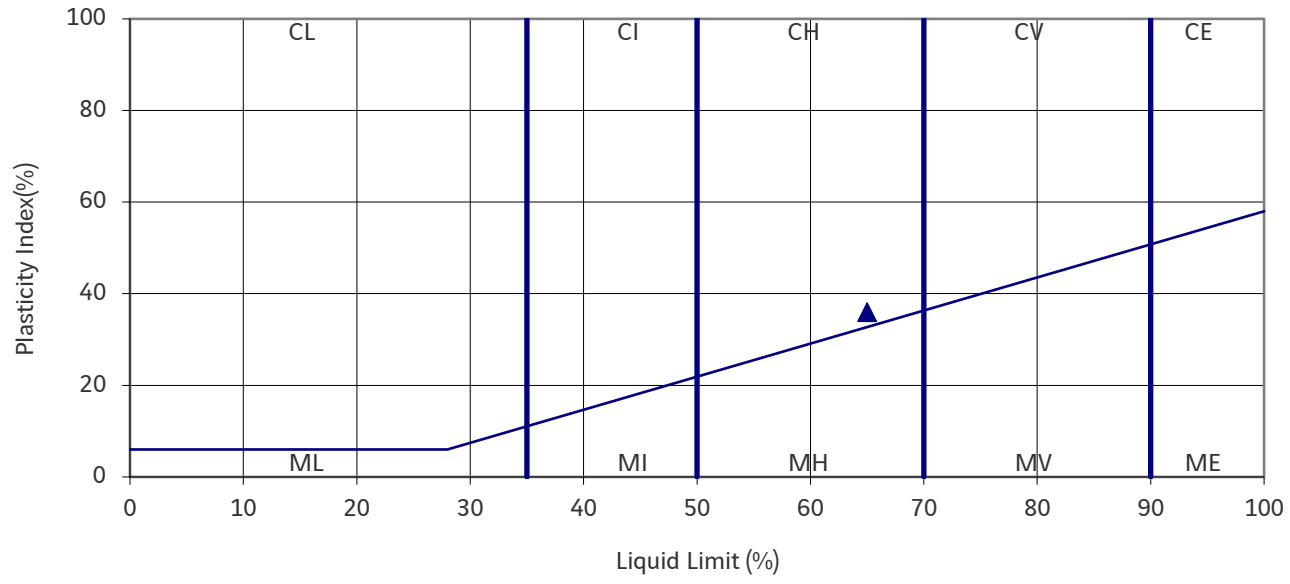
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 23/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH109
Project No.	TB8754		Sample Depth 10.00m
Engineer	Mott MacDonald		Sample Number 31
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 10.44m
			Specimen Number 1



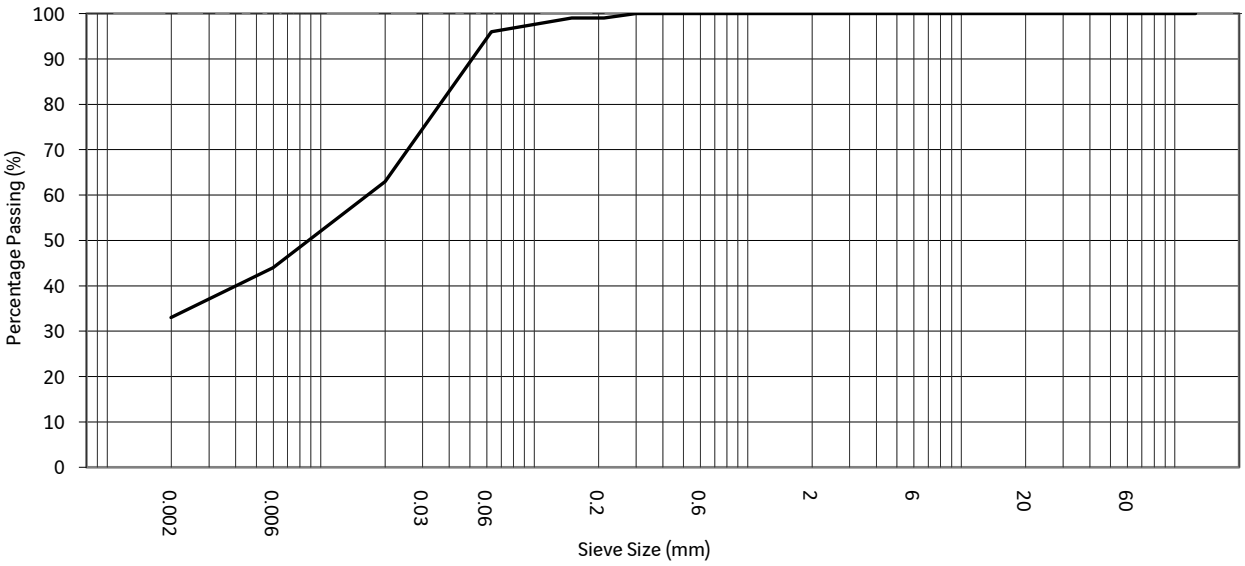
As received water content:	65.5%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	65%	Preparation of sample: Natural	
Plastic limit:	29%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	36%		
Water content of soil passing 425µm	65.5%		
Liquidity index:	1.014		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 24/07/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH109
Project No.	TB8754		Sample Depth 10.00m
Engineer	Mott MacDonald		Sample Number 31
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type P
Description	Grey CLAY.		Specimen Depth 10.48m
			Specimen No. 3



PARTICLE SIZE	%
Clay:	33.0
Silt:	63.0
Sand:	4.0
Gravel:	0.0
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA

Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	100
		10	100
		6.3	100
125.0	100	5	100
90.0	100	3.35	100
75.0	100	2	100
63.0	100	1.18	100
50.0	100	0.6	100
37.5	100	0.425	100
28.0	100	0.3	100
20.0	100	0.212	99
		0.15	99
		0.063	96

SEDIMENTATION DATA

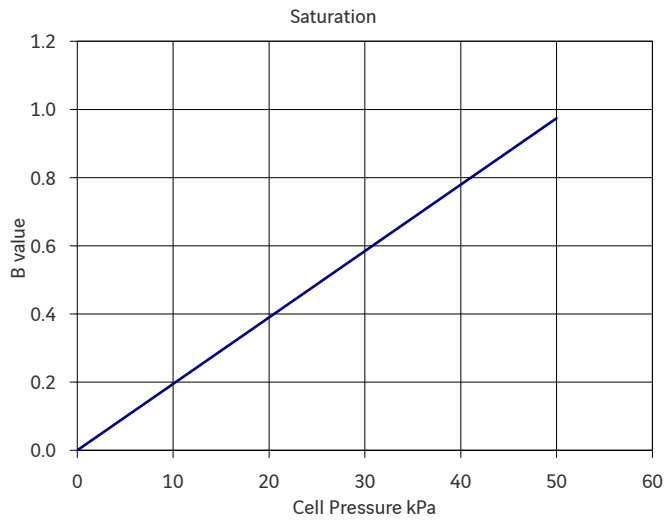
Equivalent particle diameter mm	Cumulative % passing
0.020000	63
0.005980	44
0.001990	33

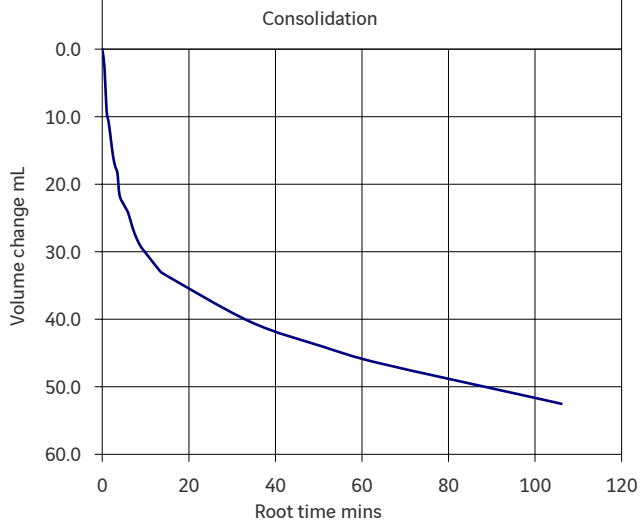
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:			
Paul Rodgers		Print date 22/07/2025	SOIL ENGINEERING
	Revision No. 3.07	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH109
Project No.	TB8754		Sample Depth 10.00m
Engineer	Mott MacDonald		Sample Number 31
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey SILT with some decomposed plant fibres.		Specimen Depth 10.62m
			Specimen Number 5

SPECIMEN INITIAL DIMENSIONS		
Test number		1
Specimen diameter	mm	100.87
Specimen length	mm	196.00
Density	Mg/m^3	1.61
Moisture content	%	66
Dry density	Mg/m^3	0.97
SATURATION STAGE		
Initial pore water pressure	kPa	-1.2
Saturated pore water pressure	kPa	47.5
Final cell pressure	kPa	50
B value		0.974
CONSOLIDATION STAGE		
Cell pressure	kPa	350
Back pressure	kPa	300
Effective consolidation pressure	kPa	50
Initial pore water pressure	kPa	339.7
Final pore water pressure	kPa	302
Pore pressure dissipation	%	95.0
c_{vi}	$m^2/year$	0.43
m_{vi}	m^2/MN	0.89
SPECIMEN AFTER CONSOLIDATION		
Density	Mg/m^3	1.63
Moisture content	%	64
Dry density	Mg/m^3	0.99



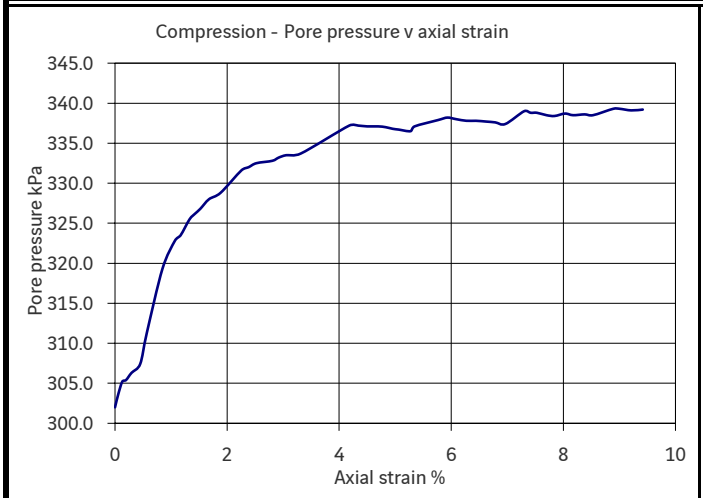


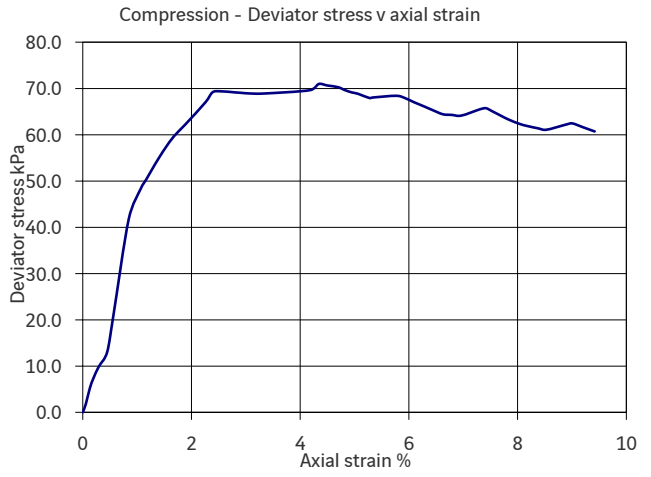
Remarks: Specimen orientation Vertical
Specimen condition for test UNDISTURBED
Saturation with 50kPa increments with a differential pressure of 10kPa
Drainage from both ends and using a radial filter drain

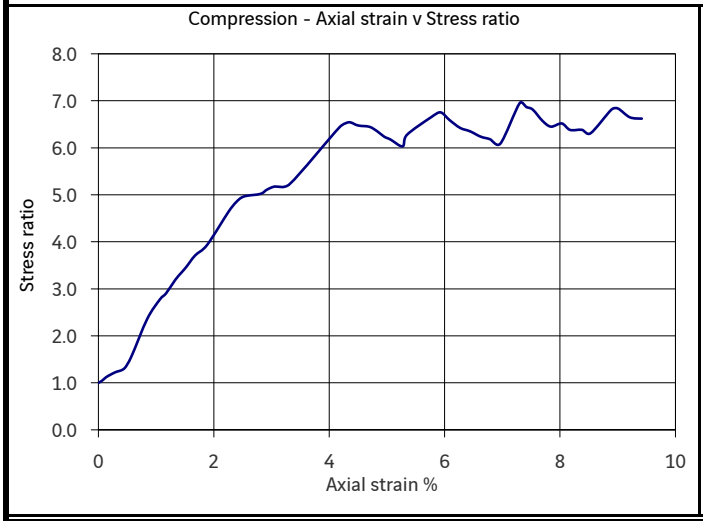
Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 23/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

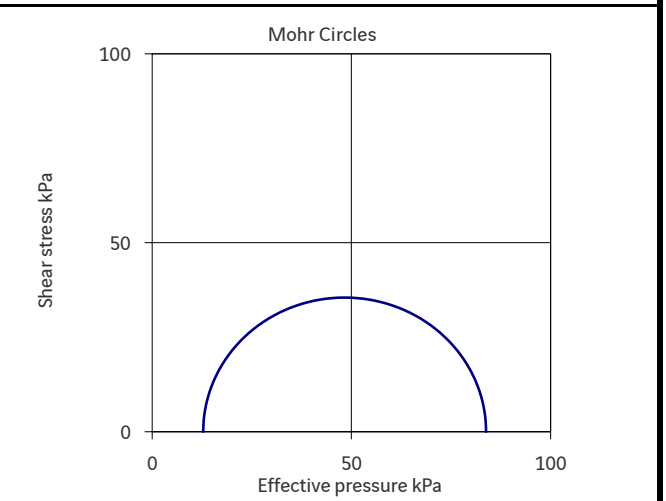
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH109
Project No.	TB8754		Sample Depth 10.00m
Engineer	Mott MacDonald		Sample Number 31
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey SILT with some decomposed plant fibres.		Specimen Depth 10.62m
			Specimen Number 5

COMPRESSION STAGE				
Test number			1	
Cell pressure		kPa	350	
Initial pore water pressure		kPa	302	
Effective confining pressure		kPa	48	
Failure conditions at			Maximum deviator stress	
Axial strain at failure		%	4.3	
Maximum deviator stress	σ_1-σ_3	kPa	71	
Pore water pressure at failure	σ	kPa	337	
Effective major principal stress	σ_1'	kPa	83.76	
Effective minor principal stress	σ_3'	kPa	12.80	
Effective principal stress ratio			6.54	
Membrane correction		kPa	0.54	
Filter drain correction		kPa	3.5	
Pore pressure coefficient			0.5	









Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 23/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

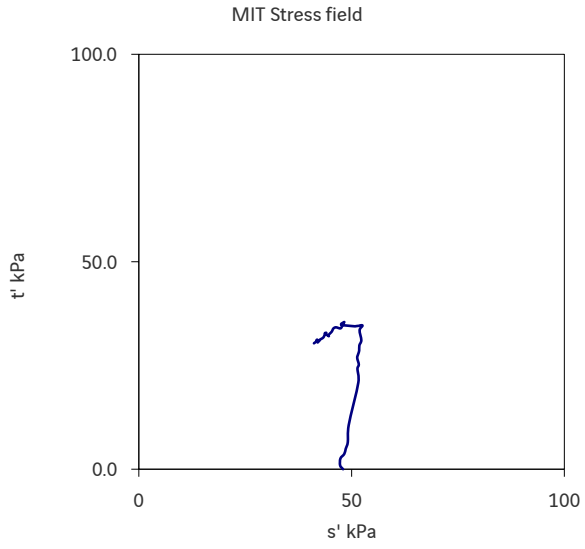
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH109
Project No.	TB8754		Sample Depth 10.00m
Engineer	Mott MacDonald		Sample Number 31
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey SILT with some decomposed plant fibres.		Specimen Depth 10.62m
			Specimen Number 5

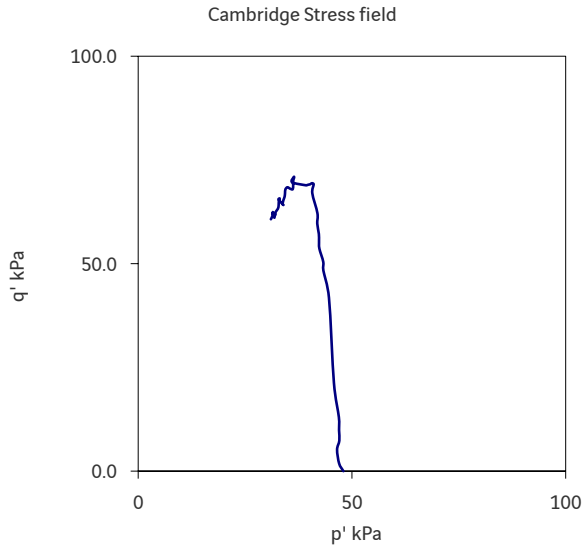
SPECIMEN AFTER TEST

Test number		1	
Mode of failure		Plastic 	
Final moisture content	%	64	
Final bulk density	Mg/m³	1.63	
Final dry density	Mg/m³	0.99	

ADDITIONAL SPECIMEN DETAILS

Rate of strain	%/hour	0.20	
Failure criterion		Maximum deviator stress	

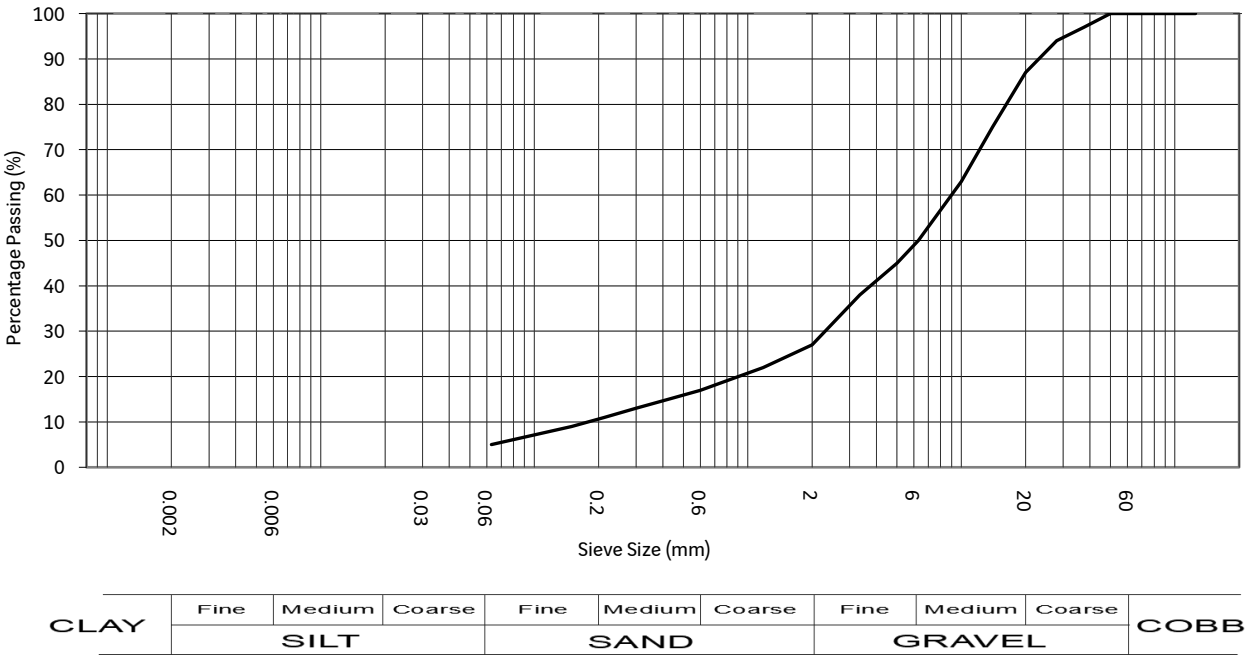




REMARKS

Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 23/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH109
Project No.	TB8754		Sample Depth 15.00m
Engineer	Mott MacDonald		Sample Number 42
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.2	Sample type B
Description	Brown sandy slightly clayey GRAVEL.		Specimen Depth 15.00m
			Specimen No. 1



PARTICLE SIZE	%
Silt and clay:	4.9
Sand:	22.4
Gravel:	72.6
Cobbles:	0.0

General remarks

WET SIEVE DATA

Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	75
		10	63
		6.3	50
125.0	100	5	45
90.0	100	3.35	38
75.0	100	2	27
63.0	100	1.18	22
50.0	100	0.6	17
37.5	97	0.425	15
28.0	94	0.3	13
20.0	87	0.212	11
		0.15	9
		0.063	5

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

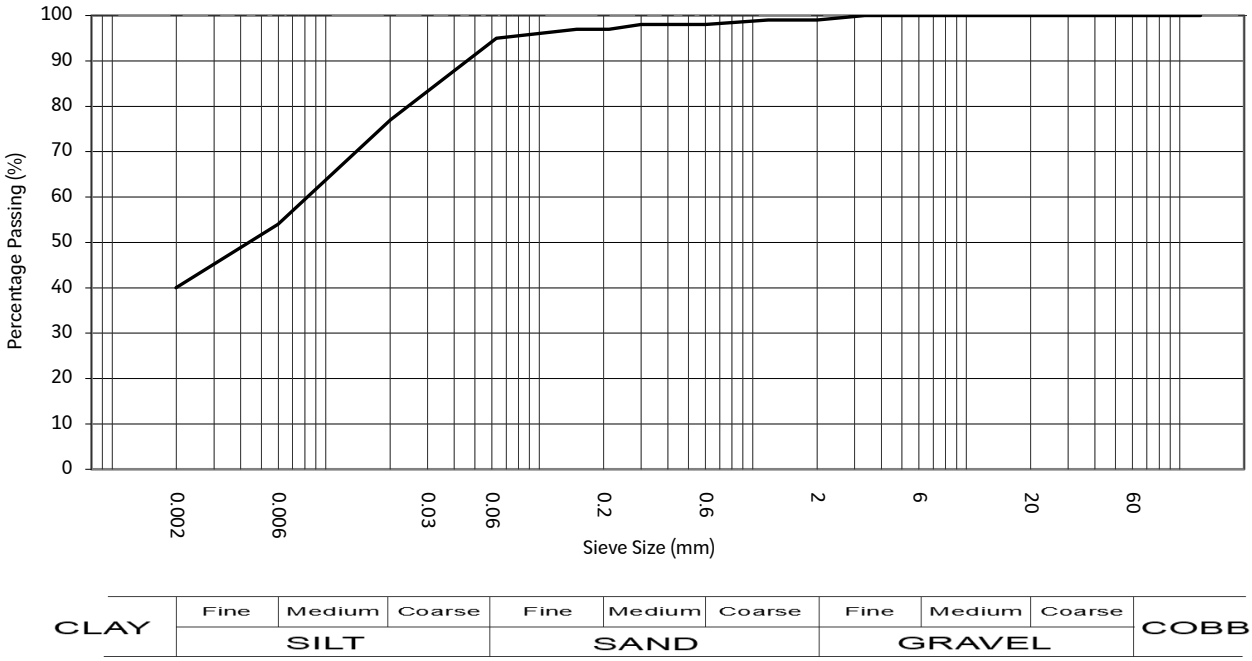
Approved by:

Paul Rodgers

Print date 22/07/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH110
Project No.	TB8754		Sample Depth 2.30m
Engineer	Mott MacDonald		Sample Number 16
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type B
Description	Brown mottled slightly organic CLAY.		Specimen Depth 2.30m
			Specimen No. 1



PARTICLE SIZE	%
Clay:	40.5
Silt:	54.7
Sand:	4.2
Gravel:	0.6
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14	100		
		10	100	0.020100	77
		6.3	100	0.005980	54
125.0	100	5	100	0.001990	40
90.0	100	3.35	100		
75.0	100	2	99		
63.0	100	1.18	99		
50.0	100	0.6	98		
37.5	100	0.425	98		
28.0	100	0.3	98		
20.0	100	0.212	97		
		0.15	97		
		0.063	95		

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by: Steve Harper

Print date 24/07/2025

SOIL ENGINEERING

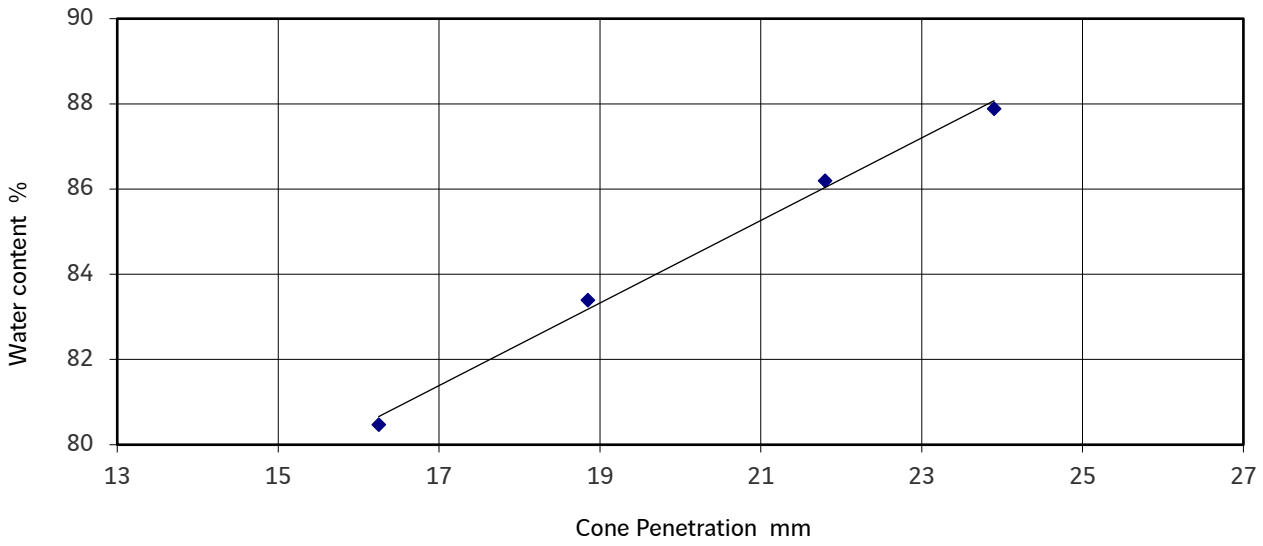
Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH110
Project No.	TB8754		Sample Depth 2.30m
Engineer	Mott MacDonald		Sample Number 15
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Greyish brown CLAY.		Specimen Depth 2.30m
			Specimen Number 2

Water content	65.5	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

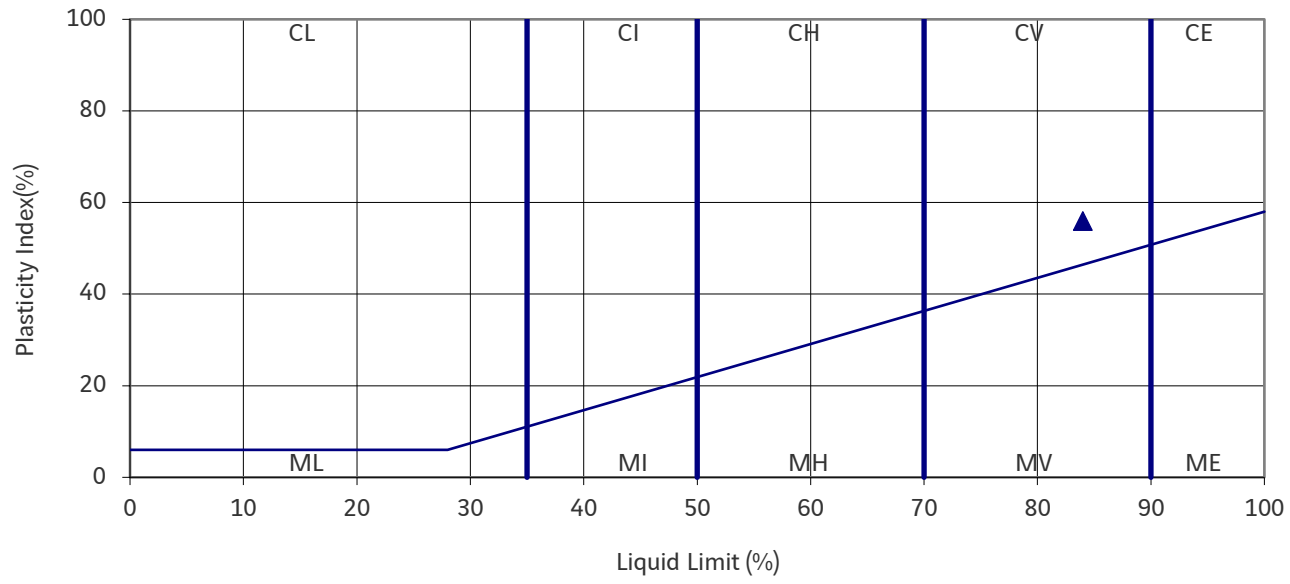
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH110
Project No.	TB8754		Sample Depth 2.30m
Engineer	Mott MacDonald		Sample Number 15
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Greyish brown CLAY.		Specimen Depth 2.30m
			Specimen Number 1



As received water content:	65.5%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	84%	Preparation of sample: Natural	
Plastic limit:	28%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	56%		
Water content of soil passing 425µm	65.5%		
Liquidity index:	0.670		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 01/08/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH110
Project No.	TB8754		Sample Depth 3.00m
Engineer	Mott MacDonald		Sample Number 17
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 3.23m
			Specimen Number 2

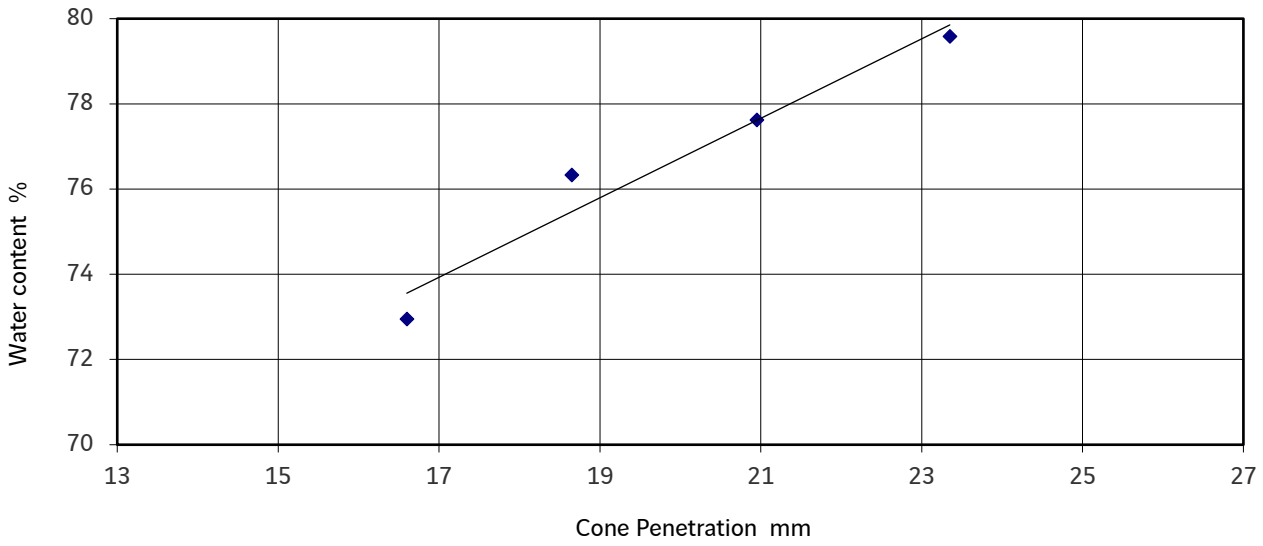
Water content	74.2	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

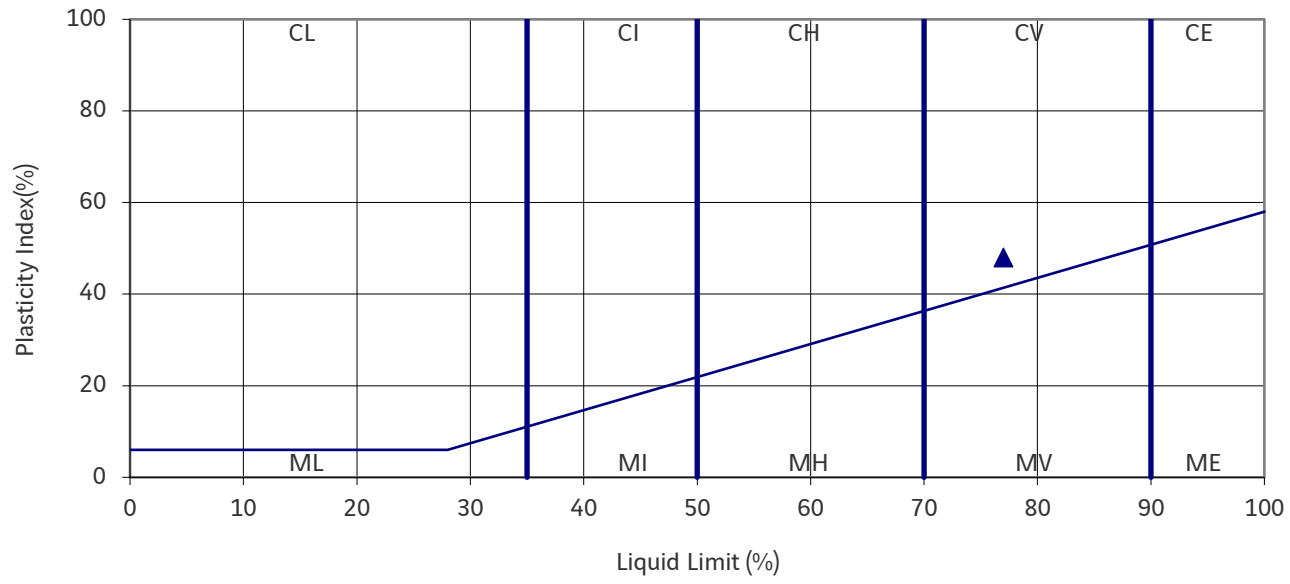
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Paul Rodgers			Print date 11/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH110
Project No.	TB8754		Sample Depth 3.00m
Engineer	Mott MacDonald		Sample Number 17
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 3.23m
			Specimen Number 1



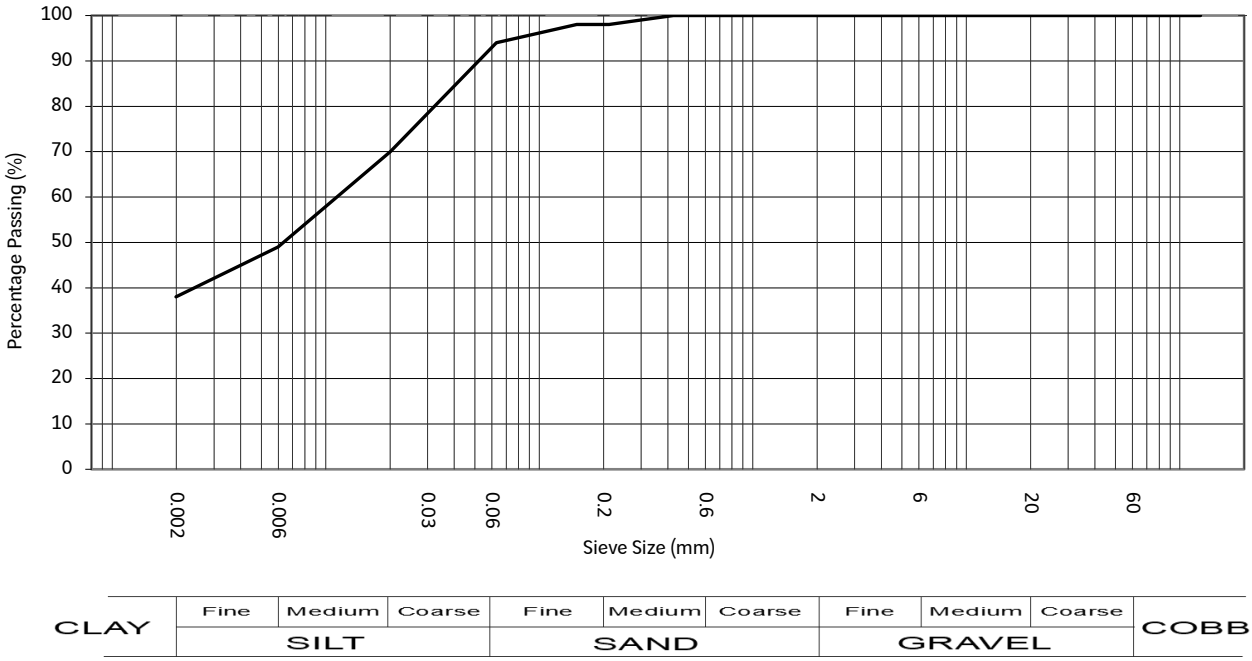
As received water content:	74.2%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	77%	Preparation of sample: Natural	
Plastic limit:	29%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	48%		
Water content of soil passing 425µm	74.2%		
Liquidity index:	0.942		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 13/08/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH110
Project No.	TB8754		Sample Depth 4.00m
Engineer	Mott MacDonald		Sample Number 20
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type B
Description	Greyish brown CLAY.		Specimen Depth 4.00m
			Specimen No. 1



PARTICLE SIZE	%
Clay:	37.9
Silt:	56.2
Sand:	5.9
Gravel:	0.0
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14	100		
		10	100	0.020100	70
		6.3	100	0.005980	49
125.0	100	5	100	0.001990	38
90.0	100	3.35	100		
75.0	100	2	100		
63.0	100	1.18	100		
50.0	100	0.6	100		
37.5	100	0.425	100		
28.0	100	0.3	99		
20.0	100	0.212	98		
		0.15	98		
		0.063	94		

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:			
Steve Harper		Print date 24/07/2025	SOIL ENGINEERING
	Revision No. 3.07	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH110
Project No.	TB8754		Sample Depth 4.00m
Engineer	Mott MacDonald		Sample Number 18
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Greyish brown slightly organic CLAY.		Specimen Depth 4.00m
			Specimen Number 2

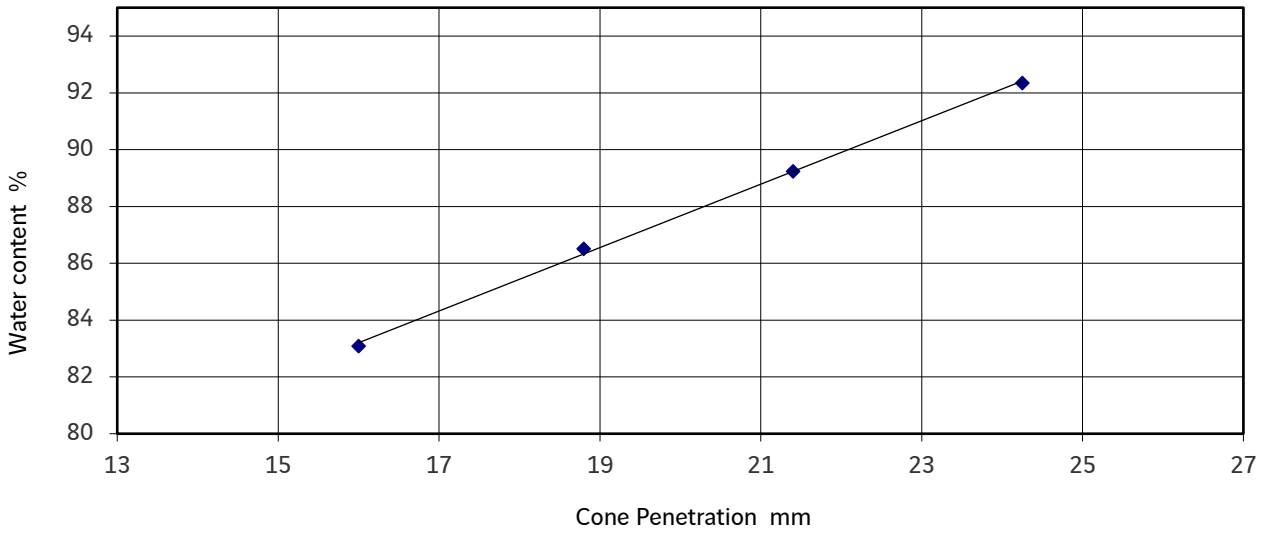
Water content	72.1	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

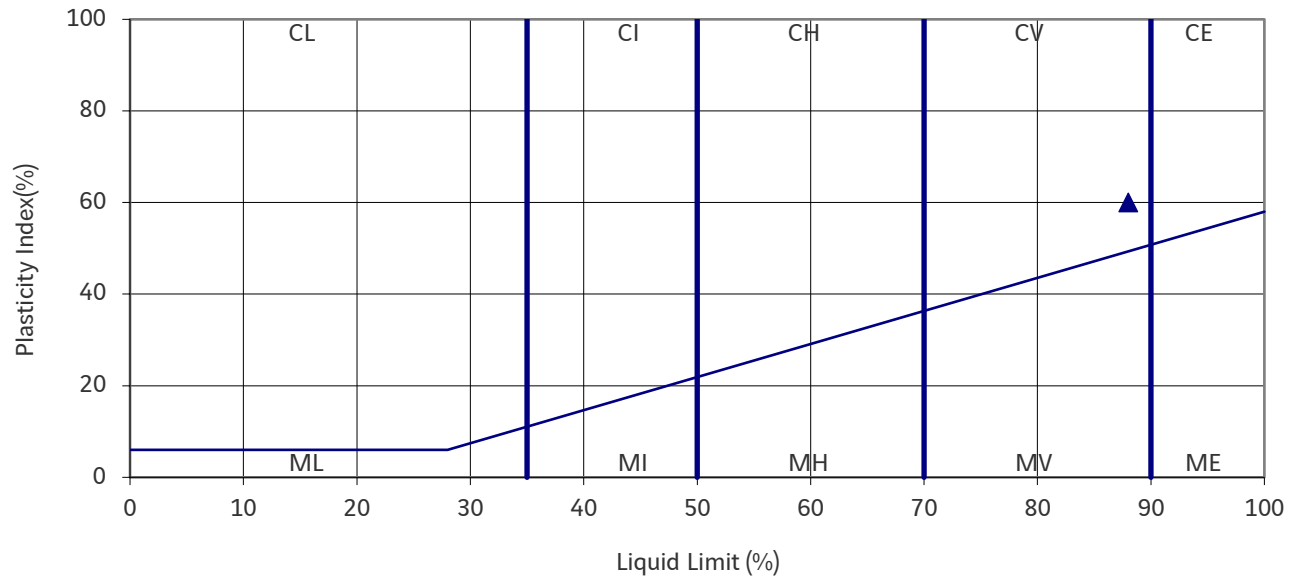
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory			SOIL ENGINEERING
Steve Harper			Print date 01/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024		

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH110
Project No.	TB8754		Sample Depth 4.00m
Engineer	Mott MacDonald		Sample Number 18
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Greyish brown slightly organic CLAY.		Specimen Depth 4.00m
			Specimen Number 1



As received water content:	72.1%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	88%	Preparation of sample: Natural	
Plastic limit:	28%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	60%		
Water content of soil passing 425µm	72.1%		
Liquidity index:	0.736		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 01/08/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

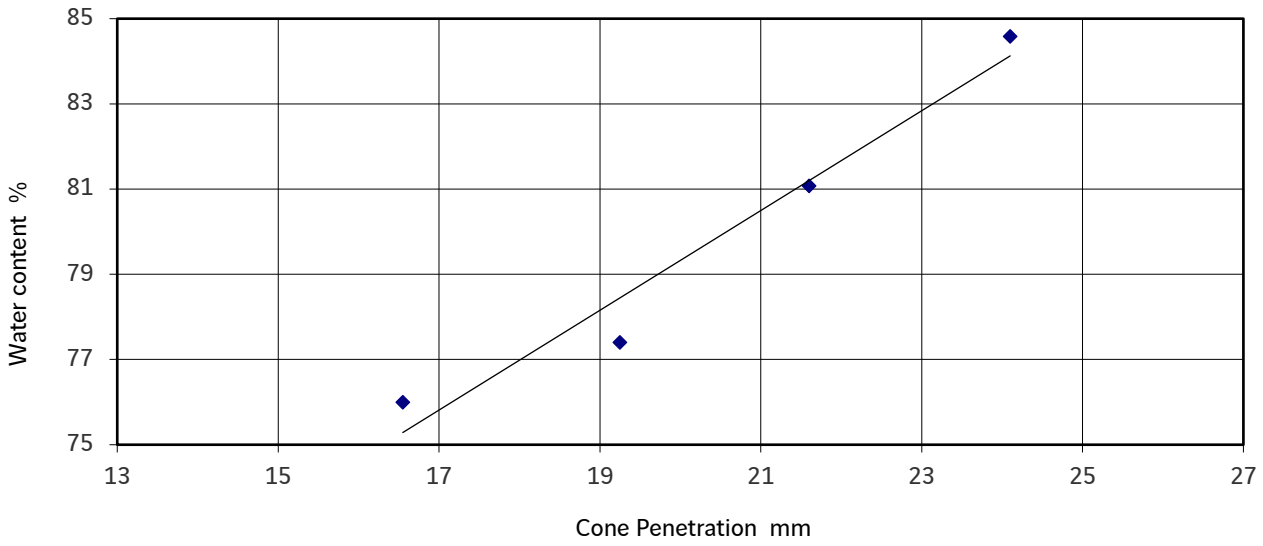
Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH110
Project No.	TB8754		Sample Depth 4.70m
Engineer	Mott MacDonald		Sample Number 22
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey slightly organic CLAY.		Specimen Depth 4.70m
			Specimen Number 2

Water content	88.2	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

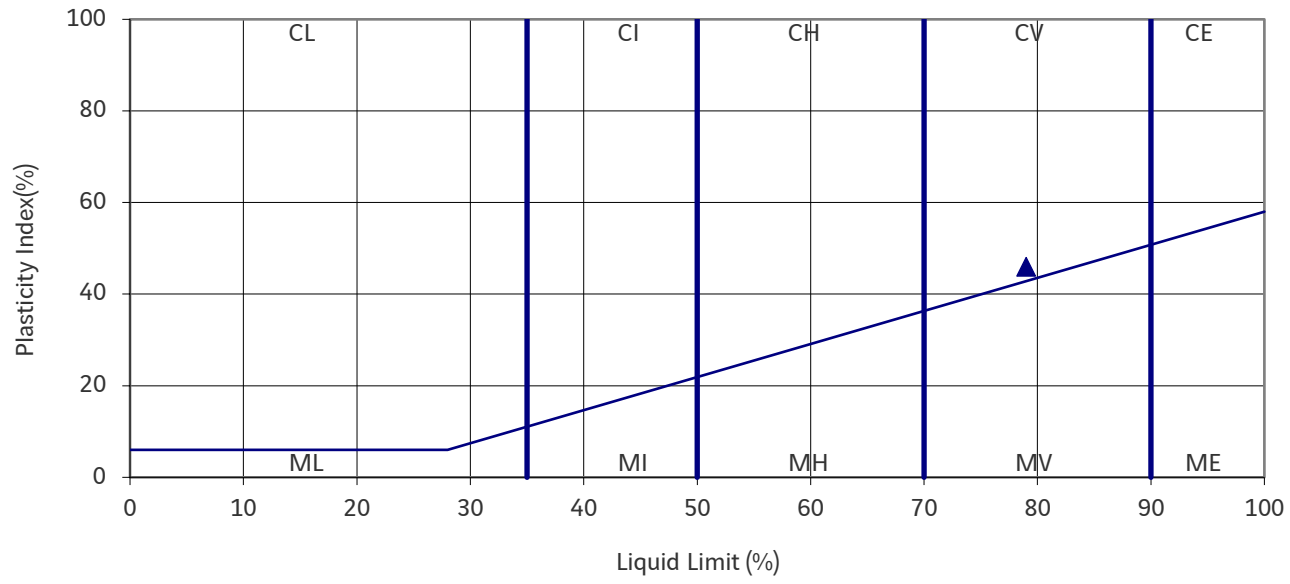
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH110
Project No.	TB8754		Sample Depth 4.70m
Engineer	Mott MacDonald		Sample Number 22
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey slightly organic CLAY.		Specimen Depth 4.70m
			Specimen Number 1



As received water content:	88.2%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	79%	Preparation of sample: Natural	
Plastic limit:	33%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	46%		
Water content of soil passing 425µm	88.2%		
Liquidity index:	1.199		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 01/08/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

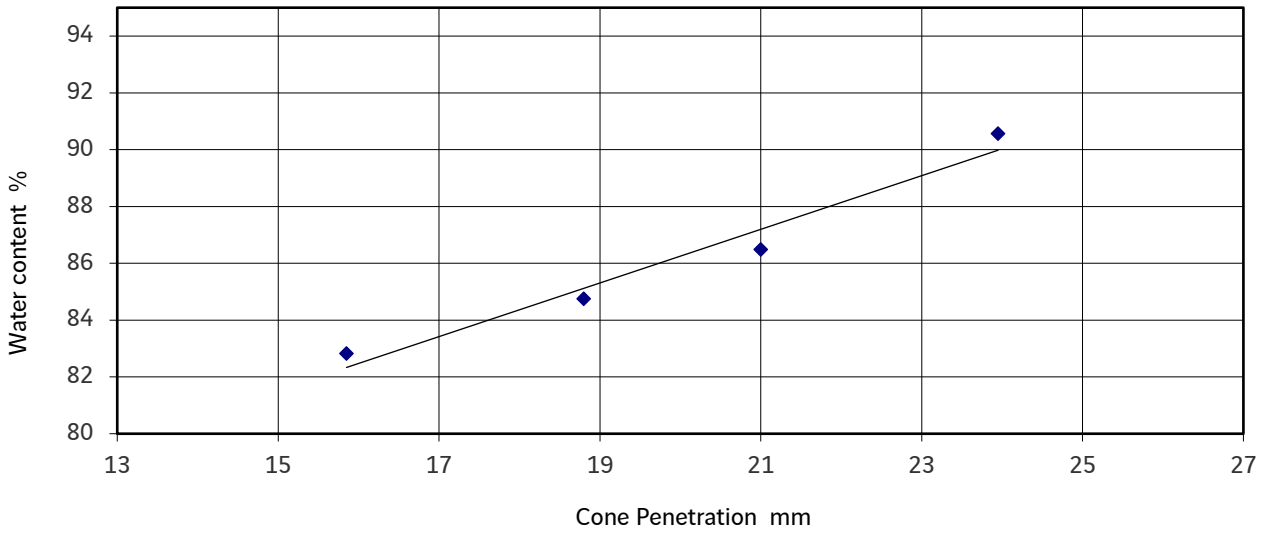
Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH110
Project No.	TB8754		Sample Depth 5.00m
Engineer	Mott MacDonald		Sample Number 23
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 5.24m
			Specimen Number 2

Water content	90.3	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

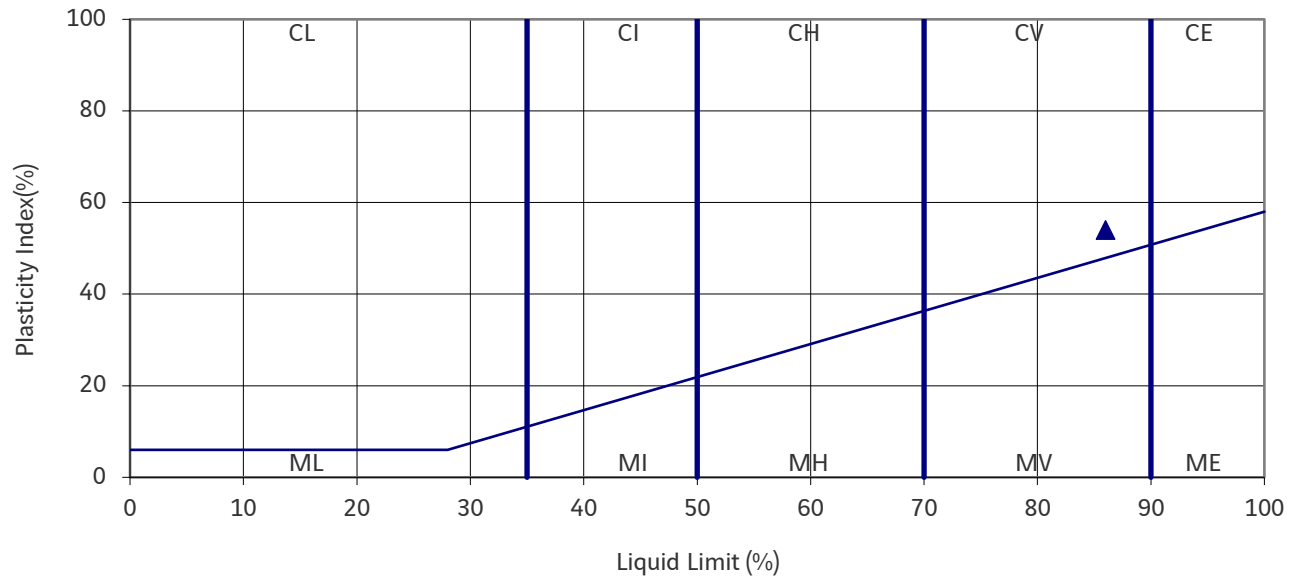
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH110
Project No.	TB8754		Sample Depth 5.00m
Engineer	Mott MacDonald		Sample Number 23
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY.		Specimen Depth 5.24m
			Specimen Number 1



As received water content:	90.3%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	86%	Preparation of sample: Natural	
Plastic limit:	32%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	54%		
Water content of soil passing 425µm	90.3%		
Liquidity index:	1.080		

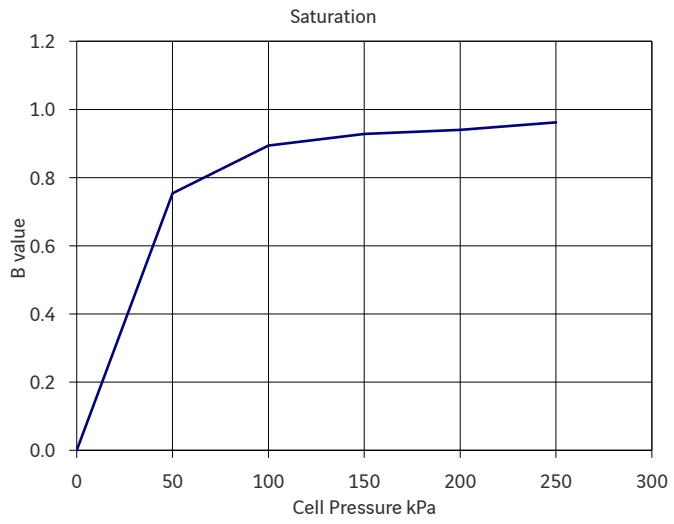


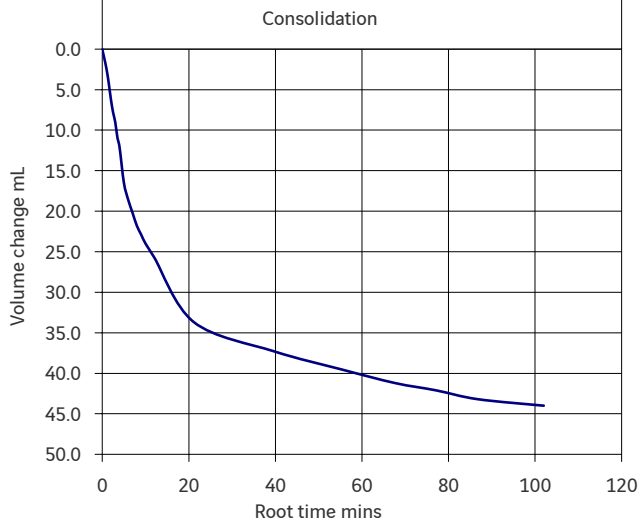
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 21/07/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH110
Project No.	TB8754		Sample Depth 5.00m
Engineer	Mott MacDonald		Sample Number 23
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY.		Specimen Depth 5.30m
			Specimen Number 4

SPECIMEN INITIAL DIMENSIONS			
Test number		1	
Specimen diameter	mm	101.18	
Specimen length	mm	193.43	
Density	Mg/m^3	1.52	
Moisture content	%	80	
Dry density	Mg/m^3	0.84	
SATURATION STAGE			
Initial pore water pressure	kPa	0.9	
Saturated pore water pressure	kPa	237.3	
Final cell pressure	kPa	250	
B value		0.962	
CONSOLIDATION STAGE			
Cell pressure	kPa	325	
Back pressure	kPa	300	
Effective consolidation pressure	kPa	25	
Initial pore water pressure	kPa	311.3	
Final pore water pressure	kPa	300	
Pore pressure dissipation	%	100.0	
c_{vi}	$m^2/year$	0.45	
m_{vi}	m^2/MN	2.50	
SPECIMEN AFTER CONSOLIDATION			
Density	Mg/m^3	1.55	
Moisture content	%	77	
Dry density	Mg/m^3	0.87	



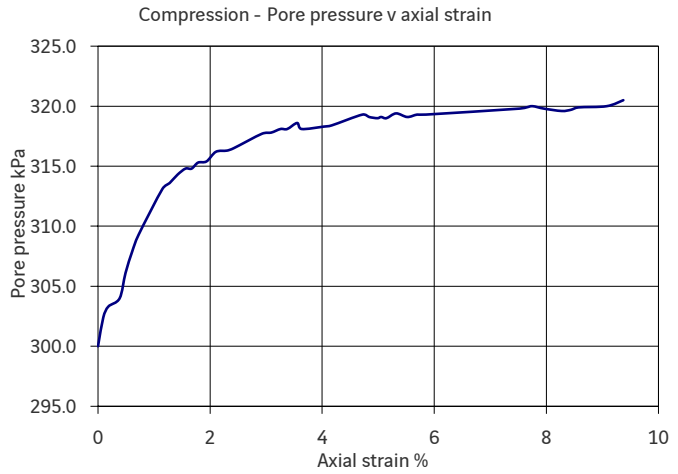


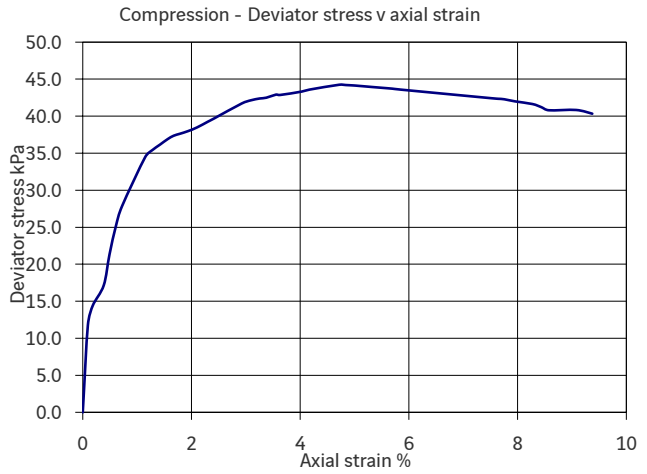
Remarks:
Specimen orientation Vertical
Specimen condition for test UNDISTURBED
Saturation with 50kPa increments with a differential pressure of 10kPa
Drainage from both ends and using a radial filter drain

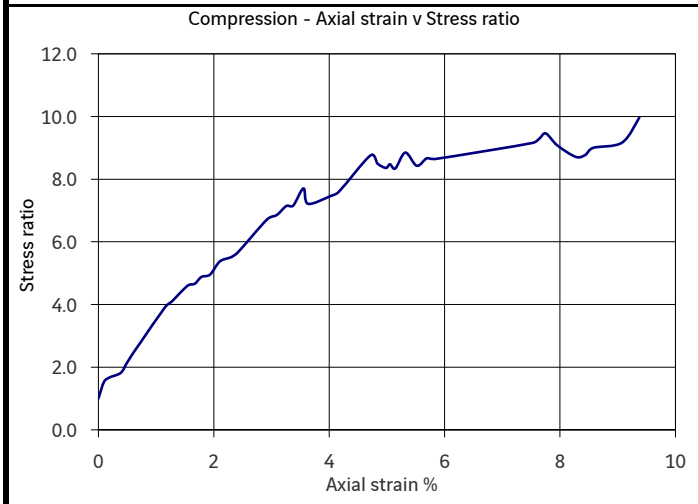
Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 26/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

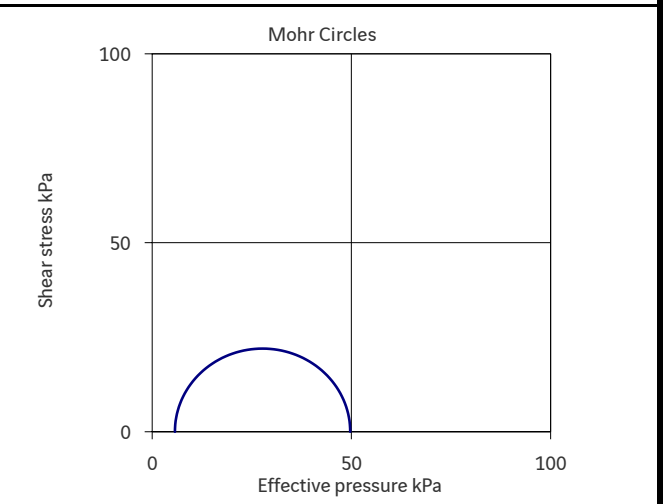
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH110
Project No.	TB8754		Sample Depth 5.00m
Engineer	Mott MacDonald		Sample Number 23
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY.		Specimen Depth 5.30m
			Specimen Number 4

COMPRESSION STAGE			
Test number			1
Cell pressure		kPa	325
Initial pore water pressure		kPa	300
Effective confining pressure		kPa	25
Failure conditions at			Maximum deviator stress
Axial strain at failure		%	4.7
Maximum deviator stress	σ_1-σ_3	kPa	44
Pore water pressure at failure	σ	kPa	319
Effective major principal stress	σ_1'	kPa	49.95
Effective minor principal stress	σ_3'	kPa	5.70
Effective principal stress ratio			8.76
Membrane correction		kPa	0.58
Filter drain correction		kPa	3.5
Pore pressure coefficient			0.4









Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 26/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

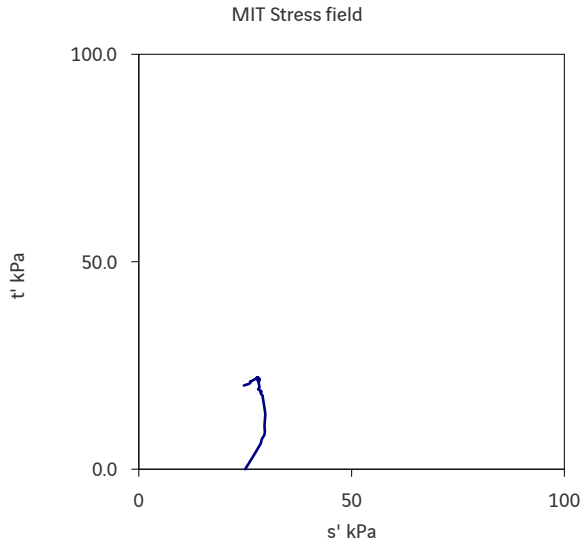
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH110
Project No.	TB8754		Sample Depth 5.00m
Engineer	Mott MacDonald		Sample Number 23
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY.		Specimen Depth 5.30m
			Specimen Number 4

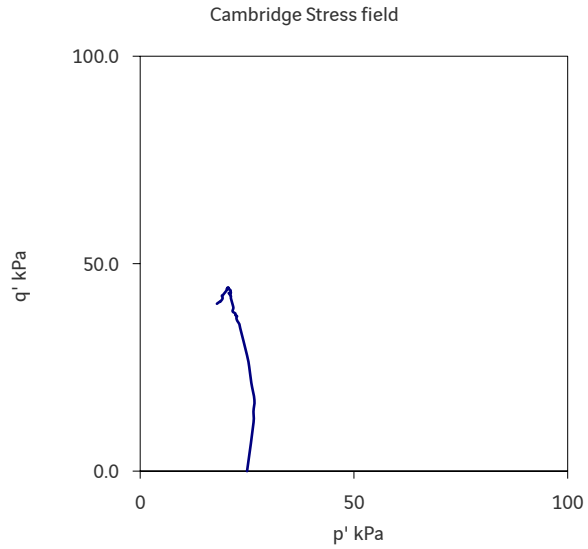
SPECIMEN AFTER TEST

Test number		1	
Mode of failure		Plastic 	
Final moisture content	%	77	
Final bulk density	Mg/m^3	1.55	
Final dry density	Mg/m^3	0.87	

ADDITIONAL SPECIMEN DETAILS

Rate of strain	%/hour	0.20	
Failure criterion		Maximum deviator stress	

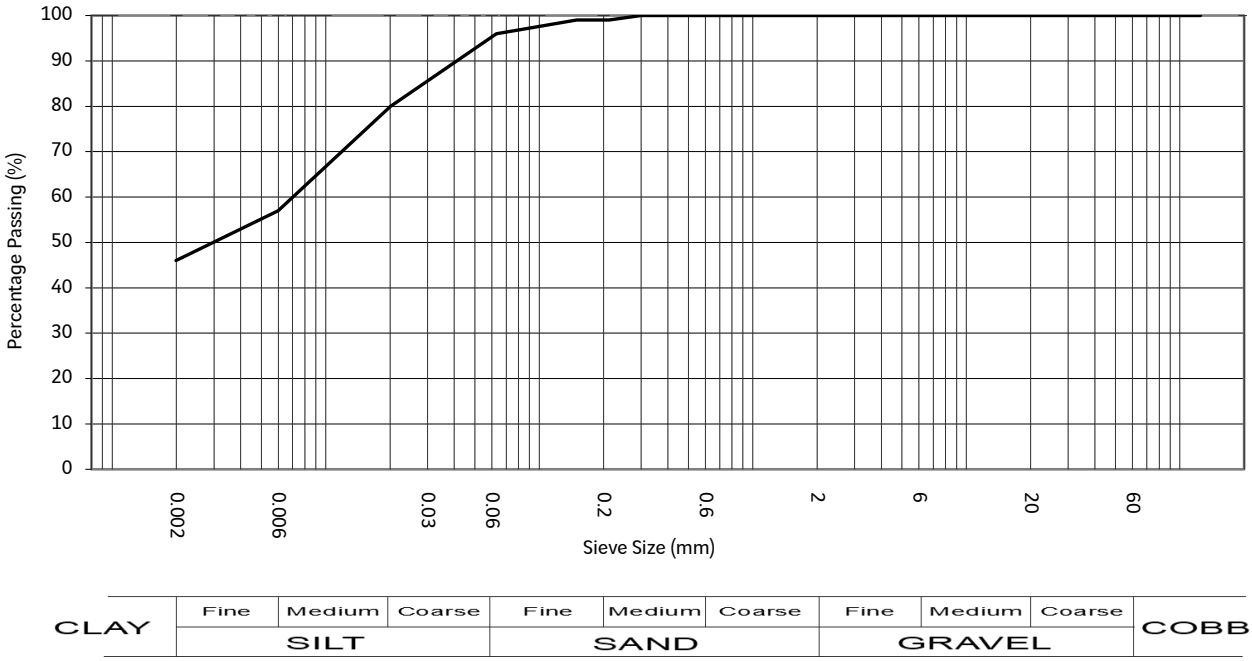




REMARKS

Preliminary	Leeds Laboratory	Results apply to samples as received.	SOIL ENGINEERING
Paul Rodgers		Print date 26/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH110
Project No.	TB8754		Sample Depth 6.00m
Engineer	Mott MacDonald		Sample Number 27
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type B
Description	Grey slightly organic CLAY.		Specimen Depth 6.00m
			Specimen No. 1



PARTICLE SIZE	%
Clay:	45.7
Silt:	50.3
Sand:	4.0
Gravel:	0.0
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14	100		
		10	100	0.020100	80
		6.3	100	0.005980	57
125.0	100	5	100	0.001990	46
90.0	100	3.35	100		
75.0	100	2	100		
63.0	100	1.18	100		
50.0	100	0.6	100		
37.5	100	0.425	100		
28.0	100	0.3	100		
20.0	100	0.212	99		
		0.15	99		
		0.063	96		

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:			
Steve Harper		Print date 24/07/2025	SOIL ENGINEERING
	Revision No. 3.07	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH110
Project No.	TB8754		Sample Depth 6.00m
Engineer	Mott MacDonald		Sample Number 25
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Brown CLAY.		Specimen Depth 6.00m
			Specimen Number 2

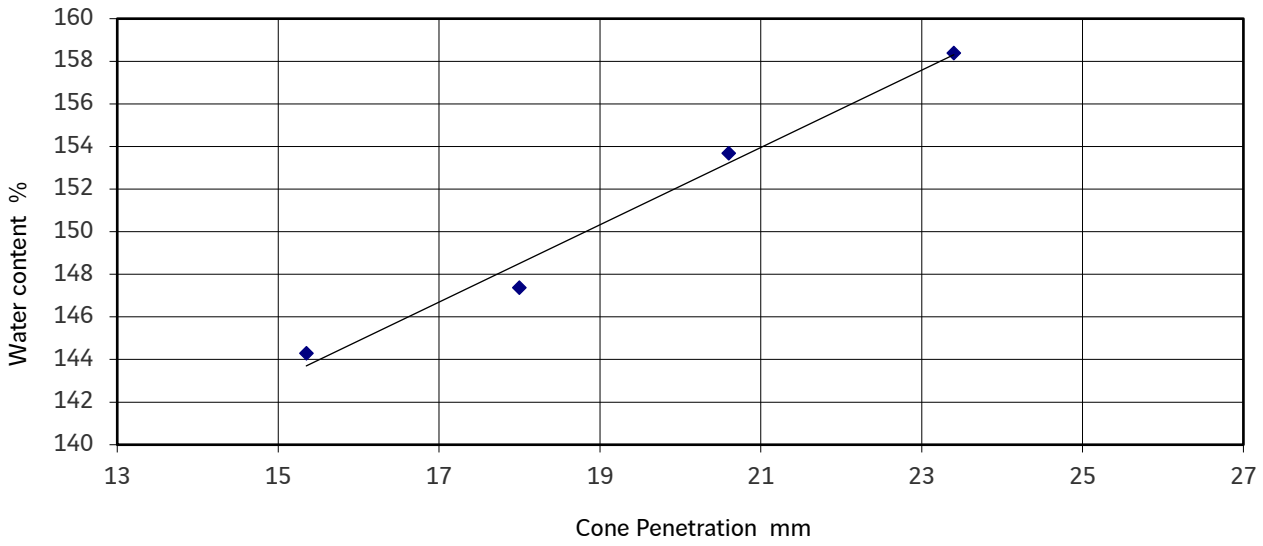
Water content	118	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

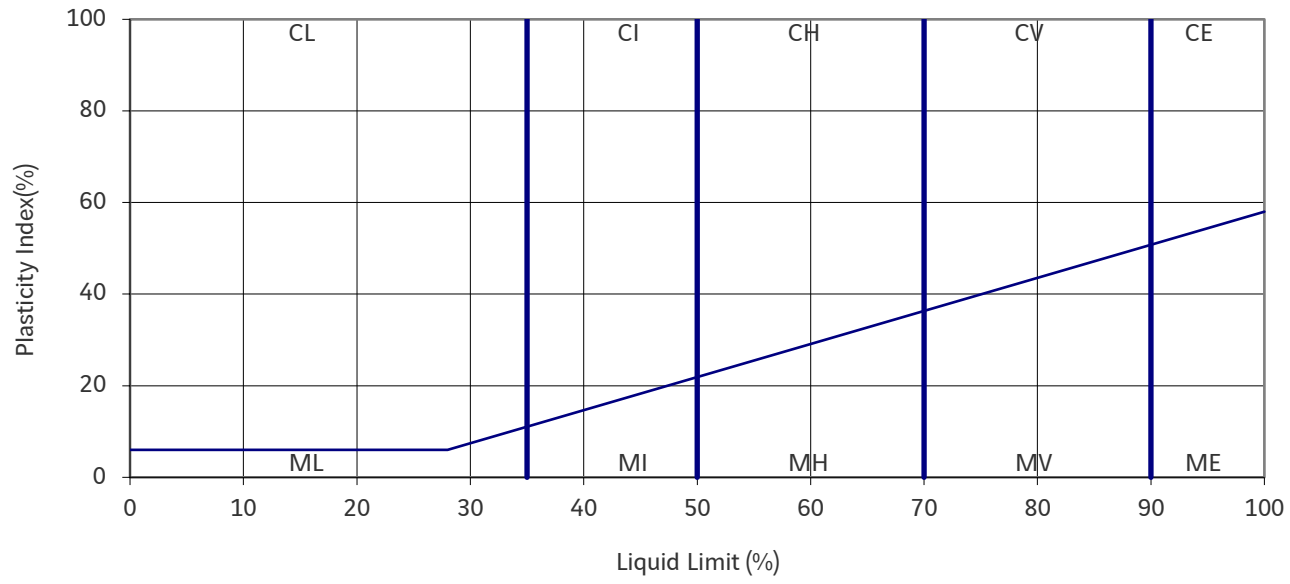
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 01/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH110
Project No.	TB8754		Sample Depth 6.00m
Engineer	Mott MacDonald		Sample Number 25
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Brown CLAY.		Specimen Depth 6.00m
			Specimen Number 1



As received water content:	118%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	150%	Preparation of sample: Natural	
Plastic limit:	62%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	88%		
Water content of soil passing 425µm	118%		
Liquidity index:	0.634		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 01/08/2025	
	Revision No. 3.00	Issue Date 19/05/2022	

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH110
Project No.	TB8754		Sample Depth 6.70m
Engineer	Mott MacDonald		Sample Number 29
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Dark grey slightly organic CLAY.		Specimen Depth 6.70m
			Specimen Number 2

Water content	92.6	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

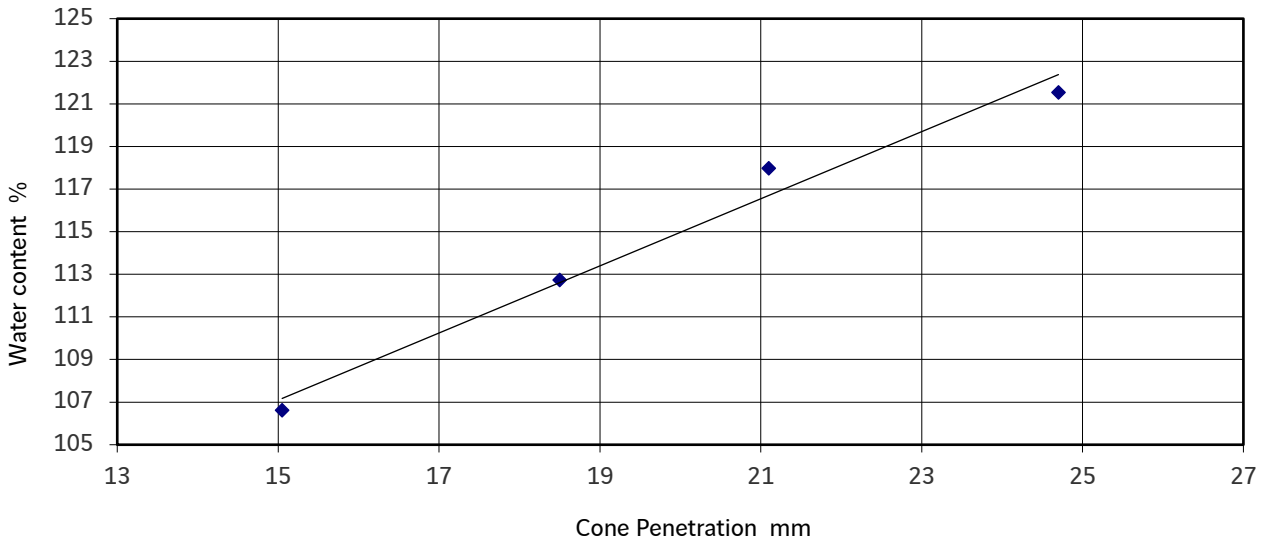
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

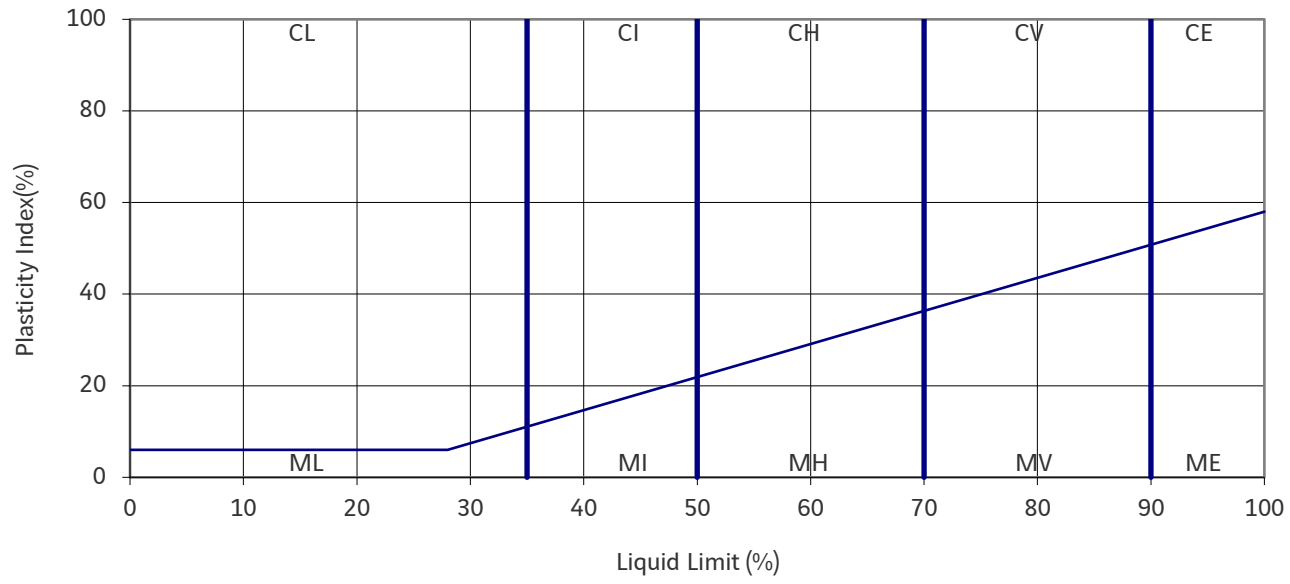
Approved by:	Leeds Laboratory		
Steve Harper		Print date 01/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024	

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH110
Project No.	TB8754		Sample Depth 6.70m
Engineer	Mott MacDonald		Sample Number 29
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Dark grey slightly organic CLAY.		Specimen Depth 6.70m
			Specimen Number 1



As received water content:	92.6%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	110%	Preparation of sample: Natural	
Plastic limit:	35%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	75%		
Water content of soil passing 425µm	92.6%		
Liquidity index:	0.768		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 01/08/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH110
Project No.	TB8754		Sample Depth 7.00m
Engineer	Mott MacDonald		Sample Number 30
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Brown PEAT.		Specimen Depth 7.60m
			Specimen Number 2

Water content	280	%
Oven temperature	50	°C
Is test result assumed to be a natural water content?	Yes	

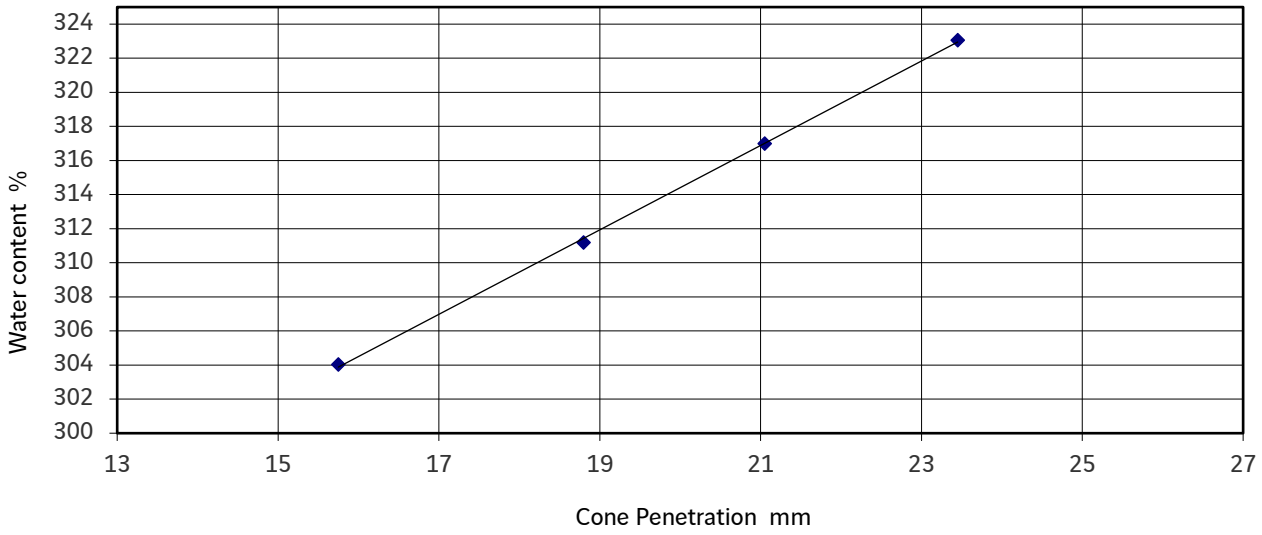
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

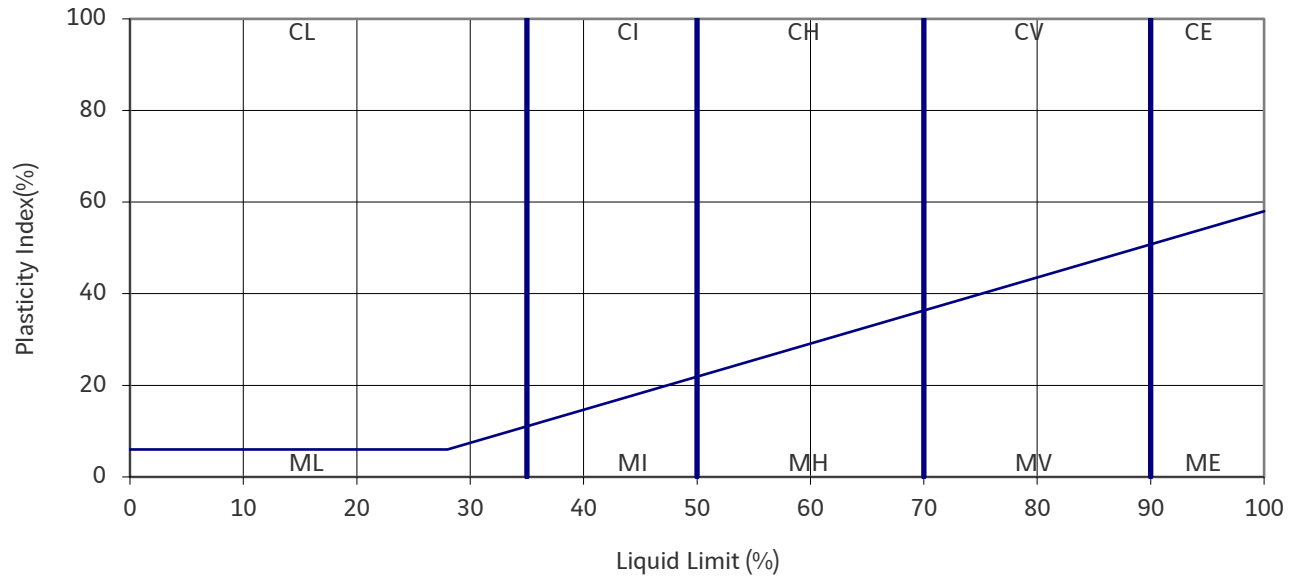
Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 22/07/2025	
	Revision No. 1.01	Issue Date 01/05/2024	

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH110
Project No.	TB8754		Sample Depth 7.00m
Engineer	Mott MacDonald		Sample Number 30
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Brown PEAT.		Specimen Depth 7.60m
			Specimen Number 1



As received water content:	280%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	310%	Preparation of sample: Natural	
Plastic limit:	170%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	140%		
Water content of soil passing 425µm	280%		
Liquidity index:	0.783		

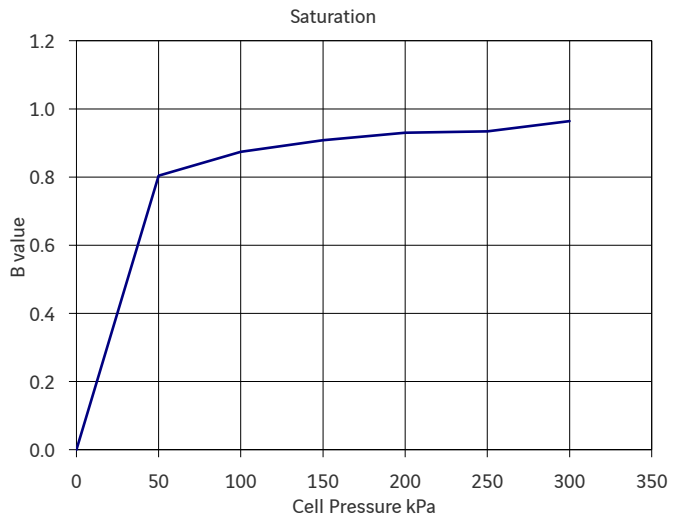


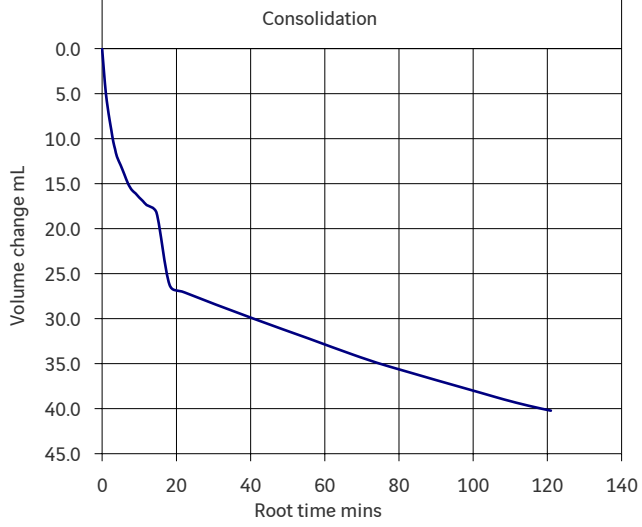
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 24/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH110
Project No.	TB8754		Sample Depth 7.00m
Engineer	Mott MacDonald		Sample Number 30
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Dark brown fibrous PEAT.		Specimen Depth 7.74m
			Specimen Number 4

SPECIMEN INITIAL DIMENSIONS		
Test number		1
Specimen diameter	mm	100.53
Specimen length	mm	196.00
Density	Mg/m^3	1.07
Moisture content	%	340
Dry density	Mg/m^3	0.24
SATURATION STAGE		
Initial pore water pressure	kPa	0.1
Saturated pore water pressure	kPa	285.3
Final cell pressure	kPa	300
B value		0.964
CONSOLIDATION STAGE		
Cell pressure	kPa	320
Back pressure	kPa	300
Effective consolidation pressure	kPa	20
Initial pore water pressure	kPa	306.6
Final pore water pressure	kPa	298.9
Pore pressure dissipation	%	116.7
c_{vi}	$m^2/year$	0.13
m_{vi}	m^2/MN	3.36
SPECIMEN AFTER CONSOLIDATION		
Density	Mg/m^3	1.09
Moisture content	%	340
Dry density	Mg/m^3	0.25



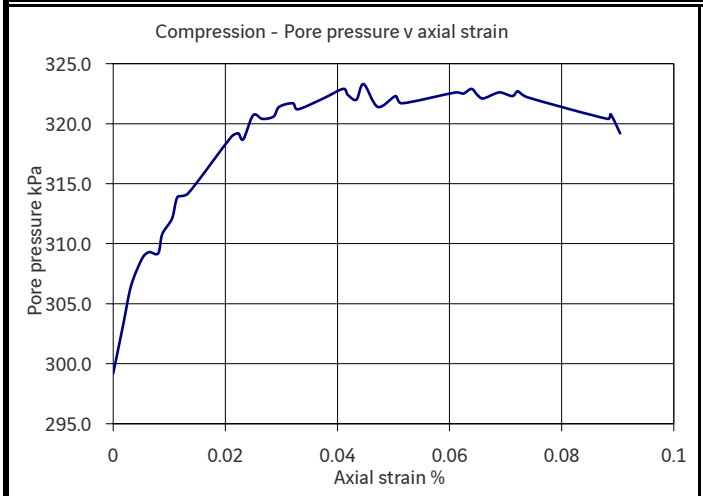


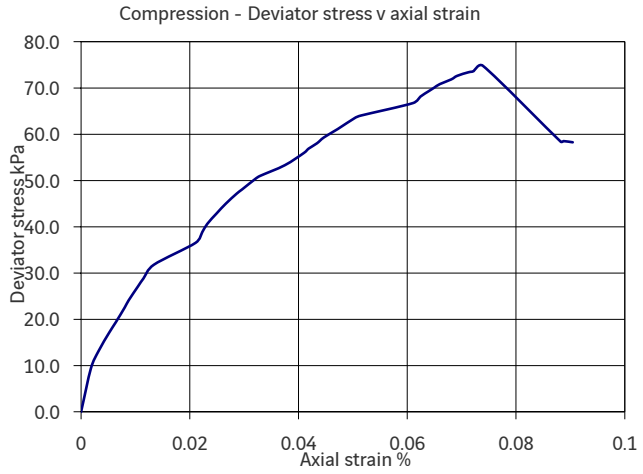
Remarks: Specimen orientation Vertical
Specimen condition for test UNDISTURBED
Saturation with 50kPa increments with a differential pressure of 10kPa
Drainage from both ends and using a radial filter drain

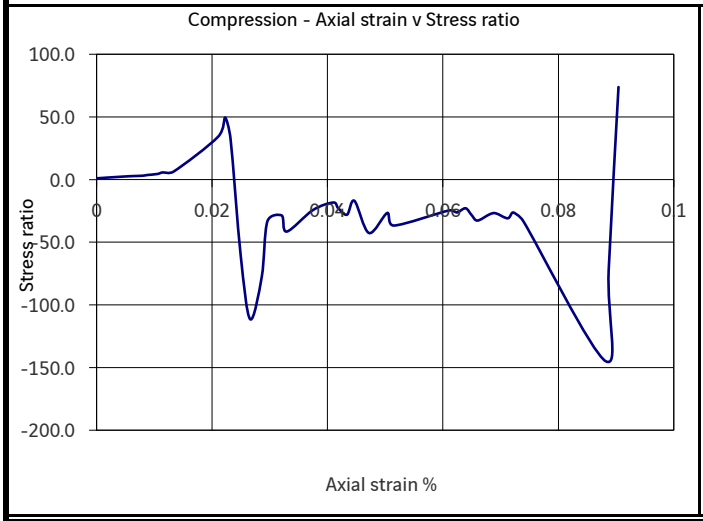
Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 05/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

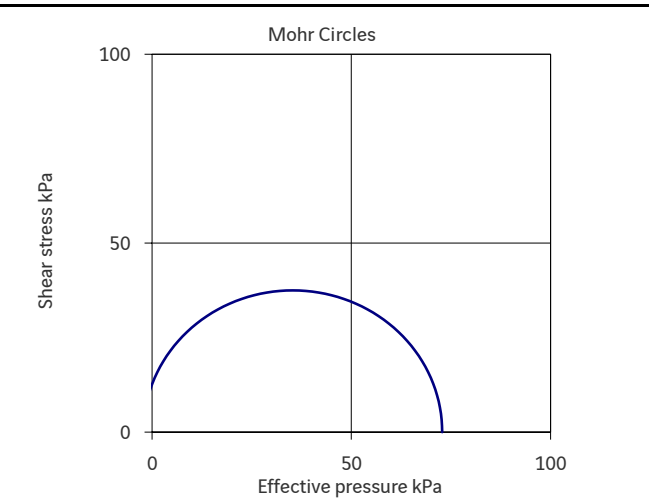
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH110
Project No.	TB8754		Sample Depth 7.00m
Engineer	Mott MacDonald		Sample Number 30
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Dark brown fibrous PEAT.		Specimen Depth 7.74m
			Specimen Number 4

COMPRESSION STAGE			
Test number			1
Cell pressure		kPa	320
Initial pore water pressure		kPa	299
Effective confining pressure		kPa	21
Failure conditions at			Maximum deviator stress
Axial strain at failure		%	0.1
Maximum deviator stress	σ_1-σ_3	kPa	75
Pore water pressure at failure	σ	kPa	322
Effective major principal stress	σ_1'	kPa	72.59
Effective minor principal stress	σ_3'	kPa	-2.20
Effective principal stress ratio			-33.00
Membrane correction		kPa	0.02
Filter drain correction		kPa	0.0
Pore pressure coefficient			0.3









Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 05/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

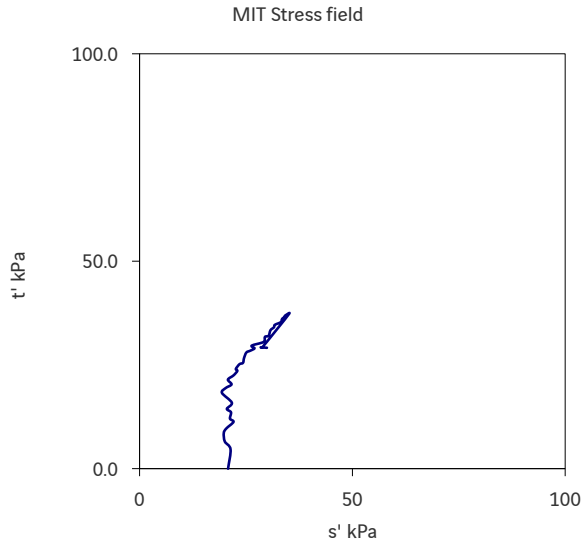
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH110
Project No.	TB8754		Sample Depth 7.00m
Engineer	Mott MacDonald		Sample Number 30
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Dark brown fibrous PEAT.		Specimen Depth 7.74m
			Specimen Number 4

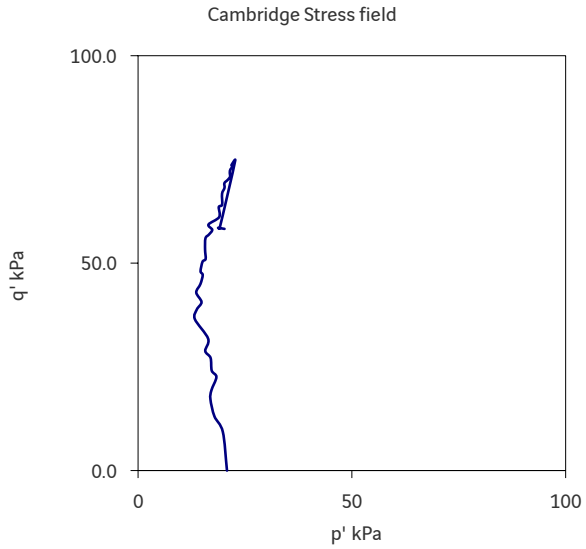
SPECIMEN AFTER TEST

Test number		1	
Mode of failure		Compound 	
Final moisture content	%	340	
Final bulk density	Mg/m^3	1.09	
Final dry density	Mg/m^3	0.25	

ADDITIONAL SPECIMEN DETAILS

Rate of strain	%/hour	0.20	
Failure criterion		Maximum deviator stress	

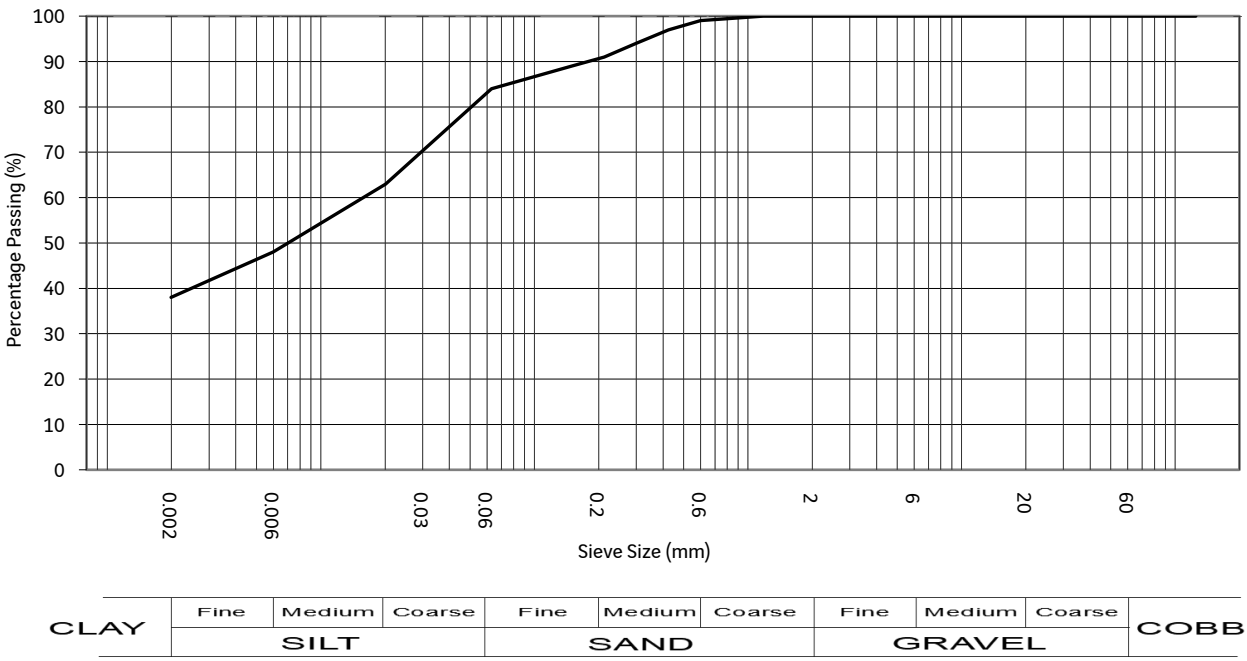




REMARKS

Preliminary	Leeds Laboratory	Results apply to samples as received.	SOIL ENGINEERING
Paul Rodgers		Print date 05/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH110
Project No.	TB8754		Sample Depth 8.00m
Engineer	Mott MacDonald		Sample Number 33
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.4	Sample type B
Description	Dark grey slightly organic CLAY.		Specimen Depth 8.00m
			Specimen No. 1



PARTICLE SIZE	%
Clay:	37.9
Silt:	46.6
Sand:	15.5
Gravel:	0.0
Cobbles:	0.0

General remarks

Particle density: 2.65Mg/m³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14	100	0.020100	63
		10	100	0.005980	48
		6.3	100	0.001990	38
125.0	100	5	100		
90.0	100	3.35	100		
75.0	100	2	100		
63.0	100	1.18	100		
50.0	100	0.6	99		
37.5	100	0.425	97		
28.0	100	0.3	94		
20.0	100	0.212	91		
		0.15	89		
		0.063	84		

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:			SOIL ENGINEERING
Paul Rodgers		Print date 11/08/2025	
	Revision No. 3.07	Issue Date 01/05/2024	

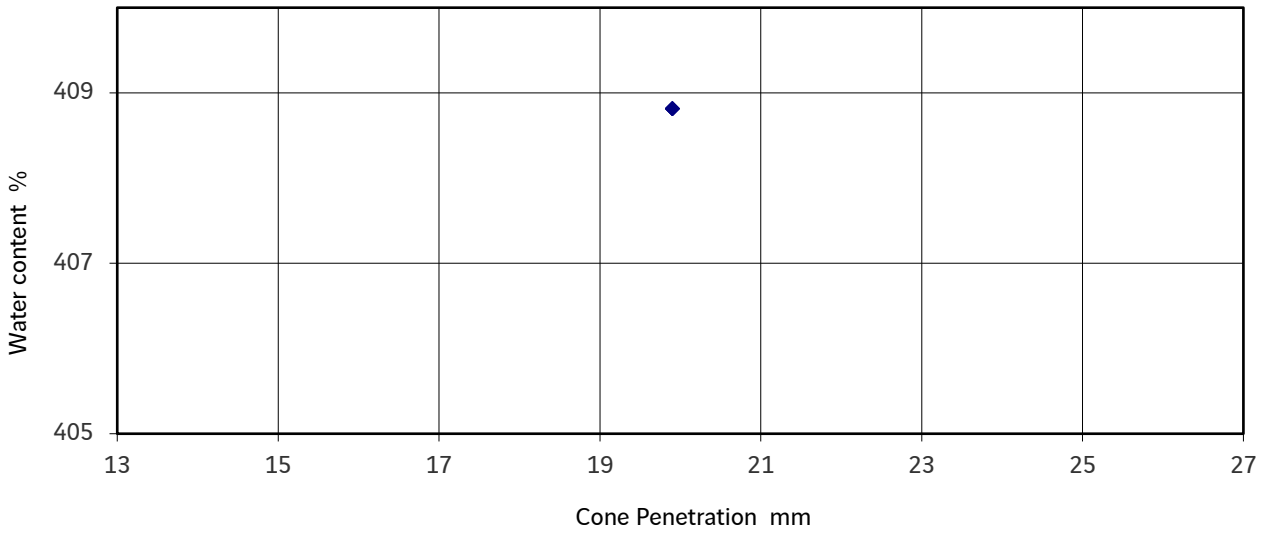
Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH110
Project No.	TB8754		Sample Depth 8.00m
Engineer	Mott MacDonald		Sample Number 31
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Dark grey slightly clayey PEAT.		Specimen Depth 8.00m
			Specimen Number 2

Water content	294	%
Oven temperature	50	°C
Is test result assumed to be a natural water content?	Yes	

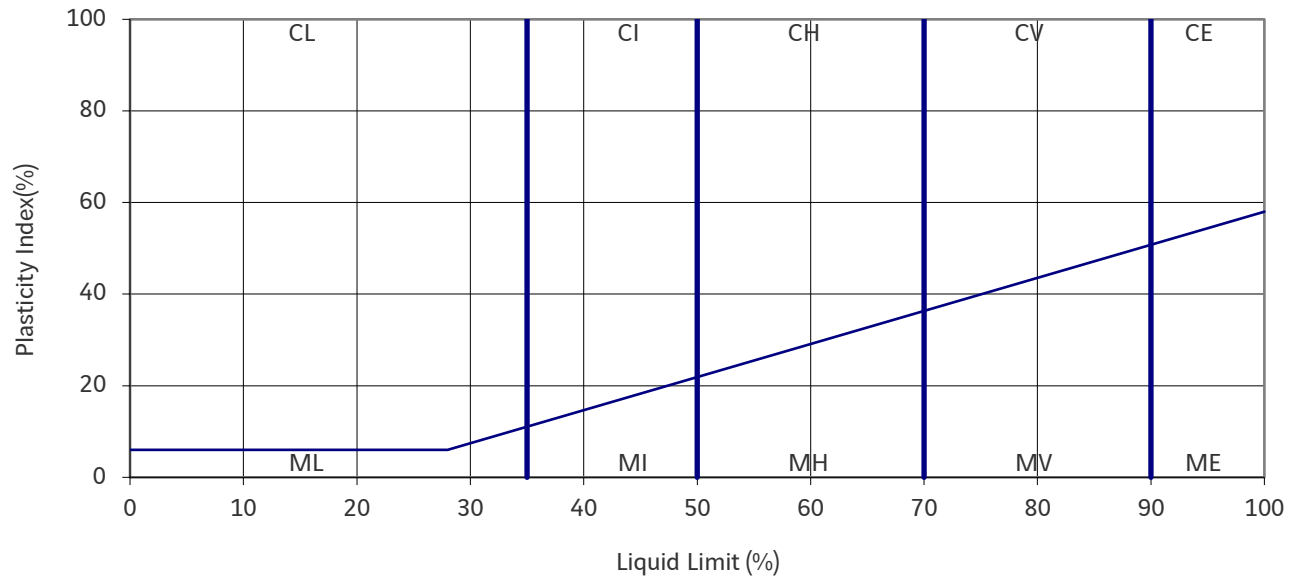
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH110
Project No.	TB8754		Sample Depth 8.00m
Engineer	Mott MacDonald		Sample Number 31
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Dark grey slightly clayey PEAT.		Specimen Depth 8.00m
			Specimen Number 1



As received water content:	294%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	410%	Preparation of sample: Natural	
Plastic limit:	NP	Remarks:	Test performed with 80g/30deg cone Tested as 1 point Limit Liquid limit due to the sample being peat and it is very difficult to get all four points on a line.
Plasticity index:			
Water content of soil passing 425µm	294%		
Liquidity index:			



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 01/08/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

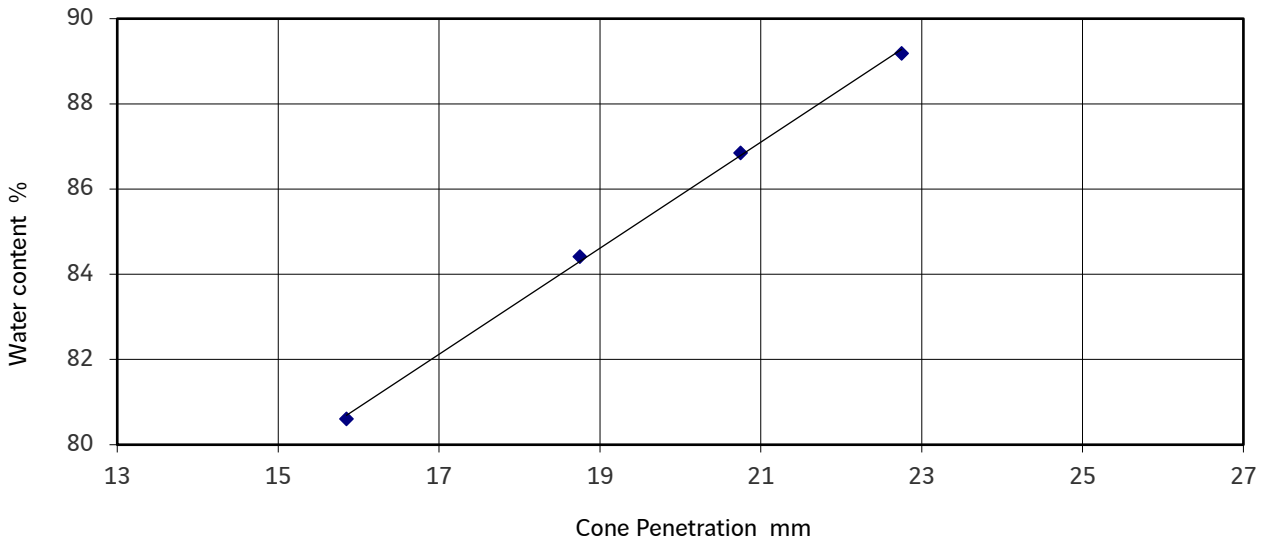
Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH110
Project No.	TB8754		Sample Depth 9.00m
Engineer	Mott MacDonald		Sample Number 34
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey slightly organic CLAY.		Specimen Depth 9.24m
			Specimen Number 2

Water content	77.4	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

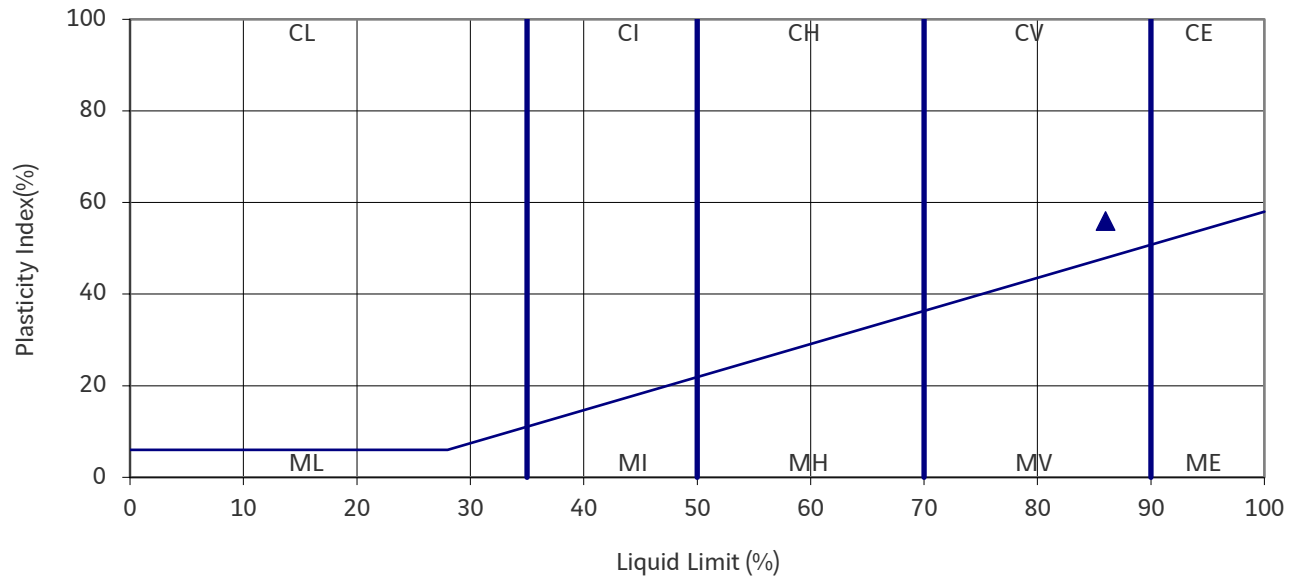
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH110
Project No.	TB8754		Sample Depth 9.00m
Engineer	Mott MacDonald		Sample Number 34
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey slightly organic CLAY.		Specimen Depth 9.24m
			Specimen Number 1



As received water content:	77.4%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	86%	Preparation of sample: Natural	
Plastic limit:	30%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	56%		
Water content of soil passing 425µm	77.4%		
Liquidity index:	0.846		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 21/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH110
Project No.	TB8754		Sample Depth 10.00m
Engineer	Mott MacDonald		Sample Number 35
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 10.00m
			Specimen Number 2

Water content	68.5	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

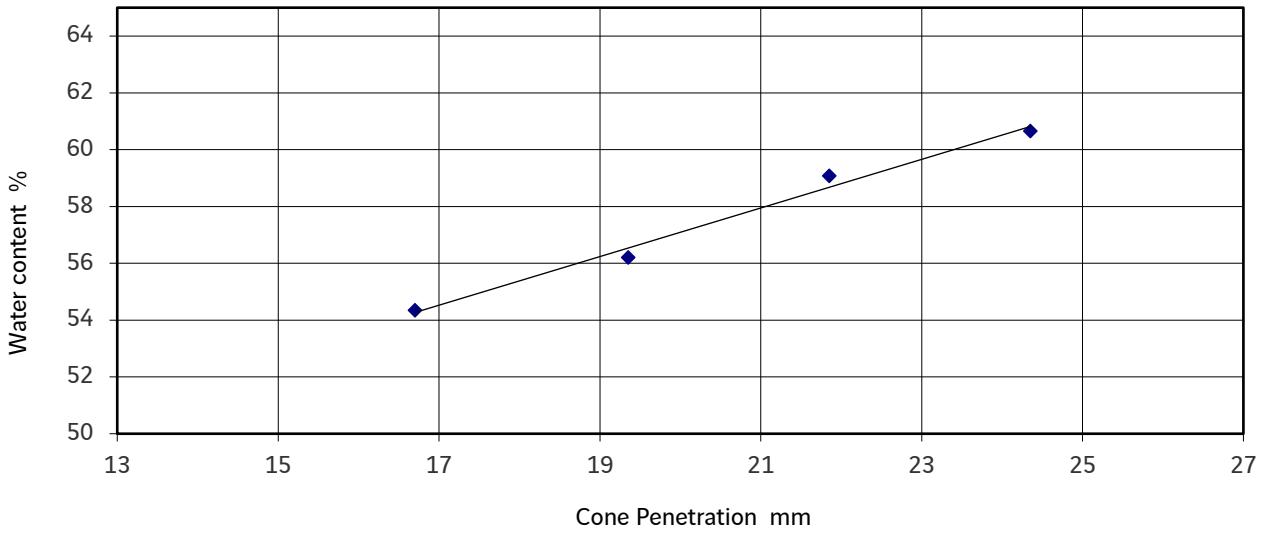
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

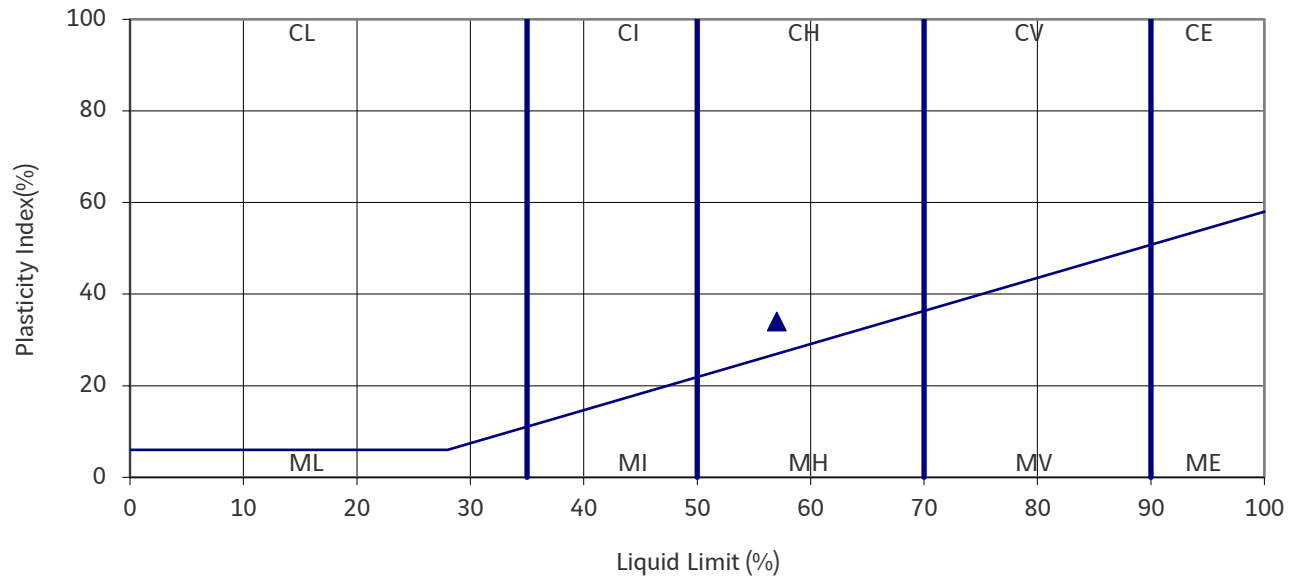
Approved by:	Leeds Laboratory		
Steve Harper		Print date 01/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024	

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH110
Project No.	TB8754		Sample Depth 10.00m
Engineer	Mott MacDonald		Sample Number 35
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 10.00m
			Specimen Number 1



As received water content:	68.5%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	57%	Preparation of sample: Natural	
Plastic limit:	23%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	34%		
Water content of soil passing 425µm	68.5%		
Liquidity index:	1.339		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 01/08/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH110
Project No.	TB8754		Sample Depth 11.00m
Engineer	Mott MacDonald		Sample Number 38
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Dark brown PEAT.		Specimen Depth 11.52m
			Specimen Number 2

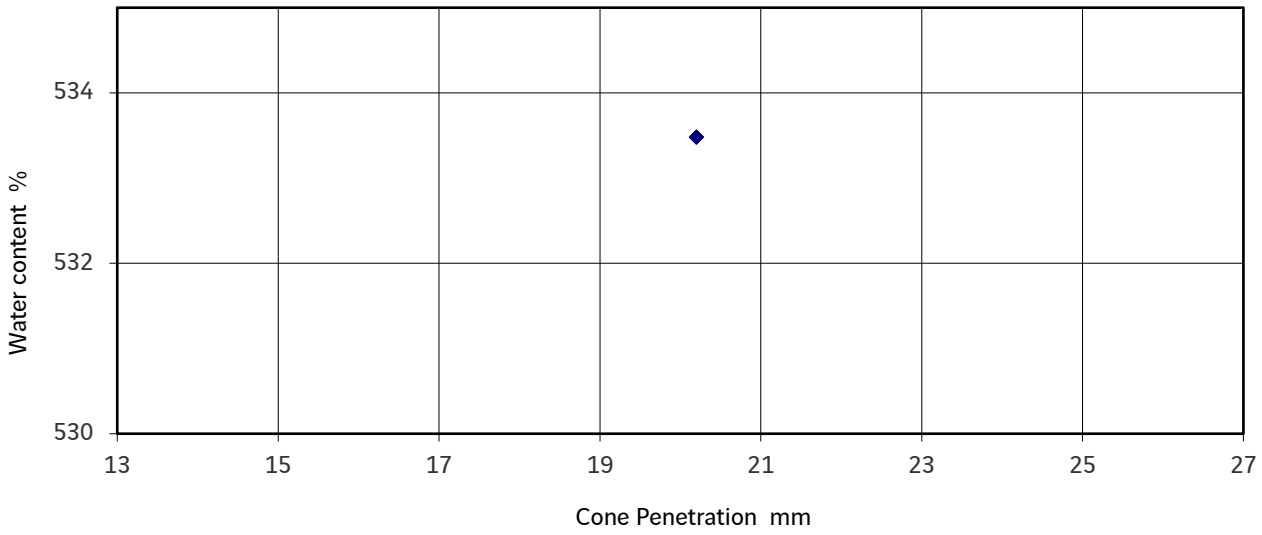
Water content	279	%
Oven temperature	50	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

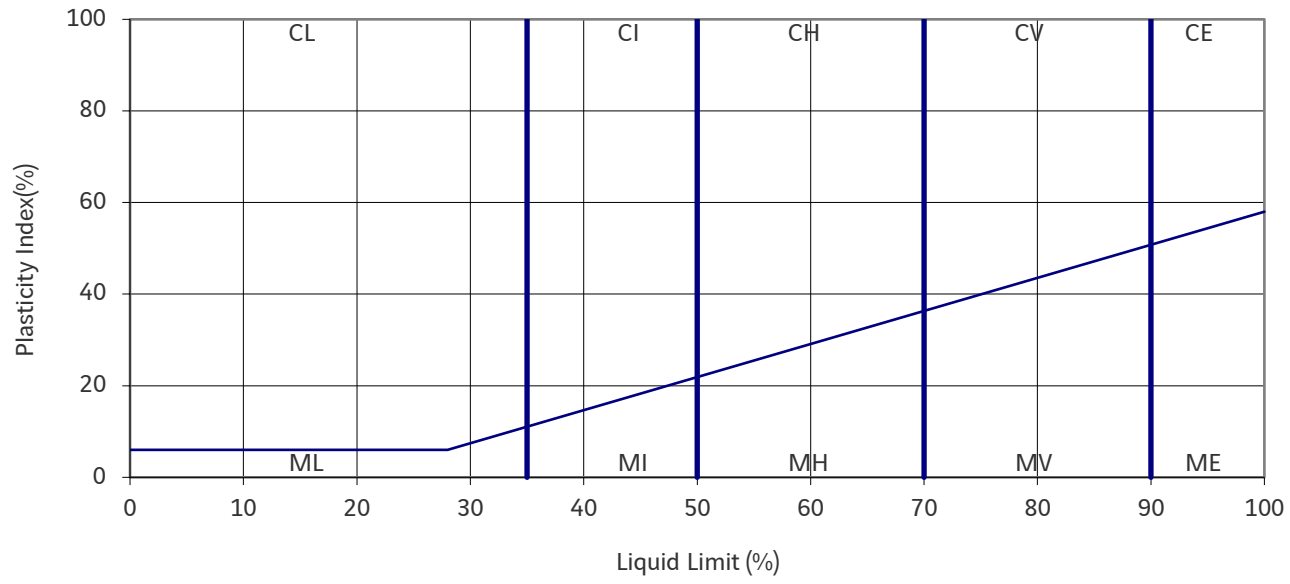
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 11/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH110
Project No.	TB8754		Sample Depth 11.00m
Engineer	Mott MacDonald		Sample Number 38
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Dark brown PEAT.		Specimen Depth 11.52m
			Specimen Number 1



As received water content:	279%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	530%	Preparation of sample: Natural	
Plastic limit:	NP	Remarks:	Test performed with 80g/30deg cone Tested as 1 point Limit Liquid limit due to the sample being peat and it is very difficult to get all four points on a line.
Plasticity index:			
Water content of soil passing 425µm	279%		
Liquidity index:			



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 13/08/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH110
Project No.	TB8754		Sample Depth 12.00m
Engineer	Mott MacDonald		Sample Number 41
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 12.00m
			Specimen Number 2

Water content	49.8	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

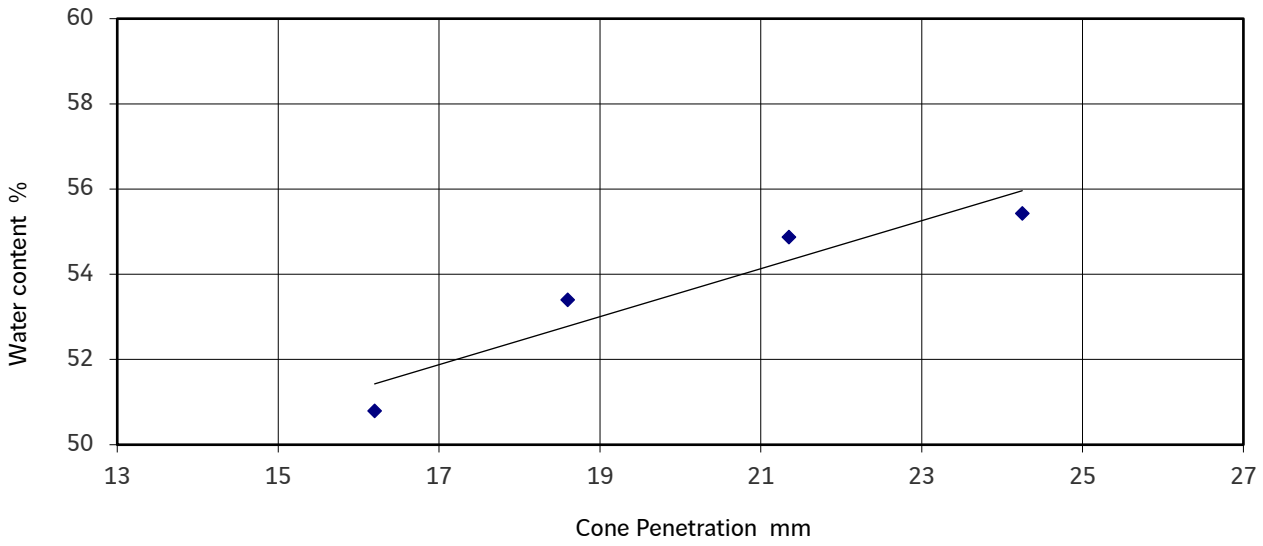
Remarks

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

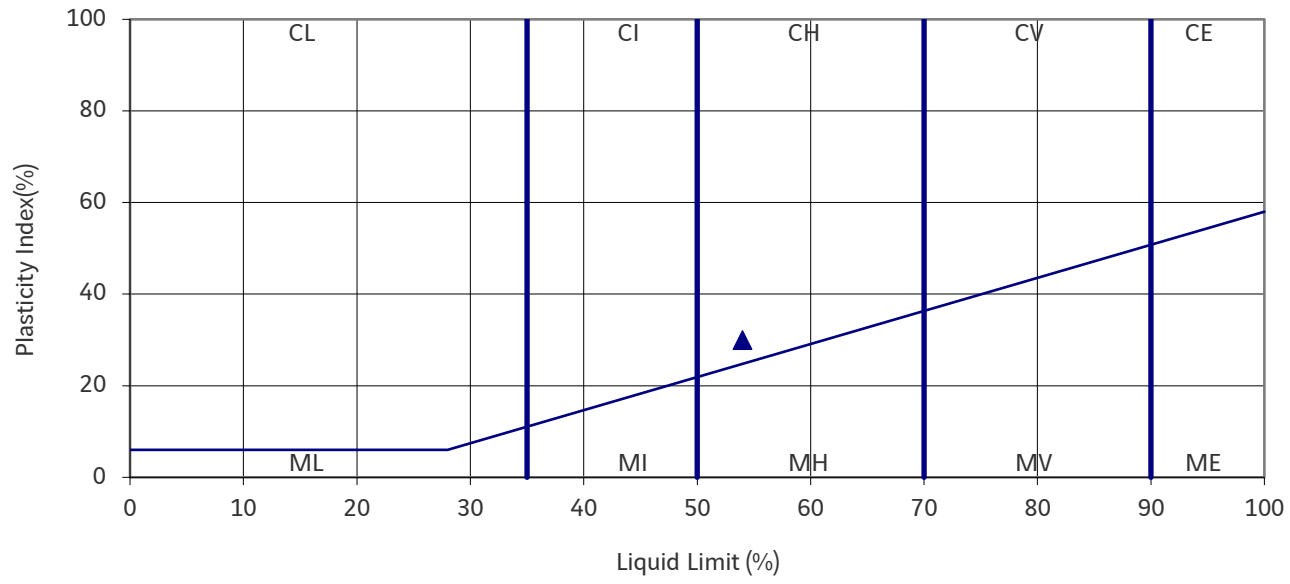
Approved by:	Leeds Laboratory		
Steve Harper		Print date 01/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024	

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH110
Project No.	TB8754		Sample Depth 12.00m
Engineer	Mott MacDonald		Sample Number 41
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 12.00m
			Specimen Number 1



As received water content:	49.8%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	54%	Preparation of sample: Natural	
Plastic limit:	24%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	30%		
Water content of soil passing 425µm	49.8%		
Liquidity index:	0.861		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 01/08/2025	
	Revision No. 3.00	Issue Date 19/05/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH110
Project No.	TB8754		Sample Depth 13.00m
Engineer	Mott MacDonald		Sample Number 44
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type P
Description	Grey CLAY with decomposed plant remains.		Specimen Depth 13.70m
			Specimen Number 3

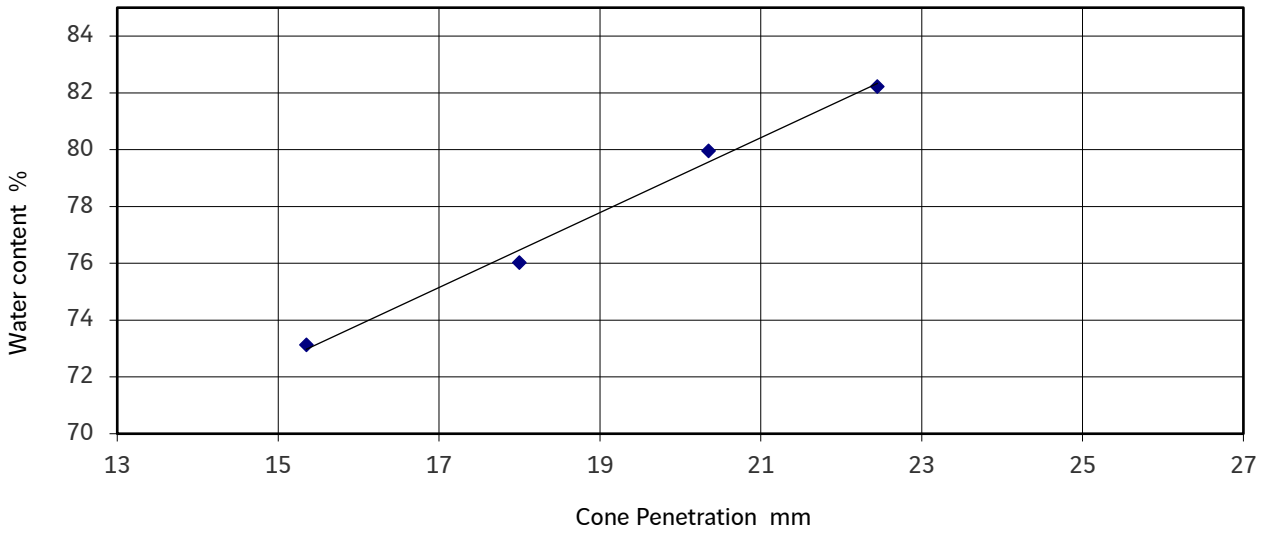
Water content	62.6	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

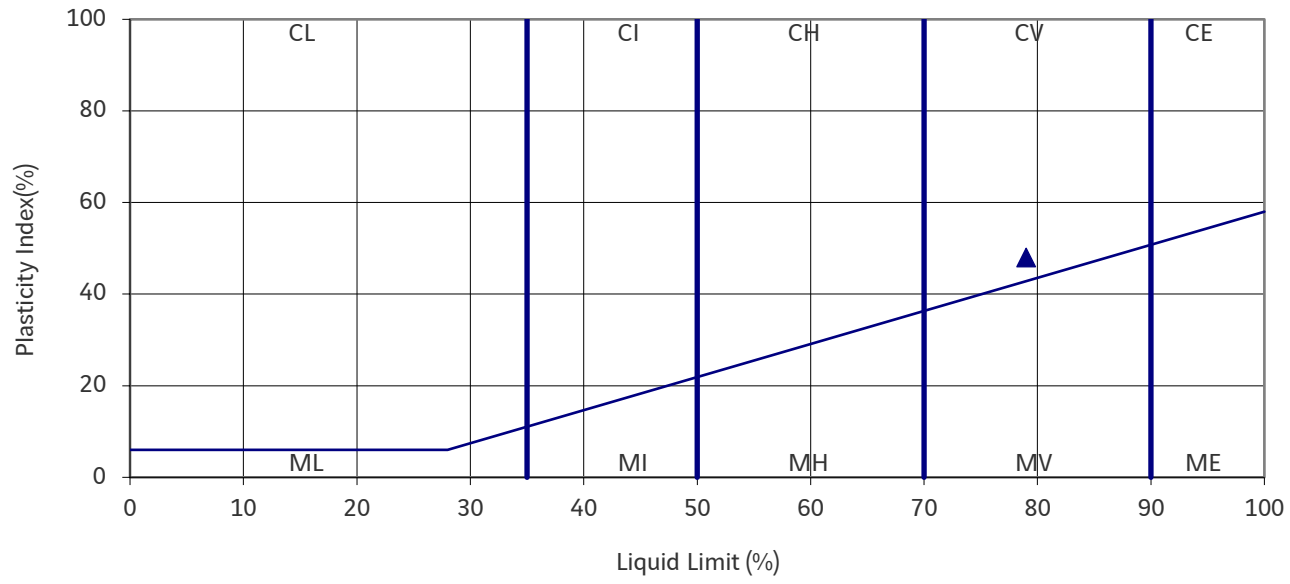
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 21/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH110
Project No.	TB8754		Sample Depth 13.00m
Engineer	Mott MacDonald		Sample Number 44
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type P
Description	Grey CLAY with decomposed plant remains.		Specimen Depth 13.70m
			Specimen Number 2



As received water content:	62.6%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	79%	Preparation of sample: Natural	
Plastic limit:	31%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	48%		
Water content of soil passing 425µm	62.6%		
Liquidity index:	0.657		

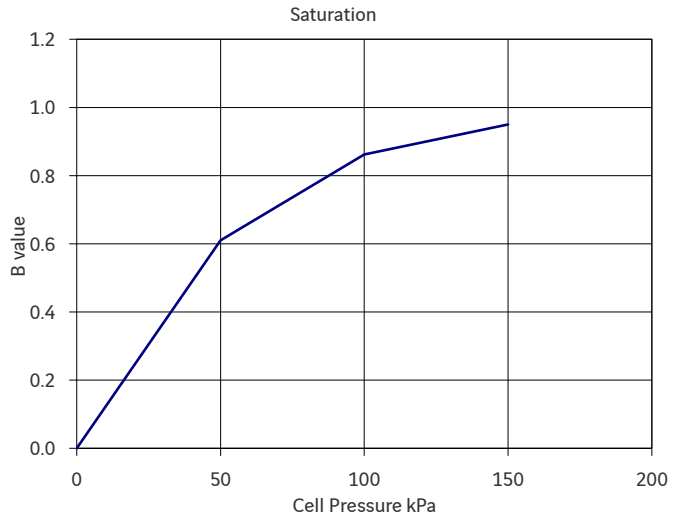


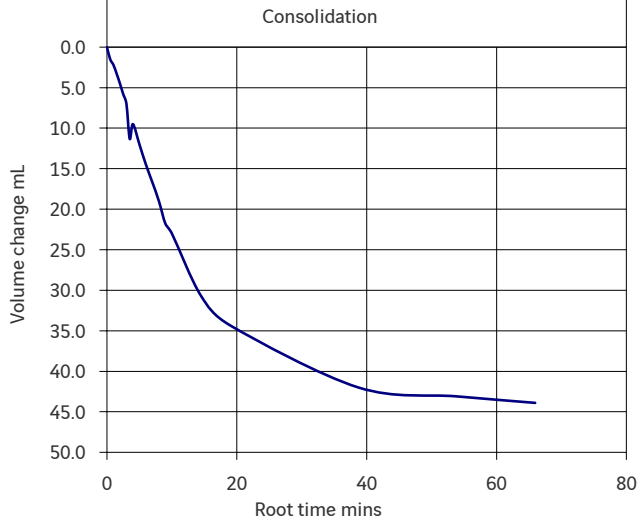
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Paul Rodgers		Print date 22/08/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH110
Project No.	TB8754		Sample Depth 13.00m
Engineer	Mott MacDonald		Sample Number 44
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with decomposed plant remains.		Specimen Depth 13.50m
			Specimen Number 1

SPECIMEN INITIAL DIMENSIONS		
Test number		1
Specimen diameter	mm	101.27
Specimen length	mm	195.50
Density	Mg/m^3	1.64
Moisture content	%	56
Dry density	Mg/m^3	1.05
SATURATION STAGE		
Initial pore water pressure	kPa	0.8
Saturated pore water pressure	kPa	139.8
Final cell pressure	kPa	150
B value		0.95
CONSOLIDATION STAGE		
Cell pressure	kPa	355
Back pressure	kPa	300
Effective consolidation pressure	kPa	55
Initial pore water pressure	kPa	341.1
Final pore water pressure	kPa	301.9
Pore pressure dissipation	%	95.4
c_{vi}	$m^2/year$	0.36
m_{vi}	m^2/MN	0.71
SPECIMEN AFTER CONSOLIDATION		
Density	Mg/m^3	1.67
Moisture content	%	54
Dry density	Mg/m^3	1.09



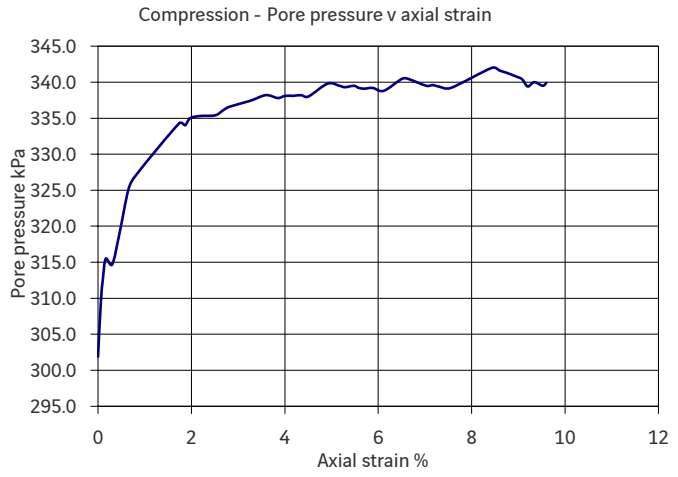


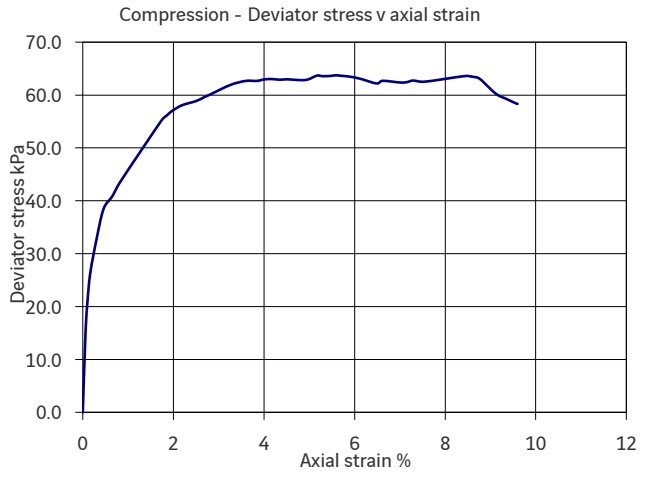
Remarks:
Specimen orientation Vertical
Specimen condition for test UNDISTURBED
Saturation with 50kPa increments with a differential pressure of 10kPa
Drainage from both ends and using a radial filter drain

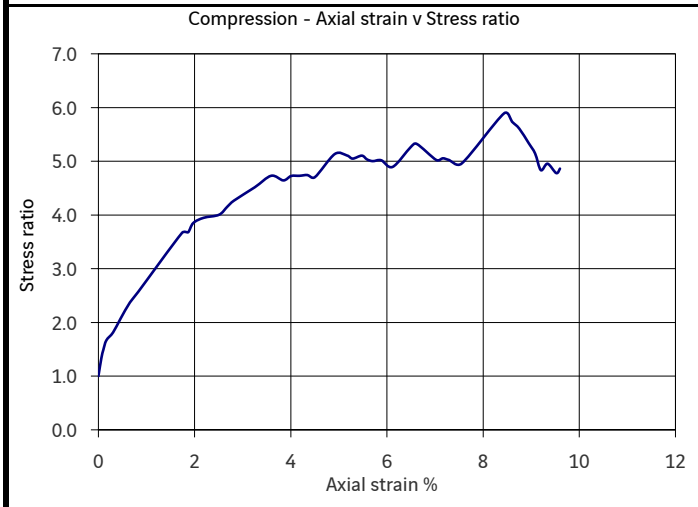
Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 23/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

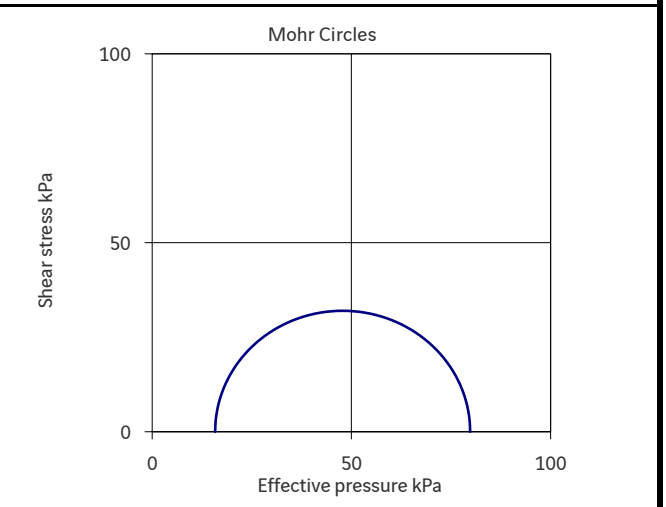
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH110
Project No.	TB8754		Sample Depth 13.00m
Engineer	Mott MacDonald		Sample Number 44
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with decomposed plant remains.		Specimen Depth 13.50m
			Specimen Number 1

COMPRESSION STAGE			
Test number			1
Cell pressure		kPa	355
Initial pore water pressure		kPa	302
Effective confining pressure		kPa	53
Failure conditions at			Maximum deviator stress
Axial strain at failure		%	5.6
Maximum deviator stress	σ_1-σ_3	kPa	64
Pore water pressure at failure	σ	kPa	339
Effective major principal stress	σ_1'	kPa	79.54
Effective minor principal stress	σ_3'	kPa	15.80
Effective principal stress ratio			5.03
Membrane correction		kPa	0.67
Filter drain correction		kPa	3.5
Pore pressure coefficient			0.6









Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 23/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

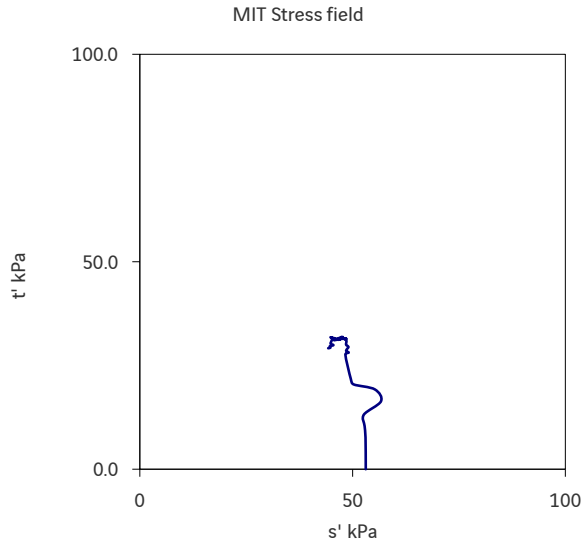
Project Name	Grain to Tilbury Tunnel GI	**Consolidated Undrained Triaxial Compression With Pore Water**	Hole ID BH110
Project No.	TB8754		Sample Depth 13.00m
Engineer	Mott MacDonald		Sample Number 44
Employer	FBJV	BS1377: Part 8: 1990: Clauses 4, 5, 6 and 7	Sample Type P
Description	Grey CLAY with decomposed plant remains.		Specimen Depth 13.50m
			Specimen Number 1

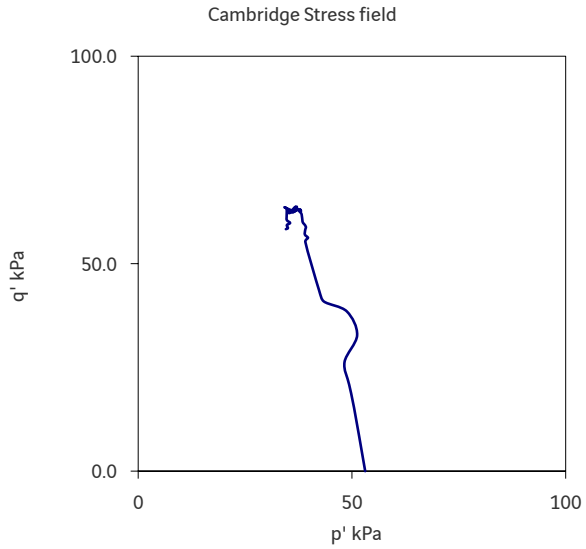
SPECIMEN AFTER TEST

Test number		1	
Mode of failure		Plastic 	
Final moisture content	%	54	
Final bulk density	Mg/m³	1.67	
Final dry density	Mg/m³	1.09	

ADDITIONAL SPECIMEN DETAILS

Rate of strain	%/hour	0.20	
Failure criterion		Maximum deviator stress	





REMARKS

Preliminary	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 23/09/2025	
	Revision No. 3.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Water Content**	Hole ID BH110
Project No.	TB8754		Sample Depth 14.00m
Engineer	Mott MacDonald		Sample Number 45
Employer	FBJV	BS 1377-2:2022 Clause 4.1 / BS EN ISO 17892-1:2014+A1:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 14.00m
			Specimen Number 2

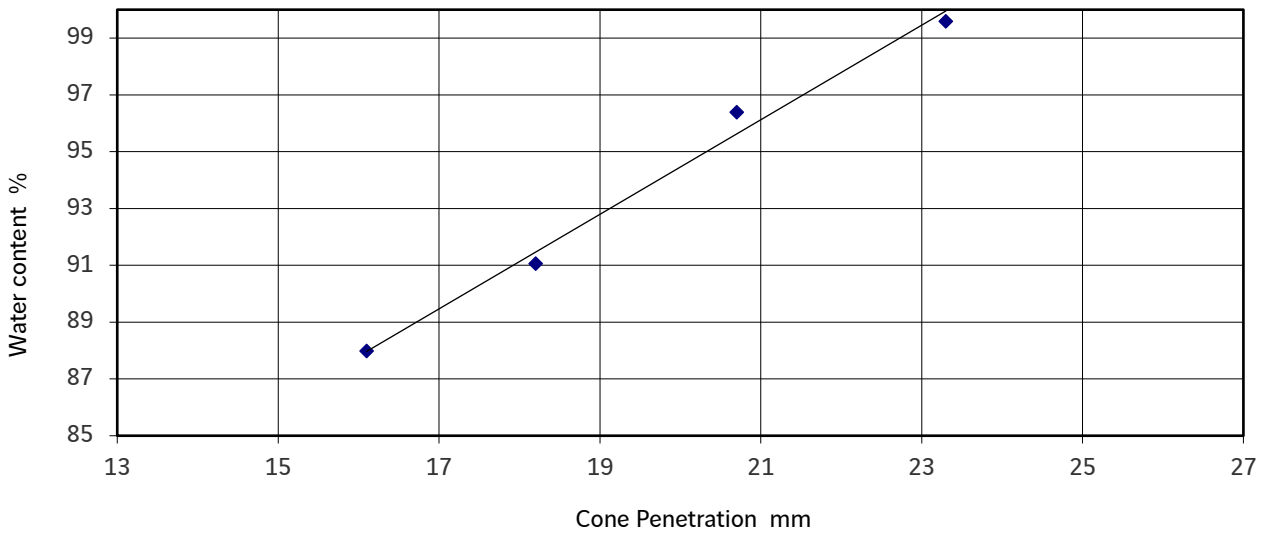
Water content	67.1	%
Oven temperature	105/110	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

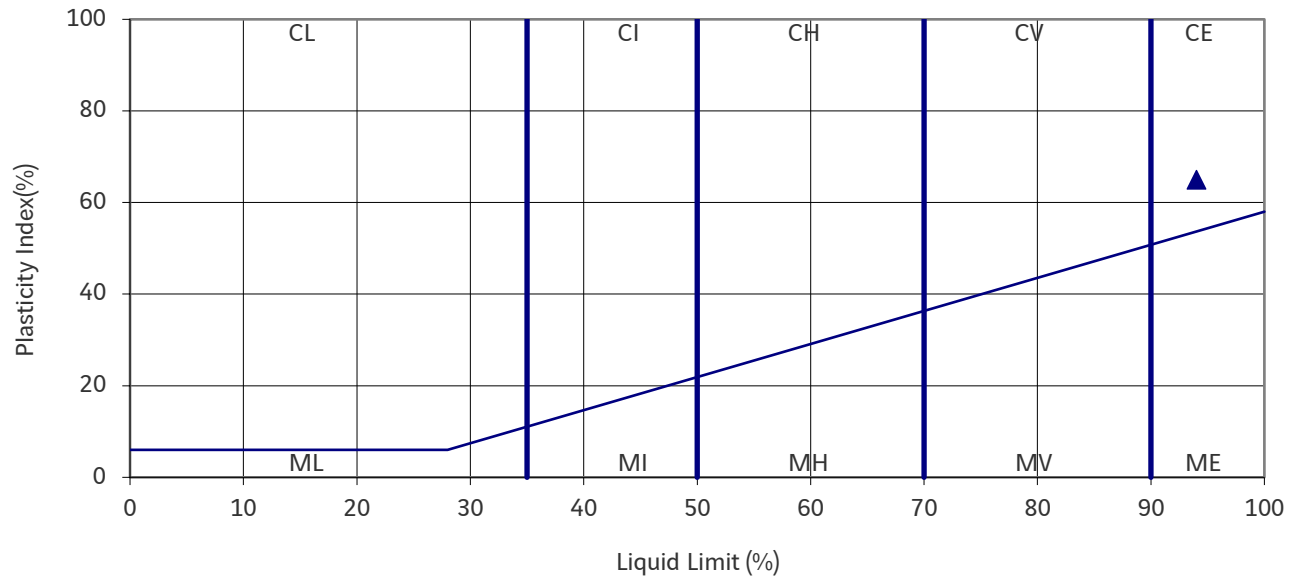
Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 01/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Liquid Limit (Fall Cone) And Plastic Limit Test**	Hole ID BH110
Project No.	TB8754		Sample Depth 14.00m
Engineer	Mott MacDonald		Sample Number 45
Employer	FBJV	BS 1377-2: 2022 / BS EN ISO 17892-12:2018+A2:2022	Sample Type D
Description	Grey CLAY.		Specimen Depth 14.00m
			Specimen Number 1



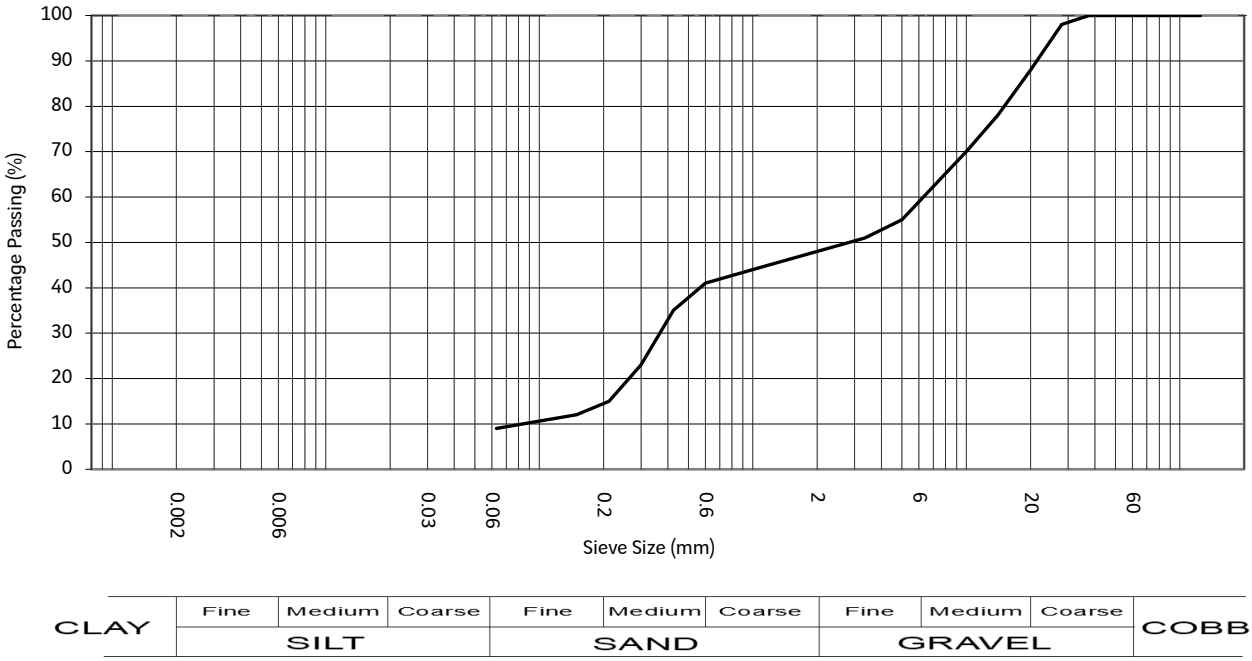
As received water content:	67.1%	Estimated percentage passing 425µm sieve:	100%
Liquid limit:	94%	Preparation of sample: Natural	
Plastic limit:	29%	Remarks: Test performed with 80g/30deg cone with increasing water content.	
Plasticity index:	65%		
Water content of soil passing 425µm	67.1%		
Liquidity index:	0.586		



Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory		
Steve Harper		Print date 01/08/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 19/05/2022	

Project Name	Grain to Tilbury Tunnel GI	**Particle Size Distribution**	Hole ID BH110
Project No.	TB8754		Sample Depth 15.00m
Engineer	Mott MacDonald		Sample Number 51
Employer	FBJV	BS 1377-2:2022 Clause 10/BS EN ISO 17892-4: 2016: 5.2	Sample type B
Description	Greyish brown clayey slightly sandy GRAVEL.		Specimen Depth 15.00m
			Specimen No. 1



PARTICLE SIZE	%
Silt and clay:	8.7
Sand:	39.2
Gravel:	52.1
Cobbles:	0.0

General remarks

WET SIEVE DATA

Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	78
		10	70
		6.3	60
125.0	100	5	55
90.0	100	3.35	51
75.0	100	2	48
63.0	100	1.18	45
50.0	100	0.6	41
37.5	100	0.425	35
28.0	98	0.3	23
20.0	88	0.212	15
		0.15	12
		0.063	9

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:

Steve Harper

Print date 24/07/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH110
Project No.	TB8754		Sample Depth 28.75m
Engineer	Mott MacDonald		Sample Number 6.1
Employer	FBJV	BS 1377-2:2022 Clause 8/BS EN ISO 17892-2:2014: 5.1	Sample Type CS
Description	Off white CHALK.		Specimen Depth 28.75m
			Specimen Number 12

Water Content	28.8	%
Density Type	Linear density	
Bulk Density	1.94	Mg/m^3
Dry Density	1.50	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 01/10/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

SOIL ENGINEERING

SUPPORTING FACTUAL DATA

SECTION B
Laboratory Testing

LABORATORY ROCK TEST DATA SHEETS

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH101
Project No.	TB8754		Sample Depth 26.31m
Engineer	Mott MacDonald		Sample Number 57.1
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 26.31m
			Specimen Number 12

Water content	25.4	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Steve Harper	Leeds Laboratory	Results apply to samples as received. Print date 13/08/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH101
Project No.	TB8754		Sample Depth 26.31m
Engineer	Mott MacDonald		Sample Number 57.1
Employer	FBJV	BS1377: Part 2: 1990: 7.3	Sample Type CS
Description	Off white CHALK.		Specimen Depth 26.31m
			Specimen Number 11

Water Content	25	%
Density Type	Immersion density	
Bulk Density	2.00	Mg/m^3
Dry Density	1.60	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH101	27.60	CS	58.1	27.60	1	Off white CHALK.	I	100.66	64.94	60.28	1.36	87.90	0.18	1.29	0.23
BH101	27.60	CS	58.1	27.60	10	Off white CHALK.	I	43.13	30.35	28.89	0.51	39.83	0.32	0.9	0.29
BH101	27.60	CS	58.1	27.60	2	Off white CHALK.	I	73.18	68.87	66.06	0.61	78.45	0.10	1.22	0.12
BH101	27.60	CS	58.1	27.60	3	Off white CHALK.	I	66.78	61.56	58.7	0.89	70.65	0.18	1.17	0.21
BH101	27.60	CS	58.1	27.60	4	Off white CHALK.	I	66.93	33.79	30.94	0.54	51.35	0.20	1.01	0.21
BH101	27.60	CS	58.1	27.60	5	Off white CHALK.	I	68.61	33.02	29.28	0.72	50.57	0.28	1.01	0.28
BH101	27.60	CS	58.1	27.60	6	Off white CHALK.	I	61.05	38.74	37.27	0.53	53.82	0.18	1.03	0.19
BH101	27.60	CS	58.1	27.60	7	Off white CHALK. Tested outside calibrated range of device	I	48.73	28.11	26.62	0.41	40.64	0.25	0.91	0.23
BH101	27.60	CS	58.1	27.60	8	Off white CHALK. Tested outside calibrated range of device	I	67.9	32.66	30.04	0.39	50.96	0.15	1.01	0.15
BH101	27.60	CS	58.1	27.60	9	Off white CHALK. Tested outside calibrated range of device	I	51.71	33.74	32.16	0.34	46.02	0.16	0.96	0.15

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:		Results apply to samples as received.	
Paul Rodgers		Print date 08/07/2025	
	Revision No. 3.00	Issue Date 07/12/2023	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH101
Project No.	TB8754		Sample Depth 31.21m
Engineer	Mott MacDonald		Sample Number 61.1
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 31.21m
			Specimen Number 12

Water content	29.7	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 31/07/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH101
Project No.	TB8754		Sample Depth 31.21m
Engineer	Mott MacDonald		Sample Number 61.1
Employer	FBJV	BS1377: Part 2: 1990: 7.3	Sample Type CS
Description	Off white CHALK.		Specimen Depth 31.21m
			Specimen Number 11

Water Content	29	%
Density Type	Immersion density	
Bulk Density	1.95	Mg/m^3
Dry Density	1.51	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH101	31.21	CS	61.1	31.21	1	Off white CHALK. Tested outside calibrated range of device	A+X	100.72	75.16	72.18	0.44	96.21	0.05	1.34	0.06
BH101	31.21	CS	61.1	31.21	10	Off white CHALK. Tested outside calibrated range of device	I	36.84	25.06	23.66	0.18	33.31	0.16	0.83	0.14
BH101	31.21	CS	61.1	31.21	2	Off white CHALK. Tested outside calibrated range of device	I	49.29	38.25	35.34	0.39	47.09	0.18	0.97	0.17
BH101	31.21	CS	61.1	31.21	3	Off white CHALK. Tested outside calibrated range of device	I	47.4	29.53	28.15	0.38	41.22	0.22	0.92	0.21
BH101	31.21	CS	61.1	31.21	4	Off white CHALK. Tested outside calibrated range of device	I	38.39	30.79	29.22	0.18	37.79	0.13	0.88	0.11
BH101	31.21	CS	61.1	31.21	5	Off white CHALK. Tested outside calibrated range of device	I	41.29	18.89	17.24	0.12	30.11	0.13	0.8	0.11
BH101	31.21	CS	61.1	31.21	6	Off white CHALK. Tested outside calibrated range of device	I	34.39	24.24	21.32	0.11	30.55	0.12	0.8	0.09
BH101	31.21	CS	61.1	31.21	7	Off white CHALK. Tested outside calibrated range of device	I	40.14	24.66	23.05	0.11	34.32	0.09	0.84	0.08
BH101	31.21	CS	61.1	31.21	8	Off white CHALK. Tested outside calibrated range of device	I	36.67	21.08	19.73	0.13	30.35	0.14	0.8	0.11
BH101	31.21	CS	61.1	31.21	9	Off white CHALK. Tested outside calibrated range of device	I	38.39	22.67	21.28	0.1	32.25	0.10	0.82	0.08

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			

For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$ For Diametral tests $De^2 = D \times D'$

Approved by:		Results apply to samples as received.	
Steve Harper		Print date 27/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 07/12/2023	

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH101	32.77	CS	62.1	32.77	1	Off white CHALK.	I	66.28	42.22	39.41	0.71	57.67	0.21	1.07	0.23
BH101	32.77	CS	62.1	32.77	10	Off white CHALK.	I	34.45	31.92	30.56	0.5	36.61	0.37	0.87	0.32
BH101	32.77	CS	62.1	32.77	2	Off white CHALK.	I	67.64	44.86	42.07	0.69	60.19	0.19	1.09	0.21
BH101	32.77	CS	62.1	32.77	3	Off white CHALK.	I	63.34	43.73	42.2	0.67	58.34	0.20	1.07	0.21
BH101	32.77	CS	62.1	32.77	4	Off white CHALK.	I	46.28	34.98	32.15	0.68	43.53	0.36	0.94	0.34
BH101	32.77	CS	62.1	32.77	5	Off white CHALK. Tested outside calibrated range of device	I	45.68	26.32	23.66	0.43	37.10	0.31	0.87	0.27
BH101	32.77	CS	62.1	32.77	6	Off white CHALK.	I	45.16	32.76	31.28	0.55	42.41	0.31	0.93	0.28
BH101	32.77	CS	62.1	32.77	7	Off white CHALK. Tested outside calibrated range of device	I	43.05	30.95	28.46	0.38	39.50	0.24	0.9	0.22
BH101	32.77	CS	62.1	32.77	8	Off white CHALK. Tested outside calibrated range of device	I+X	45.28	38.54	35.47	0.21	45.22	0.10	0.96	0.10
BH101	32.77	CS	62.1	32.77	9	Off white CHALK. Tested outside calibrated range of device	I	44.75	27.14	25.64	0.27	38.22	0.18	0.89	0.16

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:		Results apply to samples as received.	
Paul Rodgers		Print date 08/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 07/12/2023	

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH101
Project No.	TB8754		Sample Depth 35.59m
Engineer	Mott MacDonald		Sample Number 64.1
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 35.59m
			Specimen Number 12

Water content	24.5	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 31/07/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH101
Project No.	TB8754		Sample Depth 35.59m
Engineer	Mott MacDonald		Sample Number 64.1
Employer	FBJV	BS1377: Part 2: 1990: 7.2	Sample Type CS
Description	Off white CHALK.		Specimen Depth 35.59m
			Specimen Number 11

Water Content	23	%
Density Type	Linear density	
Bulk Density	2.03	Mg/m^3
Dry Density	1.65	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH101	35.59	CS	64.1	35.59	1	Off white CHALK.	A	99.31	54.9	52.05	1.67	81.13	0.25	1.24	0.32
BH101	35.59	CS	64.1	35.59	10	Off white CHALK.	I	46.96	32.52	30.92	0.5	43.00	0.27	0.93	0.25
BH101	35.59	CS	64.1	35.59	2	Off white CHALK.	I	55.27	49.9	48.5	0.73	58.42	0.21	1.07	0.23
BH101	35.59	CS	64.1	35.59	3	Off white CHALK.	I	56.13	49.26	46.62	0.87	57.72	0.26	1.07	0.28
BH101	35.59	CS	64.1	35.59	4	Off white CHALK.	I	49.89	38.83	37.31	0.81	48.68	0.34	0.99	0.34
BH101	35.59	CS	64.1	35.59	5	Off white CHALK.	I	51.15	30.75	29.2	0.71	43.61	0.37	0.94	0.35
BH101	35.59	CS	64.1	35.59	6	Off white CHALK.	A+X	98.75	65.68	61.33	0.55	87.81	0.07	1.29	0.09
BH101	35.59	CS	64.1	35.59	7	Off white CHALK.	A	98.75	61.33	51.1	1.74	80.16	0.27	1.24	0.33
BH101	35.59	CS	64.1	35.59	8	Off white CHALK.	I	68.3	53.18	50.32	0.7	66.15	0.16	1.13	0.18
BH101	35.59	CS	64.1	35.59	9	Off white CHALK.	I	59.53	45.21	42.57	0.62	56.80	0.19	1.06	0.20

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

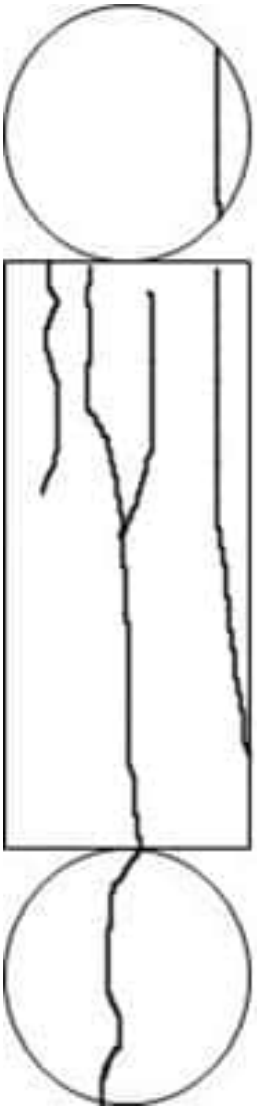
Approved by:		Results apply to samples as received.	
Steve Harper		Print date 27/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 07/12/2023	

Project Name	Grain to Tilbury Tunnel GI	**Uniaxial Compressive Strength**	Hole ID BH101
Project No.	TB8754		Sample Depth 36.64m
Engineer	Mott MacDonald	The Complete ISRM Suggested Methods - Rock Characterization Testing and Monitoring 1974 - 2006, Editors: R Ulusay & J A Hudson	Sample Number 65.1
Employer	FBJV		Sample Type CS
Description	Off white CHALK.		Specimen Depth 36.64m
			Specimen Number 1

Date and method of sampling	Not supplied
Storage history and environment	Sample stored in temperature controlled environment.

Sample details				Mean
Length	mm	189.94	190.00	190.0
Diameter (top)	mm	68.77	68.71	69.0
Diameter (middle)	mm	68.39	69.32	Length/diameter ratio
Diameter (base)	mm	69.42	69.58	2.8
Area	mm^2	3742.7		
Mass	g	1450.52		
Test details				
Test duration	min	11:00		
Failure load	kN	16.3		
Stress rate	kN/min	1.5		
U.C.S.	MPa	4.36		
Mode of failure		Axial		
Loading axis relative to anisotropy				
Machine type used in test		Controls 1300 / Automax 5		
Date of test		11/07/2025		
Additional specimen details				
Water content	%	23.0		
Bulk density	kg/m^3	2040		
Dry density	kg/m^3	1660		

Failure sketch



Test Remarks

Specimen Remarks

Sides of specimen are not smooth and straight to within ISRM tolerance, the largest irregularity measured as 0.9mm. Top and bottom of specimen are not perpendicular to ISRM tolerance of 0.05mm in 50mm

Approved by:	Leeds Laboratory	Results apply to samples as received.	SOIL ENGINEERING
Paul Rodgers		Print date 11/08/2025	
	Revision No. 2.08	Issue Date 22/01/2025	

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH101
Project No.	TB8754		Sample Depth 38.73m
Engineer	Mott MacDonald		Sample Number 66.1
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 38.73m
			Specimen Number 12

Water content	26.5	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 23/07/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH101	38.73	CS	66.1	38.73	1	Off white CHALK. Tested outside calibrated range of device	I	53.2	34.27	32.94	0.2	47.24	0.09	0.97	0.09
BH101	38.73	CS	66.1	38.73	10	Off white CHALK. Tested outside calibrated range of device	I	38.22	20.4	18.98	0.23	30.39	0.25	0.8	0.20
BH101	38.73	CS	66.1	38.73	2	Off white CHALK. Tested outside calibrated range of device	I	53.01	36.08	35.11	0.01	48.68	0.00	0.99	0.00
BH101	38.73	CS	66.1	38.73	3	Off white CHALK. Tested outside calibrated range of device	I	53	34.78	30.64	0.32	45.47	0.15	0.96	0.15
BH101	38.73	CS	66.1	38.73	4	Off white CHALK. Tested outside calibrated range of device	I	44.87	32.41	30.9	0.18	42.02	0.10	0.92	0.09
BH101	38.73	CS	66.1	38.73	5	Off white CHALK. Tested outside calibrated range of device	I	36.08	31.61	30.11	0.41	37.19	0.30	0.88	0.26
BH101	38.73	CS	66.1	38.73	6	Off white CHALK. Tested outside calibrated range of device	I	36.18	26.76	25.39	0.24	34.20	0.21	0.84	0.17
BH101	38.73	CS	66.1	38.73	7	Off white CHALK. Tested outside calibrated range of device	I	34.52	23.16	21.68	0.29	30.87	0.30	0.8	0.24
BH101	38.73	CS	66.1	38.73	8	Off white CHALK. Tested outside calibrated range of device	I	38.95	21.79	20.31	0.25	31.74	0.25	0.82	0.20
BH101	38.73	CS	66.1	38.73	9	Off white CHALK. Tested outside calibrated range of device	I	38.33	19.2	17.66	0.25	29.36	0.29	0.79	0.23

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

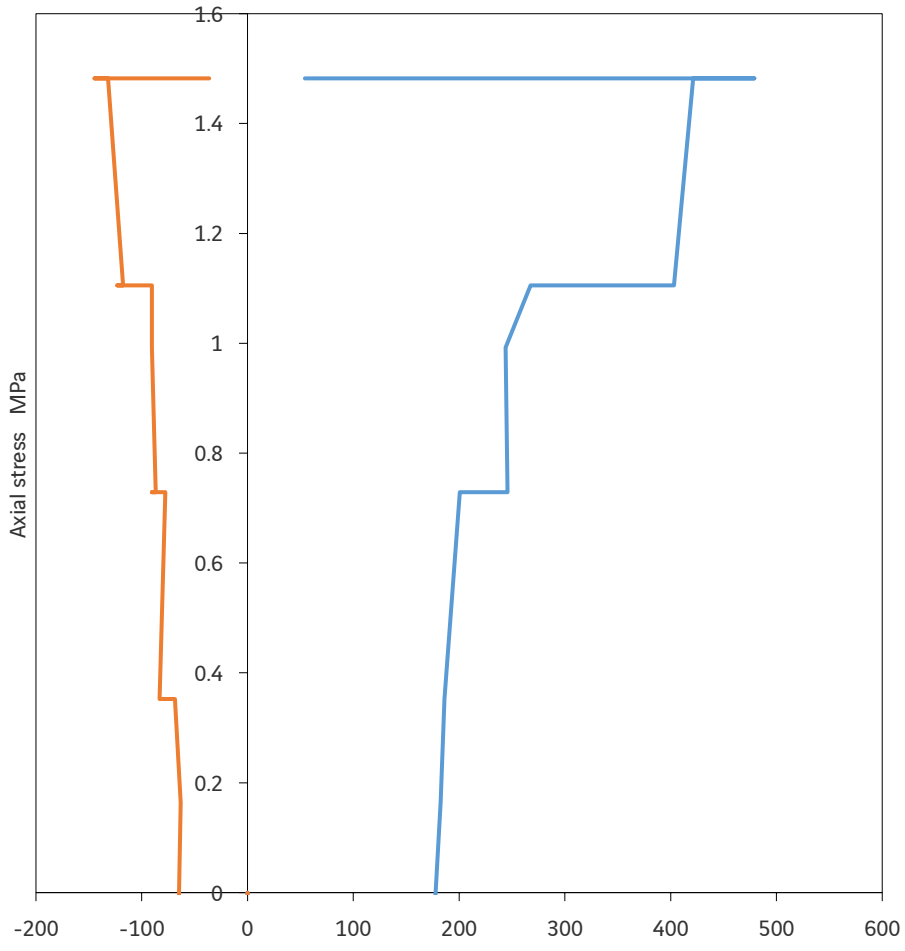
Approved by:		Results apply to samples as received.	
Paul Rodgers		Print date 23/07/2025	
	Revision No. 3.00	Issue Date 07/12/2023	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Uniaxial Compressive Strength With Youngs Modulus And Poissons Ratio**	Hole ID BH101
Project No.	TB8754	The Complete ISRM Suggested Methods - Rock Characterization Testing and Monitoring 1974 - 2006. Editors: R.Ulusay & J.A.	Sample Depth 38.73m
Engineer	Mott MacDonald		Sample Number 66.1
Employer	FBJV		Sample Type CS
Description	Off white CHALK.		Specimen Depth 38.73m
			Specimen Number 11

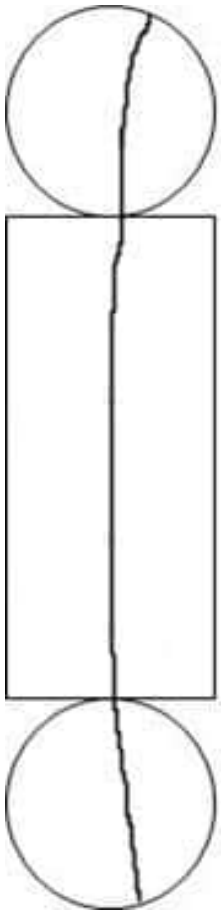
Date and method of sampling

Storage history and environment — Sample stored in temperature controlled environment.

Graph of stress strain curves



Failure sketch



Mode of Failure: Axial

Water content	%	26.5	Stress rate	MPa/s	0.01	Tangent modulus	E_t 13.5	GPa	11-67 % stress
Length	mm	144.15	Test duration	min	04:30	Average modulus	E_{ave} 5.66	GPa	11-75 % stress
Diameter	mm	53.35	U.C.S.	MPa	2.91	Secant modulus	E_{sec} 3.63	GPa	0-50 % stress
Mass	g	630.49	Type of machine	Controls 1300 / Automax 5		Poissons ratio	v 0.295		
Bulk density	kg/m^3	1960				(Determined using Average modulus)			
Dry density	kg/m^3	1550							
Date		11/07/2025							

Test remarks

Specimen remarks — Sides of specimen are not smooth and straight to within ISRM tolerance, the largest irregularity measured as 1.2mm. Top and bottom of specimen are not perpendicular to ISRM tolerance of 0.05mm in 50mm

Approved by:	Leeds Laboratory	Results apply to samples as received.	SOIL ENGINEERING
Paul Rodgers		Print date 22/08/2025	
	Revision No. 2.08	Issue Date 22/01/2025	

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH101	39.70	CS	67.1	39.70	1	Off white CHALK.	A	99.85	36.19	32.07	0.82	63.85	0.20	1.12	0.22
BH101	39.70	CS	67.1	39.70	10	Off white CHALK.	I	52.65	37.85	36.43	1.01	49.42	0.41	0.99	0.41
BH101	39.70	CS	67.1	39.70	2	Off white CHALK.	A	99.89	36.22	32.2	0.88	63.99	0.21	1.12	0.24
BH101	39.70	CS	67.1	39.70	3	Off white CHALK.	A	99.24	37.69	33.67	0.85	65.23	0.20	1.13	0.23
BH101	39.70	CS	67.1	39.70	4	Off white CHALK.	A	100.75	36.64	33.82	0.93	65.87	0.21	1.13	0.24
BH101	39.70	CS	67.1	39.70	5	Off white CHALK.	A	100.39	37.64	34.88	0.7	66.77	0.16	1.14	0.18
BH101	39.70	CS	67.1	39.70	6	Off white CHALK.	I	85.5	47.13	43.55	1.24	68.85	0.26	1.15	0.30
BH101	39.70	CS	67.1	39.70	7	Off white CHALK.	I	54.82	36.57	35.2	0.72	49.57	0.29	1	0.29
BH101	39.70	CS	67.1	39.70	8	Off white CHALK.	I	51.51	36.52	35.03	1.07	47.93	0.47	0.98	0.46
BH101	39.70	CS	67.1	39.70	9	Off white CHALK.	I	55.17	37.45	35.97	0.59	50.27	0.23	1	0.23

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:		Results apply to samples as received.	
Paul Rodgers		Print date 08/07/2025	
	Revision No. 3.00	Issue Date 07/12/2023	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH101
Project No.	TB8754		Sample Depth 42.29m
Engineer	Mott MacDonald		Sample Number 69.1
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 42.29m
			Specimen Number 12

Water content	27.5	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 23/07/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH101	42.29	CS	69.1	42.29	1	Off white CHALK. Tested outside calibrated range of device	I	53.31	30.21	28.41	0.18	43.91	0.09	0.94	0.09
BH101	42.29	CS	69.1	42.29	10	Off white CHALK. Tested outside calibrated range of device	I	28.19	22.48	20.37	0.12	27.04	0.16	0.76	0.12
BH101	42.29	CS	69.1	42.29	2	Off white CHALK. Tested outside calibrated range of device	I	53.04	34.43	32.17	0.2	46.61	0.09	0.97	0.09
BH101	42.29	CS	69.1	42.29	3	Off white CHALK. Tested outside calibrated range of device	I	43.77	24.69	23.26	0.23	36.00	0.18	0.86	0.15
BH101	42.29	CS	69.1	42.29	4	Off white CHALK. Tested outside calibrated range of device	I	37.85	22.3	20.75	0.21	31.62	0.21	0.81	0.17
BH101	42.29	CS	69.1	42.29	5	Off white CHALK. Tested outside calibrated range of device	I	37.42	20.45	18.89	0.29	30.00	0.32	0.79	0.26
BH101	42.29	CS	69.1	42.29	6	Off white CHALK. Tested outside calibrated range of device	I	32.81	19.35	17.88	0.13	27.33	0.17	0.76	0.13
BH101	42.29	CS	69.1	42.29	7	Off white CHALK. Tested outside calibrated range of device	I	30.27	27.46	25.92	0.17	31.61	0.17	0.81	0.14
BH101	42.29	CS	69.1	42.29	8	Off white CHALK. Tested outside calibrated range of device	I	34.03	26.23	25.14	0.1	33.00	0.09	0.83	0.08
BH101	42.29	CS	69.1	42.29	9	Off white CHALK. Tested outside calibrated range of device	I	31.12	24.33	23.03	0.09	30.21	0.10	0.8	0.08

Key

Point Load Type (Combination of)	D	Diametral	A	Axial
	I	Irregular lump	B	Block
	L	Parallel to planes of weakness	P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)		
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)		
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump		
	D	Distance between platens when just in contact with specimen		
	D'	Distance between platens at point of failure		
	De	Equivalent core diameter	Is	P/De^2
	Is(50)	F x Is	F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm		
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$		For Diametral tests $De^2 = D \times D'$	

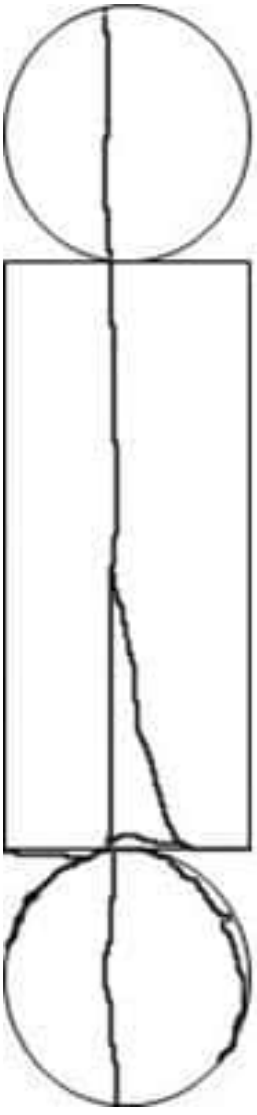
Approved by:		Results apply to samples as received.	SOIL ENGINEERING
Paul Rodgers		Print date 23/07/2025	
	Revision No. 3.00	Issue Date 07/12/2023	

Project Name	Grain to Tilbury Tunnel GI	**Uniaxial Compressive Strength**	Hole ID BH101
Project No.	TB8754		Sample Depth 42.29m
Engineer	Mott MacDonald	The Complete ISRM Suggested Methods - Rock Characterization Testing and Monitoring 1974 - 2006, Editors: R Ulusay & J A Hudson	Sample Number 69.1
Employer	FBJV		Sample Type CS
Description	Off white CHALK.		Specimen Depth 42.29m
			Specimen Number 11

Date and method of sampling	Not supplied
Storage history and environment	Sample stored in temperature controlled environment.

Sample details				Mean
Length	mm	134.76	134.49	134.6
Diameter (top)	mm	52.50	52.30	53.0
Diameter (middle)	mm	53.46	53.46	Length/diameter ratio
Diameter (base)	mm	53.24	53.24	2.5
Area	mm^2	2209.0		
Mass	g	580.41		
Test details				
Test duration	min	03:35		
Failure load	kN	5.9		
Stress rate	kN/min	1.6		
U.C.S.	MPa	2.67		
Mode of failure		Axial		
Loading axis relative to anisotropy				
Machine type used in test		Controls Pilot 4		
Date of test				
Additional specimen details				
Water content	%	27.5		
Bulk density	kg/m^3	1950		
Dry density	kg/m^3	1530		

Failure sketch



Test Remarks

Specimen Remarks

Sides of specimen are not smooth and straight to within ISRM tolerance, the largest irregularity measured as 1.4mm. Top and bottom of specimen are not perpendicular to ISRM tolerance of 0.05mm in 50mm

Approved by:	Leeds Laboratory	Results apply to samples as received.	SOIL ENGINEERING
Paul Rodgers		Print date 23/07/2025	
	Revision No. 2.08	Issue Date 22/01/2025	

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH101
Project No.	TB8754		Sample Depth 46.28m
Engineer	Mott MacDonald		Sample Number 72.1
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 46.28m
			Specimen Number 12

Water content	30.5	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 23/07/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI
Project No.	TB8754
Engineer	Mott MacDonald
Client	FBJV

Point Load Index Result

Test method: ISRM 1985 : Suggested Method

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH101	46.28	CS	72.1	46.28	1	Off white CHALK. Tested outside calibrated range of device	A	53.55	28.9	27.65	0.4	43.42	0.21	0.94	0.20
BH101	46.28	CS	72.1	46.28	10	Off white CHALK. Tested outside calibrated range of device	I	32.46	22.9	21.37	0.27	29.72	0.31	0.79	0.24
BH101	46.28	CS	72.1	46.28	2	Off white CHALK.	I	72.32	32.37	29.42	0.5	52.05	0.18	1.02	0.19
BH101	46.28	CS	72.1	46.28	3	Off white CHALK. Tested outside calibrated range of device	I	41.79	29.26	27.81	0.26	38.47	0.18	0.89	0.16
BH101	46.28	CS	72.1	46.28	4	Off white CHALK. Tested outside calibrated range of device	I	60.2	30.17	28.71	0.27	46.91	0.12	0.97	0.12
BH101	46.28	CS	72.1	46.28	5	Off white CHALK. Tested outside calibrated range of device	I	31.48	24	22.6	0.21	30.10	0.23	0.8	0.18
BH101	46.28	CS	72.1	46.28	6	Off white CHALK. Tested outside calibrated range of device	I	31.87	27.98	26.56	0.27	32.83	0.25	0.83	0.21
BH101	46.28	CS	72.1	46.28	7	Off white CHALK. Tested outside calibrated range of device	I	53.47	31.98	30.57	0.34	45.62	0.16	0.96	0.16
BH101	46.28	CS	72.1	46.28	8	Off white CHALK. Tested outside calibrated range of device	I	53.47	34.43	33.22	0.21	47.56	0.09	0.98	0.09
BH101	46.28	CS	72.1	46.28	9	Off white CHALK. Tested outside calibrated range of device	I	53.47	31.3	30.47	0.18	45.55	0.09	0.96	0.08

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:

Paul Rodgers

Results apply to samples as received.

Print date 23/07/2025

Revision No. 3.00

Issue Date 07/12/2023

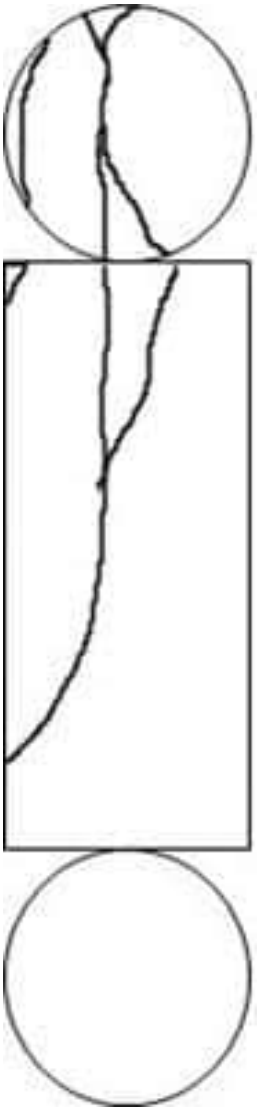
SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Uniaxial Compressive Strength**	Hole ID BH101
Project No.	TB8754		Sample Depth 46.28m
Engineer	Mott MacDonald	The Complete ISRM Suggested Methods - Rock Characterization Testing and Monitoring 1974 - 2006, Editors: R Ulusay & J A Hudson	Sample Number 72.1
Employer	FBJV		Sample Type CS
Description	Off white CHALK.		Specimen Depth 46.28m
			Specimen Number 11

Date and method of sampling	Not supplied
Storage history and environment	Sample stored in temperature controlled environment.

Sample details				Mean
Length	mm	142.71	142.67	142.7
Diameter (top)	mm	53.40	53.51	53.4
Diameter (middle)	mm	53.45	53.45	Length/diameter ratio
Diameter (base)	mm	53.39	53.30	2.7
Area	mm^2	2241.0		
Mass	g	607.46		
Test details				
Test duration	min	03:09		
Failure load	kN	3.5		
Stress rate	kN/min	1.1		
U.C.S.	MPa	1.56		
Mode of failure		Shear		
Loading axis relative to anisotropy				
Machine type used in test		Controls 1300 / Automax 5		
Date of test				
Additional specimen details				
Water content	%	30.5		
Bulk density	kg/m^3	1900		
Dry density	kg/m^3	1460		

Failure sketch



Test Remarks

Specimen Remarks

Sides of specimen are not smooth and straight to within ISRM tolerance, the largest irregularity measured as 0.7mm. Top and bottom of specimen are not perpendicular to ISRM tolerance of 0.05mm in 50mm

Approved by:	Leeds Laboratory	Results apply to samples as received.	SOIL ENGINEERING
Paul Rodgers		Print date 23/07/2025	
	Revision No. 2.08	Issue Date 22/01/2025	

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH101	47.17	CS	73.1	47.17	1	Off white CHALK. L/D<0.5 due to insufficient specimen.	D+X	101.54	101.29	98.55	0.77	99.91	0.08	1.37	0.11
BH101	47.17	CS	73.1	47.17	10	Off white CHALK. Tested outside calibrated range of device	I	71.22	30.44	28.99	0.4	51.27	0.15	1.01	0.15
BH101	47.17	CS	73.1	47.17	2	Off white CHALK.	A	101.42	79.2	68.4	0.85	93.98	0.10	1.33	0.13
BH101	47.17	CS	73.1	47.17	3	Off white CHALK. Tested outside calibrated range of device	A	101.29	58.32	55.47	0.46	84.58	0.06	1.27	0.08
BH101	47.17	CS	73.1	47.17	4	Off white CHALK. Tested outside calibrated range of device	I	81.14	49.42	47.88	0.43	70.33	0.09	1.17	0.10
BH101	47.17	CS	73.1	47.17	5	Off white CHALK.	I	60.47	43.99	42.37	0.56	57.12	0.17	1.06	0.18
BH101	47.17	CS	73.1	47.17	6	Off white CHALK.	I	50.62	37.24	34.81	0.69	47.37	0.31	0.98	0.30
BH101	47.17	CS	73.1	47.17	7	Off white CHALK.	I	58.88	31.56	30.14	0.76	47.53	0.34	0.98	0.33
BH101	47.17	CS	73.1	47.17	8	Off white CHALK.	I	50.63	38.3	36.87	0.51	48.75	0.21	0.99	0.21
BH101	47.17	CS	73.1	47.17	9	Off white CHALK. Tested outside calibrated range of device	I	46	31.66	29.11	0.46	41.29	0.27	0.92	0.25

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:		Results apply to samples as received.	
Paul Rodgers		Print date 08/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 07/12/2023	

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH101
Project No.	TB8754		Sample Depth 49.50m
Engineer	Mott MacDonald		Sample Number 74.1
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 49.50m
			Specimen Number 11

Water content	23.8	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 10/07/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH101
Project No.	TB8754		Sample Depth 49.50m
Engineer	Mott MacDonald		Sample Number 74.1
Employer	FBJV	BS1377: Part 2: 1990: 7.3	Sample Type CS
Description	Off white CHALK.		Specimen Depth 49.50m
			Specimen Number 12

Water Content	27	%
Density Type	Immersion density	
Bulk Density	1.94	Mg/m^3
Dry Density	1.53	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH101	49.50	CS	74.1	49.50	1	Off white CHALK.	D	101.86	98.25	93.91	0.51	96.06	0.06	1.34	0.07
BH101	49.50	CS	74.1	49.50	10	Off white CHALK.	I	56.71	49.26	46.45	0.57	57.91	0.17	1.07	0.18
BH101	49.50	CS	74.1	49.50	2	Off white CHALK.	D	101.36	101.59	97.32	1.08	99.43	0.11	1.36	0.15
BH101	49.50	CS	74.1	49.50	3	Off white CHALK.	A	101.18	66.59	57.91	2.05	86.37	0.27	1.28	0.35
BH101	49.50	CS	74.1	49.50	4	Off white CHALK.	A	102.08	48.61	42.93	0.86	74.70	0.15	1.2	0.18
BH101	49.50	CS	74.1	49.50	5	Off white CHALK.	A	101.68	48.5	44.22	0.83	75.66	0.14	1.2	0.17
BH101	49.50	CS	74.1	49.50	6	Off white CHALK.	I	67.22	53.08	50.14	0.96	65.51	0.22	1.13	0.25
BH101	49.50	CS	74.1	49.50	7	Off white CHALK.	I	71.13	51.49	46.35	1.16	64.79	0.28	1.12	0.31
BH101	49.50	CS	74.1	49.50	8	Off white CHALK. Tested outside calibrated range of device	I	58.11	43.32	40.76	0.3	54.92	0.10	1.04	0.10
BH101	49.50	CS	74.1	49.50	9	Off white CHALK.	I	54.24	49.67	46.75	0.62	56.82	0.19	1.06	0.20

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:		Results apply to samples as received.	SOIL ENGINEERING
Paul Rodgers		Print date 08/07/2025	
	Revision No. 3.00	Issue Date 07/12/2023	

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH101
Project No.	TB8754		Sample Depth 52.06m
Engineer	Mott MacDonald		Sample Number 76.1
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 52.06m
			Specimen Number 11

Water content	27.9	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 10/07/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH101
Project No.	TB8754		Sample Depth 52.06m
Engineer	Mott MacDonald		Sample Number 76.1
Employer	FBJV	BS1377: Part 2: 1990: 7.3	Sample Type CS
Description	Off white CHALK.		Specimen Depth 52.06m
			Specimen Number 12

Water Content	26	%
Density Type	Immersion density	
Bulk Density	1.90	Mg/m^3
Dry Density	1.51	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH101	52.06	CS	76.1	52.06	1	Off white CHALK.	D	101.66	101.36	94.96	1.23	98.11	0.13	1.35	0.17
BH101	52.06	CS	76.1	52.06	10	Off white CHALK.	I	67.54	49.95	46.35	0.82	63.13	0.21	1.11	0.23
BH101	52.06	CS	76.1	52.06	2	Off white CHALK.	D	101.84	101.48	95.47	1.67	98.43	0.17	1.36	0.23
BH101	52.06	CS	76.1	52.06	3	Off white CHALK.	D	101.6	101.46	95.26	1.2	98.31	0.12	1.36	0.17
BH101	52.06	CS	76.1	52.06	4	Off white CHALK.	D+X	101.5	101.46	92.8	1.27	97.03	0.13	1.35	0.18
BH101	52.06	CS	76.1	52.06	5	Off white CHALK.	A	101.91	64.47	56.59	1.42	85.69	0.19	1.27	0.25
BH101	52.06	CS	76.1	52.06	6	Off white CHALK.	A	101.79	58.92	52.64	1.13	82.60	0.17	1.25	0.21
BH101	52.06	CS	76.1	52.06	7	Off white CHALK.	A	101.65	49.6	42.53	1.25	74.19	0.23	1.19	0.27
BH101	52.06	CS	76.1	52.06	8	Off white CHALK.	I	101.62	74.08	67.1	1.42	93.18	0.16	1.32	0.22
BH101	52.06	CS	76.1	52.06	9	Off white CHALK.	I	67.28	49.15	41.42	0.56	59.57	0.16	1.08	0.17

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:		Results apply to samples as received.	
Paul Rodgers		Print date 08/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 07/12/2023	

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH101	54.37	CS	77.1	54.37	1	Off white CHALK. Tested outside calibrated range of device	D	100.95	100.6	98.43	0.12	99.51	0.01	1.36	0.02
BH101	54.37	CS	77.1	54.37	10	Off white CHALK.	I	61.04	46.94	37.77	0.74	54.18	0.25	1.04	0.26
BH101	54.37	CS	77.1	54.37	2	Off white CHALK. Tested outside calibrated range of device	A	100.1	76.02	65.43	0.43	91.32	0.05	1.31	0.07
BH101	54.37	CS	77.1	54.37	3	Off white CHALK.	A	100.28	63.13	49.85	1.42	79.78	0.22	1.23	0.28
BH101	54.37	CS	77.1	54.37	4	Off white CHALK. Tested outside calibrated range of device	I	70	53.28	50.34	0.06	66.98	0.01	1.14	0.02
BH101	54.37	CS	77.1	54.37	5	Off white CHALK. Tested outside calibrated range of device	I+X	82.58	53.74	50.76	0.14	73.06	0.03	1.19	0.03
BH101	54.37	CS	77.1	54.37	6	Off white CHALK.	I	55.85	42.07	38.44	1.09	52.28	0.40	1.02	0.41
BH101	54.37	CS	77.1	54.37	7	Off white CHALK. Tested outside calibrated range of device	I	53.97	33.47	30.52	0.31	45.80	0.15	0.96	0.14
BH101	54.37	CS	77.1	54.37	8	Off white CHALK.	I	57.48	40.4	33.84	0.64	49.77	0.26	1	0.26
BH101	54.37	CS	77.1	54.37	9	Off white CHALK.	I	51.93	37.21	28.97	0.55	43.77	0.29	0.94	0.27

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:		Results apply to samples as received.	
Paul Rodgers		Print date 08/07/2025	
	Revision No. 3.00	Issue Date 07/12/2023	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH101
Project No.	TB8754		Sample Depth 54.96m
Engineer	Mott MacDonald		Sample Number 78.1
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 54.96m
			Specimen Number 11

Water content	31.4	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 10/07/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH101
Project No.	TB8754		Sample Depth 54.96m
Engineer	Mott MacDonald		Sample Number 78.1
Employer	FBJV	BS1377: Part 2: 1990: 7.3	Sample Type CS
Description	Off white CHALK.		Specimen Depth 54.96m
			Specimen Number 12

Water Content	28	%
Density Type	Immersion density	
Bulk Density	1.97	Mg/m^3
Dry Density	1.54	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI
Project No.	TB8754
Engineer	Mott MacDonald
Client	FBJV

Point Load Index Result

Test method: ISRM 1985 : Suggested Method

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH101	54.96	CS	78.1	54.96	1	Off white CHALK. Tested outside calibrated range of device	D	101.23	100.74	98.43	0.13	99.58	0.01	1.36	0.02
BH101	54.96	CS	78.1	54.96	10	Off white CHALK.	I	49.54	44.32	41.42	0.81	51.11	0.31	1.01	0.31
BH101	54.96	CS	78.1	54.96	2	Off white CHALK.	D	100.45	101.22	97.95	0.74	99.57	0.07	1.36	0.10
BH101	54.96	CS	78.1	54.96	3	Off white CHALK. Tested outside calibrated range of device	A	101.04	63.55	47.66	0.42	78.30	0.07	1.22	0.08
BH101	54.96	CS	78.1	54.96	4	Off white CHALK.	A	100.91	47.32	42.8	0.52	74.16	0.09	1.19	0.11
BH101	54.96	CS	78.1	54.96	5	Off white CHALK.	A	100.93	55.01	39.34	0.6	71.10	0.12	1.17	0.14
BH101	54.96	CS	78.1	54.96	6	Off white CHALK. Tested outside calibrated range of device	I	66.51	49.95	48.46	0.11	64.06	0.03	1.12	0.03
BH101	54.96	CS	78.1	54.96	7	Off white CHALK. Tested outside calibrated range of device	I	65.41	50.61	49.14	0.18	63.97	0.04	1.12	0.05
BH101	54.96	CS	78.1	54.96	8	Off white CHALK.	I	62.95	46.41	45	0.72	60.06	0.20	1.09	0.22
BH101	54.96	CS	78.1	54.96	9	Off white CHALK. Tested outside calibrated range of device	I	52.48	40.2	28.78	0.29	43.85	0.15	0.94	0.14

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:

Paul Rodgers

Results apply to samples as received.

Print date 08/07/2025

Revision No. 3.00 Issue Date 07/12/2023

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH101
Project No.	TB8754		Sample Depth 58.45m
Engineer	Mott MacDonald		Sample Number 80.1
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 58.45m
			Specimen Number 11

Water content	25.3	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 10/07/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH101
Project No.	TB8754		Sample Depth 58.45m
Engineer	Mott MacDonald		Sample Number 80.1
Employer	FBJV	BS1377: Part 2: 1990: 7.3	Sample Type CS
Description	Off white CHALK.		Specimen Depth 58.45m
			Specimen Number 12

Water Content	24	%
Density Type	Immersion density	
Bulk Density	1.90	Mg/m^3
Dry Density	1.54	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH101	58.45	CS	80.1	58.45	1	Off white CHALK.	D	101.7	101.75	94.34	1.72	97.97	0.18	1.35	0.24
BH101	58.45	CS	80.1	58.45	10	Off white CHALK.	I	55.81	33.89	32.26	0.83	47.88	0.36	0.98	0.36
BH101	58.45	CS	80.1	58.45	2	Off white CHALK.	D	101.39	101.66	95.27	1.06	98.41	0.11	1.36	0.15
BH101	58.45	CS	80.1	58.45	3	Off white CHALK.	A	101.44	89.24	73.25	2.31	97.27	0.24	1.35	0.33
BH101	58.45	CS	80.1	58.45	4	Off white CHALK.	A	100.88	65.3	49.11	1.5	79.42	0.24	1.23	0.29
BH101	58.45	CS	80.1	58.45	5	Off white CHALK.	A	101.97	56.33	51.04	1.13	81.40	0.17	1.25	0.21
BH101	58.45	CS	80.1	58.45	6	Off white CHALK.	I+X	94.8	56.91	54.22	1.05	80.90	0.16	1.24	0.20
BH101	58.45	CS	80.1	58.45	7	Off white CHALK.	I	91.66	50.79	47.98	0.82	74.83	0.15	1.2	0.18
BH101	58.45	CS	80.1	58.45	8	Off white CHALK.	I	67.67	44.85	38.64	0.79	57.70	0.24	1.07	0.25
BH101	58.45	CS	80.1	58.45	9	Off white CHALK.	I	61.75	53.09	50.33	0.79	62.91	0.20	1.11	0.22

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:		Results apply to samples as received.	
Paul Rodgers		Print date 08/07/2025	
	Revision No. 3.00	Issue Date 07/12/2023	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH101	59.00	CS	81.1	59.00	1	Off white CHALK.	D	100.56	100.79	97.04	1.1	98.90	0.11	1.36	0.15
BH101	59.00	CS	81.1	59.00	10	Off white CHALK.	I	64.63	40.97	39.46	0.34	56.98	0.10	1.06	0.11
BH101	59.00	CS	81.1	59.00	2	Off white CHALK. Tested outside calibrated range of device	D	100.18	100.1	98.44	0.36	99.27	0.04	1.36	0.05
BH101	59.00	CS	81.1	59.00	3	Off white CHALK.	A	101.38	74.76	68.11	0.82	93.76	0.09	1.33	0.12
BH101	59.00	CS	81.1	59.00	4	Off white CHALK.	A+X	99.92	77.64	74.87	0.65	97.60	0.07	1.35	0.09
BH101	59.00	CS	81.1	59.00	5	Off white CHALK.	A	100.51	42.87	38.49	0.58	70.18	0.12	1.16	0.14
BH101	59.00	CS	81.1	59.00	6	Off white CHALK.	I	80.67	66	63.07	0.52	80.49	0.08	1.24	0.10
BH101	59.00	CS	81.1	59.00	7	Off white CHALK.	I	75.46	35.09	33.52	0.57	56.75	0.18	1.06	0.19
BH101	59.00	CS	81.1	59.00	8	Off white CHALK.	I	76.53	52.14	48.73	0.95	68.91	0.20	1.16	0.23
BH101	59.00	CS	81.1	59.00	9	Off white CHALK.	I	55.26	43.56	39.97	0.68	53.03	0.24	1.03	0.25

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:		Results apply to samples as received.	
Paul Rodgers		Print date 08/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 07/12/2023	

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH102	23.25	CS	101	23.25	1	Off white CHALK.	D	70.61	69.76	68.35	1.01	69.05	0.21	1.16	0.24
BH102	23.25	CS	101	23.25	10	Off white CHALK. Tested outside calibrated range of device	I	39.16	28.38	26.91	0.36	36.63	0.27	0.87	0.23
BH102	23.25	CS	101	23.25	2	Off white CHALK. Tested outside calibrated range of device	I	62.91	40.71	39.35	0.46	56.14	0.15	1.05	0.15
BH102	23.25	CS	101	23.25	3	Off white CHALK.	I	70.21	46.11	42.36	0.74	61.54	0.20	1.1	0.21
BH102	23.25	CS	101	23.25	4	Off white CHALK. Tested outside calibrated range of device	I	51.56	26.9	24.6	0.44	40.19	0.27	0.91	0.25
BH102	23.25	CS	101	23.25	5	Off white CHALK. Tested outside calibrated range of device	I	60.23	26.91	25.6	0.21	44.31	0.11	0.95	0.10
BH102	23.25	CS	101	23.25	6	Off white CHALK. Tested outside calibrated range of device	I	42.48	32.71	31.26	0.17	41.12	0.10	0.92	0.09
BH102	23.25	CS	101	23.25	7	Off white CHALK.	I	43.68	29.4	27.98	0.67	39.45	0.43	0.9	0.39
BH102	23.25	CS	101	23.25	8	Off white CHALK. Tested outside calibrated range of device	I	40.62	27.72	26.19	0.33	36.80	0.24	0.87	0.21
BH102	23.25	CS	101	23.25	9	Off white CHALK. Tested outside calibrated range of device	I	45.63	25.59	23.98	0.17	37.33	0.12	0.88	0.11

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:		Results apply to samples as received.	
Paul Rodgers		Print date 21/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 07/12/2023	

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH102
Project No.	TB8754		Sample Depth 27.90m
Engineer	Mott MacDonald		Sample Number 102
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 27.90m
			Specimen Number 2

Water content	27.9	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Steve Harper	Leeds Laboratory	Results apply to samples as received. Print date 13/08/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH102
Project No.	TB8754		Sample Depth 27.90m
Engineer	Mott MacDonald		Sample Number 102
Employer	FBJV	BS1377: Part 2: 1990: 7.3	Sample Type CS
Description	Off white CHALK.		Specimen Depth 27.90m
			Specimen Number 1

Water Content	28	%
Density Type	Immersion density	
Bulk Density	1.98	Mg/m^3
Dry Density	1.54	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH102
Project No.	TB8754		Sample Depth 33.50m
Engineer	Mott MacDonald		Sample Number 105
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CD
Description	Off white CHALK.		Specimen Depth 33.50m
			Specimen Number 2

Water content	29.3	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 31/07/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH102
Project No.	TB8754		Sample Depth 33.50m
Engineer	Mott MacDonald		Sample Number 105
Employer	FBJV	BS1377: Part 2: 1990: 7.3	Sample Type CD
Description	Off white CHALK.		Specimen Depth 33.50m
			Specimen Number 1

Water Content	28	%
Density Type	Immersion density	
Bulk Density	1.87	Mg/m^3
Dry Density	1.46	Mg/m^3

Remarks

Deviations from test method

Specimen size is less than $50cm^3$ at $33.56cm^3$

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH102	34.30	CS	106	34.30	1	Off white CHALK.	D	98.38	97.16	94.3	0.78	95.72	0.09	1.34	0.11
BH102	34.30	CS	106	34.30	10	Off white CHALK. Tested outside calibrated range of device	I	52.02	34.85	33.47	0.38	47.08	0.17	0.97	0.17
BH102	34.30	CS	106	34.30	2	Off white CHALK. Tested outside calibrated range of device	D	95.42	95.4	88.27	0.38	91.77	0.05	1.31	0.06
BH102	34.30	CS	106	34.30	3	Off white CHALK. Tested outside calibrated range of device	A+X	98.45	69.81	68.26	0.43	92.50	0.05	1.32	0.07
BH102	34.30	CS	106	34.30	4	Off white CHALK.	A	96.37	67.16	55.83	0.88	82.77	0.13	1.25	0.16
BH102	34.30	CS	106	34.30	5	Off white CHALK. Tested outside calibrated range of device	A	98.63	47.2	43.3	0.42	73.74	0.08	1.19	0.09
BH102	34.30	CS	106	34.30	6	Off white CHALK. Tested outside calibrated range of device	I	76.91	49.37	43.55	0.34	65.30	0.08	1.13	0.09
BH102	34.30	CS	106	34.30	7	Off white CHALK.	I	65.42	48.16	46.62	0.5	62.32	0.13	1.1	0.14
BH102	34.30	CS	106	34.30	8	Off white CHALK.	I	50.74	32.45	30.69	0.63	44.53	0.32	0.95	0.30
BH102	34.30	CS	106	34.30	9	Off white CHALK.	I	60.85	50.09	39.7	0.67	55.46	0.22	1.05	0.23

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:		Results apply to samples as received.	SOIL ENGINEERING
Paul Rodgers		Print date 21/07/2025	
	Revision No. 3.00	Issue Date 07/12/2023	

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH102
Project No.	TB8754		Sample Depth 36.15m
Engineer	Mott MacDonald		Sample Number 107
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 36.15m
			Specimen Number 12

Water content	22.9	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Steve Harper	Leeds Laboratory	Results apply to samples as received. Print date 13/08/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH102
Project No.	TB8754		Sample Depth 36.15m
Engineer	Mott MacDonald		Sample Number 107
Employer	FBJV	BS1377: Part 2: 1990: 7.3	Sample Type CS
Description	Off white CHALK.		Specimen Depth 36.15m
			Specimen Number 11

Water Content	23	%
Density Type	Immersion density	
Bulk Density	2.05	Mg/m^3
Dry Density	1.67	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 06/08/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH102
Project No.	TB8754		Sample Depth 38.71m
Engineer	Mott MacDonald		Sample Number 109
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 38.71m
			Specimen Number 2

Water content	27.0	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 31/07/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH102
Project No.	TB8754		Sample Depth 38.71m
Engineer	Mott MacDonald		Sample Number 109
Employer	FBJV	BS1377: Part 2: 1990: 7.2	Sample Type CS
Description	Off white CHALK.		Specimen Depth 38.71m
			Specimen Number 1

Water Content	27	%
Density Type	Linear density	
Bulk Density	1.97	Mg/m^3
Dry Density	1.55	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH102
Project No.	TB8754		Sample Depth 40.65m
Engineer	Mott MacDonald		Sample Number 110
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 40.65m
			Specimen Number 12

Water content	25.5	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 31/07/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH102
Project No.	TB8754		Sample Depth 40.65m
Engineer	Mott MacDonald		Sample Number 110
Employer	FBJV	BS1377: Part 2: 1990: 7.2	Sample Type CS
Description	Off white CHALK.		Specimen Depth 40.65m
			Specimen Number 11

Water Content	25	%
Density Type	Linear density	
Bulk Density	1.96	Mg/m^3
Dry Density	1.57	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI
Project No.	TB8754
Engineer	Mott MacDonald
Client	FBJV

Point Load Index Result

Test method: ISRM 1985 : Suggested Method

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH102	40.65	CS	110	40.65	1	Off white CHALK.	D	98.9	98.61	89.1	1.11	93.73	0.13	1.33	0.17
BH102	40.65	CS	110	40.65	10	Off white CHALK.	I	58.55	48.32	45.77	0.66	58.41	0.19	1.07	0.21
BH102	40.65	CS	110	40.65	2	Off white CHALK.	A	99.92	47.65	39.51	0.85	70.90	0.17	1.17	0.20
BH102	40.65	CS	110	40.65	3	Off white CHALK.	A	99.41	37.02	32.1	0.84	63.74	0.21	1.12	0.23
BH102	40.65	CS	110	40.65	4	Off white CHALK.	A	99.06	38.46	36.94	1.25	68.26	0.27	1.15	0.31
BH102	40.65	CS	110	40.65	5	Off white CHALK.	I	49.46	38.81	36.15	0.77	47.71	0.34	0.98	0.33
BH102	40.65	CS	110	40.65	6	Off white CHALK.	I	51.7	38.07	36.62	0.9	49.10	0.37	0.99	0.37
BH102	40.65	CS	110	40.65	7	Off white CHALK.	I	58.55	45.6	42.94	0.63	56.58	0.20	1.06	0.21
BH102	40.65	CS	110	40.65	8	Off white CHALK.	I	57.91	42.4	41.02	0.52	55.00	0.17	1.04	0.18
BH102	40.65	CS	110	40.65	9	Off white CHALK.	I	57	42.62	40.34	0.62	54.11	0.21	1.04	0.22

Key

Point Load Type (Combination of)	D	Diametral	A	Axial
	I	Irregular lump	B	Block
	L	Parallel to planes of weakness	P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)		
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)		
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump		
	D	Distance between platens when just in contact with specimen		
	D'	Distance between platens at point of failure		
	De	Equivalent core diameter	Is	P/De^2
	Is(50)	F x Is	F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm		

For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$ For Diametral tests $De^2 = D \times D'$

Approved by:

Paul Rodgers

Results apply to samples as received.

Print date 31/07/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI
Project No.	TB8754
Engineer	Mott MacDonald
Client	FBJV

Point Load Index Result

Test method: ISRM 1985 : Suggested Method

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH102	41.15	CS	111	41.15	1	Off white CHALK.	I	69.77	42.32	39.4	0.66	59.16	0.19	1.08	0.20
BH102	41.15	CS	111	41.15	10	Off white CHALK. Tested outside calibrated range of device	I	34.31	23.1	21.56	0.22	30.69	0.23	0.8	0.19
BH102	41.15	CS	111	41.15	2	Off white CHALK.	I	69.69	38.64	37.18	0.66	57.44	0.20	1.06	0.21
BH102	41.15	CS	111	41.15	3	Off white CHALK.	I	67.87	35.94	34.33	0.8	54.47	0.27	1.04	0.28
BH102	41.15	CS	111	41.15	4	Off white CHALK.	I	63.12	35.28	33.82	0.58	52.13	0.21	1.02	0.22
BH102	41.15	CS	111	41.15	5	Off white CHALK.	I	40.09	32.38	30.89	0.53	39.71	0.34	0.9	0.30
BH102	41.15	CS	111	41.15	6	Off white CHALK.	I	36.68	30.35	28.92	0.5	36.75	0.37	0.87	0.32
BH102	41.15	CS	111	41.15	7	Off white CHALK.	I	41.96	38.12	31.69	0.59	41.15	0.35	0.92	0.32
BH102	41.15	CS	111	41.15	8	Off white CHALK. Tested outside calibrated range of device	I	45.18	30.14	28.64	0.44	40.59	0.27	0.91	0.24
BH102	41.15	CS	111	41.15	9	Off white CHALK. Tested outside calibrated range of device	I	50.58	33.41	30.13	0.39	44.05	0.20	0.94	0.19

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:

Paul Rodgers

Results apply to samples as received.

Print date 23/07/2025

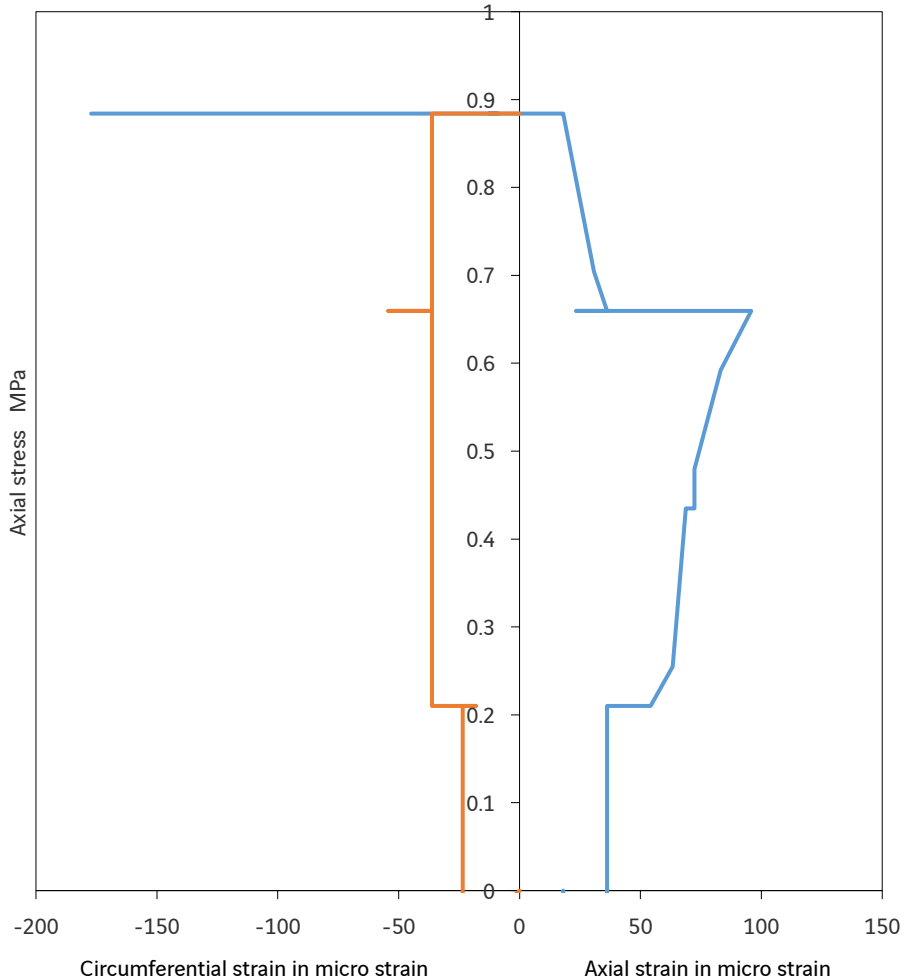
SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Uniaxial Compressive Strength With Youngs Modulus And Poissons Ratio** The Complete ISRM Suggested Methods - Rock Characterization Testing and Monitoring 1974 - 2006. Editors: R.Ulusay & J.A.	Hole ID BH102
Project No.	TB8754		Sample Depth 41.15m
Engineer	Mott MacDonald		Sample Number 111
Employer	FBJV		Sample Type CS
Description	Off white CHALK.		Specimen Depth 41.15m
			Specimen Number 11

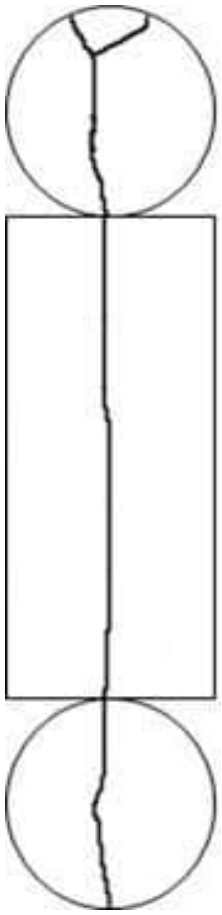
Date and method of sampling

Storage history and environment: Sample stored in temperature controlled environment.

Graph of stress strain curves



Failure sketch



Mode of Failure: Axial

Water content	%	26.9	Stress rate	MPa/s	0.01	Tangent modulus	E_t	16.9	GPa	29-67 % stress
Length	mm	183.49	Test duration	min	03:02	Average modulus	E_{ave}	16.9	GPa	29-67 % stress
Diameter	mm	69.08	U.C.S.	MPa	1.07	Secant modulus	E_{sec}	8.02	GPa	0-50 % stress
Mass	g	1329.01	Type of machine	Controls 1300 / Automax 5		Poissons ratio	v	0.317		
Bulk density	kg/m^3	1930				(Determined using Average modulus)				
Dry density	kg/m^3	1520								
Date		11/07/2025								

Test remarks

Specimen remarks: Sides of specimen are not smooth and straight to within ISRM tolerance, the largest irregularity measured as 1.3mm. Top and bottom of specimen are not perpendicular to ISRM tolerance of 0.05mm in 50mm

Approved by:	Leeds Laboratory	Results apply to samples as received.	SOIL ENGINEERING
Paul Rodgers		Print date 22/08/2025	
	Revision No. 2.08	Issue Date 22/01/2025	

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH102
Project No.	TB8754		Sample Depth 43.81m
Engineer	Mott MacDonald		Sample Number 112
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 43.81m
			Specimen Number 2

Water content	31.2	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 31/07/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH102
Project No.	TB8754		Sample Depth 43.81m
Engineer	Mott MacDonald		Sample Number 112
Employer	FBJV	BS1377: Part 2: 1990: 7.2	Sample Type CS
Description	Off white CHALK.		Specimen Depth 43.81m
			Specimen Number 1

Water Content	31	%
Density Type	Linear density	
Bulk Density	1.90	Mg/m^3
Dry Density	1.45	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH102	45.33	CS	113	45.33	1	Off white CHALK. Tested outside calibrated range of device	D	71.04	69.16	67.67	0.24	68.41	0.05	1.15	0.06
BH102	45.33	CS	113	45.33	10	Off white CHALK. Tested outside calibrated range of device	I	50.77	42.34	40.76	0.24	51.33	0.09	1.01	0.09
BH102	45.33	CS	113	45.33	2	Off white CHALK. Tested outside calibrated range of device	D	70.09	69.78	68.18	0.35	68.98	0.07	1.16	0.09
BH102	45.33	CS	113	45.33	3	Off white CHALK. Tested outside calibrated range of device	D	70.4	69.75	68.25	0.31	69.00	0.07	1.16	0.08
BH102	45.33	CS	113	45.33	4	Off white CHALK.	A	70.32	40.72	36.85	0.65	57.44	0.20	1.06	0.21
BH102	45.33	CS	113	45.33	5	Off white CHALK. Tested outside calibrated range of device	A	70.75	48.88	46	0.49	64.37	0.12	1.12	0.13
BH102	45.33	CS	113	45.33	6	Off white CHALK.	A	70.56	45.73	41.15	0.62	60.80	0.17	1.09	0.18
BH102	45.33	CS	113	45.33	7	Off white CHALK.	A	70.46	34.81	33.32	0.54	54.67	0.18	1.04	0.19
BH102	45.33	CS	113	45.33	8	Off white CHALK. Tested outside calibrated range of device	I	53.03	29.39	27.97	0.15	43.46	0.08	0.94	0.07
BH102	45.33	CS	113	45.33	9	Off white CHALK. Tested outside calibrated range of device	I	52.8	32.94	31.45	0.24	45.98	0.11	0.96	0.11

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:		Results apply to samples as received.	
Paul Rodgers		Print date 21/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 07/12/2023	

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH102
Project No.	TB8754		Sample Depth 47.82m
Engineer	Mott MacDonald		Sample Number 114
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 47.82m
			Specimen Number 12

Water content	30.3	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 31/07/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH102
Project No.	TB8754		Sample Depth 47.82m
Engineer	Mott MacDonald		Sample Number 114
Employer	FBJV	BS1377: Part 2: 1990: 7.2	Sample Type CS
Description	Off white CHALK.		Specimen Depth 47.82m
			Specimen Number 11

Water Content	30	%
Density Type	Linear density	
Bulk Density	1.87	Mg/m^3
Dry Density	1.44	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 06/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH102	47.82	CS	114	47.82	1	Off white CHALK. L/D<0.5 due to insufficient specimen.Tested outside calibrated range of device	D	97.56	97.54	96.14	0.18	96.84	0.02	1.35	0.03
BH102	47.82	CS	114	47.82	10	Off white CHALK. Tested outside calibrated range of device	I	50.21	39.36	34.28	0.34	46.81	0.16	0.97	0.15
BH102	47.82	CS	114	47.82	2	Off white CHALK.	A+X	98.3	72.53	63.16	0.63	88.91	0.08	1.3	0.10
BH102	47.82	CS	114	47.82	3	Off white CHALK.	A+X	99	59.06	55.74	0.54	83.82	0.08	1.26	0.10
BH102	47.82	CS	114	47.82	4	Off white CHALK. Tested outside calibrated range of device	A	98.93	39.92	38.45	0.28	69.59	0.06	1.16	0.07
BH102	47.82	CS	114	47.82	5	Off white CHALK. Tested outside calibrated range of device	A	98.59	32.51	30.79	0.23	62.17	0.06	1.1	0.07
BH102	47.82	CS	114	47.82	6	Off white CHALK. Tested outside calibrated range of device	I	48.97	32.12	30.62	0.19	43.69	0.10	0.94	0.09
BH102	47.82	CS	114	47.82	7	Off white CHALK. Tested outside calibrated range of device	I	51.58	31.93	30.39	0.32	44.67	0.16	0.95	0.15
BH102	47.82	CS	114	47.82	8	Off white CHALK. Tested outside calibrated range of device	I	52.42	47.56	44.69	0.27	54.61	0.09	1.04	0.09
BH102	47.82	CS	114	47.82	9	Off white CHALK.	I	49.79	42.37	37.1	0.52	48.50	0.22	0.99	0.22

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:		Results apply to samples as received.	
Paul Rodgers		Print date 31/07/2025	
	Revision No. 3.00	Issue Date 07/12/2023	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH102
Project No.	TB8754		Sample Depth 49.56m
Engineer	Mott MacDonald		Sample Number 115
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 49.56m
			Specimen Number 12

Water content	27.0	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 31/07/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH102
Project No.	TB8754		Sample Depth 49.56m
Engineer	Mott MacDonald		Sample Number 115
Employer	FBJV	BS1377: Part 2: 1990: 7.2	Sample Type CS
Description	Off white CHALK.		Specimen Depth 49.56m
			Specimen Number 11

Water Content	27	%
Density Type	Linear density	
Bulk Density	1.95	Mg/m^3
Dry Density	1.54	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 06/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI
Project No.	TB8754
Engineer	Mott MacDonald
Client	FBJV

Point Load Index Result

Test method: ISRM 1985 : Suggested Method

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH102	49.56	CS	115	49.56	1	Off white CHALK. Tested outside calibrated range of device	D	100.07	99.32	97.93	0.24	98.62	0.02	1.36	0.03
BH102	49.56	CS	115	49.56	10	Off white CHALK. Tested outside calibrated range of device	I	59.58	55.27	53.16	0.11	63.50	0.03	1.11	0.03
BH102	49.56	CS	115	49.56	2	Off white CHALK.	A	100.19	55.91	44.01	0.63	74.93	0.11	1.2	0.13
BH102	49.56	CS	115	49.56	3	Off white CHALK.	A	99.61	61.49	58.71	0.67	86.29	0.09	1.28	0.12
BH102	49.56	CS	115	49.56	4	Off white CHALK.	A+X	100.6	66.18	62.32	0.92	89.34	0.12	1.3	0.15
BH102	49.56	CS	115	49.56	5	Off white CHALK.	A	100.5	50.07	45.56	1.04	76.35	0.18	1.21	0.22
BH102	49.56	CS	115	49.56	6	Off white CHALK. Tested outside calibrated range of device	I	58.75	49.91	46.88	0.32	59.22	0.09	1.08	0.10
BH102	49.56	CS	115	49.56	7	Off white CHALK.	I	54.37	49.63	47.1	0.72	57.10	0.22	1.06	0.23
BH102	49.56	CS	115	49.56	8	Off white CHALK. Tested outside calibrated range of device	I	60.5	33.38	31.92	0.31	49.59	0.13	1	0.13
BH102	49.56	CS	115	49.56	9	Off white CHALK. Tested outside calibrated range of device	I	69.77	42.09	40.51	0.06	59.99	0.02	1.09	0.02

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:

Paul Rodgers

Results apply to samples as received.

Print date 31/07/2025

Revision No. 3.00 Issue Date 07/12/2023

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH102
Project No.	TB8754		Sample Depth 53.26m
Engineer	Mott MacDonald		Sample Number 117
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 53.26m
			Specimen Number 12

Water content	28.3	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 31/07/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH102
Project No.	TB8754		Sample Depth 53.26m
Engineer	Mott MacDonald		Sample Number 117
Employer	FBJV	BS1377: Part 2: 1990: 7.3	Sample Type CS
Description	Off white CHALK.		Specimen Depth 53.26m
			Specimen Number 11

Water Content	28	%
Density Type	Immersion density	
Bulk Density	1.97	Mg/m^3
Dry Density	1.54	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH102	53.26	CS	117	53.26	1	Off white CHALK.	D	99.59	97.57	87.5	0.63	92.40	0.07	1.32	0.10
BH102	53.26	CS	117	53.26	10	Off white CHALK.	I	65.37	40.31	34.28	0.51	53.42	0.18	1.03	0.18
BH102	53.26	CS	117	53.26	2	Off white CHALK.	A	100.43	80.58	57.32	0.79	85.61	0.11	1.27	0.14
BH102	53.26	CS	117	53.26	3	Off white CHALK.	A	95.68	64.12	61.25	0.54	86.38	0.07	1.28	0.09
BH102	53.26	CS	117	53.26	4	Off white CHALK.	I	72.22	53.83	49.47	0.63	67.45	0.14	1.14	0.16
BH102	53.26	CS	117	53.26	5	Off white CHALK. Tested outside calibrated range of device	I	53.5	37.35	28.38	0.4	43.97	0.21	0.94	0.20
BH102	53.26	CS	117	53.26	6	Off white CHALK. Tested outside calibrated range of device	I	53.74	38.05	34.99	0.43	48.93	0.18	0.99	0.18
BH102	53.26	CS	117	53.26	7	Off white CHALK.	I	76.05	46.53	43.54	0.52	64.93	0.12	1.12	0.14
BH102	53.26	CS	117	53.26	8	Off white CHALK. Tested outside calibrated range of device	I	76.49	48.18	45.09	0.24	66.27	0.05	1.14	0.06
BH102	53.26	CS	117	53.26	9	Off white CHALK.	I+X	67.53	42.04	40.51	0.53	59.02	0.15	1.08	0.16

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:		Results apply to samples as received.	
Paul Rodgers		Print date 31/07/2025	
	Revision No. 3.00	Issue Date 07/12/2023	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH102
Project No.	TB8754		Sample Depth 54.70m
Engineer	Mott MacDonald		Sample Number 118
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 54.70m
			Specimen Number 2

Water content	29.0	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Steve Harper	Leeds Laboratory	Results apply to samples as received. Print date 13/08/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH102
Project No.	TB8754		Sample Depth 54.70m
Engineer	Mott MacDonald		Sample Number 118
Employer	FBJV	BS1377: Part 2: 1990: 7.2	Sample Type CS
Description	Off white CHALK.		Specimen Depth 54.70m
			Specimen Number 1

Water Content	29	%
Density Type	Linear density	
Bulk Density	1.92	Mg/m^3
Dry Density	1.49	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 06/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH102	56.87	CS	119	56.87	1	Off white CHALK.	D	100.68	99.87	94.64	1.21	97.22	0.13	1.35	0.17
BH102	56.87	CS	119	56.87	10	Off white CHALK. Tested outside calibrated range of device	I	66.19	52.38	50.74	0.39	65.39	0.09	1.13	0.10
BH102	56.87	CS	119	56.87	2	Off white CHALK.	D	99.92	99.52	95.07	1.03	97.27	0.11	1.35	0.15
BH102	56.87	CS	119	56.87	3	Off white CHALK. Tested outside calibrated range of device	D+X	97.25	97.01	95.02	0.24	96.01	0.03	1.34	0.03
BH102	56.87	CS	119	56.87	4	Off white CHALK.	A	100.11	52.34	46.34	0.73	76.85	0.12	1.21	0.15
BH102	56.87	CS	119	56.87	5	Off white CHALK.	A	99.8	57.78	53.45	0.63	82.41	0.09	1.25	0.12
BH102	56.87	CS	119	56.87	6	Off white CHALK.	A	100.38	60.18	50.19	0.9	80.09	0.14	1.24	0.17
BH102	56.87	CS	119	56.87	7	Off white CHALK. Tested outside calibrated range of device	I	71.73	51.42	49.93	0.23	67.53	0.05	1.14	0.06
BH102	56.87	CS	119	56.87	8	Off white CHALK. Tested outside calibrated range of device	I	71.51	49.87	48.44	0.32	66.41	0.07	1.14	0.08
BH102	56.87	CS	119	56.87	9	Off white CHALK.	I	66.75	47.79	45.08	0.65	61.90	0.17	1.1	0.19

Key

Point Load Type (Combination of)

D	Diametral	A	Axial
I	Irregular lump	B	Block
L	Parallel to planes of weakness	P	Perpendicular to planes of weakness
X	Invalid failure of point load (not broken between points of load application)		

Dimensions

L	Distance between contact points and nearest free end (not applicable to axial tests)		
W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump		
D	Distance between platens when just in contact with specimen		
D'	Distance between platens at point of failure		
De	Equivalent core diameter	Is	P/De^2
Is(50)	F x Is	F	$(De/50)^{0.45}$
Is(50)	point load strength index corrected for a diametral test of core diameter 50mm		

For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$ For Diametral tests $De^2 = D \times D'$

Approved by:		Results apply to samples as received.	
Paul Rodgers		Print date 10/07/2025	
Revision No. 3.00	Issue Date 07/12/2023		SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH103
Project No.	TB8754		Sample Depth 27.18m
Engineer	Mott MacDonald		Sample Number 60.2
Employer	FBJV	BS1377: Part 2: 1990: 7.2	Sample Type CS
Description	Off white CHALK.		Specimen Depth 27.18m
			Specimen Number 11

Water Content	25	%
Density Type	Linear density	
Bulk Density	1.99	Mg/m^3
Dry Density	1.59	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 06/08/2025	
	Revision No. 1.01	Issue Date 01/05/2024	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI
Project No.	TB8754
Engineer	Mott MacDonald
Client	FBJV

Point Load Index Result

Test method: ISRM 1985 : Suggested Method

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH103	27.18	CS	60.2	27.18	1	Off white CHALK.	A	53.5	49.35	47.86	0.98	57.10	0.30	1.06	0.32
BH103	27.18	CS	60.2	27.18	10	Off white CHALK. Tested outside calibrated range of device	I	40.15	24.38	22.12	0.18	33.63	0.16	0.84	0.13
BH103	27.18	CS	60.2	27.18	2	Off white CHALK.	I	53.57	32.09	30.62	0.67	45.70	0.32	0.96	0.31
BH103	27.18	CS	60.2	27.18	3	Off white CHALK. Tested outside calibrated range of device	I	49.97	20.63	19.17	0.41	34.92	0.34	0.85	0.29
BH103	27.18	CS	60.2	27.18	4	Off white CHALK.	I	69.6	44.77	41.56	0.7	60.69	0.19	1.09	0.21
BH103	27.18	CS	60.2	27.18	5	Off white CHALK. Tested outside calibrated range of device	I	47.59	38.65	37.22	0.35	47.49	0.16	0.98	0.15
BH103	27.18	CS	60.2	27.18	6	Off white CHALK.	I	47.92	29.53	27.91	0.55	41.27	0.32	0.92	0.30
BH103	27.18	CS	60.2	27.18	7	Off white CHALK. Tested outside calibrated range of device	A	53.5	16.15	14.62	0.24	31.56	0.24	0.81	0.20
BH103	27.18	CS	60.2	27.18	8	Off white CHALK. Tested outside calibrated range of device	I	39.35	24.73	23.28	0.39	34.15	0.33	0.84	0.28
BH103	27.18	CS	60.2	27.18	9	Off white CHALK. Tested outside calibrated range of device	I	42.16	27.79	26.4	0.2	37.65	0.14	0.88	0.12

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:

Paul Rodgers

Results apply to samples as received.

Print date 31/07/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH103	28.22	CS	61.1	28.22	1	Off white CHALK.	D+X	96.67	96.85	93.42	0.53	95.12	0.06	1.34	0.08
BH103	28.22	CS	61.1	28.22	10	Off white CHALK.	I	53.43	29.14	27.63	0.55	43.35	0.29	0.94	0.27
BH103	28.22	CS	61.1	28.22	2	Off white CHALK.	D	99.33	96.4	89.93	0.89	93.11	0.10	1.32	0.14
BH103	28.22	CS	61.1	28.22	3	Off white CHALK.	A	97.97	81.6	72.85	0.92	95.33	0.10	1.34	0.14
BH103	28.22	CS	61.1	28.22	4	Off white CHALK.	A	97.78	46.16	41.17	0.71	71.59	0.14	1.18	0.16
BH103	28.22	CS	61.1	28.22	5	Off white CHALK. Tested outside calibrated range of device	I	64.78	36.16	33.41	0.49	52.49	0.18	1.02	0.18
BH103	28.22	CS	61.1	28.22	6	Off white CHALK. Tested outside calibrated range of device	I	80.55	55.55	52.73	0.48	73.54	0.09	1.19	0.11
BH103	28.22	CS	61.1	28.22	7	Off white CHALK. Tested outside calibrated range of device	I	81.46	42.19	40.67	0.22	64.95	0.05	1.12	0.06
BH103	28.22	CS	61.1	28.22	8	Off white CHALK. Tested outside calibrated range of device	I+X	58.1	44.59	42.95	0.47	56.37	0.15	1.06	0.16
BH103	28.22	CS	61.1	28.22	9	Off white CHALK.	I	58.18	35.11	33.65	0.61	49.93	0.24	1	0.24

Key

Point Load Type (Combination of)	D	Diametral	A	Axial
	I	Irregular lump	B	Block
	L	Parallel to planes of weakness	P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)		
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)		
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump		
	D	Distance between platens when just in contact with specimen		
	D'	Distance between platens at point of failure		
	De	Equivalent core diameter	Is	P/De^2
	Is(50)	F x Is	F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm		

For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$ For Diametral tests $De^2 = D \times D'$

Approved by:		Results apply to samples as received.	
Paul Rodgers		Print date 10/07/2025	
	Revision No. 3.00	Issue Date 07/12/2023	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH103
Project No.	TB8754		Sample Depth 29.70m
Engineer	Mott MacDonald		Sample Number 62.1
Employer	FBJV	BS1377: Part 2: 1990: 7.3	Sample Type CS
Description	Off white CHALK.		Specimen Depth 29.70m
			Specimen Number 11

Water Content	28	%
Density Type	Immersion density	
Bulk Density	1.95	Mg/m^3
Dry Density	1.53	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 06/08/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH103	29.70	CS	62.1	29.70	1	Off white CHALK. Tested outside calibrated range of device	D	91.62	90.8	87.87	0.28	89.32	0.04	1.3	0.05
BH103	29.70	CS	62.1	29.70	10	Off white CHALK. Tested outside calibrated range of device	I+X	49.18	33.83	33.01	0.2	45.46	0.10	0.96	0.09
BH103	29.70	CS	62.1	29.70	2	Off white CHALK. Tested outside calibrated range of device	A+X	93.37	46.62	45.22	0.13	73.32	0.02	1.19	0.03
BH103	29.70	CS	62.1	29.70	3	Off white CHALK.	I+X	79.54	52.54	50.57	0.55	71.56	0.11	1.18	0.13
BH103	29.70	CS	62.1	29.70	4	Off white CHALK. Tested outside calibrated range of device	I+X	73.21	50.2	47.51	0.32	66.55	0.07	1.14	0.08
BH103	29.70	CS	62.1	29.70	5	Off white CHALK. Tested outside calibrated range of device	I	60.19	29.21	27.84	0.32	46.19	0.15	0.96	0.14
BH103	29.70	CS	62.1	29.70	6	Off white CHALK. Tested outside calibrated range of device	I	56.35	26.6	23.67	0.12	41.21	0.07	0.92	0.06
BH103	29.70	CS	62.1	29.70	7	Off white CHALK. Tested outside calibrated range of device	I	46.91	33.31	30.47	0.28	42.66	0.15	0.93	0.14
BH103	29.70	CS	62.1	29.70	8	Off white CHALK.	I	73.38	50	46.12	0.73	65.64	0.17	1.13	0.19
BH103	29.70	CS	62.1	29.70	9	Off white CHALK. Tested outside calibrated range of device	I+X	48.94	34.22	33.01	0.08	45.35	0.04	0.96	0.04

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:		Results apply to samples as received.	
Paul Rodgers		Print date 31/07/2025	
	Revision No. 3.00	Issue Date 07/12/2023	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH103
Project No.	TB8754		Sample Depth 33.25m
Engineer	Mott MacDonald		Sample Number 64.1
Employer	FBJV	BS1377: Part 2: 1990: 7.3	Sample Type CS
Description	Off white CHALK.		Specimen Depth 33.25m
			Specimen Number 11

Water Content	25	%
Density Type	Immersion density	
Bulk Density	2.01	Mg/m^3
Dry Density	1.61	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH103	33.25	CS	64.1	33.25	1	Off white CHALK.	A	100.05	45.39	40.37	1.21	71.71	0.24	1.18	0.28
BH103	33.25	CS	64.1	33.25	10	Off white CHALK. Tested outside calibrated range of device	I	57.46	40.05	38.55	0.31	53.11	0.11	1.03	0.11
BH103	33.25	CS	64.1	33.25	2	Off white CHALK.	I+X	99.45	57.67	53.8	1.25	82.54	0.18	1.25	0.23
BH103	33.25	CS	64.1	33.25	3	Off white CHALK.	I+X	75	52.87	51.44	0.7	70.09	0.14	1.16	0.17
BH103	33.25	CS	64.1	33.25	4	Off white CHALK.	I	74.56	49.99	46.32	0.84	66.31	0.19	1.14	0.22
BH103	33.25	CS	64.1	33.25	5	Off white CHALK.	I	57.53	30.2	28.78	0.81	45.91	0.38	0.96	0.37
BH103	33.25	CS	64.1	33.25	6		I	45.36	35.51	33.97	0.76	44.29	0.39	0.95	0.37
BH103	33.25	CS	64.1	33.25	7	Off white CHALK.	I	47.57	22.34	20.74	0.6	35.44	0.48	0.86	0.41
BH103	33.25	CS	64.1	33.25	8	Off white CHALK. Tested outside calibrated range of device	I+X	59.22	50.97	43.83	0.34	57.49	0.10	1.06	0.11
BH103	33.25	CS	64.1	33.25	9	Off white CHALK.	I	48.64	42.53	40.81	0.57	50.27	0.23	1	0.23

Key

Point Load Type (Combination of)	D	Diametral	A	Axial
	I	Irregular lump	B	Block
	L	Parallel to planes of weakness	P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)		
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)		
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump		
	D	Distance between platens when just in contact with specimen		
	D'	Distance between platens at point of failure		
	De	Equivalent core diameter	Is	P/De^2
	Is(50)	F x Is	F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm		

For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$ For Diametral tests $De^2 = D \times D'$

Approved by:

Results apply to samples as received.

Print date 31/07/2025

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH103	33.63	CS	65.1	33.63	1	Off white CHALK.	D+X	99.44	99.42	97.68	0.7	98.55	0.07	1.36	0.10
BH103	33.63	CS	65.1	33.63	10	Off white CHALK.	I	52.55	31.39	29.83	1.01	44.68	0.51	0.95	0.48
BH103	33.63	CS	65.1	33.63	2	Off white CHALK.	A	99.2	80.76	72.3	2.37	95.56	0.26	1.34	0.35
BH103	33.63	CS	65.1	33.63	3	Off white CHALK.	A	99.85	54.16	49.7	0.89	79.49	0.14	1.23	0.17
BH103	33.63	CS	65.1	33.63	4	Off white CHALK. Tested outside calibrated range of device	I	88.81	37.03	35.5	0.37	63.36	0.09	1.11	0.10
BH103	33.63	CS	65.1	33.63	5	Off white CHALK.	I	85.76	56.24	54.7	0.89	77.28	0.15	1.22	0.18
BH103	33.63	CS	65.1	33.63	6	Off white CHALK.	I	77.84	42.71	41.19	0.67	63.89	0.16	1.12	0.18
BH103	33.63	CS	65.1	33.63	7	Off white CHALK.	I	56.18	37.47	36.07	0.74	50.79	0.29	1.01	0.29
BH103	33.63	CS	65.1	33.63	8	Off white CHALK.	I	61.11	39.85	38.32	0.62	54.60	0.21	1.04	0.22
BH103	33.63	CS	65.1	33.63	9	Off white CHALK.	I	39.29	34.35	32.86	0.53	40.54	0.32	0.91	0.29

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:		Results apply to samples as received.	
Paul Rodgers		Print date 10/07/2025	
	Revision No. 3.00	Issue Date 07/12/2023	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH103	34.78	CS	65.2	34.78	1	Off white CHALK. Tested outside calibrated range of device	I	53.23	38.71	37.23	0.47	50.23	0.19	1	0.19
BH103	34.78	CS	65.2	34.78	10	Off white CHALK. Tested outside calibrated range of device	I	34.31	18.02	17.01	0.28	27.26	0.38	0.76	0.29
BH103	34.78	CS	65.2	34.78	2	Off white CHALK. Tested outside calibrated range of device	I+X	53.64	34.97	33.45	0.17	47.80	0.07	0.98	0.07
BH103	34.78	CS	65.2	34.78	3	Off white CHALK. Tested outside calibrated range of device	I	43.51	36.48	35.01	0.47	44.04	0.24	0.94	0.23
BH103	34.78	CS	65.2	34.78	4	Off white CHALK. Tested outside calibrated range of device	I	51.68	34.55	32.95	0.4	46.56	0.18	0.97	0.18
BH103	34.78	CS	65.2	34.78	5	Off white CHALK. Tested outside calibrated range of device	I+X	42.61	29.55	27.94	0.37	38.93	0.24	0.89	0.22
BH103	34.78	CS	65.2	34.78	6	Off white CHALK. Tested outside calibrated range of device	I	41.15	35.47	31.96	0.24	40.92	0.14	0.91	0.13
BH103	34.78	CS	65.2	34.78	7	Off white CHALK. Tested outside calibrated range of device	I	38.56	22.86	21.47	0.4	32.47	0.38	0.82	0.31
BH103	34.78	CS	65.2	34.78	8	Off white CHALK. Tested outside calibrated range of device	I	35.64	25.75	24.24	0.28	33.17	0.25	0.83	0.21
BH103	34.78	CS	65.2	34.78	9	Off white CHALK. Tested outside calibrated range of device	I	36.29	19.64	18.14	0.33	28.95	0.39	0.78	0.31

Key

Point Load Type (Combination of)	D	Diametral	A	Axial	
	I	Irregular lump	B	Block	
	L	Parallel to planes of weakness	P	Perpendicular to planes of weakness	
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter	Is	P/De^2	
	Is(50)	F x Is	F	$(De/50)^{0.45}$	
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$		For Diametral tests $De^2 = D \times D'$		

Approved by:		Results apply to samples as received.	
Paul Rodgers		Print date 31/07/2025	
	Revision No. 3.00	Issue Date 07/12/2023	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH103	38.78	CS	69.1	38.78	1	Off white CHALK.	D	100.8	100.01	97.07	0.92	98.53	0.09	1.36	0.13
BH103	38.78	CS	69.1	38.78	10	Off white CHALK.	I	51.27	36.55	33.55	0.56	46.80	0.26	0.97	0.25
BH103	38.78	CS	69.1	38.78	2	Off white CHALK.	D	100.5	99.25	96.43	0.68	97.83	0.07	1.35	0.10
BH103	38.78	CS	69.1	38.78	3	Off white CHALK.	D	100.81	100.22	98.44	0.67	99.33	0.07	1.36	0.09
BH103	38.78	CS	69.1	38.78	4	Off white CHALK.	A	100.16	65.71	58.76	2.02	86.57	0.27	1.28	0.35
BH103	38.78	CS	69.1	38.78	5	Off white CHALK.	A+X	100.54	57.48	52.01	1.28	81.60	0.19	1.25	0.24
BH103	38.78	CS	69.1	38.78	6	Off white CHALK.	A	100.04	44.92	40.58	1.84	71.89	0.36	1.18	0.42
BH103	38.78	CS	69.1	38.78	7	Off white CHALK.	A	100.78	52.36	48.15	1.48	78.60	0.24	1.23	0.29
BH103	38.78	CS	69.1	38.78	8	Off white CHALK.	I	73.4	50.2	47.6	0.88	66.70	0.20	1.14	0.23
BH103	38.78	CS	69.1	38.78	9	Off white CHALK.	I	66.09	47.38	45.9	0.64	62.15	0.17	1.1	0.18

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:		Results apply to samples as received.	
Steve Harper		Print date 21/07/2025	
	Revision No. 3.00	Issue Date 07/12/2023	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH103	39.80	CS	68.1	39.80	1	Off white CHALK.	D	53.29	52.83	51.39	0.56	52.11	0.21	1.02	0.21
BH103	39.80	CS	68.1	39.80	10	Off white CHALK. Tested outside calibrated range of device	I	31.64	27.22	24.02	0.31	31.11	0.32	0.81	0.26
BH103	39.80	CS	68.1	39.80	2	Off white CHALK. Tested outside calibrated range of device	D+X	53.21	52.73	51.22	0.46	51.97	0.17	1.02	0.17
BH103	39.80	CS	68.1	39.80	3	Off white CHALK.	A	53.21	33.25	31.73	0.88	46.36	0.41	0.97	0.40
BH103	39.80	CS	68.1	39.80	4	Off white CHALK. Tested outside calibrated range of device	I	53.74	42.93	41	0.11	52.97	0.04	1.03	0.04
BH103	39.80	CS	68.1	39.80	5	Off white CHALK.	I	45.7	37.14	32.57	0.51	43.53	0.27	0.94	0.25
BH103	39.80	CS	68.1	39.80	6	Off white CHALK. Tested outside calibrated range of device	I+X	43.6	40.84	37.56	0.35	45.66	0.17	0.96	0.16
BH103	39.80	CS	68.1	39.80	7	Off white CHALK. Tested outside calibrated range of device	I	41.08	25.21	23.58	0.41	35.12	0.33	0.85	0.28
BH103	39.80	CS	68.1	39.80	8	Off white CHALK. Tested outside calibrated range of device	I	38.64	25.36	22.64	0.14	33.37	0.13	0.83	0.10
BH103	39.80	CS	68.1	39.80	9	Off white CHALK. Tested outside calibrated range of device	I	35.99	29.94	28.59	0.3	36.20	0.23	0.86	0.20

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

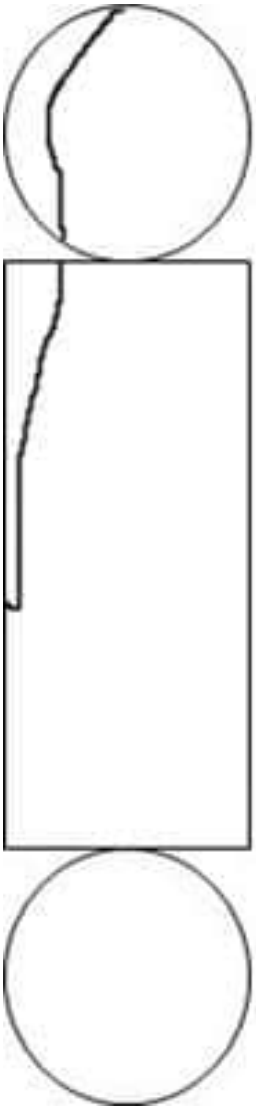
Approved by:		Results apply to samples as received.	
Paul Rodgers		Print date 01/08/2025	
	Revision No. 3.00	Issue Date 07/12/2023	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Uniaxial Compressive Strength**	Hole ID BH103
Project No.	TB8754		Sample Depth 39.80m
Engineer	Mott MacDonald	The Complete ISRM Suggested Methods - Rock Characterization Testing and Monitoring 1974 - 2006, Editors: R Ulusay & J A Hudson	Sample Number 68.1
Employer	FBJV		Sample Type CS
Description	Off white CHALK.		Specimen Depth 39.80m
			Specimen Number 11

Date and method of sampling	Not supplied
Storage history and environment	Sample stored in temperature controlled environment.

Sample details				Mean
Length	mm	133.40	133.68	133.5
Diameter (top)	mm	53.52	53.38	53.3
Diameter (middle)	mm	53.49	53.00	Length/diameter ratio
Diameter (base)	mm	53.26	53.25	2.5
Area	mm^2	2232.6		
Mass	g	584.23		
Test details				
Test duration	min	03:55		
Failure load	kN	4.4		
Stress rate	kN/min	1.1		
U.C.S.	MPa	1.97		
Mode of failure		Irregular		
Loading axis relative to anisotropy				
Machine type used in test		Controls 1300 / Automax 5		
Date of test		11/07/2025		
Additional specimen details				
Water content	%	25.8		
Bulk density	kg/m^3	1960		
Dry density	kg/m^3	1560		

Failure sketch



Test Remarks

Specimen Remarks

Sides of specimen are not smooth and straight to within ISRM tolerance, the largest irregularity measured as 1.1mm. Top and bottom of specimen are not perpendicular to ISRM tolerance of 0.05mm in 50mm

Approved by:	Leeds Laboratory	Results apply to samples as received.	SOIL ENGINEERING
Paul Rodgers		Print date 06/08/2025	
	Revision No. 2.08	Issue Date 22/01/2025	

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH103	40.15	CS	69.2	40.15	1	Off white CHALK.	D	99.32	97.57	88.79	1.7	93.08	0.20	1.32	0.26
BH103	40.15	CS	69.2	40.15	10	Off white CHALK.	I	56.31	43.77	42.3	0.52	55.07	0.17	1.04	0.18
BH103	40.15	CS	69.2	40.15	2	Off white CHALK.	D	98.04	97.82	93.57	1.77	95.67	0.19	1.34	0.26
BH103	40.15	CS	69.2	40.15	3	Off white CHALK. Tested outside calibrated range of device	D+X	97.54	97.44	94.69	0.38	96.06	0.04	1.34	0.06
BH103	40.15	CS	69.2	40.15	4	Off white CHALK.	A	98.56	70.27	61.44	1.56	87.81	0.20	1.29	0.26
BH103	40.15	CS	69.2	40.15	5	Off white CHALK.	A	99.01	68.72	55.04	1.31	83.30	0.19	1.26	0.24
BH103	40.15	CS	69.2	40.15	6	Off white CHALK.	A	99.01	45.04	38.2	1.07	69.39	0.22	1.16	0.26
BH103	40.15	CS	69.2	40.15	7	Off white CHALK.	I+X	67.81	57.64	56.2	0.55	69.66	0.11	1.16	0.13
BH103	40.15	CS	69.2	40.15	8	Off white CHALK. Tested outside calibrated range of device	I+X	59.72	47.93	44.25	0.48	58.01	0.14	1.07	0.15
BH103	40.15	CS	69.2	40.15	9	Off white CHALK.	I	75.57	51.58	49.02	0.72	68.68	0.15	1.15	0.18

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:		Results apply to samples as received.	
Paul Rodgers		Print date 01/08/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 07/12/2023	

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH103	40.77	CS	69.3	40.77	1	Off white CHALK.	D	98.03	97.2	85.74	1.68	91.29	0.20	1.31	0.26
BH103	40.77	CS	69.3	40.77	10	Off white CHALK.	I	54.32	39.71	37.96	0.7	51.24	0.27	1.01	0.27
BH103	40.77	CS	69.3	40.77	2	Off white CHALK.	D	95.49	94.39	90.26	1.75	92.30	0.21	1.32	0.27
BH103	40.77	CS	69.3	40.77	3	Off white CHALK.	A	98.58	84.69	76.86	1.24	98.22	0.13	1.36	0.17
BH103	40.77	CS	69.3	40.77	4	Off white CHALK.	A	97.24	62.25	58.48	1.79	85.09	0.25	1.27	0.31
BH103	40.77	CS	69.3	40.77	5	Off white CHALK.	A	95.55	62.53	49.6	1.45	77.68	0.24	1.22	0.29
BH103	40.77	CS	69.3	40.77	6	Off white CHALK.	I	69.88	40.82	39.16	0.63	59.03	0.18	1.08	0.19
BH103	40.77	CS	69.3	40.77	7	Off white CHALK.	I	58.84	44.9	43.31	0.67	56.96	0.21	1.06	0.22
BH103	40.77	CS	69.3	40.77	8	Off white CHALK.	I	78.06	46.99	44.08	0.5	66.19	0.11	1.13	0.13
BH103	40.77	CS	69.3	40.77	9	Off white CHALK.	I	85.69	48.4	46.19	0.78	70.99	0.15	1.17	0.18

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:		Results apply to samples as received.	
Steve Harper		Print date 21/07/2025	
	Revision No. 3.00	Issue Date 07/12/2023	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH103	42.68	CS	70.1	42.68	1	Off white CHALK. Tested outside calibrated range of device	I	53.55	42.28	40.73	0.49	52.70	0.18	1.02	0.18
BH103	42.68	CS	70.1	42.68	10	Off white CHALK. Tested outside calibrated range of device	I	41	18.12	16.49	0.29	29.34	0.34	0.79	0.27
BH103	42.68	CS	70.1	42.68	2	Off white CHALK. Tested outside calibrated range of device	I	53.52	39.06	37.64	0.37	50.65	0.14	1.01	0.15
BH103	42.68	CS	70.1	42.68	3	Off white CHALK. Tested outside calibrated range of device	I	38.09	37.21	35.65	0.33	41.58	0.19	0.92	0.18
BH103	42.68	CS	70.1	42.68	4	Off white CHALK. Tested outside calibrated range of device	I	38.81	21.83	20.34	0.25	31.70	0.25	0.81	0.20
BH103	42.68	CS	70.1	42.68	5	Off white CHALK. Tested outside calibrated range of device	I	41.34	24.15	22.6	0.29	34.49	0.24	0.85	0.21
BH103	42.68	CS	70.1	42.68	6	Off white CHALK. Tested outside calibrated range of device	I	55.28	17.54	16.1	0.1	33.66	0.09	0.84	0.07
BH103	42.68	CS	70.1	42.68	7	Off white CHALK. Tested outside calibrated range of device	I	40.68	18.02	16.61	0.3	29.33	0.35	0.79	0.27
BH103	42.68	CS	70.1	42.68	8	Off white CHALK. Tested outside calibrated range of device	I	43.49	17.2	15.83	0.23	29.61	0.26	0.79	0.21
BH103	42.68	CS	70.1	42.68	9	Off white CHALK. Tested outside calibrated range of device	I	41.4	17.95	16.54	0.27	29.53	0.31	0.79	0.24

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			

For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$ For Diametral tests $De^2 = D \times D'$

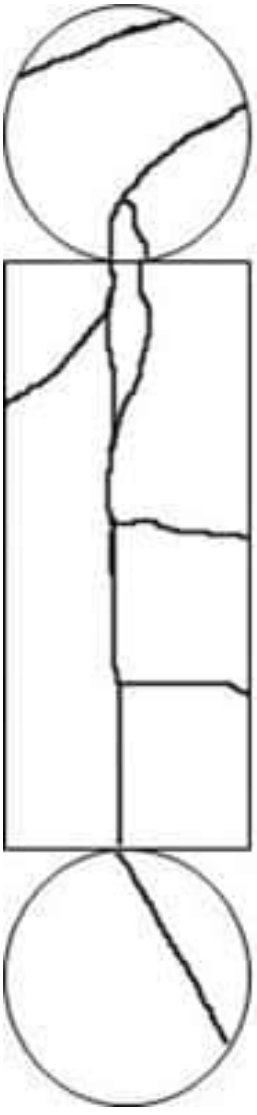
Approved by:		Results apply to samples as received.	
Steve Harper		Print date 27/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 07/12/2023	

Project Name	Grain to Tilbury Tunnel GI	**Uniaxial Compressive Strength**	Hole ID BH103
Project No.	TB8754		Sample Depth 42.68m
Engineer	Mott MacDonald	The Complete ISRM Suggested Methods - Rock Characterization Testing and Monitoring 1974 - 2006, Editors: R Ulusay & J A Hudson	Sample Number 70.1
Employer	FBJV		Sample Type CS
Description	Off white CHALK.		Specimen Depth 42.68m
			Specimen Number 11

Date and method of sampling	Not supplied
Storage history and environment	Sample stored in temperature controlled environment.

Sample details				Mean
Length	mm	146.60	146.52	146.6
Diameter (top)	mm	53.43	53.52	53.5
Diameter (middle)	mm	53.42	53.58	Length/diameter ratio
Diameter (base)	mm	53.32	53.48	2.7
Area	mm^2	2244.5		
Mass	g	644.08		
Test details				
Test duration	min	03:33		
Failure load	kN	4.8		
Stress rate	kN/min	1.4		
U.C.S.	MPa	2.14		
Mode of failure		Axial		
Loading axis relative to anisotropy				
Machine type used in test		Controls 1300 / Automax 5		
Date of test				
Additional specimen details				
Water content	%	27.9		
Bulk density	kg/m^3	1960		
Dry density	kg/m^3	1530		

Failure sketch



Test Remarks

Specimen Remarks

Top and bottom of specimen are not perpendicular to ISRM tolerance of 0.05mm in 50mm

Approved by:	Leeds Laboratory	Results apply to samples as received.	
Paul Rodgers		Print date 23/07/2025	
	Revision No. 2.08	Issue Date 22/01/2025	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH103	44.40	CS	71.2	44.40	1	Off white CHALK.	D	99.5	99.3	94.07	1.88	96.65	0.20	1.35	0.27
BH103	44.40	CS	71.2	44.40	10	Off white CHALK.	I	57.05	45.52	44.09	0.89	56.59	0.28	1.06	0.29
BH103	44.40	CS	71.2	44.40	2	Off white CHALK.	D	99.68	99.93	95.67	1.73	97.78	0.18	1.35	0.24
BH103	44.40	CS	71.2	44.40	3	Off white CHALK.	A	99.87	54.67	49.31	2.07	79.18	0.33	1.23	0.41
BH103	44.40	CS	71.2	44.40	4	Off white CHALK.	A	99.65	40.14	37.62	1.43	69.09	0.30	1.16	0.35
BH103	44.40	CS	71.2	44.40	5	Off white CHALK.	A	100.23	49.75	41.09	1.22	72.41	0.23	1.18	0.27
BH103	44.40	CS	71.2	44.40	6	Off white CHALK.	A	99.3	41.23	37.11	1.17	68.50	0.25	1.15	0.29
BH103	44.40	CS	71.2	44.40	7	Off white CHALK.	I	47.17	41.32	39.8	1.41	48.89	0.59	0.99	0.58
BH103	44.40	CS	71.2	44.40	8	Off white CHALK.	I	56.49	40.76	37.46	1.32	51.91	0.49	1.02	0.50
BH103	44.40	CS	71.2	44.40	9	Off white CHALK.	I	55.31	44.72	40.91	1	53.67	0.35	1.03	0.36

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:		Results apply to samples as received.	
Paul Rodgers		Print date 06/08/2025	
	Revision No. 3.00	Issue Date 07/12/2023	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH103	46.51	CS	72.1	46.51	1	Off white CHALK.	D	53.59	52.9	51.27	0.61	52.08	0.22	1.02	0.23
BH103	46.51	CS	72.1	46.51	10	Off white CHALK. Tested outside calibrated range of device	I	35.02	25.84	24.38	0.27	32.97	0.25	0.83	0.21
BH103	46.51	CS	72.1	46.51	2	Off white CHALK.	A	53.64	32.88	30	0.52	45.26	0.25	0.96	0.24
BH103	46.51	CS	72.1	46.51	3	Off white CHALK. Tested outside calibrated range of device	A	53.08	33.37	31.89	0.32	46.42	0.15	0.97	0.14
BH103	46.51	CS	72.1	46.51	4	Off white CHALK.	A	53.52	33.61	31.2	0.7	46.11	0.33	0.96	0.32
BH103	46.51	CS	72.1	46.51	5	Off white CHALK.	A	53.82	24.43	22.93	0.65	39.64	0.41	0.9	0.37
BH103	46.51	CS	72.1	46.51	6	Off white CHALK. Tested outside calibrated range of device	I	35.04	31.37	27.79	0.42	35.21	0.34	0.85	0.29
BH103	46.51	CS	72.1	46.51	7	Off white CHALK. Tested outside calibrated range of device	I	40.5	25.78	24.26	0.39	35.37	0.31	0.86	0.27
BH103	46.51	CS	72.1	46.51	8	Off white CHALK. Tested outside calibrated range of device	I	39.67	25.52	24.12	0.27	34.90	0.22	0.85	0.19
BH103	46.51	CS	72.1	46.51	9	Off white CHALK. Tested outside calibrated range of device	I	34.46	27.83	26.26	0.28	33.94	0.24	0.84	0.20

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:		Results apply to samples as received.	
Paul Rodgers		Print date 06/08/2025	
	Revision No. 3.00	Issue Date 07/12/2023	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH103	48.72	CS	74.1	48.72	1	Off white CHALK.	D	99.45	99.02	93.24	1.17	96.09	0.13	1.34	0.17
BH103	48.72	CS	74.1	48.72	10	Off white CHALK.	I	44.65	29.78	28.3	0.58	40.11	0.36	0.91	0.33
BH103	48.72	CS	74.1	48.72	2	Off white CHALK.	D+X	99.58	99.77	90.57	0.82	95.06	0.09	1.34	0.12
BH103	48.72	CS	74.1	48.72	3	Off white CHALK.	D	99.26	99.62	91.6	1.29	95.53	0.14	1.34	0.19
BH103	48.72	CS	74.1	48.72	4	Off white CHALK.	A	100.3	64.39	58.06	1.36	86.11	0.18	1.28	0.23
BH103	48.72	CS	74.1	48.72	5	Off white CHALK.	A	100.05	64.83	57.37	0.74	85.49	0.10	1.27	0.13
BH103	48.72	CS	74.1	48.72	6	Off white CHALK.	A	99.31	59.35	56.42	0.61	84.46	0.09	1.27	0.11
BH103	48.72	CS	74.1	48.72	7	Off white CHALK.	A	99.37	47.84	43.82	0.87	74.46	0.16	1.2	0.19
BH103	48.72	CS	74.1	48.72	8	Off white CHALK.	I	66.19	57.62	56.19	0.78	68.81	0.16	1.15	0.19
BH103	48.72	CS	74.1	48.72	9	Off white CHALK.	I	72.32	42.55	41.01	0.61	61.45	0.16	1.1	0.18

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:		Results apply to samples as received.	
Steve Harper		Print date 21/07/2025	
	Revision No. 3.00	Issue Date 07/12/2023	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH104
Project No.	TB8754		Sample Depth 32.38m
Engineer	Mott MacDonald		Sample Number 14.1
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 32.38m
			Specimen Number 12

Water content	29.5	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 26/09/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI
Project No.	TB8754
Engineer	Mott MacDonald
Client	FBJV

Point Load Index Result

Test method: ISRM 1985 : Suggested Method

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH104	32.38	CS	14.1	32.38	1	Off white CHALK. Tested outside calibrated range of device	A+X	100.17	80.54	79	0.26	100.38	0.03	1.37	0.04
BH104	32.38	CS	14.1	32.38	10	Off white CHALK. Tested outside calibrated range of device	I	34.25	28.58	27.24	0.38	34.47	0.32	0.85	0.27
BH104	32.38	CS	14.1	32.38	2	Off white CHALK.	I	85.2	56.87	53.81	0.62	76.40	0.11	1.21	0.13
BH104	32.38	CS	14.1	32.38	3	Off white CHALK.	I+X	62.56	47.7	44.02	0.83	59.21	0.24	1.08	0.26
BH104	32.38	CS	14.1	32.38	4	Off white CHALK.	I	56.1	35.44	33.9	0.51	49.21	0.21	0.99	0.21
BH104	32.38	CS	14.1	32.38	5	Off white CHALK.	I+X	50.31	48.27	46.56	0.8	54.61	0.27	1.04	0.28
BH104	32.38	CS	14.1	32.38	6	Off white CHALK. Tested outside calibrated range of device	I	44.47	33.32	31.89	0.44	42.49	0.24	0.93	0.23
BH104	32.38	CS	14.1	32.38	7	Off white CHALK. Tested outside calibrated range of device	I	45.67	36	33.22	0.32	43.95	0.17	0.94	0.16
BH104	32.38	CS	14.1	32.38	8	Off white CHALK. Tested outside calibrated range of device	I	50.91	34.85	33.42	0.37	46.54	0.17	0.97	0.17
BH104	32.38	CS	14.1	32.38	9	Off white CHALK. Tested outside calibrated range of device	I	48.61	32.32	30.88	0.44	43.72	0.23	0.94	0.22

Key

Point Load Type (Combination of)	D	Diametral	A	Axial
	I	Irregular lump	B	Block
	L	Parallel to planes of weakness	P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)		
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)		
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump		
	D	Distance between platens when just in contact with specimen		
	D'	Distance between platens at point of failure		
	De	Equivalent core diameter	Is	P/De^2
	Is(50)	F x Is	F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm		

For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$ For Diametral tests $De^2 = D \times D'$

Approved by:

Paul Rodgers

Results apply to samples as received.

Print date 16/09/2025

Revision No. 3.00 Issue Date 07/12/2023

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH104
Project No.	TB8754		Sample Depth 34.72m
Engineer	Mott MacDonald		Sample Number 15.1
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 34.72m
			Specimen Number 12

Water content	29.5	%
Oven temperature	105	℃
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 26/09/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI
Project No.	TB8754
Engineer	Mott MacDonald
Client	FBJV

Point Load Index Result

Test method: ISRM 1985 : Suggested Method

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH104	34.72	CS	15.1	34.72	1	Off white CHALK. Tested outside calibrated range of device	I	93.51	59.7	56.84	0.29	82.26	0.04	1.25	0.05
BH104	34.72	CS	15.1	34.72	10	Off white CHALK. Tested outside calibrated range of device	I	40.07	24.55	23.04	0.23	34.29	0.20	0.84	0.17
BH104	34.72	CS	15.1	34.72	2	Off white CHALK. Tested outside calibrated range of device	I	89.93	41.47	37.15	0.45	65.22	0.11	1.13	0.12
BH104	34.72	CS	15.1	34.72	3	Off white CHALK. Tested outside calibrated range of device	I	65.09	33.07	31.5	0.36	51.09	0.14	1.01	0.14
BH104	34.72	CS	15.1	34.72	4	Off white CHALK. Tested outside calibrated range of device	I	56.07	44.57	41.82	0.24	54.64	0.08	1.04	0.08
BH104	34.72	CS	15.1	34.72	5	Off white CHALK. Tested outside calibrated range of device	I	62.16	41.74	40.36	0.33	56.52	0.10	1.06	0.11
BH104	34.72	CS	15.1	34.72	6	Off white CHALK. Tested outside calibrated range of device	I	43.42	32.55	31.08	0.45	41.45	0.26	0.92	0.24
BH104	34.72	CS	15.1	34.72	7	Off white CHALK. Tested outside calibrated range of device	I	47.47	21.84	20.4	0.28	35.11	0.23	0.85	0.19
BH104	34.72	CS	15.1	34.72	8	Off white CHALK. Tested outside calibrated range of device	I	44	36.84	34.09	0.26	43.70	0.14	0.94	0.13
BH104	34.72	CS	15.1	34.72	9	Off white CHALK. Tested outside calibrated range of device	I	48.21	27.04	25.62	0.25	39.66	0.16	0.9	0.14

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:

Paul Rodgers

Results apply to samples as received.

Print date 16/09/2025

Revision No. 3.00

Issue Date 07/12/2023

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH104
Project No.	TB8754		Sample Depth 42.00m
Engineer	Mott MacDonald		Sample Number 20.1
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 42.00m
			Specimen Number 12

Water content	23.3	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 26/09/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI
Project No.	TB8754
Engineer	Mott MacDonald
Client	FBJV

Point Load Index Result

Test method: ISRM 1985 : Suggested Method

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH104	42.00	CS	20.1	42.00	1	Off white CHALK. L/D<0.5 due to insufficient specimen.Tested outside calibrated range of device	D	53.92	54.08	52.53	0.28	53.30	0.10	1.03	0.10
BH104	42.00	CS	20.1	42.00	10	Off white CHALK. Tested outside calibrated range of device	I	41.77	28.98	24.92	0.27	36.41	0.20	0.87	0.18
BH104	42.00	CS	20.1	42.00	2	Off white CHALK.	D+X	53.65	53.81	52.32	0.58	53.06	0.21	1.03	0.21
BH104	42.00	CS	20.1	42.00	3	Off white CHALK. Tested outside calibrated range of device	D+X	53.32	53.29	50.47	0.42	51.86	0.16	1.02	0.16
BH104	42.00	CS	20.1	42.00	4	Off white CHALK.	A+X	53.21	49.82	43.24	0.52	54.12	0.18	1.04	0.18
BH104	42.00	CS	20.1	42.00	5	Off white CHALK.	A	53.2	38.88	35.99	0.77	49.37	0.32	0.99	0.31
BH104	42.00	CS	20.1	42.00	6	Off white CHALK.	A	53.71	42.69	38.49	0.91	51.30	0.35	1.01	0.35
BH104	42.00	CS	20.1	42.00	7	Off white CHALK. Tested outside calibrated range of device	A	53.74	28.22	25.48	0.3	41.75	0.17	0.92	0.16
BH104	42.00	CS	20.1	42.00	8	Off white CHALK. Tested outside calibrated range of device	A	53.42	18.43	16.97	0.3	33.97	0.26	0.84	0.22
BH104	42.00	CS	20.1	42.00	9	Off white CHALK. Tested outside calibrated range of device	A	54	23.04	21.57	0.33	38.51	0.22	0.89	0.20

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:

Paul Rodgers

Results apply to samples as received.

Print date 26/09/2025

Revision No. 3.00

Issue Date 07/12/2023

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Density Test Result**	Hole ID BH110
Project No.	TB8754		Sample Depth 28.75m
Engineer	Mott MacDonald		Sample Number 6.1
Employer	FBJV	BS1377: Part 2: 1990: 7.2	Sample Type CS
Description	Off white CHALK.		Specimen Depth 28.75m
			Specimen Number 12

Water Content	29	%
Density Type	Linear density	
Bulk Density	1.94	Mg/m^3
Dry Density	1.50	Mg/m^3

Remarks

Deviations from test method

None

Results relate only to the items tested. The laboratory has not been responsible for the sampling stage, so results apply to the sample as received.

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH110	28.75	CS	6.1	28.75	1	Off white CHALK. Tested outside calibrated range of device	D	53.51	53.12	51.66	0.21	52.38	0.08	1.02	0.08
BH110	28.75	CS	6.1	28.75	10	Off white CHALK. Tested outside calibrated range of device	I	37.62	25.72	24.21	0.39	34.05	0.34	0.84	0.28
BH110	28.75	CS	6.1	28.75	2	Off white CHALK. Tested outside calibrated range of device	D	53.71	53.03	51.6	0.36	52.31	0.13	1.02	0.13
BH110	28.75	CS	6.1	28.75	3	Off white CHALK.	A	53.46	40.08	35.21	0.61	48.96	0.25	0.99	0.25
BH110	28.75	CS	6.1	28.75	4	Off white CHALK. Tested outside calibrated range of device	A	53.56	29.8	28.35	0.33	43.97	0.17	0.94	0.16
BH110	28.75	CS	6.1	28.75	5	Off white CHALK.	A	53.53	31.77	30.26	0.58	45.41	0.28	0.96	0.27
BH110	28.75	CS	6.1	28.75	6	Off white CHALK. Tested outside calibrated range of device	A	53.46	19.11	17.55	0.41	34.56	0.34	0.85	0.29
BH110	28.75	CS	6.1	28.75	7	Off white CHALK.	I	62.25	51.49	39.42	0.78	55.90	0.25	1.05	0.26
BH110	28.75	CS	6.1	28.75	8	Off white CHALK. Tested outside calibrated range of device	I	39.88	32.84	31.4	0.24	39.93	0.15	0.9	0.14
BH110	28.75	CS	6.1	28.75	9	Off white CHALK. Tested outside calibrated range of device	I	57.88	33.08	31.56	0.44	48.23	0.19	0.98	0.19

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

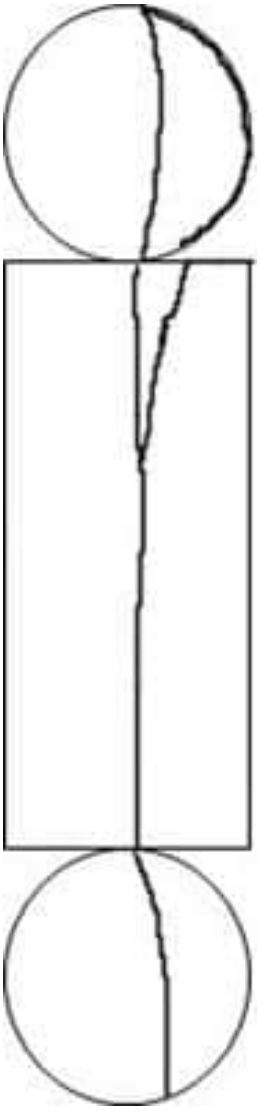
Approved by:		Results apply to samples as received.	
Steve Harper		Print date 27/07/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 07/12/2023	

Project Name	Grain to Tilbury Tunnel GI	**Uniaxial Compressive Strength**	Hole ID BH110
Project No.	TB8754		Sample Depth 32.77m
Engineer	Mott MacDonald	The Complete ISRM Suggested Methods - Rock Characterization Testing and Monitoring 1974 - 2006, Editors: R Ulusay & J A Hudson	Sample Number 9.1
Employer	FBJV		Sample Type CS
Description	Off white CHALK.		Specimen Depth 32.77m
			Specimen Number 11

Date and method of sampling	Not supplied
Storage history and environment	Sample stored in temperature controlled environment.

Sample details				Mean
Length	mm	124.33	124.40	124.4
Diameter (top)	mm	53.18	53.56	53.3
Diameter (middle)	mm	53.47	53.37	Length/diameter ratio
Diameter (base)	mm	53.42	53.00	2.3
Area	mm^2	2234.0		
Mass	g	536.75		
Test details				
Test duration	min	04:43		
Failure load	kN	3.7		
Stress rate	kN/min	0.8		
U.C.S.	MPa	1.66		
Mode of failure		Axial		
Loading axis relative to anisotropy				
Machine type used in test		Controls 1300 / Automax 5		
Date of test		10/07/2025		
Additional specimen details				
Water content	%	29.5		
Bulk density	kg/m^3	1930		
Dry density	kg/m^3	1490		

Failure sketch



Test Remarks

Tested on specimen with length to diameter ratio outside 2.5-3.0 recommendation.

Specimen Remarks

Sides of specimen are not smooth and straight to within ISRM tolerance, the largest irregularity measured as 0.3mm. Top and bottom of specimen are not perpendicular to ISRM tolerance of 0.05mm in 50mm

Approved by:	Leeds Laboratory	Results apply to samples as received.	SOIL ENGINEERING
Paul Rodgers		Print date 11/08/2025	
	Revision No. 2.08	Issue Date 22/01/2025	

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH110
Project No.	TB8754		Sample Depth 33.83m
Engineer	Mott MacDonald		Sample Number 10.1
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 33.83m
			Specimen Number 12

Water content	22.6	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 21/08/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH110
Project No.	TB8754		Sample Depth 35.00m
Engineer	Mott MacDonald		Sample Number 11.1
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 35.00m
			Specimen Number 12

Water content	26.6	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 21/08/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH110
Project No.	TB8754		Sample Depth 37.80m
Engineer	Mott MacDonald		Sample Number 12.1
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 37.80m
			Specimen Number 12

Water content	27.0	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 21/08/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH110	37.80	CS	12.1	37.80	1	Off white CHALK.	D	98.29	97.7	95.2	1.16	96.44	0.12	1.34	0.17
BH110	37.80	CS	12.1	37.80	10	Off white CHALK. Tested outside calibrated range of device	I	61.32	43.23	40.4	0.45	56.16	0.14	1.05	0.15
BH110	37.80	CS	12.1	37.80	2	Off white CHALK. Tested outside calibrated range of device	D	97.67	97.63	96.15	0.37	96.89	0.04	1.35	0.05
BH110	37.80	CS	12.1	37.80	3	Off white CHALK.	D	98.87	96.52	83.27	1.46	89.65	0.18	1.3	0.24
BH110	37.80	CS	12.1	37.80	4	Off white CHALK.	A+X	98.69	54.51	48.13	1.27	77.77	0.21	1.22	0.26
BH110	37.80	CS	12.1	37.80	5	Off white CHALK.	A	97.98	44.58	42.48	0.83	72.80	0.16	1.18	0.19
BH110	37.80	CS	12.1	37.80	6	Off white CHALK.	A	96.1	48.15	39.92	1.09	69.89	0.22	1.16	0.26
BH110	37.80	CS	12.1	37.80	7	Off white CHALK. Tested outside calibrated range of device	A	98.45	41.41	38.7	0.24	69.65	0.05	1.16	0.06
BH110	37.80	CS	12.1	37.80	8	Off white CHALK.	I	61.78	37.91	36.4	0.89	53.51	0.31	1.03	0.32
BH110	37.80	CS	12.1	37.80	9	Off white CHALK. Tested outside calibrated range of device	I	55.59	33.32	30.39	0.39	46.38	0.18	0.97	0.18

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:		Results apply to samples as received.	
Paul Rodgers		Print date 21/08/2025	
	Revision No. 3.00	Issue Date 07/12/2023	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Rock Water Content**	Hole ID BH110
Project No.	TB8754		Sample Depth 40.47m
Engineer	Mott MacDonald		Sample Number 14.1
Employer	FBJV	ISRM: Suggested method for determining water content.	Sample Type CS
Description	Off white CHALK.		Specimen Depth 40.47m
			Specimen Number 12

Water content	26.2	%
Oven temperature	105	°C
Is test result assumed to be a natural water content?	Yes	

Remarks

Approved by: Paul Rodgers	Leeds Laboratory	Results apply to samples as received. Print date 21/08/2025	SOIL ENGINEERING
	Revision No. 1.01	Issue Date 01/05/2024	

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH110	40.47	CS	14.1	40.47	1	Off white CHALK.	D	100.52	97.76	85.05	1.98	91.18	0.24	1.31	0.31
BH110	40.47	CS	14.1	40.47	10	Off white CHALK.	I	91	55.7	50.67	1.74	76.62	0.30	1.21	0.36
BH110	40.47	CS	14.1	40.47	2	Off white CHALK.	D	100.85	98.69	96.1	0.96	97.39	0.10	1.35	0.14
BH110	40.47	CS	14.1	40.47	3	Off white CHALK.	D+X	99.51	97.29	91.33	0.99	94.26	0.11	1.33	0.15
BH110	40.47	CS	14.1	40.47	4	Off white CHALK.	A	100.53	46.19	42.74	1.45	73.96	0.27	1.19	0.32
BH110	40.47	CS	14.1	40.47	5	Off white CHALK.	A	100.2	55.44	46.6	1.31	77.10	0.22	1.22	0.27
BH110	40.47	CS	14.1	40.47	6	Off white CHALK.	A	99.89	40.2	36.8	0.93	68.41	0.20	1.15	0.23
BH110	40.47	CS	14.1	40.47	7	Off white CHALK.	A	99.5	35.09	32.4	0.77	64.07	0.19	1.12	0.21
BH110	40.47	CS	14.1	40.47	8	Off white CHALK.	A+X	100.3	92.84	82.51	1.64	102.65	0.16	1.38	0.22
BH110	40.47	CS	14.1	40.47	9	Off white CHALK.	I	77.53	47.39	43.81	1.23	65.76	0.28	1.13	0.32

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:		Results apply to samples as received.	SOIL ENGINEERING
Paul Rodgers		Print date 21/08/2025	
	Revision No. 3.00	Issue Date 07/12/2023	

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH110	41.77	CS	15.1	41.77	1	Off white CHALK. Tested outside calibrated range of device	I	40.85	36.71	35.14	0.47	42.75	0.26	0.93	0.24
BH110	41.77	CS	15.1	41.77	10	Off white CHALK. Tested outside calibrated range of device	I	36.42	23.07	21.91	0.34	31.87	0.33	0.82	0.27
BH110	41.77	CS	15.1	41.77	2	Off white CHALK. Tested outside calibrated range of device	I	41.56	33.62	30.84	0.27	40.40	0.17	0.91	0.15
BH110	41.77	CS	15.1	41.77	3	Off white CHALK. Tested outside calibrated range of device	I	39.7	34.29	32.69	0.19	40.65	0.11	0.91	0.10
BH110	41.77	CS	15.1	41.77	4	Off white CHALK. Tested outside calibrated range of device	I	36.4	23.59	22.02	0.3	31.95	0.29	0.82	0.24
BH110	41.77	CS	15.1	41.77	5	Off white CHALK. Tested outside calibrated range of device	I	34.09	23.16	21.64	0.18	30.65	0.19	0.8	0.15
BH110	41.77	CS	15.1	41.77	6	Off white CHALK. Tested outside calibrated range of device	I	29.08	23.09	21.57	0.22	28.26	0.28	0.77	0.21
BH110	41.77	CS	15.1	41.77	7	Off white CHALK. Tested outside calibrated range of device	I	35.5	27.4	26.06	0.39	34.32	0.33	0.84	0.28
BH110	41.77	CS	15.1	41.77	8	Off white CHALK.	I	37.44	30.18	28.71	0.54	36.99	0.39	0.87	0.34
BH110	41.77	CS	15.1	41.77	9	Off white CHALK. Tested outside calibrated range of device	I	38.78	24.61	23.2	0.36	33.85	0.31	0.84	0.26

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

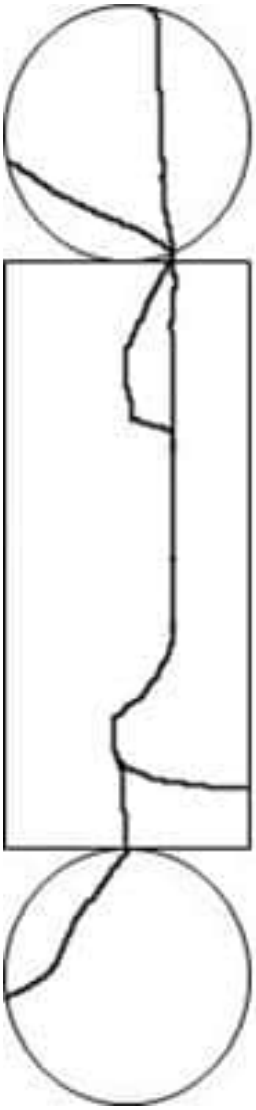
Approved by:		Results apply to samples as received.	
Paul Rodgers		Print date 21/08/2025	SOIL ENGINEERING
	Revision No. 3.00	Issue Date 07/12/2023	

Project Name	Grain to Tilbury Tunnel GI	**Uniaxial Compressive Strength**	Hole ID BH110
Project No.	TB8754		Sample Depth 41.77m
Engineer	Mott MacDonald	The Complete ISRM Suggested Methods - Rock Characterization Testing and Monitoring 1974 - 2006, Editors: R Ulusay & J A Hudson	Sample Number 15.1
Employer	FBJV		Sample Type CS
Description	Off white CHALK.		Specimen Depth 41.77m
			Specimen Number 11

Date and method of sampling	Not supplied
Storage history and environment	Sample stored in temperature controlled environment.

Sample details				Mean
Length	mm	153.92	153.88	153.9
Diameter (top)	mm	53.48	53.45	53.4
Diameter (middle)	mm	53.40	53.50	Length/diameter ratio
Diameter (base)	mm	53.35	53.41	2.9
Area	mm^2	2242.3		
Mass	g	665.12		
Test details				
Test duration	min	05:18		
Failure load	kN	5.2		
Stress rate	kN/min	1.0		
U.C.S.	MPa	2.32		
Mode of failure		Axial		
Loading axis relative to anisotropy				
Machine type used in test		Controls 1300 / Automax 5		
Date of test		10/07/2025		
Additional specimen details				
Water content	%	28.8		
Bulk density	kg/m^3	1930		
Dry density	kg/m^3	1500		

Failure sketch



Test Remarks

Specimen Remarks

Sides of specimen are not smooth and straight to within ISRM tolerance, the largest irregularity measured as 0.4mm. Top and bottom of specimen are not perpendicular to ISRM tolerance of 0.05mm in 50mm

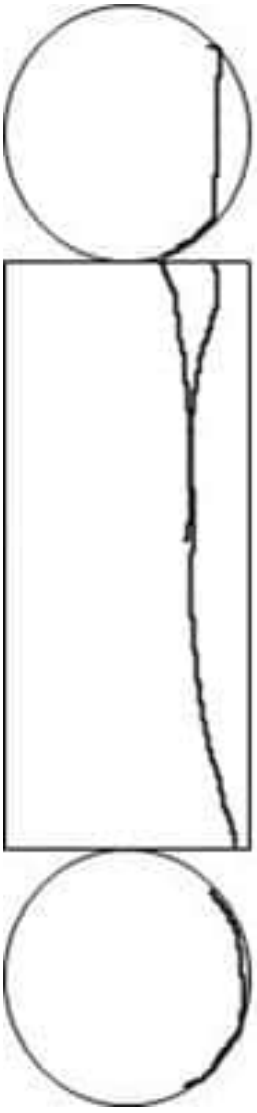
Approved by:	Leeds Laboratory	Results apply to samples as received.	SOIL ENGINEERING
Paul Rodgers		Print date 21/08/2025	
	Revision No. 2.08	Issue Date 22/01/2025	

Project Name	Grain to Tilbury Tunnel GI	**Uniaxial Compressive Strength**	Hole ID BH110
Project No.	TB8754		Sample Depth 43.60m
Engineer	Mott MacDonald	The Complete ISRM Suggested Methods - Rock Characterization Testing and Monitoring 1974 - 2006, Editors: R Ulusay & J A Hudson	Sample Number 16.1
Employer	FBJV		Sample Type CS
Description	Off white CHALK.		Specimen Depth 43.60m
			Specimen Number 11

Date and method of sampling	Not supplied
Storage history and environment	Sample stored in temperature controlled environment.

Sample details				Mean
Length	mm	218.80	219.15	219.0
Diameter (top)	mm	100.71	100.58	100.4
Diameter (middle)	mm	100.41	100.02	Length/diameter ratio
Diameter (base)	mm	100.52	100.24	2.2
Area	mm^2	7919.0		
Mass	g	3356.43		
Test details				
Test duration	min	05:56		
Failure load	kN	15.9		
Stress rate	kN/min	2.7		
U.C.S.	MPa	2.01		
Mode of failure		Irregular		
Loading axis relative to anisotropy				
Machine type used in test		Controls 1300 / Automax 5		
Date of test		11/07/2025		
Additional specimen details				
Water content	%	28.5		
Bulk density	kg/m^3	1940		
Dry density	kg/m^3	1510		

Failure sketch



Test Remarks

Tested on specimen with length to diameter ratio outside 2.5-3.0 recommendation.

Specimen Remarks

Sides of specimen are not smooth and straight to within ISRM tolerance, the largest irregularity measured as 0.4mm. Top and bottom of specimen are not perpendicular to ISRM tolerance of 0.05mm in 50mm

Approved by:	Leeds Laboratory	Results apply to samples as received.	SOIL ENGINEERING
Paul Rodgers		Print date 11/09/2025	
	Revision No. 2.08	Issue Date 22/01/2025	

Project Name	Grain to Tilbury Tunnel GI	**Point Load Index Result**	
Project No.	TB8754		
Engineer	Mott MacDonald		
Client	FBJV	Test method: ISRM 1985 : Suggested Method	

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH110	43.60	CS	16.1	43.60	1	Off white CHALK.	A	99.41	56.93	53.95	0.83	82.64	0.12	1.25	0.15
BH110	43.60	CS	16.1	43.60	10	Off white CHALK.	I	68.87	44.37	41.47	0.54	60.30	0.15	1.09	0.16
BH110	43.60	CS	16.1	43.60	2	Off white CHALK.	I	92.42	78.56	72.84	0.89	92.58	0.10	1.32	0.14
BH110	43.60	CS	16.1	43.60	3	Off white CHALK.	I	88.32	75.01	66.93	0.94	86.76	0.12	1.28	0.16
BH110	43.60	CS	16.1	43.60	4	Off white CHALK. Tested outside calibrated range of device	I+X	90.27	79.36	76.35	0.25	93.68	0.03	1.33	0.04
BH110	43.60	CS	16.1	43.60	5	Off white CHALK.	I	80.87	54.88	51.12	0.8	72.55	0.15	1.18	0.18
BH110	43.60	CS	16.1	43.60	6	Off white CHALK.	I	77.33	40.4	36.64	0.89	60.06	0.25	1.09	0.27
BH110	43.60	CS	16.1	43.60	7	Off white CHALK.	I	57.14	48.14	44.81	0.88	57.10	0.27	1.06	0.29
BH110	43.60	CS	16.1	43.60	8	Off white CHALK. Tested outside calibrated range of device	I	59.37	53.4	49.33	0.42	61.07	0.11	1.09	0.12
BH110	43.60	CS	16.1	43.60	9	Off white CHALK. Tested outside calibrated range of device	I	49.9	36.5	34.92	0.47	47.10	0.21	0.97	0.21

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:		Results apply to samples as received.	
Paul Rodgers		Print date 11/09/2025	
	Revision No. 3.00	Issue Date 07/12/2023	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI
Project No.	TB8754
Engineer	Mott MacDonald
Client	FBJV

Point Load Index Result

Test method: ISRM 1985 : Suggested Method

Hole ID	Sample depth m	Sample type	Sample no.	Specimen depth m	Specimen ref.	Description	Test Result								
							Type	W mm	D mm	D' mm	P kN	De mm	Is MN/m^2	F	Is(50) MN/m^2
BH110	44.29	CS	17.1	44.29	1	Off white CHALK.	I	83.42	78.82	75.07	0.79	89.29	0.10	1.3	0.13
BH110	44.29	CS	17.1	44.29	10	Off white CHALK.	I	42.16	26.68	24.34	0.55	36.15	0.42	0.86	0.36
BH110	44.29	CS	17.1	44.29	2	Off white CHALK.	I	86.38	60.91	51.82	1.12	75.49	0.20	1.2	0.24
BH110	44.29	CS	17.1	44.29	3	Off white CHALK.	I+X	62.58	48.52	47.04	0.6	61.22	0.16	1.1	0.18
BH110	44.29	CS	17.1	44.29	4	Off white CHALK.	I	59.17	38.29	33.14	0.53	49.97	0.21	1	0.21
BH110	44.29	CS	17.1	44.29	5	Off white CHALK.	I	50.92	44.64	35.77	0.65	48.16	0.28	0.98	0.28
BH110	44.29	CS	17.1	44.29	6	Off white CHALK. Tested outside calibrated range of device	I	48.58	29.69	28.3	0.29	41.84	0.17	0.92	0.15
BH110	44.29	CS	17.1	44.29	7	Off white CHALK.	I	57.79	29.93	28.52	0.55	45.81	0.26	0.96	0.25
BH110	44.29	CS	17.1	44.29	8	Off white CHALK. Tested outside calibrated range of device	I	47.28	33.19	31.86	0.36	43.79	0.19	0.94	0.18
BH110	44.29	CS	17.1	44.29	9	Off white CHALK.	I	43.29	37.61	35.07	0.79	43.97	0.41	0.94	0.39

Key

Point Load Type (Combination of)	D	Diametral		A	Axial
	I	Irregular lump		B	Block
	L	Parallel to planes of weakness		P	Perpendicular to planes of weakness
	X	Invalid failure of point load (not broken between points of load application)			
Dimensions	L	Distance between contact points and nearest free end (not applicable to axial tests)			
	W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump			
	D	Distance between platens when just in contact with specimen			
	D'	Distance between platens at point of failure			
	De	Equivalent core diameter		Is	P/De^2
	Is(50)	F x Is		F	$(De/50)^{0.45}$
	Is(50)	point load strength index corrected for a diametral test of core diameter 50mm			
	For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$			For Diametral tests $De^2 = D \times D'$	

Approved by:

Paul Rodgers

Results apply to samples as received.

Print date 21/08/2025

Revision No. 3.00 Issue Date 07/12/2023

SOIL ENGINEERING

SOIL ENGINEERING

SUPPORTING FACTUAL DATA

SECTION B
Laboratory Testing

CHEMICAL TEST RESULTS

eurofins | Chemtest
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Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.: 25-19639-1

Initial Date of Issue: 30-Jun-2025

Re-Issue Details:

Client *Soil Engineering Geoservices Ltd*

Client Address: *Foundation Court*
Riverside Way
Watchmoor Park
Camberley
GU15 3RG

Contact(s): *Alyson Cockburn*
Daisy Hill
Daniel Woodriffe
David Howard
Emily Birch
Emily Cross
Felicity Hales
Holly Harland
Ian Harman
Ian Swain
Josh Currie
Matthew Bellhouse
Michail Kamperis
Nathan Fullerton
Oyin Okedairo
Paschalis Staikos
Stephen Harp

Project *TC8754 Grain to Tilbury*

Quotation No.:	*Q25-37723*	**Date Received:**	13-Jun-2025
Order No.:		**Date Instructed:**	20-Jun-2025
No. of Samples:	*2*		
Turnaround (Wkdays):	5	**Results Due:**	26-Jun-2025
Date Approved:	30-Jun-2025		

Approved By:



Details: David Smith, Technical Director

Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
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Email: info@chemtest.com

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Soil

Project: TC8754 Grain to Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-19639
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1986112
				Client Sample ID.:		*ES26*
				Client Reference:		*BH109*
				Sample Type:		*SOIL*
				Top Depth (m):		*7.80*
				Bottom Depth (m):		*7.85*
				Date Sampled:		*30-May-2025*
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**	
Moisture		N	2030	%	0.020	80
Soil Colour		N	2030		N/A	Brown
Other Material		N	2030		N/A	Stones
Soil Texture		N	2030		N/A	Loam
pH (2.5:1) at 20C		N	2010		4.0	7.4
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010	1.3
Total Sulphur		U	2175	%	0.010	2.0
Sulphate (Acid Soluble)		U	2430	%	0.010	0.19

Results - Water

Project: TC8754 Grain to Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-19639
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1986111
				Client Sample ID.:		*W35*
				Client Reference:		*BH109*
				Sample Type:		*WATER*
				Sample Sub Type:		
				Top Depth (m):		*2.30*
				Date Sampled:		*02-Jun-2025*
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**	
pH at 20C		U	1010		4.0	7.5
Total Dissolved Solids		N	1020	mg/l	1.0	7700
Alkalinity (Total)		U	1220	mg/l	10	2200
Chloride		U	1220	mg/l	1.0	4000
Ammoniacal Nitrogen		U	1220	mg/l	0.050	17
Nitrite as N		U	1220	mg/l	0.010	0.011
Nitrate as N		U	1220	mg/l	0.50	< 0.50
Phosphorus (Dissolved)		N	1220	mg/l	0.020	< 0.020
Phosphorus (Dissolved)		N	1220	mg/l	0.020	< 0.020
Sulphate		U	1220	mg/l	1.0	46
Nitrogen (Total)		N	1340	mg/l	5.0	22
Calcium (Dissolved)		U	1455	mg/l	2.00	170
Potassium (Dissolved)		U	1455	mg/l	0.50	79
Magnesium (Dissolved)		U	1455	mg/l	0.20	360
Sodium (Dissolved)		U	1455	mg/l	1.50	2600
Total Hardness as CaCO3		U	1270	mg/l	15	1900
Arsenic (Dissolved)		U	1455	mg/l	0.0002	0.0009
Boron (Dissolved)		U	1455	mg/l	0.01	1.1
Barium (Dissolved)		U	1455	mg/l	0.005	0.059
Beryllium (Dissolved)		U	1455	mg/l	0.001	< 0.001
Chromium (Dissolved)		U	1455	mg/l	0.0005	< 0.0005
Copper (Dissolved)		U	1455	mg/l	0.0005	< 0.0005
Manganese (Dissolved)		U	1455	mg/l	0.0005	0.24
Molybdenum (Dissolved)		U	1455	mg/l	0.0002	0.051
Nickel (Dissolved)		U	1455	mg/l	0.0005	0.015
Lead (Dissolved)		U	1455	mg/l	0.0005	< 0.0005
Antimony (Dissolved)		U	1455	mg/l	0.0005	< 0.0005
Selenium (Dissolved)		U	1455	mg/l	0.0005	0.0018
Vanadium (Dissolved)		U	1455	mg/l	0.0005	0.0053
Zinc (Dissolved)		U	1455	mg/l	0.002	< 0.003
Cadmium (Dissolved)		N	1455	mg/l	0.00080	< 0.00080
Mercury Low Level		U	1460	mg/l	0.000010	< 0.00001
Iron (Dissolved)		N	1455	mg/l	0.005	< 0.005
Low-Level Chromium (Hexavalent)		U	1495	mg/l	0.0001	< 0.0001
Chromium (Trivalent) LL		N	1455	µg/l	1.00	< 1.0
Dissolved Organic Carbon		U	1610	mg/l	2.0	120
Aliphatic TPH >C5-C6	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10

Results - Water

Project: TC8754 Grain to Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**	25-19639
Quotation No.: Q25-37723				**Chemtest Sample ID.:**	1986111
				Client Sample ID.:	*W35*
				Client Reference:	*BH109*
				Sample Type:	*WATER*
				Sample Sub Type:	
				Top Depth (m):	*2.30*
				Date Sampled:	*02-Jun-2025*

Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**	
Aliphatic TPH >C6-C8	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10
Aliphatic TPH >C8-C10	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10
Aliphatic TPH >C10-C12	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10
Aliphatic TPH >C12-C16	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10
Aliphatic TPH >C16-C21	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10
Aliphatic TPH >C21-C35	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10
Aliphatic TPH >C35-C44	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10
Total Aliphatic Hydrocarbons	EH_2D_AL_#1	N	1675	µg/l	5.0	< 5.0
Aromatic TPH >C5-C7	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10
Aromatic TPH >C7-C8	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10
Aromatic TPH >C8-C10	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10
Aromatic TPH >C10-C12	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10
Aromatic TPH >C12-C16	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10
Aromatic TPH >C16-C21	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10
Aromatic TPH >C21-C35	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10
Aromatic TPH >C35-C44	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10
Total Aromatic Hydrocarbons	EH_2D_AR_#1	N	1675	µg/l	5.0	< 5.0
Total Petroleum Hydrocarbons	EH_2D_Total_#1	N	1675	µg/l	10	< 10
Naphthalene		U	1800	µg/l	0.10	< 0.10
Acenaphthylene		U	1800	µg/l	0.10	< 0.10
Acenaphthene		U	1800	µg/l	0.10	< 0.10
Fluorene		U	1800	µg/l	0.10	< 0.10
Phenanthrene		U	1800	µg/l	0.10	< 0.10
Anthracene		U	1800	µg/l	0.10	< 0.10
Fluoranthene		U	1800	µg/l	0.10	< 0.10
Pyrene		U	1800	µg/l	0.10	< 0.10
Benzo[a]anthracene		U	1800	µg/l	0.10	< 0.10
Chrysene		U	1800	µg/l	0.10	< 0.10
Benzo[b]fluoranthene		U	1800	µg/l	0.10	< 0.10
Benzo[k]fluoranthene		U	1800	µg/l	0.10	< 0.10
Benzo[a]pyrene		U	1800	µg/l	0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene		U	1800	µg/l	0.10	< 0.10
Dibenz(a,h)Anthracene		U	1800	µg/l	0.10	< 0.10
Benzo[g,h,i]perylene		U	1800	µg/l	0.10	< 0.10
Total Of 16 PAH's		U	1800	µg/l	2.0	< 2.0
PCB 28		N	1815	µg/l	0.010	< 0.010
PCB 52		N	1815	µg/l	0.010	< 0.010

Results - Water

Project: TC8754 Grain to Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-19639
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1986111
				Client Sample ID.:		*W35*
				Client Reference:		*BH109*
				Sample Type:		*WATER*
				Sample Sub Type:		
				Top Depth (m):		*2.30*
				Date Sampled:		*02-Jun-2025*
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**	
PCB 101		N	1815	µg/l	0.010	< 0.010
PCB 118		N	1815	µg/l	0.010	< 0.010
PCB 153		N	1815	µg/l	0.010	< 0.010
PCB 138		N	1815	µg/l	0.010	< 0.010
PCB 180		N	1815	µg/l	0.010	< 0.010
Total PCBs (7 congeners)		N	1815	µg/l	0.010	< 0.010
Total Phenols		U	1920	mg/l	0.030	< 0.030

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Chemtest Sample ID	*Clients Sample Ref:*	*Clients Sample ID:*	*Clients Reference:*	*Sampled Date:*	Deviation Code(s):	Containers Received:
1986111		*W35*	*BH109*	*02-Jun-2025*	B,H	Coloured Winchester 1000ml
1986111		*W35*	*BH109*	*02-Jun-2025*	B,H	Plastic Bottle 1000ml
1986112		*ES26*	*BH109*	*30-May-2025*	H	Amber Glass 250ml
1986112		*ES26*	*BH109*	*30-May-2025*	H	Amber Glass 60ml
1986112		*ES26*	*BH109*	*30-May-2025*	H	Plastic Tub 500g

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
1010	pH Value of Waters	pH at 20°C	pH Meter	RE PW TE TS PL DW GW
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity at 25°C and Total Dissolved Solids (TDS) in Waters	Conductivity Meter	
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.	PL LE GW
1270	Total Hardness of Waters	Total hardness	Calculation applied to calcium and magnesium results, expressed as mg l-1 CaCO3 equivalent.	GW LE
1340	Total Nitrogen in Waters	Total Nitrogen and organic Nitrogen	Persulphate digestion followed by colorimetry.	
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	GW
1460	Mercury low-level in Waters by AFS	Mercury	Atomic Fluorescence Spectrometry, with collimated UV source, wavelength 253.7 nm.	PL GW
1495	Low Level Hexavalent Chromium in Waters	Chromium [VI]	Colorimetric determination of hexavalent chromium expressed as Cr (VI) µg/l in water, using Ion Chromatography and UV-visible spectrophotometry.	GW
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation	PL SW GW
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection	
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection	PL GW SW
1815	Polychlorinated Biphenyls (PCB) ICES7 Congeners in Waters by GC-MS	ICES7 PCB congeners	Solvent extraction / GCMS detection	
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.	PL GW
2010	pH Value of Soils	pH at 20°C	pH Meter	
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <30°C.	
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES	
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.	

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection
Text example	All items indicated in italic font represent customer-supplied information that may not be independently verified by the laboratory

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.

Any comments or interpretations are outside the scope of UKAS accreditation.

The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.

Uncertainty of measurement for the determinands tested are available upon request .

None of the results in this report have been recovery corrected.

All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at ≤ 30°C prior to analysis.

All Asbestos testing is performed at the indicated laboratory .

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

NEW_ASB	Eurofins Chemtest Limited, 11 Depot Road, Newmarket, CB8 0AL
DURHAM	Eurofins Chemtest Limited, Unit A North Wing, Prospect Business Park, Crookhall Lane, Consett, Co Durham, DH8 7PW

Sample Deviation Codes

As a result of any of the below deviations applying, the test results may be unreliable

A - Date of sampling not supplied

B - Sample age exceeds stability time (sampling to extraction)

C - Sample not received in appropriate containers

D - Broken Container

E - The required amount of sample for analysis was not received

H - Appropriate cooling measures were not taken for sample transportation

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.

All water samples will be retained for 14 days from the date of receipt.

Charges may apply to extended sample storage.

Report Information

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable
PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

Asbestos Tests LOD = LOQ

Limit of Detection = Limit of Quantification for asbestos results only

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

SOIL ENGINEERING

SUPPORTING FACTUAL DATA

SECTION B
Laboratory Testing

ENVIRONMENTAL TEST RESULTS

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Amended Report

Report No.:	25-14925-2		
Initial Date of Issue:	24-May-2025	**Date of Re-Issue:**	24-Jun-2025
Re-Issue Details:	This report has been revised and directly supersedes 25-14925-1 in its entirety		
Client	*Soil Engineering Geoservices Ltd*		
Client Address:	*Foundation Court* *Riverside Way* *Watchmoor Park* *Camberley* *GU15 3RG*		
Contact(s):	*Emily Cross*		
Project	*TB8754 Grain to Tilbury Tunnel*		
Quotation No.:	*Q25-37723*	**Date Received:**	06-May-2025
Order No.:		**Date Instructed:**	13-May-2025
No. of Samples:	*3*		
Turnaround (Wkdays):	32	**Results Due:**	26-Jun-2025
Date Approved:	24-Jun-2025		

Approved By:



Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Soil

Project: TB8754 Grain to Tilbury Tunnel

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-14925	25-14925	25-14925
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1969064	1969065	1969066
Order No.:				*Client Sample Ref.:*		*ES3*	*ES5*	*ES7*
				Client Reference:		*BH102*	*BH102*	*BH102*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.30*	*0.50*	*1.00*
				Bottom Depth (m):		*0.35*	*0.55*	*1.05*
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
ACM Type		N	2192		N/A	-	-	-
Asbestos Identification		U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture		N	2030	%	0.020	11	21	18
Soil Colour		N	2030		N/A	Brown	Brown	Brown
Other Material		N	2030		N/A	Stones	Stones	Stones
Soil Texture		N	2030		N/A	Sand	Loam	Loam
pH at 20C		M	2010		4.0	8.0	7.9	8.4
pH (2.5:1) at 20C		N	2010		4.0	8.4	8.2	8.7
Boron (Hot Water Soluble)		M	2120	mg/kg	0.40	0.62	1.2	3.4
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010	0.21	0.31	1.4
Total Sulphur		U	2175	%	0.010	0.13	0.17	0.49
Cyanide (Free)		M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Iron (Total)		N	2430	mg/kg	100	9900	13000	9800
Sulphate (Acid Soluble)		U	2430	%	0.010	0.24	0.29	0.61
Arsenic		M	2455	mg/kg	0.5	23	16	9.2
Barium		M	2455	mg/kg	0.5	1000	280	100
Beryllium		U	2455	mg/kg	0.5	1.0	1.0	0.5
Cadmium		M	2455	mg/kg	0.10	1.3	0.39	0.27
Chromium		M	2455	mg/kg	0.5	21	18	14
Manganese		M	2455	mg/kg	1.0	590	250	250
Molybdenum		M	2455	mg/kg	0.5	4.4	4.3	3.6
Copper		M	2455	mg/kg	0.50	99	98	85
Mercury		M	2455	mg/kg	0.05	0.35	0.11	0.21
Nickel		M	2455	mg/kg	0.50	38	38	16
Lead		M	2455	mg/kg	0.50	210	52	100
Selenium		M	2455	mg/kg	0.25	0.50	0.41	0.45
Vanadium		U	2455	mg/kg	0.5	72	75	28
Zinc		M	2455	mg/kg	0.50	270	89	120
Chromium (Trivalent)		N	2490	mg/kg	1.0	21	18	14
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Aliphatic VPH >C5-C6	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C7	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C7-C8	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C8 (Sum)	HS_2D_AL	N	2780	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Aliphatic VPH >C8-C10	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Total Aliphatic VPH >C5-C10	HS_2D_AL	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25

Results - Soil

Project: TB8754 Grain to Tilbury Tunnel

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-14925	25-14925	25-14925
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1969064	1969065	1969066
Order No.:				*Client Sample Ref.:*		*ES3*	*ES5*	*ES7*
				Client Reference:		*BH102*	*BH102*	*BH102*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.30*	*0.50*	*1.00*
				Bottom Depth (m):		*0.35*	*0.55*	*1.05*
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
Aliphatic EPH >C10-C12 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	< 2.0	8.3	40
Aliphatic EPH >C12-C16 MC	EH_2D_AL_#1	M	2690	mg/kg	1.00	< 1.0	25	190
Aliphatic EPH >C16-C21 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	5.9	41	260
Aliphatic EPH >C21-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	3.00	27	75	150
Aliphatic EPH >C35-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	30	20	34
Total Aliphatic EPH >C10-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	5.00	34	150	640
Total Aliphatic EPH >C10-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	65	170	670
Aromatic VPH >C5-C7	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C7-C8	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C8-C10	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Total Aromatic VPH >C5-C10	HS_2D_AR	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25
Aromatic EPH >C10-C12 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0	< 1.0	9.0
Aromatic EPH >C12-C16 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0	19	70
Aromatic EPH >C16-C21 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	4.3	35	110
Aromatic EPH >C21-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	38	40	88
Aromatic EPH >C35-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	1.00	55	14	29
Total Aromatic EPH >C10-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	5.00	42	95	280
Total Aromatic EPH >C10-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	10.00	97	110	310
Total VPH >C5-C10	HS_2D_Total	U	2780	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Total EPH >C10-C35 MC	EH_2D_Total_#1	U	2690	mg/kg	10.00	77	240	910
Total EPH >C10-C40 MC	EH_2D_Total_#1	N	2690	mg/kg	10.00	160	280	980
Fraction of Organic Carbon		M	2625		0.0010	0.023	0.046	0.015
Dichlorodifluoromethane		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Chloromethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromomethane		M	2760	µg/kg	20	< 20	< 20	< 20
Chloroethane		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Trichlorofluoromethane		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Trans 1,2-Dichloroethene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
cis 1,2-Dichloroethene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane		U	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0
Trichloromethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Tetrachloromethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0

Results - Soil

Project: TB8754 Grain to Tilbury Tunnel

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-14925	25-14925	25-14925
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1969064	1969065	1969066
Order No.:				*Client Sample Ref.:*		*ES3*	*ES5*	*ES7*
				Client Reference:		*BH102*	*BH102*	*BH102*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.30*	*0.50*	*1.00*
				Bottom Depth (m):		*0.35*	*0.55*	*1.05*
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
Benzene		M	2760	µg/kg	1.0	< 1.0	17	< 1.0
1,2-Dichloroethane		M	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Trichloroethene		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Dibromomethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane		M	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0
cis-1,3-Dichloropropene		N	2760	µg/kg	10	< 10	< 10	< 10
Toluene		M	2760	µg/kg	1.0	< 1.0	6.6	< 1.0
Trans-1,3-Dichloropropene		N	2760	µg/kg	10	< 10	< 10	< 10
1,1,2-Trichloroethane		M	2760	µg/kg	10	< 10	< 10	< 10
Tetrachloroethene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Dibromochloromethane		U	2760	µg/kg	10	< 10	< 10	< 10
1,2-Dibromoethane		M	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0
Chlorobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane		M	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Ethylbenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
o-Xylene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Styrene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Tribromomethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane		N	2760	µg/kg	50	< 50	< 50	< 50
N-Propylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
2-Chlorotoluene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
4-Chlorotoluene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Tert-Butylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Sec-Butylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
4-Isopropyltoluene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
N-Butylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-Chloropropane		N	2760	µg/kg	50	< 50	< 50	< 50

Results - Soil

Project: TB8754 Grain to Tilbury Tunnel

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-14925	25-14925	25-14925
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1969064	1969065	1969066
Order No.:				*Client Sample Ref.:*		*ES3*	*ES5*	*ES7*
				Client Reference:		*BH102*	*BH102*	*BH102*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.30*	*0.50*	*1.00*
				Bottom Depth (m):		*0.35*	*0.55*	*1.05*
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
1,2,4-Trichlorobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Methyl Tert-Butyl Ether		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Naphthalene		M	2800	mg/kg	0.10	< 0.10	< 0.10	0.24
Acenaphthylene		N	2800	mg/kg	0.10	< 0.10	< 0.10	0.15
Acenaphthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Fluorene		M	2800	mg/kg	0.10	< 0.10	< 0.10	0.17
Phenanthrene		M	2800	mg/kg	0.10	0.15	1.3	1.7
Anthracene		M	2800	mg/kg	0.10	0.12	0.58	0.57
Fluoranthene		M	2800	mg/kg	0.10	0.17	1.8	3.4
Pyrene		M	2800	mg/kg	0.10	0.16	1.7	3.0
Benzo[a]anthracene		M	2800	mg/kg	0.10	0.19	1.3	2.0
Chrysene		M	2800	mg/kg	0.10	0.18	1.1	2.0
Benzo[b]fluoranthene		M	2800	mg/kg	0.10	0.18	1.4	3.3
Benzo[k]fluoranthene		M	2800	mg/kg	0.10	0.14	1.1	1.3
Benzo[a]pyrene		M	2800	mg/kg	0.10	< 0.10	1.2	2.6
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10	< 0.10	1.3	2.3
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	< 0.10	0.91	0.44
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10	< 0.10	1.4	2.2
Total Of 16 PAH's		N	2800	mg/kg	2.0	< 2.0	15	25
Resorcinol		M	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Phenol		M	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Cresols		M	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Xylenols		M	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
1-Naphthol		N	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Trimethylphenols		M	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Total Phenols		M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Chemtest Sample ID	*Clients Sample Ref:*	*Clients Sample ID:*	*Clients Reference:*	*Sampled Date:*	Deviation Code(s):	Containers Received:
1969064	*ES3*		*BH102*		A,H	Amber Glass 250ml
1969064	*ES3*		*BH102*		A,H	Plastic Tub 1000g
1969065	*ES5*		*BH102*		A,H	Amber Glass 250ml
1969065	*ES5*		*BH102*		A,H	Plastic Tub 1000g
1969066	*ES7*		*BH102*		A,H	Amber Glass 250ml
1969066	*ES7*		*BH102*		A,H	Plastic Tub 1000g

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2010	pH Value of Soils	pH at 20°C	pH Meter	
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <30°C.	
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES	
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry	
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.	
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.	
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.	
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.	
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2690	EPH A/A Split	Aliphatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40 Aromatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40	Acetone/Heptane extraction / GCxGC FID detection	
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.	
2780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C7,>C7–C8,>C8-C10 Aromatics: >C5–C7,>C7-C8,>C8–C10	Water extraction / Headspace GCxGC FID detection	
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS	
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.	

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection
Text example	All items indicated in italic font represent customer-supplied information that may not be independently verified by the laboratory

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.

Any comments or interpretations are outside the scope of UKAS accreditation.

The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.

Uncertainty of measurement for the determinands tested are available upon request .

None of the results in this report have been recovery corrected.

All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at ≤ 30°C prior to analysis.

All Asbestos testing is performed at the indicated laboratory .

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

NEW_ASB	Eurofins Chemtest Limited, 11 Depot Road, Newmarket, CB8 0AL
DURHAM	Eurofins Chemtest Limited, Unit A North Wing, Prospect Business Park, Crookhall Lane, Consett, Co Durham, DH8 7PW

Sample Deviation Codes

As a result of any of the below deviations applying, the test results may be unreliable

A - Date of sampling not supplied

B - Sample age exceeds stability time (sampling to extraction)

C - Sample not received in appropriate containers

D - Broken Container

E - The required amount of sample for analysis was not received

H - Appropriate cooling measures were not taken for sample transportation

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.

All water samples will be retained for 14 days from the date of receipt.

Charges may apply to extended sample storage.

Report Information

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable
PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

Asbestos Tests LOD = LOQ

Limit of Detection = Limit of Quantification for asbestos results only

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

eurofins | Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Amended Report

Report No.:	25-15419-2		
Initial Date of Issue:	27-May-2025	**Date of Re-Issue:**	13-Jun-2025
Re-Issue Details:	This report has been revised and directly supersedes 25-15419-1 in its entirety		
Client	*Soil Engineering Geoservices Ltd*		
Client Address:	*Foundation Court* *Riverside Way* *Watchmoor Park* *Camberley* *GU15 3RG*		
Contact(s):	*Emily Cross*		
Project	*TB8754 Grain to Tilbury Tunnel GI*		
Quotation No.:	*Q25-37723*	**Date Received:**	09-May-2025
Order No.:		**Date Instructed:**	09-May-2025
No. of Samples:	*3*		
Turnaround (Wkdays):	7	**Results Due:**	19-May-2025
Date Approved:	12-Jun-2025		

Approved By:

Details: Simon Wicks, Specialist Chemist

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Soil

Project: TB8754 Grain to Tilbury Tunnel GI

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-15419	25-15419	25-15419
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1970683	1970685	1970686
Order No.:				*Client Sample Ref.:*		*6*	*11*	*18*
				Client Sample ID.:		*SE35250507006*	*SE35250507011*	*SE35250507018*
				Client Reference:		*BH103*	*BH103*	*BH103*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.50*	*1.00*	*2.80*
				Bottom Depth (m):		*0.55*	*1.05*	*2.85*
				Date Sampled:		*07-May-2025*	*07-May-2025*	*07-May-2025*
				Time Sampled:		*15:12*	*15:28*	*15:29*
				Asbestos Lab:		DURHAM	DURHAM	DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
ACM Type		N	2192		N/A	-	-	-
Asbestos Identification		U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture		N	2030	%	0.020	16	28	41
Soil Colour		N	2030		N/A	Brown	Brown	Brown
Other Material		N	2030		N/A	Stones and Roots	Stones	None
Soil Texture		N	2030		N/A	Loam	Sand	Clay
pH at 20C		M	2010		4.0	7.4	8.3	7.7
pH (2.5:1) at 20C		N	2010		4.0	6.2	7.4	7.5
Boron (Hot Water Soluble)		M	2120	mg/kg	0.40	3.1	6.5	4.0
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010	0.31	0.35	0.18
Total Sulphur		U	2175	%	0.010	0.15	0.27	0.080
Cyanide (Free)		M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Iron (Total)		N	2430	mg/kg	100	8400	8600	9800
Sulphate (Acid Soluble)		U	2430	%	0.010	0.13	0.24	0.062
Arsenic		M	2455	mg/kg	0.5	19	20	15
Barium		M	2455	mg/kg	0.5	310	170	28
Beryllium		U	2455	mg/kg	0.5	1.1	0.9	0.9
Cadmium		M	2455	mg/kg	0.10	0.41	0.23	< 0.10
Chromium		M	2455	mg/kg	0.5	24	20	29
Manganese		M	2455	mg/kg	1.0	380	170	200
Molybdenum		M	2455	mg/kg	0.5	4.2	2.1	1.1
Copper		M	2455	mg/kg	0.50	93	120	11
Mercury		M	2455	mg/kg	0.05	0.26	0.68	< 0.05
Nickel		M	2455	mg/kg	0.50	30	20	22
Lead		M	2455	mg/kg	0.50	130	310	18
Selenium		M	2455	mg/kg	0.25	3.0	0.55	0.51
Vanadium		U	2455	mg/kg	0.5	58	31	51
Zinc		M	2455	mg/kg	0.50	200	130	56
Chromium (Trivalent)		N	2490	mg/kg	1.0	24	20	29
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Aliphatic VPH >C5-C6	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05

Results - Soil

Project: TB8754 Grain to Tilbury Tunnel GI

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-15419	25-15419	25-15419
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1970683	1970685	1970686
Order No.:				*Client Sample Ref.:*		*6*	*11*	*18*
				Client Sample ID.:		*SE35250507006*	*SE35250507011*	*SE35250507018*
				Client Reference:		*BH103*	*BH103*	*BH103*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.50*	*1.00*	*2.80*
				Bottom Depth (m):		*0.55*	*1.05*	*2.85*
				Date Sampled:		*07-May-2025*	*07-May-2025*	*07-May-2025*
				Time Sampled:		*15:12*	*15:28*	*15:29*
				Asbestos Lab:		DURHAM	DURHAM	DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
Aliphatic VPH >C6-C7	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C7-C8	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C8 (Sum)	HS_2D_AL	N	2780	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Aliphatic VPH >C8-C10	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Total Aliphatic VPH >C5-C10	HS_2D_AL	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25
Aliphatic EPH >C10-C12 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	3.6	4.2	5.4
Aliphatic EPH >C12-C16 MC	EH_2D_AL_#1	M	2690	mg/kg	1.00	2.4	< 1.0	< 1.0
Aliphatic EPH >C16-C21 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	28	21	< 2.0
Aliphatic EPH >C21-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	3.00	100	420	28
Aliphatic EPH >C35-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	16	25	11
Total Aliphatic EPH >C10-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	5.00	130	440	34
Total Aliphatic EPH >C10-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	150	470	45
Aromatic VPH >C5-C7	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C7-C8	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C8-C10	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Total Aromatic VPH >C5-C10	HS_2D_AR	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25
Aromatic EPH >C10-C12 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0	< 1.0	< 1.0
Aromatic EPH >C12-C16 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	1.3	1.3	< 1.0
Aromatic EPH >C16-C21 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	33	14	4.3
Aromatic EPH >C21-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	110	66	11
Aromatic EPH >C35-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	1.00	34	38	22
Total Aromatic EPH >C10-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	5.00	150	81	16
Total Aromatic EPH >C10-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	10.00	180	120	38
Total VPH >C5-C10	HS_2D_Total	U	2780	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Total EPH >C10-C35 MC	EH_2D_Total_#1	U	2690	mg/kg	10.00	280	520	49
Total EPH >C10-C40 MC	EH_2D_Total_#1	N	2690	mg/kg	10.00	330	590	82
Fraction of Organic Carbon		M	2625		0.0010	0.061	0.038	0.010
Dichlorodifluoromethane		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Chloromethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromomethane		M	2760	µg/kg	20	< 20	< 20	< 20
Chloroethane		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Trichlorofluoromethane		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0

Results - Soil

Project: TB8754 Grain to Tilbury Tunnel GI

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-15419	25-15419	25-15419
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1970683	1970685	1970686
Order No.:				*Client Sample Ref.:*		*6*	*11*	*18*
				Client Sample ID.:		*SE35250507006*	*SE35250507011*	*SE35250507018*
				Client Reference:		*BH103*	*BH103*	*BH103*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.50*	*1.00*	*2.80*
				Bottom Depth (m):		*0.55*	*1.05*	*2.85*
				Date Sampled:		*07-May-2025*	*07-May-2025*	*07-May-2025*
				Time Sampled:		*15:12*	*15:28*	*15:29*
				Asbestos Lab:		DURHAM	DURHAM	DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
1,1-Dichloroethene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Trans 1,2-Dichloroethene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
cis 1,2-Dichloroethene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane		U	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0
Trichloromethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Tetrachloromethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Benzene		M	2760	µg/kg	1.0	22	< 1.0	< 1.0
1,2-Dichloroethane		M	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Trichloroethene		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Dibromomethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane		M	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0
cis-1,3-Dichloropropene		N	2760	µg/kg	10	< 10	< 10	< 10
Toluene		M	2760	µg/kg	1.0	15	< 1.0	< 1.0
Trans-1,3-Dichloropropene		N	2760	µg/kg	10	< 10	< 10	< 10
1,1,2-Trichloroethane		M	2760	µg/kg	10	< 10	< 10	< 10
Tetrachloroethene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Dibromochloromethane		U	2760	µg/kg	10	< 10	< 10	< 10
1,2-Dibromoethane		M	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0
Chlorobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane		M	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Ethylbenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene		M	2760	µg/kg	1.0	6.7	< 1.0	< 1.0
o-Xylene		M	2760	µg/kg	1.0	4.3	< 1.0	< 1.0
Styrene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Tribromomethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane		N	2760	µg/kg	50	< 50	< 50	< 50

Results - Soil

Project: TB8754 Grain to Tilbury Tunnel GI

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-15419	25-15419	25-15419
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1970683	1970685	1970686
Order No.:				*Client Sample Ref.:*		*6*	*11*	*18*
				Client Sample ID.:		*SE35250507006*	*SE35250507011*	*SE35250507018*
				Client Reference:		*BH103*	*BH103*	*BH103*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.50*	*1.00*	*2.80*
				Bottom Depth (m):		*0.55*	*1.05*	*2.85*
				Date Sampled:		*07-May-2025*	*07-May-2025*	*07-May-2025*
				Time Sampled:		*15:12*	*15:28*	*15:29*
				Asbestos Lab:		DURHAM	DURHAM	DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
N-Propylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
2-Chlorotoluene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
4-Chlorotoluene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Tert-Butylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Sec-Butylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
4-Isopropyltoluene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
N-Butylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-Chloropropane		N	2760	µg/kg	50	< 50	< 50	< 50
1,2,4-Trichlorobenzene		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Methyl Tert-Butyl Ether		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Naphthalene		M	2800	mg/kg	0.10	0.63	0.49	< 0.10
Acenaphthylene		N	2800	mg/kg	0.10	0.13	< 0.10	< 0.10
Acenaphthene		M	2800	mg/kg	0.10	0.12	< 0.10	< 0.10
Fluorene		M	2800	mg/kg	0.10	0.15	< 0.10	< 0.10
Phenanthrene		M	2800	mg/kg	0.10	1.0	0.47	< 0.10
Anthracene		M	2800	mg/kg	0.10	0.24	0.10	< 0.10
Fluoranthene		M	2800	mg/kg	0.10	1.4	0.88	< 0.10
Pyrene		M	2800	mg/kg	0.10	1.1	0.78	< 0.10
Benzo[a]anthracene		M	2800	mg/kg	0.10	0.50	0.62	< 0.10
Chrysene		M	2800	mg/kg	0.10	0.53	0.73	< 0.10
Benzo[b]fluoranthene		M	2800	mg/kg	0.10	0.71	1.2	< 0.10
Benzo[k]fluoranthene		M	2800	mg/kg	0.10	0.19	0.39	< 0.10
Benzo[a]pyrene		M	2800	mg/kg	0.10	0.49	0.85	< 0.10
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10	0.41	0.83	< 0.10
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	0.11	0.19	< 0.10
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10	0.44	0.77	< 0.10

Results - Soil

Project: TB8754 Grain to Tilbury Tunnel GI

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-15419	25-15419	25-15419
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1970683	1970685	1970686
Order No.:				*Client Sample Ref.:*		*6*	*11*	*18*
				Client Sample ID.:		*SE35250507006*	*SE35250507011*	*SE35250507018*
				Client Reference:		*BH103*	*BH103*	*BH103*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.50*	*1.00*	*2.80*
				Bottom Depth (m):		*0.55*	*1.05*	*2.85*
				Date Sampled:		*07-May-2025*	*07-May-2025*	*07-May-2025*
				Time Sampled:		*15:12*	*15:28*	*15:29*
				Asbestos Lab:		DURHAM	DURHAM	DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
Total Of 16 PAH's		N	2800	mg/kg	2.0	8.2	8.3	< 2.0
Resorcinol		M	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Phenol		M	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Cresols		M	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Xylenols		M	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
1-Naphthol		N	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Trimethylphenols		M	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Total Phenols		M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2010	pH Value of Soils	pH at 20°C	pH Meter	
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <30°C.	
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES	
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry	
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.	
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.	
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.	
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.	
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2690	EPH A/A Split	Aliphatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40 Aromatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40	Acetone/Heptane extraction / GCxGC FID detection	
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.	
2780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C7,>C7–C8,>C8-C10 Aromatics: >C5–C7,>C7-C8,>C8–C10	Water extraction / Headspace GCxGC FID detection	
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS	
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.	

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection
Text example	All items indicated in italic font represent customer-supplied information that may not be independently verified by the laboratory

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.

Any comments or interpretations are outside the scope of UKAS accreditation.

The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.

Uncertainty of measurement for the determinands tested are available upon request .

None of the results in this report have been recovery corrected.

All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at ≤ 30°C prior to analysis.

All Asbestos testing is performed at the indicated laboratory .

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

NEW_ASB	Eurofins Chemtest Limited, 11 Depot Road, Newmarket, CB8 0AL
DURHAM	Eurofins Chemtest Limited, Unit A North Wing, Prospect Business Park, Crookhall Lane, Consett, Co Durham, DH8 7PW

Sample Deviation Codes

As a result of any of the below deviations applying, the test results may be unreliable

A - Date of sampling not supplied

B - Sample age exceeds stability time (sampling to extraction)

C - Sample not received in appropriate containers

D - Broken Container

E - The required amount of sample for analysis was not received

H - Appropriate cooling measures were not taken for sample transportation

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.

All water samples will be retained for 14 days from the date of receipt.

Charges may apply to extended sample storage.

Report Information

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable
PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

Asbestos Tests LOD = LOQ

Limit of Detection = Limit of Quantification for asbestos results only

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: cs@etuki.eurofins.com

Amended Report

Report No.:	25-15536-3		
Initial Date of Issue:	22-May-2025	**Date of Re-Issue:**	23-Jul-2025
Re-Issue Details:	This report has been revised and directly supersedes 25-15536-2 in its entirety		
Client	*Soil Engineering Geoservices Ltd*		
Client Address:	*Foundation Court* *Riverside Way* *Watchmoor Park* *Camberley* *GU15 3RG*		
Contact(s):	*Emily Cross*		
Project	*TB8754 Grain to Tilbury*		
Quotation No.:	*Q25-37723*	**Date Received:**	09-May-2025
Order No.:		**Date Instructed:**	09-May-2025
No. of Samples:	*2*		
Turnaround (Wkdays):	35	**Results Due:**	27-Jun-2025
Date Approved:	10-Jul-2025		

Approved By:



Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Leachate

Project: TB8754 Grain to Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-15536
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1971133
Order No.:				*Client Sample Ref.:*		*3*
				Client Reference:		*BH106*
				Sample Type:		*SOIL*
				Top Depth (m):		*0.5*
				Date Sampled:		*02-May-2025*
				Time Sampled:		*11:20*
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**	
pH at 20C	U	1010	10:1		4.0	8.8
Fluoride	U	1220	10:1	mg/l	0.050	0.40
Ammoniacal Nitrogen	U	1220	10:1	mg/l	0.050	0.057
Sulphur	N	1220	10:1	mg/l	1.0	1.4
Sulphate	U	1220	10:1	mg/l	1.0	4.2
Cyanide (Total)	U	1300	10:1	mg/l	0.050	< 0.050
Cyanide (Free)	U	1300	10:1	mg/l	0.050	< 0.050
Cyanide (Complex)	U	1300	10:1	mg/l	0.050	< 0.050
Magnesium	U	1455	10:1	mg/l	0.20	0.72
Arsenic (Dissolved)	U	1455	10:1	µg/l	0.20	4.1
Boron (Dissolved)	U	1455	10:1	µg/l	10.0	110
Barium (Dissolved)	U	1455	10:1	µg/l	5.00	< 5.0
Beryllium (Dissolved)	U	1455	10:1	µg/l	1.00	< 1.0
Cadmium (Dissolved)	U	1455	10:1	µg/l	0.11	< 0.11
Chromium (Dissolved)	U	1455	10:1	µg/l	0.50	2.2
Copper (Dissolved)	U	1455	10:1	µg/l	0.50	1.8
Mercury (Dissolved)	U	1455	10:1	µg/l	0.05	< 0.05
Molybdenum (Dissolved)	U	1455	10:1	µg/l	0.20	1.1
Nickel (Dissolved)	U	1455	10:1	µg/l	0.50	1.4
Lead (Dissolved)	U	1455	10:1	µg/l	0.50	2.1
Selenium (Dissolved)	U	1455	10:1	µg/l	0.50	0.96
Vanadium (Dissolved)	U	1455	10:1	µg/l	0.50	8.4
Zinc (Dissolved)	U	1455	10:1	µg/l	2.5	12
Iron (Dissolved)	N	1455	10:1	µg/l	5.0	1200
Low-Level Chromium (Hexavalent)	N	1495	10:1	µg/l	0.10	2.5
Chromium Trivalent LL (from 1455 1495)	N	1450	10:1	µg/l	1.00	< 1.0
Total TPH >C6-C40	U	1670	10:1	µg/l	10	< 10
Naphthalene	U	1800	10:1	µg/l	0.10	< 0.10
Acenaphthylene	U	1800	10:1	µg/l	0.10	< 0.10
Acenaphthene	U	1800	10:1	µg/l	0.10	< 0.10
Fluorene	U	1800	10:1	µg/l	0.10	< 0.10
Phenanthrene	U	1800	10:1	µg/l	0.10	< 0.10
Anthracene	U	1800	10:1	µg/l	0.10	< 0.10
Fluoranthene	U	1800	10:1	µg/l	0.10	< 0.10
Pyrene	U	1800	10:1	µg/l	0.10	< 0.10
Benzo[a]anthracene	U	1800	10:1	µg/l	0.10	< 0.10
Chrysene	U	1800	10:1	µg/l	0.10	< 0.10
Benzo[b]fluoranthene	U	1800	10:1	µg/l	0.10	< 0.10
Benzo[k]fluoranthene	U	1800	10:1	µg/l	0.10	< 0.10
Benzo[a]pyrene	U	1800	10:1	µg/l	0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1800	10:1	µg/l	0.10	< 0.10

Results - Leachate

Project: TB8754 Grain to Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-15536
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1971133
Order No.:				*Client Sample Ref.:*		*3*
				Client Reference:		*BH106*
				Sample Type:		*SOIL*
				Top Depth (m):		*0.5*
				Date Sampled:		*02-May-2025*
				Time Sampled:		*11:20*
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**	
Dibenz(a,h)Anthracene	U	1800	10:1	µg/l	0.10	< 0.10
Benzo[g,h,i]perylene	U	1800	10:1	µg/l	0.10	< 0.10
Total Of 16 PAH's	U	1800	10:1	µg/l	2.0	< 2.0
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030

Results - Soil

Project: TB8754 Grain to Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-15536	25-15536
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1971132	1971133
Order No.:				*Client Sample Ref.:*		*2*	*3*
				Client Reference:		*BH106*	*BH106*
				Sample Type:		*SOIL*	*SOIL*
				Top Depth (m):		*0.3*	*0.5*
				Date Sampled:		*02-May-2025*	*02-May-2025*
				Time Sampled:		*11:11*	*11:20*
				Asbestos Lab:			DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**		
ACM Type		N	2192		N/A		-
Asbestos Identification		U	2192		N/A		No Asbestos Detected
Moisture		N	2030	%	0.020	23	25
Soil Colour		N	2030		N/A	Brown	Brown
Other Material		N	2030		N/A	Stones and Roots	Stones and Roots
Soil Texture		N	2030		N/A	Clay	Clay
pH at 20C		M	2010		4.0		8.8
pH (2.5:1) at 20C		N	2010		4.0	8.5	
Boron (Hot Water Soluble)		M	2120	mg/kg	0.40		3.5
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010	< 0.010	< 0.010
Total Sulphur		U	2175	%	0.010	0.014	0.020
Cyanide (Free)		M	2300	mg/kg	0.50		< 0.50
Iron (Total)		N	2430	mg/kg	100		59000
Sulphate (Acid Soluble)		U	2430	%	0.010	0.046	
Arsenic		M	2455	mg/kg	0.5		38
Barium		M	2455	mg/kg	0.5		63
Beryllium		U	2455	mg/kg	0.5		2.2
Cadmium		M	2455	mg/kg	0.10		< 0.10
Chromium		M	2455	mg/kg	0.5		62
Manganese		M	2455	mg/kg	1.0		540
Molybdenum		M	2455	mg/kg	0.5		2.0
Copper		M	2455	mg/kg	0.50		22
Mercury		M	2455	mg/kg	0.05		< 0.05
Nickel		M	2455	mg/kg	0.50		46
Lead		M	2455	mg/kg	0.50		38
Selenium		M	2455	mg/kg	0.25		1.4
Vanadium		U	2455	mg/kg	0.5		120
Zinc		M	2455	mg/kg	0.50		120
Chromium (Trivalent)		N	2490	mg/kg	1.0		61
Chromium (Hexavalent)		N	2490	mg/kg	0.50		1.0
Aliphatic VPH >C5-C6	HS_2D_AL	U	2780	mg/kg	0.05		< 0.05
Aliphatic VPH >C6-C7	HS_2D_AL	U	2780	mg/kg	0.05		< 0.05
Aliphatic VPH >C7-C8	HS_2D_AL	U	2780	mg/kg	0.05		< 0.05
Aliphatic VPH >C6-C8 (Sum)	HS_2D_AL	N	2780	mg/kg	0.10		< 0.10
Aliphatic VPH >C8-C10	HS_2D_AL	U	2780	mg/kg	0.05		< 0.05
Total Aliphatic VPH >C5-C10	HS_2D_AL	U	2780	mg/kg	0.25		< 0.25
Aliphatic EPH >C10-C12 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00		3.4
Aliphatic EPH >C12-C16 MC	EH_2D_AL_#1	M	2690	mg/kg	1.00		5.8

Results - Soil

Project: TB8754 Grain to Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-15536	25-15536
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1971132	1971133
Order No.:				*Client Sample Ref.:*		*2*	*3*
				Client Reference:		*BH106*	*BH106*
				Sample Type:		*SOIL*	*SOIL*
				Top Depth (m):		*0.3*	*0.5*
				Date Sampled:		*02-May-2025*	*02-May-2025*
				Time Sampled:		*11:11*	*11:20*
				Asbestos Lab:			DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**		
Aliphatic EPH >C16-C21 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00		8.3
Aliphatic EPH >C21-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	3.00		24
Aliphatic EPH >C35-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00		14
Total Aliphatic EPH >C10-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	5.00		42
Total Aliphatic EPH >C10-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00		56
Aromatic VPH >C5-C7	HS_2D_AR	U	2780	mg/kg	0.05		< 0.05
Aromatic VPH >C7-C8	HS_2D_AR	U	2780	mg/kg	0.05		< 0.05
Aromatic VPH >C8-C10	HS_2D_AR	U	2780	mg/kg	0.05		< 0.05
Total Aromatic VPH >C5-C10	HS_2D_AR	U	2780	mg/kg	0.25		< 0.25
Aromatic EPH >C10-C12 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00		< 1.0
Aromatic EPH >C12-C16 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00		< 1.0
Aromatic EPH >C16-C21 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00		11
Aromatic EPH >C21-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00		43
Aromatic EPH >C35-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	1.00		13
Total Aromatic EPH >C10-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	5.00		54
Total Aromatic EPH >C10-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	10.00		68
Total VPH >C5-C10	HS_2D_Total	U	2780	mg/kg	0.50		< 0.50
Total EPH >C10-C35 MC	EH_2D_Total_#1	U	2690	mg/kg	10.00		96
Total EPH >C10-C40 MC	EH_2D_Total_#1	N	2690	mg/kg	10.00		120
Fraction of Organic Carbon		M	2625		0.0010		0.0097
Dichlorodifluoromethane		N	2760	µg/kg	1.0		< 1.0
Chloromethane		M	2760	µg/kg	1.0		< 1.0
Vinyl Chloride		M	2760	µg/kg	1.0		< 1.0
Bromomethane		M	2760	µg/kg	20		< 20
Chloroethane		U	2760	µg/kg	2.0		< 2.0
Trichlorofluoromethane		N	2760	µg/kg	1.0		< 1.0
1,1-Dichloroethene		M	2760	µg/kg	1.0		< 1.0
Trans 1,2-Dichloroethene		M	2760	µg/kg	1.0		< 1.0
1,1-Dichloroethane		M	2760	µg/kg	1.0		< 1.0
cis 1,2-Dichloroethene		M	2760	µg/kg	1.0		< 1.0
Bromochloromethane		U	2760	µg/kg	5.0		< 5.0
Trichloromethane		M	2760	µg/kg	1.0		< 1.0
1,1,1-Trichloroethane		M	2760	µg/kg	1.0		< 1.0
Tetrachloromethane		M	2760	µg/kg	1.0		< 1.0
1,1-Dichloropropene		U	2760	µg/kg	1.0		< 1.0
Benzene		M	2760	µg/kg	1.0		< 1.0
1,2-Dichloroethane		M	2760	µg/kg	2.0		< 2.0
Trichloroethene		N	2760	µg/kg	1.0		< 1.0
1,2-Dichloropropane		M	2760	µg/kg	1.0		< 1.0
Dibromomethane		M	2760	µg/kg	1.0		< 1.0

Results - Soil

Project: TB8754 Grain to Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-15536	25-15536
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1971132	1971133
Order No.:				*Client Sample Ref.:*		*2*	*3*
				Client Reference:		*BH106*	*BH106*
				Sample Type:		*SOIL*	*SOIL*
				Top Depth (m):		*0.3*	*0.5*
				Date Sampled:		*02-May-2025*	*02-May-2025*
				Time Sampled:		*11:11*	*11:20*
				Asbestos Lab:			DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**		
Bromodichloromethane		M	2760	µg/kg	5.0		< 5.0
cis-1,3-Dichloropropene		N	2760	µg/kg	10		< 10
Toluene		M	2760	µg/kg	1.0		< 1.0
Trans-1,3-Dichloropropene		N	2760	µg/kg	10		< 10
1,1,2-Trichloroethane		M	2760	µg/kg	10		< 10
Tetrachloroethene		M	2760	µg/kg	1.0		< 1.0
1,3-Dichloropropane		U	2760	µg/kg	2.0		< 2.0
Dibromochloromethane		U	2760	µg/kg	10		< 10
1,2-Dibromoethane		M	2760	µg/kg	5.0		< 5.0
Chlorobenzene		M	2760	µg/kg	1.0		< 1.0
1,1,1,2-Tetrachloroethane		M	2760	µg/kg	2.0		< 2.0
Ethylbenzene		M	2760	µg/kg	1.0		< 1.0
m & p-Xylene		M	2760	µg/kg	1.0		< 1.0
o-Xylene		M	2760	µg/kg	1.0		< 1.0
Styrene		M	2760	µg/kg	1.0		< 1.0
Tribromomethane		U	2760	µg/kg	1.0		< 1.0
Isopropylbenzene		M	2760	µg/kg	1.0		< 1.0
Bromobenzene		M	2760	µg/kg	1.0		< 1.0
1,2,3-Trichloropropane		N	2760	µg/kg	50		< 50
N-Propylbenzene		U	2760	µg/kg	1.0		< 1.0
2-Chlorotoluene		M	2760	µg/kg	1.0		< 1.0
1,3,5-Trimethylbenzene		M	2760	µg/kg	1.0		< 1.0
4-Chlorotoluene		U	2760	µg/kg	1.0		< 1.0
Tert-Butylbenzene		U	2760	µg/kg	1.0		< 1.0
1,2,4-Trimethylbenzene		M	2760	µg/kg	1.0		< 1.0
Sec-Butylbenzene		U	2760	µg/kg	1.0		< 1.0
1,3-Dichlorobenzene		M	2760	µg/kg	1.0		< 1.0
4-Isopropyltoluene		U	2760	µg/kg	1.0		< 1.0
1,4-Dichlorobenzene		M	2760	µg/kg	1.0		< 1.0
N-Butylbenzene		U	2760	µg/kg	1.0		< 1.0
1,2-Dichlorobenzene		M	2760	µg/kg	1.0		< 1.0
1,2-Dibromo-3-Chloropropane		N	2760	µg/kg	50		< 50
1,2,4-Trichlorobenzene		M	2760	µg/kg	1.0		< 1.0
Hexachlorobutadiene		N	2760	µg/kg	1.0		< 1.0
1,2,3-Trichlorobenzene		U	2760	µg/kg	2.0		< 2.0
Methyl Tert-Butyl Ether		M	2760	µg/kg	1.0		< 1.0
Naphthalene		M	2800	mg/kg	0.10		< 0.10
Acenaphthylene		N	2800	mg/kg	0.10		< 0.10
Acenaphthene		M	2800	mg/kg	0.10		< 0.10
Fluorene		M	2800	mg/kg	0.10		< 0.10

Results - Soil

Project: TB8754 Grain to Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-15536	25-15536
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1971132	1971133
Order No.:				*Client Sample Ref.:*		*2*	*3*
				Client Reference:		*BH106*	*BH106*
				Sample Type:		*SOIL*	*SOIL*
				Top Depth (m):		*0.3*	*0.5*
				Date Sampled:		*02-May-2025*	*02-May-2025*
				Time Sampled:		*11:11*	*11:20*
				Asbestos Lab:			DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**		
Phenanthrene		M	2800	mg/kg	0.10		< 0.10
Anthracene		M	2800	mg/kg	0.10		< 0.10
Fluoranthene		M	2800	mg/kg	0.10		< 0.10
Pyrene		M	2800	mg/kg	0.10		< 0.10
Benzo[a]anthracene		M	2800	mg/kg	0.10		< 0.10
Chrysene		M	2800	mg/kg	0.10		< 0.10
Benzo[b]fluoranthene		M	2800	mg/kg	0.10		< 0.10
Benzo[k]fluoranthene		M	2800	mg/kg	0.10		< 0.10
Benzo[a]pyrene		M	2800	mg/kg	0.10		< 0.10
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10		< 0.10
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10		< 0.10
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10		< 0.10
Total Of 16 PAH's		N	2800	mg/kg	2.0		< 2.0
Resorcinol		M	2920	mg/kg	0.020		< 0.020
Phenol		M	2920	mg/kg	0.020		< 0.020
Cresols		M	2920	mg/kg	0.020		< 0.020
Xylenols		M	2920	mg/kg	0.020		< 0.020
1-Naphthol		N	2920	mg/kg	0.020		< 0.020
Trimethylphenols		M	2920	mg/kg	0.020		< 0.020
Total Phenols		M	2920	mg/kg	0.10		< 0.10

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
1010	pH Value of Waters	pH at 20°C	pH Meter	RE PW TE TS PL DW GW
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.	RE PW PL LE DW GW
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.	
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	GW
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	RE PW PL SW DW GW
1495	Low Level Hexavalent Chromium in Waters	Chromium [VI]	Colorimetric determination of hexavalent chromium expressed as Cr (VI) µg/l in water, using Ion Chromatography and UV-visible spectrophotometry.	GW
1670	Total Petroleum Hydrocarbons (TPH) in Waters by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO	Pentane extraction / GC FID detection	PL GW
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection	PL GW SW
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.	
2010	pH Value of Soils	pH at 20°C	pH Meter	
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <30°C.	
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES	
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry	
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.	
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.	
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.	
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.	
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2690	EPH A/A Split	Aliphatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40 Aromatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40	Acetone/Heptane extraction / GCxGC FID detection	
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.	
2780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C7,>C7–C8,>C8-C10 Aromatics: >C5–C7,>C7-C8,>C8–C10	Water extraction / Headspace GCxGC FID detection	

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS	
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.	
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge	

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection
Text example	All items indicated in italic font represent customer-supplied information that may not be independently verified by the laboratory

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.

Any comments or interpretations are outside the scope of UKAS accreditation.
The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.
Uncertainty of measurement for the determinands tested are available upon request .
None of the results in this report have been recovery corrected.
All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at ≤ 30°C prior to analysis.
All Asbestos testing is performed at the indicated laboratory .
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

NEW_ASB	Eurofins Chemtest Limited, 11 Depot Road, Newmarket, CB8 0AL
DURHAM	Eurofins Chemtest Limited, Unit A North Wing, Prospect Business Park, Crookhall Lane, Consett, Co Durham, DH8 7PW

Sample Deviation Codes

As a result of any of the below deviations applying, the test results may be unreliable

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - The required amount of sample for analysis was not received
H - Appropriate cooling measures were not taken for sample transportation

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.
All water samples will be retained for 14 days from the date of receipt.

Report Information

Charges may apply to extended sample storage.

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable
PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

Asbestos Tests LOD = LOQ

Limit of Detection = Limit of Quantification for asbestos results only

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.: 25-16930-1

Initial Date of Issue: 18-Jun-2025

Re-Issue Details:

Client *Soil Engineering Geoservices Ltd*

Client Address: *Foundation Court*
Riverside Way
Watchmoor Park
Camberley
GU15 3RG

Contact(s): *Emily Cross*
Paschalis Staikos

Project *TB8754 Tilbury*

Quotation No.: *Q25-37723* **Date Received:** 22-May-2025

Order No.: **Date Instructed:** 23-May-2025

No. of Samples: *5*

Turnaround (Wkdays): 5 **Results Due:** 30-May-2025

Date Approved: 18-Jun-2025

Approved By:



Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Soil

Project: TB8754 Tilbury

Client: Soil Engineering Geoservices Ltd						**Chemtest Job No.:**	25-16930	25-16930	25-16930	25-16930	25-16930
Quotation No.: Q25-37723						**Chemtest Sample ID.:**	1976288	1976289	1976291	1976294	1976295
Order No.:						*Client Sample Ref.:*	*ES*	*ES*	*ES*	*ES*	*ES*
						Client Sample ID.:	*53*	*51*	*52*	*8*	*14*
						Client Reference:	*BH101*	*BH101*	*BH101*	*BH101*	*BH101*
						Sample Type:	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*
						Top Depth (m):	*9.00*	*4.00*	*7.00*	*0.50*	*2.10*
						Bottom Depth (m):	*9.00*	*4.00*	*7.00*	*0.55*	*2.20*
						Date Sampled:	*14-May-2025*	*14-May-2025*	*14-May-2025*	*13-May-2025*	*13-May-2025*
						Asbestos Lab:	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**						
ACM Type		N	2192		N/A		-	-	-	-	-
Asbestos Identification		U	2192		N/A		No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture		N	2030	%	0.020		43	37	57	24	38
Soil Colour		N	2030		N/A		Grey	Brown	Brown	Brown	Black
Other Material		N	2030		N/A		None	Stones	Stones	Stones	Stones
Soil Texture		N	2030		N/A		Clay	Clay	Clay	Sand	Clay
pH at 20C		U	2010		4.0		7.9	7.9	7.9	8.6	8.0
pH (2.5:1) at 20C		N	2010		4.0		7.4	7.6	8.5	8.5	8.1
Boron (Hot Water Soluble)		U	2120	mg/kg	0.40		4.9	0.46	18	0.86	8.7
Sulphate (2:1 Water Soluble) as SO4		U	2120	g/l	0.010		0.28	0.13	0.44	0.15	0.80
Total Sulphur		U	2175	%	0.010		1.2	1.3	2.1	0.18	1.5
Cyanide (Free)		U	2300	mg/kg	0.50		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Iron (Total)		N	2430	mg/kg	100		9200	30000	22000	19000	31000
Sulphate (Acid Soluble)		U	2430	%	0.010		0.094	0.17	0.15	0.050	0.24
Arsenic		U	2455	mg/kg	0.5		4.4	21	12	10	19
Barium		U	2455	mg/kg	0.5		9.5	86	24	210	88
Beryllium		U	2455	mg/kg	0.5		< 0.5	1.1	0.6	0.6	1.1
Cadmium		U	2455	mg/kg	0.10		< 0.10	0.36	< 0.10	< 0.10	0.33
Chromium		U	2455	mg/kg	0.5		8.2	39	26	13	38
Manganese		U	2455	mg/kg	1.0		170	490	270	240	500
Molybdenum		U	2455	mg/kg	0.5		< 0.5	7.9	2.1	2.6	7.1
Copper		U	2455	mg/kg	0.50		3.6	42	11	61	40
Mercury		U	2455	mg/kg	0.05		< 0.05	0.17	< 0.05	< 0.05	0.17
Nickel		U	2455	mg/kg	0.50		7.4	54	24	31	53
Lead		U	2455	mg/kg	0.50		4.6	67	14	47	66
Selenium		U	2455	mg/kg	0.25		< 0.25	1.2	0.58	0.26	1.2
Vanadium		U	2455	mg/kg	0.5		14	140	49	58	140
Zinc		U	2455	mg/kg	0.50		20	370	66	46	360
Chromium (Trivalent)		N	2490	mg/kg	1.0		8.2	39	26	13	38
Chromium (Hexavalent)		N	2490	mg/kg	0.50		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Aliphatic VPH >C5-C6	HS_2D_AL	U	2780	mg/kg	0.05		< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C7	HS_2D_AL	U	2780	mg/kg	0.05		< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C7-C8	HS_2D_AL	U	2780	mg/kg	0.05		< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C8 (Sum)	HS_2D_AL	N	2780	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

Results - Soil

Project: TB8754 Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-16930	25-16930	25-16930	25-16930	25-16930
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1976288	1976289	1976291	1976294	1976295
Order No.:				*Client Sample Ref.:*		*ES*	*ES*	*ES*	*ES*	*ES*
				Client Sample ID.:		*53*	*51*	*52*	*8*	*14*
				Client Reference:		*BH101*	*BH101*	*BH101*	*BH101*	*BH101*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*9.00*	*4.00*	*7.00*	*0.50*	*2.10*
				Bottom Depth (m):		*9.00*	*4.00*	*7.00*	*0.55*	*2.20*
				Date Sampled:		*14-May-2025*	*14-May-2025*	*14-May-2025*	*13-May-2025*	*13-May-2025*
				Asbestos Lab:		DURHAM	DURHAM	DURHAM	DURHAM	DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**					
Aliphatic VPH >C8-C10	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	0.38	< 0.05	< 0.05
Total Aliphatic VPH >C5-C10	HS_2D_AL	U	2780	mg/kg	0.25	< 0.25	< 0.25	0.38	< 0.25	< 0.25
Aliphatic EPH >C10-C12 MC	EH_2D_AL_#1	U	2690	mg/kg	2.00	3.1	< 2.0	15	6.7	3.6
Aliphatic EPH >C12-C16 MC	EH_2D_AL_#1	U	2690	mg/kg	1.00	< 1.0	< 1.0	< 1.0	29	< 1.0
Aliphatic EPH >C16-C21 MC	EH_2D_AL_#1	U	2690	mg/kg	2.00	4.9	29	< 2.0	42	10
Aliphatic EPH >C21-C35 MC	EH_2D_AL_#1	U	2690	mg/kg	3.00	19	66	48	130	58
Aliphatic EPH >C35-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	16	< 10	< 10	130	< 10
Total Aliphatic EPH >C10-C35 MC	EH_2D_AL_#1	U	2690	mg/kg	5.00	27	95	65	210	72
Total Aliphatic EPH >C10-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	43	95	65	340	72
Aromatic VPH >C5-C7	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C7-C8	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C8-C10	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Total Aromatic VPH >C5-C10	HS_2D_AR	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
Aromatic EPH >C10-C12 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic EPH >C12-C16 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic EPH >C16-C21 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	41	6.9	12	< 2.0	< 2.0
Aromatic EPH >C21-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	16	120	19	13	26
Aromatic EPH >C35-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	1.00	19	53	7.7	60	4.9
Total Aromatic EPH >C10-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	5.00	58	130	31	14	28
Total Aromatic EPH >C10-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	10.00	76	180	39	74	33
Total VPH >C5-C10	HS_2D_Total	U	2780	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Total EPH >C10-C35 MC	EH_2D_Total_#1	U	2690	mg/kg	10.00	84	220	96	220	100
Total EPH >C10-C40 MC	EH_2D_Total_#1	N	2690	mg/kg	10.00	120	270	100	410	110
Fraction of Organic Carbon		U	2625		0.0010	0.015	0.035	0.11	0.047	0.043
Dichlorodifluoromethane		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromomethane		U	2760	µg/kg	20	< 20	< 20	< 20	< 20	< 20
Chloroethane		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Trichlorofluoromethane		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans 1,2-Dichloroethene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
cis 1,2-Dichloroethene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane		U	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0

Results - Soil

Project: TB8754 Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-16930	25-16930	25-16930	25-16930	25-16930
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1976288	1976289	1976291	1976294	1976295
Order No.:				*Client Sample Ref.:*		*ES*	*ES*	*ES*	*ES*	*ES*
				Client Sample ID.:		*53*	*51*	*52*	*8*	*14*
				Client Reference:		*BH101*	*BH101*	*BH101*	*BH101*	*BH101*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*9.00*	*4.00*	*7.00*	*0.50*	*2.10*
				Bottom Depth (m):		*9.00*	*4.00*	*7.00*	*0.55*	*2.20*
				Date Sampled:		*14-May-2025*	*14-May-2025*	*14-May-2025*	*13-May-2025*	*13-May-2025*
				Asbestos Lab:		DURHAM	DURHAM	DURHAM	DURHAM	DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**					
Trichloromethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloromethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Benzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	4.3	< 1.0
1,2-Dichloroethane		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Trichloroethene		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane		U	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
cis-1,3-Dichloropropene		N	2760	µg/kg	10	< 10	< 10	< 10	< 10	< 10
Toluene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans-1,3-Dichloropropene		N	2760	µg/kg	10	< 10	< 10	< 10	< 10	< 10
1,1,2-Trichloroethane		U	2760	µg/kg	10	< 10	< 10	< 10	< 10	< 10
Tetrachloroethene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Dibromochloromethane		U	2760	µg/kg	10	< 10	< 10	< 10	< 10	< 10
1,2-Dibromoethane		U	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Chlorobenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Ethylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene		U	2760	µg/kg	1.0	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Styrene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tribromomethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromobenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane		N	2760	µg/kg	50	< 50	< 50	< 50	< 50	< 50
N-Propylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2-Chlorotoluene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Chlorotoluene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tert-Butylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Sec-Butylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Results - Soil

Project: TB8754 Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-16930	25-16930	25-16930	25-16930	25-16930
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1976288	1976289	1976291	1976294	1976295
Order No.:				*Client Sample Ref.:*		*ES*	*ES*	*ES*	*ES*	*ES*
				Client Sample ID.:		*53*	*51*	*52*	*8*	*14*
				Client Reference:		*BH101*	*BH101*	*BH101*	*BH101*	*BH101*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*9.00*	*4.00*	*7.00*	*0.50*	*2.10*
				Bottom Depth (m):		*9.00*	*4.00*	*7.00*	*0.55*	*2.20*
				Date Sampled:		*14-May-2025*	*14-May-2025*	*14-May-2025*	*13-May-2025*	*13-May-2025*
				Asbestos Lab:		DURHAM	DURHAM	DURHAM	DURHAM	DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**					
1,3-Dichlorobenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Isopropyltoluene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
N-Butylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-Chloropropane		N	2760	µg/kg	50	< 50	< 50	< 50	< 50	< 50
1,2,4-Trichlorobenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Methyl Tert-Butyl Ether		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Naphthalene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	0.16	< 0.10
Acenaphthylene		N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene		U	2800	mg/kg	0.10	< 0.10	0.33	< 0.10	< 0.10	< 0.10
Anthracene		U	2800	mg/kg	0.10	< 0.10	0.13	< 0.10	< 0.10	< 0.10
Fluoranthene		U	2800	mg/kg	0.10	< 0.10	1.1	< 0.10	< 0.10	< 0.10
Pyrene		U	2800	mg/kg	0.10	< 0.10	0.91	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene		U	2800	mg/kg	0.10	< 0.10	0.46	< 0.10	< 0.10	< 0.10
Chrysene		U	2800	mg/kg	0.10	< 0.10	0.50	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's		N	2800	mg/kg	2.0	< 2.0	3.4	< 2.0	< 2.0	< 2.0
Resorcinol		U	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020
Phenol		U	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020
Cresols		U	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020
Xylenols		U	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020
1-Naphthol		N	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020
Trimethylphenols		U	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020
Total Phenols		U	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2010	pH Value of Soils	pH at 20°C	pH Meter	
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <30°C.	
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES	
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry	
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.	
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.	
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.	
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.	
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2690	EPH A/A Split	Aliphatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40 Aromatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40	Acetone/Heptane extraction / GCxGC FID detection	
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.	
2780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C7,>C7–C8,>C8-C10 Aromatics: >C5–C7,>C7-C8,>C8–C10	Water extraction / Headspace GCxGC FID detection	
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS	
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.	

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection
Text example	All items indicated in italic font represent customer-supplied information that may not be independently verified by the laboratory

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.

Any comments or interpretations are outside the scope of UKAS accreditation.

The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.

Uncertainty of measurement for the determinands tested are available upon request .

None of the results in this report have been recovery corrected.

All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at ≤ 30°C prior to analysis.

All Asbestos testing is performed at the indicated laboratory .

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

NEW_ASB	Eurofins Chemtest Limited, 11 Depot Road, Newmarket, CB8 0AL
DURHAM	Eurofins Chemtest Limited, Unit A North Wing, Prospect Business Park, Crookhall Lane, Consett, Co Durham, DH8 7PW

Sample Deviation Codes

As a result of any of the below deviations applying, the test results may be unreliable

A - Date of sampling not supplied

B - Sample age exceeds stability time (sampling to extraction)

C - Sample not received in appropriate containers

D - Broken Container

E - The required amount of sample for analysis was not received

H - Appropriate cooling measures were not taken for sample transportation

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.

All water samples will be retained for 14 days from the date of receipt.

Charges may apply to extended sample storage.

Report Information

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable
PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

Asbestos Tests LOD = LOQ

Limit of Detection = Limit of Quantification for asbestos results only

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.: 25-16931-1

Initial Date of Issue: 09-Jun-2025

Re-Issue Details:

Client *Soil Engineering Geoservices Ltd*

Client Address: *Foundation Court*
Riverside Way
Watchmoor Park
Camberley
GU15 3RG

Contact(s): *Emily Cross*
Paschalis Staikos

Project *TB8754 Grain to Tilbury Tunnel*

Quotation No.: *Q25-37723* **Date Received:** 22-May-2025

Order No.: **Date Instructed:** 23-May-2025

No. of Samples: *3*

Turnaround (Wkdays): 6 **Results Due:** 02-Jun-2025

Date Approved: 09-Jun-2025

Approved By:



Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Soil

Project: TB8754 Grain to Tilbury Tunnel

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-16931	25-16931	25-16931
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1976298	1976300	1976303
Order No.:				*Client Sample Ref.:*		*8*	*6*	*14*
				Client Reference:		*BH108*	*BH110*	*BH110*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.60*	*0.60*	*2.00*
				Bottom Depth (m):		*0.65*	*0.65*	*2.05*
				Date Sampled:		*19-May-2025*	*20-May-2025*	*20-May-2025*
				Asbestos Lab:		DURHAM	DURHAM	DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
ACM Type		N	2192		N/A	-	-	-
Asbestos Identification		U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture		N	2030	%	0.020	22	18	30
Soil Colour		N	2030		N/A	Brown	Brown	Brown
Other Material		N	2030		N/A	Stones	Stones	None
Soil Texture		N	2030		N/A	Clay	Clay	Clay
pH at 20C		U	2010		4.0	8.1	8.0	8.2
pH (2.5:1) at 20C		N	2010		4.0	8.3	8.2	8.2
Boron (Hot Water Soluble)		U	2120	mg/kg	0.40	4.2	2.0	4.0
Sulphate (2:1 Water Soluble) as SO4		U	2120	g/l	0.010	0.031	0.26	0.15
Total Sulphur		U	2175	%	0.010	0.050	0.071	0.14
Cyanide (Free)		U	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Iron (Total)		N	2430	mg/kg	100	870	700	140
Sulphate (Acid Soluble)		U	2430	%	0.010	0.037	0.084	0.034
Arsenic		U	2455	mg/kg	0.5	18	8.3	7.7
Barium		U	2455	mg/kg	0.5	37	17	33
Beryllium		U	2455	mg/kg	0.5	0.9	< 0.5	0.6
Cadmium		U	2455	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Chromium		U	2455	mg/kg	0.5	37	12	23
Manganese		U	2455	mg/kg	1.0	500	170	190
Molybdenum		U	2455	mg/kg	0.5	0.8	< 0.5	0.6
Copper		U	2455	mg/kg	0.50	13	5.5	9.5
Mercury		U	2455	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Nickel		U	2455	mg/kg	0.50	28	11	20
Lead		U	2455	mg/kg	0.50	22	9.4	16
Selenium		U	2455	mg/kg	0.25	0.63	< 0.25	0.30
Vanadium		U	2455	mg/kg	0.5	64	24	41
Zinc		U	2455	mg/kg	0.50	66	27	51
Chromium (Trivalent)		N	2490	mg/kg	1.0	37	12	23
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Aliphatic VPH >C5-C6	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C7	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C7-C8	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C8 (Sum)	HS_2D_AL	N	2780	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Aliphatic VPH >C8-C10	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05

Results - Soil

Project: TB8754 Grain to Tilbury Tunnel

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-16931	25-16931	25-16931
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1976298	1976300	1976303
Order No.:				*Client Sample Ref.:*		*8*	*6*	*14*
				Client Reference:		*BH108*	*BH110*	*BH110*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.60*	*0.60*	*2.00*
				Bottom Depth (m):		*0.65*	*0.65*	*2.05*
				Date Sampled:		*19-May-2025*	*20-May-2025*	*20-May-2025*
				Asbestos Lab:		DURHAM	DURHAM	DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
Total Aliphatic VPH >C5-C10	HS_2D_AL	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25
Aliphatic EPH >C10-C12 MC	EH_2D_AL_#1	U	2690	mg/kg	2.00	< 2.0	< 2.0	8.4
Aliphatic EPH >C12-C16 MC	EH_2D_AL_#1	U	2690	mg/kg	1.00	< 1.0	< 1.0	15
Aliphatic EPH >C16-C21 MC	EH_2D_AL_#1	U	2690	mg/kg	2.00	3.2	< 2.0	17
Aliphatic EPH >C21-C35 MC	EH_2D_AL_#1	U	2690	mg/kg	3.00	16	18	45
Aliphatic EPH >C35-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	11	13	< 10
Total Aliphatic EPH >C10-C35 MC	EH_2D_AL_#1	U	2690	mg/kg	5.00	20	18	85
Total Aliphatic EPH >C10-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	31	31	85
Aromatic VPH >C5-C7	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C7-C8	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C8-C10	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Total Aromatic VPH >C5-C10	HS_2D_AR	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25
Aromatic EPH >C10-C12 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0	< 1.0	< 1.0
Aromatic EPH >C12-C16 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0	< 1.0	< 1.0
Aromatic EPH >C16-C21 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	11	2.7	7.4
Aromatic EPH >C21-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	20	16	28
Aromatic EPH >C35-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	1.00	15	15	30
Total Aromatic EPH >C10-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	5.00	31	19	35
Total Aromatic EPH >C10-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	10.00	47	34	66
Total VPH >C5-C10	HS_2D_Total	U	2780	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Total EPH >C10-C35 MC	EH_2D_Total_#1	U	2690	mg/kg	10.00	52	37	120
Total EPH >C10-C40 MC	EH_2D_Total_#1	N	2690	mg/kg	10.00	78	65	150
Fraction of Organic Carbon		U	2625		0.0010	0.010	0.0083	0.015
Dichlorodifluoromethane		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Chloromethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromomethane		U	2760	µg/kg	20	< 20	< 20	< 20
Chloroethane		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Trichlorofluoromethane		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Trans 1,2-Dichloroethene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
cis 1,2-Dichloroethene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane		U	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0
Trichloromethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0

Results - Soil

Project: TB8754 Grain to Tilbury Tunnel

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-16931	25-16931	25-16931
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1976298	1976300	1976303
Order No.:				*Client Sample Ref.:*		*8*	*6*	*14*
				Client Reference:		*BH108*	*BH110*	*BH110*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.60*	*0.60*	*2.00*
				Bottom Depth (m):		*0.65*	*0.65*	*2.05*
				Date Sampled:		*19-May-2025*	*20-May-2025*	*20-May-2025*
				Asbestos Lab:		DURHAM	DURHAM	DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
Tetrachloromethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Benzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Trichloroethene		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Dibromomethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane		U	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0
cis-1,3-Dichloropropene		N	2760	µg/kg	10	< 10	< 10	< 10
Toluene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Trans-1,3-Dichloropropene		N	2760	µg/kg	10	< 10	< 10	< 10
1,1,2-Trichloroethane		U	2760	µg/kg	10	< 10	< 10	< 10
Tetrachloroethene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Dibromochloromethane		U	2760	µg/kg	10	< 10	< 10	< 10
1,2-Dibromoethane		U	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0
Chlorobenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Ethylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
o-Xylene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Styrene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Tribromomethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromobenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane		N	2760	µg/kg	50	< 50	< 50	< 50
N-Propylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
2-Chlorotoluene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
4-Chlorotoluene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Tert-Butylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Sec-Butylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
4-Isopropyltoluene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0

Results - Soil

Project: TB8754 Grain to Tilbury Tunnel

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-16931	25-16931	25-16931
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1976298	1976300	1976303
Order No.:				*Client Sample Ref.:*		*8*	*6*	*14*
				Client Reference:		*BH108*	*BH110*	*BH110*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.60*	*0.60*	*2.00*
				Bottom Depth (m):		*0.65*	*0.65*	*2.05*
				Date Sampled:		*19-May-2025*	*20-May-2025*	*20-May-2025*
				Asbestos Lab:		DURHAM	DURHAM	DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
N-Butylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-Chloropropane		N	2760	µg/kg	50	< 50	< 50	< 50
1,2,4-Trichlorobenzene		U	2760	µg/kg	1.0	1.6	< 1.0	< 1.0
Hexachlorobutadiene		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene		U	2760	µg/kg	2.0	2.6	< 2.0	< 2.0
Methyl Tert-Butyl Ether		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Naphthalene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene		N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Fluorene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Phenanthrene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Anthracene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Fluoranthene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Pyrene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Chrysene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's		N	2800	mg/kg	2.0	< 2.0	< 2.0	< 2.0
Resorcinol		U	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Phenol		U	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Cresols		U	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Xylenols		U	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
1-Naphthol		N	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Trimethylphenols		U	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Total Phenols		U	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2010	pH Value of Soils	pH at 20°C	pH Meter	
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <30°C.	
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES	
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry	
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.	
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.	
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.	
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.	
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2690	EPH A/A Split	Aliphatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40 Aromatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40	Acetone/Heptane extraction / GCxGC FID detection	
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.	
2780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C7,>C7–C8,>C8-C10 Aromatics: >C5–C7,>C7-C8,>C8–C10	Water extraction / Headspace GCxGC FID detection	
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS	
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.	

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection
Text example	All items indicated in italic font represent customer-supplied information that may not be independently verified by the laboratory

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.

Any comments or interpretations are outside the scope of UKAS accreditation.

The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.

Uncertainty of measurement for the determinands tested are available upon request .

None of the results in this report have been recovery corrected.

All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at ≤ 30°C prior to analysis.

All Asbestos testing is performed at the indicated laboratory .

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

NEW_ASB	Eurofins Chemtest Limited, 11 Depot Road, Newmarket, CB8 0AL
DURHAM	Eurofins Chemtest Limited, Unit A North Wing, Prospect Business Park, Crookhall Lane, Consett, Co Durham, DH8 7PW

Sample Deviation Codes

As a result of any of the below deviations applying, the test results may be unreliable

A - Date of sampling not supplied

B - Sample age exceeds stability time (sampling to extraction)

C - Sample not received in appropriate containers

D - Broken Container

E - The required amount of sample for analysis was not received

H - Appropriate cooling measures were not taken for sample transportation

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.

All water samples will be retained for 14 days from the date of receipt.

Charges may apply to extended sample storage.

Report Information

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable
PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

Asbestos Tests LOD = LOQ

Limit of Detection = Limit of Quantification for asbestos results only

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Amended Report

Report No.:	25-16931-2		
Initial Date of Issue:	09-Jun-2025	**Date of Re-Issue:**	03-Jul-2025
Re-Issue Details:	This report has been revised and directly supersedes 25-16931-1 in its entirety		
Client	*Soil Engineering Geoservices Ltd*		
Client Address:	*Foundation Court* *Riverside Way* *Watchmoor Park* *Camberley* *GU15 3RG*		
Contact(s):	*Emily Cross* *Paschalis Staikos*		
Project	*TB8754 Grain to Tilbury Tunnel*		
Quotation No.:	*Q25-37723*	**Date Received:**	22-May-2025
Order No.:		**Date Instructed:**	23-May-2025
No. of Samples:	*4*		
Turnaround (Wkdays):	24	**Results Due:**	26-Jun-2025
Date Approved:	03-Jul-2025		

Approved By:



Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Leachate

Project: TB8754 Grain to Tilbury Tunnel

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-16931	25-16931	25-16931
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1976298	1976300	1976303
Order No.:				*Client Sample Ref.:*		*8*	*6*	*14*
				Client Reference:		*BH108*	*BH110*	*BH110*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.60*	*0.60*	*2.00*
				Bottom Depth (m):		*0.65*	*0.65*	*2.05*
				Date Sampled:		*19-May-2025*	*20-May-2025*	*20-May-2025*
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**			
pH at 20C	U	1010	10:1		4.0	7.9	7.7	7.6
Fluoride	U	1220	10:1	mg/l	0.050	0.25	0.23	0.12
Ammoniacal Nitrogen	U	1220	10:1	mg/l	0.050	0.054	0.054	0.23
Sulphur	N	1220	10:1	mg/l	1.0	1.3	9.0	2.4
Sulphate	U	1220	10:1	mg/l	1.0	4.0	27	7.1
Cyanide (Total)	U	1300	10:1	mg/l	0.050	< 0.050	< 0.050	< 0.050
Cyanide (Free)	U	1300	10:1	mg/l	0.050	< 0.050	< 0.050	< 0.050
Cyanide (Complex)	U	1300	10:1	mg/l	0.050	< 0.050	< 0.050	< 0.050
Magnesium	U	1455	10:1	mg/l	0.20	1.5	2.2	0.77
Arsenic (Dissolved)	U	1455	10:1	µg/l	0.20	2.4	1.3	1.6
Boron (Dissolved)	U	1455	10:1	µg/l	10.0	42	97	58
Barium (Dissolved)	U	1455	10:1	µg/l	5.00	< 5.0	< 5.0	< 5.0
Beryllium (Dissolved)	U	1455	10:1	µg/l	1.00	< 1.0	< 1.0	< 1.0
Cadmium (Dissolved)	U	1455	10:1	µg/l	0.11	< 0.11	< 0.11	< 0.11
Chromium (Dissolved)	U	1455	10:1	µg/l	0.50	1.7	< 0.50	0.87
Copper (Dissolved)	U	1455	10:1	µg/l	0.50	1.9	2.1	1.7
Mercury (Dissolved)	U	1455	10:1	µg/l	0.05	< 0.05	< 0.05	< 0.05
Molybdenum (Dissolved)	U	1455	10:1	µg/l	0.20	1.6	2.4	6.9
Nickel (Dissolved)	U	1455	10:1	µg/l	0.50	0.79	1.0	0.96
Lead (Dissolved)	U	1455	10:1	µg/l	0.50	2.2	< 0.50	1.1
Selenium (Dissolved)	U	1455	10:1	µg/l	0.50	0.79	0.84	< 0.50
Vanadium (Dissolved)	U	1455	10:1	µg/l	0.50	5.3	1.6	3.8
Zinc (Dissolved)	U	1455	10:1	µg/l	2.5	9.7	6.9	5.9
Iron (Dissolved)	N	1455	10:1	µg/l	5.0	1300	47	680
Low-Level Chromium (Hexavalent)	N	1495	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Chromium Trivalent LL (from 1455 1495)	N	1450	10:1	µg/l	1.00	1.7	< 1.0	< 1.0
Total TPH >C6-C40	U	1670	10:1	µg/l	10	< 10	< 10	< 10
Naphthalene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10

Results - Leachate

Project: TB8754 Grain to Tilbury Tunnel

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-16931	25-16931	25-16931
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1976298	1976300	1976303
Order No.:				*Client Sample Ref.:*		*8*	*6*	*14*
				Client Reference:		*BH108*	*BH110*	*BH110*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.60*	*0.60*	*2.00*
				Bottom Depth (m):		*0.65*	*0.65*	*2.05*
				Date Sampled:		*19-May-2025*	*20-May-2025*	*20-May-2025*
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**			
Benzo[b]fluoranthene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	1800	10:1	µg/l	2.0	< 2.0	< 2.0	< 2.0
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030	< 0.030	< 0.030

Results - Soil

Project: TB8754 Grain to Tilbury Tunnel

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-16931	25-16931	25-16931	25-16931
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1976298	1976300	1976302	1976303
Order No.:				*Client Sample Ref.:*		*8*	*6*	*21*	*14*
				Client Reference:		*BH108*	*BH110*	*BH110*	*BH110*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.60*	*0.60*	*4.00*	*2.00*
				Bottom Depth (m):		*0.65*	*0.65*	*4.05*	*2.05*
				Date Sampled:		*19-May-2025*	*20-May-2025*	*20-May-2025*	*20-May-2025*
				Asbestos Lab:		DURHAM	DURHAM	NEW-ASB	DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**				
ACM Type		N	2192		N/A	-	-	-	-
Asbestos Identification		U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture		N	2030	%	0.020	22	18	23	30
Soil Colour		N	2030		N/A	Brown	Brown	Brown	Brown
Other Material		N	2030		N/A	Stones	Stones	None	None
Soil Texture		N	2030		N/A	Clay	Clay	Clay	Clay
pH at 20C		M	2010		4.0	8.1	8.0	8.2	8.2
pH (2.5:1) at 20C		N	2010		4.0	8.3	8.2		8.2
Boron (Hot Water Soluble)		M	2120	mg/kg	0.40	4.2	2.0	6.2	4.0
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010	0.031	0.26	0.67	0.15
Total Sulphur		U	2175	%	0.010	0.050	0.071	1.6	0.14
Cyanide (Free)		M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Iron (Total)		N	2430	mg/kg	100	870	700	13000	140
Sulphate (Acid Soluble)		U	2430	%	0.010	0.037	0.084		0.034
Arsenic		M	2455	mg/kg	0.5	18	8.3	9.0	7.7
Barium		M	2455	mg/kg	0.5	37	17	13	33
Beryllium		U	2455	mg/kg	0.5	0.9	< 0.5	< 0.5	0.6
Cadmium		M	2455	mg/kg	0.10	< 0.10	< 0.10	0.21	< 0.10
Chromium		M	2455	mg/kg	0.5	37	12	15	23
Manganese		M	2455	mg/kg	1.0	500	170	220	190
Molybdenum		M	2455	mg/kg	0.5	0.8	< 0.5	< 0.5	0.6
Copper		M	2455	mg/kg	0.50	13	5.5	5.2	9.5
Mercury		M	2455	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Nickel		M	2455	mg/kg	0.50	28	11	12	20
Lead		M	2455	mg/kg	0.50	22	9.4	6.6	16
Selenium		M	2455	mg/kg	0.25	0.63	< 0.25	0.90	0.30
Vanadium		U	2455	mg/kg	0.5	64	24	26	41
Zinc		M	2455	mg/kg	0.50	66	27	29	51
Chromium (Trivalent)		N	2490	mg/kg	1.0	37	12	15	23
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Aliphatic VPH >C5-C6	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C7	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C7-C8	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C8 (Sum)	HS_2D_AL	N	2780	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic VPH >C8-C10	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05

Results - Soil

Project: TB8754 Grain to Tilbury Tunnel

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-16931	25-16931	25-16931	25-16931
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1976298	1976300	1976302	1976303
Order No.:				*Client Sample Ref.:*		*8*	*6*	*21*	*14*
				Client Reference:		*BH108*	*BH110*	*BH110*	*BH110*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.60*	*0.60*	*4.00*	*2.00*
				Bottom Depth (m):		*0.65*	*0.65*	*4.05*	*2.05*
				Date Sampled:		*19-May-2025*	*20-May-2025*	*20-May-2025*	*20-May-2025*
				Asbestos Lab:		DURHAM	DURHAM	NEW-ASB	DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**				
Total Aliphatic VPH >C5-C10	HS_2D_AL	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25	< 0.25
Aliphatic EPH >C10-C12 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	< 2.0	< 2.0	< 2.0	8.4
Aliphatic EPH >C12-C16 MC	EH_2D_AL_#1	M	2690	mg/kg	1.00	< 1.0	< 1.0	< 1.0	15
Aliphatic EPH >C16-C21 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	3.2	< 2.0	< 2.0	17
Aliphatic EPH >C21-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	3.00	16	18	3.8	45
Aliphatic EPH >C35-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	11	13	< 10	< 10
Total Aliphatic EPH >C10-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	5.00	20	18	5.8	85
Total Aliphatic EPH >C10-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	31	31	< 10	85
Aromatic VPH >C5-C7	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C7-C8	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C8-C10	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Total Aromatic VPH >C5-C10	HS_2D_AR	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25	< 0.25
Aromatic EPH >C10-C12 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic EPH >C12-C16 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic EPH >C16-C21 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	11	2.7	7.1	7.4
Aromatic EPH >C21-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	20	16	9.4	28
Aromatic EPH >C35-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	1.00	15	15	1.2	30
Total Aromatic EPH >C10-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	5.00	31	19	16	35
Total Aromatic EPH >C10-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	10.00	47	34	18	66
Total VPH >C5-C10	HS_2D_Total	U	2780	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Total EPH >C10-C35 MC	EH_2D_Total_#1	U	2690	mg/kg	10.00	52	37	22	120
Total EPH >C10-C40 MC	EH_2D_Total_#1	N	2690	mg/kg	10.00	78	65	23	150
Fraction of Organic Carbon		M	2625		0.0010	0.010	0.0083	0.012	0.015
Dichlorodifluoromethane		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromomethane		M	2760	µg/kg	20	< 20	< 20	< 20	< 20
Chloroethane		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Trichlorofluoromethane		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans 1,2-Dichloroethene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
cis 1,2-Dichloroethene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane		U	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0
Trichloromethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0

Results - Soil

Project: TB8754 Grain to Tilbury Tunnel

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-16931	25-16931	25-16931	25-16931
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1976298	1976300	1976302	1976303
Order No.:				*Client Sample Ref.:*		*8*	*6*	*21*	*14*
				Client Reference:		*BH108*	*BH110*	*BH110*	*BH110*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.60*	*0.60*	*4.00*	*2.00*
				Bottom Depth (m):		*0.65*	*0.65*	*4.05*	*2.05*
				Date Sampled:		*19-May-2025*	*20-May-2025*	*20-May-2025*	*20-May-2025*
				Asbestos Lab:		DURHAM	DURHAM	NEW-ASB	DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**				
Tetrachloromethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Benzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane		M	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Trichloroethene		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane		M	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0
cis-1,3-Dichloropropene		N	2760	µg/kg	10	< 10	< 10	< 10	< 10
Toluene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans-1,3-Dichloropropene		N	2760	µg/kg	10	< 10	< 10	< 10	< 10
1,1,2-Trichloroethane		M	2760	µg/kg	10	< 10	< 10	< 10	< 10
Tetrachloroethene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Dibromochloromethane		U	2760	µg/kg	10	< 10	< 10	< 10	< 10
1,2-Dibromoethane		M	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0
Chlorobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane		M	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Ethylbenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Styrene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tribromomethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane		N	2760	µg/kg	50	< 50	< 50	< 50	< 50
N-Propylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
2-Chlorotoluene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Chlorotoluene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tert-Butylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Sec-Butylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Isopropyltoluene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0

Results - Soil

Project: TB8754 Grain to Tilbury Tunnel

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-16931	25-16931	25-16931	25-16931
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1976298	1976300	1976302	1976303
Order No.:				*Client Sample Ref.:*		*8*	*6*	*21*	*14*
				Client Reference:		*BH108*	*BH110*	*BH110*	*BH110*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.60*	*0.60*	*4.00*	*2.00*
				Bottom Depth (m):		*0.65*	*0.65*	*4.05*	*2.05*
				Date Sampled:		*19-May-2025*	*20-May-2025*	*20-May-2025*	*20-May-2025*
				Asbestos Lab:		DURHAM	DURHAM	NEW-ASB	DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**				
N-Butylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-Chloropropane		N	2760	µg/kg	50	< 50	< 50	< 50	< 50
1,2,4-Trichlorobenzene		M	2760	µg/kg	1.0	1.6	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene		U	2760	µg/kg	2.0	2.6	< 2.0	< 2.0	< 2.0
Methyl Tert-Butyl Ether		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Naphthalene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene		N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's		N	2800	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Resorcinol		M	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020	< 0.020
Phenol		M	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020	< 0.020
Cresols		M	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020	< 0.020
Xylenols		M	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020	< 0.020
1-Naphthol		N	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020	< 0.020
Trimethylphenols		M	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020	< 0.020
Total Phenols		M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
1010	pH Value of Waters	pH at 20°C	pH Meter	RE PW TE TS PL DW GW
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.	RE PW PL LE DW GW
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.	
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	GW
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	RE PW PL SW DW GW
1495	Low Level Hexavalent Chromium in Waters	Chromium [VI]	Colorimetric determination of hexavalent chromium expressed as Cr (VI) µg/l in water, using Ion Chromatography and UV-visible spectrophotometry.	GW
1670	Total Petroleum Hydrocarbons (TPH) in Waters by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO	Pentane extraction / GC FID detection	PL GW
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection	PL GW SW
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.	
2010	pH Value of Soils	pH at 20°C	pH Meter	
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <30°C.	
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES	
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry	
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.	
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.	
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.	
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.	
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2690	EPH A/A Split	Aliphatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40 Aromatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40	Acetone/Heptane extraction / GCxGC FID detection	

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.	
2780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C7,>C7–C8,>C8-C10 Aromatics: >C5–C7,>C7-C8,>C8–C10	Water extraction / Headspace GCxGC FID detection	
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS	
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.	
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge	

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection
Text example	All items indicated in italic font represent customer-supplied information that may not be independently verified by the laboratory

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The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.

Uncertainty of measurement for the determinands tested are available upon request .

None of the results in this report have been recovery corrected.

All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at ≤ 30°C prior to analysis.

All Asbestos testing is performed at the indicated laboratory .

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

NEW_ASB	Eurofins Chemtest Limited, 11 Depot Road, Newmarket, CB8 0AL
DURHAM	Eurofins Chemtest Limited, Unit A North Wing, Prospect Business Park, Crookhall Lane, Consett, Co Durham, DH8 7PW

Sample Deviation Codes

As a result of any of the below deviations applying, the test results may be unreliable

A - Date of sampling not supplied

B - Sample age exceeds stability time (sampling to extraction)

C - Sample not received in appropriate containers

D - Broken Container

E - The required amount of sample for analysis was not received

H - Appropriate cooling measures were not taken for sample transportation

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.

All water samples will be retained for 14 days from the date of receipt.

Charges may apply to extended sample storage.

Report Information

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable
PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

Asbestos Tests LOD = LOQ

Limit of Detection = Limit of Quantification for asbestos results only

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

eurofins | Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.: 25-17197-1

Initial Date of Issue: 09-Jun-2025

Re-Issue Details:

Client *Soil Engineering Geoservices Ltd*

Client Address: *Foundation Court*
Riverside Way
Watchmoor Park
Camberley
GU15 3RG

Contact(s): *Emily Cross*
Paschalis Staikos

Project *TB8754 Grain to Tilbury*

Quotation No.: *Q25-37723* **Date Received:** 23-May-2025

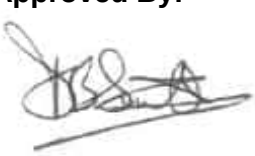
Order No.: **Date Instructed:** 27-May-2025

No. of Samples: *1*

Turnaround (Wkdays): 5 **Results Due:** 02-Jun-2025

Date Approved: 09-Jun-2025

Approved By:



Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Soil

Project: TB8754 Grain to Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-17197
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1977338
Order No.:				*Client Sample Ref.:*		*28*
				Client Sample ID.:		*6.00*
				Client Reference:		*BH110*
				Sample Type:		*SOIL*
				Top Depth (m):		*6.05*
				Date Sampled:		*21-May-2025*
				Asbestos Lab:		DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**	
ACM Type		N	2192		N/A	-
Asbestos Identification		U	2192		N/A	No Asbestos Detected
Moisture		N	2030	%	0.020	24
Soil Colour		N	2030		N/A	Brown
Other Material		N	2030		N/A	None
Soil Texture		N	2030		N/A	Clay
pH at 20C		M	2010		4.0	8.2
pH (2.5:1) at 20C		N	2010		4.0	8.3
Boron (Hot Water Soluble)		M	2120	mg/kg	0.40	4.9
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010	0.089
Total Sulphur		U	2175	%	0.010	1.8
Cyanide (Free)		M	2300	mg/kg	0.50	< 0.50
Iron (Total)		N	2430	mg/kg	100	9100
Sulphate (Acid Soluble)		U	2430	%	0.010	< 0.010
Arsenic		M	2455	mg/kg	0.5	1.0
Barium		M	2455	mg/kg	0.5	25
Beryllium		U	2455	mg/kg	0.5	< 0.5
Cadmium		M	2455	mg/kg	0.10	< 0.10
Chromium		M	2455	mg/kg	0.5	1.4
Manganese		M	2455	mg/kg	1.0	140
Molybdenum		M	2455	mg/kg	0.5	< 0.5
Copper		M	2455	mg/kg	0.50	5.7
Mercury		M	2455	mg/kg	0.05	< 0.05
Nickel		M	2455	mg/kg	0.50	8.7
Lead		M	2455	mg/kg	0.50	3.9
Selenium		M	2455	mg/kg	0.25	< 0.25
Vanadium		U	2455	mg/kg	0.5	3.5
Zinc		M	2455	mg/kg	0.50	14
Chromium (Trivalent)		N	2490	mg/kg	1.0	1.4
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50
Aliphatic VPH >C5-C6	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05
Aliphatic VPH >C6-C7	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05
Aliphatic VPH >C7-C8	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05
Aliphatic VPH >C6-C8 (Sum)	HS_2D_AL	N	2780	mg/kg	0.10	< 0.10
Aliphatic VPH >C8-C10	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05

Results - Soil

Project: TB8754 Grain to Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-17197
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Order No.:				*Client Sample Ref.:*		*28*
				Client Sample ID.:		*6.00*
				Client Reference:		*BH110*
				Sample Type:		*SOIL*
				Top Depth (m):		*6.05*
				Date Sampled:		*21-May-2025*
				Asbestos Lab:		DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**	
Total Aliphatic VPH >C5-C10	HS_2D_AL	U	2780	mg/kg	0.25	< 0.25
Aliphatic EPH >C10-C12 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	< 2.0
Aliphatic EPH >C12-C16 MC	EH_2D_AL_#1	M	2690	mg/kg	1.00	< 1.0
Aliphatic EPH >C16-C21 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	< 2.0
Aliphatic EPH >C21-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	3.00	20
Aliphatic EPH >C35-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	< 10
Total Aliphatic EPH >C10-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	5.00	21
Total Aliphatic EPH >C10-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	21
Aromatic VPH >C5-C7	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05
Aromatic VPH >C7-C8	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05
Aromatic VPH >C8-C10	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05
Total Aromatic VPH >C5-C10	HS_2D_AR	U	2780	mg/kg	0.25	< 0.25
Aromatic EPH >C10-C12 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0
Aromatic EPH >C12-C16 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0
Aromatic EPH >C16-C21 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	< 2.0
Aromatic EPH >C21-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	14
Aromatic EPH >C35-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	1.00	17
Total Aromatic EPH >C10-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	5.00	16
Total Aromatic EPH >C10-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	10.00	33
Total VPH >C5-C10	HS_2D_Total	U	2780	mg/kg	0.50	< 0.50
Total EPH >C10-C35 MC	EH_2D_Total_#1	U	2690	mg/kg	10.00	37
Total EPH >C10-C40 MC	EH_2D_Total_#1	N	2690	mg/kg	10.00	55
Fraction of Organic Carbon		M	2625		0.0010	0.017
Dichlorodifluoromethane		N	2760	µg/kg	1.0	< 1.0
Chloromethane		M	2760	µg/kg	1.0	< 1.0
Vinyl Chloride		M	2760	µg/kg	1.0	< 1.0
Bromomethane		M	2760	µg/kg	20	< 20
Chloroethane		U	2760	µg/kg	2.0	< 2.0
Trichlorofluoromethane		N	2760	µg/kg	1.0	< 1.0
1,1-Dichloroethene		M	2760	µg/kg	1.0	< 1.0
Trans 1,2-Dichloroethene		M	2760	µg/kg	1.0	< 1.0
1,1-Dichloroethane		M	2760	µg/kg	1.0	< 1.0
cis 1,2-Dichloroethene		M	2760	µg/kg	1.0	< 1.0
Bromochloromethane		U	2760	µg/kg	5.0	< 5.0
Trichloromethane		M	2760	µg/kg	1.0	< 1.0
1,1,1-Trichloroethane		M	2760	µg/kg	1.0	< 1.0

Results - Soil

Project: TB8754 Grain to Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-17197
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1977338
Order No.:				*Client Sample Ref.:*		*28*
				Client Sample ID.:		*6.00*
				Client Reference:		*BH110*
				Sample Type:		*SOIL*
				Top Depth (m):		*6.05*
				Date Sampled:		*21-May-2025*
				Asbestos Lab:		DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**	
Tetrachloromethane		M	2760	µg/kg	1.0	< 1.0
1,1-Dichloropropene		U	2760	µg/kg	1.0	< 1.0
Benzene		M	2760	µg/kg	1.0	< 1.0
1,2-Dichloroethane		M	2760	µg/kg	2.0	< 2.0
Trichloroethene		N	2760	µg/kg	1.0	< 1.0
1,2-Dichloropropane		M	2760	µg/kg	1.0	< 1.0
Dibromomethane		M	2760	µg/kg	1.0	< 1.0
Bromodichloromethane		M	2760	µg/kg	5.0	< 5.0
cis-1,3-Dichloropropene		N	2760	µg/kg	10	< 10
Toluene		M	2760	µg/kg	1.0	< 1.0
Trans-1,3-Dichloropropene		N	2760	µg/kg	10	< 10
1,1,2-Trichloroethane		M	2760	µg/kg	10	< 10
Tetrachloroethene		M	2760	µg/kg	1.0	< 1.0
1,3-Dichloropropane		U	2760	µg/kg	2.0	< 2.0
Dibromochloromethane		U	2760	µg/kg	10	< 10
1,2-Dibromoethane		M	2760	µg/kg	5.0	< 5.0
Chlorobenzene		M	2760	µg/kg	1.0	< 1.0
1,1,1,2-Tetrachloroethane		M	2760	µg/kg	2.0	< 2.0
Ethylbenzene		M	2760	µg/kg	1.0	< 1.0
m & p-Xylene		M	2760	µg/kg	1.0	< 1.0
o-Xylene		M	2760	µg/kg	1.0	< 1.0
Styrene		M	2760	µg/kg	1.0	< 1.0
Tribromomethane		U	2760	µg/kg	1.0	< 1.0
Isopropylbenzene		M	2760	µg/kg	1.0	< 1.0
Bromobenzene		M	2760	µg/kg	1.0	< 1.0
1,2,3-Trichloropropane		N	2760	µg/kg	50	< 50
N-Propylbenzene		U	2760	µg/kg	1.0	< 1.0
2-Chlorotoluene		M	2760	µg/kg	1.0	< 1.0
1,3,5-Trimethylbenzene		M	2760	µg/kg	1.0	< 1.0
4-Chlorotoluene		U	2760	µg/kg	1.0	< 1.0
Tert-Butylbenzene		U	2760	µg/kg	1.0	< 1.0
1,2,4-Trimethylbenzene		M	2760	µg/kg	1.0	< 1.0
Sec-Butylbenzene		U	2760	µg/kg	1.0	< 1.0
1,3-Dichlorobenzene		M	2760	µg/kg	1.0	< 1.0
4-Isopropyltoluene		U	2760	µg/kg	1.0	< 1.0
1,4-Dichlorobenzene		M	2760	µg/kg	1.0	< 1.0

Results - Soil

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				Date Sampled:		*21-May-2025*
				Asbestos Lab:		DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**	
N-Butylbenzene		U	2760	µg/kg	1.0	< 1.0
1,2-Dichlorobenzene		M	2760	µg/kg	1.0	< 1.0
1,2-Dibromo-3-Chloropropane		N	2760	µg/kg	50	< 50
1,2,4-Trichlorobenzene		M	2760	µg/kg	1.0	< 1.0
Hexachlorobutadiene		N	2760	µg/kg	1.0	< 1.0
1,2,3-Trichlorobenzene		U	2760	µg/kg	2.0	< 2.0
Methyl Tert-Butyl Ether		M	2760	µg/kg	1.0	< 1.0
Naphthalene		M	2800	mg/kg	0.10	< 0.10
Acenaphthylene		N	2800	mg/kg	0.10	< 0.10
Acenaphthene		M	2800	mg/kg	0.10	< 0.10
Fluorene		M	2800	mg/kg	0.10	< 0.10
Phenanthrene		M	2800	mg/kg	0.10	< 0.10
Anthracene		M	2800	mg/kg	0.10	< 0.10
Fluoranthene		M	2800	mg/kg	0.10	< 0.10
Pyrene		M	2800	mg/kg	0.10	< 0.10
Benzo[a]anthracene		M	2800	mg/kg	0.10	< 0.10
Chrysene		M	2800	mg/kg	0.10	< 0.10
Benzo[b]fluoranthene		M	2800	mg/kg	0.10	< 0.10
Benzo[k]fluoranthene		M	2800	mg/kg	0.10	< 0.10
Benzo[a]pyrene		M	2800	mg/kg	0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10	< 0.10
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	< 0.10
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10	< 0.10
Total Of 16 PAH's		N	2800	mg/kg	2.0	< 2.0
Resorcinol		M	2920	mg/kg	0.020	< 0.020
Phenol		M	2920	mg/kg	0.020	< 0.020
Cresols		M	2920	mg/kg	0.020	< 0.020
Xylenols		M	2920	mg/kg	0.020	< 0.020
1-Naphthol		N	2920	mg/kg	0.020	< 0.020
Trimethylphenols		M	2920	mg/kg	0.020	< 0.020
Total Phenols		M	2920	mg/kg	0.10	< 0.10

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2010	pH Value of Soils	pH at 20°C	pH Meter	
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <30°C.	
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES	
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry	
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.	
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.	
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.	
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.	
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2690	EPH A/A Split	Aliphatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40 Aromatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40	Acetone/Heptane extraction / GCxGC FID detection	
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.	
2780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C7,>C7–C8,>C8-C10 Aromatics: >C5–C7,>C7-C8,>C8–C10	Water extraction / Headspace GCxGC FID detection	
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS	
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.	

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection
Text example	All items indicated in italic font represent customer-supplied information that may not be independently verified by the laboratory

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NEW_ASB	Eurofins Chemtest Limited, 11 Depot Road, Newmarket, CB8 0AL
DURHAM	Eurofins Chemtest Limited, Unit A North Wing, Prospect Business Park, Crookhall Lane, Consett, Co Durham, DH8 7PW

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HWOL Acronym System

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AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

Asbestos Tests LOD = LOQ

Limit of Detection = Limit of Quantification for asbestos results only

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	25-17648-1
Initial Date of Issue:	20-Jun-2025
Re-Issue Details:	
Client	*Soil Engineering Geoservices Ltd*
Client Address:	*Foundation Court* *Riverside Way* *Watchmoor Park* *Camberley* *GU15 3RG*
Contact(s):	*Emily Cross*
Project	*TB8754 Grain to Tilbury*
Quotation No.:	*Q25-37723*
Order No.:	
No. of Samples:	*1*
Turnaround (Wkdays):	5
Date Approved:	20-Jun-2025
Approved By:	

Date Received:	28-May-2025
Date Instructed:	02-Jun-2025
Results Due:	06-Jun-2025



Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Water

Project: TB8754 Grain to Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-17648
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1979079
Order No.:				*Client Sample Ref.:*		*24*
				Client Reference:		*BH110*
				Sample Type:		*WATER*
				Sample Sub Type:		
				Top Depth (m):		*5.65*
				Bottom Depth (m):		*5.65*
				Date Sampled:		*21-May-2025*
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**	
pH at 20C		U	1010		4.0	7.8
Total Dissolved Solids		N	1020	mg/l	1.0	5100
Alkalinity (Bicarbonate)		U	1220	mg CaCO3/l	10	880
Chloride		U	1220	mg/l	1.0	2300
Fluoride		U	1220	mg/l	0.050	0.35
Ammoniacal Nitrogen		U	1220	mg/l	0.050	11
Nitrate as NO3		U	1220	mg/l	0.50	< 0.50
Sulphur		N	1220	mg/l	1.0	26
Sulphate		U	1220	mg/l	1.0	78
Cyanide (Total)		U	1300	mg/l	0.050	< 0.050
Cyanide (Free)		U	1300	mg/l	0.050	< 0.050
Cyanide (Complex)		U	1300	mg/l	0.050	< 0.050
Calcium (Dissolved)		U	1455	mg/l	2.00	96
Magnesium (Dissolved)		U	1455	mg/l	0.20	140
Total Hardness as CaCO3		U	1270	mg/l	15	820
Arsenic (Dissolved)		U	1455	µg/l	0.20	10
Boron (Dissolved)		U	1455	µg/l	10.0	1400
Barium (Dissolved)		U	1455	µg/l	5.00	55
Beryllium (Dissolved)		U	1455	µg/l	1.00	< 1.0
Cadmium (Dissolved)		U	1455	µg/l	0.11	< 0.11
Chromium (Dissolved)		U	1455	µg/l	0.50	< 0.50
Copper (Dissolved)		U	1455	µg/l	0.50	0.61
Iron (Dissolved)		N	1455	µg/l	5.0	23
Mercury (Dissolved)		U	1455	µg/l	0.05	< 0.05
Manganese (Dissolved)		U	1455	µg/l	0.50	470
Molybdenum (Dissolved)		U	1455	µg/l	0.20	23
Nickel (Dissolved)		U	1455	µg/l	0.50	3.4
Lead (Dissolved)		U	1455	µg/l	0.50	< 0.50
Antimony (Dissolved)		U	1455	µg/l	0.50	1.8
Selenium (Dissolved)		U	1455	µg/l	0.50	1.7
Vanadium (Dissolved)		U	1455	µg/l	0.50	9.2
Zinc (Dissolved)		U	1455	µg/l	2.5	14
Chromium (Trivalent)		N	1490	µg/l	20	< 20
Low-Level Chromium (Hexavalent)		U	1495	µg/l	0.10	< 0.10
Total TPH >C6-C40	EH_1D_Total	U	1670	µg/l	10	< 10

Results - Water

Project: TB8754 Grain to Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-17648
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1979079
Order No.:				*Client Sample Ref.:*		*24*
				Client Reference:		*BH110*
				Sample Type:		*WATER*
				Sample Sub Type:		
				Top Depth (m):		*5.65*
				Bottom Depth (m):		*5.65*
				Date Sampled:		*21-May-2025*
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**	
Aliphatic TPH >C5-C6	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10
Aliphatic TPH >C6-C8	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10
Aliphatic TPH >C8-C10	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10
Aliphatic TPH >C10-C12	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10
Aliphatic TPH >C12-C16	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10
Aliphatic TPH >C16-C21	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10
Aliphatic TPH >C21-C35	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10
Aliphatic TPH >C35-C44	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10
Total Aliphatic Hydrocarbons	EH_2D_AL_#1	N	1675	µg/l	5.0	< 5.0
Aromatic TPH >C5-C7	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10
Aromatic TPH >C7-C8	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10
Aromatic TPH >C8-C10	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10
Aromatic TPH >C10-C12	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10
Aromatic TPH >C12-C16	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10
Aromatic TPH >C16-C21	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10
Aromatic TPH >C21-C35	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10
Aromatic TPH >C35-C44	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10
Total Aromatic Hydrocarbons	EH_2D_AR_#1	N	1675	µg/l	5.0	< 5.0
Total Petroleum Hydrocarbons	EH_2D_Total_#1	N	1675	µg/l	10	< 10
Dichlorodifluoromethane		N	1760	µg/l	1.0	< 1.0
Chloromethane		U	1760	µg/l	1.0	< 1.0
Vinyl Chloride		N	1760	µg/l	1.0	< 1.0
Bromomethane		U	1760	µg/l	5	< 5
Chloroethane		U	1760	µg/l	2.0	< 2.0
Trichlorofluoromethane		N	1760	µg/l	1.0	< 1.0
1,1-Dichloroethene		U	1760	µg/l	1.0	< 1.0
Trans 1,2-Dichloroethene		U	1760	µg/l	1.0	< 1.0
1,1-Dichloroethane		U	1760	µg/l	1.0	< 1.0
cis 1,2-Dichloroethene		U	1760	µg/l	1.0	< 1.0
Bromochloromethane		U	1760	µg/l	5	< 5
Trichloromethane		U	1760	µg/l	1.0	< 1.0
1,1,1-Trichloroethane		U	1760	µg/l	1.0	< 1.0
Tetrachloromethane		U	1760	µg/l	1.0	< 1.0
1,1-Dichloropropene		U	1760	µg/l	1.0	< 1.0
Benzene		U	1760	µg/l	1.0	< 1.0
1,2-Dichloroethane		U	1760	µg/l	2.0	< 2.0

Results - Water

Project: TB8754 Grain to Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-17648
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1979079
Order No.:				*Client Sample Ref.:*		*24*
				Client Reference:		*BH110*
				Sample Type:		*WATER*
				Sample Sub Type:		
				Top Depth (m):		*5.65*
				Bottom Depth (m):		*5.65*
				Date Sampled:		*21-May-2025*
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**	
Trichloroethene		N	1760	µg/l	1.0	< 1.0
1,2-Dichloropropane		U	1760	µg/l	1.0	< 1.0
Dibromomethane		U	1760	µg/l	10	< 10
Bromodichloromethane		U	1760	µg/l	5	< 5
cis-1,3-Dichloropropene		N	1760	µg/l	10	< 10
Toluene		U	1760	µg/l	1.0	< 1.0
Trans-1,3-Dichloropropene		N	1760	µg/l	10	< 10
1,1,2-Trichloroethane		U	1760	µg/l	10	< 10
Tetrachloroethene		U	1760	µg/l	1.0	< 1.0
1,3-Dichloropropane		U	1760	µg/l	2.0	< 2.0
Dibromochloromethane		U	1760	µg/l	10	< 10
1,2-Dibromoethane		U	1760	µg/l	5	< 5
Chlorobenzene		N	1760	µg/l	1.0	< 1.0
1,1,1,2-Tetrachloroethane		U	1760	µg/l	2.0	< 2.0
Ethylbenzene		U	1760	µg/l	1.0	< 1.0
m & p-Xylene		U	1760	µg/l	1.0	< 1.0
o-Xylene		U	1760	µg/l	1.0	< 1.0
Styrene		U	1760	µg/l	1.0	< 1.0
Tribromomethane		U	1760	µg/l	1.0	< 1.0
Isopropylbenzene		U	1760	µg/l	1.0	< 1.0
Bromobenzene		U	1760	µg/l	1.0	< 1.0
1,2,3-Trichloropropane		N	1760	µg/l	50	< 50
N-Propylbenzene		U	1760	µg/l	1.0	< 1.0
2-Chlorotoluene		U	1760	µg/l	1.0	< 1.0
1,3,5-Trimethylbenzene		U	1760	µg/l	1.0	< 1.0
4-Chlorotoluene		U	1760	µg/l	1.0	< 1.0
Tert-Butylbenzene		U	1760	µg/l	1.0	< 1.0
1,2,4-Trimethylbenzene		U	1760	µg/l	1.0	< 1.0
Sec-Butylbenzene		U	1760	µg/l	1.0	< 1.0
1,3-Dichlorobenzene		N	1760	µg/l	1.0	< 1.0
4-Isopropyltoluene		U	1760	µg/l	1.0	< 1.0
1,4-Dichlorobenzene		U	1760	µg/l	1.0	< 1.0
N-Butylbenzene		U	1760	µg/l	1.0	< 1.0
1,2-Dichlorobenzene		U	1760	µg/l	1.0	< 1.0
1,2-Dibromo-3-Chloropropane		N	1760	µg/l	50	< 50
1,2,4-Trichlorobenzene		U	1760	µg/l	1.0	< 1.0

Results - Water

Project: TB8754 Grain to Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-17648
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1979079
Order No.:				*Client Sample Ref.:*		*24*
				Client Reference:		*BH110*
				Sample Type:		*WATER*
				Sample Sub Type:		
				Top Depth (m):		*5.65*
				Bottom Depth (m):		*5.65*
				Date Sampled:		*21-May-2025*
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**	
Hexachlorobutadiene		U	1760	µg/l	1.0	< 1.0
1,2,3-Trichlorobenzene		U	1760	µg/l	2.0	< 2.0
Methyl Tert-Butyl Ether		N	1760	µg/l	1.0	< 1.0
Naphthalene		U	1800	µg/l	0.10	< 0.10
Acenaphthylene		U	1800	µg/l	0.10	< 0.10
Acenaphthene		U	1800	µg/l	0.10	< 0.10
Fluorene		U	1800	µg/l	0.10	< 0.10
Phenanthrene		U	1800	µg/l	0.10	< 0.10
Anthracene		U	1800	µg/l	0.10	< 0.10
Fluoranthene		U	1800	µg/l	0.10	< 0.10
Pyrene		U	1800	µg/l	0.10	< 0.10
Benzo[a]anthracene		U	1800	µg/l	0.10	< 0.10
Chrysene		U	1800	µg/l	0.10	< 0.10
Benzo[b]fluoranthene		U	1800	µg/l	0.10	< 0.10
Benzo[k]fluoranthene		U	1800	µg/l	0.10	< 0.10
Benzo[a]pyrene		U	1800	µg/l	0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene		U	1800	µg/l	0.10	< 0.10
Dibenz(a,h)Anthracene		U	1800	µg/l	0.10	< 0.10
Benzo[g,h,i]perylene		U	1800	µg/l	0.10	< 0.10
Total Of 16 PAH's		U	1800	µg/l	2.0	< 2.0
Resorcinol		U	1920	mg/l	0.0050	< 0.0050
Phenol		U	1920	mg/l	0.0050	< 0.0050
Cresols		U	1920	mg/l	0.0050	< 0.0050
Xylenols		U	1920	mg/l	0.0050	< 0.0050
1-Naphthol		N	1920	mg/l	0.0050	< 0.0050
Trimethylphenols		U	1920	mg/l	0.0050	< 0.0050
Total Phenols		U	1920	mg/l	0.030	< 0.030

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Chemtest Sample ID	*Clients Sample Ref:*	*Clients Sample ID:*	*Clients Reference:*	*Sampled Date:*	Deviation Code(s):	Containers Received:
1979079	*24*		*BH110*	*21-May-2025*	B,C	Coloured Winchester 1000ml
1979079	*24*		*BH110*	*21-May-2025*	B,C	Plastic Bottle 1000ml

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
1010	pH Value of Waters	pH at 20°C	pH Meter	RE PW TE TS PL DW GW
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity at 25°C and Total Dissolved Solids (TDS) in Waters	Conductivity Meter	
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.	PL LE GW
1270	Total Hardness of Waters	Total hardness	Calculation applied to calcium and magnesium results, expressed as mg l-1 CaCO3 equivalent.	GW LE
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.	GW
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	RE PW PL SW DW GW
1490	Hexavalent Chromium in Waters	Chromium [VI]	Automated colorimetric analysis by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.	PL GW
1495	Low Level Hexavalent Chromium in Waters	Chromium [VI]	Colorimetric determination of hexavalent chromium expressed as Cr (VI) µg/l in water, using Ion Chromatography and UV-visible spectrophotometry.	GW
1670	Total Petroleum Hydrocarbons (TPH) in Waters by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO	Pentane extraction / GC FID detection	PL GW
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection	
1760	Volatile Organic Compounds (VOCs) in Waters by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics. (cf. USEPA Method 8260)	Automated headspace gas chromatographic (GC) analysis of water samples with mass spectrometric (MS) detection of volatile organic compounds.	PL GW
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection	PL GW SW
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.	PL GW

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection
Text example	All items indicated in italic font represent customer-supplied information that may not be independently verified by the laboratory

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.

Any comments or interpretations are outside the scope of UKAS accreditation.

The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.

Uncertainty of measurement for the determinands tested are available upon request .

None of the results in this report have been recovery corrected.

All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at ≤ 30°C prior to analysis.

All Asbestos testing is performed at the indicated laboratory .

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

NEW_ASB	Eurofins Chemtest Limited, 11 Depot Road, Newmarket, CB8 0AL
DURHAM	Eurofins Chemtest Limited, Unit A North Wing, Prospect Business Park, Crookhall Lane, Consett, Co Durham, DH8 7PW

Sample Deviation Codes

As a result of any of the below deviations applying, the test results may be unreliable

A - Date of sampling not supplied

B - Sample age exceeds stability time (sampling to extraction)

C - Sample not received in appropriate containers

D - Broken Container

E - The required amount of sample for analysis was not received

H - Appropriate cooling measures were not taken for sample transportation

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.

All water samples will be retained for 14 days from the date of receipt.

Charges may apply to extended sample storage.

Report Information

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable
PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

Asbestos Tests LOD = LOQ

Limit of Detection = Limit of Quantification for asbestos results only

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.: 25-17889-1

Initial Date of Issue: 12-Jun-2025

Re-Issue Details:

Client *Soil Engineering Geoservices Ltd*

Client Address: *Foundation Court*
Riverside Way
Watchmoor Park
Camberley
GU15 3RG

Contact(s): *Emily Cross*

Project *TB8754 Tilbury*

Quotation No.: *Q25-37723* **Date Received:** 30-May-2025

Order No.: **Date Instructed:** 30-May-2025

No. of Samples: *3*

Turnaround (Wkdays): 5 **Results Due:** 05-Jun-2025

Date Approved: 12-Jun-2025

Approved By:



Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Soil

Project: TB8754 Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-17889	25-17889	25-17889
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1979928	1979930	1979931
Order No.:				*Client Sample Ref.:*		*ES*	*ES*	*ES*
				Client Sample ID.:		*5*	*12*	*18*
				Client Reference:		*BH107*	*BH107*	*BH107*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.60*	*2.00*	*4.00*
				Bottom Depth (m):		*0.65*		
				Date Sampled:		*27-May-2025*	*27-May-2025*	*27-May-2025*
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
ACM Type		N	2192		N/A	-	-	-
Asbestos Identification		U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture		N	2030	%	0.020	26	35	38
Soil Colour		N	2030		N/A	Brown	Brown	Grey
Other Material		N	2030		N/A	Stones	Roots	None
Soil Texture		N	2030		N/A	Clay	Clay	Clay
pH at 20C		U	2010		4.0	8.5	8.4	9.0
pH (2.5:1) at 20C		N	2010		4.0	8.4	8.2	9.0
Boron (Hot Water Soluble)		U	2120	mg/kg	0.40	5.4	1.8	3.7
Sulphate (2:1 Water Soluble) as SO4		U	2120	g/l	0.010	0.47	0.097	0.22
Total Sulphur		U	2175	%	0.010	0.070	1.0	0.93
Cyanide (Free)		U	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Iron (Total)		N	2430	mg/kg	100	17000	16000	17000
Sulphate (Acid Soluble)		U	2430	%	0.010	0.21	0.14	0.082
Arsenic		U	2455	mg/kg	0.5	6.1	3.8	5.7
Barium		U	2455	mg/kg	0.5	45	7.9	15
Beryllium		U	2455	mg/kg	0.5	< 0.5	< 0.5	< 0.5
Cadmium		U	2455	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Chromium		U	2455	mg/kg	0.5	5.3	7.6	9.0
Manganese		U	2455	mg/kg	1.0	250	41	210
Molybdenum		U	2455	mg/kg	0.5	< 0.5	< 0.5	< 0.5
Copper		U	2455	mg/kg	0.50	14	4.6	9.2
Mercury		U	2455	mg/kg	0.05	0.08	< 0.05	< 0.05
Nickel		U	2455	mg/kg	0.50	7.6	8.5	5.4
Lead		U	2455	mg/kg	0.50	33	6.2	56
Selenium		U	2455	mg/kg	0.25	< 0.25	< 0.25	< 0.25
Vanadium		U	2455	mg/kg	0.5	6.8	15	14
Zinc		U	2455	mg/kg	0.50	30	17	38
Chromium (Trivalent)		N	2490	mg/kg	1.0	5.3	7.6	9.0
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Aliphatic VPH >C5-C6	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C7	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C7-C8	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C8 (Sum)	HS_2D_AL	N	2780	mg/kg	0.10	< 0.10	< 0.10	< 0.10

Results - Soil

Project: TB8754 Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-17889	25-17889	25-17889
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1979928	1979930	1979931
Order No.:				*Client Sample Ref.:*		*ES*	*ES*	*ES*
				Client Sample ID.:		*5*	*12*	*18*
				Client Reference:		*BH107*	*BH107*	*BH107*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.60*	*2.00*	*4.00*
				Bottom Depth (m):		*0.65*		
				Date Sampled:		*27-May-2025*	*27-May-2025*	*27-May-2025*
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
Aliphatic VPH >C8-C10	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Total Aliphatic VPH >C5-C10	HS_2D_AL	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25
Aliphatic EPH >C10-C12 MC	EH_2D_AL_#1	U	2690	mg/kg	2.00	< 2.0	< 2.0	< 2.0
Aliphatic EPH >C12-C16 MC	EH_2D_AL_#1	U	2690	mg/kg	1.00	< 1.0	2.0	< 1.0
Aliphatic EPH >C16-C21 MC	EH_2D_AL_#1	U	2690	mg/kg	2.00	< 2.0	5.9	2.1
Aliphatic EPH >C21-C35 MC	EH_2D_AL_#1	U	2690	mg/kg	3.00	8.1	65	17
Aliphatic EPH >C35-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	< 10	18	12
Total Aliphatic EPH >C10-C35 MC	EH_2D_AL_#1	U	2690	mg/kg	5.00	8.1	75	21
Total Aliphatic EPH >C10-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	< 10	93	33
Aromatic VPH >C5-C7	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C7-C8	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C8-C10	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Total Aromatic VPH >C5-C10	HS_2D_AR	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25
Aromatic EPH >C10-C12 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0	< 1.0	< 1.0
Aromatic EPH >C12-C16 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0	< 1.0	< 1.0
Aromatic EPH >C16-C21 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	4.7	6.3	2.7
Aromatic EPH >C21-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	3.9	35	12
Aromatic EPH >C35-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	1.00	4.3	14	10
Total Aromatic EPH >C10-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	5.00	8.6	41	14
Total Aromatic EPH >C10-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	10.00	13	55	25
Total VPH >C5-C10	HS_2D_Total	U	2780	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Total EPH >C10-C35 MC	EH_2D_Total_#1	U	2690	mg/kg	10.00	17	120	35
Total EPH >C10-C40 MC	EH_2D_Total_#1	N	2690	mg/kg	10.00	21	150	57
Fraction of Organic Carbon		U	2625		0.0010	0.0090	0.0087	0.0093
Dichlorodifluoromethane		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Chloromethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromomethane		U	2760	µg/kg	20	< 20	< 20	< 20
Chloroethane		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Trichlorofluoromethane		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Trans 1,2-Dichloroethene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
cis 1,2-Dichloroethene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane		U	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0

Results - Soil

Project: TB8754 Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-17889	25-17889	25-17889
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1979928	1979930	1979931
Order No.:				*Client Sample Ref.:*		*ES*	*ES*	*ES*
				Client Sample ID.:		*5*	*12*	*18*
				Client Reference:		*BH107*	*BH107*	*BH107*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.60*	*2.00*	*4.00*
				Bottom Depth (m):		*0.65*		
				Date Sampled:		*27-May-2025*	*27-May-2025*	*27-May-2025*
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
Trichloromethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Tetrachloromethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Benzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Trichloroethene		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Dibromomethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane		U	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0
cis-1,3-Dichloropropene		N	2760	µg/kg	10	< 10	< 10	< 10
Toluene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Trans-1,3-Dichloropropene		N	2760	µg/kg	10	< 10	< 10	< 10
1,1,2-Trichloroethane		U	2760	µg/kg	10	< 10	< 10	< 10
Tetrachloroethene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Dibromochloromethane		U	2760	µg/kg	10	< 10	< 10	< 10
1,2-Dibromoethane		U	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0
Chlorobenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Ethylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
o-Xylene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Styrene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Tribromomethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromobenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane		N	2760	µg/kg	50	< 50	< 50	< 50
N-Propylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
2-Chlorotoluene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
4-Chlorotoluene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Tert-Butylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Sec-Butylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0

Results - Soil

Project: TB8754 Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-17889	25-17889	25-17889
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1979928	1979930	1979931
Order No.:				*Client Sample Ref.:*		*ES*	*ES*	*ES*
				Client Sample ID.:		*5*	*12*	*18*
				Client Reference:		*BH107*	*BH107*	*BH107*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.60*	*2.00*	*4.00*
				Bottom Depth (m):		*0.65*		
				Date Sampled:		*27-May-2025*	*27-May-2025*	*27-May-2025*
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
1,3-Dichlorobenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
4-Isopropyltoluene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
N-Butylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-Chloropropane		N	2760	µg/kg	50	< 50	< 50	< 50
1,2,4-Trichlorobenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Methyl Tert-Butyl Ether		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Naphthalene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene		N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Fluorene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Phenanthrene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Anthracene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Fluoranthene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Pyrene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Chrysene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's		N	2800	mg/kg	2.0	< 2.0	< 2.0	< 2.0
Resorcinol		U	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Phenol		U	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Cresols		U	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Xylenols		U	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
1-Naphthol		N	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Trimethylphenols		U	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Total Phenols		U	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2010	pH Value of Soils	pH at 20°C	pH Meter	
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <30°C.	
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES	
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry	
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.	
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.	
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.	
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.	
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2690	EPH A/A Split	Aliphatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40 Aromatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40	Acetone/Heptane extraction / GCxGC FID detection	
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.	
2780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C7,>C7–C8,>C8-C10 Aromatics: >C5–C7,>C7-C8,>C8–C10	Water extraction / Headspace GCxGC FID detection	
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS	
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.	

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection
Text example	All items indicated in italic font represent customer-supplied information that may not be independently verified by the laboratory

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.

Any comments or interpretations are outside the scope of UKAS accreditation.

The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.

Uncertainty of measurement for the determinands tested are available upon request .

None of the results in this report have been recovery corrected.

All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at ≤ 30°C prior to analysis.

All Asbestos testing is performed at the indicated laboratory .

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

NEW_ASB	Eurofins Chemtest Limited, 11 Depot Road, Newmarket, CB8 0AL
DURHAM	Eurofins Chemtest Limited, Unit A North Wing, Prospect Business Park, Crookhall Lane, Consett, Co Durham, DH8 7PW

Sample Deviation Codes

As a result of any of the below deviations applying, the test results may be unreliable

A - Date of sampling not supplied

B - Sample age exceeds stability time (sampling to extraction)

C - Sample not received in appropriate containers

D - Broken Container

E - The required amount of sample for analysis was not received

H - Appropriate cooling measures were not taken for sample transportation

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.

All water samples will be retained for 14 days from the date of receipt.

Charges may apply to extended sample storage.

Report Information

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable
PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

Asbestos Tests LOD = LOQ

Limit of Detection = Limit of Quantification for asbestos results only

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Amended Report

Report No.:	25-17889-2		
Initial Date of Issue:	12-Jun-2025	**Date of Re-Issue:**	12-Jun-2025
Re-Issue Details:	This report has been revised and directly supersedes 25-17889-1 in its entirety		
Client	*Soil Engineering Geoservices Ltd*		
Client Address:	*Foundation Court* *Riverside Way* *Watchmoor Park* *Camberley* *GU15 3RG*		
Contact(s):	*Emily Cross*		
Project	*TB8754 Tilbury*		
Quotation No.:	*Q25-37723*	**Date Received:**	30-May-2025
Order No.:		**Date Instructed:**	30-May-2025
No. of Samples:	*3*		
Turnaround (Wkdays):	5	**Results Due:**	05-Jun-2025
Date Approved:	12-Jun-2025		

Approved By:



Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Soil

Project: TB8754 Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-17889	25-17889	25-17889
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1979928	1979930	1979931
Order No.:				*Client Sample Ref.:*		*ES*	*ES*	*ES*
				Client Sample ID.:		*5*	*12*	*18*
				Client Reference:		*BH107*	*BH107*	*BH107*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.60*	*2.00*	*4.00*
				Bottom Depth (m):		*0.65*		
				Date Sampled:		*27-May-2025*	*27-May-2025*	*27-May-2025*
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
ACM Type		N	2192		N/A	-	-	-
Asbestos Identification		U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture		N	2030	%	0.020	26	35	38
Soil Colour		N	2030		N/A	Brown	Brown	Grey
Other Material		N	2030		N/A	Stones	Roots	None
Soil Texture		N	2030		N/A	Clay	Clay	Clay
pH at 20C		M	2010		4.0	8.5	8.4	9.0
pH (2.5:1) at 20C		N	2010		4.0	8.4	8.2	9.0
Boron (Hot Water Soluble)		M	2120	mg/kg	0.40	5.4	1.8	3.7
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010	0.47	0.097	0.22
Total Sulphur		U	2175	%	0.010	0.070	1.0	0.93
Cyanide (Free)		M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Iron (Total)		N	2430	mg/kg	100	17000	16000	17000
Sulphate (Acid Soluble)		U	2430	%	0.010	0.21	0.14	0.082
Arsenic		M	2455	mg/kg	0.5	6.1	3.8	5.7
Barium		M	2455	mg/kg	0.5	45	7.9	15
Beryllium		U	2455	mg/kg	0.5	< 0.5	< 0.5	< 0.5
Cadmium		M	2455	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Chromium		M	2455	mg/kg	0.5	5.3	7.6	9.0
Manganese		M	2455	mg/kg	1.0	250	41	210
Molybdenum		M	2455	mg/kg	0.5	< 0.5	< 0.5	< 0.5
Copper		M	2455	mg/kg	0.50	14	4.6	9.2
Mercury		M	2455	mg/kg	0.05	0.08	< 0.05	< 0.05
Nickel		M	2455	mg/kg	0.50	7.6	8.5	5.4
Lead		M	2455	mg/kg	0.50	33	6.2	56
Selenium		M	2455	mg/kg	0.25	< 0.25	< 0.25	< 0.25
Vanadium		U	2455	mg/kg	0.5	6.8	15	14
Zinc		M	2455	mg/kg	0.50	30	17	38
Chromium (Trivalent)		N	2490	mg/kg	1.0	5.3	7.6	9.0
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Aliphatic VPH >C5-C6	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C7	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C7-C8	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C8 (Sum)	HS_2D_AL	N	2780	mg/kg	0.10	< 0.10	< 0.10	< 0.10

Results - Soil

Project: TB8754 Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-17889	25-17889	25-17889
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1979928	1979930	1979931
Order No.:				*Client Sample Ref.:*		*ES*	*ES*	*ES*
				Client Sample ID.:		*5*	*12*	*18*
				Client Reference:		*BH107*	*BH107*	*BH107*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.60*	*2.00*	*4.00*
				Bottom Depth (m):		*0.65*		
				Date Sampled:		*27-May-2025*	*27-May-2025*	*27-May-2025*
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
Aliphatic VPH >C8-C10	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Total Aliphatic VPH >C5-C10	HS_2D_AL	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25
Aliphatic EPH >C10-C12 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	< 2.0	< 2.0	< 2.0
Aliphatic EPH >C12-C16 MC	EH_2D_AL_#1	M	2690	mg/kg	1.00	< 1.0	2.0	< 1.0
Aliphatic EPH >C16-C21 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	< 2.0	5.9	2.1
Aliphatic EPH >C21-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	3.00	8.1	65	17
Aliphatic EPH >C35-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	< 10	18	12
Total Aliphatic EPH >C10-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	5.00	8.1	75	21
Total Aliphatic EPH >C10-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	< 10	93	33
Aromatic VPH >C5-C7	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C7-C8	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C8-C10	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Total Aromatic VPH >C5-C10	HS_2D_AR	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25
Aromatic EPH >C10-C12 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0	< 1.0	< 1.0
Aromatic EPH >C12-C16 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0	< 1.0	< 1.0
Aromatic EPH >C16-C21 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	4.7	6.3	2.7
Aromatic EPH >C21-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	3.9	35	12
Aromatic EPH >C35-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	1.00	4.3	14	10
Total Aromatic EPH >C10-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	5.00	8.6	41	14
Total Aromatic EPH >C10-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	10.00	13	55	25
Total VPH >C5-C10	HS_2D_Total	U	2780	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Total EPH >C10-C35 MC	EH_2D_Total_#1	U	2690	mg/kg	10.00	17	120	35
Total EPH >C10-C40 MC	EH_2D_Total_#1	N	2690	mg/kg	10.00	21	150	57
Fraction of Organic Carbon		M	2625		0.0010	0.0090	0.0087	0.0093
Dichlorodifluoromethane		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Chloromethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromomethane		M	2760	µg/kg	20	< 20	< 20	< 20
Chloroethane		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Trichlorofluoromethane		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Trans 1,2-Dichloroethene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
cis 1,2-Dichloroethene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane		U	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0

Results - Soil

Project: TB8754 Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-17889	25-17889	25-17889
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1979928	1979930	1979931
Order No.:				*Client Sample Ref.:*		*ES*	*ES*	*ES*
				Client Sample ID.:		*5*	*12*	*18*
				Client Reference:		*BH107*	*BH107*	*BH107*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.60*	*2.00*	*4.00*
				Bottom Depth (m):		*0.65*		
				Date Sampled:		*27-May-2025*	*27-May-2025*	*27-May-2025*
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
Trichloromethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Tetrachloromethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Benzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane		M	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Trichloroethene		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Dibromomethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane		M	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0
cis-1,3-Dichloropropene		N	2760	µg/kg	10	< 10	< 10	< 10
Toluene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Trans-1,3-Dichloropropene		N	2760	µg/kg	10	< 10	< 10	< 10
1,1,2-Trichloroethane		M	2760	µg/kg	10	< 10	< 10	< 10
Tetrachloroethene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Dibromochloromethane		U	2760	µg/kg	10	< 10	< 10	< 10
1,2-Dibromoethane		M	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0
Chlorobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane		M	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Ethylbenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
o-Xylene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Styrene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Tribromomethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane		N	2760	µg/kg	50	< 50	< 50	< 50
N-Propylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
2-Chlorotoluene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
4-Chlorotoluene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Tert-Butylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Sec-Butylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0

Results - Soil

Project: TB8754 Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-17889	25-17889	25-17889
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1979928	1979930	1979931
Order No.:				*Client Sample Ref.:*		*ES*	*ES*	*ES*
				Client Sample ID.:		*5*	*12*	*18*
				Client Reference:		*BH107*	*BH107*	*BH107*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.60*	*2.00*	*4.00*
				Bottom Depth (m):		*0.65*		
				Date Sampled:		*27-May-2025*	*27-May-2025*	*27-May-2025*
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
1,3-Dichlorobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
4-Isopropyltoluene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
N-Butylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-Chloropropane		N	2760	µg/kg	50	< 50	< 50	< 50
1,2,4-Trichlorobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Methyl Tert-Butyl Ether		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Naphthalene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene		N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Fluorene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Phenanthrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Anthracene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Chrysene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's		N	2800	mg/kg	2.0	< 2.0	< 2.0	< 2.0
Resorcinol		M	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Phenol		M	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Cresols		M	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Xylenols		M	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
1-Naphthol		N	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Trimethylphenols		M	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Total Phenols		M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2010	pH Value of Soils	pH at 20°C	pH Meter	
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <30°C.	
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES	
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry	
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.	
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.	
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.	
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.	
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2690	EPH A/A Split	Aliphatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40 Aromatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40	Acetone/Heptane extraction / GCxGC FID detection	
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.	
2780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C7,>C7–C8,>C8-C10 Aromatics: >C5–C7,>C7-C8,>C8–C10	Water extraction / Headspace GCxGC FID detection	
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS	
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.	

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection
Text example	All items indicated in italic font represent customer-supplied information that may not be independently verified by the laboratory

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.

Any comments or interpretations are outside the scope of UKAS accreditation.

The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.

Uncertainty of measurement for the determinands tested are available upon request .

None of the results in this report have been recovery corrected.

All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at ≤ 30°C prior to analysis.

All Asbestos testing is performed at the indicated laboratory .

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

NEW_ASB	Eurofins Chemtest Limited, 11 Depot Road, Newmarket, CB8 0AL
DURHAM	Eurofins Chemtest Limited, Unit A North Wing, Prospect Business Park, Crookhall Lane, Consett, Co Durham, DH8 7PW

Sample Deviation Codes

As a result of any of the below deviations applying, the test results may be unreliable

A - Date of sampling not supplied

B - Sample age exceeds stability time (sampling to extraction)

C - Sample not received in appropriate containers

D - Broken Container

E - The required amount of sample for analysis was not received

H - Appropriate cooling measures were not taken for sample transportation

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.

All water samples will be retained for 14 days from the date of receipt.

Charges may apply to extended sample storage.

Report Information

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable
PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

Asbestos Tests LOD = LOQ

Limit of Detection = Limit of Quantification for asbestos results only

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Amended Report

Report No.:	25-17889-3		
Initial Date of Issue:	12-Jun-2025	**Date of Re-Issue:**	30-Jun-2025
Re-Issue Details:	This report has been revised and directly supersedes 25-17889-2 in its entirety		
Client	*Soil Engineering Geoservices Ltd*		
Client Address:	*Foundation Court* *Riverside Way* *Watchmoor Park* *Camberley* *GU15 3RG*		
Contact(s):	*Emily Cross*		
Project	*TB8754 Tilbury*		
Quotation No.:	*Q25-37723*	**Date Received:**	30-May-2025
Order No.:		**Date Instructed:**	30-May-2025
No. of Samples:	*3*		
Turnaround (Wkdays):	20	**Results Due:**	26-Jun-2025
Date Approved:	30-Jun-2025		

Approved By:



Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Leachate

Project: TB8754 Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-17889	25-17889	25-17889
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1979928	1979930	1979931
Order No.:				*Client Sample Ref.:*		*ES*	*ES*	*ES*
				Client Sample ID.:		*5*	*12*	*18*
				Client Reference:		*BH107*	*BH107*	*BH107*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.60*	*2.00*	*4.00*
				Bottom Depth (m):		*0.65*		
				Date Sampled:		*27-May-2025*	*27-May-2025*	*27-May-2025*
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**			
pH at 20C	U	1010	10:1		4.0	7.6	7.3	7.0
Fluoride	U	1220	10:1	mg/l	0.050	0.33	0.15	0.16
Ammoniacal Nitrogen	U	1220	10:1	mg/l	0.050	0.093	0.086	0.38
Sulphur	N	1220	10:1	mg/l	1.0	8.7	5.0	2.5
Sulphate	U	1220	10:1	mg/l	1.0	26	15	7.4
Cyanide (Total)	U	1300	10:1	mg/l	0.050	< 0.050	< 0.050	< 0.050
Cyanide (Free)	U	1300	10:1	mg/l	0.050	< 0.050	< 0.050	< 0.050
Cyanide (Complex)	U	1300	10:1	mg/l	0.050	< 0.050	< 0.050	< 0.050
Magnesium	U	1455	10:1	mg/l	0.20	0.56	0.42	0.80
Arsenic (Dissolved)	U	1455	10:1	µg/l	0.20	1.0	1.3	21
Boron (Dissolved)	U	1455	10:1	µg/l	10.0	94	62	76
Barium (Dissolved)	U	1455	10:1	µg/l	5.00	< 5.0	< 5.0	< 5.0
Beryllium (Dissolved)	U	1455	10:1	µg/l	1.00	< 1.0	< 1.0	< 1.0
Cadmium (Dissolved)	U	1455	10:1	µg/l	0.11	< 0.11	< 0.11	< 0.11
Chromium (Dissolved)	U	1455	10:1	µg/l	0.50	0.64	1.8	1.4
Copper (Dissolved)	U	1455	10:1	µg/l	0.50	0.99	1.1	2.1
Mercury (Dissolved)	U	1455	10:1	µg/l	0.05	< 0.05	< 0.05	< 0.05
Molybdenum (Dissolved)	U	1455	10:1	µg/l	0.20	3.8	0.78	3.8
Nickel (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50	1.5	2.1
Lead (Dissolved)	U	1455	10:1	µg/l	0.50	0.67	1.6	3.0
Selenium (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50	< 0.50	2.0
Vanadium (Dissolved)	U	1455	10:1	µg/l	0.50	1.6	5.8	39
Zinc (Dissolved)	U	1455	10:1	µg/l	2.5	4.0	7.7	19
Iron (Dissolved)	N	1455	10:1	µg/l	5.0	390	1000	310
Low-Level Chromium (Hexavalent)	N	1495	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Chromium Trivalent LL (from 1455 1495)	N	1450	10:1	µg/l	1.00	< 1.0	1.8	1.4
Total TPH >C6-C40	U	1670	10:1	µg/l	10	< 10	< 10	< 10
Naphthalene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10

Results - Leachate

Project: TB8754 Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-17889	25-17889	25-17889
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1979928	1979930	1979931
Order No.:				*Client Sample Ref.:*		*ES*	*ES*	*ES*
				Client Sample ID.:		*5*	*12*	*18*
				Client Reference:		*BH107*	*BH107*	*BH107*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.60*	*2.00*	*4.00*
				Bottom Depth (m):		*0.65*		
				Date Sampled:		*27-May-2025*	*27-May-2025*	*27-May-2025*
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**			
Chrysene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	1800	10:1	µg/l	2.0	< 2.0	< 2.0	< 2.0
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030	< 0.030	< 0.030

Results - Soil

Project: TB8754 Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-17889	25-17889	25-17889
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1979928	1979930	1979931
Order No.:				*Client Sample Ref.:*		*ES*	*ES*	*ES*
				Client Sample ID.:		*5*	*12*	*18*
				Client Reference:		*BH107*	*BH107*	*BH107*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.60*	*2.00*	*4.00*
				Bottom Depth (m):		*0.65*		
				Date Sampled:		*27-May-2025*	*27-May-2025*	*27-May-2025*
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
ACM Type		N	2192		N/A	-	-	-
Asbestos Identification		U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture		N	2030	%	0.020	26	35	38
Soil Colour		N	2030		N/A	Brown	Brown	Grey
Other Material		N	2030		N/A	Stones	Roots	None
Soil Texture		N	2030		N/A	Clay	Clay	Clay
pH at 20C		M	2010		4.0	8.5	8.4	9.0
pH (2.5:1) at 20C		N	2010		4.0	8.4	8.2	9.0
Boron (Hot Water Soluble)		M	2120	mg/kg	0.40	5.4	1.8	3.7
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010	0.47	0.097	0.22
Total Sulphur		U	2175	%	0.010	0.070	1.0	0.93
Cyanide (Free)		M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Iron (Total)		N	2430	mg/kg	100	17000	16000	17000
Sulphate (Acid Soluble)		U	2430	%	0.010	0.21	0.14	0.082
Arsenic		M	2455	mg/kg	0.5	6.1	3.8	5.7
Barium		M	2455	mg/kg	0.5	45	7.9	15
Beryllium		U	2455	mg/kg	0.5	< 0.5	< 0.5	< 0.5
Cadmium		M	2455	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Chromium		M	2455	mg/kg	0.5	5.3	7.6	9.0
Manganese		M	2455	mg/kg	1.0	250	41	210
Molybdenum		M	2455	mg/kg	0.5	< 0.5	< 0.5	< 0.5
Copper		M	2455	mg/kg	0.50	14	4.6	9.2
Mercury		M	2455	mg/kg	0.05	0.08	< 0.05	< 0.05
Nickel		M	2455	mg/kg	0.50	7.6	8.5	5.4
Lead		M	2455	mg/kg	0.50	33	6.2	56
Selenium		M	2455	mg/kg	0.25	< 0.25	< 0.25	< 0.25
Vanadium		U	2455	mg/kg	0.5	6.8	15	14
Zinc		M	2455	mg/kg	0.50	30	17	38
Chromium (Trivalent)		N	2490	mg/kg	1.0	5.3	7.6	9.0
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Aliphatic VPH >C5-C6	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C7	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C7-C8	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C8 (Sum)	HS_2D_AL	N	2780	mg/kg	0.10	< 0.10	< 0.10	< 0.10

Results - Soil

Project: TB8754 Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-17889	25-17889	25-17889
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1979928	1979930	1979931
Order No.:				*Client Sample Ref.:*		*ES*	*ES*	*ES*
				Client Sample ID.:		*5*	*12*	*18*
				Client Reference:		*BH107*	*BH107*	*BH107*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.60*	*2.00*	*4.00*
				Bottom Depth (m):		*0.65*		
				Date Sampled:		*27-May-2025*	*27-May-2025*	*27-May-2025*
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
Aliphatic VPH >C8-C10	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Total Aliphatic VPH >C5-C10	HS_2D_AL	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25
Aliphatic EPH >C10-C12 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	< 2.0	< 2.0	< 2.0
Aliphatic EPH >C12-C16 MC	EH_2D_AL_#1	M	2690	mg/kg	1.00	< 1.0	2.0	< 1.0
Aliphatic EPH >C16-C21 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	< 2.0	5.9	2.1
Aliphatic EPH >C21-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	3.00	8.1	65	17
Aliphatic EPH >C35-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	< 10	18	12
Total Aliphatic EPH >C10-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	5.00	8.1	75	21
Total Aliphatic EPH >C10-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	< 10	93	33
Aromatic VPH >C5-C7	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C7-C8	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C8-C10	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Total Aromatic VPH >C5-C10	HS_2D_AR	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25
Aromatic EPH >C10-C12 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0	< 1.0	< 1.0
Aromatic EPH >C12-C16 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0	< 1.0	< 1.0
Aromatic EPH >C16-C21 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	4.7	6.3	2.7
Aromatic EPH >C21-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	3.9	35	12
Aromatic EPH >C35-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	1.00	4.3	14	10
Total Aromatic EPH >C10-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	5.00	8.6	41	14
Total Aromatic EPH >C10-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	10.00	13	55	25
Total VPH >C5-C10	HS_2D_Total	U	2780	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Total EPH >C10-C35 MC	EH_2D_Total_#1	U	2690	mg/kg	10.00	17	120	35
Total EPH >C10-C40 MC	EH_2D_Total_#1	N	2690	mg/kg	10.00	21	150	57
Fraction of Organic Carbon		M	2625		0.0010	0.0090	0.0087	0.0093
Dichlorodifluoromethane		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Chloromethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromomethane		M	2760	µg/kg	20	< 20	< 20	< 20
Chloroethane		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Trichlorofluoromethane		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Trans 1,2-Dichloroethene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
cis 1,2-Dichloroethene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane		U	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0

Results - Soil

Project: TB8754 Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-17889	25-17889	25-17889
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1979928	1979930	1979931
Order No.:				*Client Sample Ref.:*		*ES*	*ES*	*ES*
				Client Sample ID.:		*5*	*12*	*18*
				Client Reference:		*BH107*	*BH107*	*BH107*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.60*	*2.00*	*4.00*
				Bottom Depth (m):		*0.65*		
				Date Sampled:		*27-May-2025*	*27-May-2025*	*27-May-2025*
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
Trichloromethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Tetrachloromethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Benzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane		M	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Trichloroethene		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Dibromomethane		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane		M	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0
cis-1,3-Dichloropropene		N	2760	µg/kg	10	< 10	< 10	< 10
Toluene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Trans-1,3-Dichloropropene		N	2760	µg/kg	10	< 10	< 10	< 10
1,1,2-Trichloroethane		M	2760	µg/kg	10	< 10	< 10	< 10
Tetrachloroethene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Dibromochloromethane		U	2760	µg/kg	10	< 10	< 10	< 10
1,2-Dibromoethane		M	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0
Chlorobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane		M	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Ethylbenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
o-Xylene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Styrene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Tribromomethane		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane		N	2760	µg/kg	50	< 50	< 50	< 50
N-Propylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
2-Chlorotoluene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
4-Chlorotoluene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Tert-Butylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Sec-Butylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0

Results - Soil

Project: TB8754 Tilbury

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-17889	25-17889	25-17889
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1979928	1979930	1979931
Order No.:				*Client Sample Ref.:*		*ES*	*ES*	*ES*
				Client Sample ID.:		*5*	*12*	*18*
				Client Reference:		*BH107*	*BH107*	*BH107*
				Sample Type:		*SOIL*	*SOIL*	*SOIL*
				Top Depth (m):		*0.60*	*2.00*	*4.00*
				Bottom Depth (m):		*0.65*		
				Date Sampled:		*27-May-2025*	*27-May-2025*	*27-May-2025*
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
1,3-Dichlorobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
4-Isopropyltoluene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
N-Butylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-Chloropropane		N	2760	µg/kg	50	< 50	< 50	< 50
1,2,4-Trichlorobenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene		N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene		U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Methyl Tert-Butyl Ether		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Naphthalene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene		N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Fluorene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Phenanthrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Anthracene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Chrysene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's		N	2800	mg/kg	2.0	< 2.0	< 2.0	< 2.0
Resorcinol		M	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Phenol		M	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Cresols		M	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Xylenols		M	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
1-Naphthol		N	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Trimethylphenols		M	2920	mg/kg	0.020	< 0.020	< 0.020	< 0.020
Total Phenols		M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
1010	pH Value of Waters	pH at 20°C	pH Meter	RE PW TE TS PL DW GW
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.	RE PW PL LE DW GW
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.	
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	GW
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	RE PW PL SW DW GW
1495	Low Level Hexavalent Chromium in Waters	Chromium [VI]	Colorimetric determination of hexavalent chromium expressed as Cr (VI) µg/l in water, using Ion Chromatography and UV-visible spectrophotometry.	GW
1670	Total Petroleum Hydrocarbons (TPH) in Waters by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO	Pentane extraction / GC FID detection	PL GW
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection	PL GW SW
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.	
2010	pH Value of Soils	pH at 20°C	pH Meter	
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <30°C.	
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES	
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry	
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.	
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.	
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.	
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.	
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2690	EPH A/A Split	Aliphatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40 Aromatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40	Acetone/Heptane extraction / GCxGC FID detection	

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.	
2780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C7,>C7–C8,>C8-C10 Aromatics: >C5–C7,>C7-C8,>C8–C10	Water extraction / Headspace GCxGC FID detection	
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS	
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.	
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge	

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection
Text example	All items indicated in italic font represent customer-supplied information that may not be independently verified by the laboratory

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.

Any comments or interpretations are outside the scope of UKAS accreditation.

The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.

Uncertainty of measurement for the determinands tested are available upon request .

None of the results in this report have been recovery corrected.

All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at ≤ 30°C prior to analysis.

All Asbestos testing is performed at the indicated laboratory .

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

NEW_ASB	Eurofins Chemtest Limited, 11 Depot Road, Newmarket, CB8 0AL
DURHAM	Eurofins Chemtest Limited, Unit A North Wing, Prospect Business Park, Crookhall Lane, Consett, Co Durham, DH8 7PW

Sample Deviation Codes

As a result of any of the below deviations applying, the test results may be unreliable

A - Date of sampling not supplied

B - Sample age exceeds stability time (sampling to extraction)

C - Sample not received in appropriate containers

D - Broken Container

E - The required amount of sample for analysis was not received

H - Appropriate cooling measures were not taken for sample transportation

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.

All water samples will be retained for 14 days from the date of receipt.

Charges may apply to extended sample storage.

Report Information

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable
PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

Asbestos Tests LOD = LOQ

Limit of Detection = Limit of Quantification for asbestos results only

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	25-20452-1
Initial Date of Issue:	03-Jul-2025
Re-Issue Details:	
Client	*Soil Engineering Geoservices Ltd*
Client Address:	*Foundation Court* *Riverside Way* *Watchmoor Park* *Camberley* *GU15 3RG*
Contact(s):	*Emily Cross*
Project	*TB8754 Grain to Tilbury Tunnel GI*
Quotation No.:	*Q25-37723*
Order No.:	
No. of Samples:	*1*
Turnaround (Wkdays):	5
Date Approved:	03-Jul-2025
Approved By:	
Details:	David Smith, Technical Director

Date Received:	20-Jun-2025
Date Instructed:	20-Jun-2025
Results Due:	26-Jun-2025

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Leachate

Project: TB8754 Grain to Tilbury Tunnel GI

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-20452
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1989253
Order No.:				*Client Sample Ref.:*		*5*
				Client Sample ID.:		*SE24250616005*
				Client Reference:		*BH105*
				Sample Type:		*SOIL*
				Top Depth (m):		*1.00*
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**	
pH at 20C	U	1010	10:1		4.0	7.7
Fluoride	U	1220	10:1	mg/l	0.050	0.30
Ammoniacal Nitrogen	U	1220	10:1	mg/l	0.050	0.41
Sulphur	N	1220	10:1	mg/l	1.0	86
Sulphate	U	1220	10:1	mg/l	1.0	260
Cyanide (Total)	U	1300	10:1	mg/l	0.050	< 0.050
Cyanide (Free)	U	1300	10:1	mg/l	0.050	< 0.050
Cyanide (Complex)	U	1300	10:1	mg/l	0.050	< 0.050
Magnesium	U	1455	10:1	mg/l	0.20	24
Arsenic (Dissolved)	U	1455	10:1	µg/l	0.20	6.8
Boron (Dissolved)	U	1455	10:1	µg/l	10.0	2400
Barium (Dissolved)	U	1455	10:1	µg/l	5.00	120
Beryllium (Dissolved)	U	1455	10:1	µg/l	1.00	< 1.0
Cadmium (Dissolved)	U	1455	10:1	µg/l	0.11	< 0.11
Chromium (Dissolved)	U	1455	10:1	µg/l	0.50	1.7
Copper (Dissolved)	U	1455	10:1	µg/l	0.50	0.95
Mercury (Dissolved)	U	1455	10:1	µg/l	0.05	< 0.05
Molybdenum (Dissolved)	U	1455	10:1	µg/l	0.20	28
Nickel (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50
Lead (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50
Selenium (Dissolved)	U	1455	10:1	µg/l	0.50	53
Vanadium (Dissolved)	U	1455	10:1	µg/l	0.50	8.5
Zinc (Dissolved)	U	1455	10:1	µg/l	2.5	4.4
Iron (Dissolved)	N	1455	10:1	µg/l	5.0	< 5.0
Low-Level Chromium (Hexavalent)	N	1495	10:1	µg/l	0.10	< 0.10
Chromium Trivalent LL (from 1455 1495)	N	1450	10:1	µg/l	1.00	1.7
Total TPH >C6-C40	U	1670	10:1	µg/l	10	< 10
Naphthalene	U	1800	10:1	µg/l	0.10	< 0.10
Acenaphthylene	U	1800	10:1	µg/l	0.10	< 0.10
Acenaphthene	U	1800	10:1	µg/l	0.10	< 0.10
Fluorene	U	1800	10:1	µg/l	0.10	< 0.10
Phenanthrene	U	1800	10:1	µg/l	0.10	< 0.10
Anthracene	U	1800	10:1	µg/l	0.10	< 0.10
Fluoranthene	U	1800	10:1	µg/l	0.10	< 0.10
Pyrene	U	1800	10:1	µg/l	0.10	< 0.10
Benzo[a]anthracene	U	1800	10:1	µg/l	0.10	< 0.10
Chrysene	U	1800	10:1	µg/l	0.10	< 0.10

Results - Leachate

Project: TB8754 Grain to Tilbury Tunnel GI

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-20452
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1989253
Order No.:				*Client Sample Ref.:*		*5*
				Client Sample ID.:		*SE24250616005*
				Client Reference:		*BH105*
				Sample Type:		*SOIL*
				Top Depth (m):		*1.00*
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**	
Benzo[b]fluoranthene	U	1800	10:1	µg/l	0.10	< 0.10
Benzo[k]fluoranthene	U	1800	10:1	µg/l	0.10	< 0.10
Benzo[a]pyrene	U	1800	10:1	µg/l	0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1800	10:1	µg/l	0.10	< 0.10
Dibenz(a,h)Anthracene	U	1800	10:1	µg/l	0.10	< 0.10
Benzo[g,h,i]perylene	U	1800	10:1	µg/l	0.10	< 0.10
Total Of 16 PAH's	U	1800	10:1	µg/l	2.0	< 2.0
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030

Results - Soil

Project: TB8754 Grain to Tilbury Tunnel GI

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-20452
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1989253
Order No.:				*Client Sample Ref.:*		*5*
				Client Sample ID.:		*SE24250616005*
				Client Reference:		*BH105*
				Sample Type:		*SOIL*
				Top Depth (m):		*1.00*
				Asbestos Lab:		DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**	
ACM Type		N	2192		N/A	-
Asbestos Identification		U	2192		N/A	No Asbestos Detected
Moisture		N	2030	%	0.020	44
Soil Colour		N	2030		N/A	Black
Other Material		N	2030		N/A	Stones
Soil Texture		N	2030		N/A	Loam
pH at 20C		M	2010		4.0	7.7
Boron (Hot Water Soluble)		M	2120	mg/kg	0.40	< 0.40
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010	0.061
Total Sulphur		U	2175	%	0.010	0.22
Cyanide (Free)		M	2300	mg/kg	0.50	< 0.50
Iron (Total)		N	2430	mg/kg	100	8300
Arsenic		M	2455	mg/kg	0.5	8.5
Barium		M	2455	mg/kg	0.5	200
Beryllium		U	2455	mg/kg	0.5	< 0.5
Cadmium		M	2455	mg/kg	0.10	< 0.10
Chromium		M	2455	mg/kg	0.5	7.0
Manganese		M	2455	mg/kg	1.0	120
Molybdenum		M	2455	mg/kg	0.5	0.9
Copper		M	2455	mg/kg	0.50	7.8
Mercury		M	2455	mg/kg	0.05	0.06
Nickel		M	2455	mg/kg	0.50	8.9
Lead		M	2455	mg/kg	0.50	6.4
Selenium		M	2455	mg/kg	0.25	1.0
Vanadium		U	2455	mg/kg	0.5	18
Zinc		M	2455	mg/kg	0.50	28
Chromium (Trivalent)		N	2490	mg/kg	1.0	7.0
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50
Aliphatic VPH >C5-C6	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05
Aliphatic VPH >C6-C7	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05
Aliphatic VPH >C7-C8	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05
Aliphatic VPH >C6-C8 (Sum)	HS_2D_AL	N	2780	mg/kg	0.10	< 0.10
Aliphatic VPH >C8-C10	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05
Total Aliphatic VPH >C5-C10	HS_2D_AL	U	2780	mg/kg	0.25	< 0.25
Aliphatic EPH >C10-C12 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	< 2.0

Results - Soil

Project: TB8754 Grain to Tilbury Tunnel GI

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-20452
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1989253
Order No.:				*Client Sample Ref.:*		*5*
				Client Sample ID.:		*SE24250616005*
				Client Reference:		*BH105*
				Sample Type:		*SOIL*
				Top Depth (m):		*1.00*
				Asbestos Lab:		DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**	
Aliphatic EPH >C12-C16 MC	EH_2D_AL_#1	M	2690	mg/kg	1.00	1.6
Aliphatic EPH >C16-C21 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	15
Aliphatic EPH >C21-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	3.00	55
Aliphatic EPH >C35-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	32
Total Aliphatic EPH >C10-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	5.00	72
Total Aliphatic EPH >C10-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	100
Aromatic VPH >C5-C7	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05
Aromatic VPH >C7-C8	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05
Aromatic VPH >C8-C10	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05
Total Aromatic VPH >C5-C10	HS_2D_AR	U	2780	mg/kg	0.25	< 0.25
Aromatic EPH >C10-C12 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0
Aromatic EPH >C12-C16 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	3.1
Aromatic EPH >C16-C21 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	80
Aromatic EPH >C21-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	440
Aromatic EPH >C35-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	1.00	68
Total Aromatic EPH >C10-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	5.00	520
Total Aromatic EPH >C10-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	10.00	590
Total VPH >C5-C10	HS_2D_Total	U	2780	mg/kg	0.50	< 0.50
Total EPH >C10-C35 MC	EH_2D_Total_#1	U	2690	mg/kg	10.00	600
Total EPH >C10-C40 MC	EH_2D_Total_#1	N	2690	mg/kg	10.00	700
Fraction of Organic Carbon		M	2625		0.0010	0.080
Dichlorodifluoromethane		N	2760	µg/kg	1.0	U/S
Chloromethane		M	2760	µg/kg	1.0	U/S
Vinyl Chloride		M	2760	µg/kg	1.0	U/S
Bromomethane		M	2760	µg/kg	20	U/S
Chloroethane		U	2760	µg/kg	2.0	U/S
Trichlorofluoromethane		N	2760	µg/kg	1.0	U/S
1,1-Dichloroethene		M	2760	µg/kg	1.0	U/S
Trans 1,2-Dichloroethene		M	2760	µg/kg	1.0	U/S
1,1-Dichloroethane		M	2760	µg/kg	1.0	U/S
cis 1,2-Dichloroethene		M	2760	µg/kg	1.0	U/S
Bromochloromethane		U	2760	µg/kg	5.0	U/S
Trichloromethane		M	2760	µg/kg	1.0	U/S
1,1,1-Trichloroethane		M	2760	µg/kg	1.0	U/S
Tetrachloromethane		M	2760	µg/kg	1.0	U/S
1,1-Dichloropropene		U	2760	µg/kg	1.0	U/S

Results - Soil

Project: TB8754 Grain to Tilbury Tunnel GI

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-20452
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1989253
Order No.:				*Client Sample Ref.:*		*5*
				Client Sample ID.:		*SE24250616005*
				Client Reference:		*BH105*
				Sample Type:		*SOIL*
				Top Depth (m):		*1.00*
				Asbestos Lab:		DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**	
Benzene		M	2760	µg/kg	1.0	U/S
1,2-Dichloroethane		M	2760	µg/kg	2.0	U/S
Trichloroethene		N	2760	µg/kg	1.0	U/S
1,2-Dichloropropane		M	2760	µg/kg	1.0	U/S
Dibromomethane		M	2760	µg/kg	1.0	U/S
Bromodichloromethane		M	2760	µg/kg	5.0	U/S
cis-1,3-Dichloropropene		N	2760	µg/kg	10	U/S
Toluene		M	2760	µg/kg	1.0	U/S
Trans-1,3-Dichloropropene		N	2760	µg/kg	10	U/S
1,1,2-Trichloroethane		M	2760	µg/kg	10	U/S
Tetrachloroethene		M	2760	µg/kg	1.0	U/S
1,3-Dichloropropane		U	2760	µg/kg	2.0	U/S
Dibromochloromethane		U	2760	µg/kg	10	U/S
1,2-Dibromoethane		M	2760	µg/kg	5.0	U/S
Chlorobenzene		M	2760	µg/kg	1.0	U/S
1,1,1,2-Tetrachloroethane		M	2760	µg/kg	2.0	U/S
Ethylbenzene		M	2760	µg/kg	1.0	U/S
m & p-Xylene		M	2760	µg/kg	1.0	U/S
o-Xylene		M	2760	µg/kg	1.0	U/S
Styrene		M	2760	µg/kg	1.0	U/S
Tribromomethane		U	2760	µg/kg	1.0	U/S
Isopropylbenzene		M	2760	µg/kg	1.0	U/S
Bromobenzene		M	2760	µg/kg	1.0	U/S
1,2,3-Trichloropropane		N	2760	µg/kg	50	U/S
N-Propylbenzene		U	2760	µg/kg	1.0	U/S
2-Chlorotoluene		M	2760	µg/kg	1.0	U/S
1,3,5-Trimethylbenzene		M	2760	µg/kg	1.0	U/S
4-Chlorotoluene		U	2760	µg/kg	1.0	U/S
Tert-Butylbenzene		U	2760	µg/kg	1.0	U/S
1,2,4-Trimethylbenzene		M	2760	µg/kg	1.0	U/S
Sec-Butylbenzene		U	2760	µg/kg	1.0	U/S
1,3-Dichlorobenzene		M	2760	µg/kg	1.0	U/S
4-Isopropyltoluene		U	2760	µg/kg	1.0	U/S
1,4-Dichlorobenzene		M	2760	µg/kg	1.0	U/S
N-Butylbenzene		U	2760	µg/kg	1.0	U/S
1,2-Dichlorobenzene		M	2760	µg/kg	1.0	U/S

Results - Soil

Project: TB8754 Grain to Tilbury Tunnel GI

Client: Soil Engineering Geoservices Ltd				**Chemtest Job No.:**		25-20452
Quotation No.: Q25-37723				**Chemtest Sample ID.:**		1989253
Order No.:				*Client Sample Ref.:*		*5*
				Client Sample ID.:		*SE24250616005*
				Client Reference:		*BH105*
				Sample Type:		*SOIL*
				Top Depth (m):		*1.00*
				Asbestos Lab:		DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**	
1,2-Dibromo-3-Chloropropane		N	2760	µg/kg	50	U/S
1,2,4-Trichlorobenzene		M	2760	µg/kg	1.0	U/S
Hexachlorobutadiene		N	2760	µg/kg	1.0	U/S
1,2,3-Trichlorobenzene		U	2760	µg/kg	2.0	U/S
Methyl Tert-Butyl Ether		M	2760	µg/kg	1.0	U/S
Naphthalene		M	2800	mg/kg	0.10	< 0.10
Acenaphthylene		N	2800	mg/kg	0.10	< 0.10
Acenaphthene		M	2800	mg/kg	0.10	< 0.10
Fluorene		M	2800	mg/kg	0.10	< 0.10
Phenanthrene		M	2800	mg/kg	0.10	< 0.10
Anthracene		M	2800	mg/kg	0.10	< 0.10
Fluoranthene		M	2800	mg/kg	0.10	< 0.10
Pyrene		M	2800	mg/kg	0.10	< 0.10
Benzo[a]anthracene		M	2800	mg/kg	0.10	< 0.10
Chrysene		M	2800	mg/kg	0.10	< 0.10
Benzo[b]fluoranthene		M	2800	mg/kg	0.10	< 0.10
Benzo[k]fluoranthene		M	2800	mg/kg	0.10	< 0.10
Benzo[a]pyrene		M	2800	mg/kg	0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10	< 0.10
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	< 0.10
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10	< 0.10
Total Of 16 PAH's		N	2800	mg/kg	2.0	< 2.0
Resorcinol		M	2920	mg/kg	0.020	< 0.020
Phenol		M	2920	mg/kg	0.020	< 0.020
Cresols		M	2920	mg/kg	0.020	< 0.020
Xylenols		M	2920	mg/kg	0.020	< 0.020
1-Naphthol		N	2920	mg/kg	0.020	< 0.020
Trimethylphenols		M	2920	mg/kg	0.020	< 0.020
Total Phenols		M	2920	mg/kg	0.10	< 0.10

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Chemtest Sample ID	*Clients Sample Ref:*	*Clients Sample ID:*	*Clients Reference:*	*Sampled Date:*	Deviation Code(s):	Containers Received:
1989253	*5*	*SE24250616005*	*BH105*		A,H	Amber Glass 250ml
1989253	*5*	*SE24250616005*	*BH105*		A,H	Amber Glass 60ml
1989253	*5*	*SE24250616005*	*BH105*		A,H	Plastic Tub 500g

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
1010	pH Value of Waters	pH at 20°C	pH Meter	RE PW TE TS PL DW GW
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.	RE PW PL LE DW GW
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.	
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	GW
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	RE PW PL SW DW GW
1495	Low Level Hexavalent Chromium in Waters	Chromium [VI]	Colorimetric determination of hexavalent chromium expressed as Cr (VI) µg/l in water, using Ion Chromatography and UV-visible spectrophotometry.	GW
1670	Total Petroleum Hydrocarbons (TPH) in Waters by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO	Pentane extraction / GC FID detection	PL GW
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection	PL GW SW
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.	
2010	pH Value of Soils	pH at 20°C	pH Meter	
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <30°C.	
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES	
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry	
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.	
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.	
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.	
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.	
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2690	EPH A/A Split	Aliphatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40 Aromatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40	Acetone/Heptane extraction / GCxGC FID detection	

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.	
2780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C7,>C7–C8,>C8-C10 Aromatics: >C5–C7,>C7-C8,>C8–C10	Water extraction / Headspace GCxGC FID detection	
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS	
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.	
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge	

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection
Text example	All items indicated in italic font represent customer-supplied information that may not be independently verified by the laboratory

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.

Any comments or interpretations are outside the scope of UKAS accreditation.

The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.

Uncertainty of measurement for the determinands tested are available upon request .

None of the results in this report have been recovery corrected.

All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at ≤ 30°C prior to analysis.

All Asbestos testing is performed at the indicated laboratory .

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

NEW_ASB	Eurofins Chemtest Limited, 11 Depot Road, Newmarket, CB8 0AL
DURHAM	Eurofins Chemtest Limited, Unit A North Wing, Prospect Business Park, Crookhall Lane, Consett, Co Durham, DH8 7PW

Sample Deviation Codes

As a result of any of the below deviations applying, the test results may be unreliable

A - Date of sampling not supplied

B - Sample age exceeds stability time (sampling to extraction)

C - Sample not received in appropriate containers

D - Broken Container

E - The required amount of sample for analysis was not received

H - Appropriate cooling measures were not taken for sample transportation

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.

All water samples will be retained for 14 days from the date of receipt.

Charges may apply to extended sample storage.

Report Information

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable
PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

Asbestos Tests LOD = LOQ

Limit of Detection = Limit of Quantification for asbestos results only

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

SOIL ENGINEERING

SUPPORTING FACTUAL DATA

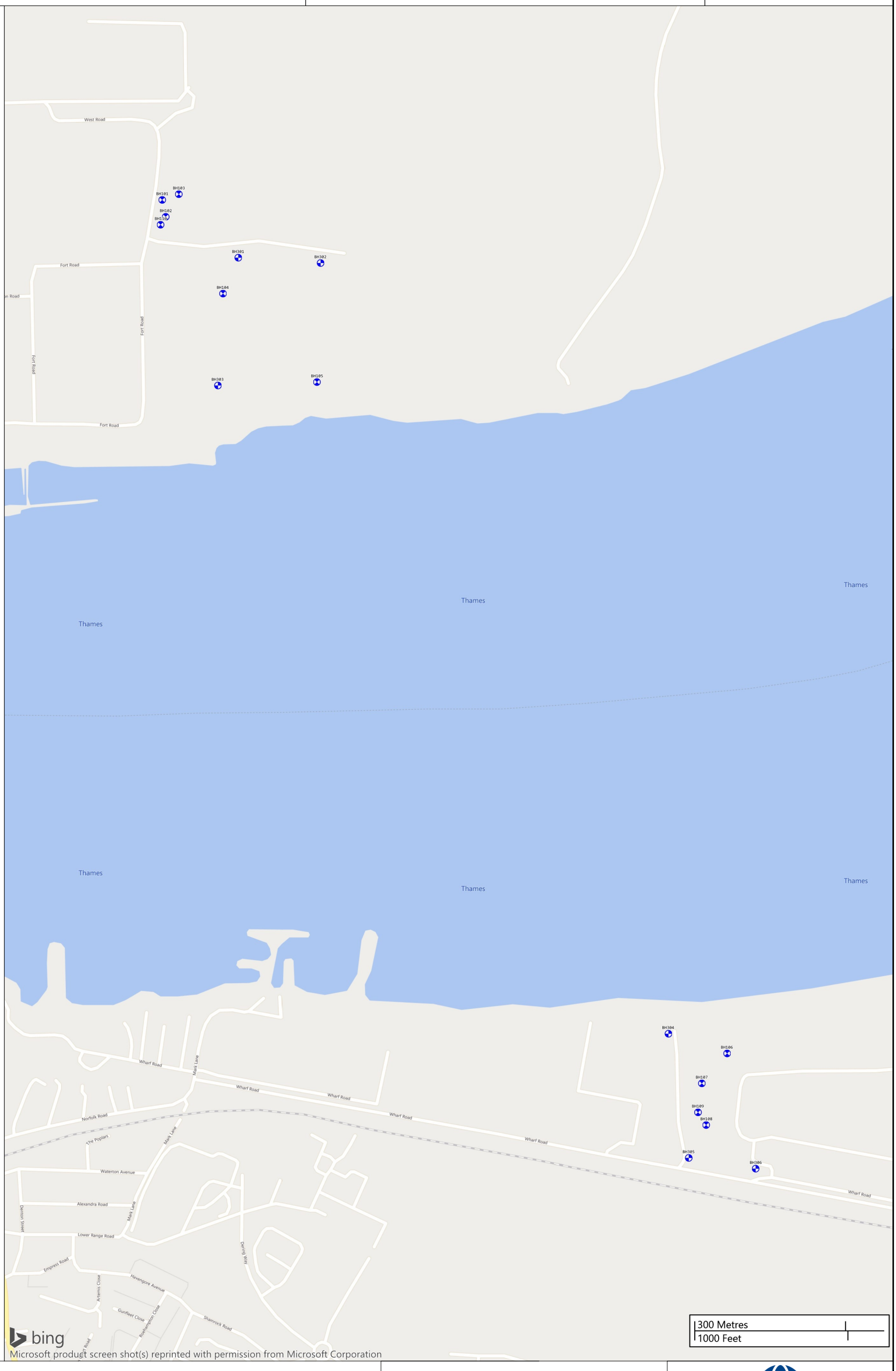
SECTION C
Plans and Drawings

EXPLORATORY HOLE LOCATION PLAN

Project Name	Grain to Tilbury Tunnel GI	Exploratory Hole Location Plan	Scale
Project ID	TB8754		
Engineer	Mott MacDonald		1:7500
Employer	FBJV		

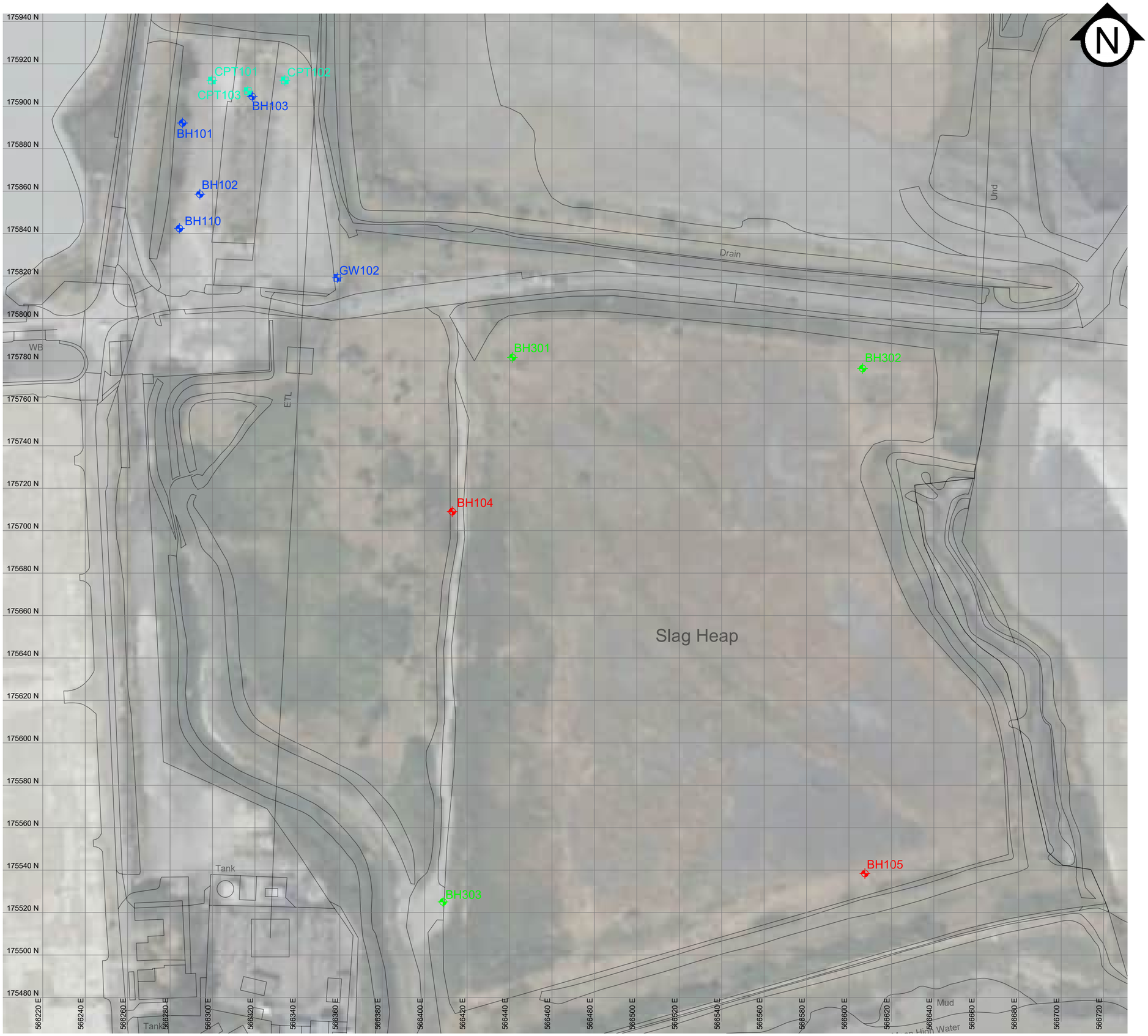
Legend Key

- Locations By Type - Empty
- Locations By Type - IP
- Locations By Type - IP +CP
- Locations By Type - IP +CP+RC
- Locations By Type - IP +RO+RC
- Locations By Type - RC



N

SOIL ENGINEERING



Legend

- Cable Percussive followed by Rotary Coring
- Open Holes followed by Rotary Coring
- Deep Datum Boreholes
- Cone Penetration Tests
- Hand Excavated Pits with Gas Installation

Title

Exploratory Hole Location Plan

Project name

Grain to Tilbury Tunnel

Project No.

TB8754

Engineer

Mott MacDonald

Client

FBJV

Drawn	Date
MPAL	23/09/25
Checked	Date
-	-
Approved	Date
-	-

Figure No.	Size
03	A2
Revision	Scale
00	1:250

Site Investigation and Drawing Completed by

SOIL ENGINEERING
Soil Engineering Geoservices Limited
Parkside Lane, Dewsbury Road, Leeds, LS11 5SX
Tel: 0113 271 11 11
www.soil-engineering.co.uk



Legend

- Cable Percussive followed by Rotary Coring
- Open Holes followed by Rotary Coring
- Deep Datum Boreholes
- Cone Penetration Tests
- Hand Excavated Pits with Gas Installation

Title

Exploratory Hole Location Plan

Project name

Grain to Tilbury Tunnel

Project No.
TB8754

Engineer
Mott MacDonald

Client
FBJV

Drawn	Date
MPAL	23/09/25
Checked	Date
-	-
Approved	Date
-	-

Figure No.	Size
02	A2
Revision	Scale
00	1:750

Site Investigation and Drawing Completed by

SOIL ENGINEERING
Soil Engineering Geoservices Limited
Parkside Lane, Dewsbury Road, Leeds, LS11 5SX
Tel: 0113 271 11 11
www.soil-engineering.co.uk

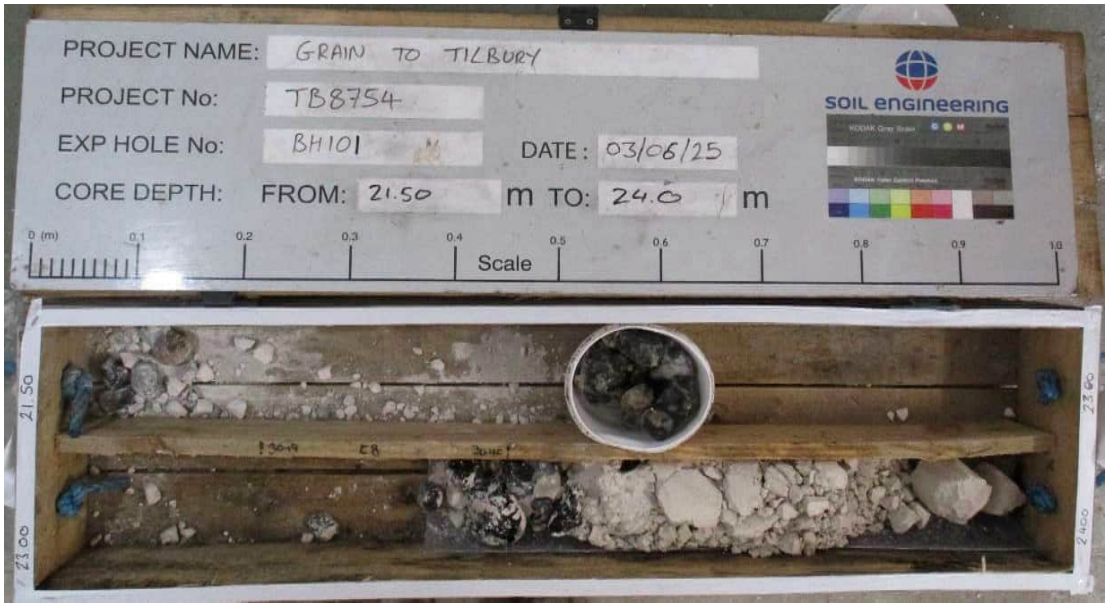
SOIL ENGINEERING

SUPPORTING FACTUAL DATA

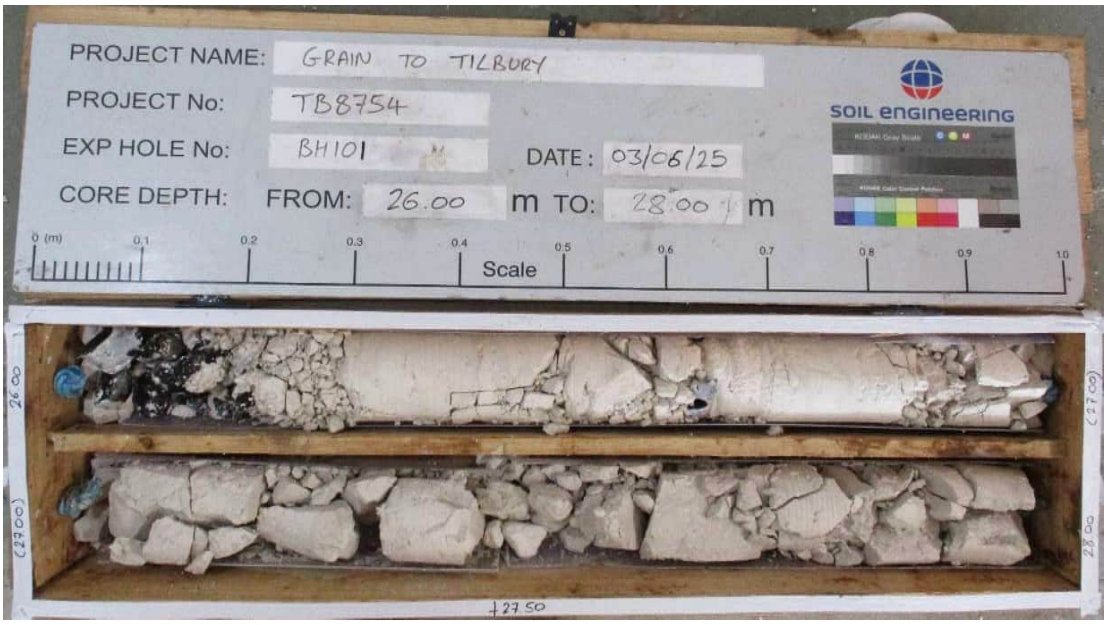
SECTION D
Photographs

SOIL SAMPLE / ROCK CORE / CONCRETE CORE PHOTOGRAPHS

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		01



From 21.50m to 24.00m



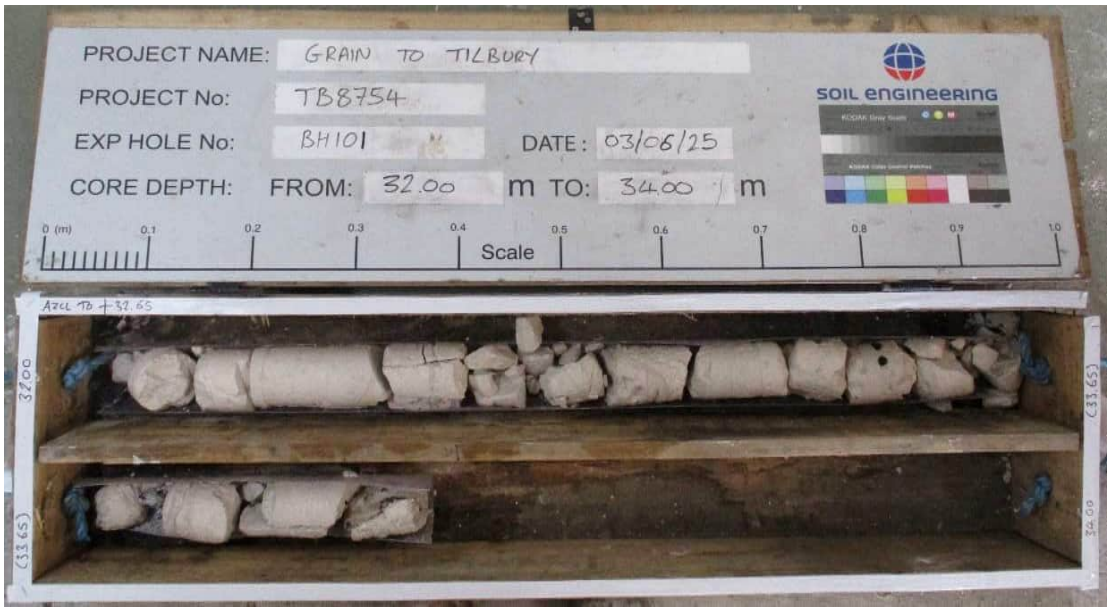
From 26.00m to 28.00m

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AW	03/06/2025	TB8754_BH101_26.00-28.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		02



From 30.00m to 32.00m



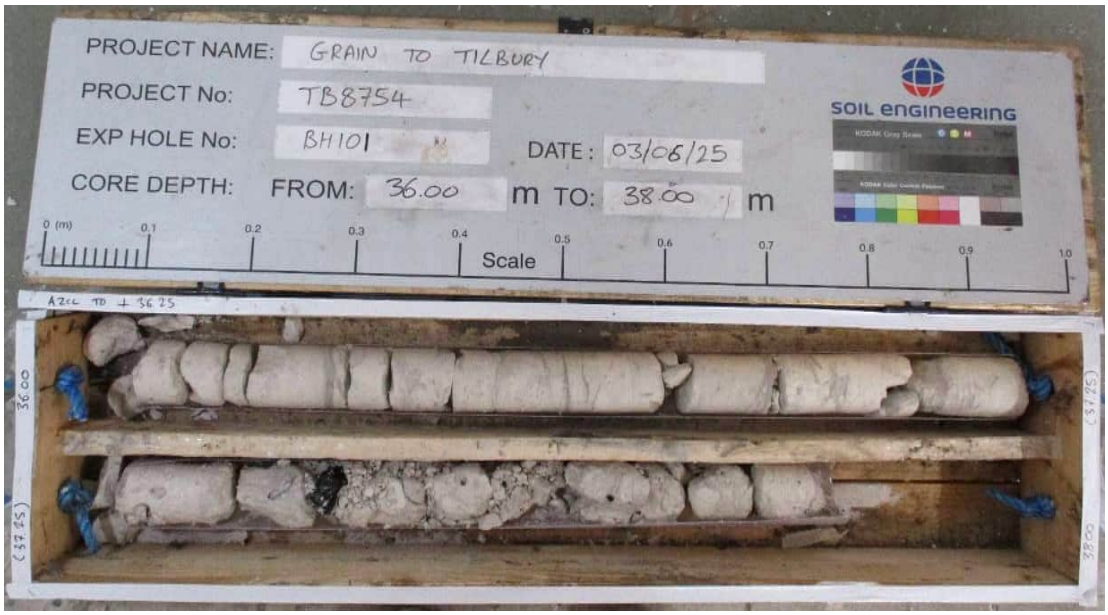
From 32.00m to 34.00m

Photographed by	Date photographed	TB8754_BH101_30.00-32.00
AW	03/06/2025	TB8754_BH101_32.00-34.00

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		03



From 34.00m to 36.00m



From 36.00m to 38.00m

Photographed by	Date photographed	TB8754_BH101_34.00-36.00	SOIL ENGINEERING
AW	03/06/2025	TB8754_BH101_36.00-38.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		04



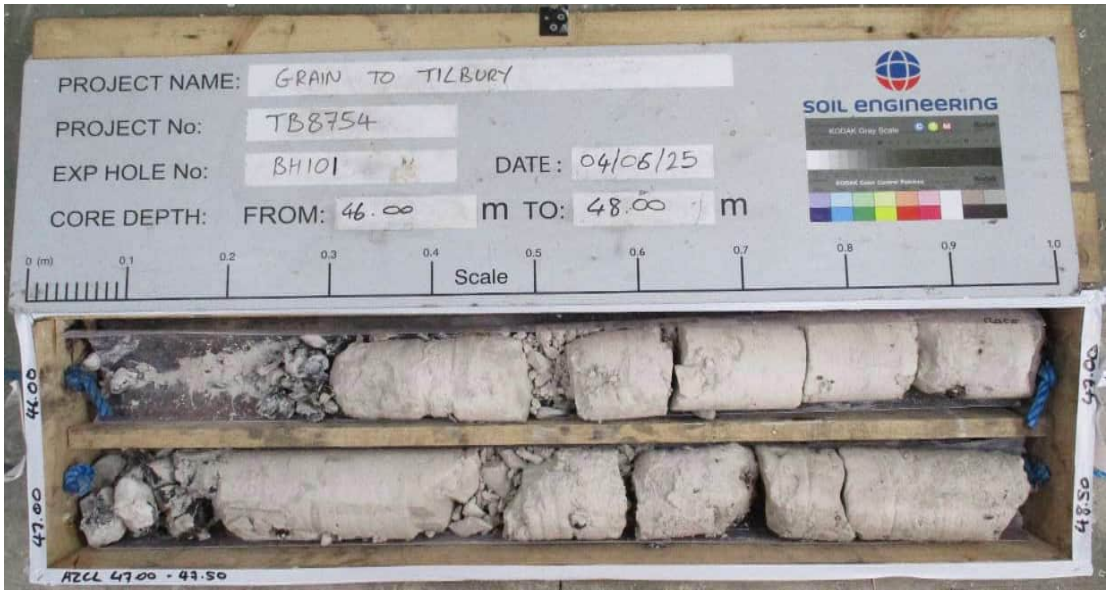
From 38.00m to 40.00m



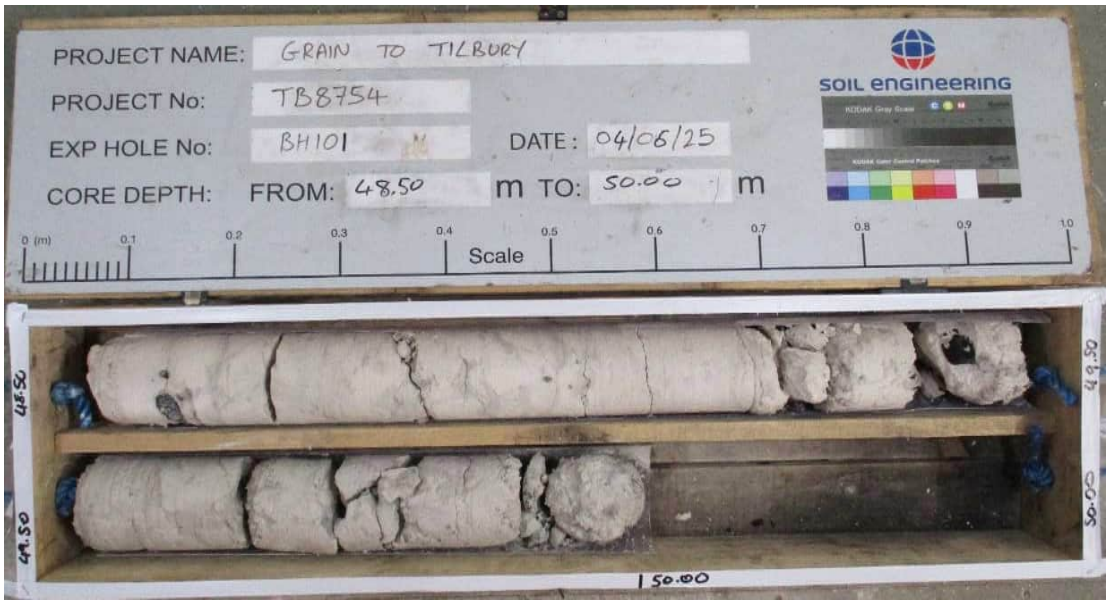
From 42.00m to 44.00m

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Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		05



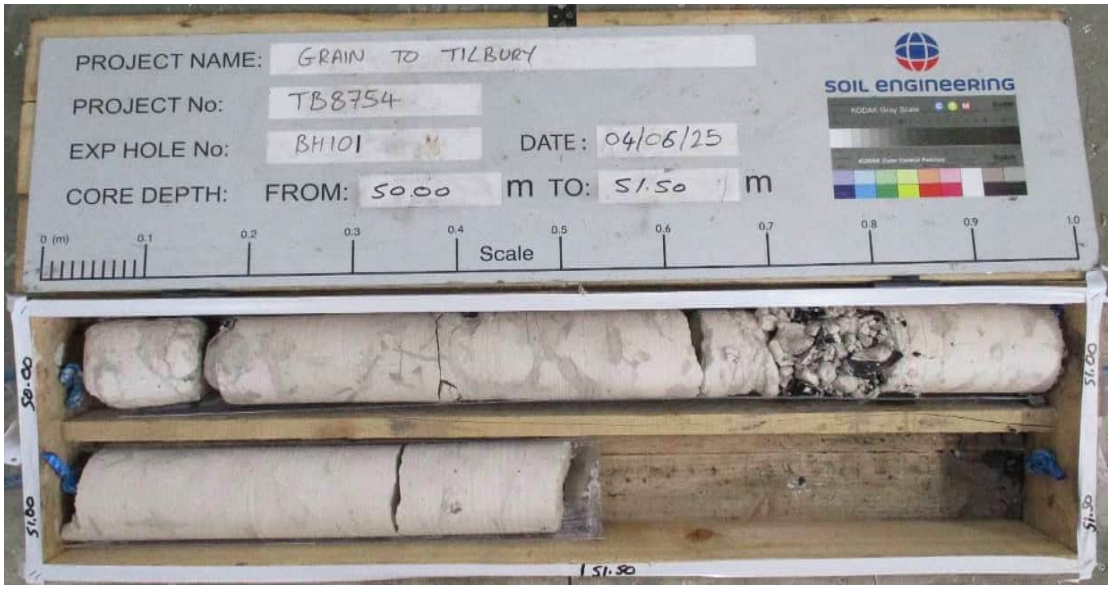
From 46.00m to 48.50m



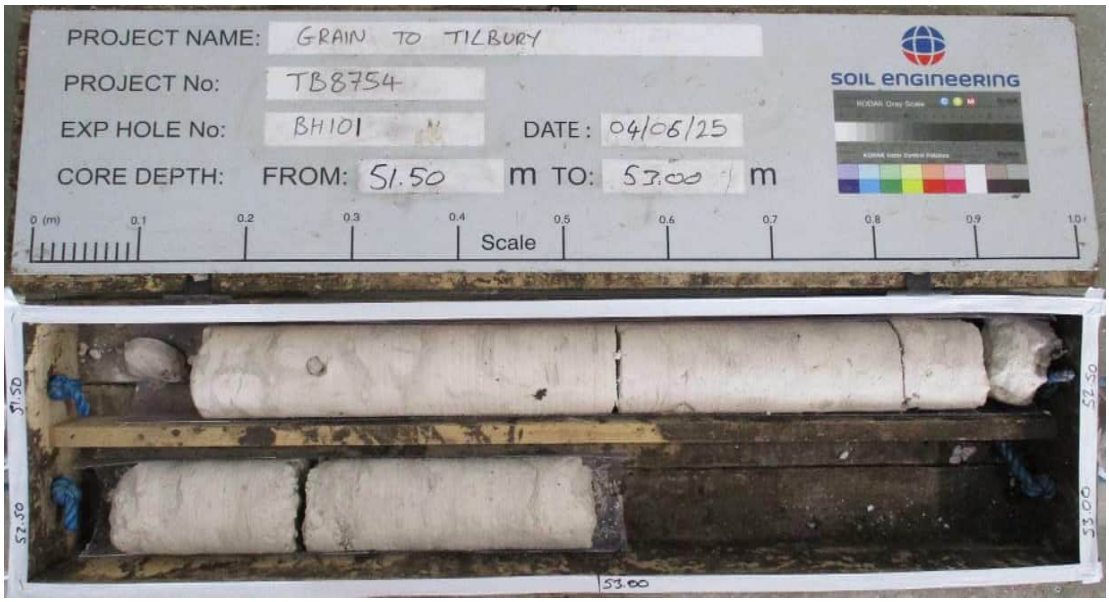
From 48.50m to 50.00m

Photographed by	Date photographed	TB8754_BH101_46.00-48.50	SOIL ENGINEERING
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Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		06



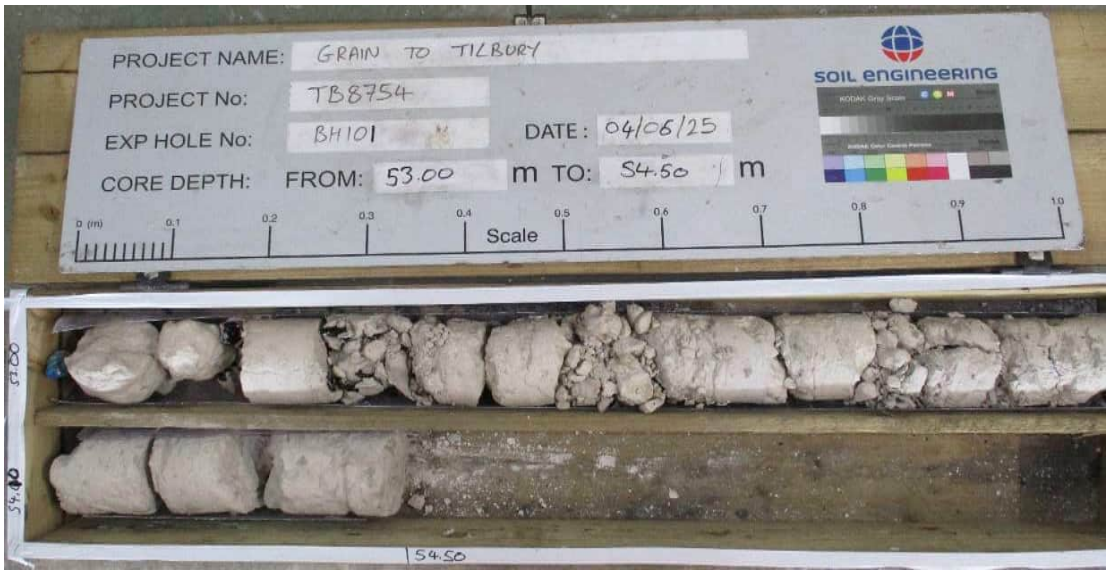
From 50.00m to 51.50m



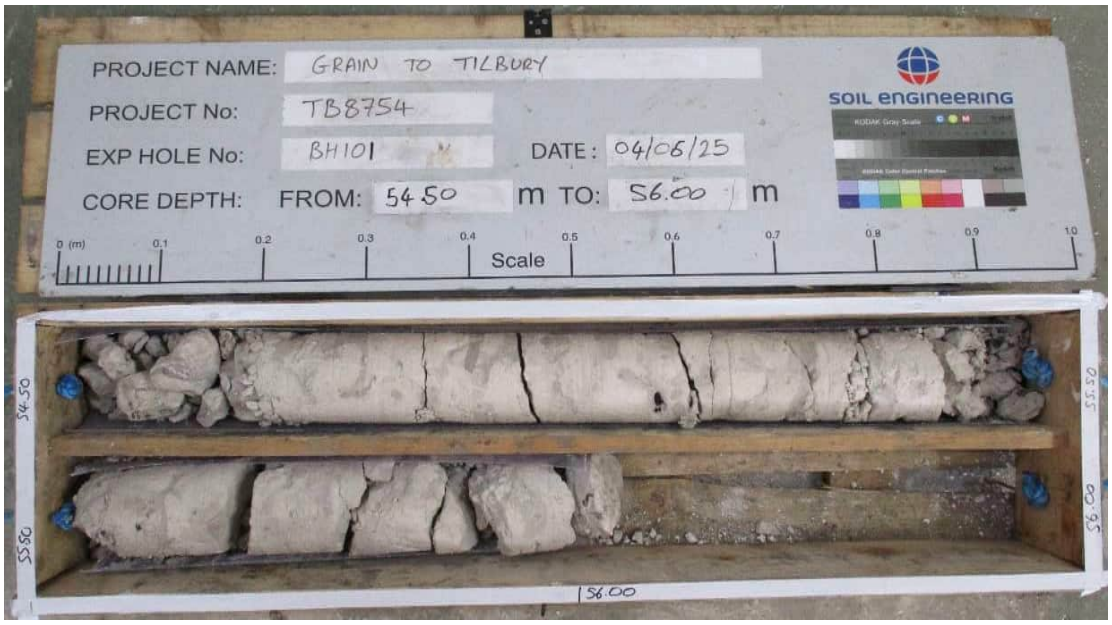
From 51.50m to 53.00m

Photographed by	Date photographed	TB8754_BH101_50.00-51.50	SOIL ENGINEERING
AW	04/06/2025	TB8754_BH101_51.50-53.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		07



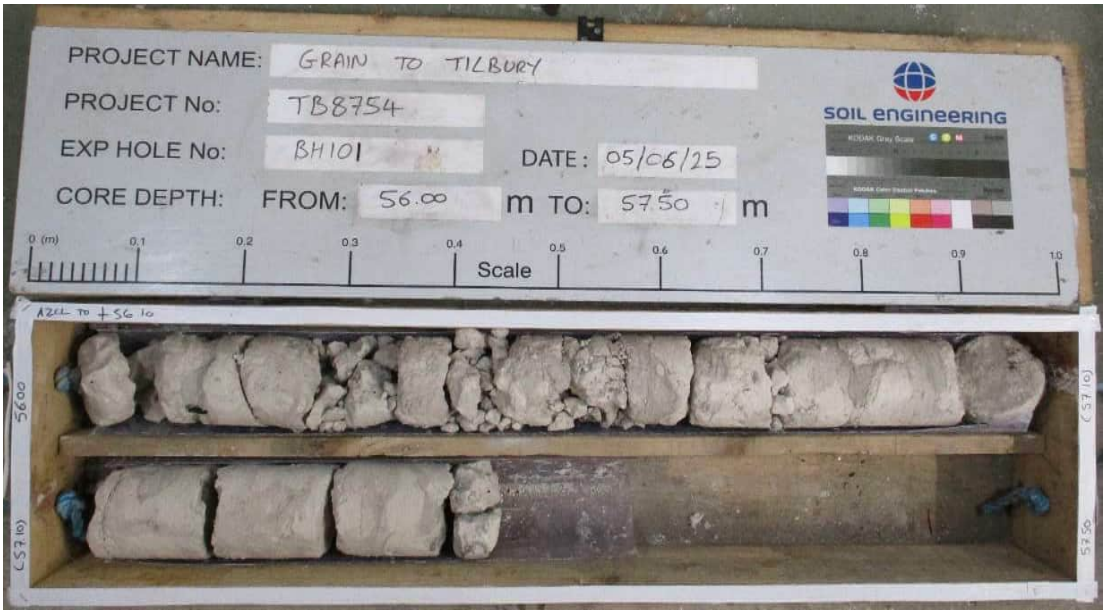
From 53.00m to 54.50m



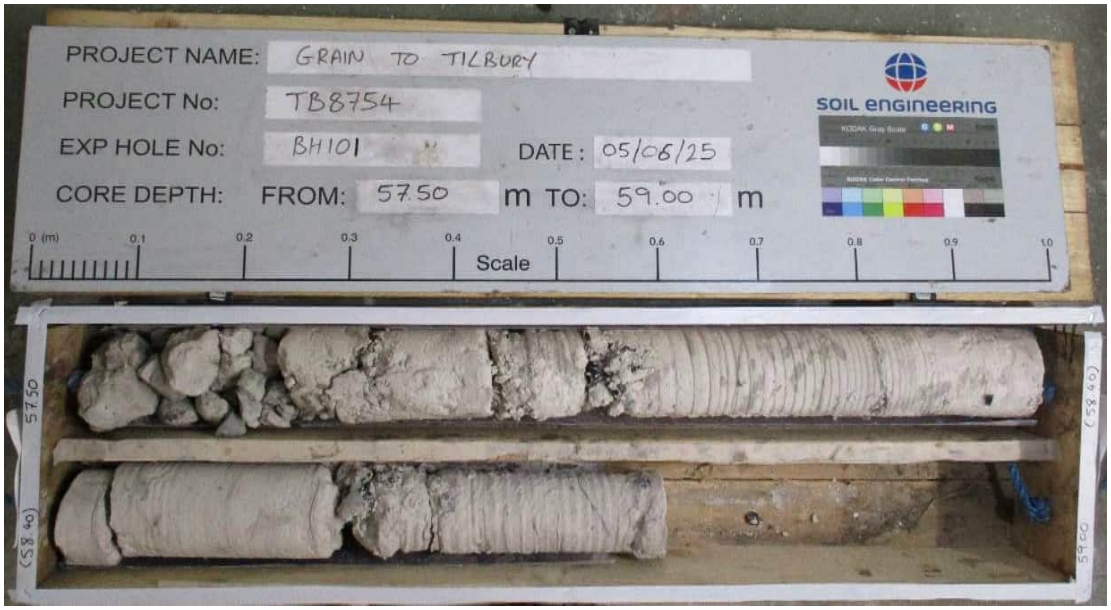
From 54.50m to 56.00m

Photographed by	Date photographed	TB8754_BH101_53.00-54.50	SOIL ENGINEERING
AW	04/06/2025	TB8754_BH101_54.50-56.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		08



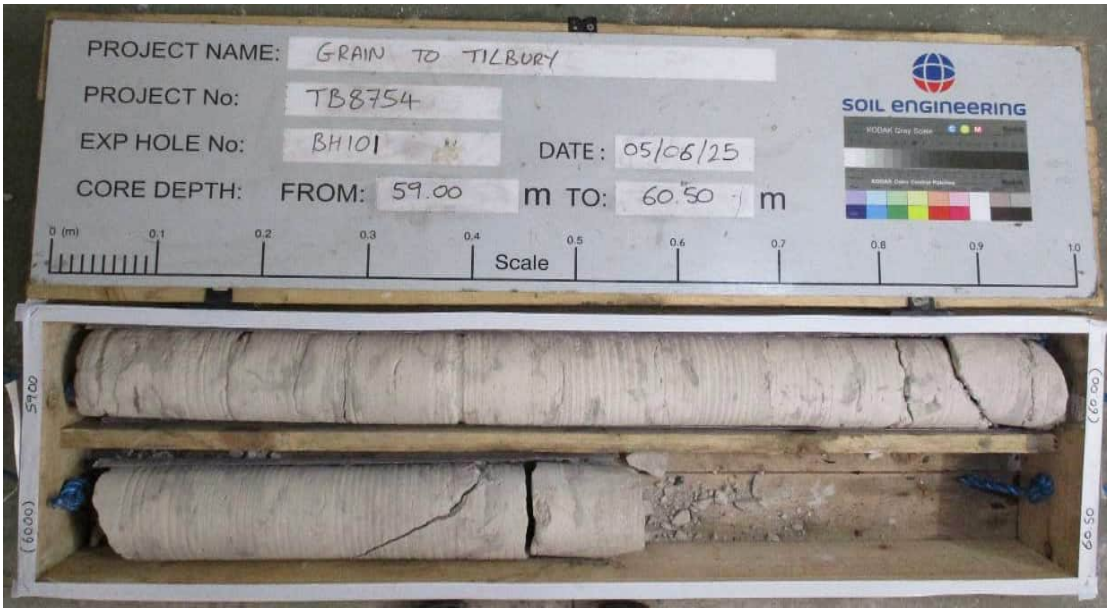
From 56.00m to 57.50m



From 57.50m to 59.00m

Photographed by	Date photographed	TB8754_BH101_56.00-57.50
AW	05/06/2025	TB8754_BH101_57.50-59.00

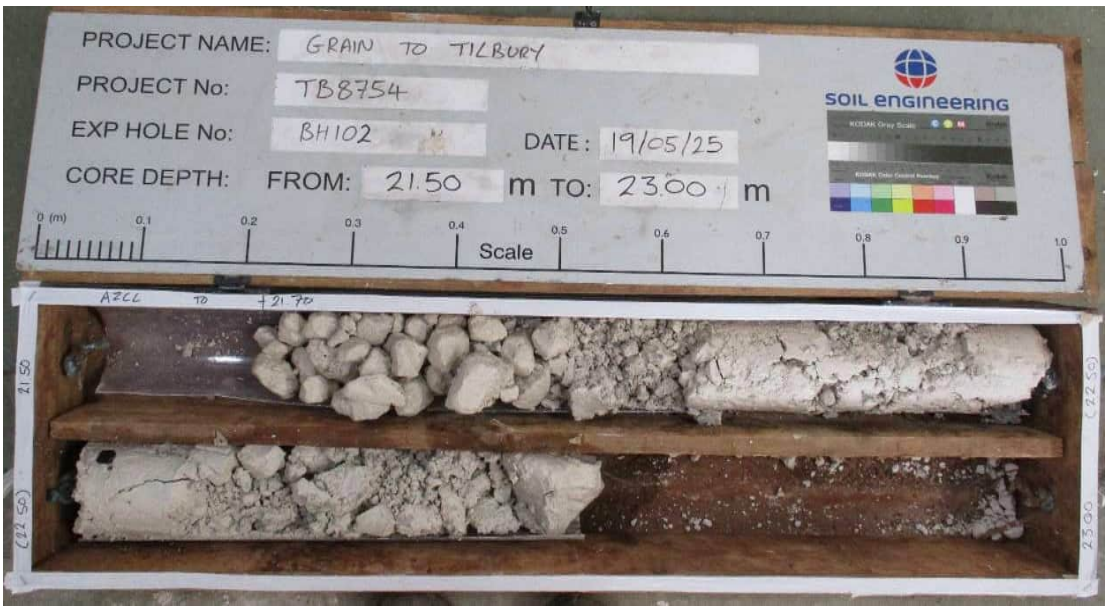
Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		09



From 59.00m to 60.50m

Photographed by	Date photographed	TB8754_BH101_59.00-60.50
AW	05/06/2025	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH102
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		01



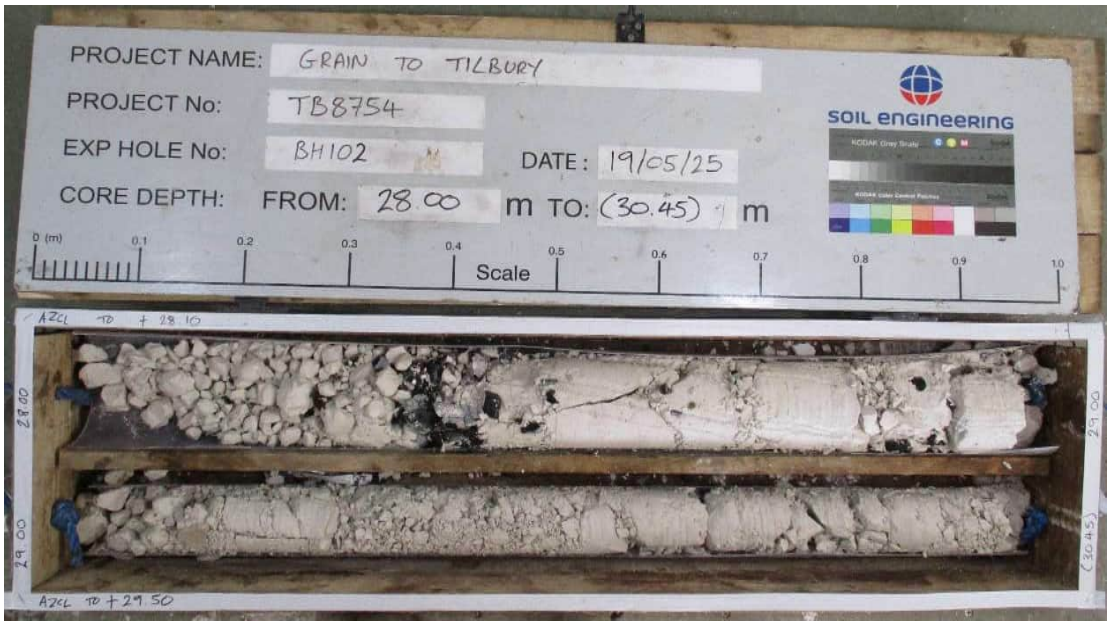
From 21.50m to 23.00m



From 23.00m to 28.00m

Photographed by	Date photographed	TB8754_BH102_21.50-23.00	SOIL ENGINEERING
AW	19/05/2025	TB8754_BH102_23.00-28.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH102
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		02



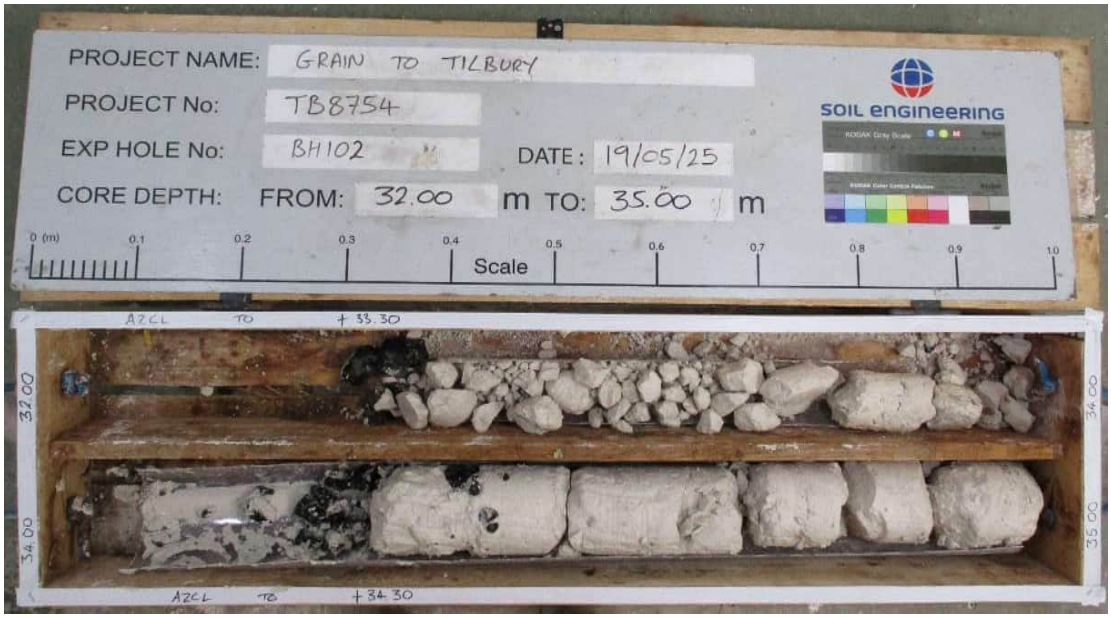
From 28.00m to 30.45m



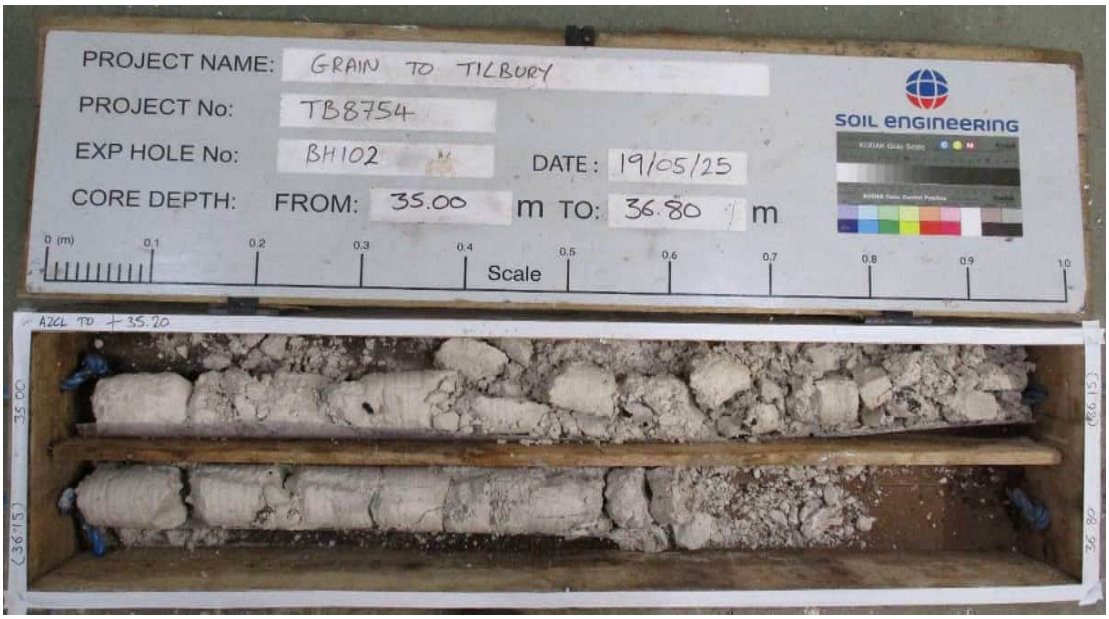
From 30.45m to 32.00m

Photographed by	Date photographed	TB8754_BH102_28.00-30.45
AW	19/05/2025	TB8754_BH102_30.45-32.00

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH102
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		03



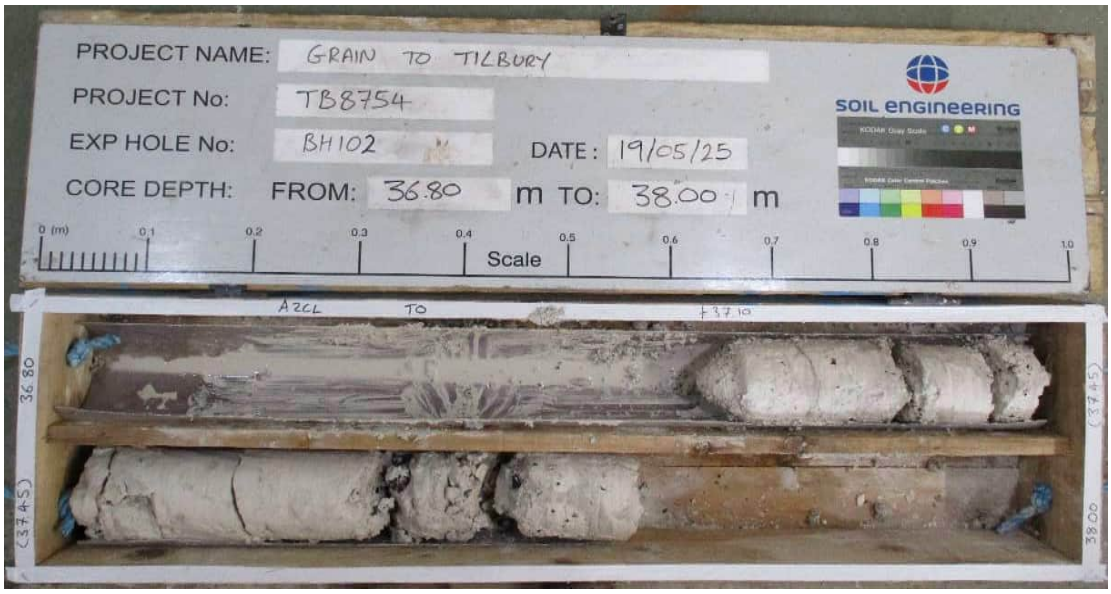
From 32.00m to 35.00m



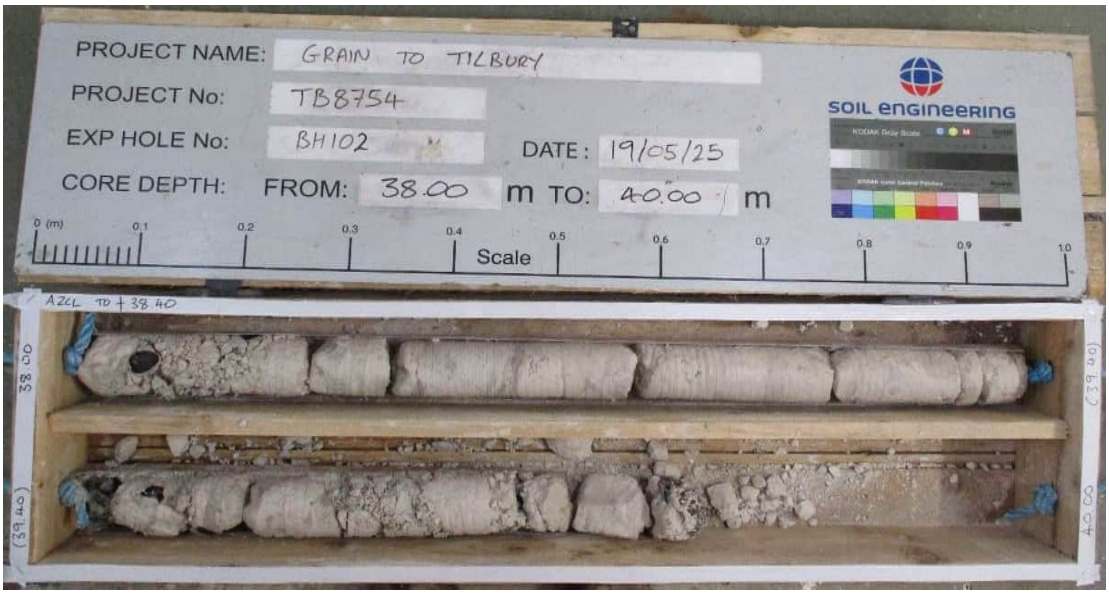
From 35.00m to 36.80m

Photographed by	Date photographed	TB8754_BH102_32.00-35.00
AW	19/05/2025	TB8754_BH102_35.00-36.80

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH102
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		04



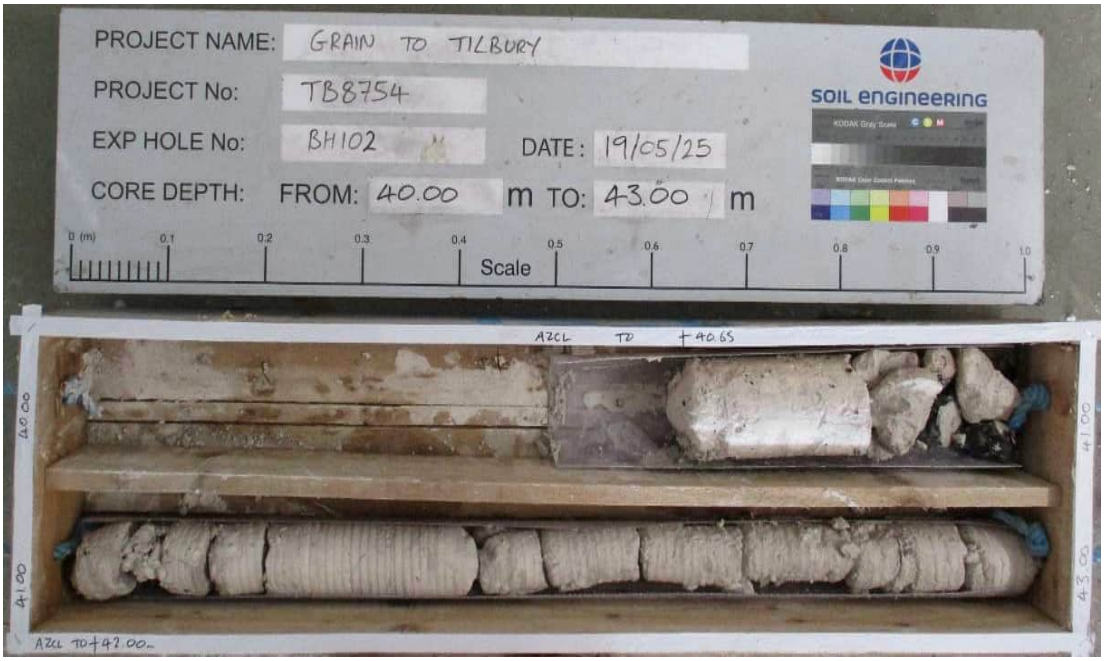
From 36.80m to 38.00m



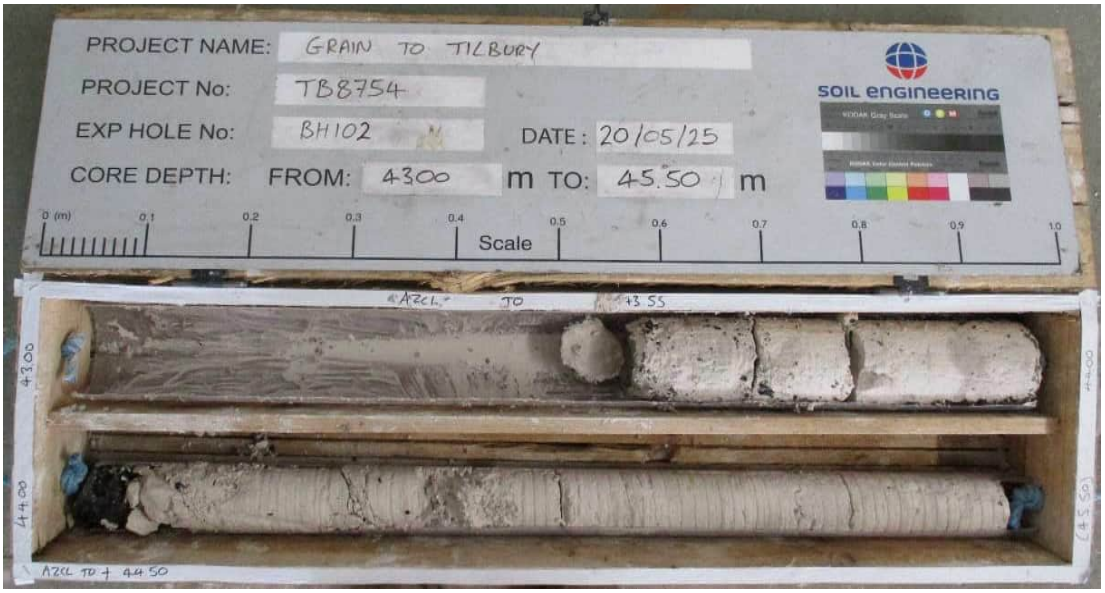
From 38.00m to 40.00m

Photographed by	Date photographed	TB8754_BH102_36.80-38.00
AW	19/05/2025	TB8754_BH102_38.00-40.00

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH102
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		05



From 40.00m to 43.00m



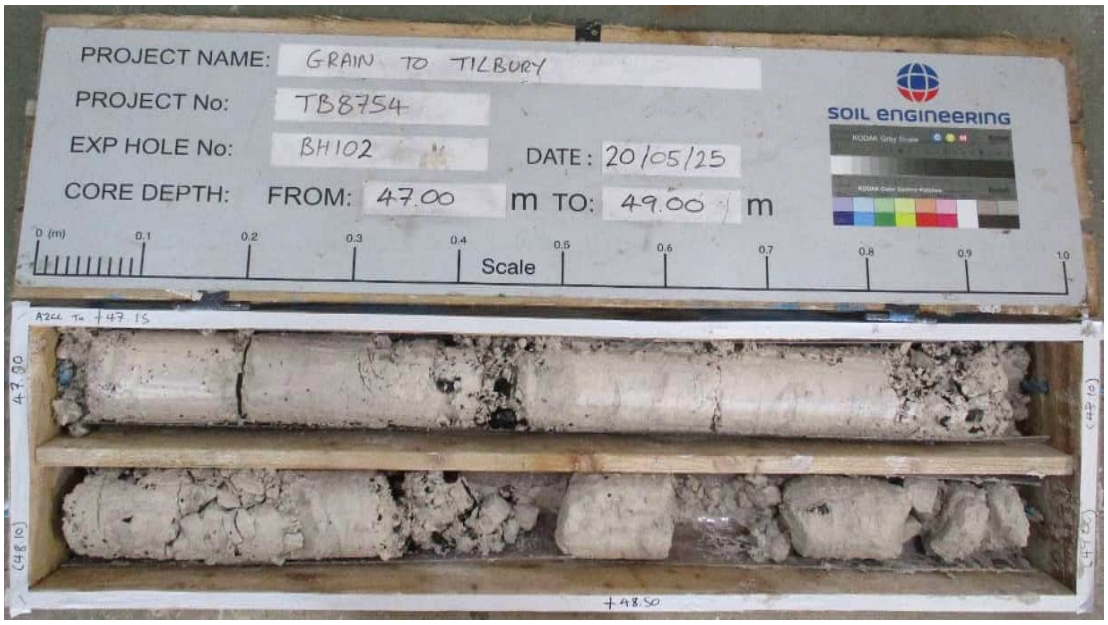
From 43.00m to 45.50m

Photographed by	Date photographed	TB8754_BH102_40.00-43.00	SOIL ENGINEERING
AW	20/05/2025	TB8754_BH102_43.00-45.50	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH102
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		06



From 45.50m to 47.00m



From 47.00m to 49.00m

Photographed by	Date photographed	TB8754_BH102_45.50-47.00
AW	20/05/2025	TB8754_BH102_47.00-49.00

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH102
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		07



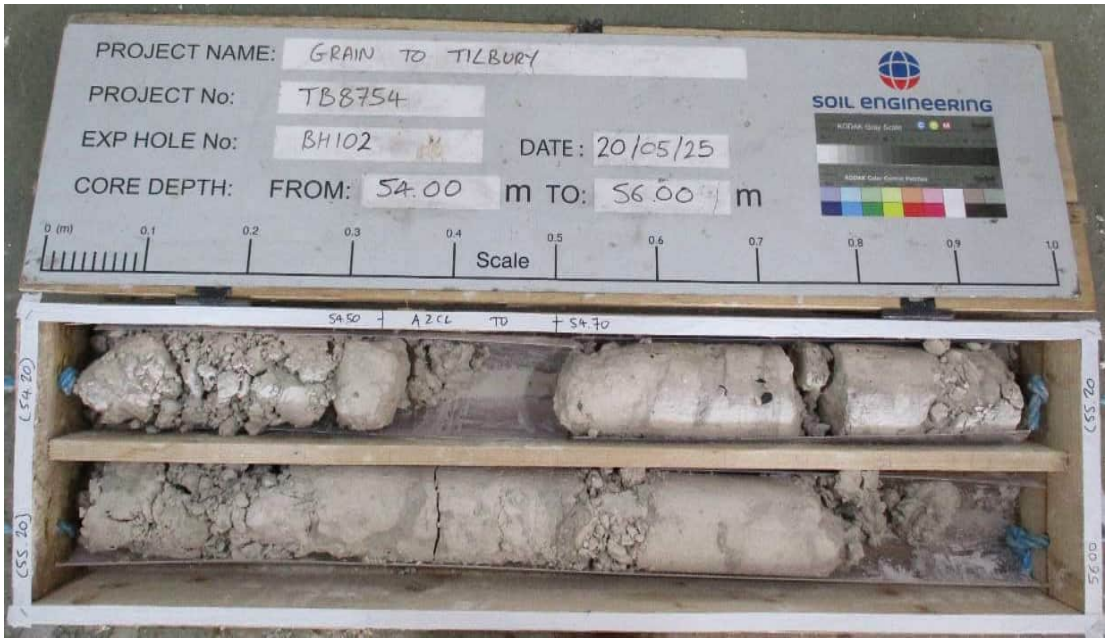
From 49.00m to 52.05m



From 52.05m to 54.00m

Photographed by	Date photographed	TB8754_BH102_49.00-52.05	SOIL ENGINEERING
AW	20/05/2025	TB8754_BH102_52.05-54.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH102
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		08



From 54.00m to 56.00m



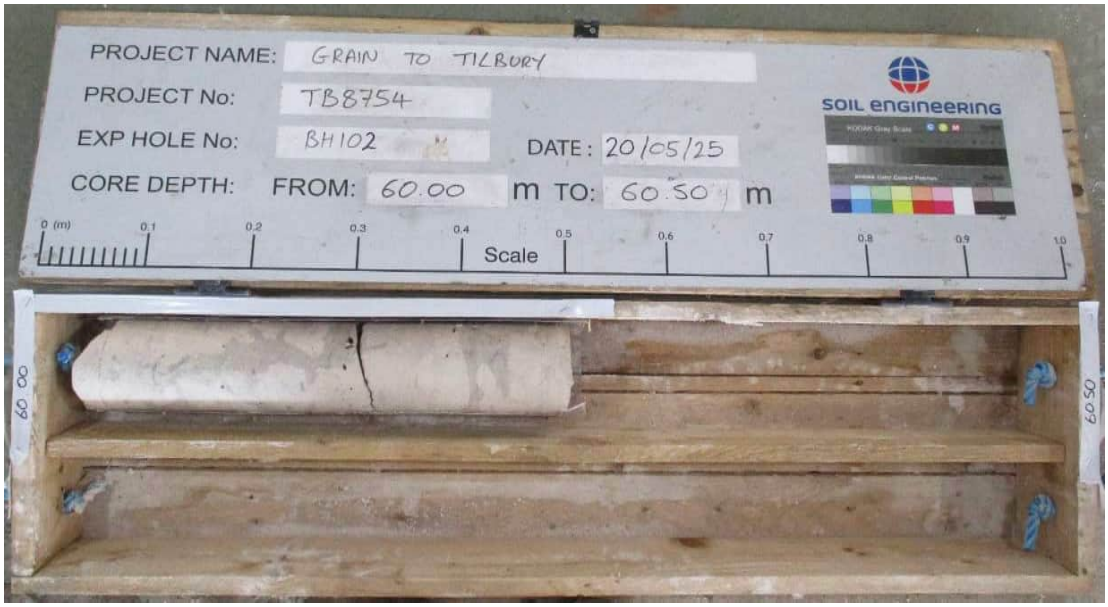
From 56.00m to 58.00m

Photographed by	Date photographed	TB8754_BH102_54.00-56.00	SOIL ENGINEERING
AW	20/05/2025	TB8754_BH102_56.00-58.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH102
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		09



From 58.00m to 60.00m

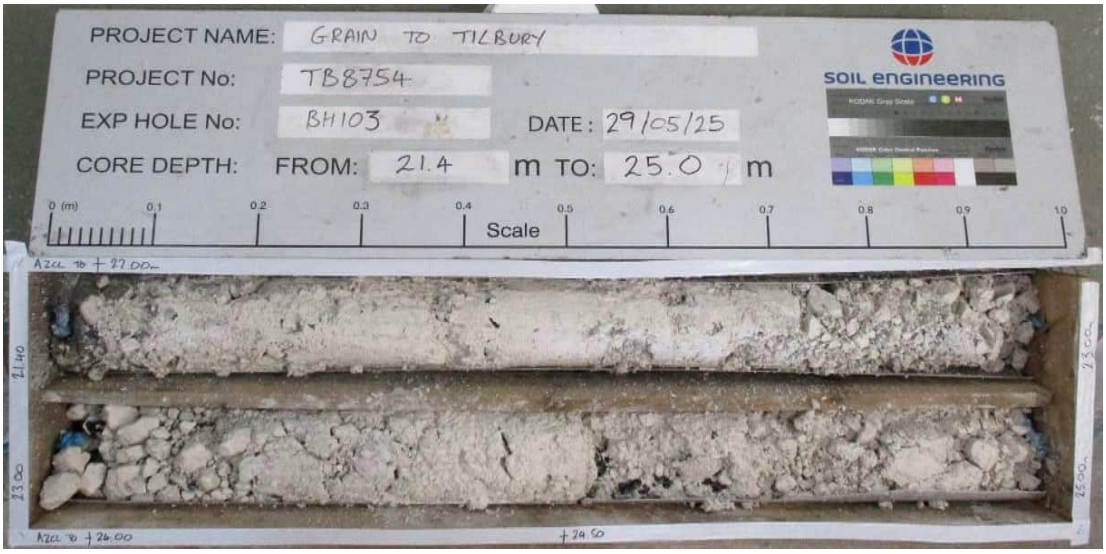


From 60.00m to 60.50m

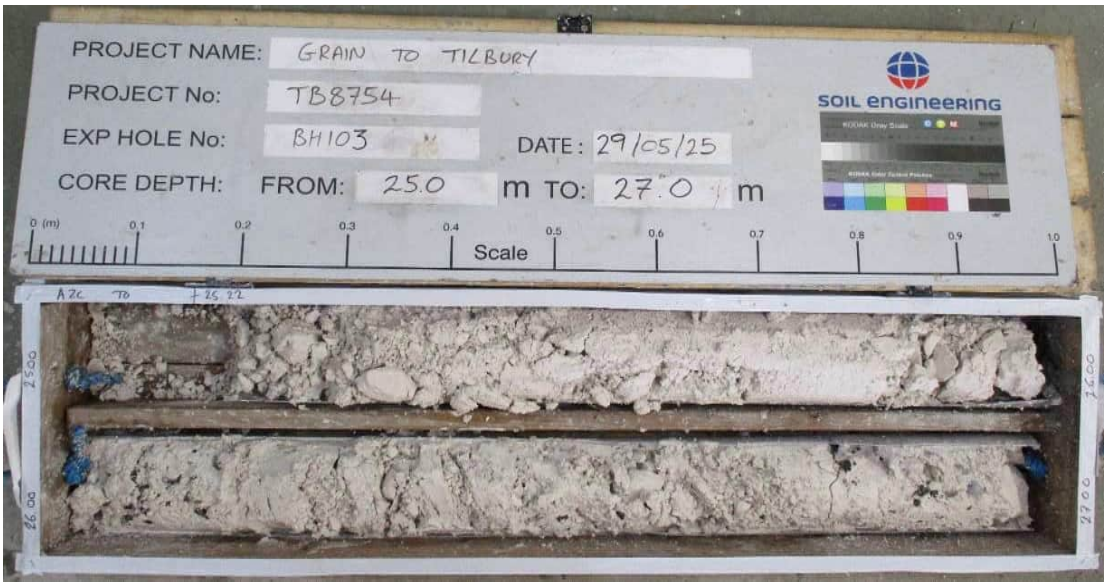
Photographed by	Date photographed	TB8754_BH102_58.00-60.00
AW	20/05/2025	TB8754_BH102_60.00-60.50

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		01



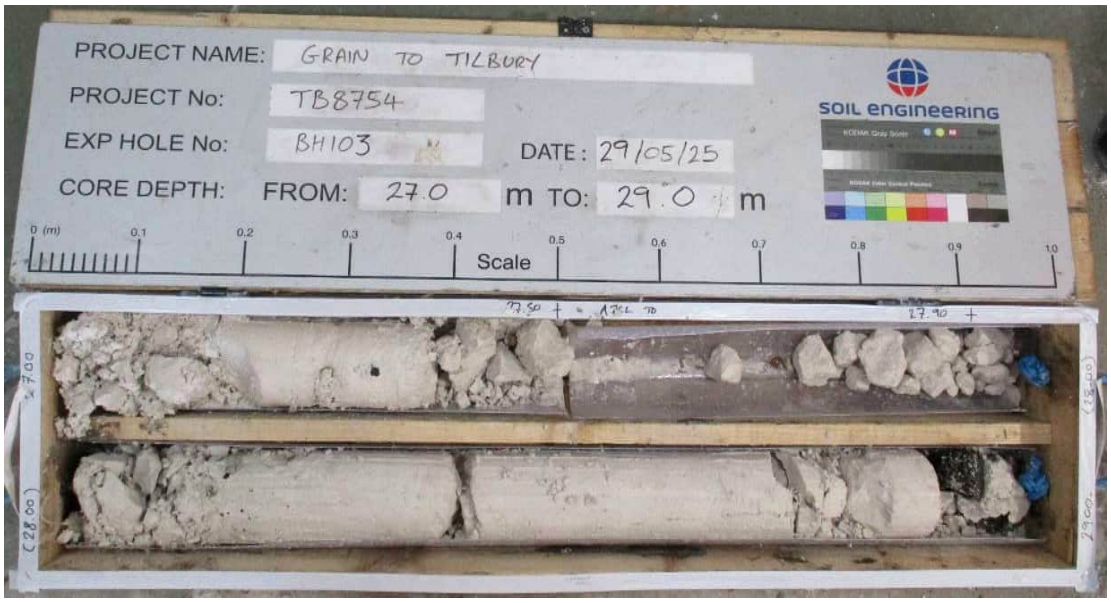
From 21.40m to 25.00m



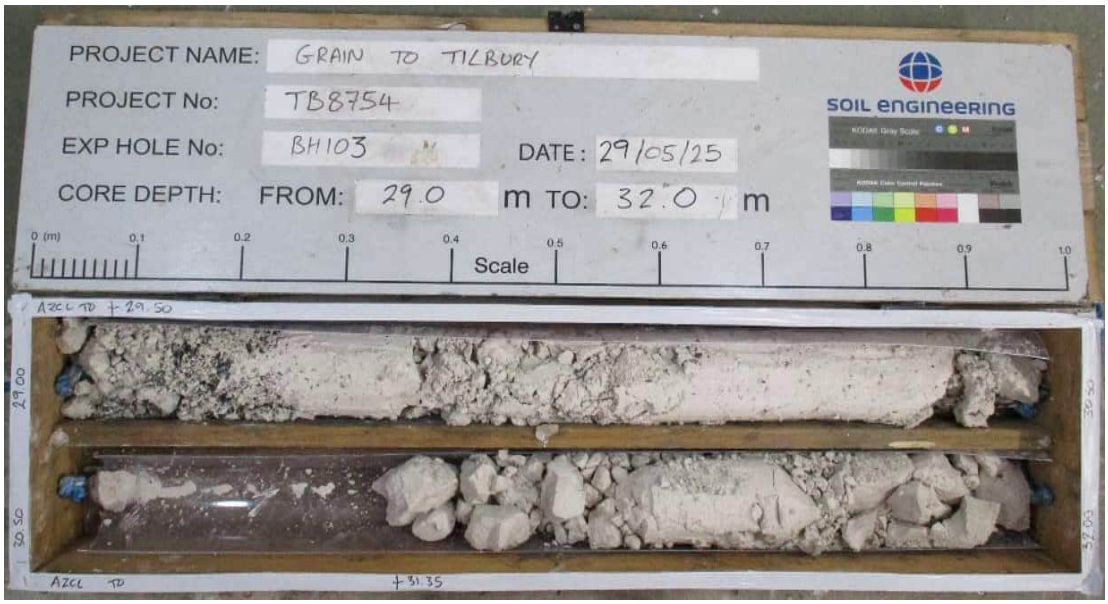
From 25.00m to 27.00m

Photographed by	Date photographed	TB8754_BH103_21.40-25.00	SOIL ENGINEERING
AW	29/05/2025	TB8754_BH103_25.00-27.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		02



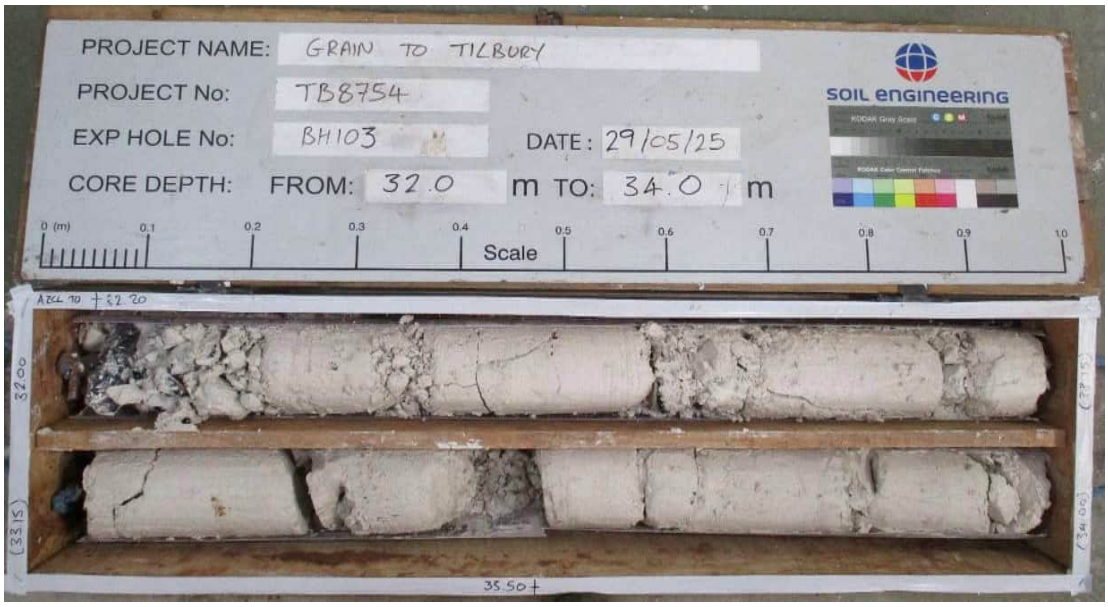
From 27.00m to 29.00m



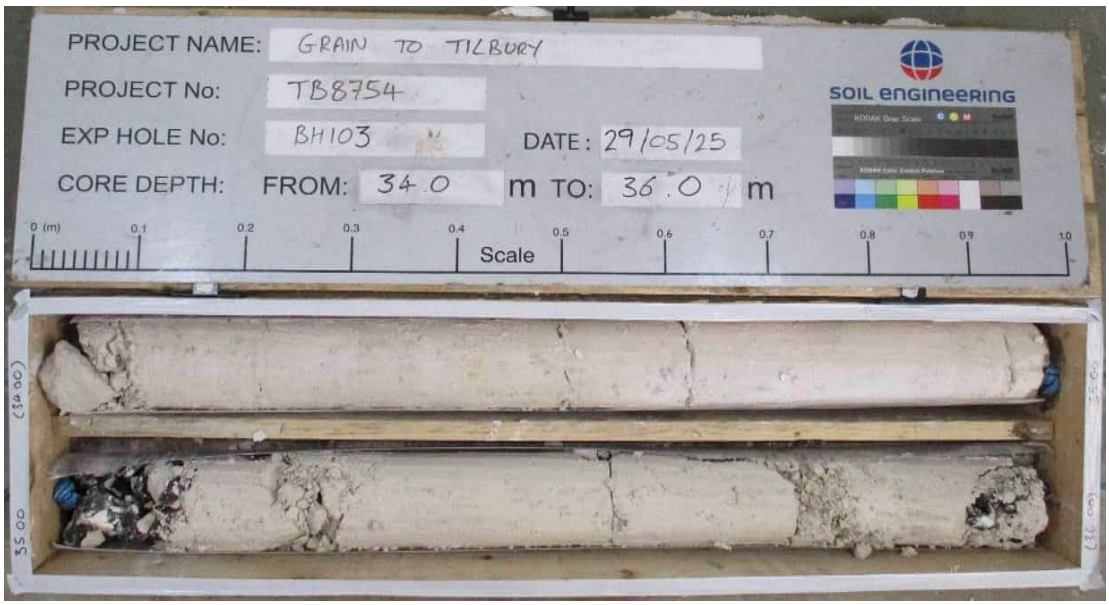
From 29.00m to 32.00m

Photographed by	Date photographed	TB8754_BH103_27.00-29.00	SOIL ENGINEERING
AW	29/05/2025	TB8754_BH103_29.00-32.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		03



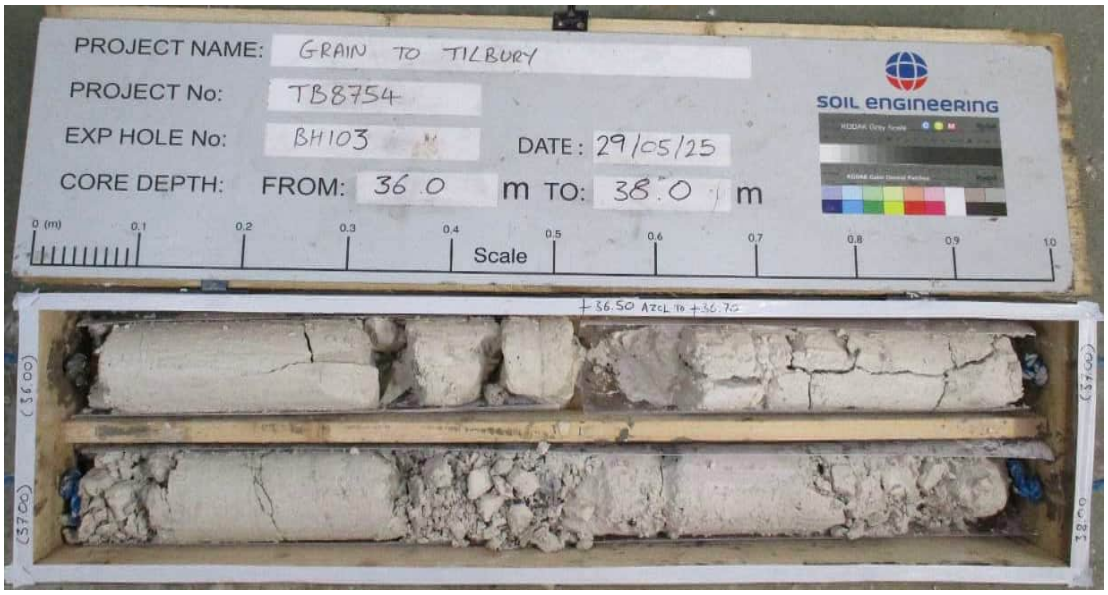
From 32.00m to 34.00m



From 34.00m to 36.00m

Photographed by	Date photographed	TB8754_BH103_32.00-34.00
AW	29/05/2025	TB8754_BH103_34.00-36.00

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		04



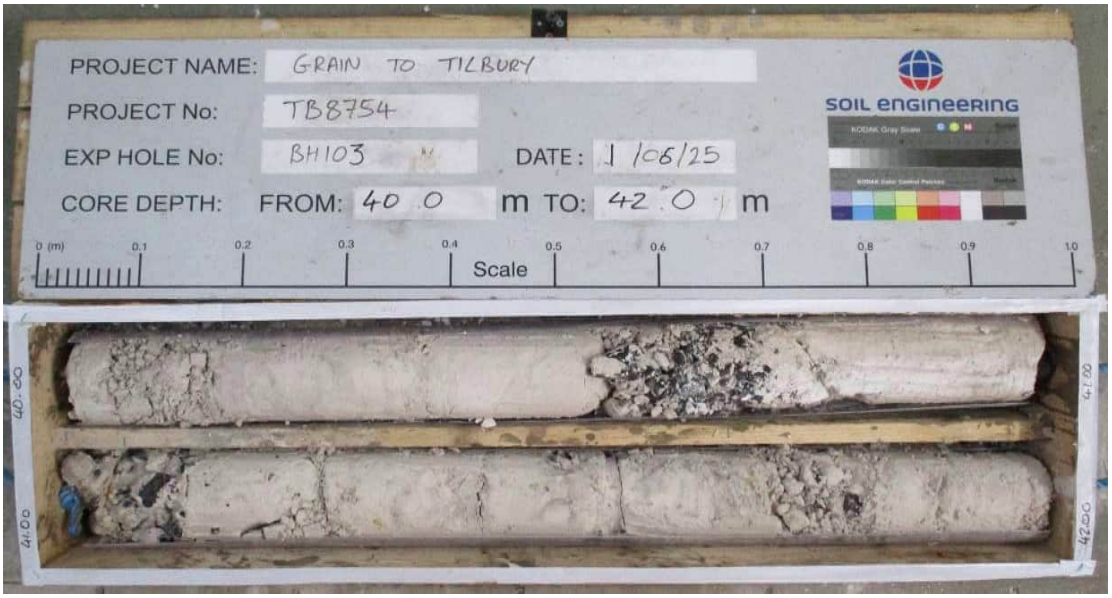
From 36.00m to 38.00m



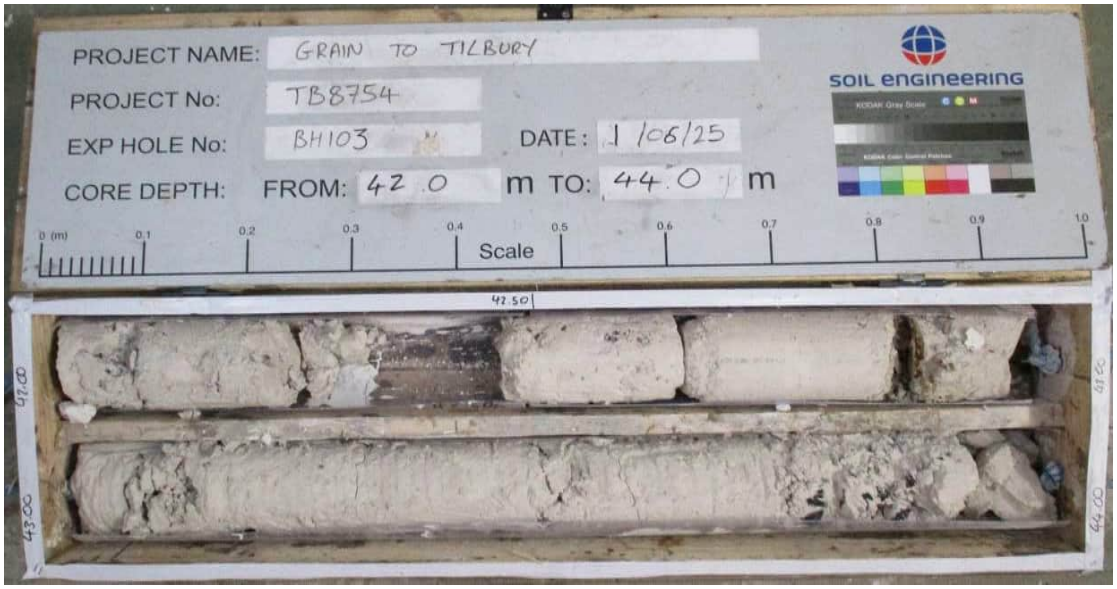
From 38.00m to 40.00m

Photographed by	Date photographed	TB8754_BH103_36.00-38.00	
AW	01/06/2025	TB8754_BH103_38.00-40.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		05



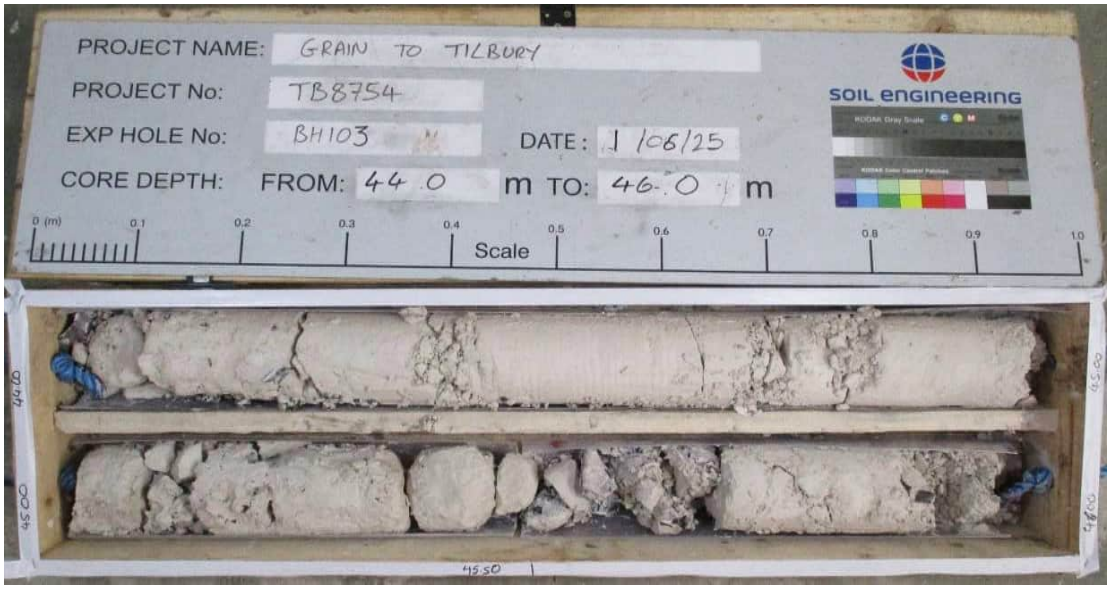
From 40.00m to 42.00m



From 42.00m to 44.00m

Photographed by	Date photographed	TB8754_BH103_40.00-42.00	
AW	01/06/2025	TB8754_BH103_42.00-44.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		06



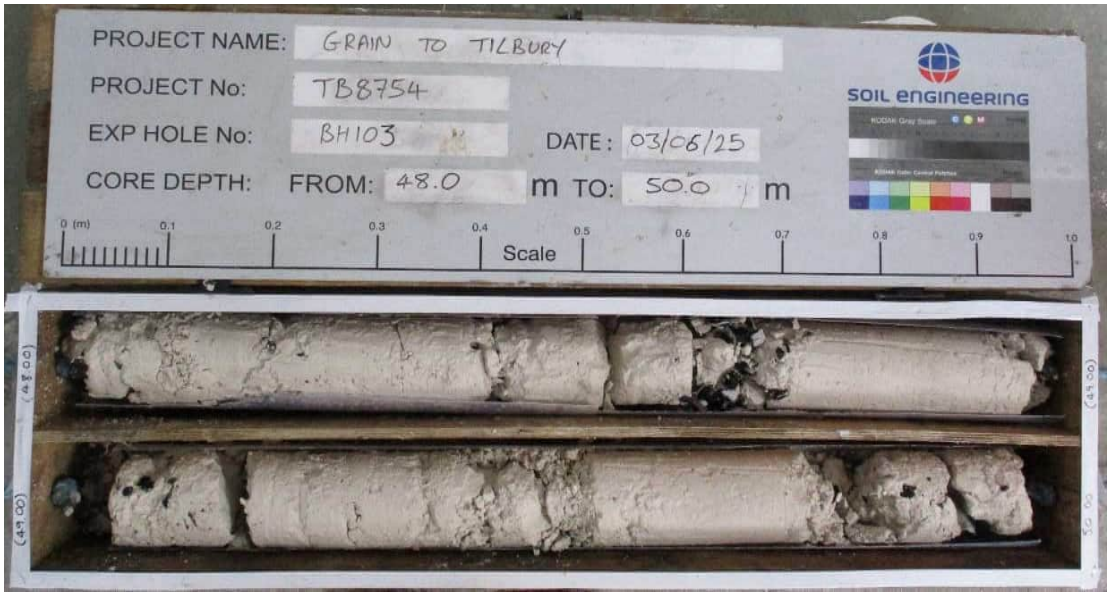
From 44.00m to 46.00m



From 46.00m to 48.00m

Photographed by	Date photographed	TB8754_BH103_44.00-46.00	
AW	01/06/2025	TB8754_BH103_46.00-48.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		07

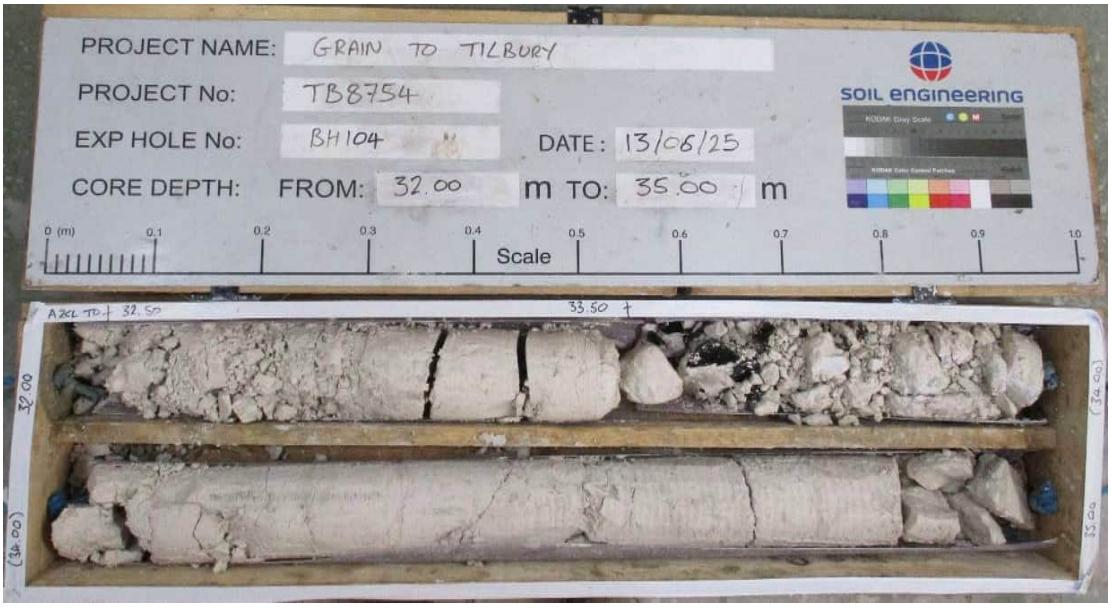


From 48.00m to 50.00m

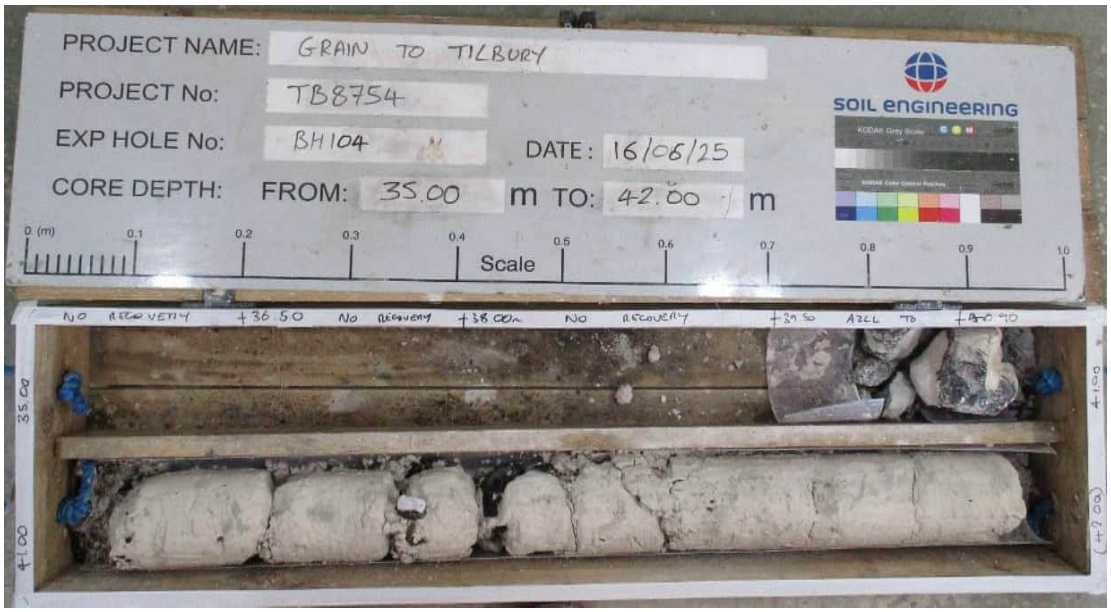
Photographed by	Date photographed	TB8754_BH103_48.00-50.00
AW	03/06/2025	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH104
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		02



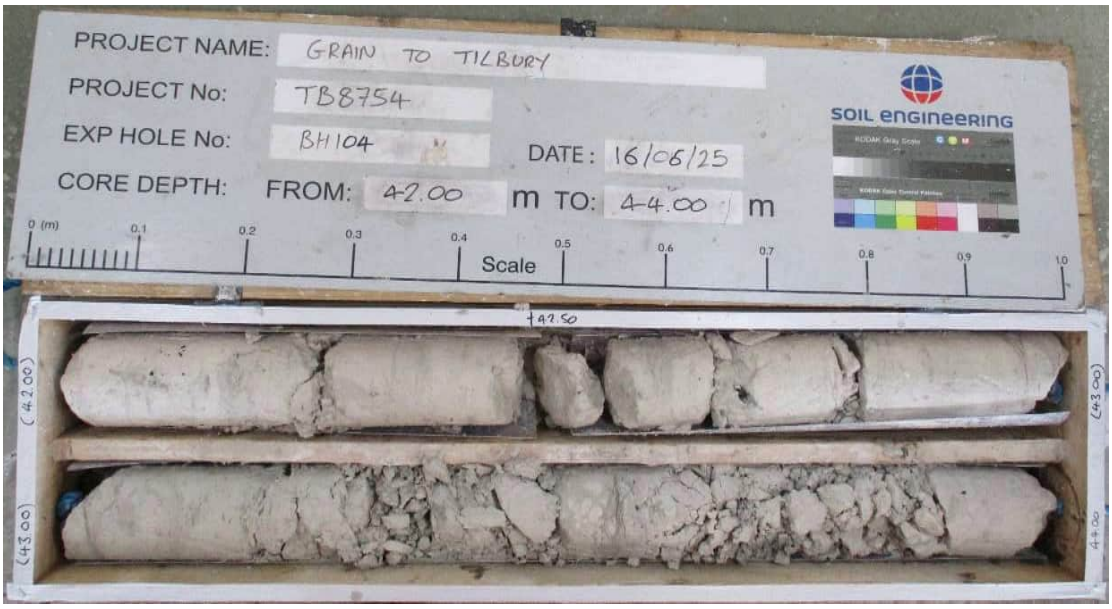
From 32.00m to 35.00m



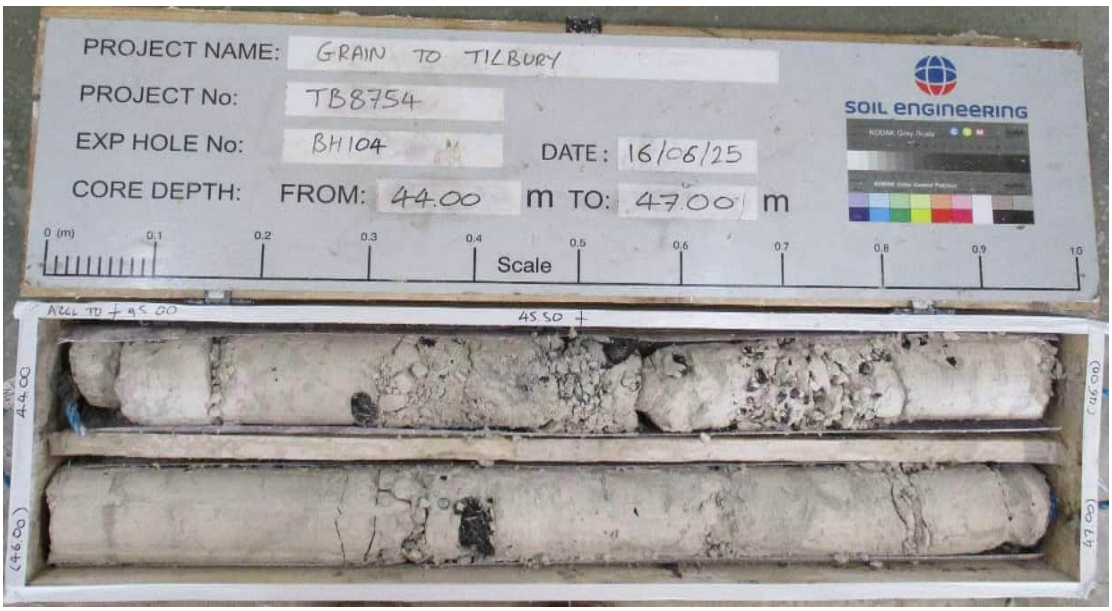
From 35.00m to 42.00m

Photographed by	Date photographed	TB8754_BH104_32.00-35.00	SOIL ENGINEERING
AW	16/06/2025	TB8754_BH104_35.00-42.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH104
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		03



From 42.00m to 44.00m



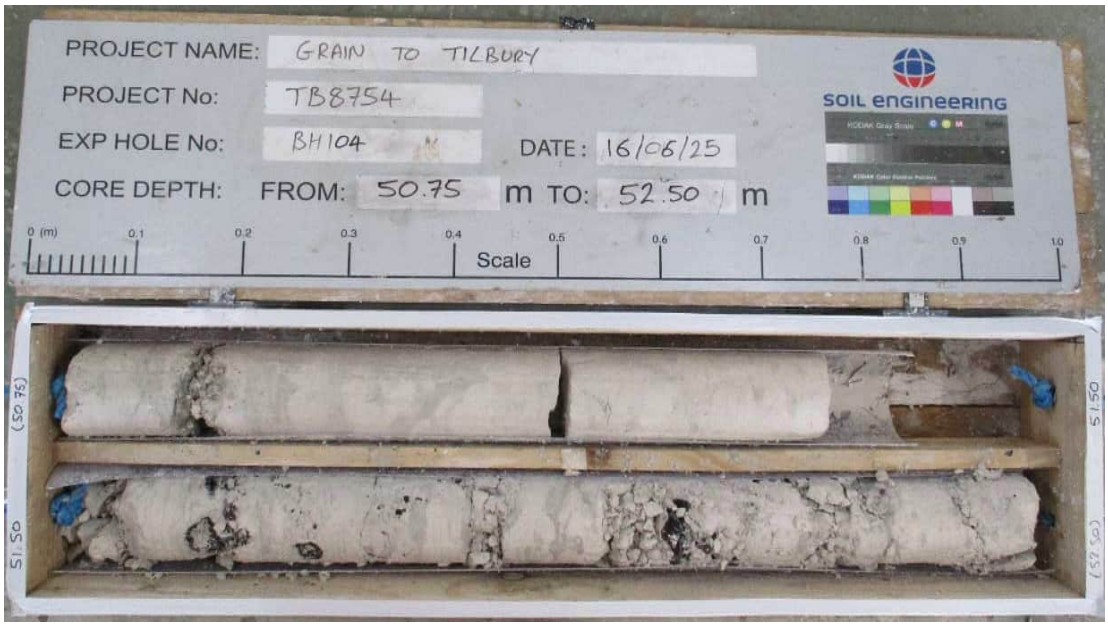
From 44.00m to 47.00m

Photographed by	Date photographed	TB8754_BH104_42.00-44.00
AW	16/06/2025	TB8754_BH104_44.00-47.00

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH104
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		04



From 47.00m to 50.75m

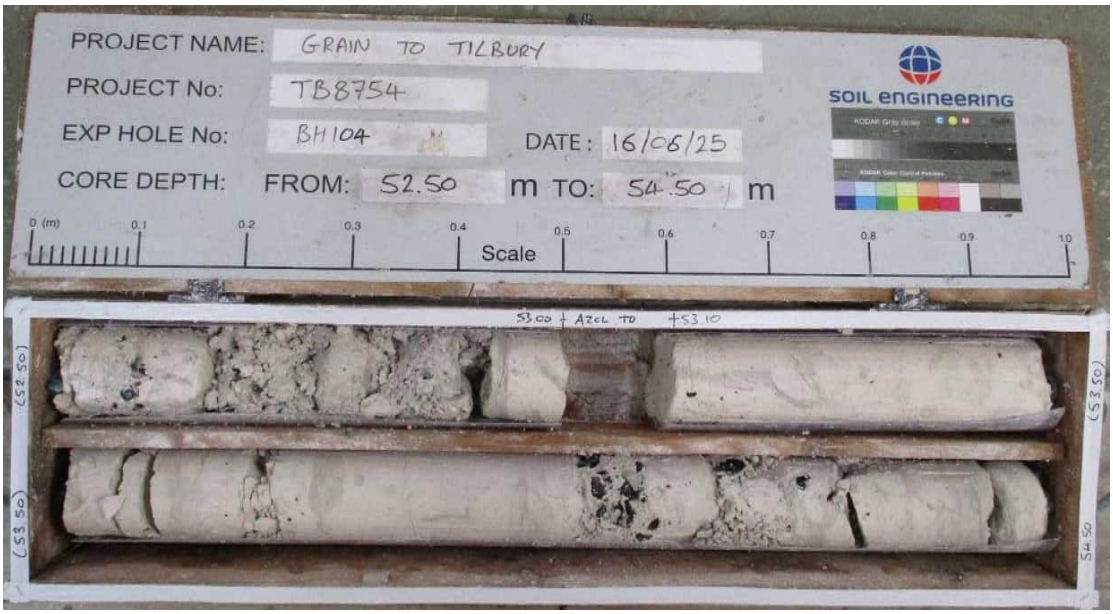


From 50.75m to 52.50m

Photographed by	Date photographed	TB8754_BH104_47.00-50.75
AW	16/06/2025	TB8754_BH104_50.75-52.50

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH104
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		05



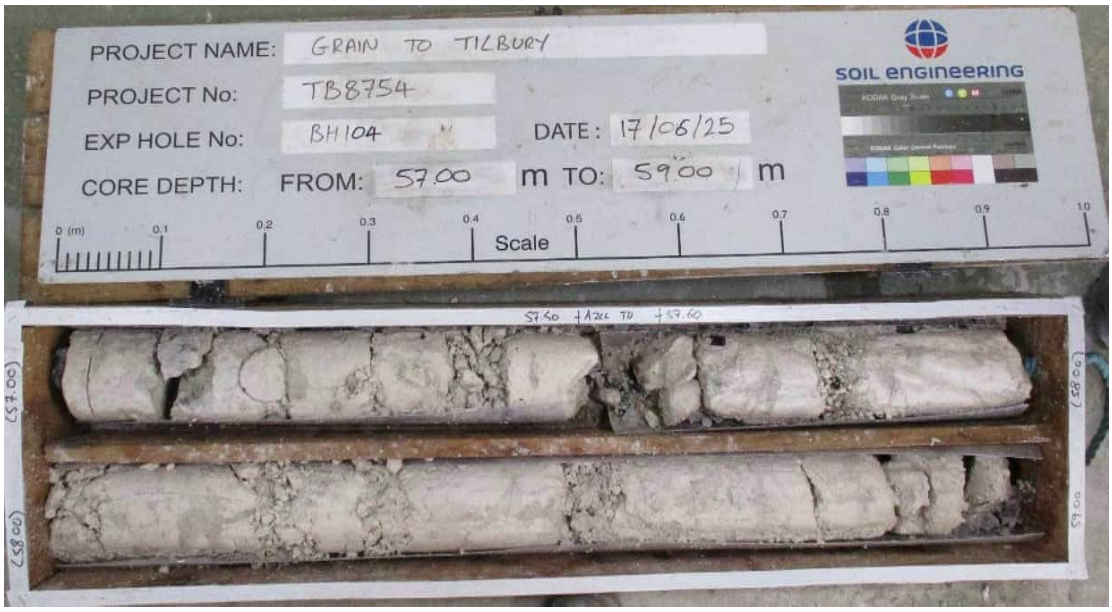
From 52.50m to 54.50m



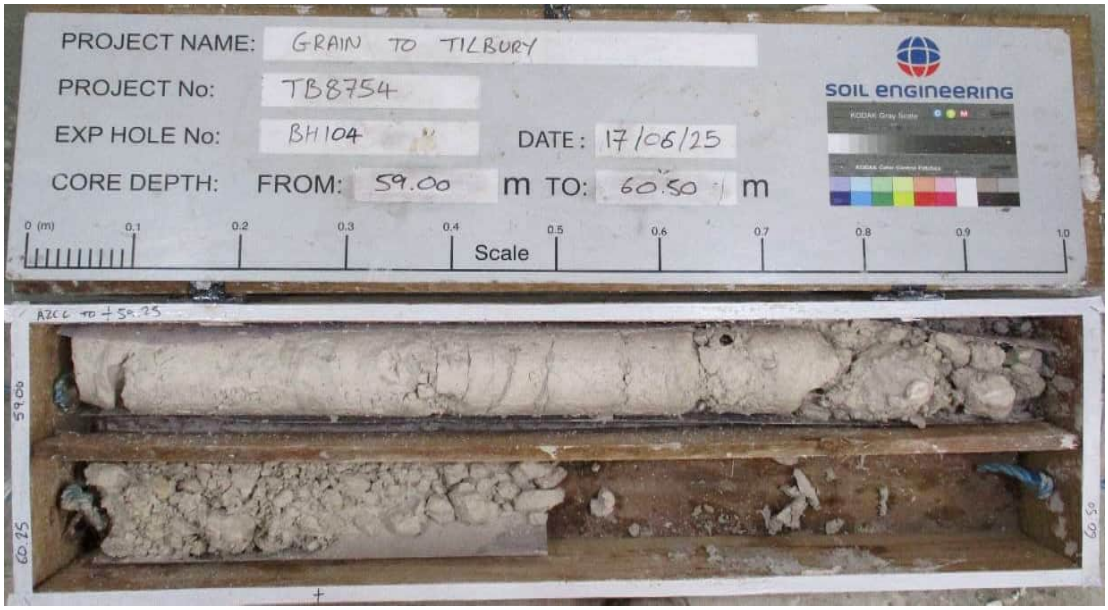
From 54.50m to 57.00m

Photographed by	Date photographed	TB8754_BH104_52.50-54.50	SOIL ENGINEERING
AW	16/06/2025	TB8754_BH104_54.50-57.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH104
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		06



From 57.00m to 59.00m



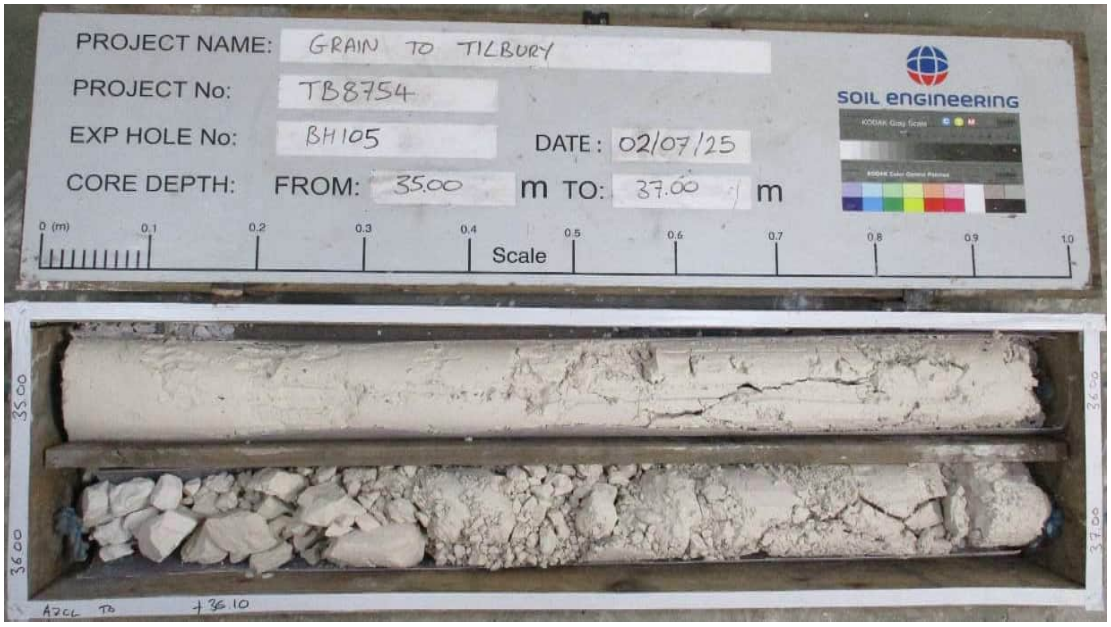
From 59.00m to 60.50m

Photographed by	Date photographed	TB8754_BH104_57.00-59.00	SOIL ENGINEERING
AW	17/06/2025	TB8754_BH104_59.00-60.50	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH105
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		01



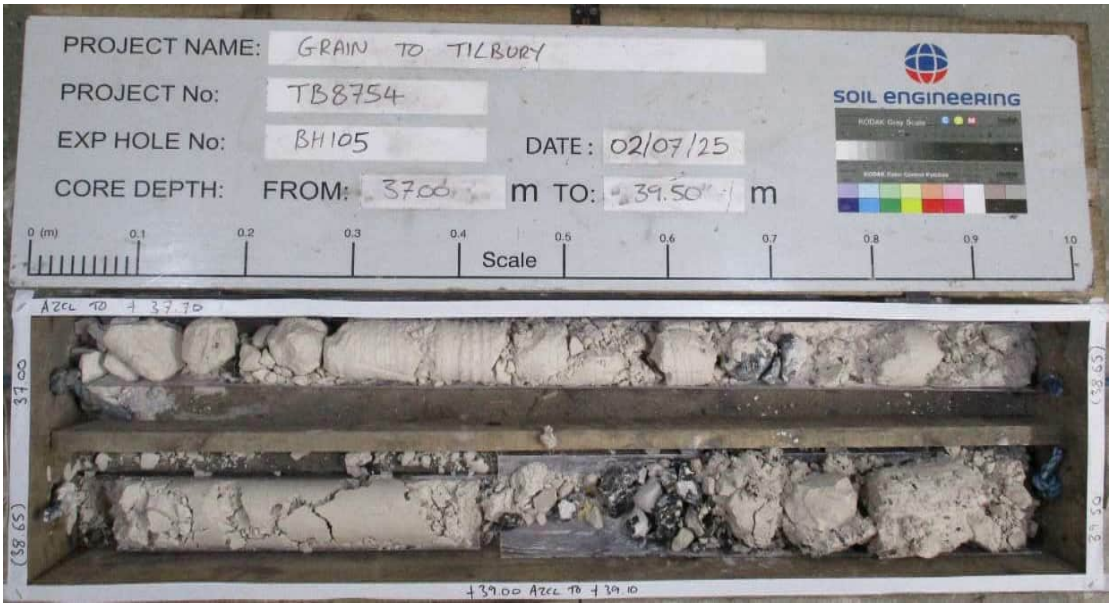
From 28.50m to 35.00m



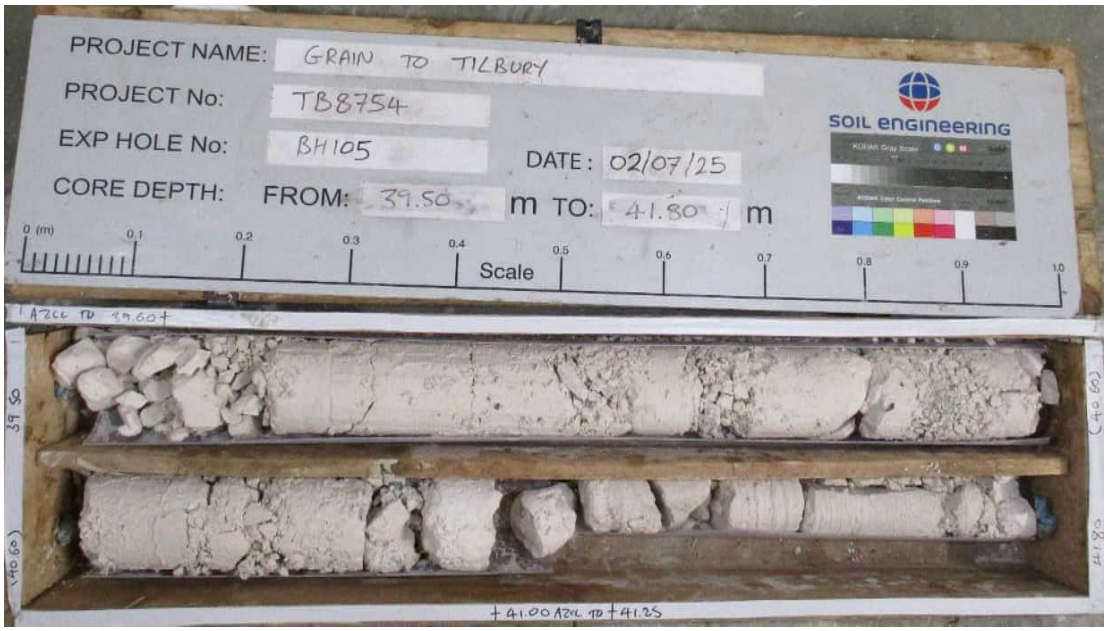
From 35.00m to 37.00m

Photographed by	Date photographed	TB8754_BH105_28.50-35.00
AW	02/07/2025	TB8754_BH105_35.00-37.00

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH105
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		02



From 37.00m to 39.00m



Photographed by	Date photographed	TB8754_BH105_37.00-39.50	
AW	02/07/2025	TB8754_BH105_39.50-41.80	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH105
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		03



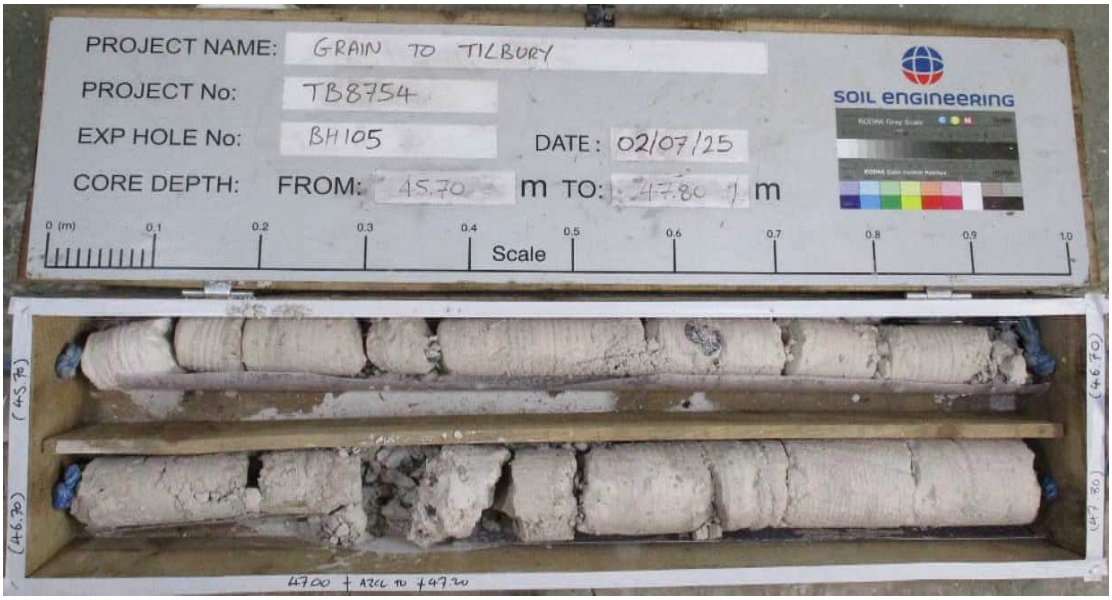
From 41.80m to 43.50m



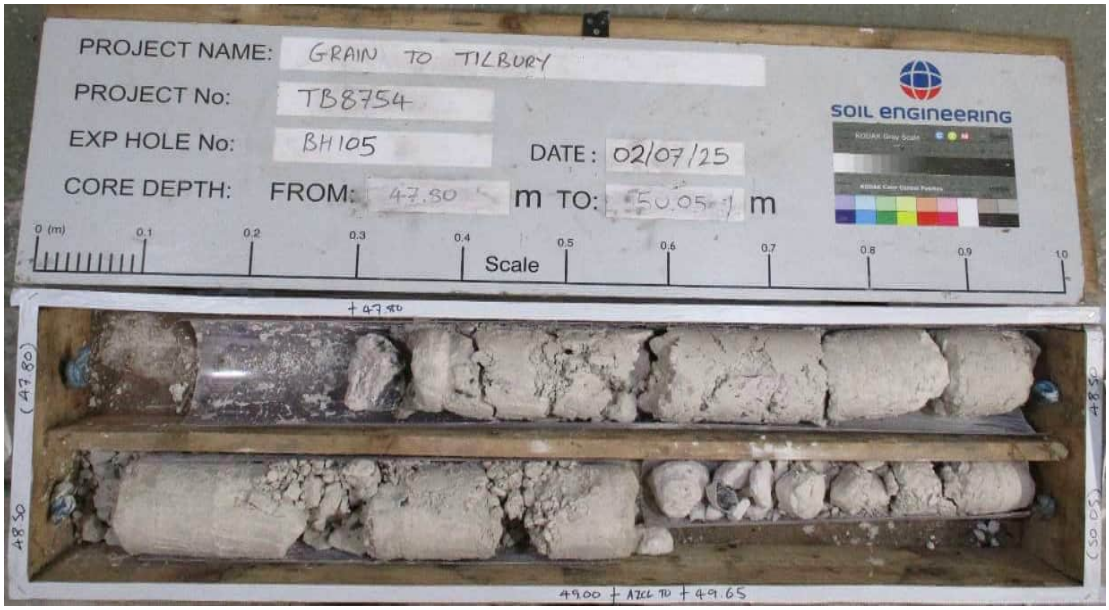
From 43.50m to 45.70m

Photographed by	Date photographed	TB8754_BH105_41.80-43.50
AW	02/07/2025	TB8754_BH105_43.50-45.70

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH105
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		04



From 45.70m to 47.80m

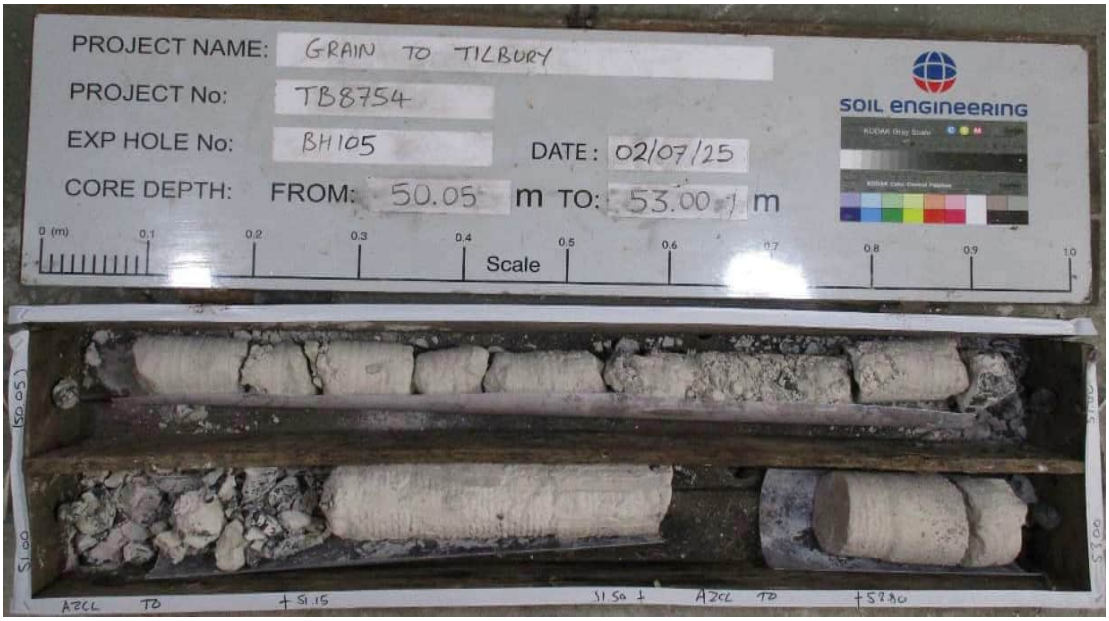


From 47.80m to 50.05m

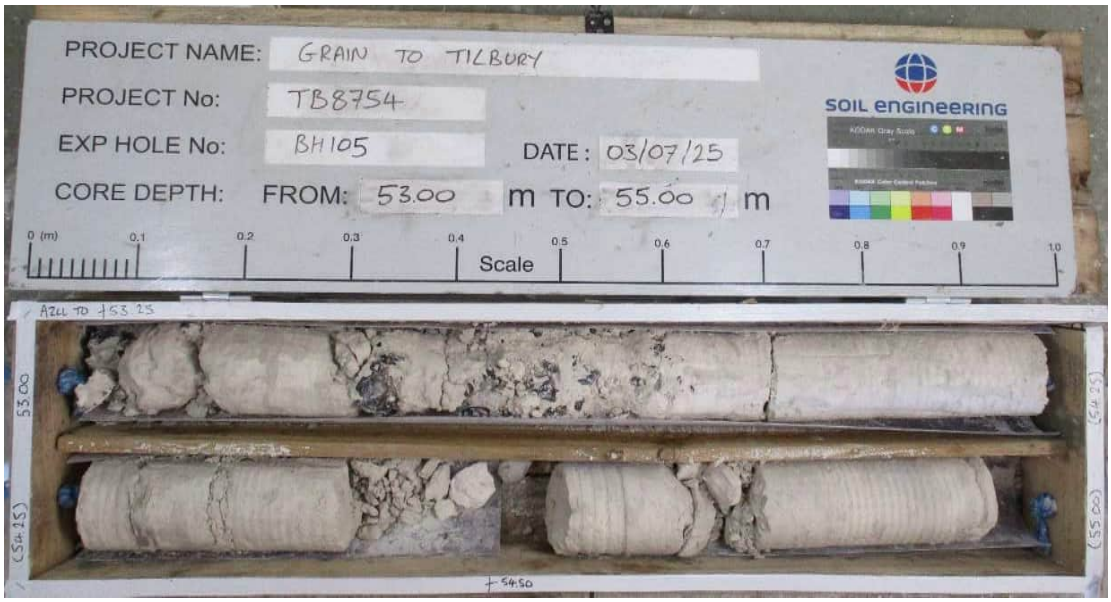
Photographed by	Date photographed	TB8754_BH105_45.70-47.80
AW	02/07/2025	TB8754_BH105_47.80-50.05

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH105
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		05



From 50.05m to 53.00m



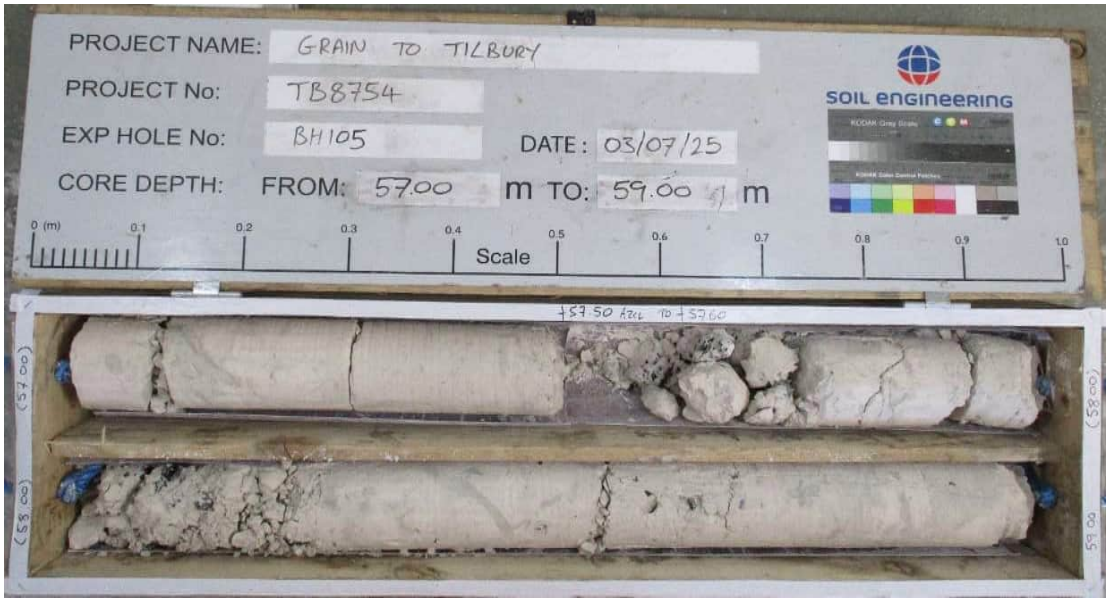
From 53.00m to 55.00m

Photographed by	Date photographed	TB8754_BH105_50.05-53.00
AW	03/07/2025	TB8754_BH105_53.00-55.00

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH105
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		06



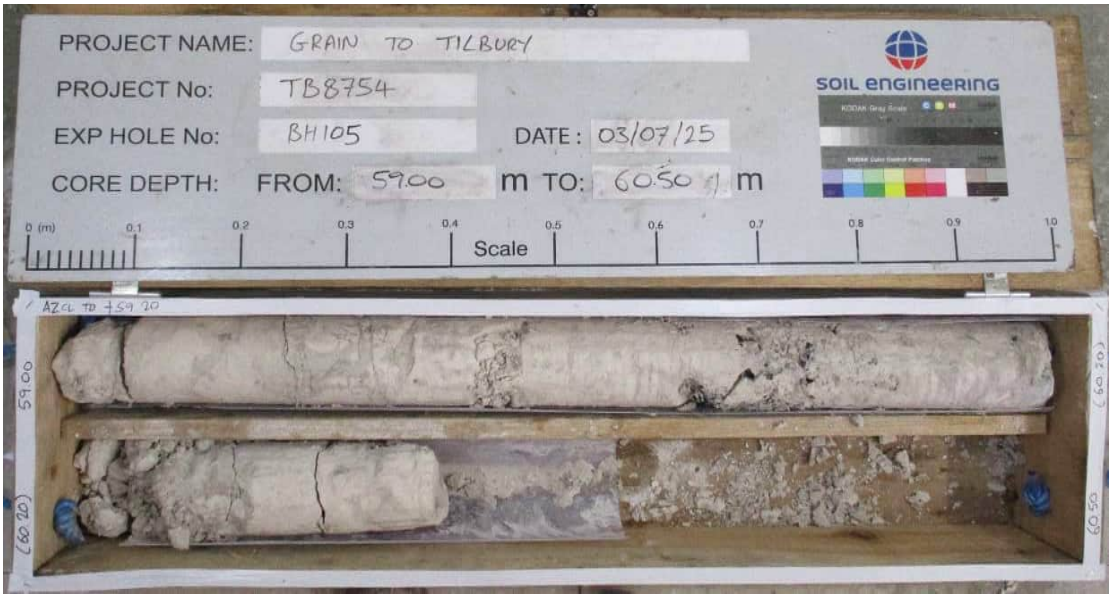
From 55.00m to 57.00m



From 57.00m to 59.00m

Photographed by	Date photographed	TB8754_BH105_55.00-57.00
AW	03/07/2025	TB8754_BH105_57.00-59.00

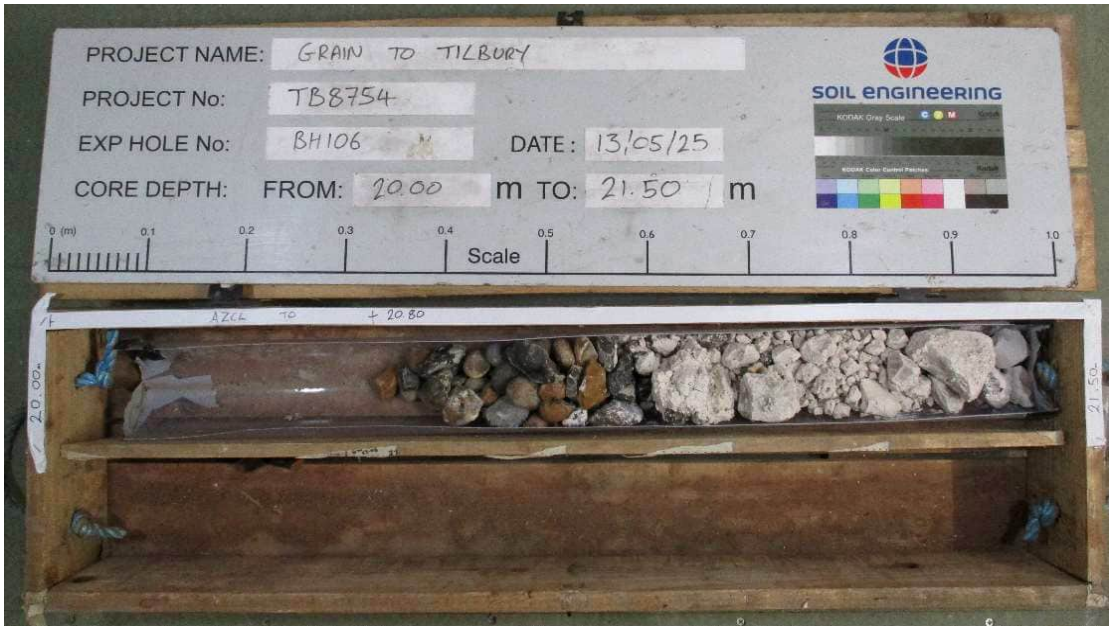
Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH105
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		07



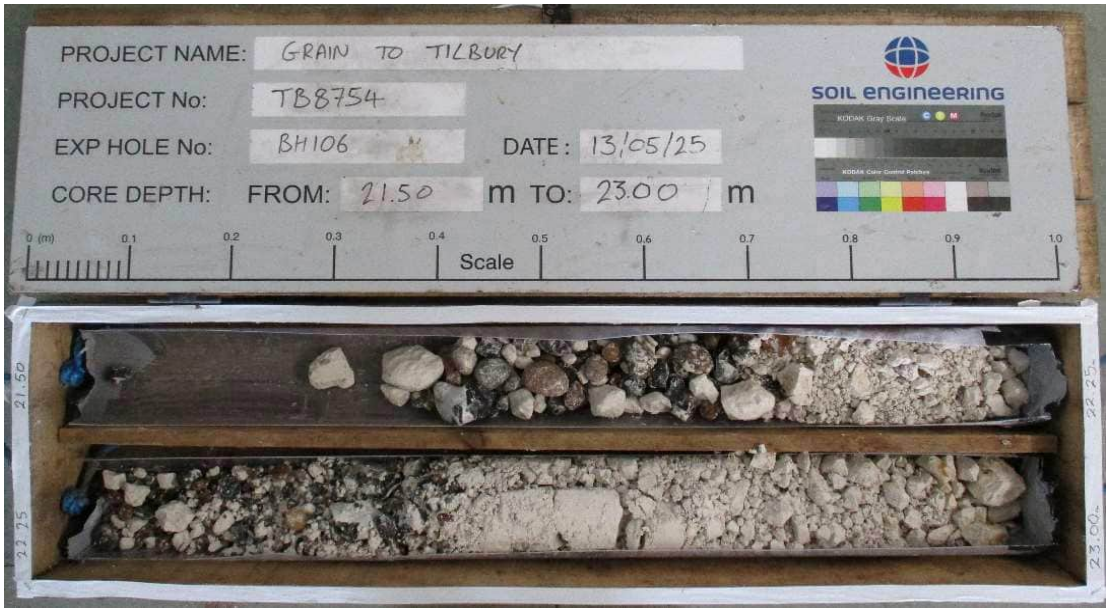
From 59.00m to 60.50m

Photographed by	Date photographed	TB8754_BH105_59.00-60.50
AW	03/07/2025	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		01



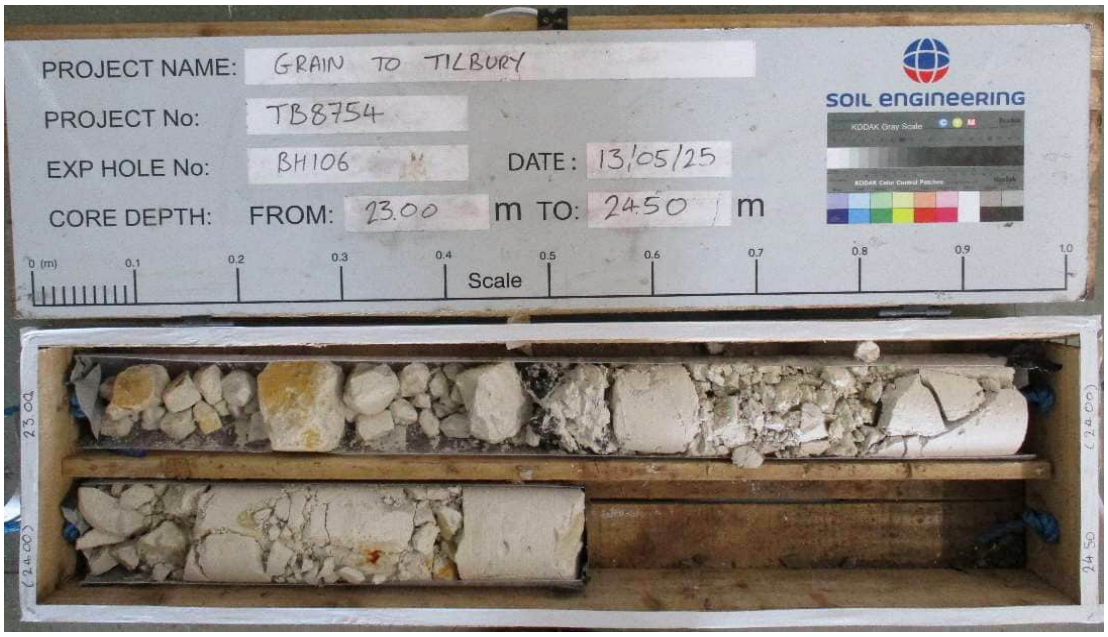
From 20.00m to 21.50m



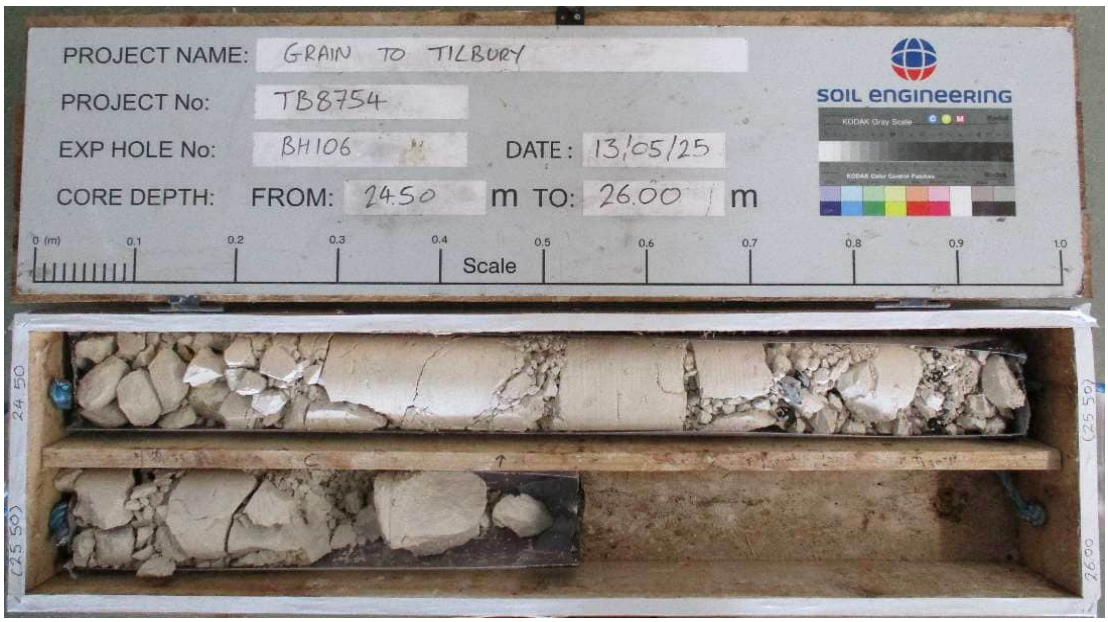
From 21.50m to 23.00m

Photographed by	Date photographed	TB8754_BH102_20.00-21.50
AW	13/05/2025	TB8754_BH102_21.50-23.00

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		02



From 23.00m to 24.50m



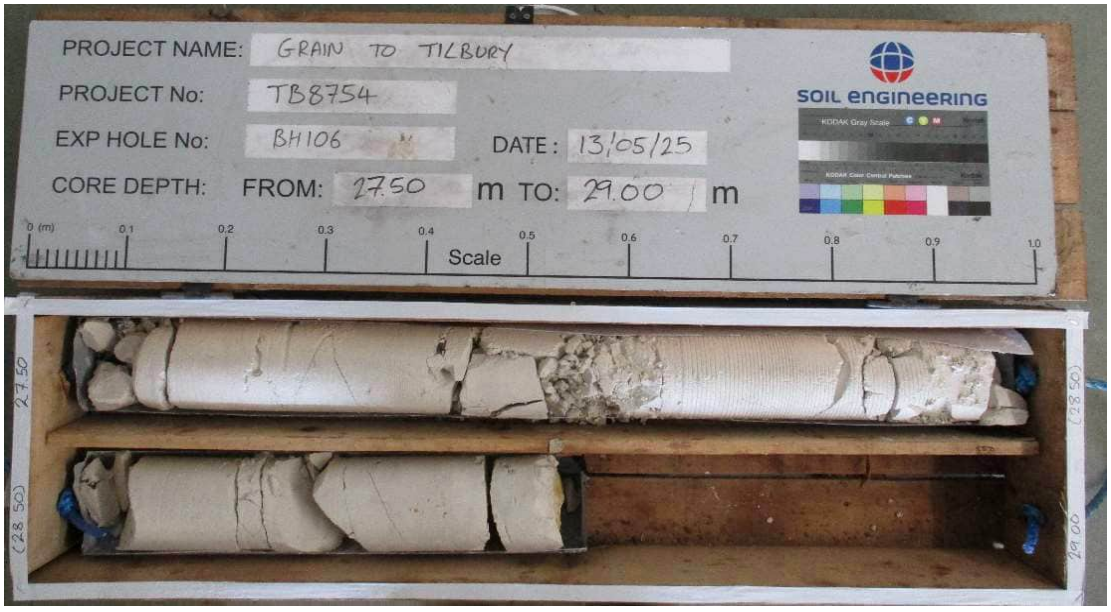
From 24.50m to 26.00m

Photographed by	Date photographed	TB8754_BH102_23.00-24.50
AW	13/05/2025	TB8754_BH102_24.50-26.00

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		03



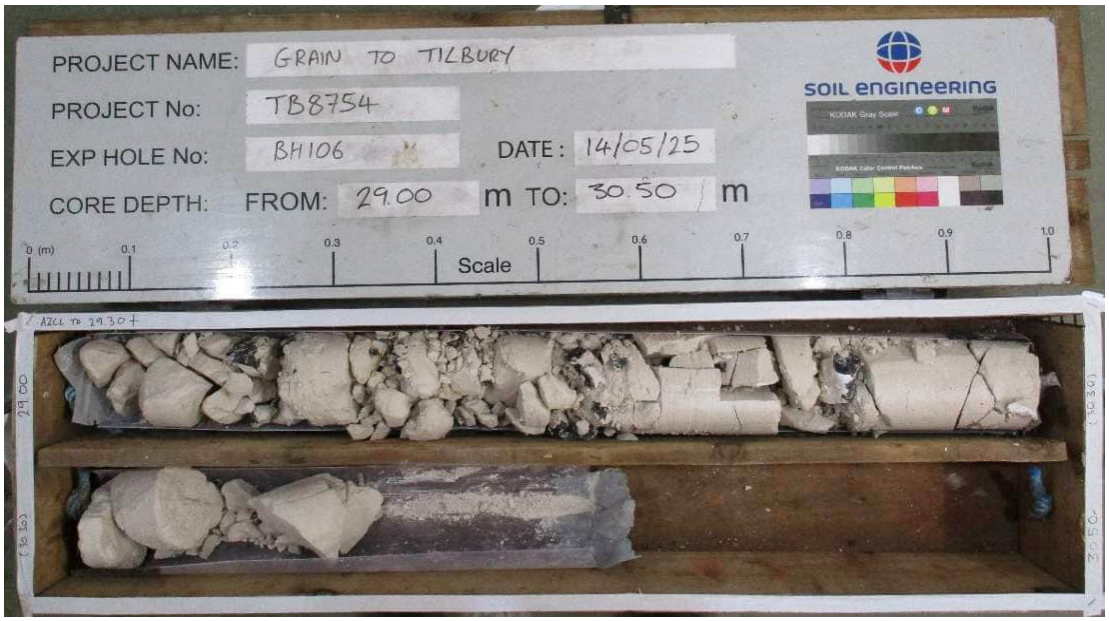
From 26.00m to 27.50m



From 27.50m to 29.00m

Photographed by	Date photographed	TB8754_BH102_26.00-27.50
AW	13/05/2025	TB8754_BH102_27.50-29.00

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		04



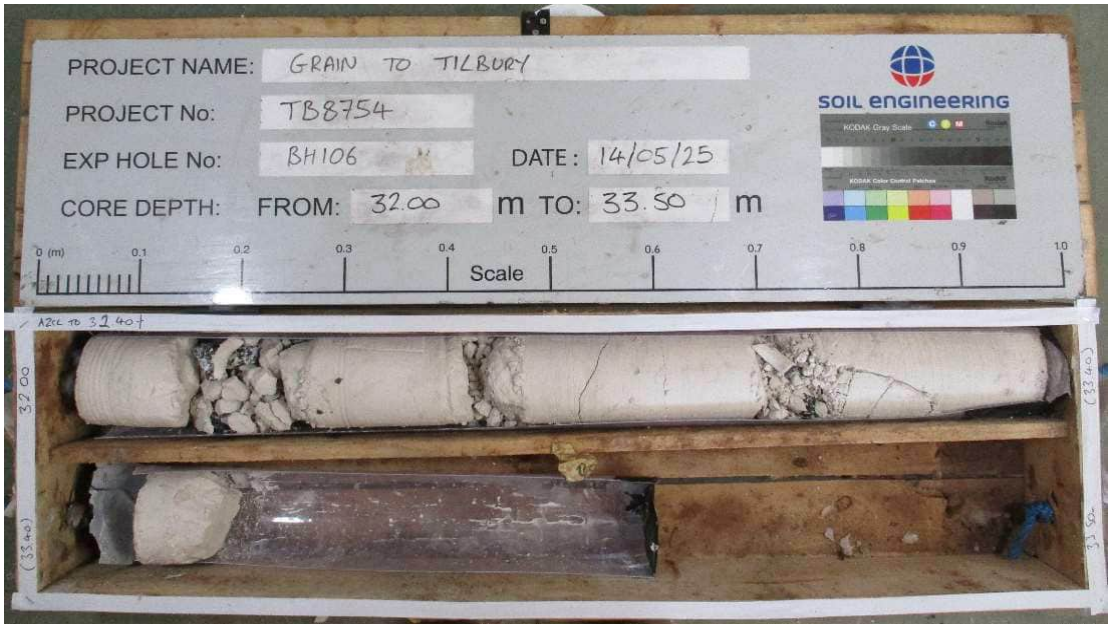
From 29.00m to 30.50m



From 30.50m to 32.00m

Photographed by	Date photographed	TB8754_BH102_29.00-30.50
AW	14/05/2025	TB8754_BH102_30.50-32.00

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		05



From 32.00m to 33.50m



From 33.50m to 35.00m

Photographed by	Date photographed	TB8754_BH102_32.00-33.50
AW	14/05/2025	TB8754_BH102_33.50-35.00

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		06



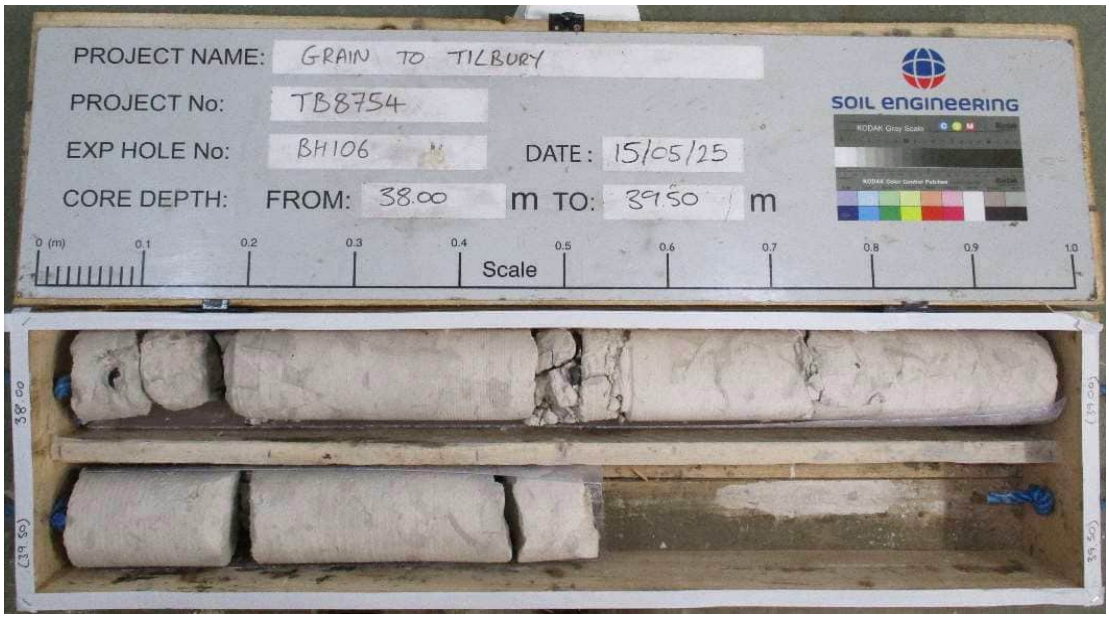
From 35.00m to 36.50m



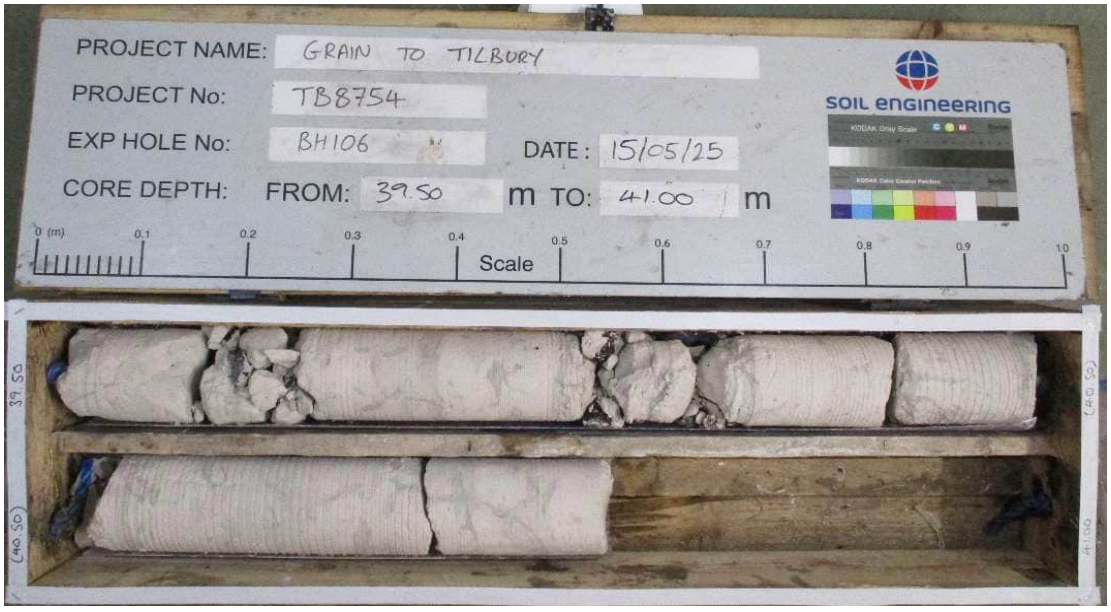
From 36.50m to 38.00m

Photographed by	Date photographed	TB8754_BH102_35.00-36.50	
AW	14/05/2025	TB8754_BH102_36.50-38.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		07



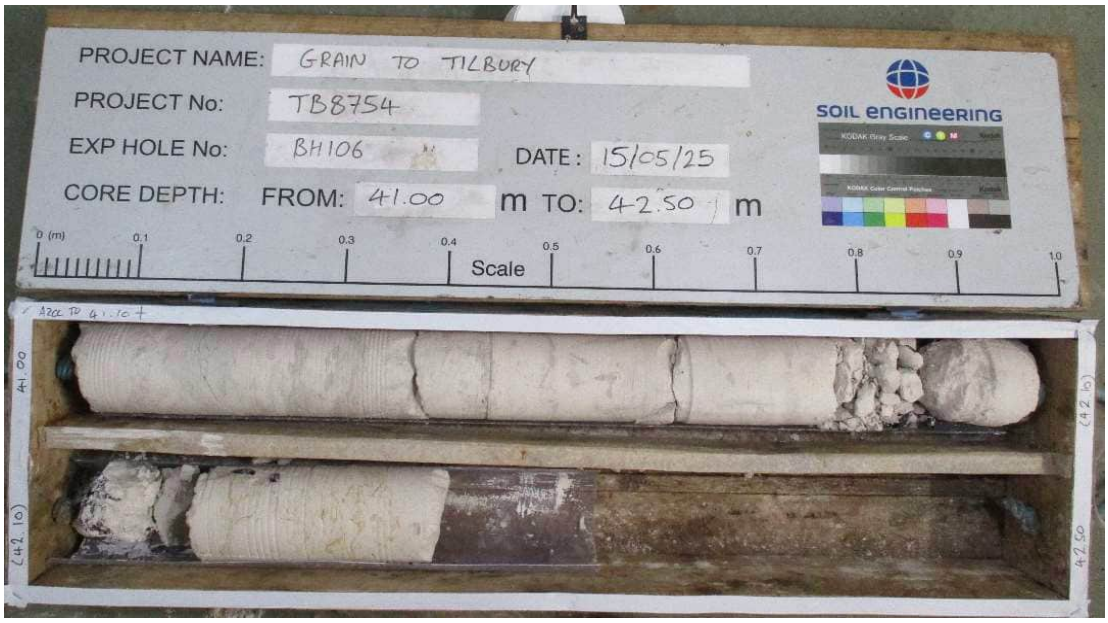
From 38.00m to 39.50m



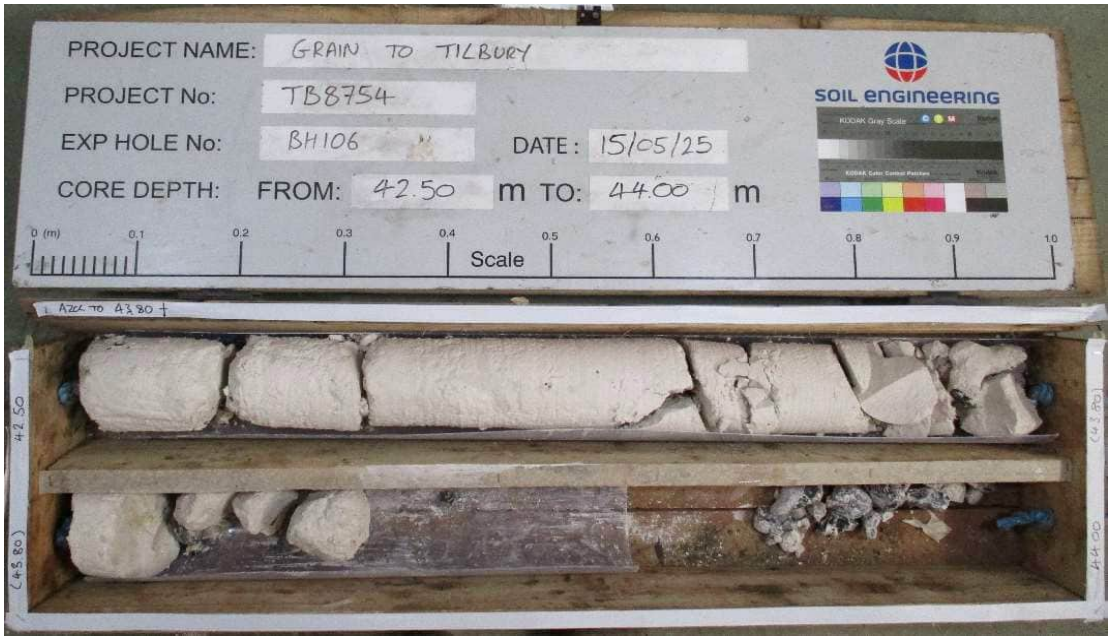
From 39.50m to 41.00m

Photographed by	Date photographed	TB8754_BH102_38.00-39.50
AW	15/05/2025	TB8754_BH102_39.50-41.00

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		08



From 41.00m to 42.50m



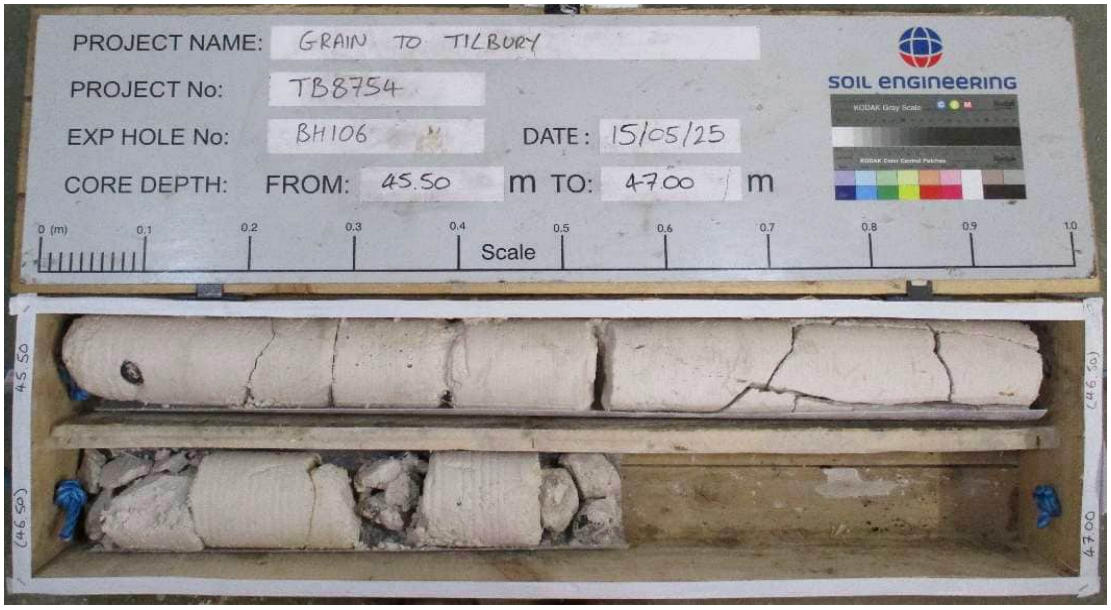
From 42.50m to 44.00m

Photographed by	Date photographed	TB8754_BH102_41.00-42.50	
AW	15/05/2025	TB8754_BH102_42.50-44.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		09



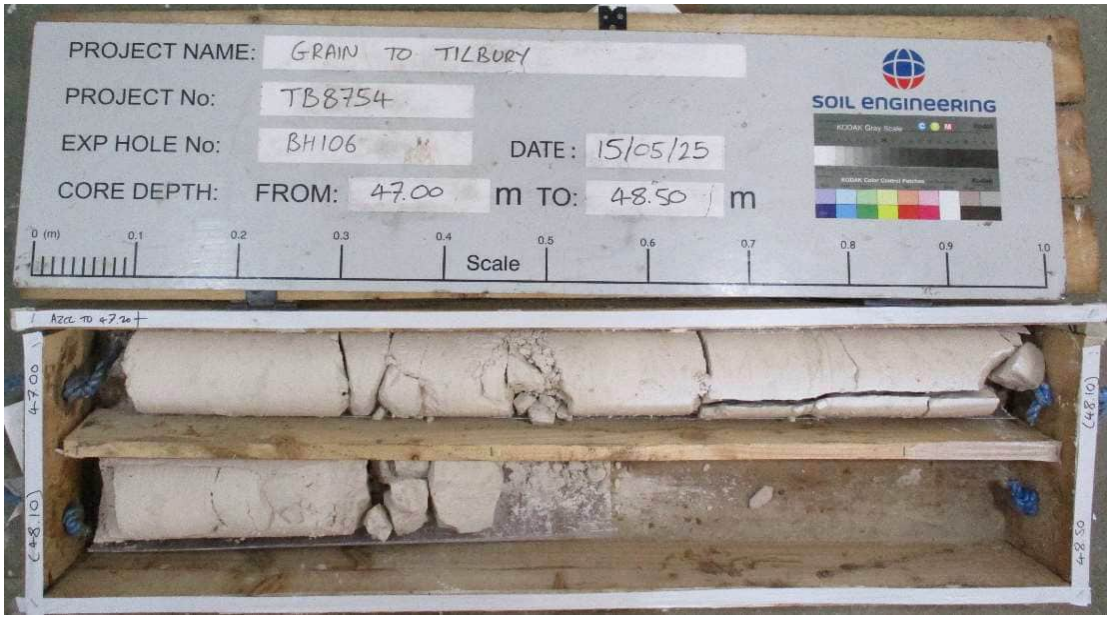
From 44.00m to 45.50m



From 45.50m to 47.00m

Photographed by	Date photographed	TB8754_BH102_44.00-45.50	
AW	13/05/2025	TB8754_BH102_45.50-47.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		10



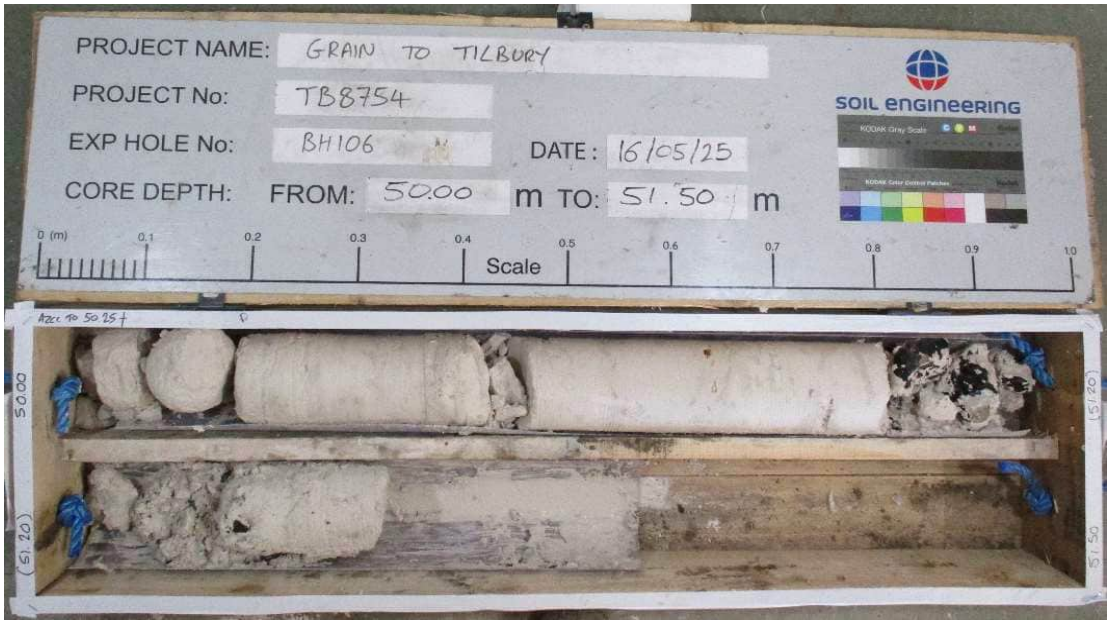
From 47.00m to 48.50m



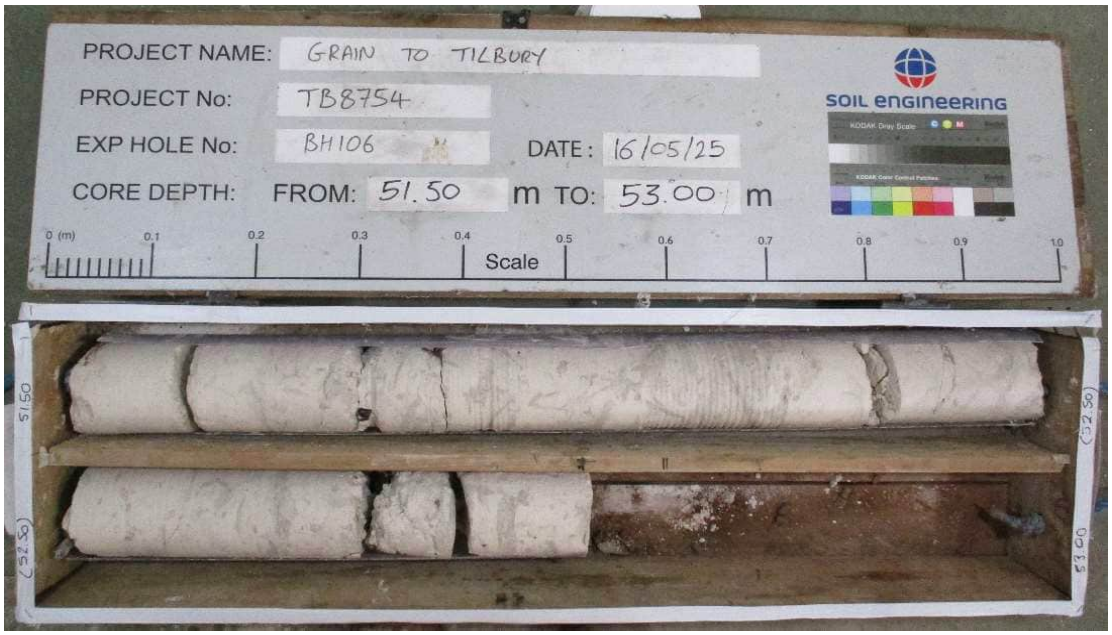
From 48.50m to 50.00m

Photographed by	Date photographed	TB8754_BH102_47.00-48.50
AW	16/05/2025	TB8754_BH102_48.50-50.00

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		11



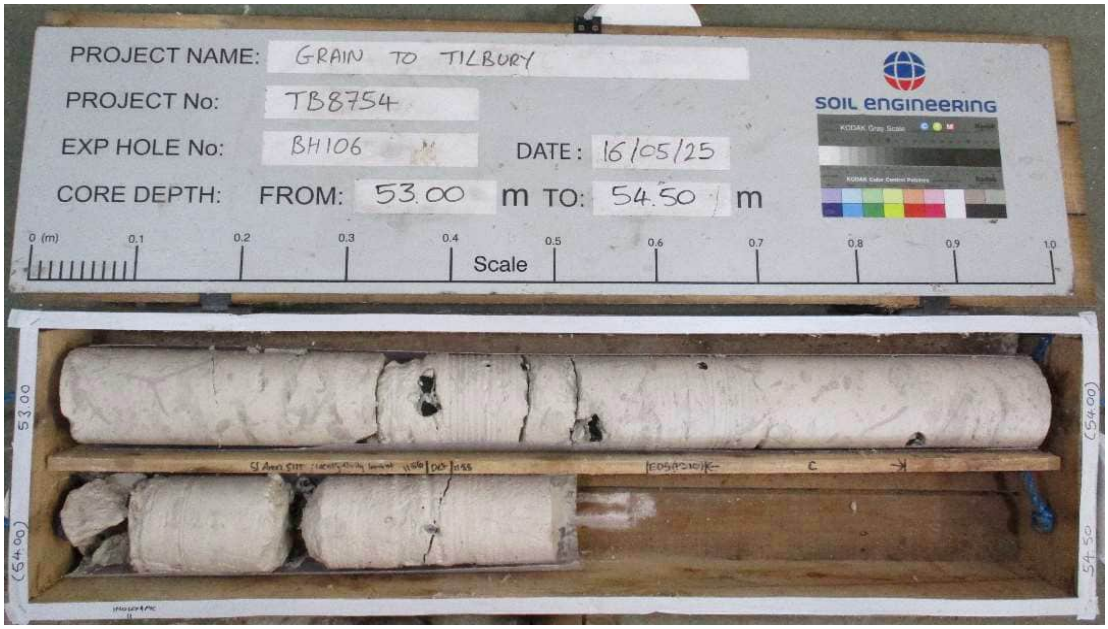
From 50.00m to 51.50m



From 51.50m to 53.00m

Photographed by	Date photographed	TB8754_BH102_50.00-51.50	
AW	16/05/2025	TB8754_BH102_51.50-53.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		12



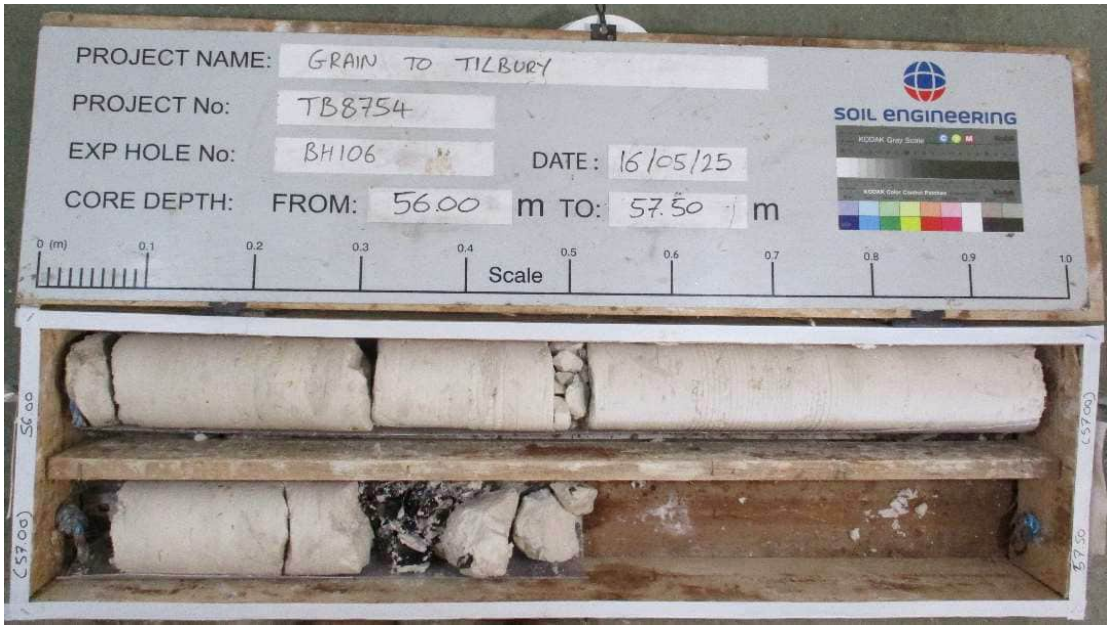
From 53.00m to 54.50m



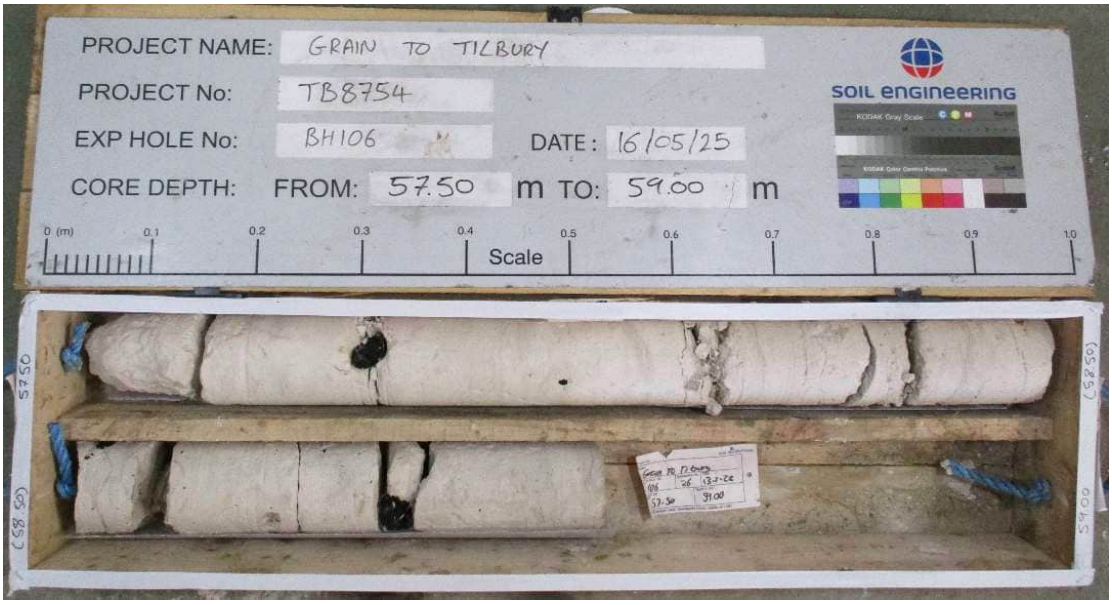
From 54.50m to 56.00m

Photographed by	Date photographed	TB8754_BH102_53.00-54.50	
AW	16/05/2025	TB8754_BH102_54.50-56.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		13



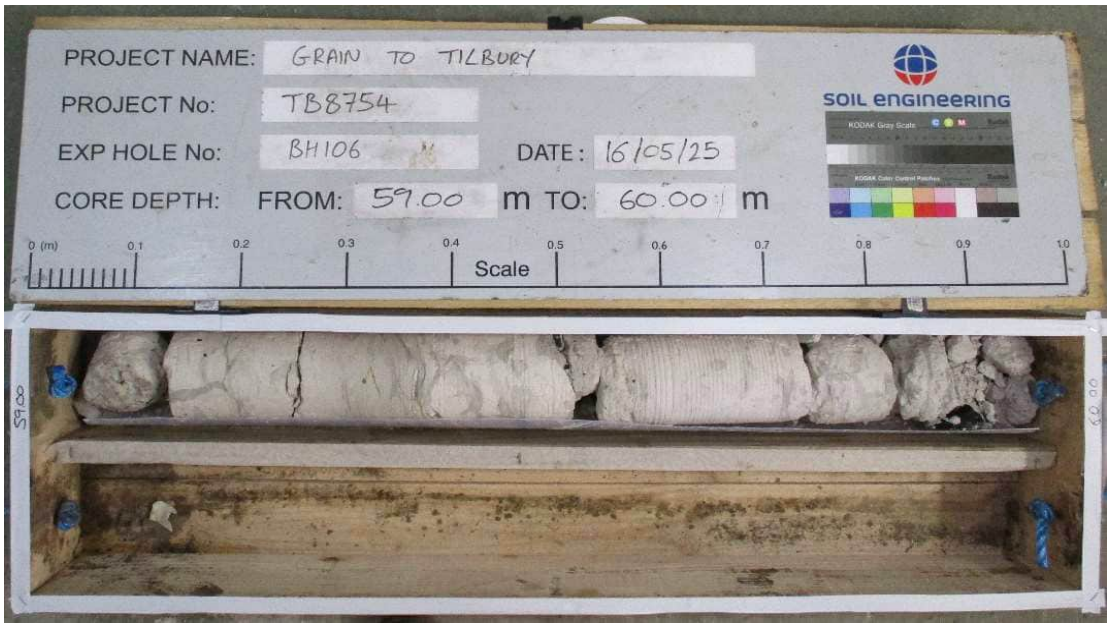
From 56.00m to 57.50m



From 57.50m to 59.00m

Photographed by	Date photographed	TB8754_BH102_56.00-57.50
AW	16/05/2025	TB8754_BH102_57.50-59.00

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		14

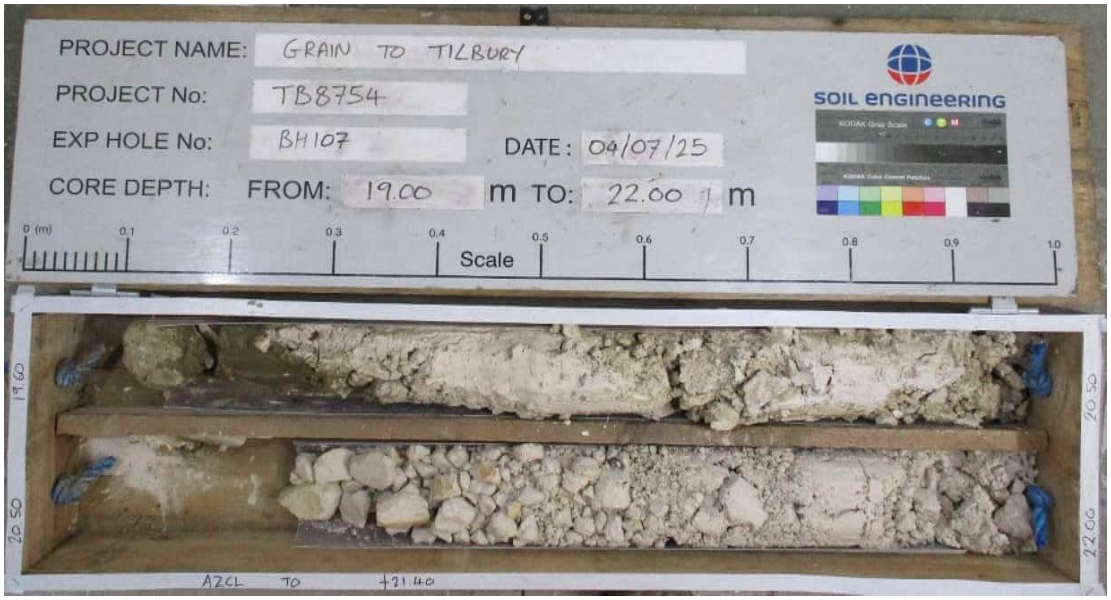


From 59.00m to 60.00m

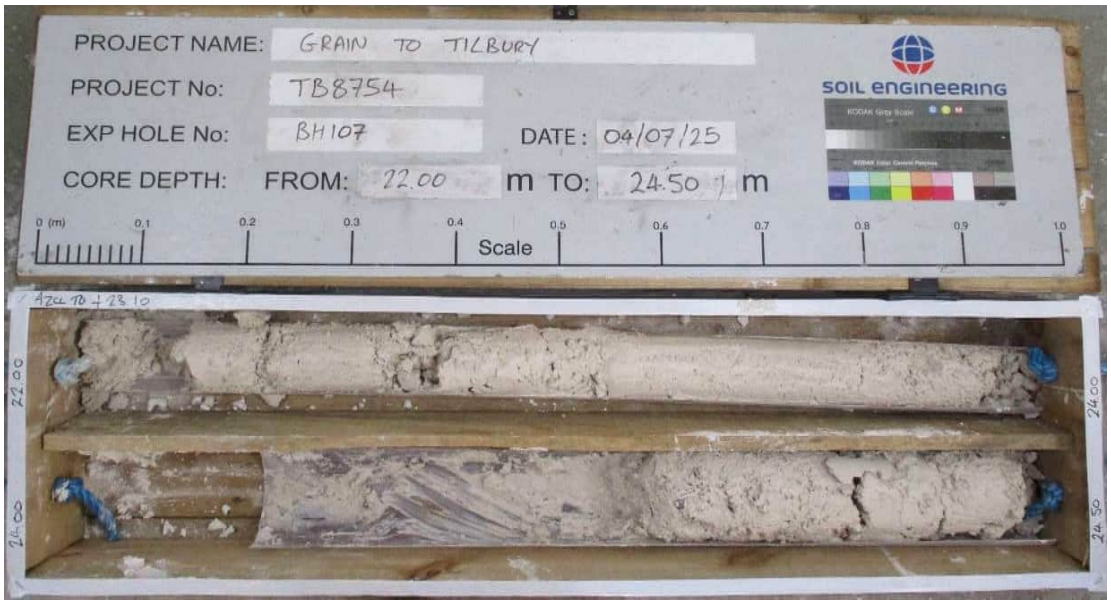
Photographed by	Date photographed	TB8754_BH102_59.00-60.00
AW	16/05/2025	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		01



From 19.00m to 22.00m



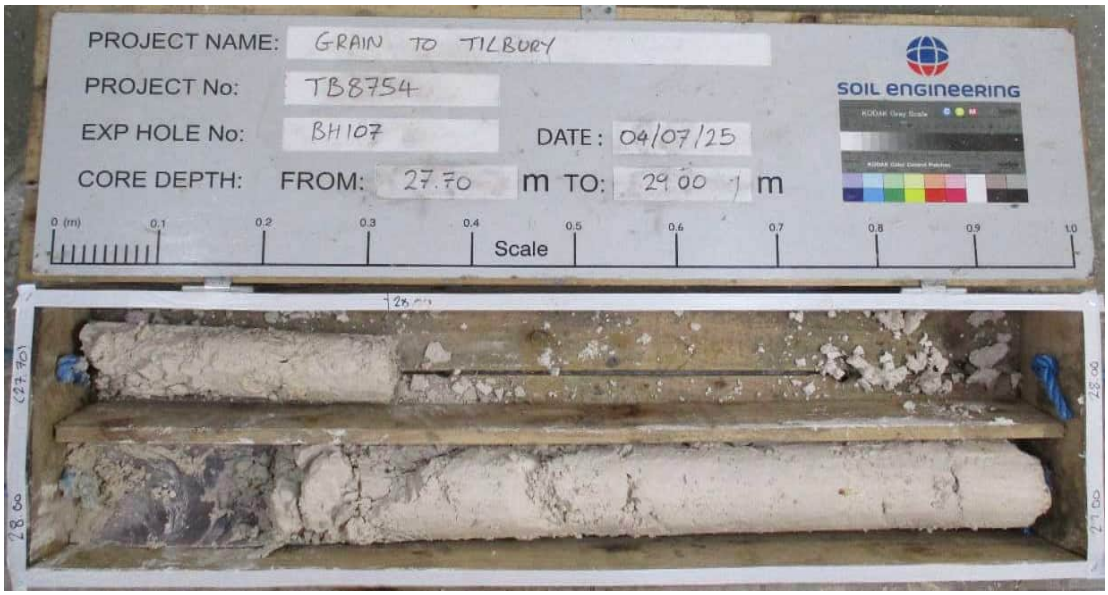
From 22.00 to 24.50m

Photographed by	Date photographed	TB8754_BH107_19.00-22.00	SOIL ENGINEERING
AW	04/07/2025	TB8754_BH107_22.00-24.50	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		02



From 24.50m to 27.70m



From 27.70m to 29.00m

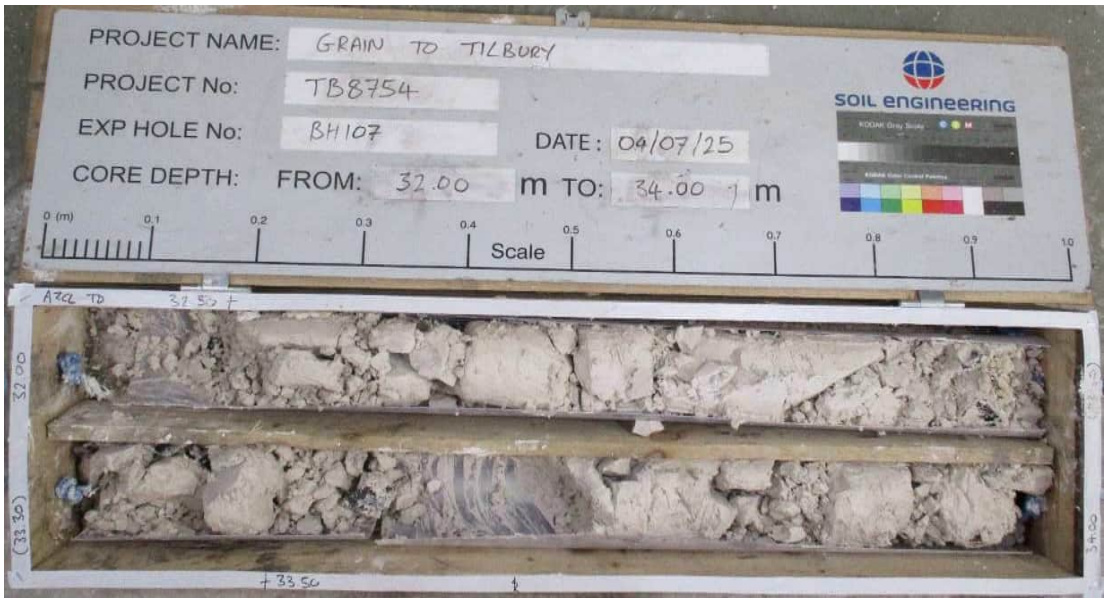
Photographed by	Date photographed	TB8754_BH107_24.50-27.70
AW	04/07/2025	TB8754_BH107_27.70-29.00

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		03



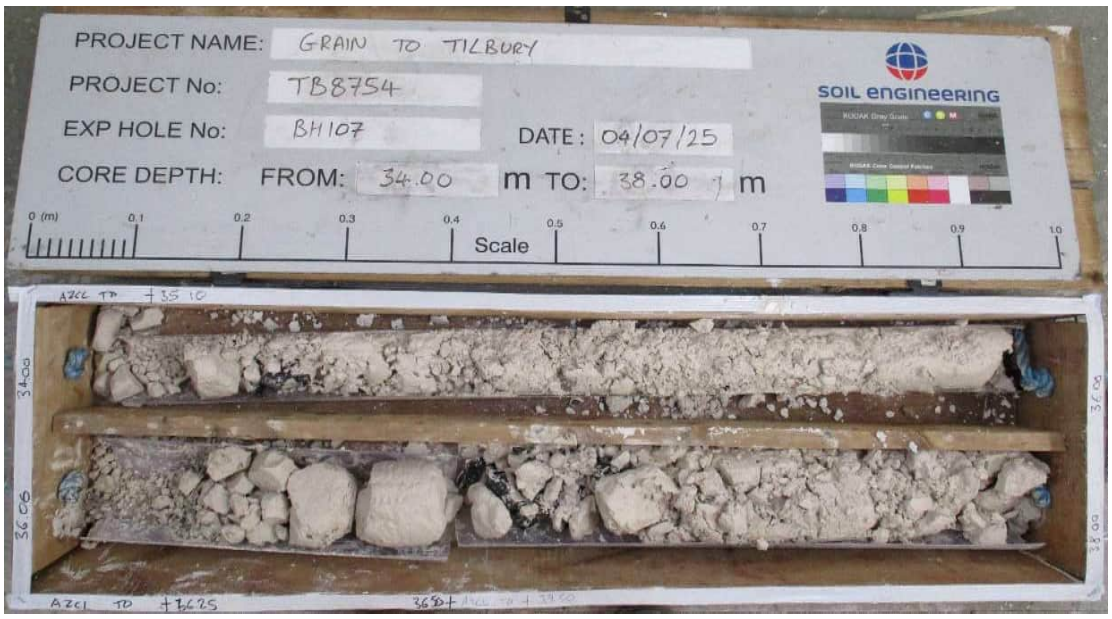
From 29.00m to 32.00m



From 32.00m to 34.00m

Photographed by	Date photographed	TB8754_BH107_29.00-32.00	SOIL ENGINEERING
AW	04/07/2025	TB8754_BH107_32.00-34.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		04



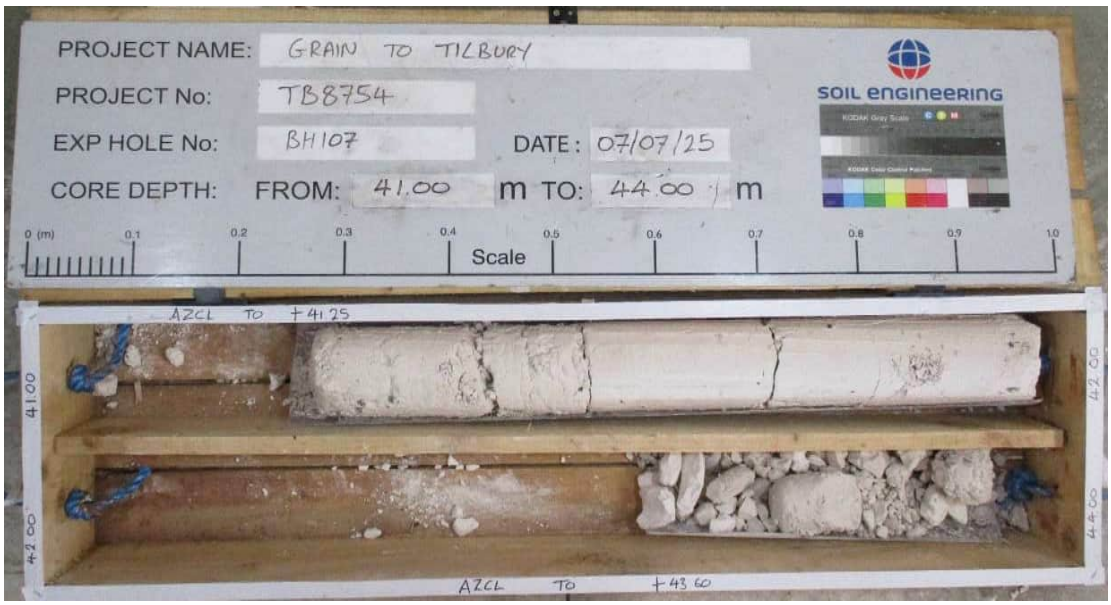
From 34.00m to 38.00m



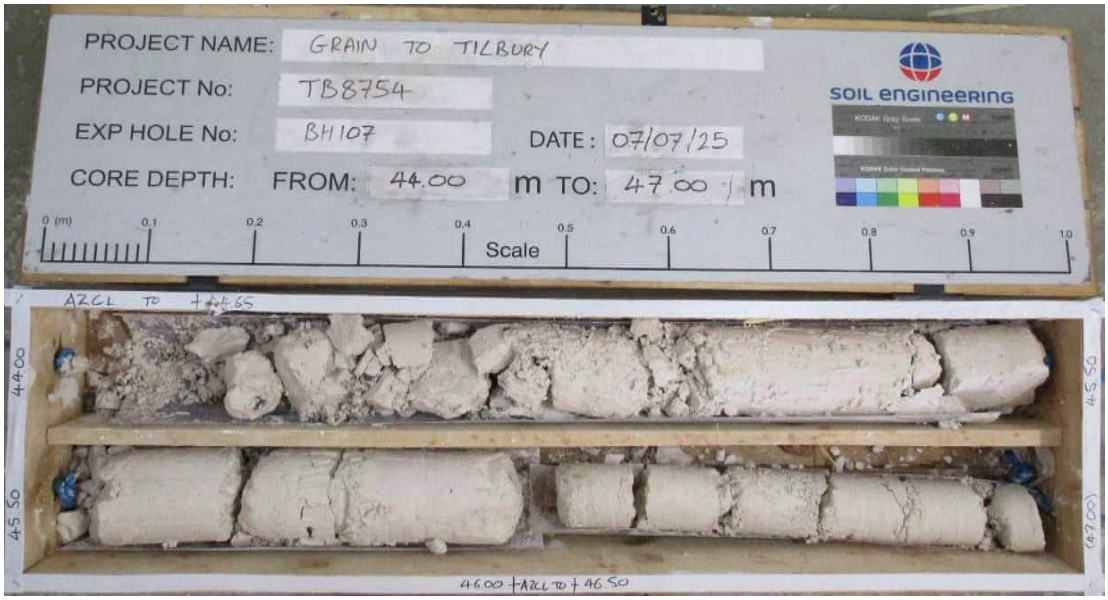
From 38.00m to 41.00m

Photographed by	Date photographed	TB8754_BH107_34.00-38.00	
AW	04/07/2025	TB8754_BH107_38.00-41.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		05



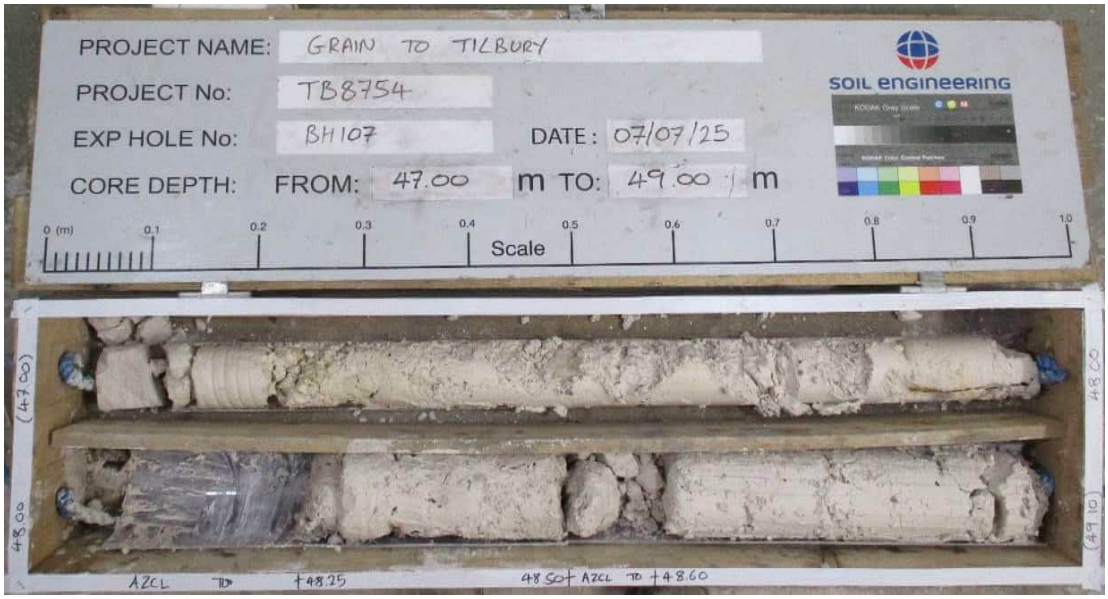
From 41.00m to 44.00m



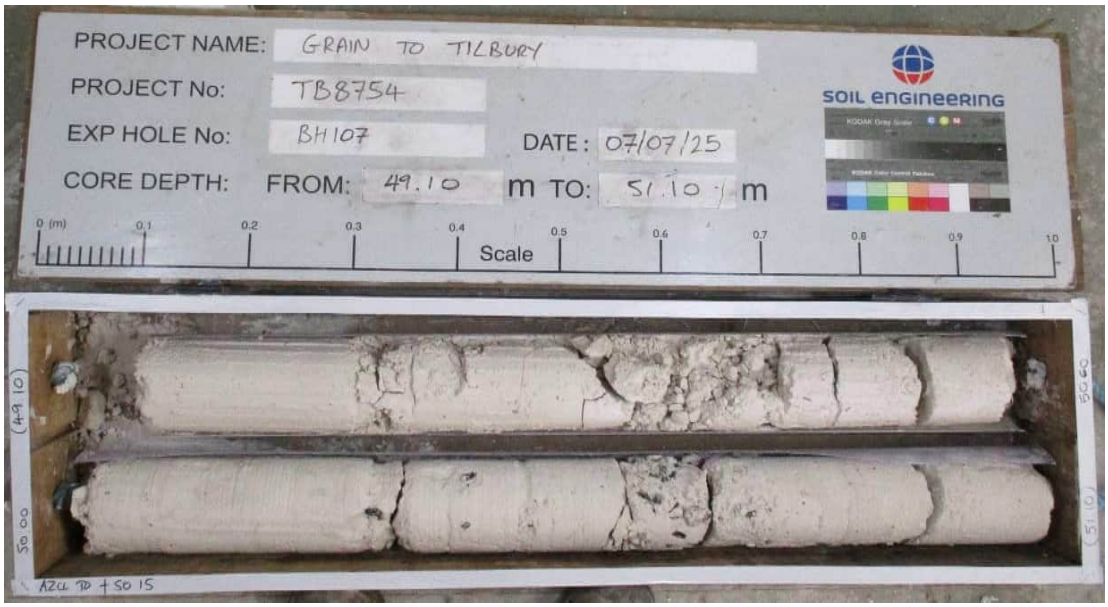
From 44.00m to 47.00m

Photographed by	Date photographed	TB8754_BH107_41.00-44.00	SOIL ENGINEERING
AW	07/07/2025	TB8754_BH107_44.00-47.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		06



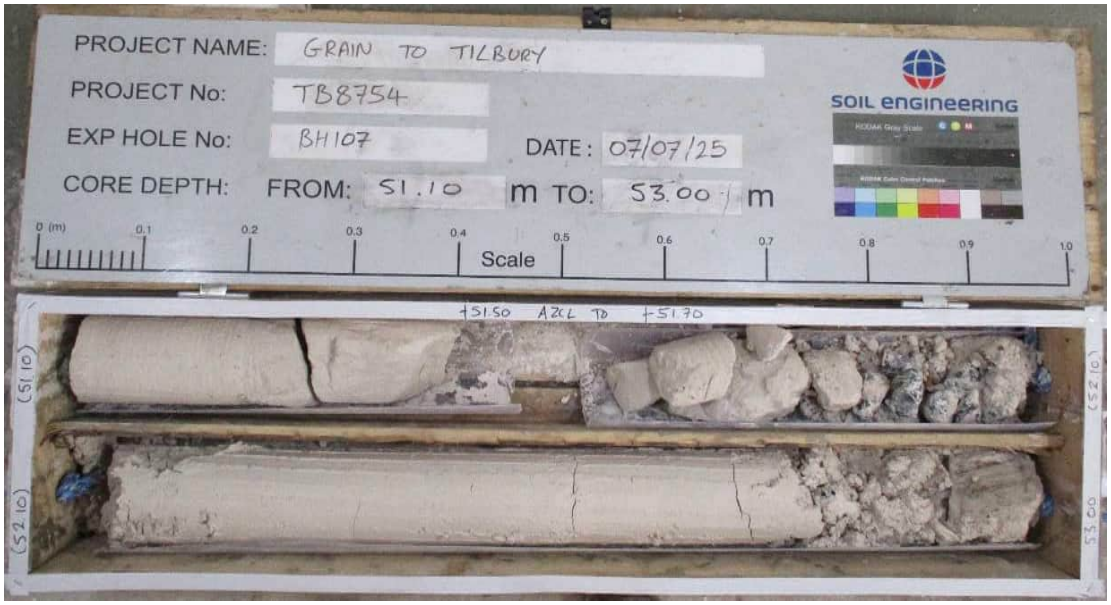
From 47.00m to 49.00m



From 49.10m to 51.10m

Photographed by	Date photographed	TB8754_BH107_47.00-49.00	SOIL ENGINEERING
AW	07/07/2025	TB8754_BH107_49.10-51.10	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		07



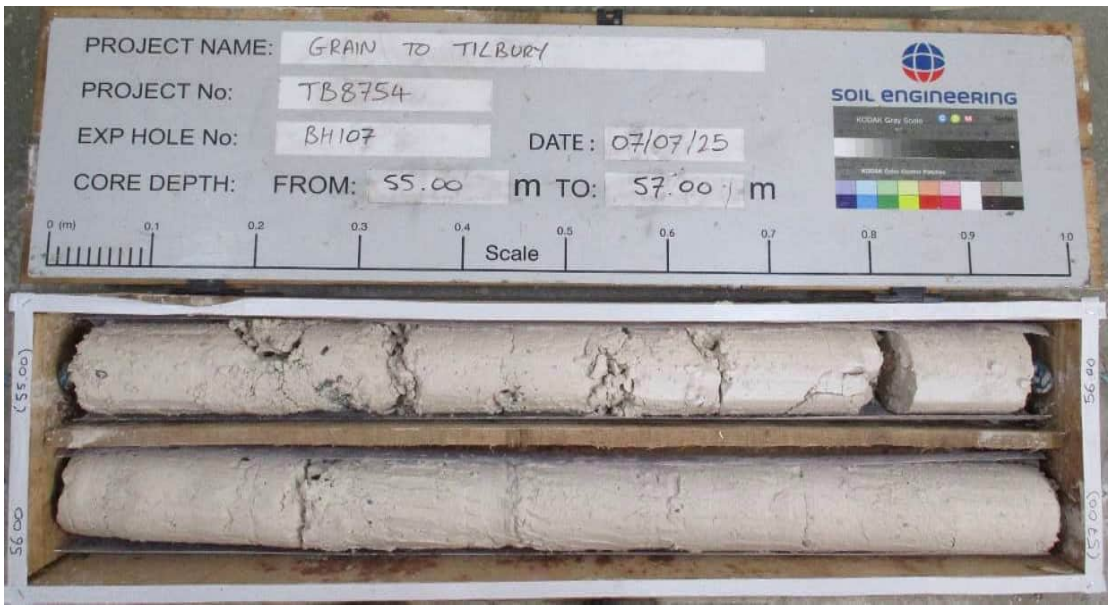
From 51.10m to 53.00m



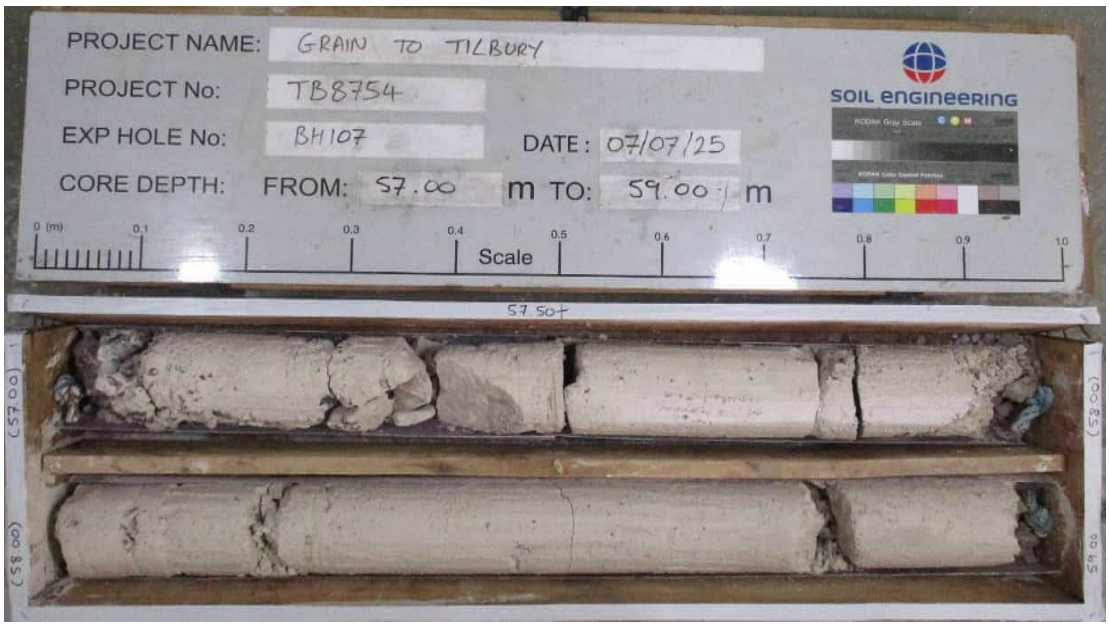
From 53.00m to 55.00m

Photographed by	Date photographed	TB8754_BH107_51.10-53.00	SOIL ENGINEERING
AW	07/07/2025	TB8754_BH107_53.00-55.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		08



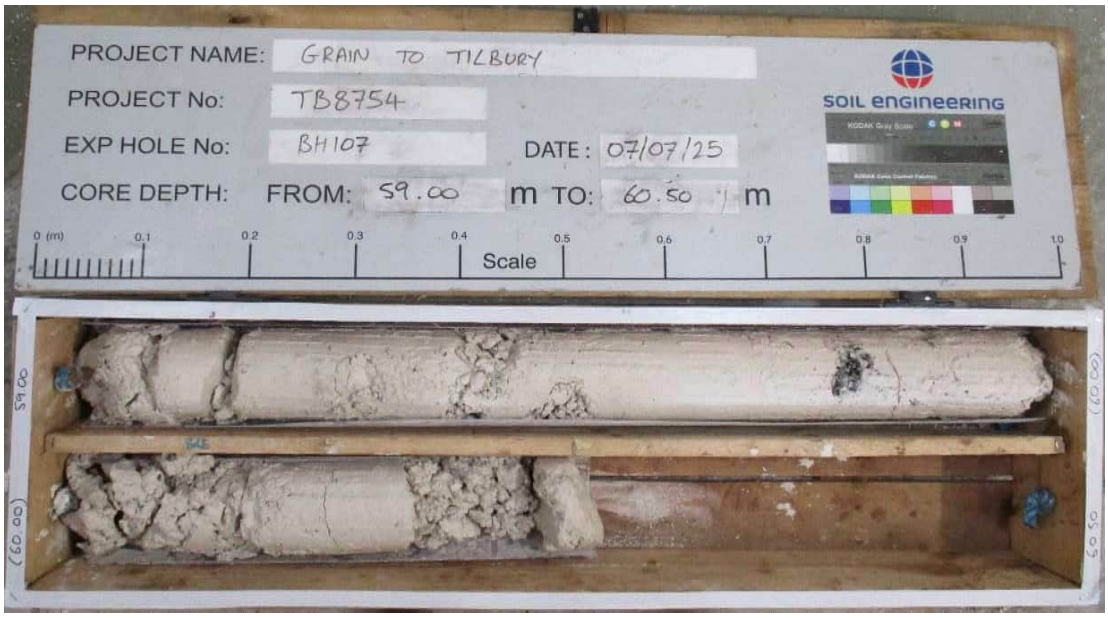
From 55.00m to 57.00m



From 57.00m to 59.00m

Photographed by	Date photographed	TB8754_BH107_55.00-57.00	SOIL ENGINEERING
AW	07/07/2025	TB8754_BH107_57.00-59.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		09



From 59.00m to 60.50m

Photographed by	Date photographed	TB8754_BH107_59.00-60.50
AW	07/07/2025	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		01



From 30.00m to 39.00m



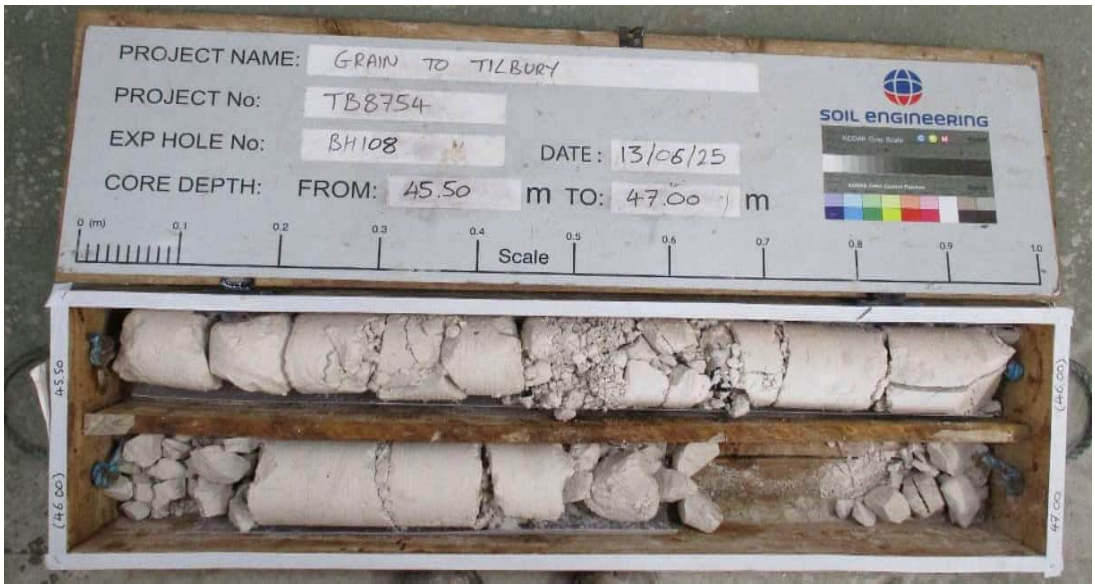
From 43.00m to 44.00m

Photographed by	Date photographed	TB8754_BH108_30.00-39.00	
AW	13/06/2025	TB8754_BH108_43.00-44.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		02



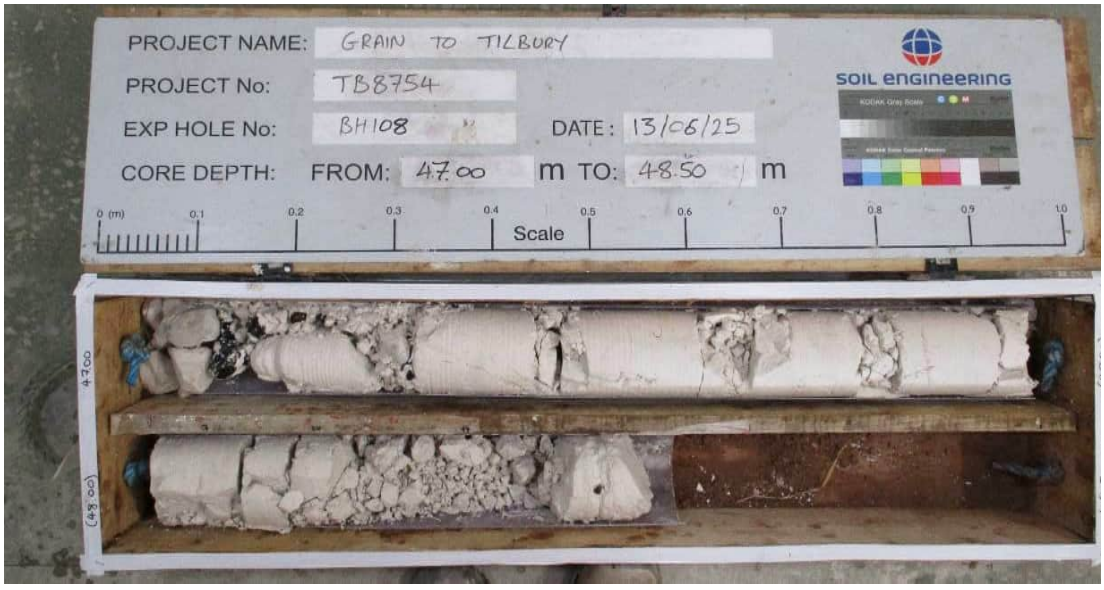
From 44.00m to 45.50m



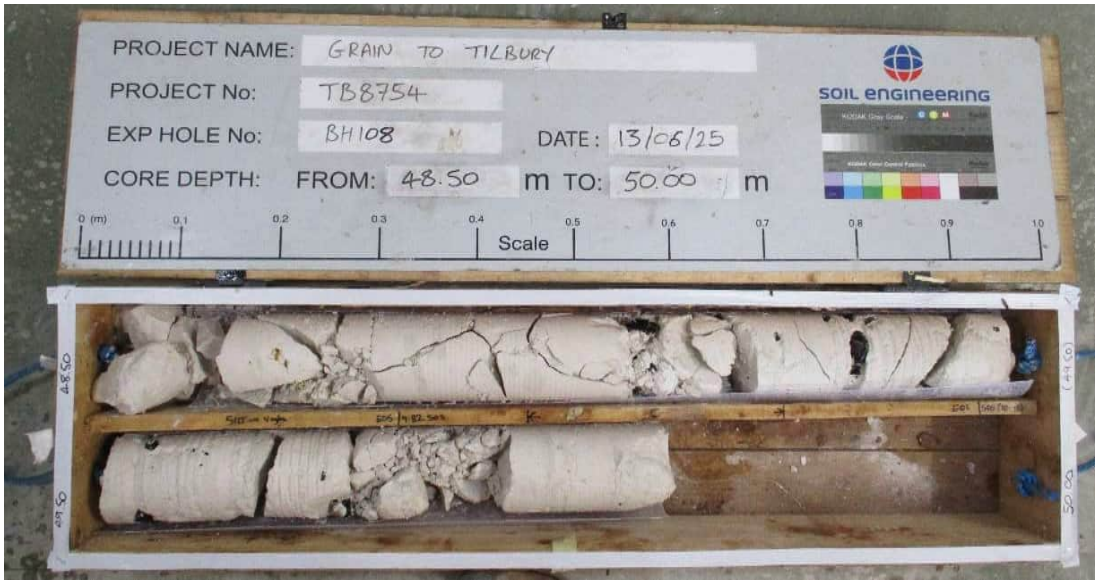
From 45.50m to 47.00m

Photographed by	Date photographed	TB8754_BH108_44.00-45.50
AW	16/06/2025	TB8754_BH108_45.50-47.00

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		03



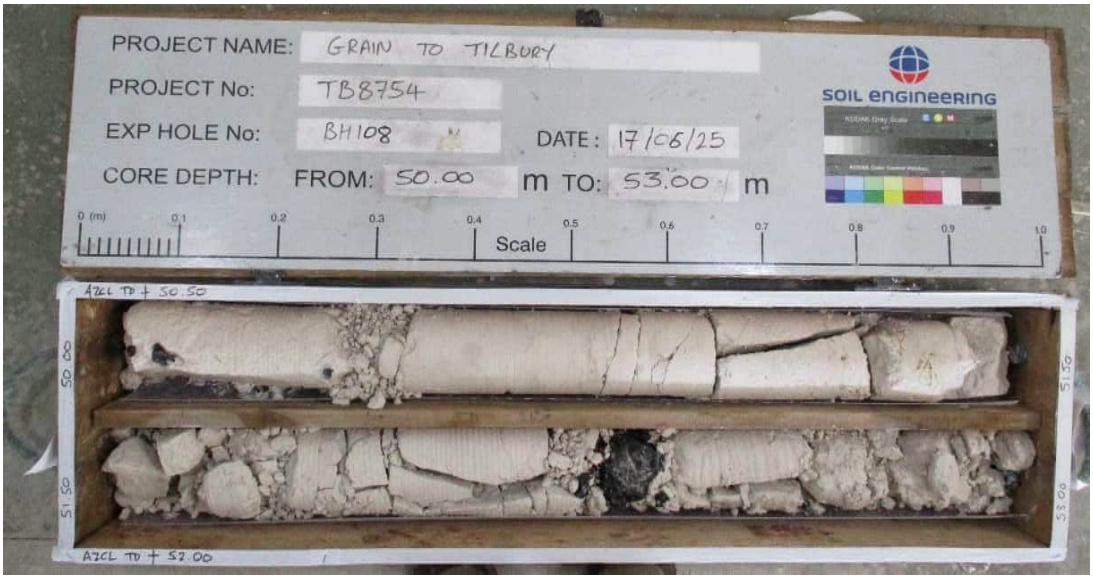
From 47.00m to 48.50m



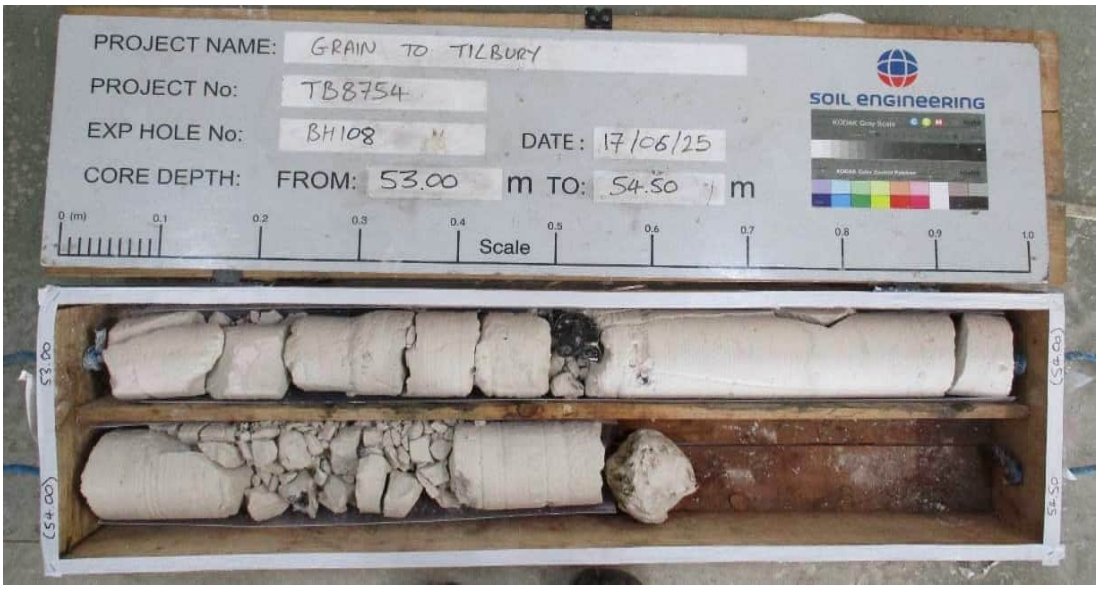
From 48.50m to 50.00m

Photographed by	Date photographed	TB8754_BH108_47.00-48.50
AW	17/06/2025	TB8754_BH108_48.50-50.00

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		04



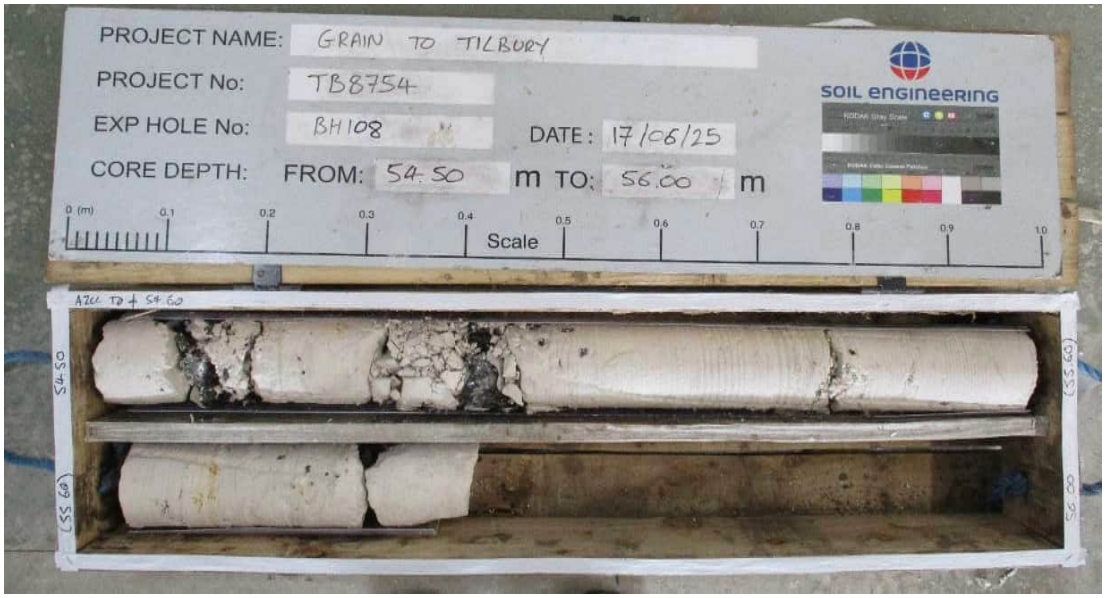
From 50.00m to 53.00m



From 53.00m to 54.50m

Photographed by	Date photographed	TB8754_BH108_50.00-53.00	SOIL ENGINEERING
AW	17/06/2025	TB8754_BH108_53.00-54.50	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		05



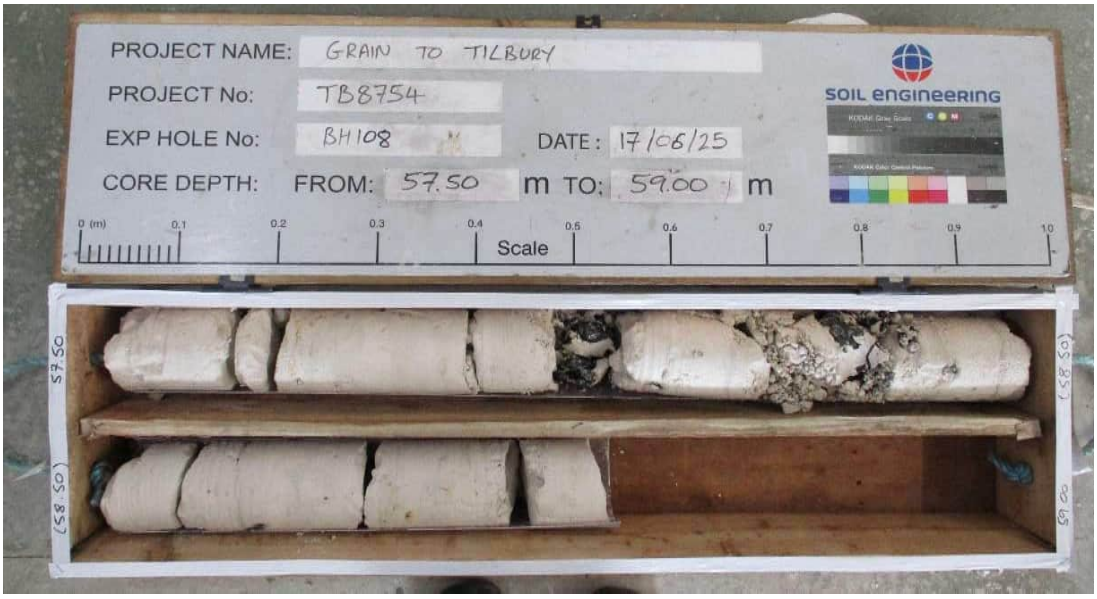
From 54.50m to 56.00m



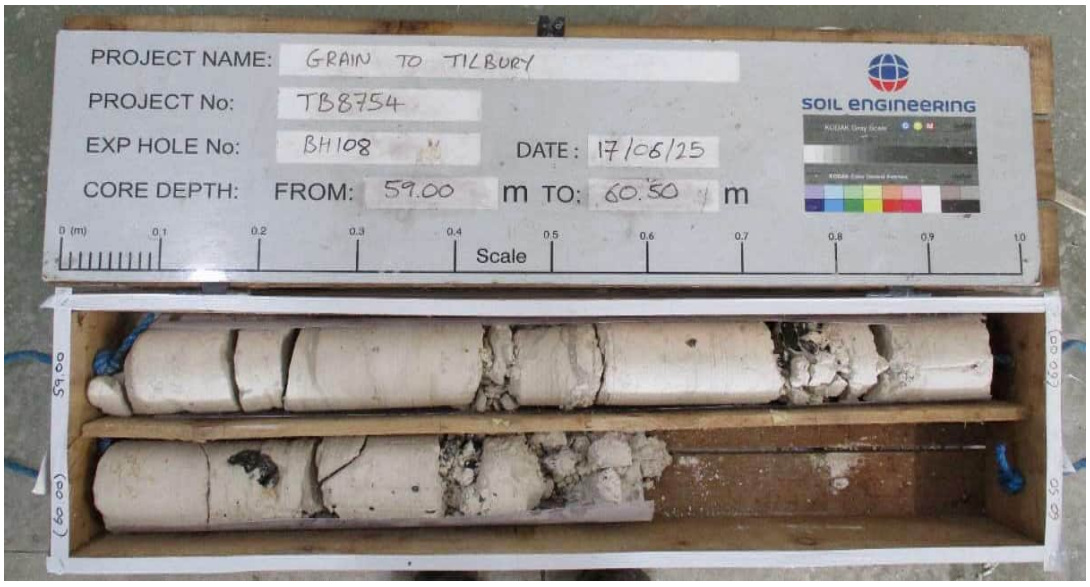
From 56.00m to 57.50m

Photographed by	Date photographed	TB8754_BH108_54.50-56.00	
AW	17/06/2025	TB8754_BH108_56.00-57.50	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		06



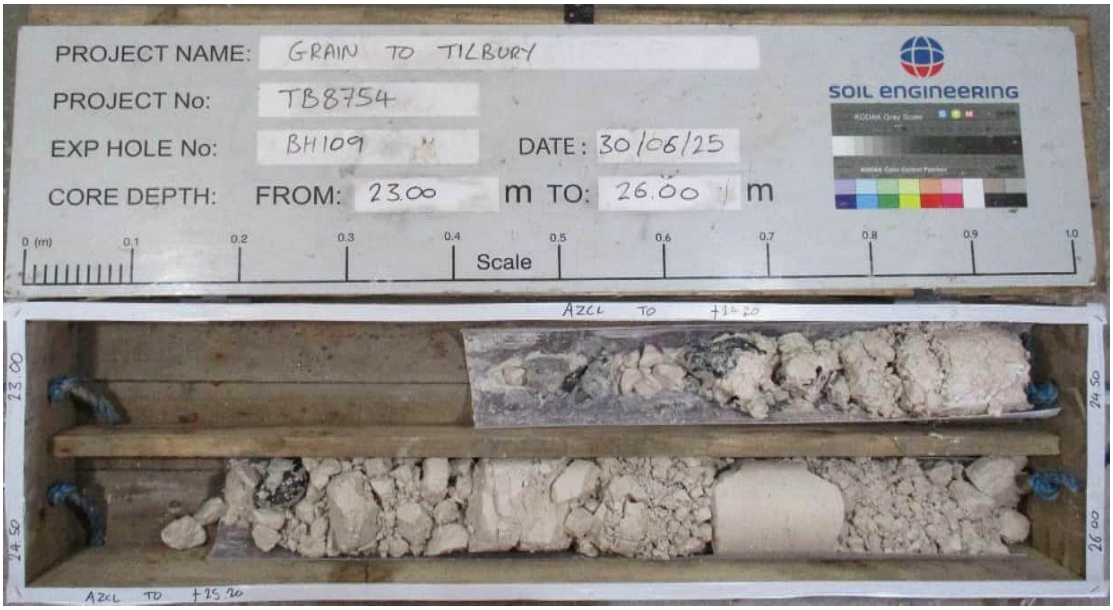
From 57.50m to 59.00m



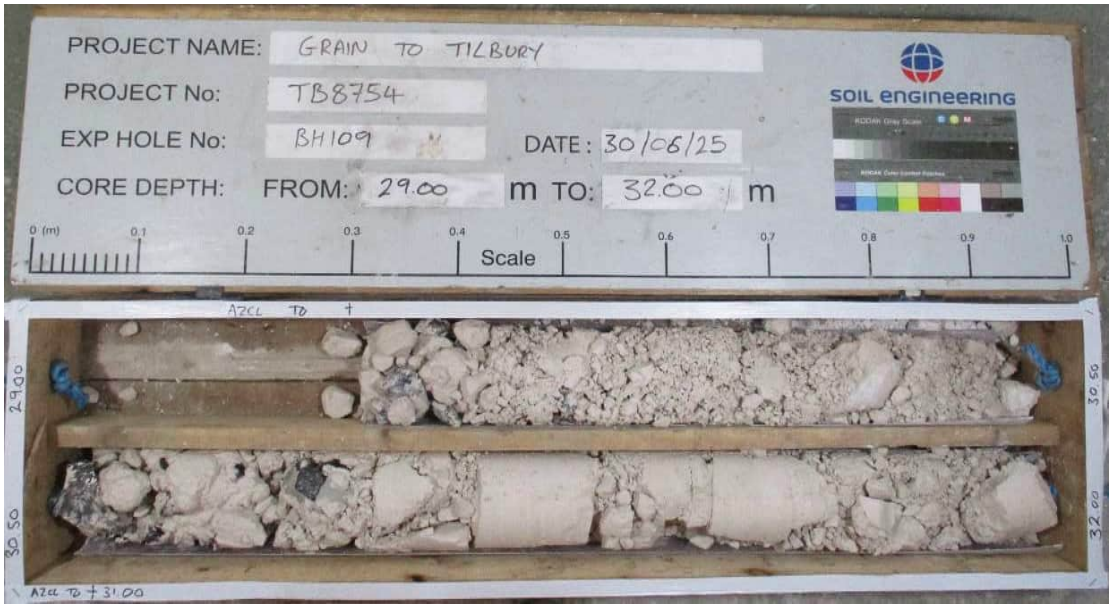
From 59.00m to 60.50m

Photographed by	Date photographed	TB8754_BH108_57.50-59.00	
AW	17/06/2025	TB8754_BH108_59.00-60.50	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		01



From 23.00m to 26.00m



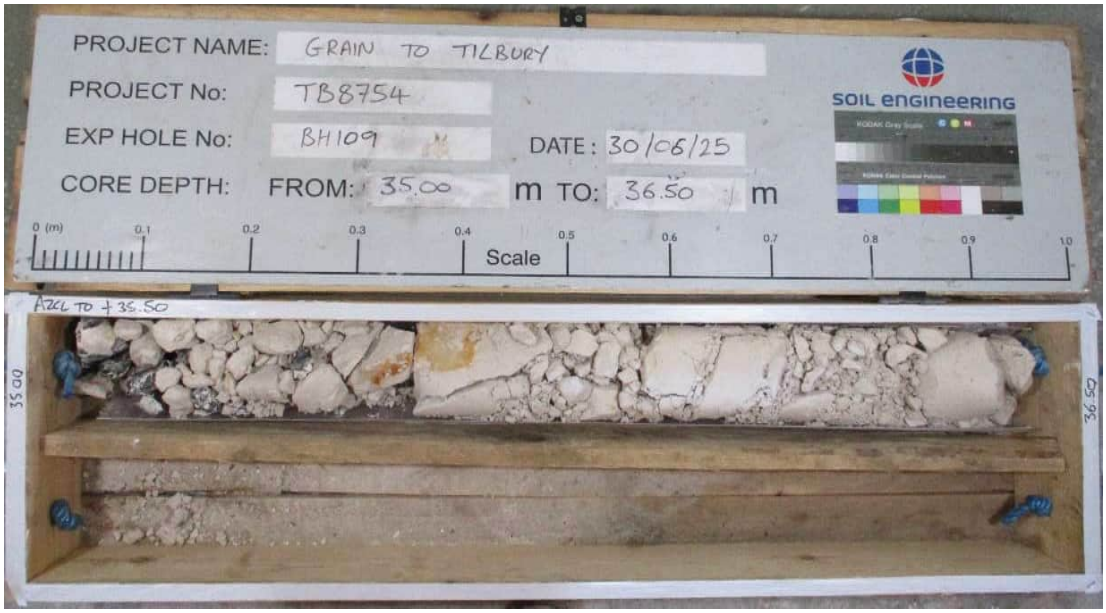
From 29.00m to 32.00m

Photographed by	Date photographed	TB8754_BH109_23.00-26.00	SOIL ENGINEERING
AW	30/06/2025	TB8754_BH109_29.00-32.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		02



From 32.00m to 35.00m



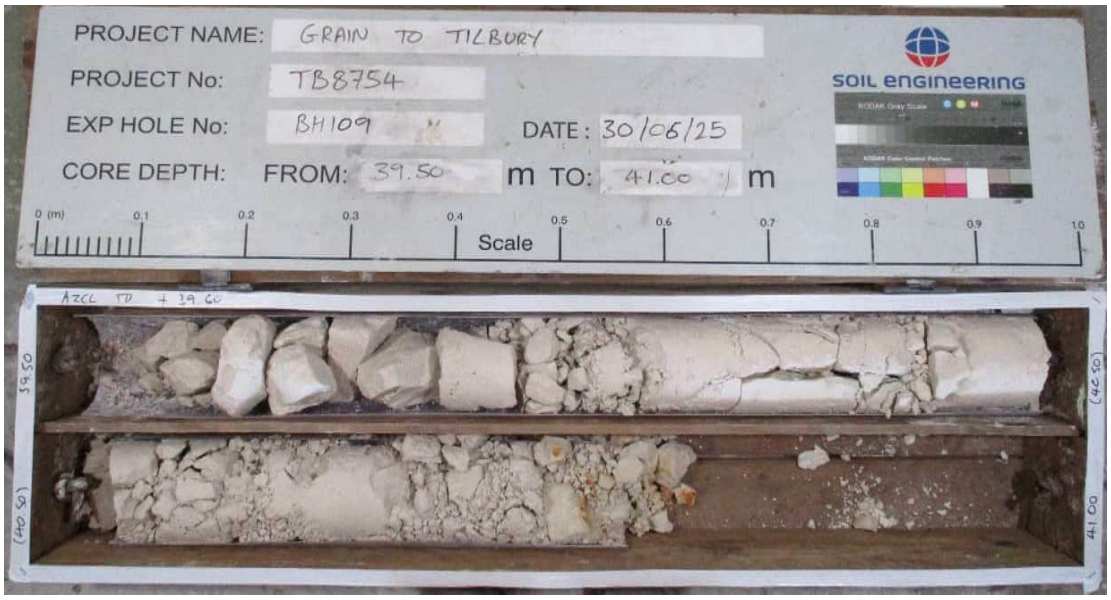
From 35.00m to 36.50m

Photographed by	Date photographed	TB8754_BH109_32.00-35.00
AW	30/06/2025	TB8754_BH109_35.00-36.50

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		03



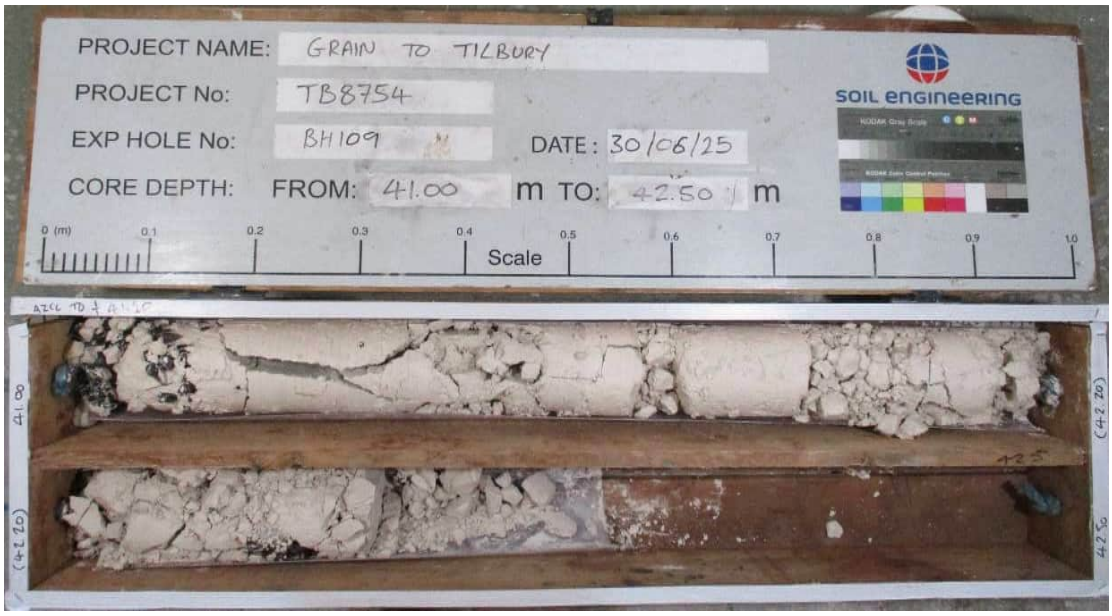
From 38.00m to 39.50m



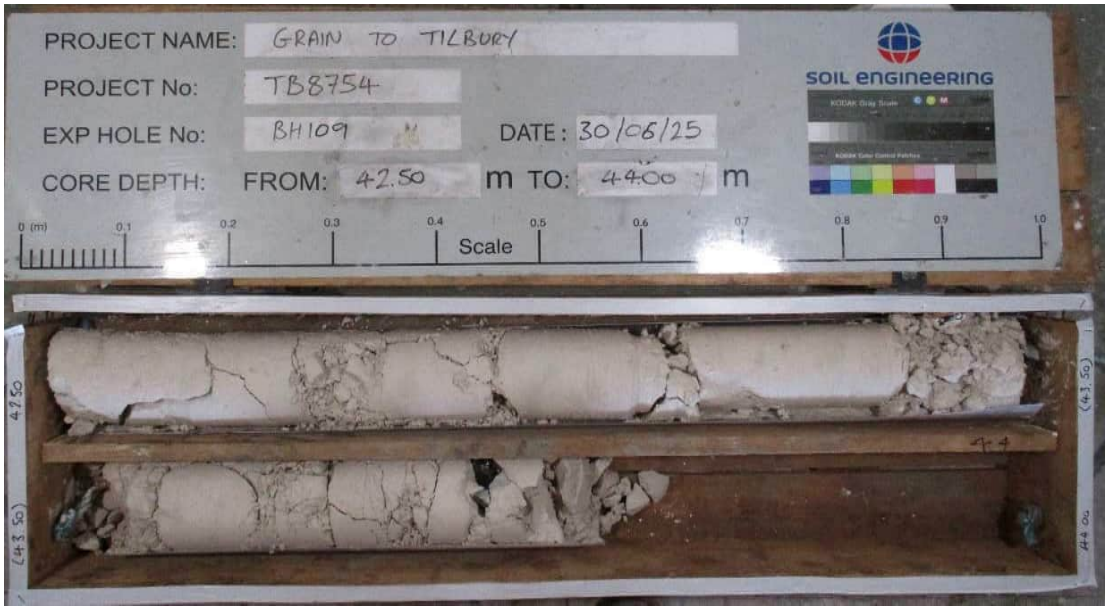
From 39.50m to 41.00m

Photographed by	Date photographed	TB8754_BH109_38.00-39.50	SOIL ENGINEERING
AW	30/06/2025	TB8754_BH109_39.50-41.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		04



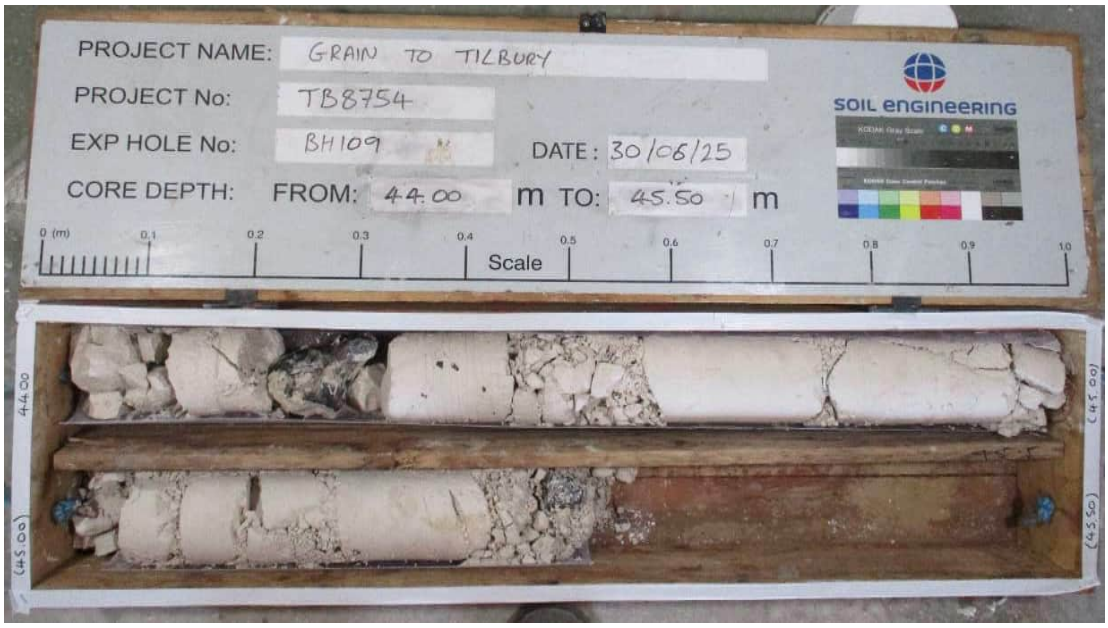
From 41.00m to 42.50m



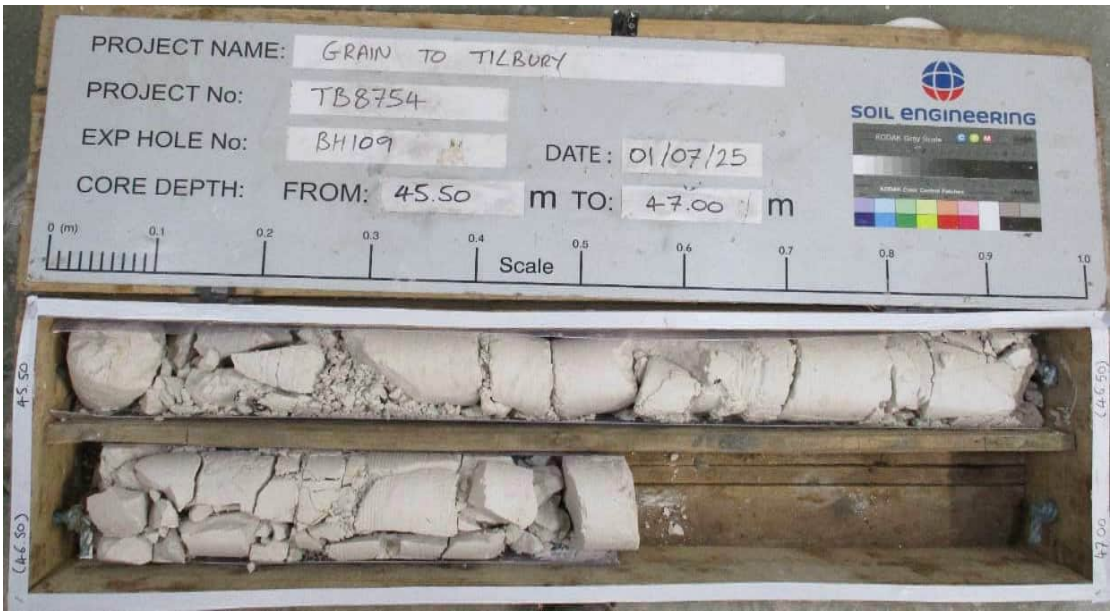
From 42.50m to 44.00m

Photographed by	Date photographed	TB8754_BH109_41.00-42.50
AW	30/06/2025	TB8754_BH109_42.50-44.00

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		05



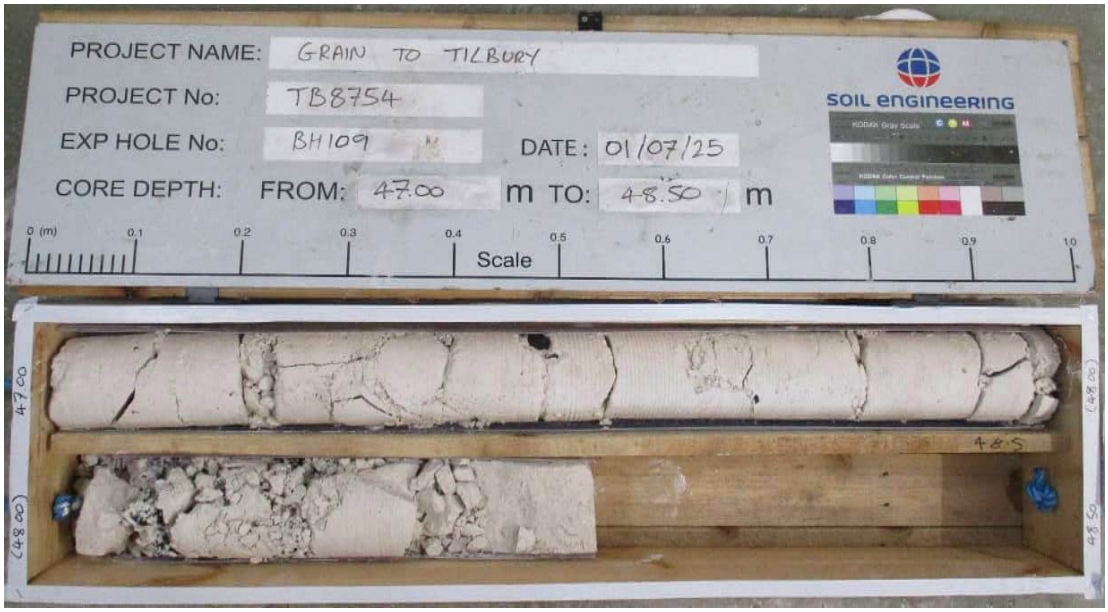
From 44.00m to 45.50m



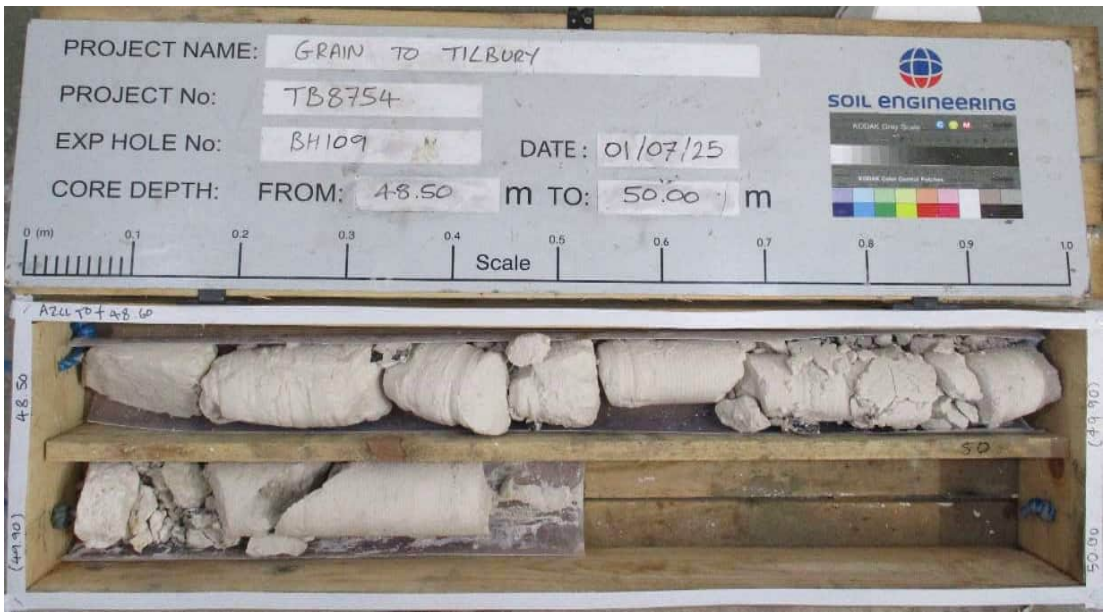
From 45.50m to 47.00m

Photographed by	Date photographed	TB8754_BH109_44.00-45.50	SOIL ENGINEERING
AW	01/07/2025	TB8754_BH109_45.50-47.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		06



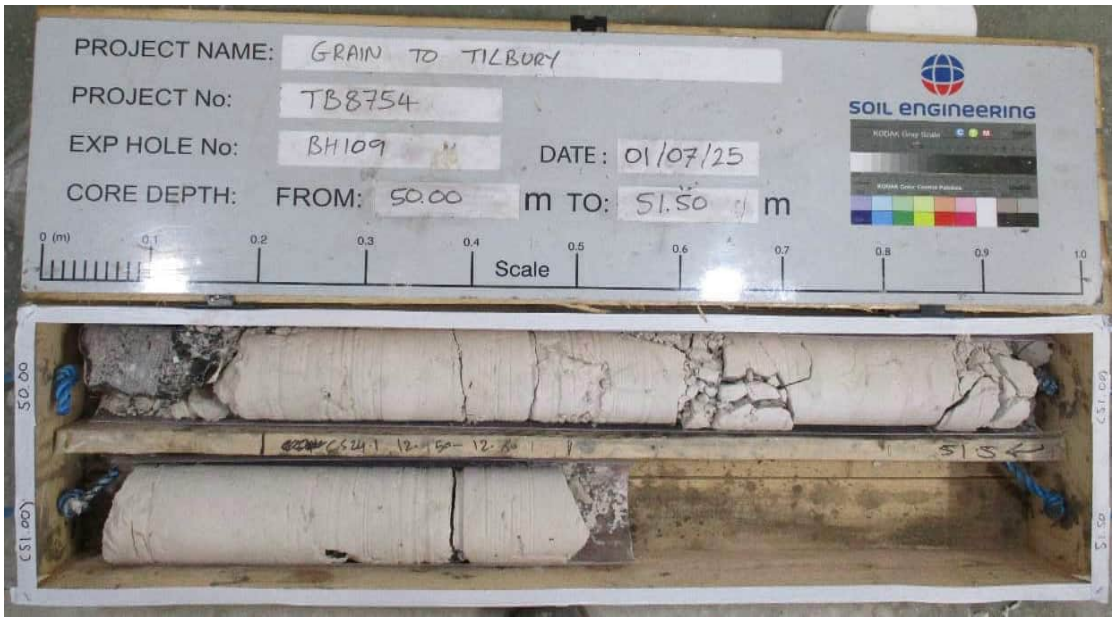
From 47.00m to 48.50m



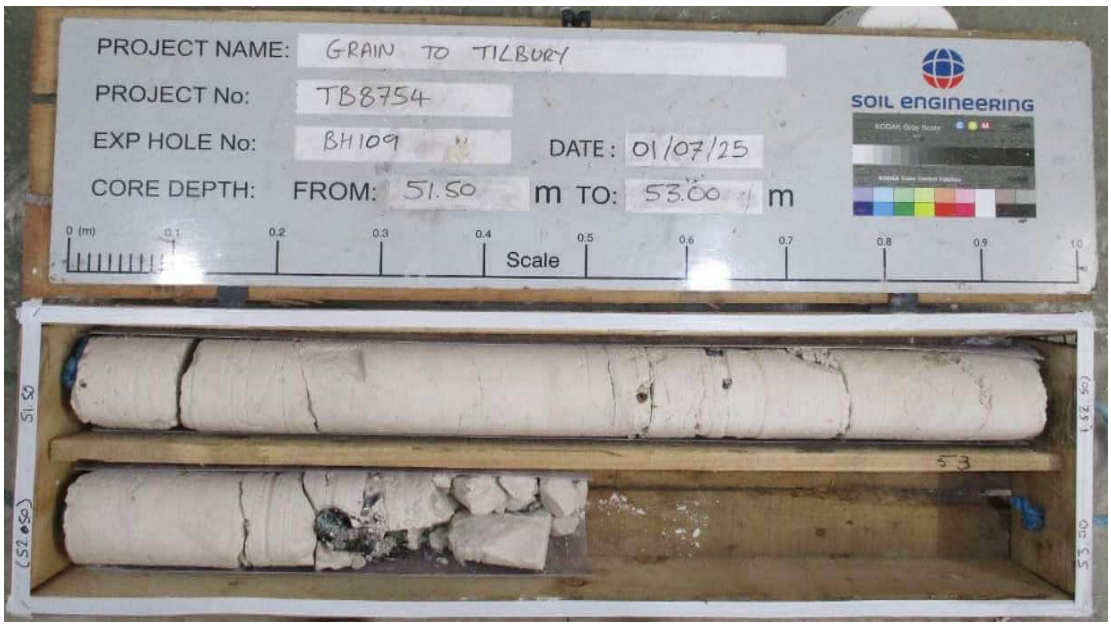
From 48.50m to 50.00m

Photographed by	Date photographed	TB8754_BH109_47.00-48.50	SOIL ENGINEERING
AW	01/07/2025	TB8754_BH109_48.50-50.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		07



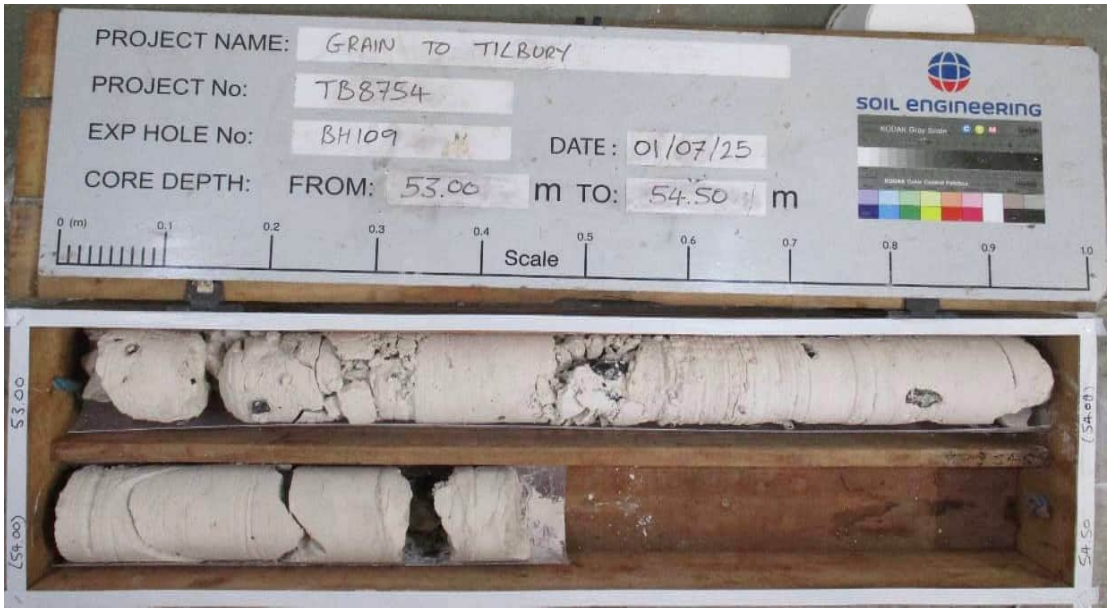
From 50.00m to 51.50m



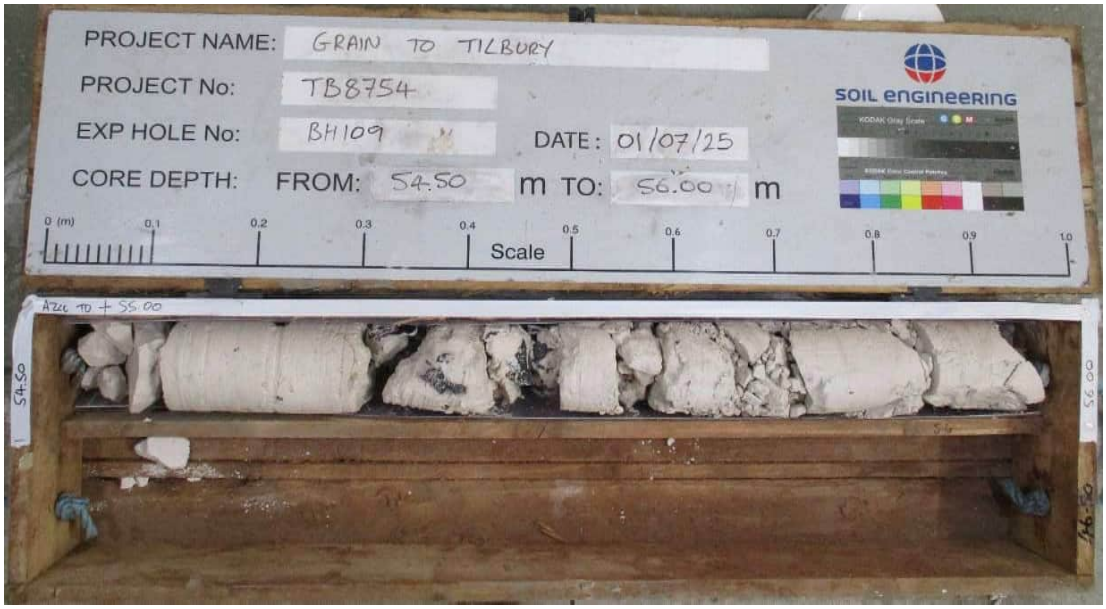
From 51.50m to 53.00m

Photographed by	Date photographed	TB8754_BH109_50.00-51.50
AW	01/07/2025	TB8754_BH109_51.50-53.00

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		08



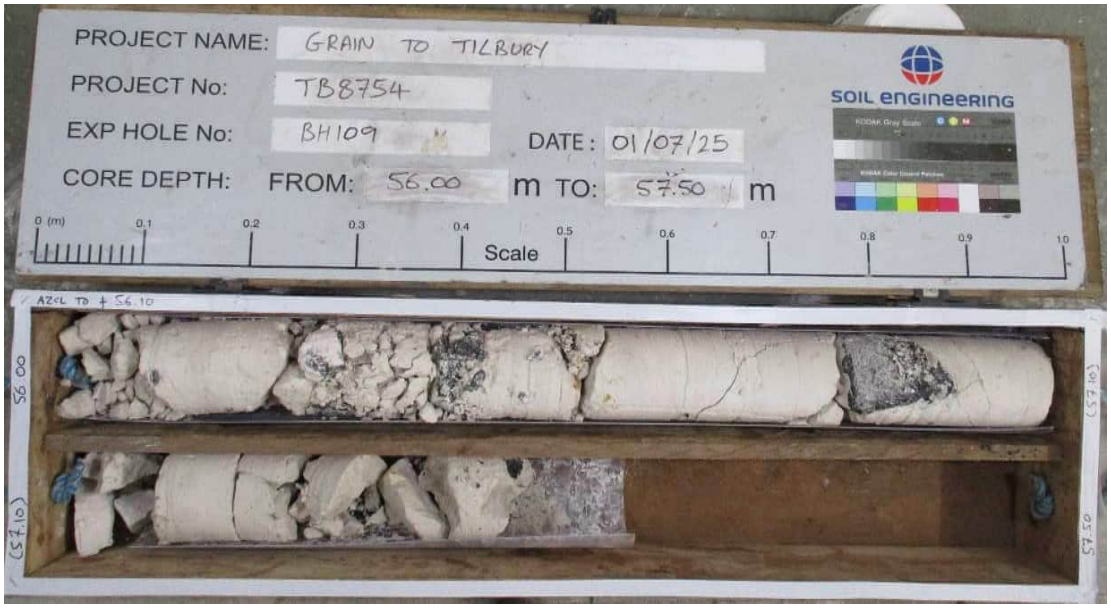
From 53.00m to 54.50m



From 54.50m to 56.00m

Photographed by	Date photographed	TB8754_BH109_53.00-54.50
AW	01/07/2025	TB8754_BH109_54.50-56.00

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		09



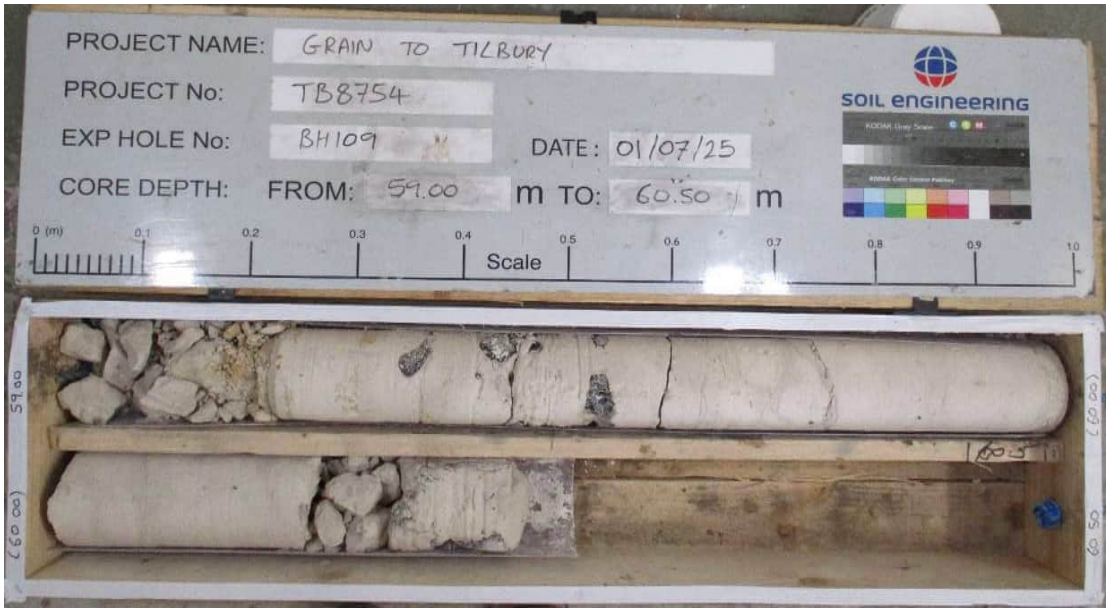
From 56.00m to 57.50m



From 57.50m to 59.00m

Photographed by	Date photographed	TB8754_BH109_56.00-57.50	SOIL ENGINEERING
AW	01/07/2025	TB8754_BH109_57.50-59.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		10

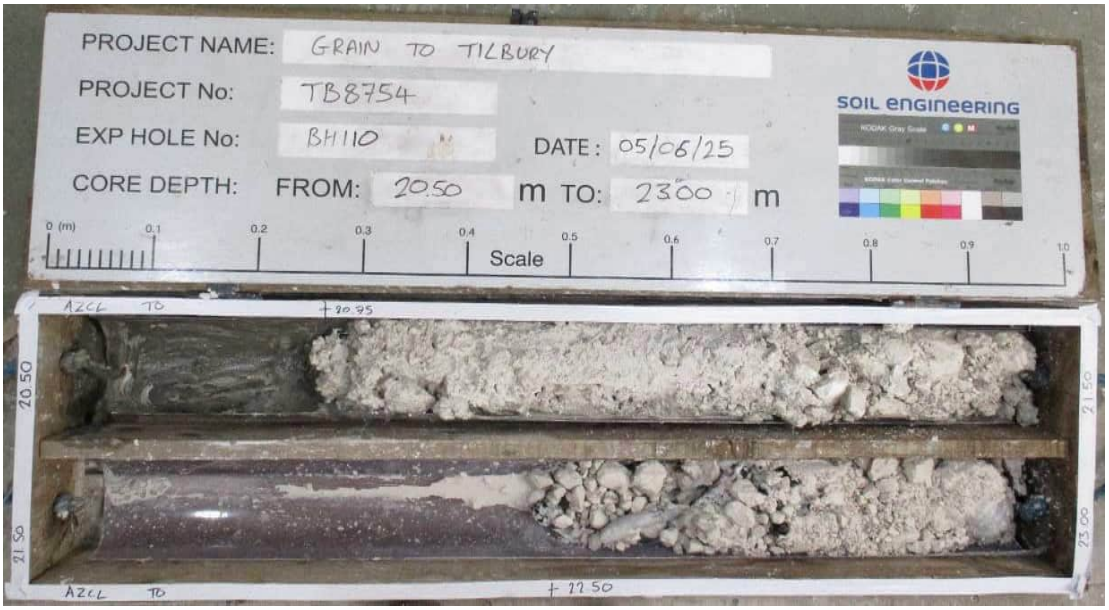


From 59.00m to 60.50m

Photographed by	Date photographed	TB8754_BH109_59.00-60.50
AW	01/07/2025	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH110
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		01



From 20.50m to 23.00m

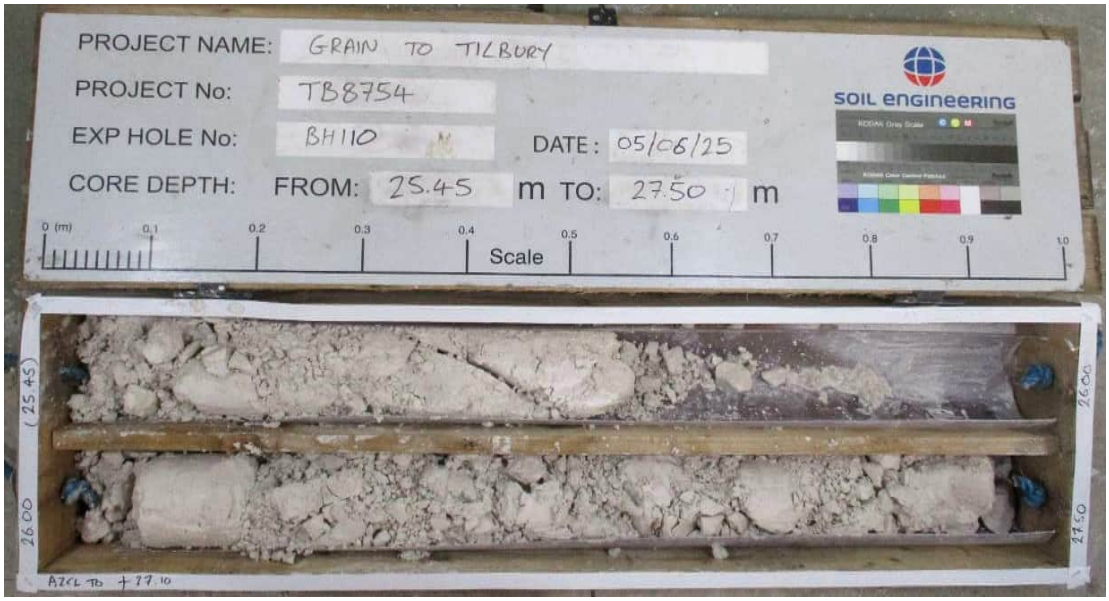


From 23.00m to 25.45m

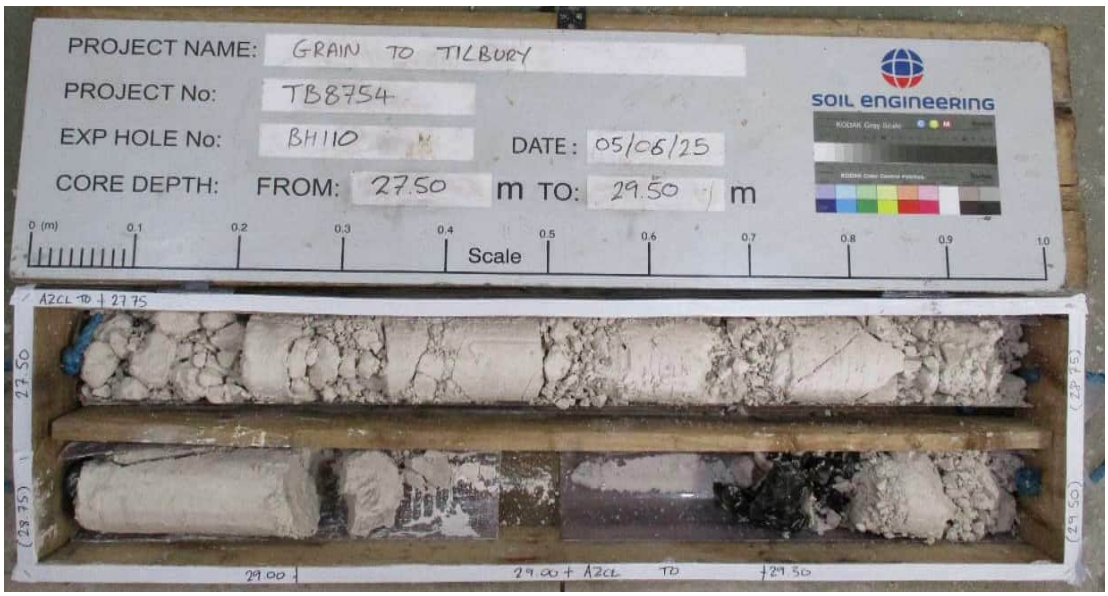
Photographed by	Date photographed	TB8754_BH110_20.50-23.00
AW	05/06/2025	TB8754_BH110_23.00-25.45

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH110
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		02



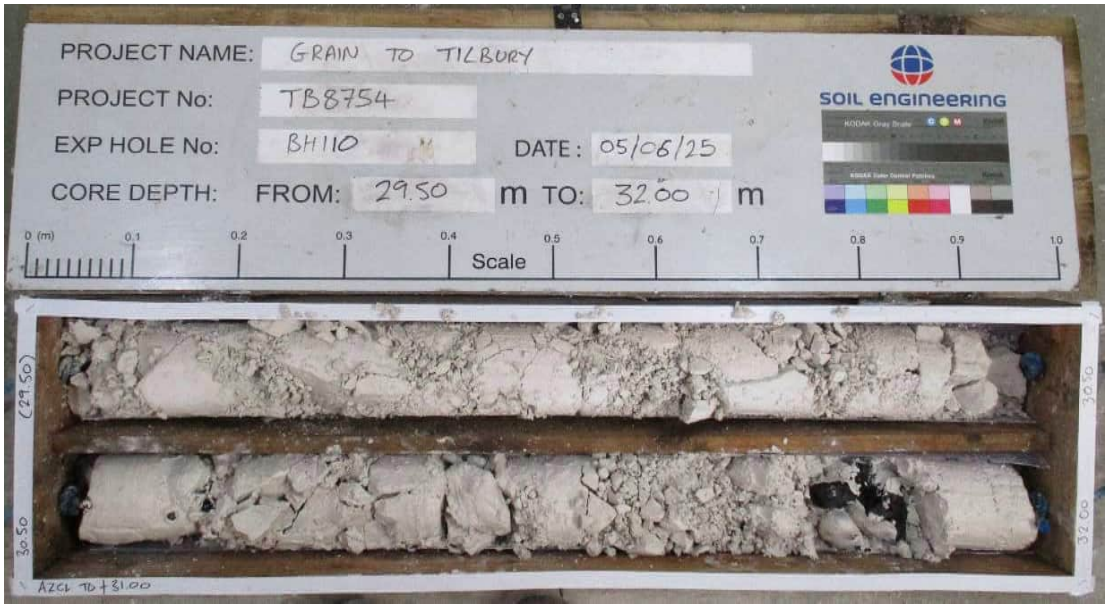
From 25.45m to 27.50m



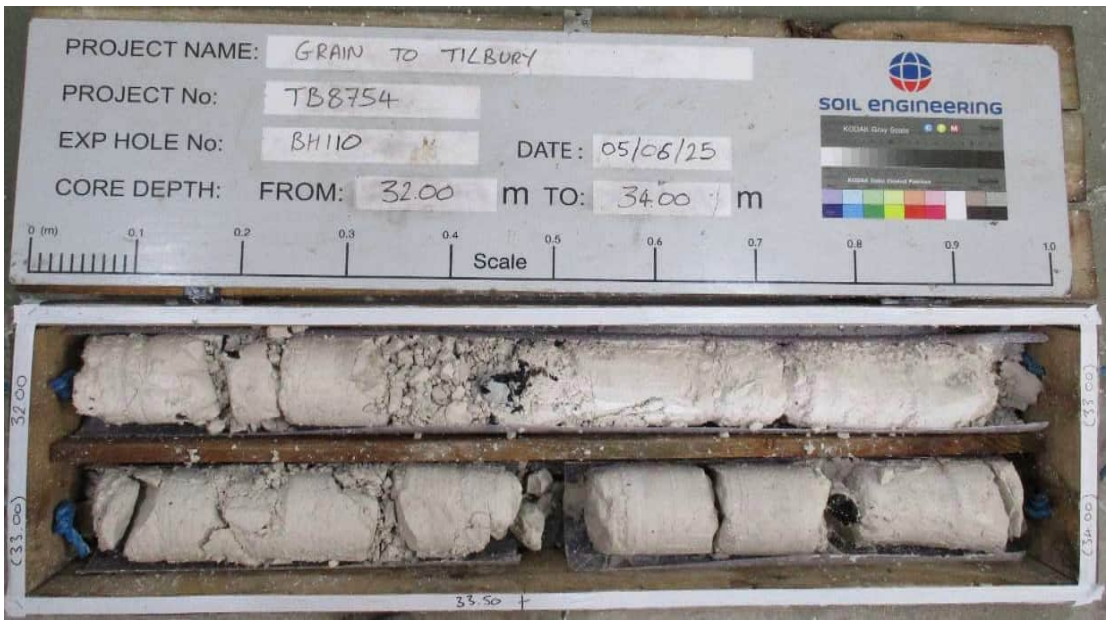
From 27.50m to 29.50m

Photographed by	Date photographed	TB8754_BH110_25.45-27.50
AW	05/06/2025	TB8754_BH110_27.50-29.50

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH110
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		03



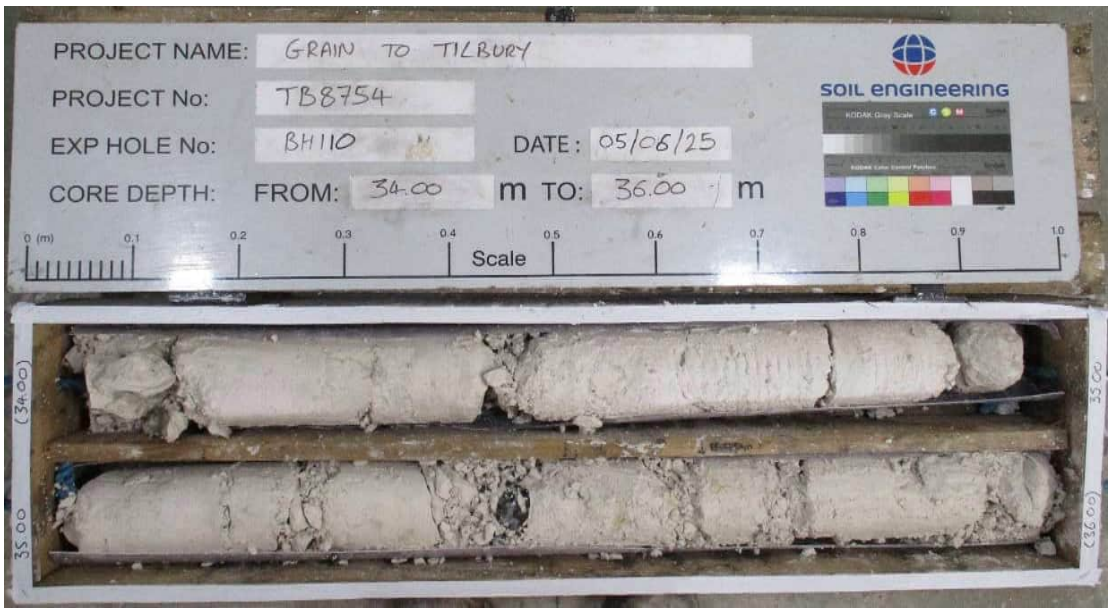
From 29.50m to 32.00m



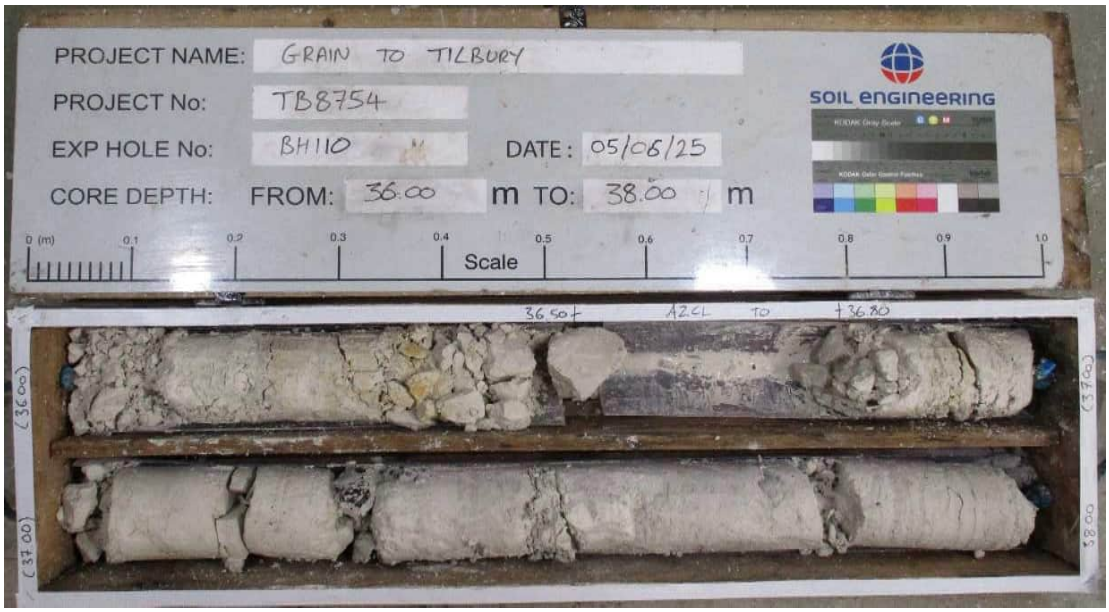
From 32.00m to 34.00m

Photographed by	Date photographed	TB8754_BH110_29.50-32.00	SOIL ENGINEERING
AW	05/06/2025	TB8754_BH110_32.00-34.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH110
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		04



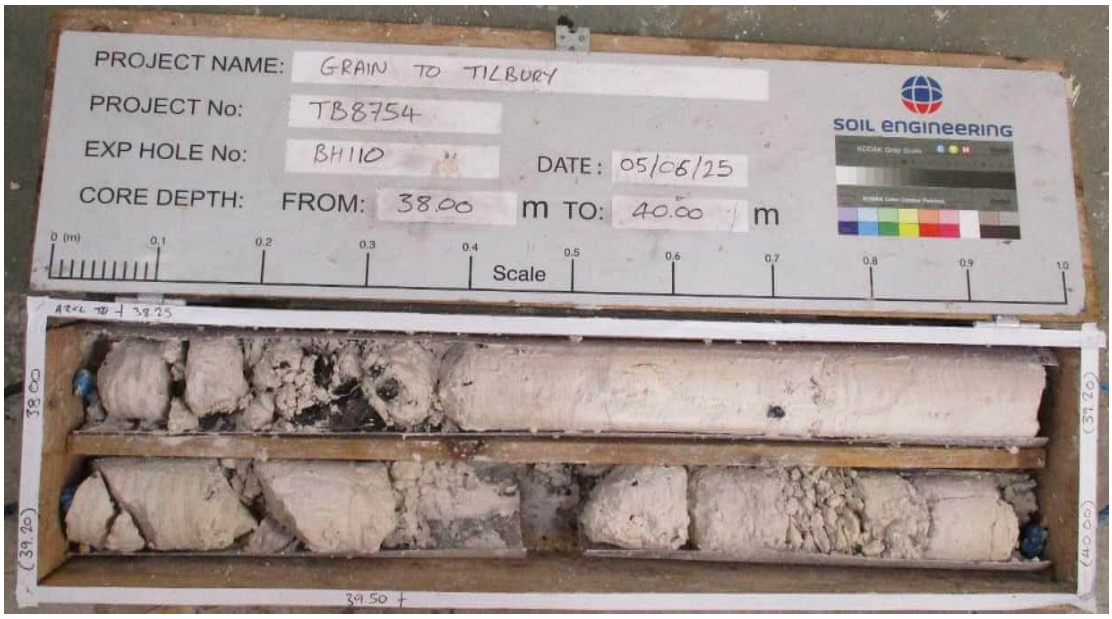
From 34.00m to 36.00m



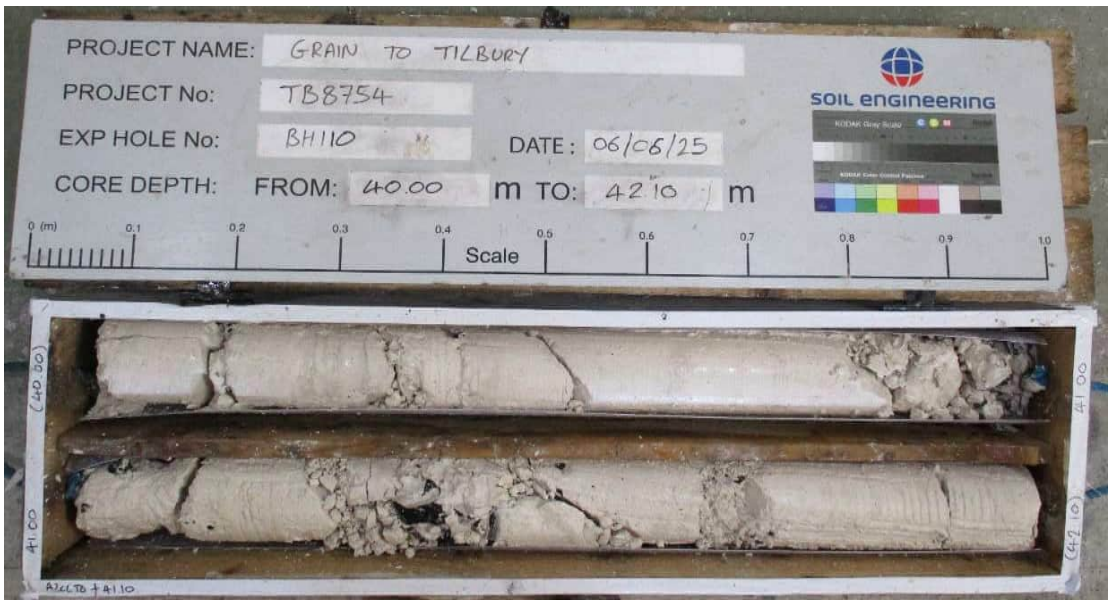
From 36.00m to 38.00m

Photographed by	Date photographed	TB8754_BH110_34.00-36.00	
AW	05/06/2025	TB8754_BH110_36.00-38.00	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH110
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		05



From 38.00m to 40.00m

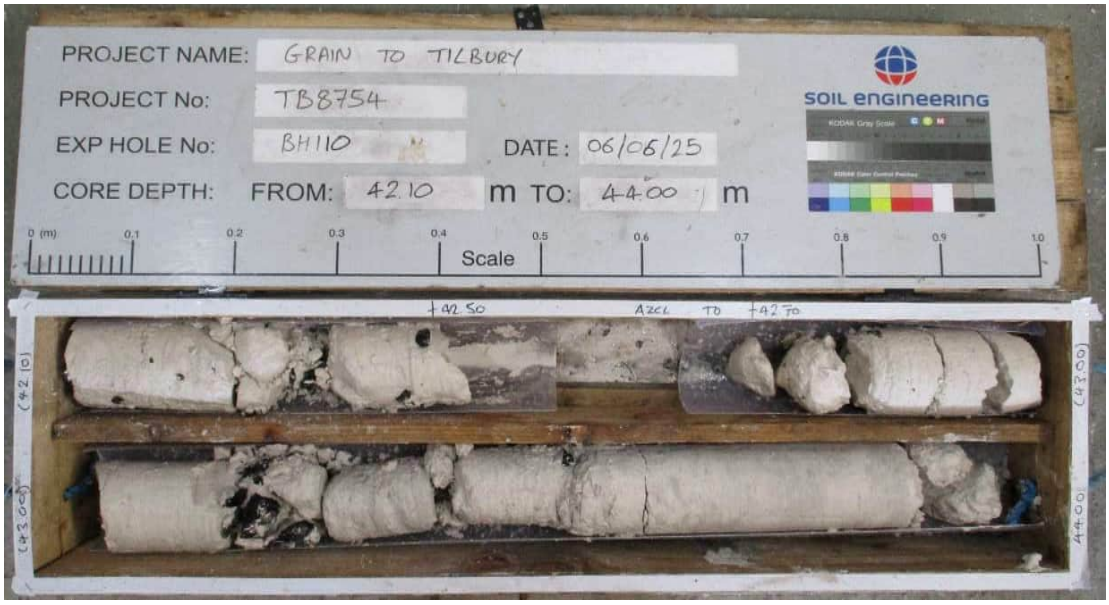


From 40.00m to 42.10m

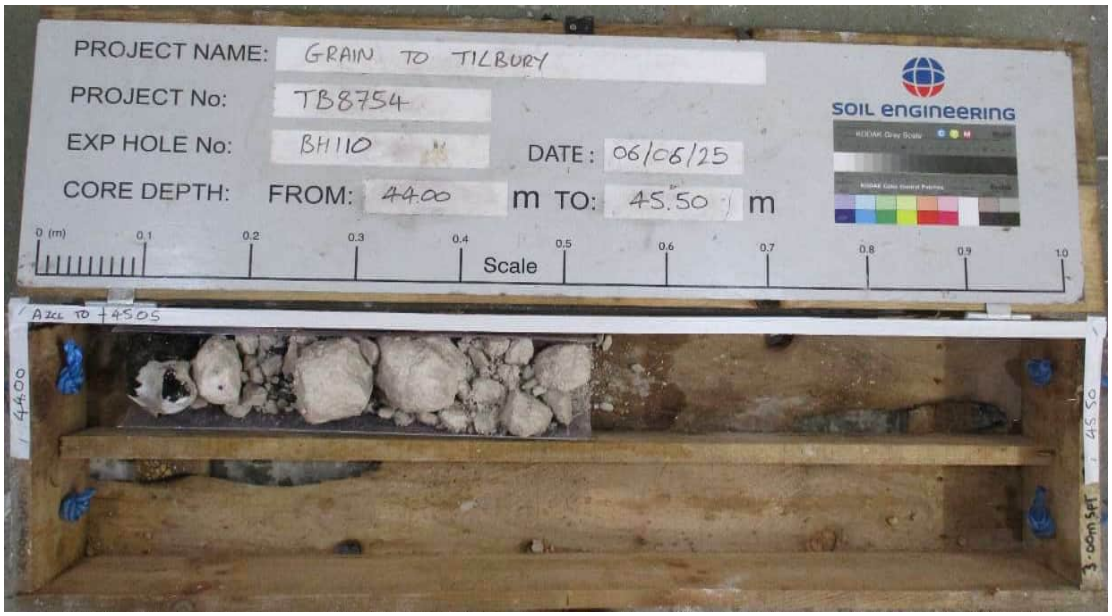
Photographed by	Date photographed	TB8754_BH110_38.00-40.00
AW	06/06/2025	TB8754_BH110_40.00-42.10

SOIL ENGINEERING

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH110
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		06



From 42.10m to 44.00m



Photographed by	Date photographed	TB8754_BH110_42.10-44.00	
AW	06/06/2025	TB8754_BH110_44.00-45.50	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.05	Issue Date 08/04/2022	SOIL ENGINEERING

SOIL ENGINEERING

SUPPORTING FACTUAL DATA

SECTION D
Photographs

PRE & POST CONDITION PHOTOGRAPHS

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		01



Description

BH101 pre condition photo. Location relocated due to obstruction in original location

Photographed by	Date photographed	Filename	
PS	06/05/2025	BH101 pre	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		02



Description

BH101 post condition photo. Location redeveloped by FBJV. Slight damage to the borehole cover

Photographed by	Date photographed	Filename	
PS	21/07/2025	BH101 post	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH102
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		01



Description

BH102 pre condition photo

Photographed by	Date photographed	Filename	
PS	06/05/2025	BH102 pre	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		02



Description

BH102 post condition photo. Location redeveloped by FBJV. Damage to the borehole cover. Cover replaced

Photographed by	Date photographed	Filename	
PS	21/07/2025	BH102 post	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		01



Description

BH103 location

Photographed by	Date photographed	Filename	
PS	06/05/2025	BH103 pre	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		02



Description

BH103 post condition photo. Location redeveloped by FBJV. Concrete slab build around the borehole
As requested by the client the borehole left open with 8" and 6" casing in the ground

Photographed by	Date photographed	Filename	
PS	21/07/2025	BH103 post	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH104
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		01



Description

BH104 pre condition photo

Photographed by	Date photographed	Filename	
PS	06/05/2025	BH104 pre	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH104
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		02



Description

BH104 post condition photo with VWP installation

Photographed by	Date photographed	Filename	
PS	21/07/2025	BH104 post	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH105
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		01



Description

BH105 pre condition photo
Vegatation clearance completed by FBJV

Photographed by	Date photographed	Filename	
PS	06/05/2025	BH105 pre	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH105
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		02



Description

BH105 post condition photo with VWP installation

Photographed by	Date photographed	Filename	
PS	21/07/2025	BH105 post	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		01



Description

BH106 pre condition photo

Photographed by	Date photographed	Filename	
PS	06/05/2025	BH106 pre	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH106
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		02



Description

BH104 post condition photo. Borehole grouted to ground level

Photographed by	Date photographed	Filename	
PS	21/07/2025	BH106 post	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		01



Description

BH107 pre condition photo

Photographed by	Date photographed	Filename	
PS	06/05/2025	BH107 pre	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		02



Description

BH107 post condition photo
As requested by the client the borehole left open with 8" and 6" casing in the ground

Photographed by	Date photographed	Filename	
PS	21/07/2025	BH107 post	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		01



Description

BH108 pre condition photo

Photographed by	Date photographed	Filename	
PS	06/05/2025	BH108 pre	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH108
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		02



Description

BH108 post condition photo with groundwater installation

Photographed by	Date photographed	Filename	
PS	21/07/2025	BH108 post	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		01



Description

BH109 pre condition photo

Photographed by	Date photographed	Filename	
PS	06/05/2025	BH109 pre	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		02



Description

BH109 post condition photo
As requested by the client the borehole left open with 8" and 6" casing in the ground

Photographed by	Date photographed	Filename	
PS	21/07/2025	BH109 post	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH110
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		01



Description

BH110 pre condition photo

Photographed by	Date photographed	Filename	
PS	06/05/2025	BH110 pre	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH110
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		02



Description

BH110 post condition photo. Location redeveloped by FBJV.
As requested by the client the borehole left open with 8" and 6" casing in the ground

Photographed by	Date photographed	Filename	
PS	21/07/2025	BH110 post	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH301
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		01



Description

BH1301 pre condition photo

Photographed by	Date photographed	Filename	
PS	06/05/2025	BH301 pre	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH301
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		02



Description

BH301 post condition photo with Deep Datum installation
Vegetation clearance completed by FBJV

Photographed by	Date photographed	Filename	
PS	21/07/2025	BH301 post	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH302
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		01



Description

BH302 pre condition photo

Photographed by	Date photographed	Filename	
PS	06/05/2025	BH302 pre	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH302
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		02



Description

BH302 post condition photo with Deep Datum installation
Vegetation clearance completed by FBJV

Photographed by	Date photographed	Filename	
PS	21/07/2025	BH302 post	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH303
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		01



Description

BH303 pre condition photo

Photographed by	Date photographed	Filename	
PS	06/05/2025	BH303 pre	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH303
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		02



Description

BH303 post condition photo with Deep Datum installation
Vegetation clearance completed by FBJV

Photographed by	Date photographed	Filename	
PS	21/07/2025	BH303 post	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH304
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		01



Description

BH304 pre condition photo

Photographed by	Date photographed	Filename	
PS	06/05/2025	BH304 pre	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH304
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		02



Description

BH304 post condition photo with Deep Datum installation
Vegetation clearance completed by FBJV

Photographed by	Date photographed	Filename	
PS	21/07/2025	BH304 post	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH305
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		01



Description

BH305 pre condition photo

Photographed by	Date photographed	Filename	
PS	06/05/2025	BH305 pre	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH305
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		02



Description

BH305 post condition photo with Deep Datum installation
Vegetation clearance completed by FBJV

Photographed by	Date photographed	Filename	
PS	21/07/2025	BH305 post	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH306
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		01



Description

BH306 pre condition photo

Photographed by	Date photographed	Filename	
PS	06/05/2025	BH306 pre	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH306
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		02



Description

BH306 post condition photo with Deep Datum installation
Vegetation clearance completed by FBJV

Photographed by	Date photographed	Filename	
PS	21/07/2025	BH306 post	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

SOIL ENGINEERING

SUPPORTING FACTUAL DATA

SECTION D
Photographs

EXCAVATION PHOTOGRAPHS

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH103
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		01



Side A



Side B

Photographed by	Date photographed	TB8754_BH103_Side A
EC	04/05/2025	TB8754_BH103_Side B

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH107
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		01



Side A



Side B

Photographed by	Date photographed	TB8754_BH107_Side A
SP	27/05/2025	TB8754_BH107_Side B

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH109
Engineer	Mott MacDonald		Sheet No.
Employer	FBJV		01



Side A



Side B

Photographed by	Date photographed	TB8754_BH109_Side A
SP	29/05/2025	TB8754_BH109_Side B

Project Name	Grain to Tilbury Tunnel GI	**Photographic Record**	Hole ID
Project No.	TB8754		BH101
Engineer	Mott MacDonald		Plate No.
Employer	FBJV		01



Description

BH101 pre condition photo. Location relocated due to obstruction in original location

Photographed by	Date photographed	Filename	
PS	06/05/2025	BH101 pre	SOIL ENGINEERING
Form No. SE-SDP-F-004	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

SOIL ENGINEERING

SUPPORTING FACTUAL DATA

APPENDIX 1
Explanatory Notes on Fieldwork, Logging and Laboratory Testing

FIELDWORK PROCEDURES

APPENDIX 1: FIELDWORK PROCEDURES

1.0 CABLE PERCUSSION BORING TECHNIQUES

Unless otherwise stated the light cable percussion technique of 'soft ground' boring has been employed in the formation of boreholes for this contract. In cohesive soils a clay cutter has been used to advance the boreholes whilst in granular deposits a shell has been employed. The combination of clay cutter and shell bring up disturbed material which is generally sufficiently representative to permit identification of the strata. Whilst these particular techniques allow the maximum data to be obtained on strata conditions, a degree of mixing of some layered soils (e.g. thin layers of coarse and fine granular material) is inevitable.

2.0 DYNAMIC SAMPLING

As an alternative to cable percussion boring, Soil Engineering employs a number of techniques for the sampling of soils. The most common alternative techniques comprise some form of dynamic sampling system which involves sampling tubes being driven into the ground by means of a sliding weight.

'Window sampling' techniques form the most common type of dynamic sampling and typically comprise 1.0m long steel cylinders with elongated windows. These are driven to the required depth by the use of a percussive hammer. In the 'windowless' mode a plastic liner can be placed in the steel cylinders such that effectively continuous sampling can be undertaken. This method of sampling only produces Quality Class 3 or 4 samples which are not suitable for any form of laboratory machine testing.

3.0 ROUTINE SAMPLING

In the UK "undisturbed" samples of predominantly cohesive soils have historically generally been obtained in a 102mm diameter open drive sampler as described in the British Standard Code of Practice BS 5930: 2015 + A1 2020 (ref 01). These samplers are known as U100 and historically are of two types; a metal tube or a plastic liner. BS EN ISO 22475- 1: 2006 (ref 03) however makes it clear that such samplers will not produce a quality class 1 sample. It is this class of sample that is required for laboratory machine testing.

Alternative methods of sampling which will produce a class 1 sample are available and these include piston samplers, Shelby tubes and the UT100. The latter is a modification of the U100 and classifies as a thin wall sampler and as such is capable of obtaining class 1 samples. It should be noted however that this type of sampler is only suitable for certain ground conditions and cannot be used in very stiff to hard cohesive soils or in very granular cohesive soils. Equally other thin walled samplers such as the piston sampler are more appropriate for very soft and soft cohesive soils.

Soil Engineering recognise that in certain soil types, there will not be a single solution to sampling and it will be necessary to utilise a variety of sampling techniques in order to obtain the best quality samples possible. Such techniques may include rotary coring and this is described in section 4.0. For some 'difficult' soil types it may not be possible to obtain truly undisturbed samples, and engineering judgement will be required if such samples are to be used for geotechnical laboratory testing. Where such challenging soil types have been encountered and alternative sampling techniques used, this is discussed in the report text.

In granular deposits and mixed cohesive granular deposits where it is not possible to recover undisturbed samples, either large or small disturbed samples are normally obtained. The size of these samples are in accordance with the requirements of BS 5930: 2015 + A1 2020 whilst the frequency of sampling is unique to this contract.

It is important to note that the number of blows taken to drive any kind of sampling tube is not necessarily indicative of the strength of the material being sampled. For this reason Soil Engineering recommends that no attempt is made to correlate such blows with the strength of cohesive strata.

4.0 ROTARY DRILLING

Where rotary open hole drilling techniques have been employed it is important to note that descriptions of the strata encountered are generally solely based on the lead drillers observations of cuttings and drill flush returns. Whilst such techniques can provide useful information in certain ground conditions it should be recognised that an accurate determination of subsurface rock strata can only be obtained by rotary coring techniques.

An examination of rock cores obtained by rotary drilling generally enables bedding planes, fissuring and consistency to be observed but does not necessarily reveal the presence of vertical fissures or joints. Where an appropriate core diameter and flushing medium have been used, sub-sampling of the core immediately following removal from the core barrel can produce quality Class 1 samples. Such samples require to be sealed and waxed in order to prevent moisture loss.

Details of the strata encountered are given on the borehole log along with the geologist's assessment of Total Core Recovery (TCR), Solid Core Recovery (SCR) and Rock Quality Designation (RQD) each expressed as a percentage of the individual core runs. When appropriate the Fracture Index (FI) or Fracture Spacing (If) is also given on the logs and represents respectively the number of natural fractures per metre run of core for core that has a similar intensity of fracturing, or the minimum, average and maximum spacing of such natural fractures over an arbitrary length of core of similar intensity of fracturing.

The symbols and abbreviations used on the rotary borehole logs are explained on the exploratory hole legend and notation sheet that precedes the exploratory hole records. It is considered however that the meaning of the abbreviations NI and NA needs further clarification. NI denotes material recovered non intact and applies to material that has numerous fractures or incipient fractures and which is either naturally broken up or which becomes broken up by drilling activities. The result in both cases is that the core is recovered in a highly fragmented state, generally as a gravel. The term NA is the abbreviation for not applicable and refers to any materials to which determination of a fracture index would be inappropriate, i.e. for clay bands.

Where significant core loss (>300mm) has occurred, it is Soil Engineering general policy to insert a separate 'stratum' on the log to coincide with the inferred zone of core loss. Unless there is good evidence as to the rock (or soil) type that has been lost, the legend column is left blank. For zones of inferred mine workings, an appropriate legend is used and this together with all the legends used on the logs is shown on the log notation sheet that precedes the exploratory logs in the report.

A summary of logging methodology for rock strata and core measurements is given in Appendix 1: Terminology used in the Description and Classification of Rocks.

5.0 IN SITU DYNAMIC PENETRATION TESTS

The Standard Penetration Test using either a split spoon (SPT) or a solid cone (SPT(C)), is generally employed where undisturbed samples cannot be obtained e.g. in granular soils, fill and rock etc, in order to obtain an indication of the in situ density, compaction or hardness. It can also be used as an alternative to undisturbed sampling in cohesive deposits. Inherent difficulties are present in obtaining true SPT or SPT(C) "N" values in water bearing fine grained granular deposits and careful consideration of the test technique and groundwater conditions are necessary before test results are used for design purposes.

The full procedure for carrying out the Standard Penetration Test (SPT) is given in BS EN ISO 22476-3: 2005 + A1 2011 (ref 02). For fine to medium granular deposits and in clays the test consists of driving a 50mm external diameter split barrel sampler into the soil using a 63.5kg hammer dropping 760mm. In coarse granular soils or in rock, the split barrel may be replaced by a solid cone. The penetration resistance is expressed as the number of blows required to obtain 300mm penetration below an initial seating drive of 150mm through any disturbed ground at the bottom of the borehole. The number of blows for the 300mm test drive penetration is recorded on the borehole logs as the "N" value. A full record of the number of blows required to drive the sampler at 75mm intervals throughout the total 450mm drive is also tabulated along with the groundwater level at the time of test. Where full 450mm penetration is not achieved, it is important to distinguish how the blow count relates to the penetration of the sampler and this may be achieved in the following manner:

(i) Where the test drive is terminated before full (300mm) penetration the number of blows for the partial test drive (usually 50) and the penetration of the sampler within the test drive are recorded. An approximate "N" value may be obtained by linear extrapolation of the number of blows recorded for the partial test drive.

(ii) If the total seating drive penetration is equal to or less than 150mm then the number of blows (usually 25) and the depth of penetration within the initial seating penetration are recorded on the borehole logs.

The "N" value obtained from the Standard Penetration Test may be used to assess the relative density of sands and gravels in accordance with Clause 33.3.2 of BS 5930: 2015 + A1 2020, as shown in table 1.

It should be noted that the "N" values reported on the logs are uncorrected, as specified in section 6 of BS EN ISO 22476-3:2005 + A1 2011.

SPT's performed by Soil Engineering are carried out using automatic trip hammers that have been calibrated in accordance with BS EN ISO 22476-3:2005 + A1 2011. The hammer ID and energy ratio are recorded on the 'header page' of each log and calibration certificates for the hammers used on the project are contained in the Appendix Section of the report, as required by BS EN ISO 22476-3:2005 + A1 2011 .

TABLE 1: DETERMINATION OF RELATIVE DENSITY FROM PENETRATION TESTS (from BS 5930)

Term	SPT N-Value: Blows/300mm Penetration
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Over 50

It should be noted that it is a requirement of BS EN ISO 22476-3: 2005 + A1 2011 that all test hammers are calibrated. Soil Engineering routinely calibrate all their test hammers and the results of the calibration are expressed as an Energy Ratio (Er) on the exploratory hole logs. The Er value is required for design purposes and should be applied to the recorded test N value in the manner described in BS EN ISO 22476-3: 2005 + A1 2011.
Standard Penetration Testing may also be performed in very stiff/hard clays in which it would be difficult to obtain undisturbed samples. In such cases the SPT "N" values may be used for design purposes based on correlations between "N" value and various soil parameters such as those proposed by Stroud and Butler (1975) (ref 04) and by Stroud (1989) (ref 05).

6.0 GROUNDWATER

The groundwater conditions entered on the exploratory hole records are those encountered at the time of the investigation. These however, may not represent the actual conditions or those which may apply in large excavations. The normal rate of boring does not always permit the recording of an equilibrium water level for any one water strike, particularly because the entry of water into a borehole may be reduced or even eliminated due to casing off a water bearing layer or due to a skin being formed on the borehole wall by the drilling tools. It should also be noted that groundwater conditions may vary seasonally and/or tidally and that the water levels as shown at the time of investigation should not necessarily be taken as being constant because they may be subject to such fluctuations.

More accurate information on groundwater conditions can be obtained from exploratory hole installations such as piezometers and standpipes. Normally a minimum of three or four monitoring visits are required at the site to provide this information.

References

01) BS 5930: 2015 + A1 2020: Code of Practice for Site Investigation. British Standards Institution.

02) BS EN ISO 22476-3: 2005 + A1 2011: Geotechnical Investigation and Testing - Field Testing - Part 3: Standard Penetration Test.

03) BS EN ISO 22475-1: 2006: Geotechnical Investigation and Testing - Sampling Methods and Groundwater measurements - Part 1: Technical Principles for Execution.

04) Stroud, M.A, Butler, F.G April 1975: 'The Standard Penetration Test and the Engineering Properties of Glacial Materials'. The Engineering Behaviour of Glacial Materials Proc. of Symp.

05) Stroud, M.A. 1989: 'The Standard Penetration Test - Its Application and Interpretation. Thomas Telford, London.

SOIL ENGINEERING

SUPPORTING FACTUAL DATA

APPENDIX 1
Explanatory Notes on Fieldwork, Logging and Laboratory Testing

TERMINOLOGY USED IN SOIL DESCRIPTIONS

APPENDIX 1: TERMINOLOGY USED IN SOIL DESCRIPTIONS

1.0 GENERAL PROCEDURES

Soil descriptions contained in this report have been produced in accordance with the procedures and principles given in BS EN ISO 14688-1: 2018 (ref 01), BS EN ISO 14688-2: 2018 (ref 02) and also where there is no conflict with the European standards, in accordance with BS 5930: 2015 + A1 2020 (ref 03).

For a soil description the main soil characteristics should be given in a standard word order although the word order can be adjusted to enhance and clarify if appropriate. The main soil characteristics can be divided as follows:-

1 **Mass Characteristics**
comprising state and structure
1a Density and Field Strength
1b Discontinuities
1c Bedding

2 **Material Characteristics**
comprising nature and state
2a Colour
2b Composite Soil Types: particle grading and composition, shape and size
2c Principal Soil Type, name in capitals eg CLAY

3 **Stratum Name (optional)**
3a Geological group or Formation

The basic soil categories may be broadly summarised as follows, with categories i to iii covered by these notes and categories iv and v by separate notes.

(i) Very coarse soils: greater than 63mm in diameter, ie cobbles and boulders.
(ii) Coarse soils: 0.063mm to 63mm in diameter, ie sands and gravels.
(iii) Fine soils: less than 0.063mm in diameter, ie clays and silts.
(iv) Organic soils.
(v) Man made "soils".

2.0 MASS CHARACTERISTICS OF SOILS

2.1 Cohesive Soils

For cohesive material determination of consistency is made in accordance with Table 1. The undrained shear strength of clays is determined by laboratory or field testing and is made in accordance with the terms given in Table 2.

TABLE 1: CONSISTENCY GUIDE FOR COHESIVE MATERIAL (from BS EN ISO 14688-1: 2018)

Term	Field Identification
Very Soft	Exudes between fingers when squeezed in the hand
Soft	Can be moulded by light finger pressure
Firm	Cannot be moulded, but can be rolled into 3mm thick thread
Stiff	Crumbles when rolled into 3mm thick thread
Very Stiff	Cannot be moulded and crumbles under pressure. Indented by thumbnail

APPENDIX 1: TERMINOLOGY USED IN SOIL DESCRIPTIONS

TABLE 2: STRENGTH TERMS OF FINE SOILS (from BS EN ISO 14688-2: 2018)

Strength Term	Undrained shear strength (Cu) kPa
Extremely Low	<10
Very Low	10 to 20
Low	20 to 40
Medium	40 to 75
High	75 to 150
Very High	150 to 300
Extremely High[1]	>300

1 Materials with shear strengths greater than 300kPa may behave as weak rocks and should be described in accordance with BS EN ISO 14689-1

2.2 Granular Soils

For granular deposits relative density may only be determined by the Standard Penetration Test (SPT). The following table provides a scale of terms related to SPT 'N' values from BS 5930: 2015 + A1 2020.

TABLE 3: ASSESSMENT OF RELATIVE DENSITY FOR GRANULAR SOILS (from BS 5930: 2015 + A1 2020)

Term	Field Identification (generally in trial pits)	SPT 'N' Values (blows for 300mm penetration)
Very loose	Very easy to excavate with a spade	0-4
Loose	Fairly easy to excavate with a spade	4-10
Medium dense	Difficult to excavate with a spade	10-30
Dense	Requires pick for excavation	30-50
Very dense	Difficult to excavate with pick	over 50

N.B: The field identification terms for very loose/loose material and dense/very dense material are very subjective and should be treated with caution.

2.3 Discontinuities

The type of discontinuity should be described eg fissures, faults and shear planes together with their spacing as given in Table 4. Discontinuity openness, and surface texture eg rough, smooth, polished and striated are recorded although these may not always be added to the borehole log if the required level of detail is low.

2.4 Bedding

Bedding spacing is assessed using the thickness terms given in Table 4.

TABLE 4: DESCRIPTIONS FOR DISCONTINUITIES AND BEDDING (from BS EN ISO 14688-1: 2018)

DISCONTINUITIES		BEDDING	
Scale of SpacingTerm	Mean Spacing mm	Scale of BeddingTerm	Mean Thickness mm
Very widely	>2000	Very thickly bedded	>2000
Widely	2000-600	Thickly bedded	2000-600
Medium	600-200	Medium bedded	600-200
Closely	200-60	Thinly bedded	200-60
Very closely	60-20	Very thinly bedded	60-20
Extremely closely	<20	Thickly laminated	20-6
		Thinly laminated	<6

N.B: Spacing terms are also used for describing the distance between partings, isolated beds, laminae or roots etc.
Interbedded/interlaminated: alternating layers of different material type. These terms are given a thickness if material is present in equal proportions. Otherwise the thickness of and spacing between subordinate layers are defined.

3.0 MATERIAL CHARACTERISTICS OF SOIL

An examination of insitu soil deposits, disturbed or undisturbed samples allows the material characteristics to be recorded. These characteristics include colour, particle shape, particle grading and particle composition.

3.1 Colour

The recorded colour is based on the logger's general impression of the overall colour. For material with more than three colours the term multicoloured may be used. The term mottled is applied to soils which exhibit two colours, one of which is subordinate to the other.

White, cream, grey, black, yellow, orange, red, brown, green and blue etc may be used but supplemented as necessary with: light, dark, mottled and reddish brownish etc. All colouration associated with chemical changes is noted ie grey gleying on fissures.

3.2 Soil Types (Including Composite Soils)

3.2.1 Very Coarse Soils (Boulders and Cobbles)

Where the soil sample is considered large enough to be representative, material is described as shown in Table 5.

TABLE 5: DESCRIPTORS FOR VERY COARSE SOILS (from BS 5930: 2015 + A1 2020)

Main Name	Estimated Boulder/Cobble Content of Very Coarse Fraction
BOULDERS	Over 50% is of boulder size (>200mm)
COBBLES	Over 50% is of cobble size (200mm to 63mm)

Mixtures of very coarse and finer materials are described by combining terms for the very coarse constituents with those for the finer constituents as shown in Table 6.

APPENDIX 1: TERMINOLOGY USED IN SOIL DESCRIPTIONS

TABLE 6: DESCRIPTORS FOR MIXTURES OF VERY COARSE AND FINER SOILS (from BS BS 5930: 2015 + A1 2020)

Term	Composition (Approx %)
BOULDERS (or COBBLES) with a little finer material [1]	Up to 5% finer material
BOULDERS (or COBBLES) with some finer material [1]	5% to 20% finer material
BOULDERS (or COBBLES) with much finer material [1]	20% to 50% finer material
FINER MATERIAL with low boulder or cobble content	Up to 5% very coarse particles
FINER MATERIAL with medium boulder or cobble content	5% to 20% boulders very coarse particles
FINER MATERIAL with high boulder or cobble content	>20% boulders or cobbles very coarse particles

(1) The description of "finer material" is made in accordance with BS 5930: 2015 + A1 2020 ignoring the very coarse fraction.

3.2.2 Coarse Soils (Gravel and Sand)

A coarse soil (omitting any cobbles and boulders) contains 65% or more of SAND or GRAVEL. The terms given in Table 7 are used to describe the coarse fraction.

TABLE 7: DESCRIPTORS FOR MIXTURES OF COARSE SOILS (from BS 5930: 2015 + A1 2020)

Term	Principal Soil Type	Approximate Proportion of Secondary Constituent
Slightly sandy or gravelly	SAND	<5%
Sandy or gravelly	or	5% to 20%
Very sandy or gravelly	GRAVEL	>20%
-	SAND and GRAVEL	About equal proportions

3.2.3 Fine Soils and Mixtures of Fine and Coarse Soils

Fine soil should be described as either a SILT or a CLAY. The use of silty CLAY or clayey SILT is however permitted, where the presence of the secondary constituent is considered important.

For deposits that contain a mixture of soil types the descriptors given in Table 8 are used. The dominant secondary fraction is placed immediately before the principal soil type. It should also be noted that the terms silty and clayey are mutually exclusive in a coarse soil. The use of the terms sandy and gravelly are however permitted.

APPENDIX 1: TERMINOLOGY USED IN SOIL DESCRIPTIONS

TABLE 8: DESCRIPTORS FOR FINE SOILS AND COMPOSITE SOIL TYPES (from BS 5930: 2015 + A1 2020)

Term	Principal Soil Type	Approximate Proportion of Secondary Constituent	
		Coarse Soil	Coarse and/or Fine Soil
Slightly clayey or silty and/or sandy or gravelly	SAND and/or		<5%
Clayey or silty and/or sandy or gravelly	GRAVEL		5% - 20% *
Very clayey or silty and/ or sandy or gravelly			>20% *
Very sandy or gravelly	SILT or	>65% +	
Sandy and/or gravelly	CLAY	35% - 65%	
Slightly sandy and/or gravelly		<35%	

* or described as fine soil depending on assessed engineering behaviour
+ or described as coarse soil depending on assessed engineering behaviour

3.3 Particle Shape and Grading

For coarser granular deposits (gravel and cobbles) the particle shape is described as shown in Table 9. A schematic of angularity and form terms is given in Figure 1.

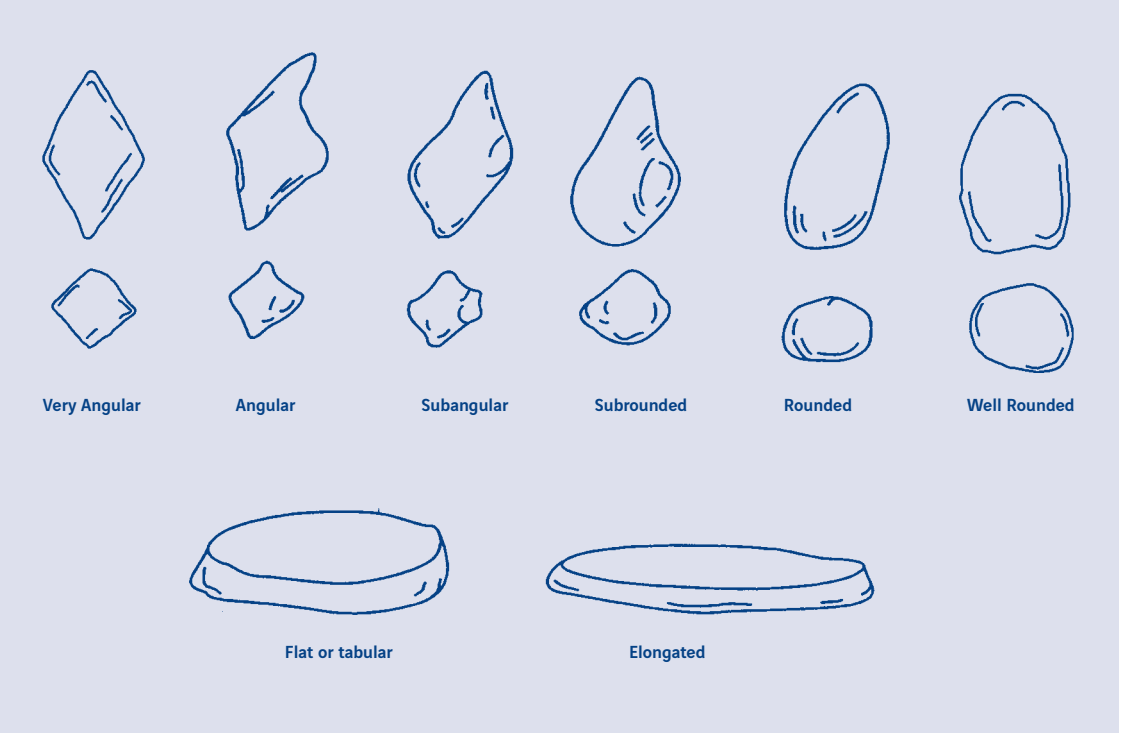
TABLE 9: DESCRIPTORS FOR PARTICLE SHAPE (from BS EN ISO 14688-1: 2018)

Angularity	Form	Surface Texture
Very Angular	Cubic	
Angular	Flat	Rough
Subangular	Elongated	Smooth
Subrounded		
Rounded		
Well Rounded		

The distribution of particle sizes within sands and gravels is described stating the predominant size fraction present eg fine to medium SAND.

APPENDIX 1: TERMINOLOGY USED IN SOIL DESCRIPTIONS

FIGURE 1: PARTICLE ANGULARITY AND FORM TERMS (from BS 5930: 2015 + A1 2020 and Soil Engineering)



References

01) BS EN ISO 14688-1: 2018: Geotechnical Investigation and Testing - Identification and Classification of Soil Part 1: Identification and Description.

02) BS EN ISO 14688-2: 2018: Geotechnical Investigation and Testing - Identification and Classification of Soil Part 2: Principles for a Classification.

03) BS 5930: 2015 + A1 2020: Code of Practice for Site Investigation. British Standards Institution.

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APPENDIX 1
Explanatory Notes on Fieldwork, Logging and Laboratory Testing

TERMINOLOGY USED IN THE DESCRIPTION OF MADE GROUND

APPENDIX 1: TERMINOLOGY USED IN THE DESCRIPTION OF MADE GROUND

1.0 GENERAL DEFINITIONS

Man made soils may be defined as those materials that have not been laid down by geomorphological processes. Under the heading of 'man made soils' two distinct material types can be identified as follows:-

TABLE 1: DEFINITIONS FOR MAN MADE SOILS

Term	Description
NATURAL SOILS (Reworked)	Use terminology outlined for soils in BS EN ISO 14688-1: 2018 (ref 01), BS EN ISO 14688-2: 2018 (ref 02) and BS 5930: 2015 + A1 2020 (ref 03). Can be described using normal approach for soils. Can be tested in accordance with BS1377.
MAN MADE MATERIALS	Can also frequently be described using normal approach and terminology as above, and tested geotechnically. Includes materials that defy description in any standard manner and includes a range of exotic materials and artifacts. Often not testable in the field or in the laboratory. For example it is not possible to measure strength of a bicycle frame or liquid limit of plastic.

There is also a distinction between the terms "Fill" and "Made Ground" as follows:

FILL = Material placed under engineering control
MADE GROUND = Material placed without any kind of control, ie non engineered

2.0 IDENTIFICATION OF MAN MADE SOILS

Some common examples of man made soils are given in Table 2 on page 2. The table illustrates that the heading of 'man made' soils can cover a wide variety of materials, some of which may not readily appear to be anything other than natural.

Natural soils re-laid by man may be difficult to identify as such and so it is necessary to look for evidence in the form of artifacts or relic structure in the material.

For example as few as one or two artifacts may be diagnostic (rare brick fragments or car body at base of trial pit). Lenses or pockets of clay that are laminated etc help to indicate natural material that has been relaid. However be aware of the following:

Contamination by driller (Clinker from around rig, green grass from 15m...).
Contamination during trial pitting (brick rubble can fall from the upper layers in a pit and then get pushed in to natural deposits by the action of the excavator bucket).

APPENDIX 1: TERMINOLOGY USED IN THE DESCRIPTION OF MADE GROUND

TABLE 2: DEFINITIONS FOR MAN MADE SOILS

CATEGORY	EXAMPLE
Natural Soils re-laid by man	Embankment Fill Colliery Spoil (Coarse Discard) Drainage Layer e.g Gravel
Man Made Materials that can be described and which are testable geotechnically	Abutment backfill e.g Crushed rock Colliery Spoil (Fine Discard) Mine Tailings from non-coal mines Crushed Concrete Pulverised Fuel Ash (PFA) Chalk whiting (slurry from cement manufacture)
Man Made Materials that are NOT readily describable and which are not testable geotechnically	Landfill Demolition rubble (including frames, slates etc) Fly tipped materials Burgy (glass work waste)

3.0 DESCRIPTION OF MAN MADE SOILS

Information that is be reported to define the material includes the following:-

Origin of materials, if known from desk study.
Layers and their inclination to inform on mode of tipping, whether ponded, end tipped, spread or stockpiled.
Large objects, obstructions such as concrete, masonry walls, old cars.
Presence of hollow objects, compressible/collapsible objects or voids such as oil drums, cellars, tanks.
Chemical wastes and dangerous or hazardous substances such as creosote, hospital wastes, unlabelled drums, asbestos.
Decomposable materials with note on degree of decomposition such as garden waste, paper.
Smell such as organic, phenolic, sulphurous, petrol.
Striking colours
Any dating possible such as type of bottles, newspapers, papers.
Signs of heat or combustion such as steam, smoke, burnt shale.

NOTES

Because of the variability of the constituents of man made soils, strength or in situ density descriptors are not generally assigned to made ground. Where describing fill as opposed to made ground it may be possible to use the descriptors that are used for natural soils.
Large or hollow objects cannot be sampled so the description is the sole information on condition and character of the features.
The constituents of made ground are grouped together under the above categories and it is usual to give volumetric percentages where possible.

Granular made ground may be given a particle size, although the following description methodology is employed.
MADE GROUND: Grey fine to coarse gravel sized fragments of brick and concrete.

OR

MADE GROUND: Grey gravelly clay with occasional subangular cobble sized fragments of brick. Gravel sized fragments are angular to subangular, fine, medium and coarse of brick.

In these two examples, note the use of term 'sized fragments' to describe the granular content. Because the material is man made we do not use the terms sand, gravel or cobbles etc in the same context as for natural soils. In other words it would be incorrect to use the following:

MADE GROUND: Grey gravelly clay with occasional cobbles. Gravel is angular coarse of brick, cobbles are rounded of brick.

The use of sand, gravel or cobble prior to 'sized fragments' is only intended to define a size range to the granular made ground material.

Similar grain size indicators are also used to describe the size of other man made materials such as concrete, bituminous road surfacing etc. In addition the terms can also be used to describe natural material that has been modified by man, such as wood that may be present in the form of railway sleepers etc. Where whole man made items are identified they should be described as follows:

'with numerous wooden railway sleepers'

For such materials it is necessary to add size measurements, since no other quantifying terms are used.

4.0 DEFINITIONS OF SOME MAN MADE SOILS

There is generally a lack of national guidance on the meaning of common terms used in made ground. This applies particularly to man made materials. For this reason descriptions of man made soils within this report aim to provide as much information as possible on the material being logged, whilst staying within the guidance provided in these notes.

For some sites a set of definitions for the likely range of made ground to be encountered may have been determined and where this is the case it is identified within the report text.

Some terms for one group of commonly encountered made ground are given below.

COMBUSTION PRODUCTS, often physically unstable and usually containing concentrations of metals and poly-aromatic hydrocarbons. The definitions below are workable compromises.

ASH: Sand or silt size by definition, so do not need but can use "ash sand", and cannot have "gravel size ash" although cinders can be gravel size but readily crush down. Can include unburnt coal.

CLINKER: Gravel size or larger by definition so do not need but can use "clinker gravel", and cannot have "sand size clinker".

SLAG: Materials fused or poured as liquid or scum or froth, of any size or shape, and will be at least strong. If in blocks or layers, can present difficulties for borehole or trial pit penetration. Slag is often pelletised, expanded or crushed for reuse in construction.

APPENDIX 1: TERMINOLOGY USED IN THE DESCRIPTION OF MADE GROUND

References

01) BS EN ISO 14688-1: 2018: Geotechnical Investigation and Testing - Identification and Classification of Soil Part 1: Identification and Description.

02) BS EN ISO 14688-2: 2018: Geotechnical Investigation and Testing - Identification and Classification of Soil Part 2: Principles for a Classification.

03) BS 5930: 2015 + A1 2020: Code of Practice for Site Investigation. British Standards Institution.

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APPENDIX 1
Explanatory Notes on Fieldwork, Logging and Laboratory Testing

TERMINOLOGY USED IN PEAT AND ORGANIC SOIL DESCRIPTIONS

APPENDIX 1: TERMINOLOGY USED IN PEAT AND ORGANIC SOIL DESCRIPTIONS

The basic designation for soils consisting principally of organic matter is summarised in Table 1.

TABLE 1: IDENTIFICATION AND DESCRIPTION OF ORGANIC SOIL

Term	Description
Fibrous Peat	Fibrous structure, easily recognisable plant structure, retains some strength
Pseudo-fibrous Peat	Recognisable plant structure, no strength of apparent plant material
Amorphous Peat	No visible plant structure, mushy consistency
Gyttja	Decomposed plant and animal remains, may contain inorganic constituents
Humus	Plant remains, living organisms and their excretions together with inorganic constituents, from the topsoil

If a soil contains organic material in identifiable fragments these are individually described using the "occasional, some and much" terms as appropriate. Any smells or odours should be noted. Where the organic materials are disseminated throughout the soil the term "organic" should be given prior to the soil type.

eg: Soft grey organic CLAY

Where the soil is composed of natural organic material a peat description may be more appropriate. Peats are normally described after BS EN ISO 14688-1: 2018 (ref 01), although as the descriptive scheme in that standard is very limited, the additional terms summarised by Hobbs (ref 02) may be used if required.

Peats can be identified as shown in Table 2. The word order is as for other natural soils, however different terms are used to describe the consistency of the peat and the soil type is preceded by an additional term (Fibrous or Amorphous).

No guidance is given in either BS EN ISO 14688-1: 2018 or 14688-2: 2018 or BS 5930: 2015 + A1 2020 as to how to deal (in terms of description) with peat soils that contain other materials such as clay or gravel. If the peat has a coarse soil fraction the proportions given in Terminology Used in Soil Descriptions, Table 6 (Descriptors for Mixtures of Very Coarse and Finer Soils) are used. It is difficult to assess visually what proportion of the fine soil is mineral and what proportion is organic therefore the terms "clayey" or "silty" are used with caution if at all.

eg: Firm black fibrous PEAT (H3)
Plastic brown amorphous PEAT (H8)
Spongy black slightly sandy fibrous PEAT (H4)

References

01) BS EN ISO 14688-1: 2018: Geotechnical Investigation and Testing - Identification and Classification of Soil Part 1: Identification and Description.

02) Hobbs, N.B. 1986: 'Mire morphology and the properties and behaviour of some British and foreign peats.' Q.J. Engng Geol. 19, No 1, 7-80.

03) BS 5930: 2015 + A1 2020: Code of Practice for Site Investigation. British Standards Institution.

04) BS EN ISO 14688-2: 2018 Geotechnical Investigation and Testing - Identification and Classification of Soil Part 2: Principles for a Classification.

TABLE 2: GUIDANCE ON THE IDENTIFICATION AND DESCRIPTION OF PEAT (AFTER BS 5930 AND HOBBS)

CONSISTENCY	SOIL TYPE	DEGREE OF HUMIFICATION	DECOMPOSITION	DESCRIPTION	MATERIAL EXTRUDED BETWEEN FINGERS	RESIDUE IN HAND
Firm or Spongy	Fibrous PEAT	H1	None	Entirely unconverted mud-free peat	Clear, colourless water	Not pasty
		H2	Insignificant	Almost entirely unconverted mud-free peat	Yellowish water	
		H3	Very slight	Very slightly converted or very slightly muddy peat	Brown, muddy water, no peat	
		H4	Slight	Slightly converted or somewhat muddy peat	Dark brown muddy water, no peat	Somewhat pasty
		H5	Moderate	Fairly converted or rather muddy peat, plant structure still quite evident	Muddy water and some peat	
		H6	Moderately strong	Fairly converted or rather muddy peat, plant structure indistinct but more obvious after squeezing	Above one third of peat squeezed out; water dark brown	Thick, pasty
		H7	Strong	Fairly well converted or markedly muddy peat; plant extract still discernible	About one half of peat squeezed out, consistency like porridge; any water is very dark brown	Very thick paste
Plastic	Amorphous PEAT	H8	Very strong	Well converted or very muddy peat, very indistinct plant structure	About two thirds of peat squeezed out, also some pasty water	Plant roots and fibre which resist decomposition
		H9	Nearly complete	Almost completely converted or mud-like peat, plant structure almost not recognisable	Nearly all the peat squeezed out as a fairly uniform paste	
		H10	Complete	Completely converted or entirely muddy peat, no plant structure visible	All the peat passes between the fingers, no free water visible	

SOIL ENGINEERING

SUPPORTING FACTUAL DATA

APPENDIX 1
Explanatory Notes on Fieldwork, Logging and Laboratory Testing

TERMINOLOGY USED IN THE DESCRIPTION AND CLASSIFICATION OF ROCKS

APPENDIX 1: TERMINOLOGY USED IN THE DESCRIPTION AND CLASSIFICATION OF ROCKS

1.0 GENERAL PROCEDURES

Rock descriptions contained in this report have been produced in accordance with the procedure and principles given in BS EN ISO 14689-1: 2018 (ref 01) and where there is no conflict with the European Standards in accordance with BS 5930: 2015 + A1 2020: Section 6 (ref 02). For rock descriptions the main rock characteristics should be given in a standard word order. The description and classification is therefore based on the following:-

1	Material Characteristics	2	General Information
1a	Strength	2a	Minor Constituents
1b	Structure	2b	Geological Formation
1c	Colour		
1d	Texture		
1e	Grain size		
1f	Weathering and alteration effects		
1g	Rock name (in capitals e.g. SANDSTONE)		

3	Mass Characteristics
3a	State of weathering
3b	Fracture state
3c	Discontinuities

2.0 MATERIAL CHARACTERISTICS OF ROCK

2.1 Strength

The descriptors given in Table 1 are used to assess rock strength.

TABLE 1: DESCRIPTORS AND FIELD IDENTIFICATION FOR ROCK STRENGTH (from BS 5930: 2015 + A1 2020)

Term	FIELD IDENTIFICATION	UNCONFINED COMPRESSIVE STRENGTH (MPa)
Extremely weak[1]	Scratched by thumbnail	0.6 to 1
Very weak	Crumbles under firm blows with point of geological hammer, can be easily peeled by pocket knife	1 to 5
Weak	Can be peeled by pocket knife with difficulty, shallow indentations can be made by firm blow with point of geological hammer	5 to 12.5
Moderately Weak	Can be scratched with difficulty by pocket knife, specimen can broken with firm blow with point of geological hammer	12.5 to 25
Medium strong	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with a single firm blow of geological hammer	25 to 50
Strong	Specimen requires more than one blow of geological hammer to fracture it	50 to 100
Very strong	Specimen requires many blows of geological hammer to fracture it	100 to 250
Extremely strong	Specimen can only be chipped with geological hammer	>250

1 Some extremely weak rocks will behave as soils and should be described as soils in accordance with BS EN ISO 14688-1

2.2 **Structure**

The descriptive terms for structure cover the inter-relationship of lithology and textural features in the rock. Terms include: bedding, laminated, foliated and banded. The thicknesses of these structures are described by the terms given in table 2 which also apply to the spacing of discontinuities (see section 4.3).

TABLE 2: DESCRIPTIVE TERMS FOR STRUCTURE AND DISCONTINUITY SPACING (from BS EN ISO 14689-1: 2018)

STRUCTURE (EG BEDDING, CLEAVAGE)	DISCONTINUITY (EG JOINT, FISSURE)	SPACING
Very thickly (bedded)	Very widely (jointed)	> 2m
Thickly (bedded)	Widely (jointed)	0.6m-2m
Medium (bedded)	Medium (jointed)	0.2m-0.6m
Thinly (bedded)	Closely (jointed)	60mm-200mm
Very thinly (bedded)	Very closely (jointed)	20mm-60mm
Thickly Laminated	Extremely closely (jointed)	6mm-20mm
Thinly laminated	-	< 6mm

2.3 **Colour**

Colour is described according to the scheme given in BS EN IS0 14689-1.

2.4 **Texture**

A description of rock texture is not normally required but when used refers to the arrangement of individual grains in the rock. Terms which may be used include: porphyritic, crystalline, amorphous and vitreous. For further guidance refer to BS 5930: 2015 + A1 2020: section 36.2.4.

2.5 **Grain Size**

The descriptive scheme given in Table 14 of BS 5930: 2015 + A1 2020 (ref 02) is used together with the accompanying notes in section 36.2.5.

2.6 **Weathering and Alteration Effects**

The results of weathering or alteration of the rock material are described in accordance with the principals given for rock mass in section 4.0.

2.7 **Rock Name**

An aid to the identification of rock type is given in Table A1 of BS EN ISO 14689-1:2018.

3.0 GENERAL INFORMATION

3.1 **Minor/Other Characteristics**

Information can include minor constituents as for soils (see Terminology used in Soil Descriptions) and can include abnormal mineralogy, presence of vugs etc.

3.2 **Geological Formation**

The geological formation, age and type of deposit are only given where this can be done with confidence and where no conjecture is involved.

APPENDIX 1: TERMINOLOGY USED IN THE DESCRIPTION AND CLASSIFICATION OF ROCKS

4.0 MASS CHARACTERISTICS

4.1 Description of Weathering for the Rock Mass

Approach 1 in BS 5930: 2015 + A1 2020 provides guidance on the factual description of weathering effects at the material and mass scales. This factual description is mandatory and requires the following indicators of weathering to be described:

- Changes in colour
- Reduction in strength
- Changes in fracture state
- Presence, character & extent of weathering products

When further classification is required, use is made of Approaches 2 and 4 in Figure 9 of BS 5930 and these tables are reproduced as Tables 3 and 4. Approach 4 is used for many specific formations in the UK, such as London Clay, Lias Clay and Mercia Mudstone. Chalk however is classified under Approach 5 as a special case.

TABLE 3: CLASSIFICATION OF WEATHERING FOR UNIFORM MATERIALS (Approach 2 in BS 5930: 2015 + A1 2020)

GRADE	CLASSIFIER	TyPICAL CHARACTERISTICS
1	Fresh	Unchanged from original state
2	Slightly weathered	Slight discolouration and weakening
3	Moderately weathered	Weakened, penetrating staining. Large pieces cannot be broken by hand
4	Highly weathered	Large pieces can be broken by hand. Does not readily slake
5	Completely weathered	Cosiderably weakened. Slakes. Original fabric apparent
6	Residual Soil	Soil remains in situ. Retains none of original fabric

TABLE 4: CLASSIFICATION OF WEATHERING INCORPORATING MATERIAL AND MASS FEATURES (Approach 4 in BS 5930: 2015 + A1 2020)

CLASS	CLASSIFIER	TYPICAL CHARACTERISTICS
A	Unweathered	Original strength, colour and fracture spacing
B	Partially Weathered	Slightly reduced strength, slightly closer fracture spacing, weathering penetrating in from fractures. Brown oxidation
C	Distinctly Weathered	Further weakened, much closer fracture spacing, grey reduction
D	Destructured	Greatly weakened, mottled, ordered lithorelics in matrix becoming weakened and disordered
E	Residual or reworked	Matrix with occasional altered random lithorelics, bedding destroyed. Classed as reworked if with foreign inclusions

4.2 Fracture State

For the purposes of logging and the recording of mechanical properties, fractures include: Joints (a discontinuity in the body of the rock along which there has been no visible displacement), Faults (a fracture along which there has been visible displacement), Bedding Fracture (a fracture along the bedding) and Cleavage Fracture (a fracture along a cleavage).

Fracture state is recorded in accordance with the terms detailed in BS EN ISO 22475-1: 2006 (ref 03) as follows:

Solid core

Core with at least one full diameter (but not necessarily a full circumference) between two natural fractures. By this definition core that has a single set of inclined fractures would have a solid core recovery of 100%. Where there are two or more sets of non parallel fractures only sections of the core in which the fractures actually intersect are excluded from the assessment of solid core.

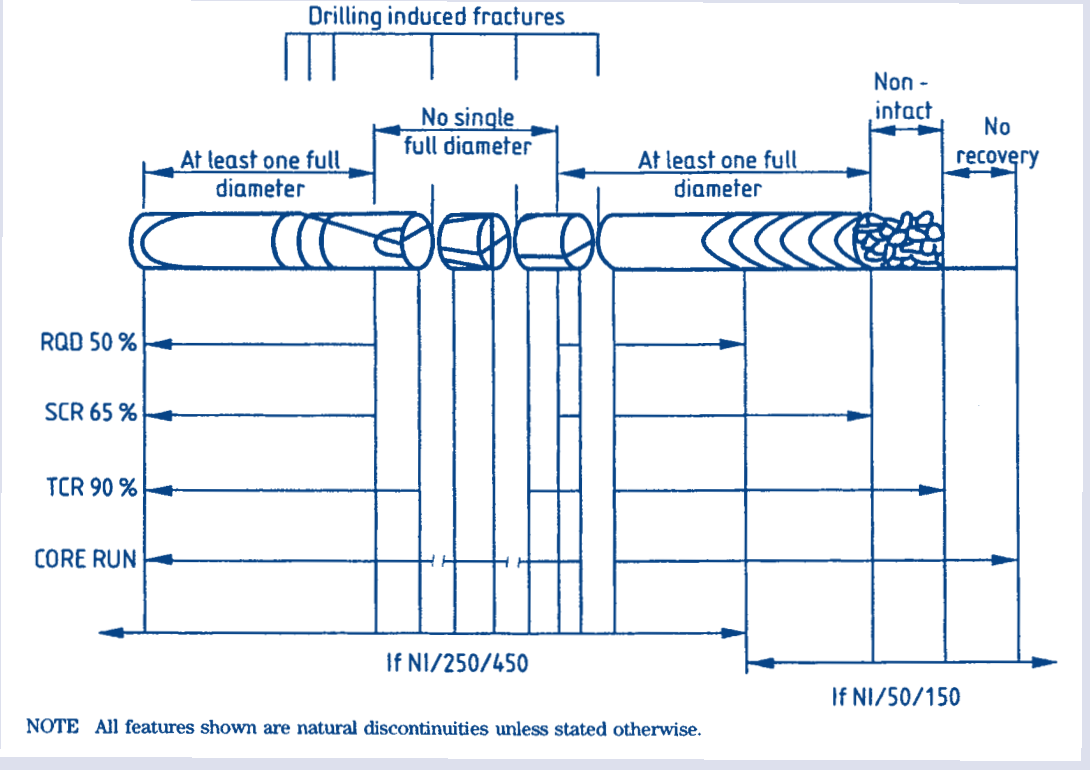
Based on these definitions the terms in Table 4 are defined and these are shown schematically in Figure 1.

APPENDIX 1: TERMINOLOGY USED IN THE DESCRIPTION AND CLASSIFICATION OF ROCKS

TABLE 5: DESCRIPTORS FOR THE MECHANICAL LOGGING OF ROCK

CORE TERM	ABBREVIATION	DEFINITION
Total Core Recovery	TCR (%)	The percentage ratio of core recovered (both solid and non-intact) to the total length of core run
Solid Core Recovery	SCR (%)	The percentage of solid core recovered to total length of core run
Rock Quality Designation	RQD(%)	The total length of solid core pieces greater than 100mm between natural fractures expressed as a percentage of total length of core run
Fracture Index	FI	The number of natural fractures contained within a metre of core of similar intensity of fracturing. This need not correspond to core runs. (NI) is used to denote non intact fragmented core.
Fracture Spacing	If min ave max	The minimum, average & maximum spacing of natural fractures within core of similar intensity of fracturing. This need not correspond to core runs. (NI) is used to denote non intact fragmented core.

FIGURE 1: ILLUSTRATION OF FRACTURE LOGGING TERMS



NOTE All features shown are natural discontinuities unless stated otherwise.

4.3 Discontinuities

Discontinuities are breaks in the rock mass and when observed in rock cores are described as:

Joint, Fissure, Fault, Induced Fracture, Incipient Fracture, Bedding Fracture and Vein. Descriptive terms for discontinuities are given below in the correct order:

Spacing:	Described in accordance with Table 2
Persistence:	Discontinuous or Continuous
Roughness:	See Table 6
Aperture:	See Table 7
Infill:	See Table 8

TABLE 5: DESCRIPTORS FOR DISCONTINUITY ROUGHNESS (After BS EN ISO 14689-1: 2018)

MEDIUM SCALE DESCRIPTORS	SMALL SCALE DESCRIPTORS Rough (irregular)
Stepped	Striated
Undulating	Smooth
Planar	Rough

Note: The large scale terms: wavy, curved and straight are only seen at the mass scale and are not observed in rock cores.

TABLE 7: DESCRIPTORS FOR DISCONTINUITY APERTURE (After BS EN ISO 14689-1: 2018)

APERTURE SIZE TERM	APERTURE
Very Tight	<0.1mm
Tight	0.1mm to 0.25mm
Partly Open	0.25mm to 0.5mm
Open	0.5mm to to 2.5mm
Moderately Wide	2.5mm to 10mm
Wide	1cm to 10cm
Very Wide	10cm to 100cm
Extremely Wide	>1.0m

TABLE 8: DESCRIPTORS FOR DISCONTINUITY INFILL

INFILL	INFILL DESCRIPTION DEFINITION
Clean	No fracture infill material
Stained	Colouration on rock only. No recognisable infill material
Filled or partially filled	Discontinuity filled with recognisable infill material which should be described, eg clay, gypsum etc, together with its thickness.

APPENDIX 1: TERMINOLOGY USED IN THE DESCRIPTION AND CLASSIFICATION OF ROCKS

References

01) BS EN ISO 14689-1: 2018: Geotechnical Investigation and Testing - Identification and Classification of Rock Part 1: Identification and Description.

02) BS 5930: 2015 + A1 2020: Code of Practice for Site Investigation. British Standards Institution.

03) BS EN ISO 22475-1: 2006: Geotechnical Investigation and Testing - Sampling Methods and Groundwater Measurements - Part 1: Technical Principles for Execution.

SOIL ENGINEERING

SUPPORTING FACTUAL DATA

APPENDIX 1
Explanatory Notes on Fieldwork, Logging and Laboratory Testing

ASSESSMENT OF AGGRESSIVE GROUND AND GROUNDWATER CONDITIONS

APPENDIX 1: ASSESSMENT OF AGGRESSIVE GROUND AND GROUNDWATER CONDITIONS

Certain ground and groundwater conditions may be described as aggressive depending on their chemical composition which is related to previous industrial use. Where foundations are proposed to be constructed on industrial sites or on landfill sites in which the ground or groundwater may be contaminated with chemical waste, detailed consideration needs to be given to both the method of investigation and the severity of ground and groundwater conditions with respect to construction materials. For such sites it will usually be necessary to undertake a full chemical analysis in order to identify the potentially aggressive compounds.

On sites where new concrete foundations are to be constructed in natural ground it is usually only necessary to examine the sulfate content and pH level of the ground. The sulfate content of soils varies widely and can range from being virtually absent to extremely high concentrations in crystals such as gypsum. In between these two extremes sulfate may be disseminated throughout a soil or may be present in discrete bands or lenses. Because of this wide variation in the sulfate content of soils, the most reliable indication of possible aggressive conditions can be obtained by testing representative samples of groundwater. In order to take account of natural variations in the distribution of sulfates in the ground, samples should be taken at a number of locations that are well spaced across the site and at different depths.

The methods for the determination of total sulfate of soil and the sulfate content of groundwater and 2:1 aqueous soil extracts are given in various specifications including BS 1377 1990: Part 3: Section 5 (ref 01). The results of tests performed in accordance with BS 1377 yield results which are expressed as percentage of dry weight retained or grammes/litre SO_3. Tests performed in accordance with other specifications however, tend to express results as SO_4.

The classification of natural sulfate conditions is based on BRE Special Digest 1 2005 (ref 02). This digest makes most use of sulfate values expressed as milligrammes/litre SO_4. In order to convert the results expressed as SO_3 (BS 1377) to SO_4 (BRE Special Digest 1) it is necessary to apply a multiplication factor of 1.2. In the following discussion of sulfate conditions values given in the tables are expressed in terms of SO_4. The current approach to the classification of aggressive ground conditions given in BRE Special Digest 1 is based on the Aggressive Chemical Environment for Concrete (ACEC). This takes into account the type of site, sulfate concentration and groundwater acidity and mobility. Different site assessment procedures are used for natural ground, for brownfield sites that contain industrial waste and pyritic ground. The reactions of sulfates in the presence of other ions, notably carbonate and magnesium are also taken into account.

In general when the results of sulfate determinations are assessed, emphasis must be given to the samples which fall in the higher classes. Therefore if eight out of ten samples are found to be non aggressive and fall within Class DS1 and the remainder fall within Class DS2 it will be necessary to adopt the precautions appropriate to Class DS2 conditions for the whole site. The current digest differentiates between 'natural ground locations' and 'brownfield locations'.

Table 1 on page 2 is reproduced from the digest and deals with natural ground locations.

APPENDIX 1: ASSESSMENT OF AGGRESSIVE GROUND AND GROUNDWATER CONDITIONS

TABLE 1: AGGRESSIVE CHEMICAL ENVIRONMENT FOR CONCRETE (ACEC) CLASSIFICATION FOR NATURAL GROUND LOCATIONS (a) (From BRE Special Digest 1)

SULFATE				GROUNDWATER		
DESIGN SULFATE CLASS FOR LOCATION	2:1 WATER/SOIL EXTRACT (b)	GROUNDWATER	TOTAL POTENTIAL SULFATE (c)	STATIC WATER	MOBILE WATER	ACEC CLASS FOR LOCATION
1	2 (SO_4 mg/l)	3 (SO_4 mg/l)	4 (SO_4 %)	5 (pH)	6 (pH)	7
DS-1	<500	<400	<0.24	>2.5	>5.5 (d) 2.5-5.5	AC-1s AC-1 (d) AC-2z
DS-2	500-1500	400-1400	0.24-0.6	>3.5 2.5-3.5	>5.5 2.5-5.5	AC-1s AC-2 AC-2s AC-3z
DS-3	1600-3000	1500-3000	0.7-1.2	>3.5 2.5-3.5	>5.5 2.5-5.5	AC-2s AC-3 AC-3s AC-4
DS-4	3100-6000	3100-6000	1.3-2.4	>3.5 2.5-3.5	>5.5 2.5-5.5	AC-3s AC-4 AC-4s AC-5
DS-5	>6000	>6000	>2.4	>3.5 2.5-3.5	>2.5	AC-4s AC-5

NOTES

a) Applies to locations on sites that comprise either undisturbed ground that is in its natural state or clean fill derived from such ground.

b) The limits of Design Sulfate Classes based on 2:1 water/soil extracts have been lowered relative to previous digests.

c) Applies only to locations where concrete will be exposed to sulphate ions (SO_4) which may result from the oxidation of sulfides (eg pyrite) following ground disturbance.

d) For flowing water that is potentially aggressive to concrete owing to high purity or an aggressive carbon dioxide level greater than 15mg/l, increase the ACEC Class to AC-2z.

Explanation of suffix symbols to ACEC Class

Suffix 's' indicates that the water has been classified as static

Concrete placed in a ACEC Class that includes the suffix 'z' primarily have to resist acid conditions and may be made with any of the cements listed in Table D2 in the Digest.

Additional testing is required for those natural sites that contain pyrite. In particular it is essential to take account of the total potential sulfate content which might result from oxidation following ground disturbance. On such sites it is necessary to determine total sulfate content (AS% $S0_4$), total sulfur (TS%S). The total potential sulfate is then determined from TPS%SO_4=3.0 x TS%S. Finally the amount of oxidisable sulfides (OS as %SO_4) is determined by subtracting the acid soluble sulfates (AS%$S0_4$) from the total potential sulfate content: OS%SO_4 = TPS%SO_4 – AS%$S0_4$. It is important to note that this testing is in addition to and not instead of the standard sulfate determination testing.

Unless the site can be demonstrated to comprise natural ground, Table 2 for brownfield locations must be used in all assessments for the design of concrete. It should be noted that the effects of the magnesium ion become relevant to concrete design for certain Design Sulfate Classes.

APPENDIX 1: ASSESSMENT OF AGGRESSIVE GROUND AND GROUNDWATER CONDITIONS

TABLE 2: AGGRESSIVE CHEMICAL ENVIRONMENT FOR CONCRETE (ACEC) CLASSIFICATION FOR BROWNFIELD LOCATIONS (a) (From BRE Special Digest 1)

SULFATE AND MAGNESIUM						GROUNDWATER		
DESIGN SULFATE CLASS FOR LOCATION	2:1 WATER/SOIL GROUNDWATER EXTRACT (b)		TOTAL		STATIC POTENTIAL SULFATE (c)	MOBILE WATER	ACEC WATER	CLASS FOR LOCATION
1	2 (SO_4 mg/l)	3 (Mg mg/l)	4 (SO_4 mg/l)	5 (Mg mg/l)	6 (SO_4 %)	7 (pH) (d)	8 (pH) (d)	9
DS-1	<500	-	<400	-	<0.24	>2.5		AC-1s
							>6.5 (d)	AC-1
							5.5-6.5	AC-2z
							4.5-5.5	AC-3z
							2.5-4.5	AC-4z
DS-2	500-1500	-	400-1400	-	0.24-0.6	>5.5		AC-1s
							>6.5	AC-2
						2.5-3.5		AC-2s
							5.5-6.5	AC-3z
							4.5-5.5	AC-4z
							2.5-4.5	AC-5z
DS-3	1600-3000	-	1500-3000	-	0.7-1.2	>5.5		AC-2s
							>6.5	AC-3
						2.5-5.5		AC-3s
							5.5-6.5	AC-4
							2.5-5.5	AC-5
DS-4	3100-6000	<1200	3100-6000	<1000	1.3-2.4	>5.5		AC-3s
							>6.5	AC-4
						2.5-3.5		AC-4s
							2.5-6.5	AC-5
DS-4m	3100-6000	>1200 (e)	3100-6000	>1000 (e)	1.3-2.4	>5.5		AC-3s
							>6.5	AC-4m
						2.5-5.5		AC-4ms
							2.5-6.5	AC-5m
DS-5	>6000	<1200	>6000	<1000	>2.4	>5.5		AC-4s
						2.5-3.5	>2.5	AC-5
DS-5m	>6000	>1200 (e)	>6000	>1000 (e)	>2.4	>5.5		AC-4ms
						2.5-5.5	>2.5	AC-5m

NOTES

a) Brownfield locations are those sites or parts of sites that might contain chemical residues produced by industrial processes.

b) The limits of Design Sulfate Classes based on 2:1 water/soil extracts have been lowered relative to previous digests.

c) Applies only to locations where concrete will be exposed to sulfate ions (SO_4) which may result from the oxidation of sulfides (eg pyrite) following ground disturbance.

d) An additional account is taken of hydrochloric and nitric acids by adjustment to sulfate content

e) The limit on water soluble magnesium does not apply to brackish groundwater (chloride content between 12000mg/l and 17000mg/l). This allows 'm' to be omitted from the relevant ACEC classification. Sea water (chloride about 18000mg/l) and stronger brines are not covered by this table.

Explanation of suffix symbols to ACEC Class

Suffix 's' indicates that the water has been classified as static

Concrete placed in ACEC Classes that include the suffix 'z' primarily have to resist acid conditions cements listed in Table D2 in the Digest.

Suffix 'm' relates to the higher levels of magnesium in Design Sulfate Classes 4 and 5.

APPENDIX 1: ASSESSMENT OF AGGRESSIVE GROUND AND GROUNDWATER CONDITIONS

The pH value of groundwater provides a crude measure of the potential aggressiveness due to the presence of organic acids. The standard procedure for measuring the acidity of soils and groundwater is the electrometric method using a pH meter and is described in BS 1377: 1990: Part 3: Section 5. The pH value of pure water is 7.0 and the presence of acid substances will yield results with values less than 7. It should be noted however that the pH of most natural waters depends mainly on the dissolved carbon dioxide content and therefore lies between pH values of 6.5 and 8.5. It is generally accepted that soils or groundwater with pH values in the range 6 to 9 may be classified as near neutral. It should be noted that the pH value of soil and groundwater can change with time and it is therefore necessary to carry out testing on fresh samples of soil or water.

The pH value of the soil or groundwater also needs to be taken into consideration when the recorded sulfate content is borderline between two classes or approaches the upper limit of a given class. In these circumstances both the pH value and the mobility of the groundwater needs to be assessed and where doubt exists, the sample should be placed in the more severe class of the sulfate classification. This general approach may be justified on the grounds that the acids present will tend to break down the concrete surface and therefore make it more susceptible to sulfate attack. This will be especially so if the sample contains large amounts of sulfides since these can be converted to sulfuric acid.

Organic acids are often found in peaty or marshy soils in which the pH value is below 6.0. In such soils it will be necessary to take specific precautions to protect any concrete which would be exposed to organic acids. The recommended precautionary measures outlined in Tomlinson 2001 (ref 03) could be followed. In all cases where mineral acids are present the groundwater is likely to be aggressive with regard to foundation concrete and in these circumstances the recommendations given in BRE Special Digest 1 Part C will need to be followed.

Apart from acid groundwater, the effects of static and mobile groundwater tables are taken into account in BRE Special Digest 1 in 'Box C9' and the incremental rules in this table need to be viewed in relation to Tables C1 and C2 in the Digest.

Alkaline groundwater is not generally considered aggressive to concrete unless present in high concentrations. Unless the aggregate used in foundation concrete is of a reactive type, pH values of groundwater up to pH = 14 need not be considered as problematic.

References

01) BS 1377: 1990: Methods of Test for Soils for Civil Engineering Purposes. Part 3: Chemical Electrochemical Tests, British Standards Institution.

02) Building Research Establishment 2005: Concrete in Aggressive Ground. BRE Special Digest 1. Building Research Station, Garston

03) Tomlinson M.J 2001: Foundation Design and Construction. 7th Edition, Pearson, Prentice Hall.

SOIL ENGINEERING

SUPPORTING FACTUAL DATA

APPENDIX 2
Calibration Certificates

CALIBRATION CERTIFICATES

GEOSENSE QUALITY FORM
GQF-149
ISS. 11
DATE : AUG-24
SIG. GC

Nova House, Rougham Industrial Estate, Rougham, Bury St Edmunds
Tel: +44(0)1359 270457 - Fax: +44(0)1359 272860
Website: www.geosense.co.uk

STANDARD VW PIEZOMETER LAE CALIBRATION

Model:	**VWP-3000**	**Cal Date:**	**12/05/2025**	**Readout No:**	**2108**
Serial No:	**380210**	**Baro:**	**1003**	**Cable Length:**	**10m**
Works ID:	**G121 9 175**	**Temp °C:**	**20**	**M Marking:**	**-m**

Applied Pressure		**Readings [digit]**			**Calculated Pressure**		**Error % FSO**	
psi	kPa	1st Cycle	2nd Cycle	avg.[digit]	lin.[kPa]	polyn.[kPa]	linear	polynomial
0.0	0.0	9198.1	9198.1	9198.1	0.7	0.0	0.20	0.00
10.0	69.0	8516.7	8516.6	8516.6	68.9	69.0	-0.04	0.00
20.0	138.0	7831.3	7831.4	7831.4	137.4	138.0	-0.17	-0.01
30.0	207.0	7140.7	7140.9	7140.8	206.5	207.0	-0.15	0.01
40.0	276.0	6447.1	6447.2	6447.2	275.9	276.0	-0.03	0.01
50.0	345.0	5749.5	5749.8	5749.7	345.7	345.0	0.19	-0.01

CALIBRATION FACTORS

	kPa per digit	**psi per digit**	**mH_20 per digit**
Linear Factor (K)	-1.00035E-1	-1.45083E-2	-1.02007E-2

	kPa	**psi**	**mH_20**
Poly Factor (A)	-4.26223E-7	-6.18162E-8	-4.34628E-8
Poly Factor (B)	-9.36633E-2	-1.35842E-2	-9.55103E-3
Poly Factor (C)			

	kPa per °C	**psi per °C**	**mH_20 per °C**
Thermal (T)	-6.64058E-2	-9.63101E-3	-6.77153E-3

THE EQUIPMENT USED IN THE CALIBRATION OF THE PRODUCT DETAILED ABOVE IS TRACEABLE TO NATIONAL/INTERNATIONAL STANDARDS

Digits = $Hz^2 \times 10^{-3}$

Linear calc = k (kPa) * (Current Reading - Site Zero Reading) + T * (Current Temp - Site Zero Temp)

Polynomial calculation = A * $(Reading)^2$ + B * (Reading) + C + T * (Current Temp - Site Zero Temp)

C = -A * $(Site\ Zero\ Reading)^2$ - B * (Site Zero Reading)

CALIBRATED TO UKAS TRACEABLE STANDARD - ISO 9001:2015

THIS IS AN ELECTRONIC CERTIFICATE AND IS VALID WITHOUT A SIGNATURE

M MARKING TAKEN FROM SENSOR END, USED AS AN INDICATOR

GEOSENSE QUALITY FORM
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Website: www.geosense.co.uk

STANDARD VW PIEZOMETER LAE CALIBRATION

Model:	**VWP-3000**	**Cal Date:**	**12/05/2025**	**Readout No:**	**2108**
Serial No:	**380211**	**Baro:**	**1003**	**Cable Length:**	**20m**
Works ID:	**G121 9 176**	**Temp °C:**	**20**	**M Marking:**	**-m**

Applied Pressure		**Readings [digit]**			**Calculated Pressure**		**Error % FSO**	
psi	kPa	1st Cycle	2nd Cycle	avg.[digit]	lin.[kPa]	polyn.[kPa]	linear	polynomial
0.0	0.0	9941.9	9942.1	9942.0	0.6	0.0	0.19	0.00
10.0	69.0	9291.8	9291.8	9291.8	68.9	69.0	-0.03	0.01
20.0	138.0	8638.6	8638.8	8638.7	137.5	138.0	-0.15	0.00
30.0	207.0	7982.7	7982.8	7982.8	206.4	206.9	-0.19	-0.03
40.0	276.0	7319.5	7319.6	7319.6	276.0	276.1	0.00	0.04
50.0	345.0	6656.4	6656.6	6656.5	345.6	345.0	0.18	-0.01

CALIBRATION FACTORS

	kPa per digit	**psi per digit**	**mH_20 per digit**
Linear Factor (K)	-1.04998E-1	-1.52282E-2	-1.07069E-2

	kPa	**psi**	**mH_20**
Poly Factor (A)	-4.54446E-7	-6.59095E-8	-4.63408E-8
Poly Factor (B)	-9.74553E-2	-1.41342E-2	-9.93772E-3
Poly Factor (C)			

	kPa per °C	**psi per °C**	**mH_20 per °C**
Thermal (T)	-3.38810E-1	-4.91385E-2	-3.45491E-2

THE EQUIPMENT USED IN THE CALIBRATION OF THE PRODUCT DETAILED ABOVE IS TRACEABLE TO NATIONAL/INTERNATIONAL STANDARDS

Digits = $Hz^2 \times 10^{-3}$

Linear calc = k (kPa) * (Current Reading - Site Zero Reading) + T * (Current Temp - Site Zero Temp)

Polynomial calculation = A * $(Reading)^2$ + B * (Reading) + C + T * (Current Temp - Site Zero Temp)

C = -A * $(Site\ Zero\ Reading)^2$ - B * (Site Zero Reading)

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STANDARD VW PIEZOMETER LAE CALIBRATION

Model:	**VWP-3000**	**Cal Date:**	**12/05/2025**	**Readout No:**	**2108**
Serial No:	**380212**	**Baro:**	**1003**	**Cable Length:**	**30m**
Works ID:	**G121 9 177**	**Temp °C:**	**20**	**M Marking:**	**-m**

Applied Pressure		**Readings [digit]**			**Calculated Pressure**		**Error % FSO**	
psi	kPa	1st Cycle	2nd Cycle	avg.[digit]	lin.[kPa]	polyn.[kPa]	linear	polynomial
0.0	0.0	9282.3	9282.3	9282.3	0.3	0.0	0.07	0.01
10.0	69.0	8657.9	8658.0	8658.0	68.9	69.0	-0.03	-0.01
20.0	138.0	8031.4	8031.5	8031.4	137.8	138.0	-0.05	0.00
30.0	207.0	7403.8	7403.9	7403.8	206.8	207.0	-0.05	0.00
40.0	276.0	6774.6	6774.7	6774.6	276.0	276.1	0.01	0.02
50.0	345.0	6145.6	6145.8	6145.7	345.2	345.0	0.05	-0.01

CALIBRATION FACTORS

	kPa per digit	**psi per digit**	**mH_20 per digit**
Linear Factor (K)	-1.09969E-1	-1.59492E-2	-1.12138E-2

	kPa	**psi**	**mH_20**
Poly Factor (A)	-1.66156E-7	-2.40980E-8	-1.69432E-8
Poly Factor (B)	-1.07406E-1	-1.55774E-2	-1.09524E-2
Poly Factor (C)			

	kPa per °C	**psi per °C**	**mH_20 per °C**
Thermal (T)	-1.05898E-1	-1.53587E-2	-1.07986E-2

THE EQUIPMENT USED IN THE CALIBRATION OF THE PRODUCT DETAILED ABOVE IS TRACEABLE TO NATIONAL/INTERNATIONAL STANDARDS

Digits = $Hz^2 \times 10^{-3}$

Linear calc = k (kPa) * (Current Reading - Site Zero Reading) + T * (Current Temp - Site Zero Temp)

Polynomial calculation = A * $(Reading)^2$ + B * (Reading) + C + T * (Current Temp - Site Zero Temp)

C = -A * $(Site\ Zero\ Reading)^2$ - B * (Site Zero Reading)

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STANDARD VW PIEZOMETER LAE CALIBRATION

Model:	**VWP-3000**	**Cal Date:**	**28/04/2025**	**Readout No:**	**2108**
Serial No:	**379129**	**Baro:**	**1019**	**Cable Length:**	**40m**
Works ID:	**G32 12 169**	**Temp °C:**	**20**	**M Marking:**	**-m**

Applied Pressure		**Readings [digit]**			**Calculated Pressure**		**Error % FSO**	
psi	kPa	1st Cycle	2nd Cycle	avg.[digit]	lin.[kPa]	polyn.[kPa]	linear	polynomial
0.0	0.0	9560.8	9561.9	9561.4	1.2	0.0	0.24	0.01
15.1	104.0	8678.0	8679.3	8678.7	103.7	104.0	-0.05	-0.01
30.2	208.0	7789.1	7790.1	7789.6	207.0	207.9	-0.20	-0.02
45.3	312.0	6892.7	6893.6	6893.1	311.1	312.0	-0.18	0.01
60.3	416.0	5990.0	5990.8	5990.4	415.9	416.1	-0.02	0.02
75.4	520.0	5083.5	5084.3	5083.9	521.1	519.9	0.22	-0.01

CALIBRATION FACTORS

	kPa per digit	**psi per digit**	**mH_20 per digit**
Linear Factor (K)	-1.16116E-1	-1.68406E-2	-1.18406E-2

	kPa	**psi**	**mH_20**
Poly Factor (A)	-4.52034E-7	-6.55596E-8	-4.60948E-8
Poly Factor (B)	-1.09495E-1	-1.58804E-2	-1.11655E-2
Poly Factor (C)			

	kPa per °C	**psi per °C**	**mH_20 per °C**
Thermal (T)	2.30215E-1	3.33887E-2	2.34755E-2

THE EQUIPMENT USED IN THE CALIBRATION OF THE PRODUCT DETAILED ABOVE IS TRACEABLE TO NATIONAL/INTERNATIONAL STANDARDS

Digits = $Hz^2 \times 10^{-3}$

Linear calc = k (kPa) * (Current Reading - Site Zero Reading) + T * (Current Temp - Site Zero Temp)

Polynomial calculation = A * $(Reading)^2$ + B * (Reading) + C + T * (Current Temp - Site Zero Temp)

C = -A * $(Site\ Zero\ Reading)^2$ - B * (Site Zero Reading)

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STANDARD VW PIEZOMETER LAE CALIBRATION

Model:	**VWP-3000**	**Cal Date:**	**28/04/2025**	**Readout No:**	**2108**
Serial No:	**379130**	**Baro:**	**1019**	**Cable Length:**	**50m**
Works ID:	**G32 12 170**	**Temp °C:**	**20**	**M Marking:**	**-m**

Applied Pressure		**Readings [digit]**			**Calculated Pressure**		**Error % FSO**	
psi	kPa	1st Cycle	2nd Cycle	avg.[digit]	lin.[kPa]	polyn.[kPa]	linear	polynomial
0.0	0.0	9534.6	9535.2	9534.9	0.9	0.0	0.18	0.02
15.1	104.0	8701.5	8702.3	8701.9	103.8	103.9	-0.05	-0.02
30.2	208.0	7864.0	7864.6	7864.3	207.2	207.9	-0.15	-0.02
45.3	312.0	7020.5	7021.2	7020.9	311.4	312.1	-0.12	0.01
60.3	416.0	6173.3	6174.0	6173.7	416.0	416.2	0.00	0.04
75.4	520.0	5325.4	5326.1	5325.8	520.7	519.9	0.14	-0.02

CALIBRATION FACTORS

	kPa per digit	**psi per digit**	**mH_20 per digit**
Linear Factor (K)	-1.23503E-1	-1.79120E-2	-1.25938E-2

	kPa	**psi**	**mH_20**
Poly Factor (A)	-3.54998E-7	-5.14863E-8	-3.61999E-8
Poly Factor (B)	-1.18227E-1	-1.71468E-2	-1.20559E-2
Poly Factor (C)			

	kPa per °C	**psi per °C**	**mH_20 per °C**
Thermal (T)	2.67690E-1	3.88238E-2	2.72969E-2

THE EQUIPMENT USED IN THE CALIBRATION OF THE PRODUCT DETAILED ABOVE IS TRACEABLE TO NATIONAL/INTERNATIONAL STANDARDS

Digits = $Hz^2 \times 10^{-3}$

Linear calc = k (kPa) * (Current Reading - Site Zero Reading) + T * (Current Temp - Site Zero Temp)

Polynomial calculation = A * $(Reading)^2$ + B * (Reading) + C + T * (Current Temp - Site Zero Temp)

C = -A * $(Site\ Zero\ Reading)^2$ - B * (Site Zero Reading)

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STANDARD VW PIEZOMETER LAE CALIBRATION

Model:	**VWP-3000**	**Cal Date:**	**06/12/2024**	**Readout No:**	**2108**
Serial No:	**379210**	**Baro:**	**1007**	**Cable Length:**	**60m**
Works ID:	**G28 8 50**	**Temp °C:**	**20**	**M Marking:**	**-m**

Applied Pressure		**Readings [digit]**			**Calculated Pressure**		**Error % FSO**	
psi	kPa	1st Cycle	2nd Cycle	avg.[digit]	lin.[kPa]	polyn.[kPa]	linear	polynomial
0.0	0.0	9801.8	9803.0	9802.4	1.8	0.0	0.25	-0.01
20.0	138.0	9012.1	9013.8	9013.0	137.8	138.1	-0.03	0.02
40.0	276.0	8218.1	8219.6	8218.9	274.6	276.0	-0.21	0.00
60.0	414.0	7417.6	7418.8	7418.2	412.5	414.0	-0.22	-0.01
80.1	552.0	6610.2	6611.3	6610.7	551.6	552.0	-0.06	0.00
100.1	690.0	5796.0	5797.2	5796.6	691.8	690.0	0.27	0.00

CALIBRATION FACTORS

	kPa per digit	**psi per digit**	**mH_20 per digit**
Linear Factor (K)	-1.72267E-1	-2.49844E-2	-1.75664E-2

	kPa	**psi**	**mH_20**
Poly Factor (A)	-8.46114E-7	-1.22714E-7	-8.62800E-8
Poly Factor (B)	-1.59068E-1	-2.30701E-2	-1.62205E-2
Poly Factor (C)			

	kPa per °C	**psi per °C**	**mH_20 per °C**
Thermal (T)	2.51728E-1	3.65087E-2	2.56692E-2

THE EQUIPMENT USED IN THE CALIBRATION OF THE PRODUCT DETAILED ABOVE IS TRACEABLE TO NATIONAL/INTERNATIONAL STANDARDS

Digits = $Hz^2 \times 10^{-3}$

Linear calc = k (kPa) * (Current Reading - Site Zero Reading) + T * (Current Temp - Site Zero Temp)

Polynomial calculation = A * $(Reading)^2$ + B * (Reading) + C + T * (Current Temp - Site Zero Temp)

C = -A * $(Site\ Zero\ Reading)^2$ - B * (Site Zero Reading)

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STANDARD VW PIEZOMETER LAE CALIBRATION

Model:	**VWP-3000**	**Cal Date:**	**12/05/2025**	**Readout No:**	**2108**
Serial No:	**380207**	**Baro:**	**1003**	**Cable Length:**	**10m**
Works ID:	**G121 9 172**	**Temp °C:**	**20**	**M Marking:**	**-m**

Applied Pressure		**Readings [digit]**			**Calculated Pressure**		**Error % FSO**	
psi	kPa	1st Cycle	2nd Cycle	avg.[digit]	lin.[kPa]	polyn.[kPa]	linear	polynomial
0.0	0.0	8692.2	8692.5	8692.4	-0.2	0.0	-0.05	0.00
10.0	69.0	8066.8	8066.9	8066.8	69.1	69.0	0.02	0.01
20.0	138.0	7443.4	7443.5	7443.4	138.1	138.0	0.03	-0.01
30.0	207.0	6819.8	6819.9	6819.9	207.1	207.0	0.04	0.00
40.0	276.0	6196.9	6197.0	6197.0	276.1	276.0	0.02	0.01
50.0	345.0	5576.1	5576.3	5576.2	344.8	345.0	-0.06	-0.01

CALIBRATION FACTORS

	kPa per digit	**psi per digit**	**mH_20 per digit**
Linear Factor (K)	-1.10709E-1	-1.60564E-2	-1.12892E-2

	kPa	**psi**	**mH_20**
Poly Factor (A)	1.32301E-7	1.91879E-8	1.34909E-8
Poly Factor (B)	-1.12597E-1	-1.63302E-2	-1.14817E-2
Poly Factor (C)			

	kPa per °C	**psi per °C**	**mH_20 per °C**
Thermal (T)	-1.50193E-1	-2.17829E-2	-1.53155E-2

THE EQUIPMENT USED IN THE CALIBRATION OF THE PRODUCT DETAILED ABOVE IS TRACEABLE TO NATIONAL/INTERNATIONAL STANDARDS

Digits = $Hz^2 \times 10^{-3}$

Linear calc = k (kPa) * (Current Reading - Site Zero Reading) + T * (Current Temp - Site Zero Temp)

Polynomial calculation = A * $(Reading)^2$ + B * (Reading) + C + T * (Current Temp - Site Zero Temp)

C = -A * $(Site\ Zero\ Reading)^2$ - B * (Site Zero Reading)

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STANDARD VW PIEZOMETER LAE CALIBRATION

Model:	**VWP-3000**	**Cal Date:**	**12/05/2025**	**Readout No:**	**2108**
Serial No:	**380208**	**Baro:**	**1003**	**Cable Length:**	**20m**
Works ID:	**G121 9 173**	**Temp °C:**	**20**	**M Marking:**	**-m**

Applied Pressure		**Readings [digit]**			**Calculated Pressure**		**Error % FSO**	
psi	kPa	1st Cycle	2nd Cycle	avg.[digit]	lin.[kPa]	polyn.[kPa]	linear	polynomial
0.0	0.0	9426.1	9426.2	9426.1	0.5	0.0	0.15	0.01
10.0	69.0	8761.9	8761.9	8761.9	68.9	69.0	-0.04	-0.01
20.0	138.0	8094.9	8095.0	8095.0	137.5	137.9	-0.14	-0.03
30.0	207.0	7422.9	7423.1	7423.0	206.7	207.1	-0.09	0.02
40.0	276.0	6750.0	6750.1	6750.0	276.0	276.1	-0.01	0.02
50.0	345.0	6075.1	6075.2	6075.1	345.4	345.0	0.12	-0.01

CALIBRATION FACTORS

	kPa per digit	**psi per digit**	**mH₂0 per digit**
Linear Factor (K)	-1.02928E-1	-1.49280E-2	-1.04958E-2

	kPa	**psi**	**mH₂0**
Poly Factor (A)	-3.16755E-7	-4.59398E-8	-3.23001E-8
Poly Factor (B)	-9.80181E-2	-1.42158E-2	-9.99510E-3
Poly Factor (C)			

	kPa per °C	**psi per °C**	**mH₂0 per °C**
Thermal (T)	-2.67593E-1	-3.88097E-2	-2.72870E-2

THE EQUIPMENT USED IN THE CALIBRATION OF THE PRODUCT DETAILED ABOVE IS TRACEABLE TO NATIONAL/INTERNATIONAL STANDARDS

Digits = $Hz^2 \times 10^{-3}$

Linear calc = k (kPa) * (Current Reading - Site Zero Reading) + T * (Current Temp - Site Zero Temp)

Polynomial calculation = A * $(Reading)^2$ + B * (Reading) + C + T * (Current Temp - Site Zero Temp)

C = -A * $(Site\ Zero\ Reading)^2$ - B * (Site Zero Reading)

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STANDARD VW PIEZOMETER LAE CALIBRATION

Model:	**VWP-3000**	**Cal Date:**	**12/05/2025**	**Readout No:**	**2108**
Serial No:	**380209**	**Baro:**	**1003**	**Cable Length:**	**30m**
Works ID:	**G121 9 174**	**Temp °C:**	**20**	**M Marking:**	**-m**

Applied Pressure		**Readings [digit]**			**Calculated Pressure**		**Error % FSO**	
psi	kPa	1st Cycle	2nd Cycle	avg.[digit]	lin.[kPa]	polyn.[kPa]	linear	polynomial
0.0	0.0	9616.7	9616.8	9616.7	0.6	0.0	0.19	0.00
10.0	69.0	8986.8	8986.9	8986.8	68.9	69.0	-0.02	0.01
20.0	138.0	8354.9	8355.0	8355.0	137.4	137.9	-0.17	-0.02
30.0	207.0	7717.5	7717.6	7717.5	206.5	207.0	-0.14	0.01
40.0	276.0	7077.7	7077.8	7077.7	275.9	276.0	-0.04	0.00
50.0	345.0	6433.7	6433.9	6433.8	345.7	345.0	0.19	0.00

CALIBRATION FACTORS

	kPa per digit	**psi per digit**	**mH_20 per digit**
Linear Factor (K)	-1.08394E-1	-1.57207E-2	-1.10532E-2

	kPa	**psi**	**mH_20**
Poly Factor (A)	-4.86830E-7	-7.06063E-8	-4.96431E-8
Poly Factor (B)	-1.00580E-1	-1.45874E-2	-1.02564E-2
Poly Factor (C)			

	kPa per °C	**psi per °C**	**mH_20 per °C**
Thermal (T)	-2.30684E-1	-3.34566E-2	-2.35233E-2

THE EQUIPMENT USED IN THE CALIBRATION OF THE PRODUCT DETAILED ABOVE IS TRACEABLE TO NATIONAL/INTERNATIONAL STANDARDS

Digits = $Hz^2 \times 10^{-3}$

Linear calc = k (kPa) * (Current Reading - Site Zero Reading) + T * (Current Temp - Site Zero Temp)

Polynomial calculation = A * $(Reading)^2$ + B * (Reading) + C + T * (Current Temp - Site Zero Temp)

C = -A * $(Site\ Zero\ Reading)^2$ - B * (Site Zero Reading)

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STANDARD VW PIEZOMETER LAE CALIBRATION

Model:	**VWP-3000**	**Cal Date:**	**28/04/2025**	**Readout No:**	**2108**
Serial No:	**379127**	**Baro:**	**1019**	**Cable Length:**	**40m**
Works ID:	**G32 12 167**	**Temp °C:**	**20**	**M Marking:**	**-m**

Applied Pressure		**Readings [digit]**			**Calculated Pressure**		**Error % FSO**	
psi	kPa	1st Cycle	2nd Cycle	avg.[digit]	lin.[kPa]	polyn.[kPa]	linear	polynomial
0.0	0.0	9378.4	9379.2	9378.8	1.2	-0.1	0.24	-0.01
15.1	104.0	8627.7	8629.0	8628.3	103.8	104.1	-0.03	0.02
30.2	208.0	7873.7	7874.8	7874.3	207.0	208.0	-0.20	0.00
45.3	312.0	7113.7	7114.6	7114.2	310.9	312.0	-0.21	-0.01
60.3	416.0	6347.4	6348.1	6347.8	415.7	416.0	-0.06	0.00
75.4	520.0	5575.1	5575.7	5575.4	521.3	520.0	0.26	0.00

CALIBRATION FACTORS

	kPa per digit	**psi per digit**	**mH_20 per digit**
Linear Factor (K)	-1.36747E-1	-1.98328E-2	-1.39444E-2

	kPa	**psi**	**mH_20**
Poly Factor (A)	-6.76685E-7	-9.81413E-8	-6.90029E-8
Poly Factor (B)	-1.26628E-1	-1.83651E-2	-1.29125E-2
Poly Factor (C)			

	kPa per °C	**psi per °C**	**mH_20 per °C**
Thermal (T)	2.38695E-1	3.46186E-2	2.43403E-2

THE EQUIPMENT USED IN THE CALIBRATION OF THE PRODUCT DETAILED ABOVE IS TRACEABLE TO NATIONAL/INTERNATIONAL STANDARDS

Digits = Hz^2 x 10^{-3}

Linear calc = k (kPa) * (Current Reading - Site Zero Reading) + T * (Current Temp - Site Zero Temp)

Polynomial calculation = A * $(Reading)^2$ + B * (Reading) + C + T * (Current Temp - Site Zero Temp)

C = -A * $(Site\ Zero\ Reading)^2$ - B * (Site Zero Reading)

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M MARKING TAKEN FROM SENSOR END, USED AS AN INDICATOR

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STANDARD VW PIEZOMETER LAE CALIBRATION

Model:	**VWP-3000**	**Cal Date:**	**28/04/2025**	**Readout No:**	**2108**
Serial No:	**379128**	**Baro:**	**1019**	**Cable Length:**	**50m**
Works ID:	**G32 12 168**	**Temp °C:**	**20**	**M Marking:**	**-m**

Applied Pressure		**Readings [digit]**			**Calculated Pressure**		**Error % FSO**	
psi	kPa	1st Cycle	2nd Cycle	avg.[digit]	lin.[kPa]	polyn.[kPa]	linear	polynomial
0.0	0.0	9210.8	9211.4	9211.1	1.4	0.0	0.28	0.00
15.1	104.0	8392.9	8393.6	8393.3	103.7	104.0	-0.05	0.00
30.2	208.0	7568.7	7569.3	7569.0	206.8	208.0	-0.23	-0.01
45.3	312.0	6737.1	6737.8	6737.5	310.8	312.0	-0.23	0.00
60.3	416.0	5898.3	5898.9	5898.6	415.7	416.1	-0.05	0.01
75.4	520.0	5053.3	5053.9	5053.6	521.4	520.0	0.27	-0.01

CALIBRATION FACTORS

	kPa per digit	**psi per digit**	**mH_20 per digit**
Linear Factor (K)	-1.25073E-1	-1.81396E-2	-1.27539E-2

	kPa	**psi**	**mH_20**
Poly Factor (A)	-6.32117E-7	-9.16776E-8	-6.44583E-8
Poly Factor (B)	-1.16055E-1	-1.68318E-2	-1.18344E-2
Poly Factor (C)			

	kPa per °C	**psi per °C**	**mH_20 per °C**
Thermal (T)	2.90434E-1	4.21225E-2	2.96162E-2

THE EQUIPMENT USED IN THE CALIBRATION OF THE PRODUCT DETAILED ABOVE IS TRACEABLE TO NATIONAL/INTERNATIONAL STANDARDS

Digits = $Hz^2 \times 10^{-3}$

Linear calc = k (kPa) * (Current Reading - Site Zero Reading) + T * (Current Temp - Site Zero Temp)

Polynomial calculation = A * $(Reading)^2$ + B * (Reading) + C + T * (Current Temp - Site Zero Temp)

C = -A * $(Site\ Zero\ Reading)^2$ - B * (Site Zero Reading)

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STANDARD VW PIEZOMETER LAE CALIBRATION

Model:	**VWP-3000**	**Cal Date:**	**06/12/2024**	**Readout No:**	**2108**
Serial No:	**379208**	**Baro:**		**Cable Length:**	**60m**
Works ID:	**G28 8 48**	**Temp °C:**	**20**	**M Marking:**	**-m**

Applied Pressure		**Readings [digit]**			**Calculated Pressure**		**Error % FSO**	
psi	kPa	1st Cycle	2nd Cycle	avg.[digit]	lin.[kPa]	polyn.[kPa]	linear	polynomial
0.0	0.0	9445.6	9447.1	9446.3	0.1	0.1	0.02	0.02
20.0	138.0	8727.0	8728.8	8727.9	137.8	137.8	-0.02	-0.02
40.0	276.0	8006.6	8008.4	8007.5	275.9	275.9	-0.01	-0.01
60.0	414.0	7286.0	7287.5	7286.7	414.1	414.1	0.01	0.01
80.1	552.0	6565.6	6566.7	6566.1	552.2	552.2	0.03	0.03
100.1	690.0	5847.2	5848.2	5847.7	689.9	689.9	-0.02	-0.02

CALIBRATION FACTORS

	kPa per digit	**psi per digit**	**mH_20 per digit**
Linear Factor (K)	-1.91668E-1	-2.77981E-2	-1.95448E-2

	kPa	**psi**	**mH_20**
Poly Factor (A)	-2.44741E-10	-3.54954E-11	-2.49567E-11
Poly Factor (B)	-1.91664E-1	-2.77976E-2	-1.95444E-2
Poly Factor (C)			

	kPa per °C	**psi per °C**	**mH_20 per °C**
Thermal (T)	2.99965E-1	4.35048E-2	3.05881E-2

THE EQUIPMENT USED IN THE CALIBRATION OF THE PRODUCT DETAILED ABOVE IS TRACEABLE TO NATIONAL/INTERNATIONAL STANDARDS

Digits = $Hz^2 \times 10^{-3}$

Linear calc = k (kPa) * (Current Reading - Site Zero Reading) + T * (Current Temp - Site Zero Temp)

Polynomial calculation = A * $(Reading)^2$ + B * (Reading) + C + T * (Current Temp - Site Zero Temp)

C = -A * $(Site\ Zero\ Reading)^2$ - B * (Site Zero Reading)

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STANDARD VW PIEZOMETER LAE CALIBRATION

Model:	**VWP-3000**	**Cal Date:**	**03/06/2025**	**Readout No:**	**2108**
Serial No:	**380328**	**Baro:**	**996**	**Cable Length:**	**15.5m**
Works ID:	**G122 9 43**	**Temp °C:**	**20**	**M Marking:**	**-m**

Applied Pressure		**Readings [digit]**			**Calculated Pressure**		**Error % FSO**	
psi	kPa	1st Cycle	2nd Cycle	avg.[digit]	lin.[kPa]	polyn.[kPa]	linear	polynomial
0.0	0.0	9923.1	9923.9	9923.5	0.7	0.0	0.22	0.00
10.0	69.0	9281.4	9282.1	9281.7	68.9	69.0	-0.04	0.00
20.0	138.0	8635.8	8636.7	8636.2	137.4	138.0	-0.19	-0.01
30.0	207.0	7984.9	7985.6	7985.2	206.5	207.1	-0.16	0.02
40.0	276.0	7331.4	7332.1	7331.7	275.8	276.0	-0.06	-0.01
50.0	345.0	6672.3	6673.0	6672.6	345.8	345.0	0.22	0.00

CALIBRATION FACTORS

	kPa per digit	**psi per digit**	**mH_20 per digit**
Linear Factor (K)	-1.06134E-1	-1.53929E-2	-1.08227E-2

	kPa	**psi**	**mH_20**
Poly Factor (A)	-5.38973E-7	-7.81686E-8	-5.49601E-8
Poly Factor (B)	-9.71887E-2	-1.40955E-2	-9.91053E-3
Poly Factor (C)			

	kPa per °C	**psi per °C**	**mH_20 per °C**
Thermal (T)	1.38188E-1	2.00418E-2	1.40913E-2

THE EQUIPMENT USED IN THE CALIBRATION OF THE PRODUCT DETAILED ABOVE IS TRACEABLE TO NATIONAL/INTERNATIONAL STANDARDS

Digits = $Hz^2 \times 10^{-3}$

Linear calc = k (kPa) * (Current Reading - Site Zero Reading) + T * (Current Temp - Site Zero Temp)

Polynomial calculation = A * $(Reading)^2$ + B * (Reading) + C + T * (Current Temp - Site Zero Temp)

C = -A * $(Site\ Zero\ Reading)^2$ - B * (Site Zero Reading)

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STANDARD VW PIEZOMETER LAE CALIBRATION

Model:	**VWP-3000**	**Cal Date:**	**03/06/2025**	**Readout No:**	**2108**
Serial No:	**380329**	**Baro:**	**996**	**Cable Length:**	**24.9m**
Works ID:	**G122 9 44**	**Temp °C:**	**20**	**M Marking:**	**-m**

Applied Pressure		**Readings [digit]**			**Calculated Pressure**		**Error % FSO**	
psi	kPa	1st Cycle	2nd Cycle	avg.[digit]	lin.[kPa]	polyn.[kPa]	linear	polynomial
0.0	0.0	9458.3	9458.3	9458.3	0.5	0.0	0.14	0.00
10.0	69.0	8831.1	8831.5	8831.3	68.9	69.0	-0.03	0.00
20.0	138.0	8200.6	8201.0	8200.8	137.7	138.1	-0.09	0.03
30.0	207.0	7569.5	7569.9	7569.7	206.5	206.9	-0.13	-0.02
40.0	276.0	6934.2	6934.5	6934.4	275.9	276.0	-0.04	-0.01
50.0	345.0	6295.6	6296.0	6295.8	345.5	345.0	0.16	0.01

CALIBRATION FACTORS

	kPa per digit	**psi per digit**	**mH_20 per digit**
Linear Factor (K)	-1.09110E-1	-1.58246E-2	-1.11262E-2

	kPa	**psi**	**mH_20**
Poly Factor (A)	-3.82016E-7	-5.54047E-8	-3.89549E-8
Poly Factor (B)	-1.03092E-1	-1.49517E-2	-1.05125E-2
Poly Factor (C)			

	kPa per °C	**psi per °C**	**mH_20 per °C**
Thermal (T)	1.92653E-1	2.79409E-2	1.96452E-2

THE EQUIPMENT USED IN THE CALIBRATION OF THE PRODUCT DETAILED ABOVE IS TRACEABLE TO NATIONAL/INTERNATIONAL STANDARDS

Digits = $Hz^2 \times 10^{-3}$

Linear calc = k (kPa) * (Current Reading - Site Zero Reading) + T * (Current Temp - Site Zero Temp)

Polynomial calculation = A * $(Reading)^2$ + B * (Reading) + C + T * (Current Temp - Site Zero Temp)

C = -A * $(Site\ Zero\ Reading)^2$ - B * (Site Zero Reading)

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STANDARD VW PIEZOMETER LAE CALIBRATION

Model:	**VWP-3000**	**Cal Date:**	**01/05/2025**	**Readout No:**	**2108**
Serial No:	**380679**	**Baro:**	**1008**	**Cable Length:**	**33m**
Works ID:	**G33 12 44**	**Temp °C:**	**20**	**M Marking:**	**-m**

Applied Pressure		**Readings [digit]**			**Calculated Pressure**		**Error % FSO**	
psi	kPa	1st Cycle	2nd Cycle	avg.[digit]	lin.[kPa]	polyn.[kPa]	linear	polynomial
0.0	0.0	9481.5	9482.9	9482.2	1.2	-0.1	0.24	0.00
15.1	104.0	8695.3	8696.5	8695.9	103.8	104.0	-0.04	0.01
30.2	208.0	7904.1	7905.3	7904.7	207.0	208.0	-0.20	0.00
45.3	312.0	7107.0	7108.1	7107.6	311.0	312.0	-0.20	0.00
60.3	416.0	6304.1	6305.0	6304.5	415.7	416.0	-0.06	0.00
75.4	520.0	5494.5	5495.4	5494.9	521.3	520.0	0.25	0.00

CALIBRATION FACTORS

	kPa per digit	**psi per digit**	**mH_20 per digit**
Linear Factor (K)	-1.30434E-1	-1.89172E-2	-1.33006E-2

	kPa	**psi**	**mH_20**
Poly Factor (A)	-6.05751E-7	-8.78536E-8	-6.17696E-8
Poly Factor (B)	-1.21361E-1	-1.76013E-2	-1.23754E-2
Poly Factor (C)			

	kPa per °C	**psi per °C**	**mH_20 per °C**
Thermal (T)	1.88815E-1	2.73843E-2	1.92538E-2

THE EQUIPMENT USED IN THE CALIBRATION OF THE PRODUCT DETAILED ABOVE IS TRACEABLE TO NATIONAL/INTERNATIONAL STANDARDS

Digits = $Hz^2 \times 10^{-3}$

Linear calc = k (kPa) * (Current Reading - Site Zero Reading) + T * (Current Temp - Site Zero Temp)

Polynomial calculation = A * $(Reading)^2$ + B * (Reading) + C + T * (Current Temp - Site Zero Temp)

C = -A * $(Site\ Zero\ Reading)^2$ - B * (Site Zero Reading)

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LANKELMA
A ConeTec Group Company

CERTIFICATE OF CALIBRATION

Certificate Number: 1719

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2116

Test Setup

Calibrated Instrument

Instrument type:	**Subtraction**	**Number of sensors:**	**6**
Serial number:	**DS15-CFIIPTTM.2116**	**Manufacturer:**	**Eijkelkamp Geopoint**
Nominal cone area:	**15 cm²**	**Nominal sleeve area:**	**227 cm²**
Calibration standard:	**BS EN ISO 22476-1:2023**	**Location:**	**Lankelma Calibration Laboratory**
Calibration date:	**02 April 2025**	**Calibration expiry:**	**02 October 2025**

Sensor measurand	Calibration range	Maximum rating	Momentary overload	Sensor stability (60 sec)	Max drift before re-calibration
Cone resistance (qc)	66.67 MPa	100 MPa	100 MPa	± 0.40 kPa	4 bar
Sleeve friction (fs)	4.41 MPa	1.00 MPa*	1.00 MPa	± 0.04 kPa	0.04 bar
Pore pressure (u)	4 MPa	10 MPa	13.5 MPa	± 0.02 kPa	0.14 bar
Inclination (i)	20 °	90 °		± 0.05 °	
Temperature (t)	30 °C	90 °C		± 0.023 °C	
Magnetic field (m)	200 uT	200 uT			

** The maximum usable sleeve friction stress is limited by the physical strength of the sleeve.*

ISO 22476-22 Cone Penetrometer Classification

Sensor measurand	Measurement uncertainty $U_{qc:class}$, $U_{fs:class}$, $U_{u:class}$	Ambient temperature stability		Transient temperature stability		Bending influence Δb_{qc}, Δb_{fs}, Δb_u	Overall classification *(highest number represents penetrometer class)*
		Uncorrected Δa_{qc}, Δa_{fs}, Δa_u	Corrected Δa_{qcc}, Δa_{fsc}, Δa_{uc}	Uncorrected Δt_{qc}, Δt_{fs}, Δt_u	Corrected Δt_{qcc}, Δt_{fsc}, Δt_{uc}		
Cone resistance	0	2	0	2	1	0	1
Sleeve friction	0	0	0	2	2	0	2
Pore pressure	0	N/A	0	3	0	0	0

Calibration signed by:

Paul Metcalf

Digitally signed by Paul Metcalf
DN: cn=Paul Metcalf, o=Lankelma Ltd, email=paulmetcalf@lankelma.co.uk
Date: 2025.04.16 08:46:04 +01'00'

P Metcalf

Calibration checked by:

Alastair Harman

Digitally signed by Alastair Harman
DN: cn=Alastair Harman, o=Lankelma Ltd, email=alastairharman@lankelma.co.uk
Date: 2025.04.16 08:46:39 +01'00'

A Harman

Cone penetrometer, serial number: DS15-CFIIPTTM.2116 was found to comply with the requirements of BS EN ISO 22476-1:2023 for the following classifications:
Cone Resistance - Class 1 Sleeve Friction - Class 2 Pore Pressure - Class 0

Reference Instruments

Device	Serial number	Uncertainty of recorded value	Calibration date
AM DSCCHA-100 kN	66914	0.02 ±%	19/06/2023
AM DSCCHA-5 kN	61065	0.05 ±%	19/06/2023
Keithley 7.5 Digit DMM	4496826	12.00 PPM	02/07/2024
MMG750V1P1MC0T3A6CE	547961	0.02 ±%	02/09/2024
ETI Ref Thermometer	D24276054	0.04 °C	17/09/2024
Lankelma HV6 Rotary Table	INC-JIG 01	0.10 °	17/07/2023
10 kg Calibration Weight	H1-S1 10kg	0.001 %	02/08/2024
Mitutoyo 200mm Caliper	A23044194	0.02 ±mm	20/06/2024

Calibration Standard

The calibration was performed according to BS EN ISO 22476-1:2023 & BS EN ISO 17025:2017 for the calibration of cone penetrometers.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation for each of the calibrated sensors has been carried out in accordance with BS EN ISO 22476-1:2023 requirements.

The report provides traceability of measurement to national standards and the SI system of units.

Clause 5.1.2 of BS EN ISO 22476-1:2023, states that the maximum period of validity of the calibration of the cone penetrometer shall not exceed 12 months. The cone penetrometer shall be recalibrated if the readings before a test show a zero baseline drift of over 2% of full scale output compared to the calibration zero load readings.

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CERTIFICATE OF CALIBRATION

Certificate Number: 1719

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2116

Cone Dimension Verification

Cone Tip

Cone shoulder diameter

Rotational position	d_c
0 °	43.85 mm
120 °	43.87 mm
240 °	43.85 mm

Height of the cylindrical extension of the cone

Rotational position	h_e
0 °	11.18 mm
120 °	11.18 mm
240 °	11.18 mm

Height of the conical section of the cone

Rotational position	h_c
0 °	35.78 mm
120 °	35.78 mm
240 °	35.78 mm

Filter element diameter

Rotational position	d_{fil}
0 °	43.47 mm
120 °	43.47 mm
240 °	43.47 mm

Friction Sleeve

Friction sleeve diameter

Rotational position	Upper section d_{2u}	Middle section d_{2m}	Lower section d_{2l}
0 °	43.99 mm	44.04 mm	44.14 mm
120 °	43.99 mm	44.00 mm	44.14 mm
240 °	43.99 mm	44.00 mm	44.13 mm

Friction sleeve length

Rotational position	l_s
0 °	165.11 mm
120 °	165.11 mm
240 °	165.11 mm

Gap between the cone and the lower end of the friction sleeve

Rotational position	l_{gl}
0 °	2.57 mm
120 °	2.57 mm
240 °	2.57 mm

Gap above the upper end of the friction sleeve

Rotational position	l_{gu}
0 °	2.35 mm
120 °	2.35 mm
240 °	2.34 mm

Cone Tip Dimension Uncertainty

Reference device uncertainty u_r	0.015 mm
Average diameter d_c	43.857 mm
Relative error b_c	0.030 %
Area A_c	1510.640 mm^2
Dimension uncertainty U_{dc}	0.017 mm
Area uncertainty u_{AC}	1.161 mm^2
Expanded area uncertainty U_{AC}	2.323 mm^2

Friction Sleeve Dimension Uncertainty

Reference device uncertainty u_r	0.015 mm
Average diameter d_2	44.047 mm
Relative error b_{c2}	0.212 %
Average length l_s	165.110 mm
Relative error b_{ls}	0.000 %
Area A_s	22847.374 mm^2
Dimension uncertainty diameter u_{d2}	0.056 mm
Dimension uncertainty length u_{ls}	0.015 mm
Area uncertainty u_{as}	29.088 mm^2
Expanded area uncertainty U_{as}	58.176 mm^2
Sleeve length to diameter ratio	3.749
Diameter difference, sleeve - tip	0.190 mm

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CERTIFICATE OF CALIBRATION

Certificate Number: 1719

Cone Penetrometer Serial No.
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Cone Resistance Calibration

Calibration method

1. The cone was loaded to full range 3 times for no less than 1 minute before calibration.
2. The cone was calibrated with 4 sets of increasing forces and 2 sets of decreasing forces, with rotation before set 3 and 5.
3. The coefficients of a linear and third order equation relating the the estimate of applied force as a function of the deflection were calculated and are shown in Table 1.
4. The forces applied, and the resulting deflections are given in Tables 2. No corrections for temperature have been applied to these results.
5. The combined expanded uncertainty* of deflection Ucqc and Uqc_class for each force is shown as a percentage of the recorded value and in units of pressure (kPa) as shown in Table 3.

* The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

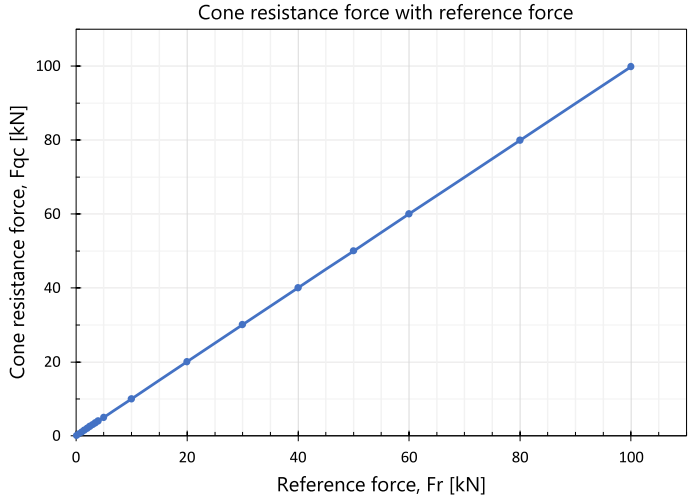
Cone Penetrometer	
Cone penetrometer type	Subtraction
Cone resistance capacity	150 kN
Calibration range	100 kN
Cone resistance effective resolution	0.0005 kN
Cone area	1,511 mm^2
Measured alpha factor cone area ratio	0.79
Historic drift between cone calibrations (u_{drift})	0.05774 %
Apparent pore pressure (u_a) at full range	0.23 kPa
Cone resistance max zero drift	4.23 kPa
Reference load cell max zero drift	2.83 kPa

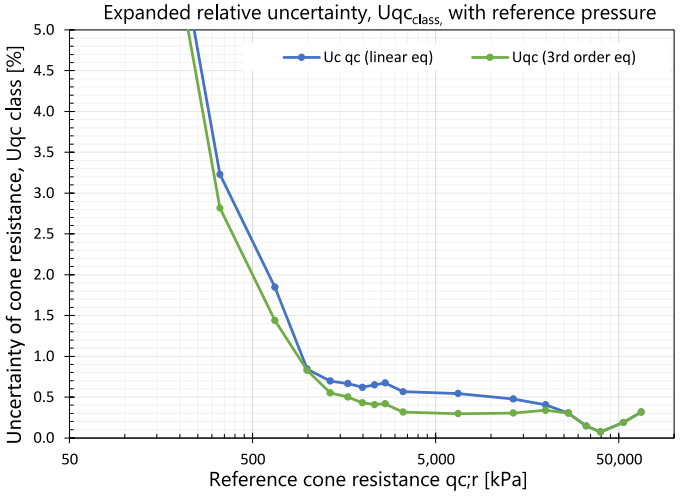
Calibration Conditions	
Ambient temperature	23.2 °C
Ambient temperature variation	0.31 °C
Instrument temperature variation	0.54 °C

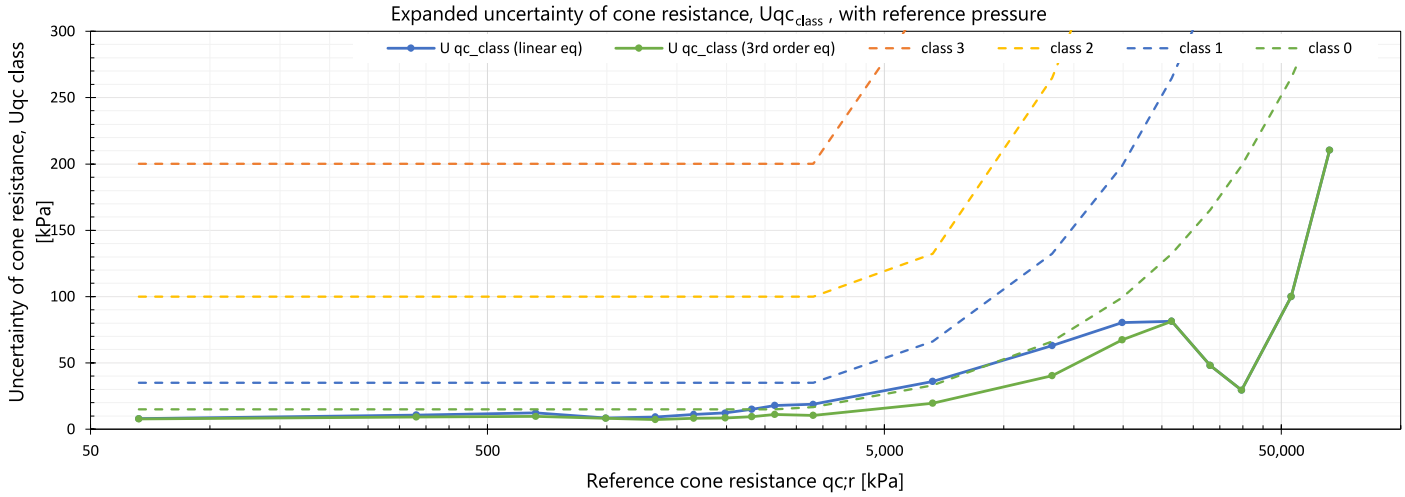
Reference Load Cell Uncertainty	
AM DSCCHA-100 kN	0.02 ±%
AM DSCCHA-5 kN	0.05 ±%

Reference Indicator Uncertainty	
Keithley 7.5 Digit DMM	12 PPM

Cone Resistance Calibration - Graphical Results







Interpolation

Table - 1

Linear Equation	*The cone output in force units of D (0.1 N) is derived using a linear factor from the raw cone output. D = Factor x RAW_Output*	0.1 N Factor = 0.009076
Polynomial Equation	*3rd order polynomial equation. For a given cone indicated output of D (in 0.1 N units), the corrected applied force, F (in 0.1 N units) is calculated from :*	a0 = 0 a1 = 0.99739681 a2 = -4.4716E-10 a3 = 9.40388E-15 *Polynomial calc. is only to be used when the cone load is under 30 kN*

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CERTIFICATE OF CALIBRATION

Certificate Number: 1719

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2116

Cone Resistance Calibration - Tabular Results

Table - 2a **Low range calibration results**

	0°	0°	120°	120°	240°	240°
kN	kN	kN	kN	kN	kN	kN
Fr	X1	X2	X3	X4'	X5	X6'
0	0.0041	0.0064	0.0021		0.0030	
0.1	0.1059	0.1075	0.1039		0.1048	
0.5	0.5066	0.5121	0.5050		0.5044	
1	1.0063	1.0115	1.0055		1.0037	
1.5	1.5004	1.5059	1.4988		1.4955	
2	2.0011	2.0059	1.9999		1.9967	
2.5	2.5013	2.5077	2.5007		2.4957	
3	3.0011	3.0071	2.9997		2.9973	
3.5	3.5026	3.5084	3.4996		3.4980	
4	4.0026	4.0080	4.0014		3.9983	
5	5.0010	5.0091	5.0023		4.9956	
4				3.9935		3.9961
3.5				3.4949		3.4958
3				2.9958		2.9955
2.5				2.4961		2.4965
2				1.9953		1.9962
1.5				1.4984		1.4942
1				0.9997		0.9965
0.5				0.5020		0.4959
0.1				0.1012		0.0958

Table -2b **High range calibration results**

	0°	0°	120°	120°	240°	240°
kN	kN	kN	kN	kN	kN	kN
Fr	X1	X2	X3	X4'	X5	X6'
10	9.9977	10.0106	10.0027		9.9981	
20	19.9841	20.0059	20.0026		19.9909	
30	29.9630	29.9974	29.9958		29.9715	
40	40.0269	40.0475	40.0875		40.0502	
50	50.0091	50.0261	50.0389		50.0406	
60	59.9859	59.9971	60.0175		60.0116	
80	79.9130	79.9268	79.9457		79.9309	
100	99.8309	99.8507	99.8744		99.8483	
80				79.9490		79.9329
60				60.0188		60.0110
50				50.0394		50.0374
40				40.0505		40.0479
30				29.9708		29.9731
20				19.9879		19.9940
10				9.9929		9.9978

Table - 3 **Uncertainty assessment**

Reference force	**Reference tip resistance**	**Standard uncertainty u1 - u8**								**Combined standard calibration uncertainty**		**Expanded calibration uncertainty [k=2]**				**BS EN ISO 22476:2023 class**	**Tip calibration drift**
kN	kPa	kN	kN	kN	kN	kN	kN	kN	kN	kN	kN	kPa	%	kPa	%		kPa
Fr	qc;r	u1*	u2	u3	u4	u5	u6	u7	u8	uc	uc;dim	Uc qc		Uqc class		Cone Class **	u_{drift}***
0	0	0.0000	0.0006	0.0000	0.0002	0.0000	0.0000	0.0000	0.0000	0.0006	0.0006	0.8		0.8		0	0.0
0.1	66	0.0007	0.0005	0.0009	0.0002	0.0000	0.0046	0.0032	0.0000	0.0058	0.0058	7.7	11.60	7.7	11.60	0	0.0
0.5	331	0.0011	0.0004	0.0031	0.0002	0.0000	0.0053	0.0033	0.0000	0.0070	0.0071	9.3	2.82	9.3	2.82	0	0.2
1	662	0.0012	0.0009	0.0030	0.0002	0.0001	0.0052	0.0038	0.0000	0.0072	0.0072	9.6	1.45	9.5	1.44	0	0.4
1.5	993	0.0048	0.0013	0.0032	0.0002	0.0001	0.0018	0.0005	0.0000	0.0062	0.0063	8.3	0.84	8.2	0.82	0	0.6
2	1,324	0.0041	0.0017	0.0027	0.0002	0.0001	0.0007	0.0015	0.0000	0.0055	0.0057	7.6	0.57	7.3	0.55	0	0.8
2.5	1,655	0.0041	0.0024	0.0037	0.0002	0.0002	0.0008	0.0016	0.0000	0.0063	0.0066	8.7	0.52	8.3	0.50	0	1.0
3	1,986	0.0044	0.0026	0.0035	0.0002	0.0002	0.0006	0.0016	0.0000	0.0064	0.0068	9.1	0.46	8.5	0.43	0	1.1
3.5	2,317	0.0053	0.0028	0.0033	0.0002	0.0002	0.0001	0.0020	0.0000	0.0072	0.0076	10.1	0.44	9.5	0.41	0	1.3
4	2,648	0.0061	0.0037	0.0031	0.0002	0.0003	0.0007	0.0029	0.0000	0.0084	0.0089	11.8	0.45	11.1	0.42	0	1.5
5	3,310	0.0020	0.0052	0.0047	0.0002	0.0003	0.0004	0.0032	0.0000	0.0079	0.0088	11.7	0.35	10.5	0.32	0	1.9
10	6,620	0.0048	0.0115	0.0075	0.0002	0.0006	0.0005	0.0029	0.0000	0.0148	0.0167	22.1	0.33	19.7	0.30	0	3.8
20	13,239	0.0074	0.0251	0.0126	0.0002	0.0013	0.0075	0.0051	0.0000	0.0305	0.0341	45.2	0.34	40.3	0.30	0	7.6
30	19,859	0.0107	0.0385	0.0199	0.0002	0.0019	0.0233	0.0077	0.0000	0.0509	0.0559	74.0	0.37	67.4	0.34	0	11.5
40	26,479	0.0135	0.0177	0.0119	0.0002	0.0026	0.0548	0.0113	0.0000	0.0614	0.0687	90.9	0.34	81.3	0.31	0	15.3
50	33,099	0.0153	0.0102	0.0098	0.0002	0.0032	0.0295	0.0011	0.0000	0.0363	0.0529	70.0	0.21	48.1	0.15	0	19.1
60	39,718	0.0179	0.0097	0.0065	0.0002	0.0038	0.0050	0.0006	0.0000	0.0223	0.0512	67.8	0.17	29.5	0.07	0	22.9
80	52,958	0.0244	0.0095	0.0080	0.0002	0.0051	0.0702	0.0015	0.0000	0.0755	0.0974	128.9	0.24	99.9	0.19	0	30.6
100	66,197	0.0521	0.0127	0.0115	0.0002	0.0064	0.1490	0.0000	0.0000	0.1589	0.1765	233.7	0.35	210.4	0.32	0	38.2

The class of the penetrometer is determined from the measurement uncertainty at any deflection
At each given deflection the expanded measurement uncertainty Uqc_class is calculated from the readings obtained during calibration.

$$Uqc_{class} = \frac{2}{S} \times \sqrt{\sum_{i=1}^{8} u_i^2}$$

where,
u1 is the standard uncertainty associated with the applied calibration force.
u2 is the standard uncertainty associated with the reproducibility of the calibration results.
u3 is the standard uncertainty associated with the repeatability of the calibration results.
u4 is the standard uncertainty associated with the resolution and noise of the system.
u5 is the standard uncertainty associated with the drift in zero output.
u6 is the standard uncertainty associated with interpolation.
u7 is the standard uncertainty associated with reversibility.
u8 is the standard uncertainty associated with apparent load transfer from other sensor.

** u1 is not a requirement for BS EN ISO 22476-1:2023 class uncertainty Uqc_class. We have included u1 for clarity and confidence in the result.*
*** If the classification is altered with the inclusion u1, then the lower classification will be given alongside a # symbol as identification.*
**** udrift is the standard uncertainty associated with the drift in sensitivity between calibrations. This is an uncertainty associated with subsequent use and not a calibration uncertainty.*

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CERTIFICATE OF CALIBRATION

Certificate Number: 1719

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2116

Sleeve Friction Calibration

Calibration method

1. The sleeve was loaded to full range 3 times for no less than 1 minute before calibration.
2. The sleeve was calibrated with 4 sets of increasing forces and 2 sets of decreasing forces, with rotation before set 3 and 5.
3. The coefficients of a linear and third order equation relating the estimate of applied force as a function of the deflection were calculated and are shown in Table 4.
4. The forces applied, and the resulting deflections are given in Tables 5. No corrections for temperature have been applied to these results.
5. The combined expanded uncertainty* of deflection Ucfs and Ufs_class for each force is shown as a percentage of the recorded value and in units of pressure (kPa) as shown in Table 6.

*The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

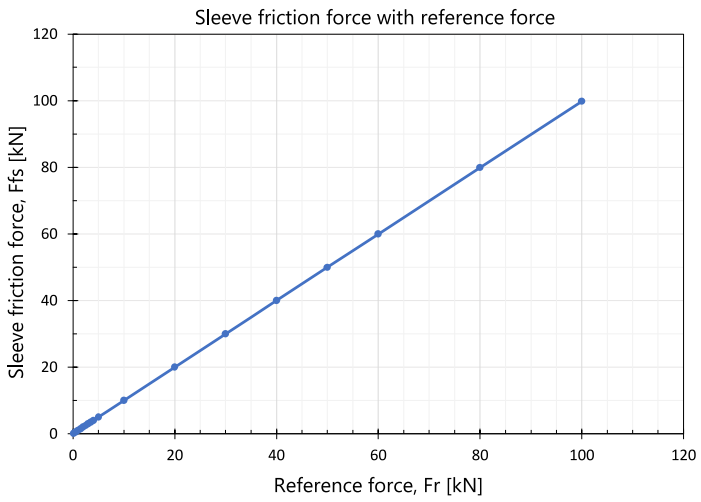
Cone Penetrometer	
Cone penetrometer type	Subtraction
Sleeve friction capacity	150 kN
Calibration range	100 kN
Sleeve friction effective resolution	0.005 kN
Sleeve area	22,847 mm^2
Measured beta factor sleeve area ratio	-0.003
Historic drift between sleeve calibrations (u_{drift})	0.05774 %
Apparent pore pressure (u_a) at full range	0.23 kPa
Sleeve friction max zero drift	0.53 kPa
Reference load cell max zero drift	0.19 kPa

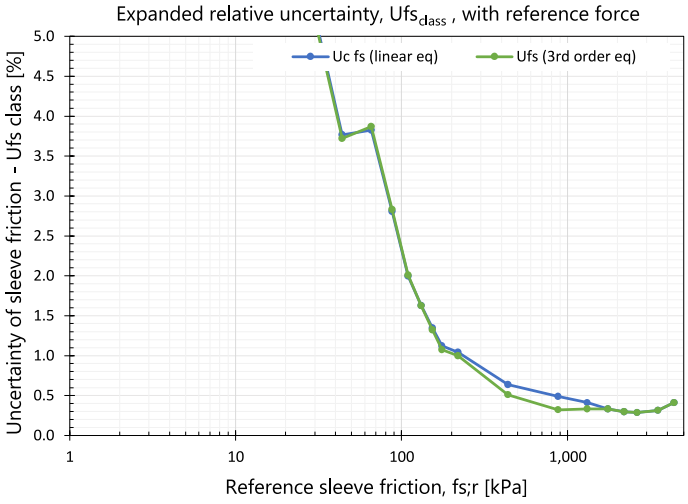
Calibration Conditions	
Ambient temperature	23.2 °C
Ambient temperature variation	0.31 °C
Instrument temperature variation	0.75 °C

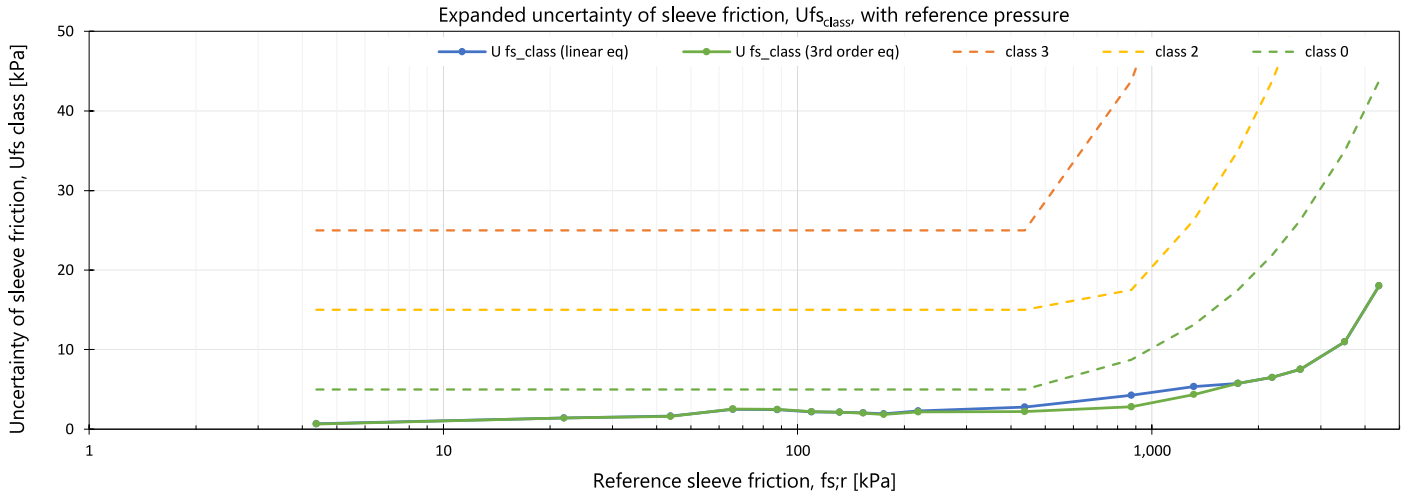
Reference Load Cell Uncertainty	
AM DSCCHA-100 kN	0.02 ±%
AM DSCCHA-5 kN	0.05 ±%

Reference Indicator Uncertainty	
Keithley 7.5 Digit DMM	12 PPM

Sleeve Friction Calibration - Graphical Results







Interpolation

Table - 4

Linear Equation	*The sleeve output in force units D (0.1 N) is derived using a linear factor from the raw sleeve output. D = Factor x RAW_Output*	0.1 N Factor = 0.008792
Polynomial Equation	*3rd order polynomial equation. For a given cone indicated output of D (0.1 N units), the corrected applied force, F (in 0.1 N units) is calculated from :*	a0 = 0 a1 = 0.998481581 a2 = 2.79418E-09 a3 = 7.34756E-16 *Polynomial calc. is only to be used when the sleeve load is under 30 kN*

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CERTIFICATE OF CALIBRATION

Certificate Number: 1719

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2116

Sleeve Friction Calibration - Tabular Results

Table - 6a **Low range calibration results**

	0°	0°	120°	120°	240°	240°
kN	kN	kN	kN	kN	kN	kN
Fr	X1	X2	X3	X4'	X5	X6'
0	0.0092	0.0022	0.0122		0.0005	
0.1	0.0982	0.1032	0.0987		0.1033	
0.5	0.4903	0.4993	0.4955		0.4966	
1	0.9892	0.9955	0.9912		0.9936	
1.5	1.4799	1.4862	1.4825		1.4804	
2	1.9794	1.9881	1.9833		1.9825	
2.5	2.4791	2.4863	2.4852		2.4855	
3	2.9795	2.9899	2.9860		2.9865	
3.5	3.4820	3.4906	3.4874		3.4870	
4	3.9853	3.9944	3.9882		3.9875	
5	4.9791	4.9936	4.9870		4.9888	
4				4.0017		3.9817
3.5				3.5083		3.4839
3				3.0063		2.9869
2.5				2.5076		2.4872
2				2.0081		1.9933
1.5				1.5069		1.4946
1				1.0123		0.9981
0.5				0.5166		0.5025
0.1				0.1133		0.1029

Table - 6b **High range calibration results**

	0°	0°	120°	120°	240°	240°
kN	kN	kN	kN	kN	kN	kN
Fr	X1	X2	X3	X4'	X5	X6'
10	9.9817	9.9969	9.9909		9.9904	
20	19.9773	20.0044	20.0004		19.9845	
30	29.9897	30.0283	30.0439		29.9897	
40	39.9708	39.9950	40.0558		39.9810	
50	49.9494	49.9668	50.0089		49.9651	
60	59.9239	59.9370	59.9906		59.9365	
80	79.8507	79.8696	79.9442		79.8767	
100	99.7739	99.7995	99.8660		99.7866	
80				80.0064		79.8506
60				60.0963		59.9462
50				50.1149		49.9763
40				40.1159		39.9957
30				30.1057		30.0070
20				20.0738		19.9874
10				10.0367		9.9821

Table - 6 **Uncertainty assessment**

Reference force	**Reference sleeve friction**	**Standard uncertainty u1 - u8**								**Combined standard calibration uncertainty**		**Expanded calibration uncertainty [k=2]**				**BS EN ISO 22476:2023 Class**	**Sleeve calibration drift**
kN	kPa	kN	kN	kN	kN	kN	kN	kN	kN	kN	kN	kPa	%	kPa	%		kPa
Fr	fs;r	u1*	u2	u3	u4	u5	u6	u7	u8	uc	uc;dim	Uc_{fs}		Ufs_{class}		Cone Class **	u_{drift}***
0	0	0.0000	0.0035	0.0000	0.0020	0.0000	0.0000	0.0000	0.0000	0.0041	0.0041	0.36		0.36		0	0.00
0.1	4	0.0007	0.0016	0.0028	0.0020	0.0000	0.0001	0.0044	-0.0048	0.0076	0.0076	0.67	15.20	0.67	15.20	0	0.00
0.5	22	0.0011	0.0020	0.0053	0.0020	0.0001	0.0059	0.0078	-0.0112	0.0161	0.0161	1.41	6.45	1.41	6.45	0	0.01
1	44	0.0012	0.0013	0.0037	0.0020	0.0001	0.0088	0.0075	-0.0139	0.0186	0.0186	1.63	3.73	1.63	3.73	0	0.03
1.5	66	0.0048	0.0008	0.0037	0.0020	0.0002	0.0193	0.0113	-0.0173	0.0290	0.0291	2.55	3.88	2.54	3.88	0	0.04
2	88	0.0041	0.0012	0.0051	0.0020	0.0002	0.0184	0.0103	-0.0175	0.0283	0.0284	2.49	2.84	2.48	2.84	0	0.05
2.5	109	0.0041	0.0021	0.0042	0.0020	0.0003	0.0168	0.0070	-0.0160	0.0251	0.0253	2.21	2.02	2.20	2.02	0	0.06
3	131	0.0044	0.0023	0.0060	0.0020	0.0004	0.0161	0.0060	-0.0154	0.0244	0.0247	2.16	1.65	2.14	1.65	0	0.08
3.5	153	0.0053	0.0018	0.0050	0.0020	0.0004	0.0146	0.0069	-0.0146	0.0231	0.0236	2.06	1.35	2.03	1.35	0	0.09
4	175	0.0061	0.0009	0.0053	0.0020	0.0005	0.0131	0.0056	-0.0138	0.0215	0.0221	1.93	1.10	1.88	1.10	0	0.10
5	219	0.0020	0.0030	0.0084	0.0020	0.0006	0.0151	0.0094	-0.0147	0.0249	0.0257	2.25	1.03	2.18	1.03	0	0.13
10	438	0.0048	0.0030	0.0088	0.0020	0.0012	0.0123	0.0156	-0.0118	0.0255	0.0285	2.50	0.57	2.23	0.57	0	0.25
20	875	0.0074	0.0068	0.0157	0.0020	0.0024	0.0126	0.0220	-0.0052	0.0321	0.0410	3.59	0.41	2.81	0.41	0	0.51
30	1,313	0.0107	0.0181	0.0223	0.0020	0.0037	0.0078	0.0228	0.0310	0.0500	0.0629	5.51	0.42	4.37	0.42	0	0.76
40	1,751	0.0135	0.0268	0.0140	0.0020	0.0049	0.0025	0.0216	-0.0523	0.0658	0.0832	7.29	0.42	5.76	0.42	0	1.01
50	2,188	0.0153	0.0178	0.0100	0.0020	0.0061	0.0255	0.0338	-0.0551	0.0743	0.0978	8.56	0.39	6.50	0.39	0	1.26
60	2,626	0.0179	0.0205	0.0076	0.0020	0.0073	0.0497	0.0333	-0.0546	0.0861	0.1151	10.08	0.38	7.54	0.38	0	1.52
80	3,501	0.0244	0.0279	0.0110	0.0020	0.0098	0.1096	0.0255	-0.0394	0.1257	0.1618	14.16	0.40	11.01	0.40	0	2.02
100	4,377	0.0521	0.0289	0.0148	0.0020	0.0122	0.1915	0.0000	-0.0424	0.2059	0.2421	21.19	0.48	18.03	0.48	0	2.53

The class of the penetrometer is determined from the measurement uncertainty at any deflection.
At each given deflection the expanded measurement uncertainty Ufs_class is calculated from the readings obtained during calibration.

$$Ufs_{class} = \frac{2}{S} \times \sqrt{\sum_{i=1}^{8} u_i^2}$$

where,
u1 is the standard uncertainty associated with the applied calibration force.
u2 is the standard uncertainty associated with the reproducibility of the calibration results.
u3 is the standard uncertainty associated with the repeatability of the calibration results.
u4 is the standard uncertainty associated with the resolution and noise of the system.
u5 is the standard uncertainty associated with the drift in zero output.
u6 is the standard uncertainty associated with interpolation.
u7 is the standard uncertainty associated with reversibility.
u8 is the standard uncertainty associated with apparent load transfer from other sensor. Includes subtraction error where: Fr;qc = Fr;fs.

** u1 is not a requirement for BS EN ISO 22476-1:2023 class uncertainty Ufs_class. We have included u1 for clarity and confidence in the result.*
*** If the classification is altered with the inclusion u1, then the lower classification will be given alongside a # symbol as identification.*
**** udrift is the standard uncertainty associated with the drift in sensitivity between calibrations. This is an uncertainty associated with subsequent use and not a calibration uncertainty.*

Sleeve Friction Calibration - Subtraction Error

In use, the forces acting on the sleeve load cell element are a combination of tip resistance and sleeve friction, with the tip resistance force value from the tip load cell element being subtracted to give the sleeve friction value. The resultant error values for differing tip and sleeve values are shown in Table 7.

The highlighted cell results in Table 7, show a direct reading of the subtraction error from the calibration results.

The non-highlighted cells in Table 7, show an interpolated subtraction error from the calibration results.

Sleeve friction - tip subtraction combined standard uncertainty uc_sub, where friction ratio is between 0.1% and 10%.

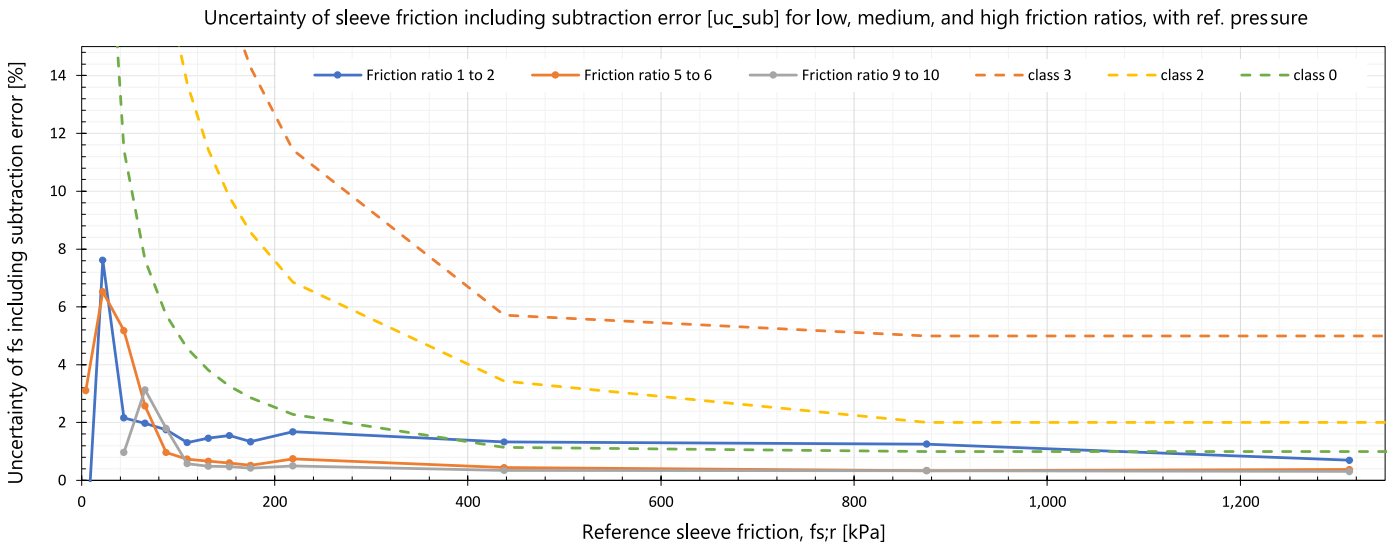
Table - 7

Sleeve friction combined standard uncertainty including subtraction error (%)

Tip resistance kPa ↓ / Sleeve friction kPa →	4	22	44	66	88	109	131	153	175	219	438	875	1,313
66	3.11	-	-	-	-	-	-	-	-	-	-	-	-
331	-2.68	***6.52***	-	-	-	-	-	-	-	-	-	-	-
662	-4.59	***10.66***	***5.18***	***3.13***	-	-	-	-	-	-	-	-	-
993	-7.24	***8.96***	***4.00***	***2.57***	***1.79***	-	-	-	-	-	-	-	-
1,324	-6.68	***8.22***	***3.97***	***2.46***	***1.69***	0.58	0.49	-	-	-	-	-	-
1,655	-4.35	***7.93***	***3.69***	1.28	0.96	0.67	0.56	0.47	-	-	-	-	-
1,986	-2.97	***7.41***	***3.39***	1.37	***1.96***	0.73	0.61	0.51	0.42	-	-	-	-
2,317	-1.46	***6.92***	1.09	1.48	1.11	0.79	0.66	0.55	0.46	0.47	-	-	-
2,648	0.16	1.86	***4.07***	1.58	1.19	0.85	0.71	0.60	0.50	0.50	-	-	-
3,310	0.79	1.98	1.32	1.63	1.22	0.88	0.74	0.62	0.52	***0.75***	-	-	-
6,620	-	4.09	2.37	2.33	1.75	1.30	1.09	0.92	0.78	0.72	***0.44***	-	-
13,239	-	8.51	4.58	3.80	2.85	2.19	1.82	1.55	1.33	1.17	***0.65***	***0.29***	0.31
19,859	-	18.83	9.74	7.24	5.43	4.25	3.54	3.02	2.62	2.20	***0.92***	***0.38***	***0.38***
26,479	-	-	2.95	2.71	2.04	1.53	1.28	1.08	0.93	0.84	***1.55***	***0.38***	0.35
33,099	-	-	4.22	3.56	2.67	2.04	1.70	1.45	1.24	1.09	***1.65***	0.43	***0.88***
39,718	-	-	5.81	4.62	3.47	2.67	2.23	1.90	1.64	1.41	0.79	***1.20***	0.45
52,958	-	-	-	7.69	5.77	4.52	3.77	3.22	2.79	2.33	1.25	***1.63***	0.60
66,197	-	-	-	-	7.16	5.63	4.70	4.01	3.49	2.89	1.53	0.87	0.69

Friction ratio (for a given row) →

Friction ratio (for a given column) ↑



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CERTIFICATE OF CALIBRATION

Certificate Number: 1719

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2116

Pore Pressure Calibration

Calibration method

1. The cone penetrometer was placed in a pressure vessel and was pressurised to full range 3 times for no less than 1 minute before calibration.
2. The pore pressure was calibrated with 2 sets of increasing pressures and 2 sets of decreasing pressures.
3. The coefficients of a linear and third order equation relating the estimate of applied pressure as a function of deflection were calculated and are shown in Table 8.
4. The pressures applied, and the resulting deflections are given in Tables 9. No corrections for temperature have been applied to these results.
5. The combined expanded uncertainty* of deflection Uu and Uu_class for each force is shown as a percentage of the recorded value and in units of pressure kPa as shown in Table 10.

* The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

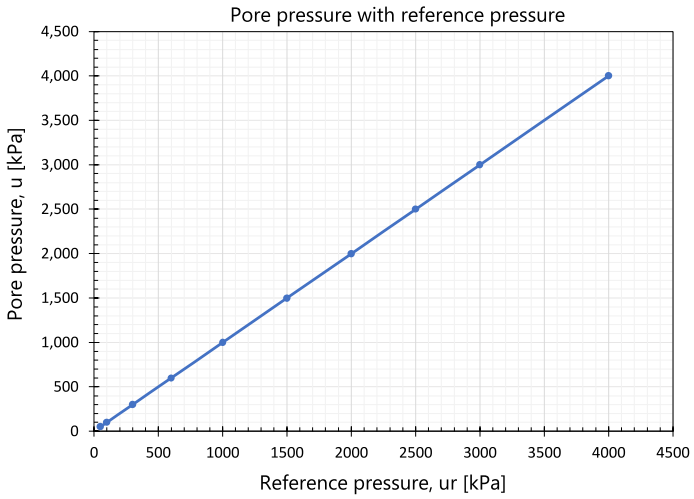
Cone Penetrometer	
Pore pressure sensor capacity	10 MPa
Calibration range	4 MPa
Pore pressure resolution	0.005 kPa
Historic drift between pore calibrations (u_{drift})	0.05774 %
Pore pressure sensor max zero drift	0.08 kPa
Reference pressure sensor max zero drift	0.04 kPa

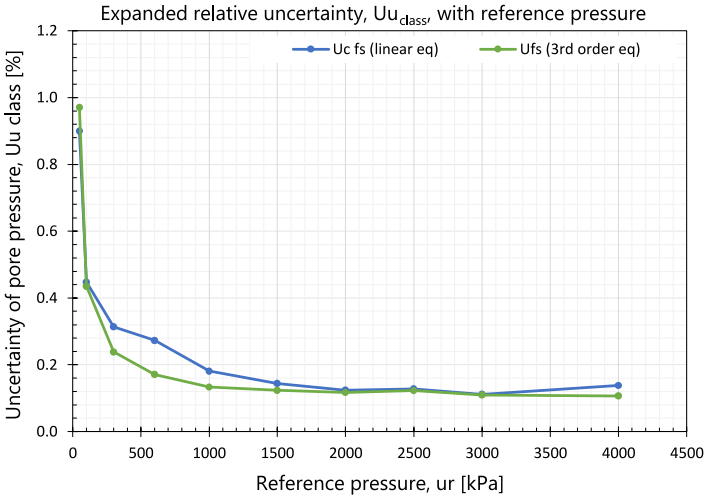
Calibration Conditions	
Ambient temperature	23.3 °C
Pressure chamber temperature variation	0.49 °C
Instrument temperature variation	0.10 °C

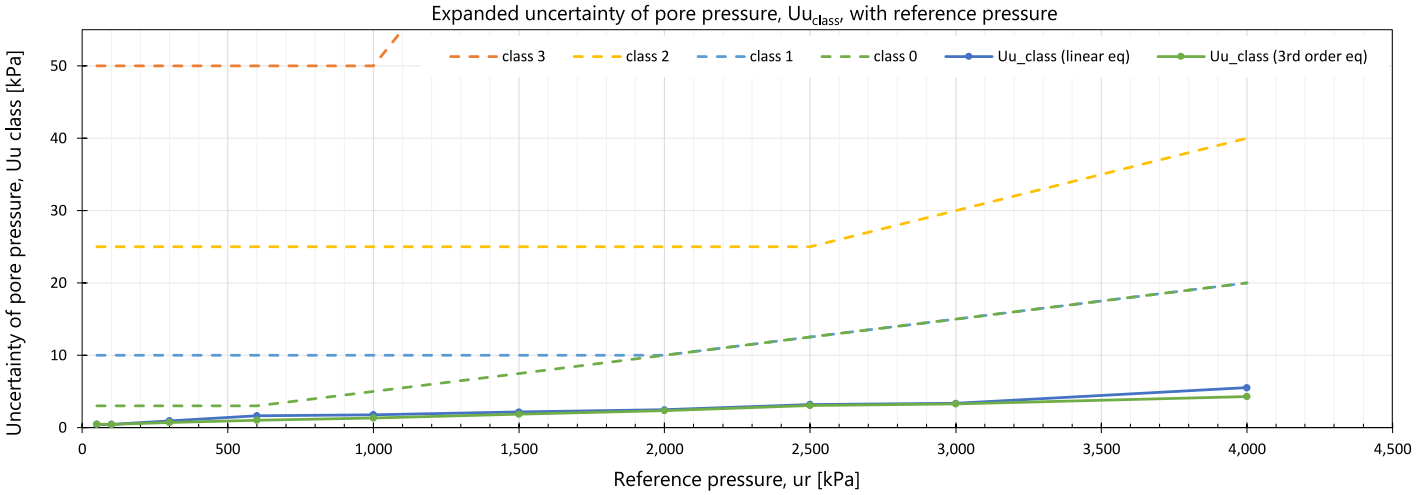
Reference Pressure Sensor Uncertainty	
MMG750V1P1MC0T3A6CE	0.02 ±%

Reference Indicator Uncertainty	
Keithley 7.5 Digit DMM	12 PPM

Pore Pressure Calibration - Graphical Results







Interpolation

Table - 8

Linear Equation	*The pore pressure output in pressure units D (0.1 Pa) is derived using a linear factor from the raw pore pressure output. D = Factor x RAW_Output*	0.1 Pa Factor = 0.050948
Polynomial Equation	*3rd order polynomial equation. For a given cone indicated output of D (0.1 Pa units), the corrected applied pressure, P (in 0.1 Pa units) is calculated from :* $P = (a3 \times D^3) + (a2 \times D^2) + (a1 \times D) + a0$	a0 = -1531.042088 a1 = 1.001362326 a2 = -5.38651E-11 a3 = 2.50761E-19

Pore Pressure Calibration - Tabular Results

Table - 9 **Calibration results**

kPa	kPa	kPa	kPa	kPa
ur	X1	X2'	X3	X4'
0	0.03		-0.08	
50	49.98		49.84	
100	100.08		100.03	
300	299.80		299.95	
600	599.76		599.87	
1000	1000.12		1000.04	
1500	1500.11		1500.25	
2000	2000.15		2000.20	
2500	2499.34		2500.26	
3000	3000.10		3000.09	
4000	4000.18		3999.88	
3000		3000.03		2999.98
2500		2500.16		2499.93
2000		2000.05		1999.74
1500		1500.11		1499.90
1000		999.93		999.87
600		600.00		600.10
300		300.12		300.02
100		100.00		100.06
50		50.16		50.01

Table - 10 **Uncertainty assessment**

Reference pressure	Standard uncertainty u1 to u6						Combined standard calibration uncertainty		Expanded calibration uncertainty [k=2]				BS EN ISO 22476:2023 class	Pore calibration drift
kPa	kPa	kPa	kPa	kPa	kPa	kPa	kPa	%	kPa	%	kPa	%		kPa
ur	u1*	u2	u3	u4	u5	u6	u_i		U_u		Uu_{class}		Cone Class **	u_{drift}***
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0	0.00
50	0.18	0.09	0.00	0.00	0.09	0.10	0.24	0.49	0.49	0.97	0.49	0.97	0	0.03
100	0.21	0.03	0.00	0.00	0.05	0.03	0.22	0.22	0.43	0.43	0.43	0.43	0	0.06
300	0.31	0.09	0.00	0.01	0.12	0.11	0.36	0.12	0.72	0.24	0.72	0.24	0	0.17
600	0.45	0.06	0.00	0.01	0.19	0.14	0.51	0.09	1.03	0.17	1.03	0.17	0	0.35
1000	0.65	0.05	0.00	0.02	0.08	0.10	0.67	0.07	1.33	0.13	1.33	0.13	0	0.58
1500	0.90	0.08	0.00	0.03	0.18	0.10	0.93	0.06	1.85	0.12	1.85	0.12	0	0.87
2000	1.15	0.03	0.00	0.04	0.18	0.16	1.17	0.06	2.34	0.12	2.34	0.12	0	1.15
2500	1.39	0.53	0.00	0.05	0.20	0.33	1.54	0.06	3.08	0.12	3.08	0.12	0	1.44
3000	1.64	0.01	0.00	0.06	0.09	0.05	1.64	0.05	3.29	0.11	3.29	0.11	0	1.73
4000	2.13	0.18	0.00	0.08	0.03	0.00	2.14	0.05	4.29	0.11	4.29	0.11	0	2.31

The class of the penetrometer is determined from the measurement uncertainty at any deflection

At each given deflection the expanded measurement uncertainty Uu_class is calculated from the readings obtained during calibration.

$$Uu_{class} = 2 \times \sqrt{\sum_{i=1}^{6} u_i^2}$$

where,
u1 is the standard uncertainty associated with the applied calibration pressure.
u2 is the standard uncertainty associated with the repeatability of the calibration results.
u3 is the standard uncertainty associated with the resolution and noise of the system.
u4 is the standard uncertainty associated with the drift in zero output.
u5 is the standard uncertainty associated with interpolation.
u6 is the standard uncertainty associated with reversibility.

** u1 is not a requirement for BS EN ISO 22476-1:2023 class uncertainty Uu_class. We have included u1 for clarity and confidence in the result.*
*** If the classification is altered with the inclusion u1, then the lower classification will be given alongside a # symbol as identification.*
**** udrift is the standard uncertainty associated with the drift in sensitivity between calibrations. This is an uncertainty associated with subsequent use and not a calibration uncertainty.*

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CERTIFICATE OF CALIBRATION

Certificate Number: 1719

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2116

Pore Pressure Calibration - Measured Area Ratios

Calibration method

1. The apparent cone resistance qc;a and apparent sleeve friction fs;a are recorded for all pore pressure calibration intervals, and shown in Table 11a and 11b.
2. The resulting net area ratios of the cone *a* and net area ratios of the sleeve *b* are computed and shown in Table 11a and 11b.
3. The final recorded cone net area ratio *a* and sleeve net area ration *b* are shown in Table 12, where reference pressure ur = 2000kPa

Table - 11a **Cone net area ratio assessment**

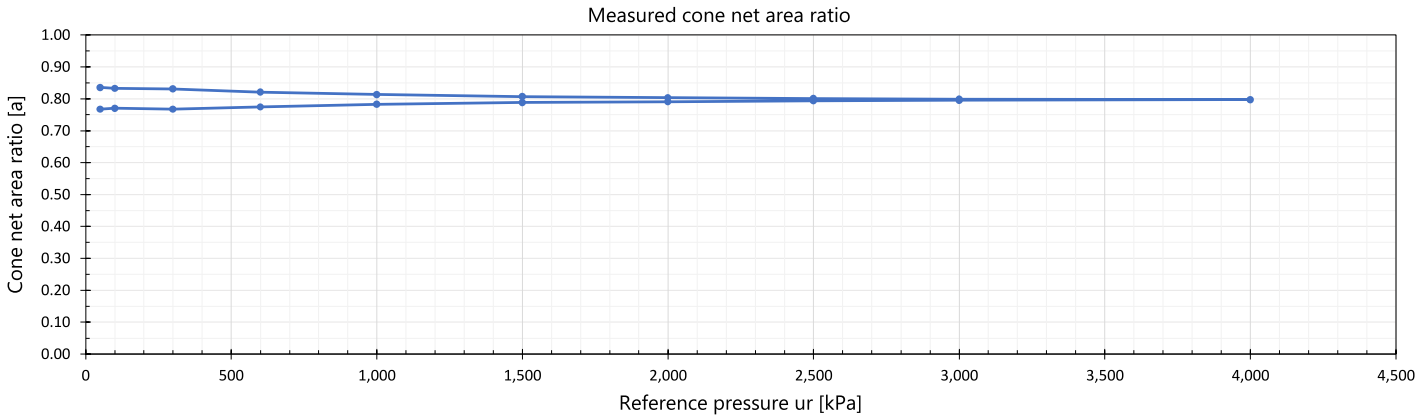
	Apparent cone resistance [qc;a]					
kPa	kPa	kPa	kPa	kPa	kPa	Alpha
ur	X1	X2'	X3	X4'	Mean	factor
50	38.0		38.8		38.4	0.77
100	77.5		76.6		77.1	0.77
300	230.4		230.2		230.3	0.77
600	465.0		464.2		464.6	0.77
1000	783.9		781.8		782.9	0.78
1500	1184.3		1180.5		1182.4	0.79
2000	1583.7		1580.4		1582.1	0.79
2500	1985.2		1983.1		1984.1	0.79
3000	2387.5		2385.3		2386.4	0.80
4000	3192.0		3189.1		3190.5	0.80
3000		2396.8		2396.6	2396.7	0.80
2500		2002.43		2001.89	2002.2	0.80
2000		1607.93		1606.95	1607.4	0.80
1500		1211.65		1210.33	1211.0	0.81
1000		814.003		812.845	813.4	0.81
600		492.056		493.298	492.7	0.82
300		250.224		248.595	249.4	0.83
100		83.4009		83.1989	83.3	0.83
50		41.8795		41.6653	41.8	0.84

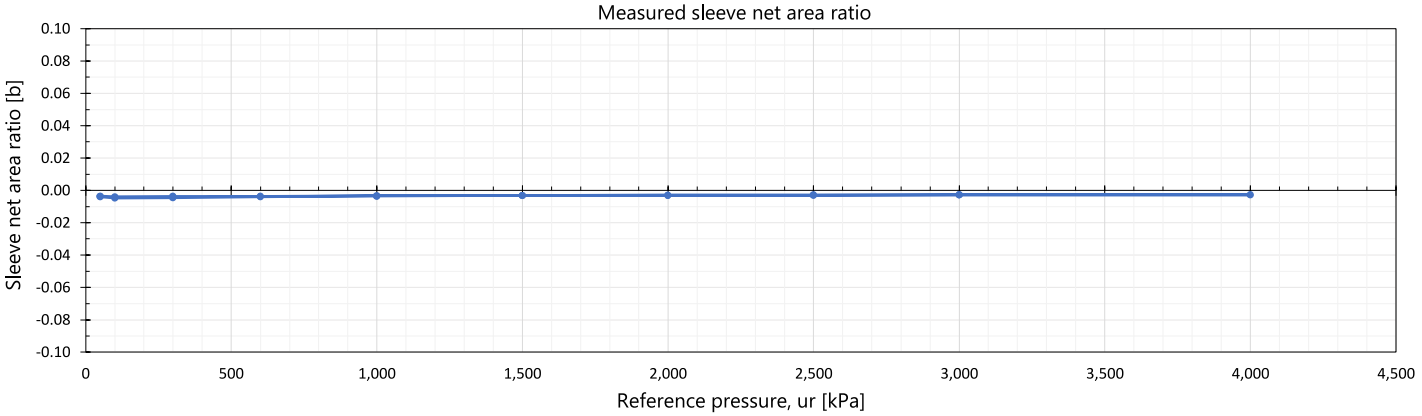
Table - 11b **Sleeve friction net area ratio assessment**

	Apparent sleeve friction [fs;a]					
kPa	kPa	kPa	kPa	kPa	kPa	Beta
ur	X1	X2'	X3	X4'	Mean	factor
50	-0.16		-0.19		-0.18	-0.004
100	-0.43		-0.37		-0.40	-0.004
300	-1.11		-1.13		-1.12	-0.004
600	-2.10		-2.27		-2.19	-0.004
1000	-3.42		-3.58		-3.50	-0.004
1500	-4.80		-4.87		-4.83	-0.003
2000	-5.94		-5.92		-5.93	-0.003
2500	-7.08		-7.25		-7.17	-0.003
3000	-8.31		-8.58		-8.44	-0.003
4000	-10.66		-10.95		-10.81	-0.003
3000		-8.23		-8.12	-8.18	-0.003
2500		-7.14		-7.12	-7.13	-0.003
2000		-6.15		-6.03	-6.09	-0.003
1500		-4.86		-4.70	-4.78	-0.003
1000		-3.58		-3.39	-3.49	-0.003
600		-2.33		-2.32	-2.32	-0.004
300		-1.46		-1.27	-1.37	-0.005
100		-0.51		-0.42	-0.47	-0.005
50		-0.26		-0.12	-0.19	-0.004

Table - 12

Cone net area ratio [a]	0.79
Sleeve friction net area ratio [b]	-0.003





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CERTIFICATE OF CALIBRATION

Certificate Number: 1719

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2116

Inclination Calibration

Calibration method

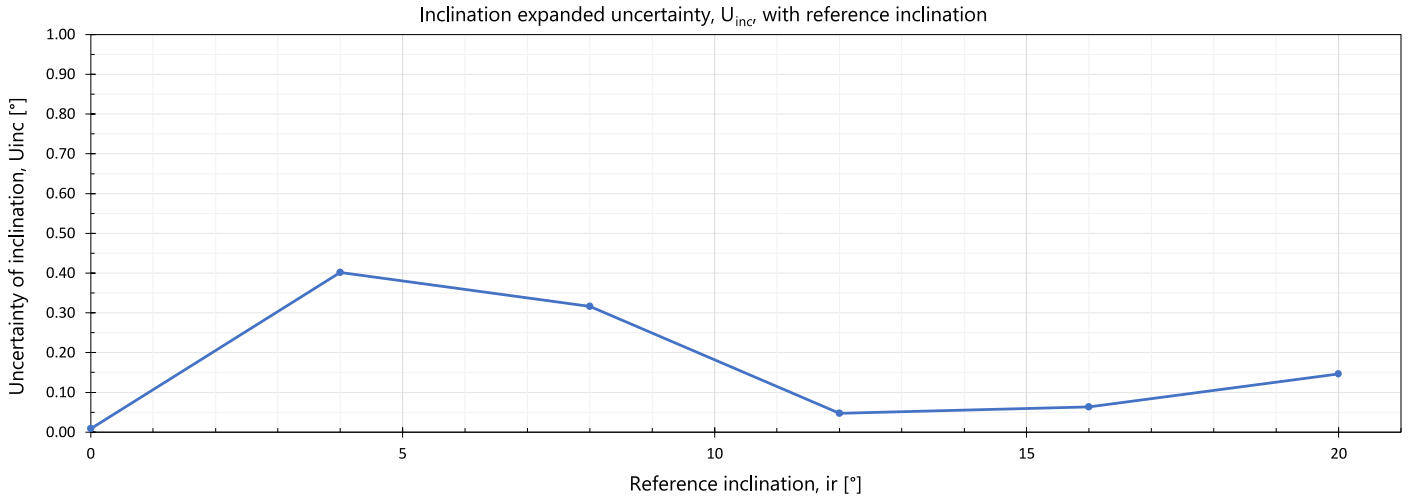
1. The cone penetrometer was placed in the inclination calibration frame and set to a vertical reference inclination of ir = 0°.
2. The inclination was calibrated from ir = 0° to ir = 20°. This was conducted twice, once with the cone at 0° rotation and once with the cone at 90° rotation.
3. The coefficients of a linear equation relating the estimate of the inclination as a function of raw sensor deflection were calculated and are shown in Table 13.
4. The inclination angle applied, and the resulting measurements are given in Table 14.
5. The combined expanded uncertainty* of measurement Uinc for each inclination angle is shown as a percentage of the recorded value and in units of arc degrees °, as shown in Table 15.

* The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

Cone Penetrometer	
Inclination sensor range	90 °
Calibration range	20 °
Inclination resolution	0.005 °
Inclinometer number of axis	2

Reference Inclination Rotary Table Uncertainty	
Lankelma HV6 Rotary Table	0.10 °

Inclination - Graphical Results



Interpolation

Table - 13

Linear Equation	*The Inclination output in angular units ($0.1° \times 10^{-3}$) is derived using a linear factor from the raw inclination output.*	X axis Factor =	9.669783
		Y axis Factor =	9.651382

Inclination Calibration - Tabular Results

Table - 14
Inclination calibration

° ir	° θ0	° θ90
0	0.00	0.00
4	4.16	4.25
8	8.16	8.16
12	12.02	11.99
16	15.98	15.97
20	19.92	19.94

Table - 15
Uncertainty assessment

Reference Inclination	Standard calibration uncertainty u1 to u4				Combined standard calibration uncertainty ui		Expanded calibration uncertainty Uinc [k=2]	
° ir	° u1	° u2	° u3	° u4	° u_i	%	° U_{inc}	%
0	0.00	0.00	0.00	0.00	0.00		0.01	
4	0.01	0.03	0.00	0.20	0.20	5.02	0.40	10.05
8	0.02	0.00	0.00	0.16	0.16	1.98	0.32	3.95
12	0.02	0.01	0.00	0.00	0.02	0.20	0.05	0.39
16	0.02	0.00	0.00	-0.02	0.03	0.20	0.06	0.40
20	0.02	0.01	0.00	-0.07	0.07	0.37	0.15	0.73

At each given deflection the expanded measurement uncertainty Uinc is calculated from the readings obtained during calibratio n.

$$U_{inc} = 2 \times \sqrt{\sum_{i=1}^{4} u_i^2}$$

where,
u1 is the standard uncertainty associated with the applied calibration inclination.
u2 is the standard uncertainty associated with the reproducibility of the calibration results.
u3 is the standard uncertainty associated with the resolution and noise of the system.
u4 is the standard uncertainty associated with interpolation.

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A ConeTec Group Company

CERTIFICATE OF CALIBRATION

Certificate Number: 1719

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2116

Temperature Calibration

Calibration method

1. The cone penetrometer was placed in the thermostatic temperature calibration bath with the temperature set to 0°C.
2. The temperature was calibrated from Tr = 0°C to Tr = 30°C.
3. The coefficients of a linear equation relating the estimate of temperature as a function of raw temperature sensor deflection were calculated and are shown in Table 16.
4. The applied temperature, and the resulting measurements are given in Table 17.
5. The combined expanded uncertainty* of measurement Utemp for each temperature is shown as a percentage of the recorded value and in units of Celsius °C, as shown in Table 18.

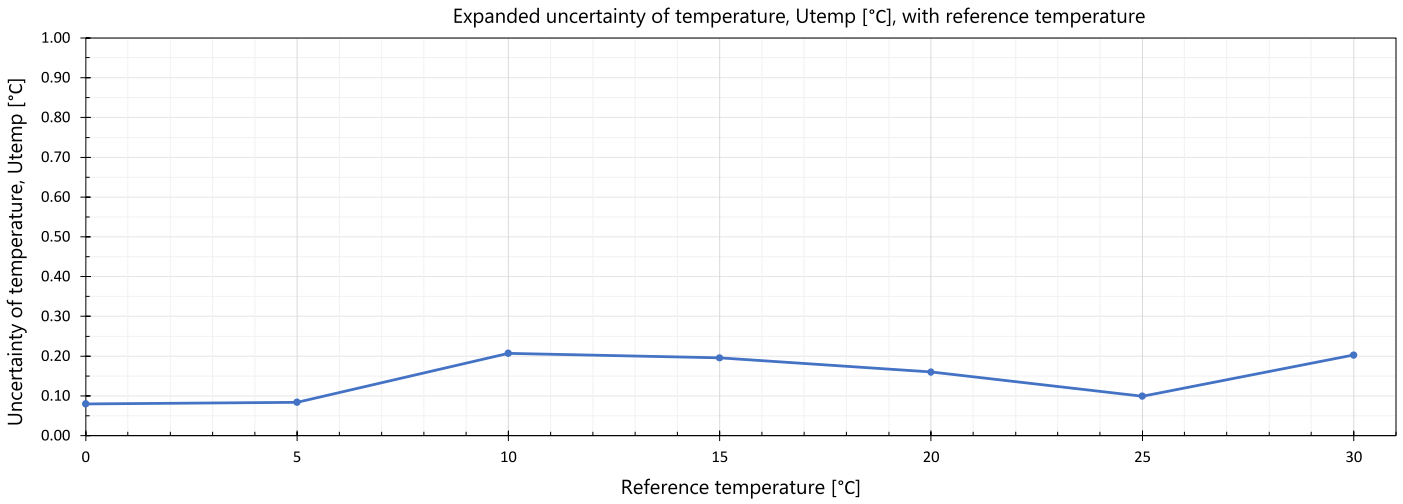
* The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

Cone Penetrometer	
Temperature sensor range	90 °
Calibration range	30 °
Temperature resolution	0.005 °
Temperature number of axis	2

Reference Thermometer Uncertainty	
ETI Ref Thermometer	0.04 °

Temperature Datalogger Uncertainty	
ETI ThermaData	0.4 °

Temperature Calibration - Graphical Results



Interpolation

Table - 16

Linear Equation	*The temperature sensor output in temperature units (0.1°C x 10^{-3}) is derived using a linear factor from the raw temperature output.*	Temperature sensor [qc] factor =	0.572412
		Temperature sensor [fs] factor =	0.577426

Temperature Calibration - Tabular Results

Table - 17
Temperature calibration

°C T_r	°C T_a
0	0.00
5	4.99
10	9.91
15	14.91
20	19.93
25	25.03
30	30.09

Table - 18 **Uncertainty assessment**

Reference temp	Standard calibration uncertainty u1 to u3			Combined standard calibration uncertainty u_t		Expanded calibration uncertainty U_{temp} [k=2]	
°C T_r	°C u1	°C u2	°C u3	°C	% u_t	°C	% U_{temp}
0	0.04	0.00	0.00	0.04		0.08	
5	0.04	0.00	-0.01	0.04	0.84	0.08	1.68
10	0.04	0.00	-0.10	0.10	1.04	0.21	2.07
15	0.04	0.00	-0.09	0.10	0.65	0.20	1.30
20	0.04	0.00	-0.07	0.08	0.40	0.16	0.80
25	0.04	0.00	0.03	0.05	0.20	0.10	0.40
30	0.04	0.00	0.09	0.10	0.34	0.20	0.68

At each given deflection the expanded measurement uncertainty Utemp is calculated from the readings obtained during calibration.

$$U_{temp} = 2 \times \sqrt{\sum_{i=1}^{3} u_i^2}$$

where,
u1 is the standard uncertainty associated with the applied calibration temperature.
u2 is the standard uncertainty associated with the resolution and noise of the system.
u3 is the standard uncertainty associated with interpolation.

Temperature Influence Verification

Verification method

1. The cone penetrometer was placed in the thermostatic temperature calibration bath with the temperature set to 30 °C, the second bath temperature was set to 0°C.
2. The test method for verification of a cone penetrometer for temperature influence was followed as set out in BS EN ISO 224 76-1:2023, clause B.2.7.2.
3. The bath temperatures, apparent cone resistance, apparent sleeve friction, apparent pore pressure, and apparent cone temperature were recorded for the duration of the test.
4. The correction factors for; corrected apparent cone resistance, corrected sleeve friction, and corrected pore pressure were applied in post processing.
5. The start and end apparent readings are shown in Table 19. The maximum and minimum apparent readings are shown in Table 20.
6. The ambient stability, transient stability, and resulting penetrometer class were calculated and are shown in Table 21.

Table - 19 **Start and end apparent readings**

	°C	°C	kPa	kPa	kPa	kPa	kPa	kPa
	Ta_{qc}	Ta_{fs}	qc;a	qc;ac	fs;a	fs;ac	u;a	u;ac
T30	30.1	30.1	-0.7	-0.8	0.0	0.0	0.0	0.0
T0	0.2	0.3	-68.7	9.3	0.9	2.6	-75.3	-1.0

Table - 20 **Maximum / minimum apparent readings**

	kPa	kPa	kPa	kPa	kPa	kPa
	qc;a	qc;ac	fs;a	fs;ac	u;a	u;ac
max	357.4	85.6	10.4	9.3	0.3	1.5
min	-383.5	-73.6	-9.4	-6.0	-76.6	-4.5

Maximum rate of change

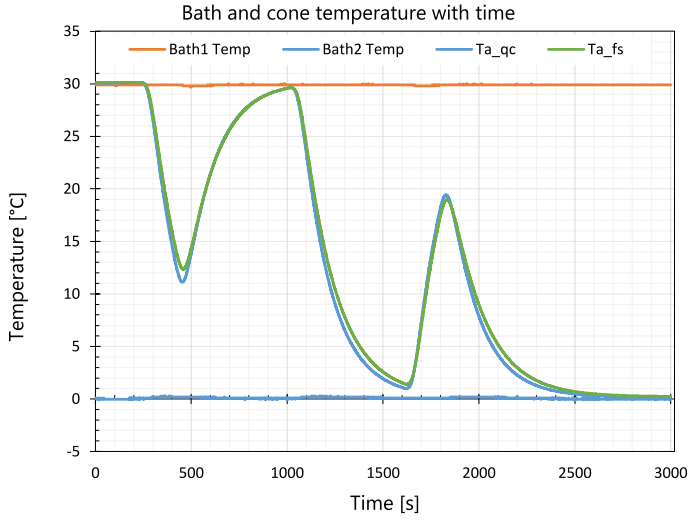
kPa/s	kPa/s	kPa/s	kPa/s	kPa/s	kPa/s
Δfgqc	Δfgqcc	Δfgfs	Δfgfsc	Δfgu	Δfguc
13.72	5.60	0.46	0.40	0.41	0.21

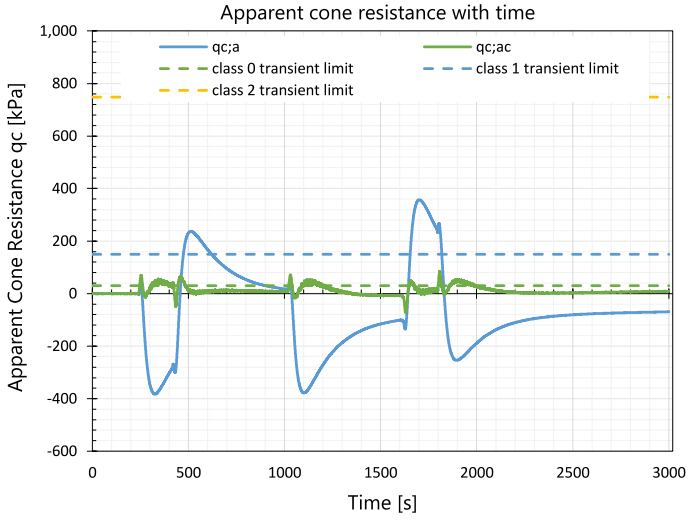
Table - 21a **Ambient temperature stability and classification**

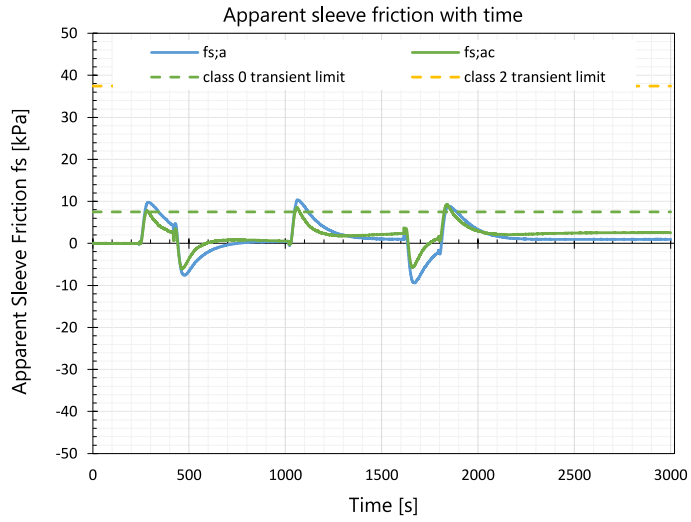
Ambient temperature stability		kPa/°C	Class
Uncorrected	Δaqc	2.27	2
	Δafs	-0.03	0
	Δau	2.52	N/A
Corrected	Δaqcc	-0.34	0
	Δafsc	-0.09	0
	Δauc	0.03	0

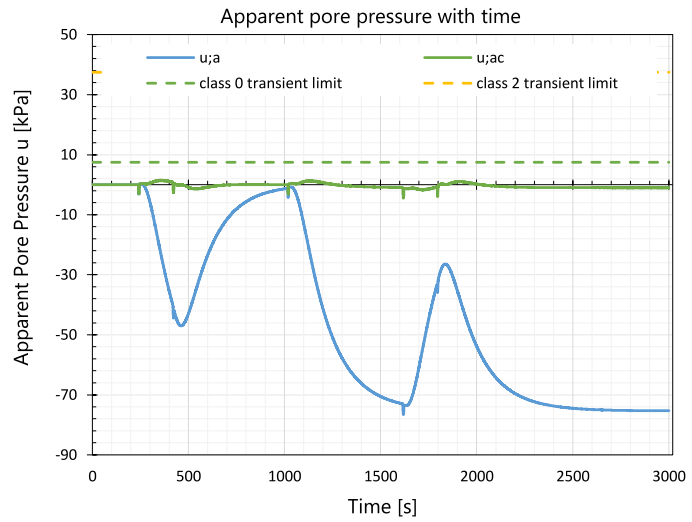
Table - 21b **Transient temperature stability and classification**

Transient temperature stability		kPa/°C	Class
Uncorrected	Δtqc	24.76	2
	Δtfs	0.66	2
	Δtu	2.57	3
Corrected	Δtqcc	5.32	1
	Δtfsc	0.51	2
	Δtuc	0.20	0









Bending Influence Verification

Verification Method

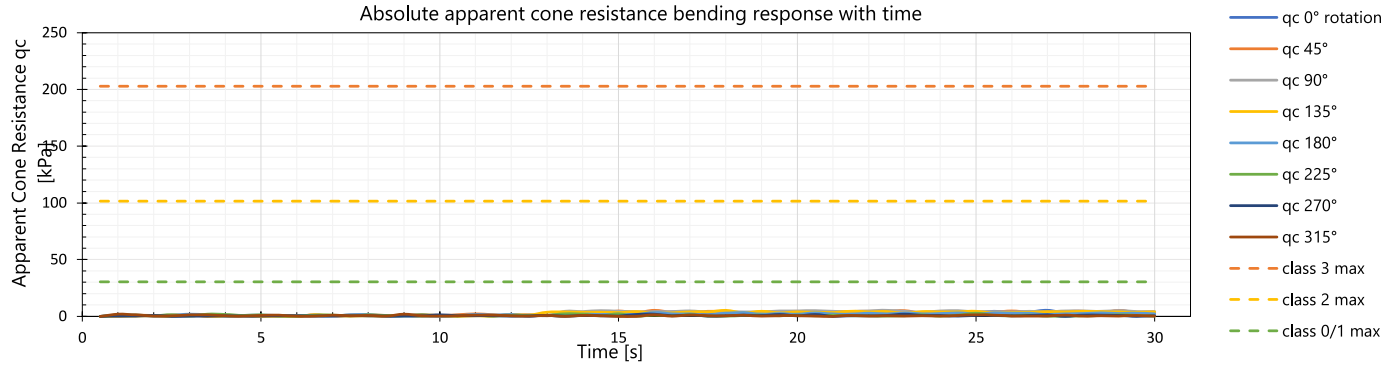
1. The cone penetrometer was placed in the bending influence frame, clamping the cone horizontally.
2. The test method for verification of a cone penetrometer for bending influence was followed as set out in BS EN ISO 22476-1:2023, clause B.2.8.2.
3. The air temperature, apparent cone resistance, apparent sleeve friction, and apparent pore pressure were recorded for the duration of each test. In total 8 tests were performed from 0° rotation to 315° rotation, evenly spaced with 45° rotation between tests.
4. The bending influence results and resulting cone penetrometer classification was calculated and are shown in Table 22.

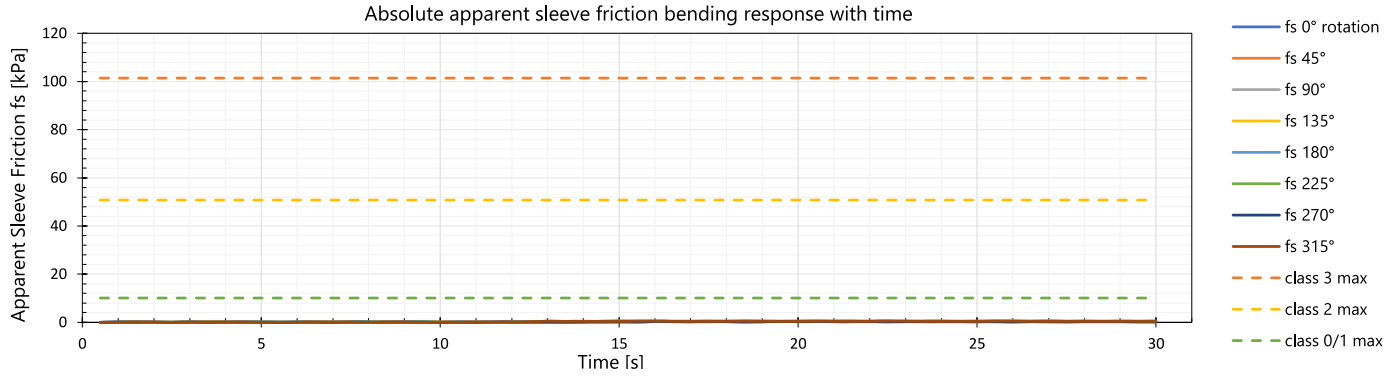
Table - 22 **Bending Influence results**

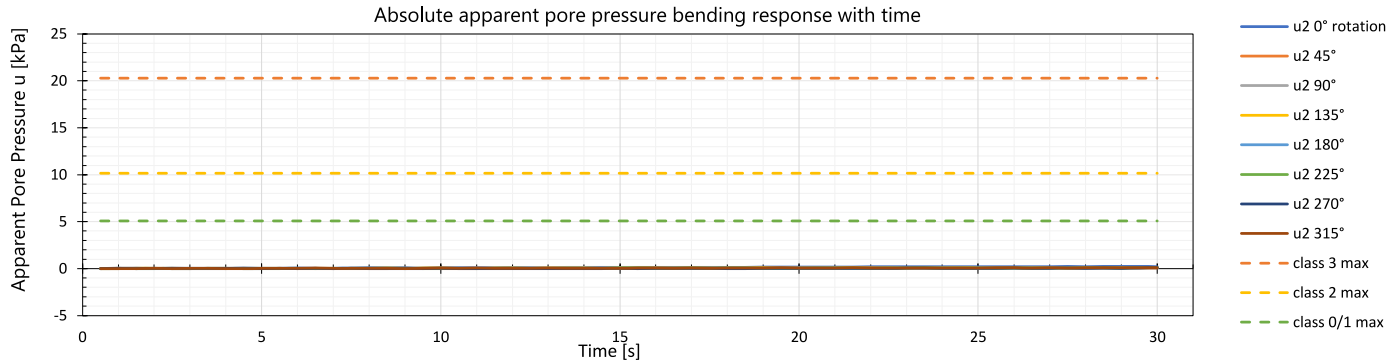
	qc;a [kPa/N]	fs;a [kPa/N]	u2;a [kPa/N]	Ambient Temp [°C]
max	0.043	0.002	0.002	28.7
min	-0.053	-0.006	0.000	28.6
max test Δb, Δt	0.096	0.008	0.003	0.1
class	0	0	0	

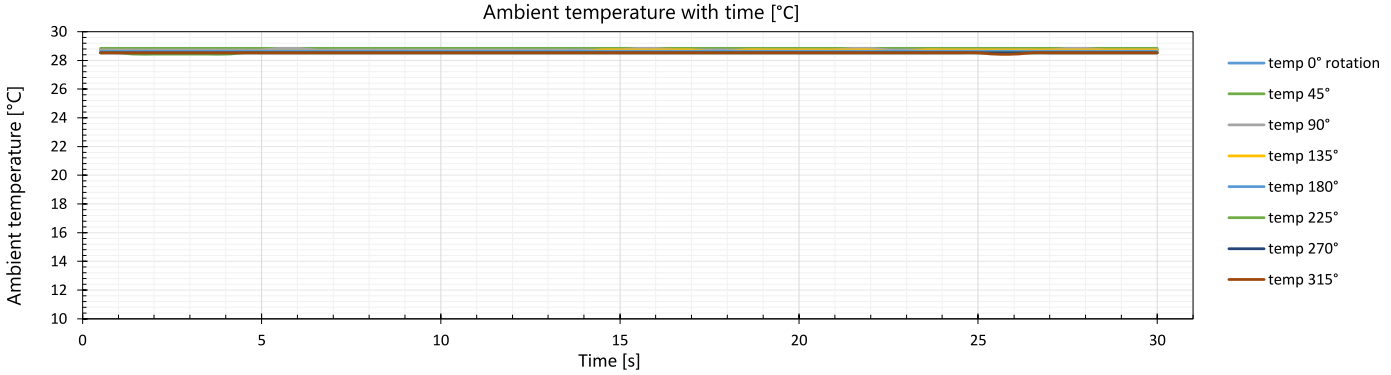
10 kg Calibration Weight Uncertainty	
10 kg Calibration Weight	0.001 %

10 kg Calibration Weight	
Reference weight	10.341 kg
Reference force	101.411 N









Sensor Stability Verification

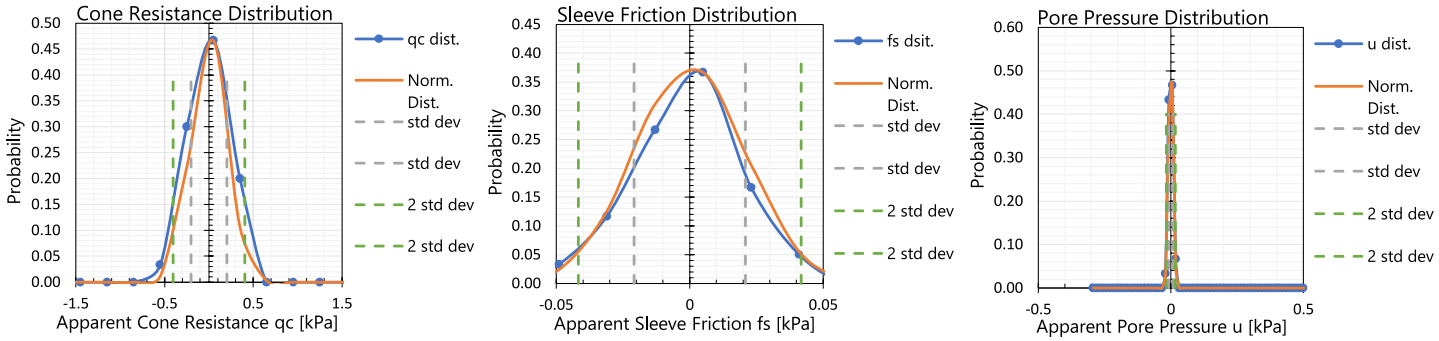
The purpose of this section is to quantify the stability of the geotechnical sensors (qc, fs, u) and demonstrate validity of applying a normal distribution, described by standard deviation and mean, when assessing probability of noise magnitude. The sampling duration has been limited to 60 seconds to allow direct comparison to the field verification data required under BS EN ISO 22476-1: 2023.

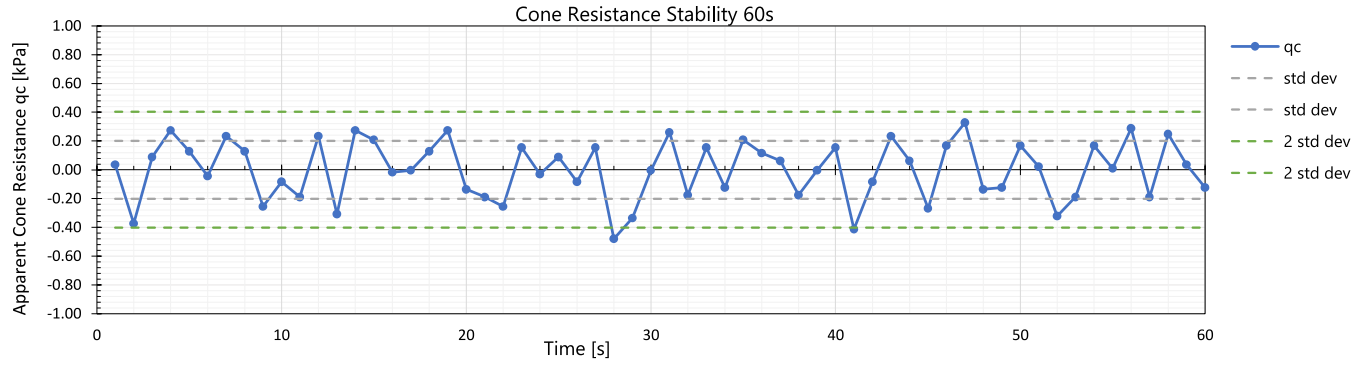
Verification method

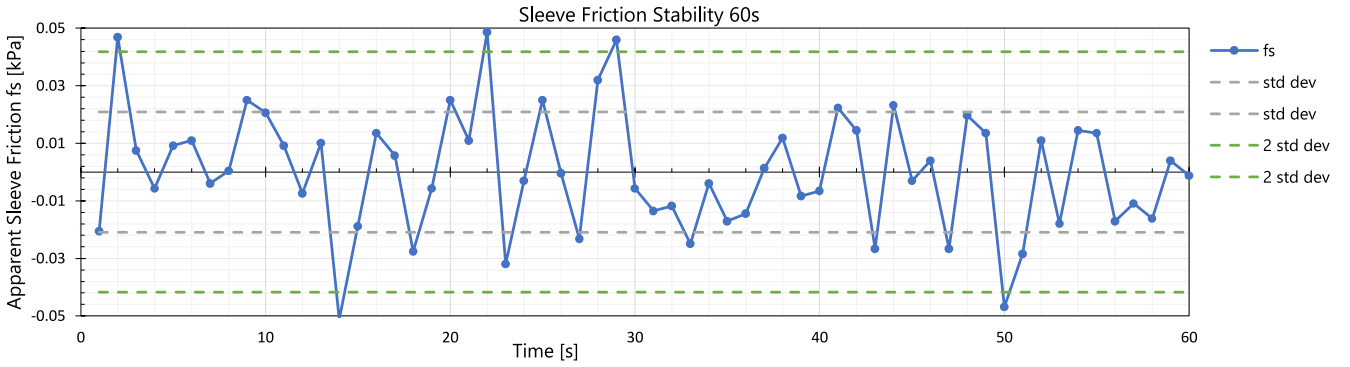
1. The cone penetrometer was placed in the thermostatic temperature calibration bath at ambient temperature.
2. The cone penetrometer was left for no less than 30 minuets or until the output was stable.
3. The output was recorded for 60 seconds at a frequency of 1Hz. The maximum change and standard deviation are shown in Table 23.

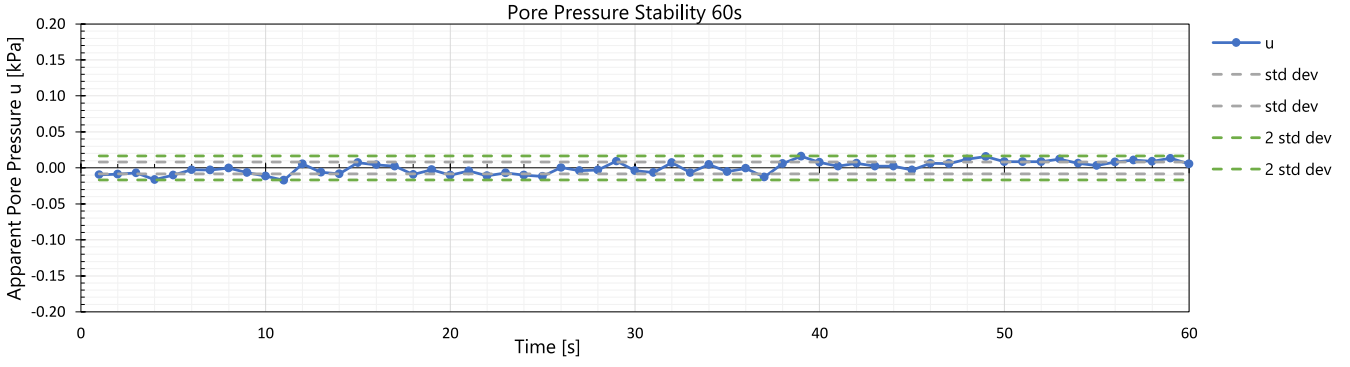
Table - 23 **Sensor stability results**

	qc (kPa)	fs (kPa)	u (kPa)	Inc (°)	Temp (°C)
Max	0.327	0.049	0.016	0.055	0.020
Min	-0.480	-0.051	-0.017	-0.062	-0.021
Δ (Max - Min)	0.808	0.100	0.033	0.127	0.100
Standard deviation (68% coverage)	± 0.201	± 0.021	± 0.008	± 0.025	± 0.012
2 standard deviations (95% coverage)	± 0.403	± 0.042	± 0.017	± 0.050	± 0.023









LANKELMA
A ConeTec Group Company

CERTIFICATE OF CALIBRATION

Certificate Number: 1719

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2116

Magnetometer Calibration

Calibration Method

1. The cone penetrometer was connected to a steel crossover rod.
2. The cone penetrometer was moved through the earths magnetic field for at least 5 minuets, at varying inclination and rotation angles.
3. The sensor was calibrated against the NOAA World Magnetic Model field estimate, using the coordinates of the calibration laboratory.
4. The resulting sensor bias, and sensor calibration factors for the calibration of soft iron effects are shown in Table 24.
5. The calibrated mean total field, total field mean error, and standard deviation of total field are shown in Table 25.

Cone Penetrometer Magnetometer	
Sensor range	200 uT
Resolution	10 nT

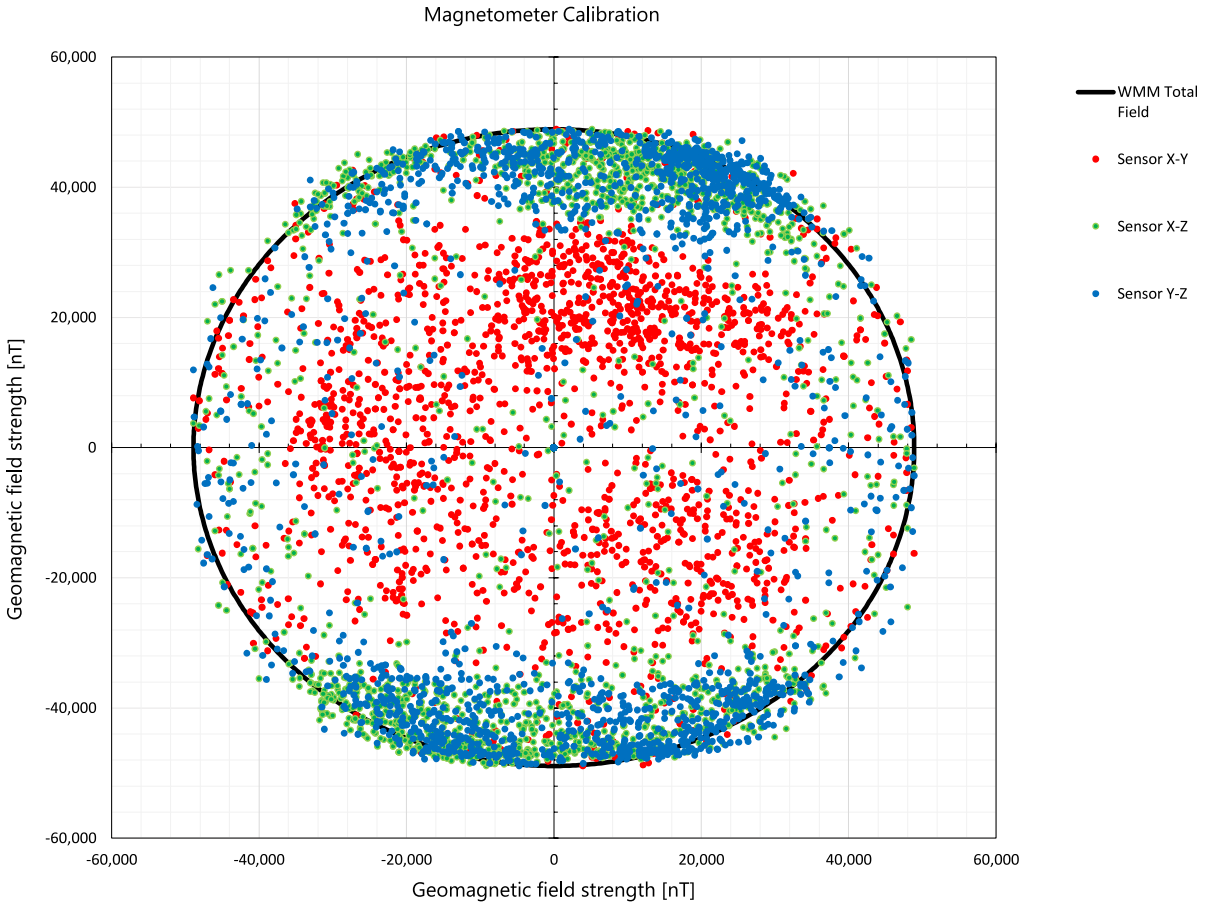
World Magnetic Model Total Field Calculations		
NOAA WMM total field estimate	48,900.8	nT
WMM field estimate uncertainty	145	nT
Latitude	50.975	N
Longitude	0.711	E
Elevation	0.031	km

Table - 24 ***Calibration factors***

X bias	-1058	nT
Y bias	1658	nT
Z bias	-26617	nT
X factor	1.11455	factor
Y factor	1.19198	factor
Z factor	0.57060	factor

Table - 25 ***Calibration for soft iron effects, including cone and crossover rod***

Calibrated average total field	49,292	nT
Calibrated total field std deviation	1,851	nT
Total field mean error	0.80	%



Ribble Enviro Ltd
www.ribble-enviro.co.uk



...everything gas detection

Certificate of Calibration

Customer:	*RIBBLE ENVIRO HIRE FLEET*
Instrument:	MiniRAE Lite +
Job:	Pre-Hire Service, Test & Calibration
Serial number:	590-909667
Fleet Number:	R33373
Certificate no:	909667 / 060525
Next calibration due date:	06 May 2026
Tested on:	06 May 2026
Calibrated for:	Isobutylene

Applied Gas Concentration:	***Cylinder Reference:***	***Final Sensor Reading***	***Accuracy Limits***	***Pass / Fail***
C6H8: 100 ppm	12848-1-2	100.3 ppm	±10%	*Pass*

The instrument has been calibrated after re-zeroing and introducing span calibration gas, using gas that is traceable to national standards and has been prepared in accordance with BS EN ISO 6145-6:2017

Calibration Engineer: BRADLEY HAYHURST

Sign:

Quality Assessed by (Print):	C. S.	**Sign:**	

Tel: 01200 445 804 **Fax:** 01200 445 809 **Email:** info@ribble-enviro.co.uk
Ribble Enviro Ltd. Unit 4, Gisburn Business Park, Gisburn, Nr Clitheroe, BB7 4JP, UK

Company Registered in England: 06140589 VAT No: GB 906 6241 34 EORI: GB906624134000034

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Dynamic SAMPLING UK LTD

Dynamic Sampling Uk Ltd
Unit 8 Victory Park
Victory Road
Derby
DE248ZF

SPT Hammer Ref:	69
Test Date:	21/01/2025
Report Date:	22/01/2025
File Name:	69.spt
Test Operator:	B.HUNTER

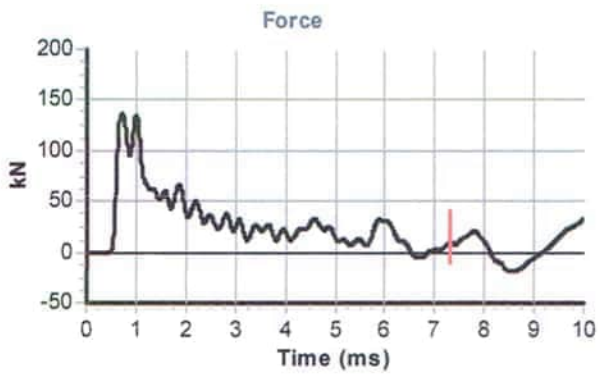
Instrumented Rod Data

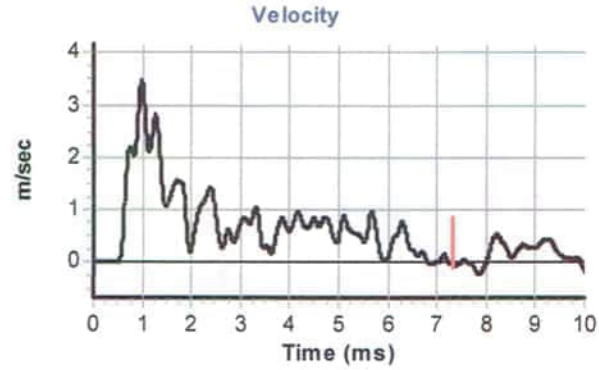
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.6
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	62901
Accelerometer No.2:	69902

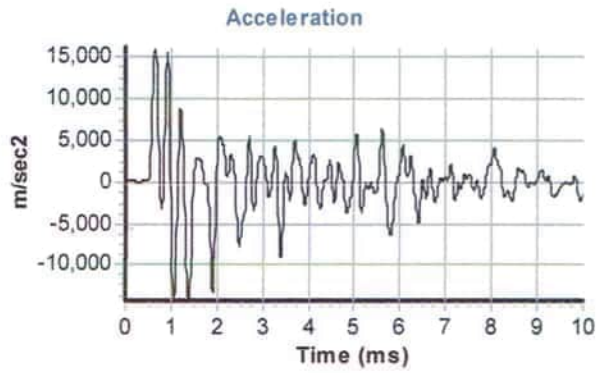
SPT Hammer Information

Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	10.0

Comments / Location









Calculations

Area of Rod A (mm2):	983
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	301

Energy Ratio E_r (%): **64**

Signed: B.Hunter

Title: Operations Manager

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SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Dynamic Sampling Uk Ltd
Unit 8 Victory Park
Victory Road
Derby
DE24 8ZF

SPT Hammer Ref:	73
Test Date:	16/10/2024
Report Date:	16/10/2024
File Name:	73.spt
Test Operator:	B.HUNTER

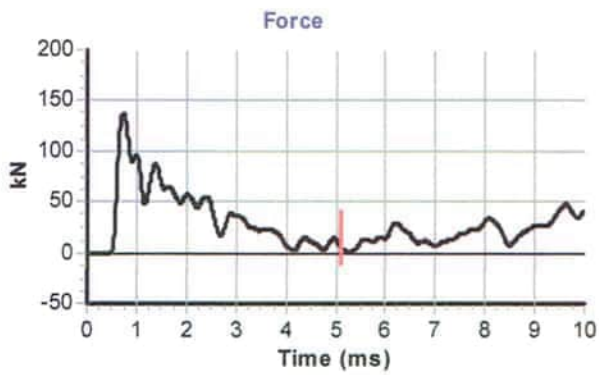
Instrumented Rod Data

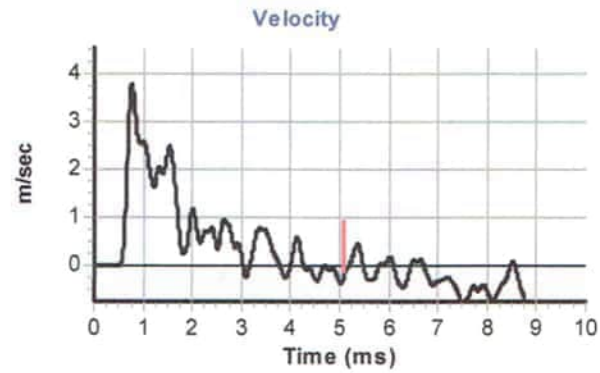
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.6
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	62901
Accelerometer No.2:	69902

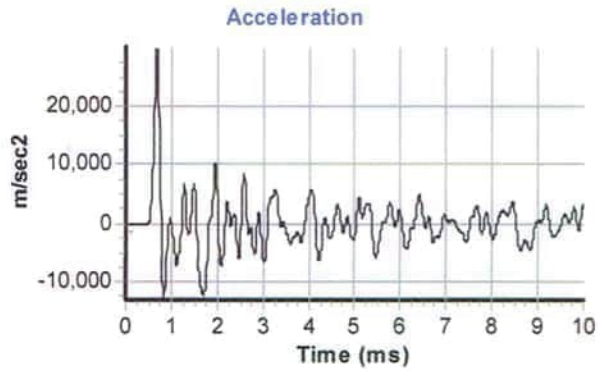
SPT Hammer Information

Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	10.0

Comments / Location









Calculations

Area of Rod A (mm2):	983
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	265

Energy Ratio E_r (%): **56**

Signed: B Hunter

Title: Operations Manager

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SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Dynamic Sampling Uk Ltd
Unit 8 Victory Park
Victory Road
Derby
DE24 8ZF

SPT Hammer Ref:	AR493.
Test Date:	16/10/2024
Report Date:	16/10/2024
File Name:	AR493..spt
Test Operator:	B.HUNTER

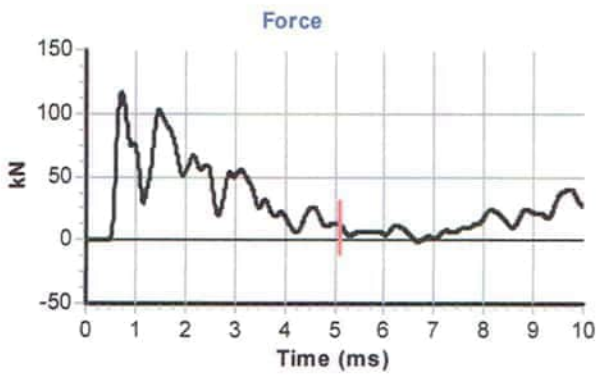
Instrumented Rod Data

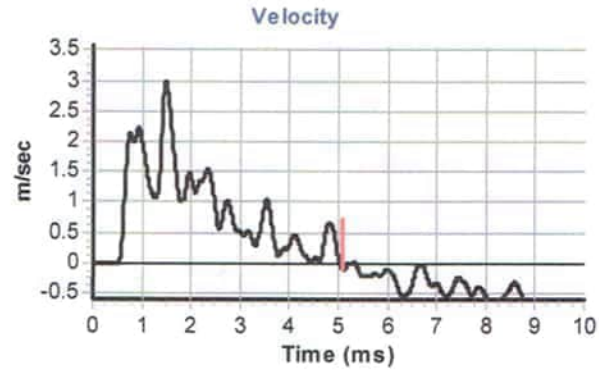
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.6
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	62901
Accelerometer No.2:	69902

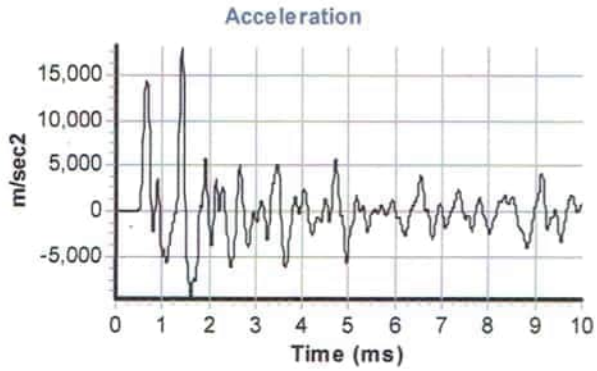
SPT Hammer Information

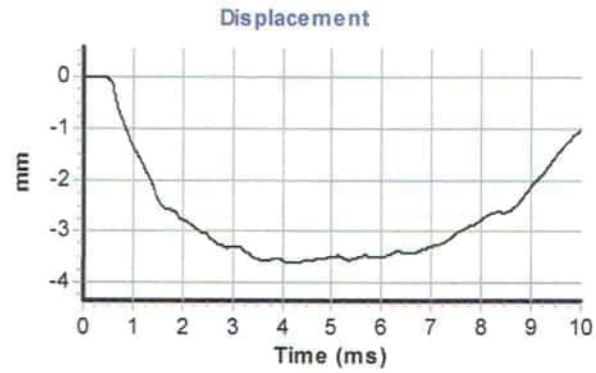
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	10.0

Comments / Location









Calculations

Area of Rod A (mm2):	983
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	259

Energy Ratio E_r (%): **55**

Signed: B Hunter

Title: Operations Manager

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SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Dynamic SAMPLING UK LTD

Dynamic Sampling Uk Ltd
Unit 8 Victory Park
Victory Road
Derby
DE248ZF

SPT Hammer Ref:	AR503
Test Date:	24/09/2024
Report Date:	25/09/2024
File Name:	AR503.spt
Test Operator:	B.HUNTER

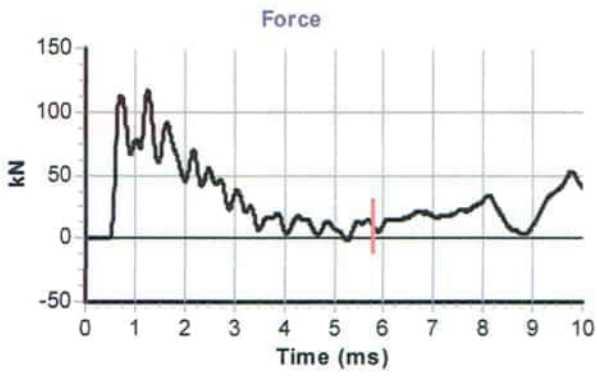
Instrumented Rod Data

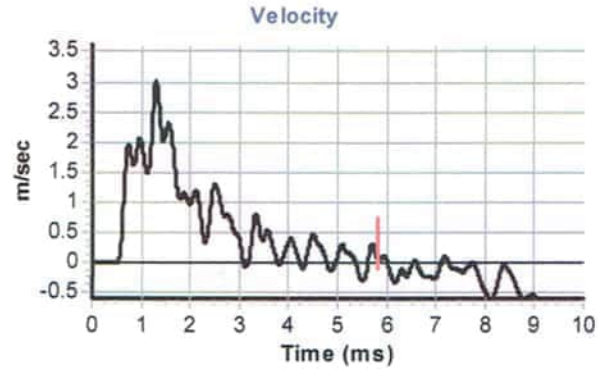
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.6
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	62901
Accelerometer No.2:	69902

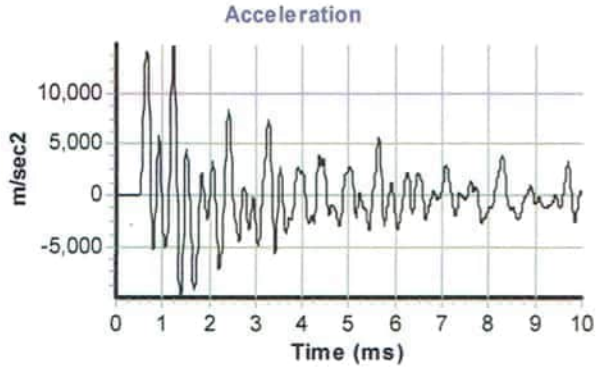
SPT Hammer Information

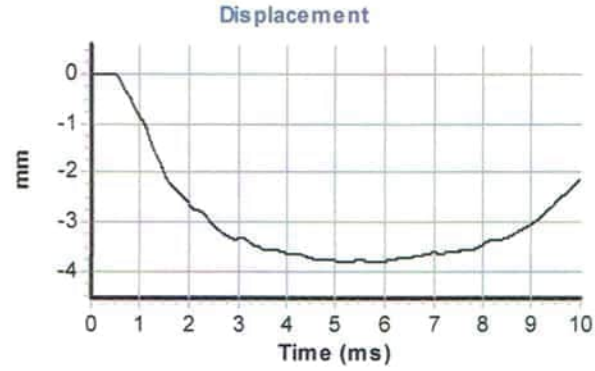
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	10.0

Comments / Location









Calculations

Area of Rod A (mm2):	983
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	270

Energy Ratio E_r (%): **57**

Signed: B.Hunter

Title: Operations Manager

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GAP GROUP
SURVEY & SAFETY

Certificate No:	4043393

Certificate of Calibration

In accordance with the manufacturer's specification

Depot:	DOCKLANDS SURVEY	**Technician:**	Sean Stevens
Make:	Leica	**Model:**	GS18 GNSS
Serial No:	3604017	**Fleet No:**	3368376

We hereby certify that the above has been tested using equipment traceable to National standards or recognised procedures

Tested by:

Signed:	

CALIBRATION:

Completed:	24/04/2025

Tested by:

PRINT:	Sean Stevens

CALIBRATION:

Due Date:	24/04/2026

ADDITIONAL COMMENTS

CALIBRATED TO MANUFACTURER'S TOLERENCES & SPECIFICATION'S

INSTRUMENT IS NOT RECOMMENDED FOR USE AFTER DUE DATE AND MUST BE RETURNED TO GAP GROUP FOR SERVICING

GAP GROUP
SURVEY & SAFETY

CERTIFICATE OF CONFORMITY

Service Number	4043405

Make	Leica	Model	CS20 Controller

Serial No	2432599	Fleet No	3368375

Manufacturer Re-Calibration Due Date	24/04/2026

This is to certify that the equipment detailed hereon has been inspected and unless otherwise stated conforms in all respects to the manufacturer's original specifications or company work instructions.

Tested by:

Signed	

Conformity:

Completed	24/04/2025

Tested by:

PRINT	Sean Stevens

ADDITIONAL COMMENTS

CERTIFICATE OF TEST

Smart Office Certificate Number	4029871
Manufacturer	Radiodetection
Equipment Type	Precision Utility Locator
GAP Fleet No	3293271
Serial No	10/C4EN03-2470

CHECKS CARRIED OUT

Visual Inspection for damage ✓ Cal Date Checked ✓ Batteries Checked ✓ Speaker Tested ✓

Wear Boot Checked ✓ Strike Alert Tested ✓ Power Mode Tested ✓ Genny Mode Tested ✓

Time/Date Checked ✓ Avoidance Mode Tested ✓ Latest Software Version ✓

Manufacturer Re-Calibration Due Date	14/10/2025

Depot	DOCKLANDS SURVEY	Date Tested	15/04/2025
Tested By	Sean Garland	Signed by	

CERTIFICATE OF CALIBRATION

Smart Office Certificate Number	4041117
Manufacturer	Radiodetection
Equipment Type	Precision Utility Locator
GAP Fleet No	3374764
Serial No	10/C4EN03-11183

CHECKS CARRIED OUT

Visual Inspection for damage ✓ Cal Date Checked ✓ Batteries Checked ✓ Speaker Tested ✓

Wear Boot Checked ✓ Strike Alert Tested ✓ Power Mode Tested ✓ Genny Mode Tested ✓

Time/Date Checked ✓ Avoidance Mode Tested ✓ Latest Software Version ✓

Manufacturer Re-Calibration Due Date	23/04/2026

Depot	DOCKLANDS SURVEY	Date Tested	24/04/2025
Tested By	Stephen Culpitt	Signed by	

SOIL ENGINEERING

Leeds

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Parkside Lane, Dewsbury Road, Leeds LS11 5SX
T: 0113 2711111
E: enquiries@soil-engineering.co.uk

Camberley

Southern Office
Foundation Court, Riverside Way, Watchmoor Park, Camberley GU15 3RG
T: 01276 674940
E: southern@soil-engineering.co.uk

Coatbridge

Block 6, Greenhill Industrial Estate, Coatbridge ML5 2AG
T: 01698 863 400
E: scotland@soil-engineering.co.uk