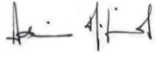
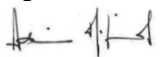


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## **FOREWORD**

### **General Conditions Relating To Ground Investigations**

Any opinions expressed in this report are based on the ground conditions revealed by the site works, together with an assessment of the site and of laboratory test results. Whilst opinions may be expressed relating to sub-soil conditions in parts of the site not investigated, for example between exploratory positions, these are only for guidance and no liability can be accepted for their accuracy.

Boring and sampling procedures are undertaken in accordance with B.S.5930, "Code of Practice for Site Investigations". Likewise in-situ and laboratory testing complies with B.S.1377, "Methods of Tests for Soils for Civil Engineering Purposes", unless stated otherwise in the text.

The groundwater conditions entered on the boring records are those observed at the time of investigation. The normal rate of boring usually does not permit the recording of an equilibrium water level for any one water strike. Moreover, groundwater levels are subject to seasonal variation or changes in local drainage conditions.

Some items of the investigation have been provided by third parties and whilst Solidbase Laboratory Ltd. has no reason to doubt the accuracy, the items relied on have not been verified. No responsibility can be accepted for errors within third party items presented in this report.

This report is produced for the benefit of the client alone. No responsibility can be accepted for any consequences of this information being passed to a third party who may act upon its contents/recommendations.

# GROUND INVESTIGATION REPORT

**Delimara Power Station, Malta - Proposed New Combined Cycle Power Plant**

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## **1 Terms of reference and introduction**

The work covered by this report was undertaken by Solidbase Laboratory Limited on behalf of Siemens Industrial Turbomachinery AB, as per document reference: 42/00004939 dated 18/06/2014 and subsequent correspondence. This investigative work was undertaken between July and August 2014.

An investigation was required to provide information on the ground conditions across the site, in order to determine suitable geotechnical design parameters for the construction of the foundations of the proposed new gas turbines, the steam turbine and all the associated plant required for the operation of these turbines and for the generation of electrical power.

The proposed site for this new installation is located within the boundaries of the existing power station at Delimara, in an area that is known to have been reclaimed from the sea. The geology of the area is known to consist primarily of moderately weak olive-green marl that is considered to provide a competent stratum for foundation construction. The investigation was commissioned with the remit of evaluating the risks and parameters associated with constructing the new combined cycle power plant primarily on piled foundations, with some ancillary structures being supported on spread foundations.

In addition to undertaking an intrusive investigation, the following desk study of existing data was performed:

- An initial geological model of the site devised by inspection of the 1:25,000 scale Sheet 1 of the Geological Maps of the Maltese Islands published by the Oil Exploration Directorate, Office of the Prime Minister (1993);
- The findings of previous investigations undertaken by Terracore Limited;

In accordance with the guidelines in BS EN 1997 Eurocode 7 the work is structured to provide both a Ground Investigation Report (GIR) and Geotechnical Design Report (GDR). These two parts have been combined into one report for ease of access to the information, on the recommendations of the geotechnical consultant of the client. This volume therefore contains both factual and interpretative data regarding the site and ground conditions encountered during the sampling and testing phases of the work.

## 2 Background Information

### 2.1 Site Description

The area of investigation was located to the southwest of the existing power station, between the main entrance of the power station complex and to the Southwest of the building that currently houses the main workshop. The area under study is shown in Figure 1 below.

The area is mostly flat with a very gentle change in level (of about 1.2m) toward the Southeast, where some landscaped areas surround the foundations of a small one-storey building that has recently been demolished. The current level of the main area, which is occasionally used as an open-air storage site, is around 2.5m above mean sea level.

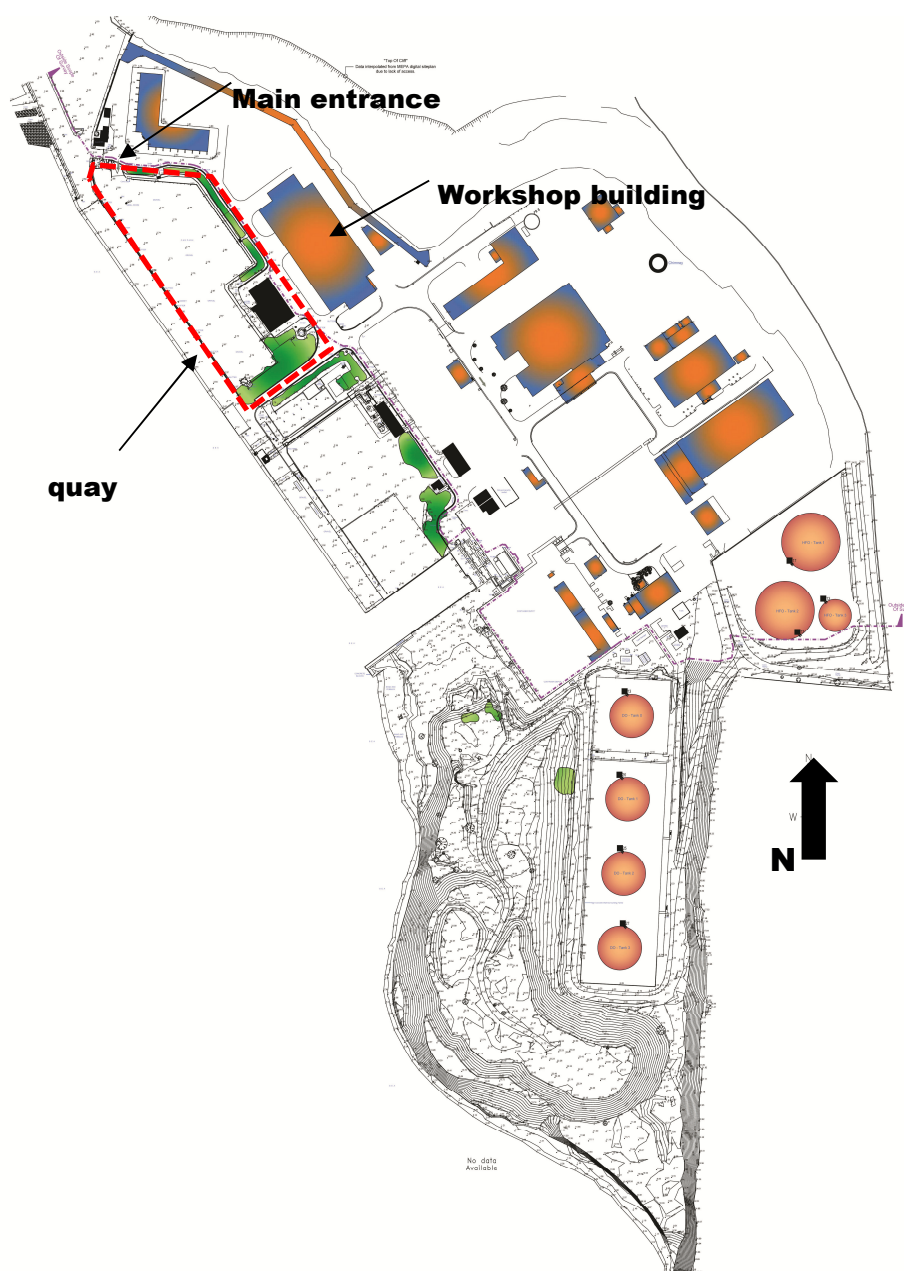


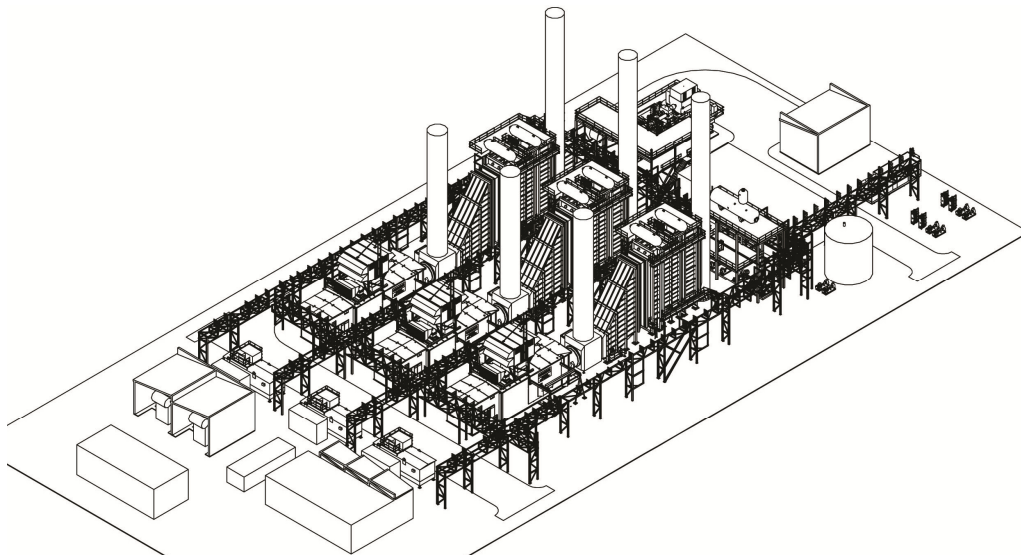
Figure 1 - Location of area investigated within the precincts of the existing power station

Historical records from the time of construction of the power station indicate that the area under study consists of land reclaimed from the sea. Anecdotal information suggests that most of this area was infilled using the material excavated from the cliff face to make space for the existing power plant.

The site is bounded to the Southwest by a quay that has a draft of around 12m. This quay is used by large marine vessels servicing the power station, and is equipped with 50 ton bollards at 25m intervals along most of its length. It also has two 100 tonne bollards at its extreme ends. This quay retains the reclamation fill and consists of a mass concrete structure, according to construction records held by Enemalta Corporation<sup>1</sup> and Kalaxlokk Co. Ltd.<sup>2</sup> These records are attached in Appendix A of this document.

## 2.2 Project description

Siemens Industrial Turbomachinery AB is planning to install a new combined cycle generating facility, consisting of three Gas Turbines SGT-800, a Steam turbine SST-900, electrical building, GIS (gas insulated switchgear) building, electrical and control building and other equipment. The general arrangement is shown in Figure 2 and Figure 3 below.



**Figure 2 - General 3D arrangement of the proposed new combined cycle power plant**

The gas turbines will consist of heavy machinery rotating at 6000 revs per minute or more, and therefore dynamic considerations will be very important in the design of the foundations for these structures. On the basis of information from preliminary investigations, it is being proposed to found these structures on concrete piles socketed into bedrock, which piles will then support a mass-concrete foundation which is envisaged to provide the required damping characteristics for the proposed plant. The primary purpose of this investigation was therefore to assess the nature of the bedrock, such that the required strength and deformational characteristics of ground could be determined.

The installation will also require a number of ancillary buildings, housing switchgear, transformers and other related equipment. Another purpose of this investigation was therefore to establish whether the existing reclamation fill can indeed support these structures without resorting to pile foundations.

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<sup>1</sup> Enemalta, 2013, *General Arrangement of Delimara Power Station Quay* – Drawing No. QS/DPS/00113

<sup>2</sup> Kalaxlokk Co.Ltd., 1989 – *Delimara Power Station – Superstructure along Quay, reinforcement details* – Drawing No. KXC 237/89

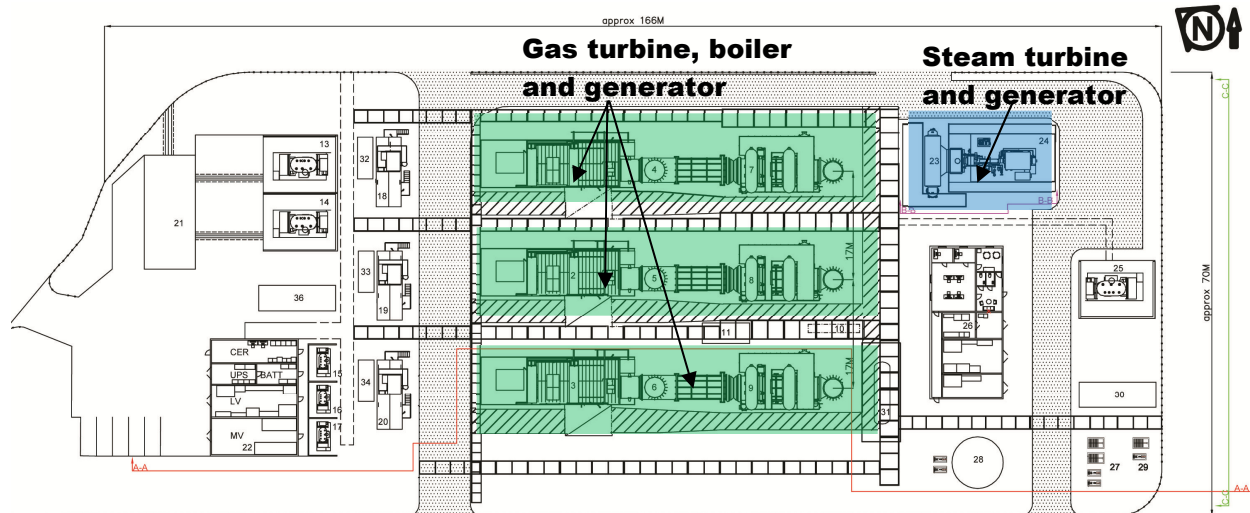


Figure 3 - Proposed general arrangement (plan) of new combined cycle power plant

## 2.3 Existing Data

Table 1 below, gives background information from the reports listed where there is a relevance to geotechnical considerations, together with mapping, online and literature sources.

Table 1 - Sources of Information for desk study

Data Source	Data Summary
Survey sheets of the Maltese Islands (1:2500)	<b>Contour data</b> (every 2.5m) showing general arrangement of the Delimara peninsula and its cliffs
Geology from Geological Map of the Maltese Islands 1:25,000 – Sheet 1, Malta, (1993), Oil Exploration Directorate, Office of the Prime Minister, Malta	<p><b>Quaternary valley fill</b> shown at the surface within Marsaxlokk Bay, to the North of the proposed site. There is a good possibility that such sediments existed at the bottom of the sea within the bay, prior to the reclamation process taking place.</p> <p><b>Rock Outcrops - Middle and Upper member, Globigerina Limestone formation</b> - Indicating that most of the Delimara peninsula is formed of the Upper and Middle members of the Globigerina Formation, and that such layers are inclined by a few degrees in an ESE direction. The dominant direction of the main fault lines is also indicated.</p>
Site Investigation at Delimara - Geological Sub-Surface Investigation Report - Terracore Malta, May 2013	Six boreholes drilled within the area of interest confirm the presence of Middle Member of the Globigerina Limestone formation and give indications of the mechanical properties of this material.
Geological Investigation in Conjunction with the proposed Construction of the Cable Turntable Foundations TD/99/376/12 - Terracore Malta, February 2013	Six boreholes drilled within the area of interest confirm the presence of Middle Member of the Globigerina Limestone formation and give indications of the mechanical properties of this material.



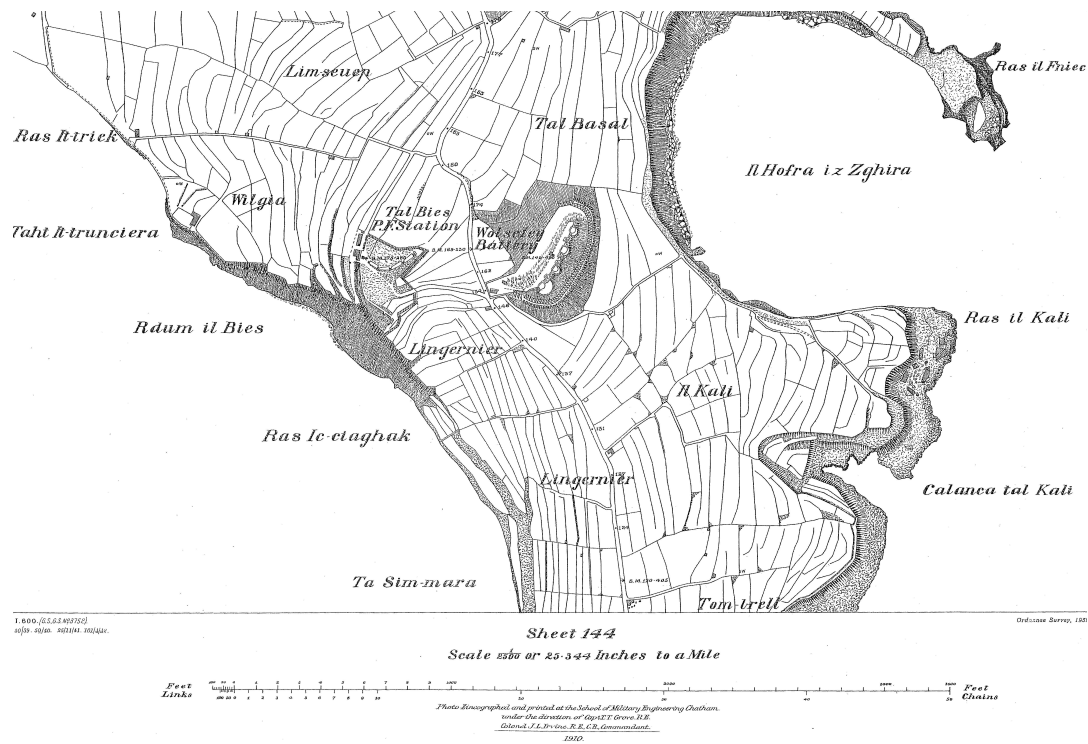
Data Source	Data Summary
New Generating Capacity At Delimara Power Station - Sub-Surface Geological Investigation Report - Terracore Malta, September 2009	<p>Eleven boreholes drilled within the area of the new BWSC plant, to the southeast of the site considered in this investigation. No boreholes were drilled within the site under review. Seven of these boreholes were drilled within the reclaimed area and the sediments encountered above bedrock were described. The deepest borehole reached a depth of 21m and Middle Globigerina limestone was still being recovered.</p> <p>Layers of sand rich in organic deposits were identified immediately above bedrock and information about the mechanical properties of the bedrock are given.</p>

The history of the site has been researched from freely available historical mapping and data sources. The site, shown in Figure 1 below, is located within Marsaxlokk bay, a natural harbour that has been created through the erosive action of a number of watercourses arranged radially around its perimeter. Of relevance to this investigation is the Marsaxlokk valley system, leading up to Hal Ginwi and Zejtun, which has resulted in layers of alluvial material being deposited in the mouth of the valley, and possibly within the area of the proposed new power plant. Figure 4 below shows the location and the adjacent valley over which the village of Marsaxlokk is built.



Figure 4 - Aerial photo of Marsaxlokk Bay (Google Earth)

The site was undeveloped until the early 1990s, when the existing power station was constructed and commissioned. Figure 5 below shows the situation at the site during the Second World War, indicating that the area, referred to as “Rdum il-Bies” and “l-Ingernier”, consisted mostly of steeply inclined cliff faces that rose directly from the sea.



**Figure 5 - The site as existing in the 1940s**

These steep escarpments are very common around the Delimara peninsula, but rarely found elsewhere around the shoreline of Marsaxlokk Bay. The exception is the headland around St. Lucjan's tower, at the place called "il-Ponta l-Kbira". The steep nature of the topography is also illustrated by the topographical map, seen in Figure 7 below. This map also indicates that the Delimara peninsula slopes to the East in a relatively consistent manner, and this sloping nature is very clearly seen in the cliffs forming the peninsula. The reclaimed area on which the power station is partially built is easily inferred from this map.

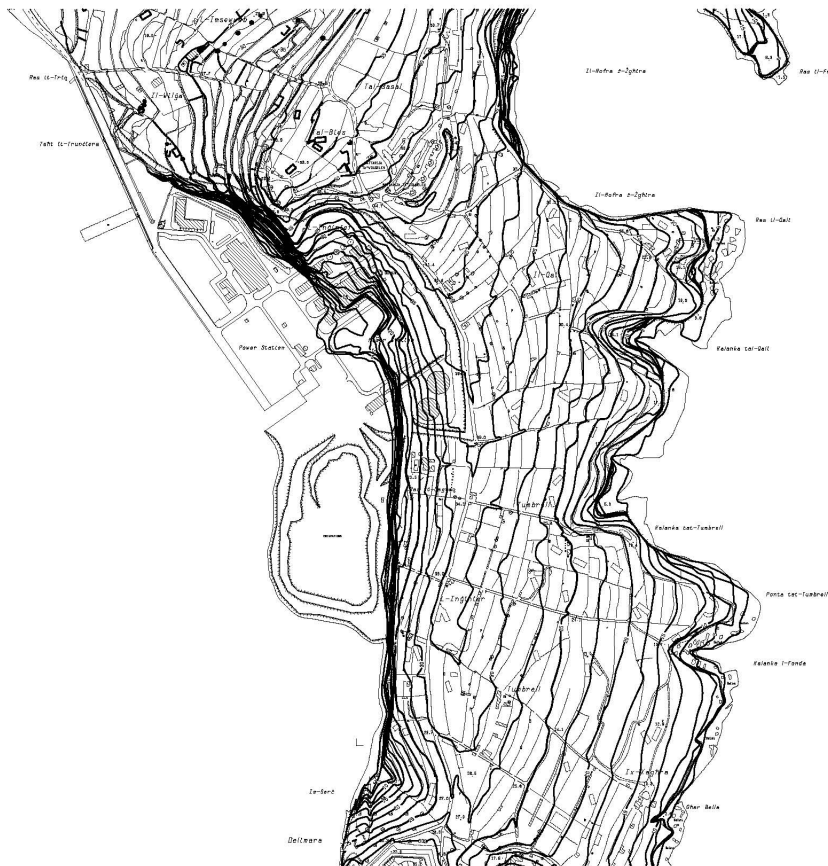


**Figure 6 - view across the sloping strata of Upper and Middle Globigerina Limestone strata forming Ras il-Fenek, Delimara Peninsula**

Both the Delimara Peninsula and il-Ponta l-Kbira are seen to consist of outcrops of the Upper and Middle members of the Globigerina Limestone formation, as opposed to the rest of the shoreline of Marsaxlokk Bay, which predominantly consists of the Lower member of the Globigerina Limestone formation. This is clearly indicated by the geological map of the Maltese Islands<sup>3</sup>, shown in Figure 8 below. The geological map also confirms the sloping nature of the strata and the section on the same map,

<sup>3</sup> Geological Map of the Maltese Islands – Sheet 1, Malta, (1993), Oil Exploration Directorate, Office of the Prime Minister, Malta

conveniently taken longitudinally along the length of the peninsula, confirms that the sloping nature of the strata continues well below sea level. It also suggests that the thickness of the Middle Globigerina Layer is likely to extend way below the depth of interest of this investigation. This is confirmed by the Terracore boreholes drilled in several locations within the power station precincts.



**Figure 7 - Topographical representation of the Delimara peninsula, in the vicinity of the power station**

The Upper and Middle members of the Globigerina Limestone formations making up the Delimara peninsula commonly create steep escarpments as they are gradually eroded by the action of the sea and the elements. This is seen all around the Delimara Peninsula, where the mechanisms of deterioration can also be observed. The upper sediments are seen to be made of alternating layers of soft and hard marls which undergo different erosion rates to create a very well defined layered effect. This differential erosion has resulted in large overhangs being formed, probably because weathering rates differ with depth.

The Upper and Middle members of the Globigerina Limestone formation are described as fine grained marls or marly mudstones, indicating that clay minerals may be present in these materials. The geological description given in the Geological map is reproduced here in Figure 10 below for reference purposes.

The intense layering seen in the upper sediments suggests that the distribution of such clay minerals is not uniform, but is perhaps intermittent due to cyclic nature of the depositional processes involved. There could be, however, a significant difference between these upper layers and the marls at depth which exist below the proposed power plant. The latter are perhaps richer in the more active clay minerals, which leads to the often-quoted observation that vertical faces excavated in such materials quickly become unstable and crumble. This is explicitly stated in the Terracore investigation report (2009).



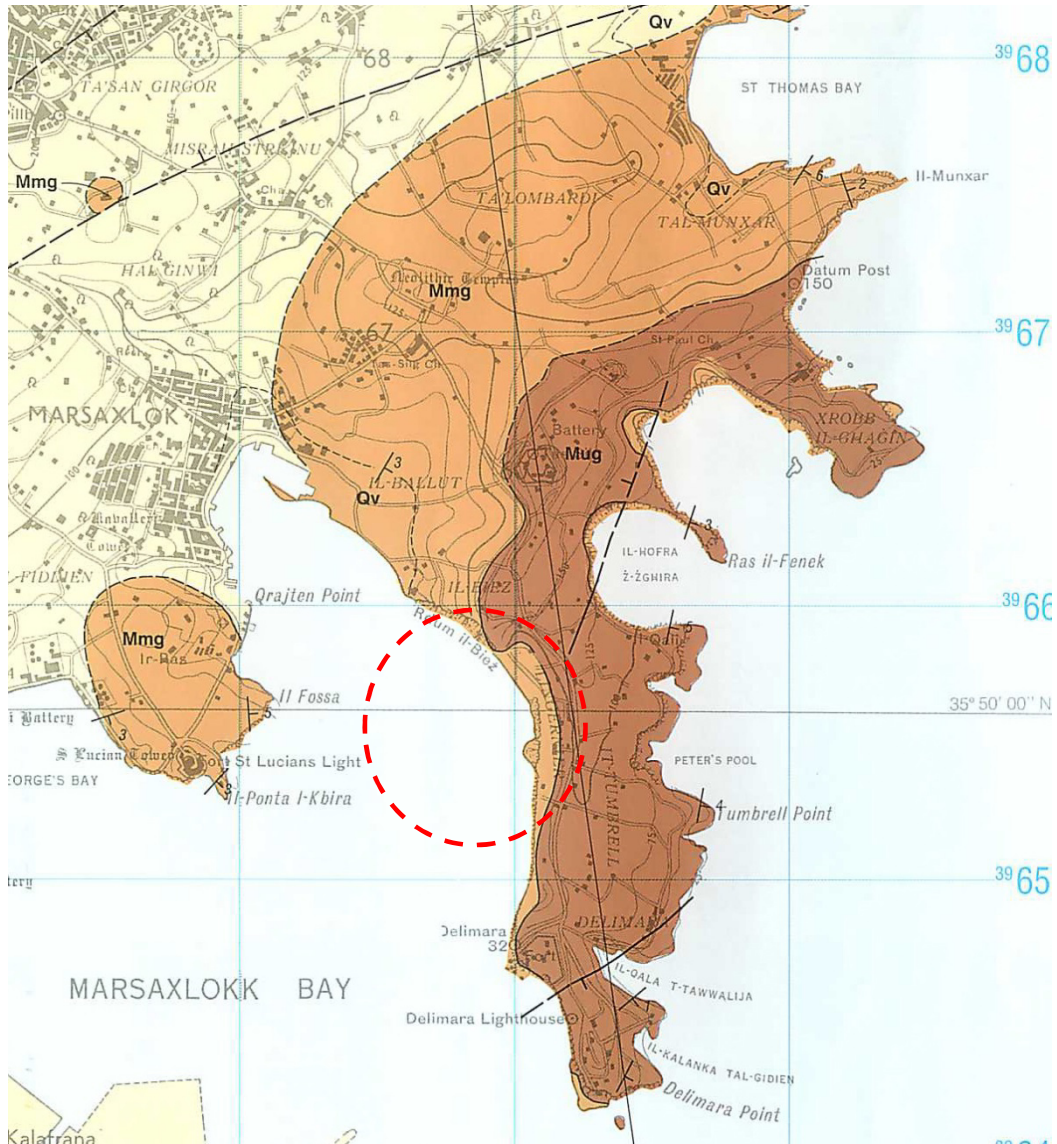


Figure 8 - Geological Map

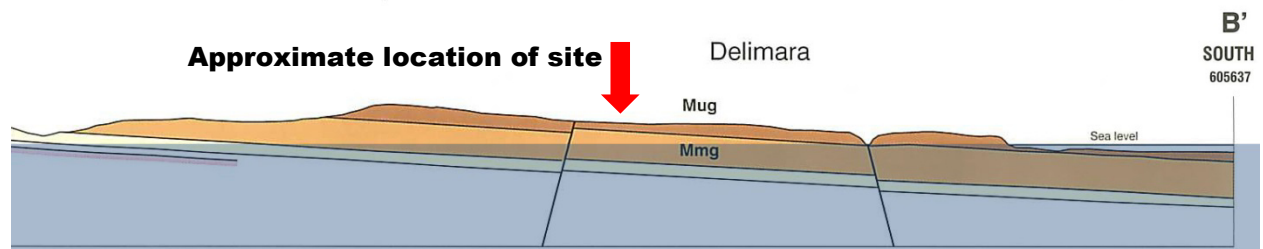


Figure 9 - Section through the Delimara Peninsula (from the geological map of the Maltese Islands)



## GLOBIGERINA LIMESTONE FORMATION

<b>Mug</b>	<b>Upper Globigerina Limestone Member:</b> A tripartite, fine grained planktonic foraminiferal limestone sequence comprised of a lower cream coloured wackestone, a central pale grey marl and an upper pale cream coloured wackestone. Pectinid bivalves and occasional echinoids are present. A ubiquitous phosphorite conglomerate bed containing fish teeth and diverse macrofossils occurs at the base of the member ( <b>Mc2</b> , Upper Main Phosphorite Conglomerate Bed). It is conformable in eastern outcrops but lies above a hardground and erosion surface in western areas. <b>Thickness 8-26m.</b> ( <b>Mug</b> MIOCENE, BURDIGALIAN TO EARLY LANGHIAN ).
<b>Mmg</b>	<b>Middle Globigerina Limestone Member:</b> A planktonic foraminifera-rich sequence of massive, white, soft carbonate mudstones locally passing into pale-grey marly mudstones. Fine bed laminae are frequent otherwise burrowing is ubiquitous. Thin-shelled pectinid bivalves and <i>Schizaster</i> echinoids are typical and coccoliths are abundant. The base of the formation is unconformable upon Lower Globigerina Limestone Member. Other minor breaks in the sequence are indicated in western outcrops by phosphorite clast beds. The sequence is thickest near Delimara. <b>Thickness 15-38m.</b> ( <b>Mmg</b> MIOCENE, AQUITANIAN TO BURDIGALIAN ).
<b>Mlg</b>	<b>Lower Globigerina Limestone Member:</b> Pale cream to yellow planktonic foraminiferal packstones rapidly becoming wackestones above the base. Glauconite is common in western outcrops south of Fomm ir-Rih. Pectinid bivalves and <i>Schizaster</i> echinoids are frequent. The top of the member is marked by a ubiquitous hardground. This is phosphatised in western areas and carries a conglomerate ( <b>Mcl</b> , Lower Phosphorite Conglomerate Bed). Common fossils include fish teeth, molluscs, solitary corals and echinoids. <b>Thickness 0-80m.</b> ( <b>Mlg</b> MIOCENE, AQUITANIAN ).

Figure 10 - Geological description of the sediments relevant to this investigation, as given on the Geological Map

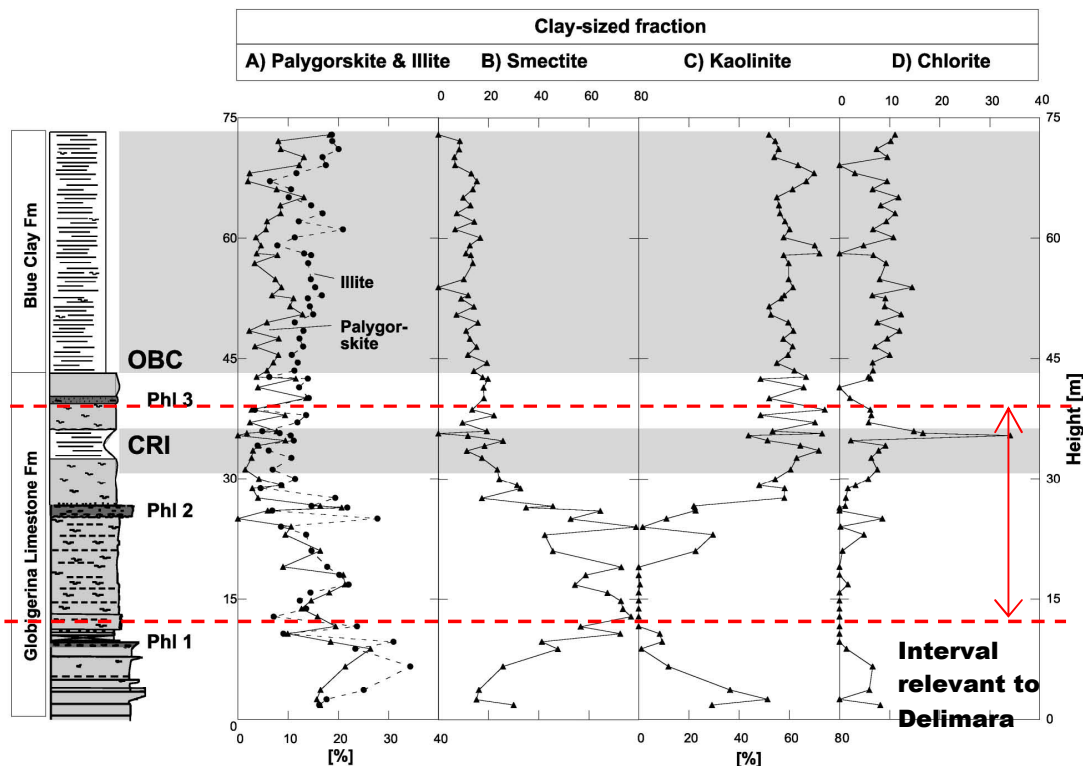


Figure 11 - Mineralogical studies on the Blue Clay - Globigerina Limestone sequence, from John et al. (2003)

It is further supported by the fact that around the Delimara Peninsula, the Middle member outcrops as steep slopes, while the Upper member results in vertical faces and overhangs in some places. The difference in geotechnical properties is perhaps best illustrated by observation of the cliff profiles around Delimara, where the characteristics illustrated in Figure 11 can actually be correlated to visible layers and sequences. An attempt to do this is shown in Figure 12 and Figure 13.

These observations are congruent with the work of John et al. (2003)<sup>4</sup> who studied the mineralogy of the Maltese Blue Clay—Globigerina Limestone sequence. They carried out extensive testing on frequent specimens taken from profiles of these sediments outcropping in the North-western parts of the Island of Malta. Some of their results are reproduced in Figure 11 above, which show that the Middle Globigerina is richer in the more active clay mineral, Smectite. The horizons within this sequence that are relevant to the Delimara peninsula are clearly marked on this extract

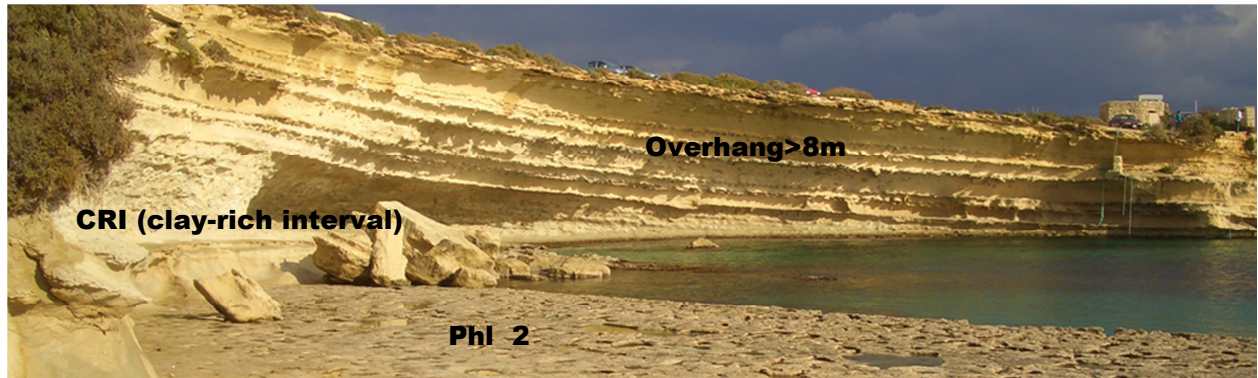


Figure 12 - Differential erosion rates for the different layers making the Upper Globigerina marls – Il-Hofra I-Kbira, Xrobb I-Ghagin, Delimara.

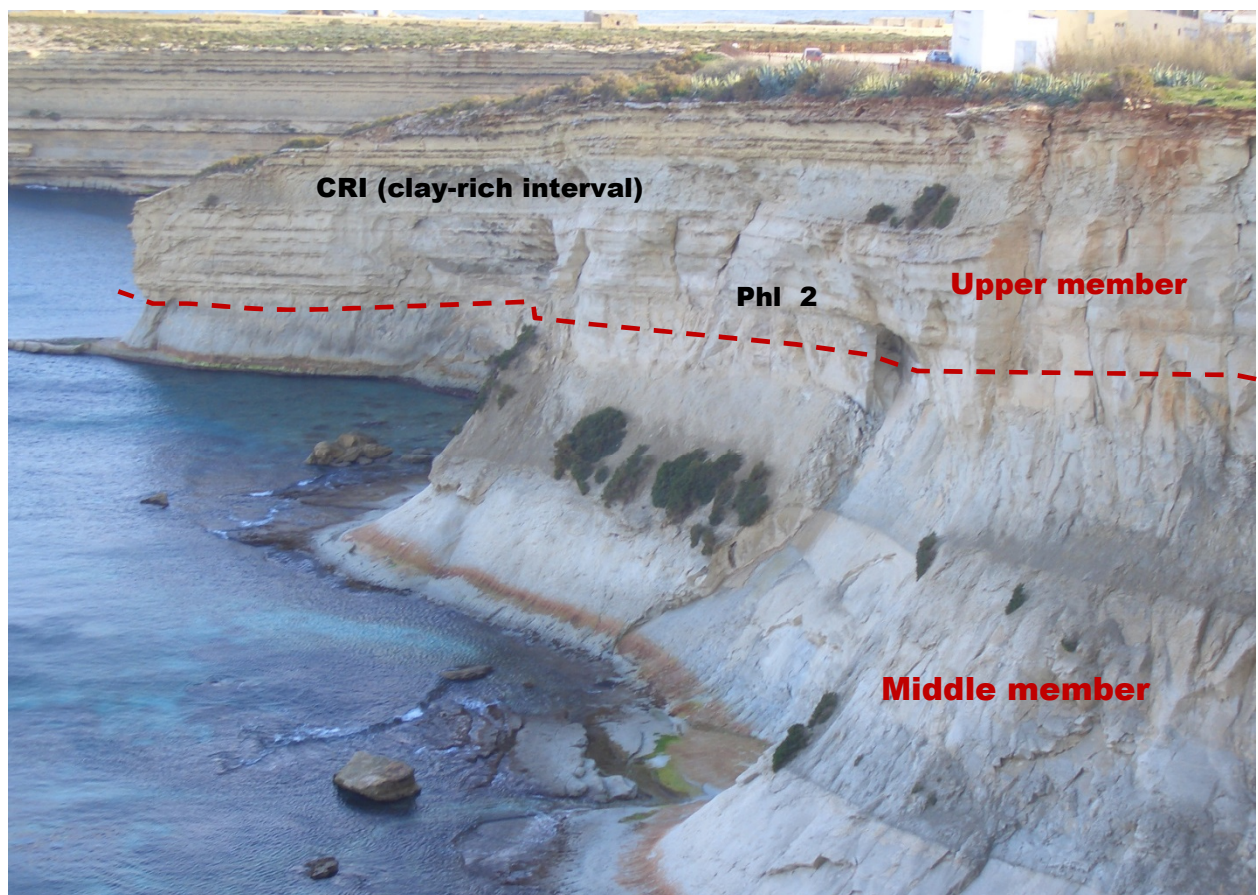


Figure 13 - The natural profiles created in the Middle Globigerina and the Upper Globigerina, at Xrobb I-Ghagin, Delimara Peninsula (to the North east of the power station site)

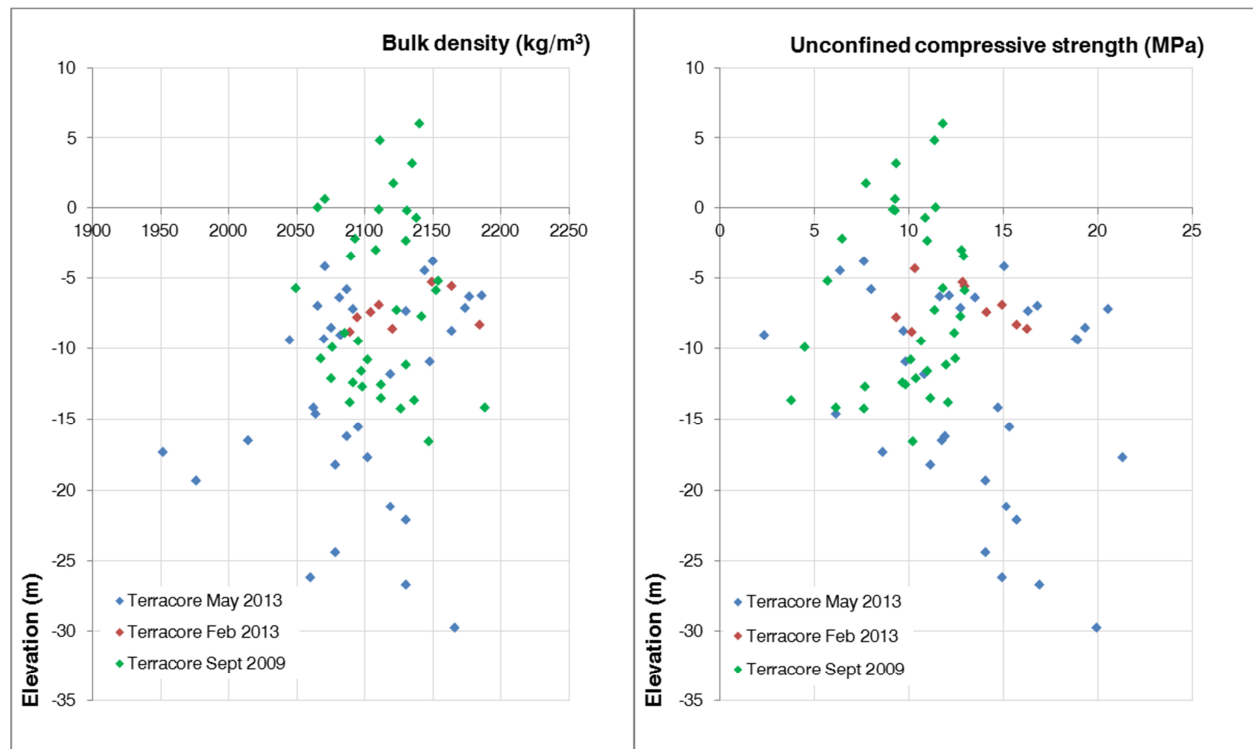
<sup>4</sup> John, Cedric M., Mutti, Maria and Adatte, Thierry (2003) *Mixed carbonate-siliciclastic record on the North African margin (Malta)—coupling of weathering processes and mid Miocene climate* Geological Society of America Bulletin. - 2003. - Vol. 115. - pp. 217-229



The Middle Globigerina Limestone is the main layer of interest for this investigation, since it is likely to underlie most of the site of the proposed combined cycle power plant. It consists of a dark grey to olive grey, massively bedded, very fine grained marl. Previous investigations by Terracore Ltd. suggest that this material can be classified as a moderately weak marl of very low permeability and having few fractures or discontinuities.

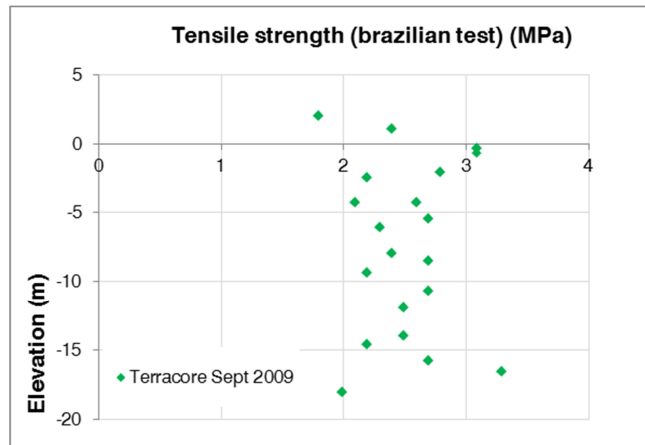
A considerable number of tests have been carried out on this material, from various horizons and from various locations within the Delimara Power station site. The Terracore investigation reports have been used for compiling a list of these tests, and each specimen was corrected for position in the vertical sense, according to the available information about the top level of each borehole. Some of these tests are from the area of the proposed Combined Cycle power plant.

The results have been plotted against depth, or rather, elevation (meaning the depth adjusted according to the top level of the borehole), and therefore the site characteristics can be assessed relative to a common datum, in this case assumed to be mean sea level. It can be seen that there is a wide scatter in unconfined compression strength, which varies from a minimum of 2.4 MPa to a maximum of 21.4 MPa. Inspection of the results suggests that there might be a slight trend indicating an increase with depth, but the amount of specimens tested from the deeper levels was relatively small. The degree of saturation of these specimens was not reported.



**Figure 14 - test results for the Terracore Investigations, corrected relative to a common datum**

The bulk density of the specimens, which were all sourced from the Middle member of the Globigerina Limestone formation, was also seen to vary between 2050 kg/m³ and 2190kg/m³. There are indications that the bulk density may decrease slightly within some horizons at depth. Plotting bulk density against unconfined compression strength revealed no particular correlation between the two properties. Again, there is very little information about the degree of saturation of the test specimens.



**Figure 15 –Tensile test results from the September 2009 Terracore Investigation - corrected relative to a common datum**

Also given in the Terracore September 2009 report are a number of results of Brazilian Tensile tests. These indicate tensile strengths varying between 2 and 3 MPa on average, and illustrate the cemented nature of this marl.

## 2.4 Tidal and wave data

Fundamental to the correct interpretation of the results obtained through this investigation are the assumed datum and its relationship with the fluctuations in sea level. All the information presented in this report is related to a common datum, which in this case has been taken as being equivalent to the Lowest Astronomical Tide level. This common datum was agreed with representatives of Siemens Industrial Turbomachinery AG, and all levels given on the existing drawings were confirmed to have this level as their zero origin.

It is useful to consider how this datum relates to sea level in Marsaxlokk Bay, and to other information that is available about the hydrography of the Maltese Islands. Figure 16 below summarises the sea level variations observed and measured in the Grand Harbour, Valletta. Considering the small size of the Maltese Islands, these variations are considered to be also applicable to Marsaxlokk Bay, which is located only a few kilometres away from the Grand Harbour, in any case. This drawing also shows the relationship of sea levels to chart datum, seen on most reference drawings related to the hydrography of the Maltese Islands.

TIDAL DATA		
Heights in Metres		
Grand Harbour, Valletta		
Mean High Water Springs	0.6889	
Mean High Water Neaps	0.5859	0.6089
Mean Sea Level		0.5629
Mean Low Water Neaps		
Mean Low Water Springs	0.4829	
P.W.D. Datum (Old M.S.L.)	0.4100	
Chart Datum	0.0000	

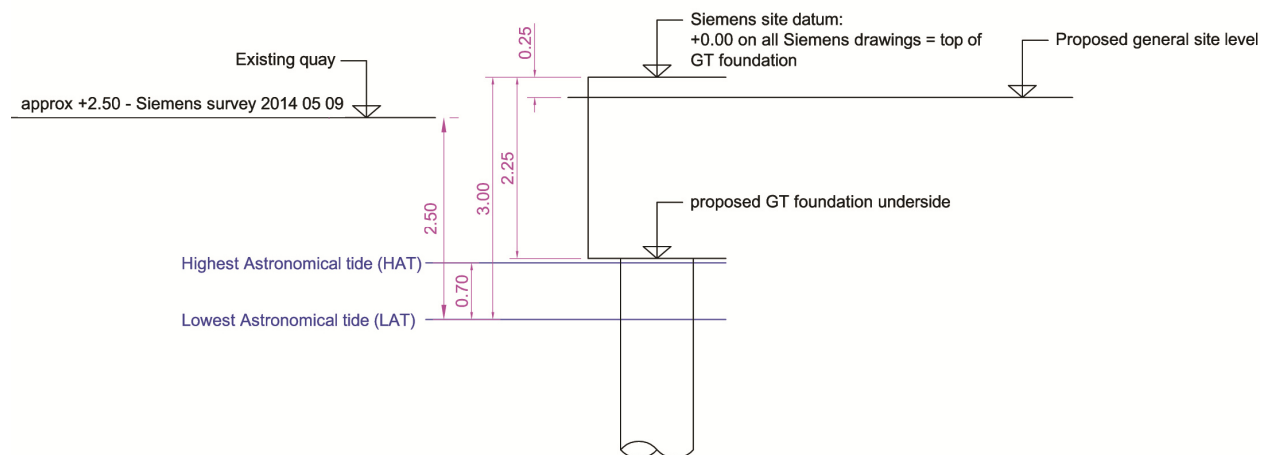
**Figure 16 - Hydrographic information - Grand Harbour, Valletta**

For the purposes of the new Combined Cycle Power Plant project, the existing and proposed site levels were assumed to be related to sea level in accordance with the drawing shown in Figure 17 below. It is to be noted that this drawing shows a sea level variation of 0.7m between the Lowest Astronomical Tide and the Highest Astronomical Tide. In this case, the Lowest Astronomical Tide (LAT) can be assumed to coincide with Chart Datum in Figure 16 above.

Other projects built close to sea level carried out in the last years have used a difference of 0.82m between LAT and HAT. However, in recent years, an atmospheric anomaly has been measured at over 1.0 m HAT with flooding at the Ferries at Sliema and in Marsascala. The phenomenon seems to be getting more common and can last for a few hours only.

The official readings at Marsaxlokk are taken by Transport Malta. There is a tidal gauge at the Malta Freeport Terminals that is managed by Transport Malta, who would supply specific readings if deemed necessary.

When interpreting historic data or long-term readings, it is common to assume that the HAT can get up to 1.0 m above LAT (or Chart Datum since the difference is minimal between CD and LAT – this can be considered as an additional safety margin when using information from the Admiralty Charts).



**Figure 17 - Assumed relationship of existing and proposed site levels to Lowest and Highest Astronomical Tides**

### 3 Intrusive Investigation

#### 3.1 General

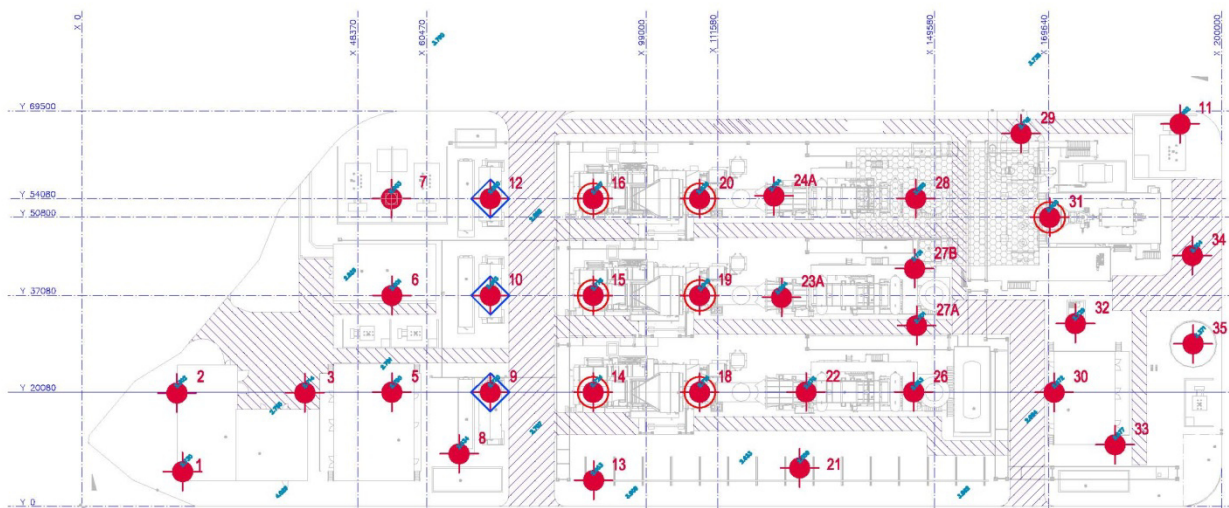
The investigation carried out by Solidbase Laboratory Ltd. for the purpose of constructing the new Combined Cycle Power Plant included both site and laboratory work.

Site work consisted of drilling a number of boreholes with full core recovery, carrying out physical and geophysical tests within some of these boreholes, excavating the uppermost layers to create trial pits and carrying out site tests on the fill, as well as geophysical tests along scanlines running across the site.

In the laboratory, the retrieved core from the boreholes was inspected, described and logged in detail, and then used to prepare specimens for both strength and index testing.

#### 3.2 Borehole drilling

A total of 33 boreholes were drilled during this investigation. The location of these boreholes is shown in Figure 18 below. The location of each borehole was specified by representatives of Siemens Industrial Turbomachinery AG, and later marked on site by a land surveyor. The top level of each borehole was measured at this stage and then again at a later stage when most of the boreholes were complete.



**Figure 18 - Location of the various boreholes drilled during this investigation**

All of these boreholes were drilled with full recovery and in general very good recovery values were obtained, resulting in complete core sets in most cases. The boreholes were drilled to varying depths, ranging from 10m to 20m below the existing site levels.

Each borehole required temporary casing to be inserted up to the depth where solid bedrock was encountered. This initial part of the borehole was cored using a simple sampler, while the double core sampler was used for the remaining depth drilled through bedrock. The double core has an internal core barrel which rotates independently of the outer barrel that is cutting through bedrock at its lower end. In this way, the rock core is held in the inner barrel which remains stationary while the outer barrel rotates. This method minimised disturbance to the rock core, allowing the nature of the weaker strata to be identified and later studied in the laboratory. This method was adopted because it was seen that the material is likely to remain intact and undisturbed when brought in contact with water used as drilling fluid during double core sampling. No open hole drilling was used in this investigation.

During drilling, a number of Standard Penetration tests were carried out in the upper reaches of most of the boreholes. This allowed the geotechnical characteristics of the fills overlying bedrock to be investigated. The often loose nature of these fills precluded any attempt at retrieving undisturbed samples of this material, which could then be tested in the laboratory.

The retrieved core was stored in plastic core boxes for transportation to the laboratory. The retrieved core recovered from bedrock was wrapped in several layers of plastic cling film immediately on extraction from the sampler, in an effort to preserve its moisture content. These cores were then opened only in the laboratory for inspection and then re-sealed immediately.

A detailed description of all the strata encountered, position and types of samples taken along with any groundwater observations made at the time of drilling are included on the borehole records presented in Appendix B.

### **3.3 Down-borehole geophysical tests**

Some of the boreholes were used at a later stage for downhole seismic testing. Two types of test were performed, namely seismic downhole tests and anchor pull-out tests. The latter will be described in more detail in section 3.4.

Using the seismic downhole investigation technique, one can determine the propagation velocity (average and interval) of seismic compression (P) waves and transverse or shear (S) waves. The down-hole method, unlike other seismic techniques, has the advantage of not having as a condition that the velocity in the ground increases with depth (e.g. seismic refraction surface) and, therefore, it is always possible to evaluate possible reversal speed of rock types encountered during drilling.

The instrumentation consists of a multi-channel seismograph A6000S MAE, having the following technical specifications:

- sample signals between 0.002 and 0.00003 sec;
- "zero time" communication and transmission system (time break);
- High Pass and Band Reject filters ;
- Automatic Gain Control;
- 24 bit A / D converter;
- 2 in number 3D geophones 10 Hz.

The boreholes chosen for the downhole seismic tests were specified by Siemens Industrial Turbomachinery AB, and included the boreholes drilled beneath the proposed future positions of the main pieces of rotating machinery. These include the three gas turbines and the steam turbine. A total of eight boreholes were prepared for such tests, and these are shown encircled in red in Figure 18 above.

Each of these boreholes was prepared for this test by lining the borehole with a smooth plastic tube, held in position with a cementitious grout pumped through a small diameter grouting tube attached to the main lining tube. This lining tube served as a guide for the double geophone used during the downhole seismic test. This lining operation was carried out in boreholes 14 and 18, 15 and 19, 16 and 20 below the three gas turbines, and in boreholes 31 and 34 below the steam turbine. The lining operation was successful in boreholes 15, 19, 16 and 20 and in borehole 34. Grout leaked into the lining tube in the remaining boreholes, and attempts to carry out the downhole test at these locations thus had to be abandoned.





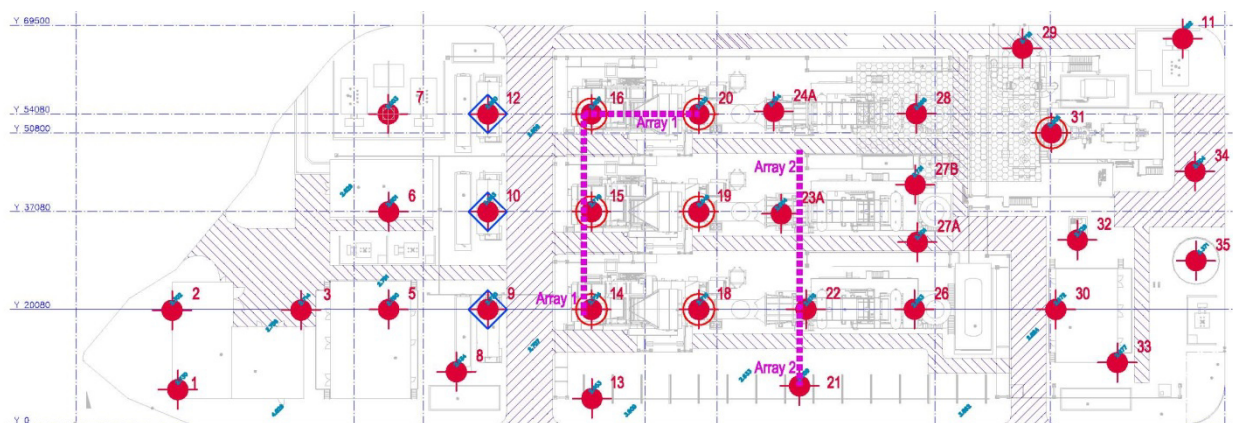
**Figure 19 - Execution of the downhole seismic test in Borehole 20**

The seismic pulse was created in two different ways for this test. A compression wave was created by hitting the ground vertically with an 8 kg sledgehammer, at a point 2m away from the borehole. Shear waves were created by hitting a wooden plank laterally with the same sledgehammer. Close contact between the plank and the ground was ensured by loading the wooden plank with the heavier (engine) end of a pick-up truck. The centre-point of the wooden plank was located at a distance of 2m away from the borehole, 90° away from the spot where the compression waves were applied.

A double geophone array was used for the downhole seismic measurements. The two geophones were separated by a constant known distance of 1m, allowing the first arrival times and the distance travelled by the seismic pulse to be considered in terms of increments rather than actual measurements. This technique allows for improved accuracy in determining the results from this test.

### 3.4 Ambient noise recordings and Rayleigh wave dispersion curve analysis

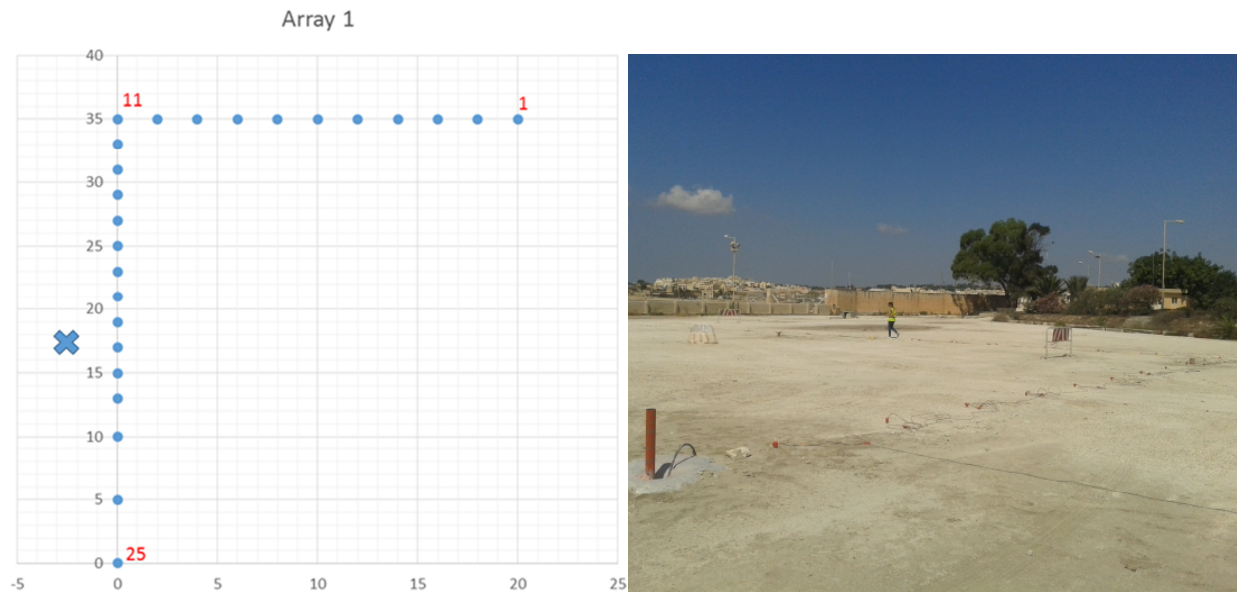
Two geophone arrays were set up respectively at the two areas characterized by a different depth to bedrock. The array set up at the shallower part (the first geophone placed close to BH16 - henceforth referred to as Array 1) consisted of 25 geophones separated by different lengths (refer to diagram) in an L shape configuration. The other array (the first geophone placed close to BH21 - henceforth referred to as Array 2), situated where a thicker layer of infill is present, was made up of 17 geophones placed in a line having different spacing.



**Figure 20 - Location of the two geophone arrays**

The geophones were left to record for about 40 minutes and a sampling frequency of 256 Hz was used. 30 minutes of 3-component single-station noise measurements were also taken close to the arrays so that the H/V curve could be plotted and used for a joint inversion with the dispersion curve.





**Figure 21 - Configuration and setup of array 1. The numbers in red show the geophone numbers while the 'X' marks the place where the 3-component measurements were taken.**



**Figure 22 - Configuration and setup of array 2. Again, the numbers in red show the geophone numbers while the 'X' marks the place where the 3-component measurements were taken.**

### 3.5 Anchor pull-out tests

A series of anchor pull-out tests have been performed within the site, for the purposes of assessing the interface between the marl and a grouted element. The information from such a test is useful to assess the shaft resistance of typical piles that would be cast against the surface of a hole drilled in the marl.

Three of the boreholes used for core recovery were chosen for these tests. The criteria for choosing these boreholes was to have locations closest to the more critical areas ( the area of the gas turbines) as well as having the shortest depth to keep the anchor length to a minimum. For these reasons, boreholes 9, 10 and 12 were chosen, since at these locations the marl is relatively closer to the surface. A 32mm diameter steel anchor was then grouted into these boreholes for later pull-out testing.

The assembly details used for this test are shown in Figure 25 below. Only a short length of anchor was grouted to enable failure to occur, should this be attainable with the equipment available. The anchor was constructed using a 32mm diameter, high-yield reinforcement bar. Since the borehole was deeper than the standard 12m length of bar available, the anchor was constructed using a 12m length spliced to a 5m length using proprietary conical threads and couplers.

Grouting of the bond length was achieved by pumping neat cement grout (w/c ratio 0.44) through a grout tube down to the lowest level of the anchor rod. The same anchor rod was equipped with a high pressure water jetting point which applied an-upward pointing water jet at the design level of the upper grout surface. After a calculated amount of grout was pumped (designed to achieve a minimum grout column height of around 2m), the high pressure water jet was applied to clear the excess height of grout column. This procedure was continued until the returns at the top of the borehole changed to a clear colour, meaning that the excess grout had been washed away.



**Figure 23 - Detail of the lower part of each anchor, as assembled prior to insertion.**



**Figure 24 - Details of the pull-out test anchors construction process**



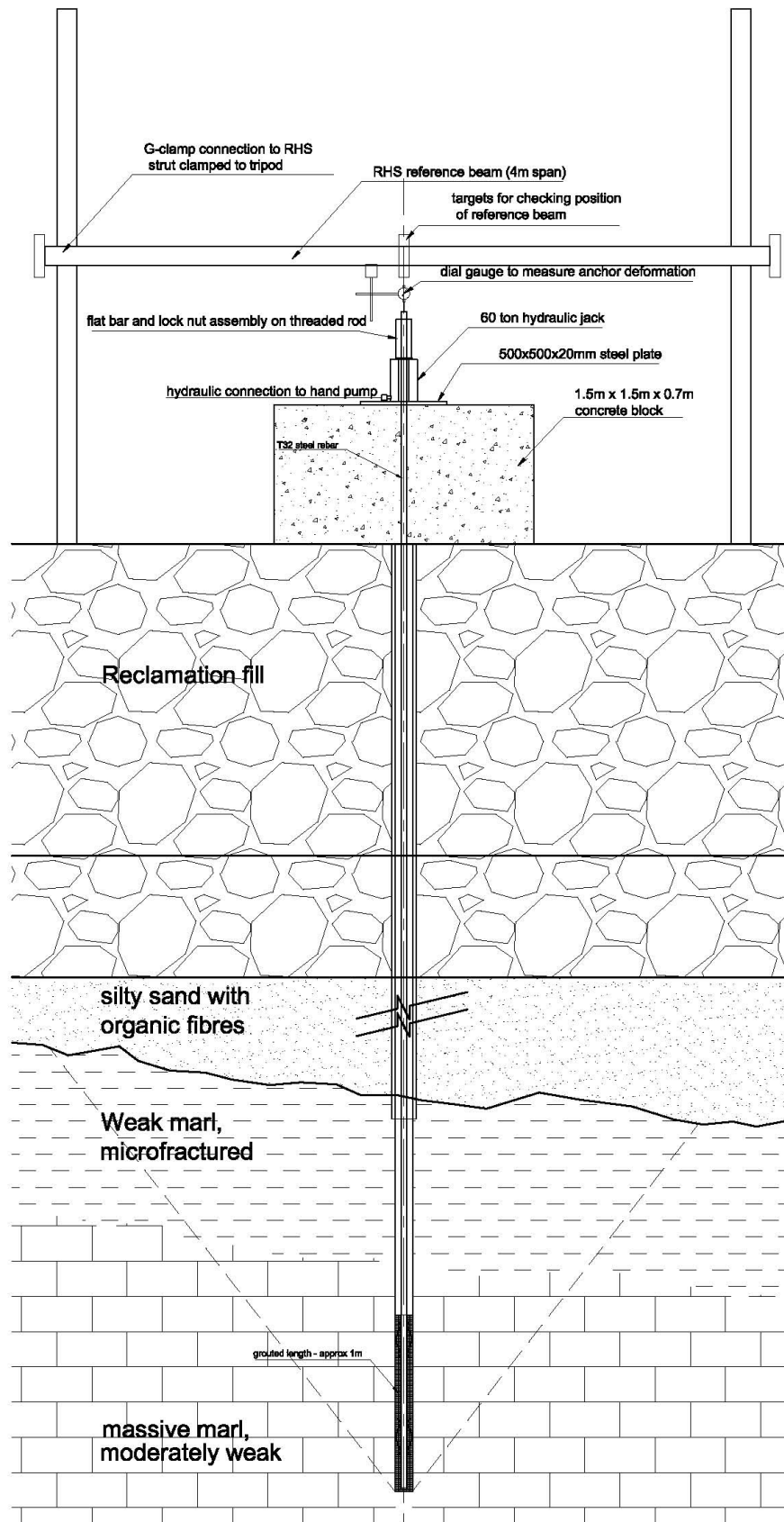


Figure 25 - Test setup for anchor pull-out tests

Failure in such an anchor can occur in four different ways: the steel bar can fail in tension, the interface between the steel bar and the grout can fail, the interface between the grout and the marl can fail, and the cone of rock supporting the borehole can fail.

Assuming a yield strength of  $500\text{N/mm}^2$ , the expected failure point of the rod would be at a load of around  $400\text{kN}$ , with yield at a load of  $260\text{kN}$ . Rock cone failure was mitigated by placing the grout body at the lowest point of the borehole, thus mobilizing the largest possible cone.

The test assembly consisted of placing a large  $1.5\text{m} \times 1.5\text{m} \times 0.7\text{m}$  concrete plinth with a central hole over the installed anchor. This plinth provided the necessary spread foundation and reaction during the test interval, when tensile loads were applied to the anchor rod via a small  $60$  tonne hydraulic jack. The jack was calibrated against the compression machine load cell in the laboratory, prior to the test, and stress level was monitored using the pressure gauge in the hydraulic lines of the jack to foot pump assembly.

An independent frame consisting of a number of rectangular hollow sections was assembled to provide the necessary support and reference datum to the deformation-measuring device. A  $50\text{mm}$  dial gauge was used for this purpose, attached to the reference beam using a magnetic stand. The level of the reference beam was checked continuously at three different points: at the far ends and at the centre, to ensure that the reference beam was not moving during the test. This was achieved by placing targets on the reference beam and then checking the level of each target using a theodolite. This same theodolite was also used to read the dial gauge from afar, thus having no need to approach the highly stressed elements in the region of the hydraulic jack.

The test setup is shown in Figure 26 below, which illustrates the test setup on borehole 12. All tests were carried out after dark to keep temperature fluctuations to a minimum.



**Figure 26 - Anchor pull-out test setup**

### 3.6 Standard Penetration Testing (SPT)

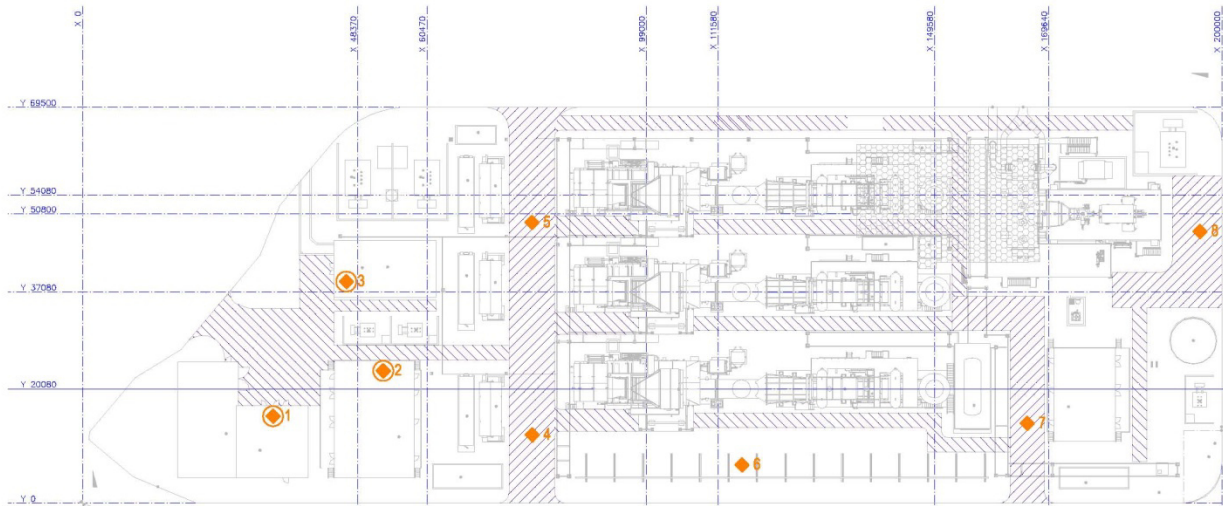
Standard penetration testing was carried out in 25 of the 33 boreholes. In most cases, three such tests were carried out within the upper part of each of the boreholes tested by this method. A total of 70 standard penetration tests were carried out. All these tests were carried out using a solid cone tip, except for the tests in boreholes 2 and 3, which were the first boreholes to be drilled and in which the open tip was used. It was soon realised that the solid nature of the larger particles in the fill would have damaged the open tip very quickly.

A number of these tests gave very little penetration after a total of 50 blows from the standard hammer. In such cases, the blow count was stopped at 50 and the penetration achieved under 50 blows was recorded.

### 3.7 Plate Loading Tests

A number of plate loading tests were carried out at locations chosen by representative of Siemens Turbomachinery AG. These were seen to be located either beneath the proposed access roadways or else beneath the lighter buildings to the northwest of the proposed gas turbine installations.

The rationale used for carrying out these tests was slightly different between these two cases. Where the plate loading test was specified below a proposed roadway, it was assumed that the test was required to assess the subgrade characteristics of a proposed road. The pressure bulb created by the standard 300mm dia. plate was deemed to be sufficiently representative of vehicular wheel loads, and for such cases, and the test was carried out using the smaller 300 mm dia. plate. The maximum stress level achieved during such tests was 500kPa. The tests were carried out on the surface of the fill as existing.



**Figure 27 - Locations of the plate loading tests. Tests carried out using the 762mm dia. plate are shown encircled**

Where the plate loading test was specified at locations corresponding to proposed buildings, it was assumed that the foundation loads would stress a much thicker stratum of fill or soil, and so the larger 762mm dia. plate was used, since this would create a deeper pressure bulb. The maximum stress achievable by this configuration was 200kPa. The latter tests were carried out at a level corresponding to 2.3m above site datum. This was deemed to be representative of typical foundation conditions where some of the fill would need to be excavated. In most cases, this required removal of the top layers of the fill, which would be the most heavily compacted layers.





**Figure 28 - Plate loading test using the large 762mm dia. plate at location 3.**

A thin layer of sand was placed between the ground and the plate to ensure full contact beneath the steel plate. Kentledge was provided in the form of a large truck filled with inert material, having a load in excess of 20 tonnes. Load was applied using a hydraulic jack and hand pump with integral pressure gauge calibrated to read vertical stress directly, according to plate diameter.

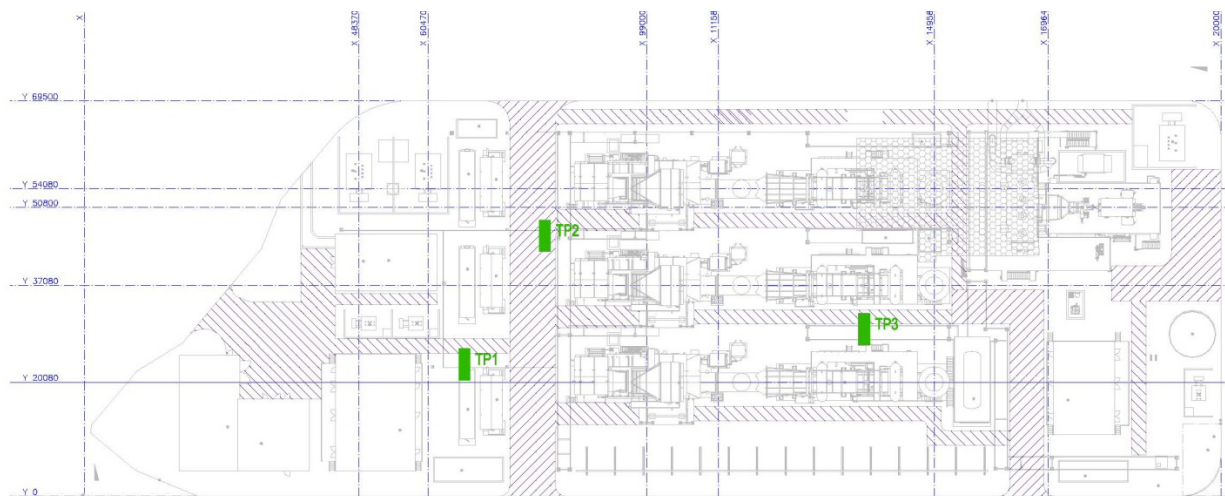
A small seating load (10% of the full load) was applied prior to the test to reduce the effect of deformation of this layer. Load increments were then applied in steps of 10, 20, 40, 80, 120, 160 and 200kPa for the 762mm dia. plate and in increments steps of 80, 160, 250, 330, 420 and 500kPa for the smaller 300mm dia. plate. After this was complete, unloading took place at intervals of 100, 50, 10 and 0 kPa for the larger plate and at intervals of 250, 130, and 0 kPa for the smaller plate, after which the plate was reloaded using the same loading steps used initially. One minute was allowed for each increment.

The applied load was maintained by pumping on the hydraulic jack. This was carried out carefully to ensure that the applied pressure was maintained more or less constant as the ground deformed.

The plate loading test at location 8 shown in Figure 27 above was not carried out since there was not enough space for the kentledge truck to manoeuvre in between the existing trees.

### 3.8 Machine Excavated Trial Pits

Trial pits were excavated using a mini excavator at three locations across the site to depths of up to 2.5m. The trial pit locations are shown in Figure 29 below.



**Figure 29 - Location of the three trial pits**

The trial pits were not shored and were not inspected directly from within. Excavation stopped when sea water was encountered.



**Figure 30 - two of the trial pits excavated during this investigation**

Further information about the trial pits, in the form of photographs of the pits and the resulting spoil, are given in Appendix C. Interpretation is given in the following section.

## 4 Ground Conditions Encountered

### 4.1 Introduction

The ground conditions evidenced in the 34 boreholes drilled during this investigation were more or less similar in type but different in extent. The same four layers were identified in nearly all the boreholes, but the thicknesses and positions of these four layers varied from one borehole to the other in the stratigraphic sequence.

Reference should be made to the appended exploratory borehole records for full details of the ground conditions recorded by this and previous investigations; however the relevant features with regard to the geology and hydrogeology of the site are summarised below.

### 4.2 Ground Conditions – the different layers

The four different layers seen in the retrieved borehole core can be summarised as follows:

Table 2 - Summary of main strata

Origin	Type	Colour code	Description	Thickness range
Man-Made	Reclamation fill		Top layer of sandy gravel underlain by a well compacted middle Globigerina marl rock fill, occasionally containing terrarossas. Rock fill below sea level appears to be less well compacted, and sometimes contains a silty clay layer at the lowest horizons.	4.4m - 12.1m (average: 5.55m)
Quaternary	Silty sand with high organic content		Sand layer containing considerable amount of organic material in the form of fibres of the seaweed 'posidonia'	0m – 3.94m (average 1.11m)
Miocene	Weathered Middle Globigerina Marl		Very weak, microfractured marl resulting in gravel-sized pieces of weak rock in a softer clay matrix.	0.1m – 4.7m (average 1.1m)
	Middle Globigerina Marl		The olive-grey, fin grained marl layer, generally massive and bioturbated, occasionally microfractured in the horizontal plane.	>20m

The four different layers were studied by observing the borehole core in the laboratory. The upper fill layer was also investigated by inspecting the sides of the trial pits. The characteristics of each layer and the expected geotechnical behaviour are described below.

### 4.3 Man-made reclamation fill

This layer was deposited during the construction of the main power station, and consists of a fill that is typically composed of rock spoil resulting from the excavation for the main power generation plant. Most of this fill is therefore composed of irregular pieces of olive-grey Middle globigerina limestone marl, having its origin in the cliff face behind the power station.





**Figure 31 - Upper layers of sandy gravel (with thin layers of bituminous binder) and underlying compacted marl rock fill**

This is not, however, valid for all boreholes. The upper part of some cores was seen to consist of a different kind of fill, predominantly made up of irregular pieces of yellowish-cream Lower globigerina limestone, which is generally a more stable material, and which would have been borrowed from elsewhere. Inspection of the trial pits indicates that such rock fill can include large boulders.

Inclusions of red terrarossa soils were also observed in some of the boreholes. This is a reddish-brown silty clay that is normally used for agricultural purposes, or else found in rock crevices and discontinuities. When included, such material is generally mixed with gravel, and generally occurs in the upper fill layers, mostly above mean sea level.

Borehole core from this fill suggests that the upper layers of the fill are better compacted than the layers at depth, presumably because compaction plant would not have been utilised below sea level. Above sea level, compaction would have been easy to achieve, and in fact appears to have been implemented in the upper layers.

The final 200-300mm at the top of the fill consist of a sandy gravel that is generally well compacted. This was clearly evident from the trial pits. Some of the boreholes indicate that layers of tarmac or bitumen binders were utilised in some places to stabilise the surface.



**Figure 32 - Rock fill in trial pit 1 – note well-compacted upper layers and thin horizon of bitumen binder.**

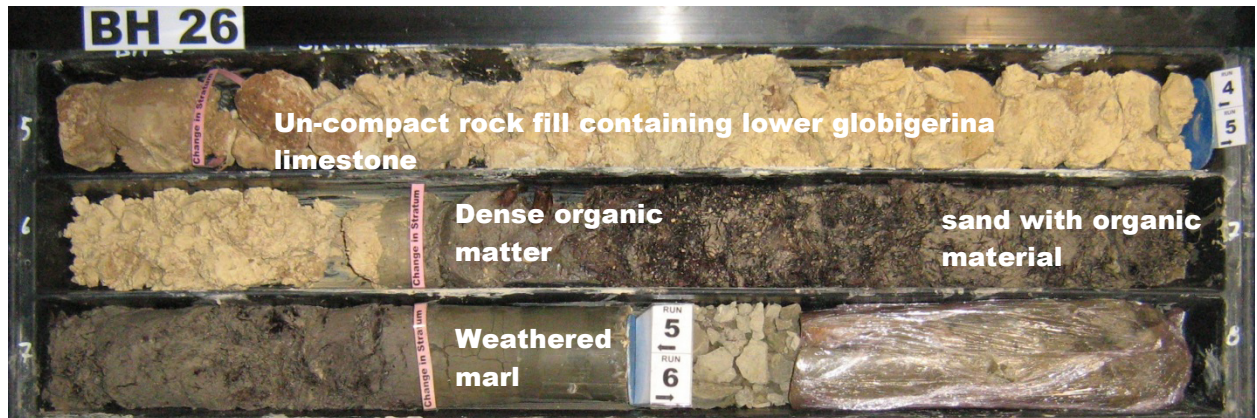
The weak nature of the marl rock fill and its susceptibility to deterioration on exposure suggests that the inter-particle contact points may be subject to crushing as the stresses in the ground increase. If this happens, particle rearrangement will occur, and the fill will then settle. Such phenomena normally happen over a span of time, and therefore the deformation mechanism can be described as long-term creep. This is most common in uncompacted fills made of materials of this type, which are known to experience large settlements over many years.

In some boreholes a layer of silty clay was observed at the bottom of the fill layer. This had the same colour as the olive-grey marl used for reclamation. It appears that a layer of fines was created by the reclamation process, possibly when the adjacent areas were being backfilled, which fines then settled on the seabed before they were covered by further backfilling. Such layers are often of the order of 300mm in thickness, and exhibit characteristics of a stiff clay deposit.

#### **4.4 Quaternary silty sand layer**

This layer is common in all boreholes, although in some cases the retrieved thickness was minimal. It consists of a single-graded carbonate sand, with some silt content and consistently very rich in vegetal matter. Such organic material is often in the form of fibres of the seaweed 'posidonia' that is very common in the sea-grass meadows around the Maltese islands. The presence of such amounts of organic material suggests a sheltered environment in which organic matter was deposited and then regularly interspersed with sand by seabed currents to create a dense but compressible sandy peat layer. Some layers, generally towards the top of the sand layer, were seen to consist in most part of compacted organic matter, generally in thicknesses not exceeding 100mm. These would be significantly more compressible than the layers where sand is the predominant constituent.





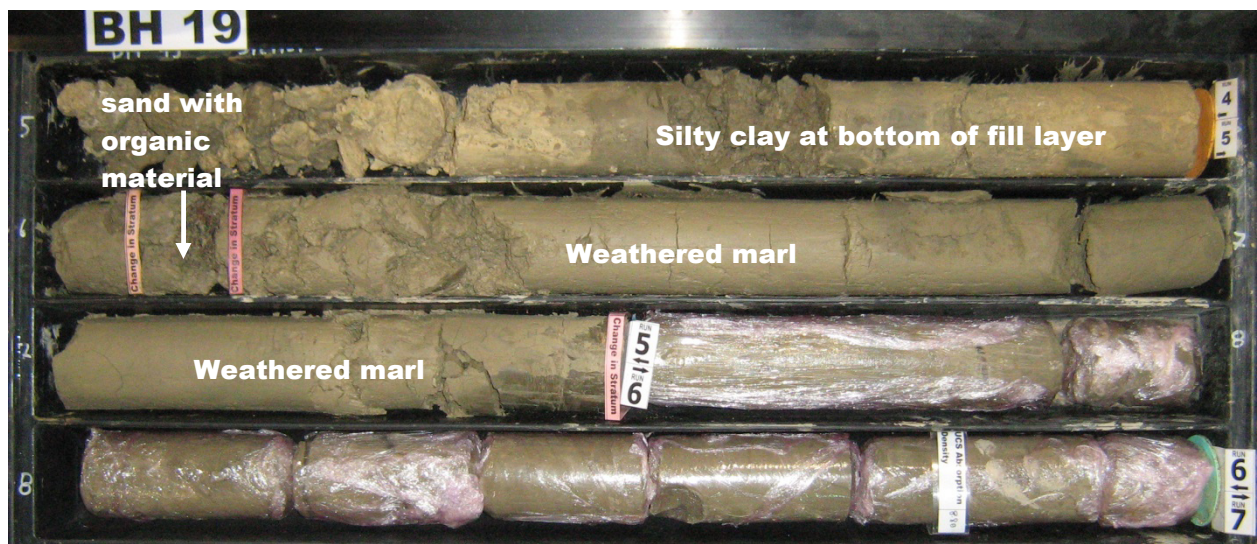
**Figure 33 - Extract from retrieved borehole core showing the organic sand layer and the weathered marl layer**

This layer would be expected to be compressible under loading, and would definitely require support in the case of bored pile construction down to bedrock

#### **4.5 Miocene weathered Middle Globigerina marl**

This layer appears to be present in many boreholes and consists of the weathered version of the more solid sedimentary deposit found at depth. In most cases, this has been retrieved as a very weak rock or stiff clay that easily disintegrates when handled or stroked gently with a geological pick. The texture of this layer is closely microfractured, often in the horizontal direction, resulting in gravel-sized pieces of weak rock (marl) in a surrounding softer clay matrix. This layer has the same olive-grey colour as the underlying Middle Globigerina limestone.

The geotechnical behaviour of this layer would be expected to be similar to that of an over-consolidated clay showing some cementation. Compression and consolidation under loading would be expected.



**Figure 34 - Extract from retrieved borehole core showing the weathered marl layer**

#### **4.6 Miocene Middle Globigerina marl**

The olive-grey, fine grained marl layer forming bedrock has often been retrieved in solid pieces of considerable length, indicating that this layer is mostly massive and generally well-cemented. Close inspection of the retrieved core indicate layering and bioturbation, but the layering is not always perfectly horizontal, possibly following the inclination of strata seen across the Delimara peninsula. Solid core



recovery was much less across some horizons, indicating that variations could possibly exist with respect to strength and microfracturing.

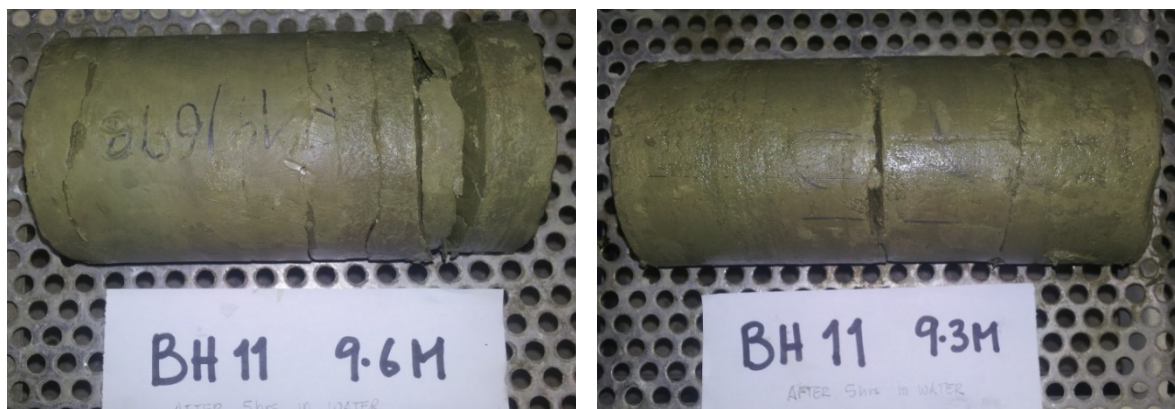
A large number of test specimens were prepared from the retrieved borehole core of this layer, but the results from the tests may be biased towards the stronger strata where the core remained intact. Inspection of the retrieved core revealed several intervals where the core was retrieved in a relatively disturbed and fractured state, thus making it impossible to prepare test specimens from these horizons.

Inspection of these fractured core sections reveals that the fractured zones were of two types – some having distinct horizontal fractures (transverse) while other sections having longitudinal fractures typically created by forces of a torsional nature. The former appear to develop along natural bedding planes, while the latter are not natural but have been created by the drilling process.



**Figure 35 - example of transversally fractured sections of borehole core from the marl layer**

Some sections of borehole core that were put aside for the preparation of test specimens exhibited related phenomena. These core pieces were trimmed to size and then submerged to preserve their saturated state. In some cases, these trimmed cores disintegrated along clearly defined horizontal planes, after some time.



**Figure 36 - test specimens that disintegrated after 5 hours submerged in water**





**Figure 37 - example of longitudinally fractured sections of borehole core from the marl layer**

The longitudinal cracks seen along some section of the retrieved core suggests that the degree of cementation within these intervals may not have been sufficient to resist the torsional forces created by the drilling process, which the overlying and the underlying layers could withstand. This is a common occurrence across many boreholes and is duly noted in the borehole logs.

Also visible in some of the retrieved core are a number of inclined fractures that are smooth, tight and invariably slickensided. Such discontinuities are not common, and most boreholes do not exhibit such features. Such features are however occasionally observed in retrieved core from the Globigerina Limestone formation across the Maltese Islands.

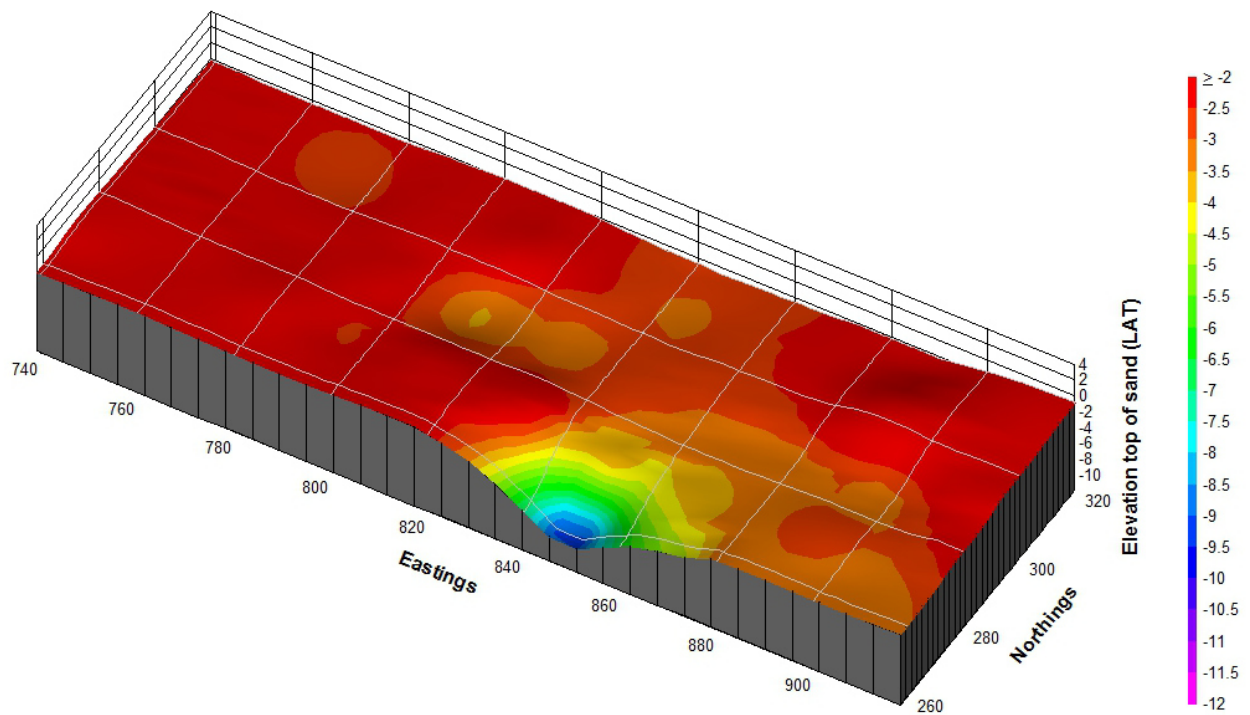
#### **4.7 Ground Conditions –geomorphology**

The various layers observed in each set of retrieved borehole core were classified according to the above sequence for each borehole that was drilled. The relatively large number of boreholes allowed this information to be correlated in relation to a common datum as described in section 2.4 above. Once all the depths to the various strata were converted to elevation above or below zero datum (LAT), these could be plotted on 3-D axes to identify the contours of each layer.

A quadratic fit between points was used to generate a surface that passes through the various coordinate points resulting from the borehole logs. The results of this exercise are shown below, where the various elevations have been colour coded according to their position relative to zero datum (LAT).

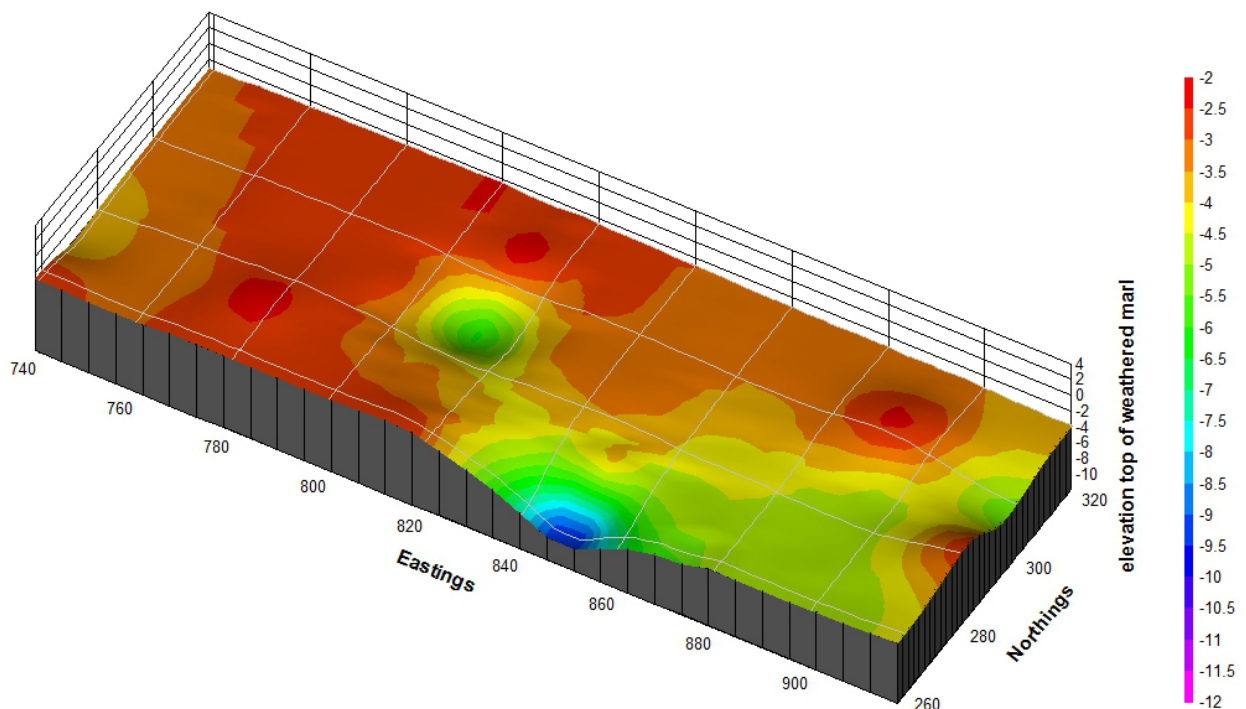
A degree of interpolation and extrapolation was necessary to produce these images. In these diagrams, zero on the vertical scale indicates LAT (lowest astronomical tide). Northings and Eastings are shown in accordance with the agreed Siemens Datum position, and therefore do not correspond with and are not oriented with the North point of the standard National Grid reference system.

2-dimensional contour maps of the three different surfaces, corresponding to the top of the sand layer, the top of the weathered marl layer, and the top of the solid marl layer are shown in Appendix G.



**Figure 38 - Interpolated curve fit between “top of silty sand” positions for the different boreholes.**

It is seen from the above model that the sand layer is more or less uniform across the site, except for the area around borehole 21, where some kind of depressed zone appears to exist. This zone is also reflected in the interpolated profile of the top of the marl layer seen in Figure 40 below. Unlike the sand layer, what can be considered to be solid bedrock is not at all uniform in elevation across the site.

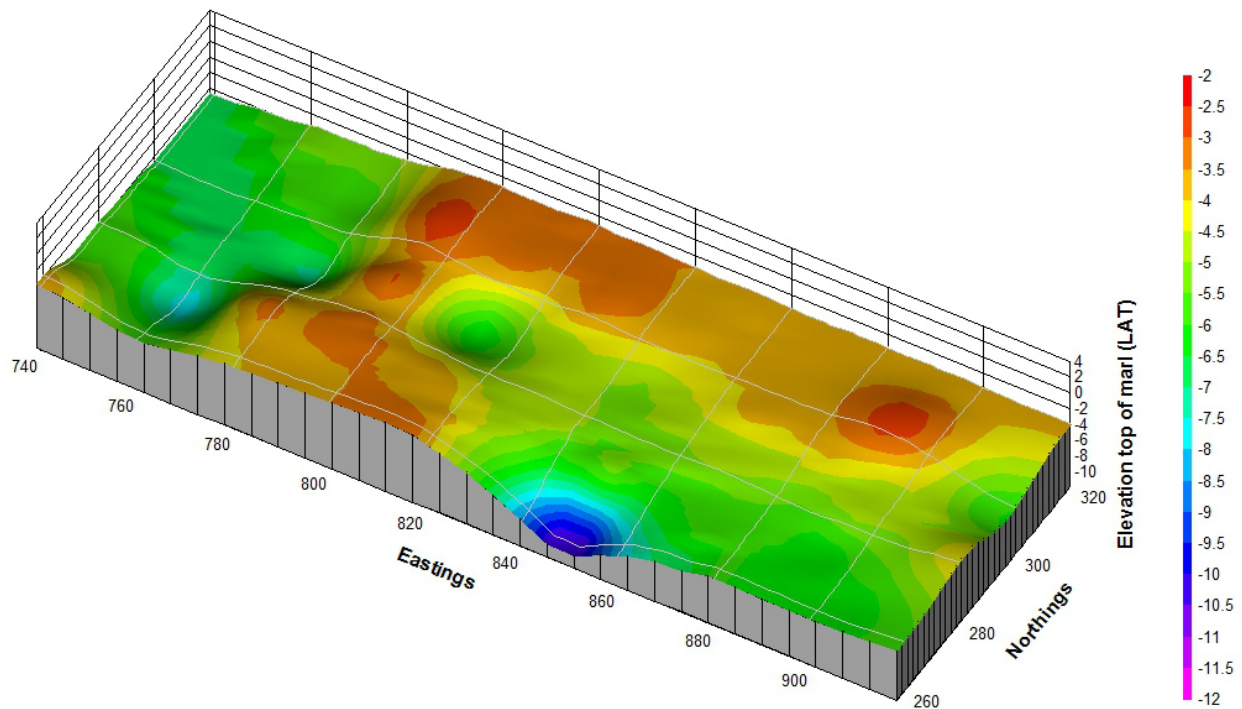


**Figure 39 -- Interpolated curve fit between “top of weathered marl” positions for the different boreholes.**

The surface illustrated in Figure 40 below represents the top of the solid marl layer as identified from the borehole core. This demarcation is somewhat subjective, and would also depend on the quality of the retrieved core and its assessment in the laboratory. In this case, this surface was defined by considering



those levels where retrieved core was distinctly solid, as opposed to the more fractured or microfractured sections. This demarcation, does not, however exclude the presence of further fractured layers at depth. Such layers were observed in several sections of the retrieved cores.



**Figure 40 – Interpolated curve fit between “top of marl” positions for the different boreholes.**

The above demarcations may also need to be considered in the light of results from the downhole seismic tests carried out in some of the boreholes. These tests have indicated that the transition from a weak weathered material to a more competent and solid bedrock at depth is rather gradual and not abrupt as the above figures may infer. These observations are described in detail in Section 6.1 below.

Very prominent in the above figures is the anomalous depressed zone at N 260, E 850, in the vicinity of borehole 21. No other area of the site shows similar depths to bedrock, and this is not repeated in any of the other boreholes. This raises doubts about borehole 21 being representative of the natural profile existing below the site. Inspection of the schematic drawings of the quay cross-section indicates that the base of the larger sections of this gravity structure is founded at a level of -12m below LAT, making formation level significantly deeper than the natural level of the marl along the quay alignment, with the exception of the marl in borehole 21.

This implies that for the quay to present a clear berthing depth of 12m, significant dredging needed to be carried out, both to create the berth and to make space for the retaining structure. It is therefore possible that borehole 21 was drilled through the edge of this dredged area, making the results completely anomalous. Very little sand was in fact retrieved from this location.

## 5 Geotechnical in-situ Testing

### 5.1 General

Geotechnical testing consisted of both site and laboratory based tests. The characteristics of the upper layers were investigated using site tests such as standard penetration tests and plate loading tests, while the marl layer at depth, considered to provide a competent bearing stratum, was investigated primarily through laboratory tests on specimens taken from the retrieved borehole core.

The above tests were then supplemented by and compared to geophysical tests, carried out in the form of downhole seismic tests and HVSr tests.

In the following sections, all test results have been plotted against elevation relative to LAT. The approximate position of the source of each test specimen is indicated by the colour of the dot on the scatter graph representing the results. The different colours refer to the different borehole positions as shown in Figure 41 below. This is relevant for both site and laboratory tests.

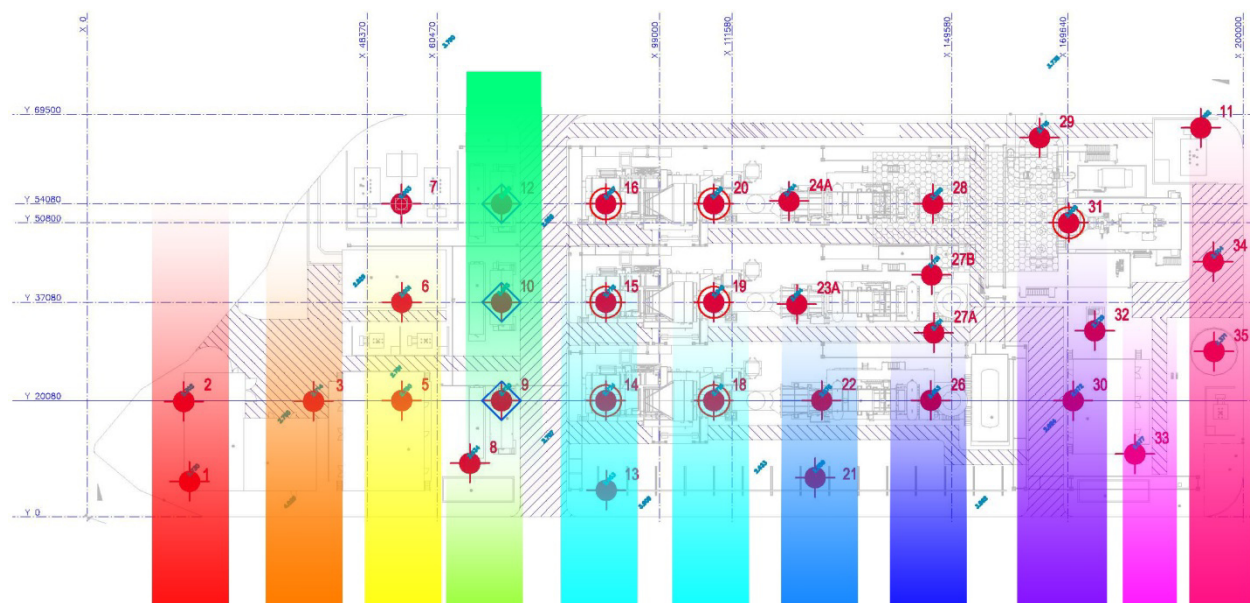


Figure 41 - Colour coding of the borehole positions for presentation of test results.

### 5.2 In-situ Testing

Site based geotechnical testing is summarised below (table 3)

Table 3 - Site geotechnical tests

Test Type and Reference	Stratum	No of tests	Results (Range)	Comments / Limitations
Standard Penetration Test (BS EN ISO 22476-3:2005)	Man-made fill	58 (29 of which were above LAT)	N = 3-50 (average 20)	(Raw SPT N values are quoted rather than corrected N(60) values). 23 tests reached a blowcount of 50
	Sand with organic inclusions	15	N = 4-50 (average 23)	(Raw SPT N values are quoted rather than corrected N(60) values). 5 tests reached a blowcount of 50.

Plate loading tests (BS EN ISO 22476-2:2005 +A1:2011)	Uppermost crust of reclamation fill	4	$E_{ur} = 350 - 504 \text{ MPa}$	Carried out using the 300mm dia. plate One set of test results considered unreliable for the unload/reload stage.
	Horizon at LAT + 2.30m	3	$E_{ur} = 183 - 438 \text{ MPa}$	Carried out using the 762mm dia. plate. Excavation of approx. 0.5m of fill was required to carry out these tests
Anchor pull-out tests	Marl Bedrock	3	$\tau_{sf} = 0.382 - 0.882 \text{ MPa}$	Failure may not have necessarily occurred at marl/grout interface

### 5.3 Standard penetration tests

Standard Penetration Tests were carried out at various levels within 25 of the 33 boreholes. These tests were all carried out using a solid cone in most cases, except for tests in boreholes 2 and 3.

The results are presented in Figure 42 below. It is seen that a considerable number of tests have a normalised blowcount exceeding 60, implying that the sampler could have hit a large boulder which could not be dislodged, split or penetrated by the hammering action used during the test. Some of the tests, on the other hand, probably went through semi-empty spaces, giving a very low blow count. It is seen that most test results have a normalised blow count between 25 and 42, indicating that the reclamation fill can be considered to be a dense fill.

Inspection of the SPT results so far suggests that the upper layers of the fill, above LAT, could be marginally denser than the fill at depth. This, however, needs to be considered in the light that such fills are rarely homogenous or uniform in their composition. On the contrary, they tend to be made up of different materials having a very wide range of particle sizes, as demonstrated by the trial pits opened during this investigation. The upper compacted layer seen in the trial pits, does however feature in these results as a very dense fill.

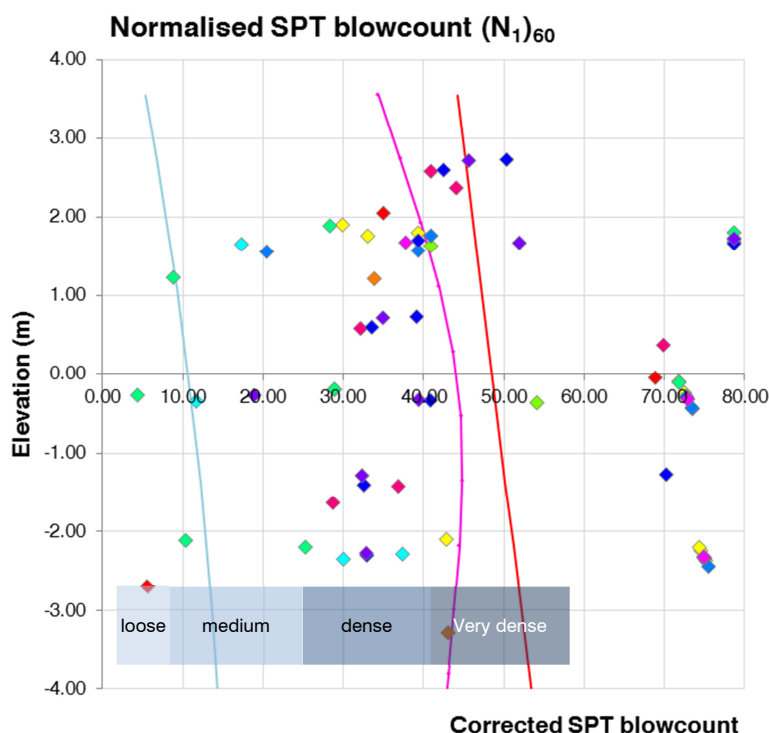


Figure 42 - Results of Standard penetration tests

## 5.4 Plate loading tests

Plate loading tests were undertaken to determine the deformation and strength characteristics of the fill that is in close proximity to the existing ground level. The tests at locations 1, 2 and 3 were assumed to provide data for the design of foundations, and so the 762mm diameter plate was used and an excavation level of LAT +2.30m was assumed for the proposed construction of spread foundations. The tests were thus carried out in small pits excavated to this level, implying the removal of the first 0.5m of fill in all three locations. This implies that the upper crust, hardened and compacted by vehicle movements, would have been removed to some degree.

The maximum stress level achievable using the large plate was 200kPa, which resulted in total settlement of around 4mm. This, however, would include deformation due to bedding of the plate, which will not exist in reality. The unload-reload part of the curve is therefore considered to be a more realistic representation of the behaviour of the fill. The results from the tests using the large plate are shown in Figure 43 below.

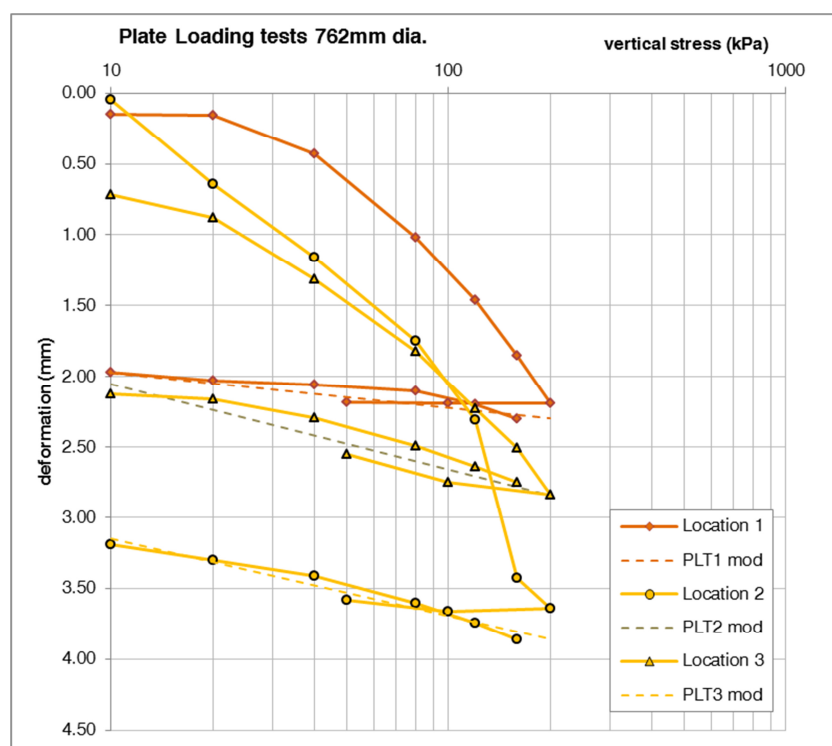


Figure 43- Results of plate loading tests carried out using the 762mm diameter plate.

These results can be compared to the same set of results from the tests carried out using the 300mm diameter plate. In these four tests, no excavation was carried out and the test was performed on the ground as existing. It was assumed that the new site levels would likely be at LAT +3.00m, and therefore the roads proposed for these areas will need backfill on the existing material. Excavation would therefore not be required.

The maximum stress level achieved during these tests amounted to 500kPa, and the total deformation was in this case much less, reaching a maximum of 1.58mm at location 6. Once again, the unload-reload part of the curve was considered to be more representative of the real behaviour of the underlying materials. The results from the tests using the smaller 300mm diameter plate are shown in Figure 44 below. One test, at location 5, experienced malfunction of the hydraulic jack creating the load, and the deformations obtained during the unload/reload part of the test cannot be considered to be realistic.



Calculation of the Plate loading deformation modulus was based on the unload-reload part of the curve, and the calculations are presented in Table 4 below. In these calculations, a pressure bulb depth equivalent to the diameter of the plate was assumed for the purpose of calculating strain. The straight line fit used to find the modulus is shown by the dotted line for each plate loading test curve.

Calculations to DIN 18134 for values of  $EV_1$  and  $EV_2$  were also carried out for the 300mm plate loading tests. These are shown in the relevant certificates in Appendix D.

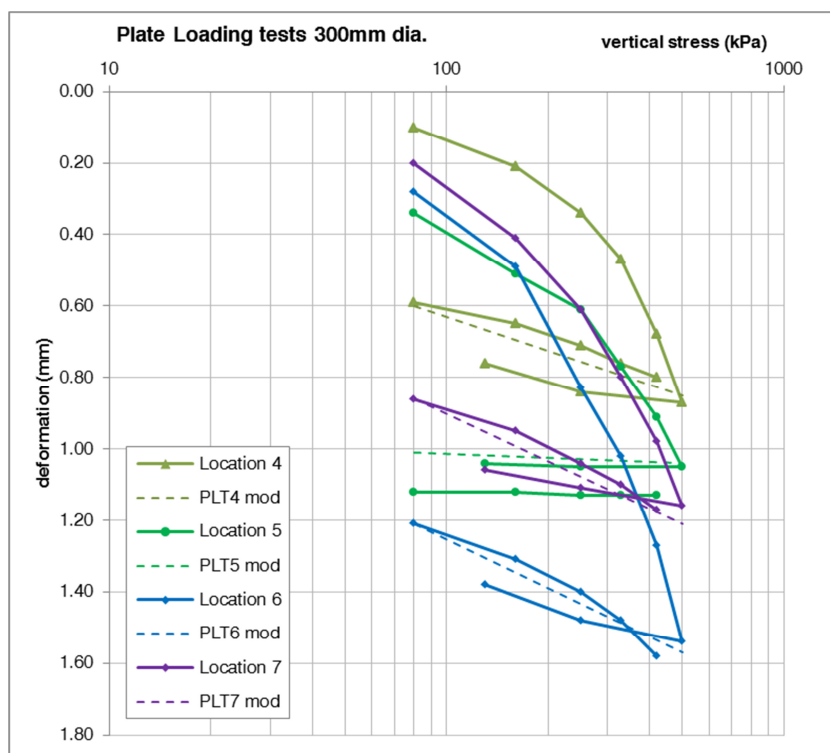


Figure 44 - Results of plate loading tests carried out using the 300mm diameter plate.

It is seen in Table 4 below that there seems to be reduction in deformation modulus for the tests carried out using the larger plate. This would be expected, due to the fact that the upper compacted crust might have been removed in full or in part by the excavation required to reach the proposed test level. The ground at this level might also have been subjected to some disturbance from the excavation process itself.

Table 4 - Determination of Deformation modulus from Plate loading tests

Test	Dia.	Stress		Deformation		Strain				modulus
PLT	D mm	$\sigma$ kPa	$\sigma$ kPa	$\delta$ mm	$\delta$ mm	$\epsilon$	$\epsilon$	$\Delta\sigma$ kPa	$\Delta\epsilon$	$E_{ur}$ MPa
1	762	10	200	1.97	2.3	0.00259	0.00302	190	0.000433	<b>438.73</b>
2	762	10	200	2.05	2.84	0.00269	0.00373	190	0.001037	<b>183.27</b>
3	762	10	200	3.15	3.86	0.00413	0.00507	190	0.000932	<b>203.92</b>
4	300	80	500	0.6	0.85	0.00200	0.00283	420	0.000833	<b>504.00</b>
5	300	80	500	1.01	1.04	0.00337	0.00347	420	0.000100	<b>unreliable</b>
6	300	80	500	1.21	1.57	0.00403	0.00523	420	0.001200	<b>350.00</b>
7	300	80	500	0.86	1.21	0.00287	0.00403	420	0.001167	<b>360.00</b>

## 5.5 Anchor pull-out tests

Three anchor pull-out tests were successfully carried out in the boreholes specifically prepare for this purpose. After grouting each anchor rod, the depth to the hardened grout was checked using a dip-stick

and compared to the original depth of the borehole prior to grouting. The following results were obtained:

- Borehole 9: 1000mm of grouted length of anchor
- Borehole 10: 650mm of grouted length of anchor
- Borehole 12: 660mm of grouted length of anchor

The above results suggest that the grouting procedure resulted in a significantly stronger anchor being created in borehole 9, due to the greater anchorage length. This was in fact demonstrated in the results, notwithstanding the fact that the anchor in borehole 9 was located at a higher level than the other anchors in boreholes 10 and 12. The grouted part of the anchor was located at -7.36m relative to LAT for borehole 9, while it was located at -11.9m relative to LAT for borehole 10 and at -11.8m relative to LAT for borehole 12.

Test cubes taken during the grouting operation indicate a 7-day strength of at least 45 N/mm<sup>2</sup> being achieved for the neat cement mix used. This may, however not be representative of the actual grout strength at the grouted body, due to the fact that water was injected at high pressure to obtain a grout column of the required length. The top part of the grout body may have been contaminated with water, resulting in a higher water cement ratio and therefore a lower strength.

The results for the three tests are shown in the following figures. It is evident that full failure was reached when loading the anchor in borehole 12 but was only approached in the other two boreholes. In the case of the anchor in borehole 10, the collar connection (between the 12m and the 5m bar segments making up the anchor) snapped, and the test was abandoned at a maximum load of 275kN.

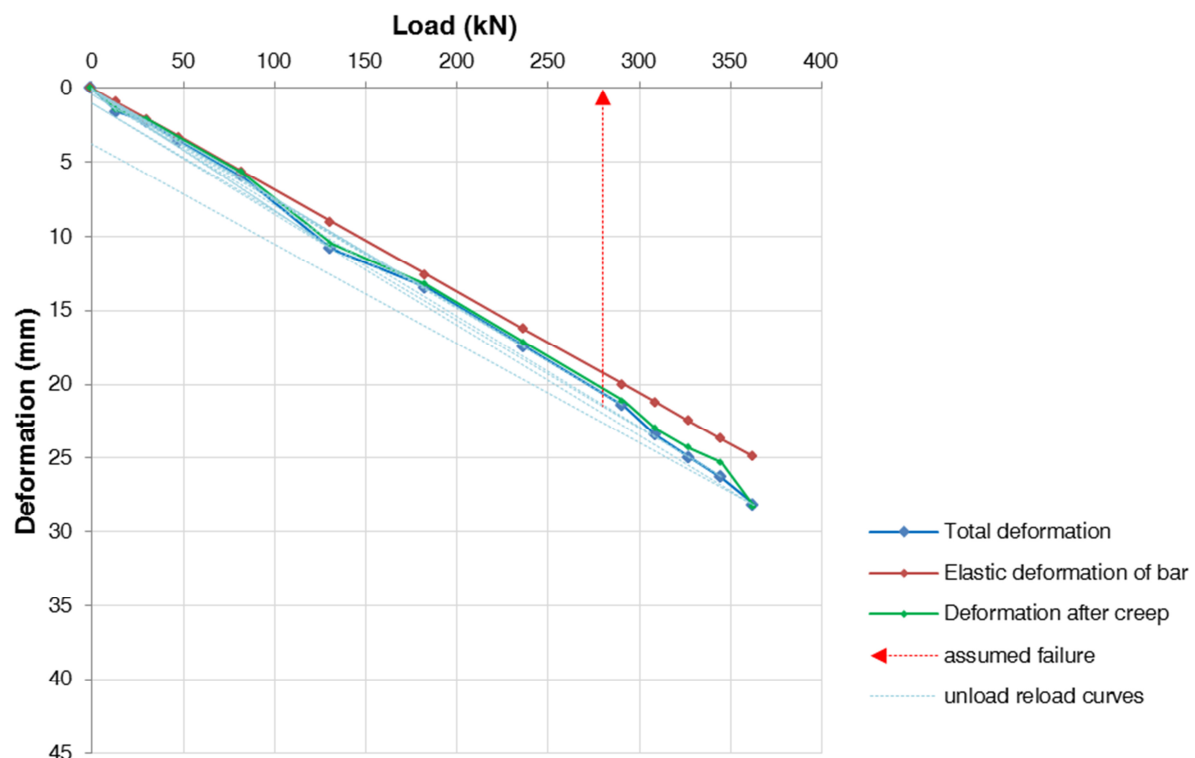


Figure 45 – Load deformation curve for anchor in borehole 9

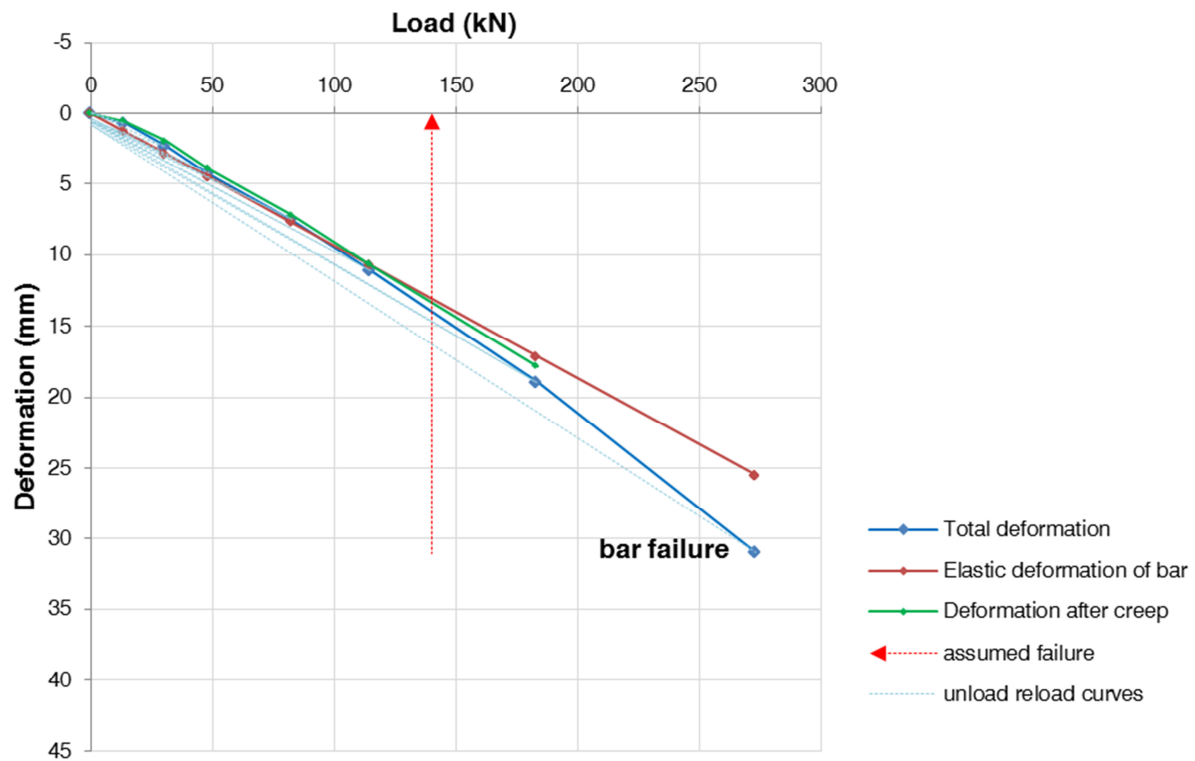


Figure 46 – Load deformation curve for anchor in borehole 10

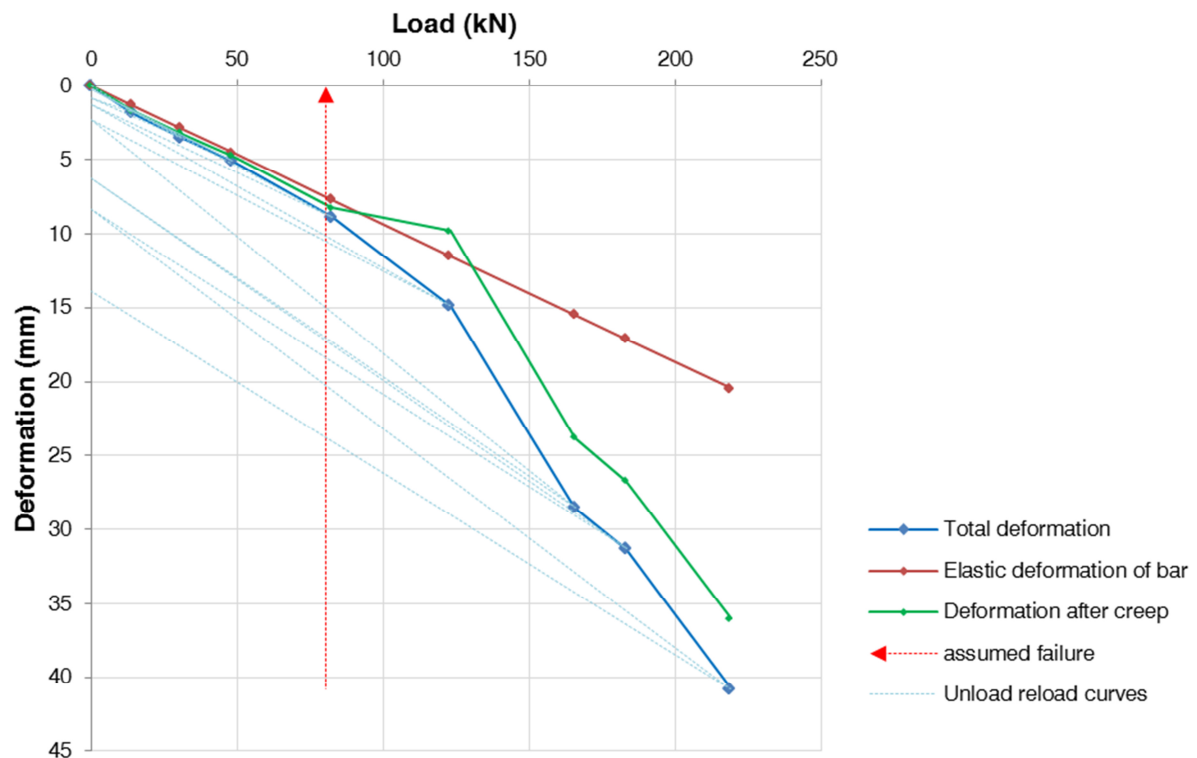


Figure 47 - Load deformation curve for anchor in borehole 12

Some amount of irreversible deformation was evident in all three pull-out tests. In the case of the anchor in borehole 12, this was much better developed and reached a total of around 14mm, whilst reaching only 4mm in the case of borehole 9. The anchor in Borehole 10 snapped before permanent deformation could be measured for the maximum load attained.

For each pull out test, the overall elastic deformation the 32mm dia. steel anchor bar was calculated for each load stage, and the estimated extension plotted on each of the load–deformation curves. This is shown by the red line in the above diagrams.

It is evident that all three load–deformation curves exhibit a linear portion, which experienced negligible permanent deformation on unloading. Beyond a certain load level, however, permanent deformations are no longer negligible and the gradient of the load-deformation curve increases. The load level at which this happens was deemed to be the onset of plastic failure, in the grout/steel bar interface, or in the marl/grout interface. The load level at which this was deemed to happen is indicated by the small red arrow on the above figures. Subsequent calculations to determine the interface stresses were then based on these chosen values.

The change in deformation with time was also measured during each loading stage. Readings of deformation were taken at time periods of 0,1,2,4 and 16 minutes after applying each load step, and then again after taking the load back to zero. It was observed that in most cases, the deformation was marginally decreasing with time (rather than increasing, as would have been the case if creep was occurring), probably as a result of some relaxation of the loading system and its hydraulics. The occurrence of creep deformation was therefore deemed to be insignificant during these tests.

Also measured during the pull-out test were the levels at the ends and midpoint of the reference beam supporting the dial gauge measuring deformation of the anchor. Such levels were checked using a theodolite at the end of each loading step. No movement whatsoever was observed in the reference beam, and so no corrections to the deformation data were necessary.

The results, based on the assumed onset of failure points chosen as described above, are presented in Table 5 below. It can be seen that there is considerable variation in the results obtained, and that the interface stress developed in Borehole 12 is less than half that developed in Borehole 9. The unconfined compression strength of marl specimens from the boreholes are also shown, these being chosen on the basis of proximity to the test location and horizon. The interface stress (or grout skin friction) developed during the test (at the onset of failure) is then expressed as a proportion of this unconfined strength, through the parameter  $\alpha$ .

**Table 5 – Results of pull-out tests**

Anchor pull-out test	Grouted length	Onset of failure	marl/grout interface stress	UCS marl ( $\sigma_c$ )	$\tau_{\text{skin friction}} = \alpha(\sigma_c/2)$ $\alpha$
	m	kN	MPa	MPa	
<b>Borehole 9</b>	1.00	240	0.882	12.35	0.143
<b>Borehole 10</b>	0.65	140	0.679	15.64	0.087
<b>Borehole 12</b>	0.66	80	0.382	12.09	0.063

A number of factors may have affected the results of these tests, which factors need to be taken into consideration when calculating the mobilized interface stress. The kind of failure experienced in boreholes 10 and 12 may have been due to premature failure in the grout/anchor interface or in the anchor assembly itself, considering that the grouted anchorage length in these boreholes was shorter. The values obtained may therefore represent minimum values for interface stress, with borehole 9 giving more realistic figures.



The grout to marl interface on which the interface strength is mobilized, depends to some extent on the interlock that is created between the grout and the marl. The quality or smoothness of the surface created when forming the hole is therefore important in determining the interface strength that can be mobilized. In this case, the surface created by the borehole drilling process was probably relatively smooth in comparison to the surface that would be created by a full size pile-boring machine.

The pull-out tests are carried out by tensioning the anchor element. This implies that the tensile stresses this created on the grout body would create negative (tensile) strains at the marl/grout interface, due to the lateral contraction effect normally described by Poisson's ratio. This would be in complete reversal of the situation developed at the interface between a compression foundation element and the surrounding marl. Considering this effect, as well as the alleged smoothness of the bore, the estimates of interface strength evidenced by these tests are likely to be conservative.

## 6 Geophysical tests

### 6.1 Downhole seismic tests

*This part of the report has been prepared by Dr. Giuseppe Coco of Geoscheck Srl.*

The downhole seismic tests provided useful very information, both in terms of stratigraphy and in terms of the physical properties of the various layers. This information complements the information from the retrieved borehole core and from the laboratory tests discussed in Section 7 below: Geotechnical in-situ Testing, and was very useful in understanding the overall characteristics of the site.

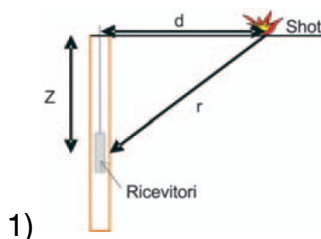
#### 6.1.1 Estimated time of arrival and first data processing

The seismic signals recorded in digital format were analyzed in the time domain with the appropriate software on the Linux platform (CWP/SU) for the estimation of the first arrival of seismic waves (P and S).

The first arrival times of the waves S were determined using the procedure of Boatwright (1987), which involves the technique of phase inversion after rotation of the horizontal components of the geophone.

The processing of data is to plot the journey times  $t$  measured along the source-receiver path in function of the depth  $z$ . The procedures of interpretation applied to the data set recorded are: the direct method and the modified interval method.

In the direct method are plotted the travel times measured  $T_{OSS}$  along the path source-receiver function of the depth  $z$ . The  $T_{OSS}$  must be corrected to take into account the inclination of the path of the waves. The equation that allows such a correction, depending on the depth of investigation is the following:

$$t_{corretto} = \frac{z}{r} \cdot t_{osservato} = \frac{z}{\sqrt{z^2 + d^2}} \cdot t_{osservato}$$


**Figure 48 - Seismic wave propagation, where  $Z$  = depth of investigation,  $r$  = distance between source and receiver,  $d$  = distance between the source and the hole axis**

In the **modified method interval** is measure the travel times of the seismic wave between two consecutive receivers located at different depths (Figure 49). Compared with the direct method, this allows for greater definition of the velocity profile. The velocity of seismic waves P and S between two consecutive receivers is equal to:

$$V = \frac{r_2 - r_1}{t_{2CORR} - t_{1CORR}}$$


**Figure 49 - Seismic wave path where  $r_1$  = distance between the source and the first receiver,  $r_2$  = distance between the source and the second receiver,  $t_1$  = travel time correctly between the source and the first receiver,  $t_2$  = travel time correctly between the source and the second receiver.**

Finally, the measured times allow, in function of the distance between the point of energization and reception of signals, to define, for each interval, the P-wave velocity ( $V_p$ ) and S-wave ( $V_s$ ), to calculate the Poisson coefficient ( $\nu$ ) the elastic-dynamic moduli and the geo-seismic parameters.

### 6.1.2 Elastic moduli and geo-seismic parameters definition

The determination of the elastic moduli is based on the theory of elasticity, according to which, for impulsive and low energy stresses, elastic bodies show deformations linearly proportional to the applied forces (linear relationships between the components of stress and strain).

These assumptions are reasonable for soils and rocks, to which we can attribute the properties of elastic bodies: homogeneity, isotropy and continuity. Therefore, for impulsive and low energy stress, soil and rock behave according to Hooke's law:

$$\sigma = \varepsilon K$$

where:  $\sigma$  = stress,  $\varepsilon$  = strain,  $K$  = constant factor.

$K$  is a generic proportionality coefficient that can have different physical meaning with respect to the nature of the applied forces and the resulting deformation (elastic constant of the material).

The strains and strains generated by a seismic input can be considered impulsive stress of low energy; therefore, as already mentioned, soils under seismic waves show elastic deformations. These deformations are correlated in one-correspondence with the P and S phases of the seismic input. Actually, the propagation velocity of seismic waves varies with the geo-mechanical characteristics and physical properties of the rock types and therefore enables information about the elastic properties of the crossed soil layers to be gained.

The parameters used to define the elastic properties of a body when it is subjected to a stress are reported below:

- **Modulus of elasticity or Young's modulus (E)**, which provides a measure of the stress-strain ratio in case of simple torsion or compression. The Young's modulus depends on the porosity and on the lithostatic pressure. The minimum values are found in high-porosity and gas-saturated lithotypes, whereas the maximum values are obtained for low-porosity rock types, under pressure and in water-saturated conditions.
- **Geophysical density ( $\gamma_{dyn}$ )**, a factor that specifies the soil's compaction and density, equivalent to the weight of the geotechnical volume
- **Poisson's ratio ( $\nu$ )** which represents the geometric deformation achieved by an elastic body, and ranges from 0.2 to 0.3 for compact rocks; from 0.3 to 0.35 for sands and from 0.4 to 0.5 for clays;
- **Stiffness modulus (G)**, expressing the stress-strain ratio for a shear stress, and defines the body's resistance to variations in shape. This parameter is strongly dependent on the porosity and on the lithostatic pressure, assuming low values in highly-porous lithotypes, in low-pressure conditions and water-saturated.
- **Bulk modulus (K)** measures the stress-strain ratio in presence of hydrostatic pressure and indicates the material's resistance to changes in volume. This parameter varies with the porosity, with the pressure and with the amount of water present in the rock. Increases with the saturation, with decreasing porosity and with increasing lithostatic pressure.
- **Contrast modulus (M)** which expresses the stress-strain ratio for a compression stress, and defines the body's resistance to variations in the direction perpendicular to the propagation front. This parameter is strongly dependent on the porosity and on the lithostatic pressure, and assumes low values in highly-porous lithotypes, in low-pressure conditions and no water.

### 6.1.3 Geo-seismic Parameters

These parameters are used to quantify the seismic behavior of a litho-stratigraphic set, in terms of transmission of seismic energy from one layer to another. This characteristic is related to the seismic impedance ( $I_s$ ) and to two related coefficients: refraction coefficient ( $t$ ) and reflection coefficient ( $\xi$ ).

**Seismic impedance ( $I_s$ )** - The seismic impedance is given by the product of the propagation velocity of transverse waves and the medium density in which the wave propagates. The  $I_s$  is a parameter that allows to evaluate the seismic amplification at the site.

**Reflection and refraction coefficients ( $t$  and  $\xi$ )** - These coefficients represent the ratio of the amplitude of the reflected or refracted wave and the amplitude of the incident wave.  $\xi$  can vary between -1 and +1: when  $\xi$  tends to +1, the reflected wave has the same phase and amplitude of the incident wave, while when  $\xi$  tends to -1, the reflected wave will have the same amplitude of the incident wave, but in phase opposition. The coefficient  $t$  is always positive and, where soils have strong seismic impedance contrast ( $\rho_2 \gg \rho_1$ ),  $t$  tends to 2 which corresponds to an increase in the portion of transmitted energy.

### 6.1.4 Results

The aim of the study was to calculate the velocity of propagation of seismic waves in volume (P and S) by measuring the travel time of seismic waves generated and recorded by the down-hole technique.

In the area under consideration, the seismic velocity increases with depth, but some local decrease in wave velocity is observed along some of the vertical measurement profiles. The model obtained from the seismic measurements can be traced to three seismic layers.

The first level is the "low-velocity layer" of the study area, and is due to man-made reclamation fill. This layer shows a regular trend of the velocity of the shear waves, while that of the P wave is very irregular. At the elevation between -4 and -5 meters and as far as -9 meters, the seismic velocity gradually increases (transition zone). This is a transition zone to the high velocity layer. Lithologically the "transition zone" can be referred to the silty sand with high organic content and/or the weathered Middle Globigerina Marl, while the area at high speed can be correlated with the Middle Globigerina Marl.

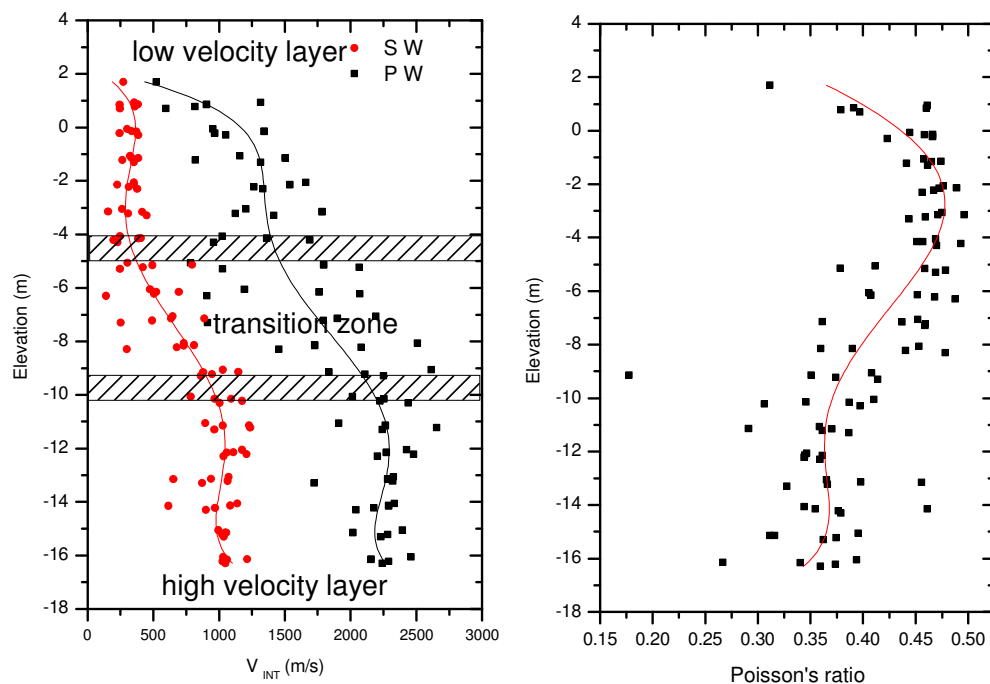
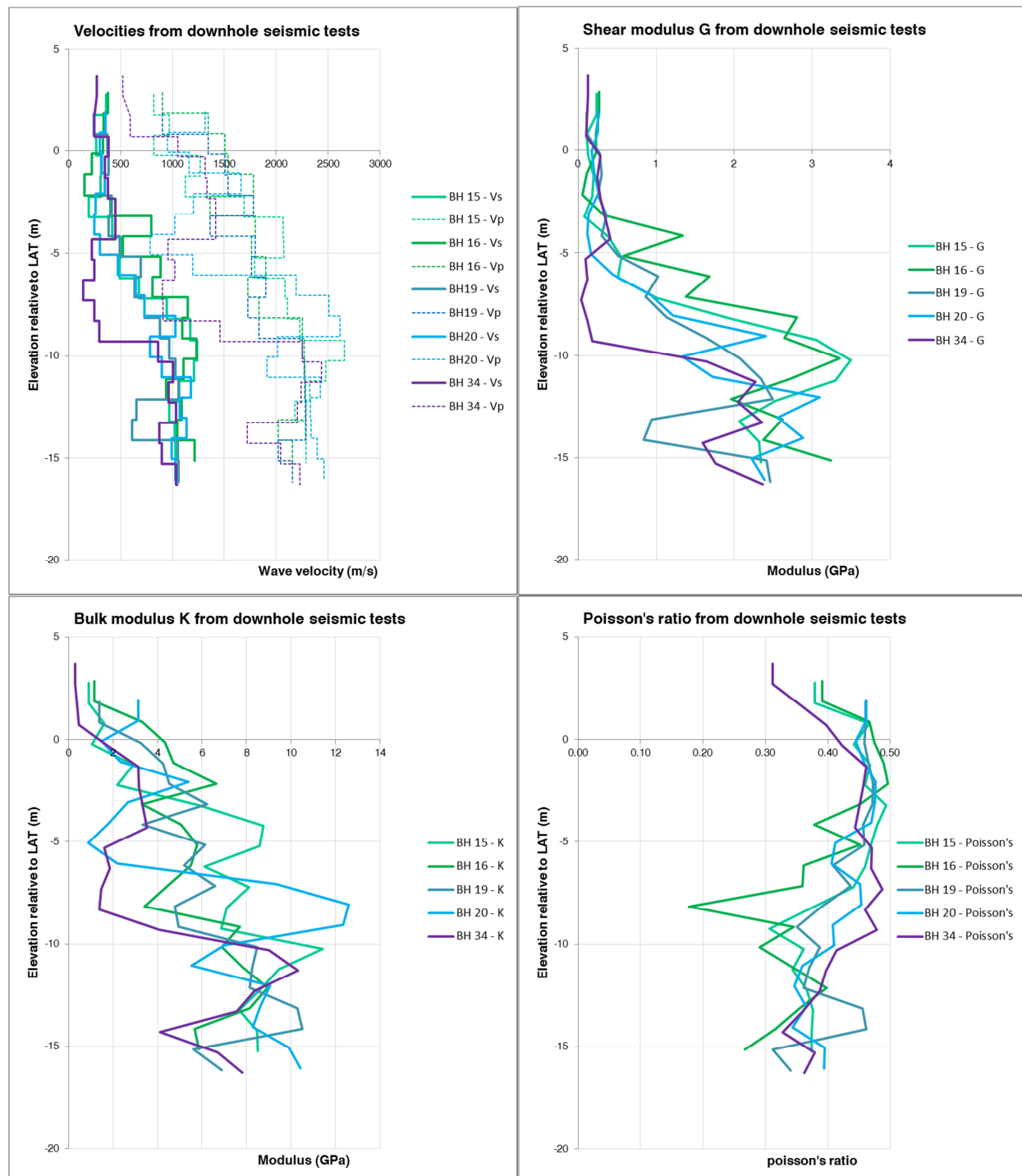


Figure 50 - Compressional and Shear Velocity - Poisson's ratio



The results from the downhole testing programme are summarized in the graphs presented in Figure 51 below. All the results have been corrected for the top level of each borehole, and are therefore shown in relation to LAT.



**Figure 51 - Results of downhole seismic tests**

It is clear from these results that the stratification proposed earlier may actually be subject to some refinement where dynamic properties are concerned. The velocities and the derived moduli indicate an upper layer of very low shear stiffness, corresponding with the upper layer of reclamation fill and the underlying sand. There is, however, a gradual transition between the surface of the underlying weathered rock and solid rock at depth in four of the five boreholes. This transition occurs over a depth

of 5-6m over which the stiffness of the rock increases gradually. The transition is, however more abrupt in borehole 34, where the shear velocities increase at a level of LAT -9.0m.

This implies that the average 0.9m thickness of weathered marl described in Table 2 above could be better thought of as a thicker intermediate layer which gradually becomes more competent with depth.

Further information about the geophysical tests is given in Appendix F: Geophysical Tests.

## 6.2 Shear wave velocity profiles obtained from non-invasive ambient noise techniques

*This part of the report has been prepared by Dr. Pauline Galea and Ms. Daniela Farrugia, Seismic Monitoring and Research Unit, Department of Physics, University of Malta.*

Surface waves are one type of waves which are present in ambient noise. Rayleigh waves, which belong to the category of surface waves, have properties which are mainly related to the thickness and the shear wave velocity of the different stratigraphical layers. One of their important characteristics is that they are dispersive, meaning that Rayleigh waves with different frequency/wavelength travel at different speeds and sample different depths. Lower frequency waves sample the deep parts of the profile while higher frequencies contain information on the shallow part. (Scherbaum *et al.*, 2003). A curve of Rayleigh wave velocity vs. frequency, known as a dispersion curve, can be obtained using an array of geophones.

The Horizontal-to-Vertical Spectral Ratio technique (H/V or HVSR) is a single-station technique utilizing the 3 components of ambient vibrations. This method is used to find the resonance frequency ( $f_0$ ) of a site which is characterized by a soft layer overlying a harder one.  $f_0$  is known to be related to the average shear wave velocity  $V_s$  of the softer layers and the depth  $H$  to bedrock by the equation:

$$f_0 = \frac{V_s}{4H}$$

Assuming that surface waves dominate ambient noise, this equation contains valueable information about the thickness of the soft layer and its average velocity.

The dispersion curve and the H/V curve can be jointly inverted to obtain a reliable shear wave velocity profile – the dispersion curve constrains the depth dependence of the shear wave velocity while the peak frequencies of spectral ratios constrain the layer thickness (Scherbaum *et al.*, 2003).

The depth to which the profile may be reliably resolved depends mainly on three factors:

- The array dimensions (the larger the array, the larger the depth that can be resolved)
- The wavefield of the noise present
- The high pass filter effect of a layered medium – this makes it difficult to predict the velocities of the layers lying underneath the ‘soft’ layers. (Scherbaum *et al.*, 2003)

Even though such limitations are present, such ambient noise techniques have been used worldwide since they can provide very reliable results in a non-invasive and cost-effective way.

### 6.2.1 Methodology

The array measurements were used to extract dispersion curves using the Extended Spatial AutoCorrelation (ESAC) method. Briefly, this method uses the correlation coefficient from the data recorded between all the station pairs to create a dispersion curve.

During the survey, single station measurements of 30 minutes of ambient noise were also taken at 4 points, using a 3-component portable seismograph. These time series were used to obtain Horizontal-to-Vertical Spectral Ratios (H/V).

A Genetic Algorithm approach (Albarelo *et al*, 2011) was utilized to invert the dispersion and the H/V curve. In the inversion process, a set of parameters for each layer are inverted from the data: the thickness (H), the shear-wave velocity ( $V_s$ ), the P wave velocity ( $V_p$ ) and the density ( $\rho$ ). The dispersion and H/V curve are not affected significantly by  $V_p$  and  $\rho$  and these are therefore not well constrained by this method. The main layer properties affecting the propagation of Rayleigh waves are the thickness and  $V_s$  of the respective layers.

For the inversion process, the parameters were allowed to vary between minimum and maximum values as shown in Table 1. Since the depth to 'bedrock' was known beforehand, the thicknesses could be constrained more than the other parameters. It was also specified in the inversion programme that low velocity layers could be present in the stratigraphy.

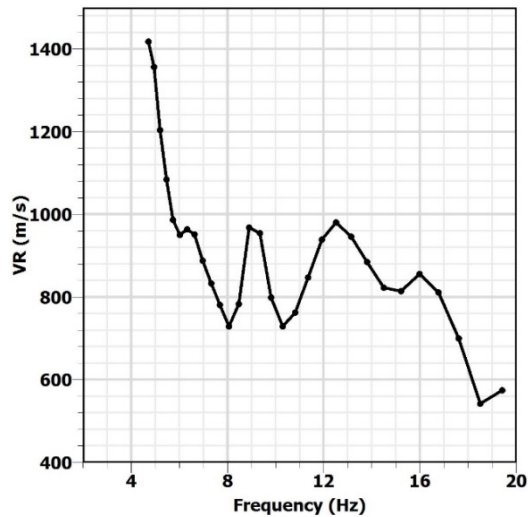
**Table 6: The initial parameters for array 1. The red numbers show the only different parameters used for Array 2 (the other numbers were left as in Array 1). The zeros in the last row refer to the half-space.**

Layer	$H_{\min}$ m	$H_{\max}$ m	$V_{P\min}$ m/s	$V_{P\max}$ m/s	$V_{S\min}$ m/s	$V_{S\max}$ m/s	$\rho_{\min}$ kg/m <sup>3</sup>	$\rho_{\max}$ kg/m <sup>3</sup>
1	1	2/3	100	600	50	500	1200	2200
2	1	2/3	500	1500	100	600	1200	2200
3	1	2/3	100	1500	150	700	1200	2300
4	3	5/8	800	1500	200	800	1200	2300
5	10	50	1300	1800	500	1000	1000	3000
6	40	100	1300	2000	500	1500	1000	3000
7	100	1000	1200	5000	800	2500	1000	3000
8	0	0	1500	6000	800	3000	1000	3000

In brief, the inversion process produces a number of models by moving through the defined parameter space and computes the dispersion and H/V curve for each models. A misfit function, which calculates the 'distance' between the points of the theoretical curves and the experimental curves, is worked out and the model with the lowest misfit is chosen to be the best model.

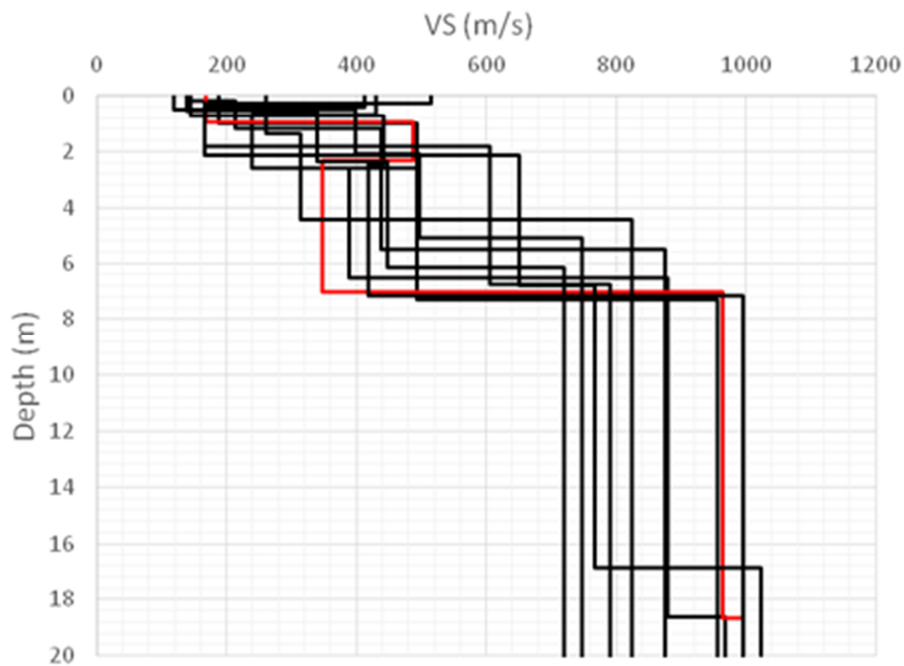
### 6.2.2 Results from Array 1

The dispersion curve (Figure 52) shows a general increase in velocity with decreasing frequency, which is associated with an increase in shear wave velocity with depth.



**Figure 52: The dispersion curve for Array 1**

Figure 53 shows the best-fitting set of models together with the model with the minimum misfit (in red) obtained by jointly inverting the dispersion and H/V curves.



**Figure 53: The profiles generated from 10 different inversion runs. The profile in red shows the profile having the minimum misfit (i.e. the best profile). Depth is measured from LAT.**

Details of the best-fit profile (starting from LAT (Lowest Astronomical Tide, as defined in Site Datum plans)) are given in Table 7. In this profile the major Vs discontinuity occurs at a depth of 7 m and is interpreted to be the top of the bedrock. Wave velocities below this depth cannot be considered as reliable.



**Table 7: The results from the inversion process from Array 1. The second column shows the depths of the layers (not thicknesses).**

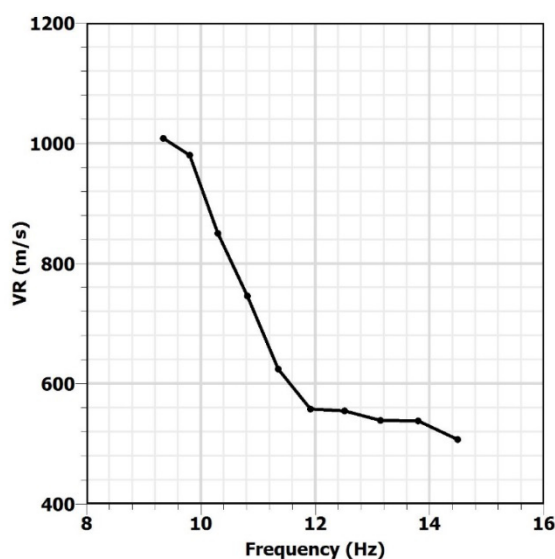
Layer	Z m	$V_p$ m/s	$V_s$ m/s	$\rho$ kg/m <sup>3</sup>
1	0 - 0.950	815.738	167.937	1719.453
2	0.950 – 2.320	1308.065	488.172	1723.363
3	2.320 – 7.000	1116.813	347.801	2063.539
4	7.000 – 18.650	1458.847	964.809	1782.014
5	18.650 – 105.750	2246.285	996.579	1930.596
6	105.750 – 881.410	4550.538	881.427	2622.678
7	0	5780.059	2853.763	2892.473

Soil classification is commonly given in terms of  $V_{s30}$ , the average shear wave velocity in the first 30m of subsoil. The  $V_{s30}$  for this profile was found to be 595 m/s. This corresponds to Site Class C on the NEHRP classification i.e. very dense soil and soft rock category. The  $V_{s30}$  calculated for the profile obtained using the downhole logging method (Section 5.5) (extrapolating the velocity at 18m down to 30m) was 675 m/s. The difference arises mainly from the fact that the velocities of the bedrock calculated from Rayleigh wave dispersion was around 970 m/s while that from the downhole experiments was around 1100 m/s.

On the other hand,  $V_{s10}$  (the average velocity of the first 10 m )from the two measurements shows a much better agreement. The  $V_{s10}$  for the profile obtained by inversion process was calculated to be around 335 m/s while that obtained from downhole experiments was 365m/s.

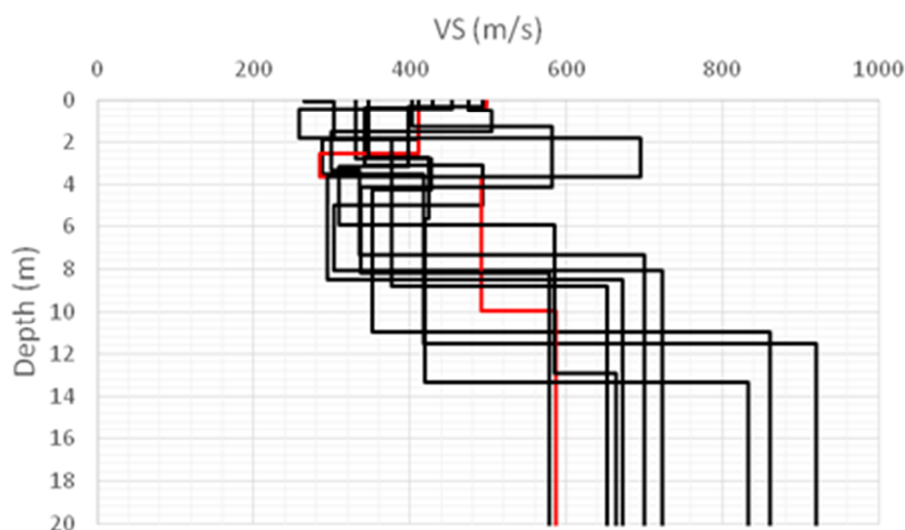
### 6.2.3 Results from Array 2

The same procedure as for Array 1 was repeated for Array 2 and the following dispersion curve was obtained.



**Figure 54: The dispersion curve for Array 2**

When the dispersion curve was jointly inverted with the H/V curve, the following profiles were obtained, the red one being the one with lowest misfit:



**Figure 55 - The profiles generated from 10 different inversion runs. The profile in red shows the profile having the minimum misfit (i.e. the best profile). Depth is measured from LAT.**

The details of the profile are given in Table 8 below.

The  $V_{s30}$  for this area was calculated to be 560 m/s (which is very similar to the site where Array 1 was placed), so that the site would also be classified as a Class C site (NEHRP).

**Table 8: The results from the inversion process from Array 2. The second column shows the depths of the layers (not thicknesses).**

Layer	Z m	$V_p$ m/s	$V_s$ m/s	$\rho$ kg/m <sup>3</sup>
1	0 – 0.320	749.365	498.680	1656.891
2	0.320 – 2.580	813.783	411.339	1531.769
3	2.580 – 3.660	448.094	284.409	1950.147
4	3.660 – 9.950	982.698	492.082	1875.855
5	9.950 – 22.920	1783.382	587.488	1930.596
6	22.920 – 97.410	2247.214	1258.553	2266.862
7	97.410 – 760.460	4751.124	1320.137	2755.621
8	0	5885.630	2969.893	3031.183

As a remark, the velocity in layer 5 is quite low when compared to the ‘bedrock’ velocity obtained from Array 1 ( $\approx 965$  m/s). One reason for this is that the profiles obtained using this technique are averaged along the whole array, so that this low velocity could be due to the area close to borehole 21 where a dip in the layers is observed. Another explanation could be that this 12 m layer is an “intermediate” layer representing a highly weathered topmost layer of the Globigerina marly limestone.

Finally, even though the model in red (Figure 55 above) is the best-fitting model (i.e. with lowest misfit), there were a number of other models whose misfit were only marginally higher. This is one of the limitations of the inversion process, in that the solution is non-unique i.e. different models (in this case, velocity profiles) can give rise to solutions that fit the experimental data equally well. The other profiles in Figure 55 above (in yellow) fit the observed dispersion curves quite well and could also be representative of the underlying velocity profile.

It is also important to note that the  $V_{s30}$  values from both Arrays 1 and 2 are similar – 595 and 560 m/s respectively.

## 7 Geotechnical laboratory testing

Laboratory testing was aimed specifically at the characterisation of the bedrock material, the Middle Globigerina marl. This sediment is likely to provide a competent bearing stratum for the proposed new combined cycle power plant.

Laboratory testing was carried out on specimens prepared from the retrieved borehole core. Specimens for index tests were taken directly from the retrieved borehole core in the laboratory. Specimens for compression testing were also taken from the retrieved core, but these needed machining to the required shape and size. The geotechnical laboratory testing that was scheduled is summarised in Table 9 below.

**Table 9 - Summary of Laboratory tests**

Test Type and Reference (BS 1377: 1990 unless stated)	Stratum	No of tests	Results (Range)	Comments / Limitations
Particle size distribution - wet sieving and Sedimentation (ASTM D422)	Silty Sand	3	Clay: 3.1% - 12.5% Silt: 10.4% - 32.7% Sand: 54.8% - 86.5%	Layer rich in organic content that was not easily dissolved.
Particle size distribution - wet sieving and Sedimentation (ASTM D422)	Marl Bedrock	6	Clay: 24.00% - 36.62% Silt: 59.09% - 67.65% Sand: 4.29% - 14.84%	This material is a cemented weak to moderately weak rock. The determination of the PSD required disaggregation of the material. This was achieved by stirring crushed marl in distilled water at low speed for 24hrs.
Particle Density tests (small Pyknometer method – Part 2:8:3)	Marl Bedrock	20	2.58 - 2.70 Mg/m <sup>3</sup> (average 2.63 Mg/m <sup>3</sup> )	Most results fall within the range 2.60 - 2.65 Mg/m <sup>3</sup>  Marl at LAT -7.00m appears to be anomalous
Liquid Limit (Part 2:5)	Marl Bedrock	6	39.5% - 71.50% (average 58.08%)	
Plasticity Limit (Part 2:5)	Marl Bedrock	6	16.80% - 28.19% (average 23.51%)	Most specimens classify as clays of high plasticity (CH). One specimen is on Intermediate plasticity (CI) an one of very High plasticity (CV)
Determination of Uniaxial Compressive Strength of Rock Materials - ISRM Suggested Method	Marl Bedrock	106	UCS : 2.67 – 27.7 MPa (average 11.7 MPa)	Test results may be biased toward the stronger facies, due to the difficulty of preparing specimens from microfractured marl. Another 8 specimens were prepared but discarded due to deviations from standard, during specimen preparation.



Test Type and Reference (BS 1377: 1990 unless stated)	Stratum	No of tests	Results (Range)	Comments / Limitations
Determination of Deformability of Rock Materials in Uniaxial Compression - ISRM Suggested Method	Marl Bedrock	3	UCS :11.08MPa Secant Modulus at 50% UCS 1.72 GPa Poisson's ratio: 0.485	Deformation measured by LVDTs mounted on specimen using superglue. Test results may be biased toward the stronger facies, due to the difficulty of preparing specimens from microfractured marl
Bulk unit weight	Marl bedrock	149	15.89 – 22.35 kN/m <sup>3</sup> (Average 21.06 kN/m <sup>3</sup> )	Results are based on measurement of UCS test specimen dimensions and weight
Natural moisture content (Part 2:3.2)	Marl bedrock	149	9.57% - 18.89% (Average 15.82%)	Results are based on moisture content of UCS test specimens, after crushing
Ultrasonic Pulse velocity	Marl bedrock	134	UPV: 1.05 – 3.00 km/s (Average 2.11 km/sec)	No attempt to measure shear velocity was made. Results are for P waves only

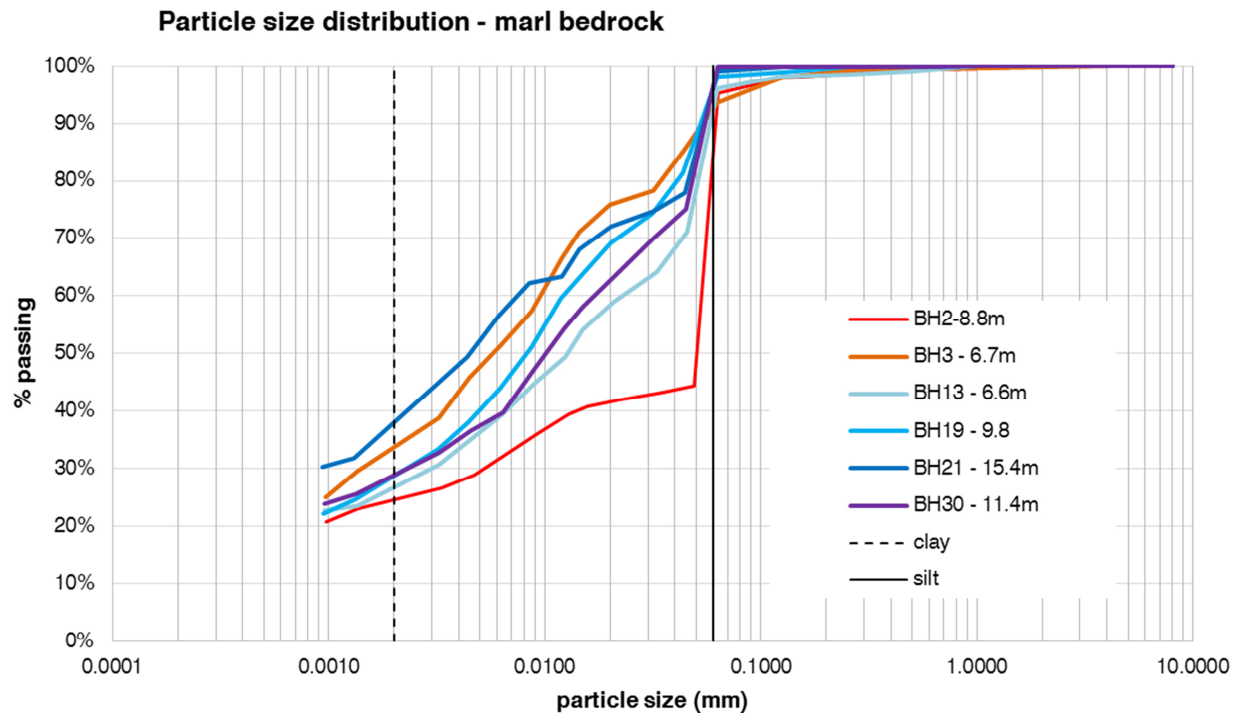
## 7.1 Index tests

The index tests carried out indicate that the marl is made up of fine-grained material falling primarily within the silt and clay-sized particle ranges. Particles greater than 63 microns form only a minor percentage (generally < 8%) of this type of material. The particle size distribution curves are shown in Figure 56 below. These curves were obtained by wet sieving and then by sedimentation, using material from the retrieved borehole core that was first crushed to pass a 5mm sieve and then placed in a container with distilled water. The mix was then stirred at slow speed (approx. 400rpm) using a small cruciform paddle for 24 hours. This resulted in slurry that could be poured through the sieves almost in its entirety, leaving behind only some small shell fragments and a small amount of cemented particles that were then broken down by light finger pressure.

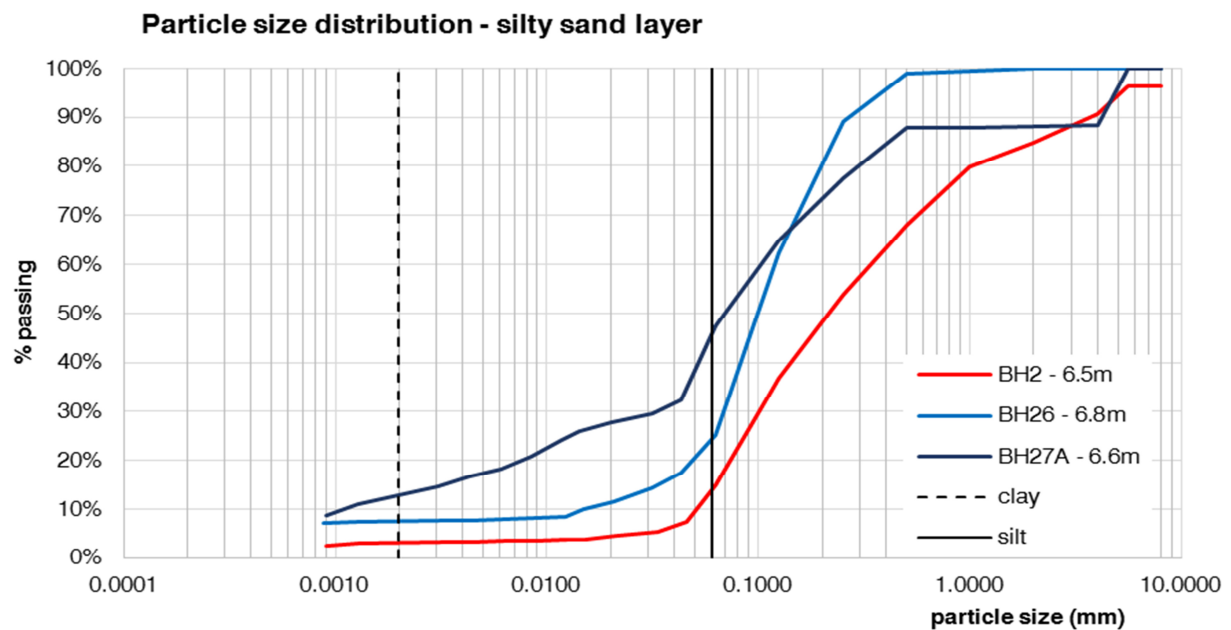
The particle size distribution as well as the other index properties suggests that this marl is very similar to marls from the Middle Globigerina limestone outcropping in the central part of the island of Malta. Tests carried out on these marls indicate a carbonate content of around 82%, the remainder being clay minerals. The fine texture of the marl is the result of large agglomerations of shells of microorganisms (plankton), typically coccoliths and other similar structures. Such skeletons are mostly Calcium carbonate, which also provides the binding agent holding the particles together. This gives the marl its cohesion and tensile strength.

The small particle size also explains the low permeability of these marls, and hence the formation of perched water tables above such outcrops.

Also shown in Figure 57 below are the results from particle size distribution tests carried out on specimens taken from the sand layer. These sand specimens had to be first pre-treated with hydrogen peroxide solution to remove the organic component. These curves indicate that the sand may exhibit some variation from one borehole to the other, with some locations having a greater silt or clay content than others.

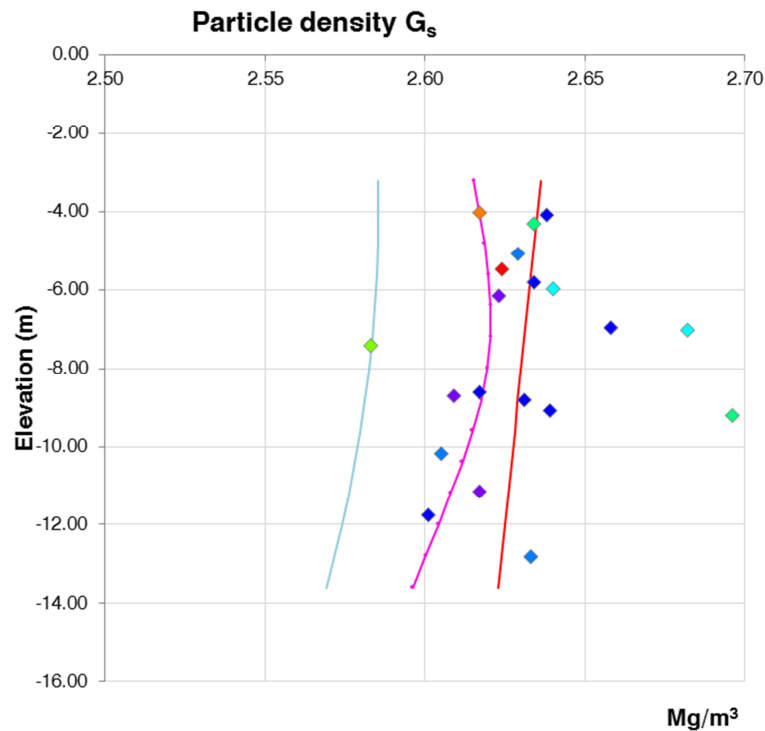


**Figure 56 - Particle size distribution test results from the marl layer**



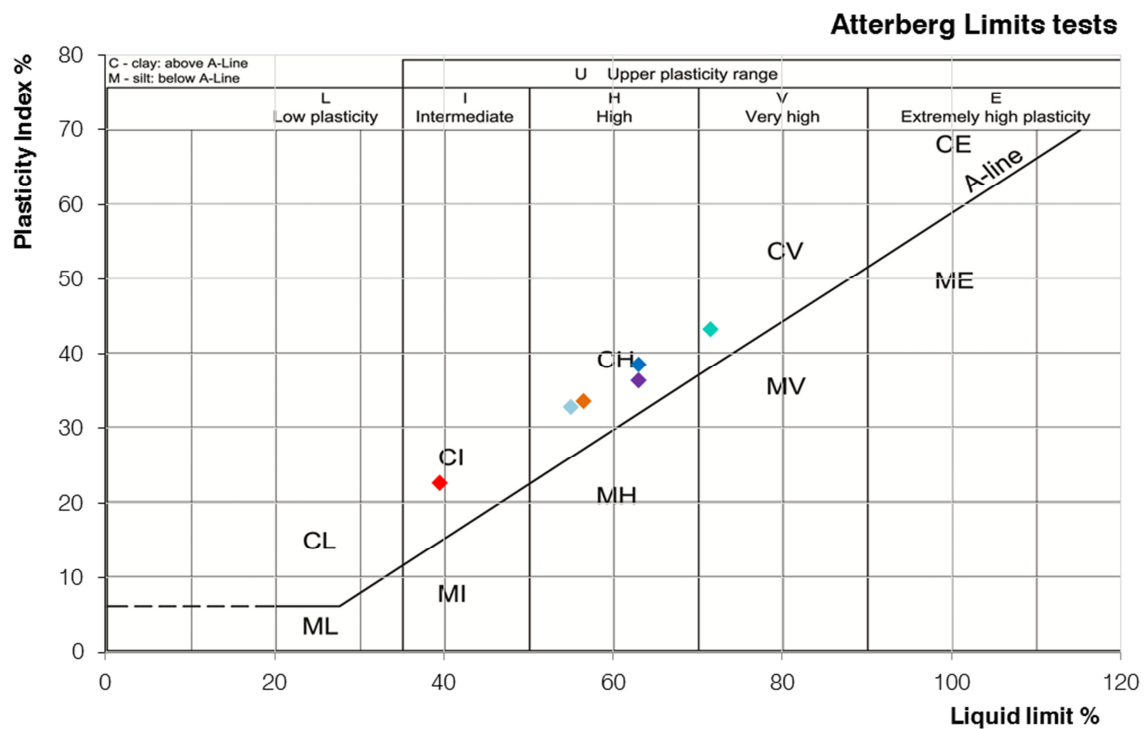
**Figure 57 - Particle size distribution test results from the silty sand layer**

Results of particle density tests carried out on marl specimens using the small pycnometer method are shown in Figure 58 below. Most results fall within the range 2.60-2.65 Mg/m<sup>3</sup> with some anomalous results at an elevation of LAT -7.0m. These are significantly different from the particle density of pure calcite (2.7Mg/m<sup>3</sup> which would normally be expected when testing the carbonate limestones of the Maltese islands. The particle density results were then used to calculate the dry and saturated unit weight, the void ratio/porosity and the degree of saturation for each test specimen.



**Figure 58 – Results of particle density tests**

The results of the Atterberg limit tests are presented on the A-Line chart in Figure 59 below. All six tests plot above the A-Line, indicating clay-like behaviour. The classification falls within the high plasticity range, with one specimen being classified as very highly plastic, and another isolated specimen being classified as a clay of intermediate plasticity.



**Figure 59 - A-Line chart for marl bedrock**

## 7.2 Specimens for the unconfined compression test to ISRM suggested method

These specimens were chosen from intact sections of the retrieved borehole core and then trimmed to size on a lathe. This ensured that perpendicularity and straightness of the sides was achieved to the tolerances of the ISRM Suggested Method. Once this was achieved, the overall dimensions of the specimen could be measured and its mass determined. This provided the necessary information for calculating the unit weight.

The test specimens prepare for the unconfined compression tests were carefully sealed at all stages of the process. This entailed wrapping the retrieved core with cling film on site, immediately after extrusion from the double core sampler, and then wrapping it again carefully after removing the samples for specimen preparation. Working time on the lathe and during measurement was kept to a minimum to prevent moisture loss, and the specimen was once again sealed in plastic film and submerged in water once these operations were complete prior to testing.

All of the marl specimens tested during this investigation were chosen from layers which exist well below sea level. It is therefore assumed that the marl exists fully saturated in its natural state. Maintaining full saturation was therefore a main objective in carrying out tests on this material, more so because it is widely known that the strength of this type of material increases as its degree of saturation decreases.

This was checked by taking pieces of the specimen for determination of moisture content immediately after crushing. The moisture content measurements are shown in Figure 61 below. Working backwards from these measurements and from an assumed average value of  $2.63 \text{ Mg/m}^3$  for particle density, the degree of saturation of each specimen could be calculated.

The determined saturation values are shown in Figure 60 below. This shows that full saturation was maintained for the greater majority of the test specimens. Values greater than 100% are normally attributable to inaccurate assumptions for particle density.

Calculated bulk unit weight based on specimen measurements is shown in Figure 61 below. The results are fairly consistent, and statistical analysis to EN1990 defines the characteristic value as  $21 \text{ kN/m}^3$  with practically no variation with depth. The characteristic curve is represented by the pink line in this format of presenting the results. The light blue line represents the 'local low' variation with depth, while the red line represents a linear regression through the data.

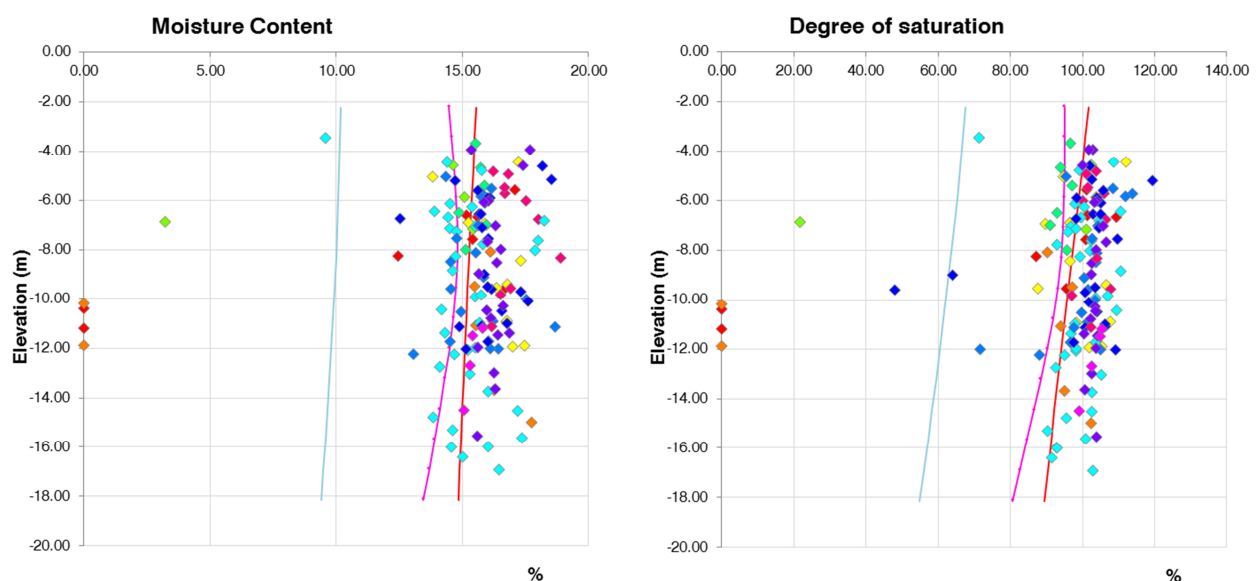
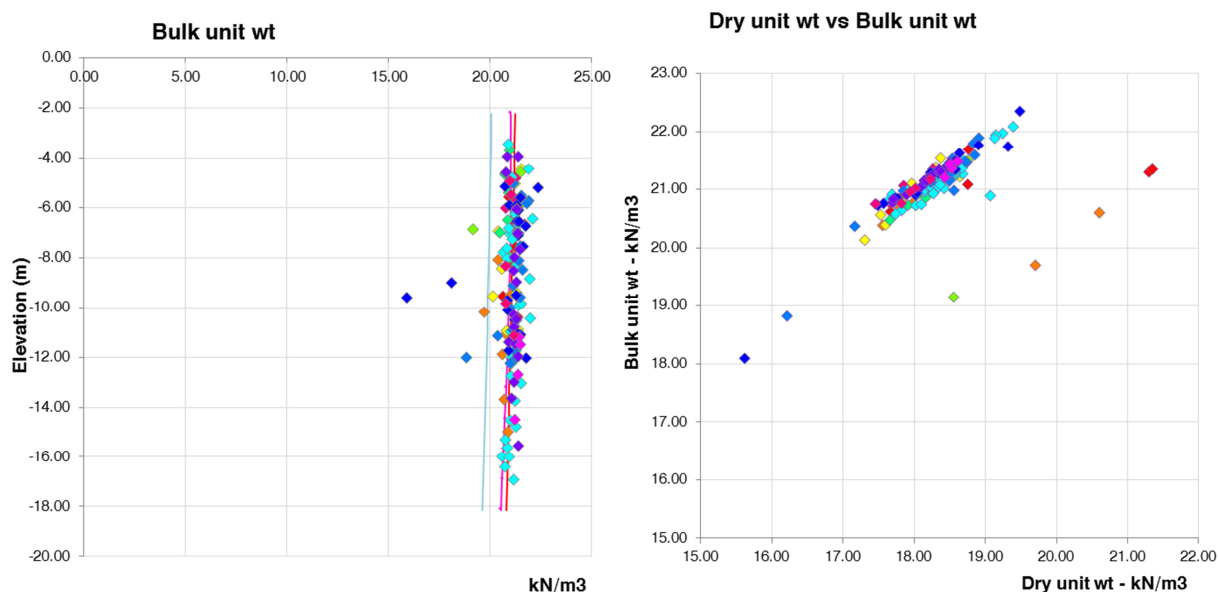


Figure 60 – Measured moisture content and calculated degree of saturation for the UCS test specimens



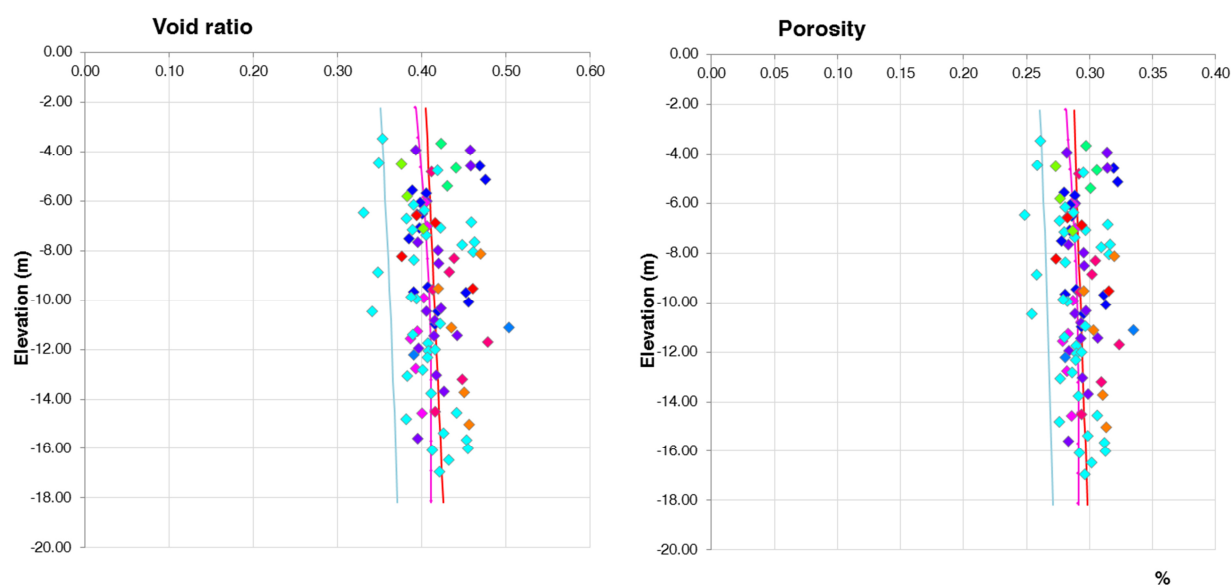


**Figure 61 - Bulk unit weight from UCS test specimens, and relationship with dry unit weight.**

The minimum, maximum and average values of the various unit weights for the marl bedrock have been calculated from standard phase relationship formulae and are presented in the table below. Such calculations also allow the void ratio and porosity to be determined for this material. These values are fairly consistent having an average of 0.41 and 29% respectively. These values are comparable with those of high density chalk, a material which similarly has high carbonate content, as indicated by Table 11 below.

**Table 10 - Unit weights for the marl bedrock**

	Minimum (kN/m <sup>3</sup> )	Maximum (kN/m <sup>3</sup> )	Average values (kN/m <sup>3</sup> )
Bulk unit weight	15.89	22.35	21.06
Dry unit weight	13.68	21.35	18.28
Saturated unit weight	18.29	23.04	21.14



**Figure 62 - Void ratio and porosity distributions for the marl bedrock**

**Table 11 - Chalk density classification - CIRIA**

**.2**      *Intact dry density scales of chalk (based on Mortimore et al, 1990 and Matthews et al, 1993)*

Density scale	Intact dry density $\gamma_d$ (Mg/m <sup>3</sup> )	Porosity n*	Saturation moisture content*
Low density	< 1.55	> 0.43	> 27.5%
Medium density	1.55–1.70	0.43–0.37	27.5–21.8%
High density	1.70–1.95	0.37–0.28	21.8–14.3%
Very high density	> 1.95	< 0.28	< 14.3%

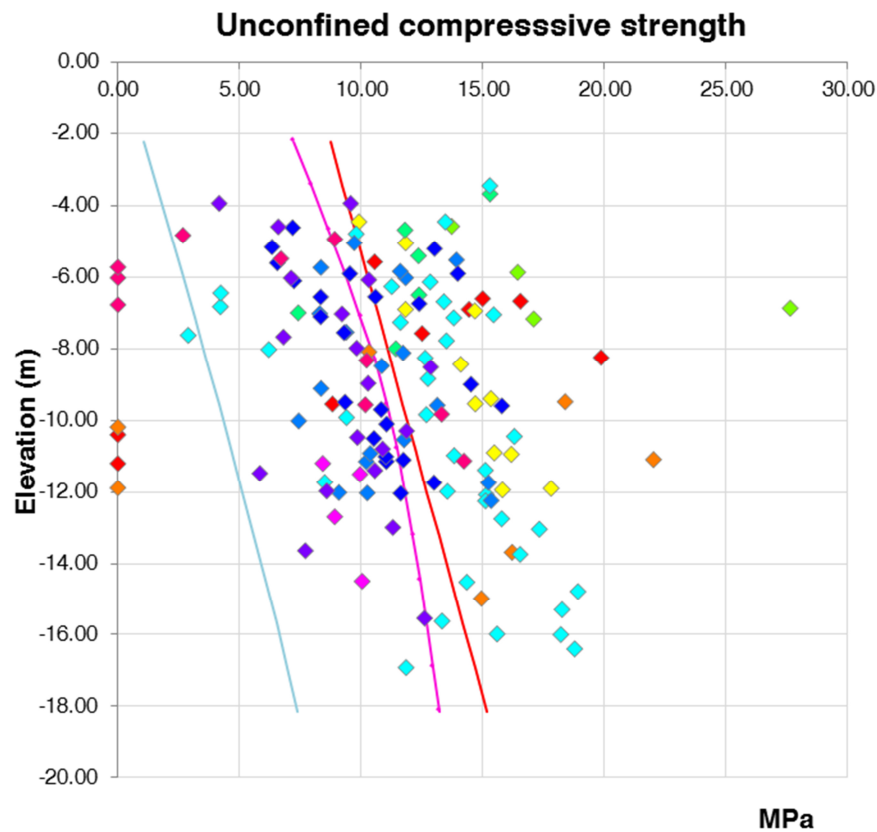
\* Based on the specific gravity of calcite  $G_s = 2.70$  (see Section 4.2)

The results from the unconfined compression strength tests are shown in Figure 63 below. These test specimens were tested in the saturated state. The relationships between these results and other calculated parameters for the same test specimens are explored in Figure 65.

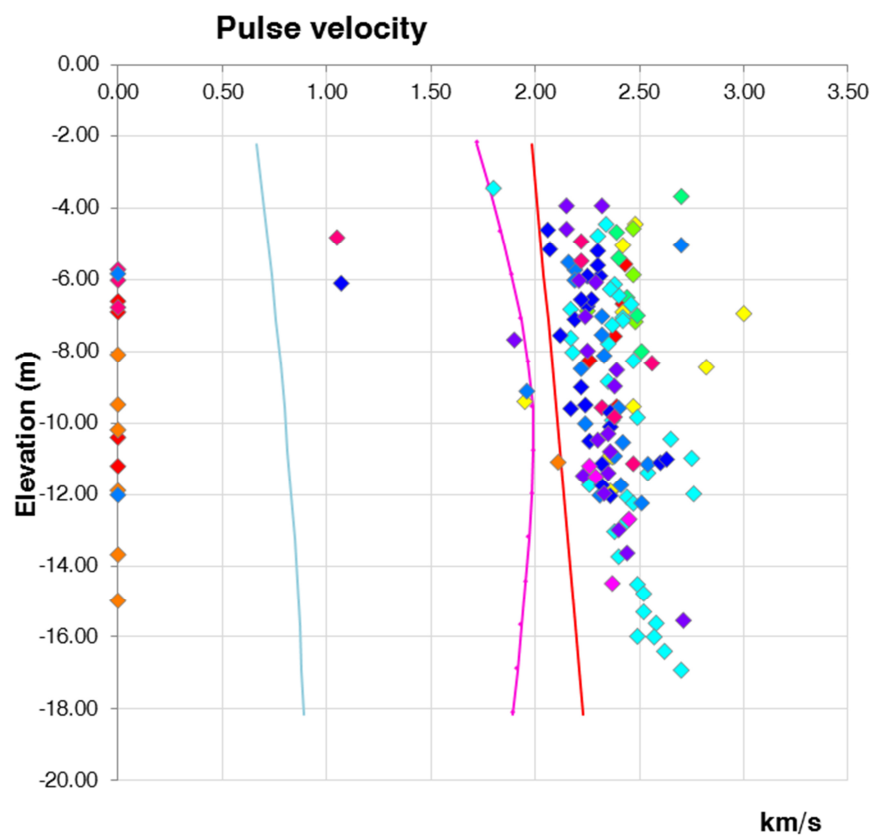
Unconfined compression strength is seen to vary between very low values (2.67 MPa) to relatively stronger values (27.6 MPa). The average strength is around 11.7 MPa, but the graphs indicate more complex variations in this important parameter. When plotted against position in the vertical sense, there is a trend that strength increases with depth, and that it also increases in a north-westerly direction, judging from the distribution of the various colours. This could be the result of inclined stratification, as described in Section 2.3.

The characteristic curve through the data has been drawn in accordance with EN 1990, and shows that strength does increase with depth, practically doubling over a depth of 16m.

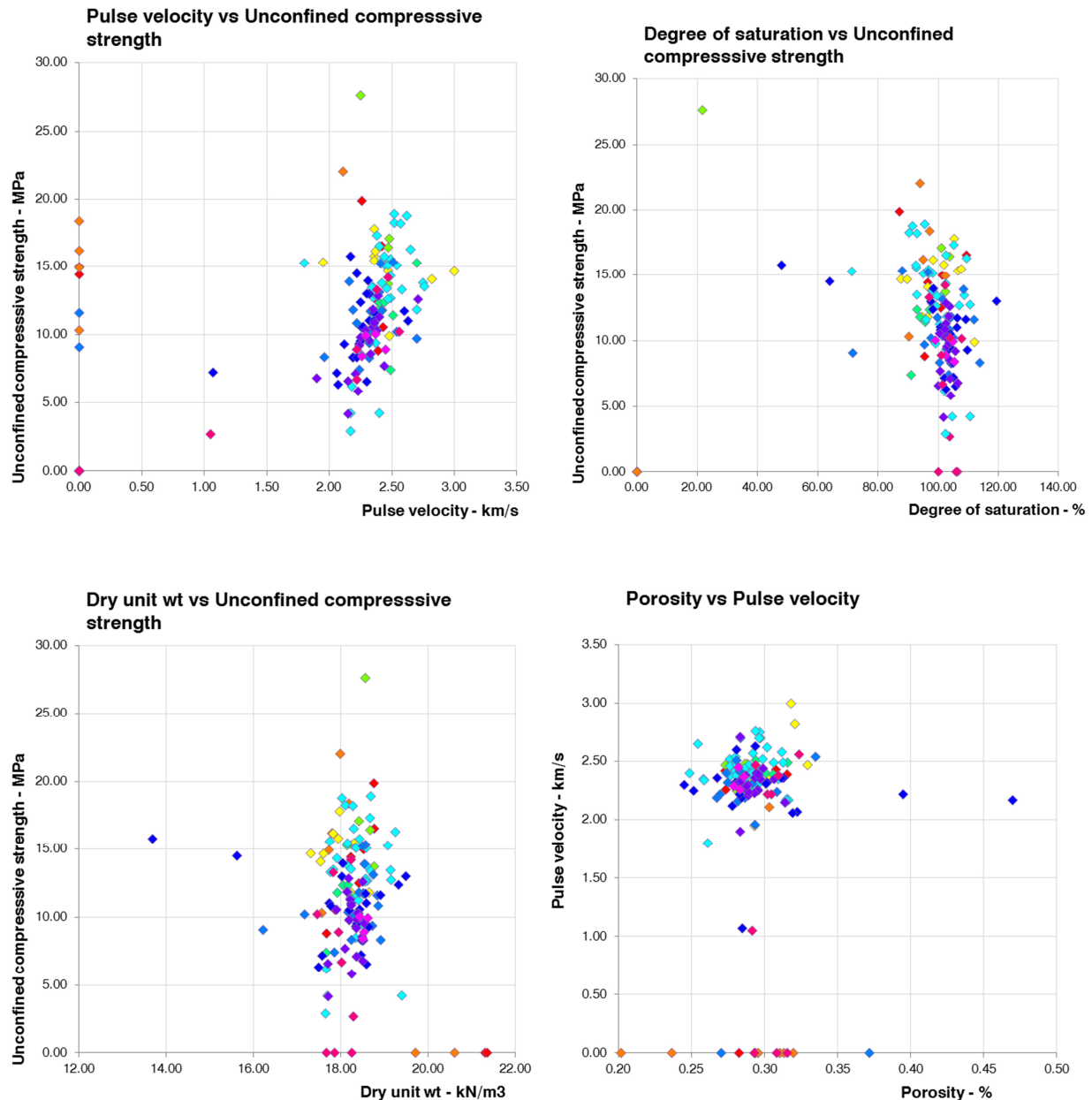
A similar trend, albeit less pronounced, seems to exist in the pulse velocity measurements. Once again, specimens taken from the Northwest part of the site appear to be marginally stiffer than those trimmed from cores drilled at the opposite end.



**Figure 63 - Results of unconfined compressive strength tests in relation to position**



**Figure 64 - Results ultrasonic pulse velocity tests in relation to position**



**Figure 65 - Relationships between the various properties of the same test specimens**

The different relationships seen between the different properties in Figure 65 above suggest that unconfined compressive strength is not related to dry density, unlike similar results for high density chalk. There does seem to be an increase in strength with a decrease in saturation. Such an effect is clearly demonstrated in tests on chalk, where double the strength is achieved for dry specimens in comparison to saturated specimens of the same material.

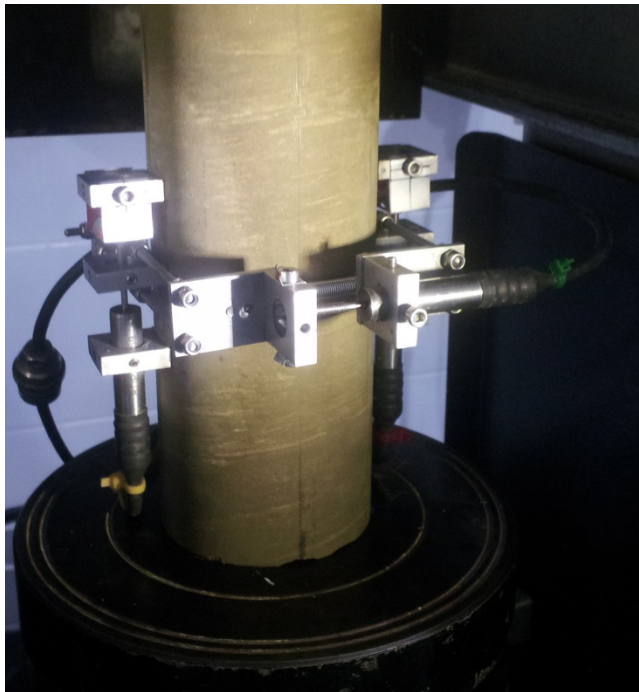
Porosity does not seem to have any effect on compressive strength or on pulse velocity. This suggests that the mechanical behaviour of the marl may be more dependent on cementation between particles rather than void ratio. Tests carried out by the undersigned on similar materials suggest that this is true for stress levels below the yield point, after which soil-like behaviour will be observed. Yield in oedometric compression for weaker materials from this same stratum occurred at around 7MPa.



### 7.3 Tests in unconfined compression with measurement of deformation

A number of tests carried out in unconfined compression were also instrumented with LVDTs to measure axial and radial deformation. This was achieved by mounting the LVDTs on specially prepared aluminium mounts fixed to the central part of the specimen using super glue. The central part of the saturated specimen was heated with a blow torch to create a thin film of natural material which could be penetrated by the glue holding the sensors in place. After crushing was complete, it was seen that this outer thickness having reduced moisture content was less than 0.5mm thick, and most of the specimen thickness remained unaffected. The deformation sensors were calibrated using a micrometer after being installed in their aluminium mounts. The radial belt device was calibrated by micrometer measurements at the specimen contact points, such that the sensor output could be converted directly to changes in diameter. The three sensors were connected to the same data logger that read the load measuring device, so that all four sensors could be read simultaneously. The load cell was placed below the specimen, with a spherical seated platen bearing on the specimen at the top.

The general arrangement of these sensors is shown in Figure 66 below.



**Figure 66 - Assembly of LVDTs to measure axial and radial strain.**

At the time of compiling this report, three such tests have been carried out, and the output from the four sensors has been converted to stress-strain curves typically as shown in Figure 67 below. The recommendations of the ISRM suggested method for this test were used to determine the elastic (Young's) modulus and Poisson's ratio.

Three different interpretations for the elastic modulus are recommended for this type of test. The tangent modulus is defined as the slope of the stress strain curve at 50% of the crushing stress (or unconfined compression strength). The average modulus is the slope of the linear part of the stress-strain curve. The secant modulus is defined as the slope of the line joining the origin to the point on the curve representing 50% of the crushing stress. The determination of Poisson's ratio was based on the linear portion of the stress/radial strain curve.

### Stress-strain relationships

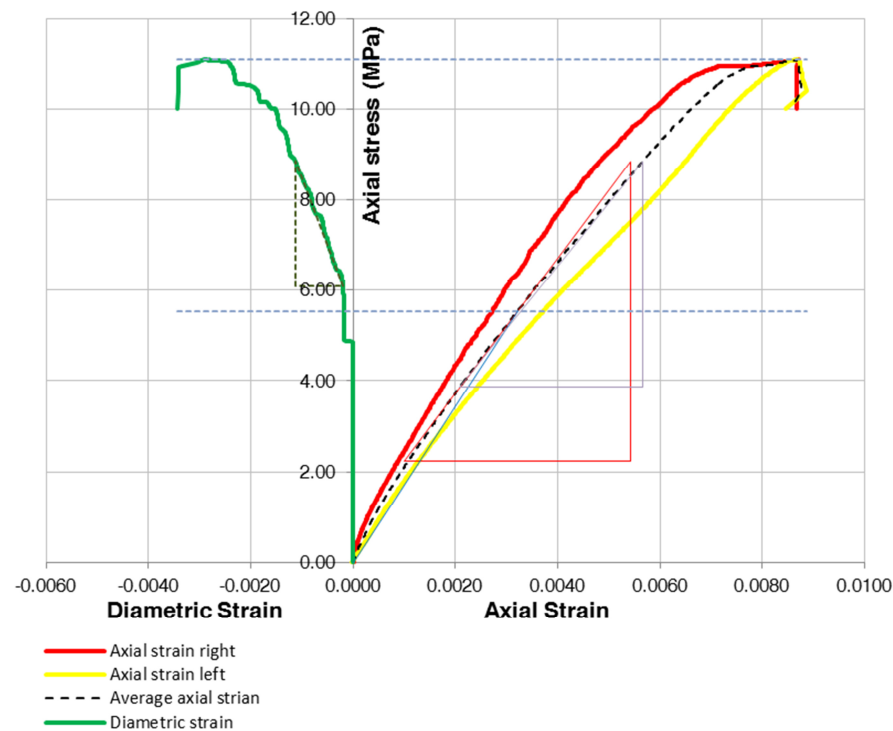


Figure 67 - Stress-strain curves from unconfined compression test with deformation measurements

Table 12 – Results and deformation moduli from unconfined compression tests

Test location	UCS (MPa)	Bulk unit wt (kN/m <sup>3</sup> )	Moisture content (%)	Tangent modulus (GPa)	Average Modulus (GPa)	Secant Modulus (GPa)	Poisson's ratio	UPV (km/s)
BH14@ 9.80m (-7.076 LAT)	11.28	20.73	15.78	1.737	1.711	1.751	0.468	2.273
BH14@15.35m (-12.626 LAT)	17.03	21.07	13.21	1.924	2.659	2.398	0.461	2.428
BH20@12.20m (-9.261 LAT)	11.1	19.91	13.92	1.492	1.396	1.721	0.485	2.101

The full set of results for these tests is given in Appendix E. It is seen from the above results that the specimen with the highest unit weight also has the highest pulse velocity and the highest Young's moduli. The trends are seen to be similar to those observed from the results of the unconfined compression strength tests.

Comparisons can also be made to the results obtained via the downhole seismic technique. The above values fall within the lower range of the values obtained from small-strain seismic methods, which is to be expected since stiffness often decreases with strain level. It is also to be noted that two of these results probably fall within the transition zone identified from the downhole-seismic results, while the specimen from BH14 at 15.35m (-12.626 LAT) is just within the zone where the marl becomes appreciably stiffer.

## 8 Suitability for foundations

The foundations of the new combined cycle power plant will need to carry both heavy loads from the main power generation plant and lighter loads from ancillary plant and supporting structures. A number of small buildings are also envisaged to provide the necessary amenities and protection to equipment.

The loads acting at foundation level will therefore need to be carefully assessed to determine whether support can be provided in the form of spread foundations supported directly by the existing fill, or by deep foundations which transfer load to the more competent strata at depth. This will also need to take into consideration the amount of settlement that can be safely accommodated by the structures, by the plant within and by the connections/pipework deemed to be necessary between different elements of the proposed power plant.

### 8.1 Foundations on and settlement within reclamation fills

In the course of this investigation, information about the nature of the existing reclamation fill has been obtained in a number of different ways:

- a) From retrieved borehole core, through which samples of the fill were retrieved in a disturbed state, but through which the different constituents of the fill could be inspected.
- b) From machine-excavated trial pits, through which the structure and homogeneity of the upper layers of fill could be inspected.
- c) From a number of plate loading tests, through which the load-deformation characteristics of the uppermost layers (not exceeding 760mm in thickness) could be investigated.
- d) From several Standard penetration tests carried out within the fill and silty sand layers, which allow limited geotechnical characterization of the fill layers at depth.
- e) From downhole and surface seismic tests, through which the in-situ small-strain stiffness of the fill layers can be assessed.

Considering all the information compiled using these methods, the following conclusions about the upper layers can be arrived at:

- a) The reclamation fill has a relatively uniform thickness ranging averaging 5.5m, of which the top 2.5m are above mean sea level.
- b) The reclamation fill is underlain by a thin layer of silty sand of variable thickness (0-4m), which layer has a very high organic content in the form of seaweed fibres. The organic content can be very dense at certain horizons; hence this layer is expected to be very compressible.
- c) The reclamation fill is not homogenous, and is not composed of the same material throughout. A considerable percentage of the fill seems to be made of rock fill from the middle globigerina formation, very similar to the material of which bedrock is composed, and most probably sourced from the extensive excavation in the same marl required for the first project phase of the existing power station. Other materials were however identified, amongst which are layers of rock fill composed of the stronger lower globigerina limestone and layers composed of the weaker upper globigerina limestone, the latter probably also sourced from the immediate vicinity. Pockets of reddish-clay like material, alien to the site and its immediate surroundings, were also identified, indicating that some of the fill was probably transported from elsewhere to be deposited at Delimara.
- d) The particle size distribution of the fill is not homogenous at all. The middle and upper globigerina limestones are weak limestones which tend to be easily crushed and which are

known to experience reductions in strength when in direct contact with water. Fill made up of these materials is therefore composed of small particle sizes, and generally has an overfilled grading when compacted, due to the excessive generation of fines. Sections of fill made of the lower globigerina rock tend to be composed of larger particle sizes, up to large boulders identified in some of the trial pits. These would render compaction less easy to achieve, and a number of voids would probably exist in between the larger particles. This is confirmed by SPT results which indicate refusal or a very low blowcount respectively.

- e) The upper layers of the reclamation fill appear to be well compacted. This refers to the thickness of fill above mean sea level. This was seen in many of the boreholes, and also in some of the trial pits. The trial pits do indicate, however, that the upper 1m or so of the fill is probably much better compacted than the remaining 1.5m above mean sea level. The upper layers in the first 1m are also much more homogenous than the rest, and particle size is limited.
- f) SPT blowcounts classify the fill as a dense granular material, while the geophysical tests give dynamic density figures ranging between 1700 and 2000 kg/m<sup>3</sup>
- g) Geophysical tests suggest values for bulk stiffness and shear stiffness as shown in Figure 51. Shear stiffness is generally less than 200MPa while bulk stiffness increases gradually from 1GPa at sea level. The stiffness of the upper layers is described by the plate loading tests; however this is likely to be relevant only for areas loaded by small patch loads, like roads and pavements.
- h) No direct information about the settlement characteristics of the fill was produced by this investigation, other than the plate loading tests. These however refer to the uppermost layers only

Considering the above, as well as local experience of similar fills, considerable settlement would be expected if the fill is used as a load bearing stratum. Such total settlement is difficult to quantify due to the lack of homogeneity of the fill, and will not only have an elastic component, (possibly developed immediately on loading), but also having a long-term component, created primarily through the phenomenon of creep. This has not been investigated by the methods used during this investigation. The following is based only on past experience.

The kind of rock fill evidenced through this investigation suggests that within the deeper levels of the reclamation fill, stresses at the interparticle contact points could be large, due to the weight of the overburden, and increasingly so if the fill is loaded with spread foundations. The distribution of particle sizes and the angularity of particles created when sourcing the rock fill imply that such contact points are likely to experience progressive yield and crushing, leading to re-arrangement of particles and therefore changes in the fill void ratio. This is likely to develop over time, due to the susceptibility of the intact parent material to undergo appreciable creep deformation, as well as by the action of water that will gradually soften the fabric of the parent marl (refer to Figure 36 above, in section 4.6). Such deformations have been observed in other reclaimed areas (e.g. at the Malta Freeport) and on some local pavements which are known to be built on reclaimed quarries. These deformations normally continue to develop over a number of years, and are typically of the order of several centimetres, depending on the overall depth of reclamation fill.

The above considerations suggest that long-term deformation may be experienced with wide spread foundations whose assumed pressure bulb reaches the less well-compacted levels of fill found at depth. This investigation provides no direct information that enables the quantification of such settlement, and in any case, this is likely to be inaccurate due to the heterogeneity of the fill.

Such settlement may be less of a problem for those structures that are likely to require small spread foundations. This also applies to paved areas, where the loads are generally applied through vehicle tyres of very limited contact area. In such cases, the plate loading test results may provide useful



information. A useful guideline in this respect is the local standard for road construction<sup>5</sup> which provides a table suggesting possible construction methods for typical pavements, on the basis of plate loading test results.

The plate loading test results have been processed according to DIN 18134, in relation to this table. The results are summarised in Table 13 below. Local pavement construction generally requires  $E_{v2}$  values that are greater than 120,150 or 180, depending on the 'Construction class' (or use) of pavement, and an  $E_{v2}/E_{v1}$  ratio that is less than 2.2. It is seen from the test results below that some re-engineering of the top layers will be necessary to build pavements, since none of the results show acceptable values of the  $E_{v2}/E_{v1}$  ratio.

**Table 13 – summary of plate loading test results in accordance with DIN 18134**

Location	Plate diameter	$E_{v1}$ (MN/m <sup>2</sup> )	$E_{v2}$ (MN/m <sup>2</sup> )	$E_{v2}/E_{v1}$	Comments
1	762mm	25.46	123.00	4.83	
2	762mm	15.43	69.43	4.50	
3	762mm	23.57	69.74	2.96	
4	300mm	67.19	176.75	2.63	
5	300mm	68.01	1029.08	15.13	Test considered unreliable
6	300mm	37.52	101.51	2.71	
7	300mm	48.71	124.84	2.56	

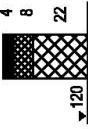
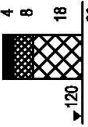
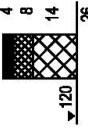
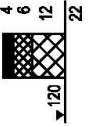
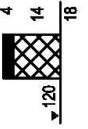
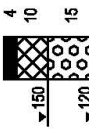
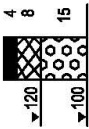

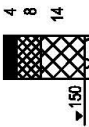

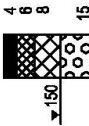
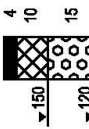
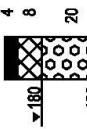
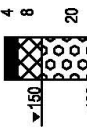



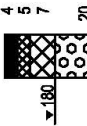
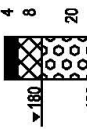
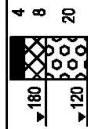
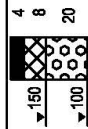
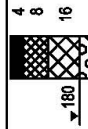
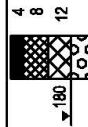
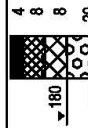
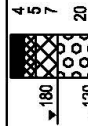
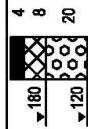
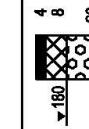
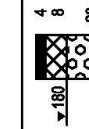
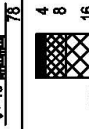

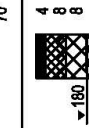
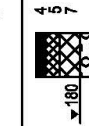
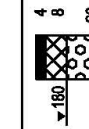


The reclamation fill may also be used to support small spread foundations that support minor loads, such as pipework runs or very small structures that are not adversely affected by settlement or that create only small increments in vertical stress on the fill layers. In these cases, settlement can be estimated using the plate loading test results in which the large diameter 762mm plate was used.

Given the possibility of long-term creep deformation, hinted at in the preceding paragraphs, the use of spread foundations (such as large rafts supporting entire buildings) is not recommended for major structures.

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<sup>5</sup> Muller, K (2000), *Directives for the Standardisation of Pavements for Traffic Areas* – Roads Department, Ministry for Transport and Communications, Govt. of Malta.

**Chart 1: Standardization for pavements with asphalt surfacing of traffic areas**

Pavement Construction	Construction Class		HD	I	II	III	IV	V	VI
	Equivalent 10 t - axle passes (mil)	B							
1 Asphalt	B		>32	>10 - 32	>3 - 10	>0.8 - 3	>0.3 - 0.8	>0.1 - 0.3	≤0.1
	Wearing Course Binder Course Base Course								
2 Asphalt Type 1	Type 1 (15 cm)								
	Type 1 (20cm)								
4 Asphalt Type 1 Foundation course	Foundation Course								
	Cement stabilization								

1) Combined base course/wearing course or asphalt construction in two layers

Figure 68 - Pavement design on the basis of plate loading test results ( $E_{v2}$  shown in small numbers on the side of each diagram)

## 8.2 Foundations in marl bedrock

The limitations inherent to supporting structures on reclamation fills imply that deep foundations will be required to bypass the fill and the silty sand layer, as well as to transfer load to a more competent stratum. The heavier elements of the proposed combined cycle power plant will also need to be supported on rigid foundations to keep settlement to an absolute minimum. In some situations this is also required to ensure that deformation at foundation level is not sufficiently well developed to hinder or interfere with the smooth operation of rotating machinery and other mechanical plant.

Pile foundations are likely to provide suitable means of transferring loads to the ground without excessive deformation. Such foundations, in conjunction with mass concrete plinths or pile caps, will also need to transmit and dampen vibrations that will be created by operation of the plant.

The weathered marl and the more competent marl layers at depth will therefore need to provide the required load bearing capacity of the foundation system. The design of such a foundation system will need to take into account the following issues, from top to bottom:

- 1) Forces created by the reclamation fill on the outer surfaces of each pile, as the fill undergoes further settlement under the newly imposed loads (negative skin friction)
- 2) Skin resistance provided by the concrete-marl interface, as this is first developed in the weaker weathered marl layers at the top, through the transition zone identified by the downhole seismic tests and then through the more competent marl layers at depth
- 3) Any base resistance that may be provided by the stronger marl layers at depth, assuming that contact between the pile concrete and the marl at the bottom of the bore is ensured. In reality this is very difficult to ascertain, considering that the piles will need to be bored under submerged conditions in a material (marl) that may partially destabilize on exposure.

### 8.2.1 Bearing capacity of bored piles

The capacity of bored piles socketed into the marl will be mostly developed through mobilization of shaft resistance. The shaft load transfer is initially much stiffer than the corresponding mechanism of base load transfer, for the reasons outlined above (Gannon et al, 1999). The magnitude of the interface stress between the concrete of the pile and the marl is a function of the relative stiffnesses of the pile and the marl, and would also depend on the geometrical properties of the interface itself. These geometrical properties will result from the smoothness or roughness of the bore, as it is drilled into the marl by the equipment available to the contractor who would be constructing the piles. A rough pile bore will therefore be desirable as the effects of interface dilation will come into play.

The stiffness of the pile itself will also influence the distribution of load down the length of the pile socket – a very stiff pile will mobilise rather uniform shaft loads, possibly transferring some load at the base as well. This would be an important consideration, keeping in mind that stiffness of the marl is likely to increase with depth. The concrete to rock mass stiffness ratio ( $E_c/E_m$ ) is likely to decrease with depth. Assuming a concrete pile stiffness of around 26GPa for a typical 900mm dia. pile with an 8T25 reinforcement cage, the  $E_c/E_m$  ratio would typically vary between 20 and 4 along the depth of, say, a 6m deep socket that just reaches the stiffer marl identified by the downhole technique.

At present no information is available about the degree of surface roughness achievable by the pile boring process, and therefore a comparatively smooth pile bore needs to be assumed, possibly resulting in conservative values of pile capacity. In this respect, the values of interface stress deduced from the anchor pull out tests can be used, since these values would be based on the smooth-bore interface characteristics achieved by small diameter borehole drilling tools.

Interface stress is normally estimated on the basis of the unconfined compressive strength values of the ground material in which the pile will be socketed. Relationships between unconfined strength values and interface stress have been investigated by many authors (see Whitworth and Turner, 1989, in Gannon et al, 1999) and are generally expressed in terms of an adhesion factor  $\alpha$ , relating the two values:

$$\tau_{sf} = \alpha \sigma_c / 2,$$

where  $\tau_{sf}$  is the shaft resistance (or interface stress) and  $\sigma_c$  is the unconfined compressive strength. An attempt to include the effects of surface roughness has been made by several researchers in the field, and is often included by the introduction of a factor  $\chi$  relating the adhesion factor  $\alpha$  to normalised compressive strength. Such relationships are often of the form:

$$\alpha = \chi (\sigma_c / 2P_a)^{-0.5}$$

where  $P_a$  is atmospheric pressure (assumed 100kPa) and  $\chi$  is a factor related to pile bore roughness. Such relationships are shown in Figure 69 below (Kulhawy and Phoon, 1993), over which the corresponding range of values from the tests carried out during this investigation have been superimposed. The range of normalised unconfined compression strengths is shown by the red shaded area, while the results from the pull-out tests are shown by the red lines and crosses. It is seen that there is good agreement with the predicted values, especially for the pull-out test from borehole 9, considered to be the most reliable due to its well-developed grout body.

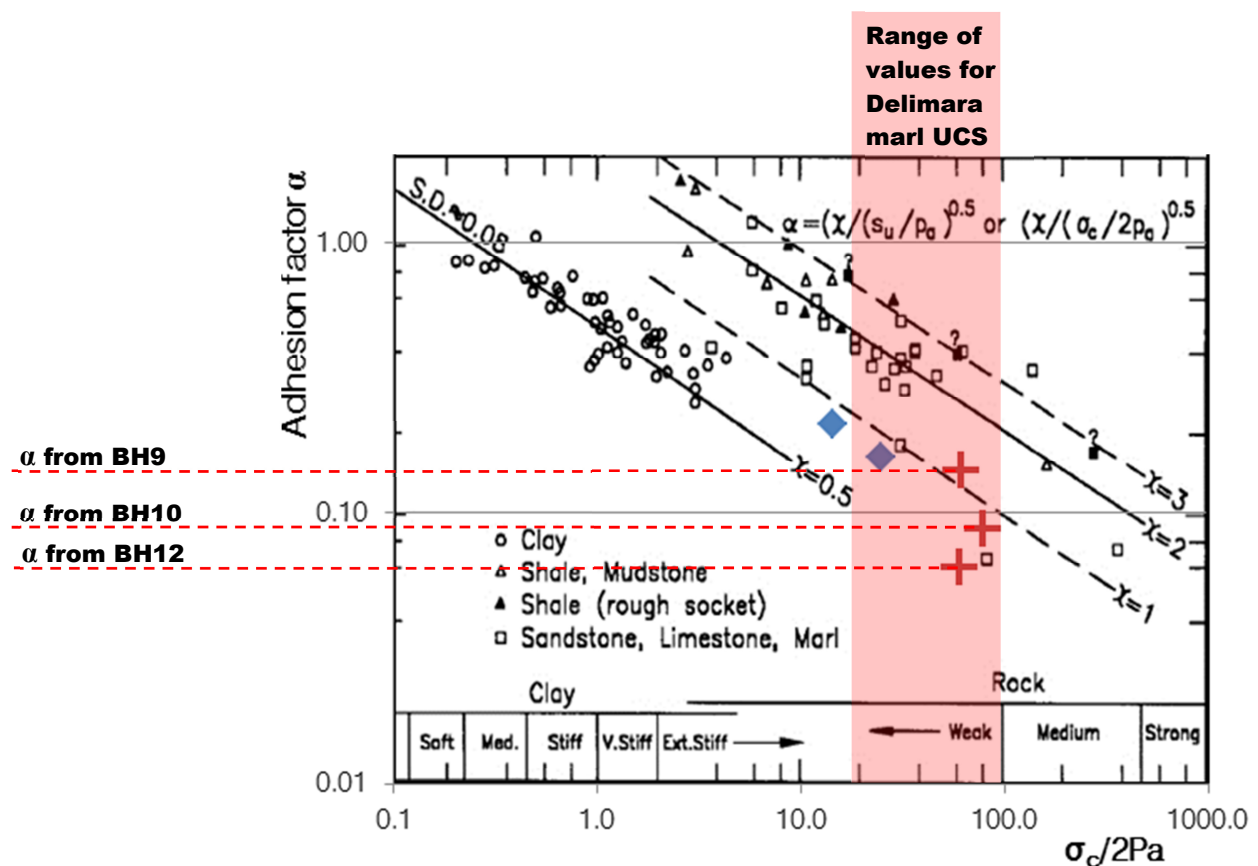


Figure 69 - Design curves for adhesion factor, with results from pull-out tests superimposed

It is also seen that the pull-out test results show good agreement with the estimated adhesion factor for values of  $\chi$  close to 1. Horvath, Kenney and Trow (1980) suggest a value of  $\chi$  equal to 0.89-1.12 for smooth drilled sockets while Rowe and Armitage (1987) suggest a value of 2.01 for regular clean sockets.

An attempt to calculate the capacity of a typical pile socket has been made using conservative estimates of the parameters outlined above. The unconfined compressive strength of the marl was assumed to vary between 4MPa at the top and up to 7MPa at the bottom of a 4m deep socket. The partial factors of safety suggested by Eurocode 7 have been introduced to arrive at a reduced design strength gradient down the length of the socket, and the corresponding values of the adhesion factor and the interface shear stress calculated on the basis of a  $\chi$  factor of 0.8, typically a smooth socket. The corresponding values for  $\alpha$  are plotted on the design curves, shown in Figure 69 above by the blue diamonds. The corresponding capacity of a 4m socket, excluding any contribution from the base of the pile, is estimated and then factored by the values suggested by Eurocode 7 for the different design approaches.

						A1	A2
Actions	Permanent unfavourable		2500	kN		1.35	1
	Variable unfavourable		2500	kN		1.5	1.3
total factored				kN		7125	5750
diameter		D	900	mm			
effective depth of socket		L	4000	mm			
surface area			11309734	mm <sup>2</sup>			
Embedment ratio		L/D	4.44				
			T <sub>top</sub> max	T <sub>bot</sub> max			
unconfined compressive strength		$\sigma_c$	4	7	N/mm <sup>2</sup>		
partial safety factor on material			1.4	1.4			
Design strength			2.86	5.00	N/mm <sup>2</sup>		
normalised strength		$\sigma_c/2p_a$	14.29	25.00			
K factor ( depends on roughness)		$\chi$	0.8	0.8			
alpha		$\alpha$	0.212	0.160			
side shear			0.605	0.800	N/mm <sup>2</sup>		
Skin resistance			1710	2262	KN/m		
Capacity without base resistance			7944	kN		R2	R4
partial safety factor on shaft resistance						1.1	1.3
Design capacity						7221	6110

**Figure 70 – Estimate of rock socket capacity**

Base resistance of bored piles in marl bedrock is best considered to be dubious and should not be relied upon unless very careful pile bore cleaning techniques are implemented and adequately supervised on site. The weak nature of the marl and the inherent clay component will easily cause degradation of the drilling spoil to form a slurry during drilling of the same pile bore. The heavier and larger particles of this slurry will very quickly sediment down the water column in the pile bore to create a cake of soft material at the bottom, even after drilling has been completed.

Such a layer is very commonly encountered as a low velocity layer in cross-hole tests on cast bored piles constructed in the local weak rocks. Such layers often have a thickness of a few centimetres and efforts to eliminate these normally have a low success rate, notwithstanding the best intentions of the local piling contractors.

## 8.2.2 Construction

The presence of the fill material, occasionally seen to be less compact, and specifically of the silty sand layer located between the fill and the marl, suggests that weak material will be encountered when boring



for deep foundations. This implies that pile bores may experience partial collapse of the sides as drilling proceeds, requiring the need for temporary steel casing to support the hole. The risk of collapse will also exist after the piles have been concreted, as temporary steel casing is withdrawn. This may severely affect pile integrity, since collapsing soils will tend to replace fresh concrete to create necking in the pile.

In view of this, permanent steel casing should be considered, to be installed over the length of pile that passes through the reclamation fill and through the weak sand layers existing below the fill. This will support the sides of the pile bore when the concrete is still fresh.

Another consideration would be the actual depth of such casing. As seen in section 4.7 above, the depth to the solid marl layer is not uniform across the site, and therefore piles drilled in different positions will end up having different lengths in contact with the less stiff materials, such as the fill and the silty sand. This will imply similar piles having different 'free' lengths across the same foundation, which may not be desirable from a dynamics perspective. The provision and use of permanent steel casing provides the opportunity of not only safeguarding pile integrity, but also having similar free lengths for piles across the same foundation. This can be achieved by using the permanent steel casing to isolate the pile concrete from the marl, for a given depth of hole.

### **8.2.3 Pile integrity testing**

The construction of piles in the scenario described above, as well as the relative importance of these foundations to the smooth operation of the proposed new combined cycle power plant, calls for adequate quality control and assurance procedures during construction. In view of this, pile integrity testing using sonic cross-hole techniques is strongly recommended.

## 9 Stability of excavations and quays

Some degree of excavation is deemed to be required within the existing fill, primarily to enable construction of the mass concrete foundations for the generating plant. Indications from representatives of Siemens Turbomachinery AB suggest that these excavations will reach but not extend below sea level. The overall depth of excavation is therefore unlikely to exceed 3m in depth.

Excavation will therefore take place within the better compacted, but partially saturated zone of the reclamation fill. Reference to the trial pit findings in Section 4.3 and to the SPT results in Section 5.3 suggests that these excavations will need to be carried out through an upper layer which is relatively dense, homogenous and well compacted and then through a less homogenous layer that may also contain large boulders. The characteristics of this fill are described in Section 4.3 and summarised in Section 8.1 above.

The above considerations suggest that while the uppermost fill layers are likely to be self-supporting but the material may be less predictable below a depth of 1m below the existing level. Various degrees of localised collapse were observed in the trial pits, especially in those locations where the fill close to sea level was seen to consist of relatively uncompacted coarse material that contains large boulders and, inevitably, numerous voids. (Refer to pictures in Appendix C).

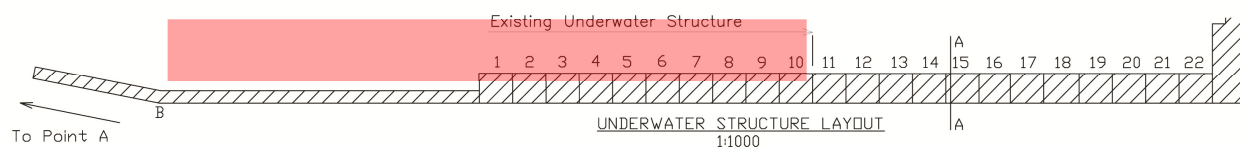
The stability of sides of excavation is unlikely to be problematic if sufficient space to form a 1:1.5 slope is allowed all round. This would imply a perimeter zone of around 3.75-4m around the proposed excavation. Some space should also be allowed for loose pieces of fill that will inevitably detach from the main body of the fill.

### 9.1 The existing retaining structures

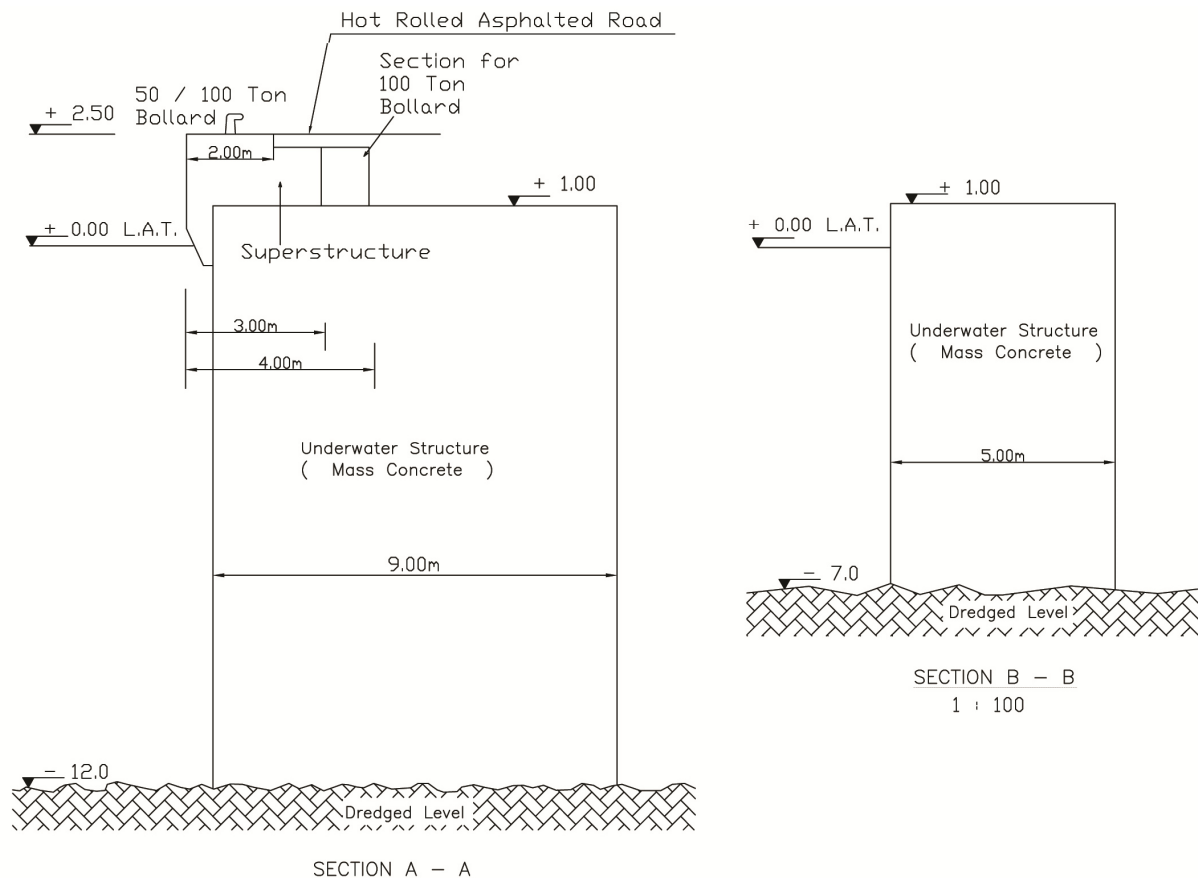
The existing structures bounding the site will need to support traffic loads, both during and after construction of the new power plant is complete. These structures consist mostly of the south-west facing quay sections that define the outer SW boundary of the site.

Trucks and cranes handling the components of the new power plant are expected to create large loads on these quay structures and such structures would therefore need to be checked for stability and strength. Investigation of these structures was beyond the scope of the current investigation, but some of the information retrieved from the boreholes drilled during this investigation can be used to understand the existing situation behind and below the retaining walls forming these quays.

The overall layout of the quays is presented in Figure 71 below. Approximately half of the site being proposed for the new combined cycle power plant is bounded by a heavier type of gravity retaining structure than the remaining half. Schematic cross-sections through these structures are shown in Figure 72.



**Figure 71 – schematic plan of underwater structure forming the quays on the SW boundary of the site (approximate location of site shown in red)**



**Figure 72 - Schematic cross-sections through the quay structure (from Enemalta, 2013, *General Arrangement of Delimara Power Station Quay* – Drawing No. QS/DPS/00113)**

Considering the results of the downhole seismic tests as well as the borehole data from the investigations close to the inner face of the quay wall, an attempt can be made to reconstruct the situation below and behind the quay wall. This is shown in Figure 73 below.

The quay is most likely to be founded on solid marl bedrock, which is just below the transition zone from the weathered sections, identified in the downhole tests. This however does not exclude the presence of weaker layers that were identified in the retrieved borehole core.

The material behind the gravity retaining structure is likely to consist of the marl strata, in their various degrees of stiffness, up to more or less half the height of the structure. A gap would have been created between the gravity structure and the marl during dredging and construction, which is now probably filled in with reclamation fill or with sand. There is the possibility that borehole 21 was drilled within this gap.

The upper half of the quay wall probably supports the various layers of reclamation fill and possibly some thickness of the silty sand layer. The latter layer may have collapsed during construction, such that the active wedge behind the wall would be composed entirely of reclamation fill. This would need to be verified by further investigation.

The reclamation fill was seen to be classified as dense granular material on the basis of SPT tests. This is however dubious, since it would have been difficult to compact such fills under water. It is more likely that the large particle sizes in the fill have contributed to the high SPT blowcounts leading to this classification.

Notwithstanding, the upper layers of fill, above sea level, were seen to be well compacted.

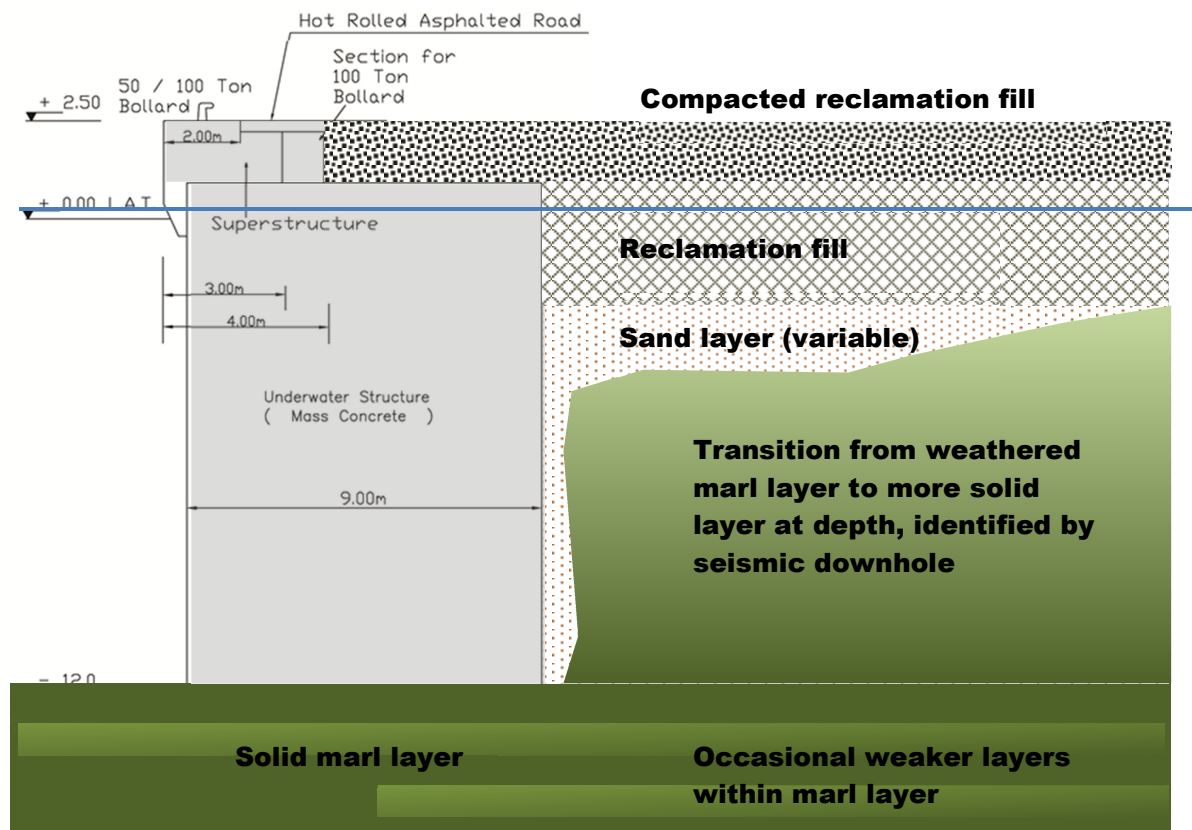
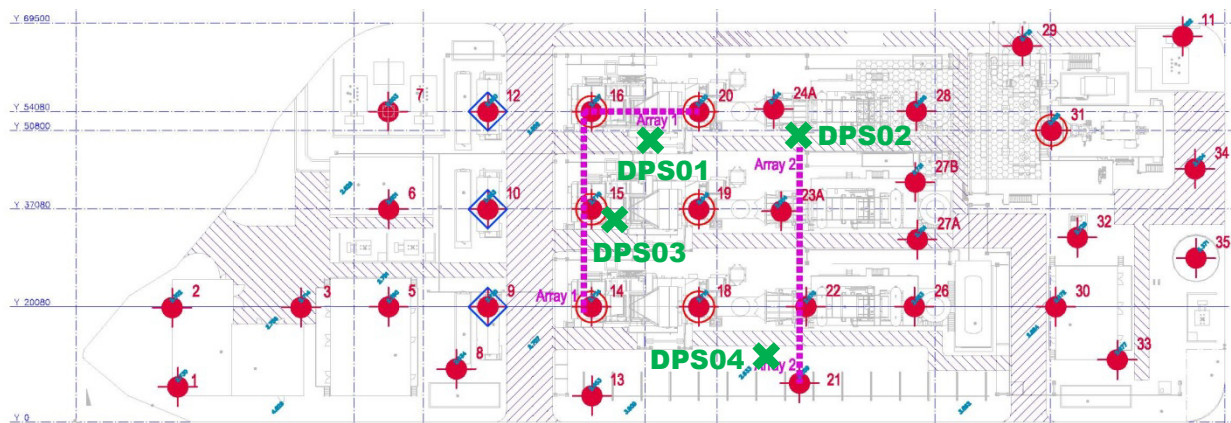


Figure 73 - Schematic reconstruction of ground conditions behind and below quay gravity structures

## 10 H/V measurements of ambient noise at Delimara site

*This part of the report has been prepared by Dr. Pauline Galea and Ms. Daniela Farrugia, Seismic Monitoring and Research Unit, Department of Physics, University of Malta.*

Four time-series recordings of ambient noise were taken on Thursday 7<sup>th</sup> August at the Delimara site, using two 3-component portable seismographs (Micromed Tromino , [www.tromino.eu](http://www.tromino.eu) ). The positions of the recording sites are denoted by DPS01 -DPS04 in Figure 74 below. The recordings were made at a sampling frequency of 512Hz, enabling the frequency analysis of the signal to be made up to 256Hz. Unfortunately, the recordings at DPS01 and DPS02 could not be utilized because of a malfunction in the instrument.



**Figure 74 - Position of single station ambient noise recording sites DPS01 – DPS04**

The 20-minute time series were processed to produce curves of horizontal-to-vertical spectral ratios. This was done by dividing the time series into windows of 20 seconds each, and carrying out the appropriate trace cleaning. For each window and each component (Z, N-S, E-W), the Fourier transform is computed and smoothed, the average of the horizontal spectra is taken and the horizontal-to-vertical spectral ratio computed. The resulting H/V curve is the average of all the time windows.

Figure 75 and Figure 77 below show the individual Fourier amplitude spectra for the three individual components (vertical and two horizontals) at sites DPS03 and DPS04 respectively. A number of peaks in the spectra are readily observed, where all components display a simultaneous peak. These are consistent among the 2 sites, and interpreted to correspond to anthropogenic noise sources, in this case most likely from the existing power station in operation at the time. The 50Hz peak is associated with the main generator frequency, while other peaks at 8.5Hz, 12Hz, and 24 Hz are probably associated with other machinery. In particular the 8.5Hz frequency is associated with pumps operating at 500 rpm.

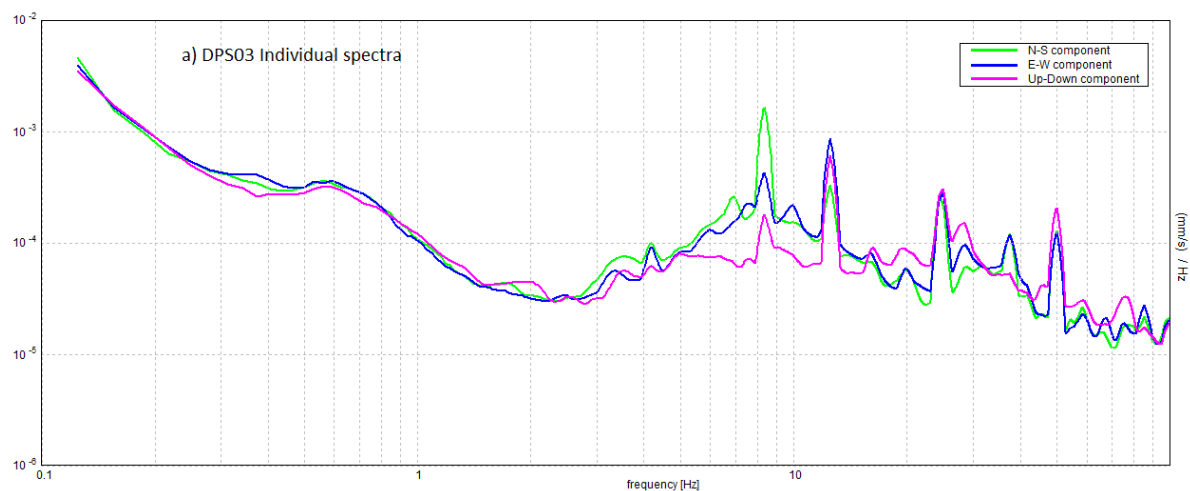
In contrast, in the region of 5 – 10 Hz in Fig 2a, and 5 – 8 Hz in Figure 77 below, it is clearly observed that there is a lowering of the vertical spectrum with respect to the horizontal spectra. This results in a peak in the H/V ratio at 8.3 Hz and 6.8 Hz respectively (Figure 76 and Figure 78). This feature (referred to as an “eye shape” in the spectra by Castellaro and Mulargia, 2009) has been shown to arise from the response of the stratigraphic column, and is therefore considered to be a site effect. In this case, it can be directly associated with the presence of the low-velocity infill layer over the “bedrock”. In the simple case of a low shear-wave velocity layer over a half-space, the site resonance frequency may be expressed as

$f_o = V_s/4H$ , where  $H$  is the thickness of the layer and  $V_s$  the average shear wave velocity in the layer.

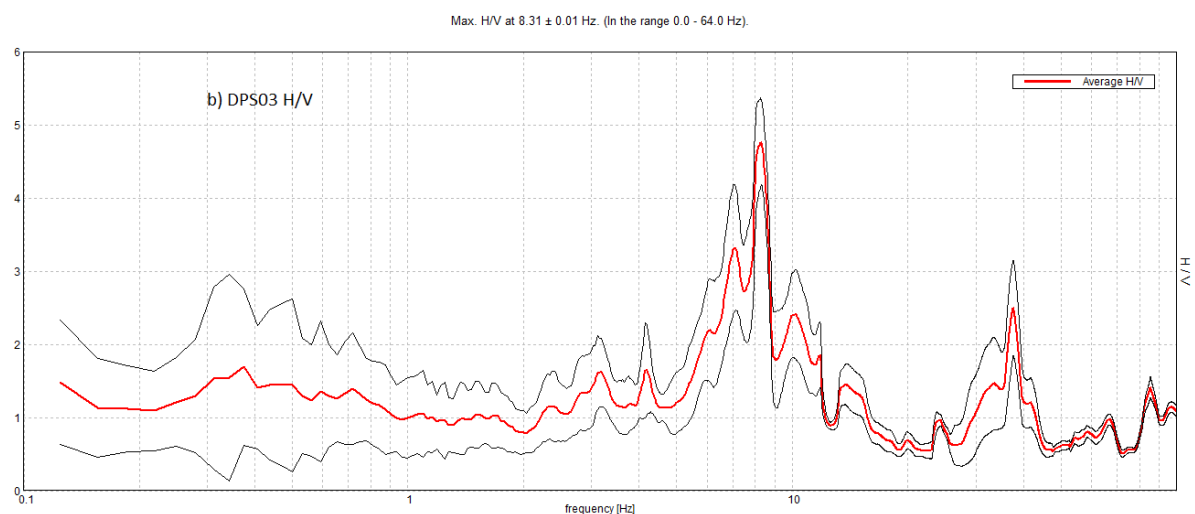


It should be pointed out that for the case of DPS03, the “stratigraphic peak” overlaps in frequency with the “industrial peaks” and some degree of interference between them must exist. Therefore the identification of the site frequency from this site is not reliable enough. At site DPS04, the two kinds of spectral peak are more distinct. This is due to a thicker layer of infill at this site, resulting in a lower resonance frequency.

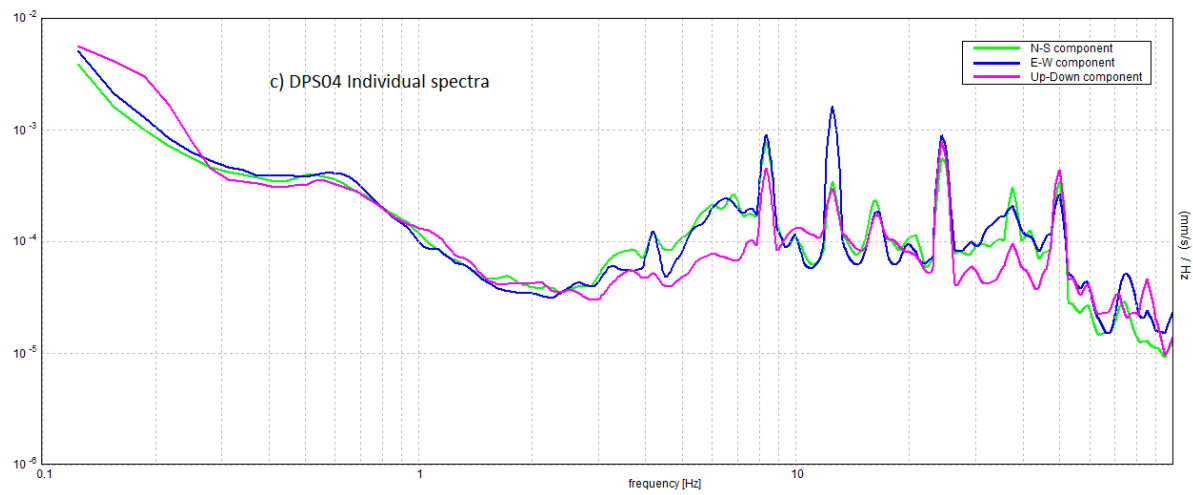
Using the results from the ESAC analysis, if we take a thickness of 12.5m for the overlying layer for DPS04, this gives a value of 340 m/s for the average shear-wave velocity of this layer, which is quite consistent with values from other methods.



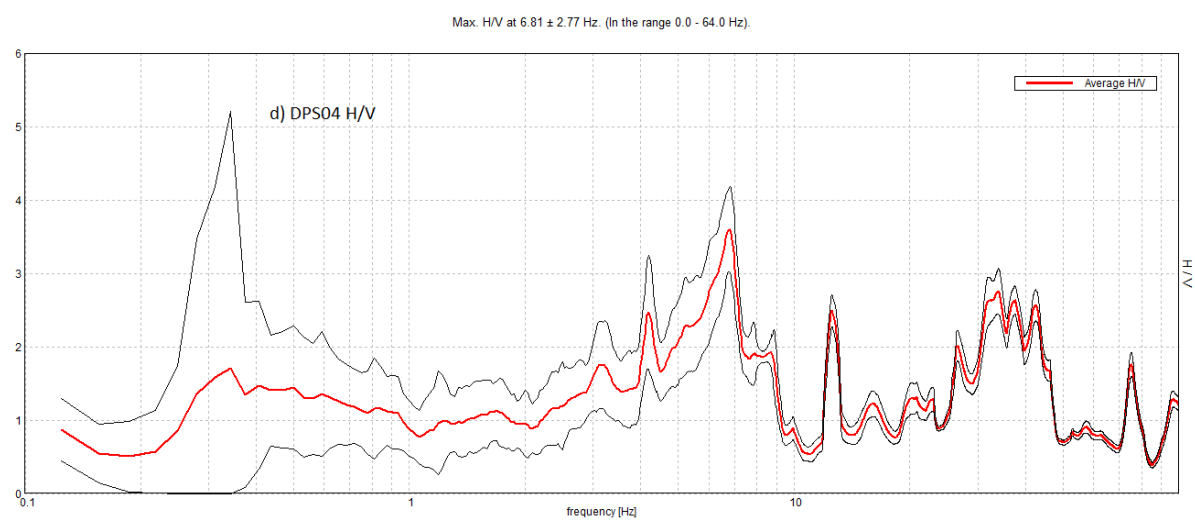
**Figure 75 - individual component spectra for Site DPS03.**



**Figure 76 - H/V spectral ratios for Site DPS03.**



**Figure 77 - individual component for Site DPS04.**



**Figure 78 - H/V spectral ratios for Site DPS04.**

In the spectral ratio graphs, the thin black lines represent  $\pm$  one standard deviation from analysis of all the time windows.

## **11 Seismic Hazard for the Maltese Islands, with particular reference to the new power plant site, Delimara.**

*This part of the report has been prepared by Dr. Pauline Galea, Seismic Monitoring and Research Unit, Department of Physics, University of Malta.*

### **11.1 Project Brief**

The Seismic Monitoring and Research Unit, University of Malta, has been entrusted with carrying out a seismic hazard report for the site of the new gas-fired power plant in Delimara. The site lies on the Delimara peninsula facing Marsaxlokk Bay, and is adjacent to the site of the present power plant. The site itself lies on reclaimed land, with a thickness of 12 – 18 m of infill overlying the Middle Globigerina Limestone layer. This report will calculate probabilistic values for ground motion parameters at the site, as well as deterministic evaluations of such parameters using numerical ground motion modeling for realistic and design earthquake scenarios.

The SMRU has also carried out array measurements of ambient noise as well as single station noise measurements on site. The data has been processed and numerically modeled in order to provide further constraints on the shallow structure and shear wave velocity profile.

### **11.2 Introduction**

The issue of seismic hazard and seismic risk for the Maltese islands is a long-standing and often controversial one, that has so far not been addressed in a fully comprehensive manner. In general, the public perception is that Malta and Gozo are relatively free from earthquake hazard. This perception probably stems from the fact that the last earthquake to produce some building damage occurred about 90 years ago, and the most damaging earthquake over 300 years ago. There is thus hardly any recollection of the danger in the collective memory. However the historical record reveals a number of events where building damage occurred, associated with earthquakes having both local and regional epicenters. Meanwhile, the local building density has increased dramatically over the past few decades, and the building footprint has spilled over to geologically diverse and more unstable areas, making it even more important to tackle the issue of seismic hazard and risk in a serious manner.

The probabilistic seismic hazard assessment for the Maltese islands is characterized by a number of inherent problems. Since the seismic history of the islands is sparse, and documentation does not go back much further than 500 years, hazard estimates are subject to large uncertainties. Seismicity patterns in the region around the islands have only begun to be properly studied in the past couple of decades. Although this seismicity does not appear to generate large and potentially destructive earthquakes, it is still important to understand the seismogenic structures and their behaviour, especially because there are at least two historical cases of damage caused by earthquakes whose epicenters were most likely in the Sicily Channel. Moreover, the effect of more distant earthquakes, e.g. in the Hellenic seismic zone, cannot be ignored since it has been historically documented that such events are capable of causing damage on the islands. This is evidently linked to a different attenuation regime, which is difficult to quantify because of the insular nature of the islands as well as the lack of instrumental records.

In this report, the problems are addressed in various ways in order to obtain a reasonable estimate of probabilistic and deterministic ground motion parameters

- The geological/seismotectonic situation in the Central Mediterranean and Maltese islands is first described and the potential sources of earthquake hazard are assessed. In particular, new

results about the seismic activity within the Sicily Channel are presented, based on observations and measurements over the past 10 years by the Seismic Monitoring and Research Unit, University of Malta.

- Hazard estimates in terms of probability of exceedance of ground motion parameters is obtained using different approaches – a site-based historical intensity approach, and a seismogenic source zone approach
- Deterministic estimates of ground motion parameters are carried out using a stochastic ground-motion simulation approach
- Uniform hazard spectra are derived

In addition the results of a geophone array experiment on site are discussed, in which ambient noise Rayleigh wave dispersion curves are inverted jointly with H/V curves (horizontal-to-vertical spectral ratio) using a genetic algorithm approach for extraction of the average shear wave velocity profile. *Single-station ambient noise measurements are also examined for spectral frequencies which are due both to stratigraphical response as well as to existing machinery within the present power station.*

### **11.3 Tectonics and Seismicity**

#### **11.3.1 The Mediterranean**

The Central Mediterranean is dominated by the overall convergence of the African (Nubian) continental plate northwestward onto the Eurasian plate, as well as by the various processes affecting the assemblage of microplates making up the lithosphere. Regional-scale kinematics reveal a diversity of tectonic processes – convergence, subduction, extension and transform – co-existing or superimposed (Vannucci *et al* 2004, Mantovani *et al* 2007). Figure 79 below shows the major tectonic features of the region in the present day. The plate boundary runs along the Maghrebid coast, through the island of Sicily and up along the Apenninic chain. It is a difficult process to unravel the past and present geodynamical intricacies of the Mediterranean as a whole, but vastly improved seismic monitoring, mapping and analysis now provides a detailed picture of the deformation taking place, and its interpretation in terms of tectonic behavior of separate regions. Figure 80 below shows the epicenters of earthquakes with magnitude greater than 4.5 in the Central Mediterranean basin since 1900, extracted from the ISC bulletin. The depth pattern reveals the two major subduction zones – the Calabrian arc/Tyrrhenian Sea, and the Hellenic arc below Greece. The Calabrian arc represents the final stages of subduction of the oceanic lithosphere below the Tyrrhenian, following roll-back of the subduction trench from the Western Mediterranean to its present position in the past 35Ma (Baccheschi 2007, Faccenna 2001). Subduction at the Calabrian arc is believed to have ceased or is very slow (about 5mm/year). Meanwhile, the Ionian crust, stated in several works to be oceanic in nature, is being subducted below the Hellenic trench in a NE direction.

Although seismicity in the Mediterranean is widespread, there are major clusters associated with the whole of the Italian peninsula, the Balkan peninsula and Hellenic arc, and the Maghreb coast of North Africa. The shallow earthquakes do not delineate a very well-defined plate boundary, but rather a complex zone of deformation. Although historically, there have been relatively few earthquakes of large magnitude (compared to, say, the circum-Pacific region), however, the urban density is very high and earthquakes have historically caused hundreds of thousands of deaths in this region. The Maltese islands, lying just south of the collision front in Sicily, cannot be considered to be in a risk-free zone.

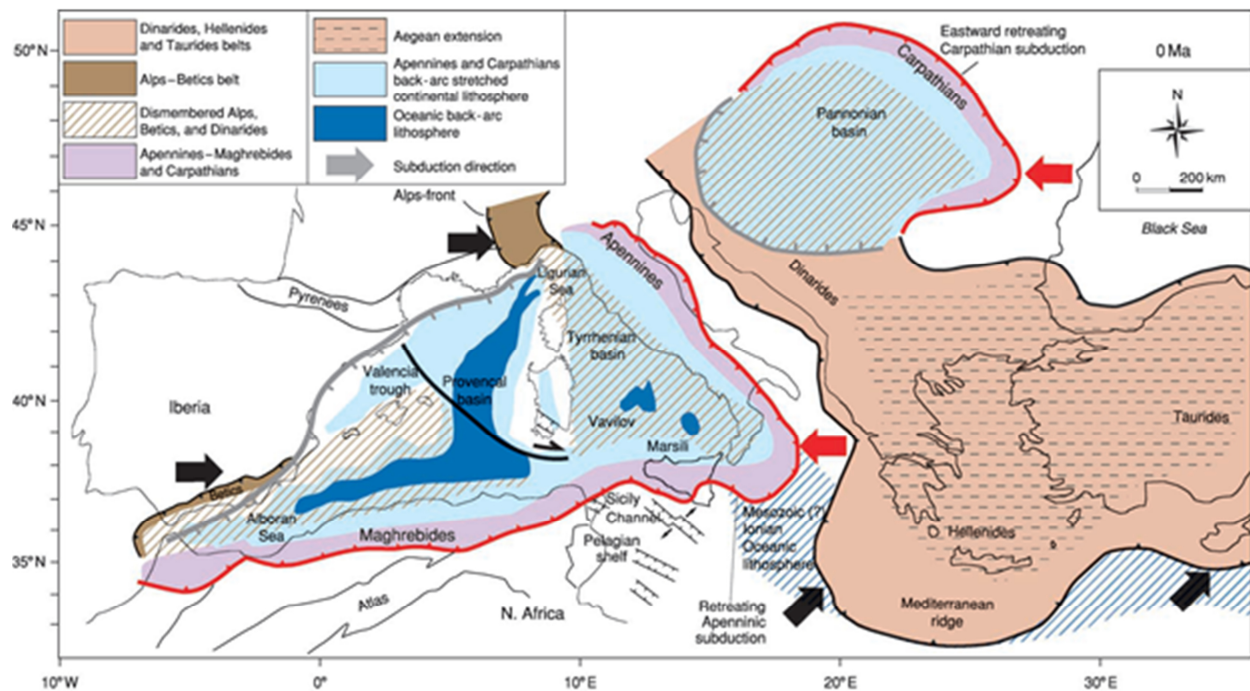


Figure 79- Geology and tectonics of the Central Mediterranean (reproduced from Carminati e Doglioni, 2004)

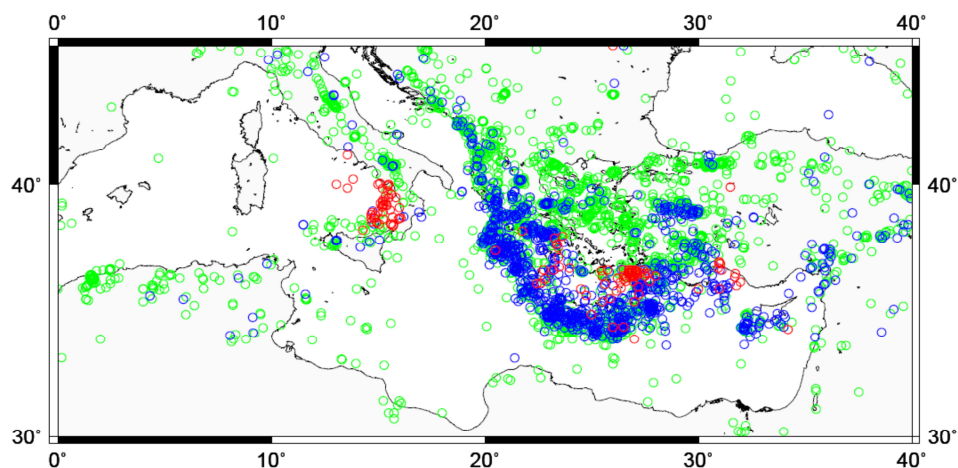


Figure 80 - Seismicity of magnitude greater than 4.5 in the Mediterranean region since 1900. Green circles - hypocentres less than 35km depth; blue circles - hypocentres between 35 and 100km depth; Red circles – hypocentres deeper than 100km. (International Seismological Centre)

### 11.3.2 The Maltese Islands

The Maltese archipelago, consisting of 3 main islands – Malta, Gozo, Comino - lies in the Sicily Channel, on a relatively stable plateau of the African foreland, the Pelagian Platform, about 200km south of the Europe - Africa plate boundary segment that runs through Sicily. The Pelagian Platform forms a shallow shelf separating the deep Ionian basin from the Western Mediterranean. Its sea-bed topography is characterised mainly by the NW trending Pantelleria Rift, or Sicily Channel Rift Zone (SCRZ) – a system that features three grabens of Miocene – Pliocene age (Pantelleria graben, Malta graben and Linosa graben) in which the water depth reaches a maximum of around 1700m (Reuther and Eisbacher, 1985) (Figure 81 below). In particular, the Malta graben passes close to the southern coast of Malta, the nearest distance being about 20 km. The grabens are governed by a fault system that extends

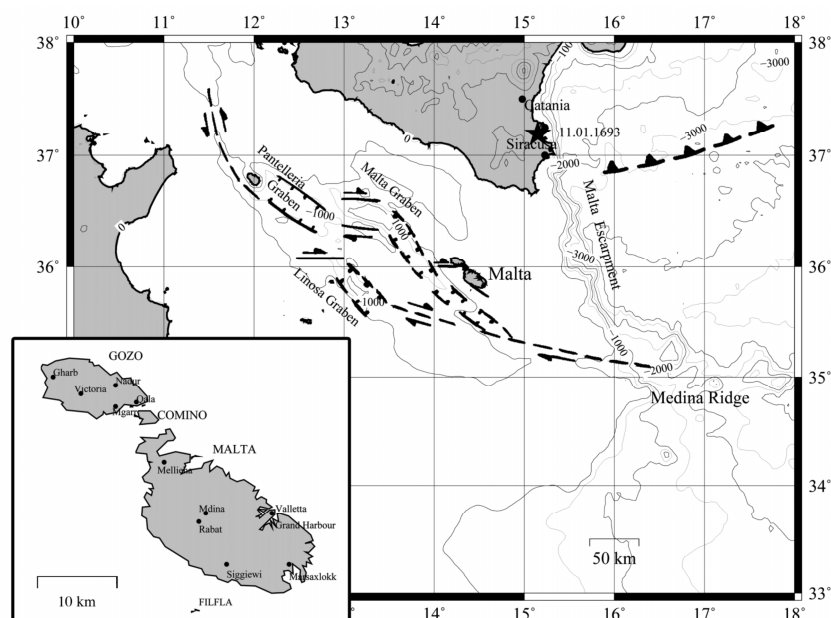


throughout the Sicily Channel from Southern Sicily to Tunisia and which has also been responsible for the major tectonic and geomorphological development of the Maltese islands (Illies, 1981). The SCRZ has been interpreted in different ways, as a set of pull-apart grabens (Reuther and Eisbacher 1985, Reuther, 1990) and as the result of a simple N-S extension regime related to Tyrrhenian back-arc spreading (Argnani 1990). Jongsma *et al.* (1987) interpret the rift zone as part of the Medina Wrench, a more than 800km long dextral transform fault which extends from the Sicily channel to the eastern end of the Medina Ridge, 200km southeast of Malta. The wrench fault is interpreted as forming the southern boundary of the Hyblean microplate. The grabens themselves are bounded by normal faults, trending mainly NW – SE, whereas a set of E-W trending features represent reactivated faults that now act as dextral transforms controlling the rift extension (Reuther and Eisbacher 1985).

The Malta Escarpment, bounding the Pelagian platform to the east, is a major geomorphological feature separating the Hyblean-Malta plateau from the deep Ionian basin. Sea depth increases dramatically from around 200m to over 5000m on crossing the Malta Escarpment. It exhibits normal faulting, with a minor sinistral strike slip component (Grasso *et al* 1985, Reuther *et al* 1993).

The islands themselves are made up of an Oligocene-Miocene shallow water sedimentary sequence of carbonates and clays (Figure 82 below). The layer sequence is intensely faulted and disrupted, mainly through an older NE – SW trending fault set, believed now to be extinct, while a more recent steeply-dipping normal fault trending NW-SE along the southern coast of Malta, the Maghlaq fault, is the most prominent onshore expression of the similarly trending normal faults bounding the grabens of the SCRZ (Illies, 1981, Reuther and Eisbacher, 1985). A fault system along the southern coast of Gozo, belonging to the older set, is interpreted by Reuther, as having been neotectonically remodelled into a strike-slip fault that contributes to the extensional kinematics of the SCRZ.

The most prominent fault passing close to the Delimara site is the Maghlaq fault. It is not established when this fault was last active, however studies of displacement in some alluvial fan conglomerates indicate a late Pliocene – Holocene age (approximately 11,000 years BP) for the most recent movements. (Bonson *et al*, 2007).



**Figure 81 - Bathymetry of the Sicily Channel and main tectonic features of the Sicily Channel Rift Zone-bounding normal faults and strike-slip lineaments (modified after Reuther and Eisbacher, 1985 and Reuther, 1990). Also shown are the Calabrian Arc subduction zone and epicentre of the 11/01/1693 earthquake (Boschi *et al.*, 2000). Inset shows the Maltese islands.**

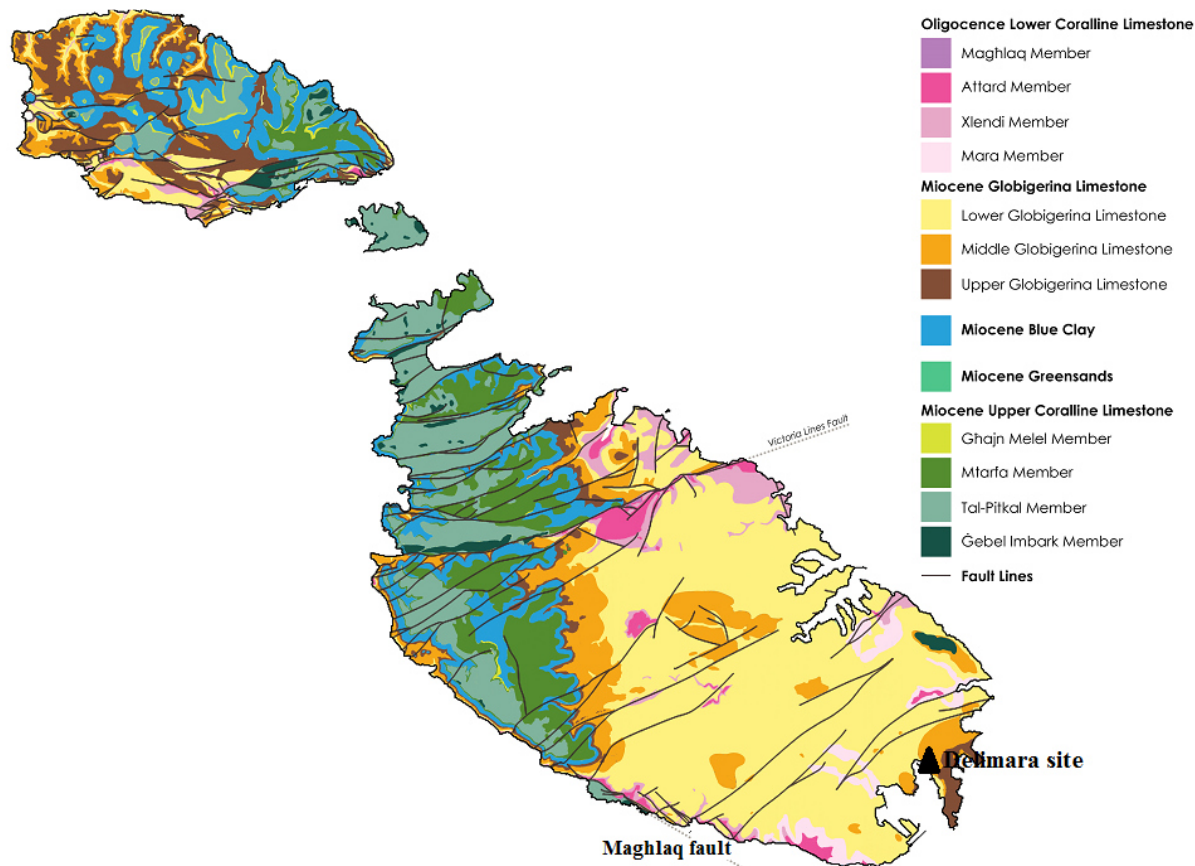
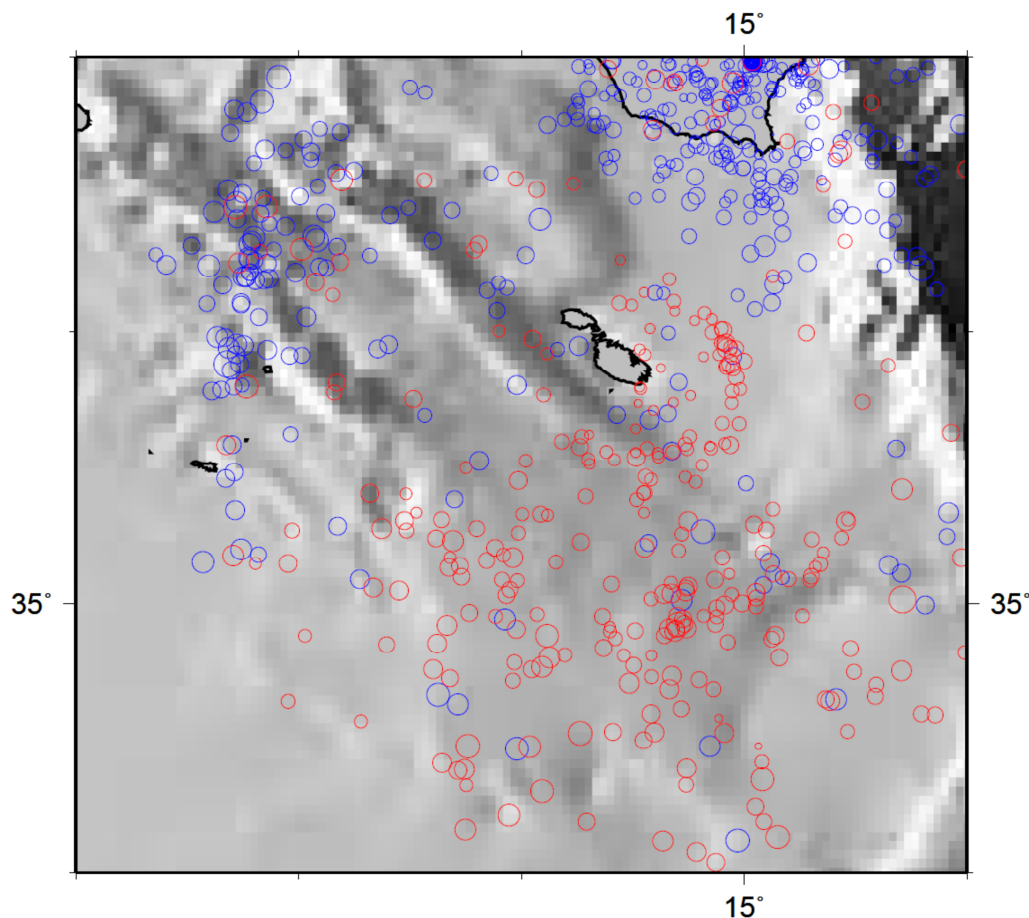


Figure 82 - Geology and main fault systems of the Maltese islands. The site under study is shown as a black triangle.

### 11.3.3 Instrumental Seismicity around the Maltese islands

Seismicity in Sicily is well monitored and located by the national and regional networks of the Istituto Nazionale di Geofisica e Vulcanologia (INGV), Rome and by other local /regional institutions. INGV also locates earthquakes in the Sicily Channel by incorporating data from island stations and Wied Dalam station (WDD) on Malta. However many earthquakes in the Sicily Channel that are either of too small a magnitude or occur to the south of the islands, are not recorded well enough on the seismic networks to be well located. The Seismic Monitoring and Research Unit (SMRU), University of Malta, has implemented a system that locates local/regional earthquakes using a single-station method, and this has revealed a previously unknown level and pattern of seismicity on the SCRZ fault system (Agius and Galea, 2011). Although location accuracy using a single station may not be as large as that using station networks, it is still possible to observe the delineation of active faults in the region as defined by the microseismicity. During this period of observation, earthquake magnitudes in the Sicily Channel have been small (not exceeding 4.5), however, it is known that historically, earthquakes in the Sicily Channel have also caused damage to the islands (see Section on Historical Seismicity). The Sicily Channel seismicity during a 12-year period is shown in Figure 83 below. The represented earthquake catalogue has been built by merging the INGV catalogue with the SMRU catalogue for the period 2002 – 2013. There is a reasonable correlation of the seismicity pattern with the tectonic features of the Sicily Channel. The normal faults bounding the Pantelleria, Linosa and Malta grabens and appear to be active especially towards their southeastward extensions. South of the Maltese islands, two active fault zones are evident. One cluster of seismicity lies at around 30 - 50km southeast of Malta, and coincides with the southeastern extremity of the Malta graben. Another active region is evident by a cluster of seismicity at 80 – 100km south of Malta. This coincides with the east-west trending right-lateral transform lineament at

35°S. Another active region lies at about 40km east of Malta. Most of the seismic activity shown in the map is derived from an earthquake swarm that occurred during April 2011, the largest event having a magnitude of 4.1 (24 April 2011, 13:01 GMT). No clear bathymetric expression of an active fault has so far been identified in this region.



**Figure 83** Seismicity in the vicinity of the Maltese islands during the period 2002 – 2013, located by the SMRU (University of Malta, red circles) and INGV(blue circles). Size of circles proportional to magnitude, largest magnitude is 4.6

#### 11.3.4 Historical Earthquake Catalogue

The compilation of a site-specific historical earthquake catalogue spanning as far back in time as possible, is the first and perhaps the most important step in any seismic hazard assessment. Such a compilation requires time-intensive documentary research in local, and possibly foreign, archives and can never be said to be totally accomplished. In Malta, archived documentation is generally very scant for the period before the arrival of the Knights of the Order of St. John in 1530. For the Maltese islands, a historical catalogue of felt earthquake intensities on the EMS-98 scale dating back to 1530 has been compiled (Galea 2007).

It is not easy to establish earthquake source parameters for a small island in the pre-instrumental period. Although, using foreign earthquake catalogues, a number of felt events can definitely be attributed to major earthquakes in Sicily or Southern Greece; many others are due to offshore earthquakes with epicentres in the Sicily Channel. In such cases there is usually very scant spatial information, making it impossible to estimate an epicentral location, especially if the event is reported to be felt only on the Maltese islands. Moreover, empirical relations for estimating magnitude from epicentral or maximum intensity clearly cannot be applied in such cases, making it impossible to estimate magnitudes. In such a situation, it is therefore more instructive to base the hazard estimation on felt intensities. The EMS-98

scale was used, and intensities were assigned after careful consideration of the reliability of historical descriptions, vis-à-vis the state of repair and vulnerability of the buildings at the time.

The catalogue contains more than 100 events which have produced effects of intensity  $\geq$  II in the Maltese islands since 1530. Figure 84 below represents the seismic history for events of intensity IV or higher. Table 14 below lists those events, together with all related available parametric information, which produced an intensity of V or higher. Intensity V is the EMS-98 at which minor damage to the most vulnerable buildings begins to be mentioned. In this work, only one intensity value is given for the whole islands. However there are a few cases in which there is a distinct attenuation of intensity from one side of the islands to the other, for example in the 1911 event which was probably located to the west of Gozo. In these cases, the intensity given here is the one estimated in the area of highest effect.

Figure 85 below shows the epicenters of the earthquakes which produced damage of intensity at least VII on the Maltese islands. It is worth noting the wide distribution of hazard sources. In particular, large events in Greece further than 1000km from Malta have also produced significant damage on the islands. Woo (1995) discusses the effects of the 1856 earthquake on the Maltese islands in some detail in the context of anomalously high intensity observed at large epicentral distances. Almost all houses in Valletta, and many houses in other villages and in Gozo suffered serious cracks to their walls, and the damage was more noticeable on the upper floors. Such damage is most probably due to long-period shaking as well as a low-attenuation regime which transmits seismic energy very efficiently across the Ionian basin. Such effects have never been properly taken into account when discussing the seismic hazard to Malta, and should feature strongly in any deterministic hazard assessment, particularly in the light of the recent increase of multi-storey buildings which are more vulnerable to low-frequency ground motion.

The highest intensity experienced since 1500 is VII-VIII, resulting from the SE Sicily earthquake of the 11 January 1693. This earthquake caused over 60,000 deaths in eastern Sicily, together with total destruction of several towns and villages in this region (Azzaro *et al* 1999, Boschi *et al*, 2000)). Its effect in Malta is extensively documented in the Archives and is also described in a contemporary book by Shower (1693). The earthquake was strongly felt throughout the whole of the islands. In Valletta, the facades of some major buildings were detached from the main structure, and were in imminent danger of collapse. A number of houses also suffered seriously cracked walls and some had to be demolished. Churches suffered major damage to their domes and walls. Serious damage was done to several buildings of the old mediaeval city of Mdina, on the island of Malta, where the Cathedral suffered partial collapse. This was mainly due, however, to the state of neglect of much of the city. Collapse of the bell tower and choir of St. Paul's church and damage to the Dominican friary in Rabat is also reported. In Gozo, Blondel notes that the damage to the fortified *Cittadella*, was most probably due to "long years of neglect", as was the damage to coastal towers. The Cathedral in Rabat lost its bell-tower, and other churches sustained damage to their domes and spires, and parts of cliff faces are reported to have been detached and fell to the sea.

Scientific publications do not all agree about the exact source of this earthquake but it is most commonly associated with the normal-faulting, northern segment of the Sicily-Malta Escarpment. This fault region is therefore considered to be possibly the largest source of hazard to the Maltese islands, as it appears to be the only fault in the region capable of generating earthquakes of magnitude larger than 7.0.

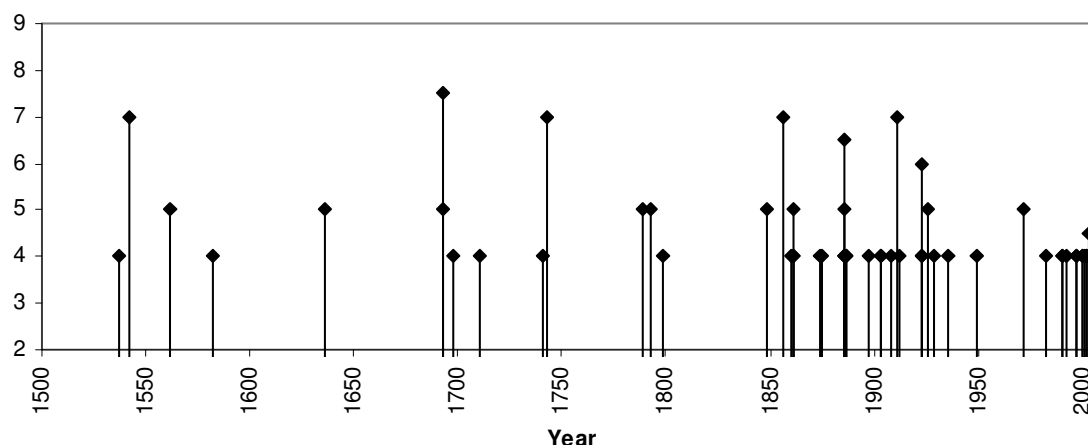


Figure 84 - Site seismic history for the Maltese islands since 1500, showing EMS-98 intensity  $\geq$  IV

Table 14 - Subset of felt earthquake catalogue, showing events that produced EMS-98 intensity V and over on the Maltese islands. The larger events, of intensities at least VI are highlighted

Year	Month	Day	Hour	Lat	Lon	Region	$I_{\max}$ on Maltese Islands	$I_0$	Magnitude	Parameter Reference
1542	12	10	15:15	37.20	14.90	E.Sicily	VII	XI	Mw 6.6	CPTI04
1562	3	8	mornin g			Sicily Channel?	V?			
1636	9	1				Sicily Channel(?)	V?			
1693	1	11	13:30	37.18	15.02	E.Sicily	VII-VIII	XI	Mw 7.4	CFTI4MED
1743	2	20	16:30	39.87	18.78	Ionian Sea	VII	IX	Mw 6.9	CPTI04
1789	1	19	mornin g			Sicily Channel(?)	V?			
1793	2	26	mornin g			Sicily Channel?	V?			
1848	1	11	12:00	37.20	15.20	E.Sicily	V	VIII-IX	Mw 5.5	CPTI04
1856	10	12	00:45	35.60	26.00	Crete	VII		Mw 7.7	Papazachos <i>et al</i> 2000
1861	2	8	23:45			Sicily Channel(?)	V?			
1886	8	15	02:45			Sicily Channel(?)	V			



Year	Month	Day	Hour	Lat	Lon	Region	I <sub>max</sub> on Maltese Islands	I <sub>o</sub>	Magnitude	Parameter Reference
1886	8	27	22:00	37.00	27.20	Aegean Sea	VI - VII	XI	Mw 7.3	Papazachos <i>et al</i> 2000
1911	9	30	09:25	36.4?	13.5?	Sicily Channel	VII			
1923	9	18	07:30	35.5?	14.5?	Sicily Channel	VI			ISC
1926	6	26	19:46	36.50	27.50	Aegean Sea	V		Mw 7.6	Papazachos <i>et al</i> 2000
1972	3	21	23:06	35.80	15.00	Sicily Channel	V		Mb 4.5	ISC

It is clear that a certain level of hazard is also presented by the lower magnitude Sicily Channel seismicity. At least two events in this region since 1900 have produced damage of intensity  $\geq$ VI. The earthquake of 30 September 1911 appears to have originated to the northwest of Gozo, and caused considerable damage to the walls of many houses in Gozo and to several churches and other buildings, while the damage in Malta was far less. The 18 September 1923 event, on the other hand, was probably located to the east of the islands, and produced mainly non-structural damage, such as cracks in residential building walls and church domes.

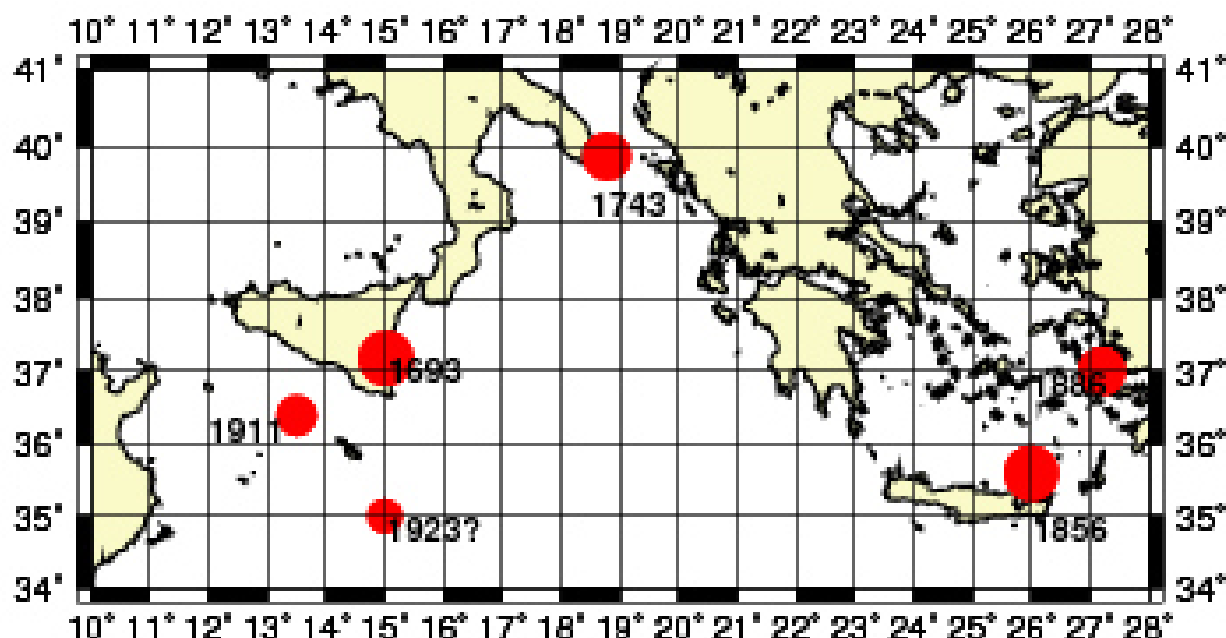


Figure 85 - Epicentres of earthquakes (scaled with magnitude) that have produced EMS-98 intensity of at least VI on the Maltese islands.

## 11.4 Hazard Assessment

*Probabilistic/Deterministic Approaches:*

Both probabilistic and deterministic approaches to seismic hazard and risk analyses have their validity in a decision-making setting. Which method is chosen depends on the nature of the decision to be made, the seismicity of the region, the information available etc. However it is becoming increasingly evident that a proper hazard estimate requires some combination of the two approaches. For insurance and engineering design purposes, probabilistic estimates are generally more suited to the problem. For a region such as Malta, however, a probabilistic estimate is characterized by a number of difficulties:

- The Maltese islands lie in an area with a level of background seismicity that is low to moderate, and not generally perceived as a high risk. However, the occurrence of rare damaging events has been shown historically. The country is thus in a situation of an “extreme event”, with potentially very serious consequences;
- The historical record does not extend far back enough to include more than one of the maximum intensity events
- The potential hazard sources are not on the national territory, and many of them are in the sea, making it very difficult to estimate the location and magnitude for pre-instrumental such earthquakes.
- Classical methods of probabilistic hazard assessment require the input of well-defined source zones, attenuation characteristics (which assume greater importance here given the differences in propagation characteristics between different directions) and stress release rates. These characteristics have not yet been fully evaluated, since the delineation of source zones in the Sicily Channel would require a much longer observational period and more accurate earthquake locations. This problem is set to be addressed in the near future by the imminent installation of a denser seismic network.
- Although the geology of the Maltese islands is simple, however intense faulting has meant that different rock/soil types outcrop at the surface in different areas. In particular the clay layer, where it exists either at the surface or underlying the top layer has been shown to affect the amplification at the surface. Thus site response effects must necessarily play a part in any damage evaluation
- Although earthquake engineers most commonly base their estimations of building damage on predicted values of peak ground acceleration, this is also not an easy parameter to deal with here, since there are no records at all of actual ground acceleration. All felt activity is described in terms of intensity and it is more natural to use this as the representative ground motion parameter. Empirical relationships between intensity and ground acceleration are highly scattered and subject to large uncertainties

In this report a combination of several approaches has been used to arrive at a reasonable figure for design ground motion parameters at the site in question.

#### **11.4.1 Historical intensity based hazard assessment**

In view of the difficulties mentioned above, a satisfactory approach has been found to be the method of Magri *et al* (1994), which estimates return periods and probabilities for events of given intensity. This method is particularly suitable for regions where historical data is scant. It requires only a set of earthquake intensities at the site, and does not make use of source characteristics. The probability values are not associated with a particular fault, but to a site-specific history considering all possible sources. The intensities may be either measured (from historical descriptions) or else estimated using a site-specific attenuation relation. In this case the intensities were all estimated from historical descriptions over a 500-year period. In this method, the intensity resulting from a particular event  $i$ , and the exceedance of the intensity are both expressed as discrete probability functions  $p_i(I)$  and  $P_i(I)$  respectively. This allows for the expression of uncertainties related to the assignment of an intensity value. The total probability of exceedance of a given intensity at a particular site is then a summation

over all events in the intensity catalogue during the completeness period of the catalogue for that intensity.

Using this method, the return periods for intensities  $\geq V$  were calculated and are shown in Figure 86 below. A 100-year return period corresponds to intensity VII. For intensity VIII the return period turns out to be 1000 years. Admittedly, this value is based on a single observation of intensity VII – VIII for the 1693 earthquake in a 500-year period, but can be justified by noting that in Sicily, the approximately 500-year return period is associated uniquely with the 1693 event source region, which also generated the 1169 earthquake (e.g. Barbano *et al* 2001, Azzaro *et al* 1999). In other words, if the occurrence of the maximum experienced intensity (VII – VIII) is tied to the source region of the 1693 earthquake then we can expect this intensity to have a return period of around 500 years. This is consistent with Figure 86 below.

D’Amico and Albarello implemented the same site-based approach in a program to estimate seismic hazard from an intensity historical catalogue at the given locality (D’Amico and Albarello, 2008). Again, this procedure allows the calculation of hazard without the use of source and attenuation data. In using this program, Malta was treated as one locality, although this could be refined in future. Figure 87 shows the site seismic hazard as a probability of exceedance of a given intensity in an exposure time of 50 years. When assigning an intensity value from historical documents, there is always a degree of uncertainty, due to insufficient knowledge of building conditions, true extent of damage, “embellished” reporting, etc. In intensity catalogues, this uncertainty is expressed by giving intensity ranges, e.g. VI – VII. This program allows the use of decimal fractions as an expression of the probability. In this procedure an idea of the uncertainty in the results was obtained by running the program with the lower bounds of the intensity ranges (i.e. a conservative evaluation), with the upper bounds and with the average values. The highest degree of uncertainty, and the most influential, was in the intensity range VI – VIII, as can be seen in Figure 87. **From this figure it can be concluded that  $I_{ref}$  the intensity with a 10% exceedance probability in 50 years is VII.**

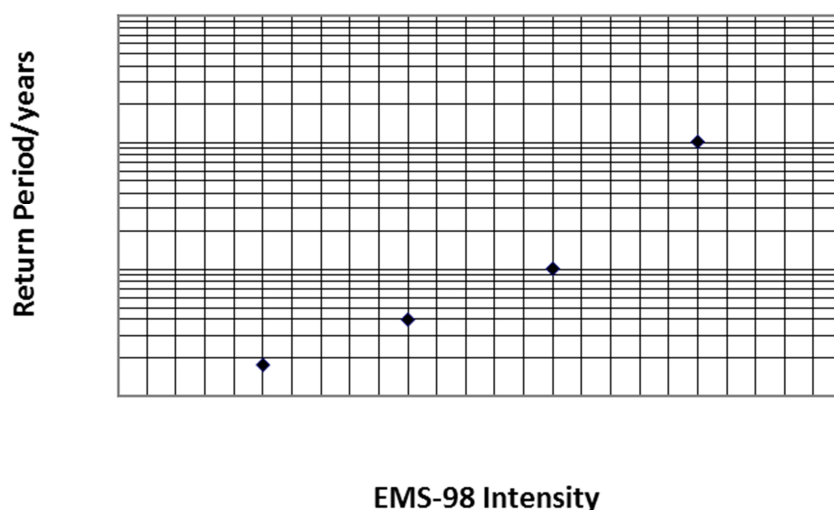


Figure 86 - Estimated return periods, following the methodology of Magri *et al* (1994)

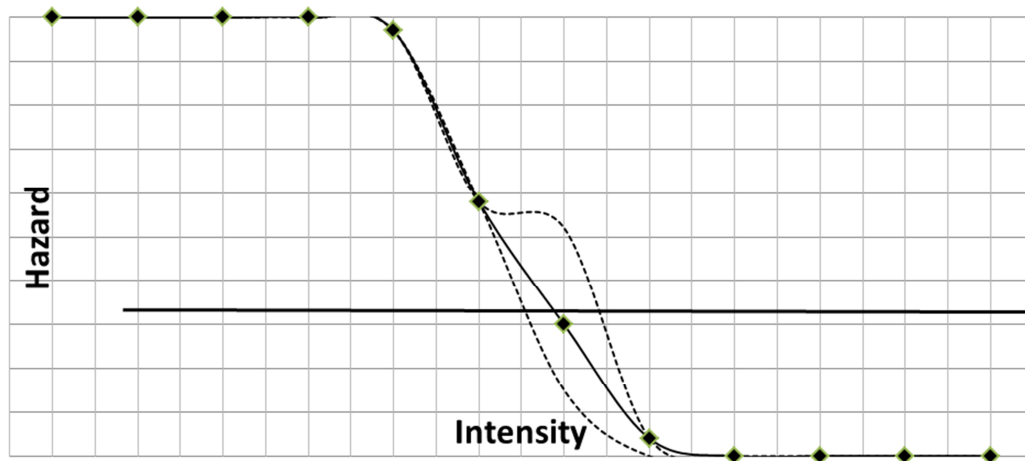


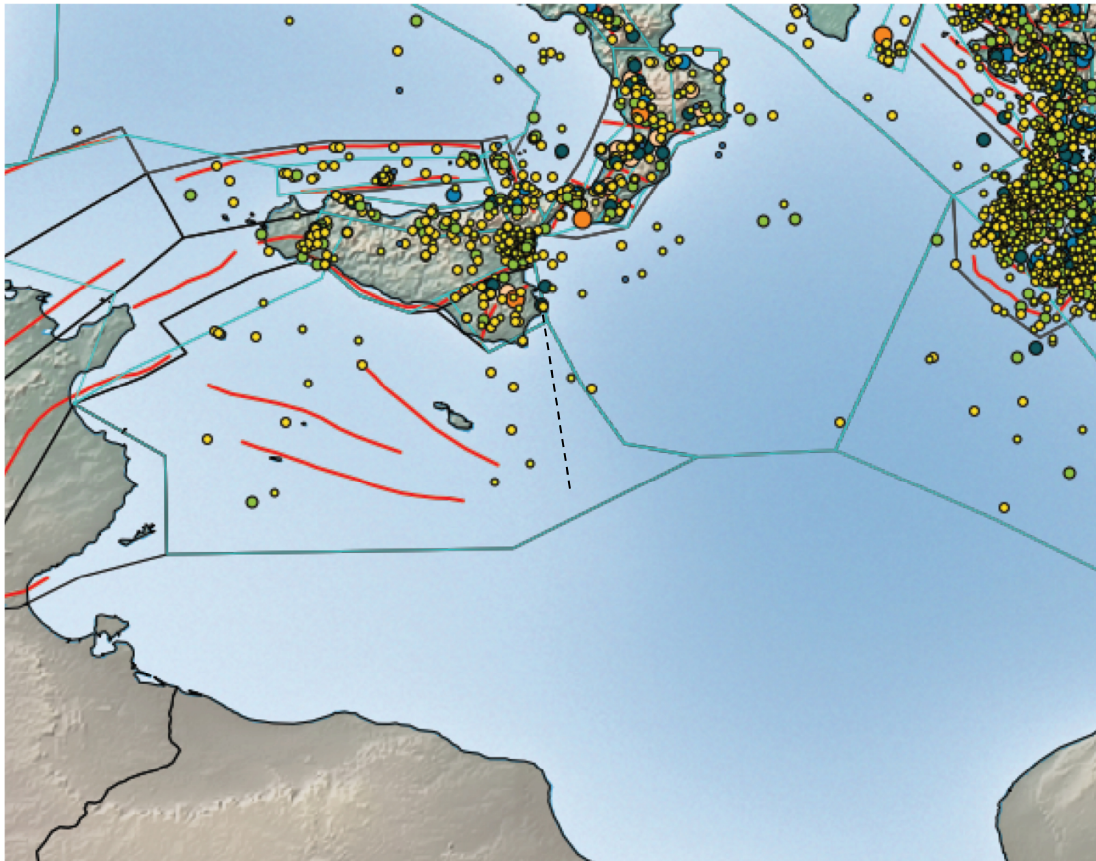
Figure 87 - Hazard curves computed at the locality of Malta. The bold line represents the  $I_{ref}$  value (10% exceedance probability in 50 years).

The conversion of intensity to peak ground acceleration (PGA) is always subject to uncertainty, however it has been shown that for the region of southeastern Sicily, the relationship by Decanini et al (1995) gives good agreement when used to compare simulated PGA from the 1693 earthquake source with historical intensity values (Abela, 2014). The relationship is  $\log(PGA) = 0.594 + 0.197I$ , **and gives a value of 0.09g – 0.12g for intensity 7 – 7.5.**

#### 11.4.2 Seismicity-based probabilistic hazard assessment

For the purpose of generating probabilistic seismic hazard curves and maps, as well as unified hazard spectra, use has been made of the SHARE project portal (Seismic Hazard Harmonisation in Europe, [www.share-eu.org](http://www.share-eu.org)), together with the EFEHR portal (European Facility for Earthquake Hazard and Risk, [www.efehr.org](http://www.efehr.org)). Within the FP7 project SHARE, a harmonized database of active faults and seismogenic source zones in Europe and surrounding areas has been compiled from a large variety of literature and expert sources, as well as comprehensive earthquake catalogues. These, together with Ground Motion Prediction Equations, or attenuation relations, have been used to compile a unified European Seismic Hazard Map, using OpenQuake (Silva et al, 2014). Figure 88 below shows the active fault zones, background seismic zones and area sources, together with the earthquake catalogue for  $M > 4.0$  that have been used as input to the probabilistic hazard computation. The programme uses a logic tree approach with appropriate weightings in order to account for the different models of earthquake sources and ground motions, and in order to provide uncertainty estimates.

Using the SHARE online database, seismic hazard curves and unified hazard spectra were generated at the Delimara site (35.84N, 14.56E) for a choice of ground motion parameters and conditions. The computations only allow for a rock site, therefore it must be kept in mind that the presence of infill at the reclaimed site will introduce some increase in the acceleration. This is dealt with in Section 4.3. Figure 89 below shows the mean hazard curve for PGA together with the 0.85 and 0.15 fractiles. Considering the site as a rock site, **the PGA with a 10% probability of exceedance in the next 50 years is 0.06g.**



**Figure 88** - Active fault source zones (red lines), area sources (blue polygons), background zones (black polygons) and earthquake epicenters for  $M > 4.0$ , used in the SHARE hazard model. The Sicily-Malta escarpment is indicated as a dashed line.

The hazard curves for spectral acceleration at 0.03Hz, 1Hz, 3Hz and 5Hz were also computed. From the graphs, it is seen that **the spectral acceleration at 5Hz with a 10% probability of exceedance in the next 50 years is 0.12g**.

Using the SHARE database, the Unified Hazard Spectra were also plotted for the site, and are shown in Figure 93 and Figure 94 below. These curves indicate that maximum ground accelerations are expected for frequencies around 5Hz, and confirm the values given in Figure 90-Figure 92.

Figure 95 shows the Seismic Hazard Map for the region of the Maltese islands. From this map, it is seen that there is a 10% probability of exceedance of PGA between 0.05g and 0.1g in the next 50 years. This is in quite close agreement with the value derived from the historical felt intensity catalogue.

SHARE Preferred Mean Hazard Model

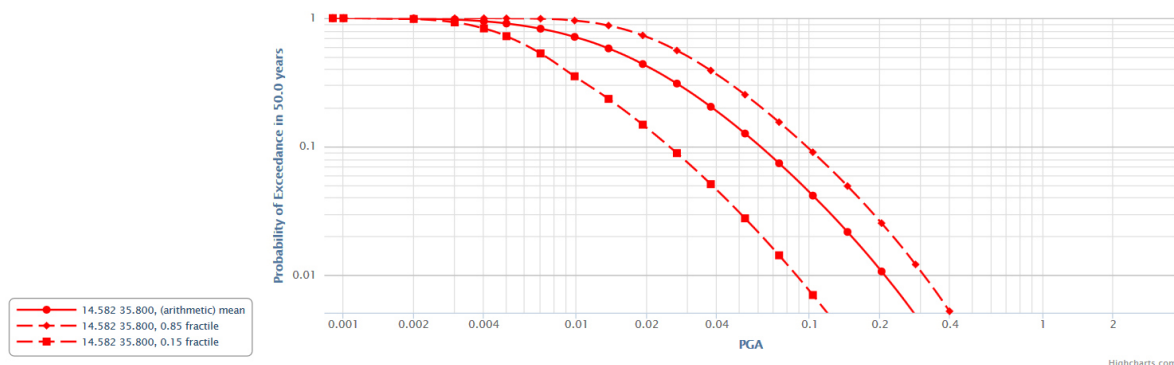




Figure 89 - Seismic Hazard curve for peak ground acceleration (PGA) against probability of exceedance in 50 years, calculated for a rock site.

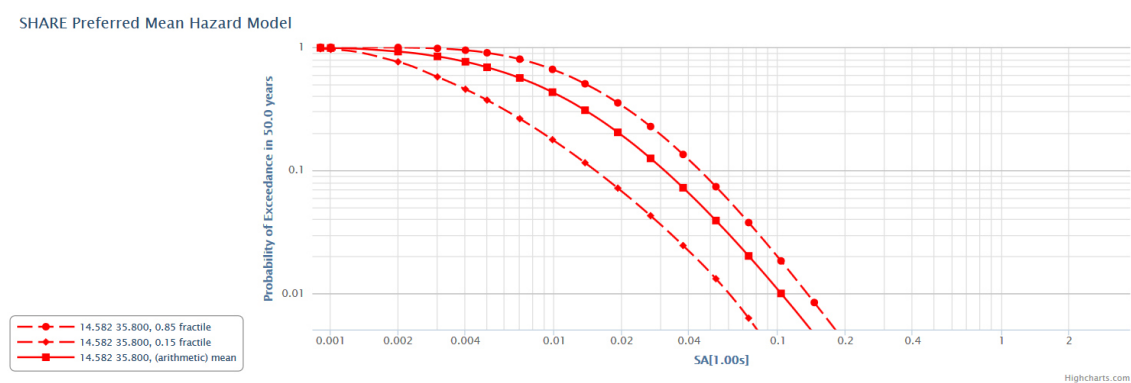


Figure 90 - Seismic Hazard curves for spectral ground acceleration (sa) at 1Hz, against probability of exceedance in 50 years, calculated for a rock site.

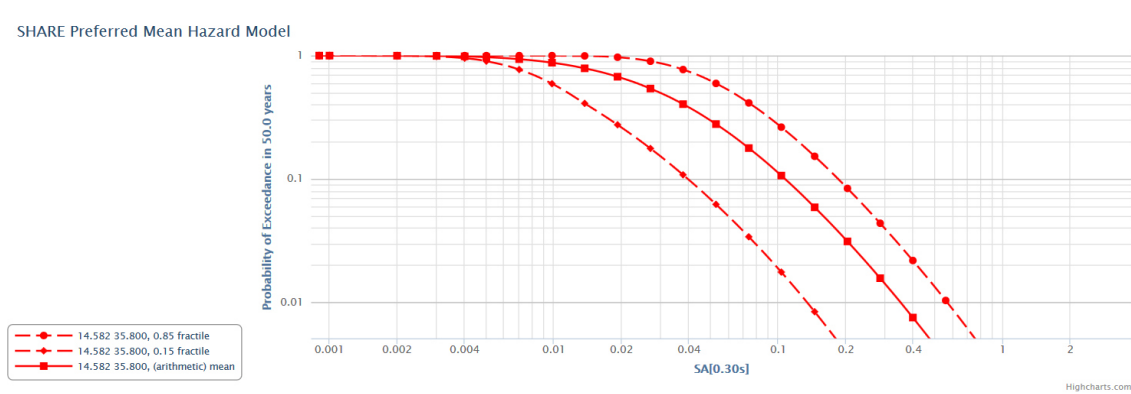


Figure 91 - Seismic Hazard curves for spectral ground acceleration (sa) at 3 Hz, against probability of exceedance in 50 years, calculated for a rock site.

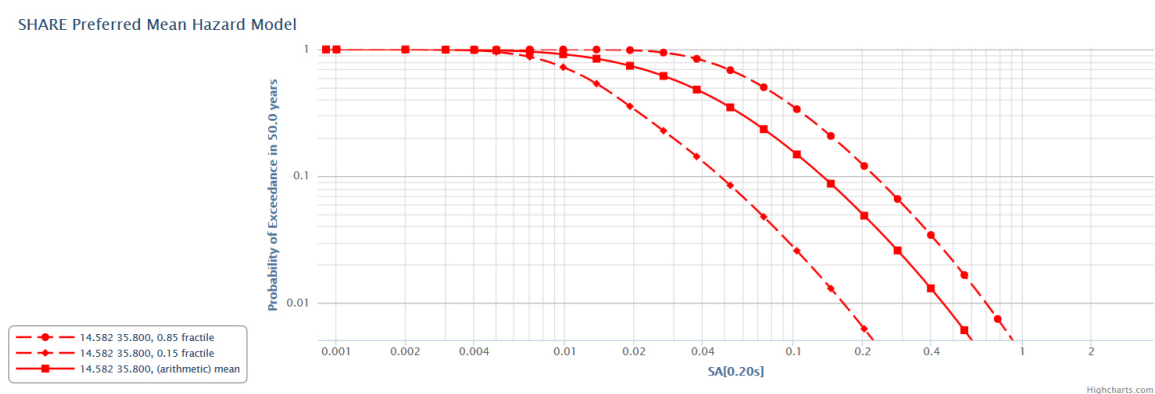
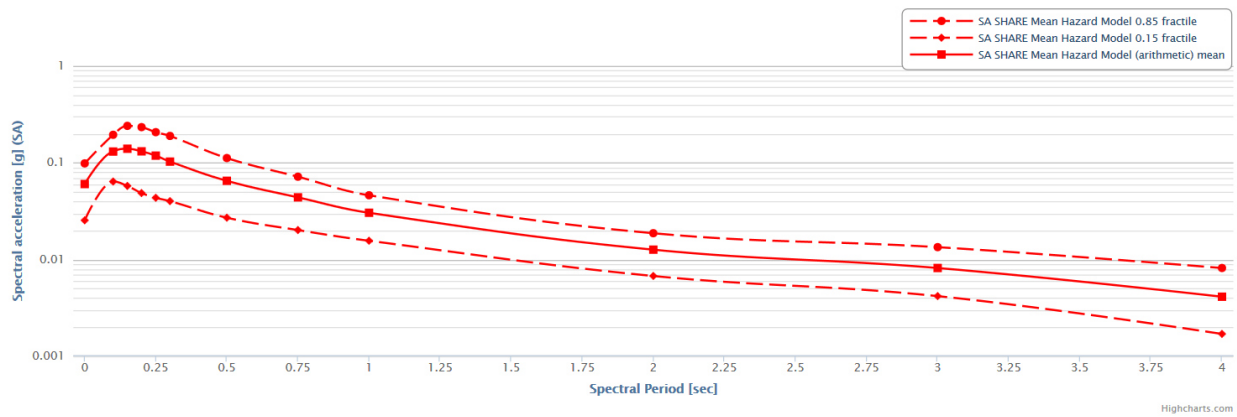
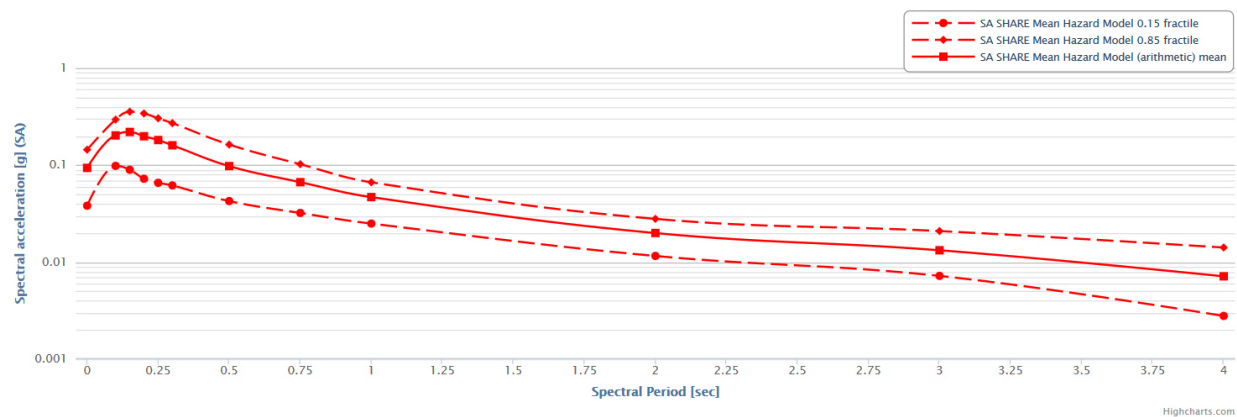


Figure 92 - Seismic Hazard curves for spectral ground acceleration (sa) at 5 Hz, against probability of exceedance in 50 years, calculated for a rock site.



**Figure 93 - Uniform Hazard Spectra for the Delimara site for 10% probability of exceedance in 50 years**



**Figure 94 - Uniform Hazard Spectra for the Delimara site for 5% probability of exceedance in 50 years.**

### 11.4.3 Deterministic Approach – calculation of ground motion parameters from scenario earthquakes

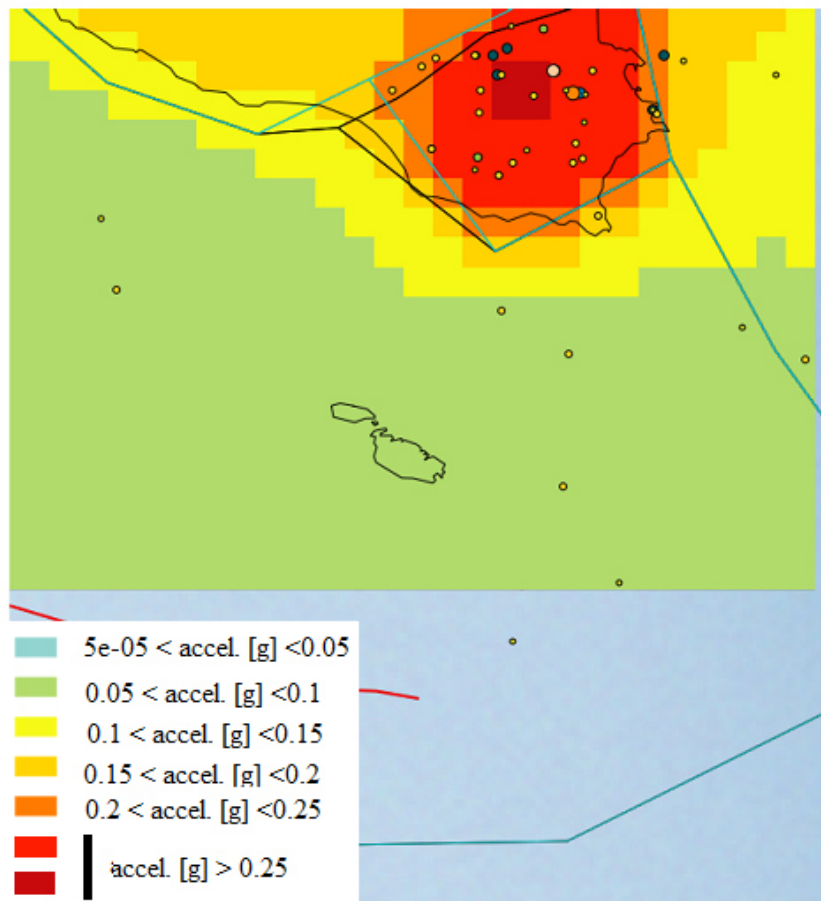
The most significant contributions to seismic hazard arise from the northern segment of the Sicily-Malta escarpment, offshore SE Sicily, which is capable of generating magnitudes  $> 7.0$ , and the faults in the vicinity of the Maltese islands. In particular, the faults related to the Malta graben lie at around 10km south of the Malta coastline, and about 15km from the Delimara site. In the SHARE database of active fault zones, the maximum credible earthquake on these faults has been set to 6.0 for the purpose of the probabilistic hazard assessment, although there is no historical or numerical evidence that such an earthquake has ever occurred, or that it is likely to occur.

In order to generate realistic, yet conservative earthquake scenarios at the Delimara site, a numerical simulation of possible scenario events has been carried out through ground motion modelling using EXSIM, a stochastic, finite-fault modelling approach (Boore, 2003; Motazedian and Atkinson, 2005). The EXSIM program models the earthquake source as a finite fault plane with defined geometry and depth, subdivided into a grid of sub-faults, on which the rupture starts and propagates. The dimensions of the fault are determined from the earthquake moment magnitude, using the empirical relations of Wells and Coppersmith (1994). The computation also requires the definition of the stress drop on the fault (bars), the geometrical spreading relationship, the kappa value (which determines the high frequency slope of the seismic spectrum) and the crustal quality factor  $Q$ . Since the Maltese islands form part of the same geo-tectonic domain as Southeast Sicily, the values of these parameters have been taken from Scognamiglio *et al* (2005), who have obtained them for southeast Sicily by a regression procedure over a local set of earthquake data. Regarding the slip distribution, it has been shown that only the gross

features of slip distribution on a fault plane that does not diverge significantly from the average value of slip may be reliable; all other complexities could be extremely uncertain (Beresnev *et al.* 2002). We thus find it reasonable to assume a random slip distribution, since we have no constraint on the particular faults that we shall be modelling.



## Hazard Map



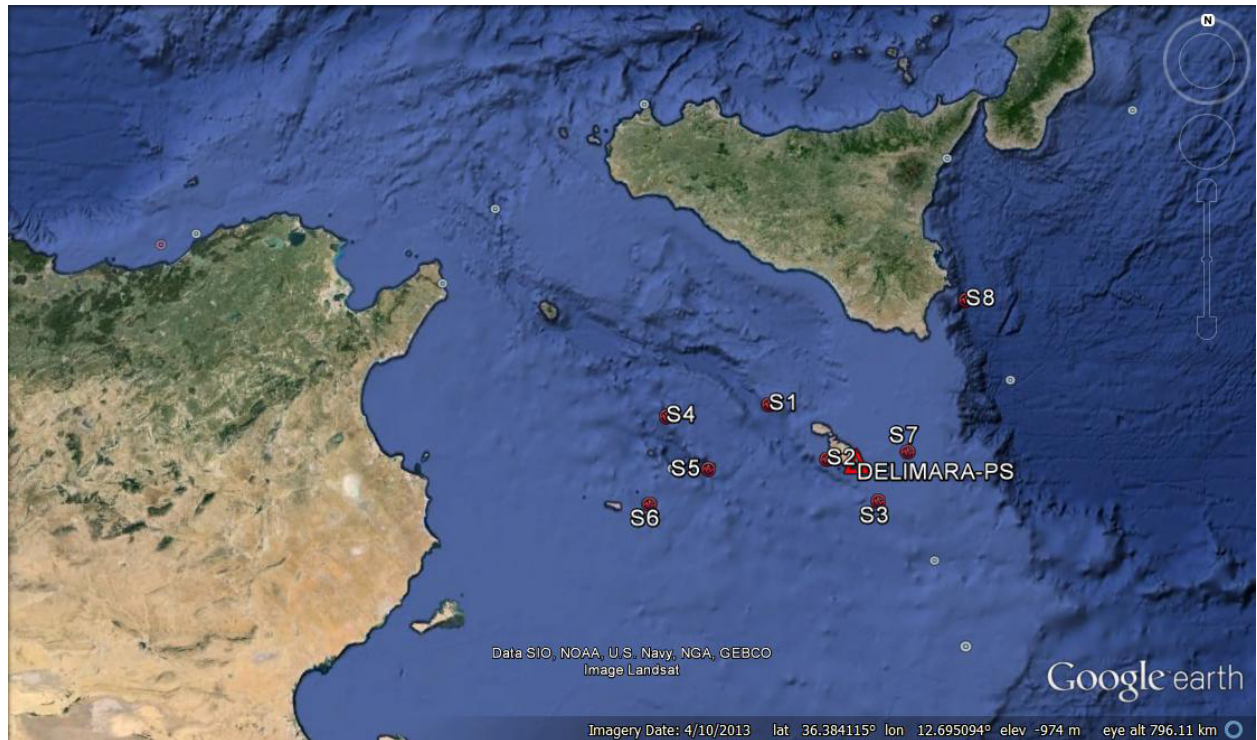
Longitude: 14.50  
Latitude: 35.87  
Model: SHARE Mean Hazard Model  
Intensity Measure Type: PGA  
Probability of Exceedance: 10% in 50 years (475 years)  
Site Class: rock  
Aggregation Level: (arithmetic) mean

**Figure 95 - Seismic hazard map for the region of the Maltese islands, based on the SHARE hazard model and database**

EXSIM also takes into account the geological conditions at the site, and uses appropriate amplification functions during the computation. For this study, an independent geophysical survey, using ambient noise Rayleigh wave dispersion on 2 geophone arrays at the site (see Section 6.2 above for description and results) was carried out, and inversion of the data revealed an average shear wave velocity of 550 m/s in the upper 30m. This characterization was used in the EXSIM simulations.

The events and their source parameters for which the simulations were carried out are listed in Table 15, and illustrated in Figure 96. Sources S1 – S6 allow for the maximum credible earthquake on the SCRZ at different distances from the Delimara site, source S7 lies on a hypothetical fault outlined by recent

seismicity, while source S8 represents the Eastern Sicily fault zone which has generated the largest magnitude event in this region. Together, these sources provide a conservative estimate of ground motion parameters that may be expected at the site. These ground motion results are listed in Table 16. EXSIM was made to output a number of ground motion parameters – peak ground velocity (PGV), peak ground acceleration (PGV), and spectral acceleration (SA) at frequencies of 0.3 Hz, 1 Hz, 3 Hz and 5 Hz. Figure 97 shows the variation of PGA with distance for sources of magnitude 5.0 and 6.0, as predicted by the EXSIM approach.



**Figure 96 - Earthquake sources for which ground motion simulations at the Delimara site were run, using EXSIM.**

As expected, a magnitude 6.0 earthquake closest to the islands on the Malta graben generates the highest PGA of around 0.26g and a spectral acceleration of 0.55g at 5.0 Hz. This is the worst case scenario, and has a probability of exceedance of far less than 1% in 50 years. A magnitude 5.0 earthquake on the same fault would generate a PGA of 0.1g. On the other hand, a recurrence of the 1693 eastern Sicily earthquake, which historically caused the most local damage, produces a PGA of 0.12g.

**Table 15 - Source, path and site parameters used for the EXSIM simulations**

Parameter identification	Parameter value
Fault geometry and location [strike/dip/depth] – [lat/lon]	S1: [130/60/10] – [36.14/13.82] *
	S2: [130/60/10] – [35.79/14.31] *
	S3: [130/60/10] – [35.51/14.73] *
	S4: [120/60/10] – [36.05/12.98] *
	S5: [120/60/10] – [35.71/13.34] *
	S6: [280/70/10] – [35.472/12.87] *
	S7: [187/71/10] – [35.84/14.97] *
	S8: [57/45/10] – [36.85/15.45] **

Parameter identification	Parameter value
Fault dimension	According to Wells and Coppersmith (1994).
Pulsing area	50 %
Slip distribution	Random (see text for details)
Crustal shear wave velocity	3.5 km/s
Density (crustal)	2.8 g/cm <sup>3</sup>
Rupture velocity	0.8 × shear wave velocity
Anelastic attenuation, Q(f)	$400(f)^{0.26}$ Scognamiglio et al. (2005)
Kappa (sec)	0.030
Geometrical spreading	$g(r) = \begin{cases} r^{-1.0} & 1 < r < 40km \\ r^{-0.5} & r > 40km \end{cases}$ Scognamiglio et al. (2005)
Windowing function	Saragoni–Hart
Stress drop	$M_w = 5.0, \Delta\sigma = 210\text{bar}$ (Di Bona et al. 1995) $M_w = 6.0, \Delta\sigma = 210\text{bar}$ (Di Bona et al. 1995) $M_w = 7.4, \Delta\sigma = 280\text{bar}$
Amplification factors	Class Site C – NEHRP; Vs~550m/s
Damping factor for PSA	5%

\*[http://diss.rm.ingv.it/share-edsf/SHARE\\_WP3.2\\_Database.html](http://diss.rm.ingv.it/share-edsf/SHARE_WP3.2_Database.html)

\*\*D'Amico S. (2014)

**Table 16 - The simulated sources and the associated ground motion parameters at the Delimara site. See Figure 14 for location of the sources.**

Source	Mw	Dist. (km)	PGV (cm/s)	PGA (g)	SA 0.33Hz (g)	SA 1Hz (g)	SA 3Hz (g)	SA 5Hz (g)
S1	5.0	71.31	1.181	0.0300	0.0006	0.0080	0.0429	0.0611
S2	5.0	20.94	3.8	0.1134	0.0015	0.0209	0.1283	0.1916
S3	5.0	39.00	2.15	0.0632	0.0009	0.0109	0.0693	0.1161
S4	5.0	140.00	0.59	0.0099	0.0004	0.0057	0.0208	0.0248
S5	5.0	108.30	0.76	0.0165	0.0004	0.0056	0.0267	0.0392



Source	Mw	Dist. (km)	PGV (cm/s)	PGA (g)	SA 0.33Hz (g)	SA 1Hz (g)	SA 3Hz (g)	SA 5Hz (g)
S6	5.0	157.00	0.44	0.0074	0.0003	0.0044	0.0165	0.0198
S7	5.0	36.62	2.36	0.0691	0.0009	0.0113	0.0923	0.1286
S1	6.0	63.17	5.83	0.0831	0.0082	0.0602	0.1582	0.1970
S2	6.0	18.03	14.14	0.2568	0.0204	0.1358	0.4449	0.5582
S3	6.0	39.00	7.58	0.1207	0.0117	0.0794	0.2217	0.2917
S4	6.0	133.00	2.92	0.0347	0.0058	0.0328	0.0762	0.0878
S5	6.0	101.80	3.96	0.0510	0.0054	0.0440	0.1122	0.0198
S6	6.0	158.00	2.28	0.0249	0.0045	0.0287	0.0601	0.0579
S8	7.4	134.70	19.93	0.1235	0.0561	0.1955	0.3061	0.2743

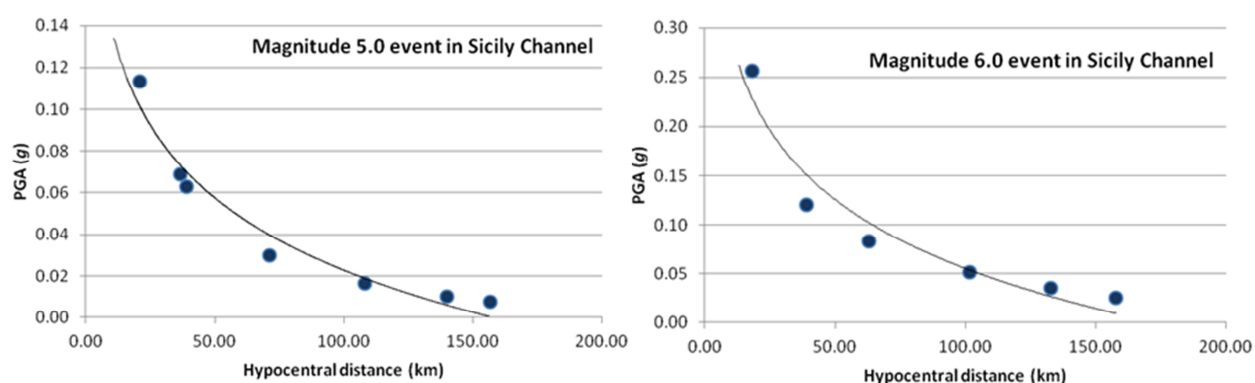


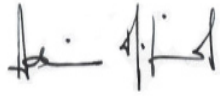
Figure 97 - Variation of PGA at the Delimara site against hypocentral distance for sources in the Sicily Channel.

## 11.5 Conclusions

A number of approaches have been followed in order to characterize the seismic hazard at the Delimara site. Using a historical record of intensities from locally felt and damaging earthquakes, it has been computed that the intensity on the EMS-98 scale with a 10% probability of exceedance in the next 50 years is VII, which corresponds approximately to a peak ground acceleration (PGA) of 0.09 – 0.12 *g*. Using a comprehensive compiled database of seismicity and seismic sources in the SHARE model, hazard curves and hazard spectra have been computed, and show an equivalent PGA value of 0.06 *g*, and a maximum spectral acceleration of 0.12 *g* at 5Hz. Using a deterministic approach through stochastic finite-fault modeling, a worst case scenario of a magnitude 6.0 event on the closest fault source predicts a PGA of 0.26 *g* at Delimara. Such an event, however, would be associated with a probability of far less than 1% in 50 years. On the other hand, a recurrence of the 1693 earthquake in SE Sicily would produce values of PGA in the region of 0.12 *g*.

Based on the above considerations, and taking into account the strategic importance of the structure proposed, we would recommend a conservative estimate of 0.10 – 0.15 *g* as a design earthquake PGA.

Report Compiled by:

A handwritten signature in black ink, appearing to read 'Adrian Mifsud', with a stylized flourish at the end.

Adrian Mifsud B.E&A(Hons),M.Sc.DIC A&CE

Geotechnical Engineer

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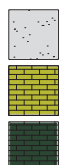
## Appendix B: Borehole data

Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant	Weather: Sunny	Date started: 26/06/2014	Date completed: 26/06/2014
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water
			Northings: 258.933	Eastings: 739.979
			Ground level: 2.73	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Pale Brown (2.5Y 8/2), loose, coarse grained sandy gravel, MAN MADE, Fill	0.00 2.73	1 0: 0	93.3	6.7	6.7			Core retrieval with simple sampler	Lost,
Pale Brown (2.5Y 7/4), compact, medium to coarse grained sandy gravel - contains Lower Globigerina limestone fill, MAN MADE, Fill	1.73 1.00					1.00	SPT N = 50, 1 cm penetration		
Dark Yellowish Brown (10YR 4/4), compact, fine to coarse grained gravelly sandy clay - contains pockets of stiff terrarossa clay fill, MAN MADE, Fill	0.73 2.00	2 0: 0	93.3					Core retrieval with simple sampler	Lost,
Light Yellowish Brown (2.5Y 6/3), un-compact, fine to coarse grained silty sandy gravel, containing lower Globigerina limestone fill, MAN MADE, Fill	-0.27 3.00								
	-1.27	3 0: 0	80			3.00	SPT N = 50, 15 cm penetration	Core retrieval with simple sampler	Lost,
	-2.27 4.00								
Dark Grey (2.5Y 4/1), un-compact, fine to medium grained silty sand - very rich in organic fibres of posidonia, QUATERNARY DEPOSITS	-3.27 5.00	4 0: 0	73.3					Core retrieval with simple sampler	Lost,
Dark Grey (2.5Y 4/1 to 5Y 4/3), very weak (rock), fine grained marl - extensively microfractured, GLOBIGERINA, Upper member to Middle member	-4.27 6.00								
	-5.27	5 0: 0	93.3	73.3	73.3	8.30	M/C: 17.08 % BD: 2132.79 kg/m3 UCS: 10.55 N/mm2	Coring using double core sampler	Full, Green
Olive (5Y 4/3), moderately weak, fine grained marl - weak bands between 7.5 to 8m, 10.5 to 14m, GLOBIGERINA, Middle member	-6.27 7.00					9.40	M/C: 15.60 % BD: 2211.56 kg/m3 UCS: 16.54 N/mm2		

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill (Recent deposits)  
Middle Globigerina Limestone - microfractured/weathered top layer (MIOCENE, Aquilanian to Burdigalian)  
Middle Globigerina Limestone (MIOCENE, Aquilanian to Burdigalian)

Quaternary Deposits (PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant			Weather: Sunny	Date started: 26/06/2014	Date completed: 26/06/2014
					Northings: 258.933	Eastings: 739.979
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.73	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Olive (5Y 4/3), moderately weak, fine grained marl - weak bands between 7.5 to 8m, 10.5 to 14m, GLOBIGERINA, Middle member	-7.27	6 0: 0	93.3	40	40		10.30 M/C: 15.40 % BD: 2166.36 kg/m3 UCS: 12.50 N/mm2	Coring using double core sampler	Full, Green
	-8.00								
	-8.27								
	-9.00	7 0: 0	100	100	100				
	-9.27								
	-10.00								
	-10.27								
	-11.00								
	-11.27	8 0: 0	100	13.3	13.3			Coring using double core sampler	Full, Green
	-12.00								
	-12.27								
	-13.00								
	-13.27	9 0: 0	100					Coring using double core sampler	Full, Green
	-14.00								
	-14.27								
	-15.00								
	-15.27	10 0: 0	33.3					Coring using double core sampler	Full, Green
	-16.00								
	-16.27								
End of borehole	-17.00								

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)



Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)



Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)



Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 110 of 512

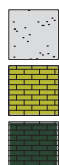


Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station New Combined Cycle Power Plant	Weather: Sunny	Date started: 02/07/2014	Date completed: 02/07/2014
Job No: J1057	Drill type: CMV -1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water
			Ground level: 3.302	Water level: 0.3
			Northings: 272.797	Eastings: 738.987

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Pale Brown (2.5Y 8/2), loose, coarse grained sandy gravel, MAN MADE, Fill	0.00 3.30	1 0:0	100					Advance casing	Lost,
Yellowish Brown (10YR 5/4), compact, fine to coarse grained sandy gravelly clay containing terrarossa, MAN MADE, Fill								Core retrieval with simple sampler	
Olive (5Y 4/3), compact, fine to coarse grained sandy gravelly clay containing MGL marl, MAN MADE, Fill	1.00 2.30					1.25	SPT N = 17, 10, 13		
Pale Brown (2.5Y 7/3), compact-firm, fine to coarse grained sandy silty gravel, MAN MADE, Fill		2 0:0	100					Core retrieval with simple sampler	Lost,
Light Yellowish Brown (2.5Y 6/4), compact, coarse grained sandy gravel, MAN MADE, Fill	2.00 1.30								
	HAT								
Grey (2.5Y 6/1), moderately strong, coarse grained concrete boulders, MAN MADE, Fill	3.00 0.30	3 0:0	80	20				Core retrieval with simple sampler	Lost,
Pale Brown (2.5Y 7/4), moderately weak, medium to coarse grained limestone boulders, MAN MADE, Fill						3.35	SPT N = 50, 0 cm penetration		
	4.00 -0.70								
Greyish Brown (2.5Y 5/2), un-compact, medium to fine grained silty sand rich in posedonia fibres, odourous. Top 100mm very rich in organic fibres. QUATERNARY DEPOSITS		4 0:0	46.7					Core retrieval with simple sampler	Lost,
	5.00 -1.70								
	6.00 -2.70	5 0:0	83.3	33.3		6.00	SPT N = 5, 2, 2	Core retrieval with simple sampler	Lost,
Dark Grey (10YR 4/1), compact, medium to fine grained silty sand - top 100mm very rich in posedonia QUATERNARY DEPOSITS						6.50	PSD: Clay 3.1%, Silt 10.5% Sand 86.4%		
Olive (5Y 4/3), very weak (rock), fine grained marl-microfractured, consists of hard lumps in stiff clay matrix, GLOBIGERINA, Middle member	7.00 -3.70	6 0:0	100	100				Core retrieval with simple sampler	Lost,
	8.00 -4.70								
Olive (5Y 4/3), moderately weak, fine grained marl, bioturbated, GLOBIGERINA, Middle member	9.00 -5.70	7 0:0	93.3	93.3	93.3		PD: 2.62 Mg/m³ PL16.8% LL: 39.5% PI: 22.7% PSD: Clay 24.0%, Silt 61.2% Sand 14.8%	Coring using double core sampler	Full, Green
	10.00					9.90	M/C: 15.16 % BD: 2174.28 kg/m³ UCS: 14.99 N/mm²		

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill (Recent deposits)  
Middle Globigerina Limestone - microfractured/weathered top layer (MIOCENE, Aquitanian to Burdigalian)  
Middle Globigerina Limestone (MIOCENE, Aquitanian to Burdigalian)

Quaternary Deposits (PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane



Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station New Combined Cycle Power Plant			Weather: Sunny	Date started: 02/07/2014	Date completed: 02/07/2014
					Northings: 272.797	Eastings: 738.987
Job No: J1057	Drill type: CMV -1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 3.302	Water level: 0.3

Description	Depth Actual depth	Run Drill time	TCR %	SCR %	RQD %	f/m /m	Sampling/testing	Drilling progress	Returns
Olive (5Y 4/3), moderately weak, fine grained marl, bioturbated, GLOBIGERINA, Middle member	-6.70						10.20 M/C: 15.25 % BD: 2141.91 kg/m3 UCS: 14.43 N/mm2		
	-7.70						11.55 M/C: 12.45 % BD: 2150.27 kg/m3 UCS: 19.86 N/mm2		
	-8.70	8 0: 0	96.7	86.7	63.3		12.85 M/C: 16.71 % BD: 2102.70 kg/m3 UCS: 8.82 N/mm2	Coring using double core sampler	Full, Green
	-9.70								
Discontinuity at 45°, slickensided sides, no infill, tight	-10.70								
	-11.70								
	-12.70								
	-13.70								
End of borehole	-14.70								
	-15.70								
	-16.70								
	-17.70								

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 113 of 512



Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station New Combined Cycle Power Plant			Weather: Sunny	Date started: 03/07/2014	Date completed: 03/07/2014
					Northings: 272.827	Eastings: 761.434
Job No: J1057	Drill type: CMV -1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.714	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Grey (2.5Y 6/1), loose, coarse to medium grained sandy gravel, MAN MADE , Fill	0.00 2.71	1 0: 0	100					Advance casing	Lost,
Light Yellowish Brown (2.5Y 6/3), compact, fine to coarse grained gravelly clay-contains some terrarossa, MAN MADE , Fill								Core retrieval with simple sampler	
Olive (5Y 5/3), compact, fine to coarse grained gravelly clay-contains mgl marl, MAN MADE , Fill	1.00 1.71								
Light Yellowish Brown (2.5Y 6/3), compact, fine to coarse grained sandy gravelly clay, MAN MADE , Fill	2.00 2.71	2 0: 0	86.7			1.50	SPT N = 13, 12, 11	Core retrieval with simple sampler	Lost,
Pale Brown (2.5Y 7/4), un-compact, coarse grained sandy gravel with some silt, MAN MADE , Fill									
	3.00 -0.29	3 0: 0	93.3					Core retrieval with simple sampler	Lost,
	4.00 -1.29								
Greyish Brown (2.5Y 5/2), un-compact, medium to fine grained silty sand rich in posidonia fibres - top 100mm very rich in fibres, odourous, QUATERNARY DEPOSITS	5.00 -2.29	4 0: 0	93.3	6.7	6.7			Core retrieval with simple sampler	Lost,
Light Grey (2.5Y 7/1), very stiff to very weak, fine grained marl, GLOBIGERINA, Middle member	6.00 -3.29	5 0: 0	100	100		6.00	SPT N = 11, 13, 17	Core retrieval with simple sampler	Lost,
	7.00 -4.29					6.70	PD: 2.62 Mg/m³ PL 22.9% LL: 56.5% PI: 33.6% PSD: Clay 33.02%, Silt 59.4% Sand 7.61%		
	8.00 -5.29	6 0: 0	100	100				Core retrieval with simple sampler	Lost,
	9.00 -6.29	7 0: 0	100	100		9.00	SPT N = 21, 23, 27	Core retrieval with simple sampler	Lost,
	10.00								

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Date completed:  
03/07/2014

Eastings:  
761.434

Water level:
0.3

100

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 116 of 512







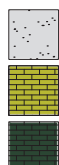


Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant	Weather: Sunny	Date started: 30/07/2014	Date completed: 30/07/2014
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water
			Ground level: 2.76	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Pale Brown (2.5Y 8/2), loose, coarse grained sandy gravel, MAN MADE, Fill	0.00 2.76	1 0:0	100					Advance casing	Lost,
Pale Brown (10YR 6/3), compact, fine to coarse grained sandy gravelly clay - contains middle globigerina limestone fill with some terrarossa, MAN MADE, Fill	1.00 1.76					1.00	SPT N = 6, 9, 12	Core retrieval with simple sampler	
Pale Brown (2.5Y 7/4), un-compact, medium to coarse grained sandy gravel (with some silt) - contains upper globigerina limestone or lower globigerina limestone fill, MAN MADE, Fill	2.00 0.76	2 0:0	100					Advance casing	Lost,
	MSL							Core retrieval with simple sampler	
	3.00 -0.24	3 0:0	93.3	16.7		3.00	SPT N = 50, 0 cm penetration	Core retrieval with simple sampler	Lost,
Dark Greyish Brown (2.5Y 4/2), un-compact, medium to fine grained silty sand - very rich in posidonia fibres, QUATERNARY DEPOSITS	4.00 -1.24								
	5.00 -2.24	4 0:0	80	20		5.00	SPT N = 50, 0 cm penetration	Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), very weak (rock), fine grained marl - extensively microfractured, GLOBIGERINA, Middle member	6.00 -3.24	5 0:0	100	33.3	33.3			Coring using double core sampler	Full, Green
Olive (5Y 4/3), moderately weak, fine grained marl - horizontally bedded with weak stratum at 11.7 - 12.0m, GLOBIGERINA, Middle member	7.00 -4.24	6 0:0	100	93.3	93.3	7.20	M/C: 17.22 % BD: 2196.02 kg/m3 UCS: 9.90 N/mm2	Coring using double core sampler	Full, Green
	8.00 -5.24	7 0:0	100	86.7	86.7	7.80	M/C: 13.82 % BD: 2163.77 kg/m3 UCS: 11.82 N/mm2	Coring using double core sampler	Full, Green
	9.00 -6.24					9.70	M/C: 15.89 % BD: 2079.69 kg/m3 UCS: 14.67 N/mm2	Coring using double core sampler	Full, Green

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 119 of 512

Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant			Weather: Sunny	Date started: 30/07/2014	Date completed: 30/07/2014
					Northings: 272.778	Eastings: 776.74
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.76	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Olive (5Y 4/3), moderately weak, fine grained marl - horizontally bedded with weak stratum at 11.7 - 12.0m, GLOBIGERINA, Middle member	10.00 -7.24								
	8 0: 0	93.3	80	80			11.20 M/C: 17.31 % BD: 2096.98 kg/m3 UCS: 14.09 N/mm2	Coring using double core sampler	Full, Green
	11.00 -8.24								
	12.00 -9.24	9 0: 0	100	100	100		12.30 M/C: 16.35 % BD: 2053.19 kg/m3 UCS: 14.69 N/mm2	Coring using double core sampler	Full, Green
	13.00 -10.24								
	14.00 -11.24	10 0: 0	100				13.70 M/C: 16.74 % BD: 2121.19 kg/m3 UCS: 16.17 N/mm2	Coring using double core sampler	Full, Green
	15.00 -12.24						14.70 M/C: 16.99 % BD: 2139.51 kg/m3 UCS: 15.80 N/mm2		
End of borehole									

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)



Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)



Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)



Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 120 of 512



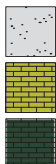


Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant	Weather: Sunny	Date started: 30/07/2014	Date completed: 30/07/2014
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water
			Ground level: 2.801	Water level: 0.3
			Northings: 289.94	Eastings: 776.704

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Pale Brown (2.5Y 8/2), loose, coarse grained sandy gravel, MAN MADE, Fill	0.00 2.80	1 0:0	100					Advance casing Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), compact, fine to coarse grained sandy gravelly clay - contains mgl fill from nearby excavation, MAN MADE, Fill	1.00 1.80					1.00	SPT N = 9, 12, 13		
	2.00 2.80	2 0:0	93.3					Advance casing Core retrieval with simple sampler	Lost,
	3.00 -0.20								
Olive (5Y 4/3), un-compact, fine to coarse grained sandy gravelly clay - contains middle globigerina limestone fill from nearby excavation - some compacted silty mud layers at 4.2-4.5 and 5-5.15m, MAN MADE, Fill	4.00 -1.20	3 0:0	93.3	16.7		3.00	SPT N = 7, 9, 11	Core retrieval with simple sampler	Lost,
	5.00 -2.20								
Dark Greyish Brown (2.5Y 4/2), compact, medium to fine grained silty sand rich in posidonia fibres - especially top 100mm. QUATERNARY DEPOSITS	6.00 -3.20	4 0:0	86.7	66.7				Core retrieval with simple sampler	Lost,
Dark Olive Grey (5Y 3/2), very weak (rock), fine grained marl - microfractured, consists of hard lumps in stiff clay matrix, GLOBIGERINA, Middle member	7.00 -4.20	5 0:0	86.7	43.3				Coring using double core sampler	Lost,
Olive (5Y 4/3), very weak (rock), fine grained marl - zone extensively fractured, GLOBIGERINA, Middle member	8.00 -5.20	6 0:0	86.7	20				Coring using double core sampler	Full, Green
	9.00 -6.20	7 0:0	93.3	16.7	16.7			Coring using double core sampler	Full, Green

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 122 of 512



Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant			Weather: Sunny	Date started: 30/07/2014	Date completed: 30/07/2014
					Northings: 289.94	Eastings: 776.704
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.801	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
Olive (5Y 4/3), weak, fine grained marl - interval 10m - 12.7m horizontally microfractured. 13.5 - 15.00m typically weaker, GLOBIGERINA, Middle member	Actual depth 10.00 -7.20	Drill time	%	%	%	/m			
	8 0: 0	100	100	100				Coring using double core sampler	Full, Green
	11.00 -8.20								
	12.00 -9.20	9 0: 0	100	86.7	86.7			Coring using double core sampler	Full, Green
	13.00 -10.20								
	14.00 -11.20	10 0: 0	100					Coring using double core sampler	Full, Green
End of borehole	15.00 -12.20								

## Legend:

GL: ground level  
 AOD: above Ordinance Datum  
 BGL: below ground level  
 AMSL: above mean sea level  
 RQD: Rock Quality Designation  
 TCR: total core recovery  
 SCR: solid core recovery  
 f: fracture frequency  
 O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)



Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
 BD: Bulk density  
 ABS: Absorption  
 MC: Moisture content  
 PD: Particle density  
 PSV: Pocket shear vane

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 123 of 512

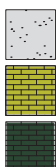


Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant			Weather: Sunny	Date started: 30/07/2014	Date completed: 30/07/2014
					Northings: 306.94	Eastings: 776.628
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.903	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Pale Brown (2.5Y 8/2), loose, coarse grained sandy gravel, MAN MADE, Fill	0.00 2.90	1 0:0	100					Advance casing	Lost,
Olive (5Y 5/4), compact, fine to coarse grained gravelly sandy clay - contains compacted middle globigerina limestone fill from adjacent excavation, MAN MADE, Fill	1.00 1.90					1.00	SPT N = 10, 8, 11	Core retrieval with simple sampler	
	2.00 0.90	2 0:0	93.3					Advance casing	Lost,
								Core retrieval with simple sampler	
Olive (5Y 4/3), un-compact, fine to coarse grained silty gravelly clay - contains compacted middle globigerina limestone fill from adjacent excavation, MAN MADE, Fill	3.00 -0.10	3 0:0	93.3			3.00	SPT N = 9, 50, 0	Core retrieval with simple sampler	Lost,
	4.00 -1.10								
	5.00 -2.10	4 0:0	100	20		5.00	SPT N = 9, 13, 16	Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), very weak (rock), fine grained marl - extensively microfractured, top 0.3m consists of a stiff clay layer, GLOBIGERINA, Middle member	6.00 -3.10	5 0:0	86.7	33.3				Coring using double core sampler	Full, Green
	7.00 -4.10								
	8.00 -5.10	6 0:0	100	33.3				Coring using double core sampler	Full, Green
Olive (5Y 4/3), moderately weak, fine grained marl - weaker layers between 12m and 15m., GLOBIGERINA, Middle member	9.00 -6.10	7 0:0	100	100	100			Coring using double core sampler	Full, Green
	10.00 -7.10					9.70	M/C: 15.24 % BD: 2142.22 kg/m3 UCS: 11.82 N/mm2		

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 125 of 512

Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant			Weather: Sunny	Date started: 30/07/2014	Date completed: 30/07/2014
					Northings: 306.94	Eastings: 776.628
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.903	Water level: 0.3

Description	Depth Actual depth	Run Drill time	TCR %	SCR %	RQD %	f/m /m	Sampling/testing	Drilling progress	Returns
Olive (5Y 4/3), moderately weak, fine grained marl - weaker layers between 12m and 15m., GLOBIGERINA, Middle member	10.00 -7.10						10.20 M/C: 26.67 % BD: 2176.16 kg/m3 UCS: 11.69 N/mm2		
	8 0: 0	100	100	100				Coring using double core sampler	Full, Green
	11.00 -8.10						12.20 M/C: 16.78 % BD: 2172.45 kg/m3 UCS: 15.33 N/mm2		
	9 0: 0	100	100	100				Coring using double core sampler	Full, Green
	13.00 -10.10						13.70 M/C: 16.76 % BD: 2179.49 kg/m3 UCS: 15.47 N/mm2		
	10 0: 0	100	100	100				Coring using double core sampler	Full, Green
	14.00 -11.10						14.70 M/C: 17.46 % BD: 2151.81 kg/m3 UCS: 17.80 N/mm2		
End of borehole	15.00 -12.10								

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)



Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 126 of 512







Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station New Combined Cycle Power Plant	Weather: Sunny	Date started: 05/07/2014	Date completed: 05/07/2014
Job No: J1057	Drill type: CMV -1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water
			Ground level: 2.634	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
white (2.5Y 8/1), loose, coarse grained sandy gravel, MAN MADE, Fill	0.00 2.63	1 0: 0	93.3					Advance casing	Lost,
Olive Grey (5Y 5/2), compact, fine to coarse grained sandy gravelly clay - contains re-worked MGL, MAN MADE, Fill	1.00 1.63					1.00	SPT N = 8, 12, 14	Core retrieval with simple sampler	
Brown (7.5YR 5/6), semi-compact, fine to coarse grained sandy silty gravelly clay, rich in terrarossa, MAN MADE, Fill	2.00 2.63	2 0: 0	93.3					Core retrieval with simple sampler	Lost,
Pale Brown (2.5Y 7/3), un-compact, coarse grained sandy gravel, MAN MADE, Fill	2.00 2.63								
	3.00 -0.37	3 0: 0	66.7			3.00	SPT N = 14, 18, 19	Core retrieval with simple sampler	Lost,
	4.00 -1.37								
	5.00 -2.37	4 0: 0	66.7					Core retrieval with simple sampler	Lost,
Dark Olive Grey (5Y 3/2), un-compact, medium to fine grained silty sand - very rich in organic fibres of posidonia, QUATERNARY DEPOSITS	5.00 -2.37					5.00	SPT N = 50, 0 cm penetration		
Olive (5Y 4/3), very weak (rock), fine grained marl - microfractured, consists of hard lumps in stiff clay matrix, GLOBIGERINA, Middle member	6.00 -3.37	5 0: 0	60					Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), very weak (rock), fine grained marl - bioturbated, GLOBIGERINA, Middle member	7.00 -4.37	6 0: 0	100	100	100		M/C: 14.62 % BD: 2192.28 kg/m3 UCS: 13.72 N/mm2	Coring using double core sampler	Full, Green
	8.00 -5.37	7 0: 0	100	100	100		M/C: 15.08 % BD: 2190.49 kg/m3 UCS: 16.43 N/mm2	Coring using double core sampler	Full, Green
	9.00 -6.37					7.20			
	9.50 -6.87					8.50	M/C: 3.22 % BD: 1952.96 kg/m3 UCS: 27.63 N/mm2		
	9.80 -7.17					9.50	M/C: 15.42 % BD: 2166.80 kg/m3 UCS: 17.09 N/mm2		
End of borehole	10.00 -7.37					9.80			

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill (Recent deposits)  
Middle Globigerina Limestone - microfractured/weathered top layer (MIOCENE, Aquilanian to Burdigalian)  
Middle Globigerina Limestone (MIOCENE, Aquilanian to Burdigalian)

Quaternary Deposits (PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

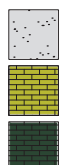


Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station New Combined Cycle Power Plant	Weather: Sunny	Date started: 08/07/2014	Date completed: 09/07/2014
Job No: J1057	Drill type: CMV -1400	Bit type/diameter: Double core	Northings: 272.905	Eastings: 793.973
	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.73	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
white (2.5Y 8/1), loose, coarse grained sandy gravel - contains some concrete lumps, MAN MADE, Fill	0.00 2.73	1 0:0	100				Borehole fitted with grouted plastic casing down to marl. T32 steel bar grouted on 8/08/2014 Pull-out test on 19/08/2014	Advance casing	Lost,
Dark Greyish Brown (2.5Y 4/2), compact, fine to coarse grained sandy gravelly clay - contains MGL marl, MAN MADE, Fill	1.00 1.73							Core retrieval with simple sampler	
Pale Brown (2.5Y 7/4), loose, coarse grained sandy gravel, MAN MADE, Fill									
Yellowish Brown (10YR 5/4), compact, fine to coarse grained sandy gravelly clay, MAN MADE, Fill	2.00 2.73	2 0:0	86.7	33.3		1.50	SPT N = 3, 3, 3	Core retrieval with simple sampler	Lost,
Pale Brown (2.5Y 7/4), un-compact, medium to coarse grained sandy gravel - with some globigerina limestone boulders, MAN MADE, Fill	3.00 -0.27	3 0:0	50	4		3.00	SPT N = 1, 1, 2	Core retrieval with simple sampler	Lost,
	4.00 -1.27								
	5.00 -2.27	4 0:0	93.3	16.7				Core retrieval with simple sampler	Lost,
Grey (2.5Y 5/1), un-compact, fine to medium grained silty sand - very rich in organic fibres of posidonia, QUATERNARY DEPOSITS	6.00 -3.27	5 0:0	93.3	86.7	86.7			Coring using double core sampler	Full, Green
Olive (5Y 4/3), very weak (rock), fine grained marl, GLOBIGERINA, Middle member	7.00 -4.27					6.40	M/C: 15.52 % BD: 2136.50 kg/m3 UCS: 15.98 N/mm2		
Olive (5Y 4/3), moderately weak, fine grained marl - with distinctly weaker bands that are also microfractured at 9m to 10m, GLOBIGERINA, Middle member	8.00 -5.27	6 0:0	100	76	56	7.40	M/C: 15.72 % BD: 2113.80 kg/m3 UCS: 11.80 N/mm2	Coring using double core sampler	Full, Green
	9.00 -6.27					8.13	M/C: 15.87 % BD: 2131.97 kg/m3 UCS: 12.35 N/mm2		
End of borehole	10.00 -6.27								

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill (Recent deposits)  
Quaternary Deposits (PLEISTOCENE, to HOLOCENE)  
Middle Globigerina Limestone - microfractured/weathered top layer (MIOCENE, Aquilanian to Burdigalian)  
Middle Globigerina Limestone (MIOCENE, Aquilanian to Burdigalian)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane





Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant	Weather: Sunny	Date started: 25/07/2014	Date completed: 25/07/2014
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water
			Ground level: 2.805	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Pale Brown (2.5Y 8/2), , coarse grained sandy gravel, MAN MADE, Fill	0.00 2.81	1 0:0	100				Borehole fitted with grouted plastic casing down to marl.	Advance casing	Lost,
Olive (5Y 4/3), compact, fine to coarse grained sandy gravelly clay - contains middle Globigerina limestone, MAN MADE, Fill	1.00 1.81					1.00	T32 steel bar grouted on 8/08/2014 Pull-out test on 19/08/2014 SPT N = 50, 0 cm penetration	Core retrieval with simple sampler	
	2.00 0.81	2 0:0	100					Advance casing	Lost,
Olive (5Y 4/3), un-compact, fine to coarse grained sandy gravelly clay - contains middle Globigerina limestone, MAN MADE, Fill	3.00 -0.20	3 0:0	86.7	5.3		3.00	SPT N = 8, 10, 10	Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), compact, fine grained silt with some gravel - compacted middle Globigerina limestone mud, MAN MADE, Fill	4.00 -1.20	4 0:0	100	40				Core retrieval with simple sampler	Lost,
Greenish Black, compact, medium to fine grained silty sand - very rich in posidonia fibres QUATERNARY DEPOSITS	5.00 -2.20					5.00	SPT N = 5, 8, 9		
Greenish Black, very weak (rock), fine grained marl, microfractured - hard lumps in clay matrix, GLOBIGERINA, Middle member	6.00 -3.20	5 0:0	100	16.7	16.7			Coring using double core sampler	Full, Green
Greenish Black, moderately weak, fine grained marl microfractured between 7.75 and 8.3m, GLOBIGERINA, Middle member	7.00 -4.20								
	8.00 -5.20	6 0:0	100	100	100			Coring using double core sampler	Full, Green
	9.00 -6.20								
	9.30 -6.80					9.30	M/C: 14.86 % BD: 190.49 kg/m3 UCS: 12.37 N/mm2		
	9.80 -7.30					9.80	M/C: 15.95 % BD: 1910.80 kg/m3 UCS: 7.41 N/mm2		

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquilanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquilanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

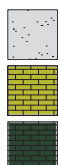


Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant			Weather: Sunny	Date started: 25/07/2014	Date completed: 25/07/2014
					Northings: 289.94	Eastings: 793.973
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.805	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Greenish Black, moderately weak, fine grained marl microfractured between 7.75 and 8.3m, GLOBIGERINA, Middle member	10.00 -7.20								
	11.00 -8.20						10.80 M/C: 15.13 % BD: 1933.34 kg/m3 UCS: 11.42 N/mm2		
	12.00 -9.20	7 0: 0	100	100	100		11.70 M/C: 31.02 % BD: 2040.72 kg/m3 UCS: 12.90 N/mm2		
	13.00 -10.20						12.50 M/C: 37.74 % BD: 1977.55 kg/m3 UCS: 14.03 N/mm2		
	14.00 -11.20						13.40 M/C: 26.90 % BD: 1854.51 kg/m3 UCS: 15.20 N/mm2		
	15.00 -12.20						14.70 M/C: 29.99 % BD: 1962.47 kg/m3 UCS: 15.64 N/mm2		
End of borehole								Anchor pull-out test - calculated interface stress 0.679 N/mm <sup>2</sup> at onset of failure grouted length 650 mm	

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 133 of 512

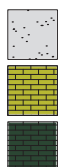


Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station New Combined Cycle Power Plant	Weather: Sunny	Date started: 22/07/2014	Date completed: 22/07/2014
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water
			Ground level: 3.582	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
Very Dark Grey (2.5Y 3/1), weak, coarse grained tarmac/bitumen, MAN MADE , Fill	Actual depth 0.00 3.58	Drill time 1 0: 0	% 100	%	%	/m		Advance casing	Lost,
White (2.5Y 8/1), compact, coarse grained sandy gravel/concrete, MAN MADE , Fill								Core retrieval with simple sampler	
Olive (5Y 4/4), loose to compact, fine to coarse grained sandy gravelly clay contains compacted mgl fill., MAN MADE , Fill	1.00 2.58					1.00	SPT N = 10, 12, 14		
		2 0: 0	93.3	93.3				Core retrieval with simple sampler	Lost,
	2.00 1.58								
	HAT 3.00 0.58								
Olive (5Y 4/4), un-compact, fine to coarse grained sandy gravelly clay, contains MGL fill, MAN MADE , Fill	MSL LAT 4.00 -0.42	3 0: 0	93.3			3.00	SPT N = 11, 10, 13	Core retrieval with simple sampler	Lost,
Dark Grey (2.5Y 4/1), compact, fine to medium grained silty sand, very rich in posidonia fibres, QUATERNARY DEPOSITS		4 0: 0	53.3					Core retrieval with simple sampler	Lost,
	5.00 -1.42								
Grey (2.5Y 5/1), loose, fine to medium grained silty sand, QUATERNARY DEPOSITS	6.00 -2.42	5 0: 0	33.3	8				Core retrieval with simple sampler	Lost,
	7.00 -3.42								
Olive (5Y 4/3), very stiff, fine grained marl - lumps in stiff clay matrix, GLOBIGERINA, Middle member		6 0: 0	96.7	86.7	83.3			Coring using double core sampler	Full, Green
Olive (5Y 4/3), moderately weak, fine grained marl, GLOBIGERINA, Middle member	8.00 -4.42								
	9.00 -5.42								
	10.00 -6.42								
						8.40	M/C: 16.22 % BD: 2166.76 kg/m3 UCS: 2.67 N/mm2		
						9.30	M/C: 16.68 % BD: 2171.03 kg/m3		
						9.60	M/C: 17.52 % BD: 2116.87 kg/m3		

### Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

### Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 135 of 512

Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station New Combined Cycle Power Plant			Weather: Sunny	Date started: 22/07/2014	Date completed: 22/07/2014
					Northings: 320.048	Eastings: 915.007
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 3.582	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Olive (5Y 4/3), moderately weak, fine grained marl, GLOBIGERINA, Middle member	10.00 -6.42								
	7 0: 0	92	52	52		10.35	M/C: 18.01 % BD: 2148.23 kg/m3	Coring using double core sampler	Full, Green
	11.00 -7.42								
	12.00 -8.42								
	13.00 -9.42	8 0: 0	100	70	70	13.15	M/C: 16.91 % BD: 2177.19 kg/m3 UCS: 10.17 N/mm2	Coring using double core sampler	Full, Green
	14.00 -10.42								
End of borehole	15.00 -11.42								

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 136 of 512





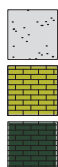


Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant	Weather: Sunny	Date started: 25/07/2014	Date completed: 25/07/2014
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water
			Ground level: 2.893	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Pale Brown (2.5Y 8/2), loose, coarse grained sandy gravel, MAN MADE, Fill	0.00 2.89	1 0:0	100				Borehole fitted with grouted plastic casing down to marl.	Advance casing	Lost,
Pale Brown (10YR 6/3), compact, fine to coarse grained sandy gravelly clay - contains some terrarossa, MAN MADE, Fill	1.00 1.89					1.00	T32 steel bar grouted on 8/08/2014 Pull-out test on 18/08/2014  SPT N = 9, 10, 8	Core retrieval with simple sampler	
Olive (5Y 4/3), compact, fine to coarse grained sandy gravelly clay - contains middle Globigerina limestone, MAN MADE, Fill	2.00 0.89 HAT	2 0:0	100					Advance casing	Lost,
	3.00 -0.11 MSL							Core retrieval with simple sampler	
Olive (5Y 4/3), un-compact, fine to coarse grained sandy gravelly clay - contains middle Globigerina limestone, MAN MADE, Fill	4.00 -1.11 LAT	3 0:0	93.3			3.00	SPT N = 50, 0 cm penetration	Core retrieval with simple sampler	Lost,
Greenish Black, compact, fine to medium grained silty sand - rich in posidonia fibres, QUATERNARY DEPOSITS	5.00 -2.11	4 0:0	100	53.3		5.00	SPT N = 4, 5, 7	Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), very weak (rock), fine grained marl - hard lumps in clay matrix, GLOBIGERINA, Middle member	6.00 -3.11	5 0:0	100	53.3	53.3	6.20	M/C: 30.49 % BD: 1468.34 kg/m3 UCS: 9.23 N/mm2	Coring using double core sampler	Full, Green
Olive (5Y 4/3), moderately weak, fine grained marl - horizontally microfractured between 5.55 - 6m, 6.6 - 7.2m, 14.3 - 15m, GLOBIGERINA, Middle member	7.00 -4.11					7.20	PD: 2.63 Mg/m³		
	8.00 -5.11								
	9.00 -6.11	6 0:0	100	96.7	96.7	9.20	M/C: 39.48 % BD: 1964.09 kg/m3 UCS: 7.48 N/mm2	Coring using double core sampler	Full, Green
	10.00 -7.11								

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill (Recent deposits)  
Middle Globigerina Limestone - microfractured/weathered top layer (MIOCENE, Aquitanian to Burdigalian)  
Middle Globigerina Limestone (MIOCENE, Aquitanian to Burdigalian)  
Quaternary Deposits (PLEISTOCENE, to HOLOCENE)

## Legend:

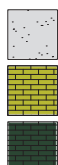
UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant			Weather: Sunny	Date started: 25/07/2014	Date completed: 25/07/2014
					Northings: 306.933	Eastings: 793.973
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.893	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Olive (5Y 4/3), moderately weak, fine grained marl - horizontally microfractured between 5.55 - 6m, 6.6 - 7.2m, 14.3 - 15m, GLOBIGERINA, Middle member	10.00 -7.11								
	11.00 -8.11						10.80 M/C: 31.60 % BD: 1838.56 kg/m3 UCS: 11.79 N/mm2		
	12.00 -9.11	7 0: 0	100	90	90		12.10 PD: 2.70 Mg/m³ M/C: 35.31 % BD: 1962.18 kg/m3 UCS: 13.88 N/mm2		
	13.00 -10.11						13.20 M/C: 32.77 % BD: 2006.98 kg/m3 UCS: 13.10 N/mm2		
	14.00 -11.11						14.25 M/C: 30.36 % BD: 1942.01 kg/m3 UCS: 12.09 N/mm2		
	15.00 -12.11								
	End of borehole								
							Anchor pull-out test - calculated interface stress 0.38 N/mm² at onset of failure		
							grouted length 660 mm		

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 139 of 512



Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station New Combined Cycle Power Plant	Weather: Sunny	Date started: 05/07/2014	Date completed: 05/07/2014
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water
			Ground level: 2.653	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Light Brownish Grey (2.5Y 6/2), loose, coarse grained sandy gravel, MAN MADE, Fill	0.00 2.65	1 0:0	93.3					Advance casing	Lost,
Light Olive Grey (5Y 6/2), compact, fine to coarse grained sandy gravelly clay, MAN MADE, Fill								Core retrieval with simple sampler	
Strong Brown (7.5YR 5/6), compact, medium to coarse grained sandy gravelly clay-contains terrarossa soil, MAN MADE, Fill	1.00 1.65					1.00	SPT N = 4, 2, 9		
Olive (5Y 5/4), compact, fine to coarse grained silty sandy gravel, MAN MADE, Fill		2 0:0	100					Core retrieval with simple sampler	Lost,
Yellowish Brown (10YR 5/4), un-compact, fine to coarse grained silty sandy gravel - bottom 100mm consists of compacted silt from reclamation, MAN MADE, Fill	HAT 2.00 0.65 MSL LAT								
Greyish Brown (2.5Y 5/2), compact, medium to fine grained silty sand, rich in posidonia fibres - top 100mm very rich in organic fibres, QUATERNARY DEPOSITS	3.00 -0.35	3 0:0	66.7	6.7		3.00	SPT N = 2, 3, 5	Core retrieval with simple sampler	Lost,
Dark Reddish Grey (2.5YR 3/1), un-compact, medium to fine grained silty sand, rich in posidonia fibres- top 100mm very rich in organic fibres, QUATERNARY DEPOSITS	4.00 -1.35								
Olive (5Y 4/3), very weak (rock), fine grained marl-extensively microfractured, GLOBIGERINA, Middle member	5.00 -2.35	4 0:0	80	14.7		5.00	SPT N = 7, 9, 11	Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), moderately weak, fine grained marl, GLOBIGERINA, Middle member	6.00 -3.35	5 0:0	60	20				Core retrieval with simple sampler	Lost,
	7.00 -4.35	6 0:0	100	100	100			Coring using double core sampler	Full, Green
	8.00 -5.35								
	9.00 -6.35								
	8.60						PD: 2.64 Mg/m³ PL 28.2% LL: 71.5% PI: 43.3% PSD: Clay 26.0%, Silt 65.73% Sand 8.27%		
	9.70						M/C: 15.51 % BD: 2137.39 kg/m³ UCS: 15.44 N/mm²		
End of borehole	10.00								

### Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill (Recent deposits)  
Quaternary Deposits (PLEISTOCENE, to HOLOCENE)  
Middle Globigerina Limestone - microfractured/weathered top layer (MIOCENE, Aquilanian to Burdigalian)  
Middle Globigerina Limestone (MIOCENE, Aquilanian to Burdigalian)

### Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane







Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station New Combined Cycle Power Plant	Weather: Sunny	Date started: 17/07/2014	Date completed: 17/07/2014
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water
			Ground level: 2.724	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
Pale Brown (2.5Y 8/2), loose, coarse grained sandy gravel, MAN MADE, Fill	0.00 2.72	1 0: 0	86.7				Borehole fitted with grouted plastic casing for downhole seismic test, after core retrieval.	Advance casing	Lost,
Olive (5Y 4/3), compact, fine to coarse grained sandy gravelly clay, contains compacted MGL, MAN MADE, Fill	1.00 1.72						Downhole seismic testing not possible due to blockages in cased borehole.	Core retrieval with simple sampler	
	2.00 0.72	2 0: 0	93.3	3.3				Core retrieval with simple sampler	Lost,
Pale Brown (2.5Y 7/3), un-compact, fine to coarse grained silty sandy gravel, MAN MADE, Fill	3.00 -0.28	3 0: 0	50					Core retrieval with simple sampler	Lost,
Pale Brown (2.5Y 7/4), compact, medium to fine grained silty sand, very rich in organic fibres of posidonia, especially top 100mm, QUATERNARY DEPOSITS	4.00 -1.28	4 0: 0	50					Core retrieval with simple sampler	Lost,
Olive Brown (2.5Y 4/3), moderately weak, fine grained marl contains phosphatic nodules (typical of a conglomerate bed), GLOBIGERINA, Middle member	5.00 -2.28	5 0: 0	100	76.7	76.7			Core retrieval with simple sampler	Full, Green
Olive (5Y 4/3), moderately weak, fine grained marl horizontally microfractured over interval 14.7 - 20m, GLOBIGERINA, Middle member	6.00 -3.28								
	7.00 -4.28								
	8.00 -5.28								
	9.00 -6.28	6 0: 0	100	93.3	93.3			Core retrieval with simple sampler	Full, Green

### Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill (Recent deposits)  
Middle Globigerina Limestone - microfractured/weathered top layer (MIOCENE, Aquilian to Burdigalian)  
Middle Globigerina Limestone (MIOCENE, Aquilian to Burdigalian)

Quaternary Deposits (PLEISTOCENE, to HOLOCENE)

### Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station New Combined Cycle Power Plant			Weather: Sunny	Date started: 17/07/2014	Date completed: 17/07/2014
					Northings: 272.94	Eastings: 811.937
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.724	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Olive (5Y 4/3), moderately weak, fine grained marl horizontally microfractured over interval 14.7 - 20m, GLOBIGERINA, Middle member	10.00 -7.28								
	11.00 -8.28								
	12.00 -9.28	7 0: 0	100	93.3	93.3		10.50 M/C: 15.81 % BD: 2104.79 kg/m3 UCS: 13.50 N/mm2		
	13.00 -10.28								
	14.00 -11.28						13.70 M/C: 15.68 % BD: 2141.06 kg/m3 UCS: 13.82 N/mm2		
	15.00 -12.28	8 0: 0	100	83.3	83.3		14.80 M/C: 15.21 % BD: 2153.61 kg/m3 UCS: 15.14 N/mm2	Core retrieval with simple sampler	Full, Green
	16.00 -13.28								
	17.00 -14.28								
	18.00 -15.28	9 0: 0	100	100	100			Core retrieval with simple sampler	Full, Green
	19.00 -16.28								
End of borehole	20.00								

### Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

### Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
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MC: Moisture content  
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Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 144 of 512





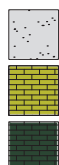


Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station New Combined Cycle Power Plant	Weather: Sunny	Date started: 16/07/2014	Date completed: 16/07/2014
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water
			Ground level: 2.778	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
Olive (5Y 4/3), loose, fine to coarse grained silty gravelly sand, contains MGL fill, top 0.3m compacted, MAN MADE, Fill	Actual depth 0.00 2.78	Drill time 1 0: 0	% 93.3	%	%	/m	Borehole fitted with grouted plastic casing for downhole seismic test, after core retrieval.  Downhole seismic testing successful	Advance casing Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), compact, fine to coarse grained gravelly sandy clay, contains compacted MGL fill, MAN MADE, Fill	1.00 1.78	2 0: 0	93.3	13.3				Core retrieval with simple sampler	Lost,
Pale Brown (2.5Y 7/3), un-compact, fine to coarse grained gravelly sandy silt, MAN MADE, Fill	2.00 0.76 MSL LAT	3 0: 0	80	6.7				Core retrieval with simple sampler	Lost,
	3.00 -0.22	4 0: 0	80					Core retrieval with simple sampler	Lost,
	4.00 -1.22	5 0: 0	50					Core retrieval with simple sampler	Full, Green
Light Grey (2.5Y 7/1), compact, medium to fine grained silty sand, contains 0.1m thick horizons of compacted mgl silt. Top 1m rich in posidonia fibres, QUATERNARY DEPOSITS	5.00 -2.22	6 0: 0	76.7	56.7	46.7			Coring using double core sampler	Full, Green
	6.00 -3.22								
	7.00 -4.22								
Olive (5Y 4/3), moderately weak, fine grained marl microfractured & consisting of hard lumps in clay matrix, GLOBIGERINA, Middle member	8.00 -5.22								
Olive (5Y 4/3), moderately weak, fine grained marl, GLOBIGERINA, Middle member	9.00 -6.22								
	10.00								

### Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill (Recent deposits)  
Middle Globigerina Limestone - microfractured/weathered top layer (MIOCENE, Aquilianian to Burdigalian)  
Middle Globigerina Limestone (MIOCENE, Aquilianian to Burdigalian)

Quaternary Deposits (PLEISTOCENE, to HOLOCENE)

### Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane



Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station New Combined Cycle Power Plant			Weather: Sunny	Date started: 16/07/2014	Date completed: 16/07/2014
					Northings: 289.91	Eastings: 812.043
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.778	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Olive (5Y 4/3), moderately weak, fine grained marl, GLOBIGERINA, Middle member	10.00 -7.22								
	7 0: 0	100	96.7	96.7		10.40	M/C: 18.00 % BD: 2122.99 kg/m3 UCS: 2.89 N/mm2	Coring using double core sampler	Full, Green
	11.00 -8.22					10.80	M/C: 17.88 % BD: 2123.13 kg/m3 UCS: 6.20 N/mm2		
	12.00 -9.22								
	13.00 -10.22					12.70	M/C: 15.50 % BD: 2180.82 kg/m3 UCS: 9.39 N/mm2		
	14.00 -11.22	8 0: 0	93.3	56.7	56.7			Coring using double core sampler	Full, Green
	15.00 -12.22					14.50	M/C: 16.04 % BD: 2169.77 kg/m3 UCS: 8.50 N/mm2		
	16.00 -13.22								
	17.00 -14.22	9 0: 0	100	60	60			Coring using double core sampler	Full, Green
	18.00 -15.22					17.30	M/C: 17.19 % BD: 2139.65 kg/m3 UCS: 14.34 N/mm2		
	19.00 -16.22	10 0: 0	100	100	100			Coring using double core sampler	Full, Green
	20.00 -17.22					18.40	M/C: 17.36 % BD: 2125.34 kg/m3 UCS: 13.32 N/mm2		
	21.00 -18.22					19.70	M/C: 16.45 % BD: 2156.56 kg/m3 UCS: 11.84 N/mm2		
End of borehole	22.00 -19.22								

### Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquilanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquilanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

### Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 148 of 512





Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station New Combined Cycle Power Plant	Weather: Sunny	Date started: 11/07/2014	Date completed: 12/07/2014
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water
			Ground level: 2.857	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Pale Brown (2.5Y 8/2), loose, coarse grained sandy gravel, MAN MADE, Fill	0.00 2.86	1 0:0	100				Borehole fitted with grouted plastic casing for downhole seismic test, after core retrieval.  Downhole seismic testing successful	Advance casing Core retrieval with simple sampler	Lost,
Light Grey (2.5Y 7/2 to 10YR 5/3), compact, fine to coarse grained sandy gravelly clay - contains terrarossa soil over depth 1-1.3m, MAN MADE, Fill	1.00 1.86								
Reddish Brown (5YR 5/3), compact, fine to coarse grained sandy gravelly clay - contains MGL fill, MAN MADE, Fill	2.00 2.86	2 0:0	93.3	26.7				Core retrieval with simple sampler	Lost,
Olive (5Y 5/3), un-compact, fine to coarse grained sandy gravelly clay - contains MGL fill, MAN MADE, Fill	3.00 -0.14	3 0:0	66.7	13.3				Core retrieval with simple sampler	Lost,
Greyish Brown (2.5Y 5/2), compact, medium to fine grained silty sand, top 100mm very rich in posidonia fibres, QUATERNARY DEPOSITS	4.00 -1.14	4 0:0	93.3	86.7				Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), very weak (rock), fine grained marl, microfractured - consists of hard lumps in stiff clay matrix, GLOBIGERINA, Middle member	5.00 -2.14								
Olive (5Y 4/3), very weak (rock), fine grained marl, GLOBIGERINA, Middle member	6.00 -3.14	5 0:0	100	100	100	6.30	M/C: 9.57 % BD: 2130.59 kg/m3 UCS: 15.28 N/mm2	Coring using double core sampler	Full, Green
	7.00 -4.14								
	8.00 -5.14								
	9.00 -6.14	6 0:0	100	96.7	96.7	9.30	M/C: 13.89 % BD: 2252.09 kg/m3 UCS: 4.22 N/mm2	Coring using double core sampler	Full, Green
	10.00								

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquilanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquilanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 151 of 512



Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station New Combined Cycle Power Plant			Weather: Sunny	Date started: 11/07/2014	Date completed: 12/07/2014
					Northings: 306.881	Eastings: 812.085
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.857	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Olive (5Y 4/3), very weak (rock), fine grained marl, GLOBIGERINA, Middle member	10.00 -7.14								
	11.00 -8.14								
	12.00 -9.14	7 0: 0	100	80	80		11.70 M/C: 14.61 % BD: 2237.58 kg/m3 UCS: 12.74 N/mm2		
	13.00 -10.14						12.70 M/C: 15.74 % BD: 2195.41 kg/m3 UCS: 12.68 N/mm2		
	14.00 -11.14						13.30 M/C: 14.17 % BD: 2240.44 kg/m3 UCS: 16.29 N/mm2		
	15.00 -12.14	8 0: 0	100	83.3	83.3				
	16.00 -13.14						15.90 M/C: 15.29 % BD: 2194.14 kg/m3 UCS: 17.32 N/mm2		
	17.00 -14.14						16.60 M/C: 16.02 % BD: 2163.80 kg/m3 UCS: 16.53 N/mm2		
	18.00 -15.14	9 0: 0	100	100	100				
	19.00 -16.14								
End of borehole	20.00								

### Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)



Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquilanian to Burdigalian)



Middle Globigerina Limestone  
(MIOCENE, Aquilanian to Burdigalian)



Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

### Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 152 of 512





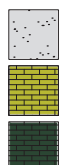


Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station New Combined Cycle Power Plant	Weather: Sunny	Date started: 07/07/2014	Date completed: 08/07/2014
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water
			Ground level: 2.716	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
Light Grey (2.5Y 7/2), loose, coarse grained sandy gravel, MAN MADE, Fill	0.00 -2.72	1 0:0	100				Borehole fitted with grouted plastic casing for downhole seismic test, after core retrieval.  Downhole seismic testing not possible due to blockages in cased borehole.	Advance casing	Lost,
Light Grey (5Y 7/2), compact, fine to coarse grained sandy gravelly clay - contains MGL fill, MAN MADE, Fill	1.00 -1.72						SPT N = 14, 50, 0	Core retrieval with simple sampler	
	2.00 -0.72	2 0:0	86.7	46.7				Core retrieval with simple sampler	Lost,
Brown (10YR 4/3), compact, fine to coarse grained sandy gravelly clay - contains terrarossa soil, MAN MADE, Fill	2.00 -0.72								
Pale Brown (2.5Y 7/4), un-compact, medium to coarse grained sandy gravel, MAN MADE, Fill	3.00 -1.28	3 0:0	50	3.3			SPT N = 34, 50, 0	Core retrieval with simple sampler	Lost,
	4.00 -1.28								
Grey (2.5Y 5/1), un-compact, medium to fine grained silty sand, very rich in posidonia fibres, QUATERNARY DEPOSITS	5.00 -2.28	4 0:0	50				SPT N = 9, 13, 12	Core retrieval with simple sampler	Lost,
	6.00 -3.28	5 0:0	83.3	40				Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), very weak (rock), fine grained marl - microfractured, consists of hard lumps of stiff clay matrix, GLOBIGERINA, Middle member	7.00 -4.28								
Olive (5Y 4/3), moderately weak, fine grained marl - bioturbated - horizontally microfractured between 10.8m and 13.2m and between 15.0m and 17.15m, GLOBIGERINA, Middle member	8.00 -5.28	6 0:0	100	76.7	66.7			Coring using double core sampler	Full, Green
	9.00 -6.28						M/C: 14.51 % BD: 2167.62 kg/m3 UCS: 12.83 N/mm2		
	9.40 -6.28						M/C: 14.43 % BD: 2179.35 kg/m3 UCS: 13.40 N/mm2		
	9.85 -6.28						M/C: 14.50 % BD: 2169.43 kg/m3 UCS: 13.80 N/mm2		

### Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill (Recent deposits)  
Middle Globigerina Limestone - microfractured/weathered top layer (MIOCENE, Aquitanian to Burdigalian)  
Middle Globigerina Limestone (MIOCENE, Aquitanian to Burdigalian)

Quaternary Deposits (PLEISTOCENE, to HOLOCENE)

### Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station New Combined Cycle Power Plant			Weather: Sunny	Date started: 07/07/2014	Date completed: 08/07/2014
					Northings: 272.908	Eastings: 830.792
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.716	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Olive (5Y 4/3), moderately weak, fine grained marl - bioturbated - horizontally microfractured between 10.8m and 13.2m and between 15.0m and 17.15m, GLOBIGERINA, Middle member	10.00 -7.28								
	7 0: 0	100	70	70				Coring using double core sampler	Full, Green
	11.00 -8.28								
	12.00 -9.28								
	13.00 -10.28								
	8 0: 0	100	83.3	83.3				Coring using double core sampler	Full, Green
	14.00 -11.28						14.10 M/C: 14.31 % BD: 2165.34 kg/m3 UCS: 15.10 N/mm2		
	15.00 -12.28						14.70 M/C: 15.51 % BD: 2146.90 kg/m3 UCS: 13.54 N/mm2		
	16.00 -13.28								
	9 0: 0	100	86.7	86.7				Coring using double core sampler	Full, Green
	17.00 -14.28						17.50 M/C: 13.84 % BD: 2168.51 kg/m3 UCS: 18.91 N/mm2		
	18.00 -15.28	10 0: 0	100	95	95			Coring using double core sampler	Full, Green
	19.00 -16.28						18.70 M/C: 16.02 % BD: 2098.71 kg/m3 UCS: 15.58 N/mm2		
End of borehole	20.00								

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)  
Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquilanian to Burdigalian)  
Middle Globigerina Limestone  
(MIOCENE, Aquilanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane







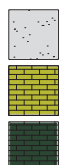


Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station New Combined Cycle Power Plant	Weather: Sunny	Date started: 09/07/2014	Date completed: 09/07/2014
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water
			Ground level: 2.849	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
white (2.5Y 8/1), loose, coarse grained sandy gravel, MAN MADE, Fill	Actual depth 0.00 2.85	Drill time 1 0:0	% 100	%	%	/m	Borehole fitted with grouted plastic casing for downhole seismic test, after core retrieval.  Downhole seismic testing successful	Advance casing	Lost,
Olive (5Y 5/3), compact, fine grained silty sandy gravel - contains pieces of middle Globigerina limestone marl, MAN MADE, Fill	1.00 1.85							Core retrieval with simple sampler	
Olive (5Y 4/3), compact, fine grained silty clay-contains pieces of middle Globigerina limestone marl, MAN MADE, Fill	2.00 0.8 HAT MSL LAT	2 0:0	100	80				Core retrieval with simple sampler	Lost,
Olive (5Y 4/3 to 5Y 6/4), un-compact, fine grained silty gravel-contains pieces of middle Globigerina limestone marl, compact at base, MAN MADE, Fill	3.00 -0.15	3 0:0	86.7	13.3				Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), compact, fine grained silt-posidonia layer, QUATERNARY DEPOSITS	4.00 -1.15								
Olive (5Y 4/3), very weak (rock), fine grained marl - pieces of marl in stiff clay matrix, GLOBIGERINA, Middle member	5.00 -2.15	4 0:0	73.3	40				Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), moderately weak, fine grained marl - microfractured bands at 9.2-14m - splits horizontally along bedding. GLOBIGERINA, Middle member	6.00 -3.15	5 0:0	100	86.7				Core retrieval with simple sampler	Lost,
	7.00 -4.15								
	8.00 -5.15	6 0:0	100	100	100			Coring using double core sampler	Full, Green
	9.00 -6.15	7 0:0	100	90	83.3			Coring using double core sampler	Full, Green
	10.00 -7.15								

### Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill (Recent deposits)  
Middle Globigerina Limestone - microfractured/weathered top layer (MIOCENE, Aquilianian to Burdigalian)  
Middle Globigerina Limestone (MIOCENE, Aquilianian to Burdigalian)  
Quaternary Deposits (PLEISTOCENE, to HOLOCENE)

### Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station New Combined Cycle Power Plant			Weather: Sunny	Date started: 09/07/2014	Date completed: 09/07/2014
					Northings: 289.879	Eastings: 830.834
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.849	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Olive (5Y 4/3), moderately weak, fine grained marl - microfractured bands at 9.2-14m - splits horizontally along bedding. GLOBIGERINA, Middle member	10.00 -7.15								
	11.00 -8.15								
	12.00 -9.15	8 0: 0	100	80	80			Coring using double core sampler	Full, Green
	13.00 -10.15								
	14.00 -11.15								
	15.00 -12.15	9 0: 0	100	53.3	53.3	15.10	M/C: 14.68 % BD: 2145.40 kg/m3 UCS: 15.11 N/mm2	Coring using double core sampler	Full, Green
	16.00 -13.15					15.60	M/C: 14.10 % BD: 2143.28 kg/m3 UCS: 15.77 N/mm2		
	17.00 -14.15								
	18.00 -15.15	10 0: 0	100	100	100	18.15	M/C: 14.61 % BD: 2115.35 kg/m3 UCS: 18.25 N/mm2	Coring using double core sampler	Full, Green
	19.00 -16.15					18.85	M/C: 14.56 % BD: 2134.31 kg/m3 UCS: 18.20 N/mm2		
	20.00 -17.15					19.25	M/C: 15.01 % BD: 2113.51 kg/m3 UCS: 18.77 N/mm2		
Discontinuity at 60°, slickensided sides, very low persistence, very tight									
End of borehole	20.00								

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)



Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquilanian to Burdigalian)



Middle Globigerina Limestone  
(MIOCENE, Aquilanian to Burdigalian)



Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 160 of 512





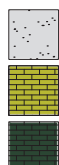


Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station New Combined Cycle Power Plant	Weather: Sunny	Date started: 10/07/2014	Date completed: 10/07/2014
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water
			Ground level: 2.939	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Pale Brown (2.5Y 8/2), loose, coarse grained sandy gravel, MAN MADE, Fill	0.00 2.94	1 0:0	100				Borehole fitted with grouted plastic casing for downhole seismic test, after core retrieval.  Downhole seismic testing successful	Advance casing Core retrieval with simple sampler	Lost,
Pale Brown (2.5Y 8/2), compact, coarse grained sandy gravel - compacted, with tar layer at 0.4m, MAN MADE, Fill	1.00 1.94								
Olive (5Y 4/3), compact, fine to coarse grained sandy gravelly clay, MAN MADE, Fill	2.00 0.94 HAT	2 0:0	100	33.3				Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), un-compact, fine to coarse grained sandy gravelly clay - contains middle Globigerina limestone, MAN MADE, Fill	3.00 -0.06 LAT	3 0:0	86.7					Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), compact, fine to coarse grained sandy gravelly clay contains middle Globigerina limestone, MAN MADE, Fill	4.00 -1.06	4 0:0	100	86.7				Core retrieval with simple sampler	Lost,
Grey (2.5Y 5/1), compact, medium to fine grained silty sand very rich in organic fibres of posidonia especially top 100mm, QUATERNARY DEPOSITS	5.00 -2.06								
Olive (5Y 4/3), very weak (rock), fine grained marl -microfractured, consists of hard lumps in stiff clay matrix, GLOBIGERINA, Middle member	6.00 -3.06	5 0:0	93.3	66.7	23.3			Coring using double core sampler	Full, Green
Olive (5Y 4/3), moderately weak, fine grained marl-horizontally fractured over 6 - 8m and 14.5 - 20m, GLOBIGERINA, Middle member	7.00 -4.06								
	8.00 -5.06								
	9.00 -6.06	6 0:0	100	83.3	83.3		9.20  M/C: 15.38 % BD: 2164.06 kg/m3 UCS: 11.25 N/mm2	Coring using double core sampler	Full, Green
	10.00 -7.06								

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station New Combined Cycle Power Plant			Weather: Sunny	Date started: 10/07/2014	Date completed: 10/07/2014
					Northings: 306.901	Eastings: 830.607
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.939	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Olive (5Y 4/3), moderately weak, fine grained marl-horizontally fractured over 6.0 - 8.0m and 14.5 - 20.0m, GLOBIGERINA, Middle member	-7.06						10.20 M/C: 14.77 % BD: 2149.45 kg/m3 UCS: 11.61 N/mm2		
	-8.06						11.20 M/C: 14.73 % BD: 2171.21 kg/m3 UCS: 12.63 N/mm2		
	-9.06	7 0: 0	100	66.7	66.7			Coring using double core sampler	Full, Green
Discontinuity at 45°, slickensided sides, no infill, tight	-10.06								
Discontinuity at 50°, slickensided sides, no infill, tight	-11.06								
Discontinuity at 55°, slickensided sides, no infill, tight	-12.06								
	-13.06	8 0: 0	96.7	56.7	56.7			Coring using double core sampler	Full, Green
	-14.06								
	-15.06								
	-16.06								
	-17.06								
	-18.06	9 0: 0	100	100	100			Coring using double core sampler	Full, Green
	-19.06								
End of borehole	-20.06								

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquilianian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquilianian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane







Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station New Combined Cycle Power Plant			Weather: Sunny	Date started: 04/07/2014	Date completed: 04/07/2014
					Northings: 259,644	Eastings: 848,261
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.559	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
white (2.5Y 8/1), loose, coarse grained sandy gravel, MAN MADE, Fill	0.00 2.56	1 0: 0	100						Lost,
Olive (5Y 5/3), compact, fine to coarse grained sandy gravelly clay - contains compacted middle Globigerina limestone, MAN MADE, Fill	1.00 1.56						SPT N = 7, 6, 7		
Dark Yellowish Brown (10YR 4/4), compact, fine to coarse grained sandy gravelly clay, MAN MADE, Fill	2.00 0.56	2 0: 0	100						Lost,
Pale Brown (2.5Y 7/4 to 10YR 4/2), un-compact, fine to coarse grained clayey sand with gravel - occasionally rich in red terrarossa soil, MAN MADE, Fill	3.00 -0.44	3 0: 0	80				SPT N = 14, 50, 0		Lost,
	4.00 -1.44								
	5.00 -2.44	4 0: 0	80				SPT N = 50, 1 cm penetration		Lost,
Yellowish Brown (10YR 5/4), un-compact, fine to coarse grained sandy gravel (with some clay), MAN MADE, Fill	6.00 -3.44	5 0: 0	50						Lost,
	7.00 -4.44								
	8.00 -5.44	6 0: 0	50						Lost,
Pale Brown (2.5Y 7/4), un-compact, coarse grained limestone boulders & gravelly sand, MAN MADE, Fill	9.00 -6.44	7 0: 0	33.3	6.7					Lost,
	10.00								

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

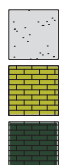
Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 167 of 512

Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station New Combined Cycle Power Plant			Weather: Sunny	Date started: 04/07/2014	Date completed: 04/07/2014
					Northings: 259,644	Eastings: 848,261
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.559	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Void	10.00 -7,44								
	8 0: 0	46.7	30	16.7				Core retrieval with simple sampler	Lost,
	11.00 -8,44								
Pale Brown (2.5Y 7/3), moderately weak, fine to coarse grained limestone boulders, MAN MADE, Fill									
Olive (5Y 4/3), stiff, fine grained clayey silt, MAN MADE, Fill	12.00 -8,44	9 0: 0	50	36.7	11.3			Core retrieval with simple sampler	Lost,
Greenish Black, very soft, medium to fine grained clayey sand-very rich in rootlets of posidonia (well defined), QUATERNARY DEPOSITS									
Olive (5Y 4/3), very stiff, fine grained marl - microfractured, consists of hard lumps in clay matrix, GLOBIGERINA, Middle member	13.00 -10,44								
Olive (5Y 4/3), moderately weak, fine grained marl - bioturbated, often horizontally microfractured, GLOBIGERINA, Middle member	14.00 -11,44	10 0: 0	86.7	71.7	71.7	13.70	M/C: 18.67 % BD: 2077.08 kg/m3 UCS: 10.21 N/mm2	Coring using double core sampler	Partial,
	15.00 -12,44					14.80	M/C: 13.06 % BD: 2139.72 kg/m3 UCS: 15.34 N/mm2		
	16.00 -13,44					15.40	PD: 2.63 Mg/m³ PL 24.5% LL: 63.0% PI: 38.5% PSD: Clay 36.62%, Silt 59.09% Sand 4.29%		
	17.00 -14,44	11 0: 0	100	76.7	76.7			Coring using double core sampler	Lost,
End of borehole	18.00 -15,44								

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill (Recent deposits)  
Middle Globigerina Limestone - microfractured/weathered top layer (MIOCENE, Aquitanian to Burdigalian)  
Middle Globigerina Limestone (MIOCENE, Aquitanian to Burdigalian)

Quaternary Deposits (PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane









Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant	Weather: Sunny	Date started: 28/07/2014	Date completed: 28/07/2014
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water
			Ground level: 2.573	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
Pale Brown (2.5Y 8/2), loose, coarse grained sandy gravel, MAN MADE , Fill	Actual depth 0.00 2.57	Drill time 1 0:0	% 93.3	%	%	/m		Advance casing Core retrieval with simple sampler	Lost,
Olive Grey (5Y 5/2), compact, fine to coarse grained sandy gravel clay - contains compacted middle Globigerina limestone fill, MAN MADE , Fill	1.00 1.57					1.00	SPT N = 7, 11, 14		
Yellowish Brown (10YR 5/4), compact, fine to coarse grained clayey sandy gravel - gravel in terrarossa matrix, MAN MADE , Fill	HAT 2.00 0.57 MSL	2 0:0	100					Core retrieval with simple sampler	Lost,
Very Dark Grey (2.5Y 3/1), compact, coarse grained limestone boulder - contains coralline limestone, MAN MADE , Fill	LAT 3.00 -0.43	3 0:0	86.7			3.00	SPT N = 50, 2 cm penetration	Core retrieval with simple sampler	Lost,
Yellowish Brown (10YR 5/4), un-compact, fine to coarse grained sandy clayey gravel - lower Globigerina limestone fill with large pockets of terrarossa clay, MAN MADE , Fill	4.00 -1.43	4 0:0	66.7	4				Core retrieval with simple sampler	Lost,
Pale Brown (10YR 6/3), un-compact, fine to coarse grained silty sandy gravel - contains gravel from coralline limestone, MAN MADE , Fill	5.00 -2.43								
Light Brownish Grey (2.5Y 6/2), compact, fine to medium grained silty sand - with some organic fibres of posidonia, QUATERNARY DEPOSITS	6.00 -3.43	5 0:0	70	20	20			Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), very weak (rock), fine grained marl - extensively microfractured, GLOBIGERINA, Middle member	7.00 -4.43	6 0:0	80	40	40			Coring using double core sampler	Full, Green
Olive (5Y 4/3), moderately weak, fine grained marl - weak zone at 10 - 13.5m, GLOBIGERINA, Middle member	8.00 -5.43					7.70 8.30	PD: 2.63 Mg/m³ M/C: 15.77 % BD: 2232.15 kg/m³ UCS: 8.34 N/mm²		
	9.00 -6.43	7 0:0	100	66.7	66.7			Coring using double core sampler	Full, Green

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill (Recent deposits)  
Middle Globigerina Limestone - microfractured/weathered top layer (MIOCENE, Aquitanian to Burdigalian)  
Middle Globigerina Limestone (MIOCENE, Aquitanian to Burdigalian)

Quaternary Deposits (PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant			Weather: Sunny	Date started: 28/07/2014	Date completed: 28/07/2014
					Northings: 272.692	Eastings: 849.41
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.573	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Olive (5Y 4/3), moderately weak, fine grained marl - weak zone at 10 - 13.5m, GLOBIGERINA, Middle member	10.00 -7.43								
	8 0: 0	100						Coring using double core sampler	Full, Green
	11.00 -8.43								
	12.00 -9.43	9 0: 0	100					Coring using double core sampler	Full, Green
	13.00 -10.43						12.80 PD: 2.61 Mg/m³		
	14.00 -11.43	10 0: 0	100	93.3	93.3			Coring using double core sampler	Full, Green
	15.00 -12.43						14.60 M/C: 16.42 % BD: 2170.01 kg/m3 UCS: 10.25 N/mm2		
End of borehole									

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)



Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)



Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)



Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 172 of 512





Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant	Weather: Sunny	Date started: 29/07/2014	Date completed: 29/07/2014
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water
			Ground level: 2.684	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth Drill time	%	%	%	%	/m			
Pale Brown (2.5Y 8/2), loose, coarse grained sandy gravel, MAN MADE, Fill	0.00 2.68	1 0:0	93.3					Advance casing Core retrieval with simple sampler	Lost,
Pale Olive (5Y 6/3), compact, fine to coarse grained silty gravelly clay - contains compacted middle Globigerina limestone fill from adjacent excavation, MAN MADE, Fill	1.00 1.68					1.00	SPT N = 10, 50, 3		
	2.00 0.68	2 0:0	100					Advance casing Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), un-compact, fine to coarse grained silty gravelly clay - contains middle Globigerina limestone fill from adjacent excavation, MAN MADE, Fill	2.00 0.68 HAT MSL LAT								
	3.00 -0.32	3 0:0	93.3	10		3.00	SPT N = 50, 4 cm penetration	Core retrieval with simple sampler	Lost,
	4.00 -1.32								
Pale Olive (5Y 6/3), compact, fine grained silty clay - mud from sedimentation of middle Globigerina limestone fill particles, MAN MADE, Fill	5.00 -2.32	4 0:0	93.3	20		5.00	SPT N = 50, 4.5 cm penetration	Core retrieval with simple sampler	Lost,
Dark Greyish Brown (2.5Y 4/2), loose, fine to medium grained silty sand - very rich in posidonia fibres, QUATERNARY DEPOSITS	6.00 -3.32	5 0:0	86.7	10	10			Coring using double core sampler	Full, Green
Olive (5Y 4/3), very weak (rock), fine grained marl - extensively microfractured, GLOBIGERINA, Middle member	7.00 -4.32	6 0:0	100	100	100			Coring using double core sampler	Full, Green
	8.00 -5.32					8.20	M/C: 16.15 % BD: 2195.54 kg/m3 UCS: 13.91 N/mm2		
	9.00 -6.32	7 0:0	100	86.7	86.7	8.70	M/C: 15.92 % BD: 2176.31 kg/m3 UCS: 11.82 N/mm2		
Olive (5Y 4/3), moderately weak, fine grained marl, GLOBIGERINA, Middle member	10.00 -6.32					9.70	M/C: 15.63 % BD: 2181.82 kg/m3 UCS: 8.29 N/mm2	Coring using double core sampler	Full, Green

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill (Recent deposits)  
Middle Globigerina Limestone - microfractured/weathered top layer (MIOCENE, Aquitanian to Burdigalian)  
Middle Globigerina Limestone (MIOCENE, Aquitanian to Burdigalian)

Quaternary Deposits (PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant	Weather: Sunny	Date started: 29/07/2014		Date completed: 29/07/2014	
			Northings: 289.297		Eastings: 844.388	
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.684	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
Olive (5Y 4/3), moderately weak, fine grained marl, GLOBIGERINA, Middle member  Discontinuity at 40°, smooth & slickensided sides, no infill, tight	Actual depth 10.00 -7.32	Drill time	%	%	%	/m			
	8 0: 0		100	86.7	86.7		10.80 M/C: 15.53 % BD: 2182.14 kg/m3 UCS: 11.72 N/mm2	Coring using double core sampler	Full, Green
	11.00 -8.32								
	12.00 -9.32	9 0: 0	100	93.3	93.3		11.80 M/C: 15.84 % BD: 2154.06 kg/m3 UCS: 8.35 N/mm2	Coring using double core sampler	Lost,
	13.00 -10.32						12.70 M/C: 17.53 % BD: 2139.00 kg/m3 UCS: 7.43 N/mm2		
End of borehole	14.00 -11.32	10 0: 0	100	100	100		13.60 M/C: 16.21 % BD: 2152.34 kg/m3 UCS: 10.37 N/mm2	Coring using double core sampler	Lost,
	15.00 -12.32						14.70 M/C: 16.10 % BD: 1919.57 kg/m3 UCS: 9.08 N/mm2		

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)



Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)



Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)



Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 175 of 512



Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant	Weather: Sunny	Date started: 29/07/2014	Date completed: 29/07/2014
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water
			Ground level: 2.764	Water level: 0.3
			Northings: 307.38	Eastings: 843.317

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Pale Brown (2.5Y 8/2), loose, coarse grained sandy gravel, MAN MADE, Fill	0.00 2.76	1 0:0	100					Advance casing Core retrieval with simple sampler	Lost,
Pale Brown (2.5Y 8/2), compact, fine to coarse grained silty gravelly clay - compacted middle Globigerina limestone fill from adjacent excavation, MAN MADE, Fill	1.00 1.76					1.00	SPT N = 15, 12, 14		
	2.00 0.76	2 0:0	100					Advance casing Core retrieval with simple sampler	Lost,
Pale Brown (2.5Y 8/2), un-compact, fine to coarse grained sandy gravelly clay - middle Globigerina limestone fill from adjacent excavation, MAN MADE, Fill	3.00 -0.24	3 0:0	93.3					Core retrieval with simple sampler	Lost,
	4.00 -1.24								
	5.00 -2.24	4 0:0	86.7	10	10			Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), very weak (rock), fine grained marl - extensively microfractured; small marl pieces in stiff clay matrix, GLOBIGERINA, Middle member	6.00 -3.24	5 0:0	100	86.7	86.7			Coring using double core sampler	Full, Green
Olive (5Y 4/3), moderately weak, fine grained marl - weak zones at 9 - 10m, 11.6 - 12.0m, GLOBIGERINA, Middle member	7.00 -4.24								
	8.00 -5.24	6 0:0	100	86.7	86.7	7.80	M/C: 14.34 % BD: 2156.02 kg/m3 UCS: 9.71 N/mm2	Coring using double core sampler	Full, Green
	9.00 -6.24	7 0:0	80	33.3	33.3	8.60	M/C: 15.74 % BD: 2222.54 kg/m3 UCS: 11.60 N/mm2	Coring using double core sampler	Full, Green
	10.00 -7.24								

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquilanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquilanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane



Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant			Weather: Sunny	Date started: 29/07/2014	Date completed: 29/07/2014
					Northings: 307.38	Eastings: 843.317
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.764	Water level: 0.3

Description	Depth Actual depth	Run Drill time	TCR %	SCR %	RQD %	f/m /m	Sampling/testing	Drilling progress	Returns
Olive (5Y 4/3), moderately weak, fine grained marl - weak zones at 9 - 10m, 11.6 - 12.0m, GLOBIGERINA, Middle member	10.00 -7.24								
	8 0: 0	100	66.7	66.7		10.30	M/C: 14.77 % BD: 2190.37 kg/m3 UCS: 9.38 N/mm2	Coring using double core sampler	Full, Green
	11.00 -8.24						11.25	M/C: 14.53 % BD: 2201.69 kg/m3 UCS: 10.84 N/mm2	
	12.00 -9.24	9 0: 0	100	100	100		12.35	M/C: 14.54 % BD: 2188.63 kg/m3 UCS: 13.12 N/mm2	Coring using double core sampler
	13.00 -10.24						13.30	M/C: 14.94 % BD: 2169.25 kg/m3 UCS: 11.76 N/mm2	
	14.00 -11.24	10 0: 0	100	100	100		14.50	M/C: 14.51 % BD: 2159.70 kg/m3 UCS: 15.23 N/mm2	Coring using double core sampler
End of borehole	15.00 -12.24								

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 178 of 512



Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant			Weather: Sunny	Date started: 28/07/2014	Date completed: 28/07/2014
					Northings: 272.473	Eastings: 868.203
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.663	Water level: 0.3

Description	Depth Actual depth	Run Drill time	TCR %	SCR %	RQD %	f/m /m	Sampling/testing	Drilling progress	Returns
Pale Brown (2.5Y 8/2), loose, coarse grained sandy gravel, MAN MADE, Fill	0.00 2.66	1 0:0	86.7					Advance casing Core retrieval with simple sampler	Lost,
Olive Grey (5Y 5/2), compact, fine to coarse grained sandy gravelly clay - contains compacted middle Globigerina limestone fill from nearby excavation, MAN MADE, Fill	1.00 1.66					1.00	SPT N = 50, 2 cm penetration		
Brown (7.5YR 5/4), compact, fine to coarse grained silty sandy gravel - contains lower Globigerina limestone fill with pockets of stiff terrarossa clay, MAN MADE, Fill	2.00 2.66 HAT MSL LAT	2 0:0	93.3					Advance casing Core retrieval with simple sampler	Lost,
Very Pale Brown (10YR 7/4), un-compact, fine to coarse grained sandy gravel - contains lower Globigerina limestone fill with some terrarossa, MAN MADE, Fill	3.00 -0.34	3 0:0	86.7			3.00	SPT N = 10, 3, 15	Core retrieval with simple sampler	Lost,
	4.00 -1.34								
	5.00 -2.34	4 0:0	86.7					Core retrieval with simple sampler	Lost,
Pale Brown (2.5Y 7/3), compact, fine to coarse grained silty sandy gravel - contains upper Globigerina limestone fill, MAN MADE, Fill	6.00 -3.34					5.00	SPT N = 50, 2.5 cm penetration		
Very Dark Greyish Brown (2.5Y 3/2), un-compact, medium to fine grained silty sand - very rich in organic fibres of posidonia, QUATERNARY DEPOSITS	7.00 -4.34	5 0:0	93.3	13.3				Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), very weak (rock), fine grained marl - stiff clay at top changing to microfractured marl, GLOBIGERINA, Middle member	8.00 -5.34	6 0:0	93.3	6.7		6.80	PSD: Clay 7.51%, Silt 16.41% Sand 76.04%		
Olive (5Y 4/3), moderately weak to weak, fine grained marl - extensively fractured (very weak) between 9.5m and 13.5m, GLOBIGERINA, Middle member	9.00 -6.34					8.50	PD: 2.63 Mg/m³	Coring using double core sampler	Full, Green
	10.00 -7.34	7 0:0	100	26.7		9.40	M/C: 12.53 % BD: 2216.76 kg/m³ UCS: 12.38 N/mm²	Coring using double core sampler	Full, Green

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill (Recent deposits)  
Middle Globigerina Limestone - microfractured/weathered top layer (MIOCENE, Aquitanian to Burdigalian)  
Middle Globigerina Limestone (MIOCENE, Aquitanian to Burdigalian)

Quaternary Deposits (PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant			Weather: Sunny	Date started: 28/07/2014	Date completed: 28/07/2014
					Northings: 272.473	Eastings: 868.203
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.663	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Olive (5Y 4/3), moderately weak to weak, fine grained marl - extensively fractured (very weak) between 9.5m and 13.5m, GLOBIGERINA, Middle member	10.00 -7.34								
	8 0: 0	100						Coring using double core sampler	Full, Green
	11.00 -8.34					11.30 11.50	PD: 2.62 Mg/m³ PD: 2.63 Mg/m³		
	12.00 -9.34	9 0: 0	100	13.3	13.3			Coring using double core sampler	Full, Green
Discontinuity at 50°, smooth & slickensided sides, no infill, tight	13.00 -10.34								
	14.00 -11.34	10 0: 0	100	93.3	93.3	13.80	M/C: 14.88 % BD: 2176.59 kg/m³ UCS: 11.03 N/mm²	Coring using double core sampler	Full, Green
	15.00 -12.34					14.40 14.70	M/C: 16.01 % BD: 2931.73 kg/m³ UCS: 12.99 N/mm² M/C: 15.14 % BD: 2219.39 kg/m³ UCS: 11.62 N/mm²		
End of borehole									

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 181 of 512





Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant	Weather: Sunny	Date started: 27/07/2014	Date completed: 27/07/2014
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water
			Ground level: 2.701	Water level: 0.3
			Northings: 284.203	Eastings: 868.777

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Pale Brown (2.5Y 8/2), loose, coarse grained sandy gravel, MAN MADE, Fill	0.00 2.70	1 0:0	93.3					Advance casing Core retrieval with simple sampler	Lost,
Pale Olive (5Y 6/3), compact, fine to coarse grained sandy gravelly clay - contains upper Globigerina limestone & middle Globigerina limestone fill, MAN MADE, Fill	1.00 1.70					1.00	SPT N = 8, 11, 14		
	2.00 0.70	2 0:0	100					Advance casing Core retrieval with simple sampler	Lost,
	HAT								
	MSL								
	LAT								
Olive (5Y 4/3), un-compact, fine to coarse grained sandy gravelly clay - contains middle Globigerina limestone fill, MAN MADE, Fill	3.00 -0.30	3 0:0	93.3			3.00	SPT N = 13, 50, 4	Core retrieval with simple sampler	Lost,
	4.00 -1.30								
Olive (5Y 4/3), compact, fine to coarse grained sandy silt - contains compacted middle Globigerina limestone mud, MAN MADE, Fill	5.00 -2.30	4 0:0	86.7	20		5.00	SPT N = 6, 9, 13	Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), un-compact, fine to coarse grained sandy silty gravel - lower 0.3m (5.7 - 6.0) contains upper Globigerina limestone fill, MAN MADE, Fill	6.00 -3.30	5 0:0	93.3	60				Core retrieval with simple sampler	Lost,
Dark Greyish Brown (2.5Y 4/2), compact, fine to medium grained sandy silt with some posidonia fibres, QUATERNARY DEPOSITS	7.00 -4.30					6.60	PSD: Clay 12.53%, Silt 32.70% Sand 54.77%		
Olive (5Y 4/3), very weak (rock), fine grained marl - very small hard lumps in a mostly clay-like matrix, GLOBIGERINA, Middle member	8.00 -5.30	6 0:0	96.7	66.7	66.7	7.90	M/C: 14.71 % BD: 1279.20 kg/m3 UCS: 13.01 N/mm2	Coring using double core sampler	Full, Green
Olive (5Y 4/3), moderately weak, fine grained marl - very weak layer at 12.7 - 15.0, GLOBIGERINA, Middle member	9.00 -6.30					8.60	M/C: 16.09 % BD: 2135.54 kg/m3 UCS: 13.97 N/mm2		
	10.00 -7.30					9.70	PD: 2.66 Mg/m³		

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill (Recent deposits)  
Middle Globigerina Limestone - microfractured/weathered top layer (MIOCENE, Aquilanian to Burdigalian)  
Middle Globigerina Limestone (MIOCENE, Aquilanian to Burdigalian)

Quaternary Deposits (PLEISTOCENE, to HOLOCENE)

## Legend:

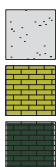
UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant			Weather: Sunny	Date started: 27/07/2014	Date completed: 27/07/2014
					Northings: 284.203	Eastings: 868.777
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.701	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Olive (5Y 4/3), moderately weak, fine grained marl - very weak layer at 12.7 - 15.0, GLOBIGERINA, Middle member	10.00 -7.30								
	7 0: 0	93.3	66.7	66.7				Coring using double core sampler	Full, Green
	11.00 -8.30								
Discontinuity at 45°, slickensided sides, no infill, aperture unclear	12.00 -9.30						11.70 M/C: 15.86 % BD: 1845.13 kg/m3 UCS: 14.51 N/mm2		
	12.30						M/C: 16.15 % BD: 1620.61 kg/m3 UCS: 15.78 N/mm2		
	13.00 -10.30								
End of borehole	14.00 -11.30	8 0: 0	53.3					Coring using double core sampler	Full, Green
	14.50						PD: 2.60 Mg/m³		
	15.00 -12.30								

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 184 of 512







Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station New Combined Cycle Power Plant	Weather: Sunny	Date started: 23/07/2014	Date completed: 23/07/2014
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water
			Ground level: 3.731	Water level: 0.3
			Northings: 295.04	Eastings: 868.272

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
Black, moderately weak, coarse grained tarmac, MAN MADE , Fill	Actual depth 3.73	1 0: 0	93.3					Advance casing	Lost,
Pale Brown (2.5Y 8/2), un-comp[act, coarse grained sandy gravel, MAN MADE , Fill								Core retrieval with simple sampler	
Olive (5Y 4/3), compact, fine to coarse grained sandy gravelly clay, contains compacted mgl fill, MAN MADE , Fill	1.00 2.73					1.00	SPT N = 12, 15, 17		
		2 0: 0	93.3					Core retrieval with simple sampler	Lost,
	2.00 1.73								
	3.00 HAT 0.73	3 0: 0	93.3			3.00	SPT N = 14, 13, 15	Core retrieval with simple sampler	Lost,
	MSL								
	LAT								
Light Yellowish Brown (2.5Y 6/3), un-compact, fine to coarse grained silty sandy gravel, MAN MADE, Fill	4.00 -0.27								
		4 0: 0	93.3	20				Core retrieval with simple sampler	Lost,
	5.00 -1.27					5.00	SPT N = 50, 2 cm penetration		
Pale Olive (5Y 6/3), compact, fine to coarse grained sandy silt- some organic fibres between 6.0-6.25m, MAN MADE , Fill	6.00 -2.27	5 0: 0	100	40				Core retrieval with simple sampler	Lost,
Greyish Brown (2.5Y 5/2), compact, fine to medium grained silty sand very rich in posidonia fibres, QUATERNARY DEPOSITS	7.00 -3.27								
Olive (5Y 4/3), stiff to very stiff, fine grained marl- horizontally layered - stiff pieces in clay matrix, GLOBIGERINA, Middle member	8.00 -4.27	6 0: 0	100	93.3	93.3	7.70	PD: 2.64 Mg/m³	Coring using double core sampler	Full, Green
Olive (5Y 4/3), moderately weak, fine grained marl extensively microfractured between 10.6 - 12.0m, GLOBIGERINA, Middle member	9.00 -5.27					8.30	M/C: 15.61 % BD: 2190.82 kg/m3 UCS: 6.55 N/mm2		
						8.80	M/C: 15.89 % BD: 2181.27 kg/m3 UCS: 7.23 N/mm2		
						9.25	M/C: 15.66 % BD: 2173.08 kg/m3 UCS: 10.58 N/mm2		
	10.00 -6.27								

## Legend:

GL: ground level  
 AOD: above Ordinance Datum  
 BGL: below ground level  
 AMSL: above mean sea level  
 RQD: Rock Quality Designation  
 TCR: total core recovery  
 SCR: solid core recovery  
 f: fracture frequency  
 O/H: open hole

## Legend:

UCS: uniaxial compressive strength  
 SSD: Saturated surface dry density  
 ABS: Absorption  
 MC: Moisture content

Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station New Combined Cycle Power Plant			Weather: Sunny	Date started: 23/07/2014	Date completed: 23/07/2014
					Northings: 295.04	Eastings: 868.272
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 3.731	Water level: 0.3

Description	Depth Actual depth	Run Drill time	TCR %	SCR %	RQD %	f/m /m	Sampling/testing	Drilling progress	Returns
Olive (5Y 4/3), moderately weak, fine grained marl extensively microfractured between 10.6 - 12.0m, GLOBIGERINA, Middle member	10.00 -6.27						10.25 M/C: 16.03 % BD: 2204.95 kg/m3 UCS: 9.30 N/mm2		
	7 0: 0	100	3.3					Coring using double core sampler	Full, Green
	11.00 -7.27								
	12.00 -8.27	8 0: 0	100	100	100		12.20 M/C: 16.00 % BD: 2169.50 kg/m3 UCS: 9.34 N/mm2	Coring using double core sampler	Full, Green
							12.70 PD: 2.64 Mg/m³		
	13.00 -9.27						13.20 M/C: 16.56 % BD: 2161.54 kg/m3 UCS: 10.52 N/mm2		
							13.80 M/C: 15.76 % BD: 2191.09 kg/m3 UCS: 11.73 N/mm2		
	14.00 -10.27								
End of borehole	15.00 -11.27								

## Legend:

GL: ground level  
 AOD: above Ordinance Datum  
 BGL: below ground level  
 AMSL: above mean sea level  
 RQD: Rock Quality Designation  
 TCR: total core recovery  
 SCR: solid core recovery  
 f: fracture frequency  
 O/H: open hole

## Legend:

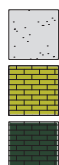


Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant	Weather: Sunny	Date started: 23/07/2014	Date completed: 23/07/2014
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water
			Ground level: 3.598	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
Grey, strong, coarse grained concrete, MAN MADE, Concrete	Actual depth 0.00 3.60	Drill time 1 0: 0	% 100	%	%	/m		Advance casing Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), compact, fine to coarse grained silty gravelly clay - compacted MGL fill, MAN MADE, Fill	1.00 2.60					1.00	SPT N = 13, 12, 15		
	2.00 1.60	2 0: 0	100					Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), un-compact, fine to coarse grained silty gravelly clay- contains MGL fill, MAN MADE, Fill	HAT 3.00 0.60 MSL LAT	3 0: 0	100			3.00	SPT N = 11, 11, 13	Core retrieval with simple sampler	Lost,
Light Yellowish Brown (2.5Y 6/3), compact, fine to coarse grained silty gravelly clay - Lower Globigerina limestone fill compacted under weight of overlying fill, MAN MADE, Fill	4.00 -0.40	4 0: 0	100	26.7				Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), compact, fine to coarse grained silty gravelly clay - middle Glob. limestone fill compacted under weight of overlying fill, MAN MADE, Fill	5.00 -1.40	5 0: 0	100	33.3				Core retrieval with simple sampler	Lost,
Greyish Brown (2.5Y 5/2), compact, fine to medium grained silty sand rich in posidonia and other organic fibres, QUATERNARY DEPOSITS	6.00 -2.40								
Olive (5Y 4/3), very weak (rock), fine grained mar - some weak lumps in a predominantly clay matrix, GLOBIGERINA, Middle member	7.00 -3.40								
Olive (5Y 4/3), moderately weak, fine grained marl - horizontally microfractured between 10.9 and 13.2m, GLOBIGERINA, Middle member	8.00 -4.40	6 0: 0	100	76.7	76.7			Coring using double core sampler	Full, Green
	9.00 -5.40					8.20	M/C: 18.17 % BD: 2117.05 kg/m3 UCS: 7.18 N/mm2		
						8.75	M/C: 18.53 % BD: 2113.76 kg/m3 UCS: 6.33 N/mm2		
						9.50	M/C: 16.00 % BD: 2172.22 kg/m3 UCS: 9.53 N/mm2		

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill (Recent deposits)  
Middle Globigerina Limestone - microfractured/weathered top layer (MIOCENE, Aquitanian to Burdigalian)  
Middle Globigerina Limestone (MIOCENE, Aquitanian to Burdigalian)  
Quaternary Deposits (PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane



Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant			Weather: Sunny	Date started: 23/07/2014	Date completed: 23/07/2014
					Northings: 306.749	Eastings: 868.647
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 3.598	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Olive (5Y 4/3), moderately weak, fine grained marl - horizontally microfractured between 10.9 and 13.2m, GLOBIGERINA, Middle member	10.00 -6,40						10.15 M/C: 15.73 % BD: 2184.09 kg/m3 UCS: 8.33 N/mm2		
	7 0: 0	96.7	43.3	43.3			10.70 M/C: 15.78 % BD: 2180.67 kg/m3 UCS: 8.33 N/mm2	Coring using double core sampler	Full, Green
	11.00 -7,40								
	12.00 -8,40								
	13.00 -9,40						13.30 M/C: 17.31 % BD: 2125.59 kg/m3 UCS: 10.82 N/mm2		
	14.00 -10,40	8 0: 0	100	100	100		13.70 M/C: 17.60 % BD: 2126.32 kg/m3 UCS: 11.04 N/mm2	Coring using double core sampler	Full, Green
	15.00 -11,40						14.60 M/C: 16.77 % BD: 2170.70 kg/m3 UCS: 11.01 N/mm2		
End of borehole									

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)



Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 190 of 512

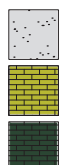


Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant	Weather: Sunny	Date started: 21/07/2014	Date completed: 22/07/2014
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water
			Ground level: 3.718	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Very Dark Grey (2.5Y 3/1), moderately weak, coarse grained tarmac/bitumen, MAN MADE, Fill	0.00 3.72	1 0:0	100					Advance casing Core retrieval with simple sampler	Lost,
Pale Brown (2.5Y 8/2), compact, coarse grained sandy gravel - coralline limestone fill, MAN MADE, Fill	1.00 2.72					1.00	SPT N = 12, 13, 16		
Olive (5Y 4/3), compact, fine to coarse grained sandy gravelly clay with some sandy gravel - contains Middle Globigerina limestone fill and Coralline limestone fill, MAN MADE, Fill	2.00 1.72	2 0:0	100					Core retrieval with simple sampler	Lost,
Brown (10YR 5/3), compact, fine to coarse grained sandy gravelly clay - contains compacted terrarossa fill, MAN MADE, Fill	3.00 0.72								
Olive (5Y 4/4), un-compact, fine to coarse grained sandy gravelly clay contains Middle Globigerina Limestone fill, MAN MADE, Fill	3.00 0.72	3 0:0	100	53.3		3.00	SPT N = 13, 11, 14	Core retrieval with simple sampler	Lost,
	4.00 -0.28								
	5.00 -1.28	4 0:0	93.3	20				Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), compact, fine grained silt - compacted mgl silt, MAN MADE, Fill	6.00 -2.28					5.00	SPT N = 8, 10, 13		
Greyish Brown (2.5Y 5/2), compact, fine to medium grained silty sand, containing some organic fibres, QUATERNARY DEPOSITS	7.00 -3.28	5 0:0	93.3	13.3				Core retrieval with simple sampler	Lost,
Olive (5Y 4/4), very stiff, fine grained marl - small lumps in clay matrix, GLOBIGERINA, Middle member	8.00 -4.28					7.65	M/C: 13.88 % BD: 2129.35 kg/m3 UCS: 9.56 N/mm2	Coring using double core sampler	Full, Green
Olive (5Y 4/3), moderately weak, fine grained marl, GLOBIGERINA, Middle member	9.00 -5.28	6 0:0	96.7	43.3	43.3	8.30	M/C: 17.40 % BD: 2118.83 kg/m3 UCS: 6.59 N/mm2		

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill (Recent deposits)  
Middle Globigerina Limestone - microfractured/weathered top layer (MIOCENE, Aquitanian to Burdigalian)  
Middle Globigerina Limestone (MIOCENE, Aquitanian to Burdigalian)  
Quaternary Deposits (PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Eastings:  
887.085

Water level:
0.3

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 193 of 512



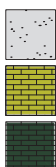


Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant			Weather: Sunny	Date started: 07/07/2014	Date completed: 07/07/2014
					Northings: 272.788	Eastings: 892.953
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.672	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
white (2.5Y 8/1), loose, coarse grained sandy gravel, MAN MADE , Fill	0.00 2.67	1 0: 0	100	66.7	66.7			Advance casing Core retrieval with simple sampler	Lost,
White (2.5Y 8/1), moderately strong, coarse grained concrete - including T32 bars, MAN MADE , Concrete Platform or foundation	1.00 1.67					1.00	SPT N = 13, 15, 18		
Olive (5Y 4/3), compact, coarse to fine grained sandy silty gravel, MAN MADE , Fill	2.00 2.67	2 0: 0	93.3	46.7				Core retrieval with simple sampler	Lost,
Light Yellowish Brown (2.5Y 6/3), compact, coarse to fine grained silty sand and some gravel, MAN MADE, Fill	3.00 3.33	3 0: 0	93.3	20		3.00	SPT N = 15, 13, 14	Core retrieval with simple sampler	Lost,
Pale Brown (2.5Y 7/3), un-compact, coarse to fine grained silty sand gravel, MAN MADE, Fill	4.00 4.33	4 0: 0	93.3			5.00	SPT N = 12, 50, 2cm penetration	Core retrieval with simple sampler	Lost,
Dark Greyish Brown (2.5Y 4/2), compact, medium to fine grained silty sand - very rich in posidonia fibres, QUATERNARY DEPOSITS	5.00 5.33	5 0: 0	100					Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), very weak (rock), fine grained marl - horizontally microfractured, GLOBIGERINA, Middle member	6.00 6.33	6 0: 0	100	100				Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), moderately weak, fine grained marl, GLOBIGERINA, Middle member	7.00 7.33	7 0: 0	100	100	100			Coring using double core sampler	Full, Green

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Date completed:  
07/07/2014

Eastings:  
892.953

Water level:	0.3
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Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 196 of 512





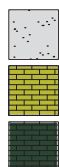


Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant			Weather: Sunny	Date started: 18/07/2014	Date completed: 19/07/2014
					Northings: 303.673	Eastings: 891.932
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 3.808	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
Very Dark Grey (2.5Y 3/1), moderately weak, coarse grained tarmac, MAN MADE, Fill	0.00 3.81	1 0: 0	93.3				Borehole fitted with grouted plastic casing for downhole seismic test, after core retrieval.  Downhole seismic testing not possible due to blockages in cased borehole.	Advance casing Core retrieval with simple sampler	Lost,
White (2.5Y 8/1), loose, coarse grained sandy gravel, MAN MADE, Fill									
Olive (5Y 5/3), compact, coarse to fine grained silty sandy gravel containing compacted middle Globigerina limestone fill, MAN MADE, Fill	1.00 2.81								
Olive (5Y 4/4), compact, fine to coarse grained silty sandy clay - compacted middle Globigerina limestone fill, containing some terrarossa soil, MAN MADE, Fill	2.00 1.81	2 0: 0	93.3					Core retrieval with simple sampler	Lost,
Olive (5Y 4/4), un-compact, fine to coarse grained silty sandy clay with some gravel - middle Globigerina limestone fill containing some terrarossa soil, MAN MADE, Fill	3.00 0.8	3 0: 0	100	10	10			Core retrieval with simple sampler	Lost,
Pale Brown (2.5Y 8/2), moderately weak, coarse grained limestone boulder, MAN MADE, Fill	4.00 -0.19								
Olive (5Y 4/3), compact, fine to coarse grained silty gravelly clay, MAN MADE, Fill									
Grey (2.5Y 5/1), compact, fine to medium grained silty sand, QUATERNARY DEPOSITS	5.00 -1.19	4 0: 0	93.8	56.3				Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), compact, fine to medium grained silt-compact mgl silt with organic inclusions (posidonia sea weed), QUATERNARY DEPOSITS	6.00 -2.19	5 0: 0	80	26.7	6.7			Coring using double core sampler	Full, Green
Olive (5Y 4/3), weak, fine grained marl - compact hard lumps in clay matrix, GLOBIGERINA, Middle member									
Olive (5Y 4/3), moderately weak, fine grained marl, GLOBIGERINA, Middle member	7.00 -3.19								
	8.00 -4.19								
	9.00 -5.19	6 0: 0	90	66.7				Coring using double core sampler	Full, Green
	10.00								

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill (Recent deposits)  
Middle Globigerina Limestone - microfractured/weathered top layer (MIOCENE, Aquilianian to Burdigalian)  
Middle Globigerina Limestone (MIOCENE, Aquilianian to Burdigalian)

Quaternary Deposits (PLEISTOCENE, to HOLOCENE)

## Legend:

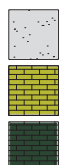
UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant			Weather: Sunny	Date started: 18/07/2014	Date completed: 19/07/2014
					Northings: 303.673	Eastings: 891.932
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 3.808	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Olive (5Y 4/3), moderately weak, fine grained marl, GLOBIGERINA, Middle member	10.00 -6.19								
	11.00 -7.19								
	12.00 -8.19	7 0: 0	70	43.3	23.3			Coring using double core sampler	Full, Green
	13.00 -9.19								
	14.00 -10.19						14.10 M/C: 16.61 % BD: 2156.87 kg/m3 UCS: 11.86 N/mm2		
	15.00 -11.19						14.60 M/C: 16.13 % BD: 2159.24 kg/m3 UCS: 10.88 N/mm2		
	16.00 -12.19								
	17.00 -13.19						15.20 M/C: 16.86 % BD: 2132.56 kg/m3 UCS: 10.56 N/mm2	Coring using double core sampler	Full, Green
	18.00 -14.19						16.80 M/C: 16.25 % BD: 2158.66 kg/m3 UCS: 11.30 N/mm2		
	19.00 -15.19						17.45 M/C: 16.30 % BD: 2145.65 kg/m3 UCS: 7.70 N/mm2		
End of borehole	20.00 -16.19								
	21.00 -17.19						19.35 M/C: 15.59 % BD: 2180.22 kg/m3 UCS: 12.60 N/mm2		

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquilianian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquilianian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane







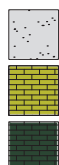


Client: Siemens Industrial Turbomachinery AB	Location:	Weather: Sunny	Date started: 24/07/2014		Date completed: 24/07/2014	
			Northings: 284.709		Eastings: 896.584	
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.729	Water level: 0.3

Description	Depth Actual depth	Run Drill time	TCR %	SCR %	RQD %	f/m /m	Sampling/testing	Drilling progress	Returns
Pale Brown (2.5Y 8/2), un-compact, coarse grained sandy gravel, MAN MADE, Fill	0.00 2.73	1 0:0	100					Advance casing Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), compact, fine to coarse grained sandy gravelly clay - contains compacted middle Globigerina limestone fill, MAN MADE, Fill	1.00 1.73					1.00	SPT N = 2, 50, 2cm penetration		
Pale Brown (2.5Y 7/4), un-compact, fine to coarse grained silty sandy gravel, MAN MADE, Fill	2.00 2.73 MSL LAT	2 0:0	100					Advance casing Core retrieval with simple sampler	Lost,
	3.00 -0.27	3 0:0	93.3			3.00	SPT N = 5, 5, 8	Core retrieval with simple sampler	Lost,
	4.00 -1.27								
	5.00 -2.27	4 0:0	86.7			5.00	SPT N = 7, 10, 12	Core retrieval with simple sampler	Lost,
	6.00 -3.27								
Light Grey (2.5Y 7/1), un-compact, fine to medium grained silty sand - very rich in organic fibres & posidonia, especially between 6.8-7.45m, QUATERNARY DEPOSITS	7.00 -4.27	5 0:0	73.3	5.3				Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), moderately weak, fine grained marl, GLOBIGERINA, Middle member	8.00 -5.27	6 0:0	100	76.7	66.7			Coring using double core sampler	Full, Green
	9.00 -6.27					8.75 8.90	M/C: 16.03 % BD: 2171.62 kg/m3 UCS: 7.12 N/mm2 PD: 2.62 Mg/m³		

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

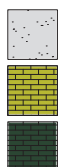
UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Client: Siemens Industrial Turbomachinery AB	Location:	Weather: Sunny	Date started: 24/07/2014		Date completed: 24/07/2014	
			Northings: 284.709		Eastings: 896.584	
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.729	Water level: 0.3

Description	Depth Actual depth	Run Drill time	TCR %	SCR %	RQD %	f/m /m	Sampling/testing	Drilling progress	Returns
Olive (5Y 4/3), moderately weak, fine grained marl, GLOBIGERINA, Middle member	10.00 -7.27								
	7 0: 0	100	66.7	66.7		10.40	M/C: 15.99 % BD: 2187.78 kg/m3 UCS: 6.80 N/mm2	Coring using double core sampler	Full, Green
	11.00 -8.27					11.25	M/C: 16.36 % BD: 2156.47 kg/m3 UCS: 12.85 N/mm2		
	12.00 -9.27								
	13.00 -10.27					13.20	M/C: 15.96 % BD: 2171.15 kg/m3 UCS: 9.84 N/mm2		
	8 0: 0	100	93.3	93.3				Coring using double core sampler	Full, Green
	14.00 -11.27					13.90	PD: 2.62 Mg/m³		
						14.20	M/C: 16.40 % BD: 2165.43 kg/m3 UCS: 5.83 N/mm2		
						14.70	M/C: 15.61 % BD: 2179.04 kg/m3 UCS: 8.58 N/mm2		
	End of borehole 15.00 -12.27								

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)  
Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)  
Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 203 of 512

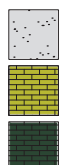


Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant	Weather: Sunny	Date started: 24/07/2014	Date completed: 24/07/2014
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water
			Ground level: 2.677	Water level: 0.3

Description	Depth Actual depth	Run Drill time	TCR %	SCR %	RQD %	f/m /m	Sampling/testing	Drilling progress	Returns
Pale Brown (2.5Y 8/2), loose, coarse grained sandy gravel, MAN MADE, Fill	0.00 2.68	1 0:0	100					Advance casing Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), compact, fine to coarse grained silty gravelly clay - compacted middle Globigerina limestone fill, MAN MADE, Fill	1.00 1.68					1.00	SPT N = 8, 11, 13		
	2.00 0.68	2 0:0	93.3					Advance casing Core retrieval with simple sampler	Lost,
	2.00 0.68								
	3.00 -0.32	3 0:0	93.3			3.00	SPT N = 50, 0 cm penetration	Core retrieval with simple sampler	Lost,
Light Yellowish Brown (2.5Y 6/3), un-compact, fine to coarse grained silty sandy gravel - lower Globigerina limestone fill, MAN MADE, Fill	4.00 -1.32								
	5.00 -2.32	4 0:0	80			5.00	SPT N = 50, 3 cm penetration	Core retrieval with simple sampler	Lost,
	6.00 -3.32	5 0:0	80	20				Core retrieval with simple sampler	Lost,
Greyish Brown (2.5Y 5/2), compact, fine to medium grained silty sand - very rich in posidonia and other organic fibres, QUATERNARY DEPOSITS	7.00 -4.32								
Olive (5Y 4/3), very stiff, fine grained marl, GLOBIGERINA, Middle member	8.00 -5.32	6 0:0	96.7	60	60			Coring using double core sampler	Lost,
Olive (5Y 4/3), moderately weak, fine grained marl - microfractured over the interval 10.0-11.0m and 12.5-14.0m, GLOBIGERINA, Middle member	9.00 -6.32					8.75	M/C: 15.85 % BD: 2171.46 kg/m3 UCS: 10.31 N/mm2		
	10.00 -7.32					9.70	M/C: 16.31 % BD: 2176.50 kg/m3 UCS: 9.21 N/mm2		

### Legend:

GL: ground level  
AOD: above Ordinance Datum  
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AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquilanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquilanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

### Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane



Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant			Weather: Sunny	Date started: 24/07/2014	Date completed: 24/07/2014
					Northings: 263.716	Eastings: 903.616
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 2.677	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Olive (5Y 4/3), moderately weak, fine grained marl - microfractured over the interval 10.0-11.0m and 12.5-14.0m, GLOBIGERINA, Middle member	10.00 -7.32								
	7 0: 0	96.7	56.7	50				Coring using double core sampler	Lost,
	11.00 -8.32								
	12.00 -9.32								
	13.00 -10.32								
	14.00 -11.32								
	15.00 -12.32								
End of borehole									

11.65  
M/C: 15.65 %  
BD: 2170.25 kg/m3  
UCS: 10.28 N/mm2

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

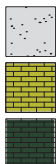


Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant	Weather: Sunny	Date started: 20/07/2014	Date completed: 20/07/2014
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water
			Ground level: 3.704	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
Reddish Brown (5YR 5/4), loose, medium to coarse grained gravelly silty sand-contains topsoil, MAN MADE, Fill	0.00 3.70	1 0: 0	100				Borehole fitted with grouted plastic casing for downhole seismic test, after core retrieval  Downhole seismic testing successful	Advance casing Core retrieval with simple sampler	Lost,
Pale Brown (2.5Y 7/3), loose, medium to coarse grained gravelly sand, MAN MADE, Fill	1.00 2.70								
Light Olive Grey (5Y 6/2), loose, medium to coarse grained sandy gravel, MAN MADE, Fill									
Olive (5Y 4/3), compact, fine to coarse grained sandy gravelly clay-contains compacted middle Globigerina limestone fill, MAN MADE, Fill	2.00 1.70	2 0: 0	100					Advance casing Core retrieval with simple sampler	Lost,
Olive (5Y 5/3), un-compact, fine to coarse grained sandy gravelly clay - contains middle Globigerina limestone, MAN MADE, Fill	3.00 0.70 HAT MSL LAT	3 0: 0	93.3	33.3				Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), compact, fine to coarse grained gravelly clay - middle Globigerina limestone gravel in clay matrix, MAN MADE, Fill	4.00 -0.30	4 0: 0	80	33.3				Core retrieval with simple sampler	Lost,
Light Grey (2.5Y 7/1), compact, medium to fine grained silty sand - very rich in organic fibres of posidonia, QUATERNARY DEPOSITS	5.00 -1.30	5 0: 0	80					Core retrieval with simple sampler	Lost,
	6.00 -2.30								
	7.00 -3.30								
	8.00 -4.30	6 0: 0	66.7					Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), very weak (rock), fine grained marl-microfractured - consists of hard lumps in clay matrix, GLOBIGERINA, Middle member	9.00 -5.30	7 0: 0	100	80				Core retrieval with simple sampler	Lost,
Olive (5Y 4/3), moderately weak, fine grained marl - horizontally microfractured over 9.8-14m, 17.2-20m, GLOBIGERINA, Middle member	10.00								

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill (Recent deposits)  
Middle Globigerina Limestone - microfractured/weathered top layer (MIOCENE, Aquitanian to Burdigalian)  
Middle Globigerina Limestone (MIOCENE, Aquitanian to Burdigalian)  
Quaternary Deposits (PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Client: Siemens Industrial Turbomachinery AB	Location: Delimara Power Station - New Combined Cycle Power Plant			Weather: Sunny	Date started: 20/07/2014	Date completed: 20/07/2014
					Northings: 296.593	Eastings: 917.235
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 3.704	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Olive (5Y 4/3), moderately weak, fine grained marl - horizontally microfractured over 9.8-14m, 17.2-20m, GLOBIGERINA, Middle member	10.00 -6.30	8 0: 0	100	100				Coring using double core sampler	Full, Green
	11.00 -7.30								
	12.00 -8.30	9 0: 0	100	73.3	10			Coring using double core sampler	Full, Green
	13.00 -9.30								
	14.00 -10.30								
	15.00 -11.30	10 0: 0	100	93.3	93.3	14.90 15.20	M/C: 15.80 % BD: 2184.81 kg/m3 UCS: 8.42 N/mm2 M/C: 15.40 % BD: 2190.24 kg/m3 UCS: 9.95 N/mm2	Coring using double core sampler	Full, Green
	16.00 -12.30								
	17.00 -13.30					16.40	M/C: 15.30 % BD: 2178.33 kg/m3 UCS: 8.91 N/mm2		
	18.00 -14.30	11 0: 0	100	85	85	18.20	M/C: 15.06 % BD: 2162.37 kg/m3 UCS: 10.04 N/mm2	Coring using double core sampler	Full, Green
	19.00 -15.30								
End of borehole	20.00								

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquilanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquilanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane







Client: Siemens Industrial Turbomachinery	Location: Delimara Power Station - New Combined Cycle Power Plant			Weather: Sunny	Date started: 21/07/2014	Date completed: 21/07/2014
					Northings: 281.633	Eastings: 917.965
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 3.371	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Pale Brown (2.5Y 8/2), loose, coarse grained tar & sandy gravel, MAN MADE, Fill	0.00 3.37	1 0:0	100					Advance casing Core retrieval with simple sampler	Lost,
Light Olive Brown (2.5Y 5/4), compact, fine to coarse grained gravelly silty sand - contains some traces of terrarossa soil, MAN MADE, Fill	1.00 2.37					1.00	SPT N = 12, 13, 15		
Olive (5Y 4/3), compact, fine to coarse grained gravelly sandy clay - compacted middle Globigerina limestone fill, MAN MADE, Fill	2.00 1.37	2 0:0	93.3	26.7				Core retrieval with simple sampler	Lost,
Pale Yellow (5Y 7/3), un-compact, fine to coarse grained gravelly silty sand with some clay - contains middle Globigerina limestone fill, MAN MADE, Fill	3.00 -0.63	3 0:0	86.7	6.7		3.00	SPT N = 50, 1 cm penetration	Core retrieval with simple sampler	Lost,
	4.00 -1.63	4 0:0	83.3	6.7				Core retrieval with simple sampler	Lost,
Pale Yellow (5Y 7/3), compact, fine grained clayey silt-contains mgl silt, MAN MADE, Fill	5.00 -2.63	5 0:0	86.7	40	26.7			Core retrieval with simple sampler	Lost,
Light Grey (2.5Y 7/1), compact, medium to fine grained silty sand very rich in posidonia & other organic matter, QUATERNARY DEPOSITS	6.00 -3.63	6 0:0	100	100	100			Core retrieval with simple sampler	Lost,
Olive Brown (2.5Y 4/3), moderately weak, fine grained marl - horizontally microfractured over 7-7.5m, 9-11m, GLOBIGERINA, Middle member	7.00 -4.63	7 0:0	100	66.7	66.7			Core retrieval with simple sampler	Lost,
	8.00 -5.63					8.30	M/C: 16.82 % BD: 2137.43 kg/m3 UCS: 8.91 N/mm2		
	9.00 -6.63					8.85	M/C: 16.67 % BD: 2143.09 kg/m3 UCS: 6.70 N/mm2		

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquilian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquilian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Client: Siemens Industrial Turbomachinery	Location: Delimara Power Station - New Combined Cycle Power Plant			Weather: Sunny	Date started: 21/07/2014	Date completed: 21/07/2014
					Northings: 281.633	Eastings: 917.965
Job No: J1057	Drill type: CMV 1400	Bit type/diameter: Double core	Orientation: vertical	Drilling fluid: Fresh Water	Ground level: 3.371	Water level: 0.3

Description	Depth	Run	TCR	SCR	RQD	f/m	Sampling/testing	Drilling progress	Returns
	Actual depth	Drill time	%	%	%	/m			
Olive Brown (2.5Y 4/3), moderately weak, fine grained marl - horizontally microfractured over 7-7.5m, 9-11m, GLOBIGERINA, Middle member	10.00 -6.63								
	8 0: 0	73.3	33.3	33.3				Coring using double core sampler	Full, Green
	11.00 -7.63								
	12.00 -8.63	9 0: 0	93.3	60	53.3			Coring using double core sampler	Full, Green
	13.00 -9.63								
	14.00 -10.63								
	15.00 -11.63								
End of borehole									

## Legend:

GL: ground level  
AOD: above Ordinance Datum  
BGL: below ground level  
AMSL: above mean sea level  
RQD: Rock Quality Designation  
TCR: total core recovery  
SCR: solid core recovery  
f: fracture frequency  
O/H: open hole



Limestone fill  
(Recent deposits)

Middle Globigerina Limestone - microfractured/weathered top layer  
(MIOCENE, Aquitanian to Burdigalian)

Middle Globigerina Limestone  
(MIOCENE, Aquitanian to Burdigalian)

Quaternary Deposits  
(PLEISTOCENE, to HOLOCENE)

## Legend:

UCS: uniaxial compressive strength  
BD: Bulk density  
ABS: Absorption  
MC: Moisture content  
PD: Particle density  
PSV: Pocket shear vane

Soil and rock colour references are according to the  
Munsell notation (Munsell soil colour charts 2009) 213 of 512





## Appendix C: Trial Pit photos

## Trial Pit 1





## Trial Pit 1











## Trial Pit 2







### Trial Pit 3













## Trial Pit 2







### Trial Pit 3







## **Appendix D: Site tests**

- **Standard penetration tests**
- **Plate loading tests**
- **Anchor pull-out tests**

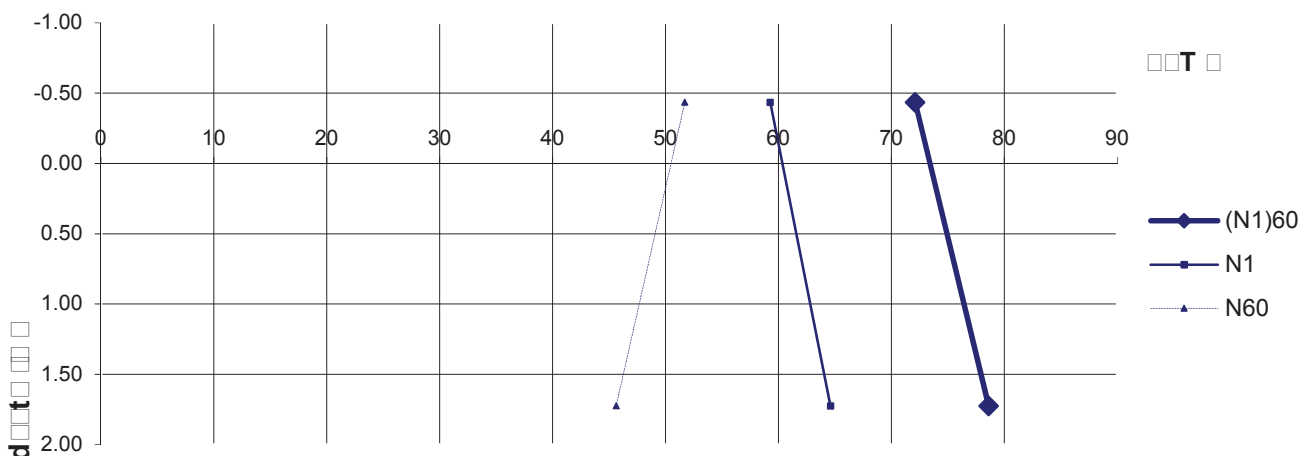
- **Standard penetration tests**

## Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:	Delimara Power Station New CCPP	Bore Hole No.	1	Top of BH above LAT	2.73 m
Borehole diameter	mm	Soil type	Normally Consolidated (Id 40-60)		
Hammer type	Automatic Trip type UK model	Position of water table (relative to LAT)	0.3 m		
Weight of hammer	63.50 Kg	unit weight of formation	16 KN/m <sup>2</sup>		
Weight of hammer & anvil	105.00 Kg	Overburden $p_o$	0 KN/m <sup>2</sup>		
Length of rods: anvil to ground	1.15 m	SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)	$N_{60}$		
weight of rods/m	6.40 Kg	SPT N value corrected for both vertical effective stress and input energy	$(N_1)_{60}$		
Sampler type		SPT N value corrected to 100kPa overburden pressure (normalised)	$N_1$		
Energy Ratio of system	73 %	$N = N_{150-300} + N_{300-450}$	$N$		

Borehole progress				SPT blowcount				Correction factors				Corrected SPT		
From	to	depth	av positio	1st	2nd	3rd		Rods	BH size*	Overb urden	Energy	$N_1$	$N_{60}$	$(N_1)_{60}$
m	m	m	m	$N_{1-150}$	$N_{150-300}$	$N_{300-450}$	$N$	$\lambda$	$C_d$	$C_N$	$ER_r/60$			
1.73	1.72	-0.01	1.73	50	50	50	50	0.75	1	1.72	1.22	64.61	45.63	78.61
-0.27	-0.29	-0.02	-0.44	50	50	50	50	0.85	1	1.39	1.22	59.26	51.71	72.10

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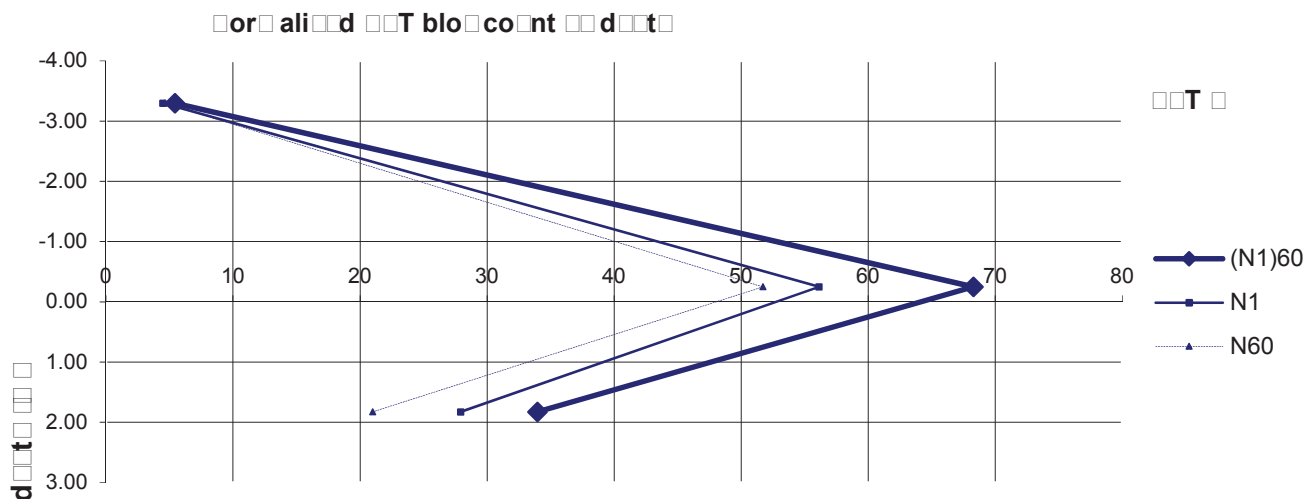


BH size\* Applying correction proposed by Skempton (1986)

## Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:	Delimara Power Station New CCPP		Bore Hole No.	2	Top of BH above LAT	3.302 m
Borehole diameter	mm		Soil type	Normally Consolidated (Id 40-60) ▼		
Hammer type	Automatic Trip type UK model		Position of water table (relative to LAT)		0.3 m	
Weight of hammer	63.50 Kg		unit weight of formation		16 KN/m <sup>2</sup>	
Weight of hammer & anvil	105.00 Kg		Overburden p <sub>o</sub>		0 KN/m <sup>2</sup>	
Length of rods: anvil to ground	1.15 m		N <sub>60</sub>	SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)		
weight of rods/m	6.40 Kg			SPT N value corrected for both vertical effective stress and input energy		
Sampler type				SPT N value corrected to 100kPa overburden pressure (normalised)		
Energy Ratio of system	73 %		N	= N <sub>150-300</sub> +N <sub>300-450</sub>		

Borehole progress				SPT blowcount				Correction factors				Corrected SPT		
From	to	depth	av positio	1st	2nd	3rd		Rods	BH size*	Overb urden	Energy	$N_1$	$N_{60}$	$(N_1)_{60}$
m	m	m	m	$N_{1-150}$	$N_{150-300}$	$N_{300-450}$	$N$	$\lambda$	$C_d$	$C_N$	$ER_r/60$			
2.05	1.60	-0.45	1.83	17	10	13	23	0.75	1	1.62	1.22	27.91	20.99	33.96
-0.05	-0.10	-0.05	-0.25	50	50	50	50	0.85	1	1.32	1.22	56.13	51.71	68.30
-2.70	-3.15	-0.45	-3.3	5	2	2	4	0.95	1	1.17	1.22	4.46	4.62	5.43



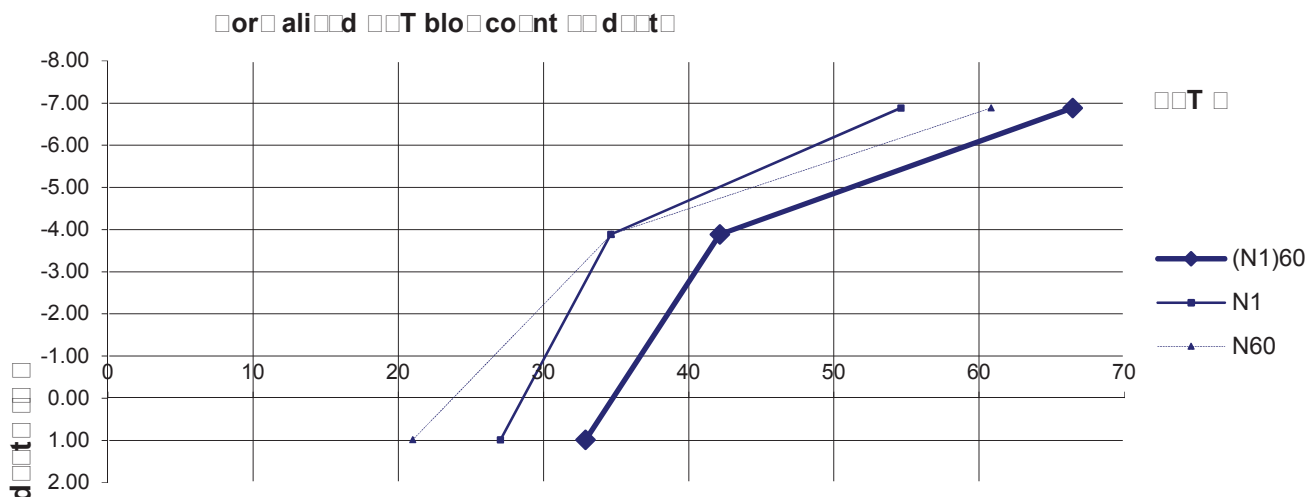
BH size\* Applying correction proposed by Skempton (1986)



## Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:	Delimara Power Station New CCPP	Bore Hole No.	3	Top of BH above LAT	2.714 m
Borehole diameter	mm	Soil type	Normally Consolidated (Id 40-60)		
Hammer type	Automatic Trip type UK model	Position of water table (relative to LAT)	0.3 m		
Weight of hammer	63.50 Kg	unit weight of formation	16 KN/m <sup>2</sup>		
Weight of hammer & anvil	105.00 Kg	Overburden $p_o$	0 KN/m <sup>2</sup>		
Length of rods: anvil to ground	1.15 m	$N_{60}$	SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)		
weight of rods/m	6.40 Kg		SPT N value corrected for both vertical effective stress and input energy		
Sampler type			SPT N value corrected to 100kPa overburden pressure (normalised)		
Energy Ratio of system	73 %	$N_1$	$N = N_{150-300} + N_{300-450}$		

Borehole progress				SPT blowcount				Correction factors				Corrected SPT		
From	to	depth	av positio	1st	2nd	3rd		Rods	BH size*	Overb urden	Energy	$N_1$	$N_{60}$	$(N_1)_{60}$
m	m	m	m	$N_{1-150}$	$N_{150-300}$	$N_{300-450}$	$N$	$\lambda$	$C_d$	$C_N$	$ER_r/60$			
1.21	0.76	-0.45	0.99	13	12	11	23	0.75	1	1.57	1.22	27.04	20.99	32.90
-3.29	-3.74	-0.45	-3.89	11	13	17	30	0.95	1	1.22	1.22	34.64	34.68	42.15
-6.29	-6.74	-0.45	-6.89	21	23	27	50	1.00	1	1.09	1.22	54.61	60.83	66.45

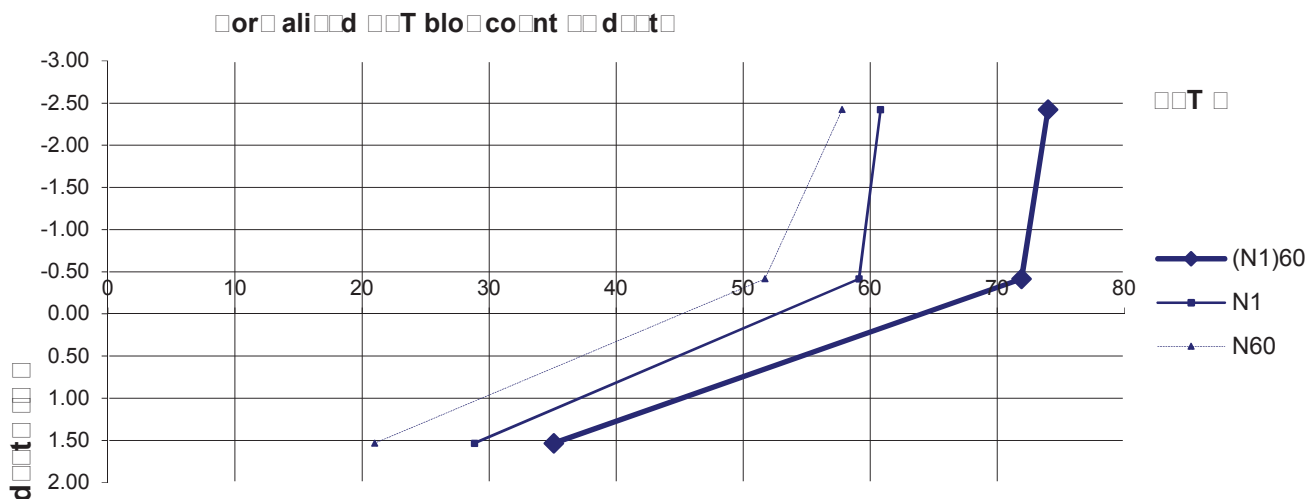


BH size\* Applying correction proposed by Skempton (1986)

## Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:	Delimara Power Station New CCPP	Bore Hole No.	5	Top of BH above LAT	2.76 m
Borehole diameter	mm	Soil type	Normally Consolidated (Id 40-60)		
Hammer type	Automatic Trip type UK model	Position of water table (relative to LAT)	0.3 m		
Weight of hammer	63.50 Kg	unit weight of formation	16 KN/m <sup>2</sup>		
Weight of hammer & anvil	105.00 Kg	Overburden $p_o$	0 KN/m <sup>2</sup>		
Length of rods: anvil to ground	1.15 m	$N_{60}$	SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)		
weight of rods/m	6.40 Kg		SPT N value corrected for both vertical effective stress and input energy		
Sampler type			SPT N value corrected to 100kPa overburden pressure (normalised)		
Energy Ratio of system	73 %	$N_1$	$N = N_{150-300} + N_{300-450}$		

Borehole progress				SPT blowcount				Correction factors				Corrected SPT		
From	to	depth	av positio	1st	2nd	3rd		Rods	BH size*	Overb urden	Energy	$N_1$	$N_{60}$	$(N_1)_{60}$
m	m	m	m	$N_{1-150}$	$N_{150-300}$	$N_{300-450}$	$N$	$\lambda$	$C_d$	$C_N$	$ER_r/60$			
1.76	1.31	-0.45	1.53	17	10	13	23	0.75	1	1.67	1.22	28.84	20.99	35.09
-0.24	-0.27	-0.03	-0.42	50			50	0.85	1	1.39	1.22	59.11	51.71	71.92
-2.24	-2.27	-0.03	-2.42	50			50	0.95	1	1.28	1.22	60.82	57.79	74.00

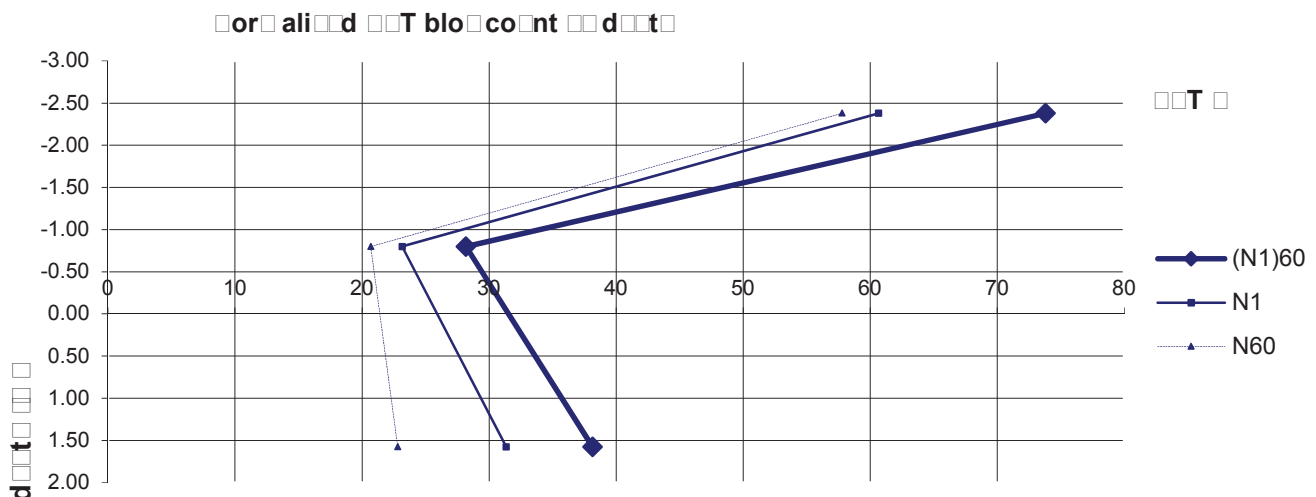


BH size\* Applying correction proposed by Skempton (1986)

## Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:	Delimara Power Station New CCPP		Bore Hole No.	6	Top of BH above LAT	2.801 m
Borehole diameter	mm		Soil type	Normally Consolidated (Id 40-60) ▼		
Hammer type	Automatic Trip type UK model		Position of water table (relative to LAT)		0.3 m	
Weight of hammer	63.50 Kg		unit weight of formation		16 KN/m <sup>2</sup>	
Weight of hammer & anvil	105.00 Kg		Overburden p <sub>o</sub>		0 KN/m <sup>2</sup>	
Length of rods: anvil to ground	1.15 m		N <sub>60</sub>	SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)		
weight of rods/m	6.40 Kg			SPT N value corrected for both vertical effective stress and input energy		
Sampler type				SPT N value corrected to 100kPa overburden pressure (normalised)		
Energy Ratio of system	73 %		N	= N <sub>150-300</sub> +N <sub>300-450</sub>		

Borehole progress				SPT blowcount				Correction factors				Corrected SPT		
From	to	depth	av positio	1st	2nd	3rd		Rods	BH size*	Overb urden	Energy	$N_1$	$N_{60}$	$(N_1)_{60}$
m	m	m	m	$N_{1-150}$	$N_{150-300}$	$N_{300-450}$	$N$	$\lambda$	$C_d$	$C_N$	$ER_r/60$			
1.80	1.35	-0.45	1.58	9	12	13	25	0.75	1	1.67	1.22	31.35	22.81	38.15
-0.20	-0.65	-0.45	-0.8	7	9	11	20	0.85	1	1.36	1.22	23.16	20.68	28.18
-2.20	-2.23	-0.03	-2.38	50			50	0.95	1	1.28	1.22	60.66	57.79	73.81

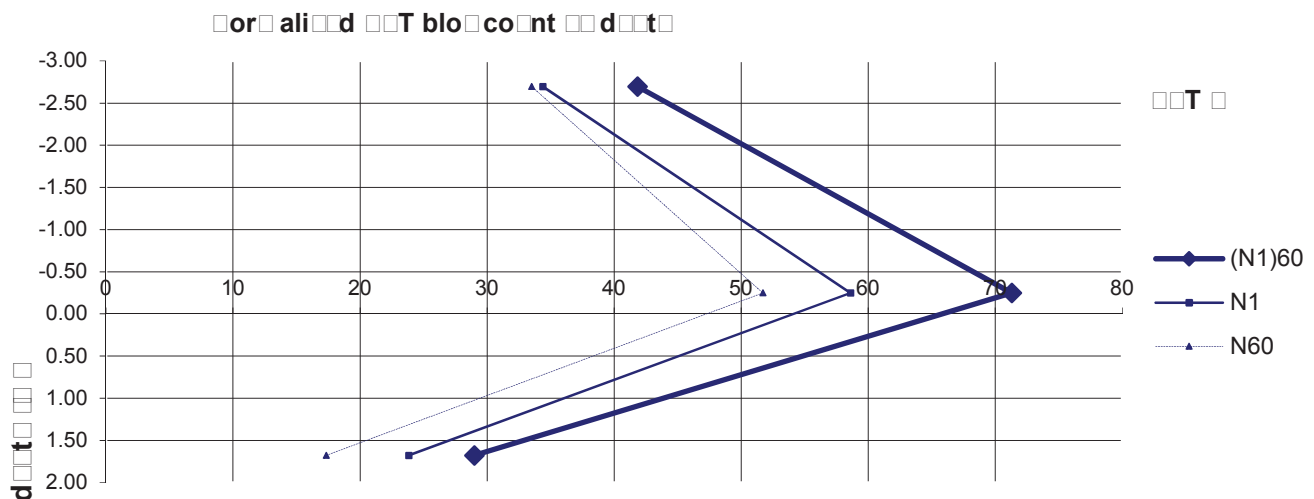


BH size\* Applying correction proposed by Skempton (1986)

## Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:	Delimara Power Station New CCPP	Bore Hole No.	7	Top of BH above LAT	2.903 m
Borehole diameter	mm	Soil type	Normally Consolidated (Id 40-60)		
Hammer type	Automatic Trip type UK model	Position of water table (relative to LAT)	0.3 m		
Weight of hammer	63.50 Kg	unit weight of formation	16 KN/m <sup>2</sup>		
Weight of hammer & anvil	105.00 Kg	Overburden $p_o$	0 KN/m <sup>2</sup>		
Length of rods: anvil to ground	1.15 m	$N_{60}$	SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)		
weight of rods/m	6.40 Kg		SPT N value corrected for both vertical effective stress and input energy		
Sampler type			SPT N value corrected to 100kPa overburden pressure (normalised)		
Energy Ratio of system	73 %	$N$	$= N_{150-300} + N_{300-450}$		

Borehole progress				SPT blowcount				Correction factors				Corrected SPT		
From	to	depth	av positio	1st	2nd	3rd		Rods	BH size*	Overb	Energy	$N_1$	$N_{60}$	$(N_1)_{60}$
m	m	m	m	$N_{1-150}$	$N_{150-300}$	$N_{300-450}$	$N$	$\lambda$	$C_d$	$C_N$	$ER_r/60$			
1.90	1.45	-0.45	1.68	10	8	11	19	0.75	1	1.67	1.22	23.83	17.34	28.99
<u>-0.10</u>	<u>-0.10</u>	<u>0</u>	<u>-0.25</u>	<u>9</u>	<u>50</u>		<u>50</u>	<u>0.85</u>	<u>1</u>	<u>1.38</u>	<u>1.22</u>	<u>58.61</u>	<u>51.71</u>	<u>71.31</u>
-2.10	-2.55	-0.45	-2.7	9	13	16	29	0.95	1	1.25	1.22	34.39	33.52	41.85



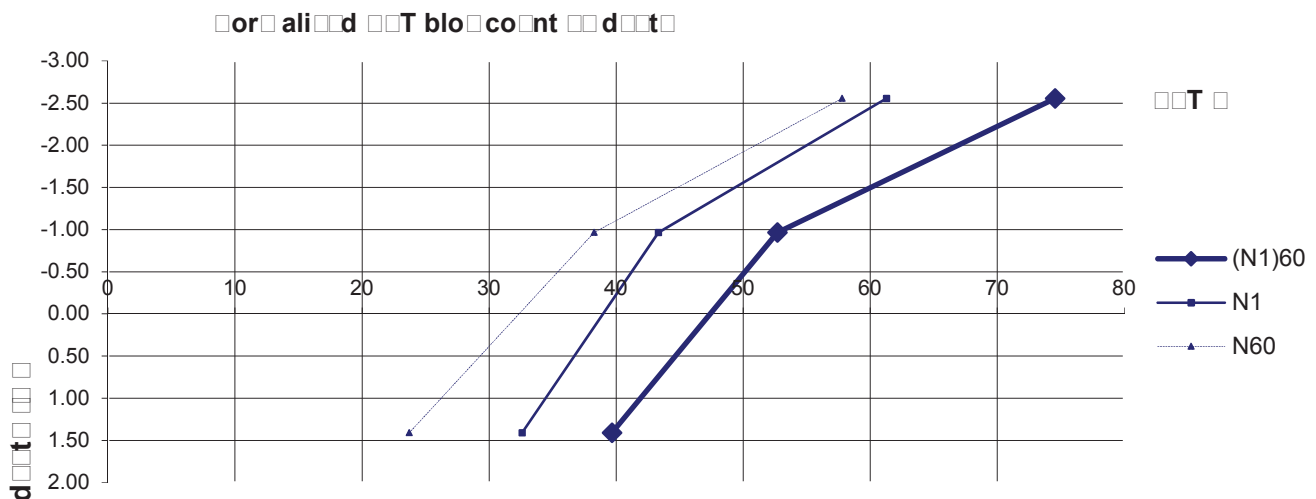
BH size\* Applying correction proposed by Skempton (1986)



## Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:	Delimara Power Station New CCPP	Bore Hole No.	8	Top of BH above LAT	2.6344 m
Borehole diameter	mm	Soil type	Normally Consolidated (Id 40-60)		
Hammer type	Automatic Trip type UK model	Position of water table (relative to LAT)	0.3 m		
Weight of hammer	63.50 Kg	unit weight of formation	16 KN/m <sup>2</sup>		
Weight of hammer & anvil	105.00 Kg	Overburden $p_o$	0 KN/m <sup>2</sup>		
Length of rods: anvil to ground	1.15 m	$N_{60}$	SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)		
weight of rods/m	6.40 Kg		SPT N value corrected for both vertical effective stress and input energy		
Sampler type			SPT N value corrected to 100kPa overburden pressure (normalised)		
Energy Ratio of system	73 %	$N_1$	$N = N_{150-300} + N_{300-450}$		

Borehole progress				SPT blowcount				Correction factors				Corrected SPT		
From	to	depth	av positio	1st	2nd	3rd		Rods	BH size*	Overb urden	Energy	$N_1$	$N_{60}$	$(N_1)_{60}$
m	m	m	m	$N_{1-150}$	$N_{150-300}$	$N_{300-450}$	$N$	$\lambda$	$C_d$	$C_N$	$ER_r/60$			
1.63	1.18	-0.45	1.41	8	12	14	26	0.75	1	1.67	1.22	32.61	23.73	39.67
-0.37	-0.82	-0.45	-0.97	14	18	19	37	0.85	1	1.38	1.22	43.32	38.26	52.71
-2.37	-2.41	-0.04	-2.56	50			50	0.95	1	1.29	1.22	61.28	57.79	74.56

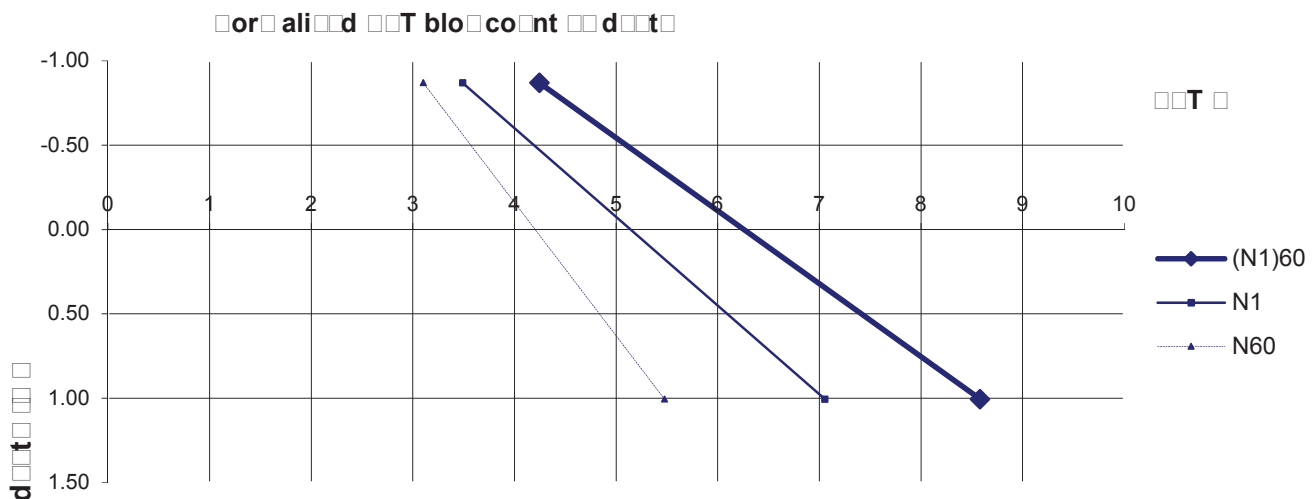


BH size\* Applying correction proposed by Skempton (1986)

## Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:	Delimara Power Station New CCPP		Bore Hole No.	9	Top of BH above LAT	2.73 m
Borehole diameter	mm		Soil type	Normally Consolidated (Id 40-60) ▼		
Hammer type	Automatic Trip type UK model		Position of water table (relative to LAT)		0.3 m	
Weight of hammer	63.50 Kg		unit weight of formation		16 KN/m <sup>2</sup>	
Weight of hammer & anvil	105.00 Kg		Overburden p <sub>o</sub>		0 KN/m <sup>2</sup>	
Length of rods: anvil to ground	1.15 m		SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)			
weight of rods/m	6.40 Kg					
Sampler type			N <sub>60</sub>	SPT N value corrected for both vertical effective stress and input energy		
			(N <sub>1</sub> ) <sub>60</sub>	SPT N value corrected to 100kPa overburden pressure (normalised)		
			N <sub>1</sub>	= N <sub>150-300</sub> +N <sub>300-450</sub>		
Energy Ratio of system	73 %		N			

Borehole progress				SPT blowcount				Correction factors				Corrected SPT		
From	to	depth	av positio	1st	2nd	3rd		Rods	BH size*	Overb urden	Energy	$N_1$	$N_{60}$	$(N_1)_{60}$
m	m	m	m	$N_{1-150}$	$N_{150-300}$	$N_{300-450}$	$N$	$\lambda$	$C_d$	$C_N$	$ER_r/60$			
1.23	0.78	-0.45	1.01	3	3	3	6	0.75	1	1.57	1.22	7.05	5.48	8.58
-0.27	-0.72	-0.45	-0.87	1	1	2	3	0.85	1	1.37	1.22	3.49	3.10	4.25

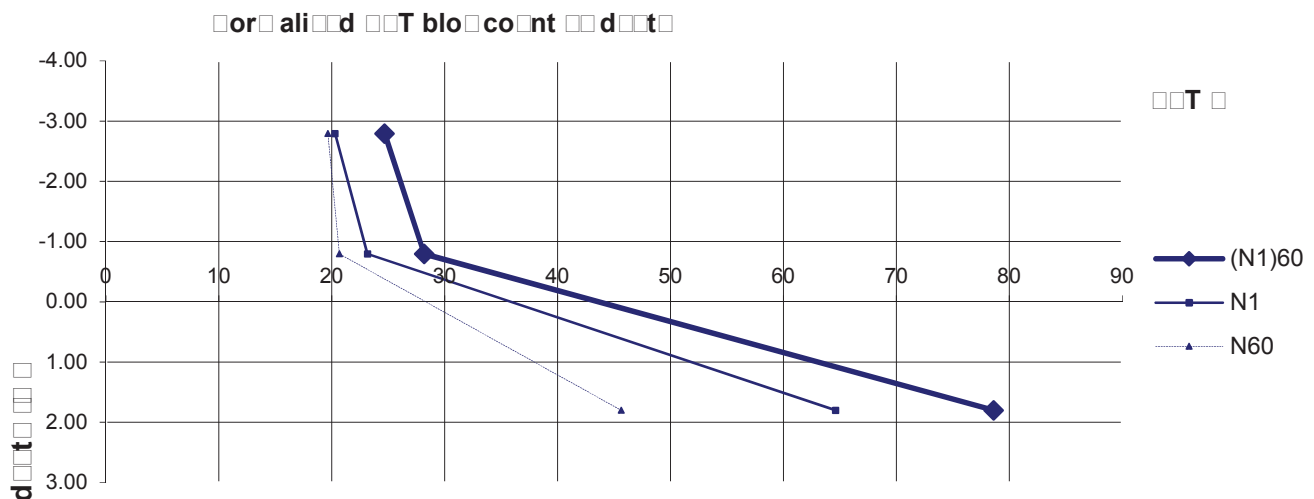


BH size\* Applying correction proposed by Skempton (1986)

## Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:	Delimara Power Station New CCPP	Bore Hole No.	10	Top of BH above LAT	2.805 m
Borehole diameter	mm	Soil type	Normally Consolidated (Id 40-60)		
Hammer type	Automatic Trip type UK model	Position of water table (relative to LAT)	0.3 m		
Weight of hammer	63.50 Kg	unit weight of formation	16 KN/m <sup>2</sup>		
Weight of hammer & anvil	105.00 Kg	Overburden $p_o$	0 KN/m <sup>2</sup>		
Length of rods: anvil to ground	1.15 m	SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)	$N_{60}$		
weight of rods/m	6.40 Kg	SPT N value corrected for both vertical effective stress and input energy	$(N_1)_{60}$		
Sampler type		SPT N value corrected to 100kPa overburden pressure (normalised)	$N_1$		
Energy Ratio of system	73 %	$N = N_{150-300} + N_{300-450}$	$N$		

Borehole progress				SPT blowcount				Correction factors				Corrected SPT		
From	to	depth	av positio	1st	2nd	3rd		Rods	BH size*	Overb urden	Energy	$N_1$	$N_{60}$	$(N_1)_{60}$
m	m	m	m	$N_{1-150}$	$N_{150-300}$	$N_{300-450}$	$N$	$\lambda$	$C_d$	$C_N$	$ER_r/60$			
1.81	1.80	-0.01	1.80	50			50	0.75	1	1.72	1.22	64.61	45.63	78.61
-0.20	-0.65	-0.45	-0.8	8	10	10	20	0.85	1	1.36	1.22	23.15	20.68	28.17
-2.20	-2.65	-0.45	-2.8	5	8	9	17	0.95	1	1.26	1.22	20.28	19.65	24.68

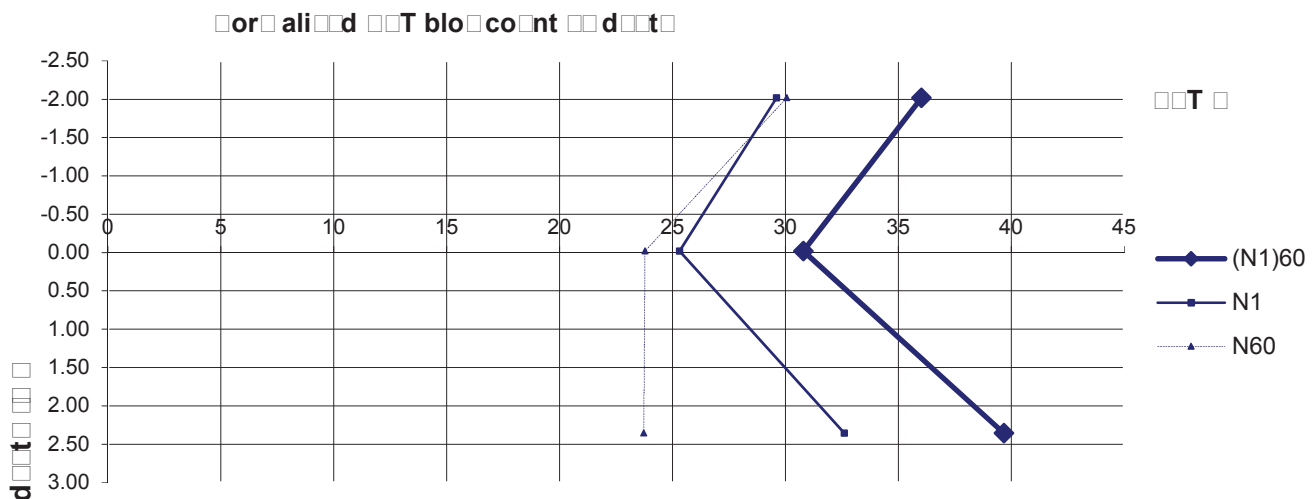


BH size\* Applying correction proposed by Skempton (1986)

## Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:	Delimara Power Station New CCPP	Bore Hole No.	11	Top of BH above LAT	3.582 m
Borehole diameter	mm	Soil type	Normally Consolidated (Id 40-60)		
Hammer type	Automatic Trip type UK model	Position of water table (relative to LAT)	0.3 m		
Weight of hammer	63.50 Kg	unit weight of formation	16 KN/m <sup>2</sup>		
Weight of hammer & anvil	105.00 Kg	Overburden $p_o$	0 KN/m <sup>2</sup>		
Length of rods: anvil to ground	1.15 m	$N_{60}$	SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)		
weight of rods/m	6.40 Kg		SPT N value corrected for both vertical effective stress and input energy		
Sampler type			SPT N value corrected to 100kPa overburden pressure (normalised)		
Energy Ratio of system	73 %	$N_1$	$N = N_{150-300} + N_{300-450}$		

Borehole progress				SPT blowcount				Correction factors				Corrected SPT		
From	to	depth	av positio	1st	2nd	3rd		Rods	BH size*	Overb urden	Energy	$N_1$	$N_{60}$	$(N_1)_{60}$
m	m	m	m	$N_{1-150}$	$N_{150-300}$	$N_{300-450}$	$N$	$\lambda$	$C_d$	$C_N$	$ER_r/60$			
2.58	2.13	-0.45	2.36	10	12	14	26	0.75	1	1.67	1.22	32.61	23.73	39.67
0.58	0.13	-0.45	-0.02	11	10	13	23	0.85	1	1.29	1.22	25.31	23.79	30.79
-1.42	-1.87	-0.45	-2.02	9	12	14	26	0.95	1	1.20	1.22	29.61	30.05	36.02



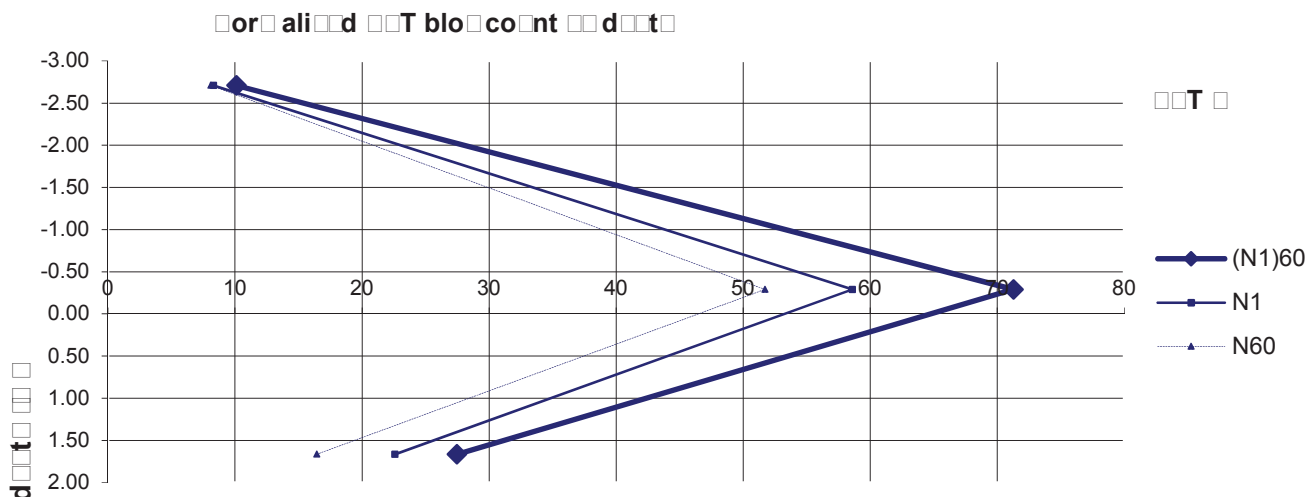
BH size\* Applying correction proposed by Skempton (1986)



## Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:	Delimara Power Station New CCPP	Bore Hole No.	12	Top of BH above LAT	2.89 m
Borehole diameter	mm	Soil type	Normally Consolidated (Id 40-60)		
Hammer type	Automatic Trip type UK model	Position of water table (relative to LAT)	0.3 m		
Weight of hammer	63.50 Kg	unit weight of formation	16 KN/m <sup>2</sup>		
Weight of hammer & anvil	105.00 Kg	Overburden $p_o$	0 KN/m <sup>2</sup>		
Length of rods: anvil to ground	1.15 m	$N_{60}$	SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)		
weight of rods/m	6.40 Kg		SPT N value corrected for both vertical effective stress and input energy		
Sampler type			SPT N value corrected to 100kPa overburden pressure (normalised)		
Energy Ratio of system	73 %	$N_1$	$N = N_{150-300} + N_{300-450}$		

Borehole progress				SPT blowcount				Correction factors				Corrected SPT		
From	to	depth	av positio	1st	2nd	3rd		Rods	BH size*	Overburden	Energy	$N_1$	$N_{60}$	$(N_1)_{60}$
m	m	m	m	$N_{1-150}$	$N_{150-300}$	$N_{300-450}$	$N$	$\lambda$	$C_d$	$C_N$	$ER_r/60$			
1.89	1.44	-0.45	1.67	9	10	8	18	0.75	1	1.67	1.22	22.58	16.43	27.47
-0.11	-0.14	-0.03	-0.29	50			50	0.85	1	1.38	1.22	58.58	51.71	71.28
-2.11	-2.56	-0.45	-2.71	4	5	2	7	0.95	1	1.25	1.22	8.31	8.09	10.11

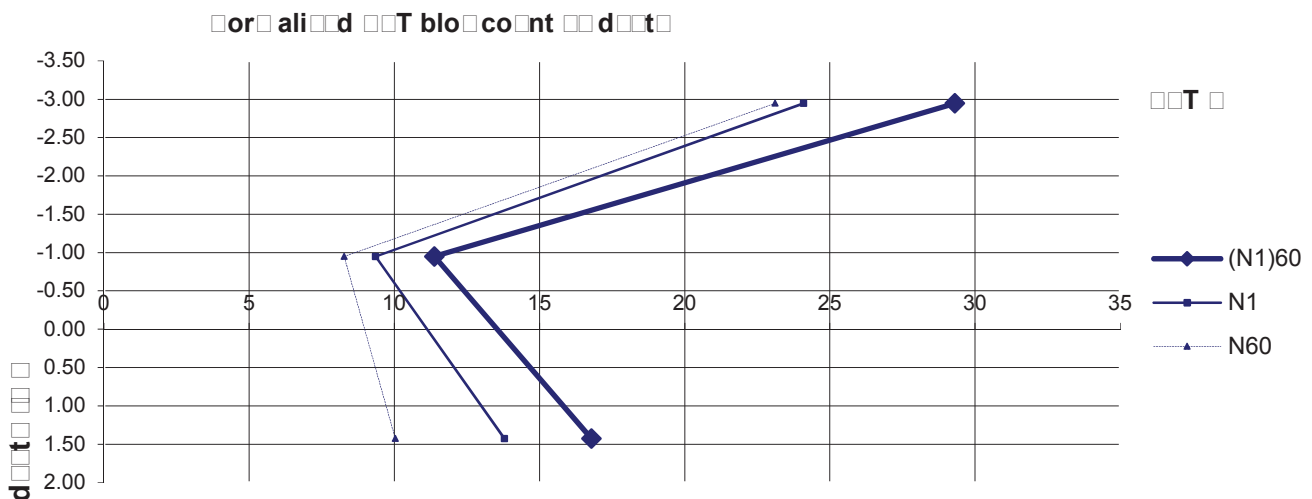


BH size\* Applying correction proposed by Skempton (1986)

## Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:	Delimara Power Station New CCPP	Bore Hole No.	13	Top of BH above LAT	2.653 m
Borehole diameter	mm	Soil type	Normally Consolidated (Id 40-60)		
Hammer type	Automatic Trip type UK model	Position of water table (relative to LAT)	0.3 m		
Weight of hammer	63.50 Kg	unit weight of formation	16 KN/m <sup>2</sup>		
Weight of hammer & anvil	105.00 Kg	Overburden $p_o$	0 KN/m <sup>2</sup>		
Length of rods: anvil to ground	1.15 m	$N_{60}$	SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)		
weight of rods/m	6.40 Kg		SPT N value corrected for both vertical effective stress and input energy		
Sampler type			SPT N value corrected to 100kPa overburden pressure (normalised)		
Energy Ratio of system	73 %	$N_1$	$N = N_{150-300} + N_{300-450}$		

Borehole progress				SPT blowcount				Correction factors				Corrected SPT		
From	to	depth	av positio	1st	2nd	3rd		Rods	BH size*	Overb urden	Energy	$N_1$	$N_{60}$	$(N_1)_{60}$
m	m	m	m	$N_{1-150}$	$N_{150-300}$	$N_{300-450}$	$N$	$\lambda$	$C_d$	$C_N$	$ER_r/60$			
1.65	1.20	-0.45	1.43	4	2	9	11	0.75	1	1.67	1.22	13.80	10.04	16.79
-0.35	-0.80	-0.45	-0.95	2	3	5	8	0.85	1	1.38	1.22	9.36	8.27	11.38
-2.35	-2.80	-0.45	-2.95	7	9	11	20	0.95	1	1.27	1.22	24.09	23.12	29.31

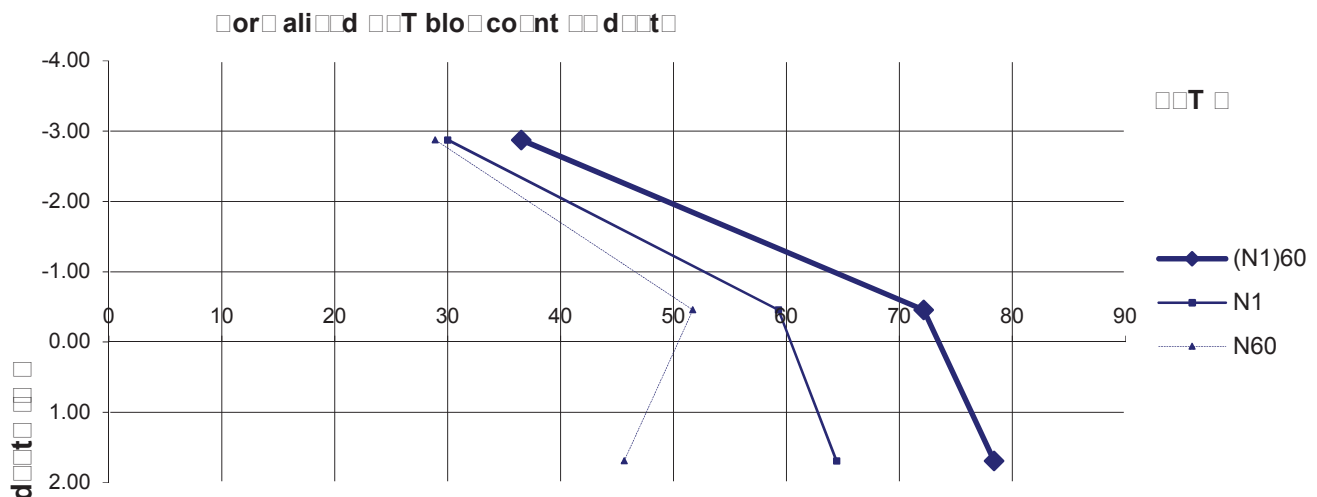


BH size\* Applying correction proposed by Skempton (1986)

## Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:	Delimara Power Station New CCPP	Bore Hole No.	18	Top of BH above LAT	2.716 m
Borehole diameter	mm	Soil type	Normally Consolidated (Id 40-60)		
Hammer type	Automatic Trip type UK model	Position of water table (relative to LAT)	0.3 m		
Weight of hammer	63.50 Kg	unit weight of formation	16 KN/m <sup>2</sup>		
Weight of hammer & anvil	105.00 Kg	Overburden $p_o$	0 KN/m <sup>2</sup>		
Length of rods: anvil to ground	1.15 m	$N_{60}$	SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)		
weight of rods/m	6.40 Kg		SPT N value corrected for both vertical effective stress and input energy		
Sampler type			SPT N value corrected to 100kPa overburden pressure (normalised)		
Energy Ratio of system	73 %	$N_1$	$N = N_{150-300} + N_{300-450}$		

Borehole progress				SPT blowcount				Correction factors				Corrected SPT		
From	to	depth	av positio	1st	2nd	3rd		Rods	BH size*	Overb urden	Energy	$N_1$	$N_{60}$	$(N_1)_{60}$
m	m	m	m	$N_{1-150}$	$N_{150-300}$	$N_{300-450}$	$N$	$\lambda$	$C_d$	$C_N$	$ER_r/60$			
1.72	1.67	-0.05	1.69	14	50		50	0.75	1	1.72	1.22	64.43	45.63	78.39
-0.28	-0.31	-0.03	-0.46	34	50		50	0.85	1	1.40	1.22	59.30	51.71	72.15
-2.28	-2.73	-0.45	-2.88	9	13	12	25	0.95	1	1.26	1.22	30.00	28.90	36.50

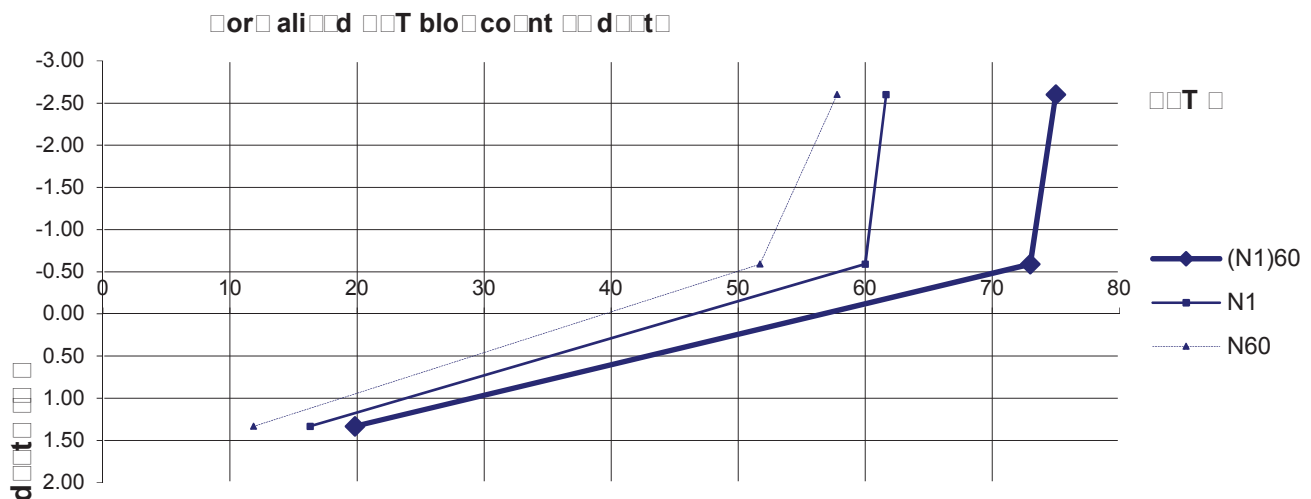


BH size\* Applying correction proposed by Skempton (1986)

## Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:	Delimara Power Station New CCPP	Bore Hole No.	21	Top of BH above LAT	2.559 m
Borehole diameter	mm	Soil type	Normally Consolidated (Id 40-60) ▼		
Hammer type	Automatic Trip type UK model	Position of water table (relative to LAT)	0.3 m		
Weight of hammer	63.50 Kg	unit weight of formation	16 KN/m <sup>2</sup>		
Weight of hammer & anvil	105.00 Kg	Overburden $p_o$	0 KN/m <sup>2</sup>		
Length of rods: anvil to ground	1.15 m	$N_{60}$	SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)		
weight of rods/m	6.40 Kg		SPT N value corrected for both vertical effective stress and input energy		
Sampler type			SPT N value corrected to 100kPa overburden pressure (normalised)		
Energy Ratio of system	73 %	$N$	$= N_{150-300} + N_{300-450}$		

Borehole progress				SPT blowcount				Correction factors				Corrected SPT		
From	to	depth	av positio	1st	2nd	3rd		Rods	BH size*	Overb	Energy	$N_1$	$N_{60}$	$(N_1)_{60}$
m	m	m	m	$N_{1-150}$	$N_{150-300}$	$N_{300-450}$	$N$	$\lambda$	$C_d$	$C_N$	$ER_r/60$			
1.56	1.11	-0.45	1.33	7	6	7	13	0.75	1	1.67	1.22	16.30	11.86	19.84
-0.44	-0.44	0	-0.59	14	50		50	0.85	1	1.41	1.22	60.00	51.71	73.00
-2.44	-2.45	-0.01	-2.6	50			50	0.95	1	1.30	1.22	61.65	57.79	75.00



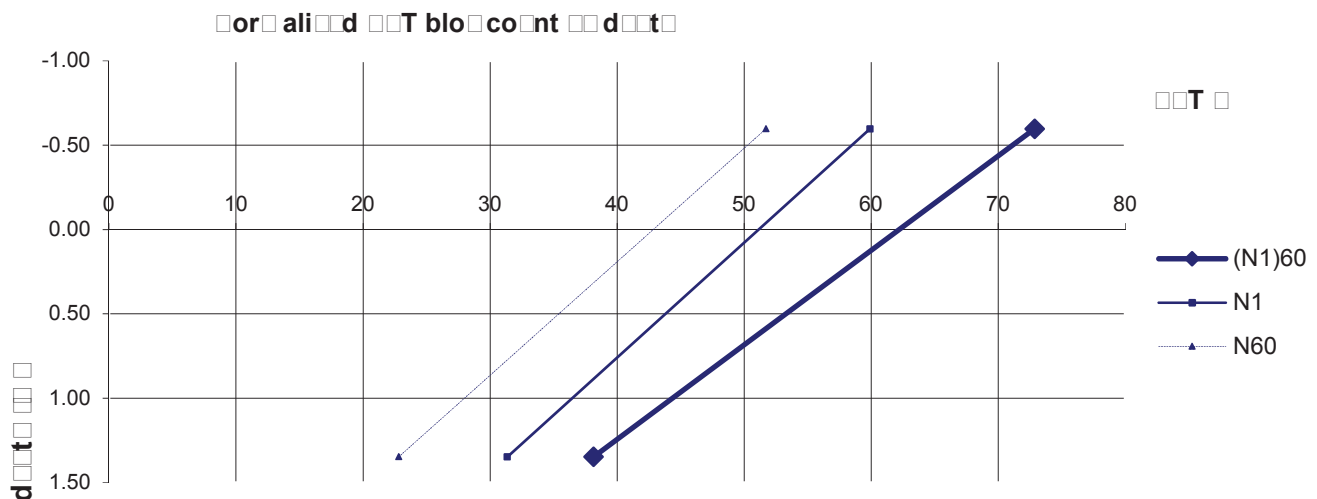
BH size\* Applying correction proposed by Skempton (1986)



## Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:	Delimara Power Station New CCPP		Bore Hole No.	22	Top of BH above LAT	2.573 m
Borehole diameter	mm		Soil type	Normally Consolidated (Id 40-60) ▼		
Hammer type	Automatic Trip type UK model		Position of water table (relative to LAT)		0.3 m	
Weight of hammer	63.50 Kg		unit weight of formation		16 KN/m <sup>2</sup>	
Weight of hammer & anvil	105.00 Kg		Overburden p <sub>o</sub>		0 KN/m <sup>2</sup>	
Length of rods: anvil to ground	1.15 m		N <sub>60</sub>	SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)		
weight of rods/m	6.40 Kg			SPT N value corrected for both vertical effective stress and input energy		
Sampler type				SPT N value corrected to 100kPa overburden pressure (normalised)		
Energy Ratio of system	73 %		N	= N <sub>150-300</sub> +N <sub>300-450</sub>		

Borehole progress				SPT blowcount				Correction factors				Corrected SPT		
From	to	depth	av position	1st	2nd	3rd		Rods	BH size*	Overburden	Energy	$N_1$	$N_{60}$	$(N_1)_{60}$
m	m	m	m	$N_{1-150}$	$N_{150-300}$	$N_{300-450}$	$N$	$\lambda$	$C_d$	$C_N$	$ER_r/60$			
1.57	1.12	-0.45	1.35	7	11	14	25	0.75	1	1.67	1.22	31.35	22.81	38.15
-0.43	-0.45	-0.02	-0.6	50			50	0.85	1	1.41	1.22	59.89	51.71	72.87

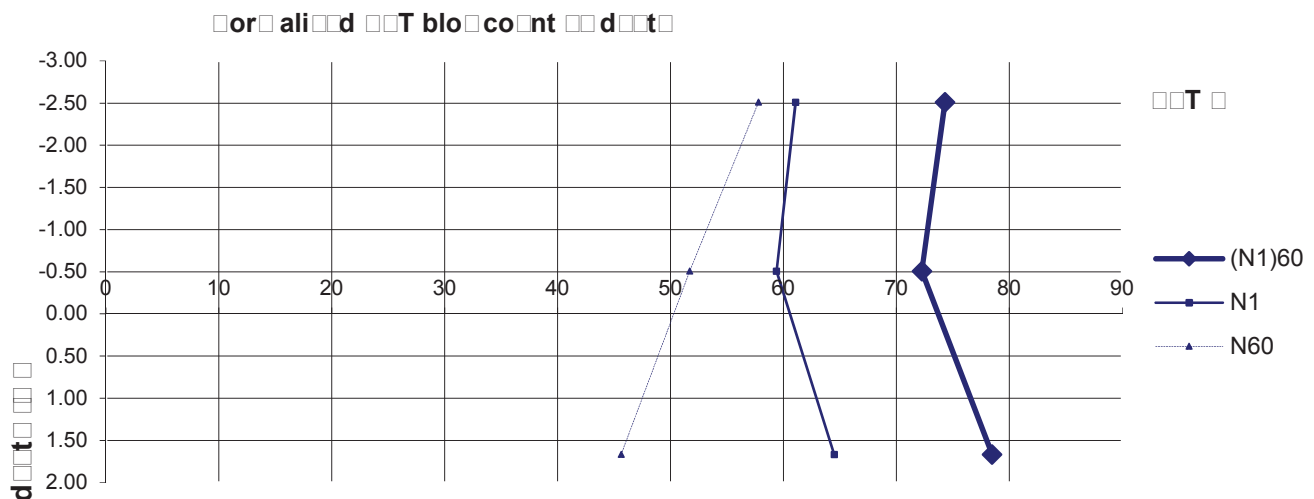


BH size\* Applying correction proposed by Skempton (1986)

## Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:	Delimara Power Station New CCPP	Bore Hole No.	23B	Top of BH above LAT	2.684 m
Borehole diameter	mm	Soil type	Normally Consolidated (Id 40-60) ▼		
Hammer type	Automatic Trip type UK model	Position of water table (relative to LAT)	0.3 m		
Weight of hammer	63.50 Kg	unit weight of formation	16 KN/m <sup>2</sup>		
Weight of hammer & anvil	105.00 Kg	Overburden $p_o$	0 KN/m <sup>2</sup>		
Length of rods: anvil to ground	1.15 m	$N_{60}$	SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)		
weight of rods/m	6.40 Kg		SPT N value corrected for both vertical effective stress and input energy		
Sampler type			SPT N value corrected to 100kPa overburden pressure (normalised)		
Energy Ratio of system	73 %	$N_1$	$N = N_{150-300} + N_{300-450}$		

Borehole progress				SPT blowcount			Correction factors				Corrected SPT		
From	to	depth	av positio	1st	2nd	3rd	Rods	BH size*	Overb urden	Energy	$N_1$	$N_{60}$	$(N_1)_{60}$
m	m	m	m	$N_{1-150}$	$N_{150-300}$	$N_{300-450}$	$\lambda$	$C_d$	$C_N$	$ER_r/60$			
1.68	1.65	-0.03	1.67	10	50		0.75	1	1.72	1.22	64.50	45.63	78.47
-0.32	-0.36	-0.04	-0.51	50			0.85	1	1.40	1.22	59.39	51.71	72.25
-2.32	-2.36	-0.04	-2.51	50			0.95	1	1.29	1.22	61.08	57.79	74.31



BH size\* Applying correction proposed by Skempton (1986)

Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:

Delimara Power Station New CCPP

Bore Hole No.

24A

Top of BH above LAT

2.764 m

Borehole diameter

mm

Soil type

Normally Consolidated (Id 40-60)

Hammer type

Automatic Trip type UK model

Position of water table (relative to LAT)

0.3 m

Weight of hammer

63.50 Kg

Weight of hammer & anvil

105.00 Kg

unit weight of formation

16 KN/m<sup>2</sup>

Length of rods: anvil to ground

1.15 m

Overburden p<sub>o</sub>

0 KN/m<sup>2</sup>

weight of rods/m

6.40 Kg

N<sub>60</sub>

SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)

(N<sub>1</sub>)<sub>60</sub>

SPT N value corrected for both vertical effective stress and input energy

N<sub>1</sub>

SPT N value corrected to 100kPa overburden pressure (normalised)

N

= N<sub>150-300</sub> + N<sub>300-450</sub>

Energy Ratio of system

73 %

Borehole progress				SPT blowcount				Correction factors				Corrected SPT		
From	to	depth	av positio	1st	2nd	3rd		Rods	BH size*	Overb urden	Energy	N <sub>1</sub>	N <sub>60</sub>	(N <sub>1</sub> ) <sub>60</sub>
m	m	m	m	N <sub>1-150</sub>	N <sub>150-300</sub>	N <sub>300-450</sub>	N	λ	C <sub>d</sub>	C <sub>N</sub>	ER <sub>r</sub> /60			
1.76	1.31	-0.45	1.54	15	12	14	26	0.75	1	1.67	1.22	32.61	23.73	39.67

Graph showing SPT blowcount (N) and corrected values (N<sub>1</sub>, N<sub>60</sub>, (N<sub>1</sub>)<sub>60</sub>) plotted against depth (m). The x-axis represents blowcount from 0 to 45, and the y-axis represents depth from 0.00 to 1.80 m. Data points are plotted for N (blue squares), N<sub>1</sub> (blue circles), N<sub>60</sub> (blue triangles), and (N<sub>1</sub>)<sub>60</sub> (blue diamonds).

Depth (m)	N	N <sub>1</sub>	N <sub>60</sub>	(N <sub>1</sub> ) <sub>60</sub>
1.76	26	32.61	23.73	39.67

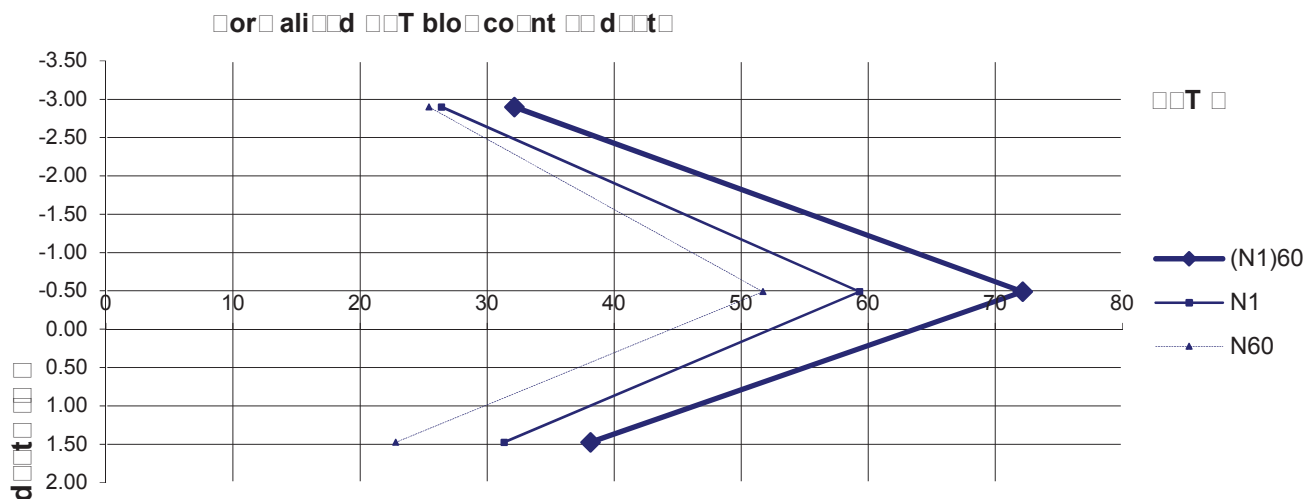
BH size\* Applying correction proposed by Skempton (1986)

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## Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:	Delimara Power Station New CCPP		Bore Hole No.	27A	Top of BH above LAT	2.701 m
Borehole diameter	mm		Soil type	Normally Consolidated (Id 40-60) ▼		
Hammer type	Automatic Trip type UK model		Position of water table (relative to LAT)			0.3 m
Weight of hammer	63.50 Kg		unit weight of formation			16 KN/m <sup>2</sup>
Weight of hammer & anvil	105.00 Kg		Overburden p <sub>o</sub>			0 KN/m <sup>2</sup>
Length of rods: anvil to ground	1.15 m		N <sub>60</sub>	SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)		
weight of rods/m	6.40 Kg			SPT N value corrected for both vertical effective stress and input energy		
Sampler type				SPT N value corrected to 100kPa overburden pressure (normalised)		
Energy Ratio of system	73 %		N	= N <sub>150-300</sub> +N <sub>300-450</sub>		

Borehole progress				SPT blowcount				Correction factors				Corrected SPT		
From	to	depth	av positio	1st	2nd	3rd		Rods	BH size*	Overb urden	Energy	$N_1$	$N_{60}$	$(N_1)_{60}$
m	m	m	m	$N_{1-150}$	$N_{150-300}$	$N_{300-450}$	$N$	$\lambda$	$C_d$	$C_N$	$ER_r/60$			
1.70	1.25	-0.45	1.48	8	11	14	25	0.75	1	1.67	1.22	31.35	22.81	38.15
-0.30	-0.34	-0.04	-0.49	13	50		50	0.85	1	1.40	1.22	59.32	51.71	72.17
-2.30	-2.75	-0.45	-2.9	6	9	13	22	0.95	1	1.26	1.22	26.42	25.43	32.14



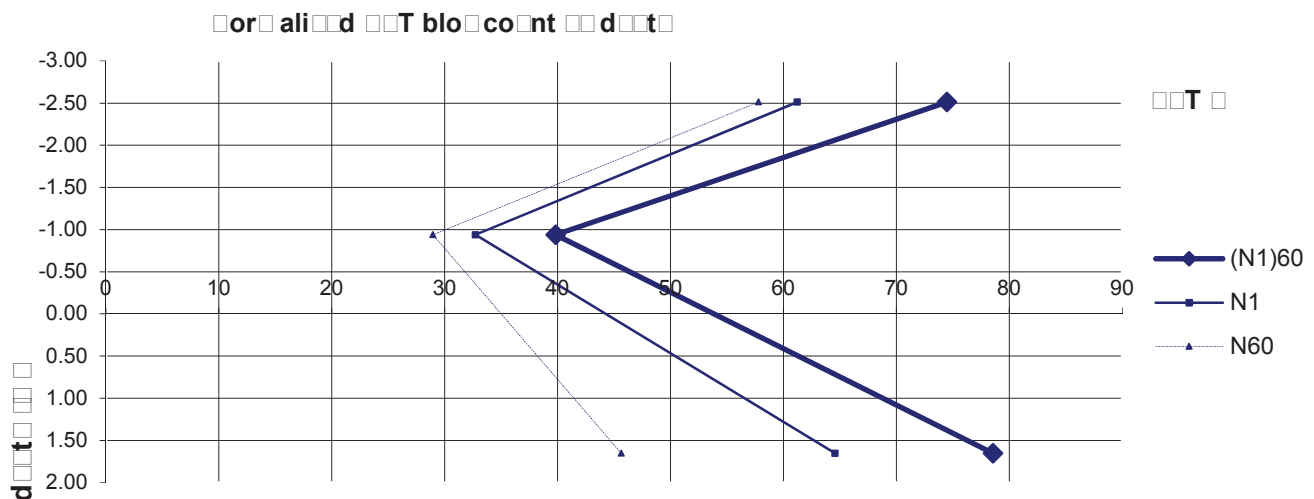
BH size\* Applying correction proposed by Skempton (1986)



## Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:	Delimara Power Station New CCPP	Bore Hole No.	26	Top of BH above LAT	2.663 m
Borehole diameter	mm	Soil type	Normally Consolidated (Id 40-60)		
Hammer type	Automatic Trip type UK model	Position of water table (relative to LAT)	0.3 m		
Weight of hammer	63.50 Kg	unit weight of formation	16 KN/m <sup>2</sup>		
Weight of hammer & anvil	105.00 Kg	Overburden $p_o$	0 KN/m <sup>2</sup>		
Length of rods: anvil to ground	1.15 m	$N_{60}$	SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)		
weight of rods/m	6.40 Kg		SPT N value corrected for both vertical effective stress and input energy		
			SPT N value corrected to 100kPa overburden pressure (normalised)		
Sampler type		$(N_1)_{60}$			
		$N_1$			
Energy Ratio of system	73 %	$N$	$= N_{150-300} + N_{300-450}$		

Borehole progress				SPT blowcount			Correction factors				Corrected SPT		
From	to	depth	av positio	1st	2nd	3rd	Rods	BH size*	Overb	Energy	$N_1$	$N_{60}$	$(N_1)_{60}$
m	m	m	m	$N_{1-150}$	$N_{150-300}$	$N_{300-450}$	$\lambda$	$C_d$	$C_N$	$ER_r/60$			
1.66	1.64	-0.02	1.65	50			0.75	1	1.72	1.22	64.57	45.63	78.56
-0.34	-0.79	-0.45	-0.94	10	13	15	0.85	1	1.37	1.22	32.72	28.96	39.81
-2.34	-2.36	-0.02	-2.51	50			0.95	1	1.29	1.22	61.21	57.79	74.47

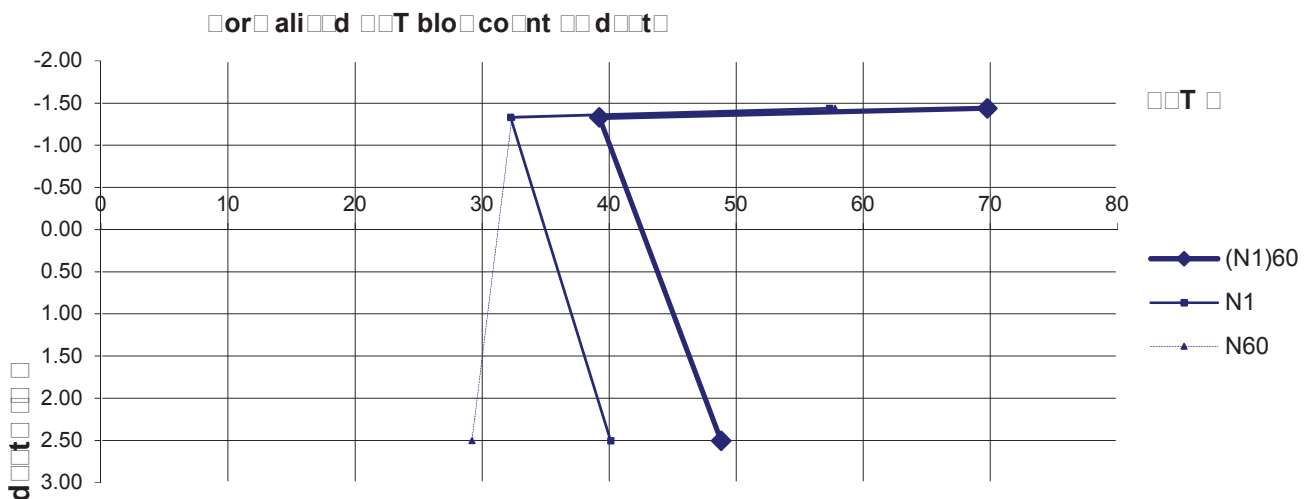


BH size\* Applying correction proposed by Skempton (1986)

## Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:	Delimara Power Station New CCPP		Bore Hole No.	27B	Top of BH above LAT	3.731 m
Borehole diameter	mm		Soil type	Normally Consolidated (Id 40-60) ▼		
Hammer type	Automatic Trip type UK model		Position of water table (relative to LAT)		0.3 m	
Weight of hammer	63.50 Kg		unit weight of formation		16 KN/m <sup>2</sup>	
Weight of hammer & anvil	105.00 Kg		Overburden p <sub>o</sub>		0 KN/m <sup>2</sup>	
Length of rods: anvil to ground	1.15 m		N <sub>60</sub>	SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)		
weight of rods/m	6.40 Kg			SPT N value corrected for both vertical effective stress and input energy		
Sampler type				SPT N value corrected to 100kPa overburden pressure (normalised)		
Energy Ratio of system	73 %		N	= N <sub>150-300</sub> +N <sub>300-450</sub>		

Borehole progress				SPT blowcount				Correction factors				Corrected SPT		
From	to	depth	av positio	1st	2nd	3rd		Rods	BH size*	Overb urden	Energy	$N_1$	$N_{60}$	$(N_1)_{60}$
m	m	m	m	$N_{1-150}$	$N_{150-300}$	$N_{300-450}$	$N$	$\lambda$	$C_d$	$C_N$	$ER_r/60$			
2.73	2.28	-0.45	2.51	12	15	17	32	0.75	1	1.67	1.22	40.13	29.20	48.83
-0.73	-1.18	-0.45	-1.33	14	13	15	28	0.95	1	1.21	1.22	32.24	32.36	39.23
-1.27	-1.29	-0.02	-1.44	50			50	0.95	1	1.21	1.22	57.35	57.79	69.77

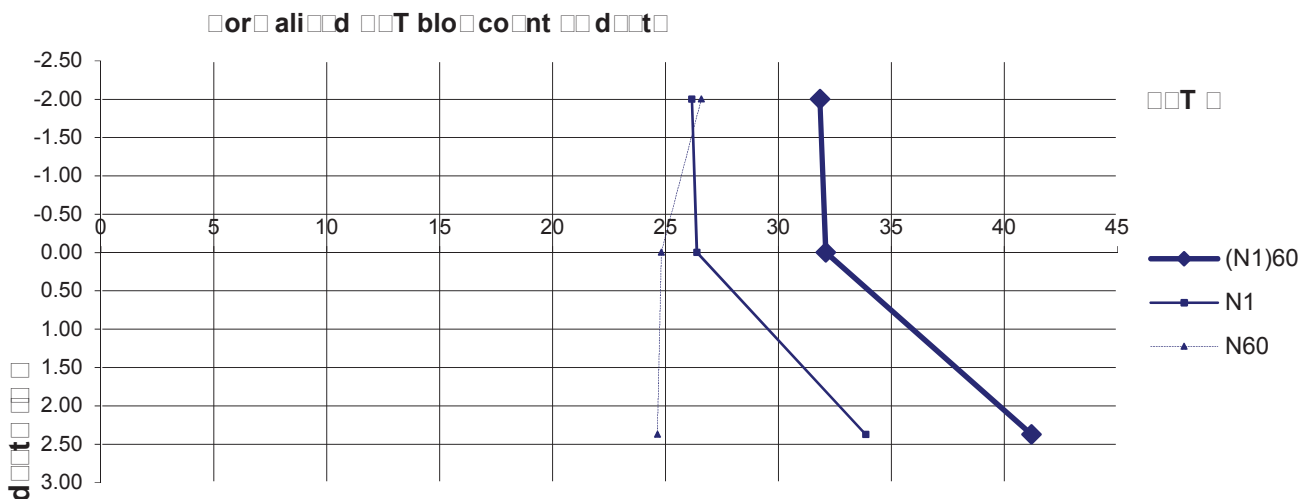


BH size\* Applying correction proposed by Skempton (1986)

## Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:	Delimara Power Station New CCPP		Bore Hole No.	28	Top of BH above LAT	3.598 m
Borehole diameter	mm		Soil type	Normally Consolidated (Id 40-60)		
Hammer type	Automatic Trip type UK model		Position of water table (relative to LAT)		0.3 m	
Weight of hammer	63.50 Kg		unit weight of formation		16 KN/m <sup>2</sup>	
Weight of hammer & anvil	105.00 Kg		Overburden p <sub>o</sub>		0 KN/m <sup>2</sup>	
Length of rods: anvil to ground	1.15 m		N <sub>60</sub>	SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)		
weight of rods/m	6.40 Kg			SPT N value corrected for both vertical effective stress and input energy		
Sampler type				SPT N value corrected to 100kPa overburden pressure (normalised)		
Energy Ratio of system	73 %		N	= N <sub>150-300</sub> +N <sub>300-450</sub>		

Borehole progress				SPT blowcount				Correction factors				Corrected SPT		
From	to	depth	av positio	1st	2nd	3rd		Rods	BH size*	Overb urden	Energy	$N_1$	$N_{60}$	$(N_1)_{60}$
m	m	m	m	$N_{1-150}$	$N_{150-300}$	$N_{300-450}$	N	$\lambda$	$C_d$	$C_N$	$ER_r/60$			
2.60	2.15	-0.45	2.37	13	12	15	27	0.75	1	1.67	1.22	33.86	24.64	41.20
0.60	0.15	-0.45	-0	11	11	13	24	0.85	1	1.29	1.22	26.38	24.82	32.10
-1.40	-1.85	-0.45	-2	8	10	13	23	0.95	1	1.20	1.22	26.16	26.58	31.83

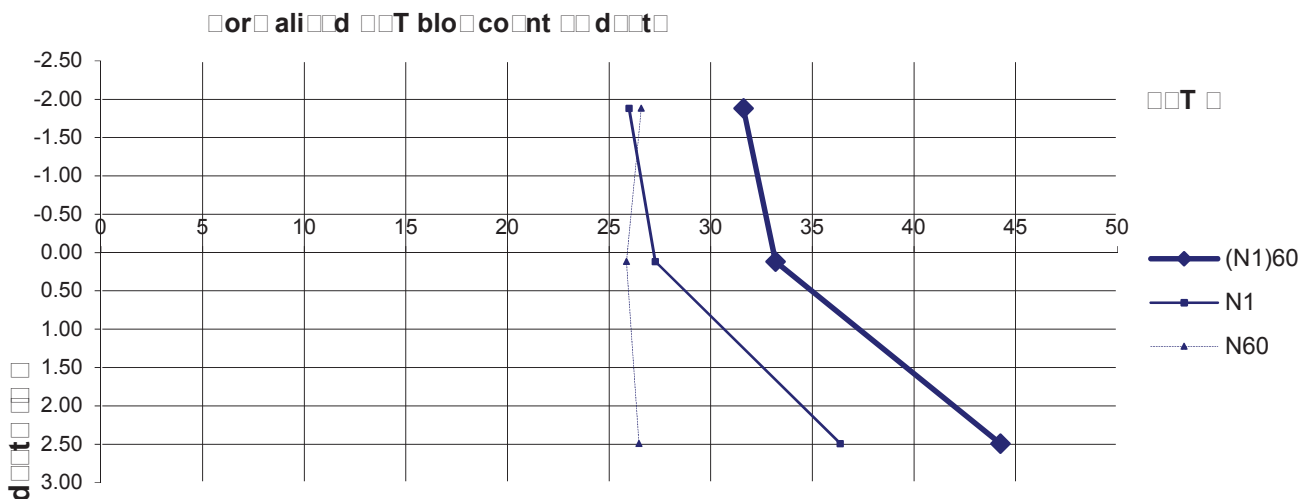


BH size\* Applying correction proposed by Skempton (1986)

## Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:	Delimara Power Station New CCPP		Bore Hole No.	29	Top of BH above LAT	3.718 m
Borehole diameter	mm		Soil type	Normally Consolidated (Id 40-60) ▼		
Hammer type	Automatic Trip type UK model		Position of water table (relative to LAT)		0.3 m	
Weight of hammer	63.50 Kg		unit weight of formation		16 KN/m <sup>2</sup>	
Weight of hammer & anvil	105.00 Kg		Overburden p <sub>o</sub>		0 KN/m <sup>2</sup>	
Length of rods: anvil to ground	1.15 m		SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)			
weight of rods/m	6.40 Kg					
Sampler type			N <sub>60</sub>	SPT N value corrected for both vertical effective stress and input energy		
			(N <sub>1</sub> ) <sub>60</sub>	SPT N value corrected to 100kPa overburden pressure (normalised)		
			N <sub>1</sub>	= N <sub>150-300</sub> +N <sub>300-450</sub>		
Energy Ratio of system	73 %		N			

Borehole progress				SPT blowcount				Correction factors				Corrected SPT		
From	to	depth	av positio	1st	2nd	3rd		Rods	BH size*	Overb urden	Energy	$N_1$	$N_{60}$	$(N_1)_{60}$
m	m	m	m	$N_{1-150}$	$N_{150-300}$	$N_{300-450}$	$N$	$\lambda$	$C_d$	$C_N$	$ER_r/60$			
2.72	2.27	-0.45	2.49	12	13	16	29	0.75	1	1.67	1.22	36.37	26.46	44.25
0.72	0.27	-0.45	0.118	13	11	14	25	0.85	1	1.28	1.22	27.28	25.85	33.19
-1.28	-1.73	-0.45	-1.88	8	10	13	23	0.95	1	1.19	1.22	25.98	26.58	31.61



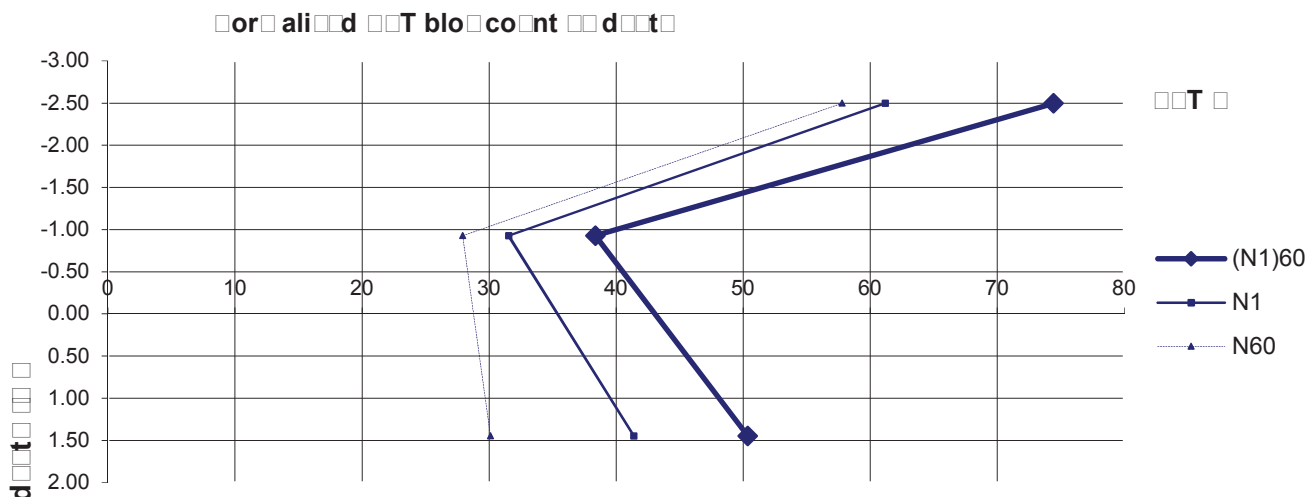
BH size\* Applying correction proposed by Skempton (1986)



## Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:	Delimara Power Station New CCPP	Bore Hole No.	30	Top of BH above LAT	2.672 m
Borehole diameter	mm	Soil type	Normally Consolidated (Id 40-60)		
Hammer type	Automatic Trip type UK model	Position of water table (relative to LAT)	0.3 m		
Weight of hammer	63.50 Kg	unit weight of formation	16 KN/m <sup>2</sup>		
Weight of hammer & anvil	105.00 Kg	Overburden $p_o$	0 KN/m <sup>2</sup>		
Length of rods: anvil to ground	1.15 m	$N_{60}$	SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)		
weight of rods/m	6.40 Kg		SPT N value corrected for both vertical effective stress and input energy		
			SPT N value corrected to 100kPa overburden pressure (normalised)		
Sampler type		$(N_1)_{60}$			
		$N_1$			
Energy Ratio of system	73 %	$N$	$= N_{150-300} + N_{300-450}$		

Borehole progress				SPT blowcount				Correction factors				Corrected SPT		
From	to	depth	av positio	1st	2nd	3rd		Rods	BH size*	Overb	Energy	$N_1$	$N_{60}$	$(N_1)_{60}$
m	m	m	m	$N_{1-150}$	$N_{150-300}$	$N_{300-450}$	$N$	$\lambda$	$C_d$	$C_N$	$ER_r/60$			
1.67	1.22	-0.45	1.45	13	15	18	33	0.75	1	1.67	1.22	41.39	30.11	50.36
-0.33	-0.78	-0.45	-0.93	15	13	14	27	0.85	1	1.37	1.22	31.53	27.92	38.37
-2.33	-2.35	-0.02	-2.5	12	50		50	0.95	1	1.29	1.22	61.18	57.79	74.44



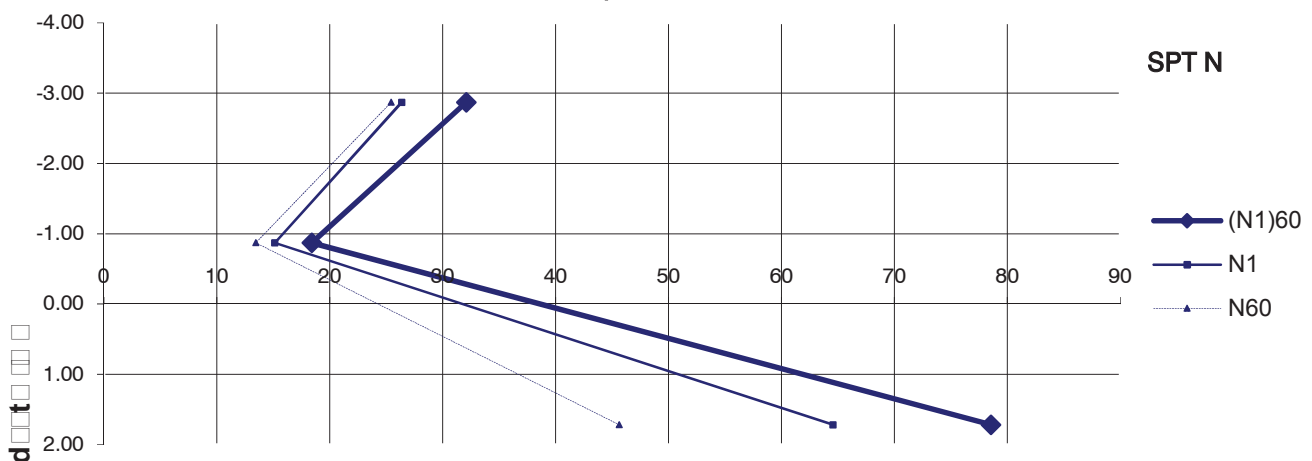
BH size\* Applying correction proposed by Skempton (1986)

## Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:	Delimara Power Station New CCPP	Bore Hole No.	32	Top of BH above LAT	2.729 m
Borehole diameter	mm	Soil type	Normally Consolidated (Id 40-60)		
Hammer type	Automatic Trip type UK model	Position of water table (relative to LAT)	0.3 m		
Weight of hammer	63.50 Kg	unit weight of formation	16 KN/m <sup>2</sup>		
Weight of hammer & anvil	105.00 Kg	Overburden $p_o$	0 KN/m <sup>2</sup>		
Length of rods: anvil to ground	1.15 m	$N_{60}$	SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)		
weight of rods/m	6.40 Kg		SPT N value corrected for both vertical effective stress and input energy		
Sampler type			SPT N value corrected to 100kPa overburden pressure (normalised)		
Energy Ratio of system	73 %	$N$	$= N_{150-300} + N_{300-450}$		

Borehole progress				SPT blowcount				Correction factors				Corrected SPT		
From	to	depth	av positi	1st	2nd	3rd		Rods	BH size*	Overb urden	Energy	$N_1$	$N_{60}$	$(N_1)_{60}$
m	m	m	m	$N_{1-150}$	$N_{150-300}$	$N_{300-450}$	$N$	$\lambda$	$C_d$	$C_N$	$ER_r/60$			
1.73	1.71	-0.02	1.72	12	50		50	0.75	1	1.72	1.22	64.57	45.63	78.56
-0.27	-0.72	-0.45	-0.87	5	5	8	13	0.85	1	1.37	1.22	15.13	13.44	18.40
-2.27	-2.72	-0.45	-2.87	7	10	12	22	0.95	1	1.26	1.22	26.37	25.43	32.09

Normalised SPT blowcount vs depth

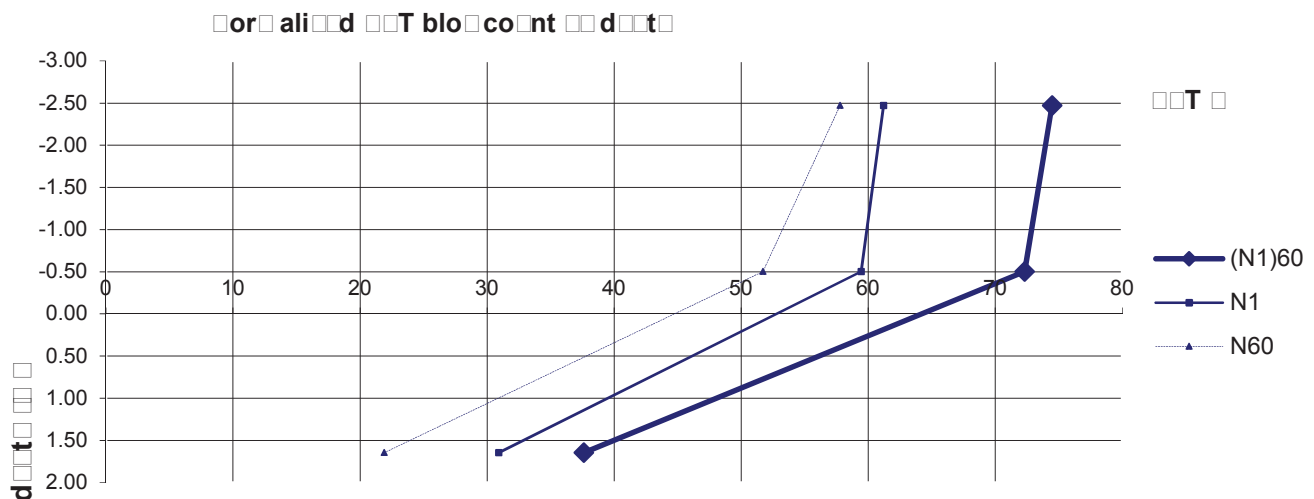


BH size\* Applying correction proposed by Skempton (1986)

## Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:	Delimara Power Station New CCPP	Bore Hole No.	33	Top of BH above LAT	2.677 m
Borehole diameter	mm	Soil type	Normally Consolidated (Id 40-60)		
Hammer type	Automatic Trip type UK model	Position of water table (relative to LAT)	0.3 m		
Weight of hammer	63.50 Kg	unit weight of formation	16 KN/m <sup>2</sup>		
Weight of hammer & anvil	105.00 Kg	Overburden $p_o$	0 KN/m <sup>2</sup>		
Length of rods: anvil to ground	1.15 m	$N_{60}$	SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)		
weight of rods/m	6.40 Kg		SPT N value corrected for both vertical effective stress and input energy		
Sampler type			SPT N value corrected to 100kPa overburden pressure (normalised)		
Energy Ratio of system	73 %	$N_1$	$N = N_{150-300} + N_{300-450}$		

Borehole progress				SPT blowcount				Correction factors				Corrected SPT		
From	to	depth	av positio	1st	2nd	3rd		Rods	BH size*	Overb urden	Energy	$N_1$	$N_{60}$	$(N_1)_{60}$
m	m	m	m	$N_{1-150}$	$N_{150-300}$	$N_{300-450}$	$N$	$\lambda$	$C_d$	$C_N$	$ER_r/60$			
1.68	1.62	-0.06	1.65	8	11	13	24	0.75	1	1.72	1.22	30.91	21.90	37.60
-0.32	-0.35	-0.03	-0.5	50			50	0.85	1	1.40	1.22	59.44	51.71	72.32
-2.32	-2.32	0.00	-2.47	50			50	0.95	1	1.29	1.22	61.21	57.79	74.48

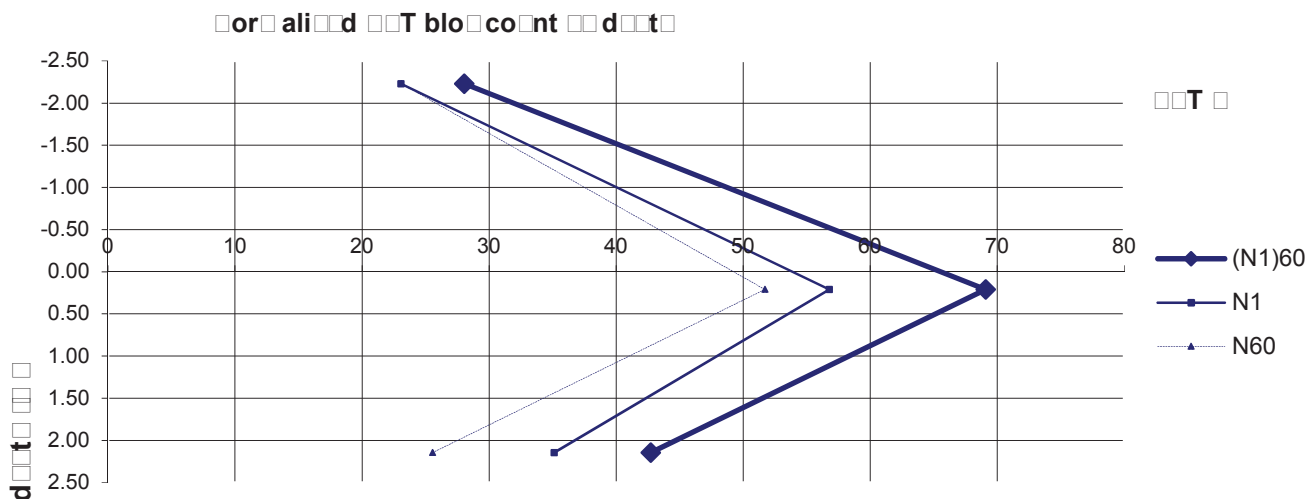


BH size\* Applying correction proposed by Skempton (1986)

## Standard Penetration Test to Eurocode 7 (DD ENV 1997-3:2000)

Location:	Delimara Power Station New CCPP	Bore Hole No.	35	Top of BH above LAT	3.371 m
Borehole diameter	mm	Soil type	Normally Consolidated (Id 40-60)		
Hammer type	Automatic Trip type UK model	Position of water table (relative to LAT)	0.3 m		
Weight of hammer	63.50 Kg	unit weight of formation	16 KN/m <sup>2</sup>		
Weight of hammer & anvil	105.00 Kg	Overburden $p_o$	0 KN/m <sup>2</sup>		
Length of rods: anvil to ground	1.15 m	$N_{60}$	SPT N value corrected to 60% of theoretical free-fall hammer energy (normalised)		
weight of rods/m	6.40 Kg		SPT N value corrected for both vertical effective stress and input energy		
Sampler type			SPT N value corrected to 100kPa overburden pressure (normalised)		
Energy Ratio of system	73 %	$N$	$= N_{150-300} + N_{300-450}$		

Borehole progress				SPT blowcount				Correction factors				Corrected SPT		
From	to	depth	av positio	1st	2nd	3rd		Rods	BH size*	Overb urden	Energy	$N_1$	$N_{60}$	$(N_1)_{60}$
m	m	m	m	$N_{1-150}$	$N_{150-300}$	$N_{300-450}$	$N$	$\lambda$	$C_d$	$C_N$	$ER_r/60$			
2.37	1.92	-0.45	2.15	12	13	15	28	0.75	1	1.67	1.22	35.12	25.55	42.73
0.37	0.36	-0.01	0.211	50			50	0.85	1	1.34	1.22	56.79	51.71	69.09
-1.63	-2.08	-0.45	-2.23	10	9	11	20	0.95	1	1.21	1.22	23.06	23.12	28.06



BH size\* Applying correction proposed by Skempton (1986)



- **Plate loading tests**

## PLATE BEARING TEST DIN - 18134

JOB NUMBER	J1057
REPORT NUMBER	228
SAMPLE NUMBER	PB14/0342
DATE AND TIME OF TEST	30/07/2014
WEATHER AND TEMPERATURE	Sunny 30 ° C
SAMPLER:	Mustafa Amory / Johannes Ringenberg
CONTRACTOR	
SUPPLIER	Existing Material
SITE - TOWN	Delimara Power Station
LOCATION	Location No 1
POSITION	
SECTION	
TYPE OF LAYER	Existing Material
TYPE OF MATERIAL	Existing Material

	1	2	3	4	5	6	7	8	1	2	3	1	2	3	4	5	6
	1 st LOAD								UNLOAD			2 nd LOAD					
PRESSURE MN/m <sup>2</sup>	0.00	0.01	0.02	0.04	0.08	0.12	0.16	0.20	0.10	0.050	0.00	0.02	0.04	0.08	0.12	0.16	
LOAD	0.00	0.15	0.16	0.43	1.02	1.46	1.85	2.19	2.19	2.18	1.90	2.03	2.06	2.10	2.20	2.30	
DEFORMATION																	
SETTLEMENT mm	0.00	0.30	0.32	0.86	2.04	2.92	3.70	4.38	4.38	4.36	3.80	4.06	4.12	4.20	4.40	4.60	

DIAMETER OF PLATE mm 762.0 mm

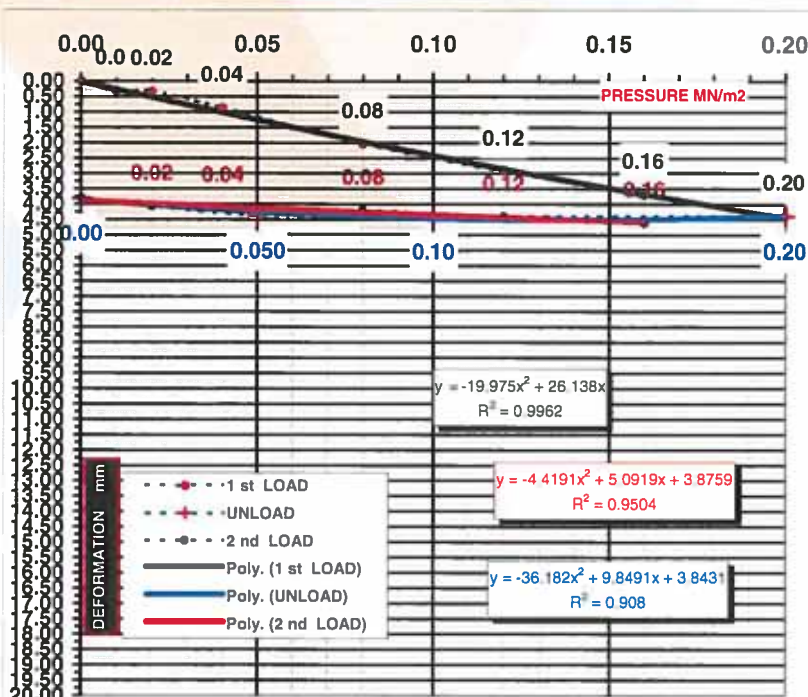
DISTANCE FROM CENTER OF PLATE TO AXLE 2.0 m

$$Ds_1 = 0.14 \text{ MN/m}^2$$

$$Ds_2 = 0.06 \text{ MN/m}^2$$

$$Ds = (Ds_1 - Ds_2) = 0.08$$

$$Ev = 0.75 \cdot d / (a_1 + a_2 \cdot \text{Sig. Max})$$



	1 st LOAD	2 nd LOAD
Sig max	0.20	0.00
a <sub>1</sub> mm ( MN/m <sup>2</sup> )	27.81946399	44.68260676
a <sub>2</sub> mm ( MN/m <sup>2</sup> )	-26.8668657	-200.181643
Ev = $\frac{1.5 \cdot d}{(a_1 + a_2 \cdot \text{Sig max})}$	25.46	123.00
Ev <sub>2</sub> / Ev <sub>1</sub> < 2.2	4.83	

UNLOAD a<sub>1</sub>= 9.849090909 Ev<sub>0</sub>= 86.12  
a<sub>2</sub>= -36.1818182

REMARKS :

## PLATE BEARING TEST DIN - 18134

JOB NUMBER	J1057
REPORT NUMBER	229
SAMPLE NUMBER	PB14/0343
DATE AND TIME OF TEST	30/07/2014
WEATHER AND TEMPERATURE	Sunny 30 ° C
SAMPLER:	Mustafa Amory / Johannes Ringenberg
CONTRACTOR	
SUPPLIER	Existing Material
SITE - TOWN	Delimara Power Station
LOCATION	Location No 2
POSITION	
SECTION	
TYPE OF LAYER	Existing Material
TYPE OF MATERIAL	Existing Material

	1	2	3	4	5	6	7	8	1	2	3	1	2	3	4	5	6
	1 st LOAD								UNLOAD			2 nd LOAD					
PRESSURE MN/m <sup>2</sup>	0.00	0.01	0.02	0.04	0.08	0.12	0.16	0.20	0.10	0.050	0.00	0.02	0.04	0.08	0.12	0.16	
LOAD	0.00	0.05	0.64	1.16	1.75	2.31	3.43	3.64	3.66	3.58	3.06	3.30	3.41	3.60	3.74	3.86	
DEFORMATION																	
SETTLEMENT mm	0.00	0.10	1.28	2.32	3.50	4.62	6.86	7.28	7.32	7.16	6.12	6.60	6.82	7.20	7.48	7.72	

DIAMETER OF PLATE mm 762.0 mm

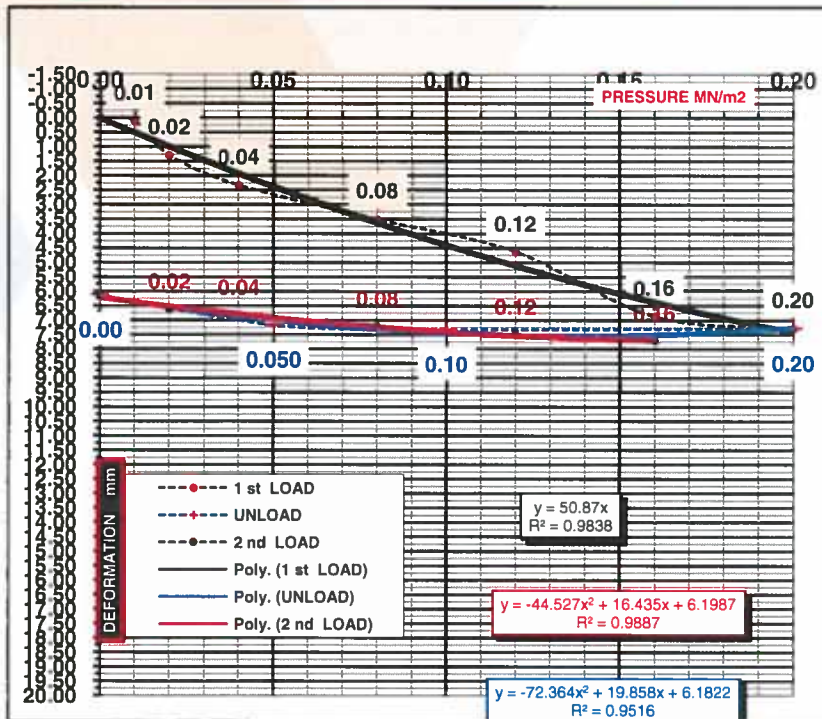
DISTANCE FROM CENTER OF PLATE TO AXLE 2.0 m

Ds1 = 0.14 MN/m<sup>2</sup>

Ds2 = 0.06 MN/m<sup>2</sup>

Ds=(Ds<sub>1</sub>-Ds<sub>2</sub>) = 0.08

Ev = 0.75 \* d / ( a<sub>1</sub> + a<sub>2</sub> \* Sig. Max )



	1 st LOAD	2 nd LOAD
Sig max	0.20	0.00
a <sub>1</sub> mm ( MN/m <sup>2</sup> )	50.67669515	79.75289146
a <sub>2</sub> mm ( MN/m <sup>2</sup> )	-68.2346197	-357.610469
Ev = $\frac{1.5 \times d}{(a_1 + a_2 \times \text{Sig max})}$	15.43	69.43
Ev <sub>2</sub> / Ev <sub>1</sub> < 2.2	4.50	
UNLOAD	a <sub>1</sub> = 19.85818182 a <sub>2</sub> = -72.3636364	Ev <sub>o</sub> = 41.78

REMARKS :

## PLATE BEARING TEST DIN - 18134

JOB NUMBER	J1057
REPORT NUMBER	230
SAMPLE NUMBER	PB14/0344
DATE AND TIME OF TEST	30/07/2014
WEATHER AND TEMPERATURE	Sunny 30 ° C
SAMPLER:	Mustafa Amory / Johannes Ringenberg
CONTRACTOR	
SUPPLIER	Existing Material
SITE - TOWN	Delimara Power Station
LOCATION	Location No 3
POSITION	
SECTION	
TYPE OF LAYER	Existing Material
TYPE OF MATERIAL	Existing Material

	1	2	3	4	5	6	7	8	1	2	3	1	2	3	4	5	6
	1 st LOAD								UNLOAD			2 nd LOAD					
PRESSURE MN/m²	0.00	0.01	0.02	0.04	0.08	0.12	0.16	0.20	0.10	0.050	0.00	0.02	0.04	0.08	0.12	0.16	
LOAD	0.00	0.72	0.88	1.31	1.82	2.23	2.51	2.84	2.75	2.55	1.98	2.16	2.29	2.49	2.64	2.75	
DEFORMATION																	
SETTLEMENT mm	0.00	1.44	1.76	2.62	3.64	4.46	5.02	5.68	5.50	5.10	3.96	4.32	4.58	4.98	5.28	5.50	

DIAMETER OF PLATE mm 762.0 mm

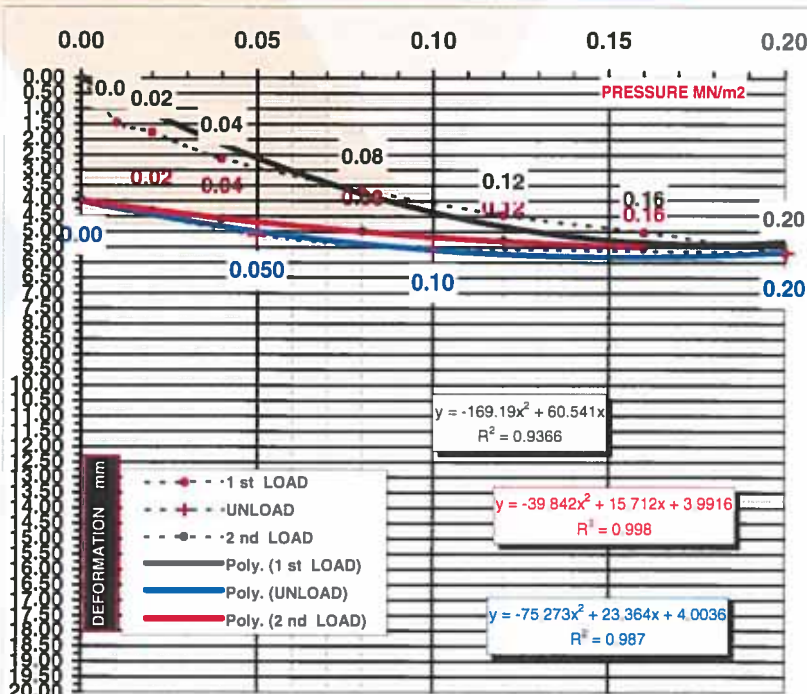
DISTANCE FROM CENTER OF PLATE TO AXLE 2.0 m

Ds1 = 0.14 MN/m²

Ds2 = 0.06 MN/m²

Ds=(Ds1-Ds2) = 0.08

Ev = 0.75 \* d / ( a1 + a2 \* Sig. Max )



	1 st LOAD	2 nd LOAD
Sig max	0.20	0.00
a <sub>1</sub> mm ( MN/m² )	46.9122872	56.48420819
a <sub>2</sub> mm ( MN/m² )	-113.329176	-241.447954
Ev = $\frac{1.5 \times d}{(a_1 + a_2 \times \text{Sig max})}$	23.57	69.74
Ev <sub>2</sub> / Ev <sub>1</sub> < 2.2	2.96	

UNLOAD a1= 23.36363636 a2= -75.2727273 Ev<sub>0</sub> = 27.08

REMARKS :

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Gormi, GRM 4000, Malta.

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W: www.solidbasemalta.com

Co. No.: C 33162  
VAT No.: MT 1695 3537

Directors: Paolo Bugeja  
Gordon Baldecchino  
Managing Director



# Test Certificate for Plate Bearing Test DIN 18134:2012-04 Fulcrum Method

Client Name Siemens Industrial Turbomachinery AB  
 Client address E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No. +46 122 82988  
 Client Fax No +46 122 82157  
 Attn.: Client Ref. Location 5

Certificate Date 27. Aug 2014  
 Certificate No: 160  
 Project: Siemens - J1057

Sample No:	Date Tested	Location of Site	Test location / Grid
PB14/0247	30. Jul 2014	Delimara Power Station	Between BH 12 and 16
Weather Condition	Contractor	Supplier	Type of Material
Sunny, 30oC			Existing Material
Layers	Bedding (if applicable)	Loading weight provided by	Technician
	Yes	Solidbase Laboratory Ltd	Amoury Mustafa

	1st Load							Unload			2nd Load					
Pressure MN/m <sup>2</sup>	0.01	0.08	0.16	0.25	0.33	0.42	0.50	0.25	0.13	0.01	0.08	0.16	0.25	0.33	0.42	
Load	0.00	0.34	0.51	0.61	0.77	0.91	1.05	1.05	1.04	1.01	1.12	1.12	1.13	1.13	1.13	
Deformation settlement (mm)	0.00	0.68	1.02	1.22	1.54	1.82	2.10	2.10	2.08	2.02	2.24	2.24	2.26	2.26	2.26	

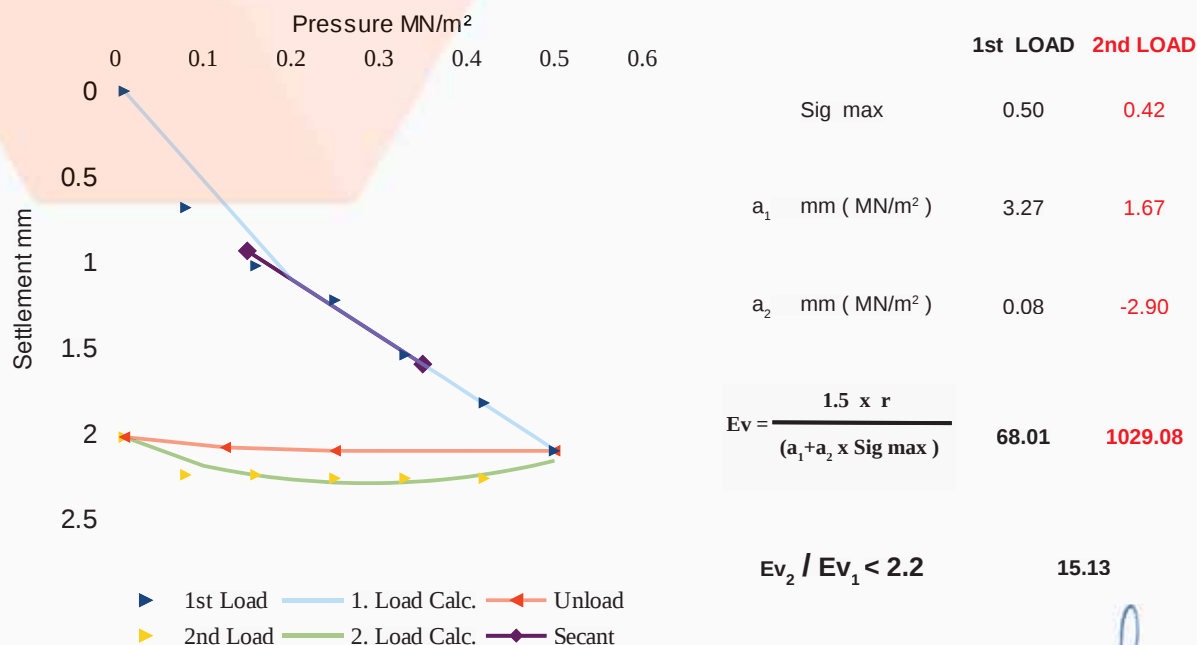
Plate diameter (mm) 300.0

Ds1 = 0.35 MN/m<sup>2</sup>

Ds2 = 0.15 MN/m<sup>2</sup>

hp / hM 2.0

Ds=(Ds<sub>1</sub>-Ds<sub>2</sub>) = 0.2 MN/m<sup>2</sup>



Comments: N.A.

Deviation: No

Bugeja Paolo  
 Managing Director

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 W: www.solidbasemalta.com

Co. No.: C 33162  
 VAT No.: MT 1695 3537

Directors: Paolo Bugeja  
 Gordon Baldacchino

# Test Certificate for Plate Bearing Test DIN 18134:2012-04 Fulcrum Method

Client Name	Siemens Industrial Turbomachinery AB	Certificate Date	27. Aug 2014
Client address	E P GT SGT FSP SOL EN 4 Slottsvaegen	Certificate No:	161
	SE-612 83 Finspang,	Project:	Siemens - J1057
	Sweden		
Client Tel No.	+46 122 82988		
Client Fax No	+46 122 82157		
Attn.:		Client Ref.	Location 4

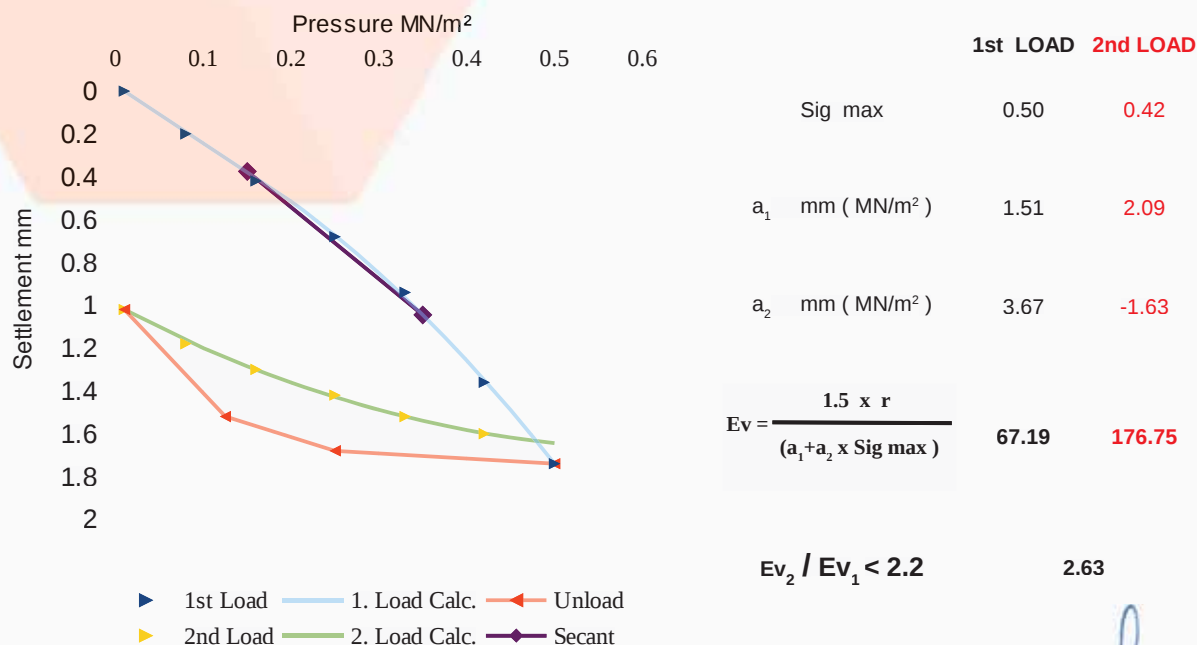
Sample No:	Date Tested	Location of Site	Test location / Grid
PB14/0248	30. Jul 2014	Delimara Power Station	Between BH 9 and 14
Weather Condition	Contractor	Supplier	Type of Material
Sunny, 30oC			Existing Material
Layers	Bedding (if applicable)	Loading weight provided by	Technician
	Yes	Solidbase Laboratory Ltd	Amoury Mustafa

	1st Load								Unload				2nd Load			
Pressure MN/m <sup>2</sup>	0.01	0.08	0.16	0.25	0.33	0.42	0.50		0.25	0.13	0.01	0.08	0.16	0.25	0.33	0.42
Load	0.00	0.10	0.21	0.34	0.47	0.68	0.87		0.84	0.76	0.51	0.59	0.65	0.71	0.76	0.80
Deformation settlement (mm)	0.00	0.20	0.42	0.68	0.94	1.36	1.74		1.68	1.52	1.02	1.18	1.30	1.42	1.52	1.60

Plate diameter (mm) 300.0

Ds1 = 0.35 MN/m<sup>2</sup>Ds2 = 0.15 MN/m<sup>2</sup>

hp / hM 2.0

Ds=(Ds<sub>1</sub>-Ds<sub>2</sub>) = 0.2 MN/m<sup>2</sup>

Comments: N.A.

Deviation: No



Bugeja Paolo  
Managing Director

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Co. No.: C 33162  
VAT No.: MT 1695 3537

Directors: Paolo Bugeja  
Gordon Baldacchino

# Test Certificate for Plate Bearing Test DIN 18134:2012-04 Fulcrum Method

Client Name	Siemens Industrial Turbomachinery AB	Certificate Date	27. Aug 2014
Client address	E P GT SGT FSP SOL EN 4 Slottsvaegen	Certificate No:	162
	SE-612 83 Finspang,	Project:	Siemens - J1057
	Sweden		
Client Tel No.	+46 122 82988		
Client Fax No	+46 122 82157		
Attn.:		Client Ref.	Location 6

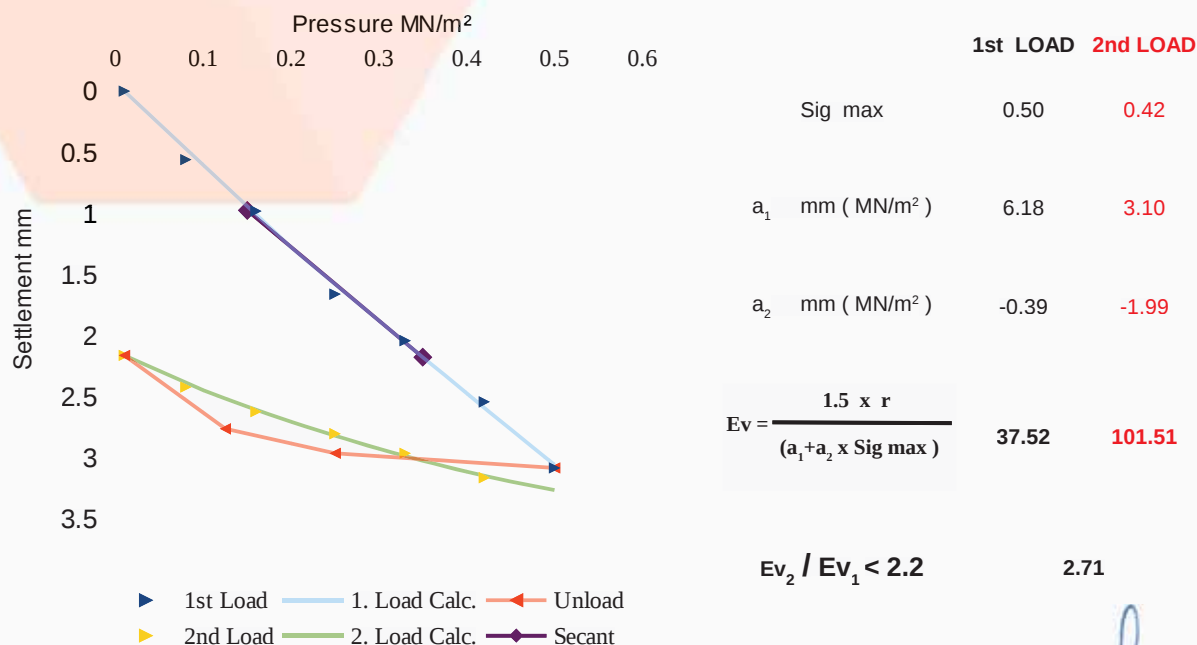
Sample No:	Date Tested	Location of Site	Test location / Grid
PB14/0249	30. Jul 2014	Delimara Power Station	Between BH 13 and 21
Weather Condition	Contractor	Supplier	Type of Material
Sunny, 30oC			Existing Material
Layers	Bedding (if applicable)	Loading weight provided by	Technician
	Yes	Solidbase Laboratory Ltd	Amoury Mustafa

	1st Load							Unload			2nd Load					
Pressure MN/m <sup>2</sup>	0.01	0.08	0.16	0.25	0.33	0.42	0.50	0.25	0.13	0.01	0.08	0.16	0.25	0.33	0.42	
Load	0.00	0.28	0.47	0.83	1.02	1.29	1.54	1.48	1.38	1.08	1.21	1.31	1.40	1.48	1.58	
Deformation settlement (mm)	0.00	0.56	0.78	1.66	2.04	2.54	3.08	2.76	2.96	2.16	2.42	2.62	2.80	2.76	3.16	

Plate diameter (mm) 300.0

Ds1 = 0.35 MN/m<sup>2</sup>Ds2 = 0.15 MN/m<sup>2</sup>

hp / hM 2.0

Ds=(Ds<sub>1</sub>-Ds<sub>2</sub>) = 0.2 MN/m<sup>2</sup>

$$E_v = \frac{1.5 \times r}{(a_1 + a_2 \times \text{Sig max})}$$

$$E_{v2} / E_{v1} < 2.2 \quad 2.71$$

Comments: N.A.

Deviation: No



Bugeja Paolo  
Managing Director

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Co. No.: C 33162  
VAT No.: MT 1695 3537

Directors: Paolo Bugeja  
Gordon Baldacchino

In respect to IEEE 754-2008 floating point calculation, the error margin of the result is &lt; 1%. Results relate only to the tested area.

# Test Certificate for Plate Bearing Test DIN 18134:2012-04 Fulcrum Method

Client Name	Siemens Industrial Turbomachinery AB	Certificate Date	27. Aug 2014
Client address	E P GT SGT FSP SOL EN 4 Slottsvaegen	Certificate No:	16-
	SE812 3- Finspang,	Project:	Siemens 8J1057
	Sweden		
Client Tel No.	+46 122 32933		
Client Fax No	+46 122 32157		
Attn.:		Client Ref.	Location 7

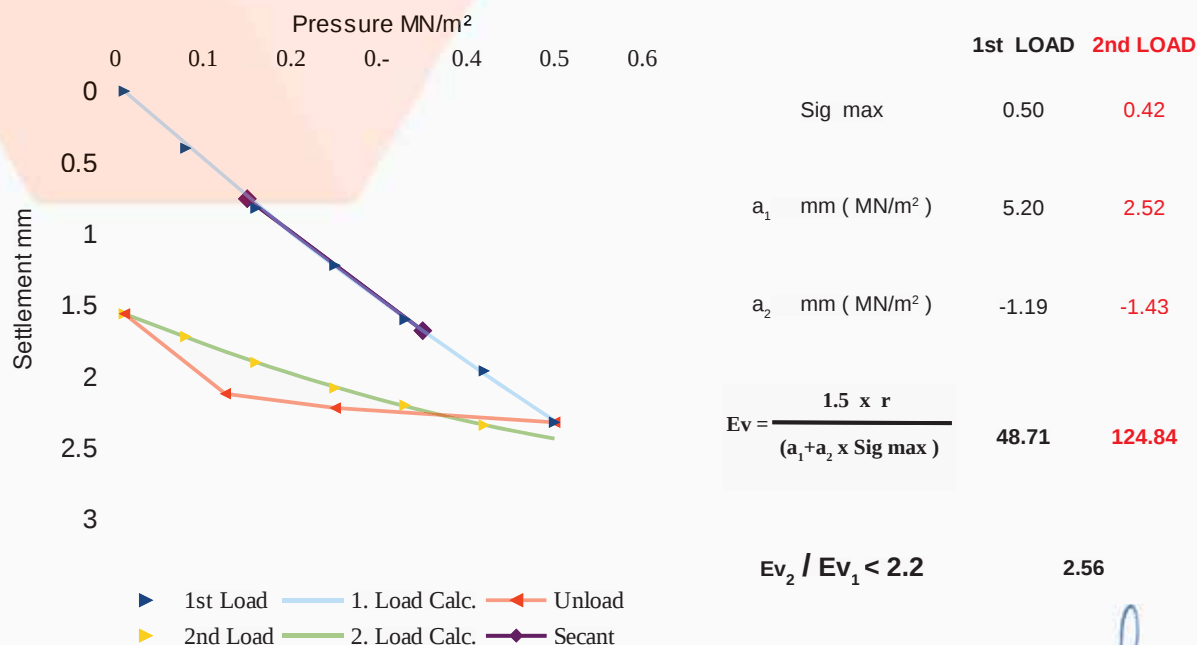
Sample No:	Date Tested	Location of Site	Test location / Grid
PB14/0250	-0. Jul 2014	Delimara Power Station	Near BH -0
Weather Condition	Contractor	Supplier	Type of Material
Sunny, -0oC			Existing Material
Layers	Bedding (if applicable)	Loading weight provided by	Technician
	Yes	Solidbase Laboratory Ltd	Amoury Mustafa

	1st Load							Unload			2nd Load						
Pressure MN/m <sup>2</sup>	0.01	0.08	0.16	0.25	0.33	0.42	0.50	0.25	0.13	0.01	0.08	0.16	0.25	0.33	0.42		
Load	0.00	0.20	0.41	0.61	0.80	0.78	1.16	1.11	1.06	0.98	0.86	0.75	1.04	1.10	1.19		
Deformation settlement (mm)	0.00	0.40	0.82	1.22	1.60	1.76	2.32	2.22	2.12	1.56	1.92	1.70	2.08	2.20	2.34		

Plate diameter (mm) 300.0

Ds1 = 0.35 MN/m<sup>2</sup>Ds2 = 0.15 MN/m<sup>2</sup>

hp / hM 2.0

Ds=(Ds<sub>1</sub>-Ds<sub>2</sub>) = 0.2 MN/m<sup>2</sup>

Comments: N.A.

Deviation: No

Bugeja Paolo  
Managing Director

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Tal-Handaq Industrial Estate,  
N/S in Handaq Road,  
Gormi, GRM 4000, Malta.

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Co. No.: C 33162  
VAT No.: MT 1695 3537

Directors: Paolo Bugeja  
Gordon Baldacchino

In respect to IEEE 75482003 floating point calculation, the error margin of the result is &lt; 1%. Results relate only to the tested area.

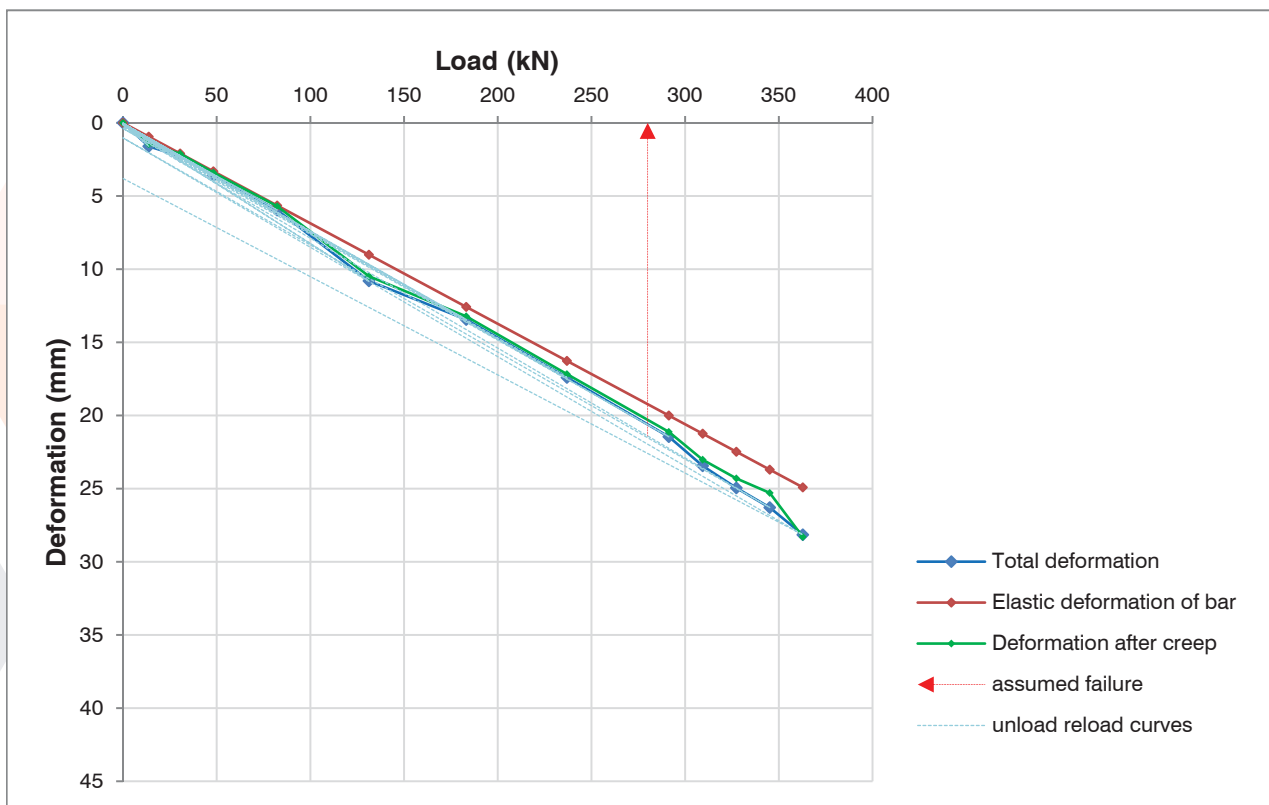


- **Anchor pull-out tests**

## Borehole 9 - Pull out test

Date tested: 19th August 2014

Top of borehole	2.73 m	Max pressure on jack	70 Mpa
Measured depth of borehole	10.5 m	effective area of jack	84.7 cm <sup>2</sup>
bottom of borehole (LAT+)	-7.77 m	Maximum force in jack	592.9 kN
Anchor diameter	32 mm	length of bar	12.15 m
Area of bar	804.25 mm <sup>2</sup>	length of bar above ground	1.465 m
Anchor grade	500 N/mm <sup>2</sup>	bottom level of bar (LAT+)	-7.955 m
Yield stress	575 N/mm <sup>2</sup>	depth to grout surface	9.5 m
Capacity of bar at yield	462.4 kN	top of grout (LAT+)	-6.77 m
Capacity of bar at failure	402.1 kN	grouted length	<b>1.000 m</b>
Modulus of steel rebar	220 GPa	average elevation of grout body	-7.363 m
		Borehole diameter	101 mm
		effective grout/rock contact	0.317 m <sup>2</sup>
		interface stress at full jack load	1.869 MPa



assumed failure point **280** kN

Stress in bar **348.15** N/mm<sup>2</sup>

interface stress **0.882** N/mm<sup>2</sup>

UCS  $\sigma_c$  measured closest to this level = 12.35MPa

assuming skin friction =  $\alpha(\sigma_c/2)$

**$\alpha$  is equivalent to 0.143**

### Comments:

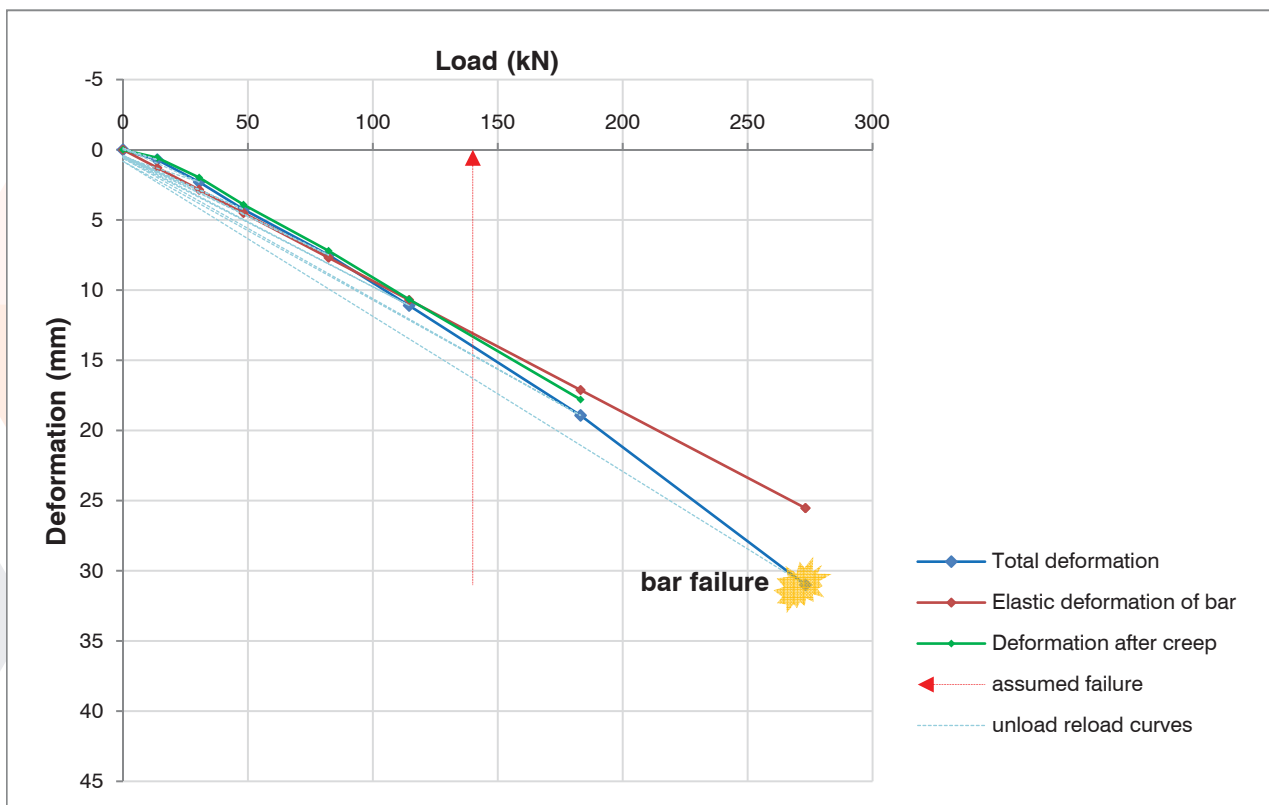
- 1) Creep deformation is in the opposite sense, indicating that sand bedding layers (below jack & plinth) may be deforming.
- 2) Interface between bar and grout may have failed (yet to be checked).
- 3) Borehole bore likely to be smoother than pile bore -(conservative).
- 4) Test in tension has effect of Poisson's ratio reversed - (conservative)

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# Borehole 10- Pull out test

Date tested: 19th August 2014

Top of borehole	2.805 m	Max pressure on jack	70 Mpa
Measured depth of borehole	15 m	effective area of jack	84.7 cm <sup>2</sup>
bottom of borehole (LAT+)	-12.195 m	Maximum force in jack	592.9 kN
Anchor diameter	32 mm	length of bar	16.54 m
Area of bar	804.25 mm <sup>2</sup>	length of bar above ground	1.49 m
Anchor grade	500 N/mm <sup>2</sup>	bottom level of bar (LAT+)	-12.245 m
Yield stress	575 N/mm <sup>2</sup>	depth to grout surface	14.4 m
Capacity of bar at yield	462.4 kN	top of grout (LAT+)	-11.595 m
Capacity of bar at failure	402.1 kN	grouted length	<b>0.650 m</b>
Modulus of steel rebar	220 GPa	average elevation of grout body	-11.92 m
		Borehole diameter	101 mm
		effective grout/rock contact	0.206 m <sup>2</sup>
		interface stress at full jack load	2.875 MPa



assumed failure point 140 kN

Stress in bar 174.08 N/mm<sup>2</sup>  
interface stress 0.679 N/mm<sup>2</sup>

UCS  $\sigma_c$  measured at this level = 15.64 MPa

assuming skin friction =  $\alpha(\sigma_c/2)$

$\alpha$  is equivalent to **0.087**

## Comments:

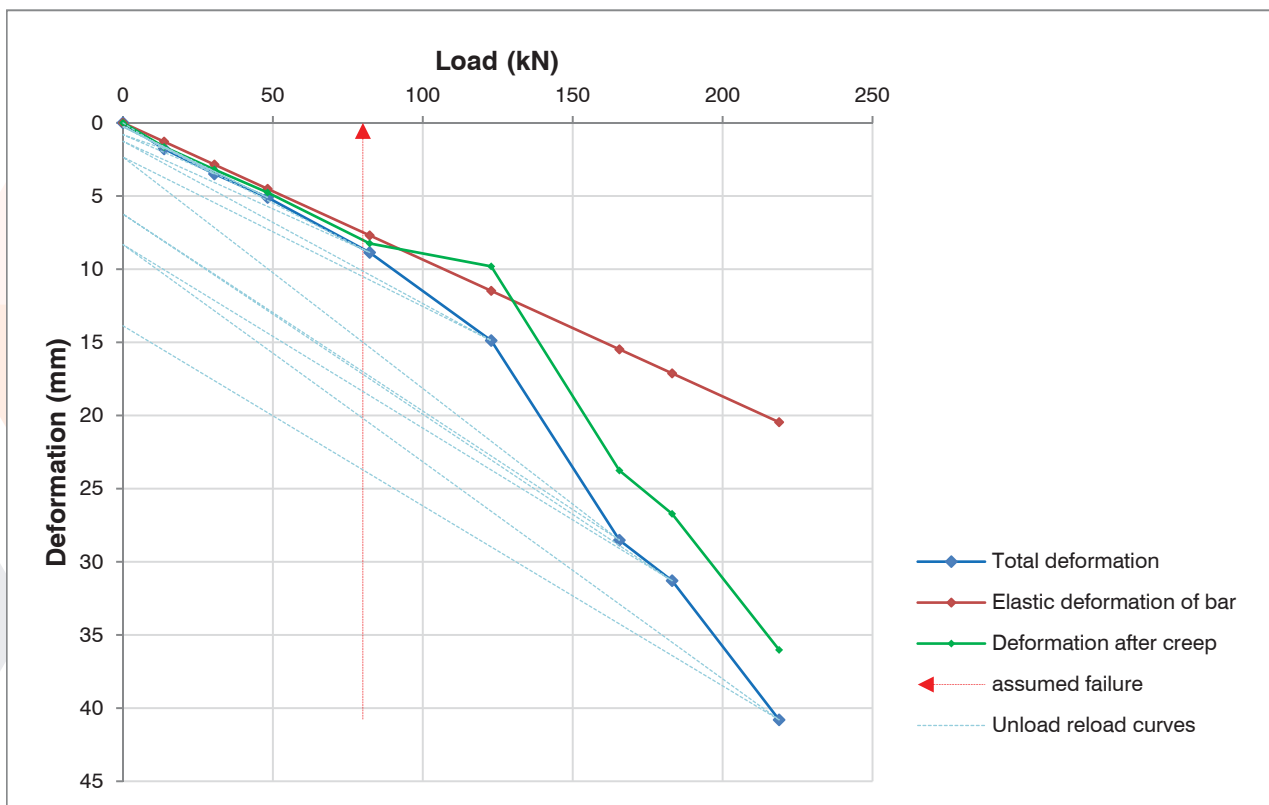
- 1) Sudden failure at 273kN - deformation at this point >30mm.
- 2) Creep deformation is in the opposite sense, indicating that sand bedding layers (below jack & plinth) may be deforming.
- 3) Interface between bar and grout may have failed (yet to be checked).
- 4) Borehole bore likely to be smoother than pile bore - (conservative).
- 5) Test in tension has effect of Poisson's ratio reversed - (conservative)

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## Borehole 12 - Pull out test

Date tested: 18th August 2014

Top of borehole	2.89 m	Max pressure on jack	70 Mpa
Measured depth of borehole	15.06 m	effective area of jack	84.7 cm <sup>2</sup>
bottom of borehole (LAT+)	-12.17 m	Maximum force in jack	592.9 kN
Anchor diameter	32 mm	length of bar	16.54 m
Area of bar	804.25 mm <sup>2</sup>	length of bar above ground	1.48 m
Anchor grade	500 N/mm <sup>2</sup>	bottom level of bar (LAT+)	-12.17 m
Yield stress	575 N/mm <sup>2</sup>	depth to grout surface	14.4 m
Capacity of bar at yield	462.4 kN	top of grout (LAT+)	-11.51 m
Capacity of bar at failure	402.1 kN	grouted length	<b>0.660 m</b>
Modulus of steel rebar	220 GPa	average elevation of grout body	-11.84 m
		Borehole diameter	101 mm
		effective grout/rock contact	0.209 m <sup>2</sup>
		interface stress at full jack load	2.831 MPa



assumed failure point **80** kN

UCS  $\sigma_c$  measured at this level = 12.09MPa

Stress in bar 99.47 N/mm<sup>2</sup>

assuming skin friction =  $\alpha(\sigma_o/2)$

interface stress 0.382 N/mm<sup>2</sup>

**$\alpha$  is equivalent to 0.063**

### Comments:

- 1) Creep deformation is in the opposite sense, indicating that sand bedding layers (below jack & plinth) may be deforming.
- 2) Interface between bar and grout may have failed (yet to be checked).
- 3) Borehole bore likely to be smoother than pile bore -(conservative).
- 4) Test in tension has effect of Poisson's ratio reversed - (conservative)

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# FRESH/HARDENED CONCRETE TEST CERTIFICATE

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:  
 Site Location: Delimara Power Station  
 Location of works: Grout for pull-out

Certificate Date: 26. Aug 2014  
 Certificate No: 228  
 Project: Siemens - J1057

Client Ref. No: N.A.  
 Batch No: 17208

## Concrete Supplier's Delivery Note Information

\*Concrete supplier: Solidbase Laboratory Ltd  
 \*Truck No:  
 \*Chit No:  
 \*Concrete grade: 30.0  
 \*Concrete quantity (m<sup>3</sup>): N.A.  
 \*Additive: Intraplast EP  
 \*Aggregate size:  
 \*Time of concrete dispatch:

## Slump Testing: EN 12350 2:2009

Location of testing:  
 Type of slump:  
 Measured slump (mm):  
 Testing deviation:  
 Concrete temp (°C):  
 Time of testing:  
 Cone lifting (seconds):  
 Total time of test (seconds):  
 Technician: N.A.

## Fresh Concrete Sampling: EN 12350 1:2009

Spot or composite: Spot  
 Chute, tremie, pump: Chute  
 Date sampled: 08. Aug 2014  
 Date received: 09. Aug 2014  
 Sampling deviation: No  
 Site Ambient temperature (°C): 31  
 Site Ambient conditions: 29C, PARTLY CLOUDY  
 MIA Conditions at time of test: Sunny  
 Time of sampling: 15:00  
 Technician: Cianciar Steven

## Specimen Making & Curing: EN 12390 2:2009

Cubes made: Solidbase  
 Time of Specimen making: 15:05  
 Temperature of concrete (°C):  
 Consistency:  
 Compaction method:  
 Number of strokes/vibration time:  
 Site storage duration/condition: Covered  
 Curing after demoulding:  
 Samples received condition:  
 Storage and curing deviations:  
 Technician: Cianciar Steven

## Crushing: EN 12390-3:2009, Dimensions: EN 12390-1:2012, Density: EN 12390-7:2009

Sample no:	C14/05979	C14/05978	C14/05977	C14/05976
Age of test (days):	28	28	7	7
Date tested:			15. Aug 2014	15. Aug 2014
Condition received:			Moist	Moist
Method of curing:			Curing in water at 20°C (±2°C)	Curing in water at 20°C (±2°C)
Surface Condition at time of test			Saturated Surface Dry	Saturated Surface Dry
Specimen Height:			101.00 mm	100.98 mm
Dimensions Width:			100.00 mm	100.00 mm
Nominal Size (mm) Breadth:			100.00 mm	100.00 mm
Weight in air:			1973 g	1965 g
Density by measurement:			1953 Kg m <sup>-3</sup>	1946 Kg m <sup>-3</sup>
Failure load:			480.7 kN	508.5 kN
Comp Strength:			47.6 Nmm <sup>-2</sup>	50.4 Nmm <sup>-2</sup>
Type of failure:			Satisfactory	Satisfactory
Technician:			Iorgulescu Carmen	Iorgulescu Carmen

\*The information gathered from the concrete supplier's chit cannot be substantiated by Solidbase Laboratory  
 Accreditation applies to quoted standards only.  
 EN 12390-1:2009 states that the first and last parts of a batch should be ignored when sampling. Consequently the sample taken from this batch of concrete could potentially be non-representative due to insufficient concrete quantity.

Additional Comments: N.A.  
 Deviation from Standard: N.A.



Bugeja Paolo  
 Managing Director

## **Appendix E: Laboratory test Certificates**

- **Index Tests**
- **Determination of Uniaxial Compressive Strength of Rock Materials - ISRM Suggested Method**
- **Determination of Deformability of Rock Materials in Uniaxial Compression - ISRM Suggested Method**

- **Index Tests**

## Particle-Size Analysis of soil

to ASTM D422 1998

Client Location	Siemens Industrial Turbomachinery AB Delimara Power Station - New Combined Cycle Power Plant	Job Ref:	J1057
		Borehole/Pit Ref:	BH26
		Sample No:	S14/00150
Soil	Very dark greyish brown (2.5Y 3/2), silty sand, very rich in organic fibres of Posidonia.	Depth (m)	6.8m
		Date tested	21/08/2014
		Report No:	231

Method of preparation	Sampled from extracted borehole core, 300g and wet sieved using distilled water, dried in oven for 24hrs, then dry sieved, crushed with pestle and mortar and then sampled for sedimentation. Mixing with stirrer prior to wet sieving was unnecessary due to lack of compaction of the soil.
-----------------------	---

### Wet sieving

Sieve	aperture	mass of sieve	mass of sieve & retained	mass of soil retained	mass of soil passing	% passing
	microns	g	g	g	g	
	8000	0.00	0.00	0.00	314.42	100.00%
	6300	0.00	0.00	0.00	314.42	100.00%
	5600	0.00	0.00	0.00	314.42	100.00%
	4000	0.00	0.00	0.00	314.42	100.00%
	2000	0.00	0.00	0.00	314.42	100.00%
18	1000	245.49	246.86	1.37	313.05	99.56%
40	500	301.56	303.45	1.89	311.16	98.96%
60	250	403.73	434.22	30.49	280.67	89.27%
100	125	268.50	353.06	84.56	196.11	62.37%
200	63	257.61	374.82	117.21	78.9	25.09%
pan		376.78	455.68	78.9		

plastic container	203.26	g		
plastic container + dry soil passing 63 micron	587.06	g		
passing 63 microns	78.9	g		
remaining in pan after drying sieves	0	g		
total passing 200	78.9	g - equivalent to	25.09%	of total
total mass of soil (dry)	314.42	g		

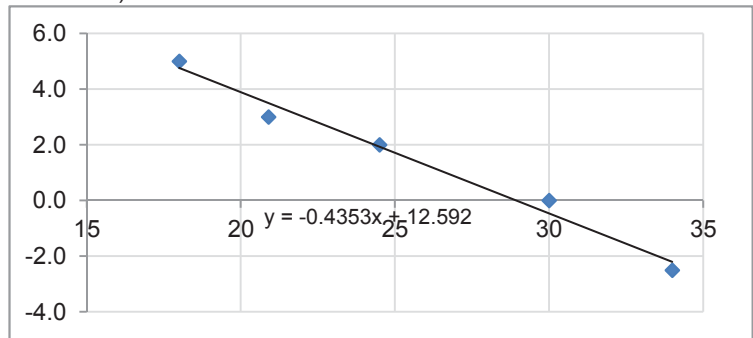
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**Composite correction for Hydrometer reading**

(dispersant+effect of variation in temperature+meniscus correction)

Temp.	Hydro- meter
°C	
18.00	5.0000
20.90	3.0000
24.50	2.0000
30.00	0.0000
34.00	-2.5000



Specific gravity of soil particles

2.617

Hydrometer used

152H

**Sedimentation test**

Container for sedimentation specimen

80.20 g

Container + dry specimen

120.20 g

mass passing 63 $\mu$  used for sedimentation

40.00

g - equivalent to

25.09% of 159.40g

mass of total sample represented by mass used in hydrometer test

W

159.40 g

**Sedimentation**

Time	Hydrometer reading	Temp. °C	Hydrometer correction	Hydro- meter reading corrected	% of soil remaining in suspension %	Constant K (depending on temp and Gs)	L cm	D mm
min								
0.00	28.0000	29.40						
1.00	25.3000	29.40	2.4797	27.7797	17.43	0.012414	12.2	0.04336
2.00	20.5000	29.40	2.4797	22.9797	14.42	0.012414	13.0	0.03165
5.00	15.9000	29.40	2.4797	18.3797	11.53	0.012414	13.8	0.02062
10.00	13.5000	29.40	2.4797	15.9797	10.02	0.012414	14.2	0.01479
15.00	11.0000	29.40	2.4797	13.4797	8.46	0.012414	14.5	0.01221
30.00	10.5000	29.40	2.4797	12.9797	8.14	0.012414	14.7	0.00869
60.00	10.0000	29.40	2.4797	12.4797	7.83	0.012414	14.7	0.00614
120.00	9.9000	29.40	2.4797	12.3797	7.77	0.012414	14.8	0.00436
240.00	9.7000	29.50	2.4495	12.1495	7.62	0.012395	14.8	0.00308
1440.00	9.5000	29.50	2.4495	11.9495	7.50	0.012395	14.8	0.00126
2880.00	9.0000	29.80	2.3586	11.3586	7.13	0.012338	14.8	0.00088

## Summary of results

Method	Diameter	% passing
Wet sieving	8.0000	100.00%
	6.3000	100.00%
	5.6000	100.00%
	4.0000	100.00%
	2.0000	100.00%
	1.0000	99.56%
	0.5000	98.96%
	0.2500	89.27%
	0.1250	62.37%
	0.0630	25.09%
Hydrometer analysis	0.0434	17.43%
	0.0316	14.42%
	0.0206	11.53%
	0.0148	10.02%
	0.0122	8.46%
	0.0087	8.14%
	0.0061	7.83%
	0.0044	7.77%
	0.0031	7.62%
	0.0013	7.50%
	0.0009	7.13%

## Size fractions

	passing	fraction
Clay	7.55%	<b>7.55%</b>
Silt	23.92%	<b>16.38%</b>
Sand		<b>76.08%</b>

Maximum particle size **1** mm

Visible particle shape

Medium to Fine grained

Visible particle hardness

Un-Compact

Difficulty in dispersing 2mm fraction

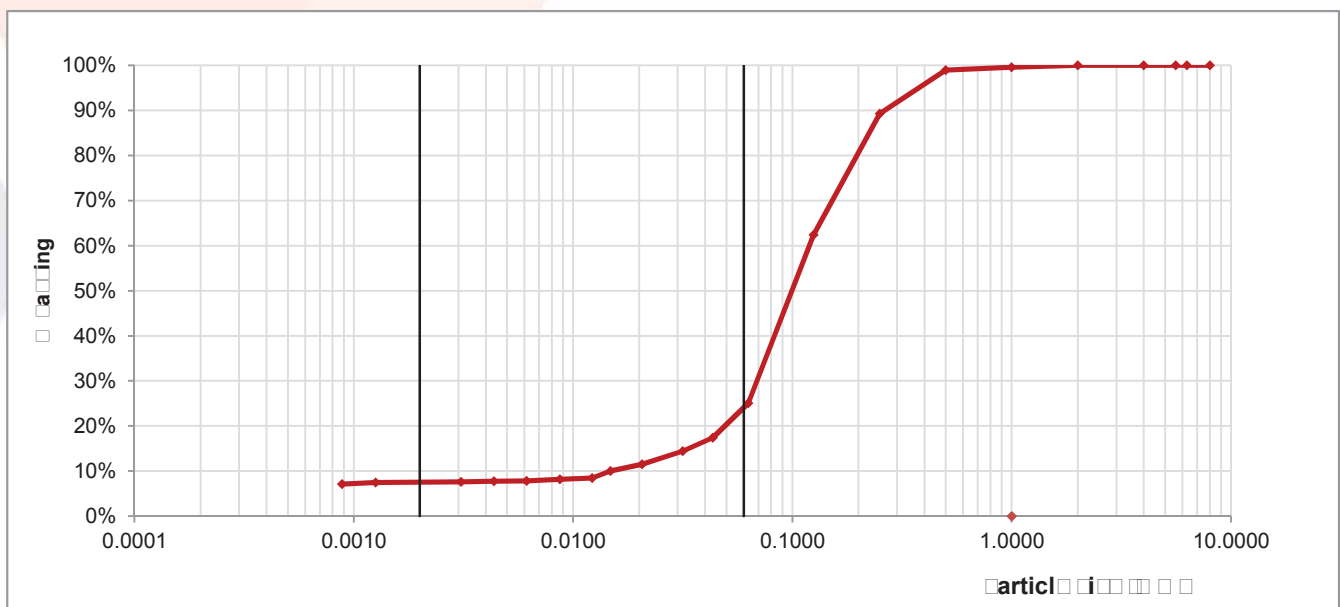
none

Dispersion device used

high speed mixer with stirring paddles

Dispersion period

1 minute



Operator	J. AZ.
Approved	A. M.

## Particle-Size Analysis of soil

to ASTM D422 1998

Client Location: Siemens Industrial Turbomachinery AB  
Delimara Power Station - New Combined Cycle Power Plant

Soil: Light Grey (2.5Y 7/1), sandy marl.

Job Ref: J1057  
Borehole/Pit Ref: BH2  
Sample No: S14/0078  
Depth (m): 6.5m  
Date tested: 21/08/2014  
Report No: 232

Method of preparation: Sampled from extracted borehole core, 300g and wet sieved using distilled water, dried in oven for 24hrs, then dry sieved, crushed with pestle and mortar and then sampled for sedimentation. Mixing with stirrer prior to wet sieving was unnecessary due to lack of compaction of the soil.

### Wet sieving

Sieve	aperture	mass of sieve	mass of sieve & retained	mass of soil retained	mass of soil passing	% passing
	microns	g	g	g	g	
	8000	329.12	350.55	21.43	571.87	96.39%
	6300	0.00	0.00	0.00	571.87	96.39%
	5600	0.00	0.00	0.00	571.87	96.39%
	4000	307.54	340.81	33.27	538.60	90.78%
	2000	325.49	361.10	35.61	502.99	84.78%
18	1000	297.37	327.19	29.82	473.17	79.75%
40	500	517.17	586.34	69.17	404.00	68.09%
60	250	360.69	444.98	84.29	319.71	53.89%
100	125	268.50	369.66	101.16	218.55	36.84%
200	63	257.61	388.16	130.55	88	14.83%
pan		376.78	464.78	88		

plastic container 203.26 g

plastic container + dry soil passing 63 micron 587.06 g

passing 63 microns 88 g

remaining in pan after drying sieves 0 g

total passing 200 88 g - equivalent to 14.83% of total

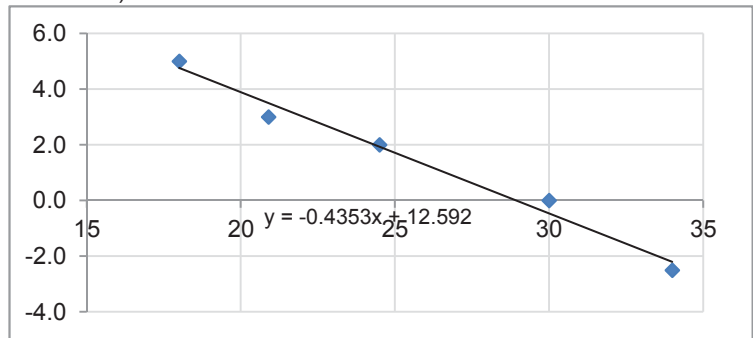
total mass of soil (dry) 593.30 g

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**Composite correction for Hydrometer reading**

(dispersant+effect of variation in temperature+meniscus correction)

Temp.	Hydro- meter
°C	
18.00	5.0000
20.90	3.0000
24.50	2.0000
30.00	0.0000
34.00	-2.5000



Specific gravity of soil particles

2.617

Hydrometer used

152H

**Sedimentation test**

Container for sedimentation specimen

80.20 g

Container + dry specimen

120.25 g

mass passing 63 $\mu$  used for sedimentation

40.05 g

- equivalent to

14.83% of 270.02g

mass of total sample represented by mass used in hydrometer test

W

270.02 g

**Sedimentation**

Time	Hydrometer reading	Temp. °C	Hydrometer correction	Hydro- meter reading corrected	% of soil remaining in suspension %	Constant K (depending on temp and Gs)	L cm	D mm
min								
0.00	25.0000	29.40						
1.00	17.3000	29.40	2.4797	19.7797	7.33	0.012414	13.5	0.04561
2.00	11.7000	29.40	2.4797	14.1797	5.25	0.012414	14.5	0.03343
5.00	10.0000	29.40	2.4797	12.4797	4.62	0.012414	14.7	0.02129
10.00	8.0000	29.40	2.4797	10.4797	3.88	0.012414	15.0	0.01520
15.00	7.5000	29.40	2.4797	9.9797	3.70	0.012414	15.2	0.01250
30.00	7.3000	29.40	2.4797	9.7797	3.62	0.012414	15.2	0.00884
60.00	7.0000	29.40	2.4797	9.4797	3.51	0.012414	15.2	0.00625
120.00	6.5000	29.40	2.4797	8.9797	3.33	0.012414	15.3	0.00443
240.00	6.1000	29.50	2.4495	8.5495	3.17	0.012395	15.3	0.00313
1440.00	5.8000	29.50	2.4495	8.2495	3.06	0.012395	15.5	0.00129
2880.00	4.5000	29.80	2.3586	6.8586	2.54	0.012338	15.6	0.00091



## Summary of results

Method	Diameter	% passing
Wet sieving	8.0000	96.39%
	6.3000	96.39%
	5.6000	96.39%
	4.0000	90.78%
	2.0000	84.78%
	1.0000	79.75%
	0.5000	68.09%
	0.2500	53.89%
	0.1250	36.84%
	0.0630	14.83%
Hydrometer analysis	0.0456	7.33%
	0.0334	5.25%
	0.0213	4.62%
	0.0152	3.88%
	0.0125	3.70%
	0.0088	3.62%
	0.0062	3.51%
	0.0044	3.33%
	0.0031	3.17%
	0.0013	3.06%
	0.0009	2.54%

## Size fractions

	passing	fraction
Clay	3.10%	<b>3.10%</b>
Silt	13.54%	<b>10.44%</b>
Sand		<b>86.46%</b>

Maximum particle size **8** mm

Visible particle shape

Fine grained

Visible particle hardness

Very stiff to very weak

Difficulty in dispersing 2mm fraction

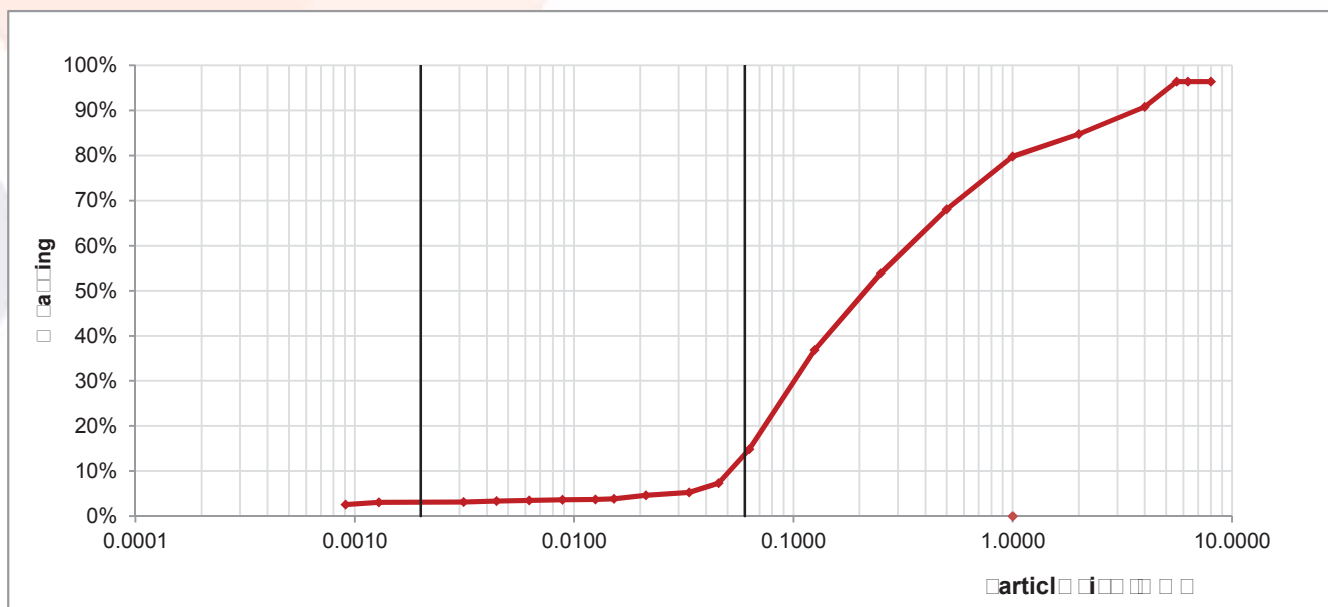
none

Dispersion device used

high speed mixer with stirring paddles

Dispersion period

1 minute



Operator	J. AZ.
Approved	A. M.

## Particle-Size Analysis of soil

to ASTM D422 1998

Client Location: Siemens Industrial Turbomachinery AB  
Delimara Power Station - New Combined Cycle Power Plant

Soil: Olive (5Y 4/3), sandy-gravelly clay.

Job Ref: J1057  
Borehole/Pit Ref: BH27a  
Sample No: S14/00151  
Depth (m): 6.6m  
Date tested: 21/08/2014  
Report No: 233

Method of preparation: Sampled from extracted borehole core, 300g and wet sieved using distilled water, dried in oven for 24hrs, then dry sieved, crushed with pestle and mortar and then sampled for sedimentation. Mixing with stirrer prior to wet sieving was unnecessary due to lack of compaction of the soil.

### Wet sieving

Sieve	aperture	mass of sieve	mass of sieve & retained	mass of soil retained	mass of soil passing	% passing
	microns	g	g	g	g	
	8000	0.00	0.00	0.00	544.86	100.00%
	6300	0.00	0.00	0.00	544.86	100.00%
	5600	0.00	0.00	0.00	544.86	100.00%
	4000	411.75	475.15	63.40	481.46	88.36%
	2000	388.28	389.24	0.96	480.50	88.19%
18	1000	344.20	345.49	1.29	479.21	87.95%
40	500	301.56	302.79	1.23	477.98	87.73%
60	250	403.73	459.40	55.67	422.31	77.51%
100	125	268.62	337.27	68.65	353.66	64.91%
200	63	257.88	353.08	95.20	258.46	47.44%
pan		376.78	635.24	258.46		

plastic container 203.26 g

plastic container + dry soil passing 63 micron 587.06 g

passing 63 microns 258.46 g

remaining in pan after drying sieves 0 g

total passing 200 258.46 g - equivalent to 47.44% of total

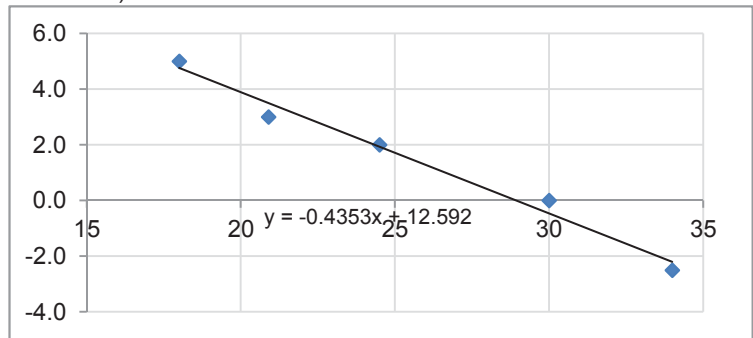
total mass of soil (dry) 544.86 g

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**Composite correction for Hydrometer reading**

(dispersant+effect of variation in temperature+meniscus correction)

Temp.	Hydro- meter
°C	
18.00	5.0000
20.90	3.0000
24.50	2.0000
30.00	0.0000
34.00	-2.5000



Specific gravity of soil particles

2.617

Hydrometer used

152H

**Sedimentation test**

Container for sedimentation specimen

80.20 g

Container + dry specimen

120.30 g

mass passing 63 $\mu$  used for sedimentation

40.10

g - equivalent to

47.44% of 84.53g

mass of total sample represented by mass used in hydrometer test

W

84.53 g

**Sedimentation**

Time	Hydrometer reading	Temp. °C	Hydrometer correction	Hydro- meter reading corrected	% of soil remaining in suspension %	Constant K (depending on temp and Gs)	L cm	D mm
min								
0.00	27.0000	29.40						
1.00	25.0000	29.40	2.4797	27.4797	32.51	0.012414	12.2	0.04336
2.00	22.5000	29.40	2.4797	24.9797	29.55	0.012414	12.7	0.03128
5.00	21.0000	29.40	2.4797	23.4797	27.78	0.012414	12.9	0.01994
10.00	19.5000	29.40	2.4797	21.9797	26.00	0.012414	13.2	0.01426
15.00	18.0000	29.40	2.4797	20.4797	24.23	0.012414	13.3	0.01169
30.00	15.0000	29.40	2.4797	17.4797	20.68	0.012414	13.8	0.00842
60.00	12.9000	29.40	2.4797	15.3797	18.19	0.012414	14.3	0.00606
120.00	11.7000	29.40	2.4797	14.1797	16.77	0.012414	14.5	0.00432
240.00	10.0000	29.50	2.4495	12.4495	14.73	0.012395	14.7	0.00307
1440.00	6.8000	29.50	2.4495	9.2495	10.94	0.012395	15.3	0.00128
2880.00	5.0000	29.80	2.3586	7.3586	8.70	0.012338	15.5	0.00091

## Summary of results

Method	Diameter	% passing
Wet sieving	8.0000	100.00%
	6.3000	100.00%
	5.6000	100.00%
	4.0000	88.36%
	2.0000	88.19%
	1.0000	87.95%
	0.5000	87.73%
	0.2500	77.51%
	0.1250	64.91%
	0.0630	47.44%
Hydrometer analysis	0.0434	32.51%
	0.0313	29.55%
	0.0199	27.78%
	0.0143	26.00%
	0.0117	24.23%
	0.0084	20.68%
	0.0061	18.19%
	0.0043	16.77%
	0.0031	14.73%
	0.0013	10.94%
	0.0009	8.70%

## Size fractions

	passing	fraction
Clay	12.47%	<b>12.47%</b>
Silt	45.16%	<b>32.69%</b>
Sand		<b>54.84%</b>

Maximum particle size **4** mm

Visible particle shape

Fine to Coarse grained

Visible particle hardness

Un-Compact

Difficulty in dispersing 2mm fraction

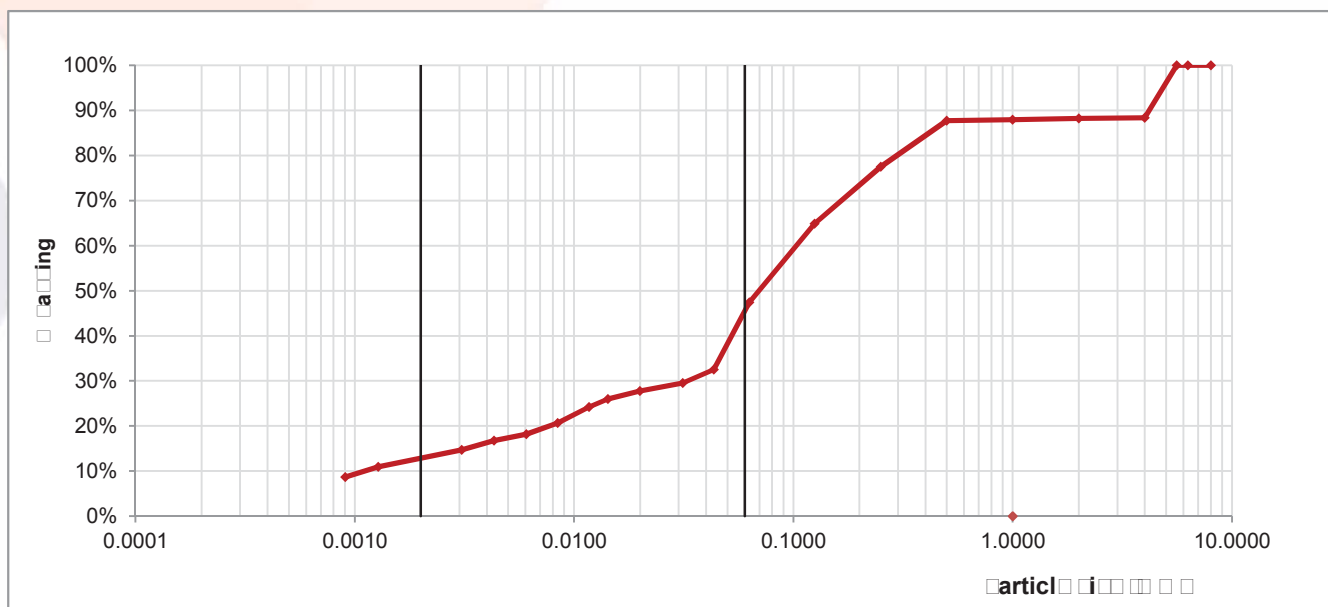
none

Dispersion device used

high speed mixer with stirring paddles

Dispersion period

1 minute



Operator	J. AZ.
Approved	A. M.



## Particle-Size Analysis of soil

to ASTM D422 1998

Client Location: Siemens Industrial Turbomachinery AB  
Delimara Power Station - New Combined Cycle Power Plant

Soil: Olive (5Y 4/3), marl, fine grained, moderately weak, globigerina.

Job Ref: J1057  
Borehole/Pit Ref: BH30  
Sample No: S14/0082  
Depth (m): 11.4m  
Date tested: 09/08/2014  
Report No: 234

Method of preparation: Sampled from extracted borehole core, 300g, then dissolved in water by continuous stirring for more than 24 hours and wet sieved using distilled water, dried in oven for 24hrs, then dry sieved, crushed with pestle and mortar and then sampled for sedimentation.

### Wet sieving

Sieve	aperture	mass of sieve	mass of sieve & retained	mass of soil retained	mass of soil passing	% passing
	microns	g	g	g	g	
	8000	0.00	0.00	0.00	419.32	100.00%
	6300	0.00	0.00	0.00	419.32	100.00%
	5600	0.00	0.00	0.00	419.32	100.00%
	4000	0.00	0.00	0.00	419.32	100.00%
	2000	289.88	289.89	0.01	419.31	100.00%
18	1000	267.55	267.67	0.12	419.19	99.97%
40	500	447.88	448.29	0.41	418.78	99.87%
60	250	276.40	276.41	0.01	418.77	99.87%
100	125	268.50	268.92	0.42	418.35	99.77%
200	63	257.61	257.62	0.01	418.34	99.77%
pan		376.78	795.12	418.34		

plastic container 203.26 g

plastic container + dry soil passing 63 micron 587.06 g

passing 63 microns 418.34 g

remaining in pan after drying sieves 0 g

total passing 200 418.34 g - equivalent to 99.77% of total

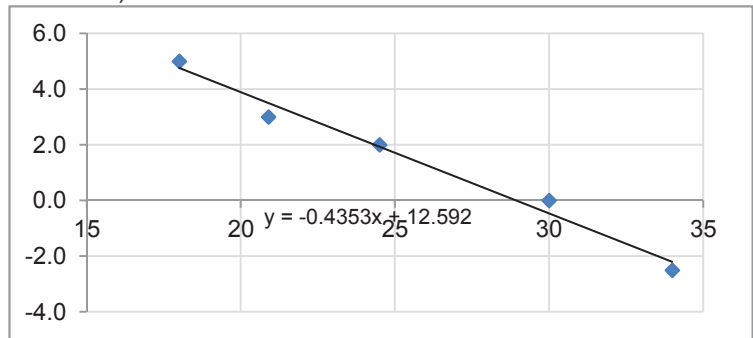
total mass of soil (dry) 419.32 g

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**Composite correction for Hydrometer reading**

(dispersant+effect of variation in temperature+meniscus correction)

Temp.	Hydro- meter
°C	
18.00	5.0000
20.90	3.0000
24.50	2.0000
30.00	0.0000
34.00	-2.5000



Specific gravity of soil particles

2.609

Hydrometer used

152H

**Sedimentation test**

Container for sedimentation specimen

80.2 g

Container + dry specimen

121.15 g

mass passing 63 $\mu$  used for sedimentation

40.95

g - equivalent to

99.77% of 41.05g

mass of total sample represented by mass used in hydrometer test

W

41.05 g

**Sedimentation**

Time	Hydrometer reading	Temp. °C	Hydrometer correction	Hydro- meter reading corrected	% of soil remaining in suspension %	Constant K (depending on temp and Gs)	L cm	D mm
min								
0.00	29.0000	25.00						
1.00	27.0000	25.00	3.8125	30.8125	75.07	0.013060	11.9	0.04505
2.00	25.0000	25.00	3.8125	28.8125	70.20	0.013060	12.2	0.03226
5.00	22.2000	25.00	3.8125	26.0125	63.37	0.013060	12.7	0.02081
10.00	20.0000	25.00	3.8125	23.8125	58.01	0.013060	13.0	0.01489
15.00	18.5000	25.00	3.8125	22.3125	54.36	0.013060	13.3	0.01230
30.00	15.5000	25.00	3.8125	19.3125	47.05	0.013060	13.8	0.00886
60.00	12.5000	25.00	3.8125	16.3125	39.74	0.013060	14.3	0.00638
120.00	11.2000	25.00	3.8125	15.0125	36.57	0.013060	14.5	0.00454
240.00	9.6000	25.00	3.8125	13.4125	32.68	0.013060	14.8	0.00324
1440.00	6.9000	25.80	3.5702	10.4702	25.51	0.012900	15.3	0.00133
2880.00	6.0000	25.00	3.8125	9.8125	23.91	0.013060	15.3	0.00095

## Summary of results

Method	Diameter	% passing
Wet sieving	8.0000	100.00%
	6.3000	100.00%
	5.6000	100.00%
	4.0000	100.00%
	2.0000	100.00%
	1.0000	99.97%
	0.5000	99.87%
	0.2500	99.87%
	0.1250	99.77%
	0.0630	99.77%
Hydrometer analysis	0.0451	75.07%
	0.0323	70.20%
	0.0208	63.37%
	0.0149	58.01%
	0.0123	54.36%
	0.0089	47.05%
	0.0064	39.74%
	0.0045	36.57%
	0.0032	32.68%
	0.0013	25.51%
	0.0010	23.91%

## Size fractions

	passing	fraction
Clay	28.02%	<b>28.02%</b>
Silt	95.64%	<b>67.62%</b>
Sand		<b>4.36%</b>

Maximum particle size **2** mm

Visible particle shape

Not Applicable

Visible particle hardness

Not Applicable

Difficulty in dispersing 2mm fraction

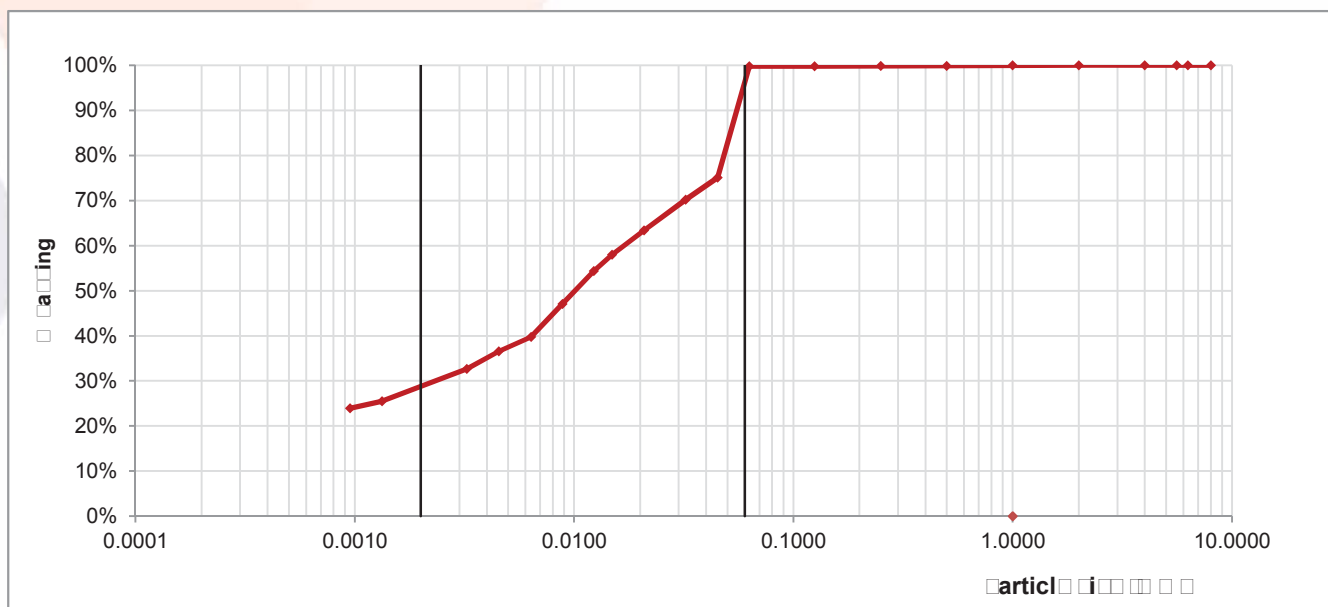
none

Dispersion device used

high speed mixer with stirring paddles

Dispersion period

1 minute



Operator	J. AZ.
Approved	A. M.

## Particle-Size Analysis of soil

to ASTM D422 1998

Client Location: Siemens Industrial Turbomachinery AB  
Delimara Power Station - New Combined Cycle Power Plant

Soil: Olive (5Y 4/3), marl - horizontally microfractured, fine grained, moderately weak, globigerina.

Job Ref: J1057  
Borehole/Pit Ref: BH21  
Sample No: S14/0081  
Depth (m): 15.4m  
Date tested: 09/08/2014  
Report No: 235

Method of preparation: Sampled from extracted borehole core, 300g, then dissolved in water by continuous stirring for more than 24 hours and wet sieved using distilled water, dried in oven for 24hrs, then dry sieved, crushed with pestle and mortar and then sampled for sedimentation .

### Wet sieving

Sieve	aperture	mass of sieve	mass of sieve & retained	mass of soil retained	mass of soil passing	% passing
	microns	g	g	g	g	
	8000	0.00	0.00	0.00	78.11	100.00%
	6300	0.00	0.00	0.00	78.11	100.00%
	5600	0.00	0.00	0.00	78.11	100.00%
	4000	0.00	0.00	0.00	78.11	100.00%
	2000	0.00	0.00	0.00	78.11	100.00%
18	1000	0.00	0.00	0.00	78.11	100.00%
40	500	447.88	448.04	0.16	77.95	99.80%
60	250	276.40	276.40	0.00	77.95	99.80%
100	125	268.50	268.53	0.03	77.92	99.76%
200	63	257.61	258.13	0.52	77.4	99.09%
pan		376.78	454.18	77.4		

plastic container 203.26 g

plastic container + dry soil passing 63 micron 587.06 g

passing 63 microns 77.4 g

remaining in pan after drying sieves 0 g

total passing 200 77.4 g - equivalent to 99.09% of total

total mass of soil (dry) 78.11 g

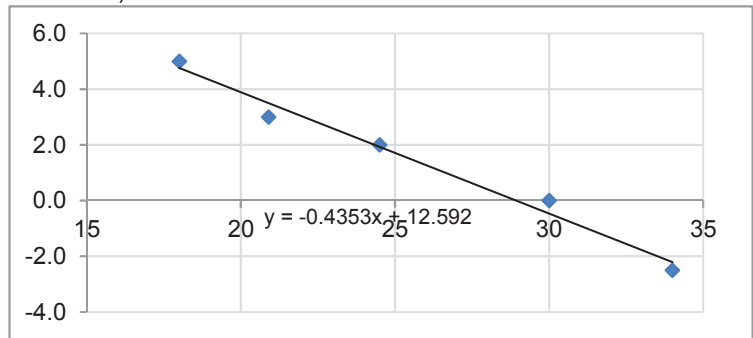
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**Composite correction for Hydrometer reading**

(dispersant+effect of variation in temperature+meniscus correction)

Temp.	Hydro- meter
°C	
18.00	5.0000
20.90	3.0000
24.50	2.0000
30.00	0.0000
34.00	-2.5000



Specific gravity of soil particles

2.633

Hydrometer used

152H

**Sedimentation test**

Container for sedimentation specimen

80.2 g

Container + dry specimen

122.14 g

mass passing 63 $\mu$  used for sedimentation

41.94

g - equivalent to

99.09% of 42.32g

mass of total sample represented by mass used in hydrometer test

W

42.32 g

**Sedimentation**

Time	Hydrometer reading	Temp. °C	Hydrometer correction	Hydro- meter reading corrected	% of soil remaining in suspension %	Constant K (depending on temp and Gs)	L cm	D mm
min								
0.00	31.0000	25.00						
1.00	29.2000	25.00	3.8125	33.0125	78.00	0.013060	11.5	0.04429
2.00	27.8000	25.00	3.8125	31.6125	74.69	0.013060	11.9	0.03186
5.00	26.7000	25.00	3.8125	30.5125	72.09	0.013060	12.0	0.02023
10.00	25.0000	25.00	3.8125	28.8125	68.07	0.013060	12.2	0.01443
15.00	23.0000	25.00	3.8125	26.8125	63.35	0.013060	12.5	0.01192
30.00	22.5000	25.00	3.8125	26.3125	62.17	0.013060	12.7	0.00850
60.00	20.1000	25.00	3.8125	23.9125	56.50	0.013060	13.0	0.00608
120.00	17.1000	25.00	3.8125	20.9125	49.41	0.013060	13.5	0.00438
240.00	15.0000	25.00	3.8125	18.8125	44.45	0.013060	13.8	0.00313
1440.00	9.9000	25.80	3.5702	13.4702	31.83	0.012900	14.8	0.00131
2880.00	9.0000	25.00	3.8125	12.8125	30.27	0.013060	14.8	0.00094

## Summary of results

Method	Diameter	% passing
Wet sieving	8.0000	100.00%
	6.3000	100.00%
	5.6000	100.00%
	4.0000	100.00%
	2.0000	100.00%
	1.0000	100.00%
	0.5000	99.80%
	0.2500	99.80%
	0.1250	99.76%
	0.0630	99.09%
Hydrometer analysis	0.0443	78.00%
	0.0319	74.69%
	0.0202	72.09%
	0.0144	68.07%
	0.0119	63.35%
	0.0085	62.17%
	0.0061	56.50%
	0.0044	49.41%
	0.0031	44.45%
	0.0013	31.83%
	0.0009	30.27%

## Size fractions

	passing	fraction
Clay	36.62%	<b>36.62%</b>
Silt	95.71%	<b>59.09%</b>
Sand		<b>4.29%</b>

Maximum particle size **0.5** mm

Visible particle shape

Not Applicable

Visible particle hardness

Not Applicable

Difficulty in dispersing 2mm fraction

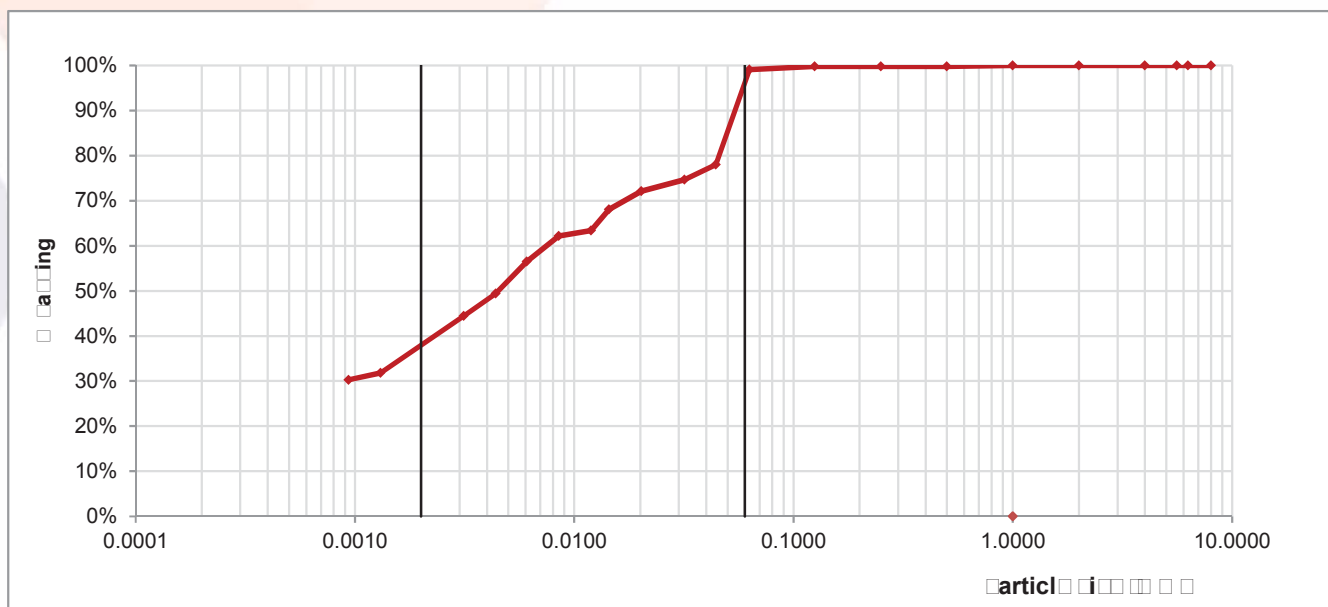
none

Dispersion device used

high speed mixer with stirring paddles

Dispersion period

1 minute



Operator	J. AZ.
Approved	A. M.

## Particle-Size Analysis of soil

to ASTM D422 1998

Client Location: Siemens Industrial Turbomachinery AB  
Delimara Power Station - New Combined Cycle Power Plant

Soil: Olive (5Y 4/3), marl - microfractured bands splitting horizontally along bedding, fine grained, moderately weak, globigerina.

Job Ref: J1057  
Borehole/Pit Ref: BH19  
Sample No: S14/0080  
Depth (m): 9.8  
Date tested: 08/08/2014  
Report No: 236

Method of preparation: Sampled from extracted borehole core, 300g, then dissolved in water by continuous stirring for more than 24 hours and wet sieved using distilled water, dried in oven for 24hrs, then dry sieved, crushed with pestle and mortar and then sampled for sedimentation .

### Wet sieving

Sieve	aperture	mass of sieve	mass of sieve & retained	mass of soil retained	mass of soil passing	% passing
	microns	g	g	g	g	
	8000	0.00	0.00	0.00	371.14	100.00%
	6300	0.00	0.00	0.00	371.14	100.00%
	5600	0.00	0.00	0.00	371.14	100.00%
	4000	0.00	0.00	0.00	371.14	100.00%
	2000	0.00	0.00	0.00	371.14	100.00%
18	1000	0.00	0.00	0.00	371.14	100.00%
40	500	276.26	276.43	0.17	370.97	99.95%
60	250	268.28	268.64	0.36	370.61	99.86%
100	125	260.21	264.00	3.79	366.82	98.84%
200	63	257.60	260.41	2.81	364.01	98.08%
pan		203.26	567.27	364.01		

plastic container 203.26 g  
plastic container + dry soil passing 63 micron 587.06 g

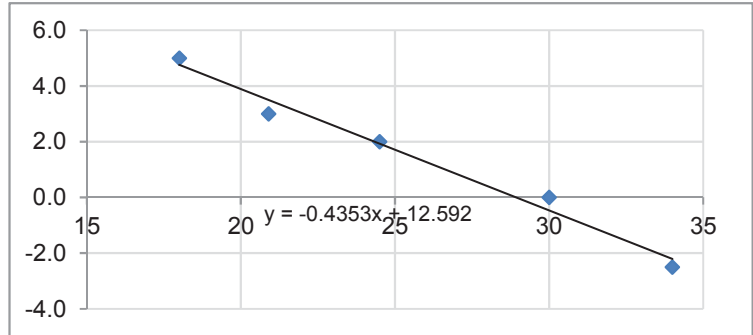
passing 63 microns 364.01 g  
remaining in pan after drying sieves 0 g  
total passing 200 364.01 g - equivalent to 98.08% of total  
total mass of soil (dry) 371.14 g

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**Composite correction for Hydrometer reading**

(dispersant+effect of variation in temperature+meniscus correction)

Temp.	Hydro- meter
°C	
18.00	5.0000
20.90	3.0000
24.50	2.0000
30.00	0.0000
34.00	-2.5000



Specific gravity of soil particles

2.682

Hydrometer used

152H

**Sedimentation test**

Container for sedimentation specimen

80.2 g

Container + dry specimen

121.12 g

mass passing 63 $\mu$  used for sedimentation

40.92

g - equivalent to

98.08% of 41.72g

mass of total sample represented by mass used in hydrometer test

W

41.72 g

**Sedimentation**

Time	Hydrometer reading	Temp. °C	Hydrometer correction	Hydro- meter reading corrected	% of soil remaining in suspension %	Constant K (depending on temp and Gs)	L cm	D mm
min		°C						
0.00	33.0000	24.60						
1.00	30.0000	24.50	3.9640	33.9640	81.41	0.012915	11.4	0.04361
2.00	27.0000	24.40	3.9942	30.9942	74.29	0.012934	11.9	0.03155
5.00	25.0000	24.80	3.8731	28.8731	69.20	0.012858	12.2	0.02008
10.00	22.5000	24.90	3.8428	26.3428	63.14	0.012839	12.7	0.01447
15.00	21.0000	24.90	3.8428	24.8428	59.54	0.012839	12.9	0.01191
30.00	17.5000	24.90	3.8428	21.3428	51.16	0.012839	13.5	0.00861
60.00	14.5000	25.00	3.8125	18.3125	43.89	0.012860	14.0	0.00621
120.00	12.1000	25.00	3.8125	15.9125	38.14	0.012860	14.3	0.00444
240.00	10.1000	25.00	3.8125	13.9125	33.35	0.012860	14.7	0.00318
1440.00	6.5000	25.00	3.8125	10.3125	24.72	0.012860	15.3	0.00133
2880.00	5.5000	25.30	3.7216	9.2216	22.10	0.012803	15.5	0.00094



## Summary of results

Method	Diameter	% passing
Wet sieving	8.0000	100.00%
	6.3000	100.00%
	5.6000	100.00%
	4.0000	100.00%
	2.0000	100.00%
	1.0000	100.00%
	0.5000	99.95%
	0.2500	99.86%
	0.1250	98.84%
	0.0630	98.08%
Hydrometer analysis	0.0436	81.41%
	0.0315	74.29%
	0.0201	69.20%
	0.0145	63.14%
	0.0119	59.54%
	0.0086	51.16%
	0.0062	43.89%
	0.0044	38.14%
	0.0032	33.35%
	0.0013	24.72%
	0.0009	22.10%

## Size fractions

	passing	fraction
Clay	27.85%	<b>27.85%</b>
Silt	95.50%	<b>67.65%</b>
Sand		<b>4.50%</b>

Maximum particle size **0.5** mm

Visible particle shape

Not Applicable

Visible particle hardness

Not Applicable

Difficulty in dispersing 2mm fraction

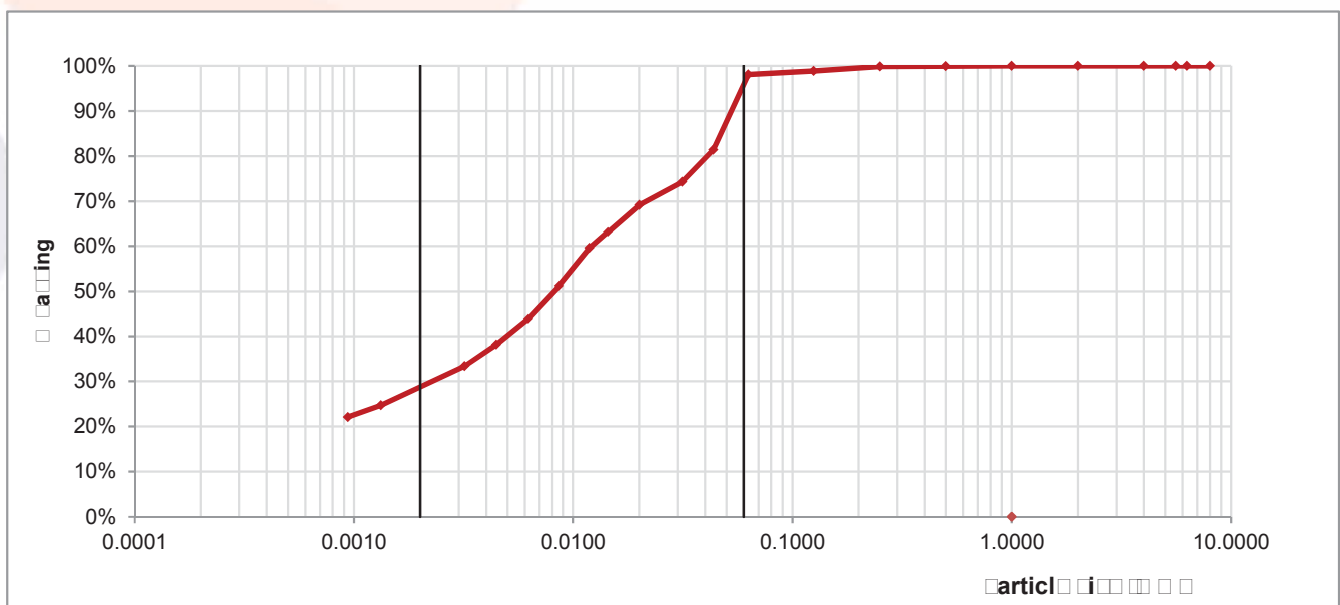
none

Dispersion device used

high speed mixer with stirring paddles

Dispersion period

1 minute



Operator	J. AZ.
Approved	A. M.

## Particle-Size Analysis of soil

to ASTM D422 1998

Client Location: Siemens Industrial Turbomachinery AB  
 Delimara Power Station - New Combined Cycle Power Plant

Soil: Olive (5Y 4/3) marl, fine grained, moderately weak globigerina

Job Ref: J1057  
 Borehole/Pit Ref: BH13  
 Sample No: S14/0079  
 Depth (m): 8.6  
 Date tested: 08/08/2014  
 Report No: 237

Method of preparation: Sampled from extracted borehole core, 300g, then dissolved in water by continuous stirring for more than 24 hours and wet sieved using distilled water, dried in oven for 24hrs, then dry sieved, crushed with pestle and mortar and then sampled for sedimentation .

### Wet sieving

Sieve	aperture	mass of sieve	mass of sieve & retained	mass of soil retained	mass of soil passing	% passing
	microns	g	g	g	g	
	8000	0.00	0.00	0.00	399.83	100.00%
	6300	0.00	0.00	0.00	399.83	100.00%
	5600	0.00	0.00	0.00	399.83	100.00%
	4000	0.00	0.00	0.00	399.83	100.00%
	2000	0.00	0.00	0.00	399.83	100.00%
18	1000	344.16	344.18	0.02	399.81	99.99%
40	500	447.95	451.41	3.46	396.35	99.13%
60	250	276.26	278.84	2.58	393.77	98.48%
100	125	268.28	269.95	1.67	392.1	98.07%
200	63	257.60	265.90	8.30	383.8	95.99%
pan		203.26	587.06	383.8		

plastic container 203.26 g

plastic container + dry soil passing 63 micron 587.06 g

passing 63 microns 383.8 g

remaining in pan after drying sieves 0 g

total passing 200 383.8 g - equivalent to 95.99% of total

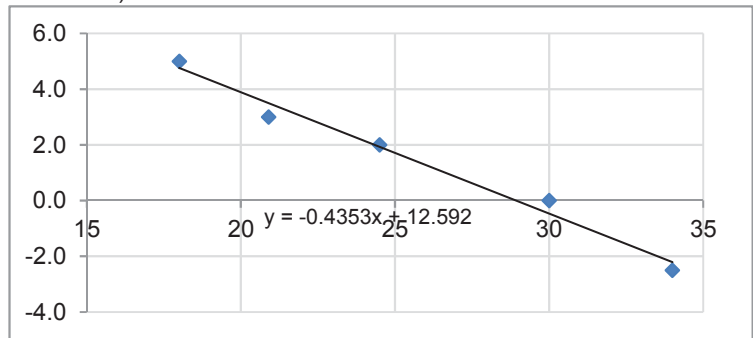
total mass of soil (dry) 399.83 g

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**Composite correction for Hydrometer reading**

(dispersant+effect of variation in temperature+meniscus correction)

Temp.	Hydro- meter
°C	
18.00	5.0000
20.90	3.0000
24.50	2.0000
30.00	0.0000
34.00	-2.5000



Specific gravity of soil particles

2.640

Hydrometer used

152H

**Sedimentation test**

Container for sedimentation specimen

80.2 g

Container + dry specimen

120.69 g

mass passing 63 $\mu$  used for sedimentation

40.49

g - equivalent to

95.99% of 42.18g

mass of total sample represented by mass used in hydrometer test

W

42.18 g

**Sedimentation**

Time	Hydrometer reading	Temp.	Hydrometer correction	Hydro- meter reading corrected	% of soil remaining in suspension	Constant K (depending on temp and Gs)	L	D
min		°C			%		cm	mm
0.00	28.0000	24.50						
1.00	26.0000	24.40	3.9942	29.9942	71.11	0.013130	12.0	0.04548
2.00	23.0000	24.30	4.0245	27.0245	64.07	0.013150	12.5	0.03288
5.00	21.0000	24.80	3.8731	24.8731	58.97	0.013050	12.9	0.02096
10.00	19.0000	25.00	3.8125	22.8125	54.08	0.013060	13.2	0.01501
15.00	17.0000	25.00	3.8125	20.8125	49.34	0.013060	13.5	0.01239
30.00	15.0000	24.90	3.8428	18.8428	44.67	0.013030	13.8	0.00884
60.00	12.8000	24.90	3.8428	16.6428	39.46	0.013030	14.3	0.00636
120.00	11.0000	25.00	3.8125	14.8125	35.12	0.013060	14.5	0.00454
240.00	9.2000	25.20	3.7519	12.9519	30.71	0.013020	14.8	0.00323
1440.00	6.1000	25.00	3.8125	9.9125	23.50	0.013060	15.3	0.00135
2880.00	5.9000	25.50	3.6611	9.5611	22.67	0.012960	15.5	0.00095

## Summary of results

Method	Diameter	% passing
Wet sieving	8.0000	100.00%
	6.3000	100.00%
	5.6000	100.00%
	4.0000	100.00%
	2.0000	100.00%
	1.0000	99.99%
	0.5000	99.13%
	0.2500	98.48%
	0.1250	98.07%
	0.0630	95.99%
Hydrometer analysis	0.0455	71.11%
	0.0329	64.07%
	0.0210	58.97%
	0.0150	54.08%
	0.0124	49.34%
	0.0088	44.67%
	0.0064	39.46%
	0.0045	35.12%
	0.0032	30.71%
	0.0013	23.50%
	0.0010	22.67%

## Size fractions

	passing	fraction
Clay	26.00%	<b>26.00%</b>
Silt	91.73%	<b>65.73%</b>
Sand		<b>8.27%</b>

Maximum particle size **1** mm

Visible particle shape

Not Applicable

Visible particle hardness

Not Applicable

Difficulty in dispersing 2mm fraction

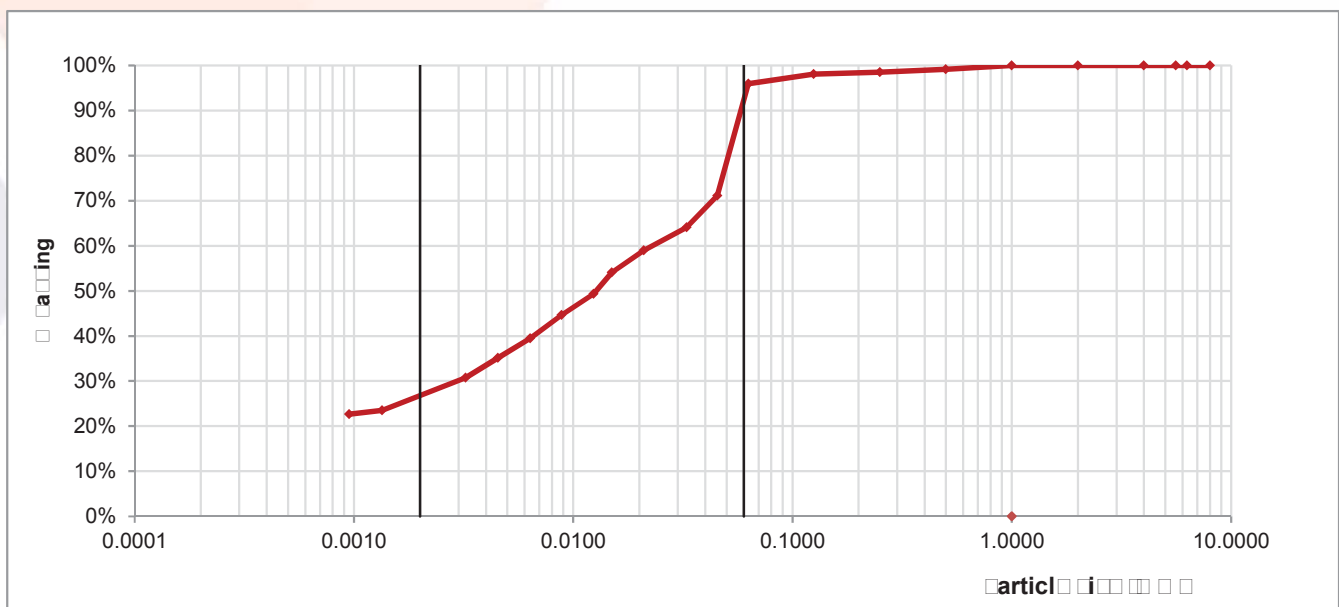
none

Dispersion device used

high speed mixer with stirring paddles

Dispersion period

1 minute



Operator	J. AZ.
Approved	A. M.



## Particle-Size Analysis of soil

to ASTM D422 1998

Client Location	Siemens Industrial Turbomachinery AB Delimara Power Station - New Combined Cycle Power Plant	Job Ref:	J1057
		Borehole/Pit Ref:	BH3
		Sample No:	S14/0069
Soil	Light grey (2.5Y 7/1), very stiff to very weak, fine grained, marl, globigerina	Depth (m)	6.7
		Date tested	04/07/2014
		Report No:	238

Method of preparation: Sampled from extracted borehole core, 300g, then dissolved in water by continuous stirring for more than 24 hours and wet sieved using distilled water, dried in oven for 24hrs, then dry sieved, crushed with pestle and mortar and then sampled for sedimentation.

### Wet sieving

Sieve	aperture	mass of sieve	mass of sieve & retained	mass of soil retained		mass of soil passing	% passing
	microns	g	g	g		g	
	8000	0.00	0.00	0.00		272.24	100.00%
	6300	0.00	0.00	0.00		272.24	100.00%
	5600	0.00	0.00	0.00		272.24	100.00%
	4000	0.00	0.00	0.00		272.24	100.00%
	2000	289.88	290.51	0.63	Soil	271.61	99.77%
18	1000	267.55	268.02	0.47	Soil	271.14	99.60%
40	500	447.88	448.47	0.59	Soil	270.55	99.38%
60	250	276.40	276.57	0.17	Soil	270.38	99.32%
100	125	268.50	272.46	3.96	Soil	266.42	97.86%
200	63	257.61	269.08	11.47		254.95	93.65%
pan		542.07	797.02	254.95			

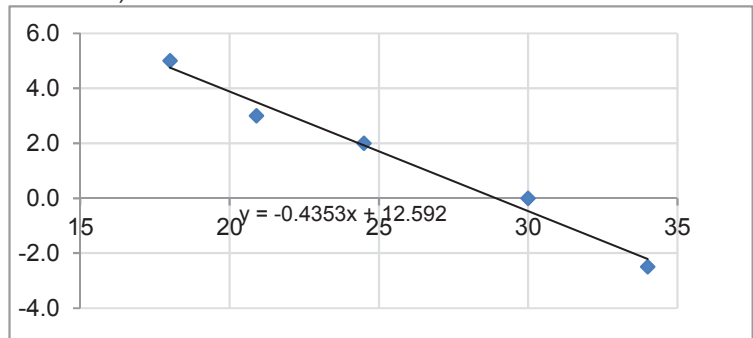
plastic container	542.07	g		
plastic container + dry soil passing 63 micron	797.02	g		
passing 63 microns	254.95	g		
remaining in pan after drying sieves	0	g		
total passing 200	254.95	g	- equivalent to	93.65% of total
total mass of soil (dry)	272.24	g		

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**Composite correction for Hydrometer reading**

(dispersant+effect of variation in temperature+meniscus correction)

Temp.	Hydro- meter
°C	
18.00	5.0000
20.90	3.0000
24.50	2.0000
30.00	0.0000
34.00	-2.5000



Specific gravity of soil particles

2.588

Hydrometer used

152H

**Sedimentation test**

Container for sedimentation specimen

37.35 g

Container + dry specimen

77.87 g

mass passing 63 $\mu$  used for sedimentation

40.52

g - equivalent to

93.65% of 43.27g

mass of total sample represented by mass used in hydrometer test

W

43.27 g

**Sedimentation**

Time	Hydrometer reading	Temp. °C	Hydrometer correction	Hydro- meter reading corrected	% of soil remaining in suspension %	Constant K (depending on temp and Gs)	L cm	D mm
min								
0.00	35.0000	24.80						
1.00	33.0000	24.80	3.8731	36.8731	85.22	0.013252	10.9	0.04375
2.00	30.0000	24.80	3.8731	33.8731	78.29	0.013252	11.4	0.03164
5.00	29.0000	24.90	3.8428	32.8428	75.91	0.013231	11.5	0.02007
10.00	27.0000	25.00	3.8125	30.8125	71.21	0.013270	11.9	0.01448
15.00	25.0000	25.00	3.8125	28.8125	66.59	0.013270	12.2	0.01197
30.00	21.0000	25.00	3.8125	24.8125	57.35	0.013270	12.9	0.00870
60.00	18.5000	25.00	3.8125	22.3125	51.57	0.013270	13.3	0.00625
120.00	16.0000	25.00	3.8125	19.8125	45.79	0.013270	13.7	0.00448
240.00	13.0000	25.00	3.8125	16.8125	38.86	0.013270	14.2	0.00323
1440.00	9.0000	25.00	3.8125	12.8125	29.61	0.013270	14.8	0.00135
2880.00	7.0000	25.00	3.8125	10.8125	24.99	0.013270	15.2	0.00096

## Summary of results

Method	Diameter	% passing
Wet sieving	8.0000	100.00%
	6.3000	100.00%
	5.6000	100.00%
	4.0000	100.00%
	2.0000	99.77%
	1.0000	99.60%
	0.5000	99.38%
	0.2500	99.32%
	0.1250	97.86%
	0.0630	93.65%
Hydrometer analysis	0.0438	85.22%
	0.0316	78.29%
	0.0201	75.91%
	0.0145	71.21%
	0.0120	66.59%
	0.0087	57.35%
	0.0062	51.57%
	0.0045	45.79%
	0.0032	38.86%
	0.0013	29.61%
	0.0010	24.99%

## Size fractions

	passing	fraction
Clay	32.83%	<b>32.83%</b>
Silt	92.34%	<b>59.51%</b>
Sand		<b>7.66%</b>

Maximum particle size **2** mm

Visible particle shape

Not Applicable

Visible particle hardness

Not Applicable

Difficulty in dispersing 2mm fraction

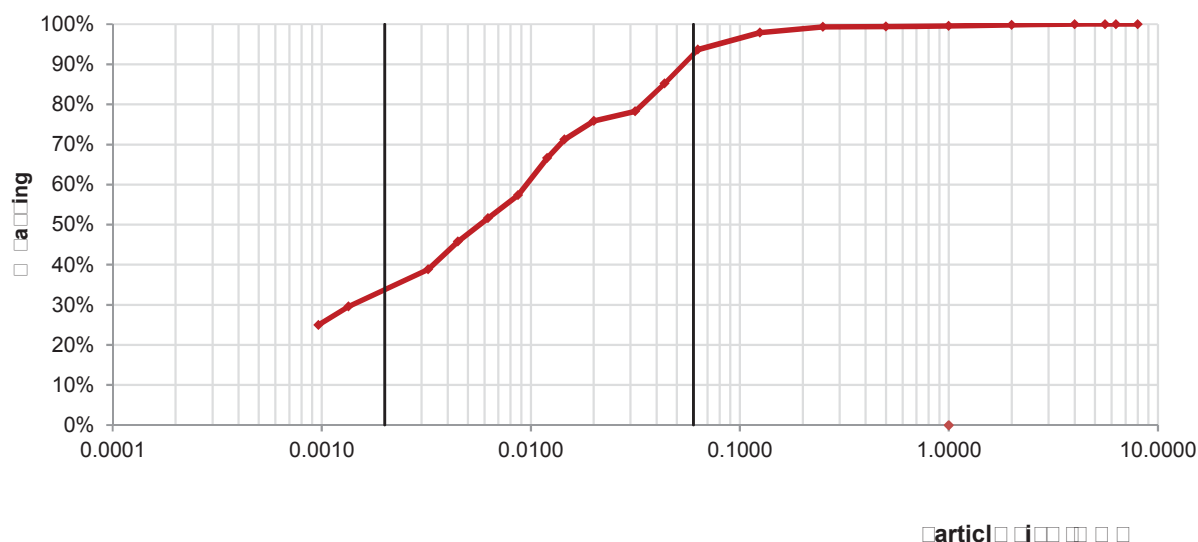
none

Dispersion device used

high speed mixer with stirring paddles

Dispersion period

1 minute



Operator	A. F.
Approved	A. M.

## Particle-Size Analysis of soil

to ASTM D422 1998

Client Location: Siemens Industrial Turbomachinery AB  
Delimara Power Station - New Combined Cycle Power Plant

Soil: Very weak (rock), olive (5Y 4/3), fine grained, marl - consists of hard lumps in stiff clay matrix.

Job Ref: J1057  
Borehole/Pit Ref: BH2  
Sample No: S14/0068  
Depth (m): 8.8  
Date tested: 04/07/2014  
Report No: 239

Method of preparation: Sampled from extracted borehole core, 300g, then dissolved in water by continuous stirring for more than 24 hours and wet sieved using distilled water, dried in oven for 24hrs, then dry sieved, crushed with pestle and mortar and then sampled for sedimentation .

### Wet sieving

Sieve	aperture	mass of sieve	mass of sieve & retained	mass of soil retained	mass of soil passing	% passing
	microns	g	g	g	g	
	8000	0.00	0.00	0.00	224.03	100.00%
	6300	0.00	0.00	0.00	224.03	100.00%
	5600	0.00	0.00	0.00	224.03	100.00%
	4000	0.00	0.00	0.00	224.03	100.00%
	2000	289.88	290.08	0.20	223.83	99.91%
18	1000	267.55	268.24	0.69	223.14	99.60%
40	500	447.88	448.30	0.42	222.72	99.42%
60	250	276.40	278.27	1.87	220.85	98.58%
100	125	268.50	270.25	1.75	219.1	97.80%
200	63	257.61	263.25	5.64	213.46	95.28%
pan		465.79	679.25	213.46		

plastic container 465.79 g  
plastic container + dry soil passing 63 micron 679.25 g

passing 63 microns 213.46 g  
remaining in pan after drying sieves 0 g  
total passing 200 213.46 g - equivalent to 95.28% of total  
total mass of soil (dry) **224.03** g

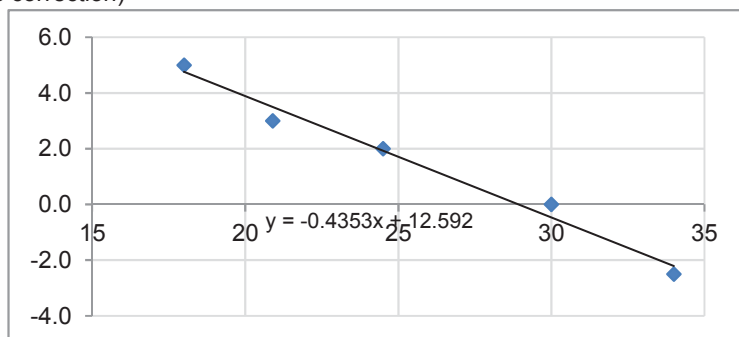
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**Composite correction for Hydrometer reading**

(dispersant+effect of variation in temperature+meniscus correction)

Temp.	Hydro- meter
°C	
18.00	5.0000
20.90	3.0000
24.50	2.0000
30.00	0.0000
34.00	-2.5000



Specific gravity of soil particles

2.588

Hydrometer used

152H

**Sedimentation test**

Container for sedimentation specimen

37.35 g

Container + dry specimen

77.87 g

mass passing 63 $\mu$  used for sedimentation

40.52

g - equivalent to

95.28% of 42.53g

mass of total sample represented by mass used in hydrometer test

W

42.53 g

**Sedimentation**

Time	Hydrometer reading	Temp.	Hydrometer correction	Hydro- meter reading corrected	% of soil remaining in suspension	Constant K (depending on temp and Gs)	L	D
min		°C			%		cm	mm
0.00	19.0000	24.80						
1.00	15.0000	24.80	3.8731	18.8731	44.38	0.013252	13.8	0.04923
2.00	14.5000	24.80	3.8731	18.3731	43.20	0.013252	14.0	0.03506
5.00	14.0000	24.90	3.8428	17.8428	41.96	0.013231	14.0	0.02214
10.00	13.5000	25.00	3.8125	17.3125	40.71	0.013270	14.2	0.01581
15.00	13.0000	25.00	3.8125	16.8125	39.53	0.013270	14.2	0.01291
30.00	11.5000	25.00	3.8125	15.3125	36.01	0.013270	14.5	0.00923
60.00	10.0000	25.00	3.8125	13.8125	32.48	0.013270	14.7	0.00657
120.00	8.5000	25.00	3.8125	12.3125	28.95	0.013270	15.0	0.00469
240.00	7.5000	25.00	3.8125	11.3125	26.60	0.013270	15.2	0.00334
1440.00	6.0000	25.00	3.8125	9.8125	23.07	0.013270	15.3	0.00137
2880.00	5.0000	25.00	3.8125	8.8125	20.72	0.013270	15.5	0.00097

## Summary of results

Method	Diameter	% passing
Wet sieving	8.0000	100.00%
	6.3000	100.00%
	5.6000	100.00%
	4.0000	100.00%
	2.0000	99.91%
	1.0000	99.60%
	0.5000	99.42%
	0.2500	98.58%
	0.1250	97.80%
	0.0630	95.28%
Hydrometer analysis	0.0492	44.38%
	0.0351	43.20%
	0.0221	41.96%
	0.0158	40.71%
	0.0129	39.53%
	0.0092	36.01%
	0.0066	32.48%
	0.0047	28.95%
	0.0033	26.60%
	0.0014	23.07%
	0.0010	20.72%

## Size fractions

	passing	fraction
Clay	24.20%	<b>24.20%</b>
Silt	84.19%	<b>59.99%</b>
Sand		<b>15.81%</b>

Maximum particle size **2** mm

Visible particle shape

Not Applicable

Visible particle hardness

Not Applicable

Difficulty in dispersing 2mm fraction

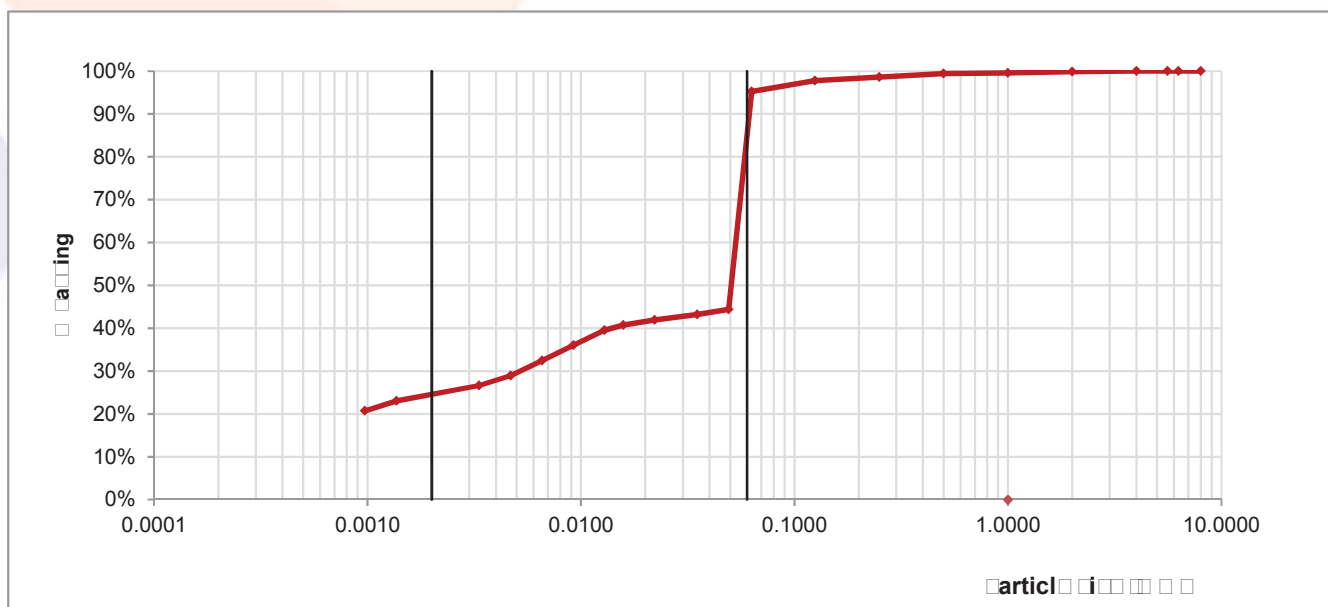
none

Dispersion device used

high speed mixer with stirring paddles

Dispersion period

1 minute



Operator	A. F.
Approved	A. M.

## Particle-Density Analysis

to BS 1377-2:1990:4.3/4.4

Client Location Siemens Industrial Turbomachinery AB  
Delimara Power Station - New Combined Cycle Power Plant

Soil Olive (5Y 4/3) Marl, fine Grained, moderately weak globigerina.

Job Ref: J1057  
Borehole/Pit Ref: BH32  
Sample No: 14/0139  
Depth (m): 13.9m  
Date tested: 29/08/2014  
Report No: 240

Method of preparation 100g of mallet - crushed material, oven dried at 105°C, sieved through 500µm, riffled into two identical specimens.

### Small Pycnometer

Specimen reference						
Pycnometer ref/number			1	2	xxx	xxx
Mass of bottle + soil + water	m <sub>3</sub>	g	86.548	86.069	0.000	0.000
Mass of bottle + soil	m <sub>2</sub>	g	38.556	38.437	0.000	0.000
Mass of bottle full of water	m <sub>4</sub>	g	82.843	82.358	0.000	0.000
Mass of bottle	m <sub>1</sub>	g	32.555	32.436	0.000	0.000
Mass of soil	m <sub>2</sub> -m <sub>1</sub>	g	6.001	6.001	0.000	0.000
Mass of water in full bottle	m <sub>4</sub> -m <sub>1</sub>	g	50.288	49.922	0.000	0.000
Mass of water used	m <sub>3</sub> -m <sub>2</sub>	g	47.991	47.632	0.000	0.000
Volume of particles	(m <sub>4</sub> -m <sub>1</sub> )-(m <sub>3</sub> -m <sub>2</sub> )	mL	2.297	2.291	0.000	0.000
Particle density	(m <sub>2</sub> -m <sub>1</sub> )/ (m <sub>4</sub> -m <sub>1</sub> )-(m <sub>3</sub> -m <sub>2</sub> )	Mg/m <sup>3</sup>	2.613	2.620	0.000	0.000
Average value	ρ <sub>s</sub>	Mg/m <sup>3</sup>	2.617			

Operator	J. AZ.
Approved	A. M.

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VAT No.: MT 1695 3537

Directors: Paolo Bugeja  
Gordon Baldacchino

## Particle-Density Analysis

to BS 1377-2:1990:4.3/4.4

Client Location Siemens Industrial Turbomachinery AB  
Delimara Power Station - New Combined Cycle Power Plant

Soil Olive (5Y 4/3) Marl, fine Grained, moderately weak globigerina.

Job Ref: J1057  
Borehole/Pit Ref: BH32  
Sample No: S14/0128  
Depth (m): 8.9m  
Date tested: 29/07/2014  
Report No: 241

Method of preparation 100g of mallet - crushed material, oven dried at 105°C, sieved through 500µm, riffled into two identical specimens.

### Small Pycnometer

Specimen reference						
Pycnometer ref/number			1	2	xxx	xxx
Mass of bottle + soil + water	$m_3$	g	92.153	92.220	0.000	0.000
Mass of bottle + soil	$m_2$	g	43.105	42.447	0.000	0.000
Mass of bottle full of water	$m_4$	g	88.443	88.505	0.000	0.000
Mass of bottle	$m_1$	g	37.104	36.447	0.000	0.000
Mass of soil	$m_2 - m_1$	g	6.001	6.000	0.000	0.000
Mass of water in full bottle	$m_4 - m_1$	g	51.339	52.057	0.000	0.000
Mass of water used	$m_3 - m_2$	g	49.049	49.772	0.000	0.000
Volume of particles	$(m_4 - m_1) - (m_3 - m_2)$	mL	2.290	2.285	0.000	0.000
Particle density	$(m_2 - m_1) / ((m_4 - m_1) - (m_3 - m_2))$	Mg/m <sup>3</sup>	2.620	2.626	0.000	0.000
Average value	$\rho_s$	Mg/m <sup>3</sup>	2.623			

Operator	J. AZ.
Approved	A. M.

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Directors: Paolo Bugeja  
Gordon Baldecchino



## Particle-Density Analysis

to BS 1377-2:1990:4.3/4.4

Client Location Siemens Industrial Turbomachinery AB  
Delimara Power Station - New Combined Cycle Power Plant

Soil Olive (5Y 4/3), marl, fine grained, moderately weak, globigerina.

Job Ref: J1057  
Borehole/Pit Ref: BH30  
Sample No: S14/0082  
Depth (m): 11.4  
Date tested: 11/07/2014  
Report No: 242

Method of preparation 100g of mallet - crushed material, oven dried at 105°C, sieved through 500µm, riffled into two identical specimens.

### Small Pycnometer

Specimen reference						
Pycnometer ref/number			1	2	XXX	XXX
Mass of bottle + soil + water	$m_3$	g	91.956	92.412	0.000	0.000
Mass of bottle + soil	$m_2$	g	42.825	42.329	0.000	0.000
Mass of bottle full of water	$m_4$	g	88.244	88.694	0.000	0.000
Mass of bottle	$m_1$	g	36.801	36.305	0.000	0.000
Mass of soil	$m_2 - m_1$	g	6.024	6.024	0.000	0.000
Mass of water in full bottle	$m_4 - m_1$	g	51.443	52.389	0.000	0.000
Mass of water used	$m_3 - m_2$	g	49.132	50.083	0.000	0.000
Volume of particles	$(m_4 - m_1) - (m_3 - m_2)$	mL	2.312	2.306	0.000	0.000
Particle density	$(m_2 - m_1) / ((m_4 - m_1) - (m_3 - m_2))$	Mg/m <sup>3</sup>	<b>2.606</b>	<b>2.612</b>	<b>0.000</b>	<b>0.000</b>
Average value	$\rho_s$	Mg/m <sup>3</sup>	<b>2.609</b>			

Operator	A. F.
Approved	A. M.

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Co. No.: C 33162  
VAT No.: MT 1695 3537

Directors: Paolo Bugeja  
Gordon Baldecchino

## Particle-Density Analysis

to BS 1377-2:1990:4.3/4.4

Client Location Siemens Industrial Turbomachinery AB  
 Delimara Power Station - New Combined Cycle Power Plant

Soil Greenish-black, hard, fine grained clay.

Job Ref: J1057  
 Borehole/Pit Ref: BH27a  
 Sample No: S14/0128  
 Depth (m): 14.5m  
 Date tested: 05/08/2014  
 Report No: 243

Method of preparation 100g of mallet - crushed material, oven dried at 105°C, sieved through 63µm, riffled into two identical specimens.

### Small Pycnometer

Specimen reference						
Pycnometer ref/number			1	2	xxx	xxx
Mass of bottle + soil + water	m <sub>3</sub>	g	86.030	86.603	0.000	0.000
Mass of bottle + soil	m <sub>2</sub>	g	38.340	38.650	0.000	0.000
Mass of bottle full of water	m <sub>4</sub>	g	82.338	82.908	0.000	0.000
Mass of bottle	m <sub>1</sub>	g	32.341	32.648	0.000	0.000
Mass of soil	m <sub>2</sub> -m <sub>1</sub>	g	5.999	6.002	0.000	0.000
Mass of water in full bottle	m <sub>4</sub> -m <sub>1</sub>	g	49.997	50.260	0.000	0.000
Mass of water used	m <sub>3</sub> -m <sub>2</sub>	g	47.690	47.953	0.000	0.000
Volume of particles	(m <sub>4</sub> -m <sub>1</sub> )-(m <sub>3</sub> -m <sub>2</sub> )	mL	2.307	2.307	0.000	0.000
Particle density	(m <sub>2</sub> -m <sub>1</sub> )/ (m <sub>4</sub> -m <sub>1</sub> )-(m <sub>3</sub> -m <sub>2</sub> )	Mg/m <sup>3</sup>	2.601	2.602	0.000	0.000
Average value	ρ <sub>s</sub>	Mg/m <sup>3</sup>	2.601			

Operator	J. AZ.
Approved	A. M.

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## Particle-Density Analysis

to BS 1377-2:1990:4.3/4.4

Client Location Siemens Industrial Turbomachinery AB  
Delimara Power Station - New Combined Cycle Power Plant

Soil Greenish-black, hard, fine grained clay.

Job Ref: J1057  
Borehole/Pit Ref: BH27a  
Sample No: S14/0129  
Depth (m): 9.7m  
Date tested: 05/08/2014  
Report No: 244

Method of preparation 100g of mallet - crushed material, oven dried at 105°C, sieved through 63µm, riffled into two identical specimens.

### Small Pycnometer

Specimen reference						
Pycnometer ref/number			1	2	xxx	xxx
Mass of bottle + soil + water	$m_3$	g	85.933	86.393	0.000	0.000
Mass of bottle + soil	$m_2$	g	38.129	38.225	0.000	0.000
Mass of bottle full of water	$m_4$	g	82.190	82.652	0.000	0.000
Mass of bottle	$m_1$	g	32.130	32.225	0.000	0.000
Mass of soil	$m_2 - m_1$	g	5.998	6.000	0.000	0.000
Mass of water in full bottle	$m_4 - m_1$	g	50.059	50.427	0.000	0.000
Mass of water used	$m_3 - m_2$	g	47.804	48.168	0.000	0.000
Volume of particles	$(m_4 - m_1) - (m_3 - m_2)$	mL	2.255	2.259	0.000	0.000
Particle density	$(m_2 - m_1) / ((m_4 - m_1) - (m_3 - m_2))$	Mg/m <sup>3</sup>	2.660	2.656	0.000	0.000
Average value	$\rho_s$	Mg/m <sup>3</sup>	2.658			

Operator	J. AZ.
Approved	A. M.

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Co. No.: C 33162  
VAT No.: MT 1695 3537

Directors: Paolo Bugeja  
Gordon Baldacchino

## Particle-Density Analysis

to BS 1377-2:1990:4.3/4.4

Client Siemens Industrial Turbomachinery AB  
Location Delimara Power Station - New Combined Cycle Power Plant  
Soil Greenish-black, hard, fine grained clay.

Job Ref: J1057  
Borehole/Pit Ref: BH26  
Sample No: S14/0130  
Depth (m) 11.5m  
Date tested 05/08/2014  
Report No: 245

Method of preparation 100g of mallet - crushed material, oven dried at 105°C, sieved through 63µm, riffled into two identical specimens.

### Small Pycnometer

Specimen reference						
Pycnometer ref/number			1	2	xxx	xxx
Mass of bottle + soil + water	$m_3$	g	92.186	92.231	0.000	0.000
Mass of bottle + soil	$m_2$	g	43.105	42.448	0.000	0.000
Mass of bottle full of water	$m_4$	g	88.459	88.517	0.000	0.000
Mass of bottle	$m_1$	g	37.103	36.447	0.000	0.000
Mass of soil	$m_2 - m_1$	g	6.002	6.001	0.000	0.000
Mass of water in full bottle	$m_4 - m_1$	g	51.356	52.070	0.000	0.000
Mass of water used	$m_3 - m_2$	g	49.081	49.783	0.000	0.000
Volume of particles	$(m_4 - m_1) - (m_3 - m_2)$	mL	2.275	2.287	0.000	0.000
Particle density	$(m_2 - m_1) / ((m_4 - m_1) - (m_3 - m_2))$	Mg/m <sup>3</sup>	2.639	2.624	0.000	0.000
Average value	$\rho_s$	Mg/m <sup>3</sup>	2.631			

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## Particle-Density Analysis

to BS 1377-2:1990:4.3/4.4

Client Location  
Siemens Industrial Turbomachinery AB  
Delimara Power Station - New Combined  
Cycle Power Plant

Soil  
Marl - microfractured at 12.7m, fine  
grained, moderately weak globigerina.

Job Ref: J1057  
Borehole/Pit Ref: BH28  
Sample No: S14/0136  
Depth (m): 12.7m  
Date tested: 29/07/2014  
Report No: 246

Method of preparation 100g of mallet - crushed material, oven dried at 105°C, sieved through 500µm, riffled into two identical specimens.

### Small Pycnometer

Specimen reference						
Pycnometer ref/number			1	2	xxx	xxx
Mass of bottle + soil + water	$m_3$	g	85.899	86.349	0.000	0.000
Mass of bottle + soil	$m_2$	g	38.130	38.226	0.000	0.000
Mass of bottle full of water	$m_4$	g	82.164	82.631	0.000	0.000
Mass of bottle	$m_1$	g	32.130	32.226	0.000	0.000
Mass of soil	$m_2 - m_1$	g	6.000	6.000	0.000	0.000
Mass of water in full bottle	$m_4 - m_1$	g	50.034	50.405	0.000	0.000
Mass of water used	$m_3 - m_2$	g	47.769	48.123	0.000	0.000
Volume of particles	$(m_4 - m_1) - (m_3 - m_2)$	mL	2.265	2.282	0.000	0.000
Particle density	$(m_2 - m_1) / ((m_4 - m_1) - (m_3 - m_2))$	Mg/m <sup>3</sup>	2.649	2.629	0.000	0.000
Average value	$\rho_s$	Mg/m <sup>3</sup>	2.639			

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## Particle-Density Analysis

to BS 1377-2:1990:4.3/4.4

Client Location Siemens Industrial Turbomachinery AB  
Delimara Power Station - New Combined Cycle Power Plant

Soil Marl, fine grained, moderately weak globigerina.

Job Ref: J1057  
Borehole/Pit Ref: BH28  
Sample No: S14/0137  
Depth (m): 7.7m  
Date tested: 29/07/2014  
Report No: 246

Method of preparation 100g of mallet - crushed material, oven dried at 105°C, sieved through 500µm, riffled into two identical specimens.

### Small Pycnometer

Specimen reference						
Pycnometer ref/number			1	2	xxx	xxx
Mass of bottle + soil + water	$m_3$	g	91.991	92.430	0.000	0.000
Mass of bottle + soil	$m_2$	g	42.797	43.305	0.000	0.000
Mass of bottle full of water	$m_4$	g	88.264	88.705	0.000	0.000
Mass of bottle	$m_1$	g	36.796	37.304	0.000	0.000
Mass of soil	$m_2 - m_1$	g	6.001	6.001	0.000	0.000
Mass of water in full bottle	$m_4 - m_1$	g	51.467	51.401	0.000	0.000
Mass of water used	$m_3 - m_2$	g	49.194	49.125	0.000	0.000
Volume of particles	$(m_4 - m_1) - (m_3 - m_2)$	mL	2.274	2.276	0.000	0.000
Particle density	$(m_2 - m_1) / ((m_4 - m_1) - (m_3 - m_2))$	Mg/m <sup>3</sup>	<b>2.639</b>	<b>2.636</b>	<b>0.000</b>	<b>0.000</b>
Average value	$\rho_s$	Mg/m <sup>3</sup>	<b>2.638</b>			

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## Particle-Density Analysis

to BS 1377-2:1990:4.3/4.4

Client Location Siemens Industrial Turbomachinery AB  
Delimara Power Station - New Combined Cycle Power Plant

Soil Greenish-black, hard, fine grained clay.

Job Ref: J1057  
Borehole/Pit Ref: BH26  
Sample No: S14/0142  
Depth (m): 11.3m  
Date tested: 09/08/2014  
Report No: 247

Method of preparation 100g of mallet - crushed material, oven dried at 105°C, sieved through 63µm, riffled into two identical specimens.

### Small Pycnometer

Specimen reference						
Pycnometer ref/number			1	2	xxx	xxx
Mass of bottle + soil + water	$m_3$	g	92.200	92.428	0.000	0.000
Mass of bottle + soil	$m_2$	g	43.113	43.258	0.000	0.000
Mass of bottle full of water	$m_4$	g	88.487	88.747	0.000	0.000
Mass of bottle	$m_1$	g	37.103	37.302	0.000	0.000
Mass of soil	$m_2 - m_1$	g	6.010	5.956	0.000	0.000
Mass of water in full bottle	$m_4 - m_1$	g	51.384	51.445	0.000	0.000
Mass of water used	$m_3 - m_2$	g	49.087	49.170	0.000	0.000
Volume of particles	$(m_4 - m_1) - (m_3 - m_2)$	mL	2.296	2.275	0.000	0.000
Particle density	$(m_2 - m_1) / ((m_4 - m_1) - (m_3 - m_2))$	Mg/m <sup>3</sup>	2.617	2.618	0.000	0.000
Average value	$\rho_s$	Mg/m <sup>3</sup>	2.617			

Operator	J. AZ.
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## Particle-Density Analysis

to BS 1377-2:1990:4.3/4.4

Client Location Siemens Industrial Turbomachinery AB  
Delimara Power Station - New Combined Cycle Power Plant

Soil Greenish-black, hard, fine grained clay.

Job Ref: J1057  
Borehole/Pit Ref: BH26  
Sample No: S14/0131  
Depth (m): 8.5m  
Date tested: 29/07/2014  
Report No: 248

Method of preparation 100g of mallet - crushed material, oven dried at 105°C, sieved through 63µm, riffled into two identical specimens.

### Small Pycnometer

Specimen reference						
Pycnometer ref/number			1	2	xxx	xxx
Mass of bottle + soil + water	$m_3$	g	91.989	92.444	0.000	0.000
Mass of bottle + soil	$m_2$	g	42.794	43.311	0.000	0.000
Mass of bottle full of water	$m_4$	g	88.268	88.717	0.000	0.000
Mass of bottle	$m_1$	g	36.796	37.302	0.000	0.000
Mass of soil	$m_2 - m_1$	g	5.998	6.009	0.000	0.000
Mass of water in full bottle	$m_4 - m_1$	g	51.472	51.415	0.000	0.000
Mass of water used	$m_3 - m_2$	g	49.195	49.133	0.000	0.000
Volume of particles	$(m_4 - m_1) - (m_3 - m_2)$	mL	2.277	2.282	0.000	0.000
Particle density	$(m_2 - m_1) / ((m_4 - m_1) - (m_3 - m_2))$	Mg/m <sup>3</sup>	2.634	2.634	0.000	0.000
Average value	$\rho_s$	Mg/m <sup>3</sup>	2.634			

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## Particle-Density Analysis

to BS 1377-2:1990:4.3/4.4

Client Location Siemens Industrial Turbomachinery AB  
Delimara Power Station - New Combined Cycle Power Plant

Soil Greenish-black, hard, fine grained clay.

Job Ref: J1057  
Borehole/Pit Ref: BH22  
Sample No: S14/0135  
Depth (m): 12.8m  
Date tested: 01/08/2014  
Report No: 249

Method of preparation 100g of mallet - crushed material, oven dried at 105°C, sieved through 500µm, riffled into two identical specimens.

### Small Pycnometer

Specimen reference						
Pycnometer ref/number			1	2	xxx	xxx
Mass of bottle + soil + water	$m_3$	g	92.143	92.210	0.000	0.000
Mass of bottle + soil	$m_2$	g	42.797	43.303	0.000	0.000
Mass of bottle full of water	$m_4$	g	88.454	88.505	0.000	0.000
Mass of bottle	$m_1$	g	36.796	37.302	0.000	0.000
Mass of soil	$m_2 - m_1$	g	6.001	6.001	0.000	0.000
Mass of water in full bottle	$m_4 - m_1$	g	51.658	51.203	0.000	0.000
Mass of water used	$m_3 - m_2$	g	49.346	48.907	0.000	0.000
Volume of particles	$(m_4 - m_1) - (m_3 - m_2)$	mL	2.312	2.295	0.000	0.000
Particle density	$(m_2 - m_1) / ((m_4 - m_1) - (m_3 - m_2))$	Mg/m <sup>3</sup>	<b>2.596</b>	<b>2.614</b>	<b>0.000</b>	<b>0.000</b>
Average value	$\rho_s$	Mg/m <sup>3</sup>	<b>2.605</b>			

Operator	J. AZ.
Approved	A. M.

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## Particle-Density Analysis

to BS 1377-2:1990:4.3/4.4

Client Location Siemens Industrial Turbomachinery AB  
Delimara Power Station - New Combined Cycle Power Plant

Soil Greenish-black, hard, fine grained clay.

Job Ref: J1057  
Borehole/Pit Ref: BH22  
Sample No: S14/0134  
Depth (m): 7.7m  
Date tested: 01/08/2014  
Report No: 250

Method of preparation 100g of mallet - crushed material, oven dried at 105°C, sieved through 63µm, riffled into two identical specimens.

### Small Pycnometer

Specimen reference						
Pycnometer ref/number			1	2	xxx	xxx
Mass of bottle + soil + water	m <sub>3</sub>	g	92.000	92.424	0.000	0.000
Mass of bottle + soil	m <sub>2</sub>	g	42.797	43.303	0.000	0.000
Mass of bottle full of water	m <sub>4</sub>	g	88.254	88.712	0.000	0.000
Mass of bottle	m <sub>1</sub>	g	36.762	37.302	0.000	0.000
Mass of soil	m <sub>2</sub> -m <sub>1</sub>	g	6.035	6.001	0.000	0.000
Mass of water in full bottle	m <sub>4</sub> -m <sub>1</sub>	g	51.492	51.410	0.000	0.000
Mass of water used	m <sub>3</sub> -m <sub>2</sub>	g	49.203	49.121	0.000	0.000
Volume of particles	(m <sub>4</sub> -m <sub>1</sub> )-(m <sub>3</sub> -m <sub>2</sub> )	mL	2.289	2.289	0.000	0.000
Particle density	(m <sub>2</sub> -m <sub>1</sub> )/ (m <sub>4</sub> -m <sub>1</sub> )-(m <sub>3</sub> -m <sub>2</sub> )	Mg/m <sup>3</sup>	<b>2.637</b>	<b>2.622</b>	<b>0.000</b>	<b>0.000</b>
Average value	ρ <sub>s</sub>	Mg/m <sup>3</sup>	<b>2.629</b>			

Operator	J. AZ.
Approved	A. M.

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## Particle-Density Analysis

to BS 1377-2:1990:4.3/4.4

Client Location Siemens Industrial Turbomachinery AB  
Delimara Power Station - New Combined Cycle Power Plant

Soil Olive (5Y 4/3), marl, fine grained, moderately weak, globigerina.

Job Ref: J1057  
Borehole/Pit Ref: BH21  
Sample No: S14/140081  
Depth (m): 15.4  
Date tested: 14/07/2014  
Report No: 251

Method of preparation 100g of mallet - crushed material, oven dried at 105°C, sieved through 500µm, riffled into two identical specimens.

### Small Pycnometer

Specimen reference						
Pycnometer number			L80	L81	X	X
Mass of bottle + soil + water	m <sub>3</sub>	g	85.869	86.350	0.000	0.000
Mass of bottle + soil	m <sub>2</sub>	g	38.127	38.239	0.000	0.000
Mass of bottle full of water	m <sub>4</sub>	g	82.156	82.624	0.000	0.000
Mass of bottle	m <sub>1</sub>	g	32.132	32.240	0.000	0.000
Mass of soil	m <sub>2</sub> -m <sub>1</sub>	g	5.996	5.999	0.000	0.000
Mass of water in full bottle	m <sub>4</sub> -m <sub>1</sub>	g	50.025	50.384	0.000	0.000
Mass of water used	m <sub>3</sub> -m <sub>2</sub>	g	47.742	48.111	0.000	0.000
Volume of particles	(m <sub>4</sub> -m <sub>1</sub> )-(m <sub>3</sub> -m <sub>2</sub> )	mL	2.283	2.273	0.000	0.000
Particle density	(m <sub>2</sub> -m <sub>1</sub> )/ (m <sub>4</sub> -m <sub>1</sub> )-(m <sub>3</sub> -m <sub>2</sub> )	Mg/m <sup>3</sup>	2.626	2.639	0.000	0.000
Average value	ρ <sub>s</sub>	Mg/m <sup>3</sup>	2.633			

Operator	A. F.
Approved	A. M.

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## Particle-Density Analysis

to BS 1377-2:1990:4.3/4.4

Client Location: Siemens Industrial Turbomachinery AB  
Delimara Power Station - New Combined Cycle Power Plant

Soil: Olive (5Y 4/3), marl-microfractured bands at 9.8m - splits horizontally along bedding, fine grained, moderately weak, globigerina.

Job Ref: J1057  
Borehole/Pit Ref: BH19  
Sample No: S14/0080  
Depth (m): 9.8m  
Date tested: 18/07/2014  
Report No: 252

Method of preparation: 100g of mallet - crushed material, oven dried at 105°C, sieved through 500µm, riffled into four identical specimens.

### Small Pyknometer

Specimen reference						
Pyknometer ref/number			1	2	3	4
Mass of bottle + soil + water	$m_3$	g	92.023	92.467	92.209	92.258
Mass of bottle + soil	$m_2$	g	42.810	43.305	43.107	42.446
Mass of bottle full of water	$m_4$	g	88.258	88.705	88.439	88.495
Mass of bottle	$m_1$	g	36.809	37.304	37.106	36.446
Mass of soil	$m_2 - m_1$	g	6.001	6.001	6.001	6.000
Mass of water in full bottle	$m_4 - m_1$	g	51.449	51.401	51.333	52.049
Mass of water used	$m_3 - m_2$	g	49.213	49.162	49.102	49.812
Volume of particles	$(m_4 - m_1) - (m_3 - m_2)$	mL	2.236	2.239	2.231	2.237
Particle density	$(m_2 - m_1) / ((m_4 - m_1) - (m_3 - m_2))$	Mg/m <sup>3</sup>	<b>2.684</b>	<b>2.680</b>	<b>2.690</b>	<b>2.682</b>
Average value	$\rho_s$	Mg/m <sup>3</sup>	<b>2.682</b>			

Operator	J. AZ.
Approved	A. M.

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## Particle-Density Analysis

to BS 1377-2:1990:4.3/4.4

Client Location Siemens Industrial Turbomachinery AB  
Delimara Power Station - New Combined Cycle Power Plant

Soil Olive (5Y 4/3), marl, fine grained, moderately weak globigerina.

Job Ref: J1057  
Borehole/Pit Ref: BH13  
Sample No: S14/0079  
Depth (m): 8.6  
Date tested: 11/07/2014  
Report No: 253

Method of preparation 100g of mallet - crushed material, oven dried at 105°C, sieved through 500µm, riffled into four identical specimens.

### Small Pycnometer

Specimen reference						
Pycnometer ref/number			1	2	3	4
Mass of bottle + soil + water	$m_3$	g	91.955	92.416	92.287	92.118
Mass of bottle + soil	$m_2$	g	42.796	43.303	43.135	42.436
Mass of bottle full of water	$m_4$	g	88.233	88.684	88.549	88.388
Mass of bottle	$m_1$	g	36.796	37.302	37.135	36.435
Mass of soil	$m_2 - m_1$	g	6.000	6.001	6.000	6.001
Mass of water in full bottle	$m_4 - m_1$	g	51.437	51.382	51.414	51.953
Mass of water used	$m_3 - m_2$	g	49.159	49.113	49.152	49.682
Volume of particles	$(m_4 - m_1) - (m_3 - m_2)$	mL	2.278	2.268	2.262	2.271
Particle density	$(m_2 - m_1) / ((m_4 - m_1) - (m_3 - m_2))$	Mg/m <sup>3</sup>	<b>2.634</b>	<b>2.645</b>	<b>2.652</b>	<b>2.642</b>
Average value	$\rho_s$	Mg/m <sup>3</sup>	<b>2.640</b>			

Operator	J. AZ.
Approved	A. M.

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Co. No.: C 33162  
VAT No.: MT 1695 3537

Directors: Paolo Bugeja  
Gordon Baldacchino

## Particle-Density Analysis

to BS 1377-2:1990:4.3/4.4

Client Location Siemens Industrial Turbomachinery AB  
Delimara Power Station - New Combined Cycle Power Plant

Soil Marl, fine grained, moderately weak globigerina.

Job Ref: J1057  
Borehole/Pit Ref: BH12  
Sample No: S14/0132  
Depth (m): 12.1m  
Date tested: 01/08/2014  
Report No: 254

Method of preparation 100g of mallet - crushed material, oven dried at 105°C, sieved through 63µm, riffled into two identical specimens.

### Small Pycnometer

Specimen reference						
Pycnometer ref/number			1	2	xxx	xxx
Mass of bottle + soil + water	$m_3$	g	86.375	85.913	0.000	0.000
Mass of bottle + soil	$m_2$	g	38.227	38.132	0.000	0.000
Mass of bottle full of water	$m_4$	g	82.590	82.146	0.000	0.000
Mass of bottle	$m_1$	g	32.223	32.131	0.000	0.000
Mass of soil	$m_2 - m_1$	g	6.004	6.001	0.000	0.000
Mass of water in full bottle	$m_4 - m_1$	g	50.367	50.015	0.000	0.000
Mass of water used	$m_3 - m_2$	g	48.148	47.781	0.000	0.000
Volume of particles	$(m_4 - m_1) - (m_3 - m_2)$	mL	2.219	2.234	0.000	0.000
Particle density	$(m_2 - m_1) / ((m_4 - m_1) - (m_3 - m_2))$	Mg/m <sup>3</sup>	<b>2.706</b>	<b>2.686</b>	<b>0.000</b>	<b>0.000</b>
Average value	$\rho_s$	Mg/m <sup>3</sup>	<b>2.696</b>			

Operator	J. AZ.
Approved	A. M.

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Directors: Paolo Bugeja  
Gordon Baldacchino

## Particle-Density Analysis

to BS 1377-2:1990:4.3/4.4

Client Location  
Siemens Industrial Turbomachinery AB  
Delimara Power Station - New Combined  
Cycle Power Plant

Soil  
Marl - horizontally microfractured at 7.2m.  
Fine grained, moderately weak  
globigerina.

Job Ref: J1057  
Borehole/Pit Ref: BH12  
Sample No: S14/0133  
Depth (m): 7.2m  
Date tested: 01/08/2014  
Report No: 255

Method of preparation  
100g of mallet - crushed material, oven dried at 105°C, sieved through 63µm, riffled into two identical specimens.

### Small Pycnometer

Specimen reference						
Pycnometer ref/number			1	2	xxx	xxx
Mass of bottle + soil + water	$m_3$	g	86.594	86.021	0.000	0.000
Mass of bottle + soil	$m_2$	g	38.649	38.341	0.000	0.000
Mass of bottle full of water	$m_4$	g	82.874	82.297	0.000	0.000
Mass of bottle	$m_1$	g	32.648	32.341	0.000	0.000
Mass of soil	$m_2 - m_1$	g	6.001	6.000	0.000	0.000
Mass of water in full bottle	$m_4 - m_1$	g	50.226	49.956	0.000	0.000
Mass of water used	$m_3 - m_2$	g	47.945	47.679	0.000	0.000
Volume of particles	$(m_4 - m_1) - (m_3 - m_2)$	mL	2.281	2.276	0.000	0.000
Particle density	$(m_2 - m_1) / ((m_4 - m_1) - (m_3 - m_2))$	Mg/m <sup>3</sup>	2.631	2.636	0.000	0.000
Average value	$\rho_s$	Mg/m <sup>3</sup>	2.634			

Operator	J. AZ.
Approved	A. M.

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## Particle-Density Analysis

to BS 1377-2:1990:4.3/4.4

Client Location Siemens Industrial Turbomachinery AB  
Delimara Power Station - New Combined Cycle Power Plant

Soil Greenish-black, hard, fine grained clay.

Job Ref: J1057  
Borehole/Pit Ref: BH5  
Sample No: S14/0141  
Depth (m): 11m  
Date tested: 09/08/2014  
Report No: 256

Method of preparation 100g of mallet - crushed material, oven dried at 105°C, sieved through 63µm, riffled into two identical specimens.

### Small Pycnometer

Specimen reference						
Pycnometer ref/number			1	2	xxx	xxx
Mass of bottle + soil + water	$m_3$	g	85.877	86.353	0.000	0.000
Mass of bottle + soil	$m_2$	g	38.134	38.238	0.000	0.000
Mass of bottle full of water	$m_4$	g	82.205	82.671	0.000	0.000
Mass of bottle	$m_1$	g	32.134	32.236	0.000	0.000
Mass of soil	$m_2 - m_1$	g	6.000	6.002	0.000	0.000
Mass of water in full bottle	$m_4 - m_1$	g	50.070	50.434	0.000	0.000
Mass of water used	$m_3 - m_2$	g	47.743	48.115	0.000	0.000
Volume of particles	$(m_4 - m_1) - (m_3 - m_2)$	mL	2.328	2.319	0.000	0.000
Particle density	$(m_2 - m_1) / ((m_4 - m_1) - (m_3 - m_2))$	Mg/m <sup>3</sup>	2.578	2.588	0.000	0.000
Average value	$\rho_s$	Mg/m <sup>3</sup>	2.583			

Operator	J. AZ.
Approved	A. M.

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## Particle-Density Analysis

to BS 1377-2:1990:4.3/4.4

Client Siemens Industrial Turbomachinery AB  
Location Delimara Power Station - New Combined Cycle Power Plant  
Soil Light grey (2.5Y 7/1), very stiff, fine grained, marl, globigerina.

Job Ref: J1057  
Borehole/Pit Ref: BH3  
Sample No: S14/0069  
Depth (m): 6.7  
Date tested: 04/07/2014  
Report No: 257

Method of preparation 100g of mallet - crushed material, oven dried at 105°C, sieved through 500µm, riffled into four identical specimens.

### Small Pycnometer

Specimen reference						
Pycnometer number			L81	L80	L05	L17
Mass of bottle + soil + water	$m_3$	g	85.874	85.898	86.025	86.605
Mass of bottle + soil	$m_2$	g	38.219	38.246	38.408	38.653
Mass of bottle full of water	$m_4$	g	82.178	82.161	82.308	82.917
Mass of bottle	$m_1$	g	32.243	32.207	32.410	32.648
Mass of soil	$m_2 - m_1$	g	5.977	6.039	5.997	6.004
Mass of water in full bottle	$m_4 - m_1$	g	49.936	49.954	49.898	50.269
Mass of water used	$m_3 - m_2$	g	47.655	47.652	47.618	47.953
Volume of particles	$(m_4 - m_1) - (m_3 - m_2)$	mL	2.281	2.302	2.280	2.316
Particle density	$(m_2 - m_1) / ((m_4 - m_1) - (m_3 - m_2))$	Mg/m <sup>3</sup>	<b>2.621</b>	<b>2.623</b>	<b>2.630</b>	<b>2.592</b>
Average value	$\rho_s$	Mg/m <sup>3</sup>	<b>2.617</b>			

Operator	A. F.
Approved	A. M.

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## Particle-Density Analysis

to BS 1377-2:1990:4.3/4.4

Client Siemens Industrial Turbomachinery AB  
Location Delimara Power Station - New Combined Cycle Power Plant  
Soil Very weak (rock), olive (5Y 4/3), fine grained, marl - consists of hard lumps in stiff clay matrix.

Job Ref: J1057  
Borehole/Pit Ref: BH2  
Sample No: S14/0068  
Depth (m): 8.8  
Date tested: 04/07/2014  
Report No: 258

Method of preparation 100g of mallet - crushed material, oven dried at 105°C, sieved through 500µm, riffled into four identical specimens.

### Small Pycnometer

Specimen reference						
Pycnometer number			1	2	3	4
Mass of bottle + soil + water	$m_3$	g	91.953	92.405	92.110	92.197
Mass of bottle + soil	$m_2$	g	42.811	43.320	43.072	42.466
Mass of bottle full of water	$m_4$	g	88.232	88.678	88.418	88.475
Mass of bottle	$m_1$	g	36.803	37.302	37.104	36.447
Mass of soil	$m_2 - m_1$	g	6.008	6.018	5.968	6.019
Mass of water in full bottle	$m_4 - m_1$	g	51.429	51.376	51.314	52.028
Mass of water used	$m_3 - m_2$	g	49.142	49.085	49.037	49.731
Volume of particles	$(m_4 - m_1) - (m_3 - m_2)$	mL	2.287	2.291	2.277	2.298
Particle density	$(m_2 - m_1) / ((m_4 - m_1) - (m_3 - m_2))$	Mg/m <sup>3</sup>	<b>2.627</b>	<b>2.626</b>	<b>2.621</b>	<b>2.620</b>
Average value	$\rho_s$	Mg/m <sup>3</sup>	<b>2.624</b>			

Operator	A. F.
Approved	A. M.

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Directors: Paolo Bugeja  
Gordon Baldecchino

Job Number: J 1057  
Certificate Number:

**Liquid Limit (Cone Penetrometer) and Plastic Limit**

Test Method: BS 1377 : Part 2 : 1990 : 4.3/4.4

Client: Siemens Industrial  
Turbomachinery AB  
Delimara Power Station - New  
Location: Combined Cycle Power Plant  
Borehole: BH13  
Depth: 8.6m

Soil Description: Olive (5Y 4/3), marl, fine grained, moderately weak globigerina.

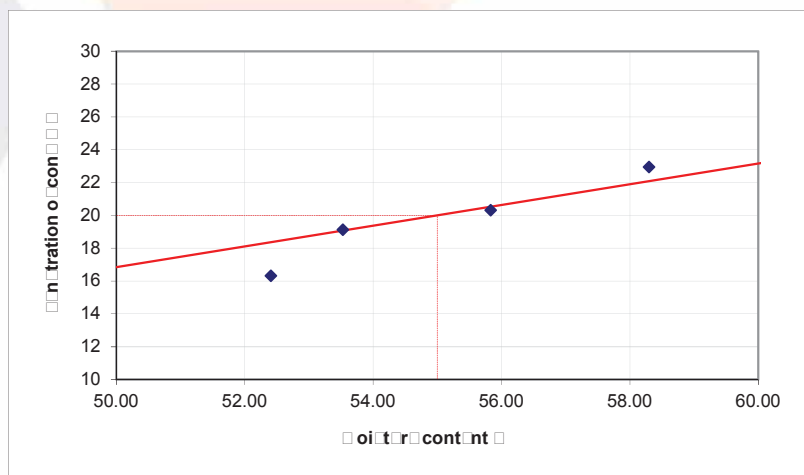
Sample Number: S14/0079

Date: 09/07/2014

Report No: 259

Plastic Limit:	Test No.	1	2	X	X		Average
Container No.							
Mass of Wet Soil + Container:	grms	82.88	82.85				
Mass of Dry Soil + Container:	grms	82.52	82.43				
Mass Of Container:	grms	80.77	80.66				
Mass of Moisture:	grms	0.36	0.42				
Mass of Dry Soil:	grms	1.75	1.77				
Moisture Content:	%	20.57	23.73				22.15

Liquid Limit:	Test No.	1	2	3	4	
Initial Dial Guage Reading:	mm					
Final Dial Guage Reading:	mm					
Average Penetration:	mm	16.32	19.12	20.31	22.95	
Container No:						
Mass of Wet Soil + Container:	grms	100.29	100.35	102.11	103.45	
Mass of Dry Soil + Container:	grms	92.35	93.45	94.45	95.02	
Mass of Container:	grms	77.2	80.56	80.73	80.56	
Mass of Moisture:	grms	7.94	6.9	7.66	8.43	
Mass of Dry Soil:	grms	15.15	12.89	13.72	14.46	
Moisture Content:	%	52.41	53.53	55.83	58.30	



Wet Weight:	21.79	grms
Dry Weight:	14.055	grms
Retaining on 425 Mic:		grms
Air Dried At:	23	°C
Oven Dried At:	105	°C

Bore Hole No:	BH13
Depth:	8.6m

Operator:	
Approved:	

Liquid Limit:	55.00
Plastic Limit:	22.15
Plasticity Index:	32.85

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Directors: Paolo Bugeja  
Gordon Baldacchino

**Liquid Limit (Cone Penetrometer) and Plastic Limit**

Test Method: BS 1377 : Part 2 : 1990 : 4.3/4.4

Client: Siemens Industrial  
Turbomachinery AB  
Delimara Power Station - New

Location: Combined Cycle Power Plant

Borehole: BH2

Depth: 8.8m

Soil Description: Very weak (rock), olive (5Y 4/3), fine grained, marl - consists of hard lumps in stiff clay matrix.

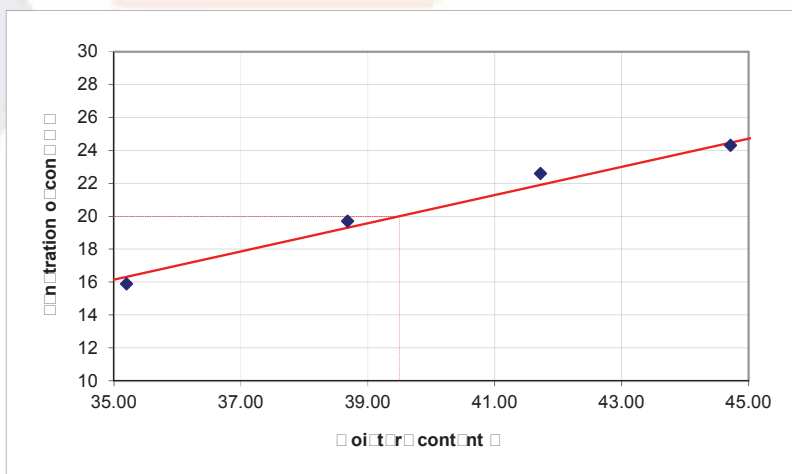
Sample Number: S14/0068

Date: 03/07/2014

Report No: 260

Plastic Limit:	Test No.	1	2	X	X		Average
Container No.							
Mass of Wet Soil + Container:	grms	83.54	85.65				
Mass of Dry Soil + Container:	grms	83.23	85.25				
Mass Of Container:	grms	81.27	83				
Mass of Moisture:	grms	0.31	0.4				
Mass of Dry Soil:	grms	1.96	2.25				
Moisture Content:	%	15.82	17.78				16.80

Liquid Limit:	Test No.	1	2	3	4	
Initial Dial Guage Reading:	mm					
Final Dial Guage Reading:	mm					
Average Penetration:	mm	15.89	19.71	22.6	24.32	
Container No:						
Mass of Wet Soil + Container:	grms	98.68	101.44	104.78	103.29	
Mass of Dry Soil + Container:	grms	93.58	96.04	97.7	96.52	
Mass of Container:	grms	79.09	82.08	80.73	81.38	
Mass of Moisture:	grms	5	5.4	7.08	6.77	
Mass of Dry Soil:	grms	14.49	13.96	16.97	15.14	
Moisture Content:	%	35.20	38.68	41.72	44.72	



Wet Weight:	21.23	grms
Dry Weight:	15.14	grms
Retaining on 425 Mic:		grms
Air Dried At:	23	°C
Oven Dried At:	105	°C

Bore Hole No:	BH2
Depth:	8.8m

Operator:	
Approved:	

Liquid Limit:	39.50
Plastic Limit:	16.80
Plasticity Index:	22.70

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Job Number: J 1057  
Certificate Number:

**Liquid Limit (Cone Penetrometer) and Plastic Limit**

Test Method: BS 1377 : Part 2 : 1990 : 4.3/4.4

Client: Siemens Industrial  
Turbomachinery AB  
Delimara Power Station - New  
Location: Combined Cycle Power Plant  
Borehole: BH13  
Depth: 8.6m

Soil Description: Olive (5Y 4/3), marl, fine grained, moderately weak globigerina.

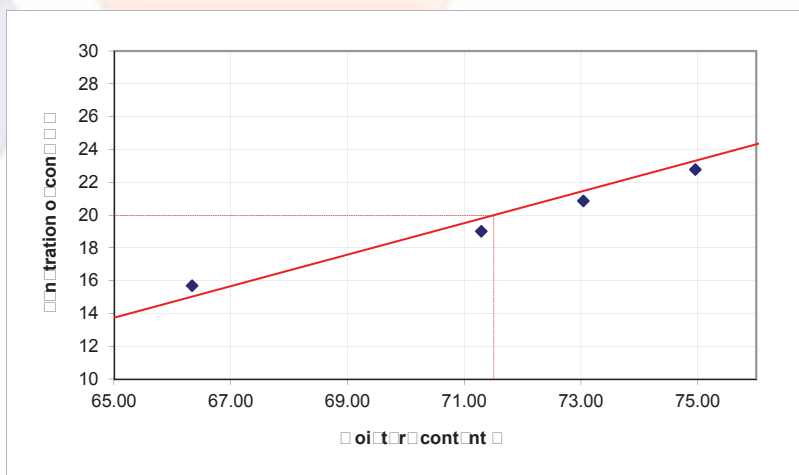
Sample Number: S14/0079

Date: 09/07/2014

Report No: 261

Plastic Limit:	Test No.	1	2	X	X		Average
Container No.							
Mass of Wet Soil + Container:	grms	83.25	82.45				
Mass of Dry Soil + Container:	grms	82.34	81.75				
Mass Of Container:	grms	79.17	79.22				
Mass of Moisture:	grms	0.91	0.7				
Mass of Dry Soil:	grms	3.17	2.53				
Moisture Content:	%	28.71	27.67				28.19

Liquid Limit:	Test No.	1	2	3	4	
Initial Dial Guage Reading:	mm					
Final Dial Guage Reading:	mm					
Average Penetration:	mm	15.72	19.03	20.88	22.79	
Container No:						
Mass of Wet Soil + Container:	grms	93.63	94.44	95.64	102.41	
Mass of Dry Soil + Container:	grms	89.02	90.07	88.95	93.91	
Mass of Container:	grms	82.07	83.94	79.79	82.57	
Mass of Moisture:	grms	4.61	4.37	6.69	8.5	
Mass of Dry Soil:	grms	6.95	6.13	9.16	11.34	
Moisture Content:	%	66.33	71.29	73.03	74.96	



Wet Weight:	14.44	grms
Dry Weight:	8.395	grms
Retaining on 425 Mic:		grms
Air Dried At:	23	°C
Oven Dried At:	105	°C

Bore Hole No:	BH13
Depth:	8.6m

Operator:	
Approved:	

Liquid Limit:	71.50
Plastic Limit:	28.19
Plasticity Index:	43.31

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Job Number: J 1057  
Certificate Number:

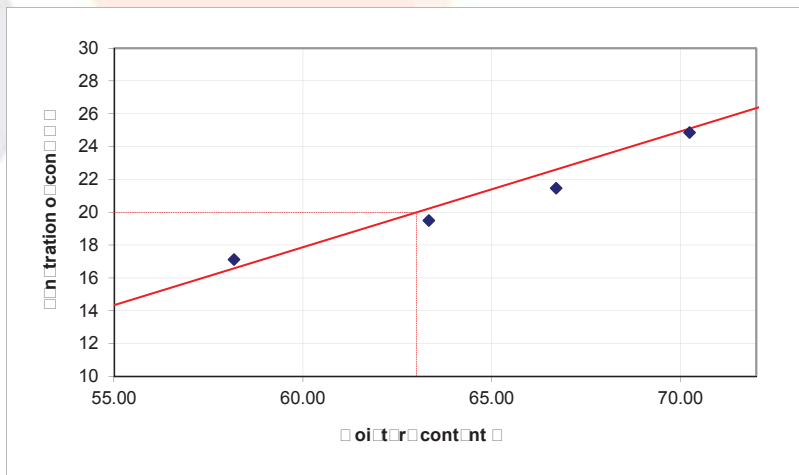
**Liquid Limit (Cone Penetrometer) and Plastic Limit** Test Method: BS 1377 : Part 2 : 1990 : 4.3/4.4

Client: Siemens Industrial  
Turbomachinery AB  
Delimara Power Station - New  
Location: Combined Cycle Power Plant  
Borehole: BH30  
Depth: 11.4m

Soil Description: Olive (5Y 4/3), marl, fine grained, moderately weak, globigerina.  
Sample Number: S14/0082  
Date: 09/07/2014  
Report No: 262

Plastic Limit:	Test No.	1	2	X	X		Average
Container No.							
Mass of Wet Soil + Container:	grms	82.56	82.89				
Mass of Dry Soil + Container:	grms	81.78	82.4				
Mass Of Container:	grms	78.86	80.55				
Mass of Moisture:	grms	0.78	0.49				
Mass of Dry Soil:	grms	2.92	1.85				
Moisture Content:	%	26.71	26.49				26.60

Liquid Limit:	Test No.	1	2	3	4	
Initial Dial Guage Reading:	mm					
Final Dial Guage Reading:	mm					
Average Penetration:	mm	17.14	19.52	21.49	24.88	
Container No:						
Mass of Wet Soil + Container:	grms	95.39	100.23	102.01	94.61	
Mass of Dry Soil + Container:	grms	89.41	93.65	95.64	88.17	
Mass of Container:	grms	79.13	83.26	86.09	79	
Mass of Moisture:	grms	5.98	6.58	6.37	6.44	
Mass of Dry Soil:	grms	10.28	10.39	9.55	9.17	
Moisture Content:	%	58.17	63.33	66.70	70.23	



Wet Weight:	16.19	grms
Dry Weight:	9.8475	grms
Retaining on 425 Mic:		grms
Air Dried At:	23	°C
Oven Dried At:	105	°C

Bore Hole No:	BH30
Depth:	11.4m

Operator:	
Approved:	

Liquid Limit:	63.00
Plastic Limit:	26.60
Plasticity Index:	36.40

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Job Number: J 1057  
Certificate Number:

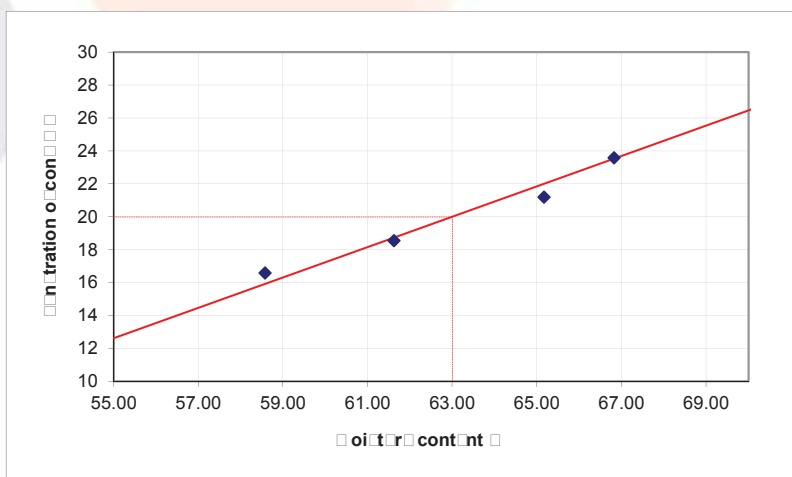
**Liquid Limit (Cone Penetrometer) and Plastic Limit** Test Method: BS 1377 : Part 2 : 1990 : 4.3/4.4

Client: Siemens Industrial  
Turbomachinery AB  
Delimara Power Station - New  
Location: Combined Cycle Power Plant  
Borehole: BH21  
Depth: 15.4m

Soil Description: Olive (5Y 4/3), marl, fine grained,  
moderately weak, globigerina.  
Sample Number: S14/0081  
Date: 04/07/2014  
Report No: 263

Plastic Limit:	Test No.	1	2	X	X		Average
Container No.							
Mass of Wet Soil + Container:	grms	82.45	82.55				
Mass of Dry Soil + Container:	grms	81.73	81.8				
Mass Of Container:	grms	78.72	78.8				
Mass of Moisture:	grms	0.72	0.75				
Mass of Dry Soil:	grms	3.01	3				
Moisture Content:	%	23.92	25.00				24.46

Liquid Limit:	Test No.	1	2	3	4	
Initial Dial Guage Reading:	mm					
Final Dial Guage Reading:	mm					
Average Penetration:	mm	16.6	18.55	21.21	23.6	
Container No:						
Mass of Wet Soil + Container:	grms	96.93	103.86	95.69	103.31	
Mass of Dry Soil + Container:	grms	91.12	95.61	88.47	94.49	
Mass of Container:	grms	81.2	82.22	77.39	81.29	
Mass of Moisture:	grms	6	8.25	7.22	8.82	
Mass of Dry Soil:	grms	9.92	13.39	11.08	13.2	
Moisture Content:	%	58.57	61.61	65.16	66.82	



Wet Weight:	19.42	grms
Dry Weight:	11.8975	grms
Retaining on 425 Mic:		grms
Air Dried At:	23	°C
Oven Dried At:	105	°C

Bore Hole No:	BH21
Depth:	15.4m

Operator:	
Approved:	

Liquid Limit:	63.00
Plastic Limit:	24.46
Plasticity Index:	38.54

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<b>Liquid Limit (Cone Penetrometer) and Plastic Limit</b>	Test Method:	BS 1377 : Part 2 : 1990 : 4.3/4.4
---	--------------	-----------------------------------

Client: Siemens Industrial  
Turbomachinery AB  
Delimara Power Station - New

Location: Combined Cycle Power Plant

Borehole: BH3  
Depth: 6.7m

Soil Description: Light grey (2.5Y 7/1), very stiff, fine grained, marl, globigerina.

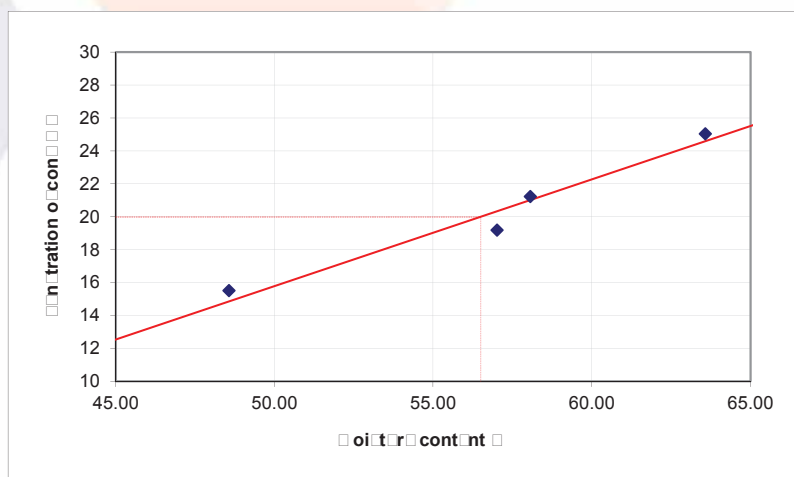
Sample Number: S14/0069

Date: 08/07/2014

Report No: 264

Plastic Limit:	Test No.	1	2	X	X	Average
Container No.						
Mass of Wet Soil + Container:	grms	84.88	84.13			
Mass of Dry Soil + Container:	grms	84.4	83.8			
Mass Of Container:	grms	82.31	82.35			
Mass of Moisture:	grms	0.48	0.33			
Mass of Dry Soil:	grms	2.09	1.45			
Moisture Content:	%	22.97	22.76			22.86

Liquid Limit:	Test No.	1	2	3	4	
Initial Dial Guage Reading:	mm					
Final Dial Guage Reading:	mm					
Average Penetration:	mm	15.53	19.2	21.24	25.06	
Container No:						
Mass of Wet Soil + Container:	grms	96.09	99.7	104.45	104.45	
Mass of Dry Soil + Container:	grms	91.04	92.99	95.91	95.13	
Mass of Container:	grms	80.64	81.22	81.2	80.47	
Mass of Moisture:	grms	5	6.71	8.54	9.32	
Mass of Dry Soil:	grms	10.4	11.77	14.71	14.66	
Moisture Content:	%	48.56	57.01	58.06	63.57	



Wet Weight:	20.29	grms
Dry Weight:	12.885	grms
Retaining on 425 Mic:		grms
Air Dried At:	23	°C
Oven Dried At:	105	°C

Bore Hole No:	BH3
Depth:	6.7m

Operator:	
Approved:	

Liquid Limit:	56.50
Plastic Limit:	22.86
Plasticity Index:	33.64

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- **Determination of Uniaxial Compressive Strength of Rock Materials - ISRM Suggested Method**

**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 1

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	2
Top of Borehole (m)	3.302	Depth (m)	9.9
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
36	0.25	Vertical	03. Jul 2014

**Specimen Test**

Date of Test	09. Jul 2014	Technician ID	Grech Charles
--------------	--------------	---------------	---------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0577

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	74.18	193.0	2.6
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
64800		230	14.99	15.16	2174.28	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 2

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	2
Top of Borehole (m)	3.302	Depth (m)	10.2
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
37	0.2	Vertical	03. Jul 2014

**Specimen Test**

Date of Test	09. Jul 2014	Technician ID	Grech Charles
--------------	--------------	---------------	---------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0578

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
NO	NO	OK	OK	75.04	195.0	2.6
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
63800		1275	14.43	15.25	2141.91	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 3

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	2
Top of Borehole (m)	3.302	Depth (m)	11.55
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
38	0.5	Vertical	03. Jul 2014

**Specimen Test**

Date of Test	15. Jul 2014	Technician ID	Grech Charles
--------------	--------------	---------------	---------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0579

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
NO	NO	OK	OK	64.92	170.0	2.62
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
65730		510	19.86	12.45	2150.27	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 4

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	2
Top of Borehole (m)	3.302	Depth (m)	12.85
		Remarks	Core left in water for 11 days

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
39	0.5	Vertical	03. Jul 2014

**Specimen Test**

Date of Test	14. Jul 2014	Technician ID	Grech Charles
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0580

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
NO	NO	OK	OK	66.52	172.0	2.59
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
30640		268	8.82	16.71	2102.7	

Deviation Core suffered a broken edge during trimming.



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 8

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	3
Top of Borehole (m)	2.714	Depth (m)	16.4
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
43	0.5	Vertical	03. Jul 2014

**Specimen Test**

Date of Test	09. Jul 2014	Technician ID	Grech Charles
--------------	--------------	---------------	---------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0584

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	75.11	195.0	2.6
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
71800		1152	16.2	16.25	2109.21	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 10

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	3
Top of Borehole (m)	2.714	Depth (m)	10.8
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
45	0.5	Vertical	03. Jul 2014

**Specimen Test**

Date of Test	09. Jul 2014	Technician ID	Grech Charles
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0586

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	72.85	195.0	2.68
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
43000		549	10.32	16.11	2078.79	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 11

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	3
Top of Borehole (m)	2.714	Depth (m)	12.2
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
46	0.25	Vertical	03. Jul 2014

**Specimen Test**

Date of Test	10. Jul 2014	Technician ID	Grech Charles
--------------	--------------	---------------	---------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0587

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	74.16	191.0	2.58
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
79400		1052	18.38	15.48	2140.89	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 13

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	3
Top of Borehole (m)	2.714	Depth (m)	13.8
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
48	0.5	Vertical	03. Jul 2014

**Specimen Test**

Date of Test	15. Jul 2014	Technician ID	Grech Charles
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0589

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	74.12	193.0	2.6
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
94990		751	22.01	15.53	2118.47	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82i 88  
 Client Fax No: 946 122 821w7  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 1w

Project: Siemens - 510w7

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+er Station	Borehole	8
Top of Borehole (m)	2.634	Depth (m)	7.2
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
w0	0.6w	Vertical	08. Jul 2014

**Specimen Test**

Date of Test	16. Jul 2014	Technician ID	Amoury Mustafa
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0wi 1

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	74.36	1i 4.0	2.61
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
wi w70		463	13.72	14.62	21i 2.28	

Deviation No



BugeJa Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 16

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	8
Top of Borehole (m)	2.634	Depth (m)	8.5
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
51	0.45	Vertical	08. Jul 2014

**Specimen Test**

Date of Test	16. Jul 2014	Technician ID	Amoury Mustafa
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0592

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	71.94	187.0	2.6
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
66770		534	16.43	15.08	2190.49	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 17

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	8
Top of Borehole (m)	2.634	Depth (m)	9.5
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
52	0.2	Vertical	08. Jul 2014

**Specimen Test**

Date of Test	16. Jul 2014	Technician ID	Amoury Mustafa
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0593

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	NO	OK	56.82	146.0	2.57
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
70060		454	27.63	3.22	1952.96	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 18

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	8
Top of Borehole (m)	2.634	Depth (m)	9.8
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
53	0.3	Vertical	08. Jul 2014

**Specimen Test**

Date of Test	16. Jul 2014	Technician ID	Amoury Mustafa
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0594

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.07	197.0	2.59
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
77650		618	17.09	15.42	2166.8	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+ eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 1w

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+ er Station	Borehole	13
Top of Borehole (m)	2.653	Depth (m)	w7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
54	0.35	Vertical	08. Jul 2014

**Specimen Test**

Date of Test	16. Jul 2014	Technician ID	Amoury Mustafa
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/05w5

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	71.8w	182.0	2.53
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
62680		500	15.44	15.51	2137.3w	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 20

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	21
Top of Borehole (m)	2.559	Depth (m)	13.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
55	0.35	Vertical	08. Jul 2014

**Specimen Test**

Date of Test	16. Jul 2014	Technician ID	Amoury Mustafa
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0596

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	74.34	194.0	2.61
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
44330		355	10.21	18.67	2077.08	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 21

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	21
Top of Borehole (m)	2.559	Depth (m)	14.8
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
56	0.2	Vertical	08. Jul 2014

**Specimen Test**

Date of Test	16. Jul 2014	Technician ID	Amoury Mustafa
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0597

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	64.81	170.0	2.62
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
50590		405	15.34	13.06	2139.72	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 22

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	9
Top of Borehole (m)	2.73	Depth (m)	6.4
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
57	0.4	Vertical	08. Jul 2014

**Specimen Test**

Date of Test	17. Jul 2014	Technician ID	Grech Charles
--------------	--------------	---------------	---------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0598

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	73.0	190.0	2.6
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
64000		563	15.29	15.52	2136.5	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 23

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	9
Top of Borehole (m)	2.73	Depth (m)	7.4
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
58	0.45	Vertical	08. Jul 2014

**Specimen Test**

Date of Test	17. Jul 2014	Technician ID	Grech Charles
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0599

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	75.0	195.0	2.6
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
52130		451	11.8	15.72	2113.8	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 24

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	9
Top of Borehole (m)	2.73	Depth (m)	8.13
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
59	0.2	Vertical	08. Jul 2014

**Specimen Test**

Date of Test	17. Jul 2014	Technician ID	Grech Charles
--------------	--------------	---------------	---------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0600

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	71.0	186.0	2.62
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
48910		423	12.35	15.87	2131.97	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82i 88  
 Client Fax No: 946 122 821w7  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 2w

Project: Siemens - 510w7

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	18
Top of Borehole (m)	2.716	Depth (m)	8.8w
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
60	0.3	Vertical	08. Jul 2014

**Specimen Test**

Date of Test	17. Jul 2014	Technician ID	Grech Charles
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters are based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0602

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.0	118.0	2.61
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
10810		604	12.83	14.1	2167.62	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 26

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	18
Top of Borehole (m)	2.716	Depth (m)	9.4
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
61	0.3	Vertical	08. Jul 2014

**Specimen Test**

Date of Test	17. Jul 2014	Technician ID	Grech Charles
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0603

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	74.0	193.0	2.61
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
57610		599	13.4	14.43	2179.35	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 27

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	18
Top of Borehole (m)	2.716	Depth (m)	9.85
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
62	0.4	Vertical	08. Jul 2014

**Specimen Test**

Date of Test	17. Jul 2014	Technician ID	Grech Charles
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0604

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	71.0	185.0	2.61
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
54650		568	13.8	14.5	2169.43	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 28

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	18
Top of Borehole (m)	2.716	Depth (m)	14.1
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
63	0.8	Vertical	08. Jul 2014

**Specimen Test**

Date of Test	17. Jul 2014	Technician ID	Grech Charles
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0605

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	71.0	185.0	2.61
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
59780		689	15.1	14.31	2165.34	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 2w

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	18
Top of Borehole (m)	2.716	Depth (m)	14.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
64	0.8	Vertical	08. Jul 2014

**Specimen Test**

Date of Test	17. Jul 2014	Technician ID	Grech Charles
--------------	--------------	---------------	---------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters are based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0606

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	75.0	1w6.0	2.61
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
5w800		651	13.54	15.51	2146.w	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 30

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	18
Top of Borehole (m)	2.716	Depth (m)	17.5
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
65	0.7	Vertical	08. Jul 2014

**Specimen Test**

Date of Test	17. Jul 2014	Technician ID	Grech Charles
--------------	--------------	---------------	---------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0607

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	74.0	193.0	2.61
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
81330		797	18.91	13.84	2168.51	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 31

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	18
Top of Borehole (m)	2.716	Depth (m)	18.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
66	0.5	Vertical	08. Jul 2014

**Specimen Test**

Date of Test	17. Jul 2014	Technician ID	Grech Charles
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0608

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	75.0	195.0	2.6
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
68810		649	15.58	16.02	2098.71	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 34

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	19
Top of Borehole (m)	2.849	Depth (m)	15.6
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
69	0.4	Vertical	09. Jul 2014

**Specimen Test**

Date of Test	18. Jul 2014	Technician ID	Amoury Mustafa
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0612

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	73.5	192.0	2.61
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
66890		630	15.77	14.1	2143.28	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82i 88  
 Client Fax No: 946 122 821w7  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 3w

Project: Siemens - 510w7

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+er Station	Borehole	1i
Top of Borehole (m)	2.84i	Depth (m)	1w1
Remarks			

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
70	0.4	Vertical	0i . 5ul 2014

**Specimen Test**

Date of Test	18. 5ul 2014	Technician ID	Amoury Mustafa
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0613

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	73.i	1i 3.0	2.61
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m³)	
64820		611	1w11	14.68	214w4	

Deviation No



BugeJa Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 36

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	19
Top of Borehole (m)	2.849	Depth (m)	18.85
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
71	0.2	Vertical	09. Jul 2014

**Specimen Test**

Date of Test	09. Jul 2014	Technician ID	Amoury Mustafa
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0614

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	75.8	198.0	2.61
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
82150		775	18.2	14.56	2134.31	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 37

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	19
Top of Borehole (m)	2.849	Depth (m)	18.15
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
72	0.8	Vertical	09. Jul 2014

**Specimen Test**

Date of Test	18. Jul 2014	Technician ID	Amoury Mustafa
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0615

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	75.17	196.0	2.61
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
80990		763	18.25	14.61	2115.35	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 38

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	19
Top of Borehole (m)	2.849	Depth (m)	19.25
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
73	0.3	Vertical	09. Jul 2014

**Specimen Test**

Date of Test	18. Jul 2014	Technician ID	Amoury Mustafa
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0616

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	74.93	197.0	2.63
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
82790		780	18.77	15.01	2113.51	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 41

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	16
Top of Borehole (m)	2.857	Depth (m)	6.3
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
76	0.6	Vertical	11. Jul 2014

**Specimen Test**

Date of Test	28. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0623

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	74.63	190.0	2.55
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
66830		691	15.28	9.57	2130.59	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 42

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	16
Top of Borehole (m)	2.857	Depth (m)	7.3
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
77	0.5	Vertical	11. Jul 2014

**Specimen Test**

Date of Test	28. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0624

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	75.93	192.0	2.53
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
60960		631	13.46	14.39	2231.78	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 43

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	16
Top of Borehole (m)	2.857	Depth (m)	9.3
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
78	0.4	Vertical	11. Jul 2014

**Specimen Test**

Date of Test	28. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0625

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	75.02	190.0	2.53
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
18650		198	4.22	13.89	2252.09	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 44

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	16
Top of Borehole (m)	2.857	Depth (m)	11.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
79	2.84	Vertical	11. Jul 2014

**Specimen Test**

Date of Test	28. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0626

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	68.42	175.0	2.56
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
46840		486	12.74	14.61	2237.58	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82i 88  
 Client Fax No: 946 122 821w7  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 4w

Project: Siemens - 510w7

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+er Station	Borehole	16
Top of Borehole (m)	2.8w7	Depth (m)	12.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
80	0.3	Vertical	11. Jul 2014

**Specimen Test**

Date of Test	28. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0627

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	71.i 2	181.0	2.v2
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
w1w10		w3w	12.68	1w74	21i w41	

Deviation No



BugeJa Paolo  
Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 46

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	16
Top of Borehole (m)	2.857	Depth (m)	13.3
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
81	0.5	Vertical	11. Jul 2014

**Specimen Test**

Date of Test	28. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0628

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	72.79	185.0	2.54
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
67770		698	16.29	14.17	2240.44	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 47

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	16
Top of Borehole (m)	2.857	Depth (m)	15.9
Remarks			

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
82	0.2	Vertical	11. Jul 2014

**Specimen Test**

Date of Test	28. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0629

Flatness	Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top Bottom					
OK OK	OK	OK	74.13	189.0	2.55
Failure Load (N)	Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
74750	752	17.32	15.29	2194.14	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 48

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	16
Top of Borehole (m)	2.857	Depth (m)	16.6
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
83	0.2	Vertical	11. Jul 2014

**Specimen Test**

Date of Test	28. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0630

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	72.79	185.0	2.54
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
68770		687	16.53	16.02	2163.8	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82i 88  
 Client Fax No: 946 122 821w7  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: w1

Project: Siemens - 510w7

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+er Station	Borehole	20
Top of Borehole (m)	2.i 3i	Depth (m)	i .2
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
86	0.i	Vertical	11. 5ul 2014

**Specimen Test**

Date of Test	31. 5ul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0633

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	wi .67	1ww0	2.6
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
31470		330	11.2w	1w38	2164.06	

Deviation No



BugeJa Paolo  
Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+ eden  
 Client Tel No: 946 122 82i 88  
 Client Fax No: 946 122 821w7  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: w2

Project: Siemens - 510w7

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	20
Top of Borehole (m)	2.13i	Depth (m)	10.2
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
87	0.4	Vertical	11. Jul 2014

**Specimen Test**

Date of Test	31. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters are based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0634

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	60.0	1000	2.08
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m³)	
32840		42i	11.61	14.77	2141.4w	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82i 88  
 Client Fax No: 946 122 821w7  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: w3

Project: Siemens - 510w7

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	20
Top of Borehole (m)	2.13i	Depth (m)	11.2
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
88	0.6w	Vertical	11. Jul 2014

**Specimen Test**

Date of Test	31. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters are based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/063w

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	66.73	174.1	2.61
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
44180		w74	12.63	14.73	2171.21	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82i 88  
 Client Fax No: 946 122 821w7  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: w7

Project: Siemens - 510w7

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+er Station	Borehole	14
Top of Borehole (m)	2.724	Depth (m)	7.w
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
i 2	0.2	Vertical	11. Jul 2014

**Specimen Test**

Date of Test	31. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/063i

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	6i .77	183.2	2.63
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
37420		48i	i .7i	1w76	2147.31	

Deviation No



BugeJa Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S9 eden  
 Client Tel No: i 46 122 82+88  
 Client Fax No: i 46 122 821w7  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: w+

Project: Siemens - 510w7

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	14
Top of Borehole (m)	2.724	Depth (m)	10.w
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
+4	0.7	Vertical	11. Jul 2014

**Specimen Test**

Date of Test	31. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters are based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0641

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	72.w+	1+0.8	2.63
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
ww870		72w	13.w	1w81	2104.7+	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 62

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	14
Top of Borehole (m)	2.724	Depth (m)	13.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
97	0.7	Vertical	11. Jul 2014

**Specimen Test**

Date of Test	31. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0644

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	71.82	187.0	2.6
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
55990		727	13.82	15.68	2141.06	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 63

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	14
Top of Borehole (m)	2.724	Depth (m)	14.8
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
98	0.3	Vertical	11. Jul 2014

**Specimen Test**

Date of Test	31. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0645

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	72.5	189.3	2.61
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
62520		810	15.14	15.21	2153.61	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 68

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	15
Top of Borehole (m)	2.778	Depth (m)	9.6
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
103	0.2	Vertical	16. Jul 2014

**Specimen Test**

Date of Test	29. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0650

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	75.37	190.0	2.52
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
18800		246	4.21	18.24	2132.84	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 6w

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+er Station	Borehole	15
Top of Borehole (m)	2.778	Depth (m)	10.4
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
104	0.4	Vertical	16. Jul 2014

**Specimen Test**

Date of Test	2w Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0651

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.7	1w3.8	2.53
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
13360		200	2.8w	18.0	2122.ww	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 70

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	15
Top of Borehole (m)	2.778	Depth (m)	10.8
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
105	0.3	Vertical	16. Jul 2014

**Specimen Test**

Date of Test	29. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0652

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.67	192.0	2.5
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
28630		750	6.2	17.88	2123.13	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 71

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	15
Top of Borehole (m)	2.778	Depth (m)	12.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
106	0.6	Vertical	16. Jul 2014

**Specimen Test**

Date of Test	29. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0653

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	NO	OK	75.93	192.0	2.53
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
42500		1105	9.39	15.5	2180.82	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 72

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	15
Top of Borehole (m)	2.778	Depth (m)	14.5
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
107	0.4	Vertical	16. Jul 2014

**Specimen Test**

Date of Test	29. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0654

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	75.97	170.0	2.24
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
38520		1001	8.5	16.04	2169.77	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 73

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	15
Top of Borehole (m)	2.778	Depth (m)	17.3
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
108	0.3	Vertical	16. Jul 2014

**Specimen Test**

Date of Test	29. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0655

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.33	191.3	2.51
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
65630		851	14.34	17.19	2139.65	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 74

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	15
Top of Borehole (m)	2.778	Depth (m)	18.4
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
109	0.6	Vertical	16. Jul 2014

**Specimen Test**

Date of Test	29. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0656

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.6	194.5	2.54
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
61370		581	13.32	17.36	2125.34	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82i 88  
 Client Fax No: 946 122 821w7  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 7w

Project: Siemens - 510w7

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+er Station	Borehole	1w
Top of Borehole (m)	2.778	Depth (m)	1i .7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
110	0.w	Vertical	16. Jul 2014

**Specimen Test**

Date of Test	2i . 5ul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/06w7

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	NO	OK	OK	7w68	160.w	2.12
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
w3240		760	11.84	16.4w	21w6.w6	

Deviation No



BugeJa Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 76

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	34
Top of Borehole (m)	3.704	Depth (m)	14.9
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
111	0.25	Vertical	16. Jul 2014

**Specimen Test**

Date of Test	29. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0658

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.8	190.0	2.47
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
39000		370	8.42	15.8	2184.81	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 77

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	34
Top of Borehole (m)	3.704	Depth (m)	15.2
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
112	0.6	Vertical	16. Jul 2014

**Specimen Test**

Date of Test	29. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0659

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	75.87	132.6	1.75
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
44970		520	9.95	15.4	2190.24	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 78

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	34
Top of Borehole (m)	3.704	Depth (m)	16.4
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
113	0.4	Vertical	16. Jul 2014

**Specimen Test**

Date of Test	29. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0660

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.22	180.9	2.37
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
40670		472	8.91	15.3	2178.33	

Deviation No



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 Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 7w

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	34
Top of Borehole (m)	3.704	Depth (m)	18.2
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
114	0.4	Vertical	16. Jul 2014

**Specimen Test**

Date of Test	2w Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters are based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0661

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.8	175.1	2.28
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
46530		53w	10.04	15.06	2162.37	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 81

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	35
Top of Borehole (m)	3.371	Depth (m)	8.3
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
116	0.7	Vertical	23. Jul 2014

**Specimen Test**

Date of Test	29. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0663

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.12	190.5	2.5
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
40550		470	8.91	16.82	2137.43	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 82

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	35
Top of Borehole (m)	3.371	Depth (m)	8.85
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
117	0.2	Vertical	23. Jul 2014

**Specimen Test**

Date of Test	29. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0664

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	73.67	187.3	2.54
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
28540		319	6.7	16.67	2143.09	

Deviation No



Bugeja Paolo  
Managing Director

This document can only be reproduced in full and with written authorisation from Solidbase Laboratory Ltd.

**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 83

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	35
Top of Borehole (m)	3.371	Depth (m)	11.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
118	0.4	Vertical	23. Jul 2014

**Specimen Test**

Date of Test	29. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0665

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	75.82	190.9	2.52
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
46150		535	10.22	18.89	2116.22	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 84

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	35
Top of Borehole (m)	3.371	Depth (m)	13.2
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
119	0.3	Vertical	23. Jul 2014

**Specimen Test**

Date of Test	29. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0666

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	73.98	193.6	2.62
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
57190		660	13.3	16.51	2117.3	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82i 88  
 Client Fax No: 946 122 821w7  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 8w

Project: Siemens - 510w7

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+er Station	Borehole	3w
Top of Borehole (m)	3.371	Depth (m)	14.w
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
120	0.4	Vertical	23. Jul 2014

**Specimen Test**

Date of Test	2i . 5ul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0667

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.12	188.8	2.48
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
64730		74w	14.22	16.16	21wi .01	

Deviation No



BugeJa Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 86

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	29
Top of Borehole (m)	3.718	Depth (m)	7.65
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
121	0.2	Vertical	19. Jul 2014

**Specimen Test**

Date of Test	30. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0684

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	75.62	170.5	2.25
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
18700		219	4.16	17.68	2124.71	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 87

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	29
Top of Borehole (m)	3.718	Depth (m)	8.3
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
122	0.7	Vertical	19. Jul 2014

**Specimen Test**

Date of Test	30. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0685

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.27	184.6	2.42
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
30100		359	6.59	17.4	2118.83	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 8w

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	2w
Top of Borehole (m)	3.718	Depth (m)	11.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
124	0.35	Vertical	1w Jul 2014

**Specimen Test**

Date of Test	30. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters are based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0687

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.13	16w4	2.23
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m³)	
44670		514	w81	16.52	2160.53	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+ eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: w0

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+ er Station	Borehole	31
Top of Borehole (m)	3.808	Depth (m)	14.1
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
125	1.0	Vertical	22. Jul 2014

**Specimen Test**

Date of Test	30. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0688

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.77	185.4	2.42
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
54w20		635	11.86	16.61	2156.87	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+ eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: w1

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+ er Station	Borehole	31
Top of Borehole (m)	3.808	Depth (m)	14.6
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
126	1.0	Vertical	22. Jul 2014

**Specimen Test**

Date of Test	30. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/068w

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	77.17	1w1.5	2.48
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
50880		587	10.88	16.13	215w24	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+ eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: w2

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+ er Station	Borehole	31
Top of Borehole (m)	3.808	Depth (m)	15.2
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
127	0.3	Vertical	22. Jul 2014

**Specimen Test**

Date of Test	30. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/06w0

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.8	1w0.1	2.48
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m³)	
48w40		567	10.56	16.86	2132.56	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: w3

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+er Station	Borehole	31
Top of Borehole (m)	3.808	Depth (m)	16.8
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
128	0.3	Vertical	22. Jul 2014

**Specimen Test**

Date of Test	30. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/06w1

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.82	1w4.8	2.54
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
523w0		605	11.3	16.25	2158.66	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+ eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: w4

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+ er Station	Borehole	31
Top of Borehole (m)	3.808	Depth (m)	17.45
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
12w	0.3	Vertical	22. Jul 2014

**Specimen Test**

Date of Test	30. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/06w2

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.77	1w0.w	2.4w
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
35660		415	7.7	16.3	2145.65	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S9 eden  
 Client Tel No: i 46 122 82w88  
 Client Fax No: i 46 122 821+7  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: w+

Project: Siemens - 510+7

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	31
Top of Borehole (m)	3.808	Depth (m)	1w3+
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
130	0.3	Vertical	22. Jul 2014

**Specimen Test**

Date of Test	30. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters are based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/06w3

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.72	1w0.4	2.48
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
+8230		672	12.6	1+.%	2180.22	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: w6

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+er Station	Borehole	11
Top of Borehole (m)	3.582	Depth (m)	8.4
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
131	0.4	Vertical	20. Jul 2014

**Specimen Test**

Date of Test	31. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/06w4

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.08	1w3.5	2.54
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
12160		14w	2.67	16.22	2166.76	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: w7

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	11
Top of Borehole (m)	3.582	Depth (m)	w3
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
132	0.3	Vertical	20. Jul 2014

**Specimen Test**

Date of Test	31. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on:

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/06w5

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	75.65	177.w	2.35
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
0		0	0.0	16.68	2171.03	

Deviation Sample dissolved after 5 hours curing in water



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: w8

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	11
Top of Borehole (m)	3.582	Depth (m)	w6
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
133	0.3	Vertical	20. Jul 2014

**Specimen Test**

Date of Test	31. Jul 2014	Technician ID	Iorgulescu Carmen
--------------	--------------	---------------	-------------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on:

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/06w6

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	75.w8	141.8	1.87
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
0		0	0.0	17.52	2116.87	

Deviation Sample dissolved after 5 hours curing in water



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: ww  
 Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+er Station	Borehole	11
Top of Borehole (m)	3.582	Depth (m)	10.35
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
134	0.4	Vertical	20. Jul 2014

**Specimen Test**

Date of Test	31. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/06w7

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	75.45	156.w	2.08
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
0		0	0.0	18.01	2148.23	

Deviation Sample dissolved after 5 hours curing in + ater



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 100

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	11
Top of Borehole (m)	3.582	Depth (m)	13.15
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
135	0.3	Vertical	20. Jul 2014

**Specimen Test**

Date of Test	31. Jul 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0698

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.97	191.6	2.49
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
47300		982	10.17	16.91	2177.19	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 102

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	27
Top of Borehole (m)	3.731	Depth (m)	8.8
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
137	0.25	Vertical	23. Jul 2014

**Specimen Test**

Date of Test	01. Aug 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0700

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	75.6	191.7	2.54
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
32450		424	7.23	15.89	2181.27	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 103

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	27
Top of Borehole (m)	3.731	Depth (m)	8.3
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
138	0.4	Vertical	23. Jul 2014

**Specimen Test**

Date of Test	01. Aug 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0701

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	75.48	132.0	1.75
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
29300		383	6.55	15.61	2190.82	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 104

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	27
Top of Borehole (m)	3.731	Depth (m)	9.25
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
139	0.4	Vertical	23. Jul 2014

**Specimen Test**

Date of Test	01. Aug 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0702

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	75.85	193.6	2.55
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
47790		625	10.58	15.66	2173.08	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82i 88  
 Client Fax No: 946 122 821w7  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 10w

Project: Siemens - 510w7

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+er Station	Borehole	27
Top of Borehole (m)	3.731	Depth (m)	10.2w
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
140	0.w	Vertical	23. Jul 2014

**Specimen Test**

Date of Test	01. Aug 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0703

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	7w8	120.2	1.wi
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
41i 70		w4w	i .3	16.03	2204.i w	

Deviation No



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Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 106

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	27
Top of Borehole (m)	3.731	Depth (m)	12.2
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
141	0.4	Vertical	23. Jul 2014

**Specimen Test**

Date of Test	01. Aug 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0704

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.4	184.2	2.41
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
42810		558	9.34	16.0	2169.5	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 107

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	27
Top of Borehole (m)	3.731	Depth (m)	13.8
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
142	0.3	Vertical	23. Jul 2014

**Specimen Test**

Date of Test	01. Aug 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0705

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	77.15	193.5	2.51
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
54850		711	11.73	15.76	2191.09	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 108

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	27
Top of Borehole (m)	3.731	Depth (m)	13.2
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
143	0.3	Vertical	23. Jul 2014

**Specimen Test**

Date of Test	01. Aug 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0706

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.25	192.8	2.53
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
48030		626	10.52	16.56	2161.54	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 110

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	28
Top of Borehole (m)	3.598	Depth (m)	8.2
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
145	0.6	Vertical	24. Jul 2014

**Specimen Test**

Date of Test	01. Aug 2014	Technician ID	Iorgulescu Carmen
--------------	--------------	---------------	-------------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0708

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.7	155.7	2.03
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
33190		432	7.18	18.17	2117.05	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 111

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	28
Top of Borehole (m)	3.598	Depth (m)	8.75
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
146	0.3	Vertical	24. Jul 2014

**Specimen Test**

Date of Test	01. Aug 2014	Technician ID	Iorgulescu Carmen
--------------	--------------	---------------	-------------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0709

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.65	174.6	2.28
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
29210		385	6.33	18.53	2113.76	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 112

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	32
Top of Borehole (m)	2.729	Depth (m)	14.2
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
147	0.2	Vertical	24. Jul 2014

**Specimen Test**

Date of Test	01. Aug 2014	Technician ID	Iorgulescu Carmen
--------------	--------------	---------------	-------------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0720

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	NO	OK	76.42	191.9	2.51
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
26720		348	5.83	16.4	2165.43	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 113

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	32
Top of Borehole (m)	2.729	Depth (m)	14.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
148	0.4	Vertical	24. Jul 2014

**Specimen Test**

Date of Test	01. Aug 2014	Technician ID	Iorgulescu Carmen
--------------	--------------	---------------	-------------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0721

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.32	190.7	2.5
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
39250		512	8.58	15.61	2179.04	

Deviation No



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Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 114

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	33
Top of Borehole (m)	2.677	Depth (m)	8.75
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
149	0.3	Vertical	24. Jul 2014

**Specimen Test**

Date of Test	01. Aug 2014	Technician ID	Iorgulescu Carmen
--------------	--------------	---------------	-------------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0722

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	NO	76.07	190.7	2.51
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
46870		604	10.31	15.85	2171.46	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 116

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	33
Top of Borehole (m)	2.677	Depth (m)	9.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
151	0.5	Vertical	24. Jul 2014

**Specimen Test**

Date of Test	01. Aug 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0724

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	77.05	188.8	2.45
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
42950		558	9.21	16.31	2176.5	

Deviation No



Bugeja Paolo  
 Managing Director

This document can only be reproduced in full and with written authorisation from Solidbase Laboratory Ltd.

**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 117

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	33
Top of Borehole (m)	2.677	Depth (m)	11.65
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
152	0.2	Vertical	24. Jul 2014

**Specimen Test**

Date of Test	01. Aug 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0725

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	77.22	189.2	2.45
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
48160		625	10.28	15.65	2170.25	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 118

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	28
Top of Borehole (m)	3.598	Depth (m)	9.5
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
153	0.8	Vertical	24. Jul 2014

**Specimen Test**

Date of Test	01. Aug 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0710

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	NO	NO	75.05	192.0	2.56
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
42180		730	9.53	16.0	2172.22	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 11w

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+er Station	Borehole	28
Top of Borehole (m)	3.5w8	Depth (m)	10.15
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
154	0.3	Vertical	24. Jul 2014

**Specimen Test**

Date of Test	01. Aug 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0711

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	NO	OK	74.57	1w5.1	2.62
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m³)	
36360		633	8.33	15.73	2184.0w	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 120

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	28
Top of Borehole (m)	3.598	Depth (m)	10.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
155	0.5	Vertical	24. Jul 2014

**Specimen Test**

Date of Test	01. Aug 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0712

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	75.68	194.1	2.56
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
37460		651	8.33	15.78	2180.67	

Deviation No



Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 121

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	28
Top of Borehole (m)	3.598	Depth (m)	13.3
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
156	0.2	Vertical	24. Jul 2014

**Specimen Test**

Date of Test	01. Aug 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0713

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.52	195.6	2.56
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
49750		861	10.82	17.31	2125.59	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 122

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	28
Top of Borehole (m)	3.598	Depth (m)	13.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
157	0.5	Vertical	24. Jul 2014

**Specimen Test**

Date of Test	01. Aug 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0714

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.6	193.9	2.53
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
50880		663	11.04	17.6	2126.32	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 123

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	28
Top of Borehole (m)	3.598	Depth (m)	14.6
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
158	0.3	Vertical	24. Jul 2014

**Specimen Test**

Date of Test	01. Aug 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0715

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	77.22	192.8	2.5
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
51580		669	11.01	16.77	2170.7	

**Deviation**


Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 124

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	32
Top of Borehole (m)	2.729	Depth (m)	8.75
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
159	0.2	Vertical	24. Jul 2014

**Specimen Test**

Date of Test	01. Aug 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0716

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.53	187.4	2.45
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
32760		428	7.12	16.03	2171.62	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+ eden  
 Client Tel No: 946 122 82i 88  
 Client Fax No: 946 122 821w7  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 12w

Project: Siemens - 510w7

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+ er Station	Borehole	32
Top of Borehole (m)	2.72i	Depth (m)	10.4
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
160	0.3	Vertical	24. Jul 2014

**Specimen Test**

Date of Test	01. Aug 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0717

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	NO	OK	77.28	168.0	2.17
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
31i 10		416	6.8	1wi i	2187.78	

Deviation No



BugeJa Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 126

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	32
Top of Borehole (m)	2.729	Depth (m)	11.25
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
161	0.8	Vertical	24. Jul 2014

**Specimen Test**

Date of Test	01. Aug 2014	Technician ID	Iorgulescu Carmen
--------------	--------------	---------------	-------------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0718

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.48	192.9	2.52
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
59010		766	12.85	16.36	2156.47	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 127

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	32
Top of Borehole (m)	2.729	Depth (m)	13.2
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
162	0.3	Vertical	24. Jul 2014

**Specimen Test**

Date of Test	01. Aug 2014	Technician ID	Iorgulescu Carmen
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0719

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.17	187.7	2.46
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
44840		583	9.84	15.96	2171.15	

Deviation No



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+ eden  
 Client Tel No: 946 122 82i 88  
 Client Fax No: 946 122 821w7  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 16w

Project: Siemens - 510w7

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+ er Station	Borehole	10
Top of Borehole (m)	2.80w	Depth (m)	i .3
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
164	204.7	Vertical	23. Jul 2014

**Specimen Test**

Date of Test	12. Aug 2014	Technician ID	Amoury Mustafa
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0740

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	6i .4	183.3	2.64
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m³)	
46800		416	12.37	14.86	2127.26	

**Deviation**


BugeJa Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 166

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	10
Top of Borehole (m)	2.805	Depth (m)	9.8
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
165	211.0	Vertical	23. Jul 2014

**Specimen Test**

Date of Test	12. Aug 2014	Technician ID	Amoury Mustafa
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0741

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.0	193.1	2.54
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
33600		344	7.41	15.95	2087.92	

**Deviation**


Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 167

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	10
Top of Borehole (m)	2.805	Depth (m)	10.8
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
166	209.0	Vertical	23. Jul 2014

**Specimen Test**

Date of Test	12. Aug 2014	Technician ID	Amoury Mustafa
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0742

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	NO	OK	75.5	188.9	2.5
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
51110		531	11.42	15.13	2139.06	

**Deviation**


Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 168

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	10
Top of Borehole (m)	2.805	Depth (m)	11.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
167	201.3	Vertical	23. Jul 2014

**Specimen Test**

Date of Test	12. Aug 2014	Technician ID	Amoury Mustafa
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0743

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	NO	OK	76.8	188.6	2.46
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
59770		619	12.9	31.02	2178.13	

**Deviation**


Bugeja Paolo  
Managing Director

This document can only be reproduced in full and with written authorisation from Solidbase Laboratory Ltd.

**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 16w

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+er Station	Borehole	10
Top of Borehole (m)	2.805	Depth (m)	12.5
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
168	207.0	Vertical	23. Jul 2014

**Specimen Test**

Date of Test	12. Aug 2014	Technician ID	Amoury Mustafa
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0744

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	73.63	1w1.1	2.6
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
5w750		618	14.03	37.74	2142.0w	

**Deviation**


Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 170

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	10
Top of Borehole (m)	2.805	Depth (m)	13.4
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
169	212.0	Vertical	23. Jul 2014

**Specimen Test**

Date of Test	12. Aug 2014	Technician ID	Amoury Mustafa
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0745

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.35	181.7	2.38
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
69600		680	15.2	26.9	2163.76	

**Deviation**


Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 171

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	10
Top of Borehole (m)	2.805	Depth (m)	14.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
170	203.1	Vertical	23. Jul 2014

**Specimen Test**

Date of Test	12. Aug 2014	Technician ID	Amoury Mustafa
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0746

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.75	189.6	2.47
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
72380		711	15.64	29.99	2102.21	

**Deviation**


Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 172

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	12
Top of Borehole (m)	2.89	Depth (m)	6.2
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
171	204.0	Vertical	25. Jul 2014

**Specimen Test**

Date of Test	12. Aug 2014	Technician ID	Amoury Mustafa
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0747

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	NO	OK	76.7	139.6	1.82
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
42640		401	9.23	30.49	2145.71	

**Deviation**


Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 174

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	12
Top of Borehole (m)	2.89	Depth (m)	9.2
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
173	205.6	Vertical	25. Jul 2014

**Specimen Test**

Date of Test	12. Aug 2014	Technician ID	Amoury Mustafa
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0749

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	NO	OK	76.23	189.7	2.49
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
34140		389	7.48	39.48	2128.71	

**Deviation**


Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+ eden  
 Client Tel No: 946 122 82i 88  
 Client Fax No: 946 122 821w7  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 17w

Project: Siemens - 510w7

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+ er Station	Borehole	12
Top of Borehole (m)	2.8i	Depth (m)	10.8
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
174	211.7	Vertical	2w 5ul 2014

**Specimen Test**

Date of Test	12. Aug 2014	Technician ID	Amoury Mustafa
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/07w0

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.82	1i 3.4	2.v2
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m³)	
w4640		607	11.7i	31.6	2012.w3	

**Deviation**


BugeJa Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 176

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	12
Top of Borehole (m)	2.89	Depth (m)	12.3
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
175	212.0	Vertical	25. Jul 2014

**Specimen Test**

Date of Test	12. Aug 2014	Technician ID	Amoury Mustafa
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0751

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.4	191.5	2.51
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
63610		641	13.88	35.31	2172.23	

**Deviation**


Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 177

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	12
Top of Borehole (m)	2.89	Depth (m)	13.2
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
176	201.1	Vertical	25. Jul 2014

**Specimen Test**

Date of Test	12. Aug 2014	Technician ID	Amoury Mustafa
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0752

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	NO	OK	76.25	187.0	2.45
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
59810		618	13.1	32.77	2158.31	

**Deviation**


Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 178

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	12
Top of Borehole (m)	2.89	Depth (m)	14.25
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
177	203.4	Vertical	25. Jul 2014

**Specimen Test**

Date of Test	12. Aug 2014	Technician ID	Amoury Mustafa
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0753

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.53	183.0	2.39
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
55600		577	12.09	30.36	2158.49	

**Deviation**


Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 17w

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+er Station	Borehole	5
Top of Borehole (m)	2.76	Depth (m)	7.2
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
178	0.0	Vertical	27. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Amoury Mustafa
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0763

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	77.32	1w0.0	2.46
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m³)	
46470		483	ww	17.22	21w6.02	

**Deviation**


Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 180

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	5
Top of Borehole (m)	2.76	Depth (m)	7.8
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
179	0.0	Vertical	27. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Amoury Mustafa
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0764

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	65.58	165.4	2.52
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
39930		518	11.82	13.82	2163.77	

**Deviation**


Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 181

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	5
Top of Borehole (m)	2.76	Depth (m)	9.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
180	0.0	Vertical	27. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Amoury Mustafa
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0765

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	77.5	190.0	2.45
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
69190		715	14.67	15.89	2079.69	

**Deviation**


Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 182

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	5
Top of Borehole (m)	2.76	Depth (m)	11.2
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
181	0.0	Vertical	27. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Amoury Mustafa
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0766

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	77.83	191.0	2.45
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
67050		462	14.09	17.31	2096.98	

**Deviation**


Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 183

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	5
Top of Borehole (m)	2.76	Depth (m)	12.3
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
182	260.0	Vertical	27. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Amoury Mustafa
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0767

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	NO	OK	77.73	189.0	2.43
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
69700		599	14.69	16.35	2053.19	

**Deviation**


Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 184

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	5
Top of Borehole (m)	2.76	Depth (m)	13.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
183	0.0	Vertical	27. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Amoury Mustafa
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0768

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	NO	OK	72.35	189.0	2.61
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
66480		574	16.17	16.74	2121.19	

**Deviation**


Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+ eden  
 Client Tel No: 946 122 82i 88  
 Client Fax No: 946 122 821w7  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 18w

Project: Siemens - 510w7

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+ er Station	Borehole	w
Top of Borehole (m)	2.76	Depth (m)	14.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
184	0.0	Vertical	27. Jul 2014

**Specimen Test**

Date of Test	2w Aug 2014	Technician ID	Amoury Mustafa
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/076i

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	62.6w	162.2	2.w
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
48720		421	1w8	16.i i	213i .w1	

**Deviation**


BugeJa Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 188

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	22
Top of Borehole (m)	2.573	Depth (m)	8.3
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
187	0.0	Vertical	28. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Amoury Mustafa
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0772

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.65	190.0	2.48
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
38490		456	8.34	15.77	2232.15	

**Deviation**


Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 1w1

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	22
Top of Borehole (m)	2.573	Depth (m)	14.6
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
1w0	1w0.0	Vertical	28. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters are based on:

QP 021 &amp; SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0775

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.72	1w0.0	2.48
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
47380		463	10.25	16.42	2170.01	

**Deviation**


Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+ eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 1w2

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+ er Station	Borehole	26
Top of Borehole (m)	2.663	Depth (m)	w4
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
1w1	0.0	Vertical	28. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0776

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	NO	OK	76.57	183.0	2.3w
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m³)	
57010		521	12.38	12.53	2216.76	

**Deviation**


Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 1w3

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+er Station	Borehole	26
Top of Borehole (m)	2.663	Depth (m)	13.8
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
1w2	0.0	Vertical	28. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0777

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	77.78	1w3.0	2.48
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
523w0		54w	11.03	14.88	2176.5w	

**Deviation**


Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 1w4

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+er Station	Borehole	26
Top of Borehole (m)	2.663	Depth (m)	14.4
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
1w3	0.0	Vertical	28. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0778

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	66.62	1w1.5	2.87
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
45280		45w	12.ww	16.01	2w31.73	

**Deviation**


Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S9 eden  
 Client Tel No: i 46 122 82w88  
 Client Fax No: i 46 122 821+7  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 1w+

Project: Siemens - 510+7

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	26
Top of Borehole (m)	2.663	Depth (m)	14.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
1w4	0.0	Vertical	28. Jul 2014

**Specimen Test**

Date of Test	2+. Aug 2014	Technician ID	Ademovic Mirza
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters are based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/077w

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.w3	1w3.0	2.+1
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
+4030		+03	11.62	1+.14	221w3w	

**Deviation**


Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+ eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 1w6

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+ er Station	Borehole	27
Top of Borehole (m)	2.701	Depth (m)	2.w
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
1w5	0.0	Vertical	30. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0780

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.52	140.7	1.84
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m³)	
5w830		621	13.01	14.71	127w2	

**Deviation**


Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+ eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 1w7

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+ er Station	Borehole	27
Top of Borehole (m)	2.701	Depth (m)	8.6
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
1w6	0.0	Vertical	30. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0781

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.w3	1w0.0	2.47
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m³)	
64w20		4w5	13.w7	16.0w	2135.54	

**Deviation**


Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+ eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 1w8

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+ er Station	Borehole	27
Top of Borehole (m)	2.701	Depth (m)	w5
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
1w7	0.0	Vertical	30. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0782

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	0.0	0.0	
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
0		0				

Deviation Core damaged during trimming



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+ eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 1w

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+ er Station	Borehole	27
Top of Borehole (m)	2.701	Depth (m)	11.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
1w8	0.0	Vertical	30. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0783

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	77.38	185.4	2.4
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
68250		463	14.51	15.86	1845.13	

**Deviation**


Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 200

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	27
Top of Borehole (m)	2.701	Depth (m)	12.3
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
199	0.0	Vertical	30. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0784

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.97	172.0	2.23
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
73410		521	15.78	16.15	1620.61	

**Deviation**


Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 203

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	1
Top of Borehole (m)	2.73	Depth (m)	8.3
Remarks			

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
201	202.0	Vertical	29. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0792

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	73.28	186.1	2.54
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
44500		420	10.55	17.08	2132.79	

**Deviation**


Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 204

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	1
Top of Borehole (m)	2.73	Depth (m)	9.4
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
202	202.0	Vertical	29. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0793

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	74.55	184.7	2.48
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
72200		662	16.54	15.6	2211.56	

**Deviation**


Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82i 88  
 Client Fax No: 946 122 821w7  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 20w

Project: Siemens - 510w7

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+er Station	Borehole	1
Top of Borehole (m)	2.73	Depth (m)	10.3
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
203	211.0	Vertical	2i . 5ul 2014

**Specimen Test**

Date of Test	2w Aug 2014	Technician ID	Ademovic Mirza
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/07i 4

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	w6.4	141.i	2.v2
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
31230		407	12.w	1w4	2166.36	

**Deviation**


BugeJa Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 206

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	7
Top of Borehole (m)	2.903	Depth (m)	9.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
204	200.0	Vertical	29. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0795

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.83	189.9	2.47
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
54800		487	11.82	15.24	2142.22	

**Deviation**


Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 207

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	7
Top of Borehole (m)	2.903	Depth (m)	10.2
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
205	201.0	Vertical	29. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0796

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	77.6	188.3	2.43
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
55300		600	11.69	26.67	2176.16	

**Deviation**


Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 208

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	7
Top of Borehole (m)	2.903	Depth (m)	13.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
206	201.0	Vertical	29. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0797

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.17	189.6	2.49
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
70500		508	15.47	16.76	2179.49	

**Deviation**


Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 20w

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	7
Top of Borehole (m)	2.03	Depth (m)	12.2
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
207	202.0	Vertical	2w Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters are based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/07w8

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	75.65	1112	2.53
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
6800		620	15.33	16.78	2172.45	

**Deviation**


Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 210

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	7
Top of Borehole (m)	2.903	Depth (m)	14.8
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
208	0.0	Vertical	29. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0799

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	0.0	0.0	
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
0		0				

Deviation Core damaged during trimming



Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 211

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	7
Top of Borehole (m)	2.903	Depth (m)	14.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
209	200.0	Vertical	29. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0800

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	NO	OK	66.28	142.1	2.14
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
61400		620	17.8	17.46	2151.81	

**Deviation**


Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 212

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	23
Top of Borehole (m)	2.684	Depth (m)	8.2
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
210	208.0	Vertical	30. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0801

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	77.27	192.8	2.5
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
65250		421	13.91	16.15	2195.54	

**Deviation**


Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 213

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	23
Top of Borehole (m)	2.684	Depth (m)	8.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
211	200.0	Vertical	30. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0802

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	77.93	189.2	2.43
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
56380		403	11.82	15.92	2176.31	

**Deviation**


Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 214

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	23
Top of Borehole (m)	2.684	Depth (m)	9.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
212	198.0	Vertical	30. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0803

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	70.13	155.2	2.21
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
32010		345	8.29	15.63	2181.82	

**Deviation**


Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82i 88  
 Client Fax No: 946 122 821w7  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 21w

Project: Siemens - 510w7

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+er Station	Borehole	23
Top of Borehole (m)	2.684	Depth (m)	10.8
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
213	18w0	Vertical	30. Jul 2014

**Specimen Test**

Date of Test	2w Aug 2014	Technician ID	Ademovic Mirza
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**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0804

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	6i.i 7	1w4.1	2.2
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
4w080		w8w	11.72	1ww3	2182.14	

**Deviation**


BugeJa Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 216

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	23
Top of Borehole (m)	2.684	Depth (m)	11.8
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
214	201.0	Vertical	30. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
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**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0805

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	77.4	192.4	2.49
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
39270		509	8.35	15.84	2154.06	

**Deviation**


Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 217

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	23
Top of Borehole (m)	2.684	Depth (m)	12.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
215	200.0	Vertical	30. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0806

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.5	190.0	2.48
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
34130		398	7.43	17.53	2139.0	

**Deviation**


Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 218

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	23
Top of Borehole (m)	2.684	Depth (m)	13.6
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
216	177.0	Vertical	30. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0807

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	NO	OK	73.65	177.0	2.4
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
44200		572	10.37	16.21	2152.34	

**Deviation**


Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82w88  
 Client Fax No: 946 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 21w

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+er Station	Borehole	23
Top of Borehole (m)	2.684	Depth (m)	14.7
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
217	180.0	Vertical	30. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0808

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	65.68	135.0	2.06
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
30750		400	w08	16.1	1w1w57	

**Deviation**


Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 221

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	24
Top of Borehole (m)	2.764	Depth (m)	7.8
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
219	211.0	Vertical	30. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0810

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	74.08	182.4	2.46
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
41830		543	9.71	14.34	2156.02	

**Deviation**


Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 222

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	24
Top of Borehole (m)	2.764	Depth (m)	8.6
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
220	201.0	Vertical	30. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0811

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	76.48	190.3	2.49
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
53280		584	11.6	15.74	2222.54	

**Deviation**


Bugeja Paolo  
Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 223

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	24
Top of Borehole (m)	2.764	Depth (m)	10.3
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
221	200.0	Vertical	30. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0812

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	77.33	191.4	2.48
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
44040		571	9.38	14.77	2190.37	

**Deviation**


Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 224

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	24
Top of Borehole (m)	2.764	Depth (m)	11.25
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
222	200.0	Vertical	30. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0813

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	77.5	189.1	2.44
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
51130		700	10.84	14.53	2201.69	

**Deviation**


Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE**

Determination of Rock Compressive Strength - ISRM suggested Method

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 S+eden  
 Client Tel No: 946 122 82i 88  
 Client Fax No: 946 122 821w7  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 22w

Project: Siemens - 510w7

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Po+er Station	Borehole	24
Top of Borehole (m)	2.764	Depth (m)	12.3w
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
223	210.0	Vertical	30. Jul 2014

**Specimen Test**

Date of Test	2w Aug 2014	Technician ID	Ademovic Mirza
--------------	-------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance + ith client's instructions.

Test procedure and test parameters + ere based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0814

Flatness		Perpedicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	NO	OK	74.17	183.i	2.48
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
w6680		720	13.12	14.w4	2188.63	

**Deviation**


BugeJa Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014  
 Certificate No: 226

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	24
Top of Borehole (m)	2.764	Depth (m)	13.3
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
224	205.0	Vertical	30. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0815

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	OK	OK	77.05	192.1	2.49
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
54830		705	11.76	14.94	2169.25	

**Deviation**


Bugeja Paolo  
 Managing Director

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**TEST CERTIFICATE****Determination of Rock Compressive Strength - ISRM suggested Method**

Client Name: Siemens Industrial Turbomachinery AB  
 Client Address: E P GT SGT FSP SOL EN 4 Slottsvaegen  
 SE-612 83 Finspang,  
 Sweden  
 Client Tel No: +46 122 82988  
 Client Fax No: +46 122 82157  
 Attn.:

Certificate Date: 27. Aug 2014

Certificate No: 227

Project: Siemens - J1057

**Specimen Coring**

Specimen Test	Unconfined compressive strength of intact rock core specimen	Technician ID	Manfroi Stefano
Site Location	Delimara Power Station	Borehole	24
Top of Borehole (m)	2.764	Depth (m)	14.5
		Remarks	

Logbook ID	Maximum Core Length (m)	Coring Angle (horizontal or vertical)	Date of Coring
225	190.0	Vertical	30. Jul 2014

**Specimen Test**

Date of Test	25. Aug 2014	Technician ID	Ademovic Mirza
--------------	--------------	---------------	----------------

**Applied Specifications**

The tests have been carried out in accordance with client's instructions.

Test procedure and test parameters were based on :

QP 021 & SOP 021 version 3.0 : The Determination of Rock Compressive Strength according ISRM suggested Method

**Test Performed**

Unconfined compressive strength of intact rock core specimen

Core Ref R14/0816

Flatness		Perpendicularity	Straightness	Diameter (mm)	Length (mm)	Length / Diameter ratio
Top	Bottom					
OK	OK	NO	OK	55.92	148.6	2.66
Failure Load (N)		Seconds	Core Strength (MPa)	Moisture (%)	Density (Kg/m <sup>3</sup> )	
37410		486	15.23	14.51	2159.7	

**Deviation**


Bugeja Paolo  
Managing Director

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- **Determination of Deformability of Rock Materials in Uniaxial Compression - ISRM Suggested Method**



## TEST CERTIFICATE

### Determination of Uniaxial Compressive Strength of Rock Materials - ISRM Suggested Method

Client			
<b>Client Name :</b>	Siemens Industrial Turbomachinery AB	<b>Manufacturer :</b>	
<b>Client Address :</b>	E P GT SGT FSP SOL EN 4 Slottsvaegen, SE-612 83 Finspang, Sweden	<b>Client Job No:</b>	J1057
<b>Client Tel No :</b>	+46 122 82988	<b>Client Reference :</b>	Siemens
<b>Client Fax No :</b>	+46 122 82157	<b>Attention :</b>	Mr. Fredrik Nilssen

Certificate and Report			
<b>Test Certificate n° :</b>	1	<b>Certificate Date :</b>	22/08/2014
<b>Test Report n° :</b>	160	<b>Copy n°:</b>	1

Specimen Coring			
<b>Specimen Test :</b>	Unconfined compressive strength of intact rock core specimen	<b>Technician ID :</b>	Adrian Mifsud
<b>Site Location :</b>	Delimara Power Station	<b>Source of Test Specimen / Location of Work :</b>	9.80m deep in BH14 (LAT - 7.076m)
<b>Core ref :</b>	<b>Maximum Core Length</b>	<b>Coring Angle (horizontal or vertical)</b>	<b>Date of Coring</b>
Borehole No 14		Vertical	
<b>Core Description</b>	Calcareous marl of olive-grey colour, below water table - Middle Globigerina Limestone		
#REF!			

Specimen Test			
<b>Date of Test :</b>	22 August 2014	<b>Technician ID :</b>	AM
<b>Moisture content</b>	15.78%		

<b>Applied Specifications :</b>
Test procedure and test parameters were based on : QP 021 & SOP 021 version 2.0 : The Determination of Rock Compressive Strength according to ISRM Suggested Methods

<b>Test Performed :</b>
Unconfined compressive strength of intact rock core specimen with strain measurement

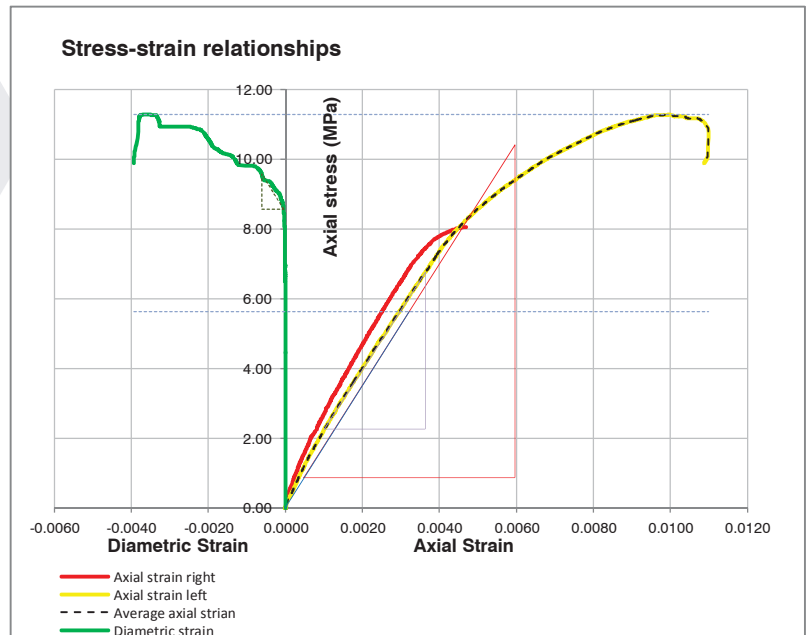
Core ref :	Flatness		Perpendicularity / Straightness	Diameter (mm)	Length (mm)	Failure Load (N)	Core Strength (N/mm²)
	Top	Bottom					
Borehole No 14	OK	OK	OK	75.0	195.5	49811.7	11.3

<b>Deviations :</b> Time anticipated for test was 600 seconds. Actual duration of test was 663 seconds.
---

Signature	
Assistant Laboratory Manager :	Quality Manager :

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### Deformation characteristics



### Determination of Axial Young's Modulus E

Maximum axial stress	UCS	11.28 MPa	
50% uniaxial compression strength		5.64 MPa	
Tangent Modulus at 50% of UCS	$E_t$	1.737 GPa	
Average Modulus over linear portion of curve	$E_{av}$	1.711 GPa	between 20% and 60% of UCS
Secant Modulus at 50% of UCS	$E_s$	1.751 GPa	

### Determination of Poisson's ratio $\nu$

#### Using stress level at 80.5% of UCS:

Tangent modulus at 80.5% of UCS	0.830 GPa
Slope of diametric curve between 76% and 85% of UCS	-1.773 GPa

Poisson's ratio	$\nu$	0.468
Volumetric strain at 80.5% of UCS	$\epsilon_v$	0.00596

### Mode of failure

Axial Cleavage

### Signature

Assistant Laboratory Manager :

Quality Manager :

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## TEST CERTIFICATE

### Determination of Uniaxial Compressive Strength of Rock Materials - ISRM Suggested Method

Client			
Client Name :	Siemens Industrial Turbomachinery AB	Manufacturer :	
Client Address :	E P GT SGT FSP SOL EN 4 Slottsvaegen, SE-612 83 Finspang, Sweden	Client Job No:	J1057
Client Tel No :	+46 122 82988	Client Reference :	Siemens
Client Fax No :	+46 122 82157	Attention :	Mr. Fredrik Nilssen

Certificate and Report			
Test Certificate n° :	1	Certificate Date :	08/08/2014
Test Report n° :	160	Copy n°:	1

Specimen Coring			
Specimen Test :	Unconfined compressive strength of intact rock core specimen	Technician ID :	Adrian Mifsud
Site Location :	Delimara Power Station	Source of Test Specimen / Location of Work :	12.2m deep in BH20 (LAT - 9.261m)
Core ref :	Maximum Core Length	Coring Angle (horizontal or vertical)	Date of Coring
Borehole No 20		Vertical	
Core Description	Calcareous marl of olive-grey colour, below water table - Middle Globigerina Limestone		
#REF!			

Specimen Test			
Date of Test :	06 August 2014	Technician ID :	AM
Moisture content	13.92%		

<b>Applied Specifications :</b>
Test procedure and test parameters were based on : QP 021 & SOP 021 version 2.0 : The Determination of Rock Compressive Strength according to ISRM Suggested Methods

<b>Test Performed :</b>
Unconfined compressive strength of intact rock core specimen with strain measurement

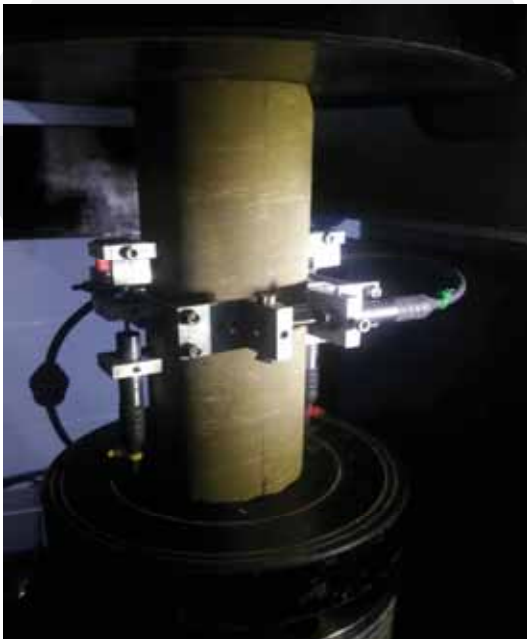
Core ref :	Flatness		Perpendicularity / Straightness	Diameter (mm)	Length (mm)	Failure Load (N)	Core Strength (N/mm²)
	Top	Bottom					
Borehole No 20	OK	OK	OK	70.0	182.8	42627.7	11.1

<b>Deviations :</b> Time anticipated for test was 600 seconds. Actual duration of test was 611.94 seconds.
--

Signature	
Assistant Laboratory Manager :	Quality Manager :

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### Deformation characteristics



### Determination of Axial Young's Modulus E

Maximum axial stress	UCS	11.08 MPa	
50% uniaxial compression strength		5.54 MPa	
Tangent Modulus at 50% of UCS	$E_t$	1.492 GPa	
Average Modulus over linear portion of curve	$E_{av}$	1.396 GPa	between 35% and 80% of UCS
Secant Modulus at 50% of UCS	$E_s$	1.721 GPa	

### Determination of Poisson's ratio $\nu$

#### Using stress level at 67.5% of UCS:

Tangent modulus at 67.5% of UCS	1.441 GPa
Slope of diametric curve between 55% and 80% of UCS	-2.972 GPa

Poisson's ratio	$\nu$	0.485
Volumetric strain at 67.5% of UCS	$\epsilon_v$	0.00579

### Mode of failure

Axial Cleavage

### Signature

Assistant Laboratory Manager :

Quality Manager :

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## TEST CERTIFICATE

### Determination of Uniaxial Compressive Strength of Rock Materials - ISRM Suggested Method

#### Client

<b>Client Name :</b>	Siemens Industrial Turbomachinery AB	<b>Manufacturer :</b>	
<b>Client Address :</b>	E P GT SGT FSP SOL EN 4 Slottsvaegen, SE-612 83 Finspang, Sweden	<b>Client Job No:</b>	J1057
<b>Client Tel No :</b>	+46 122 82988	<b>Client Reference :</b>	Siemens
<b>Client Fax No :</b>	+46 122 82157	<b>Attention :</b>	Mr. Fredrik Nilssen

#### Certificate and Report

<b>Test Certificate n° :</b>	1	<b>Certificate Date :</b>	22/08/2014
<b>Test Report n° :</b>	160	<b>Copy n°:</b>	1

#### Specimen Coring

<b>Specimen Test :</b>	Unconfined compressive strength of intact rock core specimen	<b>Technician ID :</b>	Adrian Mifsud
<b>Site Location :</b>	Delimara Power Station	<b>Source of Test Specimen / Location of Work :</b>	15.35m deep in BH14 (LAT - 12.626m)

<b>Core ref :</b>	<b>Maximum Core Length</b>	<b>Coring Angle (horizontal or vertical)</b>	<b>Date of Coring</b>
Borehole No 14		Vertical	
<b>Core Description</b>	Calcareous marl of olive-grey colour, below water table - Middle Globigerina Limestone		
#REF!			

#### Specimen Test

<b>Date of Test :</b>	22 August 2014	<b>Technician ID :</b>	AM
<b>Moisture content</b>	13.21%		

#### Applied Specifications :

Test procedure and test parameters were based on :  
QP 021 & SOP 021 version 2.0 : The Determination of Rock Compressive Strength according to ISRM Suggested Methods

#### Test Performed :

Unconfined compressive strength of intact rock core specimen with strain measurement

Core ref :	Flatness		Perpendicularity / Straightness	Diameter (mm)	Length (mm)	Failure Load (N)	Core Strength (N/mm²)
	Top	Bottom					
Borehole No 14	OK	OK	OK	72.9	190.6	71097.4	17.0

#### Deviations : Time anticipated for test was 600 seconds. Actual duration of test was 1100.46 seconds.

Right side axial displacement transducer detached during test and therefore ignored in calculations

#### Signature

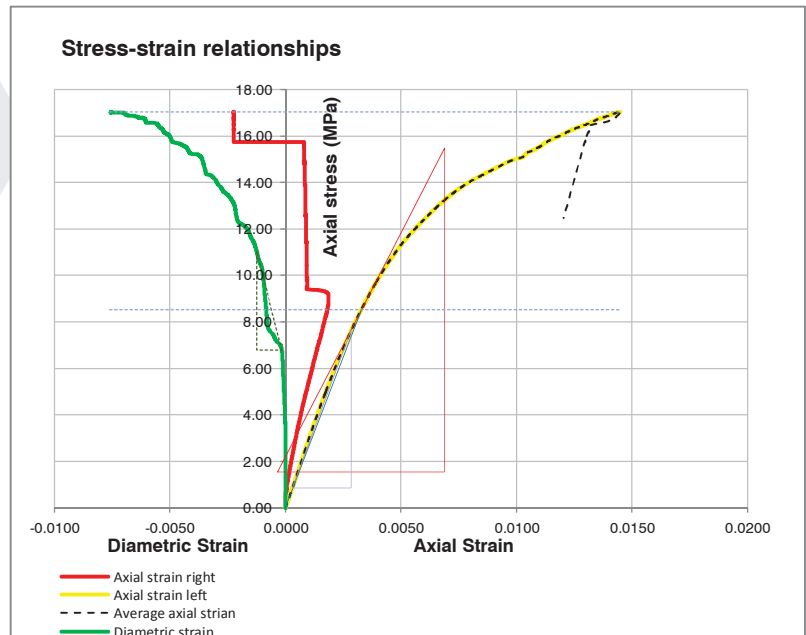
Assistant Laboratory Manager :

Quality Manager :

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### Deformation characteristics



### Determination of Axial Young's Modulus E

Maximum axial stress	UCS	17.03 MPa	
50% uniaxial compression strength		8.52 MPa	
Tangent Modulus at 50% of UCS	$E_t$	1.924 GPa	
Average Modulus over linear portion of curve	$E_{av}$	2.659 GPa	between 5% and 45% of UCS
Secant Modulus at 50% of UCS	$E_s$	2.598 GPa	

### Determination of Poisson's ratio $\nu$

#### Using stress level at 52.5% of UCS:

Tangent modulus at 52.5% of UCS	1.809 GPa
Slope of diametric curve between 40% and 65% of UCS	-3.920 GPa

Poisson's ratio	$\nu$	0.461
Volumetric strain at 52.5% of UCS	$\epsilon_v$	0.00524

### Mode of failure

Axial Cleavage

### Signature

Assistant Laboratory Manager :

Quality Manager :

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## Appendix F: Geophysical Tests

- Downhole seismic test data
- HVSr test data

## Appendix F: Geophysical Tests

### Downhole seismic test data

#### Borehole 15

The vertical measurement is characterized by two physical steps (marker) placed at 6 and 10 meters deep, which allow to differentiate the vertical measurement in three seismic layers. The first has a thickness of about 6 meters and is characterized by velocity of propagation of P waves 999.26 m/s and S-waves of 298.65 m/s. From 6 to 10 meters depth we observe a gradual increase of the velocity. From 10 meters there is a significant increase of the seismic velocity propagation (P-waves 2291.41 m/s - S waves 1037.19 m/s).

Seismic layer	Depth m	V <sub>pi</sub> m/s	V <sub>si</sub> m/s	$\gamma_{din}$ g/cm <sup>3</sup>	G kg/cm <sup>2</sup>	K kg/cm <sup>2</sup>	E kg/cm <sup>2</sup>	M kg/cm <sup>2</sup>	$\nu$	I <sub>s</sub> t*m <sup>-2</sup> *s <sup>-1</sup>
1	0-6	999.26	298.65	1.89	1750.64	17722.10	5031.37	20056.29	0.44	564.54
2	6 - 10	1904.93	404.32	2.14	3920.91	74811.76	11520.49	80039.64	0.47	868.36
3		2291.41	1037.19	2.22	24984.64	86313.13	67984.52	119625.98	0.37	2303.65

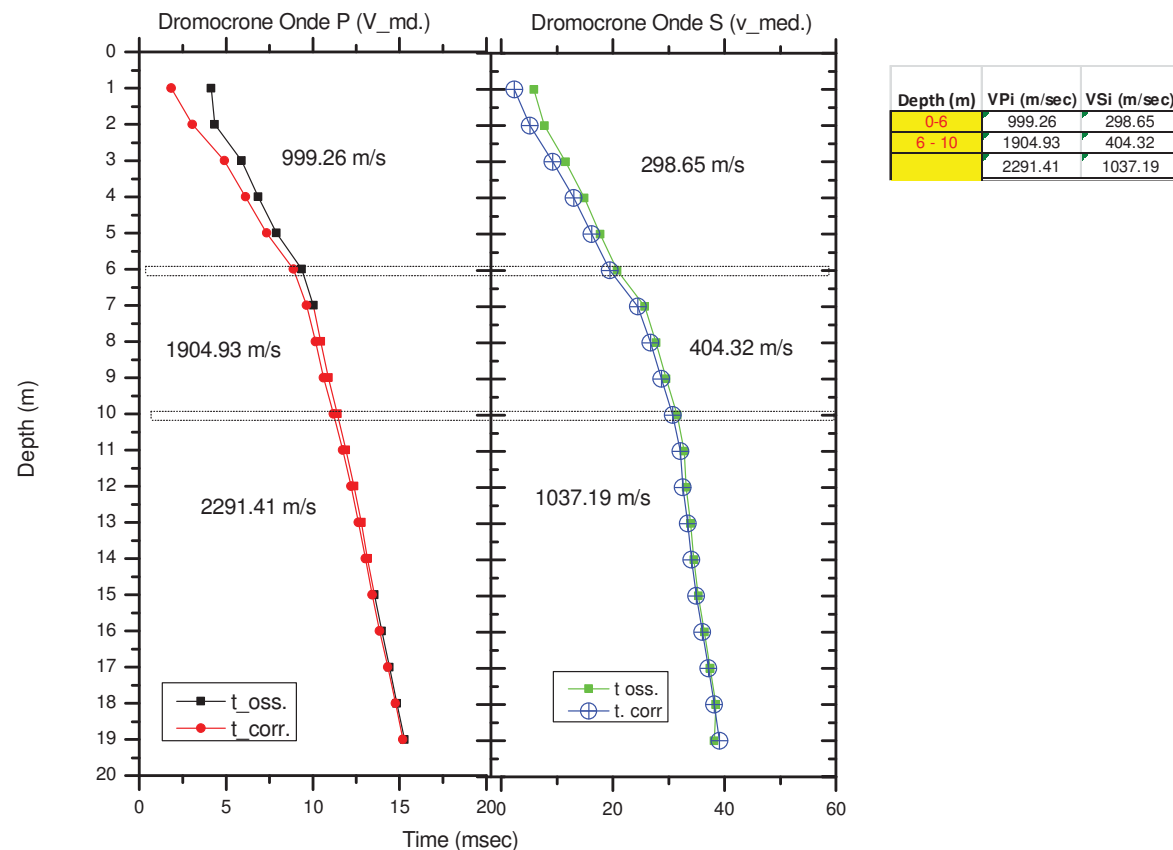


Figure 1 - Dromocrone observed time (t<sub>oss.</sub>) and corrected time.

Z (m)	V <sub>p,i</sub> m/s	V <sub>s,i</sub> m/s	$\gamma^{din}$ g/cm <sup>3</sup>	G kg/cm <sup>2</sup>	K kg/cm <sup>2</sup>	E kg/cm <sup>2</sup>	M kg/cm <sup>2</sup>	v	V <sub>p</sub> /V <sub>s</sub>	Imp. Sismica (t*m <sup>-2</sup> *sec <sup>-1</sup> )	Coeff. T	Coeff. $\xi$
1 _ 2	818.43	361.33	1.82	2.4E+03	9.2E+03	6.7E+03	1.2E+04	0.3789	2.27	659.09	0.8215	0.1785
2 _ 3	967.90	243.95	1.88	1.1E+03	1.6E+04	3.4E+03	1.8E+04	0.4661	3.97	459.39	1.0281	-0.0281
3 _ 4	821.20	266.25	1.83	1.3E+03	1.1E+04	3.8E+03	1.3E+04	0.4413	3.08	485.96	1.1232	-0.1232
4 _ 5	1265.30	314.20	1.98	2.0E+03	3.0E+04	5.9E+03	3.2E+04	0.4671	4.03	622.57	0.9779	0.0221
5 _ 6	1123.45	307.50	1.94	1.9E+03	2.2E+04	5.5E+03	2.5E+04	0.4595	3.65	595.68	0.8200	0.1800
6 _ 7	1691.09	197.71	2.09	8.3E+02	6.0E+04	2.5E+03	6.1E+04	0.4931	8.55	413.96	1.3779	-0.3779
7 _ 8	2065.25	421.57	2.17	3.9E+03	8.9E+04	1.2E+04	9.5E+04	0.4783	4.90	916.81	1.0919	-0.0919
8 _ 9	2070.45	506.64	2.18	5.7E+03	8.8E+04	1.7E+04	9.5E+04	0.4682	4.09	1102.36	0.9710	0.0290
9 _ 10	1792.92	491.37	2.12	5.2E+03	6.2E+04	1.5E+04	6.9E+04	0.4594	3.65	1040.30	1.1745	-0.1745
10 _ 11	2082.16	679.51	2.18	1.0E+04	8.3E+04	3.0E+04	9.6E+04	0.4404	3.06	1480.08	1.1653	-0.1653
11 _ 12	2110.09	946.15	2.18	2.0E+04	7.3E+04	5.5E+04	9.9E+04	0.3742	2.23	2066.09	1.1130	-0.1130
12 _ 13	2224.87	1175.39	2.21	3.1E+04	7.0E+04	8.1E+04	1.1E+05	0.3064	1.89	2592.63	1.0427	-0.0427
13 _ 14	2655.61	1238.00	2.28	3.6E+04	1.2E+05	9.7E+04	1.6E+05	0.3612	2.15	2824.11	0.9818	0.0182
14 _ 15	2478.99	1209.38	2.25	3.4E+04	9.6E+04	9.0E+04	1.4E+05	0.3438	2.05	2722.97	0.9308	0.0692
15 _ 16	2320.33	1066.20	2.22	2.6E+04	8.8E+04	7.0E+04	1.2E+05	0.3662	2.18	2370.62	0.9466	0.0534
16 _ 17	2178.17	969.60	2.20	2.1E+04	7.8E+04	5.8E+04	1.1E+05	0.3764	2.25	2130.11	1.0314	-0.0314
17 _ 18	2283.45	1023.27	2.22	2.4E+04	8.6E+04	6.5E+04	1.2E+05	0.3744	2.23	2268.25	1.0021	-0.0021
18 _ 19	2289.04	1027.20	2.22	2.4E+04	8.7E+04	6.6E+04	1.2E+05	0.3739	2.23	2278.02	0.0000	1.0000

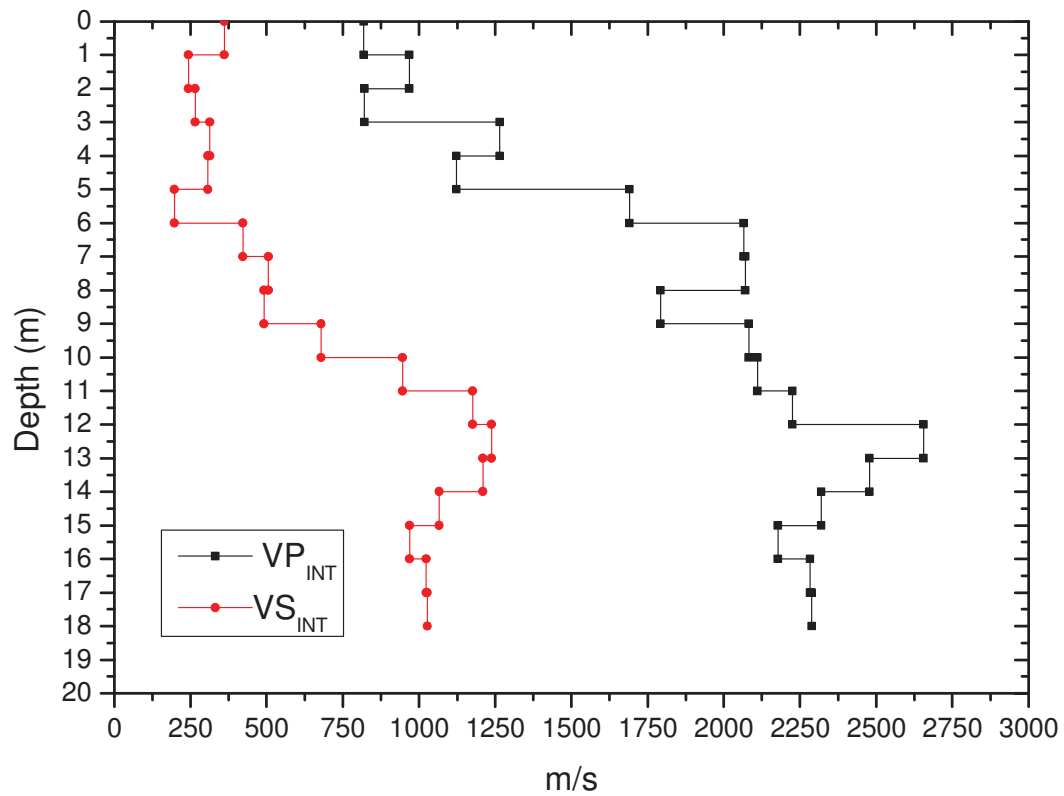


Figure 2 - Interval Velocity

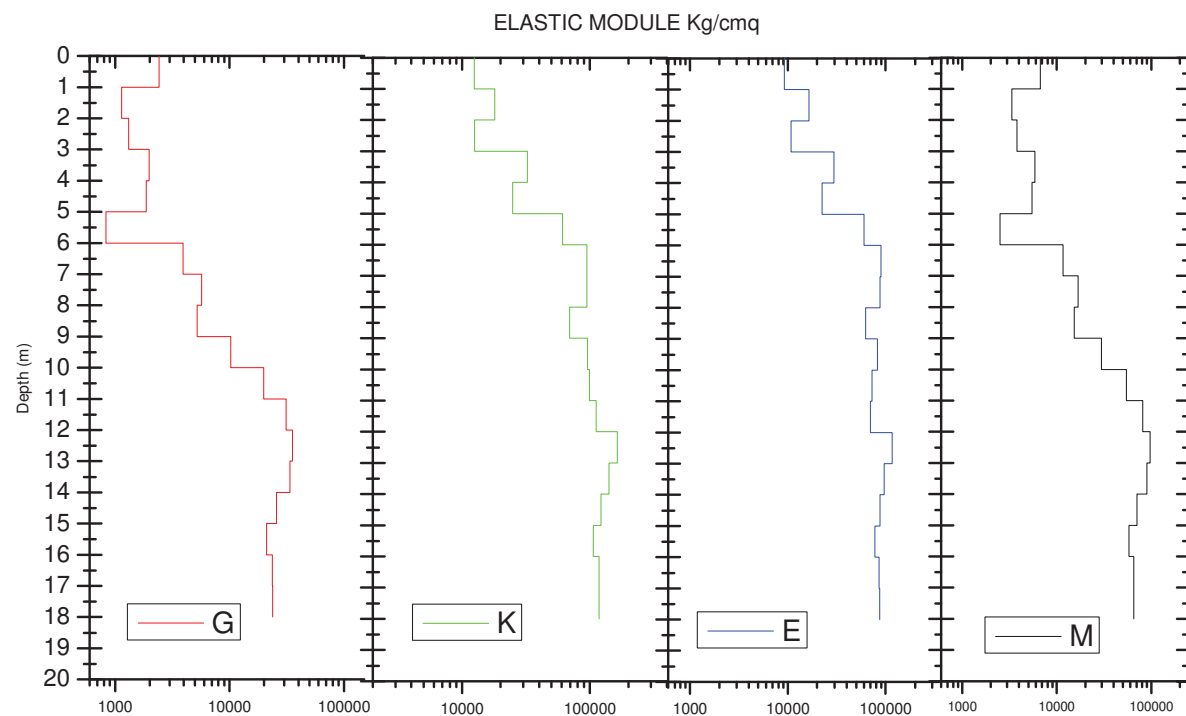


Figure 3 - Elastic Moduli



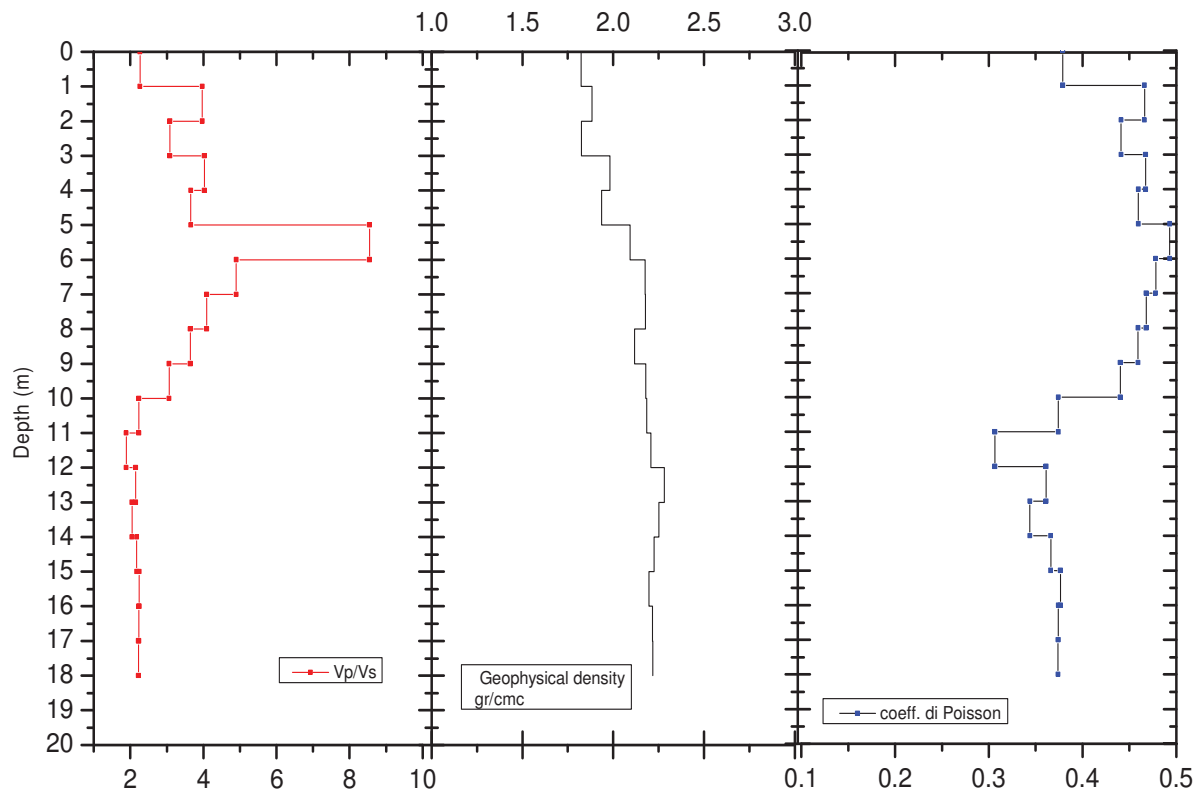


Figure 4 - Vp/Vs, geophysical density and Poisson's ratio

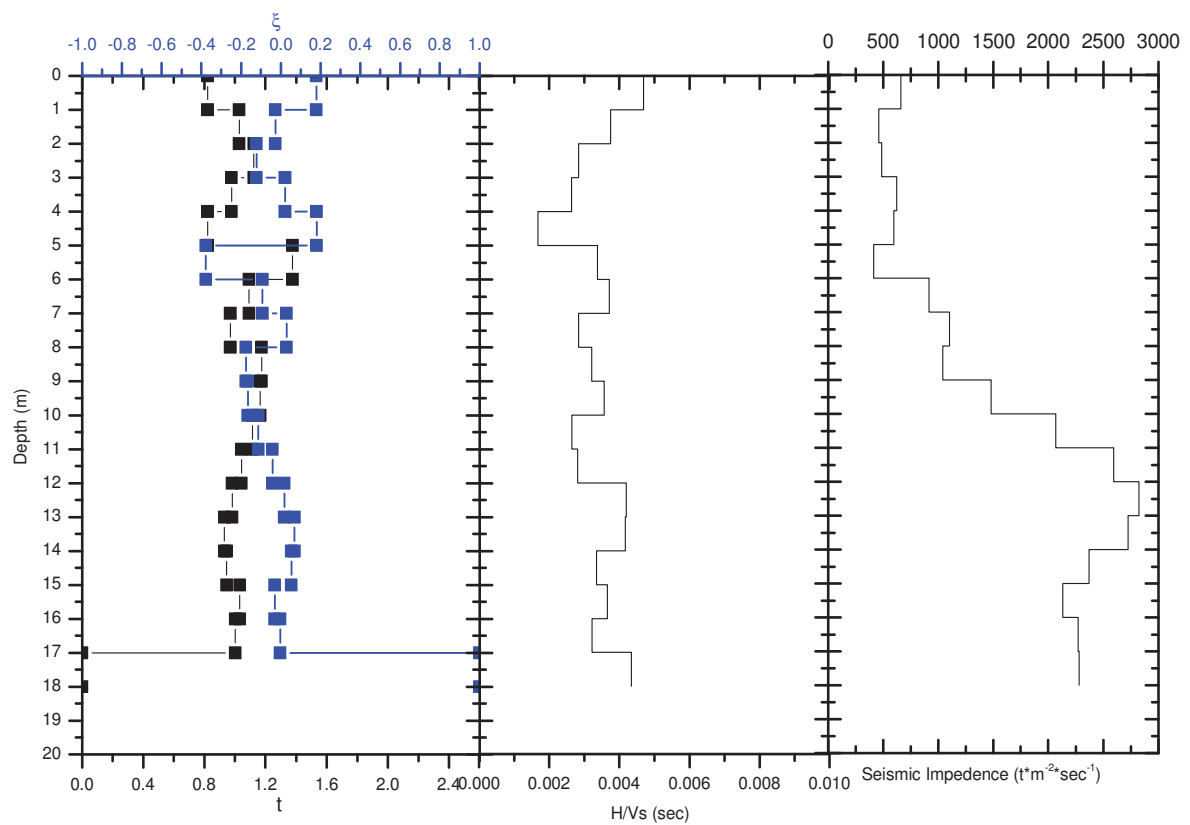


Figure 5 -  $t$ ,  $\xi$ , H VS Ratio and Seismic impedance

## Borehole 16

The vertical measurement is characterized by two physical steps (marker) seats 6 and 9 meters deep, that allow to differentiate the vertical measurement in three seismo-layer: the first seismo-layer has a thickness of about 6 meters and is characterized by average speed of seismic waves of P wave 1415.13 m/s of the S wave of 287.81 m/s. From 6 to 9 meters depth the seismic waves velocity increases gradually with depth. In this level the average velocity is 1640.81 m/s for P waves and 574.55 m/s for the waves S. At the depth 9 meters a high velocity layer is detected. This is characterized by average velocity seismic waves 2046.84 m/s (P-waves) and 990.23 m/s (S waves)

Seismic layer	Depth m	V <sub>Pi</sub> m/s	V <sub>Si</sub> m/s	$\gamma^{din}$ g/cm <sup>3</sup>	G kg/cm <sup>2</sup>	K kg/cm <sup>2</sup>	E kg/cm <sup>2</sup>	M kg/cm <sup>2</sup>	$\nu$	I <sub>s</sub> t*m <sup>-2</sup> *s <sup>-1</sup>
1	0-6	1415.13	287.81	2.02	1811.62	41174.94	5252.39	43590.44	0.46	574.50
2	6 - 9	1640.81	574.55	2.08	7634.93	48029.06	21498.83	58208.97	0.43	1200.88
3		2046.84	990.23	2.17	22673.29	63919.63	59821.52	94150.68	0.34	2154.05

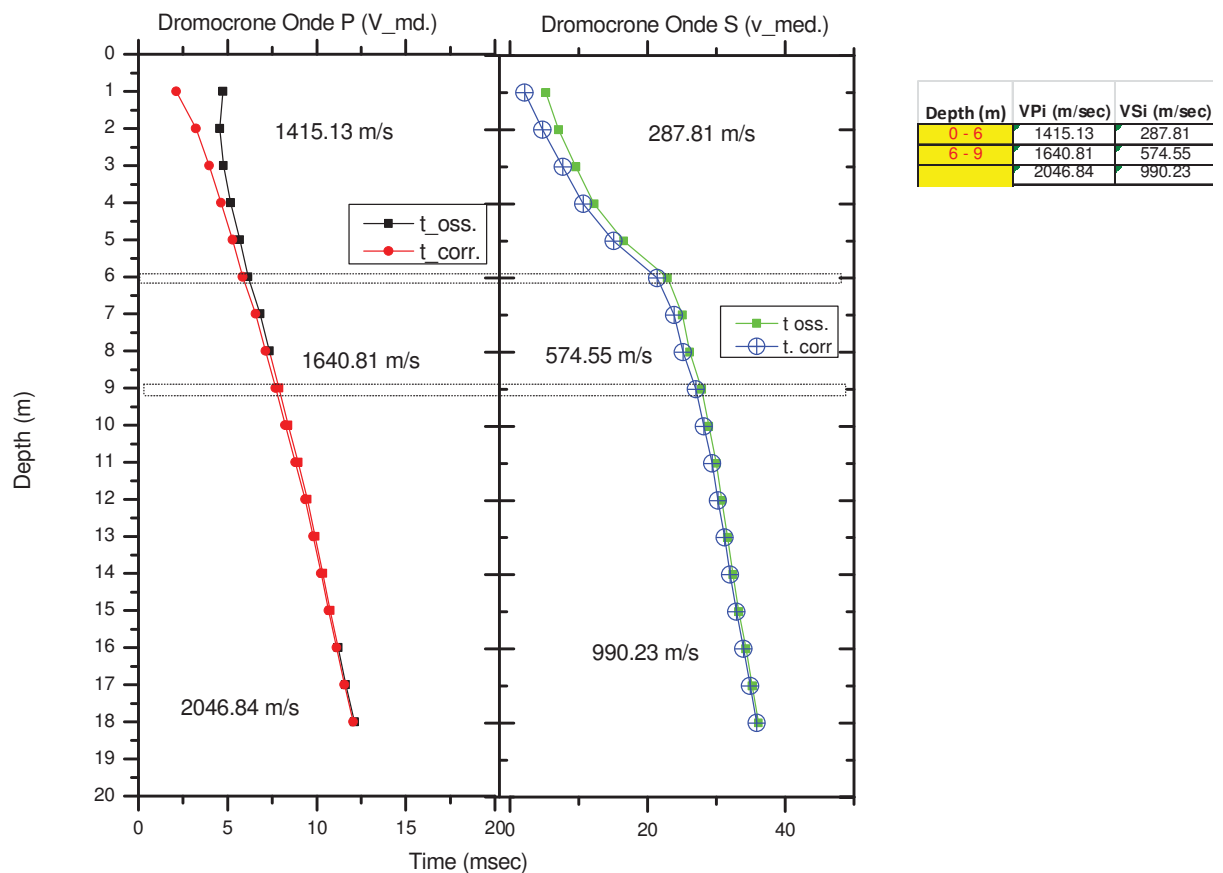


Figure 6 - Dromocrone observed time (t<sub>oss.</sub>) and corrected time

Z (m)	V <sub>p,i</sub> m/s	V <sub>s,i</sub> m/s	$\gamma^{din}$ g/cm <sup>3</sup>	G kg/cm <sup>2</sup>	K kg/cm <sup>2</sup>	E kg/cm <sup>2</sup>	M kg/cm <sup>2</sup>	v	V <sub>p</sub> N <sub>s</sub>	Imp. Sismica (t*m <sup>2</sup> *sec <sup>-1</sup> )	Coeff. T	Coeff. $\xi$
1 _ 2	905.29	382.89	1.86	2.8E+03	1.2E+04	7.7E+03	1.6E+04	0.3911	2.36	711.93	0.9755	0.1785
2 _ 3	1343.23	338.25	2.00	2.3E+03	3.4E+04	6.9E+03	3.7E+04	0.4661	3.97	677.89	1.0040	-0.0281
3 _ 4	1505.45	333.69	2.05	2.3E+03	4.4E+04	6.9E+03	4.7E+04	0.4742	4.51	683.39	0.8126	-0.1232
4 _ 5	1538.70	227.41	2.06	1.1E+03	4.8E+04	3.2E+03	5.0E+04	0.4888	6.77	467.68	0.8298	0.0221
5 _ 6	1782.99	156.81	2.11	5.3E+02	6.8E+04	1.6E+03	6.9E+04	0.4961	11.37	331.63	1.4221	0.1800
6 _ 7	1364.38	405.98	2.01	3.4E+03	3.4E+04	9.8E+03	3.8E+04	0.4514	3.36	816.04	1.3471	-0.3779
7 _ 8	1796.51	794.88	2.12	1.4E+04	5.2E+04	3.8E+04	7.0E+04	0.3783	2.26	1683.51	0.7917	-0.0919
8 _ 9	1761.55	522.79	2.11	5.9E+03	5.9E+04	1.7E+04	6.7E+04	0.4517	3.37	1103.10	1.2648	0.0290
9 _ 10	1901.39	886.45	2.14	1.7E+04	5.6E+04	4.7E+04	7.9E+04	0.3611	2.14	1897.79	0.9455	-0.1745
10 _ 11	1728.42	809.43	2.10	1.4E+04	4.5E+04	3.8E+04	6.4E+04	0.3595	2.14	1701.78	1.1783	-0.1653
11 _ 12	1833.59	1147.82	2.13	2.9E+04	3.5E+04	6.7E+04	7.3E+04	0.1778	1.60	2440.45	0.9957	-0.1130
12 _ 13	2253.53	1094.24	2.21	2.7E+04	7.9E+04	7.3E+04	1.1E+05	0.3457	2.06	2419.50	1.0589	-0.0427
13 _ 14	2265.96	1229.96	2.21	3.4E+04	7.0E+04	8.8E+04	1.2E+05	0.2912	1.84	2722.45	0.9482	0.0182
14 _ 15	2275.59	1107.99	2.22	2.8E+04	8.0E+04	7.5E+04	1.2E+05	0.3446	2.05	2454.45	0.9183	0.0692
15 _ 16	2283.17	939.96	2.22	2.0E+04	9.1E+04	5.6E+04	1.2E+05	0.3980	2.43	2083.54	1.0728	0.0534
16 _ 17	2289.22	1086.99	2.22	2.7E+04	8.3E+04	7.2E+04	1.2E+05	0.3545	2.11	2410.66	0.9692	-0.0314
17 _ 18	2018.04	1046.78	2.17	2.4E+04	5.8E+04	6.4E+04	9.0E+04	0.3159	1.93	2266.53	1.0808	-0.0021
18 _ 19	2155.11	1215.44	2.19	3.3E+04	6.0E+04	8.4E+04	1.0E+05	0.2668	1.77	2664.79	0.0000	1.0000

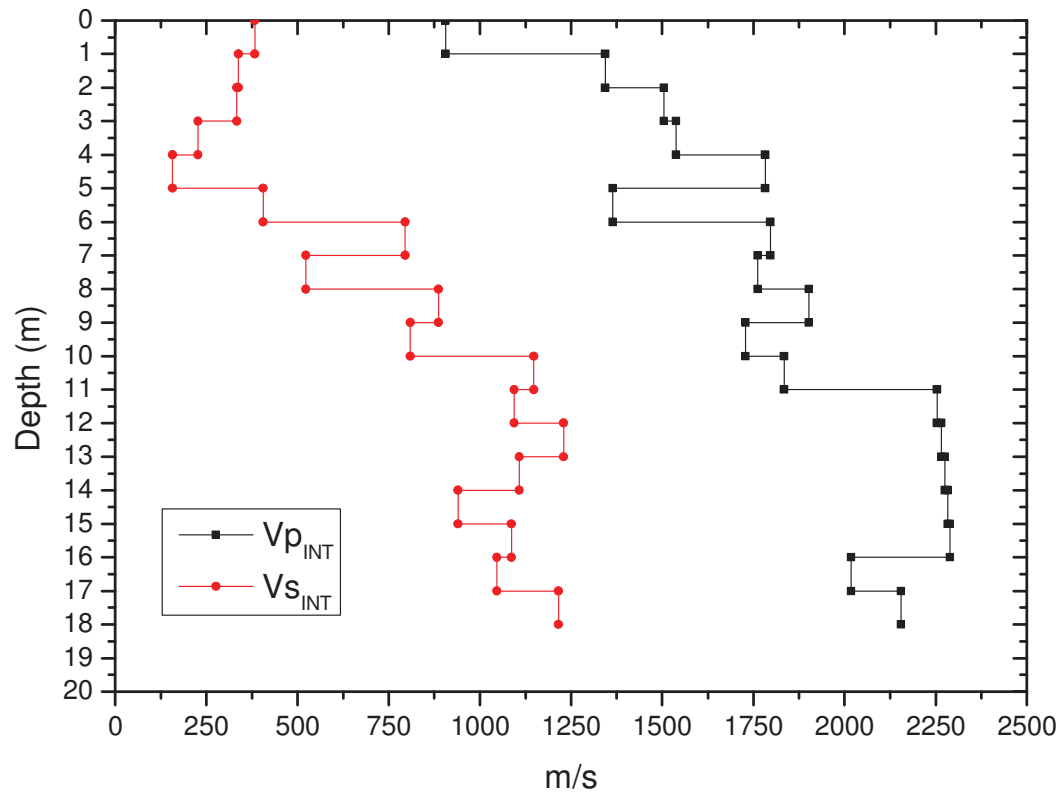


Figure 7 - Interval Velocity

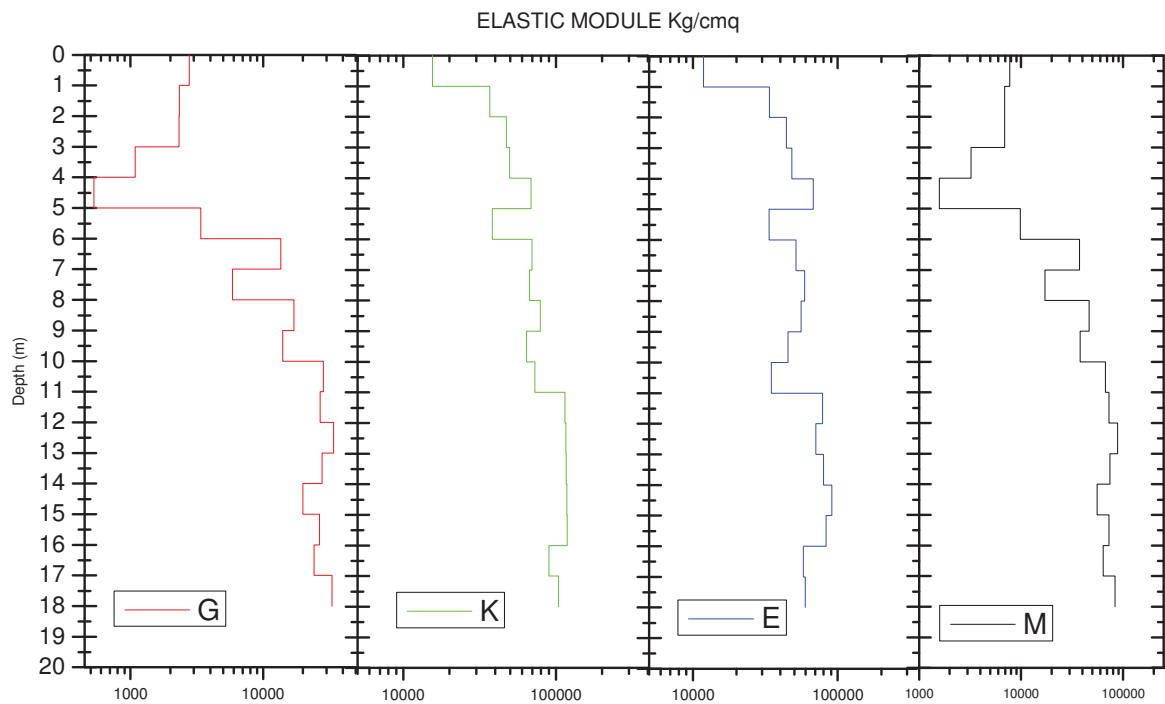


Figure 8 - Elastic Moduli

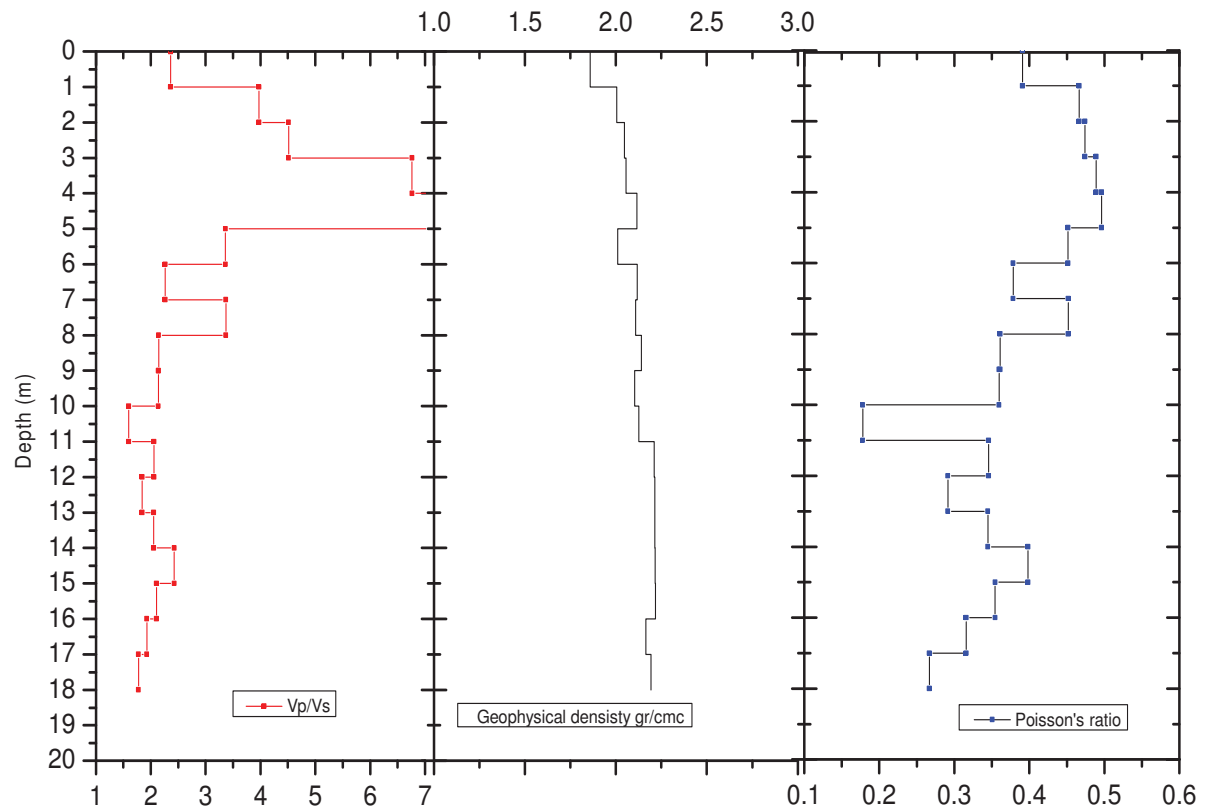


Figure 9- Vp/Vs, geophysical density and Poisson's ratio

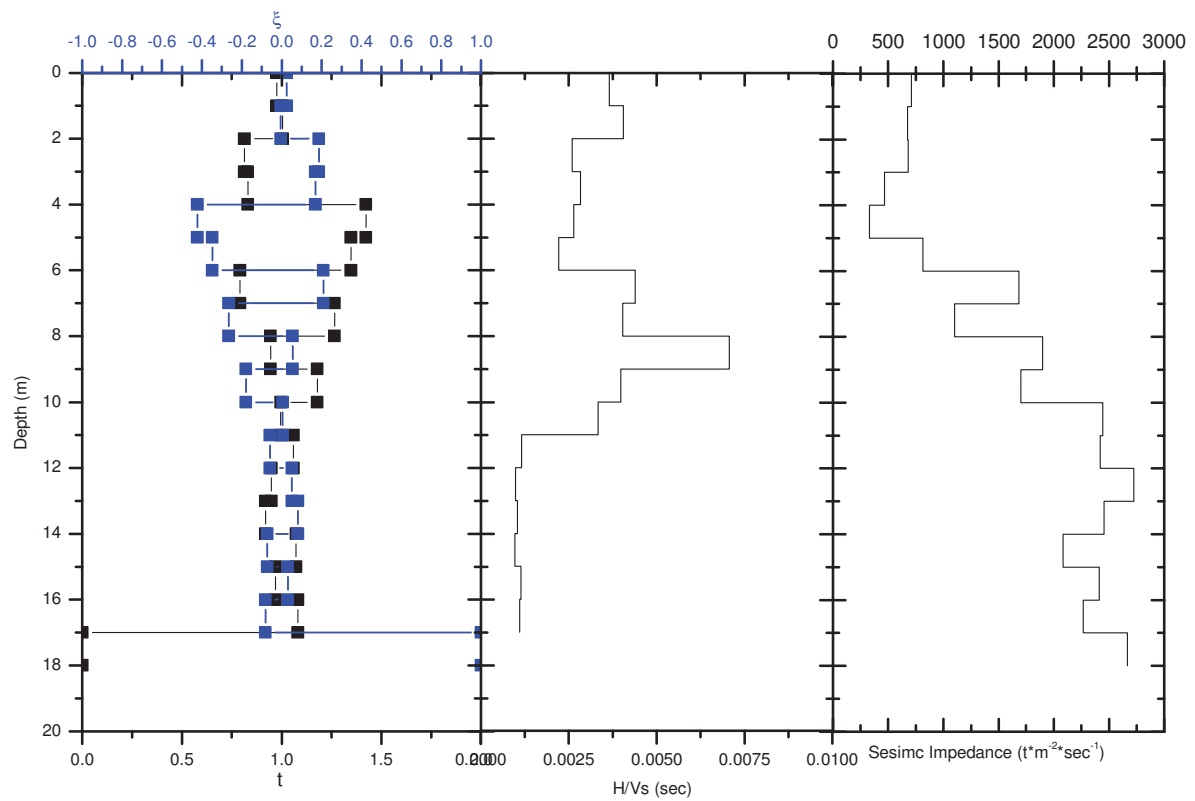


Figure 10 -  $\xi$ , t, H VS Ratio and Seismic impedance



## Borehole 19

The velocity profile is characterized by two physical steps (marker) located at 7 and 11 meters deep. which allow to differentiate the vertical measurement in three seismo layers: The first has a thickness of about 7 meters and is characterized by speed of propagation of seismic waves of P wave 1415.13 m/s of the S wave of 287.81 m/s. From 7 to 11 meters depth there is a velocity gradient. In this interval, the average velocity of propagation of seismic waves is equal to 1722.54 m/s (P-waves) and 560.20 m/s (S waves). At 11 meters there is the transition to the high speed area characterized by average velocity of seismic waves P of 2171.78 m/s and S waves to 915.13 m/s. In this seismo layer at a depth of between 15 and 17 meters a reduction velocity is detect (shear velocity average 634.4 m/s).

Seismic layer	Depth m	V <sub>pi</sub> m/s	V <sub>si</sub> m/s	$\gamma^{din}$ g/cm <sup>3</sup>	G kg/cm <sup>2</sup>	K kg/cm <sup>2</sup>	E kg/cm <sup>2</sup>	M kg/cm <sup>2</sup>	$\nu$	I <sub>s</sub> t*m <sup>-2</sup> *s <sup>-1</sup>
1	0-7	1406.67	359.32	2.02	2740.57	39030.58	8027.62	42684.67	0.46	728.15
2	7 - 11	1722.54	560.20	2.10	7139.44	54840.73	20337.89	64359.99	0.44	1178.94
3		2171.78	915.13	2.19	19390.57	80441.37	52939.94	106295.46	0.38	2007.40

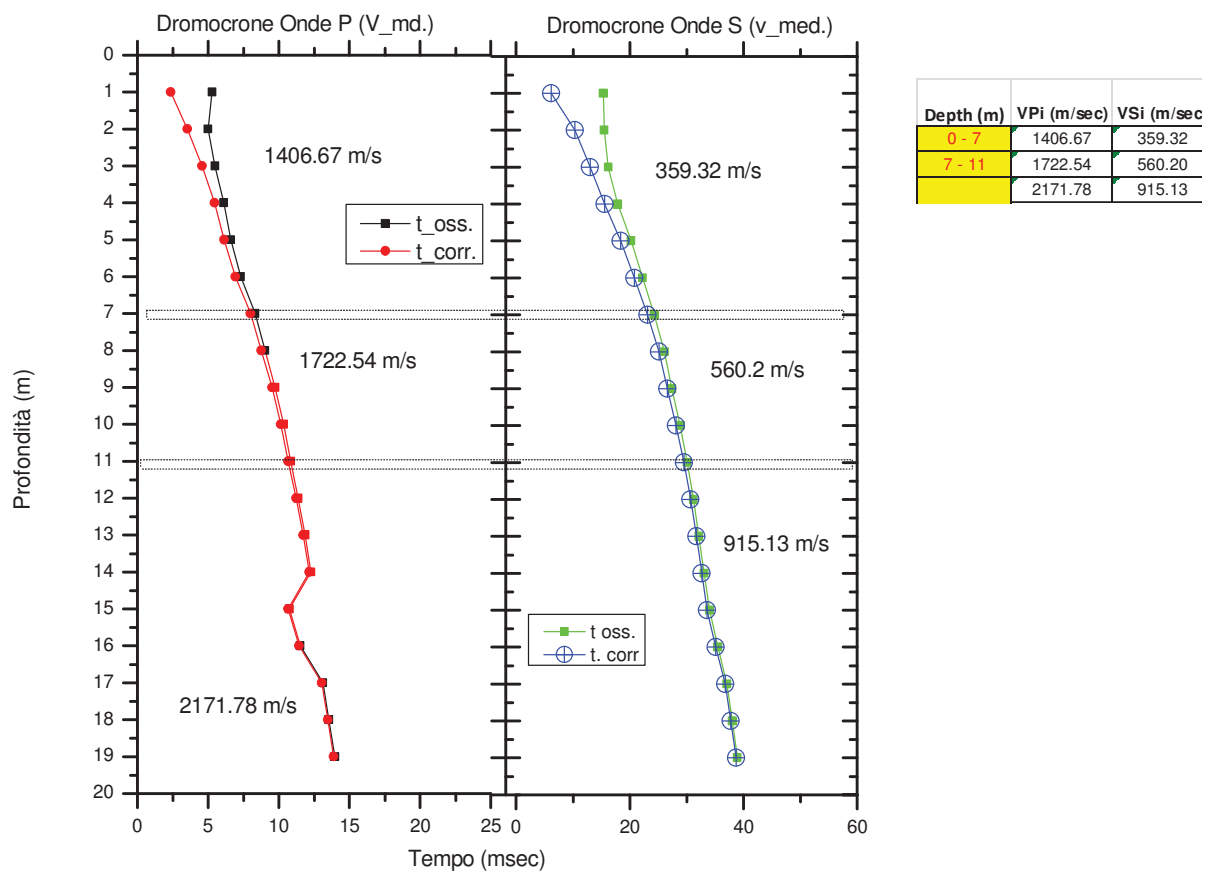


Figure 11 - Dromocrone observed time (t<sub>oss.</sub>) and corrected time

Z (m)	V <sub>p,i</sub> m/s	V <sub>s,i</sub> m/s	$\gamma^{din}$ g/cm <sup>3</sup>	G kg/cm <sup>2</sup>	K kg/cm <sup>2</sup>	E kg/cm <sup>2</sup>	M kg/cm <sup>2</sup>	v	V <sub>p</sub> N <sub>s</sub>	Imp. Sismica (t*m <sup>2</sup> *sec <sup>-1</sup> )	Coeff. T	Coeff. $\xi$
1 _ 2	905.29	245.12	1.86	1.1E+03	1.4E+04	3.3E+03	1.6E+04	0.4604	3.69	455.76	1.2415	-0.2415
2 _ 3	1343.23	372.25	2.00	2.8E+03	3.3E+04	8.3E+03	3.7E+04	0.4584	3.61	746.03	1.0272	-0.0272
3 _ 4	1505.45	384.65	2.05	3.1E+03	4.3E+04	9.1E+03	4.7E+04	0.4651	3.91	787.76	0.9584	0.0416
4 _ 5	1538.70	352.48	2.06	2.6E+03	4.6E+04	7.7E+03	5.0E+04	0.4723	4.37	724.88	1.0967	-0.0967
5 _ 6	1782.99	416.16	2.11	3.7E+03	6.4E+04	1.1E+04	6.9E+04	0.4712	4.28	880.14	0.9361	0.0639
6 _ 7	1364.38	385.24	2.01	3.0E+03	3.4E+04	8.9E+03	3.8E+04	0.4567	3.54	774.35	1.1504	-0.1504
7 _ 8	1796.51	495.10	2.12	5.3E+03	6.3E+04	1.5E+04	7.0E+04	0.4589	3.63	1048.60	1.1666	-0.1666
8 _ 9	1761.55	695.63	2.11	1.0E+04	5.3E+04	2.9E+04	6.7E+04	0.4076	2.53	1467.81	0.9619	0.0381
9 _ 10	1901.39	635.22	2.14	8.8E+03	6.7E+04	2.5E+04	7.9E+04	0.4372	2.99	1359.94	1.0630	-0.0630
10 _ 11	1728.42	733.81	2.10	1.2E+04	4.9E+04	3.2E+04	6.4E+04	0.3901	2.36	1542.79	1.0959	-0.0959
11 _ 12	1833.59	879.50	2.13	1.7E+04	5.1E+04	4.5E+04	7.3E+04	0.3506	2.08	1869.97	1.0674	-0.0674
12 _ 13	2253.53	967.95	2.21	2.1E+04	8.6E+04	5.9E+04	1.1E+05	0.3869	2.33	2140.26	1.0310	-0.0310
13 _ 14	2265.96	1028.77	2.21	2.4E+04	8.4E+04	6.5E+04	1.2E+05	0.3702	2.20	2277.12	1.0155	-0.0155
14 _ 15	2275.59	1060.22	2.22	2.5E+04	8.3E+04	6.9E+04	1.2E+05	0.3614	2.15	2348.63	0.7630	0.2370
15 _ 16	2283.17	653.48	2.22	9.7E+03	1.0E+05	2.8E+04	1.2E+05	0.4554	3.49	1448.52	0.9702	0.0298
16 _ 17	2289.22	615.33	2.22	8.6E+03	1.1E+05	2.5E+04	1.2E+05	0.4611	3.72	1364.64	1.2524	-0.2524
17 _ 18	2018.04	1055.81	2.17	2.5E+04	5.7E+04	6.5E+04	9.0E+04	0.3116	1.91	2286.08	1.0082	-0.0082
18 _ 19	2155.11	1060.00	2.19	2.5E+04	7.0E+04	6.7E+04	1.0E+05	0.3404	2.03	2324.00	0.0000	1.0000

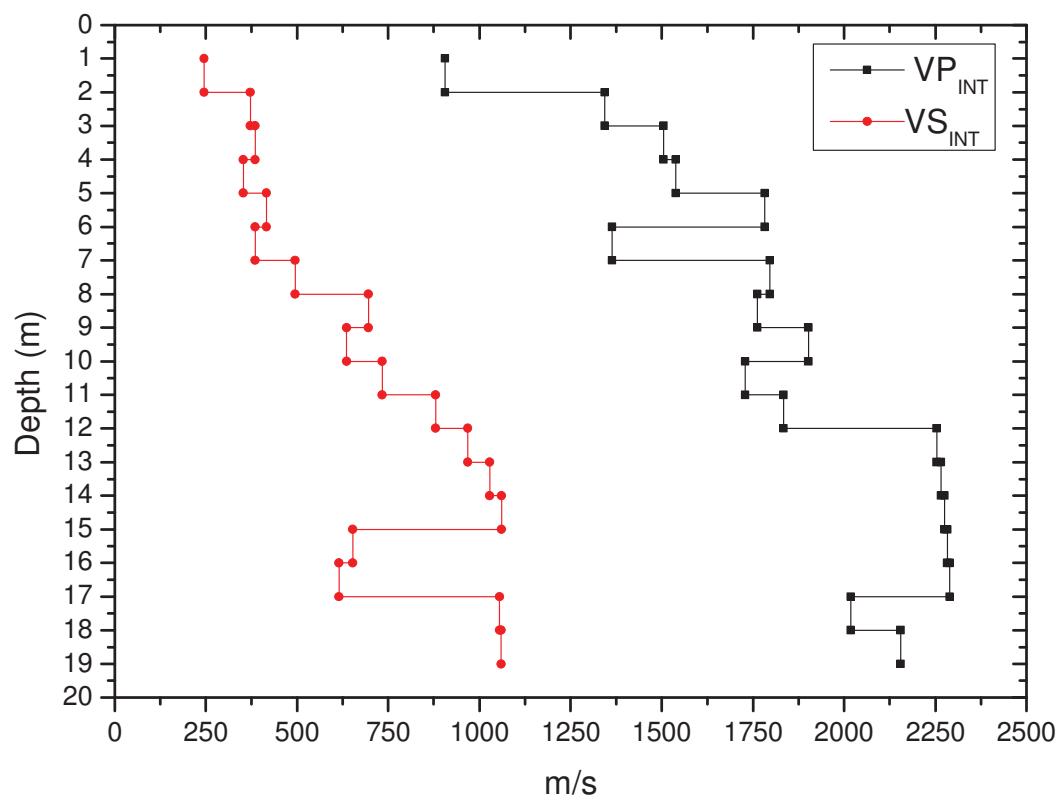


Figure 12 - Interval Velocity

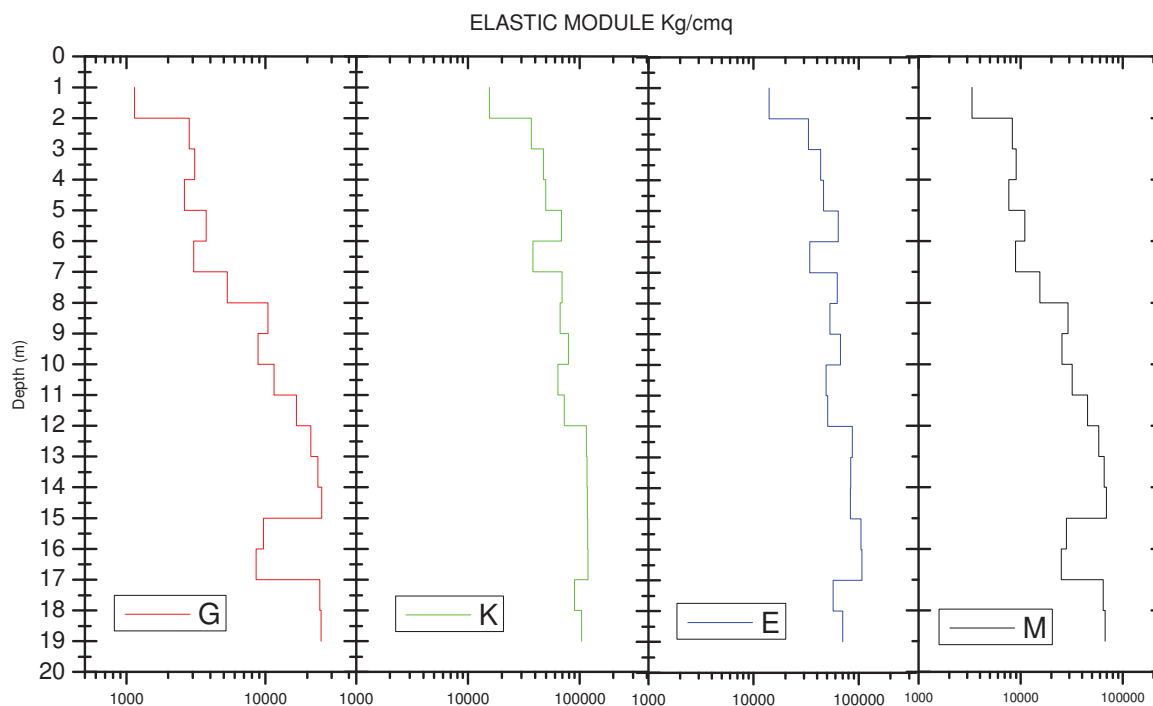


Figure 13 - Elastic Moduli

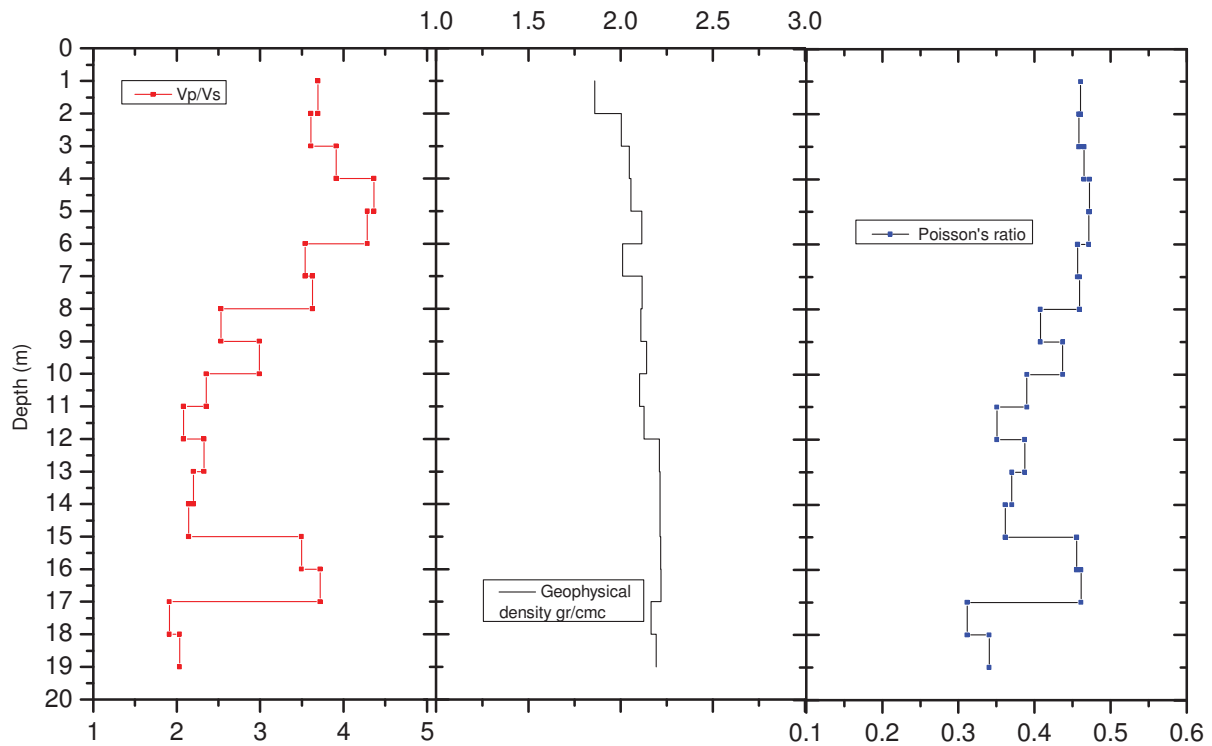


Figure 14 - Vp/Vs, geophysical density and Poisson's ratio

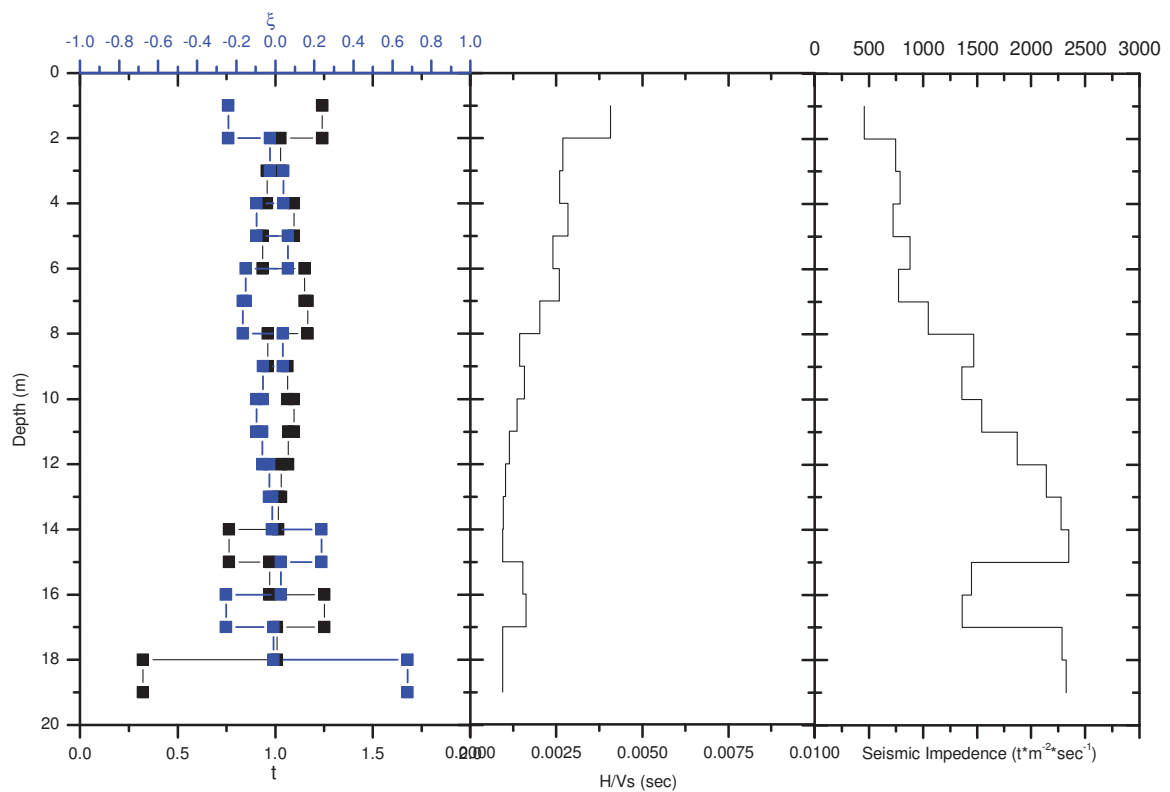


Figure 15 -  $t$ ,  $\xi$ , H VS Ratio and Seismic impedance

## Borehole 20

The velocity profile is characterized by two marker set to 9 and 11 meters deep, which allow to differentiate the vertical measurement in three seismo layers: The first has a thickness of about 9 meters and average velocity , respectively, of 1162.15 m/s for P-wave and of 327.72 m/s for S-wave. At the deep of 9 to 11 meters have a gradual increase of the velocity of seismic waves. In this interval, the average velocity is equal to 1965.00 m/s P-wave and 619.72 m/s S-wave. At 11 meters there is the transition to the high velocity layer characterized by average velocity of seismic waves P of 2332.1 m/s and S waves to 984.37 m/s.

Seismic layer	Depth m	V <sub>p</sub> i m/s	V <sub>s</sub> i m/s	$\gamma^{din}$ g/cm <sup>3</sup>	G kg/cm <sup>2</sup>	K kg/cm <sup>2</sup>	E kg/cm <sup>2</sup>	M kg/cm <sup>2</sup>	$\nu$	I <sub>s</sub> t*m <sup>-2</sup> *s <sup>-1</sup>
1	0-9	1162.15	327.72	1.94	2227.94	25436.53	6434.78	28407.12	0.45	638.60
2	9 - 11	1965.00	619.72	2.20	9449.62	95161.96	27440.57	107761.45	0.45	1427.67
3		2332.10	984.37	2.22	22475.08	94833.25	61989.41	124800.01	0.39	2191.29

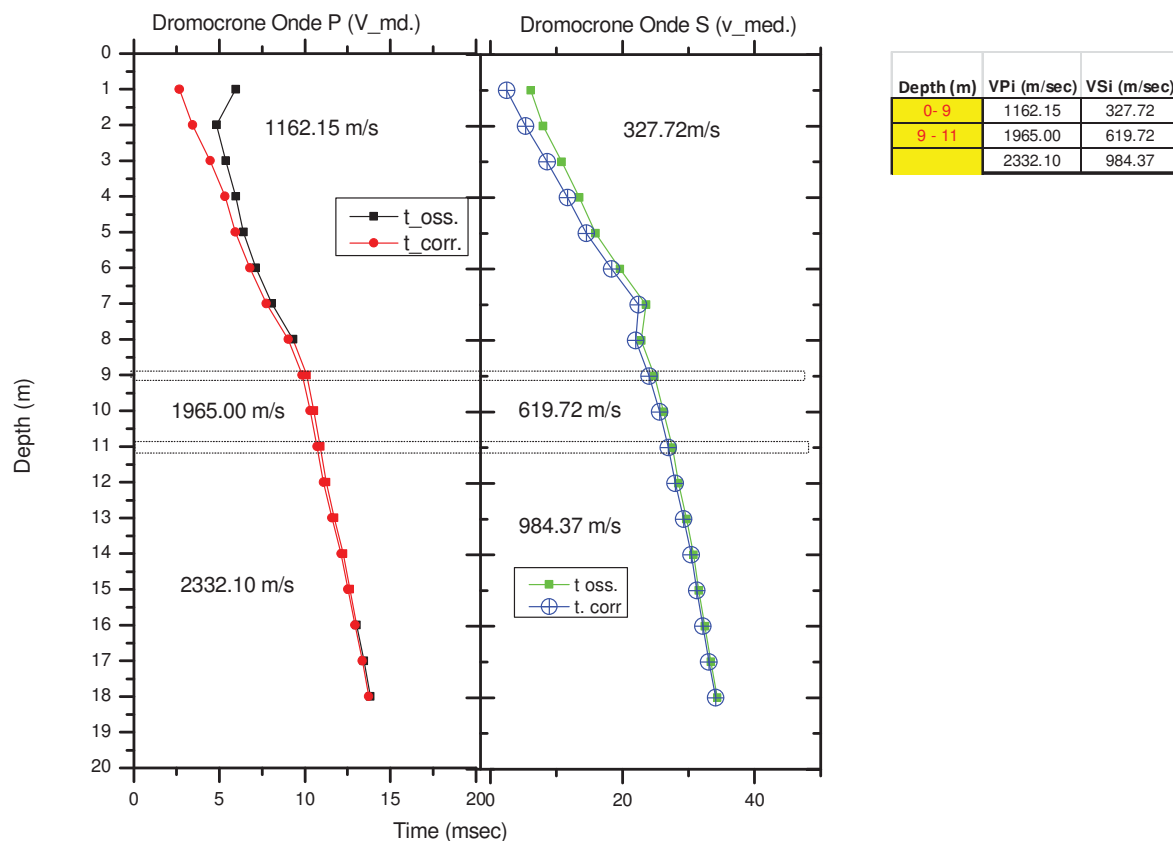


Figure 16 - Dromocrone observed time ( t<sub>oss.</sub>) and corrected time



Z (m)	V <sub>p</sub> i m/s	V <sub>s</sub> i m/s	$\gamma^{din}$ g/cm <sup>3</sup>	G kg/cm <sup>2</sup>	K kg/cm <sup>2</sup>	E kg/cm <sup>2</sup>	M kg/cm <sup>2</sup>	v	V <sub>p</sub> N <sub>s</sub>	Imp. Sismica (t*m <sup>3</sup> *sec <sup>-1</sup> )	Coeff. T	Coeff. $\xi$
1_ 2	1316.48	353.95	2.00	2.6E+03	3.2E+04	7.5E+03	3.5E+04	0.4610	3.72	706.64	0.8909	0.1091
2_ 3	955.14	302.20	1.88	1.7E+03	1.5E+04	5.1E+03	1.7E+04	0.4444	3.16	567.64	1.0525	-0.0525
3_ 4	1158.35	323.63	1.95	2.1E+03	2.4E+04	6.1E+03	2.7E+04	0.4577	3.58	630.59	1.0777	-0.0777
4_ 5	1659.69	353.21	2.09	2.7E+03	5.5E+04	7.8E+03	5.9E+04	0.4763	4.70	736.90	0.8209	0.1791
5_ 6	1202.87	261.39	1.96	1.4E+03	2.7E+04	4.0E+03	2.9E+04	0.4752	4.60	512.99	0.9563	0.0437
6_ 7	1024.29	246.94	1.90	1.2E+03	1.9E+04	3.5E+03	2.0E+04	0.4691	4.15	470.06	1.0797	-0.0797
7_ 8	785.89	304.65	1.81	1.7E+03	9.1E+03	4.8E+03	1.1E+04	0.4116	2.58	551.42	1.2568	-0.2568
8_ 9	1194.51	475.81	1.96	4.5E+03	2.2E+04	1.3E+04	2.9E+04	0.4057	2.51	932.54	1.2098	-0.2098
9_ 10	2191.93	649.09	2.20	9.4E+03	9.5E+04	2.7E+04	1.1E+05	0.4519	3.38	1427.67	1.0743	-0.0743
10_ 11	2508.56	734.28	2.26	1.2E+04	1.3E+05	3.6E+04	1.4E+05	0.4531	3.42	1657.00	1.1711	-0.1711
11_ 12	2613.78	1029.26	2.27	2.5E+04	1.3E+05	6.9E+04	1.6E+05	0.4082	2.54	2340.88	0.8415	0.1585
12_ 13	2013.42	785.69	2.16	1.4E+04	7.1E+04	3.8E+04	8.9E+04	0.4102	2.56	1700.48	1.0610	-0.0610
13_ 14	1910.71	896.63	2.14	1.8E+04	5.6E+04	4.8E+04	8.0E+04	0.3588	2.13	1921.37	1.1569	-0.1569
14_ 15	2426.44	1175.80	2.24	3.2E+04	9.2E+04	8.5E+04	1.3E+05	0.3466	2.06	2636.62	0.9497	0.0503
15_ 16	2325.48	1071.87	2.22	2.6E+04	8.8E+04	7.1E+04	1.2E+05	0.3651	2.17	2384.24	1.0305	-0.0305
16_ 17	2333.75	1138.51	2.23	2.9E+04	8.4E+04	7.9E+04	1.2E+05	0.3438	2.05	2534.17	0.9361	0.0639
17_ 18	2396.10	996.75	2.24	2.3E+04	1.0E+05	6.3E+04	1.3E+05	0.3954	2.40	2229.77	1.0192	-0.0192
18_ 19	2460.66	1030.57	2.25	2.4E+04	1.1E+05	6.8E+04	1.4E+05	0.3936	2.39	2317.12	0.0000	1.0000

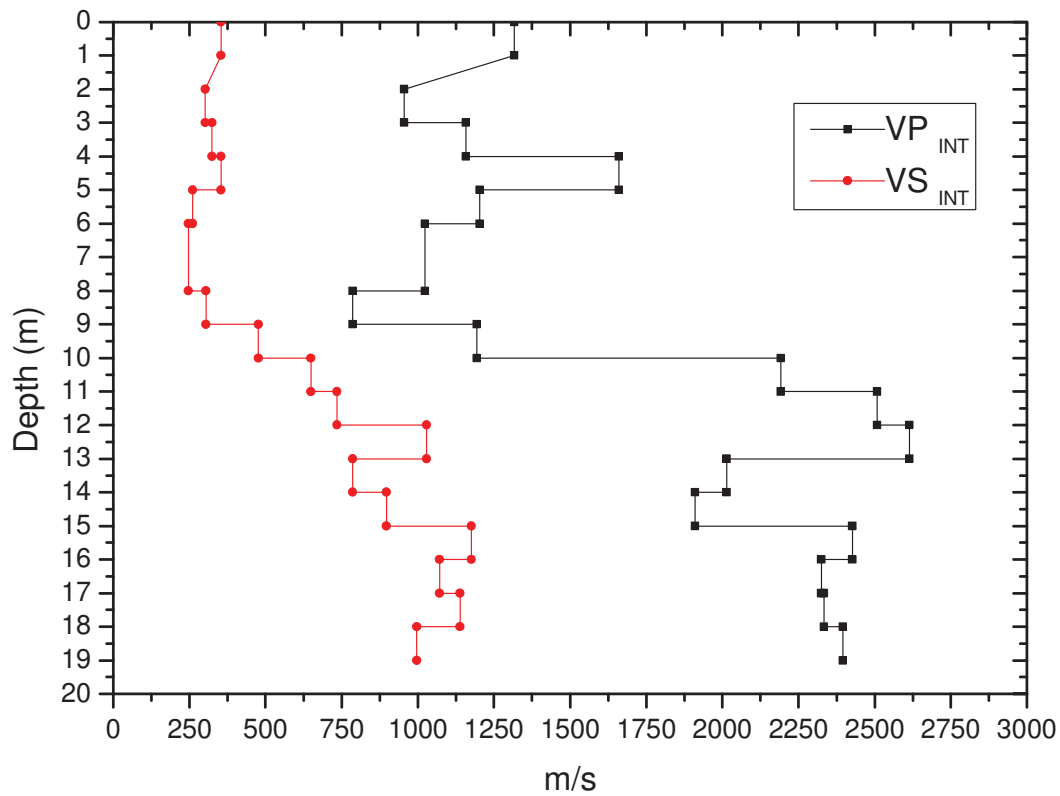


Figure 17 - Interval Velocity

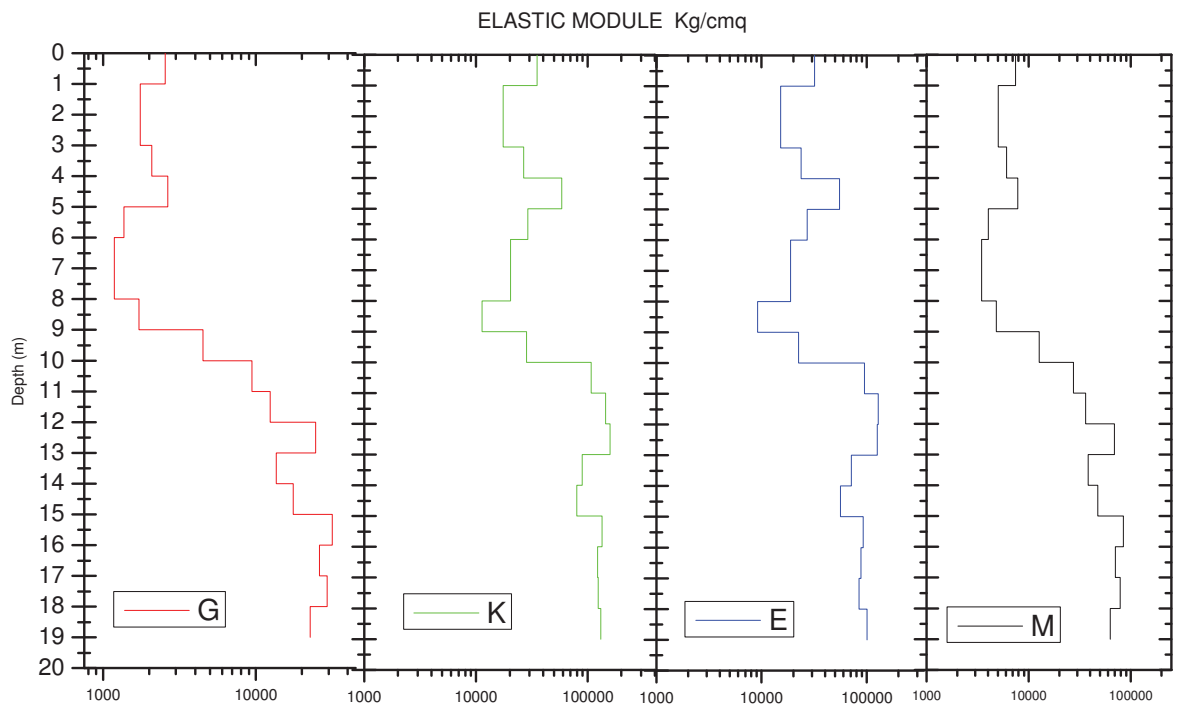


Figure 18 - Elastic Moduli

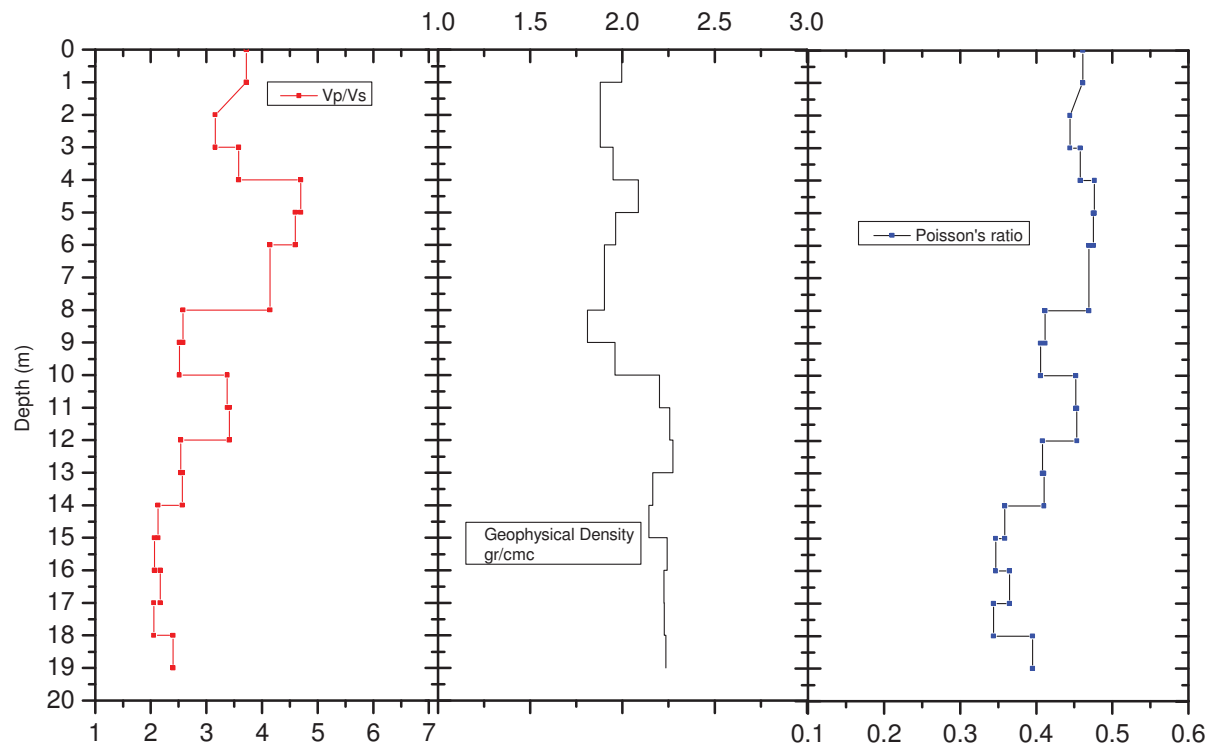


Figure 19 - Vp/Vs, geophysical density and Poisson's ratio

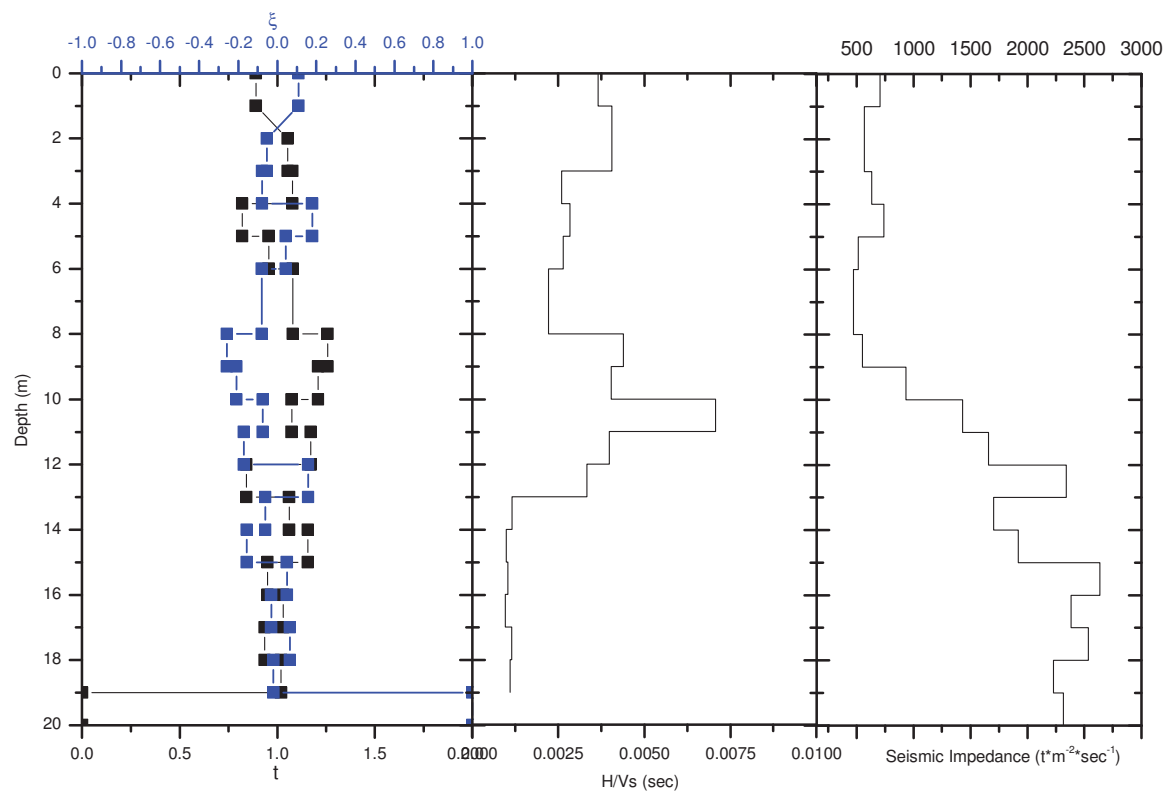


Figure 20 -  $t$ ,  $\xi$ , H VS Ratio and Seismic impedance

## Borehole 34

In the profile velocity BH 34 are intercepted two seismic horizons located, respectively, at 5 and 12 meters deep. These horizons allow us to identify three seismic layers. The first seismic layer has a thickness of about 5 meters and is characterized by average velocity of seismic waves of 724.11 m/s (P wave) and 301.56 m/s (S wave). From 5 to 12 meters, there was a decrease in the velocity of propagation of shear waves (low velocity layer). At a depth of 12 meters it intercepts the area at high speed which is characterized by average velocity of seismic waves P of 2171.37 m/s S-wave of 965.75 m/s.

Seismic layer	Depth m	V <sub>Pi</sub> m/s	V <sub>Si</sub> m/s	$\gamma^{din}$ g/cm <sup>3</sup>	G kg/cm <sup>2</sup>	K kg/cm <sup>2</sup>	E kg/cm <sup>2</sup>	M kg/cm <sup>2</sup>	$\nu$	I <sub>s</sub> t*m <sup>-2</sup> *s <sup>-1</sup>
1	0-5	724.11	301.56	1.77	1743.11	8525.93	4847.51	10850.07	0.38	539.21
2	5- 12	1165.99	293.52	1.95	1906.83	25770.76	5564.97	28313.20	0.47	576.44
3		2171.37	965.75	2.19	21017.33	78657.93	57705.62	106681.04	0.37	2120.59

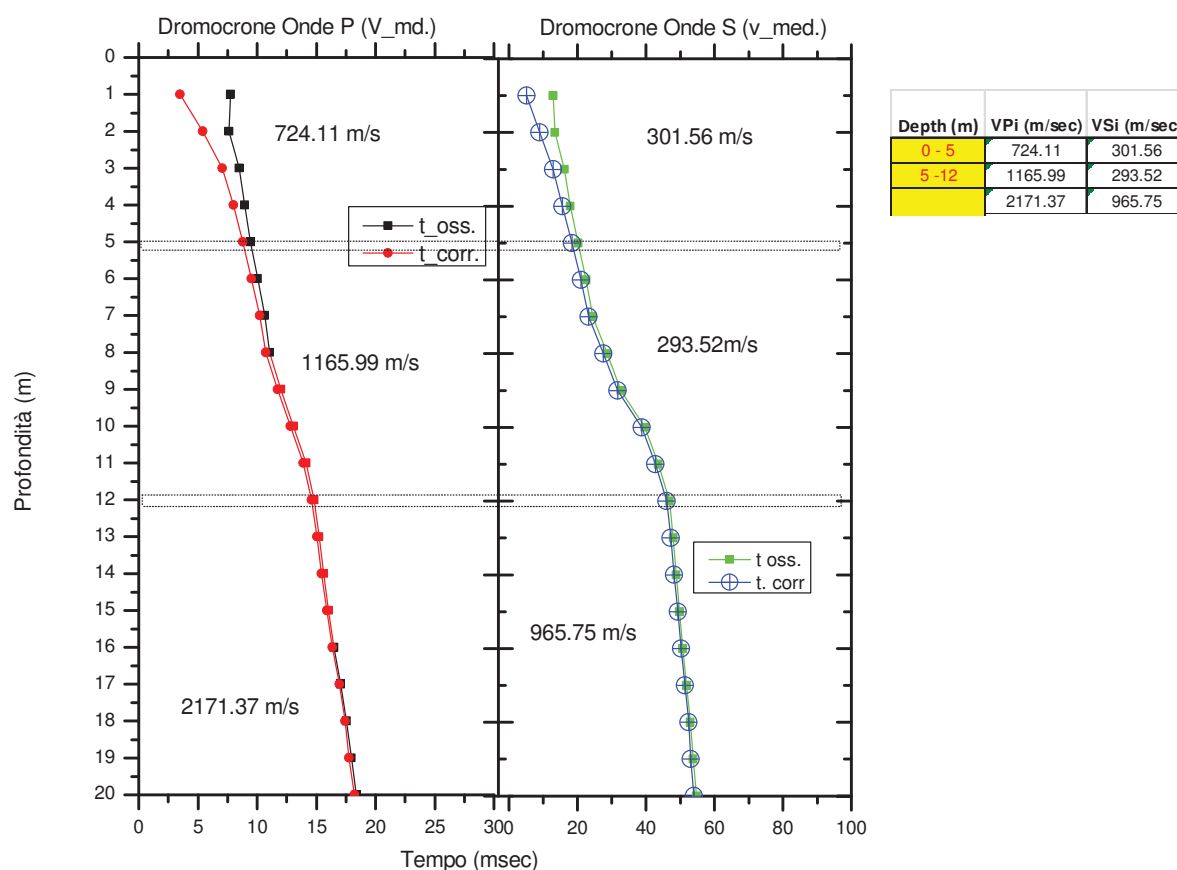


Figure 21 - Dromocrone observed time (t<sub>oss.</sub>) and corrected time

Z (m)	V <sub>p</sub> i m/s	V <sub>s</sub> i m/s	γ <sup>di</sup> g/cm <sup>3</sup>	G kg/cm <sup>2</sup>	K kg/cm <sup>2</sup>	E kg/cm <sup>2</sup>	M kg/cm <sup>2</sup>	v	V <sub>p</sub> /V <sub>s</sub>	Imp. Sismica (t*m <sup>2</sup> *sec <sup>-1</sup> )	Coeff. T	Coeff. ξ
1 _ 2	522.46	273.42	1.67	1.3E+03	3.0E+03	3.3E+03	4.7E+03	0.3114	1.91	457.96	0.9610	0.0390
2 _ 3	596.33	246.61	1.72	1.1E+03	4.8E+03	3.0E+03	6.2E+03	0.3968	2.42	423.57	1.2695	-0.2695
3 _ 4	1053.53	384.65	1.91	2.9E+03	1.8E+04	8.2E+03	2.2E+04	0.4231	2.74	736.10	0.9776	0.0224
4 _ 5	1317.28	352.48	2.00	2.5E+03	3.2E+04	7.4E+03	3.5E+04	0.4614	3.74	703.79	1.0358	-0.0358
5 _ 6	1332.13	377.84	2.00	2.9E+03	3.2E+04	8.5E+03	3.6E+04	0.4563	3.53	756.04	1.0936	-0.0936
6 _ 7	1416.76	450.61	2.02	4.2E+03	3.6E+04	1.2E+04	4.1E+04	0.4437	3.14	912.26	0.6390	0.3610
7 _ 8	959.45	227.81	1.88	9.9E+02	1.6E+04	2.9E+03	1.8E+04	0.4701	4.21	428.28	1.0481	-0.0481
8 _ 9	1025.95	247.66	1.90	1.2E+03	1.9E+04	3.5E+03	2.0E+04	0.4691	4.14	471.57	0.7165	0.2835
9 _ 10	907.49	141.51	1.86	3.8E+02	1.5E+04	1.1E+03	1.6E+04	0.4875	6.41	263.24	1.2794	-0.2794
10 _ 11	912.63	251.00	1.86	1.2E+03	1.4E+04	3.5E+03	1.6E+04	0.4591	3.64	467.41	1.1315	-0.1315
11 _ 12	1456.22	299.22	2.04	1.9E+03	4.2E+04	5.5E+03	4.4E+04	0.4780	4.87	608.95	1.5154	-0.5154
12 _ 13	2250.29	861.53	2.21	1.7E+04	9.2E+04	4.7E+04	1.1E+05	0.4141	2.61	1904.43	1.0852	-0.0852
13 _ 14	2438.46	1006.60	2.24	2.3E+04	1.1E+05	6.5E+04	1.4E+05	0.3973	2.42	2259.32	0.9702	0.0298
14 _ 15	2241.23	963.61	2.21	2.1E+04	8.5E+04	5.8E+04	1.1E+05	0.3866	2.33	2128.44	1.0338	-0.0338
15 _ 16	2205.34	1034.18	2.20	2.4E+04	7.7E+04	6.5E+04	1.1E+05	0.3590	2.13	2277.34	0.8919	0.1081
16 _ 17	1722.72	872.42	2.10	1.6E+04	4.2E+04	4.3E+04	6.4E+04	0.3275	1.97	1833.06	1.0324	-0.0324
17 _ 18	2042.63	901.22	2.17	1.8E+04	6.8E+04	5.0E+04	9.2E+04	0.3791	2.27	1955.85	1.0780	-0.0780
18 _ 19	2229.75	1036.27	2.21	2.4E+04	8.0E+04	6.6E+04	1.1E+05	0.3623	2.15	2286.70	1.0071	-0.0071
19 _ 20	2240.50	1050.20	2.21	2.5E+04	8.0E+04	6.8E+04	1.1E+05	0.3592	2.13	2319.57	0.0000	1.0000



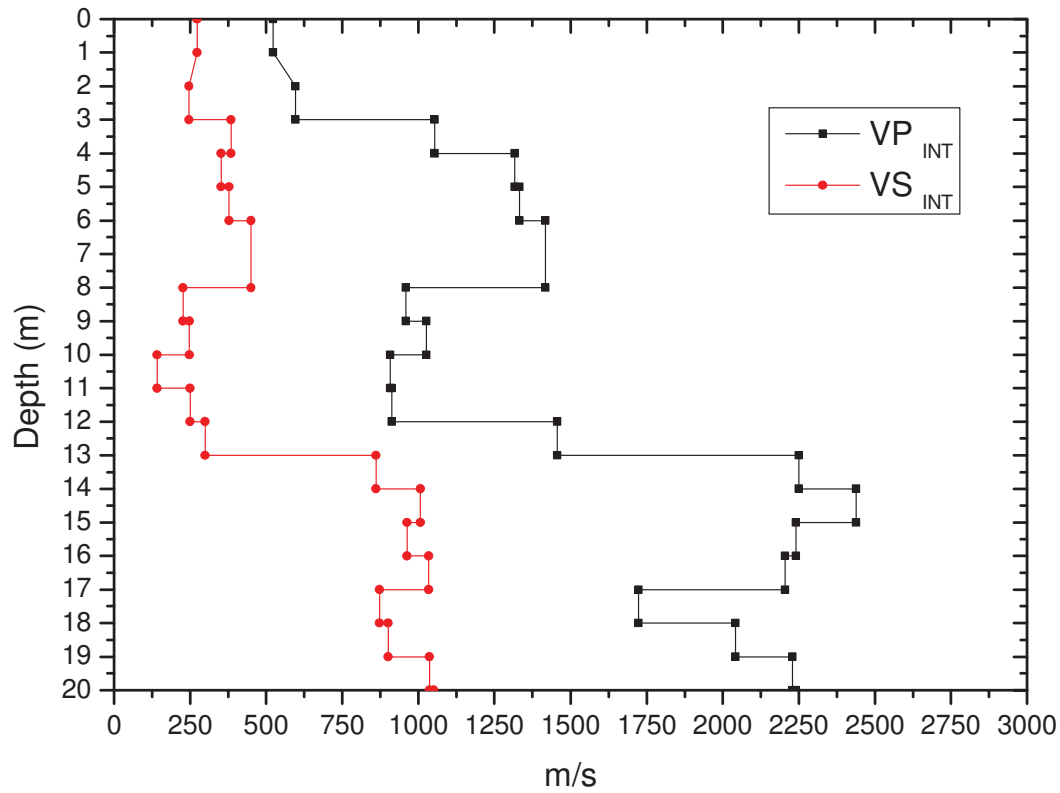


Figure 22 - Interval Velocity

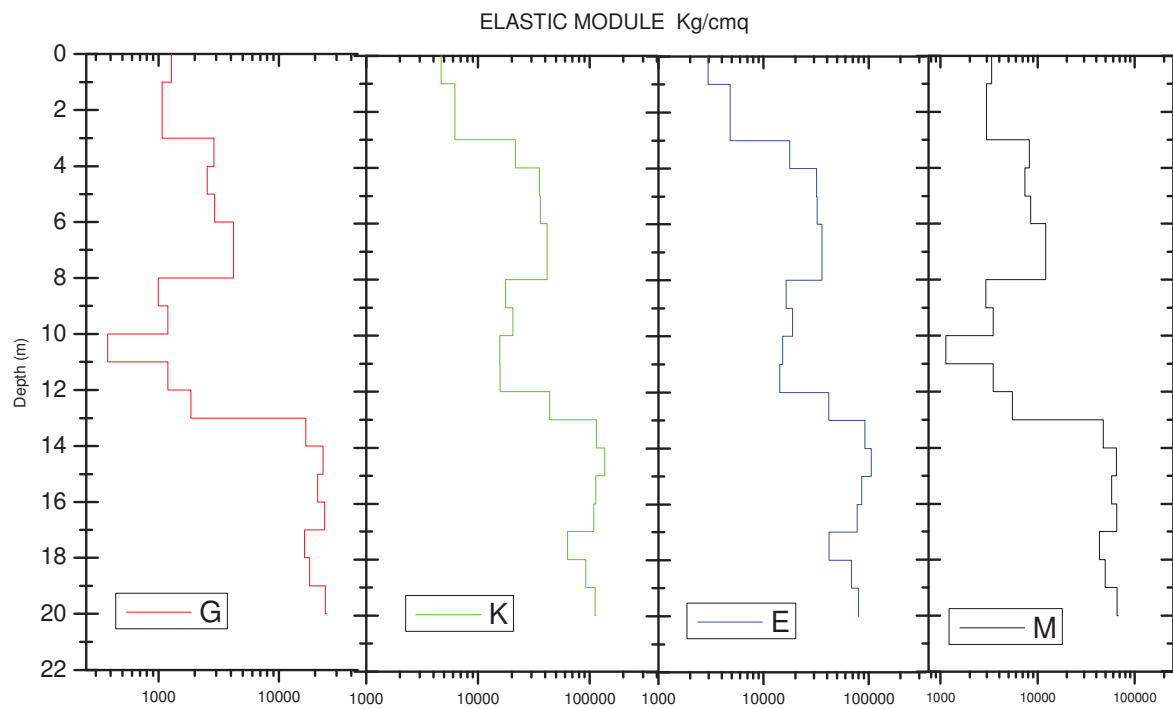


Figure 23 - Elastic Moduli

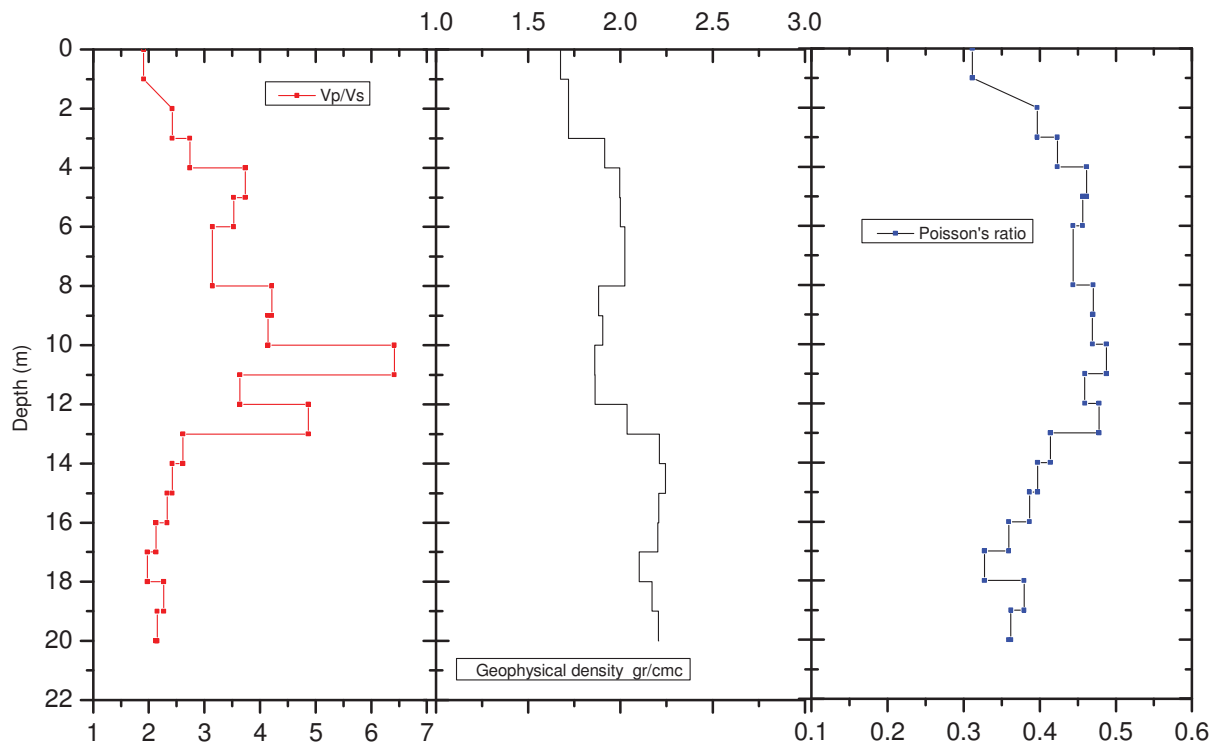


Figure 24 - Vp/Vs, geophysical density and Poisson's ratio

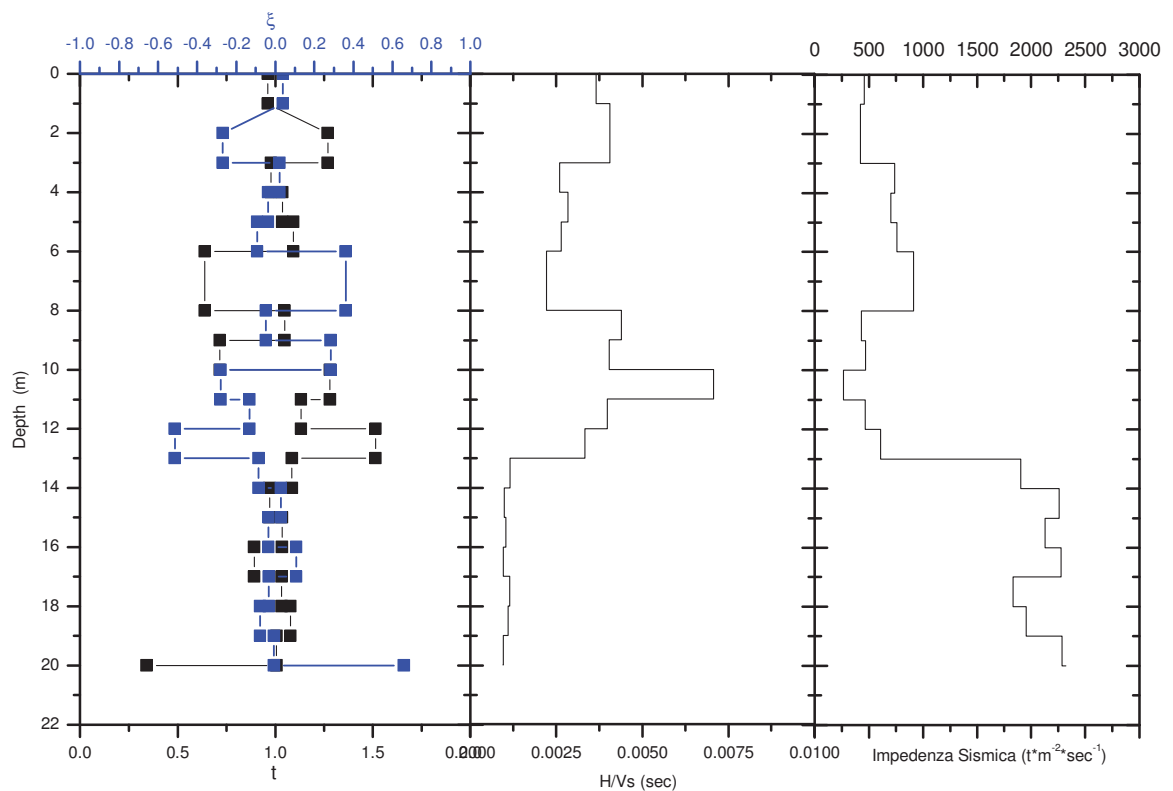
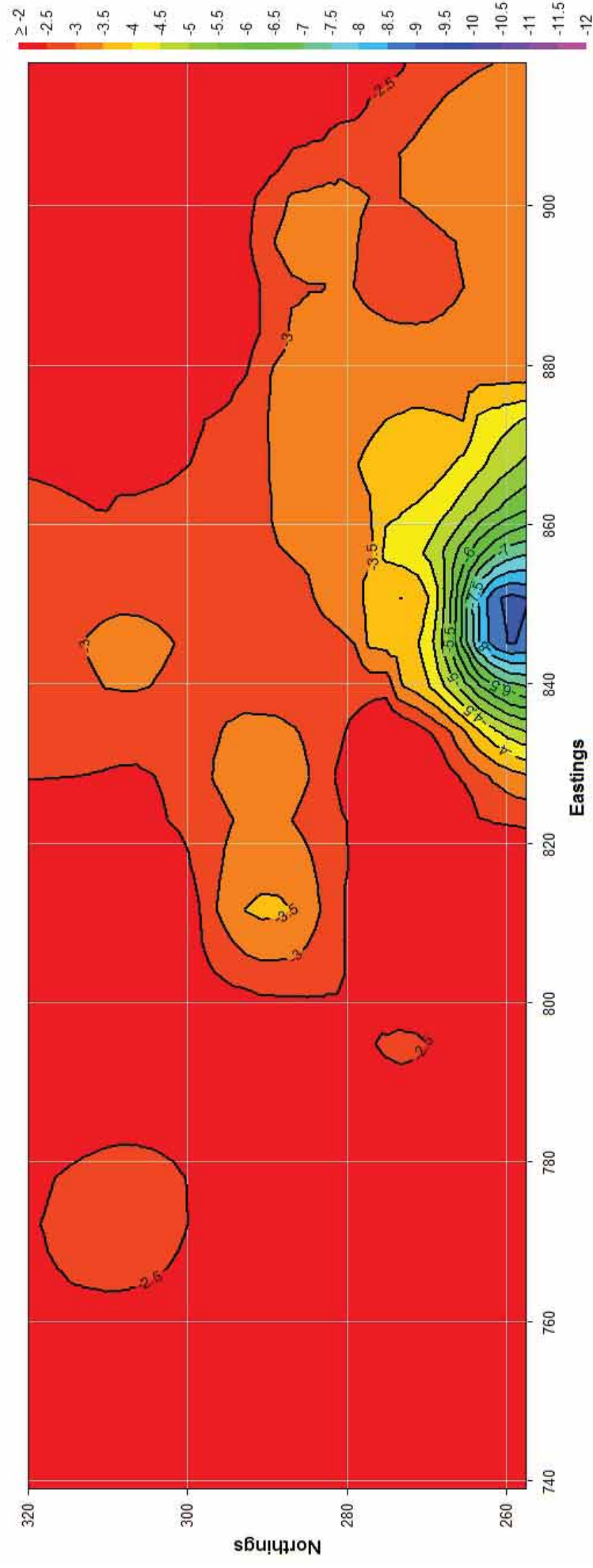


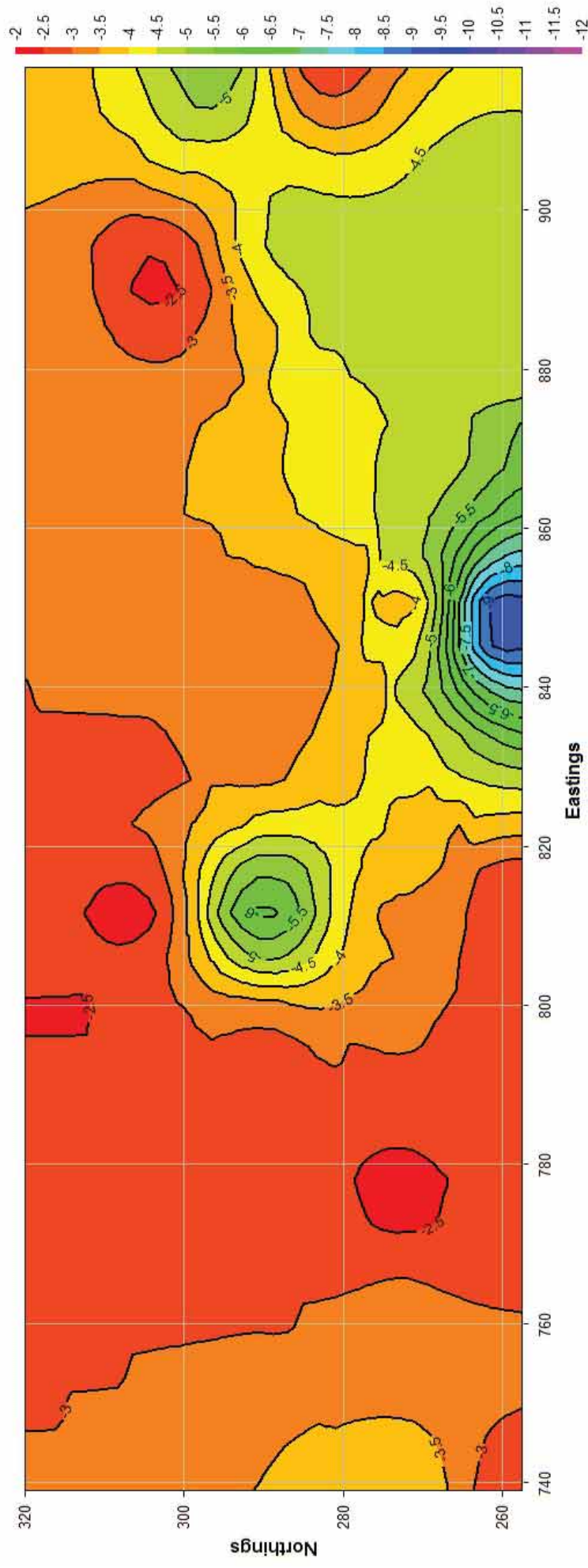
Figure 25 -  $t$ ,  $\xi$ , H VS Ratio and Seismic impedance

## Appendix G: Contour maps of layers identified during this investigation

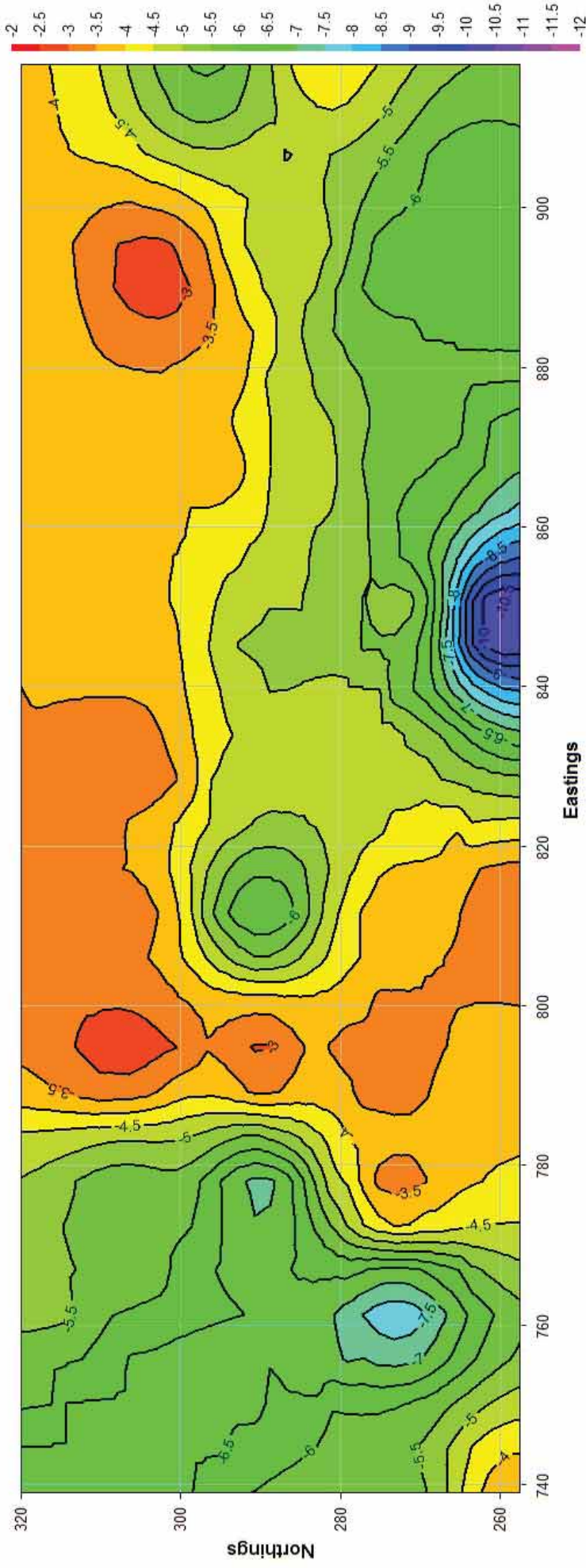
Top of sand layer (relative to LAT)



Top of weathered marl layer (relative to LAT)



Top of marl layer (relative to LAT)





**Addendum 1 – revised summary of stratigraphic data – fills and overburden above bedrock**

Origin	Type	Colour code	Description	Comments	Thickness range	Main investigative methods	SPT (N1) <sub>60</sub> and correlated geotechnical properties*	Downhole seismic tests	Recommended values for design
Man-Made (1990s)	Reclamation fill above sea level – first 0.6m		Top layer of sandy gravel, generally well compacted and occasionally having thin layers of a bituminous material.	This layer is likely to have been compacted and then used occasionally as a storage area	0.5m-0.6m Average value 0.5m	Trial pits, Plate loading tests	40 – 50  Soil classifies as dense to very dense - $D_r=85-100\%$ $\gamma = 18.5 -19.0 \text{ kN/m}^3$ $\phi'=38.5^\circ -41^\circ$ $E' = 40-50 \text{ MPa}$	$E_{dyn} = 330\text{MPa}-760\text{MPa}$ $v_{dyn} = 0.31 - 0.46$ Correlation to static equivalent not considered reliable for fills	$\phi'=38^\circ$ $c'=0 \text{ kPa}$ $\gamma = 18.5 \text{ kN/m}^3$ $E' = 45 \text{ MPa}$ on factored bearing pressure Consider using plate loading tests results in Table 4, pg 45
Man-Made (1990s)	Reclamation fill above sea level -		Layer of sandy gravel occasionally containing cobbles and large boulders and associated large voids. Fill constituents vary and include olive-coloured rockfill from the middle globigerina limestone (angular fragments of rock from the excavation for the existing power plant), and from the pale yellowish-brown lower globigerina limestone (from external sources, which is also mixed with reddish brown terrarossa clays)	This layer is unlikely to have been compacted. Large boulders within indicate that compaction was not intended, as otherwise such large particles would not have made this possible	1.56m – 2.8m Average value 2.45m	BH core, Trial pits, SPTs, downhole seismic	20 – 40  Soil classifies as medium to dense - $D_r=60-80\%$ $\gamma = 16.5 -18.0 \text{ kN/m}^3$ $\phi'=33^\circ -38.5^\circ$ $E' = 20-40 \text{ MPa}$	$E_{dyn} = 290\text{MPa}-760\text{MPa}$ $v_{dyn} = 0.31 - 0.47$ Correlation to static equivalent not considered reliable for fills	$\phi'=33^\circ$ $c'=0 \text{ kPa}$ $\gamma = 16.5 \text{ kN/m}^3$ $E' = 20 \text{ MPa}$ on factored bearing pressure
Man Made (1990s)	Reclamation fill at sea level		Layer of sandy gravel of mixed origin. Fill constituents vary and include olive-coloured rockfill from the middle globigerina limestone (angular fragments of rock from the excavation for the existing power plant), and from the pale yellowish-brown lower globigerina limestone (from external sources, which is also mixed with reddish brown terrarossa clays)	This layer is very variable and unlikely to have been compacted. Large boulders within indicate that compaction was not intended, as otherwise such large particles would not have made this possible.	1m Average value 1m	BH core, trial pits, SPTs, downhole seismic,	4 - 54  Soil is very variable and classifies as very loose to very dense - $D_r=0-100\%$ $\gamma = 12.0 -19.0 \text{ kN/m}^3$ $\phi'=28^\circ$ $E' = 4 \text{ MPa}$	$E_{dyn} = 370\text{MPa}-810\text{MPa}$ $v_{dyn} = 0.42 - 0.47$ Correlation to static equivalent not considered reliable for fills	$\phi'=28^\circ$ $c'=0 \text{ kPa}$ $\gamma = 14 \text{ kN/m}^3$ $E' = 4 \text{ MPa}$ on factored bearing pressure
Man Made (1990s)	Reclamation fill below sea level		Layer of sandy gravel of mixed origin. Fill constituents vary and include olive-coloured rockfill from the middle globigerina limestone (angular fragments of rock from the excavation for the existing power plant), and from the pale yellowish-brown lower globigerina limestone (from external sources, which is also mixed with reddish brown terrarossa clays)	This layer was placed underwater, without first cleaning the seabed of any existing overburden. Compaction would not have been possible.	0.3m - 8.95m Average value 1.87m (8.95m in BH 21)	BH core, SPTs, downhole seismic,	20 – 40  Soil classifies as medium to dense - $D_r=60-80\%$ $\gamma = 16.5 -18.0 \text{ kN/m}^3$ $\phi'=33^\circ -38.5^\circ$ $E' = 20-40\text{MPa}$	$E_{dyn} = 240\text{MPa}-1080\text{MPa}$ $v_{dyn} = 0.46 - 0.49$ Correlation to static equivalent not considered reliable for fills	$\phi'=33^\circ$ $c'=0 \text{ kPa}$ $\gamma = 16.5 \text{ kN/m}^3$ $E' = 20 \text{ MPa}$ on factored bearing pressure
Quaternary - Holocene	Silty sand with high organic content		Sand layer containing considerable amount of organic material in the form of fibres of the seaweed 'posidonia'. Some boreholes indicate thin layers (0.1m-0.15m) where the amount of organic fibres is much higher in proportion to the sand	This layer consists of overburden that exists all over Marsaxlokk bay. Its presence suggests that no attempts were made to clean the seabed, proving that the fill is not engineered. Layers of compressed seaweed were retrieved in the BH core, inferring the presence of layers that are very compressible.	0m – 3.94m average 1.11m 5 in no. BHs show thicknesses > 2.1m	BH core, SPTs	25 – 43  Soil classifies as dense - $D_r=65-85\%$ $\gamma = 16.8 -18.3 \text{ kN/m}^3$ $\phi'=33^\circ - 38.5^\circ$	$E_{dyn} = 160\text{MPa}-1640\text{MPa}$ $v_{dyn} = 0.44 - 0.5$ Correlation to static equivalent not considered reliable for fills	$\phi'=33^\circ$ $c'=0 \text{ kPa}$ $\gamma = 17 \text{ kN/m}^3$ $E' = <100 \text{ kPa}$ on basis of literature values for fibrous peat sands

- Correlations between SPT blowcount and angle of shearing resistance are based on the chart by Peck et al, 1974<sup>6</sup>
- Correlations between SPT blowcount and E' are based on Stroud (1989)<sup>7</sup>. These figures assume a factor of safety of 3 on bearing capacity ( $q_{net}/q_{ult}=1/3$ ), and are therefore conservative estimates.

Note: Given the heterogeneous nature of the fill, foundations >1m are NOT recommended. The zone of influence of wider foundations will inevitably go through the more variable layers at sea level and below, where large particles and large voids are possible. The geotechnical parameters quoted in the table above do not account for creep or long term settlement of the fill. This is known to happen in such fills in the Maltese Islands.

Assuming strip footings of 1m width, and 3m length, with no embedment and no adjacent overburden,  $q_{ult} = 0.5 \cdot s_\gamma \cdot B \cdot \gamma' \cdot N_\gamma^{strip}$

$\phi' = 38^\circ, c' = 0 \text{ kPa}$

partial safety factor on  $\tan \phi' = M2 = 1.25 \rightarrow \text{use } \phi' = 32^\circ$

$s_\gamma = 1 - 0.3(B/L) = 0.9$

$B = 1 \text{ m}$

$\gamma' = 18.5 \text{ kN/m}^3$

$N_\theta^{strip} = e^{\pi \tan \phi'} \tan^2(45 + \phi'/2) = 23.176$

$N_\gamma^{strip} = 2(N_q - 1) \tan \phi' = 27.71$

$q_{ult} = 0.5 \times 0.9 \times 1 \times 18.5 \times 27.71 = 230.68 \text{ kPa}$

partial safety factor on resistance =  $R2 = 1.4$

**$q_{allowable} = 164 \text{ kPa}$**

Considering plate loading test results (762mm dia.), this will have an equivalent settlement of around 3.5mm in the short term, if the worst test is considered. In view of possible voids and other inconsistencies in the fill, higher factors of safety should be considered, depending on the overlying structure.

Foundations having dimensions smaller than 1m can benefit from improved ground conditions if a 300mm thick layer of compacted fill is introduced above the existing strata of fill.

For information about long term settlement and bearing capacity of foundations larger than 1m, sustained pad loading tests (sand-filled skip on a concrete pad) to BS1377 Part 9 are recommended.

Constrained modulus  $E_s$

While values of the constrained modulus  $E_s$  are applicable for uniformly distributed loading, this may not be the case under foundations of small dimensions, which will influence only a small patch of soil. Conversion between the elastic modulus E and the constrained modulus  $E_s$  can be carried out using the following table, which is based on Elastic Theory and therefore applicable only to elastic conditions, which in such fills will imply very small strains.

$\phi'$ degrees	$K_o = 1 - \sin \phi$	$\nu = K_o / (1 + K_o)$	$E_s / E$
30	0.50	0.3333	1.500
32	0.47	0.3198	1.430
34	0.44	0.3059	1.369
36	0.41	0.2919	1.317
38	0.38	0.2776	1.271
40	0.36	0.2632	1.232
42	0.33	0.2486	1.197
44	0.31	0.2339	1.167
$E_s / E = (1 + K_o) / [(1 - K_o)(1 + 2K_o)]$			

<sup>6</sup> Clayton, C, (1995), *The Standard Penetration Test (SPT): Methods and Use*, CIRIA. London

<sup>7</sup> Stroud, M.A. (1989), *The Standard Penetration Test –its application and interpretation*, Proc. ICE Conf. on Penetration Testing in the UK, Birmingham, Thomas Telford, London

Note: Frequency of SPT tests was limited to 1.5m in the absence of specific instructions from Siemens Turbomachinery AB. This coincided with the drilling run length used during this investigation, and thus minimized the loss of retrieved core required for logging purposes.

### Liquefaction potential

Liquefaction during seismic events is not recorded in the Maltese Islands, mostly because most of the island consists of rock and stiff clay. The SPT data was used to check for liquefaction potential of the fills and underlying silty sands. The normalised STP blowcount for the fill and the silty sand is shown in Figure 1 below. Blowcounts in excess of 58 are not considered since these are probably refusals on some large stone particle or boulder. It is to be noted that some of the lower blowcounts might represent a void that was encountered in between the larger particles.

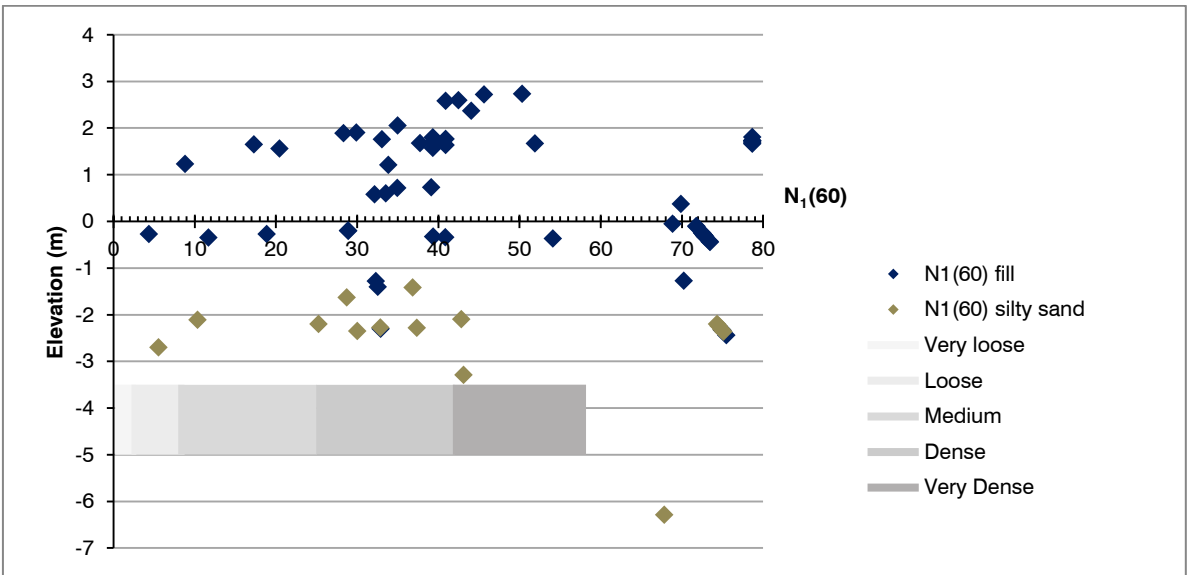
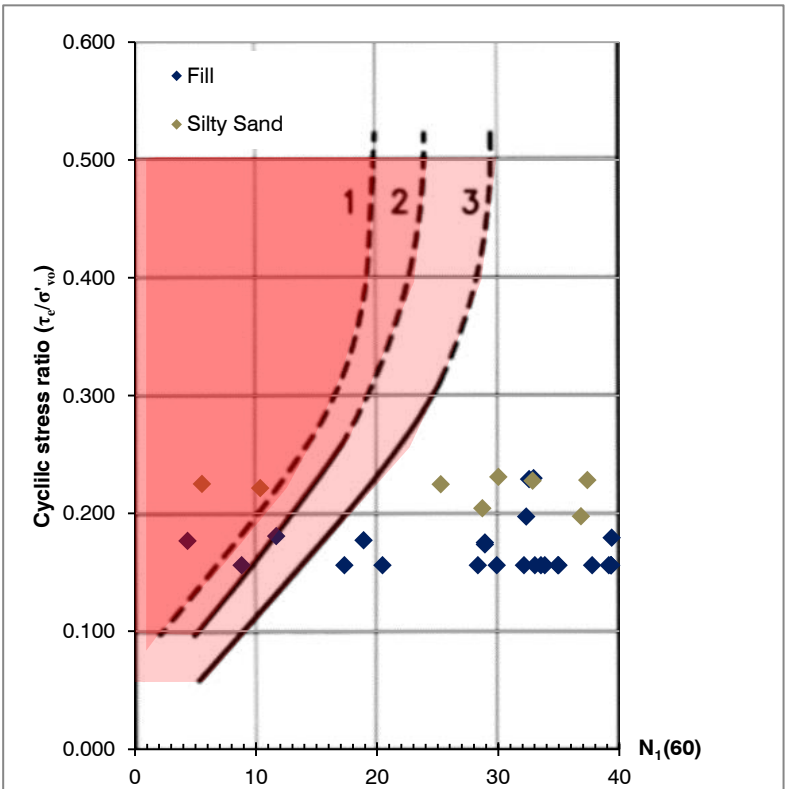


Figure 1 – Normalised SPT blowcounts for fill and underlying silty sand.

The method outlined in Eurocode 8: *Design of structures for earthquake resistance Part 5: Foundations, retaining structures and geotechnical aspects* has been used for this analysis, specifically by use of the charts in Annex B (Normative) *Empirical charts for simplified liquefaction analysis*. Peak ground acceleration  $\alpha$  was assumed at 0.15g (see Section 11.5 on page 103). A surface wave of magnitude greater than 5.5 was assumed, hence adopting a Type 1 spectrum (Refer to EN 1998-1 Section 3.2.2.2). This results in a soil factor S of 1.4 for Ground type E, considered to be the closest to the situation at Delimara.



The total overburden stress  $\sigma_{v0}$  and the effective overburden stress  $\sigma'_{v0}$  were computed for each SPT test, and the seismic shear stress  $\tau_e$  computed accordingly using  $\tau_e = 0.68 \cdot \alpha \cdot S \cdot \sigma_{v0}$ . Cyclic stress ratio was then computed as  $\tau_e / \sigma'_{v0}$ . Each value was then plotted on Figure 2 below, taken from EN 1998-5 Annex B.

In Figure 2, curve 1: 35 % fines, curve 2: 15% fines, curve 3: < 5% fines

It is seen that most SPT results fall outside the zone where liquefaction is possible.

Figure 2 - Relationship between stress ratios causing liquefaction and  $N_1(60)$  values for silty sands for MS=7,5 earthquakes.

## Stability of excavations

Information provided by Siemens re proposed levels is described in the figure below (reproduced from Figure 17, page 23 of report). This suggests that excavation for the main plinth foundations are unlikely to exceed 2m depth, assuming that a blinding layer is introduced and that the higher levels of the site are levelled to a common level of +2.5 to 2.6m LAT.

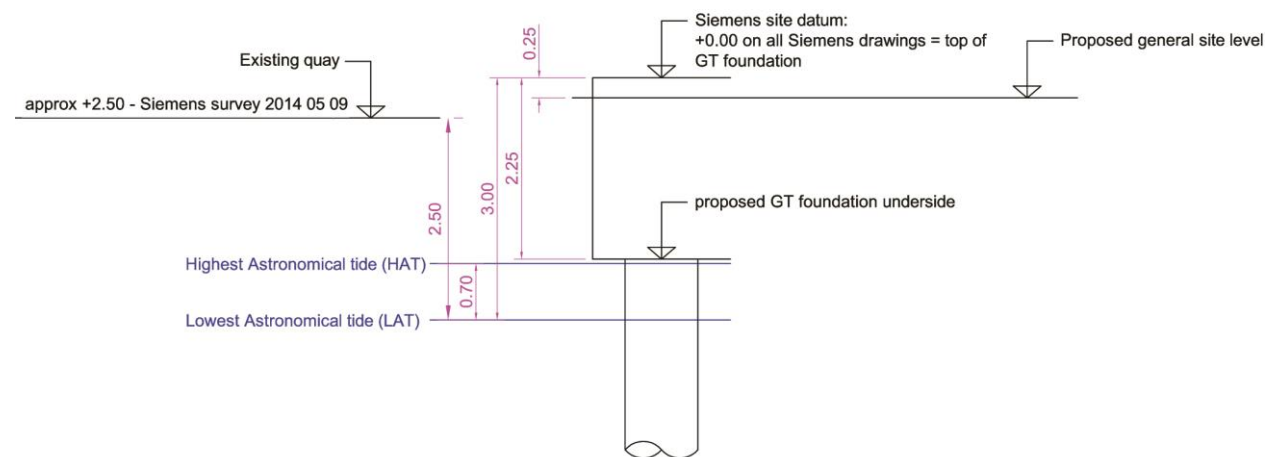


Figure 3 – Assumed relationship of existing and proposed site levels to Lowest and Highest Astronomical Tides

Stability analyses for a 1:1.5 slope, using the stratigraphy presented in this addendum, have been carried out. The models shown below use a factor of safety of 1.25 on material properties ( $\tan\phi'$ ), and an excavation depth of 2.3m. A uniformly distributed load of 60kN/m<sup>2</sup> has been assumed to act at 1.5m away from the edge of the slope. The water table has been assumed to exist at the top of the weak fill at sea level. Figure 4 (left) represents Bishop circle analysis which shows that failures, if any, are likely to occur by unravelling of the surfaces, hence the need for some additional space at the bottom of the excavation. If more space is available, a more gentle slope (1:2) can be introduced, with improved factors of safety:

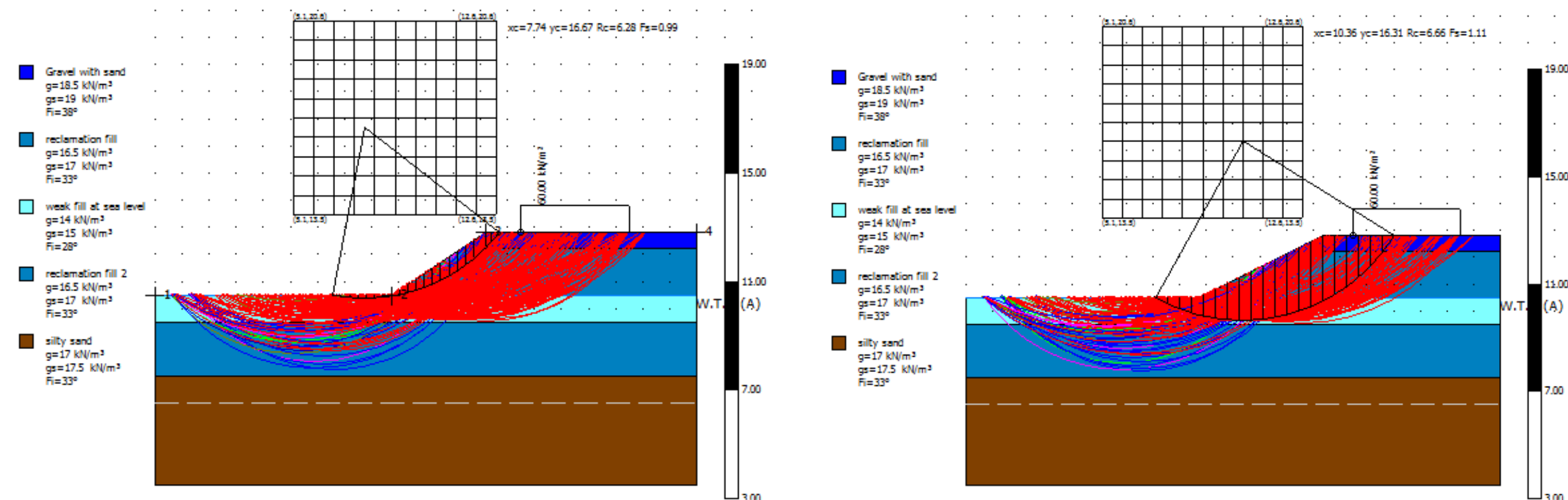


Figure 4 - Bishop circle analysis for a 1:1.5 slope (left) and for a 1:2 slope (right)

It is to be noted that the above models and analyses do not capture the possibility of having localised weak zones due to some large void or boulder. The heterogeneous nature of the fill implies that such situations may exist, which situations could possibly create localised failures, as seen in the trial pits. Excavation and the use of the adjacent areas should therefore be supervised and checked by a competent person.

Addendum 2 – revised summary of stratigraphic data – weathered marl and massive marl bedrock

Origin	Type	Colour code	Description	Comments	Thickness range	Main investigative methods	SPT (N1) <sub>60</sub> and correlated geotechnical properties*	Downhole seismic tests	Recommended values for design
Miocene	Weathered Middle Globigerina Marl		Very weak, microfractured marl resulting in gravel-sized pieces of weak rock in a softer clay matrix towards the top of the sequence. Degree of fracturing decreases with depth	Downhole seismic tests indicate that weaker zones may extend further than the core segments identified as 'weak' by inspection of BH core.	0.1m – 7.0m	BH core, Downhole seismic, lab testing (index)	N/A	$E_{dyn} = 340\text{MPa} - 960\text{MPa}$ at top $E_{dyn} = 3.77\text{GPa} - 8.0\text{GPa}$ at bottom $v_{dyn} = 0.4 - 0.48$ at top $v_{dyn} = 0.3 - 0.4$ at bottom	To be chosen from specified range, according to type of analysis  See discussion below for static values: $E' = 85\text{MPa} - 240\text{MPa}$ top $E' = 0.94\text{GPa} - 2.0\text{GPa}$ bottom
	Middle Globigerina Marl		The olive-grey, fine grained marl layer, generally massive and bioturbated, occasionally microfractured in the horizontal plane.	Presence of microfracturing may include weaker strata that are not uniformly distributed across the site – see figure below	>20m	BH core, Downhole seismic, lab testing (index and strength)	N/A	$E_{dyn} = 3.77\text{GPa} - 8.0\text{GPa}$ $v_{dyn} = 0.3 - 0.4$	See discussion below for static values: $E' = 0.94\text{GPa} - 2.0\text{GPa}$

Stratification

The figure below compares the weaker marl layers as identified from the inspected BH core, for all the boreholes drilled during this investigation. The yellow segments represent the very weak microfractured material that was almost clay-like. This is generally of limited depth, and gradually changes to a stiffer and more solid material. The green segments represent the weaker zones identified within the stronger marl.

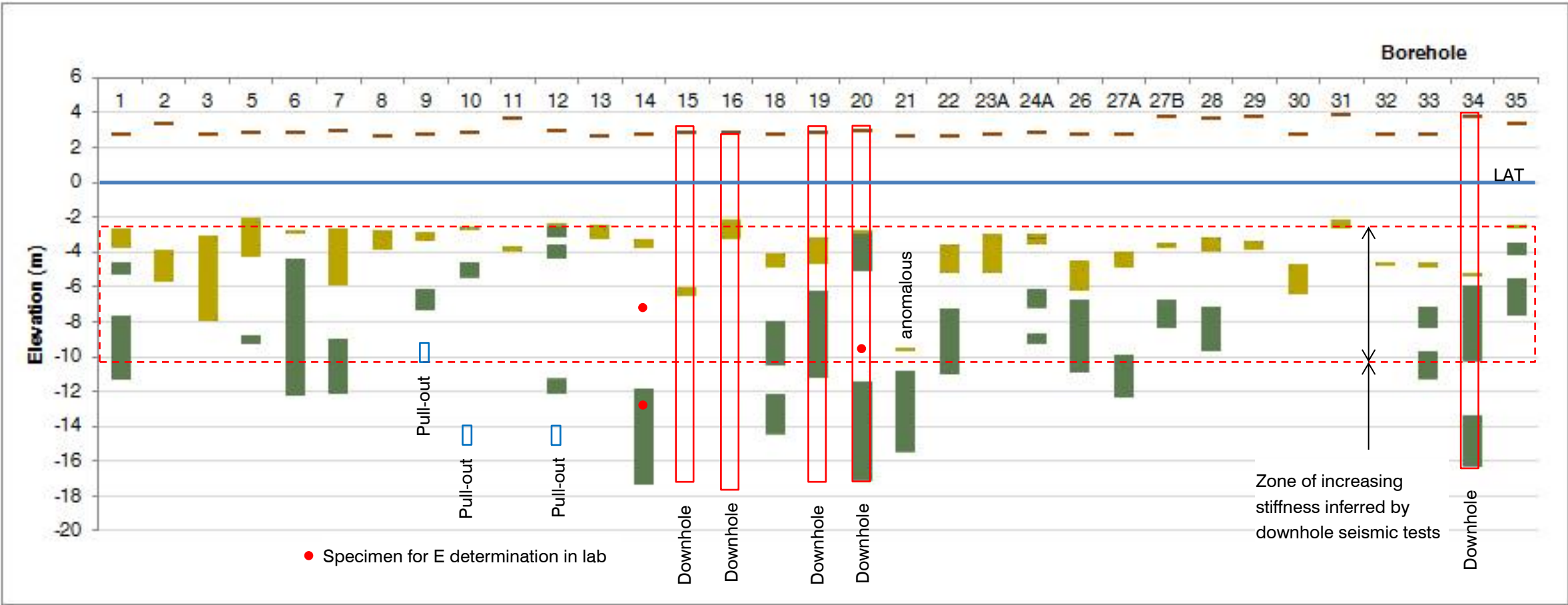


Figure 1 – weak strata in marl as observed from retrieved borehole core.



The darker green segments represent those segments of core that were retrieved in a heavily fractured state or where the core was seen to be weak and microfractured. It is seen that there is no distinct pattern across the site for such weak layers. It is to be noted that in general, these weaker segments exist in the upper reaches of the boreholes, but there are isolated exceptions to this.

The downhole seismic tests, carried out in BHs 15, 16, 19, 20 and 34, do however indicate that these weaker layers may form part of a gradual transition in stiffness occurring between the uppermost surface of the marl and a depth of around -10m LAT. Again, there are exceptions to this, but the downhole stiffness profiles of BH20 and BH34 show good correlation with the observations on the respective BH core.

### Elastic Modulus

Correlation between dynamic and static values of the Elastic Modulus E can be attempted on the basis of empirical relationships given in the geotechnical literature. The correlations by Van Heerden(1987) and others summarised in Brotons et al.(2013) were attempted, but these correlations are generally based on research carried out on rocks that are significantly stronger than the marl at Delimara (on the basis of unconfined compressive strength). These relationships resulted in static values of E that were many times less than the values obtained in laboratory tests on specimens equipped with local strain measurement (see section 7.3, pag 69), and were thus not considered to be realistic.

The marls of Malta have many similarities to Chalk as a geotechnical material. At microscopic level, both materials are predominantly composed of marine planktonic coccolithic algae, and many similarities can be observed when looking at the structure of these materials using the scanning electron microscope. Many similarities are also observed when the mechanical properties of these two materials are compared. In this respect, the marl at Delimara is very similar to High Density Chalk (see Mortimore et al, 1990 and Matthews et al, 1993, in CIRIA, 1994)<sup>8</sup>. A comparison of index properties is discussed in Section 7.2 on pages 64-68.

The values for the static modulus compare favourably with the values quoted for High Density Chalk<sup>8</sup>. In this case, Grade A (few discontinuities) is applicable, and the values quoted are all secant values. The same reference gives indications on how the elastic modulus of the rock mass changes with changes in structure, reproduced in Table 3 below. On the basis of the specimen in BH 20 at -9.26LAT, the values of the static modulus obtained in the laboratory tests would amount to 25% of their dynamic equivalent.

#### MEDIUM/HIGH DENSITY CHALK, GRADE A

$$E_s = 1500 \text{ to } 3000 \text{ MN/m}^2$$

$$q_u > 16 \text{ MN/m}^2$$

(Note that  $q_y$  not observed up to applied stresses of 1600 to 2400 kN/m<sup>2</sup>)

#### MEDIUM/HIGH DENSITY CHALK, GRADES B AND C

$$E_s = 1500 \text{ to } 2000 \text{ MN/m}^2 \text{ (Grade B)}$$

$$= 300 \text{ to } 1500 \text{ MN/m}^2 \text{ (Grade C)}$$

$$q_y = 300 \text{ to } 500 \text{ kN/m}^2$$

$$E_y = 35 \text{ to } 80 \text{ MN/m}^2$$

$$q_u = 4.0 \text{ to } 7.7 \text{ MN/m}^2$$

#### LOW DENSITY CHALK, GRADES B AND C

$$E_s = 200 \text{ to } 700 \text{ MN/m}^2$$

$$q_y = 250 \text{ to } 500 \text{ kN/m}^2$$

$$E_y = 15 \text{ to } 35 \text{ MN/m}^2$$

$$q_u = 1.5 \text{ to } 2 \text{ MN/m}^2$$

**Table 3** Assessment of mass compressibility from visual description  
(after Matthews et al., 1993)

Class	Description	Compressibility characteristics (refer to Section 2.3)
A	Structured chalk: joints and bedding planes more than 200 mm apart, and closed	$E_s = 1000 \text{ to } 10,000 \text{ MN/m}^2$ $q_y > 1000 \text{ kN/m}^2$
B	Structured chalk: joints and bedding planes less than 200 mm apart, and open	$E_s = 300 \text{ to } 1000 \text{ MN/m}^2$ $q_y = 150 \text{ to } 420 \text{ kN/m}^2$ normally $> 200 \text{ kN/m}^2$
C	Structureless chalk: melange of fines and intact chalk lumps, with no regular orientation of bedding or jointing	$E_s = 100 \text{ to } 300 \text{ MN/m}^2$ $q_y$ unknown - probably $< 200 \text{ kN/m}^2$

If the above values are taken into consideration, the gradual variation in stiffness observed in the downhole seismic tests can be approximated to a static equivalent by multiplying the dynamic moduli by a factor of 0.25. It is seen that the lowest values of  $E_{dyn}$  at the top of the weathered marl (340MPa – 960MPa) will result in a static equivalent of 85MPa – 240MPa, which is comparable to Grade C or structureless chalk in table 3 above. It is to be noted that the description of Grade C chalk is very similar to the description of the sections of retrieved core from this upper horizon – “fine grained marl, microfractured and consisting of hard lumps in clay matrix”

<sup>8</sup> Lord et al, (1994), *Foundations in Chalk*, CIRIA Project Report 11, London

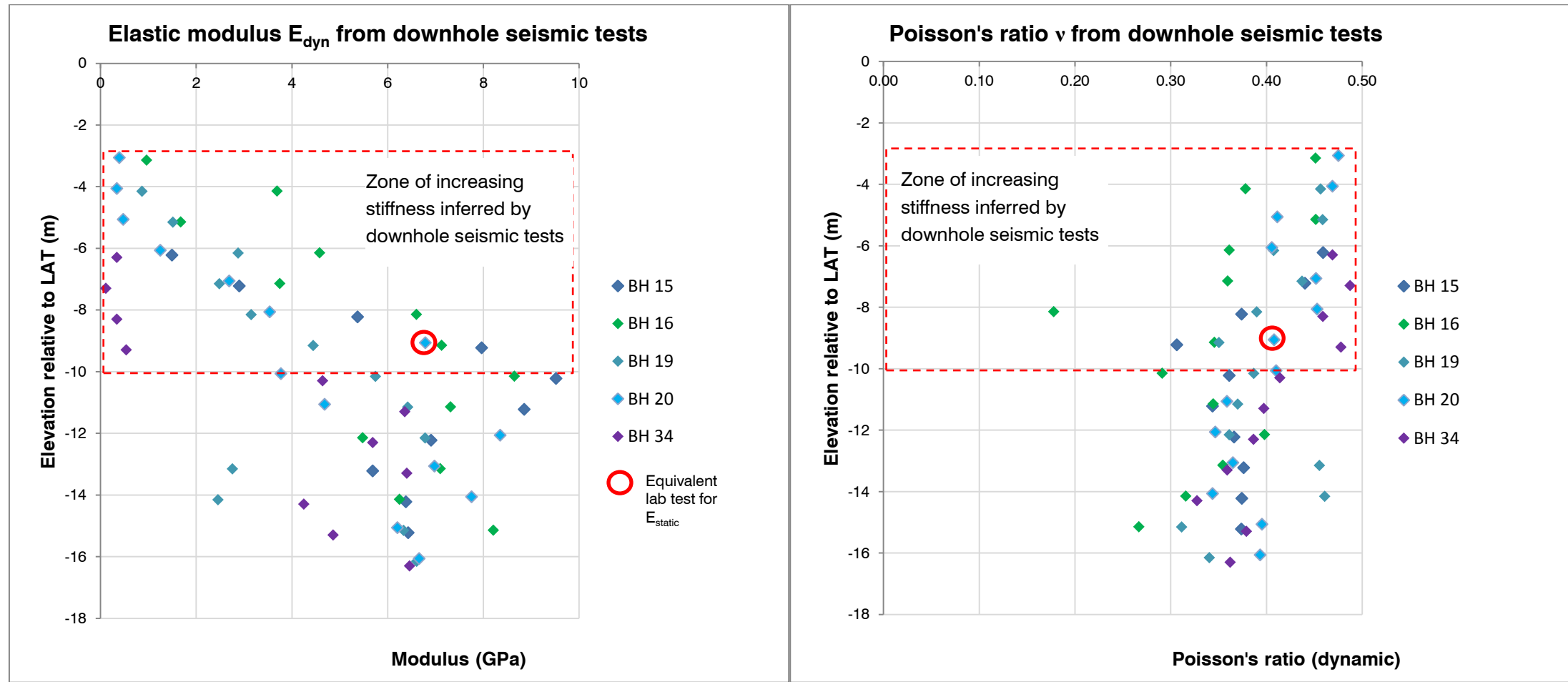


Figure 2 - Dynamic Elastic Modulus and poisson's ratio for the marl sequence

### Other geotechnical properties

The results of laboratory tests on the intact marl are given in Section 7.2. In summary:

$$\gamma = 21 \text{ kN/m}^3$$

$q_u$  = unconfined compressive strength of *intact* rock = 3MPa – 13MPa at top of weathered marl, gradually increasing to 10MPa -18MPa at around -16m LAT. In view of the various inhomogeneities seen in Figure 1 above, the lower limit of this range of values is recommended for design purposes. Calculations in Section 8.2 page 75 have been implemented on this basis, which calculations have not taken into account dynamic considerations or seismic considerations.

### **Addendum 3 – other issues and clarifications**

#### **Previous use of the site**

The site was undeveloped prior to the construction of the existing power station. No records of previous uses (e.g. during WW2) exist.

After the existing power station was completed, the reclaimed area forming the site of this investigation was mostly unused, according to Enemalta officials. Solidbase Laboratory was informed that the site was used as a storage area for a short time during the construction of the recently commissioned BWSC plant.

A small structure (1-storey masonry building) was erected up to a short while ago in the vicinity of the eastern corner of the site. This building is now demolished but the foundations (raft) still exist. The location of this building is shown in Figure 1 on page 12 of the report.

#### **Piling in marl bedrock – pile integrity tests**

Further to section 8.2.3 on page 78, pile integrity testing using the cross hole technique is recommended in this situation, assuming that reinforced concrete bored piles are used. Locally, this technique has shown to give better results than other types of integrity tests, because defects along the depth of the pile are more clearly identified and the results are less subject to interpretation for quality control purposes.

## Test for Chloride Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	07/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	14
Depth (m)	19

Method of preparation	5g of sample was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425µm sieve. 10ml of nitric acid was added and vacuum filtered through a slow filter paper. The chlorides were precipitated with silver nitrate quantitatively and similarly with thiocyanate.
-----------------------	--

### Gavimetric Method

Specimen reference	BH14 at 3m		
Volume of thiocyanate solution used for standardization	V <sub>1</sub>	ml	25.00
concentration of thiocyanate solution	C	mol/L	0.1
volume of silver nitrate used	V <sub>3</sub>	ml	0.82
volume of thiocyanate used	V <sub>3</sub>	ml	113.00
mass of sample used for acid-extract		grams	5.029
Chloride ion content in grams per kilogram of sample	6.58		
Percentage of chloride ion content	0.07092 [V <sub>2</sub> -(10·C) V <sub>3</sub> ]	% by mass	<b>0.658%</b>

Operator	J. AZ.
Approved	A. M.

## Test for Chloride Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	07/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	14
Depth (m)	19

Method of preparation	5g of sample was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425µm sieve. 10ml of nitric acid was added and vacuum filtered through a slow filter paper. The chlorides were precipitated with silver nitrate quantitatively and similarly with thiocyanate.
-----------------------	--

### Gavimetric Method

Specimen reference	BH14 at 19m		
Volume of thiocyanate solution used for standardization	V <sub>1</sub>	ml	25.00
concentration of thiocyanate solution	C	mol/L	0.1
volume of silver nitrate used	V <sub>3</sub>	ml	3.12
volume of thiocyanate used	V <sub>3</sub>	ml	139.80
mass of sample used for acid-extract		grams	5.035
Chloride ion content in grams per kilogram of sample	30.93		
Percentage of chloride ion content	0.07092 [V <sub>2</sub> -(10·C) V <sub>3</sub> ]	% by mass	<b>3.093%</b>

Operator	J. AZ.
Approved	A. M.



## Test for Chloride Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	07/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	14
Depth (m)	3

Method of preparation 5g of sample was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425µm sieve. 10ml of nitric acid was added and vacuum filtered through a slow filter paper. The chlorides were precipitated with silver nitrate quantitatively and similarly with thiocyanate.

### Gavimetric Method

Specimen reference			BH14 at 3m
Volume of thiocyanate solution used for standardization	V <sub>1</sub>	ml	25.00
concentration of thiocyanate solution	C	mol/L	0.1
volume of silver nitrate used	V <sub>3</sub>	ml	2.48
volume of thicyanate used	V <sub>3</sub>	ml	137.70
mass of sample used for acid-extract		grams	5.029
Chloride ion content in grams per kilogram of sample			14.4
Percentage of chloride ion content	0.07092 [V2-(10·C) V3]	% by mass	<b>1.440%</b>

Operator	J. AZ.
Approved	A. M.

## Test for Chloride Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	07/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	20
Depth (m)	1.9

Method of preparation 5g of sample was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425µm sieve. 10ml of nitric acid was added and vacuum filtered through a slow filter paper. The chlorides were precipitated with silver nitrate quantitatively and similarly with thiocyanate.

### Gavimetric Method

Specimen reference			BH20 at 1.9m
Volume of thiocyanate solution used for standardization	V <sub>1</sub>	ml	25.00
concentration of thiocyanate solution	C	mol/L	0.1
volume of silver nitrate used	V <sub>3</sub>	ml	2.37
volume of thiocyanate used	V <sub>3</sub>	ml	140.60
mass of sample used for acid-extract		grams	5.021
Chloride ion content in grams per kilogram of sample			13.66
Percentage of chloride ion content	0.07092 [V <sub>2</sub> -(10·C) V <sub>3</sub> ]	% by mass	<b>1.366%</b>

Operator	J. AZ.
Approved	A. M.

## Test for Chloride Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	07/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	20
Depth (m)	11

Method of preparation 5g of sample was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425µm sieve. 10ml of nitric acid was added and vacuum filtered through a slow filter paper. The chlorides were precipitated with silver nitrate quantitatively and similarly with thiocyanate.

### Gavimetric Method

Specimen reference			BH20 at 11m
Volume of thiocyanate solution used for standardization	V <sub>1</sub>	ml	25.00
concentration of thiocyanate solution	C	mol/L	0.1
volume of silver nitrate used	V <sub>3</sub>	ml	1.52
volume of thiocyanate used	V <sub>3</sub>	ml	135.00
mass of sample used for acid-extract		grams	5.064
Chloride ion content in grams per kilogram of sample			4.9
Percentage of chloride ion content	0.07092 [V <sub>2</sub> -(10·C) V <sub>3</sub> ]	% by mass	<b>0.490%</b>

Operator	J. AZ.
Approved	A. M.

## Test for Chloride Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	07/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	34
Depth (m)	4.5

Method of preparation 5g of sample was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425µm sieve. 10ml of nitric acid was added and vacuum filtered through a slow filter paper. The chlorides were precipitated with silver nitrate quantitatively and similarly with thiocyanate.

### Gavimetric Method

Specimen reference	BH34 at 4.5m		
Volume of thiocyanate solution used for standardization	V <sub>1</sub>	ml	25.00
concentration of thiocyanate solution	C	mol/L	0.1
volume of silver nitrate used	V <sub>3</sub>	ml	1.59
volume of thiocyanate used	V <sub>3</sub>	ml	143.20
mass of sample used for acid-extract		grams	5.002
Chloride ion content in grams per kilogram of sample	16.15		
Percentage of chloride ion content	0.07092 [V <sub>2</sub> -(10·C) V <sub>3</sub> ]	% by mass	<b>1.615%</b>

Operator	J. AZ.
Approved	A. M.

## Test for Chloride Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	07/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	20
Depth (m)	3

Method of preparation 5g of sample was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425µm sieve. 10ml of nitric acid was added and vacuum filtered through a slow filter paper. The chlorides were precipitated with silver nitrate quantitatively and similarly with thiocyanate.

### Gavimetric Method

Specimen reference	BH20 at 3m		
Volume of thiocyanate solution used for standardization	V <sub>1</sub>	ml	25.00
concentration of thiocyanate solution	C	mol/L	0.1
volume of silver nitrate used	V <sub>3</sub>	ml	2.98
volume of thiocyanate used	V <sub>3</sub>	ml	152.60
mass of sample used for acid-extract		grams	4.995
Chloride ion content in grams per kilogram of sample	32.25		
Percentage of chloride ion content	0.07092 [V <sub>2</sub> -(10·C) V <sub>3</sub> ]	% by mass	3.225%

Operator	J. AZ.
Approved	A. M.



## Test for Chloride Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	07/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	20
Depth (m)	3

Method of preparation 5g of sample was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425µm sieve. 10ml of nitric acid was added and vacuum filtered through a slow filter paper. The chlorides were precipitated with silver nitrate quantitatively and similarly with thiocyanate.

### Gavimetric Method

Specimen reference			BH20 at 3m
Volume of thiocyanate solution used for standardization	V <sub>1</sub>	ml	25.00
concentration of thiocyanate solution	C	mol/L	0.1
volume of silver nitrate used	V <sub>3</sub>	ml	2.97
volume of thiocyanate used	V <sub>3</sub>	ml	139.00
mass of sample used for acid-extract		grams	5.004
Chloride ion content in grams per kilogram of sample			29.43
Percentage of chloride ion content	0.07092 [V <sub>2</sub> -(10·C) V <sub>3</sub> ]	% by mass	<b>2.943%</b>

Operator	J. AZ.
Approved	A. M.

## Test for Chloride Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	07/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	20
Depth (m)	4

Method of preparation	5g of sample was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425µm sieve. 10ml of nitric acid was added and vacuum filtered through a slow filter paper. The chlorides were precipitated with silver nitrate quantitatively and similarly with thiocyanate.
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### Gavimetric Method

Specimen reference			BH20 at 4m
Volume of thiocyanate solution used for standardization	V <sub>1</sub>	ml	25.00
concentration of thiocyanate solution	C	mol/L	0.1
volume of silver nitrate used	V <sub>3</sub>	ml	3.12
volume of thiocyanate used	V <sub>3</sub>	ml	136.70
mass of sample used for acid-extract		grams	4.984
Chloride ion content in grams per kilogram of sample			30.25
Percentage of chloride ion content	0.07092 [V <sub>2</sub> -(10·C) V <sub>3</sub> ]	% by mass	<b>3.025%</b>

Operator	J. AZ.
Approved	A. M.

## Test for Sulphates in Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	06/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	5
Depth (m)	9

Method of preparation	5g of sample ( $\pm 0.001$ ) was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425 $\mu$ m sieve. 10ml of hydrochloric acid was added and vacuum filtered through a slow filter paper. The filtrate was neutralized with ammonia and the sulphates were precipitated with barium chloride, collected and ignited.
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### Gavimetric Method

Specimen reference	BH 5 at 9m		
mass of original sample	m1	grams	54.52
mass of soil passing 2mm test sieve	m2	grams	52.26
mass of dry soil	m3	grams	5.000
mass of crucible		grams	84.600
mass of crucible and ignited precipitate		grams	84.625
mass of precipitate	m4	grams	0.025
Sulphate ion content in grams per kilogram of sample	1.72		
Soil Sample acid extract: Percentage of total sulphates (as SO <sub>3</sub> ) in soil specimen finer than 2mm	0.172%		

Operator	J. AZ.	
Approved		A. M.

## Test for Sulphates in Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	06/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	14
Depth (m)	3

Method of preparation	5g of sample ( $\pm 0.001$ ) was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425 $\mu$ m sieve. 10ml of hydrochloric acid was added and vacuum filtered through a slow filter paper. The filtrate was neutralized with ammonia and the sulphates were precipitated with barium chloride, collected and ignited.
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### Gavimetric Method

Specimen reference	BH 14 at 3m		
mass of original sample	m1	grams	53.36
mass of soil passing 2mm test sieve	m2	grams	49.76
mass of dry soil	m3	grams	5.001
mass of crucible		grams	84.600
mass of crucible and ignited precipitate		grams	84.700
mass of precipitate	m4	grams	0.100
Sulphate ion content in grams per kilogram of sample	6.86		
Soil Sample acid extract: Percentage of total sulphates (as SO <sub>3</sub> ) in soil specimen finer than 2mm	<b>0.686%</b>		

Operator	J. AZ.	
Approved		A. M.

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## Test for Sulphates in Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	06/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	20
Depth (m)	1.9

Method of preparation	5g of sample ( $\pm 0.001$ ) was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425 $\mu$ m sieve. 10ml of hydrochloric acid was added and vacuum filtered through a slow filter paper. The filtrate was neutralized with ammonia and the sulphates were precipitated with barium chloride, collected and ignited.
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### Gavimetric Method

Specimen reference	BH 20 at 1.9m		
mass of original sample	m1	grams	59.14
mass of soil passing 2mm test sieve	m2	grams	54.34
mass of dry soil	m3	grams	5.000
mass of crucible		grams	84.600
mass of crucible and ignited precipitate		grams	84.634
mass of precipitate	m4	grams	0.034
Sulphate ion content in grams per kilogram of sample	2.33		
Soil Sample acid extract: Percentage of total sulphates (as SO <sub>3</sub> ) in soil specimen finer than 2mm	<b>0.233%</b>		

Operator	J. AZ.	
Approved		A. M.

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## Test for Sulphates in Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	06/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	20
Depth (m)	11

Method of preparation	5g of sample ( $\pm 0.001$ ) was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425 $\mu$ m sieve. 10ml of hydrochloric acid was added and vacuum filtered through a slow filter paper. The filtrate was neutralized with ammonia and the sulphates were precipitated with barium chloride, collected and ignited.
-----------------------	--

### Gavimetric Method

Specimen reference	BH 20 at 11m		
mass of original sample	m1	grams	51.92
mass of soil passing 2mm test sieve	m2	grams	49.44
mass of dry soil	m3	grams	4.999
mass of crucible		grams	84.600
mass of crucible and ignited precipitate		grams	84.623
mass of precipitate	m4	grams	0.023
Sulphate ion content in grams per kilogram of sample	1.58		
Soil Sample acid extract: Percentage of total sulphates (as SO <sub>3</sub> ) in soil specimen finer than 2mm	<b>0.158%</b>		

Operator	J. AZ.	
Approved		A. M.

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## Test for Sulphates in Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	06/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	14
Depth (m)	19

Method of preparation	5g of sample ( $\pm 0.001$ ) was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425 $\mu$ m sieve. 10ml of hydrochloric acid was added and vacuum filtered through a slow filter paper. The filtrate was neutralized with ammonia and the sulphates were precipitated with barium chloride, collected and ignited.
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### Gavimetric Method

Specimen reference	BH 14 at 19m		
mass of original sample	m1	grams	53.26
mass of soil passing 2mm test sieve	m2	grams	50.84
mass of dry soil	m3	grams	5.000
mass of crucible		grams	84.600
mass of crucible and ignited precipitate		grams	84.635
mass of precipitate	m4	grams	0.035
Sulphate ion content in grams per kilogram of sample	2.4		
Soil Sample acid extract: Percentage of total sulphates (as SO <sub>3</sub> ) in soil specimen finer than 2mm	0.240%		

Operator	J. AZ.	
Approved		A. M.

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## Test for Sulphates in Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	06/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	34
Depth (m)	4.5

Method of preparation	5g of sample ( $\pm 0.001$ ) was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425 $\mu$ m sieve. 10ml of hydrochloric acid was added and vacuum filtered through a slow filter paper. The filtrate was neutralized with ammonia and the sulphates were precipitated with barium chloride, collected and ignited.
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### Gavimetric Method

Specimen reference	BH 34 at 4.5m		
mass of original sample	m1	grams	51.16
mass of soil passing 2mm test sieve	m2	grams	49.38
mass of dry soil	m3	grams	4.999
mass of crucible		grams	84.600
mass of crucible and ignited precipitate		grams	84.611
mass of precipitate	m4	grams	0.011
Sulphate ion content in grams per kilogram of sample	0.75		
Soil Sample acid extract: Percentage of total sulphates (as SO <sub>3</sub> ) in soil specimen finer than 2mm	0.075%		

Operator	J. AZ.	
Approved		A. M.

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## Test for Sulphates in Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	06/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	20
Depth (m)	3

Method of preparation	5g of sample ( $\pm 0.001$ ) was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425 $\mu$ m sieve. 10ml of hydrochloric acid was added and vacuum filtered through a slow filter paper. The filtrate was neutralized with ammonia and the sulphates were precipitated with barium chloride, collected and ignited.
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### Gavimetric Method

Specimen reference	BH 20 at 3m		
mass of original sample	m1	grams	56.78
mass of soil passing 2mm test sieve	m2	grams	53.22
mass of dry soil	m3	grams	5.001
mass of crucible		grams	84.600
mass of crucible and ignited precipitate		grams	84.653
mass of precipitate	m4	grams	0.053
Sulphate ion content in grams per kilogram of sample	3.43		
Soil Sample acid extract: Percentage of total sulphates (as SO <sub>3</sub> ) in soil specimen finer than 2mm	<b>0.343%</b>		

Operator	J. AZ.	
Approved		A. M.

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## Test for Sulphates in Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	06/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	14
Depth (m)	9.5

Method of preparation	5g of sample ( $\pm 0.001$ ) was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425 $\mu$ m sieve. 10ml of hydrochloric acid was added and vacuum filtered through a slow filter paper. The filtrate was neutralized with ammonia and the sulphates were precipitated with barium chloride, collected and ignited.
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### Gavimetric Method

Specimen reference	BH 14 at 9.5m		
mass of original sample	m1	grams	52.46
mass of soil passing 2mm test sieve	m2	grams	51.28
mass of dry soil	m3	grams	4.999
mass of crucible		grams	84.600
mass of crucible and ignited precipitate		grams	84.633
mass of precipitate	m4	grams	0.033
Sulphate ion content in grams per kilogram of sample	2.26		
Soil Sample acid extract: Percentage of total sulphates (as SO <sub>3</sub> ) in soil specimen finer than 2mm	0.226%		

Operator	J. AZ.	
Approved		A. M.

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## Test for Sulphates in Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	06/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	20
Depth (m)	4

Method of preparation	5g of sample ( $\pm 0.001$ ) was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425 $\mu$ m sieve. 10ml of hydrochloric acid was added and vacuum filtered through a slow filter paper. The filtrate was neutralized with ammonia and the sulphates were precipitated with barium chloride, collected and ignited.
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### Gavimetric Method

Specimen reference	BH 20 at 4m		
mass of original sample	m1	grams	56.04
mass of soil passing 2mm test sieve	m2	grams	50.81
mass of dry soil	m3	grams	5.001
mass of crucible		grams	84.600
mass of crucible and ignited precipitate		grams	84.643
mass of precipitate	m4	grams	0.043
Sulphate ion content in grams per kilogram of sample	2.95		
Soil Sample acid extract: Percentage of total sulphates (as SO <sub>3</sub> ) in soil specimen finer than 2mm	<b>0.295%</b>		

Operator	J. AZ.	
Approved		A. M.

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## Test for Total Organic Carbon in Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	08/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	20
Depth (m)	4

Method of preparation	5g of sample was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425µm sieve. 10ml of potassium dichromate and sulphuric acid were added followed by 10ml of phosphoric acid. In 0.5ml (±0.05ml) increments, the solution was titrated against iron II sulphate and back-titrated using 0.5ml (±0.05ml) increments of potassium dichromate to find an appropriate average value.
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### Gravimetric Method

Specimen reference	BH20 at 4m		
mass of original sample	m1	g	56.04
mass of soil passing 2mm test sieve	m2	g	50.81
volume of ferrous sulphate solution added to standardize potassium dichromate solution	x	ml	2.35
mass of dry soil used	m3	g	5.00
volume of ferrous sulphate solution used to oxidize excess potassium dichromate solution	y	ml	3.78
volume of potassium dichromate used to oxidize organic matter in soil	$V = 10.5[(1-y) \div x]$	ml	3.60
percentage of soil finer than 2mm in original sample	$(m1 \div m2) 100$	% by mass	90.67
percentage of organic matter in soil specimen finer than 2mm	$m3 \div (0.67V)$	% by mass	0.48

Operator	J. AZ.
Approved	A. M.

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## Test for Total Organic Carbon in Soil Analysis

to BS 1377-3:1990

Client Location	Siemens Industrial Turbomachinery AB Delimara Power Station - New Combined Cycle Power Plant
Date tested	08/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	14
Depth (m)	9.5

Method of preparation	5g of sample was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425µm sieve. 10ml of potassium dichromate and sulphuric acid were added followed by 10ml of phosphoric acid. In 0.5ml (±0.05ml) increments, the solution was titrated against iron II sulphate and back-titrated using 0.5ml (±0.05ml) increments of potassium dichromate to find an appropriate average value.
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### Gravimetric Method

Specimen reference			BH14 at 9.5m
mass of original sample	m1	g	52.46
mass of soil passing 2mm test sieve	m2	g	51.28
volume of ferrous sulphate solution added to standardize potassium dichromate solution	x	ml	2.35
mass of dry soil used	m3	g	5.00
volume of ferrous sulphate solution used to oxidize excess potassium dichromate solution	y	ml	3.78
volume of potassium dichromate used to oxidize organic matter in soil	$V = 10.5[(1-y) \div x]$	ml	2.70
percentage of soil finer than 2mm in original sample	$(m1 \div m2) 100$	% by mass	97.75
percentage of organic matter in soil specimen finer than 2mm	$m3 \div (0.67V)$	% by mass	0.36

Operator	J. AZ.
Approved	A. M.

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## Test for Total Organic Carbon in Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	08/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	20
Depth (m)	3

Method of preparation	5g of sample was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425µm sieve. 10ml of potassium dichromate and sulphuric acid were added followed by 10ml of phosphoric acid. In 0.5ml (±0.05ml) increments, the solution was titrated against iron II sulphate and back-titrated using 0.5ml (±0.05ml) increments of potassium dichromate to find an appropriate average value.
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### Gravimetric Method

Specimen reference			BH20 at 3m
mass of original sample	m1	g	56.78
mass of soil passing 2mm test sieve	m2	g	53.22
volume of ferrous sulphate solution added to standardize potassium dichromate solution	x	ml	2.35
mass of dry soil used	m3	g	5.00
volume of ferrous sulphate solution used to oxidize excess potassium dichromate solution	y	ml	3.78
volume of potassium dichromate used to oxidize organic matter in soil	$V = 10.5[(1-y) \div x]$	ml	3.49
percentage of soil finer than 2mm in original sample	$(m1 \div m2) 100$	% by mass	93.73
percentage of organic matter in soil specimen finer than 2mm	$m3 \div (0.67V)$	% by mass	0.47

Operator	J. AZ.
Approved	A. M.

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## Test for Total Organic Carbon in Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	08/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	34
Depth (m)	4.5

Method of preparation	5g of sample was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425µm sieve. 10ml of potassium dichromate and sulphuric acid were added followed by 10ml of phosphoric acid. In 0.5ml (±0.05ml) increments, the solution was titrated against iron II sulphate and back-titrated using 0.5ml (±0.05ml) increments of potassium dichromate to find an appropriate average value.
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### Gravimetric Method

Specimen reference			BH34 at 4.5m
mass of original sample	m1	g	51.16
mass of soil passing 2mm test sieve	m2	g	49.38
volume of ferrous sulphate solution added to standardize potassium dichromate solution	x	ml	2.35
mass of dry soil used	m3	g	5.00
volume of ferrous sulphate solution used to oxidize excess potassium dichromate solution	y	ml	1.26
volume of potassium dichromate used to oxidize organic matter in soil	$V = 10.5[(1-y) \div x]$	ml	1.16
percentage of soil finer than 2mm in original sample	$(m1 \div m2) 100$	% by mass	96.52
percentage of organic matter in soil specimen finer than 2mm	$m3 \div (0.67V)$	% by mass	0.16

Operator	J. AZ.
Approved	A. M.



## Test for Total Organic Carbon in Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	08/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	14
Depth (m)	19

Method of preparation	5g of sample was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425µm sieve. 10ml of potassium dichromate and sulphuric acid were added followed by 10ml of phosphoric acid. In 0.5ml (±0.05ml) increments, the solution was titrated against iron II sulphate and back-titrated using 0.5ml (±0.05ml) increments of potassium dichromate to find an appropriate average value.
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### Gravimetric Method

Specimen reference			BH14 at 19m
mass of original sample	m1	g	53.26
mass of soil passing 2mm test sieve	m2	g	50.84
volume of ferrous sulphate solution added to standardize potassium dichromate solution	x	ml	2.35
mass of dry soil used	m3	g	5.00
volume of ferrous sulphate solution used to oxidize excess potassium dichromate solution	y	ml	1.26
volume of potassium dichromate used to oxidize organic matter in soil	$V = 10.5[(1-y) \div x]$	ml	3.32
percentage of soil finer than 2mm in original sample	$(m1 \div m2) 100$	% by mass	95.46
percentage of organic matter in soil specimen finer than 2mm	$m3 \div (0.67V)$	% by mass	0.44

Operator	J. AZ.
Approved	A. M.

## Test for Total Organic Carbon in Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	08/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	20
Depth (m)	11

Method of preparation	5g of sample was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425µm sieve. 10ml of potassium dichromate and sulphuric acid were added followed by 10ml of phosphoric acid. In 0.5ml (±0.05ml) increments, the solution was titrated against iron II sulphate and back-titrated using 0.5ml (±0.05ml) increments of potassium dichromate to find an appropriate average value.
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### Gravimetric Method

Specimen reference	BH20 at 11m		
mass of original sample	m1	g	51.92
mass of soil passing 2mm test sieve	m2	g	49.44
volume of ferrous sulphate solution added to standardize potassium dichromate solution	x	ml	2.35
mass of dry soil used	m3	g	5.00
volume of ferrous sulphate solution used to oxidize excess potassium dichromate solution	y	ml	1.26
volume of potassium dichromate used to oxidize organic matter in soil	$V = 10.5[(1-y) \div x]$	ml	1.29
percentage of soil finer than 2mm in original sample	$(m1 \div m2) 100$	% by mass	95.22
percentage of organic matter in soil specimen finer than 2mm	$m3 \div (0.67V)$	% by mass	0.17

Operator	J. AZ.
Approved	A. M.

## Test for Total Organic Carbon in Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	08/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	20
Depth (m)	1.9

Method of preparation	5g of sample was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425µm sieve. 10ml of potassium dichromate and sulphuric acid were added followed by 10ml of phosphoric acid. In 0.5ml (±0.05ml) increments, the solution was titrated against iron II sulphate and back-titrated using 0.5ml (±0.05ml) increments of potassium dichromate to find an appropriate average value.
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### Gravimetric Method

Specimen reference	BH20 at 1.9m		
mass of original sample	m1	g	53.36
mass of soil passing 2mm test sieve	m2	g	49.76
volume of ferrous sulphate solution added to standardize potassium dichromate solution	x	ml	2.35
mass of dry soil used	m3	g	5.00
volume of ferrous sulphate solution used to oxidize excess potassium dichromate solution	y	ml	1.26
volume of potassium dichromate used to oxidize organic matter in soil	$V = 10.5[(1-y) \div x]$	ml	1.16
percentage of soil finer than 2mm in original sample	$(m1 \div m2) 100$	% by mass	93.25
percentage of organic matter in soil specimen finer than 2mm	$m3 \div (0.67V)$	% by mass	0.16

Operator	J. AZ.
Approved	A. M.

## Test for Total Organic Carbon in Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	08/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	14
Depth (m)	3

Method of preparation	5g of sample was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425µm sieve. 10ml of potassium dichromate and sulphuric acid were added followed by 10ml of phosphoric acid. In 0.5ml (±0.05ml) increments, the solution was titrated against iron II sulphate and back-titrated using 0.5ml (±0.05ml) increments of potassium dichromate to find an appropriate average value.
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### Gravimetric Method

Specimen reference	BH14 at 3m		
mass of original sample	m1	g	53.36
mass of soil passing 2mm test sieve	m2	g	49.76
volume of ferrous sulphate solution added to standardize potassium dichromate solution	x	ml	2.35
mass of dry soil used	m3	g	5.00
volume of ferrous sulphate solution used to oxidize excess potassium dichromate solution	y	ml	1.26
volume of potassium dichromate used to oxidize organic matter in soil	$V = 10.5[(1-y) \div x]$	ml	1.92
percentage of soil finer than 2mm in original sample	$(m1 \div m2) 100$	% by mass	93.25
percentage of organic matter in soil specimen finer than 2mm	$m3 \div (0.67V)$	% by mass	0.26

Operator	J. AZ.
Approved	A. M.

## Test for Total Organic Carbon in Soil Analysis

to BS 1377-3:1990

Client	Siemens Industrial Turbomachinery AB
Location	Delimara Power Station - New Combined Cycle Power Plant
Date tested	08/11/2014
Job Ref:	J1057
Borehole/Pit Ref:	5
Depth (m)	9

Method of preparation	5g of sample was dried in an oven at 105°C and subsequently crushed to pass the 2mm and the 425µm sieve. 10ml of potassium dichromate and sulphuric acid were added followed by 10ml of phosphoric acid. In 0.5ml (±0.05ml) increments, the solution was titrated against iron II sulphate and back-titrated using 0.5ml (±0.05ml) increments of potassium dichromate to find an appropriate average value.
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### Gravimetric Method

Specimen reference	BH5 at 9m		
mass of original sample	m1	g	54.52
mass of soil passing 2mm test sieve	m2	g	52.26
volume of ferrous sulphate solution added to standardize potassium dichromate solution	x	ml	2.35
mass of dry soil used	m3	g	5.00
volume of ferrous sulphate solution used to oxidize excess potassium dichromate solution	y	ml	2.60
volume of potassium dichromate used to oxidize organic matter in soil	$V = 10.5[(1-y) \div x]$	ml	2.14
percentage of soil finer than 2mm in original sample	$(m1 \div m2) 100$	% by mass	95.85
percentage of organic matter in soil specimen finer than 2mm	$m3 \div (0.67V)$	% by mass	0.29

Operator	J. AZ.
Approved	A. M.

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## CERTIFICATE OF ANALYSIS

**Certificate No.: 1846**

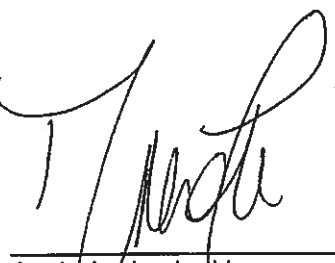
**Customer:** Mr Kenneth Spiteri  
Solidbase Laboratory Ltd.  
Handaq Industrial Estate  
N/S in Handaq Road  
Qormi, QRM 4000

**Sample Description:** Lab number L.N. 14-7265: Sample A: E14/0048 Delimara Power Station  
L.N. 14-7266: Sample B: E14/0049  
L.N. 14-7267: Sample C: E14/0050

**Date of Sample Submission:**  
17<sup>th</sup> November 2014

**Date of commencement of analysis:**  
17<sup>th</sup> November 2014

PARAMETER	UNITS	METHOD OF ANALYSIS	SOP No.	RESULTS		
				LN: 7265	LN: 7266	LN: 7267
CHEMICAL ANALYSIS						
Chlorides	mg/L	Titration	SOP/C/013	23000	22500	21000
Sulphates	mg/L	UV/ VIS Spectrophotometer	LAB WQC 021	2028	2412	2051



Analysis checked by:  
Dianora Caruana B.Sc.(Hons)  
Scientist



Analysis approved by:  
David Spiteri B.Sc.(Hons) M.Sc.  
Senior Professional

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**Date of issue of certificate: 18<sup>th</sup> November 2014**

**No. 1846/ Page 1 of 1**