

Report On

**GEOTECHNICAL INVESTIGATION FOR THE PROPOSED EXTENSION OF OLD
ACADEMIC BLOCK IN THE PREMISES OF NATIONAL LAW SCHOOL OF
INDIA UNIVERSITY AT NAGARABHAVI, BENGALURU**

Report for: **National Law School of India University**
Gnana Bharathi Main Road,
Opp NAAC, Teachers Colony,
Nagarabhavi,
Bengaluru – 560 072

December - 2024



STEDRANT Technoclinic Private Limited

NABL ACCREDITED LABORATORY AS PER ISO/IEC 17025-2017

95, "Sunkav Pride" Model House Street, Basavanagudi, Bengaluru – 560 004

Email: geotech@stedrant.com, Phone: 080 2662 9992



Report on	: Geotechnical investigation for the proposed extension of Old Academic Block in the premises of National Law School of India University at Nagarabhavi, Bengaluru.
Report For	: National Law School of India University Gnana Bharathi Main Road, Opp NAAC, Teachers Colony, Nagarabhavi, Bengaluru – 560 072
Reference	: WO No.:
Period of Field Investigation	: 12.11.2024 to 24.12.2024
Field Investigation carried out by	: Mr. Navaz Sharief Assistant Engineer – Geotech M/s. Stedrant Technoclinic Pvt Ltd., Bengaluru.
Laboratory Investigation carried out by	: Mr. Thilak S Assistant Engineer – Geotech Mr. B G Keshava Senior Technician Mr. Rangaswami C Technician M/s. Stedrant Technoclinic Pvt Ltd., Bengaluru
Analysis and Recommendations by	: Dr. P S R Narasimha Raju Senior Director Mr. Lakshmisha K S Principal Engineer – Geotech M/s. Stedrant Technoclinic Pvt Ltd., Bengaluru
Date of submission of Report	: 09.12.2024





CONTENTS

1. INTRODUCTION
2. RECONNAISSANCE
3. FIELD INVESTIGATION
4. LABORATORY INVESTIGATION
5. STRATIFICATION
6. RECOMMENDATIONS

APPENDIX

DRAWING

BORE LOGS

TABLES

PHOTOGRAPHS





GEOTECHNICAL INVESTIGATION FOR THE PROPOSED EXTENSION OF OLD ACADEMIC BLOCK IN THE PREMISES OF NATIONAL LAW SCHOOL OF INDIA UNIVERSITY AT NAGARBHAVI, BENGALURU

1. Introduction

The National Law School of India University, Bengaluru has proposed for an extension of Old Academic Block inside their premises by demolishing a part of the existing Academic Block, Bengaluru. In this regard, a reference was made to M/s. Stedrant Technoclinic Private Limited (STPL), Bengaluru to carry out the geotechnical investigation work in order to evaluate the allowable bearing pressure to rest the foundation system for the proposed structure.

In response to the above, a detailed field assessment study was carried out by STPL during the period 12.11.2024 to 24.12.2024.

The scope of the investigation includes the following:

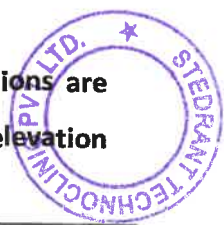
- a. Characterizing the subsoil profile by
 - ♦ Drilling 150mm diameter boreholes using rotary drilling rig.
 - ♦ Conducting Standard Penetration Test at various depths in the boreholes.
 - ♦ Collecting disturbed and undisturbed soil samples and rock core samples.
 - ♦ Conducting necessary laboratory tests on soil and rock core samples.
- b. Report including recommendations for suitable type of foundation and allowable bearing pressure on the soil/Rock.

2. Reconnaissance

The site for the proposed construction is located inside the premises of National Law School of India University at Nagarbhavi, Bengaluru.

Investigation was carried out all around the existing block at 7 identified locations namely, BH 1 to BH 7. BH 1 location is located in the front side of the existing block, BH 5 is located at rear side of the existing block, BH 2 to BH 4 locations are existed beside the academic block where basement floor is existed and BH 5 to BH 6 locations are located in the Open to Sky region of the existing academic block.

As per the visual inspection of the proposed construction site, BH 1 and BH 5 locations are located on higher elevation region and BH 2 to BH 4 locations are located on lower elevation





region. However, by considering the existing ground profile of the proposed construction site, there will be an elevation difference of about 3.0m. At the time of investigation, reduced level of existing ground level borehole wise are not furnished.

The details of Site layout and borehole locations are shown in the drawing enclosed.

3. Field Investigation

The field investigation was carried out by drilling 150mm diameter boreholes using Calyx type rotary drilling rig at **Seven** identified locations shown by the client's representative, conducting standard penetration test and collecting disturbed and undisturbed soil samples and rock cores.

The Standard Penetration Tests were conducted at regular intervals in the boreholes as per IS: 2131-1981(RA-2021).

4. Laboratory Testing

The following laboratory tests were conducted on the soil and rock samples collected from the boreholes:

Soil Samples

Test Name	Test Method
In-situ Density	IS: 2720 (Part 29)-1975 (RA 2020)
In-situ Moisture Content	IS: 2720(Part 2)-1973 (RA 2020)
Grain Size Analysis	IS: 2720 (Part 4)-1985 (RA 2020)
Liquid Limit and Plastic Limit	IS: 2720 (Part 5)-1985 (RA 2020)
Tri-axial Shear Test	IS:2720 (Part 11)-1993 (RA 2021)
Direct Shear Test	IS:2720 (Part 13)-1993 (RA 2021)

Rock Samples

Test Name	Test Method
Uni-axial Compressive strength of rock	IS: 9143: 1979 (RA 2001)
Point Load Index Strength	IS: 8764: 1988 (RA 2019)
Specific Gravity and water Absorption of rock	IS:2386(Part3)-1963 (RA 2021)
Density of rock	IS: 13030-1991 (RA 2021)

These tests were carried out as per the guidelines given in relevant Indian Standards. The test results are tabulated in **Table 1 and Table 2**.





5. Stratification

Based on the investigation data, the following stratification is arrived at Borehole wise:

The stratification at **BH 01** is as follows:

- a. Soil strata from the existing ground level to 3.0m depth.
- b. Weathered Rock Strata from 3.0m to till the investigated depth of 9.0m.

The stratification at **BH 02** is as follows:

- a. Soil strata from the existing ground level to 3.0m depth.
- b. Refusal strata/ Highly Disintegrated Rock, where SPT 'N' values rebound from 3.0m to till the investigated depth of 9.0m.

The stratification at **BH 03** is as follows:

- a. Soil strata from the existing ground level to 3.0m depth.
- b. Refusal strata/ Highly Disintegrated Rock, where SPT 'N' values rebound from 3.0m to till the investigated depth of 9.0m.

The stratification at **BH 04** is as follows:

- a. Soil strata from the existing ground level to 3.0m depth.
- b. Refusal strata/ Highly Disintegrated Rock where SPT 'N' values rebound from 3.0m to 4.5m.
- c. Weathered Rock strata from 4.5m to till the investigated depth of 9.0m.

The stratification at **BH 05** is as follows:

- a. Soil strata from the existing ground level to 1.5m depth.
- b. Refusal strata/ Highly Disintegrated Rock where SPT 'N' values rebound from 1.5m to 3.0m.
- c. Weathered Rock strata from 3.0m to till the investigated depth of 9.0m.

The stratification at **BH 06** is as follows:

- a. Soil strata from the existing ground level to 4.5m depth.
- b. Refusal strata/ Highly Disintegrated Rock where, SPT 'N' values rebound from 4.5m to 7.5m.
- c. Weathered Rock strata from 7.5m to till the investigated depth of 9.0m.

The stratification at **BH 07** is as follows:

- a. Soil strata from the existing ground level to 1.5m depth.
- b. Refusal strata/ Highly Disintegrated Rock where, SPT 'N' values rebound from 1.5m to 2.5m.
- c. Weathered Rock strata from 2.5m to till the investigated depth of 9.0m.





Water Table: At the time of investigation, water was not observed till the investigated depth in any of the boreholes investigated.

The details of field tests, stratification, sampling and water table are furnished in the form of borelogs.

6. Recommendations

The allowable bearing pressure on soil depends on stratification, load coming on the foundation, type of structure, degree of saturation, permissible settlement etc. The proposed construction is an **Academic Block** and is comprising of **Ground Plus Four Upper Floors**. The loads coming on the foundation are Moderate to High.

During investigation, it is observed that the stratification in general shows the presence of relatively loose to dense soil strata from the existing ground level to a depth ranging from 1.5m to 4.5m, followed by Disintegrated Rocky strata of various degrees of weathering till the investigated depth.

As per the investigation data, the stratification in general shows the presence of varying strata in terms of relative density/ strength below the existing ground level. The proposed structure may undergo differential settlement, if the foundations rested on non-uniform strata. Hence, it is recommended to rest the foundation on uniform strata (i.e., Disintegrated Rock of Various Degrees of Weathering) to avoid the differential settlement of the footings.

As the recommended founding strata is rocky strata, the allowable bearing pressure for the prevailing ground condition is governed by the strength of the strata rather than shear and settlement criteria.

Based on the investigation data and analysis of the same, an allowable bearing pressure of 100 T/m^2 is recommended for the design of Isolated Foundation on Disintegrated Rocky Strata.





Table A: Details of Recommended Founding Strata

Block#	Borehole Number#	EGL RL# (m)	Ground Formation Level RL# (m)	Depth of Founding Strata below EGL (m)	Recommended Founding Strata	Allowable Bearing Pressure (T/m ²)
						Isolated Footings
Academic Block [G+4F] **	BH 1	Not Furnished *	Not Furnished	3.0	Weathered Rock/ Highly Disintegrated Rock	100
	BH 2					
	BH 3					
	BH 4			2.0		
	BH 5					
	BH 6					
	BH 7			2.0		

#- As furnished by client

EGL – Existing Ground Level

***- Reduced Levels**

As per the visual inspection of the proposed construction site, there will be an elevation difference of about 3.0m within the proposed construction site. Hence, it is recommended to adopt the depth of foundation as recommended in the above table borehole wise and recommended founding strata shall be ensured before laying PCC.

**** - Academic Block**

The National Law School of India University, Bengaluru has proposed for an extension of Academic Block by demolishing a part it. The founding strata and depth of foundation of existing block is not known and at present, for new building, it is recommended to transfer the loads to Disintegrated Rocky strata. If the founding strata of both new and old buildings are not same, then the structure may undergo differential settlement, if both the blocks are connected structurally. Hence, it is recommended not to connect both old and new building structurally.

P.S.R. Narasimha Raju

Dr. P.S.R. Narasimha Raju
Senior Director

APPENDIX

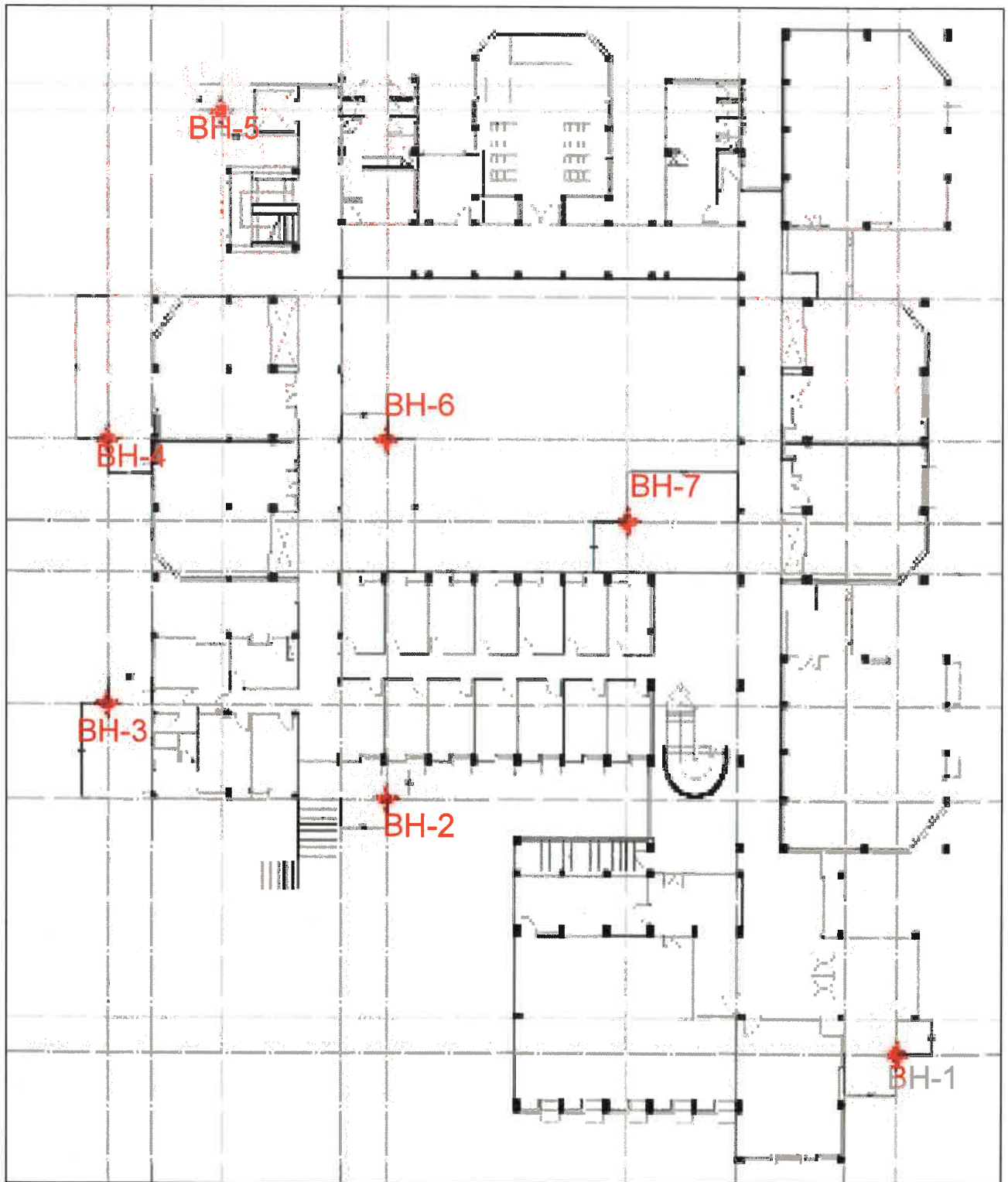
DRAWING

BORE LOGS

TABLES

PHOTOGRAPHS

DRAWING



BORE LOGS



STEDRANT TECHNOCLINIC PVT LTD
BORE LOG

Project : Geotechnical Investigation for the
Proposed Construction of New Building
Around Old Academic Block, in the
premises of National Law School of India
University, Nagarabhavi, Bengaluru.

Client : M/s. NLSIU

BH : 1

Date of commencement : 19.11.2024

Date of completion : 20.11.2024

Ground water table : Not Encountered

Depth below GL (m)	Soil description	Thickness of strata (m)	Legend	Details of sampling		SPT N Value	Remarks
				Type	Depth (m)		
1.0	Yellowish/Greyish/ Brownish	3.0		SPT	1.0	5/8/11 N=19	
2.0				SPT	2.0	9/20/25 N=45	
3.0				SPT	3.0	N>32/100R For 11cm Penetration	
4.0	Weathered Rock 3.0m - 4.5m CR=20% RQD=NIL	6.0					
5.0	4.5m - 6.0m CR=16% RQD=NIL						
6.0	6.0m - 7.5m CR=11% RQD=NIL						
7.0							
8.0							
9.0	7.5m - 9.0m CR=24% RQD=15%						
10.0							

Borehole was terminated at a depth of 9.0m.

SPT - Standard penetration test

UDS - Undisturbed sample

CR-Core Recovery

R - Rebound

* - Sample not retrieved

RQD - Rock Quality Designation



STEDRANT TECHNOCLINIC PVT LTD
BORE LOG

Project : Geotechnical Investigation for the Proposed
Construction of New Building Around Old
Academic Block, in the premises of
National Law School of India University,
Nagarabhavi, Bengaluru.

Date of commencement : 18.11.2024

Client : M/s. National Law School of India University

Date of completion : 19.11.2024

BH : 2

Ground water table : Not Encountered

Depth below GL (m)	Soil description	Thickness of strata (m)	Legend	Details of sampling		SPT N Value	Remarks
				Type	Depth (m)		
1.0	Pinkish/Yellowish/Brownish Silty Sand with Gravel & Mica			SPT	1.0	5/8/9 N=17	
2.0				SPT	2.0	23/33/42 N=75	
3.0				SPT	3.0	N>39/100R For 9cm Penetration	
4.0	Pinkish/Yellowish/Brownish Completely Weathered Rock			SPT	4.5	N>100R For 12cm Penetration	
5.0							
6.0				SPT	6.0	N>100R For 10cm Penetration	
7.0							
8.0				SPT	7.5	N>100R For 13cm Penetration	
9.0				SPT	9.0	N>100R For 8cm Penetration	
10.0							

Borehole was terminated at a depth of 9.0m.

SPT - Standard penetration test

UDS - Undisturbed sample

CR-Core Recovery

R - Rebound

* - Sample not retrieved

RQD - Rock Quality Designation





STEDRANT TECHNOCLINIC PVT LTD
BORE LOG

Project : Geotechnical Investigation for the Proposed
Construction of New Building Around Old
Academic Block, in the premises of
National Law School of India University,
Nagarabhavi, Bengaluru.

Date of commencement : 17.11.2024

Client : M/s. National Law School of India University

Date of completion : 18.11.2024

BH : 3

Ground water table : Not Encountered

Depth below GL (m)	Soil description	Thickness of strata (m)	Legend	Details of sampling		SPT N Value	Remarks
				Type	Depth (m)		
1.0	Greenish/Greyish/Pinkish/ Yellowish/Brownish Silty Sand	3.0		DS	0.5	10/18/33 N=51	
2.0				SPT	1.5		
3.0				SPT	3.0		
4.0	Whitish/Pinkish/Yellowish Completely Weathered Rock	6.0				N>38/100/R For 8cm Penetration	
5.0				SPT	4.5	N>100R For 5cm Penetration	
6.0				SPT*	6.0	N>100R For no Penetration	
7.0							
8.0				SPT*	7.5	N>100R For no Penetration	
9.0				SPT*	9.0	N>100R For no Penetration	
10.0							

Borehole was terminated at a depth of 9.0m.

SPT - Standard penetration test

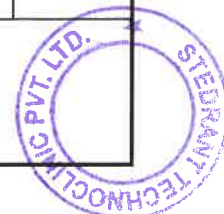
R - Rebound

UDS - Undisturbed sample

* - Sample not retrieved

CR-Core Recovery

RQD - Rock Quality Designation





STEDRANT TECHNOCLINIC PVT LTD
BORE LOG

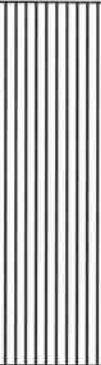

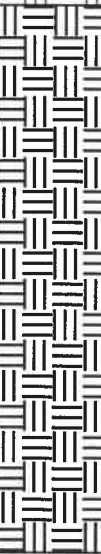
Project : Geotechnical Investigation for the Proposed
Construction of New Building Around Old
Academic Block, in the premises of
National Law School of India University,
Nagarabhavi, Bengaluru.

Date of commencement : 12.11.2024

Client : M/s. National Law School of India University
BH : 4

Date of completion : 15.11.2024

Ground water table : Not Encountered

Depth below GL (m)	Soil description	Thickness of strata (m)	Legend	Details of sampling		SPT N Value	Remarks
				Type	Depth (m)		
1.0	Reddish/Yellowish/ Brownish Silty Sand	3.0		DS	0.5	7/12/18 N=30	
2.0				SPT	1.5		
3.0				SPT	3.0		
4.0	Whitish/Pinkish/Yellowish Completely Weathered Rock	1.5		SPT*	4.5	N>100R For 13cm Penetration	
5.0	Weathered Rock 4.5m - 6.0m CR=9% RQD=NIL	4.5				N>100R For no Penetration	
6.0	6.0m - 7.5m CR=5% RQD=NIL						
7.0	7.5m - 9.0m CR=20% RQD=NIL						
8.0							
9.0							
10.0							

Borehole was terminated at a depth of 9.0m.

SPT - Standard penetration test

UDS - Undisturbed sample

CR-Core Recovery

R - Rebound

* - Sample not retrieved

RQD - Rock Quality Designation





STEDRANT TECHNOCLINIC PVT LTD
BORE LOG

Project : Geotechnical Investigation for the Proposed Construction of New Building Around Old Academic Block, in the premises of National Law School of India University, Nagarabhavi, Bengaluru.

Date of commencement : 16.11.2024

Client : M/s. National Law School of India University
BH : 5

Date of completion : 17.11.2024

Ground water table : Not Encountered

Depth below GL (m)	Soil description	Thickness of strata (m)	Legend	Details of sampling		SPT N Value	Remarks
				Type	Depth (m)		
1.0	Madeup Ground/ Filled Up Soil	1.5		DS	0.5		
2.0	Reddish/Yellowish/ Brownish Silty Sand			SPT	1.5	N>32/100R For 8cm Penetration	
3.0	Completely Weathered Rock	1.5		SPT	3.0	N>100R For 12cm Penetration	
4.0	Weathered Rock 3.0m - 4.5m CR=3% RQD=NIL						
5.0	4.5m - 6.0m CR=12% RQD=NIL						
6.0	6.0m - 7.5m CR=15% RQD=NIL						
7.0	7.5m - 9.0m CR=19% RQD=NIL						
8.0							
9.0		6.0					
10.0							

Borehole was terminated at a depth of 9.0m.

SPT - Standard penetration test

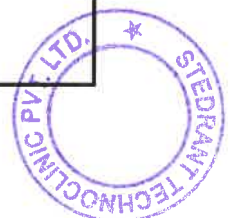
R - Rebound

UDS - Undisturbed sample

* - Sample not retrieved

CR-Core Recovery

RQD - Rock Quality Designation





STEDRANT TECHNOCLINIC PVT LTD
BORE LOG

Project : Geotechnical Investigation for the Proposed Construction of New Building Around Old Academic Block, in the premises of National Law School of India University, Nagarabhavi, Bengaluru.

Date of commencement : 22.11.2024

Client : M/s. National Law School of India University

Date of completion : 23.11.2024

BH : 6

Ground water table : Not Encountered

Depth below GL (m)	Soil description	Thickness of strata (m)	Legend	Details of sampling		SPT N Value	Remarks
				Type	Depth (m)		
1.0	Yellowish/Brownish/ Reddish Silty Sand			SPT	1.0	2/3/3 N=6	
2.0				SPT	2.0	5/9/9 N=18	
				UDS	2.5		
3.0				SPT	3.0	9/11/14 N=25	
4.0	Whitish/Pinkish/Yellowish/ Brownish Completely Weathered Rock	4.5		SPT	4.5	N>100R For 12cm Penetration	
5.0							
6.0				SPT	6.0	N>100R For 10cm Penetration	
7.0							
8.0	Weathered Rock 7.5m - 9.0m CR=10% RQD=NIL	3.0		SPT	7.5	N>100R For 4cm Penetration	
9.0							
10.0		1.5					

Borehole was terminated at a depth of 9.0m.

SPT - Standard penetration test

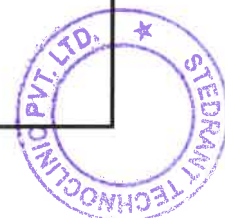
R - Rebound

UDS - Undisturbed sample

* - Sample not retrieved

CR-Core Recovery

RQD - Rock Quality Designation





STEDRANT TECHNOCLINIC PVT LTD
BORE LOG

Project : Geotechnical Investigation for the Proposed
Construction of New Building Around Old
Academic Block, in the premises of
National Law School of India University,
Nagarabhavi, Bengaluru.

Date of commencement : 23.11.2024

Client : M/s. National Law School of India University

Date of completion : 24.11.2024

BH : 7

Ground water table : Not Encountered

Depth below GL (m)	Soil description	Thickness of strata (m)	Legend	Details of sampling		SPT N Value	Remarks
				Type	Depth (m)		
1.0	Reddish/Whitish/Yellowish/ Greyish/Blackish Silty Sand with Mica	2.5		DS	0.5	N>24/100R For 8cm Penetration	
2.0				SPT	1.5		
3.0	Weathered Rock 2.5m - 4.0m CR=11% RQD=NIL	6.5		SPT*	2.5	N>100R For no Penetration	
4.0	4.0m - 5.5m CR=14% RQD=NIL						
5.0	5.5m - 7.0m CR=13% RQD=NIL						
6.0	7.0m - 8.0m CR=18% RQD=NIL						
7.0	8.0m - 9.0m CR=25% RQD=NIL						
8.0							
9.0							
10.0							

Borehole was terminated at a depth of 9.0m.

SPT - Standard penetration test

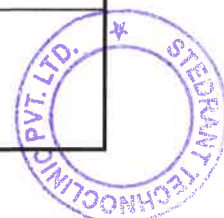
R - Rebound

UDS - Undisturbed sample

* - Sample not retrieved

CR-Core Recovery

RQD - Rock Quality Designation



TABLES



Table-1

Laboratory Test Results Soil Samples

BH. No.	Depth (m)	Bulk Density (g/cc)	Water Content (%)	Grain Size Analysis					Atterberg Limits (%)		Shear Test		
				Gravel (%)	Sand (%)			Silt & Clay (%)	Liquid Limit	Plastic Limit	Type	Cohesion (C) (Kg/cm ²)	Angle of Internal Friction (Ø)
					Coarse	Med.	Fine						
BH-1	1.0			-	1	22	37	40	38	27			
	2.0			-	1	5	51	43	40	29			
	3.0			2	3	32	35	28	NON PLASTIC				
BH-2	1.0			14	8	19	27	32	31	NP			
	2.0			16	4	31	15	34	33	28			
	3.0			16	6	37	26	15	NON PLASTIC				
	4.5			8	4	33	32	23					
	6.0			13	4	33	24	26					
	7.5			28	7	20	30	15					
	9.0			14	3	15	43	25					
BH-3	1.5			5	1	28	32	34	35	25			
	3.0			4	2	31	30	33	NON PLASTIC				
	4.5			12	24	25	13	26					

*Sample is insufficient for testing & NP-Non Plastic





Table-1

Laboratory Test Results Soil Samples

BH. No.	Depth (m)	Bulk Density (g/cc)	Water Content (%)	Grain Size Analysis						Atterberg Limits (%)		Shear Test		
				Gravel (%)	Sand (%)			Silt & Clay (%)	Liquid Limit	Plastic Limit	Type	Cohesion (C) (Kg/cm²)	Angle of Internal Friction (ø)	
					Coarse	Med.	Fine							
BH-4	1.5			7	5	20	29	39	38	27				
	3.0			3	6	38	25	28	NON PLASTIC					
BH-5	1.5			3	4	26	45	22	NON PLASTIC					
	3.0			3	11	45	25	16						
BH-6	1.0			10	2	22	31	35	34	25				
	2.0			8	6	20	32	34	32	26				
	2.5	2.02	12	1	-	21	40	38	39	27	Direct	0.11	25	
	3.0			12	3	21	27	37	35	25				
	4.5			-	12	48	19	21	*	*				
	6.0			-	12	22	43	23	*	*				
	7.5			-	2	39	33	26	*	*				
BH-7	0.5			8	2	23	24	43	41	27				
	1.5			3	2	10	57	28	NON PLASTIC					

* Sample is insufficient for testing & NP-Non Plastic





Table-2

Laboratory Test Results of Rock Core Samples

BH No.	Depth (m)	Water Absorption	Density (g/cc)	Specific gravity	Uniaxial Compressive Strength (Kg/cm ²)
BH-1	7.5 – 9.0	2.19	2.71	2.74	71.17
BH-7	8.0 – 9.0	0.13	2.90	2.92	569.71



PHOTOGRAPHS



General View of the Site





Standard Penetration Test in Progress





Soil Sample inside the Split Spoon Sampler

