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F.S. ENGINEERS P. LTD

Soil Exploration & Foundation Design Division



SOIL EXPLORATION REPORT

SOIL EXPLORATION REPORT

OF

PROJECT : SOIL INVESTIGATION WORK RESIDENTIAL APARTMENT BUILDING AT NO. 9, 10 & 11, GREENWAYS ROAD, R.A. PURAM, CHENNAI

PN : 7754

SITE PLAN

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE BUILDING WITH 36.0M HEIGHT CONSISTING OF EXTENDED BASEMENT FLOOR PART (PUMP ROOM & PIT PARKING) + STILT FLOOR PART (PIT PARKING) / GROUND FLOOR PART (DOUBLE HEIGHT LOBBY) + 11 FLOORS RESIDENTIAL BUILDING (GYM, MULTI-PURPOSE HALL & GAMES ROOM AT 1ST FLOOR LEVEL) WITH 28 DWELLING UNITS AVAILING WITH PREMIUM FSI AT OLD DOOR NO.20L (PART), NEW DOOR NO. 09,10 & 11, GREENWAYS ROAD (DR.DGS DHINAKRAN SALAI), RAJA ANNAMALAIPURAM, CHENNAI-600 028 COMPRISED IN OLDS NO.13, NEW R.S.NO.4274/12, 4274/13, 4274/14, 4274/42 & 4274/43 IN BLOCK NO. 93 OF MYLAPORE VILLAGE, MYLAPORE TALUK WITHIN THE LIMITS OF GREATER CHENNAI CORPORATION.

F.S.ENGINEERS PVT LTD

Foundation & Structural Engineers

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Guindy, Chennai – 600 032.

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SOIL EXPLORATION REPORT

PROJECT NO : 7754

PROJECT NAME : **Construction of Multistorey Residential Apartment Building At No. 9, 10 & 11, Greenways Road, R.A. Puram, Chennai**

1. INTRODUCTION

M/s. Altis Properties Pvt Ltd.,are proposing to construct of Mutistoried Apartment Building at No.9,10&11, Greenways Road, R.A.Puram, Chennai at the location shown in Fig.1. Soil Exploration work was referred to us this firm by M/s.Wisma Project Management Services with a view to determining the soil properties of the area and to arrive at the most suitable foundation system for the proposed structure. For this purpose three boreholes were bored upto depth of 19.5 to 20 M below ground level. The boreholes were terminated after drilling for the required depth in the very dense disintegrated rock layer. The work comprised of conducting Standard Penetration Tests in the field and collecting samples for testing in the laboratory. The report presents the details of the work, analysis of test results and foundation recommendations made based on the analysis.

2. EXPLORATION TECHNIQUE

Rotary Drilling technique was adopted for boring in this area. Casing pipes and bentonite slurry were used to protect the sides of the boreholes. Standard Penetration Tests were conducted at change of layers and at specified intervals Disturbed samples were collected in plastic bags from all the layers for visual observation and classification tests. Undisturbed samples were not be collected since the cohesive layers met with were soft and expansive

3. SOIL PROFILE

The profile of the area as observed in the boreholes is given in Fig.2 to 4. The top soil of 0.50M non-uniform. At the location of Bh-2 non uniform soil is present upto the depth of 2.2M. The soil layer below upto about 5 to 7.0M is silty sand followed by sand upto 15.5 to 17M below G.L. The underlying layer is disintegrated rock. Water table was met with at 2.5 to 2.8 M below ground level at the time of exploration. The water table could however rise to about 2M below G.L during heavy rain.

4. ANALYSIS OF TEST RESULTS

1. Standard Penetration Test
2. Grain Size Analysis
3 Determination of Specific Gravity

An analysis of the results of these tests were presented in this section of the report

4.1 Standard Penetration Test

These tests were conducted at change of layers and at specified intervals, commencing the test at 1.5 M below ground level. The results are presented graphically in Fig. 2 to 4. The relative density of the cohesionless layers obtained from the N values are given in the bore log.

4. 2 Grain Size Analysis

Combined sieve and hydrometer analyses were conducted on the various samples collected. The results are given in Table-1. Based on the proportion of the different soil constituents, the soil is classified using the Triangular Chart .

4.3 Determination of Specific Gravity

The specific gravities of the soil grains were determined from the various samples collected. The results are given in Table-1. No abnormal value is noted in the test results.

5. FOUNDATION ANALYSIS

5.1 Shallow Foundation

For the proposed structure shallow foundations can be given for lightly loaded structures by placing the foundation at a depth of 1.5M. The SBC that could be computed using the formula

$$Q_a = (0.5\gamma \times B \times N_\gamma + \gamma D_f N_q) \div 2.5$$

where,

B	=	Width of footing
γ	=	Submerged unit weight of soil taken as 1 gm/cc,
D_f	=	Depth of surcharge
$N\gamma$ Nq	=	Bearing capacity factors based on the N values taken from Fig. 7

Based on the N value the SBC is 1.5kg/cm^2 at 1.5M depth for a minimum width of foundation of 1M.

The estimated modulus sub grade reaction under submerged conditions would be 1kg/cm^3

5.2 Regular Pile Foundation

The pile could be seated for 1.5M in the disintegrated rock layer with N >50. The length of pile could thus be about 18M uniformly

The piles could be designed as end bearing pile. The end bearing capacity of the pile could be computed using the formula,

$$Qe = 4 \times N \times As \text{ Tonnes}$$

Where,

N	=	Standard Penetration Test value
As	=	Area of cross-section of pile expressed in sq.ft

When the piles are seated in the disintegrated rock layer with N>50 the structural capacity

of the pile would determine the allowable load. This is limited to 50kg/cm^2 for cast-in-situ concrete

The lateral load capacity for a minimum of reinforcement of 0.4% of C.S of pile is 10% of vertical capacity. The pull out capacity which is given by skin friction computed using the formula Qs = N/3 + 1 T/M^2 of surface area of pile gives more than 50% of vertical capacity. Accordingly the pile capacities are given below

Pile dia (D)	Vertical Capacity T	Lateral Capacity T	Pull out Capacity T
50	98	10	Pull out capacity is 50% of vertical capacity
60	141	14	
70	192	19	
90	318	32	

Since the pile is seated in the DR layer if auger piling is adopted it is essential to do the seating depth of 1.5M by DMC chisel method. High horse power pump is needed to flush out cut soil using good quality bentonite slurry with minimum density of 1.2gm/cc. SPT in one pile in a group should be done after the flushing to see the minimum SPT value is 50.

6. CONCLUSIONS

1. The area explored has got the top soil of 0.50M non-uniform. At the location of Bh-2 non uniform soil is present upto the depth of 2.2M. The soil layer below upto about 5 to 7.0M is silty sand followed by sand upto 15.5 to 17M below G.L. The underlying layer is disintegrated rock. Water table was met with at 2.5 to 2.8 M below ground level at the time of exploration. The water table could however rise to about 2M below G.L during heavy rain.

2. For the proposed structure shallow foundations can be given for lightly loaded structures by placing the foundation at a depth of 1.5 M. with an SBC of 1.5kg/cm^2 for a minimum width of foundation of 1M

3. Pile foundation with length of pile of 18M by seating the pile for 1.5M in the disintegrated rock layer with N>50 can be given for regular structures. The pile capacities as given in the report.

4. Suggested precautions and piling method should be adopted while undertaking the construction.



(Dr.A. Verghese Chummar)

Director

Dated: October 4th, 2023

F.S.ENGINEERS PVT.LTD

NEW NO.98,(Old No.109)

VELACHERY ROAD

GUINDY

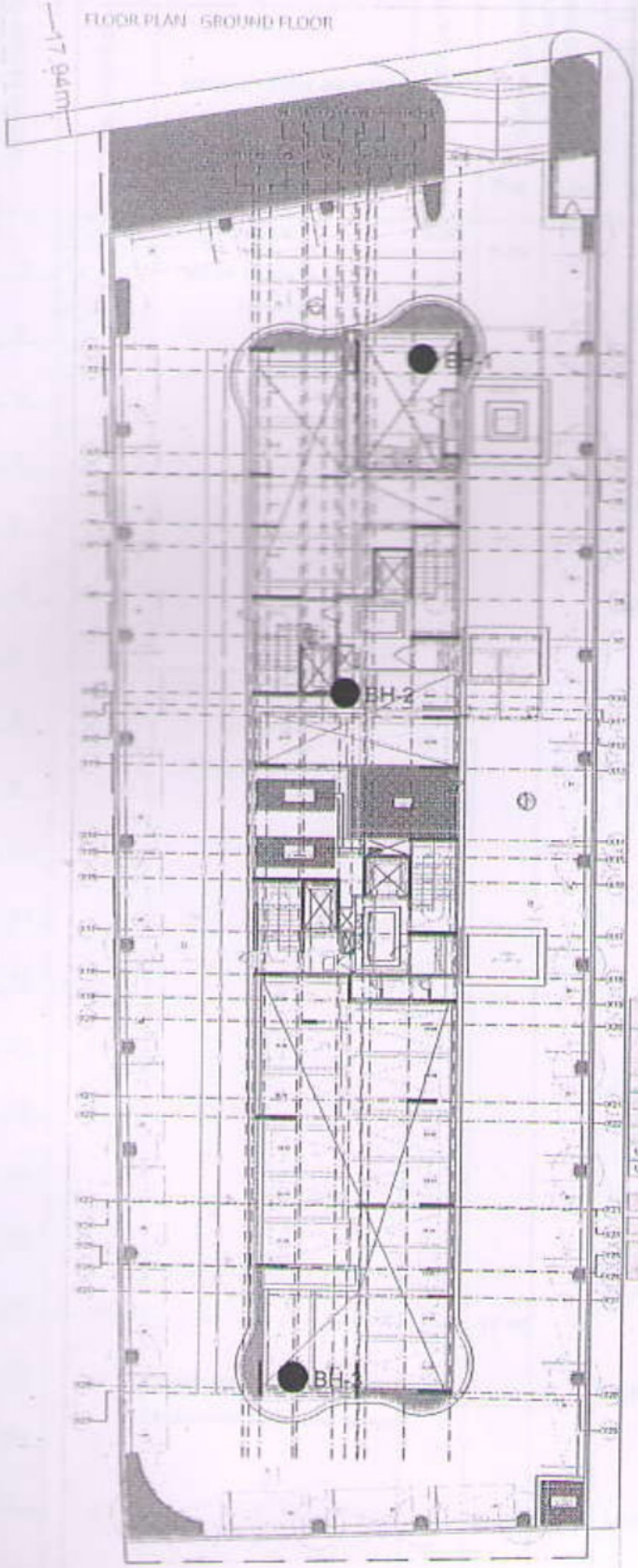
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PROJECT : SOIL INVESTIGATION WORK AT R.A PURAM CHENNAI

GROUND FLOOR

RECEPTION , LOBBY & PARKING



PARKING ANALYSIS							
UNIT TYPE	UNIT PLINTH AREA	UNIT SALEABLE AREA	TOTAL UNITS	CMDA Car Slots per Unit	CMDA Total Car Parks	AUTO Car Slots per Unit	AUTO Total Car Parks
	Sq.Mts	Sq.Mts	Nos.	Nos.	Nos.	Nos.	Nos.
Unit 1 - 3 Bedrm 5th Floor	349.65	3,570.00	6	2	12	2	12
Unit 2 - 3 Bedrm 5th Floor	335.68	3,115.00	6	1	6	2	12
Unit 3 - 3 Bedrm 12th Floor	291.30	4,420.00	10	3	30	3	30
Unit 1 Duplex - 10th & 11th Floor	300.00	4,000.00	1	4	4	5	5
Unit 2 Duplex - 10th & 11th Floor	259.36	3,925.00	1	3	3	3	3
			24	15	61	15	48
		VISITOR CAR PARKS			6		6
		TOTAL CAR PARKS REQ.			67		54

ACHIEVED PARKING SLOTS

Covered Pit Parking	: 24 X 2 = 48 Cars
Open Parallel Parking	: 29 Cars
Total Achieved Car Parks	: 77 Cars

F.S.ENGINEERS PRIVATE LIMITED

SOIL EXPLORATION AND FOUNDATION DESIGN DIVISION

FIELD BORE LOG

PROJECT : SOIL INVESTIGATION WORK AT R.A PURAM CHENNAI

DATE OF COMMENCEMENT : 27.09.2023

BORE HOLE NO : 1

DATE OF COMPLETION : 28.09.2023

TYPE OF BORING : ROTARY DRILLING

G.W.L : 2.5 Mtr

DEPTH BELOW GL	SOIL PROFILE	DESCRIPTION OF SOIL	THICKNESS OF LAYER	DEPTH AT WHICH SAMPLES ARE COLLECTED		STANDARD PENETRATION TEST DATA				GRAPHICAL REPRESENTATION OF PENETRATION RESISTANCE
				D.S	U.D.S	DEPTH AT WHICH TEST CONDUCTED	N - VALUE	PENETRATION IN " CMS "	RELATIVE DENSITY CONSISTANCYD	10 20 30 40 >50
0		FILLING	0.50	0.50						
1		SILTY SAND SLS1 (Brown)	6.50			1.50	12	30	MEDIUM	
2										
3						3.00	10	30	MEDIUM	
4										
5						4.50	13	30	MEDIUM	
6						6.00	17	30	MEDIUM	
7				7.00						
8		SAND S1 (Greyish Brown)	10.00			7.50	20	30	MEDIUM	
9						9.00	31	30	DENSE	
10										
11						10.50	46	30	DENSE	
12						12.00	28	30	MEDIUM	
13										
14						13.50	24	30	MEDIUM	
15										
16						15.00	26	30	MEDIUM	
17				17.00		16.50	88 (>50)	30	V.DENSE	
18		DISINTEGRATED ROCK DR1 (Yellowish Brownish Grey)	3.00			18.00	>100	19	V.DENSE	
19										
20.00				20.00		20.00			REBOUND	

REMARKS : ALL DIMENSIONS ARE IN METRES

END OF BORING

Fig : 2

P N : 7754

F.S.ENGINEERS PRIVATE LIMITED

SOIL EXPLORATION AND FOUNDATION DESIGN DIVISION

FIELD BORE LOG

PROJECT : SOIL INVESTIGATION WORK AT R.A PURAM CHENNAI

BOIRE HOLE NO : 2

TYPE OF BORING : ROTARY DRILLING

DATE OF COMMENCEMENT : 29.09.202

DATE OF COMPLETION : 30.09.2023

G.W.L : 2.8 Mtr

DEPTH BELOW GL	SOIL PROFILE	DESCRIPTION OF SOIL	THICKNESS OF LAYER	DEPTH AT WHICH SAMPLES ARE COLLECTED		STANDARD PENETRATION TEST DATA				GRAPHICAL REPRESENTATION OF PENETRATION RESISTANCE
				D.S	U.D.S	DEPTH AT WHICH TEST CONDUCTED	N - VALUE	PENETRATION IN " CMS "	RELATIVE DENSITY CONSISTANCYD	10 20 30 40 >50
1		FILLING	2.20							
2						1.50	14	30	MEDIUM	
3		SILTY SAND SLS1 (Brown)	2.80	2.20						
4						3.00	14	30	MEDIUM	
5				5.00		4.50	19	30	MEDIUM	
6						6.00	22	30	MEDIUM	
7										
8		SAND S1 (Greyish Brown)	10.50			7.50	28	30	MEDIUM	
9										
10						9.00	40	30	DENSE	
11						10.50	48	30	DENSE	
12										
13						12.00	38	30	DENSE	
14						13.50	25	30	MEDIUM	
15										
16		DISINTEGRATED ROCK DR1 (Yellowish Brownish Grey)	4.00	15.50		15.00	41	30	DENSE	
17						16.50	92 (>50)	30	V.DENSE	
18										
19						18.00	>100	15	V.DENSE	
19.50				19.50		19.50			REBOUND	

REMARKS : ALL DIMENSIONS ARE IN METRES

→ END OF BORING

Fig : 3

P.N : 7754

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SOIL EXPLORATION AND FOUNDATION DESIGN DIVISION

FIELD BORE LOG

PROJECT : SOIL INVESTIGATION WORK AT R.A PURAM CHENNAI

DATE OF COMMENCEMENT : 28.09.2023

BORE HOLE NO : 3

DATE OF COMPLETION : 29.09.2023

TYPE OF BORING : ROTARY DRILLING

G.W.L : 2.8 Mtr

DEPTH BELOW GL	SOIL PROFILE	DESCRIPTION OF SOIL	THICKNESS OF LAYER	DEPTH AT WHICH SAMPLES ARE COLLECTED		STANDARD PENETRATION TEST DATA				GRAPHICAL REPRESENTATION OF PENETRATION RESISTANCE
				D.S	U.D.S	DEPTH AT WHICH TEST CONDUCTED	N - VALUE	PENETRATION IN " CMS "	RELATIVE DENSITY CONSISTANCYD	10 20 30 40 >50
		FILLING	0.70	0.70						
1										
2						1.50	11	30	MEDIUM	
3		SILTY SAND SLS1 (Brown)	4.30			3.00	17	30	MEDIUM	
4										
5				5.00		4.50	21	30	MEDIUM	
6						6.00	29	30	MEDIUM	
7										
8		SAND S1 (Greyish Brown)	11.00			7.50	31	30	DENSE	
9						9.00	39	30	DENSE	
10										
11						10.50	49	30	DENSE	
12						12.00	>50	10	V.DENSE	
13										
14						13.50	>50	11	V.DENSE	
15						15.00	>50	18	V.DENSE	
16				16.00						
17		DISINTEGRATED ROCK DR1 (Yellowish Brownish Grey)	3.50			16.50	85 (>50)	30	V.DENSE	
18						18.00	>100	18	V.DENSE	
19										
19.50				19.50		19.50			REBOUND	

REMARKS : ALL DIMENSIONS ARE IN METRES

END OF BORING

Fig : 4

P N : 7754

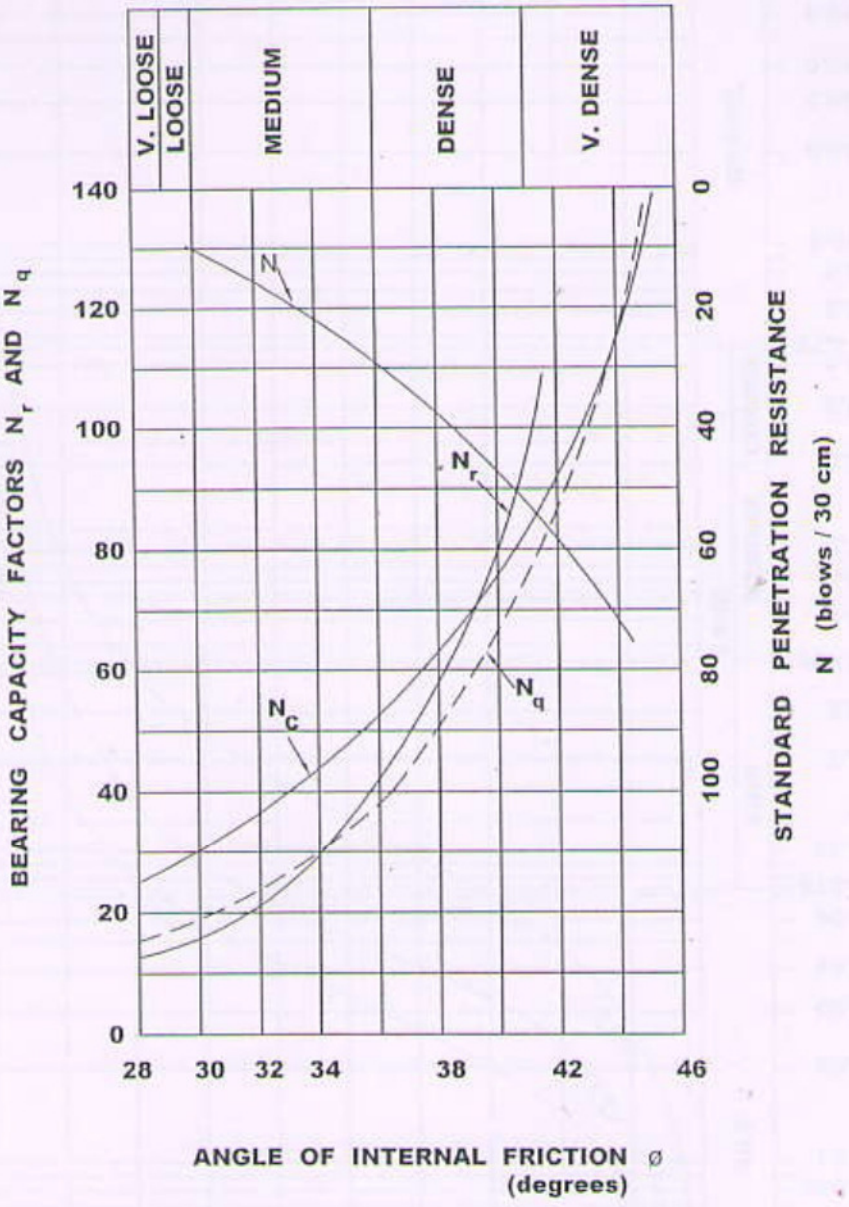


FIG. 5 CURVES SHOWING THE RELATIONSHIP BETWEEN ø N_r N_q, N_c AND N

Ref : Foundation Analysis & Design.
Joseph. E. Bowles.

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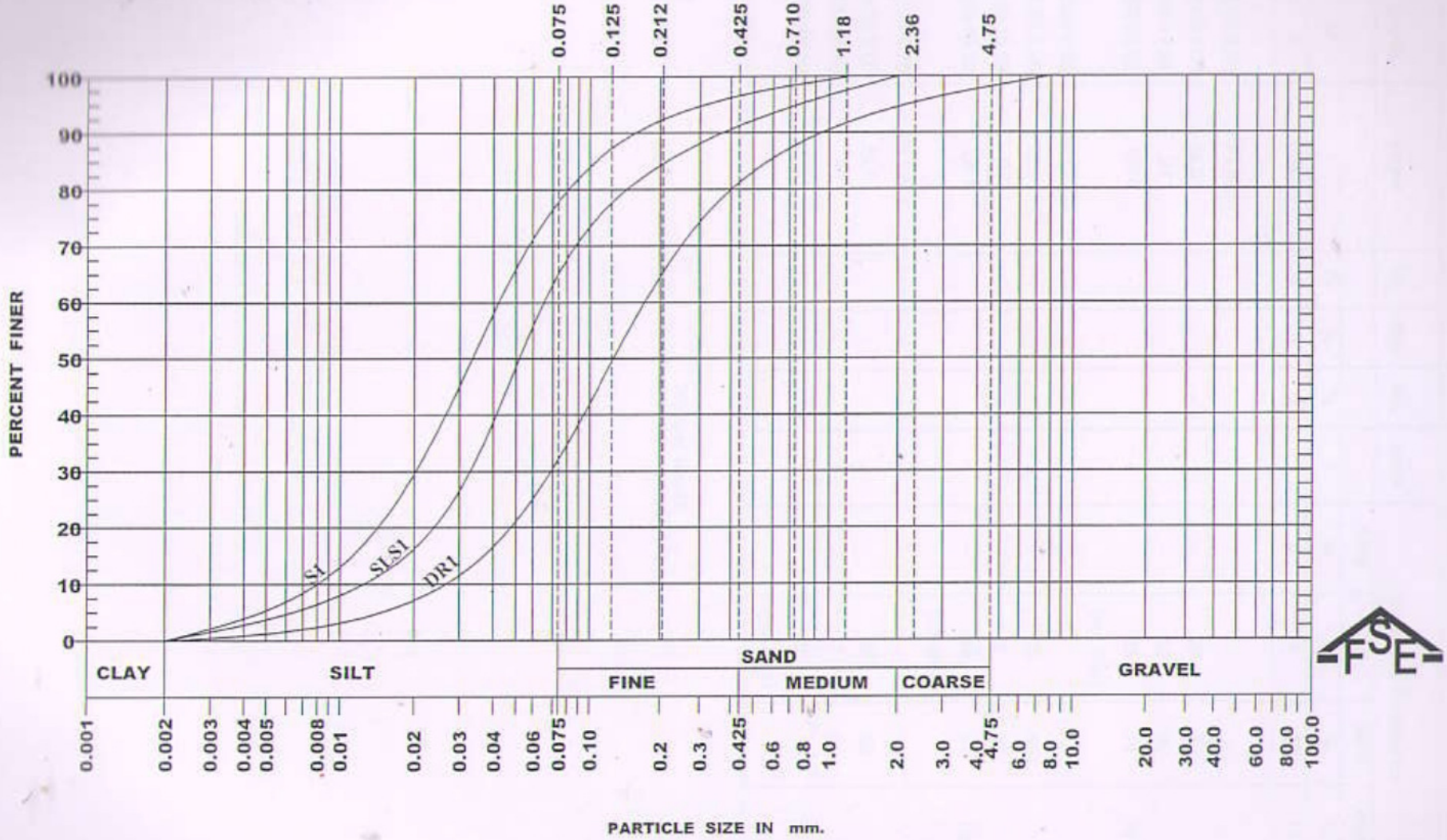


FIG. 6 GRAIN SIZE DISTRIBUTION CURVE

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PROJECT : SOIL INVESTIGATION WORK AT R.A PURAM CHENNAI

Sl.No	Depth	Layer	W_L	Wp	Wn	swell	Grain Size Distribution				Sp. Gr. G
							Clay	Silt	Sand	Gravel	
	M		%	%	%	%	%	%	%	%	
1	2	3	4	5	6	7	8	9	10	11	12
BH.1											
	0.00-0.50	FILLING	-	-	-	-	-	-	-	-	-
	0.50-7.00	SLS1	-	-	-	-	-	30	70	-	2.64
	7.00-17.00	S1	-	-	-	-	-	10	90	-	2.64
	17.00-20.00	DR1	-	-	-	-	-	15 (not clay)	14	71	2.64
BH.2											
	0.00-2.20	FILLING	-	-	-	-	-	-	-	-	-
	2.20-5.00	SLS1	-	-	-	-	-	35	65	-	2.64
	5.00-15.50	S1	-	-	-	-	-	8	92	-	2.64
	15.50-19.50	DR1	-	-	-	-	-	14 (not clay)	12	74	2.64
BH.3											
	0.00-0.70	FILLING	-	-	-	-	-	-	-	-	-
	0.70-5.00	SLS1	-	-	-	-	-	38	62	-	2.64
	5.00-16.00	S1	-	-	-	-	-	7	93	-	2.64
	16.00-19.50	DR1	-	-	-	-	-	10 (not clay)	10	80	2.64

Lab table : 1

lab test result

PN : 7754



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