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NAME OF PROJECT

SOIL INVESTIGATION FOR THE PROPOSED (BASEMENT+STILT+9 FLOORS) STRUCTURE AT AMBATTUR, CHENNAI.

CLIENT

M/s. VOORA PROPERTY DEVELOPERS PVT LTD.,
'VOORA' 139, RADHAKRISHNAN SALAI,
MYLAPORE, CHENNAI – 600 004

GEOTECHNICAL CONSULTANT

GEO FOUNDATIONS & STRUCTURES PVT LTD.,
No.89, 1ST MAIN ROAD, GANDHI NAGAR,
ADYAR, CHENNAI - 600 020

PROJECT No.: 1742					
Rev. No.	Date	Description	Created by	Verified by	Approved by
DR/01	26.02.2024	DRAFT REPORT	NAMRITHA RAVI M.Sc (UK)	A. SURESH KUMAR, M. Tech - (Geotechnical)	DR. K. MUTHUKRISHNAIAH M. Tech., Ph.D.,
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CONTENTS

		Page No.
1	Introduction	1
2	Objective of investigation	1
3	Scope of work	1-2
4	Field investigations- Geo-technical studies	2-3
5	Laboratory Investigation	3
6	Soil Profile	4
7	Recommendations For Suitable Type of Foundations	4-7

APPENDIXES

APPENDIX - I	Borehole Locations Drawing	8-10
APPENDIX - II	Bore logs	11-19
APPENDIX - III	Laboratory Test Results	20-24

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GEO FOUNDATIONS & STRUCTURES PVT LTD

LABORATORY TEST RESULTS

Project : Soil Investigation for the Proposed (B+Stilt+9 Floors) Structure at Ambattur, Chennai.

Boring Start : 21.02.2024 | **Table No. 4**

Boring End : 22.02.2024 | **Bore-Hole No. 4**

Location | **G.W.T: 2 m**

Ambattur, Chennai. | **Termination Depth: 18.5 m**

Site Recorded N Value	Corrected N Value	DEPTH FROM E.G.L (m)	SAMPLE	SOIL DESCRIPTION	IS. CLASSIFICATION	GRAIN SIZE ANALYSIS			ATTERBERG LIMITS				DRY DENSITY, gm/cc	WET DENSITY, gm/cc	WATER CONTENT, %	SPECIFIC GRAVITY	FREE SWELL INDEX, %	SHEAR PARAMETERS		
						GRAVEL, %	SAND, %	SILT & CLAY %	LIQUID LIMIT,%	PLASTIC LIMIT,%	PLASTICITY INDEX	SHRINKAGE LIMIT, %						TEST METHOD	C In Kg/cm²	Φ In degrees
11	17	1.00	SPT-1	Clayey **SAND**	SC	0	56	44							20					
12	16	2.00	SPT-2	Silty **SAND**	SM	0	74	26							19					
8	8	3.00	SPT-3		CL	0	47	53	30	12	18				27					
-	-	3.50	UDS-1										1.61	1.96				TA	0.48	
15	15	4.00	SPT-4	Sandy **CLAY**	CL	0	34	66	28	16	12				31					
16	16	5.00	SPT-5		CI	0	35	65	38	16	22				31					
3	3	6.50	SPT-6		CI	1	35	64	34	18	16				27		35			
26	22	8.00	SPT-7		SP	0	94	6							13					
22	19	9.50	SPT-8	**SAND**	SP	0	92	8							14	2.66				
33	24	11.00	SPT-9		SP	0	93	7							14					
49	31	12.50	SPT-10	Silty **SAND**	SM	0	89	11							14					
68	40	14.00	SPT-11	**SAND**	SP	1	93	6							13					
>100	>100	15.50-15.74	SPT-12	**Weathered Rock**																
>100	>100	17.00-17.10	SPT-13																	
>100	>100	18.50-18.62	SPT-14																	

NOTE: Type of Sample
SPT- Standard Penetration Test
UDS- Un Disturbed Sample

Test Method:
UCS- UnConfined Compressive Strength
DS - Direct Shear
TA - Tri Axial test

GEO FOUNDATIONS & STRUCTURES PVT LTD

LABORATORY TEST RESULTS

Project : Soil Investigation for the Proposed (B+Stilt+9 Floors) Structure at Ambattur, Chennai.

Boring Start : 20.02.2024	Table No. 3
Boring End : 21.02.2024	Bore-Hole No. 3
Location	G.W.T: 2 m
Ambattur, Chennai.	Termination Depth: 18.5 m

Site Recorded N Value	Corrected N Value	DEPTH FROM E.G.L (m)	SAMPLE	SOIL DESCRIPTION	IS. CLASSIFICATION	GRAIN SIZE ANALYSIS			ATTERBERG LIMITS				DRY DENSITY, gm/cc	WET DENSITY, gm/cc	WATER CONTENT, %	SPECIFIC GRAVITY	FREE SWELL INDEX, %	SHEAR PARAMETERS		
						GRAVEL, %	SAND, %	SILT & CLAY %	LIQUID LIMIT,%	PLASTIC LIMIT,%	PLASTICITY INDEX	SHRINKAGE LIMIT, %						TEST METHOD	C in Kg/cm²	Φ in degrees
11	11	1.00	SPT-1	Sandy **CLAY**	CL	2	45	53	24	10	14				19					
5	5	2.00	SPT-2		CL	0	25	75	27	13	14				23					
7	7	3.00	SPT-3			1	27	72							23					
13	13	4.00	SPT-4		CI	1	39	60	36	15	21				21					
-	-	4.50	UDS-1															TA	0.41	
15	15	5.00	SPT-5		CI	0	33	67	39	14	25				24		45			
2	2	6.50	SPT-6		CI	0	47	53	47	23	24				27					
3	3	8.00	SPT-7		CI	0	40	60	46	26	20				29		50			
18	17	9.50	SPT-8	**SAND**	SP	2	96	2							15	2.64				
25	20	11.00	SPT-9		SP	2	96	2							13					
47	30	12.50	SPT-10		SP	0	88	12							15					
64	38	14.00	SPT-11		SP	0	89	11							17					
>100	>100	15.50-15.74	SPT-12	**Weathered Rock**																
>100	>100	17.00-17.11	SPT-13																	
>100	>100	18.50-18.63	SPT-14																	

NOTE: Type of Sample
SPT- Standard Penetration Test
UDS- Un Disturbed Sample

Test Method:
UCS- UnConfined Compressive Strength
DS - Direct Shear
TA - Tri Axial test

GEO FOUNDATIONS & STRUCTURES PVT LTD

LABORATORY TEST RESULTS

Project : Soil Investigation for the Proposed (B+Stilt+9 Floors) Structure at Ambattur, Chennai.

Boring Start : 19.02.2024 | **Table No. 2**

Boring End : 20.02.2024 | **Bore-Hole No. 2**

Location | **G.W.T: 2 m**

Ambattur, Chennai. | **Termination Depth: 18.5 m**

Site Recorded N Value	Corrected N Value	DEPTH FROM E.G.L (m)	SAMPLE	SOIL DESCRIPTION	IS. CLASSIFICATION	GRAIN SIZE ANALYSIS			ATTERBERG LIMITS				DRY DENSITY, gm/cc	WET DENSITY, gm/cc	WATER CONTENT, %	SPECIFIC GRAVITY	FREE SWELL INDEX, %	SHEAR PARAMETERS		
						GRAVEL, %	SAND, %	SILT & CLAY %	LIQUID LIMIT,%	PLASTIC LIMIT,%	PLASTICITY INDEX	SHRINKAGE LIMIT, %						TEST METHOD	C In Kg/cm²	Φ In degrees
15	15	1.00	SPT-1	Sandy **CLAY**	CL	0	46	54	27	14	13				20					
5	5	2.00	SPT-2		CL	0	27	73	29	16	13				23					
7	7	3.00	SPT-3		CL	0	39	61	25	13	12				23					
-	-	3.50	UDS-1															TA	0.40	
7	7	4.00	SPT-4		CL	0	30	70	28	17	11				28					
15	16	5.00	SPT-5	Silty **SAND**	SM	1	85	14							16					
13	13	6.50	SPT-6	**CLAY**	CI				36	20	16				31		40			
18	18	8.00	SPT-7												40					
25	21	9.50	SPT-8	Silty **SAND**	SM	0	84	16							16	2.63				
36	26	11.00	SPT-9		SM	1	85	14							17					
45	45	12.50	SPT-10	Gravelly Sandy **CLAY**	CI	10	20	70	39	21	18				27					
65	65	14.00	SPT-11	Sandy **CLAY**	CI	5	21	74	36	20	16				24					
>100	>100	15.50-15.73	SPT-12	Silty **CLAY**	CI				48	25	23				27					
>100	>100	17.00-17.10	SPT-13		CI				46	24	22									
>100	>100	18.50-18.62	SPT-14		CI										27					

NOTE: Type of Sample
SPT- Standard Penetration Test
UDS- Un Disturbed Sample

Test Method:
UCS- UnConfined Compressive Strength
DS - Direct Shear
TA - Tri Axial test

GEO FOUNDATIONS & STRUCTURES PVT LTD

LABORATORY TEST RESULTS

Project : Soil Investigation for the Proposed (B+Stilt+9 Floors) Structure at Ambattur, Chennai.

Boring Start : 17.02.2024	Table No. 1
Boring End : 18.02.2024	Bore-Hole No. 1
Location	G.W.T: 2.5 m
Ambattur, Chennai.	Termination Depth: 20 m

Site Recorded N Value	Corrected N Value	DEPTH FROM E.G.L (m)	SAMPLE	SOIL DESCRIPTION	IS. CLASSIFICATION	GRAIN SIZE ANALYSIS			ATTERBERG LIMITS				DRY DENSITY, gm/cc	WET DENSITY, gm/cc	WATER CONTENT, %	SPECIFIC GRAVITY	FREE SWELL INDEX, %	SHEAR PARAMETERS		
						GRAVEL, %	SAND, %	SILT & CLAY %	LIQUID LIMIT,%	PLASTIC LIMIT,%	PLASTICITY INDEX	SHRINKAGE LIMIT, %						TEST METHOD	C in Kg/cm²	Φ in degrees
13	13	1.00	SPT-1	Sandy **CLAY**	CL	0	23	77	29	16	13				19					
5	5	2.00	SPT-2		CL	0	21	79	32	16	16				27					
6	6	3.00	SPT-3		CL	0	39	61	26	15	11				19					
-	-	3.50	UDS-1										1.69	1.99				TA	0.40	
8	8	4.00	SPT-4		CL	0	23	77	33	18	15				30					
23	23	5.00	SPT-5		CL	0	28	72	28	16	12				27		30			
17	17	6.50	SPT-6	Silty **SAND**	SM	0	74	26							17					
11	11	8.00	SPT-7	Sandy **CLAY**	CL	0	41	59	25	15	10				24					
17	17	9.50	SPT-8		CL	0	23	77	28	14	14				31					
19	19	11.00	SPT-9		CL	0	28	72							29					
21	21	12.50	SPT-10		CI	0	26	74	39	17	22				26		50			
24	24	14.00	SPT-11		CI	1	10	89	43	20	23				36					
80	80	15.50	SPT-12		CI	13	18	69							28					
>100	>100	17.00-17.38	SPT-13		CH	0	17	83	55	31	24				30					
>100	>100	18.50-18.58	SPT-14		CH	0	10	90	58	33	25				27					
>100	>100	20.00-20.12	SPT-15																	

NOTE: Type of Sample
SPT- Standard Penetration Test
UDS- Un Disturbed Sample

Test Method:
UCS- UnConfined Compressive Strength
DS - Direct Shear
TA - Tri Axial test

APPENDIX-III

LABORATORY TEST RESULTS

Project : Soil Investigation for the Proposed (Basement+Stilt+9 Floors) Structure at Ambattur, Chennai.

GEO FOUNDATIONS & STRUCTURES PVT. LTD

Bore Hole No	: BH 4
Location	: Ambattur, Chennai
Type of Boring	: Calyx
Ground Water Level	: 2 m from E.G.L on 23.02.2024
UTM Co-ordinate	: 408996 N, 1447551 E
Termination Depth	: 18.5 m

Drilling Hole Record-BH 1

Fig No. 5

Reduced Level	:	
Start Date	:	21.02.2024
End Date	:	22.02.2024

SOIL DESCRIPTION	COLOUR	STRUCTURE	DEPTH BELOW GROUND LEVEL (m)	REDUCED LEVEL (m)	LEGEND	TEST NO	SAMPLE TYPE	DEPTH BELOW GROUND LEVEL (m)	TEST DEPTH	PENETRATION VALUES 15cm	30cm	45cm	SPT"N" Blows/300mm	SPT 'N' PROFILE	C.R (%)	R.Q.D(%)	REMARKS
Greyish, Dense, **SAND** (SP)			12.50			SPT-10	SS	12.50	12.50-12.95	12	22	27	49				
Silty **SAND** (SM)	Grey	Dense, Granular	14.00			SPT-11	SS	14.00	14.00-14.45	16	39	29	68				
SAND (SP)	Brown	Very Dense, Granular	15.50			SPT-12	SS	15.50	15.50-15.73	45	>50	-	>100				50/8 cm Penetration
Weathered Rock						SPT-13	SS	17.00	17.00-17.10	>50	-	-	>100				50/10 cm Penetration
			20.00			SPT-14	SS	18.50	18.50-18.62	>50	-	-	>100				50/12 cm Penetration

SPT 'N' PROFILE: 20, 40, 60, 80, 100

G.W.L: 2 m from E.G.L on 23.02.2024	No of SPT: 14 Nos.	No of UDS : 1 No.	No of CR : Nil.	Remarks
---	---	---	---	---

Note: SPT-Standard Peneration Test
SS-Split Spoon Sample
OT- Open Tube

UDS-Un Disturbed Sample
CS-Core Sample

CR-Core Recovery
RQD-Rock Quality Designation

Project : Soil Investigation for the Proposed (Basement+Stilt+9 Floors) Structure at Ambattur, Chennai.

GEO FOUNDATIONS & STRUCTURES PVT. LTD

Bore Hole No	: BH 4
Location	: Ambattur, Chennai
Type of Boring	: Calyx
Ground Water Level	: 2 m from E.G.L on 23.02.2024
UTM Co-ordinate	: 408996 N, 1447551 E
Termination Depth	: 18.5 m

Drilling Hole Record-BH 1

Fig No. 5

Reduced Level	:	
Start Date	:	21.02.2024
End Date	:	22.02.2024

SOIL DESCRIPTION	COLOUR	STRUCTURE	DEPTH BELOW GROUND LEVEL (m)	REDUCED LEVEL (m)	LEGEND	TEST NO	SAMPLE TYPE	DEPTH BELOW GROUND LEVEL (m)	TEST DEPTH	PENETRATION VALUES 15cm	30cm	45cm	SPT "N" Blows/300mm	SPT 'N' PROFILE	C.R (%)	R.Q.D(%)	REMARKS
Clayey **SAND** (SC)	Brown	Medium Dense, Granular	2.00			SPT-1	SS	1.00	1.00-1.45	3	4	7	11				G.W.L
Brownish, Medium Dense, Silty **SAND** (SM)			3.00			SPT-2	SS	2.00	2.00-2.45	4	5	7	12				
Brownish, Medium Stiff, Sandy **CLAY** (CL)			4.00			SPT-3	SS	3.00	3.00-3.45	3	3	5	8				
						UDS-1	OT	3.50	3.50-3.95	-	-	-	-				
Sandy **CLAY** (CL)	Brown	Stiff, Layered				SPT-4	SS	4.00	4.00-4.45	5	7	8	15				
						SPT-5	SS	5.00	5.00-5.45	7	9	7	16				
Sandy **CLAY** (CI)	Dark Grey		6.50			SPT-6	SS	6.50	6.50-6.95	2	1	2	3				
		Soft, Layered	8.00			SPT-7	SS	8.00	8.00-8.45	8	12	14	26				
SAND (SP)	Grey	Medium Dense, Granular	11.00			SPT-8	SS	9.50	9.50-9.95	7	10	12	22				
		Dense, Granular				SPT-9	SS	11.00	11.00-11.45	9	15	18	33				

SPT 'N' PROFILE scale: 20, 40, 60, 80, 100

G.W.L: 2 m from E.G.L on 23.02.2024	No of SPT: 14 Nos.	No of UDS : 1 No.	No of CR : Nil.	Remarks
---	---	---	---	---

Note: SPT-Standard Peneration Test
SS-Split Spoon Sample
OT- Open Tube

UDS-Un Disturbed Sample
CS-Core Sample

CR-Core Recovery
RQD-Rock Quality Designation

Project : Soil Investigation for the Proposed (Basement+Stilt+9 Floors) Structure at Ambattur, Chennai.

GEO FOUNDATIONS & STRUCTURES PVT. LTD

Bore Hole No	: BH 3
Location	: Ambattur, Chennai
Type of Boring	: Calyx
Ground Water Level	: 2 m from E.G.L on 22.02.2024
UTM Co-ordinate	: 409025 N, 1447565 E
Termination Depth	: 18.5 m

Drilling Hole Record-BH 3

Fig No. 4

Reduced Level	:	
Start Date	:	20.02.2024
End Date	:	21.02.2024

SOIL DESCRIPTION	COLOUR	STRUCTURE	DEPTH BELOW GROUND LEVEL (m)	REDUCED LEVEL (m)	LEGEND	TEST NO	SAMPLE TYPE	DEPTH BELOW GROUND LEVEL (m)	TEST DEPTH	PENETRATION VALUES 15cm	30cm	45cm	SPT "N" Blows/300mm	SPT 'N' PROFILE	C.R (%)	R.Q.D(%)	REMARKS
Brownish, Medium Dense, SAND (SP)						SPT-10	SS	12.50	12.50-12.95	10	20	27	47				
SAND (SP)	Grey	Dense, Granular	14.00			SPT-11	SS	14.00	14.00-14.45	15	37	27	64				
		Very Dense, Granular	15.50			SPT-12	SS	15.50	15.50-15.74	42	>50	-	>100				50/9 cm Penetration
Weathered Rock						SPT-13	SS	17.00	17.00-17.11	>50	-	-	>100				50/11 cm Penetration
			20.00			SPT-14	SS	18.50	18.50-18.63	>50	-	-	>100				50/13 cm Penetration

SPT 'N' PROFILE scale: 20, 40, 60, 80, 100

G.W.L: 2 m from E.G.L on 22.02.2024	No of SPT: 14 Nos.	No of UDS : 1 No.	No of CR : Nil.	Remarks
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Note: SPT-Standard Peneration Test
SS-Split Spoon Sample
OT- Open Tube

UDS-Un Disturbed Sample
CS-Core Sample

CR-Core Recovery
RQD-Rock Quality Designation

Project : Soil Investigation for the Proposed (Basement+Stilt+9 Floors) Structure at Ambattur, Chennai.

GEO FOUNDATIONS & STRUCTURES PVT. LTD

Bore Hole No	: BH 3
Location	: Ambattur, Chennai
Type of Boring	: Calyx
Ground Water Level	: 2 m from E.G.L on 22.02.2024
UTM Co-ordinate	: 409025 N, 1447565 E
Termination Depth	: 18.5 m

Drilling Hole Record-BH 3

Fig No. 4

Reduced Level	:	
Start Date	:	20.02.2024
End Date	:	21.02.2024

SOIL DESCRIPTION	COLOUR	STRUCTURE	DEPTH BELOW GROUND LEVEL (m)	REDUCED LEVEL (m)	LEGEND	TEST NO	SAMPLE TYPE	DEPTH BELOW GROUND LEVEL (m)	TEST DEPTH	PENETRATION VALUES 15cm	30cm	45cm	SPT "N" Blows/300mm	SPT 'N' PROFILE	C.R (%)	R.Q.D(%)	REMARKS
Sandy **CLAY** (CL)	Brown	Stiff, Layered	2.00			SPT-1	SS	1.00	1.00-1.45	3	5	6	11				G.W.L
		Medium Stiff, Layered				SPT-2	SS	2.00	2.00-2.45	3	2	3	5				
			4.00			SPT-3	SS	3.00	3.00-3.45	3	3	4	7				
						SPT-4	SS	4.00	4.00-4.45	4	6	7	13				
						UDS-1	OT	4.50	4.50-4.95	-	-	-	-				
Sandy **CLAY** (CI)	Dark Grey	Stiff, Layered	6.50			SPT-5	SS	5.00	5.00-5.45	5	8	7	15				
						SPT-6	SS	6.50	6.50-6.95	0	1	1	2				
		Soft, Layered				SPT-7	SS	8.00	8.00-8.45	1	1	2	3				
			9.50			SPT-8	SS	9.50	9.50-9.95	5	8	10	18				
SAND (SP)	Brown	Medium Dense, Granular				SPT-9	SS	11.00	11.00-11.45	9	12	13	25				

G.W.L: 2 m from E.G.L on 22.02.2024	No of SPT: 14 Nos.	No of UDS : 1 No.	No of CR : Nil.	Remarks

Note: SPT-Standard Peneration Test
SS-Split Spoon Sample
OT- Open Tube

UDS-Un Disturbed Sample
CS-Core Sample

CR-Core Recovery
RQD-Rock Quality Designation

Project : Soil Investigation for the Proposed (Basement+Stilt+9 Floors) Structure at Ambattur, Chennai.

GEO FOUNDATIONS & STRUCTURES PVT. LTD

Bore Hole No	: BH 2
Location	: Ambattur, Chennai
Type of Boring	: Calyx
Ground Water Level	: 2 m from E.G.L on 21.02.2024
UTM Co-ordinate	: 409038 N, 1447550 E
Termination Depth	: 18.5 m

Drilling Hole Record-BH 2

Fig No. 3

Reduced Level	:	
Start Date	:	19.02.2024
End Date	:	20.02.2024

SOIL DESCRIPTION	COLOUR	STRUCTURE	DEPTH BELOW GROUND LEVEL (m)	REDUCED LEVEL (m)	LEGEND	TEST NO	SAMPLE TYPE	DEPTH BELOW GROUND LEVEL (m)	TEST DEPTH	PENETRATION VALUES 15cm	30cm	45cm	SPT "N" Blows/300mm	SPT 'N' PROFILE	C.R (%)	R.Q.D(%)	REMARKS
Greyish, Dense, Silty **SAND** (SM)						SPT-10	SS	12.50	12.50-12.95	9	20	25	45				
Gravelly Sandy **CLAY** (CI)	Grey	Hard, Layered	14.00			SPT-11	SS	14.00	14.00-14.45	12	35	30	65				
Sandy **CLAY** (CI)	Grey	Hard, Layered	15.50			SPT-12	SS	15.50	15.50-15.78	39	>50	-	>100				50/8 cm Penetration
Silty **CLAY** (CI)	Grey / Brown	Hard, Layered	18.50			SPT-13	SS	17.00	17.00-17.10	>50	-	-	>100				50/10 cm Penetration
						SPT-14	SS	18.50	18.50-18.62	>50	-	-	>100				50/12 cm Penetration

SPT 'N' PROFILE: 20, 40, 60, 80, 100

G.W.L: 2 m from E.G.L on 21.02.2024	No of SPT: 14 Nos.	No of UDS : 1 No.	No of CR : Nil.	Remarks
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Note: SPT-Standard Peneration Test
SS-Split Spoon Sample
OT- Open Tube

UDS-Un Disturbed Sample
CS-Core Sample

CR-Core Recovery
RQD-Rock Quality Designation

Project : Soil Investigation for the Proposed (Basement+Stilt+9 Floors) Structure at Ambattur, Chennai.

GEO FOUNDATIONS & STRUCTURES PVT. LTD

Bore Hole No	: BH 2
Location	: Ambattur, Chennai
Type of Boring	: Calyx
Ground Water Level	: 2 m from E.G.L on 21.02.2024
UTM Co-ordinate	: 409038 N, 1447550 E
Termination Depth	: 18.5 m

Drilling Hole Record-BH 2

Fig No. 3

Reduced Level	:	
Start Date	:	19.02.2024
End Date	:	20.02.2024

SOIL DESCRIPTION	COLOUR	STRUCTURE	DEPTH BELOW GROUND LEVEL (m)	REDUCED LEVEL (m)	LEGEND	TEST NO	SAMPLE TYPE	DEPTH BELOW GROUND LEVEL (m)	TEST DEPTH	PENETRATION VALUES 15cm	30cm	45cm	SPT 'N' Blows/300mm	SPT 'N' PROFILE	C.R (%)	R.Q.D(%)	REMARKS
Sandy **CLAY** (CL)	Brown	Stiff, Layered	2.00			SPT-1	SS	1.00	1.00-1.45	4	7	8	15				G.W.L
	Grey	Medium Stiff, Layered				SPT-2	SS	2.00	2.00-2.45	1	2	3	5				
						SPT-3	SS	3.00	3.00-3.45	2	3	4	7				
						UDS-1	OT	3.50	3.50-3.95	-	-	-	-				
			5.00			SPT-4	SS	4.00	4.00-4.45	4	2	6	8				
Silty **SAND** (SM)	Brown	Medium Dense, Granular	6.50			SPT-5	SS	5.00	5.00-5.45	8	8	7	15				
CLAY (CI)	Dark Grey	Stiff, Layered	8.00			SPT-6	SS	6.50	6.50-6.95	7	6	7	13				
		Very Stiff, Layerede	9.50			SPT-7	SS	8.00	8.00-8.45	9	8	10	18				
Silty **SAND** (SM)	Grey	Medium Dense, Granular	11.00			SPT-8	SS	9.50	9.50-9.95	10	15	10	25				
		Dense, Granular				SPT-9	SS	11.00	11.00-11.45	15	21	15	36				

SPT 'N' PROFILE scale: 20, 40, 60, 80, 100

G.W.L: 2 m from E.G.L on 21.02.2024	No of SPT: 14 Nos.	No of UDS : 1 No.	No of CR : Nil.	Remarks
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Note: SPT-Standard Peneration Test
SS-Split Spoon Sample
OT- Open Tube

UDS-Un Disturbed Sample
CS-Core Sample

CR-Core Recovery
RQD-Rock Quality Designation

Project : Soil Investigation for the Proposed (Basement+Stilt+9 Floors) Structure at Ambattur, Chennai.

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Bore Hole No	: BH 1	Drilling Hole Record-BH 1	
Location	: Ambattur, Chennai	Fig No. 2	
Type of Boring	: Calyx	Reduced Level	:
Ground Water Level	: 2.5 m from E.G.L on 19.02.2024	Start Date	: 17.02.2024
UTM Co-ordinate	: 409073 N, 1447561 E	End Date	: 18.02.2024
Termination Depth	: 20.0 m		

SOIL DESCRIPTION	COLOUR	STRUCTURE	DEPTH BELOW GROUND LEVEL (m)	REDUCED LEVEL (m)	LEGEND	TEST NO	SAMPLE TYPE	DEPTH BELOW GROUND LEVEL (m)	TEST DEPTH	PENETRATION VALUES 15cm	30cm	45cm	SPT 'N' Blows/300mm	SPT 'N' PROFILE 20 40 60 80 100	C.R (%)	R.Q.D(%)	REMARKS
Dark Grey, Very Stiff, Sandy **CLAY**(CL)			12.50			SPT-10	SS	12.50	12.50-12.95	12	10	11	21				
Sandy **CLAY** (CI)	Dark Grey / Grey	Very Stiff, Layered	15.50			SPT-11	SS	14.00	14.00-14.45	10	9	15	24				
	Dark Grey	Hard, Layered	17.00			SPT-12	SS	15.50	15.50-15.95	18	36	44	80				
Sandy **CLAY** (CH)	Dark Grey	Hard, Layered	20.00			SPT-13	SS	17.00	17.00-17.38	21	45	>50	>100				50/8 cm Penetration
						SPT-14	SS	18.50	18.50-18.58	>50	-	-	>100				50/8 cm Penetration
						SPT-15	SS	20.00	20.00-20.12	>50	-	-	>100				50/12 cm Penetration

G.W.L: 2.5 m from E.G.L on 19.02.2024 | No of SPT: 15 Nos. | No of UDS : 1 No. | No of CR : Nil. | Remarks

Note: SPT-Standard Peneration Test
SS-Split Spoon Sample
OT- Open Tube

UDS-Un Disturbed Sample
CS-Core Sample

CR-Core Recovery
RQD-Rock Quality Designation

Project : Soil Investigation for the Proposed (Basement+Stilt+9 Floors) Structure at Ambattur, Chennai.

GEO FOUNDATIONS & STRUCTURES PVT. LTD

Bore Hole No	: BH 1	Drilling Hole Record-BH 1	
Location	: Ambattur, Chennai	Fig No. 2	
Type of Boring	: Calyx	Reduced Level	:
Ground Water Level	: 2.5 m from E.G.L on 19.02.2024	Start Date	: 17.02.2024
UTM Co-ordinate	: 409073 N, 1447561 E	End Date	: 18.02.2024
Termination Depth	: 20.0 m		

SOIL DESCRIPTION	COLOUR	STRUCTURE	DEPTH BELOW GROUND LEVEL (m)	REDUCED LEVEL (m)	TEST NO	SAMPLE TYPE	DEPTH BELOW GROUND LEVEL (m)	TEST DEPTH	PENETRATION VALUES 15cm	30cm	45cm	SPT 'N' Blows/300mm	REMARKS
Sandy **CLAY** (CL)	Brown	Stiff, Layered	2.00		SPT-1	SS	1.00	1.00-1.45	4	5	8	13	
					SPT-2	SS	2.00	2.00-2.45	2	2	3	5	G.W.L
	Grey	Medium Stiff, Layered	5.00		SPT-3	SS	3.00	3.00-3.45	2	3	3	6	
					UDS-1	OT	3.50	3.50-3.95	-	-	-	-	
					SPT-4	SS	4.00	4.00-4.45	4	3	5	8	
	Dark Grey	Very Stiff, Layered	6.50		SPT-5	SS	5.00	5.00-5.45	4	12	11	23	
Silty **SAND** (SM)	Dark Grey	Medium Dense, Granular	8.00		SPT-6	SS	6.50	6.50-6.95	7	8	9	17	
Sandy **CLAY** (CL)	Dark Grey	Stiff, Layered	9.50		SPT-7	SS	8.00	8.00-8.45	5	4	7	11	
		Very Stiff, Layered			SPT-8	SS	9.50	9.50-9.95	8	8	9	17	
					SPT-9	SS	11.00	11.00-11.45	10	9	10	19	

SPT 'N' PROFILE: 20 | 40 | 60 | 80 | 100 | C.R (%) | R.Q.D(%)

G.W.L: 2.5 m from E.G.L on 19.02.2024 | No of SPT: 15 Nos. | No of UDS : 1 No. | No of CR : Nil. | Remarks

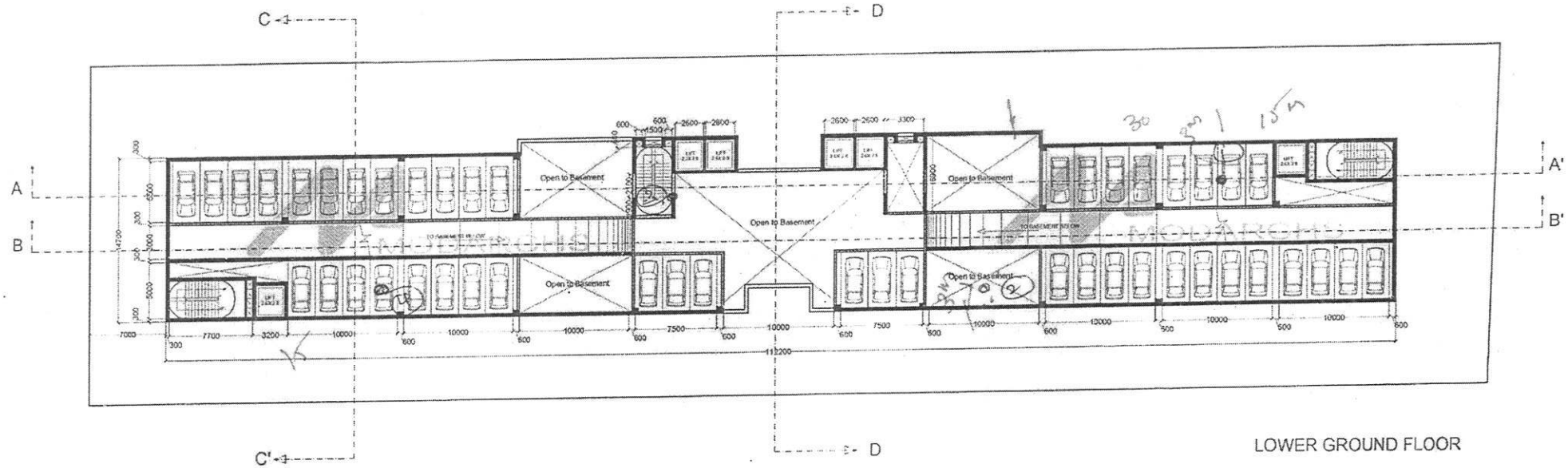
Note: SPT-Standard Peneration Test
SS-Split Spoon Sample
OT- Open Tube

UDS-Un Disturbed Sample
CS-Core Sample

CR-Core Recovery
RQD-Rock Quality Designation

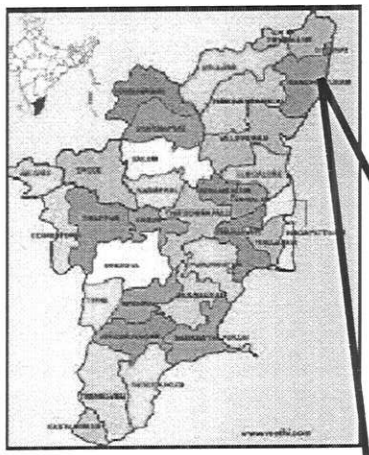
APPENDIX-II

BORELOGS



LOWER GROUND FLOOR

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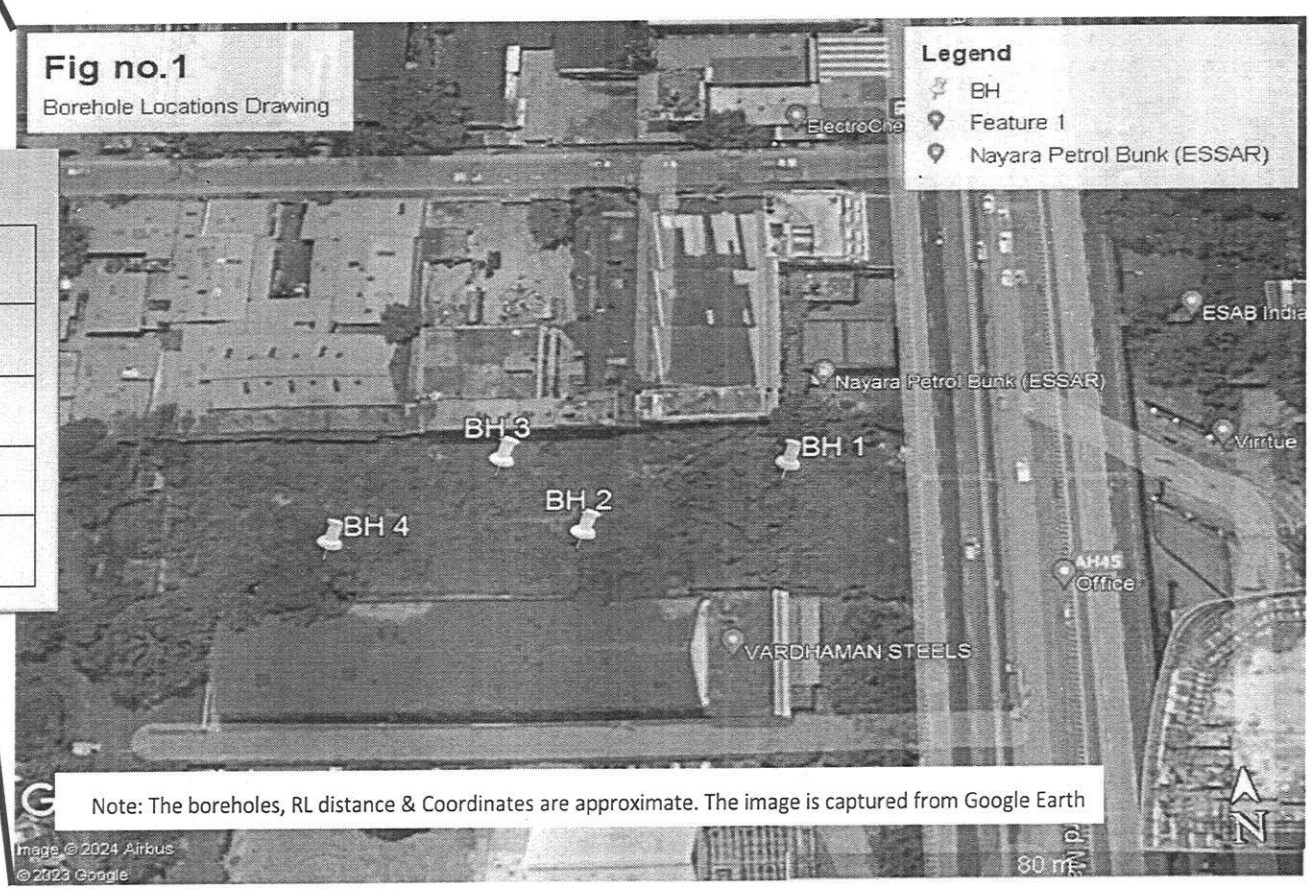


Project Number : 1742

Project Name : Soil Investigation for the Proposed (B+Stilt+9 Floors) Structure at Ambattur, Chennai.

COORDINATES:

Borehole No.	UTM Co-ordinates
BH 1	409073 N, 1447561 E
BH 2	409038 N, 1447550 E
BH 3	409025 N, 1447565 E
BH 4	408996 N, 1447551 E



APPENDIX-I

BOREHOLE LOCATIONS DRAWING

Table B

Approximate Length of pile from G.L (m)	Pile Diameter (mm)	Recommended Safe Vertical Load Capacity (T)
20	500	95
	600	130
	750	185

9.0 The results given in this report are based on the results of the soil investigation carried out. In actual execution, if any variation is found, the consultants may also be referred to.

APPROVED BY,

For GEO FOUNDATIONS & STRUCTURES PVT LTD.

Dr. K. Muthukrishnaiah BE (Hons), M.Tech., Ph.D.,
(Professor & Head, Ocean Engineering Dept. IIT Madras)(Rtd),
(Chief Consultant)

Anala Suresh Kumar, M.Tech (Geo technical),**M.B.A**(T.M)
General Manager(Geo Technical)

On behalf of CMDA MSB Panel the Geotechnical Investigation Report is Generally reviewed.

14/10/24

Superintending Engineer, P.W.D.,
Planning and Designs Circle,
Chepauk, Chennai-5.

Where, A_p = Cross sectional area of pile toe in cm^2

D= Stem dia. in cm

γ= Effective unit weight of soil at pile toe in kg /cm^3

P_D = Effective overburden pressure in kg / cm^2

$N\gamma$ and Nq = Bearing capacity factors depending upon the angle of internal friction Ø at toe

i =n

$\sum$ = Summation of N layers in which pile is installed i =1

K = Coefficient of earth pressure

P_{Di} = Effective overburden pressure in kg /cm^2 for the i^{th} layer where i varies from 1 to n.

δ= Angle of wall friction between pile and soil in degrees (may be taken equal to Ø)

A_{si} =Surface area of pile stem in cm^2 in the i^{th} layer where i varies from 1 to n.

For cohesive soil:-

Safe capacity of pile = $(A_P. Nc. Cp+\alpha. C.A_S)/f$

Where,

A_p- c/s area of pile toe in cm^2

Nc- bearing capacity factor

Cp- average cohesion at pile tip in kg/cm^2

α - Reduction factor

C – average cohesion throughout the length of pile in kg/cm^2

A_S- Surface area of pile shaft in cm^2

f - factor of safety.

of foundations and safe bearing capacity. Based on the subsoil conditions described in Sl. No. 6, the following recommendations are made for suitable type of foundations for the proposed (Basement+Stilt+9 Floors) Structure.

8.1.1 Pile Foundations

8.1.1.1 Bored cast in situ concrete pile foundations are recommended.

8.1.1.2 The recommended safe load carrying capacity of bored cast in situ concrete piles are considered as per IS 2911 (Part 1/Sec2): 2010 (Reaffirmed 2020)

8.1.1.3 The pile bore may be terminated at a depth of minimum five times diameter of the pile in to hard strata (where six consecutive SPT 'N' values of more than 100 are obtained in each test at depth intervals of one pile diameter).

8.1.1.4 To satisfy the above criterion, the pile length may be of the order of **20 m** from the existing ground level.

8.1.1.5 In terms of concrete used for the piles, to provide the required factor of safety of **2.5** for stress in the pile concrete, we recommend minimum M 30 Grade Concrete.

8.1.1.6 According to the structural strength of concrete determined for different pile diameters, assuming 5 grades less to allow for underwater concreting, consider M 25 grade concrete instead of M 30 grade concrete.

8.1.1.7 The recommended safe load carrying capacity of bored cast in situ concrete piles as per IS 2911 (Part 1/Sec2): 2010 (Reaffirmed 2020) for different pile lengths & diameters are presented in **Table B**

8.1.1.8 R.C.C. BORED CAST IN SITU PILES

Safe capacity of RCC Bored cast-in-situ pile can be computed by using the formula given in IS: 2911 (Part-1/Sec-2):2010 (Reaffirmed 2020)

Ultimate bearing capacity Qu of piles in Cohesionless soil:

$$Q_U = A_P(0.5.D.\gamma.N\gamma + P_D.N_q) + \sum_{I=1}^{I=n} K.P_{Di}.\tan\delta.A_{si}$$

6.0 SOIL PROFILE

In borehole BH 1, stiff sandy clay of low plasticity occurs from existing ground level up to 2 m, followed By medium stiff sandy clay of low plasticity up to 5 m, very stiff sandy clay of low plasticity up to 6.5 m, medium dense silty sand up to 8 m, stiff sandy clay of low plasticity up to 9.5 m, very stiff sandy clay of low plasticity up to 12.5 m, very stiff sandy clay of medium plasticity 15.5 m, hard sandy clay of medium plasticity up to 17 m, followed by hard sandy clay of high plasticity up to **20 m**, at which depth the bore hole was terminated.

In borehole BH 2, stiff sandy clay of low plasticity occurs from existing ground level up to 2 m, followed by medium stiff sandy clay of low plasticity up to 5 m, medium dense silty sand up to 6.5 m, stiff clay of medium plasticity up to 8 m, very stiff clay of medium plasticity up to 9.5 m, medium dense silty sand up to 12.5 m, hard gravelly sandy clay of medium plasticity up to 14 m, hard sandy clay of medium plasticity up to 15.5 m, followed by hard silty clay of medium plasticity up to **18.5 m**, at which depth the bore hole was terminated.

In borehole BH 3, stiff sandy clay of low plasticity occurs from existing ground level up to 2 m, followed by medium stiff sandy clay of low plasticity up to 4 m, stiff sandy clay of medium plasticity up to 6.5 m, soft sandy clay of medium plasticity up to 9.5 m, medium dense sand up to 14 m, dense sand up to 15.5 m, followed by weathered rock up to **18.5 m**, at which depth the bore hole was terminated.

In borehole BH 4, medium dense clayey sand occurs from existing ground level up to 2 m, followed by medium dense silty sand up to 3 m, stiff sandy clay of low plasticity up to 5 m, very stiff sandy clay of medium plasticity up to 6.5 m, soft sandy clay of medium plasticity up to 8 m, medium dense sand up to 12.5 m, dense silty sand up to 14 m, dense sand up to 15.5 m, followed by weathered rock up to **18.5 m**, at which depth the bore hole was terminated.

8.0 RECOMMENDATIONS FOR SUITABLE TYPE OF FOUNDATIONS:

Bore holes were made for soil investigation to assess the nature and strength of the subsoil strata for sustainability of the loads. This report gives the details of the soil strata, suitable type

presence of settled, suspended matters at the bottom of the bore- holes. The total number of blows for the next 30 cm depth of penetration is considered as SPT 'N' value as shown in Figure nos. 2 to 5 **(Appendix II).**

Table A

Bore Hole No.	Structure	Coordinates	Termination Depth from E.G.L (m)	Ground Water level from E.G.L (m)
BH 1	Basement+Stilt +9 Floors	409073 N, 1447561 E	20	2.5
BH 2		409038 N, 1447550 E	18.5	2
BH 3		409025 N, 1447565 E	18.5	2
BH 4		408996 N, 1447551 E	18.5	2

5.0 LABORATORY INVESTIGATION

The following laboratory tests were conducted on the selected soil samples collected from the bore holes:

(a) Grain size analysis

(b) Index properties on clayey and silty soil samples

  (i) Liquid limit

  (ii) Plastic limit

(c) Natural Moisture content

(d) Dry & Bulk density

(e) Specific Gravity

(f) Free Swell Index

(g) Triaxial Test

All the above laboratory tests were carried out as per relevant Indian Standards.

All the soil samples were identified and classified as per relevant Indian Standard, IS: 1498-1970(Reaffirmed 2021). The results are shown in Table Nos.1 to 4 **(Appendix III).**

(c) Dry and bulk density

(d) Moisture content

(e) Specific Gravity

(f) Free Swell Index

(g) Triaxial / Direct Shear Test

(h) Unconfined Compressive Strength

(i) Chemical Analysis of Ground Water

3.5 Preparation and submission of detailed report of field and laboratory results with recommendations for suitable type of foundations.

4.0 FIELD INVESTIGATIONS-GEO-TECHNICAL STUDIES

4.1 Boring rig, with all requisite equipments and accessories, were mobilized at the worksite. A team of technical personnel with skilled laborers were also deputed.

4.2 **Four** bore holes of 150 mm diameter were bored to a maximum depth up to **20 m** below the existing ground level. The bore holes were made as per relevant Indian Standard IS: 1892: 2021. The borehole locations are shown in Fig. no. 1 **(Appendix I).**

4.3 Representative soil samples were collected at every change of strata or at about 1 m depth intervals, up to 5 m, from the existing ground level, followed by 1.5 m depth intervals, up to termination depth. The samples so collected were sealed and numbered with full particulars for identification and sent to the laboratory for conducting the required tests. The boreholes termination depth and the ground water table levels are given in the **Table A**.

4.4 Standard Penetration tests were conducted in the bore holes at 1 m depth intervals, up to 5 m, from the existing ground level, followed by 1.5 m depth intervals, up to termination depth, as per the relevant Indian Standard, IS: 2131-1981(Reaffirmed 2021). In this test, a standard split spoon sampler is driven into the ground at the required depth by means of standard hammer of 63.5 kgs weight, falling from a height of 75 cm. Number of blows for the first 15 cm is not taken into consideration because of possible disturbances or

SOIL INVESTIGATION REPORT

1.0 INTRODUCTION

1.1 The work of "Soil Investigation for the Proposed (Basement+Stilt+9 Floors) Structure at Ambattur, Chennai." was entrusted to **M/s. Geo Foundations and Structures Pvt Ltd., Adyar, Chennai – 600 020**, by **M/s. Voora Property Developers Pvt Ltd.,** Mylapore, Chennai – 600 004.

1.2 The soil investigation (field works) were carried out during **17th to 22nd February 2024.** This report summarizes the results of the soil investigation, and presents recommendations for suitable type of foundations for the proposed (Basement+Stilt+9 Floors) Structure.

2.0 OBJECTIVE OF INVESTIGATION

2.1 The objective of soil investigation is to determine the nature and characteristics of sub-soil below the ground level for the proposed (Basement+Stilt+9 Floors) Structure. The study includes identification of suitable type of foundations and assessment of safe bearing capacities for the proposed (Basement+Stilt+9 Floors) Structure.

3.0 SCOPE OF WORK

The scope of work at this site comprises of the following:

3.1 Mobilization of Calyx drilling machine with all necessary equipments and personnel.

3.2 Boring of **4** bore holes of 150 mm diameter with Calyx drilling equipments through sand, silt, clay & weathered rock.

3.3 Conducting Standard Penetration Tests in the bore holes and collecting the disturbed but representative soil samples, including packing and transportation to laboratory.

3.4 To conduct the following laboratory tests on soil samples:

(a) Grain size analysis

(b) Index properties on clayey and silty soil samples

(i) Liquid limit

(ii) Plastic limit

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