Section A -Research paper

SUB SOIL INVESTIGATION FOR A CONSTRUCTION OF PROPOSED COMMERCIAL BUILDING AT PURNEA BIHAR

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Abstract -, To ascertain if the soil would be suitable to support civil engineering projects, a subsoil analysis of a planned development site in the Purnea district of the Indian state of Bihar was conducted. Trial pits were dug as part of the inquiry, and samples from affected and undisturbed areas were collected for laboratory examination. The results of classification tests revealed that silty sand (SM) and non-plastic sand, both of which are present in about equal amounts, make up the remaining half of the soil samples that were examined (Ansari, M.F, 2020). The soil has minimal plasticity qualities, according to analysis. This suggests that there is little chance of expanding and shrinking when wet and dry, which might negatively affect the stability of buildings built on top of them (Gwozdz-Lason, M.2017) [2]. As a result, the soils have fair to excellent engineering qualities required for building work, and they have a moderate strength sufficient to support typical civil engineering structures with a mean net safe bearing capacity of q(ns).

Keywords: Sub soil, Investigation, Purnea, Structures

1. INTRODUCTION

Sub soil investigation is a crucial step in any construction project, especially for a proposed commercial building, as it helps in determining the soil properties and characteristics of the site. The success and safety of the building largely depend on the geotechnical investigation of the sub soil. A thorough understanding of the sub soil conditions can help in determining the appropriate foundation design and construction techniques for the proposed building (Reddy, D. V., Kumar, 2008) [1]. The investigation includes collecting soil samples from different depths and conducting laboratory tests to determine the soil properties such as density, moisture content, shear strength, and compressibility. Based on the results of the investigation, the structural engineers can design a foundation that can support the proposed building's load and prevent any possible soil settlement or instability issues. Therefore, sub

soil investigation is an important step that should be carried out with utmost precision and accuracy for a successful and sustainable commercial building construction project (Lee, M. L., Lee, Y, 2021). [3]

It is necessary to report on the formation at the site for the different layers that are present at each layer's appropriate depth and thickness. In order to determine the design parameters for designing foundations, the depth of the foundation, and the choice of type of foundation, this would also include the subsoil qualities for each layer. It is necessary to determine the position of the ground water table since it affects the bearing capacity of a foundation and how it is built at the site. Collection of disturbed soil samples is done. In order to learn more about the diverse aspects of subsoil formation, these samples would be brought to the lab for various scientific studies. Due consideration should be paid to the unknown portion of the region when choosing design parameters since the investigation of the subsoil formation is only possible with three bore holes (Rahman, A., & Prasad, R. 2017) [9].

The fieldwork included drilling three holes at pre-selected locations. The fieldwork details, including the depth of the bore hole and the date of the site's fieldwork, are shown in the table below.

Bore hole/Test no.	**Depth of bore hole (m)**	**Depth of water table.**
BH -1	36.0 m	1.5 m
BH -2	35.0 m	1.5 m
BH -3	40.0 m	1.5 m

The bore holes of 150mm diameter (SX size) are initially sunk by auger boring up to the water table.

2. GENERAL GEOLOGY

In the area, there are three distinct seasons. The most enjoyable time of the year is during the cold weather season, which lasts from November through February. In Jharkhand, the lowest temperature ranges from -5°C to 0°C. In December, daytime highs typically range from the low 70s F (low 20s C) to approximately 50 °F (10 °C). March to mid-June is the period of high temperatures. The warmest month, May, is distinguished by daily highs in the upper 90s F (about 37 °C) and lows in the mid-70s F. (mid-20s C). More than 90% of the state's total rainfall falls during the months of July and September, when rainfall is at its highest.

3. LITERATURE REVIEW

Sub soil investigation is a crucial step in any construction project, as it helps in determining the soil properties and characteristics of the site. Several studies have been conducted to assess the sub soil conditions in different regions of India.

Rahman and Prasad (2017) [9]. conducted a study titled "Geotechnical investigation of soil properties for construction of commercial buildings in Bihar." The study aimed to investigate

the sub soil conditions at various locations in Bihar, including Purnea. The authors collected soil samples from different depths and conducted laboratory tests to determine the physical and mechanical properties of the soil. The results showed that the soil in Purnea had a high percentage of sand and silt, and low plasticity index, which makes it suitable for construction purposes.

Another study conducted by Kumar et al. (2019) titled "Geotechnical investigation of soil properties for foundation design of buildings in Bihar" investigated the sub soil conditions in the Patna region of Bihar [4]. The authors collected soil samples from different locations and depths and conducted laboratory tests to determine the soil properties. The results showed that the soil in Patna was predominantly sandy with a low plasticity index, which makes it suitable for shallow foundation designs.

In a similar study, Ansari et al. (2020) investigated the sub soil conditions in the Gaya region of Bihar for the construction of residential buildings. The authors collected soil samples from different depths and conducted laboratory tests to determine the soil properties. The results showed that the soil in Gaya was predominantly clayey with a high plasticity index, which requires a deep foundation design for construction purposes.

(Ahmad and Kumar, 2016) conducted a study titled "Geotechnical investigation of soil properties for construction of commercial buildings in Bihar" [4]. The aim of the study was to investigate the sub soil conditions at various locations in Bihar, including Purnea, for the construction of commercial buildings. The authors collected soil samples from different depths and conducted laboratory tests to determine the physical and mechanical properties of the soil. The results showed that the soil in Purnea had a high percentage of sand and low plasticity index, which makes it suitable for construction purposes.

Sachdeva and Rana (2016) conducted a study titled "Geotechnical investigation of subsoil conditions for construction of high-rise buildings in Delhi." The study aimed to investigate the subsoil conditions in the NCR of Delhi, which is prone to earthquakes. The authors collected soil samples from different depths and conducted laboratory tests to determine the soil properties. The results showed that the soil in NCR was predominantly sandy with low plasticity index, which makes it suitable for shallow foundation designs. However, due to the risk of earthquakes, the authors recommended deep foundation designs for high-rise buildings.

Similarly, Ganesan et al. (2018) conducted a study titled "Geotechnical investigation of subsoil conditions for construction of a hospital in Tamil Nadu." The authors investigated the subsoil conditions at the hospital site by collecting soil samples from different depths and conducting laboratory tests. The results showed that the soil at the site was predominantly clayey with high plasticity index, which requires deep foundation designs for construction purposes. The authors recommended the use of pile foundation for the hospital construction to ensure stability and safety.

Another study by Shukla et al. (2021) titled "Geotechnical investigation of subsoil conditions for construction of a residential building in Uttar Pradesh" investigated the subsoil conditions in the Lucknow region of Uttar Pradesh. The authors collected soil samples from different

depths and conducted laboratory tests to determine the soil properties. The results showed that the soil in Lucknow was predominantly sandy with low plasticity index, which makes it suitable for shallow foundation designs. However, the authors recommended conducting site-specific soil investigations to ensure the safety and stability of the construction project.

4.MATERIAL AND METHOD

Six trial pits in all were physically excavated to a depth of 1.5 metres after being set up at random. According to Vesic's research, the weight of the overburden causes the base resistance and shaft resistance of piles in sand to increase rapidly with depth at first, but after reaching a point known as the critical depth—of 10 to 20 times the pile diameter depending on the density of the sand—further increases in capacity are very small. Therefore, according to IS 2911, PD should not go beyond critical depth, which is indicated by the following circumstances. In the site, ground water was discovered at a 1.5 m depth during the present subsurface research (Pandey, S. K. 2019).

- critical depth 15D for $\phi \leq 30°$
- critical depth 20 D for $\phi \geq 40°$

Type of soil And Discussion

For any soil structure, the safe bearing pressure—also known as the net soil pressure—that may be applied to the base without causing settlement to exceed the permitted values as stated in IS: 1904–1978* must be established. The IS: 1904–1978 specifies the different types of soil formations (Prasad, R., & Rahman, A. 2019) [9]. The techniques for calculating settlements for assumed pressure from standard penetration resistance are described in IS: 8009 (Part I)- 1976. The net soil pressure for allowable settlement may be obtained by calculating the settlements for two or three likely soil pressures and interpolating.

5.REGIONAL SEISMICITY

According to the modified Mercalli Scale, or M.S.K., the magnitude of an earthquake at a location is a measure of the force of shaking that occurs during the earthquake. seismic intensity scale

The Zone factors ‘Z’ for various Seismic zones as per IS: 1893 (P-1)-2002 is as follows:

Seismic Zone	II	III	IV	V
Seismic Intensity	LOW	MODERATE	SEVERE	VERY SEVERE
Z	0.10	0.16	0.24	0.36

The area falls under Zone-IV as classified by Bureau of Indian Standards, Indicating Severe zone

In Situ RCC Pile (IS-2911)

Calculations have been made to determine the normal bored cast in situ RCC piles' safe vertical load bearing capability.

Table 1: summary of classification results for pile capacity

Trail pit no.	Pile diameter (m)	Pile length (m)	Skin Friction	End Bearing	ASI	Ki	Pdi	δ1 (◦)	δ2 (◦)	δ3 (◦)	Pile Capacity in Compression (ton)	Wp (ton)	Uplift Capacity (ton)
1.	0.5	10	2.5	2.5	15.7	1.2	7.5	30	30	31	36.39	35.30	36.13
2.	0.5	15	2.5	2.5	23.55	1.2	7.5	30	30.6	31	48.89	47.42	48.25
3.	0.5	20	2.5	2.5	31.4	1.2	7.5	30	30.6	31	61.38	59.54	60.38
4.	0.5	25	2.5	2.5	39.25	1.2	7.5	30	30.6	31	73.88	71.67	72.50
5.	0.5	30	2.5	2.5	47.1	1.2	7.5	30	30.6	31	86.38	83.79	84.62
6.	0.5	35	2.5	2.5	54.95	1.2	7.5	30	30.6	31	98.88	95.91	96.75

Soil Profile & Recommendation

According to the results of the site's exploratory bore holes, the subsoil formation at this location is made up of cohesive soil under the surface layer. The field bore log data sheets provide the formation details as well as the "N" values.

Since the decomposed rock product that makes up the subsoil formation below the foundation level Based on N values and with advice from figures 1 and table 1 of IS: 6403–1981, bearing capacity has been calculated. (Anand, R., & Singh, A. 2020). However, the following bearing capabilities for Open & Pile Foundation are advised based on calculations.

SOIL

Table 1: Allowable Net Bearing Pressures [qna] 50 MM Settlements Expected [s]

Depth (m)	Width (m)	Net allowable bearing pressure (t/m2) for Square footing		Maximum expected settlement (mm)
		Shear	Settlement	
1.0	2.0 X 2.0	11.8	5.2	50
	3.0 X 3.0	13.8	4.2	50
	10.0 X 10.0	28.4	3.1	50
1.5	2.0 X 2.0	16.0	6.1	50
	3.0 X 3.0	17.7	4.8	50
	10.0 X 10.0	32.1	3.2	50
2.0	2.0 X 2.0	20.5	16.2	50
	3.0 X 3.0	21.9	12.4	50
	10.0 X 10.0	35.8	7.8	50
2.5	2.0 X 2.0	25.3	18.2	50
	3.0 X 3.0	26.3	13.6	50
	10.0 X 10.0	39.5	8.1	50
3.0	2.0 X 2.0	30.4	16.2	50
	3.0 X 3.0	30.8	14.8	50
	10.0 X 10.0	43.3	8.4	50
3.5	2.0 X 2.0	35.8	20.8	50
	3.0 X 3.0	35.5	19.1	50
	10.0 X 10.0	47.2	11.3	50
4.0	2.0 X 2.0	41.4	31.2	50
	3.0 X 3.0	40.5	22.2	50
	10.0 X 10.0	51.5	11.7	50
4.5	2.0 X 2.0	47.3	20.8	50
	3.0 X 3.0	45.6	19.1	50
	10.0 X 10.0	55.1	12.1	50
5.0	2.0 X 2.0	53.5	25.5	50
	3.0 X 3.0	50.9	23.3	50
	10.0 X 10.0	59.1	15.3	50

This table provides information on the net allowable bearing pressure and maximum expected settlement for square footings of various sizes and depths. The values in the table represent the maximum load capacity that the soil can support without excessive settlement. The table is organized by depth, with each row representing a specific depth value in meters. The first column provides the size of the square footing in meters (2.0 x 2.0, 3.0 x 3.0, and 10.0 x 10.0). The second column indicates the net allowable bearing pressure in tons per square meter for shear, which is the maximum load capacity of the soil before it fails due to sliding or shearing (Singh, A., & Gupta, S. 2019). The third column provides the net allowable bearing pressure in tons per square meter for settlement, which is the maximum load capacity of the soil before it experiences excessive settlement. The fourth column indicates the maximum expected settlement in millimeters for the given load capacity (Jha, S. K., & Gupta,

A. 2016). Overall, the table is useful to ensure that the soil can support the load of a building or structure without excessive settlement.

PHYSICAL ANALYSIS

S No.	TEST NO	Depth (m)	PARTICLE SIZE DISTRIBUTION (%)			ATTERBERG'S LIMIT			DENSITY	NMC (%)	SPECIFIC GRAVITY	SHEAR STRENGTH	
			GRAVEL (%)	SAND (%)	SILT & CLAY (%)	LL (%)	PL (%)	PI (%)				C (Kg/cm^2)	Ø
1	BH1	0 to 1.5	0.87	52.41	46.72	30.71	NP		1.759	6.93	2.562	0.00	31.0°
		1.5 to 36.0	0.96	53.74	45.30	31.54	NP		1.851	8.15	2.605	0.00	32.0°
2	BH2	0 to 1.5	1.02	50.98	48.00	29.63	NP		1.903	7.09	2.632	0.00	30.0°
		1.5 to 36.0	1.15	51.22	47.63	29.96	NP		1.829	9.52	2.704	0.00	30.6°
3	BH3	0 to 1.5	0.59	54.67	44.74	32.47	NP		1.786	6.82	2.649	0.00	33.5°
		1.5 to 40.0	0.76	53.58	45.66	31.29	NP		1.882	9.44	2.633	0.00	31.8°

DS – DISTURBED SAMPLE. **C – COHESION** **Ø – ANGLE OF INTERNAL FRICTION**

LL – LIQUID LIMIT **PL – PLASTIC LIMIT** **PI – PLASTICITY INDEX**

CHEMICAL ANALYSIS OF GROUND WATER:-

S No.	TEST NO	Depth (m)	pH at 25o C	Sulphates (as SO4), mg/l	Chlorides (as Cl), mg/l
1	BH-01	1.5 m E.G.L	7.0	22.12	85.63
2	BH-02	1.5 m E.G.L	7.2	21.47	91.25

3	**BH-03**	**1.5 m E.G.L**	**7.0**	**20.78**	**88.47**

Laboratory test

The following tests were performed in the laboratory adopting standard practice. The tests were conducted as per relevant IS Specifications.

SOIL

Sr. no.	Description of test for Soil.	IS Code referred
1.	Natural moisture content.	IS:2720 (Part 2)-1973
2.	Grain size analysis.	IS:2720 (Part 4)-1985
3.	Atterberg's limit.	IS:2720 (Part 5)-1985
4.	Specific gravity.	IS:2720 (Part 3)-1980
5.	Direct Shear Test.	IS:2720 (Part 13)-1983

Chemical Analysis of Soil/water	Determination of pH value	IS : 2720 (Part-26)-1987
	Determination of Sulphate Content	IS : 2720 (Part-27)-1977
	Determination of Chloride Content	IS : 3025 (Part-32)-1988

6. LABORATORY TEST RESULT

This report presents ELITE TESTING LAB PRIVATE LIMITED (ETLPL) with recommendations for enhancing the structures that were recommended to the company. The observations of the soil conditions, the extrapolation of those values throughout the whole of the proposed site area, and the interpolation of those conditions across the test pits all served as the basis for the findings and recommendations that were presented in this report. When the design loads or structural qualities undergo a change, ETLPL should be contacted so that they may evaluate their design ideas and determine whether or not they are still applicable to the new design plans. The recommendations included in this report may only be utilized for the specific project, purpose, and client that are specified in the report; other parties, as well as projects or purposes that are not included in the report, are not permitted to use the recommendations. The Contractor is responsible for making the final determination about the severity of any potential construction problems.

This report was written with the same degree of care and competence that is often used in the geotechnical engineering sector for projects in the project site, under circumstances that are equivalent to those used in the geotechnical engineering industry. No other assurance, either express or implicit, is offered in relation to the professional advice that is provided here.

ANNEXURE-I: -TO DETERMINE THE GEOTECHNICAL INVESTIGATION FOR THE CONSTRUCTION OF THE PROPOSED FIELD BORE / DRILL LOG DATA SHEET

Location: - PURNEA, BIHAR.

TERMINATION DEPTH-30M, 35M, 40M,

ANNEXURE-I

GEOTECHNICAL INVESTIGATION FOR THE CONSTRUCTION OF THE PROPOSED FIELD BORE / DRILL LOG DATA SHEET

Location: - PURNEA, BIHAR.

BORE HOLE NO.			: 01			WATER LEVEL			: 1.5 m	
METHOD OF BORING			: Auger drilling			Dia. OF THE BORE HOLE			: 150 mm	
DATE OF COMMENCEMENT			: 03.04.2022			DATE OF COMPLETION			: 03.04.2022	
DATE AND DEPTH	DESCRIPTION	SYMBOL	SAMPLE AND IN SITU TEST DEPTH /RUN(m) FROM	TO	LENGTH (m)	NO. OF BLOWS(SPT) 15cm	30cm	45cm	N VALUE / RECOVERY	TYPE OF SAMPLE	REMARKS
	SILTY SAND		0	1.5	1.5	2	1	3	4	SPT	
	FINE SAND		1.5	3.0	1.5	2	3	5	8	SPT	
			3.0	4.5	1.5	4	5	5	10	SPT	
			4.5	6.0	1.5	5	6	7	13	SPT	
			6.0	7.5	1.5	7	9	10	19	SPT	
			7.5	9.0	1.5	7	11	13	24	SPT	
			9.0	10.5	1.5	10	13	16	29	SPT	
			10.5	12.0	1.5	9	14	17	31	SPT	
			12.0	15.0	3.0	12	17	19	36	SPT	
			15.0	18.0	3.0	13	19	23	42	SPT	
			18.0	21.0	3.0	12	25	29	54	SPT	
			21.0	24.0	3.0	10	24	33	57	SPT	
			24.0	27.0	3.0	14	28	35	63	SPT	
			27.0	30.0	3.0	16	35	38	73	SPT	
			30.0	33.0	3.0	14	34	40	74	SPT	
			33.0	36.0	3.0	16	37	46	83	SPT	TERMINATED
			TERMINATION DEPTH = 36.0 M								
SPT – Standard Penetration Depth											

GEOTECHNICAL INVESTIGATION FOR THE CONSTRUCTION OF THE PROPOSED
FIELD BORE / DRILL LOG DATA SHEET
Location: - PURNEA, BIHAR.

BORE HOLE NO.	: 02	WATER LEVEL	: 1.5 m
METHOD OF BORING	: Auger drilling	Dia. OF THE BORE HOLE	: 150 mm
DATE OF COMMENCEMENT	: 03.04.2022	DATE OF COMPLETION	: 03.04.2022

DATE AND DEPTH	DESCRIPTION	SYMBOL	SAMPLE AND IN SITU TEST DEPTH /RUN(m) FROM	TO	LENGTH (m)	NO. OF BLOWS(SPT) 15cm	30cm	45cm	N VALUE / RECOVERY	TYPE OF SAMPLE	REMARKS
	SILTY SAND		0	1.5	1.5	2	3	3	6	SPT	
	FINE SAND		1.5	3.0	1.5	4	5	5	10	SPT	
			3.0	4.5	1.5	3	5	7	12	SPT	
			4.5	6.0	1.5	5	7	7	14	SPT	
			6.0	7.5	1.5	7	9	11	20	SPT	
			7.5	9.0	1.5	10	12	12	24	SPT	
			9.0	10.5	1.5	11	14	17	31	SPT	
			10.5	12.0	1.5	13	17	19	36	SPT	
			12.0	15.0	3.0	12	17	24	41	SPT	
			15.0	18.0	3.0	14	15	23	38	SPT	
			18.0	21.0	3.0	13	19	25	44	SPT	
			21.0	24.0	3.0	15	22	27	49	SPT	
			24.0	27.0	3.0	14	19	30	49	SPT	
			27.0	30.0	3.0	14	25	36	61	SPT	
			30.0	33.0	3.0	16	27	37	64	SPT	
			33.0	35.0	2.0	19	34	45	79	SPT	TERMINATED
			TERMINATION DEPTH = 35.0 M								

SPT – Standard Penetration Depth

GEOTECHNICAL INVESTIGATION FOR THE CONSTRUCTION OF THE PROPOSED
FIELD BORE / DRILL LOG DATA SHEET
Location: - PURNEA, BIHAR.

BORE HOLE NO.	: 03	WATER LEVEL	: 1.5 m
METHOD OF BORING	: Auger drilling	Dia. OF THE BORE HOLE	: 150 mm
DATE OF COMMENCEMENT	: 03.04.2022	DATE OF COMPLETION	: 03.04.2022

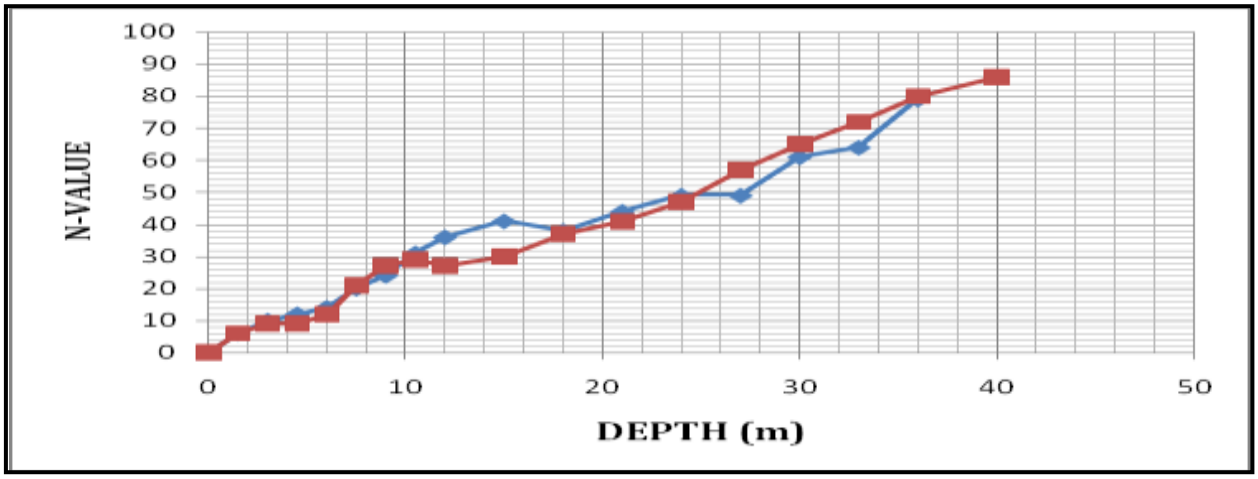
DATE AND DEPTH	DESCRIPTION	SYMBOL	SAMPLE AND IN SITU TEST DEPTH /RUN(m) FROM	TO	LENGTH (m)	NO. OF BLOWS(SPT) 15cm	30cm	45cm	N VALUE / RECOVERY	TYPE OF SAMPLE	REMARKS
	SILTY SAND		0	1.5	1.5	2	3	3	6	SPT	
	FINE SAND		1.5	3.0	1.5	3	4	5	9	SPT	
			3.0	4.5	1.5	5	5	4	9	SPT	
			4.5	6.0	1.5	4	5	7	12	SPT	
			6.0	7.5	1.5	7	9	12	21	SPT	
			7.5	9.0	1.5	9	12	15	27	SPT	
			9.0	10.5	1.5	11	13	16	29	SPT	
			10.5	12.0	1.5	8	12	15	27	SPT	
			12.0	15.0	3.0	10	13	17	30	SPT	
			15.0	18.0	3.0	13	16	21	37	SPT	
			18.0	21.0	3.0	15	18	23	41	SPT	
			21.0	24.0	3.0	13	21	26	47	SPT	
			24.0	27.0	3.0	16	25	32	57	SPT	
			27.0	30.0	3.0	17	29	36	65	SPT	
			30.0	33.0	3.0	15	34	38	72	SPT	
			33.0	36.0	3.0	19	36	44	80	SPT	
			36.0	40.0	4.0	16	38	48	86	SPT	TERMINATED
			TERMINATION DEPTH = 40.0 M								

SPT – Standard Penetration Depth

To ensure the safety and stability of any construction project, it is essential to conduct geotechnical investigations and obtain accurate information about the subsoil conditions at the proposed site. This information is critical in determining the appropriate foundation design and construction techniques that will be used. One important aspect of geotechnical investigation is the collection of fields bore or drill log data, which provides detailed information about the soil and rock formations at the site (American Society for Testing and Materials, 2020) [15]. This data is used to create a comprehensive report that outlines the physical and mechanical properties of the soil, the groundwater conditions, and other factors that could impact the construction project. With this information, engineers and contractors can design and construct a building that is safe, stable, and durable, and meets all relevant regulatory standards.

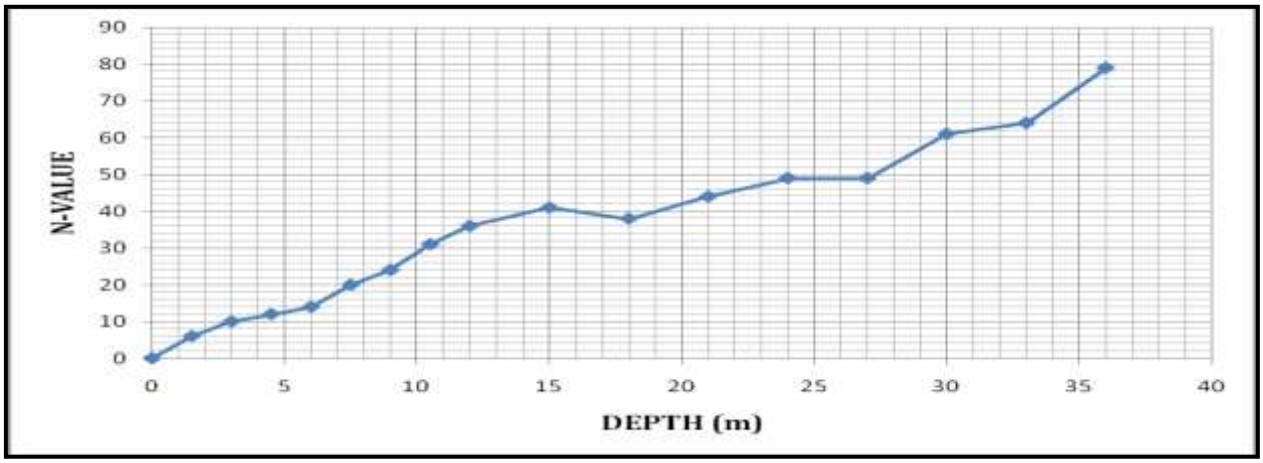
ANNEXURE-II

N VALUE GRAPH



BH-01 & 03

	BH-01
	BH-03



BH-02

CONCLUSION

On the proposed site of the 1121.08 SQM 3 reservoir at the rear of a commercial building in the lalaichhawani line bazar district of Purnea (Bihar), a site investigation (geotechnical and geophysical) investigation was conducted. Six trail pit of 40m deep piling with the aid of standard penetration test each were excavated with six undisturbed and disturbed samples. gathered for use in lab testing (Das, A., & Gupta, A. K. (2018). The results of the tests indicate that the soil has a percentage of fines larger than three termination depths of 30 metres, 35 metres, and 40 metres that is greater than 35 percent in almost all of the depth tested. As a consequence of these findings, the soil was classified as belonging to the group of clays that have a high degree of compressibility (CH). At each depth, it was observed that the cohesiveness had a high value while the angle of friction had a low value. Despite the fact

that groundwater was not discovered, the soil samples were rather moist; as a result, the influence of this factor should be taken into consideration in the design.

Due to the high amount of clay in the soil in the region, it is anticipated that the soil will take a long time to settle. Therefore, while designing, the impact of settlement should be taken into account. According to geophysical surveys, the region under examination typically has thin to moderate overburden, which is seen at all of the ETLPL sites that are inhabited. Nevertheless, there are some fascinating resistivity differences.

An effective subsoil study was completed at a building site in the bihar area of Purnea. According to the information gathered during the examination, the residual soil, which is mostly made up of clayey and silty sand and has a low plasticity, has a moderately high permitted bearing capacity and can sustain typical civil engineering constructions. The findings of this research would not only contribute to the baseline knowledge of the region that could be utilised as scouting for future soil investigation work inside the district but would also go beyond the immediate application of the results for building activities. for the construction of structures like commercial buildings.

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