添付資料 – 5.1.7 (2)

地質調査レポート

Soil Investigation Report on

Natural Conditions for preparatory survey on Matarbari Ultra Super Critical Coal-Fired Power Plant Project (Phase-2)

Project Location: Matarbari, Maheshkhali, Cox's Bazar

Client: SGS Bangladesh Ltd

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1.0 INTRODUCTION

The Government of the People's Republic of Bangladesh has taken up a project for the establishment of a coal-fired power plant at Matarbari in Maheshkhali Upazila of Cox's Bazar District. Coal Power Generation Company Bangladesh Limited (CPGCBL) is the implementation agency on behalf of the Government of Bangladesh. To conduct Natural and Social Environmental Survey, Topographic Survey and Soil Investigation, and Survey on Natural Conditions for Preparatory Survey on Matarbari Ultra Super Critical Coal-Fired Power Plant Project (Phase-2), CPGCBL has engaged an international consulting firm Tokyo Electric Power Services Co., Ltd. (TEPSCO) who provides wide-ranging engineering services; planning, study, design, construction supervision and after care.

Ground Instrumentation & Engineering Pte. Ltd. (GIE) has been awarded Geotechnical Investigation work for this project from SGS Bangladesh Ltd.

For the geotechnical investigation, a total of 8 (eight) boreholes drilling was executed by GIE. A Satellite Map showing the project location in Figure 02 (Site Vicinity Map) and a satellite image of the borehole locations is provided in Figure 03 at the end of the report. A borehole layout map provided by the client is presented in Figure 04. The purpose of the soil investigation was to provide the subsoil information and the pertinent soil strength for the design of the proposed coal-fired power plant and other ancillary structures at the site.

The field investigation of the project was conducted from 03 February 2021 to 20 February 2021. Lab testing for samples was conducted thereafter in GIE Laboratory, Dhaka & SAC-SINGLAS accredited laboratory in GIE, Singapore, and Bangladesh University of Engineering and Technology (BUET).

This report presents the results of the field investigation and laboratory works including interpolated subsurface profiles between the boreholes investigated. The interpolated profiles are prepared based on the borehole information in Figure 05. Variation of subsurface conditions between the holes may exist as the boreholes are quite apart.

2.0 SCOPE OF WORK

The scope of works as stipulated in Contract Specification is summarized as follows.

- Mobilization and demobilization of 02 (two) hydraulic rotary drilling rig, necessary equipment, and personnel to the project site.
- Drilling and sampling of 8 (eight) boreholes as specified. The in-situ tests (SPTs) were conducted as specified and undisturbed samplings from every cohesive soil layer were taken.
- Full-time field supervision of drilling and sampling work during the fieldwork and prepare bore log.
- Conducting laboratory testing for all the samples to evaluate the pertinent physical, chemical and engineering characteristics of the soil underlying the site.
- Preparing a factual report following the requirement of contract specifications.

3.0 REFERENCES / CODE OF PRACTICES

Soil investigation was carried out in compliance with ASTM Standards. The soil description and geological classification are described with relevant ASTM D2488 and Unified Soil Classification Systems (USCS). Standard Penetration Tests were conducted at intervals specified in accordance with D1586. The laboratory testing and Classification of soils were made following the relevant ASTM standard.

4.0 EQUIPMENT

Two rotary drilling rigs were mobilized at this site to drill the boreholes of this project. The manual excavation was conducted for trial excavation for boreholes to avoid any utilities in borehole locations. Split spoon sampler was used for disturbed sampling, while Shelby tubes & Mazier samplers were used for undisturbed sampling. Laboratory testing was conducted using standard equipment for the respective laboratory testing.

5.0 METHODS OF FIELD INVESTIGATION

5.1 General

The fieldwork for this sub-soil investigation was conducted from 03 February 2021 to 20 February 2021 upon receipt of the instruction from the Client. Search for any existing service lines and utility facilities were carried out at the drilling locations.

5.2 Setting Out

All borehole locations were set out jointly by GIE and the client's representative. The reduced level (RL) of the boreholes is provided by the client. The RL and coordinates of borehole points are given in the following table.

Table 5.1: Borehole Coordinates and Reduced Levels

Location- Matarbari, Maheshkhali, Cox's Bazar			
BH Ref.	**Northing (m)**	**Easting (m)**	**Elevation (m)**
BH-01	2400600	385231	4.680
BH-02	2400781	384907	4.300
BH-03	2400612	384904	4.970
BH-04	2400455	384901	4.192
BH-05	2400617	384596	4.332
BH-06	2400493	384316	7.179
BH-07	2400624	384147	6.774
BH-08	2400763	383978	5.885

5.3 Field Work for Exploratory Boreholes

One skid-mounted rotary drilling rig & one tractor mounted rotary drilling utilizing wash techniques were used to drill the boreholes. Flush jointed casings with nominal diameters of 100 mm were used to stabilize and prevent the collapse of the borehole walls.
A tri-cone drag bit was used to advance the borehole and water was used as the flushing medium. Bentonite was added to the water when it was necessary to stabilize uncased sections of a borehole or where running sands are encountered.
Sampling and in situ testing (SPT) were performed at specified intervals over the depth drilled. The undisturbed soil sample is recovered using a thin-walled sampler. The disturbed sample is collected from the SPT split spoon sampler after each Standard Penetration Test (SPT). A standard split barrel sampler of 50 mm outer diameter was lowered to the bottom of the borehole on drill rods. The sampler was then be driven 450 mm into the soil by a 63.5 kg self-tripping hammer free falling from a height of 760 mm.
The blow counts required to advance the final 300 mm of a 450 mm sampler drive was recorded on the borehole logs as SPT 'N' values. In dense strata where it is difficult to drive the sampler the full 450 mm, the penetration achieved beyond the initial 150 mm seating drive, with 50 blows of the hammer was recorded instead.
All the SPT samples were extruded at the site for necessary inspection and identification of the soils encountered.
SPT continued until reaching the hard layer with N value of 50 or more for 5 consecutive times.

After inspection, the recovered SPT samples were placed in double polythene bags to prevent moisture loss. The undisturbed samples were preserved within Shelby tubes with proper waxing and were kept in a cool environment and were later transported to a Laboratory in Dhaka (GIE Lab) for extrusion.
Upon extrusion, the samples were cut into pieces and wrapped with several layers of polyethylene and finally with aluminium foil. All scheduled soil tests were conducted in GIE Laboratory, Bangladesh & Singapore and Bangladesh University of Engineering and Technology (BUET).
The logging of boreholes was carried out by a geologist/site engineer with wide experience on subsoil and geological conditions of the site and in accordance with relevant ASTM and USCS. The Borehole Logs are presented in Appendix A of this report.

6.0 LABORATORY TESTS

A program of laboratory testing was specified by the client to obtain the relevant material properties of the soil strata at the project site. Upon receipt of the Test Program from the Consultant, laboratory investigation of the selected samples was carried out. All samples were examined by a soil technician and checked against the laboratory test results before the final description. The Laboratory Test Result is presented in Appendix B.
In general, the testing is divided into the following areas:
(I) Index Property Tests

- Natural Moisture Content
- Specific Gravity
- Unit Weight (wet and dry density)
- Atterberg Limits Test
- Particle Size Distribution by Sieve and Hydrometer Analysis

- Laboratory Permeability Test (Falling Head)

(II) Strength Tests
- Unconsolidated-Undrained Triaxial Compression Tests (UU)
- Unconfined Compression Test (UCT)
- Direct Shear Test

(III) Deformation Tests
- Consolidation Test
- Modified Proctor Compaction Test

(IV) Chemical Tests
- Chemical Test of Soil (pH, Chloride, Sulfate)
- Chemical Test of Water (pH, Chloride, Sulfate)

6.1 Index Property Tests

6.1.1 Moisture Content

The water content is determined by oven drying selected moist/wet soil material for at least 24 hours to a constant dry mass at a temperature of 105 °C. The loss in weight of the sample due to drying represents the weight of the moisture of the soil. The moisture content of the soil is presented as a percentage of the dry weight of the soil. This test is performed in accordance with ASTM D2216.

6.1.2 Specific Gravity

The specific gravity of the soil particles is determined using a stoppered bottle pycnometer with a volume of 50 ml. The bottle is filled with distilled water and weighed. The unit weight of the water can then be determined. Then the bottle is partly filled with distilled water in which 10 g of dry crumbled soil is mixed. Entrapped air is removed from this mixture by subjecting the contents of the bottle to a vacuum. The bottle is then filled up with distilled water and weighed. The unit weight of the particles of the soil can be computed with these data. The weights of the bottle and contents are determined at a temperature of 20°C. The test is performed in general accordance with ASTM D 854-02.

6.1.3 Unit Weight (wet and dry density)

Unit weights are computed from the wet and dry weights of a standard volume of soil. The dry weight is obtained after determining the moisture content of a wet sample of the standard volume of soil.
The unit weight, γ (kN/m^3), refers to the unit weight of the soil at the sampled water content. The dry unit weight γ_d, is determined from the mass of the oven-dried soil and the initial volume. This test is performed in accordance with ASTM 7263-09.

6.1.4 Atterberg Limits

The Atterberg limits refer to arbitrarily defined boundaries between the liquid and plastic states (i.e., liquid limit, W_L, and between the plastic and brittle states i.e., plastic limit, W_P), of fine-grained soils. They are expressed in the percentage of water content. The range of water contents over which soil behaves plastically is termed the Plastic Index and corresponds to the numerical difference between the liquid and plastic limit (i.e., W_L-W_P). Tests to determine the Atterberg limits were performed on soil samples of cohesive material.
The soil is dried and then ground into separate grains using a mortar. The soil grains larger than 425 μm size are removed by sieving. The soil is then thoroughly mixed with different quantities of distilled water. The liquid and plastic limits of the soil are then determined in accordance with ASTM D 4318.

6.1.5 Particle Size Analysis

Particle size distribution is determined utilizing sieving, hydrometer tests, or both. The percentage of the weight of the various particle sizes above 74 μm is determined by sieving through a set of standard sieves using an electric shaker capable of horizontal and vertical motions. Wire sieves of up to and including the opening size of 2 mm, are used. Plate sieves with an opening size of more than 2 mm are used when more than 5 % of the weight of the specimen is retained on the 2 mm sieve.

When there is a considerable amount of particles smaller than 74 μm, the sieving is complemented by a hydrometer test in which the sample is mixed with water and stirred for about 15 minutes. An additive was used to prevent the flocculation of the soil particles.

After mixing, the density of the water-soil slurry is measured at fixed time intervals, and the particle size distribution of the sediment particles was determined. This test is performed in accordance with ASTM D 422.

6.1.6 Laboratory Permeability Test (Falling Head)

The falling head permeability test involves flow of water through a relatively short soil sample connected to a standpipe which provides the water head and also allows measuring the volume of water passing through the sample. The diameter of the standpipe depends on the permeability of the tested soil. The test can be carried out in a Falling Head permeability cell or in an oedometer cell.

Before starting the flow measurements, the soil sample is saturated and the standpipes are filled with de-aired water to a given level. The test then starts by allowing water to flow through the sample until the water in the standpipe reaches a given lower limit. The time required for the water in the standpipe to drop from the upper to the lower level is recorded. This test is performed in accordance with ASTM D5084.

6.2 Soil Strength Tests

6.2.1 Unconsolidated-Undrained Triaxial Compression Tests (UU)

This test was performed on undisturbed samples of cohesive soils. Depending on the consistency of the cohesive material, the test specimen was prepared by trimming the sample or by pushing a mould into the sample. The height to diameter ratio of the sample was two. A rubber membrane was placed around the specimen and a confining pressure was applied to the sample. During the axial loading of the specimen, the confining pressure was kept constant and the drainage of pore water was not allowed. The test was strain-controlled at the rate of 2 percent per minute and the test was continued until the specimen shears and a peak value was obtained, or until 20 percent strain has occurred. A multi-stage test was performed for this investigation. The results of the test are presented as deviator stress versus axial strain. In accordance with the ASTM requirement, the results of Triaxial compression were expressed as ultimate deviator stress. The undrained shear strength, defined as half the ultimate deviator stress, can be derived from these presentations and is reported to the nearest whole kPa. This test is performed in general accordance with ASTM D 2850.

6.2.2 Unconfined Compressive Strength Test (UCT)

This test was performed on undisturbed samples of cohesive soils. Depending on the consistency of the cohesive material, the test specimen was prepared by trimming the sample or by pushing a mould into the sample. The height to diameter ratio of the sample was two. The test was strain-controlled at the rate of 1 percent of sample height per minute and the test was continued until the specimen shears and a peak value was obtained, or until 20 percent strain has occurred. A single-stage test was performed for this investigation.

The results of the test are presented as deviator stress versus axial strain. In accordance with the ASTM requirement, the results of Triaxial compression were expressed as ultimate deviator stress. The undrained shear strength, defined as half the ultimate deviator stress, can be derived from these presentations and is reported to the nearest whole kPa. The test is performed in general accordance with ASTM D 2166.

6.2.3 Direct Shear Test

Direct shear test, a simple and commonly used test, is performed in the shear box apparatus consists of two pieces shear box of a square cross-section. The test is conducted in accordance with ASTM D3080. The direct shear test is one of the oldest strength tests for soils. A direct shear device is used to determine the shear strength of cohesionless soils. The experiment is run three times at various normal confining stresses. For each of the tests, a plot of the maximum normal stresses vs maximum shear stresses is produced. From the plot, a straight-line approximation of the Mohr-coulomb failure envelope is produced and presented in Appendix B of this report.

6.3 Deformation Tests

6.3.1 Consolidation Tests

Consolidation is the process of time-dependent settlement of saturated clayey soil when subjected to increased loading. The consolidation test unit consists of a consolidometer and a loading device. The consolidometer can be either a floating ring consolidometer or a fixed ring consolidometer. The floating ring consolidometer usually consists of a brass ring in which the soil specimen is placed. One porous stone is placed at the top of the specimen and another porous stone at the bottom. A plastic ring surrounding the specimen fits into a groove on the base plate. The load is applied through a loading head that is placed on the top porous stone. In the floating ring consolidometer, compression of the soil specimen occurs from the top and bottom towards the center. The fixed ring consolidometer essentially consists of the same components i.e., a hollow base plate, two porous stones, a brass ring to hold the soil specimen, and a metal ring that can be fixed tightly to the top of the base plate. In the fixed ring consolidometer, the compression of the specimen occurs from the top towards the bottom. Consolidation of saturated clay soil occurs due to the expulsion of water under a static, sustained load. The consolidation characteristics of soils are required to predict the magnitude and the rate of settlement. The test is conducted in accordance with ASTM D 2435.

6.3.2 Modified Proctor Compaction Test

The degree of soil compaction required to achieve the desired engineering properties is often specified as a percentage of the modified maximum dry unit weight as determined using this test method. If the required degree of compaction is substantially less than the modified maximum dry unit weight using this test method, it may be practicable for testing to be performed using Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort and to specify the degree of compaction as a percentage of the standard maximum dry unit weight.

When a series of samples of soil is compacted at different water content the plot usually shows a distinct peak. Compaction is the process of densification of soil by reducing air voids. The degree of compaction of a given soil is measured in terms of its dry density. The dry density is maximum at the optimum water content. A curve is drawn between the water content and the dry density to obtain the maximum dry density and the optimum water content. The test methodology followed is ASTM D1557.

6.4 Chemical Tests

6.4.1 Chemical Tests of Soil

The samples were collected from boreholes and sent to Sac Singlas accredited laboratory (GIE Singapore Lab) in Singapore for conduction of chemical Tests. The test methodology followed is BS 1377: Part-3 (2018). The pH Value was performed using Electrometric Method (Clause 12), Sulfate Content was performed using Gravimetric Method (Clause 7) & Chloride test was performed using Volhard's Method (Clause 9). The summary of the test results is presented in the following table

Table-6.1: Summary of chemical test results (Soil Sample)

Borehole	Sample	pH Value (pH Unit)	Chloride Content (%)	Sulfate Content (%)
BH-01	UD-01	4.3	0.69	0.51
BH-02	UD-02	4.3	0.43	0.27
BH-03	UD-02	7.0	0.34	0.08
BH-04	UD-02	7.5	0.36	0.16
BH-05	UD -01	7.4	0.46	0.31
BH-06	UD-03	7.5	0.44	0.45
BH-07	UD-01	5.2	0.49	0.31

6.4.2 Chemical Tests of Water

After collecting water samples from the corresponding boreholes, they were sent to the Sac Singlas accredited laboratory (GIE Singapore Lab) in Singapore for conduction of chemical Tests. The test methodology followed is BS 1377: Part-3 (2018). The pH Value was performed using Electrometric Method (Clause 12), Sulfate Content was performed using Gravimetric Method (Clause 7) & Chloride test was performed using Volhard's Method (Clause 9). The summary of the test results is presented in the following table

Table-6.2: Summary of chemical test results (Water Sample)

Borehole	pH Value (pH Unit)	Sulphate as SO_4 (mg/L)	Chloride Content (g/L)
BH-02	6.8	7.7	1424
BH-03	6.7	8.4	1218
BH-04	6.7	8.79	1597
BH-06	6.6	7.56	1959
BH-07	6.7	5.91	362

7.0 SOIL DESCRIPTION

7.1 General

All boreholes are properly logged and drawn showing the thickness of each layer, the color, the type and visual description of each layer, depth below the surface, depth of water level, etc.
Classification of soils is made in accordance with the Unified Classification System (USCS).
Consistency and Apparent Density for cohesive and granular soil as well as their classification system are presented below.
Consistency and Apparent Density of Soil (a 140-pound hammer dropped 30 inches) ASTM D 1586

Table 7.1: Apparent Density of cohesionless soil

SPT N-Value	Apparent Density
0 - 4	Very loose
5 - 10	Loose
11 - 30	Medium dense
31 - 50	Dense
> 50	Very dense

Table: 7.2 Consistency of Cohesive Soil (Clay & Silt)

SPT N-Value	Consistency
<2	Very soft
3 - 4	Soft
5 - 8	Medium stiff
9 - 15	Stiff
16 - 30	Very stiff

7.2 Engineering Classification of Soils (As adopted in BNBC 2017)

Soils are divided into three major groups, coarse-grained, fine-grained, and organic. The classification is based on classification test results namely grain size analysis and consistency test. The coarse-grained soils shall be classified using Table 7.3. Outlines of organic and inorganic soil separations are also provided in Table 7.3. The fine-grained soils shall be classified using the plasticity chart shown in Figure 7.1. In this context, this Code adopts the provisions of ASTM D2487. In addition to these classifications, a soil shall be described by its color, particle angularity (for coarse-grained soils), and consistency. Further to the above classification soils exhibiting swelling or collapsing characteristics shall be recorded. For undisturbed soil information on stratification, compactness, cementation, moisture conditions and drainage characteristics shall be included.

Table 7.3: Engineering Classification of Soils (Criteria for Assigning Group Symbols and Names using Laboratory Tests)

Classification (For particles smaller than 75 mm and based on estimated weights)			Group Symbol	Group Name [B]	Laboratory Classification		
					Percent finer than 0.075mm	Other Criteria	
Coarse grained soils (More than 50% of the material retained on No. 200 sieve (0.075 mm)	**Gravels** (More than 50%of coarse fraction retained on No. 4 sieve (4.75 mm)	Clean gravels	GW	Well graded gravels, sandy gravels, sand gravel mixture, little or no fines. [D]	< 5 [E]	$C_u \geq 4$ and $1 \leq C_z \leq 3$ [C]	
			GP	Poorly graded gravels, sandy gravels, Sand gravel mixture, little or no fines. [D]		$C_u < 4$ and/or $1 > C_z > 3$ [C]	
		Gravel with fines	GM	Silty gravels, silty sandy gravels. [D, F, G]	> 12 [E]	Ip< 4 or the limit values below 'A' line of plasticity chart	For 4> Ip > 7 and limit values above 'A' line, dual symbol required*
			GC	Clayey gravels, silty clayey gravels. . [D, F, G]		Ip >7 and the limit values above 'A' line of Plasticity Chart	
	Sands (over 50% of coarse fraction smaller than 4.75 mm)	Clean Sands	SW	Well graded sand, gravelly sand, little or no fines. [H]	< 5 [E]	Cu ≥ 6 and 1≤ Cz ≤ 3 [C]	
			SP	Poorly graded sands, gravelly sand, little or no fines. [H]		$C_u < 6$ and/or $1 > C_z > 3$ [C]	
		Sands with fines	SM	Silty sand, poorly graded sand silt mixtures. [F, G, H]	> 12 [E]	Ip < 4 or the limit values below 'A' line of Plasticity chart	For 4 > Ip >7 and limit values above A-line, dual symbols required.
			SC	Clayey sand, sand clay mixtures. [F, G, H]		Ip >7 and the limit values above 'A' line of plasticity chart	
Fine grained soils (Over 50% of the material smaller than 0.075 mm)	**Silts & Clays** $w_L < 50$	Inorganic	ML	Silt of low to medium compressibility, very fine sands, rock flour, silt with sand. [K, L, M]	Limit values on or below 'A' line of plasticity chart & Ip <4		
			CL	Clays of low to medium plasticity, gravelly clay, sandy clay, silty clay, lean clay. [K, L, M]	Limit values above 'A' line of plasticity chart and/or Ip > 4		
		Organic	OL	Organic clay [K, L, M, N] and Organic silt [K, L, M, O] of low to medium plasticity	$\frac{\text{Liquid limit (oven dried)}}{\text{Liquid limit (undried)}} < 0.75$		
	Silts & Clays $w_L \geq 50$	Inorganic	MH	Silt of high plasticity, micaceous fine sandy or silty soil, elastic silt. [K, L, M]	Limit values on or below 'A' line of plasticity chart		
			CH	High plastic clay, fat clay. [K, L, M]	Limit values above 'A' line of plasticity chart		
		Organic	OH	Organic clay of high plasticity. [K, L, M, P]	$\frac{\text{Liquid limit (oven dried)}}{\text{Liquid limit (undried)}} < 0.75$		
Soils of high organic origin			PT	Peat and highly organic soils. [K, L, M, Q]	Identified by colour, odour, fibrous texture and spongy characteristics.		

NOTES:

A Based on the material passing the 3-in. (75-mm) sieve

B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

C $C_u = D_{60}/D_{10}$, $C_Z = (D_{30})^2 / (D_{10} \times D_{60})$

D If soil contains ≥ 15 % sand, add "with sand" to group name.

E Gravels with 5 to 12 % fines require dual symbols:

- GW-GM well-graded gravel with silt
- GW-GC well-graded gravel with clay
- GP-GM poorly graded gravel with silt
- GP-GC poorly graded gravel with clay

F If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

G If fines are organic, add "with organic fines" to group name.

H If soil contains ≥ 15 % gravel, add "with gravel" to group name.

I Sands with 5 to 12 % fines require dual symbols:

- SW-SM well-graded sand with silt
- SW-SC well-graded sand with clay
- SP-SM poorly graded sand with silt
- SP-SC poorly graded sand with clay.

J If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.

K If soil contains 15 to 29 % plus No. 200, add "with sand" or "with gravel," whichever is predominant.

L If soil contains ≥30 % plus No. 200, predominantly sand, add "sand " to group name.

M If soil contains ≥ 30 % plus No. 200, predominantly gravel, add "gravelly" to group name.

N PI ≥ 4 and plots on or above "A" line.

O PI < 4 or plots below" A" line.

P PI plots on or above "A" line.

Q PI plots below "A" line.

If desired, the percentages of gravel, sand, and fines may be stated in terms indicating a range of percentages, as follows:

Trace –	Particles are present but estimated to be less than 5 %
Few –	5 to 10 %
Little –	15 to 25 %
Some –	30 to 45 %
Mostly –	50 to 100 %

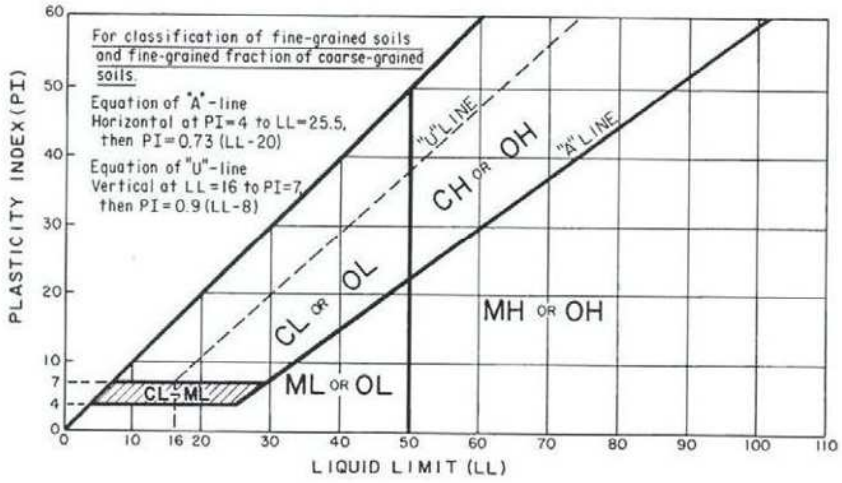

Fig-7.1: Plasticity Chart (Based on materials passing 425 μm)

8.0 SITE GEOLOGY

The surface geology of Bangladesh is dominated by young (Holocene) alluvial and deltaic sediments deposited within the last 6000 to 10000 years. Surface sediments in the north include coarse-grained mountain front alluvial fan deposits. Sediments in much of lowland central Bangladesh are alluvial sands and silts, while in the South closer to the coast, sediments are predominantly deltaic silts and clays where the present site of investigation is located.
An extract from 'Geological Map of Bangladesh' showing the geology of the project area is presented in Figure 01 (Ref. Geological Map of Bangladesh –by Geological Survey of Bangladesh). This geological map indicates that the soil type of the site is categorized as alluvial deposits (alluvial sand and alluvial silt & clay). This is a recent type of deposit and constitutes the major land surface of Bangladesh. Geologically there is no significant variation in the process of soil formation of our studied areas.

The original ground level was MSL+1.0 m before starting Matarbari Project. At this moment (Feb-2021), reclamation work is ongoing in the project site by phase-I of the Matarbari Project.

9.0 SUBSURFACE CONDITIONS

The subsurface soil stratification at this selected area may be broadly categorized into the following layers-
Layer 01- The topmost non-cohesive layer (Fill) consists of greyish to brownish, fine to medium-grained SAND/Silty SAND with traces of mica, seashell fragments, and partially mixed with clay and silt. The thickness of the layer is from 1.00m to 13.00m.

Layer 02- This underlying non-cohesive intermittent layer is about 01m to 03m thick and consists of fine-grained grey to dark grey SAND/Silty SAND. This layer extends up to 5.50m BGL at BH-01, 3.50m BGL at BH-02, 4.50m BGL at BH-03, and 3.50m BGL at BH-08. The SPT N Values range from 5 to 22 and the relative density of the layer is loose to medium dense.

Layer 03- This cohesive layer consists of grey to dark grey CLAY /CLAY with Sand/ Sandy CLAY/SILT/ Clayey SILT. The thickness of the layer is from 5.00m to 15.50m. The SPT N Values range from 0 to 8 and the consistency of the layer is very soft to medium stiff.

Layer 04- This underlying non-cohesive layer is about 3.00m to 28.00m thick and consists of grey to dark grey Silty SAND. The SPT N Values range from 12 to 50 and the relative density of the layer is medium dense to dense and dense to very dense. There are few intermittent cohesive layers consist of CLAY with Sand/ SILT with Sand are found at different depths into this layer. The thickness of these intermittent layers varies between 1m to 2m and SPT N Values range from 15 to 23. The Consistency of these layers shows that they are medium-stiff to stiff in nature.

Layer 05- The lowermost grey to dark grey cohesive intermittent layer consists of CLAY with Sand/ Sandy CLAY/ Clayey SILT/Sandy SILT. The thickness of the layer is from 5.00m to 20.00m. The SPT N Values range from 23 to 50 and the consistency of the layer is very stiff to hard. This layer extends up to 24m BGL at NBH-351, 23.30m BGL at BH-05, 35m BGL at NBH-201, 28.43m BGL at BH-01, 25.32M BGL at BH-04, and 28.37m BGL at BH-06.

The general variation in the subsurface conditions across the site is indicated on soil profiles presented in Figure 06. It should be noted that the profile is interpolated between the boreholes which

are quite a distance apart and therefore natural variations between the investigation points may exist. For detailed information on the subsurface condition, the individual bore logs are referred to in Appendix A.

10.0 GROUNDWATER CONDITIONS

Groundwater is measured in boreholes upon completion of boreholes and recorded in the Bore logs. The groundwater as measured during drilling is found at 1.3 m to 2.7 m depth below the ground surface. However, these water levels were measured inside the boreholes during drilling and do not represent the precise groundwater condition of the site. Moreover, the groundwater at the project site is subjected to fluctuations during the dry and rainy seasons as well as with the tidal flow. The water levels encountered in borehole are mentioned in the following table.

Table-10.1: Water Level (MSL)

Borehole Reference	Water Level (m_MSL)	Date
BH-01	1.98	04-Feb-21
BH-02	-0.20	16-Feb-21
BH-03	2.47	13-Feb-21
BH-04	1.79	07-Feb-21
BH-05	-0.67	17-Feb-21
BH-06	4.18	09-Feb-21
BH-07	0.77	20-Feb-21
BH-08	0.89	04-Feb-21

11.0 SITE CLASSIFICATION

11.1 General

The Site Class Definition quantifies the soil's propensity to amplify, or in some cases decrease, surface ground motion propagating from underlying rock. The Site Class Definition is also used by designers to determine the Seismic Performance Zone for a structure.

According to Bangladesh National Building Code (BNBC), site will be classified as type SA, SB, SC, SD, SE, S1 and S2 based on the provisions of this Section. Classification will be done in accordance with the following table based on the soil properties of upper 30 meters of the site profile.

Table-11.1: Site Classification Based on Soil Properties

Site Class	Description of soil profile up to 30 meters depth	Average Soil Properties in top 30 meters		
		Shear wave velocity, $\overline{V_s}$ (m/s)	SPT Value, $\overline{N}$ (blows/30cm)	Undrained shear strength, $\bar{S}_u$ (kPa)
SA	Rock or other rock-like geological formation, including at most 5 m of weaker material at the surface.	> 800	--	--

Site Class	Description of soil profile up to 30 meters depth	Average Soil Properties in top 30 meters		
		Shear wave velocity, $\overline{V_s}$ (m/s)	SPT Value, $\overline{N}$ (blows/30cm)	Undrained shear strength, $\bar{S}_u$ (kPa)
SB	Deposits of very dense sand, gravel, or very stiff clay, at least several tens of meters in thickness, characterized by a gradual increase of mechanical properties with depth.	360-800	> 50	> 250
SC	Deep deposits of dense or medium dense sand, gravel or stiff clay with thickness from several tens to many hundreds of metres.	180-360	15-50	70-250
SD	Deposits of loose-to-medium cohesionless soil (with or without some soft cohesive layers), or of predominantly soft-to-firm cohesive soil.	< 180	< 15	< 70
SE	A soil profile consisting of a surface alluvium layer with Vs values of type SC or SD and thickness varying between about 5m and 20m, underlain by stiffer material with Vs > 800 m/s.	--	--	--
S_1	Deposits consisting, or containing a layer at least 10 m thick, of soft clays/silts with a high plasticity index (PI>40) and high-water content.	< 100 (indicative)	--	10-20
S_2	Deposits of liquefiable soils, of sensitive clays, or any other soil profile not included in types SA to SE or S1	--	--	--

Average soil properties will be determined as given in the following equations:

$$\overline{V_s} = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{V_{si}}} \text{----------(i)}$$

$$\overline{N} = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{N_i}} \text{----------(ii)}$$

$$\bar{S}_u = \frac{\sum_{i=1}^{k} d_{ci}}{\sum_{i=1}^{k} \frac{d_{ci}}{S_{ui}}} \text{----------(iii)}$$

Where,

n = Number of soil layers in upper 30 m

d_i = Thickness of layer i

V_{si} = Shear wave velocity of layer i

N_i = Field (uncorrected) Standard Penetration Value for layer i

k = Number of cohesive soil layers in upper 30 m

d_{ci} = Thickness of cohesive layer i

S_{ui} = Undrained shear strength of cohesive layer i

The site profile up to a depth of 30 m is divided into n number of distinct soil or rock layers. Where some of the layers are cohesive, k is the number of cohesive layers. Hence $\sum_{i=1}^{n} d_i = 30$ m, while $\sum_{i=1}^{k} d_{ci} < 30$ m if $k < n$. In other words, if there are both cohesionless and cohesive layers, the standard penetration value N as directly measured in the field without correction will be used.

11.2 Analysis of Site Classification Based on the SPT N Values (for Reference only)

$\bar{N}$ Method [Equation (ii)] is used to determine the site classification of this project. The summary of the site classification at this moment of Feb-2021 is given in the following table.

Table-11.2: Summary of the site classification

Borehole Ref.	BH 01	BH 02	BH 03	BH 04	BH 05	BH 06	BH 07	BH 08
Total Thickness (m)	30	30	30	30	30	30	30	30
Total (Thickness/ N Value)	2.50	2.56	2.09	1.89	3.16	4.47	1.75	3.12
Total $\bar{N}$ for Individual boreholes	12.02	11.72	14.33	15.91	9.51	6.71	17.15	9.60
Average $\bar{N}$ for boreholes	**12.12**							
Site Class	**SD**							
Description of soil profile up to 30 meters depth (BNBC)	Deep deposits of dense or medium dense sand, gravel or stiff clay with thickness from several tens to many hundreds of meters.							

The details calculation of the site classification is given in Appendix C of this report.

This site classification should be conducted again after the completion of the reclamation work and soil improvement work (if necessary) at the project site.

12.0 PRECAUTIONARY MEASURE

12.1 Soil Liquefaction (for Reference only)

Soil liquefaction occurs when a saturated or partially saturated soil substantially loses strength and stiffness in response to an applied stress such as shaking during an earthquake or other sudden change in stress condition, in which material that is ordinarily a solid behaves like a liquid. To occur liquefaction in any soil layer following 3 prerequisites are to be fulfilled-

- Soil is to be granular
- State of soil is to be loose
- Water should be present

Liquefaction susceptibility at a site is commonly expressed in terms of a factor of safety versus the occurrence of liquefaction. This factor is defined as the ratio between available cyclic resistance ratio (CRR) and cyclic stresses ratio (CSR). The cyclic stresses generated by the anticipated earthquake.

So, $F_L = \frac{CRR}{CSR}$ [According to BNBC (Chapter-3, Part-6)]

If $F_L \leq 1$, liquefaction is said to take place. Otherwise, liquefaction does not occur.

Both parameters are commonly normalized with respect to the effective overburden stress at the depth in question. With the present state of knowledge, the prediction of liquefaction is an approximation.

However, Seed and Idriss (1971) formulated the following equation for the calculation of CSR;

$$CSR = 0.65 \times \frac{a_{max}}{g} \times \frac{\sigma_0}{\sigma_0'} \times r_d$$

Where,

a_{max} = Peak horizontal acceleration at ground surface due to earthquake in terms of "g" [According to Bangladesh National Building Code (BNBC) 2007, Peak Ground Acceleration for the project area is 0.12g which falls in earthquake zone 1]

σ_0 & σ_0' = total and effective vertical overburden stresses

r_d = Stress reduction coefficient

= 1.0 - 0.00765 z for z ≤ 9.15 m

= 1.174 - 0.0267 z for 9.15 m ≤ z ≤ 23 m

= 0.744 - 0.008 z for 23 ≤ z ≤ 30 m

= 0.50 for z > 30 m

Thomas F. Blake (Fugro-West, Inc., Ventura, Calif., written Commun) approximated the simplified CRR by the following equation,

$$CRR = \frac{a+cx+ex^2+gx^3}{1+bx+dx^2+fx^3+hx^4}$$

Where,

x = $(N_1)_{60cs}$; a = 0.048; b = -0.1248; c = -0.004721; d = 0.009578; e = 0.0006136;

f = - 0.0003285; g = -1.673 X 10^{-5}; and h = 3.714 X 10^{-6}.

$(N_1)_{60}$ = Corrected SPT N Value for overburden pressure.

$(N_1)_{60cs}$ = Corrected SPT N Value for clean SAND (if fine content, FC < 5%)

The above formula for calculating CRR is not applicable for $(N_1)_{60cs}$ >30. According to BNBC, any SPT value higher than 30 will not liquify (Thumb Rule).

In order to consider the effect of fines content percentage (%FC) on CRR, various suggestions have been made to correct the normalized standard penetration resistance values. Idriss and Boulanger (2010) recommended the following formula:

$(N_1)_{60cs} = (N_1)_{60} + \Delta(N_1)_{60}$

$\Delta(N_1)_{60} = e^{\left[1.63+\frac{9.7}{FC+0.01}-\left(\frac{15.7}{FC+0.01}\right)^2\right]}$

The following assumptions are considered during liquefaction analysis of the present site.

- Liquefaction is analysed based on the soil investigation of the site.
- 30.0m depth from the existing ground level is analysed for liquefaction. [Any depth more than 30.0m does not tend to liquify. (Seed, 1968; Seed & Idriss, 1971; Dobry, et al. 1982; Prakash, 1987)]
- If a bore hole got terminated before 30.0 m below ground level (BGL), then the last counted SPT and soil type is considered as same for the depth of 30.0 m BGL.
- The fine content for a sample is assumed if particle size analysis was not performed.
- The ground water level is assumed to be equal to the existing ground level.
- SPT value higher than 30 is considered 30 during the calculation.

After analysing the liquefaction probability of the sites, we can conclude the following probability for the stations area.

According to the analysis, the present site is susceptible to liquefaction is about 16 m below ground level. The details of the liquefaction analysis are presented in appendix D in this report.

This soil liquefaction study should be conducted again after the completion of the reclamation work and soil improvement work (if necessary) at the project site.

12.2 Pile Load Test

We recommend that an indicator pile program be implemented across the project site before the commencement of actual construction to ascertain pile driving criteria and pile length requirements. The indicator piles should be installed with the same equipment and techniques that will be used to install the production piles.
The calculated capacity of piles must be checked/ verified by testing adequate numbers of test piles (usually 1%-2% of total piles) Precautions should be taken for long term effects of compressibility of soft layers which may produce negative skin friction and other factors as well.

12.3 Instrumentation

In the case of deep excavation, Instrumentation plays an important role. It is suggested to monitor any soil movement or any change in the soil stress condition around the excavation zones. This is particularly important when the proposed construction is taking place within a heavily urbanized area. This is to avoid any possible damages or accident which may otherwise risk the lives of construction crews, workers and safety of the nearby structures. This instrumentation and monitoring will help the Engineer to take remedial measures for problems, which may be encountered during construction. It would also help to assess the performance of the proposed temporary/permanent structure during the construction as well as during the service period.

In addition to the above, the instrumentation monitoring records would be powerful tools in protecting the owner/contractor from the possible damage dispute.

Different types of instruments as recommended for this project are tabulated in the following Table.

Table 12.1: Recommended Instrumentation Programme

Types of Instruments	Location	Suggested Quantity	Purpose
Inclinometer in soils	Along the excavation boundaries	To be decided by PE	To monitor the lateral movement of the ground due to the effect of excavation
Inclinometer in retaining wall	Along the Diaphragm wall boundary	To be decided by PE	To monitor the lateral movement of the Diaphragm wall due to the effect of excavation

Types of Instruments	Location	Suggested Quantity	Purpose
Piezometers (Vibrating wire/ Pneumatic)	Along the excavation boundaries	To be decided by PE	To monitor change in piezometric pressure due to excavation
Water Stand Pipe	Along the excavation boundaries	To be decided by PE	To monitor the groundwater level
Road/Ground settlement point	Along the boundaries	@10m c/c	To monitor ground/road settlement during the construction period

Prepared By	Checked By	Approved By
Md. Aminul Islam Geotechnical Engineer B.Sc. in Civil Engineering	**Md. Touhidul Islam** Senior Geologist M.Sc. in Geological Sciences, JU	**Md. Mafizur Rahman** Executive Director B.Sc. in Civil Engineering, BUET PGD (The Netherlands)

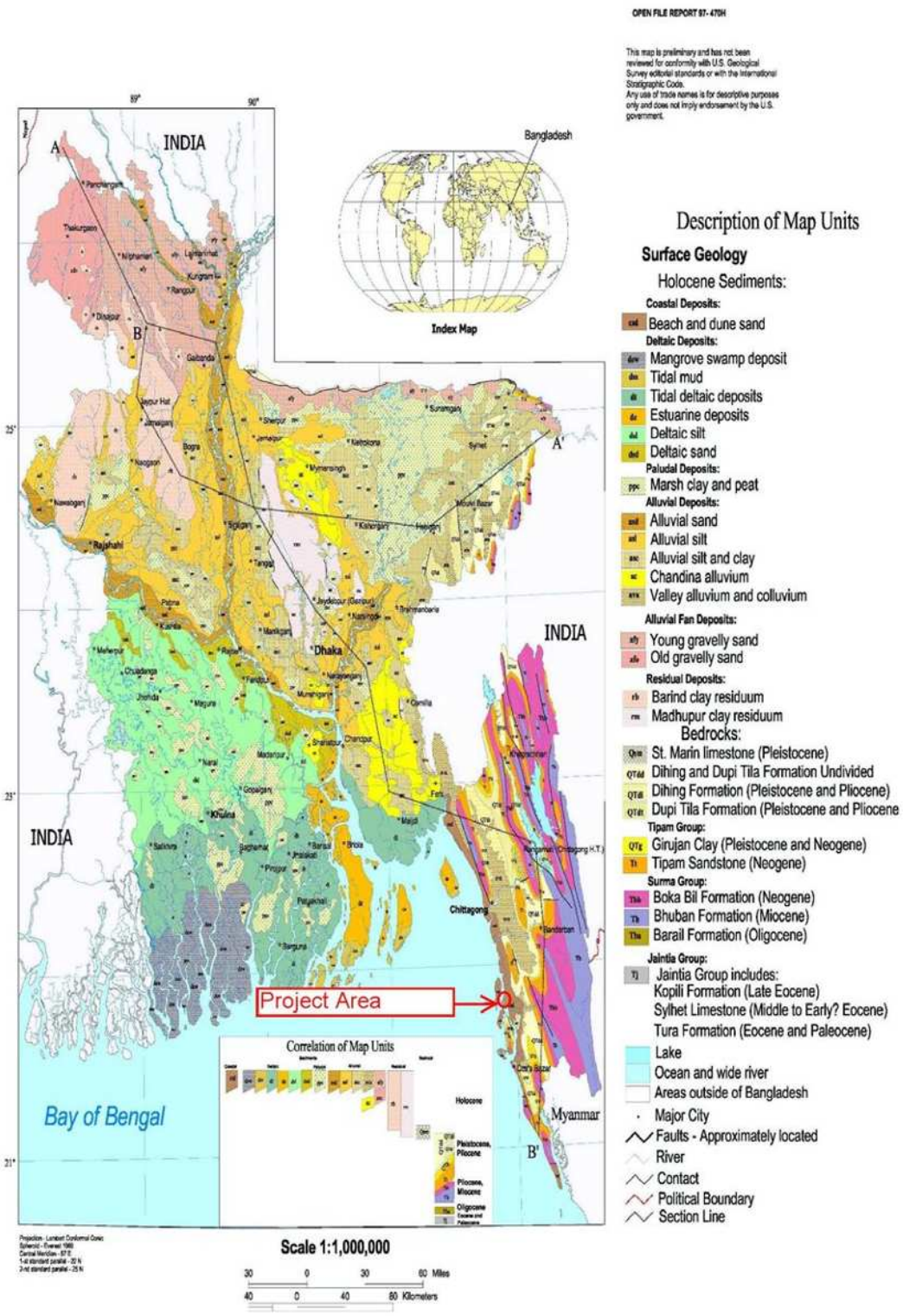

Figure 01: Geological Map of Bangladesh

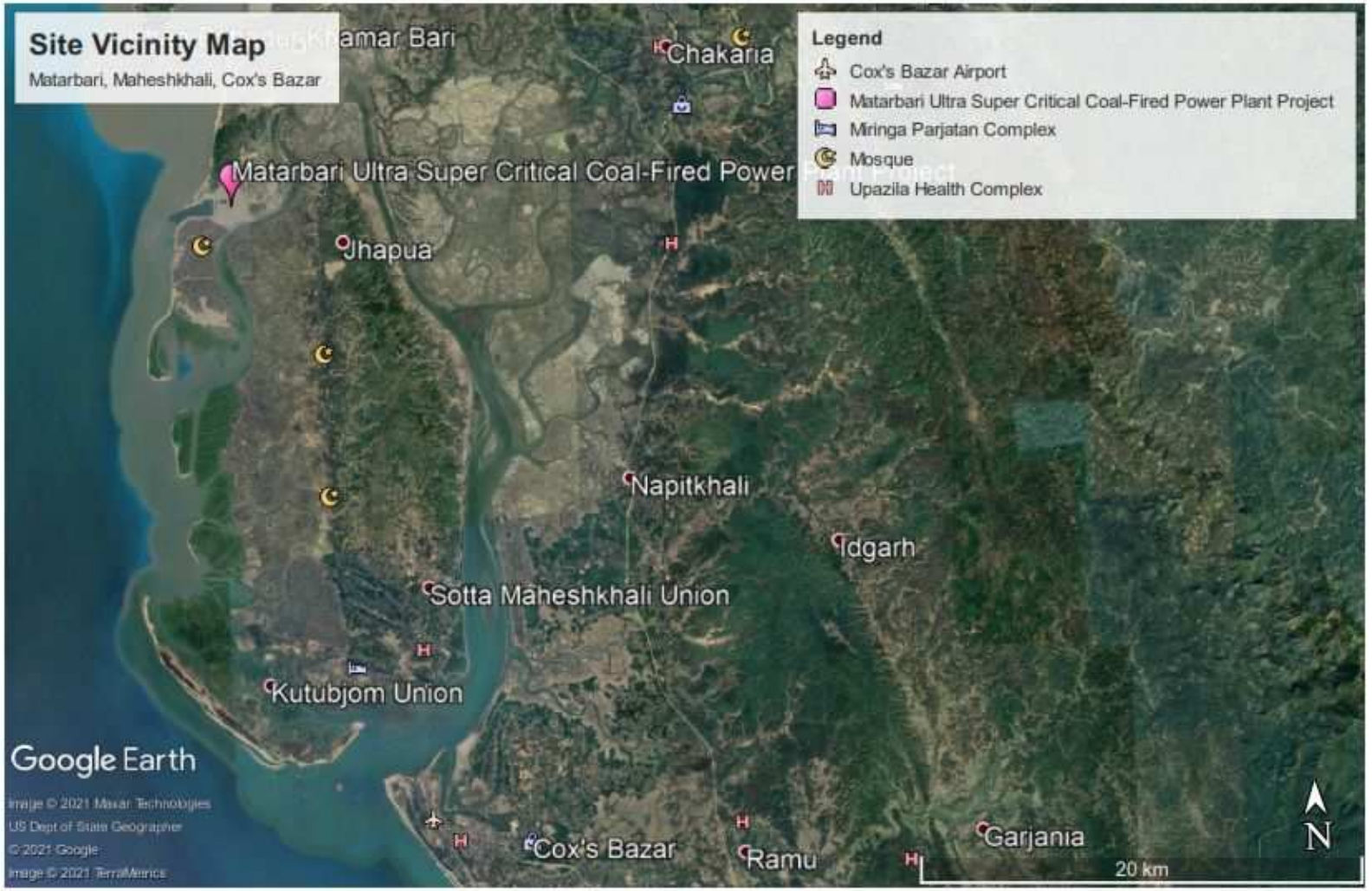

Figure-02: Site Vicinity Map (Satellite Image)

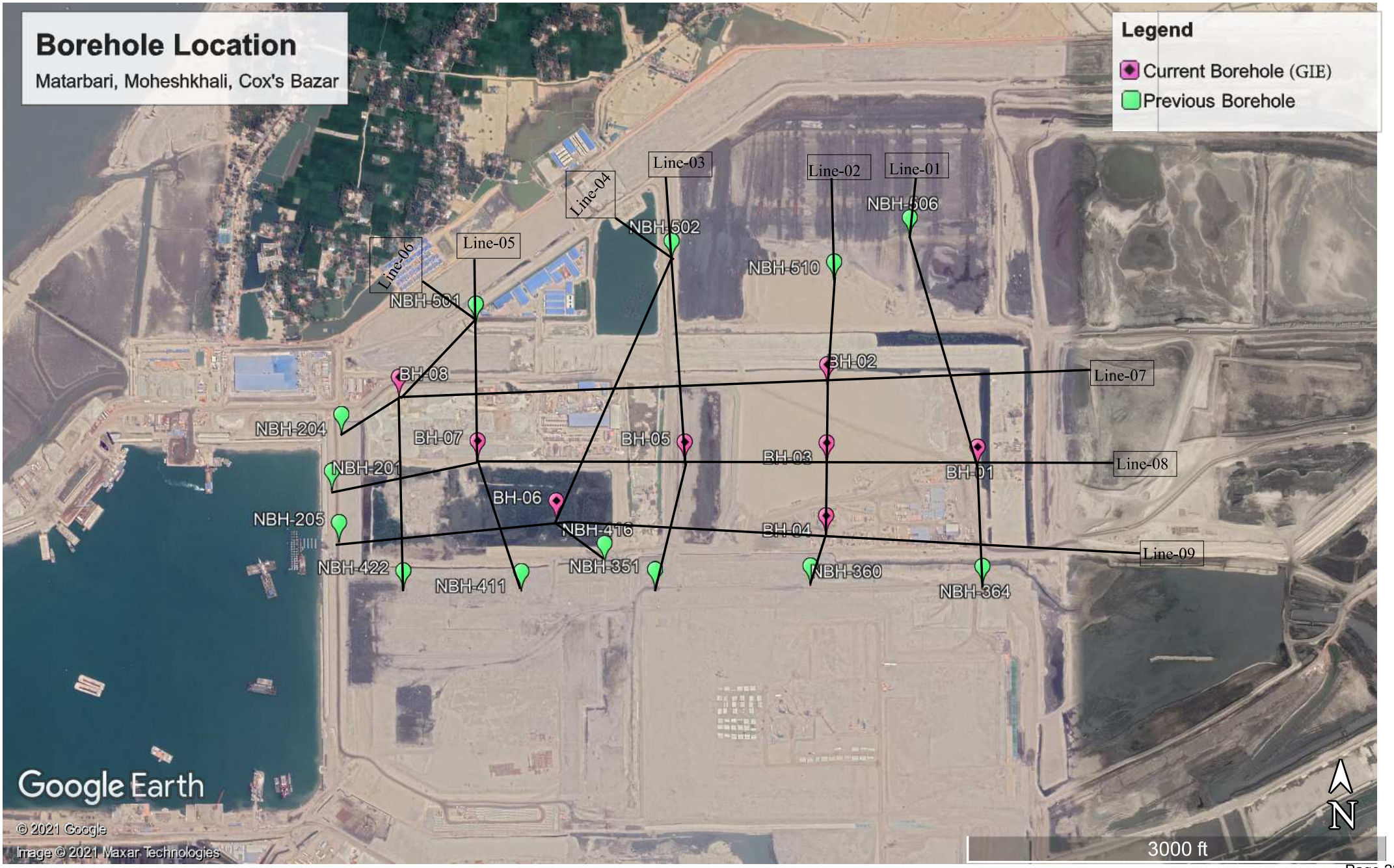

Figure-03: Borehole Location (Satellite Image)

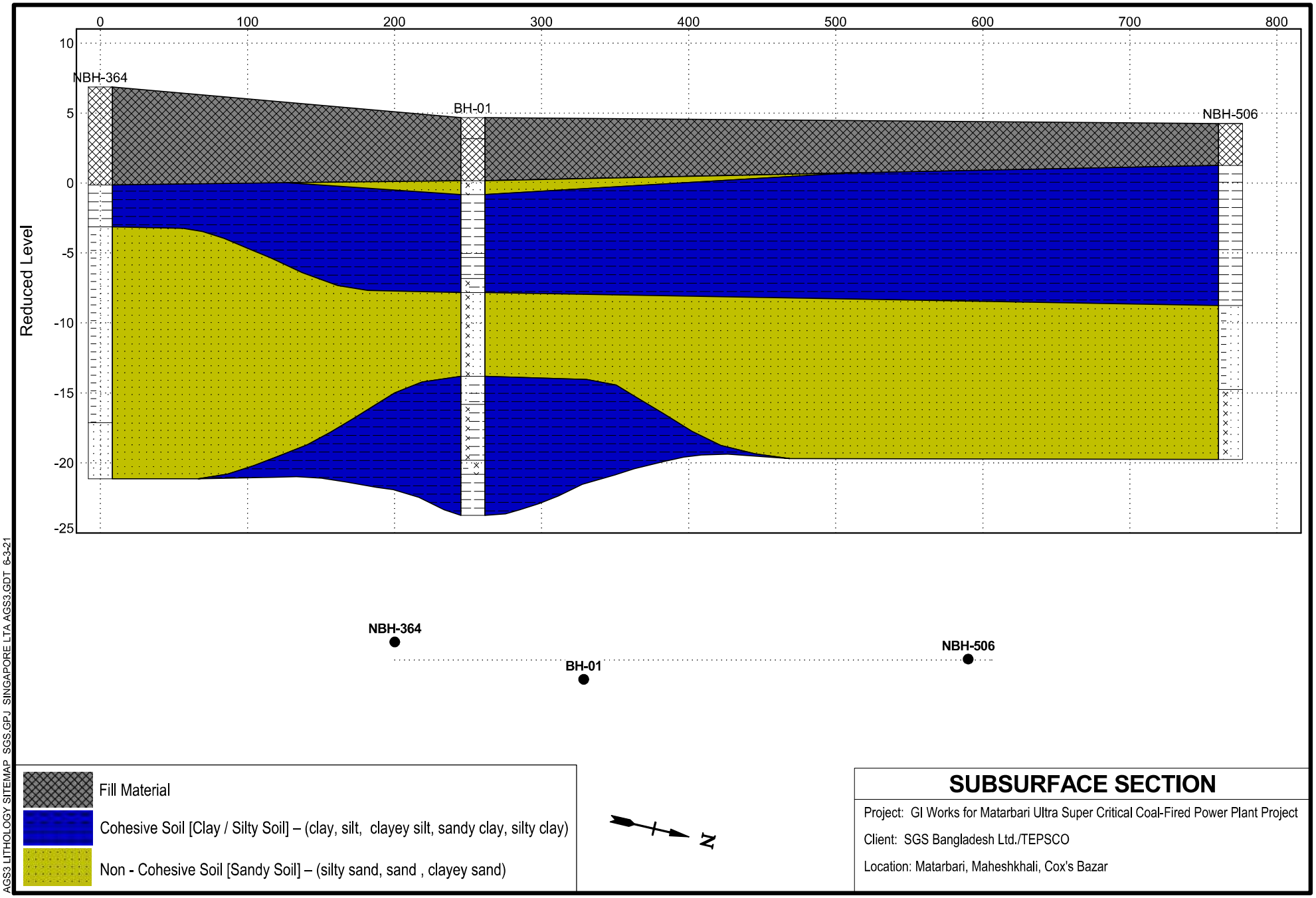

Figure-5.1: Soil Profile (Line-01)

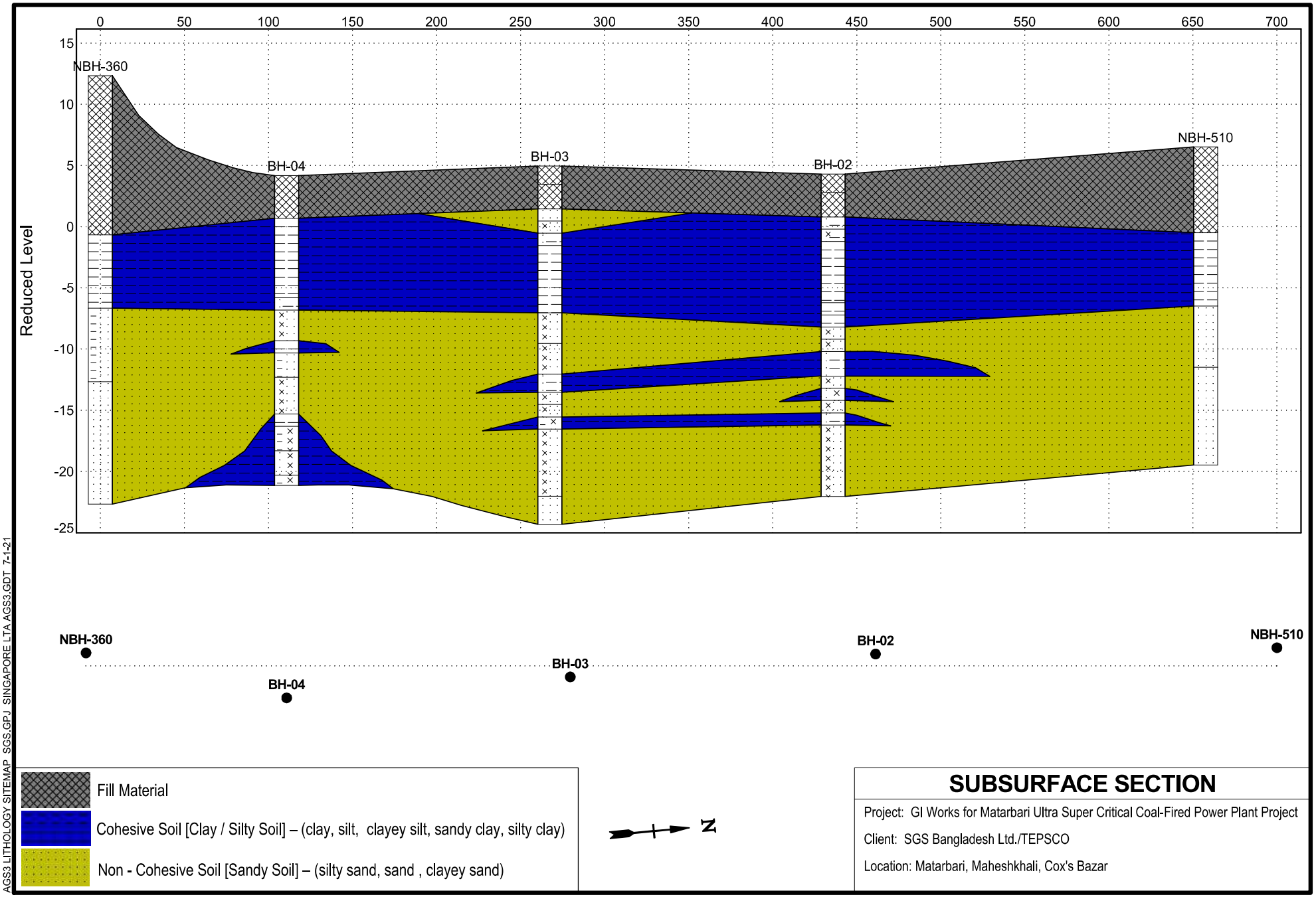

Figure-5.2: Soil Profile (Line-02)

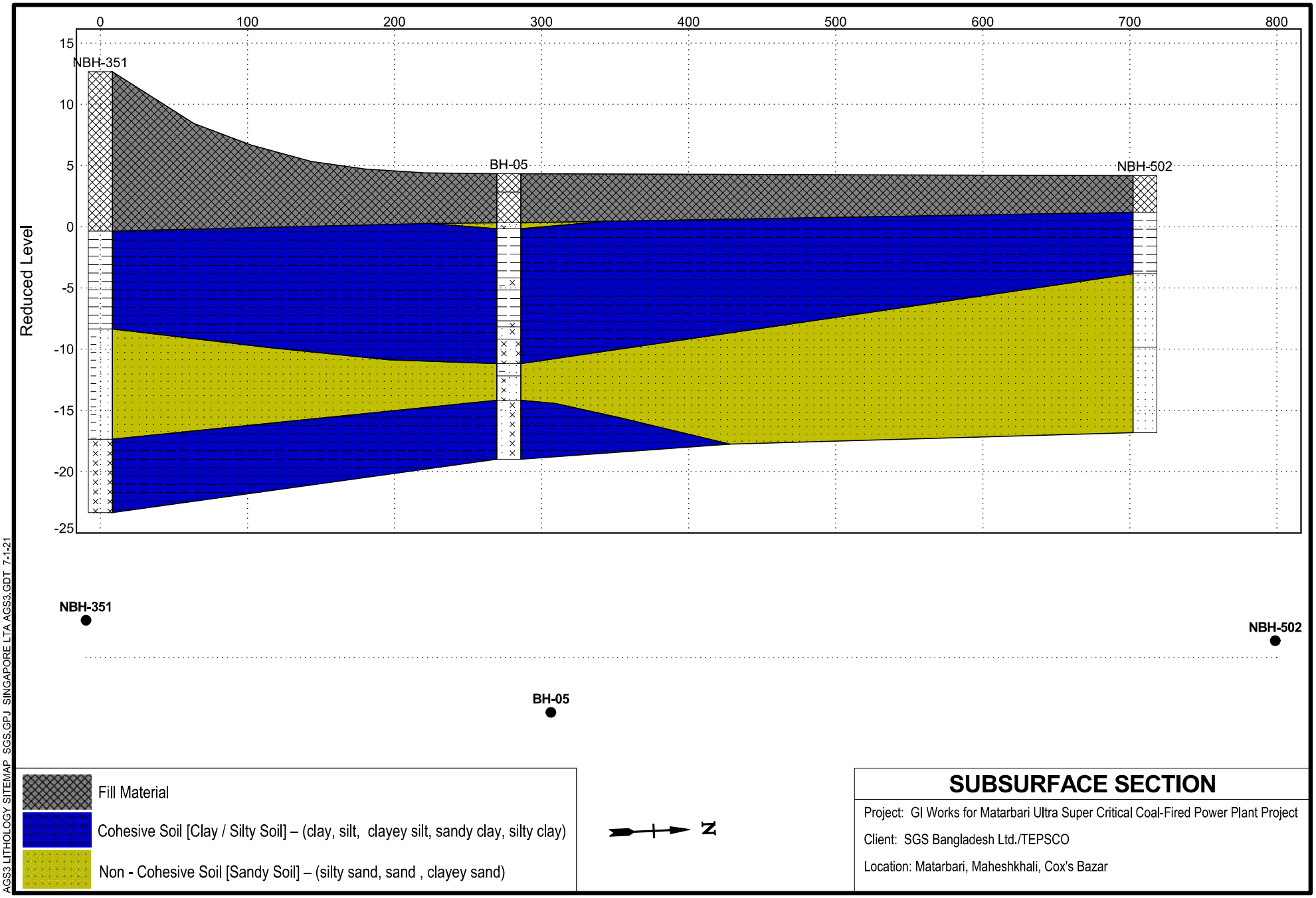

Figure-5.3: Soil Profile (Line-03)

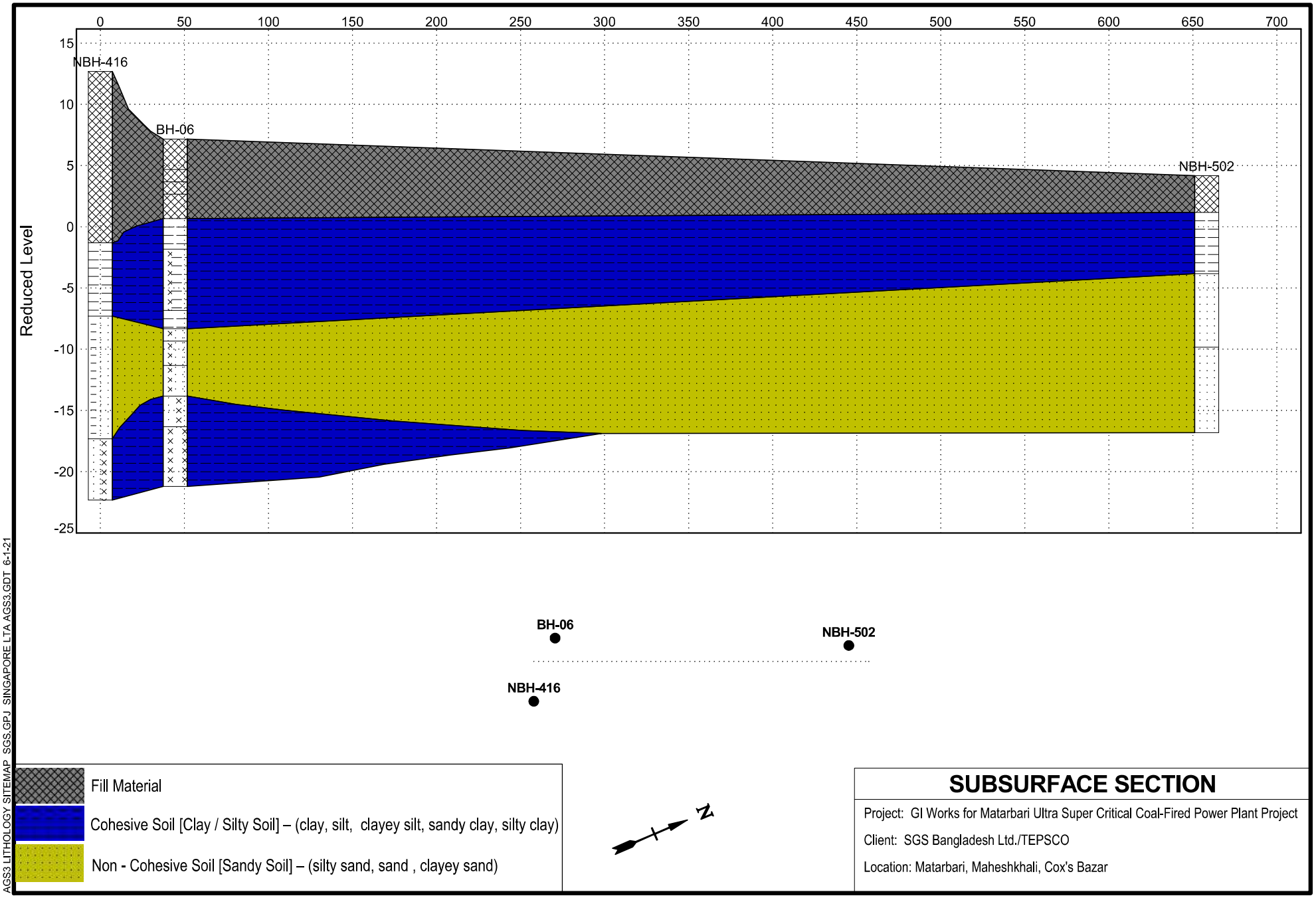

Figure-5.4: Soil Profile (Line-04)

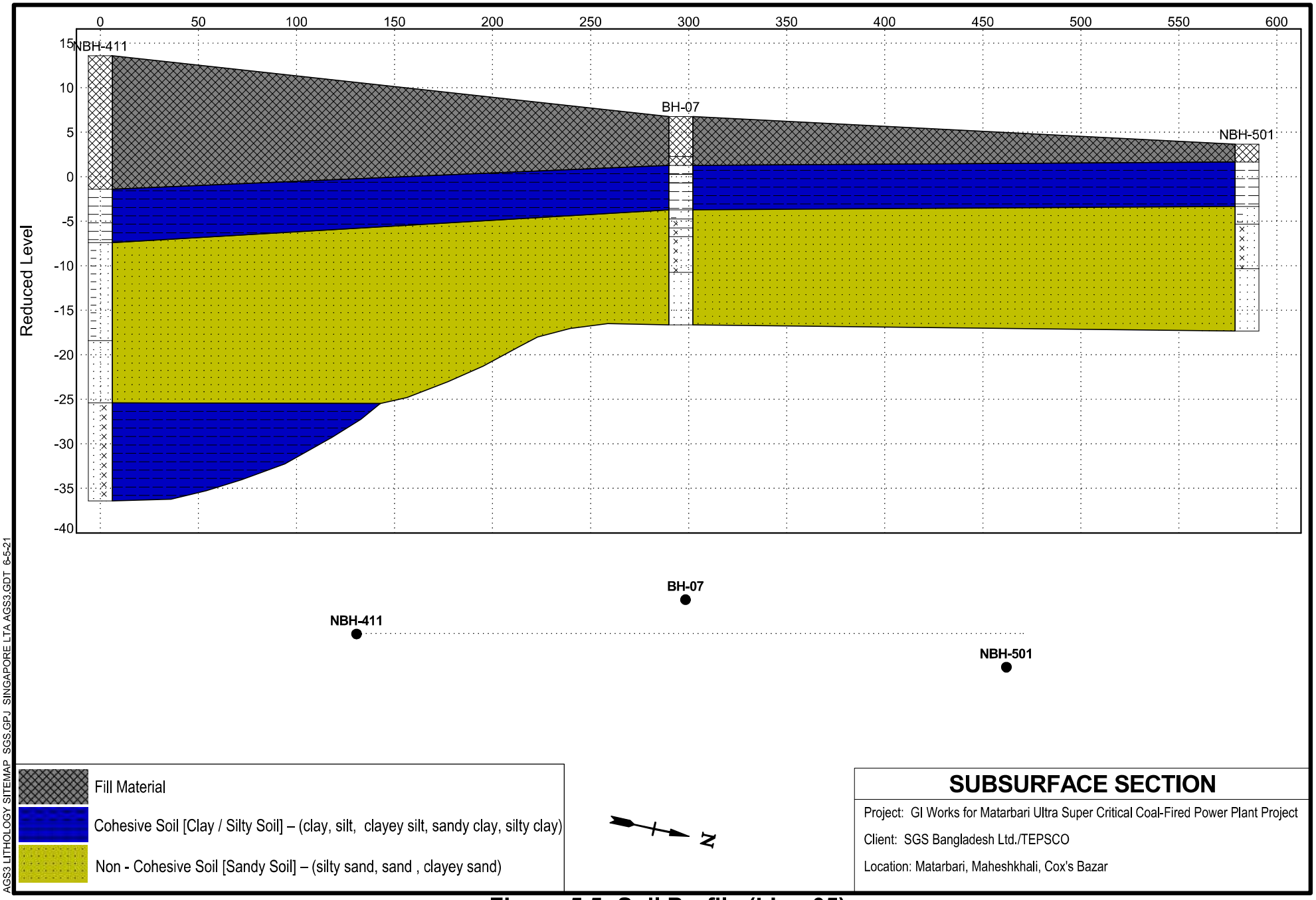

Figure-5.5: Soil Profile (Line-05)

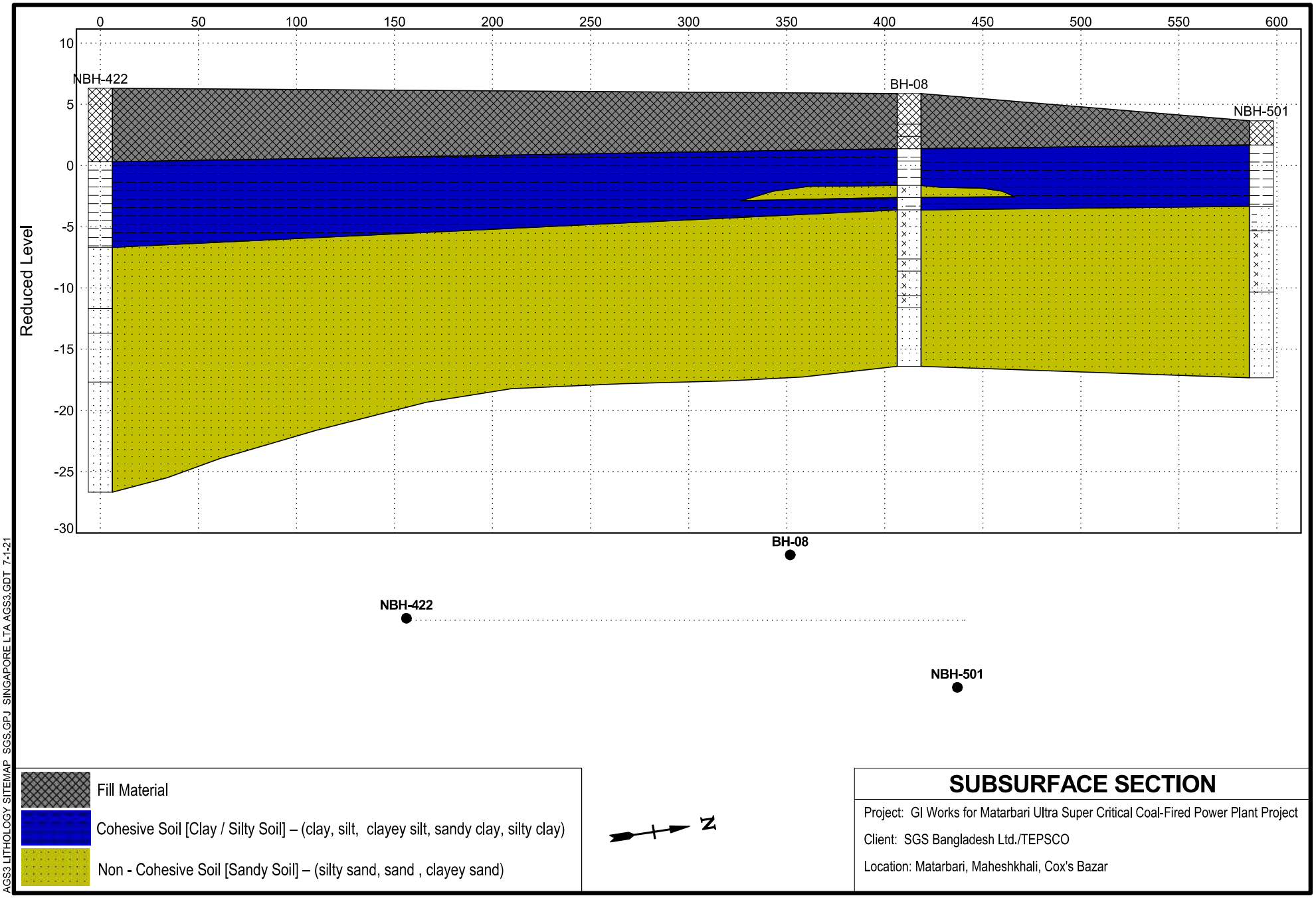

Figure-5.6: Soil Profile (Line-06)

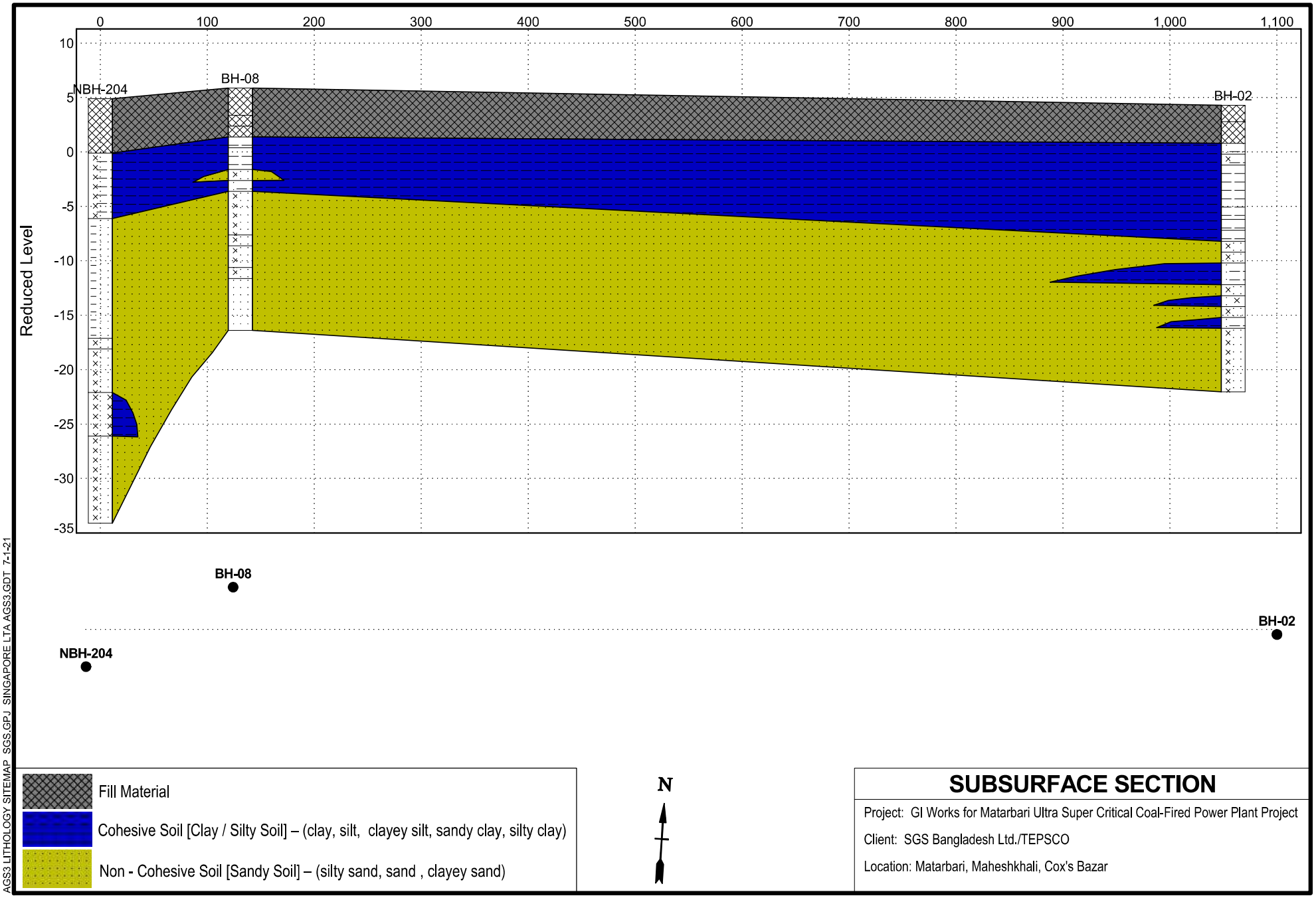

Figure-5.7: Soil Profile (Line-07)

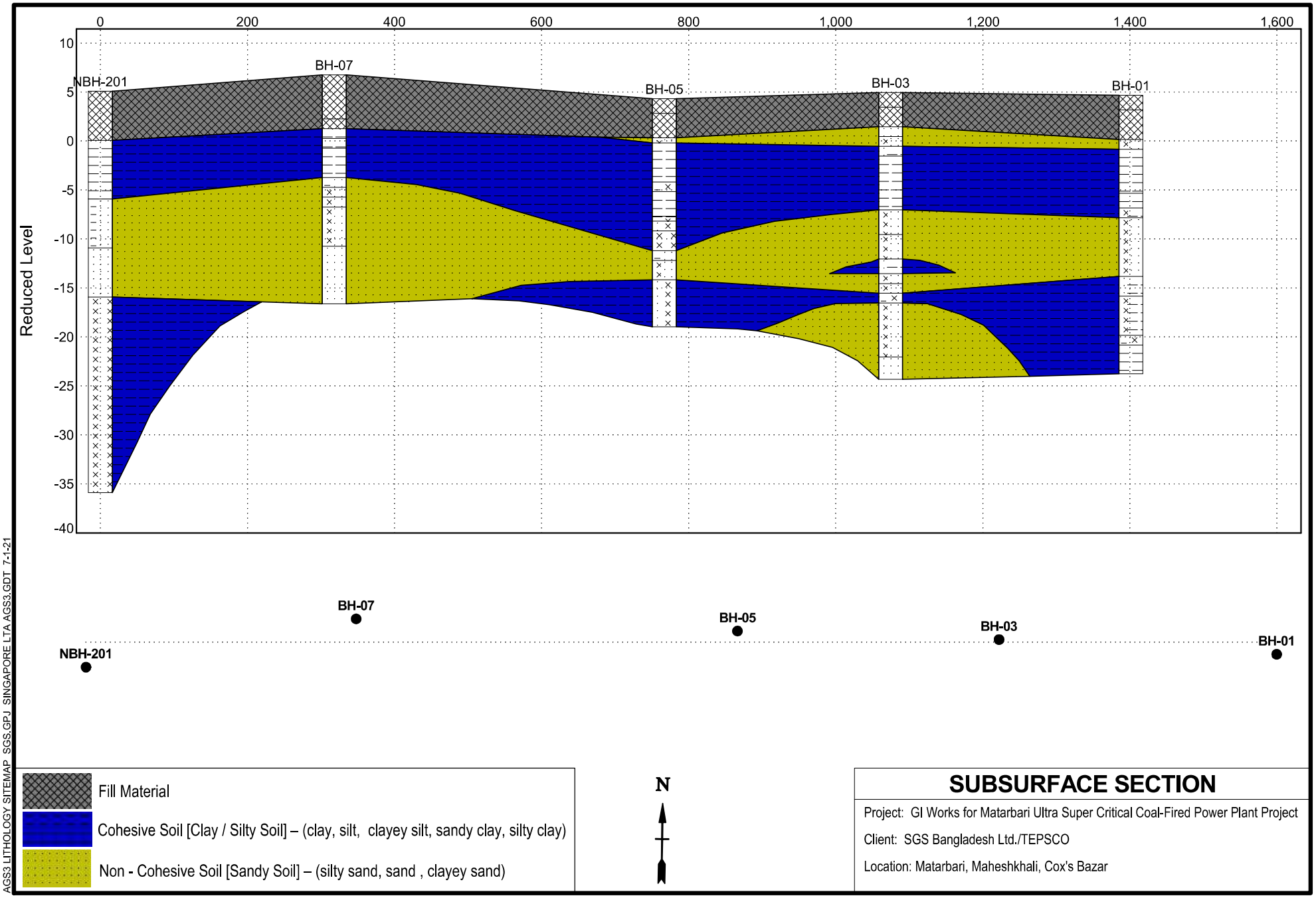

Figure-5.8: Soil Profile (Line-08)

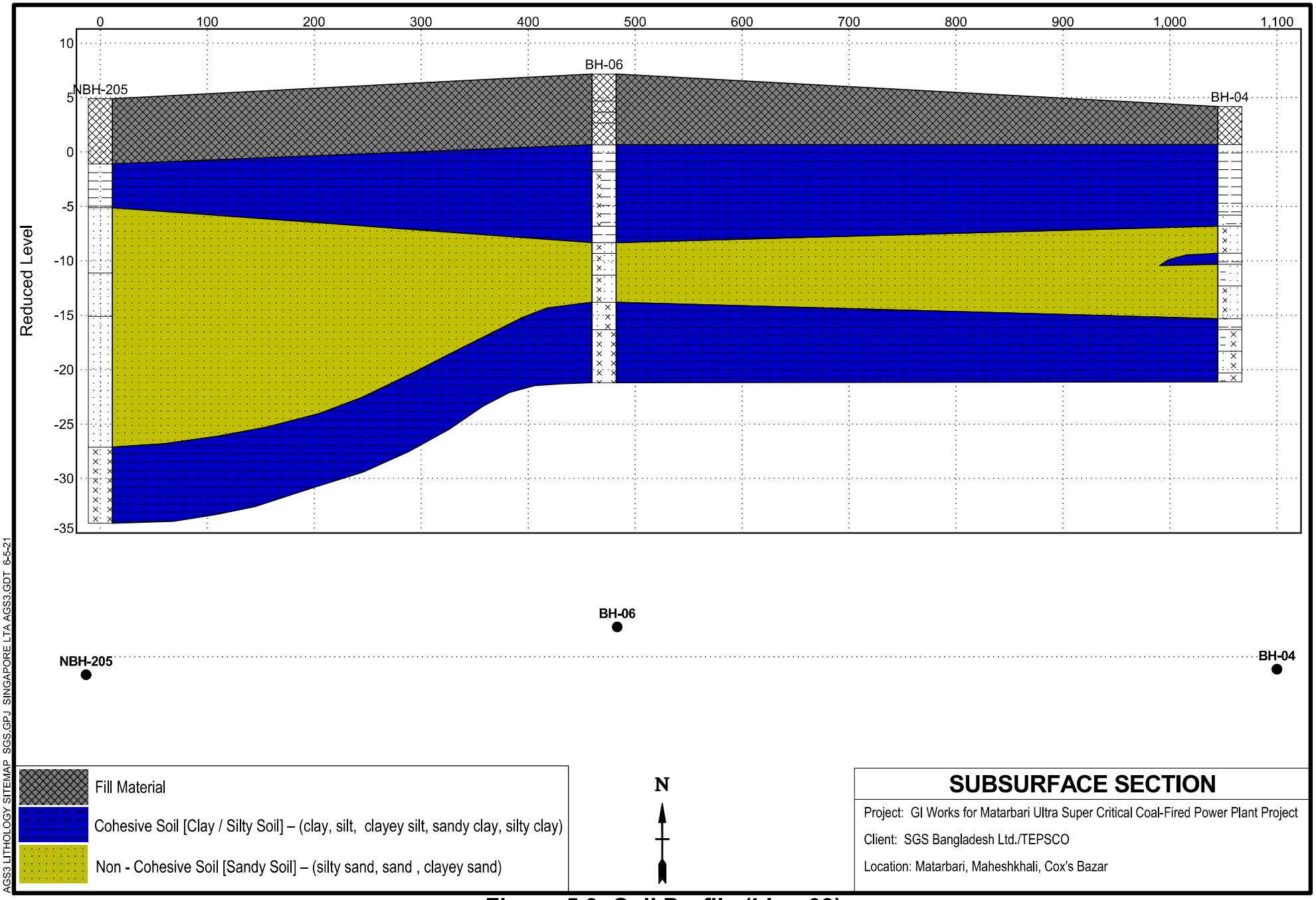

Figure-5.9: Soil Profile (Line-09)

APPENDIX A

BOREHOLE LOGS

APPENDIX A (i)

Final Field Bore Logs (Based on Lab Test Result)

PROJECT: Geotechnical Investigation Works for Matarbari Ultra Super Critical Coal-Fired Power Plant Project (Phase-2)

CLIENT: TEPSCO

GIE PROJECT NO: SIBD2104

LOCATION: Matarbari, Maheshkhali, Cox's Bazar

BORING LOG: BH-01

DRILLING DATE STARTED: 03-02-2021	**BOREHOLE DIA:** 150 mm	**NORTHING:** 2400600.000 m
DRILLING DATE COMPLETED: 04-02-2021	**FLUSHING MEDIUM:** Water	**EASTING:** 385231.000 m
PREPARED BY: Md. Shahjalal	**DRILLING METHOD:** Rotary open hole	**REDUCED LEVEL:** 4.68 m
CHECKED BY: Aminul Islam	**FIELD SUPERVISOR:** Nakibul Alam Chowdhury	**PERCHED WL*:** 2.7 m dated 04-02-2021

Scale	Reduced Level (m)	Depth (m) (Thickness)	Graphic Log	Legend	Type & No.	Description	SPT N blows/30cm	Rock TCR (%)	Rock RQD (%)	Soil Type (USCS)	Geological Deposition	Grain Size Analysis G/SA/S/C	Shear Strength C (kN/m²)	Shear Strength ϕ (°)	Bulk Density Mg/m³
1	3.18	1.50 (1.50)			1.00 SPT1 1.45	ϕ Silty SAND (0-1.5m) grey, fine grained Silty SAND Loose (Fill)	9			FILL	Fill				
2					2.00 SPT2 2.45		48					0/82/18/0 0/83/14/3			
3		3.00 (3.00)			3.00 SPT3 3.45	ϕ Silty SAND (1.5-3.5m) Grey and light brown, fine to medium grained silty SAND Medium dense to dense (Fill)	27			FILL	Fill				
4	0.18	4.50			4.00 SPT4 4.45		26								
5	-0.82	5.50 (1.00)			5.00 SPT5 5.45	ϕ Silty SAND (4.5-5.5m) Grey, fine to medium grained SAND Very loose (Alluvial Sand)	4			SM	asd	0/76/24/0 0/76/19/5			
6					6.00 SPT6 6.45		5								
7					7.00 UD1 8.00								59 (UCT) 60 (UU)		
8		(4.50)			8.00 SPT7 8.45	ϕ Lean CLAY (5.5-10.0m) Grey and dark grey, lean CLAY Soft to medium stiff (Alluvial Silt & Clay)	3			CL	asc				
9					9.00 SPT8 9.45		5								
10	-5.32	10.00													
11	-6.82	11.50 (1.50)			10.00 UD2 11.00 11.00 SPT9 11.45	ϕ Fat CLAY (10.0-11.5m) Grey, fat CLAY Stiff (Alluvial Silt & Clay)	13			CH	asc		30 (UCT) 78 (UU)		
12	-7.82	12.50 (1.00)			12.00 SPT10 12.45	ϕ Silty CLAY (11.5-12.5m) Grey, silty CLAY Medium stiff (Alluvial Silt & Clay)	5			CL-ML	asc				
13					13.00 SPT11 13.45		34								
14					14.00 SPT12 14.45	ϕ Silty SAND (12.5-18.5m) Grey, fine grained silty SAND Medium dense to dense (Alluvial Sand)	20			SM	asd	0/70/30/0 0/71/23/6	(DST)	38	
15															

TO BE CONTINUED

RQD/TCR(%)

LEGEND:

- Pressuremeter Test (PMT)
- Vane Shear Test (V)
- Permeability Test (PBT)
- Packer Test (PKT)
- Standard Penetration Test (SPT)
- Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- Mazier Sample (MZ) Denison Sample (DS)
- Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- Core Run (CR)
- TCR
- RQD

Ground Instrumentation & Engineering

REMARKS:

*WL - Ground Water Level observed from Borehole (BGL)

BORING LOG SGS.GPJ SINGAPORE LTA AGS3.GDT 6-5-21

PROJECT: Geotechnical Investigation Works for Matarbari Ultra Super Critical Coal-Fired Power Plant Project (Phase-2)

CLIENT: TEPSCO

GIE PROJECT NO: SIBD2104

LOCATION: Matarbari, Maheshkhali, Cox's Bazar

BORING LOG: BH-01

DRILLING DATE STARTED: 03-02-2021	**BOREHOLE DIA:** 150 mm	**NORTHING:** 2400600.000 m
DRILLING DATE COMPLETED: 04-02-2021	**FLUSHING MEDIUM:** Water	**EASTING:** 385231.000 m
PREPARED BY: Md. Shahjalal	**DRILLING METHOD:** Rotary open hole	**REDUCED LEVEL:** 4.68 m
CHECKED BY: Aminul Islam	**FIELD SUPERVISOR:** Nakibul Alam Chowdhury	**PERCHED WL*:** 2.7 m dated 04-02-2021

Scale	Reduced Level (m)	Depth (m) (Thickness)	Graphic Log	Legend	Type & No.	Description	SPT N blows/30cm	Rock TCR (%)	Rock RQD (%)	Soil Type (USCS)	Geological Deposition	Grain Size Analysis G/SA/S/C	Shear Strength C (kN/m²)	Shear Strength ϕ (°)	PL WC LL / Bulk Density Mg/m³
16		(6.00)			15.00 SPT13 15.45		21								
					16.00 SPT14 16.45	ϕ Silty SAND (12.5-18.5m) Grey, fine grained silty SAND Medium dense to dense (Alluvial Sand) *(continued)*	15			SM	asd				
17					17.00 SPT15 17.45		23								
18	-13.82	18.50			18.00 SPT16 18.45		29								
19		(2.00)			19.00 SPT17 19.45	ϕ Sandy lean CLAY (18.5-20.5m) Grey, sandy lean CLAY Stiff (Alluvial Silt & Clay)	13			CL	asc	0/38/62/0 0/40/44/16			
20	-15.82	20.50			20.00 SPT18 20.45		15								
21					21.00 SPT19 21.45		50/30cm								
22		(4.00)			22.00 SPT20 22.42	ϕ Silty CLAY (20.5-24.5m) Grey, silty CLAY Hard (Alluvial Silt & Clay)	50/27cm			CL-ML	asc				
23					23.00 SPT21 23.45		45								
24	-19.82	24.50			24.00 SPT22 24.41		50/26cm								
25	-20.82	(1.00) 25.50			25.00 SPT23 25.34	ϕ Clayey SILT (24.5-25.5m) Grey clayey SILT Hard (Alluvial Silt & Clay)	50/19cm			CL-ML	asc				
26					26.00 SPT24 26.41		50/26cm					0/3/97/0 0/4/75/21			
27		(2.93)			27.00 SPT25 27.42	ϕ Lean CLAY (25.5-28.43m) Grey, lean CLAY Hard (Alluvial Silt & Clay)	50/27cm			CL	asc				
28	-23.75	28.43			28.00 SPT26 28.43		50/28cm								
29						Borehole terminated at 28.43m									
30															

RQD/TCR(%)

Ground Instrumentation & Engineering

REMARKS:

LEGEND:

- Pressuremeter Test (PMT)
- Vane Shear Test (V)
- Permeability Test (PBT)
- Packer Test (PKT)
- Standard Penetration Test (SPT)
- Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- Mazier Sample (MZ) Denison Sample (DS)
- Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- Core Run (CR)
- TCR
- RQD

*WL - Ground Water Level observed from Borehole (BGL)

BORING LOG SGS.GPJ SINGAPORE LTA AGS3.GDT 6-5-21

PROJECT: Geotechnical Investigation Works for Matarbari Ultra Super Critical Coal-Fired Power Plant Project (Phase-2)

CLIENT: TEPSCO

GIE PROJECT NO: SIBD2104

LOCATION: Matarbari, Maheshkhali, Cox's Bazar

BORING LOG: BH-02

DRILLING DATE STARTED: 15-02-2021	**BOREHOLE DIA:** 150 mm	**NORTHING:** 2400781.000 m
DRILLING DATE COMPLETED: 16-02-2021	**FLUSHING MEDIUM:** Water	**EASTING:** 384907.000 m
PREPARED BY: Md. Shahjalal	**DRILLING METHOD:** Rotary open hole	**REDUCED LEVEL:** 4.3 m
CHECKED BY: Aminul Islam	**FIELD SUPERVISOR:** Raju Ahmed	**PERCHED WL*:** 4.5 m dated 16-02-2021

Scale	Reduced Level (m)	Depth (m) (Thickness)	Graphic Log	Legend	Type & No.	Description	SPT N blows/30cm	Rock TCR (%)	Rock RQD (%)	Soil Type (USCS)	Geological Deposition	Grain Size Analysis G/SA/S/C	Shear Strength C (kN/m²)	Shear Strength ϕ (°)	Bulk Density Mg/m³
1		(1.50)			1.00 SPT1 1.45	SAND (0-1.5m) Grey, fine grained SAND with traces of mica Medium dense (Fill)	13			FILL	Fill				
	2.80	1.50													
2					2.00 SPT2 2.45	SAND (1.5-3.5m) Grey, fine grained SAND with traces of shell fragments Loose (Fill)	9			FILL	Fill	0/96/4/0 0/95/5/0	(DST)	26.3	
3		(2.00)			3.00 SPT3 3.45		10								
	0.80	3.50													
4		(1.00)			4.00 SPT4 4.45	Sandy CLAY (3.5-4.5m) Grey, sandy CLAY Medium stiff (Alluvial Silt & Clay)	6			CL	asc				
	-0.70	4.50													
5		(1.00)			5.00 SPT5 5.45	Silty CLAY (4.5-5.5m) Brownish grey, Silty CLAY Medium stiff (Alluvial Silt & Clay)	6			CL-ML	asc				
	-1.20	5.50													
6					6.00 UD1 7.00	Lean CLAY (5.5-10.5m) Grey, Lean CLAY Very soft to soft (Alluvial Silt & Clay)				CL	asc		59 (UCT) 36 (UU)		
7					7.00 SPT6 7.45		3								
8		(5.00)			8.00 UD2 9.00								48 (UCT) 46 (UU)		
9					9.00 SPT7 9.45		0								
10					10.00 SPT8 10.45		3								
	-6.20	10.50													
11		(1.00)			11.00 SPT9 11.45	Lean CLAY (10.5-11.5m) Grey, Lean CLAY Medium stiff (Alluvial Silt & Clay)	5			CL	asc	0/4/69/27			
	-7.20	11.50													
12		(1.00)			12.00 SPT10 12.45	Lean CLAY (11.5-12.5m) Grey, Lean CLAY with sand Medium stiff (Alluvial Silt & Clay)	7			CL	asc	0/24/54/22			
	-8.20	12.50													
13		(1.00)			13.00 SPT11 13.45	Silty SAND (12.5-13.5m) Grey, fine grained Silty SAND with slightly Clay Medium dense (Alluvial Sand)	22			SM	asd				
	-9.20	13.50													
14		(1.00)			14.00 SPT12 14.45	Silty SAND (13.5-14.5m) Grey, fine grained Silty SAND with laminated Clay Medium dense (Alluvial Sand)	22			SM	asd				
	-10.20	14.50													
15										CL	asc				

SPT N blows/30cm (20 40 60 80) | Undrained Shear Strength kN/m² (20 40 60 80) | RQD/TCR(%)

PL WC LL (20 40 60 80) | Bulk Density Mg/m³ (1.3 1.6 1.9 2.2)

TO BE CONTINUED

Ground Instrumentation & Engineering

REMARKS:

LEGEND:

- Pressuremeter Test (PMT)
- Vane Shear Test (V)
- Permeability Test (PBT)
- Packer Test (PKT)
- Standard Penetration Test (SPT)
- Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- Mazier Sample (MZ) Denison Sample (DS)
- Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- Core Run (CR)
- TCR
- RQD

*WL - Ground Water Level observed from Borehole (BGL)

BORING LOG SGS.GPJ SINGAPORE LTA AGS3.GDT 7-3-21

PROJECT: Geotechnical Investigation Works for Matarbari Ultra Super Critical Coal-Fired Power Plant Project (Phase-2)

CLIENT: TEPSCO

GIE PROJECT NO: SIBD2104

LOCATION: Matarbari, Maheshkhali, Cox's Bazar

BORING LOG: BH-02

DRILLING DATE STARTED: 15-02-2021	**BOREHOLE DIA:** 150 mm	**NORTHING:** 2400781.000 m
DRILLING DATE COMPLETED: 16-02-2021	**FLUSHING MEDIUM:** Water	**EASTING:** 384907.000 m
PREPARED BY: Md. Shahjalal	**DRILLING METHOD:** Rotary open hole	**REDUCED LEVEL:** 4.3 m
CHECKED BY: Aminul Islam	**FIELD SUPERVISOR:** Raju Ahmed	**PERCHED WL*:** 4.5 m dated 16-02-2021

Scale	Reduced Level (m)	Depth (m) (Thickness)	Graphic Log	Legend	Type & No.	Description	SPT N blows/30cm	Rock TCR (%)	Rock RQD (%)	Soil Type (USCS)	Geological Deposition	Grain Size Analysis G/SA/S/C	Shear Strength C (kN/m²)	Shear Strength ϕ (°)	Bulk Density Mg/m³
16		(2.00)			15.00 SPT13 15.45	ϕ Lean CLAY (14.5-16.5m) Grey, sandy lean CLAY Very stiff (Alluvial Silt & Clay) *(continued)*	20			CL	asc	0/36/64/0 0/36/46/18			
	-12.20	16.50			16.00 SPT14 16.45		21								
17		(1.00)			17.00 SPT15 17.45	ϕ Silty SAND (16.5-17.5m) Grey, fine grained silty SAND with slightly Clay Medium dense (Alluvial Sand)	15			SM	asd				
	-13.20	17.50													
18		(1.00)			18.00 SPT16 18.45	ϕ Sandy SILT (17.5-18.5m) Grey,sandy SILT with slightly Clay Very stiff (Alluvial Silt & Clay)	22			ML	asc				
	-14.20	18.50													
19		(1.00)			19.00 SPT17 19.45	ϕ Silty SAND (18.5-19.5m) Grey, fine grained silty SAND with slightly Clay Medium dense (Alluvial Sand)	22			SM	asd				
	-15.20	19.50													
20		(1.00)			20.00 SPT18 20.45	ϕ Sandy lean CLAY (19.5-20.5m) Grey, sandy lean CLAY Very stiff (Alluvial Silt & Clay)	23			CL	asc	0/33/53/14			
	-16.20	20.50													
21					21.00 SPT19 21.45		38								
22					22.00 SPT20 22.44		50/29cm								
23		(5.84)			23.00 SPT21 23.39	ϕ Silty SAND (20.5-26.34m) Brownish grey to grey, greyish brown, grey to light brown and light grey, fine grained silty SAND Dense to very dense (Alluvial Sand)	50/24cm			SM	asd	0/85/15/0 0/85/12/3	4 (DST)	34.8	
24					24.00 SPT22 24.27		50/12cm								
25					25.00 SPT23 25.33		50/18cm					0/86/14/0 0/86/12/2	(DST)	40	
26					26.00 SPT24 26.34		50/19cm								
	-22.04	26.34			26.34	Borehole terminated at 26.34m									
27															
28															
29															
30															

SPT N blows/30cm (20 40 60 80) | Undrained Shear Strength kN/m² (20 40 60 80) | PL WC LL (20 40 60 80) | Bulk Density Mg/m³ (1.3 1.6 1.9 2.2)

RQD/TCR(%)

Ground Instrumentation & Engineering

REMARKS:

LEGEND:

- Pressuremeter Test (PMT)
- Vane Shear Test (V)
- Permeability Test (PBT)
- Packer Test (PKT)
- Standard Penetration Test (SPT)
- Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- Mazier Sample (MZ) Denison Sample (DS)
- Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- Core Run (CR)
- TCR
- RQD

*WL - Ground Water Level observed from Borehole (BGL)

BORING LOG SGS.GPJ SINGAPORE LTA AGS3.GDT 7-3-21

PROJECT: Geotechnical Investigation Works for Matarbari Ultra Super Critical Coal-Fired Power Plant Project (Phase-2)

CLIENT: TEPSCO

GIE PROJECT NO: SIBD2104

LOCATION: Matarbari, Maheshkhali, Cox's Bazar

BORING LOG: BH-03

DRILLING DATE STARTED: 11-02-2021	**BOREHOLE DIA:** 150 mm	**NORTHING:** 2400612.000 m
DRILLING DATE COMPLETED: 13-02-2021	**FLUSHING MEDIUM:** Water	**EASTING:** 384904.000 m
PREPARED BY: Md. Shahjalal	**DRILLING METHOD:** Rotary open hole	**REDUCED LEVEL:** 4.97 m
CHECKED BY: Aminul Islam	**FIELD SUPERVISOR:** Raju Ahmed	**PERCHED WL*:** 2.5 m dated 13-02-2021

Scale	Reduced Level (m)	Depth (m) (Thickness)	Graphic Log	Legend	Type & No.	Description	SPT N blows/30cm	Rock TCR (%)	Rock RQD (%)	Soil Type (USCS)	Geological Deposition	Grain Size Analysis G/SA/S/C	Shear Strength C (kN/m²)	Shear Strength ϕ (°)	Bulk Density Mg/m³
1	3.47	(1.50) 1.50			1.00 SPT1 1.45	ϕ Silty SAND (0.0-1.5m) Grey, fine grained silty SAND Loose (Fill)	7			FILL	Fil				
2					2.00 SPT2 2.45	ϕ SAND (1.5-3.5m) Grey, fine-medium grained SAND with Silt Dense (Fill)	42			FILL	Fil	0/91/9/0 0/91/7/2			
3	1.47	(2.00) 3.50			3.00 SPT3 3.45		40								
4	0.47	(1.00) 4.50			4.00 SPT4 4.45	ϕ SAND (3.5-4.5m) Grey, fine-medium grained SAND Loose (Alluvial Sand)	9			SP	asd	0/96/4/0	(DST)	39	
5	-0.53	(1.00) 5.50			5.00 SPT5 5.45	ϕ Silty SAND (4.5-5.5m) Grey, fine grained silty SAND with traces of shell fragments Medium dense (Alluvial Sand)	22			SM	asd				
6	-1.53	(1.00) 6.50			6.00 SPT6 6.45	ϕ Sandy CLAY (5.5-6.5m) Grey, sandy CLAY Medium stiff (Alluvial Silt & Clay)	5			CL	asc				
7					7.00 SPT7 7.45		5								
8					8.00 UD1 9.00								56 (UCT) 45 (UU)		
9					9.00 SPT8 9.45	ϕ Lean CLAY (6.5-12.0m) Grey, lean CLAY Medium stiff (Alluvial Silt & Clay)	5			CL	asc				
10		(5.50)			10.00 SPT9 10.45		5								
11					11.00 SPT10 11.45		8								
12	-7.03	12.00			12.00 UD2 13.00							0/79/21/0 0/82/13/5			
13					13.00 SPT11 13.45	ϕ Silty SAND (12.0-14.5m) Grey, fine grained silty SAND Medium dense (Alluvial Sand)	22			SM	asd				
14		(2.50)			14.00 SPT12 14.45		25								
15	-9.53	14.50								SM	asd				

SPT N blows/30cm (20 40 60 80) | Undrained Shear Strength kN/m² (20 40 60 80) | RQD/TCR(%)

PL WC LL (20 40 60 80) | Bulk Density Mg/m³ (1.3 1.6 1.9 2.2)

TO BE CONTINUED

Ground Instrumentation & Engineering

REMARKS:

LEGEND:

- Pressuremeter Test (PMT)
- Vane Shear Test (V)
- Permeability Test (PBT)
- Packer Test (PKT)
- Standard Penetration Test (SPT)
- Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- Mazier Sample (MZ) Denison Sample (DS)
- Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- Core Run (CR)
- TCR
- RQD

*WL - Ground Water Level observed from Borehole (BGL)

BORING LOG SGS.GPJ SINGAPORE LTA AGS3.GDT 6-5-21

PROJECT: Geotechnical Investigation Works for Matarbari Ultra Super Critical Coal-Fired Power Plant Project (Phase-2)

CLIENT: TEPSCO

GIE PROJECT NO: SIBD2104

LOCATION: Matarbari, Maheshkhali, Cox's Bazar

BORING LOG: BH-03

DRILLING DATE STARTED: 11-02-2021	**BOREHOLE DIA:** 150 mm	**NORTHING:** 2400612.000 m
DRILLING DATE COMPLETED: 13-02-2021	**FLUSHING MEDIUM:** Water	**EASTING:** 384904.000 m
PREPARED BY: Md. Shahjalal	**DRILLING METHOD:** Rotary open hole	**REDUCED LEVEL:** 4.97 m
CHECKED BY: Aminul Islam	**FIELD SUPERVISOR:** Raju Ahmed	**PERCHED WL*:** 2.5 m dated 13-02-2021

Scale	Reduced Level (m)	Depth (m) (Thickness)	Graphic Log	Legend	Type & No.	Description	SPT N blows/30cm	Rock TCR (%)	Rock RQD (%)	Soil Type (USCS)	Geological Deposition	Grain Size Analysis G/SA/S/C	Shear Strength C (kN/m²)	Shear Strength ϕ (°)	Bulk Density Mg/m³
16		(2.50)			15.00 SPT13 15.45	Silty SAND (14.5-17.0m) Grey, fine grained silty SAND with slightly Clay Medium dense (Alluvial Sand) *(continued)*	26								
					16.00 SPT14 16.45		20			SM	asd				
17	-12.03	17.00										0/28/72/0 0/27/57/16	15 (DST)	21.9	
		(1.50)			17.00 MZ1 18.00	Sandy lean CLAY (17.0-18.5m) Grey, sandy lean CLAY Very stiff (Alluvial Silt & Clay)				CL	asc				
18	-13.53	18.50			18.00 SPT15 18.45		22					0/32/54/14			
19		(1.00)			19.00 SPT16 19.73	Silty SAND (18.5-19.5m) Grey, fine grained silty SAND with laminated Clay Very dense (Alluvial Sand)	50/28cm			SM	asd				
	-14.53	19.50				Silty SAND (19.5-20.5m) Grey, fine grained silty SAND with slightly Clay Dense (Alluvial Silt & Clay)									
20		(1.00)			20.00 SPT17 20.45		37			SM	asd				
	-15.53	20.50				Clayey SILT (20.5-21.5m) Grey, Clayey SILT Stiff (Alluvial Silt & Clay)									
21		(1.00)			21.00 SPT18 21.45		13			CL-ML	asc	0/5/70/25			
	-16.53	21.50													
22					22.00 SPT19 22.34		50/19cm								
23					23.00 SPT20 23.45		38					0/83/17/0 0/84/12/4			
24		(5.50)			24.00 SPT21 24.34	Silty SAND (21.5-27.0m) Grey and light grey, fine grained silty SAND Very dense (Alluvial Sand)	50/19cm			SM	asd				
25					25.00 SPT22 25.28		50/13cm								
26					26.00 SPT23 26.27		50/12cm								
27	-22.03	27.00										0/93/6/1	1 (DST)	30.3	
		(2.29)			27.00 MZ2 28.00										
28					28.00 SPT24 28.29	SAND (27.0-29.29m) Grey, fine grained SAND with Silt Very dense (Alluvial Sand)	50/14cm			SP-SM	asd				
29	-24.32	29.29			29.00 SPT25 29.29		50/14cm								
						Borehole terminated at 29.29m									
30															

RQD/TCR(%)

LEGEND:

- Pressuremeter Test (PMT)
- Vane Shear Test (V)
- Permeability Test (PBT)
- Packer Test (PKT)
- Standard Penetration Test (SPT)
- Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- Mazier Sample (MZ) Denison Sample (DS)
- Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- Core Run (CR)
- TCR
- RQD

Ground Instrumentation & Engineering

REMARKS:

*WL - Ground Water Level observed from Borehole (BGL)

BORING LOG SGS.GPJ SINGAPORE LTA AGS3.GDT 6-5-21

PROJECT: Geotechnical Investigation Works for Matarbari Ultra Super Critical Coal-Fired Power Plant Project (Phase-2)

CLIENT: TEPSCO

GIE PROJECT NO: SIBD2104

LOCATION: Matarbari, Maheshkhali, Cox's Bazar

BORING LOG: BH-04

DRILLING DATE STARTED: 06-02-2021	**BOREHOLE DIA:** 150 mm	**NORTHING:** 2400455.000 m
DRILLING DATE COMPLETED: 07-02-2021	**FLUSHING MEDIUM:** Water	**EASTING:** 384901.000 m
PREPARED BY: Md. Shahjalal	**DRILLING METHOD:** Rotary open hole	**REDUCED LEVEL:** 4.192 m
CHECKED BY: Aminul Islam	**FIELD SUPERVISOR:** Nakibul Ahmed Chowdhury	**PERCHED WL*:** 2.4 m dated 07-02-2021

Scale	Reduced Level (m)	Depth (m) (Thickness)	Graphic Log	Legend	Type & No.	Description	SPT N blows/30cm	Rock TCR (%)	Rock RQD (%)	Soil Type (USCS)	Geological Deposition	Grain Size Analysis G/SA/S/C	Shear Strength C (kN/m²)	Shear Strength ϕ (°)
1					1.00 SPT1 1.45	Silty SAND (0.0-3.5m) Grey, fine grained silty SAND Medium dense to dense (Fill)	32			FILL	Fill	0/72/28/0 0/74/20/6	1 (DST)	33.7
2		(3.50)			2.00 SPT2 2.45		27							
3					3.00 SPT3 3.45		13							
	0.69	3.50												
4					4.00 SPT4 4.45	Lean CLAY (3.5-10.0m) Dark grey, lean CLAY Very soft (Alluvial Silt & Clay)	0			CL	asc			
5					5.00 SPT5 5.45		0							
6					6.00 SPT6 6.45		2							
7		(6.50)			7.00 UD1 8.00									
8					8.00 SPT7 8.45		0							
9					9.00 UD2 10.00							0/2/76/22	31 (UCT)	
10	-5.81	10.00			10.00 SPT8 10.45	Sandy lean CLAY (10.0-11.0m) Dark grey, sandy lean CLAY Medium stiff (Alluvial Silt & Clay)	5			CL	asc	0/36/64/0 0/37/46/17		
		(1.00)												
11	-6.81	11.00			11.00 SPT9 11.45	Silty SAND (11.0-13.5m) Grey, fine grained silty SAND Medium dense (Alluvial Sand)	27			SM	asd			
12		(2.50)			12.00 SPT10 12.45		17							
13					13.00 SPT11 13.45		22							
	-9.31	13.50												
14		(1.00)			14.00 SPT12 14.45	Lean CLAY (13.5-14.5m) Grey, lean CLAY Medium stiff (Alluvial Silt & Clay)	6			CL	asc			
	-10.31	14.50												
15										SC	asd			

RQD/TCR(%)

TO BE CONTINUED

Ground Instrumentation & Engineering

REMARKS:

LEGEND:

- Pressuremeter Test (PMT)
- Vane Shear Test (V)
- Permeability Test (PBT)
- Packer Test (PKT)
- Standard Penetration Test (SPT)
- Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- Mazier Sample (MZ) Denison Sample (DS)
- Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- Core Run (CR)
- TCR
- RQD

*WL - Ground Water Level observed from Borehole (BGL)

BORING LOG SGS.GPJ SINGAPORE LTA AGS3.GDT 6-5-21

PROJECT: Geotechnical Investigation Works for Matarbari Ultra Super Critical Coal-Fired Power Plant Project (Phase-2)

CLIENT: TEPSCO

GIE PROJECT NO: SIBD2104

LOCATION: Matarbari, Maheshkhali, Cox's Bazar

BORING LOG: BH-04

DRILLING DATE STARTED: 06-02-2021	**BOREHOLE DIA:** 150 mm	**NORTHING:** 2400455.000 m
DRILLING DATE COMPLETED: 07-02-2021	**FLUSHING MEDIUM:** Water	**EASTING:** 384901.000 m
PREPARED BY: Md. Shahjalal	**DRILLING METHOD:** Rotary open hole	**REDUCED LEVEL:** 4.192 m
CHECKED BY: Aminul Islam	**FIELD SUPERVISOR:** Nakibul Ahmed Chowdhury	**PERCHED WL*:** 2.4 m dated 07-02-2021

Scale	Reduced Level (m)	Depth (m) (Thickness)	Graphic Log	Legend	Type & No.	Description	SPT N blows/30cm	Rock TCR (%)	Rock RQD (%)	Soil Type (USCS)	Geological Deposition	Grain Size Analysis G/SA/S/C	Shear Strength C (kN/m²)	Shear Strength ϕ (°)	Bulk Density Mg/m³
16		(2.00)			15.00 SPT13 15.45	Clayey SAND (14.5-16.5m) Grey, clayey SAND with slightly Silt Loose to medium (Alluvial Sand) *(continued)*	10			SC	asd				
	-12.31	16.50			16.00 SPT14 16.45		12								
17					17.00 SPT15 17.45		22					0/83/17/0 0/81/14/5	(DST)	37	
18		(3.00)			18.00 SPT16 18.45	Silty SAND (16.5-19.5m) Grey, fine-medium grained SAND Medium dense (Alluvial Sand)	26			SM	asd				
19					19.00 SPT17 19.45		24								
	-15.31	19.50													
20		(1.00)			20.00 SPT18 20.45	Lean CLAY (19.5-20.5m) Grey, lean CLAY Hard (Alluvial Silt & Clay)	42			CL	asc	0/2/82/16			
	-16.31	20.50													
21					21.00 SPT19 21.43	Clayey SILT (20.5-22.5m) Grey, clayey SILT Hard (Alluvial Silt & Clay)	50/28cm			CL-ML	asc				
22		(2.00)			22.00 SPT20 22.42		50/27cm								
	-18.31	22.50													
23					23.00 SPT21 23.40	Sandy SILT (22.5-24.5m) Grey, sandy SILT Hard (Alluvial Silt & Clay)	50/25cm			ML	asc				
24		(2.00)			24.00 SPT22 24.36		50/21cm					0/42/48/10 0/41/59/0			
	-20.31	24.50													
25		(0.82)			25.00 SPT23 25.32	Clayey SILT (24.5-25.32m) Grey, clayey SILT Hard (Alluvial Silt & Clay)	50/17cm			CL-ML	asc				
	-21.13	25.32				Borehole terminated at 25.32m									
26															
27															
28															
29															
30															

SPT N blows/30cm (20 40 60 80) × Undrained Shear Strength kN/m² (20 40 60 80)

Shear Strength: PL WC LL (20 40 60 80)

RQD/TCR(%)

Ground Instrumentation & Engineering

REMARKS:

LEGEND:

- ▼ – Pressuremeter Test (PMT)
- ◔ – Vane Shear Test (V)
- ⊗ – Permeability Test (PBT)
- ▤ – Packer Test (PKT)
- ☒ – Standard Penetration Test (SPT)
- ▨ – Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- ▨ – Mazier Sample (MZ) Denison Sample (DS)
- □ – Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- ■ – Piston Sample (PS)
- ▯ – Core Run (CR)
- ▩ – TCR
- ▩ – RQD

*WL - Ground Water Level observed from Borehole (BGL)

BORING LOG SGS.GPJ SINGAPORE LTA AGS3.GDT 6-5-21

PROJECT: Geotechnical Investigation Works for Matarbari Ultra Super Critical Coal-Fired Power Plant Project (Phase-2)

CLIENT: TEPSCO

GIE PROJECT NO: SIBD2104

LOCATION: Matarbari, Maheshkhali, Cox's Bazar

BORING LOG: BH-05

DRILLING DATE STARTED: 16-02-2021	**BOREHOLE DIA:** 150 mm	**NORTHING:** 2400617.000 m
DRILLING DATE COMPLETED: 17-02-2021	**FLUSHING MEDIUM:** Water	**EASTING:** 384596.000 m
PREPARED BY: Md. Shahjalal	**DRILLING METHOD:** Rotary open hole	**REDUCED LEVEL:** 4.332 m
CHECKED BY: Aminul Islam	**FIELD SUPERVISOR:** Nakibul Ahmed Chowdhury	**PERCHED WL*:** 5 m dated 17-02-2021

Scale	Reduced Level (m)	Depth (m) (Thickness)	Graphic Log	Legend	Type & No.	Description	SPT N blows/30cm	Rock TCR (%)	Rock RQD (%)	Soil Type (USCS)	Geological Deposition	Grain Size Analysis G/SA/S/C	Shear Strength C (kN/m²)	Shear Strength ϕ (°)	PL WC LL / Bulk Density Mg/m³
1		(1.50)			1.00 SPT1 1.45	ϕ Silty CLAY (0.0-1.5m) Grey, silty CLAY with lamination of sand Very soft (Fill)	0			FILL	Fill				
	2.83	1.50													
2					2.00 SPT2 2.45		2								
3		(2.50)			3.00 UD1 4.00	ϕ Lean CLAY (1.5-4.0m) Grey, lean CLAY Very soft (Fill)				FILL	Fill		24 (UCT) 21 (UU)		
4	0.33	4.00			4.00 SPT3 4.45	ϕ Silty SAND (4.0-4.5m) Grey, fine grained silty SAND Medium dense (Alluvial Sand)	16			SM	asd				
	-0.17	(0.50) 4.50													
5	▽				5.00 SPT4 5.45		0								
6					6.00 SPT5 6.45		0								
7		(4.00)			7.00 UD2 8.00	ϕ Lean CLAY (4.5-8.5m) Grey, lean CLAY Very soft (Alluvial Silt & Clay)				CL	asc		29 (UCT) 27 (UU)		
8					8.00 SPT6 8.45		0								
	-4.17	8.50													
9		(1.00)			9.00 SPT7 9.45	ϕ Clayey SILT (8.5-9.5m) Grey, clayey SILT Very soft (Alluvial Silt & Clay)	0			CL-ML	asc				
	-5.17	9.50													
10					10.00 SPT8 10.45		2								
11		(2.50)			11.00 UD3 12.00	ϕ Lean CLAY (9.5-12.0m) Grey, lean CLAY Very soft (Alluvial Silt & Clay)				CL	asc		27 (UCT)		
12	-7.67	12.00			12.00 SPT9 12.45	ϕ Clayey SILT (12.0-12.5m) Grey, clayey SILT with lamination of sand Soft (Alluvial Silt & Clay)	3			CL-ML	asc				
	-8.17	(0.50) 12.50													
13		(1.00)			13.00 SPT10 13.45	ϕ Sandy SILT (12.5-13.5m) Grey, sandy SILT with lamination of clay Very soft (Alluvial Silt & Clay)	2			ML	asc				
	-9.17	13.50													
14					14.00 SPT11 14.45	ϕ SILT (13.5-15.5m) Grey, SILT with sand Medium stiff (Alluvial Silt & Clay)	7			ML	asc	0/16/84/0 0/16/68/16			
15		(2.00)													

SPT N blows/30cm: 20 40 60 80 | Undrained Shear Strength kN/m²: 20 40 60 80 | RQD/TCR(%)

Shear Strength: 20 40 60 80 | Bulk Density Mg/m³: 1.3 1.6 1.9 2.2

TO BE CONTINUED

Ground Instrumentation & Engineering

REMARKS:

LEGEND:

- Pressuremeter Test (PMT)
- Vane Shear Test (V)
- Permeability Test (PBT)
- Packer Test (PKT)
- Standard Penetration Test (SPT)
- Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- Mazier Sample (MZ) Denison Sample (DS)
- Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- Core Run (CR)
- TCR
- RQD

*WL - Ground Water Level observed from Borehole (BGL)

BORING LOG SGS.GPJ SINGAPORE LTA AGS3.GDT 7-3-21

PROJECT: Geotechnical Investigation Works for Matarbari Ultra Super Critical Coal-Fired Power Plant Project (Phase-2)

CLIENT: TEPSCO

GIE PROJECT NO: SIBD2104

LOCATION: Matarbari, Maheshkhali, Cox's Bazar

BORING LOG: BH-05

DRILLING DATE STARTED: 16-02-2021	**BOREHOLE DIA:** 150 mm	**NORTHING:** 2400617.000 m
DRILLING DATE COMPLETED: 17-02-2021	**FLUSHING MEDIUM:** Water	**EASTING:** 384596.000 m
PREPARED BY: Md. Shahjalal	**DRILLING METHOD:** Rotary open hole	**REDUCED LEVEL:** 4.332 m
CHECKED BY: Aminul Islam	**FIELD SUPERVISOR:** Nakibul Ahmed Chowdhury	**PERCHED WL*:** 5 m dated 17-02-2021

Scale	Reduced Level (m)	Depth (m) (Thickness)	Type & No.	Description	SPT N blows/30cm	Rock TCR (%)	Rock RQD (%)	Soil Type (USCS)	Geological Deposition	Grain Size Analysis G/SA/S/C	Shear Strength C (kN/m²)	Shear Strength ϕ (°)	Bulk Density Mg/m³
16	-11.17	15.50	15.00 SPT12 15.45		5			ML	asc				
		(1.00)	16.00 SPT13 16.45	Clayey SAND (15.5-16.5m) Grey, clayey SAND Loose (Alluvial Sand)	5			SC	asd				
17	-12.17	16.50	17.00 SPT14 17.45	Silty SAND (16.5-18.5m) Grey, fine grained silty SAND Medium dense (Alluvial Sand)	20			SM	asd	0/55/45/0 0/55/37/8	(DST)	37	
18	-14.17	18.50	18.00 SPT15 18.45		32								
19			19.00 SPT16 19.36		50/21cm								
20			20.00 SPT17 20.27		50/12cm								
21		(4.80)	21.00 SPT18 21.45	Sandy SILT (18.5-23.3m) Grey, sandy SILT Hard (Alluvial Silt & Clay)	50			ML	asc	0/43/57/0 0/44/46/10	3 (DST)	35.1	
22			22.00 SPT19 22.43		50/28cm								
23			23.00 SPT20 23.30		50/15cm								
24	-18.97	23.30		Borehole terminated at 23.3m									
25													
26													
27													
28													
29													
30													

SPT N blows/30cm (20 40 60 80); Undrained Shear Strength kN/m² (20 40 60 80); RQD/TCR(%)

PL WC LL (20 40 60 80); Bulk Density Mg/m³ (1.3 1.6 1.9 2.2)

Ground Instrumentation & Engineering

LEGEND:

- Pressuremeter Test (PMT)
- Vane Shear Test (V)
- Permeability Test (PBT)
- Packer Test (PKT)
- Standard Penetration Test (SPT)
- Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- Mazier Sample (MZ) Denison Sample (DS)
- Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- Core Run (CR)
- TCR
- RQD

REMARKS:

*WL - Ground Water Level observed from Borehole (BGL)

BORING LOG SGS.GPJ SINGAPORE LTA AGS3.GDT 7-3-21

PROJECT: Geotechnical Investigation Works for Matarbari Ultra Super Critical Coal-Fired Power Plant Project (Phase-2)

CLIENT: TEPSCO

GIE PROJECT NO: SIBD2104

LOCATION: Matarbari, Maheshkhali, Cox's Bazar

BORING LOG: BH-06

DRILLING DATE STARTED: 08-02-2021	**BOREHOLE DIA:** 150 mm	**NORTHING:** 2400493.000 m
DRILLING DATE COMPLETED: 09-02-2021	**FLUSHING MEDIUM:** Water	**EASTING:** 384316.000 m
PREPARED BY: Md. Shahjalal	**DRILLING METHOD:** Rotary open hole	**REDUCED LEVEL:** 7.179 m
CHECKED BY: Aminul Islam	**FIELD SUPERVISOR:** Raju Ahmed	**PERCHED WL*:** 3 m dated 09-02-2021

Scale	Reduced Level (m)	Depth (m) (Thickness)	Graphic Log	Legend	Type & No.	Description	SPT N blows/30cm	Rock TCR (%)	Rock RQD (%)	Soil Type (USCS)	Geological Deposition	Grain Size Analysis G/SA/S/C	Shear Strength C (kN/m²)	Shear Strength ϕ (°)	Bulk Density Mg/m³
1		(2.50)			1.00 SPT1 1.45	Silty SAND (0.0-2.5m) Grey, fine grained silty SAND with traces of shell fragments Very loose to loose (Fill)	2			FILL	Fill				
2	4.68	2.50			2.00 SPT2 2.45		3								
3	3.68	(1.00) 3.50			3.00 SPT3 3.45	Silty SAND (2.5-3.5m) Grey, fine grained silty SAND Loose (Fill)	5			FILL	Fill				
4	2.68	(1.00) 4.50			4.00 SPT4 4.45	Silty SAND (3.5-4.5m) Grey, fine grained silty SAND with slightly Clay Very loose (Fill)	3			FILL	Fill				
5		(2.00)			5.00 SPT5 5.45	SAND (4.5-6.5m) Light brown, fine-medium grained SAND with Silt Medium dense to dense (Fill)	12			FILL	Fill				
6	0.68	6.50			6.00 SPT6 6.45		32					0/91/9/0 0/93/5/2	1 (DST)	39.4	
7		(2.50)			7.00 SPT7 7.45	Lean CLAY (6.5-9.0m) Brown, lean CLAY Medium stiff (Alluvial Silt & Clay)	6			CL	asc				
8					8.00 UD1 9.00								30 (UCT) 25 (UU)		
9	-1.82	9.00			9.00 SPT8 9.45	Silty CLAY (9.0-14.0m) Dark grey and grey silty CLAY Very soft to soft (Alluvial Silt & Clay)	0			CL-ML	asc				
10					10.00 UD2 11.00										
11		(5.00)			11.00 SPT9 11.45		2								
12					12.00 SPT10 12.45		2								
13					13.00 SPT11 13.45		3								
14	-6.82	14.00			14.00 UD3 15.00	Lean CLAY (14.0-15.5m) Grey, lean CLAY Medium stiff (Alluvial Silt & Clay)				CL	asc	0/5/73/22	25 (UCT)		
15		(1.50)													

SPT N blows/30cm (20 40 60 80) | Undrained Shear Strength kN/m² (20 40 60 80) | RQD/TCR(%)

Shear Strength: PL WC LL (20 40 60 80)

TO BE CONTINUED

BORING LOG SGS.GPJ SINGAPORE LTA AGS3.GDT 6-5-21

Ground Instrumentation & Engineering

REMARKS:

LEGEND:

- Pressuremeter Test (PMT)
- Vane Shear Test (V)
- Permeability Test (PBT)
- Packer Test (PKT)
- Standard Penetration Test (SPT)
- Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- Mazier Sample (MZ) Denison Sample (DS)
- Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- Core Run (CR)
- TCR
- RQD

*WL - Ground Water Level observed from Borehole (BGL)

PROJECT: Geotechnical Investigation Works for Matarbari Ultra Super Critical Coal-Fired Power Plant Project (Phase-2)

CLIENT: TEPSCO

GIE PROJECT NO: SIBD2104

LOCATION: Matarbari, Maheshkhali, Cox's Bazar

BORING LOG: BH-06

DRILLING DATE STARTED: 08-02-2021	**BOREHOLE DIA:** 150 mm	**NORTHING:** 2400493.000 m
DRILLING DATE COMPLETED: 09-02-2021	**FLUSHING MEDIUM:** Water	**EASTING:** 384316.000 m
PREPARED BY: Md. Shahjalal	**DRILLING METHOD:** Rotary open hole	**REDUCED LEVEL:** 7.179 m
CHECKED BY: Aminul Islam	**FIELD SUPERVISOR:** Raju Ahmed	**PERCHED WL*:** 3 m dated 09-02-2021

Scale	Reduced Level (m)	Depth (m) (Thickness)	Graphic Log	Legend	Type & No.	Description	SPT N blows/30cm	Rock TCR (%)	Rock RQD (%)	Soil Type (USCS)	Geological Deposition	Grain Size Analysis G/SA/S/C	Shear Strength C (kN/m²)	Shear Strength ϕ (°)	Bulk Density Mg/m³
					15.00 SPT12 15.45		6			CL	asc				
	-8.32	15.50													
16		(1.00)			16.00 SPT13 16.45	ϕ Silty SAND (15.5-16.5m) Grey, fine grained silty SAND with slightly Clay Medium dense (Alluvial Sand)	13			SM	asd				
	-9.32	16.50													
17					17.00 SPT14 17.44	ϕ Silty SAND (16.5-18.5m) Grey, fine grained silty SAND with traces of mica Very dense (Alluvial Sand)	50/29cm			SM	asd				
18		(2.00)			18.00 SPT15 18.44		50/29cm								
	-11.32	18.50													
19					19.00 SPT16 19.45	ϕ Silty SAND (18.5-21.0m) Grey, fine grained silty SAND with slightly Clay Loose to medium dense (Alluvial Sand)	27			SM	asd				
20		(2.50)			20.00 SPT17 20.45		6								
21	-13.82	21.00			21.00 SPT18 21.45		22			ML	asc	0/39/61/0 0/37/50/13	3 (DST)	28	
22					22.00 SPT19 22.45	ϕ Sandy SILT (21.0-23.5m) Grey, sandy SILT Stiff to very stiff (Alluvial Silt & Clay)	11								
23		(2.50)			23.00 SPT20 23.45		16								
	-16.32	23.50													
24					24.00 SPT21 24.42		50/27cm			ML	asc				
25					25.00 SPT22 25.37		50/22cm								
26		(4.87)			26.00 SPT23 26.41	ϕ SILT (23.5-28.37m) Grey, SILT with traces of sand Hard (Alluvial Silt & Clay)	50/26cm					0/6/94/0 0/7/74/19	(DST)	33	
27					27.00 SPT24 27.43		50/28cm								
28					28.00 SPT25 28.37		50/22cm								
	-21.19	28.37													
29						Borehole terminated at 28.37m									
30															

SPT N blows/30cm (20 40 60 80) | Undrained Shear Strength kN/m² (20 40 60 80) | PL WC LL (20 40 60 80) | Bulk Density Mg/m³ (1.3 1.6 1.9 2.2)

RQD/TCR(%)

Ground Instrumentation & Engineering

REMARKS:

LEGEND:

- Pressuremeter Test (PMT)
- Vane Shear Test (V)
- Permeability Test (PBT)
- Packer Test (PKT)
- Standard Penetration Test (SPT)
- Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- Mazier Sample (MZ) Denison Sample (DS)
- Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- Core Run (CR)
- TCR
- RQD

*WL - Ground Water Level observed from Borehole (BGL)

BORING LOG SGS.GPJ SINGAPORE LTA AGS3.GDT 6-5-21

PROJECT: Geotechnical Investigation Works for Matarbari Ultra Super Critical Coal-Fired Power Plant Project (Phase-2)

CLIENT: TEPSCO

GIE PROJECT NO: SIBD2104

LOCATION: Matarbari, Maheshkhali, Cox's Bazar

BORING LOG: BH-07

DRILLING DATE STARTED: 18-02-2021	**BOREHOLE DIA:** 150 mm	**NORTHING:** 2400624.000 m
DRILLING DATE COMPLETED: 20-02-2021	**FLUSHING MEDIUM:** Water	**EASTING:** 384147.000 m
PREPARED BY: Md. Shahjalal	**DRILLING METHOD:** Rotary open hole	**REDUCED LEVEL:** 6.774 m
CHECKED BY: Aminul Islam	**FIELD SUPERVISOR:** Raju Ahmed	**PERCHED WL*:** 6 m dated 20-02-2021

Scale	Reduced Level (m)	Depth (m) (Thickness)	Graphic Log	Legend	Type & No.	Description	SPT N blows/30cm	Rock TCR (%)	Rock RQD (%)	Soil Type (USCS)	Geological Deposition	Grain Size Analysis G/SA/S/C	Shear Strength C (kN/m²)	Shear Strength ϕ (°)	Bulk Density Mg/m³
1					1.00 SPT1 1.45	ϕ SAND (0.0-4.5m) Light brown, fine-medium grained SAND with Silt Loose to medium dense (Fill)	17			FILL	Fill				
2		(4.50)			2.00 SPT2 2.45		18								
3					3.00 SPT3 3.45		11					0/89/11/0 0/90/7/3	1 (DST)	33.4	
4	2.27	4.50			4.00 SPT4 4.45		10								
5	1.27	(1.00) 5.50			5.00 SPT5 5.45	ϕ Silty SAND (4.5-5.5m) Brownish grey, fine grained silty SAND Dense (Fill)	34			FILL	Fill				
6	0.27	(1.00) 6.50			6.00 SPT6 6.45	ϕ Sandy lean CLAY (5.5-6.5m) Grey, sandy lean CLAY Medium stiff (Alluvial Silt & Clay)	6			CL	asc	0/40/60/0 0/42/39/19			
7	-0.73	(1.00) 7.50			7.00 SPT7 7.45	ϕ Lean CLAY (6.5-7.5m) Yellowish brown to grey, lean CLAY Medium stiff (Alluvial Silt & Clay)	7			CL	asc				
8					8.00 SPT8 8.45		2								
9		(3.00)			9.00 UD1 10.00	ϕ Lean CLAY (7.5-10.5m) Grey, lean CLAY with Sand Very soft (Alluvial Silt & Clay)				CL	asc	0/23/63/14	26 (UCT)		
10	-3.73	10.50			10.00 SPT9 10.45		0								
11	-4.73	(1.00) 11.50			11.00 SPT10 11.45	ϕ Clayey SAND (10.5-11.5m) Grey, clayey SAND Loose (Alluvial Sand)	8			SC	asd				
12	-5.73	(1.00) 12.50			12.00 SPT11 12.45	ϕ Silty SAND (11.5-12.5m) Grey, fine grained silty SAND Dense (Alluvial Sand)	35			SM	asd				
13	-6.73	(1.00) 13.50			13.00 SPT12 13.45	ϕ Silty SAND (12.5-13.5m) Grey, fine grained silty SAND with slightly Clay Medium dense (Alluvial Sand)	15			SM	asd				
14					14.00 SPT13 14.45	ϕ Silty SAND (13.5-17.5m) Grey, fine-medium grained silty SAND Medium dense to dense (Alluvial Sand)	41			SM	asd	0/80/20/0 0/81/14/5			
15															

SPT N blows/30cm (20 40 60 80) × Undrained Shear Strength kN/m² (20 40 60 80)

RQD/TCR(%)

Shear Strength: PL WC LL (20 40 60 80)

Bulk Density Mg/m³ (1.3 1.6 1.9 2.2)

TO BE CONTINUED

Ground Instrumentation & Engineering

REMARKS:

LEGEND:

- Pressuremeter Test (PMT)
- Vane Shear Test (V)
- Permeability Test (PBT)
- Packer Test (PKT)
- Standard Penetration Test (SPT)
- Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- Mazier Sample (MZ) Denison Sample (DS)
- Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- Core Run (CR)
- TCR
- RQD

*WL - Ground Water Level observed from Borehole (BGL)

BORING LOG SGS.GPJ SINGAPORE LTA AGS3.GDT 6-5-21

PROJECT: Geotechnical Investigation Works for Matarbari Ultra Super Critical Coal-Fired Power Plant Project (Phase-2)

CLIENT: TEPSCO

GIE PROJECT NO: SIBD2104

LOCATION: Matarbari, Maheshkhali, Cox's Bazar

BORING LOG: BH-07

DRILLING DATE STARTED: 18-02-2021	**BOREHOLE DIA:** 150 mm	**NORTHING:** 2400624.000 m
DRILLING DATE COMPLETED: 20-02-2021	**FLUSHING MEDIUM:** Water	**EASTING:** 384147.000 m
PREPARED BY: Md. Shahjalal	**DRILLING METHOD:** Rotary open hole	**REDUCED LEVEL:** 6.774 m
CHECKED BY: Aminul Islam	**FIELD SUPERVISOR:** Raju Ahmed	**PERCHED WL*:** 6 m dated 20-02-2021

Scale	Reduced Level (m)	Depth (m) (Thickness)	Graphic Log	Legend	Type & No.	Description	SPT N blows/30cm	Rock TCR (%)	Rock RQD (%)	Soil Type (USCS)	Geological Deposition	Grain Size Analysis G/SA/S/C	Shear Strength C (kN/m²)	Shear Strength ϕ (°)	Bulk Density Mg/m³
16		(4.00)			15.00 SPT14 15.45		45								
					16.00 SPT15 16.45	Silty SAND (13.5-17.5m) Grey, fine-medium grained silty SAND Medium dense to dense (Alluvial Sand) *(continued)*	24			SM	asd	0/63/37/0 0/63/27/10			
17	-10.73	17.50			17.00 SPT16 17.45		27								
18					18.00 SPT17 18.34		50/19cm					0/86/11/3	(DST)	39	
19					19.00 SPT18 19.35		50/20cm								
20		(5.89)			20.00 SPT19 20.27	SAND (17.5-23.39m) Grey, fine grained SAND with Silt Very dense (Alluvial Sand)	50/12cm			SP-SM	asd				
21					21.00 MZ1 22.00							0/93/5/2	(DST)	35.1	
22					22.00 SPT20 22.38		50/23cm								
23	-16.62	23.39			23.00 SPT21 23.39		50/24cm								
24						Borehole terminated at 23.39m									
25															
26															
27															
28															
29															
30															

SPT N blows/30cm (20 40 60 80)
Undrained Shear Strength kN/m² (20 40 60 80)
Shear Strength (PL WC LL 20 40 60 80)
Bulk Density Mg/m³ (1.3 1.6 1.9 2.2)
RQD/TCR(%)

Ground Instrumentation & Engineering

REMARKS:

LEGEND:

- Pressuremeter Test (PMT)
- Vane Shear Test (V)
- Permeability Test (PBT)
- Packer Test (PKT)
- Standard Penetration Test (SPT)
- Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- Mazier Sample (MZ) Denison Sample (DS)
- Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- Core Run (CR)
- TCR
- RQD

*WL - Ground Water Level observed from Borehole (BGL)

BORING LOG SGS.GPJ SINGAPORE LTA AGS3.GDT 6-5-21

PROJECT: Geotechnical Investigation Works for Matarbari Ultra Super Critical Coal-Fired Power Plant Project (Phase-2)

CLIENT: TEPSCO

GIE PROJECT NO: SIBD2104

LOCATION: Matarbari, Maheshkhali, Cox's Bazar

BORING LOG: BH-08

DRILLING DATE STARTED: 18-02-2021	**BOREHOLE DIA:** 150 mm	**NORTHING:** 2400763.000 m
DRILLING DATE COMPLETED: 20-02-2021	**FLUSHING MEDIUM:** Water	**EASTING:** 383978.000 m
PREPARED BY: Md. Shahjalal	**DRILLING METHOD:** Rotary open hole	**REDUCED LEVEL:** 5.885 m
CHECKED BY: Aminul Islam	**FIELD SUPERVISOR:** Nakibul Alam Chowdhury	**PERCHED WL*:** 5 m dated 20-02-2021

Scale	Reduced Level (m)	Depth (m) (Thickness)	Graphic Log	Legend	Type & No.	Description	SPT N blows/30cm	Rock TCR (%)	Rock RQD (%)	Soil Type (USCS)	Geological Deposition	Grain Size Analysis G/SA/S/C	Shear Strength C (kN/m²)	Shear Strength ϕ (°)	Bulk Density Mg/m³
1		(2.50)			1.00 SPT1 1.45	ϕ SAND(0.0-2.5m) Brownish grey, fine-medium grained SAND Loose to medium dense (Fill)	13			FILL	Fill				
2	3.39	2.50			2.00 SPT2 2.45		5					0/98/2/0	1 (DST)	31.5	
3	2.39	(1.00) 3.50			3.00 SPT3 3.45	ϕ Silty SAND (2.5-3.5m) Brownish grey, fine-medium grained silty SAND with shell fragments Very loose (Fill)	1			FILL	Fill				
4	1.39	(1.00) 4.50			4.00 SPT4 4.45	ϕ Silty SAND (3.5-4.5m) Grey, fine-medium grained SAND Medium dense (Fill)	19			FILL	Fill				
5	0.38	(1.00) 5.50			5.00 SPT5 5.45	ϕ Lean CLAY (4.5-5.5m) Grey, lean CLAY Very soft (Alluvial Silt & Clay)	2			CL	asc				
6					6.00 SPT6 6.45	ϕ Lean CLAY 5.5-7.5) Reddish brown and brownish grey, lean CLAY Soft to medium stiff (Alluvial Silt & Clay)	8			CL	asc				
7	-1.62	(2.00) 7.50			7.00 SPT7 7.45		4								
8	-2.62	(1.00) 8.50			8.00 SPT8 8.45	ϕ Silty SAND (7.5-8.5m) Grey, fine grained silty SAND Medium dense (Alluvial Sand)	25			SM	asd				
9	-3.62	(1.00) 9.50			9.00 SPT9 9.45	ϕ Sandy lean CLAY (8.5-9.5m) Grey, sandy lean CLAY Soft (Alluvial Silt & Clay)	3			CL	asc	0/38/44/18			
10					10.00 SPT10 10.45		29								
11					11.00 SPT11 11.45	ϕ Silty SAND (9.5-13.5m) Grey, fine grained silty SAND Medium dense to dense (Alluvial Sand)	22			SM	asd				
12		(4.00)			12.00 SPT12 12.45		24					0/68/32/0 0/69/21/10			
13	-7.62	13.50			13.00 SPT13 13.45		31								
14	-8.62	(1.00) 14.50			14.00 SPT14 14.45	ϕ Silty SAND (13.5-14.5m) Grey, fine-medium grained silty SAND Medium dense (Alluvial Sand)	23			SM	asd				
15										SM	asd				

SPT N blows/30cm (20 40 60 80) × Undrained Shear Strength kN/m² (20 40 60 80) — RQD/TCR(%)

PL WC LL (20 40 60 80) ■ Bulk Density Mg/m³ (1.3 1.6 1.9 2.2)

TO BE CONTINUED

Ground Instrumentation & Engineering

REMARKS:

LEGEND:

- ▼ – Pressuremeter Test (PMT)
- ◔ – Vane Shear Test (V)
- ⊗ – Permeability Test (PBT)
- ▤ – Packer Test (PKT)
- ☒ – Standard Penetration Test (SPT)
- ▨ – Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- ▨ – Mazier Sample (MZ) Denison Sample (DS)
- □ – Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- ■ – Piston Sample (PS)
- ▥ – Core Run (CR)
- ▥ – TCR
- ▩ – RQD

*WL - Ground Water Level observed from Borehole (BGL)

BORING LOG SGS.GPJ SINGAPORE LTA AGS3.GDT 7-3-21

PROJECT: Geotechnical Investigation Works for Matarbari Ultra Super Critical Coal-Fired Power Plant Project (Phase-2)

CLIENT: TEPSCO

GIE PROJECT NO: SIBD2104

LOCATION: Matarbari, Maheshkhali, Cox's Bazar

BORING LOG: BH-08

DRILLING DATE STARTED: 18-02-2021	**BOREHOLE DIA:** 150 mm	**NORTHING:** 2400763.000 m
DRILLING DATE COMPLETED: 20-02-2021	**FLUSHING MEDIUM:** Water	**EASTING:** 383978.000 m
PREPARED BY: Md. Shahjalal	**DRILLING METHOD:** Rotary open hole	**REDUCED LEVEL:** 5.885 m
CHECKED BY: Aminul Islam	**FIELD SUPERVISOR:** Nakibul Alam Chowdhury	**PERCHED WL*:** 5 m dated 20-02-2021

Scale	Reduced Level (m)	Depth (m) (Thickness)	Graphic Log	Legend	Type & No.	Description	SPT N blows/30cm	Rock TCR (%)	Rock RQD (%)	Soil Type (USCS)	Geological Deposition	Grain Size Analysis G/SA/S/C	Shear Strength C (kN/m²)	Shear Strength ϕ (°)	Bulk Density Mg/m³
16		(2.00)			15.00 SPT15 15.45	ϕ Silty SAND (14.5-16.5m) Grey, fine grained silty SAND Dense (Alluvial Sand) *(continued)*	37								
					16.00 SPT16 16.45		32			SM	asd	0/53/47/0 0/53/33/14	10 (DST)	37.1	
	-10.62	16.50													
17		(1.00)			17.00 SPT17 17.45	ϕ Silty SAND (16.5-17.5m) Grey, fine grained silty SAND with clay lamination Dense (Alluvial Sand)	33			SM	asd				
	-11.62	17.50													
18					18.00 SPT18 18.42		50/27cm								
19					19.00 SPT19 19.35		50/20cm								
20		(4.78)			20.00 SPT20 20.42	ϕ SAND (17.5-22.28m) Grey, fine grained SAND with Silt Very dense (Alluvial Sand)	50/27cm			SP-SM	asd				
21					21.00 SPT21 21.36		50/21cm					0/90/10/0 0/90/8/2	(DST)	40	
22	-16.40	22.28			22.00 SPT22 22.28	Borehole terminated at 22.28m	50/13cm								
23															
24															
25															
26															
27															
28															
29															
30															

SPT N blows/30cm (20 40 60 80) | Undrained Shear Strength kN/m² (20 40 60 80) | Atterberg Limits PL WC LL (20 40 60 80) | Bulk Density Mg/m³ (1.3 1.6 1.9 2.2)

RQD/TCR(%)

Ground Instrumentation & Engineering

REMARKS:

LEGEND:

- Pressuremeter Test (PMT)
- Vane Shear Test (V)
- Permeability Test (PBT)
- Packer Test (PKT)
- Standard Penetration Test (SPT)
- Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- Mazier Sample (MZ) Denison Sample (DS)
- Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- Core Run (CR)
- TCR
- RQD

*WL - Ground Water Level observed from Borehole (BGL)

BORING LOG SGS.GPJ SINGAPORE LTA AGS3.GDT 7-3-21

APPENDIX A (ii)

Field Bore Logs

FIELD LOG
(ISO 22475-1:2006)

GIE Project ID: SI

Sheet 1 of 3

PROJECT: GI Works for Matarbari Power Plant		BORING LOG: BH-01
CLIENT: TEPSCO	DRILL RIG MODEL: YWE RIG NO: 01	
CONTRACTOR: GIE	BOREHOLE DIA: 150 mm	
LOCATION: Power Plant Area	DIA: N/A	
DRILLING DATE: 03.02.2021	DRILLING METHOD: Rotary	NORTHING: 2400600.50
DRILLING ROD TYPE / SIZE: BW / 50 mm	FLUSHING MEDIUM: Water	EASTING: 985231.00
HAMMER TYPE / S/NO: Auto trip	CASING DIA / LENGTH: 150 mm / 6.0 m	REDUCED LEVEL: 4.68
CAL. CERT. NO./ DATE: N/A	DRILLER: Jahangir SITE ENGR: [redacted] CLIENT'S REP: [redacted]	WL*: 2.10 m

Scale	Depth (m) (Thickness)	Legend	Type & No	Description	Standard Penetration Test: 1st (0cm)	2nd (0cm)	3rd (0cm)	SPT 'N' Value / Blow	TCR (%)	SCR (%)	RQD (%)	Geological Classification	Remarks
	0												
	1		SPT 01	Grey loose silty fine SAND (fill)	4	4	5	9					Rec: 18cm
	2		SPT 02	Grey dense silty fine to medium SAND (fill)	12	21	27	48					Rec: 24 cm
	3		SPT 03	Light brown medium dense silty fine SAND (fill)	10	12	15	27					Rec: 25cm
	4		SPT 04	Grey medium dense silty fine SAND (fill)	7	12	14	26					Rec: 29cm
	5		SPT 05	Grey very loose silty fine SAND with slightly clay	2	2	2	4					Rec: 30cm
	6		SPT 06	Grey medium stiff silty CLAY	1	2	3	5					Rec = 25cm
	7		UD 01	UD-01 sample taken from 7.0m to 8.0m depth									UD-01 Rec: 85cm
	8		SPT 07	Dark grey soft silty CLAY	0	1	2	3					Rec: 42cm
	9		SPT 08	Grey medium stiff silty CLAY	1	2	3	5					Rec: 34cm
	10												

Ground Instrumentation & Engineering

LEGEND:

- ▼ – Pressuremeter Test (PMT)
- ⊗ – Vane Shear Test (V)
- ⊗ – Permeability Test (PBT)
- ▤ – Packer Test (PKT)
- ▨ – Standard Penetration Test (SPT)
- ▨ – Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- ▨ – Mazier Sample (MZ) Denison Sample (DS)
- □ – Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- ■ – Piston Sample (PS)
- ▮ – Core Run (CR)
- □ – TCR
- ▩ – RQD

*WL - Ground Water Level observed from Borehole (BGL)

FIELD LOG
(ISO 22475-1:2006)

GIE Project ID: SI

Sheet 2 of 3

PROJECT: GI Works for Matarbari Power Plant		BORING LOG: BH-01
CLIENT: TEPSCO	DRILL RIG MODEL: YWE RIG NO: 01	
CONTRACTOR: GIE	BOREHOLE DIA: 150 mm	
LOCATION: Power Plant Area	DIA: N/A	
DRILLING DATE: 03.02.2021	DRILLING METHOD: Rotary	NORTHING: 2400600.00
DRILLING ROD TYPE / SIZE: BW / 50mm	FLUSHING MEDIUM: Water	EASTING: 385231.00
HAMMER TYPE / S/NO: Autotrip	CASING DIA / LENGTH: 152 mm / 6.0 m	REDUCED LEVEL: 4.68
CAL. CERT. NO / DATE: N/A DRILLER: Johangir SITE ENGR: [redacted] CLIENT'S REP: [redacted] 04.02.21		▽ WL*: 2.10 m

Water	Depth (m) / (Thickness)	Legend	Type & No	Description	Standard Penetration Test: 1st (/cm)	2nd (/cm)	3rd (/cm)	SPT N Value / Blow	Rock: TCR (%)	SCR (%)	RQD (%)	Geological Classification	Results
	10		UD 02	UD-02 Sample taken from 10.0m to 11.0m depth									UD-02 Rec: 82 cm
	11		SPT 09	Grey stiff clayey SILT with slightly sand	2	8	5	13					Rec: 29 cm ▲ 03.02.21 04.02.21 ▼
	12		SPT 10	Grey medium stiff silty CLAY	1	2	3	5					Rec: 36 cm
	13		SPT 11	Grey dense silty fine SAND	8	14	20	34					Rec: 25 cm
	14		SPT 12	Grey medium dense silty fine SAND with slightly clay	6	8	12	20					Rec: 34 cm
	15		SPT 13	Grey medium dense silty fine SAND with slightly clay	7	9	12	21					Rec: 30 cm
	16		SPT 14	Grey medium dense silty fine SAND with slightly clay	5	6	9	15					Rec: 33 cm
	17		SPT 15	Grey medium dense silty fine SAND with slightly clay	6	9	14	23					Rec: 28 cm
	18		SPT 16	Grey medium dense silty fine SAND with slightly clay	7	10	19	29					Rec: 29 cm
	19		SPT 17	Grey medium dense clayey SAND with slightly Silt	5	6	7	13					Rec: 30 cm
	20												

Ground Instrumentation & Engineering

LEGEND:

- ▼ – Pressuremeter Test (PMT)
- ◐ – Vane Shear Test (V)
- ⊗ – Permeability Test (PBT)
- ▤ – Packer Test (PKT)
- ☒ – Standard Penetration Test (SPT)
- ▨ – Undisturbed Sample (UD) Open Drive Thinkwall Sample (OD)
- ▧ – Master Sample (MZ) Denison Sample (DS)
- □ – Auto-piston (UD*), (OD*), (PS*), (MZ*) & (DS*)
- ■ – Piston Sample (PS)
- ▮ – Core Run (CR)
- □ – TCR
- ▩ – RQD

*WL - Ground Water Level observed from Borehole (BGL)

FIELD LOG
(ISO 22475-1:2006)

GIE Project ID: SI

Sheet 3 of 3

PROJECT: GI Works for Matarbari Power Plant
CLIENT: TEPSCO
CONTRACTOR: GIE
LOCATION: Power Plant Area
DRILLING DATE: 04.02.2021
DRILLING ROD TYPE / SIZE: BW / 50 mm
HAMMER TYPE / S/NO: Auto-trip
CAL. CERT. NO / DATE: N/A
DRILLER: Johangir
DRILL RIG MODEL: YWE RIG NO: 01
BOREHOLE DIA: 150mm
DIA: N/A
DRILLING METHOD: Rotary
FLUSHING MEDIUM: Water
CASING DIA / LENGTH: 150 mm / 6.0 m
SITE ENGR:
CLIENT'S REP:

BORING LOG: BH-01

NORTHING: 2400600.00
EASTING: 985231.00
REDUCED LEVEL: 4.68
WL*: 2.70 m

Scale	Depth (m) (Thickness)	Legend	Type & No	Description	Standard Penetration Test 1st 6cm	2nd 6cm	3rd 6cm	SPT N (blows / 30cm)	Rock TCR (%)	Rock SCR (%)	Rock RQD (%)	Geological Classification	Remarks
	20		SPT 18	Grey medium dense clayey BAND with slightly silt	4	6	9	15					Rec: 32 cm
	21		SPT 19	Grey hard silty CLAY	11/15	18/15	32/15	50/30					Rec: 32 cm
	22		SPT 20	Grey hard silty CLAY	10/15	25/15	25/12	50/27					Rec: 30 cm
	23		SPT 21	Grey hard silty CLAY	11	18	27	45					Rec: 32 cm
	24		SPT 22	Grey hard silty CLAY	18/15	23/15	27/11	50/26					Rec: 36cm
	25		SPT 23	Grey hard clayey SILT	23/15	30/15	20/4	50/19					Rec: 34cm
	26		SPT 24	Grey hard silty CLAY	15/15	26/15	24/11	50/26					Rec: 35cm
	27		SPT 25	Grey hard silty CLAY	17/15	26/15	24/12	50/27					Rec: 36cm
	28		SPT 26	Grey hard silty CLAY	15/15	23/15	27/13	50/28					Rec: 45cm
	29												
	30												

Ground Instrumentation & Engineering

LEGEND:

- ▼ – Permeameter Test (PMT)
- ◐ – Vane Shear Test (V)
- ⊗ – Permeability Test (PRT)
- ▤ – Packer Test (PKT)
- ☒ – Standard Penetration Test (SPT)
- ▨ – Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- ▩ – Mazier Sample (MZ) Denison Sample (DS)
- □ – Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- ■ – Piston Sample (PS)
- ▮ – Core Run (CR)
- □ – TCR
- ▩ – RQD

*WL - Ground Water Level observed from Borehole (BGL)

FIELD LOG
(ISO 22475-1:2006)

GIE Project ID: SI

Sheet 01 of 03

PROJECT: GI Works for Matarbari Power Plant			BORING LOG: BH-02
CLIENT: TEPSCO	DRILL RIG MODEL: PRD	RIG NO: 01	
CONTRACTOR: GIE	BOREHOLE DIA: 150 mm		
LOCATION: Power Plant Area	DIA: N/A		NORTHING: 2400781.00
DRILLING DATE: 15.02.2021	DRILLING METHOD: Rotary		EASTING: 384907.60
DRILLING ROD TYPE / SIZE: BW/ 50mm	FLUSHING MEDIUM: Water		REDUCED LEVEL: 4.53
HAMMER TYPE / S/NO: Autotrip	CASING DIA / LENGTH: 150 mm / 6.0 m		
CAL. CERT. NO./ DATE: N/A DRILLER:	SITE ENGR: Rock	CLIENT'S REP:	WL*: 1.5 m

Scale	Depth (m) (Thickness)	Legend	Type & No	Description	Standard Penetration Test 1st 15cm	2nd 15cm	3rd 15cm	SPT N Blows / 30cm	Rock TCR (%)	SCR (%)	RQD (%)	Geological Classification	Remarks
	0												
	1		SPT 01	Grey medium dense fine SAND with traces of mica. (fill)	5	6	7	13					Rec=17cm
	2		SPT 02	Grey Loose fine SAND with traces of mica (fill)	3	3	6	9					Rec=18cm
	3		SPT 03	Grey Loose fine SAND with traces of shell fragments (fill)	4	4	6	10					Rec=24cm
	4		SPT 04	Grey medium stiff sandy clay.	2	3	3	6					Rec=23cm
	5		SPT 05	Brownish grey medium stiff silty CLAY.	2	2	4	6					Rec=19cm
	6		UD 01	UD-01 sample taken from 6.0-7.0m depth									UD-01 Rec=90cm
	7		SPT 06	Grey soft silty CLAY.	1	1	2	3					Rec=21cm 15.02.21 16.02.21
	8		UD 02	UD-02 sample taken from 8.0-9.0m depth.									UD-02 Rec=85cm
	9		SPT 07	Grey very soft silty CLAY.	0	0	0	0					Rec=37cm
	10												

Ground Instrumentation & Engineering

LEGEND:

- ▼ – Piezometer Test (PMT)
- ⊗ – Vane Shear Test (V)
- ⊗ – Permeability Test (PBT)
- ▤ – Packer Test (PKT)
- ☒ – Standard Penetration Test (SPT)
- ▨ – Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- ▧ – Mazier Sample (MZ) Denison Sample (DS)
- □ – Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- ■ – Piston Sample (PS)
- ▮ – Core Run (CR)
- □ – TCR
- ▩ – RQD

*WL - Ground Water Level observed from Borehole (DGL)

FIELD LOG
(ISO 22475-1:2006)

GIE Project ID: SI

Sheet 02 of 03

PROJECT: GI Works for Matarbari Power Plant			BORING LOG: BH-02
CLIENT: TEPSCO	DRILL RIG MODEL: PRD	RIG NO: 01	
CONTRACTOR: GIE	BOREHOLE DIA: 150 mm		
LOCATION: Power Plant Area	DIA: N/A		
DRILLING DATE: 16.02.21	DRILLING METHOD: Rotary		NORTHING: 2460781.00
DRILLING ROD TYPE / SIZE: BW / 50 mm	FLUSHING MEDIUM: Water		EASTING: 384907.00
HAMMER TYPE / S/NO: Auto trip	CASING DIA / LENGTH: 150 mm / 6.0 m		REDUCED LEVEL: 4.53
CAL. CERT. NO / DATE: N/A DRILLER:	SITE ENGR: [signature]	CLIENT'S REP: [signature] 17.02.21	WL*: 1.5 m

Scale	Depth (m) (Thickness)	Legend	Type & No	Description	Standard Penetration Test: 1st 15cm	2nd 15cm	3rd 15cm	SPT N Blows / 30cm	Rock: TCR (%)	SCR (%)	RQD (%)	Geological Classification	Remarks (Always Record Water level during SPT, SPT Recovery, Straightness of and discovery 30 SPT, UD Recovery)
	10	☒	SPT 08	Grey soft silty CLAY.	1	1	2	3					Rec = 36cm
	11	☒	SPT 09	Grey medium stiff silty CLAY with laminated sand	1	2	3	5					Rec = 36cm
	12	☒	SPT 10	Grey medium stiff silty CLAY with slightly sand.	2	3	4	7					Rec = 35cm
	13	☒	SPT 11	Grey medium dense silty SAND with slightly clay.	4	9	13	22					Rec = 29cm
	14	☒	SPT 12	Grey medium dense silty SAND with laminated clay.	4	8	14	22					Rec = 25cm
	15	☒	SPT 13	Grey medium dense clayey SAND.	4	8	12	20					Rec = 22cm
	16	☒	SPT 14	Grey medium dense clayey SAND with laminated silt.	3	8	13	21					Rec = 27cm
	17	☒	SPT 15	Grey medium dense silty SAND with slightly clay.	2	6	9	15					Rec = 30cm
	18	☒	SPT 16	Grey very stiff sandy SILT with slightly clay.	4	9	13	22					Rec = 29cm
	19	☒	SPT 17	Grey medium dense silty SAND with slightly clay	6	11	11	22					Rec = 23cm
	20												

Ground Instrumentation & Engineering

LEGEND:

- ▼ – Pressuremeter Test (PMT)
- Vane Shear Test (V)
- ⊗ – Permeability Test (PBT)
- Packer Test (PKT)
- ☒ – Standard Penetration Test (SPT)
- Undisturbed Sample (UD) / Open Drive Thickwall Sample (OD)
- Mazier Sample (MZ) / Denison Sample (DS)
- Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- TCR
- Core Run (CR)
- RQD

*WL - Ground Water Level observed from Borehole (BGL)

FIELD LOG
(ISO 22475-1:2006)

GIE Project ID: SI

Sheet 03 of 03

PROJECT: GI Works for Matarbari Power Plant
CLIENT: TEPSCO
CONTRACTOR: GIE
LOCATION: Power Plant Area
DRILLING DATE: 16.02.21
DRILLING ROD TYPE / SIZE: BW / 50 mm
HAMMER TYPE / S/NO: Auto trip
CAL. CERT. NO. / DATE: N/A
DRILLER: Masud
DRILL RIG MODEL: PRD
RIG NO: 01
BOREHOLE DIA: CORE: 150 mm
DIA: N/A
DRILLING METHOD: Rotary
FLUSHING MEDIUM: Water
CASING DIA / LENGTH: 150 mm / 6.0 m
SITE ENGR: Rafi
CLIENT'S REP: 17.02.21

BORING LOG: BH-02

NORTHING: 2400781.00
EASTING: 384907.00
REDUCED LEVEL: 4.53
WL = 4.15 m

Scale	Depth (m) (Thickness)	Legend	Type & No	Description	Standard Penetration Test: 1st (0 to 15)	2nd (15 to 30)	3rd (30 to 45)	SPT N (blows / 30cm)	Rock: TCR (%)	SCR (%)	RQD (%)	Geological Classification	Remarks
	20		SPT 18	Grey Very stiff Sandy SILT.	3	6	17	23					Ree=36cm
	21		SPT 19	Brownish grey to grey dense silty SAND.	9	17	21	38					Ree=20cm
	22		SPT 20	Greyish Brown very dense Silty fine SAND	13/15	22/15	28/14	50/29					Ree=21cm
	23		SPT 21	Grey to light Brown very dense silty fine SAND.	10/15	26/15	24/9	50/24					Ree=22cm
	24		SPT 22	Light Grey very dense Silty fine SAND	32/15	50/12	0/0	50/12					Ree=17cm 16.02.21 17.02.21 Ree=19cm
	25		SPT 23	Light grey very dense fine SAND.	24/15	44/15	6/3	50/18					
	26		SPT 24	Light grey very dense fine SAND	22/15	38/15	12/4	50/19					Ree=20cm
	27												
	28												
	29												
	30												

Ground Instrumentation & Engineering

LEGEND:

- ▼ – Pressuremeter Test (PMT)
- Vane Shear Test (V)
- ⊗ – Permeability Test (PST)
- Packer Test (PKT)
- ⊠ – Standard Penetration Test (SPT)
- Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- Mazier Sample (MZ) Denison Sample (DS)
- Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- Core Run (CR)
- TCR
- RQD

*WL - Ground Water Level observed from Borehole (BGL)

FIELD LOG
(ISO 22475-1:2006)

GIE Project ID: SI

Sheet 01 of 03

PROJECT: GI Works for Matarbari Power Plant
CLIENT: TEPSCO
CONTRACTOR: GIE
LOCATION: Power Plant Area
DRILLING DATE: 11.02.2021
DRILLING ROD TYPE / SIZE: BW / 50 mm
HAMMER TYPE / S/NO: Auto trip
CAL. CERT. NO / DATE: N/A
DRILLER: MASUD
DRILL RIG MODEL: PRD
RIG NO: 01
BOREHOLE DIA: 150 mm
DIA: N/A
DRILLING METHOD: Rotary
FLUSHING MEDIUM: Water
CASING DIA / LENGTH: 150 mm / 6.0 m
SITE ENGR: RAJU
CLIENT'S REP:
11.02.21

BORING LOG:
BH-03

NORTHING: 2400612.00
EASTING: 384904.80
REDUCED LEVEL: 4.97
WL*: 2.0 m

Scale	Depth (m) (Thickness)	Legend	Type & No.	Description	Standard Penetration Test: 1st 15cm	2nd 15cm	3rd 15cm	SPT 'N' (blows / 30cm)	Rock: TCR (%)	Rock: SCR (%)	Rock: RQD (%)	Geological Classification	Remarks
	0												
	1		SPT 01	Grey Loose silty fine SAND. (Fill)	1	1	6	7					Rec = 29cm
	2		SPT 02	Grey Dense silty fine SAND with traces of shell fragments. (Fill)	7	20	22	42					Rec = 39cm
	3		SPT 03	Grey Dense fine SAND with traces of shell fragments. (Fill)	8	17	23	40					Rec = 29cm
	4		SPT 04	Grey Loose fine SAND with traces of shell fragments.	3	4	5	9					Rec = 22cm
	5		SPT 05	Grey medium dense silty fine SAND with traces of shell fragments.	8	10	12	22					Rec = 40cm
	6		SPT 06	Grey medium stiff sandy CLAY.	2	2	3	5					Rec = 25cm
	7		SPT 07	Grey medium stiff silty CLAY	0	2	3	5					Rec = 25cm
	8		UD 01	UD-01 Sample taken from 8.0 – 9.0 m depth									UD-01 Rec = 82cm
	9		SPT 08	Grey medium stiff silty CLAY.	0	2	3	5					Rec = 31cm
	10												

Ground Instrumentation & Engineering

LEGEND:
- ▼ – Pressuremeter Test (PMT)
- Vane Shear Test (V)
- ⊗ – Permeability Test (PBT)
- Packer Test (PKT)
- Standard Penetration Test (SPT)
- Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- Mazier Sample (MZ) Denison Sample (DS)
- Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- Core Run (CR)
- TCR
- RQD

*WL - Ground Water Level observed from Borehole (BGL)

FIELD LOG
(ISO 22475-1:2006)

GIE Project ID: SI

Sheet 02 of 03

PROJECT: GI Works for Matarbari Power plant
CLIENT: TEPSCO
CONTRACTOR: GIE
LOCATION: Power Plant Area
DRILLING DATE: 11.02.2021
DRILLING ROD TYPE / SIZE: BW/ 50 mm
HAMMER TYPE / S/NO: Auto trip
CAL. CERT. NO / DATE: N/A
DRILLER: Masud
DRILL RIG MODEL: PRD
RIG NO: 01
BOREHOLE DIA: 150 mm
DIA: N/A
DRILLING METHOD: Rotary
FLUSHING MEDIUM: Water
CASING DIA / LENGTH: 150 mm / 6.0 m
SITE ENGR: Rafiq
CLIENT'S REP: (illegible) 11.02.21

BORING LOG: BH-03

NORTHING: 2480612.00
EASTING: 384904.00
REDUCED LEVEL: 4.97
WL*: 2.5 m

Scale	Depth (m) (Thickness)	Legend	Type & No	Description	Standard Penetration Test 1st (0to	2nd (0to	3rd (0to	SPT N Blows / 20cm	Rock TCR (%)	Rock SCR (%)	Rock RQD (%)	Geological Classification	Remarks
	10		SPT 09	Grey medium stiff silty CLAY.	1	2	3	5					Rec = 36cm
	11		SPT 10	Grey medium stiff silty CLAY.	2	3	5	8					Rec = 34cm
	12		UD 02	UD-02 sample taken from - 12.0 - 13.0 m depth									UD-02 Rec = 40cm
	13		SPT 11	Grey medium dense silty SAND.	4	8	14	22					Rec = 32cm
	14		SPT 12	Grey medium dense silty SAND.	10	12	13	25					Rec = 16cm 11.02.21 13.02.21
	15		SPT 13	Grey medium dense silty SAND. with slightly clay	7	10	16	26					Rec = 19cm
	16		SPT 14	Grey medium dense silty SAND with slightly clay.	6	8	12	20					Rec = 27cm
	17		MZ 01	MZ-01 sample taken from 17.0 ÷ 18.0 m depth									MZ-01 Rec = 83cm
	18		SPT 15	Grey very stiff clayey SILT with traces of sand	5	10	12	22					Rec = 22cm
	19		SPT 16	Grey very dense silty SAND with laminated clay	8/15	17/15	33/13	50/28					Rec = 23cm
	20												

Ground Instrumentation & Engineering

LEGEND:
- ▼ – Piezometer Test (PMT)
- Vane Shear Test (V)
- ⊗ – Permeability Test (PBT)
- Packer Test (PKT)
- Standard Penetration Test (SPT)
- Undisturbed Sample (UD): Open Drive Thickwall Sample (OD)
- Mazier Sample (MZ) Denison Sample (DS)
- Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- Core Run (CR)
- TCR
- RQD

*WL - Ground Water Level observed from Borehole (BGL)

FIELD LOG
(ISO 22475-1:2006)

GIE Project ID: SI

Sheet 03 of 03

PROJECT: GI WORKS for Matarbari Power Plant		BORING LOG: BH-03
CLIENT: TEPSCO	DRILL RIG MODEL: PRD RIG NO: 01	
CONTRACTOR: GIE	BOREHOLE DIA: 150 mm	
LOCATION: Power Plant Area	DIA: N/A	
DRILLING DATE: 13.02.2021	DRILLING METHOD: Rotary	NORTHING: 2400612.00
DRILLING ROD TYPE / SIZE: BW / 50 mm	FLUSHING MEDIUM: Water	EASTING: 384904.00
HAMMER TYPE / S/NO: Auto trip	CASING DIA / LENGTH: 150 mm / 6.0 m	REDUCED LEVEL: 4.97
CAL. CERT. NO / DATE: N/A	DRILLER: Masud SITE ENGR: Rony CLIENT'S REP: 11.02.21	▽ WL= 2.5 m

Scale	Depth (m) (Thickness)	Legend	Type & No.	Description	Standard Penetration Test (0-15cm / 15-30cm / 30-45cm)	SPT N (blows / 30cm)	Rock: TCR (%) / SCR (%) / RQD (%)	Geological Classification	Remarks
	20		SPT 17	Grey dense silty SAND with slightly CLAY.	13 / 23 / 14	37			Rec = 19cm
	21		SPT 18	Grey stiff clayey SILT with slightly sand.	4 / 5 / 8	13			Rec = 36cm
	22		SPT 19	Grey very dense silty SAND	15/15 / 34/15 / 16/4	50/19			Rec = 23cm
	23		SPT 20	Grey dense silty SAND	10 / 20 / 18	38			Rec = 21cm
	24		SPT 21	Grey very dense silty SAND.	16/15 / 42/15 / 8/4	50/19			Rec = 20cm
	25		SPT 22	Grey very dense silty SAND with traces of mica,	23/15 / 50/13 / 0/0	50/13			Rec = 17cm
	26		SPT 23	Light grey very dense silty SAND.	30/15 / 52/12 / 0/0	50/12			Rec = 15cm
	27		MZ 02	MZ-02 sample taken from 27.0-28.0m depth					MZ-02 Rec = 65cm
	28		SPT 24	Light Grey very dense silty SAND.	28/15 / 50/14 / 0/0	50/14			Rec = 18cm 13.02.21 14.02.21
	29		SPT 25	Light grey very dense silty SAND	32/15 / 50/14 / 0/0	50/14			Rec = 17cm

LEGEND:

- ▼ – Pressuremeter Test (PMT)
- – Vane Shear Test (V)
- ⊗ – Permeability Test (PBT)
- – Packer Test (PKT)
- – Standard Penetration Test (SPT)
- – Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- – Master Sample (MZ) Denison Sample (DS)
- – Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- – Piston Sample (PS)
- – TCR
- – Core Run (CR)
- – RQD

Ground Instrumentation & Engineering

*WL - Ground Water Level observed from Borehole (BGL)

FIELD LOG
(ISO 22475-1:2006)

GIE Project ID: SI

Sheet 01 of 03

PROJECT: GI Works for Matarbari Power Plant		**BORING LOG:** BH-04
CLIENT: TEPSCO	DRILL RIG MODEL: YWE RIG NO: 01	
CONTRACTOR: GIE	BOREHOLE DIA: 150mm	
LOCATION: Power Plant Area	DIA: N/A	
DRILLING DATE: 06.02.21	DRILLING METHOD: Rotary	NORTHING: 2400455.00
DRILLING ROD TYPE / SIZE: BW/50mm	FLUSHING MEDIUM: Water	EASTING: 384901.00
HAMMER TYPE / S/NO: Autotrip	CASING DIA / LENGTH: 150 mm / 3.0 m	REDUCED LEVEL: 4.192
CAL. CERT. NO/ DATE: N/A DRILLER: Jhangir	SITE ENGR: CLIENTS REP.	WL*: 2.0m

Scale	Depth (m) (Thickness)	Legend	Type & No	Description	Standard Penetration Test 1st 15cm	2nd 15cm	3rd 15cm	SPT N blows / 30cm	Rock TCR (%)	SCR (%)	RQD (%)	Geological Classification	Remarks (Always Record Water Level during SPT, SPT Recovery, Standpipe of cut after every 3m SPT, UD Recovery)
	0												
	1	SPT	SPT 01	Grey dense silty fine SAND (fill)	5	13	19	32					Rec: 24cm
	2	SPT	SPT 02	Grey medium dense silty fine SAND (fill)	6	11	16	27					Rec: 24cm
	3	SPT	SPT 03	Grey medium dense silty fine SAND	5	6	7	13					Rec: 22cm
	4	SPT	SPT 04	Dark grey very soft silty CLAY	0	0	0	0					Rec: 33cm
	5	SPT	SPT 05	Dark grey very soft silty CLAY	0	0	0	0					Rec: 32cm
	6	SPT	SPT 06	Dark grey very soft silty CLAY	0	0	2	2					Rec: 35cm
	7	UD	UD* 01	UD*-01 sample taken from 7.0m to 8.0m depth (Sample missed)									UD*-01 Rec: 0.0cm
	8	SPT	SPT 07	Dark grey very soft silty CLAY	0	0	0						Rec: 33cm
	9	UD	UD 02	UD-02 taken from 9.0m to 10.0m depth									UD-02 Rec: 80cm
	10												

Ground Instrumentation & Engineering

LEGEND:

- ▼ – Pressuremeter Test (PMT)
- Vane Shear Test (V)
- ⊗ – Permeability Test (PBT)
- Packer Test (PKT)
- ☒ – Standard Penetration Test (SPT)
- Undisturbed Sample (UD) / Open Drive Thickwall Sample (OD)
- Mazier Sample (MZ) / Denison Sample (DS)
- Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- TCR
- Core Run (CR)
- RQD

*WL - Ground Water Level observed from Borehole (BGL)

FIELD LOG
(ISO 22475-1:2006)

GIE Project ID: SI

Sheet 02 of 03

BORING LOG: BH-04

PROJECT: GI works for Matarbari Power Plant			
CLIENT: TEPSCO	DRILL RIG MODEL: YWE	RIG NO: 01	
CONTRACTOR: GIE	BOREHOLE DIA: 150mm		
LOCATION: Power Plant Area	DIA: N/A		
DRILLING DATE: 06.02.21	DRILLING METHOD: Rotary		NORTHING: 2400455.00
DRILLING ROD TYPE / SIZE: BW/50mm	FLUSHING MEDIUM: Water		EASTING: 384901.00
HAMMER TYPE / S/NO: Auto trip	CASING DIA / LENGTH: 150 mm / 3.9 m		REDUCED LEVEL: 4.192
CAL. CERT. NO / DATE: N/A	DRILLER: Jahangir	SITE ENGR: [signature] / CLIENT'S REP: [signature]	WL*: 2.0m

Scale	Depth (m) (Thickness)	Legend	Type & No	Description	SPT 1st 15cm	SPT 2nd 15cm	SPT 3rd 15cm	SPT N Blows/ft	TCR (%)	SCR (%)	RQD (%)	Geological Classification	Remarks
	10	☒	SPT 08	Dark grey clayey SAND with slightly silt	1	2	3	5					Rec: 27cm
	11	☒	SPT 09	Grey medium dense silty SAND	7	10	17	27					Rec: 31cm
	12	☒	SPT 10	Grey medium dense silty SAND	4	7	10	17					Rec: 30cm
	13	☒	SPT 11	Grey medium dense silty SAND	6	9	13	22					Rec: 25cm
	14	☒	SPT 12	Grey medium stiff clayey SILT with slightly sand	2	2	4	6					Rec: 28cm
	15	☒	SPT 13	Grey loose clayey SAND with slightly silt	2	3	7	10					Rec: 30cm
	16	☒	SPT 14	Grey medium dense clayey SAND with slightly silt	5	5	7	12					Rec: 24cm
	17	☒	SPT 15	Grey medium dense silty fine SAND	2	7	15	22					Rec: 30cm
	18	☒	SPT 16	Grey medium dense silty fine SAND	9	11	15	26					Rec: 30cm
	19	☒	SPT 17	Grey medium dense silty fine SAND	9	10	14	24					Rec: 27cm
	20												

Ground Instrumentation & Engineering

LEGEND:

- ▼ – Pressuremeter Test (PMT)
- Vane Shear Test (V)
- Permeability Test (PBT)
- Packer Test (PKT)
- ☒ – Standard Penetration Test (SPT)
- Undisturbed Sample (UD) / Open Drive Thickwall Sample (OD)
- Mazier Sample (MZ) / Denison Sample (DS)
- Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- TCR
- Core Run (CR)
- RQD

*WL – Ground Water Level observed from Borehole (BGL)

FIELD LOG
(ISO 22475-1:2006)

GIE Project ID: SI

Sheet 03 of 03

PROJECT: GI Works for Mubarraz Power Plant		BORING LOG: BH-04
CLIENT: TEPSCO	DRILL RIG MODEL: YWE RIG NO: 01	
CONTRACTOR: GIE	BOREHOLE DIA: 150mm	
LOCATION: Power Plant Area	DIA: N/A	
DRILLING DATE: 07.02.21	DRILLING METHOD: Rotary	NORTHING: 2480455.00
DRILLING ROD TYPE / SIZE: BQ/50mm	FLUSHING MEDIUM: Water	EASTING: 384901.06
HAMMER TYPE / S/NO: Autotrip	CASING DIA / LENGTH: 150 mm / 03 m	REDUCED LEVEL: 4.192
CAL. CERT. NO / DATE: N/A DRILLER: Jahangir	SITE ENGR: [illegible] CLIENT'S REP: [illegible] 07.02.21	∇ WL*: 2.40m

State	Depth (m) (Thickness)	Legend	Type & No	Description	Standard Penetration Test (1st / 2nd / 3rd 15cm)	SPT 'N' (blows / 30cm)	Rock TCR (%)	Rock SCR (%)	Rock RQD (%)	Geological Classification	Remarks
	20		SPT 18	Grey hard silty CLAY	9 / 15 / 27	42					Rec: 33cm
	21		SPT 19	Grey hard clayey SILT	13/15 / 29/15 / 27/13	50/28					Rec: 22cm
	22		SPT 20	Grey hard clayey SILT	11/15 / 21/15 / 29/15	50/27					Rec: 30cm
	23		SPT 21	Grey hard sandy SILT	14/15 / 23/15 / 27/10	50/25					Rec: 29cm
	24		SPT 22	Grey hard sandy SILT	16/15 / 29/15 / 22/6	50/21					↑ 06.02.21 07.02.21 ↓ Rec: 26cm
	25		SPT 23	Grey hard clayey SILT	24/15 / 41/15 / 9/2	50/17					Rec: 36cm
	26										
	27										
	28										
	29										
	30										

Ground Instrumentation & Engineering

LEGEND:

- ▼ – Pressuremeter Test (PMT)
- ◐ – Vane Shear Test (V)
- ⊗ – Permeability Test (PBT)
- ▤ – Packer Test (PKT)
- ▨ – Standard Penetration Test (SPT)
- ▨ – Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- ▨ – Mazier Sample (MZ) Denison Sample (DS)
- □ – Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- ■ – Piston Sample (PS)
- □ – TCR
- ▮ – Core Run (CR)
- ▩ – RQD

*WL - Ground Water Level observed from Borehole (BGL)

FIELD LOG
(ISO 22475-1:2006)

GIE Project ID: SI

Sheet 01 of 03

PROJECT: GI works for Maturkhali Power Plant		BORING LOG: BH-05
CLIENT: TEPSCO	DRILL RIG MODEL: YWE RIG NO: 02	
CONTRACTOR: GIE	BOREHOLE DIA: 100 mm	
LOCATION: Power Plant Area	DIA: N/A	
DRILLING DATE: 16.02.21	DRILLING METHOD: Rotary	NORTHING: 2400617.00
DRILLING ROD TYPE / SIZE: BW/50mm	FLUSHING MEDIUM: Water	EASTING: 384596.00
HAMMER TYPE / S/NO: Autotrip	CASING DIA / LENGTH: 100 mm / 6.0 m	REDUCED LEVEL: 4.532
CAL. CERT. NO / DATE: N/A	DRILLER: Jahangir SITE ENGR: CLIENT'S REP: 17.02.21	∇ WL*: 4.0m

Scale	Depth (m) (Thickness)	Legend	Type & No	Description	Standard Penetration Test: 1st 15cm	2nd 15cm	3rd 15cm	SPT N Value / 30cm	Rock: TCR (%)	SCR (%)	RQD (%)	Geological Classification	Remarks
	0												
	1		SPT 01	Grey very soft silty CLAY with lamination of sand (fill)	0	0	0	0					Rec: 20cm
	2		SPT 02	Grey very soft clayey SILT (fill)	0	1	1	2					Rec: 16cm
	3		UD 01	UD-01 sample taken from 3.0m to 4.0m depth									UD-01 Rec: 70cm
	4		SPT 03	Grey medium dense silty fine SAND	5	7	9	16					Rec: 28cm
	5		SPT 04	Grey very soft silty CLAY with traces of organic compound.	0	0	0	0					Rec: 34cm
	6		SPT 05	Grey very soft silty CLAY	0	0	0	0					Rec: 36cm
	7		UD 02	UD-02 sample taken from 7.0m to 8.0m depth									UD-02 Rec: 62cm
	8		SPT 06	Grey very soft silty CLAY with traces of organic compound	0	0	0	0					Rec: 33cm
	9		SPT 07	Grey very soft clayey SILT	0	0	0	0					Rec: 33cm
	10												

Ground Instrumentation & Engineering

LEGEND:

- ▼ – Pressuremeter Test (PMT)
- ⊗ – Permeability Test (PBT)
- ▤ – Packer Test (PKT)
- ⊠ – Standard Penetration Test (SPT)
- ▨ – Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- ▧ – Mazier Sample (MZ) Denison Sample (DS)
- □ – Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- ■ – Piston Sample (PS)
- ▮ – Core Run (CR)
- □ – TCR
- ▩ – RQD

*WL - Ground Water Level observed from Borehole (BGL)

FIELD LOG
(ISO 22475-1:2006)

GIE Project ID: SI

Sheet 02 of 03

PROJECT: GI Works		BORING LOG: BH-05
CLIENT: TEPSCO	DRILL RIG MODEL: YWE RIG NO: 02	
CONTRACTOR: GIE	BOREHOLE DIA: 100 mm	
LOCATION: Power Plant Area	DIA: N/A	
DRILLING DATE: 16.02.21	DRILLING METHOD: Rotary	NORTHING: 2600617.00
DRILLING ROD TYPE / SIZE: BW/50m	FLUSHING MEDIUM: Water	EASTING: 394596.00
HAMMER TYPE / S/NO: Autotrip	CASING DIA / LENGTH: 100 mm / 6.0 m	REDUCED LEVEL: 4.392
CAL. CERT. NO / DATE: N/A	DRILLER: Johangir SITE ENGR: [redacted] CLIENT'S REP: [redacted] 17.02.21	▽ WL* 4.0m

Scale	Depth (m) (Thickness)	Legend	Type & No	Description	Standard Penetration Test 1st (0cm)	2nd (15cm)	3rd (30cm)	SPT N (blows / 30cm)	Rock TCR (%)	SCR (%)	RQD (%)	Geological Classification	Remarks
	10		SPT 08	Grey very soft silty CLAY	0	0	2	2					Rec: 36cm
	11		UD 03	UD-03 taken from 11.0m to 12.0m depth									UD-03 Rec: 94cm
	12		SPT 09	Grey soft clayey SILT with lamination of sand	1	1	2	3					Rec: 35cm
	13		SPT 10	Grey very soft sandy SILT with lamination of clay	0	1	1	2					Rec: 41cm
	14		SPT 11	Grey medium stiff sandy SILT with slightly clay.	2	3	4	7					Rec: 42cm
	15		SPT 12	Grey medium stiff sandy SILT with slightly clay	2	2	3	5					Rec: 30cm
	16		SPT 13	Grey loose clayey SAND	1	1	4	5					Rec: 43cm
	17		SPT 14	Grey medium dense silty fine SAND	5	8	12	20					Rec: 25cm
	18		SPT 15	Grey medium dense silty fine SAND	12	14	18	32					Rec: 20cm
	19		SPT 16	Grey very dense silty fine SAND	18/15cm	37/15cm	13/6cm	50/21cm					Rec: 22cm
	20												

Ground Instrumentation & Engineering

LEGEND:

- ▼ – Pressuremeter Test (PMT)
- ◔ – Vane Shear Test (V)
- ⊗ – Permeability Test (PBT)
- ▤ – Packer Test (PKT)
- ⊠ – Standard Penetration Test (SPT)
- ▨ – Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- ▧ – Mazier Sample (MZ) Denison Sample (DS)
- □ – Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- ■ – Piston Sample (PS)
- ▮ – Core Run (CR)
- □ – TCR
- ▩ – RQD

*WL - Ground Water Level observed from Borehole (BGL)

FIELD LOG
(ISO 22475-1:2006)

GIE Project ID: SI

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PROJECT: GeI works for Meherpur Power Plant		BORING LOG: BH-05
CLIENT: TEPSCO	DRILL RIG MODEL: YWE RIG NO: 02	
CONTRACTOR: GIE	BOREHOLE DIA: 150mm	
LOCATION: Power Plant Area	DIA: N/A	
DRILLING DATE: 17.02.21	DRILLING METHOD: Rotary	NORTHING: 2400617.00
DRILLING ROD TYPE / SIZE: BW/50mm	FLUSHING MEDIUM: Water	EASTING: 384596.00
HAMMER TYPE / S/NO: Autotrip	CASING DIA / LENGTH: 100 mm / 6.0 m	REDUCED LEVEL: 4.932
CAL. CERT. NO / DATE: N/A DRILLER: Jahangir SITE ENGR:	CLIENT'S REP: 17.02.21	▽ WL: 5.0m

Scale	Depth (m) (Thickness)	Legend	Type & No.	Description	Standard Penetration Test 1st 15cm	2nd 15cm	3rd 15cm	SPT N Value / 30cm	Rock TCR (%)	SCR (%)	RQD (%)	Geological Classification	Remarks
	20		SPT 17	Grey very dense silty fine SAND	90 / 15cm	50 / 12cm	0 / 0cm	50 / 12cm					Rec: 18cm
	21		SPT 18	Grey very dense silty fine SAND	14	22	28	50					Rec: 28cm ↑ 16.02.21 17.02.21 ↓
	22		SPT 19	Grey very dense silty fine SAND	12 / 15cm	21 / 15cm	29 / 15cm	50 / 28cm					Rec: 32cm
	23		SPT 20	Grey very dense silty fine SAND with lamination of clay	17 / 15cm	50 / 15cm	0 / 0cm	50 / 15cm					Rec: 28cm
	24												
	25												
	26												
	27												
	28												
	29												
	30												

Ground Instrumentation & Engineering

LEGEND:

- ▼ – Pressuremeter Test (PMT)
- ◔ – Vane Shear Test (V)
- ⊗ – Permeability Test (PBT)
- ▤ – Packer Test (PKT)
- ☒ – Standard Penetration Test (SPT)
- ▨ – Undisturbed Sample (UD) / Open Drive Thickwall Sample (OD)
- ▧ – Mazier Sample (MZ) / Denison Sample (DS)
- □ – Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- ■ – Piston Sample (PS)
- ▮ – Core Run (CR)
- □ – TCR
- ▩ – RQD

*WL - Ground Water Level observed from Borehole (BGL)

FIELD LOG
(ISO 22475-1:2006)

GIE Project ID: SI

Sheet 01 of 03

PROJECT: GI WORKS for Matarbari Power plant			**BORING LOG:** BH-06
CLIENT: TEPSCO	DRILL RIG MODEL: PRD	RIG NO: 01	
CONTRACTOR: GIE	BOREHOLE DIA: 150 mm		
LOCATION: Power plant Area	DIA: N/A		
DRILLING DATE: 08.02.2021	DRILLING METHOD: Rotary		NORTHING: 2400493.00
DRILLING ROD TYPE / SIZE: BW / 50 mm	FLUSHING MEDIUM: Water		EASTING: 384316.00
HAMMER TYPE / S/NO: Autotrip	CASING DIA / LENGTH: 150 mm / 6.0 m		REDUCED LEVEL: 7.179
CAL. CERT. NO / DATE: N/A DRILLER: masud	SITE ENGR: [signature]	CLIENT'S REP: [signature]	WL*: 2.20 m

Scale	Depth (m) (Thickness)	Legend	Type & No	Description	1st 15cm	2nd 15cm	3rd 15cm	SPT N Blows / 30cm	TCR (%)	SCR (%)	RQD (%)	Geological Classification	Remarks
	0												
	1		SPT 01	Grey very Loose silty fine SAND with traces of shell fragments. (fill)	1	1	1	2					Rec = 24cm
	2		SPT 02	Grey very Loose silty fine SAND with traces of shell fragments (fill)	1	1	2	3					Rec = 29cm
	3		SPT 03	Grey Loose silty fine SAND (fill)	2	2	3	5					Rec = 18cm
	4		SPT 04	Grey very Loose silty fine SAND with slightly clay. (fill)	0	1	2	3					Rec = 25cm
	5		SPT 05	Light Brown medium dense silty fine SAND with traces of mica. (fill)	4	5	7	12					Rec = 29cm
	6		SPT 06	Light Brown Dense fine SAND with traces of mica. (fill)	7	16	16	32					Rec = 22cm
	7		SPT 07	Brown medium stiff silty CLAY.	2	2	4	6					Rec = 23cm
	8		UD 01	UD-01 sample taken from 8.0-9.0m depth									UD-01 Rec = 80cm
	9		SPT 08	Dark grey very soft silty CLAY	0	0	0	0					Rec = 30cm
	10												

Remarks column note: (Always Record Water level during SPT, SPT Recovery, Breakdown of rod after every 20 SPT, UD Recovery)

Ground Instrumentation & Engineering

LEGEND:
- Pressuremeter Test (PMT)
- Vane Shear Test (V)
- Permeability Test (PIT)
- Packer Test (PKT)
- Standard Penetration Test (SPT)
- Undisturbed Sample (UD) / Open Drive Thickwall Sample (OD)
- Mazier Sample (MZ) / Denison Sample (DS)
- Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- TCR
- Core Run (CR)
- RQD

*WL - Ground Water Level observed from Borehole (BGL)

FIELD LOG
(ISO 22475-1:2006)

GIE Project ID: SI

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PROJECT: GI WORKS for matarbari Power plant			BORING LOG: BH-06
CLIENT: TEPSCO	DRILL RIG MODEL:	RIG NO: 01	
CONTRACTOR: GIE	BOREHOLE DIA:	150 mm	
LOCATION: Power plant Area	DIA: N/A		
DRILLING DATE: 08.02.2021	DRILLING METHOD: Rotary		NORTHING: 2400493.00
DRILLING ROD TYPE / SIZE: BW / 50mm	FLUSHING MEDIUM: Water		EASTING: 384916.00
HAMMER TYPE / S/NO: Auto trip	CASING DIA / LENGTH: 150 mm / 6.0 m		REDUCED LEVEL: 7.179
CAL. CERT. NO / DATE: N/A DRILLER: MASUD	SITE ENGR: Rez	CLIENT'S REP: 11.02.21	▽ WL*: 3.0 m

Note	Depth (m) (Thickness)	Legend	Type & No	Description	Standard Penetration Test: 1st (15cm)	2nd (30cm)	3rd (45cm)	SPT N Value / Shear Strength	Rock: TCR (%)	SCR (%)	RQD (%)	Geological Classification	Remarks
	10		UD 02	UD-02 sample taken from 10.0 – 11.0 m depth									UD-02 Rec = 90cm
	11		SPT 09	Dark grey very soft silty CLAY.	1	1	1	2					Rec = 29cm ↑ 08.02.21 09.02.21
	12		SPT 10	Grey very soft silty CLAY	1	1	1	2					Rec = 36cm
	13		SPT 11	Grey Soft silty CLAY	1	1	2	3					Rec = 29cm
	14		UD 03	UD-03 sample taken from 14.0 to 15.0m depth									UD-03 Rec = 85cm
	15		SPT 12	Grey medium stiff silty CLAY.	2	3	3	6					Rec = 24cm
	16		SPT 13	Grey medium dense silty SAND with slightly clay.	6	6	7	13					Rec = 19cm
	17		SPT 14	Grey very dense silty SAND with traces of mica.	11/15	21/15	29/14	50/29					Rec = 25cm
	18		SPT 15	Grey very dense silty SAND.	14/15	24/15	26/14	50/29					Rec = 23cm
	19		SPT 16	Grey medium dense silty SAND with slightly clay.	6	16	11	27					Rec = 22cm
	20												

General Instrumentation & Engineering

LEGEND:

- ▼ – Pressuremeter Test (PMT)
- ⊗ – Vane Shear Test (V)
- ⊗ – Permeability Test (PBT)
- ▤ – Packer Test (PKT)
- ⊠ – Standard Penetration Test (SPT)
- ▨ – Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- ▧ – Mazier Sample (MZ) Denison Sample (DS)
- □ – Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- ■ – Piston Sample (PS)
- ▮ – Core Run (CR)
- □ – TCR
- ▩ – RQD

*WL - Ground Water Level observed from Borehole (BGL)

FIELD LOG
(ISO 22475-1:2006)

GIE Project ID: SI

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PROJECT: GI Works for Matarbari Power Plant			**BORING LOG:** BH-06
CLIENT: TEPSCO	DRILL RIG MODEL: PRD	RIG NO: 01	
CONTRACTOR: GIE	BOREHOLE DIA: 150 mm		
LOCATION: Power Plant Area	DIA: N/A		
DRILLING DATE: 09.02.2021	DRILLING METHOD: Rotary		NORTHING: 2400499.10
DRILLING ROD TYPE / SIZE: BW / 50 mm	FLUSHING MEDIUM: Water		EASTING: 384316.05
HAMMER TYPE / S/NO: Autotrip	CASING DIA / LENGTH: 152 mm / 6.0 m		REDUCED LEVEL: 7.179
CAL. CERT. NO / DATE: N/A DRILLER: Masud	SITE ENGR: Raza	CLIENT'S REP: [signature] 09.02.21	WL*: 3.0 m

Scale	Depth (m) (Thickness)	Legend	Type & No	Description	Standard Penetration Test: 1st 15cm	2nd 15cm	3rd 15cm	SPT N (Blows / 30cm)	Rock: TCR (%)	SCR (%)	RQD (%)	Geological Classification	Remarks (At Ground Water level during SPT, SPT Recovery, Penetration of cut after every 50 SPT, UD Recovery)
	20		SPT 17	Grey Loose silty SAND with slightly clay	2	2	4	6					Rec = 30 cm
	21		SPT 18	Grey medium dense silty SAND.	5	7	15	22					Rec = 29 cm
	22		SPT 19	Grey medium dense silty SAND.	2	2	9	11					Rec = 44 cm
	23		SPT 20	Grey medium dense silty SAND.	2	8	8	16					Rec = 22 cm
	24		SPT 21	Grey hard sandy SILT.	11/15	23/15	27/12	50/27					Rec = 25 cm
	25		SPT 22	Grey hard sandy SILT.	16/15	33/15	17/7	50/22					Rec = 26 cm
	26		SPT 23	Grey hard sandy SILT.	12/15	24/15	26/11	50/26					Rec = 30 cm ↑09.02.21 10.02.21↓
	27		SPT 24	Grey hard sandy SILT	10/15	21/15	29/13	50/28					Rec = 31 cm
	28		SPT 25	Grey hard sandy SILT	17/15	34/15	16/7	50/22					Rec = 25 cm
	29												
	30												

Ground Instrumentation & Engineering

LEGEND:

- ▼ – Pressuremeter Test (PMT)
- Vane Shear Test (V)
- Permeability Test (PBT)
- Packer Test (PKT)
- Standard Penetration Test (SPT)
- Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- Mazier Sample (MZ) Denison Sample (DS)
- Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- TCR
- Core Run (CR)
- RQD

*WL – Ground Water Level observed from Borehole (BGL)

FIELD LOG
(ISO 22475-1:2006)

GIE Project ID: SI

Sheet 01 of 03

PROJECT: GI Works for Matarbari Power Plant		BORING LOG: BH-07
CLIENT: TEPSCO	DRILL RIG MODEL: PRD RIG NO: 01	
CONTRACTOR: GIE	BOREHOLE DIA: CORE 150mm	
LOCATION: Power Plant Area	DIA: N/A	
DRILLING DATE: 18.02.2021	DRILLING METHOD: Rotary	NORTHING: 2400624.00
DRILLING ROD TYPE / SIZE: BW/ 50mm	FLUSHING MEDIUM: Water	EASTING: 384147.00
HAMMER TYPE / S/NO: Auto trip	CASING DIA / LENGTH: 150 mm / 6.0 m	REDUCED LEVEL: 6.774
CAL. CERT. NO / DATE: N/A DRILLER: Masud	SITE ENGR: Rony CLIENT'S REP:	WL*: 4.5 m

Scale	Depth (m) (Thickness)	Legend	Type & No	Description	1st 15cm	2nd 15cm	3rd 15cm	SPT N blows / 30cm	TCR (%)	SCR (%)	RQD (%)	Geological Classification	Remarks
	0												
	1	☒	SPT 01	Light brown medium dense silty SAND. (fill)	5	8	9	17					Rec=24cm
	2	☒	SPT 02	Light Brown medium dense silty SAND. (fill)	5	8	10	18					Rec=21cm
	3	☒	SPT 03	Light Brown medium dense silty SAND with traces of shell fragments (fill)	3	5	6	11					Rec=23cm
	4	☒	SPT 04	Light brown Loose silty SAND with traces of shell fragments, (fill)	3	5	5	10					Rec=27cm
	5	☒	SPT 05	Brownish grey dense silty SAND. (fill)	9	17	17	34					Rec=31cm
	6	☒	SPT 06	Grey Loose silty SAND with slightly clay.	1	2	4	6					Rec=24cm
	7	☒	SPT 07	yellowish brown to grey medium stiff CLAY with slightly sand.	2	3	4	7					Rec=22cm
	8	☒	SPT 08	Grey very soft silty CLAY.	0	0	2	2					Rec=36cm
	9	▨	UD 01	UD-01 sample taken from 9.0-10.0 m depth.									UD-01 Rec=80cm
	10												

Remarks: (Always Record Water level during SPT, SPT Recovery, Sample size and after every 20 SPT, 1st Recovery)

Ground Instrumentation & Engineering

LEGEND:
- ▼ – Pressuremeter Test (PMT)
- Vane Shear Test (V)
- ⊗ – Permeability Test (PBT)
- Packer Test (PKT)
- ☒ – Standard Penetration Test (SPT)
- Undisturbed Sample (UD) / Open Drive Thickwall Sample (OD)
- Mazier Sample (MZ) / Denison Sample (DS)
- Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- TCR
- Core Run (CR)
- RQD

*WL - Ground Water Level observed from Borehole (BGL)

FIELD LOG
(ISO 22475-1:2006)

GIE Project ID: SI

Sheet 02 of 03

PROJECT: GI WORKS for Matarbari Power Plant			BORING LOG: BH-07
CLIENT: TEPSCO	DRILL RIG MODEL: PRD	RIG NO: 01	
CONTRACTOR: GIE	BOREHOLE DIA: CORE: 150 mm		
LOCATION: Power Plant Area	DIA: N/A		
DRILLING DATE: 18.02.2021	DRILLING METHOD: Rotary		NORTHING: 2450624.00
DRILLING ROD TYPE / SIZE: BW/ 50 mm	FLUSHING MEDIUM: Water		EASTING: 384147.60
HAMMER TYPE / S/NO: Autotrip	CASING DIA / LENGTH: 150 mm / 6'0" m		REDUCED LEVEL: 6.774
CAL. CERT. NO / DATE: N/A	DRILLER: MASUD	SITE ENGR: Rock	CLIENT'S REP: 20.02.21

Scale	Depth (m) (Thickness)	Legend	Type & No	Description	Standard Penetration Test: 1st (0cm)	2nd (15cm)	3rd (30cm)	SPT N (blows / 30cm)	Rock: TCR (%)	SCR (%)	RQD (%)	Geological Classification	Remarks
	10		SPT 09	Grey very soft silty CLAY. with traces of sand.	0	0	0	0					Rec=39cm
	11		SPT 10	Grey loose clayey SAND.	1	3	5	8					Rec=23cm
	12		SPT 11	Grey dense silty SAND.	12	12	23	35					Rec=25cm
	13		SPT 12	Grey medium dense silty SAND with slightly clay.	4	5	10	15					Rec=23cm
	14		SPT 13	Grey dense silty SAND.	15	20	21	41					Rec=20cm
	15		SPT 14	Grey dense silty SAND.	12	18	27	45					Rec=25cm
	16		SPT 15	Grey Medium dense silty SAND.	10	12	12	24					Rec=20cm
	17		SPT 16	Grey medium dense silty SAND.	7	13	14	27					Rec=19cm
	18		SPT 17	Grey very dense silty fine SAND	21/15	40/15	10/4	50/19					Rec=19cm 18.02.21 20.02.21
	19		SPT 18	Grey very dense silty fine SAND.	17/15	38/15	12/5	50/20					Rec=17cm
	20												

Ground Instrumentation & Engineering

LEGEND:

- ▼ – Piezometer Test (PMT)
- ⊗ – Vane Shear Test (V)
- ⊗ – Permeability Test (PBT)
- ▤ – Packer Test (PKT)
- ☒ – Standard Penetration Test (SPT)
- ▨ – Undisturbed Sample (UD) Open Drive Thinwall Sample (OD)
- ▨ – Mazier Sample (MZ) Denison Sample (DS)
- □ – Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- ■ – Piston Sample (PS)
- ▯ – Core Run (CR)
- ▯ – TCR
- ▩ – RQD

*WL - Ground Water Level observed from Borehole (BGL)

FIELD LOG
(ISO 22475-1:2006)

GIE Project ID: SI

Sheet 03 of 03

PROJECT: GeI Works for Matarbari Power Plant		BORING LOG: BH-07
CLIENT: TEPSCO	DRILL RIG MODEL: PRD RIG NO: 01	
CONTRACTOR: GIE	BOREHOLE DIA: CORE: 150 mm	
LOCATION: Power Plant Area	DIA: N/A	
DRILLING DATE: 20.02.2021	DRILLING METHOD: Rotary	NORTHING: 2450624.00
DRILLING ROD TYPE / SIZE: BW/ 50 mm	FLUSHING MEDIUM: Water	EASTING: 384147.00
HAMMER TYPE / S/NO: Autotrip	CASING DIA / LENGTH: 150 mm / 6.81 m	REDUCED LEVEL: 6.774
CAL. CERT. NO / DATE: N/A	DRILLER: Majid SITE ENGR: Rais CLIENT'S REF: 20.02	▽ WL*: 6.0 m

Scale	Depth (m) / (Thickness)	Legend	Type & No.	Description	Standard Penetration Test: 1st 15cm	2nd 15cm	3rd 15cm	SPT N blows / 30cm	Rock: TCR (%)	SCR (%)	RQD (%)	Geological Classification	Remarks (Always Record Water level during SPT, SPT Recovery, Completion of bed after every 50 SPT, UD Recovery)
	20		SPT 19	Grey very dense silty fine SAND.	35/15	50/12	0/0	50/12					Ree=18cm
	21		MZ 01	MZ-01 sample taken from 21.0 – 22.0 m depth									MZ-01 Ree=58cm
	22		SPT 20	Grey very dense silty fine SAND.	20/15	31/15	19/8	50/23					Ree=21cm
	23		SPT 21	Grey very dense silty fine SAND.	15/15	28/15	22/9	50/24					Ree=18cm
	24												
	25												
	26												

Ground Instrumentation & Engineering

LEGEND:

- ▼ – Pressuremeter Test (PMT)
- – Vane Shear Test (V)
- ⊗ – Permeability Test (PRT)
- – Packer Test (PKT)
- – Standard Penetration Test (SPT)
- – Undisturbed Sample (UD) Open Drive Thickwall Sample (OD)
- – Mazier Sample (MZ) Denison Sample (DS)
- – Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- – Piston Sample (PS)
- – Core Run (CR)
- – TCR
- – RQD

*WL - Ground Water Level observed from Borehole (BGL)

FIELD LOG
(ISO 22475-1:2006)

GIE Project ID: SI

Sheet 01 of 03

PROJECT: GI works for Matarbari Power Plant		**BORING LOG:** BH-08
CLIENT: TEPSCO	DRILL RIG MODEL: YWE RIG NO: 02	
CONTRACTOR: GIE	BOREHOLE DIA: ~~CORE~~ 100mm	
LOCATION: Power Plant Area	DIA: N/A	
DRILLING DATE: 18.02.21	DRILLING METHOD: Rotary	NORTHING: 2400763.00
DRILLING ROD TYPE / SIZE: BW / 50mm	FLUSHING MEDIUM: Water	EASTING: 383978.00
HAMMER TYPE / S/NO: Autotrip	CASING DIA / LENGTH: 100 mm / 6.0 m	REDUCED LEVEL: 5.885
CAL. CERT. NO / DATE: N/A DRILLER: Jahangir	SITE ENGR: ~~[illegible]~~ CLIENT'S REP: [signature] 20.02.21	WL*: 4.0m

Scale	Depth (m) (Thickness)	Legend	Type & No.	Description	SPT 1st 15cm	SPT 2nd 15cm	SPT 3rd 15cm	SPT N (blows/30cm)	TCR (%)	SCR (%)	RQD (%)	Geological Classification	Remarks
	0												
	1	⊠	SPT 01	Brownish grey medium dense SAND with rubbish (fill)	5	6	7	13					Rec: 33cm
	2	⊠	SPT 02	Brownish grey loose SAND with rubbish (fill)	1	2	3	5					Rec: 35cm
	3	⊠	SPT 03	Brownish grey very loose silty fine to medium SAND with shell fragments (fill)	0	0	1	1					Rec: 28cm
	4	⊠	SPT 04	Grey medium dense silty fine to medium SAND (fill)	7	9	10	19					Rec: 18cm
	5	⊠	SPT 05	Grey very soft silty CLAY	0	1	1	2					Rec: 34cm
	6	⊠	SPT 06	Reddish brownish grey silty CLAY	2	3	5	8					Rec: 26cm
	7	⊠	SPT 07	Brownish grey silty CLAY	1	2	2	4					Rec: 29cm
	8	⊠	SPT 08	Grey medium dense silty SAND	8	14	11	25					Rec: 23cm
	9	⊠	SPT 09	Grey soft sandy CLAY	1	1	2	3					Rec: 37cm
	10												

Remarks column heading: (Always Record Water level during SPT, SPT Recovery, Weightless or bad after every 3m SPT, UD Recovery)

Ground Instrumentation & Engineering

LEGEND:

- ▼ – Pressuremeter Test (PMT)
- Vane Shear Test (V)
- ⊗ – Permeability Test (PBT)
- Packer Test (PKT)
- ⊠ – Standard Penetration Test (SPT)
- Undisturbed Sample (UD) / Open Drive Thickwall Sample (OD)
- Marker Sample (MZ) / Denison Sample (DS)
- ☐ – Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- Core Run (CR)
- ☐ – TCR
- RQD

*WL – Ground Water Level observed from Borehole (BGL)

FIELD LOG
(ISO 22475-1:2006)

GIE Project ID: SI   Sheet 02 of 03

PROJECT: GI works for Matarbari Power Plant		BORING LOG: BH-08
CLIENT: TEPSCO	DRILL RIG MODEL: YWE RIG NO: 02	
CONTRACTOR: GIE	BOREHOLE DIA: ~~CORE~~ 100mm	
LOCATION: Power Plant Area	DIA: N/A	
DRILLING DATE: 18.02.21	DRILLING METHOD: Rotary	NORTHING: 2400763.00
DRILLING ROD TYPE / SIZE: BW/50mm	FLUSHING MEDIUM: Water	EASTING: 383378.00
HAMMER TYPE / S/NO: Autotrip	CASING DIA / LENGTH: 100 mm / 6.0 m	REDUCED LEVEL: 5.885
CAL. CERT. NO / DATE: N/A DRILLER: Jahangir	SITE ENGR: — CLIENT'S REP: [signature] 20.02.21	WL*: 4.0m

Scale	Depth (m) (Thickness)	Legend	Type & №	Description	SPT 1st 15cm	SPT 2nd 15cm	SPT 3rd 15cm	SPT N Blows / 30cm	TCR (%)	SCR (%)	RQD (%)	Geological Classification	Remarks (Always Record Water level during SPT, SPT Recovery, Straightness of rod after every 20 SPT, UD Recovery)
	10	⊠	SPT 10	Grey medium dense silty fine SAND	5	13	16	29					Rec: 28cm
	11	⊠	SPT 11	Grey medium dense silty fine SAND	8	8	14	22					Rec: 25cm
	12	⊠	SPT 12	Grey medium dense silty fine SAND	7	11	13	24					Rec: 24cm
	13	⊠	SPT 13	Grey dense silty fine SAND	12	12	19	31					Rec: 28cm
	14	⊠	SPT 14	Grey medium dense silty fine to medium SAND	5	6	17	23					Rec: 35cm
	15	⊠	SPT 15	Grey dense silty fine SAND	12	17	20	37					Rec: 24cm ↑ 18-02-21 20-02-21 ↓
	16	⊠	SPT 16	Grey dense silty fine SAND	12	14	18	32					Rec: 20cm
	17	⊠	SPT 17	Grey dense silty SAND with clay lamination	6	10	23	33					Rec: 31cm
	18	⊠	SPT 18	Grey very dense silty fine SAND	14 / 15cm	28 / 15cm	22 / 12cm	50 / 27cm					Rec: 21cm
	19	⊠	SPT 19	Grey very dense silty fine SAND	31 / 15cm	41 / 15cm	9 / 5cm	50 / 20cm					Rec: 18cm
	20												

Ground Instrumentation & Engineering

LEGEND:

- ▼ – Pressuremeter Test (PMT)
- Vane Shear Test (V)
- ⊗ – Permeability Test (PBT)
- Packer Test (PKT)
- ⊠ – Standard Penetration Test (SPT)
- Undisturbed Sample (UD) / Open Drive Thickwall Sample (OD)
- Mazier Sample (MZ) / Denison Sample (DS)
- ☐ – Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- ☐ – TCR
- Core Run (CR)
- RQD

*WL - Ground Water Level observed from Borehole (BGL)

FIELD LOG
(ISO 22475-1:2006)

GIE Project ID: SI

Sheet 09 of 09

PROJECT: GI Works for Matarbari Power Plant		**BORING LOG:** BH-08
CLIENT: TEPSCO	DRILL RIG MODEL: YWE RIG NO: 02	
CONTRACTOR: GIE	BOREHOLE DIA: 100mm	
LOCATION: Power Plant Area	DIA: N/A	
DRILLING DATE: 20.02.21	DRILLING METHOD: Rotary	NORTHING: 2400763.00
DRILLING ROD TYPE / SIZE: BW/50mm	FLUSHING MEDIUM: Water	EASTING: 383978.00
HAMMER TYPE / S/NO: Autotrip	CASING DIA / LENGTH: 100 mm / 6.0 m	REDUCED LEVEL: 5.885
CAL. CERT. NO / DATE: N/A DRILLER: Jahangir	SITE ENGR: [signature] CLIENT'S REP: [signature] 20.02.21	WL*: 5.0m

Scale	Depth (m) (Thickness)	Legend	Type & No	Description	SPT 1st 15cm	SPT 2nd 15cm	SPT 3rd 15cm	SPT N Blows / 30cm	TCR (%)	SCR (%)	RQD (%)	Geological Classification	Remarks
	20	☒	SPT 20	Grey very dense silty fine SAND	16 / 15cm	23 / 15cm	27 / 12cm	50 / 27cm					Rec: 24cm
	21	☒	SPT 21	Grey very dense silty fine SAND	20 / 15cm	36 / 15cm	14 / 6cm	50 / 21cm					Rec: 21cm
	22	☒	SPT 22	Grey very dense silty fine SAND	28 / 15cm	50 / 13cm	0 / 0cm	50 / 13cm					Rec: 19cm
	23												
	24												
	25												
	26												
	27												
	28												
	29												
	30												

Remarks: (Always Record Water level during SPT, SPT Recovery, Designation of soil after every 3rd SPT, UD Recovery)

Ground Instrumentation & Engineering

LEGEND:
- Pressuremeter Test (PMT)
- Vane Shear Test (V)
- Permeability Test (PBT)
- Packer Test (PKT)
- Standard Penetration Test (SPT)
- Undisturbed Sample (UD) / Open Drive Thickwall Sample (OD)
- Mazier Sample (MZ) / Denison Sample (DS)
- Attempted (UD*), (OD*), (PS*), (MZ*) & (DS*)
- Piston Sample (PS)
- TCR
- Core Run (CR)
- RQD

*WL- Ground Water Level observed from Borehole (BGL)

APPENDIX B

TEST RESULT

APPENDIX B (i)

Summary of Laboratory Test Result

Ground Instrumentation & Engineering Pte.Ltd.

Geotechnical Investigation for Matarbari Project

SUMMARY OF TEST RESULTS

Client: TEPSCO

BH No.: BH-01

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Sample No.				SPT-02	SPT-05	UD-01	UD-02	SPT-12	SPT-17	SPT-24
Depth (m)			from	2.00	5.00	7.00	10.00	14.00	19.00	26.00
			to	2.45	5.45	8.00	11.00	14.45	19.45	26.45
Classification Test										
Moisture Content:			%	12.58	14.29	35.79	26.73	21.62	24.66	22.40
Atterberg Limits	Liquid Limit		%			42.70	50.60		28.50	
	Plastic Limit		%			23.18	27.07		16.96	
	Plasticity Index		%			19.52	23.53		11.54	
Particle Size Distribution (Sieve)	Gravel		%	0.00	0.00			0.00	0.00	0.00
	Sand		%	82.08	75.94			69.94	38.36	3.00
	Silt/Clay		%	17.92	24.06			30.06	61.64	97.00
Particle Size Distribution (Hydrometer)	Gravel		%	0.00	0.00			0.00	0.00	0.00
	Sand		%	82.82	75.84			70.54	39.96	4.02
	Silt		%	14.00	19.38			23.09	44.12	75.29
	Clay		%	3.18	4.78			6.37	15.92	20.69
Specific Gravity				2.66	2.67	2.73	**2.68**	**2.72**	2.69	2.73
Bulk Density			g/cm^3			1.81	1.88			
Dry Density			g/cm^3			1.33	1.48			
Soil Strength Test										
Unconfined Compression	Shear Strength		kPa			58.93	**29.5**			
	Phi angle		°							
Direct Shear	Cohesion		kPa	#						
	Phi angle		°	#				**38**		
Triaxial Compression (UU)	Shear Strength		kPa			60.10	**97 to 116**			
	Phi angle		°			0.00				
Soil Deformation Test										
Consolidation	Initial Void Ratio					1.21	0.903			
	Degree of Saturation		%			74.9	88			
	Preconsolidation pressure, PC		kPa			176	65			
	Compression Index, Cc					0.5298	0.2474			
Compaction	Maximum Dry Density		g/cm^3							
	Optimum MC		%							
Chemical Analysis Test										
SOIL	pH					4.3				
	Chloride Content (acid-extract)		%			0.69				
	Sulfate Content (acid-extract)		%			0.51				
WATER	pH									
	Chloride content (in groundwater)		g/l							
	Sulfate content (as SO_4)		g/l							

Legend:			
	UC- Unconfined Compression UU- Unconsolidated Undrained CIU-Consolidated Isotropic Undrained CID-Consolidated Isotropic Drained	DST - Direct Shear OED - Oedometer	**Remarks:** *Sample is non plastic "#" Test on fill layer

N.B.: Test performed at GIE Laboratory (Denoted by black color)
Test performed at BUET (Denoted by red color)

BUET update their previous UU test result at UD-02

Ground Instrumentation & Engineering Pte.Ltd.

Geotechnical Investigation for Matarbari Project

SUMMARY OF TEST RESULTS

Client: TEPSCO

BH No.: BH-02

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Sample No.			SPT-01	SPT-02	UD-01	UD-02	SPT-09	SPT-10	SPT-13	SPT-18	SPT-21	SPT-23
Depth (m)		from	1.00	2.00	6.00	8.00	11.00	12.00	15.00	20.00	23.00	25.00
		to	1.45	2.45	7.00	9.00	11.45	12.45	15.45	20.45	23.45	25.45
Soil Classification Test												
Moisture Content:		%		20.71	50.08	37.30	37.55		26.92	25.04	16.93	15.67
Atterberg Limits	Liquid Limit	%			47.10	32.40	36.30		25.50			
	Plastic Limit	%			27.22	19.22	19.61		16.08			
	Plasticity Index	%			19.88	13.18	16.69		9.42			
Particle Size Distribution (Sieve)	Gravel	%		0.00					0.00		0.00	0.00
	Sand	%		95.90					35.86		85.44	86.00
	Silt/Clay	%		4.10					64.14		14.56	14.00
Particle Size Distribution (Hydrometer)	Gravel	%		0.00			0.00	0.00	0.00	0.00	0.00	0.00
	Sand	%		95.18			4.12	24.36	36.38	33.34	85.00	85.74
	Silt	%		4.82			68.82	53.36	46.11	52.33	12.45	12.03
	Clay	%					27.06	22.28	17.51	14.33	2.55	2.23
Specific Gravity				2.65	**2.72**	2.70	2.69		2.69		2.66	**2.78**
Bulk Density		g/cm^3			1.76	1.74						
Dry Density		g/cm^3			1.18	1.27						
Soil Strength Test												
Unconfined Compression	Shear Strength	kPa			**59.16**	48.28						
	Phi angle	°										
Direct Shear	Cohesion	kPa		0.00							3.65	
	Phi angle	°		26.30							34.8	**40**
Triaxial Compression (UU)	Shear Strength	kPa			32 to 39	46.4						
	Phi angle	°				0.00						
Soil Deformation Test												
Consolidation	Initial Void Ratio				1.234	1.038						
	Degree of Saturation	%			100	98.5						
	Preconsolidation pressure, PC	kPa			101	147						
	Compression Index, Cc				0.257	0.2503						
Compaction	Maximum Dry Density	g/cm^3	1.555									
	Optimum MC	%	15.6									
Chemical Analysis Test												
SOIL	pH				4.3							
	Chloride Content (acid-extract)	%			0.43							
	Sulfate Content (acid-extract)	%			0.27							
WATER	pH		6.8									
	Chloride	g/l	7.7									
	Sulphate	g/l	1.424									

Legend:	UC- Unconfined Compression UU- Unconsolidated Undrained CIU-Consolidated Isotropic Undrained CID-Consolidated Isotropic Drained	DST - Direct Shear OED - Oedometer	**Remarks:** *Sample is non plastic

N.B.: Test performed at GIE Laboratory (Denoted by black color)
Test performed at BUET (Denoted by red color)

BUET update their previous UU test result at UD-01

Geotechnical Investigation for Matarbari Project

SUMMARY OF TEST RESULTS

Client: TEPSCO

BH No.: BH-03

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Sample No.			SPT-01	SPT-02	SPT-04	UD-01	UD-02	MZ-01	SPT-15	SPT-18	SPT-20	MZ-02
Depth (m)		from	1.00	2.00	4.00	8.00	12.00	17.00	18.00	21.00	23.00	27.00
		to	1.45	2.45	4.45	9.00	13.00	18.00	18.45	21.45	23.45	27.45
Classification Test												
Moisture Content:		%		20.14	17.70	34.31	25.97	32.69	30.32		24.50	18.73
Atterberg Limits	Liquid Limit	%				34.50	*		25.30			
	Plastic Limit	%				20.59	*		16.67			
	Plasticity Index	%				13.91	*		8.63			
Particle Size Distribution (Sieve)	Gravel	%		0.00	0.00		**0.00**	0.00			0.00	
	Sand	%		91.36	95.72		**79.08**	28.08			83.32	
	Silt/Clay	%		8.64	4.28		**20.92**	71.92			16.68	
Particle Size Distribution (Hydrometer)	Gravel	%		0.00	0.00		**0.00**	0.00	0.00	0.00	0.00	0.00
	Sand	%		91.24	95.50		**81.72**	27.22	31.88	4.94	83.76	92.78
	Silt	%		7.17	4.50		**13.50**	56.86	53.79	69.59	12.42	5.95
	Clay	%		1.59			**4.78**	15.92	14.33	25.47	3.82	1.27
Specific Gravity				2.65	**2.67**	**2.77**	2.67	2.70	2.69		2.66	2.65
Bulk Density		g/cm^3				1.82	1.91	1.92				1.84
Dry Density		g/cm^3				1.36	1.52	1.45				1.55
Soil Strength Test												
Unconfined Compression	Shear Strength	kPa				**55.67**	#					
	Phi angle	°										
Direct Shear	Cohesion	kPa						15.04				0.69
	Phi angle	°			**39**			21.90				30.30
Triaxial Compression (UU)	Shear Strength	kPa				47 to 51	#					
	Phi angle	°					#					
Soil Deformation Test												
Consolidation	Initial Void Ratio					1.03	0.75					
	Degree of Saturation	%				96.6	92.8					
	Preconsolidation pressure, PC	kPa				102	108					
	Compression Index, Cc					0.2657	0.0971					
Compaction	Maximum Dry Density	g/cm^3	1.552									
	Optimum MC	%	15.6									
Hydraulic Property Test												
Permeability Test		m/s						6.87E-09				
Chemical Analysis Test												
SOIL	pH						7.00					
	Chloride Content (acid-extract)	%					0.34					
	Sulfate Content (acid-extract)	%					0.08					
WATER	pH		6.7									
	Chloride	g/l	8.4									
	Sulphate	mg/l	1218									

Legend:			
	UC- Unconfined Compression UU- Unconsolidated Undrained CIU-Consolidated Isotropic Undrained CID-Consolidated Isotropic Drained	DST - Direct Shear OED - Oedometer	**Remarks:** *Sample is non plastic " #"= Test perform can not possible, because the sample is Sand in nature.

N.B.: Test performed at GIE Laboratory (Denoted by black color)
Test performed at BUET (Denoted by red color)
BUET update their previous UU test result at UD-01

Ground Instrumentation & Engineering Pte.Ltd.

Geotechnical Investigation for Matarbari Project

SUMMARY OF TEST RESULTS

Client: TEPSCO
BH No.: BH-04
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Sample No.				SPT-01	SPT-02	SPT-06	UD-02	SPT-08	SPT-12	SPT-15	SPT-18	SPT-22
Depth (m)			from	1.00	2.00	6.00	9.00	10.00	14.00	17.00	20.00	24.00
			to	1.45	2.45	6.45	10.00	10.45	14.45	17.45	20.45	24.45
Classification Test												
Moisture Content:			%		18.37	25.24	40.59	20.00	23.99	21.05	24.55	24.24
Atterberg Limits	Liquid Limit		%			28.80	32.50		26.80		42.80	*
	Plastic Limit		%			18.63	19.78		17.45		23.78	*
	Plasticity Index		%			10.17	12.72		9.35		19.02	*
Particle Size Distribution (Sieve)	Gravel		%		0.00			0.00		0.00		0.00
	Sand		%		71.74			36.36		82.88		41.02
	Silt/Clay		%		28.26			63.64		17.12		58.98
Particle Size Distribution (Hydrometer)	Gravel		%		0.00		0.00	0.00		0.00	0.00	0.00
	Sand		%		73.68		2.08	36.94		81.16	2.42	42.48
	Silt		%		19.95		75.64	45.55		13.43	81.66	47.97
	Clay		%		6.37		22.28	17.51		5.41	15.92	9.55
Specific Gravity					2.67	2.72	**2.77**	2.69	2.70	**2.71**	2.73	2.69
Bulk Density			g/cm^3				1.83					
Dry Density			g/cm^3				1.30					
Soil Strength Test												
Unconfined Compression	Shear Strength		kPa				**31.33**					
	Phi angle		°									
Direct Shear	Cohesion		kPa		1.15							
	Phi angle		°		33.7					**37**		
Triaxial Compression (UU)	Shear Strength		kPa				**34 to 64**					
	Phi angle		°									
Soil Deformation Test												
Consolidation	Initial Void Ratio						1.223					
	Degree of Saturation		%				100.0					
	Preconsolidation pressure, PC		kPa				134					
	Compression Index, Cc						0.4817					
Compaction	Maximum Dry Density		g/cm^3	1.598								
	Optimum MC		%	15.3								
Chemical Analysis Test												
SOIL	pH						7.5					
	Chloride Content (acid-extract)		%				0.36					
	Sulfate Content (acid-extract)		%				0.16					
WATER	pH			6.7								
	Chloride		g/l	8.79								
	Sulphate		g/l	1.60								

Legend:	UC- Unconfined Compression UU- Unconsolidated Undrained CIU-Consolidated Isotropic Undrained CID-Consolidated Isotropic Drained	DST - Direct Shear OED - Oedometer	**Remarks:** *Sample is non plastic "-": Test Progressing

N.B.: Test performed at GIE Laboratory (Denoted by black color)
Test performed at BUET (Denoted by red color)

Geotechnical Investigation for Matarbari Project

SUMMARY OF TEST RESULTS

Client: TEPSCO

BH No.: BH-05

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Sample No.			SPT-01	UD-01	UD-02	UD-03	SPT-11	SPT-14	SPT-18		
Depth (m)		from	1.00	3.00	7.00	11.00	14.00	17.00	21.00		
		to	1.45	4.00	8.00	12.00	14.45	17.45	21.45		
Classification Test											
Moisture Content:		%		38.20	37.70	28.79	32.53	20.66	22.13		
Atterberg Limits	Liquid Limit	%		36.60	30.80	27.40		*			
	Plastic Limit	%		23.29	19.26	18.02		*			
	Plasticity Index	%		13.31	11.54	9.38		*			
Particle Size Distribution (Sieve)	Gravel	%					0.00	0.00	0.00		
	Sand	%					15.90	55.00	43.38		
	Silt/Clay	%					84.10	45.00	56.62		
Particle Size Distribution (Hydrometer)	Gravel	%					0.00	0.00	0.00		
	Sand	%					16.24	54.82	44.12		
	Silt	%					67.84	37.22	46.33		
	Clay	%					15.92	7.96	9.55		
Specific Gravity				2.73	2.72	**2.77**	2.71	**2.69**	2.69		
Bulk Density		g/cm^3		1.86	1.83	1.90					
Dry Density		g/cm^3		1.35	1.33	1.48					
Soil Strength Test											
Unconfined Compression	Shear Strength	kPa		24.02	29.12	**26.83**					
	Phi angle	°									
Direct Shear	Cohesion	kPa							3.28		
	Phi angle	°						**37**	35.1		
Triaxial Compression (UU)	Shear Strength	kPa		21.3	27.2	41 to 75					
	Phi angle	°		0	0						
Soil Deformation Test											
Consolidation	Initial Void Ratio			0.932	1.035	1.002					
	Degree of Saturation	%		100	100	99.9					
	Preconsolidation pressure, PC	kPa		77	100	133					
	Compression Index, Cc			0.22	0.2664	0.2885					
Compaction	Maximum Dry Density	g/cm^3	1.66								
	Optimum MC	%	17.9								
Chemical Analysis Test											
SOIL	pH			7.4							
	Chloride Content (acid-extract)	%		0.46							
	Sulfate Content (acid-extract)	%		0.31							
WATER	pH										
	Chloride										
	Sulphate										

Legend:	UC- Unconfined Compression UU- Unconsolidated Undrained CIU-Consolidated Isotropic Undrained CID-Consolidated Isotropic Drained	DST - Direct Shear OED - Oedometer	**Remarks:** *Sample is non plastic

N.B.: Test performed at GIE Laboratory (Denoted by black color)
Test performed at BUET (Denoted by red color)

Ground Instrumentation & Engineering Pte.Ltd.

Geotechnical Investigation for Matarbari Project

SUMMARY OF TEST RESULTS

Client: TEPSCO

BH No.: BH-06

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Sample No.			SPT-06	UD-01	UD-03	SPT-18	SPT-23				
Depth (m)		from	6.00	8.00	14.00	21.00	26.00				
		to	6.45	9.00	15.00	21.45	26.45				
Classification Test											
Moisture Content:		%	17.57	34.18	35.55	26.21	23.76				
Atterberg Limits	Liquid Limit	%		27.60	32.30						
	Plastic Limit	%		17.97	19.58						
	Plasticity Index	%		9.63	12.72						
Particle Size Distribution (Sieve)	Gravel	%	0.00			0.00	0.00				
	Sand	%	91.42			38.70	6.04				
	Silt/Clay	%	8.58			61.30	93.96				
Particle Size Distribution (Hydrometer)	Gravel	%	0.00		0.00	0.00	0.00				
	Sand	%	93.08		4.98	37.54	6.56				
	Silt	%	4.69		72.74	49.73	74.34				
	Clay	%	2.23		22.28	12.73	19.10				
Specific Gravity			2.65	2.71	**2.79**	2.69	**2.80**				
Bulk Density		g/cm^3		1.86	1.89						
Dry Density		g/cm^3		1.39	1.40						
Soil Strength Test											
Unconfined Compression	Shear Strength	kPa		30.42	**25.33**						
	Phi angle	°									
Direct Shear	Cohesion	kPa	0.72			3.24					
	Phi angle	°	39.4			28.00	**33**				
Triaxial Compression (UU)	Shear Strength	kPa		25.3	**36 to 50**						
	Phi angle	°		0							
Soil Deformation Test											
Consolidation	Initial Void Ratio			0.948	0.986						
	Degree of Saturation	%		100	89.3						
	Preconsolidation pressure, PC	kPa		100	111						
	Compression Index, Cc			0.2442	0.2056						
Compaction	Maximum Dry Density	g/cm^3									
	Optimum MC	%									
Chemical Analysis Test											
SOIL	pH				7.5						
	Chloride Content (acid-extract)	%			0.44						
	Sulfate Content (acid-extract)	%			0.45						
WATER	pH		6.6								
	Chloride	g/l	17.56								
	Sulphate	g/l	1.96								

Legend:	UC- Unconfined Compression UU- Unconsolidated Undrained CIU-Consolidated Isotropic Undrained CID-Consolidated Isotropic Drained	DST - Direct Shear OED - Oedometer	**Remarks:** *Sample is non plastic

N.B.: Test performed at GIE Laboratory (Denoted by black color)
Test performed at BUET (Denoted by red color)

Geotechnical Investigation for Matarbari Project

SUMMARY OF TEST RESULTS

Client: TEPSCO

BH No.: BH-07

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Sample No.			SPT-01	SPT-03	SPT-06	SPT-07	UD-01	SPT-13	SPT-15	SPT-17	MZ-01
Depth (m)		from	1.00	3.00	6.00	7.00	9.00	14.00	16.00	18.00	21.00
		to	1.45	3.45	6.45	7.45	10.00	14.45	16.45	18.45	22.00
Classification Test											
Moisture Content:		%		16.66	22.48	28.13	30.53	18.23	24.45	21.21	19.28
Atterberg Limits	Liquid Limit	%				42.30	27.50				
	Plastic Limit	%				21.40	14.85				
	Plasticity Index	%				20.90	12.65				
Particle Size Distribution (Sieve)	Gravel	%		0.00	0.00			0.00	0.00		
	Sand	%		89.24	40.36			80.16	63.44		
	Silt/Clay	%		10.76	59.64			19.84	36.56		
Particle Size Distribution (Hydrometer)	Gravel	%		0.00	0.00		0.00	0.00	0.00	0.00	0.00
	Sand	%		90.12	41.50		22.54	81.24	63.04	85.68	92.74
	Silt	%		7.01	39.40		63.13	13.98	27.41	11.45	5.03
	Clay	%		2.87	19.10		14.33	4.78	9.55	2.87	2.23
Specific Gravity				2.65	2.69		2.77	2.66	2.67	2.67	2.65
Bulk Density		g/cm^3					1.90				1.96
Dry Density		g/cm^3					1.45				1.64
Soil Strength Test											
Unconfined Compression	Shear Strength	kPa					26.16				
	Phi angle	°									
Direct Shear	Cohesion	kPa		0.51							0.00
	Phi angle	°		33.4						39	35.1
Triaxial Compression (UU)	Shear Strength	kPa					40 to 59				
	Phi angle	°									
Soil Deformation Test											
Consolidation	Initial Void Ratio						0.821				
	Degree of Saturation	%					100				
	Preconsolidation pressure, PC	kPa					62				
	Compression Index, Cc						0.1377				
Compaction	Maximum Dry Density	g/cm^3	1.658								
	Optimum MC	%	15.5								
Hydraulic Property Test											
Permeability Test		m/s									1.58E-07
Chemical Analysis Test											
SOIL	pH						5.2				
	Chloride Content (acid-extract)	%					0.49				
	Sulfate Content (acid-extract)	%					0.31				
WATER	pH		6.7								
	Chloride	g/l	5.91								
	Sulphate	g/l	0.362								

Legend:	UC- Unconfined Compression UU- Unconsolidated Undrained CIU-Consolidated Isotropic Undrained CID-Consolidated Isotropic Drained	DST - Direct Shear OED - Oedometer	**Remarks:** *Sample is non plastic

N.B.: Test performed at GIE Laboratory (Denoted by black color)
Test performed at BUET (Denoted by red color)

Geotechnical Investigation for Matarbari Project

SUMMARY OF TEST RESULTS

Client: TEPSCO

BH No.: BH-08

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Sample No.			SPT-02	SPT-05	SPT-07	SPT-09	SPT-12	SPT-16	SPT-21		
Depth (m)		from	2.00	5.00	7.00	9.00	12.00	16.00	21.00		
		to	2.45	5.45	7.45	9.45	12.45	16.45	21.45		
Classification Test											
Moisture Content:		%	16.70	27.61	35.52	21.10	25.29	23.84	19.42		
Atterberg Limits	Liquid Limit	%		31.20	41.50	26.50					
	Plastic Limit	%		18.00	23.45	15.64					
	Plasticity Index	%		13.20	18.05	10.86					
Particle Size Distribution (Sieve)	Gravel	%	0.00				0.00	0.00	0.00		
	Sand	%	97.50				68.48	53.32	90.14		
	Silt/Clay	%	2.50				31.52	46.68	9.86		
Particle Size Distribution (Hydrometer)	Gravel	%	0.00			0.00	0.00	0.00	0.00		
	Sand	%	97.90			38.18	68.98	52.48	90.70		
	Silt	%	2.10			44.31	21.47	33.19	7.71		
	Clay	%				17.51	9.55	14.33	1.59		
Specific Gravity			2.65	2.71	2.72	2.69	2.67	2.68	**2.68**		
Bulk Density		g/cm^3									
Dry Density		g/cm^3									
Soil Strength Test											
Unconfined Compression	Shear Strength	kPa									
	Phi angle	°									
Direct Shear	Cohesion	kPa	0.79					9.74			
	Phi angle	°	31.5					37.1	**40**		
Triaxial Compression (UU)	Shear Strength	kPa									
	Phi angle	°									
Soil Deformation Test											
Consolidation	Initial Void Ratio										
	Degree of Saturation	%									
	Preconsolidation pressure, PC	kPa									
	Compression Index, Cc										
Compaction	Maximum Dry Density	g/cm^3									
	Optimum MC	%									
Chemical Analysis Test											
SOIL	pH			6.8							
	Chloride Content (acid-extract)	%		0.43							
	Sulfate Content (acid-extract)	%		0.41							
WATER	pH										
	Chloride										
	Sulphate										

Legend:	UC- Unconfined Compression UU- Unconsolidated Undrained CIU-Consolidated Isotropic Undrained CID-Consolidated Isotropic Drained	DST - Direct Shear OED - Oedometer	**Remarks:** *Sample is non plastic

N.B.: Test performed at GIE Laboratory (Denoted by black color)
Test performed at BUET (Denoted by red color)

APPENDIX B (ii)

Details Laboratory Test Result

BH-01

Ground Instrumentation & Engineering Pte Ltd	**MOISTURE CONTENT** **ASTM D2216-10**	

Sample No.:	SPT-02	Depth (m): 2.00-2.45
Can No.		180
Weight of Wet Soil + Can (gm)		216.68
Weight of Dry Soil + can (gm)		195.49
Weight of Can (gm)		27.08
Moisture Content (%)		**12.58**
Description		**Silty fine-medium SAND, SM**

Sample No.:	SPT-05	Depth (m): 5.00-5.45
Can No.		408
Weight of Wet Soil + Can (gm)		255.16
Weight of Dry Soil + can (gm)		226.38
Weight of Can (gm)		24.91
Moisture Content (%)		**14.29**
Description		**Silty fine-medium SAND, SM**

Sample No.:	UD-01	Depth (m): 7.00-8.00
Can No.		203
Weight of Wet Soil + Can (gm)		273.60
Weight of Dry Soil + can (gm)		208.36
Weight of Can (gm)		26.08
Moisture Content (%)		**35.79**
Description		**Lean CLAY, CL**

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-01
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 28-02-2021

Checked by: Suvashis Paul
Date: 05-03-2021

Ground Instrumentation & Engineering Pte Ltd	**MOISTURE CONTENT** **ASTM D2216-10**	

Sample No.:	UD-02	Depth (m): 10.00-11.00
Can No.		107
Weight of Wet Soil + Can (gm)		207.20
Weight of Dry Soil + can (gm)		170.02
Weight of Can (gm)		30.93
Moisture Content (%)		**26.73**
Description		**Fat CLAY, CH**

Sample No.:	SPT-12	Depth (m): 14.00-14.45
Can No.		365
Weight of Wet Soil + Can (gm)		170.74
Weight of Dry Soil + can (gm)		142.92
Weight of Can (gm)		14.25
Moisture Content (%)		**21.62**
Description		**Silty fine SAND, SM**

Sample No.:	SPT-17	Depth (m): 19.00-19.45
Can No.		341
Weight of Wet Soil + Can (gm)		178.37
Weight of Dry Soil + can (gm)		145.93
Weight of Can (gm)		14.39
Moisture Content (%)		**24.66**
Description		**Sandy lean CLAY, CL**

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-01
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 28-02-2021

Checked by: Suvashis Paul
Date: 05-03-2021

Ground Instrumentation & Engineering Pte Ltd	**MOISTURE CONTENT** **ASTM D2216-10**	

Sample No.:	SPT-24	Depth (m): 26.00-26.45
Can No.		486
Weight of Wet Soil + Can (gm)		201.58
Weight of Dry Soil + can (gm)		167.44
Weight of Can (gm)		15.04
Moisture Content (%)		**22.40**
Description		**Lean CLAY, CL**

Sample No.:		Depth (m):
Can No.		
Weight of Wet Soil + Can (gm)		
Weight of Dry Soil + can (gm)		
Weight of Can (gm)		
Moisture Content (%)		
Description		

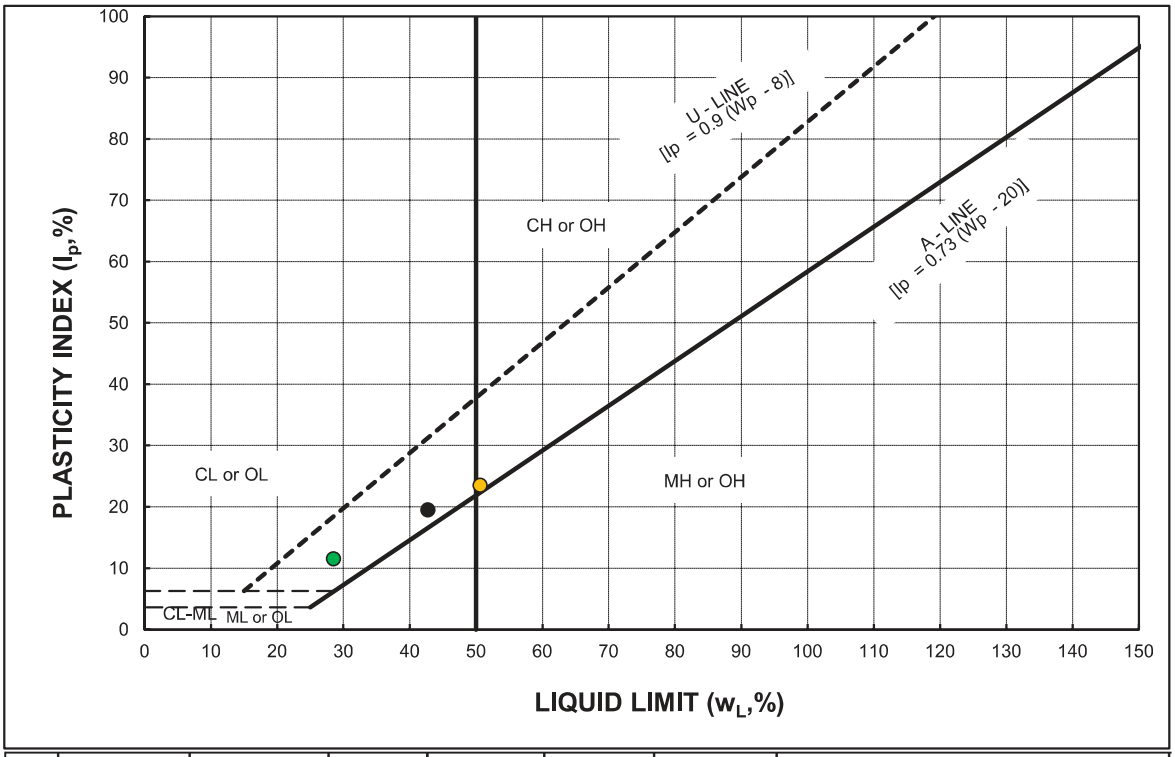
Sample No.:		Depth (m):
Can No.		
Weight of Wet Soil + Can (gm)		
Weight of Dry Soil + can (gm)		
Weight of Can (gm)		
Moisture Content (%)		
Description		

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-01
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 28-02-2021

Checked by: Suvashis Paul
Date: 05-03-2021

Ground Instrumentation & Engineering Pte. Ltd.



	Sample No.	Depth	W_L	W_P	I_p	Fines	Remarks
●	UD-01	7.00-8.00	42.70	23.18	19.52		Lean CLAY, CL
●	UD-02	10.00-11.00	50.60	27.07	23.53		Fat CLAY, CH
●	SPT-17	19.00-19.45	28.50	16.96	11.54		Lean CLAY, CL
●							
●							
●							
●							
●							
●							
○							

Note : All the above Liquid Limit tests was performed in accordance to Method A (Multi-Point) of ASTM D 4318-05

*Hydrometer analysis were performed instead of atterberg limit and presented with the Particle Size Distribution Section

ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands, etc.	**MH**	Inorganic silts, or diatomaceous fine sands or silts, elastic silts, etc.
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays, etc.	**CH**	Inorganic clays of high plasticity, fat clays, etc.
OL	Organic silts and organic silty clays of low plasticity.	**OH**	Organic silts and organic clays of medium to high plasticity.

PLASTICITY CHART (ASTM D 2487 - 06 & D 4318 - 05)

Geotechnical Investigation for Matarbari Project

Client: TEPSCO

Project ID: SIBD2105

BH No.: BH-01

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 01-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

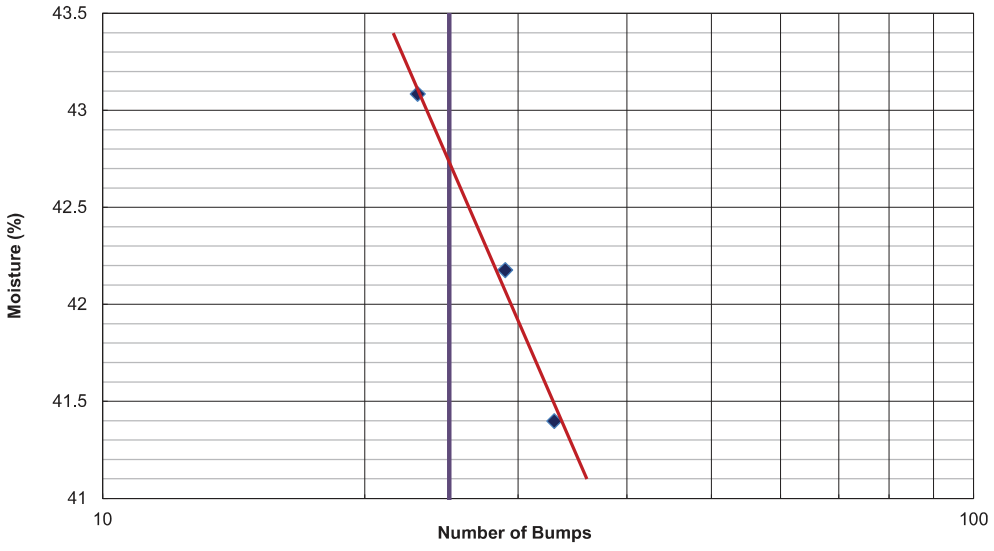
Ground Instrumentation & Engineering Pte. Ltd.

Liquid and Plastic Limits Test: ASTM D4318-10 (Casagrande Method)

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)
Project ID: SIBD2105 Sample No: UD-01
BH No.: BH-01 Sample Depth: 7.00-8.00

Plastic Limit Test		
Container No.	57	318
Weight of can (gm)	7.71	7.67
Wet weight of soil + can (gm)	32.87	32.89
Dry Weight of soil + can (gm)	28.15	28.13
Moisture Content %	23.09	23.26
Average	23.18	

Liquid Limit Test (Casagrande, Blow count: 20-35, ASTM Method-A- multi-pt)			
Test No	1	2	3
Number of Bumps	23	29	33
Container No.	432	436	477
Weight of can (gm)	3.63	3.83	3.77
Wet weight of soil + can (gm)	25.15	23.82	22.18
Dry Weight of soil + can (gm)	18.67	17.89	16.79
Moisture Content %	**43.09**	**42.18**	**41.40**



LL: 42.70	PL: 23.18	PI: 19.52
Description	Lean CLAY, CL	

Tested by: Rayhan
Date: 01-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

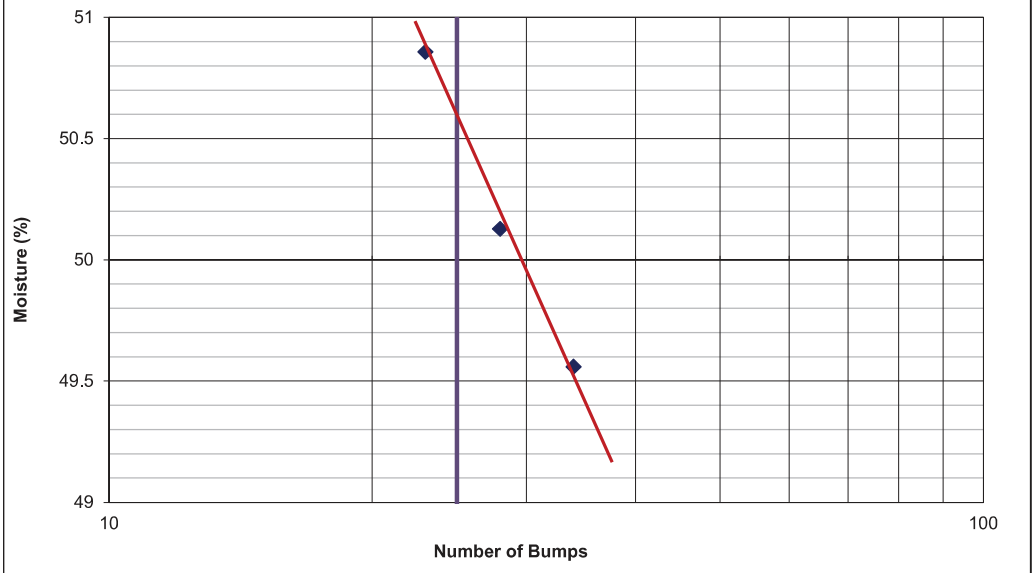
Ground Instrumentation & Engineering Pte. Ltd.

Liquid and Plastic Limits Test: ASTM D4318-10 (Casagrande Method)

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)
Project ID: SIBD2105 Sample No.: UD-02
BH No.: BH-01 Sample Depth: 10.00-11.00

Plastic Limit Test		
Container No.	415	336
Weight of can (gm)	9.42	9.33
Wet weight of soil + can (gm)	29.74	29.76
Dry Weight of soil + can (gm)	25.42	25.4
Moisture Content %	27.00	27.13
Average	27.07	

Liquid Limit Test (Casagrande, Blow count: 20-35, ASTM Method-A- multi-pt)			
Test No	1	2	3
Number of Bumps	23	28	34
Container No.	332	435	475
Weight of can (gm)	7.4	3.89	4.35
Wet weight of soil + can (gm)	28.49	27.52	24.72
Dry Weight of soil + can (gm)	21.38	19.63	17.97
Moisture Content %	**50.86**	**50.13**	**49.56**



LL: 50.60	PL: 27.07	PI: 23.53
Description	Fat CLAY, CH	

Tested by: Rayhan
Date: 01-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

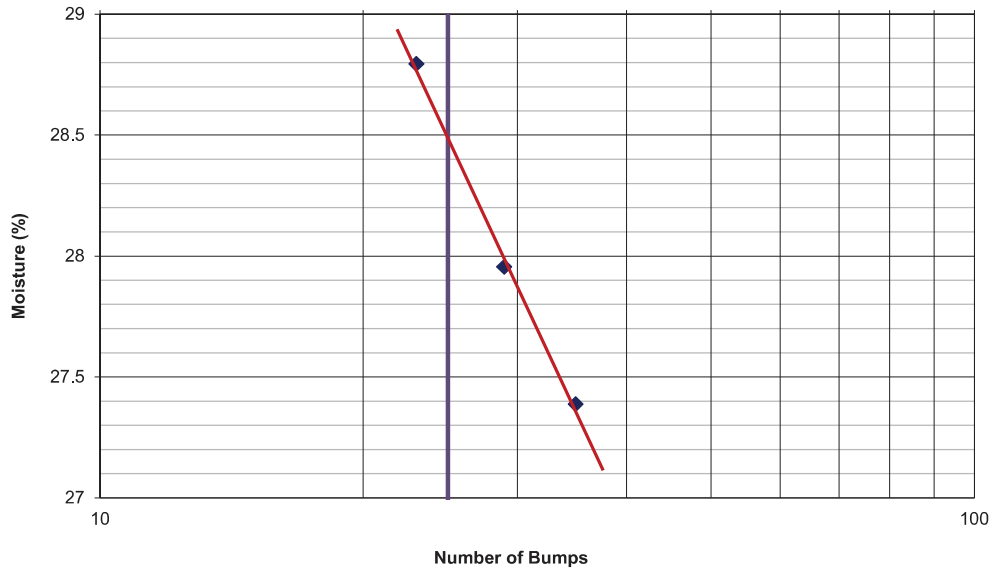
Ground Instrumentation & Engineering Pte. Ltd.

Liquid and Plastic Limits Test: ASTM D4318-10 (Casagrande Method)

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)
Project ID: SIBD2105 Sample No.: SPT-17
BH No.: BH-01 Sample Depth.: 19.00-19.45

Plastic Limit Test		
Container No.	224	51
Weight of can (gm)	12.84	12.79
Wet weight of soil + can (gm)	36.46	36.48
Dry Weight of soil + can (gm)	33.05	33.03
Moisture Content %	16.87	17.05
Average	16.96	

Liquid Limit Test (Casagrande, Blow count: 20-35, ASTM Method-A- multi-pt)			
Test No	1	2	3
Number of Bumps	23	29	35
Container No.	325	441	479
Weight of can (gm)	7.2	3.76	9.22
Wet weight of soil + can (gm)	30.28	28.98	27.36
Dry Weight of soil + can (gm)	25.12	23.47	23.46
Moisture Content %	**28.79**	**27.96**	**27.39**

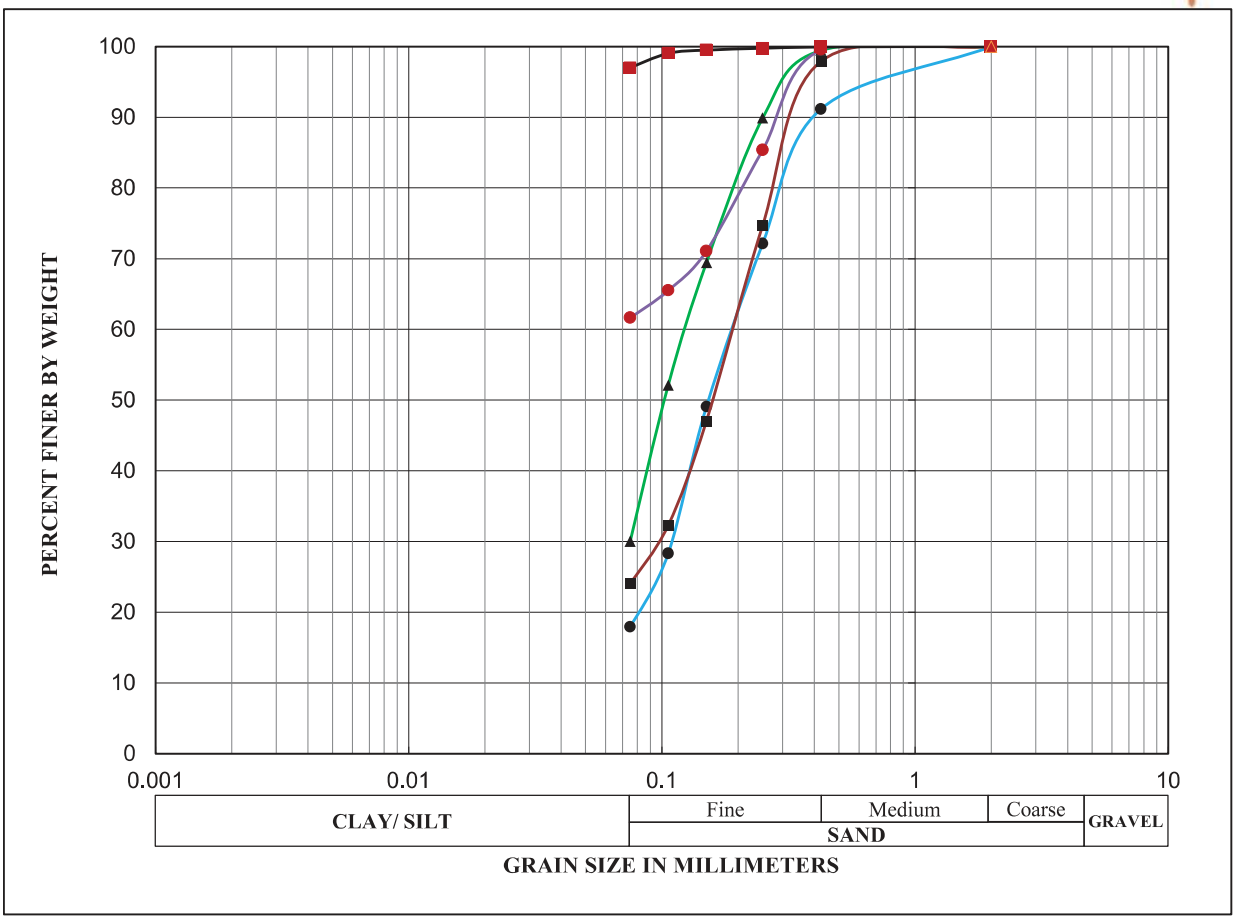


LL: 28.50	PL: 16.96	PI: 11.54
Description	Lean CLAY, CL	

Tested by: Rayhan
Date: 01-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

Ground Instrumentation & Engineering Pte.Ltd.



	Sample	Depth	Classification	W(%)	W_L	P_L	I_P	C_U	C_C
●	SPT-02	2.00-2.45	Silty fine-medium SAND, SM						
■	SPT-05	5.00-5.45	Silty fine-medium SAND, SM						
▲	SPT-12	14.00-14.45	Silty fine SAND, SM						
●	SPT-17	19.00-19.45	Sandy lean CLAY, CL						
■	SPT-24	26.00-26.45	Lean CLAY, CL						
▲									

	Sample	Depth	D60	D50	D30	D10	%Gravel	%Sand			%SILT/ %CLAY
								%Fine	%Meidum	%Coarse	
●	SPT-02	2.00-2.45	0.197	0.154	0.110	0.042	0.00	73.24	8.84	0.00	17.92
■	SPT-05	5.00-5.45	0.197	0.161	0.097	0.031	0.00	73.86	2.08	0.00	24.06
▲	SPT-12	14.00-14.45	0.126	0.103	0.075	0.025	0.00	69.38	0.56	0.00	30.06
●	SPT-17	19.00-19.45	0.073	0.061	0.037	0.012	0.00	37.90	0.46	0.00	61.64
■	SPT-24	26.00-26.45	0.046	0.039	0.023	0.008	0.00	2.94	0.06	0.00	97.00
▲											

GRADATION CURVES (ASTM D 2487 - 06 & D 422 - 63)

Geotechnical Investigation for Matarbari Project

Client: TEPSCO

Project ID: SIBD2105

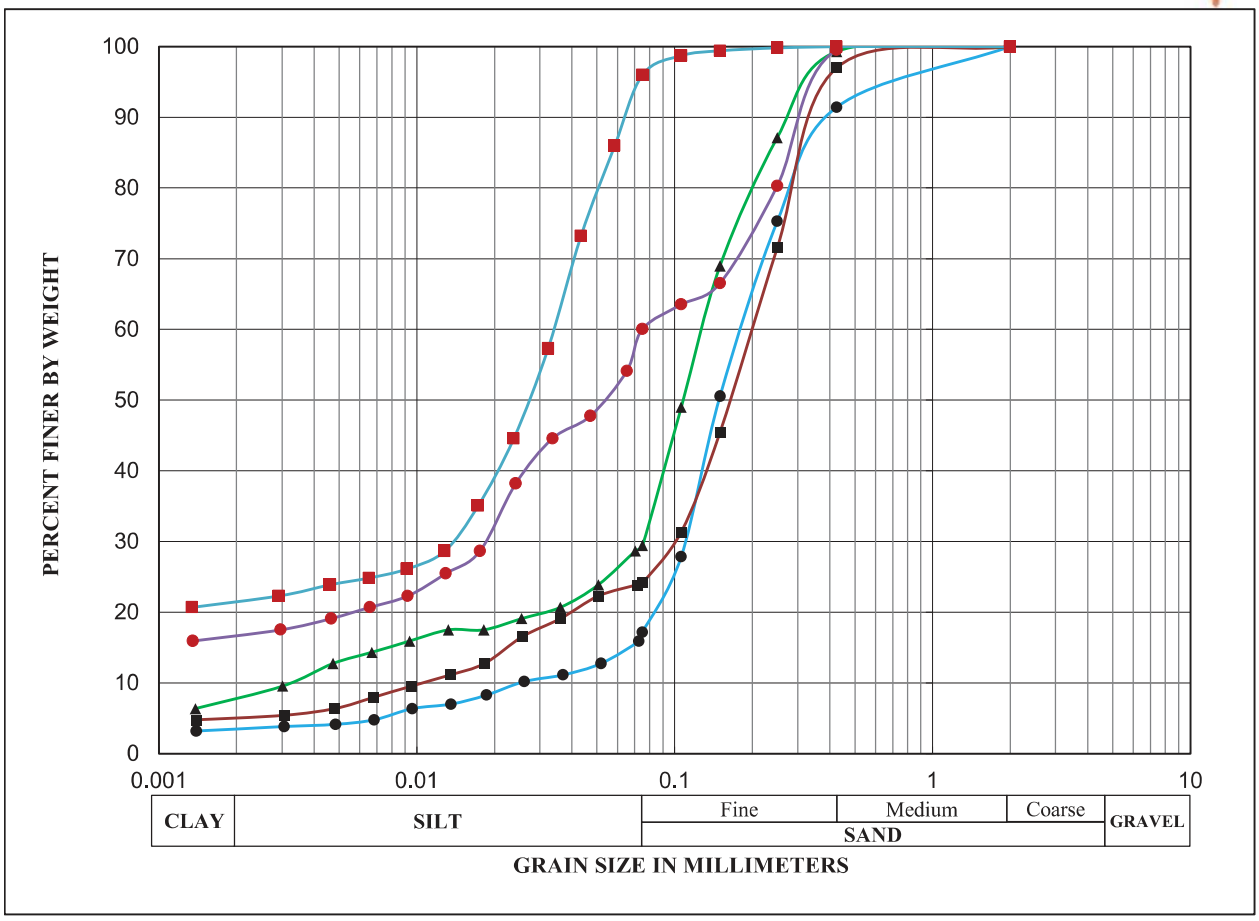
BH No.: BH-01

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 01-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

Ground Instrumentation & Engineering Pte.Ltd.



	Sample	Depth	Classification	W(%)	W_L	P_L	I_P	C_U	C_C
●	SPT-02	2.00-2.45	Silty fine-medium SAND, SM						
■	SPT-05	5.00-5.45	Silty fine-medium SAND, SM						
▲	SPT-12	14.00-14.45	Silty fine SAND, SM						
●	SPT-17	19.00-19.45	Sandy lean CLAY, CL						
■	SPT-24	26.00-26.45	Lean CLAY, CL						
▲									

	Sample	Depth	D60	D50	D30	D10	%Gravel	%Sand			%SILT	%CLAY
								%Fine	%Meidum	%Coarse		
●	SPT-02	2.00-2.45	0.188	0.149	0.110	0.025	0.00	74.24	8.58	0.00	14.00	3.18
■	SPT-05	5.00-5.45	0.206	0.167	0.100	0.011	0.00	72.84	3.00	0.00	19.38	4.78
▲	SPT-12	14.00-14.45	0.130	0.108	0.076	0.003	0.00	69.84	0.70	0.00	23.09	6.37
●	SPT-17	19.00-19.45	0.075	0.054	0.019	0.001	0.00	39.48	0.48	0.00	44.12	15.92
■	SPT-24	26.00-26.45	0.034	0.027	0.014	0.001	0.00	4.00	0.02	0.00	75.29	20.69
▲												

GRADATION CURVES (ASTM D 2487 - 06 & D 422 - 63)

Geotechnical Investigation for Matarbari Project

Client: TEPSCO

Project ID: SIBD2105

BH No.: BH-01

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 03-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

Ground Instrumentation & Engineering Pte Ltd	**PARTICLE DENSITY** **BS 1733 Part 2 Section 8** **(Small Pyknometer Method)**	

SPT-02	Depth(m)	2.00-2.45
Pyknometer No.		1
Mass of bottle + soil + water: M_3	gm	118.73
Mass of bottle + soil: M_2	gm	74.04
Mass of bottle + water: M_4	gm	99.99
Mass of bottle: M_1	gm	44.00
Mass of soil: $M_2 - M_1$	gm	30.04
Mass of water in full bottle: $M_4 - M_2$	gm	25.95
Mass of water used: $M_3 - M_2$	gm	44.69
Volume of soil particles: $(M_4 - M_1) - (M_3 - M_2)$	ml	11.30
Particle Density: $\frac{M_2 - M_1}{(M_4 - M_1) - (M_3 - M_2)}$	g/cm3	2.66

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-01
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 02-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

Ground Instrumentation & Engineering Pte Ltd	**PARTICLE DENSITY** **BS 1733 Part 2 Section 8** **(Small Pyknometer Method)**	

SPT-05	Depth(m)	5.00-5.45
Pyknometer No.		2
Mass of bottle + soil + water: M_3	gm	117.15
Mass of bottle + soil: M_2	gm	74.10
Mass of bottle + water: M_4	gm	98.41
Mass of bottle: M_1	gm	44.13
Mass of soil: $M_2 - M_1$	gm	29.97
Mass of water in full bottle: $M_4 - M_2$	gm	24.31
Mass of water used: $M_3 - M_2$	gm	43.05
Volume of soil particles: $(M_4 - M_1) - (M_3 - M_2)$	ml	11.23
Particle Density: $\frac{M_2 - M_1}{(M_4 - M_1) - (M_3 - M_2)}$	g/cm3	2.67

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-01
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 02-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

Ground Instrumentation & Engineering Pte Ltd	**PARTICLE DENSITY** **BS 1733 Part 2 Section 8** **(Small Pyknometer Method)**	

UD-01	Depth(m)	7.00-8.00
Pyknometer No.		3
Mass of bottle + soil + water: M_3	gm	117.97
Mass of bottle + soil: M_2	gm	74.54
Mass of bottle + water: M_4	gm	98.92
Mass of bottle: M_1	gm	44.52
Mass of soil: $M_2 - M_1$	gm	30.02
Mass of water in full bottle: $M_4 - M_2$	gm	24.38
Mass of water used: $M_3 - M_2$	gm	43.43
Volume of soil particles: $(M_4 - M_1) - (M_3 - M_2)$	ml	10.97
Particle Density: $\frac{M_2 - M_1}{(M_4 - M_1) - (M_3 - M_2)}$	g/cm3	2.73

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-01
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 02-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

Mobile: 01819 557964; PABX: 966 5650-80 Ext. 7226

BRTC Bureau of Research, Testing & Consultation

GEOTECHNICAL ENGINEERING LABORATORY

BRTC No.:	110-231613/20-21/CE Dated 11.3.21
Client :	Manager, Environment, Health and Safety, SGS Bangladesh Ltd., Bir Uttam CR Datta Rd, Dhaka
Ref :	SGS/Phase-2/SI/090321 dated 9.3.21
Project :	Geotechnical Investigation at Matarbari
Location:	Matarbari
Test Method:	ASTM
Date of Test:	1-10.4.21

SPECIFIC GRAVITY DETERMINATION OF SOIL

Borehole	1	2	3.0	4.0	5.0	6.0
Depth (m)	14-14.5	25-25.45	4-4.5	17-17.45	17-17.45	26-26.45
Sample No.	12.0	23.0	4.0	15.0	14.0	23.0
Soil Type	Grey silty sand	Grey silty sand	Grey silty sand	Grey silty sand	Grey silty sand	Grey silty sand
Wt. of bottle+water+ soil, gm	371.6	375.3	373.4	371.6	380.1	396.4
Temperature (°C)	30.5	30.0	30.5	30.5	30.5	30.0
Wt. of bottle+water, gm	340.0	343.7	342.1	340.4	348.8	365.1
Wt. of soil, gm	49.8	49.2	49.9	49.3	49.7	48.6
Specific Gravity	**2.72**	**2.78**	**2.67**	**2.71**	**2.69**	**2.80**

Note: Tests were conducted on samples received in unsealed condition. BRTC, BUET does not have any responsibility as to the representative character of the supplied samples.

2

44A76bmM6

Countersigned by :

Dr. A.B.M. Badruzzaman
Professor
Department of Civil Engineering
BUET, Dhaka - 1000.

Test performed by :

25.5.21

Dr. Tahmeed M. Al-Hussaini
Professor
Department of Civil Engineering
BUET, Dhaka - 1000.

Department of Civil Engineering BUET, Dhaka-1000, Bangladesh

Ground Instrumentation & Engineering Pte Ltd	**PARTICLE DENSITY** **BS 1733 Part 2 Section 8** **(Small Pyknometer Method)**	

SPT-17	Depth(m)	19.00-19.45
Pyknometer No.		6
Mass of bottle + soil + water: M_3	gm	94.09
Mass of bottle + soil: M_2	gm	55.21
Mass of bottle + water: M_4	gm	75.23
Mass of bottle: M_1	gm	25.22
Mass of soil: $M_2 - M_1$	gm	29.99
Mass of water in full bottle: $M_4 - M_2$	gm	20.02
Mass of water used: $M_3 - M_2$	gm	38.88
Volume of soil particles: $(M_4 - M_1) - (M_3 - M_2)$	ml	11.13
Particle Density: $\frac{M_2 - M_1}{(M_4 - M_{1)} - (M_3 - M_2)}$	g/cm3	2.69

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-01
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 02-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

Ground Instrumentation & Engineering Pte Ltd	**PARTICLE DENSITY** **BS 1733 Part 2 Section 8** **(Small Pyknometer Method)**	

SPT-24	Depth(m)	26.00-26.45
Pyknometer No.		7
Mass of bottle + soil + water: M_3	gm	90.91
Mass of bottle + soil: M_2	gm	51.10
Mass of bottle + water: M_4	gm	71.90
Mass of bottle: M_1	gm	21.11
Mass of soil: $M_2 - M_1$	gm	29.99
Mass of water in full bottle: $M_4 - M_2$	gm	20.80
Mass of water used: $M_3 - M_2$	gm	39.81
Volume of soil particles: $(M_4 - M_1) - (M_3 - M_2)$	ml	10.98
Particle Density: $\frac{M_2 - M_1}{(M_4 - M_1) - (M_3 - M_2)}$	g/cm3	2.73

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-01
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 02-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

UNIT WEIGHT / BULK DENSITY
VOID RATIO

Ground Instrumentation
& Engineering Pte Ltd

UD-01	Depth (m):	7.00-8.00
Weight of soil	gm	155.90
Height	mm	76
Diameter	mm	38
Volume	mm3	86193
Bulk Density	(g/cm3)	1.81
Dry Density	(g/cm3)	1.33
Void Ratio		1.05
Moisture Content	%	35.79
Specific Gravity	(g/cm3)	2.73

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-01
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 02-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

UNIT WEIGHT / BULK DENSITY
VOID RATIO

Ground Instrumentation & Engineering Pte Ltd

UD-02	Depth (m):	10.00-11.00
Weight of soil	gm	162.10
Height	mm	76
Diameter	mm	38
Volume	mm3	86193
Bulk Density	(g/cm3)	1.88
Dry Density	(g/cm3)	1.48
Void Ratio		0.81
Moisture Content	%	26.73
Specific Gravity	(g/cm3)	2.68

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-01
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 02-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

Total Stress Triaxial Compression

Unconfined Compression

Summary Report

Sample Details				
 *sketch showing specimen location in original sample*	Depth			7.00-8.00
	Description			Lean CLAY, CL
	Type			UD
	Initial Sample Length	L_0	(mm)	76.0
	Initial Sample Diameter	D_0	(mm)	38.0
	Initial Sample Weight	W_0	(gr)	149.3
	Bulk Density	ρ_0	(Mg/m3)	1.73
	Particle Density	ρ_s	(Mg/m3)	2.73

Initial Conditions

Strain Rate	m_s	(mm/min)	0.76000
MembraneThickness	m_b	(mm)	0.00
Displacement Input	L_{IP}	(mm)	CH 7
Load Input	N_{IP}	(N)	CH 2
Initial Moisture	$\omega_i\%$	(%)	36
Initial Dry Density	ρ_{d0}	(Mg/m3)	1.27
Initial Voids Ratio	e_0	.	1.15
Initial Degree of Saturation	S_o	(%)	86

Final Conditions

Max Deviator Stress	$(\sigma_1-\sigma_3)_f$	(kPa)	117.86
Strain At Max Stress	$\varepsilon_f\%$	(%)	5.87
Final Moisture	$\omega_f\%$	(%)	36
Final Dry Density	ρ_{df}	(Mg/m3)	1.27
Final Voids Ratio	e_f	.	1.15
Final Degree of Saturation	S_f	(%)	86.2

Notes

Failure Sketch

(surface inclination)

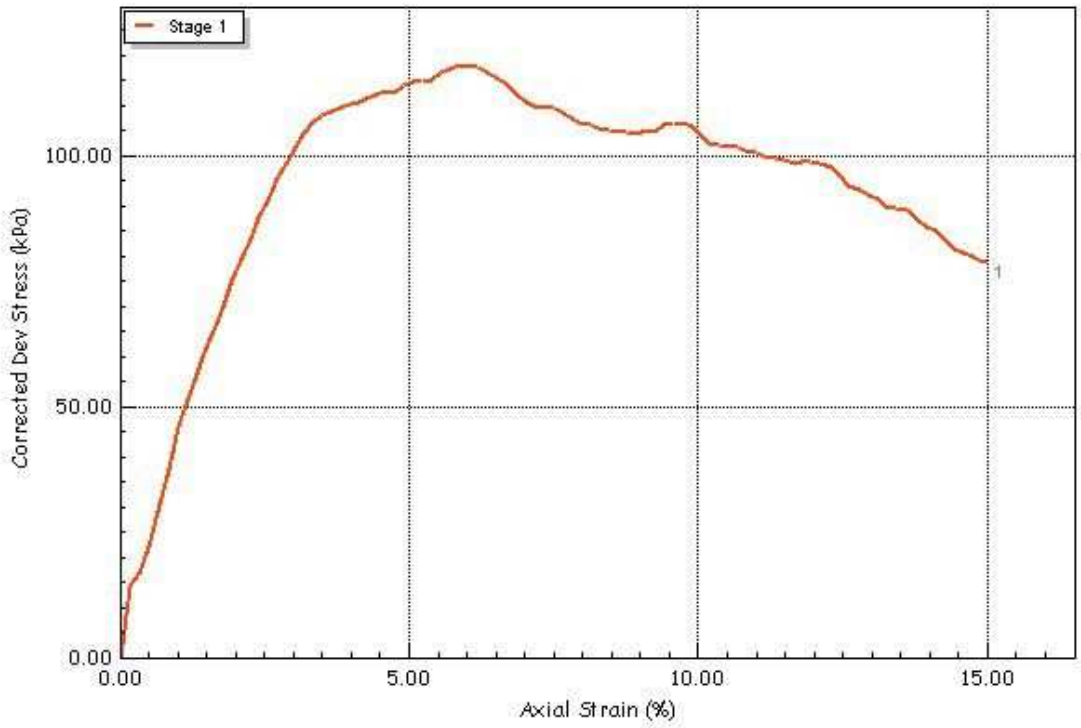
Test Method	D 2166/D2166M-13			Test Name	UCT
Database: .\SQLEXPRESS \ GIE-D				Test Date	3/16/2021
Site Reference				Borehole	BH-01
Jobfile	UCT			Sample	UD-01
Client	SGS			Depth	7.00-8.00
Operator	R. Islam	Checked	Aminul	Approved	T. Islam

GIE

Total Stress Triaxial Compression

Unconfined Compression

Test Results Plots



Test Method	D 2166/D2166M-13			Test Name	UCT
Database: .\SQLEXPRESS \ GIE-D				Test Date	3/16/2021
Site Reference				Borehole	BH-01
Jobfile	UCT			Sample	UD-01
Client	SGS			Depth	7.00-8.00
Operator	R. Islam	Checked	Aminul	Approved	T. Islam

GIE

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

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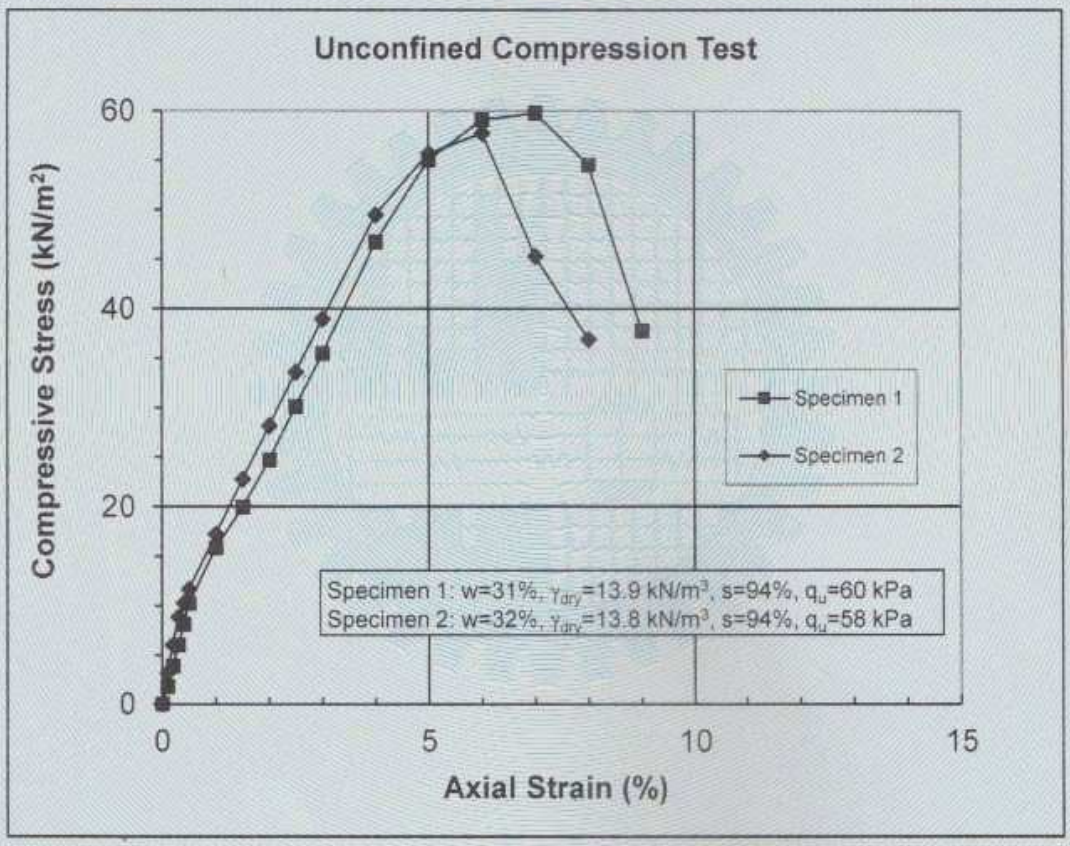
GEOTECHNICAL ENGINEERING LABORATORY

BRTC Bureau of Research Testing & Consultation

BRTC No.:	110-231613/20-21/CE dated 11.3.21			
Client :	Manager, Environment Health & Safety, SGS Bangladesh Ltd., Bir Uttam CR Datta Road, Dhaka			
Ref :	SGS/Phase-2/SI/090321 dated 9.3.21			
Project :	Geotechnical Investigation at Matarbari			
Soil description :	Grey silty clay, trace fine sand			
Test Method:	ASTM		Date of Test:	29.3.21-1.4.21
BH No. : 1		Sample ID : UD-2	Depth:	10-11 m
			Location:	Matarbari



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PGhXAY8en

Note: Samples as supplied to us in sampler tubes have been tested in our laboratory. BRTC, BUET does not have any responsibility as to the representative character of the sample. Initial water content, dry density, degree of saturation and unconfined compressive strength is reported.

Only two specimens could be prepared from the tube sample.
Sample was received in unsealed condition.

Specific Gravity= 2.68

Department of Civil Engineering, BUET, Dhaka-1000, Bangladesh

Countersigned by :

Dr. A.B.M. Badruzzaman
Professor
Department of Civil Engineering
BUET, Dhaka - 1000.

Test performed by :

7.5.21

Dr. Tahmeed M. Al-Hussaini
Professor
Department of Civil Engineering
BUET, Dhaka - 1000.

BRTC BUET

BUETCE 0 2 7 2 3 8 0

Total Stress Triaxial Compression

Unconsolidated Undrained (Multiple Specimen)

Summary Report

Sample Details

sketch showing specimen location in original sample

Depth	7.00-8.00				
Description	Lean CLAY, CL				
Type	UD				
			Spm. 1	2	3
Initial Sample Length	L_0	(mm)	76.0	76.0	76.0
Initial Sample Diameter	D_0	(mm)	38.0	38.0	38.0
Initial Sample Weight	W_0	(gr)	143.1	143.5	143.8
Bulk Density	ρ_0	(Mg/m3)	1.66	1.66	1.67
Particle Density	ρ_s	(Mg/m3)	2.73	2.73	2.73

Initial Conditions

Specimen			Spm. 1	2	3
Initial Cell Pressure	σ_3	(kPa)	65	130	260
Strain Rate	m_s	(mm/min)	0.76000	0.76000	0.76000
MembraneThickness	m_b	(mm)	0.02	0.02	0.02
Displacement Input	L_{IP}	(mm)	CH 7	CH 7	CH 7
Load Input	N_{IP}	(N)	CH 2	CH 2	CH 2
Initial Moisture	$\omega_i\%$	(%)	36	36	36
Initial Dry Density	ρ_{d0}	(Mg/m3)	1.22	1.22	1.23
Initial Voids Ratio	e_0	.	1.24	1.23	1.23
Initial Degree of Saturation	S_o	(%)	80	80	80

Final Conditions

			Spm. 1	2	3
Max Deviator Stress	$(\sigma_1-\sigma_3)_f$	(kPa)	118.94	123.52	126.52
MembraneCorrection	m_c	(kPa)	40.760	40.728	40.760
Strain At Max Stress	$\varepsilon_f\%$	(%)	6.36	8.75	6.51
Shear Strength	c_u	(kPa)	59.47	61.76	63.26
Final Moisture	$\omega_f\%$	(%)	35	35	35
Final Dry Density	ρ_{df}	(Mg/m3)	1.23	1.23	1.23
Final Voids Ratio	e_f	.	1.23	1.22	1.22
Final Degree of Saturation	S_f	(%)	78.8	79.3	79.6

Notes

Failure Sketch

(surface inclination)

Test Method	D 2850-03A (2007)			Test Name	UU
Database: .\SQLEXPRESS \ GIE-D				Test Date	3/16/2021
Site Reference				Borehole	BH-01
Jobfile	UU			Sample	UD-01
Client	SGS			Depth	7.00-8.00
Operator	R. Islam	Checked	Aminul	Approved	T. Islam

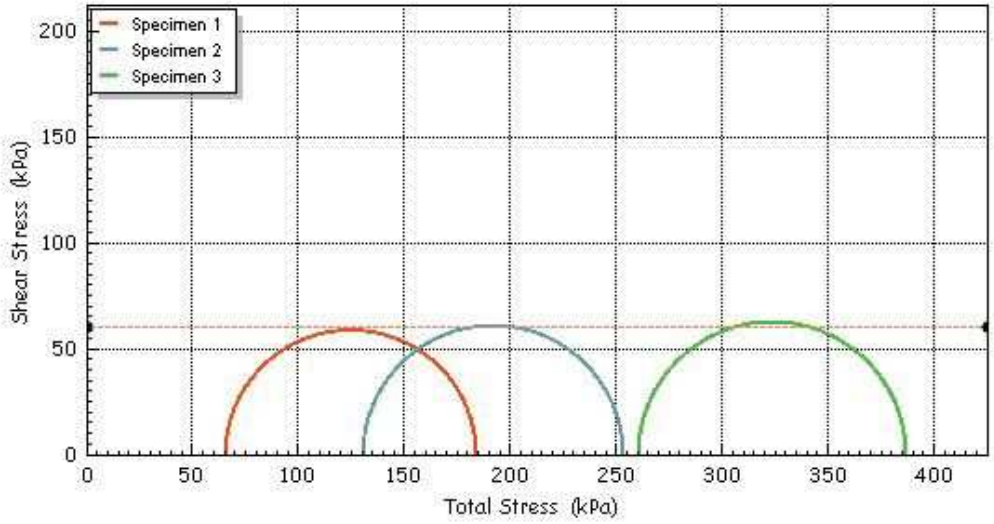
GIE

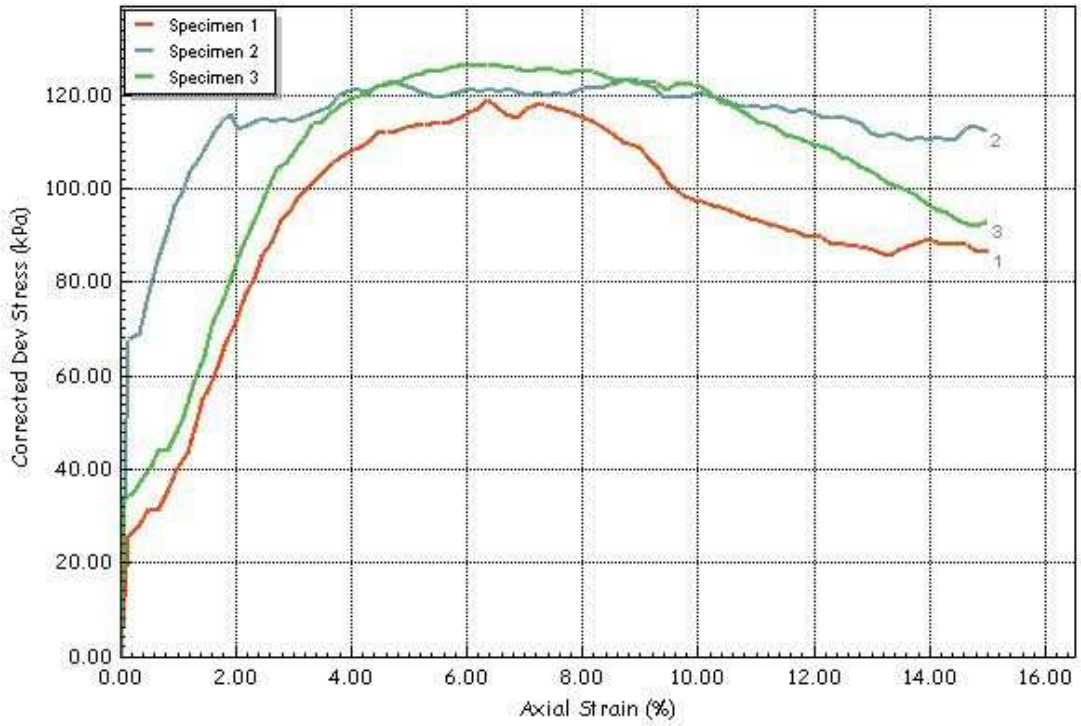
Total Stress Triaxial Compression

Unconsolidated Undrained (Multiple Specimen)

Test Results Plots

Cohesion Level	c	(kPa)	60.1
Friction Angle	ϕ	(deg)	0.0





Test Method	D 2850-03A (2007)		Test Name	UU	
Database: .\SQLEXPRESS \ GIE-D			Test Date	3/16/2021	
Site Reference			Borehole	BH-01	
Jobfile	UU		Sample	UD-01	
Client	SGS		Depth	7.00-8.00	
Operator	R. Islam	Checked	Aminul	Approved	T. Islam

GIE

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

Mobile: 01819 557964; PABX: 966 5650-80 Ext. 7226

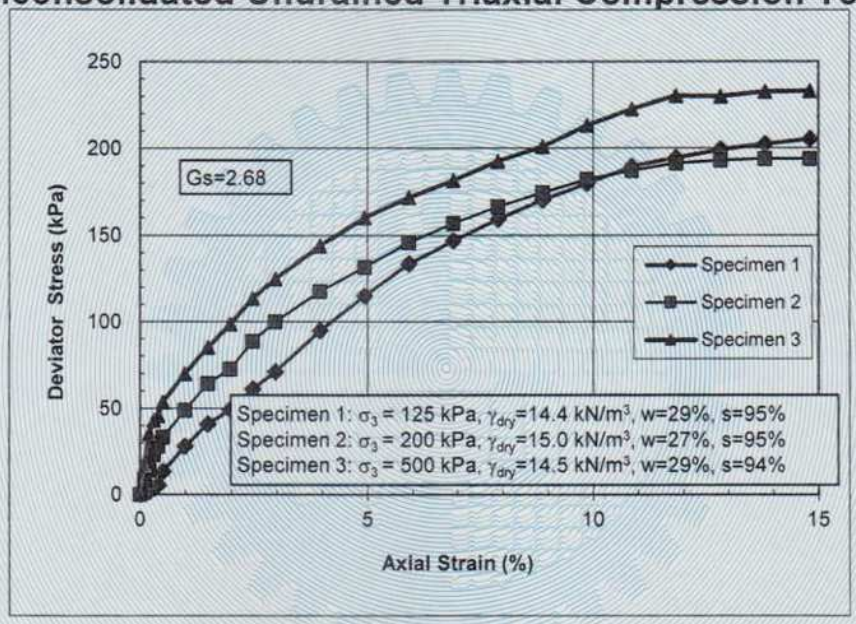
BRTC Bureau of Research, Testing & Consultation

GEOTECHNICAL ENGINEERING LABORATORY

BRTC No. :	110-231613/20-21/CE dated 11.3.21		
Sent by :	Manager, Environment Health & Safety, SGS Bangladesh Ltd., Bir Uttam CR Datta Road, Dhaka		
Ref:	SGS/Phase-2/SI/090321 dated 9.3.21		
Project :	Geotechnical Investigation at Matarbari		
Soil description :	Grey silty clay, trace fine sand	**Test Method:**	ASTM
B.H. No.:	1 **Sample:** UD-2	**Depth:**	10-11 m
Location:	Matarbari	**Date of Test:**	27.4.21-2.5.21

(Corrected Report)

Unconsolidated Undrained Triaxial Compression Test



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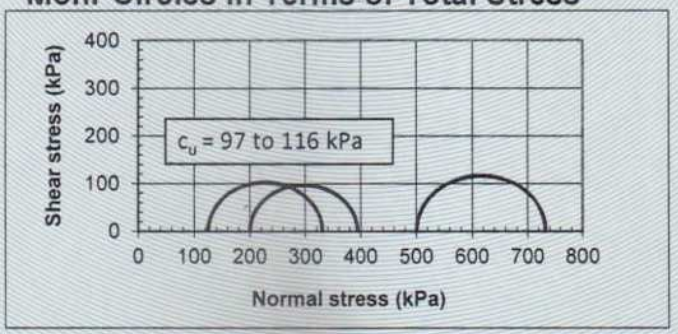
E7d6DBGdA

Mohr Circles in Terms of Total Stress



Remarks: Initial dry density, water content and degree of saturation is indicated. All specimens were subjected to saturation prior to loading.

Countersigned by :

Dr. A.B.M. Badruzzaman
Professor, Dept. of Civil Engineering
BUET, Dhaka - 1000.

Test performed by :

3.6.21

Dr. Tahmeed M. Al-Hussaini
Professor, Dept. of Civil Engineering
BUET, Dhaka - 1000.

Department of Civil Engineering BUET, Dhaka-1000, Bangladesh

BRTC BUET

Ground Instrumentation & Engineering Pte Ltd	**OEDOMETER TEST RESULTS** **ASTM D2435/D2435M - 11**	

Project	:	Geotechnical Investigation for Matarbari Project
Client - Location	:	TEPSCO
Boring No	:	BH-01
Sample No	:	UD-01
Depth (m)	:	7.00-8.00
Soil Description	:	Lean CLAY, CL

Moisture Content Determination

		Initial	Final
Wt. of Ring + Wet Soil, gm	=	134.10	131.37
Wt. of Ring + Dry Soil, gm	=	118.00	118.00
Weight of Water, gm	=	16.10	13.37
Weight of Container, gm	=	69.47	69.47
Weight of Dry Soil, gm	=	48.53	48.53
Water Content, %	=	33.2	27.5

Unit Weight Determination

		Initial	Final
Wt. of Ring + Wet Soil, gm	=	134.10	131.37
Weight of Ring, gm	=	69.47	69.47
Weight of Wet Soil, gm	=	64.63	61.90
Height of Sample, cm	=	2	1.817
Diameter of Sample, cm	=	5	5
Volume of Sample, cm^3	=	39.27	35.68
Unit Wet Weight, kN/m^3	=	16.1	17.0
Unit Dry Weight, kN/m^3	=	12.1	13.3

Specific Gravity	=	2.73
Initial Void Ratio	=	1.209
Degree of Saturation, %	=	74.9
Room Temperature, ^oC	=	24.0
Temp. correction factor	=	0.91
Initial Transducer Reading	=	8.94
Effective Overburden Pressure	=	
Preconsolidation Pressure (kPA)	=	176
Compression Index (Cc)	=	0.5298

Inc. No.	Load, p (kPa)	Transducer Reading (div)	Machine Corr. (div)	Change in Height (mm)	e Void Ratio	t_{90} (min)	c_v (cm^2/day.)	$c_v(20^oC)$ (cm^2/day.)	m_v (m^2/MN)	k x 10^{-9} (m/s)
1	12	8.899	0.001	0.042	1.204	7.809	156.518	142.431	0.175	7.752
2	25	8.805	0.001	0.136	1.194	35.226	34.534	31.426	0.362	3.541
3	50	8.737	0.002	0.203	1.187	22.350	53.990	49.131	0.135	2.062
4	100	8.559	0.007	0.376	1.168	4.886	243.988	222.029	0.175	12.068
5	200	8.130	0.012	0.800	1.121	10.932	105.771	96.252	0.216	6.468
6	400	6.743	0.021	2.178	0.969	39.292	26.760	24.351	0.359	2.718
7	200	6.798	0.016	2.128	0.974				0.014	
8	100	6.928	0.012	2.002	0.988				0.071	
9	50	7.078	0.009	1.855	1.004				0.163	
10	25	7.106	0.007	1.829	1.007				0.057	

Tested By: Rayhan

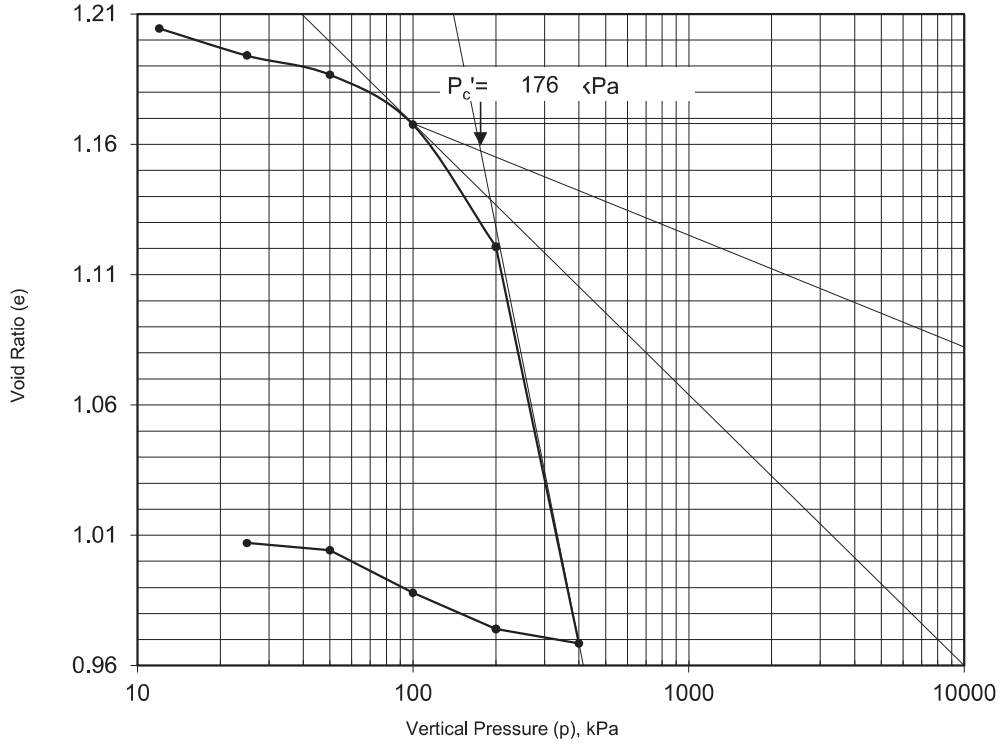
Date: 19-03-2021

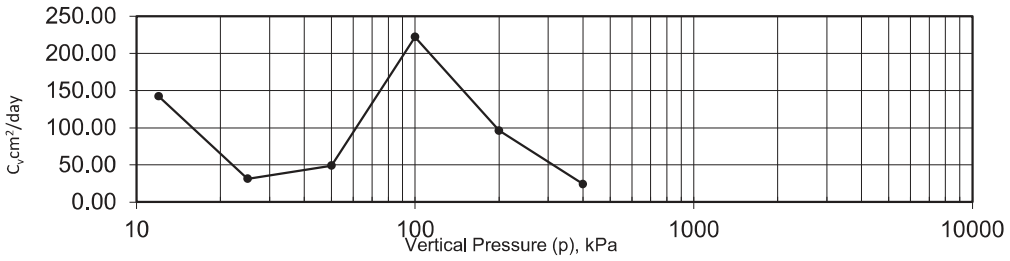
Checked & Approved By:T. Isla

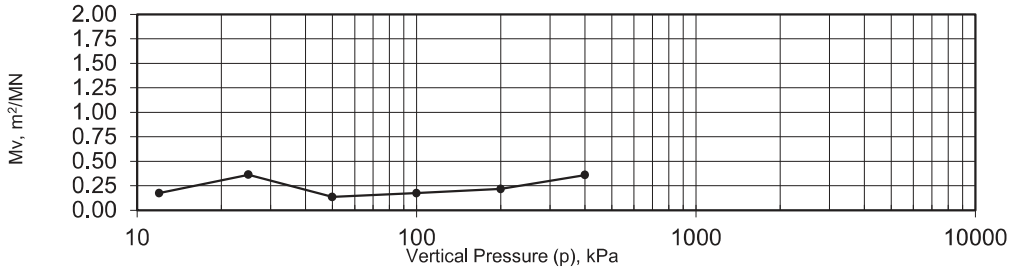
Date: 23-03-2021

ASTM D2435/D2435M - 11

Cc= 0.529751







Job No.	:	SIBD2105
Project	:	Geotechnical Investigation for Matarbari Project
Location	:	Matarbari, Power Plant Area
Borehole	:	BH-01
Sample	:	UD-01
Depth (m)	:	7.00-8.00

Ground Instrumentation & Engineering Pte Ltd

Ground Instrumentation & Engineering Pte Ltd	**OEDOMETER TEST RESULTS** **ASTM D2435/D2435M - 11**	

Project : SIBD2105
Client - Location : Geotechnical Investigation for Matarbari Project
Boring No : BH-01
Sample No : UD-02
Depth (m) : 10.00-11.00
Soil Description : Fat CLAY, CH

Moisture Content Determination

		Initial	Final
Wt. of Ring + Wet Soil, gm	=	142.40	137.50
Wt. of Ring + Dry Soil, gm	=	126.00	126.00
Weight of Water, gm	=	16.40	11.50
Weight of Container, gm	=	69.47	69.47
Weight of Dry Soil, gm	=	56.53	56.53
Water Content, %	=	29.0	20.3

Unit Weight Determination

		Initial	Final
Wt. of Ring + Wet Soil, gm	=	142.40	137.50
Weight of Ring, gm	=	69.47	69.47
Weight of Wet Soil, gm	=	72.93	68.03
Height of Sample, cm	=	2	1.744
Diameter of Sample, cm	=	5	5
Volume of Sample, cm^3	=	39.27	34.25
Unit Wet Weight, kN/m^3	=	18.2	19.5
Unit Dry Weight, kN/m^3	=	14.1	16.2

Specific Gravity	=	2.74
Initial Void Ratio	=	0.903
Degree of Saturation, %	=	88.0
Room Temperature, ^oC	=	24.0
Temp. correction factor	=	0.91
Initial Transducer Reading	=	8.47
Effective Overburden Pressure	=	
Preconsolidation Pressure	=	65
Compression Index (Cc)	=	0.2474

Inc. No.	Load, p (kPa)	Transducer Reading (div)	Machine Corr. (div)	Change in Height (mm)	e Void Ratio	t_{90} (min)	c_v ('cm2/day)	$c_v(20^oC)$ ('cm2/day)	m_v (m^2/MN)	k x 10^{-9} (m/s)
1	12	8.123	0.001	0.347	0.870	97.568	12.147	11.054	1.446	4.970
2	25	7.970	0.001	0.500	0.856	48.277	24.359	22.166	0.599	4.128
3	50	7.635	0.004	0.832	0.824	41.438	27.680	25.189	0.681	5.335
4	100	7.150	0.010	1.311	0.779	56.610	19.421	17.673	0.500	2.747
5	200	6.533	0.017	1.921	0.721	86.327	12.013	10.932	0.326	1.110
6	400	5.705	0.027	2.739	0.643	39.299	24.379	22.185	0.226	1.561
7	200	5.737	0.023	2.711	0.645				0.008	
8	100	5.806	0.019	2.646	0.652				0.038	
9	50	5.882	0.016	2.573	0.659				0.084	
10	25	5.897	0.015	2.559	0.660				0.032	

Tested By: Rayhan **Checked & Approved By:T. Islam**

Date: 19-03-2021 **Date: 23-03-2021**

BH-02

Ground Instrumentation & Engineering Pte Ltd	**MOISTURE CONTENT** **ASTM D2216-10**	

Sample No.:	SPT-02	Depth (m): 2.00-2.45
Can No.		103
Weight of Wet Soil + Can (gm)		188.99
Weight of Dry Soil + can (gm)		158.78
Weight of Can (gm)		12.90
Moisture Content (%)		**20.71**
Description		**Fine-medium SAND, SP**

Sample No.:	UD-01	Depth (m): 6.00-7.00
Can No.		94
Weight of Wet Soil + Can (gm)		181.70
Weight of Dry Soil + can (gm)		125.81
Weight of Can (gm)		14.21
Moisture Content (%)		**50.08**
Description		**Lean CLAY, CL**

Sample No.:	UD-02	Depth (m): 8.00-9.00
Can No.		109
Weight of Wet Soil + Can (gm)		325.00
Weight of Dry Soil + can (gm)		243.29
Weight of Can (gm)		24.21
Moisture Content (%)		**37.30**
Description		**Lean CLAY, CL**

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-02
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 28-02-2021

Checked by: Suvashis Paul
Date: 05-03-2021

Ground Instrumentation & Engineering Pte Ltd	**MOISTURE CONTENT** **ASTM D2216-10**	

Sample No.:	SPT-09	Depth (m): 11.00-11.45
Can No.		201
Weight of Wet Soil + Can (gm)		218.89
Weight of Dry Soil + can (gm)		165.87
Weight of Can (gm)		24.68
Moisture Content (%)		**37.55**
Description		**Lean CLAY, CL**

Sample No.:	SPT-13	Depth (m): 15.00-15.45
Can No.		98
Weight of Wet Soil + Can (gm)		177.30
Weight of Dry Soil + can (gm)		143.09
Weight of Can (gm)		15.99
Moisture Content (%)		**26.92**
Description		**Sandy lean CLAY, CL**

Sample No.:	SPT-18	Depth (m): 20.00-20.45
Can No.		406
Weight of Wet Soil + Can (gm)		205.29
Weight of Dry Soil + can (gm)		169.54
Weight of Can (gm)		26.78
Moisture Content (%)		**25.04**
Description		**Sandy lean CLAY, CL**

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-02
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 28-02-2021

Checked by: Suvashis Paul
Date: 05-03-2021

Ground Instrumentation & Engineering Pte Ltd	**MOISTURE CONTENT** **ASTM D2216-10**	

Sample No.:	SPT-21	Depth (m): 23.00-23.45
Can No.		97
Weight of Wet Soil + Can (gm)		178.27
Weight of Dry Soil + can (gm)		154.58
Weight of Can (gm)		14.61
Moisture Content (%)		**16.93**
Description		**Silty fine SAND, SM**

Sample No.:	SPT-23	Depth (m): 25.00-25.45
Can No.		484
Weight of Wet Soil + Can (gm)		214.64
Weight of Dry Soil + can (gm)		188.78
Weight of Can (gm)		23.78
Moisture Content (%)		**15.67**
Description		**Silty fine SAND, SM**

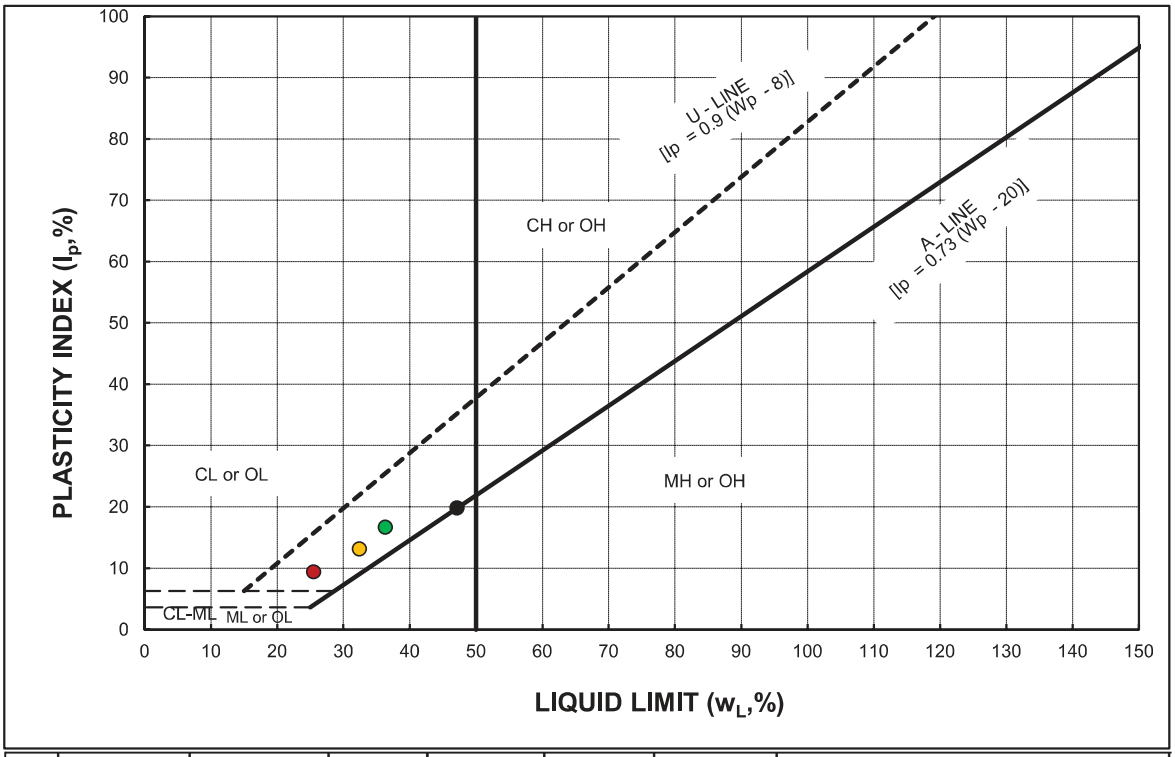
Sample No.:		
Can No.		
Weight of Wet Soil + Can (gm)		
Weight of Dry Soil + can (gm)		
Weight of Can (gm)		
Moisture Content (%)		
Description		

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-02
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 28-02-2021

Checked by: Suvashis Paul
Date: 05-03-2021

Ground Instrumentation & Engineering Pte. Ltd.



	Sample No.	Depth	W_L	W_P	I_p	Fines	Remarks
●	UD-01	6.00-7.00	47.10	27.22	19.88		Lean CLAY, CL
●	UD-02	8.00-9.00	32.40	19.22	13.18		Lean CLAY, CL
●	SPT-09	11.00-11.45	36.30	19.61	16.69		Lean CLAY, CL
●	SPT-13	15.00-15.45	25.50	16.08	9.42		Lean CLAY, CL
●							
●							
●							
●							
●							
○							

Note : All the above Liquid Limit tests was performed in accordance to Method A (Multi-Point) of ASTM D 4318-05

*Hydrometer analysis were performed instead of atterberg limit and presented with the Particle Size Distribution Section

ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands, etc.	**MH**	Inorganic silts, or diatomaceous fine sands or silts, elastic silts, etc.
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays, etc.	**CH**	Inorganic clays of high plasticity, fat clays, etc.
OL	Organic silts and organic silty clays of low plasticity.	**OH**	Organic silts and organic clays of medium to high plasticity.

PLASTICITY CHART (ASTM D 2487 - 06 & D 4318 - 05)

Geotechnical Investigation for Matarbari Project

Client: TEPSCO

Project ID: SIBD2105

BH No.: BH-02

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 01-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

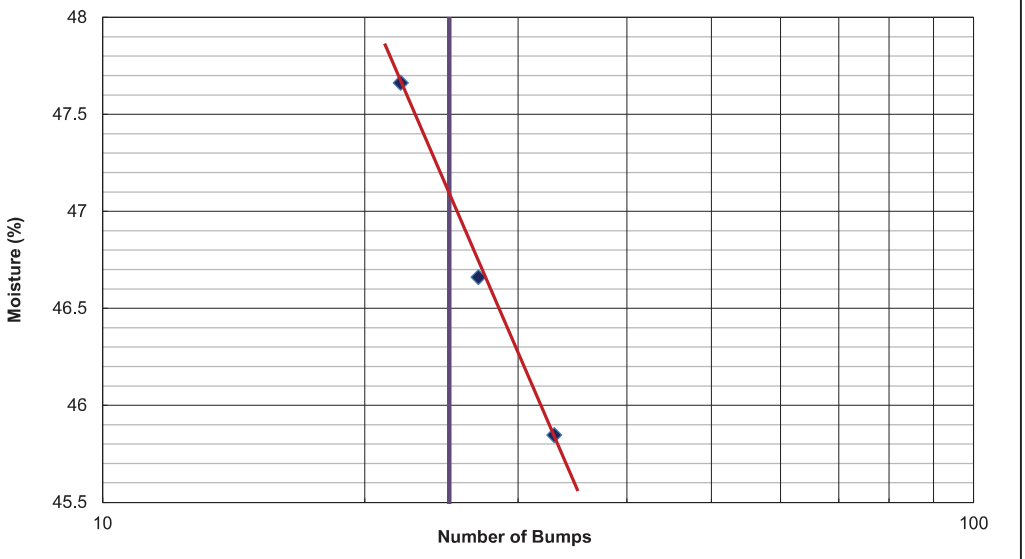
Ground Instrumentation & Engineering Pte. Ltd.

Liquid and Plastic Limits Test: ASTM D4318-10 (Casagrande Method)

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)
Project ID: SIBD2105 Sample No: UD-01
BH No.: BH-02 Sample Depth: 6.00-7.00

Plastic Limit Test		
Container No.	422	322
Weight of can (gm)	7.59	7.55
Wet weight of soil + can (gm)	36.63	36.65
Dry Weight of soil + can (gm)	30.43	30.41
Moisture Content %	27.15	27.30
Average	27.22	

Liquid Limit Test (Casagrande, Blow count: 20-35, ASTM Method-A- multi-pt)			
Test No	1	2	3
Number of Bumps	22	27	33
Container No.	328	320	327
Weight of can (gm)	8.24	7.67	8.08
Wet weight of soil + can (gm)	25.93	23.92	23
Dry Weight of soil + can (gm)	20.22	18.75	18.31
Moisture Content %	**47.66**	**46.66**	**45.85**



LL: 47.10	PL: 27.22	PI: 19.88
Description	Lean CLAY, CL	

Tested by: Rayhan
Date: 01-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

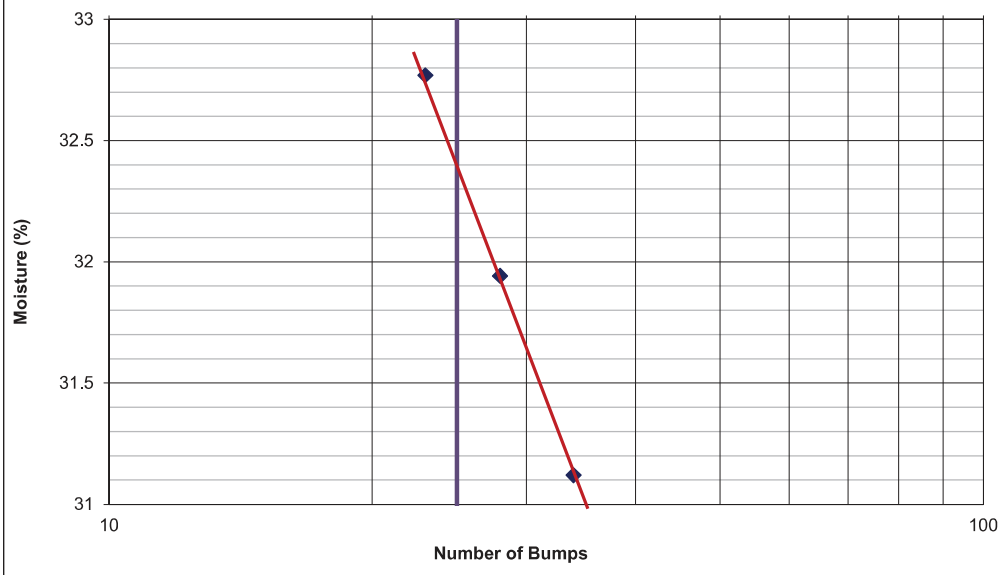
Ground Instrumentation & Engineering Pte. Ltd.

Liquid and Plastic Limits Test: ASTM D4318-10 (Casagrande Method)

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)
Project ID: SIBD2105 Sample No.: UD-02
BH No.: BH-02 Sample Depth: 8.00-9.00

Plastic Limit Test		
Container No.	228	34
Weight of can (gm)	12.19	12.15
Wet weight of soil + can (gm)	35.92	35.94
Dry Weight of soil + can (gm)	32.11	32.09
Moisture Content %	19.13	19.31
Average	19.22	

Liquid Limit Test (Casagrande, Blow count: 20-35, ASTM Method-A- multi-pt)			
Test No	1	2	3
Number of Bumps	23	28	34
Container No.	441	442	433
Weight of can (gm)	3.76	3.95	4.02
Wet weight of soil + can (gm)	26.53	25.14	23.57
Dry Weight of soil + can (gm)	20.91	20.01	18.93
Moisture Content %	**32.77**	**31.94**	**31.12**



LL: 32.40	PL: 19.22	PI: 13.18
Description	Lean CLAY, CL	

Tested by: Rayhan
Date: 01-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

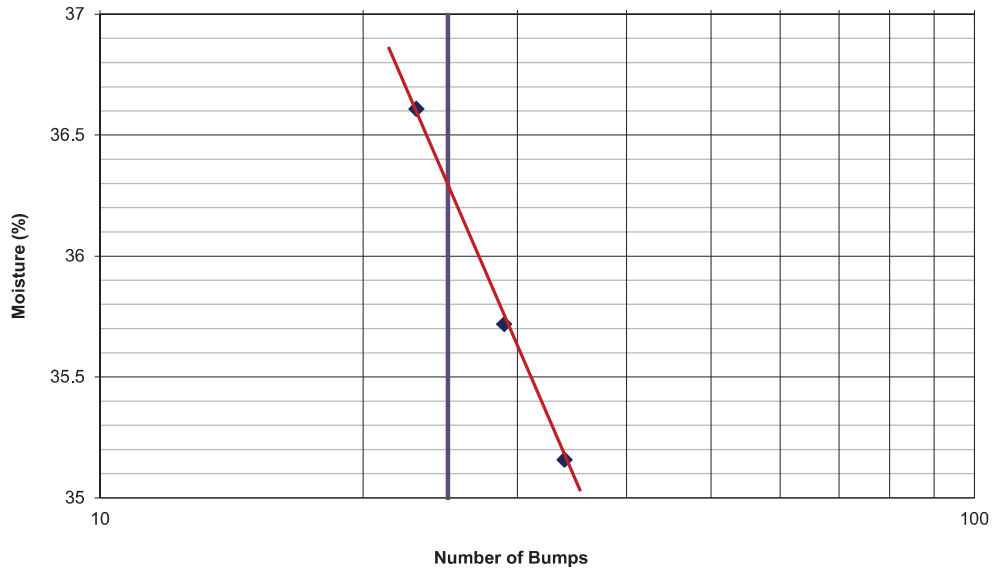
Ground Instrumentation & Engineering Pte. Ltd.

Liquid and Plastic Limits Test: ASTM D4318-10 (Casagrande Method)

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)
Project ID: SIBD2105 Sample No.: SPT-09
BH No.: BH-02 Sample Depth.: 11.00-11.45

Plastic Limit Test		
Container No.	350	347
Weight of can (gm)	8.61	8.54
Wet weight of soil + can (gm)	30.46	30.48
Dry Weight of soil + can (gm)	26.89	26.87
Moisture Content %	19.53	19.69
Average	19.61	

Liquid Limit Test (Casagrande, Blow count: 20-35, ASTM Method-A- multi-pt)			
Test No	1	2	3
Number of Bumps	23	29	34
Container No.	332	329	331
Weight of can (gm)	7.4	9.42	9.86
Wet weight of soil + can (gm)	29.23	28.76	27.89
Dry Weight of soil + can (gm)	23.38	23.67	23.2
Moisture Content %	**36.61**	**35.72**	**35.16**



LL: 36.30	PL: 19.61	PI: 16.69
Description	Lean CLAY, CL	

Tested by: Rayhan
Date: 01-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

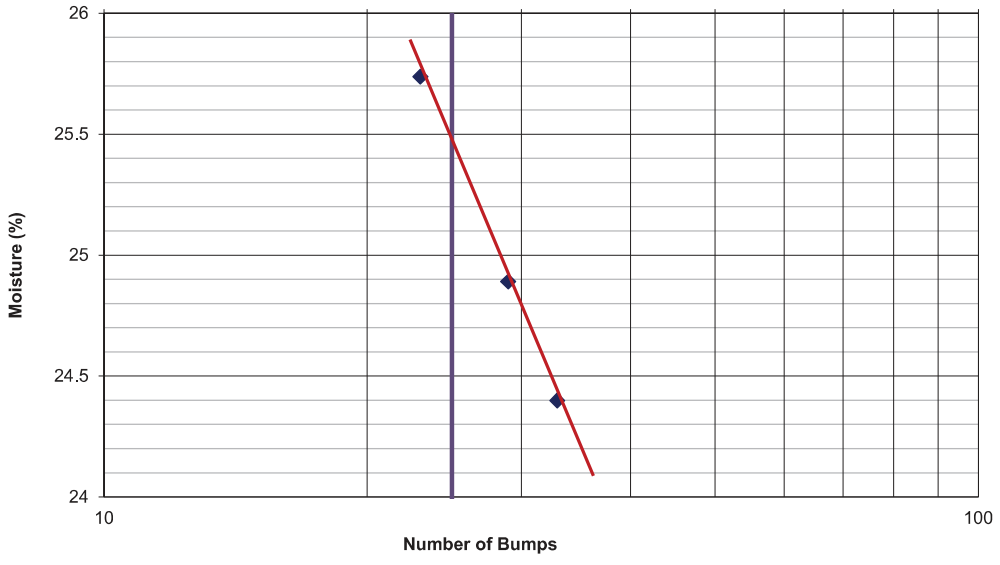
Ground Instrumentation & Engineering Pte. Ltd.

Liquid and Plastic Limits Test: ASTM D4318-10 (Casagrande Method)

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)
Project ID: SIBD2105 Sample No.: SPT-13
BH No.: BH-02 Sample Depth.: 15.00-15.45

Plastic Limit Test		
Container No.	43	30
Weight of can (gm)	11.67	11.51
Wet weight of soil + can (gm)	38.14	38.16
Dry Weight of soil + can (gm)	34.48	34.46
Moisture Content %	16.05	16.12
Average	16.08	

Liquid Limit Test (Casagrande, Blow count: 20-35, ASTM Method-A- multi-pt)			
Test No	1	2	3
Number of Bumps	23	29	33
Container No.	438	440	444
Weight of can (gm)	4.07	3.76	4.19
Wet weight of soil + can (gm)	25.37	23.93	20.76
Dry Weight of soil + can (gm)	21.01	19.91	17.51
Moisture Content %	25.74	24.89	24.40

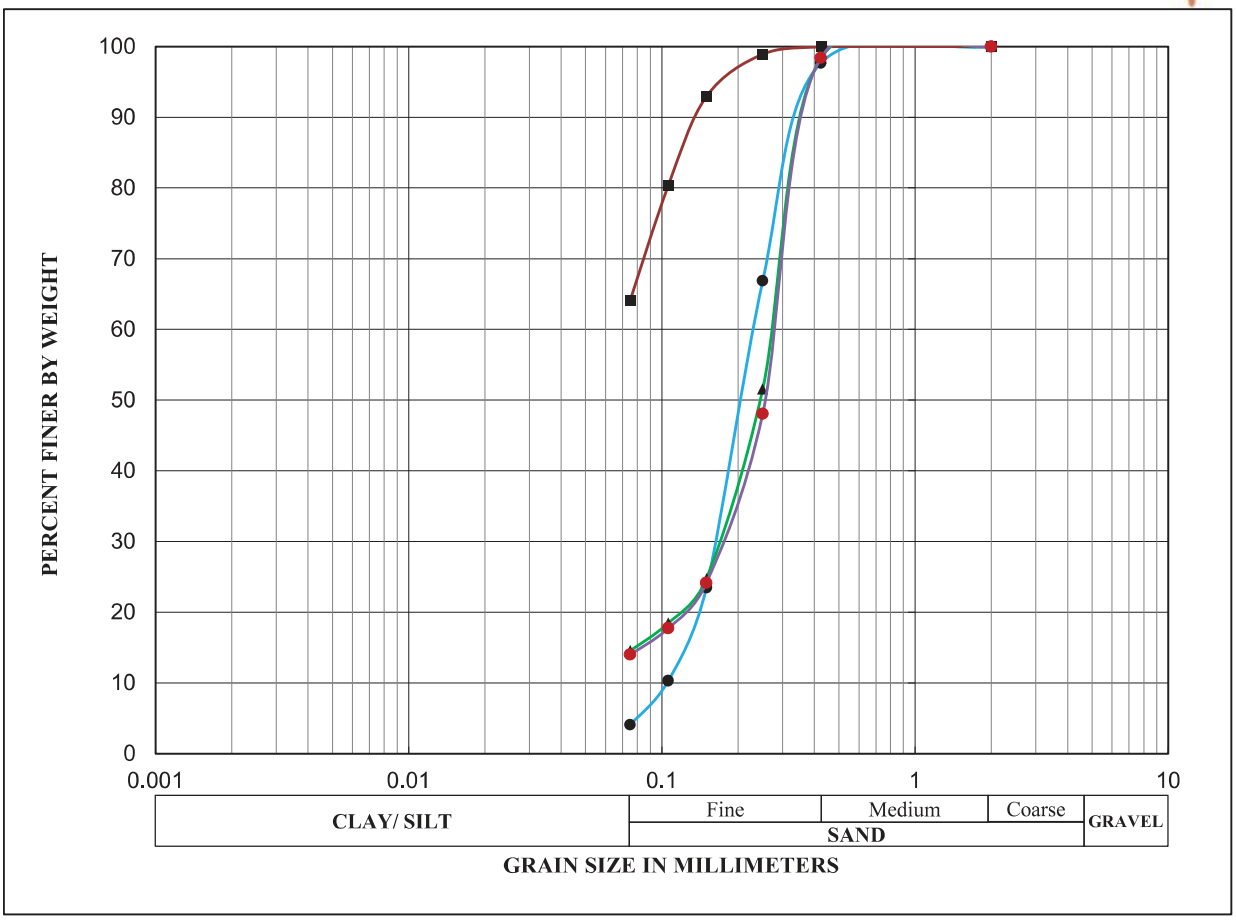


LL: 25.50	PL: 16.08	PI: 9.42
Description	Lean CLAY, CL	

Tested by: Rayhan
Date: 01-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

Ground Instrumentation & Engineering Pte.Ltd.



	Sample	Depth	Classification	W(%)	W_L	P_L	I_P	C_U	C_C
●	SPT-02	2.00-2.45	Fine-medium SAND, SP					2.24	1.11
■	SPT-13	15.00-15.45	Sandy lean CLAY, CL						
▲	SPT-21	23.00-23.45	Silty fine SAND, SM						
●	SPT-23	25.00-25.45	Silty fine SAND, SM						
■	SPT-00	#N/A	5					#N/A	#N/A
▲	SPT-00	#N/A	6					#N/A	#N/A

	Sample	Depth	D60	D50	D30	D10	%Gravel	%Sand			%SILT/ %CLAY
								%Fine	%Meidum	%Coarse	
●	SPT-02	2.00-2.45	0.234	0.211	0.165	0.105	0.00	93.60	2.30	0.00	4.10
■	SPT-13	15.00-15.45	0.070	0.058	0.035	0.012	0.00	35.80	0.06	0.00	64.14
▲	SPT-21	23.00-23.45	0.282	0.244	0.170	0.052	0.00	83.78	1.66	0.00	14.56
●	SPT-23	25.00-25.45	0.292	0.257	0.174	0.054	0.00	84.40	1.60	0.00	14.00
■	SPT-00	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	#N/A
▲	SPT-00	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	#N/A

GRADATION CURVES (ASTM D 2487 - 06 & D 422 - 63)

Geotechnical Investigation for Matarbari Project

Client: TEPSCO

Project ID: SIBD2105

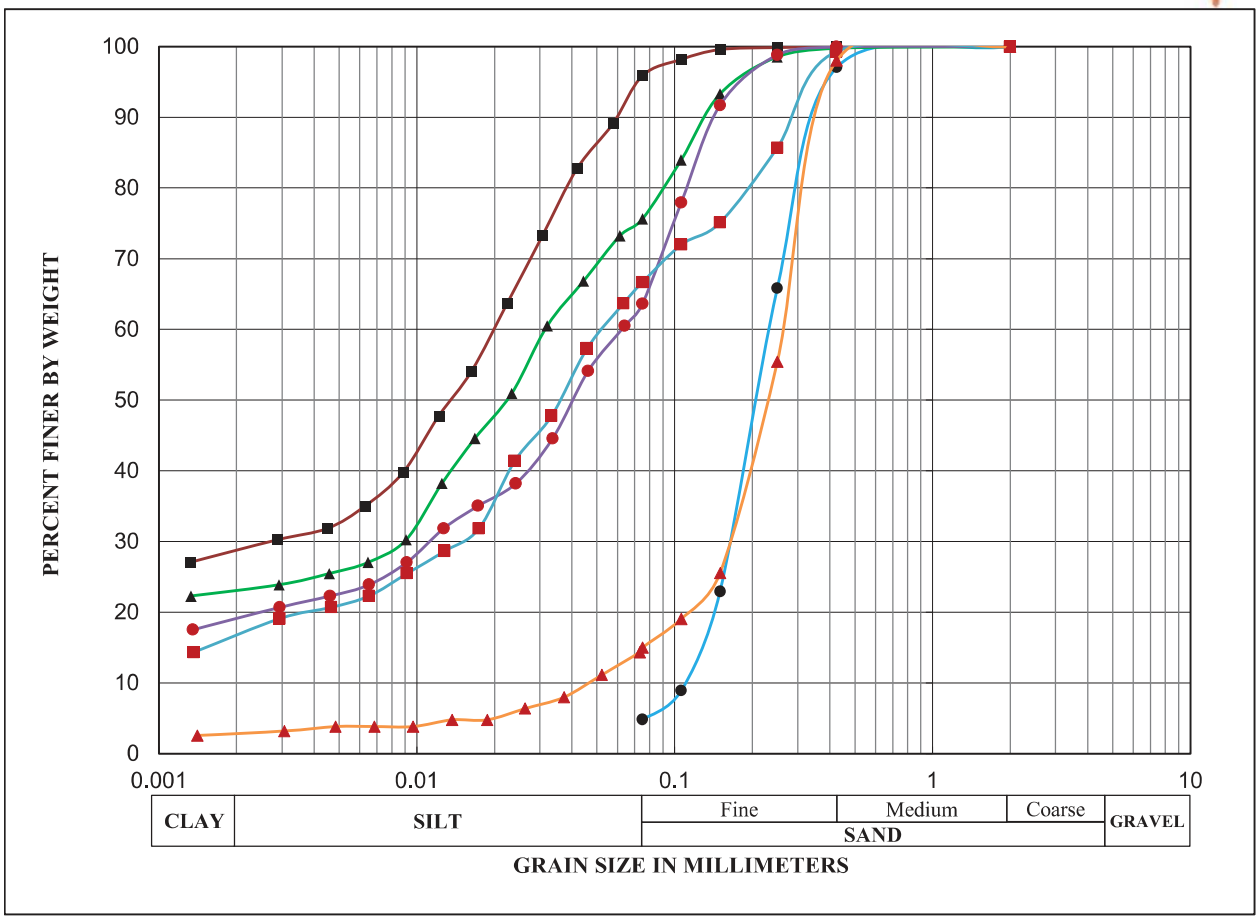
BH No.: BH-02

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 01-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

Ground Instrumentation & Engineering Pte.Ltd.



	Sample	Depth	Classification	W(%)	W_L	P_L	I_P	C_U	C_C
●	SPT-02	2.00-2.45	Fine-medium SAND, SP					2.16	1.07
■	SPT-09	11.00-11.45	Lean CLAY, CL						
▲	SPT-10	12.00-12.45	Lean CLAY with Sand, CL						
●	SPT-13	15.00-15.45	Sandy lean CLAY, CL						
■	SPT-18	20.00-20.45	Sandy lean CLAY, CL						
▲	SPT-21	23.00-23.45	Silty fine SAND, SM						

	Sample	Depth	D60	D50	D30	D10	%Gravel	%Sand			%SILT	%CLAY
								%Fine	%Meidum	%Coarse		
●	SPT-02	2.00-2.45	0.236	0.213	0.167	0.109	0.00	92.22	2.96	0.00	4.82	
■	SPT-09	11.00-11.45	0.020	0.014	0.003	0.000	0.00	4.08	0.04	0.00	68.82	27.06
▲	SPT-10	12.00-12.45	0.032	0.022	0.009	0.001	0.00	24.10	0.26	0.00	53.36	22.28
●	SPT-13	15.00-15.45	0.063	0.041	0.011	0.001	0.00	36.30	0.08	0.00	46.11	17.51
■	SPT-18	20.00-20.45	0.053	0.036	0.015	0.001	0.00	32.64	0.70	0.00	52.33	14.33
▲	SPT-21	23.00-23.45	0.269	0.232	0.165	0.047	0.00	83.04	1.96	0.00	12.45	2.55

GRADATION CURVES (ASTM D 2487 - 06 & D 422 - 63)

Geotechnical Investigation for Matarbari Project

Client: TEPSCO

Project ID: SIBD2105

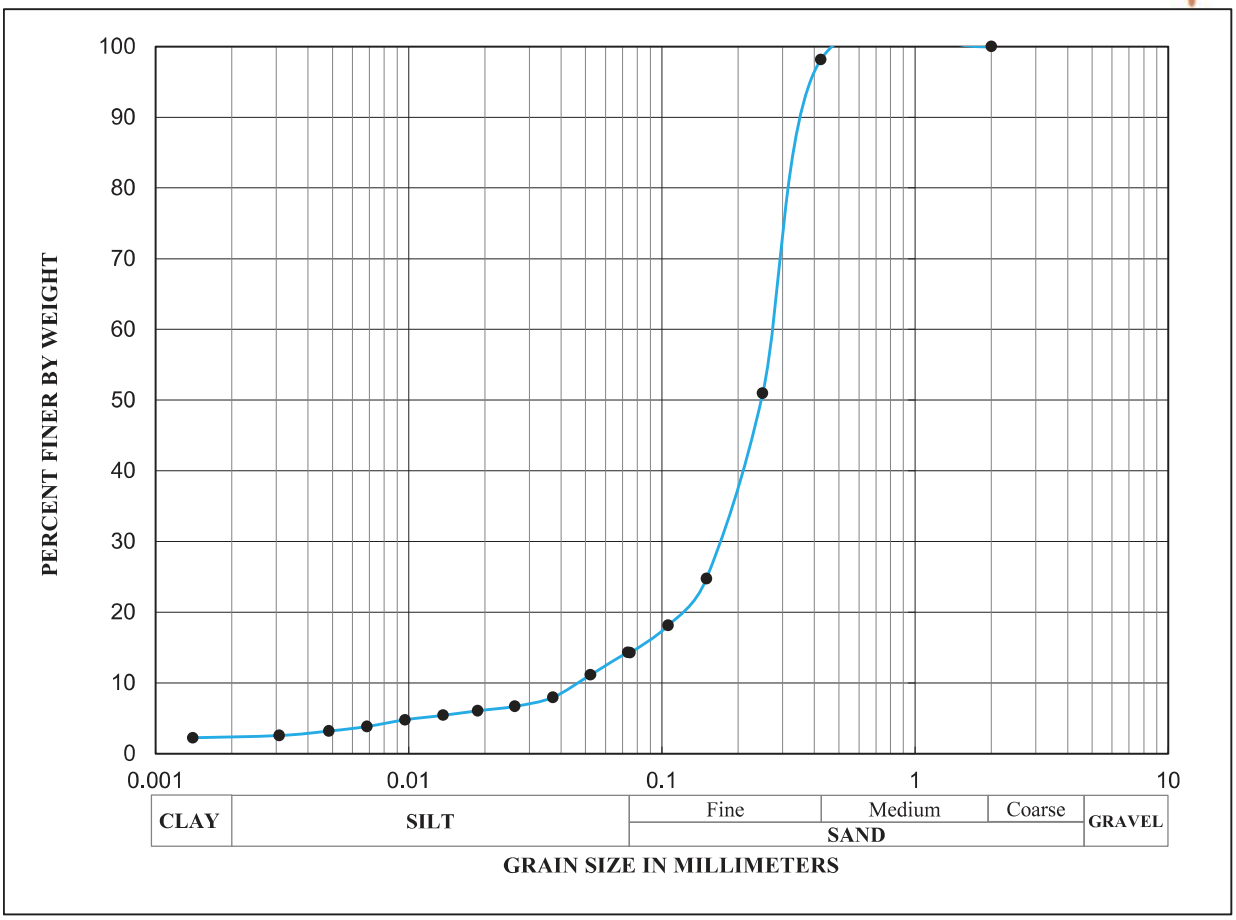
BH No.: BH-02

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 03-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

Ground Instrumentation & Engineering Pte.Ltd.



	Sample	Depth	Classification	W(%)	W_L	P_L	I_P	C_U	C_C
●	SPT-23	25.00-25.45	Silty fine SAND, SM						
■									
▲									
●									
■									
▲									

	Sample	Depth	D60	D50	D30	D10	%Gravel	%Sand			%SILT	%CLAY
								%Fine	%Meidum	%Coarse		
●	SPT-23	25.00-25.45	0.284	0.246	0.170	0.047	0.00	83.90	1.84	0.00	12.03	2.23
■												
▲												
●												
■												
▲												

GRADATION CURVES (ASTM D 2487 - 06 & D 422 - 63)

Geotechnical Investigation for Matarbari Project

Client: TEPSCO

Project ID: SIBD2105

BH No.: BH-02

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 03-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

Ground Instrumentation & Engineering Pte Ltd	**PARTICLE DENSITY** **BS 1733 Part 2 Section 8** **(Small Pyknometer Method)**	

SPT-02	Depth(m)	2.00-2.45
Pyknometer No.		9
Mass of bottle + soil + water: M_3	gm	97.32
Mass of bottle + soil: M_2	gm	57.84
Mass of bottle + water: M_4	gm	78.61
Mass of bottle: M_1	gm	27.80
Mass of soil: $M_2 - M_1$	gm	30.04
Mass of water in full bottle: $M_4 - M_2$	gm	20.77
Mass of water used: $M_3 - M_2$	gm	39.48
Volume of soil particles: $(M_4 - M_1) - (M_3 - M_2)$	ml	11.33
Particle Density: $\frac{M_2 - M_1}{(M_4 - M_1) - (M_3 - M_2)}$	g/cm3	2.65

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-02
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 02-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

Ground Instrumentation & Engineering Pte Ltd	**PARTICLE DENSITY** **BS 1733 Part 2 Section 8** **(Small Pyknometer Method)**	

UD-02	Depth(m)	8.00-9.00
Pyknometer No.		8
Mass of bottle + soil + water: M_3	gm	91.39
Mass of bottle + soil: M_2	gm	51.16
Mass of bottle + water: M_4	gm	72.48
Mass of bottle: M_1	gm	21.14
Mass of soil: $M_2 - M_1$	gm	30.02
Mass of water in full bottle: $M_4 - M_2$	gm	21.32
Mass of water used: $M_3 - M_2$	gm	40.23
Volume of soil particles: $(M_4 - M_1) - (M_3 - M_2)$	ml	11.11
Particle Density: $\frac{M_2 - M_1}{(M_4 - M_1) - (M_3 - M_2)}$	g/cm3	2.70

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-02
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 02-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

Ground Instrumentation & Engineering Pte Ltd	**PARTICLE DENSITY** **BS 1733 Part 2 Section 8** **(Small Pyknometer Method)**	

SPT-09	Depth(m)	11.00-11.45
Pyknometer No.		17
Mass of bottle + soil + water: M_3	gm	124.09
Mass of bottle + soil: M_2	gm	71.87
Mass of bottle + water: M_4	gm	105.23
Mass of bottle: M_1	gm	41.89
Mass of soil: $M_2 - M_1$	gm	29.98
Mass of water in full bottle: $M_4 - M_2$	gm	33.37
Mass of water used: $M_3 - M_2$	gm	52.22
Volume of soil particles: $(M_4 - M_1) - (M_3 - M_2)$	ml	11.12
Particle Density: $\frac{M_2 - M_1}{(M_4 - M_1) - (M_3 - M_2)}$	g/cm3	2.69

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-02
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 02-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

Ground Instrumentation & Engineering Pte Ltd	**PARTICLE DENSITY** **BS 1733 Part 2 Section 8** **(Small Pyknometer Method)**	

SPT-13	Depth(m)	15.00-15.45
Pyknometer No.		12
Mass of bottle + soil + water: M_3	gm	98.76
Mass of bottle + soil: M_2	gm	59.81
Mass of bottle + water: M_4	gm	79.85
Mass of bottle: M_1	gm	29.76
Mass of soil: $M_2 - M_1$	gm	30.05
Mass of water in full bottle: $M_4 - M_2$	gm	20.04
Mass of water used: $M_3 - M_2$	gm	38.95
Volume of soil particles: $(M_4 - M_1) - (M_3 - M_2)$	ml	11.14
Particle Density: $\frac{M_2 - M_1}{(M_4 - M_1) - (M_3 - M_2)}$	g/cm3	2.69

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-02
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 02-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

Ground Instrumentation & Engineering Pte Ltd	**PARTICLE DENSITY** **BS 1733 Part 2 Section 8** **(Small Pyknometer Method)**	

SPT-21	Depth(m)	23.00-23.45
Pyknometer No.		16
Mass of bottle + soil + water: M_3	gm	119.06
Mass of bottle + soil: M_2	gm	73.91
Mass of bottle + water: M_4	gm	100.35
Mass of bottle: M_1	gm	43.92
Mass of soil: $M_2 - M_1$	gm	29.99
Mass of water in full bottle: $M_4 - M_2$	gm	26.45
Mass of water used: $M_3 - M_2$	gm	45.16
Volume of soil particles: $(M_4 - M_1) - (M_3 - M_2)$	ml	11.28
Particle Density: $\frac{M_2 - M_1}{(M_4 - M_1) - (M_3 - M_2)}$	g/cm3	2.66

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-02
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 02-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

Mobile: 01819 557964; PABX: 966 5650-80 Ext. 7226

BRTC Bureau of Research, Testing & Consultation

GEOTECHNICAL ENGINEERING LABORATORY

BRTC No.:	110-231613/20-21/CE Dated 11.3.21		
Client :	Manager, Environment, Health and Safety, SGS Bangladesh Ltd., Bir Uttam CR Datta Rd, Dhaka		
Ref :	SGS/Phase-2/SI/090321 dated 9.3.21		
Project :	Geotechnical Investigation at Matarbari		
Location:	Matarbari		
Test Method:	ASTM	**Date of Test:**	1-10.4.21

SPECIFIC GRAVITY DETERMINATION OF SOIL

Borehole	1	2	3.0	4.0	5.0	6.0
Depth (m)	14-14.5	25-25.45	4-4.5	17-17.45	17-17.45	26-26.45
Sample No.	12.0	23.0	4.0	15.0	14.0	23.0
Soil Type	Grey silty sand	Grey silty sand	Grey silty sand	Grey silty sand	Grey silty sand	Grey silty sand
Wt. of bottle+water+ soil, gm	371.6	375.3	373.4	371.6	380.1	396.4
Temperature (°C)	30.5	30.0	30.5	30.5	30.5	30.0
Wt. of bottle+water, gm	340.0	343.7	342.1	340.4	348.8	365.1
Wt. of soil, gm	49.8	49.2	49.9	49.3	49.7	48.6
Specific Gravity	**2.72**	**2.78**	**2.67**	**2.71**	**2.69**	**2.80**

Note: Tests were conducted on samples received in unsealed condition. BRTC, BUET does not have any responsibility as to the representative character of the supplied samples.

2

44A76bmM6

Countersigned by :

Dr. A.B.M. Badruzzaman
Professor
Department of Civil Engineering
BUET, Dhaka - 1000.

Test performed by :

25.5.21

Dr. Tahmeed M. Al-Hussaini
Professor
Department of Civil Engineering
BUET, Dhaka - 1000.

Department of Civil Engineering BUET, Dhaka-1000, Bangladesh

UNIT WEIGHT / BULK DENSITY
VOID RATIO

Ground Instrumentation & Engineering Pte Ltd

UD-01	Depth (m):	6.00-7.00
Weight of soil	gm	152.10
Height	mm	76
Diameter	mm	38
Volume	mm3	86193
Bulk Density	(g/cm3)	1.76
Dry Density	(g/cm3)	1.18
Void Ratio		1.31
Moisture Content	%	50.08
Specific Gravity	(g/cm3)	2.72

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-02
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 02-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

ACCREDITED LABORATORY SAC-SINGLAS	**UNIT WEIGHT / BULK DENSITY** **VOID RATIO**	Ground Instrumentation & Engineering Pte Ltd

UD-02	Depth (m):	8.00-9.00
Weight of soil	gm	150.00
Height	mm	76
Diameter	mm	38
Volume	mm3	86193
Bulk Density	(g/cm3)	1.74
Dry Density	(g/cm3)	1.27
Void Ratio		1.13
Moisture Content	%	37.30
Specific Gravity	(g/cm3)	2.70

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-02
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 02-03-2021

Checked by: Suvashis Paul
Date: 05-03-2021

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

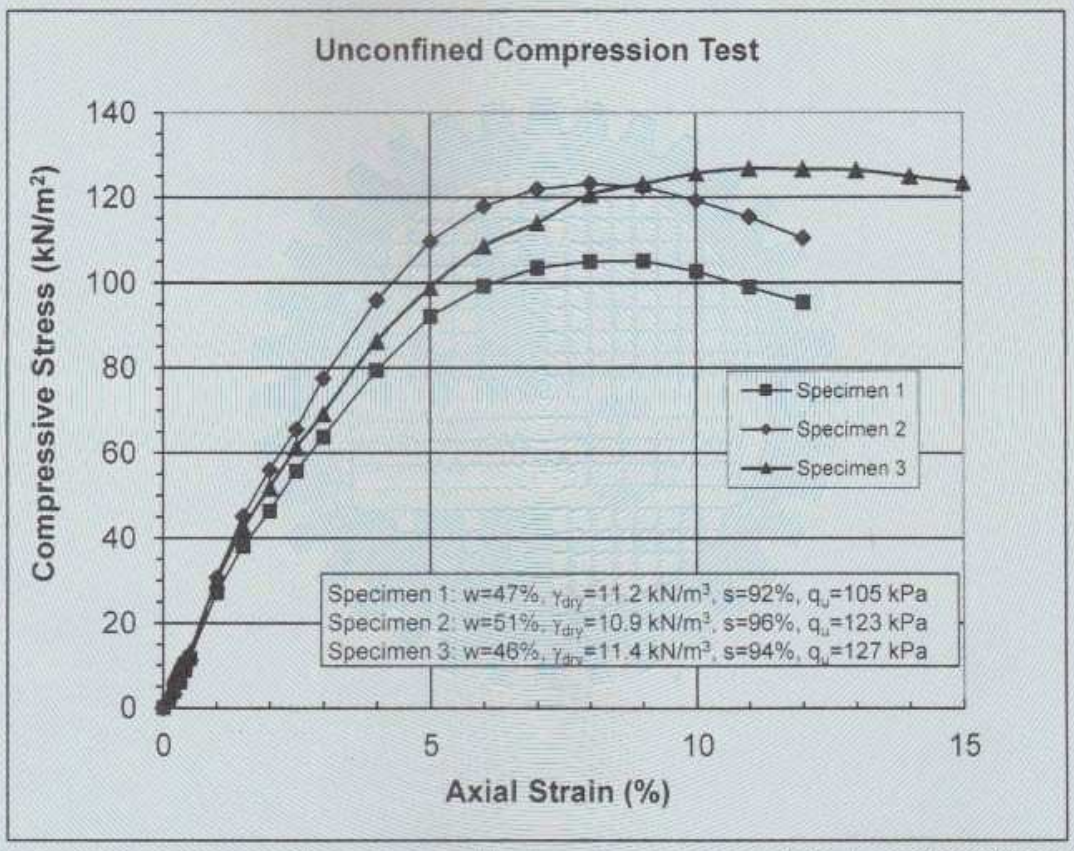
DEPARTMENT OF CIVIL ENGINEERING

Mobile: 01819 557964; PABX: 966 5650-80 Ext. 7226

GEOTECHNICAL ENGINEERING LABORATORY

BRTC Bureau of Research Testing & Consultation

BRTC No.:	110-231613/20-21/CE dated 11.3.21			
Client :	Manager, Environment Health & Safety, SGS Bangladesh Ltd., Bir Uttam CR Datta Road, Dhaka			
Ref :	SGS/Phase-2/SI/090321 dated 9.3.21			
Project :	Geotechnical Investigation at Matarbari			
Soil description :	Grey to dary grey silty clay, trace roots			
Test Method:	ASTM		Date of Test:	29.3.21-1.4.21
BH No. : 2		Sample ID : UD-1	Depth:	6-7 m
			Location:	Matarbari



Note: Samples as supplied to us in sampler tubes have been tested in our laboratory. BRTC, BUET does not have any responsibility as to the representative character of the sample. Initial water content, dry density, degree of saturation and unconfined compressive strength is reported.

19

YWLg5BBrK

Sample was received in unsealed condition.

Specific Gravity= 2.72

Countersigned by :

Dr. A.B.M. Badruzzaman
Professor
Department of Civil Engineering
BUET, Dhaka - 1000.

Test performed by :

7.5.21

Dr. Tahmeed M. Al-Hussaini
Professor
Department of Civil Engineering
BUET, Dhaka - 1000.

Department of Civil Engineering BUET, Dhaka-1000, Bangladesh

BRTC BUET

BUETCE 0 2 2 3 8 1

Total Stress Triaxial Compression

Unconfined Compression

Summary Report

Sample Details				
 *sketch showing specimen location in original sample*	Depth			8.00-9.00
	Description			Lean CLAY, CL
	Type			UD
	Initial Sample Length	L_0	(mm)	76.0
	Initial Sample Diameter	D_0	(mm)	38.0
	Initial Sample Weight	W_0	(gr)	160.5
	Bulk Density	ρ_0	(Mg/m3)	1.86
	Particle Density	ρ_s	(Mg/m3)	2.70

Initial Conditions

Strain Rate	m_s	(mm/min)	0.76000
MembraneThickness	m_b	(mm)	0.00
Displacement Input	L_{IP}	(mm)	CH 7
Load Input	N_{IP}	(N)	CH 2
Initial Moisture	$\omega_i\%$	(%)	37
Initial Dry Density	ρ_{d0}	(Mg/m3)	1.36
Initial Voids Ratio	e_0	.	0.98
Initial Degree of Saturation	S_o	(%)	100

Final Conditions

Max Deviator Stress	$(\sigma_1-\sigma_3)_f$	(kPa)	96.57
Strain At Max Stress	$\varepsilon_f\%$	(%)	7.18
Final Moisture	$\omega_f\%$	(%)	37
Final Dry Density	ρ_{df}	(Mg/m3)	1.36
Final Voids Ratio	e_f	.	0.98
Final Degree of Saturation	S_f	(%)	100.0

Notes

Failure Sketch

(surface inclination)

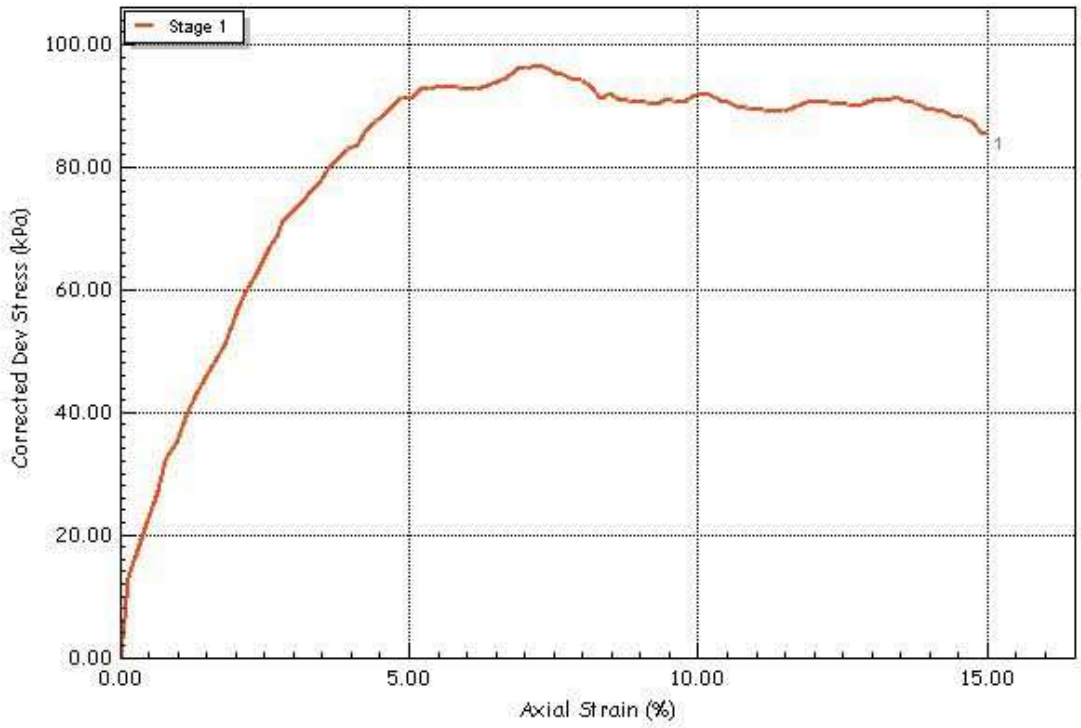
Test Method	D 2166/D2166M-13			Test Name	UCT
Database: .\SQLEXPRESS \ GIE-D				Test Date	3/16/2021
Site Reference				Borehole	BH-02
Jobfile	UCT			Sample	UD-02
Client	SGS			Depth	8.00-9.00
Operator	R. Islam	Checked	Aminul	Approved	T. Islam

GIE

Total Stress Triaxial Compression

Unconfined Compression

Test Results Plots



Test Method	D 2166/D2166M-13			Test Name	UCT
Database: .\SQLEXPRESS \ GIE-D				Test Date	3/16/2021
Site Reference				Borehole	BH-02
Jobfile	UCT			Sample	UD-02
Client	SGS			Depth	8.00-9.00
Operator	R. Islam	Checked	Aminul	Approved	T. Islam

GIE

Direct Shear Tests

Direct Shearbox Test

Summary

Sample Details						
 *sketch showing specimen location in original sample*	Depth		2.00-2.45			
	Description		Silty fine SAND, SP			
	Type		Disturbed Soil			
				Spm. 1	2	3
	Initial Height	H_0	(mm)	20.0	20.0	20.0
	Initial Width	D_0	(mm)	60.0	60.0	60.0
	Initial Weight	W_0	(gr)	129.0	129.0	129.0
	Initial Bulk Density	ρ_0	(Mg/m3)	1.79	1.79	1.79
	Particle Density	ρ_s	(Mg/m3)	2.65	2.65	2.65

Initial Condition					
			Spm. 1	2	3
Normal Stress Level		(kPa)	50	100	200
Is Specimen Submersed?			Yes	Yes	Yes
Reverse Method			Motor Drive		
Hoz. Control Machine			Not Used	Not Used	Not Used
Initial Moisture	ω_i%	(%)	21	21	21
Initial Dry Density	ρ_{di}	(Mg/m3)	1.48	1.48	1.48
Initial Voids Ratio	e_i	.	0.788	0.788	0.788
Initial Degree of Saturation	S_i	(%)	70.3	70.3	70.3

Notes

Max Shear Stress Results					
			Spm. 1	2	3
Final Moisture	ω_f%	(%)	23	22	22
Final Dry Density	ρ_{df}	(Mg/m3)	1.49	1.51	1.60
Final Voids Ratio	e_f	.	0.814	0.790	0.689
Final Degree of Saturation	S_f	(%)	74.4	72.8	83.4
Peak Shear Stress		(kPa)	23.8	49.6	99.5
Hoz Displacement	L_H	(mm)	12.000	12.000	10.220
Vertical Displacement	L_V	(mm)	-0.300	-0.510	0.360

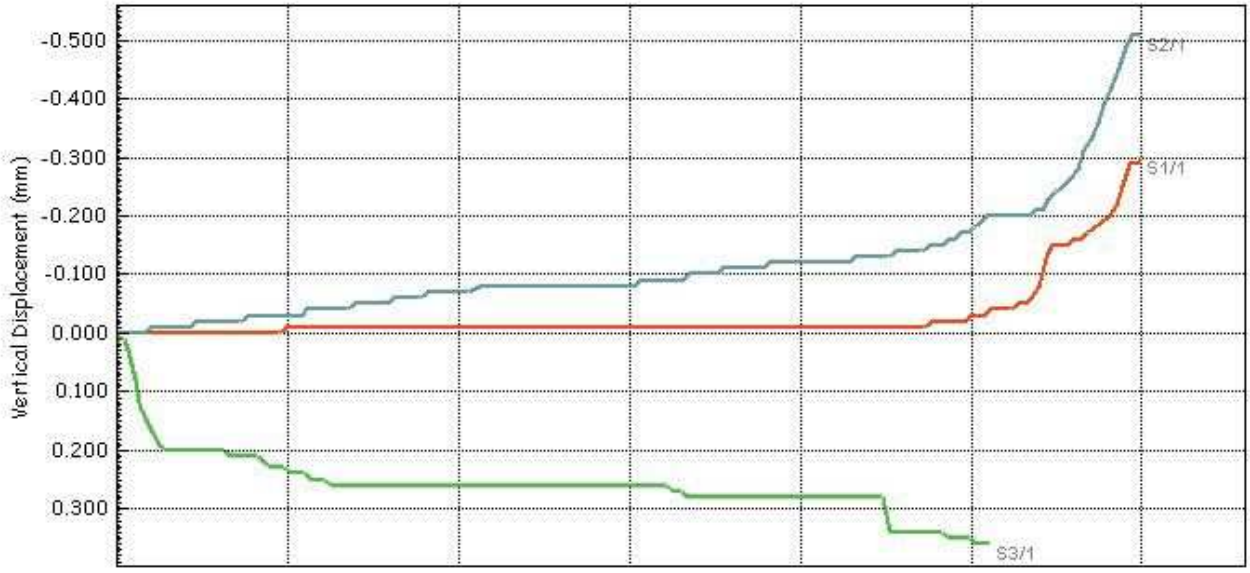
GIE

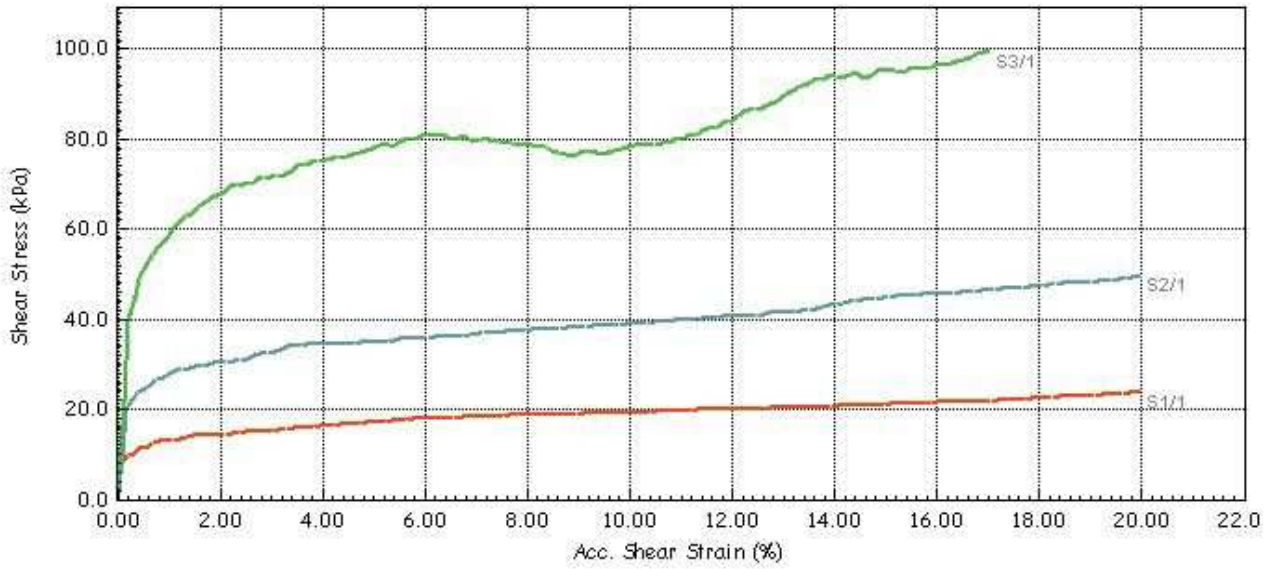
Test Method	ASTM D 3080-04			Test Name	Direct Shear
				Database: .\SQLEXPRESS \ GIE-D	
Site Reference				Test Date	3/11/2021
Jobfile	Direct Shear Test			Sample	SPT-02
Client	SGS			Borehole	BH-02
Operator	R. Islam	Checked	Aminul	Approved	T. Islam

Direct Shear Tests

Direct Shearbox Test

Shear Stage





Test Method	ASTM D 3080-04			Test Name	Direct Shear
				Database: .\SQLEXPRESS \ GIE-D	
Site Reference				Test Date	3/11/2021
Jobfile	Direct Shear Test			Sample	SPT-02
Client	SGS			Borehole	BH-02
Operator	R. Islam	Checked	Aminul	Approved	T. Islam

GIE

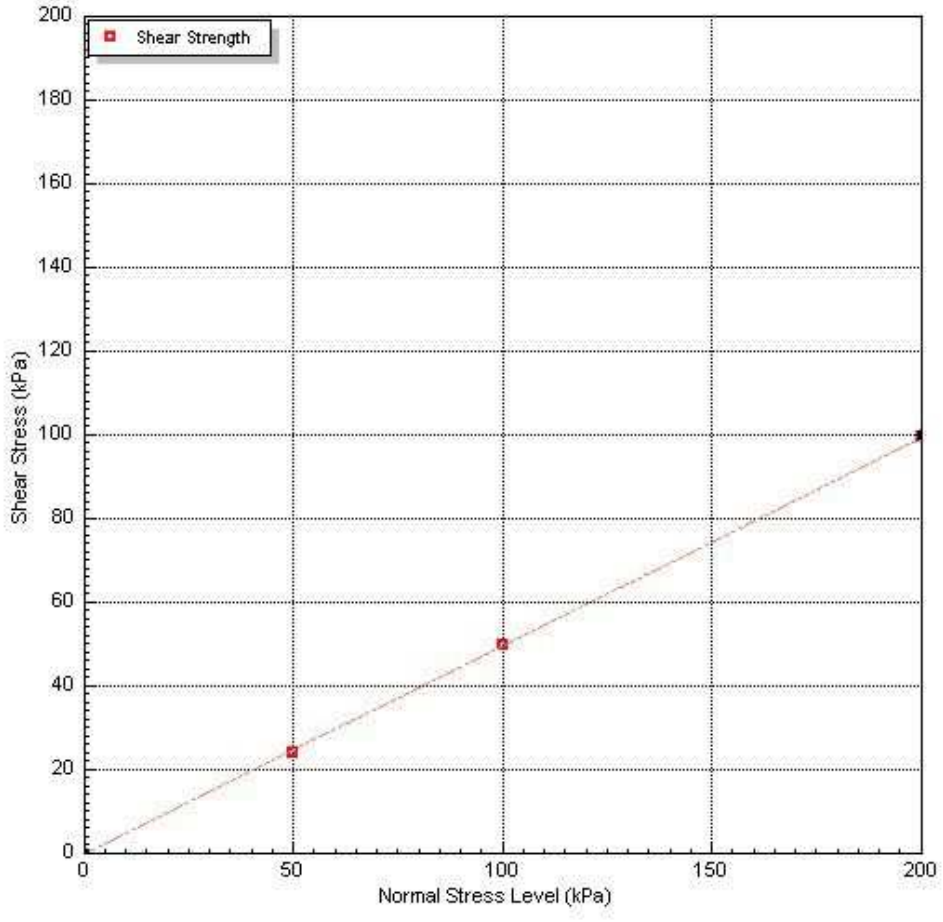
Direct Shear Tests

Direct Shearbox Test

Shear Stage

Envelope Failure Results			Spm. 1	2	3
Final Moisture	ω_f%	(%)	23	22	22
Final Dry Density	ρ_{df}	(Mg/m3)	1.49	1.51	1.60
Final Voids Ratio	e_f	.	0.814	0.790	0.689
Final Degree of Saturation	S_f	(%)	74.4	72.8	83.4
Apparent cohesion	c	(kPa)	0.00		
Angle of Shearing Resistance	ϕ	.	26.3		

Notes



Test Method	ASTM D 3080-04		Test Name	Direct Shear	
			Database: .\SQLEXPRESS \ GIE-D		
Site Reference			Test Date	3/11/2021	
Jobfile	Direct Shear Test		Sample	SPT-02	
Client	SGS		Borehole	BH-02	
Operator	R. Islam	Checked	Aminul	Approved	T. Islam

GIE

Direct Shear Tests

Direct Shearbox Test

Summary

Sample Details						
 *sketch showing specimen location in original sample*	Depth		23.00-23.45			
	Type		Disturbed Soil			
				Spm. 1	2	3
	Initial Height	H_0	(mm)	20.0	20.0	20.0
	Initial Width	D_0	(mm)	60.0	60.0	60.0
	Initial Weight	W_0	(gr)	152.7	152.7	152.7
	Initial Bulk Density	ρ_0	(Mg/m3)	2.12	2.12	2.12
	Particle Density	ρ_s	(Mg/m3)	2.66	2.66	2.66

Initial Condition

			Spm. 1	2	3
Normal Stress Level		(kPa)	250	500	1000
Is Specimen Submersed?			Yes	Yes	Yes
Reverse Method			Motor Drive		
Hoz. Control Machine			Not Used	Not Used	Not Used
Initial Moisture	ω_i%	(%)	17	17	17
Initial Dry Density	ρ_{di}	(Mg/m3)	1.82	1.82	1.82
Initial Voids Ratio	e_i	.	0.463	0.463	0.463
Initial Degree of Saturation	S_i	(%)	95.7	95.7	95.7

Notes

Max Shear Stress Results

			Spm. 1	2	3
Final Moisture	ω_f%	(%)	20	18	17
Final Dry Density	ρ_{df}	(Mg/m3)	1.82	1.87	1.90
Final Voids Ratio	e_f	.	0.440	0.368	0.351
Final Degree of Saturation	S_f	(%)	100.0	100.0	100.0
Peak Shear Stress		(kPa)	184.8	353.7	696.9
Hoz Displacement	L_H	(mm)	11.380	12.000	11.150
Vertical Displacement	L_V	(mm)	-0.240	-0.160	0.190

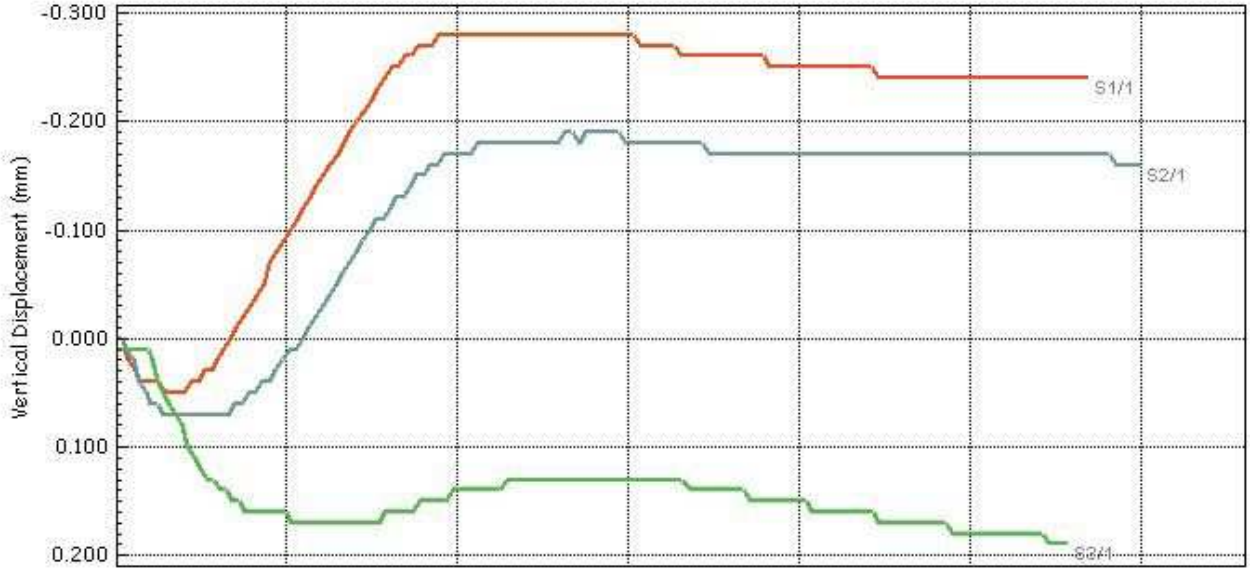
GIE

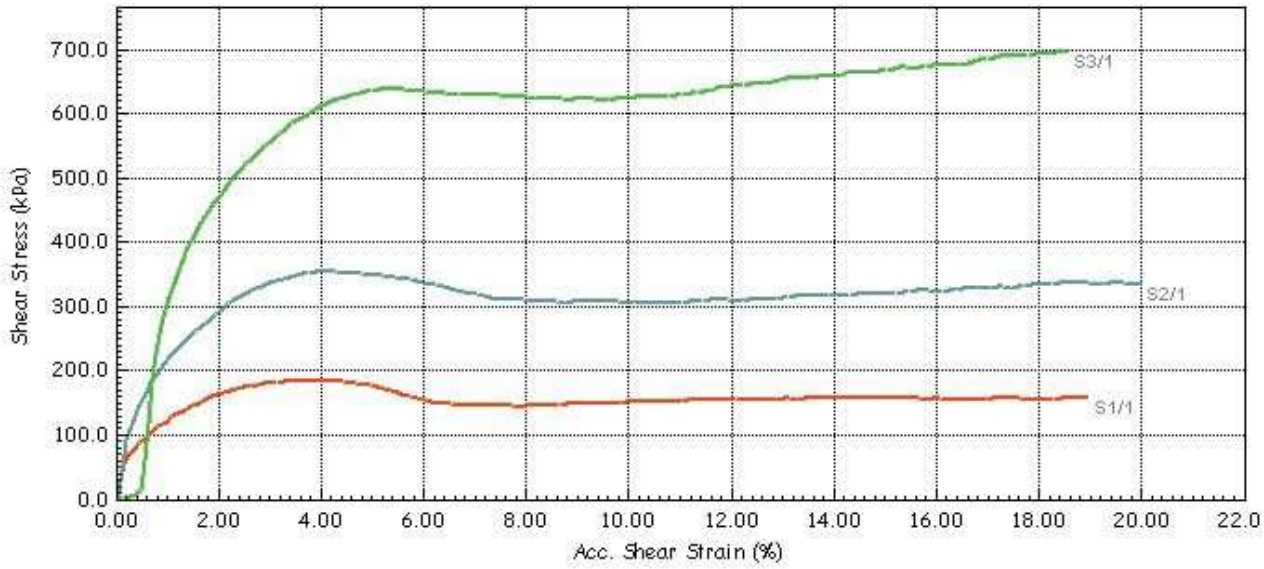
Test Method	ASTM D 3080-04			Test Name	Direct Shear Test
				Database: .\SQLEXPRESS \ GIE-D	
Site Reference				Test Date	3/14/2021
Jobfile	Direct Shear Test			Sample	SPT-21
Client	SGS			Borehole	BH-02
Operator	R. Islam	Checked	Aminul	Approved	T. Islam

Direct Shear Tests

Direct Shearbox Test

Shear Stage





Test Method	ASTM D 3080-04			Test Name	Direct Shear Test
				Database: .\SQLEXPRESS \ GIE-D	
Site Reference				Test Date	3/14/2021
Jobfile	Direct Shear Test			Sample	SPT-21
Client	SGS			Borehole	BH-02
Operator	R. Islam	Checked	Aminul	Approved	T. Islam

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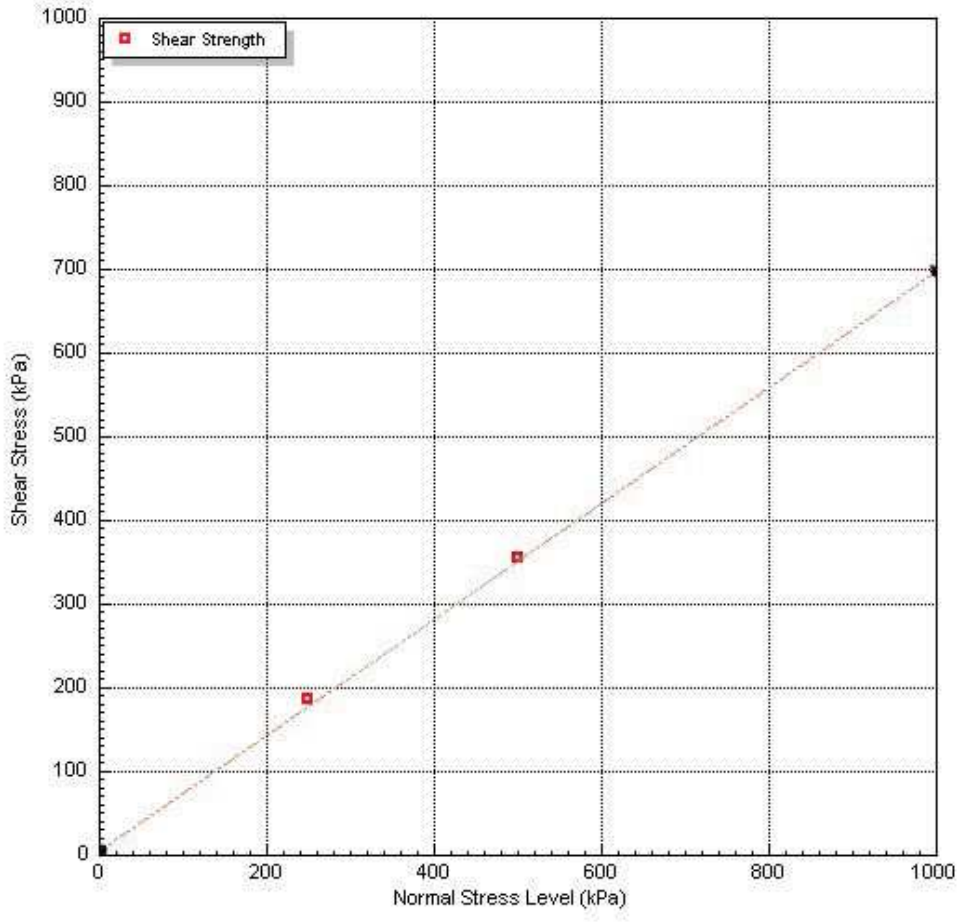
Direct Shear Tests

Direct Shearbox Test

Shear Stage

Envelope Failure Results			Spm. 1	2	3
Final Moisture	ω_f%	(%)	20	18	17
Final Dry Density	ρ_{df}	(Mg/m3)	1.82	1.87	1.90
Final Voids Ratio	e_f	.	0.440	0.368	0.351
Final Degree of Saturation	S_f	(%)	100.0	100.0	100.0
Apparent cohesion	c	(kPa)	3.65		
Angle of Shearing Resistance	ϕ	.	34.8		

Notes



Test Method	ASTM D 3080-04	Test Name	Direct Shear Test
		Database: .\SQLEXPRESS \ GIE-D	
Site Reference		Test Date	3/14/2021
Jobfile	Direct Shear Test	Sample	SPT-21
Client	SGS	Borehole	BH-02
Operator	R. Islam	Checked	Aminul
		Approved	T. Islam

GIE

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

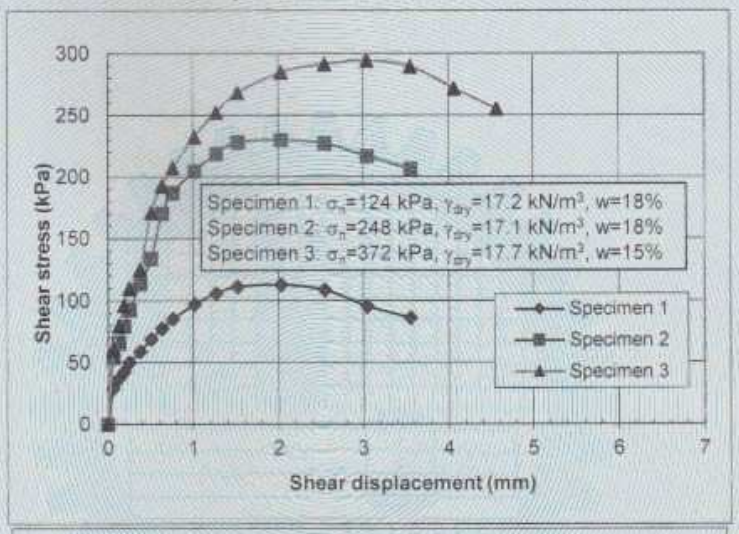
Mobile: 01819 557964, PABX: 966 5650-80 Ext. 7226

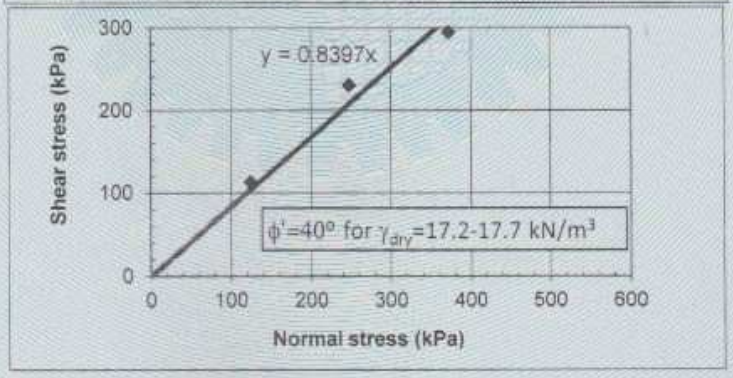
BRTC Bureau of Research, Testing & Consultation

GEOTECHNICAL ENGINEERING LABORATORY

BRTC No. :	110-231613/20-21/CE dated 11.3.21
Sent by :	Manager, Environment Health & Safety, SGS Bangladesh Ltd., Bir Uttam CR Datta Road, Dhaka
Ref:	SGS/Phase-2/SI/090321 dated 9.3.21
Project :	Geotechnical Investigation at Matarbari
Soil Description :	Grey silty fine sand
Location:	Matarbari
Bore-Hole: 2	**Sample:** 23
Depth:	25-25.45 m
Date of Test:	7.4.21-12.4.21

Direct Shear (Consolidated Drained) Test





13

nrBWT9DH9

Note: Sample was received in unsealed condition.
Test specimens were prepared manually from disturbed samples. The dry density specified is after application of normal load prior to shearing, the water content represents the sample after shearing.

Department of Civil Engineering, BUET, Dhaka-1000, Bangladesh

Countersigned by :

Dr. A.B.M. Badruzzaman
Professor
Department of Civil Engineering
BUET, Dhaka - 1000.

Test performed by :

8.5.21

Dr. Tahmeed M. Al-Hussaini
Professor
Department of Civil Engineering
BUET, Dhaka - 1000.

BRTC BUET

BUETCE 0 2 7 2 3 8 7

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

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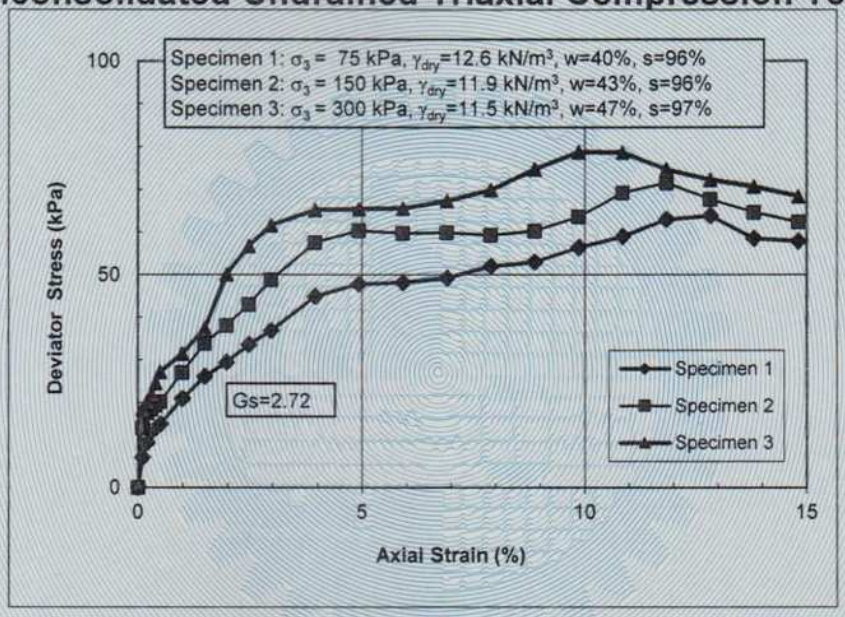
Sent by :	Manager, Environment Health & Safety, SGS Bangladesh Ltd., Bir Uttam CR Datta Road, Dhaka		
Ref:	SGS/Phase-2/SI/090321 dated 9.3.21		
Project :	Geotechnical Investigation at Matarbari		
Soil description :	Grey soft silty clay, trace roots	**Test Method:**	ASTM
B.H. No.:	2 **Sample:** UD-1	**Depth:**	6-7 m
Location:	Matarbari	**Date of Test:**	2.5.21-5.5.21

(Corrected Report)

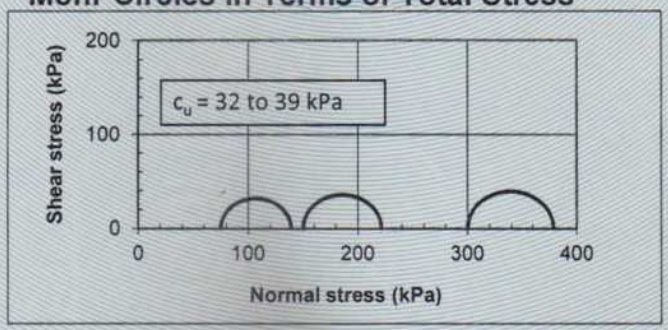
Unconsolidated Undrained Triaxial Compression Test



6

38DjE8tL7

Mohr Circles in Terms of Total Stress



Remarks: Initial dry density, water content and degree of saturation is indicated. All specimens were subjected to saturation prior to loading.

Countersigned by :

Dr. A.B.M. Badruzzaman
Professor, Dept. of Civil Engineering
BUET, Dhaka - 1000.

Test performed by :

3.6.21

Dr. Tahmeed M. Al-Hussaini
Professor, Dept. of Civil Engineering
BUET, Dhaka - 1000.

Department of Civil Engineering * BUET, Dhaka-1000, Bangladesh *

BUETCE 0274869

Total Stress Triaxial Compression

Unconsolidated Undrained (Multiple Specimen)

Summary Report

Sample Details

sketch showing specimen location in original sample

Depth	8.00-9.00				
Type	UD				
			Spm. 1	2	3
Initial Sample Length	L_0	(mm)	76.0	76.0	76.0
Initial Sample Diameter	D_0	(mm)	38.0	38.0	38.0
Initial Sample Weight	W_0	(gr)	158.4	158.9	158.0
Bulk Density	ρ_0	(Mg/m3)	1.84	1.84	1.83
Particle Density	ρ_s	(Mg/m3)	2.70	2.70	2.70

Initial Conditions

Specimen			Spm. 1	2	3
Initial Cell Pressure	σ_3	(kPa)	80	160	320
Strain Rate	m_s	(mm/min)	0.76000	0.76000	0.76000
MembraneThickness	m_b	(mm)	0.02	0.02	0.02
Displacement Input	L_{IP}	(mm)	CH 7	CH 7	CH 7
Load Input	N_{IP}	(N)	CH 2	CH 2	CH 2
Initial Moisture	$\omega_i\%$	(%)	37	40	40
Initial Dry Density	ρ_{d0}	(Mg/m3)	1.34	1.32	1.31
Initial Voids Ratio	e_0	.	1.02	1.05	1.06
Initial Degree of Saturation	S_o	(%)	99	100	100

Final Conditions

			Spm. 1	2	3
Max Deviator Stress	$(\sigma_1-\sigma_3)_f$	(kPa)	73.66	97.53	105.49
MembraneCorrection	m_c	(kPa)	40.760	40.727	40.760
Strain At Max Stress	$\varepsilon_f\%$	(%)	6.54	6.34	5.37
Shear Strength	c_u	(kPa)	36.83	48.76	52.74
Final Moisture	$\omega_f\%$	(%)	37	38	38
Final Dry Density	ρ_{df}	(Mg/m3)	1.34	1.34	1.33
Final Voids Ratio	e_f	.	1.02	1.02	1.03
Final Degree of Saturation	S_f	(%)	99.0	100.0	99.3

Notes

Failure Sketch

(surface inclination)

Test Method	D 2850-03A (2007)	Test Name	UU
Database: .\SQLEXPRESS \ GIE-D		Test Date	3/16/2021
Site Reference		Borehole	BH-02
Jobfile	UU	Sample	UD-02
Client	SGS	Depth	8.00-9.00
Operator R. Islam	Checked Aminul	Approved T. Islam	

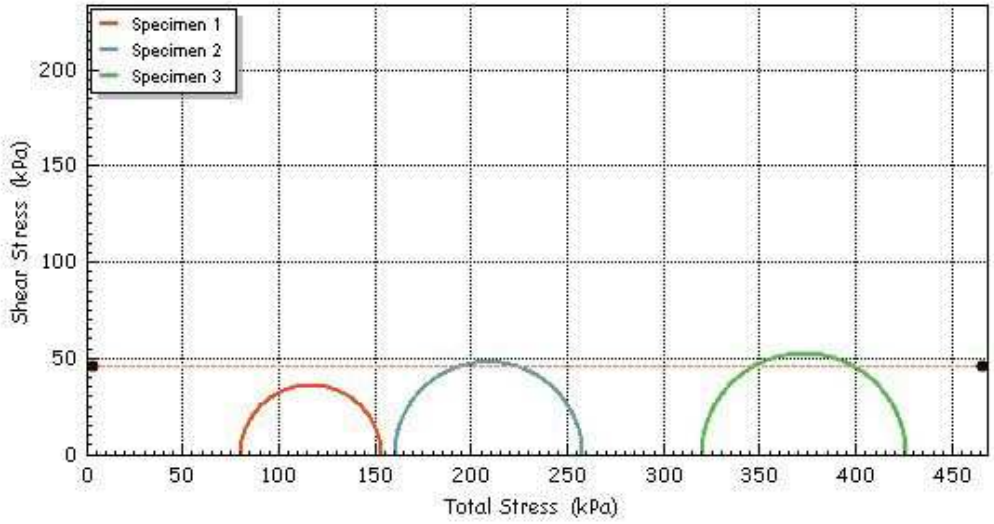
GIE

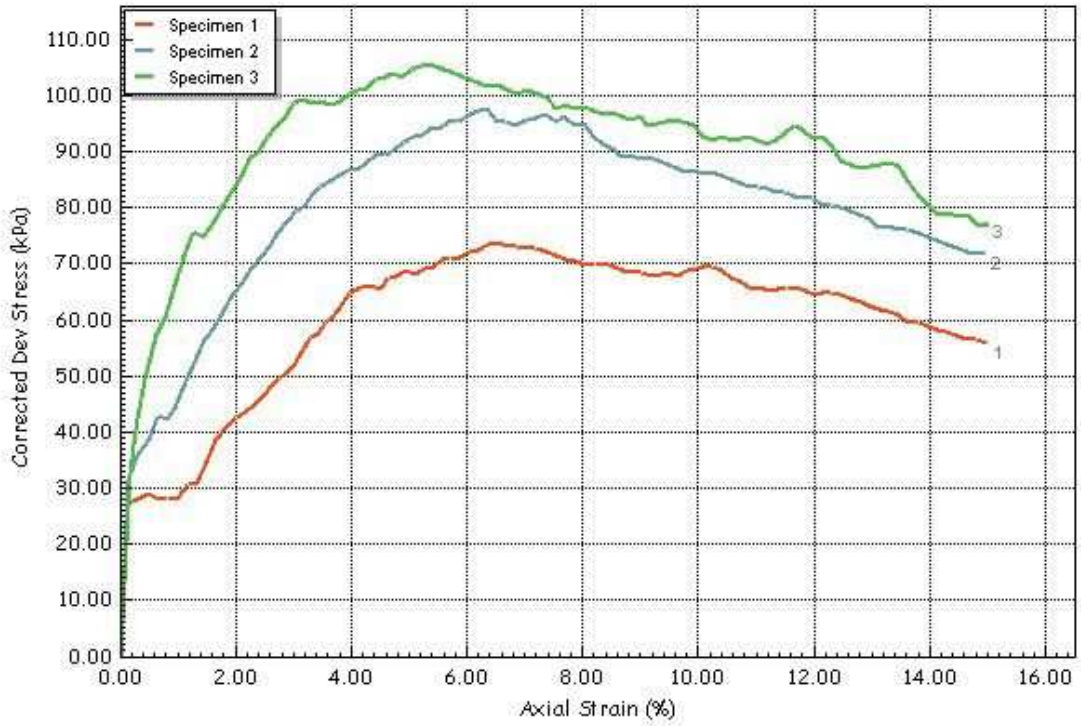
Total Stress Triaxial Compression

Unconsolidated Undrained (Multiple Specimen)

Test Results Plots

Cohesion Level	c	(kPa)	46.4
Friction Angle	ϕ	(deg)	0.0





Test Method	D 2850-03A (2007)		Test Name	UU	
Database: .\SQLEXPRESS \ GIE-D			Test Date	3/16/2021	
Site Reference			Borehole	BH-02	
Jobfile	UU		Sample	UD-02	
Client	SGS		Depth	8.00-9.00	
Operator	R. Islam	Checked	Aminul	Approved	T. Islam

GIE

Ground Instrumentation & Engineering Pte Ltd	**OEDOMETER TEST RESULTS** **ASTM D2435/D2435M - 11**	

Project	:	SIBD2105
Client - Location	:	Geotechnical Investigation for Matarbari Project
Boring No	:	BH-02
Sample No	:	UD-01
Depth (m)	:	6.00-7.00
Soil Description	:	Lean CLAY, CL

Moisture Content Determination

		Initial	Final
Wt. of Ring + Wet Soil, gm	=	142.00	139.66
Wt. of Ring + Dry Soil, gm	=	117.50	117.50
Weight of Water, gm	=	24.50	22.16
Weight of Container, gm	=	69.52	69.52
Weight of Dry Soil, gm	=	47.98	47.98
Water Content, %	=	51.1	46.2

Unit Weight Determination

		Initial	Final
Wt. of Ring + Wet Soil, gm	=	142.00	139.66
Weight of Ring, gm	=	69.52	69.52
Weight of Wet Soil, gm	=	72.48	70.14
Height of Sample, cm	=	2	1.828
Diameter of Sample, cm	=	5	5
Volume of Sample, cm^3	=	39.27	35.89
Unit Wet Weight, kN/m^3	=	18.1	19.2
Unit Dry Weight, kN/m^3	=	12.0	13.1

Specific Gravity	=	2.73
Initial Void Ratio	=	1.234
Degree of Saturation, %	=	100.0
Room Temperature, ^oC	=	24.0
Temp. correction factor	=	0.91
Initial Transducer Reading	=	8.52
Effective Overburden Pressure	=	
Preconsolidation Pressure	=	101
Compression Index (Cc)	=	0.2570

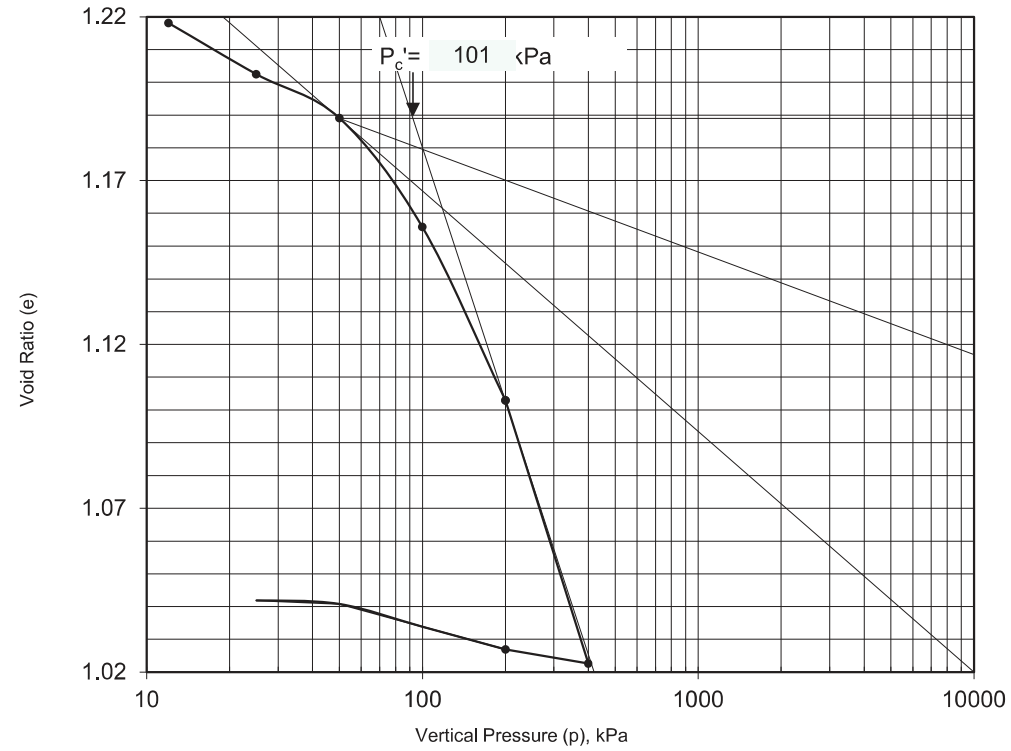
Inc. No.	Load, p (kPa)	Transducer Reading (div)	Machine Corr. (div)	Change in Height (mm)	e Void Ratio	t_{90} (min)	c_v ('cm2/day)	$c_v(20^oC)$ ('cm2/day)	m_v (m^2/MN)	k x 10^{-9} (m/s)
1	12	8.370	0.001	0.146	1.218	3.642	332.110	302.220	0.608	57.178
2	25	8.230	0.001	0.286	1.202	7.506	160.009	145.609	0.542	24.563
3	50	8.110	0.001	0.406	1.189	24.734	47.922	43.609	0.243	3.302
4	100	7.810	0.004	0.703	1.156	4.895	237.034	215.701	0.303	20.337
5	200	7.332	0.008	1.177	1.103	9.167	121.603	110.659	0.246	8.453
6	400	6.606	0.015	1.896	1.023	4.720	221.621	201.676	0.191	11.979
7	200	6.650	0.010	1.857	1.027				0.011	
8	100	6.716	0.006	1.795	1.034				0.034	
9	50	6.782	0.002	1.733	1.041				0.068	
10	25	6.792	0.002	1.723	1.042				0.022	

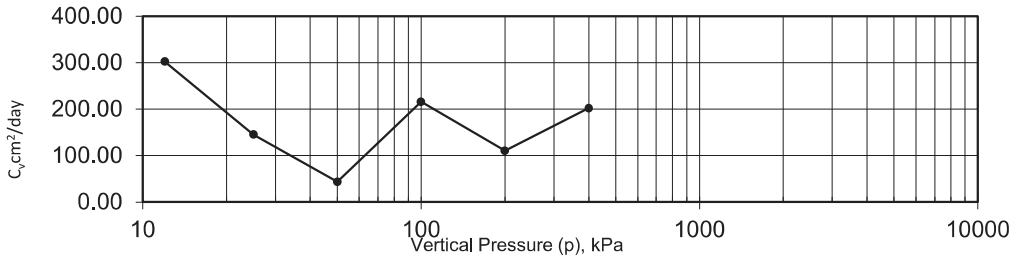
Tested By: Rayhan **Checked & Approved By:T. Islam**

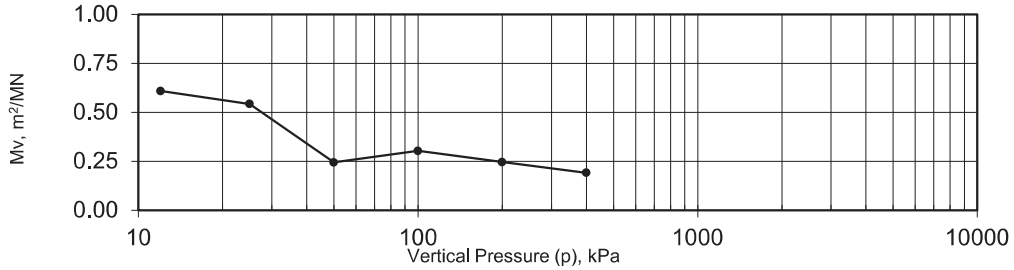
Date: 19-03-2021 **Date: 23-03-2021**

ASTM D2435/D2435M - 11

Cc= 0.257019







Coefficient of consolidation (Cv). cm^2/day

Job No.	:	SIBD2105
Project	:	Geotechnical Investigation for Matarbari Project
Location	:	Matarbari, Power Plant Area
Borehole	:	BH-02
Sample	:	UD-01
Depth (m)	:	6.00-7.00

Ground Instrumentation & Engineering Pte Ltd

Ground Instrumentation & Engineering Pte Ltd	**OEDOMETER TEST RESULTS** **ASTM D2435/D2435M - 11**	

Project : Geotechnical Investigation for Matarbari Project
Client - Location : TEPSCO
Boring No : BH-02
Sample No : UD-02
Depth (m) : 8.00-9.00
Soil Description : Lean CLAY, CL

Moisture Content Determination

		Initial	Final
Wt. of Ring + Wet Soil, gm	=	141.20	138.68
Wt. of Ring + Dry Soil, gm	=	121.50	121.50
Weight of Water, gm	=	19.70	17.18
Weight of Container, gm	=	69.47	69.47
Weight of Dry Soil, gm	=	52.03	52.03
Water Content, %	=	37.9	33.0

Unit Weight Determination

		Initial	Final
Wt. of Ring + Wet Soil, gm	=	141.20	138.68
Weight of Ring, gm	=	69.47	69.47
Weight of Wet Soil, gm	=	71.73	69.21
Height of Sample, cm	=	2	1.852
Diameter of Sample, cm	=	5	5
Volume of Sample, cm^3	=	39.27	36.37
Unit Wet Weight, kN/m^3	=	17.9	18.7
Unit Dry Weight, kN/m^3	=	13.0	14.0

Specific Gravity	=	2.70
Initial Void Ratio	=	1.038
Degree of Saturation, %	=	98.5
Room Temperature, °C	=	24.0
Temp. correction factor	=	0.91
Initial Transducer Reading	=	8.95
Effective Overburden Pressure	=	
Preconsolidation Pressure (kPA)	=	147
Compression Index (Cc)	=	0.2503

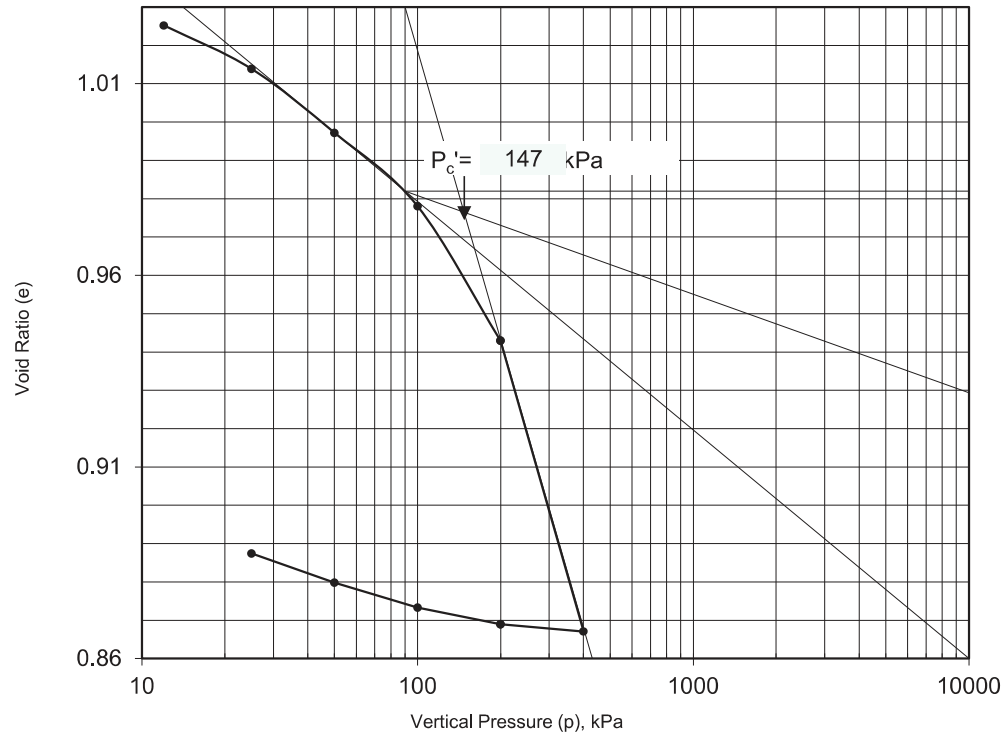
Inc. No.	Load, p (kPa)	Transducer Reading (div)	Machine Corr. (div)	Change in Height (mm)	e Void Ratio	t_{90} (min)	c_v (cm^2/day.)	c_v(20°C) (cm^2/day.)	m_v (m^2/MN)	k x 10^{-9} (m/s)
1	12	8.822	0.001	0.124	1.025	20.318	59.663	54.293	0.517	8.724
2	25	8.711	0.001	0.235	1.014	4.397	274.156	249.482	0.430	33.331
3	50	8.546	0.002	0.399	0.997	7.775	152.900	139.139	0.332	14.362
4	100	8.353	0.007	0.587	0.978	6.047	193.093	175.715	0.192	10.483
5	200	8.004	0.012	0.931	0.943	48.103	23.616	21.491	0.177	1.184
6	400	7.250	0.021	1.676	0.867	6.420	167.075	152.038	0.195	9.237
7	200	7.274	0.016	1.657	0.869				0.005	
8	100	7.320	0.012	1.615	0.873				0.023	
9	50	7.387	0.009	1.551	0.880				0.070	
10	25	7.464	0.007	1.476	0.887				0.163	

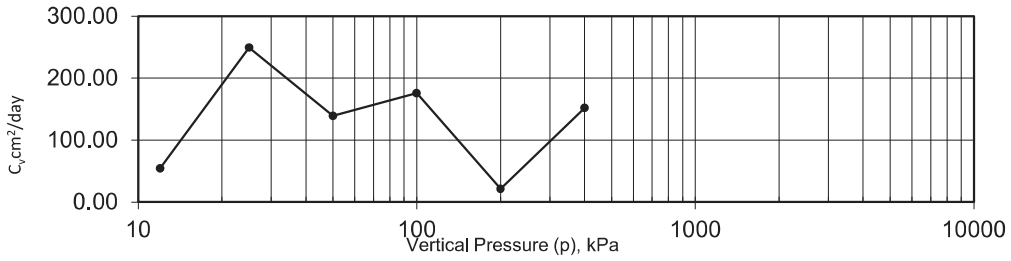
Tested By: Rayhan
Date: 19-03-2021

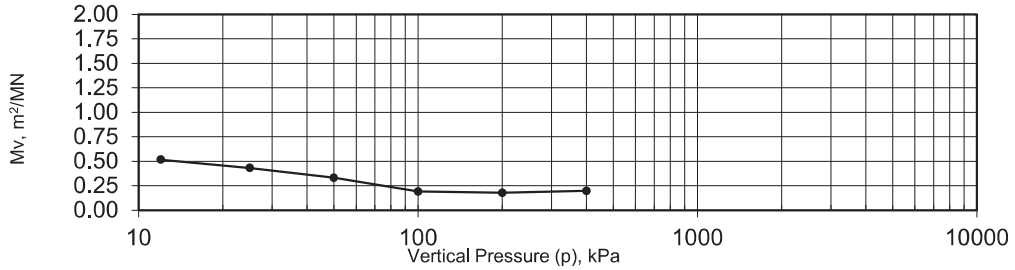
Checked & Approved By:T. Isla
Date: 23-03-2021

ASTM D2435/D2435M - 11

Cc= 0.250285







Job No.	:	SIBD2105
Project	:	Geotechnical Investigation for Matarbari Project
Location	:	Matarbari, Power Plant Area
Borehole	:	BH-02
Sample	:	UD-02
Depth (m)	:	8.00-9.00

Ground Instrumentation & Engineering Pte Ltd

GEOTECHNICAL AND MATERIAL LABORATORY
Ground Instrumentation & Engineering Pte.Ltd.
House-7 Road-12, Dhaka 1230

LABORATORY COMPACTION TEST DATA
(Dry Density- Moisture Content Relationship)
ASTM D1557

Date: 25/03/2021

Project : **Geotechnical Investigation for Matarbari, ID-SIBD-2105**
Client : SGS
Test Pit No. : **BH-02**
Sample Depth : 1.00 m
Method: Standard Proctor (using 2.5 kg rammer)

Volume of Mould: 950 cm^3

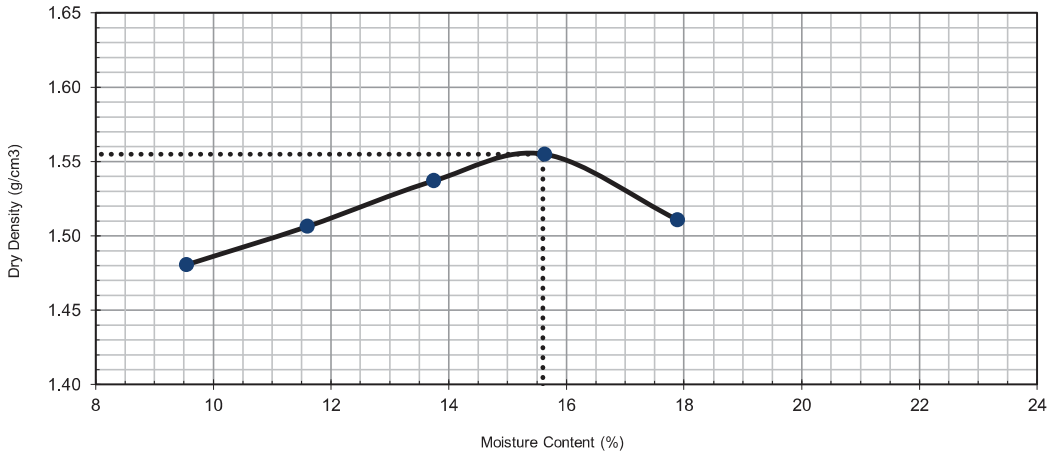
Test No.:		1	2	3	4	5	
Mass of Mould+ Base+Compacted Materials (m2)	g	5201	5257	5321	5368	5352	
Mass of Mould+ Base(m1)	g	3660	3660	3660	3660	3660	
mass of Compacted Materials(m2-m1)	g	1541	1597	1661	1708	1692	
Bulk Density,ρ= $\frac{m2-m1}{vol.of\ mold}$	g/cm^3	1.622	1.681	1.748	1.798	1.781	
Moisture Content (w)	%	9.55	11.60	13.75	15.63	17.89	
Dry Density, ρ_d = $\frac{100\rho}{100+w}$	g/cm^3	1.481	1.506	1.537	1.555	1.511	

MOISTURE CONTENT

Test No.:		1		2		3		4		5			
Container No.:		B-42	B-55	B-50	B-43	B-68	B-47	B-63	B-77	B-54	B-40		
Mass of container + wet soil	g	62.5	61.7	71.9	57.34	60.56	60.94	57.16	60.53	72.83	80.27		
mass of container + dry soil	g	59.3	58.8	67.91	53.49	56.1	57.3	53.17	55.6	66.9	73.8		
Mass of Water	g	3.16	2.81	3.96	3.85	4.46	3.69	3.99	4.93	5.91	6.49		
Mass of Container	g	26.42	29.24	33.67	20.39	23.91	30.21	27.37	24.4	33.8	37.6		
Mass of Dry Soil	g	32.9	29.6	34.24	33.1	32.19	27.04	25.8	31.2	33.12	36.18		
Moisture Content	%	9.60	9.49	11.57	11.63	13.86	13.65	15.47	15.80	17.84	17.94		
Average Moisture Content	%	9.5		11.6		13.8		15.6		17.9			

Maximum Dry Density	***1.555***	g/cm^3
Optimum Moisture Content	***15.6***	%

Fig. : Dry Density vs Moisture Content Curve



BH-03

Ground Instrumentation & Engineering Pte Ltd	**MOISTURE CONTENT** **ASTM D2216-10**	

Sample No.:	SPT-02	Depth (m): 2.00-2.45
Can No.		405
Weight of Wet Soil + Can (gm)		230.34
Weight of Dry Soil + can (gm)		196.33
Weight of Can (gm)		27.45
Moisture Content (%)		**20.14**
Description		**Fine-medium SAND with Silt, SP-SM**

Sample No.:	SPT-04	Depth (m): 4.00-4.45
Can No.		402
Weight of Wet Soil + Can (gm)		159.50
Weight of Dry Soil + can (gm)		139.41
Weight of Can (gm)		25.92
Moisture Content (%)		**17.70**
Description		**Fine-medium SAND, SP**

Sample No.:	UD-01	Depth (m): 8.00-9.00
Can No.		105
Weight of Wet Soil + Can (gm)		180.80
Weight of Dry Soil + can (gm)		138.34
Weight of Can (gm)		14.58
Moisture Content (%)		**34.31**
Description		**Lean CLAY, CL**

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-03
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 01-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

Ground Instrumentation & Engineering Pte Ltd	**MOISTURE CONTENT** **ASTM D2216-10**	

Sample No.:	UD-02	Depth (m): 12.00-13.00
Can No.		95
Weight of Wet Soil + Can (gm)		208.00
Weight of Dry Soil + can (gm)		167.94
Weight of Can (gm)		13.70
Moisture Content (%)		**25.97**
Description		**Silty fine SAND, SM**

Sample No.:	MZ-01	Depth (m): 17.00-18.00
Can No.		410
Weight of Wet Soil + Can (gm)		236.60
Weight of Dry Soil + can (gm)		184.93
Weight of Can (gm)		26.86
Moisture Content (%)		**32.69**
Description		**Lean CLAY with Sand, CL**

Sample No.:	SPT-15	Depth (m): 18.00-18.45
Can No.		102
Weight of Wet Soil + Can (gm)		187.81
Weight of Dry Soil + can (gm)		147.34
Weight of Can (gm)		13.85
Moisture Content (%)		**30.32**
Description		**Sandy lean CLAY, CL**

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-03
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 01-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

Ground Instrumentation & Engineering Pte Ltd	**MOISTURE CONTENT** **ASTM D2216-10**	

Sample No.:	SPT-20	Depth (m): 23.00-23.45
Can No.		50
Weight of Wet Soil + Can (gm)		173.03
Weight of Dry Soil + can (gm)		141.50
Weight of Can (gm)		12.78
Moisture Content (%)		**24.50**
Description		**Silty fine SAND, SM**

Sample No.:	MZ-02	Depth (m): 27.00-27.45
Can No.		210
Weight of Wet Soil + Can (gm)		176.12
Weight of Dry Soil + can (gm)		152.45
Weight of Can (gm)		26.05
Moisture Content (%)		**18.73**
Description		**Fine SAND with Silt, SP-SM**

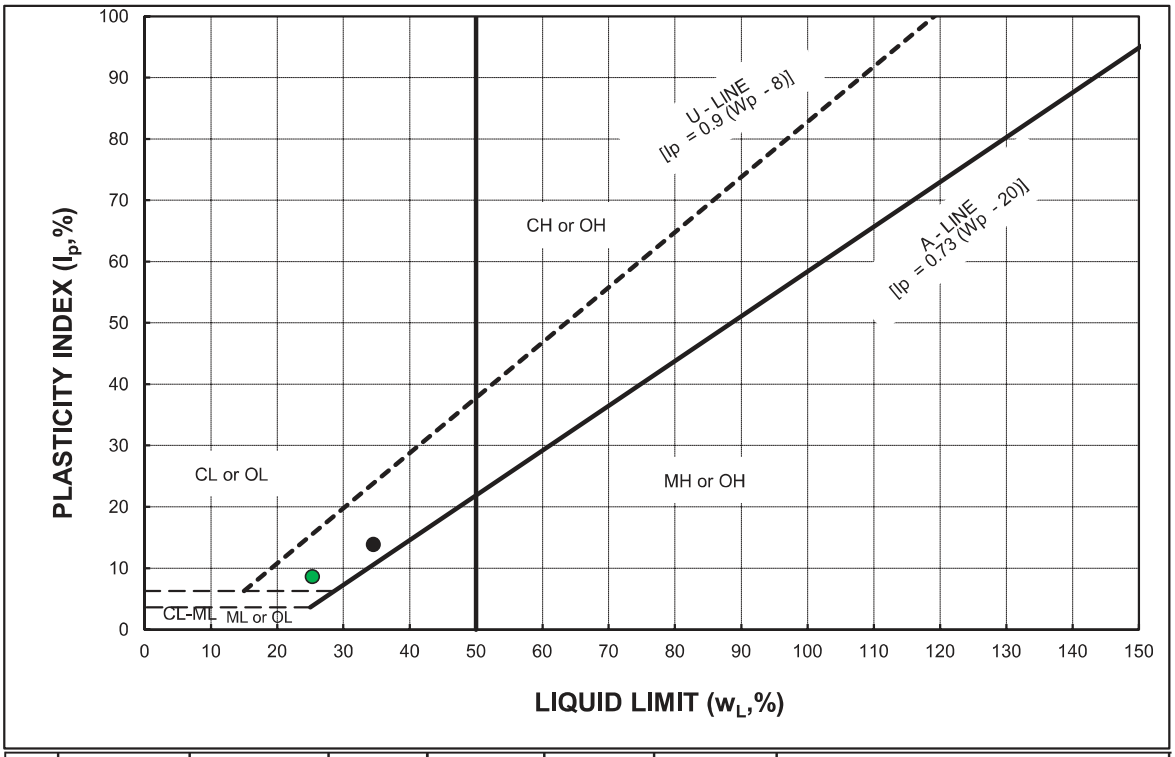
Sample No.:		
Can No.		
Weight of Wet Soil + Can (gm)		
Weight of Dry Soil + can (gm)		
Weight of Can (gm)		
Moisture Content (%)		
Description		

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-03
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 01-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

Ground Instrumentation & Engineering Pte. Ltd.



	Sample No.	Depth	W_L	W_P	I_p	Fines	Remarks
●	UD-01	8.00-9.00	34.50	20.59	13.91		Lean CLAY, CL
●	UD-02	12.00-13.00	*	*	*		The sample is nonplastic
●	SPT-15	18.00-18.45	25.30	16.67	8.63		Lean CLAY, CL
●							
●							
●							
●							
●							
●							
○							

Note : All the above Liquid Limit tests was performed in accordance to Method A (Multi-Point) of ASTM D 4318-05

*Hydrometer analysis were performed instead of atterberg limit and presented with the Particle Size Distribution Section

ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands, etc.	**MH**	Inorganic silts, or diatomaceous fine sands or silts, elastic silts, etc.
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays, etc.	**CH**	Inorganic clays of high plasticity, fat clays, etc.
OL	Organic silts and organic silty clays of low plasticity.	**OH**	Organic silts and organic clays of medium to high plasticity.

PLASTICITY CHART (ASTM D 2487 - 06 & D 4318 - 05)

Geotechnical Investigation for Matarbari Project

Client: TEPSCO

Project ID: SIBD2105

BH No.: BH-03

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 02-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

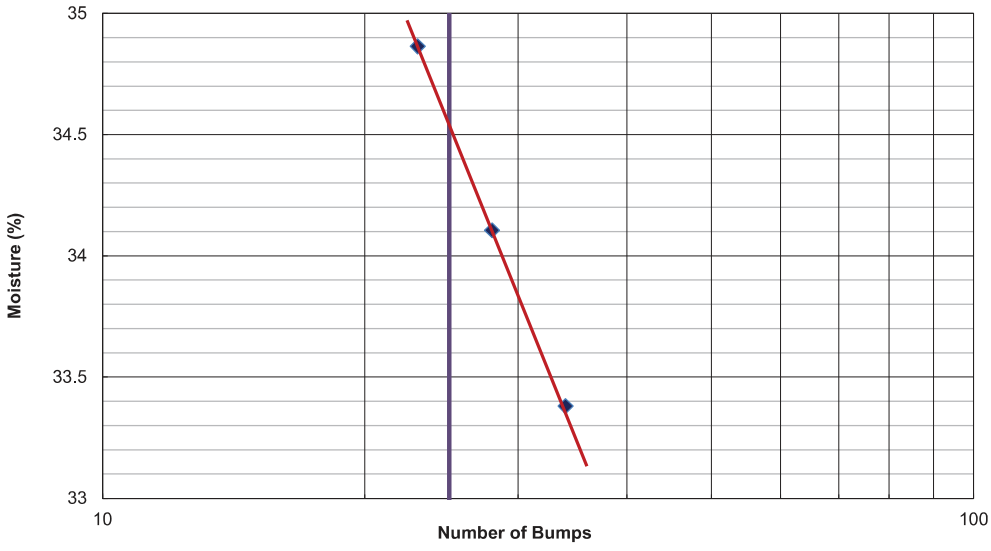
Ground Instrumentation & Engineering Pte. Ltd.

Liquid and Plastic Limits Test: ASTM D4318-10 (Casagrande Method)

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)
Project ID: SIBD2105 Sample No: UD-01
BH No.: BH-03 Sample Depth: 8.00-9.00

Plastic Limit Test		
Container No.	224	51
Weight of can (gm)	12.84	12.79
Wet weight of soil + can (gm)	35.35	35.37
Dry Weight of soil + can (gm)	31.52	31.5
Moisture Content %	20.50	20.68
Average	20.59	

Liquid Limit Test (Casagrande, Blow count: 20-35, ASTM Method-A- multi-pt)			
Test No	1	2	3
Number of Bumps	23	28	34
Container No.	319	478	476
Weight of can (gm)	9.25	4.08	4.16
Wet weight of soil + can (gm)	28.63	24.33	23.18
Dry Weight of soil + can (gm)	23.62	19.18	18.42
Moisture Content %	**34.86**	**34.11**	**33.38**



LL: 34.50	PL: 20.59	PI: 13.91
Description	Lean CLAY, CL	

Tested by: Rayhan
Date: 02-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

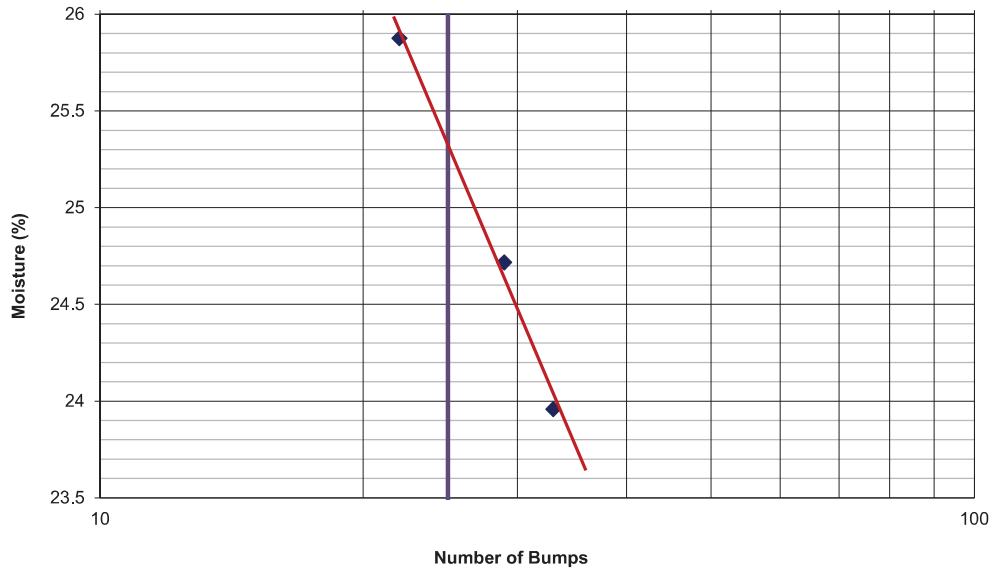
Ground Instrumentation & Engineering Pte. Ltd.

Liquid and Plastic Limits Test: ASTM D4318-10 (Casagrande Method)

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)
Project ID: SIBD2105 Sample No.: SPT-15
BH No.: BH-03 Sample Depth.: 18.00-18.45

Plastic Limit Test		
Container No.	423	348
Weight of can (gm)	8.26	8.24
Wet weight of soil + can (gm)	33.72	33.74
Dry Weight of soil + can (gm)	30.1	30.08
Moisture Content %	16.58	16.76
Average	16.67	

Liquid Limit Test (Casagrande, Blow count: 20-35, ASTM Method-A- multi-pt)			
Test No	1	2	3
Number of Bumps	22	29	33
Container No.	334	327	328
Weight of can (gm)	9.9	8.08	8.24
Wet weight of soil + can (gm)	29.31	25.74	24.9
Dry Weight of soil + can (gm)	25.32	22.24	21.68
Moisture Content %	**25.88**	**24.72**	**23.96**

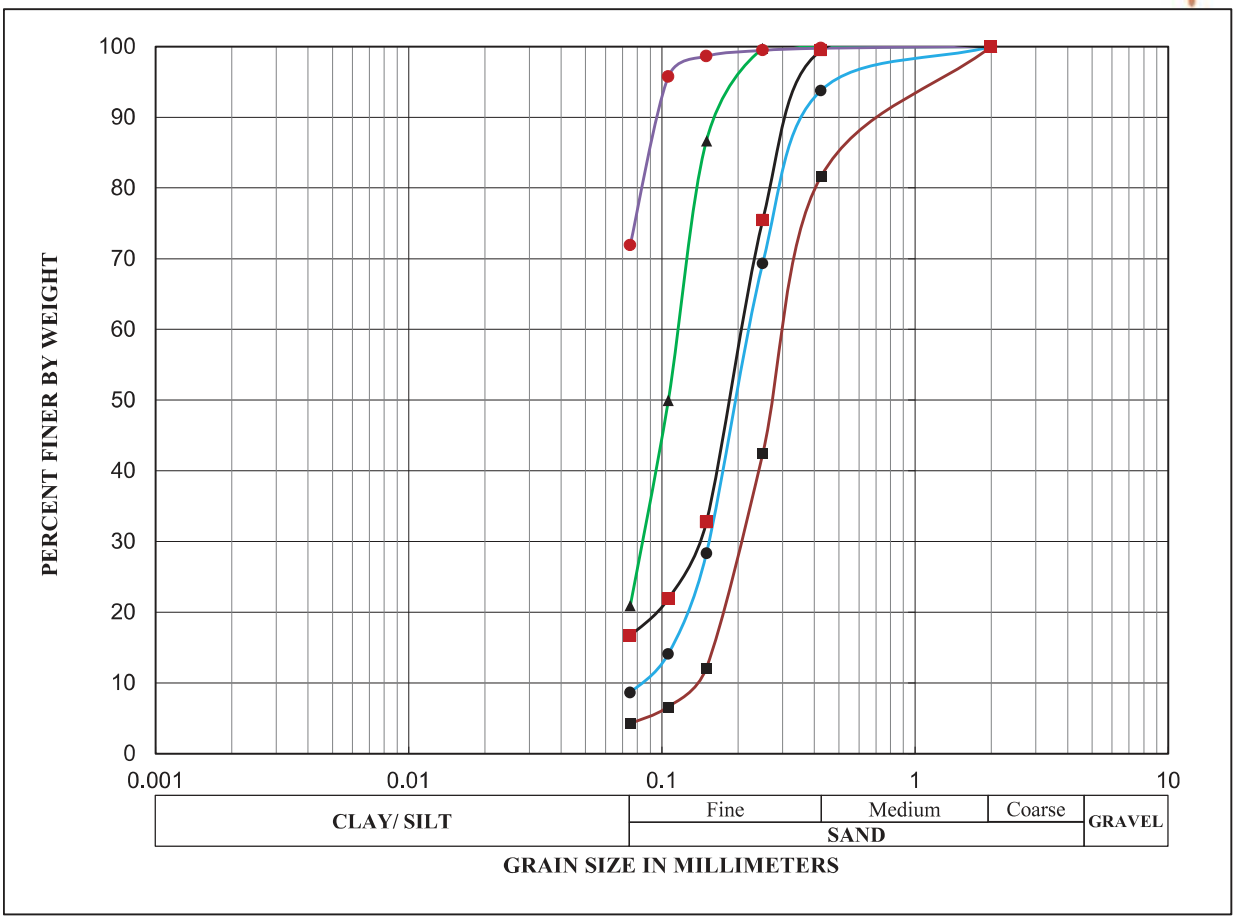


LL: 25.30	PL: 16.67	PI: 8.63
Description	Lean CLAY, CL	

Tested by: Rayhan
Date: 02-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

Ground Instrumentation & Engineering Pte.Ltd.



	Sample	Depth	Classification	W(%)	W_L	P_L	I_P	C_U	C_C
●	SPT-02	2.00-2.45	Fine-medium SAND with Silt, SP-SM					2.75	1.26
■	SPT-04	4.00-4.45	Fine-medium SAND, SP					2.47	1.00
▲	UD-02	12.00-13.00	Silty fine SAND, SM						
●	MZ-01	17.00-18.00	Lean CLAY with Sand, CL						
■	SPT-20	23.00-23.45	Silty fine SAND, SM						
▲									

	Sample	Depth	D60	D50	D30	D10	%Gravel	%Sand			%SILT/ %CLAY
								%Fine	%Meidum	%Coarse	
●	SPT-02	2.00-2.45	0.227	0.203	0.154	0.083	0.00	85.14	6.22	0.00	8.64
■	SPT-04	4.00-4.45	0.329	0.284	0.209	0.133	0.00	77.32	18.40	0.00	4.28
▲	UD-02	12.00-13.00	0.118	0.106	0.085	0.036	0.00	78.96	0.12	0.00	20.92
●	MZ-01	17.00-18.00	0.063	0.052	0.031	0.010	0.00	27.84	0.24	0.00	71.92
■											
▲											

GRADATION CURVES (ASTM D 2487 - 06 & D 422 - 63)

Geotechnical Investigation for Matarbari Project

Client: TEPSCO

Project ID: SIBD2105

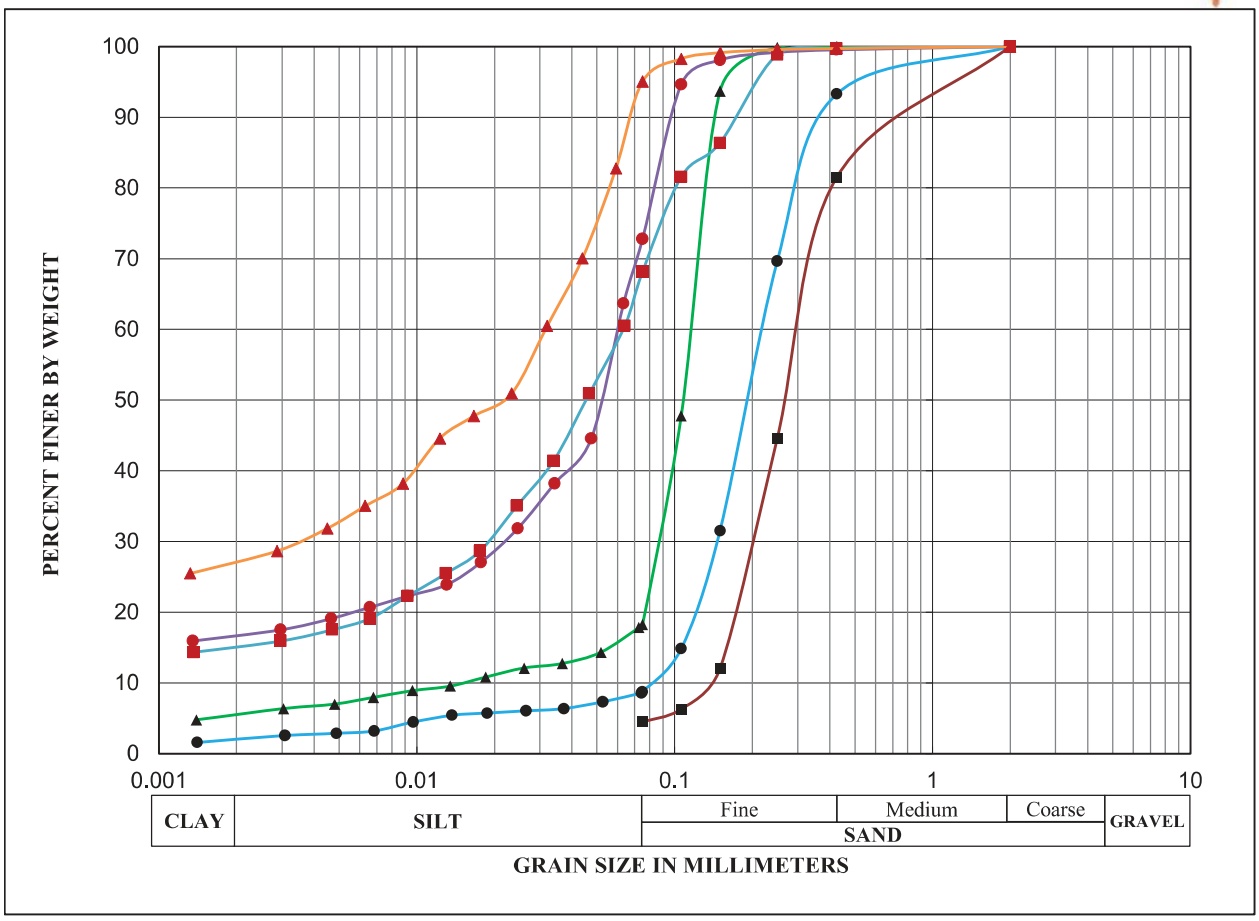
BH No.: BH-03

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 02-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

Ground Instrumentation & Engineering Pte.Ltd.



	Sample	Depth	Classification	W(%)	W_L	P_L	I_P	C_U	C_C
●	SPT-02	2.00-2.45	Fine-medium SAND with Silt, SP-SM					2.76	1.17
■	SPT-04	4.00-4.45	Fine-medium SAND, SP					2.40	0.97
▲	UD-02	12.00-13.00	Silty fine SAND, SM						
●	MZ-01	17.00-18.00	Lean CLAY with Sand, CL						
■	SPT-15	18.00-18.45	Sandy lean CLAY, CL						
▲	SPT-18	21.00-21.45	Clayey SILT, CL-ML						

	Sample	Depth	D60	D50	D30	D10	%Gravel	%Sand			%SILT	%CLAY
								%Fine	%Meidum	%Coarse		
●	SPT-02	2.00-2.45	0.225	0.198	0.146	0.081	0.00	84.54	6.70	0.00	7.17	1.59
■	SPT-04	4.00-4.45	0.323	0.276	0.205	0.134	0.00	77.00	18.50	0.00	4.50	
▲	UD-02	12.00-13.00	0.118	0.108	0.087	0.015	0.00	81.72	0.00	0.00	13.50	4.78
●	MZ-01	17.00-18.00	0.060	0.052	0.022	0.001	0.00	26.76	0.46	0.00	56.86	15.92
■	SPT-15	18.00-18.45	0.063	0.045	0.019	0.001	0.00	31.62	0.26	0.00	53.79	14.33
▲	SPT-18	21.00-21.45	0.032	0.021	0.004	0.001	0.00	4.66	0.28	0.00	69.59	25.47

GRADATION CURVES (ASTM D 2487 - 06 & D 422 - 63)

Geotechnical Investigation for Matarbari Project

Client: TEPSCO

Project ID: SIBD2105

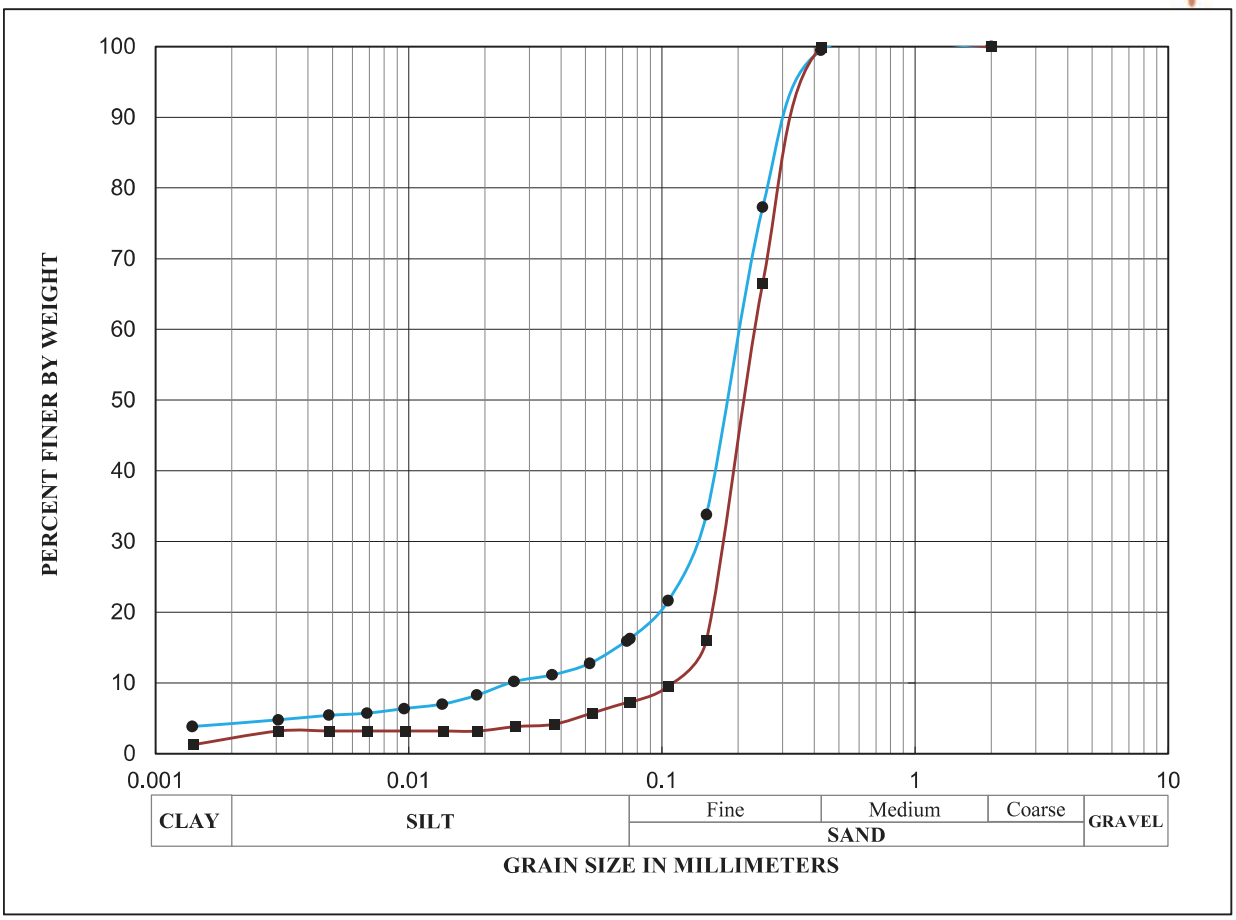
BH No.: BH-03

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 03-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

Ground Instrumentation & Engineering Pte.Ltd.



	Sample	Depth	Classification	W(%)	W_L	P_L	I_P	C_U	C_C
●	SPT-20	23.00-23.45	Silty fine SAND, SM						
■	MZ-02	27.00-27.45	Fine SAND with Silt, SP-SM					2.17	1.22
▲									
●									
■									
▲									

	Sample	Depth	D60	D50	D30	D10	%Gravel	%Sand			%SILT	%CLAY
								%Fine	%Meidum	%Coarse		
●	SPT-20	23.00-23.45	0.210	0.187	0.136	0.025	0.00	83.22	0.54	0.00	12.42	3.82
■												
▲												
●												
■												
▲												

GRADATION CURVES (ASTM D 2487 - 06 & D 422 - 63)

Geotechnical Investigation for Matarbari Project

Client: TEPSCO

Project ID: SIBD2105

BH No.: BH-03

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 03-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

Ground Instrumentation & Engineering Pte Ltd	**PARTICLE DENSITY** **BS 1733 Part 2 Section 8** **(Small Pyknometer Method)**	

SPT-02	Depth(m)	2.00-2.45
Pyknometer No.		14
Mass of bottle + soil + water: M_3	gm	99.02
Mass of bottle + soil: M_2	gm	60.32
Mass of bottle + water: M_4	gm	80.30
Mass of bottle: M_1	gm	30.28
Mass of soil: $M_2 - M_1$	gm	30.04
Mass of water in full bottle: $M_4 - M_2$	gm	19.99
Mass of water used: $M_3 - M_2$	gm	38.70
Volume of soil particles: $(M_4 - M_1) - (M_3 - M_2)$	ml	11.32
Particle Density: $\frac{M_2 - M_1}{(M_4 - M_1) - (M_3 - M_2)}$	g/cm3	2.65

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-03
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 03-03-2021

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Date: 07-03-2021

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

Mobile: 01819 557964; PABX: 966 5650-80 Ext. 7226

BRTC Bureau of Research, Testing & Consultation

GEOTECHNICAL ENGINEERING LABORATORY

BRTC No.:	110-231613/20-21/CE Dated 11.3.21
Client :	Manager, Environment, Health and Safety, SGS Bangladesh Ltd., Bir Uttam CR Datta Rd, Dhaka
Ref :	SGS/Phase-2/SI/090321 dated 9.3.21
Project :	Geotechnical Investigation at Matarbari
Location:	Matarbari
Test Method:	ASTM
Date of Test:	1-10.4.21

SPECIFIC GRAVITY DETERMINATION OF SOIL

Borehole	1	2	3.0	4.0	5.0	6.0
Depth (m)	14-14.5	25-25.45	4-4.5	17-17.45	17-17.45	26-26.45
Sample No.	12.0	23.0	4.0	15.0	14.0	23.0
Soil Type	Grey silty sand	Grey silty sand	Grey silty sand	Grey silty sand	Grey silty sand	Grey silty sand
Wt. of bottle+water+ soil, gm	371.6	375.3	373.4	371.6	380.1	396.4
Temperature (°C)	30.5	30.0	30.5	30.5	30.5	30.0
Wt. of bottle+water, gm	340.0	343.7	342.1	340.4	348.8	365.1
Wt. of soil, gm	49.8	49.2	49.9	49.3	49.7	48.6
Specific Gravity	**2.72**	**2.78**	**2.67**	**2.71**	**2.69**	**2.80**

Note: Tests were conducted on samples received in unsealed condition. BRTC, BUET does not have any responsibility as to the representative character of the supplied samples.

2

44A76bmM6

Countersigned by :

Dr. A.B.M. Badruzzaman
Professor
Department of Civil Engineering
BUET, Dhaka - 1000.

Test performed by :

25.5.21

Dr. Tahmeed M. Al-Hussaini
Professor
Department of Civil Engineering
BUET, Dhaka - 1000.

Department of Civil Engineering, BUET, Dhaka-1000, Bangladesh

Ground Instrumentation & Engineering Pte Ltd	**PARTICLE DENSITY** **BS 1733 Part 2 Section 8** **(Small Pyknometer Method)**	

UD-02	Depth(m)	12.00-13.00
Pyknometer No.		19
Mass of bottle + soil + water: M_3	gm	123.82
Mass of bottle + soil: M_2	gm	72.39
Mass of bottle + water: M_4	gm	105.04
Mass of bottle: M_1	gm	42.41
Mass of soil: $M_2 - M_1$	gm	29.98
Mass of water in full bottle: $M_4 - M_2$	gm	32.65
Mass of water used: $M_3 - M_2$	gm	51.43
Volume of soil particles: $(M_4 - M_1) - (M_3 - M_2)$	ml	11.20
Particle Density: $\frac{M_2 - M_1}{(M_4 - M_1) - (M_3 - M_2)}$	g/cm3	2.67

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-03
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 03-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

Ground Instrumentation & Engineering Pte Ltd	**PARTICLE DENSITY** **BS 1733 Part 2 Section 8** **(Small Pyknometer Method)**	

MZ-01	Depth(m)	17.00-18.00
Pyknometer No.		18
Mass of bottle + soil + water: M_3	gm	118.74
Mass of bottle + soil: M_2	gm	73.90
Mass of bottle + water: M_4	gm	99.79
Mass of bottle: M_1	gm	43.85
Mass of soil: $M_2 - M_1$	gm	30.05
Mass of water in full bottle: $M_4 - M_2$	gm	25.89
Mass of water used: $M_3 - M_2$	gm	44.84
Volume of soil particles: $(M_4 - M_1) - (M_3 - M_2)$	ml	11.10
Particle Density: $\frac{M_2 - M_1}{(M_4 - M_1) - (M_3 - M_2)}$	g/cm3	2.70

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-03
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

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Date: 03-03-2021

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Date: 07-03-2021

Ground Instrumentation & Engineering Pte Ltd	**PARTICLE DENSITY** **BS 1733 Part 2 Section 8** **(Small Pyknometer Method)**	

SPT-15	Depth(m)	18.00-18.45
Pyknometer No.		10
Mass of bottle + soil + water: M_3	gm	99.24
Mass of bottle + soil: M_2	gm	59.82
Mass of bottle + water: M_4	gm	80.37
Mass of bottle: M_1	gm	29.83
Mass of soil: $M_2 - M_1$	gm	29.99
Mass of water in full bottle: $M_4 - M_2$	gm	20.55
Mass of water used: $M_3 - M_2$	gm	39.42
Volume of soil particles: $(M_4 - M_1) - (M_3 - M_2)$	ml	11.12
Particle Density: $\frac{M_2 - M_1}{(M_4 - M_1) - (M_3 - M_2)}$	g/cm3	2.69

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-03
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 03-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

Ground Instrumentation & Engineering Pte Ltd	**PARTICLE DENSITY** **BS 1733 Part 2 Section 8** **(Small Pyknometer Method)**	

SPT-20	Depth(m)	23.00-23.45
Pyknometer No.		9
Mass of bottle + soil + water: M_3	gm	97.33
Mass of bottle + soil: M_2	gm	57.79
Mass of bottle + water: M_4	gm	78.61
Mass of bottle: M_1	gm	27.80
Mass of soil: $M_2 - M_1$	gm	29.99
Mass of water in full bottle: $M_4 - M_2$	gm	20.82
Mass of water used: $M_3 - M_2$	gm	39.54
Volume of soil particles: $(M_4 - M_1) - (M_3 - M_2)$	ml	11.27
Particle Density: $\frac{M_2 - M_1}{(M_4 - M_1) - (M_3 - M_2)}$	g/cm3	2.66

Geotechnical Investigation for Matarbari Project
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Tested by: Rayhan
Date: 03-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

Ground Instrumentation & Engineering Pte Ltd	**PARTICLE DENSITY** **BS 1733 Part 2 Section 8** **(Small Pyknometer Method)**	

MZ-02	Depth(m)	27.00-27.45
Pyknometer No.		4
Mass of bottle + soil + water: M_3	gm	118.60
Mass of bottle + soil: M_2	gm	73.87
Mass of bottle + water: M_4	gm	99.90
Mass of bottle: M_1	gm	43.88
Mass of soil: $M_2 - M_1$	gm	29.99
Mass of water in full bottle: $M_4 - M_2$	gm	26.03
Mass of water used: $M_3 - M_2$	gm	44.73
Volume of soil particles: $(M_4 - M_1) - (M_3 - M_2)$	ml	11.29
Particle Density: $\frac{M_2 - M_1}{(M_4 - M_1) - (M_3 - M_2)}$	g/cm3	2.65

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-03
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 03-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

UNIT WEIGHT / BULK DENSITY
VOID RATIO

Ground Instrumentation & Engineering Pte Ltd

UD-01	Depth (m):	8.00-9.00
Weight of soil	gm	157.20
Height	mm	76
Diameter	mm	38
Volume	mm3	86193
Bulk Density	(g/cm3)	1.82
Dry Density	(g/cm3)	1.36
Void Ratio		1.04
Moisture Content	%	34.31
Specific Gravity	(g/cm3)	2.77

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-03
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 03-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

UNIT WEIGHT / BULK DENSITY
VOID RATIO

Ground Instrumentation
& Engineering Pte Ltd

UD-02	Depth (m):	12.00-13.00
Weight of soil	gm	164.70
Height	mm	76
Diameter	mm	38
Volume	mm3	86193
Bulk Density	(g/cm3)	1.91
Dry Density	(g/cm3)	1.52
Void Ratio		0.76
Moisture Content	%	25.97
Specific Gravity	(g/cm3)	2.67

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-03
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 03-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

UNIT WEIGHT / BULK DENSITY
VOID RATIO

Ground Instrumentation
& Engineering Pte Ltd

MZ-01	Depth (m):	17.00-18.00
Weight of soil	gm	165.30
Height	mm	76
Diameter	mm	38
Volume	mm3	86193
Bulk Density	(g/cm3)	1.92
Dry Density	(g/cm3)	1.45
Void Ratio		0.87
Moisture Content	%	32.69
Specific Gravity	(g/cm3)	2.70

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-03
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 03-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

UNIT WEIGHT / BULK DENSITY
VOID RATIO

Ground Instrumentation & Engineering Pte Ltd

MZ-02	Depth (m):	27.00-27.45
Weight of soil	gm	158.90
Height	mm	76
Diameter	mm	38
Volume	mm3	86193
Bulk Density	(g/cm3)	1.84
Dry Density	(g/cm3)	1.55
Void Ratio		0.71
Moisture Content	%	18.73
Specific Gravity	(g/cm3)	2.65

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-03
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 03-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

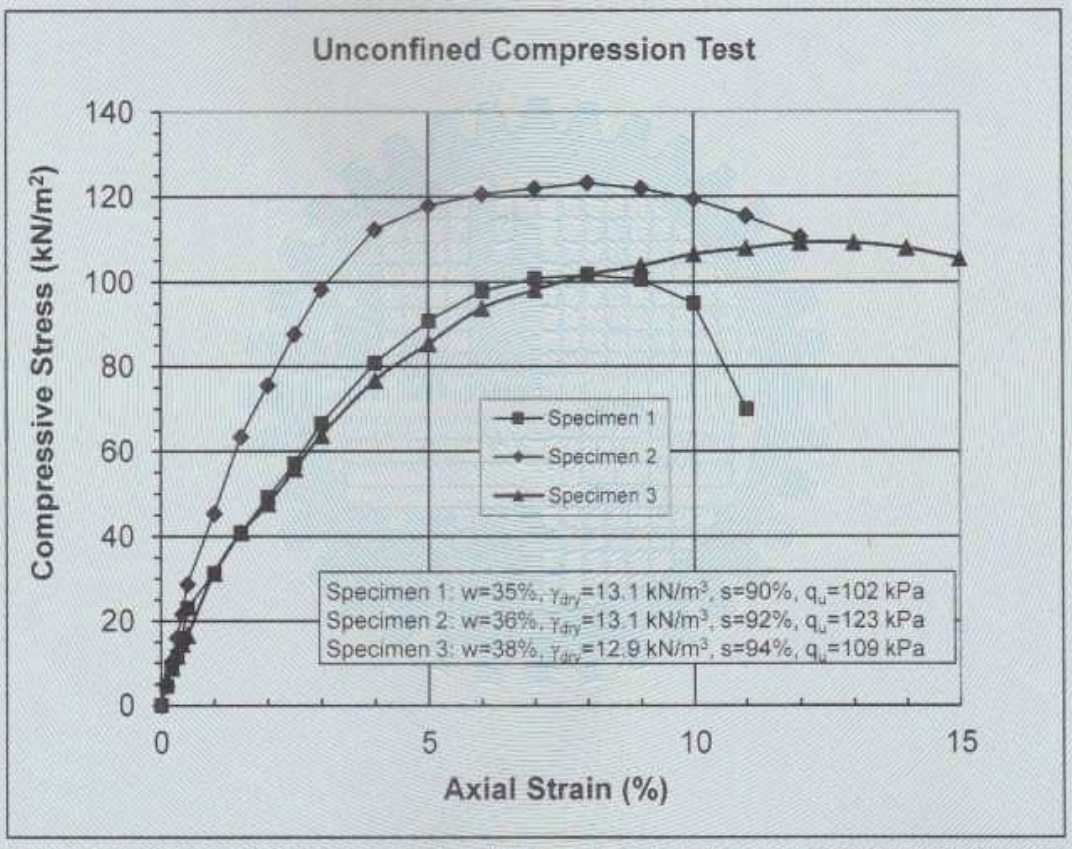
DEPARTMENT OF CIVIL ENGINEERING

Mobile: 01819 557964; PABX: 966 5650-80 Ext. 7226

BRTC Bureau of Research, Testing & Consultation

GEOTECHNICAL ENGINEERING LABORATORY

BRTC No.:	110-231613/20-21/CE dated 11.3.21			
Client :	Manager, Environment Health & Safety, SGS Bangladesh Ltd., Bir Uttam CR Datta Road, Dhaka			
Ref :	SGS/Phase-2/SI/090321 dated 9.3.21			
Project :	Geotechnical Investigation at Matarbari			
Soil description :	Grey silty clay			
Test Method:	ASTM		Date of Test:	29.3.21-1.4.21
BH No. : 3		Sample ID : UD-1	Depth:	8-9 m
			Location:	Matarbari



Note: Samples as supplied to us in sampler tubes have been tested in our laboratory. BRTC, BUET does not have any responsibility as to the representative character of the sample. Initial water content, dry density, degree of saturation and unconfined compressive strength is reported.

18

82TZbrZRb

Sample was received in unsealed condition

Specific Gravity= 2.77

Department of Civil Engineering, BUET, Dhaka-1000, Bangladesh

Countersigned by :

Dr. A.B.M. Badruzzaman
Professor
Department of Civil Engineering
BUET, Dhaka - 1000.

Test performed by :

7.5.21

Dr. Tahmeed M. Al-Hussaini
Professor
Department of Civil Engineering
BUET, Dhaka - 1000.

BRTC BUET

BUETCE 0 2 7 2 3 8 2

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

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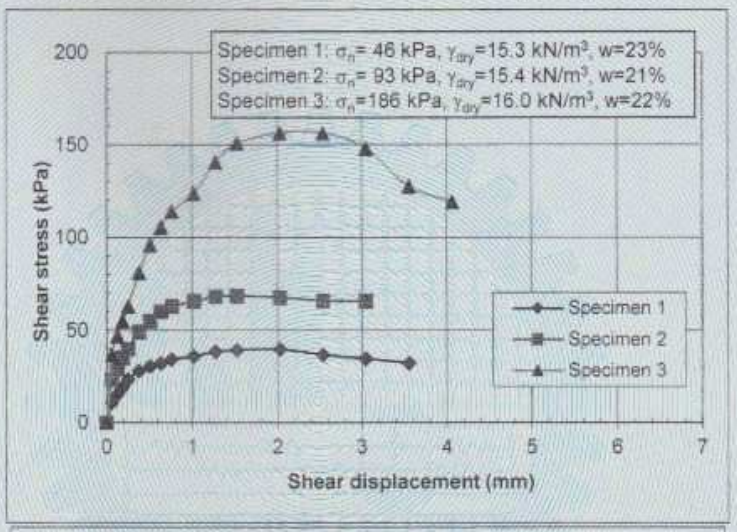
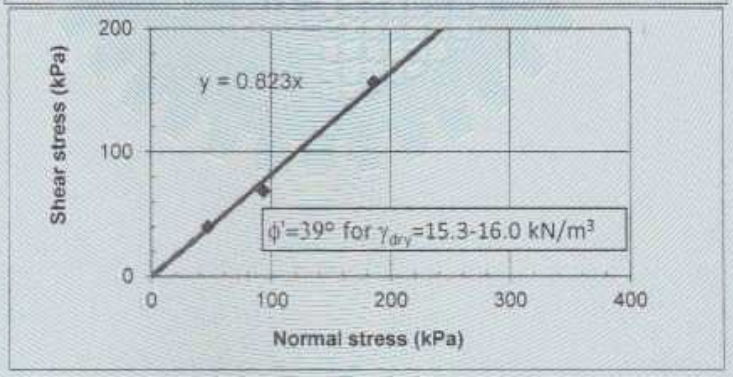
BRTC Bureau of Research, Testing & Consultation

GEOTECHNICAL ENGINEERING LABORATORY

BRTC No. : 110-231613/20-21/CE dated 11.3.21			
Sent by :	Manager, Environment Health & Safety, SGS Bangladesh Ltd., Bir Uttam CR Datta Road, Dhaka		
Ref:	SGS/Phase-2/SI/090321 dated 9.3.21		
Project :	Geotechnical Investigation at Matarbari		
Soil Description :	Grey silty fine sand	**Location:** Matarbari	
Bore-Hole: 3	**Sample:** 4	**Depth:** 4-4.45 m	
		Date of Test: 31.3.21-6.4.21	

Direct Shear (Consolidated Drained) Test





12

D7LJtG5F8

Note: Sample was received in unsealed condition.
Test specimens were prepared manually from disturbed samples. The dry density specified is after application of normal load prior to shearing, the water content represents the sample after shearing.

Department of Civil Engineering, BUET, Dhaka-1000, Bangladesh

Countersigned by :

Dr. A.B.M. Badruzzaman
Professor
Department of Civil Engineering
BUET, Dhaka - 1000.

Test performed by :

8.5.21

Dr. Tahmeed M. Al-Hussaini
Professor
Department of Civil Engineering
BUET, Dhaka - 1000.

BUETCE 0 2 7 2 3 8 8

Direct Shear Tests

Direct Shearbox Test

Summary

Sample Details						
 *sketch showing specimen location in original sample*	Depth			17.00-18.00		
	Description			Lean CLAY with sand, CL		
	Type			Mazier		
				Spm. 1	2	3
	Initial Height	H_0	(mm)	20.0	20.0	20.0
	Initial Width	D_0	(mm)	60.0	60.0	60.0
	Initial Weight	W_0	(gr)	136.0	136.0	136.0
	Initial Bulk Density	ρ_0	(Mg/m3)	1.89	1.89	1.89
	Particle Density	ρ_s	(Mg/m3)	2.70	2.70	2.70

Initial Condition					
			Spm. 1	2	3
Normal Stress Level		(kPa)	150	300	600
Is Specimen Submersed?			Yes	Yes	Yes
Reverse Method			Motor Drive		
Hoz. Control Machine			Not Used	Not Used	Not Used
Initial Moisture	ω_i%	(%)	33	33	33
Initial Dry Density	ρ_{di}	(Mg/m3)	1.42	1.42	1.42
Initial Voids Ratio	e_i	.	0.902	0.902	0.902
Initial Degree of Saturation	S_i	(%)	98.9	98.9	98.9

Notes

Max Shear Stress Results					
			Spm. 1	2	3
Final Moisture	ω_f%	(%)	33	34	34
Final Dry Density	ρ_{df}	(Mg/m3)	1.48	1.43	1.55
Final Voids Ratio	e_f	.	0.439	0.760	0.372
Final Degree of Saturation	S_f	(%)	100.0	100.0	100.0
Peak Shear Stress		(kPa)	78.2	127.1	253.4
Hoz Displacement	L_H	(mm)	11.250	12.000	12.000
Vertical Displacement	L_V	(mm)	0.290	0.350	0.420

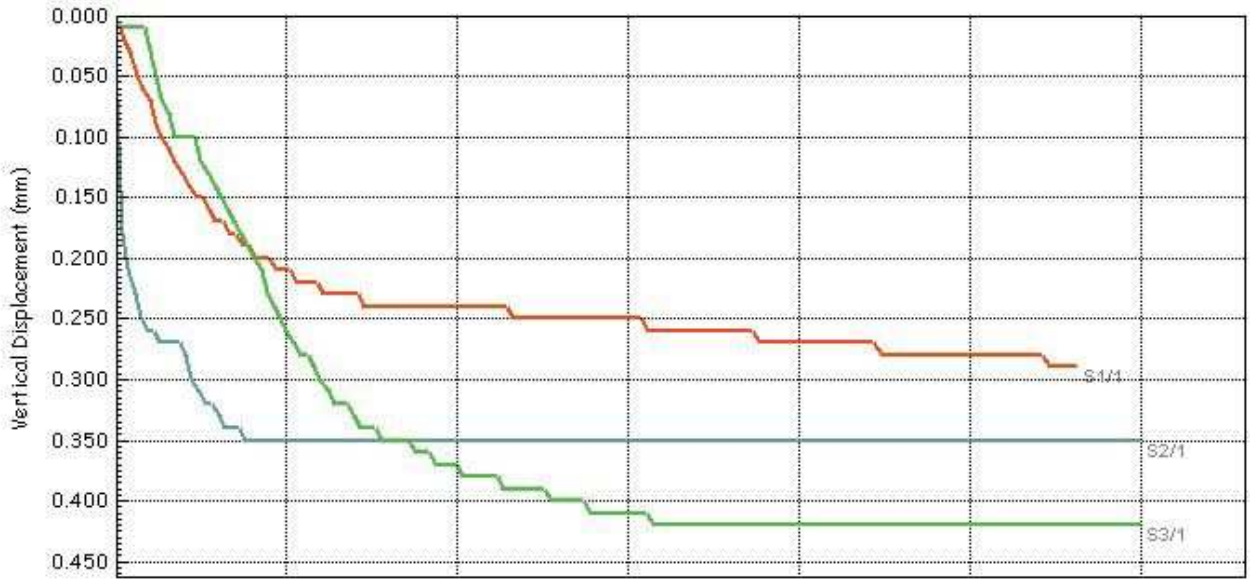
GIE

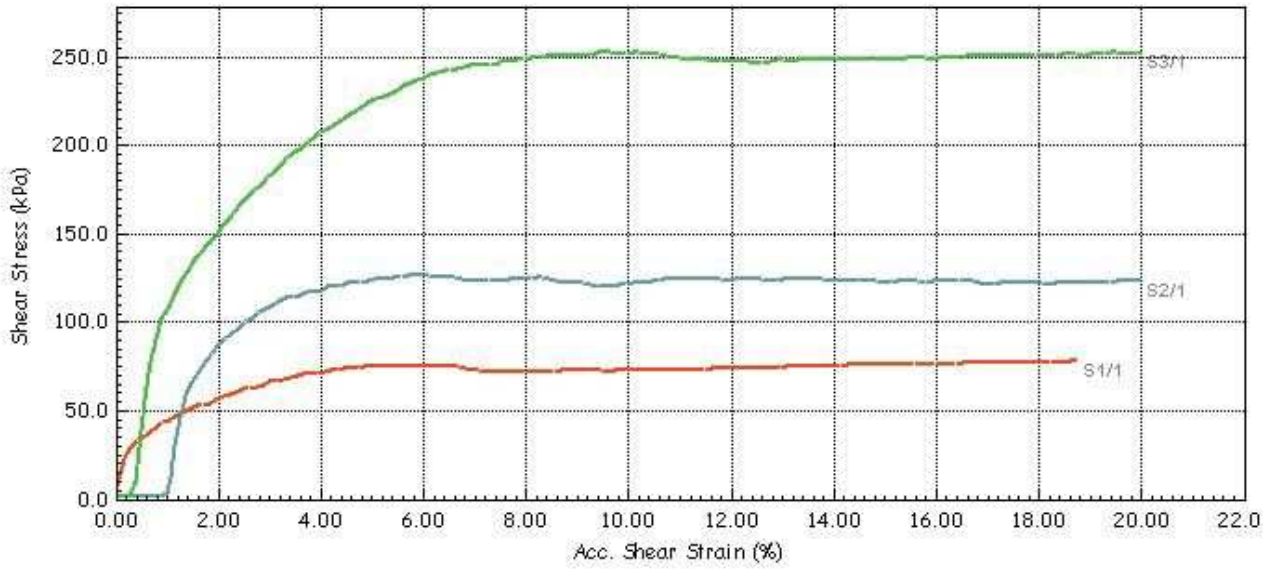
Test Method	ASTM D 3080-04			Test Name	Direct Shear
				Database: .\SQLEXPRESS \ GIE-D	
Site Reference				Test Date	3/15/2021
Jobfile	Direct Shear Test			Sample	Mazier-01
Client	SGS			Borehole	BH-03
Operator	R. Islam	Checked	Aminul	Approved	T. Islam

Direct Shear Tests

Direct Shearbox Test

Shear Stage





Test Method	ASTM D 3080-04			Test Name	Direct Shear
				Database: .\SQLEXPRESS \ GIE-D	
Site Reference				Test Date	3/15/2021
Jobfile	Direct Shear Test			Sample	Mazier-01
Client	SGS			Borehole	BH-03
Operator	R. Islam	Checked	Aminul	Approved	T. Islam

GIE

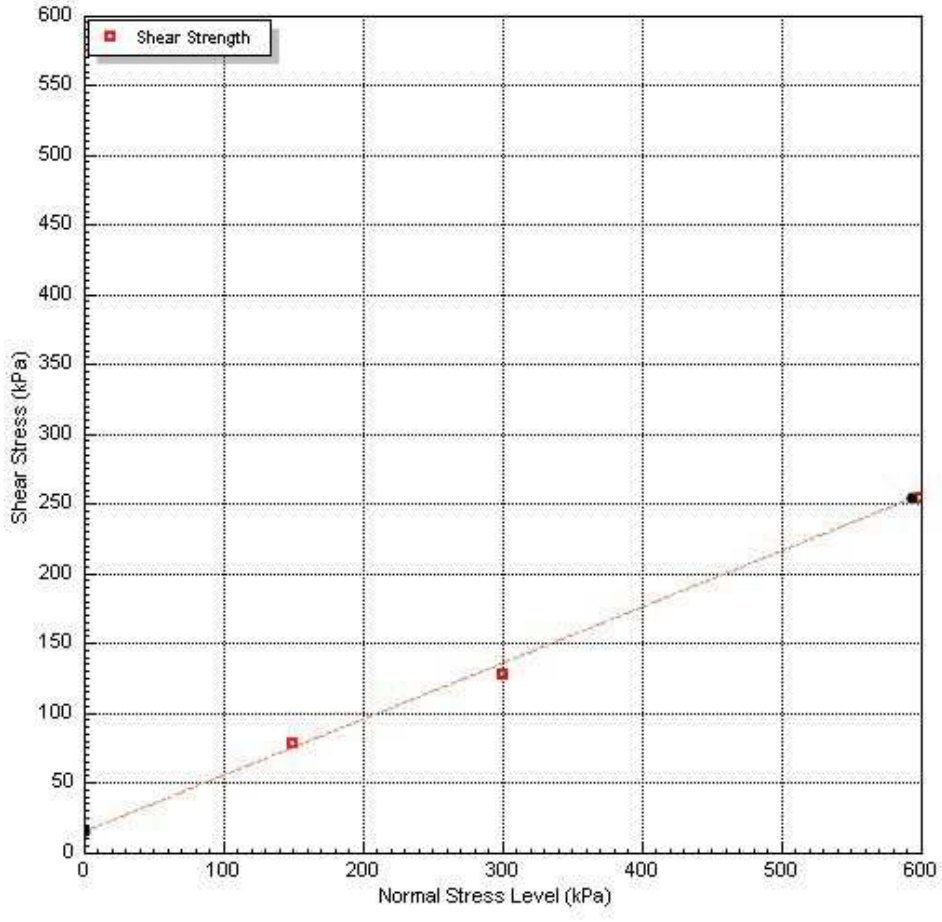
Direct Shear Tests

Direct Shearbox Test

Shear Stage

Envelope Failure Results			Spm. 1	2	3
Final Moisture	ω_f%	(%)	33	34	34
Final Dry Density	ρ_{df}	(Mg/m3)	1.48	1.43	1.55
Final Voids Ratio	e_f	.	0.439	0.760	0.372
Final Degree of Saturation	S_f	(%)	100.0	100.0	100.0
Apparent cohesion	c	(kPa)	15.04		
Angle of Shearing Resistance	ϕ	.	21.9		

Notes



Test Method	ASTM D 3080-04	Test Name	Direct Shear
		Database: .\SQLEXPRESS \ GIE-D	
Site Reference		Test Date	3/15/2021
Jobfile	Direct Shear Test	Sample	Mazier-01
Client	SGS	Borehole	BH-03
Operator	R. Islam	Checked	Aminul
Approved	T. Islam		

GIE

Direct Shear Tests

Direct Shearbox Test

Summary

Sample Details				Spm. 1	2	3
 *sketch showing specimen location in original sample*	Depth		27.00-28.00			
	Description					
	Type		Disturbed Soil			
	Initial Height	H o	(mm)	20.0	20.0	20.0
	Initial Width	D o	(mm)	60.0	60.0	60.0
	Initial Weight	W o	(gr)	149.5	149.5	149.5
	Initial Bulk Density	ρ o	(Mg/m3)	2.08	2.08	2.08
	Particle Density	ρ s	(Mg/m3)	2.65	2.65	2.65

Initial Condition			Spm. 1	2	3
Normal Stress Level		(kPa)	250	500	1000
Is Specimen Submersed?			Yes	Yes	Yes
Reverse Method			Motor Drive		
Hoz. Control Machine			Not Used	Not Used	Not Used
Initial Moisture	ω i%	(%)	19	19	19
Initial Dry Density	ρ di	(Mg/m3)	1.75	1.75	1.75
Initial Voids Ratio	e i	.	0.513	0.513	0.513
Initial Degree of Saturation	S i	(%)	95.9	95.9	95.9

Notes

Max Shear Stress Results			Spm. 1	2	3
Final Moisture	ω f%	(%)	19	20	19
Final Dry Density	ρ df	(Mg/m3)	1.78	1.87	1.88
Final Voids Ratio	e f	.	0.513	0.370	0.360
Final Degree of Saturation	S f	(%)	97.8	100.0	100.0
Peak Shear Stress		(kPa)	153.4	291.6	583.0
Hoz Displacement	L H	(mm)	12.000	12.000	12.000
Vertical Displacement	L V	(mm)	-0.010	0.300	0.310

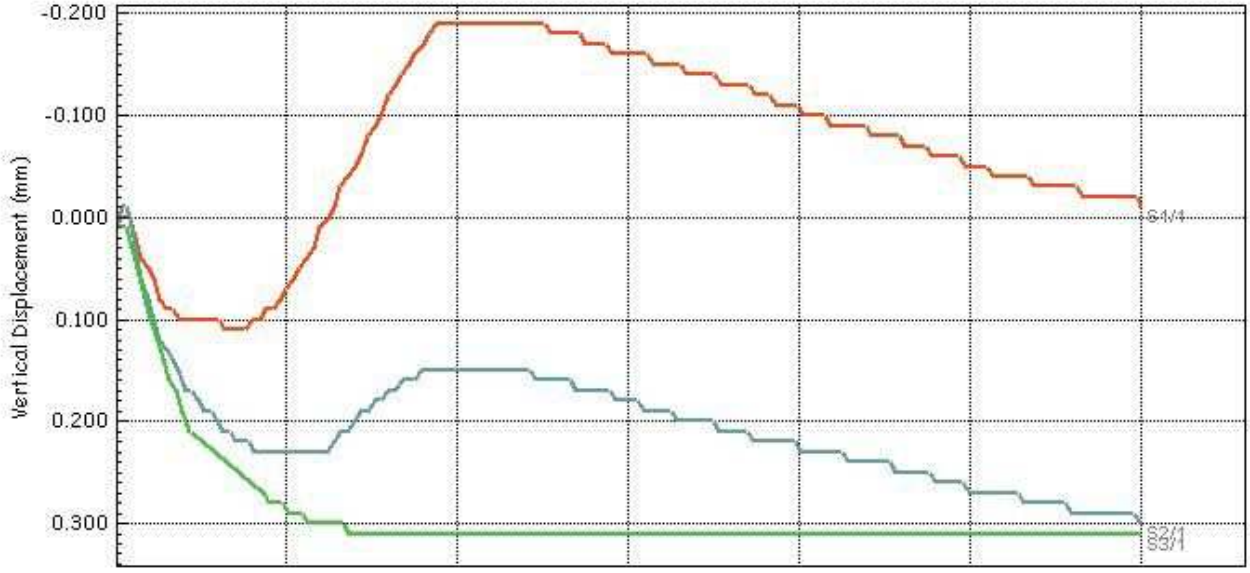
GIE

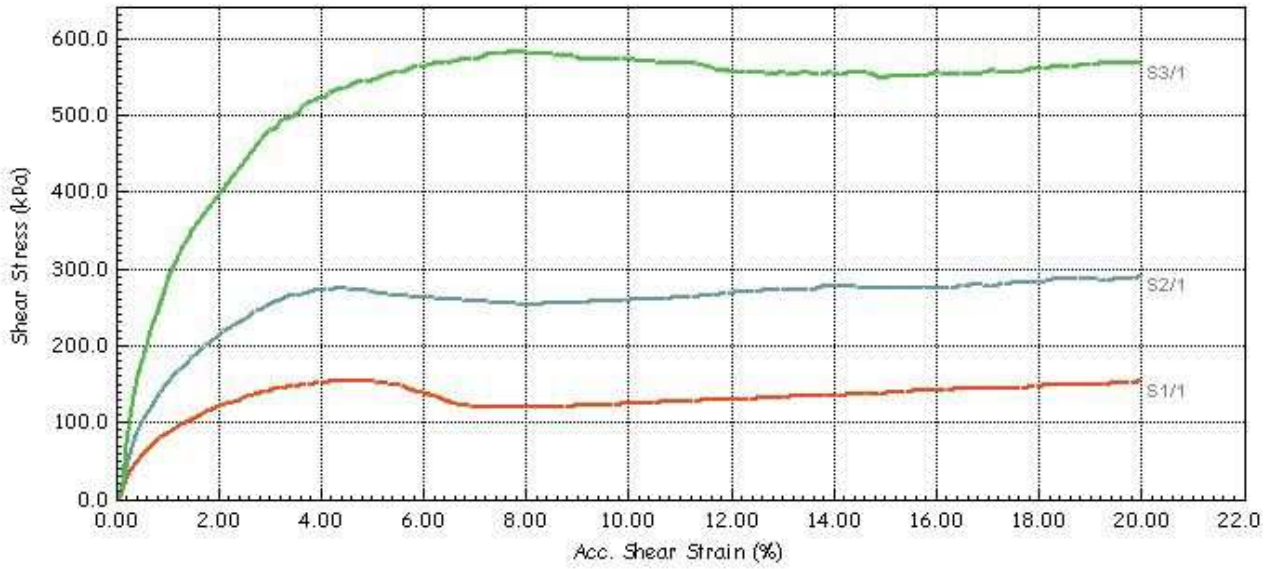
Test Method	ASTM D 3080-04			Test Name	Direct Shear
				Database: .\SQLEXPRESS \ GIE-D	
Site Reference				Test Date	3/16/2021
Jobfile	Direct Shear Test			Sample	Mazier-02
Client	SGS			Borehole	BH-03
Operator	R. Islam	Checked	Aminul	Approved	T. Islam

Direct Shear Tests

Direct Shearbox Test

Shear Stage





Test Method	ASTM D 3080-04		Test Name	Direct Shear	
			Database: .\SQLEXPRESS \ GIE-D		
Site Reference			Test Date	3/16/2021	
Jobfile	Direct Shear Test		Sample	Mazier-02	
Client	SGS		Borehole	BH-03	
Operator	R. Islam	Checked	Aminul	Approved	T. Islam

GIE

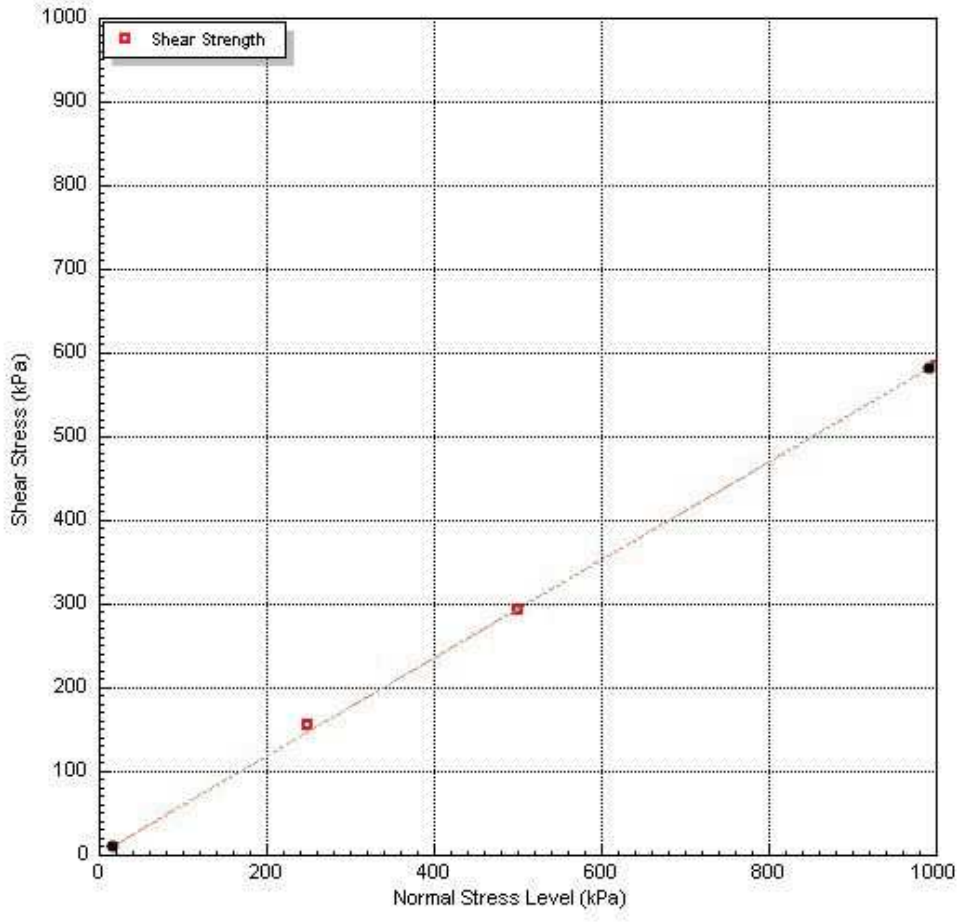
Direct Shear Tests

Direct Shearbox Test

Shear Stage

Envelope Failure Results			Spm. 1	2	3
Final Moisture	ω_f%	(%)	19	20	19
Final Dry Density	ρ_{df}	(Mg/m3)	1.78	1.87	1.88
Final Voids Ratio	e_f	.	0.513	0.370	0.360
Final Degree of Saturation	S_f	(%)	97.8	100.0	100.0
Apparent cohesion	c	(kPa)	0.69		
Angle of Shearing Resistance	ϕ	.	30.3		

Notes



Test Method	ASTM D 3080-04		Test Name	Direct Shear	
			Database: .\SQLEXPRESS \ GIE-D		
Site Reference			Test Date	3/16/2021	
Jobfile	Direct Shear Test		Sample	Mazier-02	
Client	SGS		Borehole	BH-03	
Operator	R. Islam	Checked	Aminul	Approved	T. Islam

GIE

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

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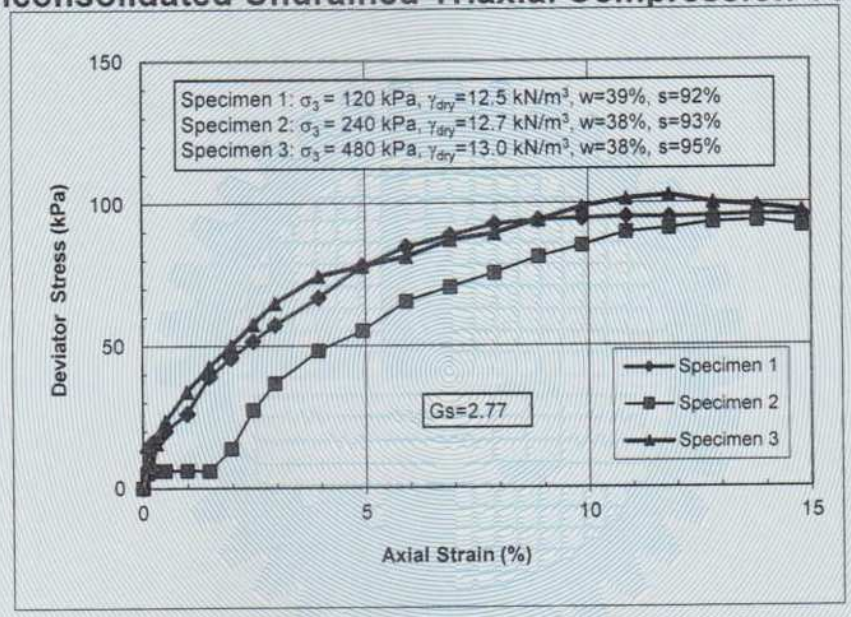
BRTC Bureau of Research, Testing & Consultation

GEOTECHNICAL ENGINEERING LABORATORY

BRTC No. :	110-231613/20-21/CE dated 11.3.21		
Sent by :	Manager, Environment Health & Safety, SGS Bangladesh Ltd., Bir Uttam CR Datta Road, Dhaka		
Ref:	SGS/Phase-2/SI/090321 dated 9.3.21		
Project :	Geotechnical Investigation at Matarbari		
Soil description :	Grey silty clay	**Test Method:**	ASTM
B.H. No.:	3 **Sample:** UD-1	**Depth:**	8-9 m
Location:	Matarbari	**Date of Test:**	5.5.21-9.5.21

(Corrected Report)

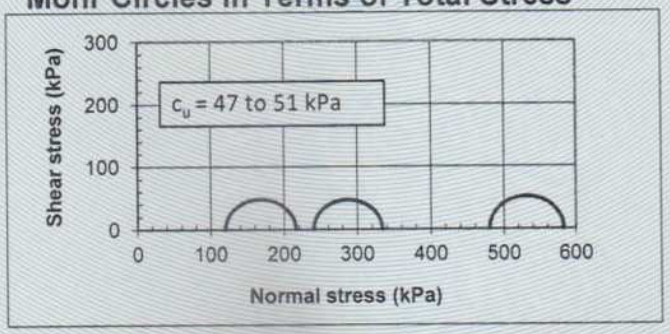
Unconsolidated Undrained Triaxial Compression Test



7

5FWRHJ2Gj

Mohr Circles in Terms of Total Stress



Remarks: Initial dry density, water content and degree of saturation is indicated. All specimens were subjected to saturation prior to loading.

Countersigned by :

Dr. A.B.M. Badruzzaman
Professor, Dept. of Civil Engineering
BUET, Dhaka - 1000.

Test performed by :

3.6.21

Dr. Tahmeed M. Al-Hussaini
Professor, Dept. of Civil Engineering
BUET, Dhaka - 1000.

Department of Civil Engineering * BUET, Dhaka-1000, Bangladesh *

BUETCE 0 2 7 4 8 7 0

Ground Instrumentation & Engineering Pte Ltd	**OEDOMETER TEST RESULTS** **ASTM D2435/D2435M - 11**	

Project	:	Geotechnical Investigation for Matarbari Project
Client - Location	:	TEPSCO
Boring No	:	BH-03
Sample No	:	UD-01
Depth (m)	:	8.00-9.00
Soil Description	:	Lean CLAY, CL

Moisture Content Determination

		Initial	Final
Wt. of Ring + Wet Soil, gm	=	141.40	139.04
Wt. of Ring + Dry Soil, gm	=	122.19	122.19
Weight of Water, gm	=	19.21	16.85
Weight of Container, gm	=	69.47	69.47
Weight of Dry Soil, gm	=	52.72	52.72
Water Content, %	=	36.4	32.0

Unit Weight Determination

		Initial	Final
Wt. of Ring + Wet Soil, gm	=	141.40	139.04
Weight of Ring, gm	=	69.47	69.47
Weight of Wet Soil, gm	=	71.93	69.57
Height of Sample, cm	=	2	1.836
Diameter of Sample, cm	=	5	5
Volume of Sample, cm^3	=	39.27	36.05
Unit Wet Weight, kN/m^3	=	18.0	18.9
Unit Dry Weight, kN/m^3	=	13.2	14.3

Specific Gravity	=	2.72
Initial Void Ratio	=	1.026
Degree of Saturation, %	=	96.6
Room Temperature, ^oC	=	24.0
Temp. correction factor	=	0.91
Initial Transducer Reading	=	8.70
Effective Overburden Pressure	=	
Preconsolidation Pressure (kPA)	=	102
Compression Index (Cc)	=	0.2657

Inc. No.	Load, p (kPa)	Transducer Reading (div)	Machine Corr. (div)	Change in Height (mm)	e Void Ratio	t_{90} (min)	c_v (cm^2/day.)	$c_v(20^oC)$ (cm^2/day.)	m_v (m^2/MN)	k x 10^{-9} (m/s)
1	12	8.500	0.001	0.199	1.006	0.878	1370.268	1246.944	0.829	321.550
2	25	8.451	0.001	0.248	1.001	2.432	493.470	449.058	0.190	26.584
3	50	8.360	0.002	0.338	0.992	0.436	2733.256	2487.263	0.182	140.985
4	100	8.081	0.007	0.612	0.964	1.344	870.379	792.045	0.279	68.654
5	200	7.484	0.012	1.204	0.904	1.448	772.432	702.913	0.305	66.750
6	400	6.693	0.021	1.986	0.825	2.985	348.220	316.880	0.208	20.501
7	200	6.759	0.016	1.925	0.831				0.017	
8	100	6.853	0.012	1.835	0.840				0.050	
9	50	6.967	0.009	1.724	0.851				0.122	
10	25	7.052	0.007	1.641	0.860				0.182	

Tested By: Rayhan

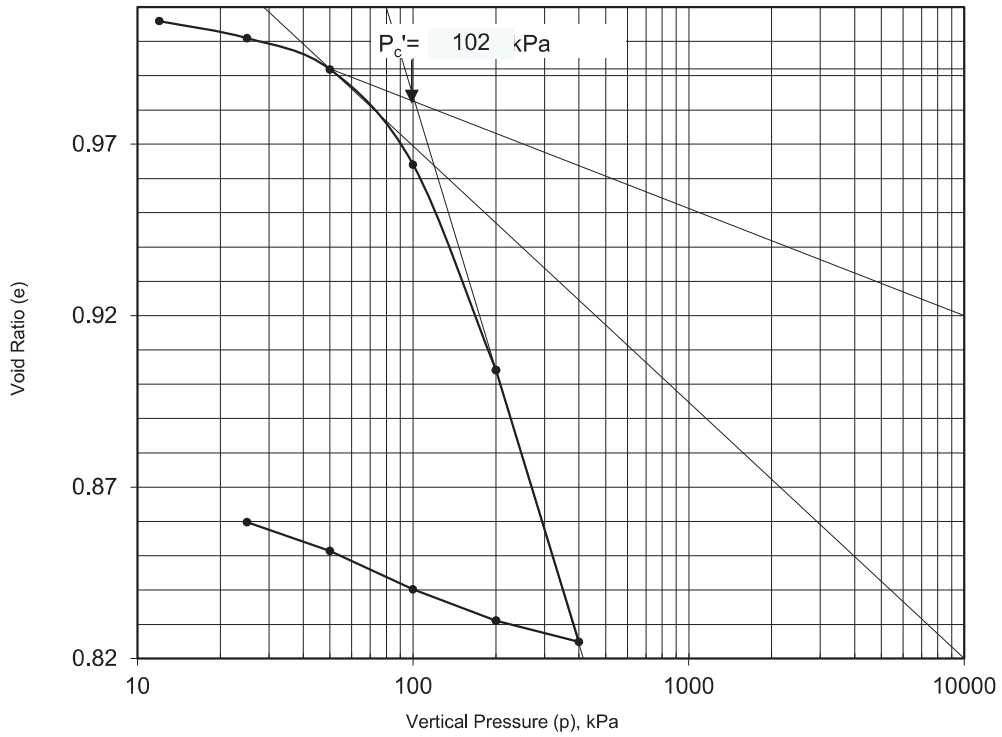
Date: 20-03-2021

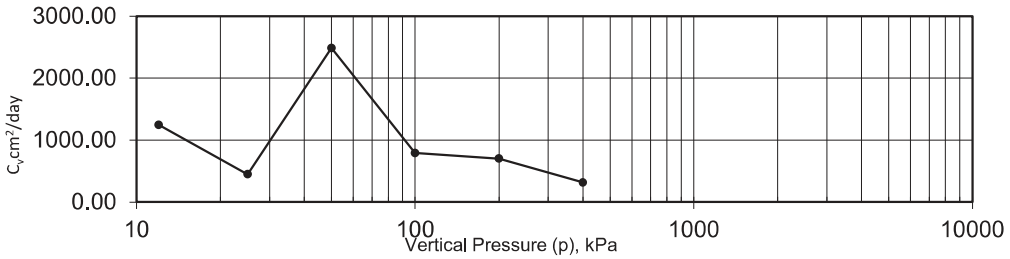
Checked & Approved By:T. Isla

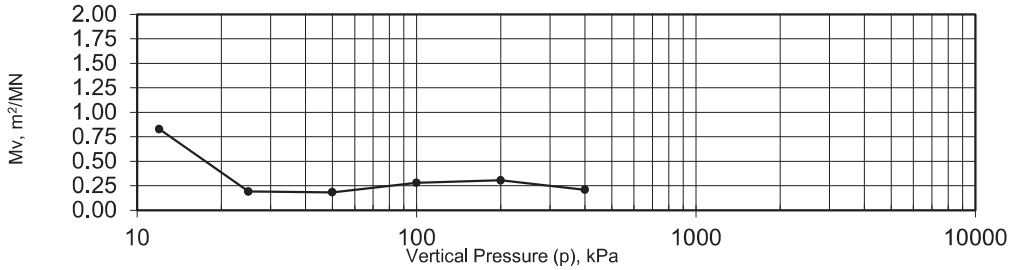
Date: 24-03-2021

ASTM D2435/D2435M - 11

Cc= 0.26575







Job No.	:	SIBD2105
Project	:	Geotechnical Investigation for Matarbari Project
Location	:	Matarbari, Power Plant Area
Borehole	:	BH-03
Sample	:	UD-01
Depth (m)	:	8.00-9.00

Ground Instrumentation & Engineering Pte Ltd

Ground Instrumentation & Engineering Pte Ltd	**OEDOMETER TEST RESULTS** **ASTM D2435/D2435M - 11**	

Project : SIBD2105
Client - Location : Geotechnical Investigation for Matarbari Project
Boring No : BH-03
Sample No : UD-02
Depth (m) : 12.00-13.00
Soil Description : Silty SAND

Moisture Content Determination

		Initial	Final
Wt. of Ring + Wet Soil, gm	=	144.96	144.8
Wt. of Ring + Dry Soil, gm	=	129.33	129.33
Weight of Water, gm	=	15.63	15.47
Weight of Container, gm	=	69.47	69.47
Weight of Dry Soil, gm	=	59.86	59.86
Water Content, %	=	26.1	25.8

Unit Weight Determination

		Initial	Final
Wt. of Ring + Wet Soil, gm	=	144.96	144.8
Weight of Ring, gm	=	69.47	69.47
Weight of Wet Soil, gm	=	75.49	75.33
Height of Sample, cm	=	2	1.926
Diameter of Sample, cm	=	5	5
Volume of Sample, cm^3	=	39.27	37.82
Unit Wet Weight, kN/m^3	=	18.9	19.5
Unit Dry Weight, kN/m^3	=	15.0	15.5

Specific Gravity	=	2.67
Initial Void Ratio	=	0.752
Degree of Saturation, %	=	92.8
Room Temperature, ^oC	=	24.0
Temp. correction factor	=	0.91
Initial Transducer Reading	=	8.08
Effective Overburden Pressure	=	
Preconsolidation Pressure	=	108
Compression Index (Cc)	=	0.0971

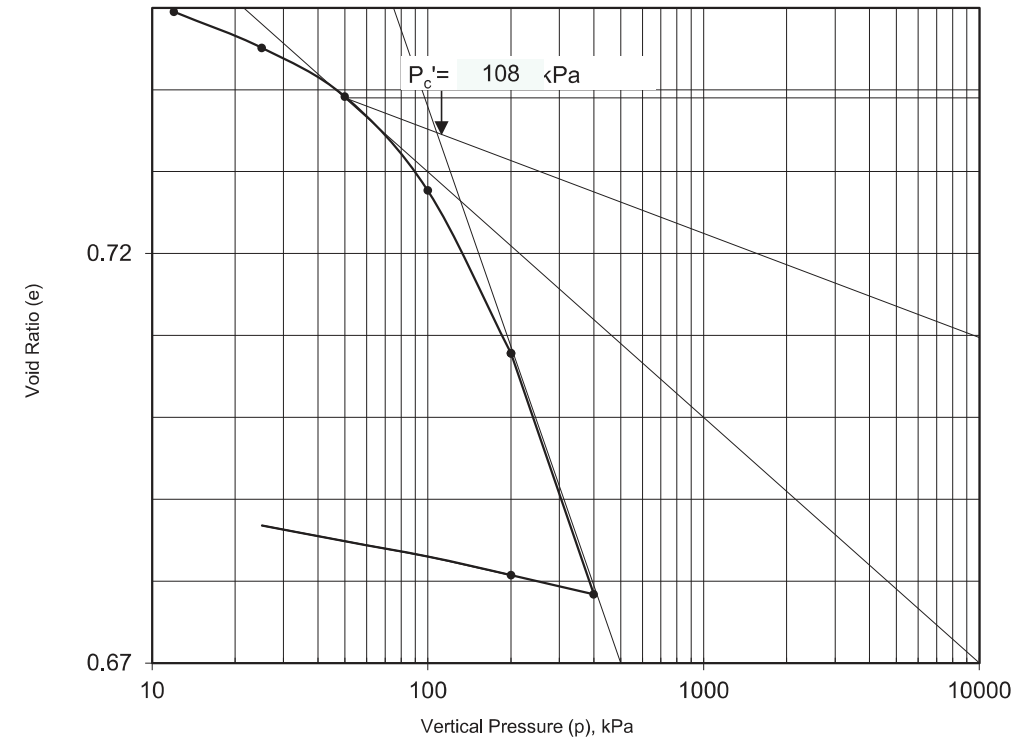
Inc. No.	Load, p (kPa)	Transducer Reading (div)	Machine Corr. (div)	Change in Height (mm)	e Void Ratio	t_{90} (min)	c_v ('cm2/day)	$c_v(20^oC)$ ('cm2/day)	m_v (m^2/MN)	k x 10^{-9} (m/s)
1	12	8.053	0.001	0.024	0.749	2.478	494.130	449.659	0.100	13.984
2	25	8.003	0.001	0.074	0.745	3.027	403.499	367.184	0.193	21.987
3	50	7.932	0.004	0.142	0.739	2.315	524.483	477.280	0.137	20.262
4	100	7.795	0.010	0.273	0.728	0.981	1225.344	1115.063	0.132	45.754
5	200	7.561	0.017	0.500	0.708	9.209	128.181	116.645	0.115	4.174
6	400	7.215	0.027	0.836	0.678	3.374	339.887	309.297	0.086	8.287
7	200	7.246	0.023	0.809	0.681				0.007	
8	100	7.276	0.019	0.783	0.683				0.014	
9	50	7.300	0.016	0.762	0.685				0.022	
10	25	7.323	0.015	0.740	0.687				0.046	

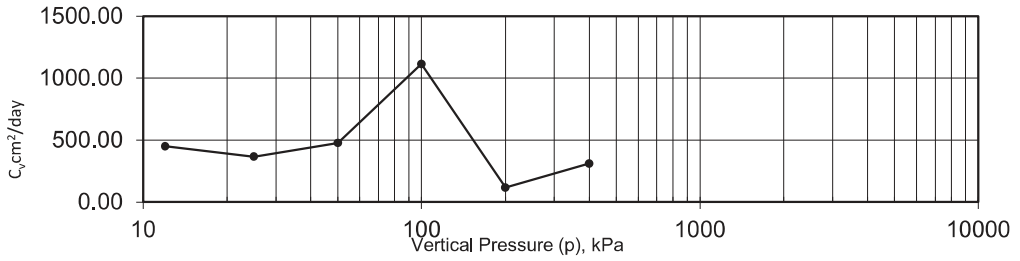
Tested By: Rayhan **Checked & Approved By:T. Islam**

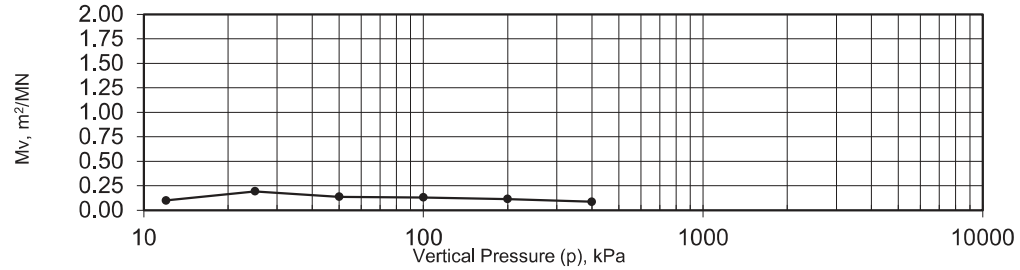
Date: 20-03-2021 **Date: 24-03-2021**

ASTM D2435/D2435M - 11

Cc= 0.097098







Coefficient of consolidation (Cv). cm^2/day

Job No.	:	SIBD2105
Project	:	Geotechnical Investigation for Matarbari Project
Location	:	Matarbari, Power Plant Area
Borehole	:	BH-03
Sample	:	UD-02
Depth (m)	:	12.00-13.00

Ground Instrumentation & Engineering Pte Ltd

GEOTECHNICAL AND MATERIAL LABORATORY
Ground Instrumentation & Engineering
Pte.Ltd. House-7 Road-12, Dhaka 1230

LABORATORY COMPACTION TEST DATA
(Dry Density- Moisture Content Relationship)
ASTM D1557

Date: 25/03/2021

Project : **Geotechnical Investigation for Matarbari, ID-SIBD-2105**
Client : SGS
Test Pit No. : **BH-03**
Sample Depth : 1.00 m
Method: Standard Proctor (using 2.5 kg rammer)

Volume of Mould: 950 cm^3

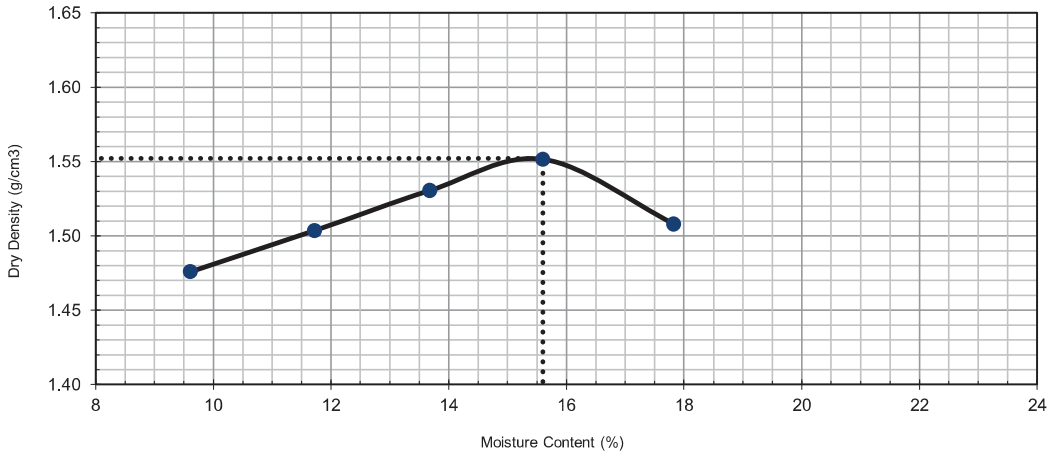
Test No.:		1	2	3	4	5	
Mass of Mould+ Base+Compacted Materials (m2)	g	5197	5256	5313	5364	5348	
Mass of Mould+ Base(m1)	g	3660	3660	3660	3660	3660	
mass of Compacted Materials(m2-m1)	g	1537	1596	1653	1704	1688	
Bulk Density,ρ= $\frac{m2-m1}{vol.of\ mold}$	g/cm^3	1.618	1.680	1.740	1.794	1.777	
Moisture Content (w)	%	9.62	11.73	13.68	15.61	17.83	
Dry Density, ρ_d = $\frac{100\rho}{100+w}$	g/cm^3	1.476	1.504	1.531	1.552	1.508	

MOISTURE CONTENT

Test No.:		1		2		3		4		5			
Container No.:		B-31	B-16	B-20	B-24	B-138	B-10	B-112	B-90	B-124	B-118		
Mass of container + wet soil	g	54.8	46.9	74.6	60.85	67.02	71.13	55.64	63.84	65.07	72.99		
mass of container + dry soil	g	52.2	44.4	71.12	57.57	62.26	66.5	51.12	58.94	58.9	67.2		
Mass of Water	g	2.61	2.43	3.52	3.28	4.76	4.6	4.52	4.90	6.13	5.81		
Mass of Container	g	24.91	19.31	40.83	29.85	26.92	33.43	22.05	27.66	24.68	34.48		
Mass of Dry Soil	g	27.3	25.12	30.29	27.72	35.34	33.1	29.07	31.28	34.26	32.7		
Moisture Content	%	9.56	9.67	11.62	11.83	13.47	13.90	15.55	15.66	17.89	17.77		
Average Moisture Content	%	9.6		11.7		13.7		15.6		17.8			

Maximum Dry Density	***1.552***	g/cm^3
Optimum Moisture Content	***15.6***	%

Fig. : Dry Density vs Moisture Content Curve



Ground Instrumentation &

Falling Head Permeability Test

K.H. Head Vol.2

ACCREDITED LABORATORY SAC-SINGLAS

Project ID:	SI BD2105	Project/Location:	Geotechnical Investigation for Matarbari Project
Borehole No.	BH-03	Sample: MZ-01	Depth: 17.00 - 18.00 (m)
Soil Description :	Lean CLAY with sand, CL		
Method of Preparartion:	Undisturbed √	or	Compacted

Diameter, *D*, mm	73.00	Moisture Content, %	32	
Area, *A*, mm^2	4185.40	Bulk Density, ρ, Mg/m^3	1.86	
Length, *L*, mm	72.15	Dry Density, ρ_D, Mg/m^3	1.41	
Volume, *V*, mm^3	301976.36	Particle Density, ρs	2.70	measured / ~~assumed~~
Voids ratio, e	0.912	Temperature, °C	25	
Standpipe diameter, mm	4.70	Standpipe area,(a) mm^2	17.3	
Correction Factor for test temperature corresponding to 20°C			0.890	

HEIGHT ABOVE OUTLET h (mm)	TIME TAKEN t (min)	HEIGHT RATIO	COEFFICIENT OF PERMEABILITY Kv (m/s)	AVERAGE Kv AT TEST TEMPERATURE Kv (m/s)
1070	0	-	-	-
465	520.00	2.30	7.97E-09	**7.72E-09**
202	555.00	2.30	7.47E-09	

CORRECTED AVERAGE Kv @ 20 °C	**6.87E-09**

Tested by : Faysal Checked/Approved by : Mario Date: 16/4/21

BH-04

Ground Instrumentation & Engineering Pte Ltd	**MOISTURE CONTENT** **ASTM D2216-10**	

Sample No.:	SPT-02	Depth (m): 2.00-2.45
Can No.		206
Weight of Wet Soil + Can (gm)		260.18
Weight of Dry Soil + can (gm)		223.45
Weight of Can (gm)		23.52
Moisture Content (%)		**18.37**
Description		**Silty fine SAND, SM**

Sample No.:	SPT-06	Depth (m): 6.00-6.45
Can No.		413
Weight of Wet Soil + Can (gm)		229.91
Weight of Dry Soil + can (gm)		188.66
Weight of Can (gm)		25.26
Moisture Content (%)		**25.24**
Description		**Lean CLAY, CL**

Sample No.:	UD-02	Depth (m): 9.00-9.45
Can No.		413
Weight of Wet Soil + Can (gm)		183.00
Weight of Dry Soil + can (gm)		137.46
Weight of Can (gm)		25.26
Moisture Content (%)		**40.59**
Description		**Lean CLAY, CL**

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-04
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 02-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

Ground Instrumentation & Engineering Pte Ltd	**MOISTURE CONTENT** **ASTM D2216-10**	

Sample No.:	SPT-08	Depth (m): 10.00-10.45
Can No.		209
Weight of Wet Soil + Can (gm)		221.89
Weight of Dry Soil + can (gm)		189.67
Weight of Can (gm)		28.55
Moisture Content (%)		**20.00**
Description		**Sandy Lean CLAY, CL**

Sample No.:	SPT-12	Depth (m): 14.00-14.45
Can No.		207
Weight of Wet Soil + Can (gm)		179.86
Weight of Dry Soil + can (gm)		149.88
Weight of Can (gm)		24.92
Moisture Content (%)		**23.99**
Description		**Lean CLAY, CL**

Sample No.:	SPT-15	Depth (m): 17.00-17.45
Can No.		47
Weight of Wet Soil + Can (gm)		182.06
Weight of Dry Soil + can (gm)		152.70
Weight of Can (gm)		13.24
Moisture Content (%)		**21.05**
Description		**Silty fine-medium SAND, SM**

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-04
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 02-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

Ground Instrumentation & Engineering Pte Ltd	**MOISTURE CONTENT** **ASTM D2216-10**	

Sample No.:	SPT-18	Depth (m): 20.00-20.45
Can No.		447
Weight of Wet Soil + Can (gm)		201.83
Weight of Dry Soil + can (gm)		164.65
Weight of Can (gm)		13.22
Moisture Content (%)		**24.55**
Description		**Lean CLAY, CL**

Sample No.:	SPT-22	Depth (m): 24.00-24.45
Can No.		100
Weight of Wet Soil + Can (gm)		186.69
Weight of Dry Soil + can (gm)		152.81
Weight of Can (gm)		13.03
Moisture Content (%)		**24.24**
Description		**Sandy SILT, ML**

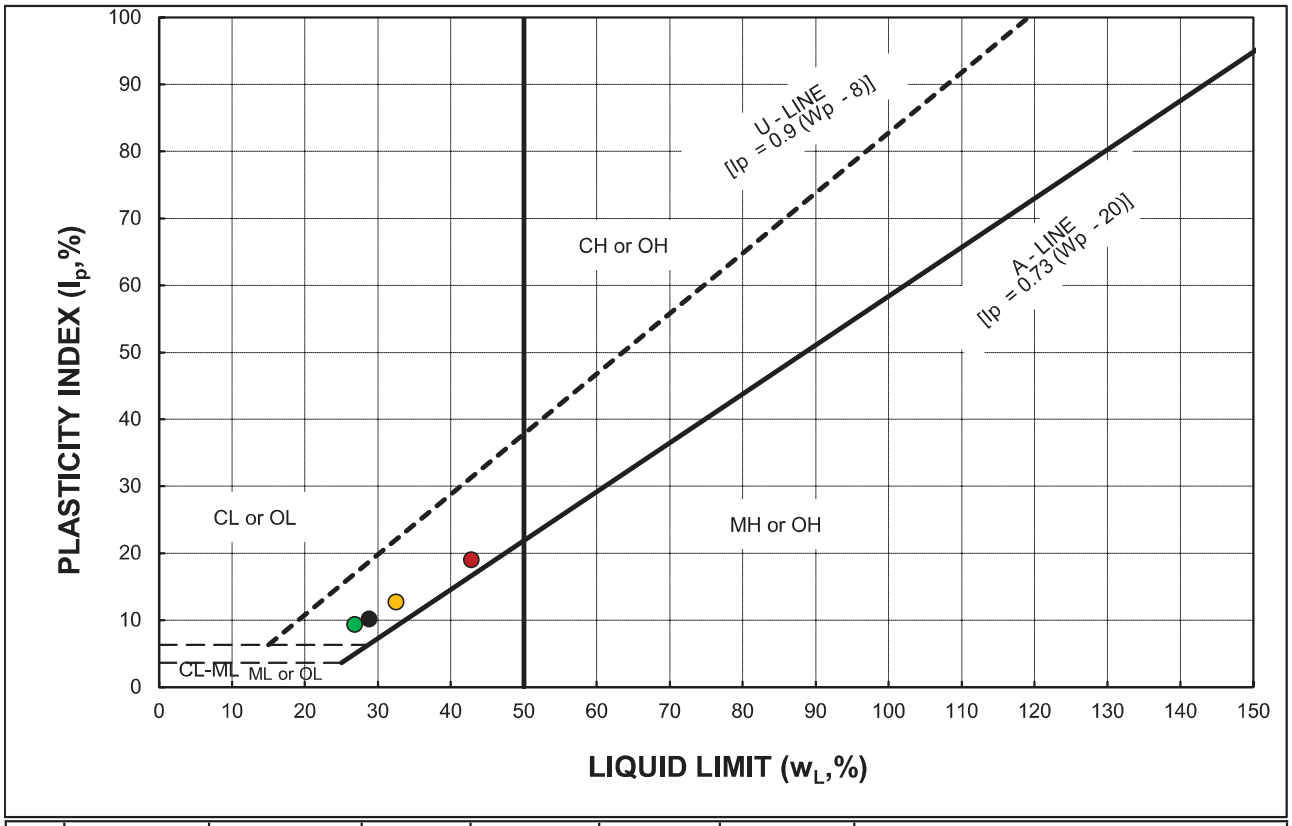
Sample No.:		
Can No.		
Weight of Wet Soil + Can (gm)		
Weight of Dry Soil + can (gm)		
Weight of Can (gm)		
Moisture Content (%)		
Description		

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-04
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 02-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

Ground Instrumentation & Engineering Pte. Ltd.



	Sample No.	Depth	W_L	W_P	I_p	Fines	Remarks
●	SPT-06	6.00-6.45	28.80	18.63	10.17		Lean CLAY, CL
●	UD-02	9.00-9.45	32.50	19.78	12.72		Lean CLAY, CL
●	SPT-12	14.00-14.45	26.80	17.45	9.35		Lean CLAY, CL
●	SPT-18	20.00-20.45	42.80	23.78	19.02		Lean CLAY, CL
●	SPT-22	24.00-24.45	*	*	*		The sample is nonplastic
●							
●							
●							
●							
○							

Note : All the above Liquid Limit tests was performed in accordance to Method A (Multi-Point) of ASTM D 4318-05

*Hydrometer analysis were performed instead of atterberg limit and presented with the Particle Size Distribution Section

ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands, etc.	**MH**	Inorganic silts, or diatomaceous fine sands or silts, elastic silts, etc.
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays, etc.	**CH**	Inorganic clays of high plasticity, fat clays, etc.
OL	Organic silts and organic silty clays of low plasticity.	**OH**	Organic silts and organic clays of medium to high plasticity.

PLASTICITY CHART (ASTM D 2487 - 06 & D 4318 - 05)

Geotechnical Investigation for Matarbari Project

Client: TEPSCO

Project ID: SIBD2105

BH No.: BH-04

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 03-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

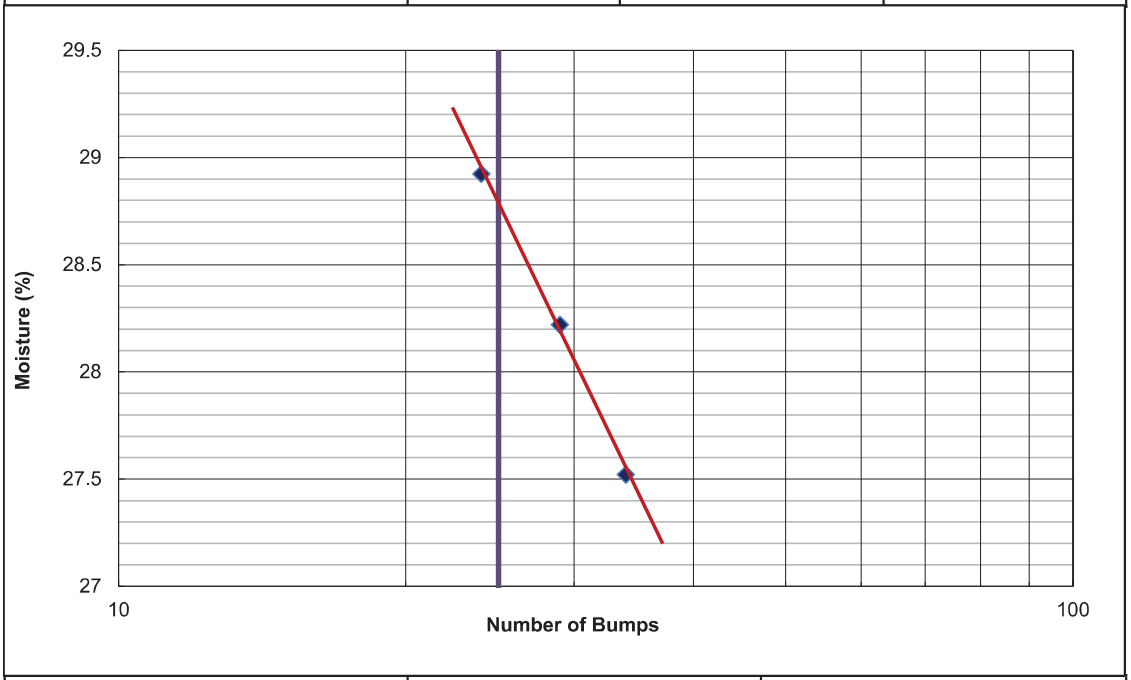
Ground Instrumentation & Engineering Pte. Ltd.

Liquid and Plastic Limits Test: ASTM D4318-10 (Casagrande Method)

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)
Project ID: SIBD2105 Sample No: SPT-06
BH No.: BH-04 Sample Depth: 6.00-6.45

Plastic Limit Test		
Container No.	426	59
Weight of can (gm)	7.64	7.61
Wet weight of soil + can (gm)	31.43	31.45
Dry Weight of soil + can (gm)	27.71	27.69
Moisture Content %	18.54	18.73
Average	18.63	

Liquid Limit Test (Casagrande, Blow count: 20-35, ASTM Method-A- multi-pt)			
Test No	1	2	3
Number of Bumps	24	29	34
Container No.	478	475	435
Weight of can (gm)	4.08	4.35	3.89
Wet weight of soil + can (gm)	25.03	24.16	23.86
Dry Weight of soil + can (gm)	20.33	19.8	19.55
Moisture Content %	**28.92**	**28.22**	**27.52**



LL: 28.80	PL: 18.63	PI: 10.17
Description	Lean CLAY, CL	

Tested by: Rayhan
Date: 03-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

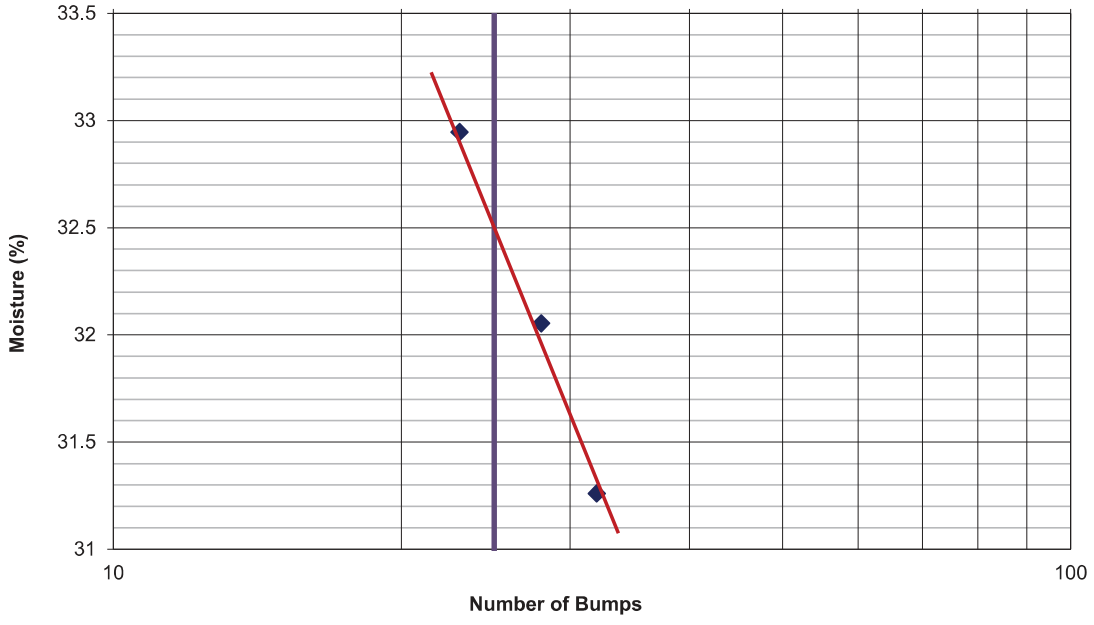
Ground Instrumentation & Engineering Pte. Ltd.

Liquid and Plastic Limits Test: ASTM D4318-10 (Casagrande Method)

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)
Project ID: SIBD2105 Sample No.: UD-02
BH No.: BH-04 Sample Depth: 9.00-9.45

Plastic Limit Test		
Container No.	353	345
Weight of can (gm)	9.01	8.99
Wet weight of soil + can (gm)	30.43	30.45
Dry Weight of soil + can (gm)	26.91	26.89
Moisture Content %	19.66	19.89
Average	19.78	

Liquid Limit Test (Casagrande, Blow count: 20-35, ASTM Method-A- multi-pt)			
Test No	1	2	3
Number of Bumps	23	28	32
Container No.	443	474	322
Weight of can (gm)	3.96	4.23	7.55
Wet weight of soil + can (gm)	26.92	23.51	22.33
Dry Weight of soil + can (gm)	21.23	18.83	18.81
Moisture Content %	**32.95**	**32.05**	**31.26**



LL: 32.50	PL: 19.78	PI: 12.72
Description	Lean CLAY, CL	

Tested by: Rayhan
Date: 03-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

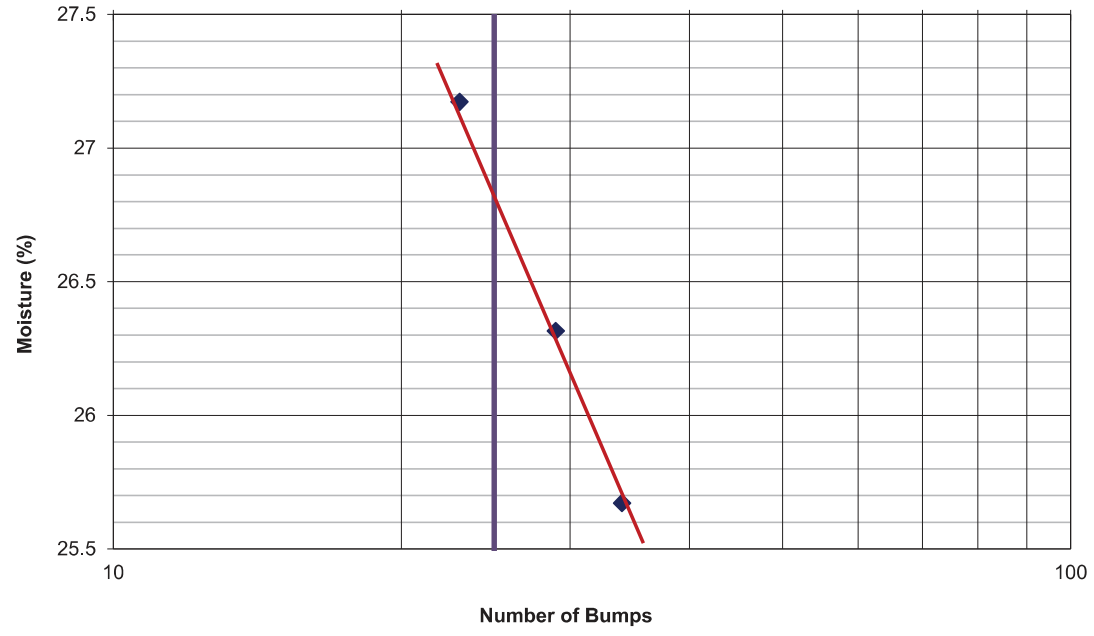
Ground Instrumentation & Engineering Pte. Ltd.

Liquid and Plastic Limits Test: ASTM D4318-10 (Casagrande Method)

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)
Project ID: SIBD2105 Sample No.: SPT-12
BH No.: BH-04 Sample Depth.: 14.00-14.45

Plastic Limit Test		
Container No.	227	9
Weight of can (gm)	14.07	14.06
Wet weight of soil + can (gm)	36.81	36.83
Dry Weight of soil + can (gm)	33.45	33.43
Moisture Content %	17.34	17.55
Average	17.45	

Liquid Limit Test (Casagrande, Blow count: 20-35, ASTM Method-A- multi-pt)			
Test No	1	2	3
Number of Bumps	23	29	34
Container No.	321	330	433
Weight of can (gm)	9.13	9.1	4.02
Wet weight of soil + can (gm)	28.74	27.82	24.14
Dry Weight of soil + can (gm)	24.55	23.92	20.03
Moisture Content %	**27.17**	**26.32**	**25.67**



LL: 26.80	PL: 17.45	PI: 9.35
Description	Lean CLAY, CL	

Tested by: Rayhan
Date: 03-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

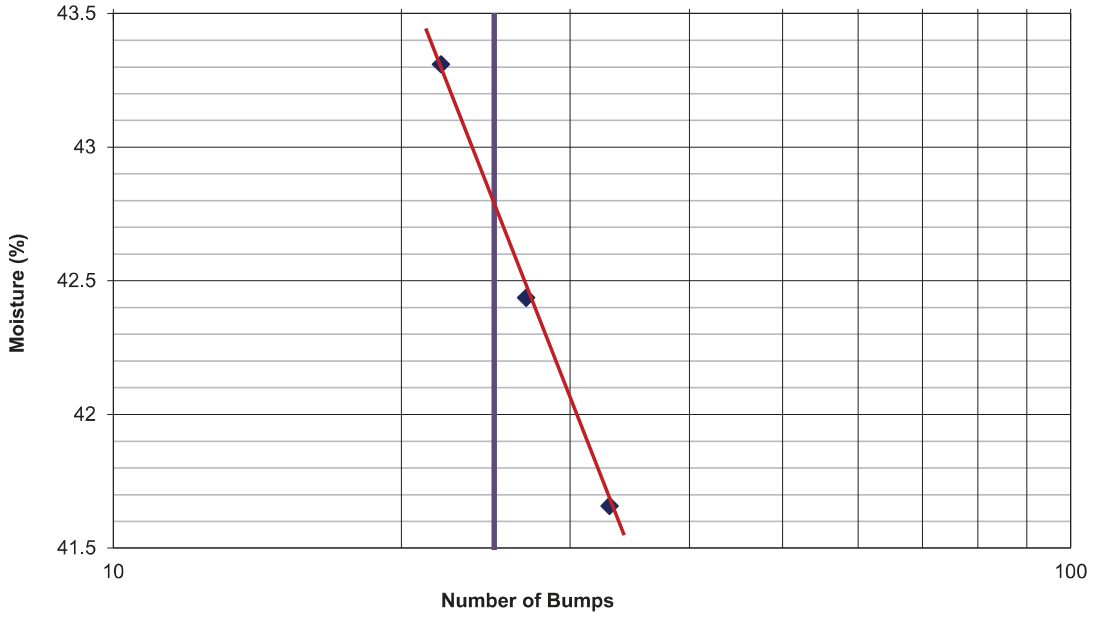
Ground Instrumentation & Engineering Pte. Ltd.

Liquid and Plastic Limits Test: ASTM D4318-10 (Casagrande Method)

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)
Project ID: SIBD2105 Sample No.: SPT-18
BH No.: BH-04 Sample Depth.: 20.00-20.45

Plastic Limit Test		
Container No.	421	333
Weight of can (gm)	7.18	6.93
Wet weight of soil + can (gm)	26.93	26.95
Dry Weight of soil + can (gm)	23.13	23.11
Moisture Content %	23.82	23.73
Average	23.78	

Liquid Limit Test (Casagrande, Blow count: 20-35, ASTM Method-A- multi-pt)			
Test No	1	2	3
Number of Bumps	22	27	33
Container No.	436	433	435
Weight of can (gm)	3.83	4.02	3.89
Wet weight of soil + can (gm)	25.04	21.44	18.41
Dry Weight of soil + can (gm)	18.63	16.25	14.14
Moisture Content %	43.31	42.44	41.66

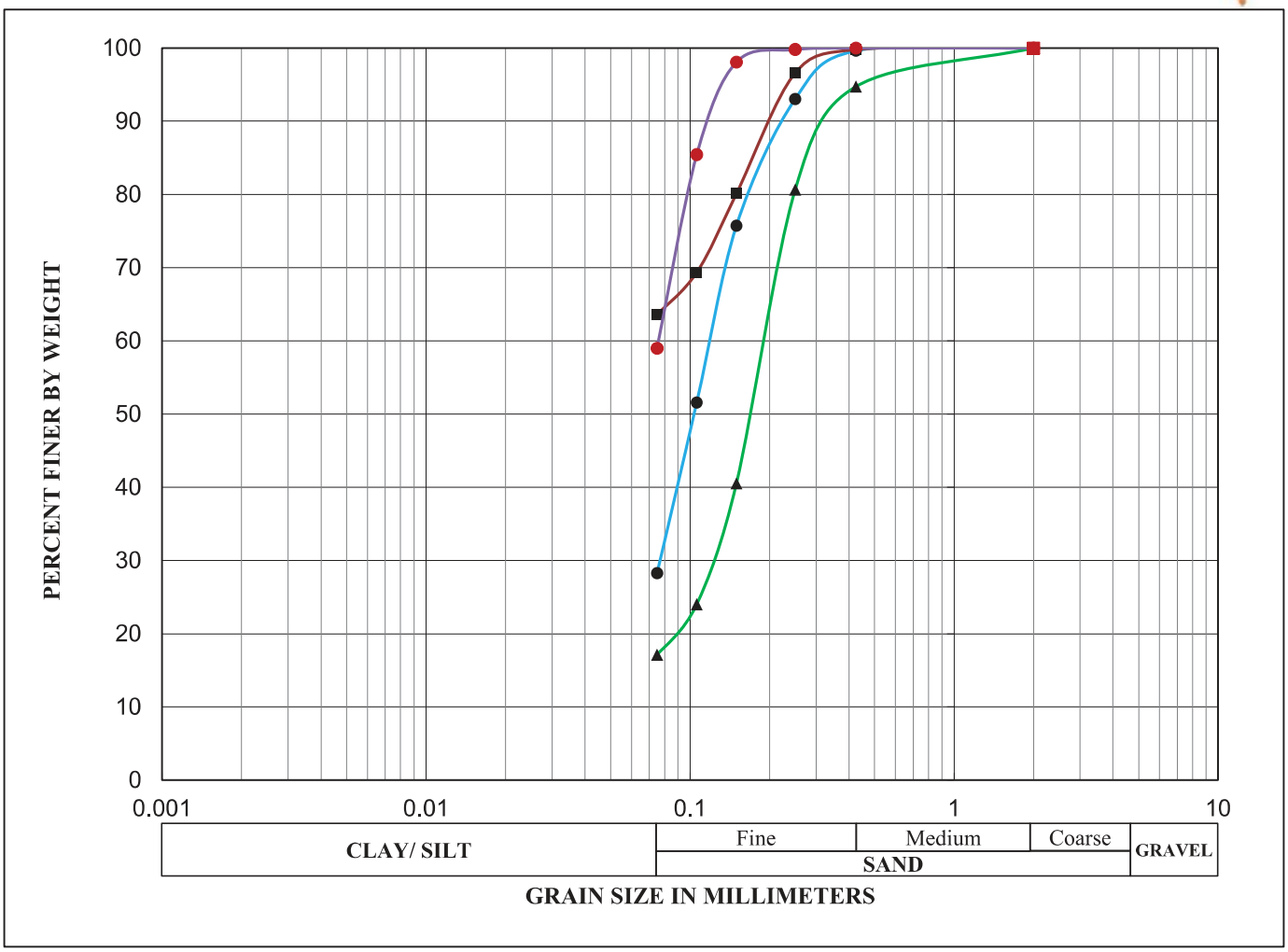


LL: 42.80	PL: 23.78	PI: 19.02
Description	Lean CLAY, CL	

Tested by: Rayhan
Date: 03-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

Ground Instrumentation & Engineering Pte.Ltd.



	Sample	Depth	Classification	W(%)	W_L	P_L	I_P	C_U	C_C
●	SPT-02	2.00-2.45	Silty fine SAND, SM						
■	SPT-08	10.00-10.45	Sandy Lean CLAY, CL						
▲	SPT-15	17.00-17.45	Silty fine-medium SAND, SM						
●	SPT-22	24.00-24.45	Sandy SILT, ML						
■									
▲									

	Sample	Depth	D60	D50	D30	D10	%Gravel	%Sand			%SILT/ %CLAY
								%Fine	%Meidum	%Coarse	
●	SPT-02	2.00-2.45	0.121	0.104	0.077	0.027	0.00	71.36	0.38	0.00	28.26
■	SPT-08	10.00-10.45	0.071	0.059	0.035	0.012	0.00	36.16	0.20	0.00	63.64
▲	SPT-15	17.00-17.45	0.198	0.174	0.122	0.044	0.00	77.62	5.26	0.00	17.12
●	SPT-22	24.00-24.45	0.076	0.064	0.038	0.013	0.00	41.02	0.00	0.00	58.98
■											
▲											

GRADATION CURVES (ASTM D 2487 - 06 & D 422 - 63)

Geotechnical Investigation for Matarbari Project

Client: TEPSCO

Project ID: SIBD2105

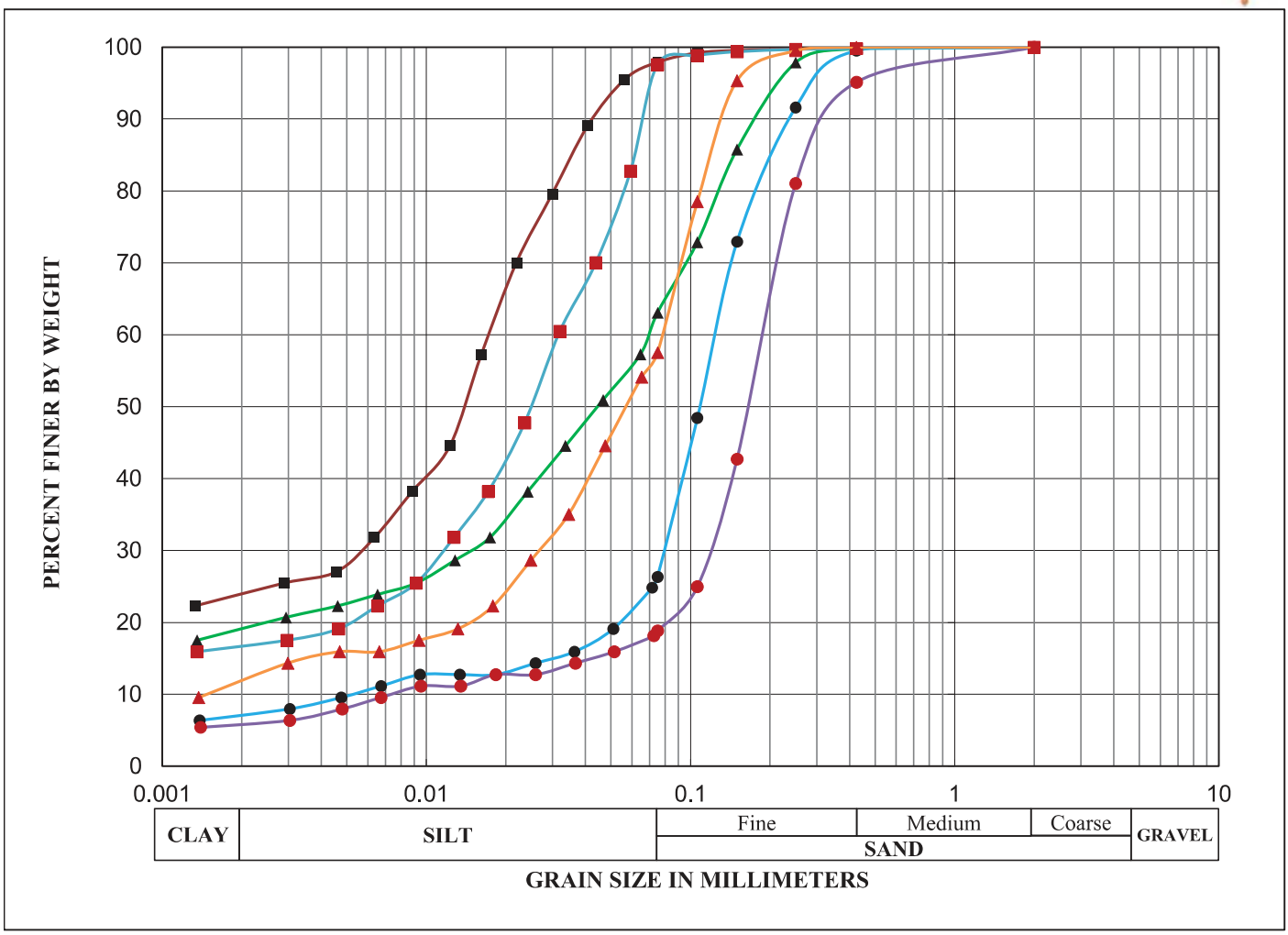
BH No.: BH-04

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 03-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

Ground Instrumentation & Engineering Pte.Ltd.



	Sample	Depth	Classification	W(%)	W_L	P_L	I_P	C_U	C_C
●	SPT-02	2.00-2.45	Silty fine SAND, SM						
■	UD-02	9.00-9.45	Lean CLAY, CL						
▲	SPT-08	10.00-10.45	Sandy Lean CLAY, CL						
●	SPT-15	17.00-17.45	Silty fine-medium SAND, SM						
■	SPT-18	20.00-20.45	Lean CLAY, CL						
▲	SPT-22	24.00-24.45	Sandy SILT, ML						

	Sample	Depth	D60	D50	D30	D10	%Gravel	%Sand			%SILT	%CLAY
								%Fine	%Meidum	%Coarse		
●	SPT-02	2.00-2.45	0.127	0.109	0.080	0.005	0.00	73.20	0.48	0.00	19.95	6.37
■	UD-02	9.00-9.45	0.017	0.014	0.006	0.001	0.00	1.94	0.14	0.00	75.64	22.28
▲	SPT-08	10.00-10.45	0.070	0.045	0.015	0.001	0.00	36.72	0.22	0.00	45.55	17.51
●	SPT-15	17.00-17.45	0.195	0.169	0.119	0.008	0.00	76.28	4.88	0.00	13.43	5.41
■	SPT-18	20.00-20.45	0.032	0.025	0.012	0.001	0.00	2.20	0.22	0.00	81.66	15.92
▲	SPT-22	24.00-24.45	0.079	0.058	0.027	0.002	0.00	42.46	0.02	0.00	47.97	9.55

GRADATION CURVES (ASTM D 2487 - 06 & D 422 - 63)

Geotechnical Investigation for Matarbari Project

Client: TEPSCO

Project ID: SIBD2105

BH No.: BH-04

Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 04-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

Ground Instrumentation & Engineering Pte Ltd	**PARTICLE DENSITY** **BS 1733 Part 2 Section 8** **(Small Pyknometer Method)**	

SPT-02	Depth(m)	2.00-2.45
Pyknometer No.		1
Mass of bottle + soil + water: M_3	gm	118.80
Mass of bottle + soil: M_2	gm	74.04
Mass of bottle + water: M_4	gm	99.99
Mass of bottle: M_1	gm	44.00
Mass of soil: $M_2 - M_1$	gm	30.04
Mass of water in full bottle: $M_4 - M_2$	gm	25.95
Mass of water used: $M_3 - M_2$	gm	44.76
Volume of soil particles: $(M_4 - M_1) - (M_3 - M_2)$	ml	11.23
Particle Density: $\frac{M_2 - M_1}{(M_4 - M_1) - (M_3 - M_2)}$	g/cm3	2.67

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-04
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 04-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

Ground Instrumentation & Engineering Pte Ltd	**PARTICLE DENSITY** **BS 1733 Part 2 Section 8** **(Small Pyknometer Method)**	

SPT-06	Depth(m)	6.00-6.45
Pyknometer No.		3
Mass of bottle + soil + water: M_3	gm	117.88
Mass of bottle + soil: M_2	gm	74.49
Mass of bottle + water: M_4	gm	98.92
Mass of bottle: M_1	gm	44.52
Mass of soil: $M_2 - M_1$	gm	29.97
Mass of water in full bottle: $M_4 - M_2$	gm	24.43
Mass of water used: $M_3 - M_2$	gm	43.39
Volume of soil particles: $(M_4 - M_1) - (M_3 - M_2)$	ml	11.01
Particle Density: $\frac{M_2 - M_1}{(M_4 - M_1) - (M_3 - M_2)}$	g/cm3	2.72

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-04
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 04-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

Ground Instrumentation & Engineering Pte Ltd	**PARTICLE DENSITY** **BS 1733 Part 2 Section 8** **(Small Pyknometer Method)**	

SPT-08	Depth(m)	10.00-10.45
Pyknometer No.		2
Mass of bottle + soil + water: M_3	gm	117.26
Mass of bottle + soil: M_2	gm	74.11
Mass of bottle + water: M_4	gm	98.41
Mass of bottle: M_1	gm	44.13
Mass of soil: $M_2 - M_1$	gm	29.98
Mass of water in full bottle: $M_4 - M_2$	gm	24.30
Mass of water used: $M_3 - M_2$	gm	43.15
Volume of soil particles: $(M_4 - M_1) - (M_3 - M_2)$	ml	11.13
Particle Density: $\frac{M_2 - M_1}{(M_4 - M_1) - (M_3 - M_2)}$	g/cm3	2.69

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-04
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 04-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

Ground Instrumentation & Engineering Pte Ltd	**PARTICLE DENSITY** **BS 1733 Part 2 Section 8** **(Small Pyknometer Method)**	

SPT-12	Depth(m)	14.00-14.45
Pyknometer No.		9
Mass of bottle + soil + water: M_3	gm	97.54
Mass of bottle + soil: M_2	gm	57.85
Mass of bottle + water: M_4	gm	78.61
Mass of bottle: M_1	gm	27.80
Mass of soil: $M_2 - M_1$	gm	30.05
Mass of water in full bottle: $M_4 - M_2$	gm	20.76
Mass of water used: $M_3 - M_2$	gm	39.69
Volume of soil particles: $(M_4 - M_1) - (M_3 - M_2)$	ml	11.12
Particle Density: $\frac{M_2 - M_1}{(M_4 - M_1) - (M_3 - M_2)}$	g/cm3	2.70

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-04
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 04-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

Mobile: 01819 557964; PABX: 966 5650-80 Ext. 7226

BRTC Bureau of Research, Testing & Consultation

GEOTECHNICAL ENGINEERING LABORATORY

BRTC No.:	110-231613/20-21/CE Dated 11.3.21
Client :	Manager, Environment, Health and Safety, SGS Bangladesh Ltd., Bir Uttam CR Datta Rd, Dhaka
Ref :	SGS/Phase-2/SI/090321 dated 9.3.21
Project :	Geotechnical Investigation at Matarbari
Location:	Matarbari
Test Method:	ASTM
Date of Test:	1-10.4.21

SPECIFIC GRAVITY DETERMINATION OF SOIL

Borehole	1	2	3.0	4.0	5.0	6.0
Depth (m)	14-14.5	25-25.45	4-4.5	17-17.45	17-17.45	26-26.45
Sample No.	12.0	23.0	4.0	15.0	14.0	23.0
Soil Type	Grey silty sand	Grey silty sand	Grey silty sand	Grey silty sand	Grey silty sand	Grey silty sand
Wt. of bottle+water+ soil, gm	371.6	375.3	373.4	371.6	380.1	396.4
Temperature (°C)	30.5	30.0	30.5	30.5	30.5	30.0
Wt. of bottle+water, gm	340.0	343.7	342.1	340.4	348.8	365.1
Wt. of soil, gm	49.8	49.2	49.9	49.3	49.7	48.6
Specific Gravity	**2.72**	**2.78**	**2.67**	**2.71**	**2.69**	**2.80**

Note: Tests were conducted on samples received in unsealed condition. BRTC, BUET does not have any responsibility as to the representative character of the supplied samples.

2

44A76bmM6

Countersigned by :

Dr. A.B.M. Badruzzaman
Professor
Department of Civil Engineering
BUET, Dhaka - 1000.

Test performed by :

25.5.21

Dr. Tahmeed M. Al-Hussaini
Professor
Department of Civil Engineering
BUET, Dhaka - 1000.

Department of Civil Engineering, BUET, Dhaka-1000, Bangladesh

Ground Instrumentation & Engineering Pte Ltd	**PARTICLE DENSITY** **BS 1733 Part 2 Section 8** **(Small Pyknometer Method)**	

SPT-18	Depth(m)	20.00-20.45
Pyknometer No.		13
Mass of bottle + soil + water: M_3	gm	98.84
Mass of bottle + soil: M_2	gm	59.28
Mass of bottle + water: M_4	gm	79.84
Mass of bottle: M_1	gm	29.29
Mass of soil: $M_2 - M_1$	gm	29.99
Mass of water in full bottle: $M_4 - M_2$	gm	20.56
Mass of water used: $M_3 - M_2$	gm	39.56
Volume of soil particles: $(M_4 - M_1) - (M_3 - M_2)$	ml	10.99
Particle Density: $\frac{M_2 - M_1}{(M_4 - M_1) - (M_3 - M_2)}$	g/cm3	2.73

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-04
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 04-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

Ground Instrumentation & Engineering Pte Ltd	**PARTICLE DENSITY** **BS 1733 Part 2 Section 8** **(Small Pyknometer Method)**	

SPT-22	Depth(m)	24.00-24.45
Pyknometer No.		8
Mass of bottle + soil + water: M_3	gm	91.33
Mass of bottle + soil: M_2	gm	51.13
Mass of bottle + water: M_4	gm	72.48
Mass of bottle: M_1	gm	21.14
Mass of soil: $M_2 - M_1$	gm	29.99
Mass of water in full bottle: $M_4 - M_2$	gm	21.35
Mass of water used: $M_3 - M_2$	gm	40.20
Volume of soil particles: $(M_4 - M_1) - (M_3 - M_2)$	ml	11.14
Particle Density: $\frac{M_2 - M_1}{(M_4 - M_1) - (M_3 - M_2)}$	g/cm3	2.69

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-04
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 04-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

UNIT WEIGHT / BULK DENSITY
VOID RATIO

Ground Instrumentation & Engineering Pte Ltd

UD-02	Depth (m):	9.00-9.45
Weight of soil	gm	158.10
Height	mm	76
Diameter	mm	38
Volume	mm3	86193
Bulk Density	(g/cm3)	1.83
Dry Density	(g/cm3)	1.30
Void Ratio		1.12
Moisture Content	%	40.59
Specific Gravity	(g/cm3)	2.77

Geotechnical Investigation for Matarbari Project
Client: TEPSCO
Project ID: SIBD2105
BH No.: BH-04
Project Location: Matarbari Ultra Super Critical Coal-Fired Power Project (Phase-2)

Tested by: Rayhan
Date: 04-03-2021

Checked by: Suvashis Paul
Date: 07-03-2021

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

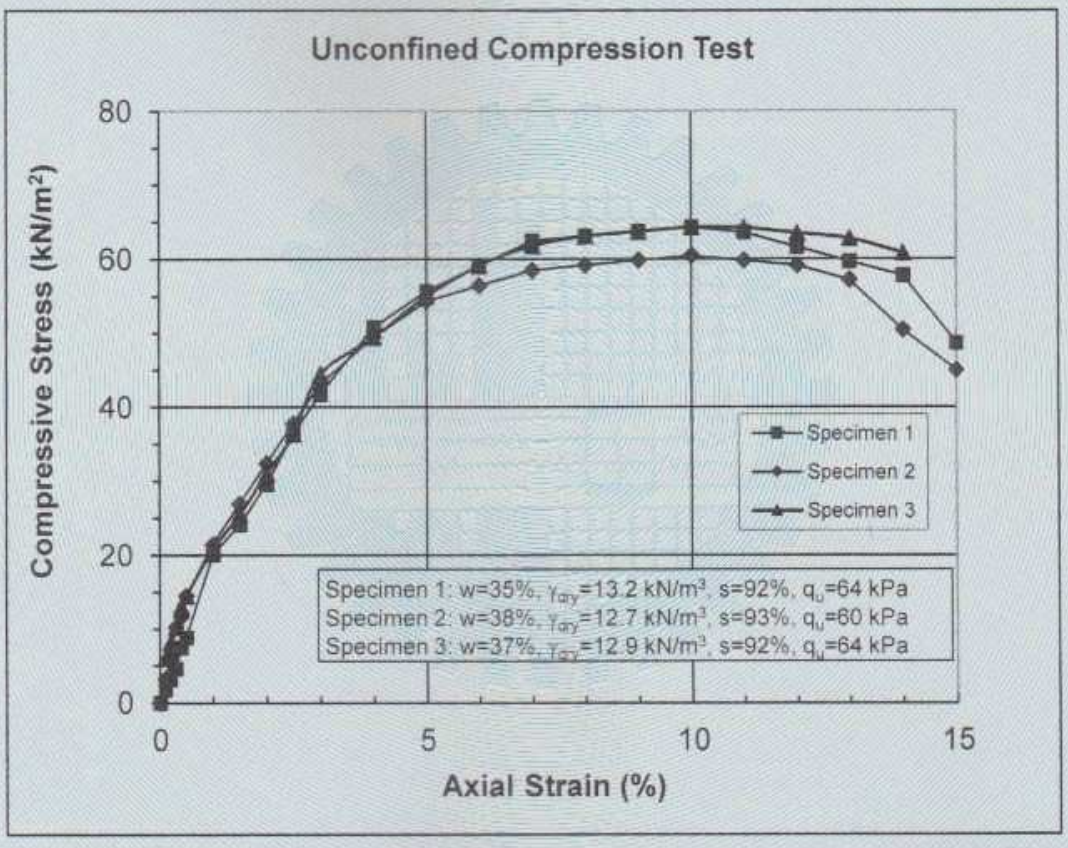
DEPARTMENT OF CIVIL ENGINEERING

Mobile: 01819 557964; PABX: 966 5650-80 Ext. 7226

GEOTECHNICAL ENGINEERING LABORATORY

BRTC Bureau of Research, Testing & Consultation

BRTC No.:	110-231613/20-21/CE dated 11.3.21			
Client :	Manager, Environment Health & Safety, SGS Bangladesh Ltd., Bir Uttam CR Datta Road, Dhaka			
Ref :	SGS/Phase-2/SI/090321 dated 9.3.21			
Project :	Geotechnical Investigation at Matarbari			
Soil description :	Grey silty clay			
Test Method:	ASTM		Date of Test:	29.3.21-1.4.21
BH No. : 4		Sample ID : UD-2	Depth:	9-10 m
			Location:	Matarbari



Note: Samples as supplied to us in sampler tubes have been tested in our laboratory. BRTC, BUET does not have any responsibility as to the representative character of the sample. Initial water content, dry density, degree of saturation and unconfined compressive strength is reported.

17

Sample was received in unsealed condition.

hS5tjZJt3

Specific Gravity= 2.77

Department of Civil Engineering, BUET, Dhaka-1000, Bangladesh

Countersigned by :

Dr. A.B.M. Badruzzaman
Professor
Department of Civil Engineering
BUET, Dhaka - 1000.

Test performed by :

7.5.21

Dr. Tahmeed M. Al-Hussaini
Professor
Department of Civil Engineering
BUET, Dhaka - 1000.

BRTC BUET

BUETCE 0272383

Direct Shear Tests

Direct Shearbox Test

Summary

Sample Details				Spm. 1	2	3
 *sketch showing specimen location in original sample*	Depth		2.00-2.45			
	Description		Silty SAND,SM			
	Type		Disturbed Soil			
	Initial Height	H_0	(mm)	20.0	20.0	20.0
	Initial Width	D_0	(mm)	60.0	60.0	60.0
	Initial Weight	W_0	(gr)	139.4	139.4	139.4
	Initial Bulk Density	ρ_0	(Mg/m3)	1.94	1.94	1.94
	Particle Density	ρ_s	(Mg/m3)	2.65	2.65	2.65

Initial Condition

			Spm. 1	2	3
Normal Stress Level		(kPa)	50	100	200
Is Specimen Submersed?			Yes	Yes	Yes
Reverse Method			Motor Drive		
Hoz. Control Machine			Not Used	Not Used	Not Used
Initial Moisture	ω_i%	(%)	18	18	18
Initial Dry Density	ρ_{di}	(Mg/m3)	1.64	1.64	1.64
Initial Voids Ratio	e_i	.	0.620	0.620	0.620
Initial Degree of Saturation	S_i	(%)	78.4	78.4	78.4

Notes

Max Shear Stress Results

			Spm. 1	2	3
Final Moisture	ω_f%	(%)	19	19	19
Final Dry Density	ρ_{df}	(Mg/m3)	1.64	1.68	1.68
Final Voids Ratio	e_f	.	0.613	0.569	0.566
Final Degree of Saturation	S_f	(%)	80.3	86.6	86.9
Peak Shear Stress		(kPa)	36.6	65.6	134.7
Hoz Displacement	L_H	(mm)	12.000	12.000	12.000
Vertical Displacement	L_V	(mm)	0.050	0.030	0.050

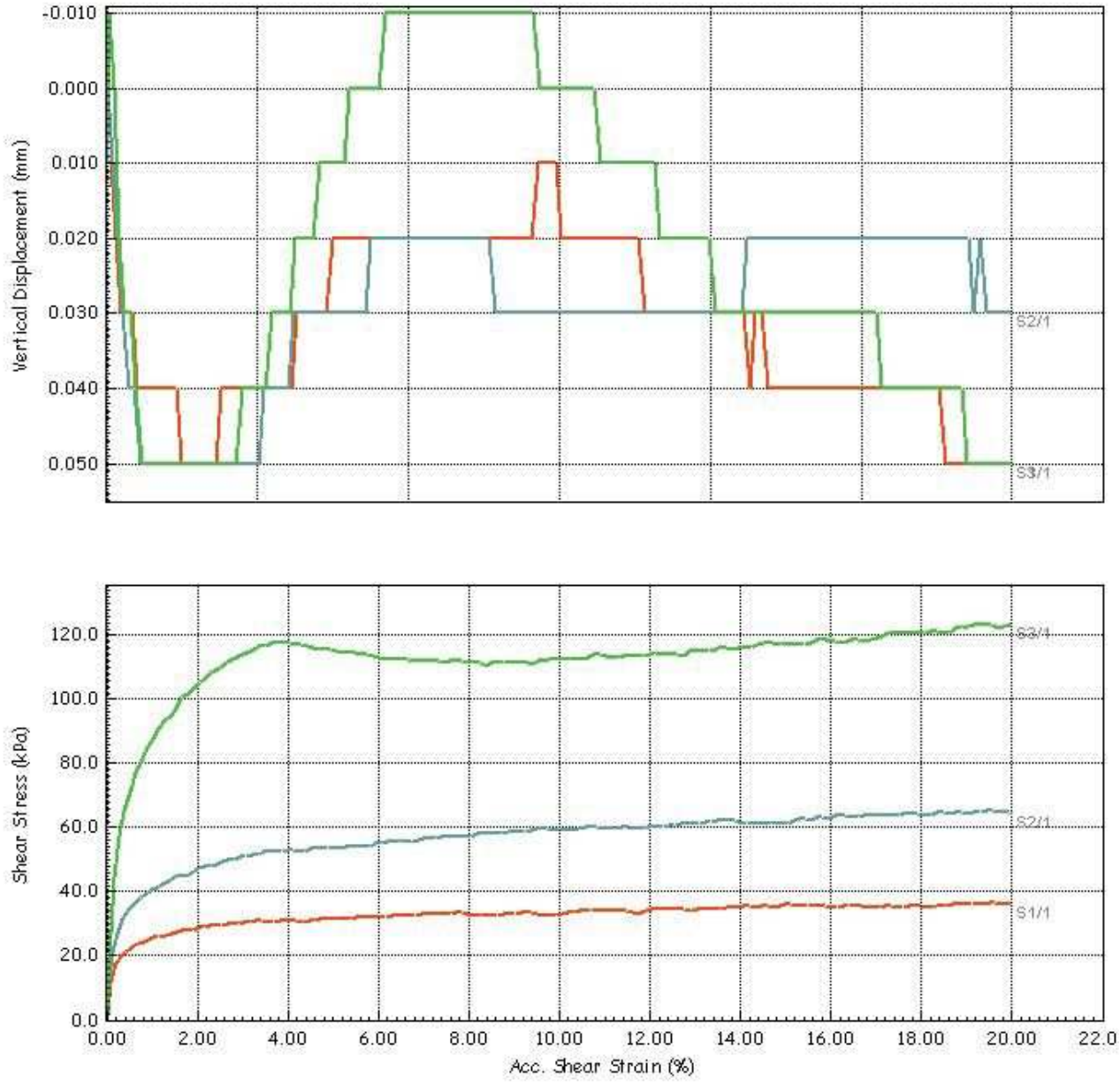
GIE

Test Method	ASTM D 3080-04			Test Name	Direct Shear
				Database: .\SQLEXPRESS \ GIE-D	
Site Reference				Test Date	3/20/2021
Jobfile	Direct Shear Test			Sample	SPT-02
Client	SGS			Borehole	BH-04
Operator	R. Islam	Checked	Aminul	Approved	T. Islam

Direct Shear Tests

Direct Shearbox Test

Shear Stage



Test Method	ASTM D 3080-04			Test Name	Direct Shear
				Database: .\SQLEXPRESS \ GIE-D	
Site Reference				Test Date	3/20/2021
Jobfile	Direct Shear Test			Sample	SPT-02
Client	SGS			Borehole	BH-04
Operator	R. Islam	Checked	Aminul	Approved	T. Islam

GIE

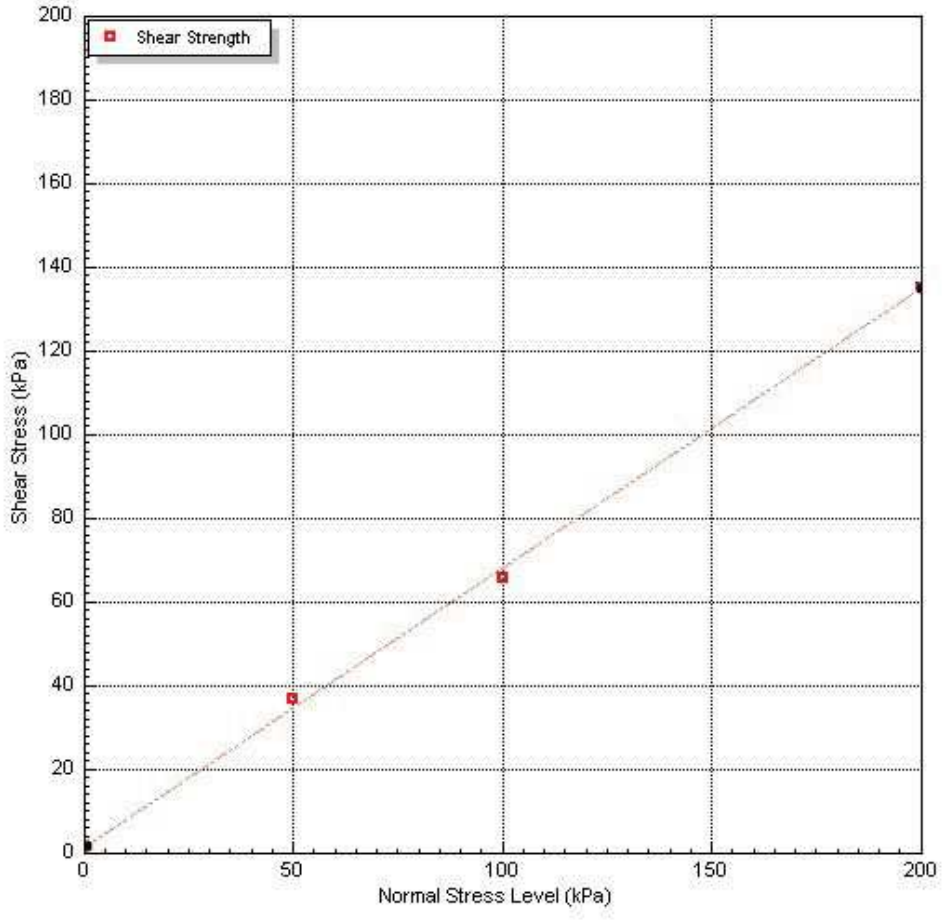
Direct Shear Tests

Direct Shearbox Test

Shear Stage

Envelope Failure Results			Spm. 1	2	3
Final Moisture	ω_f%	(%)	19	19	19
Final Dry Density	ρ_{df}	(Mg/m3)	1.64	1.68	1.68
Final Voids Ratio	e_f	.	0.613	0.569	0.566
Final Degree of Saturation	S_f	(%)	80.3	86.6	86.9
Apparent cohesion	c	(kPa)	1.15		
Angle of Shearing Resistance	ϕ	.	33.7		

Notes



Test Method	ASTM D 3080-04	Test Name	Direct Shear
		Database: .\SQLEXPRESS \ GIE-D	
Site Reference		Test Date	3/20/2021
Jobfile	Direct Shear Test	Sample	SPT-02
Client	SGS	Borehole	BH-04
Operator	R. Islam	Checked	Aminul
		Approved	T. Islam

GIE

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

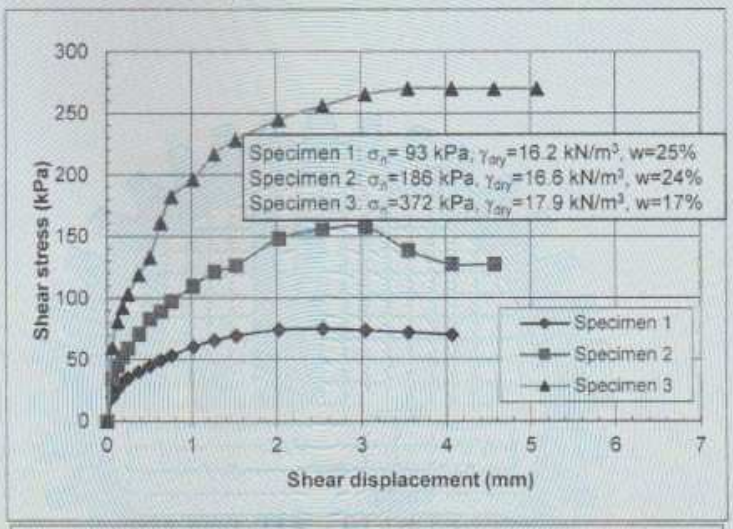
Mobile: 01819 557964; PABX: 966 5650-80 Ext. 7226

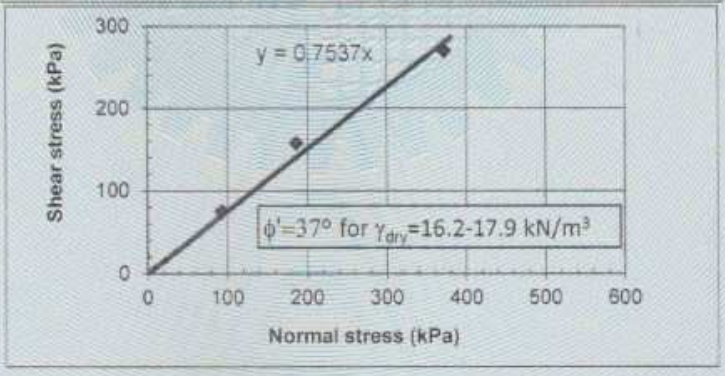
BRTC Bureau of Research, Testing & Consultation

GEOTECHNICAL ENGINEERING LABORATORY

BRTC No. : 110-231613/20-21/CE dated 11.3.21		
Sent by :	Manager, Environment Health & Safety, SGS Bangladesh Ltd., Bir Uttam CR Datta Road, Dhaka	
Ref:	SGS/Phase-2/SI/090321 dated 9.3.21	
Project :	Geotechnical Investigation at Matarbari	
Soil Description :	Grey silty fine sand, trace clay	Location: Matarbari
Bore-Hole: 4	Sample: 15	Depth: 17-17.45 m
		Date of Test: 28.3.21-5.4.21

Direct Shear (Consolidated Drained) Test





11

Q69mg5BP9

Note: Sample was received in unsealed condition.
Test specimens were prepared manually from disturbed samples. The dry density specified is after application of normal load prior to shearing, the water content represents the sample after shearing.

Department of Civil Engineering * BUET, Dhaka-1000, Bangladesh *

Countersigned by :

Dr. A.B.M. Badruzzaman
Professor
Department of Civil Engineering
BUET, Dhaka - 1000.

Test performed by :

8.5.21

Dr. Tahmeed M. Al-Hussaini
Professor
Department of Civil Engineering
BUET, Dhaka - 1000.

BUETCE 0272389

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

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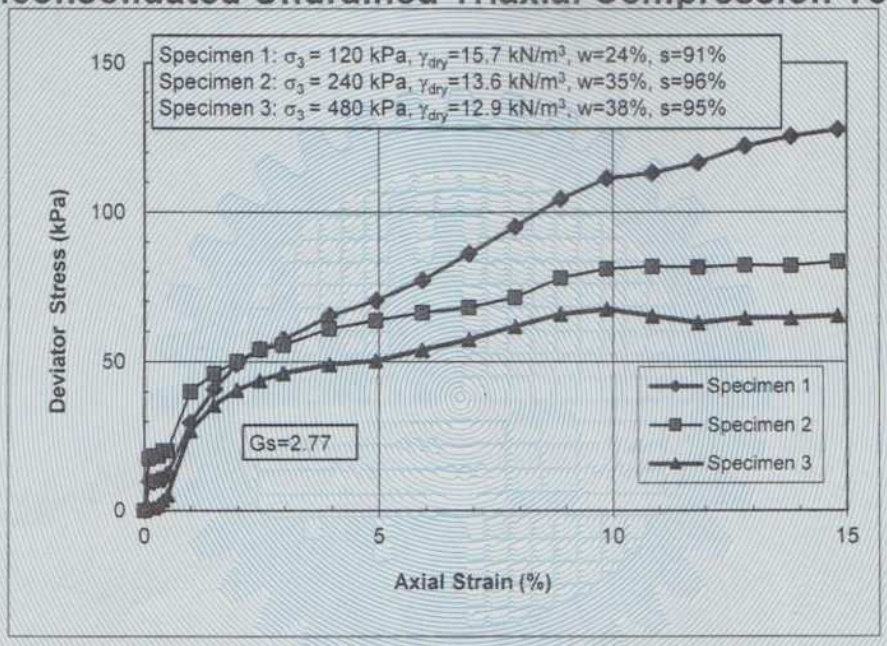
BRTC Bureau of Research, Testing & Consultation

GEOTECHNICAL ENGINEERING LABORATORY

BRTC No. : 110-231613/20-21/CE dated 11.3.21			
Sent by : Manager, Environment Health & Safety, SGS Bangladesh Ltd., Bir Uttam CR Datta Road, Dhaka			
Ref: SGS/Phase-2/SI/090321 dated 9.3.21			
Project : Geotechnical Investigation at Matarbari			
Soil description : Grey silty clay		Test Method: ASTM	
B.H. No.: 4	Sample: UD-2	Depth: 9-10 m	
Location: Matarbari		Date of Test: 17.5.21-23.5.21	

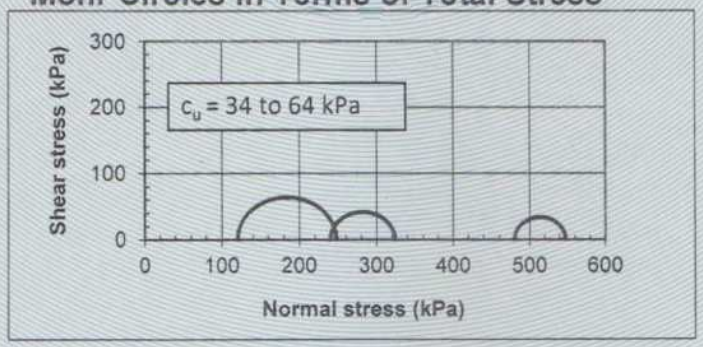
Unconsolidated Undrained Triaxial Compression Test



1

rXreFnPjW

Mohr Circles in Terms of Total Stress



Remarks: Initial dry density, water content and degree of saturation is indicated. All specimens were subjected to saturation prior to loading. Differences in soil density may be noted resulting in different undrained shear strength.

Countersigned by :

Dr. A.B.M. Badruzzaman
Professor, Dept. of Civil Engineering
BUET, Dhaka - 1000.

Test performed by :

3.6.21

Dr. Tahmeed M. Al-Hussaini
Professor, Dept. of Civil Engineering
BUET, Dhaka - 1000.

Department of Civil Engineering BUET, Dhaka-1000, Bangladesh

BUETCE 0 2 7 4 8 6 4

Ground Instrumentation & Engineering Pte Ltd	**OEDOMETER TEST RESULTS** **ASTM D2435/D2435M - 11**	

Project : SIBD2105
Client - Location : Geotechnical Investigation for Matarbari Project
Boring No : BH-04
Sample No : UD-02
Depth (m) : 9.00-10.00
Soil Description : Lean CLAY, CL

Moisture Content Determination

		Initial	Final
Wt. of Ring + Wet Soil, gm	=	140.50	135.71
Wt. of Ring + Dry Soil, gm	=	117.97	117.97
Weight of Water, gm	=	22.53	17.74
Weight of Container, gm	=	69.56	69.56
Weight of Dry Soil, gm	=	48.41	48.41
Water Content, %	=	46.5	36.6

Unit Weight Determination

		Initial	Final
Wt. of Ring + Wet Soil, gm	=	140.50	135.71
Weight of Ring, gm	=	69.56	69.56
Weight of Wet Soil, gm	=	70.94	66.15
Height of Sample, cm	=	2	1.738
Diameter of Sample, cm	=	5	5
Volume of Sample, cm^3	=	39.27	34.12
Unit Wet Weight, kN/m^3	=	17.7	19.0
Unit Dry Weight, kN/m^3	=	12.1	13.9

Specific Gravity	=	2.74
Initial Void Ratio	=	1.223
Degree of Saturation, %	=	100.0
Room Temperature, °C	=	24.0
Temp. correction factor	=	0.91
Initial Transducer Reading	=	8.50
Effective Overburden Pressure	=	
Preconsolidation Pressure	=	134
Compression Index (Cc)	=	0.4817

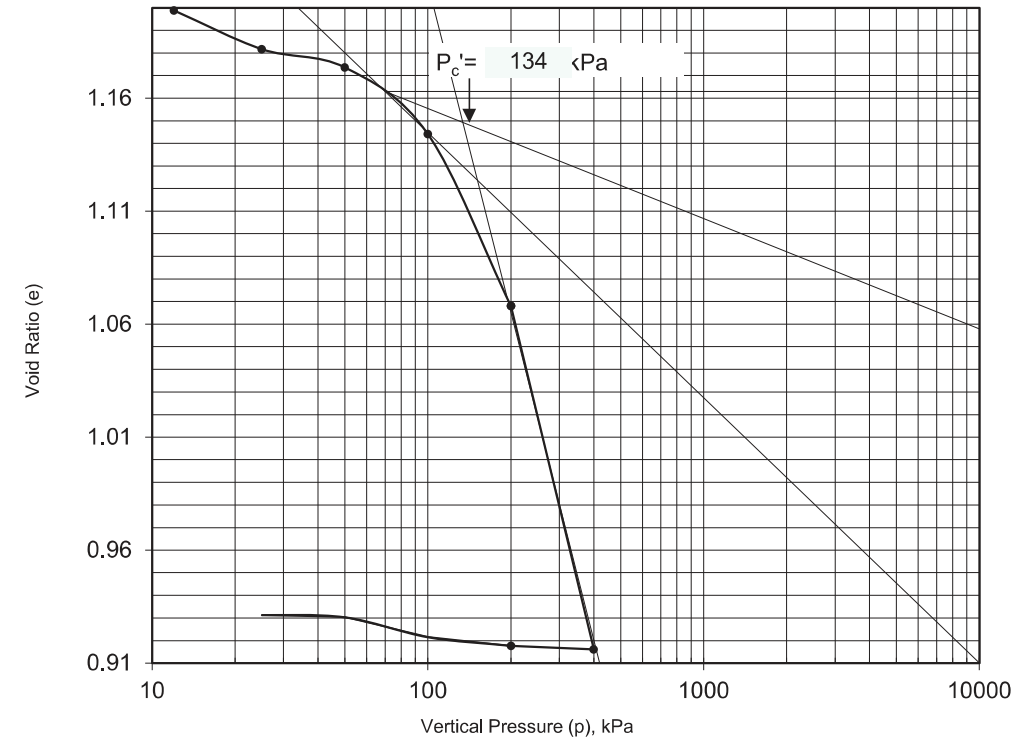
Inc. No.	Load, p (kPa)	Transducer Reading (div)	Machine Corr. (div)	Change in Height (mm)	e Void Ratio	t_{90} (min)	c_v ('cm2/day)	$c_v(20°C)$ ('cm2/day)	m_v (m^2/MN)	k x 10^{-9} (m/s)
1	12	8.284	0.001	0.215	1.199	8.929	134.523	122.416	0.896	34.105
2	25	8.130	0.001	0.369	1.182	10.286	115.868	105.440	0.599	19.634
3	50	8.057	0.001	0.442	1.174	21.549	54.672	49.752	0.149	2.301
4	100	7.789	0.004	0.707	1.144	5.695	203.318	185.020	0.271	15.593
5	200	7.100	0.008	1.392	1.068	11.705	94.145	85.672	0.355	9.460
6	400	5.726	0.015	2.759	0.916	7.955	123.931	112.777	0.367	12.883
7	200	5.745	0.010	2.745	0.918				0.004	
8	100	5.784	0.006	2.710	0.921				0.020	
9	50	5.867	0.002	2.631	0.930				0.091	
10	25	5.875	0.002	2.623	0.931				0.018	

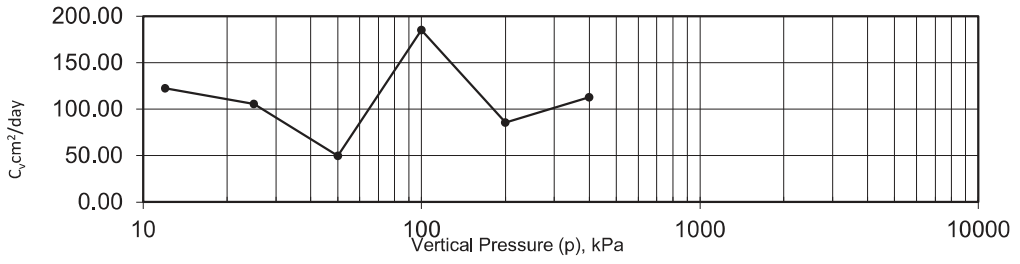
Tested By: Rayhan **Checked & Approved By:T. Islam**

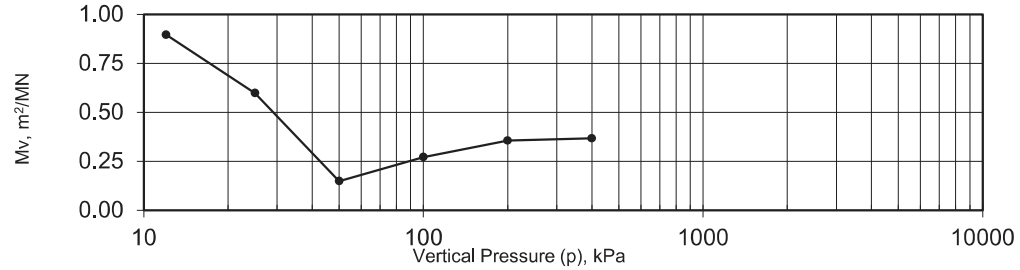
Date: 24-03-2021 **Date: 28-03-2021**

ASTM D2435/D2435M - 11

Cc= 0.48168







Coefficient of consolidation (Cv). cm^2/day

Job No.	:	SIBD2105
Project	:	Geotechnical Investigation for Matarbari Project
Location	:	Matarbari, Power Plant Area
Borehole	:	BH-04
Sample	:	UD-02
Depth (m)	:	9.00-10.00

Ground Instrumentation & Engineering Pte Ltd

GEOTECHNICAL AND MATERIAL LABORATORY
Ground Instrumentation & Engineering
Pte.Ltd. House-7 Road-12, Dhaka 1230

LABORATORY COMPACTION TEST DATA
(Dry Density- Moisture Content Relationship)
ASTM D1557

Date: 29/03/2021

Project : **Geotechnical Investigation for Matarbari, ID-SIBD-2105**
Client : SGS
Test Pit No. : **BH-04**
Sample Depth : 1.00 m
Method: Standard Proctor (using 2.5 kg rammer)

Volume of Mould: 950 cm^3

Test No.:		1	2	3	4	5	
Mass of Mould+ Base+Compacted Materials (m2)	g	5211	5288	5360	5410	5395	
Mass of Mould+ Base(m1)	g	3660	3660	3660	3660	3660	
mass of Compacted Materials(m2-m1)	g	1551	1628	1700	1750	1735	
Bulk Density,ρ= $\frac{m2-m1}{vol.of\ mold}$	g/cm^3	1.633	1.714	1.789	1.842	1.826	
Moisture Content (w)	%	9.42	11.58	13.62	15.27	17.83	
Dry Density, ρ_d = $\frac{100\rho}{100+w}$	g/cm^3	1.492	1.536	1.575	1.598	1.550	

MOISTURE CONTENT

Test No.:		1		2		3		4		5			
Container No.:		B-10	B-118	B-16	B-90	B-16	B-42	B-113	B-31	B-55	B-43		
Mass of container + wet soil	g	65.5	67.4	57.9	55.71	67.3	66.3	95.71	91.57	65.94	65.44		
mass of container + dry soil	g	62.6	64.6	53.91	52.76	61.52	61.5	86.42	82.53	60.4	58.6		
Mass of Water	g	2.81	2.78	3.95	2.95	5.78	4.76	9.29	9.04	5.5	6.88		
Mass of Container	g	33.43	34.48	19.31	27.66	19.31	26.42	23.84	24.93	29.24	20.39		
Mass of Dry Soil	g	29.2	30.12	34.6	25.1	42.21	35.12	62.58	57.6	31.2	38.17		
Moisture Content	%	9.62	9.23	11.42	11.75	13.69	13.55	14.84	15.69	17.63	18.02		
Average Moisture Content	%	9.4		11.6		13.6		15.3		17.8			

Maximum Dry Density	***1.598***	g/cm^3
Optimum Moisture Content	***15.3***	%

Fig. : Dry Density vs Moisture Content Curve