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GEOTECHNICAL SITE INVESTIGATION

BORING 1 THROUGH 15

PROPOSED MULTI-STORIED RESIDENTIAL APARTMENTS BUILDINGS COMPLEX SITE

S. NO. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, MOONDRANKATTALAI VILLAGE, CHENNAI 600 128

KUNDRATHUR TALUK, KANCHEEPURAM DISTRICT, TN.

Report to

M/s. Casagrand Fresh Pvt. Ltd.
NPL Devi, 3rd Floor
N. No. 111, O. No. 59, L B Road
Thiruvanmiyur, Chennai 600 041, TN.

PRASAD ARMSTRONG YEN G E C (P) LTD.
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Phone: 044 - 2363 7146; e-mail: paygec@yahoo.com
CIN: U74210TN1992PTC023645

Report No. 025/GI/23-24.
July 7, 2023.

M/s. Casagrand Fresh Pvt. Ltd.
NPL Devi, 3rd Floor
N. No. 111, O. No. 59, L B Road
Thiruvanmiyur, Chennai 600 041, TN.

Attention: Ms. Vidhya

Geotechnical Site Investigation
Boring 1 through 15
Proposed Multi-Storied Residential Apartments Buildings Complex Site
S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1
Moonrankattalai Village, Chennai 600128
Kundrathur Taluk, Kancheepuram District, TN.

The Prasad Armstrong Yen GEC (P) Ltd., Chennai is pleased to submit this report on our geotechnical site investigation conducted at the above location. This work was authorized by your Confirmation Letter No. Nil dated, and received through e-mail on May 02, 2023.

Estimated capacities of the foundations recommended for the proposed buildings are presented here in final form together with a summary of laboratory and field data.

We appreciate the opportunity to be of service to you on this project. Please call us if you have any questions or when we can be of further assistance.

Sincerely,

PRASAD ARMSTRONG YEN GEC (P) Ltd.

B. Ram Prasad ME, PhD (Texas A&M)
Managing Director
CMDA Registration No. GTE/19/02/002

(025brpt)
Copies Submitted: (3)

CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
'Thalamuthu Natarajan Building', No.1, Gandhi Irwin Road,
Egmore, Chennai-600 008.

PROFESSIONAL REGISTRATION CERTIFICATE

This is to certify that the **Dr.B.RAM PRASAD** has enrolled as **Registered Geo-Technical Engineer (RGTE)** with Chennai Metropolitan Development Authority (CMDA) who has the qualification of **B.E.,(Civil Engg.), M.E.,(Geo-Tech.), Ph.D.,** and experience in the relevant field for **30 years**.

He has been given the Registration No.**GTE/19/02/002** on **19.02.2019.** 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 MAWS (MA1) Dept. dated 04.02.2019.

This Registration is valid upto **18.02.2024**.



(R.SHIVAKUMAR)
ASSISTANT PLANNER
CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
CHENNAI - 600 008

For PRASAD ARMSTRONG YEN
GEOTECH ENGINEERING CONSULTANTS (P) LTD.

Dr. B. Ramprasad
ME, PhD (Texas A&M)
Reg. No. GTE/2024/2/0068
Managing Director

CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
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PROFESSIONAL REGISTRATION CERTIFICATE

This is to certify that the Thiru / Tmt. / M/s. **Dr. B. Ram Prasad** has enrolled as **Registered Geo Tech Engineer** with Chennai Metropolitan Development Authority (CMDA) who has the qualification of **Equivalent degree** and experience in the relevant field for **35** years.

He/She has been given the Registration No. **GTE/2024/2/0055** on **29-Feb-2024** He/She 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 MAWS (MA1) Dept. Dated. 04.02.2019.

This Registration is valid upto **27-Feb-2029**.

Signature valid
Name :A. Meganathan
Designation :Superintendent
Date :02/29/2024 3:07:28 PM



A Meganathan

Superintendent

SELF ATTESTED
For PRASAD ARMSTRONG YEN
GEOTECH ENGINEERING CONSULTANTS (P) LTD.
Dr. B. Ramprasad
ME, PhD (Texas A&M)
Reg. No. GTE/2024/2/0055
Managing Director

CONTENTS

	Page
SUMMARY	i
INTRODUCTION	1
Purpose and Scope	1
Report Format	1
FIELD AND LABORATORY INVESTIGATIONS	1
Exploratory Borings	1
Field and Laboratory Tests	2
GENERAL SOIL CONDITIONS	2
Topography and General Geology	2
Soil Stratigraphy	2
Interpretation of Soil Properties	5
DESIGN INFORMATION	10
GROUNDWATER AND SOIL CHEMICAL ANALYSIS	11
CONSTRUCTION CONSIDERATIONS	11
REFERENCES	13

ILLUSTRATIONS

	Plate
Bore Hole Location Plan	1
Log of Boring 1	2
Log of Boring 2	3
Log of Boring 3	4
Log of Boring 4	5
Log of Boring 5	6
Log of Boring 6	7
Log of Boring 7	8
Log of Boring 8	9
Log of Boring 9	10
Log of Boring 10	11
Log of Boring 11	12
Log of Boring 12	13
Log of Boring 13	14
Log of Boring 14	15
Log of Boring 15	16
Summary of Test Results	17
Grain Size Distribution Curves	18
Summary of Water and Soil Chemical Test Results	19
Sample Calculations for Recommended Foundation	20
Liquefaction Analysis Results	21

SUMMARY

Prasad Armstrong Yen GEC (P) Ltd. performed a geotechnical site investigation at the Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moonrankattalai Village, Chennai 600128, Kundrathur Taluk, Kancheepuram District, TN. The primary purpose of our investigation was to obtain data to select suitable foundation type and estimate load carrying capacity of the selected foundation for the proposed three building towers with G + 21 Floors with a common extended basement floor below. For the proposed building type typical expected maximum column load to be about 600 tons. These load details were used only for estimating the preliminary foundation size and type of foundation.

The field investigation was performed from May 4 through 15, 2023. Number and location of borings was selected and provided by the client through a bore location drawing. On site client's survey team marked the borings as per bore location drawing to cover the proposed building areas. Boring 1 through 15 were drilled between 12.5- to 15.65-M below EGL. Drilling of the borings was terminated after encountering continuous hard strata (SPT N $\geq$ 100) in at least 5-M and / or recovery of rock core pieces of hard jointed granite. NX Diamond bit core barrels were used for drilling through the rocky stratum for a minimum of 4-M. In most of the borings at the bore termination depth Core Recovery (CR), and Rock Quality Designation (RQD) were low inferring weathered and highly jointed nature of the rocky formation even through hard stratum weathered rock was encountered from about 8- / 9-M below EGL. Tests were conducted to determine the pertinent index and engineering properties of the soils, weathered rock and jointed rock encountered. We then performed engineering analyses to develop the required design data.

Natural topography of the site reflects a rolling terrain. Visual observation inferred that the Existing Ground Level (EGL) of the site varied from 1- to 2.6-M below the Existing Road Level (ERL) of the Kundrathur Main Road in front of the site. Many trees, bushes and shrubs were present in the site during this investigation. Major portion of the site's boundary line was provided with metal sheet cladding, and some portions had compound walls.

Encountered soil profiles of the borings infer presence of sand and clay soil layers with variable SPT "N" values in the top 8- / 9-M, and beyond 8- / 9-M hard stratum weathered rock (SPT "N" $\geq$ 75") was encountered. In some borings highly jointed granite rock with SPT "N" values were much higher than 300 was encountered. In the borings hard stratum with SPT "N" $\geq$ 100 was continuously present from 8- / 9-M to drilled depths of 12.5- / 15.65-M below EGL. On average drilling through the hard stratum weathered rock was about 5-M.

For the expected column loads, and encountered soil profiles, it was recommended to provide "**Bored Cast-In-Situ Pile**" foundation with at least 2-M drilling into hard strata weathered rock formation and / or at least 1-M into hard rock formation. For this site pile capacities were estimated using the lower bound soil profiles of Boring 12. In the design it was considered that the piles will be installed with at least 2-M pile penetration into the hard rocky strata. The **total and effective pile lengths will be 10-, and 9-M** below EGL with 1-M pile cutoff for basement floor. Ultimate and allowable pile capacities of various pile diameters are summarized below.

Pile Dia. M	Compressive Capacity		Uplift Capacity		Lateral Capacity @ 4 mm Defl.
	Ultimate Tons	Allowable Tons	Ultimate Tons	Allowable Tons	Allowable Tons
0.40	100.89	40	47.31	16	1.26
0.45	142.66	57	53.45	18	1.45
0.50	197.22	79	59.63	20	1.63
0.60	272.12	109	72.16	24	2.0
0.75	408.06	163	91.31	30	2.56

It was recommended to provide at least a two-pile group using suitable pile diameter instead of single pile - single column for better resistance to bending forces from column loads and seismic forces. In case of columns for lift or staircase area or places with close column spacing, and low column loads single pile per column can be provided with a common pile cap. Also, piles should be **structurally designed for higher bending / flexural capacity** to resist moments due to lateral forces during seismic events. All the pile caps should be tied together through rigid tie-beams. In case of single pile and single column unit extreme care should be taken to match center line of pile and column to minimize eccentricity to avoid additional bending moments in the pile. All the piles should be terminated in the hard rocky strata with at least 2-M embedment into NX core barrel drilled weathered rock. At some locations pile may reach 11.5-M below EGL to reach NX core barrel drilled weathered rock.

Groundwater was seen in the borings between 1- and 2.6-M below EGL depending on the site's EGL. There was no known groundwater source in the site. A bore well of unknown depth was present in a nearby plot behind the adjacent HP petrol bunk beyond eastern boundary. Groundwater sample was collected from this bore well for construction suitability test purposes. Test results inferred that the groundwater from the bore well was suitable for construction purposes as per IS: 456 - 2000 guidelines. After installation of bore well in the site, groundwater from the site should be checked for construction suitability purposes at regular intervals from beginning of construction activities. If necessary, suitable treatment should be provided for the groundwater to make the water suitable for construction purposes. Chemical tests were performed on 30 soil samples (two samples per boring – one from shallow depth and one from deeper depth). Soil samples were tested for pH, Chlorides, and Sulphates. A 5% soil solution was initially prepared by mixing with distilled water. This solution was allowed to soak and settle for 24 hours. After that soil solution was filtered pH test was performed on the derived solution. Test results infer concentration of tested chemicals were less than the acceptable limits as per IS: 456 - 2000 code guideline values for construction water.

We do expect construction problems at this site due to groundwater and soil conditions due to high groundwater in rainy season or a few months after rainy season. Site's EGL was 1- to 2.6-M below ERL of Kundrathur Main Road in front of the site. It was recommended to raise the Finished Ground Level (FGL) of the site to at least 1-M above the ERL of road in front of the site for proper internal surface drainage systems. The Finished Floor Level (FFL) of the stilt floor should be at least 0.2-M above FGL of the site. With such levels from EGL to FFL 2.2- to 4.8-M will be available. Therefore, no deep excavation will be necessary for the proposed basement excavations. In any case, basement excavation should be provided with suitable side slopes. **Basement floor slabs should be designed for uplift pressure at least 1 to 2 tons/M^2** as the case may be as groundwater level can rise to ERL of the road in front of the site. Groundwater level in the site can rise to EGL during rainy season as groundwater even in peak summer was at about 1- to 2.6-M below EGL. Therefore,

foundation work, basement work should be completed when groundwater level was below the required basement bottom level to avoid expensive **dewatering systems**. This dewatering will be required for maintain dry working condition at basement bottom level.

Exposed bottom surface of the basement excavation must be properly cleaned of loose soils, and compacted with heavy duty mechanical rammer to compact the exposed surface that might get loosened by mechanical excavation activities. Back filling of the excavation around the basement floors of the proposed building, site filling should be done with granular material with heavy compaction to provide better confinement and lateral resistance of building to design seismic forces. Site's granular soils can be used for filling purposes.

In case of pile foundation installation "**Pile Necking / Bulging**" can be a potential problem due to presence of sand layers with low % of fines. Suitable good quality Bentonite and Bentonite solution of proper density should be used for the piling work. **In case of pile installation by hydraulic rotary rig it was strongly recommended to use bucket / barrel unit instead of auger unit for making the bore in soils with full flow of bentonite solution to bottom of the bore. Diamond tipped barrel will be required for drilling through the weathered rock and intact rock formation. In case hydraulic rotary rig was considered then it was recommended to** reevaluate pile capacities based on the rig parameters based on input from piling people, evaluate rig operations in the site, install test piles to check feasibility, check test piles for defects by Non-Destructive Tests (NDT), and **perform a few initial load tests** to confirm the load carrying capacity of the piles installed by the hydraulic rotary rig. NDTs should be performed on each and every pile of the planned building to confirm the pile integrity. Required total pile length for many piles will be more than the recommended minimum pile length of 10-M (below raft bottom level) due to variations in the depth to NX drilled weathered rock level. Routine pile load tests should be performed on the installed piles as per IS code guidelines. At pile termination depth extreme care should be taken to clear all loosened material to avoid low pile tip bearing capacity as major portion of pile capacity was the end bearing due to short pile lengths.

All structures have to be designed for higher seismic forces (**Zone III**) due to increased seismic activity in peninsular India for the past two decades. Seismic events of 5.1 magnitude on August 24, 2021, 5.1 magnitude on February 12, 2019, 7.9 magnitude on April 25, 2015, 6.0 magnitude on May 21, 2014, 8.4 magnitude on April 11, 2012, 7.2 magnitude on June 13, 2010, and 7.6 magnitude on August 11, 2009 with epicenters in Himalayas, Bay of Bengal, and near Andaman Islands were felt at Chennai. It is recommended to provide rigid plinth beams in ground level, columns designed for shear forces or shear walls in the structure. Plinth beams must be designed to be rigid to allow redistribution of loads in case of differential settlements. For the site's lower bound soil profile with groundwater at 1-M below EGL infers "**No**" seismic susceptibility. Under a seismic event of **6.0 Richter scale**, and **0.16g** peak ground acceleration (IS code for **Zone III** design horizontal acceleration), **at EGL** total estimated vertical settlement was 0.06 cms and total horizontal displacement was about 0.06 cms. Iwasaki liquefaction potential was 0.0 inferring "**No Liquefaction**."

For PRASAD ARMSTRONG YEN
GEOTECH ENGINEERING CONSULTANTS (P) LTD.

Dr. B. Ramprasad
ME, PhD (Texas A&M)
Reg. No. GTE/2024/2/0008
Managing Director

INTRODUCTION

Purpose and Scope

Prasad Armstrong Yen GEC (P) Ltd. performed a geotechnical site investigation at the Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moonrankattalai Village, Chennai 600128, Kundrathur Taluk, Kancheepuram District, TN. The primary purpose of our investigation was to obtain data to select suitable foundation type and estimate load carrying capacity of the selected foundation for the proposed three building towers with G + 21 Floors with a common extended basement floor below. For the proposed building type typical expected maximum column load to be about 600 tons. These load details were used only for estimating the preliminary foundation size and type of foundation. To accomplish these purposes, the following tasks were performed:

(1) Boring 1 through 15 were drilled between 12.5- and 15.65-M to explore subsurface stratigraphy to confirmed hard strata and obtain soil and rock samples for lab testing;

(2) Tests were conducted to evaluate the pertinent index and engineering properties of the foundation materials; and

(3) Engineering analyses were performed to develop foundation design information for the proposed building foundation.

Report Format

The initial sections of this report contain brief descriptions of the field and laboratory phases of our study. A general soils description is then presented, followed by discussions of foundation design calculations followed by a brief on construction considerations for this project.

FIELD AND LABORATORY INVESTIGATIONS

Exploratory Borings

Soil conditions at the site for the proposed building area were explored by Boring 1 through 15. Boring location details are presented on Plate 1. Number and location of borings was selected and provided by the client through a bore location drawing. On site client's survey team marked the borings as per bore location drawing to cover the proposed building areas. Boring 1 through 15 were drilled between 12.5- to 15.65-M below EGL. Drilling of the borings was terminated after encountering continuous hard strata (SPT N $\geq$ 100) in at least 5-M and / or recovery of rock core pieces of hard jointed granite. NX Diamond bit core barrels were used for drilling through the rocky stratum for a minimum of 4-M. In most of the borings at the bore termination depth CR, and RQD were low inferring weathered and highly jointed nature of the rocky formation even through hard stratum weathered rock was encountered from about 8- / 9-M below EGL. Tests were conducted to determine the pertinent index and engineering properties of the soils, weathered rock and jointed rock encountered. We then performed engineering analyses to develop the required design data. Groundwater level was present between 1- and 2.6-M below EGL in various borings. Log of Boring is presented on Plate 2 through 16.

Field and Laboratory Tests

Borings were drilled using Calyx drilling unit. In the borings SPT was performed at 0.75-M interval upto 4, at 1-M interval upto 10-M, at 1.5-M interval beyond 10-M. SPT consists of driving a standard split spoon sampler, 51-mm outside diameter and 38-mm inside diameter into soil under the blows of a drop hammer of 63.5 kg falling weight freely through 75-cm. The number of blows required for 30-cm of penetration of sampler in soil is designated as N value and it is termed as SPT blow count. Detailed information regarding SPT can be found in the IS: 2131 code of practice.

The soil-testing program was designed to evaluate pertinent index and engineering properties of the foundation soils. During the field operations soil or rock samples were collected at 0.75-, 1-, and 1.5-M intervals either disturbed or undisturbed as the case may be. All samples were shipped to our Chennai laboratory where pertinent index properties - grain size analyses, natural water content, Atterberg limit tests were performed on collected soil samples. All the test results are tabulated on the Summary of Test Results on Plate 17. Grain size distribution curves of tested soil are presented on Plate 18. Summary of Water and Soil Chemical Test Results are presented on Plate 19.

GENERAL SOIL CONDITIONS

Topography and General Geology

Natural topography of the site reflects a rolling terrain. Visual observation inferred that EGL of the site varied from 1- to 2.6-M below ERL of the Kundrathur Main Road in front of the site. Many trees, bushes and shrubs were present in the site during this investigation. Major portion of the site's boundary line was provided with metal sheet cladding, and some portions had compound walls.

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Soil Stratigraphy

The soil stratigraphy disclosed by our investigation is presented on the log of boring on Plate 2 through 16. The soil stratigraphy is based on classification of soil samples recovered from the boring, and our observations during drilling operations. A generalized summary of the major soil strata is tabulated below:

Boring – 1:

Stratum	Penetration, M From	To	Description
I	0	1.0	Brown Fine to Coarse Sand with Stone Pieces - Filled Up Soil
II	1.0	7.0	Brown and Gray Firm to Stiff Clay
III	7.0	9.0	Brown Gray Silty Fine to Medium Sand
IV	9.0	14.5+	Brown Gray Weathered Rock

INTRODUCTION

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Boring – 2:

Stratum	Penetration, M From	To	Description
I	0	1.0	Brown Gray Silty Fine to Medium Sand
II	1.0	3.25	Brown Fine to Medium Sand
III	3.25	5.5	Gray Firm to Stiff Clay
IV	5.5	8.0	Gray Silty Fine to Medium Sand
V	8.0	11.5	Brown Gray Weathered Rock
VI	11.5	13.5+	Brown Gray Jointed Granite

Boring – 3:

Stratum	Penetration, M From	To	Description
I	0	1.0	Brown Firm Sandy Clay
II	1.0	3.0	Brown Fine to Medium Sand
III	3.0	8.0	Gray Stiff to Very Stiff Clay
IV	8.0	14.0+	Brown Gray Weathered Rock

Boring – 4:

Stratum	Penetration, M From	To	Description
I	0	2.5	Brown Fine to Medium Sand
II	2.5	7.0	Gray Stiff to Very Stiff Clay
III	7.0	9.0	Brown Gray Silty Fine to Medium Sand
IV	9.0	14.5+	Brown Weathered Rock

Boring – 5:

Stratum	Penetration, M From	To	Description
I	0	1.0	Brown Weathered Rock – Filled Up Soil
II	1.0	8.0	Brown Gray Stiff to Very Stiff Clay
III	8.0	12.5+	Brown Gray Weathered Rock

Boring – 6:

Stratum	Penetration, M From	To	Description
I	0	2.5	Brown Stiff Clay
II	2.5	3.25	Brown Silty Fine Sand
III	3.25	7.0	Gray Firm to Stiff Clay
IV	7.0	9.0	Brown Silty Fine to Medium Sand
IV	9.0	14.5+	Gray Brown Weathered Rock

Boring – 7:

Stratum	Penetration, M From	To	Description
I	0	2.5	Brown Fine to Medium Sand with Silt
II	2.5	3.25	Brown Gray Silty Fine Sand with Clay Binder
III	3.25	6.0	Gray Stiff to Very Stiff Clay
IV	6.0	8.0	Brown Gray Silty Fine to Medium Sand
V	8.0	14.5+	White Brown Gray Weathered Rock

Boring – 8:

Stratum	Penetration, M From	To	Description
I	0	1.0	Brown Soft Clay
II	1.0	3.25	Brown Fine to Medium Sand
III	3.25	7.0	Gray Stiff to Very Stiff Clay
IV	7.0	8.0	Brown Silty Fine to Medium Sand
V	8.0	14.5+	Brown Gray Weathered Rock

Boring – 9:

Stratum	Penetration, M From	To	Description
I	0	1.0	Brown Weathered Rock - Filled Up Soil
II	1.0	7.0	Brown Gray Firm to Stiff Clay
III	7.0	9.0	Brown Silty Fine to Medium Sand
IV	9.0	15.65+	Brown Weathered Rock

Boring – 10:

Stratum	Penetration, M From	To	Description
I	0	1.0	Brown Weathered Rock - Filled Up Soil
II	1.0	7.0	Brown Gray Soft to Stiff Clay
III	7.0	9.0	Brown Gray Silty Fine to Medium Sand
IV	9.0	14.5+	Brown Blue Weathered Rock

Boring – 11:

Stratum	Penetration, M From	To	Description
I	0	1.75	Brown Gray Silty Fine Sand
II	1.75	3.25	Brown Gray Firm to Very Stiff Clay
III	3.25	5.0	Brown Gray Silty Fine Sand
IV	5.0	7.0	Brown Gray Stiff Clay
V	7.0	9.0	Brown Gray Silty Fine to Medium Sand
VI	9.0	13.35+	Brown Gray Weathered Rock

Boring – 12:

Stratum	Penetration, M From	To	Description
I	0	1.0	Brown Fine to Coarse Sand with Silt and Stone Pieces - Filled Up Soil
II	1.0	6.0	Brown and Gray Firm to Stiff Clay
III	6.0	7.0	Gray Silty Fine Sand with Clay Binder
IV	7.0	8.0	Gray Very Stiff Clay
V	8.0	14.0+	Brown Blue Weathered Rock

Boring – 13:

Stratum	Penetration, M From	To	Description
I	0	1.75	Brown Gray Very Soft to Firm Clay
II	1.75	3.25	Brown Gray Silty Fine Sand with Clay Binder

III	3.25	5.0	Brown Gray Firm to Stiff Clay
IV	5.0	6.0	Gray Silty Fine Sand with Clay Binder
V	6.0	9.0	Brown Gray Fine to Medium Sand with Silt
VI	9.0	14.5+	Brown Blue Weathered Rock

Boring – 14:

Stratum	Penetration, M From	To	Description
I	0	1.0	Brown Gray Silty Fine Sand with Clay Binder
II	1.0	7.0	Brown Gray Stiff to Very Stiff Clay
III	7.0	8.0	Brown Gray Silty Fine to Medium Sand
IV	8.0	14.0+	Brown Gray Weathered Rock

Boring – 15:

Stratum	Penetration, M From	To	Description
I	0	1.0	Brown Gray Silty Fine Sand with Clay Binder
II	1.0	2.5	Brown Gray Stiff Clay
III	2.5	3.25	Brown Gray Silty Fine Sand with Clay Binder
IV	3.25	5.0	Brown Gray Firm to Stiff Clay
V	5.0	7.0	Gray Very Stiff Clay
VI	7.0	8.0	Brown Gray Silty Fine to Medium Sand
VII	8.0	14.0+	Brown Blue Weathered Rock

Detailed soil descriptions that include textural variations and inclusions were noted on log of boring presented on Plate 2 through 16.

Interpretation of Soil Properties

Shear strength parameters for cohesion less soils were selected based on the field SPT results, grain size distribution analyses, and associated correlation. Shear strength parameters for cohesive soils were selected based on the field SPT results, and associated correlation. The unit weight (soil density) profiles of the soils in the borings were developed from estimated values based on correlations of unit weight with particle size gradation and field test results (Bowles, 1982.)

Foundation calculations presented in this report were based on the lower bound soil proprieties of Boring 12. A reevaluation of the recommendations in this report may be necessary if variations in the soil profile are encountered during the foundation excavation work. In addition, there may be a need to drill additional borings to investigate soil variability at that location. Based on the field and laboratory test results the following are the properties for soils encountered in the boring.

Boring – 1:

Stratum	Penetration, M From	To	Properties
I	0	1.0	$\phi = 31^{\circ}$; $\gamma_{sat} = 1.65$ tons/M^3
IIa	1.0	1.75	$C_u = 3$ tons/M^2; $\gamma_{sat} = 1.5$ tons/M^3

IIb	1.75	3.0	$C_u = 6$ tons/M^2; $\gamma_{sat} = 1.6$ tons/M^3
IIc	3.0	4.0	$C_u = 4$ tons/M^2; $\gamma_{sat} = 1.55$ tons/M^3
IId	4.0	5.0	$C_u = 6$ tons/M^2; $\gamma_{sat} = 1.6$ tons/M^3
IIe	5.0	7.0	$C_u = 9$ tons/M^2; $\gamma_{sat} = 1.65$ tons/M^3
IIIa	7.0	8.0	$\phi = 32^\circ$; $\gamma_{sat} = 1.7$ tons/M^3
IIIb	8.0	9.0	$\phi = 34^\circ$; $\gamma_{sat} = 1.8$ tons/M^3
IVa	9.0	10.0	$\phi = 38^\circ$; $\gamma_{sat} = 2.2$ tons/M^3
IVb	10.0	14.5+	$\phi = 40^\circ$; $\gamma_{sat} = 2.3$ tons/M^3

Boring – 2:

Stratum	Penetration, M From	To	Properties
I	0	1.0	$\phi = 26^\circ$; $\gamma_{sat} = 1.55$ tons/M^3
IIa	1.0	1.75	$\phi = 30^\circ$; $\gamma_{sat} = 1.65$ tons/M^3
IIb	1.75	2.5	$\phi = 32^\circ$; $\gamma_{sat} = 1.7$ tons/M^3
IIc	2.5	3.25	$\phi = 33^\circ$; $\gamma_{sat} = 1.75$ tons/M^3
IIIa	3.25	4.0	$C_u = 3$ tons/M^2; $\gamma_{sat} = 1.55$ tons/M^3
IIIb	4.0	5.0	$C_u = 5.5$ tons/M^2; $\gamma_{sat} = 1.6$ tons/M^3
IIIc	5.0	5.5	$C_u = 7.5$ tons/M^2; $\gamma_{sat} = 1.65$ tons/M^3
IVa	5.5	7.0	$\phi = 32^\circ$; $\gamma_{sat} = 1.7$ tons/M^3
IVb	7.0	8.0	$\phi = 33^\circ$; $\gamma_{sat} = 1.75$ tons/M^3
Va	8.0	9.0	$\phi = 37^\circ$; $\gamma_{sat} = 2.1$ tons/M^3
Vb	9.0	11.5	$\phi = 40^\circ$; $\gamma_{sat} = 2.3$ tons/M^3
VI	11.5	13.5+	$\phi = 41^\circ$; $\gamma_{sat} = 2.35$ tons/M^3

Boring – 3:

Stratum	Penetration, M From	To	Properties
I	0	1.0	$C_u = 4$ tons/M^2; $\gamma_{sat} = 1.55$ tons/M^3
IIa	1.0	1.75	$\phi = 26^\circ$; $\gamma_{sat} = 1.55$ tons/M^3
IIb	1.75	2.5	$\phi = 29^\circ$; $\gamma_{sat} = 1.6$ tons/M^3
IIc	2.5	3.0	$\phi = 31^\circ$; $\gamma_{sat} = 1.65$ tons/M^3
IIIa	3.0	4.0	$C_u = 5$ tons/M^2; $\gamma_{sat} = 1.6$ tons/M^3
IIIb	4.0	6.0	$C_u = 8.5$ tons/M^2; $\gamma_{sat} = 1.65$ tons/M^3
IIIc	6.0	8.0	$C_u = 12$ tons/M^2; $\gamma_{sat} = 1.7$ tons/M^3
IVa	8.0	9.0	$\phi = 39^\circ$; $\gamma_{sat} = 2.25$ tons/M^3
IVb	9.0	14.0+	$\phi = 40^\circ$; $\gamma_{sat} = 2.3$ tons/M^3

Boring – 4:

Stratum	Penetration, M From	To	Properties
Ia	0	1.75	$\phi = 29^\circ$; $\gamma_{sat} = 1.6$ tons/M^3
Ib	1.75	2.5	$\phi = 31^\circ$; $\gamma_{sat} = 1.65$ tons/M^3
IIa	2.5	5.0	$C_u = 7$ tons/M^2; $\gamma_{sat} = 1.65$ tons/M^3
IIb	5.0	7.0	$C_u = 12$ tons/M^2; $\gamma_{sat} = 1.7$ tons/M^3
IIIa	7.0	8.0	$\phi = 33^\circ$; $\gamma_{sat} = 1.8$ tons/M^3
IIIb	8.0	9.0	$\phi = 35^\circ$; $\gamma_{sat} = 1.95$ tons/M^3
IVa	9.0	10.0	$\phi = 38^\circ$; $\gamma_{sat} = 2.2$ tons/M^3
IVb	10.0	14.5+	$\phi = 40^\circ$; $\gamma_{sat} = 2.3$ tons/M^3

Boring – 5:

Stratum	Penetration, M From	To	Properties
I	0	1.0	$\phi = 26^{\circ}$; $\gamma_{sat} = 1.55$ tons/M^3
IIa	1.0	1.75	$C_u = 5$ tons/M^2; $\gamma_{sat} = 1.6$ tons/M^3
IIb	1.75	3.0	$C_u = 7$ tons/M^2; $\gamma_{sat} = 1.65$ tons/M^3
IIc	3.0	5.0	$C_u = 6$ tons/M^2; $\gamma_{sat} = 1.6$ tons/M^3
IId	5.0	7.0	$C_u = 11$ tons/M^2; $\gamma_{sat} = 1.7$ tons/M^3
IIe	7.0	8.0	$C_u = 14$ tons/M^2; $\gamma_{sat} = 1.75$ tons/M^3
IIIa	8.0	9.0	$\phi = 35^{\circ}$; $\gamma_{sat} = 2.0$ tons/M^3
IIIb	9.0	10.0	$\phi = 39^{\circ}$; $\gamma_{sat} = 2.25$ tons/M^3
IIIc	10.0	12.5+	$\phi = 40^{\circ}$; $\gamma_{sat} = 2.3$ tons/M^3

Boring – 6:

Stratum	Penetration, M From	To	Properties
Ia	0	1.75	$C_u = 5$ tons/M^2; $\gamma_{sat} = 1.6$ tons/M^3
Ib	1.75	2.5	$C_u = 8$ tons/M^2; $\gamma_{sat} = 1.65$ tons/M^3
II	2.5	3.25	$\phi = 31^{\circ}$; $\gamma_{sat} = 1.7$ tons/M^3
IIIa	3.25	4.0	$C_u = 6$ tons/M^2; $\gamma_{sat} = 1.65$ tons/M^3
IIIb	4.0	5.0	$C_u = 4$ tons/M^2; $\gamma_{sat} = 1.55$ tons/M^3
IIIc	5.0	6.0	$C_u = 6$ tons/M^2; $\gamma_{sat} = 1.6$ tons/M^3
IIId	6.0	7.0	$C_u = 9$ tons/M^2; $\gamma_{sat} = 1.7$ tons/M^3
IVa	7.0	8.0	$\phi = 33^{\circ}$; $\gamma_{sat} = 1.75$ tons/M^3
IVb	8.0	9.0	$\phi = 34^{\circ}$; $\gamma_{sat} = 1.85$ tons/M^3
Va	9.0	10.0	$\phi = 39^{\circ}$; $\gamma_{sat} = 2.25$ tons/M^3
Vb	10.0	14.5+	$\phi = 40^{\circ}$; $\gamma_{sat} = 2.3$ tons/M^3

Boring – 7:

Stratum	Penetration, M From	To	Properties
Ia	0	1.0	$\phi = 26^{\circ}$; $\gamma_{sat} = 1.5$ tons/M^3
Ib	1.0	2.5	$\phi = 28^{\circ}$; $\gamma_{sat} = 1.6$ tons/M^3
II	2.5	3.25	$\phi = 29^{\circ}$; $\gamma_{sat} = 1.65$ tons/M^3
III	3.25	6.0	$C_u = 10$ tons/M^2; $\gamma_{sat} = 1.7$ tons/M^3
IV	6.0	8.0	$\phi = 32^{\circ}$; $\gamma_{sat} = 1.7$ tons/M^3
Va	8.0	9.0	$\phi = 35^{\circ}$; $\gamma_{sat} = 1.95$ tons/M^3
Vb	9.0	10.0	$\phi = 38^{\circ}$; $\gamma_{sat} = 2.2$ tons/M^3
Vc	10.0	14.5+	$\phi = 40^{\circ}$; $\gamma_{sat} = 2.3$ tons/M^3

Boring – 8:

Stratum	Penetration, M From	To	Properties
I	0	1.0	$C_u = 2.5$ tons/M^2; $\gamma_{sat} = 1.45$ tons/M^3
IIa	1.0	1.75	$\phi = 28^{\circ}$; $\gamma_{sat} = 1.6$ tons/M^3
IIb	1.75	2.5	$\phi = 30^{\circ}$; $\gamma_{sat} = 1.65$ tons/M^3
IIc	2.5	3.25	$\phi = 32^{\circ}$; $\gamma_{sat} = 1.7$ tons/M^3
IIIa	3.25	4.0	$C_u = 5$ tons/M^2; $\gamma_{sat} = 1.6$ tons/M^3

IIIb	4.0	5.0	$C_u = 8$ tons/M^2; $\gamma_{sat} = 1.65$ tons/M^3
IIIc	5.0	6.0	$C_u = 12$ tons/M^2; $\gamma_{sat} = 1.7$ tons/M^3
IIId	6.0	7.0	$C_u = 16$ tons/M^2; $\gamma_{sat} = 1.8$ tons/M^3
IV	7.0	8.0	$\phi = 34^o$; $\gamma_{sat} = 1.85$ tons/M^3
Va	8.0	9.0	$\phi = 37^o$; $\gamma_{sat} = 2.1$ tons/M^3
Vb	9.0	10.0	$\phi = 38^o$; $\gamma_{sat} = 2.2$ tons/M^3
Vc	10.0	14.5+	$\phi = 40^o$; $\gamma_{sat} = 2.3$ tons/M^3

Boring – 9:

Stratum	Penetration, M From	To	Properties
I	0	1.0	$\phi = 32^o$; $\gamma_{sat} = 1.7$ tons/M^3
IIa	1.0	3.25	$C_u = 5$ tons/M^2; $\gamma_{sat} = 1.6$ tons/M^3
IIb	3.25	6.0	$C_u = 4$ tons/M^2; $\gamma_{sat} = 1.55$ tons/M^3
IIc	6.0	7.0	$C_u = 7.5$ tons/M^2; $\gamma_{sat} = 1.65$ tons/M^3
IIIa	7.0	8.0	$\phi = 33^o$; $\gamma_{sat} = 1.75$ tons/M^3
IIIb	8.0	9.0	$\phi = 35^o$; $\gamma_{sat} = 1.95$ tons/M^3
IVa	9.0	10.0	$\phi = 38^o$; $\gamma_{sat} = 2.2$ tons/M^3
IVb	10.0	15.65+	$\phi = 40^o$; $\gamma_{sat} = 2.3$ tons/M^3

Boring – 10:

Stratum	Penetration, M From	To	Properties
I	0	1.0	$\phi = 30^o$; $\gamma_{sat} = 1.65$ tons/M^3
IIa	1.0	1.75	$C_u = 2.5$ tons/M^2; $\gamma_{sat} = 1.5$ tons/M^3
IIb	1.75	3.0	$C_u = 5$ tons/M^2; $\gamma_{sat} = 1.6$ tons/M^3
IIc	3.0	5.0	$C_u = 3.5$ tons/M^2; $\gamma_{sat} = 1.5$ tons/M^3
IId	5.0	6.0	$C_u = 5$ tons/M^2; $\gamma_{sat} = 1.6$ tons/M^3
IIe	6.0	7.0	$C_u = 9$ tons/M^2; $\gamma_{sat} = 1.7$ tons/M^3
IIIa	7.0	8.0	$\phi = 32^o$; $\gamma_{sat} = 1.7$ tons/M^3
IIIb	8.0	9.0	$\phi = 34^o$; $\gamma_{sat} = 1.9$ tons/M^3
IVa	9.0	11.5	$\phi = 39^o$; $\gamma_{sat} = 2.25$ tons/M^3
IVb	11.5	14.5+	$\phi = 40^o$; $\gamma_{sat} = 2.3$ tons/M^3

Boring – 11:

Stratum	Penetration, M From	To	Properties
Ia	0	1.0	$\phi = 30^o$; $\gamma_{sat} = 1.65$ tons/M^3
Ib	1.0	1.75	$\phi = 31^o$; $\gamma_{sat} = 1.7$ tons/M^3
IIa	1.75	2.5	$C_u = 12$ tons/M^2; $\gamma_{sat} = 1.7$ tons/M^3
IIb	2.5	3.25	$C_u = 4$ tons/M^2; $\gamma_{sat} = 1.6$ tons/M^3
IIIa	3.25	4.0	$\phi = 30^o$; $\gamma_{sat} = 1.65$ tons/M^3
IIIb	4.0	5.0	$\phi = 27^o$; $\gamma_{sat} = 1.6$ tons/M^3
IV	5.0	7.0	$C_u = 7.5$ tons/M^2; $\gamma_{sat} = 1.65$ tons/M^3
V	7.0	9.0	$\phi = 35^o$; $\gamma_{sat} = 1.95$ tons/M^3
VIa	9.0	10.0	$\phi = 38^o$; $\gamma_{sat} = 2.2$ tons/M^3
VIb	10.0	13.35+	$\phi = 40^o$; $\gamma_{sat} = 2.3$ tons/M^3

Boring – 12:

Stratum	Penetration, M From	To	Properties
I	0	1.0	$\phi = 31^{\circ}$; $\gamma_{sat} = 1.65$ tons/M^3
IIa	1.0	2.5	$C_u = 4.5$ tons/M^2; $\gamma_{sat} = 1.55$ tons/M^3
IIb	2.5	3.75	$C_u = 6.5$ tons/M^2; $\gamma_{sat} = 1.65$ tons/M^3
IIc	3.75	5.0	$C_u = 4.5$ tons/M^2; $\gamma_{sat} = 1.55$ tons/M^3
IId	5.0	6.0	$C_u = 9$ tons/M^2; $\gamma_{sat} = 1.65$ tons/M^3
III	6.0	7.0	$\phi = 30^{\circ}$; $\gamma_{sat} = 1.65$ tons/M^3
IV	7.0	8.0	$C_u = 11$ tons/M^2; $\gamma_{sat} = 1.7$ tons/M^3
Va	8.0	9.0	$\phi = 39^{\circ}$; $\gamma_{sat} = 2.25$ tons/M^3
Vb	9.0	14.0+	$\phi = 40^{\circ}$; $\gamma_{sat} = 2.3$ tons/M^3

Boring – 13:

Stratum	Penetration, M From	To	Properties
I	0	1.75	$C_u = 6$ tons/M^2; $\gamma_{sat} = 1.6$ tons/M^3
II	1.75	3.25	$\phi = 30^{\circ}$; $\gamma_{sat} = 1.65$ tons/M^3
IIIa	3.25	4.0	$C_u = 4$ tons/M^2; $\gamma_{sat} = 1.5$ tons/M^3
IIIb	4.0	5.0	$C_u = 6$ tons/M^2; $\gamma_{sat} = 1.6$ tons/M^3
IV	5.0	6.0	$\phi = 28^{\circ}$; $\gamma_{sat} = 1.6$ tons/M^3
Va	6.0	8.0	$\phi = 34^{\circ}$; $\gamma_{sat} = 1.8$ tons/M^3
Vb	8.0	9.0	$\phi = 35^{\circ}$; $\gamma_{sat} = 1.95$ tons/M^3
VI	9.0	14.5+	$\phi = 40^{\circ}$; $\gamma_{sat} = 2.3$ tons/M^3

Boring – 14:

Stratum	Penetration, M From	To	Properties
I	0	1.0	$\phi = 30^{\circ}$; $\gamma_{sat} = 1.65$ tons/M^3
IIa	1.0	4.0	$C_u = 5.5$ tons/M^2; $\gamma_{sat} = 1.6$ tons/M^3
IIb	4.0	6.0	$C_u = 7$ tons/M^2; $\gamma_{sat} = 1.65$ tons/M^3
IIc	6.0	7.0	$C_u = 10$ tons/M^2; $\gamma_{sat} = 1.7$ tons/M^3
III	7.0	8.0	$\phi = 32^{\circ}$; $\gamma_{sat} = 1.7$ tons/M^3
IVa	8.0	9.0	$\phi = 39^{\circ}$; $\gamma_{sat} = 2.25$ tons/M^3
IVb	9.0	14.0+	$\phi = 40^{\circ}$; $\gamma_{sat} = 2.3$ tons/M^3

Boring – 15:

Stratum	Penetration, M From	To	Properties
I	0	1.0	$\phi = 27^{\circ}$; $\gamma_{sat} = 1.6$ tons/M^3
IIa	1.0	1.75	$C_u = 7.5$ tons/M^2; $\gamma_{sat} = 1.65$ tons/M^3
IIb	1.75	2.5	$C_u = 10$ tons/M^2; $\gamma_{sat} = 1.7$ tons/M^3
III	2.5	3.25	$\phi = 29^{\circ}$; $\gamma_{sat} = 1.65$ tons/M^3
IVa	3.25	4.0	$C_u = 3$ tons/M^2; $\gamma_{sat} = 1.5$ tons/M^3
IVb	4.0	5.0	$C_u = 6.5$ tons/M^2; $\gamma_{sat} = 1.65$ tons/M^3
V	5.0	7.0	$C_u = 14$ tons/M^2; $\gamma_{sat} = 1.75$ tons/M^3
VI	7.0	8.0	$\phi = 35^{\circ}$; $\gamma_{sat} = 2.0$ tons/M^3
VIIa	8.0	9.0	$\phi = 37^{\circ}$; $\gamma_{sat} = 2.1$ tons/M^3

VIIb	9.0	10.0	$\phi = 39^{o}$; $\gamma_{sat} = 2.25$ tons/M^3
VIIc	10.0	14.0+	$\phi = 40^{o}$; $\gamma_{sat} = 2.3$ tons/M^3

DESIGN INFORMATION

For the expected column loads, and encountered soil profiles, it was recommended to provide "**Bored Cast-In-Situ Pile**" foundation with at least 2-M drilling into hard strata weathered rock formation and / or at least 1-M into hard rock formation. For this site pile capacities were estimated using the lower bound soil profiles of Boring 12. In the design it was considered that the piles will be installed with at least 2-M pile penetration into the hard rocky strata. The **total and effective pile lengths will be 10-, and 9-M** below EGL with 1-M pile cutoff for basement floor. Pile capacity was estimated as per the IS: 2911 - 2010 (Part 1 / Section 2) Code guidelines. Ultimate and allowable pile capacities of various pile diameters are summarized below.

Pile Dia. M	Compressive Capacity		Uplift Capacity		Lateral Capacity @ 4 mm Defl.
	Ultimate Tons	Allowable Tons	Ultimate Tons	Allowable Tons	Allowable Tons
0.40	100.89	40	47.31	16	1.26
0.45	142.66	57	53.45	18	1.45
0.50	197.22	79	59.63	20	1.63
0.60	272.12	109	72.16	24	2.0
0.75	408.06	163	91.31	30	2.56

It was recommended to provide at least a two-pile group using suitable pile diameter instead of single pile - single column for better resistance to bending forces from column loads and seismic forces. In case of columns for lift or staircase area or places with close column spacing, and low column loads single pile per column can be provided with a common pile cap. Also, piles should be **structurally designed for higher bending / flexural capacity** to resist moments due to lateral forces during seismic events. All the pile caps should be tied together through rigid tie-beams. In case of single pile and single column unit extreme care should be taken to match center line of pile and column to minimize eccentricity to avoid additional bending moments in the pile. All the piles should be terminated in the hard rocky strata with at least 2-M embedment into NX core barrel drilled weathered rock. At some locations pile may reach 11.5-M below EGL to reach NX core barrel drilled weathered rock. Foundation capacity calculations were presented on Plate 20.

GROUNDWATER AND SOIL CHEMICAL ANALYSIS

Groundwater was seen in the borings between 1- and 2.6-M below EGL depending on the site's EGL. There was no known groundwater source in the site. A bore well of unknown depth was present in a nearby plot behind the adjacent HP petrol bunk beyond eastern boundary. Groundwater sample was collected from this bore well for construction suitability test purposes. Test results inferred that the groundwater from the bore well was suitable for construction purposes as per IS: 456 - 2000 guidelines. After installation of bore well in the site, groundwater from the site should be checked for construction suitability purposes at regular intervals from beginning of construction activities. If necessary, suitable treatment should be provided for the groundwater to make the water suitable for construction purposes. Chemical tests were performed on 30 soil samples (two samples per boring – one from shallow depth and one from deeper depth). Soil samples were tested for pH, Chlorides, and

Sulphates. A 5% soil solution was initially prepared by mixing with distilled water. This solution was allowed to soak and settle for 24 hours. After that soil solution was filtered pH test was performed on the derived solution. Test results infer concentration of tested chemicals were less than the acceptable limits as per IS: 456 - 2000 code guideline values for construction water. Summary of Water Test Results are presented on Plate 19.

CONSTRUCTION CONSIDERATIONS

We do expect construction problems at this site due to groundwater and soil conditions due to high groundwater in rainy season or a few months after rainy season. Site's EGL was 1- to 2.6-M below ERL of Kundrathur Main Road in front of the site. It was recommended to raise FGL of the site to at least 1-M above the ERL of road in front of the site for proper internal surface drainage systems. FFL of the stilt floor should be at least 0.2-M above FGL of the site. With such levels from EGL to FFL 2.2- to 4.8-M will be available. Therefore, no deep excavation will be necessary for the proposed basement excavations. In any case, basement excavation should be provided with suitable side slopes. **Basement floor slabs should be designed for uplift pressure at least 1 to 2 tons/M^2** as the case may be as groundwater level can rise to ERL of the road in front of the site. Groundwater level in the site can rise to EGL during rainy season as groundwater even in peak summer was at about 1- to 2.6-M below EGL. Therefore, foundation work, basement work should be completed when groundwater level was below the required basement bottom level to avoid expensive **dewatering systems**. This dewatering will be required for maintain dry working condition at basement bottom level.

Exposed bottom surface of the basement excavation must be properly cleaned of loose soils, and compacted with heavy duty mechanical rammer to compact the exposed surface that might get loosened by mechanical excavation activities. Back filling of the excavation around the basement floors of the proposed building, site filling should be done with granular material with heavy compaction to provide better confinement and lateral resistance of building to design seismic forces. Site's granular soils can be used for filling purposes.

In case of pile foundation installation "Pile Necking / Bulging" can be a potential problem due to presence of sand layers with low % of fines. Suitable good quality Bentonite and Bentonite solution of proper density should be used for the piling work. **In case of pile installation by hydraulic rotary rig it was strongly recommended to use bucket / barrel unit instead of auger unit for making the bore in soils with full flow of bentonite solution to bottom of the bore. Diamond tipped barrel will be required for drilling through the weathered rock and intact rock formation. In case hydraulic rotary rig was considered then it was recommended to** reevaluate pile capacities based on the rig parameters based on input from piling people, evaluate rig operations in the site, install test piles to check feasibility, check test piles for defects by Non-Destructive Tests (NDT), and **perform a few initial load tests** to confirm the load carrying capacity of the piles installed by the hydraulic rotary rig. NDTs should be performed on each and every pile of the planned building to confirm the pile integrity. Required total pile length for many piles will be more than the recommended minimum pile length of 10-M (below raft bottom level) due to variations in the depth to NX drilled weathered rock level. Routine pile load tests should be performed on the installed piles as per IS code guidelines. At pile termination depth extreme care should be taken to clear all loosened material to avoid low pile tip bearing capacity as major portion of pile capacity was the end bearing due to short pile lengths.

All structures have to be designed for higher seismic forces (**Zone III**) due to increased seismic activity in peninsular India for the past two decades. Seismic events of 5.1 magnitude on August 24, 2021, 5.1 magnitude on February 12, 2019, 7.9 magnitude on April 25, 2015, 6.0 magnitude on May 21, 2014, 8.4 magnitude on April 11, 2012, 7.2 magnitude on June 13, 2010, and 7.6 magnitude on August 11, 2009 with epicenters in Himalayas, Bay of Bengal, and near Andaman Islands were felt at Chennai. It is recommended to provide rigid plinth beams in ground level, columns designed for shear forces or shear walls in the structure. Plinth beams must be designed to be rigid to allow redistribution of loads in case of differential settlements. For the site's lower bound soil profile with groundwater at 1-M below EGL infers "**No**" seismic susceptibility. Under a seismic event of **6.0 Richter scale**, and **0.16g** peak ground acceleration (IS code for **Zone III** design horizontal acceleration), **at EGL** total estimated vertical settlement was 0.06 cms and total horizontal displacement was about 0.06 cms. Iwasaki liquefaction potential was 0.0 inferring "**No Liquefaction.**" Liquefaction Analysis results are presented on Plate 21.



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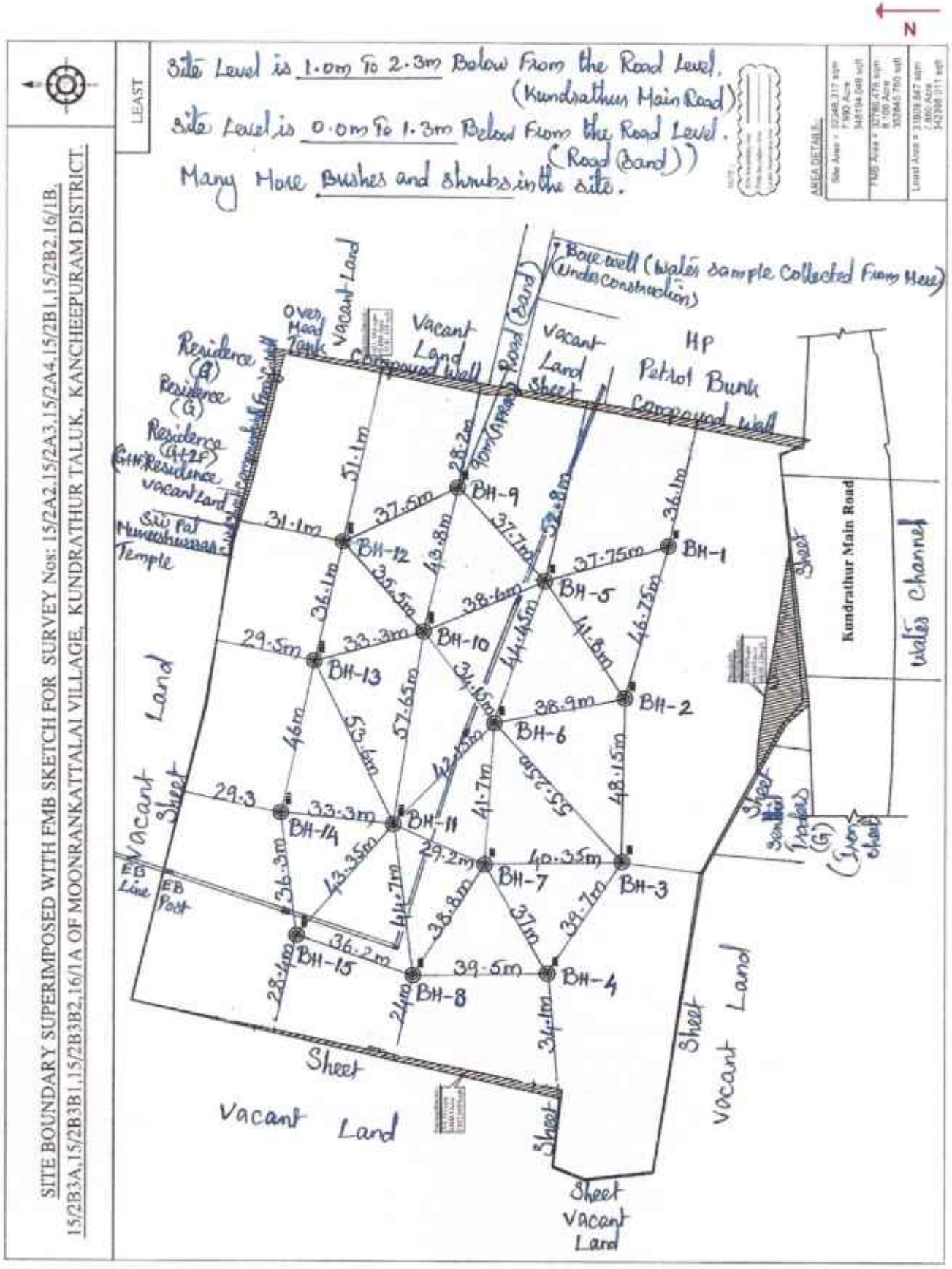
Bureau of Indian Standards (2010), Code of Practice for Design and Construction of Bored Cast-In-Situ Pile Founded on Rocks - Guidelines, IS: 14593 - 2010, New Delhi.

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Bureau of Indian Standards (2016), Criteria for Earthquake Resistant Design of Structures, Part – 1: General Provision and Buildings, IS: 1893 - 2016 (Part 1), New Delhi.

Bureau of Indian Standards (1980), Recommended Procedure for Standard Penetration Test, IS:2131 - 1980, New Delhi.

The Indian Road Congress (2000), Standard Specifications and Code of Practice for Road Bridges IRC: 78 – 2000, Section: VII – Foundations and Substructures, New Delhi.



(Not to Scale)

Site EGL = 1- to 2.3-M Below ERL of Kundrathur Main Road In Front of the Site.

BORE HOLE LOCATION DETAILS.

PLATE 1

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 1 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 13-05-'23 **Ended on:** 14-05-'23 **Field Work In Charge:** Y Saravanan
Final Depth: 14.5-M **Depth to G W S:** 1.85-M **Remarks:** None.

DEPTH, M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE 25 50 75	INDEX TEST DATA 25 50 75
	BROWN FINE TO COARSE SAND with stone pieces – Filled Up Soil (To 1.0-M)	SPT @ 0.25 M 9/7/6 = 13 Blows		
1.0	0.0- to 1.0-m – ϕ = 31°, γ_t = 1.65 tons/M^3 (N_{avg} = 13)	SPT @ 1 M 2/2/3 = 5 Blows		
	BROWN AND GRAY FIRM TO STIFF CLAY (To 7.0-M) (N_{avg} = 5)	SPT @ 1.75 M		
GWL 2.0	1.0- to 1.75-m – C_u = 3 tons/M^2, γ_t = 1.5 tons/M^3	2/3/5 = 8 Blows		
	1.7- to 3.0-m – C_u = 6 tons/M^2, γ_t = 1.6 tons/M^3 (N_{avg} = 9)	SPT @ 2.5 M 3/4/6 = 10 Blows		
3.0		SPT @ 3.25 M 2/3/3 = 6 Blows		
	3.0- to 4.0-m – C_u = 4 tons/M^2, γ_t = 1.55 tons/M^3 (N_{avg} = 6)	SPT @ 4 M 3/4/6 = 10 Blows		
4.0				
	4.0- to 5.0-m – C_u = 6 tons/M^2, γ_t = 1.6 tons/M^3 (N_{avg} = 10)	SPT @ 5 M 4/6/7 = 13 Blows		
5.0				
		SPT @ 6 M 5/6/9 = 15 Blows		
6.0	5.0- to 7.0-m – C_u = 9 tons/M^2, γ_t = 1.65 tons/M^3 (N_{avg} = 14)			
		SPT @ 7 M 6/8/11 = 19 Blows		
7.0				
	BROWN GRAY SILTY FINE TO MEDIUM SAND (To 9.0-M)			
	7.0- to 8.0-m – ϕ = 32°, γ_t = 1.7 tons/M^3 (N_{avg} = 19)	SPT @ 8 M 9/12/15 = 27 Blows		
8.0				
	8.0- to 9.0-m – ϕ = 34°, γ_t = 1.8 tons/M^3 (N_{avg} = 27)			
		SPT @ 9 M 3 cms for 10 Blows		
9.0				
	BROWN GRAY WEATHERED ROCK (Below 9.0-M)	2 cms for 10 Blows (Hammer Rebound)		
	9.0- to 10.0-m – ϕ = 38°, γ_t = 2.2 tons/M^3 (N_{avg} > 100)	SPT @ 10 M (SNR) 1 cm for 10 Blows		
10.0				
	-NX diamond bit drilling from 10-m	0.5 cms for 10 Blows (Hammer Rebound)		
	10.0- to 14.5-m – ϕ = 40°, γ_t = 2.3 tons/M^3 (N_{avg} >> 100)			
11.0				

CONTINUED ON PLATE 2b

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; ←→ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 2a

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 1 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm

Started on: 13-05-'23 **Ended on:** 14-05-'23 **Field Work In Charge:** Y Saravanan

Final Depth: 14.5-M **Depth to G W S:** 1.85-M **Remarks:** Continued from Plate 2a.

DEPTH, M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE 25 50 75	INDEX TEST DATA 25 50 75
	BROWN GRAY WEATHERED ROCK (Below 9.0-M)	SPT @ 11.5M (SNR) 0.5 cms for 10 Blows		
12.0	-drilled from 10- to 11.5-m in 75 minutes -stone pieces recovered drilling to 11.5-m	0 cms for 10 Blows (Hammer Rebound)		
13.0	10.0- to 14.5-m – ϕ = 40°, γ_t = 2.3 tons/M^3 (N_{corr} >> 100) -drilled from 11.5- to 13-m in 85 minutes -5 stone pieces recovered drilling to 13-m	SPT @ 13 M (SNR) 0 cms for 10 Blows (Hammer Rebound)		
14.0				
	-drilled from 13- to 14.5-m in 90 minutes	SPT @ 14.5M (SNR) 0 cms for 10 Blows		
15.0	-9 cms core & 8 stone pieces recovered drilling to 14.5-m	(Hammer Rebound)		
16.0				
17.0				
18.0				
19.0				
20.0				
21.0				
22.0				

BORE HOLE TERMINATED AT 14.5-M

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; +—+ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 2b

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 2 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 12-05-'23 **Ended on:** 13-05-'23 **Field Work In Charge:** Y Saravanan
Final Depth: 13.5-M **Depth to G W S:** 1.0-M **Remarks:** None.

DEPTH M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE 25 50 75	INDEX TEST DATA 25 50 75
	BROWN GRAY SILTY FINE TO MEDIUM SAND (To 1.0-M)	SPT @ 0.25 M 2/3/3 = 6 Blows		
1.0	0.0- to 1.0-m – ϕ = 26°, γ_t = 1.55 tons/M^3 (N_{avg} = 6)	SPT @ 1 M 3/5/7 = 12 Blows		
GWL	BROWN FINE TO MEDIUM SAND (To 3.25-M) 1.0- to 1.75-m – ϕ = 30°, γ_t = 1.65 tons/M^3 (N_{avg} = 12)	SPT @ 1.75 M 5/7/10 = 17 Blows		
2.0	1.75- to 2.5-m – ϕ = 32°, γ_t = 1.7 tons/M^3 (N_{avg} = 17)	SPT @ 2.5 M 5/9/12 = 21 Blows		
3.0	2.5- to 3.25-m – ϕ = 33°, γ_t = 1.75 tons/M^3 (N_{avg} = 21)	SPT @ 3.25 M 2/2/3 = 5 Blows		
4.0	GRAY FIRM TO STIFF CLAY (To 5.5-M) 3.25- to 4.0-m – C_u = 3 tons/M^2, γ_t = 1.55 tons/M^3 (N_{avg} = 5)	SPT @ 4 M 2/4/5 = 9 Blows		
5.0	4.0- to 5.0-m – C_u = 5.5 tons/M^2, γ_t = 1.6 tons/M^3 (N_{avg} = 9)	SPT @ 5 M 4/6/10 = 16 Blows		
6.0	5.0- to 5.5-m – C_u = 7.5 tons/M^2, γ_t = 1.65 tons/M^3 (N_{avg} = 12) GRAY SILTY FINE TO MEDIUM SAND (To 8.0-M)	SPT @ 6 M 5/7/8 = 15 Blows		
7.0	5.5- to 7.0-m – ϕ = 32°, γ_t = 1.7 tons/M^3 (N_{avg} = 15)	SPT @ 7 M 7/11/14 = 25 Blows		
8.0	7.0- to 8.0-m – ϕ = 33°, γ_t = 1.75 tons/M^3 (N_{avg} = 25)	SPT @ 8 M 4 cms for 10 Blows		
9.0	BROWN GRAY WEATHERED ROCK (To 11.5-M) 8.0- to 9.0-m – ϕ = 37°, γ_t = 2.1 tons/M^3 (N_{avg} = 100)	3 cms for 10 Blows (Hammer Rebound) SPT @ 9 M (SNR) 1 cm for 20 Blows		
10.0	NX diamond bit drilling from 10-m 9.0- to 11.5-m – ϕ = 40°, γ_t = 2.3 tons/M^3 (N_{avg} >> 100)	0.5 cms for 10 Blows (Hammer Rebound) SPT @ 10 M (SNR) 0.5 cms for 5 Blows 0 cms for 5 Blows (Hammer Rebound)		
11.0	drilled from 10- to 11.5-m in 90 minutes 16 cms core & stone pieces recovered drilling to 11.5-m			

CONTINUED ON PLATE 3b

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; ←→ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 3a

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 2 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 12-05-'23 **Ended on:** 13-05-'23 **Field Work In Charge:** Y Saravanan
Final Depth: 13.5-M **Depth to G W S:** 1.0-M **Remarks:** Continued from Plate 3a.

DEPTH, M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE 25 50 75	INDEX TEST DATA 25 50 75
	BROWN GRAY WEATHERED ROCK (To 11.5-M)	SPT @ 11.5M (SNR) 0 cms for 10 Blows (Hammer Rebound)		
12.0	BROWN GRAY JOINTED GRANITE (Below 11.5-M)			
	drilled from 11.5- to 12.5-m in 85 minutes			
	44 cms core & stone pieces recovered drilling to 12.5-m			
	11.5- to 13.5-m – ϕ = 41°, γ_t = 2.35 tons/M^3			
13.0	(N_{cor} >> 100)			
	drilled from 12.5- to 13.5-m in 125 minutes	SPT @ 13.5M (SNR) 0 cms for 10 Blows (Hammer Rebound)		
	56 cms core & stone pieces recovered drilling to 13.5-m			
14.0				
15.0				
16.0				
17.0				
18.0				
19.0				
20.0				
21.0				
22.0				

BORE HOLE TERMINATED AT 13.5-M

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; ←→ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 3b

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 3 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 6-07-'22 **Ended on:** 7-07-'22 **Field Work In Charge:** Y Saravanan
Final Depth: 14.0-M **Depth to G W S:** 1.0-M **Remarks:** None.

DEPTH, M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE 25 50 75	INDEX TEST DATA 25 50 75
	BROWN FIRM SANDY CLAY (To 1.0-M)	SPT @ 0.25 M		
	0.0- to 1.0-m – C_u = 4 tons/M^2; γ_t = 1.55 tons/M^3	2/3/3 = 6 Blows		
	(N_{avg} = 6)	SPT @ 1 M		
1.0		2/2/4 = 6 Blows		
GWL	BROWN FINE TO MEDIUM SAND (To 3.0-M)			
	1.0- to 1.75-m – ϕ = 26°; γ_t = 1.55 tons/M^3	SPT @ 1.75 M		
	(N_{avg} = 6)	3/4/6 = 10 Blows		
2.0	1.75- to 2.5-m – ϕ = 29°; γ_t = 1.6 tons/M^3			
	(N_{avg} = 10)	SPT @ 2.5 M		
		4/6/8 = 14 Blows		
	2.5- to 3.0-m – ϕ = 31°; γ_t = 1.65 tons/M^3			
3.0	(N_{avg} = 14)	SPT @ 3.25 M		
	GRAY STIFF TO VERY STIFF CLAY (To 8.0-M)	3/4/4 = 8 Blows		
	3.0- to 4.0-m – C_u = 5 tons/M^2; γ_t = 1.6 tons/M^3			
	(N_{avg} = 8)	SPT @ 4 M		
4.0		4/5/7 = 12 Blows		
		SPT @ 5 M		
5.0	4.0- to 6.0-m – C_u = 8.5 tons/M^2; γ_t = 1.65 tons/M^3	4/6/8 = 14 Blows		
	(N_{avg} = 13)			
6.0		SPT @ 6 M		
		5/7/9 = 16 Blows		
		SPT @ 7 M		
7.0	6.0- to 8.0-m – C_u = 12 tons/M^2; γ_t = 1.7 tons/M^3	7/9/11 = 20 Blows		
	(N_{avg} = 18)			
		SPT @ 8 M		
8.0	NX diamond bit drilling from 8.5-m	2 cms for 10 Blows		
	BROWN GRAY WEATHERED ROCK	1 cm for 10 Blows		
	(Below 8.0-M)	(Hammer Rebound)		
	8.0- to 9.0-m – ϕ = 39°; γ_t = 2.25 tons/M^3	SPT @ 9 M (SNR)		
9.0	(N_{avg} >> 100)	1 cm for 20 Blows		
	drilled from 8.5- to 9-m in 35 minutes	(Hammer Rebound)		
	7 cms core & stone pieces recovered drilling to 9-m			
	9.0- to 14.0-m – ϕ = 40°; γ_t = 2.3 tons/M^3	SPT @ 10 M (SNR)		
10.0	(N_{avg} >> 100)	0 cms for 10 Blows		
	drilled from 9- to 10-m in 95 minutes	(Hammer Rebound)		
	33 cms core & stone pieces recovered drilling to 10-m			
	drilled from 10- to 11-m in 50 minutes			
11.0	stone pieces recovered drilling to 11-m			

CONTINUED ON PLATE 4b

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; ←→ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 4a

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site. S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 3 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 6-07-'22 **Ended on:** 7-07-'22 **Field Work In Charge:** Y Saravanan
Final Depth: 14.0-M **Depth to G W S:** 1.0-M **Remarks:** Continued from Plate 4a.

DEPTH M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE 25 50 75	INDEX TEST DATA 25 50 75
	BROWN GRAY WEATHERED ROCK (Below 8.0-M)			
12.0	drilled from 11- to 12-m in 50 minutes	SPT @ 12 M (SNR) 1 cm for 20 Blows (Hammer Rebound)		
	9.0- to 14.0-m – ϕ = 40°, γ = 2.3 tons/M^3 (N_{cor} >> 100)			
13.0	drilled from 12- to 13-m in 50 minutes	SPT @ 13 M (SNR) 0.5 cms for 10 Blows		
		0 cms for 10 Blows (Hammer Rebound)		
14.0	drilled from 13- to 14-m in 55 minutes	SPT @ 14 M (SNR) 0.5 cms for 10 Blows		
	stone pieces recovered drilling to 13-m	0 cms for 10 Blows (Hammer Rebound)		
15.0				
16.0				
17.0				
18.0				
19.0				
20.0				
21.0				
22.0				

BORE HOLE TERMINATED AT 14.0-M

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; +—+ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 4b

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 4 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 5-05-'23 **Ended on:** 6-05-'23 **Field Work In Charge:** M Munivel
Final Depth: 14.5-M **Depth to G W S:** 1.05-M **Remarks:** None.

DEPTH, M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE 25 50 75	INDEX TEST DATA 25 50 75
	BROWN FINE TO MEDIUM SAND (To 2.5-M)	SPT @ 0.25 M 4/4/5 = 9 Blows		
1.0	0.0- to 1.75-m – ϕ = 29°, γ_t = 1.6 tons/M^3 (N_{avg} = 8)	SPT @ 1 M 3/4/4 = 8 Blows		
GWL				
		SPT @ 1.75 M 3/6/7 = 13 Blows		
2.0	1.75- to 2.5-m – ϕ = 31°, γ_t = 1.65 tons/M^3 (N_{avg} = 13) brownish gray color, 2.5- to 4-m			
		SPT @ 2.5 M 3/4/5 = 9 Blows		
3.0	GRAY STIFF TO VERY STIFF CLAY (To 7.0-M)	SPT @ 3.25 M 4/5/6 = 11 Blows		
4.0	2.5- to 5.0-m – C_u = 7 tons/M^2, γ_t = 1.65 tons/M^3 (N_{avg} = 11)	SPT @ 4 M 3/6/6 = 12 Blows		
5.0		SPT @ 5 M 6/8/12 = 20 Blows		
6.0	5.0- to 7.0-m – C_u = 12 tons/M^2, γ_t = 1.7 tons/M^3 (N_{avg} = 19)	SPT @ 6 M 7/9/10 = 19 Blows		
7.0		SPT @ 7 M 7/12/14 = 26 Blows		
	BROWN GRAY SILTY FINE TO MEDIUM SAND (To 9.0-M)			
8.0	7.0- to 8.0-m – ϕ = 33°, γ_t = 1.8 tons/M^3 (N_{avg} = 26)	SPT @ 8 M 10/15/24 = 39 Blows		
	8.0- to 9.0-m – ϕ = 35°, γ_t = 1.95 tons/M^3 (N_{avg} = 39)			
9.0		SPT @ 9 M 3 cms for 10 Blows		
	BROWN WEATHERED ROCK (Below 9.0-M)	2 cms for 10 Blows (Hammer Rebound)		
	9.0- to 10.0-m – ϕ = 38°, γ_t = 2.2 tons/M^3 (N_{avg} > 100)	SPT @ 10 M (SNR) 1.5 cms for 15 Blows		
10.0		0 cms for 5 Blows (Hammer Rebound)		
	10.0- to 14.5-m – ϕ = 40°, γ_t = 2.3 tons/M^3 (N_{avg} >> 100)			
11.0	NX diamond bit drilling from 10.75-m			

CONTINUED ON PLATE 5b

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; ←→ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 5a

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 4 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 5-05-'23 **Ended on:** 6-05-'23 **Field Work In Charge:** M Munivel
Final Depth: 14.5-M **Depth to G W S:** 1.05-M **Remarks:** Continued from Plate 5a.

DEPTH M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE 25 50 75	INDEX TEST DATA 25 50 75
	BROWN WEATHERED ROCK (Below 9.0-M)	SPT @ 11.5M (SNR)		
	-drilled from 10.75- to 11.5-m in 55 minutes	0 cms for 5 Blows		
12.0	-7 cms core & 8 stone pieces recovered drilling to 11.5-m	(Hammer Rebound)		
13.0	10.0- to 14.5-m – $\phi = 40°$, $\gamma_b = 2.3$ tons/M^3 ($N_{cor} >= 100$)	SPT @ 13 M (SNR) 0 cms for 5 Blows (Hammer Rebound)		
	-drilled from 11.5- to 13-m in 80 minutes			
14.0	-3 stone pieces recovered drilling to 13-m			
	-drilled from 13- to 14.5-m in 140 minutes	SPT @ 14.5M (SNR) 0.5 cms for 5 Blows		
15.0	-9 cms core & 8 stone pieces recovered drilling to 11.5-m	0 cms for 5 Blows (Hammer Rebound)		
16.0				
17.0				
18.0				
19.0				
20.0				
21.0				
22.0				

BORE HOLE TERMINATED AT 14.5-M

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; +—+ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 5b

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 5 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 14-05-'23 **Ended on:** 15-05-'23 **Field Work In Charge:** M Munivel
Final Depth: 12.5-M **Depth to G W S:** Not Measured **Remarks:** None.

DEPTH, M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE 25 50 75	INDEX TEST DATA 25 50 75
	BROWN WEATHERED ROCK – Filled Up Soil (To 1.0-M)	SPT @ 0.25 M 2/2/3 = 5 Blows		
	0.0- to 1.0-m – $\phi = 26°$, $\gamma_t = 1.55$ tons/M^3	SPT @ 1 M		
1.0	($N_{avg} = 5$)	4/4/4 = 8 Blows		
	BROWN GRAY STIFF TO VERY STIFF CLAY (To 8.0-M)	SPT @ 1.75 M		
	1.0- to 1.75-m – $C_u = 5$ tons/M^2; $\gamma_t = 1.6$ tons/M^3	4/5/5 = 10 Blows		
2.0	($N_{avg} = 8$)			
	1.75- to 3.0-m – $C_u = 7$ tons/M^2; $\gamma_t = 1.65$ tons/M^3	SPT @ 2.5 M 3/6/6 = 12 Blows		
3.0	($N_{avg} = 11$)	SPT @ 3.25 M		
		3/4/4 = 8 Blows		
4.0	3.0- to 5.0-m – $C_u = 6$ tons/M^2; $\gamma_t = 1.6$ tons/M^3	SPT @ 4 M 4/5/5 = 10 Blows		
	($N_{avg} = 9$)			
5.0	-gray color, 5- to 8-m	SPT @ 5 M 6/7/9 = 16 Blows		
6.0	5.0- to 7.0-m – $C_u = 11$ tons/M^2; $\gamma_t = 1.7$ tons/M^3	SPT @ 6 M 6/7/10 = 17 Blows		
	($N_{avg} = 16$)			
7.0		SPT @ 7 M 7/9/12 = 21 Blows		
	7.0- to 8.0-m – $C_u = 14$ tons/M^2; $\gamma_t = 1.75$ tons/M^3			
8.0	($N_{avg} = 21$)	SPT @ 8 M 12/14/28 = 42 Blows		
	BROWN GARY WEATHERED ROCK (Below 8.0-M)			
9.0	8.0- to 9.0-m – $\phi = 35°$, $\gamma_t = 2.0$ tons/M^3 ($N_{avg} = 42$)	SPT @ 9 M 2 cms for 10 Blows 1 cm for 10 Blows (Hammer Rebound)		
	9.0- to 10.0-m – $\phi = 39°$, $\gamma_t = 2.25$ tons/M^3			
10.0	($N_{avg} >> 100$) -NX diamond bit drilling from 10-m	SPT @ 10 M (SNR) 0.5 cms for 5 Blows		
	10.0- to 12.5-m – $\phi = 40°$, $\gamma_t = 2.3$ tons/M^3	0 cms for 5 Blows (Hammer Rebound)		
11.0	($N_{avg} >> 100$)			

CONTINUED ON PLATE 6b

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; ←→ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 6a

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 5 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 14-05-'23 **Ended on:** 15-05-'23 **Field Work In Charge:** M Munivel
Final Depth: 12.5-M **Depth to G W S:** Not Measured **Remarks:** Continued from Plate 6a.

DEPTH, M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE 25 50 75	INDEX TEST DATA 25 50 75
	BROWN GARY WEATHERED ROCK (Below 8.0-M)	SPT @ 11.5M (SNR) 0 cms for 5 Blows (Hammer Rebound)		
12.0	-drilled from 10- to 11.5-m in 105 minutes -3 cms core & 8 stone pieces recovered drilling to 11.5-m			
	10.0- to 12.5-m – $\phi = 40°$, $\gamma = 2.3$ tons/M^3 ($N_{cor} >> 100$)	SPT @ 12.5M (SNR) 0 cms for 5 Blows (Hammer Rebound)		
13.0	-drilled from 11.5- to 12.5-m in 90 minutes -7 cms core & 17 stone pieces recovered drilling to 12.5-m			
14.0				
15.0				
16.0				
17.0				
18.0				
19.0				
20.0				
21.0				
22.0				

BORE HOLE TERMINATED AT 12.5-M

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; +—+ = Plastic and Liquid Limits; ♦ = N M C, ■ = % -75μ Size

PLATE 6b

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 6 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 10-05-'23 **Ended on:** 11-05-'23 **Field Work In Charge:** Y Saravanan
Final Depth: 14.5-M **Depth to G W S:** 1.4-M **Remarks:** None.

DEPTH M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE 25 50 75	INDEX TEST DATA 25 50 75
	BROWN STIFF CLAY (To 2.5-M)	SPT @ 0.25 M 3/4/4 = 8 Blows		
1.0	0.0- to 1.75-m – C_u = 5 tons/M^2; γ_t = 1.6 tons/M^3 (N_{avg} = 8)	SPT @ 1 M 2/3/5 = 8 Blows		
GWL		SPT @ 1.75 M 4/5/9 = 14 Blows		
2.0	1.75- to 2.5-m – C_u = 8 tons/M^2; γ_t = 1.65 tons/M^3 (N_{avg} = 14)	SPT @ 2.5 M 6/8/10 = 18 Blows		
3.0	BROWN SILTY FINE SAND (To 3.25-M) 2.5- to 3.25-m – ϕ = 31°; γ_t = 1.7 tons/M^3 (N_{avg} = 18)	SPT @ 3.25 M 4/4/7 = 11 Blows		
	GRAY FIRM TO STIFF CLAY (To 7.0-M) 3.25- to 4.0-m – C_u = 6 tons/M^2; γ_t = 1.65 tons/M^3 (N_{avg} = 11)	SPT @ 4 M 2/3/3 = 6 Blows		
4.0	4.0- to 5.0-m – C_u = 4 tons/M^2; γ_t = 1.55 tons/M^3 (N_{avg} = 6)			
5.0		SPT @ 5 M 2/4/5 = 9 Blows		
	5.0- to 6.0-m – C_u = 6 tons/M^2; γ_t = 1.6 tons/M^3 (N_{avg} = 9)			
6.0		SPT @ 6 M 5/7/8 = 15 Blows		
	6.0- to 7.0-m – C_u = 9 tons/M^2; γ_t = 1.7 tons/M^3 (N_{avg} = 15)			
7.0		SPT @ 7 M 7/10/12 = 22 Blows		
	BROWN SILTY FINE TO MEDIUM SAND (To 9.0-M) 7.0- to 8.0-m – ϕ = 33°; γ_t = 1.75 tons/M^3 (N_{avg} = 22)	SPT @ 8 M 11/14/17 = 31 Blows		
8.0	8.0- to 9.0-m – ϕ = 34°; γ_t = 1.85 tons/M^3 (N_{avg} = 31)			
9.0		SPT @ 9 M (SNR) 2 cms for 20 Blows (Hammer Rebound)		
	GRAY BROWN WEATHERED ROCK (Below 9.0-M) 9.0- to 10.0-m – ϕ = 39°; γ_t = 2.25 tons/M^3 (N_{avg} >> 100)	SPT @ 10 M (SNR) 1 cm for 10 Blows		
10.0	NX diamond bit drilling from 10-m 10.0- to 14.5-m – ϕ = 40°; γ_t = 2.3 tons/M^3 (N_{avg} >> 100)	0.5 cms for 10 Blows (Hammer Rebound)		
11.0				

CONTINUED ON PLATE 7b

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; ←→ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 7a

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 6 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 10-05-'23 **Ended on:** 11-05-'23 **Field Work In Charge:** Y Saravanan
Final Depth: 14.5-M **Depth to G W S:** 1.4-M **Remarks:** Continued from Plate 7a.

DEPTH M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE 25 50 75	INDEX TEST DATA 25 50 75
	GRAY BROWN WEATHERED ROCK (Below 9.0-M)	SPT @ 11.5M (SNR) 0 cms for 10 Blows (Hammer Rebound)		
12.0	-drilled from 10- to 11.5-m in 85 minutes -6 cms core & stone pieces recovered drilling to 11.5-m			
13.0	10.0- to 14.5-m - $\phi = 40°$, $\gamma_t = 2.3$ tons/M^3 ($N_{cor} >> 100$) -drilled from 11.5- to 13-m in 90 minutes -5 cms core & stone pieces recovered drilling to 13-m	SPT @ 13 M (SNR) 0 cms for 10 Blows (Hammer Rebound)		
14.0	-drilled from 13- to 14.5-m in 95 minutes -14 cms core & stone pieces recovered drilling to 14.5-m	No SPT @ 14.5 M due to core recovery		
15.0				
16.0				
17.0				
18.0				
19.0				
20.0				
21.0				
22.0				

BORE HOLE TERMINATED AT 14.5-M

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; +—+ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 7b

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 7 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 8-05-'23 **Ended on:** 9-05-'23 **Field Work In Charge:** M Munivel
Final Depth: 14.5-M **Depth to G W S:** 1.3-M **Remarks:** None.

DEPTH, M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE 25 50 75	INDEX TEST DATA 25 50 75
	BROWN FINE TO MEDIUM SAND with silt (To 2.5-M)	SPT @ 0.25 M 2/2/2 = 4 Blows		
	0.0- to 1.0-m – ϕ = 26°, γ_t = 1.5 tons/M^3	SPT @ 1 M		
1.0	(N_{avg} = 4)	2/3/4 = 7 Blows		
		SPT @ 1.75 M		
GWL 2.0	1.0- to 2.5-m – ϕ = 28°, γ_t = 1.6 tons/M^3 (N_{avg} = 8)	2/3/6 = 9 Blows		
		SPT @ 2.5 M 4/6/6 = 12 Blows		
3.0	BROWN GRAY SILTY FINE SAND with clay binder (To 3.25-M) (N_{avg} = 12)	SPT @ 3.25 M		
	2.5- to 3.25-m – ϕ = 29°, γ_t = 1.65 tons/M^3	5/6/8 = 14 Blows		
	GRAY STIFF TO VERY STIFF CLAY (To 6.0-M)	SPT @ 4 M		
4.0		5/7/10 = 17 Blows		
	3.25- to 6.0-m – C_u = 10 tons/M^2, γ_t = 1.7 tons/M^3	SPT @ 5 M		
5.0	(N_{avg} = 15)	4/6/8 = 14 Blows		
		SPT @ 6 M		
6.0		5/7/10 = 17 Blows		
	BROWN GRAY SILTY FINE TO MEDIUM SAND (To 8.0-M)	SPT @ 7 M		
7.0	6.0- to 8.0-m – ϕ = 32°, γ_t = 1.7 tons/M^3 (N_{avg} = 19)	7/9/12 = 21 Blows		
		SPT @ 8 M		
8.0		10/16/24 = 40 Blows		
	WHITE BROWN GRAY WEATHERED ROCK (Below 8.0-M)	SPT @ 9 M 23/		
9.0	8.0- to 9.0-m – ϕ = 35°, γ_t = 1.95 tons/M^3 (N_{avg} = 40)	3 cms for 10 Blows		
		2 cms for 10 Blows (Hammer Rebound)		
	9.0- to 10.0-m – ϕ = 38°, γ_t = 2.2 tons/M^3 (N_{avg} > 100)	SPT @ 10 M (SNR)		
10.0	NX diamond bit drilling from 10-m	1 cm for 10 Blows		
		0.5 cms for 10 Blows (Hammer Rebound)		
	10.0- to 14.5-m – ϕ = 40°, γ_t = 2.3 tons/M^3			
11.0	(N_{avg} >> 100)			

CONTINUED ON PLATE 8b

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; ←—→ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 8a

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 7 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 8-05-'23 **Ended on:** 9-05-'23 **Field Work In Charge:** M Munivel
Final Depth: 14.5-M **Depth to G W S:** 1.3-M **Remarks:** Continued from Plate 8a.

DEPTH M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE 25 50 75	INDEX TEST DATA 25 50 75
	BROWN GRAY WEATHERED ROCK (Below 8.0-M)	SPT @ 11.5M (SNR) 1 cm for 20 Blows (Hammer Rebound)		
12.0	drilled from 10- to 11.5-m in 85 minutes			
	drilled from 11.5- to 13-m in 80 minutes	SPT @ 13 M (SNR) 1 cm for 20 Blows (Hammer Rebound)		
13.0	stone pieces recovered drilling to 13-m			
	10.0- to 14.5-m – $\phi = 40°$, $\gamma_b = 2.3$ tons/M^3 (N_{corr} >> 100)			
14.0				
	drilled from 13- to 14.5-m in 90 minutes	SPT @ 14.5M (SNR) 0.5 cms for 10 Blows		
15.0	4 cms core & stone pieces recovered drilling to 14.5-m	0 cms for 10 Blows (Hammer Rebound)		
16.0				
17.0				
18.0				
19.0				
20.0				
21.0				
22.0				

BORE HOLE TERMINATED AT 14.5-M

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; +—+ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 8b

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 8 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 9-05-'23 **Ended on:** 10-05-'23 **Field Work In Charge:** Y Saravanan
Final Depth: 14.5-M **Depth to G W S:** 1.55-M **Remarks:** None.

DEPTH M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE
	BROWN SOFT CLAY (To 1.0-M)	SPT @ 0.25 M
	0.0- to 1.0-m – C_u = 2.5 tons/M^2; γ_t = 1.45 tons/M^3	2/2/2 = 4 Blows
	(N_{avg} = 4)	SPT @ 1 M
1.0	silty at 1-m	2/3/5 = 8 Blows
	BROWN FINE TO MEDIUM SAND (To 3.25-M)	
	1.0- to 1.75-m – ϕ = 28°; γ_t = 1.6 tons/M^3	SPT @ 1.75 M
GWL	(N_{avg} = 8)	5/5/8 = 13 Blows
2.0	1.75- to 2.5-m – ϕ = 30°; γ_t = 1.65 tons/M^3	
	(N_{avg} = 13)	SPT @ 2.5 M
		6/8/11 = 19 Blows
	2.5- to 3.25-m – ϕ = 32°; γ_t = 1.7 tons/M^3	
3.0	(N_{avg} = 19)	SPT @ 3.25 M
		3/3/6 = 9 Blows
	GRAY STIFF TO VERY STIFF CLAY (To 7.0-M)	
	3.25- to 4.0-m – C_u = 5 tons/M^2; γ_t = 1.6 tons/M^3	SPT @ 4 M
4.0	(N_{avg} = 9)	4/6/7 = 13 Blows
	4.0- to 5.0-m – C_u = 8 tons/M^2; γ_t = 1.65 tons/M^3	
	(N_{avg} = 13)	SPT @ 5 M
5.0		5/8/11 = 19 Blows
	5.0- to 6.0-m – C_u = 12 tons/M^2; γ_t = 1.7 tons/M^3	
	(N_{avg} = 19)	SPT @ 6 M
6.0	brown gray color at 6-m	7/11/15 = 26 Blows
	6.0- to 7.0-m – C_u = 16 tons/M^2; γ_t = 1.8 tons/M^3	
	(N_{avg} = 26)	SPT @ 7 M
7.0		10/13/19 = 32 Blows
	BROWN SILTY FINE TO MEDIUM SAND (To 8.0-M)	
	7.0- to 8.0-m – ϕ = 34°; γ_t = 1.85 tons/M^3	SPT @ 8 M 23/
8.0	(N_{avg} = 32)	4 cms for 10 Blows
	BROWN GRAY WEATHERED ROCK (Below 8.0-M)	3 cms for 10 Blows (Hammer Rebound)
	8.0- to 9.0-m – ϕ = 37°; γ_t = 2.1 tons/M^3	SPT @ 9 M
9.0	(N_{avg} > 75)	3 cms for 10 Blows
		2 cms for 10 Blows
	9.0- to 10.0-m – ϕ = 38°; γ_t = 2.2 tons/M^3	(Hammer Rebound)
	(N_{avg} > 100)	SPT @ 10 M (SNR)
10.0	NX diamond bit drilling from 9.6-m	0 cms for 5 Blows
	drilled from 9.6- to 10-m in 15 minutes	(Hammer Rebound)
	10.0- to 14.5-m – ϕ = 40°; γ_t = 2.3 tons/M^3	
11.0	(N_{avg} >= 100)	

CONTINUED ON PLATE 9b

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; ←—→ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 9a

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 8 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 9-05-'23 **Ended on:** 10-05-'23 **Field Work In Charge:** Y Saravanan
Final Depth: 14.5-M **Depth to G W S:** 1.55-M **Remarks:** Continued from Plate 9a.

DEPTH M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE 25 50 75	INDEX TEST DATA 25 50 75
	BROWN GRAY WEATHERED ROCK (Below 8.0-M)	SPT @ 11.5M (SNR) 0 cms for 5 Blows (Hammer Rebound)		
12.0	-drilled from 10- to 11.5-m in 85 minutes -4 stone pieces recovered drilling to 11.5-m			
13.0	-drilled from 11.5- to 13-m in 90 minutes -10 cms core & stone pieces recovered drilling to 13-m 10.0- to 14.5-m – $\phi = 40°$, $\gamma_t = 2.3$ tons/M^3 ($N_{corr} >= 100$)	SPT @ 13 M (SNR) 0 cms for 10 Blows (Hammer Rebound)		
14.0				
	-drilled from 13- to 14.5-m in 95 minutes	SPT @ 14.5M (SNR) 0 cms for 10 Blows (Hammer Rebound)		
15.0	-stone pieces recovered drilling to 14.5-m			
16.0				
17.0				
18.0				
19.0				
20.0				
21.0				
22.0				

BORE HOLE TERMINATED AT 14.5-M

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; ←—→ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 9b

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 9 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 5-05-'23 **Ended on:** 6-05-'23 **Field Work In Charge:** M Munivel
Final Depth: 15.65-M **Depth to G W S:** 2.4-M **Remarks:** None.

DEPTH M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE 25 50 75	INDEX TEST DATA 25 50 75
	BROWN WEATHERED ROCK – Filled Up Soil (To 1.0-M)	SPT @ 0.25 M 8/11/8 = 19 Blows		
	0.0- to 1.0-m – ϕ = 32°, γ_t = 1.7 tons/M^3 (N_{avg} = 19)	SPT @ 1 M 3/4/4 = 8 Blows		
1.0				
	BROWN GRAY FIRM TO STIFF CLAY (To 7.0-M)	SPT @ 1.75 M 3/4/4 = 8 Blows		
2.0				
GWL	1.0- to 3.25-m – C_u = 5 tons/M^2, γ_t = 1.6 tons/M^3 (N_{avg} = 8)	SPT @ 2.5 M 3/3/5 = 8 Blows		
3.0		SPT @ 3.25 M 2/2/4 = 6 Blows		
		SPT @ 4 M 1/2/4 = 6 Blows		
4.0				
	3.25- to 6.0-m – C_u = 4 tons/M^2, γ_t = 1.55 tons/M^3 (N_{avg} = 6)	SPT @ 5 M 3/2/4 = 6 Blows		
5.0				
		SPT @ 6 M 4/5/7 = 12 Blows		
6.0				
	6.0- to 7.0-m – C_u = 7.5 tons/M^2, γ_t = 1.65 tons/M^3 (N_{avg} = 12)	SPT @ 7 M 10/11/13 = 24 Blows		
7.0				
	BROWN SILTY FINE TO MEDIUM SAND (To 9.0-M)	SPT @ 8 M 11/17/22 = 39 Blows		
8.0	7.0- to 8.0-m – ϕ = 33°, γ_t = 1.75 tons/M^3 (N_{avg} = 24)			
	8.0- to 9.0-m – ϕ = 35°, γ_t = 1.95 tons/M^3 (N_{avg} = 39)			
9.0		SPT @ 9 M 4 cms for 20 Blows (Hammer Rebound)		
	BROWN WEATHERED ROCK (Below 9.0-M) 9.0- to 10.0-m – ϕ = 38°, γ_t = 2.2 tons/M^3 (N_{avg} > 100)	SPT @ 10 M (SNR) 0.5 cms for 5 Blows		
10.0				
	10.0- to 15.65-m – ϕ = 40°, γ_t = 2.3 tons/M^3 (N_{avg} >= 100)	0 cms for 5 Blows (Hammer Rebound)		
11.0				

CONTINUED ON PLATE 10b

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; ←—→ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 10a

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 9 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 5-05-'23 **Ended on:** 6-05-'23 **Field Work In Charge:** M Munivel
Final Depth: 15.65-M **Depth to G W S:** 2.4-M **Remarks:** Continued from Plate 10a.

DEPTH M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE 25 50 75	INDEX TEST DATA 25 50 75
	BROWN WEATHERED ROCK (Below 9.0-M)	SPT @ 11.5M (SNR)		
	-NX diamond bit drilling from 11.5-m	0 cms for 5 Blows		
12.0		(Hammer Rebound)		
13.0	-drilled from 11.5- to 13-m in 50 minutes	SPT @ 13 M (SNR) 0 cms for 5 Blows		
	-5 cms core & 10 stone pieces recovered drilling to 13-m	(Hammer Rebound)		
	10.0- to 15.65-m – $\phi = 40°$, $\gamma_b = 2.3$ tons/M^3			
14.0	(N_{corr} >> 100)			
		SPT @ 14.5M (SNR)		
	-drilled from 13- to 14.5-m in 100 minutes	0 cms for 5 Blows		
15.0	-18 stone pieces recovered drilling to 14.5-m	(Hammer Rebound)		
		SPT@ 15.65M(SNR)		
	-drilled from 14.5- to 15.65-m in 100 minutes	0 cms for 5 Blows		
16.0	-10 stone pieces recovered drilling to 15.65-m	(Hammer Rebound)		
17.0				
18.0				
19.0				
20.0				
21.0				
22.0				

BORE HOLE TERMINATED AT 15.65-M

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; ←→ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 10b

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 10 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 13-05-'23 **Ended on:** 14-05-'23 **Field Work In Charge:** M Munivel
Final Depth: 14.5-M **Depth to G W S:** 2.6-M **Remarks:** None.

DEPTH, M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE (25 50 75)	INDEX TEST DATA (25 50 75)
	BROWN WEATHERED ROCK – Filled Up Soil (To 1.0-M)	SPT @ 0.25 M 7/5/5 = 10 Blows		
	0.0- to 1.0-m – ϕ = 30°, γ_t = 1.65 tons/M^3	SPT @ 1 M 3/2/2 = 4 Blows		
1.0	(N_{avg} = 10)			
	BROWN GRAY SOFT TO STIFF CLAY (To 7.0-M) (N_{avg} = 4)	SPT @ 1.75 M 3/3/4 = 7 Blows		
	1.0- to 1.75-m – C_u = 2.5 tons/M^2, γ_t = 1.5 tons/M^3			
2.0				
		SPT @ 2.5 M 3/4/5 = 9 Blows		
GWL	1.75- to 3.0-m – C_u = 5 tons/M^2, γ_t = 1.6 tons/M^3			
	(N_{avg} = 8)			
3.0		SPT @ 3.25 M 5/3/3 = 6 Blows		
		SPT @ 4 M 1/2/3 = 5 Blows		
4.0	3.0- to 5.0-m – C_u = 3.5 tons/M^2, γ_t = 1.5 tons/M^3			
	(N_{avg} = 5.5)			
		SPT @ 5 M 2/3/5 = 8 Blows		
5.0				
	5.0- to 6.0-m – C_u = 5 tons/M^2, γ_t = 1.6 tons/M^3			
	(N_{avg} = 8)	SPT @ 6 M 5/6/9 = 15 Blows		
6.0				
	6.0- to 7.0-m – C_u = 9 tons/M^2, γ_t = 1.7 tons/M^3			
	(N_{avg} = 15)	SPT @ 7 M 5/6/12 = 18 Blows		
7.0				
	BROWN GRAY SILTY FINE TO MEDIUM SAND (To 9.0-M)			
	7.0- to 8.0-m – ϕ = 32°, γ_t = 1.7 tons/M^3	SPT @ 8 M 7/16/19 = 35 Blows		
8.0	(N_{avg} = 18)			
	8.0- to 9.0-m – ϕ = 34°, γ_t = 1.9 tons/M^3			
	(N_{avg} = 35)			
9.0		SPT @ 9 M 30/ 2 cms for 10 Blows		
	BROWN BLUE WEATHERED ROCK (Below 9.0-M)	1 cm for 10 Blows (Hammer Rebound)		
10.0	NX diamond bit drilling from 10-m	SPT @ 10 M 2 cms for 10 Blows		
	9.0- to 11.5-m – ϕ = 39°, γ_t = 2.25 tons/M^3	1 cm for 10 Blows (Hammer Rebound)		
	(N_{avg} >> 100)			
11.0				

CONTINUED ON PLATE 11b

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; ←—→ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 11a

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 10 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 13-05-'23 **Ended on:** 14-05-'23 **Field Work In Charge:** M Munivel
Final Depth: 14.5-M **Depth to G W S:** 2.6-M **Remarks:** Continued from Plate 11a.

DEPTH, M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE 25 50 75	INDEX TEST DATA 25 50 75
	BROWN BLUE WEATHERED ROCK (Below 9.0-M)	SPT @ 11.5M (SNR) 0 cms for 5 Blows (Hammer Rebound)		
12.0	-drilled from 10- to 11.5-m in 40 minutes -2 stone pieces recovered drilling to 11.5-m			
13.0	-drilled from 11.5- to 13-m in 95 minutes -7 stone pieces recovered drilling to 13-m	SPT @ 13 M (SNR) 0 cms for 5 Blows (Hammer Rebound)		
14.0	11.5- to 14.5-m – $\phi = 40^0$, $\gamma = 2.3$ tons/M^3 (N_{cor} >> 100)			
15.0	-drilled from 13- to 14.5-m in 115 minutes -14.5 cms core & 6 stone pieces recovered drilling to 14.5-m	SPT @ 14.5M (SNR) 0 cms for 5 Blows (Hammer Rebound)		
16.0				
17.0				
18.0				
19.0				
20.0				
21.0				
22.0				

BORE HOLE TERMINATED AT 14.5-M

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; ←—• = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 11b

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 11 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 8-05-'23 **Ended on:** 9-05-'23 **Field Work In Charge:** M Munivel
Final Depth: 13.35-M **Depth to G W S:** 1.2-M **Remarks:** None.

DEPTH, M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE
	BROWN GRAY SILTY FINE SAND (To 1.75-M)	SPT @ 0.25 M
	0.0- to 1.0-m – ϕ = 30°; γ_t = 1.65 tons/M^3	5/5/6 = 11 Blows
	(N_{avg} = 11)	SPT @ 1 M
1.0		5/7/8 = 15 Blows
GWL	1.0- to 1.75-m – ϕ = 31°; γ_t = 1.7 tons/M^3	
	(N_{avg} = 15)	SPT @ 1.75 M
		5/9/10 = 19 Blows
2.0	**BROWN GRAY FIRM TO VERY STIFF CLAY**	
	(To 3.25-M) (N_{avg} = 19)	SPT @ 2.5 M
	1.75- to 2.5-m – C_u = 12 tons/M^2; γ_t = 1.7 tons/M^3	2/3/4 = 7 Blows
3.0	2.5- to 3.25-m – C_u = 4 tons/M^2; γ_t = 1.6 tons/M^3	SPT @ 3.25 M
	(N_{avg} = 7)	6/6/7 = 13 Blows
	BROWN GRAY SILTY FINE SAND (To 5.0-M)	
	3.25- to 4.0-m – ϕ = 30°; γ_t = 1.65 tons/M^3	SPT @ 4 M
4.0	(N_{avg} = 13)	2/4/4 = 8 Blows
	4.0- to 5.0-m – ϕ = 27°; γ_t = 1.6 tons/M^3	
	(N_{avg} = 8)	SPT @ 5 M
5.0		4/5/7 = 12 Blows
	BROWN GRAY STIFF CLAY (To 7.0-M)	
		SPT @ 6 M
6.0	5.0- to 7.0-m – C_u = 7.5 tons/M^2; γ_t = 1.65 tons/M^3	5/5/8 = 13 Blows
	(N_{avg} = 12)	
		SPT @ 7 M
7.0		8/15/21 = 36 Blows
	BROWN GRAY SILTY FINE TO MEDIUM SAND (To 9.0-M)	
		SPT @ 8 M
8.0	7.0- to 9.0-m – ϕ = 35°; γ_t = 1.95 tons/M^3	12/15/25 = 40 Blows
	(N_{avg} = 38)	
		SPT @ 9 M
9.0	NX diamond bit drilling from 9-m	4 cms for 20 Blows
	BROWN GRAY WEATHERED ROCK	(Hammer Rebound)
	(Below 9.0-M)	
	9.0- to 10.0-m – ϕ = 38°; γ_t = 2.2 tons/M^3	SPT @ 10 M (SNR)
10.0	(N_{avg} > 100)	0 cms for 5 Blows
	drilled from 9- to 10-m in 40 minutes	(Hammer Rebound)
	8.5 cms core and stone pieces recovered drilling to 10-m	
	10.0- to 13.35-m – ϕ = 40°; γ_t = 2.3 tons/M^3	
11.0	(N_{avg} >> 100)	

SPT @ 25 50 75 | INDEX TEST DATA 25 50 75

CONTINUED ON PLATE 12b

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; ←→ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 12a

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 11 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 8-05-'23 **Ended on:** 9-05-'23 **Field Work In Charge:** M Munivel
Final Depth: 13.35-M **Depth to G W S:** 1.2-M **Remarks:** Continued from Plate 12a.

DEPTH M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE 25 50 75	INDEX TEST DATA 25 50 75
	BROWN GRAY WEATHERED ROCK (Below 9.0-M)	SPT @ 11.5M (SNR) 0 cms for 5 Blows (Hammer Rebound)		
12.0	-drilled from 10- to 11.5-m in 45 minutes -16 stone pieces recovered drilling to 11.5-m 10.0- to 13.35-m – $\phi = 40^{\circ}$, $\gamma_b = 2.3$ tons/M^3 ($N_{c\phi} >= 100$)			
13.0	-drilled from 11.5- to 13-m in 90 minutes -8 cms core & 7 stone pieces recovered drilling to 13-m -drilled from 13- to 13.5-m in 80 minutes	SPT @ 13 M (SNR) 0 cms for 5 Blows (Hammer Rebound) SPT@13.35M (SNR)		
14.0	-7 stone pieces recovered drilling to 13.35-m	0 cms for 5 Blows (Hammer Rebound)		
15.0				
16.0				
17.0				
18.0				
19.0				
20.0				
21.0				
22.0				

BORE HOLE TERMINATED AT 13.35-M

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; ←—+ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 12b

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 12 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 11-05-'23 **Ended on:** 13-05-'23 **Field Work In Charge:** M Munivel
Final Depth: 14.0-M **Depth to G W S:** 2.4-M **Remarks:** None.

DEPTH M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE 25 50 75	INDEX TEST DATA 25 50 75
	BROWN FINE TO COARSE SAND with silt and stone pieces - Filled Up Soil (To 1.0-M)	SPT @ 0.25 M 10/8/5 = 13 Blows		
	0.0- to 1.0-m – ϕ = 31°; γ_t = 1.65 tons/M^3	SPT @ 1 M		
1.0	(N_{avg} = 13)	3/2/6 = 8 Blows		
	BROWN AND GRAY FIRM TO STIFF CLAY (To 6.0-M)	SPT @ 1.75 M		
	1.0- to 2.5-m – C_u = 4.5 tons/M^2; γ_t = 1.55 tons/M^3	2/2/4 = 6 Blows		
2.0	(N_{avg} = 7)			
GWL		SPT @ 2.5 M		
		4/5/5 = 10 Blows		
3.0		SPT @ 3.25 M		
	2.5- to 3.75-m – C_u = 6.5 tons/M^2; γ_t = 1.65 tons/M^3	5/5/6 = 11 Blows		
	(N_{avg} = 10.5)			
4.0		SPT @ 4 M		
		2/2/5 = 7 Blows		
	3.75- to 5.0-m – C_u = 4.5 tons/M^2; γ_t = 1.55 tons/M^3			
	(N_{avg} = 7)			
5.0		SPT @ 5 M		
		5/6/8 = 14 Blows		
	5.0- to 6.0-m – C_u = 9 tons/M^2; γ_t = 1.65 tons/M^3			
	(N_{avg} = 14)			
6.0		SPT @ 6 M		
		6/6/8 = 14 Blows		
	GRAY SILTY FINE SAND with clay binder (To 7.0-M)			
	6.0- to 7.0-m – ϕ = 30°; γ_t = 1.65 tons/M^3	SPT @ 7 M		
7.0	(N_{avg} = 14)	7/8/10 = 18 Blows		
	GRAY VERY STIFF CLAY (To 8.0-M)			
	7.0- to 8.0-m – C_u = 11 tons/M^2; γ_t = 1.7 tons/M^3			
	(N_{avg} = 18)			
8.0		SPT @ 8 M		
		2 cms for 10 Blows		
	BROWN BLUE WEATHERED ROCK (Below 8.0-M)	1 cm for 10 Blows (Hammer Rebound)		
	8.0- to 9.0-m – ϕ = 39°; γ_t = 2.25 tons/M^3	SPT @ 9 M (SNR)		
9.0	(N_{avg} >> 100)	0 cms for 5 Blows		
	NX diamond bit drilling from 9-m	(Hammer Rebound)		
	9.0- to 14.0-m – ϕ = 40°; γ_t = 2.3 tons/M^3	SPT @ 10 M (SNR)		
10.0	(N_{avg} >> 100)	0 cms for 5 Blows		
	drilled from 9- to 10-m in 65 minutes	(Hammer Rebound)		
	4.5 cms core & 7 stone pieces recovered drilling to 10-m			
11.0				

CONTINUED ON PLATE 13b

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; ←—→ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 13a

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 12 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 11-05-'23 **Ended on:** 13-05-'23 **Field Work In Charge:** M Munivel
Final Depth: 14.0-M **Depth to G W S:** 2.4-M **Remarks:** Continued from Plate 13a.

DEPTH, M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE 25 50 75	INDEX TEST DATA 25 50 75
	BROWN BLUE WEATHERED ROCK	SPT @ 11.5M (SNR)		
	(Below 8.0-M)	0 cms for 5 Blows		
	-drilled from 10- to 11.5-m in 100 minutes	(Hammer Rebound)		
12.0	-7 stone pieces recovered drilling to 11.5-m			
	9.0- to 14.0-m – $\phi = 40°$, $\gamma_b = 2.3$ tons/M^3			
	(N_{avg} >> 100)	SPT @ 13 M (SNR)		
13.0	-drilled from 11.5- to 13-m in 105 minutes	0 cms for 5 Blows		
	-16 cms core & 13 stone pieces recovered drilling to 13-m	(Hammer Rebound)		
		SPT @ 14 M (SNR)		
14.0	-drilled from 13- to 14-m in 100 minutes	0 cms for 5 Blows		
	-11 cms core & 17 stone pieces recovered drilling to 14-m	(Hammer Rebound)		
15.0				
16.0				
17.0				
18.0				
19.0				
20.0				
21.0				
22.0				

BORE HOLE TERMINATED AT 14.0-M

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; ←→ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 13b

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 13 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 10-05-'23 **Ended on:** 11-05-'23 **Field Work In Charge:** M Munivel
Final Depth: 14.5-M **Depth to G W S:** 1.65-M **Remarks:** None.

DEPTH, M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE (25 50 75)	INDEX TEST DATA (25 50 75)
	BROWN GRAY VERY SOFT TO FIRM CLAY (To 1.75-M)	SPT @ 0.25 M 3/4/6 = 10 Blows		
1.0	0.0- to 1.75-m – C_u = 6 tons/M^2, γ_t = 1.6 tons/M^3 (N_{avg} = 9)	SPT @ 1 M 4/4/5 = 9 Blows		
GWL		SPT @ 1.75 M 2/5/6 = 11 Blows		
2.0	**BROWN GRAY SILTY FINE SAND with clay binder (To 3.25-M)**	SPT @ 2.5 M 3/6/5 = 11 Blows		
	1.75- to 3.25-m – ϕ = 30°, γ_t = 1.65 tons/M^3 (N_{avg} = 11)			
3.0		SPT @ 3.25 M 2/2/4 = 6 Blows		
	BROWN GRAY FIRM TO STIFF CLAY (To 5.0-M) (N_{avg} = 6)	SPT @ 4 M 3/4/6 = 10 Blows		
4.0	3.25- to 4.0-m – C_u = 4 tons/M^2, γ_t = 1.5 tons/M^3			
	4.0- to 5.0-m – C_u = 6 tons/M^2, γ_t = 1.6 tons/M^3 (N_{avg} = 10)	SPT @ 5 M 5/4/4 = 8 Blows		
5.0				
	GRAY SILTY FINE SAND with clay binder (To 6.0-M)	SPT @ 6 M 8/14/18 = 32 Blows		
6.0	5.0- to 6.0-m – ϕ = 28°, γ_t = 1.6 tons/M^3 (N_{avg} = 8)			
	BROWN GRAY FINE TO MEDIUM SAND with silt (To 9.0-M)	SPT @ 7 M 8//11/16 = 27 Blows		
7.0	6.0- to 8.0-m – ϕ = 34°, γ_t = 1.8 tons/M^3 (N_{avg} = 29)			
		SPT @ 8 M 10/17/21 = 38 Blows		
8.0				
	8.0- to 9.0-m – ϕ = 35°, γ_t = 1.95 tons/M^3 (N_{avg} = 38)	SPT @ 9 M (SNR) 1.5 cms for 15 Blows		
9.0	-NX diamond bit drilling from 9-m			
	BROWN BLUE WEATHERED ROCK (Below 9.0-M)	0 cms for 5 Blows (Hammer Rebound)		
10.0	9.0- to 14.5-m – ϕ = 40°, γ_t = 2.3 tons/M^3 (N_{avg} >> 100)	SPT @ 10 M (SNR) 0.5 cms for 5 Blows		
	-drilled from 9- to 10-m in 55 minutes	0 cms for 5 Blows (Hammer Rebound)		
11.0	-stone pieces recovered drilling to 10-m			

CONTINUED ON PLATE 14b

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; ←→ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 14a

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 13 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 10-05-'23 **Ended on:** 11-05-'23 **Field Work In Charge:** M Munivel
Final Depth: 14.5-M **Depth to G W S:** 1.65-M **Remarks:** Continued from Plate 14a.

DEPTH, M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE 25 50 75	INDEX TEST DATA 25 50 75
	BROWN BLUE WEATHERED ROCK	SPT @ 11.5M (SNR)		
	(Below 9.0-M)	0 cms for 5 Blows		
	-drilled from 10- to 11.5-m in 85 minutes	(Hammer Rebound)		
12.0	-7 stone pieces recovered drilling to 11.5-m			
	-drilled from 11.5- to 13-m in 145 minutes	SPT @ 13 M (SNR)		
13.0	-4 cms core & 7 stone pieces recovered drilling to 13-m	0 cms for 5 Blows		
	9.0- to 14.5-m – $\phi = 40°$, $\gamma_b = 2.3$ tons/M^3	(Hammer Rebound)		
	(N_{corr} >> 100)			
14.0				
		SPT @ 14.5M (SNR)		
	-drilled from 13- to 14.5-m in 170 minutes	0 cms for 5 Blows		
	-8 cms core & 2 stone pieces recovered drilling to 14.5-m	(Hammer Rebound)		
15.0				
16.0				
17.0				
18.0				
19.0				
20.0				
21.0				
22.0				

BORE HOLE TERMINATED AT 14.5-M

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; ←→ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 14b

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600126, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 14 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 9-05-'23 **Ended on:** 10-05-'23 **Field Work In Charge:** M Munivel
Final Depth: 14.0-M **Depth to G W S:** 1.65-M **Remarks:** None.

DEPTH, M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE
	BROWN GRAY SILTY FINE SAND with clay binder (To 1.0-M)	SPT @ 0.25 M 3/5/7 = 12 Blows
	0.0- to 1.0-m – ϕ = 30°; γ_t = 1.65 tons/M^3	SPT @ 1 M
1.0	(N_{avg} = 12)	3/3/6 = 9 Blows
	BROWN GRAY STIFF TO VERY STIFF CLAY	
GWL	(To 7.0-M)	SPT @ 1.75 M
		4/4/5 = 9 Blows
2.0		
		SPT @ 2.5 M
	1.0- to 4.0-m – C_u = 5.5 tons/M^2; γ_t = 1.6 tons/M^3	2/3/4 = 7 Blows
	(N_{avg} = 8)	
3.0		SPT @ 3.25 M
	-grey color, 3.25- to 7-m	3/4/4 = 8 Blows
		SPT @ 4 M
4.0		4/4/7 = 11 Blows
		SPT @ 5 M
5.0	4.0- to 6.0-m – C_u = 7 tons/M^2; γ_t = 1.65 tons/M^3	5/5/7 = 12 Blows
	(N_{avg} = 11)	
		SPT @ 6 M
6.0		5/6/10 = 16 Blows
	6.0- to 7.0-m – C_u = 10 tons/M^2; γ_t = 1.7 tons/M^3	
	(N_{avg} = 16)	SPT @ 7 M
7.0		6/8/12 = 20 Blows
	BROWN GRAY SILTY FINE TO MEDIUM SAND (To 8.0-M)	
	7.0- to 8.0-m – ϕ = 32°; γ_t = 1.7 tons/M^3	SPT @ 8 M 30/
8.0	(N_{avg} = 20)	2 cms for 20 Blows
	BROWN GRAY WEATHERED ROCK	(Hammer Rebound)
	(Below 8.0-M) (N_{avg} >> 100)	
	8.0- to 9.0-m – ϕ = 39°; γ_t = 2.25 tons/M^3	SPT @ 9 M
9.0	-NX diamond bit drilling from 9-m	0.5 cms for 5 Blows
		0 cms for 5 Blows
		(Hammer Rebound)
	9.0- to 14.0-m – ϕ = 40°; γ_t = 2.3 tons/M^3	SPT @ 10 M (SNR)
10.0	(N_{avg} >> 100)	0 cms for 5 Blows
	-drilled from 9- to 10-m in 40 minutes	(Hammer Rebound)
	-13.5 cms core & 8 stone pieces recovered drilling to 10-m	
11.0		

CONTINUED ON PLATE 15b

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; ←→ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 15a

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 14 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 9-05-'23 **Ended on:** 10-05-'23 **Field Work In Charge:** M Munivel
Final Depth: 14.0-M **Depth to G W S:** 1.65-M **Remarks:** Continued from Plate 15a.

DEPTH M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE 25 50 75	INDEX TEST DATA 25 50 75
	BROWN GRAY WEATHERED ROCK (Below 8.0-M)	SPT @ 11.5M (SNR) 0 cms for 5 Blows (Hammer Rebound)		
12.0	-drilled from 10- to 11.5-m in 110 minutes -15 stone pieces recovered drilling to 11.5-m			
	9.0- to 14.0-m – $\phi = 40°$; $\gamma_t = 2.3$ tons/M^3 ($N_{avg} >> 100$)			
13.0	-drilled from 11.5- to 13-m in 105 minutes -4 cms core & 4 stone pieces recovered drilling to 13-m	SPT @ 13 M (SNR) 0 cms for 5 Blows (Hammer Rebound)		
14.0	-drilled from 13- to 14-m in 95 minutes -13 cms core & 8 stone pieces recovered drilling to 14-m	SPT @ 14 M (SNR) 0 cms for 5 Blows (Hammer Rebound)		
15.0				
16.0				
17.0				
18.0				
19.0				
20.0				
21.0				
22.0				

BORE HOLE TERMINATED AT 14.0-M

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; +—+ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 15b

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 15 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 6-05-'23 **Ended on:** 7-05-'23 **Field Work In Charge:** M Munivel
Final Depth: 14.0-M **Depth to G W S:** 1.45-M **Remarks:** None.

DEPTH M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE
	BROWN GRAY SILTY FINE SAND with clay binder (To 1.0-M)	SPT @ 0.25 M 3/3/5 = 8 Blows
	0.0- to 1.0-m – ϕ = 27°, γ_t = 1.6 tons/M³	SPT @ 1 M
1.0	(N_{avg} = 8)	4/5/8 = 13 Blows
	BROWN GRAY STIFF CLAY (To 2.5-M)	
GWL	1.0- to 1.75-m – C_u = 7.5 tons/M², γ_t = 1.65 tons/M³	SPT @ 1.75 M
	(N_{avg} = 13)	6/8/8 = 16 Blows
2.0	1.75- to 2.5-m – C_u = 10 tons/M², γ_t = 1.7 tons/M³	
	(N_{avg} = 16)	SPT @ 2.5 M
		2/4/7 = 11 Blows
	BROWN GRAY SILTY FINE SAND with clay	
3.0	binder (To 3.25-M) (N_{avg} = 11)	SPT @ 3.25 M
	2.5- to 3.25-m – ϕ = 29°, γ_t = 1.65 tons/M³	2/2/3 = 5 Blows
	BROWN GRAY FIRM TO STIFF CLAY	
	(To 5.0-M) (N_{avg} = 5)	SPT @ 4 M
4.0	3.25- to 4.0-m – C_u = 3 tons/M², γ_t = 1.5 tons/M³	5/5/6 = 11 Blows
	4.0- to 5.0-m – C_u = 6.5 tons/M², γ_t = 1.65 tons/M³	
	(N_{avg} = 11)	SPT @ 5 M
5.0		6/9/11 = 20 Blows
	GRAY VERY STIFF CLAY (To 7.0-M)	
		SPT @ 6 M
6.0	5.0- to 7.0-m – C_u = 14 tons/M², γ_t = 1.75 tons/M³	7/11/13 = 24 Blows
	(N_{avg} = 22)	
		SPT @ 7 M
7.0		18/20/22 = 42 Blows
	BROWN GRAY SILTY FINE TO MEDIUM SAND (To 8.0-M)	
	7.0- to 8.0-m – ϕ = 35°, γ_t = 2.0 tons/M³	SPT @ 8 M 23/
8.0	(N_{avg} = 42)	4 cms for 10 Blows
	BROWN BLUE WEATHERED ROCK (Below 8.0-M)	4 cms for 10 Blows
	8.0- to 9.0-m – ϕ = 37°, γ_t = 2.1 tons/M³	SPT @ 9 M
9.0	(N_{avg} = 75)	1.5 cms for 10 Blows
	9.0- to 10.0-m – ϕ = 39°, γ_t = 2.25 tons/M³	1 cm for 10 Blows (Hammer Rebound)
	(N_{avg} >> 100)	SPT @ 10 M (SNR)
10.0	NX diamond bit drilling from 10-m	0.5 cms for 5 Blows
	10.0- to 14.0-m – ϕ = 40°, γ_t = 2.3 tons/M³	0 cms for 5 Blows (Hammer Rebound)
	(N_{avg} >> 100)	
11.0		

SPT / INDEX TEST DATA: 25 50 75

CONTINUED ON PLATE 16b

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; ←→ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 16a

LOG OF BORING

Project: Proposed Multi-Storied Residential Apartments Buildings Complex Site, S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B, 16/1, Moondramkattalai Village 600128, Kundrathur Taluk, Kancheepuram District, TN.

Bore Hole No.: 15 **Type of Boring:** Calyx Drill **Dia. of Hole:** 150 mm
Started on: 6-05-'23 **Ended on:** 7-05-'23 **Field Work In Charge:** M Munivel
Final Depth: 14.0-M **Depth to G W S:** 1.45-M **Remarks:** Continued from Plate 16a.

DEPTH M	SOIL DESCRIPTION	SPT / VANE & SAMPLE TYPE	SPT "N" PROFILE 25 50 75	INDEX TEST DATA 25 50 75
	BROWN BLUE WEATHERED ROCK (Below 8.0-M)	No SPT @ 11.5 M due to rock core recovery		
12.0	drilled from 10- to 11.15-m in 125 minutes; 23.5 cms core & 14 stone pieces recovered drilling to 11.15-m			
	drilled from 11.15- to 12.15-m in 105 minutes; 15 cms core pieces recovered drilling to 12.15-m			
13.0	10.0- to 14.0-m – $\phi = 40°$, $\gamma_b = 2.3$ tons/M^3 ($N_{corr} >> 100$)	No SPT @ 13 M due to rock core recovery		
	drilled from 12.15- to 13.15-m in 90 minutes; 9 stone pieces recovered drilling to 12.15-m			
14.0	drilled from 13.15- to 14-m in 70 minutes	SPT @ 14 M (SNR) 0 cms for 5 Blows (Hammer Rebound)		
	2 stone pieces recovered drilling to 14-m			
15.0				
16.0				
17.0				
18.0				
19.0				
20.0				
21.0				
22.0				

BORE HOLE TERMINATED AT 14.0-M

SPT=Standard Penetration Test; DS=Disturbed Sample; UDS = UnDisturbed Sample; WS=Water Sample; SNR=Sample Not Recovered; LS = Liner Sample; ←—→ = Plastic and Liquid Limits; ♦ = N M C; ■ = % -75μ Size

PLATE 16b

SUMMARY OF TEST RESULTS

Boring	Depth,	w %	PL	LL	-75μ%	SAND			GRAVEL	IS
No.	M					Fine%	Medium%	Coarse%	%	CLASS.
1	0.25	5			1					
	1.0	27	32	66						CH
	1.75	26	29	66						CH
	2.5	27	30	71						CH
	3.25	28								
	4.0	20	32	60						CH
	5.0	30								
	6.0	30	31	62						CH
	7.0	18			14	52	21	8	5	SM
	8.0	24			24	62	14	0	0	SM
	9.0	17			18	69	12	1	0	SM
	10.0	SNR	stone	pieces						
	11.5	SNR	stone	pieces						
	13.0	SNR	stone	pieces						
	14.5	SNR	core &	stone	pieces					
2	0.25	13			16					
	1.0	14			8	55	36	1	0	SP
	1.75	14			2					
	2.5	12			4	34	55	7	0	SP
	3.25	36	36	69						CH
	4.0	32	37	71						CH
	5.0a	33	33	66						CH
	5.0b	18			14	78	8	0	0	SM
	6.0	21			27	55	16	2	0	SM
	7.0	14			11					
	8.0	12			22	53	24	1	0	SM
	9.0	SNR								
	10.0	SNR								
	11.5	SNR	core &	stone	pieces					
	13.0	SNR	core	pieces						
	13.5	SNR	core	pieces						
3	0.25a	20	23	48						CL
	0.25b	15			15					
	1.0	14			3	39	52	6	0	SP
	1.75	14			4					
	2.5	15			3	30	61	6	0	SP
	3.25	39	26	67						CH
	4.0	26	25	63						CH
	5.0	30								
	6.0	41	37	71						CH
	7.0	36	37	76						CH
	8.0	10			11	46	28	4	11	SP-SM
	9.0	SNR	core &	stone	pieces					
	10.0	SNR	core &	stone	pieces					
	11.0	SNR	stone	pieces						
	12.0	SNR								
	13.0	SNR								
	14.0	SNR	stone	pieces						
4	0.25	12			4					
	1.0	18			3	58	38	1	0	SP
	1.75	13			4	43	51	2	0	SP
	2.5	28	22	52						CH
	3.25	30								
	4.0	22	26	66						CH

PLATE 17a

SUMMARY OF TEST RESULTS

Boring	Depth,	w %	PL	LL	-75μ%	SAND			GRAVEL	IS
No.	M					Fine%	Medium%	Coarse%	%	CLASS.
4	5.0	28								
	6.0	30	32	75						CH
	7.0	17			21	59	19	1	0	SM
	8.0	17			20	57	19	3	1	SM
	9.0	9			10	25	7	6	52	SP-SM
	10.0	SNR								
	11.5	SNR	core &	stone	pieces					
	13.0	SNR	stone	pieces						
	14.5	SNR	core &	stone	pieces					
5	0.25	17			4					
	1.0	24	21	70						CH
	1.75	25	24	72						CH
	2.5	29								
	3.25	36	35	61						CH
	4.0	36								
	5.0	32	32	63						CH
	6.0	35								
	7.0	33	33	71						CH
	8.0	16			20	61	18	1	0	SM
	9.0	9			14	63	17	4	2	SM
	10.0	SNR								
	11.5	SNR	core &	stone	pieces					
	12.5	SNR	core &	stone	pieces					
6	0.25	22	22	64						CH
	1.0	23	23	49						CL
	1.75	21	22	51						CH
	2.5	20			45	55	0	0	0	SM
	3.25	27	29	55						CH
	4.0	22	27	42						CL
	5.0	25								
	6.0	34	23	49						CL
	7.0	19			13	60	25	2	0	SM
	8.0	18			12	46	31	10	8	SM
	9.0	SNR								
	10.0	SNR								
	11.5	SNR	core &	stone	pieces					
	13.0	SNR	core &	stone	pieces					
	14.5	SNR	core &	stone	pieces					
7	0.25	14			5					
	1.0	11			5	44	45	6	0	SP
	1.75	15			8					
	2.5	29			34	64	2	0	0	SM
	3.25	29	27	48						CL
	4.0	31	28	56						CH
	5.0	30	35	62						CH
	6.0	19			20	62	16	2	0	SM
	7.0	18			15					
	8.0	17			7	53	37	3	0	SP
	9.0	19			9	40	25	9	17	SP-SM
	10.0	SNR								
	11.5	SNR								
	13.0	SNR	stone	pieces						
	14.5	SNR	core &	stone	pieces					

PLATE 17b

SUMMARY OF TEST RESULTS

Boring	Depth,	w %	PL	LL	-75μ%	SAND			GRAVEL	IS
No.	M					Fine%	Medium%	Coarse%	%	CLASS.
8	0.25	22	24	55						CH
	1.0	18			21	65	14	0	0	SM
	1.75	12			2					
	2.5	13			3	48	47	2	0	SP
	3.25	33	37	59						CH
	4.0	17	25	52						CH
	5.0	25								
	6.0	26	27	51						CH
	7.0	12			15	54	26	4	1	SM
	8.0	11			14	38	27	16	5	SM
	9.0	6			5	24	25	21	25	SW
	10.0	SNR								
	11.5	SNR	stone	pieces						
	13.0	SNR	core &	stone	pieces					
	14.5	SNR	stone	pieces						
9	0.25	4			2					
	1.0	23	24	73						CH
	1.75	28	32	70						CH
	2.5	30	25	66						CH
	3.25	35								
	4.0	30	20	44						CL
	5.0	33								
	6.0	37	35	63						CH
	7.0	19			12	46	35	7	0	SM
	8.0	20			13	62	22	3	0	SM
	9.0	14			22	76	2	0	0	SM
	10.0	SNR								
	11.5	SNR								
	13.0	SNR	core &	stone	pieces					
	14.5	SNR	stone	pieces						
	15.65	SNR	stone	pieces						
10	0.25	11			3					
	1.0	28	21	60						CH
	1.75	27	29	58						CH
	2.5	32	26	65						CH
	3.25	28								
	4.0	32	18	49						CL
	5.0	33								
	6.0	33	35	71						CH
	7.0	18			17	62	21	0	0	SM
	8.0	21			16	60	21	3	0	SM
	9.0	14			7					
	10.0	14			14	59	26	1	0	SM
	11.5	SNR	stone	pieces						
	13.0	SNR	stone	pieces						
	14.5	SNR	core &	stone	pieces					
11	0.25	16			19					
	1.0	28			33	66	1	0	0	SM
	1.75	27	21	43						CL
	2.5	34	20	45						CL
	3.25	30			45	53	3	0	0	SM
	4.0	26			37	58	5	0	0	SM
	5.0	31	18	50						CH

PLATE 17c

SUMMARY OF TEST RESULTS

Boring	Depth,	w %	PL	LL	-75μ%	SAND			GRAVEL	IS
No.	M					Fine%	Medium%	Coarse%	%	CLASS.
11	6.0	38	25	56						CH
	7.0	16			16	63	20	1	0	SM
	8.0	16			12	59	24	4	1	SM
	9.0	9			7	35	2	3	53	GW
	10.0	SNR								
	11.5	SNR	stone	pieces						
	13.0	SNR	core &	stone	pieces					
	13.35	SNR	stone	pieces						
12	0.25	11			6					
	1.0	26	28	62						CH
	1.75	23	25	50						CH
	2.5	27								
	3.25	30	23	47						CL
	4.0	36								
	5.0	34	34	61						CH
	6.0	28			39	60	1	0	0	SM
	7.0	32	33	56						CH
	8.0	10			23	62	14	1	0	CH
	9.0	SNR								
	10.0	SNR	core &	stone	pieces					
	11.5	SNR	stone	pieces						
	13.0	SNR	core &	stone	pieces					
	14.5	SNR	core &	stone	pieces					
13	0.25	19	25	67						CH
	1.0	24	27	56						CH
	1.75	20			28	71	1	0	0	SM
	2.5	28			42	58	0	0	0	SM
	3.25	32	33	51						CH
	4.0	23	29	45						CL
	5.0	25			33	64	3	0	0	SM
	6.0	15			9	57	31	3	0	SP-SM
	7.0	19			6					
	8.0	20			11	56	27	6	0	SP-SM
	9.0	SNR								
	10.0	SNR	stone	pieces						
	11.5	SNR	stone	pieces						
	13.0	SNR	core &	stone	pieces					
	14.5	SNR	core &	stone	pieces					
14	0.25	16			23					
	1.0	29	25	55						CH
	1.75	25	27	51						CH
	2.5	32	33	45						CL
	3.25	27								
	4.0	29	27	46						CL
	5.0	37								
	6.0	33	32	64						CH
	7.0	17			23	61	15	1	0	SM
	8.0	17			16	60	22	2	0	SM
	9.0	SNR								
	10.0	SNR	core &	stone	pieces					
	11.5	SNR	stone	pieces						
	13.0	SNR	core &	stone	pieces					
	14.0	SNR	core &	stone	pieces					

PLATE 17d

SUMMARY OF TEST RESULTS

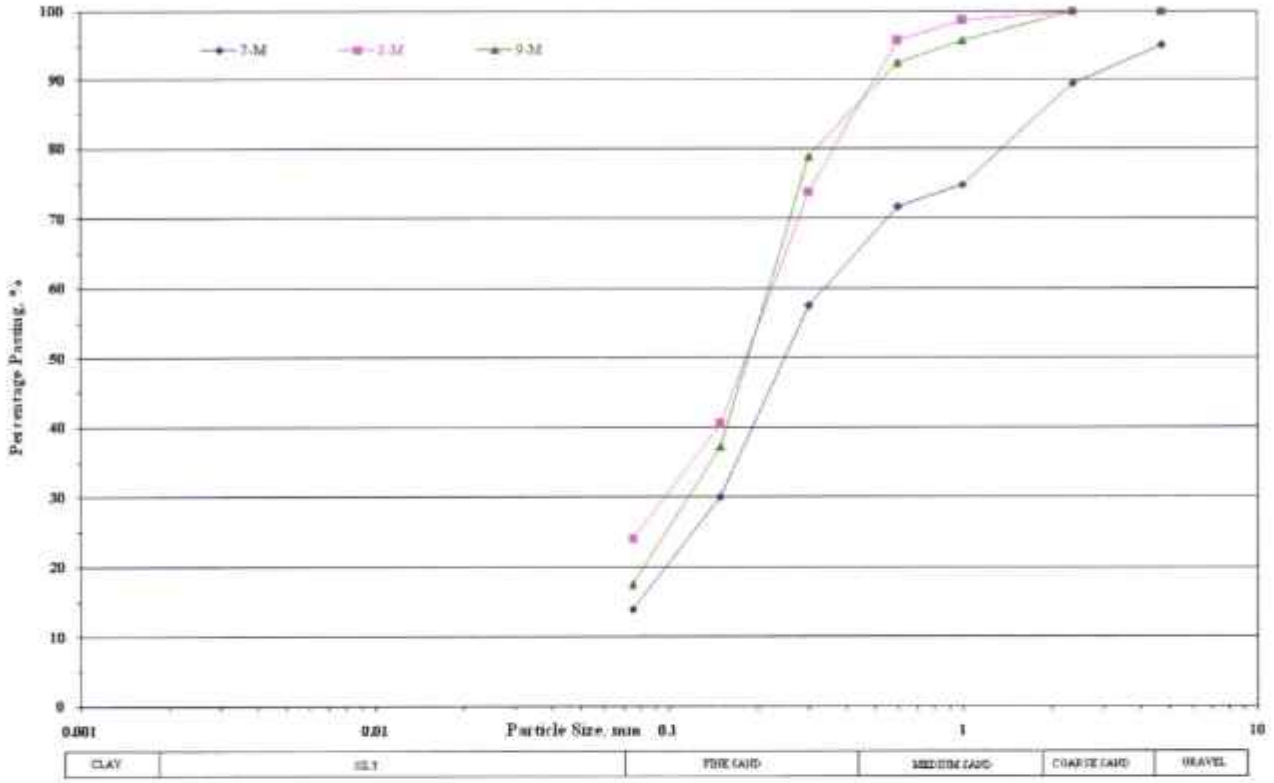
Boring	Depth,	w %	PL	LL	-75μ%	SAND			GRAVEL	IS
No.	M					Fine%	Medium%	Coarse%	%	CLASS.
15	0.25	20			25					
	1.0	21	22	54						CH
	1.75	22	25	56						CH
	2.5	28			32	63	5	0	0	SM
	3.25	40	25	64						CH
	4.0	41	38	74						CH
	5.0	32								
	6.0	43	28	64						CH
	7.0	15			20	55	23	2	0	SM
	8.0	16			18	55	20	6	1	SM
	9.0	8			7	27	6	6	54	GW
	10.0	SNR								
	11.5	SNR	core &	stone	pieces					
	13.0	SNR	core &	stone	pieces					
	14.0	SNR	stone	pieces						

FREE SWELL INDEX TEST RESULTS, %

BORE NO.	DEPTH M	FREE SWELL INDEX, %	BORE NO.	DEPTH M	FREE SWELL INDEX, %
1	1.0	89	13	0.25	60
	1.75	92		1.0	100
	2.5	106		3.25	92
	3.25	113	14	1.0	133
2	3.25	131		1.75	92
3	0.25	83		2.5	110
	3.25	114		3.25	106
4	2.5	65	15	1.0	90
	3.25	107		1.75	83
5	1.0	108		3.25	128
	1.75	133			
	2.5	105			
	3.25	113			
6	0.25	47			
	1.0	65			
	1.75	76			
	3.25	94			
7	3.25	111			
8	0.25	92			
	3.25	100			
9	1.0	63			
	1.75	114			
	2.5	106			
	3.25	119			
10	1.0	75			
	1.75	85			
	2.5	108			
	3.25	100			
11	1.75	100			
	2.5	111			
12	1.0	65			
	1.75	106			
	2.5	106			
	3.25	80			

PLATE 17e

Grain Size Distribution Curves
Boring 1



Grain Size Distribution Curves
Boring 2

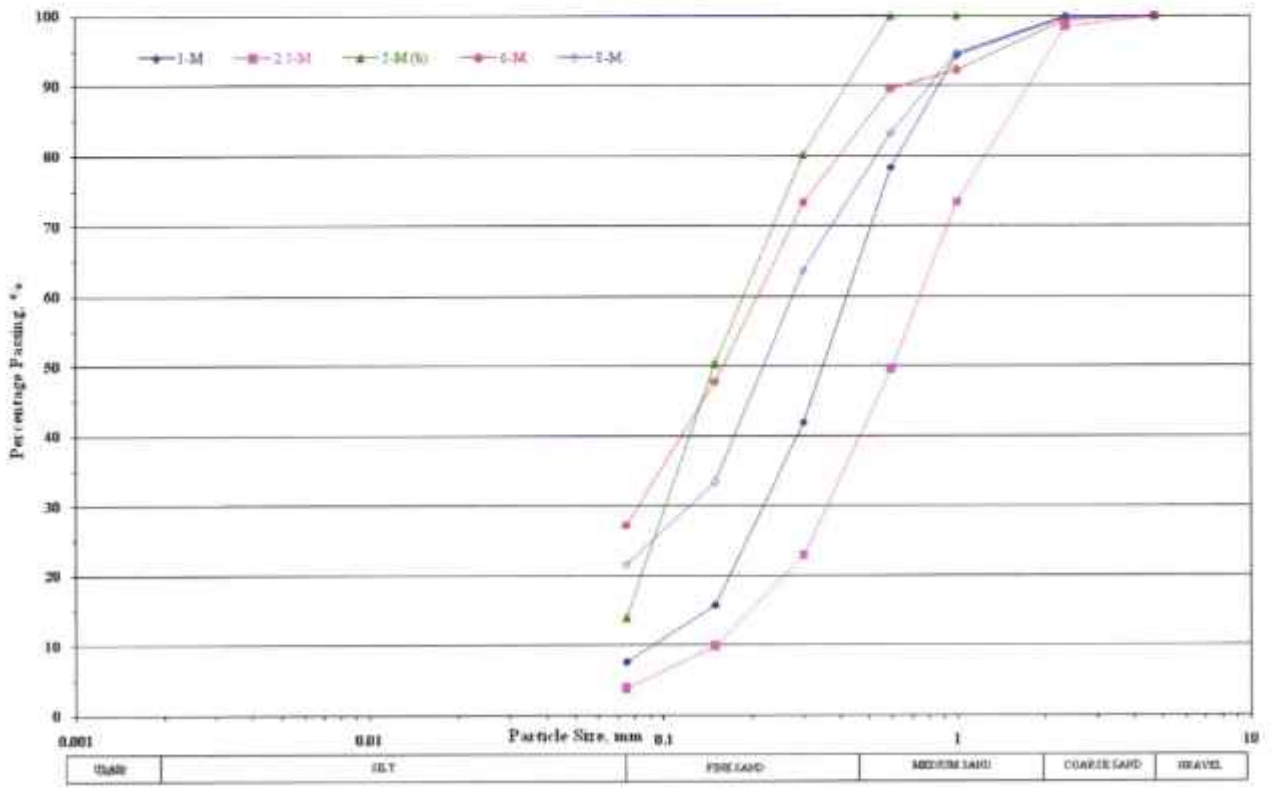
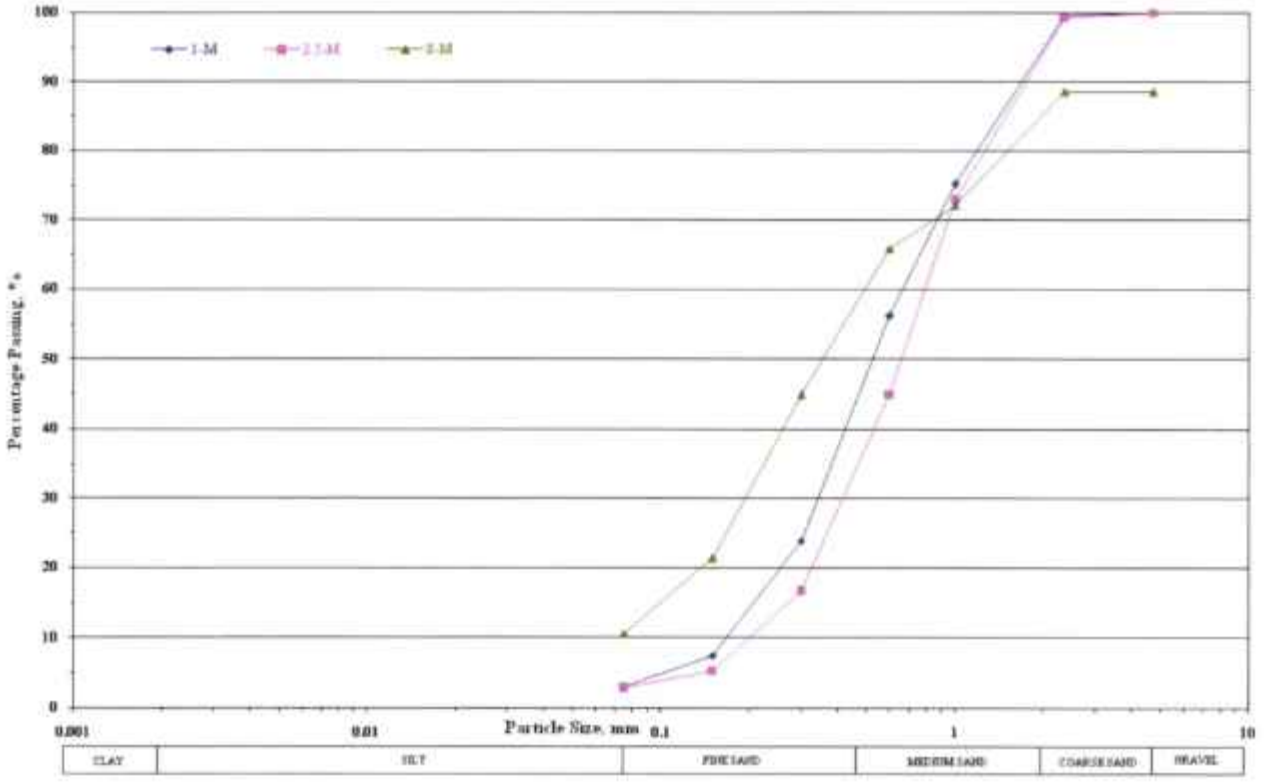


PLATE 18a

Grain Size Distribution Curves
Boring 3



Grain Size Distribution Curves
Boring 4

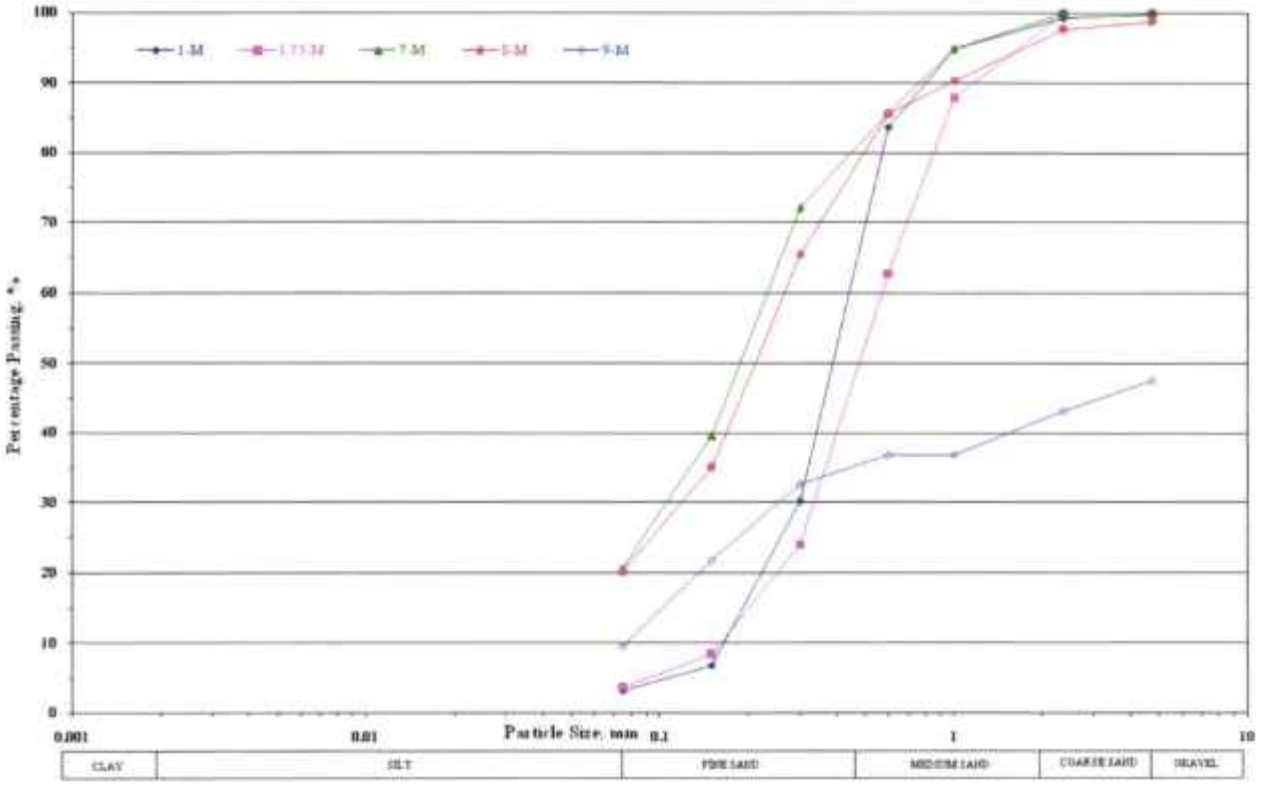
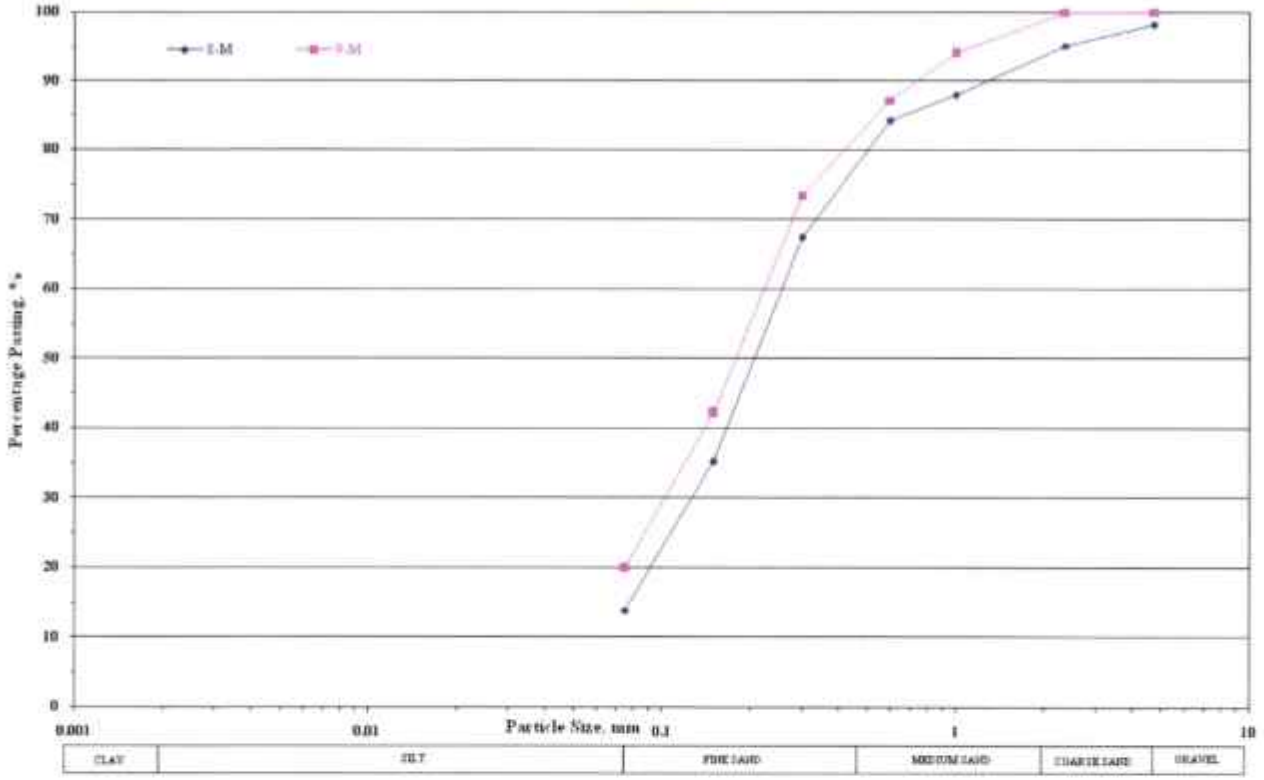


PLATE 18b

Grain Size Distribution Curves
Boring 5



Grain Size Distribution Curves
Boring 6

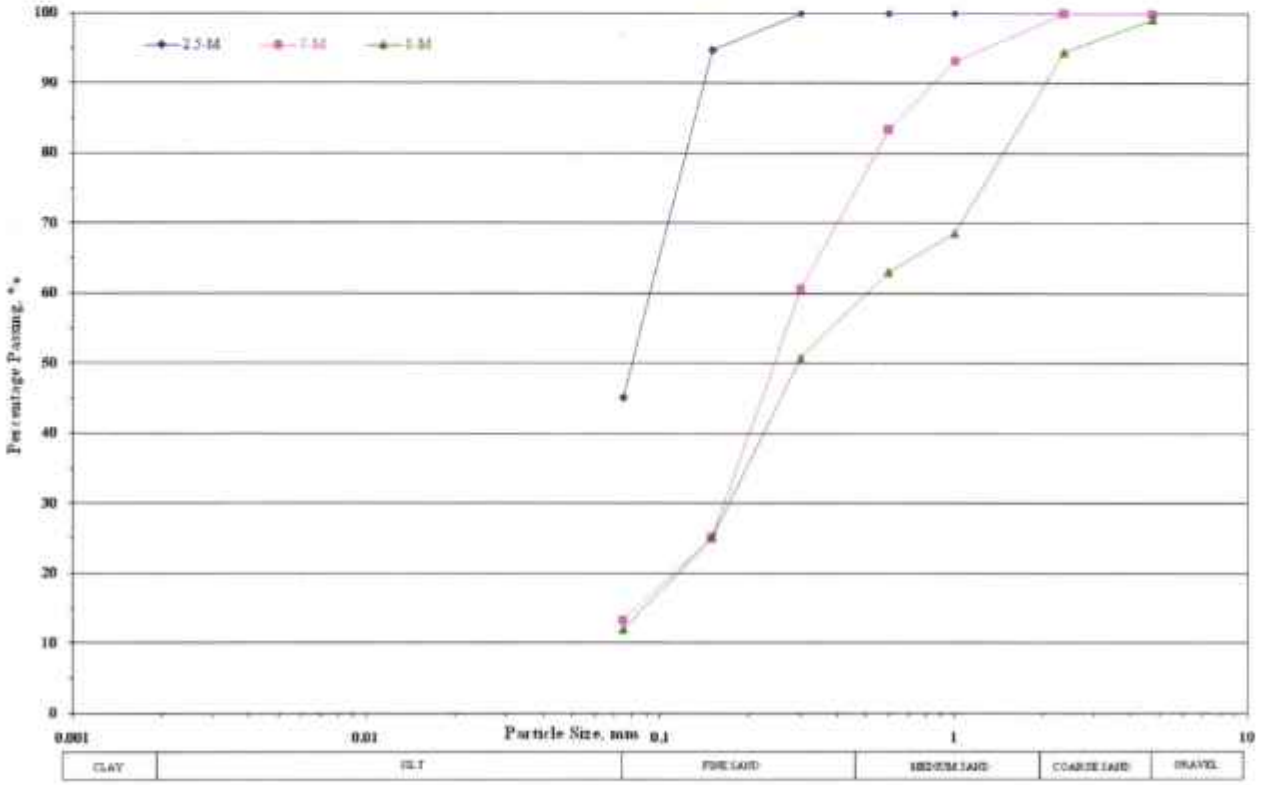
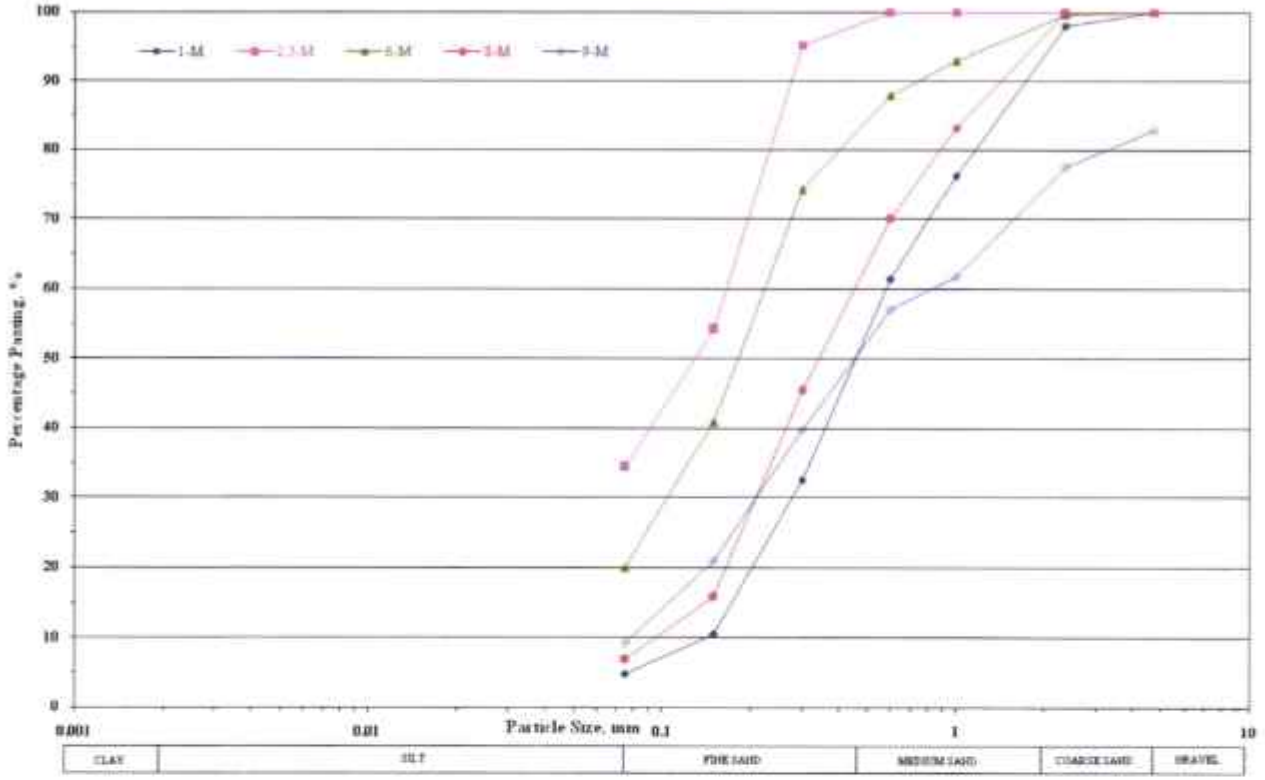


PLATE 18c

Grain Size Distribution Curves
Boring 7



Grain Size Distribution Curves
Boring 8

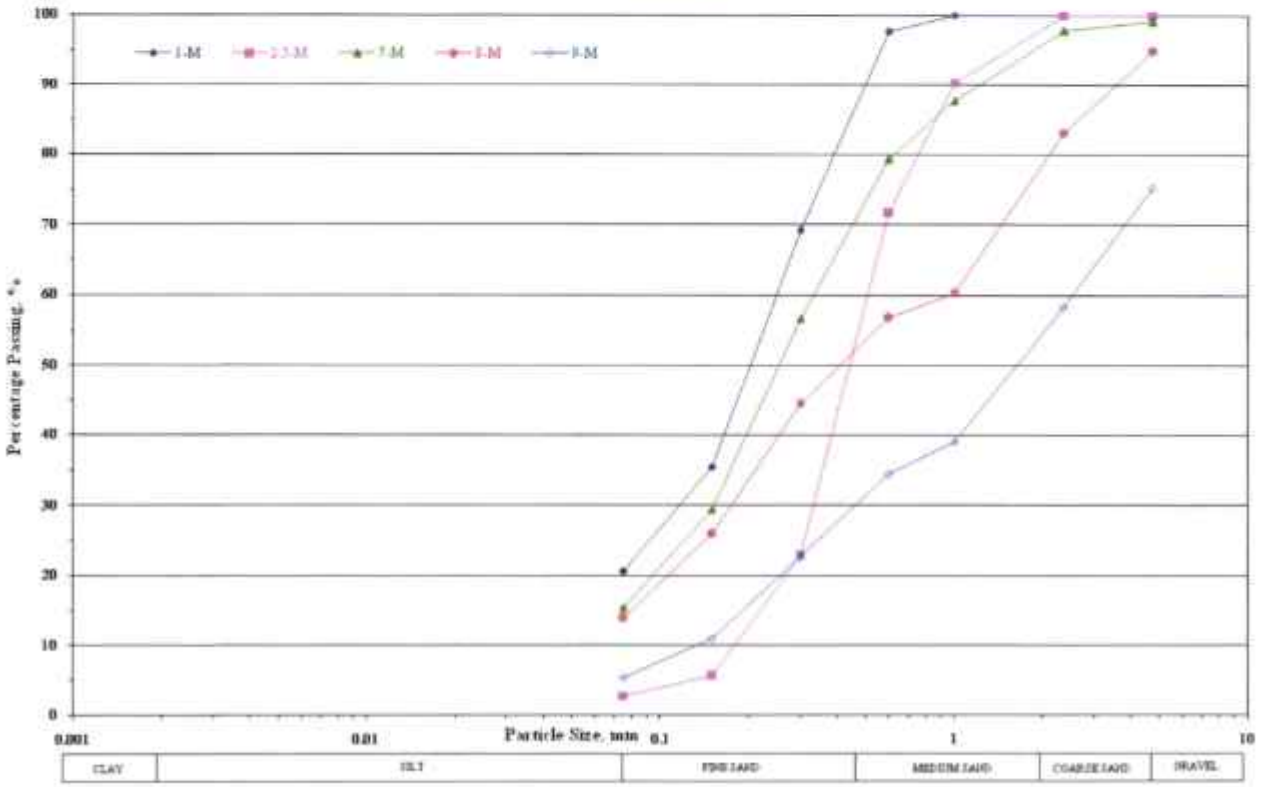
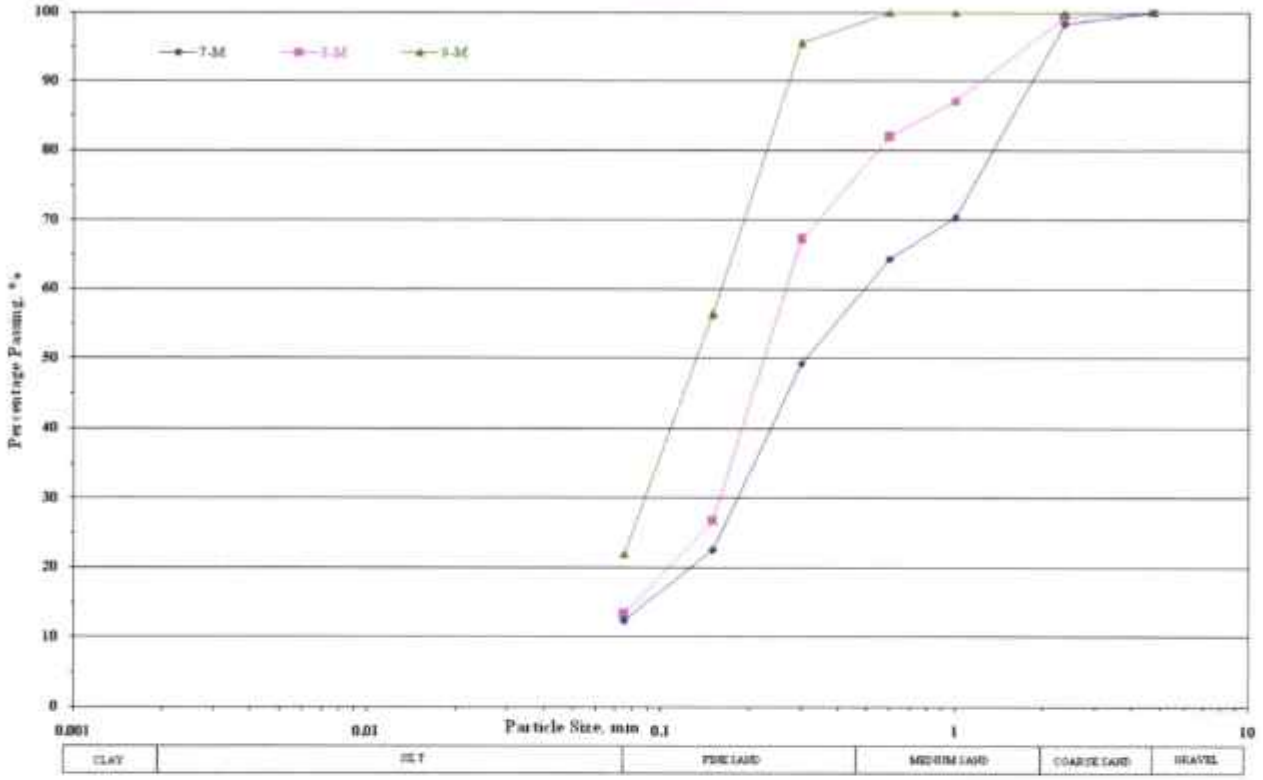


PLATE 18d

Grain Size Distribution Curves
Boring 9



Grain Size Distribution Curves
Boring 10

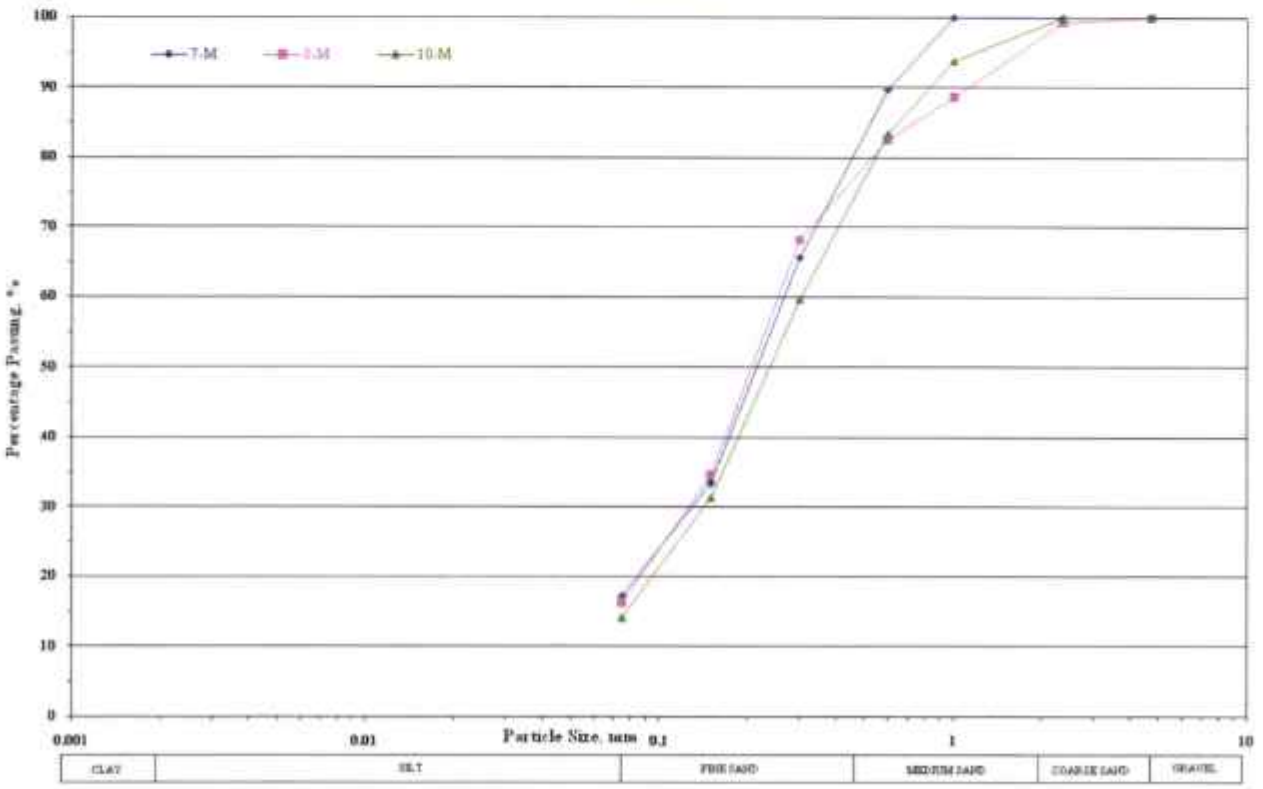
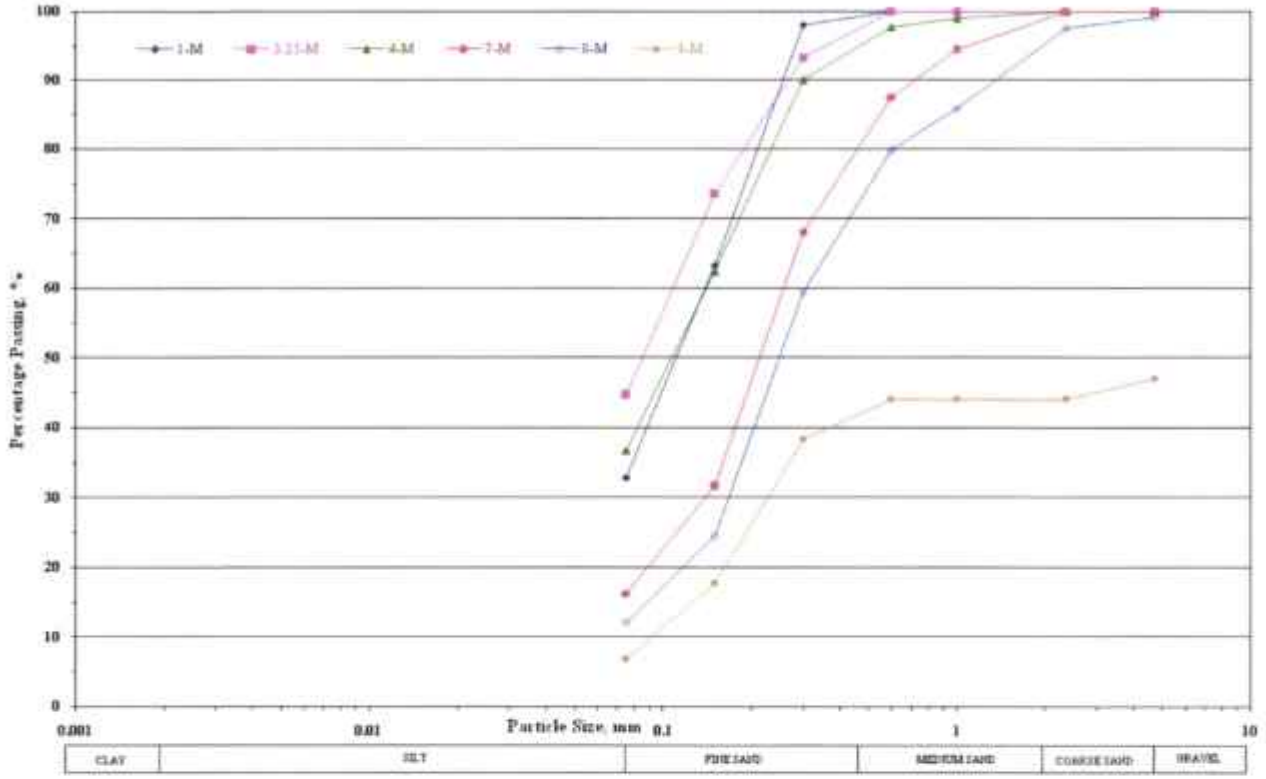


PLATE 18e

Grain Size Distribution Curves
Boring 11



Grain Size Distribution Curves
Boring 12

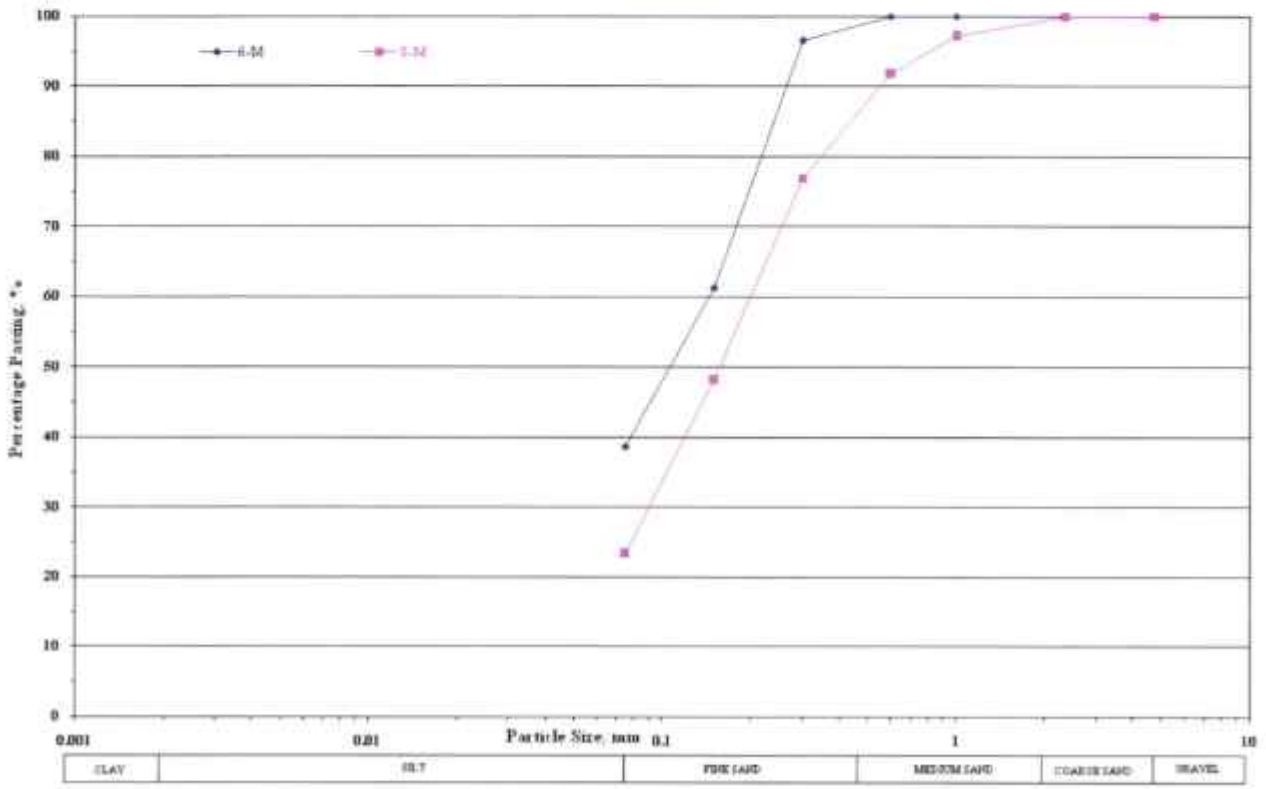
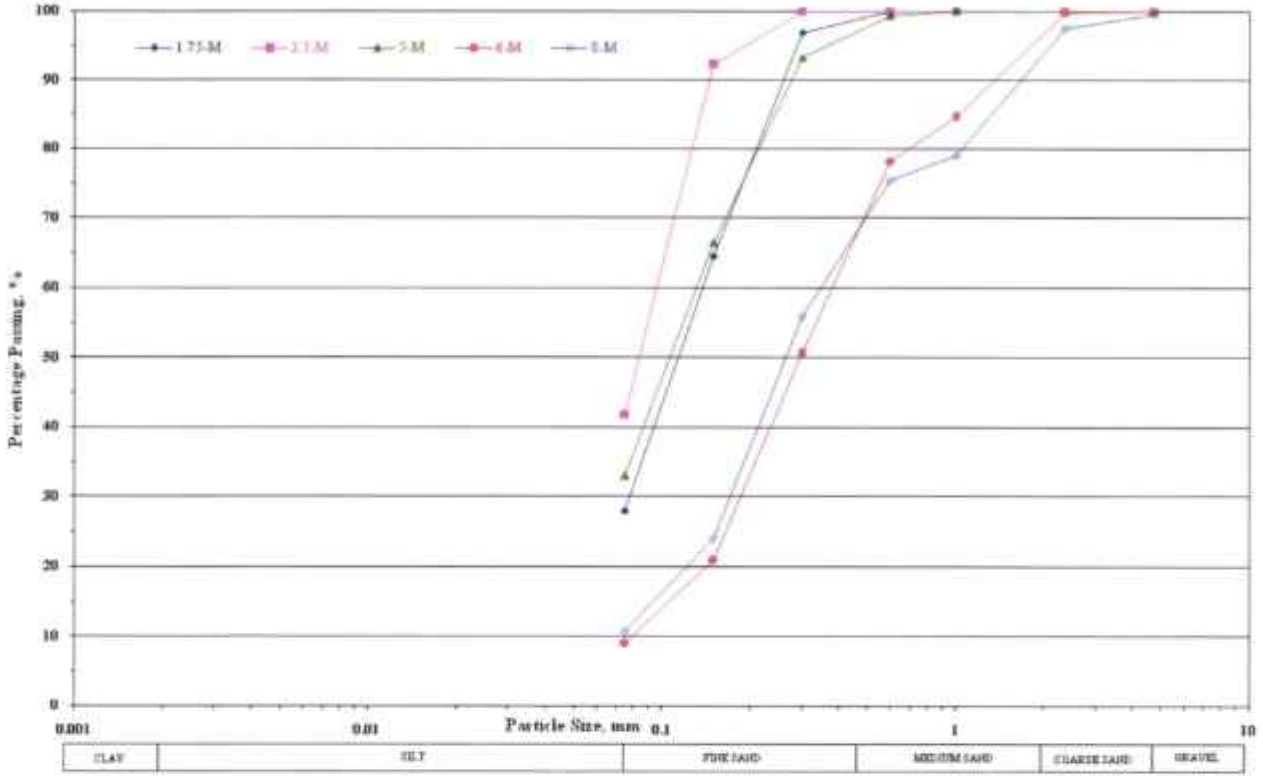


PLATE 18f

Grain Size Distribution Curves
Boring 13



Grain Size Distribution Curves
Boring 14

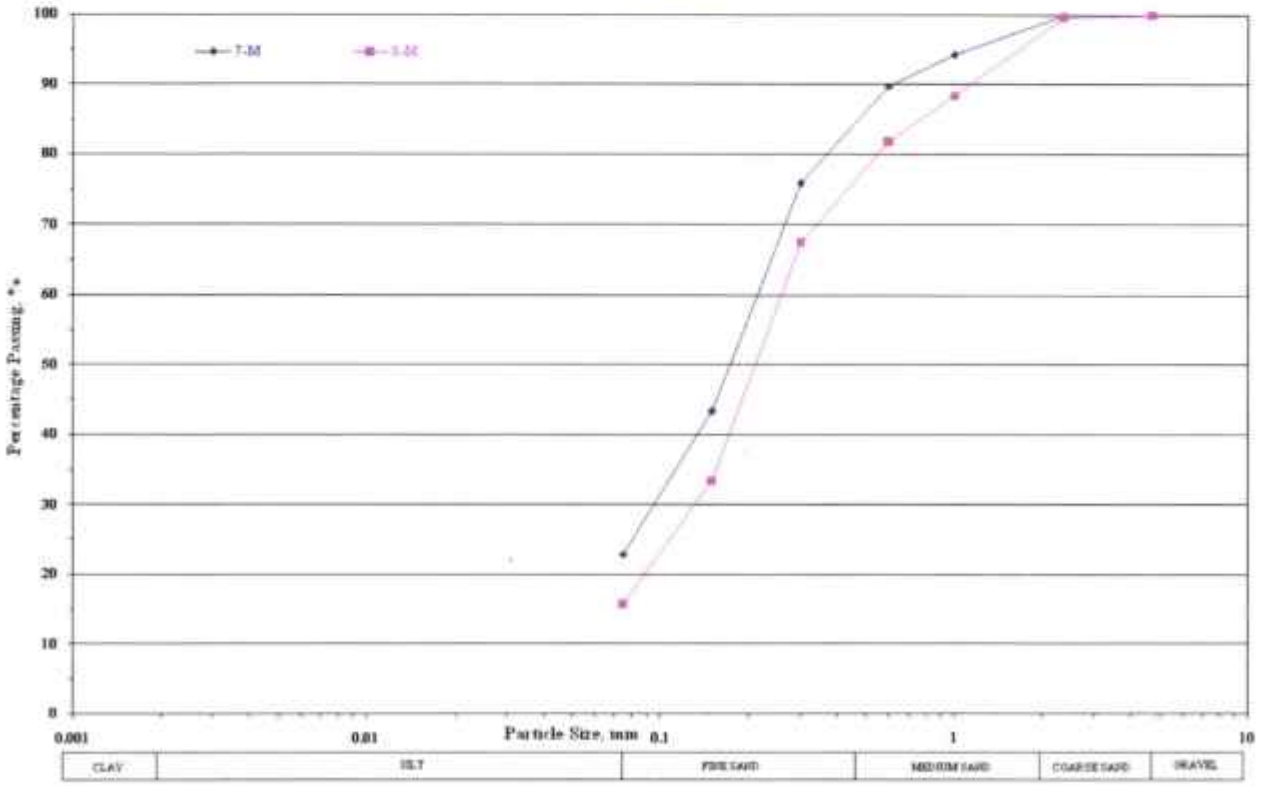


PLATE 18g

Grain Size Distribution Curves
Boring 15

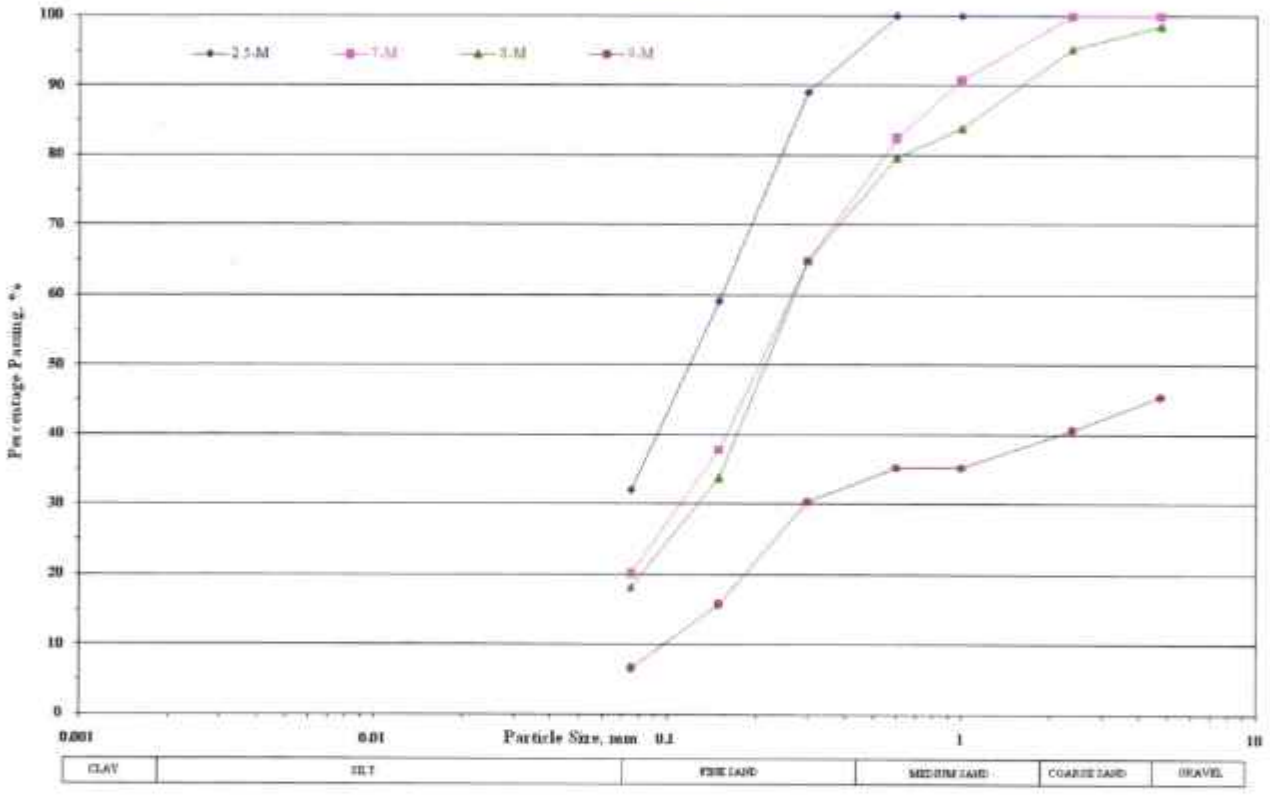


PLATE 18h

SUMMARY OF WATER TEST RESULTS

ADJACENT PLOT'S BORE WELL; DEPTH = UNKNOWN; LOCATED IN PLOT BEHIND HP PETROL BUNK

DISTANCE ~ 90-M FROM BORING 9; WATER LEVEL = 1-M TO 2.6-M IN BORINGS.

S. No.		Description	Results Obtained	As per IS:456 – 2000
1		To neutralize 100 cc of water using phenolphthalein as indicator	1.00 ml	Not more than 5 ml of 0.02N NaOH
2		To neutralize 100 cc of water using methyl orange as indicator	24.00 ml	Not more than 25 ml of 0.02N H_2SO_4
3	a	Organic Solids, mg/liter	40	200 Max.
	b	Inorganic Solids, mg/liter	962	3,000 Max.
	c	Sulphates as SO_3, mg/liter	98	400 Max.
	d	Chlorides as Cl, mg/liter	199	2,000 Max. - Plain Concrete 500 Max. RCC
	e	Suspended Solids, mg/liter	0	2,000 Max.
	f	Ph	6.83	6 Min.

Remarks: Sample meets the requirements of above clauses.
Hence water can be used for construction purposes as per IS 456 - 2000.

SUMMARY OF SOIL CHEMICAL TEST RESULTS

Boring	Depth	pH	Chlorides	Sulphates	
	M		ppm	SO_4	SO_3
1	2.5	6.38	80	52	43
	7.0	7.03	106	71	59
2	1.75	6.54	85	62	52
	6.0	7.20	90	78	65
3	3.25	6.78	70	32	27
	7.0	7.37	54	28	23
4	1.0	6.90	56	28	23
	8.0	8.10	63	30	25
5	3.25	6.67	108	96	80
	6.0	7.08	104	90	75
6	1.0	7.34	42	0	0
	6.0	7.74	42	0	0
7	2.5	7.02	44	0	0
	9.0	8.12	68	30	25
8	1.75	7.48	56	27	22
	8.0	7.92	62	30	25
9	1.0	7.12	40	0	0
	8.0	7.13	43	0	0
10	2.5	7.02	119	98	82
	9.0	6.89	84	60	50
11	3.25	6.83	42	0	0
	8.0	8.23	66	32	27
12	2.5	6.82	72	40	33
	7.0	7.40	70	40	33
13	1.75	7.25	41	0	0
	6.0	7.41	69	38	32
14	1.0	7.77	61	30	25
	7.0	8.15	60	30	25
15	3.25	7.05	50	28	23
	8.0	8.12	59	31	26

Remarks:

pH tests on soil samples were performed on soil solution prepared with 5% soil. Soil solution was soaked in water for 24 hours, and the solution was filtered. Tests were performed on the filtered water.

Sulphates and chlorides content were for total soil weight.

Test results infer tested site soils had low adverse chemical ions.

PLATE 19b

SAMPLE CALCULATIONS FOR TRACTOR MOUNTED DMC BORED CAST IN SITU PILES

PILE CAPACITY CALCULATIONS - By IS : 2911 (Part 1 / Sec. 2) - 2010 Method.

PROPOSED MODEL RESIDENTIAL APARTMENT BUILDING SITE

S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B1, 15/2B3B2, 16/1A, 16/1B, Moonrankattalai Village, Kundrathur Main Road, Chennai 600128, TN.

Bored Cast In-Situ Pile Details:

Total Pile Length = **10.00 M** below EGL

Top Pile Cutoff Length = 1.00 M Top pile cutoff length for basement floors and pilecaps.

Pile Effective Concreting Length = 9.00 M

Pile Diameters Considered: 0.40 0.45 0.50 0.60 0.75 -M.

Design Soil Profile Used in the Pile Capacity Calculations (Boring 12 Data)

S.No.	Soil Description	From	To	N_{avg}	C_u, T/M^2	ϕ°	γ_T, T/M^3	
1	Brown F to C Sand ... Filled Up Soil	0.00	1.00	13		31	1.65	
2a	Brown & Gray Firm to Stiff Clay	1.00	2.50	7	4.50		1.55	
2b	Brown & Gray Firm to Stiff Clay	2.50	3.75	10.5	6.50		1.65	
2c	Brown & Gray Firm to Stiff Clay	3.75	5.00	7	4.50		1.55	
2d	Brown & Gray Firm to Stiff Clay	5.00	6.00	14	9.00		1.65	
3	Gray Silty Fine Sand with Clay Binder	6.00	7.00	14		30	1.60	
4	Gray Very Stiff Clay	7.00	8.00	18	11.00		1.70	
5a	Brown Blue Weathered Rock	8.00	9.00	>> 100		39	2.25	
5b	Brown Blue Weathered Rock	9.00	14.00	>> 100		40	2.30	NX Diamond Bit Drilling Rock Layer

For Cohesive Soils :-

C_u	α
4.50	0.95
6.50	0.67
9.00	0.50
11.00	0.40

Pile Capacity Calculations by IS : 2911 (Part 1 / Sec. 2) Method.

Unit Skin Friction in Clay Soils, f_s = αC_u

Unit Skin Friction in Sand Soils, f_s = $\sigma' K_o \tan\delta$ K_o = 1.00

Skin Friction of the Each Strata, Q_{si} = $f_s * \pi D L_i$

Total Ult. Skin Frition, $Q_{s\,ult}$ = ΣQ_{si}

Unit End Bearing in Clay Soils, q_{ult} = $9C_u$

Unit End bearing in Sand Soils, q_{ult} = $\sigma' N_q + 0.5 D \gamma N_\gamma$

Ultimate End Bearing, $Q_{p\,ult}$ = $q_{ult} * \pi D^2/4$

Total Ultmate Pile Capacity, Q_{ult} = $Q_{s\,ult} + Q_{p\,ult}$

Allowable Pile Capacity, Q_{all} = Q_{ult}/FS FS = Factor of Safety = **2.50**

PLATE 1

COMPRESSIVE PILE CAPACITY CALCULATIONS

Skin Friction Calculations

S.No.	Soil Description	From	To	ϕ^0 / C_u	$\delta = \phi$	γ_s T/M^3	$\sigma'_{M@}$ T/M^2	f_s T/M^2	Pile Dia 0.40 Q_s T	0.45 Q_s T	0.50 Q_s T	0.60 Q_s T	0.75 Q_s T	-M.
1	Brown F to C Sand ... Filled Up Soil	0.00	1.00	31	31	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Base Cutoff
2a	Brown & Gray Firm to Stiff Clay	1.00	2.50	4.50		0.55	0.41	4.28	8.06	9.07	10.08	12.09	15.12	
2b	Brown & Gray Firm to Stiff Clay	2.50	3.75	6.50		0.65	1.23	4.36	6.84	7.70	8.55	10.27	12.83	
2c	Brown & Gray Firm to Stiff Clay	3.75	5.00	4.50		0.55	1.98	4.28	6.72	7.56	8.40	10.08	12.60	
2d	Brown & Gray Firm to Stiff Clay	5.00	6.00	9.00		0.65	2.31	4.50	5.66	6.36	7.07	8.49	10.61	
3	Gray Silty Fine Sand with Clay Binder	6.00	7.00	30	30	0.60	2.93	1.69	2.13	2.39	2.66	3.19	3.99	
4	Gray Very Stiff Clay	7.00	8.00	11.00		0.70	3.58	4.40	5.53	6.22	6.91	8.30	10.37	
5a	Brown Blue Weathered Rock	8.00	9.00	39	39	1.25	4.56	3.69	4.64	5.22	5.80	6.96	8.70	
5b	Brown Blue Weathered Rock	9.00	10.00	40	40	1.30	5.83	4.89	6.15	6.92	7.69	9.23	11.53	
								Net Total Ultimate Skin Friction, $Q_{s\,ult}$ =	45.73	51.44	57.16	68.59	85.74	

@ 10-M below EGL Soil Formation
- NX Drillied Weathered Granite.

L/D of Pile = 10.0/0.60 < 20
L/D of Pile = 10.0/0.75 < 20
L/D of Pile = 10.0/0.90 < 20
L/D of Pile = 10.0/1.00 < 20
L/D of Pile = 10.0/1.20 < 20
Use Lim. Value or Actual σ'_{base}

N = >> 100
N_q = 105
N_γ = 100

		0.40	0.45	0.50	0.60	0.75	-M
	Base A=	0.1257	0.1591	0.1964	0.2829	0.4420	-M^2
	σ'_{base} =	3.93	5.18	6.48	6.48	6.48	T/M^2
	$q_{b\,ult}$ =	438.78	573.28	713.03	719.53	729.28	T/M^2
Limited to as per IRC 78 - 2014: (Page 80, Note-2)	$q_{b\,ult}$ =	750.00	750.00	750.00	750.00	750.00	T/M^2
	$Q_{b\,ult}$ =	55.16	91.21	140.06	203.52	322.32	Tons
	$Q_{s\,ult}$ =	45.73	51.44	57.16	68.59	85.74	Tons
	$Q_{tot\,ult}$ =	100.89	142.66	197.22	272.12	408.06	Tons
	F.S. =	2.5	2.5	2.5	2.5	2.5	
Allowable Compressive Capacity =	Q_{All} =	40.36	57.06	78.89	108.85	163.22	Tons
Use	Q_{All} =	40	57	79	109	163	Tons

Note:-

1 Pile Load Test must be conducted as per relavant IS Code to confirm the above estimated pile capacities before completion of installtion of all piles.
2 Pile installation must be done with extreme care to prevent "Necking" and "Buldging" problems due to presence of thick layers of sand soils.
3 Ground water level was assumed to rise to ground level in worst case conditions.
4 Limiting All. End Bearing Pressure in "**Hard Rock**" as per IS code was 500 tons/M^2. Therefore, q_b (all) is limited to 300 tons/M^2 in Weathered Granite.

PLATE 2

UPLIFT PILE CAPACITY CALCULATIONS

Skin Friction Calculations

S.No.	Soil Description	From	To	ϕ° / C_u	$\delta = \phi$	γ_{sat} T/M^3	$\sigma'_{M@}$ T/M^2	f_{su} T/M^2	Pile Dia 0.40 Q_{su} T	0.45 Q_{su} T	0.50 Q_{su} T	0.60 Q_{su} T	0.75 Q_{su} T	-M.
1	Brown F to C Sand ... Filled Up Soil	0.00	1.00	31	31	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Base Cutoff
2a	Brown & Gray Firm to Stiff Clay	1.00	2.50	4.50		0.55	0.41	4.28	8.06	9.07	10.08	12.09	15.12	
2b	Brown & Gray Firm to Stiff Clay	2.50	3.75	6.50		0.65	1.23	4.36	6.84	7.70	8.55	10.27	12.83	
2c	Brown & Gray Firm to Stiff Clay	3.75	5.00	4.50		0.55	1.98	4.28	6.72	7.56	8.40	10.08	12.60	
2d	Brown & Gray Firm to Stiff Clay	5.00	6.00	9.00		0.65	2.31	4.50	5.66	6.36	7.07	8.49	10.61	
3	Gray Silty Fine Sand with Clay Binder	6.00	7.00	30	30	0.60	2.93	1.69	2.13	2.39	2.66	3.19	3.99	
4	Gray Very Stiff Clay	7.00	8.00	11.00		0.70	3.58	4.40	5.53	6.22	6.91	8.30	10.37	
5a	Brown Blue Weathered Rock	8.00	9.00	39	39	1.25	4.56	3.69	4.64	5.22	5.80	6.96	8.70	
5b	Brown Blue Weathered Rock	9.00	10.00	40	40	1.30	5.83	4.89	6.15	6.92	7.69	9.23	11.53	
								Net Total Ultimate Skin Friction, $Q_{s\,ult}$=	45.73	51.44	57.16	68.59	85.74	

Unit Weight of Pile RCC = γ_{conc} 2.40 T/M^3

	0.40	0.45	0.50	0.60	0.75	
Base A=	0.1257	0.1591	0.1964	0.2829	0.4420	-M^2
Pile Length, L =	9.00	9.00	9.00	9.00	9.00	-M
Pile Volume, V =	1.13	1.43	1.77	2.55	3.98	-M^3
Submerged Pile Weight W =	1.58	2.00	2.48	3.56	5.57	Tons
$Q_{s\,ult}$ =	45.73	51.44	57.16	68.59	85.74	Tons
$Q_{tot\,ult}$=	**47.31**	**53.45**	**59.63**	**72.16**	**91.31**	Tons
F.S. =	3.0	3.0	3.0	3.0	3.0	
Allowable Uplift Capacity = Q_{All} =	15.77	17.82	19.88	24.05	30.44	Tons
Use Q_{All} =	**16**	**18**	**20**	**24**	**30**	Tons

Note:-

1 Pile Load Test must be conducted as per relavant IS Code to confirm the above estimated pile capacities before completion of installtion of all piles;

2 Pile installation must be done with extreme care to prevent "Necking" and "Buldging" problems;

3 Ground water level was assumed to rise to ground level in worst case conditions.

SAMPLE CALCULATIONS FOR HYDRAULIC BORED CAST IN SITU PILES.

PILE CAPACITY CALCULATIONS - By IS : 2911 (Part 1 / Sec. 2) - 2010 Method.

PROPOSED MULTI-STORIED RESIDENTIAL APARTMENTS BUILDINGS COMPLEX SITE

S. No. 15/2A2, 15/2A3, 15/2A4, 15/2B1, 15/2B2, 15/2B3A, 15/2B3B1, 15/2B3B2, 16/1A, 16/1B, Moonrankattalai Village, Kundrathur Main Road, Chennai 600128, TN.

Treat Soil Profile from 1- to 6-M = Clay Soil
Average "N" Value = ~ 7
Undrained Shear Strength, C_u = 45.00 kN/M^2

As per IS : 2911 (Part 1 / Sec 2) : 2010, Annex C, Table 3, Page 14
For Soft Clay with Estimated $N_{av.g}$, Subgrade Modulus, k_1 = 7000 kN/M^2/M
(For Soft Clay with with Some Increase in Value due to to sand soil layers)
As per IS : 2911 (Part 1 / Sec 2) : 2010, Annex C, Page 14, Section C. 2.3.1

Deflec., $y = \frac{H(e+Z_f)^3*1000}{12EI}$ mm

Lateral Load $H = \frac{y*12EI}{(e+Z_f)^3*1000}$ kN

Stiffness Factor R, in M = $\sqrt[4]{\frac{EI}{KB}}$ $K = \frac{k_1*0.3}{1.5*Dia.}$

Concrete Grade = M30
Min. % of Reinforcement Content = 0.40%
Modulus of Pile, E_c = 200000 Kg/cm^2 = 2.00E+07 kN/M^2

Max. Comp. Stress in Bending f_c = 3000 Tons/M^2 = 300 Kg/cm^2

Dia., D M	(I) Mom. of Inertia, M^4	EI	K	R M	L_1 M	L_1/R	L_e/R	L_e M	y mm	L_1+L_e (Z_f) M	H Tons
0.40	0.00126	25132	3500.0	2.06	0.25	0.121	2.10	4.32	4.00	4.57	**1.26**
0.45	0.00201	40256.6	3111.1	2.32	0.25	0.108	2.10	4.86	4.00	5.11	**1.45**
0.50	0.00307	61357.4	2800.0	2.57	0.25	0.097	2.10	5.40	4.00	5.65	**1.63**
0.60	0.00636	127231	2333.3	3.09	0.25	0.081	2.10	6.48	4.00	6.73	**2.00**
0.75	0.01553	310622	1866.7	3.86	0.25	0.065	2.10	8.10	4.00	8.35	**2.56**

For the present vaiable soil profile, depth of pile fixity varies from 4.6- to 8.4-M for various pile diameters in sandy soil and weathered rock profiles.

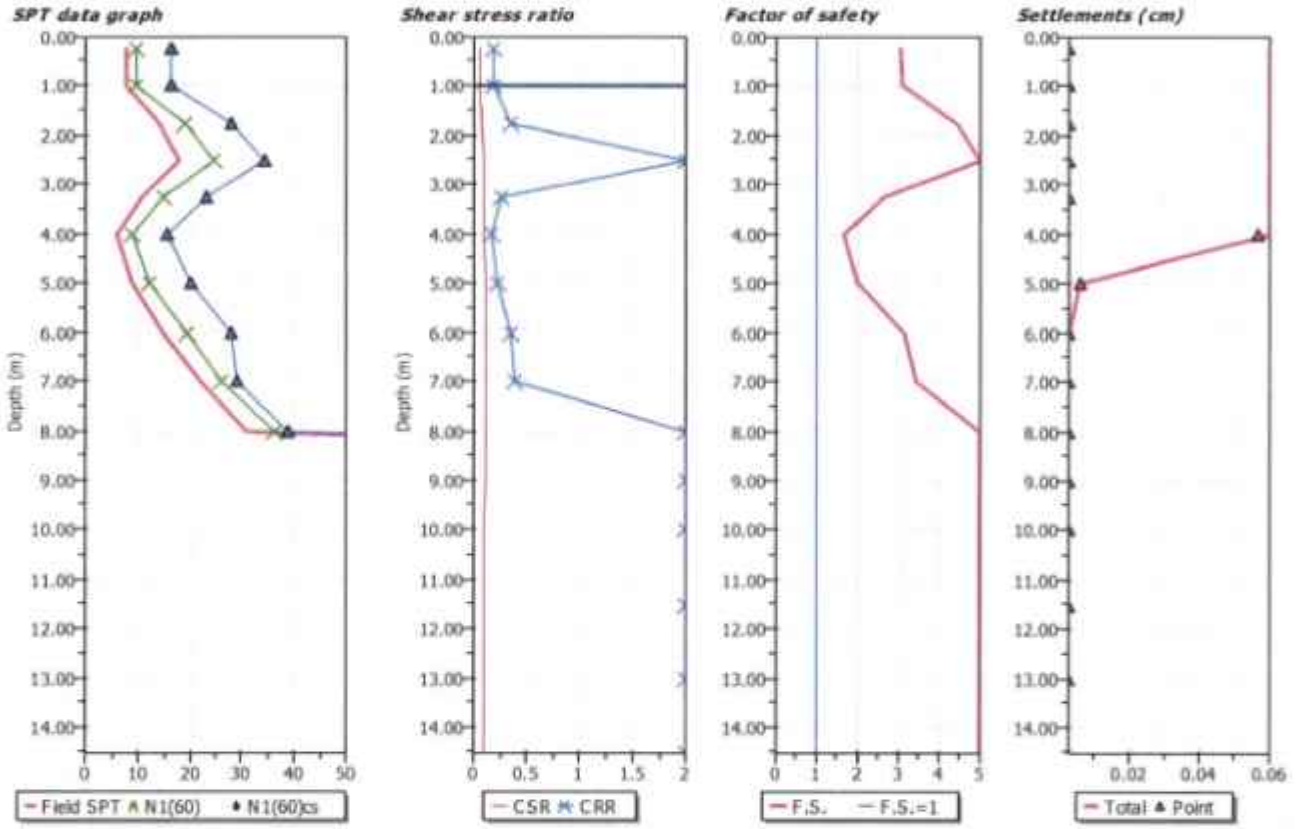
LIQUEFACTION ANALYSIS REPORT

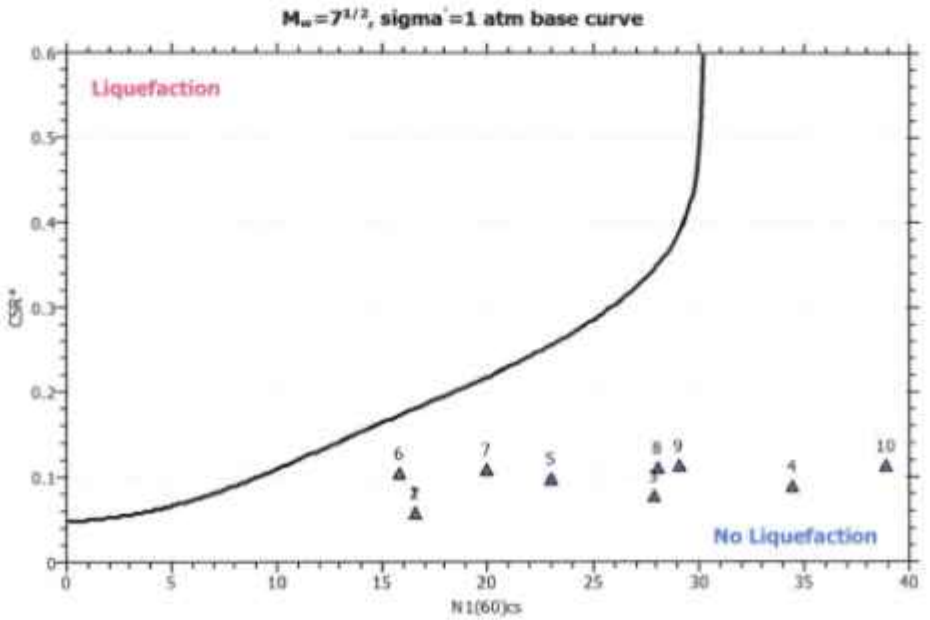
Project title : Kundrathur Main Road, Moonrankattalai Village, Chennai 600128, TN.

Project subtitle : Boring 6 Soil Profile

Input parameters and analysis data

In-situ data type:	Standard Penetration Test	Depth to water table:	1.00 m
Analysis type:	Deterministic	Earthquake magnitude M_w:	6.00
Analysis method:	NCEER 1998	Peak ground accelaration:	0.16 g
Fines correction method:	Idriss & Seed	User defined F.S.:	1.00





Horizontal Acceleration, A_h = **0.16g**

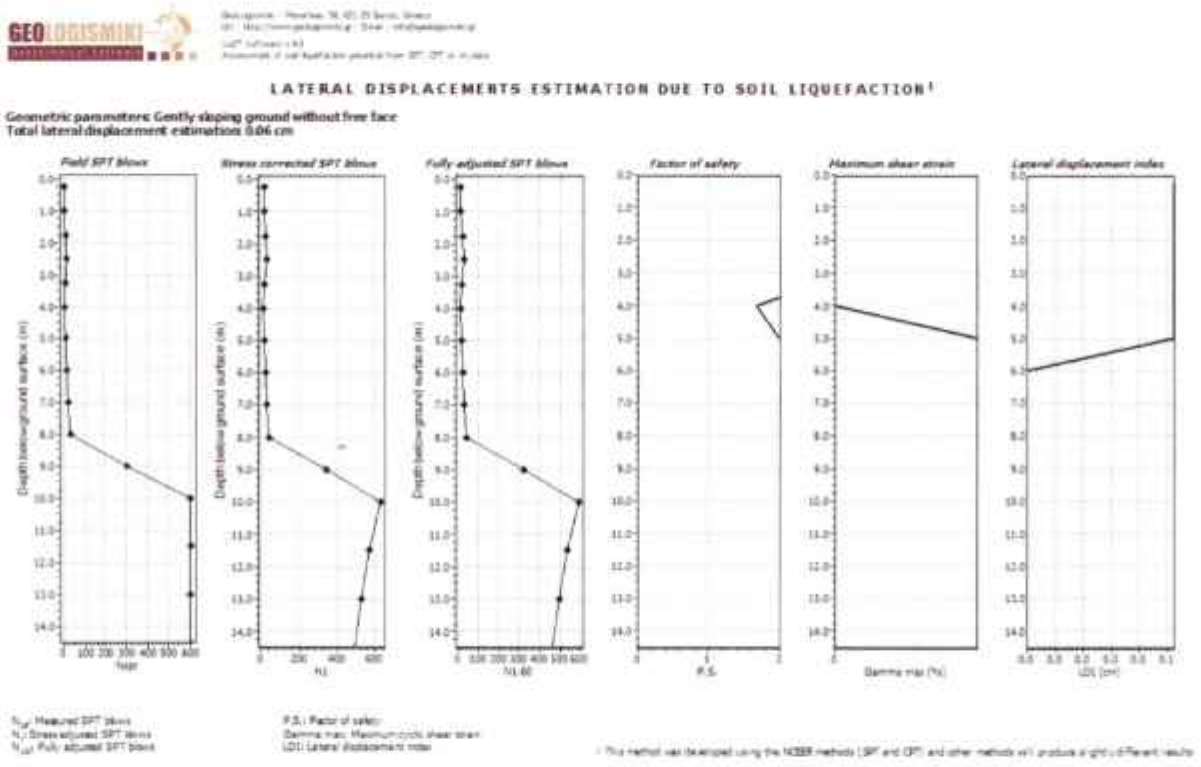


PLATE 21b

PRASAD ARMSTRONG YEN G E C (P) LTD.
821 (Old # 439/4) Poonamallee High Road
Arumbakkam, Chennai 600 106.
Phone: 044 - 2363 7146; e-mail: paygec@gmail.com

THE LANDLENS SUITE

Eight ways to know a piece of land before you pay for it.

This report covers one part of the picture. These cover the rest, drawn from the same government records, for any property in Tamil Nadu.

LandLens One
Ask anything about a property and get an answer grounded in live government records, with the sources shown.
/landlens/one

Verify My Land
Every record check run on one property and returned as a single report.
/landlens/verify-my-land

Legal Opinion
An advocate's written opinion on the title, built on the records we pull for it.
/landlens

One Map
Every layer on one map: the parcel, its boundary, zoning, water bodies and what sits around it.
/landlens/one/map

PriceMap
What land actually changed hands for around this plot, taken from the registered deeds.
/landlens/pricemap

Build Scope
What you are allowed to build here: floor space, height, coverage and setbacks.
/landlens/build-scope

Property Tracker
Watch a property and hear about it when something new is registered against it.
/landlens/property-tracker

Deal Room
Run the transaction in one place: documents, stamping, signatures and the parties.
/landlens/deal-room

FREE TOOLS · NO ACCOUNT NEEDED

Twenty-four checks you can run yourself, at no cost.

Records and verification

The registers themselves, read for you.

- Encumbrance Certificate
- Patta and Chitta
- Field Measurement Sketch
- EC Analyzer
- Bank charge check
- Court case search
- Seller background check
- Approval check by survey

Value and duty

What it is worth and what it costs to register.

- Guideline value by street
- Guideline value by survey
- Stamp duty and registration fees
- Capital gains
- Floor space index
- Area unit converter

Zoning and land use

What the plan says can happen on this land.

- Land use zone finder
- CMDA land use check
- Coastal regulation zone
- Master plan check
- Water bodies finder
- Airport height clearance

Registers and directories

Who holds it, and which office keeps the record.

- Find your registering office
- Temple property check
- Waqf property check
- RERA register

Every free tool
/tools

Services we run for you
/services

The LandLens suite
/landlens/one

Verified RealEstate™

Every claim in this document traces back to a government record.

- Legal opinions, due diligence and title verification
- Building plan, layout and sub-division approvals
- Completion and occupancy certificates, regularisation
- Escrow, negotiation and NRI property management
- Land survey, soil testing, architecture and construction

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