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PROJECT

GEOTECHNICAL INVESTIGATION REPORT FOR THE PROPOSED CONSTRUCTION OF COMMERCIAL BUILDING CONSISTING OF STIILT + 5 UPPER FLOORS AT DRA EGMORE RAILWAY LAND, P.V CRECENT CHERIAN SALAI, EGMORE, CHENNAI, TAMIL NADU- 600 008

CLIENT

M/s CHENNAI PREMIUM PROJECTS PVT LTD,
NEW NO'S: 109, 111 & 113, AVVAI SHANMUGAM SALAI,
LLOYDS ROAD, ROYAPETTAH,
CHENNAI, TAMIL NADU- 600 014

TITLE

GEOTECHNICAL INVESTIGATION REPORT

REPORT NO.: GT- 2573

Dr.C.VENKATA PRASAD
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DATE	REVISON	DESCRIPTION		AUTHORISED SIGNATORY
30/05/2023	0.0	SUBMISSION OF GEOTECHNICAL INVESTIGATION REPORT	SIGN	
20/06/2023	1.0	SUBMISSION OF GEOTECHNICAL REPORT WITH ADDITIONAL BOREHOLE	DATE OF FIRST SUBMISSION	30/05/2023
12/09/2024	2.0	ADDITIONAL RECOMMENDATION FOR UG SUMP & STP	DESIGNATION	**MANAGING DIRECTOR**
			NAME	**DR. C.V.PRASAD**

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REPORT TEXT

CHAPTER-2

INVESTIGATION METHODOLOGY & TEST RESULTS

2.0 PREAMBLE:

Five soil investigation boreholes were put as per the planning of the engineer in-charge and these locations are shown in Fig.2.0.The equipment used and the methodology adopted to carry out the fieldwork is described below.

2.1 METHODOLOGY OF FIELD WORK:

2.1.1 EQUIPMENT USED AND METHOD OF DRILLING:

All the boreholes were sunk by conventional rotary drilling rigs. For borehole Methodology followed for boring conformed to IS: 1892 -2000. Boring was progressed by the cutting action of rotating bit with water circulation and stabilizing the side of the boreholes by using casing pipes/bentonite slurry up to required depth to prevent collapse of sidewall. Boring was continued by normal boring process using MS soil cutter in soil. However Tungsten Carbide (TC) bit drilling was resorted to drill in highly weathered rock stratum where the normal boring process became slow. Diamond Core (DC) bit drilling was adopted in moderately weathered rock formations where penetration using TC bit was became slow.

2.1.2 STANDARD PENETRATION TESTS:

This is a field test to determine "Penetration Resistance of Stratum at the Test Depth". This has been conducted in the boreholes generally up to refusal depth using procedures described in IS: 2131- 2002. In this test, split spoon sampler (50.8 mm OD and 35 mm ID) has replaced driving bit. Sampler is then driven by dropping 63.5 kg hammer on top of driving collar with free fall of 75 cm. The length of sampler is 60 cm.

The tests were conducted at the depth intervals indicated in Chapter-1 (Sec.1.1.1).

2.1.3 COLLECTION OF SOIL SAMPLES:

2.1.3.1 DISTURBED SAMPLES:

The SPT-samples collected were used as disturbed soil samples. These samples were used for visual and physical identification and for conducting laboratory classification tests as per I.S.1498-1970.

2.1.3.2 UNDISTURBED SAMPLES:

From the soft to stiff clay layer, representative undisturbed samples were collected. These samples were used primarily to establish the compressibility parameters to estimate the settlements of shallow foundation system wherever applicable.

2.1.4 COLLECTION OF GROUND WATER SAMPLES:

One representative water sample from each borehole was collected after 24 hours of completing the borehole if water table met within the investigated depth.

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SITE PLAN

SOIL PROFILES

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SITE INVESTIGATION RECORD

BORE HOLE No.	BH-01						
SHEET	2	OF	2				
PROJECT NAME	PROPOSED CONSTRUCTION OF A COMMERICAL BUILDING			DIA OF BORE HOLE	150mm ✓		
					NX ✓		
LOCATION	P.V. CRESCENT CHERIAN SALAI	MACHINE No.	CR-06	CHAINAGE (m)	-	BORE START DATE	18/05/2023
STRUCTURE	STILT + 5 UPPER FLOORS	DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE END DATE	19/05/2023
JOB CODE	GT-2573	FLUSHING MEDIUM	Bentonite		E -	TOTAL DRILL DAYS	2

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	RL (m)	Layer Data: Legend	No	Depth	Geotechnical Description
10																		
11	18/05/2023	15	35	SC	-	-	3	2	4	6	10.50	10	SS	-10.5		L3	10.5	Grey,Moist,Poorly Graded,Fine & Medium Grains Sands,Loose & Medium Dense,**Silty SAND (SM)**
		To									10.95							
		15	36															
12							0	3	2	5	12.00	11	SS	-12.0				Grey to Black,Moist,Poorly Graded, Fine & Medium Grains Sands,Loose, **Clayey Silty SAND (SC) & Silty SAND (SM) With Binder**
											12.45							
13		16	00	SC	-	-												
		To																
		16	04															
14							10Cm Penet for 55 Blows			>100	14.00	12	SS	-14.0		L4	14.0	
		16	26								14.10				+ + + + + + + + +			Grey Brown,Moist,Fine to Coarse Sand Size Particles With Gravel Size Particles,Very Dense,**Completely to Highly Weathered Rock - Grade W5 & W4 Rock Formation**
		To		DB	15	0												
		17	05															
15							-	-	-	-	15.00	13	CS	-15.0	+ + + + + + + + +	L5	15.0	
	19/05/2023	Total drilling time 1 hr 52mins																
16				DB	55	0									+ + + + + + + + +			Green to Grey Brown,Medium to Coarse Grain Structure,Highly Fractured,**Moderately Weathered Rock - Grade W3 Rock Formation** Hypersthene Grantiic Rock Formation
							-	-	-	-	16.00	14	CS	-16.0	+ + + + + + + + +	L6	16.0	
17																		
18																		
19																		
20																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	K.Selvam	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	18/05/2023	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	G.Sharmila	WATER TABLE (m) 2.50	
WS - Wash Sample	DB - Diamond Bit	DATE	19/05/2023	CASING DEPTH (m) 0.00	

Borehole terminated at 16 m depth below E.G.L

FIG.2.1 Sub Soil Profile at BH-01 Location

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SITE INVESTIGATION RECORD

BORE HOLE No.	BH-02		
SHEET	2	OF	2
DIA OF BORE HOLE	150mm ✓		
	NX ✓		

PROJECT NAME	PROPOSED CONSTRUCTION OF A COMMERICAL BUILDING					BORE START DATE	06/07/2023
LOCATION	P.V. CRESCENT CHERIAN SALAI	MACHINE No.	CR-06	CHAINAGE (m)	-		
STRUCTURE	STILT + 5 UPPER FLOORS	DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE END DATE	07/07/2023
JOB CODE	GT-2573	FLUSHING MEDIUM	Bentonite		E -	TOTAL DRILL DAYS	2

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	Blows/cm. 15-30	Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	RL (m)	Layer Data: Legend	No	Depth	Geotechnical Description
																L4	10.5	Grey,Moist,Poorly Graded,Fine & Medium Grains Sands,Medium Dense, **Silty SAND (SM)**
11		10	49				1	3	2	**5**	10.50	9	SS	-10.5				
		To		SC	-	-					10.95							Grey,Moist,Medium Stiff,**Silty CLAY (CH) With Lenses of SAND** Clays of High Plasticity
12		10	50				7	12	18	**30**	12.00	10	SS	-12.0		L5	12.0	
											12.45							
13	07/07/2023	11	15															Offwhite Grey,Moist,Medium Dense, **Clayey Sandy SILT (MI) Predominantly Lime Mixture**
		To		SC	-	-												
14		11	19													L6	14.0	
							2Cm Penet for 55 Blows			**>100**	14.00	-	WS	-14.0				
											14.02							
		11	37															
		To		DB	8	0												
15		12	05				-	-	-	-	15.50	11	CS	-15.5				Grey,Brown Shades @ Parts,Medium to Coarse Grain Structure,Highly to Completley Fractured & Disintegrated, **Highly Weathered Rock - Grade W4 Rock Formation** Hypersthene Granitic Rock
		12	30															
16		To		DB	10	0												
		12	58															
17							-	-	-	-	17.00	12	CS	-17.0		L7	17.0	
18																		
19																		
20																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	S.Ananth	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	07/07/2023	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	G.Sharmila	WATER TABLE (m) 3.20	
WS - Wash Sample	DB - Diamond Bit	DATE	10/07/2023	CASING DEPTH (m) 0.00	

Borehole terminated at 17 m depth below E.G.L

FIG.2.2 Sub Soil Profile at BH-02 Location

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SITE INVESTIGATION RECORD

BORE HOLE No.	BH-03
SHEET	2 OF 2

PROJECT NAME	PROPOSED CONSTRUCTION OF A COMMERICAL BUILDING					DIA OF BORE HOLE	150mm ✓ / NX ✓
LOCATION	P.V. CRESCENT CHERIAN SALAI	MACHINE No.	-	CHAINAGE (m)	-	BORE START DATE	08/07/2023
STRUCTURE	STILT + 5 UPPER FLOORS	DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE END DATE	08/07/2023
JOB CODE	GT-2573	FLUSHING MEDIUM	Bentonite		E -	TOTAL DRILL DAYS	1

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	RL (m)	Layer Data: Legend	No	Depth	Geotechnical Description
11	08/07/2023	14	20	SC	-	-	7	9	12	21	10.50	10	SS	-10.5				
		To									10.95							
		14	21															
12							8	5	7	12	12.00	11	SS	-12.0				Grey,Moist,Poorly Graded,Fine & Medium Grains Sands,Medium Dense, **Silty SAND (SM)**
											12.45							
		14	50															
13		To		SC	-	-												
		14	53															
14							SPT-Hammer Rebound			>100	14.00	-	WS	-14.0		L5	14.0	
		15	15												+ + +			
		To													+ + +			
15		15	42	DB	0	0									+ + +			No Core Recovery & No SPT Penetration **Completely to Highly Weathered Rock - Grade W5 Rock Formation** Disintegrted Hypersthene Granitic Rock Formation
							SPT-Hammer Rebound			>100	15.50	-	WS	-15.5	+ + +			
															+ + +			
16		16	10												+ + +			
		To		DB	0	0									+ + +			
		16	37												+ + +	L6	17.0	
17							SPT-Hammer Rebound			>100	17.00	-	WS	-17.0				
18																		
19																		
20																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	S.Ananth	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	08/07/2023	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonraj	WATER TABLE (m) 3.50	
WS - Wash Sample	DB - Diamond Bit	DATE	10/07/2023	CASING DEPTH (m) 0.00	

Borehole terminated at 17 m depth below E.G.L

FIG.2.3 Sub Soil Profile at BH-03 Location

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SITE INVESTIGATION RECORD

BORE HOLE No.	BH-04		
SHEET	2	OF	2

PROJECT NAME	PROPOSED CONSTRUCTION OF A COMMERICAL BUILDING					DIA OF BORE HOLE	150mm ✓ / NX ✓
LOCATION	P.V. CRESCENT CHERIAN SALAI	MACHINE No.	CR-06	CHAINAGE (m)	-	BORE START DATE	05/07/2023
STRUCTURE	STILT + 5 UPPER FLOORS	DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE END DATE	06/07/2023
JOB CODE	GT-2573	FLUSHING MEDIUM	Bentonite		E -	TOTAL DRILL DAYS	2

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	RL (m)	Layer Data: Legend	No	Depth	Geotechnical Description
10																		
11	05/07/2023	15	27	SC	-	-	4	5	7	12	10.50	7	SS	-10.5		L5	10.5	Grey,Moist,Poorly Graded,Fine & Medium Grains Sands,Medium Dense, **Silty SAND (SM)**
		To									10.95							
12		15	30				15	22	34	56	12.00	8	SS	-12.0		L6	12.0	Black,Moist,Stiff,**Silty CLAY (CH)** Clays of High Plasticity
											12.45							
13		16	05	SC	-	-												Offwhite Grey,Moist,Fine to Coarse Sand Particles With Gravels,Very Dense,**Silty SAND (SM) With Gravels/ Residual Soil**
		To																
14		16	12				8Cm Penet for 55 Blows			>100	14.00	9	SS	-14.0		L7	14.0	
											14.08							
15	06/07/2023	09	35	DB	0	0										L8	15.5	Brown Grey,Moist,Fine & Medium Grains Sands,Very Dense,**Completely Weathered Rock - Grade W5 Rock Formation** Disintegratred Hypersthene Granitic Rock
		To																
		09	57				SPT-Hammer Rebound			>100	15.50	-	WS	-15.5				
16		09	35	DB	12	0												Grey,Brown Grey,Medium to Coarse Grain Structure,Highly Fractured & Disintegrated,**Highly Weathered Rock - Grade W4 Rock Formation** Hypersthene Granitic Rock Formation
		To														L9	17.0	
		09	57															
17							-	-	-	-	17.00	10	CS	-17.0				
18																		
19																		
20																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	S.Ananth	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	06/07/2023	GROUND LEVEL (m)	0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	G.Sharmila	WATER TABLE (m)	3.10	
WS - Wash Sample	DB - Diamond Bit	DATE	07/07/2023	CASING DEPTH (m)	0.00	

Borehole terminated at 17 m depth below E.G.L

FIG 2.4 Sub Soil Profile at BH-04 Location

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SITE INVESTIGATION RECORD

BORE HOLE No.	BH-05		
SHEET	2	OF	2
DIA OF BORE HOLE	150mm ✓		
	NX ✓		

PROJECT NAME	PROPOSED CONSTRUCTION OF A COMMERICAL BUILDING					BORE START DATE	04/07/2023
LOCATION	P.V. CRESCENT CHERIAN SALAI	MACHINE No.	CR-06	CHAINAGE (m)	-		
STRUCTURE	STILT + 5 UPPER FLOORS	DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE END DATE	05/07/2023
JOB CODE	GT-2573	FLUSHING MEDIUM	Bentonite		E -	TOTAL DRILL DAYS	2

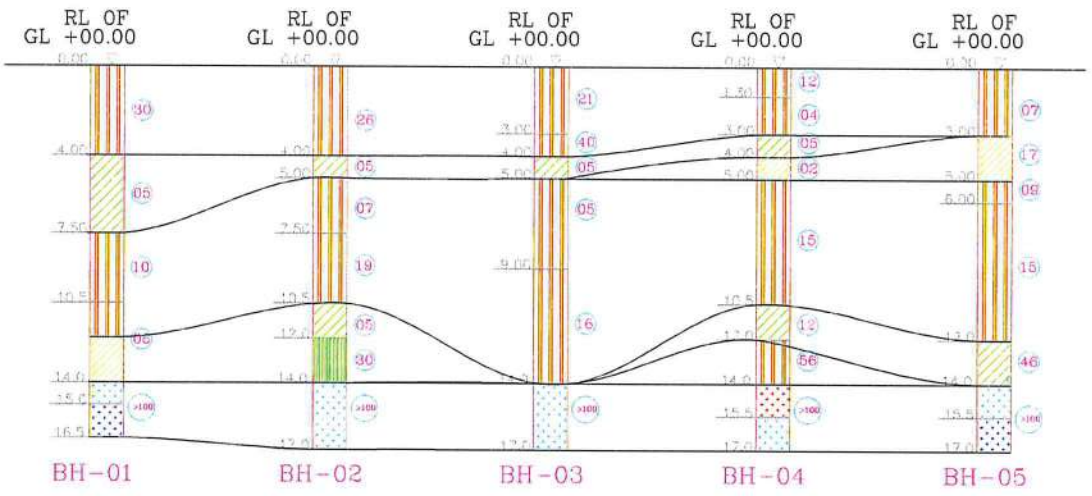
Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	RL (m)	Layer Data: Legend	No	Depth	Geotechnical Description
11	04/07/2023	14	50				6	8	9	17	10.50	9	SS	-10.5				Grey,Moist,Poorly Graded,Fine & Medium Grains Sands,Medium Dense, **Silty SAND (SM) & Poorly Graded SAND - Silty SAND (SP-SM)**
		To		SC	-	-					10.95							
		14	52															
12							12	20	26	46	12.00	10	SS	-12.0		L4	12.0	
											12.45							Grey Offwhite,Moist,Fine & Medium Grains Sands Mixture,Hard,**Sandy Sitly CLAY (CH)**
13		15	18															
		To		SC	-	-												
		15	20															
14							4Cm Penet for 50 Blows			>100	14.00	-	WS	-14.0		L5	14.0	
											14.04							Brown Grey,Medium to Coarse Grian Structure,Highly Fractured & Disintegrated,**Highly Weathered Rock - Grade W4 Rock Formation** Hypersthene Granitic Rock
		15	45															
15		To		DB	10	0												
		16	10															
	05/07/2023						-	-	-	-	15.50	11	CS	-15.5		L6	15.5	
16		09	40															Brown Grey,Grey,Medium to Coarse Grain Structure,Highly Fractured & Disintegrated @ Parts,**Moderately Weathered Rock - Grade W3 Rock Formation** Hypersthene Granitic Rock
		To		DB	22	0												
		10	10															
17							-	-	-	-	17.00	12	CS	-17.0		L7	17.0	
18																		
19																		
20																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	S.Ananth	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	05/07/2023	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	G.Sharmila	WATER TABLE (m) 3.20	
WS - Wash Sample	DB - Diamond Bit	DATE	05/07/2023	CASING DEPTH (m) 0.00	

Borehole terminated at 17 m depth below E.G.L

FIG.2.5 Sub Soil Profile at BH-05 Location

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LEGEND

- SILTY CLAY (CI)
- SILTY CLAY (CH)
- CLAYEY SILTY SAND (SC)
- SILTY SAND (SM)
- Residual Soil, Residual Soil to Completely Weathered & Completely Weathered Rock
- Completely to Highly Weathered Rock & Highly Weathered Rock
- Highly to Moderately Weathered Rock & Moderately Weathered Rock
- Clayey Sandy SILT (MH)

FIG.No.2.6 CROSS SECTIONAL VARIATION OF SUB SOIL PROFILE THROUGH BH-01 TO 05

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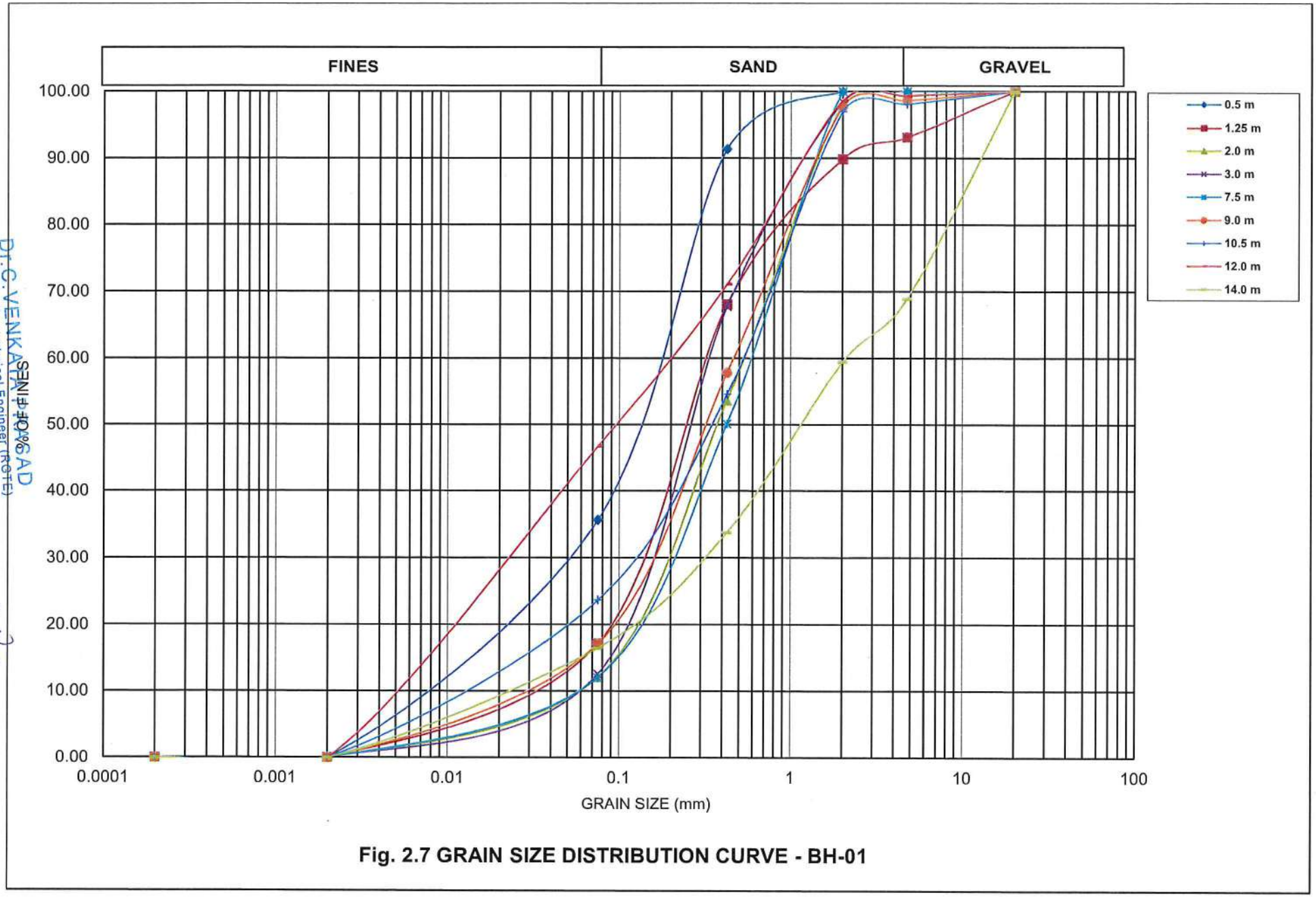


Fig. 2.7 GRAIN SIZE DISTRIBUTION CURVE - BH-01

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...@geomarineindia.com

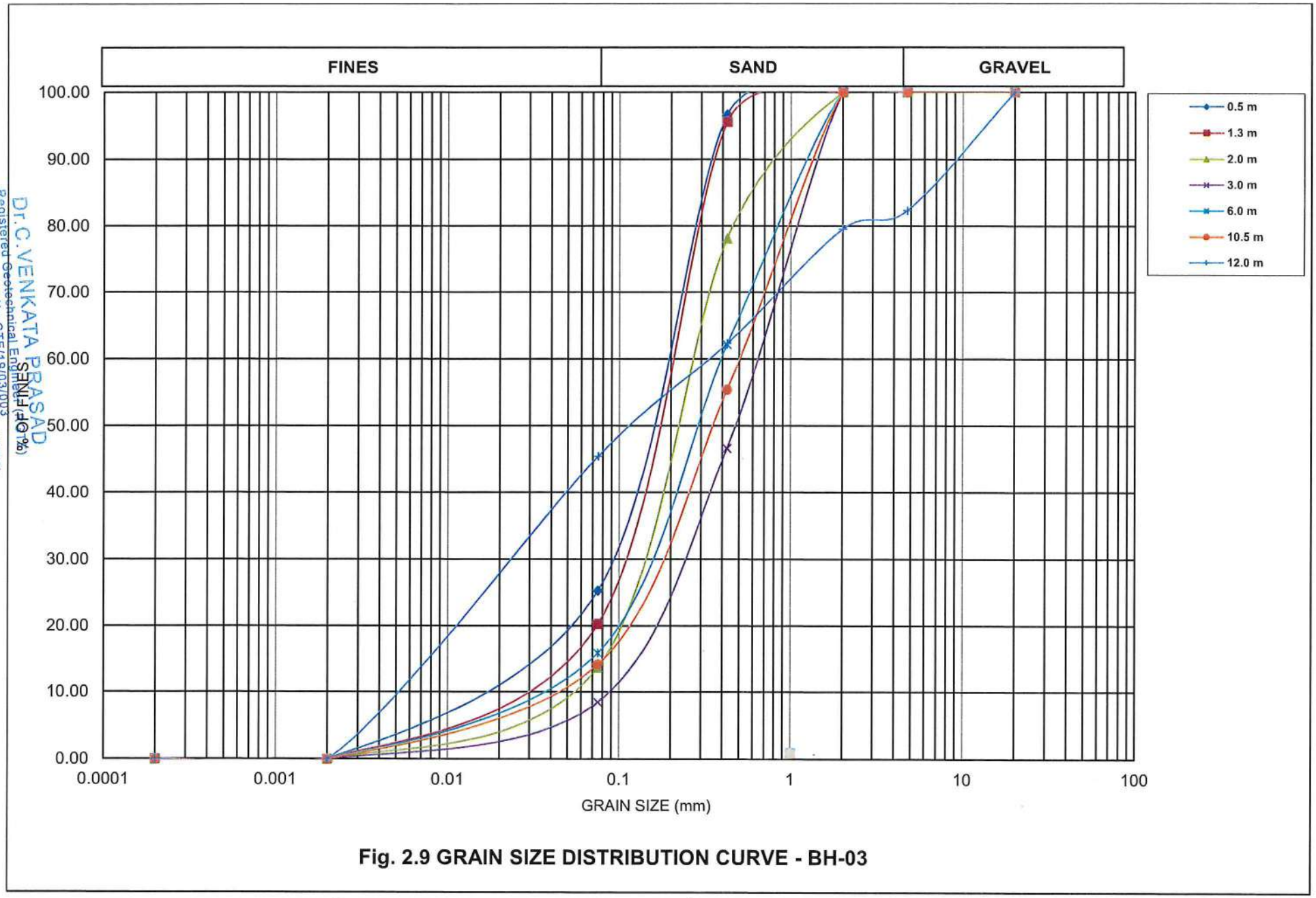


Fig. 2.9 GRAIN SIZE DISTRIBUTION CURVE - BH-03

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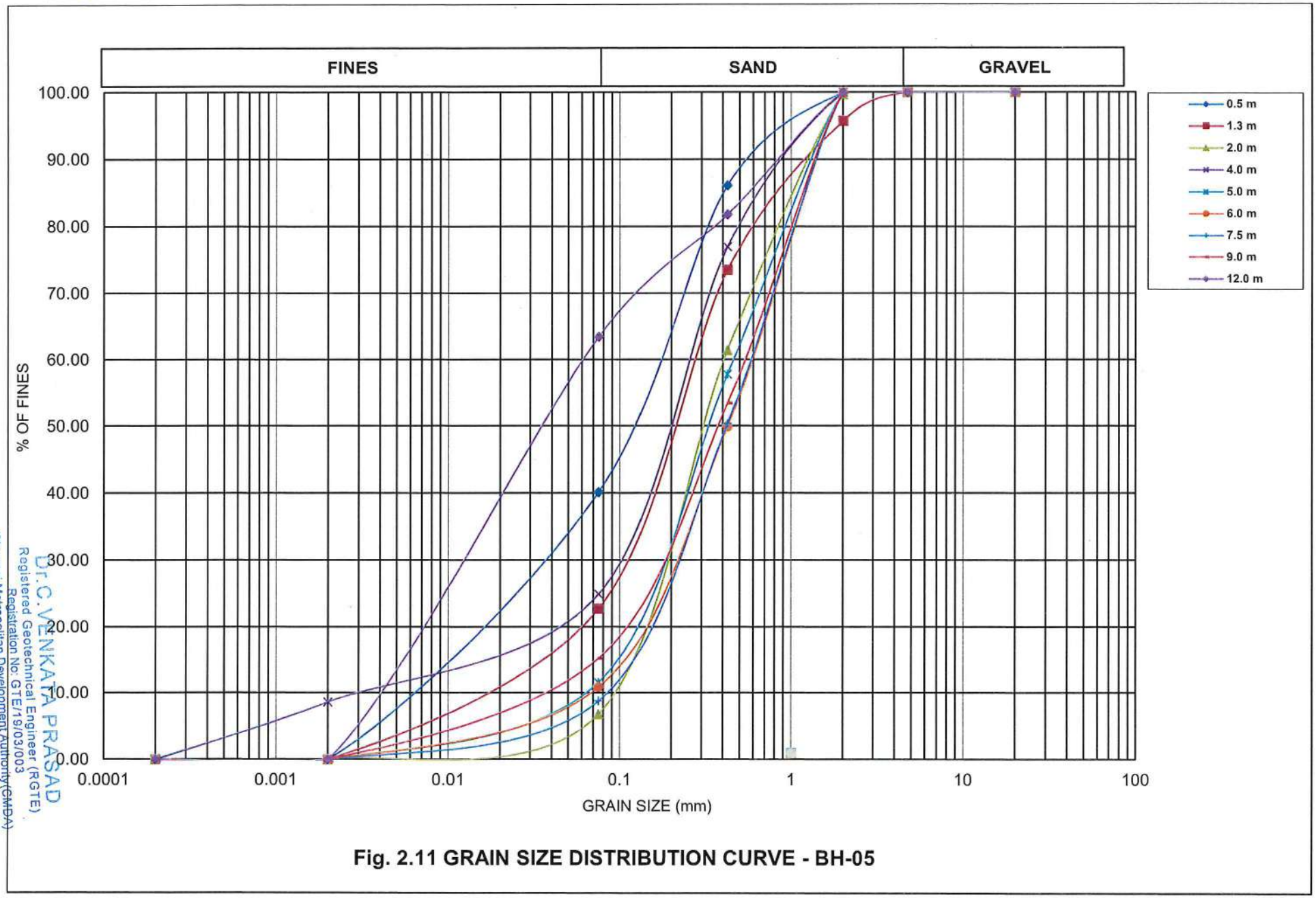


Fig. 2.11 GRAIN SIZE DISTRIBUTION CURVE - BH-05

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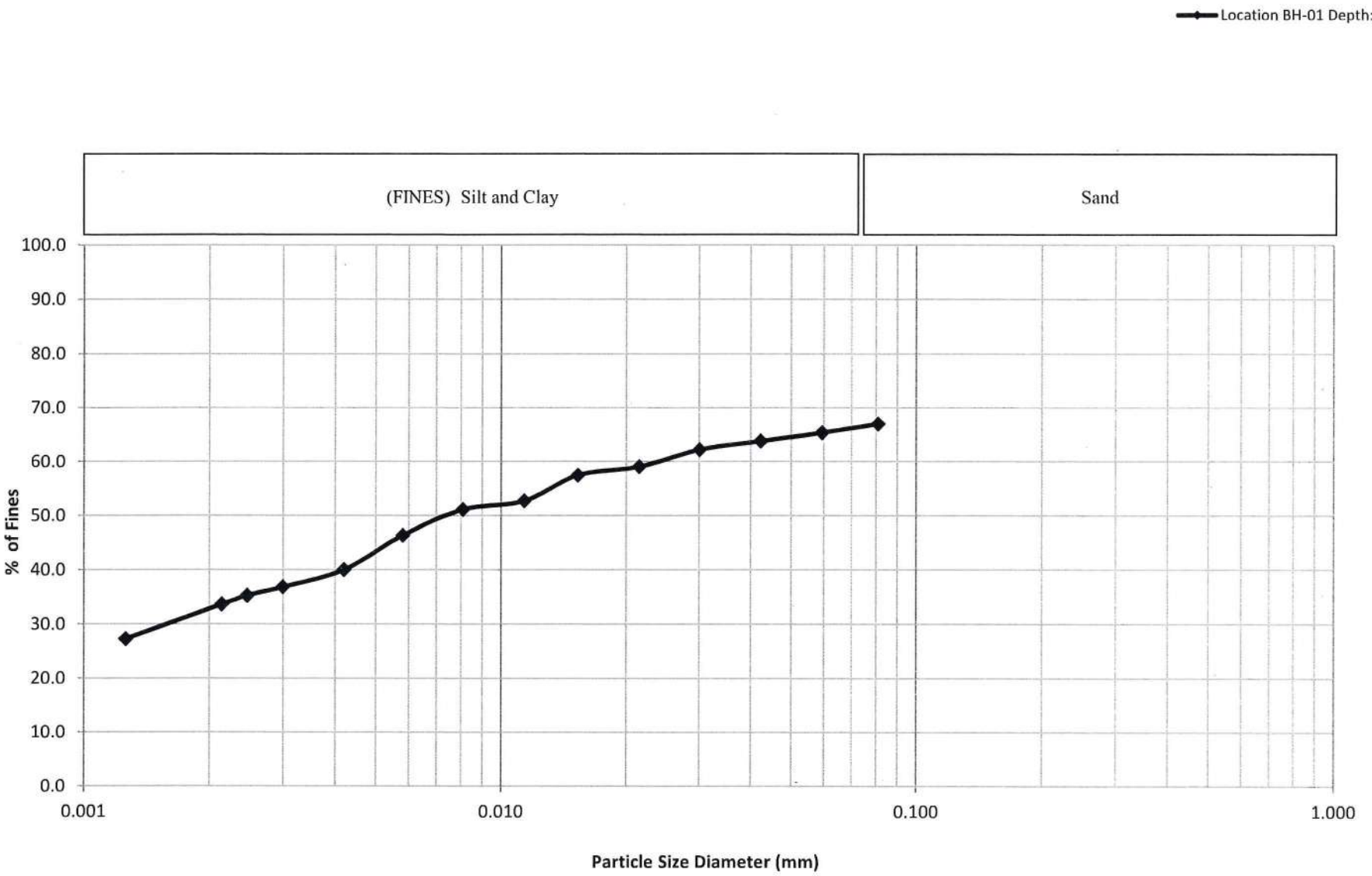


Fig 2.12 Hydrometer Analysis Master Curve

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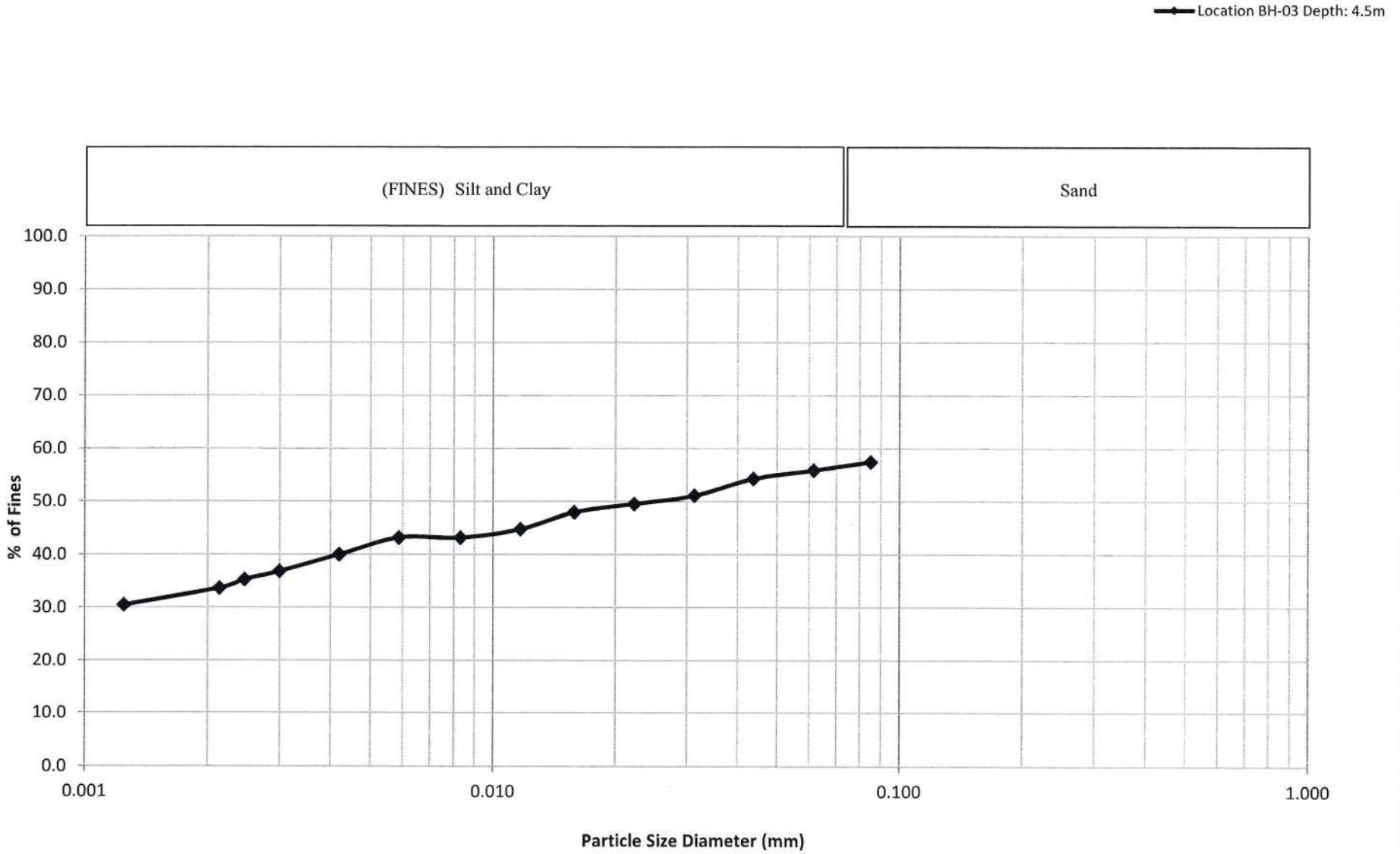


Fig 2.14 Hydrometer Analysis Master Curve

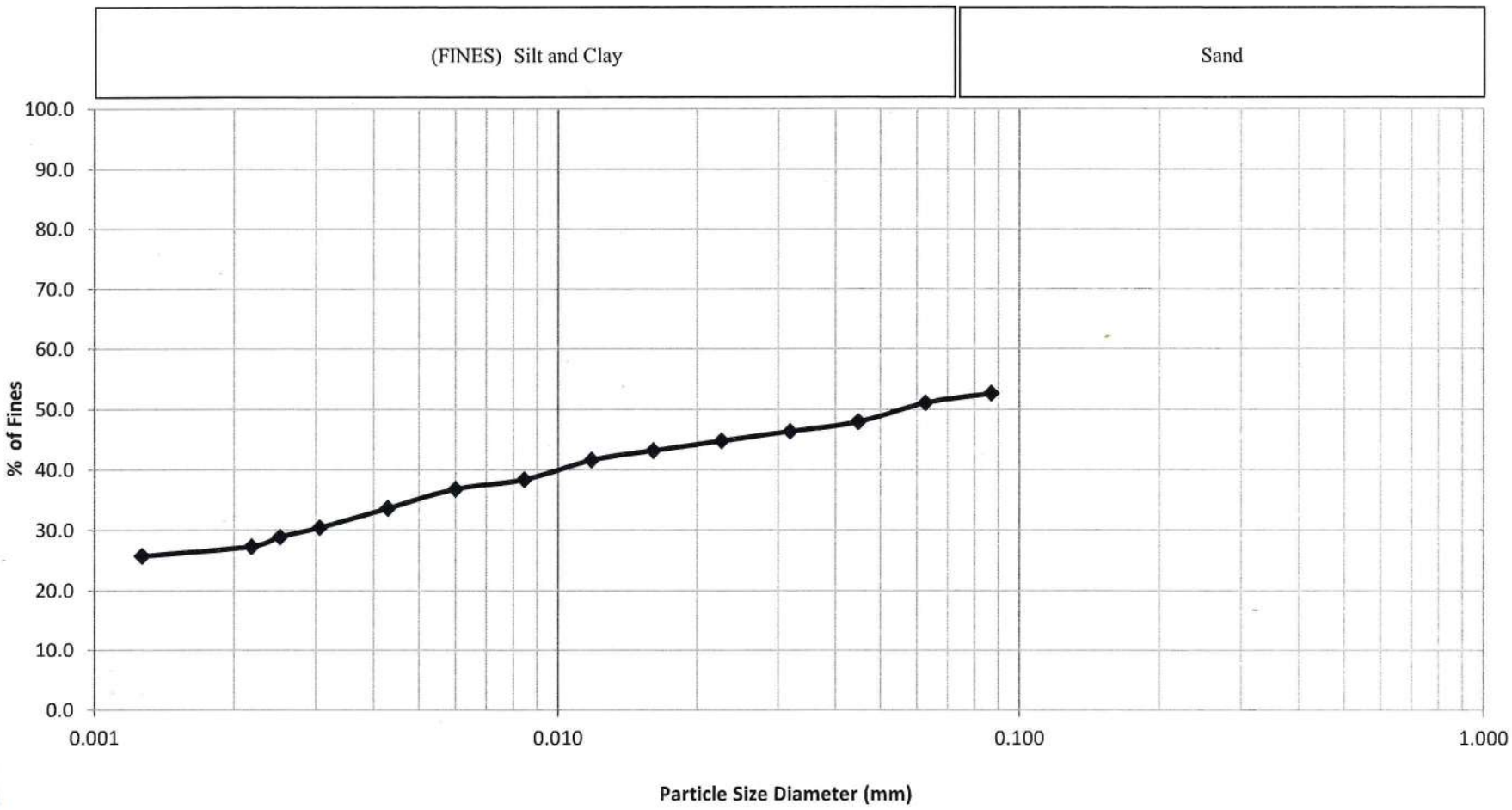


Fig 2.16 Hydrometer Analysis Master Curve

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LABORATORY TEST REPORT

GEOMARINE CONSULTANTS PVT LTD- GEOTECHNICAL LABORATORY
NO.11 2nd MAIN ROAD, KANNAPA NAGAR EXTN,
KOTTIVAKKAM, CHENNAI

TC-11410

Name & Address of the Customer	:	**M/s CHENNAI PREMIUM PROJECTS PVT LTD,**	**Customer Reference**	:	By Email
Sample Description	:	Soil Sample	**Period of Testing**	:	22/05/2023 to 27/05/2023
Source of Sample	:	Customer Supplied- Borehole No. BH-01	**Sample Identification Number**	:	GMC/0523/665
Sample Condition	:	Satisfactory	**Test Report No.**	:	GT-2573
Test Method	:	As per Bureau of Indian Standards	**Report Date**	:	30/05/2023
Sample Receipt Date	:	19/05/2023	**Test Report Pages**	:	One Page

Table-2.1 Laboratory Classification of Soil Samples from BH-01

Sample Depth (m)	SPT- "N" Value	Type of Sample	Fine Grained (FG)											Coarse Grained (CG)													
			Moisture Content (%) AS PER IS 2720 (P-II) - 1973, RA-2015	LIQUID LIMIT (%) AS PER IS 2720 (P-V) - 1985, RA-2015	PLASTIC LIMIT (%) AS PER IS 2720 (P-V) - 1985, RA-2015	Plasticity Index (I_P= LL-PL)	Consistency Index (Ic=LL-NMC/I_P)	SHRINKAGE LIMIT (%) AS PER IS 2720 (P-VI) - 1972, RA-2011	FREE SWELL INDEX (%) AS PER IS 2720 (P-XL) - 1977, RA-2011	Consistancy	Position With Respect to A-Aline	IS:Notation	SPECIFIC GRAVITY AS PER IS 2720 (P-III, SEC-1) - 1980, RA-2010	GRAIN SIZE ANALYSIS AS PER IS 2720 (P-IV) - 1985, RA-2015						D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	Uniformity Co-Efficient $C_U=D_{60}/D_{10}$	Co-Efficient of Curvature $C_c=D_{30}^2/(D_{10}xD_{60})$	Relative Density	IS-Notation	
														Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)							Gravel	Sand
0.5	17	SS	7.2	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	8.6	55.7	35.7		-	-	-	-	-	M.Dense	<50%	SM
1.25	22	SS	11.9	-	-	-	-	-	-	CG>50%	-	-	-	6.8	3.3	21.7	50.9	17.2		-	-	-	-	-	M.Dense	<50%	SM
2.0	32	SS	13.3	-	-	-	-	-	-	CG>50%	-	-	2.63	0.7	1.1	44.5	41.6	12.1		-	-	-	-	-	Dense	<50%	SM
3.0	47	SS	13.7	-	-	-	-	-	-	CG>50%	-	-	-	0.0	1.6	30.6	55.2	12.6		-	-	-	-	-	Dense	<50%	SM
4.0	4	SS	40.3	54.0	25.6	28.4	0.5	-	6.7	Soft	Above	CH	-	-	-	-	-	66.4	33.6	-	-	-	-	-	FG>50%	FG>50%	FG>50%
5.0	-	UDS	34.7	59.2	26.5	32.7	0.7	-	20.0	-	Above	CH	-	0	0.86	7.2	18.06	73.9	0.0	-	-	-	-	-	FG>50%	FG>50%	FG>50%
6.0	5	*SS	Sample Failed																								
7.5	11	SS	17.4	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	49.8	38.1	12.1		-	-	-	-	-	M.Dense	<50%	SM
9.0	10	SS	18.4	-	-	-	-	-	-	CG>50%	-	-	2.60	1.3	0.9	39.9	40.7	17.2		-	-	-	-	-	Loose	<50%	SM
10.5	6	SS	18.4	Clayey Sand to Sand With Little Plastic Binder/ Low Sample for Atterbergs Limit					27.3	CG>50%	-	-	-	1.9	1.1	42.3	31.0	23.7		-	-	-	-	-	Loose	<50%	SM
12.0	5	SS	48.3						69.2	CG>50%	Above	-	-	0.6	0.8	27.5	24.4	46.8		-	-	-	-	-	Loose	<50%	SC
14.0	>100	SS	17.4	-	-	-	-	-	-	CG>50%	-	-	-	31.1	9.5	25.6	17.3	16.5		-	-	-	-	-	V.Dense	<50%	SM

** END OF REPORT**

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(3) Any correction in this reports invalidates the reports

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ULR No : TC114102300000046F

LABORATORY TEST REPORT

GEOMARINE CONSULTANTS PVT LTD- GEOTECHNICAL LABORATORY
NO.11 2nd MAIN ROAD, KANNAPA NAGAR EXTN,
KOTTIVAKKAM, CHENNAI

TC-11410

Name & Address of the Customer	:	**M/s CHENNAI PREMIUM PROJECTS PVT LTD,**	**Customer Reference**	:	By Email
Sample Description	:	Soil Sample	**Period of Testing**	:	12/07/2023 to 19/07/2023
Source of Sample	:	Customer Supplied- Borehole No. BH-03	**Sample Identification Number**	:	GMC/0523/665
Sample Condition	:	Satisfactory	**Test Report No.**	:	GT-2573
Test Method	:	As per Bureau of Indian Standards	**Report Date**	:	20/07/2023
Sample Receipt Date	:	07/07/2023	**Test Report Pages**	:	One Page

Table-2.3 Laboratory Classification of Soil Samples from BH-03

Sample Depth (m)	SPT- "N" Value	Type of Sample	Fine Grained (FG)										Coarse Grained (CG)												
			Moisture Content (%) AS PER IS 2720 (P-II) - 1973, RA-2015	LIQUID LIMIT (%) AS PER IS 2720 (P-V) - 1985, RA-2015	PLASTIC LIMIT (%) AS PER IS 2720 (P-V) - 1985, RA-2015	Plasticity Index (I_p= LL-PL)	Consistency Index (Ic=LL-NMC/I_p)	SHRINKAGE LIMIT (%) AS PER IS 2720 (P-VI) - 1972, RA-2011	FREE SWELL INDEX (%) AS PER IS 2720 (P-XL) - 1977, RA-2011	Consistancy	Position With Respect to A-Aline	IS:Notation	SPECIFIC GRAVITY AS PER IS 2720 (P-III, SEC-1) - 1980, RA-2010	GRAIN SIZE ANALYSIS AS PER IS 2720 (P-IV) - 1985, RA-2015						D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	Uniformity Co-Efficient $C_U=D_{60}/D_{10}$	Co-Efficient of Curvature $C_c=D_{30}^2/(D_{10}*D_{60})$	Relative Density	IS-Notation	
													Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)							Gravel	Sand
0.5	14	SS	9.9	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	3.3	71.3	25.3		-	-	-	-	-	M.Dense	<50%	SM
1.25	21	SS	9.2	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	4.4	75.3	20.3		-	-	-	-	-	M.Dense	<50%	SM
2.0	29	SS	9.1	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	21.8	64.5	13.7		-	-	-	-	-	M.Dense	<50%	SM
3.0	40	SS	12.4	-	-	-	-	-	-	CG>50%	-	-	2.64	0.0	0.0	53.3	38.2	8.5		-	-	-	-	-	Dense	<50%	SP-SM
4.5	5	SS	45.6	70.0	30.8	39.3	0.6	9.8	26.7	M.Stiff	Above	CH	-	-	-	-	-	66.4	33.6	-	-	-	-	-	FG>50%	FG>50%	FG>50%
6.0	3	SS	17.8	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	37.8	46.3	15.9		-	-	-	-	-	V.Loose	<50%	SM
10.5	21	SS	16.3	-	-	-	-	-	-	CG>50%	-	-	2.63	0.0	0.0	44.5	41.3	14.2		-	-	-	-	-	M.Dense	<50%	SM
12.0	12	SS	32.9	Clay Binder/ Little Plasticity					0.0	CG>50%	-	-	-	17.6	2.8	17.2	16.9	45.5		-	-	-	-	-	M.Dense	<50%	SM
14.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	-	33.6	15.3	39.6	10.8	0.7		-	-	-	-	-	V.Dense	<50%	SP
15.5	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	-	22.9	13.1	51.5	10.8	1.8		-	-	-	-	-	V.Dense	<50%	SP
17.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	-	12.7	12.5	55.0	17.8	2.1		-	-	-	-	-	V.Dense	<50%	SP

** END OF REPORT**

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Authorised Signatory

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ULR No : TC114102300000046F

LABORATORY TEST REPORT

GEOMARINE CONSULTANTS PVT LTD- GEOTECHNICAL LABORATORY
NO.11 2nd MAIN ROAD, KANNAPA NAGAR EXTN,
KOTTIVAKKAM, CHENNAI

TC-11410

Name & Address of the Customer	:	**M/s CHENNAI PREMIUM PROJECTS PVT LTD,**	**Customer Reference**	:	By Email
Sample Description	:	Soil Sample	**Period of Testing**	:	12/07/2023 to 19/07/2023
Source of Sample	:	Customer Supplied- Borehole No. BH-05	**Sample Identification Number**	:	GMC/0523/665
Sample Condition	:	Satisfactory	**Test Report No.**	:	GT-2573
Test Method	:	As per Bureau of Indian Standards	**Report Date**	:	20/07/2023
Sample Receipt Date	:	07/07/2023	**Test Report Pages**	:	One Page

Table-2.5 Laboratory Classification of Soil Samples from BH-05

Sample Depth (m)	SPT- "N" Value	Type of Sample	Fine Grained (FG)										Coarse Grained (CG)													
			Moisture Content (%) AS PER IS 2720 (P-II) - 1973, RA-2015	LIQUID LIMIT (%) AS PER IS 2720 (P-V) - 1985, RA-2015	PLASTIC LIMIT (%) AS PER IS 2720 (P-V) - 1985, RA-2015	Plasticity Index (I_P= LL-PL)	Consistency Index (Ic=LL-NMC/I_p)	SHRINKAGE LIMIT (%) AS PER IS 2720 (P-VI) - 1972, RA-2011	FREE SWELL INDEX (%) AS PER IS 2720 (P-XL) - 1977, RA-2011	Consistancy	Position With Respect to A-Aline	IS:Notation	SPECIFIC GRAVITY AS PER IS 2720 (P-III, SEC-1) - 1980, RA-2010	GRAIN SIZE ANALYSIS AS PER IS 2720 (P-IV) - 1985, RA-2015						D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	Uniformity Co-Efficient $C_U=D_{60}/D_{10}$	Co-Efficient of Curvature $C_c=D_{30}^2/(D_{10}xD_{60})$	Relative Density	IS-Notation	
													Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)							Gravel	Sand
0.5	8	SS	10.6	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	13.8	46.0	40.2		-	-	-	-	-	Loose	<50%	SM
1.25	4	SS	11.0	-	-	-	-	-	-	CG>50%	-	-	2.62	0.0	4.3	22.2	50.8	22.8		-	-	-	-	-	V.Loose	<50%	SM
2.0	10	SS	8.9	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.3	38.2	54.6	6.8		-	-	-	-	-	Loose	<50%	SP-SM
4.0	16	SS	21.7	53.5	28.3	25.2	1.3	17.2	15.4	CG>50%	Above	-	-	0.0	0.0	23.0	45.6	22.8	8.6	-	-	-	-	-	M.Dense	<50%	SC
5.0	9	SS	17.3	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	42.2	46.2	11.6		-	-	-	-	-	Loose	<50%	SP-SM
6.0	15	SS	18.1	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	50.0	39.1	10.9		-	-	-	-	-	M.Dense	<50%	SP-SM
7.5	12	SS	17.2	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	49.6	41.6	8.8		-	-	-	-	-	M.Dense	<50%	SP-SM
9.0	11	SS	18.0	-	-	-	-	-	-	CG>50%	-	-	2.64	0.0	0.0	46.5	38.2	15.3		-	-	-	-	-	M.Dense	<50%	SM
10.5	17	SS	47.7	-	-	-	-	-	-	CG>50%	-	-	-	36.3	6.1	13.4	22.9	21.4		-	-	-	-	-	M.Dense	<50%	SM
12.0	46	SS	15.6	70.9	28.8	42.1	1.3	14.6	42.9	Hard	Above	CH	-	0.0	0.0	18.2	18.4	63.5		-	-	-	-	-	FG>50%	FG>50%	FG>50%
14.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	-	14.8	27.3	38.5	16.5	2.8		-	-	-	-	-	V.Dense	<50%	SP

** END OF REPORT**

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LABORATORY TEST REPORT
GEOMARINE CONSULTANTS PVT LTD- GEOTECHNICAL LABORATORY
NO.11 2nd MAIN ROAD, KANNAPA NAGAR EXTN,
KOTTIVAKKAM, CHENNAI

TC-11410

Table 2.6 Result of Chemical Test

Name & Address of the Customer:	**M/s CHENNAI PREMIUM PROJECTS PVT LTD,**		
Sample Description:	Water and Soil	**Sample Identification Number:**	GMC/0523/665
Source of Sample:	Customer Supplied	**Period of Testing:**	23/05/2023 & 11 to 19/07/2023
Sample Condition:	Satisfactory	**Report Date:**	20/07/2023
Test Method	As per Bureau of Indian Standards	**Test Report No.:**	GT-2573
Sample Receipt Date:	19/05/2023 & 07/07/2023	**Test Report Pages:**	One Page

S No.	Bore Hole Number	Water				SOIL (2:1)	
		DEPTH OF SAMPLE (m)	pH AS PER IS 3025 (P-XI) - 2022	SULPHATES (mg/l) AS PER APHA 23rd Edn.2017-4500	CHLORIDES (mg/l) AS PER IS 3025(P-XXXII) - 1988, RA-2019	DEPTH OF SAMPLE (m)	pH AS PER IS 2720 (P-XXVI) - 1987, RA-2021
1.0	BH-01	2.50	7.94	352.7	314.2	2.00	8.23
2.0	BH-02	3.20	Sample Mixed With Mud			2.00	7.13
3.0	BH-03	3.50	6.97	236.1	206.7	2.00	6.64
4.0	BH-04	3.10	7.10	368.4	283.6	2.00	6.96
5.0	BH-05	3.20	7.29	312.9	269.2	2.00	7.26

**** END OF REPORT****

Authorised Signatory

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(Technical Manager)

Terms and Conditions

(1) The test results furnished corresponds to the sample received

(2) The tested sample will not be retained for more than 30 days from the date of issue of test report except in the case as required by the applicable regulations.

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LABORATORY TEST REPORT
GEOMARINE CONSULTANTS PVT LTD- GEOTECHNICAL LABORATORY
NO.11 2nd MAIN ROAD, KANNAPA NAGAR EXTN,
KOTTIVAKKAM, CHENNAI

TC-11410

Table 2.8 Result of Rock Test

Name & Address of the Customer:	**M/s CHENNAI PREMIUM PROJECTS PVT LTD,**		
Sample Description:	Rock	**Sample Identification Number:**	GMC/0523/665
Source of Sample:	Customer Supplied	**Period of Testing:**	17/07/2023 to 18/07/2023
Sample Condition:	Satisfactory	**Report Date:**	20/07/2023
Test Method	As per Bureau of Indian Stan	**Test Report No.:**	GT-2573
Sample Receipt Date:	19/05/2023 & 07/07/2023	**Test Report Pages:**	One Page

S.No	Bore Hole Number	DEPTH (m)	POINT LOAD STRENGTH INDEX, mPa AS PER IS 8764 - 1998, RA-2019	WATER CONTENT, % AS PER IS 13030 - 1991, RA-2021	SLAKE DURABILITY, % AS PER IS 10050 - 1981, RA-2021	TENSILE STRENGTH, mPa AS PER IS 10082 - 1981, RA-2021
1	BH - 01	15.00 to 16.00	1.81	0.12	96.21	3.85
2	BH - 02	15.50 to 17.00	-	0.34	94.28	-
3	BH - 04	15.50 to 17.00	-	0.31	94.51	-
4	BH - 05	15.50 to 17.00	0.35	0.23	95.63	2.61

** END OF REPORT**

Authorised Signatory

A. VINOTH
(Technical Manager)

Terms and Conditions

(1) The test results furnished corresponds to the sample received

(2) The tested sample will not be retained for more than 45 days from the date of issue of test report except in the case as required by the applicable regulations.

(3) Any correction in this reports invalidates the reports

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3.4 GEOLOGICAL ORDER OF THE STUDY AREA:

The stratigraphy of the study area can be classified as recent formation which is underlain by basement rock of meta-igneous origin (hypersthene granite/ Charnockite rock)

Deposits of Recent Age

---------- Eparchean Unconformity ----------

Archaean Basement Rock (Charnockite Rock / Hypersthene Granite)

3.5 DESIGN SUB SOIL PROFILE: (WRT Foundation Engineering Application)

The sub soil characteristics obtained at the test location are further processed to arrive at the design soil parameters required for the design of sub structure using the following shear strength correlations with respect to the Standard Penetration Test Values of different layers.

- For Coarse Grained Material, Ref. IS: 6403 to estimate Angle of Shearing Resistance (Reproduced and shown in Fig.A1)
- For Fine Grained Material, Ref. Terzaghi & Peck, 1948, to estimate Unconfined Compressive Strength (Reproduced and shown in Fig.A2)

Based on the above, the average design soil characteristics are given below:

REFERENCE BORE HOLE				BH-01	Ref R.L. of G.L. (m):			0.00		
Layer No.	Layer Thk. (m)			Type of Strata	Colour	Ave. Design SPT	Relative Density	Consistency	(γ) kN/m^3	Shear Parameters	
	Top BGL	Bottom BGL	Thickness							(C_u) kPa	(ϕ) Deg.
1.0	0.00	4.00	4.00	Silty Sand	Brown	30	Medium Dense	-	19	-	36
2.0	4.00	7.50	3.50	Silty Clay	Brown Grey to Black	5	-	Medium Stiff	15	33	-
3.0	7.50	10.50	3.00	Silty Sand	Grey	11	Medium Dense	-	15.5	-	30.3
4.0	10.50	14.00	3.50	Clayey Silty Sand	Grey to Black	6	Loose	-	14.5	-	29.2
5.0	14.00	15.00	1.00	Completely to Highly Weathered Rock	Grey Brown	CRR:15%; RQD: 0%					
6.0	15.00	16.00	1.00	Moderately Weathered Rock	Green to Grey Brown	CRR:55%; RQD: 0%					

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REFERENCE BORE HOLE					BH-04	Ref R.L. of G.L. (m):			0.00		
Layer No.	Layer Thk. (m)			Type of Strata	Colour	Ave. Design SPT	Relative Density	Consistency	(γ) kN/m³	Shear Parameters	
	Top BGL	Bottom BGL	Thickness							(Cu) kPa	(ϕ) Deg.
1.0	0.00	1.25	1.25	Silty Sand	Brown	12	Medium Dense	-	16	-	31
2.0	1.25	3.00	1.75	Silty Sand	Brown	4	Very Loose	-	13.5	-	20
3.0	3.00	4.00	1.00	Silty Clay	Grey or Black	5	-	Medium Stiff	15	33	-
4.0	4.00	5.00	1.00	Clayey Silty Sand	Grey	2	Very Loose	-	13	-	20
5.0	5.00	10.50	5.50	Silty Sand	Grey	15	Medium Dense	-	17.5	-	32
6.0	10.50	12.00	1.50	Silty Clay	Black	12	-	Stiff	18.5	80	-
7.0	12.00	14.00	2.00	Silty Sand	Offwhite Grey	56	Very Dense	-	20.5	-	42
8.0	14.00	15.50	1.50	Completely Weathered Rock	Brown Grey	>100	Very Dense	-	21	-	43
9.0	15.50	17.00	1.50	Highly Weathered Rock	Grey	CRR:12%; RQD: 0%					

REFERENCE BORE HOLE					BH-05	Ref R.L. of G.L. (m):			0.00		
Layer No.	Layer Thk. (m)			Type of Strata	Colour	Ave. Design SPT	Relative Density	Consistency	(γ) kN/m³	Shear Parameters	
	Top BGL	Bottom BGL	Thickness							(Cu) kPa	(ϕ) Deg.
1.0	0.00	3.00	3.00	Silty Sand	Brown	7	Loose	-	14.5	-	29
2.0	3.00	5.00	2.00	Clayey Silty Sand	Grey	17	Medium Dense	-	18	-	32
3.0	5.00	6.00	1.00	Silty Sand	Grey	9	Loose	-	14.5	-	30
4.0	6.00	12.00	6.00	Silty Sand	Grey	14	Medium Dense	-	17	-	31
5.0	12.00	14.00	2.00	Sandy Silty Clay	Grey	46	-	Hard	21	307	-
6.0	14.00	15.50	1.50	Highly Weathered Rock	Brown Grey	CRR:10% ; RQD: 0%					
7.0	15.50	17.00	1.50	Moderately Weathered Rock	Brown Grey	CRR: 22%; RQD: 0%					

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CHAPTER-4

FOUNDATION SYSTEM

4.0 PREAMBLE:

In the design of foundation system, the stress-strain compatibility of the super structure, sub structure and the bearing strata should be satisfied both individually and as a combined system. In view of this, the following data are needed for the design of foundation system, defined in terms of the type of sub structure and the bearing strata characteristics.

- The super structure characteristics along with the loading pattern on the sub structure
- The sub soil characteristics that define the required substructure configuration for a safe transfer of super-structural loads to the bearing strata

Considering the above aspects of the foundation design, the suitable type of foundation system is presented below.

4.1 PROPOSED STRUCTURES:

An understanding of the proposed construction and the order of loads on the foundations is needed for choosing the appropriate foundation system. In the present case, the proposed structure is configured with stilt and five upper floors which is meant for commercial occupancy. For this kind of structure, the column loads could vary between 2500kN to 5000kN.

The above mentioned loads have no bearing on the design of either sub or super structures and are mentioned just to provide an insight to choose an appropriate foundation system with respect to subsoil conditions.

4.2 SUB SOIL STRATIFICATION:

The sub surface stratification of the project location is:

0.0m to 4.0m	Medium Dense & Dense, Silty Sand
4.0m to 7.5m	Soft, Silty Clay with Organic Matter With Sand Lenses
7.5m to 14m	Loose & Medium Dense, Silty Sand/Clayey Sand With Intermittent Clayey Silt Lenses at Location
14.0m to 16.0m	Completely to Moderately Weathered Rock (Grade W5 to W3 Rock)

4.3 FOUNDATION SYSTEM:

Taking into account of the superstructure configuration and sub soil conditions it is not possible to adopt any kind of open foundation system from both shear and settlement considerations. Hence, it is advisable to adopt deep pile foundation system.

The piles can be installed by drilling with direct mud circulation technique **(Bored Cast Insitu Piles)** and the recommended safe load carrying capacity of bored cast insitu piles in compression, tension and lateral for different diameters is worked out as per IS 2911-Part-I-Section-2 and are presented in Table 4.1.

Typical computations are presented in Annexure-I

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RECOMMENDATIONS

ANNEXURE-I

GEOMARINE
THE SPIRIT OF ENGINEERING

ESTIMATION OF SAFE LOAD CARRYING CAPACITY OF BORED CAST-INSITU PILES

Type of Pile	Bored	**Diameter of Pile**		**Length of Pile below G.L. (m)**	16.0	**As Per IS:2911-(P-I,S-2)-2010**			
Reference Bore Hole	BH-02			500	mm	**Surcharge Pressure**	0	**kPa**	

Layer No.	Layer Thk. (m) Top. R.L.	Bot. R.L.	Thickness	Type of Strata	Ave. SPT	(γ) kN/m^3 of Layer	Ave. upto Layer	Shear Parameters (C_u) kPa	(ϕ) Deg.	Effective Overburden Pressure (kPa) At top of Layer	At Bot. of Layer	At Mid. of Layer	Adhesion Factor (α)	Earth Pressure Coefficient (k)	Skin Friction (Q_f) kN
1.0	0.0	5.0	5.0	Cut-Off Level											
2.0	5.0	7.5	2.5	Silty Sand	7	14.5	14.5	-	29	0.0	11.3	5.6	-	1.0	qf 2 = 12.5
3.0	7.5	10.5	3.0	Silty Sand	19	18.0	16.3	-	33	11.3	35.3	23.3	-	1.1	qf 3 = 80.0
4.0	10.5	12.0	1.5	Silty Clay	5	15.0	16.5	33	-	35.3	42.8	39.0	1.0	-	qf 4 = 77.8
5.0	12.0	14.0	2.0	Clayey Silt	30	19.0	17.0	-	30	42.8	60.8	51.8	-	1.3	qf 5 = 122.4
6.0	14.0	16.0	2.0	Highly Weathered Rock	50	20.5	19.8	-	41	60.8	81.8	71.3	-	1.5	qf 6 = 291.9

Summation of Positive Skin Resitance (kN) Q_f= 584.42

Summation of Negative Skin Resistance (kN) -Qf= 0.00

Computation of End Bearing Resistance

		SPT	ϕ	C_u	N_q	N_c			
Bearing Stratum	Highly Weathered Rock	100	41	-	157.31	-	Eff.Ht.of Overburden	9	m
							Effective Overburden Pressure	94.50	kN/m^2

End Bearing Resistance (kN) Q_p= 2918.86

Skin Resistance in Clay Layer is $\pi*d*T_i*C_u*\alpha$	Ultimate Load Carrying Capacity (Q_{ult})	$Q_u=Q_f-Q_f+Q_p$ (kN)	3503.27
Skin Resistance in Sand Layer is $\pi*d*T_i*q_i*K*Tan(\phi)$	Safe Load Carrying Capacity (Q_{safe})	$Q_u/2.5$ (kN)	1401.31
End Bearing Resistance in Clay Layer is $\pi*d^2/4*C_u*N_c$	Allowable Safe Load Carrying Capacity	$Q_{A\text{-}safe}$ (kN)	1401.31
End Bearing Resistance in Sand Layer is $\pi*d^2/4*Q*N_q$	Allowable Safe Pull out Capacity	$Q_{A\text{-}pull}$: Qf/3 (kN)	194.81

Where

Cu=Undrained Shear Strength of Clay
K=Coef. Earth Pressure at Rest
d=Dia. Of Pile
ϕ=Angle of Shearing Resistance
q_i=Effecitve Overburden Pressure at middle of Layer
α=Adhesion Factor
N_c=Bearing Capacity Factor = 9
N_q=Bearing Capacity Factor, Ref. Fig.1 of IS: Code Referred above
T_i=Thickness of Layer
Q (i.e) Effecitve Overburden Pressure at pile tip=Effective height of overburden X (γ-10)

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GEOMARINE
THE SPIRIT OF ENGINEERING

ESTIMATION OF SAFE LOAD CARRYING CAPACITY OF BORED CAST-INSITU PILES

Type of Pile	Bored	Diameter of Pile		Length of Pile below G.L. (m)	16.0	As Per IS:2911-(P-I,S-2)-2010
Reference Bore Hole	BH-04		500 mm	Surcharge Pressure	0	kPa

Layer No.	Layer Thk. (m) Top. R.L.	Bot. R.L.	Thickness	Type of Strata	Ave. SPT	(γ) kN/m³ of Layer	Ave. upto Layer	Shear Parameters (C_u) kPa	(ϕ) Deg.	Effective Overburden Pressure (kPa) At top of Layer	At Bot. of Layer	At Mid. of Layer	Adhesion Factor (α)	Earth Pressure Coefficient (k)	Skin Friction (Q_f) kN		
1.0	0.0	5.0	5.0	Cut-Off Level													
2.0	5.0	10.5	5.5	Silty Sand	15	17.5	17.5	-	32	0.0	41.3	20.6	-	1.1	qf	2	117.5
3.0	10.5	12.0	1.5	Silty Clay	12	18.5	18.0	80	-	41.3	54.0	47.6	0.6	-	qf	3	103.7
4.0	12.0	14.0	2.0	Silty Sand	50	20.5	19.5	-	40	54.0	75.0	64.5	-	1.5	qf	4	255.0
5.0	14.0	16.0	2.0	Completely Weathered Rock	50	20.5	20.5	-	41	75.0	96.0	85.5	-	1.5	qf	5	350.2

Summation of Positive Skin Resitance (kN) Q_f= 826.47

Summation of Negative Skin Resistance (kN) -Qf= 0.00

Computation of End Bearing Resistance

		SPT	ϕ	C_u	N_q	N_c			
Bearing Stratum	Completely Weathered Rock	100	41	-	157.31	-	Eff.Ht.of Overburden	9	m
							Effective Overburden Pressure	94.50	kN/m²

End Bearing Resistance (kN) Q_p= 2918.86

Skin Resistance in Clay Layer is $\pi*d*T_i*C_u*\alpha$

Skin Resistance in Sand Layer is $\pi*d*T_i*q_i*K*Tan(\phi)$

End Bearing Resistance in Clay Layer is $\pi*d^2/4*C_u*N_c$

End Bearing Resistance in Sand Layer is $\pi*d^2/4*Q*N_q$

Ultimate Load Carrying Capacity (Q_{ult})	$Q_u=Q_f-Q_f+Q_p$ (kN)	3745.33
Safe Load Carrying Capacity (Q_{safe})	$Q_u/2.5$ (kN)	1498.13
Allowable Safe Load Carrying Capacity	$Q_{A\text{-}safe}$ (kN)	1498.13
Allowable Safe Pull out Capacity	$Q_{A\text{-}pull}$: Qf/3 (kN)	275.49

Where

Cu=Undrained Shear Strength of Clay
K=Coef. Earth Pressure at Rest
d=Dia. Of Pile
ϕ=Angle of Shearing Resistance
q_i=Effecitve Overburden Pressure at middle of Layer
α=Adhesion Factor
N_c=Bearing Capacity Factor = 9
N_q=Bearing Capacity Factor, Ref. Fig.1 of IS: Code Referred above
T_i=Thickness of Layer

Q (i.e) Effecitve Overburden Pressure at pile tip=Effective height of overburden X (γ-10)

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GEO MARINE
THE SPIRIT OF ENGINEERING

LATERAL LOAD CARRYING CAPACITY OF BORED CAST- SITU PILES

Reference Bore Hole : BH-01

1.0 Geometrical Data

Type of Pile Head Considered	Fixed	
Diameter of Pile (d) :	0.50	m
Free standing Length of Pile (e) :	0	m
Length of Pile below E.G.L (Le) :	16.0	m
Cut-Off Level From E.G.L :	4.5	
Length of Pile below Cut-Off Level (Le) :	11.5	m
Grade of Concrete (M) :	25	MN/m^2
Young's Modulus of Concrete (E) :	25000000	kN/m^2
Momemnt of Inertia (I) :	0.003068	m^4

2.0 Determination of Depth of Fixity

Type of Soil Strata :	Clay	
Ground Water Condition :	Submerged	
Design SPT "N" Value :	5	
K=((k1/1.5)*(0.3/B))		

(n can be read as h in the above and below equation in case of Sand)

K1= :	12000	kN/m^3
K= :	4800	kN/m^4
R= :	2.38	m
L1/R :	0.00	
Lf/R :	2.20	
Depth of Fixity below Cut off (z_f) :	5.23	m

3.0 Determincation of Lateral Load and Moment Carrying Capacity for 0.005 m Lateral Deflection:

Allowable Lateral Deflection (Y) :	0.005	m
Lateral Load Carrying Capacity (H)= Y*12EI/(e+zf)^3 :	32.15	kN
Recommended Design Lateral Load carrying Capacity :	**30**	**kN**
Fixed End Moment,M_F=H(e+z_f)/2	84	
Reduction Factor (L_1/T) :	0.67	m
Actual Moment (Fixed End Moment/Reduction Factor),M_F	**56**	kN-m

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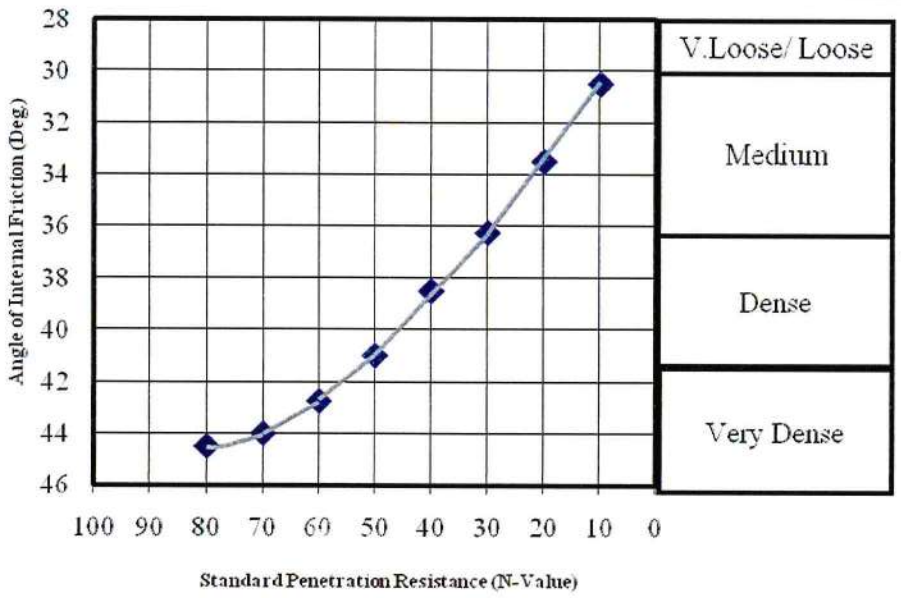


FIG. A1 Relation Ship between Angle of Internal Friction & N-value (Reproduced from IS:6403-1981)

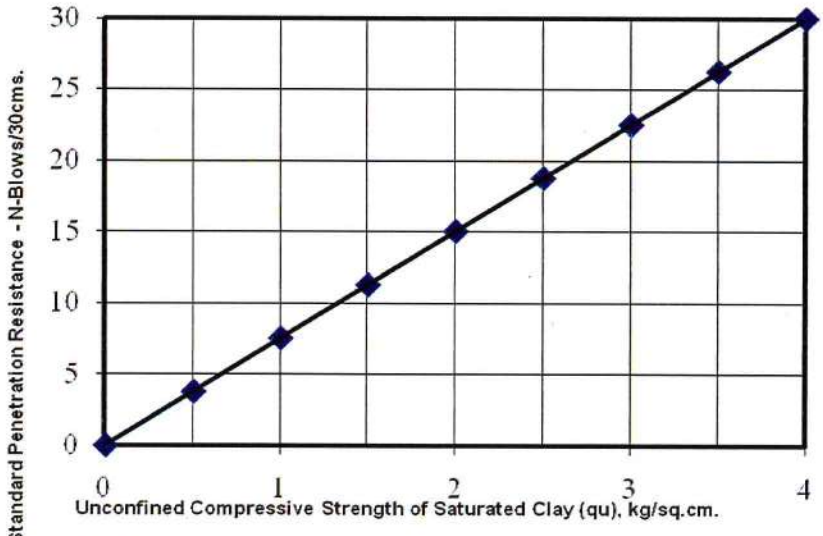


FIG. A2 : Relationship between UCC & SPT-Value (N) of Saturated Clay (AfterTerzhagi & Peck, 1948)

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GEOMARINE
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SITE INVESTIGATION RECORD

BORE HOLE No. 01
PAGE No. 01

PROJECT NAME: DRA - Egmore
DIA OF BORE HOLE: 150mm ✓ / 100mm
LOCATION: Crescent Sabai Road | MACHINE No.: CR-06 | CHAINAGE (m):
STRUCTURE: 1B+STILT+5 | DRILLING METHOD: Rotary | CO-ORDINATES: N, E
JOB CODE: | FLUSHING MEDIUM: Bentonite
BORE START DATE: 18/05/23
BORE END DATE: 19/05/23
TOTAL DRILLING DAYS:

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Layer Data: Depth (m)	Layer Data: Geotechnical Description
0	18-05-23	09	40												
		09	41	SC			7	8	9	17	0.50	1	SS		Medium dense, Brown, Silty Sand.
		09	52												
1		09	53	SC			9	11	11	22	1.25	2	SS		Medium dense, Brown, Silty Sand.
		10	01												
2		10	02	SC			10	14	18	32	2.00	3	SS		Dense, Brown, Silty Sand.
		10	12												
3		10	13	SC			11	25	22	47	3.00	4	SS		Dense, Brown. Silty Sand
		10	25												
4		10	26	SC			1	2	2	4	4.00	5	SS	4.00 L.C	Soft, Brown-Black clay with organic Substances.
		10	38												
5		10	40	SC			-	-	-	-	5.00	6	UDS		~~~ UDS Sample ~~~
		11	07												
6		11	09	SC			3	2	3	5	6.00	7	SS (Nil)		Sample slipped (Loose Sand)
		11	22												
7		11	23	SC			4	4	7	11	7.50	8	SS		Medium dense, Greyish Sand.
		11	37												
9		11	38	SC			4	4	6	10	9.00	9	SS		Loose, Greyish Sand. Mix Nilu
		11	55												
10		11	56	SC			3	2	4	6	10.50	10	SS		Loose Greyish clayey Sand.

CS - Core Sample
SS - Split Spoon Sample
UDS-Undisturbed Sample
WS - Wash Sample

DS - Disturbed Sample
SC - Soil Cutter
TCB - Tungsten Carbide Bit
DB - Diamond Bit

SUPERVISOR NAME: K. SELVAM
SIGNATURE
DATE: 18/05/23
CLIENT IN-CHARGE

PROJECT SITE DETAILS
GROUND LEVEL (m):
WATER TABLE (m): 2.50 m.
CASING DEPTH (m):

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SITE INVESTIGATION RECORD

BORE HOLE No.	02		
PAGE No.	1		
DIA OF BORE HOLE	150mm	✓	
	100mm		
BORE START DATE	06/07/2023		
BORE END DATE	07/07/2023		
TOTAL DRILLING DAYS	2		

PROJECT NAME	DRA - EGMORE						
LOCATION	Crescent Sala	MACHINE No.	CR-06	CHAINAGE (m)		N	
STRUCTURE		DRILLING METHOD	Rotary	CO-ORDINATES		E	
JOB CODE		FLUSHING MEDIUM	Bentonite				

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Layer Data: Depth (m)	Geotechnical Description
0	06/07/2023	14	25												
		14	26	SC			4	7	12	19	0.50	1	SS	0.5	M.Dense, Brownish Silt SAND.
		14	39												
1		14	40	SC			5	9	13	22	1.25	2	SS	1.25	M.Dense, Brownish Silt SAND.
		15	02												
		15	03	SC			7	12	15	27	2.00	3	SS	2	M.Dense, Brownish Silt SAND.
2		15	27												
		15	28	SC			8	15	19	34	3.00	4	SS	3	Dense, Brownish Silt SAND.
		15	55												
3		15	56	SC			2	2	3	5	4.00	5	SS	4	Stiff, Greyish silty clay with organic substance.
		16	20												
		16	21	SC			1	2	2	4	5.00	6	SS	5	Loose, Greyish SAND.
4		16	39												
		16	40	SC			2	3	5	8	6.00	7	SS	6	Loose, Greyish SAND.
	07/07/2023	9	35												
5		9	36	SC			4	6	5	11	7.50	8	-	7.5	SAMPLE FAILED N12.
		9	57												
		9	58	SC			6	10	17	27	9.00	9	SS	9	M.Dense, Greyish SAND.
6		10	20												
		10	21	SC			1	3	2	5	10.5	10	SS	10.5	Stiff, Greyish Silty Sandy With CLAY.
7															
8															
9															
10															

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	S. ANANTH
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE	
UDS-Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	06/07/2023
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE	

PROJECT SITE DETAILS	
GROUND LEVEL (m)	
WATER TABLE (m)	
CASING DEPTH (m)	

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SITE INVESTIGATION RECORD

BORE HOLE No. 03
PAGE No. 1

PROJECT NAME: DRA - EGMORE
DIA OF BORE HOLE: 150mm ✓ / 100mm

LOCATION	Cresent Salai	MACHINE No.	CR-06	CHAINAGE (m)		BORE START DATE	08/07/2023
STRUCTURE		DRILLING METHOD	Rotary	CO-ORDINATES	N	BORE END DATE	08/07/2023
JOB CODE		FLUSHING MEDIUM	Bentonite		E	TOTAL DRILLING DAYS	1

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	Blows/cm. 15-30	Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	Layer Data: Depth (m)	Geotechnical Description
0	08/07/2023	10	10												
		10	11	SC			3	6	8	14	0.50	1	SS	0.5	M.Dense, Brownish Silt SAND.
1		10	26												
		10	27	SC			4	9	12	21	1.25	2	SS	1.25	M.Dense, Brownish Silt SAND.
		10	40												
2		10	41	SC			12	13	16	29	2.00	3	SS	2	M.Dense, Brownish Silt SAND.
		11	02												
3		11	03	SC			12	18	22	40	3.00	4	SS	3	Dense, Brownish Silt SAND.
		11	19												
		11	20	SC						29	4.00	-	UDS	4	UDS SAMPLE SLIPPED NIL.
4		11	35												
		11	36	SC			2	3	2	5	4.50	5	SS	4.5	Loose, Greyish SAND with CLAY
		11	50												
5		11	51	SC						23	5.00	-	UDS	5	UDS SAMPLE SLIPPED NIL.
		12	07												
		12	08	SC			2	1	2	3	6.00	6	SS	6	Loose, Greyish SAND.
6															
		12	22												
7		12	23												
				SC			2	2	4	6	7.50	7	SS	7.5	SAMPLE SLIPPED NIL.
8															
		12	45												
		12	46												
9				SC			8	7	9	16	9.00	8	SS	9	SAMPLE SLIPPED NIL.
		13	05												
10		13	06												
				SC			7	9	12	21	10.50	9	SS	10.5	M.Dense, Greyish SAND.

CS - Core Sample
SS - Split Spoon Sample
UDS - Undisturbed Sample
WS - Wash Sample

DS - Disturbed Sample
SC - Soil Cutter
TCB - Tungsten Carbide Bit
DB - Diamond Bit

SUPERVISOR NAME: S. ANANTH
SIGNATURE: S.A
DATE: 08/07/2023
CLIENT IN-CHARGE:

PROJECT SITE DETAILS
GROUND LEVEL (m):
WATER TABLE (m):
CASING DEPTH (m):

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SITE INVESTIGATION RECORD

BORE HOLE No. 04
PAGE No. 1

PROJECT NAME: DRA - EGMORE
DIA OF BORE HOLE: 150mm ✓ / 100mm

LOCATION	Cresent Salai	MACHINE No.	CR-06	CHAINAGE (m)		BORE START DATE	05/07/2023
STRUCTURE		DRILLING METHOD	Rotary	CO-ORDINATES	N	BORE END DATE	06/07/2023
JOB CODE		FLUSHING MEDIUM	Bentonite		E	TOTAL DRILLING DAYS	2

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	Blows/cm. 15-30	Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	Layer Data: Depth (m)	Geotechnical Description
0	05/07/2023	11	20												
		11	21	SC			3	5	7	12	0.50	1	SS	0.5	M.Dense, Brownish Silt SAND.
		11	34												
1		11	35	SC			1	2	1	3	1.25	2	SS	1.25	V.Loose, Brownish Silt SAND.
		11	48												
2		11	49	SC			1	2	2	4	2.00	3	SS	2	V.Loose, Brownish Silt SAND.
		12	05												
		12	06												
3				SC			3	2	3	5	3.00	4	SS	3	Loose, Brownish Silt SAND.
		12	19												
		12	20												
4				SC			1	1	1	2	4.00	5	SS	4	V.Soft, Greyish Black, fine grain Silt SAND with CLAY.
		12	32												
		12	33												
5				SC			5	6	8	14	5.00	6	-	5	SAMPLE SLIPPED NIL.
		12	49												
		12	50												
6				SC			3	6	9	15	6.00	7	-	6	SAMPLE SLIPPED NIL
		14	10												
7		14	11												
				SC			4	7	8	15	7.50	8	-	7.5	SAMPLE SLIPPED NIL.
8															
		14	32												
		14	33												
9				SC			3	6	8	14	9.00	9	SS	9	M.Dense, Greyish SAND.
		14	57												
10		14	58												
				SC			4	5	7	12	10.50	10	SS	10.5	M.Dense, Greyish Silty clay with SAND.

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	S. ANANTH	PROJECT SITE DETAILS
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE	S.	GROUND LEVEL (m)
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	05/07/2023	WATER TABLE (m)
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		CASING DEPTH (m)

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SITE INVESTIGATION RECORD

BORE HOLE No. 05
PAGE No. 1

PROJECT NAME: DRA - EGMORE
DIA OF BORE HOLE: 150mm ✓ / 100mm

LOCATION: Cresent Salai Road | MACHINE No.: CR-06 | CHAINAGE (m): | BORE START DATE: 04/07/2023
STRUCTURE: | DRILLING METHOD: Rotary | CO-ORDINATES: N | BORE END DATE: 05/07/2023
JOB CODE: | FLUSHING MEDIUM: Bentonite | E | TOTAL DRILLING DAYS: 2

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Layer Data: Depth (m)	Layer Data: Geotechnical Description
0	04/07/2023	10	40												
		10	41	SC			2	4	4	8	0.50	1	SS	0.5	Loose, Brownish, Silt SAND.
1		10	53												
		10	54	SC			1	2	2	4	1.25	2	SS	1.25	V. Loose, Brownish Silt SAND.
		11	12												
2		11	13	SC			3	4	6	10	2.00	3	SS	2	M. Dense, Brownish Silt SAND.
		11	27												
		11	28	SC			7	8	10	18	3.00	-	-	3	SAMPLE SLIPPED. N12
3		11	42												
		11	43	SC			5	7	9	16	4.00	4	SS	4	M. Dense, Greyish Black Silt Sand with Clay.
4		12	02												
		12	03	SC			6	4	5	9	5.00	5	SS	5	M. Dense, Greyish SAND.
5		12	24												
		12	25	SC			5	7	8	15	6.00	6	SS	6	M. Dense, Greyish SAND.
6		12	48												
		12	49	SC			4	5	7	12	7.50	7	SS	7	M. Dense, Greyish SAND.
7		14	05												
		14	07	SC			5	4	7	11	9.00	8	SS	9	M. Dense, Greyish SAND.
8		14	29												
		14	30	SC			6	8	9	17	10.50	9	SS	10.5	M. Dense, Greyish SAND.
9															
10															

CS - Core Sample
SS - Split Spoon Sample
UDS-Undisturbed Sample
WS - Wash Sample

DS - Disturbed Sample
SC - Soil Cutter
TCB - Tungsten Carbide Bit
DB - Diamond Bit

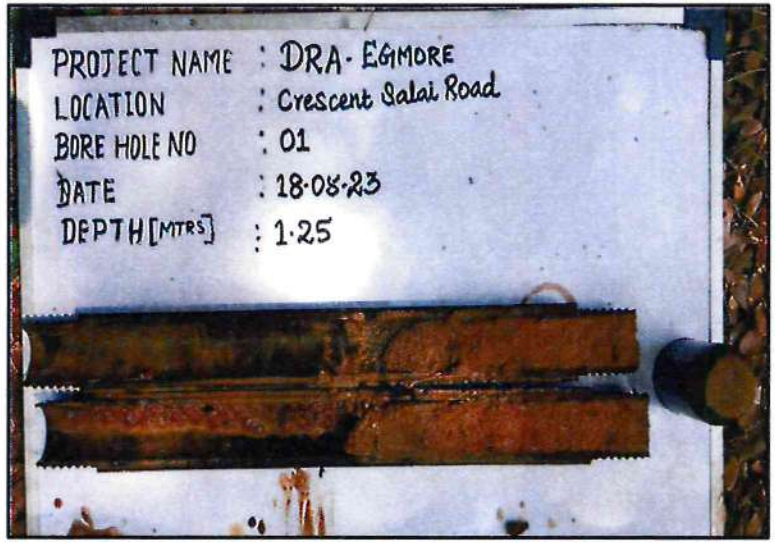
SUPERVISOR NAME: S. ANANTH
SIGNATURE:
DATE: 04/07/2023
CLIENT IN-CHARGE:

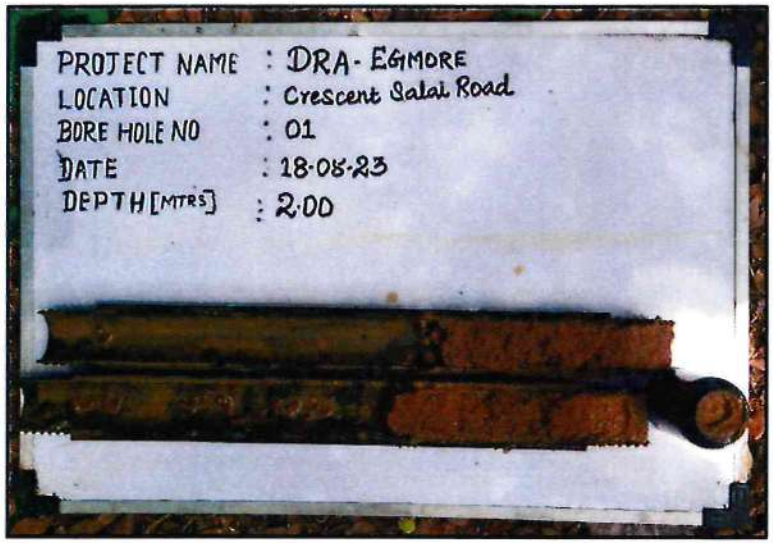
PROJECT SITE DETAILS
GROUND LEVEL (m):
WATER TABLE (m):
CASING DEPTH (m):

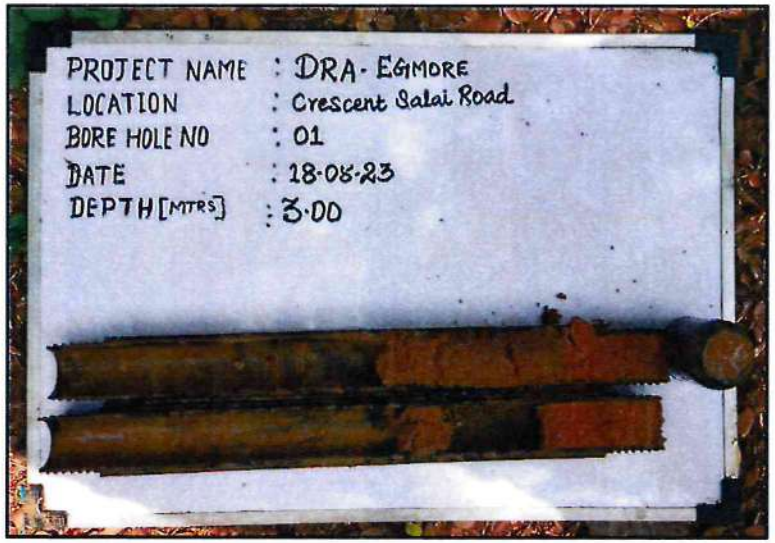
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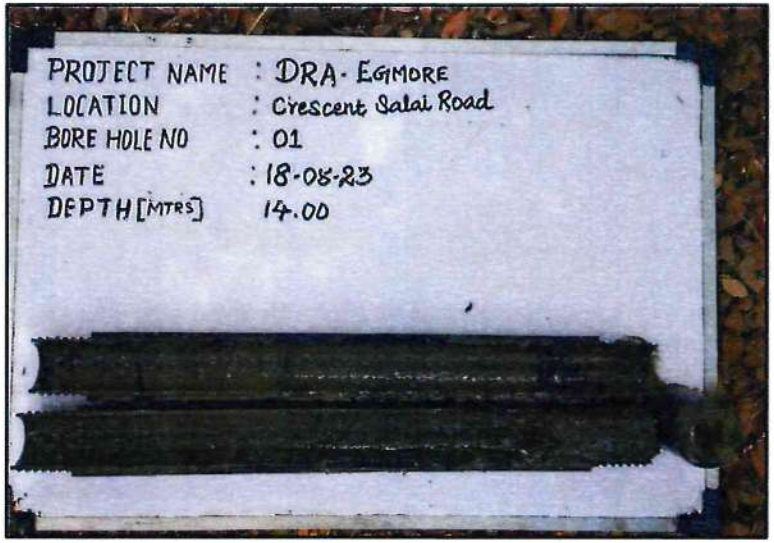


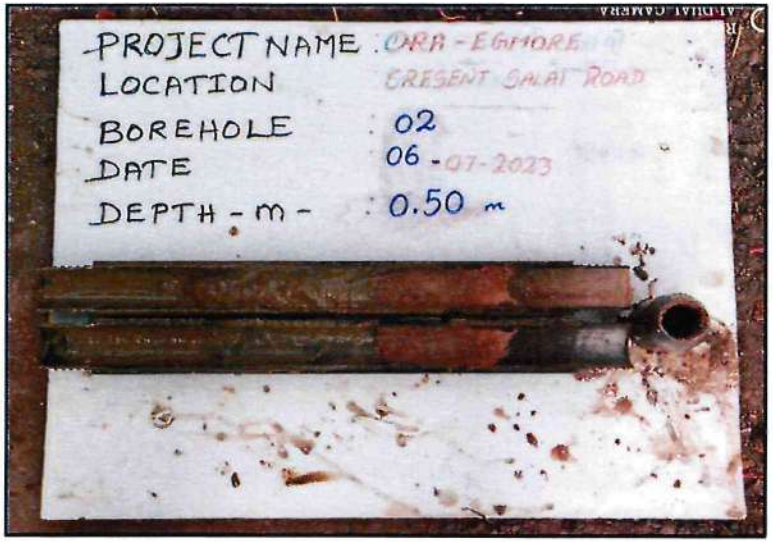


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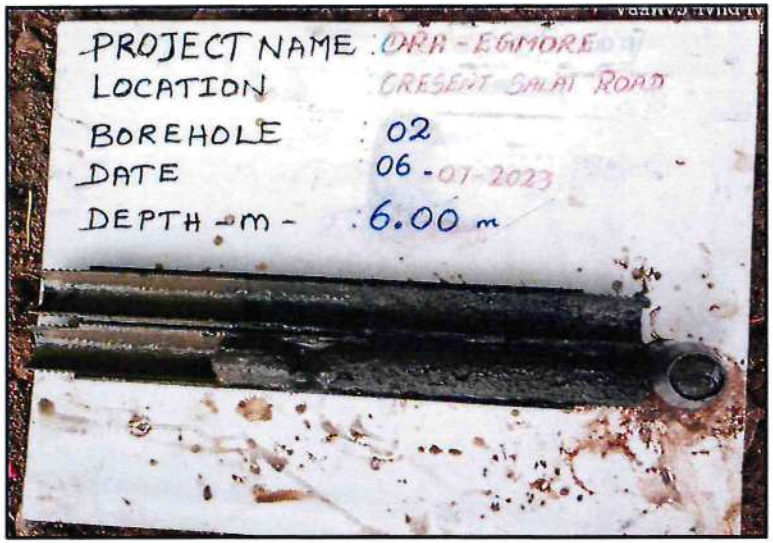




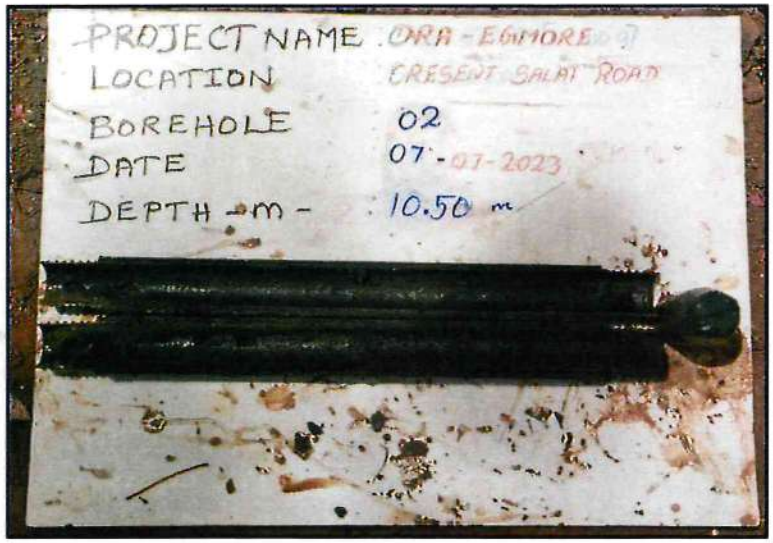


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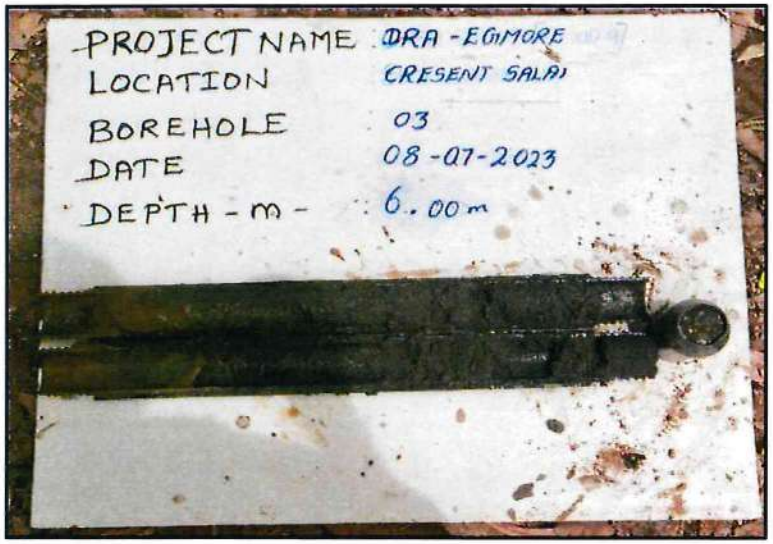






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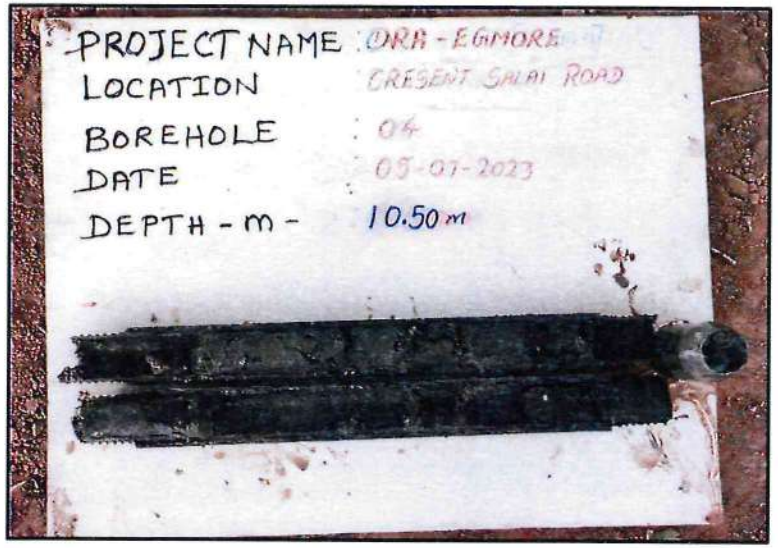


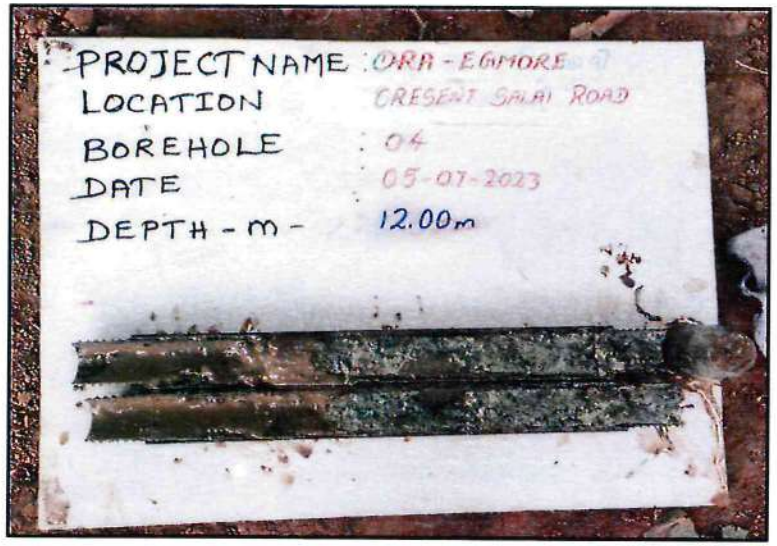


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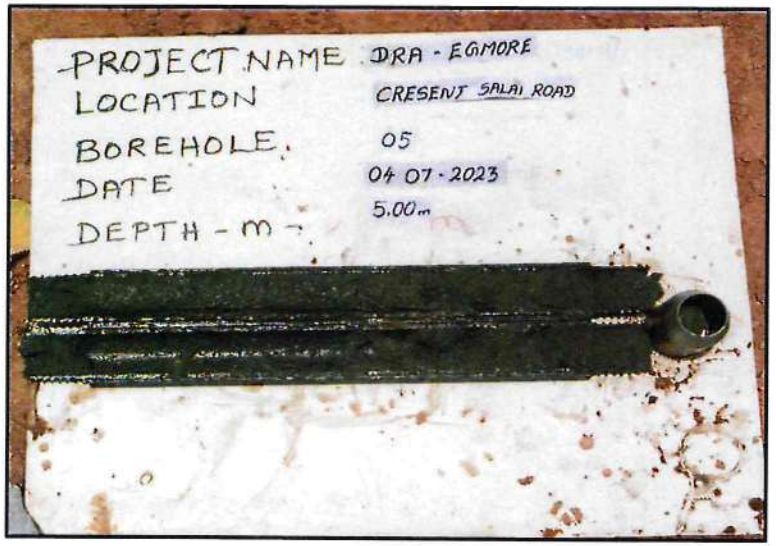


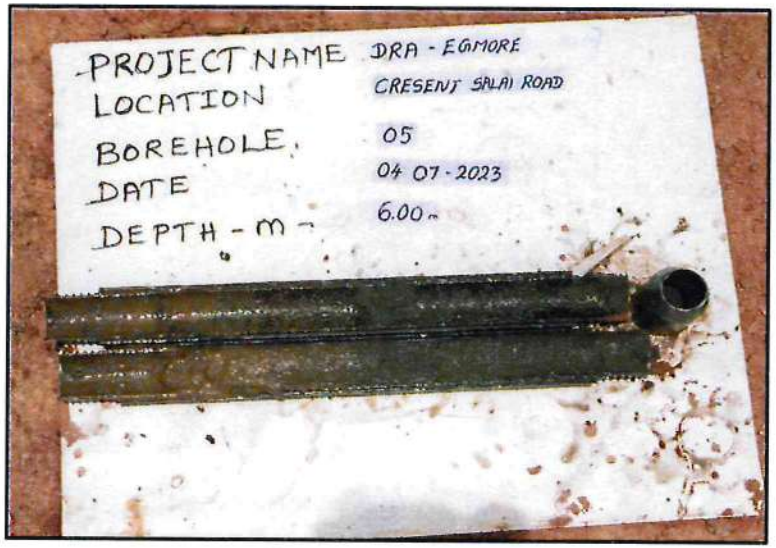




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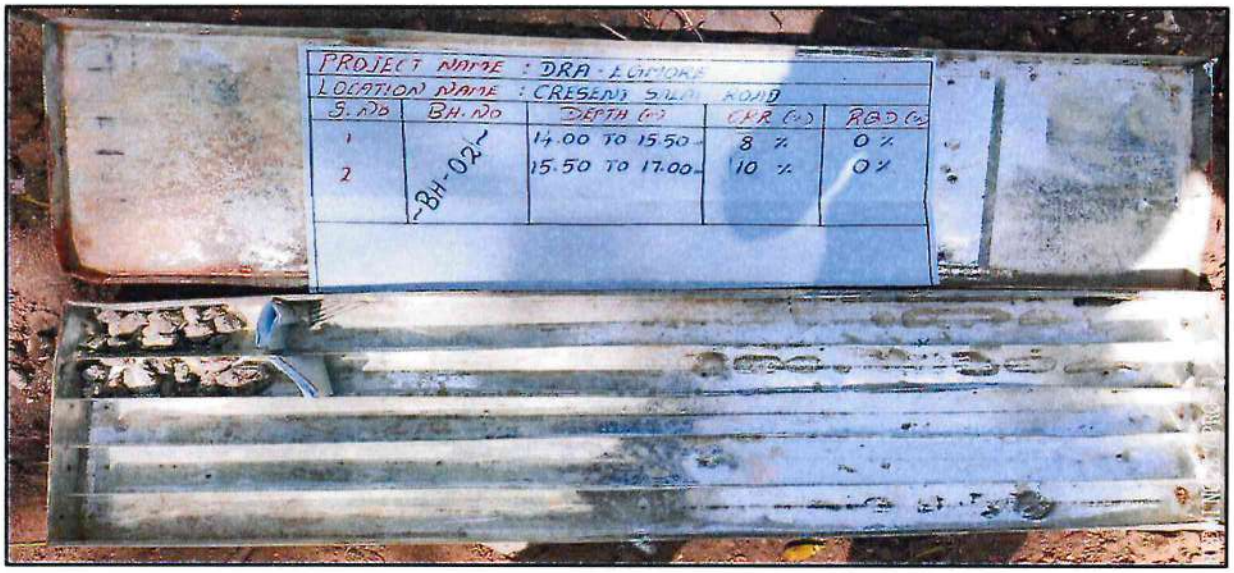


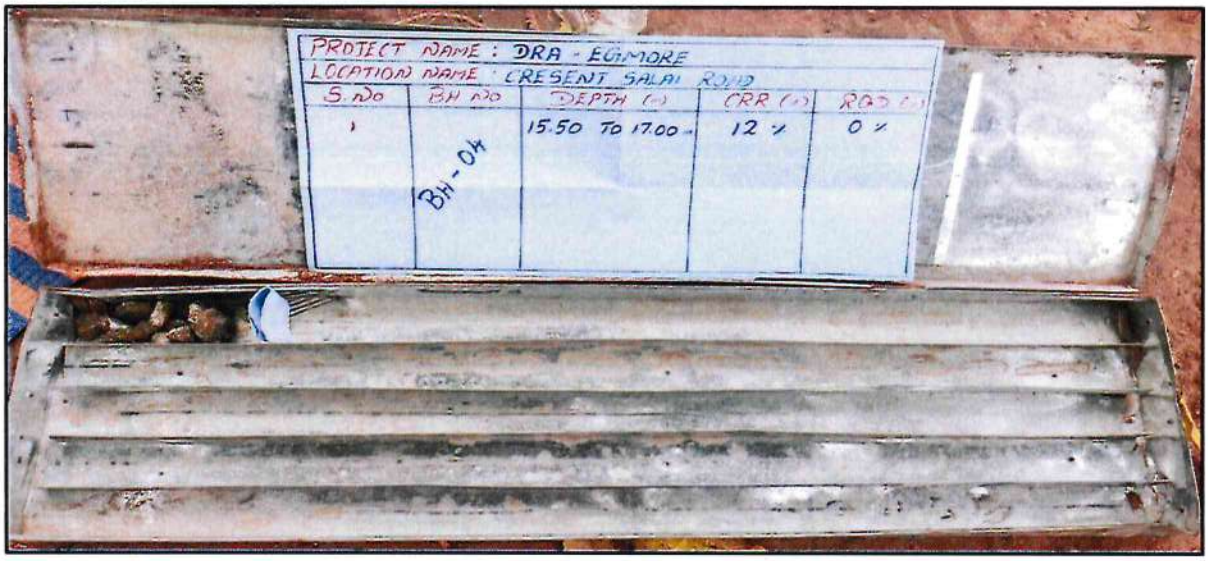


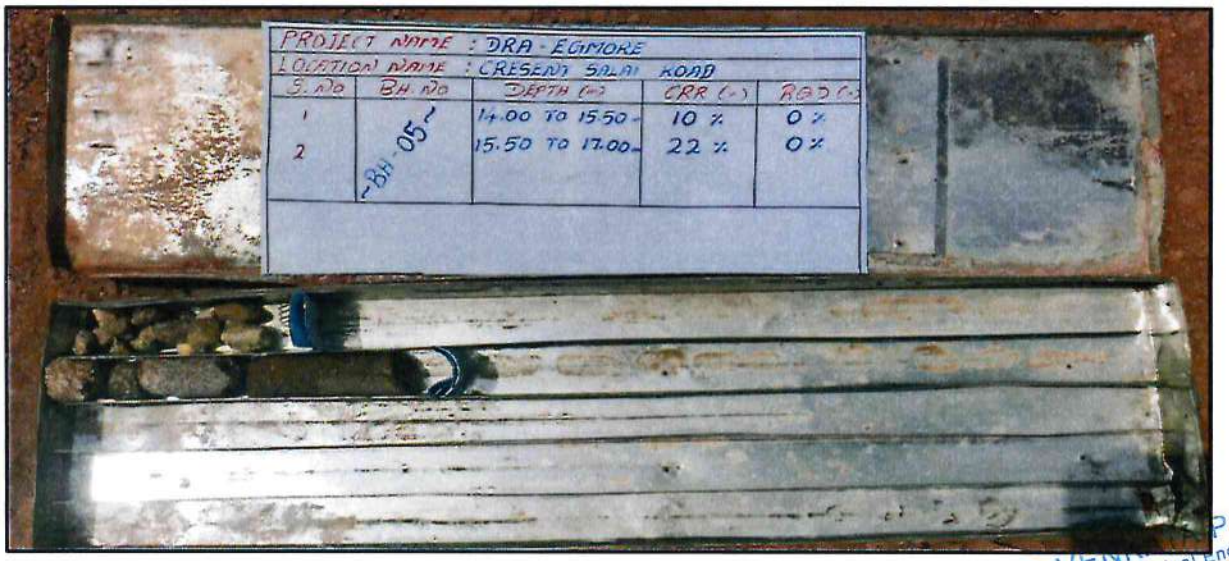


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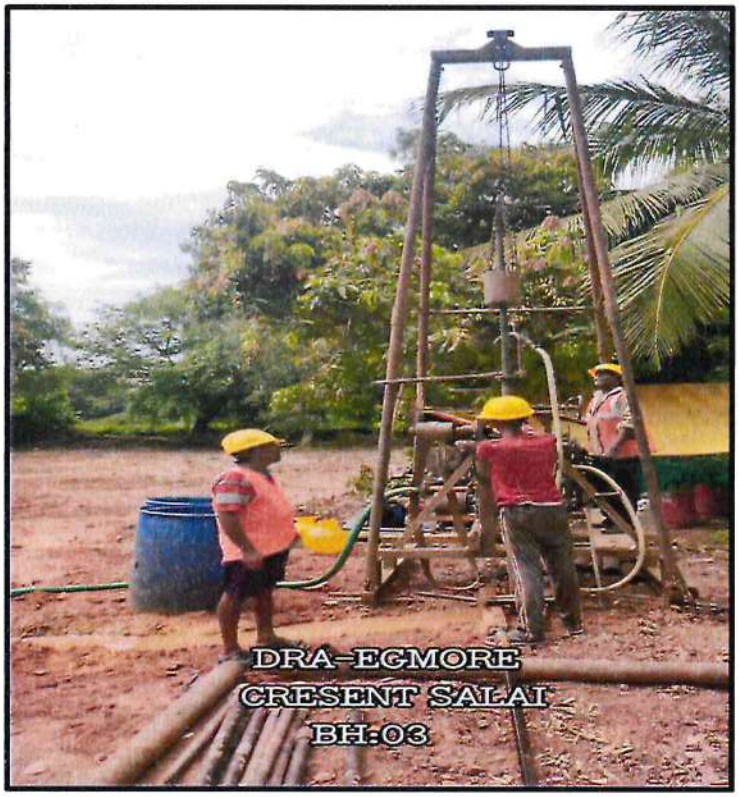


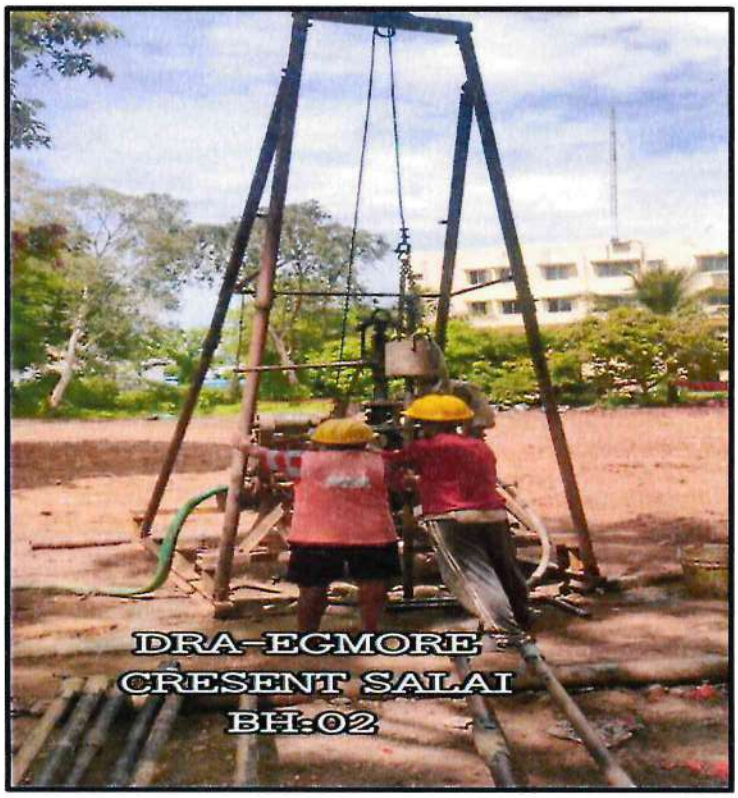




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