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SOIL EXPLORATION REPORT

NAME OF PROJECT :

PROPOSED CONSTRUCTION OF STILT FLOOR + 5 FLOOR (HEIGHT 18.3M) RESIDENTIAL BUILDING WITH 10 DWELLING UNITS AT DOOR NO 3/75-A, ASHOK NAGAR IST AVENUE, CHENNAI-60083 COMPRISED IN OLD S.NO 278/3 PART, T.S NO 5/16, BLOCK NO 71 OF KODAMBAKKAM VILLAGE, WITH IN THE LIMITS OF GREATER CHENNAI CORPORATION

Owner :Mr.K.SUBBURAMAN

Report ID : 1/09052023
Date : :09/05/2023

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ID 1/09052024 **Date:- 09/05/2024**

Soil Exploration Report

Name of Project:

PROPOSED CONSTRUCTION OF STILT FLOOR + 5 FLOOR (HEIGHT 18.3M) RESIDENTIAL BUILDING WITH 10 DWELLING UNITS AT DOOR NO 3/75-A, ASHOK NAGAR IST AVENUE, CHENNAI-60083

Introduction:

Mr.K.SUBBURAMAN owner of the above plot, has proposed to Construct Residential building at the above address in Greater Chennai corporation Block No 71 of kodampakkam village. For the construction of any structure a detailed soil investigation is essential for collecting the relevant data required for preparing the design. The sub surface investigation reveals the presence and the extent of soil and rock stratum in the region likely to be affected by the proposed work and determines the nature of each stratum and engineering properties of soil which may affect the design. Detailed investigation reveals depth of fill up or artificially filled up soil and Natural soil. The data collected provide reliable, specific and detailed information to facilitate a safe and economic design of the proposed structure.

Method of exploration:

Rotary drilling with auger of dia.100mm dia has been used for making bore holes duly circulating bentonite slurry. In this method, the advancement of boring is made by the cutting action of a rotating bit that is kept in firm contact with the bottom of the hole. The bit is attached to the lower end of hollow drill rod, which is rotated by a suitable chuck. Drilling mud, (viz) bentonite is continuously forced down the hollow drill rods. The mud returning upward through the annular space between the drill rods and side of the hole brings the soil particles to the surface. The soil exploration consists of three stages i.e., boring, sampling and testing which includes both field and lab tests. The Samples were collected at every 1.5 m depth of the bore hole. Samples were properly labeled for Lab tests. Bore log particulars and location of bore holes are annexed with this report.

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Depth of Exploration:

Exploration has to be carried out to a depth at which the net increase in vertical stress is less than the allowable bearing pressure of the soil. For the Structure work soil exploration is carried out below the proposed sill level of the proposed structure. In this site hard strata is observed less than 10.m depth

Ground water level:

Observation of location of water table and its fluctuation under different seasons is very important. The location of ground water level is also important for deep excavation and foundation works and also on sites susceptible to be water logged. Open wells at the site or in the vicinity of the site can give a clear idea of water table and its fluctuation. Boreholes can also be used for recording water levels. One open WELL and one bore WELL are available at site.

Field Tests:

Penetration and sounding tests are the generally adopted field Tests. Standard Penetration Test is performed as per I.S. 2131-1981 as an in-situ test especially for cohesion less soils. The resistance is empirically correlated with some of the Engineering properties of soil such as density index, consistency, bearing capacity, etc. These tests are useful for general exploration of erratic soil profiles for finding depth to bedrock or hard stratum and to have an approximate indication of the strength and other properties of soils, particularly for cohesion less soil where it is difficult to obtain U.D.S.

In the field test the Standard Penetration Test sampler is driven by the free fall of a hammer weighing 63.5kg dropped from a height of 76cm.The sampler is initially driven through 15cm as a seating drive. It is further driven through 30cm. The number of blows required to drive the sampler 30cm below the seating drive is termed the penetration resistance 'N'. Three bore holes are made at site indexed as BH1, BH2 and BH3. In each location 6 samples are collected.



SUB SOIL INVESTIGATION (BORE 1) UNDER PROGRESS

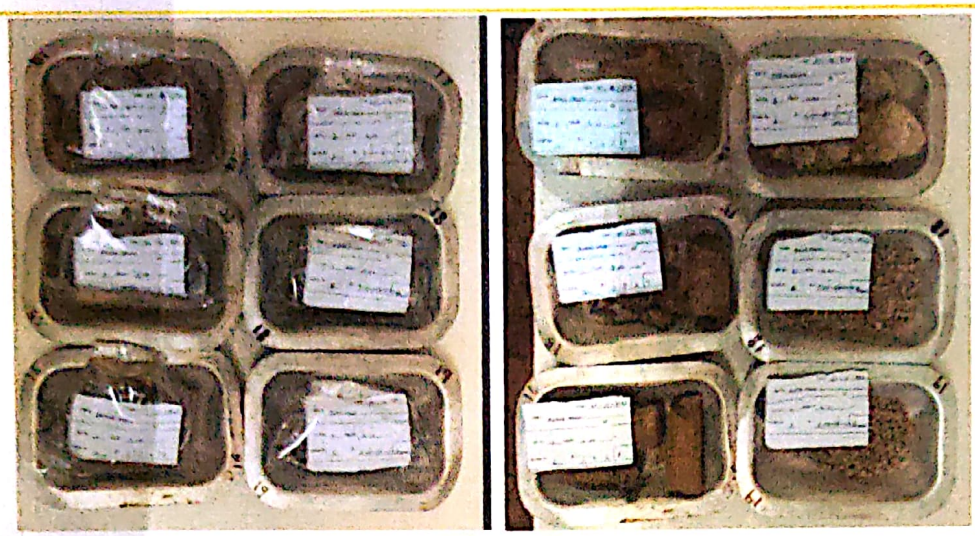
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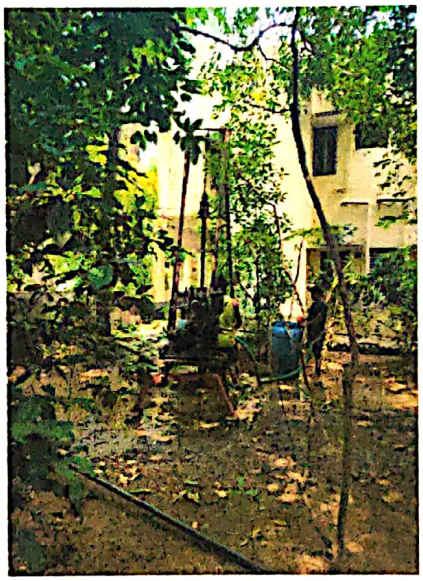
BEFORE TEST (BORE – 1 SAMPLES 6) AFTER OVEN DRY



SUB SOIL INVESTIGATION (BORE 2) UNDER PROGRESS



BEFORE TEST (BORE – 2 SAMPLES 6) AFTER OVEN DRY



SUB SOIL INVESTIGATION (BORE 3) UNDER PROGRESS



BEFORE TEST (BORE – 3 SAMPLES 6) AFTER OVEN DRY

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SUB SOIL INVESTIGATION (BORE 4) UNDER PROGRESS



BEFORE TEST (BORE – 4 SAMPLES 5) AFTER OVEN DRY

Laboratory Tests:

The samples collected at the field were supplied to laboratory tests to determine the Atterberg limit, Particle size and etc., The test results are tabulated and annexed to this report.

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Field & Laboratory observations:

FOUR Bore hole were made at this site. The soil exploration reveals that it consists of sand stratum and consistency is Loose to very hard. The stratum from 1.5m to 4.5m is very week. From 4.50m to 7.0, Soft rock and weathered rock is observed and stratum is very strong. Indian standard classification of soil are tabulated in the soil test results majority of the soil is classified as "CH". This type of soil is sand in nature with some small amount of clay mix. Angle of internal friction for this type of soil varies from 30 to 40 Deg .Average angle of friction 35deg is taken for the design.

Water table fluctuation`s:

During the borehole operations, the water table was encountered at depth of 1.80-2.0m.

Assessment of Bearing & Allowable Capacity:

The bearing capacity has been assessed as per the IS 6403: 1981 based on the field test (SPT) conducted at site as per IS 2131:1981.The allowable bearing pressure is calculated as per IS 8009(Part I)-1976 (Reaffirmed 1998). Water table is considered to be at 1.80m. The safe bearing pressure is very less between 1.0 to 4.50m depth. The bearing capacity of the layers at various levels, where Standard Penetration Test were conducted, has been calculated and appended in the table.

Variation of the physical properties of soil with respect to depth of Bore is as follows

BORE -1					
DEPTH (M)	STANDARD PENETRATION TEST (SPT)	ALLOWABLE PRESSURE T/SQ.M	ANGLE OF FRICTION IN DEGREE	COHESION T/SQ.M	IS SOIL CLASSIFICATION
1.00	6.0	5.60	30.00	0.40	CI
2.00	7.0	3.30	30.00	0.40	CH
3.00	11.0	5.29	31.00	0.80	SC
4.50	22.0	9.74	34.00	1.50	SC-SM
6.00	60.0	23.89	40.00	0.00	SP-SM
7.00	70.0	23.89	40.00	0.00	SP

BORE -2					
DEPTH (M)	STANDARD PENETRATION TEST (SPT)	ALLOWABLE PRESSURE T/SQ.M	ANGLE OF FRICTION IN DEGREE	COHESION T/SQ.M	IS SOIL CLASSIFICATION
1.00	5.0	4.38	30.00	0.40	CH
2.00	7.0	3.30	30.00	0.40	CH
3.00	8.0	3.47	30.00	0.80	CH
4.50	50.0	23.89	40.00	5.00	SC-SM
6.00	65.0	23.89	40.00	0.00	SP
6.70	75.0	23.89	40.00	0.00	SP

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BORE -3					
DEPTH (M)	STANDARD PENETRATION TEST (SPT)	ALLOWABLE PRESSURE T/SQ.M	ANGLE OF FRICTION IN DEGREE	COHESION T/SQ.M	IS SOIL CLASSIFICATION
1.00	6.0	5.60	30.00	0.40	CH
2.00	7.0	3.30	30.00	0.40	CH
3.00	8.0	3.47	30.00	0.80	CH
4.50	50.0	23.89	40.00	5.00	SC
6.00	60.0	23.89	40.00	5.00	SP
6.80	75.0	23.89	40.00	5.00	SP

BORE -4					
DEPTH (M)	STANDARD PENETRATION TEST (SPT)	ALLOWABLE PRESSURE T/SQ.M	ANGLE OF FRICTION IN DEGREE	COHESION T/SQ.M	IS SOIL CLASSIFICATION
1.00	8.0	8.69	31.00	0.80	CH
2.00	11.0	5.76	31.00	0.80	CH
3.00	14.0	6.97	32.00	0.80	CH
4.50	55.0	23.89	40.00	0.00	SP
5.50	60.0	23.89	40.00	0.00	SP

Type of foundation

The following factors are considered for the selection of the foundation

1) Proposed structure height
2) Anticipated loading
3) Soil bearing capacity
4) Flood condition
5) Boundary condition

Based on the SPT "N" values and the presence of a weak layer between depths of 1.0-4.50m, it is evident that the lower layers (BELOW 0.5M) are significantly weaker, with SPT value less than 8.

Considering the soil classification of "CH" ,SC, and "SC-SM" soil, it is essential to prioritize the safety and stability of this residential building, especially in the context of the area being prone to flooding. During the heavy flood, liquefaction of the soil is possible in the layers 1.5-4.5m depth. Despite the possibility of ground improvement techniques, it is not feasible to strengthen the weak strata below 0-4.5m effectively. Therefore, an open foundation is not a viable option for this site, even after ground improvement.

Upon conducting a subsoil investigation, the following findings have been observed:

1) The uppermost layer, extending to a depth of 0.5 meters, consists of a 0.5-meter layer of fill soil.
2) From a depth of 0.5 meters to 4.5 meters, the soil exhibits a clayey sand consistency "Loose – Medium"
3) Beyond the depth of 4.5 meters, a hard strata composed of weathered rock or SDR is encountered.

It has been determined that the safe bearing capacity of the soil within the 0.5 to 4.5-meter range is notably less than 5 tons per square meter. This suboptimal bearing capacity renders the use of an open foundation unviable due to concerns related to soil stability and potential sliding issues during construction. Given the height of the proposed building, including the lift and water tank, it is advisable to forego an open or raft foundation. Therefore, the recommended alternative is to employ a pile foundation.

Considering the critical functionality of the building height (stilt+5 floors) and taking into account the area's flooding, it is crucial to prioritize stability and safety in the foundation design. As a result, the most suitable foundation alternative for this scenario is a pile foundation.

A pile foundation involves driving or installing deep columns (piles) into the ground to transfer the building's load to stronger and more stable strata at greater depths. By using pile foundations, the building can be securely supported by the competent strata beneath the weak layers, offering greater resilience against potential flood-related risks

In conclusion, due to the unsuitable ground conditions, the inability to effectively improve the weak strata, and the critical functionality of the public building, it is recommended to opt for a pile foundation. This choice will guarantee the safety and structural integrity of the construction project, even in flood-prone areas, while efficiently distributing the building's load to reliable and stronger strata at greater depths.

When calculating the pile's loading capacity, the following factors are taken into account:

1) Unit weight of the soil
2) Water table
3) Drained/undrained condition
4) C and phi value
5) Diameter of the pile
6) Cut of length

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Pile design for the various size is enclosed. Hard stratum is available below 7.00m depth where SPT value is more than 50.0.Hence cut off length is fixed at 7.00m

Limitations : This soil investigation report is applicable to this point of testing only and height of building is (Stilt + 5 floors) 18.00m

Conclusion:- Pile foundation is recommended. Loading capacity of various piles sizes capacity are detailed below. Depends on the design load, diameter of the pile can be suitably adopted.

PILE LOAD CAPACITY	
CUT OF LENGTH 7m	
DIA	CAPACITY KN
300 MM	244
450 MM	469
600MM	752

This conclusion is drawn from a comprehensive evaluation of the site's soil characteristics and engineering considerations at the drilled location

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R. VIGNESH, M.E (Soil Engg)
Geo - Technical Engineer
CMDA, Reg. No. GTE/2019/05/027

BORE LOG

Name of Project :	PROPOSED CONSTRUCTION OF STILT FLOOR + 5 FLOOR (HEIGHT 18.3M) RESIDENTIAL BUILDING WITH 10 DWELLING UNITS AT DOOR NO 3/75-A, ASHOK NAGAR IST AVENUE, CHENNAI-60083						
BH No	1	RL of the existing GL #	100.00 m	Ground water level	1.80 m below GL		
Date of commencement		06-10-2023		Type of Drilling	Rotary		
Date of completion		06-10-2023		Dia of Bore hole	100 mm		

Depth from RL (m)	Description of soil stratum (SITE OBSERFATION)*	Soil profile	Thickness of layer	SAMPLE UDS/DS	Standard Penetrometer Test Depth	Number of blows I	II	III	N	Relative density / consistency	Graphical representation of penetration resistance 0 10 20 30 40 50 60 70 80 90 100
100.00	Existing ground level										
99.50	FILLUP SOIL 0.50		3.00	DS	1.00	2	3	3	6	Loose	
97.00	BROWN CLAY SAND			DS	2.00	3	3	4	7	Loose	
				DS	3.00	5	5	6	11	Loose	
95.50	BROWN SAND		1.50	DS	4.50	9	10	12	22	Medium	
94.00	SDR		1.50	DS	6.00	50/8 CM REBOUND				Very dense	
93.00	SOFT ROCK		1.00	DS	7.00	REBOUND				Very dense	

Bore Hole terminated at 93 m RL

*Description of soil may vary. It is only site observation. Please refer laboratory test for soil classification

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BORE LOG

Name of Project :	PROPOSED CONSTRUCTION OF STILT FLOOR + 5 FLOOR (HEIGHT 18.3M) RESIDENTIAL BUILDING WITH 10 DWELLING UNITS AT DOOR NO 3/75-A, ASHOK NAGAR IST AVENUE, CHENNAI-60083

BH No	2	RL of the existing GL #	100.00 m	Ground water level	1.80 m below GL		
Date of commencement		06-10-2023		Type of Drilling	Rotary		
Date of completion		06-10-2023		Dia of Bore hole	100 mm		

Depth from RL (m)	Description of soil stratum (SITE OBSERFATION)*	Soil profile	Thickness of layer	SAMPLE UDS/DS	Standard Penetrometer Test: Depth	Number of blows: I	II	III	N	Relative density / consistency	Graphical representation of penetration resistance (0 10 20 30 40 50 60 70 80 90 100)
100.00	Existing ground level										
99.50	FILLUP SOIL 0.50										
				DS	1.00	1	2	3	5	Loose	
				DS	2.00	2	3	4	7	Loose	
95.50	BROWN CLAY SAND		4.50	DS	3.00	3	4	4	8	Loose	
				DS	4.50	50/9 REBOUND				Very dense	
93.30	WEATHERED ROCK		2.20	DS	6.00	50/3 REBOUND				Very dense	
				DS	6.70	50/1 REBOUND				Very dense	

Bore Hole terminated at 95.5 m RL

*Description of soil may vary. It is only site observation. Please refer laboratory test for soil classification

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BORE LOG

Name of Project :	PROPOSED CONSTRUCTION OF STILT FLOOR + 5 FLOOR (HEIGHT 18.3M) RESIDENTIAL BUILDING WITH 10 DWELLING UNITS AT DOOR NO 3/75-A, ASHOK NAGAR IST AVENUE, CHENNAI-60083

BH No	3	RL of the existing GL #	100.00 m	Ground water level	1.80 m below GL
Date of commencement		06-10-2023		Type of Drilling	Rotary
Date of completion		06-10-2023		Dia of Bore hole	100 mm

Depth from RL (m)	Description of soil stratum (SITE OBSERFATION)*	Soil profile	Thickness of layer	SAMPLE UDS/DS	Standard Penetrometer Test: Depth	Number of blows: I	II	III	N	Relative density / consistency	Graphical representation of penetration resistance (0 10 20 30 40 50 60 70 80 90 100)
100.00	Existing ground level										
99.50	FILLUP SOIL 0.50										
95.50	BROWN CLAY SAND		4.50	DS	1.00	2	3	3	6	Loose	
				DS	2.00	2	3	4	7	Loose	
				DS	3.00	3	4	4	8	Loose	
				DS	4.50	50/10 CM REBOUND				Very dense	
93.20	WEATHERED ROCK		2.30	DS	6.00	50/4 CM REBOUND				Very dense	
				DS	6.80	50/1 CM REBOUND				Very dense	

Bore Hole terminated at 93.2 m RL

*Description of soil may vary. It is only site observation. Please refer laboratory test for soil classification

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BORE LOG

Name of Project :	PROPOSED CONSTRUCTION OF STILT FLOOR + 5 FLOOR (HEIGHT 18.3M) RESIDENTIAL BUILDING WITH 10 DWELLING UNITS AT DOOR NO 3/75-A, ASHOK NAGAR IST AVENUE, CHENNAI-60083

BH No	4	RL of the existing GL #	100.00 m	Ground water level	2.00 m below GL	
Date of commencement		04-05-2024		Type of Drilling	Rotary	
Date of completion		04-05-2024		Dia of Bore hole	100 mm	

Depth from RL (m)	Description of soil stratum (SITE OBSERFATION)*	Soil profile	Thickness of layer	SAMPLE UDS/DS	Standard Penetrometer Test: Depth	Number of blows I	II	III	N	Relative density / consistency	Graphical representation of penetration resistance (0 10 20 30 40 50 60 70 80 90 100)
100.00	Existing ground level										
99.50	FILLUP SOIL 0.50		3.30								
96.70	BROWN CLAY SAND			DS	1.00	2	4	4	8	Loose	
				DS	2.00	5	5	6	11	Medium	
				DS	3.00	6	7	7	14	Medium	
95.20	GRAVEL		1.50	DS	4.50	50/13 CM REBOUND				Very dense	
93.70	SDR		1.50	DS	5.50	50/15 CM REBOUND				Very dense	

Bore Hole terminated at 92.7 m RL

*Description of soil may vary. It is only site observation. Please refer laboratory test for soil classification

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Bearing capacity calculations based on IS:6403-1981

NAME OF WORK:- PROPOSED CONSTRUCTION OF STILT FLOOR + 5 FLOOR (HEIGHT 18.3M) RESIDENTIAL BUILDING WITH 10 DWELLING UNITS AT DOOR NO 3/75-A, ASHOK NAGAR IST AVENUE, CHENNAI-60083

Location : **Bore 1**

Data input for calculations :

Depth of footing (D)	m	**1.00**	**2.00**	**3.00**	**4.50**	**6.00**	**7.00**
Width of footing (B)	m	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**
Length(L)	m	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**
Water table correction							
Maximum depth of water level below ground	m	1.80	1.80	1.80	1.80	1.80	1.80
RW1 = 0.5(1+(ZW1/D)	Z_{W1}= depth of maximum water	1.00	0.95	0.80	0.70	0.65	0.63
RW2 = 0.5(1+(ZW2/B)	Z_{W2}= depth of water below ba	0.77	0.50	0.50	0.50	0.50	0.50
Dry density	T/m^2	1.60	1.68	1.78	1.83	2.15	2.21
Submerged density if layer is submergible in water		1.60	1.60	1.42	1.28	1.40	1.39
Overburden Correction for N							
N Recorded		6	7	11	22	60	70
Overburden pressure	T/m^2	1.60	3.19	4.27	5.76	8.39	9.72
N corrected for Over burden pressure	N'	14.4	12.0	15.8	25.8	58.2	65.7
N' corrected for Dilatancy							
15+((N'-15)*0.5)	N" =	6.0	7.0	11.0	18.5	37.5	42.5
Adopted "N"		**10.19**	**9.50**	**13.40**	**22.16**	**50.00**	**50.00**
Angle of Internal friction		30	30	31	34	40	40
Cohesion		0.4	0.4	0.8	1.5	0.0	0.0
Bearing capacity fac	N_c	30.14	30.14	33.34	42.92	75.31	75.31
	N_q	18.40	18.40	21.38	30.32	64.20	64.20
	N_r	22.40	22.40	27.53	42.90	109.41	109.41
Shape of footing		Square	Square	Square	Square	Square	Square
Shape factor	Sc	1.30	1.30	1.30	1.30	1.30	1.30
	Sq	1.20	1.20	1.20	1.20	1.20	1.20
	Sr	0.80	0.80	0.80	0.80	0.80	0.80
Depth factor	Dc	1.40	1.80	2.25	3.12	4.68	5.29
	Dq & Dr	1.20	1.40	1.62	2.06	2.84	3.15
Inclination factor		1.00	1.00	1.00	1.00	1.00	1.00
Allowable bearing pressure	T/m^2	11.21	6.61	10.57	19.48	47.78	47.78
Net safe bearing capacity with factor of safety 2	T/m^2	**5.6**	**3.3**	**5.29**	**9.7**	**23.9**	**23.89**

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Bearing capacity calculations based on IS:6403-1981

NAME OF WORK:- PROPOSED CONSTRUCTION OF STILT FLOOR + 5 FLOOR (HEIGHT 18.3M) RESIDENTIAL BUILDING WITH 10 DWELLING UNITS AT DOOR NO 3/75-A, ASHOK NAGAR IST AVENUE, CHENNAI-60083

Location : **Bore 2**

Data input for calculations :							
Depth of footing (D)	m	**1.00**	**2.00**	**3.00**	**4.50**	**6.00**	**6.70**
Width of footing (B)	m	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**
Length(L)	m	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**
Water table correction							
Maximum depth of water level below ground	m	1.80	1.80	1.80	1.80	1.80	1.80
RW1 = 0.5(1+(ZW1/D)	Z_{w1}= depth of maximum water	1.00	0.95	0.80	0.70	0.65	0.63
RW2 = 0.5(1+(ZW2/B)	Z_{w2}= depth of water below ba	0.77	0.50	0.50	0.50	0.50	0.50
Dry density	T/m^2	1.52	1.68	1.74	2.08	2.18	2.24
Submerged density if layer is submergible in water		1.52	1.60	1.39	1.46	1.42	1.42
Overburden Correction for N							
N Recorded		5	7	8	50	65	75
Overburden pressure	T/m^2	1.52	3.19	4.18	6.55	8.50	9.52
N corrected for Over burden pressure	N'	12.2	12.0	11.6	53.5	62.9	70.8
N' corrected for Dilatancy							
15+((N'-15)*0.5)	N" =	5.0	7.0	8.0	32.5	40.0	45.0
Adopted "N"		**8.61**	**9.50**	**9.82**	**50.00**	**50.00**	**50.00**
Angle of Internal friction		30	30	30	40	40	40
Cohesion		0.4	0.4	0.8	5.0	0.0	0.0
Bearing capacity fac	N_c	30.14	30.14	30.14	75.31	75.31	75.31
	N_q	18.40	18.40	18.40	64.20	64.20	64.20
	N_r	22.40	22.40	22.40	109.41	109.41	109.41
Shape of footing		Square	Square	Square	Square	Square	Square
Shape factor	Sc	1.30	1.30	1.30	1.30	1.30	1.30
	Sq	1.20	1.20	1.20	1.20	1.20	1.20
	Sr	0.80	0.80	0.80	0.80	0.80	0.80
Depth factor	Dc	1.40	1.80	2.20	3.76	4.68	5.11
	Dq & Dr	1.20	1.40	1.60	2.38	2.84	3.05
Inclination factor		1.00	1.00	1.00	1.00	1.00	1.00
Allowable bearing pressure	T/m^2	8.75	6.61	6.94	47.78	47.78	47.78
Net safe bearing capacity with factor of safety 2	T/m^2	**4.4**	**3.3**	**3.47**	**23.9**	**23.9**	**23.89**

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Bearing capacity calculations based on IS:6403-1981

NAME OF WORK:- PROPOSED CONSTRUCTION OF STILT FLOOR + 5 FLOOR (HEIGHT 18.3M) RESIDENTIAL BUILDING WITH 10 DWELLING UNITS AT DOOR NO 3/75-A, ASHOK NAGAR IST AVENUE, CHENNAI-60083

Location : **Bore 3**

Data input for calculations :

Depth of footing (D)	m	**1.00**	**2.00**	**3.00**	**4.50**	**6.00**	**6.80**
Width of footing (B)	m	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**
Length(L)	m	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**
Water table correction							
Maximum depth of water level below ground	m	1.80	1.80	1.80	1.80	1.80	1.80
RW1 = 0.5(1+(ZW1/D) Z_{W1}= depth of maximum water		1.00	0.95	0.80	0.70	0.65	0.63
RW2 = 0.5(1+(ZW2/B) Z_{W2}= depth of water below ba		0.77	0.50	0.50	0.50	0.50	0.50
Dry density	T/m^2	1.60	1.68	1.74	2.08	2.15	2.24
Submerged density if layer is submergible in water		1.60	1.60	1.39	1.46	1.40	1.42
Overburden Correction for N							
N Recorded		6	7	8	50	60	75
Overburden pressure	T/m^2	1.60	3.19	4.18	6.55	8.39	9.63
N corrected for Over burden pressure	**N'**	14.4	12.0	11.6	53.5	58.2	70.6
N' corrected for Dilatancy							
15+((N'-15)*0.5)	**N" =**	6.0	7.0	8.0	32.5	37.5	45.0
Adopted "N"		**10.19**	**9.50**	**9.82**	**50.00**	**50.00**	**50.00**
Angle of Internal friction		30	30	30	40	40	40
Cohesion		0.4	0.4	0.8	5.0	5.0	5.0
Bearing capacity fac	N_c	30.14	30.14	30.14	75.31	75.31	75.31
	N_q	18.40	18.40	18.40	64.20	64.20	64.20
	N_r	22.40	22.40	22.40	109.41	109.41	109.41
Shape of footing		Square	Square	Square	Square	Square	Square
Shape factor	Sc	1.30	1.30	1.30	1.30	1.30	1.30
	Sq	1.20	1.20	1.20	1.20	1.20	1.20
	Sr	0.80	0.80	0.80	0.80	0.80	0.80
Depth factor	Dc	1.40	1.80	2.20	3.76	4.68	5.17
	Dq & Dr	1.20	1.40	1.60	2.38	2.84	3.08
Inclination factor		1.00	1.00	1.00	1.00	1.00	1.00
Allowable bearing pressure	T/m^2	11.21	6.61	6.94	47.78	47.78	47.78
Net safe bearing capacity with factor of safety 2	T/m^2	**5.6**	**3.3**	**3.47**	**23.9**	**23.9**	**23.89**

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Bearing capacity calculations based on IS:6403-1981

NAME OF WORK:- PROPOSED CONSTRUCTION OF STILT FLOOR + 5 FLOOR (HEIGHT 18.3M) RESIDENTIAL BUILDING WITH 10 DWELLING UNITS AT DOOR NO 3/75-A, ASHOK NAGAR IST AVENUE, CHENNAI-60083

Location : **Bore 4**

Data input for calculations :						
Depth of footing (D)	m	**1.00**	**2.00**	**3.00**	**4.50**	**5.50**
Width of footing (B)	m	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**
Length(L)	m	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**
Water table correction						
Maximum depth of water level below ground	m	2.00	2.00	2.00	2.00	2.00
RW1 = 0.5(1+(ZW1/D) Z_{W1}= depth of maximum water		1.00	1.00	0.83	0.72	0.68
RW2 = 0.5(1+(ZW2/B) Z_{W2}= depth of water below ba		0.83	0.50	0.50	0.50	0.50
Dry density	T/m^2	1.74	1.78	1.80	2.11	2.15
Submerged density if layer is submergible in water		1.74	1.78	1.50	1.52	1.47
Overburden Correction for N						
N Recorded		8	11	14	55	60
Overburden pressure	T/m^2	1.74	3.56	4.50	6.86	8.06
N corrected for Over burden pressure	**N'**	18.5	17.7	19.4	56.9	58.7
N' corrected for Dilatancy						
15+((N'-15)*0.5)	**N" =**	8.0	11.0	14.0	35.0	37.5
Adopted "N"		**13.26**	**14.34**	**16.72**	**50.00**	**50.00**
Angle of Internal friction		31	31	32	40	40
Cohesion		0.8	0.8	0.8	0.0	0.0
Bearing capacity fac	N_c	33.34	33.34	36.53	75.31	75.31
	N_q	21.38	21.38	24.36	64.20	64.20
	N_r	27.53	27.53	32.65	109.41	109.41
Shape of footing		Square	Square	Square	Square	Square
Shape factor	Sc	1.30	1.30	1.30	1.30	1.30
	Sq	1.20	1.20	1.20	1.20	1.20
	Sr	0.80	0.80	0.80	0.80	0.80
Depth factor	Dc	1.42	1.83	2.30	3.76	4.37
	Dq & Dr	1.21	1.42	1.65	2.38	2.69
Inclination factor		1.00	1.00	1.00	1.00	1.00
Allowable bearing pressure	T/m^2	17.39	11.53	13.95	47.78	47.78
Net safe bearing capacity with factor of safety 2	T/m^2	**8.7**	**5.8**	**6.97**	**23.9**	**23.9**

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LABORATORY TEST RESULTS OF SOIL

Name of Work : PROPOSED CONSTRUCTION OF STILT FLOOR + 5 FLOOR (HEIGHT 18.3M) RESIDENTIAL BUILDING WITH 10 DWELLING UNITS AT DOOR NO 3/75-A, ASHOK NAGAR IST AVENUE, CHENNAI-60083

BH :1

Date : 11/10/2023

Sample number	DEPTH IN "M"	Type of Soil	Sieve Analysis % Passing				Sand Content	Atterberg Limits			IS Classification
			4.75 mm	2.36 mm	0.425 mm	0.075 mm		LL	PL	PI	
1	1.0	Sandy Clay	100.0	100.0	99.0	54.6	45.4	42	24	18	CI
2	2.0	Sandy Clay	100.0	100.0	98.7	82.3	17.7	62	18	44	CH
3	3.0	Clayey Sand	99.4	98.8	81.7	34.1	65.3	31	21	10	SC
4	4.5	Clayey Sand	99.1	96.9	57.8	25.4	73.7	27	20	7	SC-SM
5	6.0	SDR	100.0	97.3	38.7	6.1	93.9	NON PLASTIC			SP-SM
6	7.0	SOFT ROCK	93.5	68.1	3.3	1.4	92.0	NON PLASTIC			SP

M. Gilbert Raj

LAB INCHARGE

GAIA GEOSCIENCE INDIA PVT. LTD. CHENNAI 600 015

MATERIAL ENGINEER

LABORATORY TEST RESULTS OF SOIL

Name of Work : PROPOSED CONSTRUCTION OF STILT FLOOR + 5 FLOOR (HEIGHT 18.3M) RESIDENTIAL BUILDING WITH 10 DWELLING UNITS AT DOOR NO 3/75-A, ASHOK NAGAR IST AVENUE, CHENNAI-60083

BH :2

Date : 11/10/2023

Sample number	DEPTH IN "M"	Type of Soil	Sieve Analysis % Passing				Sand Content	Atterberg Limits			IS Classification
			4.75 mm	2.36 mm	0.425 mm	0.075 mm		LL	PL	PI	
1	1.0	Sandy Clay	98.8	98.6	96.8	70.0	28.8	53	23	30	CH
2	2.0	Silty Clay	100.0	100.0	97.9	87.5	12.5	62	17	45	CH
3	3.0	Sandy Clay	100.0	99.4	98.4	78.7	21.3	59	20	39	CH
4	4.5	Clayey Sand	98.5	89.9	48.3	24.9	73.6	27	20	7	SC-SM
5	6.0	SDR	99.6	77.7	4.1	1.5	98.1	NON PLASTIC			SP
6	7.0	SOFT ROCK	96.5	74.5	5.6	1.6	94.9	NON PLASTIC			SP

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MATERIAL ENGINEER

LABORATORY TEST RESULTS OF SOIL

Name of Work : PROPOSED CONSTRUCTION OF STILT FLOOR + 5 FLOOR (HEIGHT 18.3M) RESIDENTIAL BUILDING WITH 10 DWELLING UNITS AT DOOR NO 3/75-A, ASHOK NAGAR IST AVENUE, CHENNAI-60083

BH :3

Date : 11/10/2023

Sample number	DEPTH IN "M"	Type of Soil	Sieve Analysis % Passing				Sand Content	Atterberg Limits			IS Classification
			4.75 mm	2.36 mm	0.425 mm	0.075 mm		LL	PL	PI	
1	1.0	Sandy Clay	100.0	99.7	95.4	82.5	17.5	62	18	44	CH
2	2.0	Sandy Clay	100.0	99.5	94.0	83.3	16.7	63	18	45	CH
3	3.0	Sandy Clay	100.0	99.7	97.0	76.0	24.0	57	21	36	CH
4	4.5	Clayey Sand	99.1	95.4	61.2	29.7	69.4	29	20	9	SC
5	6.0	SDR	94.2	62.7	2.9	1.7	92.5	NON PLASTIC			SP
6	7.0	SOFT ROCK	91.7	56.4	2.7	1.5	90.2	NON PLASTIC			SP

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LABORATORY TEST RESULTS OF SOIL

Name of Work : PROPOSED CONSTRUCTION OF STILT FLOOR + 5 FLOOR (HEIGHT 18.3M) RESIDENTIAL BUILDING WITH 10 DWELLING UNITS AT DOOR NO 3/75-A, ASHOK NAGAR IST AVENUE, CHENNAI-60083

BH :4

Date : 08-05-2024

Sample number	DEPTH IN "M"	Type of Soil	Sieve Analysis % Passing				Sand Content	Atterberg Limits			IS Classification
			4.75 mm	2.36 mm	0.425 mm	0.075 mm		LL	PL	PI	
1	1	Sandy Clay	100.0	98.5	96.0	83.7	16.3	63	17	46	CH
2	2	Silty Clay	100.0	100.0	99.4	95.7	4.3	64	19	45	CH
3	3	Silty Clay	100.0	100.0	98.2	87.9	12.1	64	20	44	CH
4	4.5	Silty Sand	94.2	62.8	3.8	1.7	92.6	NON PLASTIC			SP
5	5.5	SDR	94.4	62.6	3.5	1.5	92.9	NON PLASTIC			SP

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MATERIAL ENGINEER

PROPOSED CONSTRUCTION OF STILT FLOOR + 5 FLOOR (HEIGHT 18.3M) RESIDENTIAL BUILDING WITH 10 DWELLING UNITS AT DOOR NO 3/75-A, ASHOK NAGAR IST AVENUE, CHENNAI-60083

PILE LOAD CAPACITY CUT OF LENGTH 7.0M	
DIA	CAPACITY KN
300 MM	244
450 MM	469
600MM	752

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PROPOSED CONSTRUCTION OF STILT FLOOR + 5 FLOOR (HEIGHT 18.3M) RESIDENTIAL BUILDING WITH 10 DWELLING UNITS AT DOOR NO 3/75-A, ASHOK NAGAR IST AVENUE, CHENNAI-60083

300 mm dia Pile

Soil Details

γ	18.4	kN/m³	Unit weight of soil (gamma)
c' (or su)	17	kN/m²	For undrained soils use phi' = 0
ϕ	35	deg	Angle of friction (phi')
α	0.5		Adhesion Factor
Ks	0.4		Coefficient of Earth Pressure
δ	18	deg	Angle of friction between pile and soil
Water Table	1.8	m	Depth to Water Table

Pile Details

Shape	ci Circular		sq=Square, ci=Circular
Diameter	0.3	m	Diameter of pile
Toe Depth	7	m	Depth to base of pile
Load	244	kN	Applied load - includes weight of pile

Safety Factors

Base	2	Shaft	2

Results

7m long Circular pile
0.3m diameter
Drained Analysis

Base Resistance
337.8 kN
Shaft Resistance
151.1 kN
Total ultimate resistance
489.0 kN (Base + Shaft)

Allowable Load
244 kN

Overall factor of safety
2.00
OK
Actual Load <=Allowable
Pile Volume
0.49 m³

300 mm dia Pile	
CUT OF LENGTH	7
PILE CAPACITY	244 KN

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PROPOSED CONSTRUCTION OF STILT FLOOR + 5 FLOOR (HEIGHT 18.3M) RESIDENTIAL BUILDING WITH 10 DWELLING UNITS AT DOOR NO 3/75-A, ASHOK NAGAR IST AVENUE, CHENNAI-60083

450 mm dia

Soil Details

γ	18.4 kN/m³	Unit weight of soil (gamma)
c' (or su)	17 kN/m²	For undrained soils use phi' = 0
ϕ	35 deg	Angle of friction (phi')
α	0.5	Adhesion Factor
Ks	0.4	Coefficient of Earth Pressure
δ	18 deg	Angle of friction between pile and soil
Water Table	1.8 m	Depth to Water Table

Pile Details

Shape	ci Circular	sq=Square, ci=Circular
Diameter	0.45 m	Diameter of pile
Toe Depth	7 m	Depth to base of pile
Load	469 kN	Applied load - includes weight of pile

Safety Factors

Base	2	Shaft	2

Results

7m long Circular pile
0.45m diameter
Drained Analysis

Base Resistance
712.0 kN
Shaft Resistance
226.7 kN
Total ultimate resistance
938.7 kN (Base + Shaft)

Allowable Load
469.4 kN

Overall factor of safety
2.00

OK
Actual Load <=Allowable
Pile Volume
1.11 m³

450 mm dia	
CUT OF LENGTH	7
PILE CAPACITY	469 KN

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PROPOSED CONSTRUCTION OF STILT FLOOR + 5 FLOOR (HEIGHT 18.3M) RESIDENTIAL BUILDING WITH 10 DWELLING UNITS AT DOOR NO 3/75-A, ASHOK NAGAR IST AVENUE, CHENNAI-60083

600 mm dia Pile

Soil Details

γ	18.4	kN/m³	Unit weight of soil (gamma)
c' (or su)	17	kN/m²	For undrained soils use phi' = 0
ϕ	35	deg	Angle of friction (phi')
α	0.5		Adhesion Factor
Ks	0.4		Coefficient of Earth Pressure
δ	18	deg	Angle of friction between pile and soil
Water Table	1.8	m	Depth to Water Table

Pile Details

Shape	ci		sq=Square, ci=Circular
	Circular		
Diameter	0.6	m	Diameter of pile
Toe Depth	7	m	Depth to base of pile
Load	752	kN	Applied load - includes weight of pile

Safety Factors

Base	2	Shaft	2

Results

7m long Circular pile
0.6m diameter
Drained Analysis

Base Resistance
1202.9 kN
Shaft Resistance
302.3 kN
Total ultimate resistance
1505.1 kN (Base + Shaft)

Allowable Load
753 kN

Overall factor of safety
2.00
OK
Actual Load <=Allowable
Pile Volume
1.98 m³

600 mm dia Pile	
CUT OF LENGTH	7
PILE CAPACITY	752 KN

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