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15, 2nd Floor, Murphy Das Street,
Dr.Seethapathy Nagar, Velachery,
Chennai – 600 042.
Ph.No. 9841036964 / 9940176229.
Email:info@gecindia.net/geoengineeringconsultant@gmail.com.

PROJECT

PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING (GROUND FLOOR + 3 UPPER FLOORS) AT PLOT NO. 9 , S.NO.87/3A1D ROYAL BEACH ENCLAVE,KANATHUR,CHENGALPET DISTRICT

CLIENT NAME

ARIMA BUILDERS & TECHNOLOGIES PVT. LTD.,
DOOR NO. 34, PLOT NO.3, AURA VILLA 5C,
PANDIAN SALAI, NEELANKARAI
CHENNAI – 600 041.

TITLE

GEOTECHNICAL INVESTIGATION REPORT

PROJECT NO: GEC-JC-GT-5019/2023-2024

DATE: 16/06/2023

GEO ENGINEERING CONSULTANTS
G. MANOJ KUMAR
DDTC - No. GTE / VLR/01/2019
CMDA No. GTE/19/03/012
IInd Floor, No 15, Murphy Das Stree
Dr. Seethapathy Nagar, Velachery
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Chennai - 600 042

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IInd Floor, No 15, Murphy Das Stree
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Chennai - 600 042

D T C P

Office of the Deputy Director of Town And Country Planning
Tirunelvei Region,
South Bypass Road, Tirunelveli – 627 005.

Phone : 0462 2352318
E-mail: ddtcptnv@gmail.com
Website: www.tn.gov.in/tcp

Roc. No. 2620/2019 TVLR 3-2 Date 28.08.2019

PROFESSIONAL REGISTRATION CERTIFICATE

This is to certify that the **Thiru G. MANOJ KUMAR** has enrolled as Registered Geo Tech Engineer (GTE) with office of the Deputy Director of Town and Country Planning who has the qualification of **M.E., (Soil Mechanics and Foundation Engineering)** and experience in the relevant field for **11 years.**

He has been given the Registration No. **GTE/TVLR/01/2019** on **28.08.2019.** He shall be required to comply with the duties and responsibilities prescribed by the Government of Tamil Nadu in Part V, "Registration of Professionals", Tamil Nadu Combined Development and Building Rules, 2019 approved vide G.O. (Ms) No. 18, Municipal Administration and Water Supply (MA1) Department, Dated. 04.02.2019.

This Registration is valid upto **27.08.2024.**



D.T & CP TVLI.

D.T & CP TVLI.

(A. MANIMEKALAI)
Deputy Director of Town and Country Planning (I/c)
Tirunelveli - 5

To
Thiru G. MANOJ KUMAR
277A, South Street, V. Pudur,
Keelarajakularaman (Post) - 626 136,
Rajapalayam (Via)
Virudhunagar District

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G. MANOJ KUMAR
DDTC - No. GTE / TVLR/01/2019
CMDA No. GTE/19/03/012
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Dr. Seethapathy Nagar, Velachery
Chennai - 600 042

CHAPTER-1

INTRODUCTION

1.0 Project Information Matrix

Nature of project	: Proposed Construction of Residential Building
Type of Structures	: Ground Floor +3 Upper Floor
Project Client	: **M/s Arima Builders & Technologies Pvt. Ltd.,**
Project Location	: Kanathur Reddikuppam Village, Thiruporur Taluk.
Job Code	: GEC-JC-GT-5019

1.1 Scope Of Work

1.1.1 Field Work

- Conducting two soil investigation bore holes of 150 mm diameter up to 10.0m depth or up to the refusal strata with SPT>100
- Conducting Standard Penetration Test (SPT) within the borehole at every 1.0m depth interval up to 5.0m and thereafter at every 1.5m up to the termination depth
- Collection of soil samples and undisturbed samples from the clayey strata with SPT-value greater than 2 to less than 15 if met within the investigation depth
- Collection of water samples if groundwater table met within the investigation depth

1.1.2 Laboratory Work

- Natural Moisture Content
- Atterberg's limits
- Grain Size Analysis
- Chemical Analysis test on soil and water samples to give pH, Chlorides and Sulphates

1.2 Structure of the Report

- Contents
- Introduction
- Investigation Methodology & Test Results
- Geology &Sub-Surface Stratification
- Foundation System
- Recommendation
- Annexure

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Dr. Seethapathy Nagar, Velacherry
Chennai - 600 042

CHAPTER-2

INVESTIGATION METHODOLOGY & TEST RESULTS

2.0 Preamble:

Two soil investigation boreholes was put as per the planning of the engineer in-charge and these locations are shown in Fig.2.0.The equipment used and the methodology adopted to carry out the fieldwork is described below.

2.1 Methodology of Field Work:

2.1.1 Equipment Used and Method of Drilling:

All the boreholes were sunk by conventional rotary drilling rigs. For borehole Methodology followed for boring conformed to IS: 1892 -2000. Boring was progressed by the cutting action of rotating bit with water circulation and stabilizing the side of the boreholes by using casing pipes/bentonite slurry up to required depth to prevent collapse of sidewall. Boring was continued by normal boring process using MS soil cutter in soil. However Tungsten Carbide (TC) bit drilling was resorted to drill in highly weathered rock stratum where the normal boring process became slow. Diamond Core (DC) bit drilling was adopted in moderately weathered rock formations where penetration using TC bit was became slow.

2.1.2 Standard Penetration Tests:

This is a field test to determine “Penetration Resistance of Stratum at the Test Depth”. This has been conducted in the boreholes generally up to refusal depth using procedures described in IS: 2131- 2002. In this test, split spoon sampler (50.8 mm OD and 35 mm ID) has replaced driving bit. Sampler is then driven by dropping 63.5 kg hammer on top of driving collar with free fall of 75 cm. The length of sampler is 60 cm.

The tests were conducted at the depth intervals indicated in Chapter-1 (Sec.1.1.1).

2.1.3 Collection of Soil Samples:

2.1.3.1 Disturbed 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.

2.1.4 Collection of Ground Water Samples:

One representative water sample from each borehole was collected after 24 hours of completing the borehole if water table met within the investigated depth.

Note on Groundwater Table Record:

- Groundwater table observation in geotechnical report is predominantly to arrive at foundation design criteria and shall not be construed as design guidelines for the design of dewatering systems
- The groundwater level indicated in the bore logs is specific to the duration of investigation and intensity of the monsoon rains during the time of investigation.

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G. MANOJ KUMAR
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CMDA No. GTE/19/03/012
IInd Floor, No.15, Murphy Das Stree
Dr. Seethapathy Nagar, Velachery
Chennai - 600 042

Hence, the level shall be taken as guidelines only to plan the investigation for the dewatering system

- ❖ No foundation excavation or basement excavations if anticipated within the groundwater table zone shall be carried out without implementing groundwater lowering schemes

2.2 Laboratory testing:

2.2.1 On Coarse Grained Soil

On the representative samples, sieve analysis tests were conducted to arrive at grain size distribution. These tests were conducted as per I.S.2720 (part 4)-1985 and the results are presented in Tables-2.1 to 2.2. The graphical representation of grain size distribution curve for the representative samples in each bore is presented in Fig.2.3 to 2.4.

2.2.2 On Fine Grained Soil

On the SPT sample index property tests were conducted to estimate consistency. These test results are presented in Tables-2.1 to 2.2.

2.2.3 Chemical Analysis Tests

On representative soil and water samples chemical analysis tests were conducted to estimate pH, Chloride and Sulphates and these results are presented in Table - 2.3.

2.3 Summary:

The locations of the field investigation boreholes are shown in site plan given in Fig.2.0. The average sub soil profiles encountered at each location along with their classification and engineering properties are presented in Figs.2.1 to 2.2.

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G. MANOJ KUMAR
DDTC - No. GTL / VLE/01/2019
CMDA No. GTE/19/03.012
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Dr. Seethapathy Nagar, Velachery
Chennai - 600 042

SOIL PROFILE

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DDTC - No. GTE / VLR/01/2019
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IInd Floor, No 15, Murphy Das Stree
Dr. Seethapathy Nagar, Velachery
Chennai - 600 042

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-01		
SHEET	1	OF	2
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING AT KANATHUR, CHENNAI	DIA OF BORE HOLE	150mm ✓ / NX
LOCATION	Kanathur, Chennai	MACHINE No.	CR-01
CHAINAGE (m)	-	BORE START DATE	13/06/2023
STRUCTURE	G+3Upper Floors	DRILLING METHOD	Rotary
CO-ORDINATES	N -	BORE END DATE	13/06/2023
JOB CODE	JC-GT-5019	FLUSHING MEDIUM	Bentonite
CO-ORDINATES	E -	TOTAL DRILL DAYS	1

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Sample Details: RL (m)	Layer Data: Legend	Layer Data: No	Layer Data: Depth	Geotechnical Description
0	13/06/2023	12	10	SC	-	-										L1	0.5	**Filled Up Soil** (Brick waste and Sand)
		To																
		12	11															
1							5	8	11	**19**	1.00	1	SS	-1.0				
		12	24								1.45							
		To		SC	-	-												
		12	25															
2							9	13	13	**26**	2.00	2	SS	-2.0				Brownish/Greyish, Moist, Medium Dense, Poorly Graded, **Silty SAND (SP/SP-SM)** Sand-Silt mixtures
		12	38								2.45							
		To		SC	-	-												
		12	39															
3							9	12	9	**21**	3.00	3	SS	-3.0				
		12	56								3.45							
		To		SC	-	-												
		12	57															
4							26	13cm Penet. For 50Blows		**>100**	4.00	4	SS	-4.0		L2	4.0	
		14	00								4.28							Greyish, Moist, Very Dense, Poorly Graded, Fine to Medium Grained **SAND (SP)**
		To		SC	-	-												
		14	01													L3	5.0	
5							26	26	18	**44**	5.00	5	SS	-5.0				
		14	20								5.45							
		To		SC	-	-												
		14	21															
6																		
							18	18	20	**38**	6.50	6	SS	-6.5				
											6.95							
7																		Greyish/Brownish, Moist, Dense, Poorly Graded, **Silty SAND (SP/SP-SM)** Sand-Silt mixtures
		14	43															
		To		SC	-	-												
		14	44															
8							13	16	19	**35**	8.00	7	SS	-8.0				
		15	21								8.45							
		To		SC	-	-												
		15	23															
9																L4	9.5	
							4	3	1	**4**	9.50	8	SS	-9.5				
											9.95							
10																L5	10.0	Greyish, Moist, Very Loose, Poorly Graded, **Silty SAND (SM)** Sand-Silt mixtures

CS - Core Sample	DS - Disturbed Sample	LOGGED	K.J.VINODPRADAP	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	13/06/2023	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	Jaleel Yasin	WATER TABLE (m) 2.60	
WS - Wash Sample	DB - Diamond Bit	DATE	16/06/2023	CASING DEPTH (m) 0.00	

Borehole terminated at 10 m depth below E.G.L

FIG.2.1 Sub Soil Profile at BH-01 Location

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G. MANOJ KUMAR
DDTC - No. GTE / VLR/01/2019
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IInd Floor, No 15, Murphy Das Street
Dr. Seethapathy Nagar, Velachery
Chennai - 600 042

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-02		
SHEET	1	OF	2
DIA OF BORE HOLE	150mm ✓ / NX		
BORE START DATE	13/06/2023		
BORE END DATE	14/06/2023		
TOTAL DRILL DAYS	2		

PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING AT KANATHUR, CHENNAI						
LOCATION	Kanathur, Chennai	MACHINE No.	CR-01	CHAINAGE (m)	-		
STRUCTURE	G+3 Upper Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N	-	
JOB CODE	JC-GT-5019	FLUSHING MEDIUM	Bentonite		E	-	

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Sample Details: RL (m)	Layer Data: Legend	Layer Data: No	Layer Data: Depth	Geotechnical Description
0		17	40													L1	0.5	**Filled Up Soil** (Brick waste and Sand)
		To		SC	-	-												
		17	41															
1	13/06/2023						8	12	16	**28**	1.00	1	SS	-1.0				
		17	54								1.45							
		To		SC	-	-												
		17	55															
2							9	13	15	**28**	2.00	2	SS	-2.0				Brownish, Moist, Medium Dense, Poorly Graded, Fine to Medium Grained **SAND (SP)**
		18	14								2.45							
		To		SC	-	-												
		18	15															
3							7	6	6	**12**	3.00	3	SS	-3.0				
		06	40								3.45							
		To		SC	-	-												
		06	41															
4							26	11cm Penet. For 50Blows		**>100**	4.00	4	SS	-4.0		L2	4.0	
		06	59								4.26							Brownish, Moist, Very Dense, Poorly Graded, Fine to Medium Grained **SAND (SP)**
		To		SC	-	-												
		07	00															
5							18	24	26	**50**	5.00	5	SS	-5.0		L3	5.0	
		07	18								5.45							
		To		SC	-	-												
		07	19															
6																		
	14/06/2023						16	19	23	**42**	6.50	6	SS	-6.5				
7											6.95							Brownish, Moist, Dense, Poorly Graded, **Silty SAND (SP/SP-SM)** Sand-Silt mixtures
		07	33															
		To		SC	-	-												
		07	34															
8							13	18	14	**32**	8.00	7	SS	-8.0				
		07	47								8.45							
		To		SC	-	-												
		07	48															
9																L4	9.5	
							2	1	1	**2**	9.50	8	SS	-9.5				
											9.95							Brownish, Moist, Very Loose, Poorly Graded, **Silty SAND (SM)** Sand-Silt mixtures
10																L5	10.0	

CS - Core Sample	DS - Disturbed Sample	LOGGED	K.J.VINODPRADAP	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	14/06/2023	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	Jaleel Yasin	WATER TABLE (m) 2.60	
WS - Wash Sample	DB - Diamond Bit	DATE	16/06/2023	CASING DEPTH (m) 0.00	

Borehole terminated at 10 m depth below E.G.L

FIG.2.2 Sub Soil Profile at BH-02 Location

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G. MANOJ KUMAR
DDTC - No. GTE/VLR/01/2019
CMDA No. GTE/19/03/012
IInd Floor, No 15, Murphy Das Street
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Grain Size Distribution Curves

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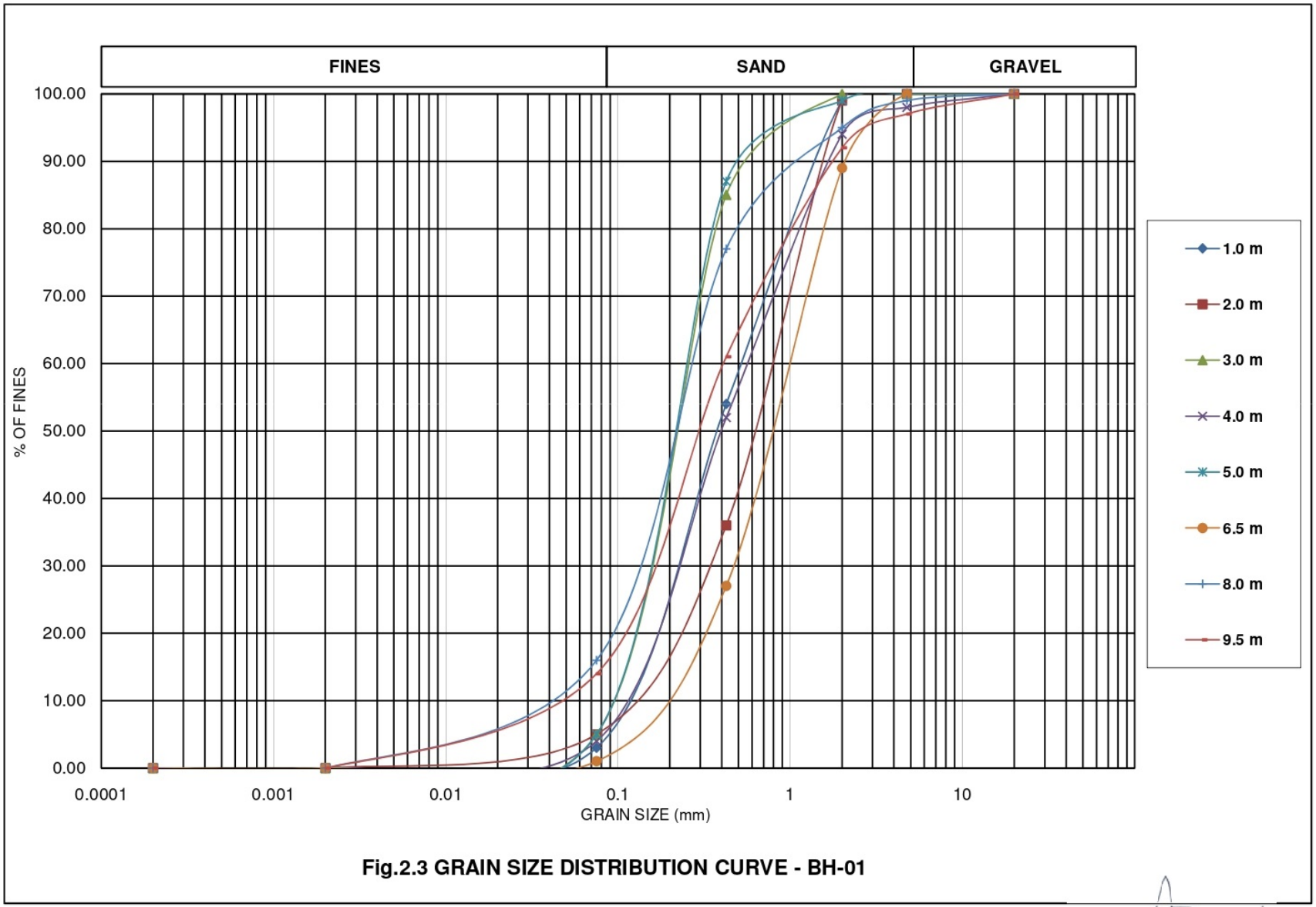


Fig.2.3 GRAIN SIZE DISTRIBUTION CURVE - BH-01

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Dr. Seethapathy Nagar, Velachery
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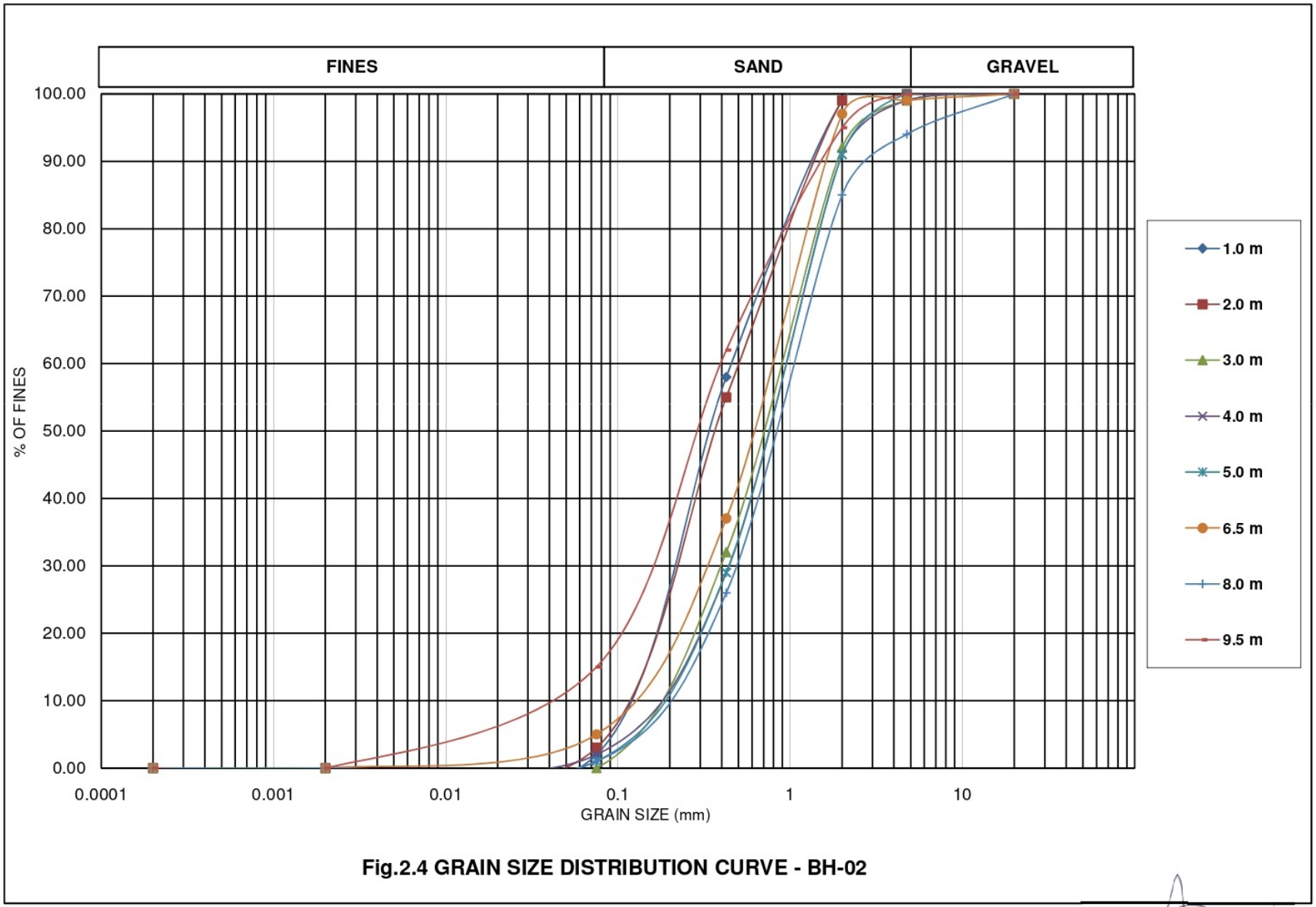


Fig.2.4 GRAIN SIZE DISTRIBUTION CURVE - BH-02

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IInd Floor, No 15, Murphy Das Street
Dr. Seethapathy Nagar, Velachery
Chennai - 600 042

LABORATORY TEST RESULTS

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DDTC - No. GTE / VLR/01/2019
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IInd Floor, No 15, Murphy Das Stree
Dr. Seethapathy Nagar, Velachery
Chennai - 600 042

Table-2.1 Laboratory Classification of Soil Samples from BH-01

Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																								
			Fine Grained (FG)										Coarse Grained (CG)												IS-Notation	
			NMC(%)	LL (%)	PL (%)	I_P	Ic	SL (%)	FS (%)	Consistancy	Position With Respect to A-Aline	IS:Notation	Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	$C_U=D_{60}/D_{10}$	$C_c=D_{30}^2/(D_{10}xD_{60})$	Relative Density	Gravel	Sand
1.0	19	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	45	51	3	0	-	-	-	-	-	M.Dense	<50%	SP
2.0	26	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	63	31	5	0	-	-	-	-	-	M.Dense	<50%	SP-SM
3.0	21	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	0	15	80	5	0	-	-	-	-	-	M.Dense	<50%	SP-SM
4.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	2	4	42	48	4	0	-	-	-	-	-	V.Dense	<50%	SP
5.0	44	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	12	82	5	0	-	-	-	-	-	Dense	<50%	SP-SM
6.5	38	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	11	62	26	1	0	-	-	-	-	-	Dense	<50%	SP
8.0	35	SS	-	-	-	-	-	-	-	CG>50%	-	-	1	4	18	61	16	0	-	-	-	-	-	Dense	<50%	SM
9.5	4	SS	-	-	-	-	-	-	-	CG>50%	-	-	3	5	31	47	14	0	-	-	-	-	-	V.Loose	<50%	SM

FG = Fine Grained
CG = Coarse Grained
NMC= Nature Moisture Content
LL = Liquid Limit
PL = Plastic Limit
Ip = Plasticity Index
Ic = (LL-NMC)/Ip
SL = Shrinkage Limit
FS = Differential Frees Well Index
C_U = Uniformity Coefficient
C_C = Coefficient of Curvature
IP=LL-PL

LAB IN-CHARGE	M.PRAVEEN
REVIEWED BY	JALEEL YASIN

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G. MANOJ KUMAR
DDTC - No. GTE/VLR/01/2019
CMDA No. GTE/19/03/012
IInd Floor, No 15, Murphy Das Street
Dr. Seethapathy Nagar, Velachery
Chennai - 600 042

Table-2.2 Laboratory Classification of Soil Samples from BH-02

Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																								
			Fine Grained (FG)										Coarse Grained (CG)													IS-Notation	
			NMC(%)	LL (%)	PL (%)	I_P	Ic	SL (%)	FS (%)	Consistancy	Position With Respect to A-Aline	IS:Notation	Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	$C_U=D_{60}/D_{10}$	$C_c=D_{30}^2/(D_{10}xD_{60})$	Relative Density	Gravel	Sand
1.0	28	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	41	56	2	0	-	-	-	-	-	M.Dense	<50%	SP
2.0	28	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	44	52	3	0	-	-	-	-	-	M.Dense	<50%	SP
3.0	12	SS	-	-	-	-	-	-	-	CG>50%	-	-	1	7	60	32	0	0	-	-	-	-	-	M.Dense	<50%	SP
4.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	1	8	62	27	2	0	-	-	-	-	-	V.Dense	<50%	SP
5.0	50	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	9	62	28	1	0	-	-	-	-	-	Dense	<50%	SP
6.5	42	SS	-	-	-	-	-	-	-	CG>50%	-	-	1	2	60	32	5	0	-	-	-	-	-	Dense	<50%	SP-SM
8.0	32	SS	-	-	-	-	-	-	-	CG>50%	-	-	6	9	59	25	1	0	-	-	-	-	-	Dense	<50%	SP
9.5	2	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	5	33	47	15	0	-	-	-	-	-	V.Loose	<50%	SM

FG = Fine Grained
CG = Coarse Grained
NMC= Nature Moisture Content
LL = Liquid Limit
PL = Plastic Limit
Ip = Plasticity Index
Ic = (LL-NMC)/Ip
SL = Shrinkage Limit
FS = Differential Frees Well Index
C_U = Uniformity Coefficient
C_C = Coefficient of Curvature
IP=LL-PL

LAB IN-CHARGE	M.PRAVEEN
REVIEWED BY	JALEEL YASIN

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CMDA No. GTE/19/03/012
IInd Floor, No 15, Murphy Das Stree
Dr. Seethapathy Nagar, Velachery
Chennai - 600 042

Table-2.3 Results of Chemical Analysis									
SL No.	Bore HoleNo.	Water				Soil (2:1)			
		Depth of Sample (m)	pH	Chlorides (mg/l)	Sulphates (mg/l)	Depth of Sample (m)	pH	Chlorides (mg/l)	Sulphates (mg/l)
1	BH-01	2.60	7.14	195	215	2.0	7.11	156	187

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CMDA No. GTE/19/03/012
IInd Floor, No 15, Murphy Das Stree
Dr. Seethapathy Nagar, Velachery
Chennai - 600 042

CHAPTER-3

GEOLOGY & SUB-SURFACE STRATIFICATION

3.0 Preamble:

Geotechnical investigation carried out at a specific site provides location specific sub surface engineering characteristics. However, in major project sites, where the construction activities spread over a very large area, location specific sub surface strata characteristics are studied together with the geological mapping data. This is required to incorporate the impact of any documented macro-level geological characteristics of the region on the foundation design, irrespective of the location specific sub surface strata characteristics.

In view on the above, though it is beyond the scope of the present study to carry out macro-level geological investigation, the regional geology based on the published data is presented and discussed with respect to the foundation design.

3.1 Geology of the Region (based on the published data)

Formation Characteristics:

The present location falls under Kanathur village, Chennai, geologically it is classified as recent alluvium deposits consisting of silty sand, which is underlain with basement rock.

↑ Recent Clays/Sand (Alluvium Deposits)

---------- Eparchean Unconformity ----------

Archaean Basement Rock (Charnockite Rock / Hypersthene Granite)

3.2 DESIGN SUB SOIL PROFILE :(WRT Foundation Engineering Application)

The sub soil characteristics obtained at the test location are further processed to arrive at the design soil parameters required for the design of sub structure using the following shear strength correlations with respect to the Standard Penetration Test Values of different layers.

- **For Coarse Grained Material, Ref. IS: 6403 to estimate Angle of Shearing Resistance (Reproduced and shown in Fig.A1)**
- **For Fine Grained Material, Ref. Terzaghi& Peck, 1948, to estimate Unconfined Compressive Strength (Reproduced and shown in Fig.A2)**

Based on the above, the average design soil characteristics are given below:

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Dr. Seethapathy Nagar, Velachery
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REFERENCE BORE HOLE-BH:					01	Ref R.L. of G.L. (m):			0.00		
Layer No.	Layer Thk. (m)			Type of Strata	Colour	Ave. Design SPT	Relative Density	Consistency	(γ) kN/m^3	Shear Parameters	
	Top. R.L.	Bot. R.L.	Thickness							(C_u) kPa	(ϕ) Deg.
1	0.00	0.50	0.50	Filled Up Soil	-	-	-	-	-	-	-
2	0.50	4.00	3.50	Silty Sand	Brownish	22	Medium Dense	-	18.5	-	33.6
3	4.00	5.00	1.00	Sand	Greyish	>100	Very Dense	-	21	-	42.5
4	5.00	9.50	4.50	Silty Sand	Greyish	39	Dense	-	19.5	-	38.48
5	9.50	10.00	0.50	Silty Sand	Greyish	4	Very Loose	-	21	-	42.5

REFERENCE BORE HOLE-BH:					02	Ref R.L. of G.L. (m):			0.00		
Layer No.	Layer Thk. (m)			Type of Strata	Colour	Ave. Design SPT	Relative Density	Consistency	(γ) kN/m^3	Shear Parameters	
	Top. R.L.	Bot. R.L.	Thickness							(C_u) kPa	(ϕ) Deg.
1	0.00	0.50	0.50	Filled Up Soil	-	-	-	-	-	-	-
2	0.50	4.00	3.50	Sand	Brownish	23	Medium Dense	-	18.5	-	33.9
3	4.00	5.00	1.00	Sand	Brownish	>100	Very Dense	-	21	-	42.5
4	5.00	9.50	4.50	Sand	Brownish	41	Dense	-	20	-	38.98
5	9.50	10.00	0.50	Silty Sand	Greyish	2	Very Loose	-	13	-	19.91

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IInd Floor, No 15, Murphy Das Street
Dr. Seethapathy Nagar, Velachery
Chennai - 600 042

FOUNDATION SYSTEM

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DDTC - No. GTE/VLR/01/2019
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IInd Floor, No 15, Murphy Das Stree
Dr. Seethapathy Nagar, Velachery
Chennai - 600 042

CHAPTER-4

FOUNDATION SYSTEM

4.0 Preamble:

In the design of foundation system, the stress-strain compatibility of the super structure, sub structure and the bearing strata should be satisfied both individually and as a combined system. In view of this, the following data are needed for the design of foundation system, defined in terms of the type of sub structure and the bearing strata characteristics.

- The super structure characteristics along with the loading pattern on the sub structure
- The sub soil characteristics that define the required substructure configuration for a safe transfer of super-structural loads to the bearing strata

Considering the above aspects of the foundation design, the suitable type of foundation system is presented below.

4.1 Proposed Structures

An understanding of the proposed construction and the order of loads on the foundations is needed for choosing the appropriate foundation system. In the present case, the proposed structure is configured with ground floor plus two upper floors, and is meant for residential use. For this kind of structure, the column loads could vary between 600 kN to 900 kN. The above mentioned loads have no bearing on the design of either sub or super structures and are mentioned just to provide an insight to choose an appropriate foundation system with respect to subsoil conditions.

4.2 Foundation System

For the kind of proposed structure and the sub soil conditions, open foundation system shall be adopted. The footing shall be located at a depth of 1.20m below existing ground level. The footings shall be designed for a recommended allowable safe bearing pressure is 150kPa. All footings shall rest on 100mm thick M10 Grade levelling coarse bed.

Typical computations are presented in the annexure.

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G. MANOJ KUMAR
DDTC - No. GTE_LVL8/01/2019
CMDA No. GTE/19/03/012
IInd Floor, No 15, Murphy Das Street
Dr. Seethapathy Nagar, Velachery
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RECOMMENDATIONS

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CHAPTER-5

RECOMMENDATIONS

5.0 Recommendation for shallow foundation

- For the kind of proposed structure and the sub soil conditions, open foundation system shall be adopted.
- The footing shall be located at a depth of 1.20m below existing ground level.
- The footings shall be designed for a recommended allowable safe bearing pressure is 150kPa.
- All footings shall rest on 100mm thick M10 Grade levelling coarse bed.
- The excavated soil shall be used for foundation trenches.
- All columns shall be connected with grade beams in both the directions irrespective of wall layout
- The ground floor shall be minimum 1.0m above the natural ground and the plinth shall be filled with sand/gravel/quarry dust. This height is recommended to contain the influence of soil volume change on the flooring. In case, floor is not raised, the ground floor shall be constructed as a suspended R.C.C. slab.

5.1 General Recommendation:

- Since, chlorides and sulphates are well within the permissible limits, no special steel or cement is required for the construction of footings

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G. MANOJ KUMAR
DDTC - No. GTE / VLR/01/2019
CMDA No. GTE/19/03/012
IInd Floor, No 15, Murphy Das Stree
Dr. Seethapathy Nagar, Velachery
Chennai - 600 042

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ANNEXURE

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G. MANOJ KUMAR,
DDTC - No. GTE_LVLR/01/2019
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Dr. Seethapathy Nagar, Velachery
Chennai - 600 042

TYPICAL BEARING CAPACITY COMPUTATIONS FOR SHALLOW FOUNDATIONS

1.0 COMPUTATION OF BEARING CAPACITY AS PER IS:6403

Ref.BH-01

1.1 Geometrical Data :

Shape of the Foundation	Square	
Depth of Foundation Below E.G.L"Df" (m)	1.20	
Soil Replacement Thickness of CNS Layer (m)	0.00	
Total Depth of Foundation (m)	1.20	
Breadth of Footing "B" (m)	1.00	
Length of Footing "L" (m)	1.00	
B/L	1.00	
Inclination of Vertical Load with the Vertical (a)	0.00	

1.2 Soil Data :

Type of Effective Bearing Strata :	Sand	
Average SPT-value of the Bearing Strata	19.00	
Type of Shear Failure:	General	
Angle of Shearing Resistance	32.70	phi

1.3 Design Parameters:

Bulk Density of Soil above the foundation depth (γ_{bulk})	18.00	kN/m^3
Water Table Correction Factor (w')	0.50	
Effective Overburden pressure at foundation level (q)	9.60	kPa

Bearing Capacity Factors:

N_c = N/A

N_q = 26.45

N_g = 36.24

Shape Factors:

S_c = -

S_q = 1.20

S_g = 0.80

Depth Factors :

D_c = -

D_q = 1.03

D_g = 1.03

Inclination Factor:

I_c = 1.00

I_q = 1.00

I_g = 1.00

1.4 Ultimate Bearing Capacity (Qu) :

Qu=q'(Nq-1)'Sq'Dq'Iq + 0.5'B'g'Ng'Sg'Dg'Ig'w' 434.69 kPa

(g should be read as gama)

1.5 Safe Bearing Capacity (Qsafe) :

Factor of Safety (F.S.) :	2.50	
Qsafe :	173.87	kPa
Say Q_{safe}	**150**	**kPa**

2 Computation of Settlement for Maximum Pressure and Size of Footing: (as per IS:8009-Part-I-Ref. Eq.11) (Elastic Analysis)

The immediate elastic settlement (S_i)= $qB(1-m^2)*I/E_s$

q= bearing pressure	150.00	kPa
Poission's Ratio (μ)	0.30	

Modulus of Elasticity (E_s)(Ref. Joseph E Bowels,1996,page316,Table5.6, Japanese design standards)

Modulus of Elasticity (E_s)	49400.00	kPa
Size of footing considered for maximum settlement(m)	1.00	
Influence factor	1.00	
Rigidity Factor	1.00	
Elastic Settlement (DH_i)	2.76	mm
	<50	mm

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G. MANOJ KUMAR
DDTC - No. GTE / VLR/01/2019
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IInd Floor, No 15, Murphy Das Stree
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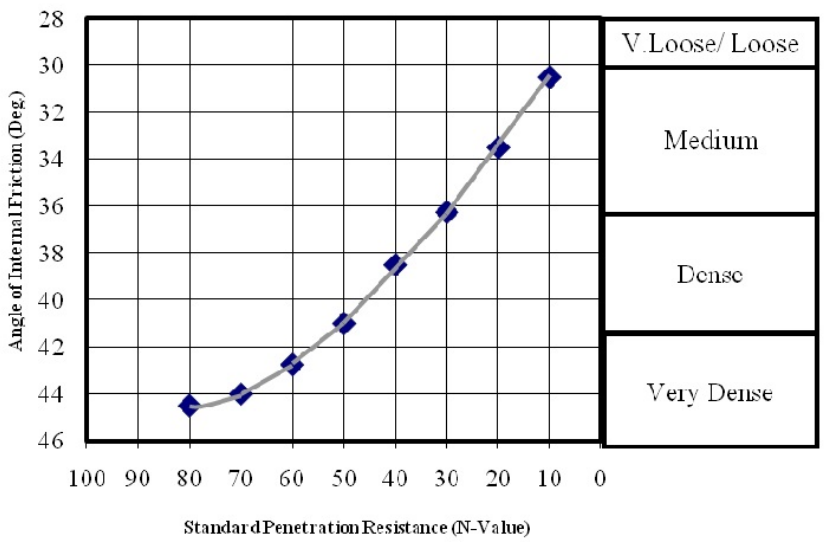


FIG. A1 Relation Ship between Angle of Internal Friction & N-value (Reproduced from IS:6403-1981)

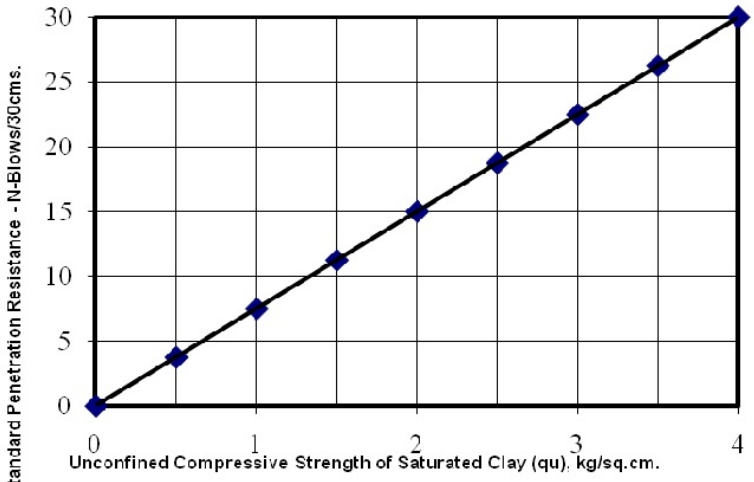


FIG. A2 : Relationship between UCC & SPT-Value (N) of Saturated Clay (AfterTerzhagi & Peck, 1948)

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G. MANOJ KUMAR
DDTC - No. GTE - VLR/01/2019
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IInd Floor, No 15, Murphy Das Street
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