GEOTECHNICAL INVESTIGATIONS

FOR

MEGA CFC AT SEEPZ, MUMBAI

CLIENT: SEEPZ SEZ MUMBAI

SUBMITTED BY:-

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INTRODUCTION

The Geotechnical Investigations for proposed Construction of Multistoried Structure at Andheri, Mumbai. have been recently completed under the directives of M/s SEEPZ SEZ, Mumbai. The object of the investigations was to study the subsoil characteristics for Construction of the proposed structure.

The works of the subsoil explorations covering field and Laboratory tests were awarded to M/s Renuka Consultants, vide Work Order No. SEEPZ-SEZ/Estate/CFC/55/2021-22 dated 17th of May 2022. The work was executed as per specified specifications and under the directives of Authorities.

The specified scope of the total project work consists of:

Boring and drilling of 4 number of boreholes and maximum depth of investigations is 10.18m.

2) Conducting field tests such as Standard Penetration Tests, and collection undisturbed soil samples from the borehole.

3) Various Laboratory tests to be conducted on the undisturbed as well as disturbed soil samples.

4) Submission of expert's report based on the above studies including foundation recommendations

Codes and Standards

In the present studies all field and laboratory equipment, testing and methods of working with procedures laid in as per Indian Standards have been strictly followed. Immediate applicable standards as below are followed for execution, laboratory conduction and recommendatory report.

IS: 1080 : Code of Practice for Design and Construction of Shallow Foundations in Soil (other than Raft, Ring and Shell).
IS: 1498 : Classification and Identification of Soils for General Engineering Purposes.
IS: 1892 : Code of Practice for Subsurface Investigation for Foundations.
IS: 1904 : Code of Practice for Design and Construction of foundations in Soils General requirements
IS: 2131 : Method for Standard Penetration Test for Soils.
IS: 2132 : Code of Practice for Thin Walled Tube Sampling of Soils.
IS: 2720 : Method of Test for Soils. (Part 1 to 41)
IS: 4078 : Code of Practice for Indexing and Storage of Drill Cores.
IS: 4464 : Code of Practice for Presentation of Drilling Information and Core description in Foundation Investigation.
IS: 4968 : Method for Sub-Surface Sounding for Soils. (Part 1 to 3)
IS: 5313 : Specification for Guide for Core Drilling Observations.
IS: 6403 1981 : Code of Practice for Determination of Bearing (Reaffirmed 1987)
Capacity of Shallow Foundations.
IS: 7422 : Symbols and Abbreviations for Use in Geological Maps, Sections and Subsurface Exploratory Logs (Part 1 to 5).
IS: 8009 : Code of practice for calculation of settlement of foundations (Part 1 and 2).
IS: 8763 : Guide for Undisturbed Sampling of sands.
IS: 9259 : Specification for Liquid Limit Apparatus for Soils.
IS: 9640 : Split Spoon Sampler.
IS: 10042 : Code of Practice for Site Investigations for Foundation in Gravel-Boulder Deposits.

WORKS FEATURES:-

The field work consists of drilling of boreholes, standard penetration tests, and collection of disturbed and undisturbed soil and water samples and carrying out the various field tests. The samples collected from the site are transported and tested at "**Renuka Engineering Research Laboratories**, Thane, Maharashtra.

This report has been prepared after careful study of the data collected from the site and Laboratory test results on different soil samples. The report deals with subsoil conditions which were encountered during exploration studies for various bores up to maximum 10.18m depth below ground level. The strength, settlement and other related parameters at specified layer of subsoil deposit have also been presented.

Based on the analysis of different field and laboratory test results, this report is prepared and presented in the following different sections and related annexes.

Section – I : General Site Conditions, Nature and Procedure of Investigations

Section – II : Discussions on field and Laboratory tests.

Section – III : Discussion on Foundations.

Section IV : Recommendations

Annexure – I: Location, Soil Profile and Bore logs data Sheets.

Annexure –II: Laboratory Test Results

Annexure – III: Standard Proctor and Sand replacement test

Annexure – IV: Topography survey and Electric Resistivity test Result with Polar Diagram

Annexure – V: SPT and Corebox Photos

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SECTION - I

GENERAL SITE CONDITIONS, TOPOGRAPHY AND NATURE OF INVESTIGATIONS

1. LOCATION AND TOPOGRAPHY:

The proposed site is located at Andheri, Mumbai.

The location plan of the works is attached in Annexure I, The investigations were carried out on the given layout of proposed works as per the directives of the Client's representative.

2. SELECTION OF BOREHOLE LOCATIONS:

The locations of the boreholes have been chosen as directed in the borehole location plan provided by the client.

3. DETAILS OF EXPLORATIONS:

3.1 BORING IN SOFT OVERBURDEN:

Field works were executed by experienced geotechnical personnel, under the supervision of a geotechnical engineer/engineering geologist, in accordance with the Indian Standard IS 1892, "Code of Practice for subsurface Investigations for foundations" and IS: 5313. The core drilling operations have been carried out as per IS: 6926-1973 "COP for diamond core drilling for site investigation for river valley projects.

150mm size bore holes were drilled in overburden. The boreholes were of wash boring by rotary drilling method. NMLC Tripple tube core barrel with diamond bit was adopted for drilling through rock formation to obtain 54.00mm size core samples. Water was used to flush the cuttings. The soft formation in overburden was cased using temporary casing. The field tests, sampling and specifications have been exclusively followed as per the directives and schedule of the specifications. The details of bore holes including collection of soil samples are given in Table - 1.1 of this report.

4. SAMPLING: Sequence of Sampling: -

The general sequence of sampling adopted is such as to obtain alternatively undisturbed (UDS), Cutter samples and disturbed (standard penetration tests, SPT) samples at every 3.00m intervals and at every significant change of stratum. However, in some cases the changes have been effected as per site conditions. Also wherever UDS samples have slipped, it shall be repeated after d 0.5m. The interval has been increased as per site conditions.

Even in highly weathered/disintegrated rock where core recovery is poor, SPT has been conducted. Likewise, disturbed samples, as obtained in the standard split spoon, are collected by conducting the standard penetration test at 1.5m intervals and at the significant change of soil stratum.

The details of boreholes including collection of soil samples are given in Table - 1.1 of this Report. The bore logs details and soil profile have been presented in Annexure - I.

5. UNDISTURBED AND DISTURBED SOIL SAMPLES:

The undisturbed soil samples were collected from subsoil strata by means of a two tier open drive soil sampler. The internal diameter of the tube was 90 mm and both the outside and inside clearance were maintained at about 2 % of the internal diameter of sample tube. In current boreholes 3 UDS samples were collected.

Similarly, the dimensions of the cutting shoe were so selected so as to achieve an area ratio of about 14% thereby minimizing disturbance of soil during sampling operations. The disturbed representative samples were collected from shell, cutting shoes of the undisturbed soil sampler and split spoon sampler. The samples collected in such a manner are logged, labeled and depth wise placed in polythene bags.

TABLE NO. 1.1
DETAILS OF BORE HOLES AND SOIL SAMPLES

Bore hole no.	**Total Depth** Below G.L. (m)	**Ground** Water Level in m	**UDS** S1	**S.P.T. S2**	**D.S. S3**
BH-01	10.18	1.40	1	4	2
BH-02	10.05	3.48	2	4	5
BH-03	10.05	6.86	-	4	1
BH-04	10.07	7.30	-	3	1
Total			**3**	**15**	**9**

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SECTION II
FIELD AND LABORATORY TESTS

This section deals with the results of field and laboratory tests conducted on various insitu soil and rock samples during the execution process of the proposal.

1.0. FIELD TESTS:

The field tests conducted cover the standard penetration tests. The details of the same are summarized in following paras. The actual values have been entered in bore log sheets.

1.1. STANDARD PENETRATION TESTS:

This test was carried out using a Terzaghi split spoon sampler driven by a 63.50 k.g. hammer weight falling freely through a height 750 mm. A comparative study of "N" values (i.e. no. of blows / 30 cm) penetration using Terzaghi's split spoon sampler, are presented in Table no. 2.1.

The actual values of S.P.T. such as (N2 + N3) have been reported. Refusals have been indicated by mentioning penetration in centimeters and the no. of blows. The S.P.T. values help in assessing the stratum strength in general. SPT Refusals are taken when a penetration of 30cms are not possible with 100 blows or 15 cm is not possible with 50 blows respectively.

TABLE NO. 2.1
STANDARD PENETRATION TEST RESULTS IN SOIL AND ROCK FORMATION

B.H. No.	Sr. No.	Depth of test m	"N" Value blows/30 cms	Remarks
BH-1	1	1.50 --- 1.95	08-12-25	37 Clayey Gravel
	2	3.00 --- 3.06	50/6	R Refusal
	3	4.06 --- 4.13	50/7	R Refusal
	4	5.13 --- 5.18	50/5	R Refusal

B.H. No.	Sr. No.	Depth of test m	"N" Value blows/30 cms	Remarks
BH-2	1	2.50 --- 2.95	10-14-19	33 Silty Sand
	2	4.00 --- 4.45	09-14-21	35 Clayey Gravel
	3	5.50 --- 5.95	04-04-06	10 Silty Clay
	4	7.00 --- 7.05	50/5	R Refusal
BH-3	1	1.00 --- 1.05	50/5	R Refusal
	2	2.00 --- 2.04	50/4	R Refusal
	3	2.50 --- 2.95	04-07-13	20 Clayey silt
	4	4.00 --- 4.05	50/5	R Refusal
BH-4	1	1.00 --- 1.04	50/4	R Refusal
	2	2.00 --- 2.05	50/5	R Refusal
	3	3.00 --- 3.07	50/7	R Refusal

Note: R: Refusal. Figures in bracket indicate penetration in centimeters / no. of blows.

2.0. LABORATORY TESTS:

The laboratory tests conducted on undisturbed, disturbed soil samples and rock samples recovered from bore holes are given in Table No. 2.3 and Table No. 2.4 respectively. The complete tests data will help in assessing the design parameters at corresponding stratum depth to assess the strength, settlement and related characteristics. The tests as specified in schedule only have been conducted.

The basic Index properties tests, strength tests and settlement tests have been conducted on U.D.S. samples only. Few index tests have been conducted on D.S. and samples of S.P. Tests. The unconsolidated, undrained shear strength tests have been conducted. The representative rock samples for various depths have been selected for various tests related to rock.
The soil and rock samples have been tested as per IS codes. The important IS codes for soils are IS: 2720–1985 (part--4), IS: 2720–1980 (part--3), IS: 2720–1973 (part – 2, 4, 10, 24 & 26), IS: 2720--1986 (part-15) and IS: 9259-(part-1979). The detailed list is separately enclosed in annexure.

The tests on rock samples also have been conducted as per IS codes IS: 2720-1983 (Part-VIII), IS: 2720-1980 (Part III & VII), IS: 2720—1973(Part-X) and IS: 8764-1978.

TABLE NO. 2.3

DETAILS OF LABORATORY TESTS CONDUCTED ON SOIL AND WATER SAMPLES

S. No.	Description	Total Nos.	Nos.	Remarks
1.	Moisture Content and Bulk Density	35	3	
2.	Grain Size Analysis		8	
3.	Hydrometer Analysis		2	
4.	Atterberg Limits		8	
5.	Specific Gravity		3	
6.	Direct Shear test		2	
7.	Triaxial Shear test		1	
8.	Consolidation test		1	
9.	Chemical Analysis of soil		3	
10.	Chemical Analysis of water		4	

TABLE NO. 2.4
DETAILS OF LABORATORY TESTS CONDUCTED ON ROCK SAMPLES

S. No.	Description	Total Nos.	Nos.	Remarks
1.	Unconfined Compression Strength	37	3	
2.	Water Absorption, and Porosity		13	
3.	Dry Density		13	
4.	Point Load test		10	
5.	Brazilian Test		2	
6.	Modulus of Elasticity		3	
7.	Poissons Ratio		3	

The laboratory tests results have been presented in following pages. The findings and conclusions of the studies are presented in subsequent sections.

2.0. The brief procedure of laboratory tests are mentioned hereunder.

2.1. Field Density and Natural Water Content (IS: 2132, IS: 2720 P-2):

The volume and weight of sample in UDS tube were determined for calculation of field density. Before emptying tube, wherever, shear tests were to be carried out, smaller sampling tube of 38mm diameter and about 76mm height were pushed into the sample in the direction of sampling on site. For consolidation tests, consolidation ring was pushed and extruded from UDS tube before emptying the same. Water content of the specimen was determined from representative sample taken from UDS tube by oven drying method

2.2. Grain Size Analysis (IS: 2720 P-4):

The grain size analysis was carried out by wet sieving using sieves of sizes 10 mm, 4.75 mm, 2.36 mm, 1.18 mm, 0.60 mm, 0.425 mm, 0.3 mm, 0.150 mm, 0.090 mm and 0.075 mm. Hydrometer analysis was carried out on sample passing through 0.075 mm sieve.

2.3. Atterberg's Limit (IS: 2720 P-5):

Liquid limit test was carried out on fraction passing through 0.425 mm sieve by mechanical method (Casangrande's Apparatus) or one point apparatus. Plastic limit was also carried out on fraction passing 0.425 mm sieve by rolling threads of 3 mm diameter till the thread crumbled.

2.4. Direct Shear Test (IS: 2720 P-13):

The direct shear tests were conducted on undisturbed as well as disturbed soil samples of cohesionless soil and SPT samples. The soil was compacted at saturated content directly into shear box. The tests were carried out for normal stress of 50, 100 and 150 kPa respectively. The tests on cohesive soils were carried out in unconsolidated undrained condition while tests on cohesionless soils were carried out in consolidated drained condition. The shear strength parameters (c-φ) were obtained by plotting graph for applied normal stress and maximum shear stress.

2.5 Triaxial Unconsolidated Undrained Test (IS: 2720 P-11):

The sample extruded from UDS tube were tested in triaxial test apparatus in unconsolidated undrained condition at field density and natural water content with cell pressure of 1 kg/cm^2, 2 kg/cm^2 and 3 kg/cm^2 respectively. The shear strength parameters (c-ϕ) were obtained by plotting Mohr's circle for peak values.

2.6. Consolidation Test (IS: 2720 P-15):

The sample extruded from UDS tube were tested in Consolidation test apparatus by applying stress of 0.2kg/cm^2, 0.5kg/cm^2, 1kg/cm^2, 2kg/cm^2, 4kg/cm^2 and 8kg/cm^2. The loading increment was left till the end of primary consolidation was indicated on square root time plot.

On completion of final stage of loading, the specimen was unloaded by pressure decrements which decrease the load to ¼ of the last load. Coefficient of consolidation (Cv) was obtained by using square root of time plot. Preconsolidation pressure (Pc), Compression index (Cc), Recompression index (Cr) were obtained from e-log p curve plotted as per Appendix C, IS: 8009 P-1.

2.7. Unconfined Compressive Strength Tests of Rock Cores (IS: 9143):

The samples were selected for rock tests and prepared for Unconfined compression and Point load tests as per length and diameter criteria of IS specifications. Samples were sliced using high speed diamond cutting wheel and diametric surfaces were checked for parallax before subjecting to stress in compression testing machines.

The unconfined compressive strength of rock core was determined by applying the axial load to failure on core specimen at a rate of 0.5 MPa/s to 1 MPa/s.

2.8. Point Load Strength Index Tests on Rock Cores (IS: 8764):

The point load strength index of rock core was determined by conducting diametral/axial test on rock core. The load was applied to rock core placed along diameter/axially such that failure occurs within 10-60 s.

2.9 Brazilian Test on Rock Cores (IS: 10082):

The tensile strength of rock core was determined by conducting diametral test on rock core. The load was applied to rock core at the rate of 200N/s.

SECTION III

The present exploration studies have been carried out to assess the subsoil characteristics and evaluation of foundation characteristics for proposed construction of Multistoried structure at Andheri, Mumbai for Mega CFC at SEEPZ, Mumbai.

The integrated foundation of structural system needs to be safe dependable and economic. The present structure is an industrial structure holding highly important and variable loading pattern. The static and dynamic heavy loads corresponding to this system are expected to be established in the area.

1.0. FOUNDATIONS:

Present exploration data confirms that rock interface portion is located between 3.07 to 10.18 m depth from ground level. The foundation requirements of the structure have been planned considering overall exploration studies.

1.1 Calculation for Net Safe Bearing Capacity of soil based on field & laboratory test results:

(As per IS 6403 – 1981) based on Shear Parameter Criteria:

On the basis of available structural details and load on foundation, following assumptions/ adoptions are made for the bearing capacity. Computation for Ch. **1.50** m below ground level as per I.S. : 6403 - 1981.

1.Width of foundation	=	10.000	m footing		
2.Depth of foundation	=	1.500	m		
3.Cohesion ©	=	0.030	kg/cm^2 =	0.030	t/m^2
4.Field Dry density (FDD)	=	1.620	gm/cc =	1.620	t/m^3
5.Field Moisture Content (FMC)	=	5.80	%		
6.Specific Gravity	=	2.660			
7.Angle of internal friction (Ø)	=	30.00	°		
8.Soil Strata	=	--			

(1) Size of footing :

Width of footing (B)	=	10.000	m
Length of footing (L)	=	12.000	m

Depth of foundation = GL -FL = 1.500 m

(2) Shape factor :

Shape of foundation = Rectangle

Sc = 1+0.2*B/L = **1.17**

Sq = 1+0.2*B/L = **1.17**

Sr = 1-0.4*B/L = **0.67**

(3) Depth factor :

$$dc = 1+0.2 \times \frac{Df}{B} \sqrt{N\ \emptyset}$$

where,

$$\sqrt{N\ \emptyset} = \tan\left(45 + \frac{30}{2}\right)$$

= 1.73

dc = **1.05**

$$dq = dr = 1+0.1 \times \frac{Df}{B} \sqrt{N\ \emptyset}$$

For Ø>10°

dq = dr = **1.03**

(4) Inclination factor :

Angle of inclination = **0.000**

ic = iq = **1.000**

ir = **1.000**

(5) Bulk Unit Wt. of Foundation Soil :

$$Y = yd\,(1+ W/100)$$
$$= \mathbf{1.80}\ t/m^3$$

(6) Effctive surcharge :

$$q = Y \times Df$$
$$= yd\,(1+ W/100) \times Df$$
$$= 2.210\ t/m^2$$

(7) Correction factor for Water table :

Water table	=	0.000	m
FL - WTL =	0.000	<	1.500
FL - WTL	<	Df	
FL - WTL	0.500		

(8) Type of failure :

Initial Void ratio

$$eo = \frac{\text{Specific gravity}}{\text{Dry density}} - 1 = \frac{2.660}{1.620} - 1$$

$$= 0.6420 > 0.55$$

\ **MSF**

(9) Factors Nc, Nq, Nr from table :1, Pg. 8 of IS:6403-1981 :

a) For GSF, Ø = 30.00 °

Nc = 30.14 Nq = 18.4 \Nr = 22.4

With the use of above parameters, safe bearing capacity for GSF is calculated as below:

Net ultimate bearing capacity

$$q_d = CN_cS_cd_ci_c + q(Nq- 1)\,S_qd_qi_q + 1/2 \times B \times YN_rS_rd_ri_rW'$$
$$= 1.11 + 46.03 + 68.94591$$
$$q_d = 116.08\ t/m^2$$

SAFE BEARING CAPACITY :

$$SBC = \frac{\text{Net ultimate bearing capacity}}{\text{Factor of safety}}$$

$$SBC = \frac{116.08}{3}$$

$$SBC = 38.69 \quad t/m^2$$

b) For LSF, Ø = 21.15 °

Nc' = 16.18 Nq' = 7.38 Nr' = 6.65

With the use of above parameters, safe bearing capacity for LSF is calculated as below:

Net ultimate bearing capacity

$$q_{d'} = CN_{c'}S_cd_ci_c + q(N_{q'} - 1)\,S_qd_qi_q + 1/2 \times B \times YNr'S_rd_ri_rW'$$

0.595726 + 16.87714 + 20.46832

qd'= 37.94 t/m²

SAFE BEARING CAPACITY :

$$SBC = \frac{\text{Net ultimate bearing capacity}}{\text{Factor of safety}}$$

$$SBC = \frac{37.94}{3}$$

$$SBC = 12.65 \quad t/m^2$$

Now, The SBC value for Mixed shear Failure condition is obtained by the interpolation

Say SBC = 26.72 t/m²

Allowable Bearing Pressure by Considering 50 mm Settlement criteria:

1	Width of Foundation (B)	=	10.000	m	1000	cm
2	Length of Foundation (L)	=	12.000	m	1200	cm
3	Depth of Foundation (D)	=	1.500	m	150	cm
4	Field Dry Density (rd)	=	1.620	gm/cc	0.00162	kg/cm3
5	Field moisture Content (w)	=	5.800	%		
6	Wet density (rb)	=	1.800	gm/cc	0.001800000	kg/cm3
7	Submerged Density (rsub)	=	0.820		0.000820000	kg/cm3
8	Specific Gravity (G)	=	2.660			
9	Void ratio (eo)	=	0.642			
10	Depth of borehole	=	10.000	m		
11	Depth of water table	=	3.200	m		

Average N Value between base of the footing and the depth equal to 1.5 times the width of footing N avg = 60

Applying correction for overburden & dilatancy

(1) Overburden pressure below foundation q = r*D

= 2.2100 t/m2

q' = 2.2100 t/m2

Correction factor =CF = 1.5

N = 60

N' = CF*N

N' = 90.00

N' = 90.00

(2) Correction for Dilatancy

N" = 15 + 0.50 (N' -15)

N" = 52.50

N" = 53.00

Taking N- Value as 53 & width of footing as 10.000 m, total settlement for 1.00 kg/cm2 pressure is 6.5 mm as per fig.-9 IS-8009(Part-1)

L/B	1.20
D/_/LB	0.140
_/LB/D	7.143
Depth correction =	0.93

Rigidity correction=	1.00			
Water Table correction =	0.50			
Corrected Settlement =	12.09	mm	for 1 Kg/cm2 pressure	

Allowable Bearing Pressure for 75 mm Settlement = 6.203 kg/cm^2

Say Allowable Bearing Pressure = **62.03** t/m^2

Hence, lowest of the above two criteria are considered as SBC for isolated/raft foundation with basement.

TABLE NO. 3.1

Size (L x B) m	Depth (m)	SBC from shear, t/m^2	SBC from settlement, t/m^2	Recommended SBC, t/m^2
12.00 x 10.00	1.50	26.72	62.03	25
12.00 x 10.00	2.00	28.98	67.28	29

1.2. ALLOWABLE SAFE BEARING CAPACITY AT 4.00 m DEPTH:

Calculation for Permissible Bearing Pressure of Rock

Safe Bearing Pressure(Gross) (qs) = Nj * qc

Where Nj = Empirical coefficient depending upon spacing of discontinuities.
& Including a Factor of Safety of 3

$$Nj = \frac{3+S/Bt}{10\sqrt{1+300\delta/S}}$$

δ = thickness of discontinuities in cm,
S = spacing of discontinuities in cm,
Bt = footing width in cm.

Type of Discontinuity	Nj
Very Wide	0.40
Wide	0.25
Moderately	0.10

q_c = Average unconfined compressive strength of rock

= 200 Kg/cm^2 at 4m depth

Considering Moderately Discontinuity and computing the above values,

q_s = 0.10 x 200

= 20.00 Kg/cm^2

Gross Safe Bearing Pressure = 20.00 Kg/cm^2 = 200t/m^2

Applying corrections:

Correction for Submerged condition = 0.50

Correction for cavities = 1.00

Correction for Slope = 0.50

Allowable Bearing Pressure = 50t/m^2

In the light of above we recommend an allowable safe bearing capacity of 50t/m^2 at 4m depth with basement. The presence of soft pockets shall be excavated and back filled with plump concrete and made up to the thickness.

TABLE NO. 3.2

Depth, m	Average UCS kg/cm^2	Allowable Bearing Pressure, t/m^2
4.00	200	50
5.00	300	75
6.00	500	125

2.0. FOUNDING STRATA:

The rock properties indicate a light grayish to a black light yellowish to yellowish brown, fine to medium grained, slightly to highly weathered Basaltic rock stratum. As per IS: 4464-1985 rock quality in terms weathering grades of rock mass conveys that bore hole nos. 1 and 3 rock mass grade falls within IV Grade. As compared to this Bore Hole nos. 2 and Bore Hole no. 4 rock mass is categorized as Grade II. This grading is confirmation of comparative improvement of rock quality. The rock core pattern for all the bores in general is similar one.

Considering the rock output of exploration, we observe that insitu rock quality and subsoil laboratory field data conveys the extreme variability of rock profile. It needs to be stressed that rock strengths have been evaluated on the basis of saturated conditions only. We present rock stratum data bore wise as below.

TABLE NO. 3.3

Bore hole no.	Depth range, m	Weathering grade	Point load Strength, N/mm^2	UCS N/mm^2
1.	3.06—4.06	IV	---	---
2.	7.05 – 8.05	II	0.71	---
3.	4.05 – 5.05	IV	4.06	---
4.	4.07 – 5.07	II		20.63

An overall consideration of detailed core inspection, water absorption, weak planes, strength and SPT tests in rock formation have been taken into account. In light of all the data the average unconfined compression value has been adopted as 300 kg/cm^2 for 5m depth and 500kg/cm^2 for 6m depth strata.

3.0. FOUNDATION CONSTRUCTION CONSIDERATIONS:

3.1. EXCAVATION SLOPES:

Excavation in soft stratum (N< 50) can be done easily. Need for rock excavations may arise in fewer portions of the site. Slopes of temporary open-cut excavations in soil should not be steeper than about 1-vertical on 1.5-horizontal; permanent side slopes and embankment slopes through soil should not be steeper than 1-vertical on 3-horizontal for stability considerations. Both open-cut and embankment side slopes should be protected from wind and water erosion.

Excavations for below-grade facilities can be made by either sheeted vertical cuts or open-cut procedures. Open-cut methods of completing excavations are considered generally satisfactory for relatively shallow below-grade structures. For deeper-seated facilities, because of increased space requirements to accommodate side slopes and associated difficulties in effectively dewatering such excavations, open-cut methods may pose difficulties.

A cap layer is recommended to cover the permanent fill area.

3.2. FOUNDATION BEARING SURFACE:

Foundations soils should be protected against disturbance from construction activities. Surfaces exposed at the bearing grade shall be cleaned for loose pockets. Positive drainage should be established away from foundation excavations to prevent water from pounding within the excavations or around the completed foundation, prior to, or during backfill placement.

3.3. RETAINING WALLS

Permanent or temporary walls retaining in excess of 0.5 m of backfill should be designed to resist lateral earth pressure. A freestanding retaining wall not restrained from minor rotational movement should be designed for the active earth pressure case. Foundation walls restrained from rotational movement, such as the walls for basements should be designed for the at-rest condition.

Resistance to lateral movement of a retaining wall is provided by net passive earth pressure. The active, passive and at-rest lateral earth pressure may be calculated using the earth pressure diagrams at the location point. The earth pressure values are based on the assumption that the backfill will be free-draining material and will be compacted in accordance with structural fill recommendations.

If compaction using heavy equipment is performed near retaining walls, or buried structures, soil pressures against these structures can be as much as two times the normal values. It is recommended that large vibratory rollers not be used within 2 m from retaining walls and within 2 m directly above any buried structures. Small hand-guided plate tempers should be used in pipe trenches and next to retaining walls.

Lateral earth pressures are recommended hereunder for design of retaining walls. Phi values adopted based on the laboratory results are 27º. Accordingly

$K_a = (1-\sin(\phi)) / (1+\sin(\phi))$
$K_p = (1+\sin(\phi)) / (1-\sin(\phi))$
The active earth pressure co-efficient arrive are around =0.38 and
passive earth pressure co-efficient =2.66

3.4 DESIGN FOR UPLIFT :

Considering the requirement for the basement for the structure, it is advised to design to base slab for uplift pressure due to seasonal and incidental rise on water table during the service life of the building. Appropriate anchoring or grouting can be carried out for the same.

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RECOMMENDATIONS

1. Shallow foundations covering, isolated/raft foundation recommendations for allowable safe bearing capacity have been provided in the entire explored area.

2. The slope of excavations should be 1: 2 ½. The angle of repose for the excavated material below fill material is 19.0^0.

3. Basement slabs if any to be designed shall be for uplift capacity also.

8. Detailed Geotechnical investigation has been carried out to provide the designer with sufficiently accurate information about the substrata profile and relevant soil parameters of the project site, on the basis of which the foundations for various structures and equipment can be designed rationally.

RENUKA CONSULTANTS

Dr. Yogini Deshpande

REFERENCES

1) Foundation Design by Tomlinson

2) Foundations in difficult soils, H.G. Bells

3) ISRM Symposium: EUROCK '92: Rock Characterization.

4) Proceedings of the I.G.S. Conference Dec. 1990.

5) IS: 1498: 1970, IS: 2720 -1983, IS: 2911-1979., IS-1892, IS: 2131, IS: 2132, IS: 5313, IS: 6403-1981, IS-1080-1980, IS: 8009 - 1976, IS: 2911, IS: 6403

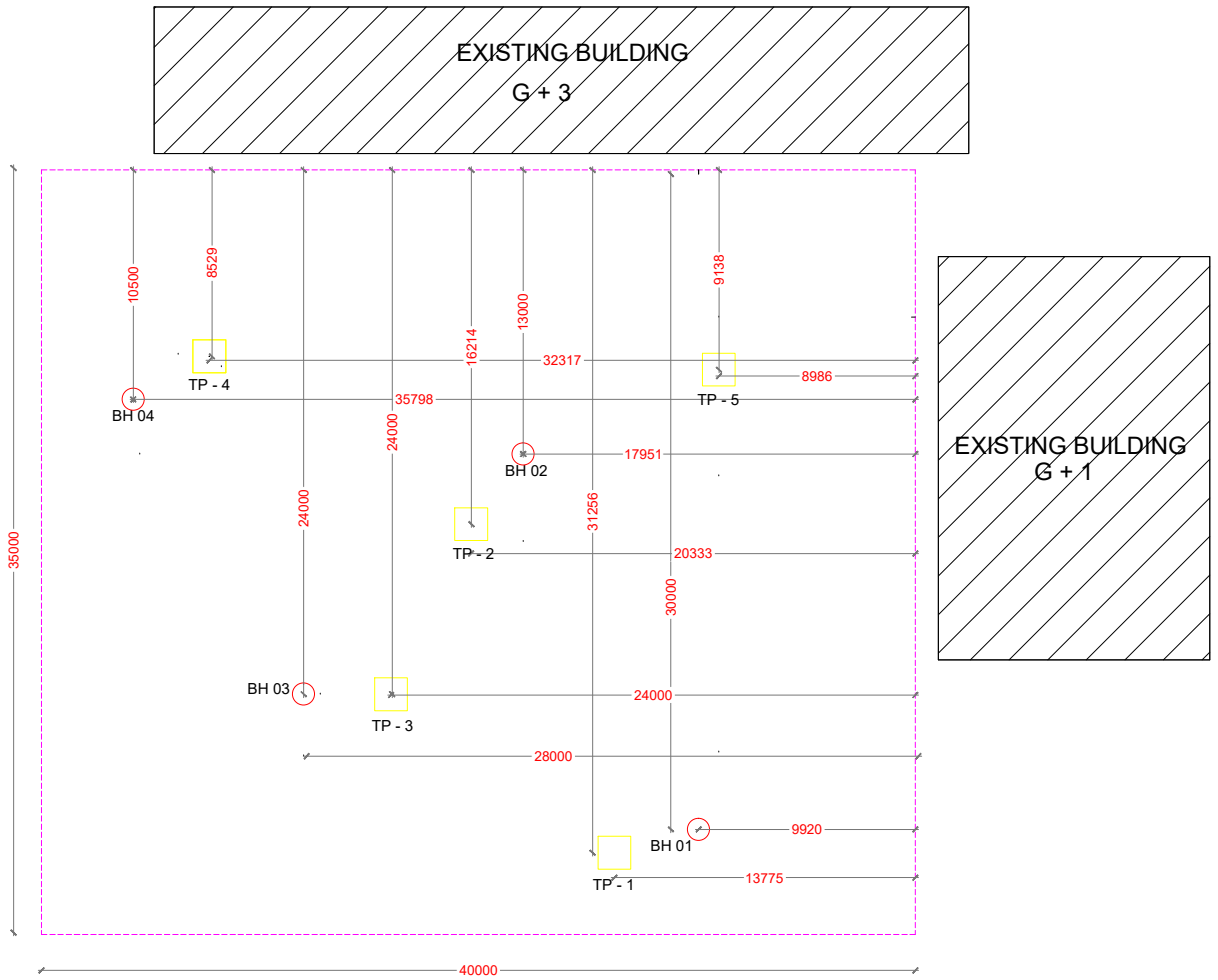
6) Design Aids in Soil Mechanics and Foundation Engineering, Shanbaga R. Kaniraj, Tata McGRAW-HILL, New Delhi.

****

ABBREVIATIONS

Sr. No.	Abbreviations	Abbreviations
1.	DS	Disturbed Sample
2.	UDS	Undisturbed Soil Sample
3.	SPT	Standard Penetration Test
4.	SPT (R)	Standard Penetration Test Refusal
5.	▼	Ground Water Level
6.	UCT	Unconfined Compression Strength
7.	LL	Liquid Limit
8.	PL	Plastic Limit
9.	PI	Plasticity Index
10.	TCR	Total Core Recovery
11.	SCR	Select core recovery
12.	RQD	Rock Quality Designation
13.	T.D.	Total Depth
14.	(BGL) R.L.	Bore hole ground Level
15.	B.H.	Bore hole
16.	N.M.C.	Natural Moisture Content
17.	Qa	Allowable capacity of Single Pile in ton.
18.	Ap	Pile tip area in Square meters.
19.	Qb	Base Resistance of Pile in ton/m^2
20.	Qs	Pile skin friction resistance in ton/m^2
21.	Q_{25}	Allowable safe bearing capacity for 25mm
22.	Q_{40}	Allowable safe bearing capacity for 40mm
23.	L	Socket length
24.	L_1	Pile length in metres.
25.	C	Cohesion
26.	ϕ	Angle of intergranular friction
27.	Rho	Density of Concrete 25 kn/m^3

ANNEXURE I
LOCATION PLAN, SOIL PROFILE AND BORELOG



NOTE: ALL DIMENSIONS ARE IN MM

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email - lab@reukac.com

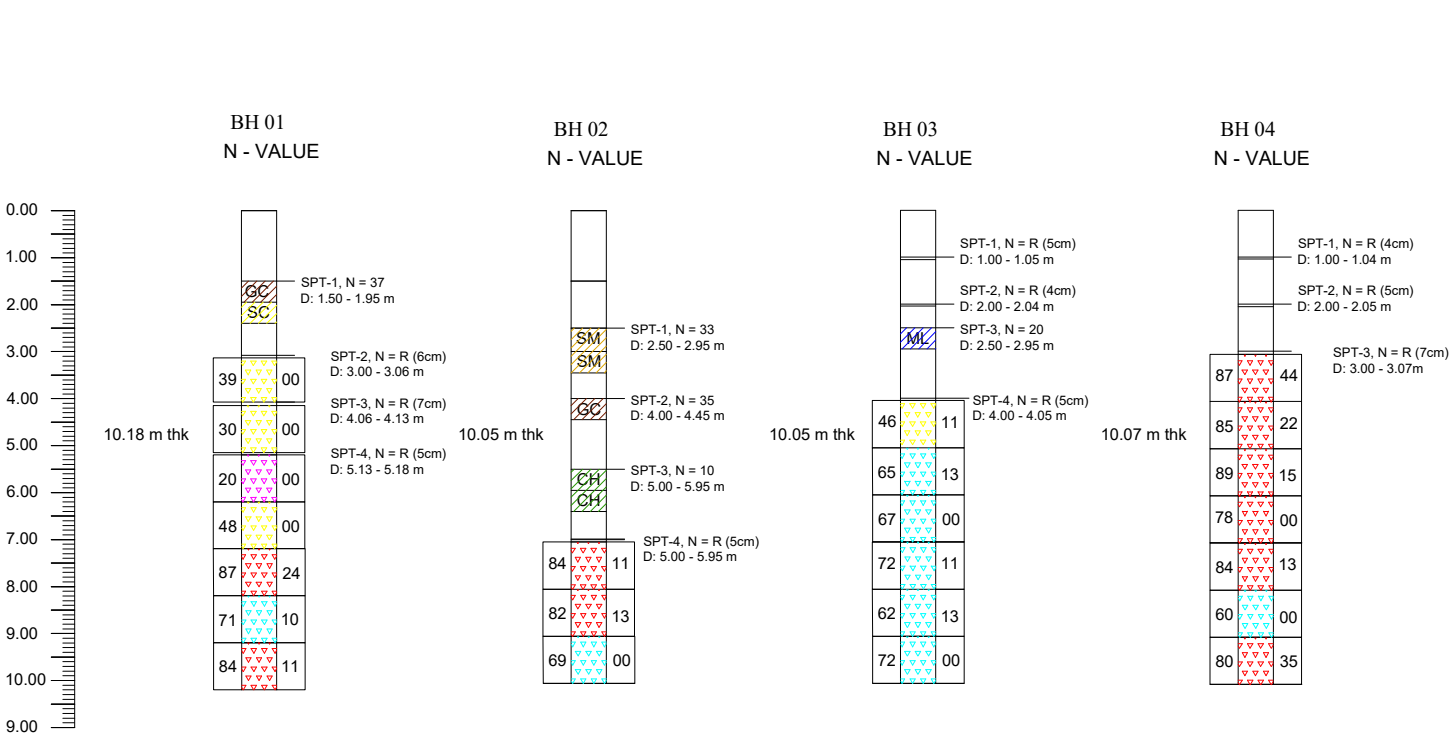
PROJECT: GTI FOR MEGA CFC AT SEEPZ, MUMBAI

CLIENT : SEEPZ, MUMBAI

SITE: ANDHERI, SEEPZ MUMBAI

DRAWN BY: SHARATH R.M CHECK BY: SUJIT DESAI

SOIL PROFILE FOR MEGA CFC PROJECT



LEGEND

C I		C H	
ML		SM	
MI		GC	
C L		GM	
SC		MH	
Residual Soil			

LEGEND

- RESIDUAL SOIL
- As Per IS 4464, Grade VI is residual soil. (GRADE - VI)
- COMPLETELY WEATHERED ROCKS. (GRADE - V)
- HIGHLY WEATHERED ROCKS. (GRADE - IV)
- MODERATELY WEATHERED ROCKS. (GRADE - III)
- SLIGHTLY TO FRESH ROCKS. (GRADE - II, I)

SHEET-1 OF 1

NOTES

- ALL DIMENSION IN METER
- STRATIFICATION INDICATED IS ONLY AT BORE HOLE LOCATION & NOT BETWEEN THE BORE HOLES
- R INDICATES REFUSAL WHERE NUMBER OF BLOWS GIVEN ARE 100 AND CORRESPONDING PENETRATION IS NOTED.

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1, SAMATA CHS, SHRINAGAR,
WAGLE ESTATE,
THANE (W) - 400 604.

PROJECT: GTI FOR MEGA CFC

CLIENT: SEEPZ MUMBAI

RENUKA CONSULTANTS

Borelog
As per IS 1892 : 2002

Job No: 22-238
Page No: 1 of 1

Project :-GTI For MEGA CFC at SEEPZ Mumbai.
Client :-SEEPZ Mumbai

Date of Commencement & Completion : 22/05/2022 -23/05/2022
Location : MEGA CFC (SEEPZ)
Bentonite/water

Length of casing 2.0m-3.1m
BH Dia. in soil : 150 mm
Chainage : ---

Bore Hole No : BH 01
Termination Depth : 10.18 m
GWT : 1.40 m

R.L. : 99.059 m

Depth/ Scale (m)	Thk. (m)	Log	Material Description	Group Symbol	Sample No.	Type	Depth (m) From	Depth (m) To	SPT 'N' Value 15	30	45	N	FI	TCR (%)	SCR (%)	RQD (%)	Weathering Grade
0.00		-------	Brownish gray, fine to medium coarse, clay bricks & concrete remains.		1	WS	0.00	1.50									
1.00		-------															
		:/:/ /:/	Brownish, fine to medium, very stiff to hard,	GC	1	SPT	1.50	1.95	8	12	25	37					
2.00	0.45	:/ /:/ /:/	CLAYEY GRAVEL														
	0.45	#####	Light yellowish brown, fine to medium, CLAYEY SAND	SC	1	UDS	2.00	2.45									
		-------			2	WS	2.50	3.00									
3.00		-------	Grayish brown, fine to medium hard, weatherd rock GRAVELS		2	SPT	3.00	3.06	06/50	-	-	R					
			dark gray, fine grain, highly weathered BASALT.		1	CORE	3.06	4.06						39	NILL	NILL	IV
4.00		-------	Grayish, fine grain, hard, weatherd rock GRAVELS.		3	SPT	4.06	4.13	07/50	-	-	R					
			Gray to light gray, fine to medium, highly weathered BASALT.		2	CORE	4.13	5.13						30	NILL	NILL	IV
5.00		-------	Light gray, fine to medium hard, weatherd rock GRAVELS.		4	SPT	5.13	5.18	05/50	-	-	R					
			Light grayish brown, fine grain completely weatherd, BASALT.		3	CORE	5.18	6.18					2	20	NILL	NILL	V
6.00			Grayish to brown, fine to medium, highly weathered, BASALT.		4	CORE	6.18	7.18					1	48	NILL	NILL	IV
7.00			Grayish to light brown, fine to medium slightly, weatherd vein present, BASALT & volcanic TUFF		5	CORE	7.18	8.18					7	87	46	24	II
8.00			Light brown, fine to medium, moderately weathered TUFF.		6	CORE	8.18	9.18					5	71	26	10	III
9.00			Light brownish gray,fine to medium, slightly weathered TUFF		7	CORE	9.18	10.18					5	84	30	11	II

DS : Disturbed Sample
UDS : Undisturbed Sample
SPT : Standard Penetration Test
WS : Wash Sample

CR : Core Recovery
RQD : Rock Quality Designation
PR : Rate of Penetration
VST : Vane Shear Test

Site Engg.	Drawn By	Checked By	Client Rept.	
Sujith Desai	Ankit Singh	Sandip S. Deshpande		BORE HOLE IS TERMINATED AT A DEPTH OF 10.18 M BELOW EGL.

RENUKA CONSULTANTS

Borelog

As per IS 1892 : 2002

Job No: 22-238

Page No: 1 of 1

Project :-GTI For MEGA CFC at SEEPZ Mumbai.
Client :- SEEPZ Mumbai

Date of Commencement & Completion : 24/05/2022 To 24/05/2022
Location : MEGA CFC (SEEPZ)
Bentonite/water

Length of casing : 4.50m-6.50m
BH Dia. in soil : 150 mm
Chainage : ---

Bore Hole No : BH 02 R.L. : 99.204 m
Termination Depth : 10.05 m
GWT : 3.48 m

Depth/ Scale (m)	Thk. (m)	Log	Material Description	Group Symbol	Sample No.	Type	Depth (m) From	Depth (m) To	SPT 'N' Value 15	30	45	N	FI	TCR (%)	SCR (%)	RQD (%)	Weathering Grade
0.00		-------	Brownish gray, fine to medium hard,		1	WS	0.00	1.50									
		-------	Bricks & concrete remains.														

1.00		-------															

		-------			2	WS	1.50	2.50									

2.00		-------															

		|:|:|:|:|:|	Brown, fine to medium, stiff to very stiff,	SM	1	SPT	2.50	2.95	10	14	19	33					
		|:|:|:|:|:|	SILTY SAND														
		|:|:|:|:|:|															
3.00	1.6	|:|:|:|:|:|	Brown, fine to medium, SILTY SAND	SM	1	UDS	3.00	3.45									
		|:|:|:|:|:|															
		|:|:|:|:|:|			3	WS	3.50	4.00									
		|:|:|:|:|:|															
		|:|:|:|:|:|															
4.00		:/ /:/ /:/	Light Brown to light yellowish, fine to medium,	GC	2	SPT	4.00	4.45	9	14	21	35					
		:/ /:/ /:/	stiff to very stiff, CLAYEY GRAVEL														
	1.40	:/ /:/ /:/			4	WS	4.50	5.50									
		:/ /:/ /:/															
		:/ /:/ /:/															
5.00		:/ /:/ /:/															
		:/ /:/ /:/															
		/////////	Light yellowish, fine to medium stiff, high plastic silty CLAY.	CH	3	SPT	5.50	5.95	4	4	6	10					
		/////////															
	1.00	/////////															
6.00		/////////	Light yellowish, fine to medium, high plastic silty CLAY.	CH	2	UDS	6.00	6.45									
		/////////															
		-------	Light yellowish to light brown, fine to medium,		5	WS	6.50	7.50									
		-------	stiff to very stiff, CLAY with GRAVELS.														

7.00		-------	Light yellowish, fine to medium hard, Weatherd rock GRAVELS.		4	SPT	7.00	7.05	5/50			R					
			Light yellowish, fine to medium, slightly weatherd, volcanic TUFF.		1	CORE	7.05	8.05						84	49	11	II
8.00																	
			Light brown to dark gray, fine grain,		2	CORE	8.05	9.05						82	36	13	II
			slightely weathered, BASALT.														
9.00																	
			Dark gray,fine grain, vertical joint present		3	CORE	9.05	10.05						69	14	NILL	III
			moderately weatherd, BASALT.														

DS : Disturbed Sample
UDS : Undisturbed Sample
SPT : Standard Penetration Test
WS : Wash Sample

CR : Core Recovery
RQD : Rock Quality Designation
PR : Rate of Penetration
VST : Vane Shear Test

Site Engg.	Drawn By	Checked By	Client Rept.	
Sujith Desai	Ankit Singh	Sandip S. Deshpande		BORE HOLE IS TERMINATED AT A DEPTH OF 10.05 M BELOW EGL.

RENUKA CONSULTANTS	Borelog As per IS 1892 : 2002	Job No: 22-238 Page No: 1 of 1

Project :-GTI For MEGA CFC at SEEPZ Mumbai.
Client :-SEEPZ Mumbai

Date of Commencement & Completion : 27/05/2022 To 28/05/2022 | Dia of casing 7.0 m/7.0 m | Bore Hole No : BH 03 | R.L. : 99.402 m
Location : MEGA CFC (SEEPZ) | BH Dia. in soil : 150 mm | Termination Depth : 10.05m m
Drilling Fluid : Water flushings | Chainage : --- | GWT : 6.86 m

Depth/ Scale (m)	Thk. (m)	Log	Material Description	Group Symbol	Sample No.	Type	Depth (m) From	Depth (m) To	SPT 'N' Value 15	30	45	N	FI	TCR (%)	SCR (%)	RQD (%)	Weathering Grade
0.00		-------	Light yellowish brown, fine to medium, very stiff to hard, CLAY with GRAVELS.		1	DS	0.00	1.00									
1.00		-------	Light yellowish brown, fine to medium, very stiff to hard, CLAY with GRAVELS.		1 1	SPT WS	1.00 1.00	1.05 2.00	05/50			R					
2.00		-------	Light yellowish brown, fine to medium, very stiff to hard, CLAY with GRAVELS.		2 2	SPT WS	2.00 2.00	2.04 2.50	04/50			R					
3.00		-------	Light yellowish brown, fine to medium, very stiff to hard, clayey SILT with low plasticity.	ML	3 3	SPT WS	2.50 3.00	2.95 4.00	4	7	13	20					
4.00		-------	Light yellowish, fine to medium,hard, rock GRAVELS		4	SPT	4.00	4.05	05/50			R					
5.00			Light yellowish, fine to medium, highely weathered, BASALT.		1	CORE	4.05	5.05					4	46	17	NILL	IV
6.00			Light yellowish brown, fine grain, vein & closely sapaced joint present, moderately weathered, BASALT.		2	CORE	5.05	6.05					3	65	19	NILL	III
7.00	▽		Light yellowish brown, fine grain vein & closely spaced joint present, moderately weathered, BASALT.		3	CORE	6.05	7.05					1	67	3	NILL	III
8.00			Grayish to light brown, fine grain vein present, moderately weathered, BASALT.		4	CORE	7.05	8.05					5	72	18	NILL	III
9.00			Grayish to light brown, fine grain vein present, moderately weathered, BASALT.		5	CORE	8.05	9.05					3	62	17	NILL	III
			Grayish to light brown, fine grain, vein present, moderately weathered, BASALT.		6	CORE	9.05	10.05					4	72	13	NILL	III

DS : Disturbed Sample
UDS : Undisturbed Sample
SPT : Standard Penetration Test
WS : Wash Sample

CR : Core Recovery
RQD : Rock Quality Designation
PR : Rate of Penetration
VST : Vane Shear Test

Site Engg.	Drawn By	Checked By	Client Rept.	
Sujith Desai	Ankit Singh	Sandip S. Deshpande		BORE HOLE IS TERMINATED AT A DEPTH OF 10.05 M BELOW EGL.

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Borelog

As per IS 1892 : 2002

Job No: 22-238

Page No: 1 of 1

Project :-GTI For MEGA CFC at SEEPZ Mumbai.
Client :-SEEPZ Mumbai

Date of Commencement & Completion : 22/05/2022 To 23/05/2022
Location : MEGA CFC (SEEPZ)
Bentonite/water

Length of casing 1:00-2.50m
BH Dia. in soil : 150 mm
Chainage : ---

Bore Hole No : BH 04
Termination Depth : 10.07 m
GWT : 7.30 m

R.L. : 99.633 m

Depth/ Scale (m)	Thk. (m)	Log		Group Symbol	Sample No.	Type	Depth (m) From	Depth (m) To	SPT 'N' Value 15	30	45	N	FI	TCR (%)	SCR (%)	RQD (%)	Weathering Grade
0.00		-------	Light yellowish brown, medium to coarse, hard filling material.		1	WS	0.00	1.00									
1.00		-------	Light yellowish, fine to medium hard, weathered rock,		1	SPT	1.00	1.04	4/50	-	-	R					
		-------	CLAY with GRAVELS.		1	WS	1.00	2.00									
2.00		-------	Light yellowish, fine to medium hard, weathered rock,		2	SPT	2.00	2.05	5/50	-	-	R					
		-------	CLAY with GRAVELS.		2	WS	2.00	3.00									
3.00		-------	Light yellowish, fine to medium hard, rock GRAVELS.		3	SPT	3.00	3.07	07/50	-	-	R					
			Light yellowish, fine grain, slightly weathered, BASALT		1	CORE	3.07	4.07					6	87	70	44	II
4.00			Light yellowish, fine grain, slightly weathered, BASALT		2	CORE	4.07	5.07					7	85	41	22	II
5.00			Light yellowish, fine grain, slightly weathered, BASALT		3	CORE	5.07	6.07					6	89	37	15	II
6.00			Light yellowish, fine grain, slightly weathered, BASALT		4	CORE	6.07	7.07					3	78	8	NILL	II
7.00			Light yellowish, fine grain, slightly weathered, BASALT		5	CORE	7.07	8.07					3	84	15	13	II
8.00			Light yellowish, fine grain, moderately weathered, BASALT.		6	CORE	8.07	9.07					3	60	12	NILL	III
9.00			Light yellowish brown, fine to medium, slightly weathered volcanic TUFF.		7	CORE	9.07	10.07					9	80	52	35	II

DS : Disturbed Sample
UDS : Undisturbed Sample
SPT : Standard Penetration Test
WS : Wash Sample

CR : Core Recovery
RQD : Rock Quality Designation
PR : Rate of Penetration
VST : Vane Shear Test

Site Engg.	Drawn By	Checked By	Client Rept.	
Sujith Desai	Ankit Singh	Sandip S. Deshpande		BORE HOLE IS TERMINATED AT A DEPTH OF 10.07 M BELOW EGL.

ANNEXURE II
TEST RESULTS

TEST REPORT FOR SOIL

Client:	SEEPZ SEZ MUMBAI	Test Report No:	TC-701522000001548
Ref No.:	SEEPZ-SEZ/Estate/CFC/55/2021-22	Sample Received Date:	--
Project / Site:	GTI for Mega CFC at SEEPZ Mumbai,	Test Date:	27-05-2022
Sample	Soil Sample	Report Date:	06-06-2022
Description	BH 01	Type & Number of Sample:	Soil, 2 No's

Sr. No.	Lab Sample Id	Depth below EGL	Type of samples	Grain Size Particles IS 2720 (Part–4) RA 2020: 1984			Atterberg Limit IS 2720 (Part–5) RA 2020: 1985			Classification IS 1498 RA 2002: 1970	Free Swell Index (%)	Consolidation Test IS 2720 (Part–15) RA 2016: 1965		Triaxial shear test (UU) IS 2720 (Part-11), RA 2016: 1993		Direct shear test IS 2720 (Part–13) RA 2016: 1986	
				Gravel %	Sand %	Silt + Clay (%)	Liquid Limit %	Plastic Limit %	Plasticity Index %			Void Ration "e"	Compression Index "C_c"	Cohesion "C kPa"	Angle of Friction "ϕ"	Cohesion "C kPa"	Angle of Friction "ϕ"
BH - 01																	
1	2022050200	1.50-1.95	SPT	36.42	29.78	33.80	34	26	8	GC							
2	2022050201	2.00-2.45	UDS	26.75	47.86	25.39	49	26	23	SC						6.3	31

Note: 1) Results as shown in the report relates only to the sample/s received and tested in this laboratory. The sample is not drawn by laboratory.
2) This statement of compliance is based on 95% coverage probability for the expanded uncertainty of the measured results.
3) This Certificate should not be produced in any part. 4) Any query regarding the report should be reported immediately.
5) While 'RC (RERL)' has made their best endeavors to provide accurate and reliable information, 'RC (RERL)' is not responsible for any financial liability due to any act of omission or error made. 6) (#) Not covered under NABL scope. 7) Part presentation or reproduction of results without permission of RC(RERL) is not acceptable.

Authorised Signatory
Sandip Deshpande
Technical Manager

Authorised Signatory
Dr. Yogini Deshpande
Quality Manager

TEST REPORT FOR SOIL

Client:	SEEPZ SEZ MUMBAI	Test Report No:	TC-701522000001548
Ref No.:	SEEPZ-SEZ/Estate/CFC/55/2021-22	Sample Received Date:	--
Project / Site:	Andheri, Mumbai	Test Date:	27-05-2022
Sample	Soil Sample	Report Date:	06-06-2022
Description	BH 01	Type & Number of Sample:	Soil, 1 No's

Sr. No.	Lab Sample Id	Depth below EGL	Type of samples	Bulk Density in gm/cc IS 2720 (Part 2):1973, RA: 2015	Moisture Content, % IS 2720 (Part 2), RA 2020: 1992	Specific Gravity IS-2720 (PART 3) 1980
BH - 01						
1	2022050201	2.00-2.45	UDS	1.63	19.14	2.62

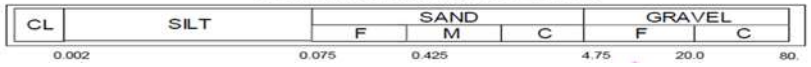
Note: 1) Results as shown in the report relates only to the sample/s received and tested in this laboratory. The sample is not drawn by laboratory.
2) This statement of compliance is based on 95% coverage probability for the expanded uncertainty of the measured results.
3) This Certificate should not be produced in any part. 4) Any query regarding the report should be reported immediately.
5) While 'RC (RERL)' has made their best endeavors to provide accurate and reliable information, 'RC (RERL)' is not responsible for any financial liability due to any act of omission or error made. 6) (#) Not covered under NABL scope. 7) Part presentation or reproduction of results without permission of RC(RERL) is not acceptable.

Authorised Signatory
Sandip Deshpande
Technical Manager

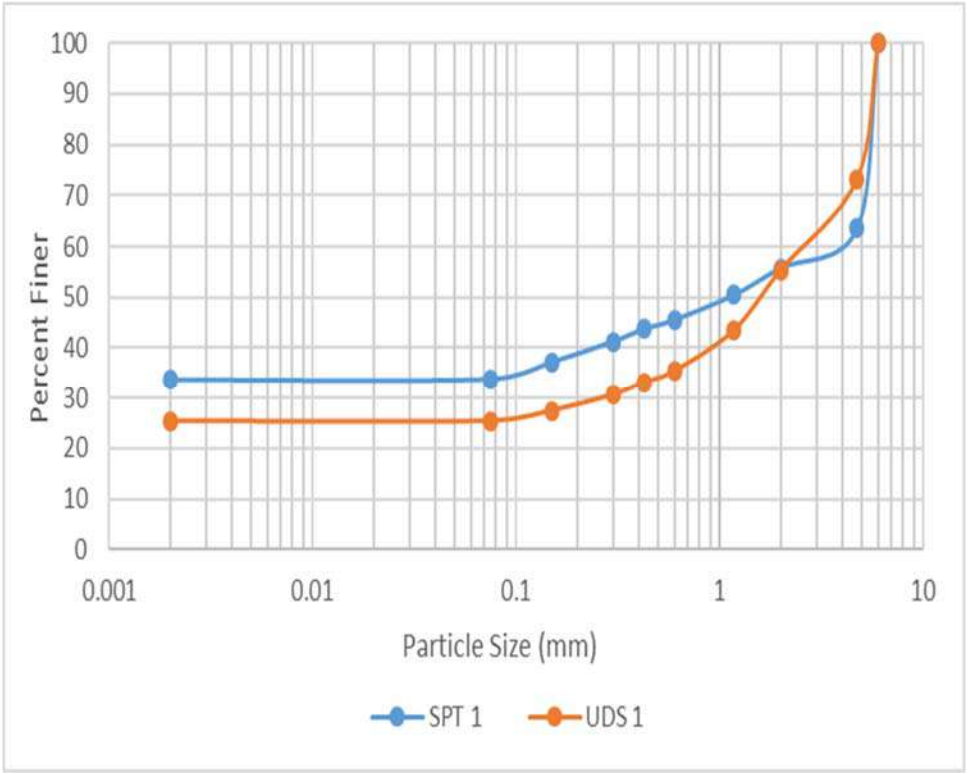
Authorised Signatory
Dr. Yogini Deshpande
Quality Manager

BH 01

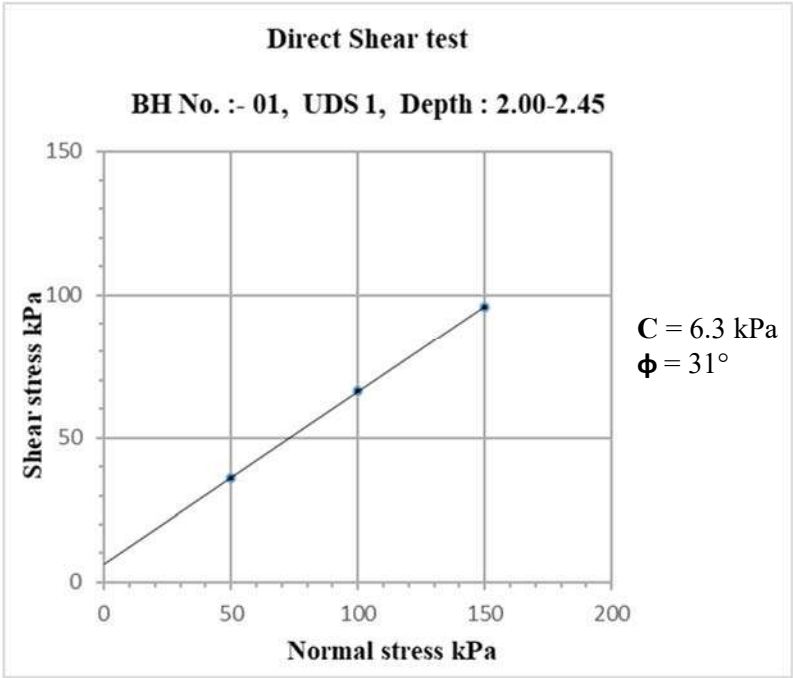
Grain Size Distribution Curve



Type	Depth	Gravel	Sand	Silt	Clay
SPT 1	0.00 – 1.50	36.42	29.78	33.80	
UDS 1	2.00 – 2.45	26.75	47.86	25.39	

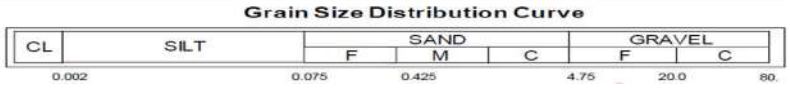


Plot no. L-139, Taloja, MIDC, Panvel, Dist. Raigad – 410208. Maharashtra.
Email: info@renukac.com Mb no. +91- 8657522702, 9372278261.

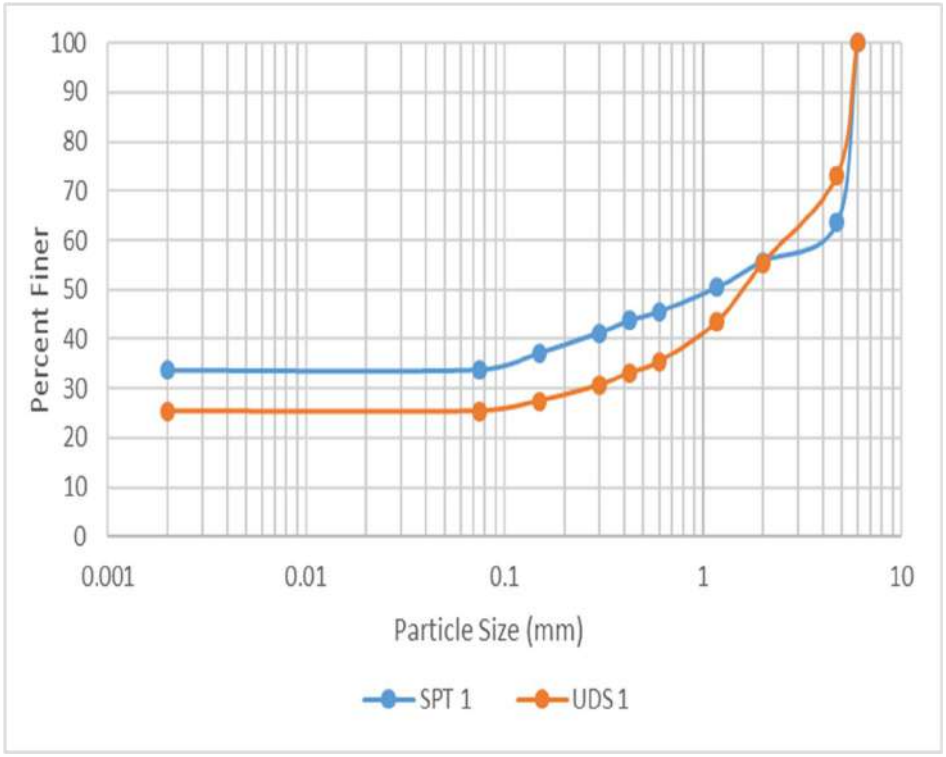


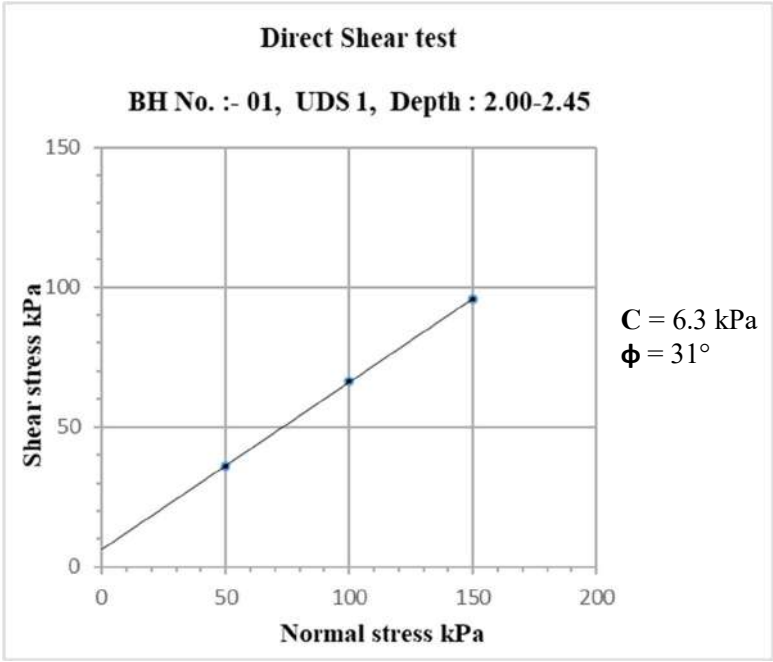
Sr. No.	Tests	Test Method	Results Obtained	Remarks
1	Direct Shear Test	IS 2720 (Part-13), RA 2016: 1986		
	(a) Cohesion (kPa)		6.3	
	(b) Angle of Internal Friction in Degree		31	

BH 01



Type	Depth	Gravel	Sand	Silt	Clay
SPT 1	0.00 – 1.50	36.42	29.78	33.80	
UDS 1	2.00 – 2.45	26.75	47.86	25.39	





Sr. No.	Tests	Test Method	Results Obtained	Remarks
1	Direct Shear Test	IS 2720 (Part-13), RA 2016: 1986		
	(a) Cohesion (kPa)		6.3	
	(b) Angle of Internal Friction in Degree		31	

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Renuka Consultants

•GEOTECHNICAL SERVICES • STRUCTURAL SERVICES• MATERIAL ASSESSMENT

TEST REPORT FOR SOIL

To, SEEPZ SEZ MUMBAI		Test Report No:	TC-701522000001548
		Sample Received Date:	----
		Test Date	27/05/2022
		Report Date:	06/06/2022
Ref No.	: SEEPZ-SEZ/Estate/CFC/55/2021-22		
Project / Site	: GTI for Mega CFC at SEEPZ Mumbai,		
Sample	: Soil Sample		
Description	: BH-01		
Type of Sample	: UDS-1		
Type of Test	: Chemical Analysis		
Date of receipt	: ----		
Date of Testing	: 27/05/2022		
Lab ID	: 2022050201		

Sr. No.	Name of Test	Test Method	Results Obtained
1	pH of Soil	IS 2720(Part 26) (RA: 2016) 1987	7.89
2	Soluble Sulphates in Soil %	IS 2720 (Part–27) (RA: 2020) 1977	0.077
3	Organic Impurities %	IS 2720 (Part–22) (RA: 2020) 1972	0.098

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Authorised Signatory
SandipDeshpande
Technical Manager

Authorised Signatory
Dr. Yogini Deshpande
Quality Manager

TEST REPORT FOR SOIL

To, SEEPZ SEZ MUMBAI		Test Report No:	TC-701522000001549
		Sample Received Date:	----
		Test Date	27/05/2022
		Report Date:	06/06/2022
Ref No.	: SEEPZ-SEZ/Estate/CFC/55/2021-22		
Project / Site	: Andheri, Mumbai		
Sample	: Soil Sample		
Description	: BH-01		
Type of Sample	: UDS-1		
Type of Test	: Chemical Analysis		
Date of receipt	: ----		
Date of Testing	: 27/05/2022		
Lab ID	: 2022050201		

Sr. No.	Name of Test	Test Method	Results Obtained
1	Chloride Content in Soil %	BS 1377 (Part-3) 1990	0.0007

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Authorised Signatory
SandipDeshpande
Technical Manager

Authorised Signatory
Dr. Yogini Deshpande
Quality Manager

TEST REPORT FOR ROCK

Client:	SEEPZ SEZ MUMBAI	Test Report No:	TC-701522000001550
Ref No.:	SEEPZ-SEZ/Estate/CFC/55/2021-22	Sample Received Date:	--
Project / Site:	GTI for Mega CFC at SEEPZ Mumbai,	Test Date:	27-05-2022
Sample	Rock Sample	Report Date:	06-06-2022
Description	BH-01	Type & Number of Sample:	Core & 3 No s

Sr. No.	Lab Sample Id	Piece No.	Depth (m)	Dry Density in gm/cc IS 13030: RA (2021) 1991	Porosity, % IS 13030: RA (2021) 1991	Water Absorption, % IS 1124, RA 2017: 1974	Specific Gravity IS 1122, RA 2017: 1974	Unconfined Compressive Test IS 9143:1979, RA:2021			MEPR IS: 9221, RA2021: 1979		Point Load Index Test N/mm² (*Soaked) IS 8764, RA 2019:1998	Brazilian Test IS: 10082-1981 Mpa
								Failure Load, (kN)	Cross Sectional Area, (mm²)	Unconfined Compressive Strength, Mpa	Elastic Modulus (E)*10^8, Kpa	Poisson's Ratio		
BH-01														
1	2022050202	8/6	7.18-8.18	2.37	4.94	2.08	2.82	225.00	2348.19	95.82	0.55	0.24		5.48
2	2022050203	12/11	8.18-9.18	2.36	5.06	2.14	2.72						1.57	
3	2022050204	16/20	9.18-10.18	2.34	4.99	2.13	2.76						4.01	

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Authorised Signatory
Sandip Deshpande
Technical Manager

Authorised Signatory
Dr. Yogini Deshpande
Quality Manager

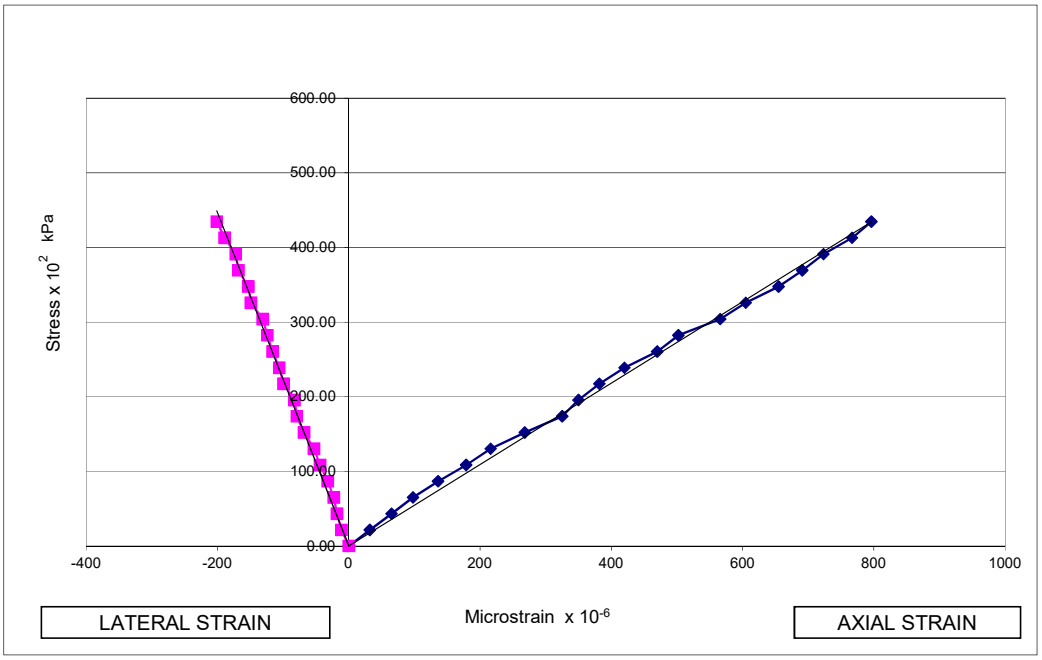
Renuka Consultants

Modulus of Elasticity and Poisson's Ratio

IS: 9221

Report No-	TC-701522000001550	Date of report	06-06-2022
Name of Project:	GTI for Mega CFC at SEEPZ Mumbai		
Name of client :	SEEPZ SEZ MUMBAI		
Sample sent by:	Renuka Consultants	BH.NO:	BH-01
Sample ID	2022050202		
Date of sample Received:	-	Depth (m):	7.18-8.18
Type of Sample:	ROCK	P.No:	8
Condition of Sample on Receipt:	Satisfactory	Diamter of Sample(cm):	5.47
Lithology of sample:	Grayish to light brown,fine to medium, slightly weatherd vein present BASALT & VOLCANIC TUFF.	Area (cm^2):	23.07
Date of Testing:	27/05/2022	Length of Sample(cm):	11.01

Stress x 10^2 kPa	Axial Strain x 10^{-6}	Lateral Strain x 10^{-6}
0.00	0	0
21.72	32	11
43.45	65	18
65.17	98	23
86.89	136	32
108.61	216	44



Modulus of Elasticity (kPa): 0.55×10^8 Poisson's Ratio : 0.24

Note: 1) Results as shown in the report relates only to the sample/s received and tested in this laboratory.
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For RENUKA CONSULTANTS **TECHNICAL MANAGER**

Plot no. L-139, Taloja, MIDC, Panvel,Dist. Raigad – 410208. Maharashtra.
Email: info@renukac.com Mb no. +91- 8657522702, 9372278261.

TEST REPORT FOR WATER SAMPLE

To, SEEPZ SEZ MUMBAI		Date:	06-06-2022
		Test Report No:	TC-701522000001551
		Sample Received Date:	---
		Test Date:	27-05-2022
Ref No.	: SEEPZ-SEZ/Estate/CFC/55/2021-22		
Project / Site	: GTI for Mega CFC at SEEPZ Mumbai,		
Sample	: Water Sample		
Description	: BH 01		
Quantity	: 1 liter		
Condition of Sample	: Good		
Date of receipt	: -----		
Date of Testing	: 27-05-2022	Temp. in Laboratory: 25 ± 2 ºC	
Lab ID	: 2022050205		

Sr. No.	Name of Test	Test Method	Acceptable Limits	Results	Remarks
1	Volume of 0.02 normal NaOH required to neutralize 100 ml sample of water, using phenolphthalein as an indicator, ml	IS:3025(Pt. 22)-1986(R-2014)	5.0 Max.	---	---
2	Volume of 0.02 normal H2SO4 required to neutralize 100 ml sample of water, using mixed indicator, ml	IS:3025(Pt. 23)-1986(R-2014)	25.0 Max.	---	---
3	**Solid Contents, mg/l**				
	a) Organic Solids (in mg/l)	IS:3025(Pt. 18)-1984(R-2012)	200 Max	0.60	Acceptable
	b) Inorganic Solids (in mg/l)	IS:3025(Pt. 18)-1984(R-2012)	3000 Max	12.02	---
	c) Sulphates as SO4 (in mg/l)	IS:3025(Pt. 24)-1986(R-2014)	400 Max	32.92	Acceptable
	d) Chlorides as Cl (in mg/l)	IS:3025(Pt. 32)-1986(R-2014)	2000/500 Max. Plain Concrete/ Reinforced Concrete	5.22	Acceptable
	e) Suspended Matter (in mg/l)	IS:3025(Pt. 17)-1984(R-2012)	2000 Max	---	---
4	pH Value at 25ºC	IS:3025(Pt. 11)-1983(R-2012)	Not less than 6.0	7.98	Acceptable

Note: 1) Sample provided by Client
2) Tests conducted as per IS: 3025
3) Acceptable limit as per IS 456-2000

Note: 1) Results as shown in the report relates only to the sample/s received and tested in this laboratory.
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Authorised Signatory
SandipDeshpande
Technical Manager

Authorised Signatory
Dr. Yogini Deshpande
Quality Manager

TEST REPORT FOR SOIL

Client:	SEEPZ SEZ MUMBAI	Test Report No:	TC-701522000001555
Ref No.:	SEEPZ-SEZ/Estate/CFC/55/2021-22	Sample Received Date:	--
Project / Site:	GTI for Mega CFC at SEEPZ Mumbai,	Test Date:	27-05-2022
Sample	Soil Sample	Report Date:	07-06-2022
Description	BH 02	Type & Number of Sample:	Soil, 2 No's

Sr. No.	Lab Sample Id	Depth below EGL	Type of samples	Grain Size Particles IS 2720 (Part–4) RA 2020: 1984			Atterberg Limit IS 2720 (Part–5) RA 2020: 1985			Classification IS 1498 RA 2002: 1970	Free Swell Index (%)	Consolidation Test IS 2720 (Part–15) RA 2016: 1965		Triaxial shear test (UU) IS 2720 (Part-11), RA 2016: 1993		Direct shear test IS 2720 (Part–13) RA 2016: 1986	
				Gravel %	Sand %	Silt + Clay (%)	Liquid Limit %	Plastic Limit %	Plasticity Index %			Void Ration "e"	Compression Index "C_c"	Cohesion "C kPa"	Angle of Friction "ϕ"	Cohesion "C kPa"	Angle of Friction "ϕ"
BH - 02																	
1	2022050206	2.50-2.95	SPT	10.54	56.66	32.81	36	25	11	SM							
2	2022050207	3.00-3.45	UDS	3.19	47.44	49.37	38	25	13	SM						3	27.05
3	2022050208	4.00-4.45	SPT	44.31	40.04	15.66	41	24	17	GC							
4	2022050209	5.00-5.45	SPT	1.28	14.87	83.85	68	28	40	CH							
5	2022050210	6.00-6.45	UDS	2.61	17.19	80.20	74	31	43	CH		0.82	0.215	15	13.55		

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TEST REPORT FOR SOIL

Client:	SEEPZ SEZ MUMBAI	Test Report No:	TC-701522000001555
Ref No.:	SEEPZ-SEZ/Estate/CFC/55/2021-22	Sample Received Date:	--
Project / Site:	GTI for Mega CFC at SEEPZ Mumbai,	Test Date:	27-05-2022
Sample	Soil Sample	Report Date:	07-06-2022
Description	Hydrometer test	Type & Number of Sample:	Soil, 2 No's

Sr. No.	Lab Sample Id	Depth below EGL	Type of samples	Silt (%)	Clay (%)
BH - 02					
1	2022050209	5.00-5.95	SPT	26.66	57.19
2	2022050210	6.00-6.45	UDS	18.63	61.57

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Sandip Deshpande
Technical Manager

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Dr. Yogini Deshpande
Quality Manager

TEST REPORT FOR SOIL

Client:	SEEPZ SEZ MUMBAI	Test Report No:	TC-701522000001555
Ref No.:	SEEPZ-SEZ/Estate/CFC/55/2021-22	Sample Received Date:	--
Project / Site:	GTI for Mega CFC at SEEPZ Mumbai,	Test Date:	27-05-2022
Sample	Soil Sample	Report Date:	07-06-2022
Description	BH 02	Type & Number of Sample:	Soil, 2 No's

Sr. No.	Lab Sample Id	Depth below EGL	Type of samples	Bulk Density in gm/cc IS 2720 (Part 2):1973, RA: 2015	Moisture Content, % IS 2720 (Part 2), RA 2020: 1992	Specific Gravity IS-2720 (PART 3) 1980
BH - 02						
1	2022050207	3.00-3.45	UDS	1.88	26.54	2.65
2	2022050210	6.00-6.45	UDS	1.93	29.30	2.68

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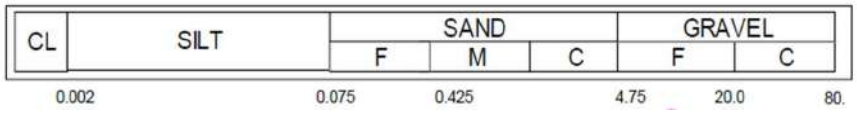
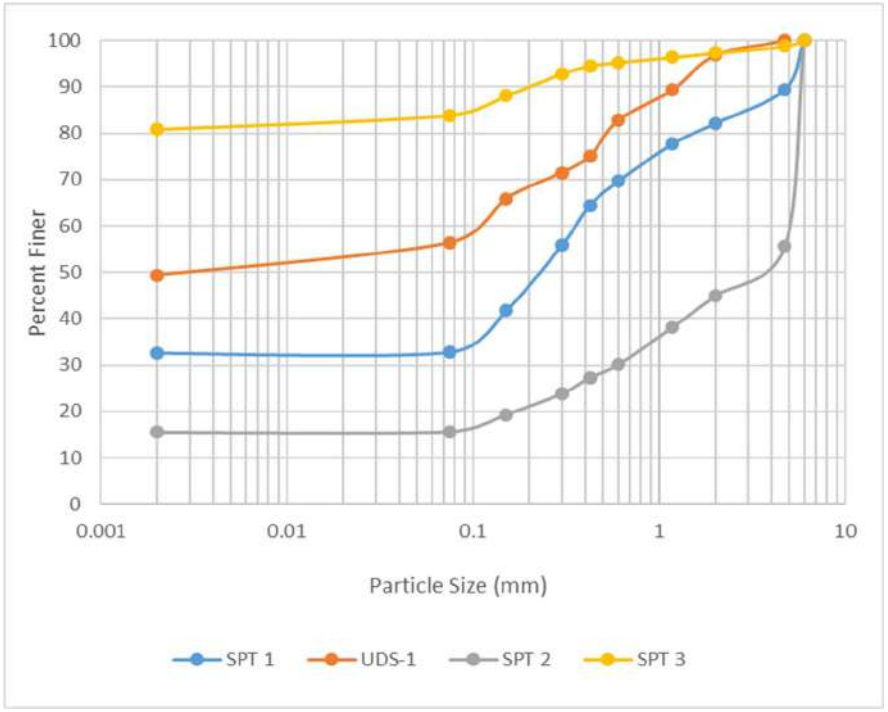
Quality Manager

BH. No.:- 02

Grain Size Distribution Curve

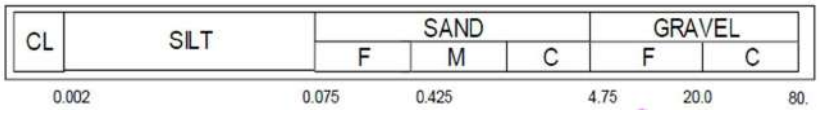


Type	Depth	Gravel	Sand	Silt	Clay
SPT 1	2.50-2.95	10.54	56.66	32.81	
UDS 1	3.00-3.45	3.19	47.44	49.37	
SPT 2	4.00-4.45	44.31	40.04	15.66	
SPT 3	5.00-5.95	1.28	14.87	26.66	57.19

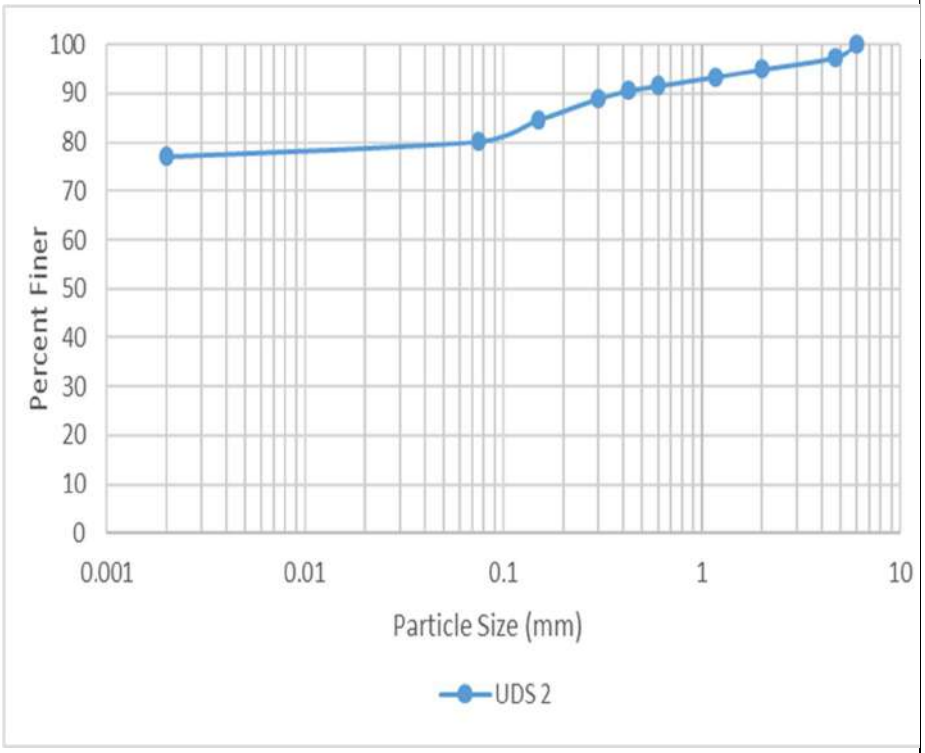


BH. No.:- 02

Grain Size Distribution Curve



Type	Depth	Gravel	Sand	Silt	Clay
UDS 2	6.00-6.45	2.61	17.19	18.63	61.57



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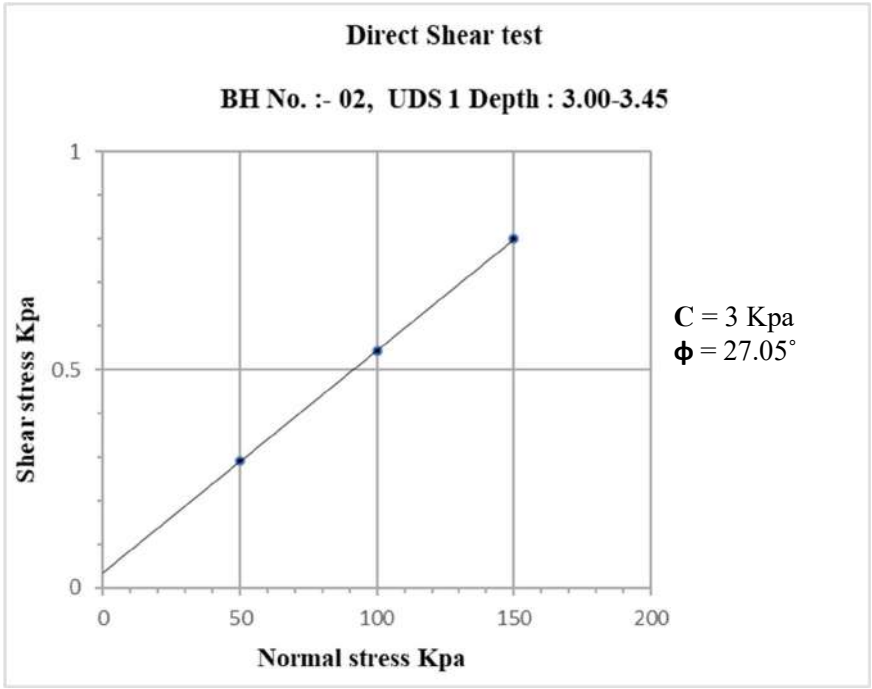
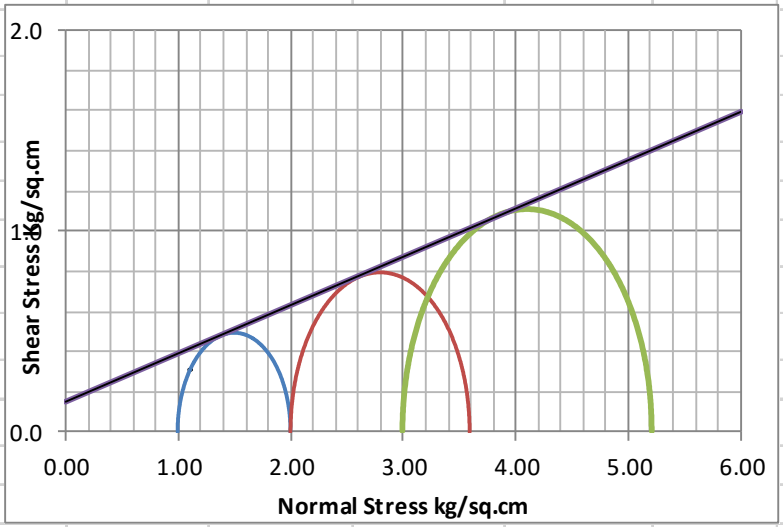


Sr. No.	Tests	Test Method	Results Obtained	Remarks
1	Direct Shear Test	IS 2720 (Part-13), RA 2016: 1986		
	(a) Cohesion (kPa)		3	
	(b) Angle of Internal Friction in Degree		27.05	

Triaxial Unconsolidated Undrained Test

BH. No.:-02, Type:- UDS 02, Depth :- 6.00 - 6.45

Cell Pressure σ_3	Deviatoric force at Failure	Deviatoric Stress at Failure, σd	Shear stress at Failure, σ_1	Change in Length at Failure, Δ_L	Strain at Failure, ε
kg/cm^2	kg	kg/cm^2	kg/cm^2	mm	%
1	12.39	0.99	1.99	7.00	9.21
2	20.06	1.59	3.59	7.50	9.87
3	28.03	2.21	5.21	8.00	10.53



Diameter of Sample (mm) :	38	Height of Sample (mm) :	76
Cohession, kg/sq.cm :	0.15	Angle of internal friction, ϕ :	13.55°
Bulk Density g/cc :	1.93	Moisture Content % :	29.30

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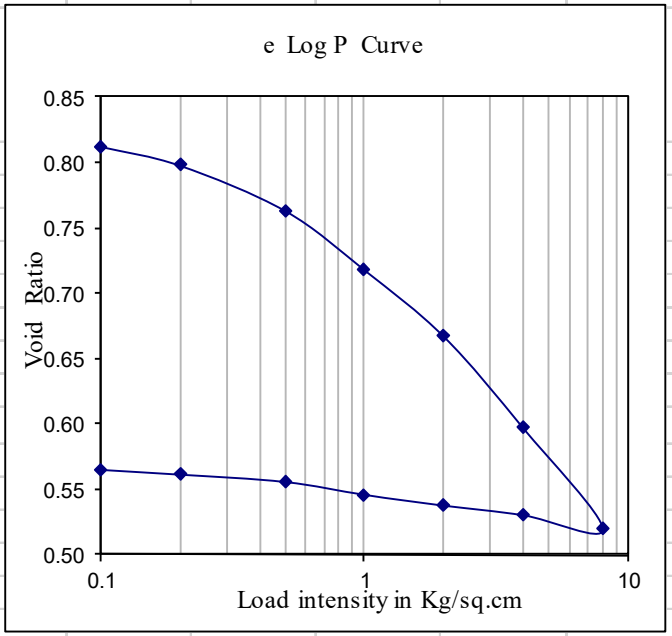
CONSOLIDATION TEST RESULTS

PROJECT: GTI WORK FOR MEGA CFC

SEEPZ Mumbai

B.H. No.	2	Void Ratio (e_0)	0.8198
Depth :	6.00-6.45	Coefficient of Compression	0.215
Degree of saturation : 97.63%		Pre-consolidation Pressure (kg/sq.cm)	0.52

Applied load in kg/cm^2	Void Ratio (e)=(H-Hs)/Hs	Δe_0	a_v	$m_v = a_v/(1+e_0)$
0	**0.8198**			
0.1	**0.8126**	(0.0073)	0.0728	0.0400
0.2	**0.7980**	(0.0146)	0.1456	0.0800
0.5	**0.7634**	(0.0346)	0.1153	0.0633
1	**0.7179**	(0.0455)	0.0910	0.0500
2	**0.6670**	(0.0510)	0.0510	0.0280
4	**0.5969**	(0.0701)	0.0350	0.0193
8	**0.5196**	(0.0773)	0.0193	0.0106
4	**0.5305**	0.0109		
2	**0.5378**	0.0073		
1	**0.5460**	0.0082		
0.5	**0.5560**	0.0100		
0.2	**0.5614**	0.0055		
0.1	**0.5651**	0.0036		
0	**0.5696**	0.0045		



Coefficient of consolidation @ 1.0-2.0 kg.cm² = 0.021 cm²/sec

Coefficient of consolidation @ 2.0-4.0 kg.cm² = 0.025 cm²/sec

TEST REPORT FOR SOIL

To, SEEPZ SEZ MUMBAI		Test Report No:	TC-701522000001555
		Sample Received Date:	----
		Test Date	27/05/2022
		Report Date:	07/06/2022
Ref No.	: SEEPZ-SEZ/Estate/CFC/55/2021-22		
Project / Site	: GTI for Mega CFC at SEEPZ Mumbai,		
Sample	: Soil Sample		
Description	: BH-02		
Type of Sample	: UDS-1		
Type of Test	: Chemical Analysis		
Date of receipt	: ----		
Date of Testing	: 27/05/2022		
Lab ID	: 2022050207		

Sr. No.	Name of Test	Test Method	Results Obtained
1	pH of Soil	IS 2720(Part 26) (RA: 2016) 1987	7.81
2	Soluble Sulphates in Soil %	IS 2720 (Part–27) (RA: 2020) 1977	0.099
3	Organic Impurities %	IS 2720 (Part–22) (RA: 2020) 1972	0.081

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Authorised Signatory
SandipDeshpande
Technical Manager

Authorised Signatory
Dr. Yogini Deshpande
Quality Manager

TEST REPORT FOR SOIL

To, SEEPZ SEZ MUMBAI		Test Report No:	TC-701522000001556
		Sample Received Date:	----
		Test Date	27/05/2022
		Report Date:	07/06/2022
Ref No.	: SEEPZ-SEZ/Estate/CFC/55/2021-22		
Project / Site	: Andheri, Mumbai		
Sample	: Soil Sample		
Description	: BH-02		
Type of Sample	: UDS-1		
Type of Test	: Chemical Analysis		
Date of receipt	: ----		
Date of Testing	: 27/05/2022		
Lab ID	: 2022050207		

Sr. No.	Name of Test	Test Method	Results Obtained
1	Chloride Content in Soil %	BS 1377 (Part-3) 1990	0.0007

Note: 1) Results as shown in the report relates only to the sample/s received and tested in this laboratory. The sample is not drawn by laboratory.
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Authorised Signatory
SandipDeshpande
Technical Manager

Authorised Signatory
Dr. Yogini Deshpande
Quality Manager

TEST REPORT FOR ROCK

Client:	SEEPZ SEZ MUMBAI	Test Report No:	TC-701522000001557
Ref No.:	SEEPZ-SEZ/Estate/CFC/55/2021-22	Sample Received Date:	--
Project / Site:	GTI for Mega CFC at SEEPZ Mumbai,	Test Date:	27-05-2022
Sample	RockSample	Report Date:	07/06/2022
Description	BH-02	Type & Number of Sample:	Core & 2 No s

Sr. No.	Lab Sample Id	Piece No.	Depth (m)	Dry Density in gm/cc IS 13030: RA (2021) 1991	Porosity, % IS 13030: RA (2021) 1991	Water Absorption, % IS 1124, RA 2017: 1974	Specific Gravity IS 1122, RA 2017: 1974	Unconfined Compressive Test IS 9143:1979, RA:2021			MEPR IS: 9221, RA2021: 1979		Point Load Index Test N/mm² (*Soaked) IS 8764, RA 2019:1998	Brazilian Test IS: 10082-1981 Mpa
								Failure Load, (kN)	Cross Sectional Area, (mm²)	Unconfined Compressive Strength, Mpa	Elastic Modulus (E)*10^8, Kpa	Poisson's Ratio		
BH-02														
1	2022050211	04	7.05-8.05	1.91	22.58	11.82	2.78						0.71	
2	2022050212	09	8.05-9.05	2.72	0.89	0.33	2.81						3.49	5.20

Note: 1) Results as shown in the report relates only to the sample/s received and tested in this laboratory. The sample is not drawn by laboratory.
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Authorised Signatory
Sandip Deshpande
Technical Manager

Authorised Signatory
Dr. Yogini Deshpande
Quality Manager

TEST REPORT FOR WATER SAMPLE

To, SEEPZ SEZ MUMBAI		Date:	07-06-2022
		Test Report No:	TC-701522000001558
		Sample Received Date:	---
		Test Date:	27-05-2022
Ref No.	: SEEPZ-SEZ/Estate/CFC/55/2021-22		
Project / Site	: GTI for Mega CFC at SEEPZ Mumbai,		
Sample	: Water Sample		
Description	: BH 02		
Quantity	: 1 liter		
Condition of Sample	: Good		
Date of receipt	: -----		
Date of Testing	: 27-05-2022	Temp. in Laboratory: 25 ± 2 ºC	
Lab ID	: 2022050213		

Sr. No.	Name of Test	Test Method	Acceptable Limits	Results	Remarks
1	Volume of 0.02 normal NaOH required to neutralize 100 ml sample of water, using phenolphthalein as an indicator, ml	IS:3025(Pt. 22)-1986(R-2014)	5.0 Max.	---	---
2	Volume of 0.02 normal H2SO4 required to neutralize 100 ml sample of water, using mixed indicator, ml	IS:3025(Pt. 23)-1986(R-2014)	25.0 Max.	---	---
3	**Solid Contents, mg/l**				
	a) Organic Solids (in mg/l)	IS:3025(Pt. 18)-1984(R-2012)	200 Max	0.59	Acceptable
	b) Inorganic Solids (in mg/l)	IS:3025(Pt. 18)-1984(R-2012)	3000 Max	----	---
	c) Sulphates as SO4 (in mg/l)	IS:3025(Pt. 24)-1986(R-2014)	400 Max	34.98	Acceptable
	d) Chlorides as Cl (in mg/l)	IS:3025(Pt. 32)-1986(R-2014)	2000/500 Max. Plain Concrete/ Reinforced Concrete	5.70	Acceptable
	e) Suspended Matter (in mg/l)	IS:3025(Pt. 17)-1984(R-2012)	2000 Max	---	---
4	pH Value at 25ºC	IS:3025(Pt. 11)-1983(R-2012)	Not less than 6.0	8.10	Acceptable

Note: 1) Sample provided by Client
2) Tests conducted as per IS: 3025
3) Acceptable limit as per IS 456-2000

Note: 1) Results as shown in the report relates only to the sample/s received and tested in this laboratory.
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Authorised Signatory
SandipDeshpande
Technical Manager

Authorised Signatory
Dr. Yogini Deshpande
Quality Manager

TEST REPORT FOR SOIL

Client:	SEEPZ SEZ MUMBAI	Test Report No:	TC-701522000001559
Ref No.:	SEEPZ-SEZ/Estate/CFC/55/2021-22	Sample Received Date:	--
Project / Site:	GTI for Mega CFC at SEEPZ Mumbai,	Test Date:	28-05-2022
Sample	Soil Sample	Report Date:	07-06-2022
Description	BH 03	Type & Number of Sample:	Soil, 1 No's

Sr. No.	Lab Sample Id	Depth below EGL	Type of samples	Grain Size Particles IS 2720 (Part–4) RA 2020: 1984			Atterberg Limit IS 2720 (Part–5) RA 2020: 1985			Classification IS 1498 RA 2002: 1970	Free Swell Index (%)	Consolidation Test IS 2720 (Part–15) RA 2016: 1965		Triaxial shear test (UU) IS 2720 (Part-11), RA 2016: 1993		Direct shear test IS 2720 (Part–13) RA 2016: 1986	
				Gravel %	Sand %	Silt + Clay (%)	Liquid Limit %	Plastic Limit %	Plasticity Index %			Void Ration "e"	Compression Index "C_c"	Cohesion "C kPa"	Angle of Friction "ϕ"	Cohesion "C kPa"	Angle of Friction "ϕ"
BH - 03																	
1	2022050224	2.50-2.95	SPT	5.17	63.29	31.54	28	23	5	ML							

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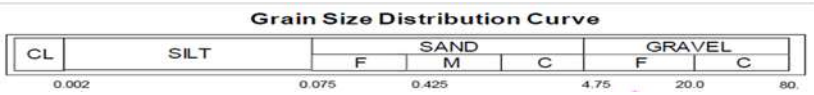
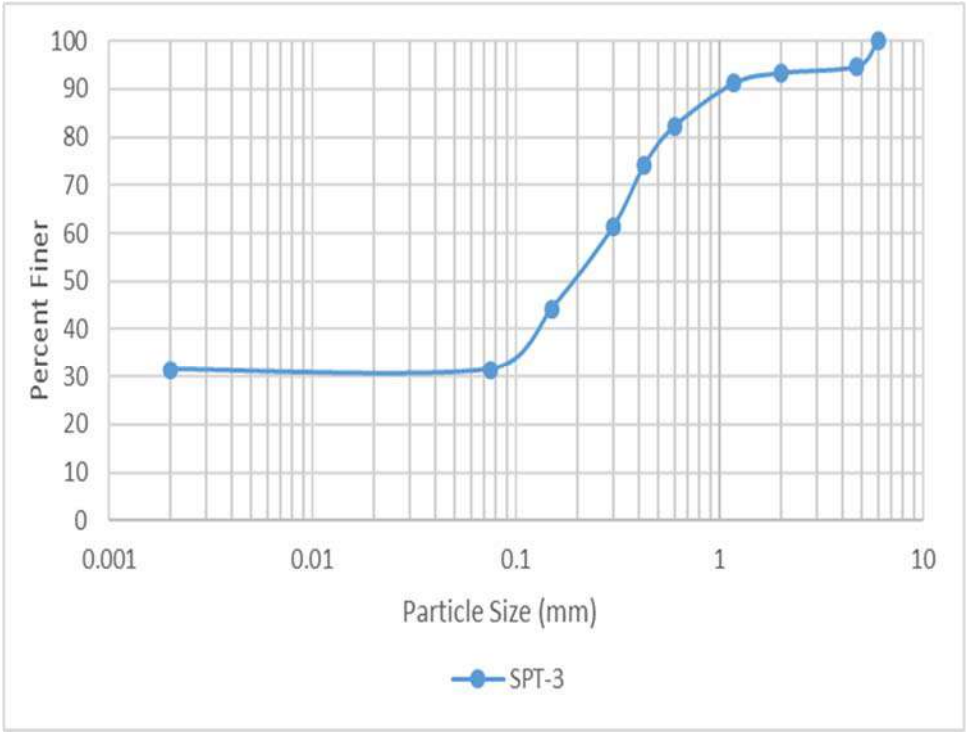
Dr. Yogini Deshpande
Quality Manager

BH 03



Type	Depth	Gravel	Sand	Silt	Clay
SPT 3	2.50-2.95	5.17	63.29	31.54	



TEST REPORT FOR SOIL

To, SEEPZ SEZ MUMBAI		Test Report No:	TC-701522000001559
		Sample Received Date:	----
		Test Date	28/05/2022
		Report Date:	07/06/2022
Ref No.	: SEEPZ-SEZ/Estate/CFC/55/2021-22		
Project / Site	: GTI for Mega CFC at SEEPZ Mumbai,		
Sample	: Soil Sample		
Description	: BH-03		
Type of Sample	: SPT-3		
Type of Test	: Chemical Analysis		
Date of receipt	: ----		
Date of Testing	: 28/05/2022		
Lab ID	: 2022050224		

Sr. No.	Name of Test	Test Method	Results Obtained
1	pH of Soil	IS 2720(Part 26) (RA: 2016) 1987	7.94
2	Soluble Sulphates in Soil %	IS 2720 (Part–27) (RA: 2020) 1977	0.085
3	Organic Impurities %	IS 2720 (Part–22) (RA: 2020) 1972	0.076

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Quality Manager

TEST REPORT FOR SOIL

To, SEEPZ SEZ MUMBAI		Test Report No:	TC-701522000001560
		Sample Received Date:	----
		Test Date	28/05/2022
		Report Date:	07/06/2022
Ref No.	: SEEPZ-SEZ/Estate/CFC/55/2021-22		
Project / Site	: Andheri, Mumbai		
Sample	: Soil Sample		
Description	: BH-03		
Type of Sample	: SPT-3		
Type of Test	: Chemical Analysis		
Date of receipt	: ----		
Date of Testing	: 28/05/2022		
Lab ID	: 2022050224		

Sr. No.	Name of Test	Test Method	Results Obtained
1	Chloride Content in Soil %	BS 1377 (Part-3) 1990	0.0014

Note: 1) Results as shown in the report relates only to the sample/s received and tested in this laboratory. The sample is not drawn by laboratory.
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Authorised Signatory
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Technical Manager

Authorised Signatory
Dr. Yogini Deshpande
Quality Manager

TEST REPORT FOR ROCK

Client:	SEEPZ SEZ MUMBAI	Test Report No:	TC-701522000001561
Ref No.:	SEEPZ-SEZ/Estate/CFC/55/2021-22	Sample Received Date:	--
Project / Site:	GTI for Mega CFC at SEEPZ Mumbai,	Test Date:	28-05-2022
Sample	RockSample	Report Date:	07-06-2022
Description	BH-03	Type & Number of Sample:	Core & 3 No s

Sr. No.	Lab Sample Id	Piece No.	Depth (m)	Dry Density in gm/cc IS 13030: RA (2021) 1991	Porosity, % IS 13030: RA (2021) 1991	Water Absorption, % IS 1124, RA 2017: 1974	Specific Gravity IS 1122, RA 2017: 1974	Unconfined Compressive Test IS 9143:1979, RA:2021			MEPR IS: 9221, RA2021: 1979		Point Load Index Test N/mm² (*Soaked) IS 8764, RA 2019:1998	Brazilian Test IS: 10082-1981 Mpa
								Failure Load, (kN)	Cross Sectional Area, (mm²)	Unconfined Compressive Strength, Mpa	Elastic Modulus (E)*10^8, Kpa	Poisson's Ratio		
BH-03														
1	2022050225	3	4.05-5.05	2.13	14.01	6.59	2.56						4.26	
2	2022050226	5	5.05-6.05	2.24	8.20	3.66	2.58						4.44	
3	2022050227	10	7.05-8.05	2.38	3.30	1.39	2.51						3.68	

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Technical Manager

Authorised Signatory
Dr. Yogini Deshpande
Quality Manager

TEST REPORT FOR WATER SAMPLE

To, SEEPZ SEZ MUMBAI		Date:	07-06-2022
		Test Report No:	TC-701522000001562
		Sample Received Date:	---
		Test Date:	28-05-2022
Ref No.	: SEEPZ-SEZ/Estate/CFC/55/2021-22		
Project / Site	: GTI for Mega CFC at SEEPZ Mumbai,		
Sample	: Water Sample		
Description	: BH 03		
Quantity	: 1 liter		
Condition of Sample	: Good		
Date of receipt	: -----		
Date of Testing	: 28-05-2022	Temp. in Laboratory: 25 ± 2 ºC	
Lab ID	: 2022050228		

Sr. No.	Name of Test	Test Method	Acceptable Limits	Results	Remarks
1	Volume of 0.02 normal NaOH required to neutralize 100 ml sample of water, using phenolphthalein as an indicator, ml	IS:3025(Pt. 22)-1986(R-2014)	5.0 Max.	---	---
2	Volume of 0.02 normal H2SO4 required to neutralize 100 ml sample of water, using mixed indicator, ml	IS:3025(Pt. 23)-1986(R-2014)	25.0 Max.	---	---
3	**Solid Contents, mg/l**				
	a) Organic Solids (in mg/l)	IS:3025(Pt. 18)-1984(R-2012)	200 Max	0.51	Acceptable
	b) Inorganic Solids (in mg/l)	IS:3025(Pt. 18)-1984(R-2012)	3000 Max	----	---
	c) Sulphates as SO4 (in mg/l)	IS:3025(Pt. 24)-1986(R-2014)	400 Max	27.98	Acceptable
	d) Chlorides as Cl (in mg/l)	IS:3025(Pt. 32)-1986(R-2014)	2000/500 Max. Plain Concrete/ Reinforced Concrete	4.75	Acceptable
	e) Suspended Matter (in mg/l)	IS:3025(Pt. 17)-1984(R-2012)	2000 Max	---	---
4	pH Value at 25ºC	IS:3025(Pt. 11)-1983(R-2012)	Not less than 6.0	7.80	Acceptable

Note: 1) Sample provided by Client
2) Tests conducted as per IS: 3025
3) Acceptable limit as per IS 456-2000

Note: 1) Results as shown in the report relates only to the sample/s received and tested in this laboratory.
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Authorised Signatory
SandipDeshpande
Technical Manager

Authorised Signatory
Dr. Yogini Deshpande
Quality Manager

TEST REPORT FOR ROCK

Client:	SEEPZ SEZ MUMBAI	Test Report No:	TC-701522000001563
Ref No.:	SEEPZ-SEZ/Estate/CFC/55/2021-22	Sample Received Date:	--
Project / Site:	GTI for Mega CFC at SEEPZ Mumbai,	Test Date:	28-05-2022
Sample	RockSample	Report Date:	07-06-2022
Description	BH-04	Type & Number of Sample:	Core & 5 No s

Sr. No.	Lab Sample Id	Piece No.	Depth (m)	Dry Density in gm/cc IS 13030: RA (2021) 1991	Porosity, % IS 13030: RA (2021) 1991	Water Absorption, % IS 1124, RA 2017: 1974	Specific Gravity IS 1122, RA 2017: 1974	Unconfined Compressive Test IS 9143:1979, RA:2021			MEPR IS: 9221, RA2021: 1979		Point Load Index Test N/mm² (*Soaked) IS 8764, RA 2019:1998	Brazilian Test IS: 10082-1981 Mpa
								Failure Load, (kN)	Cross Sectional Area, (mm²)	Unconfined Compressive Strength, Mpa	Elastic Modulus (E)*10^8, Kpa	Poisson's Ratio		
BH-04														
1	2022050230	3	3.07-4.07	2.33	4.62	1.98	2.71	130.7	2343.90	55.76	0.61	0.27		
2	2022050231	11	4.07-5.07	2.36	6.20	2.63	2.69	48.7	2361.10	20.63	0.66	0.28		
3	2022050232	18	5.07-6.07	2.25	7.79	3.47	2.63						5.97	
4	2022050233	24	7.07-8.07	2.17	9.85	4.55	2.65						0.70	
5	2022050234	34	9.07-10.07	2.11	7.02	3.33	2.68						4.37	

Note: 1) Results as shown in the report relates only to the sample/s received and tested in this laboratory. The sample is not drawn by laboratory.
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Technical Manager

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Dr. Yogini Deshpande
Quality Manager

Renuka Consultants

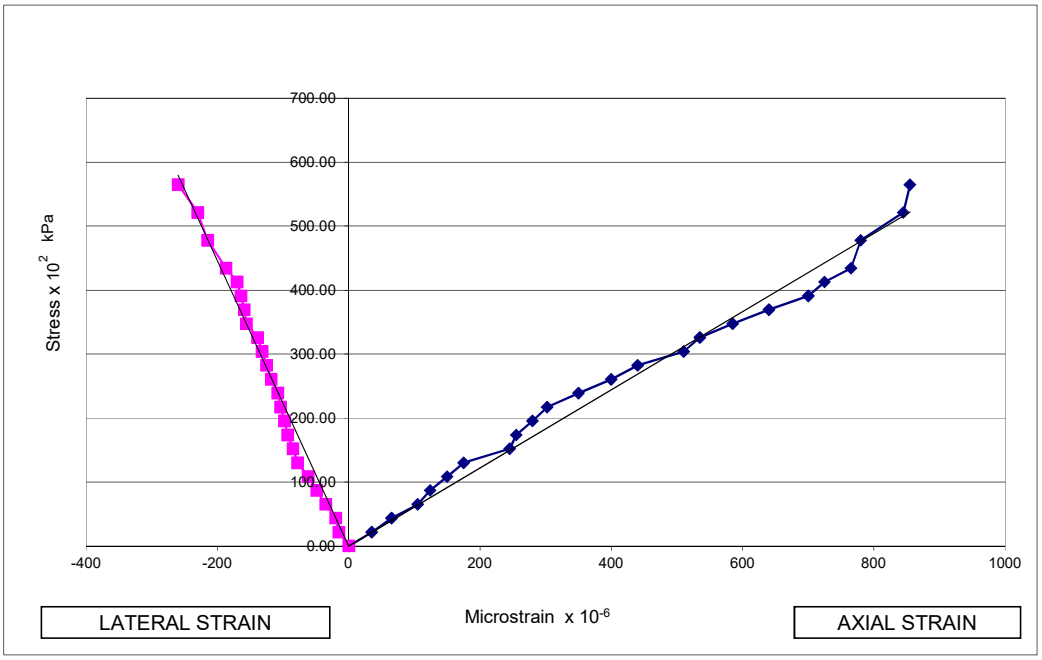
• GEOTECHNICAL SERVICES • STRUCTURAL SERVICES • MATERIAL ASSESSMENT

Modulus of Elasticity and Poisson's Ratio

IS: 9221

Report No-	TC-701522000001563	Date of report	07-06-2022
Name of Project:	GTI for Mega CFC at SEEPZ Mumbai		
Name of client :	SEEPZ SEZ MUMBAI		
Sample sent by:	Renuka Consultants	BH.NO:	BH-04
Sample ID	2022050230		
Date of sample Received:	-	Depth (m):	3.07-4.07
Type of Sample:	ROCK	P.No:	3
Condition of Sample on Receipt:	Satisfactory	Diamter of Sample(cm):	5.47
Lithology of sample:	Light yellowish, fine grain, slightly weathered BASALT.	Area (cm^2):	23.07
Date of Testing:	28/05/2022	Length of Sample(cm):	12.16

Stress x 10^2 kPa	Axial Strain x 10^{-6}	Lateral Strain x 10^{-6}
0.00	0	0
21.72	35	15
43.45	65	20
65.17	105	35
86.89	124	49
108.61	175	62



Modulus of Elasticity (kPa): 0.61×10^8 Poisson's Ratio : 0.27

Note: 1) Results as shown in the report relates only to the sample/s received and tested in this laboratory.
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For RENUKA CONSULTANTS **TECHNICAL MANAGER**

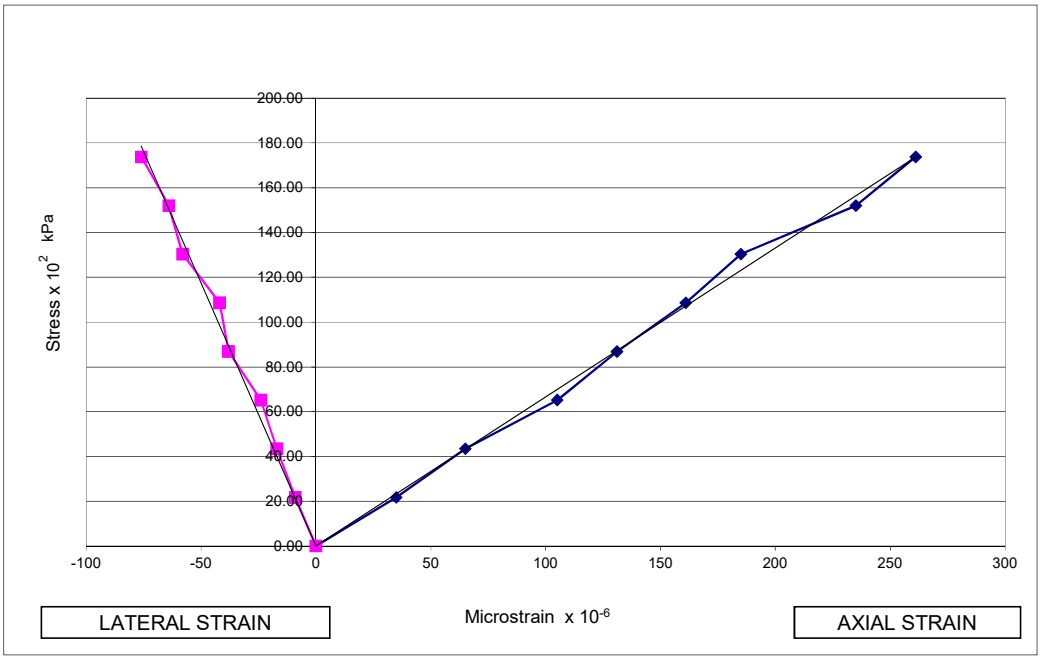
Plot no. L-139, Taloja, MIDC, Panvel,Dist. Raigad – 410208. Maharashtra.
Email: info@renukac.com Mb no. +91- 8657522702, 9372278261.

Modulus of Elasticity and Poisson's Ratio

IS: 9221

Report No-	TC-701522000001563	Date of report	07-06-2022
Name of Project:	GTI for Mega CFC at SEEPZ Mumbai		
Name of client :	SEEPZ SEZ MUMBAI		
Sample sent by:	Renuka Consultants	BH.NO:	BH-04
Sample ID	2022050231		
Date of sample Received:	-	Depth (m):	4.07-5.07
Type of Sample:	ROCK	P.No:	11
Condition of Sample on Receipt:	Satisfactory	Diamter of Sample(cm):	5.47
Lithology of sample:	Light yellowish, fine grain, slightly weathered BASALT.	Area (cm^2):	23.07
Date of Testing:	28/05/2022	Length of Sample(cm):	12.11

Stress x 10^2 kPa	Axial Strain x 10^{-6}	Lateral Strain x 10^{-6}
0.00	0	0
21.72	35	9
43.45	65	17
65.17	105	24
86.89	131	38
108.61	185	42



Modulus of Elasticity (kPa): 0.66×10^8 Poisson's Ratio : 0.28

Note: 1) Results as shown in the report relates only to the sample/s received and tested in this laboratory.
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For RENUKA CONSULTANTS **TECHNICAL MANAGER**

Plot no. L-139, Taloja, MIDC, Panvel,Dist. Raigad – 410208. Maharashtra.
Email: info@renukac.com Mb no. +91- 8657522702, 9372278261.

TEST REPORT FOR WATER SAMPLE

To, SEEPZ SEZ MUMBAI		Date:	07-06-2022
		Test Report No:	TC-701522000001564
		Sample Received Date:	---
		Test Date:	28-05-2022
Ref No.	: SEEPZ-SEZ/Estate/CFC/55/2021-22		
Project / Site	: GTI for Mega CFC at SEEPZ Mumbai,		
Sample	: Water Sample		
Description	: BH 04		
Quantity	: 1 liter		
Condition of Sample	: Good		
Date of receipt	: -----		
Date of Testing	: 28-05-2022	Temp. in Laboratory: 25 ± 2 ºC	
Lab ID	: 2022050235		

Sr. No.	Name of Test	Test Method	Acceptable Limits	Results	Remarks
1	Volume of 0.02 normal NaOH required to neutralize 100 ml sample of water, using phenolphthalein as an indicator, ml	IS:3025(Pt. 22)-1986(R-2014)	5.0 Max.	---	---
2	Volume of 0.02 normal H2SO4 required to neutralize 100 ml sample of water, using mixed indicator, ml	IS:3025(Pt. 23)-1986(R-2014)	25.0 Max.	---	---
3	**Solid Contents, mg/l**				
	a) Organic Solids (in mg/l)	IS:3025(Pt. 18)-1984(R-2012)	200 Max	0.63	Acceptable
	b) Inorganic Solids (in mg/l)	IS:3025(Pt. 18)-1984(R-2012)	3000 Max	6.93	---
	c) Sulphates as SO4 (in mg/l)	IS:3025(Pt. 24)-1986(R-2014)	400 Max	23.45	Acceptable
	d) Chlorides as Cl (in mg/l)	IS:3025(Pt. 32)-1986(R-2014)	2000/500 Max. Plain Concrete/ Reinforced Concrete	5.22	Acceptable
	e) Suspended Matter (in mg/l)	IS:3025(Pt. 17)-1984(R-2012)	2000 Max	---	---
4	pH Value at 25ºC	IS:3025(Pt. 11)-1983(R-2012)	Not less than 6.0	8.12	Acceptable

Note: 1) Sample provided by Client
2) Tests conducted as per IS: 3025
3) Acceptable limit as per IS 456-2000

Note: 1) Results as shown in the report relates only to the sample/s received and tested in this laboratory.
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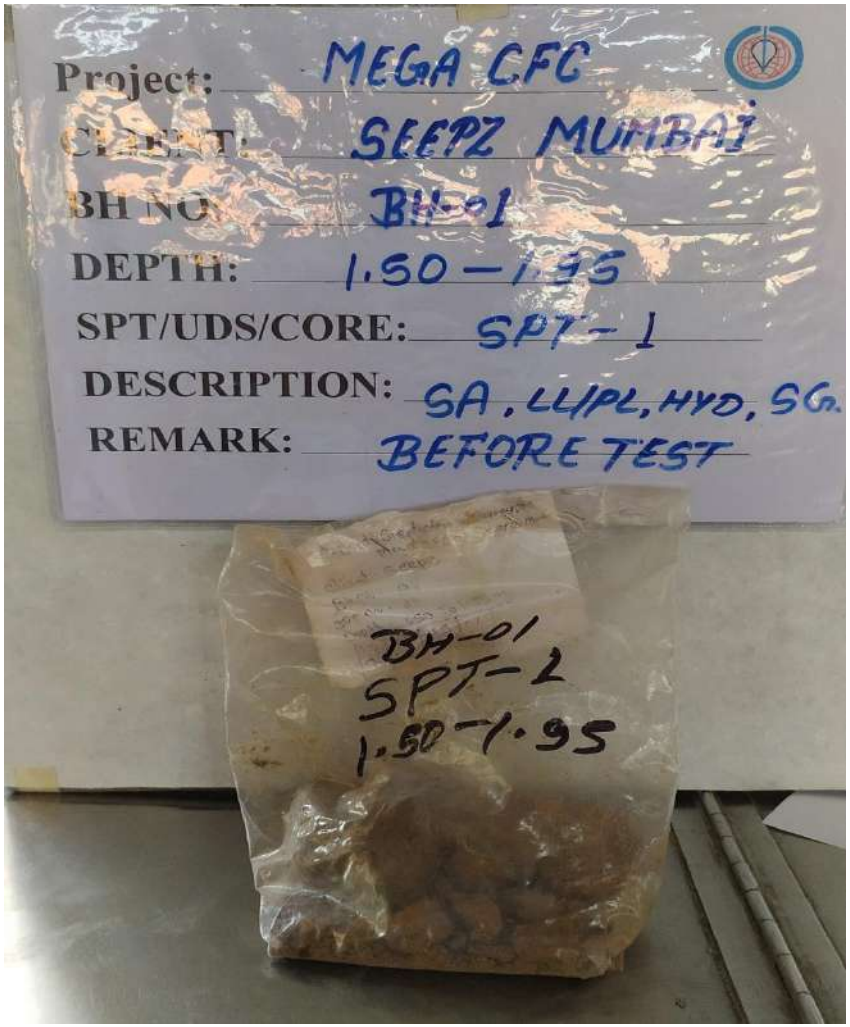
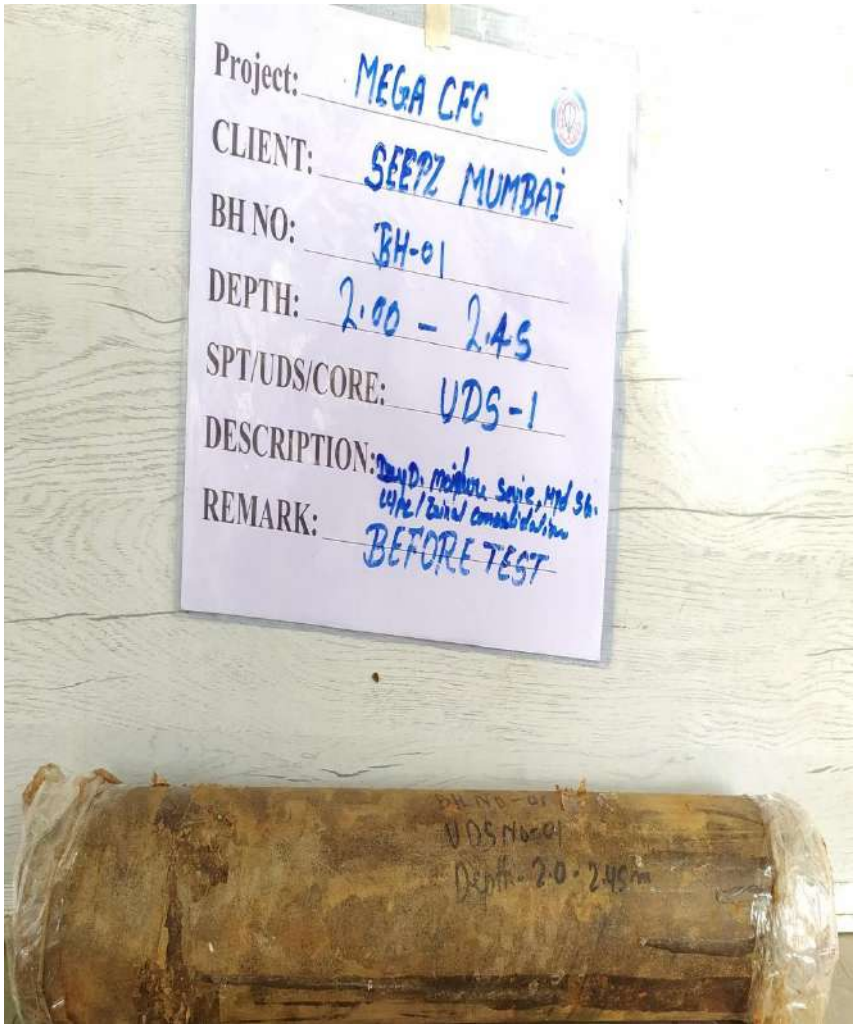
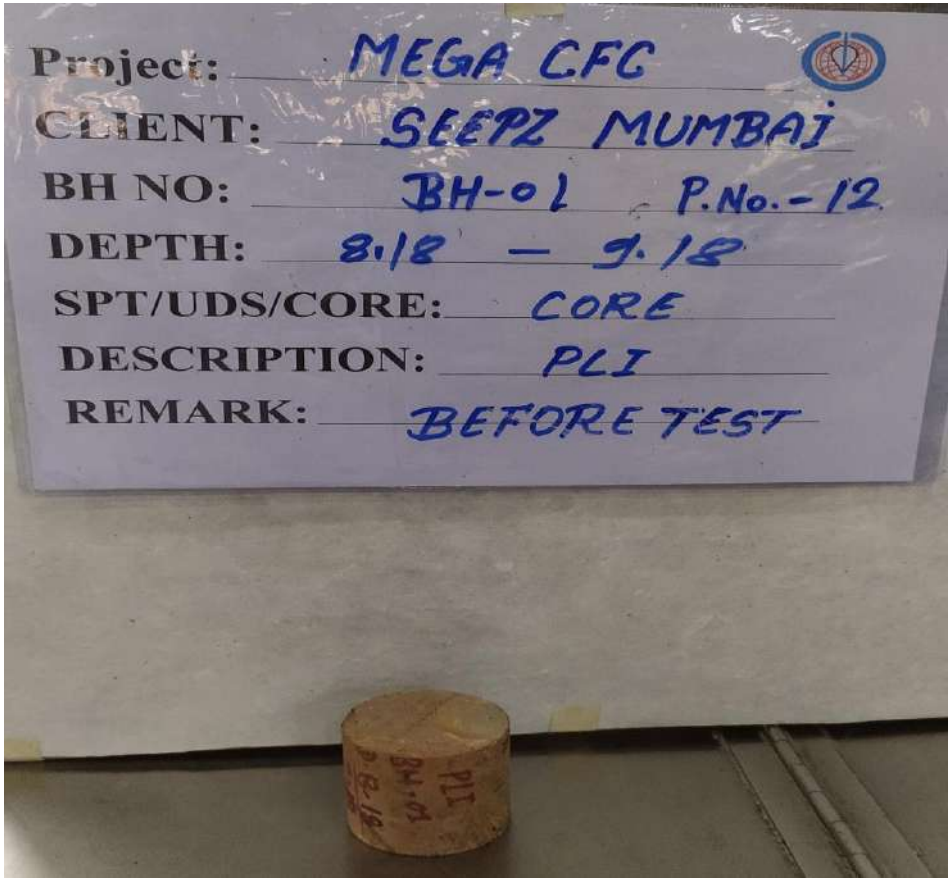
Authorised Signatory
SandipDeshpande
Technical Manager

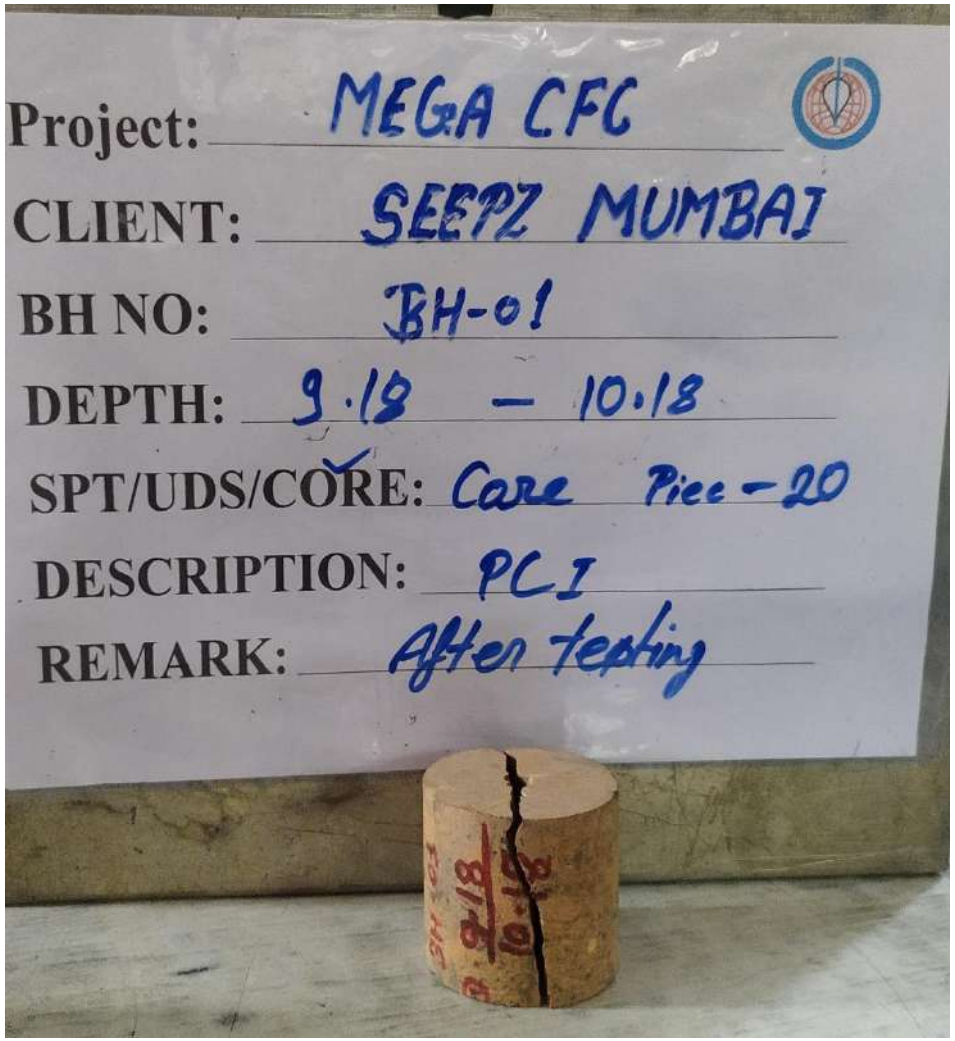
Authorised Signatory
Dr. Yogini Deshpande
Quality Manager

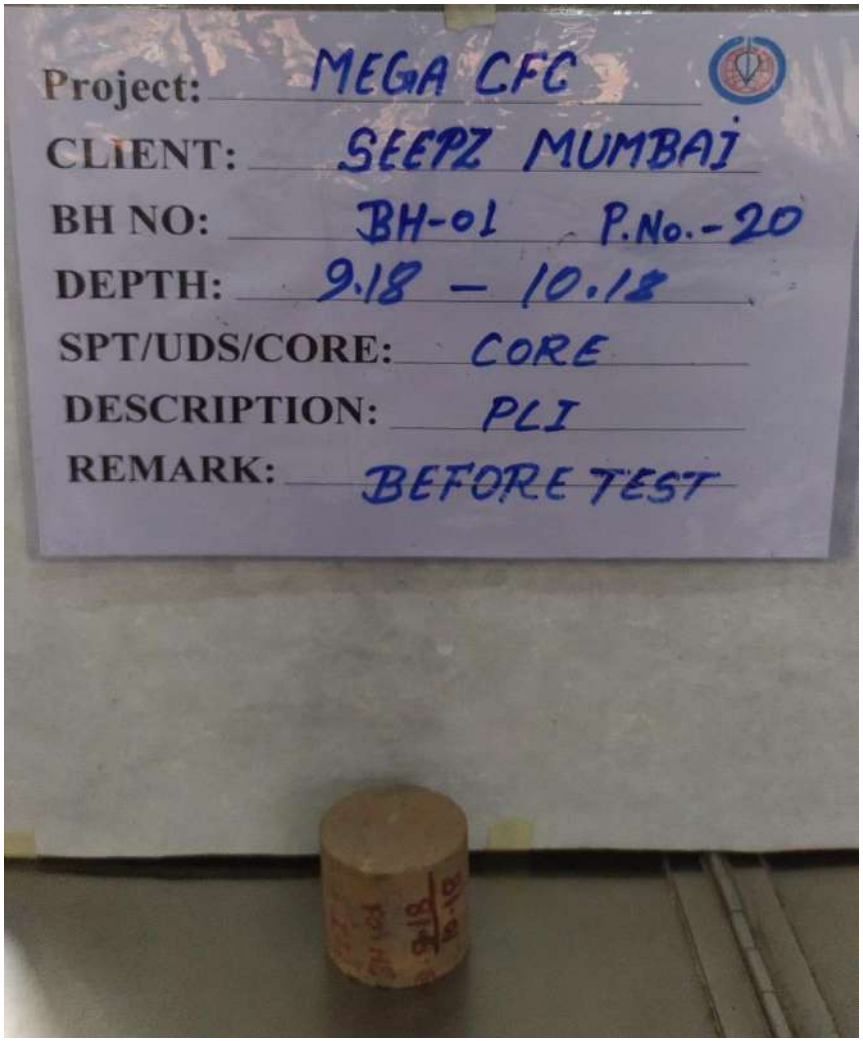

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-01
DEPTH: 1.50 – 1.95
SPT/UDS/CORE: SPT – 1
DESCRIPTION: SA, LL/PL, HYD, SG.
REMARK: BEFORE TEST
BH-01
SPT-1
1.50-1.95

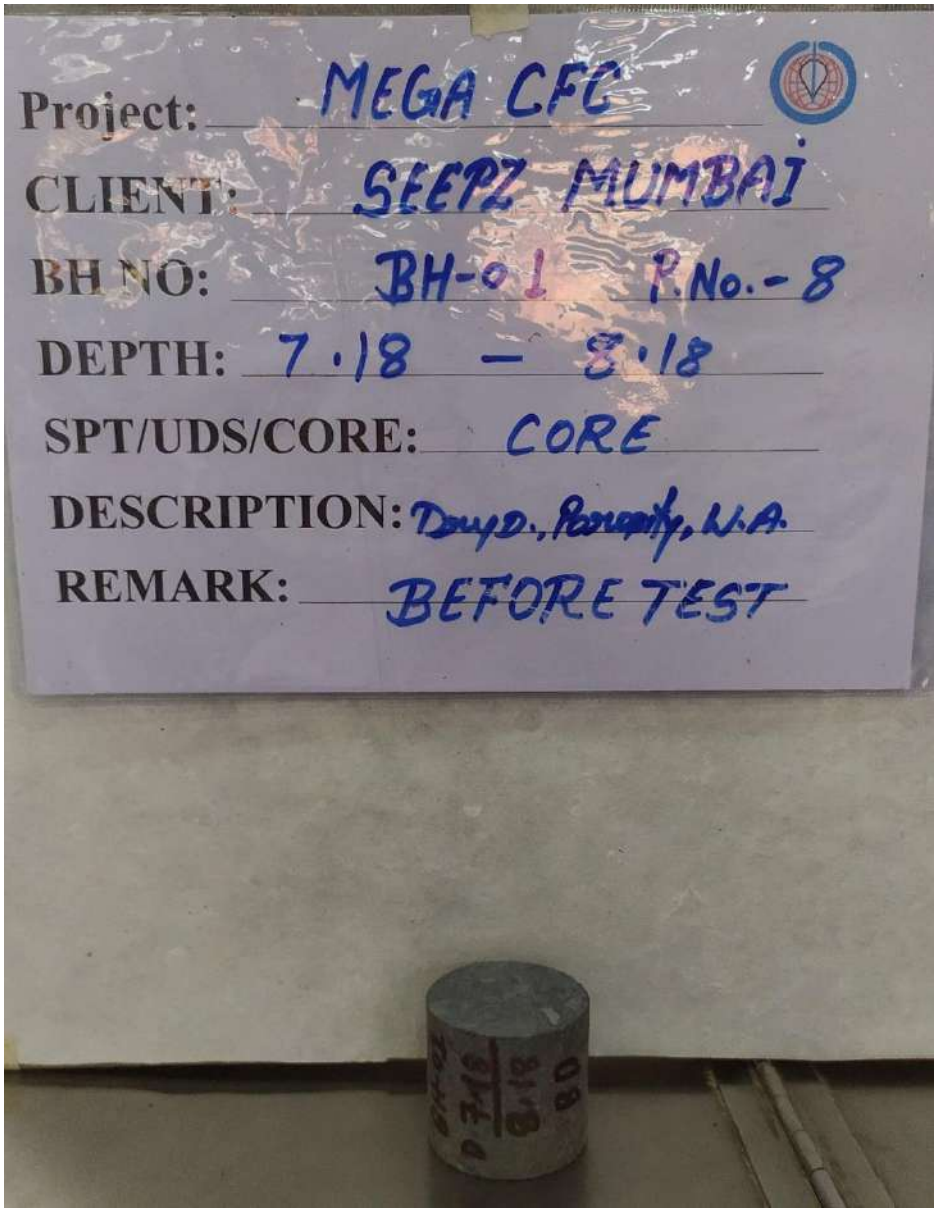

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-01
DEPTH: 2.00 – 2.45
SPT/UDS/CORE: UDS-1
DESCRIPTION:
REMARK: BEFORE TEST
UDS No-01
Depth-2.0-2.45m

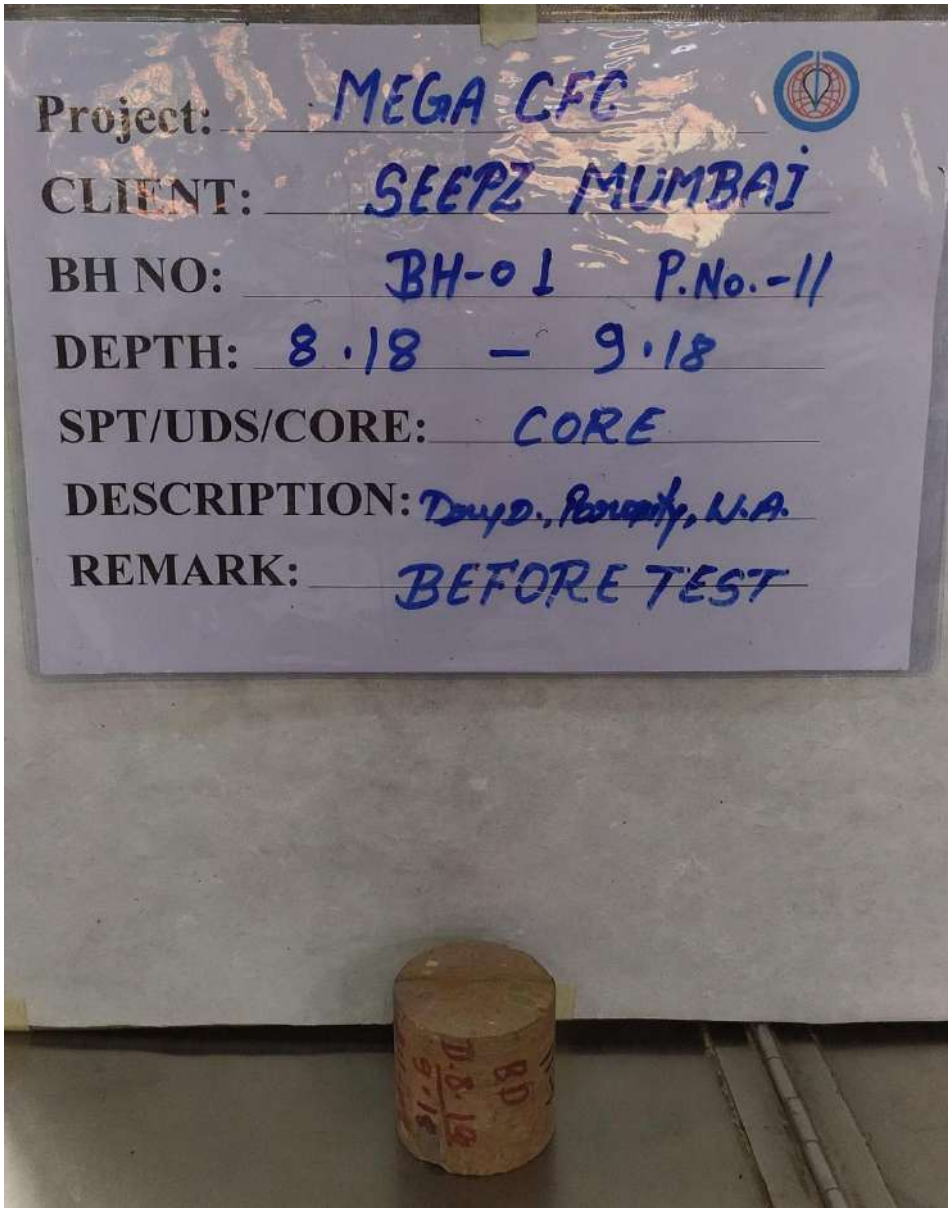

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-01 P.No.-12
DEPTH: 8.18 – 9.18
SPT/UDS/CORE: CORE
DESCRIPTION: PLI
REMARK: BEFORE TEST
PLI
BH-01

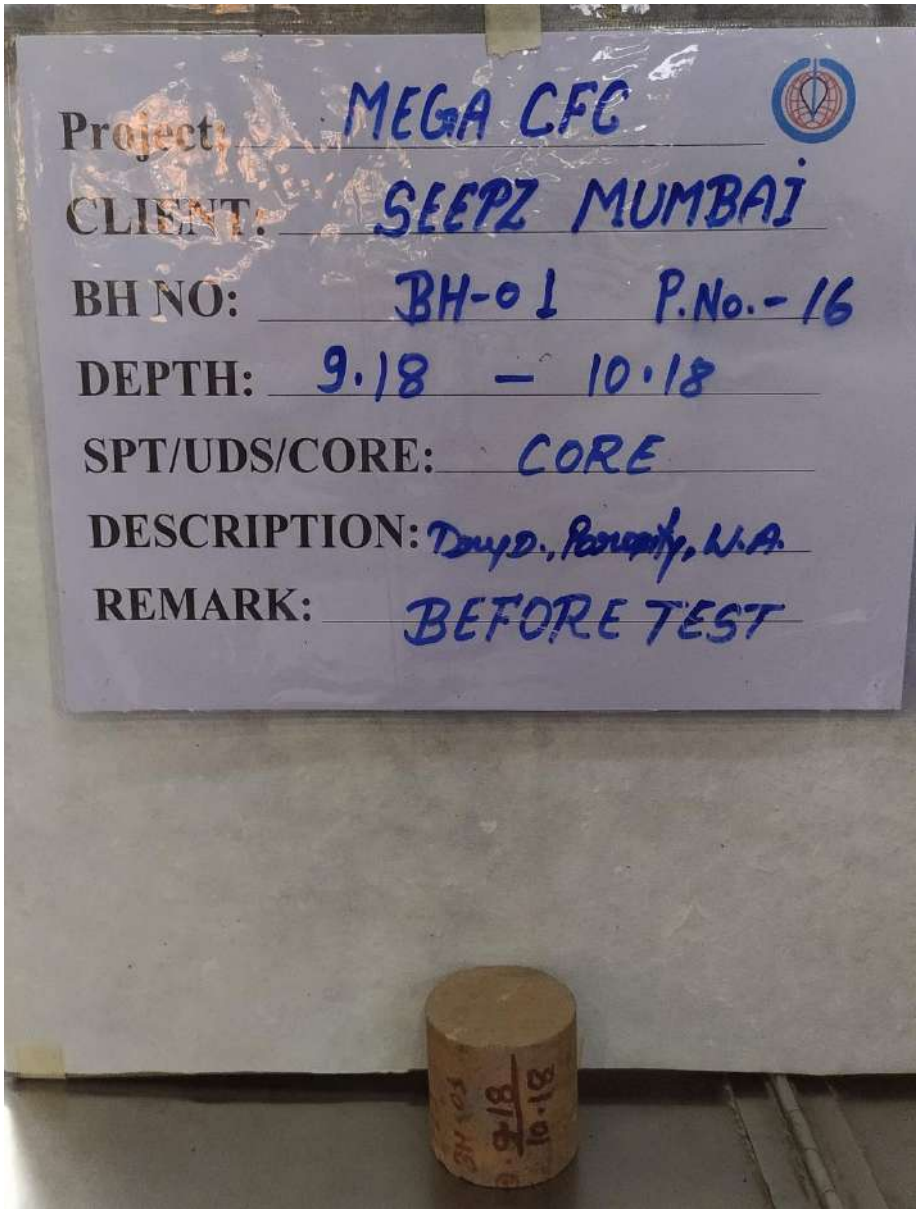

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-01
DEPTH: 8.18 – 9.18
SPT/UDS/CORE: Core Piec-12
DESCRIPTION: PLI
REMARK: After testing
PLI
BH-01

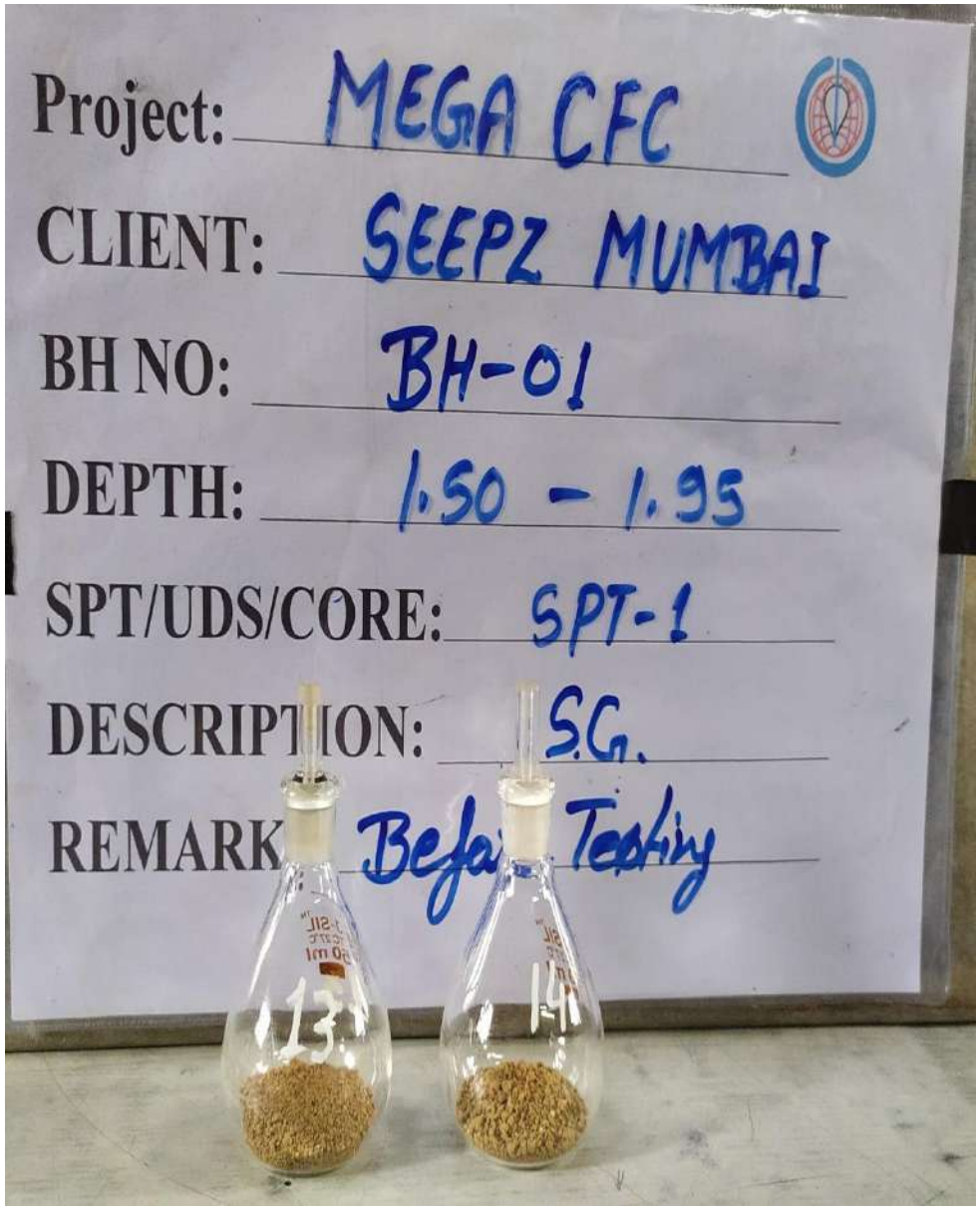

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-01
DEPTH: 9.18 – 10.18
SPT/UDS/CORE: Core Piece – 20
DESCRIPTION: PCI
REMARK: After testing


Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-01 P.No.-20
DEPTH: 9.18 – 10.18
SPT/UDS/CORE: CORE
DESCRIPTION: PCI
REMARK: BEFORE TEST


Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-01 P.No.-8
DEPTH: 7.18 – 8.18
SPT/UDS/CORE: CORE
DESCRIPTION: Dry D., Porosity, V.A.
REMARK: BEFORE TEST


Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-01 P.No.-11
DEPTH: 8.18 – 9.18
SPT/UDS/CORE: CORE
DESCRIPTION: Dry D., Porosity, V.A.
REMARK: BEFORE TEST

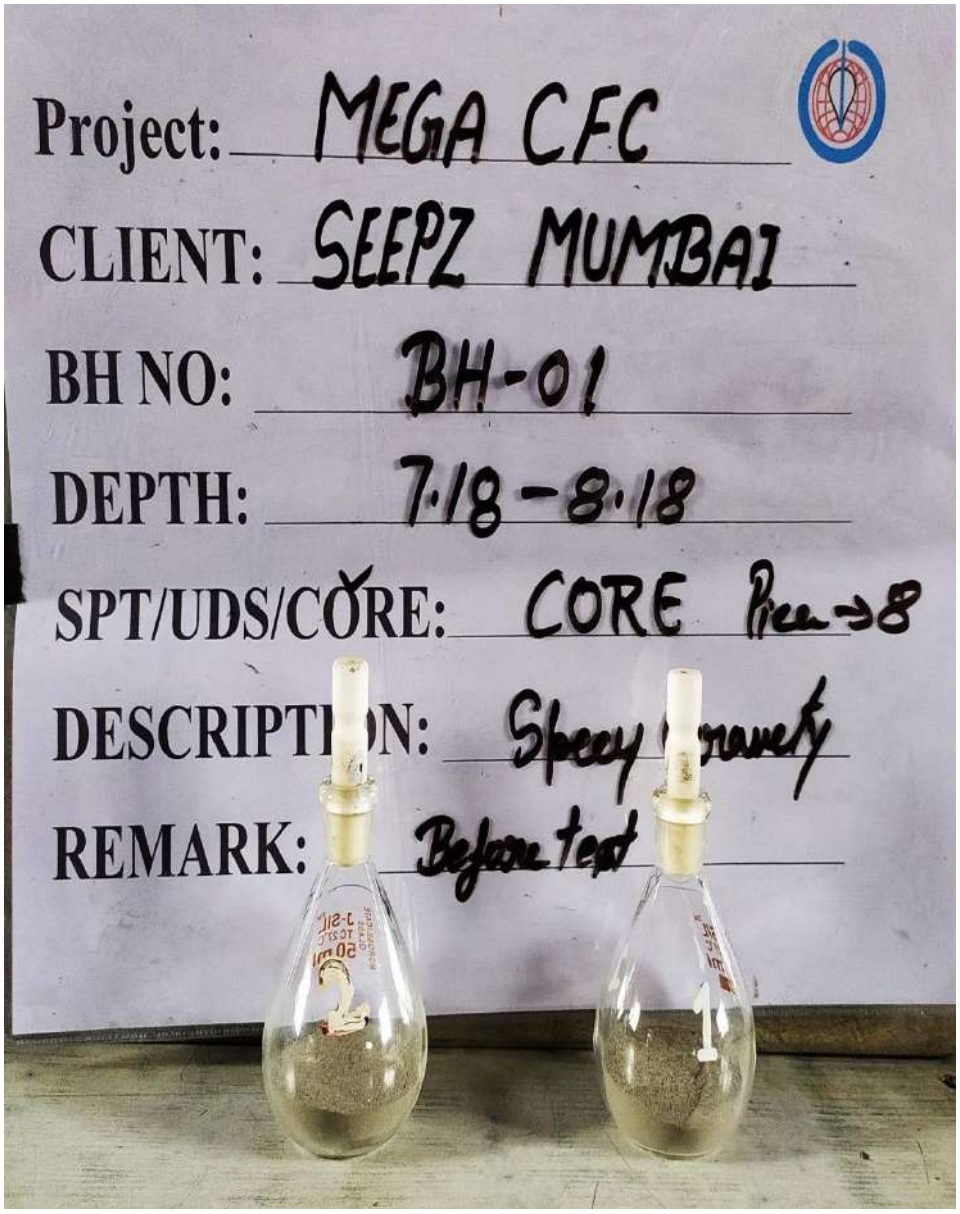

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-01 P.No.-16
DEPTH: 9.18 – 10.18
SPT/UDS/CORE: CORE
DESCRIPTION: Dry D., Porosity, V.A.
REMARK: BEFORE TEST

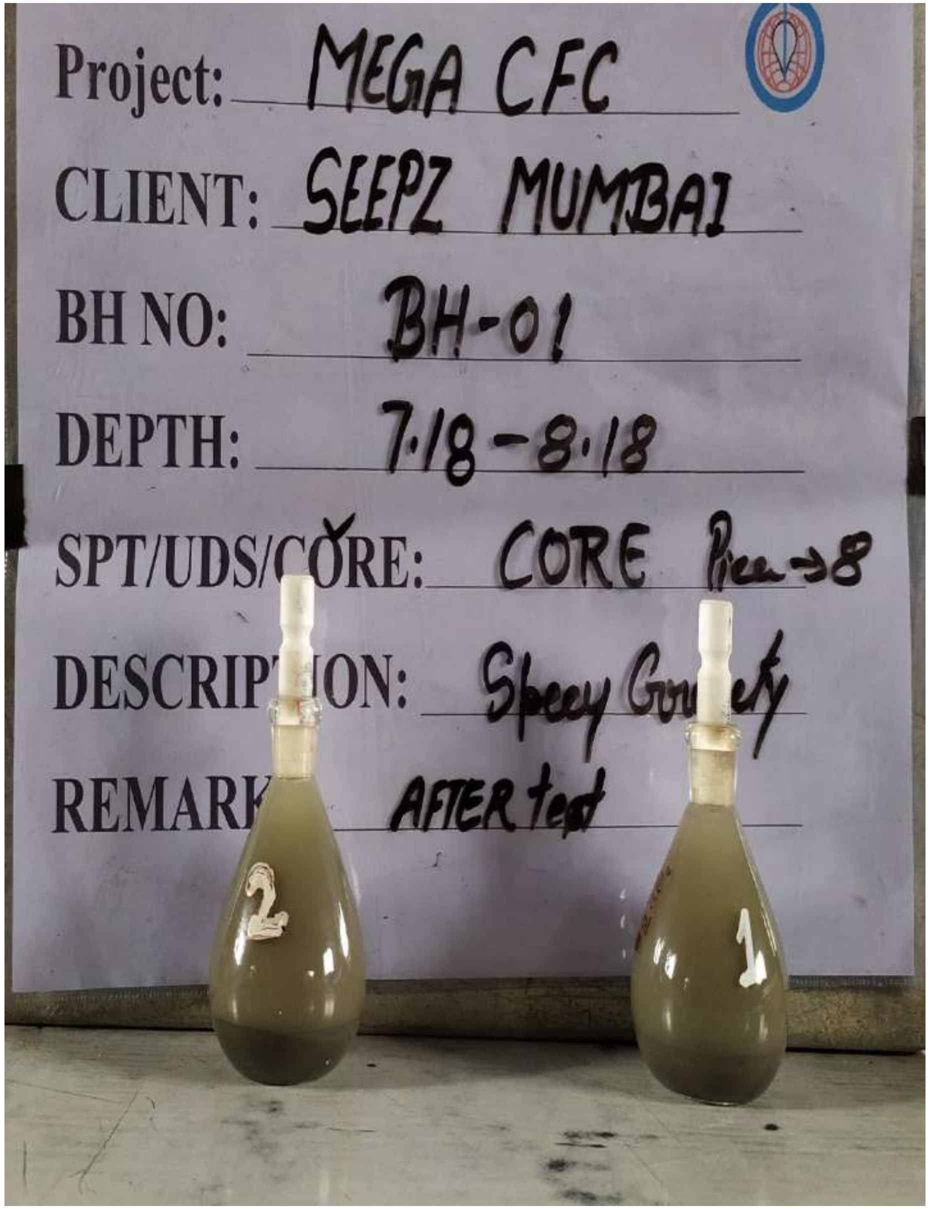

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-01
DEPTH: 1.50 – 1.95
SPT/UDS/CORE: SPT-1
DESCRIPTION: S.G.
REMARK: Before Testing
13
14

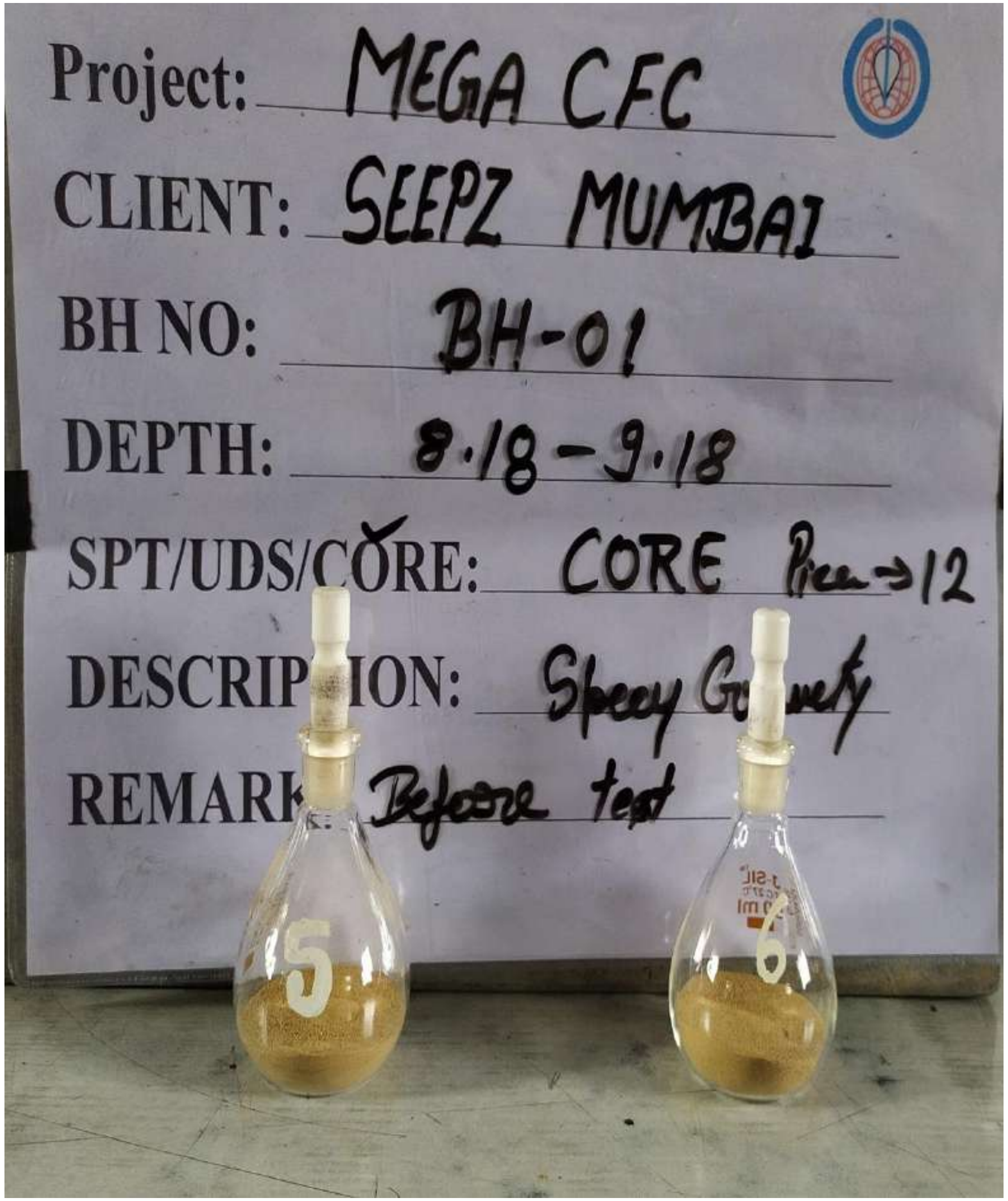

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-01
DEPTH: 1.50 - 1.95
SPT/UDS/CORE: SPT-1
DESCRIPTION: S.G.
REMARK:
13
14


Project: MEGA CF
CLIENT: SEEPZ MUMBAI
BH NO: BH- 01
DEPTH: 2.00 - 2.45
SPT/UDS/CORE: UDS-1
DESCRIPTION: S.G.
REMARK:
14
13

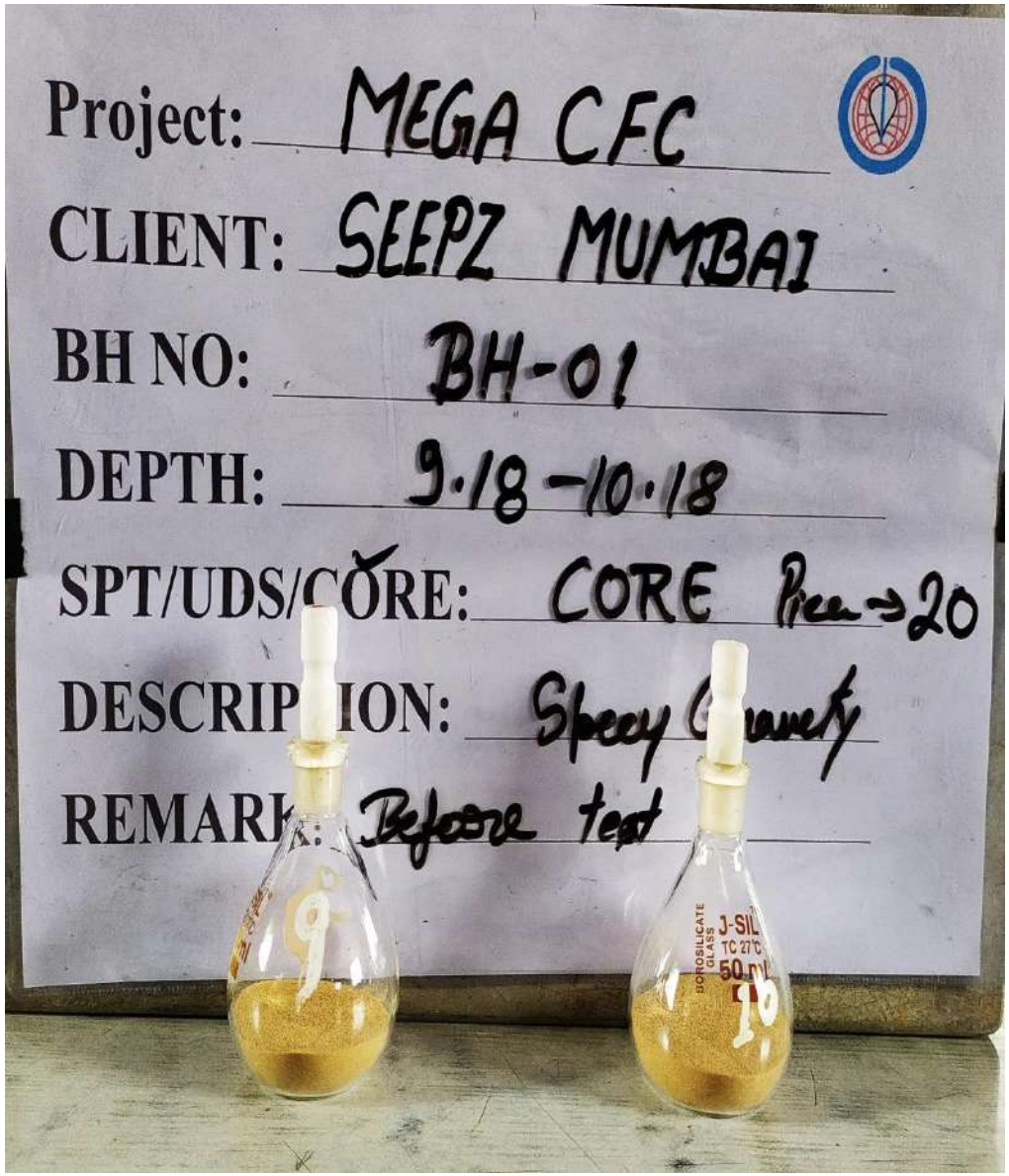

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-01
DEPTH: 2.00 - 2.45
SPT/UDS/CORE: UDS-1
DESCRIPTION: specific gravity
REMARK:
14
13
50 ml

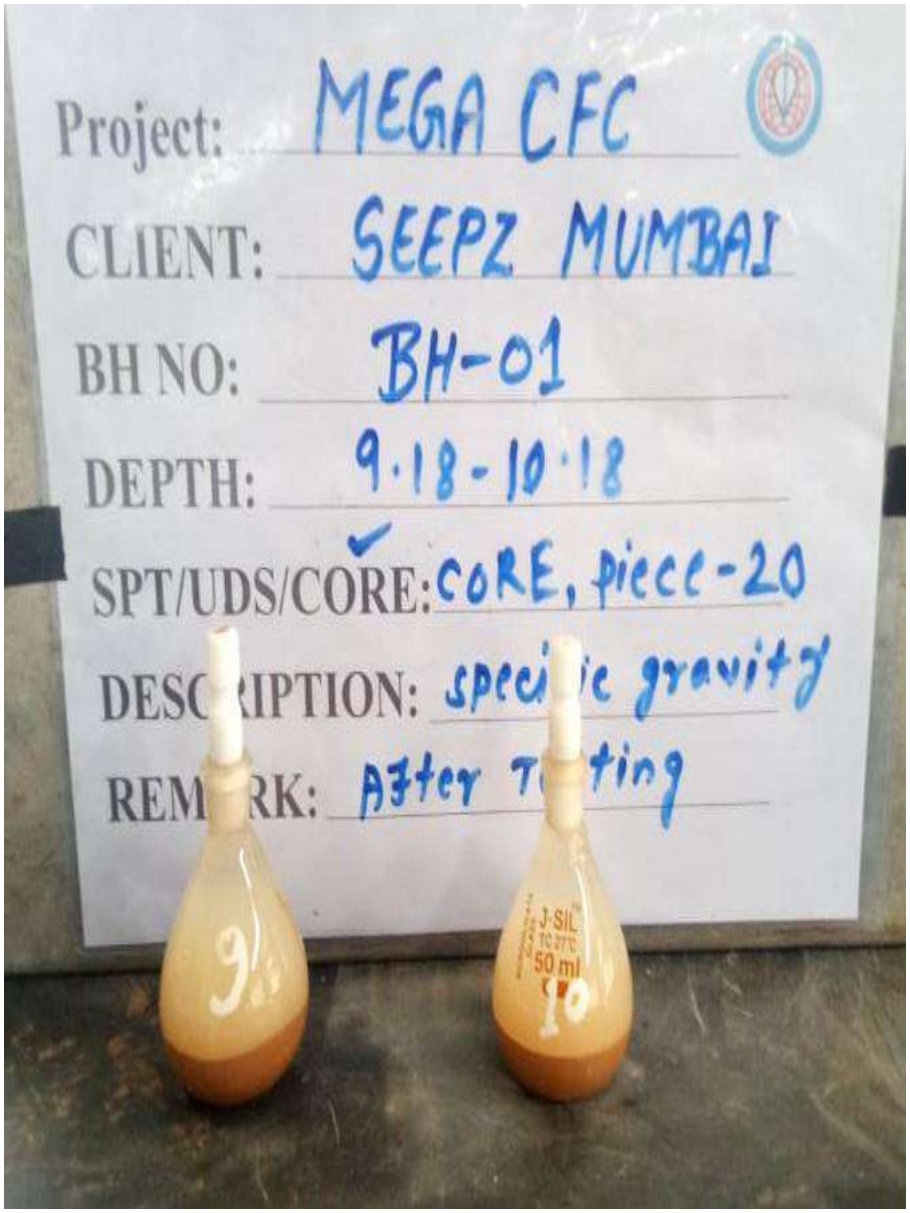

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-01
DEPTH: 7.18 - 8.18
SPT/UDS/CORE: CORE
DESCRIPTION:
REMARK: Before test
2
1

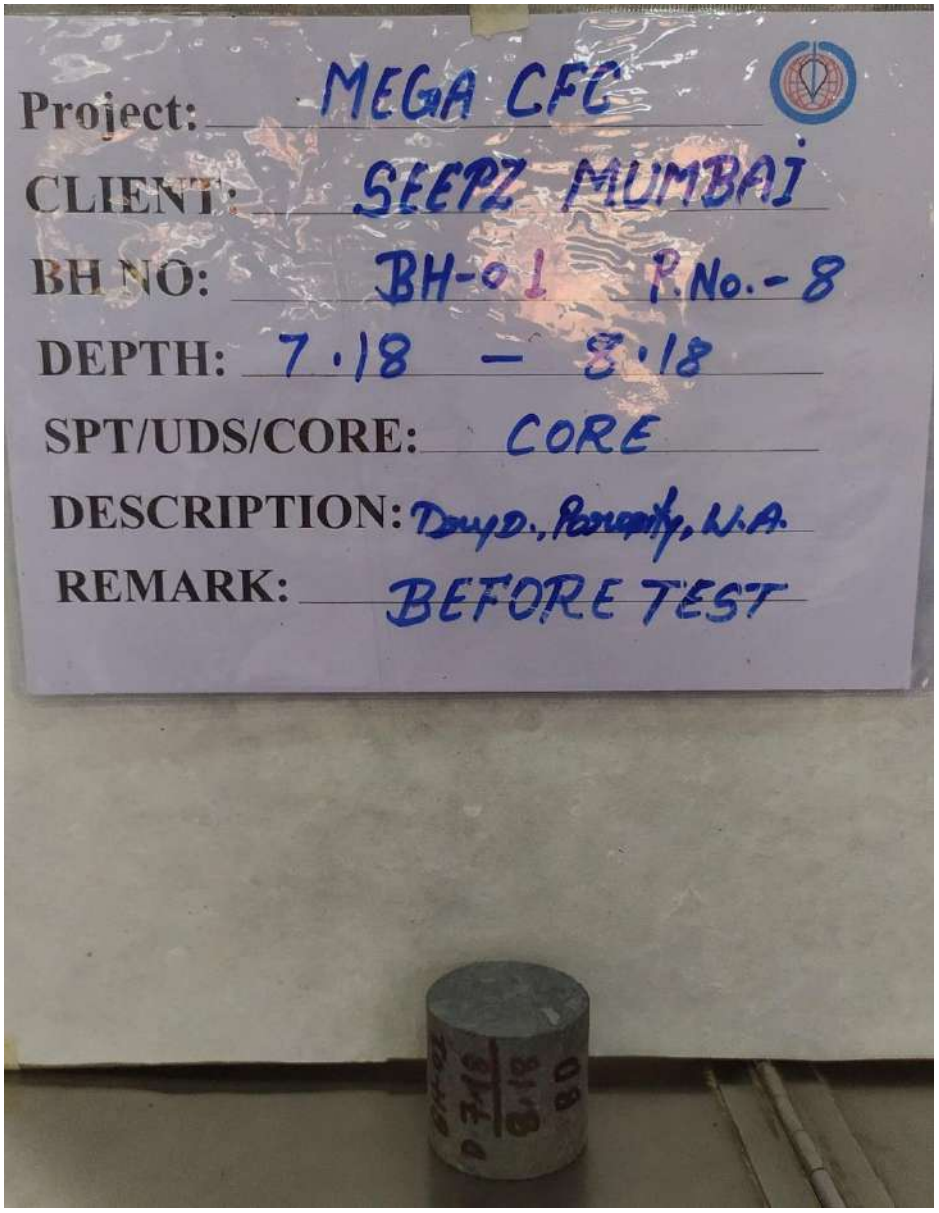

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-01
DEPTH: 7.18-8.18
SPT/UDS/CORE: CORE Piece→8
REMARK AFTER test
2
1

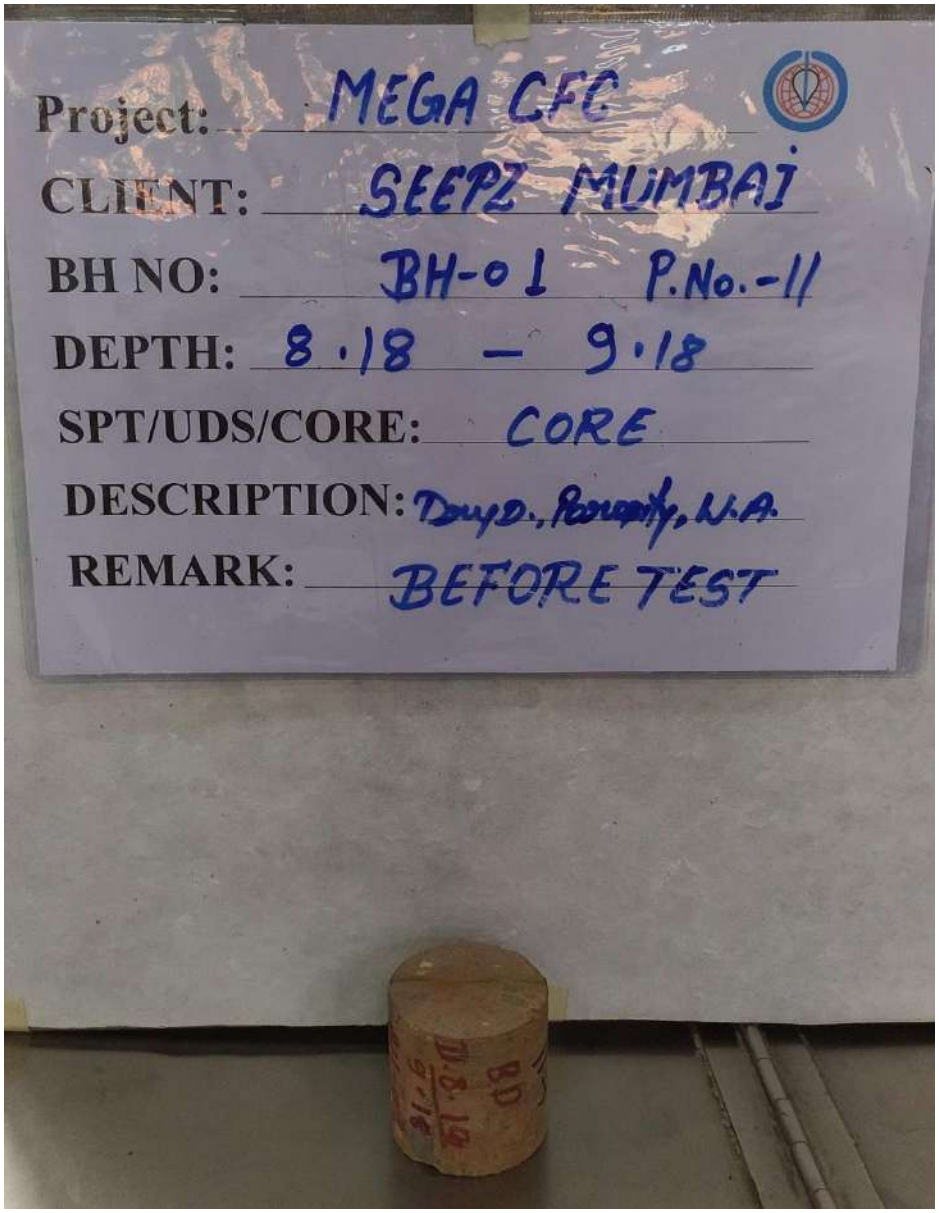

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-01
DEPTH: 8.18-9.18
SPT/UDS/CORE: CORE Piece→12
REMARK Before test
5
6

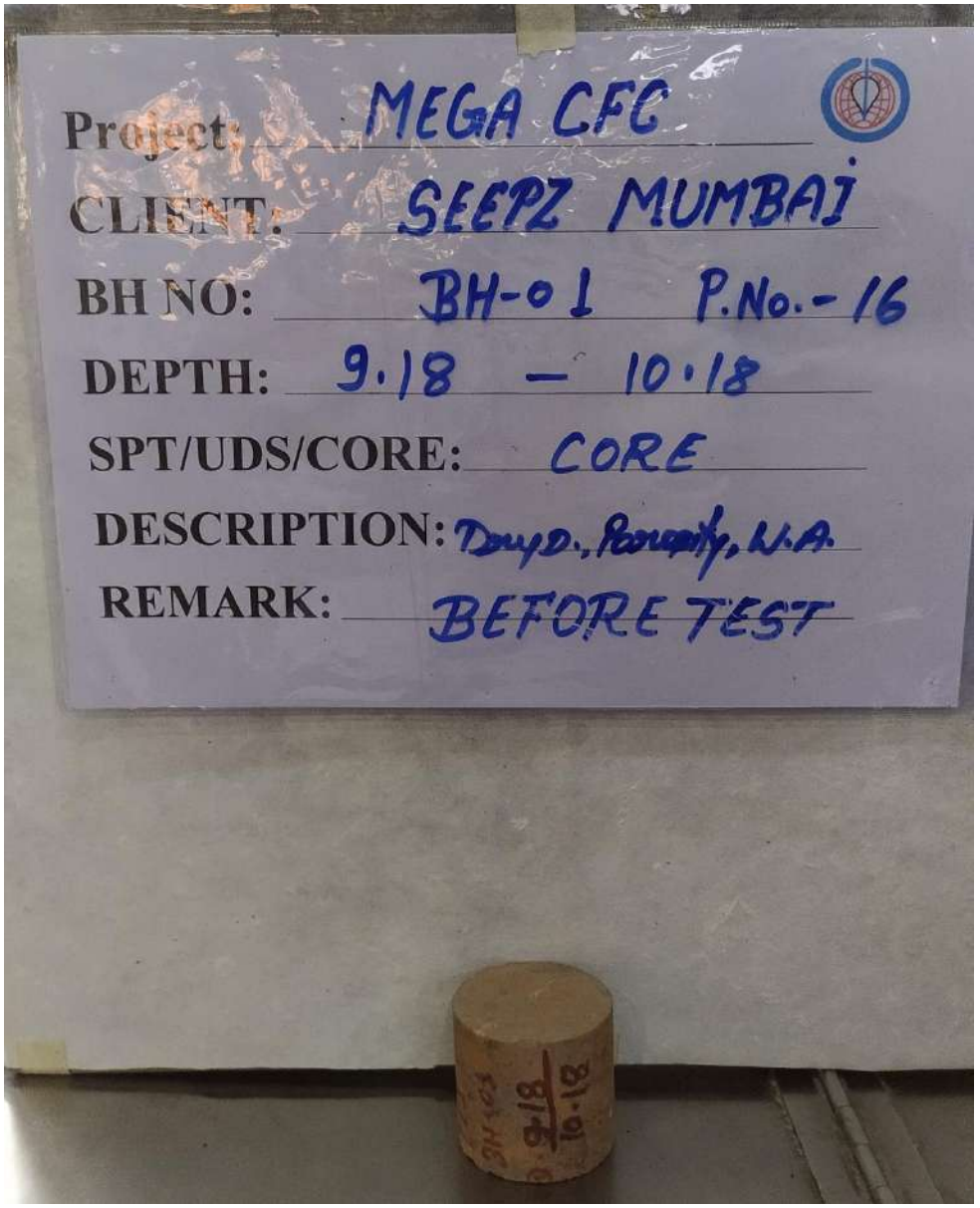

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-01
DEPTH: 8.18-9.18
SPT/UDS/CORE: CORE, piece-12
DESCRIPTION: specific gravity
REMARK: After testi
5
6

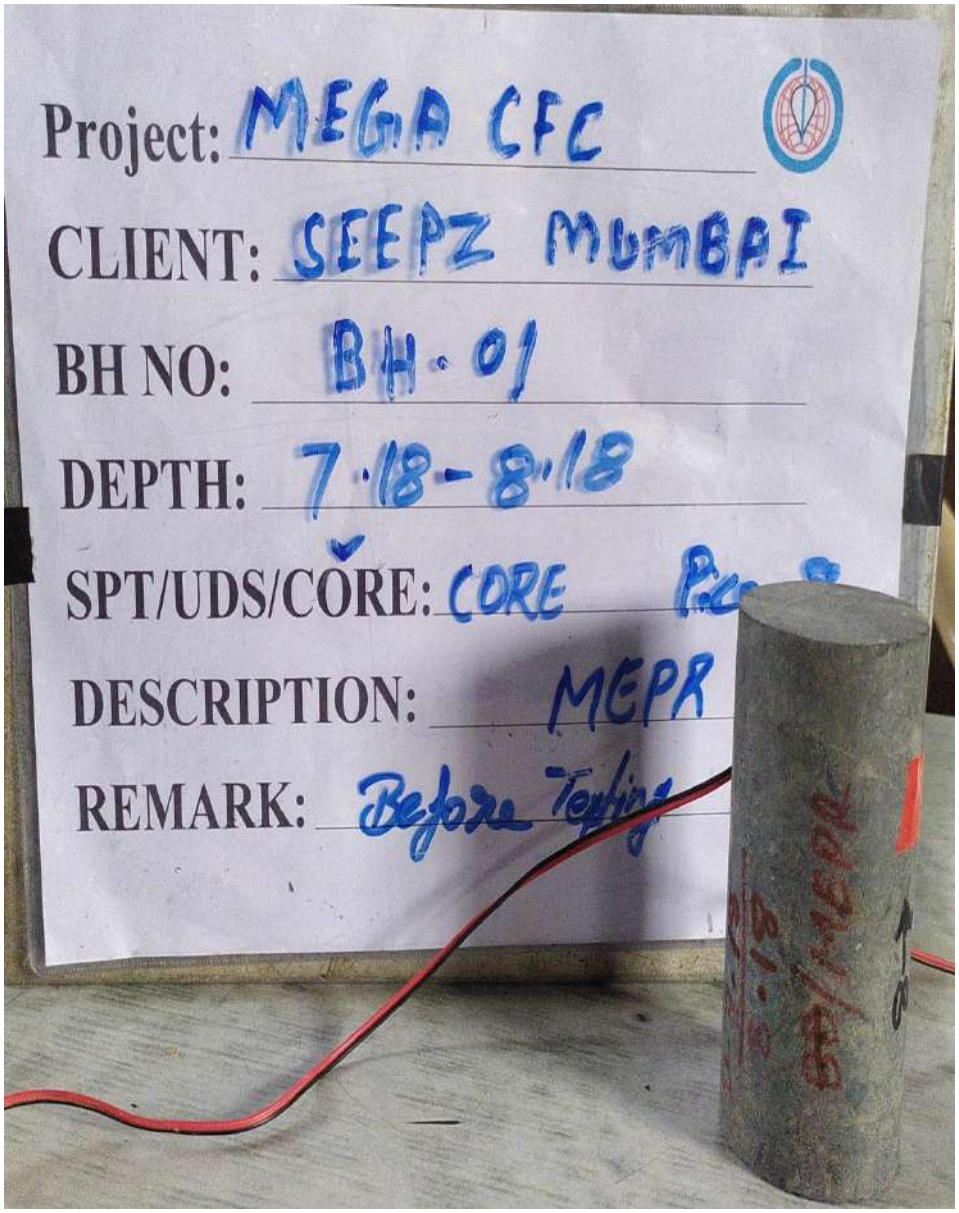

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-01
DEPTH: 9.18-10.18
SPT/UDS/CORE: CORE Piece→20
DESCRIPTION: Specy Gravity
REMARK: Before test
9
10
BOROSILICATE GLASS
J-SIL
TC 27°C
50 mL

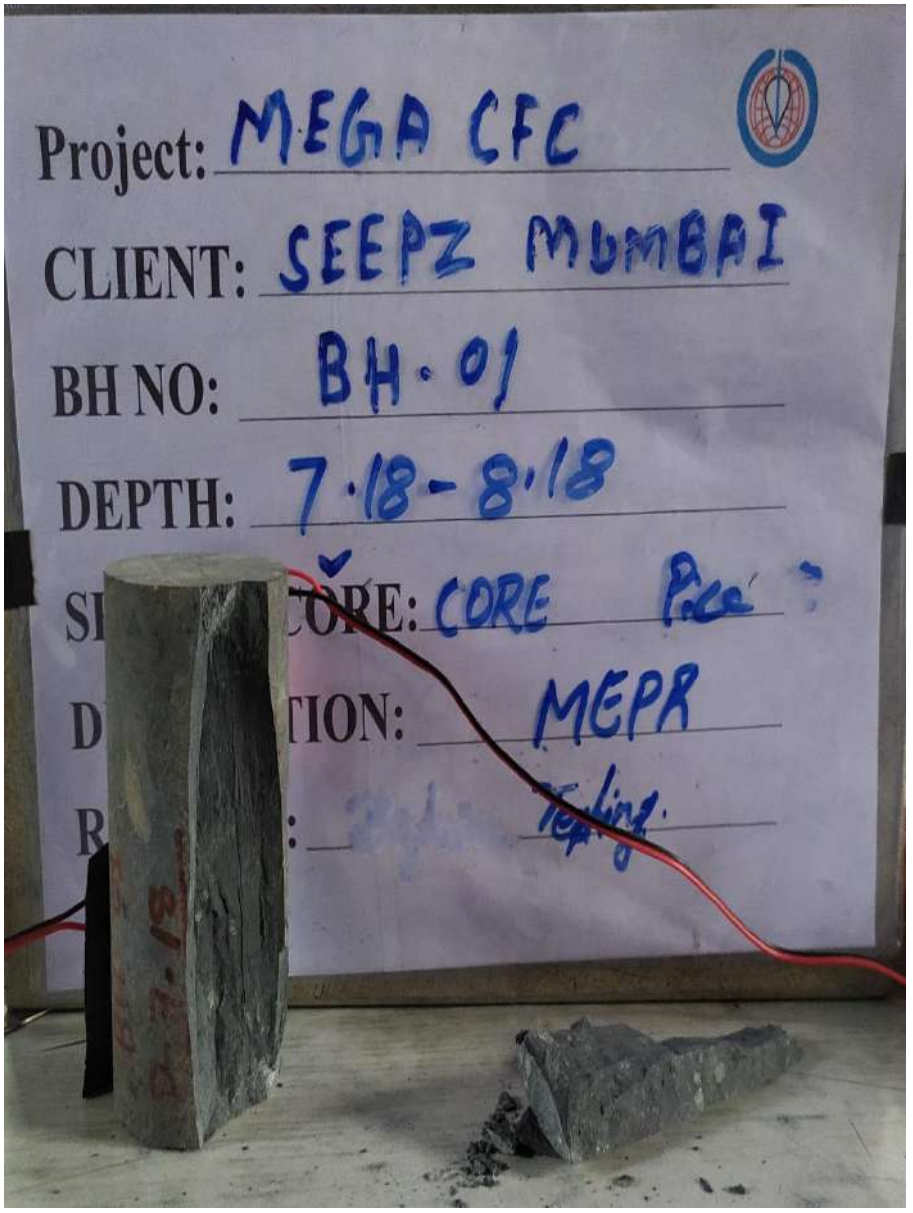

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-01
DEPTH: 9.18-10.18
SPT/UDS/CORE: CORE, piece-20
DESCRIPTION: specific gravity
REMARK: After Testing
J-SIL
50 ml
9.
10


Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-01 P.No.-8
DEPTH: 7.18 - 8.18
SPT/UDS/CORE: CORE
DESCRIPTION: Dry D., Porosity, U.A.
REMARK: BEFORE TEST

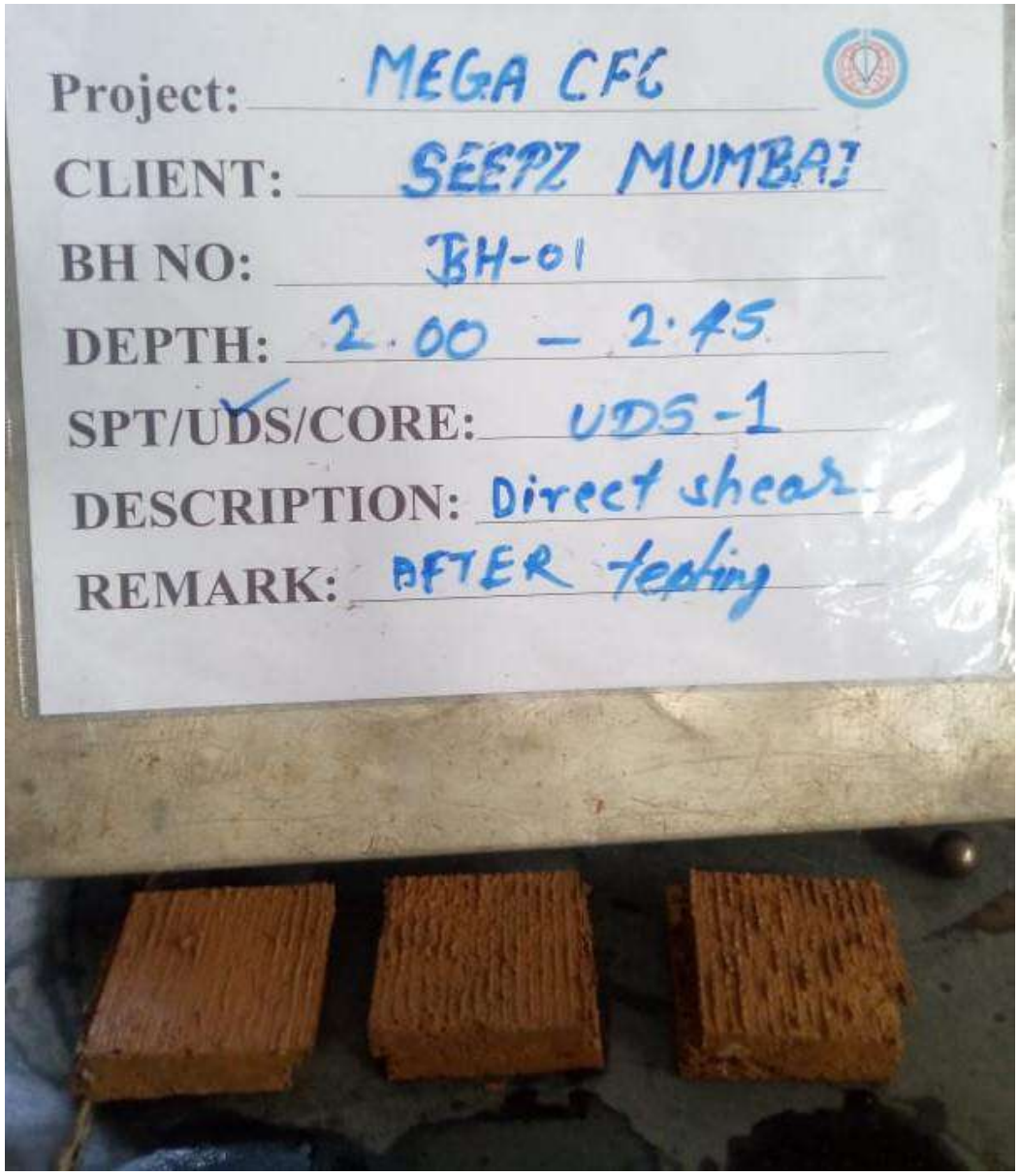

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-01 P.No.-11
DEPTH: 8.18 – 9.18
SPT/UDS/CORE: CORE
DESCRIPTION: Dayd., Porosity, V.A.
REMARK: BEFORE TEST

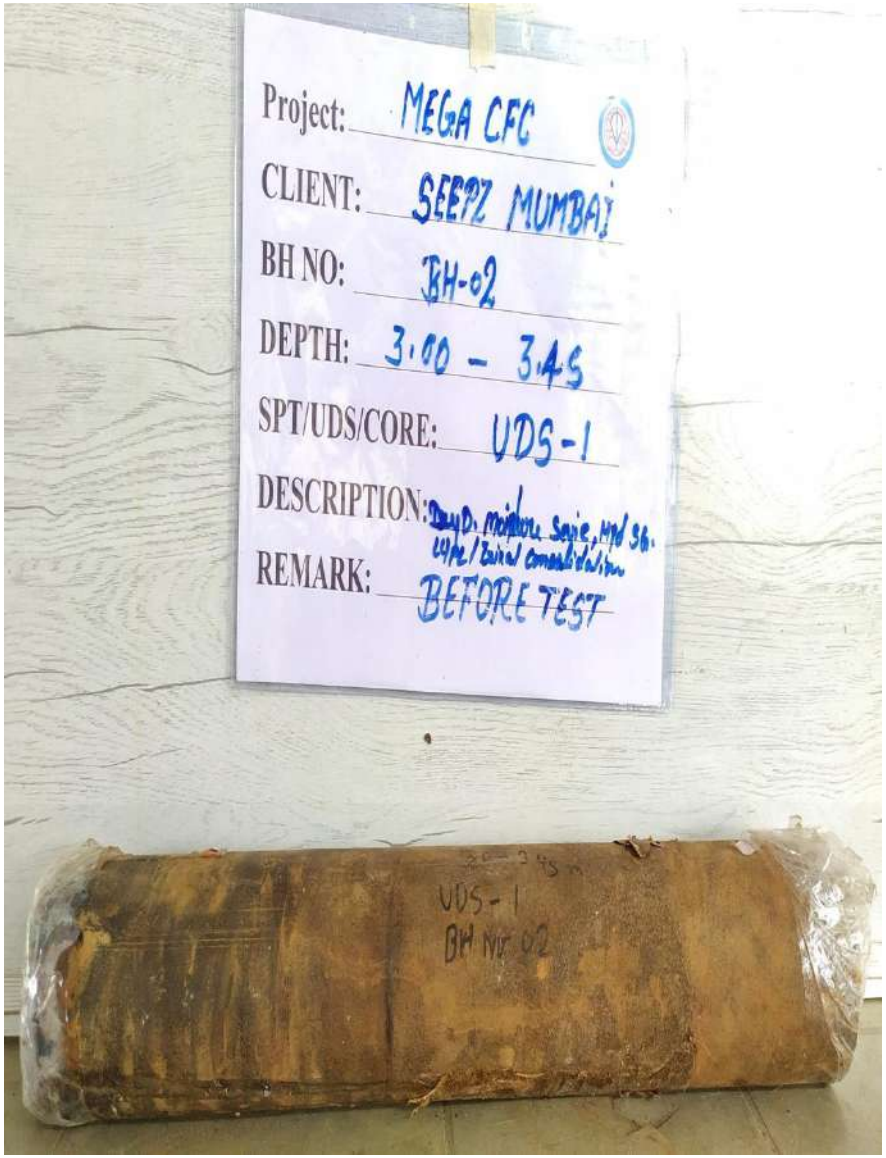

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-01 P.No.-16
DEPTH: 9.18 – 10.18
SPT/UDS/CORE: CORE
DESCRIPTION: Dayd., Porosity, V.A.
REMARK: BEFORE TEST

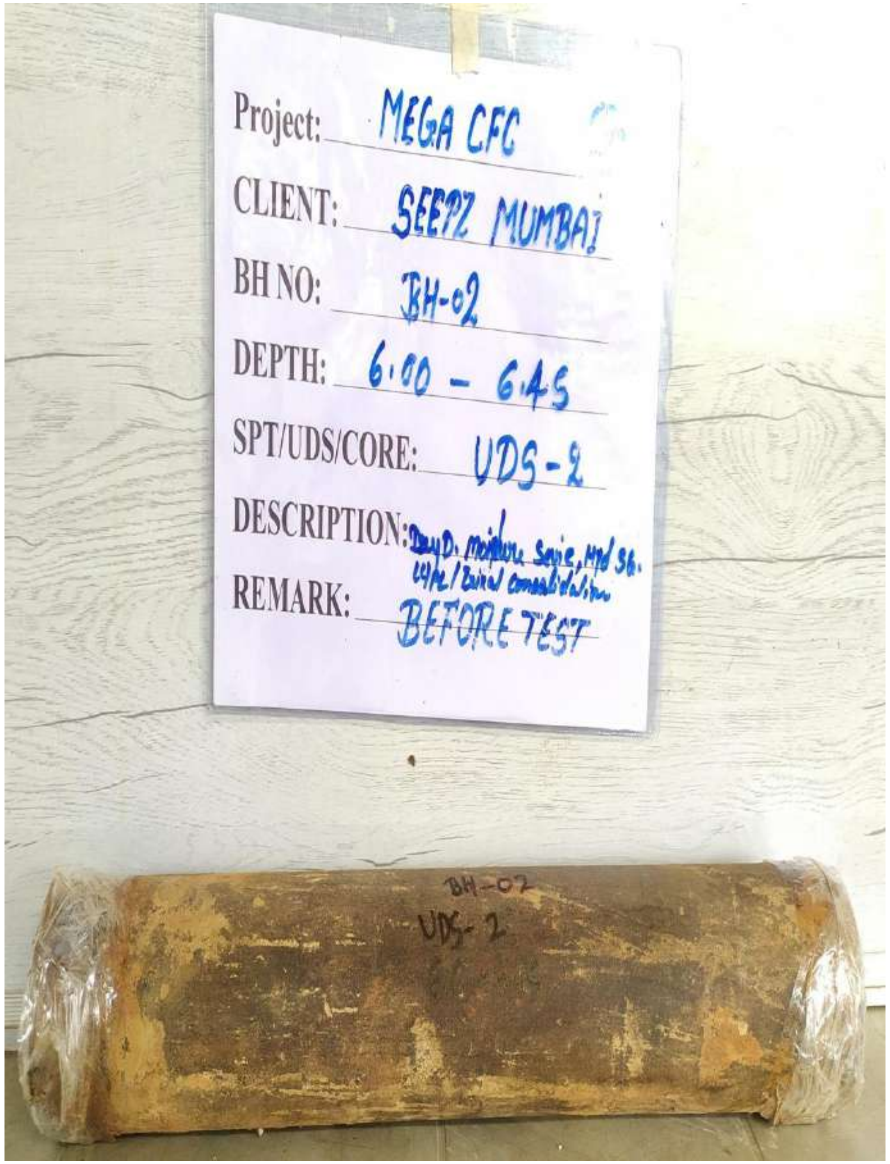

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-01
DEPTH: 7.18-8.18
SPT/UDS/CORE: CORE
DESCRIPTION: MEPR
REMARK: Before Testing

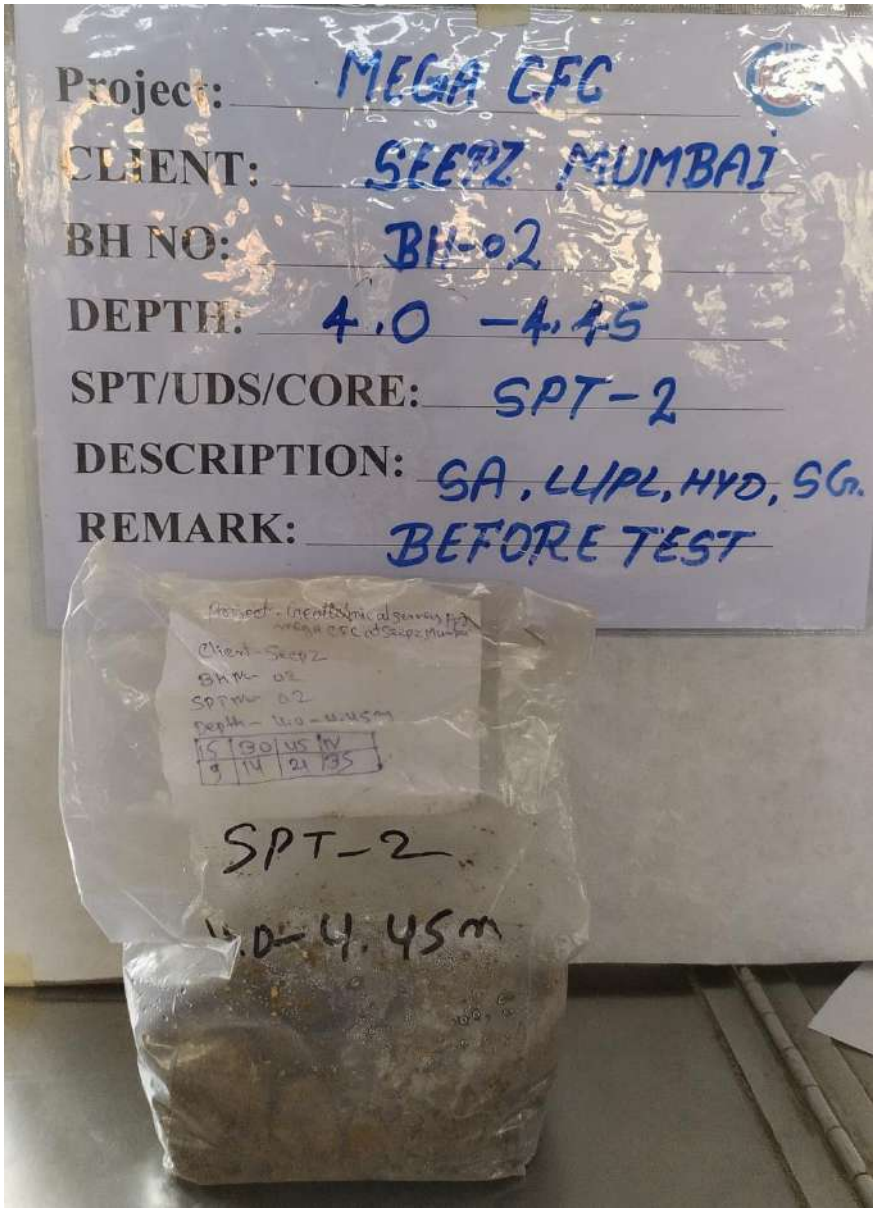

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-01
DEPTH: 7.18-8.18
CORE: CORE
MEPR

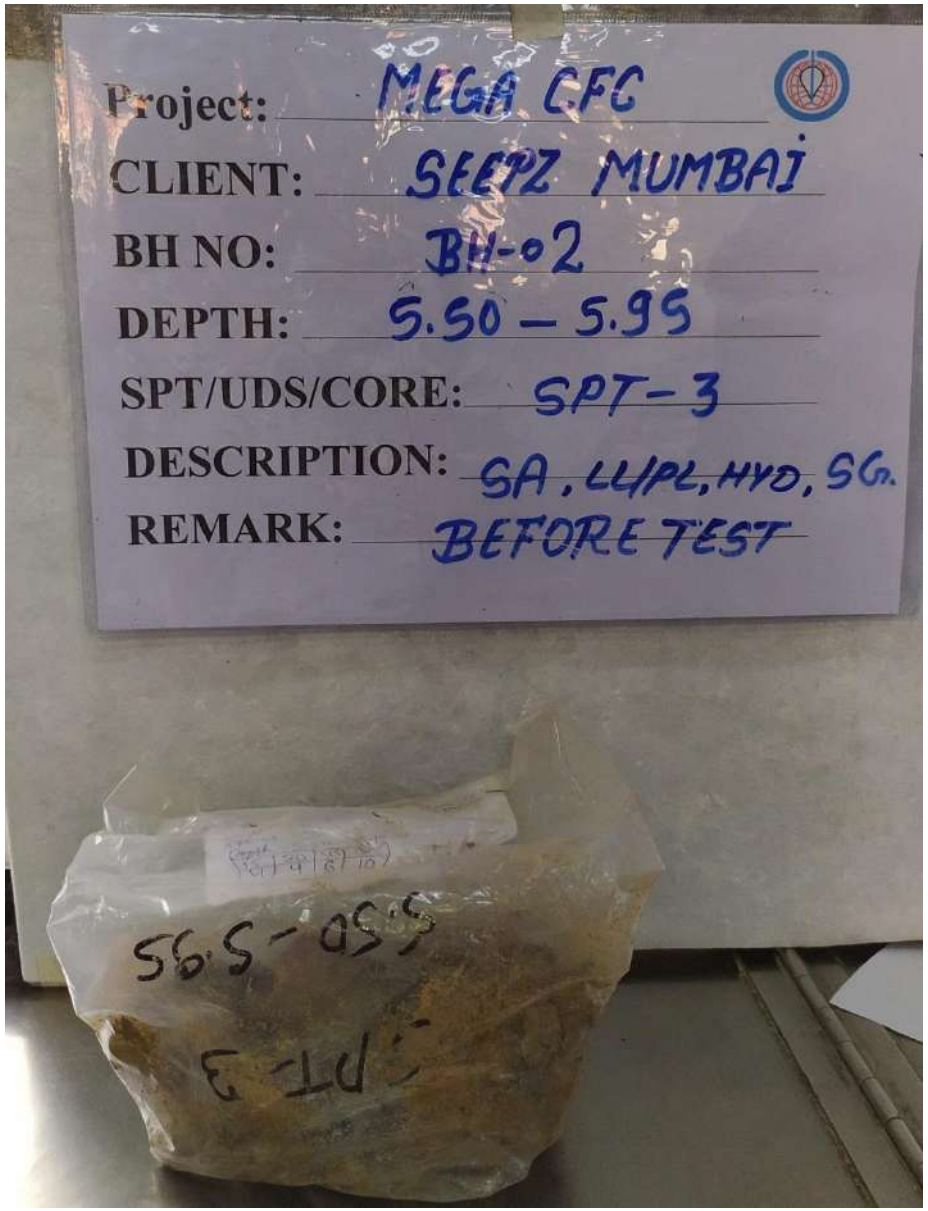

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-01
DEPTH: 2.00 – 2.45
SPT/UDS/CORE: UDS-1
DESCRIPTION: Direct shear.
REMARK: Before testing

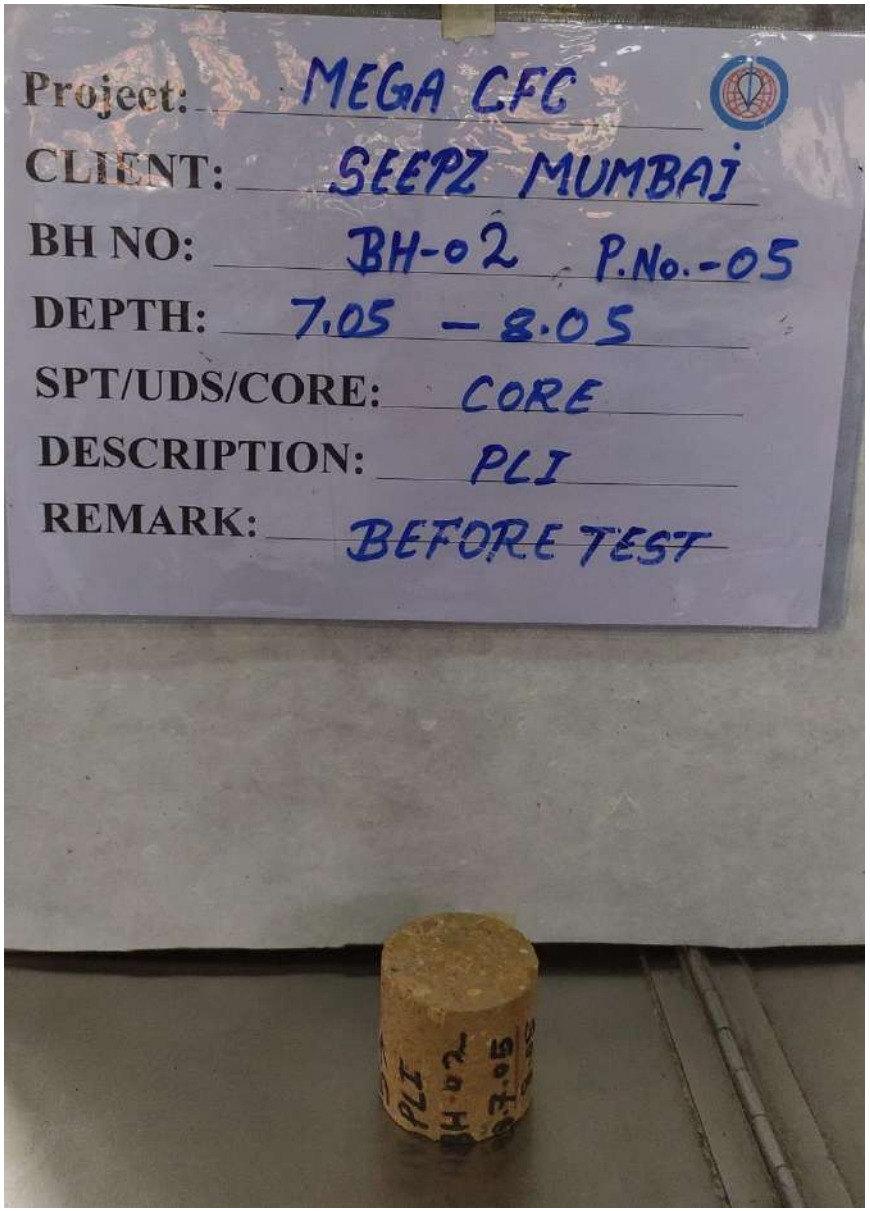

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-01
DEPTH: 2.00 – 2.45
SPT/UDS/CORE: UDS-1
DESCRIPTION: Direct shear.
REMARK: AFTER testing

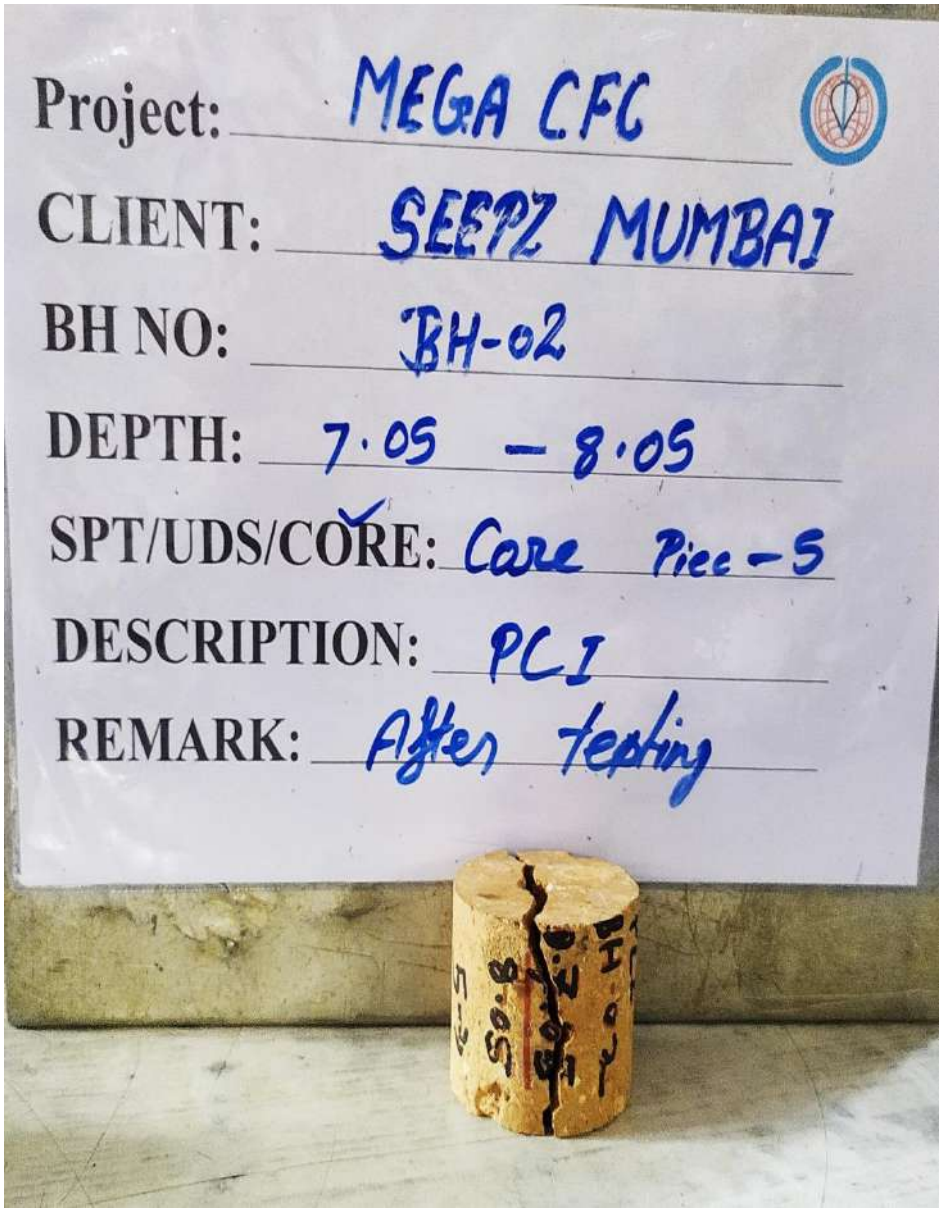

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-02
DEPTH: 3.00 - 3.45
SPT/UDS/CORE: UDS-1
DESCRIPTION:
REMARK: BEFORE TEST
UDS-1
BH NO 02


Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-02
DEPTH: 6.00 - 6.45
SPT/UDS/CORE: UDS-2
DESCRIPTION:
REMARK: BEFORE TEST
BH-02
UDS-2


Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-02
DEPTH: 4.0 -4.45
SPT/UDS/CORE: SPT-2
DESCRIPTION: SA, LL/PL, HYD, SG.
REMARK: BEFORE TEST
SPT-2
4.0-4.45m

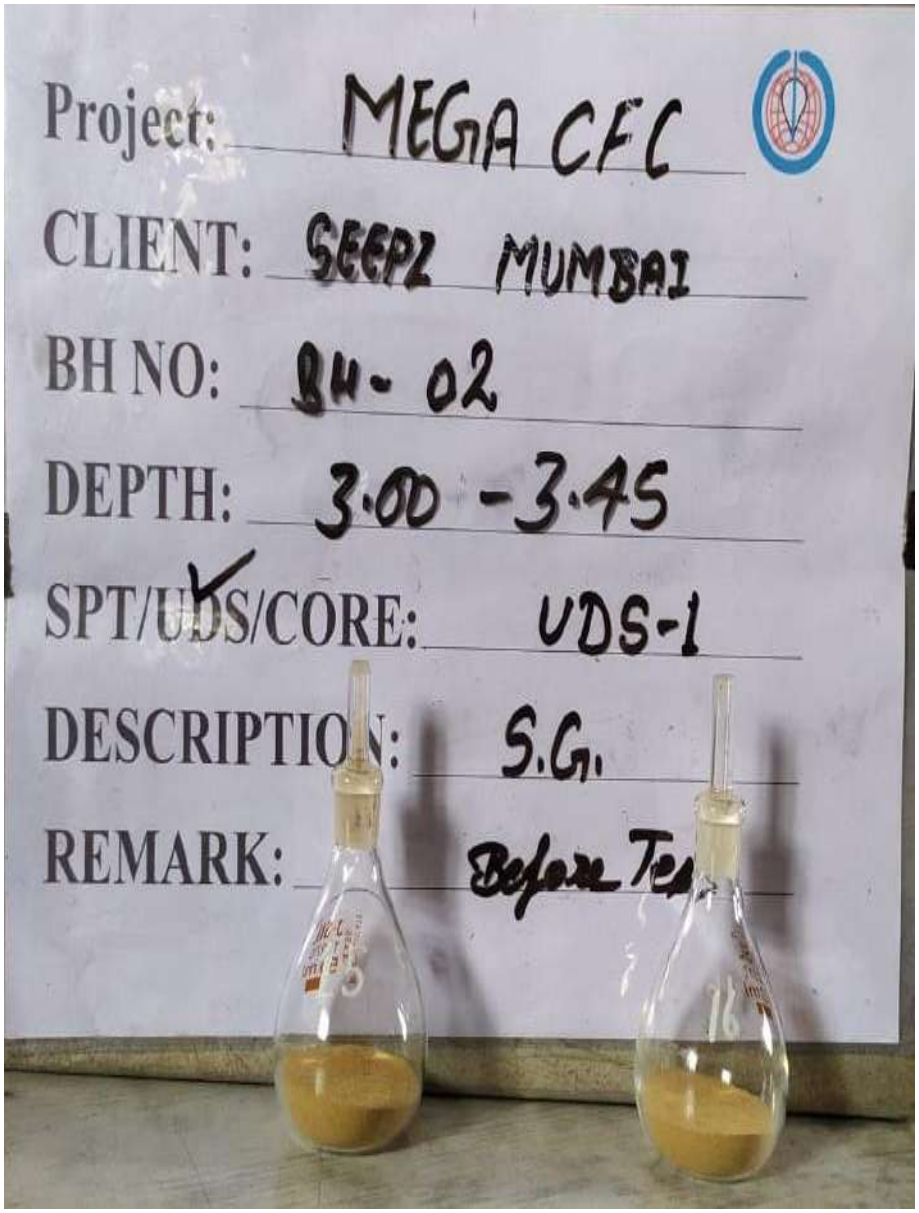

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-02
DEPTH: 5.50 – 5.95
SPT/UDS/CORE: SPT-3
DESCRIPTION: SA, LL/PL, HYD, SG.
REMARK: BEFORE TEST


Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-02 P.No.-05
DEPTH: 7.05 – 8.05
SPT/UDS/CORE: CORE
DESCRIPTION: PLI
REMARK: BEFORE TEST

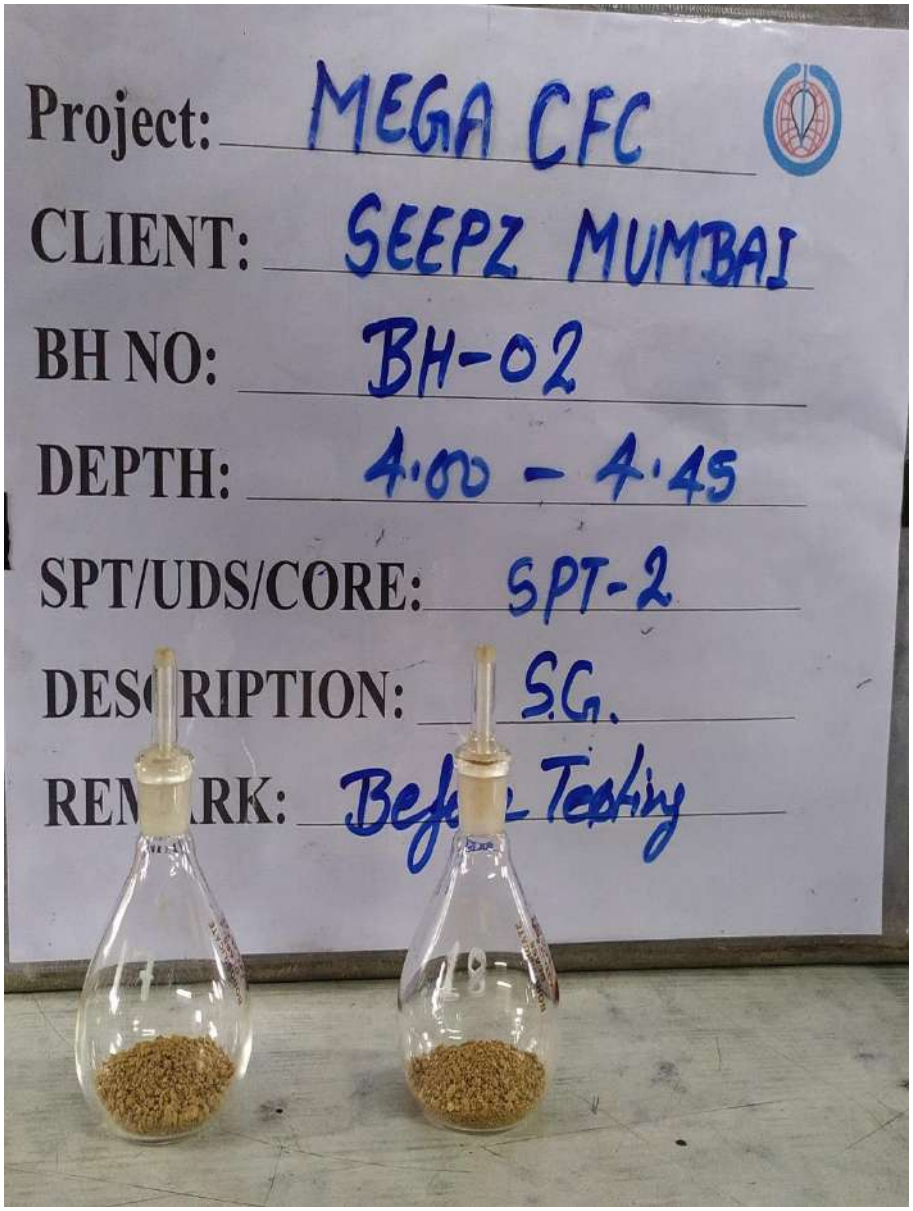

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-02
DEPTH: 7.05 – 8.05
SPT/UDS/CORE: Core Piec-5
DESCRIPTION: PLI
REMARK: After Testing

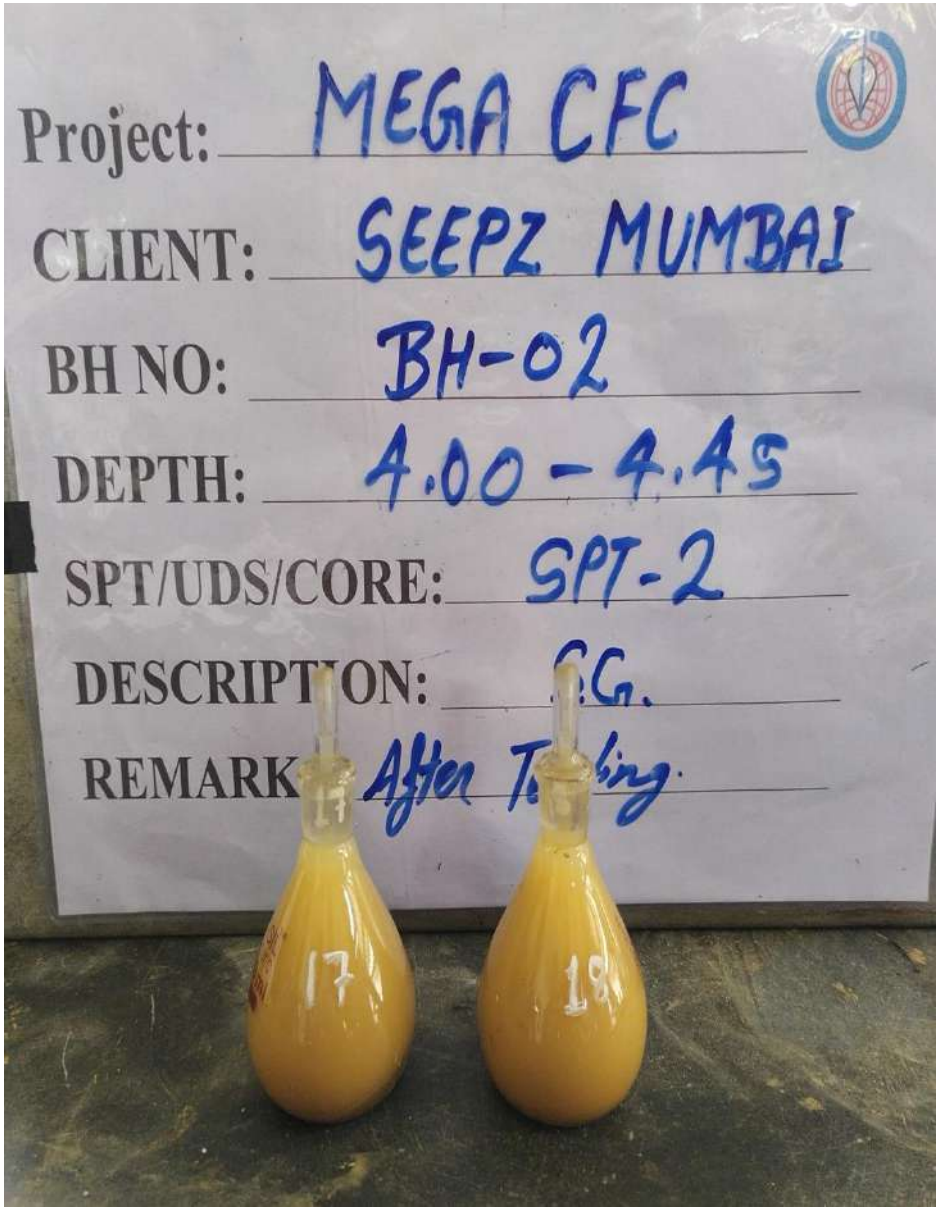

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-02
DEPTH: 2.50 - 2.95
SPT/UDS/CORE: SPT-1
DESCRIPTION: S.G.
REMARK: Before Testing
15
16


Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-02
DEPTH: 2.50 - 2.95
SPT/UDS/CORE: SPT-1
DESCRIPTION: S.G.
REMARK: After Testing
15
16


Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH- 02
DEPTH: 3.00 -3.45
SPT/UDS/CORE: UDS-1
DESCRIPTION: S.G.
REMARK: Before Te
15
16

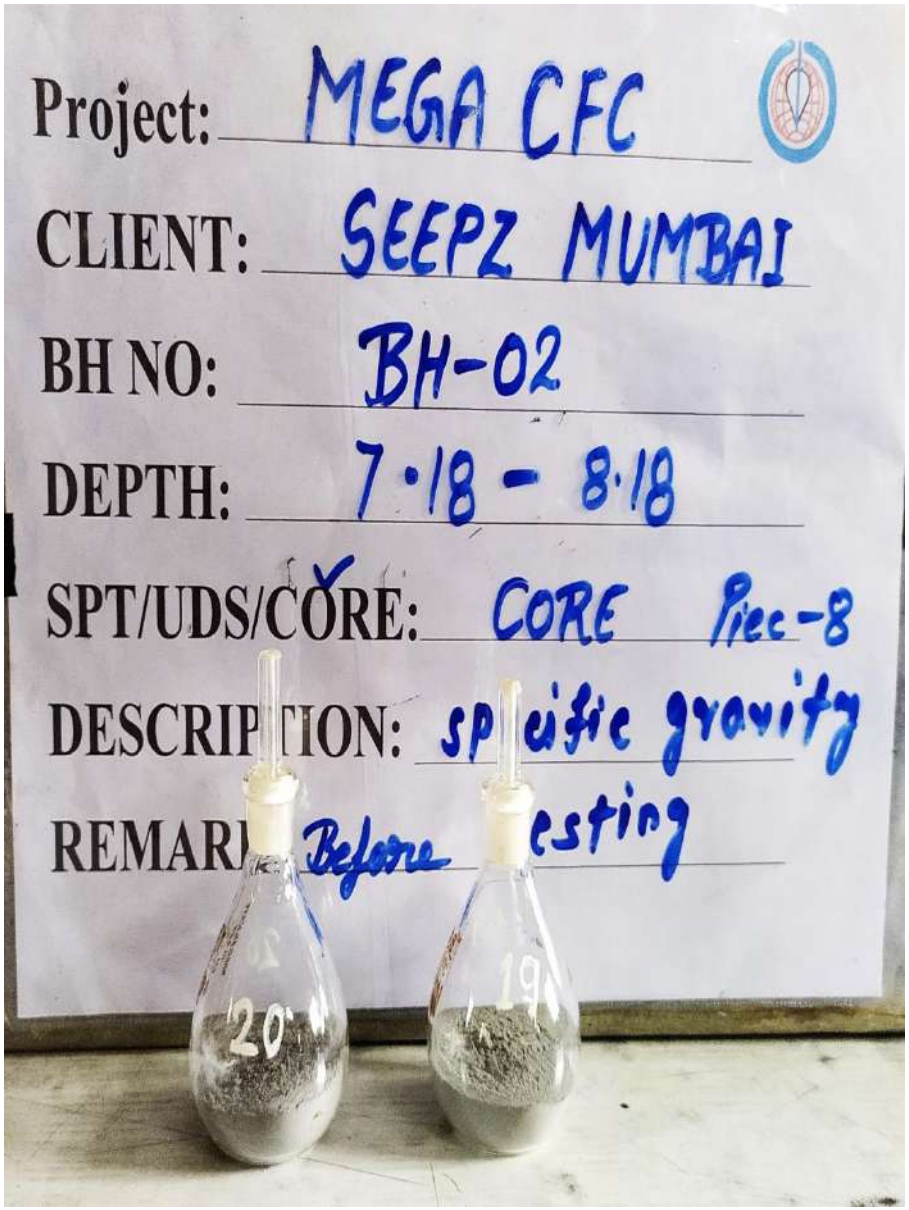

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-02
DEPTH: 3.00 - 3.45
SPT/UDS/CORE: UDS-1
DESCRIPTION: specific gravity
REMARK:
15
16

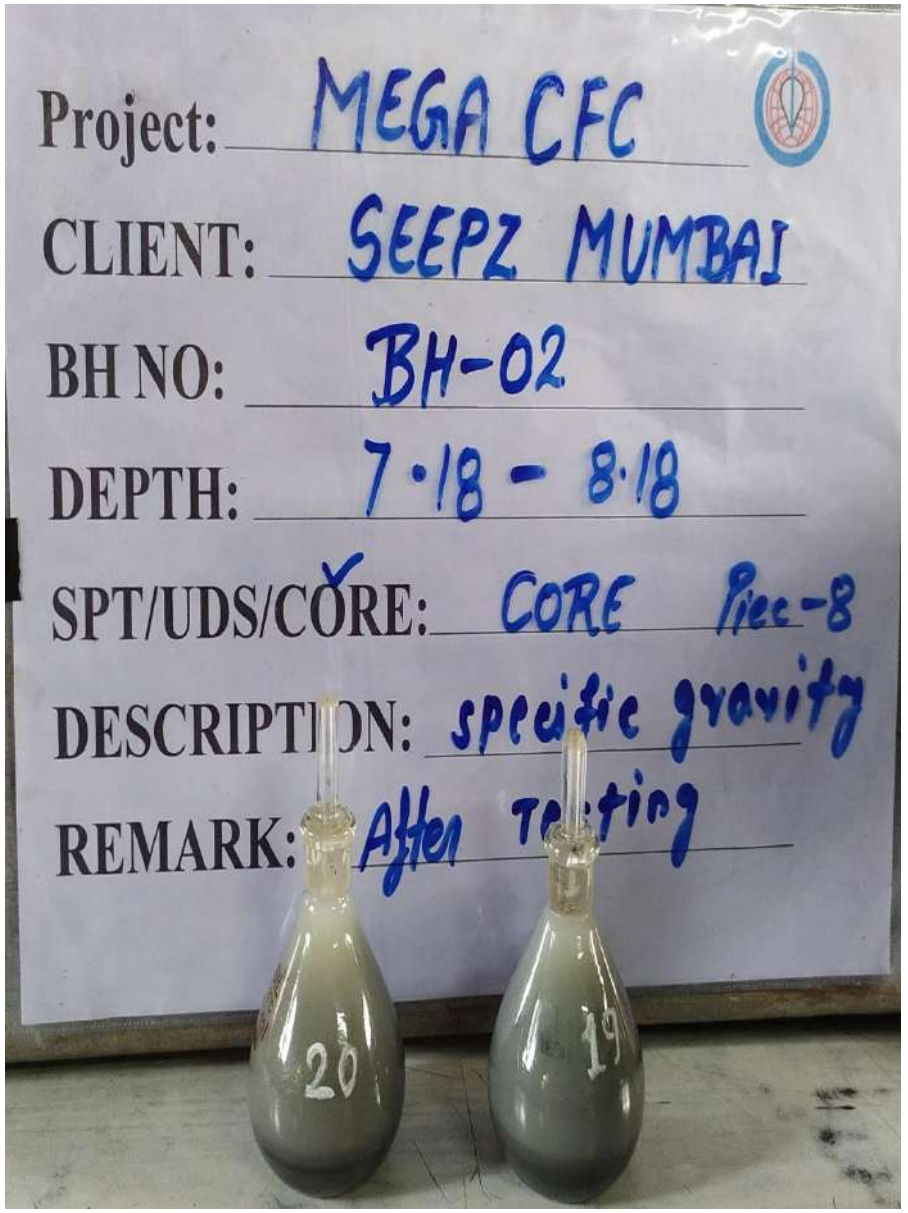

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-02
DEPTH: 4.00 - 4.45
SPT/UDS/CORE: SPT-2
DESCRIPTION: S.G.
REMARK: Before Testing


Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-02
DEPTH: 4.00 - 4.45
SPT/UDS/CORE: SPT-2
DESCRIPTION: S.G.
REMARK: After Testing


Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-02
DEPTH: 5.50 - 5.95
SPT/UDS/CORE: SPT-3
DESCRIPTION: S.G.
REMARK: Before Testing
19
20

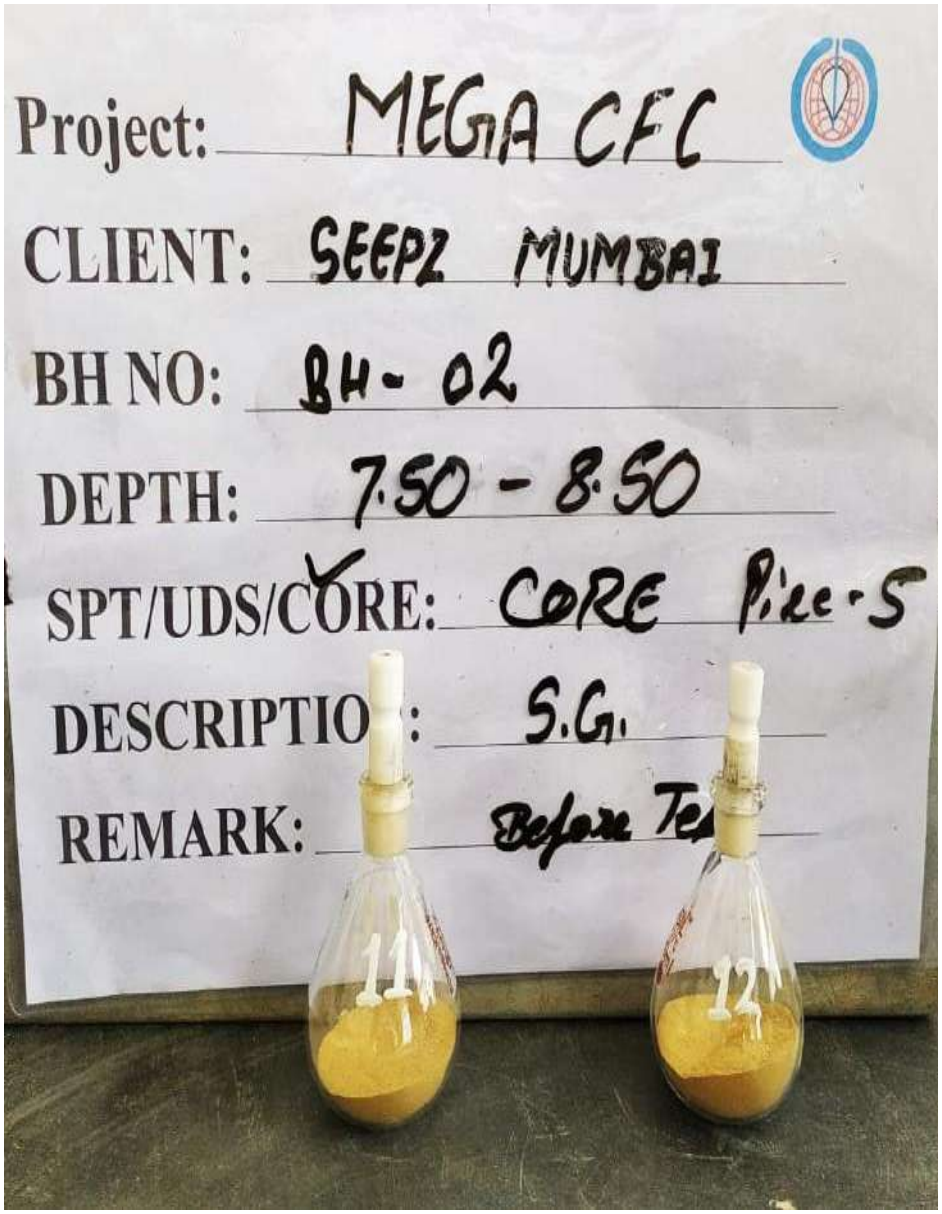

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-02
DEPTH: 5.50 - 5.95
SPT/UDS/CORE: SPT-3
19
20


Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-02
DEPTH: 7.18 - 8.18
SPT/UDS/CORE: CORE Piec-8
DESCRIPTION: specific gravity
REMARK: Before esting
20
19


Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-02
DEPTH: 7.18 - 8.18
SPT/UDS/CORE: CORE Piec-8
DESCRIPTION: specific gravity
REMARK: After testing
20
19

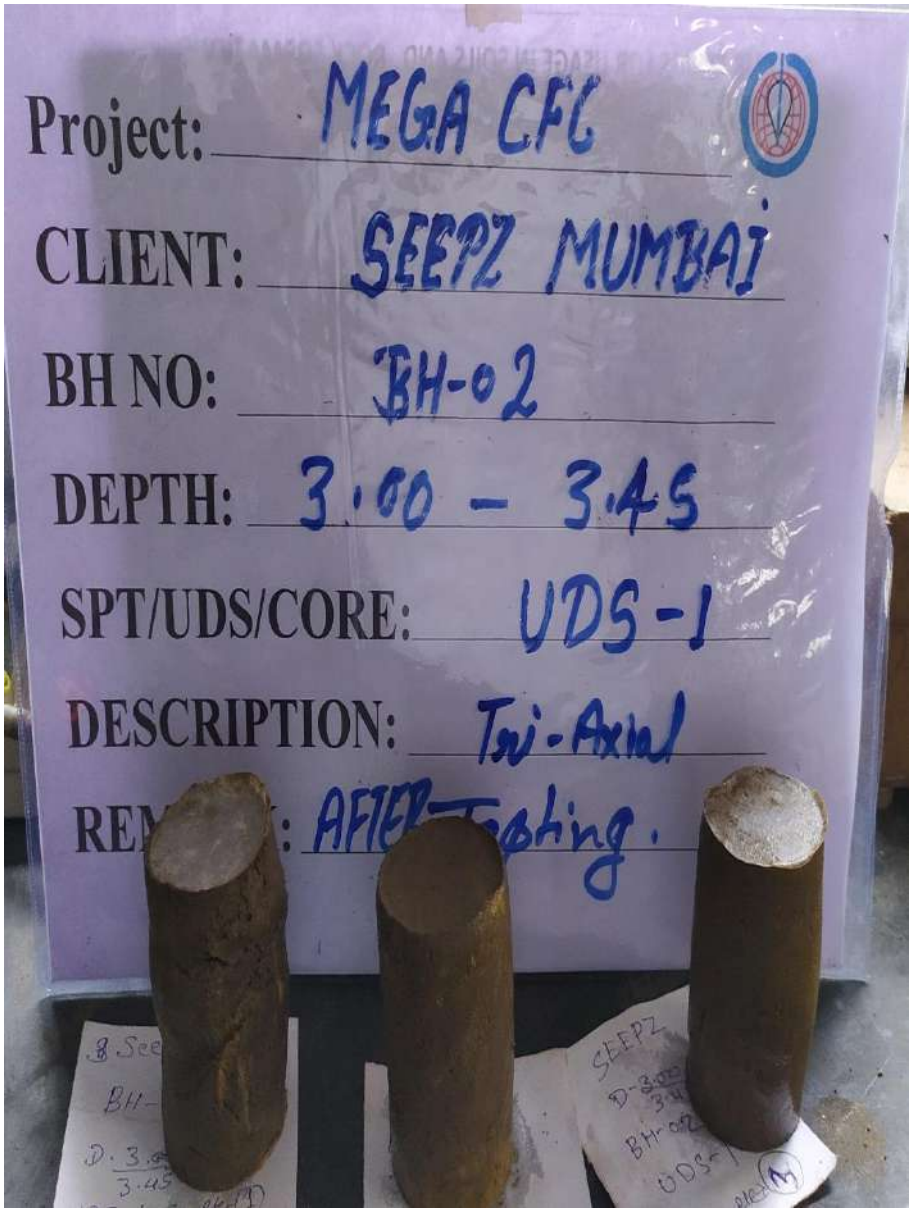

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH- 02
DEPTH: 6.00 -6.45
SPT/UDS/CORE: UDS-2
DESCRIPTION: S.G.
REMARK: Before. Tes

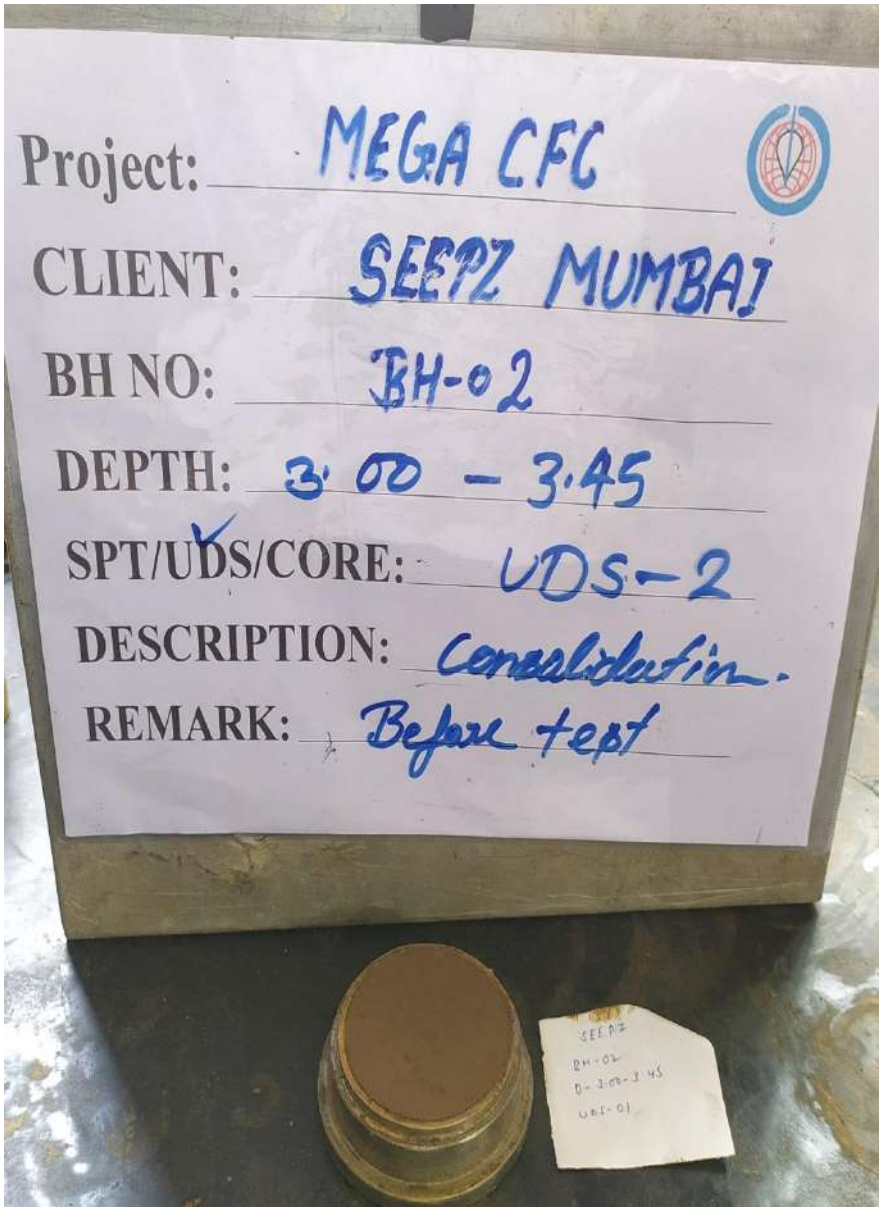

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-02
DEPTH: 6.00 - 6.45
SPT/UDS/CORE: UDS-2
DESCRIPTION: specific gravity
REMARK: After Testi

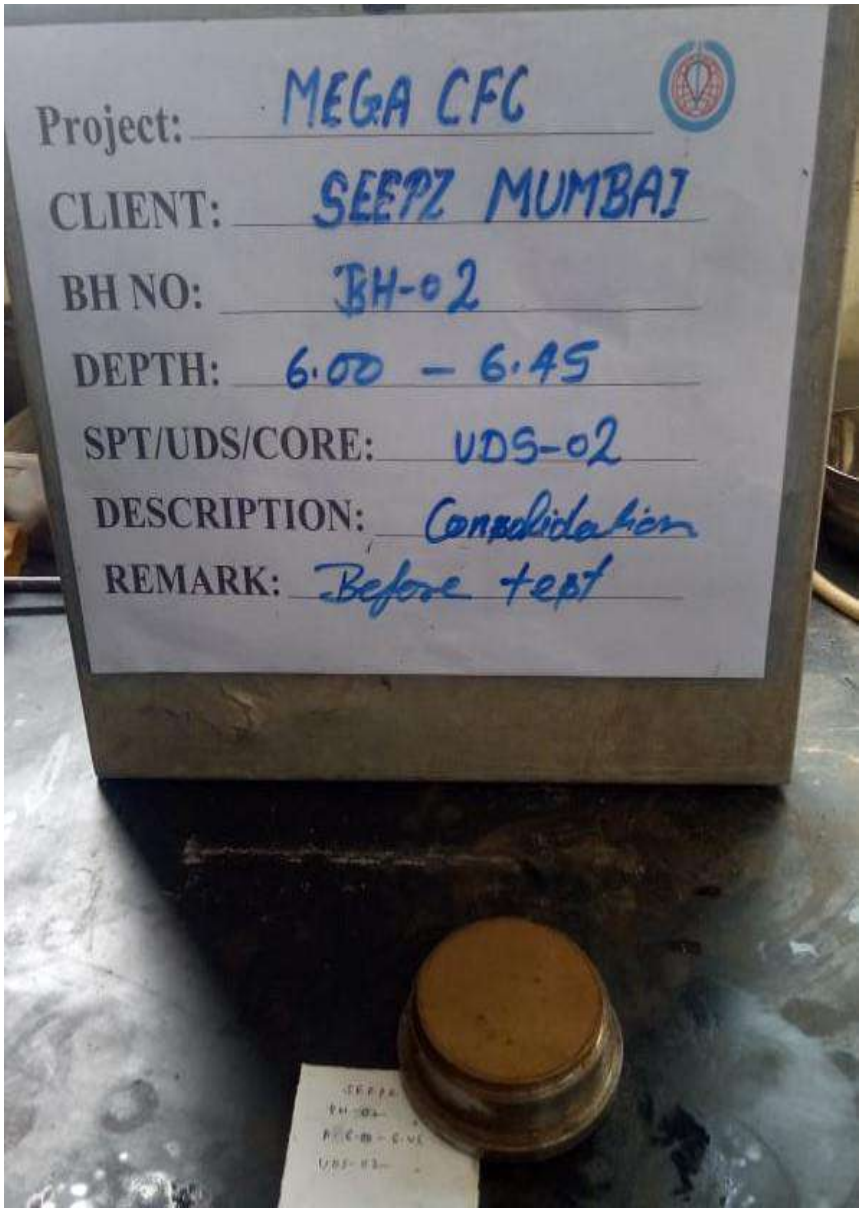

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH- 02
DEPTH: 7.50 - 8.50
SPT/UDS/CORE: CORE Piece-5
DESCRIPTIO : S.G.
REMARK: Before Tes
11
12

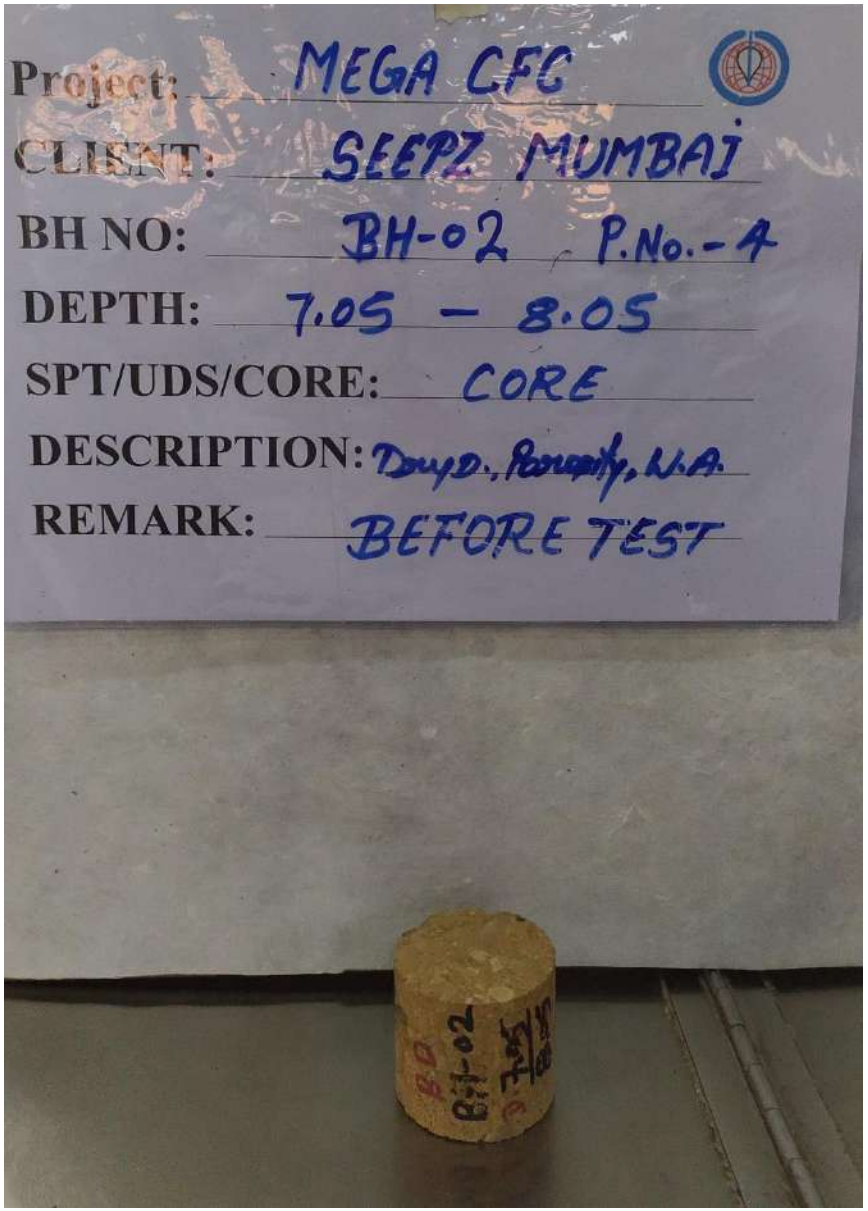

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-02
DEPTH: 7.50-8.50
SPT/UDS/CORE: CORE, piece-5
DESCRIPTION: specific gravity
REMAR : After testin
11
12

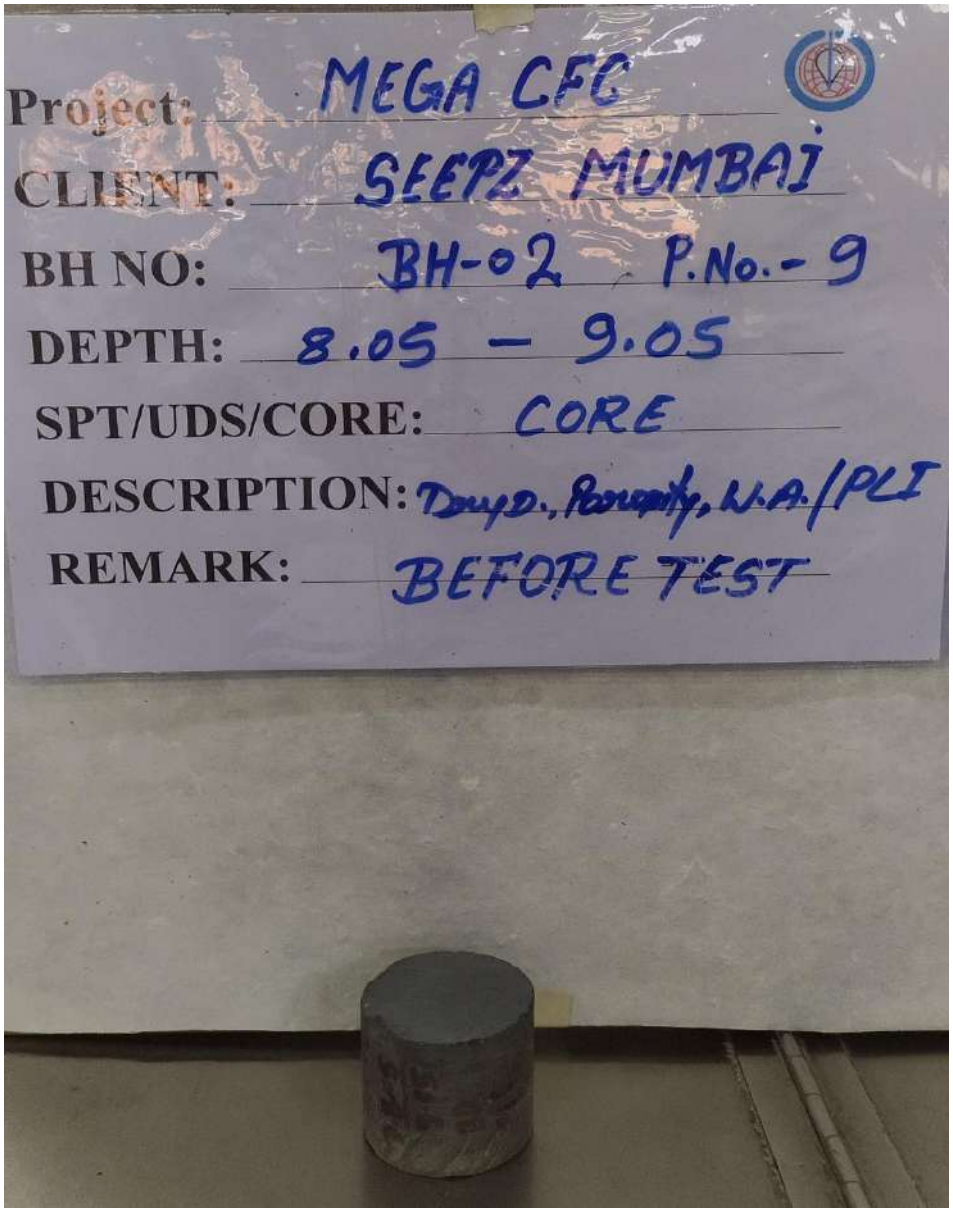

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-02
DEPTH: 3.00 - 3.45
SPT/UDS/CORE: UDS-1
DESCRIPTION: Tri-Axial
REMARK: Testing.

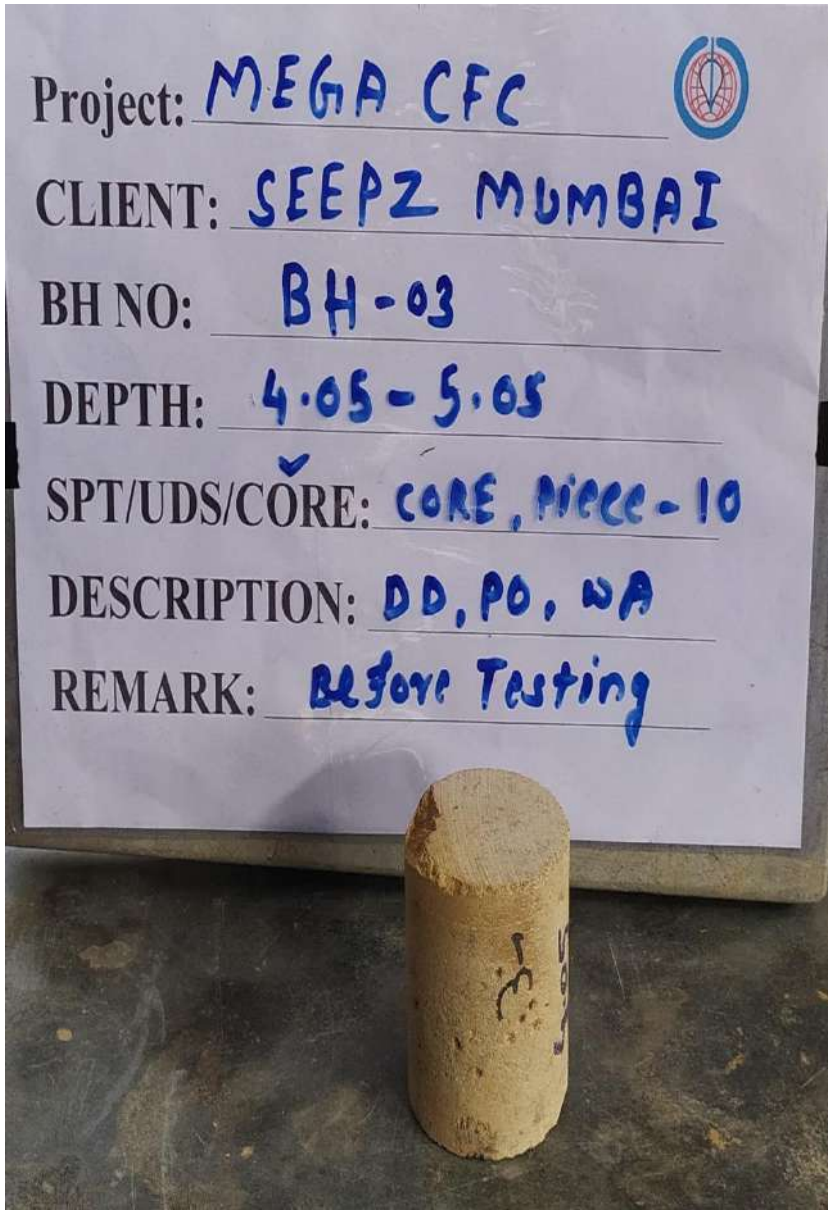

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-02
DEPTH: 3.00 - 3.45
SPT/UDS/CORE: UDS-1
DESCRIPTION: Tri-Axial
AFTER Testing.

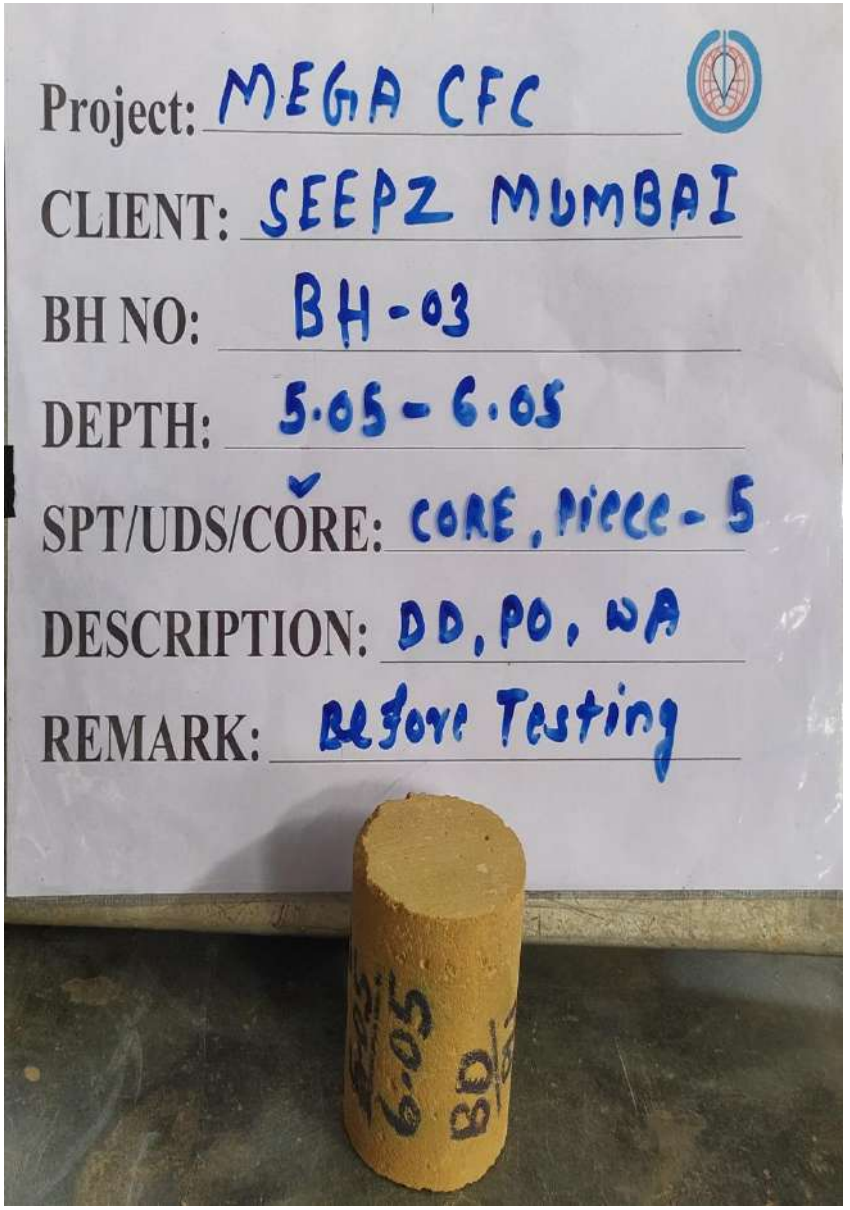

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-02
DEPTH: 3.00 - 3.45
SPT/UDS/CORE: UDS-2
DESCRIPTION: Consolidation.
REMARK: Before test

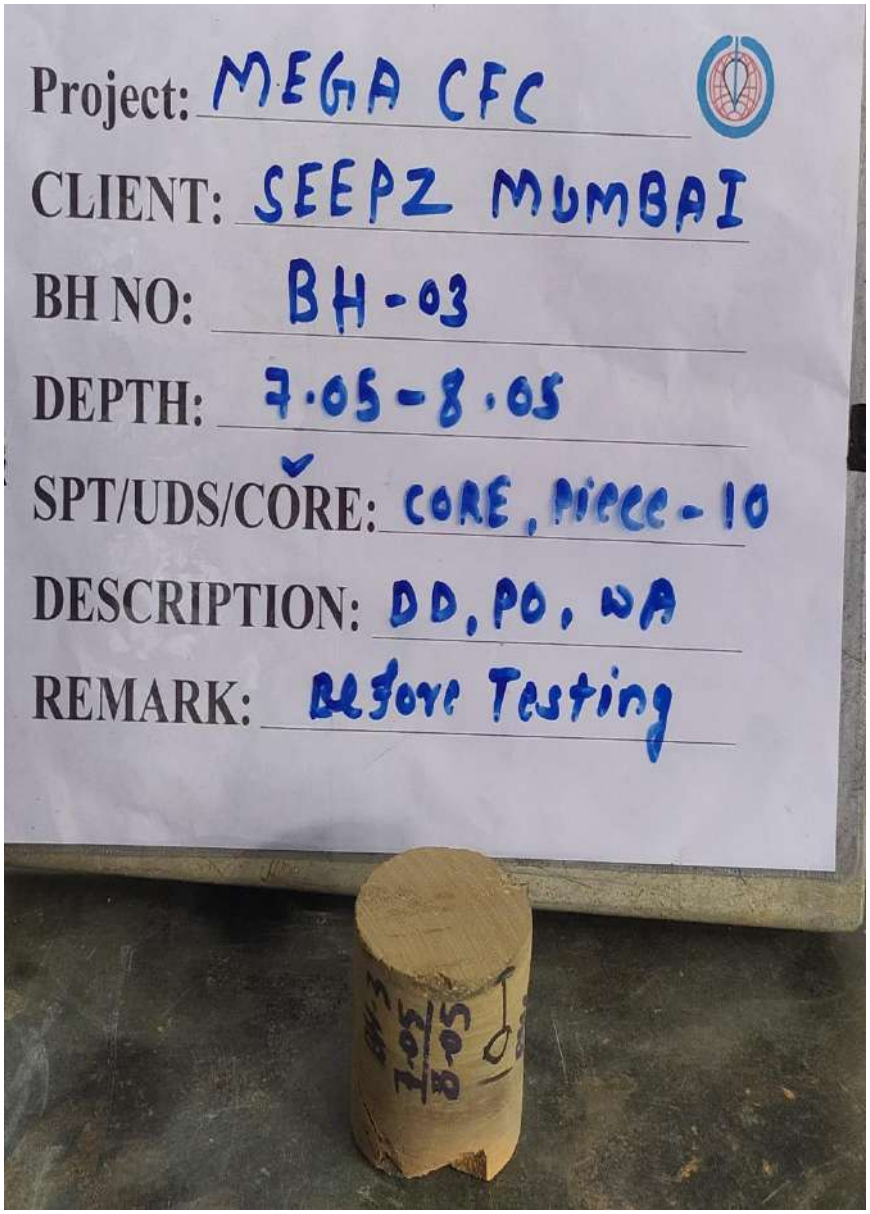

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-02
DEPTH: 6.00 - 6.45
SPT/UDS/CORE: UDS-02
DESCRIPTION: Consolidation
REMARK: Before test

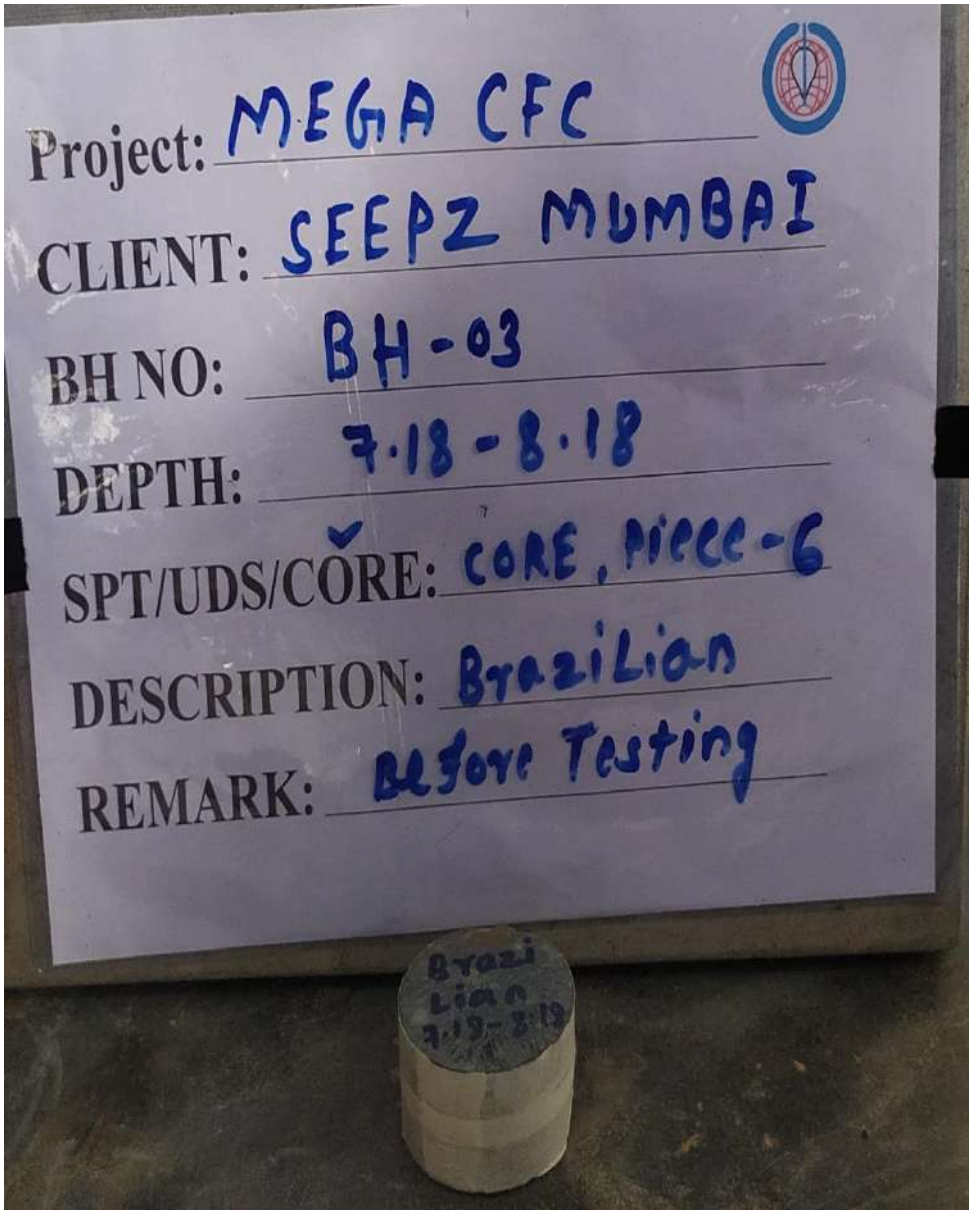

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-02 P.No.-4
DEPTH: 7.05 - 8.05
SPT/UDS/CORE: CORE
DESCRIPTION: Dry D., Porosity, V.A.
REMARK: BEFORE TEST

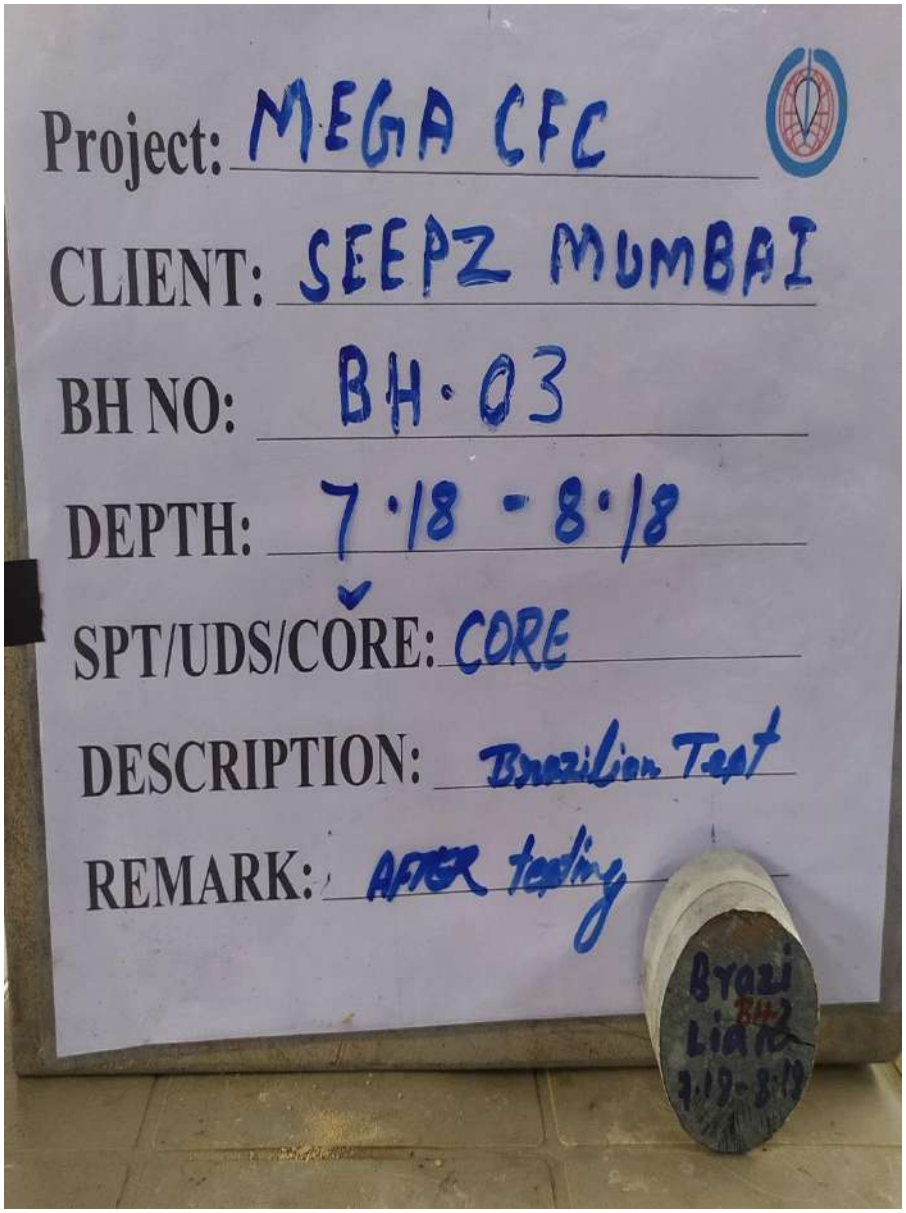

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-02 P.No.- 9
DEPTH: 8.05 - 9.05
SPT/UDS/CORE: CORE
DESCRIPTION: Dry D., Porosity, V.A./PLI
REMARK: BEFORE TEST

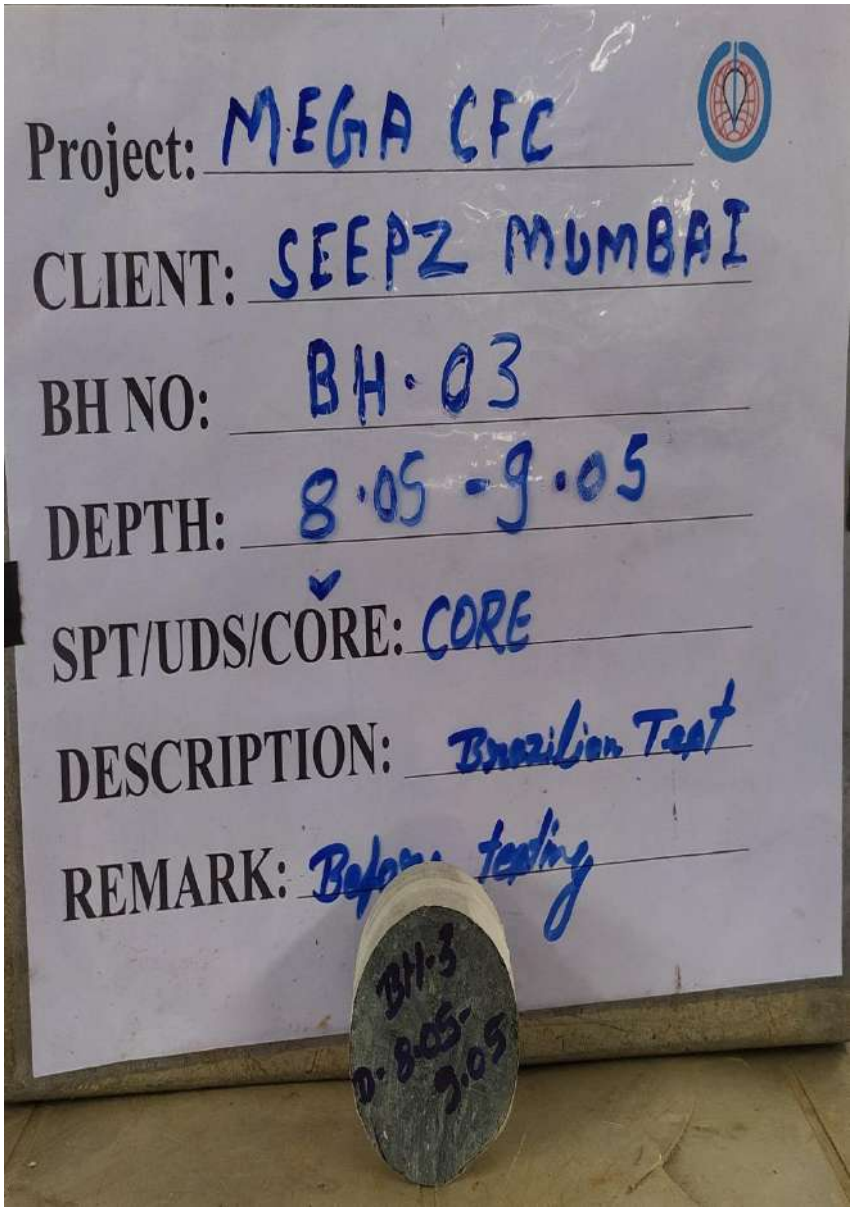

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-03
DEPTH: 4.05 - 5.05
SPT/UDS/CORE: CORE, Piece - 10
DESCRIPTION: DD, PO, WA
REMARK: Before Testing

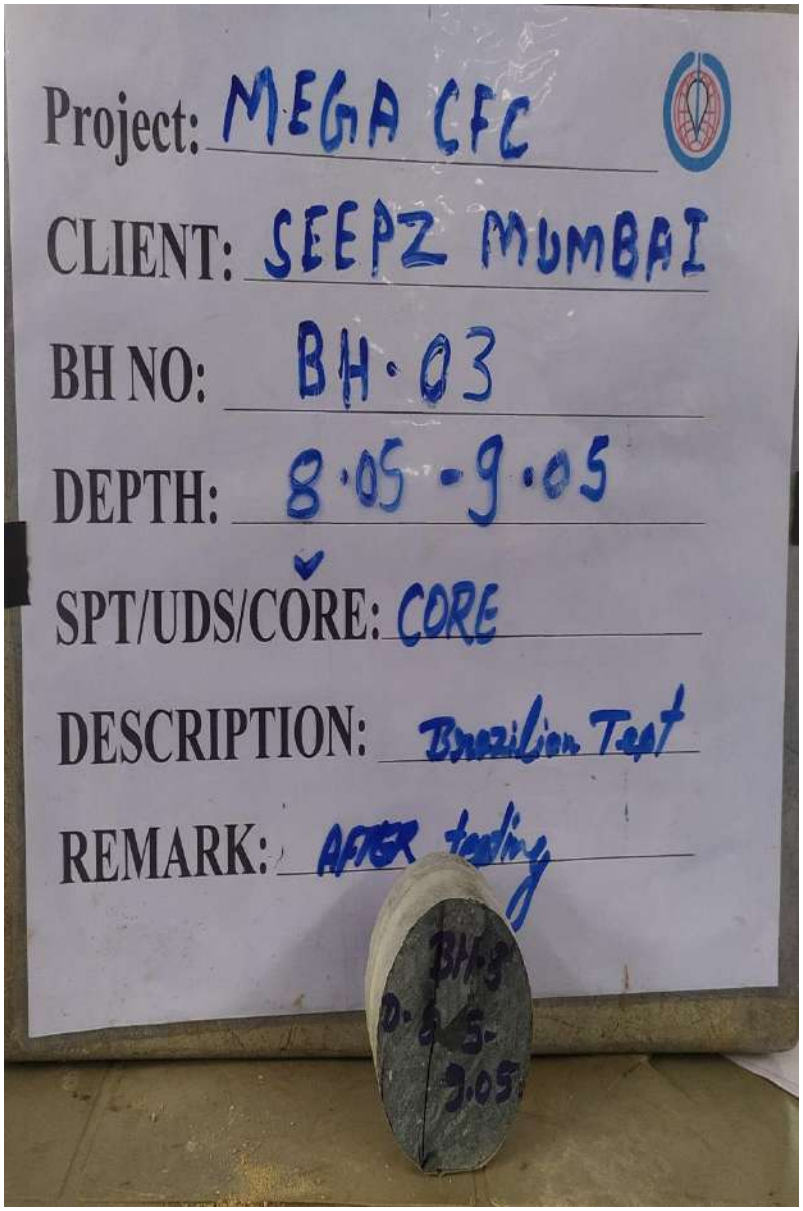

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-03
DEPTH: 5.05 - 6.05
SPT/UDS/CORE: CORE, Piece - 5
DESCRIPTION: DD, PO, WA
REMARK: Before Testing

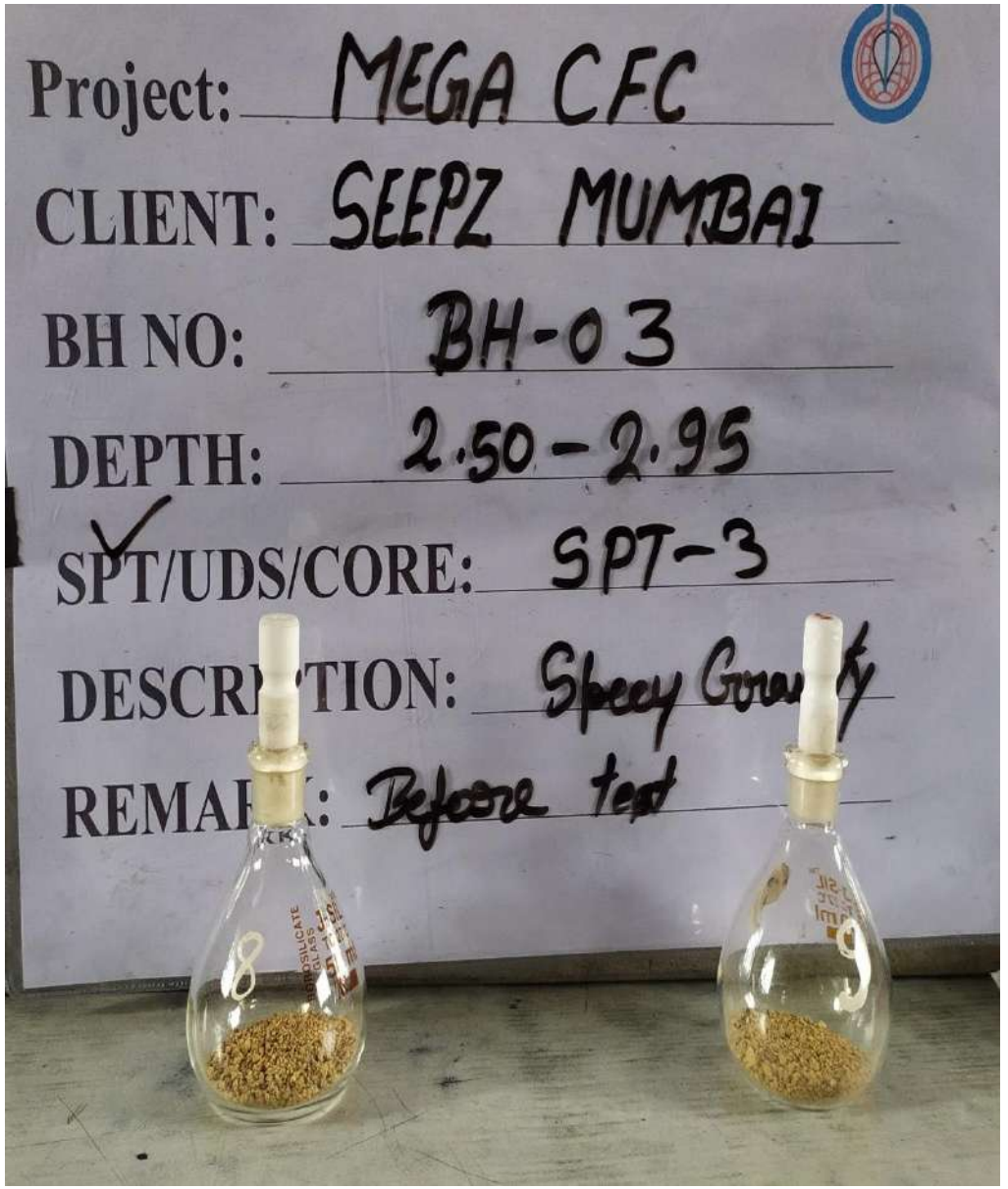

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-03
DEPTH: 7.05-8.05
SPT/UDS/CORE: CORE, PIECE-10
DESCRIPTION: DD, PO, WA
REMARK: Before Testing


Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-03
DEPTH: 7.18-8.18
SPT/UDS/CORE: CORE, PIECE-6
DESCRIPTION: BraziLian
REMARK: Before Testing

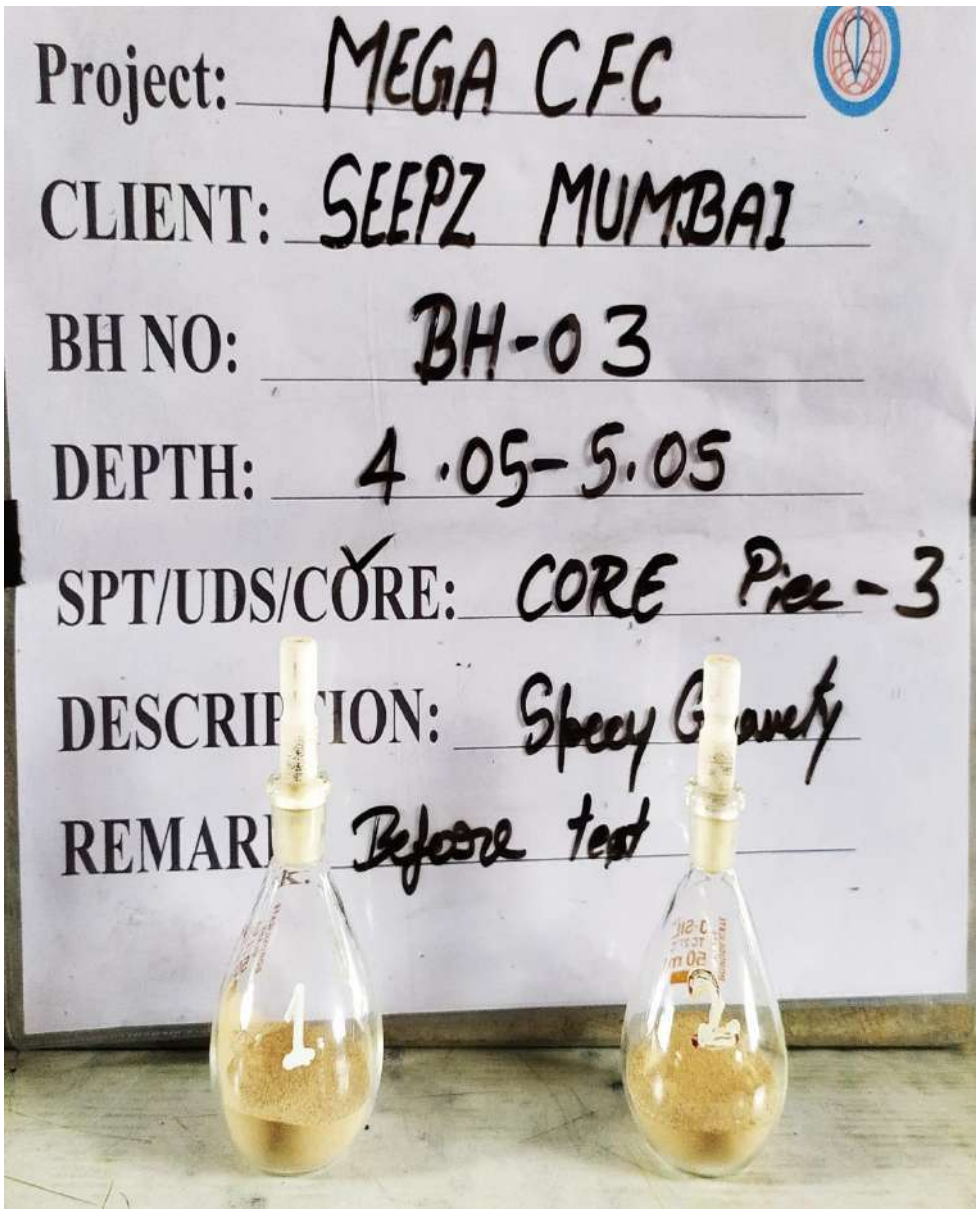

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-03
DEPTH: 7.18 - 8.18
SPT/UDS/CORE: CORE
DESCRIPTION: Brazilian Test
REMARK: AFTER testing


Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-03
DEPTH: 8.05 - 9.05
SPT/UDS/CORE: CORE
DESCRIPTION: Brazilian Test
REMARK: Before testing

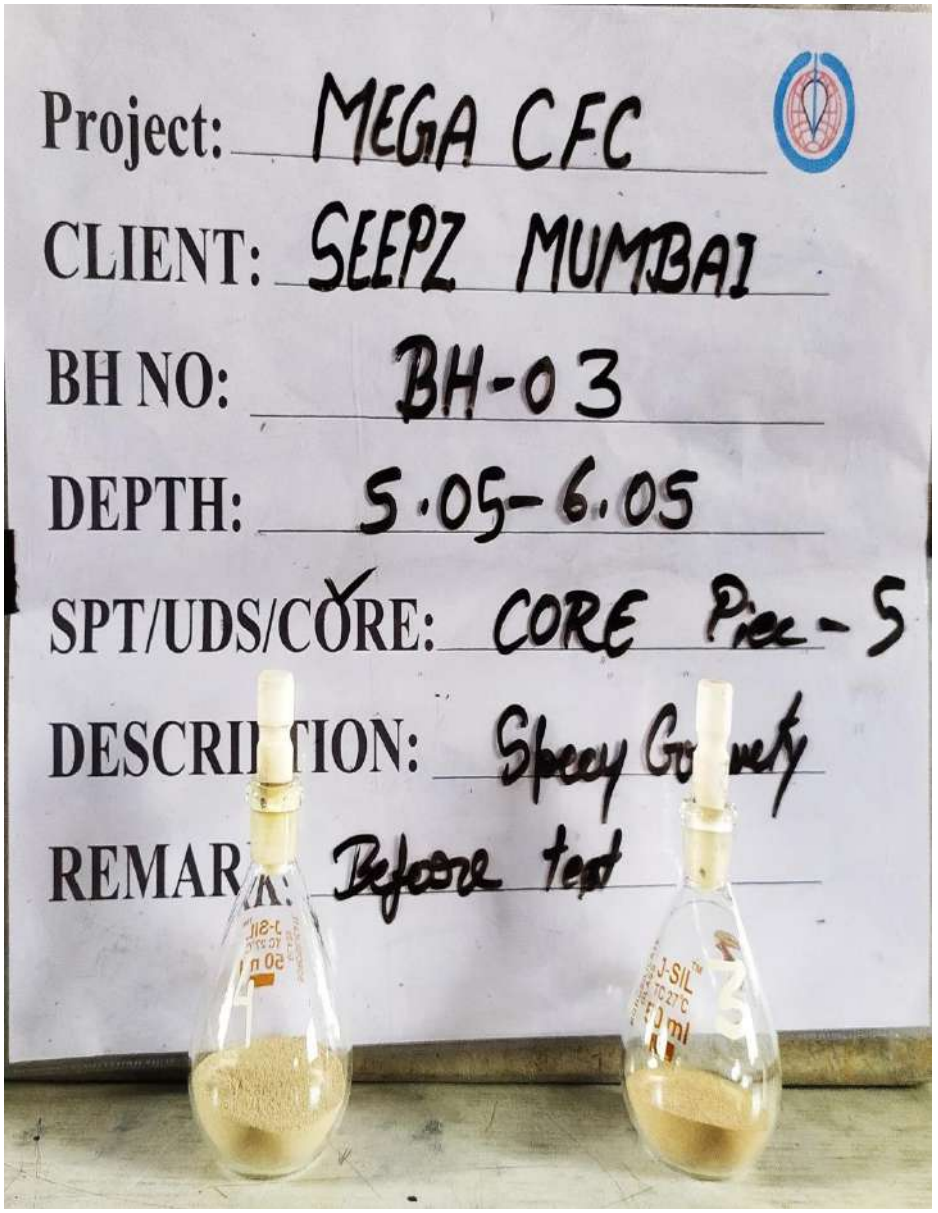

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-03
DEPTH: 8.05 - 9.05
SPT/UDS/CORE: CORE
DESCRIPTION: Brazilian Test
REMARK: AFTER testing
BH-3
8.05-
9.05

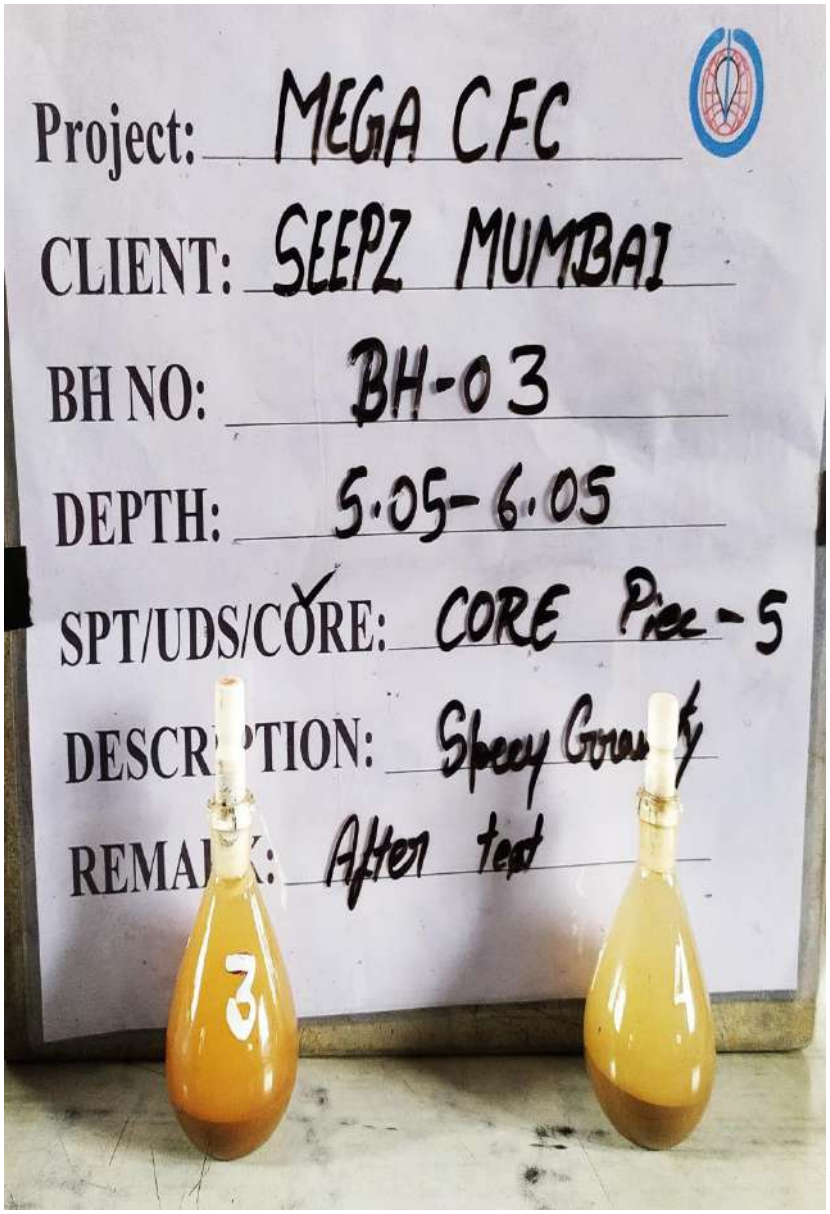

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-03
DEPTH: 2.50 - 2.95
SPT/UDS/CORE: SPT-3
DESCRIPTION: Specy Gravity
REMARK: Before test
8
9


Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-03
DEPTH: 2.50-2.95
SPT/UDS/CORE: SPT-3
DESCRIPTION: Silty Gravelly
REMARK: After test
9
8

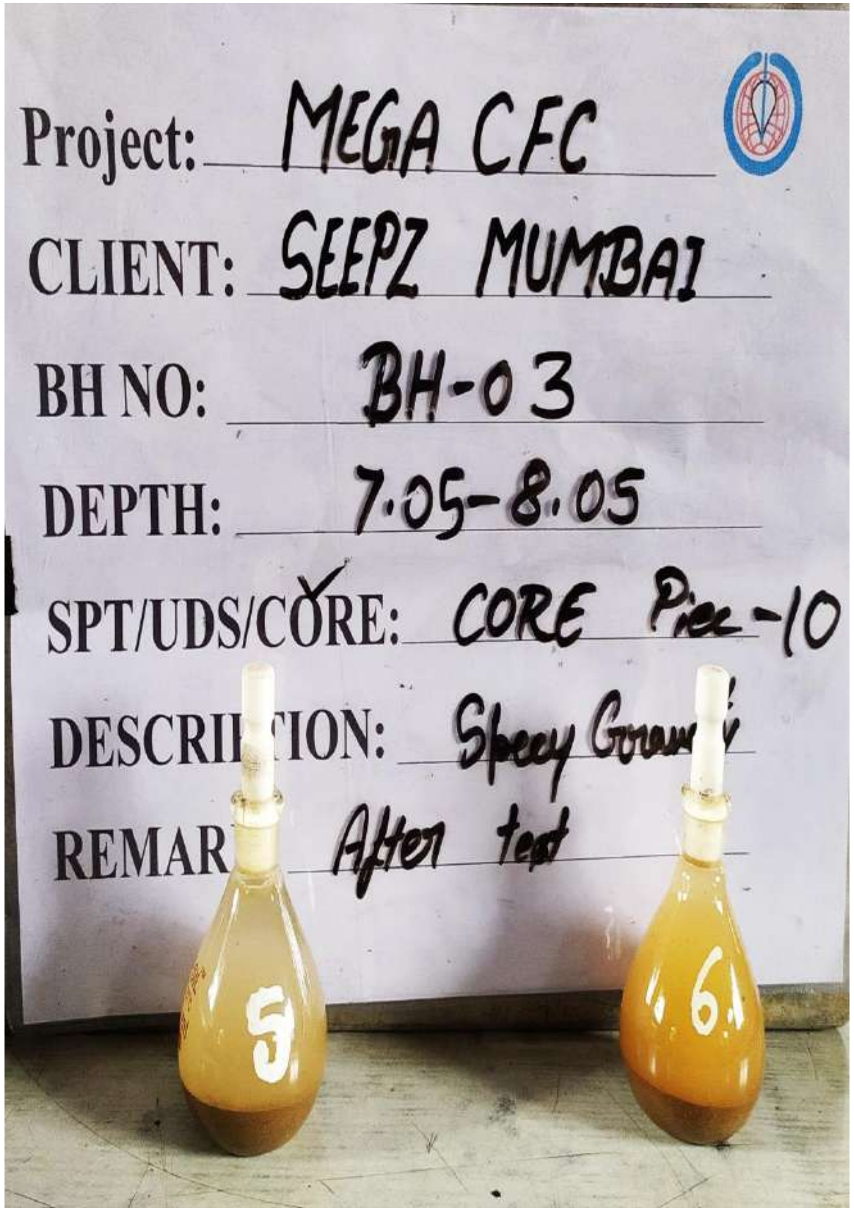

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-03
DEPTH: 4.05-5.05
SPT/UDS/CORE: CORE Piece-3
DESCRIPTION: Silty Gravelly
REMARK: Before test
1

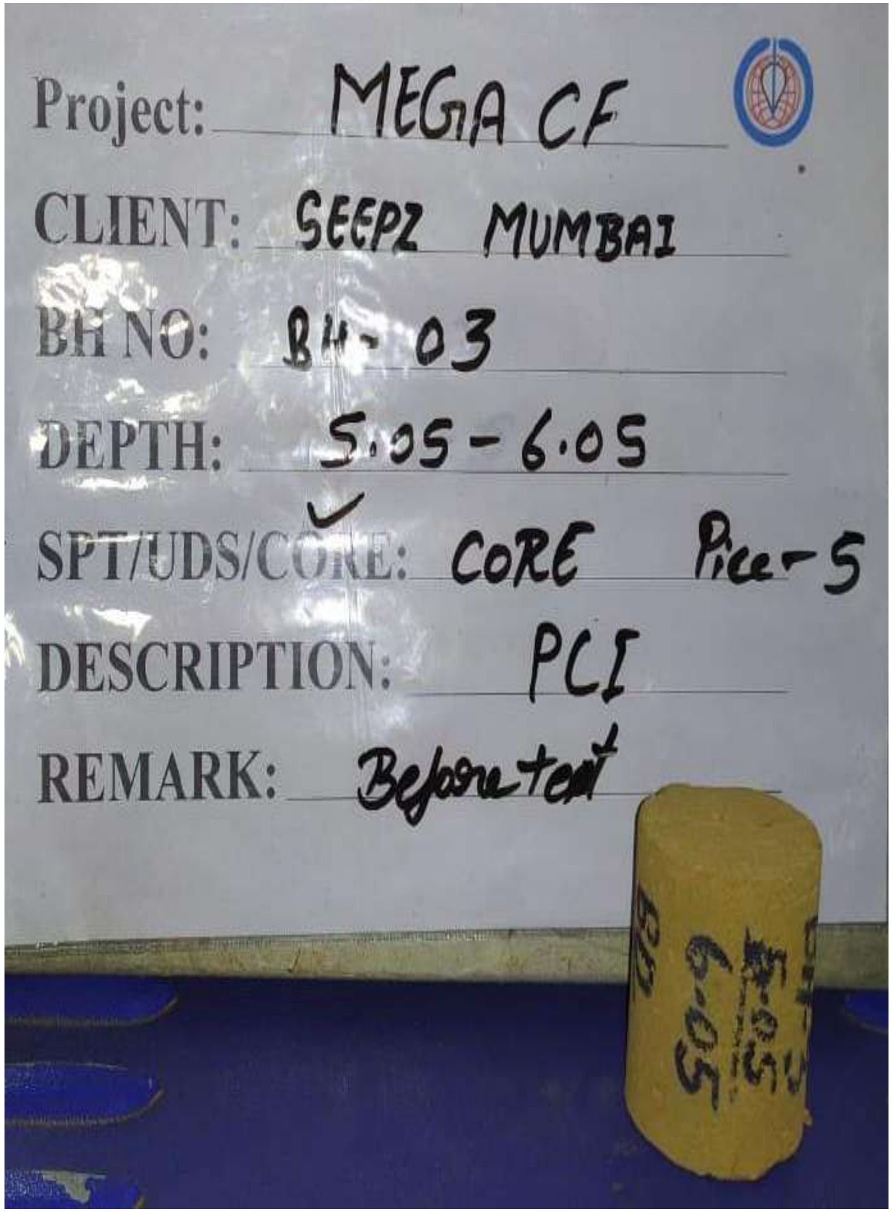

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-03
DEPTH: 4.05-5.05
SPT/UDS/CORE: CORE Piec-3
DESCRIPTION: Specy Gravity
REMARK: After test
J-SIL
50 ml


Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-03
DEPTH: 5.05-6.05
SPT/UDS/CORE: CORE Piec-5
DESCRIPTION: Specy Gravity
REMARK: Before test
J-SIL

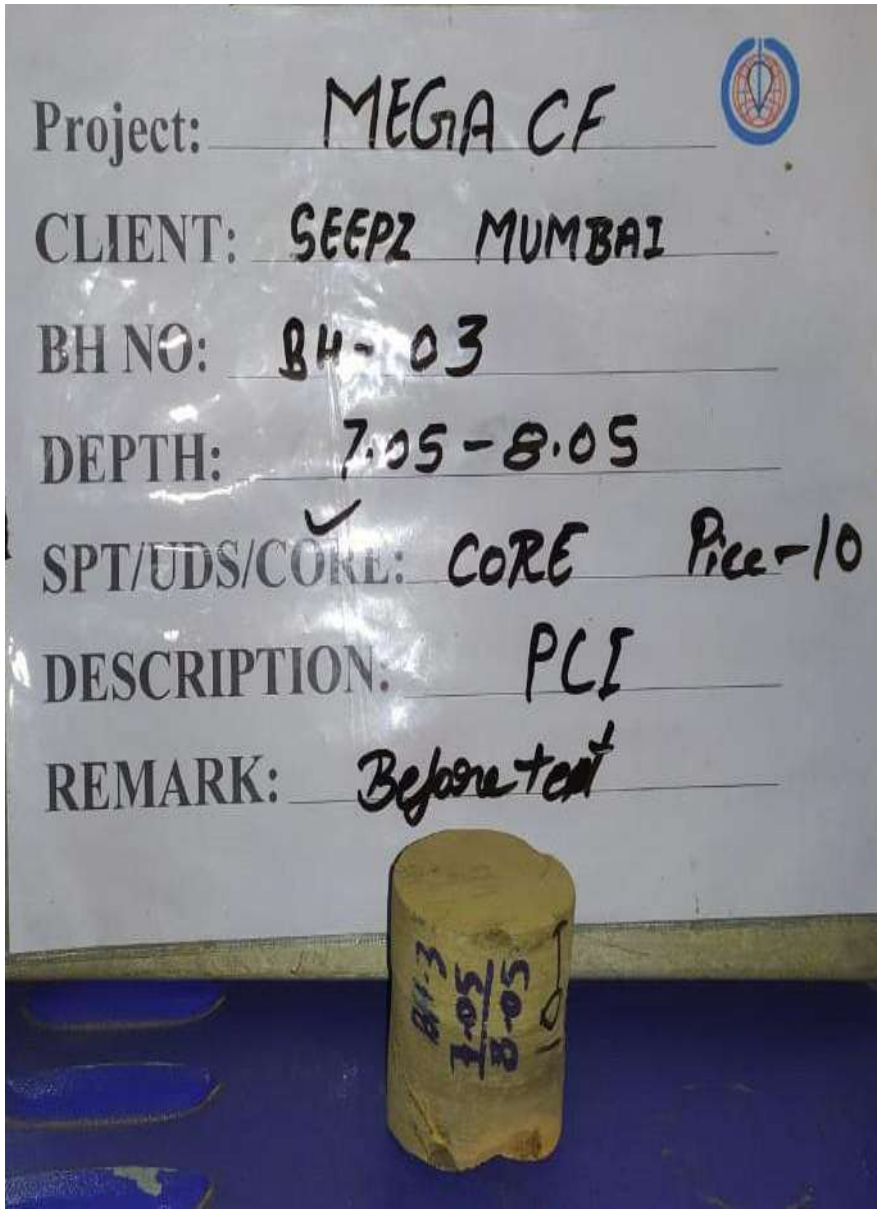

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-03
DEPTH: 5.05-6.05
SPT/UDS/CORE: CORE Piec-5
DESCRIPTION: Speey Gravely
REMARK: After test
3
4

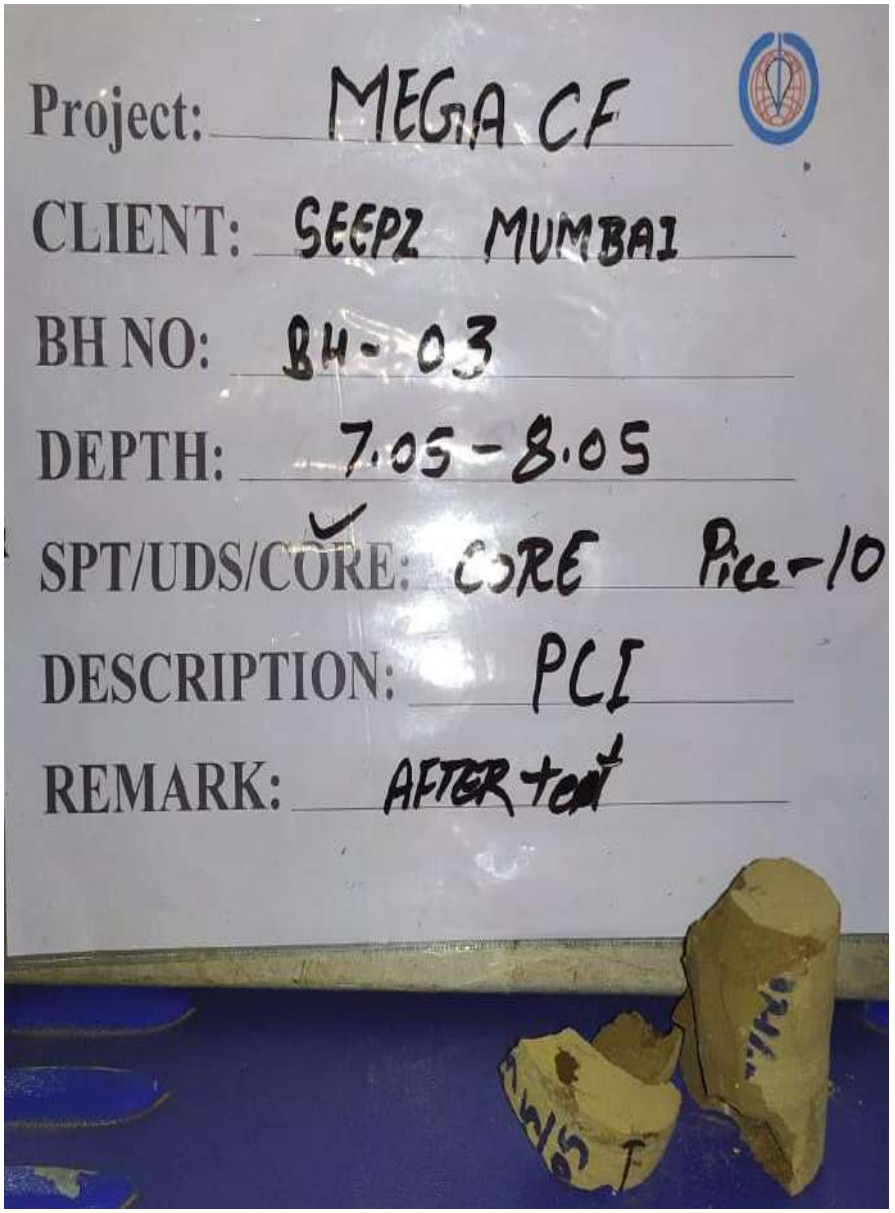

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-03
DEPTH: 7.05-8.05
SPT/UDS/CORE: CORE Piec-10
DESCRIPTION: Speey Gravely
REMARK: Before test
6
5

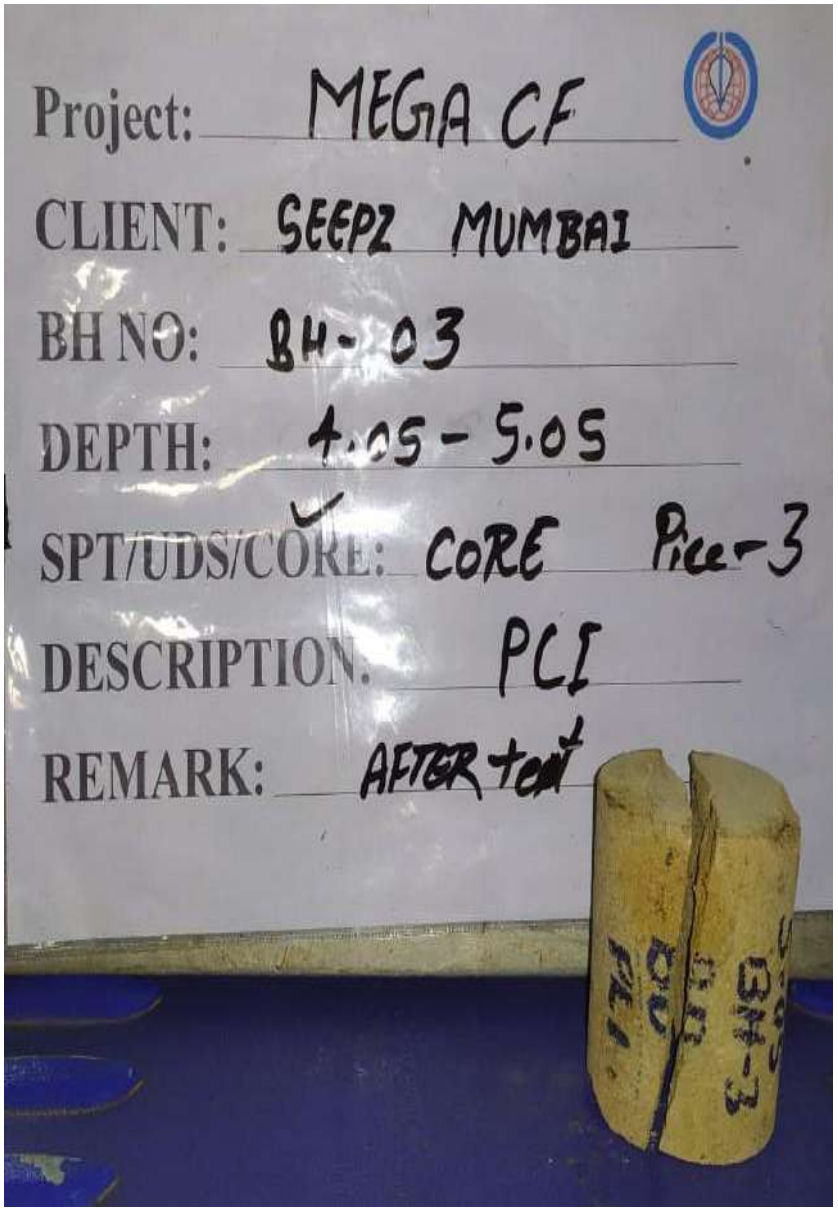

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-03
DEPTH: 7.05-8.05
SPT/UDS/CORE: CORE Piec-10
DESCRIPTION:
REMARK: After test
5
6

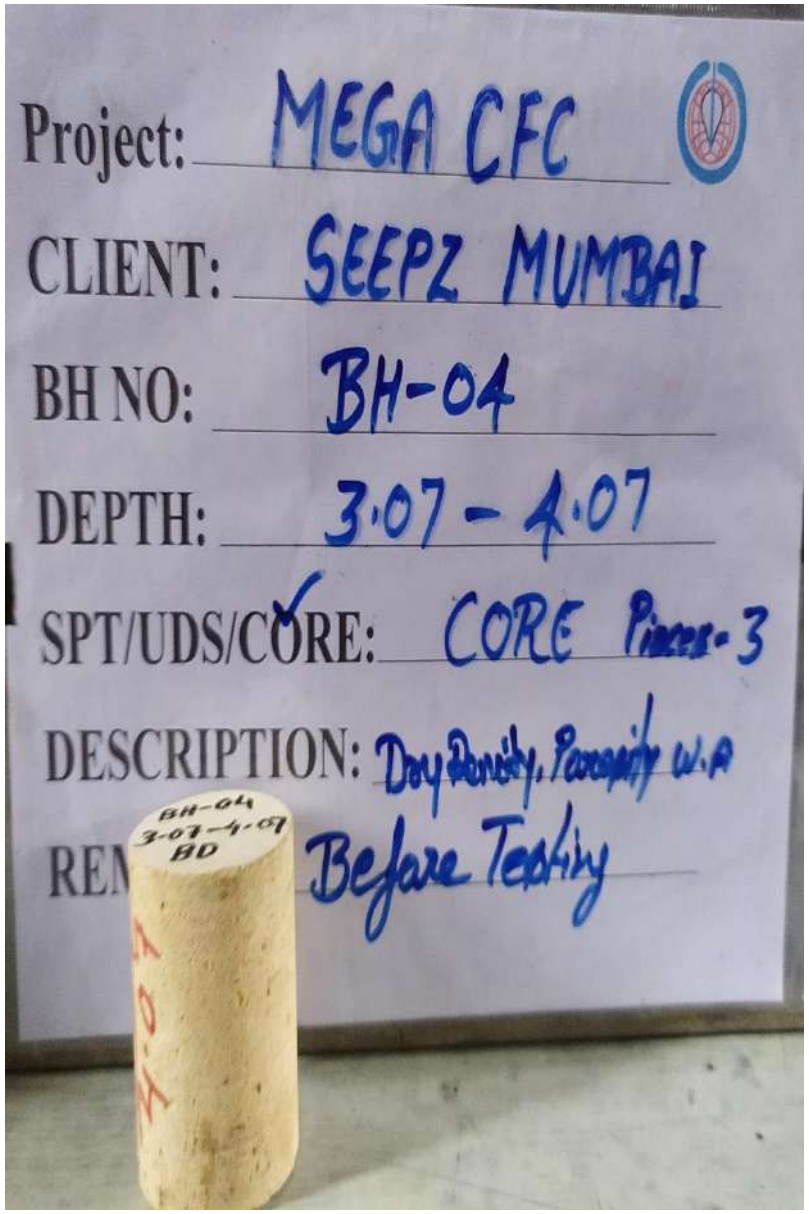

Project: MEGA CF
CLIENT: SEEPZ MUMBAI
BH NO: BH-03
DEPTH: 5.05-6.05
SPT/UDS/CORE: CORE Piec-5
DESCRIPTION: PCI
REMARK: Before test

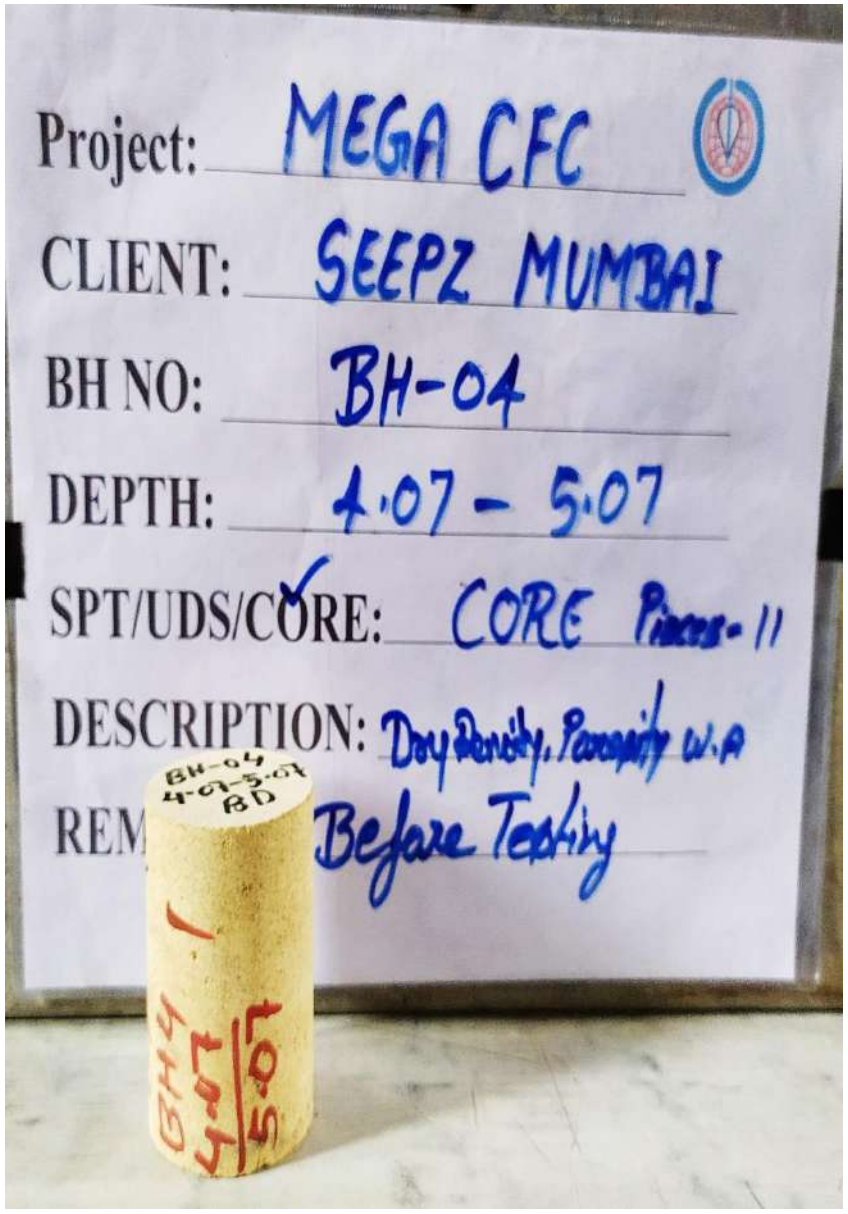

Project: MEGA CF
CLIENT: SEEPZ MUMBAI
BH NO: BH-03
DEPTH: 5.05-6.05
SPT/UDS/CORE: CORE Pice-5
DESCRIPTION: PCI
REMARK: AFTER test

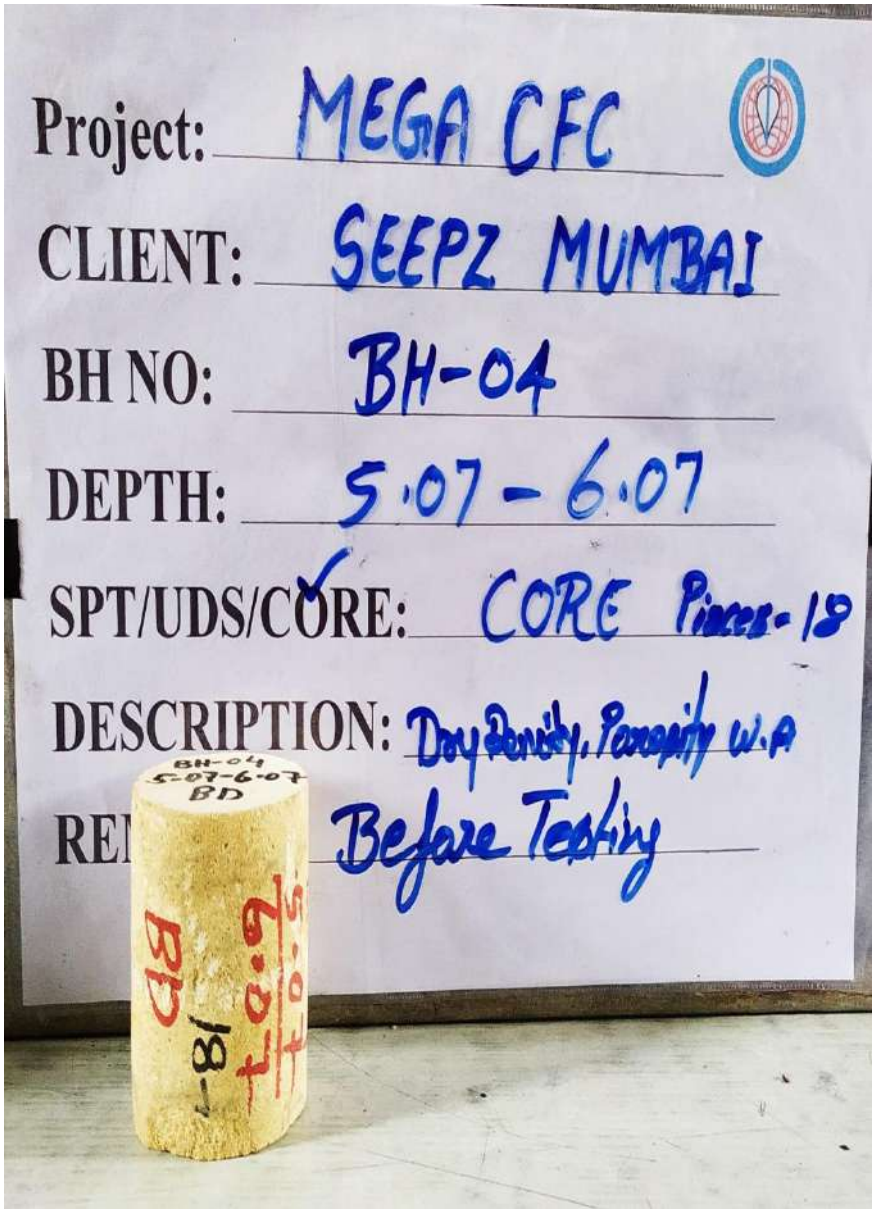

Project: MEGA CF
CLIENT: SEEPZ MUMBAI
BH NO: BH-03
DEPTH: 7.05-8.05
SPT/UDS/CORE: CORE Pice-10
DESCRIPTION: PCI
REMARK: Before test

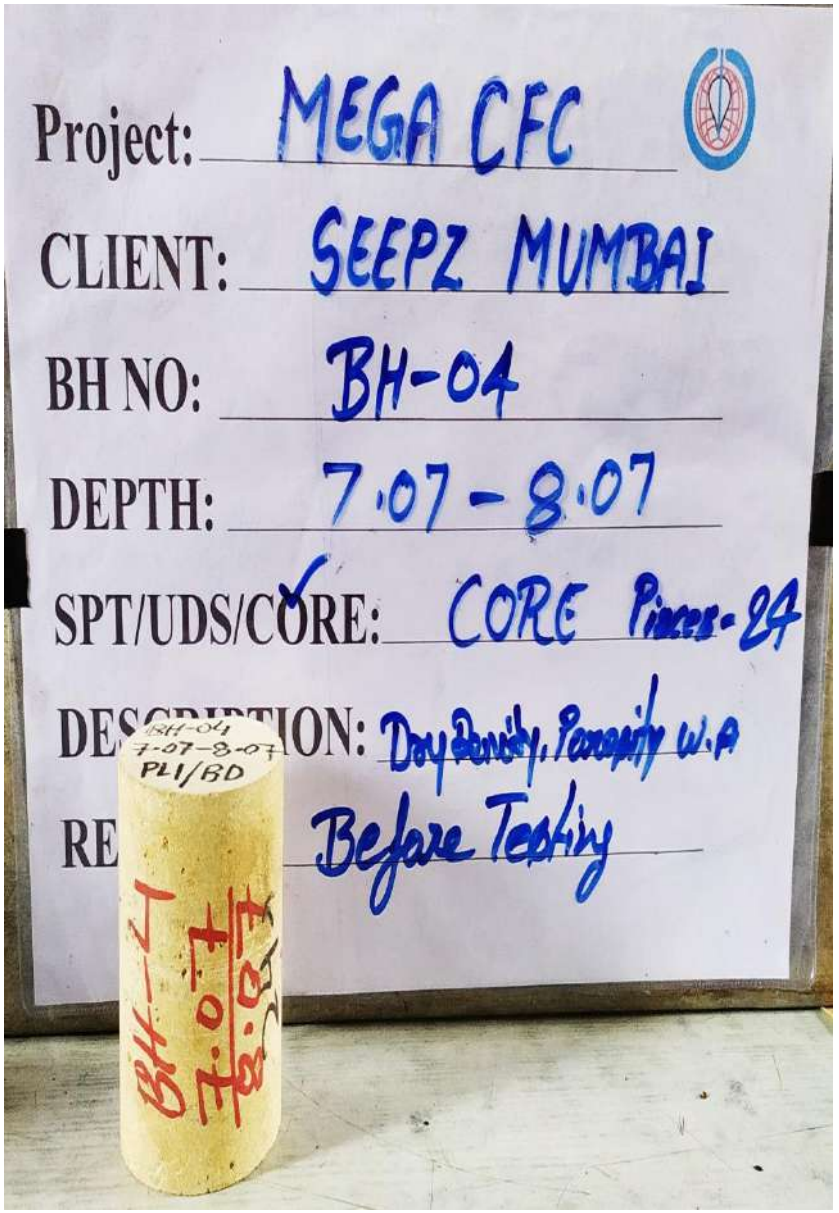

Project: MEGA CF
CLIENT: SEEPZ MUMBAI
BH NO: BH-03
DEPTH: 7.05-8.05
SPT/UDS/CORE: CORE Pice-10
DESCRIPTION: PCI
REMARK: AFTER test

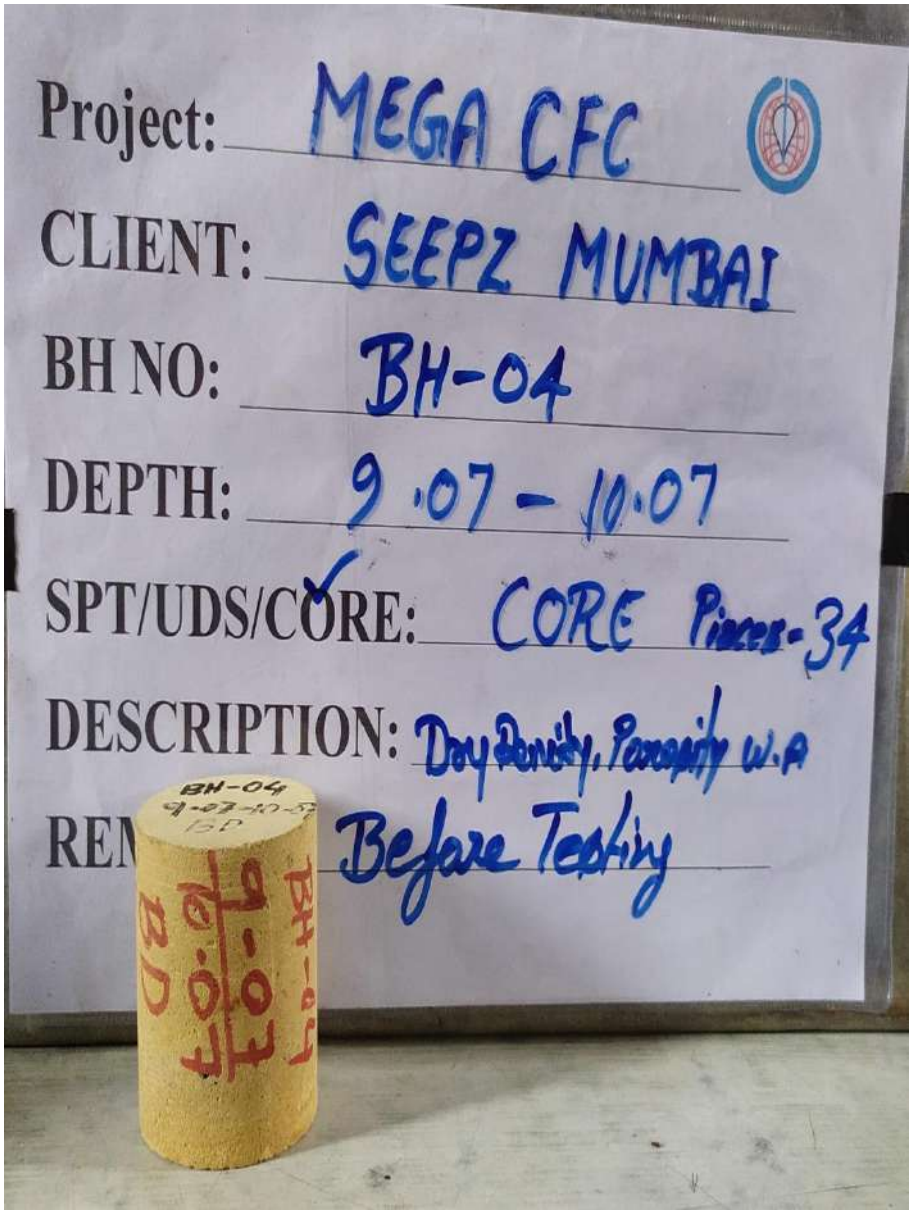

Project: MEGA CF
CLIENT: SEEPZ MUMBAI
BH NO: BH-03
DEPTH: 4.05-5.05
SPT/UDS/CORE: CORE Pice-3
DESCRIPTION: PCI
REMARK: AFTER test

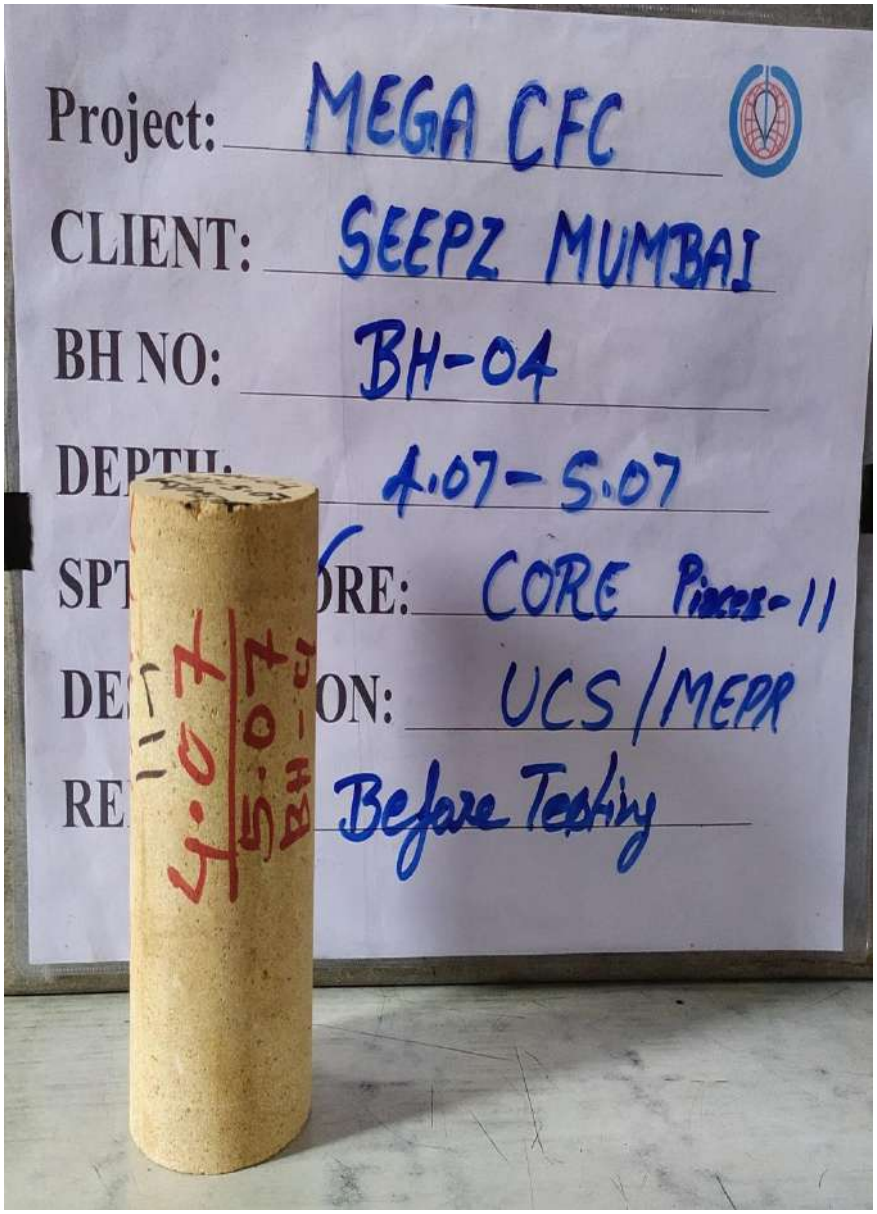

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-04
DEPTH: 3.07 - 4.07
SPT/UDS/CORE: CORE Pieces-3
DESCRIPTION: Dry Density, Porosity W.A
REM Before Testing
BH-04
3.07-4.07
BD

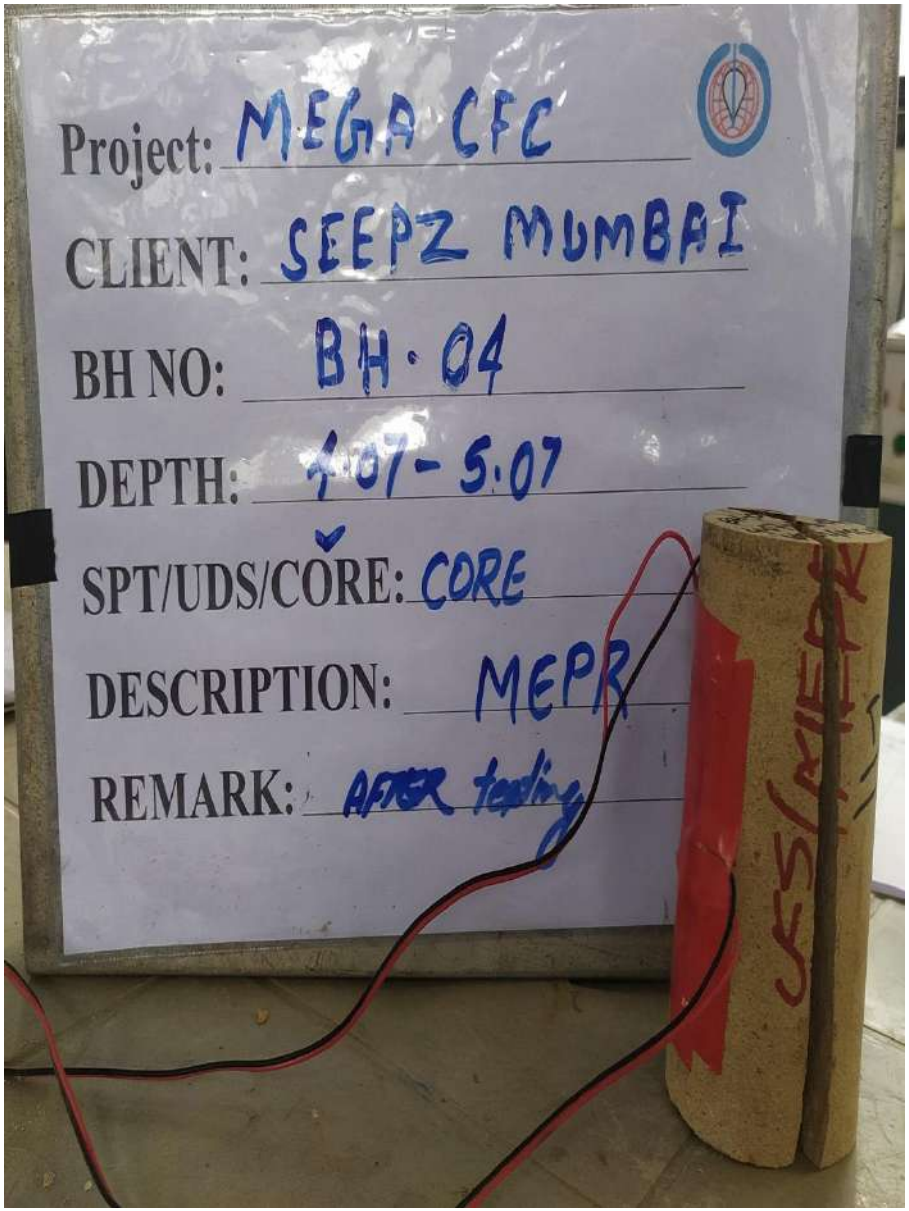

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-04
DEPTH: 4.07 - 5.07
SPT/UDS/CORE: CORE Pieces-11
DESCRIPTION: Dry Density, Porosity W.A
REM Before Testing
BH-04
4.07-5.07
BD

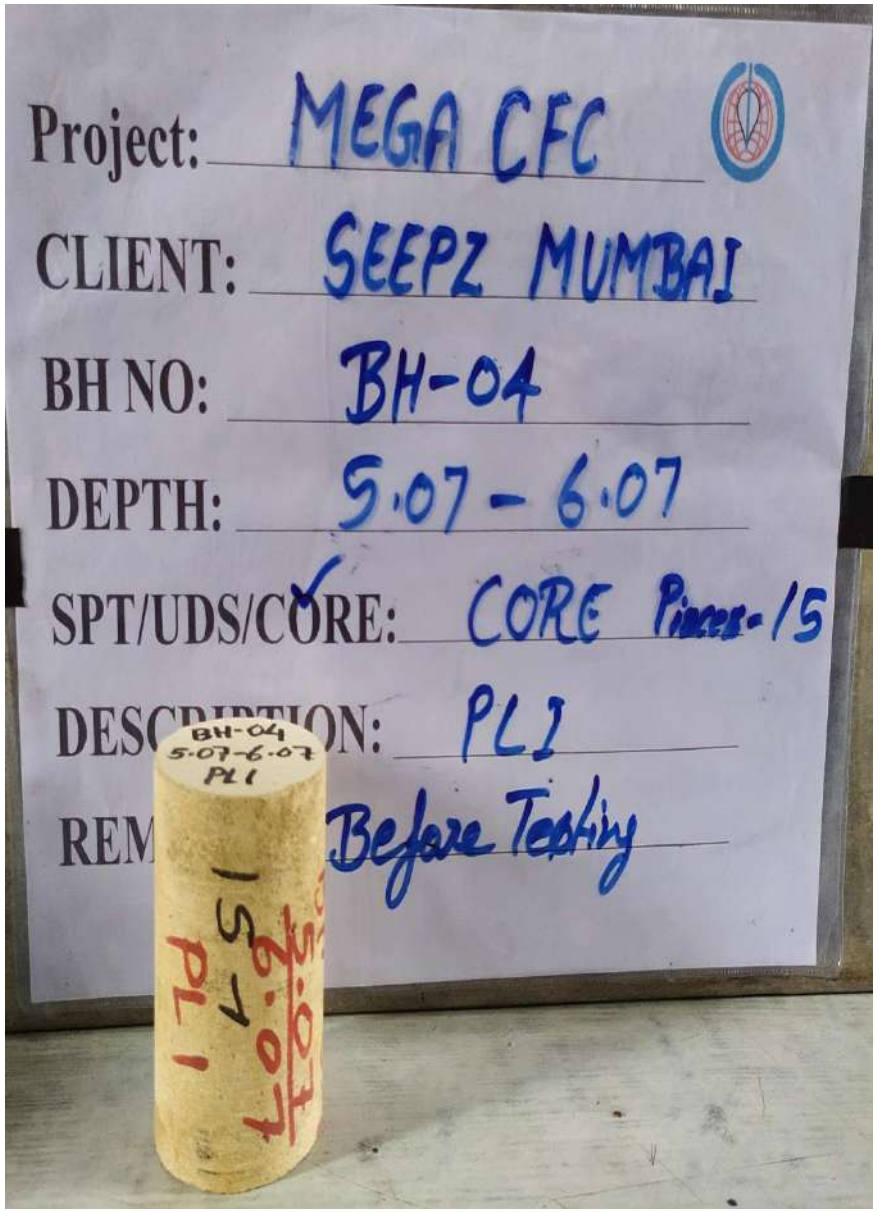

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-04
DEPTH: 5.07 - 6.07
SPT/UDS/CORE: CORE Pieces - 18
DESCRIPTION: Dry Density, Porosity W.A
Before Testing
BH-04
5.07-6.07
BD

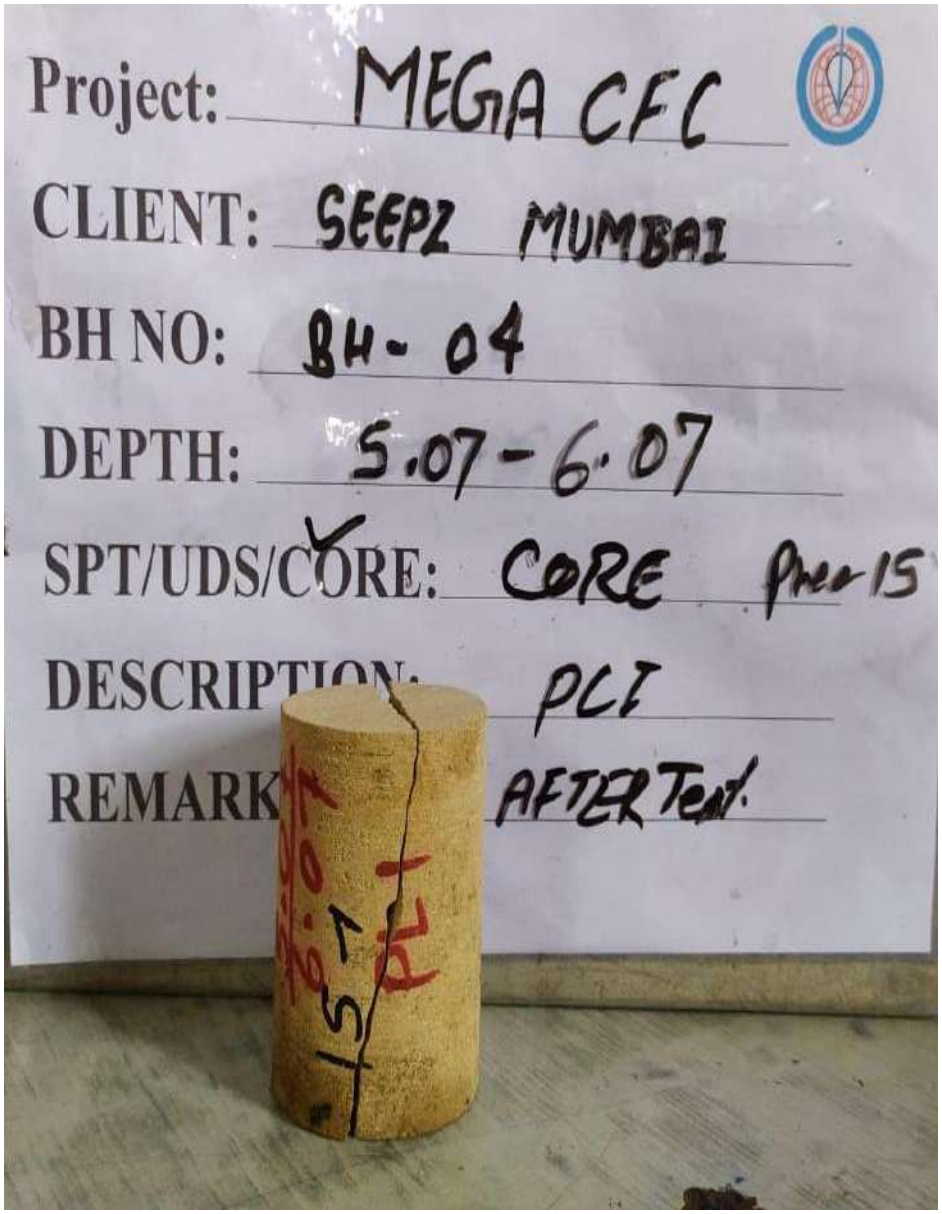

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-04
DEPTH: 7.07 - 8.07
SPT/UDS/CORE: CORE Pieces - 24
Dry Density, Porosity W.A
Before Testing
BH-04
7.07-8.07
PLI/BD

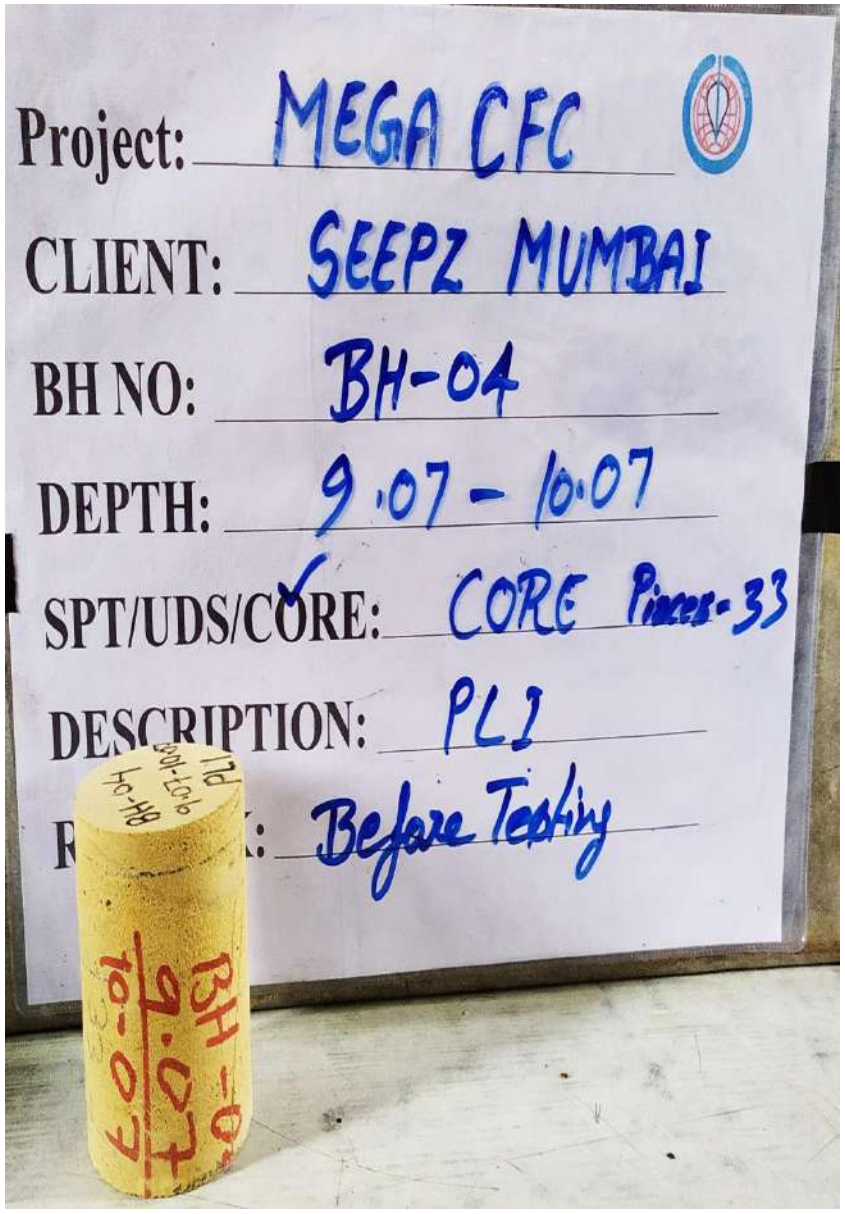

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-04
DEPTH: 9.07 - 10.07
SPT/UDS/CORE: CORE Pieces-34
DESCRIPTION: Dry Density, Porosity W.A
REM Before Testing
BH-04
9.07-10.07
BP
9.07
10.07
BH-04

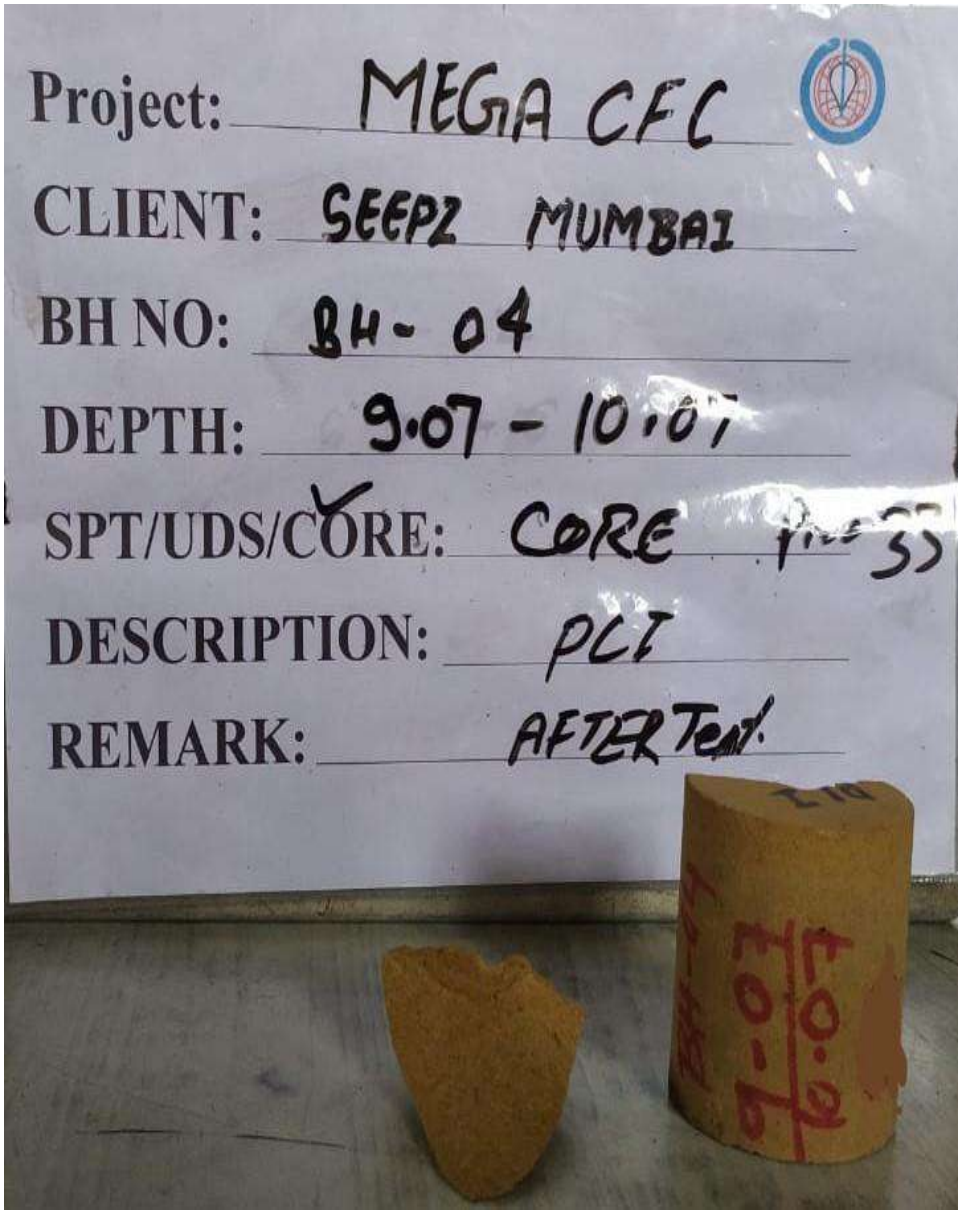

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-04
DEPTH: 4.07 - 5.07
SPT/UDS/CORE: CORE Pieces-11
DESCRIPTION: UCS / MEPR
RE Before Testing
4.07
5.07
BH-04

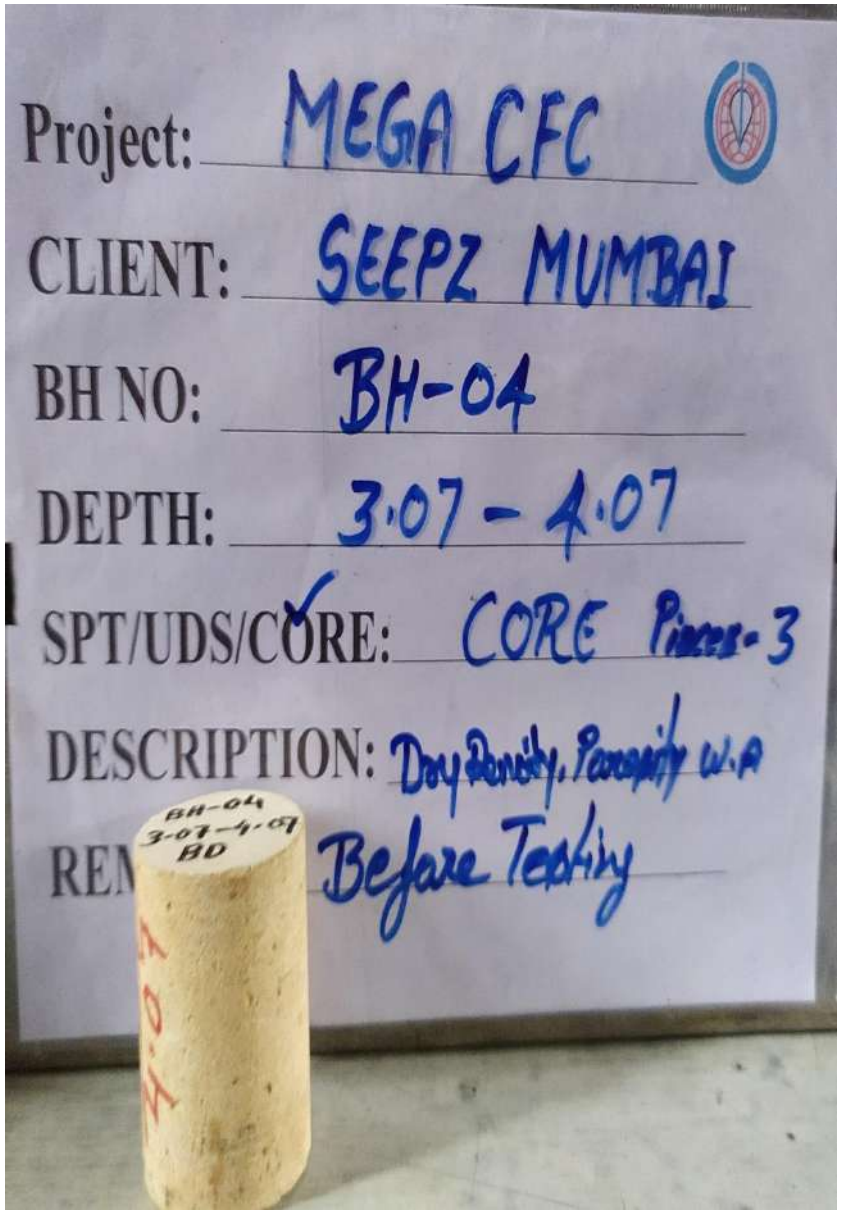

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-04
DEPTH: 4.07-5.07
SPT/UDS/CORE: CORE
DESCRIPTION: MEPR
REMARK: AFTER testing


Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-04
DEPTH: 5.07 - 6.07
SPT/UDS/CORE: CORE Pieces-15
DESCRIPTION: PLI
REM Before Testing
BH-04
5.07-6.07
PLI

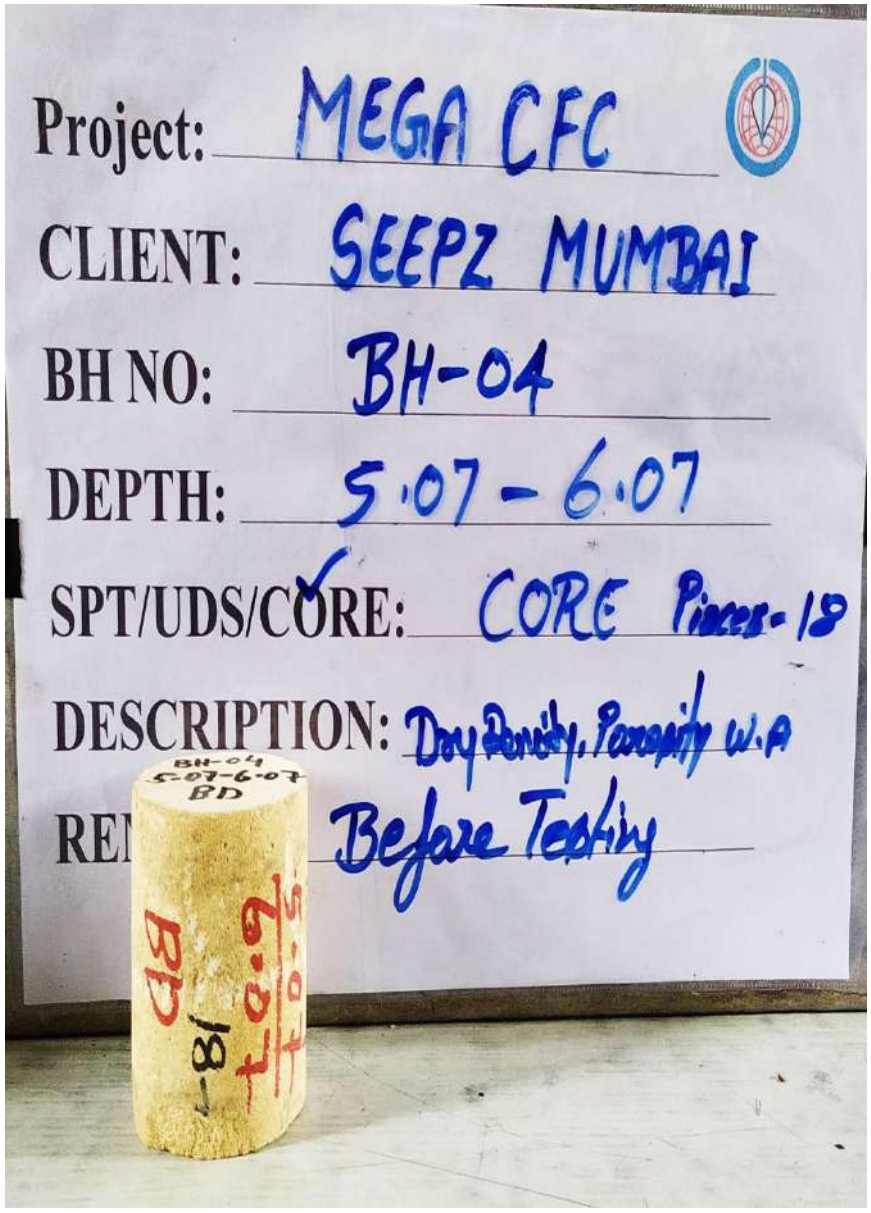

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-04
DEPTH: 5.07-6.07
SPT/UDS/CORE: CORE Pcs-15
DESCRIPTION: PLI
REMARK: AFTER Test.
BH-04
5.07-6.07
PLI
1ST

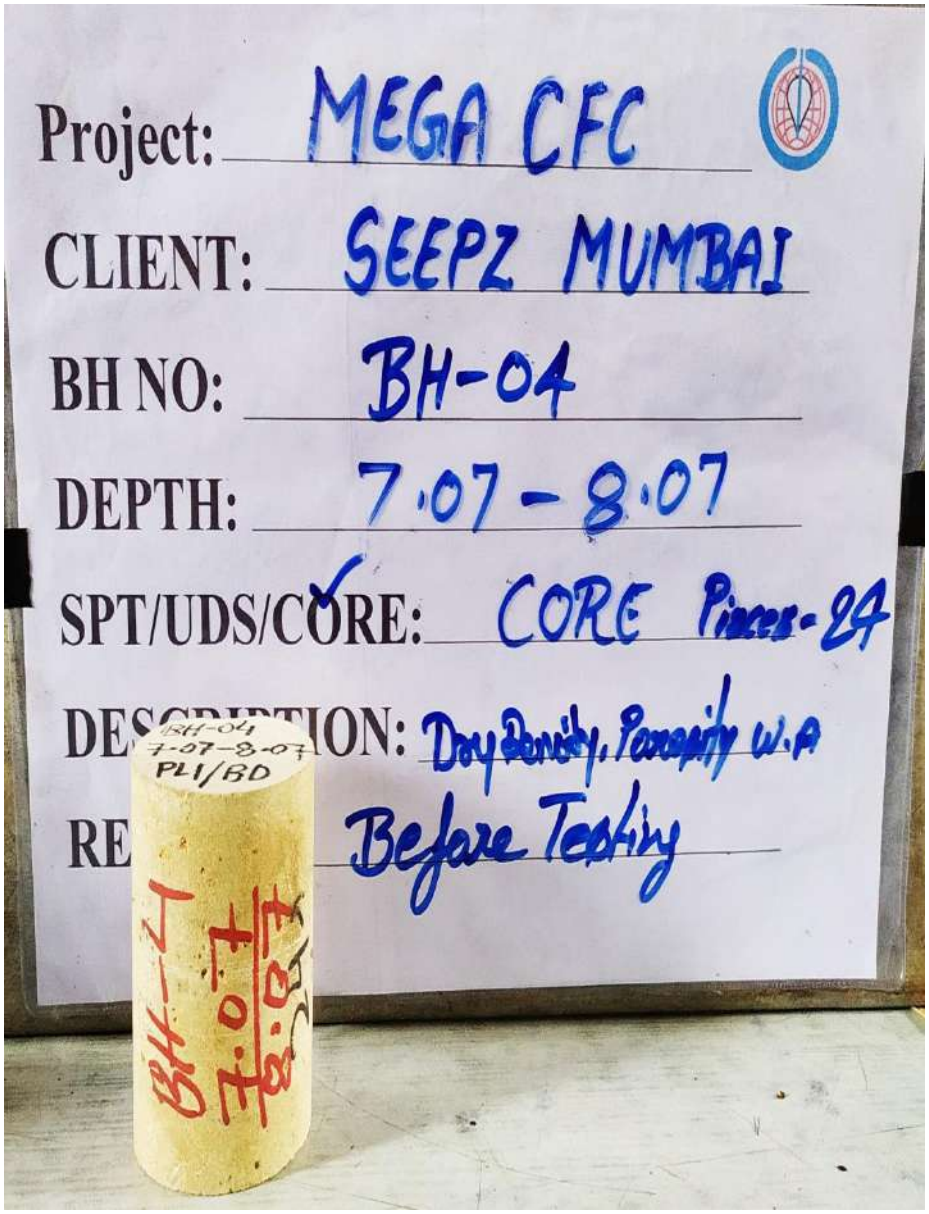

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-04
DEPTH: 9.07-10.07
SPT/UDS/CORE: CORE Pieces-33
DESCRIPTION: PLI
Before Testing
BH-04
9.07-10.07
PLI

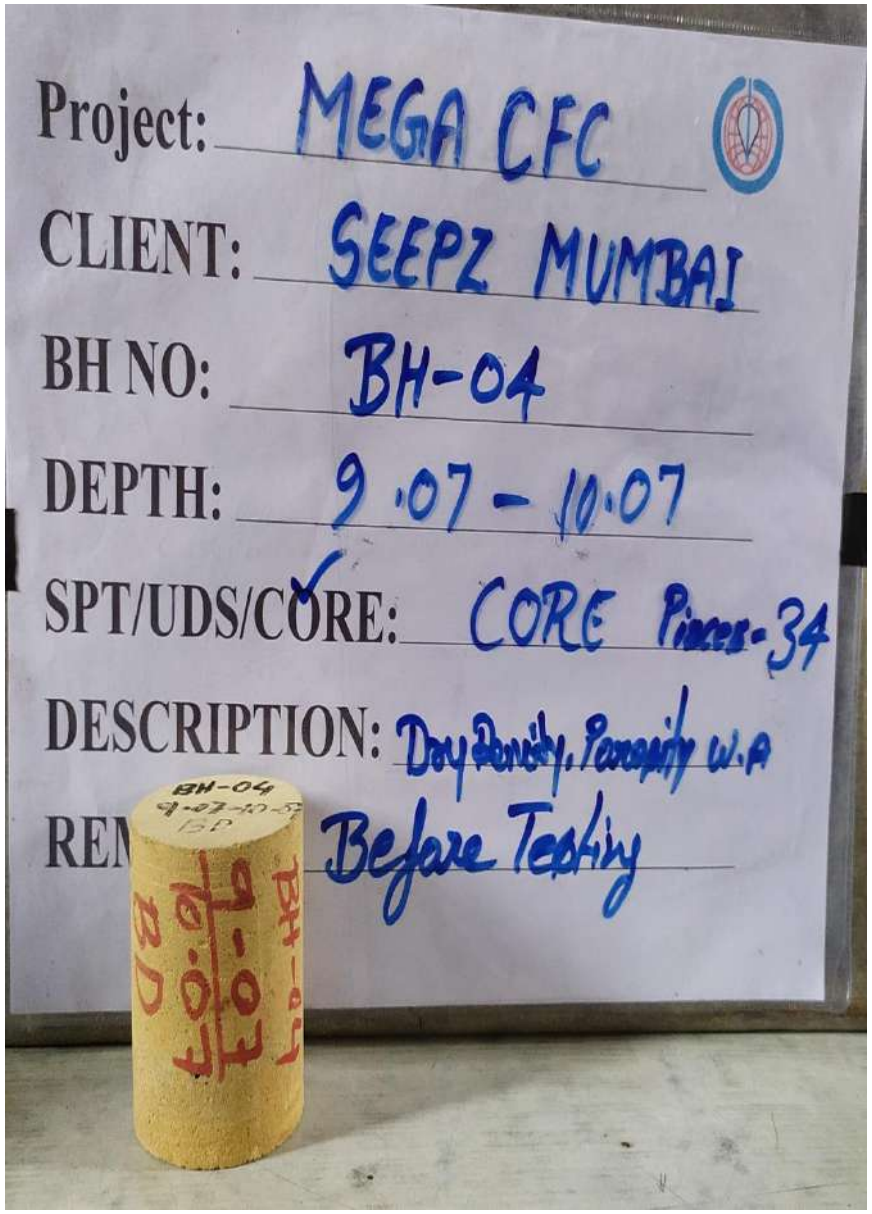

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH- 04
DEPTH: 9.07 - 10.07
SPT/UDS/CORE: CORE
DESCRIPTION: PCT
REMARK: AFTER Test

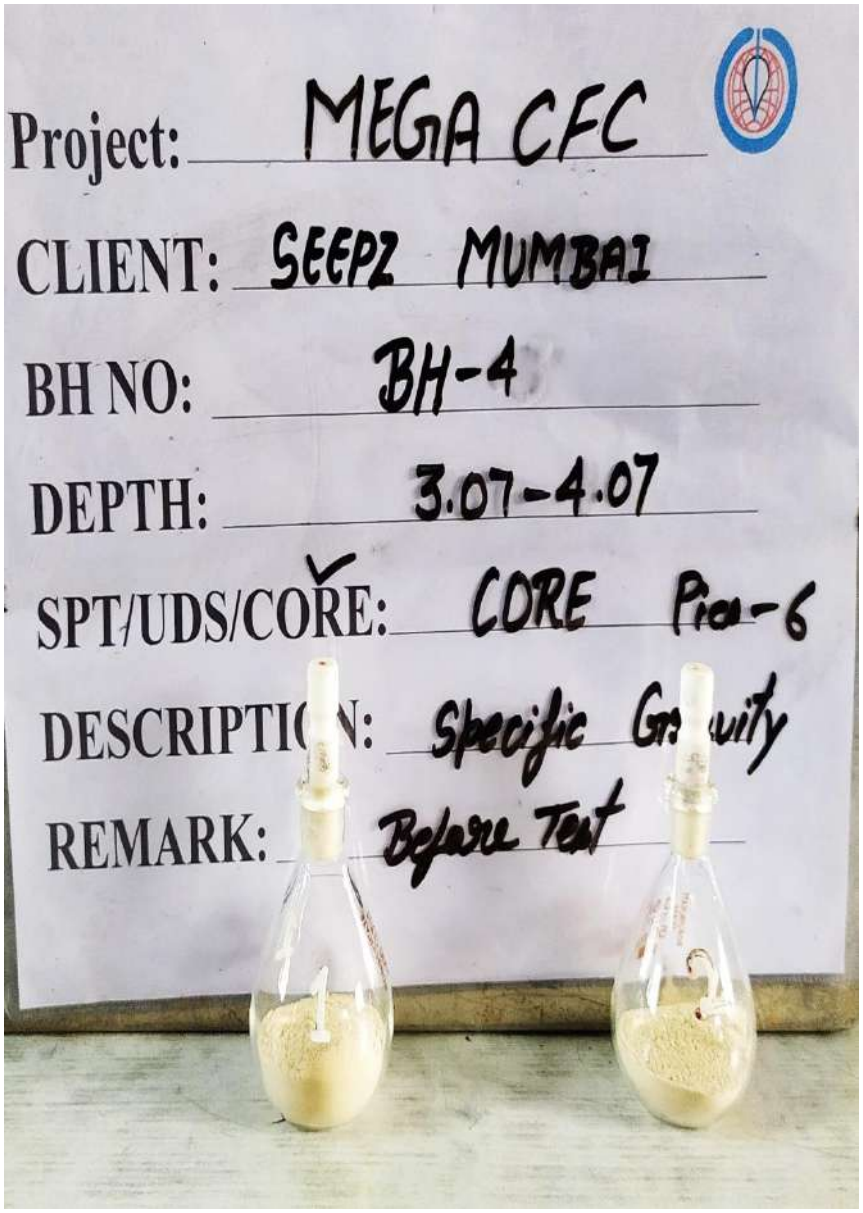

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-04
DEPTH: 3.07 - 4.07
SPT/UDS/CORE: CORE Pieces-3
DESCRIPTION: Dry Density, Porosity W.A
Before Testing
BH-04
3.07-4.07
BD

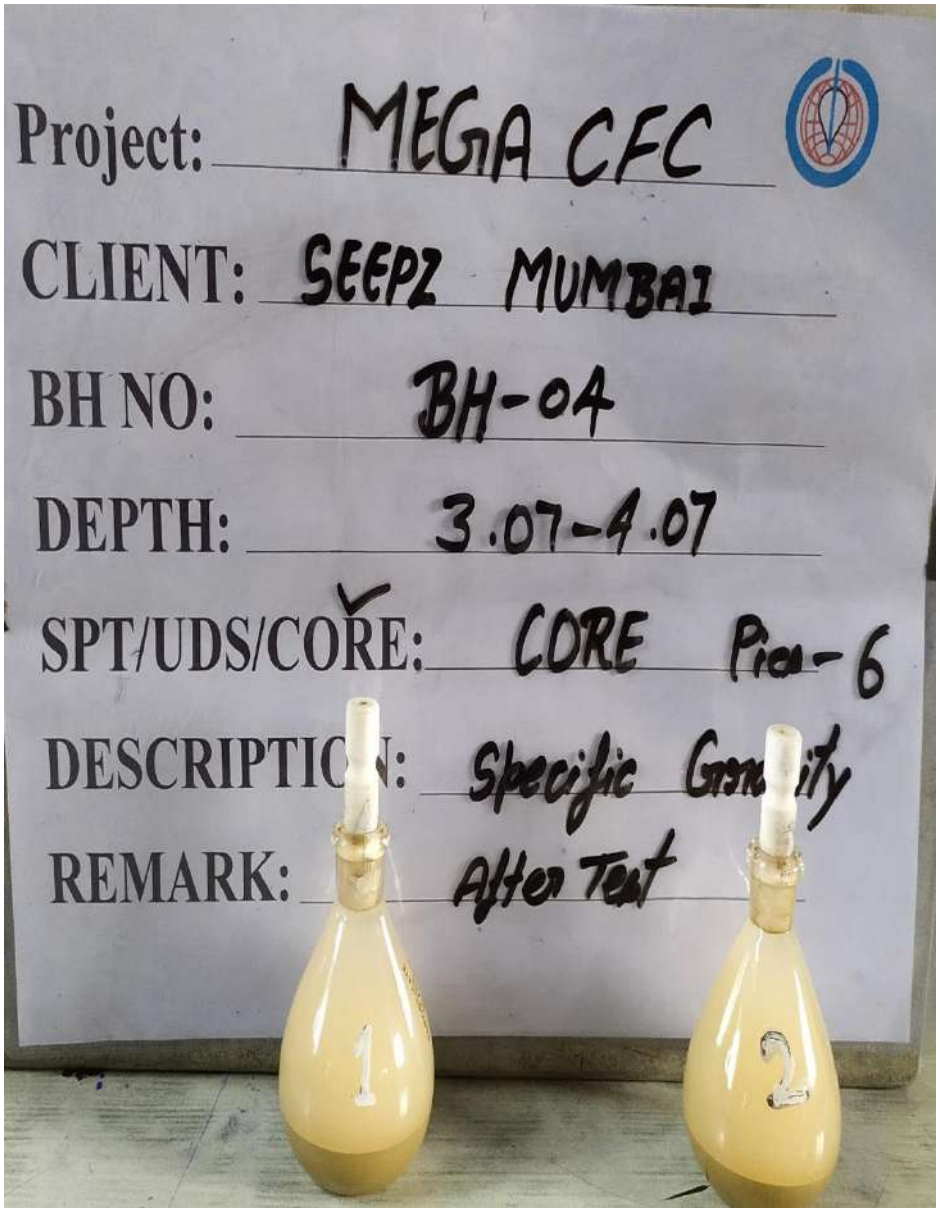

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-04
DEPTH: 4.07 - 5.07
SPT/UDS/CORE: CORE Pieces-11
DESCRIPTION: Dry Density, Porosity W.A
REM Before Testing
BH-04
4.07-5.07
BD
BH4
4.07
5.07

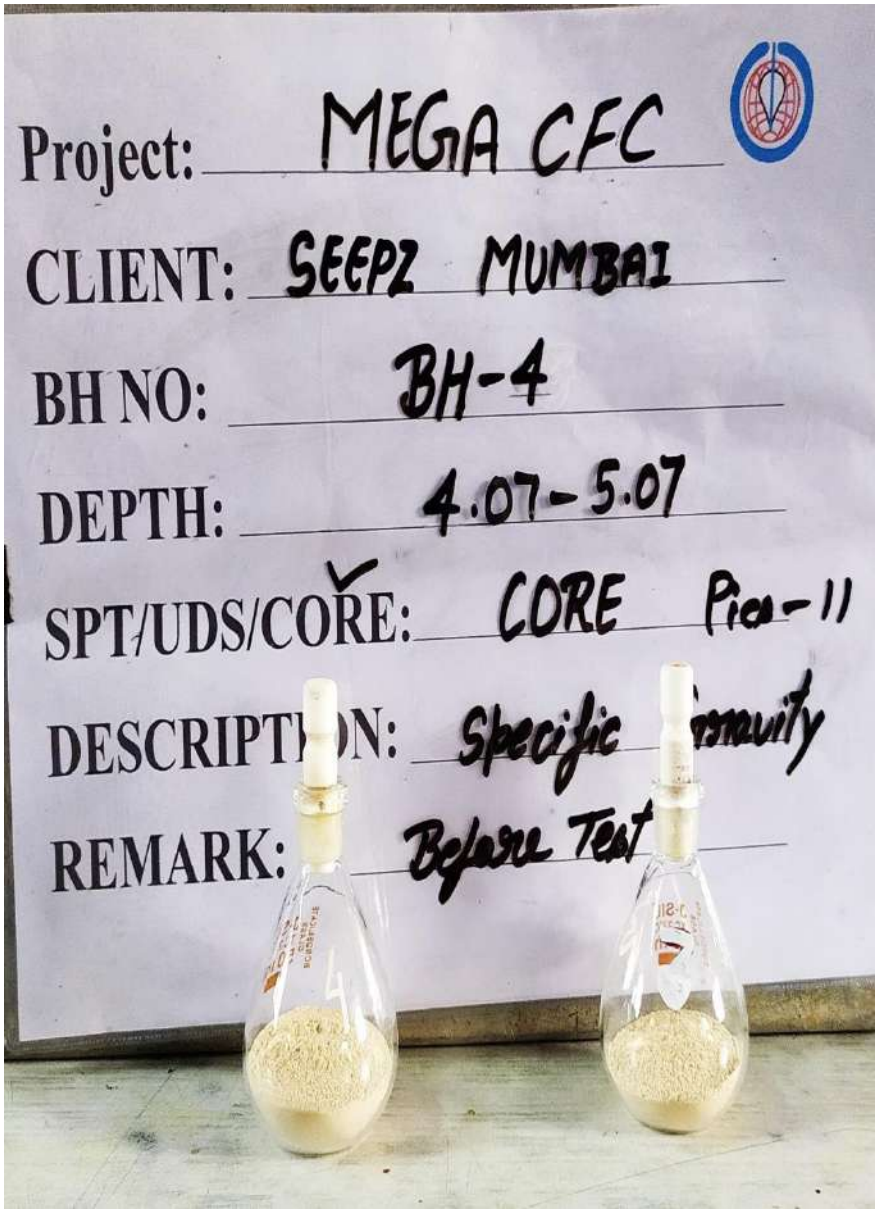

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-04
DEPTH: 5.07 - 6.07
SPT/UDS/CORE: CORE Pieces-13
DESCRIPTION: Dry Density, Porosity W.A
REM Before Testing
BH-04
5.07-6.07
BD
BH-4
5.07
6.07

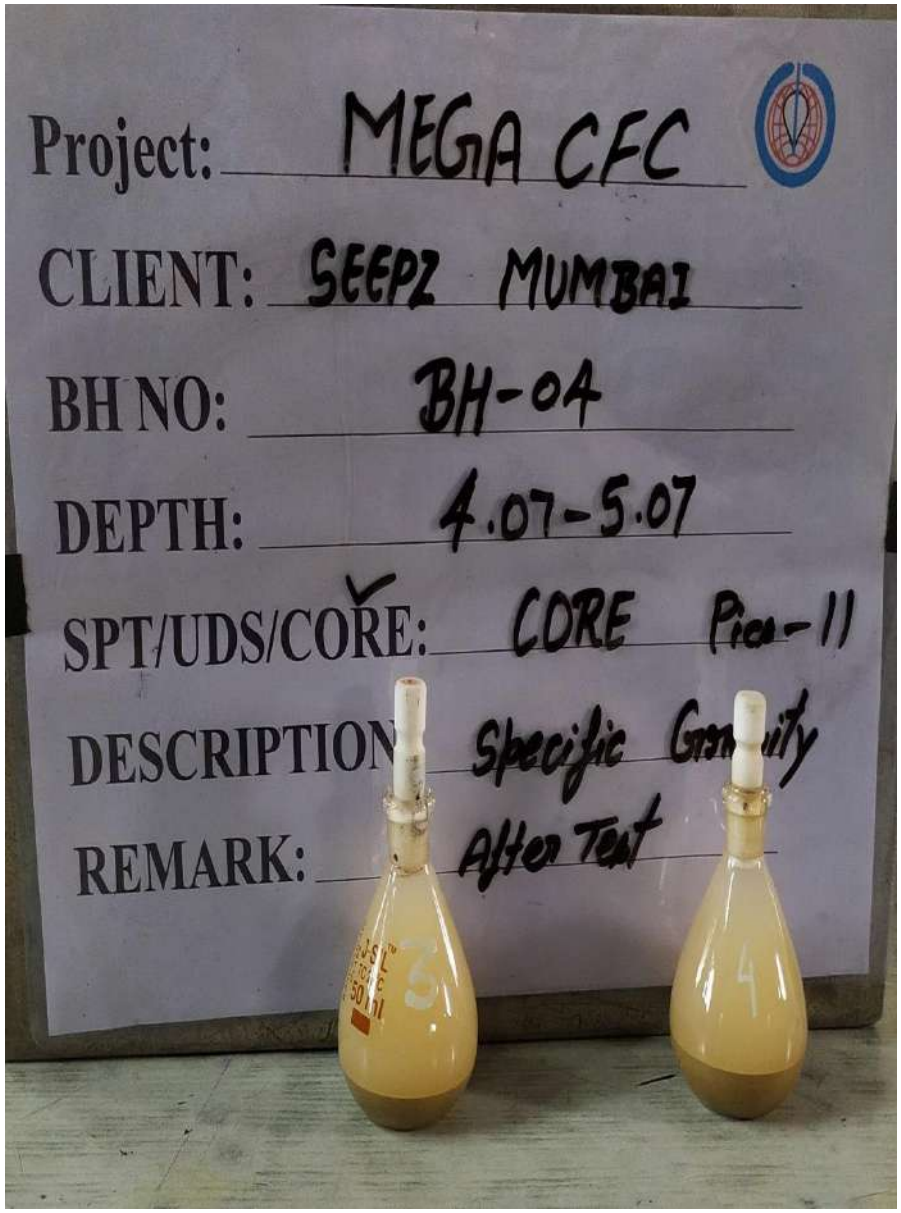

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-04
DEPTH: 7.07 - 8.07
SPT/UDS/CORE: CORE Pieces - 24
DESCRIPTION: Dry Density, Porosity W.A
RE Before Testing
BH-04
7-07-8-07
PLI/BD

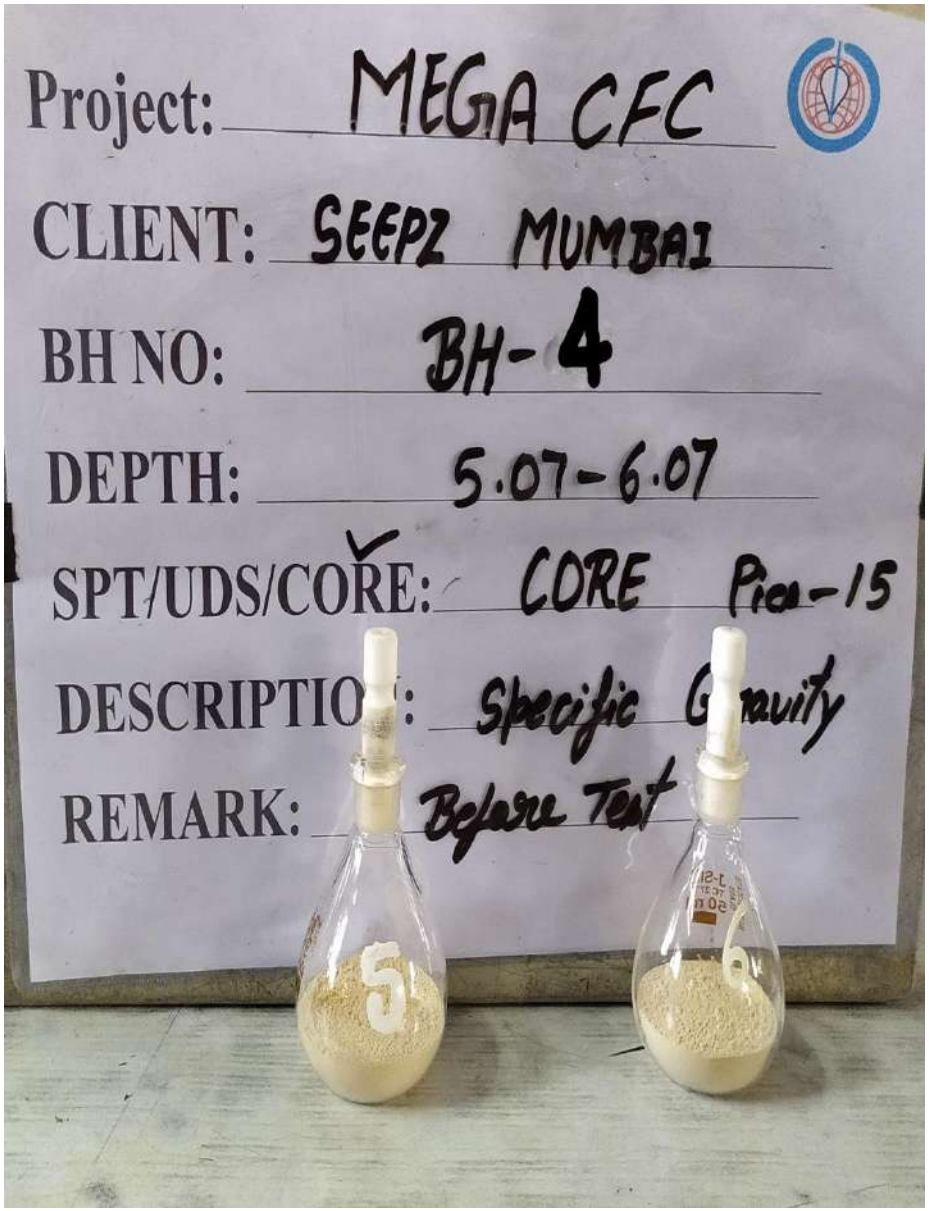

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-04
DEPTH: 9.07 - 10.07
SPT/UDS/CORE: CORE Pieces - 34
DESCRIPTION: Dry Density, Porosity W.A
REM Before Testing
BH-04

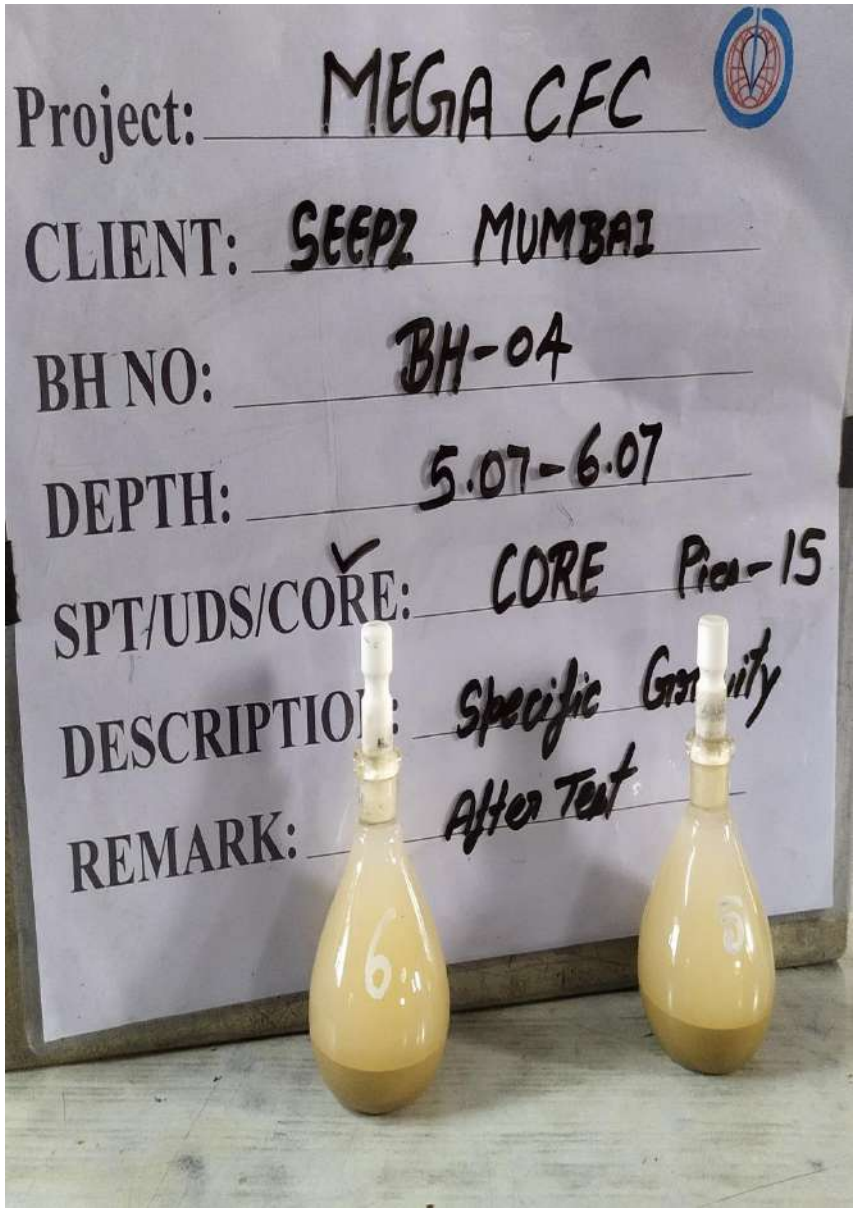

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-4
DEPTH: 3.07-4.07
SPT/UDS/CORE: CORE Pics-6
DESCRIPTION: Specific Gravity
REMARK: Before Test
1
2

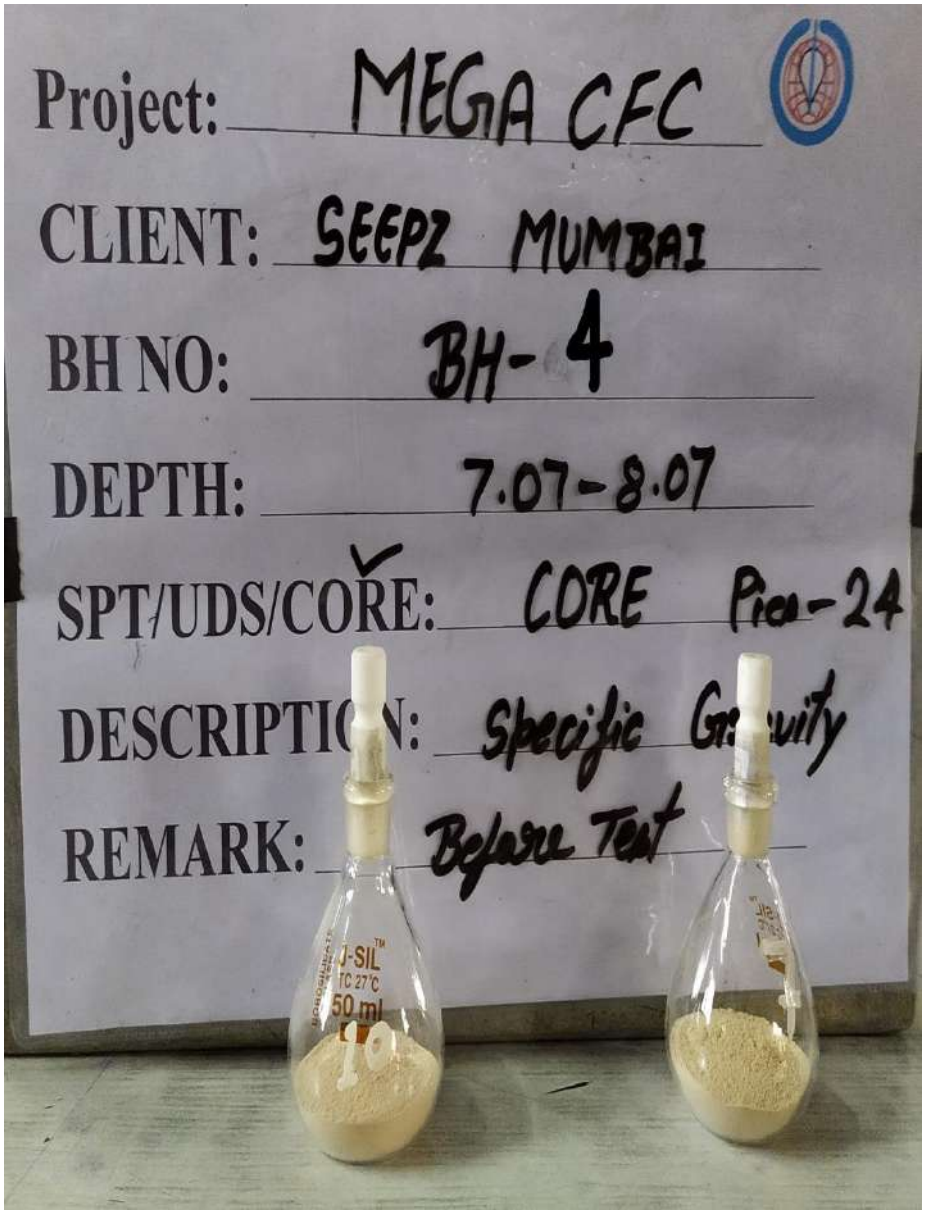

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-04
DEPTH: 3.07-4.07
SPT/UDS/CORE: CORE Pics-6
DESCRIPTION: Specific Gravity
REMARK: After Test
1
2

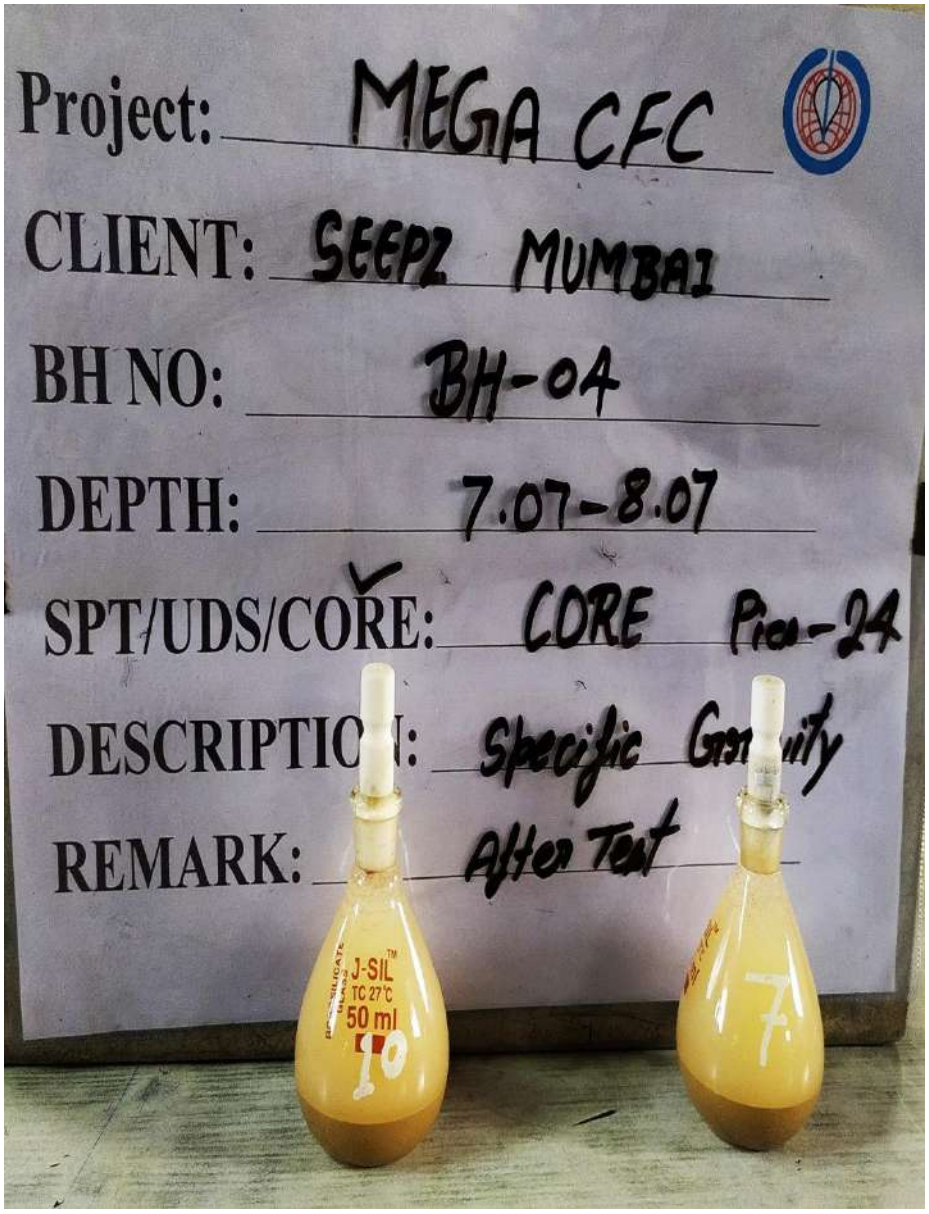

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-4
DEPTH: 4.07-5.07
SPT/UDS/CORE: CORE Pics-11
DESCRIPTION: Specific Gravity
REMARK: Before Test

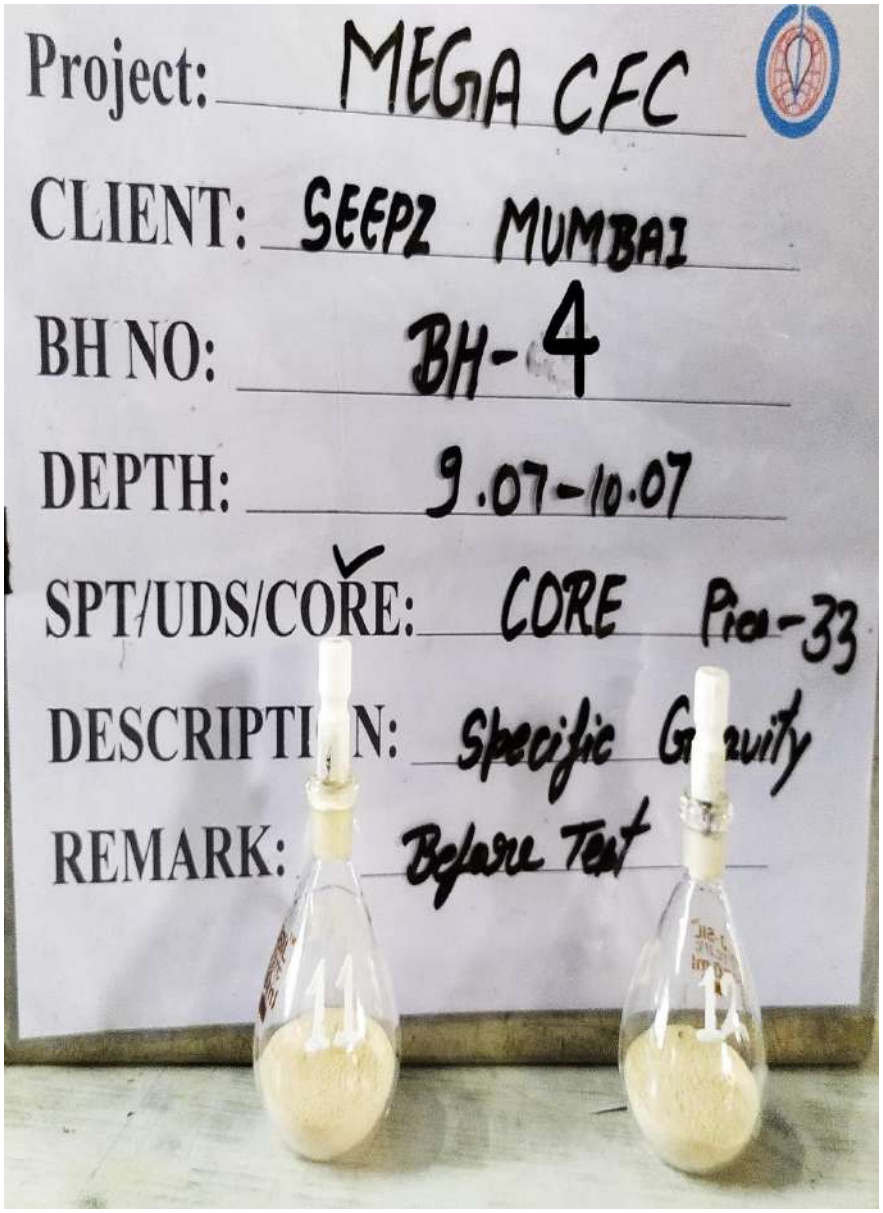

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-04
DEPTH: 4.07-5.07
SPT/UDS/CORE: CORE Pics-11
DESCRIPTION: Specific Gravity
REMARK: After Test

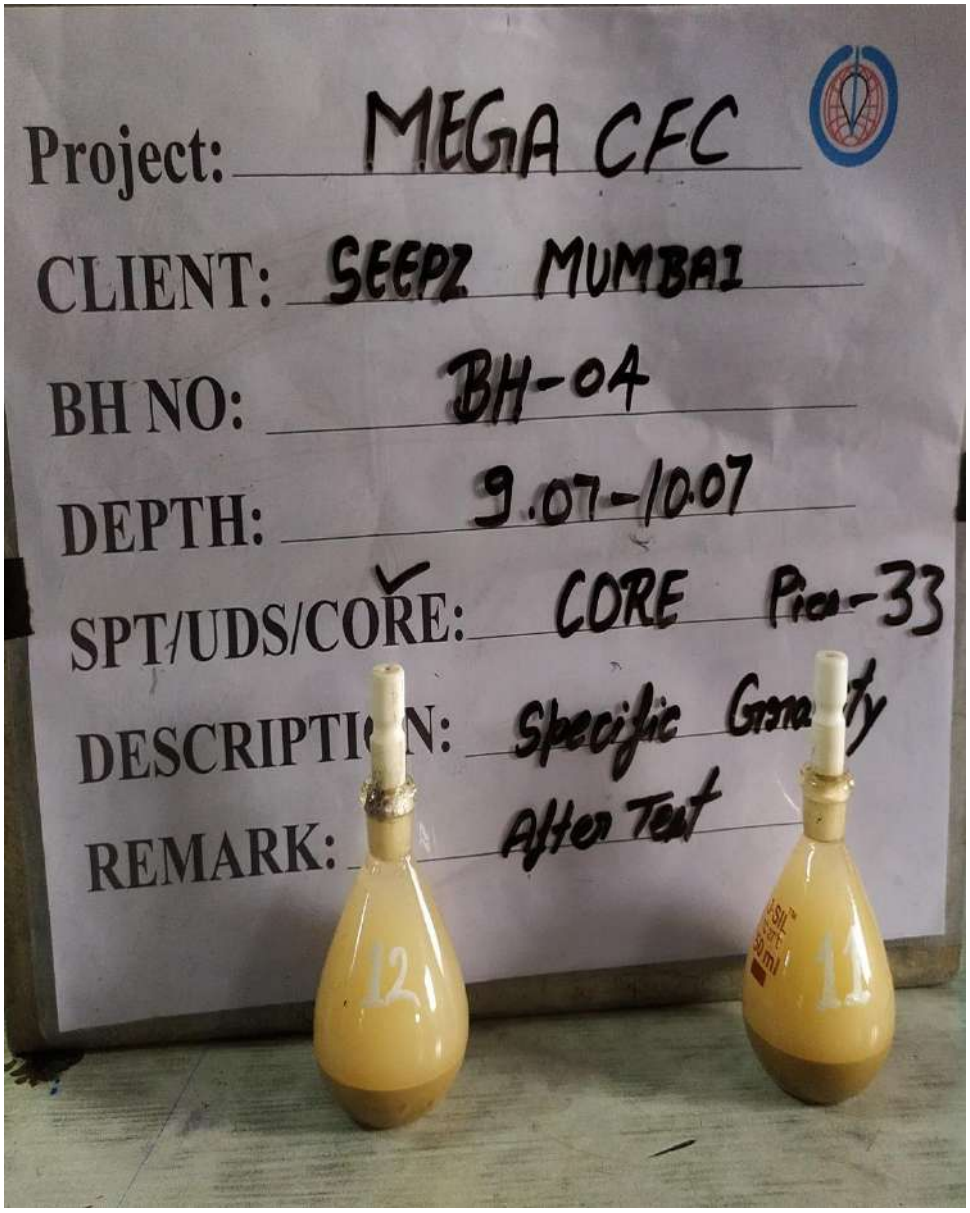

Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-4
DEPTH: 5.07-6.07
SPT/UDS/CORE: CORE Pics-15
DESCRIPTION: Specific Gravity
REMARK: Before Test
5
6


Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-04
DEPTH: 5.07-6.07
SPT/UDS/CORE: CORE Pics-15
DESCRIPTION: Specific Gravity
REMARK: After Test
6
5


Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-4
DEPTH: 7.07-8.07
SPT/UDS/CORE: CORE Pico-24
DESCRIPTION: Specific Gravity
REMARK: Before Test
J-SIL
TC 27°C
50 ml


Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-04
DEPTH: 7.07-8.07
SPT/UDS/CORE: CORE Pico-24
DESCRIPTION: Specific Gravity
REMARK: After Test
J-SIL
TC 27°C
50 ml


Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-4
DEPTH: 9.07-10.07
SPT/UDS/CORE: CORE Pics-33
DESCRIPTION: Specific Gravity
REMARK: Before Test
11
12


Project: MEGA CFC
CLIENT: SEEPZ MUMBAI
BH NO: BH-04
DEPTH: 9.07-10.07
SPT/UDS/CORE: CORE Pics-33
DESCRIPTION: Specific Gravity
REMARK: After Test
12
11

ANNEXURE-III

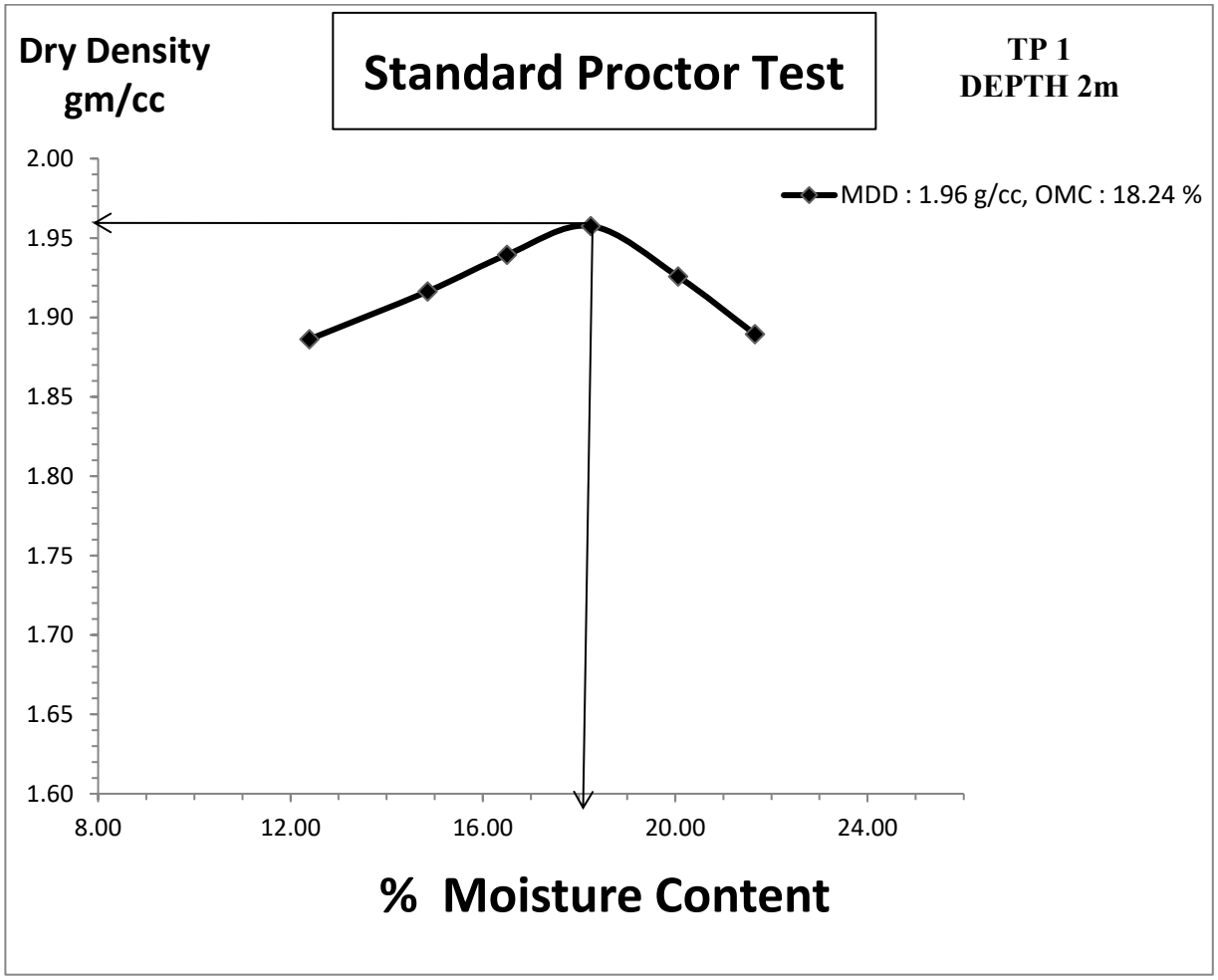
STANDARD PROCTOR TEST AND SAND REPLACEMENT TEST RESULTS

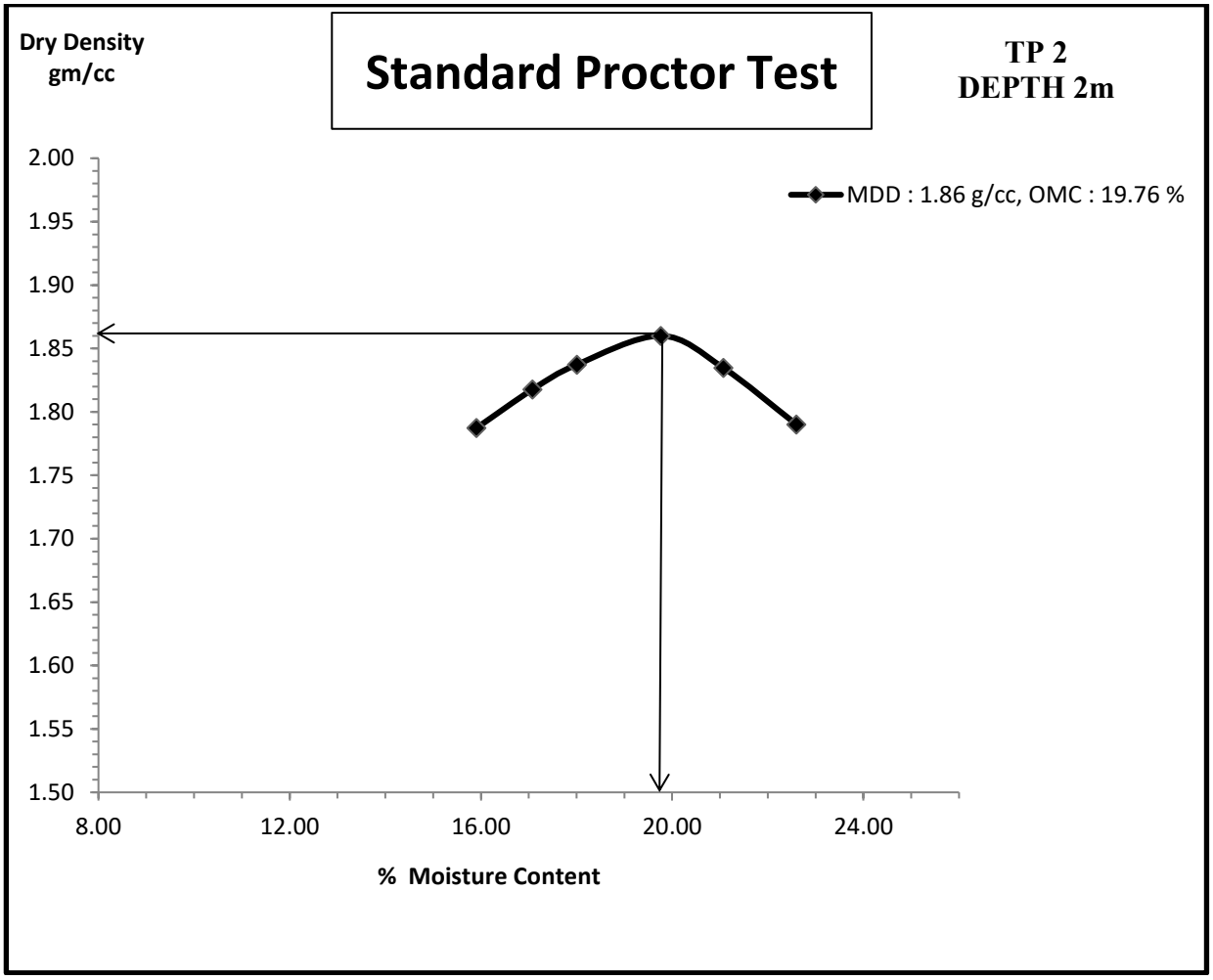
TABLE NO.1 (STANDARD PROCTOR TEST RESULTS)

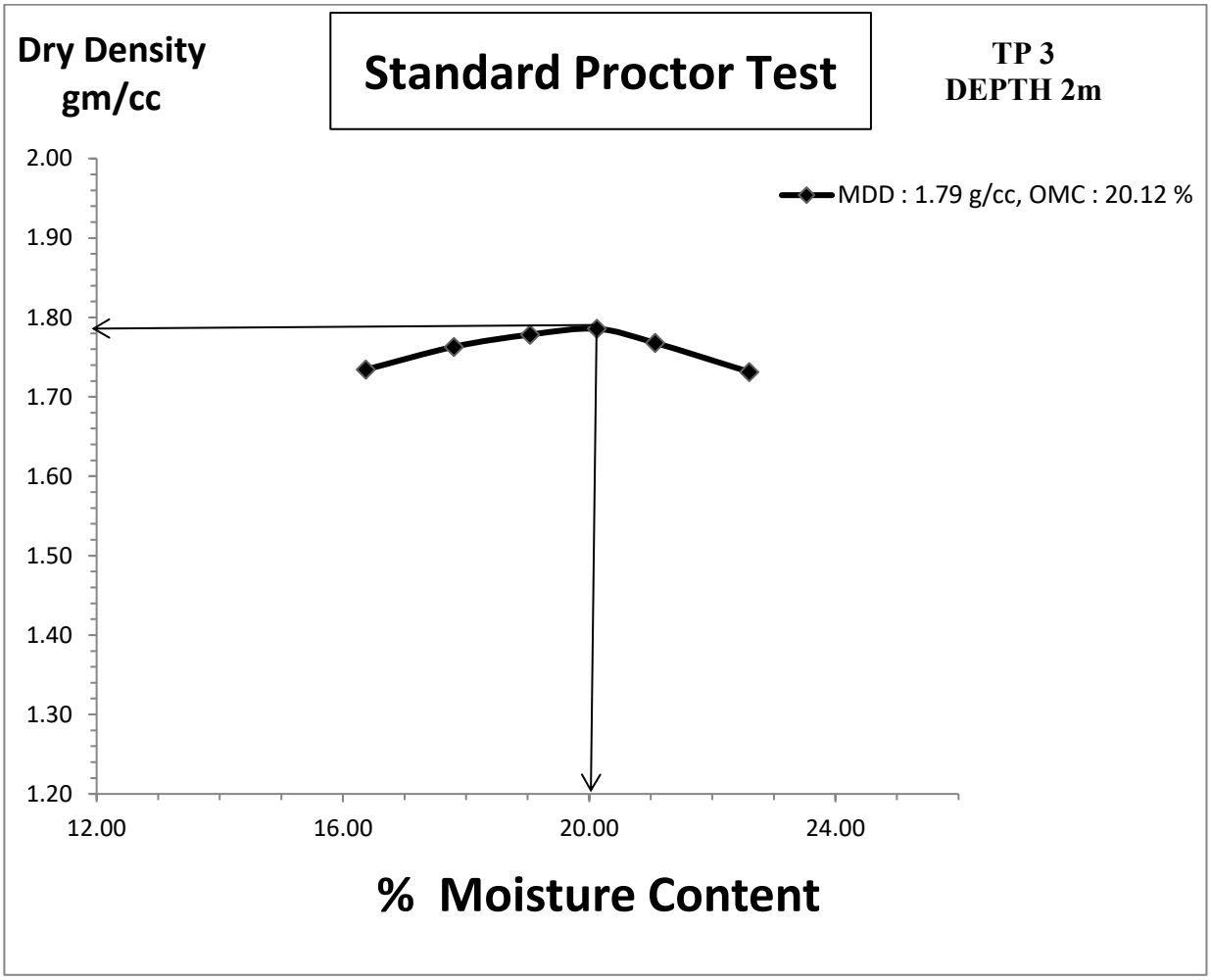
SR NO.	R.L. (m)	TRIAL PIT	MDD (g/cc)	OMC (%)
1	99.240	TP 01	1.96	18.24
2	99.340	TP 02	1.86	19.76
3	99.340	TP 03	1.79	20.12
4	99.534	TP 04	1.87	19.44
5	99.030	TP 05	1.92	18.84

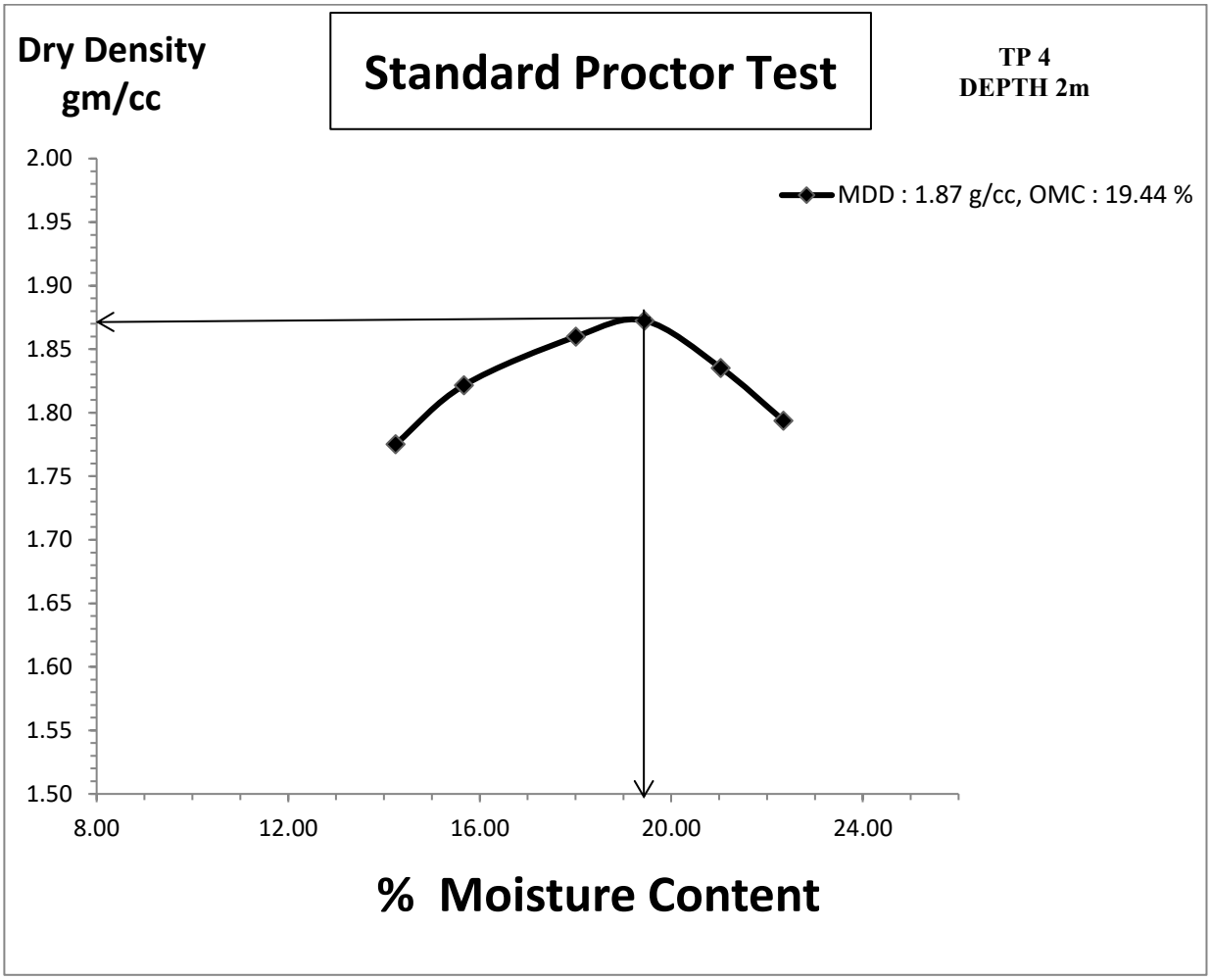
TABLE NO.2 (SAND REPLACEMENT TEST RESULTS)

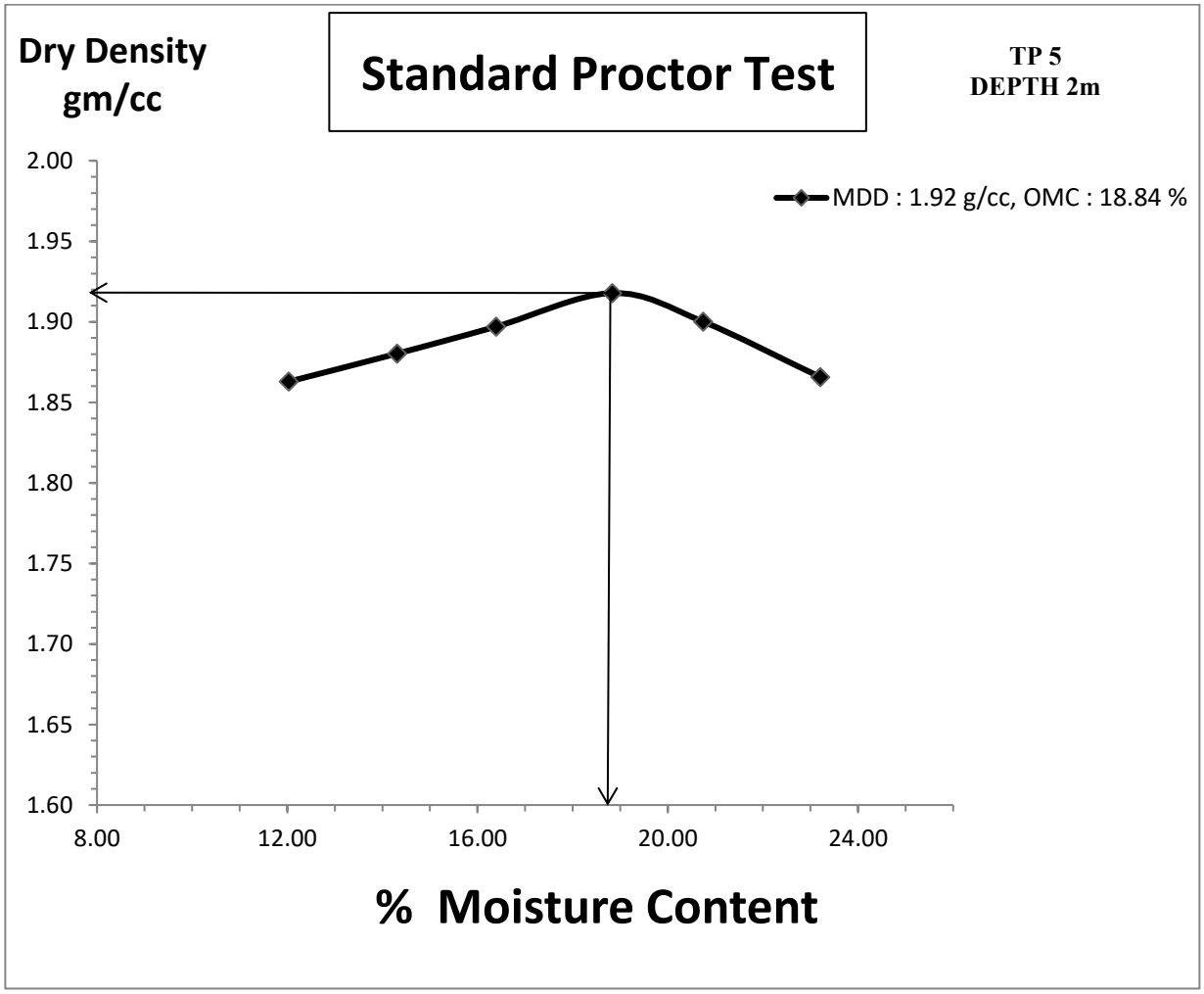
SR NO.	BH NO.	BULK DENSITY (g/cc)	DRY DENSITY (g/cc)	WATER CONTENT (%)
1	BH-01	1.84	1.74	5.8
2	BH-02	1.62	1.52	6.5


Dry Density gm/cc
Standard Proctor Test
TP 1
DEPTH 2m
MDD : 1.96 g/cc, OMC : 18.24 %
2.00
1.95
1.90
1.85
1.80
1.75
1.70
1.65
1.60
8.00
12.00
16.00
20.00
24.00
% Moisture Content


Dry Density
gm/cc
Standard Proctor Test
TP 2
DEPTH 2m
MDD : 1.86 g/cc, OMC : 19.76 %
2.00
1.95
1.90
1.85
1.80
1.75
1.70
1.65
1.60
1.55
1.50
8.00
12.00
16.00
20.00
24.00
% Moisture Content

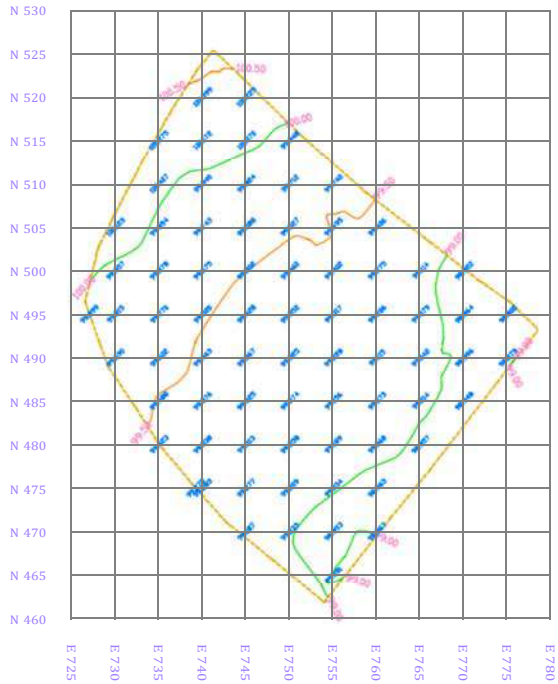

Dry Density gm/cc
Standard Proctor Test
TP 3
DEPTH 2m
MDD : 1.79 g/cc, OMC : 20.12 %
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
12.00
16.00
20.00
24.00
% Moisture Content


Dry Density gm/cc
Standard Proctor Test
TP 4
DEPTH 2m
MDD : 1.87 g/cc, OMC : 19.44 %
2.00
1.95
1.90
1.85
1.80
1.75
1.70
1.65
1.60
1.55
1.50
8.00
12.00
16.00
20.00
24.00
% Moisture Content

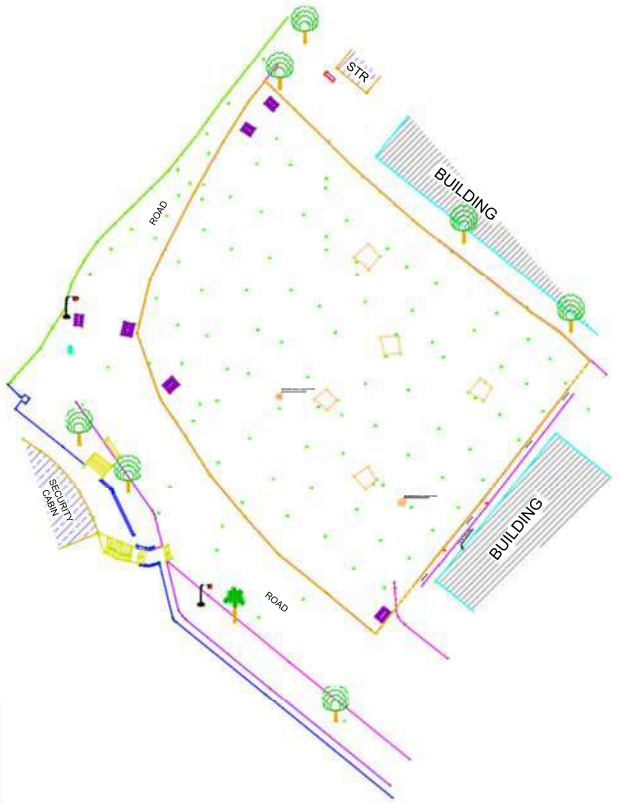

Dry Density gm/cc
Standard Proctor Test
TP 5
DEPTH 2m
MDD : 1.92 g/cc, OMC : 18.84 %
2.00
1.95
1.90
1.85
1.80
1.75
1.70
1.65
1.60
8.00
12.00
16.00
20.00
24.00
% Moisture Content

ANNEXURE –IV

TOPOGRAPHY SURVEY AND ELECTRIC RESISTIVITY TEST RESULT WITH POLAR DIAGRAM



TOTAL PLOT AREA = 1748.316 Sq.M.
= 18818.72 Sq.Ft.



CLIENT:-

TOTAL STATION SURVEY OF KRANTIVEER LAKHUJI SALVE MARG SEEPZ SPECIAL ECONOMIC ZONE, ANDHERI EAST, MUMBAI - 400 093.

STRUCTURE
BUILDING
COMPOUND WALL
GATE
MANHOLE / CHEMBAR

ROAD EDGE
DRAIN
LIGHT / TEL. POLE
TREE

CTS LINE
AREA LINE
9.83 DIMENSIONS
FIRE HYDRANT & POST BOX

Drg Ref. No. :- SNE/TS/128/22-23

Date Of Survey : 27/05/2022

Drawn by: Sumant Jadhav

Surveyed by : BHAVESH

N

Scale: 1:500

SURVEY BY :
S. N. EQUIPMENT
(LAND SURVEY)
B. I. T. BUILDING NO.04, ROOM NO.02
M. S. ROAD, AGARIPADA , Mumbai 400 011.
M : 9833361729 Off : 2300 9158
Email : sumantjadhav1987@gmail.com

ELECTRICAL RESISVITY

TOMOGRAPHY REPORT at Andheri

Background

Electrical Resistivity Test (ERT) was carried out at Andheri. Vertical Electrical Sounding was carried out at 2 locations. The test was carried out using Wenner's Configuration as per IS 3043-1987. ERT was conducted at the site for an electrode spread (a) of 10.0m in order to ascertain earth resistance details.

Principle

This arrangement uses four electrodes equally spaced along a straight line. It is the simplest and the most symmetrical arrangement. It is designed to measure the potential difference between M and N as shown in Fig.2. The formula for calculating apparent resistivity from a Wenner's measurement is:

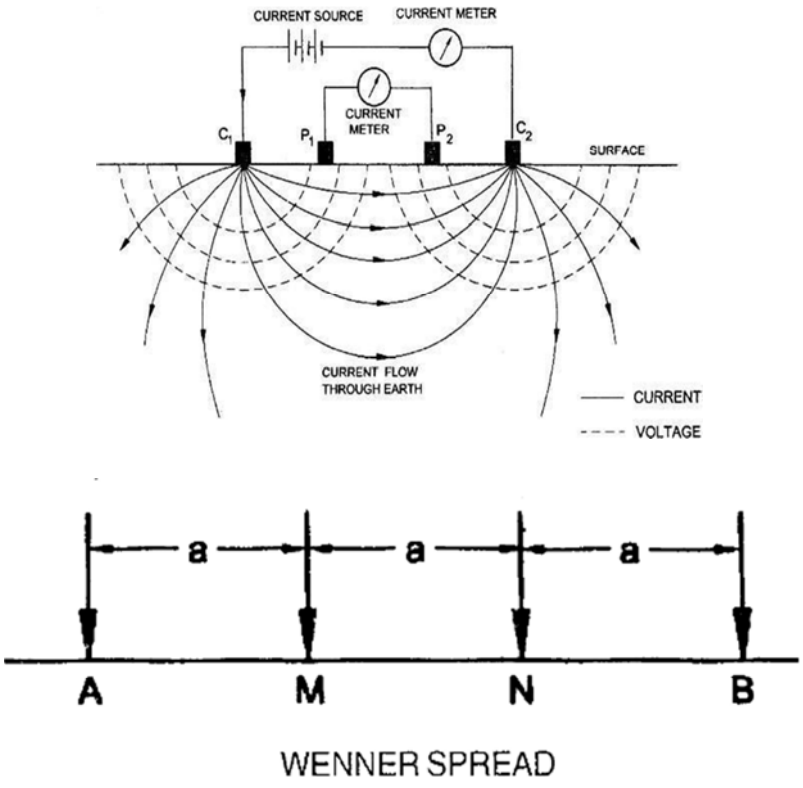
$$\rho_a = 2\pi a \left(\frac{\Delta V}{I}\right)$$

Where 'a' is the spacing between adjacent electrodes, V is the potential drop and I the applied current.

The measurement of electrical resistivity requires that four electrodes be placed in contact with the surface material as shown in Fig. 1. The geometry, separation of the electrode array and spacing are selected on the basis of the application and required depth of investigation. A direct current, or a very low frequency alternating current, is passed into the ground through a pair of current electrodes, and the resulting potential drop is measured across a pair of potential electrodes as shown in Fig.1.The resistance is then derived as the ratio of the voltage measured across the potential electrodes and the current electrodes. The apparent resistivity of subsurface materials is the resistance multiplied by a geometric factor determined by the geometry and spacing of the electrode array. The apparent resistivity

depends on resistivity contrast between adjacent layers.

The apparent resistivity depends not only on the nature of Geo-electric section but also on geometric configuration of the electrodes used for the measurement. This apparent resistivity is different from true resistivity unless the subsurface materials are homogeneous.



WENNER SPREAD

Fig. 2

The resistivity and polarity curve is tabulated below

ERT (IS: 3043 – 1987)

Client	**SEEPZ SEZ MUMBAI**
Project	**MEGA CFC AT SEEPZ MUMBAI**

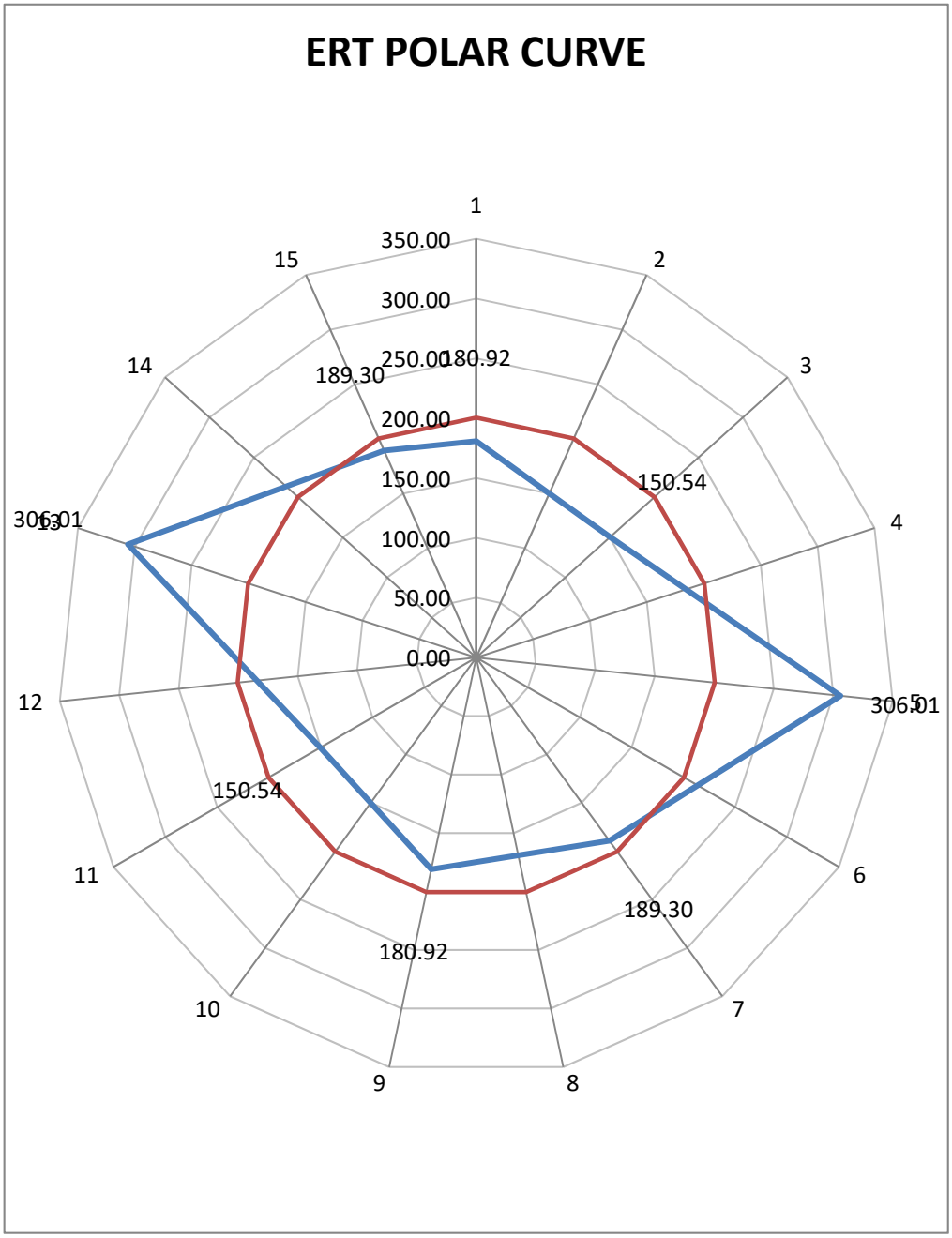
Location : ERT Location-1
Method Used : Wenner Four Pin Equal Probe Spacing.

ERT										
Direction		**N**		**E**		**S**		**W**		**Average Appar Resistivity r_{avg}**
Sr. No.	Electrodes Spacing, **a**	Resistance	$r_{(N)}$	Resistance	$r_{(E)}$	Resistance	$r_{(S)}$	Resistance	$r_{(W)}$	
	(m)	Ohm	Ohm-m	Ohm	Ohm-m	Ohm	Ohm-m	Ohm	Ohm-m	
1	1	19.10	120.06	20.00	125.71	19.10	120.06	20.00	125.71	87.69
2	3	5.10	96.17	5.80	109.37	5.10	96.17	5.80	109.37	104.66
3	5	6.80	213.71	20.40	641.14	6.80	213.71	20.40	641.14	274.21
4	10	3.50	220.00	7.80	490.29	3.50	220.00	7.80	490.29	320.57

Resistivity , $\rho = 2 \pi a R$

POLAR CURVE

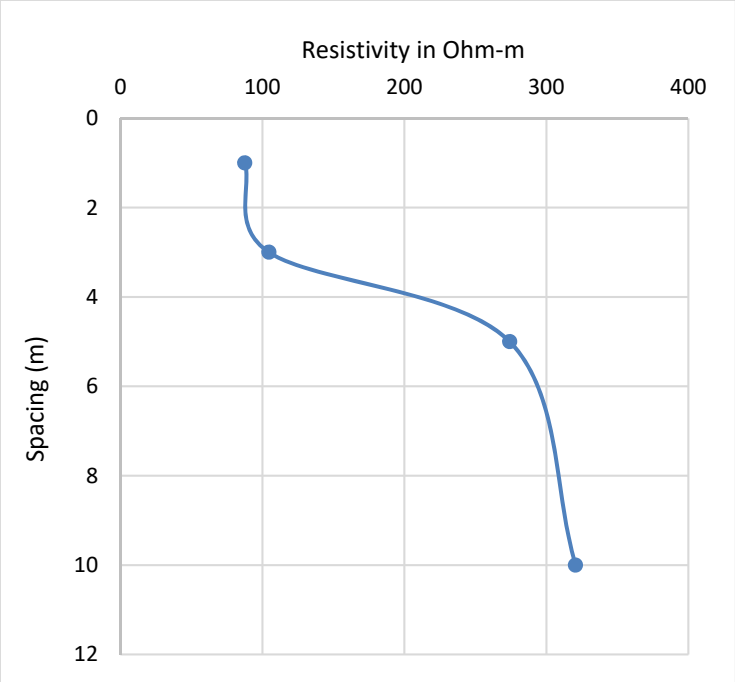
Location : ERT Location-1



Area of Polygon = 70896.65

Mean Resistivity= 150.22 Ohm M

Note: 1=N, 2=S, 3=E, 4=W



Spacing vs Resistivity ERT 1

ERT (IS: 3043 - 1987)

Client	**SEEPZ SEZ MUMBAI**
Project	**MEGA CFC AT SEEPZ MUMBAI**

Location : ERT Location-2

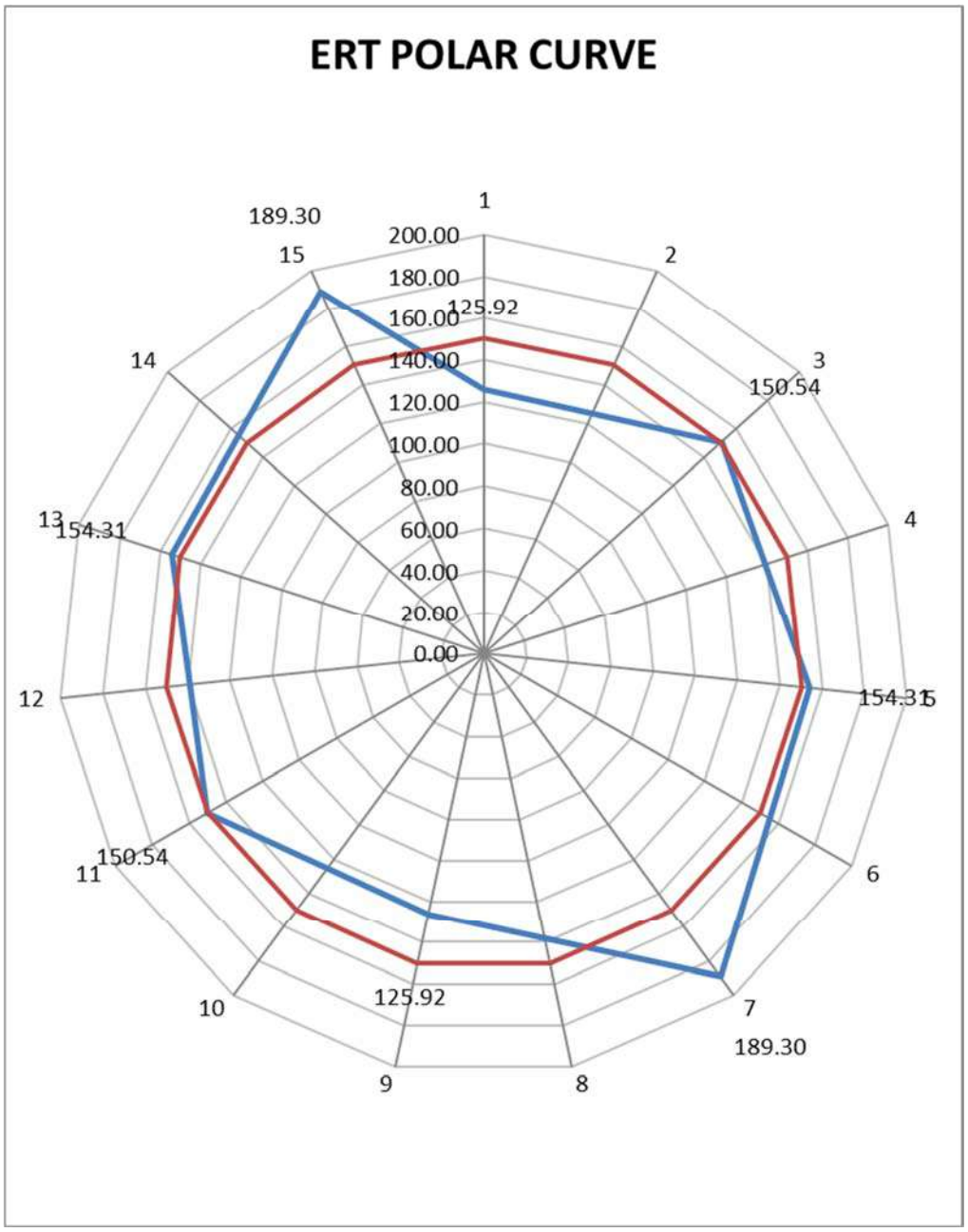
Method Used : Wenner Four Pin Equal Probe Spacing.

ERT										
Direction		**N**		**E**		**S**		**W**		**Average Apparent Resistivity r_{avg}**
Sr. No.	Electrodes Spacing, **a**	Resistance	**r** (N)	Resistance	**r** (E)	Resistance	**r** (S)	Resistance	**r** (W)	
	(m)	Ohm	Ohm-m	Ohm	Ohm-m	Ohm	Ohm-m	Ohm	Ohm-m	
1	1	12.00	75.43	18.20	114.40	12.00	75.43	18.20	114.40	73.70
2	3	2.70	50.91	5.40	101.83	2.70	50.91	5.40	101.83	91.46
3	5	2.80	88.00	3.30	103.71	2.80	88.00	3.30	103.71	108.43
4	10	1.68	105.60	2.17	136.40	1.68	105.60	2.17	136.40	203.50

Resistivity , $\rho = 2 \pi a R$

POLAR CURVE

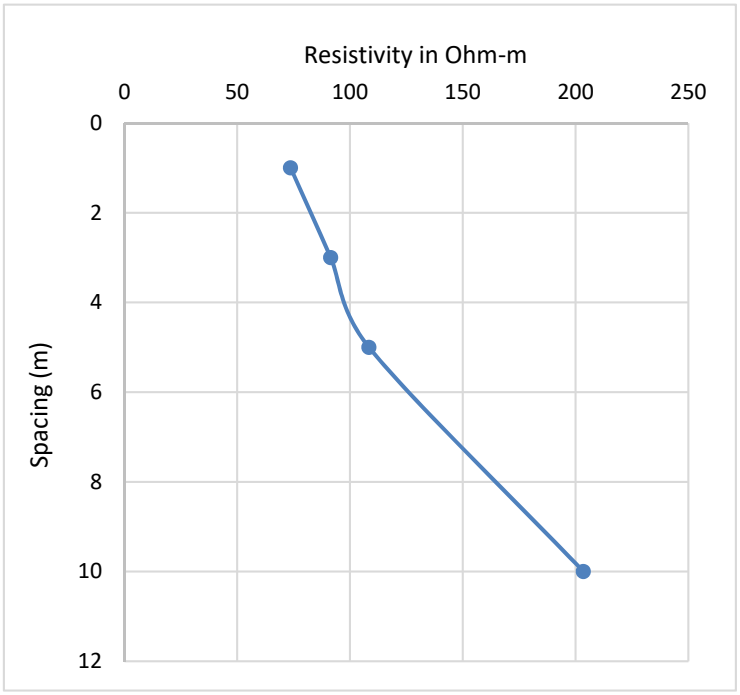
Location: ERT Lactation-2



Area of Polygon = 70896.65

Mean Resistivity= 150.22 Ohm M

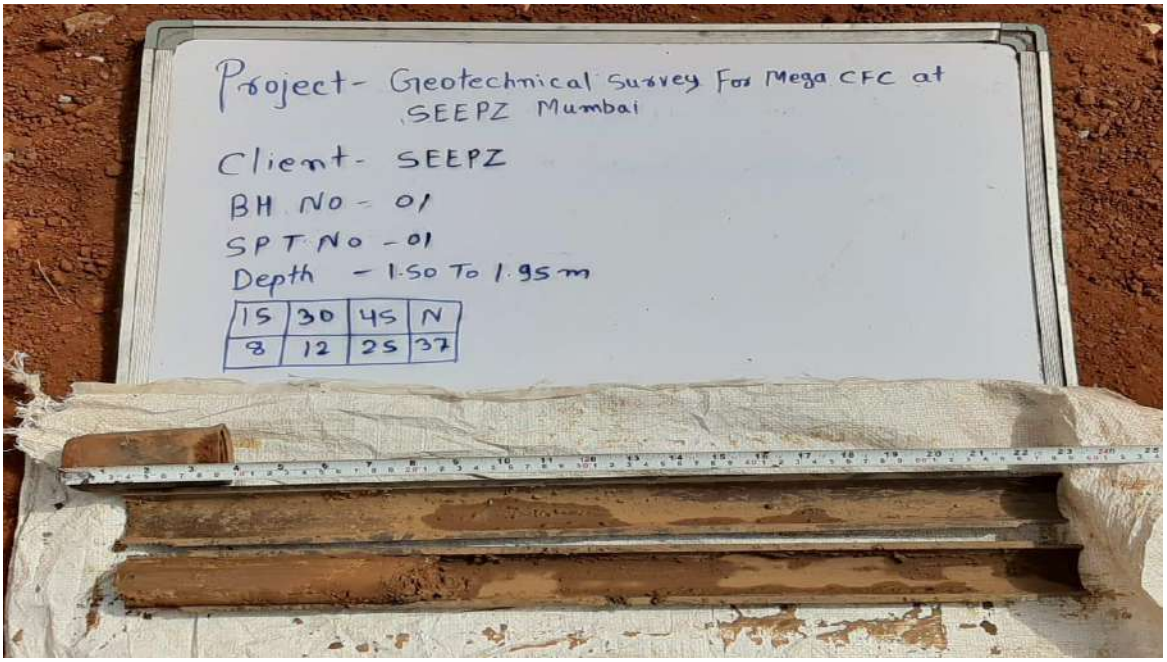
Note: 1=N, 2=S, 3=E, 4=W



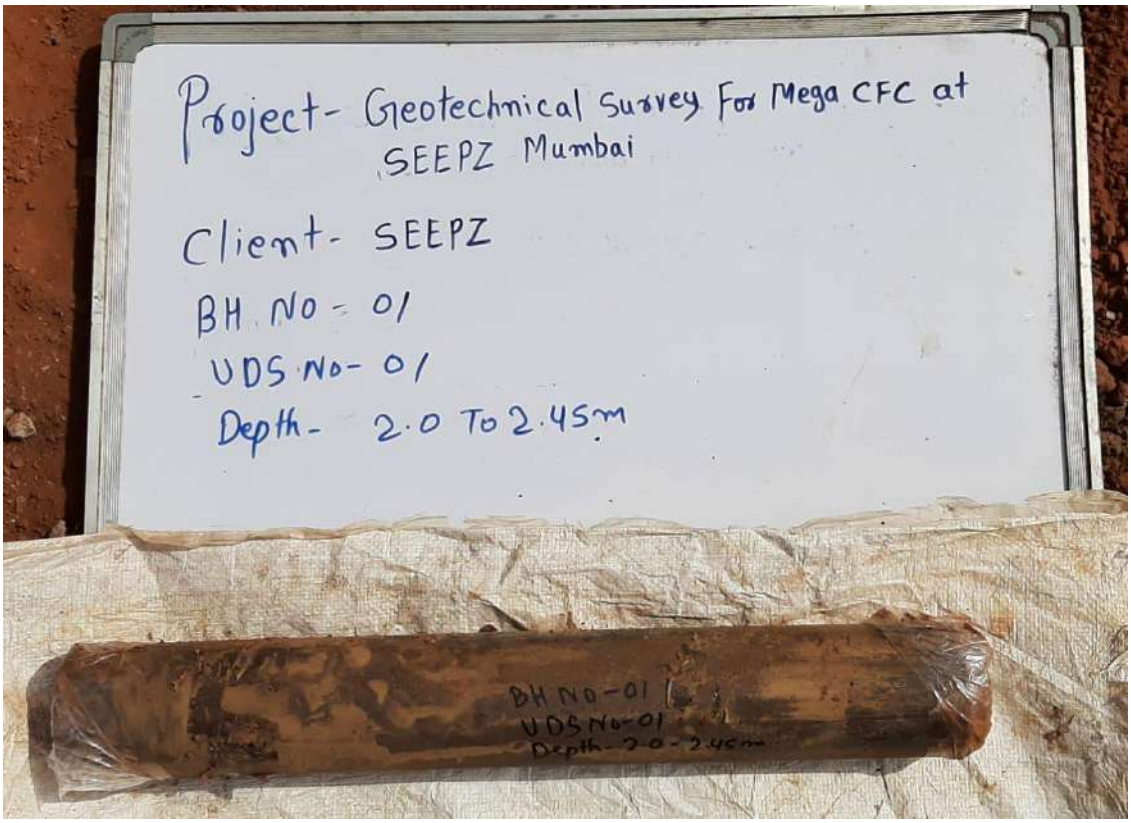
Spacing vs Resistivity ERT 2

ANNEXURE-V

SPT AND COREBOX PHOTOS

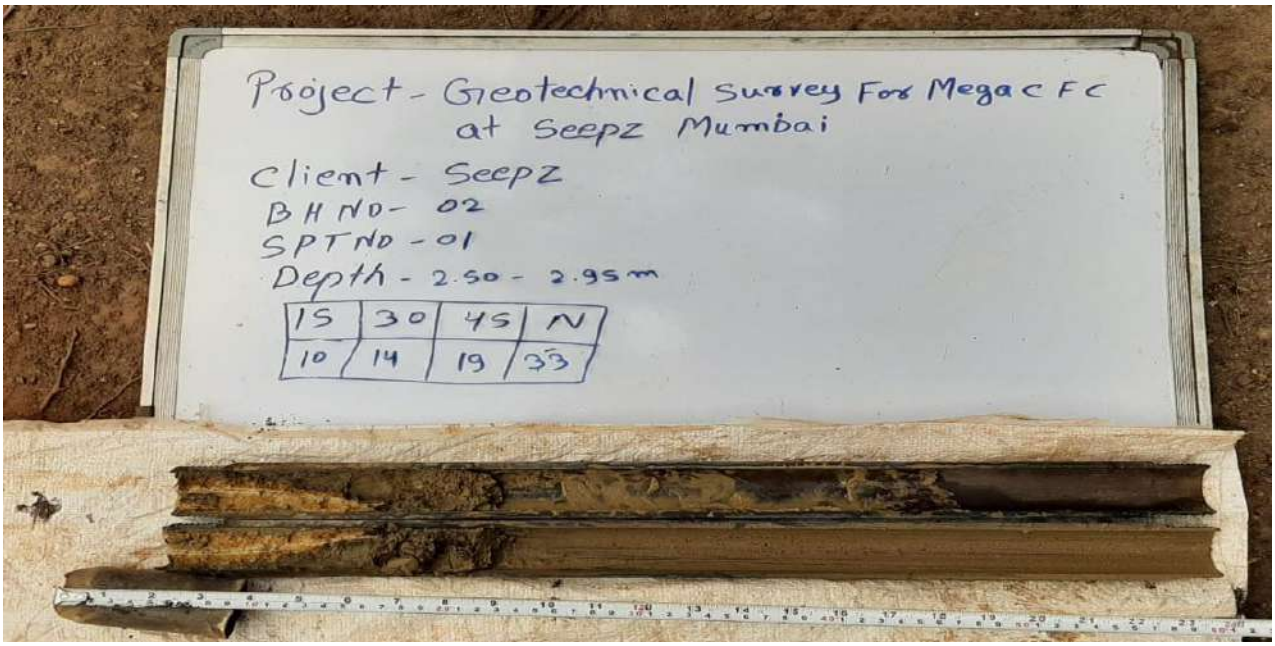


BH 01 - Depth :-1.50-1.95 SPT No-01

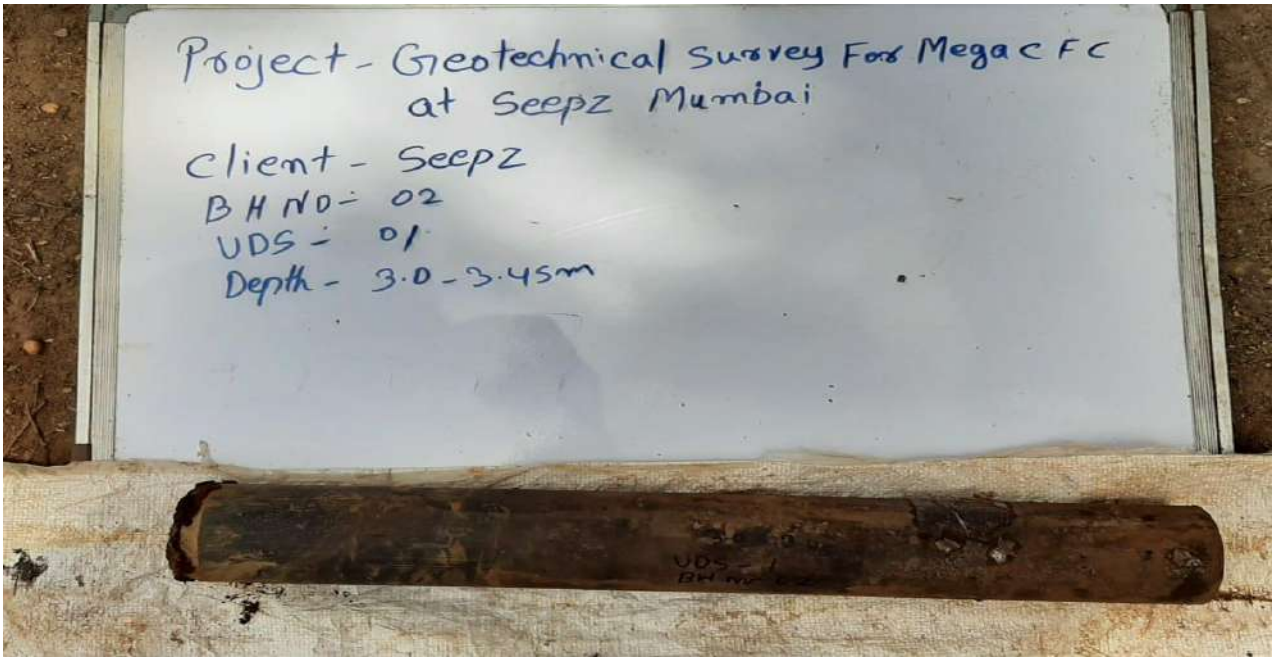


BH 01 - Depth:-2.00-2.45 UDS 1

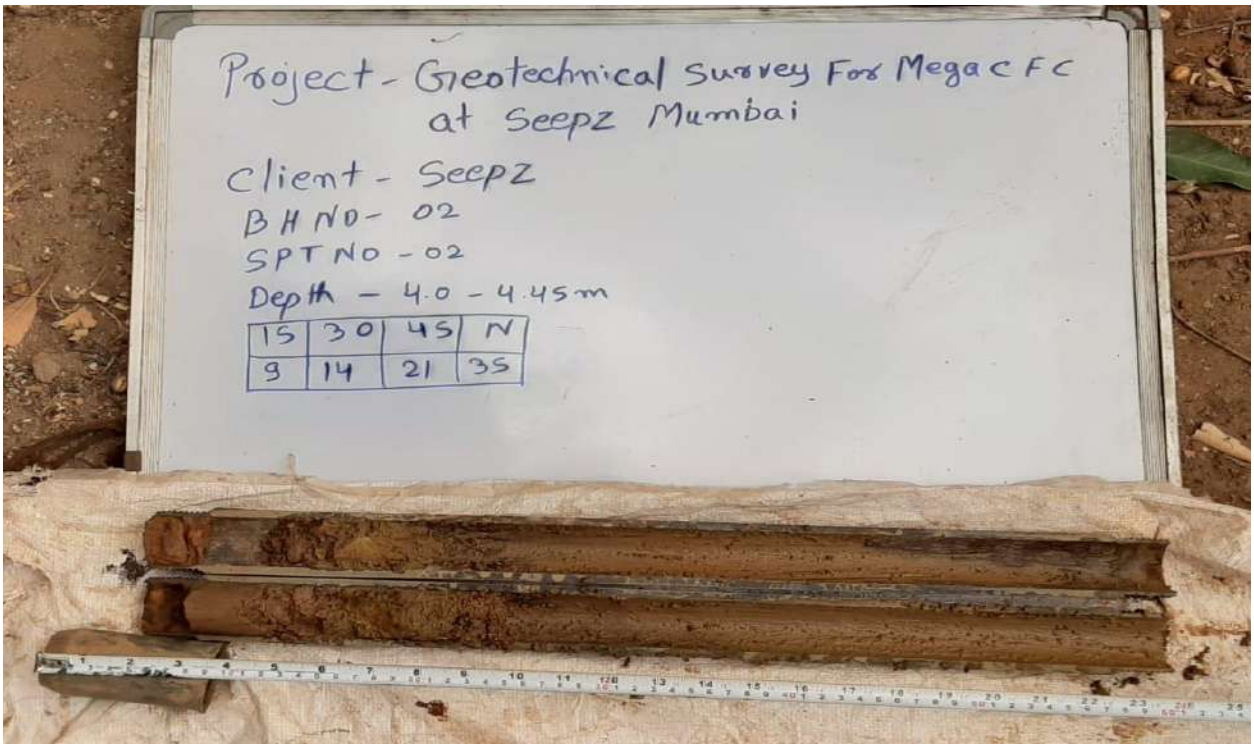
BH 01 - Depth : 0.00-10.00 Core Box No:-1 OF 1



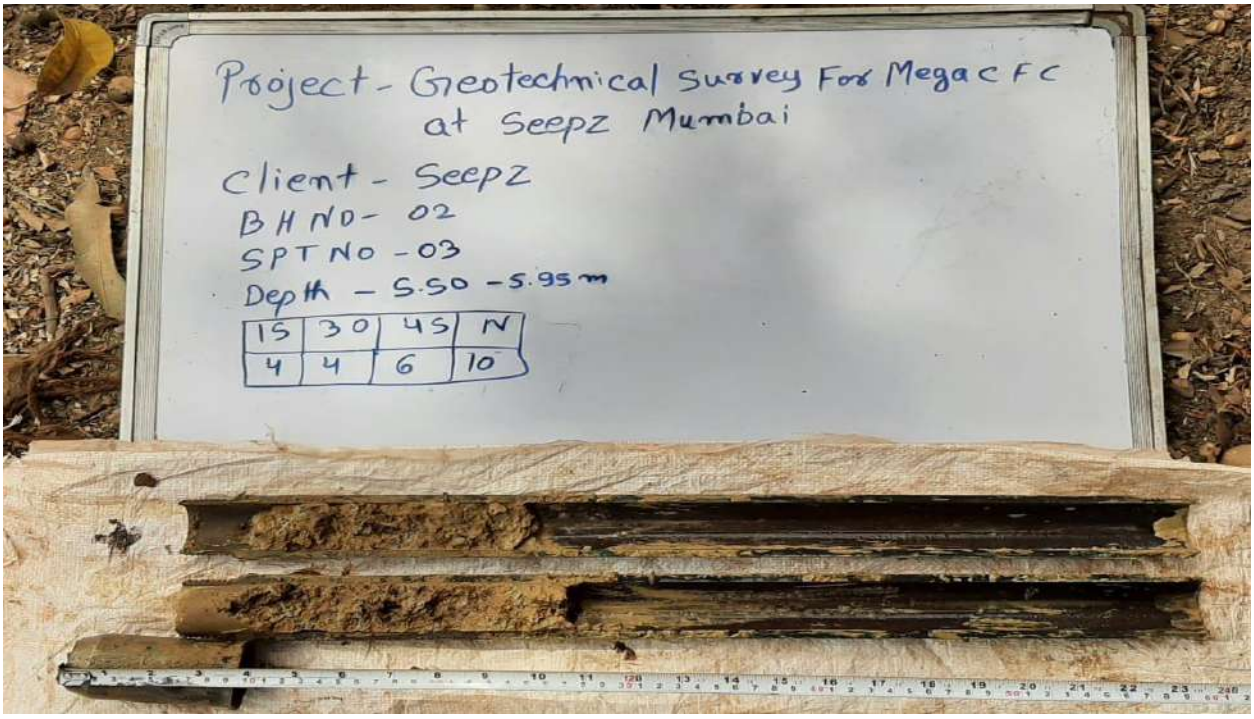
BH 02 - Depth:-2.50-2.95 SPT No:-01



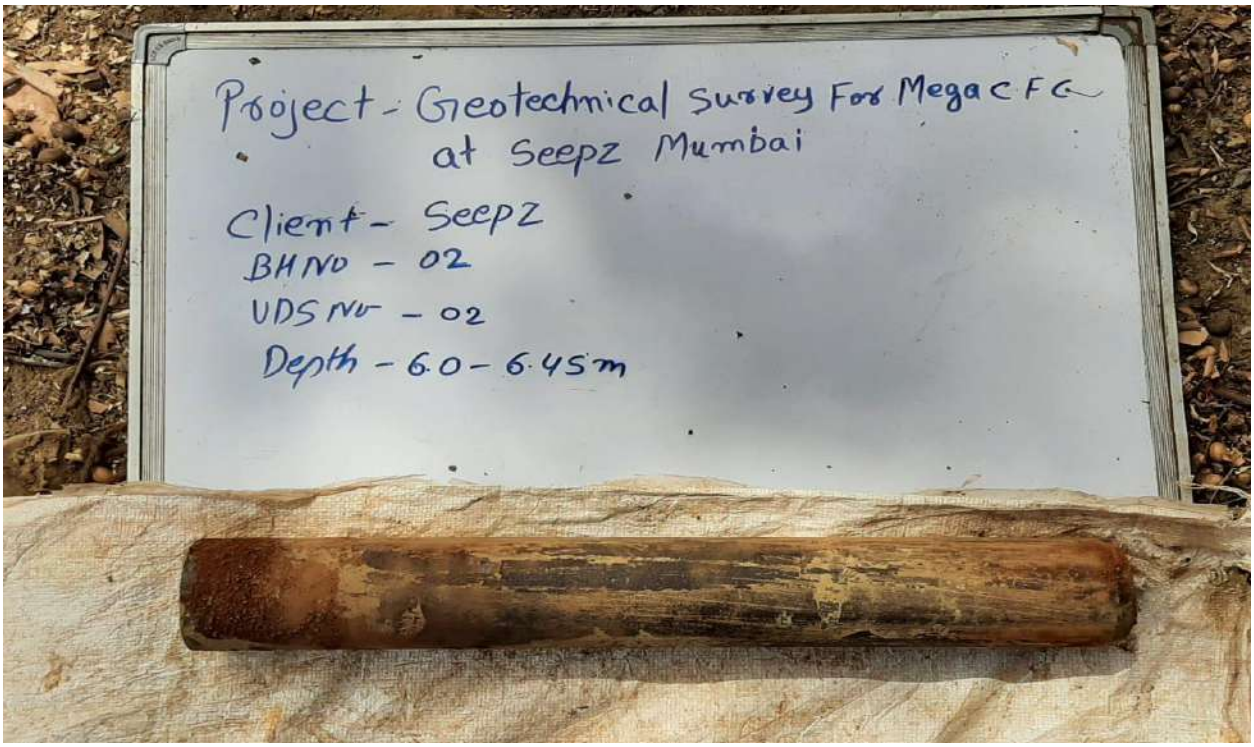
BH 02 - Depth:-3.00-3.45 UDS:-01



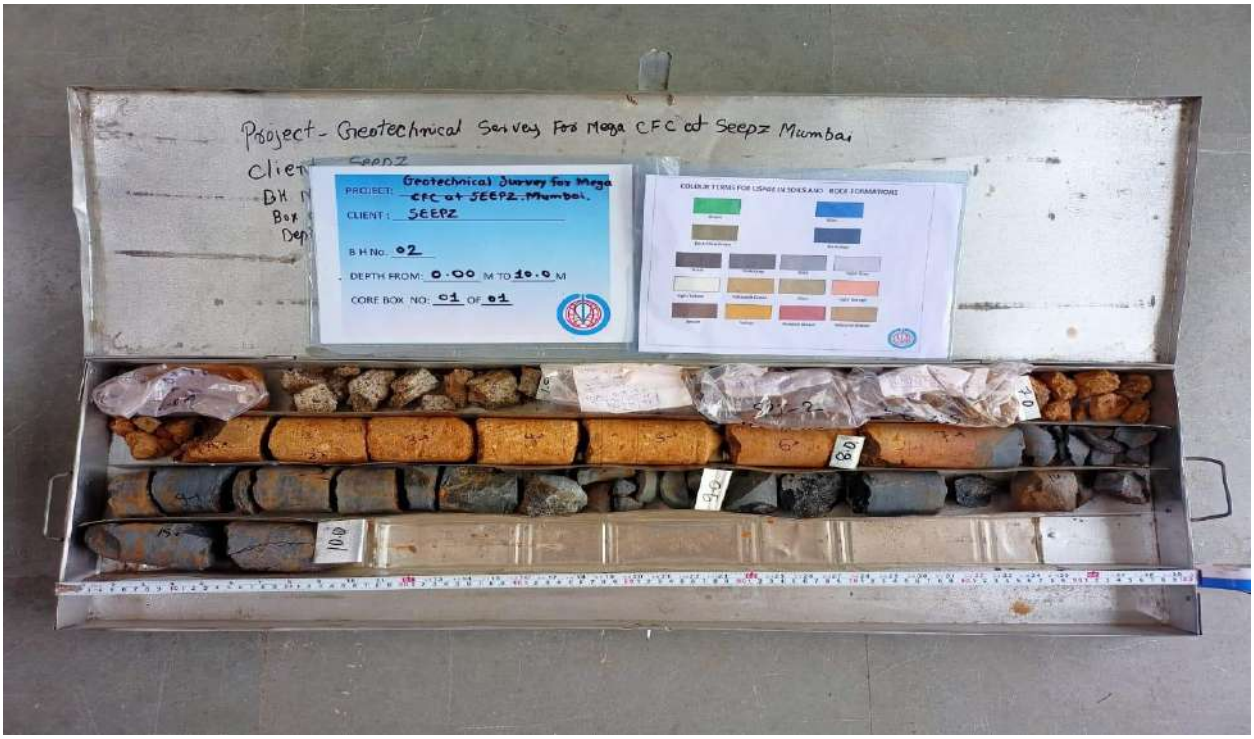
BH 02 - Depth :-4.0-4.45 SPT:-02



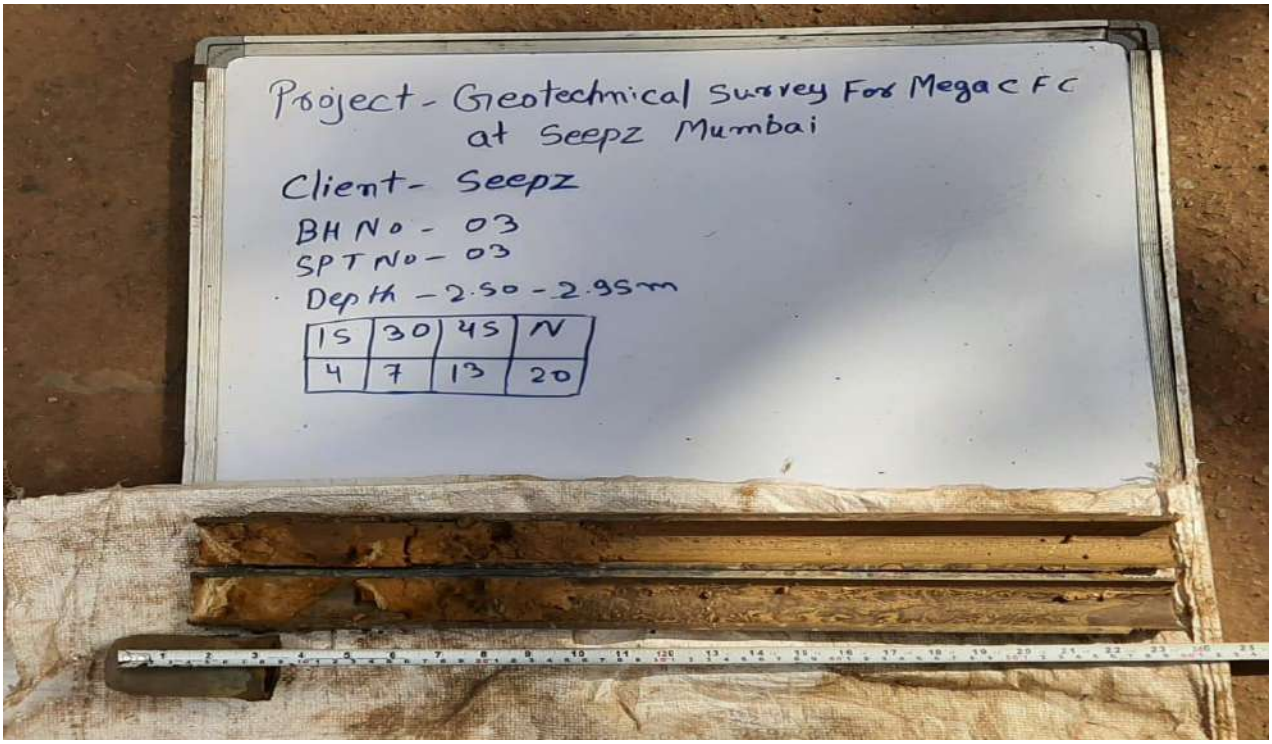
BH 02 - Depth:-5.50-5.95 SPT:-03



BH 02 - Depth:- 6.00-6.45 UDS:-2



BH 02 - Depth: -0.00-10.00 Core Box 1 OF 1



BH 03 - Depth:-2.50-2.95 SPT No:-03

BH 03 - Depth:- 0.00-10.05 Core Box No:-1 OF 1

BH 04 - Depth:-0.00-7.07 core Box No:- 1 OF 2

BH 04 - Depth:-7.07-10.07 Core Box No:- 2 of 2