GEOTECHNICAL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING AT 2ND CROSS, PAVANI LAYOUT, NEAR BYANAPALYA, VAJARAHALLI, BANGALORE

Report for

Mr M Basavaraju

2nd Cross, Pavani Layout, near Byanapalya,

Vajarahalli, Bangalore

Location: Vajarahalli

Date: 08/02/2024

Report No – RGEOMA009

GEOCEST LABORATORIES

ISO 9001:2015 CERTIFIED LABORATORY
AS PER ISO/IEC – 17025:2017
No. 004, KAVERI SHELTERS, 3RD CROSS, SAI LOTUS LAYOUT
RR NAGARA, BANGALORE

In Association with

MERIDIAN SURVEY

Geotechnical Investigation for the Proposed Construction of Residential Building at 2nd Cross, Pavani Layout, near Byanapalya, Vajarahalli, Bangalore

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1 INTRODUCTION:

Geocest laboratories in association with **Meridian Survey** were commissioned for carrying out Soil Investigation for the Proposed Construction of Residential Building at Vajarahalli, Bangalore by the Client **Mr M Basavaraju**. The work involved field study of the soil condition, drilling, sample collection, testing of the samples in laboratory, examination and interpretation of the data thus collected. This report presents the results of the investigation along with an assessment of the soil type, its bearing capacity, its physical behavior etc. and guidelines regarding the proposed foundation.

2 LOCATION OF PROJECT SITE:

The Proposed Construction of Residential Building is located at 2nd Cross, Pavani Layout, near Byanapalya, Vajarahalli, Bangalore. The investigation was carried out at two locations as shown by the client.

3 FIELD METHODOLOGY

3.1 Soil Investigation:

Sinking of the boreholes were carried out by employing auger technique using a Manual Auger. The boreholes were drilled up to 3.0m depth from the existing ground level (EGL). Disturbed samples were collected from the borehole in split spoon sampler during drilling at appropriate depths and logged. After completion of the drilling boreholes kept under observation for ground water monitoring for 24 hours after which they were backfilled.

3.2 Standard Penetration Test:

The Standard Penetration Tests was conducted at regular intervals in the boreholes to determine penetration resistance as per IS 2131-1981. The no. of blows was recorded at every 15-cm penetration up to 45 cm penetrations. The number of blows required to drive the sampler for 30 cm beyond seating drive is termed as penetration resistance ‘N’. Refusal is said to have been reached when the sampler penetrates less than 15 cm under 50 blows. The

Standard Penetration Tests (SPT) was conducted at the boreholes using the split spoon sampler as per IS-2131-1981 at various depths to determine the 'N' value of the soil.

4 LABORATORY TESTING:

Disturbed samples of the formation were collected from the boreholes in split spoon sampler and Core Samples by using casing tubes during drilling. These samples and the return water sludge were visually examined, logged and preserved for future reference. The sampling data were utilized for reconstruction of the boreholes.

The following laboratory tests were conducted on the soil samples collected from boreholes:

a. Grain size analysis
b. Atterberg Limits

5 INSITU CONDTITIONS:

5.1 Surface Condition:

The surface topography of the plot consists of slightly undulated ground and is covered by silty SAND. The plot is devoid of any vegetation during investigation.

5.2 Sub-Surface Condition:

Full details of the strata encountered are given in the borehole logs. The subsurface profile and lithology encountered in the boreholes show minor lateral variation. The subsurface conditions as revealed by the investigation are summarized below.

The top layer consists of filled up soil followed by Reddish Brown medium dense to dense and becoming Very dense Silty SAND with occasional fine Gravel up to 3.0m depth explored.

6 GROUND WATER CONDITION:

Ground water was not encountered at this site during the time of conducting the field investigation. Ground water was not observed at the time of investigation. Thus, the ground water conditions established is applicable for the time of investigation only. The ground water condition is subjected to climatic changes and any changes in the surrounding area. Reconfirmation of groundwater level is recommended prior to any work relating to the groundwater regime.

7 CALCULATION OF SAFE BEARING CAPACITY:

OPEN FOUNDATIONS - BASIS OF APPROACH

Based on sub-soil profile noticed, open foundations have been considered for various structures. IS-6403 approach has been adopted idealizing the stratum as sandy soil.

A. SBC calculations for Isolated Footing

Safe Bearing Capacity (SBC) is calculated by using procedure described in IS: 6403-2002. Ultimate bearing capacity is given by,

$$\mathbf{Q_u = c\ N_c\ s_c\ d_c\ i_c + \gamma\ D\ (N_q\ -1)\ s_q\ d_q\ i_q + 0.5\ \gamma\ B\ N_\gamma\ s_\gamma\ d_\gamma\ i_\gamma\ w'}$$

Where, Q_u	=	Ultimate net bearing capacity
c	=	Cohesion of stratum-Ignored
γ	=	Bulk Density
D	=	depth of footing = Minimum 1.5m
B	=	Width of footing considered
N_c, N_q and N_γ	=	Bearing capacity factors
s_c, s_q and s_γ	=	Shape factors, d_c, d_q and d_γ = Depth factors
i_c, i_q and i_γ	=	Inclination factors,
w'	=	Water table correction
ϕ	=	Angle of internal friction

General shear failure condition to occur

B. SETTLEMENT CRITERIA (IS-8009 (Part-I) Approach)

The magnitude of settlement, when foundation loads are applied, depends upon the compressibility of the underlying strata and rigidity of the substructure. The safe bearing pressure is evaluated for Total settlement 50 mm for rectangle footing as per table 1 of IS : 1904.

8 RECOMMENDATIONS:

The recommended allowable bearing pressure considering isolated footings, at different foundations depths for allowable settlement of 50mm from existing ground level are as given below.

Isolated Pad Footing:

Sr No	Depth of Foundation from lowest existing ground level (m)	Allowable Bearing Pressure (T/M^2)
1	2.0	20
2	2.5	24

The foundation excavation up to the recommended depth is possible by mechanical means. Care should be taken to ensure that the foundation soil is not disturbed during excavation. No loose portion may be left on the excavated floor at founding depth. The excavated floor may not be left open to nature for long and it may be well compacted before the foundation concrete is laid. All the filled up and loose materials shall be removed and compacted well before placing any foundation concrete.

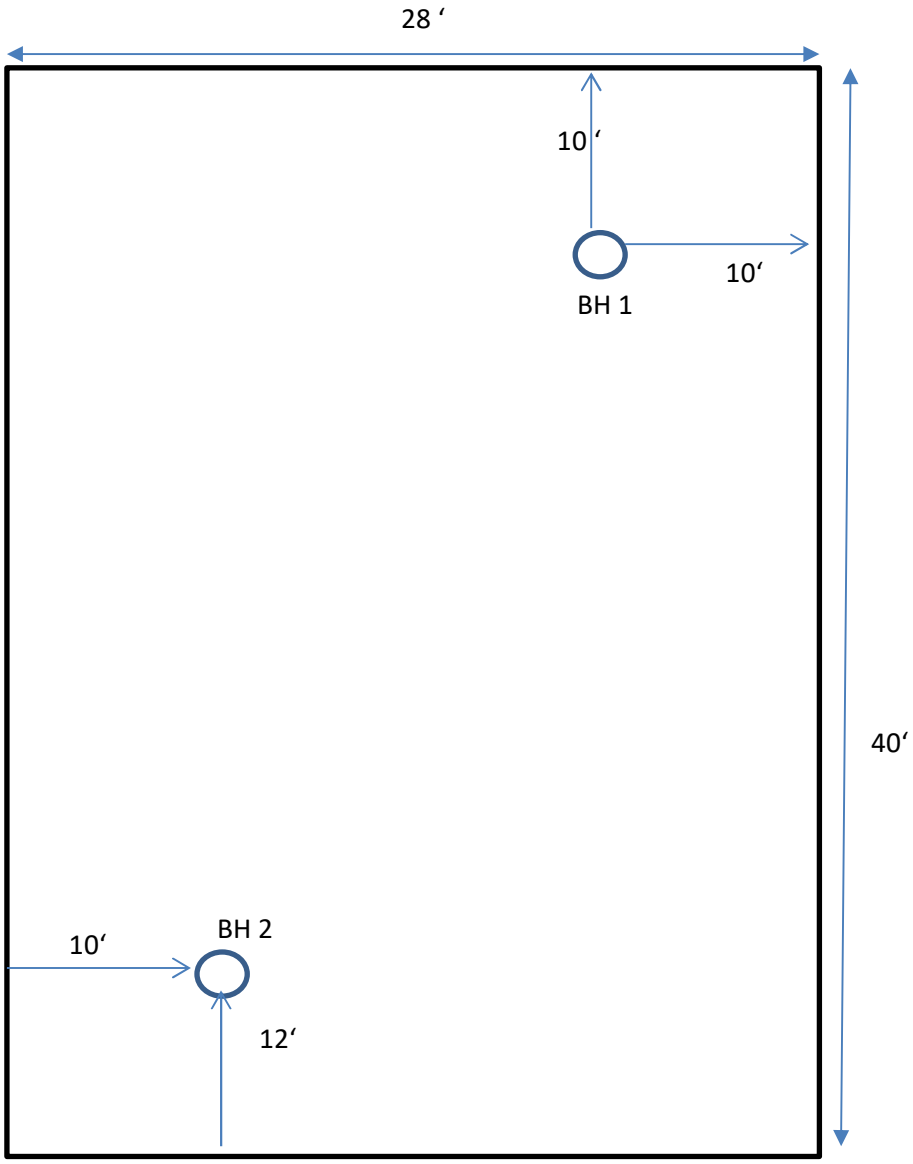
9 DISCLAIMER:

The scope of Geotechnical investigation was limited only to the purpose of evaluating the nature & type of sub-soil strata, foundation design parameters, type and depth of sub-structure foundations and was carried out at the clients identified locations. The recommendations are based on limited field and laboratory tests carried out. When actual excavations are carried out for the construction of the structure, if any substantial change in the strata is noticed, same should be brought to the notice of Geocest laboratories, if found necessary, recommendations and appropriate modifications shall be suggested.

For
Geocest Laboratories

APPENDIX A

SITE LAYOUT PLAN



Site Layout Plan

Project: Geotechnical Investigation for the Proposed Construction of Residential Building at 2nd Cross, Pavani Layout, near Byanapalya, Vajarahalli, Bangalore

APPENDIX B

BORELOGS

GEOCEST LABORATORIES

BORE LOG

Project: Geotechnical Investigation for the Proposed Construction of Residential Building at 2nd Cross, Pavani Layout, near Byanapalya, Vajarahalli, Bangalore

Date of commencement: 07/02/2024

Date of completion: 07/02/2024

Client Mr M Basavaraju

Ground water table: NIL

BH No. 1

Reduced Level -

Location: Vajarahalli

Method: Manual Auger

Northing:

Easting:

Depth below GL (m)	Soil description	Thickness of strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0										
	Filled Up									
1.0		1.5		DS						
2.0	Reddish Brown very dense Silty SAND with occasional Fine Gravel									
3.0		1.5		SPT	3.0	25/30/50R				
						N>50				
4.0										
5.0										
6.0										
7.0										
8.0										
9.0										
10.0										

BH was terminated at 3.0m depth from Existing ground level.

Note :

SPT - Standard penetration test

R - Rebound

C- Core

UDS - Undisturbed sample

* - Sample not retrieved

GEOCEST LABORATORIES

BORE LOG

Project: Geotechnical Investigation for the Proposed Construction of Residential Building at 2nd Cross, Pavani Layout, near Byanapalya, Vajarahalli, Bangalore

Date of commencement: 07/02/2024

Date of completion: 07/02/2024

Client Mr M Basavaraju

Ground water table: NIL

BH No. 2

Reduced Level -

Location: Vajarahalli

Method: Manual Auger

Northing:

Easting:

Depth below GL (m)	Soil description	Thickness of strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0										
1.0	Filled Up									
2.0		2.0		SPT	1.50	5/9/11				
	Reddish Brown very dense Silty SAND with occasional Fine Gravel					N=20				
3.0		1.0		SPT	3.0	27/35/50R				
						N>50				
4.0										
5.0										
6.0										
7.0										
8.0										
9.0										
10.0										

BH was terminated at 3.0m depth from Existing ground level.

Note :

SPT - Standard penetration test

R - Rebound

C- Core

UDS - Undisturbed sample

* - Sample not retrieved

APPENDIX C

LABORATORY TEST RESULTS

Laboratory Test Results on Soil Samples

BH No	Depth (m)	Grain Size Distribution (%)			Atterberg Limits (%)		
		Gravel	Sand	Silt & Clay	Liquid Limit	Plastic Limit	Plasticity Index
BH – 01	1.5	0	65	35	29	20	9
	3.0	2	67	31	-	-	-
BH – 02	3.0	1	65	34	30	20	10

Specimen SBC and Settlement Calculations : for Depth 2.0m from existing ground level

Terzaghi's Bearing Capacity Factors :

ϕ	Nc	Nq	Nγ
0	5.70	1.00	0.00
5	7.30	1.60	0.50
10	9.60	2.70	1.20
15	12.90	4.40	2.50
20	17.70	7.40	5.00
25	25.10	12.70	9.70
30	37.20	22.50	19.70
34	52.60	36.50	30.00
35	57.80	41.40	42.40
40	95.70	81.30	100.40
45	172.30	173.30	297.50
48	258.30	287.90	780.10
50	347.50	415.10	1153.20

Water Table Correction Factors:

Wq	Wr	
1.00	1.00	(No Water Table is Encountered)
0.50	0.50	(If Water Table touches the FL)

12.2.1. SAFE BEARING CAPACITY BASED ON TERZAGHI'S THEORY :

a) Calculation of Bearing Capacity Factors:

ϕ	Nc	Nq	Ng
23	22.14	10.58	7.82

Na= SPT = 20

b) Calculation of SBC : Over Burden Pr. = 0.34

UBC (kg/Sq.cms) = 1.3 CNc + γ*D*Wq*Nq +0.5 * γ *B*Wg *Nγ

c	ϕ	γ	B	L	D	Nc
0.01	23	0.0017	150	150	200	20
(Kg/Sq.cms)	(degrees)	(kg/Cu.cms)	(cms)	(cms)	(cms)	(Blows)

UBC(T/Sq.m)	SBC(T/sq.m)
48.82	19.53
(T/Sq.mts)	(T/Sq.mts)

12.2.3. ALLOWABLE SETTLEMENT AS PER IS 8009 -1982 BASED ON N VALUES :

For N=20 Blows B = 1.5 m Sett Factor = 0.015

Recommended SBC =20 T/Sq.m = 2.0 kg/Sq.cms 2.00

Allowable Settlement (mm) = 30.00 < 50 mm, Hence Safe

Hence the Foundation is safe against allowable settlement of 50mm with 20.00 T/sq.m SBC

12.2.2. SAFE BEARING CAPACITY AS PER IS 6403 -1982 :

ϕ	Nc	Nq	Ng
0	5.140	1.000	0.000
5	6.490	1.570	0.450
10	8.350	2.470	1.220
15	10.980	3.940	2.650
20	14.830	6.400	5.390
25	20.720	10.660	10.880
30	30.140	18.400	22.400
32	35.500	23.200	30.200
35	46.120	33.300	48.030
36	50.600	37.800	56.500
38	61.400	48.900	78.000
40	75.310	64.200	109.410
45	138.880	134.880	271.760
50	266.890	319.070	762.890

a) Bearing Capacity Factors (IS 6403):

ϕ	Nc	Nq	Nγ
23	18.364	8.96	8.68

b) Water Table Correction Factors:

Water Table is not Found

Wq	Wr
1.00	1.00

c) Depth Factors:

Dc = 1.403 Dq=Dg= 1.201

d) Shape Factors:

Sc = 1.30 for Square & circle

Sq = 1.20 for Square & circle

Sg = 0.80 for Square 0.6 for circle

e) Load Inclination Factors:

Ic = 1.00

Iq = 1.00

Ig = 1.00

Qult (T/Sq.m) = C Nc Sc Dc Ic +q (Nq-1) Sq Dq iq + 0.5 g B Ng DgSg Ig Wg

Qult (T/Sq.m) = 51.87

Factor of Safety = 2.5 Qsafe = (T/Sq.m) Qult/FS = 20.75

Minimum of the Above three SBC (T/Sq.m) = 19.53 19.50

Actual Recommended = 20.00 T/Sq.m