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REPORT ON GEOTECHNICAL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF SHRESHTA VILLAS AT S.F.NO 181,182,183,184 & 185 AT WARD NO 27 AT MADUKARAI IN COIMBATORE

REPORT NO: **AGIS/C-896/24** **Dt: 08.04.2024**

CLIENT:
M/s AKSHATHAM LIFE SPACE PVT LTD
1/8 SS ENCLAVE AVENUE,
OLD DINAMALAR OFFICE BACKSIDE,
SIDCO POST COIMBATORE SOUTH,
COIMBATORE 641 021

ALZUM GEOCIVIL INTEGRATED SERVICES
Experts in all types of Structures
ALZUM

18,4th Street, Periannan Nagar, Thadagam Road
Coimbatore – 641 025
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REPORT ON GEOTECHNICAL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF SHRESHTA VILLAS AT S.F.NO 181,182,183,184 & 185 AT WARD NO 27 AT MADUKARAI IN COIMBATORE

1.0 GENERAL

The Client has requested for testing services for deciding suitable foundation based on soil investigation for the proposed Construction of Shreshta Villas at S.F.No 181,182,183,184 & 185 at Ward No 27 at Madukarai in Coimbatore. Geotechnical investigation for the proposed construction was carried out by Alzum Geocivil Integrated Services, Coimbatore.

The scope of work includes identification of the depth of foundation, evaluation of safe bearing capacity to be the adopted in the design of foundation system, selection of suitable type of foundation and other detrimental effects of the soil by conducting Field investigation and Laboratory investigation.

Four trial pits were excavated with varying depths of 0.90m to 1.50m covering the plan area of the proposed building. Standard Penetration Test (SPT) was planned to assess the soil parameters to achieve the scope of investigation. The location of the trial pits were decided as per codal requirements and in consultation with the client. The topography of the site is generally plain.The location of the trial pits is shown under Annexure I.

2.0 SOIL PROFILE

The soil profile of the trial pits made is discussed below.

2.1 Trial Pit(TP-01)

The pit was excavated upto the depth of 1.50m. It consists of Reddish Brown Silt at top for 0.90m thickness. Below Reddish Brown Silt, Soft Disintegrated Rock exists. This layer appears to continue for a large depth. The soil profile is shown in Annexure II.

2.2 Trial Pit (TP-02)

The pit was excavated upto the depth of 1.30m. It consists of Reddish Brown Silt at top for 0.50m thickness. Below Reddish Brown Silt, Soft Disintegrated Rock exists. This layer appears to continue for a large depth. The soil profile is shown in Annexure II.

2.3 Trial Pit (TP-03)

The pit was excavated upto the depth of 0.90m. It consists of Reddish Brown Silt at top for 0.70m thickness. Below Reddish Brown Silt, Soft Disintegrated Rock exists. This layer appears to continue for a large depth. The soil profile is shown in Annexure II.

2.4 Trial Pit (TP-04)

The pit was excavated upto the depth of 1.50m. It consists of Reddish Brown Silt at top for 0.10m thickness. Below Reddish Brown Silt, Soft Disintegrated Rock exists. This layer appears to continue for a large depth. The soil profile is shown in Annexure II.

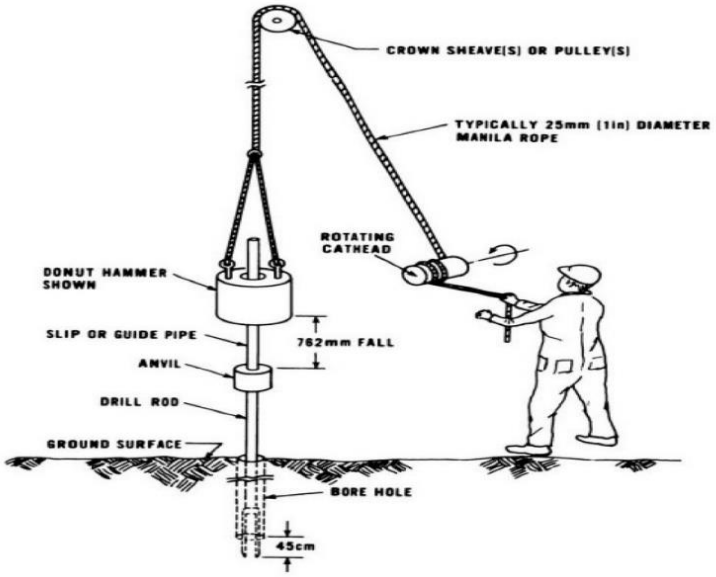
3.0 FIELD INVESTIGATIONS

The excavated trial pits namely TP01, TP02, TP03 AND TP04 were examined with simple tools over the depths ranging from 0.90m to 1.50m. Soil samples were collected from different layers and analyzed in the Geotechnical Engineering laboratory. It was decided to conduct Standard Penetration Test (SPT) in TP01, TP02, TP03 and TP04 to assess the bearing capacity of soil.

3.1 STANDARD PENETRATION TEST

Standard penetration test was performed in accordance with IS:2131-1981, It is the most commonly used in-situ test. This test measures the resistance of the split-spoon sampler, when it is driven into the soil, at the bottom of a borehole under standard conditions. The result of the SPT is termed as the N-Value of the soil. The N value is the number of blows required to achieve 300mm penetration into the soil by the split spoon sampler. This value indicated the Relative density for a coarse grained soil and consistency for fine grained soils. The guidelines of the standard penetration test are taken from IS:2131-1981. The split spoon sampler is merged with the drill rod and lowered to the bottom of the drilled borehole. The falling through a 750mm guide rod, it is ensured that maximum amount of dynamic energy is transferred to the sampler. The number of blows required to achieve each of 150mm penetration is recorded for an overall penetration of 450mm. The initial 150mm penetration is referred to as seating drive and the blows required for this penetration is neglected in the calculation of

N value as the soil in this stage falls under the disturbed zone. The total number of blows required for the second and third 150mm of penetration is termed as 'N' value. The N value thus observed will be subjected to two corrections namely correction due to dilatancy and correction due to overburden.



3.1.1 SPT 1 (TP01)

The pit was excavated upto 1.50m. Standard Penetration Test was conducted at 1.50m on SDR. The SPT N value is >50 (50/6).

3.1.2 SPT 2 (TP02)

The pit was excavated upto 1.30m. Standard Penetration Test was conducted at 1.30m on SDR. The SPT N value is >50 (50/5).

3.1.3 SPT 3 (TP03)

The pit was excavated upto 0.90m. Standard Penetration Test was conducted at 0.90m on SDR. The SPT N value is >50 (50/5).

3.1.4 SPT 4 (TP04)

The pit was excavated upto 1.50m. Standard Penetration Test was conducted at 1.50m on SDR. The SPT N value is >50 (50/3).

4.0 WATER TABLE

Water Table is not met within the depth of exploration.

5.0 LABORATARY TESTS

The operations to be performed in the laboratory depend upon the type of the nature of data required for the problem at hand. In case of cohesion less

material, like sand, the laboratory tests are usually minimum and the design parameters are worked out from field test data such as form SPT- N value, Core resistance and plate load test data.In the case of cohesive soils, the programme of laboratory testing can vary from carrying out simple tests such as unconfined tests to comprehensive study of soil behaviour using Triaxial shear tests and consolidation tests.

Following laboratory tests are conducted.

For cohesion less, soil

- Specific gravity
- Sieve analysis
- Direct shear test

For cohesive soil

- Specific gravity
- Natural moisture content
- Atterberg's limits
- Sieve Analysis
- Unconfined compression test

Thefield record is shown in Annexure III, results of the laboratory tests are shown in Annexure IV and the results of particle size distribution is shown in Annexure V.

6.0 FOUNDATION ANALYSIS

The Bearing Capacity of soil is calculated using the N value obtained from the standard penetration test. It is worked out based on the shear stress failure criterion and settlement criterion, for an observed N value of 50.

6.1 BASED ON SHEAR STRENGTH FAILURE CRITERION

The safe bearing capacity based on shear failure is worked out empirically by the following equation,

Safe bearing capacity (SBC) = q =$0.314N^2B.Rw2 + 0.943 (100 + N2) Df. Rw1$

N : SPT N value

Df : Depth of foundation in m

B : Breadth of the foundation (taken as 2.0m)

Rw1& Rw2 : Water table correction

6.2 BASED ON SETTLEMENT CRITERION

The safe bearing capacity based on settlement failure is worked out by the following equation.

The safe bearing capacity, by

$$q = 1.36\,(N-3)\left(\frac{B + 0.3}{2 \times B}\right)^2 \times S.Rd.\ Rw1$$

Where, B: Breadth of the footing (taken as 2.0m)

R: Water table correction factor (For the worst case, taken as 0.5)

Rd: Depth factor (taken as 1.2)

S: Permissible settlement in mm

The calculations of allowable net safe bearing capacity are shown under Annexure VI.

7.0 DISCUSSIONS

The first layer is made of Reddish Brown Silt. The thickness of the first layer varies from 0.10m to 0.90m. The second layer is made of Soft Disintegrated Rock (SDR) and it continues upto the depth of exploration. SDR appears to continue for a large depth as observed from the nearby borehole drilled. The SPT N value at 1.50m depth on SDR is greater than 50. Refusal for penetration was observed beyond a few cm of penetration. The safe bearing capacity of soil is evaluated based on the N value >50. The allowable bearing capacity based on shear failure and settlement criteria works out to 317.003 kN/m^2 based on the observed N value. The foundation can be rested on SDR. Water Table was not met within the depth of exploration.Water Table reduction factors are however considered in evaluating bearing capacity. The stiffness of soil increases with increase in depth.

8.0 RECOMMENDATIONS

8.1 DEPTH OF FOUNDATION

a) The minimum depth of foundation shall be taken as 1.50m such that the foundation rests on SDR.

b) The stiffness of soil increases with increase in depth.

8.2 ALLOWABLE NET SAFE BEARING CAPACITY

a) The engineering properties of soil and SPT N value are considered for the evaluation of safe bearing capacity.

b) The allowable bearing capacity of soil shall be taken as 300 kN/m^2 in the foundation design.

8.3 TYPE OF FOUNDATION

a) The type of foundation depends upon the founding strata, loading intensity at the foundation level and configuration at loading points.

b) Framed structure with Isolated footing shall be provided for the proposed structure.

c) The size of the foundation shall be decided by the design engineer, based on the allowable bearing capacity recommended

9.0 PRECAUTIONS

a) Entire report should be studied before implementing the recommendations.

b) The silty sand available in location TP01 is compacted with Vibroflotation until it reaches its dense state.

c) Loose pockets of soil/ weathered / fissured and fractured rock if encountered shall be removed and backfilled with concrete. A leveling course of concrete of M20 grade shall be laid and construction of foundations can be taken up subsequently.

10.0 LIMITATIONS

a) The soil investigation has been carried out at locations in the site chosen by the clients so as to represent the entire site. The recommendations provided in this report are hence valid only for these test locations. However, if there is any change in sub soil conditions and properties at

places between or beyond chosen test locations, Geocivil Integrated Services may be contacted for further advice.

b) With passage of time, the recommendations may vary due to manmade and naturals environment changes.

For Alzum Geocivil Integrated Services

Dr.P.D. Arumairaj, M.E., Ph.D.,
FIGS., FIE, C.Eng., MIEEE., MISTE
Principal Consultant
Professor of Civil Engg (Retd)
Govt College of Technology, Coimbatore.

11.0 REFERENCES

LIST OF IS CODE

LABORATORY TESTS

1.	IS 2720 (Part 1) – 1983	: Preparations of soil samples
2.	IS 2720 (Part 2) – 1983	: Determination of Water Content
3.	IS 2720 (Part 4) – 1983	: Grain Size Analysis
4.	IS 2720 (Part 5) – 1983	: Atterberg's Limits
5.	IS 2720 (Part 11) – 1983	: Determination of shear strength parameters using Triaxial Shear apparatus

FIELD INVESTIGATIONS

1.	IS 1498 - 1970	: Classification and Identification of soils for General Engineering Purposes
2.	IS 1892 – 1979	: Code of practice for Subsurface Investigation of Foundations
3.	IS 2131 – 1981	: Method for Standard Penetration Test for Soil
4.	IS 2132 – 1986	: Code for practice for Thin Walled Tube Sampling of Soil
5.	IS 6403 – 2004	: Determination of Bearing Capacity of Shallow Foundation
6.	IS 2911-(part1/sec-2)-2010	: Design of Construction of Pile foundation
7.	IS 8009 (Part-1) 1976	: Calculations of settlements of foundation

ANNEXURE-I

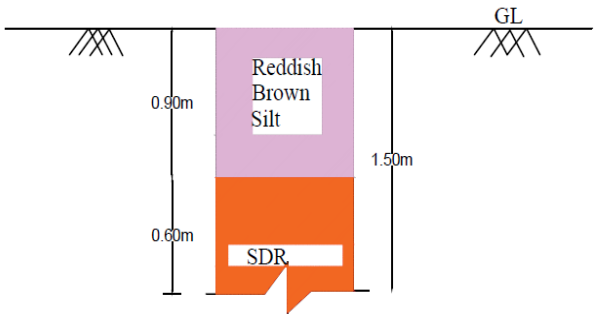
LOCATION


N
TP04
TP03
TP02
TP01
Shriram Shreshta
Shriram Shreshta
Elite Apartments
Google

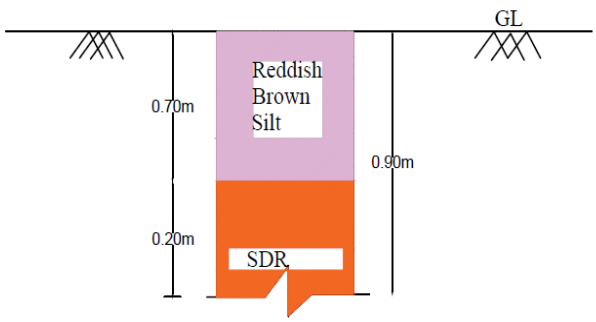
ANNEXURE-II

SOIL PROFILE

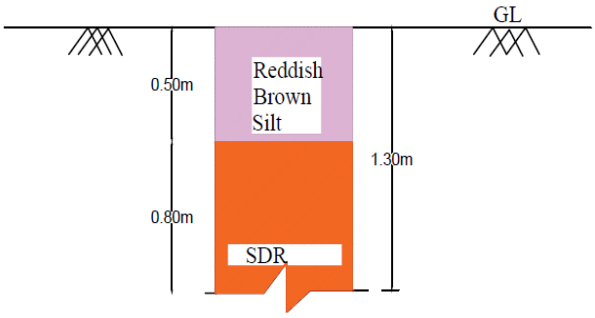
TP01



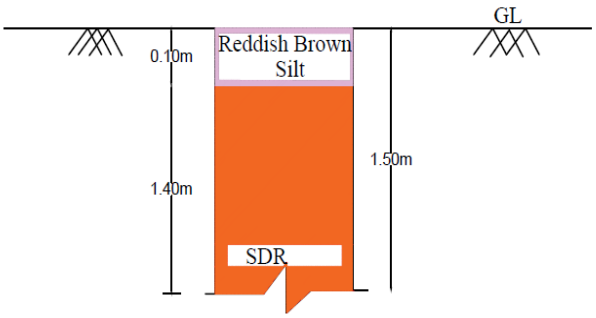
TP03



TP02



TP04



ANNEXURE – III

FIELD RECORD

Ref: AGIS/CBE/2024-25/C – 896/DOC 001															
Name of Work:	**REPORT ON GEOTECHNICAL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF SHRESHTA VILLAS AT S.F.NO 181,182,183,184 & 185 AT WARD NO 27 AT MADUKARAI IN COIMBATORE**														
Soil Investigation done by:	ALZUM GEOCIVIL INTEGRATED SERVICES, CBE		**Type of Exploration:** Open exploration							Date of Commencement					06.04.2024
			Ground Water Level: NIL							Date of Completion					06.04.2024
Trial Pit No: 1	TP 01				`Standard penetration test data					Bed Level					
Location:	Mentioned on site plan									Chainage					
Depth below G.L.(R.L)	Soil Profile	Description of Soil	Thickness of layer (m)	Type of testing	N – Value- Depth of penetration					Relative density / Consistency	Graphical representation of penetration resistance				
					1st 15cm	2nd 15cm	3rd 15cm	For last 30cm/ observed N' value			10	20	30	40	50
0.90		Reddish Brown Silt	0.90	SPT	--	--	--	--		----					
1.50		SDR	0.60	SPT	50/6			>50							

Ref: AGIS/CBE/2024-25/C – 896/DOC 001															
Name of Work:	**REPORT ON GEOTECHNICAL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF SHRESHTA VILLAS AT S.F.NO 181,182,183,184 & 185 AT WARD NO 27 AT MADUKARAI IN COIMBATORE**														
Soil Investigation done by:	ALZUM GEOCIVIL INTEGRATED SERVICES, CBE	**Type of Exploration:** Open exploration								Date of Commencement					06.04.2024
		Ground Water Level: NIL								Date of Completion					06.04.2024
Trial Pit No: 2	TP 02	Thickness of layer (m)	Type of testing	`Standard penetration test data						Bed Level					
Location:	Mentioned on site plan									Chainage					
Depth below G.L.(R.L)	Soil Profile	Description of Soil			N – Value- Depth of penetration					Relative density / Consistency	Graphical representation of penetration resistance				
					1st 15cm	2nd 15cm	3rd 15cm	For last 30cm/ observed N' value			10	20	30	40	50
0.50		Reddish Brown Silt	0.50m	SPT	--	--	--	--		----					
1.30		SDR	0.80m	SPT	50/5			>50		----					

Ref: AGIS/CBE/2024-25/C – 896/DOC 001														
Name of Work:	**REPORT ON GEOTECHNICAL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF SHRESHTA VILLAS AT S.F.NO 181,182,183,184 & 185 AT WARD NO 27 AT MADUKARAI IN COIMBATORE**													
Soil Investigation done by:	ALZUM GEOCIVIL INTEGRATED SERVICES, CBE	**Type of Exploration:** Open exploration								Date of Commencement				06.04.2024
		Ground Water Level: NIL								Date of Completion				06.04.2024
Trial Pit No: 3	TP 03	Thickness of layer (m)	Type of testing	`Standard penetration test data						Bed Level				
Location:	Mentioned on site plan									Chainage				
Depth below G.L.(R.L)	Soil Profile	Description of Soil			N – Value- Depth of penetration					Relative density / Consistency	Graphical representation of penetration resistance			
					1st 15cm	2nd 15cm	3rd 15cm	For last 30cm/ observed N' value			10	20	30	40	50
0.70		Reddish Brown Silt	0.70m	SPT	--	--	--	--		----					
0.90		SDR	0.20m	SPT	50/5			>50		----					

Ref: AGIS/CBE/2024-25/C – 896/DOC 001															
Name of Work:	**REPORT ON GEOTECHNICAL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF SHRESHTA VILLAS AT S.F.NO 181,182,183,184 & 185 AT WARD NO 27 AT MADUKARAI IN COIMBATORE**														
Soil Investigation done by:	ALZUM GEOCIVIL INTEGRATED SERVICES, CBE	**Type of Exploration:** Open exploration								Date of Commencement					06.04.2024
		Ground Water Level: NIL								Date of Completion					06.04.2024
Trial Pit No: 4	TP 04	Thickness of layer (m)	Type of testing	`Standard penetration test data						Bed Level					
Location:	Mentioned on site plan									Chainage					
Depth below G.L.(R.L)	Soil Profile	Description of Soil			N – Value- Depth of penetration					Relative density / Consistency	Graphical representation of penetration resistance				
					1st 15cm	2nd 15cm	3rd 15cm	For last 30cm/ observed N' value			10	20	30	40	50
0.10		Reddish Brown Silt	0.10m	SPT	--	--	--	--		----					
1.50		SDR	1.40m	SPT	50/3			>50		----					

ANNEXURE IV

LAB TEST RESULTS

Ref: AGIS/CBE/2024-25/C-896/DOC 001

Name of work	**REPORT ON GEOTECHNICAL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF SHRESHTA VILLAS AT S.F.NO 181,182,183,184 & 185 AT WARD NO 27 AT MADUKARAI IN COIMBATORE**

Soil Investigation done by: ALZUM GEOCIVIL INTEGRATED SERVICES, CBE	**Bore hole id** TP-01	**Location:** Mentioned on Site Plan	**Ground Water Level: NIL**	**Work Commenced on**	06.04.2024
				Work Completed on	06.04.2024

SOIL PROFILE AND DEPTH IN METRES	DEPTH OF SAMPLING	IS SOIL CLASSIFICATION	NATURAL WET DENSITY (kN/m³)	NATURAL MOISTURE CONTENT %	INDEX TEST			SIEVE ANALYSIS			SPECIFIC GRAVITY	SHEAR TEST		STANDARD PENETRATION TEST		ROCK PARAMETERS		
					LIQUID LIMIT %	PLASTIC LIMIT %	PLASTICITY INDEX %	GRAVEL %	SAND %	SILT & CLAY %		COHESION C kN/m²	ANGLE OF INTERNAL FRICTION °	DEPTH OF TESTING m	OBSERVED N VALUE	Core Recovery	RQD	Free swell, %
	0.90	-	-	-	-			-	-	-	-	-	-	0.90	-	NA	NA	-
	1.50	SM	22.87	3.17	Non-Plastic			0.00	78.13	27.87	2.65	-	-	1.50	>50	NA	NA	-

Name of work	**REPORT ON GEOTECHNICAL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF SHRESHTA VILLAS AT S.F.NO 181,182,183,184 & 185 AT WARD NO 27 AT MADUKARAI IN COIMBATORE**

Soil Investigation done by: ALZUM GEOCIVIL INTEGRATED SERVICES, CBE	**Bore hole id** TP-02	**Location:** Mentioned on Site Plan	**Ground Water Level: NIL**	**Work Commenced on**	06.04.2024
				Work Completed on	06.04.2024

SOIL PROFILE AND DEPTH IN METRES	DEPTH OF SAMPLING	IS SOIL CLASSIFICATION	NATURAL WET DENSITY (kN/m³)	NATURAL MOISTURE CONTENT %	INDEX TEST			SIEVE ANALYSIS			SPECIFIC GRAVITY	SHEAR TEST		STANDARD PENETRATION TEST		ROCK PARAMETERS		
					LIQUID LIMIT %	PLASTIC LIMIT %	PLASTICITY INDEX %	GRAVEL %	SAND %	SILT & CLAY %		COHESION C kN/m²	ANGLE OF INTERNAL FRICTION °	DEPTH OF TESTING m	OBSERVED N VALUE	Core Recovery	RQD	Free swell, %
	0.50	-	-	-	-			-	-	-	-	-	-	0.50	-	NA	NA	-
	1.30	SM	22.63	2.70	Non-Plastic			0.00	83.21	16.79	2.66	-	-	1.30	>50	NA	NA	-

Name of work	**REPORT ON GEOTECHNICAL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF SHRESHTA VILLAS AT S.F.NO 181,182,183,184 & 185 AT WARD NO 27 AT MADUKARAI IN COIMBATORE**

Soil Investigation done by: ALZUM GEOCIVIL INTEGRATED SERVICES, CBE	**Bore hole id** TP-03	**Location:** Mentioned on Site Plan	**Ground Water Level: NIL**	**Work Commenced on**	06.04.2024
				Work Completed on	06.04.2024

SOIL PROFILE AND DEPTH IN METRES	DEPTH OF SAMPLING	IS SOIL CLASSIFICATION	NATURAL WET DENSITY (kN/m³)	NATURAL MOISTURE CONTENT %	INDEX TEST			SIEVE ANALYSIS			SPECIFIC GRAVITY	SHEAR TEST		STANDARD PENETRATION TEST		ROCK PARAMETERS		
					LIQUID LIMIT %	PLASTIC LIMIT %	PLASTICITY INDEX %	GRAVEL %	SAND %	SILT & CLAY %		COHESION C kN/m²	ANGLE OF INTERNAL FRICTION °	DEPTH OF TESTING m	OBSERVED N VALUE	Core Recovery	RQD	Free swell, %
	0.70	-	-	-	-			-	-	-	-	-	-	0.70	-	NA	NA	-
	0.90	SM	22.91	3.17	Non-Plastic			0.00	87.07	12.93	2.65	-	-	0.90	>50	NA	NA	-

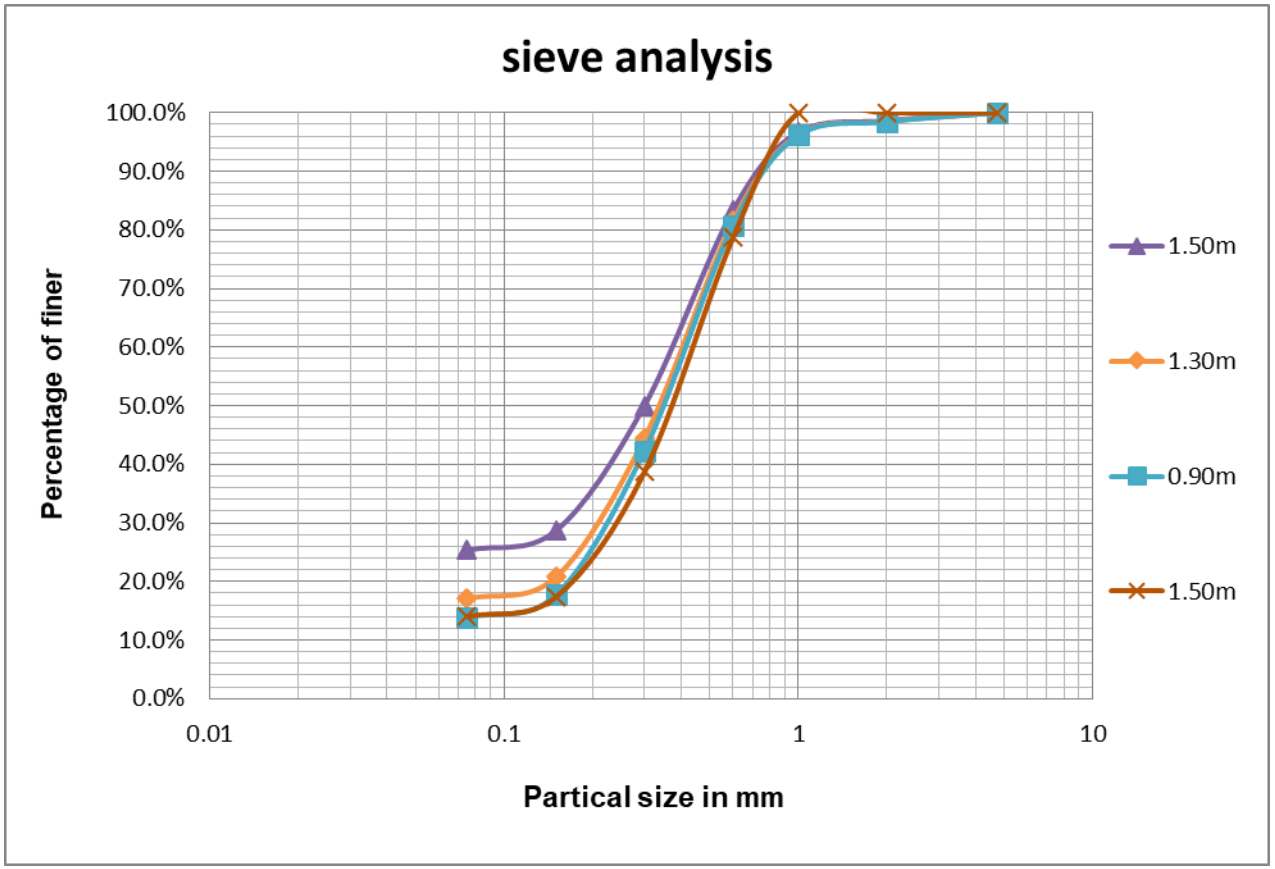
Name of work	**REPORT ON GEOTECHNICAL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF SHRESHTA VILLAS AT S.F.NO 181,182,183,184 & 185 AT WARD NO 27 AT MADUKARAI IN COIMBATORE**

Soil Investigation done by: ALZUM GEOCIVIL INTEGRATED SERVICES, CBE	**Bore hole id** TP-04	**Location:** Mentioned on Site Plan	**Ground Water Level: NIL**	**Work Commenced on**	06.04.2024
				Work Completed on	06.04.2024

SOIL PROFILE AND DEPTH IN METRES	DEPTH OF SAMPLING	IS SOIL CLASSIFICATION	NATURAL WET DENSITY (kN/m³)	NATURAL MOISTURE CONTENT %	INDEX TEST			SIEVE ANALYSIS			SPECIFIC GRAVITY	SHEAR TEST		STANDARD PENETRATION TEST		ROCK PARAMETERS		
					LIQUID LIMIT %	PLASTIC LIMIT %	PLASTICITY INDEX %	GRAVEL %	SAND %	SILT & CLAY %		COHESION C kN/m²	ANGLE OF INTERNAL FRICTION °	DEPTH OF TESTING m	OBSERVED N VALUE	Core Recovery	RQD	Free swell, %
	0.10	-	-	-	-			-	-	-	-	-	-	0.10	-	NA	NA	-
	1.40	SM	23.12	4.10	Non-Plastic			0.00	87.20	12.80	2.65	-	-	1.40	>50	NA	NA	-

ANNEXURE – V

SIEVE ANALYSIS RESULTS

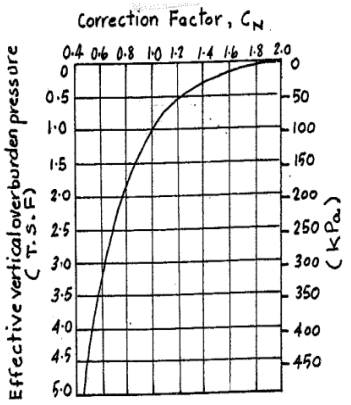

sieve analysis
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
Percentage of finer
0.01
0.1
1
10
Partical size in mm
1.50m
1.30m
0.90m
1.50m

ANNEXURE – VI

SAFE BEARING CAPACITY

Allowable bearing capacity calculation

Width of the footing, B	=	2	m
Depth of foundation, Df	=	1.5	m
Unit weight of soil	=	17	kN/m^3
Submergible unt wt	=	7	kN/m^3
Avg. observed N value	=	50	
Eff. overburden pressure at foundation level	=	10.5	kN/m^3
Overburden correction factor	=	1	
N value after overburden corretion, N'	=	50	
Depth of GWT	=	0	m
Dialtancy corretion, N''	=	NA	
Factor of Safety	=	3	
Rw1	=	0.5	
Rw2	=	0.5	
Ultimate Bearing capacity based on shear	=	$0.314xN'^2xBxRw1+0.943x(100+N'^2)xDfxRw2$	
	=	2623.85	KN/m^2
Safe bearing capacity based on shear	=	874.617	KN/m^2
Safe bearing capacity based on settlement	=	$1.36x(N'-3)x((B+0.3)/2B)^2xSxRdxRw$	
Settlement for Sand	=	25	mm
Depth factor, Rd	=	1+Df/B <2	
Rd	=	1.2	Say
Water table factor, Rw	=	0.5+0.5(Dw/B)	0.5<Rw<1
Rw	=	0.5	Since GWT is below 0m from EGL
Qs	=	317.003 kN/m^2	For 25mm controlled Settlement
Allowable Bearing Pressure at Df depth is	=	**300** kN/m^2	



ANNEXURE – VII

WORKING PHOTOS









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