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Soil Test Report
combined block

SHANMUGHA GEOTECH CONSULTANTS

Project:

Stilt+3 Residential Building

Mr. R.Radhakrishnanadan
Plot No:B
Gandhi Street,
Lakshmipuram
Thiruneermalai,
CHENNAI-600044.

REPORT ON
GEOTECHNICAL INVESTIGATION

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REPORT ON GEOTECHNICAL INVESTIGATION FOR PROPOSED STILT+3 RESIDENTIAL BUILDING

1.1 INTRODUCTION

Mr.R.Radhakrishnanadan to construct STILT+3 RESIDENTIAL BUILDING at Plot No-B, Gandhi Street, Lakshmipuram, Thiruneermalai, Chennai. M/s Shanmuga Geotech Consultants has carried out a detailed geotechnical investigation to study the sub soil conditions of the proposed area. The present report deals with the field and laboratory investigation carried out to assess the nature of sub-strata and to evaluate the soil parameters required for the design of various foundations for the proposed project. To assess the ground condition.

1.2 SCOPE OF WORK

A. We are submitting GT-Report of 2 nos. of Standard Soil Investigation boreholes depth of 4.50m. The details of the Borehole locations are mentioned in TABLE 1 below.

TABLE 1: DETAILS OF BOREHOLE LOCATIONS

Sl. No.	Bore Hole ID.	Location	Terminated Depth
1	BH-1	Thiruneermalai	4.50m
2	BH-2		4.50m

B. Bore hole layout submitted at Attachment at A0.

C. Conducting SPT's at regular depth intervals.

D. Conducting relevant laboratory tests.

E. Submitting report with Field observations, laboratory test results along with recommendations for foundations.

1.3 DETAILS OF STRUCTURES

The Structure is Stilt +3 Residential Building.

The objective of the proposed GT Investigations is to obtain

a. Specific data regarding the sub-soil stratum at the proposed site and
b. To obtain the foundation design parameters.

1.4 FIELD & LABORATORY INVESTIGATION

The details of field and laboratory investigations are presented in the following paras.

1.4.1 Field Investigation

One Rotary calyx drilling machine was mobilized and drilling operation was done. 150mm diameter boreholes were made at pre-determined locations and the boreholes.

Standard Penetration Tests (SPT) was conducted at different depths in the boreholes. SPT split spoon sampler of standard dimensions was driven into the soil from the borehole bottom using 63.5 kg hammer falling from 75 cm height. The SPT weight was lifted to the specified height and allowed to fall freely on the anvil with the use of cat-head winch with one to one and half turn of the drum. The efficiency of the SPT blows is expected to be 65 to 75% in this system and can be directly used in most of analyses involving "N" values. Blow count for the penetration of every 15 cm was recorded and the N is reported as the blow counts for 30 cm penetration of the sampler leaving the first 15cm penetration as seating drive.

When the number of blows exceeded 50, to penetrate the first or second 15cms length of the sampler, the SPT is regarded as more than 100 as described in IS 2131-1981. The test is terminated in such case and a record of penetration of the sampler under 50 blows is made. SPT refusal is recorded when there is no penetration of the sampler at any stage and also when a rebound of the sounding system is recoded. These tests were conducted at close intervals of 1.5m depth intervals.

Disturbed soil collected in the SPT sampler was preserved in polythene covers and transported to the laboratory. One more polythene cover was provided to prevent the loss of moisture during the transit period.

The presence of sub-soil water table is noted and this information is presented in individual bore-logs. Individual bore-logs are presented in **Attachments A1**.

1.4.2 Laboratory Testing

Sieve analysis and Atterberg limits tests were conducted wherever necessary and possible. Based on the result of these tests, soil samples were classified based on IS: 1498-1970.

The specific gravity of soil grains was found by the pycnometer procedure and results are listed in summary of Laboratory test results are presented in **Attachment A2**.All the strength properties confirmed based on well-known correlations between SPT values and strength parameters. The laboratory test results in graphical format are present in **Attachment A3**.

1.5 SUBSOIL PROFILE

Based on field and laboratory observations and visual identification of the soil samples, From existing ground level to 1.00m Silty Sand with Clay and N- Valu 21&51, 1.00m to 2.00m and Reddish Silty Sand/Silty Sand with Clay and N- Value 30 & 33 from 3.00m to 4.50 Weathered Rock these details are provided in Attachment A1.

1.6 DISCUSSION ON FOUNDATION

Detailed SBC Calculations are presented in **Attachment A4.**

1.7 RECOMMENDATIONS

Based on the sub-soil conditions encountered, capacity calculations are made and summary of the same is presented below in Table 2.

TABLE 2: RECOMMENDED SBC

S.No.	BH No.	Footing Size(m)		Foundation Depth (m)	SBC (KN/m2)
		B (m)	L (m)		
1	BH-1	1.50	1.50	2.0	180
2	BH-2	1.50	1.50	2.0	180

Following recommendations are made based on the type of structure, sub-soil conditions encountered and other site conditions.

A. SBC recommendations for foundations are provided in above Table 2.

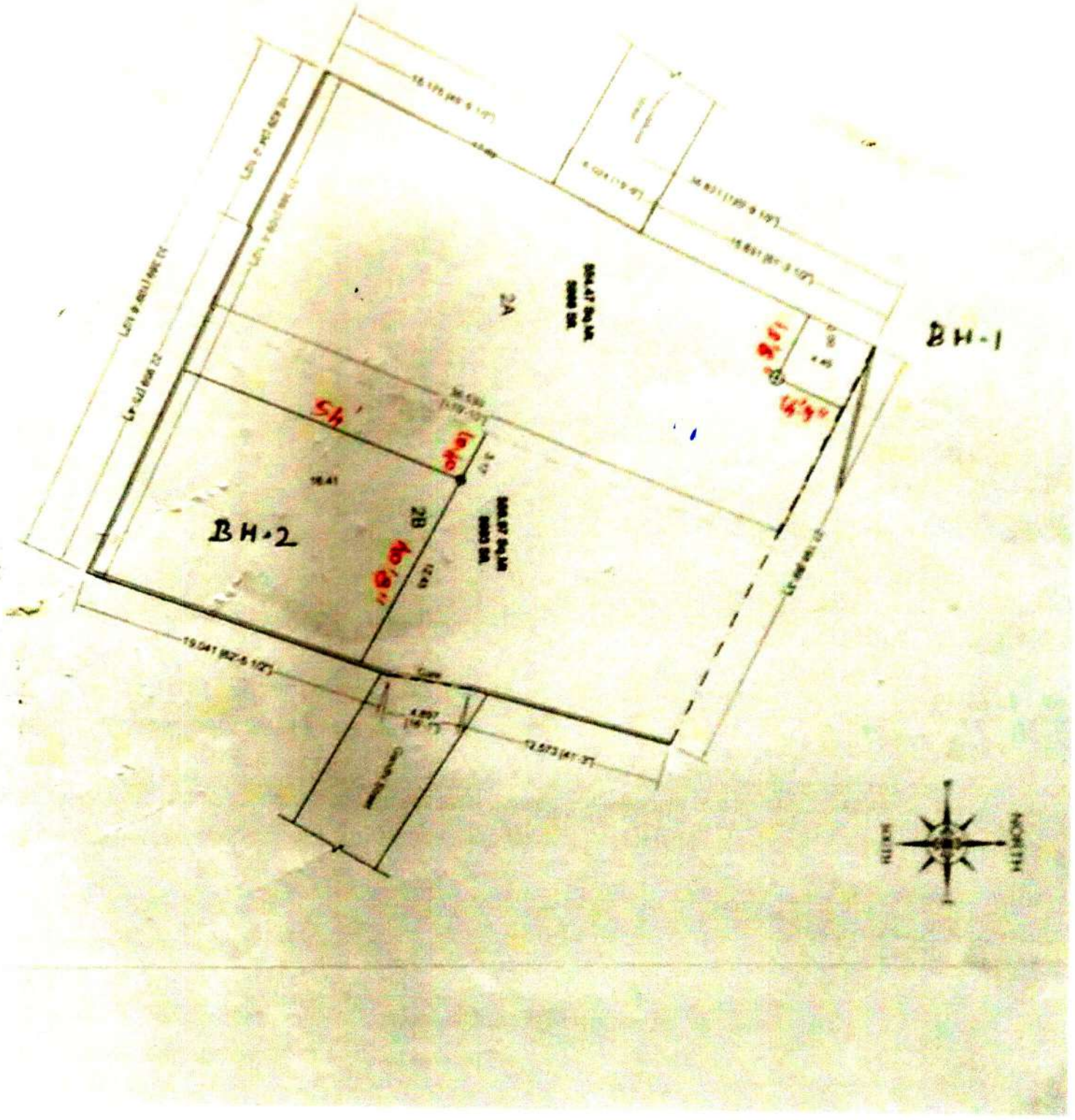
B. Excavation of pit at foundation level shall carefully be done, without changing the natural properties of Soil.

C. Settlements are within the allowable limits for the foundation.

P.Kalpana

P.KALPANA,M.E.,
GEOTECHNICAL ENGINEER,
Regn No.GTE / 19/03/009
M/s. SHANMUGHA GEOTECH

ATTACHMENT A0: BORE HOLE LOCATION LAYOUT


BH-1
BH-2
NORTH
WEST

ATTACHMENT A1: BORE LOGS

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Bore Hole No.	BH-1	G.W.T	Not Encountered
Type of Boring	Rotary	Dia of Boring	:150mm
Commenced	17-08-2021	Location	
Completed	18-08-2021	Total Depth	4.50m

R.L of Layers	Soil Profiles	Soil Description	BIS Classification	SPT Details: Depth (m)	15	30	45	N	Graphical Representation of SPT (0 10 20 30 40 50 60 70 80 90 100)	Type of Samples
		Reddish Medium Dense Silty Clayey SAND with Gravel	SC-Cl/CL	1.0	7	9	12	21		SPT
				2.0	10	16	14	30		SPT
3.00				3.0	15	36	41	77		SPT
		Brownish Weathered Rock								
4.50				4.5	51	9 cm for 100				SPT

Borehole Terminated at 4.5m Below Ground Level.

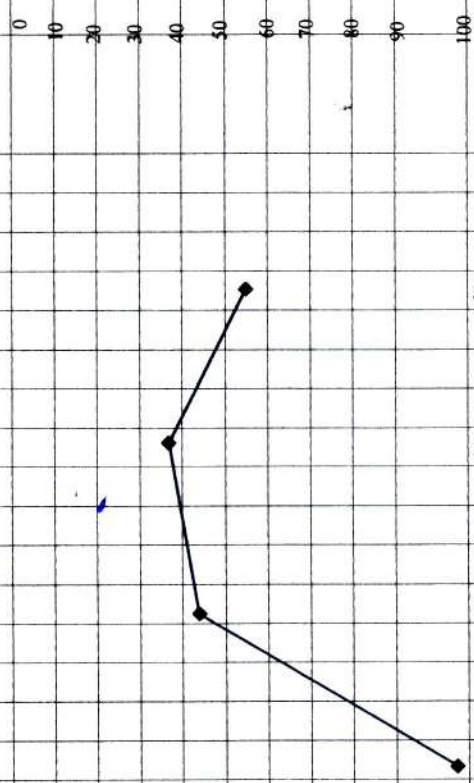
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Bore Hole No.	BH-2	G.W.T	Not Encountered
Type of Boring	Rotary	Dia of Boring	:150mm
Commenced	17-08-2021	Location	
Completed	18-08-2021	Total Depth	4.50m

R.L of Layers	Soil Profiles	Soil Description	BIS Classification	SPT Details: Depth (m)	15	30	45	N	Type of Samples
1.00		Reddish Hard Silty Clay with Sand and Gravel	CH	1.0	8	27	24	51	SPT
3.00		Reddish Yellow Dense Silty SAND with Clay and Gravel	SC-CI	2.0	10	12	21	33	SPT
				3.0	10	14	26	40	SPT
4.50		Weathered Rock		4.5	0 cm for 100				SPT

Graphical Representation of SPT



Borehole Terminated at 4.50m Below Ground Level.

ATTACHMENT A2: SUMMARY OF LABORATORY TEST RESULTS

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SUMMARY OF LABORATORY TEST RESULTS

S.No.	Chainage.	Name of the Structure.	Borehole No.	Depth of Sample collected	SPT "N" Value	Natural Moisture content	Consistency Properties(%)			Specific Gravity	Gradation Properties (%)			Hydro meter Analysis (%)		I.S. Classification of soil
							Liquid Limit	Plastic Limit	Plasticity Index		Gravel	Sand	Silt & Clay	Silt (%)	Clay (%)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1	Vallanchery	Stilt+3	BH-1	1.00	21	12	48	22	26	2.70	0	52	48			SC-CI
2				2.00	30	14	41	20	21		11	50	39			SC-CI
3				3.00	>100	12	34	16	18		16	56	28			SC-CL
4				4.50	>100	10			0		0	98	2			
1			BH-2	1.00	51	10	56	24	32	2.71	4	40	56			CH
2				2.00	45	13	40	18	22		0	53	47			SC-CI
3				3.00	40	12	36	17	19		16	49	35			SC-CI
4				4.50	>100	8			0		60	37	3			

ATTACHMENT A3: LABORATORY TEST GRAPHS

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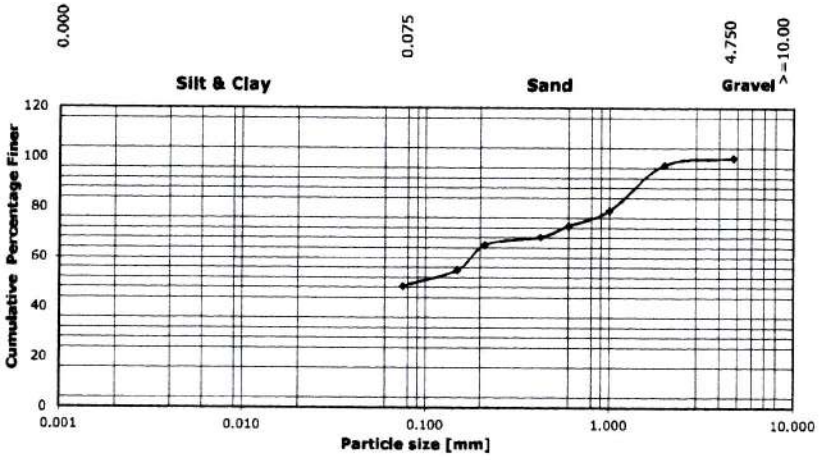
Sieve Analysis Test

Weight of sample taken (g): **100**

Bore Hole No.: 1
Depth(m): 1.00

S.No.	Sieve Aperture size used (mm)	% Soil retained PSR % (1)	Cumulative % Finer F % (2)	Average Sieve size (mm) (3)	Product of Columns (1) x (3)
1	4.750	0.00	100.00	4.750	0.00
2	2.000	2.75	97.25	3.375	9.28
3	1.000	18.40	78.85	1.500	27.60
4	0.600	5.99	72.86	0.800	4.79
5	0.425	4.51	68.35	0.513	2.31
6	0.212	3.20	65.15	0.319	1.02
7	0.150	10.10	55.05	0.181	1.83
8	0.075	6.50	48.55	0.113	0.73
9	passing 0.075				47.565

Average Particle Diameter = 0.4955



Description	%	Particle Size
Gravel	0	D_{10} =
Coarse Sand	3	D_{30} =
Medium Sand	29	D_{60} = 0.180
Fine Sand	20	C_u =
Silt & Clay	48	C_c =

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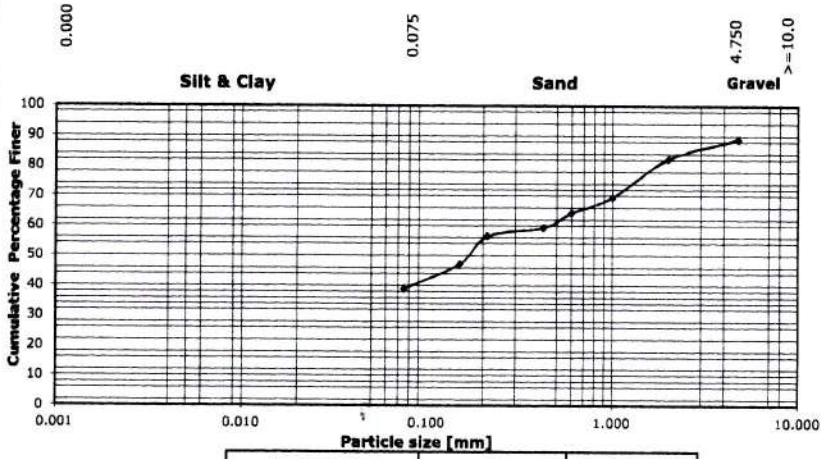
Sieve Analysis Test

Weight of sample taken (g): **100**

Bore Hole No.: 1
Depth(m): 2.00

S.No.	Sieve Aperture size used (mm)	% Soil retained PSR % (1)	Cumulative % Finer F % (2)	Average Sieve size (mm) (3)	Product of Columns (1) x (3)
1	4.750	11.23	88.77	4.750	53.34
2	2.000	6.50	82.27	3.375	21.94
3	1.000	12.80	69.47	1.500	19.20
4	0.600	5.24	64.23	0.800	4.19
5	0.425	4.97	59.26	0.513	2.55
6	0.212	2.86	56.40	0.319	0.91
7	0.150	9.26	47.14	0.181	1.68
8	0.075	8.22	38.92	0.113	0.92
9	passing 0.075				104.732

Average Particle Diameter = 1.0910



Description	%	Particle Size
Gravel	11	
Coarse Sand	7	D_{10} =
Medium Sand	23	D_{30} = 0.451
Fine Sand	20	D_{60} =
Silt & Clay	39	C_u =
		C_c =

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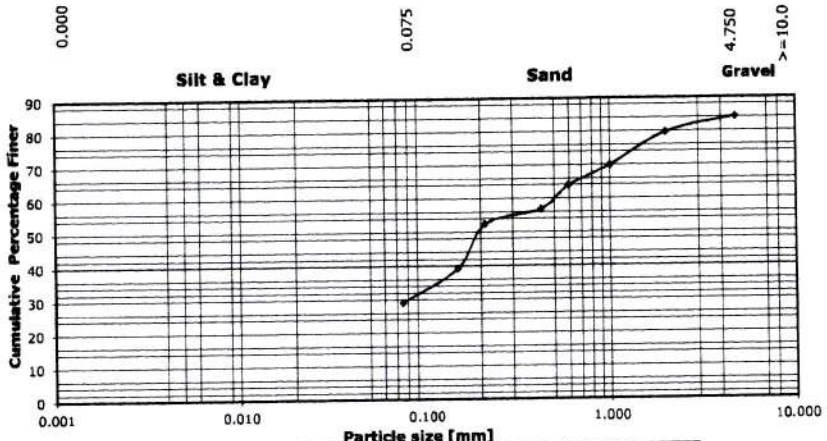
Sieve Analysis Test

Weight of sample taken (g): **100**

Bore Hole No.: 1
Depth(m): 3.00

S.No.	Sieve Aperture size used (mm)	% Soil retained PSR % (1)	Cumulative % Finer F % (2)	Average Sieve size (mm) (3)	Product of Columns (1) x (3)
1	4.750	15.79	84.21	4.750	75.00
2	2.000	4.61	79.60	3.375	15.56
3	1.000	9.73	69.87	1.500	14.60
4	0.600	5.99	63.88	0.800	4.79
5	0.425	7.11	56.77	0.513	3.64
6	0.212	4.38	52.39	0.319	1.40
7	0.150	13.15	39.24	0.181	2.38
8	0.075	10.19	29.05	0.113	1.15
9	passing 0.075				118.516

Average Particle Diameter = 1.2345



Description	%	Particle Size
Gravel	16	
Coarse Sand	5	D_{10} = 0.082
Medium Sand	23	D_{30} = 0.505
Fine Sand	28	D_{60} =
Silt & Clay	28	C_u =
		C_c =

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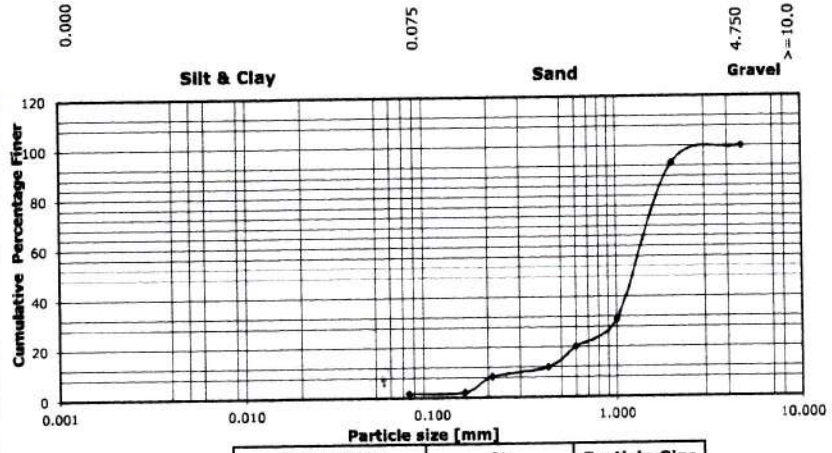
Sieve Analysis Test

Weight of sample taken (g): **100**

Chainage.: 0
Bore Hole No.: 1
Depth(m): 4.50

S.No.	Sieve Aperture size used (mm)	% Soil retained PSR % (1)	Cumulative % Finer F % (2)	Average Sieve size (mm) (3)	Product of Columns (1) x (3)
1	4.750	0.00	100.00	4.750	0.00
2	2.000	6.87	93.13	3.375	23.19
3	1.000	62.18	30.95	1.500	93.27
4	0.600	10.86	20.09	0.800	8.69
5	0.425	8.15	11.94	0.513	4.18
6	0.212	3.62	8.32	0.319	1.15
7	0.150	6.20	2.12	0.181	1.12
8	0.075	0.43	1.69	0.113	0.05
9	passing 0.075				131.646

Average Particle Diameter = 1.3713



Description	%	Particle Size
Gravel	0	0.311
Coarse Sand	7	D_{10} = 0.965
Medium Sand	81	D_{30} = 1.467
Fine Sand	10	D_{60} = 4.720
Silt & Clay	2	C_u = 2.042
		C_c =

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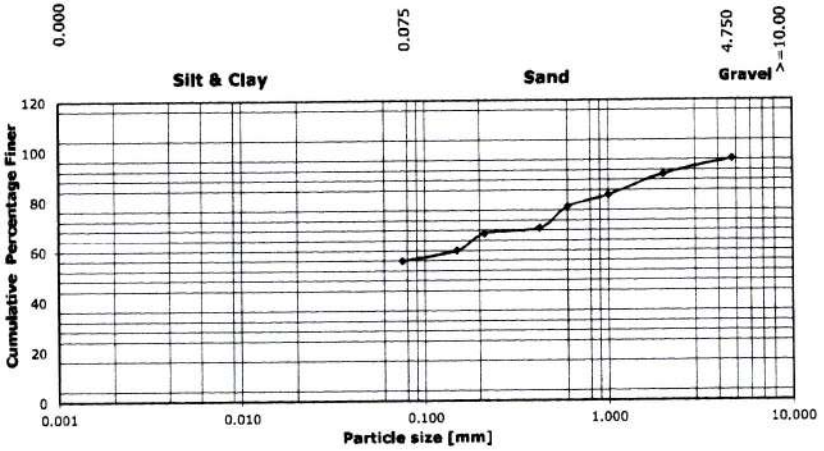
Sieve Analysis Test

Chainage.: 0
Bore Hole No.: 2
Depth(m): 1.00

Weight of sample taken (g): **100**

S.No.	Sieve Aperture size used (mm)	% Soil retained PSR % (1)	Cumulative % Finer F % (2)	Average Sieve size (mm) (3)	Product of Columns (1) x (3)
1	4.750	3.65	96.35	4.750	17.34
2	2.000	6.08	90.27	3.375	20.52
3	1.000	8.30	81.97	1.500	12.45
4	0.600	4.56	77.41	0.800	3.65
5	0.425	8.46	68.95	0.513	4.34
6	0.212	2.23	66.72	0.319	0.71
7	0.150	6.72	60.00	0.181	1.22
8	0.075	4.11	55.89	0.113	0.46
9	passing 0.075				60.681

Average Particle Diameter = 0.6321



Description	%	Particle Size
Gravel	4	D_{10} =
Coarse Sand	6	D_{30} =
Medium Sand	21	D_{60} = 0.150
Fine Sand	13	C_u =
Silt & Clay	56	C_c =

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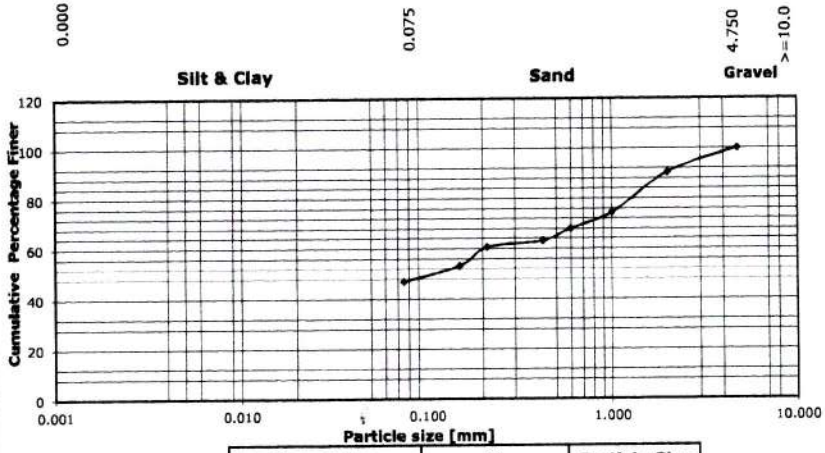
Sieve Analysis Test

Chainage.: 0
Bore Hole No.: 2
Depth(m): 2.00

Weight of sample taken (g): **100**

S.No.	Sieve Aperture size used (mm)	% Soil retained PSR % (1)	Cumulative % Finer F % (2)	Average Sieve size (mm) (3)	Product of Columns (1) x (3)
1	4.750	0.00	100.00	4.750	0.00
2	2.000	9.65	90.35	3.375	32.57
3	1.000	16.01	74.34	1.500	24.02
4	0.600	6.22	68.12	0.800	4.98
5	0.425	4.96	63.16	0.513	2.54
6	0.212	2.64	60.52	0.319	0.84
7	0.150	7.32	53.20	0.181	1.32
8	0.075	6.31	46.89	0.113	0.71
9	passing 0.075				66.979

Average Particle Diameter = 0.6977



Description	%	Particle Size
Gravel	0	
Coarse Sand	10	D_{10} =
Medium Sand	27	D_{30} = 0.208
Fine Sand	16	D_{60} =
Silt & Clay	47	C_u =
		C_c =

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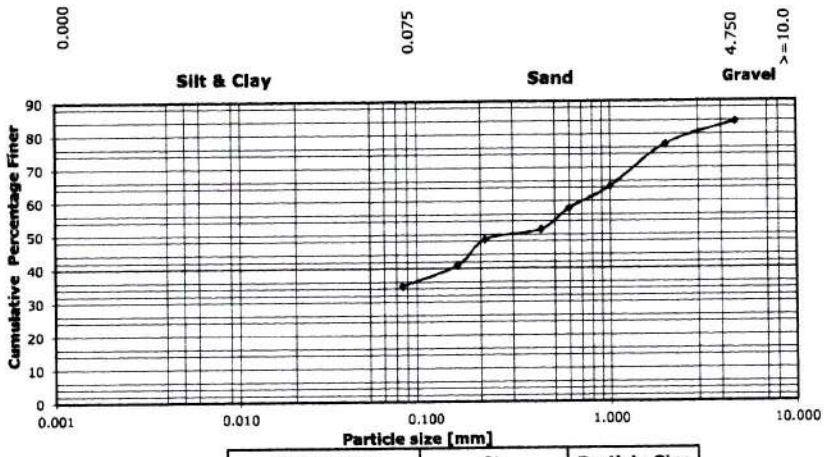
Sieve Analysis Test

Chainage.: 0
Bore Hole No.: 2
Depth(m): 3.00

Weight of sample taken (g): **100**

S.No.	Sieve Aperture size used (mm)	% Soil retained PSR % (1)	Cumulative % Finer F % (2)	Average Sieve size (mm) (3)	Product of Columns (1) x (3)
1	4.750	16.32	83.68	4.750	77.52
2	2.000	6.64	77.04	3.375	22.41
3	1.000	12.61	64.43	1.500	18.92
4	0.600	6.55	57.88	0.800	5.24
5	0.425	6.28	51.60	0.513	3.22
6	0.212	3.06	48.54	0.319	0.98
7	0.150	7.62	40.92	0.181	1.38
8	0.075	6.20	34.72	0.113	0.70
9	passing 0.075				130.356

Average Particle Diameter = 1.3579



Description	%	Particle Size
Gravel	16	
Coarse Sand	7	D_{10} =
Medium Sand	25	D_{30} = 0.729
Fine Sand	17	D_{60} =
Silt & Clay	35	C_u =
		C_c =

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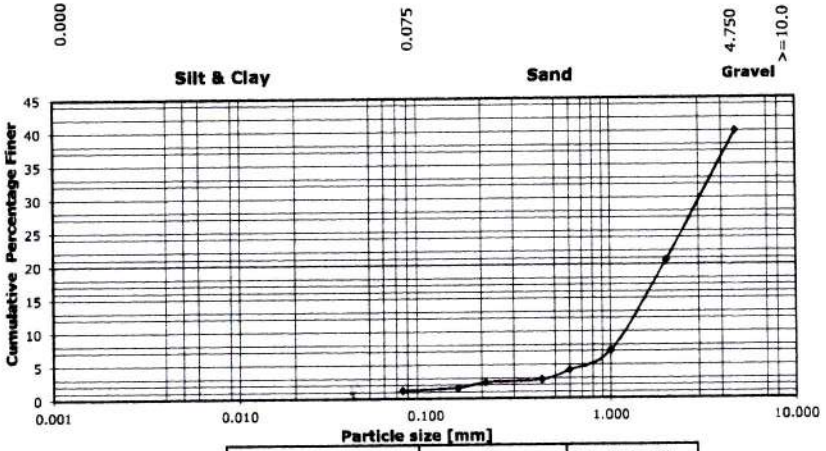
Sieve Analysis Test

Chainage.: 0
Bore Hole No.: 2
Depth(m): 4.50

Weight of sample taken (g): **100**

S.No.	Sieve Aperture size used (mm)	% Soil retained PSR % (1)	Cumulative % Finer F % (2)	Average Sieve size (mm) (3)	Product of Columns (1) x (3)
1	4.750	60.10	39.90	4.750	285.48
2	2.000	19.32	20.58	3.375	65.21
3	1.000	13.46	7.12	1.500	20.19
4	0.600	2.94	4.18	0.800	2.35
5	0.425	1.38	2.80	0.513	0.71
6	0.212	0.40	2.40	0.319	0.13
7	0.150	0.77	1.63	0.181	0.14
8	0.075	0.44	1.19	0.113	0.05
9	passing 0.075				374.246

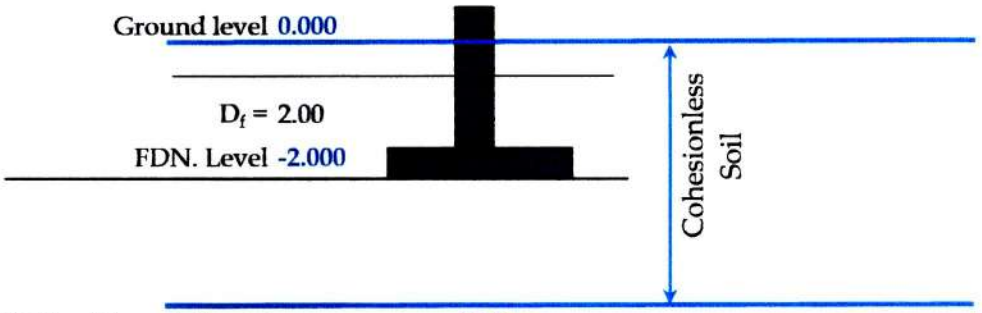
Average Particle Diameter = 3.8984



Description	%	Particle Size
Gravel	60	1.214
Coarse Sand	19	D_{10} = 3.341
Medium Sand	18	D_{30} = 7.143
Fine Sand	2	D_{60} = 5.884
Silt & Clay	1	C_u = 1.287
		C_c =

ATTACHMENT A4: CAPACITY CALCULATION

DATA FOR SBC CALCULATIONS - BH-1



Width of Foundation, B	=	1.50	m
Foundation Stratum	=	Silty Sand with Clay	
SPT	=	30	For SBC Cals
	=	80	for Settlement Cals
ϕ	=	31	Degrees
C	=	0	kN/m^2
γ	=	17	kN/m^3
Length, L	=	1.5	m
Foundation Load Inclination, a	=	0	Degrees
Factor Of Safety	=	2.5	
Foundation Shape Code	=	3	

Strip	Rectangular	Square	Circular
1	2	3	4

Allowable Settle	=	25	mm

In Accordance with IS: 6403-1981

SHAPE FACTORS

SHAPE OF BASE	SHAPE FACTORS		
	S_c	S_q	S_γ
Continuous strip	1.00	1.00	1.00
Rectangular	1+0.2*(B/L)	1+0.2*(B/L)	1-0.4*(B/L)
Square	1.30	1.20	0.80
Circle	1.30	1.20	0.60

DEPTH FACTORS

DEPTH FACTORS		
d_c	d_q	d_γ
For any value of ϕ	For a value of ϕ > 10 degrees	
$1 + 0.2 \times (D_f/B) \times \tan(45+\phi/2)$	$1 + 0.1 \times (D_f/B) \times \tan(45+\phi/2)$	
	For a value of ϕ < 10 degrees	
	1.00	

INCLINATION FACTORS

i_c	i_q	i_g
$(1 - \alpha/90)^2$	$(1 - \alpha/90)^2$	$(1 - \alpha/\phi)^2$
α & ϕ are in degrees		

Influence Factor

Table 2 of IS:8009, Part 1

Shape	Average I
Circle	0.85
Square	0.95
Rectangle	
L/B	
1.5	1.2
2	1.31
5	1.83
10	2.25
100	2.96

SBC CALCULATIONS - BH-1

$Q_U = q\,(Nq-1)\,s_q\,d_q\,i_q + 0.5\,B\,g\,N_g\,s_g\,d_g\,i_g\,W' + C\,N_c\,s_c\,d_c\,i_c$

Where γ = Bulk unit weight of foundation soil = 17 kN/m^3

q = Effective Surcharge at the base of foundation (kN/m^2) 14 kN/m^2

B = Width of Footing 1.5 m

D_f = Depth of Foundation, m 2.00 m

ϕ = Angle of shering resistance of soil in degrees 31 Degrees

C = Cohesion 0.00 kN/m^2

N_c, N_q, N_γ = Bearing capacity factors

Refer IS:6403

N_c	N_q	N_γ
32.54	20.54	25.87

S_c, S_q, S_γ = Shape Factors

S_c	S_q	S_g
1.30	1.20	0.80

d_c, d_q, d_γ = Depth Factors

d_c	d_q	d_γ
1.471	1.235	1.235

α = Inclination of the load to the vertical in degrees 0 Degrees

i_c, i_q, i_γ = Inclination Facors

i_c	i_q	i_γ
1.00	1.00	1.00

W' = Water table correction

0.5

The Sub-Soil Water Table is considered to be at GL as the worest case

$Q_U = 14 \times (20.54 - 1) \times 1.2 \times 1.235 \times 1$

$+ 0.5 \times 1.5 \times 17 \times 25.87 \times 0.8 \times 1.235 \times 1 \times 0.5$

$+ 0 \times 32.54 \times 1.3 \times 1.471 \times 1$

405.42 + 67.09 + 0.00 = 472.51 kN/m^2

Q_{Safe} = 189 kN/m^2

Consider an allowable SBC of 180 kN/m^2

Elastic Settlement (as per IS: 8009 - Part - I)

Si = $p*B(1-\mu^2)*I/E$

P = Contact Pressure

B = Width of Foundation 1.50 m

L = Length of Foundation 1.5 m

μ = Poission Ratio 0.5

E = Young's modulus = 500*(15+N) kN/m^2

I = Average Influence factor

L/B = 1.0 0.95 $D/(L \times B)^{0.5}$ = 1.333

AS per Table No. 2 of IS: 8009 - Part - I)

I = 0.95 Refer Table 2 of IS:8009, Part 1

N = 80 where N is Average SPT value within influence depth below

E = 47500 kN / Sq.m

Si = 0.0041 m = 4.05 mm

Depth Correction Factor = 0.92 From Fig No. 12 of IS:8009, Part 1

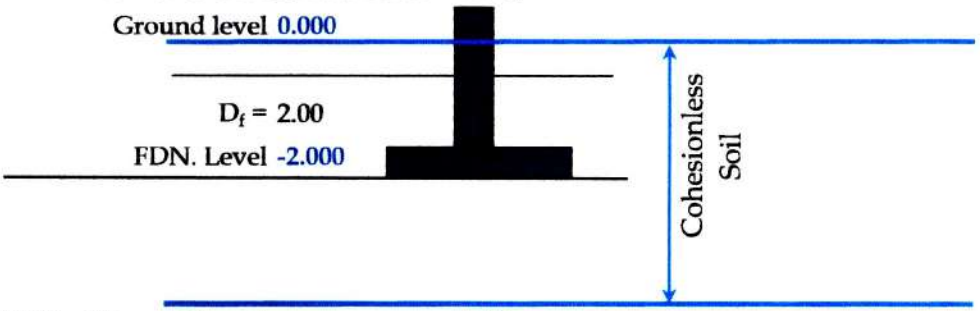
Rigidity Factor = 0.80 As per Clause 9.5.2 of IS:8009 - Part 1

Settlements after corrections = 2.98 mm

Allowable elastic Settlement = 25 mm

AS ALLOWABLE SETTLEMTS ARE WITHIN LIMITS SAFE

DATA FOR SBC CALCULATIONS - BH-2



Width of Foundation, B	=	1.50	m
Foundation Stratum	=	Silty Sand with Clay	
SPT	=	33	For SBC Cals
	=	80	for Settlement Cals
ϕ	=	31	Degrees
C	=	0	kN/m^2
γ	=	17	kN/m^3
Length, L	=	1.5	m
Foundation Load Inclination, a	=	0	Degrees
Factor Of Safety	=	2.5	
Foundation Shape Code	=	3	

Strip	Rectangular	Square	Circular
1	2	3	4

Allowable Settle = 25 mm

In Accordance with IS: 6403-1981

SHAPE FACTORS

SHAPE OF BASE	SHAPE FACTORS		
	S_c	S_q	S_γ
Continuous strip	1.00	1.00	1.00
Rectangular	1+0.2*(B/L)	1+0.2*(B/L)	1-0.4*(B/L)
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	For a value of ϕ < 10 degrees	
	1.00	

INCLINATION FACTORS

i_c	i_q	i_g
$(1 - \alpha/90)^2$	$(1 - \alpha/90)^2$	$(1 - \alpha/\phi)^2$
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Where

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+ 0.5 x 1.5 x 17 x 25.87 x 0.8 x 1.235 x 1 x 0.5
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AS ALLOWABLE SETTLEMTS ARE WITHIN LIMITS, SAFE





our services doesn't just end there

Buying & Selling Services

Property Buying Assistance, Property Selling Support, Market Price Analysis, Owner Outreach and Negotiation.

Legal & Documentation Services

Certified EC, Patta, legal opinions, property verification, due diligence, litigation solutions, and legal heir certificates.

Property Development & Approvals

Building plan approvals, construction, layout and sub-division approvals, zone conversion, and occupancy certification.

NRI & Investment Services

Escrow Services, Rentals, Litigation Solutions, Property Valuation and Property Management

Compliance & Special Services

Demolition, Vaasthu checks, regularization of unauthorized buildings, and office space solutions.



empowering your real estate decisions with smart tools

Property Valuation & Cost Estimation

Guideline Value, Apartment Composite Value, Stamp Duty & Registration Fees Calculator, Building Value Calculator, Capital Gains Calculator, Area Unit Converter, Length Unit Converter

Ownership, Compliance & Legal Verification

Encumbrance Certificate (EC) Search, Find Your SRO, Temple Property Check, WAQF Property Check, View Patta/Chitta, View FMB, Patta Analyzer, EC Analyzer

Zoning & Land Use Analysis

Land Use Zone Finder, CRZ Zone Check, Aquifer Zone Check, CBA Check, EWS Check, Road Width Check, Proposed Road Widening Check, FSI Calculator

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