Verified RealEstate™

Your trusted partner for buying, selling, and managing property, ensuring hassle-free service with 100% transparency.

3/350/2 Mettukuppam,
OMR Thoraipakkam,
Chennai, India

hello@verified.realestate
+91 9996 12 9996

Official Property Record

Digitally Verified Record - Powered by Verified RealEstate™



CONSULTANTS	**GEO MINES ENGINEERS PVT. LTD.** **GEOTECHNICAL ENGINEERING DIVISION,** **NO: 96, 3RD FLOOR, VELLALAR STREET,** **MOGAPPAIR WEST, CHENNAI-37** **Ph. No. 98413 16631, 9840157478** **Hello: 9840496660** **Email: geomines@gmail.com, gmepl77@gmail.com** **Website: www.geominesengineers.com**
CLIENT	**KALYANI PROPERTY DEVELOPERS, CHENNAI**
PROJECT	**PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING (STILT+03) AT PLOT NO: 64, S.NO: 396/1A 396/2 & 396/9, PATTA NO: 9179, SAKTHI GADEN, VIVEKANANDA NAGAR, OKKIYAM THORAIPAKKAM VILLAGE, TAMBARAM TALUK, NOW SHOLINGANALLUR TALUK, CHENGALPATTU DISTRICT, CHENNAI-600097**
TITLE	**GEOTECHNICAL INVESTIGATION REPORT**

0	**09-09-2023**	**GMEPL/SAISHRINE HOUSING PVT. LTD./301/2023-24**	
REV.	**DATE**	**REPORT NUMBER**	**PREP. BY**

Dr. R. Venkata Krishnaiah M.E., Ph.D.,
Geotechnical Expert
Regd. No. GTE/19/07/032
No. 7/4, Munawar Avenue,
4th Street, Pallavaram, Chen...

DISCLAIMER

We've been asked to look into the ground and identify and quantify everything that mother nature has put there and predict how those materials will react to construction and long-term performance of a facility - and we may fall short of this lofty goal.

We have made reasonable and prudent conclusions but a cloud of uncertainty inherently looms over the project as per the pre and post facilities laid and their elemental behaviour on the mother soil.

Also, the variable nature of soil strata and it's varying characteristics may make the recommended foundation system disqualify and hence it's recommended that special care shall be taken by the owner during and after the construction is complete and during the run period of the building.

Dr. R. Venkata Krishnaiah M.E., Ph.D.,
Geotechnical Expert
Regd. No. GTE/19/07/032
No. 7/4, Munuswar Avenue
4th Street, Pallavaram, Chen...

CONTENTS

	SEC. NO.		PAGE NO.
		REPORT COVER PAGE	I
		CONTENTS	I
CHAPTER-1		**INTRODUCTION**	
	1.0	Preamble	1
	1.1	Scope of Work	1
	1.2	Structure of the Report	1
CHAPTER-2		**INVESTIGATION METHODOLOGY & TEST RESULTS**	
	2.0	Field Testing	2
	2.1	Preamble	2
	2.2	Equipment Used and Method of Drilling	2
	2.2.1	Equipment Used	2
	2.2.2	Method of Drilling	2
	2.3	In-situ Strength Tests	2
	2.3.1	Standard Penetration Tests	2
	2.4	Collection of Samples	2
	2.4.1	Disturbed Soil Samples	2
	2.4.2	Ground Water	3
	2.5	Summary of Field Work	3
	2.6	Laboratory Testing	3
	2.6.1	Coarse Grained Soil Samples	3
	2.6.1.1	Grain Size Analysis Tests	3
	2.6.2	Fine Grained Soil Samples	3
	2.6.2.1	Index Property & Free Swell Tests	3
	2.6.3	Chemical Analysis Tests	3
	2.6.3.1	Water Samples	3
FIGURES	2.0	Site Plan representing the locations of Field investigation points	4
	2.1	Soil Profile at BH-01 Location	5
	2.2	Soil Profile at BH-02 Location	6
	2.3	Soil Profile at BH-03 Location	7
TABLES	2.1	Laboratory Test Results on the Soil Samples collected from BH-01 Location	8
	2.2	Laboratory Test Results on the Soil Samples collected from BH-02 Location	9
	2.3	Laboratory Test Results on the Soil Samples collected from BH-03 Location	10
	2.4	Chemical Analysis Test Result on the water Samples collected from borehole Locations	11
CHAPTER-3		**SUB-SURFACE STRATIFICATION**	
	3.0	Preamble	12

Dr. R. Venkata Krishnaiah, M.Tech., Ph.D.,
Geotechnical Expert
Regd. No. GTE/19/07/032
No. 7/4, Munuswar Avenue
4th Street, Pallavaram, Chen...

	3.1	Sub surface Stratification	12
	3.1.1	Soil Profile at BH-01 Location	12
	3.1.2	Soil Profile at BH-02 Location	13
	3.1.3	Soil Profile at BH-03 Location	14-15
CHAPTER-4		**FOUNDATION SYSTEM**	
	4.0	Preamble	16
	4.1	Bearing Strata Characteristics	16
	4.2	Foundation System	16
	4.2.1	Deep Foundation System-14.00m Long Bored Cast-in-Situ Friction cum End Bearing Piles	16-17
CHAPTER-5		**RECOMMENDATIONS**	18
ANNEXURE		Design of Deep Foundation System (Ref. BH-03)	19-20



Dr. R. Venkata Krishnaiah M.E., Ph.D.,
Geotechnical Expert
Regd. No. GTE/19/07/032
No. 7/4, Munuswar Avenue
4th Street, Pallavaram, Chen...

CHAPTER-1

INTRODUCTION

1.0 Preamble

Kalyani Property Developers, Chennai proposed to construct a **Residential Building (Stilt+03) at Plot No: 64, S.No: 396/1A , 396/2 & 396/9, Patta No: 9179, Sakthi Garden, Vivekananda Nagar, Okkiyam Thoraipakkam Village, Rambaram Taluk, now Sholinganallur Taluk, Chengalpattu District, Chennai-600097.**

For the purpose of designing the foundations, the responsibility of carrying out suitable soil investigation was entrusted to **M/s. Geo Mines ENGINEERS Pvt. Ltd., Chennai.**

This report contains the field and laboratory test results along with Design computations and recommendations for suitable foundation systems.

1.1 Scope of Work

- Sinking Three Standard Soil investigation bore holes of 150mm diameter up to a depth of 14.00m below existing ground level as directed by the engineer-in-charge.
- Conducting Standard Penetration Test (SPT) at regular depth intervals.
- Collection of Split Spoon Samples or Disturbed Soil Samples
- Collection of water samples from each bore hole.
- Conducting relevant laboratory test results.

1.2 Structure of the Report

- Contents
- Introduction
- Investigation Methodology & Test Results
- Figures & Tables
- Sub-Surface Stratification
- Foundation Systems
- Recommendations
- Annexure (Design Computations)

Dr. R. Venkata Krishnaiah M.E., Ph.D.,
Geotechnical Expert
Regd. No. GTE/19/07/032
No. 7/4, Munuvar Avenue
4th Street, Pallavaram, Chen...

CHAPTER-2

INVESTIGATION METHODOLOGY & TEST RESULTS

2.0 Field Testing:

2.1 Preamble:

Three standard soil investigation boreholes were put. The equipment used and the methodology adopted to carry out the fieldwork is described below.

2.2 Equipment Used and Method of Drilling:

2.2.1 Equipment Used

The equipment used for performing the drilling operations was a Calyx Rotary Drill Rig with direct mud circulation technique. The drill mud used was made out of Sodium Bentonite.

2.2.2 Methodology of drilling

In the soil strata, the drilling operations were carried out using special drill bits and cutters coupled with direct mud circulation.

2.3 In-Situ Strength Tests:

2.3.1 Standard Penetration Test:

Standard penetration tests were conducted at the borehole locations, in accordance with IS: 2131. The tests were conducted at every change of strata up to the depth of termination of the borehole as directed by the engineer-in-charge.

2.4. Collection of Samples:

2.4.1 Disturbed Soil Samples

The SPT-samples collected were used as disturbed soil samples. These samples were used for visual and physical identification and for conducting laboratory classification tests as per I.S.1498-1970.

Dr. R. Venkata Krishnaiah M.E. Ph.D
Geotechnical Expert
Regd. No. GTE/19/07/032
No. 7/4, Munuswar Avenue

2.4.2 Ground Water

For conducting suitable chemical tests, the ground water sample was collected from the respective boreholes.

2.5 Summary of Field Work

The locations of the boreholes are shown in site plan given in Fig. 2.0. The soil profiles obtained at each location is shown in Fig. 2.1 to 2.3.

2.6 Laboratory Testing:

2.6.1 Coarse Grained Samples:

2.6.1.1 Grain size Analysis Tests:

On the coarse-grained soil samples, grain size distribution tests were conducted as per I.S.2720 (Part 4)-1985, to know the gradation characteristics and to classify them. These results are presented in Tables 2.1 to 2.3.

2.6.2 Fine Grained Samples:

2.6.2.1 Index Property – Free Swell Tests:

Atterberg Limits were carried out on fine grained soil samples to evaluate the limits of different consistency states. Generally Liquid limits, Plastic limits and Shrinkage Limits tests were conducted as per I.S.2720 (Part-5)-1985 and I.S.2720 (Part 6)-1972. On such type of soil strata encountered at the investigation locations, such tests were conducted and the test results are presented in Tables 2.1 to 2.3.

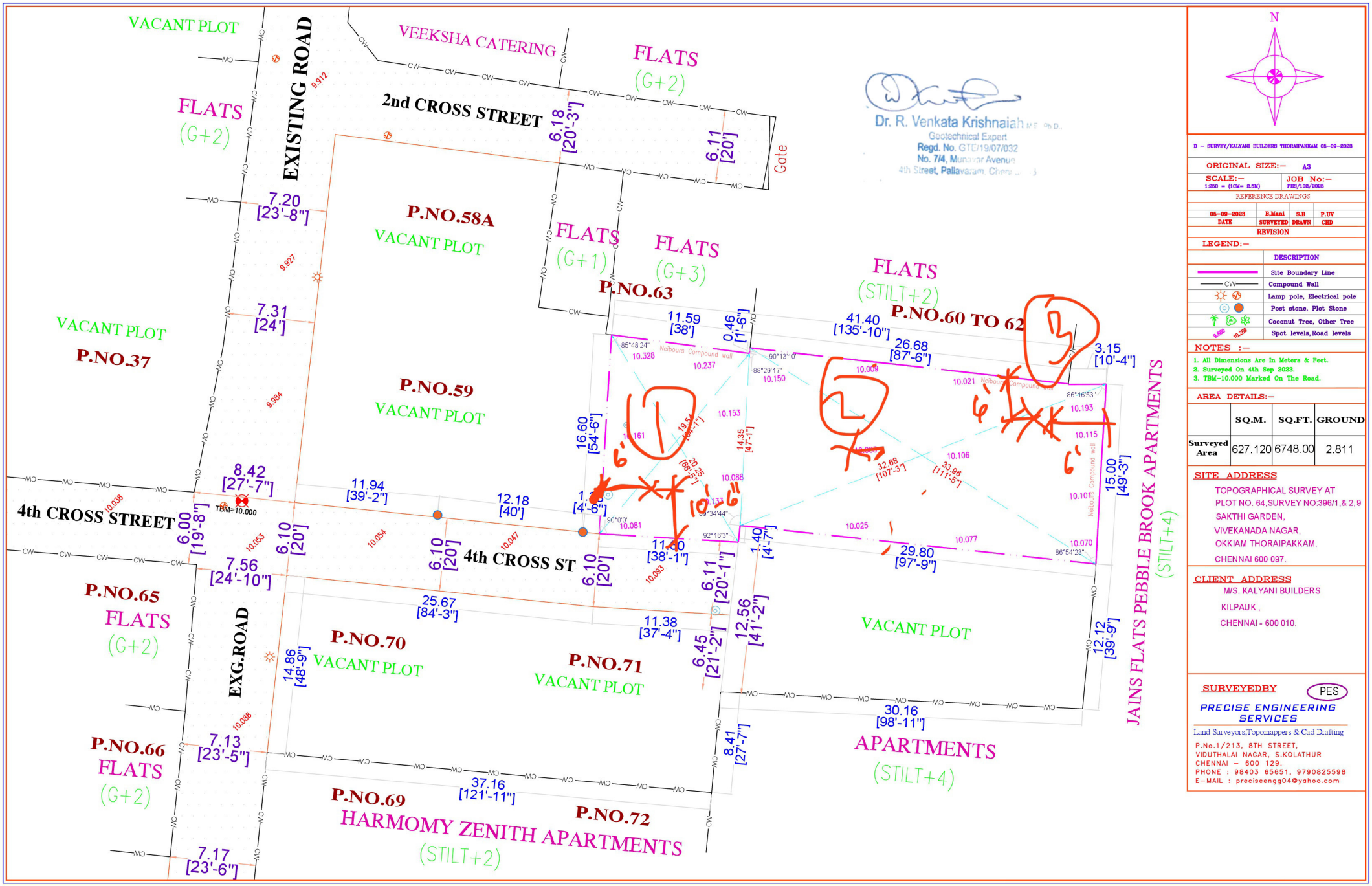
2.6.3 Chemical Analysis Tests:

2.6.3.1 Water Samples:

On representative water samples, chemical analysis tests were conducted to estimate pH, Chlorides and Sulphates. These results are presented in Table-2.4.



Dr. R. Venkata Krishnaiah M.E., Ph.D.,
Geotechnical Expert
Regd. No. GTE/19/07/032
No. 7/4, Munuvar Avenue
4th Street, Pallavaram, Chen...


VACANT PLOT
EXISTING ROAD
VEEKSHA CATERING
FLATS (G+2)
2nd CROSS STREET
6.18 [20'-3"]
6.11 [20']
Gate
FLATS (G+2)
7.20 [23'-8"]
P.NO.58A
VACANT PLOT
FLATS (G+1)
FLATS (G+3)
P.NO.63
FLATS (STILT+2)
P.NO.60 TO 62
VACANT PLOT
P.NO.37
7.31 [24']
P.NO.59
VACANT PLOT
11.59 [38']
0.46 [1'-6"]
41.40 [135'-10"]
26.68 [87'-6"]
3.15 [10'-4"]
16.60 [54'-6"]
8.42 [27'-7"]
11.94 [39'-2"]
12.18 [40']
4th CROSS STREET
TBM=10.000
6.00 [19'-8"]
6.10 [20']
4th CROSS ST
11.00 [38'-1"]
1.40 [4'-7"]
29.80 [97'-9"]
15.00 [49'-3"]
7.56 [24'-10"]
P.NO.65
FLATS (G+2)
EXG.ROAD
25.67 [84'-3"]
11.38 [37'-4"]
6.45 [21'-2"]
12.56 [41'-2"]
6.11 [20'-1"]
P.NO.70
VACANT PLOT
P.NO.71
VACANT PLOT
VACANT PLOT
12.12 [39'-9"]
14.86 [48'-9"]
30.16 [98'-11"]
JAINS FLATS PEBBLE BROOK APARTMENTS (STILT+4)
P.NO.66
FLATS (G+2)
7.13 [23'-5"]
8.41 [27'-7"]
APARTMENTS (STILT+4)
37.16 [121'-11"]
P.NO.69
HARMOMY ZENITH APARTMENTS (STILT+2)
P.NO.72
7.17 [23'-6"]
Dr. R. Venkata Krishnaiah
Geotechnical Expert
Regd. No. GTE/19/07/032
No. 7/4, Munuvar Avenue
4th Street, Paliavaram, Chen
N
D – SURVEY/KALYANI BUILDERS THORAIPAKKAM 05-09-2023
ORIGINAL SIZE:– A3
SCALE:– 1:250 = (1CM= 2.5M)
JOB No:– PES/102/2023
REFERENCE DRAWINGS
05-09-2023 DATE | B.Mani SURVEYED | S.B DRAWN | P.UV CHD
REVISION
LEGEND:–
DESCRIPTION
Site Boundary Line
Compound Wall
Lamp pole, Electrical pole
Post stone, Plot Stone
Coconut Tree, Other Tree
Spot levels,Road levels
NOTES :–
1. All Dimensions Are In Meters & Feet.
2. Surveyed On 4th Sep 2023.
3. TBM–10.000 Marked On The Road.
AREA DETAILS:–
SQ.M. | SQ.FT. | GROUND
Surveyed Area | 627.120 | 6748.00 | 2.811
SITE ADDRESS
TOPOGRAPHICAL SURVEY AT PLOT NO. 64,SURVEY NO:396/1,& 2,9 SAKTHI GARDEN, VIVEKANADA NAGAR, OKKIAM THORAIPAKKAM. CHENNAI 600 097.
CLIENT ADDRESS
M/S. KALYANI BUILDERS KILPAUK , CHENNAI - 600 010.
SURVEYEDBY PES
PRECISE ENGINEERING SERVICES
Land Surveyors,Topomappers & Cad Drafting
P.No.1/213, 8TH STREET, VIDUTHALAI NAGAR, S.KOLATHUR CHENNAI – 600 129.
PHONE : 98403 65651, 9790825598
E–MAIL : preciseengg04@yahoo.com

Project : Proposed Construction of Residential Building (Stilt+03) at Plot No: 64, S.No: 396/1A , 396/2 & 396/9, Patta No: 9179, Sakthi Garden, Vivekananda Nagar, Okkiyam Thoraipakkam Village, Rambaram Taluk, now Sholinganallur Taluk, Chengalpattu District, Chennai-600097.

Location: BH-01

Started On : 06/09/2023; Ended On : 07/09/2023 G.W.T: 0.00m below existing ground level

R.L of Layer (m)	G.W.T. (m)	Soil Profile	Engineering Description of Soil	SPT - Details: Depth of SPT below E.G.L (m)	0-15 cm	15-30 cm	30-45 cm	N-Value	Graphical Representation of SPT (0 10 20 30 40 50 60 70 80 90)	Relative Density/Consistency	Type of Sample
G.W.T	▼		Filled Up Soil							-	DS
1.00											
			Greyish Very Loose Silty Fine Sand	1.50	2	2	2	4		V.Loose	SS
2.00											
			Greyish Loose Silty Fine Sand	3.00	2	3	3	6		Loose	SS
				4.50	4	4	4	8		Loose	SS
6.00				6.00	1	2	2	4		V.Loose	SS
			Greyish Very Loose Silty Fine Sand	7.50	2	2	3	5		Loose	SS
			Greyish Loose Silty Fine Sand	9.00	3	3	3	6		Loose	SS
				10.00	2	3	3	6		Loose	SS
11.00											
			Greenish Very Stiff Silty Clay	12.00	7	8	10	18		V.Stiff	SS
13.50											
			Weathered Rock	14.00	09cms Penetration for 50 Blows					V.Dense	SS
14.20											

Bore Hole Terminated at a depth of 14.20m below the existing ground level

Fig. 2.1 Soil Profile at BH-01 Location

Dr. R. Venkata Krishnaiah M.E., Ph.D.,
Geotechnical Expert
Regd. No. GTE/19/07/032
No. 7/4, Munuswar Avenue
4th Street, Pallavaram, Chen...

Project : Proposed Construction of Residential Building (Stilt+03) at Plot No: 64, S.No: 396/1A , 396/2 & 396/9, Patta No: 9179, Sakthi Garden, Vivekananda Nagar, Okkiyam Thoraipakkam Village, Rambaram Taluk, now Sholinganallur Taluk, Chengalpattu District, Chennai-600097.

Location: BH-02

Started On : 07/09/2023; Ended On : 07/09/2023 G.W.T: 0.00m below existing ground level

R.L of Layer (m)	G.W.T. (m)	Soil Profile	Engineering Description of Soil	Depth of SPT below E.G.L (m)	SPT - Details 0-15 cm	15-30 cm	30-45 cm	N-Value	Graphical Representation of SPT (0 10 20 30 40 50 60 70 80 90)	Relative Density/Consistency	Type of Sample
G.W.T	▼		Filled Up							-	DS
1.00			Soil								
				1.50	2	2	2	4		Soft	SS
			Brownish Soft								
			Silty Sandy Clay	3.00	2	1	2	3		Soft	SS
4.00											
				4.50	2	3	2	5		Loose	SS
				6.00	2	2	3	5		Loose	SS
				7.50	2	3	3	6		Loose	SS
			Greyish								
			Loose	9.00	3	3	4	7		Loose	SS
			Silty Clayey Fine Sand								
				10.00	3	3	3	6		Loose	SS
				12.00	3	4	4	8		Loose	SS
13.50											
			Weathered	14.00	SPT Hammer Rebounded					V.Dense	SS
14.20			Rock								

Bore Hole Terminated at a depth of 14.20m below the existing ground level

Fig. 2.2 Soil Profile at BH-02 Location

Dr. R. Venkata Krishnaiah M.E., Ph.D.,
Geotechnical Expert
Regd. No. GTE/19/07/032
No. 7/4, Munuvar Avenue
4th Street, Pallavaram, Chen...

Project : Proposed Construction of Residential Building (Stilt+03) at Plot No: 64, S.No: 396/1A , 396/2 & 396/9, Patta No: 9179, Sakthi Garden, Vivekananda Nagar, Okkiyam Thoraipakkam Village, Rambaram Taluk, now Sholinganallur Taluk, Chengalpattu District, Chennai-600097.

Location: BH-03

Started On : 07/09/2023; Ended On : 07/09/2023 G.W.T: 0.00m below existing ground level

R.L of Layer (m)	G.W.T. (m)	Soil Profile	Engineering Description of Soil	SPT - Details: Depth of SPT below E.G.L (m)	0-15 cm	15-30 cm	30-45 cm	N-Value	Graphical Representation of SPT (0 10 20 30 40 50 60 70 80 90)	Relative Density/Consistency	Type of Sample
0.50	▼		Filled Up Soil							-	DS
			Greyish Soft Silty Sandy Clay	1.50	2	2	2	4		Soft	SS
2.50				3.00	2	2	3	5		M.Stiff	SS
			Greyish Medium Stiff Silty Sandy Clay	4.50	3	3	2	5		M.Stiff	SS
				6.00	3	4	4	8		M.Stiff	SS
7.00				7.50	3	4	3	7		Loose	SS
				9.00	4	4	4	8		Loose	SS
			Greyish Loose Silty Fine Sand	10.00	3	3	4	7		Loose	SS
				12.00	3	4	5	9		Loose	SS
13.50											
			Weathered Rock	14.00	SPT Hammer Rebounded					V.Dense	SS
14.20											

Bore Hole Terminated at a depth of 14.20m below the existing ground level

Fig. 2.3 Soil Profile at BH-03 Location

Dr. R. Venkata Krishnaiah M.E., Ph.D.,
Geotechnical Expert
Regd. No. GTE/19/07/032
No. 7/4, Munuswar Avenue
4th Street, Pallavaram, Chen...

Table 2.1: Laboratory Test Results on the Soil Samples Collected from BH-01

Depth of Sample below E.G.L. (m)	SPT of Sample	Type of Sample	Engineering Description of Soil	NMC(%)	Natural Density (g/cc)	Clay					Relative Density/ Consistency	Sieve Analysis						IS-Classification
						LL (%)	PL (%)	PI	I_c	FS		Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	
0.00 to 1.00	-	DS	Filled Up Soil	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.00 to 2.00	4	SS	Silty Fine Sand	-	1.4	-	-	-	-	-	V.Loose	0	0	7	67	26	0	SM
2.00 to 6.00	7	SS	Silty Fine Sand	-	1.5	-	-	-	-	-	Loose	0	0	0	70	30	0	SM
6.00 to 7.50	4	SS	Silty Fine Sand	-	1.4	-	-	-	-	-	V.Loose	0	0	0	69	31	0	SM
7.50 to 11.00	5	SS	Silty Fine Sand	-	1.5	-	-	-	-	-	Loose	0	0	6	72	22	0	SM
11.00 to 13.50	18	SS	Silty Clay	29	1.8	43	32	11	1.27	-	V.Stiff	0	0	0	0	23	77	CI
13.50 to 14.20	>100	SS	Weathered Rock	-	2.0	-	-	-	-	-	V.Dense	39	14	26	17	4	0	SDR

Dr. R. Venkata Krishnaiah M.E., Ph.D.,
Geotechnical Expert
Regd. No. GTE/19/07/032
No. 7/4, Munuvar Avenue
4th Street, Pallavaram, Chen...

Table 2.2: Laboratory Test Results on the Soil Samples Collected from BH-02

Depth of Sample below E.G.L. (m)	SPT of Sample	Type of Sample	Engineering Description of Soil	NMC(%)	Natural Density (g/cc)	Clay					Relative Density/ Consistency	Sieve Analysis						IS-Classification
						LL (%)	PL (%)	PI	I_c	FS		Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	
0.00 to 1.00	-	DS	Filled Up Soil	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.00 to 4.00	3	SS	Silty Sandy Clay	47	1.3	61	21	40	0.35	14	Soft	0	0	0	9	5	86	CH
4.00 to 13.50	6	SS	Silty Clayey Fine Sand	-	1.5	-	-	-	-	-	Loose	0	0	0	60	19	21	SM
13.50 to 14.20	>100	SS	Weathered Rock	-	2.0	-	-	-	-	-	V.Dense	43	19	21	15	2	0	SDR

Dr. R. Venkata Krishnaiah M.E., Ph.D.,
Geotechnical Expert
Regd. No. GTE/19/07/032
No. 7/4, Munnivar Avenue
4th Street, Pallavaram, Chen...

Table 2.3: Laboratory Test Results on the Soil Samples Collected from BH-03

Depth of Sample below E.G.L. (m)	SPT of Sample	Type of Sample	Engineering Description of Soil	NMC(%)	Natural Density (g/cc)	Clay					Relative Density/ Consistency	Sieve Analysis						IS-Classification
						LL (%)	PL (%)	PI	I_c	FS		Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	
0.00 to 0.50	-	DS	Filled Up Soil	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.50 to 2.50	4	SS	Silty Sandy Clay	44	1.4	60	21	39	0.41	11	Soft	0	0	0	13	7	80	CH
2.50 to 7.00	6	SS	Silty Sandy Clay	38	1.5	57	25	32	0.59	-	M.Stiff	0	0	0	10	13	77	CH
7.00 to 13.50	7	SS	Silty Fine Sand	-	1.5	-	-	-	-	-	Loose	0	0	0	74	26	0	SM
13.50 to 14.20	>100	SS	Weathered Rock	-	2.0	-	-	-	-	-	V.Dense	44	18	18	17	3	0	SDR

Dr. R. Venkata Krishnaiah M.E., Ph.D.,
Geotechnical Expert
Regd. No. GTE/19/07/032
No. 7/4, Munuswar Avenue
4th Street, Pallavaram, Chen...

Table 2.4: Chemical Analysis Results conducted on Water Samples collected from BH-01 to BH-03

Location	Depth of Sample below E.G.L. (m)	pH	Chlorides (ppm)	Sulphates (ppm)
BH-01	3.00	6.71	318.88	140.12
BH-02	3.00	6.73	308.73	133.95
BH-03	3.00	6.73	309.05	134.00



Dr. R. Venkata Krishnaiah M.E., Ph.D.,
Geotechnical Expert
Regd. No. GTE/19/07/032
No. 7/4, Munuswar Avenue
4th Street, Pallavaram, Chen[illegible]

CHAPTER-3

SUB-SURFACE STRATIFICATION

3.0 Preamble

The sub surface stratification at borehole locations, with respect to foundation/geotechnical engineering application are derived based on the visual identification, laboratory classification tests and field in-situ strength tests. Further, the strength parameters are estimated based on the in-situ strength test results as per the following correlation.

* **For Coarse Grained Samples, Ref. Fig.1, IS: 6403 to estimate Angle of Shearing Resistance.**
* **For Fine Grained Samples, Ref. Terzaghi & Peck, 1948, to estimate Unconfined Compressive Strength.**

Dr. R. Venkata Krishnaiah
Geotechnical Expert
Regd. No. GTE/19/07/032
No. 7/4, Munuswar Avenue
4th Street, Pallavaram, Chen

3.1 Sub Surface Stratification:

3.1.1 Soil Profile at BH-01 Location

(At BH-01 Location, as presented in Site plan)

* **Layer-1 (from E.G.L to 1.00m depth)**

Type of Strata	Filled Up Soil
Colour	-
Thickness of Layer	1.00m

* **Layer-2 (from 1.00m to 2.00m depth)**

Type of Strata	Silty Fine Sand
Colour	Greyish
Thickness of Layer	1.00m
SPT of the layer	04
Relative Density	Very Loose
Angle of Shearing Resistance, ϕ	28.80^0

* **Layer-3 (from 2.00m to 6.00m depth)**

Type of Strata	Silty Fine Sand
Colour	Greyish
Thickness of Layer	4.00m
SPT of the layer	07
Relative Density	Loose
Angle of Shearing Resistance, ϕ	29.40^0

* **Layer-4 (from 6.00m to 7.50m depth)**

Type of Strata	Silty Fine Sand
Colour	Greyish
Thickness of Layer	1.50m
SPT of the layer	04

Relative Density	Very Loose
Angle of Shearing Resistance, ϕ	28.80^0

* **Layer-5 (from 7.50m to 11.00m depth)**

Type of Strata	Silty Fine Sand
Colour	Greyish
Thickness of Layer	3.50m
SPT of the layer	05
Relative Density	Loose
Angle of Shearing Resistance, ϕ	29.00^0

* **Layer-6 (from 11.00m to 13.50m depth)**

Type of Strata	Silty Clay
Colour	Greenish
Thickness of Layer	2.50m
SPT of the layer	18
Consistency	Very Stiff
Un-drained Cohesion, Cu	120.00kPa

* **Layer-7 (from 13.50m to 14.20m depth)**

Type of Strata	Weathered Rock
Colour	-
Thickness of Layer	0.70m
SPT of the layer	>100
Relative Density	Very Dense
Angle of Shearing Resistance, ϕ	42.50^0

Ground Water

Ground water table was encountered at a depth of 0.00m below the existing ground level during the second week of September 2023.

3.1.2 Soil Profile at BH-02 Location
(At BH-02 Location, as presented in Site plan)

* **Layer-1 (from E.G.L to 1.00m depth)**

Type of Strata	Filled Up Soil
Colour	-
Thickness of Layer	1.00m

* **Layer-2 (from 1.00m to 4.00m depth)**

Type of Strata	Silty Sandy Clay
Colour	Brownish
Thickness of Layer	3.00m
SPT of the layer	03
Consistency	Soft
Un-drained Cohesion, Cu	20.00kPa

* **Layer-3 (from 4.00m to 13.50m depth)**

Type of Strata	Silty Clayey Fine Sand
Colour	Greyish
Thickness of Layer	9.50m
SPT of the layer	06
Relative Density	Loose
Angle of Shearing Resistance, ϕ	29.20^0

Dr. R. Venkata Krishnaiah
Geotechnical Expert
Regd. No. GTE/19/07/032
No. 7/4, Munuvar Avenue
4th Street, Pallavaram, Chen...

* **Layer-4 (from 13.50m to 14.20m depth)**

Type of Strata	Weathered Rock
Colour	-
Thickness of Layer	0.70m
SPT of the layer	>100
Relative Density	Very Dense
Angle of Shearing Resistance, ϕ	42.50^0

Ground Water

Ground water table was encountered at a depth of 0.00m below the existing ground level during the second week of September 2023.

3.1.3 Soil Profile at BH-03 Location
(At BH-03 Location, as presented in Site plan)

* **Layer-1 (from E.G.L to 0.50m depth)**

Type of Strata	Filled Up Soil
Colour	-
Thickness of Layer	0.50m

* **Layer-2 (from 0.50m to 2.50m depth)**

Type of Strata	Silty Sandy Clay
Colour	Greyish
Thickness of Layer	2.00m
SPT of the layer	04
Consistency	Soft
Un-drained Cohesion, Cu	26.66kPa

* **Layer-3 (from 2.50m to 7.00m depth)**

Type of Strata	Silty Sandy Clay
Colour	Greyish
Thickness of Layer	4.50m
SPT of the layer	06
Consistency	Medium Stiff
Un-drained Cohesion, Cu	40.00kPa

* **Layer-4 (from 7.00m to 13.50m depth)**

Type of Strata	Silty Fine Sand
Colour	Greyish
Thickness of Layer	6.50m
SPT of the layer	07
Relative Density	Loose
Angle of Shearing Resistance, ϕ	29.40^0

* **Layer-5 (from 13.50m to 14.20m depth)**

Type of Strata	Weathered Rock
Colour	-
Thickness of Layer	0.70m
SPT of the layer	>100
Relative Density	Very Dense
Angle of Shearing Resistance, ϕ	42.50^0

Ground Water

Dr. R. Venkata Krishnaiah M.E.
Geotechnical Expert
Regd. No. GTE/19/07/032
No. 7/4, Munuvar Avenue
4th Street, Pallavaram, Chen...

Ground water table was encountered at a depth of 0.00m below the existing ground level during the second week of September 2023.

Dr. R. Venkata Krishnaiah M.E., Ph.D.,
Geotechnical Expert
Regd. No. GTE/19/07/032
No. 7/4, Munuvar Avenue
4th Street, Pallavaram, Chen...

CHAPTER-4

FOUNDATION SYSTEM

4.0 Preamble

The foundation system design is an interface between super structure and the sub soil bearing strata characteristics. A sound foundation system should be safe against bearing strata shear response under the super structure load intensity. Similarly, the stability of the foundation system is governed by the bearing strata deformation response under the super structure load intensity. In addition, as a combined system of super structure and foundation, the overall stability is also governed by the super structure arrangement.

Considering the above aspects of foundation design, the suitable type of foundation system with respect to the sub soil conditions encountered at the borehole locations is presented in the subsequent sections.

4.1 Bearing Strata Characteristics

From field investigations, it can be observed that the sub-soil strata encountered at shallow depths are weak from both shear strength characteristics and deformation considerations and hence cannot be considered as bearing strata for proposed impending loads from structure.

However, the refusal strata (SPT>100) encountered below a uniform depth of 13.50m below existing ground level can be considered as good end bearing strata for proposed impending loads from structure.

Considering the above, suitable foundation system is presented below.

4.2 Foundation System

4.2.1 Deep Foundation System-14.00m Long Bored Cast-in-Situ Friction cum End Bearing Piles

Considering the weak shear strength characteristics of the sub-soil strata encountered at the investigation location @ shallow depths, deep foundation system consisting of 14.00m long bored cast-in-situ Friction cum End Bearing Piles can be adopted.

Piles shall be drilled through DMC (direct mud circulation) technique.

Dr. R. Venkata Krishnaiah M.E. Ph.D
Geotechnical Expert
Regd. No. GTE/19/07/032
No. 7/4, Munuvar Avenue

For four different diameters, the safe load carrying capacities of 14.00m long bored cast-in-situ Friction cum End Bearing Piles are computed and presented below which can be adopted for foundation design purposes.

S. No	Type of Installation of Pile	Type of Pile Head Group	Length of Pile below Existing Ground Level (m)	Diameter of Pile (mm)	Safe Load Carrying Capacity (MT)	Safe Pull Out Capacity (MT)
1	Bored Cast-in-Situ	Fixed	14.00	400	40	16
2				450	50	18
3				500	60	20
4				550	70	22

The computations of safe load carrying capacity for 400mm diameter and 14.00m long bored cast-in-situ Friction cum End Bearing pile are annexed to this report.

Dr. R. Venkata Krishnaiah M.E., Ph.D.,
Geotechnical Expert
Regd. No. GTE/19/07/032
No. 7/4, Munuvar Avenue
4th Street, Pallavaram, Chen...

CHAPTER-5

CONCLUSIONS & RECOMMENDATIONS

1. Deep foundation system presented in Clause 4.2.1, Chapter-IV can be adopted for foundation design purposes.
2. Suitable pile load tests (as per I.S: 2911, part-IV) shall be performed to confirm the presented **theoretical** safe load carrying capacities and shall be used as **allowable/design** load carrying capacities of pile under considerations. **(Mandatory).**
3. **Pile cap can be located on 0.50m thick ground replaced surface. Ground replacement can be done with well compacted CNS (Cohesive Non-Swelling) Soil.**
4. **Piles shall be grouped according to the column design load requirements.**
5. Safe load carrying capacities of piles shall be limited to their structural capacities.
6. **Care shall be taken so that the ultimate end bearing strata are none other than recommended Weathered Rock type. (Note)**
7. CNS can be non-plastic soil material like quarry-dust or clean river sand or sand-gravel mix or M-Sand, etc that shall well-compacted at optimum moisture content to achieve more than 95% of laboratory maximum dry density at site.
8. As the chlorides present in water samples collected at shallow depths are within the permissible limits, no chloride resistant steel or sulphate resistant cement is recommended to be used for **open** foundation (if recommended) construction purposes. **However, it is recommended to sample the water at different depth intervals from deeper levels to ascertain the chemical parameters present in it to understand their usage as per the requirements and also for type of construction material to be used for deep foundation purposes.**

For Geo Mines Engineers Pvt Ltd

Dr. R. Venkata Krishnaiah M.E., Ph.D.,
Geotechnical Expert

DESIGN OF PILE FOUNDATION (Ref. BH-03)

Refer, IS:2911(Part I/Sec 2)-1979, Reaffirmed 1997

1.0 Type of Installation of Pile — **Bored Cast in Situ**

1.1 Geometrical Data

Assumed Diameter of pile(D):	**400.0**	mm
Assumed R.L of E.G.L:	0.000	m
Length of pile below E.G.L.(l) :	**14.000**	m
R.L. of Bot. of Pile	-14.00	m

1.2 Design of Pile for Vertical Compression

1.2.1 Computation of Skin Resistance:

1.2.1.1 **Layer-II**

Type of Strata:	Silty Sandy Clay	
Average SPT of the strata,N:	4	
Bulk Density of the strata,γ:	14	kN/m^3
Undrained Cohesion, Cu:	26.67	kPa
R.L of top of Strata:	-0.50	m
R.L of bottom of Strata:	-2.50	m
Average Thickness of Strata,I_c:	2.00	m
Effective overburden pressure over the top of strata,σ_{top}:	0.00	kN/m^2
Effective overburden pressure over the bottom of strata,σ_{bottom}:	8.00	kN/m^2
Effective overburden pressure at the middle of the strata,σ_{middle}:	4.00	kN/m^2
Adhesion Factor, α:	1.00	
Negative Skin Resistance of the pile,q_s:	**-67.02**	**kN**
(q_s:α*Cu*pi()*d*Ic)		

1.2.1.2 **Layer-III**

Type of Strata:	Silty Sandy Clay	
Average SPT of the strata,N:	6	
Bulk Density of the strata,γ:	15	kN/m^3
Undrained Cohesion, Cu:	40.00	kPa
R.L of top of Strata:	-2.50	m
R.L of bottom of Strata:	-7.00	m
Average Thickness of Strata,I_c:	4.50	m
Effective overburden pressure over the top of strata,σ_{top}:	8.00	kN/m^2
Effective overburden pressure over the bottom of strata,σ_{bottom}:	30.50	kN/m^2
Effective overburden pressure at the middle of the strata,σ_{middle}:	19.25	kN/m^2
Adhesion Factor, α:	0.70	
Skin Resistance of the pile,q_s:	158.34	kN
(q_s:α*Cu*pi()*d*Ic)		

1.2.1.3 **Layer-IV**

Type of Strata:	Silty Fine Sand	
Average SPT of the strata,N:	7	
Bulk Density of the strata,γ:	15	kN/m^3
Angle of Shearing Resistance,ϕ:	29.4	Deg.
R.L of top of Strata:	-7.00	m
R.L of bottom of Strata:	-13.50	m

Dr. R. Venkata Krishnaiah M.E., Ph.D.,
Geotechnical Expert
Regd. No. GTE/19/07/032
No. 7/4, Munuvar Avenue
4th Street, Pallavaram, Chen...

Average Thickness of Strata,I_c:	6.50	m
Effective overburden pressure over the top of strata,σ_{top}:	30.50	kN/m^2
Effective overburden pressure over the bottom of strata,σ_{bottom}:	63.00	kN/m^2
Effective overburden pressure at the middle of the strata,σ_{middle}:	46.75	kN/m^2
Coeff. Of Earth Pressure, k:	1.00	
Skin Resistance of the pile,q_s:	215.17	kN
(q_s:σ*k*tanϕ*pi()*d*Ic)		

1.2.1.4 Layer-V

Type of Strata:	Weathered Rock	
Average SPT of the strata,N:	60	
Bulk Density of the strata,γ:	20	kN/m^3
Angle of Shearing Resistance,ϕ:	42.5	Deg.
R.L of top of Strata:	-13.50	m
R.L of bottom of Strata:	-14.00	m
Average Thickness of Strata,I_c:	0.50	m
Effective overburden pressure over the top of strata,σ_{top}:	63.00	kN/m^2
Effective overburden pressure over the bottom of strata,σ_{bottom}:	68.00	kN/m^2
Effective overburden pressure at the middle of the strata,σ_{middle}:	65.50	kN/m^2
Coeff. Of Earth Pressure, k:	2.50	
Skin Resistance of the pile,q_s:	94.28	kN
(q_s:σ*k*tanϕ*pi()*d*Ic)		

Ultimate Skin Resistance,q_s:	**400.76**	**kN**

1.2.2 Computation of End Bearing Resistance:

Type of Bearing Strata	Weathered Rock	
Cross-Sectional Area of pile,Ap:	0.126	m^2
R.L of bottom of pile:	-14.00	
Minimum SPT-value of the Bearing Strata	60	
Angle of Shearing Resistance(ASR)	42.50	Degrees
Bearing Capacity Factor(Nq)	220.00	
Effecitve Over Burden Pressure at the bottom of pile (q)	27.00	kPa
Ultimate End Bearing Resistance (Qp)	**746.4**	**kN**
(Qp=Ap*q*Nq)		

1.3.0	**Ultimate Load Carrying Capacity ($Qu=Qs+Q_p$)**	**1147.2**	**kN**
	Safe Load Carrying Capacity (Qsafe =Qu/2.50)	**458.9**	**kN**
	However, limit Q_{safe} to the structural capacity of pile:	**400.0**	**kN**

Dr. R. Venkata Krishnaiah M.E., Ph.D.,
Geotechnical Expert
Regd. No. GTE/19/07/032
No. 7/4, Munavar Avenue
4th Street, Pallavaram, Chen...



our services doesn't just end there

Buying & Selling Services

Property Buying Assistance, Property Selling Support, Market Price Analysis, Owner Outreach and Negotiation.

Legal & Documentation Services

Certified EC, Patta, legal opinions, property verification, due diligence, litigation solutions, and legal heir certificates.

Property Development & Approvals

Building plan approvals, construction, layout and sub-division approvals, zone conversion, and occupancy certification.

NRI & Investment Services

Escrow Services, Rentals, Litigation Solutions, Property Valuation and Property Management

Compliance & Special Services

Demolition, Vaasthu checks, regularization of unauthorized buildings, and office space solutions.



empowering your real estate decisions with smart tools

Property Valuation & Cost Estimation

Guideline Value, Apartment Composite Value, Stamp Duty & Registration Fees Calculator, Building Value Calculator, Capital Gains Calculator, Area Unit Converter, Length Unit Converter

Ownership, Compliance & Legal Verification

Encumbrance Certificate (EC) Search, Find Your SRO, Temple Property Check, WAQF Property Check, View Patta/Chitta, View FMB, Patta Analyzer, EC Analyzer

Zoning & Land Use Analysis

Land Use Zone Finder, CRZ Zone Check, Aquifer Zone Check, CBA Check, EWS Check, Road Width Check, Proposed Road Widening Check, FSI Calculator

Property Documentation & Workflow Tools

Forms & Templates, Document Generator, Document Translation, Dictionary

Vastu & Property Management Tools

Home Vastu Shastra, Plot Vastu Shastra, Property Management

Verified RealEstate™

We're honored to be part of your real estate journey

3/350/2 Mettukuppam,
OMR Thoraipakkam,
Chennai, India

hello@verified.realestate
+91 9996 12 9996
www.verified.realestate