

**PROPOSED CONSTRUCTION OF (G+2) RESIDENTIAL BUILDING  
AT BHARATHI POONGA STREET, SELAIYUR, CHENNAI.**

**Report on Geotechnical Investigation**

**Client:**

**M/s. Alankar Construction,  
Chennai.**



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**Project No: MSGTPL/SI-3308/15-16**

**Jan-2016.**

## **TABLE OF CONTENTS**

1.0 INTRODUCTION.....	1
1.1 DESCRIPTION OF STRUCTURE.....	1
1.2 SOIL INVESTIGATION PROGRAMME .....	1
1.3 FIELD SAMPLING.....	2
1.4 LABORATORY TESTS.....	2
1.5 SOIL PROFILE.....	2
1.6 GROUND WATER TABLE.....	3
1.7 DISCUSSION ON FOUNDATION.....	3
1.8 RECOMMENDATIONS.....	3
1.9 SAFE BEARING CAPACITY CALCULATIONS.....	4
3.0 SITE PLAN –MSGTPL/SI- <b>3308</b> .....	5
4.0 BORE-LOGS.....	6
5.0 TEST RESULTS.....	8
6.0 NATURAL MOISTURE CONTENT.....	10
7.0 SPECIFIC GRAVITY.....	11
8.0 GRAIN SIZE ANALYSIS.....	13

## **REPORT ON SUB SOIL INVESTIGATION AND RECOMMENDATIONS FOR SUITABLE TYPE OF FOUNDATIONS OF THE PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING (G+2) AT SELAIYUR.**

### **1.0 INTRODUCTION**

**M/s. Alankar Construction**, Chennai are planning to construct the residential building (G+2) at No: 12/A, Bharathi Poonga Street, Selaiyur, Chennai-600 073, Tamilnadu, INDIA. **M/s. Mars Synergy Geotech Pvt Ltd**, Chennai has carried out this investigation and completed the field work on 22<sup>nd</sup> Jan 2016 according to the instructions from the owner of the project.

#### **The scope of work includes the following**

- Making two numbers of Standard Soil Investigation bore-holes
- Collecting soil samples at regular depth intervals
- Conducting SPTs at every 1.0m/1.50m depth intervals
- Conducting laboratory tests on samples collected
- Submitting report with laboratory test results and recommendation for foundations.

### **1.1 DESCRIPTION OF STRUCTURE**

The proposed structure is residential building (G+2). The exact details of columns are not available at the time of preparation of this report. Assuming an approximate column spacing of 4 to 5 m c/c considering this the central column load works about 60 tones for proposed building. These loads are assumed for the purpose of foundation only and for the structural design, exact loads are to be estimated based on a suitable structural analysis.

### **1.2 SOIL INVESTIGATION**

The field investigation works were carried out using 1 set of Rotary mechanical drilling Rig. The following activities, carried out in chronological sequence, comprised the fieldwork for the project

- Mobilisation of rotary drill rig, water pump, testing tools and accessories.
- Collection of disturbed samples of non-cohesive soils.
- Sampling and logging of the boreholes. Packing, labeling and dispatching the samples to laboratory.
- Field investigation, tests and laboratory tests conducted as per IS-1892 and IS -2720

### 1.3 FIELD SAMPLING

Two numbers of standard soil investigation boreholes of 100mm diameter was made at the locations shown in the figure, **MSGTPL/SI-3309** enclosed. Investigations were conducted 4.0m from existing ground level where SPT is more than 50blows. SPTs were conducted at every 1.0m/1.5m depth intervals and samples were collected for identification and testing.

### 1.4 LABORATORY TESTS

The laboratory-testing scheme is so designed to obtain the design parameters for the foundations. The following parameters are evaluated:

- Type of soil and it's gradation properties
- Specific Gravity
- Natural Moisture Content (NMC)
- Sieve analysis on the coarse grained soil fraction

All the test results are presented in the tabular forms. Comprehensive field information along with SPT values is presented on separate sheet.

### 1.5 SOIL PROFILE

Based on visual identification of soil samples and test results (of both field and laboratory tests), the soil profile arrived. Subsoil is made-up of four distinctive layers there are

- (i) Filled soil up to -1.0m with **SPT's N=4-6**
- (ii) Loose silty SAND -1.0m to -2.50m with **SPT's N=8-10**
- (iii) Very Dense moorum -2.50m to -3.0m with **SPT's N=>50**
- (iv) Soft disintegrated Rock -3.0m to -4.0m with **SPT's N=>100**

The soil profile details are presented in the bore-chart.

### 1.6 GROUND WATER TABLE

At the time of soil investigation (22/01/2016), the ground water table was (-)1.0m encountered within the drilled depth.

## 1.6 DISCUSSION ON FOUNDATION

From the sub soil profile and laboratory test data, it can be seen that the soil is filled up soil up to -1.0m followed by loose silty SAND up to -2.50m below this layer 1.0m thick very dense moorum followed by soft disintegrated rock till -4.0m.

Soil strata at shallow depth good and compacted hence open shallow foundation can be adopted at -2.0m for the proposed building.

## 1.8 RECOMMENDATION

- ✓ Excavate soil up to -2.0m, after exaction proper compaction to be done.
- ✓ Open shallow isolated column footings located at a depth of 2.0m below the G.L
- ✓ The Safe bearing capacity of soil at 2.0m below G.L can be taken as **15Tones/sq.m.**
- ✓ All footings should rest on 100mm thick 1:3:6 concrete.
- ✓ All foundation works should be done in dry conditions only.
- ✓ Columns shall be tied in both directions at plinth level.
- ✓ Settlements are within permissible limits as per IS-1904.
- ✓ Proper dewatering technique can be adopted.
- ✓ Excavated soil should not back fill in the foundation trench. Use river sand/moorum soil/Quarry dust

**Note:** This recommendation has been given on the assumed loads. The structural engineer can modify it based on structural analysis on actual size of the building and column details.

## 1.9 DETERMINATION OF BEARING CAPACITY OF SHALLOW FOUNDATIONS

[Based On IS: 6403-1981]

Type of Foundation: Isolated footing

Width of footing: 1.5x1.5m (For Calculation Purpose)

Depth of Foundation: 2.0m

Existing Ground level: 0.00M

Ground Water Table level: -0.00M (Due to Heavy Rain Temporary)

Bulk Density (W) of Soil above Footing Base: 1.70

Submerged Density (W') of Soil above Footing Base: 1.70T/Cu.M.

Bulk Density (W) of Soil below Footing Base: 1.70T/Cu.M.

Factor of Safety 2.5

$$Sq = 1.200 \quad Dq = 1.17 \quad Iq = 1.000$$

$$Sg = 0.600 \quad Dg = 1.17 \quad Ig = 1.000$$

Water Table Correction Factor  $w' = 0.50$

Effective surcharge at base level  $q = 1.40 \text{ T/Sq.M.}$

$$\text{Ultimate Net B.C.} = Q_{ult\_n} = q * (N_q - 1) * S_q * D_q * I_q + 0.5 * B * W * N_g * S_g * D_g * I_g * W'$$

Angle of Internal Friction (phai):  $28^\circ$

Bearing Capacity Factors

$$N_q = 15.30, N_g = 17.79$$

$$\text{Thus } Q_{ult\_n} = 37.61 \text{ T/Sq.M.}$$

$$\text{Allowable Bearing Capacity (Qall)} = 37.61 / 2.5 = 15.04 \text{ T/Sq.M.}$$

**Say 15 T/m<sup>2</sup>**

### Settlement Calculations as per IS-8009-(Part1) 1998

$$S = S_c + S_i$$

$$S_c \approx 5 \text{ mm}$$

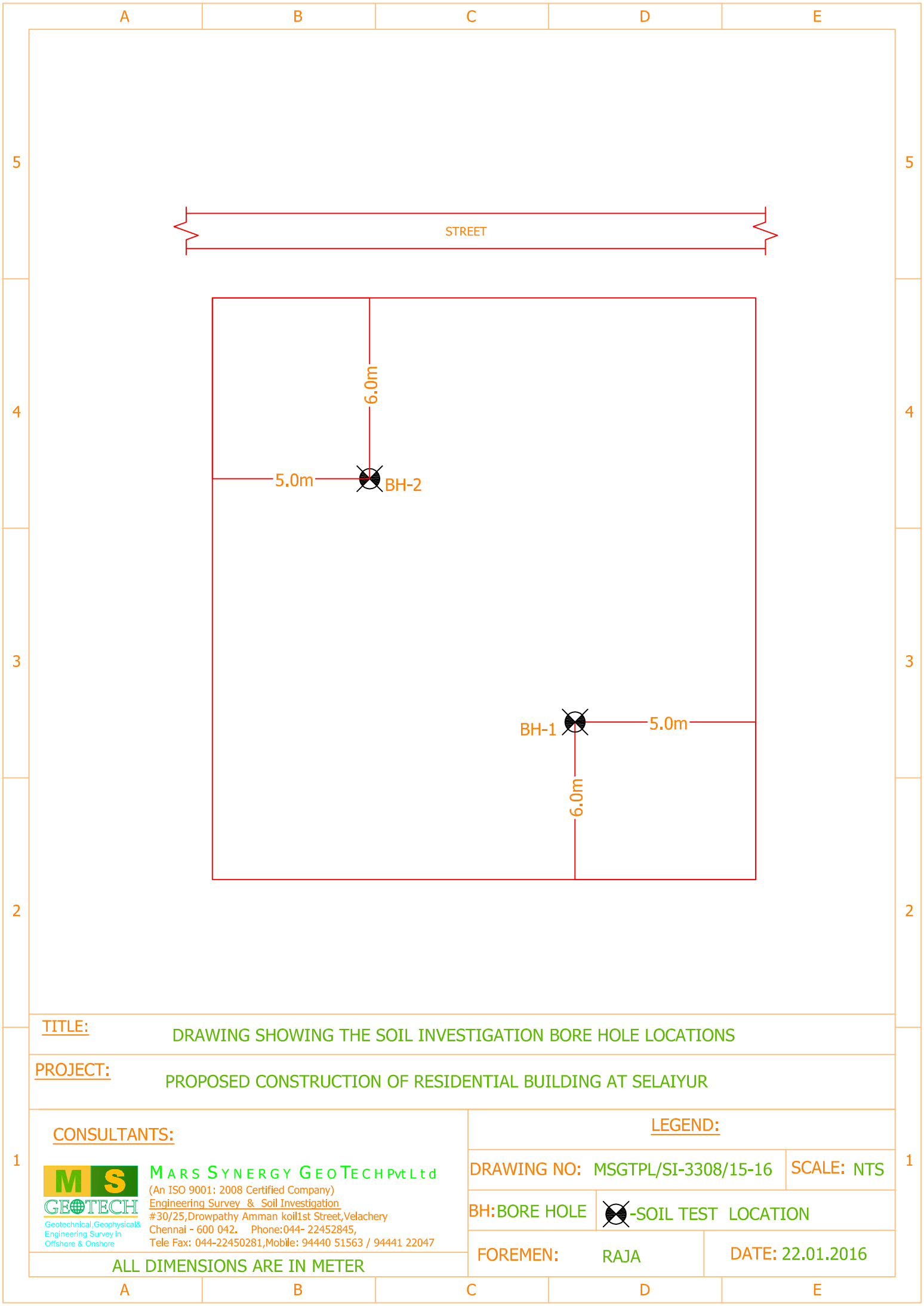
$$S_i = pB \frac{(1 - \mu^2)}{E_s} I$$

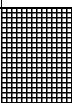
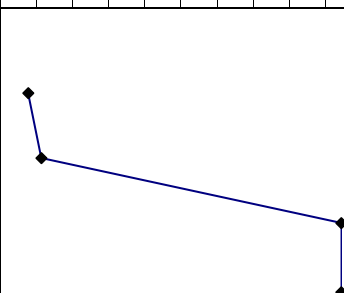
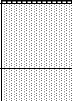
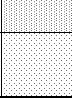
$$S_i = 15 \times 1.5 \times \frac{(1 - 0.3^2)}{2500} \times 1.31 = 0.0178 \text{ m} \quad = 0.0178 \times 1000 = 17.88 \text{ mm}$$

$$S = S_c + S_i$$

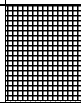
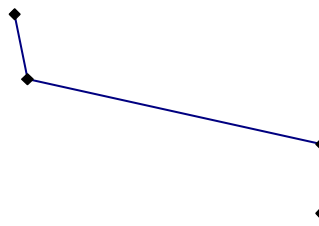



$$S = 5 + 17.88 = 22.88 \text{ mm} \quad \text{Say } 23 \text{ mm}$$

**Total settlements 23mm, It is less than 25mm hence safe as per IS 1904-1986.**



Project No: MSGTPL/SI-3308/15-16																															
Project : Proposed Construction of (G+2) Residential Building at Selaiyur.																															
Bore Hole No.		:1														G.W.L :(-)1.0m															
Type of Boring		:Rotary														Dia of Boring :100mm															
Started on		:22/01/2016														Location : Ref. Fig															
Ended on		:22/01/2016														Soil Drilled : 4.0m															
Depth (m)	Layer Thickness	Soil Profiles	Soil Description	IS Classification	SPT Details					Graphical Representation of SPT											Type of Samples										
					Depth (m)	15	30	45	N	0	10	20	30	40	50	60	70	80	90	100											
0.0	1.00		Filled up Soil		0.00																SPT										
0.5																															
1.0					1.00	3	2	2	4																						
1.5	2.00		Loose Brownish Fine to Medium SAND	SM	2.00	5	4	4	8																						SPT
2.0																															
2.5																															
3.0	3.00		Very Dense Brownish Medium to Fine SAND	SC	3.00	50	50 Blows for 5cm																							SPT	
3.5																															
4.0	4.00				Soft Disintegrated Rock				GP												4.00	50 Blows for 0cm									
4.5																															
5.0																															
5.5																															
6.0																															
6.5																															
7.0																															
7.5																															
8.0																															
8.5																															
9.0																															
9.5																															
10.0																															
Soil Profile BH-1 Location																															
Borehole Terminated at 4.0m Below Ground Level.																															



Project No: MSGTPL/SI-3308/15-16																					
Project : Proposed Construction of (G+2) Residential Building at Selaiyur.																					
Bore Hole No.		:2										G.W.L :(-)1.0m									
Type of Boring		:Rotary										Dia of Boring :100mm									
Started on		:22/01/2016										Location : Ref. Fig									
Ended on		:22/01/2016										Soil Drilled : 4.0m									
Depth (m)	Layer Thickness	Soil Profiles	Soil Description	IS Classification	SPT Details					Graphical Representation of SPT										Type of Samples	
					Depth (m)	15	30	45	N	0	10	20	30	40	50	60	70	80	90		100
0.0	1.00		Filled up Soil		0.00															SPT	
0.5																					
1.0					1.00																2
1.5	2.00		Loose Brownish SAND	SM																SPT	
2.0					2.00	3	4	6	10												
2.5	3.00		Brownish Moorum	SC		50 Blows for 10cm														SPT	
3.0					3.00	50 Blows for 10cm															
3.5	4.00		Soft Disintegrated Rock	GP		50 Blows for 0cm														SPT	
4.0					4.00	50 Blows for 0cm															
4.5																					
5.0																					
5.5																					
6.0																					
6.5																					
7.0																					
7.5																					
8.0																					
8.5																					
9.0																					
9.5																					
10.0																					
Soil Profile BH-2 Location																					
Borehole Terminated at 4.0m Below Ground Level.																					

## 5.0 TEST RESULTS

Project No: MSGTPL/SI-3308/15-16																
Project : Proposed Construction of (G+2) Residential Building at Selaiyur.																
BH No		1			Ground Water Level:(-)1.0m						Termination Depth: -: 4.0m					
SUMMARY OF TEST RESULTS																
N' Value	Layer Thickness	Depth (m)	Soil Description	IS Classification	Index Properties (%)						Specific Gravity	Grain Size Analysis (%)				
					NMC	W <sub>L</sub>	W <sub>P</sub>	I <sub>P</sub>	I <sub>c</sub>	FreeSwell		Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt & Clay
	0.00	0.00	Filled up Soil													
4	1.00	1.00														
			Loose Brownish Fine to Medium SAND	SM												
8	2.00	2.00			11					2.64	18	13	27	25	17	
			Very Dense Brownish Medium to Fine SAND	SC												
>100	3.00	3.00			17					2.65	3	3	30	35	29	
			Soft Disintegrated Rock	GP												
>100	4.00	4.00														

Project No: MSGTPL/SI-3308/15-16																
Project : Proposed Construction of (G+2) Residential Building at Selaiyur.																
BH No		2			Ground Water Level:(-)1.0m						Termination Depth: -: 4.0m					
SUMMARY OF TEST RESULTS																
N' Value	Layer Thickness	Depth (m)	Soil Description	IS Classification	Index Properties (%)						Specific Gravity	Grain Size Analysis (%)				
					NMC	W <sub>L</sub>	W <sub>P</sub>	I <sub>P</sub>	I <sub>c</sub>	FreeSwell		Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt & Clay
	0.00	0.00	Filled up Soil													
6	1.00	1.00														
10	2.00	2.00	Loose Brownish SAND	SM	13						2.66	11	10	30	30	19
			Brownish Moorum	SC	13						2.70					
>100	3.00	3.00														
>100	4.00	4.00	Soft Disintegrated Rock	GP												

## 6.0 NATURAL MOISTURE CONTENT

**Project No: MSGTPL/SI-3308/15-16**

**Project : Proposed Construction of (G+2) Residential Building at Selaiyur.**

**Method: IS-2720 P-2**

**Natural Moisture Content Data Sheet**

BH.No/ Pit no	1		1		2		2					
Depth (m)	2.0		3.0		2.0		3.0					
Tare No	1	90	147	195	251	201	203	204				
Wt of Tare (gr)	28.42	25.97	29.47	24.77	25.40	29.33	28.61	27.81				
Tare + Soil (gr)	55.38	57.36	43.46	44.40	50.61	54.39	50.16	46.23				
Tare+Dry soil (gr)	52.64	54.30	41.42	41.66	47.70	51.40	47.56	44.08				
Wt of Water (gr)	2.74	3.06	2.04	2.74	2.91	2.99	2.60	2.15				
Wt Dry soil (gr)	24.22	28.33	11.95	16.89	22.30	22.07	18.95	16.27				
Water Content (%)	11.31	10.80	17.07	16.22	13.05	13.55	13.72	13.21				
Average Water Content (%)	11		17		13		13					

## 7.0 SPECIFIC GRAVITY

### SPECIFIC GRAVITY TEST

**Project No: MSGTPL/SI-3308/15-16**

**Project : Proposed Construction of (G+2) Residential Building at Selaiyur.**

BH.No	1			
Depth(m)	2.00			
Pycnometer number			43	38
Weight of bottle	$w_1$	g	32.2000	40.6300
Weight of bottle + soil	$w_2$	g	49.8500	61.8700
Weight of bottle + soil + water	$w_3$	g	98.6700	107.4000
Weight of bottle full of water	$w_4$	g	87.7100	94.1900
Weight of soil	$w_2-w_1$	g	17.6500	21.2400
Specific gravity	$w_2-w_1$		2.63827	2.64508
	$(w_4-w_1)-(w_3-w_2)$			
Average value $G_s$			2.64	

BH.No	1			
Depth(m)	3.00			
Pycnometer number			45	17
Weight of bottle	$w_1$	g	28.2200	36.3600
Weight of bottle + soil	$w_2$	g	41.0800	40.8700
Weight of bottle + soil + water	$w_3$	g	87.5000	91.5000
Weight of bottle full of water	$w_4$	g	79.5000	88.6900
Weight of soil	$w_2-w_1$	g	12.8600	4.5100
Specific gravity	$w_2-w_1$		2.64609	2.65294
	$(w_4-w_1)-(w_3-w_2)$			
Average value $G_s$			2.65	

### SPECIFIC GRAVITY TEST

**Project No: MSGTPL/SI-3308/15-16**

**Project : Proposed Construction of (G+2) Residential Building at Selaiyur.**

BH.No	2			
Depth(m)	2.00			
Pycnometer number			13	1
Weight of bottle	$w_1$	g	27.7700	34.9600
Weight of bottle + soil	$w_2$	g	41.7700	52.0100
Weight of bottle + soil + water	$w_3$	g	86.6300	99.0500
Weight of bottle full of water	$w_4$	g	77.8900	88.4100
Weight of soil	$w_2-w_1$	g	14.0000	17.0500
Specific gravity	$w_2-w_1$		2.66160	2.65991
	$(w_4-w_1)-(w_3-w_2)$			
Average value $G_s$			2.66	

BH.No	2			
Depth(m)	3.00			
Pycnometer number			3	34
Weight of bottle	$w_1$	g	32.8300	32.5600
Weight of bottle + soil	$w_2$	g	46.4500	49.7200
Weight of bottle + soil + water	$w_3$	g	92.6200	95.8200
Weight of bottle full of water	$w_4$	g	84.0500	85.0000
Weight of soil	$w_2-w_1$	g	13.6200	17.1600
Specific gravity	$w_2-w_1$		2.69703	2.70662
	$(w_4-w_1)-(w_3-w_2)$			
Average value $G_s$			2.70	

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Project : Proposed Construction of (G+2) Residential Building at Selaiyur.

BH 1

**Sieve Analysis Test**

Depth 2.0m

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	18.39	81.62	4.750	87.33
2	2.000	12.74	68.88	3.375	42.98
3	1.000	15.71	53.17	1.500	23.57
4	0.600	4.78	48.39	0.800	3.82
5	0.425	6.32	42.08	0.513	3.24
6	0.212	9.62	32.46	0.319	3.06
7	0.150	5.22	27.24	0.181	0.94
8	0.075	9.86	17.39	0.113	1.11
9	passing 0.075				166.051

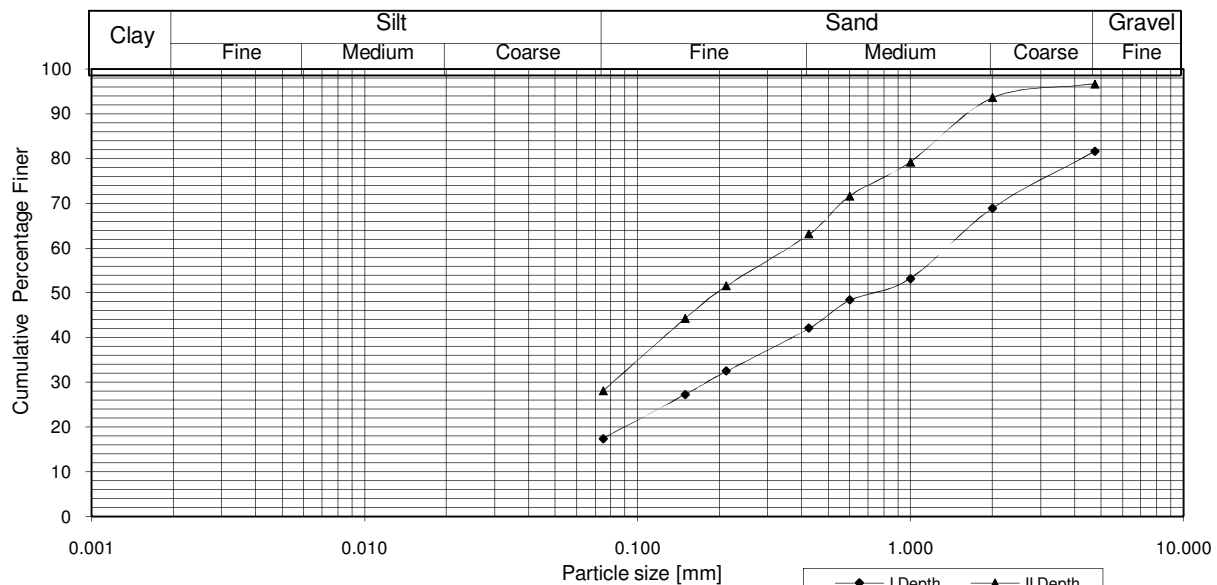
Average Particle Diameter = 1.7297

BH 1

Depth 3.0m

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	3.38	96.62	4.750	16.06
2	2.000	3.03	93.59	3.375	10.23
3	1.000	14.44	79.15	1.500	21.66
4	0.600	7.56	71.59	0.800	6.05
5	0.425	8.47	63.12	0.513	4.34
6	0.212	11.58	51.54	0.319	3.69
7	0.150	7.28	44.26	0.181	1.32
8	0.075	16.19	28.07	0.113	1.82
9	passing 0.075				65.157

Average Particle Diameter = 0.6787



Depth = 2.0	%	Particle Size	Depth = 3.0	%	Particle Size
Gravel	18	$D_{10} =$	Gravel	3	$D_{10} =$
Coarse Sand	13	$D_{30} = 0.183$	Coarse Sand	3	$D_{30} = 0.084$
Medium Sand	27	$D_{60} = 3.713$	Medium Sand	30	$D_{60} = 0.368$
Fine Sand	25	$C_u =$	Fine Sand	35	$C_u =$
Silt & Clay	17	$C_c =$	Silt & Clay	29	$C_c =$

Project No: MSGTPL/SI-3308/15-16

Project : Proposed Construction of (G+2) Residential Building at Selaiyur.

BH 2

**Sieve Analysis Test**

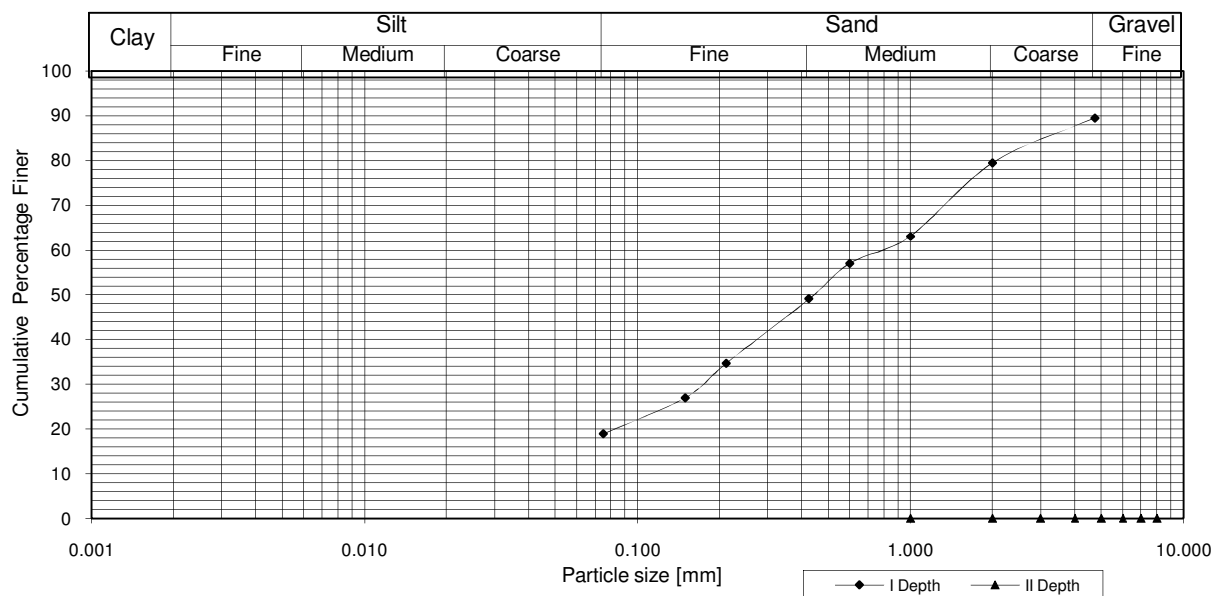
Depth 2.0m

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	10.53	89.48	4.750	49.99
2	2.000	10.03	79.45	3.375	33.83
3	1.000	16.39	63.06	1.500	24.59
4	0.600	6.03	57.04	0.800	4.82
5	0.425	7.97	49.07	0.513	4.08
6	0.212	14.34	34.73	0.319	4.57
7	0.150	7.73	27.00	0.181	1.40
8	0.075	8.12	18.88	0.113	0.91
9	passing 0.075				124.197

Average Particle Diameter = 1.2937

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					
2					
3					
4					
5					
6					
7					
8					
9					

Average Particle Diameter =



Depth = 2.0	%	Particle Size	Depth =	%	Particle Size
Gravel	11	$D_{10} =$	Gravel		$D_{10} =$
Coarse Sand	10	$D_{30} = 0.174$	Coarse Sand		$D_{30} =$
Medium Sand	30	$D_{60} = 3.330$	Medium Sand		$D_{60} =$
Fine Sand	30	$C_u =$	Fine Sand		$C_u =$
Silt & Clay	19	$C_c =$	Silt & Clay		$C_c =$