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Date: 26-February-2026

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Report No. ABC/25-26/SRS00346

## TEST - REPORT ON SUB-SOIL-INVESTIGATION AT THE PROPOSED SITE FOR CONSTRUCTION OF HOSPITAL BUILDING FOR DISTRICT HOSPITAL BALLIA CAMPUS AT DISTRICT - BALLIA (U.P.)



**CONSULTANTS**

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**-: HOUSE FOR :-**

**Soil / Material Testing, Geological Investigation, Quality  
Control & Survey of sites**

**Administrative Office: - C-1074/75, SECTOR - B. MAHANAGAR, LUCKNOW**

**ACKNOWLEDGEMENT**

*We are thankful for providing us the opportunity to prepare and submit the soil investigation report and we appreciate the co-operation & assistance provided by the client. Looking forward to provide, many such reliable & timely services in future.*



**ABC CONSULTANTS**  
(Soil Investigations and Laboratory Works)

**Authorized Signatory**

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## **1.0 INTRODUCTION :**

This report cover the results of field and Laboratory test Conducted at the Proposed Site for Construction of 300 Bedded Hospital Building for District Hospital Ballia Campus at District – Ballia(U.P.). These Investigations have been made to find out the allowable pressure of the soil required for the safe and economical design and execution of engineering works. The work of soil investigation was entrusted to **ABC CONSULTANTS, Administrative Office:- C-1074/75, SECTOR – B. MAHANAGAR, LUCKNOW**

It was decided by the concerned to conduct boring at Six points up to depth of 30.0 meter each at the point marked by them at the site. Accordingly, the boring was conducted in accordance to I.S:1892–1979. Disturbed & undisturbed soil samples were collected along with conducting the standard penetration test at an interval of 1.5 meter. Or change of strata which ever met earlier starting from boring points to the termination of bore holes.

### **1.1 UNDISTURBED SOIL SAMPLES:**

These samples have been collected by the oven dry sampler. After recovery of soil samples from the bore holes the ends of the tube have been cleaned waxed and marked properly. The depth of undisturbed soil samples have been indicated on the bore log chart as well on the Laboratory test result sheet attached. The soil samples have been collected as per I.S. 1892 – 1979.

### **2.1.2 DISTURBED SOIL SAMPLES:**

The depth of the disturbed soil samples have been indicated on the bore log chart as well as on the Laboratory test result and were collected in polythene bags & properly leveled.

### **2.2.1 STANDARD PENETRATION TEST:**

The Standard Penetration Test has been conducted in the bore log charts at the intervals of 1.5 meter as per latest IS: 2131-1981 i.e. “Method for standard penetration test for soils”. In this depth Standard split spoon sampler is driven in to the soil are required depth,



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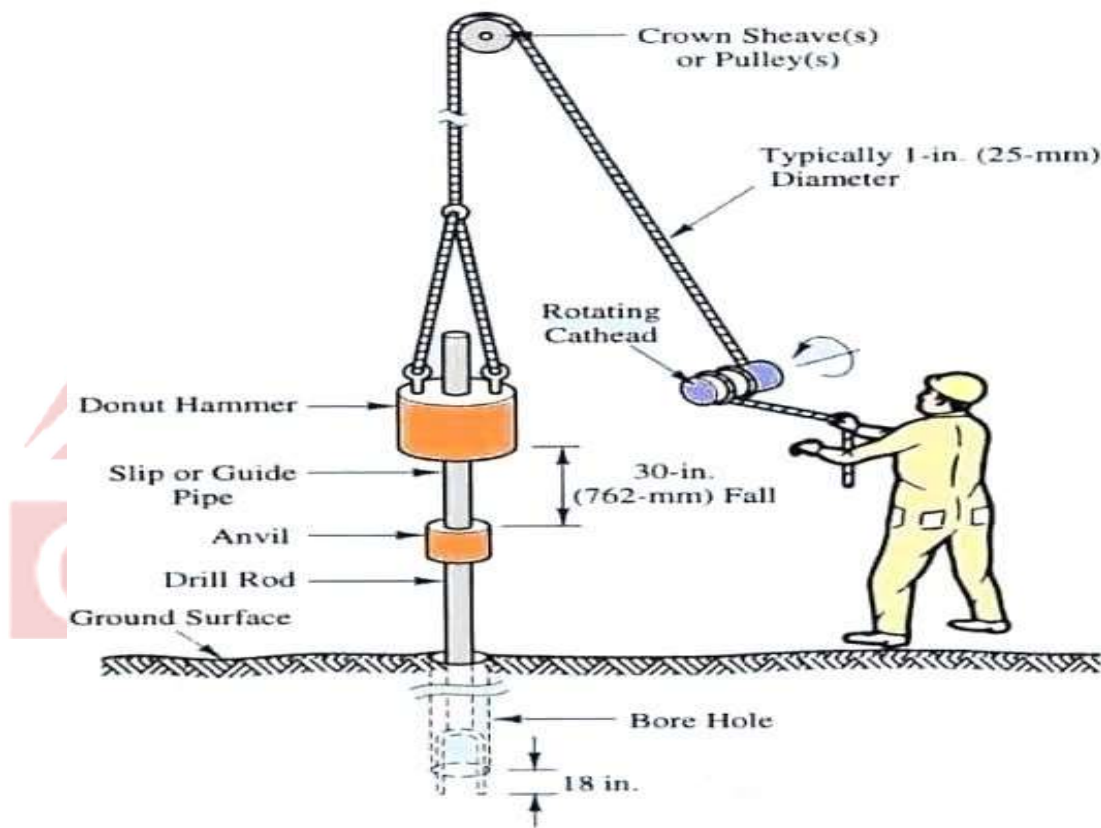
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with the help of drive weight of 63.5 kg falling freely under gravity through a Vertical height of 75cm. The number of blows for every 15 cms is recorded. The number of blow for the first 15 cm. is neglected due to local disturbance and as a seating drive. The number of blows next 30 cm. are recorded as penetration blows 'N' of the soil at the depth. The result of the standard penetration test have been indicated on the laboratory test results sheet as well as on the bore log chart. Disturbed Soil samples obtained from standard split spoon sampler were collected in polythene bags of suitable size. These samples were properly sealed, labelled, recorded and carefully transported to laboratory for testing.



**DIAGRAMMATIC OF SPT**

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## 2.2.2 CONSISTENCY/RELATIVE DENSITY OF SOIL WITH SPT VALUES AS PER IRC: 75-2015

CORRELATION FOR CLAY/PLASTIC SILT		CORRELATION FOR SAND/NON-PLASTIC SILT	
Consistency	Penetration Value	Relative Density	Penetration Value
Very Soft	0 to 2 Blows	Very loose	0 to 4 Blows
Soft	2 to 4 Blows	Loose	5 to 10 Blows
Medium Stiff	4 to 8 Blows	Medium	11 to 30 Blows
Stiff	8 to 15 Blows	Dense	31 to 50 Blows
Very Stiff	15 to 30 Blows	Very Dense	Above 50
Hard	Above 30		

### 3.0 LABORATORY WORK

#### 3.1 UNDISTURBED SOIL SAMPLES:

The Undisturbed soils collected from the bore holes have been tested for the following to determine the engineering properties of soil as per requirement.

- Sieve Analysis (I.S. Code 2720 (Part IV)-2007
- Atterberg's Limit (Via Liquid and Plastic Limit & Plasticity Index)  
(I.S. Code 2720 (Part V)-2007
- Particle size analysis (I.S. Code 2720 (Part IV)-2007
- Bulk and Dry Density (I.S. Code 2720 (Part XXIX)-2007
- Natural Moisture Content (I.S. Code 2720 (Part II)-2010
- Shear Parameters  $C$  &  $\Phi$  (I.S. Code 2720 (Part XII & XIII)-2007
- Consolidation Test (For determination of  $C_c$  values of clayey soil samples) (I.S. Code 2720 (Part XV)-2007
- Specific Gravity (I.S. Code 2720 (Part III)-2007

#### 3.2 DISTURBED SOIL SAMPLES :

The disturbed soil samples have been tested for the following parameters.

- Sieve Analysis (I.S. Code 2720 (Part IV)-2007

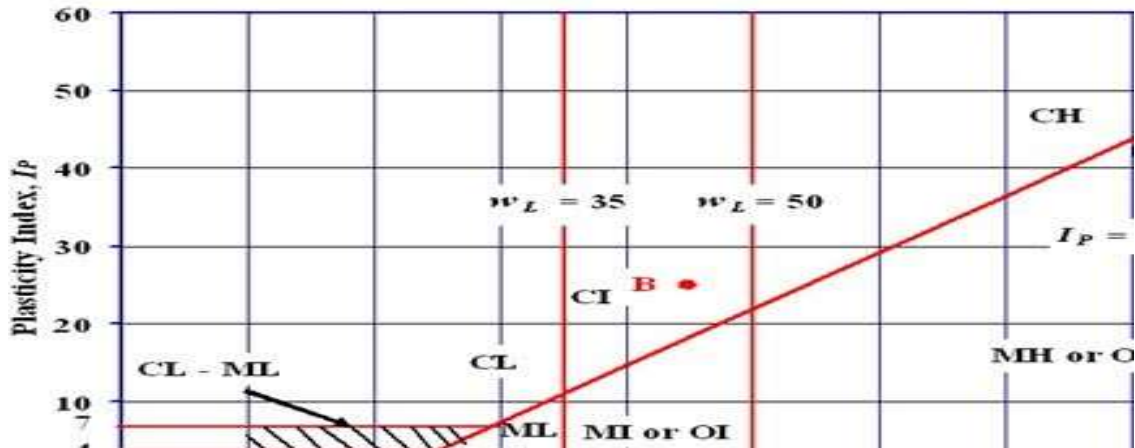
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**4.0 SOIL CLASSIFICATION:** Soil classification has been done with the help of the soil properties obtained by laboratory test as per I.S. 1498 "Methods of classification and identification of soil for general engineering purposes".

b) Atterberg's Limits (I.S. Code 2720 (Part IV)-2007

The entire Laboratory has been carried out as per relevant I.S. code & has been tabulated.



FOR COHESIVE SOIL		FOR NON-COHESIVE SOIL	
Plasticity	Liquid Limit	Soil Classification	% Passing on IS Sieve 0.075 mm
Low Plastic	<35	ML	>50
Medium Plastic	35 to 50	SM	13-49
High Plastic	>50	SM-SP	5-12
		SP	1-4

### ABBREVIATIONS

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>CL - SILTY CLAY OF LOW PLASTICITY</li> <li>CI - SILTY CLAY OF MEDIUM PLASTICITY</li> <li>CH - SILTY CLAY OF HIGH PLASTICITY</li> <li>ML - CLAYEY SILT OF LOW PLASTICITY</li> <li>CL-ML - CLAYEY SILT OF LOW PLASTICITY</li> <li>MI - CLAYEY SILT OF MEDIUM PLASTICITY</li> <li>SC - CLAYEY SAND</li> <li>GL - GROUND LEVEL</li> </ul> | <ul style="list-style-type: none"> <li>ML - SANDY SILT</li> <li>SM - SILTY SAND</li> <li>SM-SP - POORLY GRADED SAND-SILT MIXTURE</li> <li>SW/SP - WELL/POORLY GRADED SAND</li> <li>GSF - GENERAL SHEAR FAILURE</li> <li>LSF - LOCAL SHEAR FAILURE</li> <li>ISF - INTERMEDIATE SHEAR FAILURE</li> <li>BGL - BELOW GROUND LEVEL</li> </ul> |
|--|--|

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## **5.0 GENERAL NATURE OF SOIL STRATA:**

The general nature of the soil strata met during boring in each of bore holes are indicated on the bore log charts as well as on the laboratory test results sheet. The filled-up soil is met up to 0.70m depth in bore hole nos-1 & 3, 0.50m depth in bore hole no.2, 1.00m depth in bore hole no.-4 and 1.85m depth in bore hole no.-5 & 6 below existing ground level. Below filled-up soil the entire Strata is comprising of 'CI' silty clay of medium plasticity, 'ML' sandy silt and 'SM' silty sand.

## **5.1 STANDARD PENETRATION TEST:**

The 'N' values (or SPT values recorded) during penetration test in the strata in the bore hole No. 1, 2, 3, 4, 5, & 6 were found vary from 6 to 53 indicate the consistency of the soil as medium.

## **6.0 WATER TABLE:**

The depth of water table was met up to. 12.00 m depth during boring operation in bore hole at the time of soil exploration in the month of since February 2026. Water is expected 1.00 m rise in post monsoon period. Accordingly, water table is assuming 11.0 m for calculation purpose.

## **7.0 INTERPRETATION OF THE TEST RESULTS (SHEAR CONSIDERATION):**

**7.1** The choice of the type of foundation depends upon the safe bearing capacity, design and layout of super structure, relative economics of various alternatives and practical consideration. In case of strip footing the safe bearing capacity / allowable bearing pressure, calculation is governed by IS: 6403-1981, for shear consideration & IS: 1904-1986 & IS: 8009 (Part-I)-1976, for consideration of settlement. Net Safe Bearing capacity from Shear Failure consideration has been computed in accordance with IS: 6403-1981. A factor of safety of 3.0

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is selected based on clause 706.3.1.1.1 of IRC 78- 2014 to estimate the net safe bearing capacity from ultimate net bearing capacity. The modified bearing capacity formula are as below considering the shape of footing, inclination of loading, depth of embedment and effect of water table.

$$Q_s = 1/F [C.N_c.S_c.d_c.i_c. + q(N_q-1) S_q.d_q.i_q. + 0.50 \gamma B. N_\gamma.s_\gamma.d_\gamma.i_\gamma.w']$$

Where:

$Q_s$  = Bearing capacity on shear consideration in Kg/cm<sup>2</sup>

$F$  = Factor of safety

$\gamma$  = Unit weight of soil

$C$  = Cohesion in Kg/cm<sup>2</sup>

$q$  = effective overburden pressure Kg/cm<sup>2</sup>

$B$  = Width of footing

$w'$  = Correction factor for position of water table.

$N_c.N_q.N_\gamma$  = Non dimensional bearing capacity factors depends upon angle of internal friction  $\phi$  and void ratio  $e$

$S_c.S_q.S_\gamma$  = Shape factors

$d_c.d_q.d_\gamma$  = Depth factors

$i_c.i_q.i_\gamma$  = Inclination factors

### 7.3 SETTLEMENT CONSOLIDATION: (For Plastic soil)

The settlement in the plastic soil indicating some cohesion is given by the formula:

$$S = \frac{C_c}{1 + e} \times \frac{P_o + \Delta P}{P_o} \times H \times \log_{10} \frac{P_o + \Delta P}{P_o}$$

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$$1 + e_o$$

$$P_o$$

Where:

$C_c$  = Compression Index

$H$  = Thickness of Plastic layer

$P_o$  = Original Pressure at mid depth of Plastic layer

$\Delta P$  = Change in Pressure at mid depth of Plastic layer

$e_o$  = Void ratio for pressure  $P_o$

#### **7.4 SETTLEMENT CONSIDERATION:** (For non-Plastic soils)

The allowable bearing pressure is also to be so restricted that the anticipated settlement does not exceed the permissible settlement as specified in IS: 1904-1986, for a particular type of structure and nature of soil.

#### **7.5 Proposed Design Parameter's for Soil:**

##### **7.5.1 For Cohesionless Soils**

In cohesion-less soils since it is difficult to collect undisturbed samples, it is preferred to estimate the angle of internal friction from corrected SPT values (Ref: IS: 6403, IRC:78, Euro Code / British Code BS:8004). Particle size distribution among the non-cohesive soils will also affect on angle of internal friction, generally all codes and literatures have provided the curves between corrected SPT(N) value and angle of internal friction for sands (SP type soils) however when fine content increases, the angle of friction reduces. Although it is not necessary to conduct tests on cohesionless soils (Sandy Soils) as  $\phi$  value may directly be taken from Corrected SPT N value but to check the values as per laboratory tests also the same have been conducted. Direct shear tests may also be conducted on remoulded samples at simulated density; however, the structure of the soil cannot be duplicated.

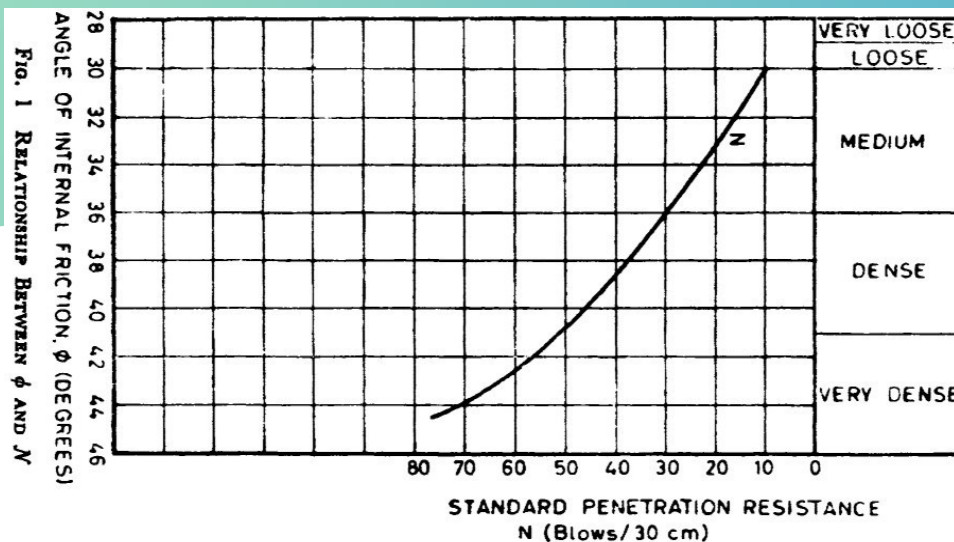
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## 7.5.2 Caltrans Geotechnical Manual:

### Soil Correlations

This section of the Geotechnical Manual presents the SPT correlations to be used for friction angle ( $\phi$  angle) and unit weight. The correlations use Standard Penetration Test (N) values corrected for overburden and hammer efficiency (N160). Usage of correlations for geotechnical design is addressed in the various design sections of the Geotechnical Manual. Other correlations, e.g. CPT correlations and shear wave velocity correlations are found elsewhere in the Geotechnical Manual.

### Cohesionless Soil: Friction Angle

Correlations of SPT blow counts to cohesionless soil friction angle and unit weight follow Bowles (1977) and are consistent with many of the NHI manuals used by the department. The correlations use Standard Penetration Test (N) values corrected for overburden and hammer efficiency (N160). Use Chart 1 to correlate N160 to the friction ( $\phi$ ) angle.

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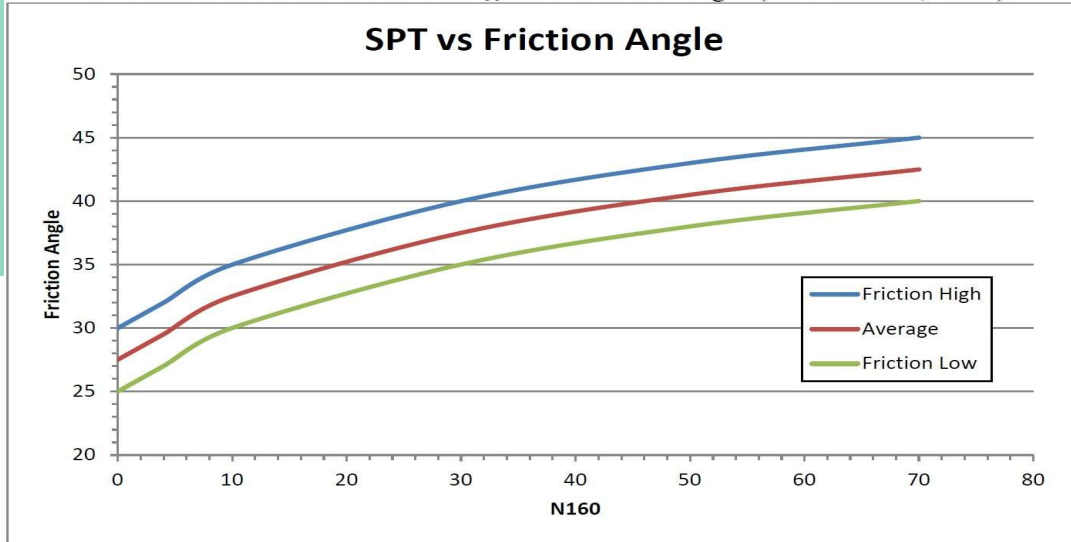
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Chart 1: Correlation of SPT  $N_{160}$  with Friction Angle (after Bowles, 1977)



Choose the friction angle (expressed to the nearest degree) based upon the soil type, particle size(s), and rounding or angularity. Experience should be used to select specific values within the ranges. In general, finer materials or materials with significant (about 30+ %) silt-sized material will fall in the lower portion of the range. Coarser materials with less than 5% fines will fall in the upper portion of the range. The extreme range of phi angles for any  $N_{160}$  is five degrees, so the adjustment factors for particle size and roundness should be only a degree or two. The following bullets provide help in determining which value to select for a given  $N_{160}$  and soil type:

- Use the maximum value for GW
- Use the average for GM and SP
- Use the minimum for SC
- Use the minimum + 0.5 for ML
- Use the average +1 for SW
- Use the average -1 for GC
- Use the Maximum -1 for GP

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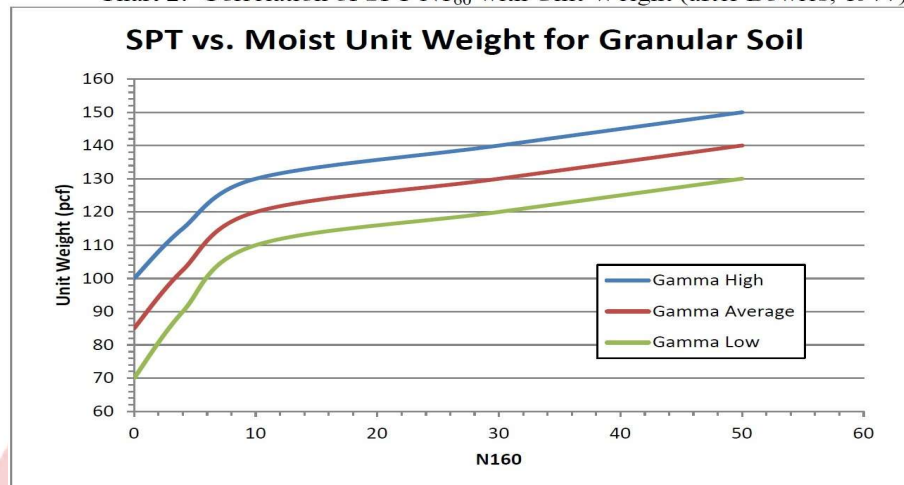


Values may also be increased with increasing grain size and/or particle angularity and decreased with decreasing grain size and/or increasing roundness. For example, an SP with N160 = 30 could be assigned phi angles of 37, 38 or 39 degrees for fine, medium and coarse grain sizes respectively.

### Cohesion less Soil: Unit Weight

Use Chart 2 to correlate N160 to the moist unit weight for cohesion less (Granular) soil.

Chart 2: Correlation of SPT N1<sub>60</sub> with Unit Weight (after Bowles, 1977).



Choose the unit weight expressed to the nearest five pcf for the soil type based on the following guidelines:

- Use the higher values for well-graded sands and gravels and average values for poorly-graded sands and gravels.
- Use lower values for elastic silt, and clayey or silty sands and gravel.
- Deduct up to 20% for dry soils.

### ii. For Cohesive Soil's

For very stiff to hard consistency cohesive/plastic soils where undisturbed samples cannot be collected, correlation for estimating Un-drained cohesion of fine-grained soils based on (N)60 and plasticity index is proposed by M J Tomlinson. "Foundation Design and Construction" seventh edition as below;

$$C_u \text{ (kN/m}^2\text{)} = f_1 \cdot (N)_{60}$$

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Where,

(N)<sub>60</sub> = SPT 'N' value corrected for 100 kPa and 60% of theoretical free fall hammer energy

$f_1$  = factor to be taken from Figure shown below.

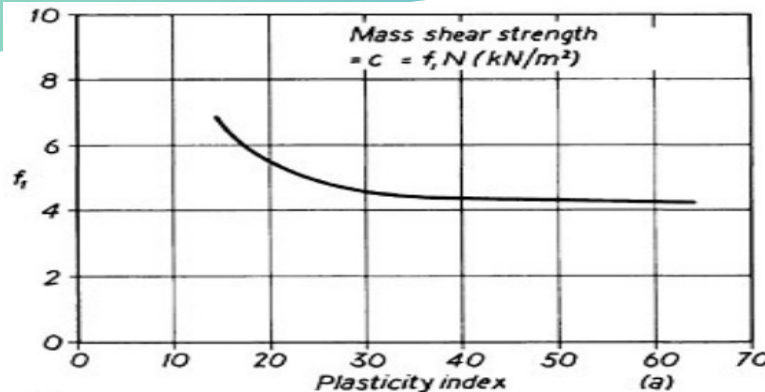


Fig. Relationship between mass shear strength plasticity index and standard penetration test N-values

- **Caltrans Geotechnical Manual:**

Cohesive Soil: Unconfined Compressive Strength ( $Q_u$ ) / Undrained Shear Strength ( $S_u$ )

The standard practice is to determine shear strength of cohesive soils in the field based on measurements with torvane, pocket penetrometer, or vane shear. It is not acceptable to use SPT correlations to determine shear strength or to assign consistency values. For preliminary studies, use Chart 3 to assign shear strength values when only SPT values are available. Usually this is applicable when data are available from old as-built LOTBs where field or laboratory strength tests are not available.

**Chart 3: Correlation of SPT N<sub>160</sub> to Unconfined Compressive Strength**

(after Bowles, 1977)

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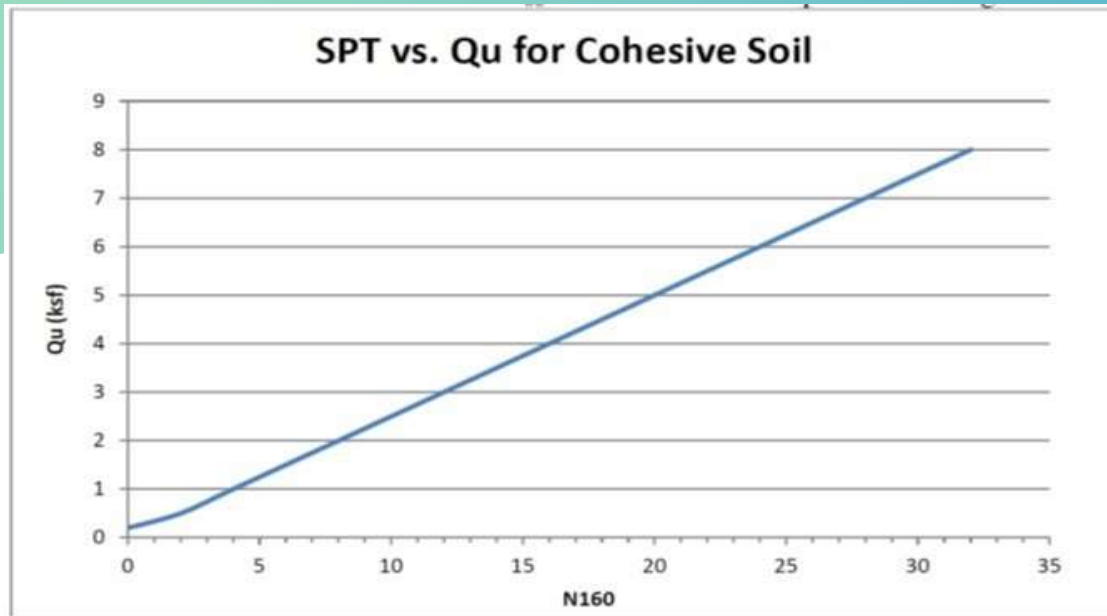
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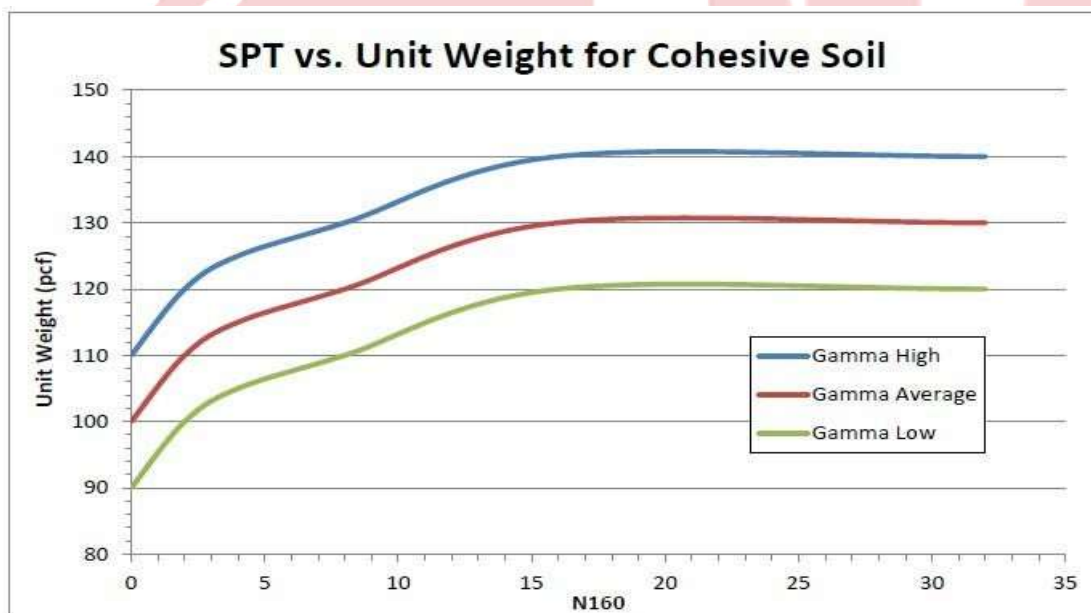
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#### Cohesive Soil: Unit Weight

Use Chart 4 to correlate N160 with the Unit Weight of cohesive soil.

Chart 4: Correlation of SPT N160 with Unit Weight (after Bowles, 1977).



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Comparing field pocket penetrometer and/or torvane readings to Chart 4 is a good way of determining whether high or low values should be used. For example, if the pocket penetrometer reading for a clay with  $N_{160} = 10$  is about 2.5 ksf (the same as the value shown in Chart 3) the unit weight should correspond to the average value. If the pocket penetrometer reading is higher, the unit weight should be increased from the average, and if the pocket penetrometer reading is lower, the unit weight should be decreased from the average. In the absence of SPT data, unit weights can be estimated using Charts 3 and 4 and the strength data (e.g., pocket penetrometer reading). For example, from Chart 3, a pocket penetrometer value of 5 ksf corresponds to an SPT  $N_{160}$  value of 20. Chart 4 shows the average unit weight of a cohesive soil with  $SPT\ N_{160} = 20$  is 130 pcf.

## 8.0 COMPUTATION OF BEARING CAPACITY:

### 8.1 BEARING CAPACITY FROM SHEAR CRITERIA:

Bearing capacity calculations were carried out Isolated / R.C.C. Raft Foundation at depth 1.20m, 1.50m, 2.00m, 3.00m, 4.50m, 6.00m & 7.50m below ground level with width & size of foundation 1.20m, 1.50m, 2.00m & (10.00x10.00)m However governing values of bearing capacity was found the calculations for the same are produced below:

#### 8.1.1 Bearing capacity Calculation:

Governing soil parameter are from bore hole no. 02

1.	Angle of internal friction $\phi$	=	$6^0$
2.	Cohesion C	=	0.37 Kg/cm <sup>2</sup>
3.	Unit weight of soil $\gamma$	=	1.80 gm/cc
4.	Submerged density. of soil $\gamma$	=	-
5.	Specific Gravity	=	2.72
6.	Dry Density	=	1.62 gm/cc

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7. Void ratio  $e_0$  = 0.68
8. Condition = Medium (Interpolation)
9. Bearing Capacity Factor

Shear Parameters	Nc	Nq	Nr
General Shear failure $e_0 \leq 0.55$	6.860	1.750	0.604
Local Shear failure $> 0.75$	6.220	1.456	0.360
Interpolated value for $e_0 = 0.68$	6.444	1.559	0.445

10. Water Table correction Factor  $w'$  = 1.0
11. Overburden pressure  $q$  at depth 1.20 m = 0.216 Kg/cm<sup>2</sup>
12. Type of foundation = Isolated Foundation
13. Depth of foundation  $d_f$  = 1.20 m
14. Width of foundation = 1.20 m
15. Shape factors
- $S_c = 1.30$     $S_q = 1.20$ ,    $S_\gamma = 0.80$
16. Inclination factors
- $i_c = 1.0$ ,    $i_q = 1.0$ ,    $i_\gamma = 1.0$
17. Depth Factors
- $d_c = 1.222$     $d_q \text{ \& } d_\gamma = 1.0$
18. Factor of safety  $f = 3.0$

**Bearing Capacity: -**

$$\begin{aligned} Q_c &= 1/3[0.2897 \times 6.444 \times 1.222 \times 1.30 \times 1.0 + 0.216 \times (1.559 - 1.0) \times 1.20 \times 1.0 + 0.5 \times 1.80 \\ &\quad \times 1.20 \times 0.445 \times 0.80 \times 1.0 \times 1.0 / 10.0] \\ &= 1/3 [2.966 + 0.145 + 0.038] \text{ Kg/cm}^2 \\ &= 1.050 \text{ Kg/cm}^2 \end{aligned}$$

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**8.1.2 Bearing capacity Calculation:**

Governing soil parameter are from bore hole no. 02

1. Angle of internal friction  $\phi$  =  $6^\circ$
2. Cohesion C = 0.37 Kg/cm<sup>2</sup>
3. Unit weight of soil  $\gamma$  = 1.80 gm/cc
4. Submerged density. of soil  $\gamma$  = -
5. Specific Gravity = 2.72
6. Dry Density = 1.62 gm/cc
7. Void ratio  $e_0$  = 0.68
8. Condition = Medium (Interpolation)
9. Bearing Capacity Factor

Shear Parameters	Nc	Nq	Nr
General Shear failure $e_0 \leq 0.55$	6.860	1.750	0.604
Local Shear failure $> 0.75$	6.220	1.456	0.360
Interpolated value for $e_0 = 0.68$	6.444	1.559	0.445

10. Water Table correction Factor  $w'$  = 1.0
11. Overburden pressure  $q$  at depth 1.50 m = 0.270 Kg/cm<sup>2</sup>
12. Type of foundation = Isolated Foundation
13. Depth of foundation  $d_f$  = 1.50 m
14. Width of foundation = 1.50 m
15. Shape factors  
 $S_c = 1.30$     $S_q = 1.20$ ,    $S_\gamma = 0.80$
16. Inclination factors  
 $i_c = 1.0$ ,    $i_q = 1.0$ ,    $i_\gamma = 1.0$
17. Depth Factors

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$$\begin{aligned}dc &= 1.222 & dq \text{ \& } d\gamma &= 1.0 \\18. \text{ Factor of safety } f &= 3.0\end{aligned}$$

**Bearing Capacity: -**

$$\begin{aligned}Q_c &= 1/3[0.2897 \times 6.444 \times 1.222 \times 1.30 \times 1.0 + 0.270 \times (1.559 - 1.0) \times 1.20 \times 1.0 + 0.5 \times 1.80 \\&\quad \times 1.50 \times 0.445 \times 0.80 \times 1.0 \times 1.0 / 10.0] \\&= 1/3 [2.966 + 0.181 + 0.048] \text{ Kg/cm}^2 \\&= 1.065 \text{ Kg/cm}^2\end{aligned}$$

**8.1.3 Bearing capacity Calculation:**

Governing soil parameter are from bore hole no. 02

1. Angle of internal friction  $\phi$  =  $7^\circ$
2. Cohesion C =  $0.33 \text{ Kg/cm}^2$
3. Unit weight of soil  $\gamma$  =  $1.82 \text{ gm/cc}$
4. Submerged density. of soil  $\gamma$  = -
5. Specific Gravity =  $2.70$
6. Dry Density =  $1.62 \text{ gm/cc}$
7. Void ratio  $e_0$  =  $0.67$
8. Condition = Medium (Interpolation)
9. Bearing Capacity Factor

Shear Parameters	Nc	Nq	Nr
General Shear failure $e_0 \leq 0.55$	7.230	1.930	0.760
Local Shear failure $> 0.75$	6.400	1.533	0.420
Interpolated value for $e_0 = 0.67$	6.732	1.691	0.556

10. Water Table correction Factor  $w'$  =  $1.0$
11. Overburden pressure  $q$  at depth  $2.00 \text{ m}$  =  $0.364 \text{ Kg/cm}^2$
12. Type of foundation = Isolated foundation
13. Depth of foundation  $d_f$  =  $2.00 \text{ m}$
14. Width of foundation =  $2.00 \text{ m}$

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15. Shape factors

$$S_c = 1.30 \quad S_q = 1.20, \quad S_\gamma = 0.80$$

16. Inclination factors

$$i_c = 1.0, \quad i_q = 1.0, \quad i_\gamma = 1.0$$

17. Depth Factors

$$d_c = 1.226 \quad d_q \text{ \& } d_\gamma = 1.0$$

18. Factor of safety  $f = 3.0$

**Bearing Capacity: -**

$$\begin{aligned} Q_c &= 1/3 [0.2640 \times 6.732 \times 1.226 \times 1.30 \times 1.0 + 0.362 \times (1.691 - 1.0) \times 1.20 \times 1.0 + 0.5 \times 1.82 \\ &\quad \times 2.00 \times 0.556 \times 0.80 \times 1.0 \times 1.0 / 10.0] \\ &= 1/3 [2.833 + 0.302 + 0.081] \text{ Kg/cm}^2 \\ &= 1.072 \text{ Kg/cm}^2 \end{aligned}$$

**8.1.3 Bearing capacity Calculation:**

Governing soil parameter are from bore hole no. 02

1. Angle of internal friction  $\phi = 7^\circ$
2. Cohesion  $C = 0.33 \text{ Kg/cm}^2$
3. Unit weight of soil  $\gamma = 1.82 \text{ gm/cc}$
4. Submerged density. of soil  $\gamma = -$
5. Specific Gravity  $= 2.70$
6. Dry Density  $= 1.62 \text{ gm/cc}$
7. Void ratio  $e_o = 0.67$
8. Condition  $= \text{Medium (Interpolation)}$
9. Bearing Capacity Factor

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Shear Parameters	Nc	Nq	Nr
General Shear failure $e_0 \leq 0.55$	7.230	1.930	0.760
Local Shear failure $> 0.75$	6.400	1.533	0.420
Interpolated value for $e_0 = 0.67$	6.732	1.691	0.556

10. Water Table correction Factor  $w'$  = 1.0
11. Overburden pressure  $q$  at depth 2.00 m = 0.364 Kg/cm<sup>2</sup>
12. Type of foundation = R.C.C. raft foundation
13. Depth of foundation  $d_f$  = 2.00 m
14. Width of foundation = (10.00x10.00) m
15. Shape factors  
 $S_c = 1.30$   $S_q = 1.20$ ,  $S_\gamma = 0.60$
16. Inclination factors  
 $i_c = 1.0$ ,  $i_q = 1.0$ ,  $i_\gamma = 1.0$
17. Depth Factors  
 $d_c = 1.045$   $d_q \text{ \& } d_\gamma = 1.0$
18. Factor of safety  $f = 3.0$

**Bearing Capacity: -**

$$\begin{aligned} Q_c &= 1/3 [0.2640 \times 6.732 \times 1.045 \times 1.30 \times 1.0 + 0.364 \times (1.691 - 1.0) \times 1.2 \times 1.0 + 0.5 \times 1.82 \\ &\quad \times 10.00 \times 0.556 \times 0.60 \times 1.0 \times 1.0 / 10.0] \\ &= 1/3 [2.414 + 0.302 + 0.304] \text{ Kg/cm}^2 \\ &= 1.007 \text{ Kg/cm}^2 \end{aligned}$$

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**8.1.4 Bearing capacity Calculation:**

Governing soil parameter are from bore hole no. 02

1. Angle of internal friction  $\phi$  =  $7^{\circ}$
2. Cohesion C = 0.33 Kg/cm<sup>2</sup>
3. Unit weight of soil  $\gamma$  = 1.82 gm/cc
4. Submerged density. of soil  $\gamma$  = -
5. Specific Gravity = 2.70
6. Dry Density = 1.62 gm/cc
7. Void ratio  $e_0$  = 0.67
8. Condition = Medium (Interpolation)
9. Bearing Capacity Factor

Shear Parameters	Nc	Nq	Nr
General Shear failure $e_0 \leq 0.55$	7.230	1.930	0.760
Local Shear failure $> 0.75$	6.400	1.533	0.420
Interpolated value for $e_0 = 0.67$	6.732	1.691	0.556

10. Water Table correction Factor  $w'$  = 1.0
11. Overburden pressure  $q$  at depth 3.00 m = 0.546 Kg/cm<sup>2</sup>
12. Type of foundation = R.C.C. raft foundation
13. Depth of foundation  $d_f$  = 3.00 m
14. Width of foundation = (10.00x10.00) m
15. Shape factors  
 $S_c = 1.30$     $S_q = 1.20$     $S_\gamma = 0.60$
16. Inclination factors  
 $i_c = 1.0$ ,    $i_q = 1.0$ ,    $i_\gamma = 1.0$
17. Depth Factors  
 $d_c = 1.067$     $d_q \text{ \& } d_\gamma = 1.0$

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18. Factor of safety  $f = 3.0$ **Bearing Capacity: -**

$$\begin{aligned}
 Q_c &= 1/3[0.2640 \times 6.732 \times 1.067 \times 1.30 \times 1.0 + 0.546 \times (1.691 - 1.0) \times 1.2 \times 1.0 + 0.5 \times 1.82 \\
 &\quad \times 10.00 \times 0.556 \times 0.60 \times 1.0 \times 1.0 / 10.0] \\
 &= 1/3 [2.465 + 0.453 + 0.304] \text{ Kg/cm}^2 \\
 &= 1.074 \text{ Kg/cm}^2
 \end{aligned}$$

**8.1.5 Bearing capacity Calculation:**

Governing soil parameter are from bore hole no. 02

1. Angle of internal friction  $\phi = 8^\circ$
2. Cohesion  $C = 0.30 \text{ Kg/cm}^2$
3. Unit weight of soil  $\gamma = 1.83 \text{ gm/cc}$
4. Submerged density. of soil  $\gamma = -$
5. Specific Gravity  $= 2.69$
6. Dry Density  $= 1.62 \text{ gm/cc}$
7. Void ratio  $e_0 = 0.66$
8. Condition  $= \text{Medium (Interpolation)}$
9. Bearing Capacity Factor

Shear Parameters	Nc	Nq	Nr
General Shear failure $e_0 \leq 0.55$	7.610	2.110	0.912
Local Shear failure $> 0.75$	6.620	1.630	0.503
Interpolated value for $e_0 = 0.66$	7.066	1.846	0.687

10. Water Table correction Factor  $w' = 0.95$
11. Overburden pressure  $q$  at depth 4.50 m  $= 0.824 \text{ Kg/cm}^2$
12. Type of foundation  $= \text{R.C.C. raft foundation}$
13. Depth of foundation  $d_f = 4.50 \text{ m}$
14. Width of foundation  $= (10.00 \times 10.00) \text{ m}$
15. Shape factors

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$$S_c = 1.30 \quad S_q = 1.20, \quad S_\gamma = 0.60$$

16. Inclination factors

$$i_c = 1.0, \quad i_q = 1.0, \quad i_\gamma = 1.0$$

17. Depth Factors

$$d_c = 1.103 \quad d_q \text{ \& } d_\gamma = 1.0$$

18. Factor of safety  $f = 3.0$

**Bearing Capacity: -**

$$\begin{aligned} Q_c &= 1/3 [0.2448 \times 7.066 \times 1.103 \times 1.30 \times 1.0 + 0.824 \times (1.846 - 1.0) \times 1.2 \times 1.0 + 0.5 \times 1.83 \\ &\quad \times 10.00 \times 0.687 \times 0.60 \times 1.0 \times 0.95 / 10.0] \\ &= 1/3 [2.480 + 0.836 + 0.358] \text{ Kg/cm}^2 \\ &= 1.225 \text{ Kg/cm}^2 \end{aligned}$$

**8.1.6 Bearing capacity Calculation:**

Governing soil parameter are from bore hole no. 02

1. Angle of internal friction  $\phi = 20^\circ$
2. Cohesion  $C = 0.00 \text{ Kg/cm}^2$
3. Unit weight of soil  $\gamma = 1.75 \text{ gm/cc}$
4. Submerged density. of soil  $\gamma = -$
5. Specific Gravity  $= 2.66$
6. Dry Density  $= 1.53 \text{ gm/cc}$
7. Void ratio  $e_0 = 0.74$
8. Condition  $= \text{Medium (Interpolation)}$
9. Bearing Capacity Factor

Shear Parameters	Nc	Nq	Nr
General Shear failure $e_0 \leq 0.55$	14.830	6.400	5.390
Local Shear failure $> 0.75$	10.260	3.546	2.259
Interpolated value for $e_0 = 0.74$	10.489	3.689	2.416

10. Water Table correction Factor  $w' = 0.875$

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11. Overburden pressure  $q$  at depth 6.00 m = 1.050 Kg/cm<sup>2</sup>
12. Type of foundation = R.C.C. raft foundation
13. Depth of foundation  $d_f$  = 6.00 m
14. Width of foundation = (10.00x10.00) m
15. Shape factors
- $S_c = 1.30$     $S_q = 1.20$ ,    $S_\gamma = 0.60$
16. Inclination factors
- $i_c = 1.0$ ,    $i_q = 1.0$ ,    $i_\gamma = 1.0$
17. Depth Factors
- $d_c = 1.171$     $d_q \text{ \& } d_\gamma = 1.085$
18. Factor of safety  $f = 3.0$

**Bearing Capacity: -**

$$\begin{aligned} Q_c &= 1/3 [0.000 \times 10.489 \times 1.171 \times 1.30 \times 1.0 + 1.050 \times (3.689 - 1.0) \times 1.2 \times 1.085 + 0.5 \times 1.75 \\ &\quad \times 10.00 \times 2.416 \times 0.60 \times 1.085 \times 0.875 / 10.0] \\ &= 1/3 [0.000 + 3.676 + 1.204] \text{ Kg/cm}^2 \\ &= 1.627 \text{ Kg/cm}^2 \end{aligned}$$

**8.1.7 Bearing capacity Calculation:**

Governing soil parameter are from bore hole no. 02

1. Angle of internal friction  $\phi$  = 21°
2. Cohesion  $C$  = 0.00 Kg/cm<sup>2</sup>
3. Unit weight of soil  $\gamma$  = 1.76 gm/cc
4. Submerged density. of soil  $\gamma$  = -
5. Specific Gravity = 2.66
6. Dry Density = 1.52 gm/cc
7. Void ratio  $e_o$  = 0.75
8. Condition = Medium (Interpolation)

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## 9. Bearing Capacity Factor

Shear Parameters	Nc	Nq	Nr
General Shear failure $e_0 \leq 0.55$	16.000	7.250	6.490
Local Shear failure $> 0.75$	10.630	3.757	2.463
Interpolated value for $e_0 = 0.75$	10.630	3.757	2.463

10. Water Table correction Factor  $w'$  = 0.80
11. Overburden pressure  $q$  at depth 7.50 m = 1.320 Kg/cm<sup>2</sup>
12. Type of foundation = R.C.C. raft foundation
13. Depth of foundation  $d_f$  = 7.50 m
14. Width of foundation = (10.00x10.00) m
15. Shape factors  
 $S_c = 1.30$     $S_q = 1.20$ ,    $S_\gamma = 0.60$
16. Inclination factors  
 $i_c = 1.0$ ,    $i_q = 1.0$ ,    $i_\gamma = 1.0$
17. Depth Factors  
 $d_c = 1.218$     $d_q \text{ \& } d_\gamma = 1.109$
18. Factor of safety  $f = 3.0$

### Bearing Capacity: -

$$\begin{aligned}
 Q_c &= \frac{1}{3} [0.000 \times 10.630 \times 1.218 \times 1.30 \times 1.0 + 1.320 \times (3.757 - 1.0) \times 1.2 \times 1.109 + 0.5 \times 1.76 \\
 &\quad \times 10.00 \times 2.463 \times 0.60 \times 1.109 \times 0.80 / 10.0] \\
 &= \frac{1}{3} [0.000 + 4.843 + 1.154] \text{ Kg/cm}^2 \\
 &= 1.999 \text{ Kg/cm}^2
 \end{aligned}$$

## 8.2 BEARING CAPACITY FROM SETTLEMENT CRITERIA:

### Estimation of Settlement:

Bearing Capacity from settlement consideration is the bearing pressure, which restricts the settlement within permissible limits. Bearing capacity as obtained from the previous section is tried first as the bearing pressure to compute the settlement of foundation. If settlement thus obtained is excessive, lower values of bearing pressures are tried. The settlement

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calculation shown below is corresponding to safe bearing pressure. The soil in the effective zone below footing level is non-cohesive soil hence the settlement for both layers has been computed accordingly.

### Settlement of Non - Cohesive soil

Standard penetration resistance at different depths in the effective zone will determine the settlement of sandy strata. S.P.T. values of sandy strata in the effective zone have been corrected for overburden as per I.S. 2131 – 1981

The recorded and corrected S.P.T. values are given below.

Depth below ground level (meter)	Over burden (Kg/cm <sup>2</sup> )	correctio n factor	S.P.T. Value recorded						Lowest Corrected S.P.T. Value	
			Bore hole							
	2	2	1	2	3	4	5	6	2	
3.35-3.80	0.687	1.124	10	8	11	9	10	9	8	8.99
4.85-5.30	0.961	1.015	12	10	12	14	14	12	10	10.15
6.35-6.80	1.223	0.928	14	12	15	15	17	14	12	11.13
7.85-8.30	1.487	0.876	16	14	18	19	19	16	14	12.26
9.35-9.80	1.754	0.820	18	16	20	21	21	18	16	13.12
10.85-11.30	2.021	0.778	21	17	22	24	24	22	17	13.22
12.35-12.80	2.292	0.741	23	19	25	26	27	24	19	14.08
13.85-14.30	2.565	0.704	26	20	27	27	30	26	20	14.08
15.35-15.80	2.706	0.690	27	22	29	30	33	27	22	15.18
16.85-17.30	2.847	0.671	29	24	33	32	36	29	24	16.10
18.35-18.80	2.986	0.652	31	25	34	35	38	31	25	16.30
19.85-20.30	3.122	0.638	33	27	36	38	40	36	27	17.22
21.35-21.80	3.263	0.624	35	29	38	42	42	39	29	18.09
22.85-23.30	3.404	0.610	37	31	40	45	44	42	31	18.91

The average and lowest corrected S.P.T. value is given below.

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S.No.	Average Lowest corrected Value
1	12.83
2	13.89
3	14.61
4	15.32

Lowest average corrected S.P.T. Value have been taken used for analysis

### 8.2.0 BEARING CAPACITY FROM SETTLEMENT FAILURE CRITERIA :

#### Settlement of Cohesive soil at 1.20 m Depth

Description	Calculation
Thickness of compressible layer	1.80
Mid depth of clay layer	0.90
Pressure at foundation level	0.216
Po original pressure at mid depth	0.378
Net safe bearing capacity	1.050
Change pressure at foundation level	0.834
Influence factor	0.688
Change pressure at mid layer	0.574
$P_0 + \Delta P / P_0$	2.517
$\log P_0 + \Delta P / P_0$	0.400
Void ratio $e_0$	0.68
Compression Index $C_c$	0.130
Settlement	5.57
Depth factor	0.95
Settlement after applying rigidity & depth factor	4.233

The settlement is less than permissible limit 7.5 cm as per I.S: 1904 - 1986.

Then safe Bearing capacity 10.50 t/m<sup>2</sup>.

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### 8.2.1 BEARING CAPACITY FROM SETTLEMENT FAILURE CRITERIA :

#### Settlement of Cohesive soil at 1.50 m Depth

Description	Calculation
Thickness of compressible layer	2.25
Mid depth of clay layer	1.125
Pressure at foundation level	0.270
Po original pressure at mid depth	0.473
Net safe bearing capacity	1.065
Change pressure at foundation level	0.795
Influence factor	0.688
Change pressure at mid layer	0.547
$P_0 + \Delta P / P_0$	2.158
$\log P_0 + \Delta P / P_0$	0.334
Void ratio $e_0$	0.68
Compression Index $C_c$	0.130
Settlement	5.82
Depth factor	0.95
Settlement after applying rigidity & depth factor	4.423

The settlement is less than permissible limit 7.5 cm as per I.S: 1904 - 1986.

Then safe Bearing capacity 10.65 t/m<sup>2</sup>.

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## 8.2.2 BEARING CAPACITY FROM SETTLEMENT FAILURE CRITERIA :

### Settlement of Cohesive soil at 2.00 m Depth

Description	Calculation
Thickness of compressible layer	3.00
Mid depth of clay layer	1.50
Pressure at foundation level	0.364
Po original pressure at mid depth	0.637
Net safe bearing capacity	1.072
Change pressure at foundation level	0.708
Influence factor	0.688
Change pressure at mid layer	0.487
$P_0 + \Delta P / P_0$	1.764
$\log P_0 + \Delta P / P_0$	0.246
Void ratio $e_0$	0.67
Compression Index $C_c$	0.127
Settlement	5.60
Depth factor	0.95
Settlement after applying rigidity & depth factor	4.256

The settlement is less than permissible limit 7.5 cm as per I.S: 1904 - 1986.

Then safe Bearing capacity 10.72 t/m<sup>2</sup>.

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### **8.2.2 Settlement of Non - Cohesive soil:**

Settlement of a footing with width 'B' under unit intensity of pressure resting on cohesion less deposit with known standard penetration test values can be determine from I.S. 8009: 1981  
The settlement of any other pressure is computed by assuming that the settlement is proportional to the intensity of pressure

- (i) Thus, the settlement for unit pressure for the lowest corrected S.P.T. value and for 1.007 Kg/Sqcm<sup>2</sup>. as the allowable pressure for 2.00 m depth with R.C.C. Raft foundation of size (10.00x10.00) m is given below:

Type of Foundation	=	R.C.C. Raft Foundation
Lowest corrected value	=	12.83
Settlement for unit pressure	=	2.9256 cm.
Settlement for 1.007 Kg/sqcm <sup>2</sup>	=	2.946 cm.
Settlement after applying rigidity factor	=	2.356 cm.

The settlement is within permissible limit as per I.S: 1904 – 1986

Then safe Bearing capacity 10.07 t/m<sup>2</sup>.

- (ii) Thus, the settlement for unit pressure for the lowest corrected S.P.T. value and for 1.074 Kg/Sqcm<sup>2</sup>. as the allowable pressure for 3.00 m depth with R.C.C. Raft foundation of size (10.00x10.00) m is given below:

Type of Foundation	=	R.C.C. Raft Foundation
Lowest corrected value	=	12.83
Settlement for unit pressure	=	2.9256 cm.
Settlement for 1.074 Kg/sqcm <sup>2</sup>	=	3.142 cm.
Settlement after applying rigidity factor	=	2.513 cm.

The settlement is within permissible limit as per I.S: 1904 – 1986

Then safe Bearing capacity 10.74 t/m<sup>2</sup>.

(iii) Thus, the settlement for unit pressure for the lowest corrected S.P.T. value and for 1.225 Kg/Sqcm<sup>2</sup>. as the allowable pressure for 4.50 m depth with R.C.C. Raft foundation of size (10.00x10.00) m is given below:

Type of Foundation	=	R.C.C. Raft Foundation
Lowest corrected value	=	13.89
Settlement for unit pressure	=	2.6282 cm.
Settlement for 1.225 Kg/sqcm <sup>2</sup>	=	3.219 cm.
Settlement after applying rigidity factor	=	2.575 cm.

The settlement is within permissible limit as per I.S: 1904 – 1986

Then safe Bearing capacity 12.25 t/m<sup>2</sup>.

(iv) Thus, the settlement for unit pressure for the lowest corrected S.P.T. value and for 1.627 Kg/Sqcm<sup>2</sup>. as the allowable pressure for 6.00 m depth with R.C.C. Raft foundation of size (10.00x10.00) m is given below:

Type of Foundation	=	R.C.C. Raft Foundation
Lowest corrected value	=	14.61
Settlement for unit pressure	=	2.3994 cm.
Settlement for 1.627 Kg/sqcm <sup>2</sup>	=	3.903 cm.
Settlement after applying rigidity factor	=	3.123 cm.

The settlement is within permissible limit as per I.S: 1904 – 1986

Then safe Bearing capacity 16.27 t/m<sup>2</sup>.

(v) Thus, the settlement for unit pressure for the lowest corrected S.P.T. value and for 1.999 Kg/Sqcm<sup>2</sup>. as the allowable pressure for 7.50 m depth with R.C.C. Raft foundation of size (10.00x10.00) m is given below:

Type of Foundation	=	R.C.C. Raft Foundation
Lowest corrected value	=	15.32
Settlement for unit pressure	=	2.1992 cm.
Settlement for 1.999 Kg/sqcm <sup>2</sup>	=	4.396 cm.
Settlement after applying rigidity factor	=	3.517 cm.

The settlement is within permissible limit as per I.S: 1904 – 1986

Then safe Bearing capacity 19.99 t/m<sup>2</sup>.

#### **9.0 SAFE LOAD FROM ULTIMATE LOAD CAPACITY:**

The Ultimate bearing capacity of pile can be calculated from soil properties as per IS: 2911 (Part-I /Sec 2)-2010. The soil properties required are strength properties, cohesion, angle of internal friction and soil density. If these properties are not available directly from laboratory and field tests, they may be indirectly obtained from in situ penetration test data.

#### **STATIC FORMULA: -**

(A) Clayey soil: -

The ultimate bearing capacity of pile in cohesive soil may be worked out from the following formula: -

n

$$Q_u = A_p \cdot N_c \cdot C_p + \sum \alpha_i \cdot C_i \cdot A_{si}$$

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$$i=1.$$

Where

$Q_u$  = Ultimate bearing capacity of pile (Kg.).

$A_p$  = Cross sectional area of pile stem at toe Level (Cm<sup>2</sup>).

$N_c$  = Bearing Capacity Factor Usually taken as (9.0).

$C_p$  = Average Cohesion at pile tip (Kg/ Cm<sup>2</sup>).

$\alpha_i$  = Adhesion factor = 1.0

$C_i$  = Average Cohesion throughout the length of pile (Kg/ Cm<sup>2</sup>).

$A_{si}$  = Surface area of the pile shaft (Cm<sup>2</sup>).

(B) For Sandy Soil: -

The ultimate bearing capacity of pile in non-cohesive soil may be worked out from the following formula: -

$$Q_u = A_p (0.50 \cdot \gamma \cdot D \cdot N_r + P_D \cdot N_q) + \sum_{i=1}^n K \cdot P_{Di} \cdot \tan \delta \cdot A_{si}$$

$$i=1$$

Where

$A_p$  = Cross-sectional area of pile toe in cm<sup>2</sup>.

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$D$  = Stem diameter in cm.

$\gamma$  = Effective unit weight of soil at pile toe  $\text{Kgf/Cm}^3$ .

$P_D$  = Effective over burden pressure at pile toe  $\text{Kgf/Cm}^2$ .

$N_q \& N_r$  = Bearing Capacity Factors depending upon the angle of internal friction  $\Phi$  at toe.

$K$  = Earth pressure coefficient

$\delta$  = Angle of wall friction (may be taken equal to the angle of internal friction of soil).

$n$

$\Sigma$  = Summation for  $n$  layers which piles is installed

$i=1$

$P_{Di}$  = Effective over burden pressure in  $\text{Kgf/Cm}^2$  for the  $i^{\text{th}}$  layer where  $i$  varies from 1 to  $n$ .

$A_{si}$  = Surface area of the pile stem in  $\text{Cm}^2$  in the  $i^{\text{th}}$  layer where  $i$  varies from 1 to  $n$ .

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The soil strata comprise of cohesion & non cohesion soil the safe load may be estimated using clayey & sandy soil formula and tabulated below.

Length of pile

= 15.0m

Dia of pile

= 0.50m

Depth (m)	Ap (cm <sup>2</sup> )	Nc	c <sub>p</sub> (kg/cm <sup>2</sup> )	α	c <sub>i</sub> (kg/cm <sup>2</sup> )	As / Asi (cm <sup>2</sup> )	D (cm)	Y	P <sub>d</sub>	N <sub>q</sub>	N <sub>r</sub>	K	P <sub>di</sub>	φ	Qu		F.O.C.	Safe load on pile (tone)
															(Kg)	(Tone)		
1.50	1962.5	9	0.37	1	0.37	23550	50.0	-	-	-	-	-	-	-	15248.63	15.25	2.50	6.10
1.50	1962.5	9	0.33	1	0.33	23550	50.0	-	-	-	-	-	-	-	13600.13	13.60	2.50	5.44
1.50	1962.5	9	0.30	1	0.30	23550	50.0	-	-	-	-	-	-	-	12363.75	12.36	2.50	4.95
1.50	1962.5	-	-	1	-	23550	50.0	0.0175	0.262	3.689	2.416	1.5	0.262	20	5476.4	5.4764	2.50	2.19
1.50	1962.5	-	-	1	-	23550	50.0	0.0176	0.264	3.757	2.463	1.5	0.264	21	5732.8	5.7328	2.50	2.29
1.50	1962.5	-	-	1	-	23550	50.0	0.0178	0.267	3.757	2.463	1.5	0.267	21	5798.4	5.7984	2.50	2.32
1.50	1962.5	-	-	1	-	23550	50.0	0.0178	0.267	3.831	2.572	1.5	0.267	20	5715.1	5.7151	2.50	2.29
1.50	1962.5	-	-	1	-	23550	50.0	0.0181	0.271	3.689	2.416	1.5	0.271	20	5665.6	5.6656	2.50	2.27
1.50	1962.5	-	-	1	-	23550	50.0	0.0182	0.273	3.757	2.463	1.5	0.273	21	5929.5	5.9295	2.50	2.37
1.50	1962.5	-	-	1	-	23550	50.0	0.0094	0.141	6.441	5.63	1.5	0.141	26	5038.9	5.0389	2.50	2.02
Total length= 15.0m			Dia of Pile= 500mm												Total Safe load		32.23	

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## 9.02 Calculation

The soil strata comprise of cohesion & non cohesive soil the safe load may be estimated using clayey & sandy soil formula and tabulated below.

Length of pile

= 15.0m

Dia of pile

= 0.60m

Depth (m)	Ap (cm <sup>2</sup> )	Nc	c <sub>p</sub> (kg/cm <sup>2</sup> )	α	c <sub>i</sub> (kg/cm <sup>2</sup> )	As / Asi (cm <sup>2</sup> )	D (cm)	Y	P <sub>d</sub>	N <sub>q</sub>	N <sub>r</sub>	K	P <sub>di</sub>	ø	Qu		F.O.C.	Safe load on pile (tone)
															(Kg)	(Tone)		
1.50	2826	9	0.37	1	0.37	28260	60.0	-	-	-	-	-	-	-	19866.78	19.87	2.50	7.95
1.50	2826	9	0.33	1	0.33	28260	60.0	-	-	-	-	-	-	-	17719.02	17.72	2.50	7.09
1.50	2826	9	0.30	1	0.30	28260	60.0	-	-	-	-	-	-	-	16108.20	16.11	2.50	6.44
1.50	2826	-	-	1	-	28260	60.0	0.0175	0.262	3.689	2.416	1.5	0.262	20	7674.9	7.6749	2.50	3.07
1.50	2826	-	-	1	-	28260	60.0	0.0176	0.264	3.757	2.463	1.5	0.264	21	8010.6	8.0106	2.50	3.20
1.50	2826	-	-	1	-	28260	60.0	0.0178	0.267	3.757	2.463	1.5	0.267	21	8102.2	8.1022	2.50	3.24
1.50	2826	-	-	1	-	28260	60.0	0.0178	0.267	3.831	2.572	1.5	0.267	20	8052.6	8.0526	2.50	3.22
1.50	2826	-	-	1	-	28260	60.0	0.0181	0.271	3.689	2.416	1.5	0.271	20	7940.1	7.9401	2.50	3.18
1.50	2826	-	-	1	-	28260	60.0	0.0182	0.273	3.757	2.463	1.5	0.273	21	8285.4	8.2854	2.50	3.31
1.50	2826	-	-	1	-	28260	60.0	0.0094	0.141	6.441	5.63	1.5	0.141	26	7421.6	7.4216	2.50	2.97
Total length= 15.0m`							Dia of Pile= 600mm							Total Safe load		43.67		

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The soil strata comprise of cohesion & non cohesive soil the safe load may be estimated using clayey & sandy soil formula and tabulated below.

Length of pile

= 15.0m

Dia of pile

= 0.70m

Depth (m)	Ap (cm <sup>2</sup> )	Nc	Cp (kN/cm <sup>2</sup> )	$\alpha$	Ci (kN/cm <sup>2</sup> )	As / Asi (cm <sup>2</sup> )	D (cm)	Y	Pd	Nq	Nr	K	Pdi	$\phi$	Qu		F.O.C.	Safe load on pile (tone)
															(Kg)	(Tone)		
1.50	3846.5	9	0.37	1	0.37	32970	70.0	-	-	-	-	-	-	-	25007.75	25.01	2.50	10.00
1.50	3846.5	9	0.33	1	0.33	32970	70.0	-	-	-	-	-	-	-	22304.21	22.30	2.50	8.92
1.50	3846.5	9	0.30	1	0.30	32970	70.0	-	-	-	-	-	-	-	20276.55	20.28	2.50	8.11
1.50	3846.5	-	-	1	-	32970	70.0	0.0175	0.262	3.689	2.416	1.5	0.262	20	10473.5	10.4735	2.50	4.19
1.50	3846.5	-	-	1	-	32970	70.0	0.0176	0.264	3.757	2.463	1.5	0.264	21	10903.6	10.9036	2.50	4.36
1.50	3846.5	-	-	1	-	32970	70.0	0.0178	0.267	3.757	2.463	1.5	0.267	21	11028.3	11.0283	2.50	4.41
1.50	3846.5	-	-	1	-	32970	70.0	0.0178	0.267	3.831	2.572	1.5	0.267	20	11039.9	11.0399	2.50	4.42
1.50	3846.5	-	-	1	-	32970	70.0	0.0181	0.271	3.689	2.416	1.5	0.271	20	10835.2	10.8352	2.50	4.33
1.50	3846.5	-	-	1	-	32970	70.0	0.0182	0.273	3.757	2.463	1.5	0.273	21	11277.7	11.2777	2.50	4.51
1.50	3846.5	-	-	1	-	32970	70.0	0.0094	0.141	6.441	5.63	1.5	0.141	26	10553.5	10.5535	2.50	4.22
Total length= 15.0m							Dia of Pile= 700mm							Total Safe load		57.48		

**CONSULTANTS****AIRY BE CREATIVE CONSULTANTS (OPC) PRIVATE LIMITED**

OFFICE ADDRESS : C-1074/75, SECTOR -B, MAHANAGAR, LUCKNOW-226006, LAB ADDRESS HOUSE NO.- TEMP-68, SAHEED

BHAGAT SING WARD-1(146) KANCHANPUR MATIYARI, KAMTA, LUCKNOW, PH NO.: 0522- 3639933, 09451371403,

07275268881, E-Mail ID :- [abcsoillab@gmail.com](mailto:abcsoillab@gmail.com), [abccconsultants2006@gmail.com](mailto:abccconsultants2006@gmail.com).

CIN: U71200UP20230PC194892A

GST NO.: 9AAZCA9203H1Z6

ISO/ ICE 17025 ACCREDITED LABORATORY  
(NABL ACCREDITED LAB)**ABC CONSULTANTS**GEO-TECHNICAL INVESTIGATION, SOIL/ MATERIAL/  
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The soil strata comprise of cohesion & non cohesive soil the safe load may be estimated using clayey & sandy soil formula and tabulated below.

Length of pile

= 18.0m

Dia of pile

= 0.50m

Depth (m)	Ap (cm <sup>2</sup> )	Nc	c <sub>p</sub> (kg/cm <sup>2</sup> )	α	c <sub>i</sub> (kg/cm <sup>2</sup> )	As / Asi (cm <sup>2</sup> )	D (cm)	Y	P <sub>d</sub>	N <sub>q</sub>	N <sub>r</sub>	K	P <sub>di</sub>	φ	Qu		F.O.C.	Safe load on pile (tone)
															(Kg)	(Tone)		
1.50	1962.5	9	0.37	1	0.37	23550	50.0	-	-	-	-	-	-	-	15248.63	15.25	2.50	6.10
1.50	1962.5	9	0.33	1	0.33	23550	50.0	-	-	-	-	-	-	-	13600.13	13.60	2.50	5.44
1.50	1962.5	9	0.30	1	0.30	23550	50.0	-	-	-	-	-	-	-	12363.75	12.36	2.50	4.95
1.50	1962.5	-	-	1	-	23550	50.0	0.0175	0.262	3.689	2.416	1.5	0.262	20	5476.4	5.4764	2.50	2.19
1.50	1962.5	-	-	1	-	23550	50.0	0.0176	0.264	3.757	2.463	1.5	0.264	21	5732.8	5.7328	2.50	2.29
1.50	1962.5	-	-	1	-	23550	50.0	0.0178	0.267	3.757	2.463	1.5	0.267	21	5798.4	5.7984	2.50	2.32
1.50	1962.5	-	-	1	-	23550	50.0	0.0178	0.267	3.831	2.572	1.5	0.267	20	5715.1	5.7151	2.50	2.29
1.50	1962.5	-	-	1	-	23550	50.0	0.0181	0.271	3.689	2.416	1.5	0.271	20	5665.6	5.6656	2.50	2.27
1.50	1962.5	-	-	1	-	23550	50.0	0.0182	0.273	3.757	2.463	1.5	0.273	21	5929.5	5.9295	2.50	2.37
1.50	1962.5	-	-	1	-	23550	50.0	0.0094	0.141	6.441	5.63	1.5	0.141	26	5038.9	5.0389	2.50	2.02
1.50	1962.5	-	-	1	-	23550	50.0	0.094	0.141	5.763	4.742	1.5	0.141	26	4627.6	4.6276	2.50	1.85
1.50	1962.5	-	-	1	-	23550	50.0	0.093	0.139	5.424	4.298	1.5	0.139	26	4366.1	4.3661	2.50	1.75
Total length= 18.0m`							Dia of Pile= 500mm					Total Safe load				35.83		

**CONSULTANTS****AIRY BE CREATIVE CONSULTANTS (OPC) PRIVATE LIMITED**

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BHAGAT SING WARD-1(146) KANCHANPUR MATIYARI, KAMTA, LUCKNOW, PH NO.: 0522- 3639933, 09451371403,

07275268881, E-Mail ID :- [abcsoillab@gmail.com](mailto:abcsoillab@gmail.com), [abcconsultants2006@gmail.com](mailto:abcconsultants2006@gmail.com).

CIN: U71200UP20230PC194892A

GST NO.: 9AAZCA9203H1Z6

ISO/ ICE 17025 ACCREDITED LABORATORY  
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The soil strata comprise of cohesion & non cohesive soil the safe load may be estimated using clayey & sandy soil formula and tabulated below.

Length of pile = 18.0m

Dia of pile = 0.60m

Depth (m)	Ap (cm <sup>2</sup> )	Nc	Cp (N/m <sup>2</sup> )	$\alpha$	C (N/m <sup>2</sup> )	As / Asi (cm <sup>2</sup> )	D (cm)	Y	Pd	Nq	Nr	K	Pdi	$\phi$	Qu		F.O.C.	Safe load on pile (tone)
															(Kg)	(Tone)		
1.50	2826	9	0.37	1	0.37	28260	60.0	-	-	-	-	-	-	-	19866.78	19.87	2.50	7.95
1.50	2826	9	0.33	1	0.33	28260	60.0	-	-	-	-	-	-	-	17719.02	17.72	2.50	7.09
1.50	2826	9	0.30	1	0.30	28260	60.0	-	-	-	-	-	-	-	16108.20	16.11	2.50	6.44
1.50	2826	-	-	1	-	28260	60.0	0.0175	0.262	3.689	2.416	1.5	0.262	20	7674.9	7.6749	2.50	3.07
1.50	2826	-	-	1	-	28260	60.0	0.0176	0.264	3.757	2.463	1.5	0.264	21	8010.6	8.0106	2.50	3.20
1.50	2826	-	-	1	-	28260	60.0	0.0178	0.267	3.757	2.463	1.5	0.267	21	8102.2	8.1022	2.50	3.24
1.50	2826	-	-	1	-	28260	60.0	0.0178	0.267	3.831	2.572	1.5	0.267	20	8052.6	8.0526	2.50	3.22
1.50	2826	-	-	1	-	28260	60.0	0.0181	0.271	3.689	2.416	1.5	0.271	20	7940.1	7.9401	2.50	3.18
1.50	2826	-	-	1	-	28260	60.0	0.0182	0.273	3.757	2.463	1.5	0.273	21	8285.4	8.2854	2.50	3.31
1.50	2826	-	-	1	-	28260	60.0	0.0094	0.141	6.441	5.63	1.5	0.141	26	7421.6	7.4216	2.50	2.97
1.50	2826	-	-	1	-	28260	60.0	0.094	0.141	5.763	4.742	1.5	0.141	26	6711.4	6.7114	2.50	2.68
1.50	2826	-	-	1	-	28260	60.0	0.093	0.139	5.424	4.298	1.5	0.139	26	6278.1	6.2781	2.50	2.51
Total length= 18.0m						Dia of Pile= 600mm						Total Safe load				48.87		

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07275268881, E-Mail ID :- [abcsoillab@gmail.com](mailto:abcsoillab@gmail.com), [abccconsultants2006@gmail.com](mailto:abccconsultants2006@gmail.com).



CIN: U71200UP20230PC194892A

GST NO.: 9AAZCA9203H1Z6

ISO/ ICE 17025 ACCREDITED LABORATORY  
(NABL ACCREDITED LAB)**ABC CONSULTANTS**GEO-TECHNICAL INVESTIGATION, SOIL/ MATERIAL/  
WATER CONSULTANTS AND CIVIL ENGINEERING PROJECT**9.06 Calculation**

The soil strata comprise of cohesion & non cohesive soil the safe load may be estimated using clayey & sandy soil formula and tabulated below.

Length of pile = 18.0m

Dia of pile = 0.70m

Depth (m)	Ap (cm <sup>2</sup> )	Nc	c <sub>p</sub> (kg/cm <sup>2</sup> )	α	c <sub>i</sub> (kg/cm <sup>2</sup> )	As / Asi (cm <sup>2</sup> )	D (cm)	Y	P <sub>d</sub>	N <sub>q</sub>	N <sub>r</sub>	K	P <sub>di</sub>	Ø	Qu		F.O.C.	Safe load on pile (tone)
															(Kg)	(Tone)		
1.50	3846.5	9	0.37	1	0.37	32970	70.0	-	-	-	-	-	-	-	25007.75	25.01	2.50	10.00
1.50	3846.5	9	0.33	1	0.33	32970	70.0	-	-	-	-	-	-	-	22304.21	22.30	2.50	8.92
1.50	3846.5	9	0.30	1	0.30	32970	70.0	-	-	-	-	-	-	-	20276.55	20.28	2.50	8.11
1.50	3846.5	-	-	1	-	32970	70.0	0.0175	0.262	3.689	2.416	1.5	0.262	20	10473.5	10.4735	2.50	4.19
1.50	3846.5	-	-	1	-	32970	70.0	0.0176	0.264	3.757	2.463	1.5	0.264	21	10903.6	10.9036	2.50	4.36
1.50	3846.5	-	-	1	-	32970	70.0	0.0178	0.267	3.757	2.463	1.5	0.267	21	11028.3	11.0283	2.50	4.41
1.50	3846.5	-	-	1	-	32970	70.0	0.0178	0.267	3.831	2.572	1.5	0.267	20	11039.9	11.0399	2.50	4.42
1.50	3846.5	-	-	1	-	32970	70.0	0.0181	0.271	3.689	2.416	1.5	0.271	20	10835.2	10.8352	2.50	4.33
1.50	3846.5	-	-	1	-	32970	70.0	0.0182	0.273	3.757	2.463	1.5	0.273	21	11277.7	11.2777	2.50	4.51
1.50	3846.5	-	-	1	-	32970	70.0	0.0094	0.141	6.441	5.63	1.5	0.141	26	10553.5	10.5535	2.50	4.22
1.50	3846.5	-	-	1	-	32970	70.0	0.094	0.141	5.763	4.742	1.5	0.141	26	9426.3	9.4263	2.50	3.77
1.50	3846.5	-	-	1	-	32970	70.0	0.093	0.139	5.424	4.298	1.5	0.139	26	8756.0	8.7560	2.50	3.50
Total length= 18.0m			Dia of Pile= 700mm												Total Safe load		64.76	

**CONSULTANTS****AIRY BE CREATIVE CONSULTANTS (OPC) PRIVATE LIMITED**

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BHAGAT SING WARD-1(146) KANCHANPUR MATIYARI, KAMTA, LUCKNOW, PH NO.: 0522- 3639933, 09451371403,

07275268881, E-Mail ID :- [abcsoillab@gmail.com](mailto:abcsoillab@gmail.com), [abccconsultants2006@gmail.com](mailto:abccconsultants2006@gmail.com).

## 10.0 RECOMMENDATION:

- 10.1 The soil strata are effective zone comprises of cohesive & non-cohesive layers. The design load has therefore to ensure safety against failure due to shear failure.
- 10.2 The water table was met at about of 12.00 m depth below existing ground level. Water is expected 1.00 m rise in post monsoon period. Accordingly, water table is assuming 11.00 m for calculation purpose.
- 10.3 The values of net safe bearing capacity for Isolated / R.C.C. Raft foundation below existing ground level are tabulated below: -

S. L. No.	Depth (m)	Type of foundation	Width of foundation (m)	Allowable Bearing Capacity	
				Kg/cm <sup>2</sup>	T/m <sup>2</sup>
1	1.20	Isolated foundation	1.20	1.050	10.50
2	1.50		1.50	1.065	10.65
3	2.00		2.00	1.072	10.72
4	2.00	R.C.C. Raft foundation	(10.00x10.00)	1.007	10.07
5	3.00			1.074	10.74
6	4.50			1.225	12.25
7	6.00			1.627	16.27
8	7.50			1.999	19.99

The 'CI' group soil is found in the effective zone below footing level. Accordingly, plinth beam, lintel beam and apron all around the structure will be provided.

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10.4 The safe load on pile is calculated as per I IS: 2911 (Part-I /Sec 2)-2010. As per Static formula calculations are assumed for design and tabulated below

Length of Pile(m)	Dia of Pile (cm)	Safe Load On Pile (Tone)
15.00	50.0	32.23
	60.0	43.67
	70.0	57.48
18.00	50.0	35.83
	60.0	48.87
	70.0	64.76

**Final design diameter & length of pile etc. will depend on incoming loads and capacity of piles, as determine by load test at site.**

The above recommendations are based on the field investigation data and the laboratory test result of the sample collected from site and our experience in this regard.

If the actual sub – soil condition during excavation for foundation differs from that has been reported a reference should be made to us for suggestion.



**ABC CONSULTANTS**  
(Soil Investigations and Laboratory Works)

Authorized Signatory

## AIRY BE CREATIVE CONSULTANTS (OPC) PRIVATE LIMITED

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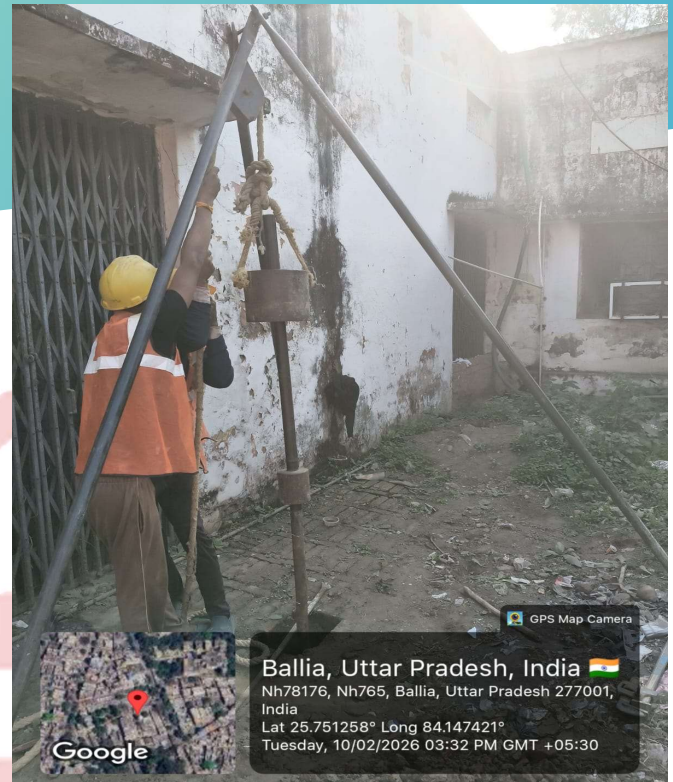
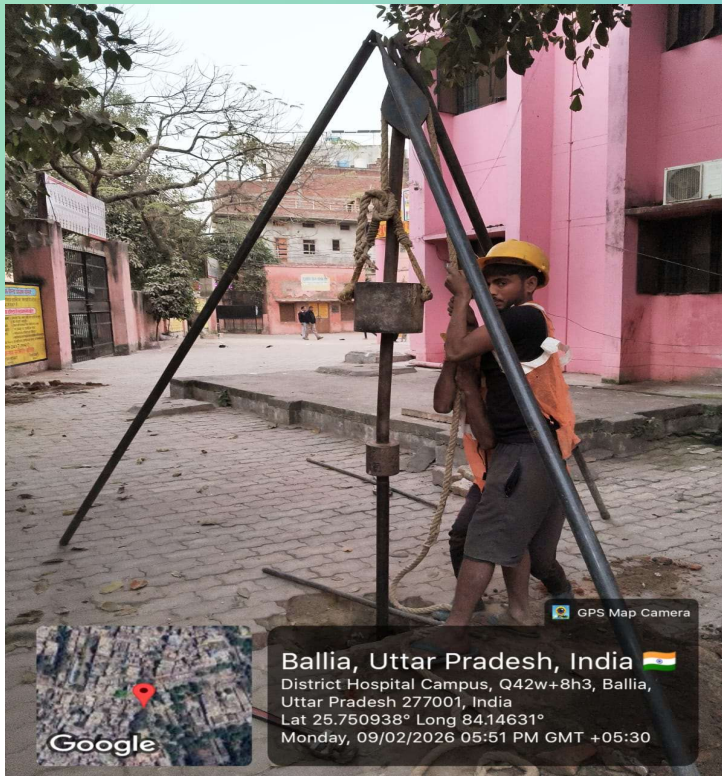
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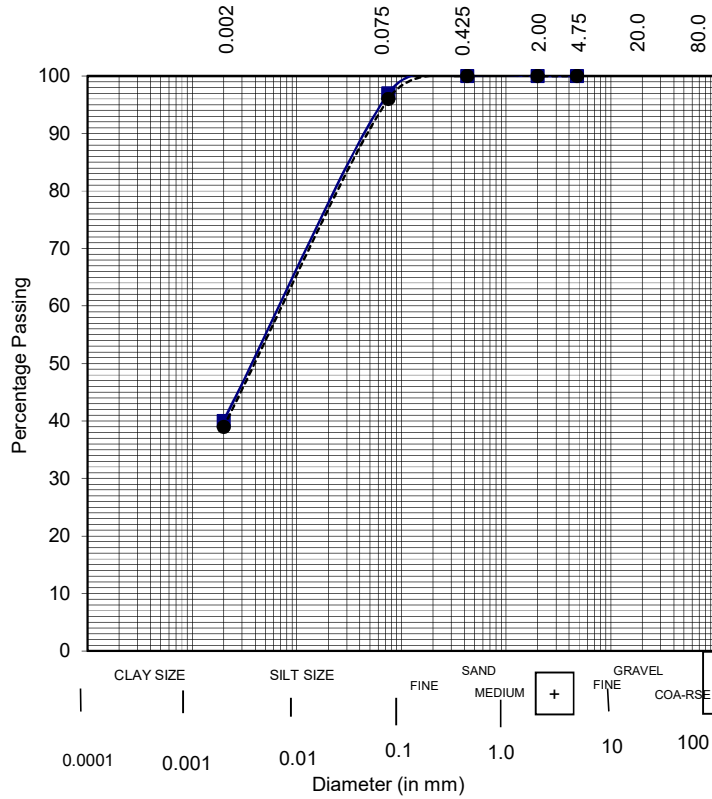
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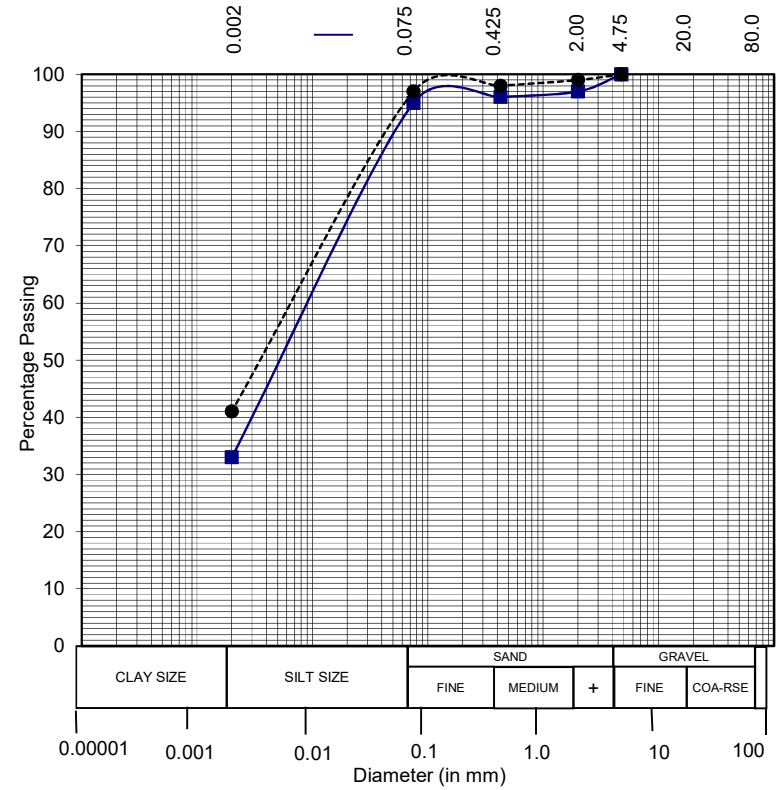
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Depth



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Bore Hole No. 1  
Depth





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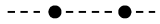
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Bore Hole No. 1

Depth



6.00-6.35



7.50-7.85

Bore Hole No. 1

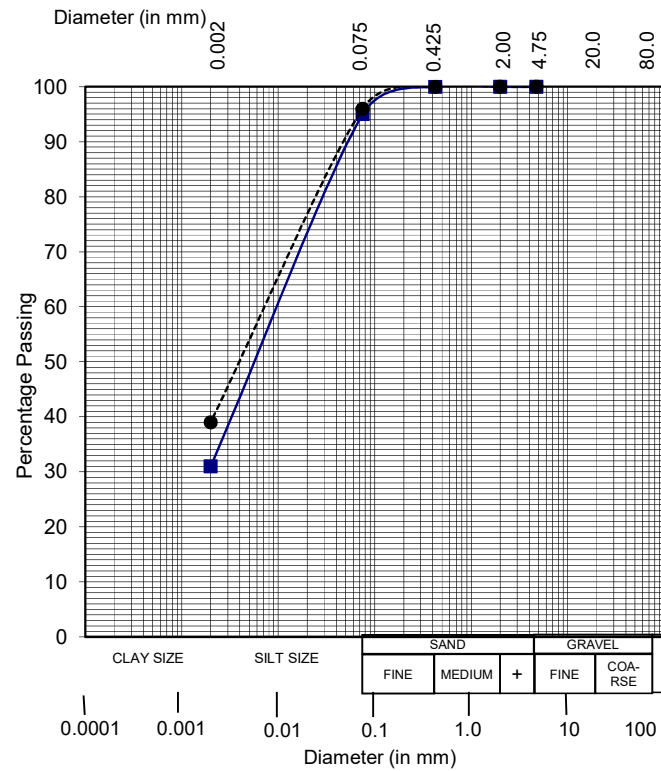
Depth



9.00-9.35



10.50-10.85



## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 1

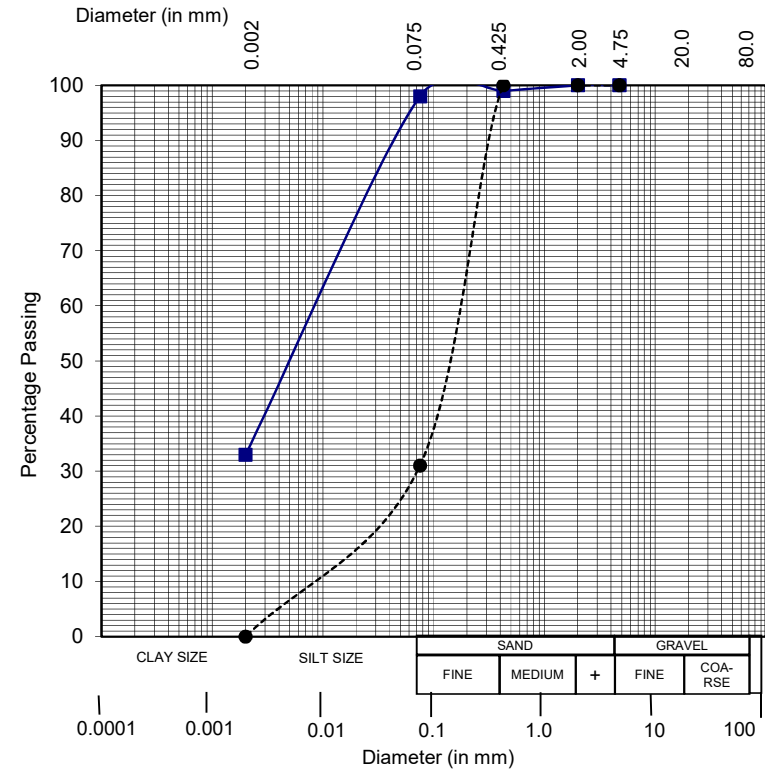
Depth



9.00-9.35



10.50-10.85



## ABC CONSULTANTS

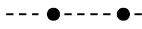
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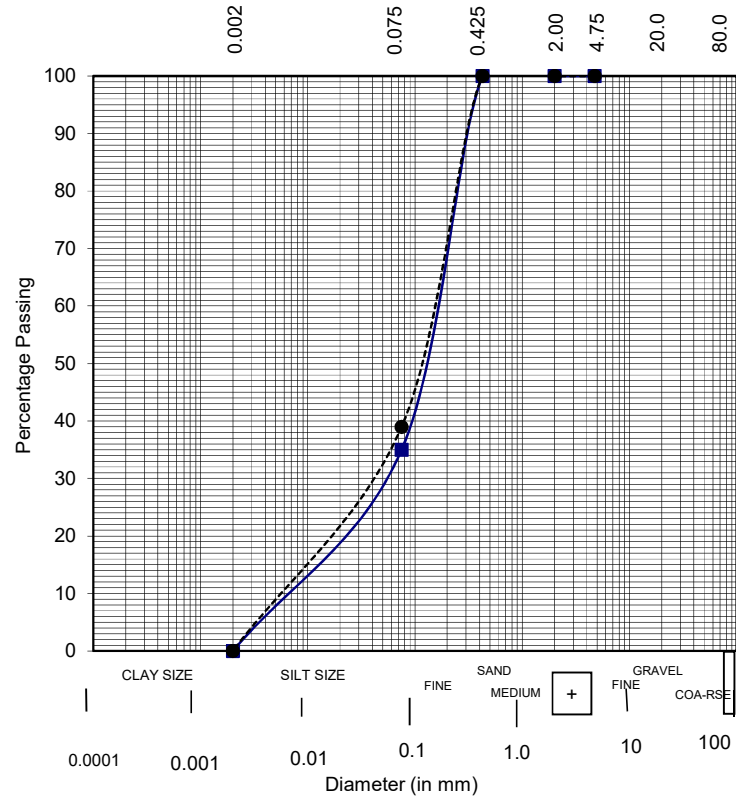
Depth



12.00-12.35



13.50-13.85



## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 1

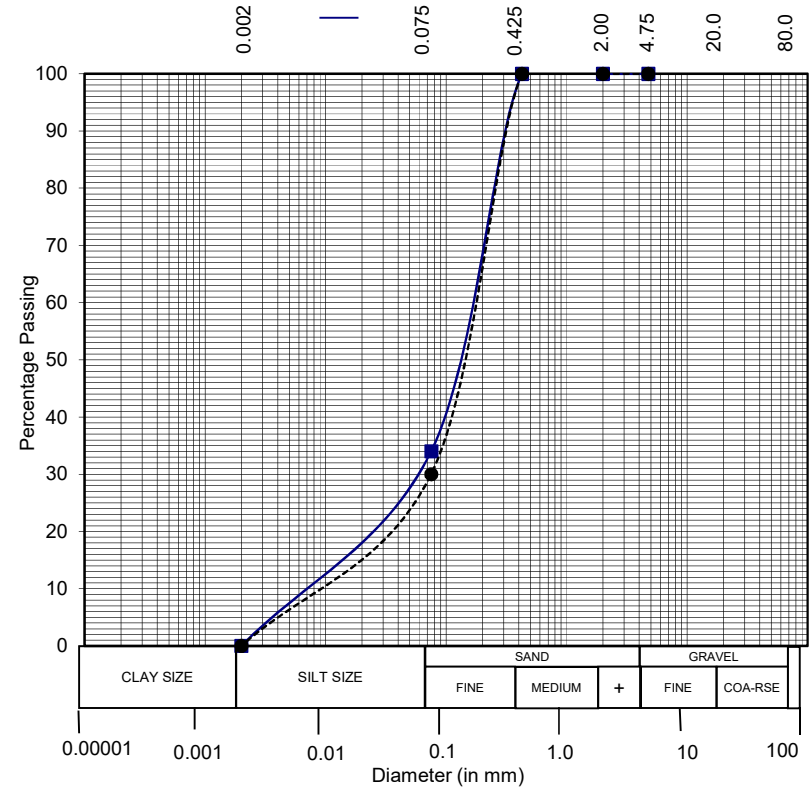
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15.00-15.35



16.50-16.85

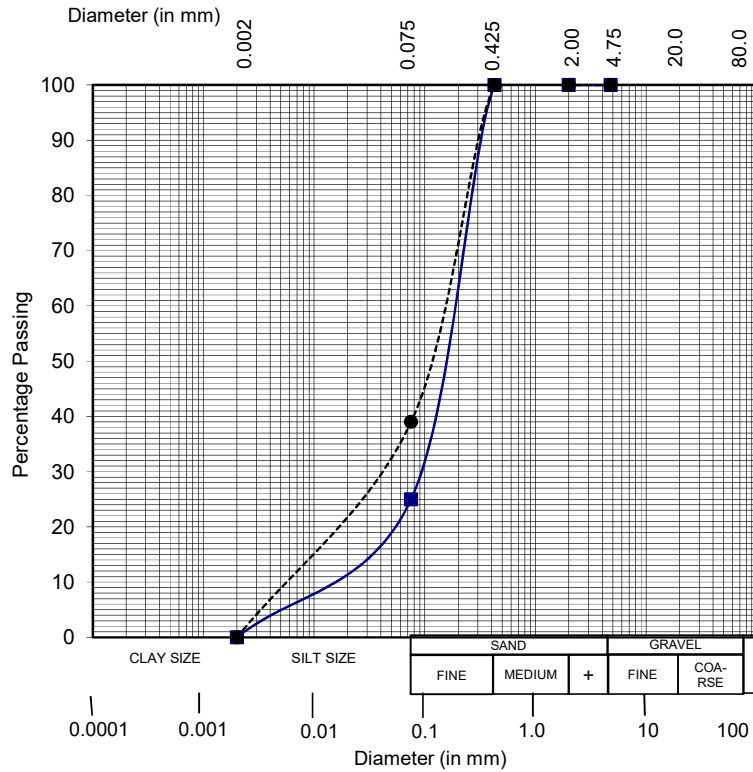


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OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 1

Depth

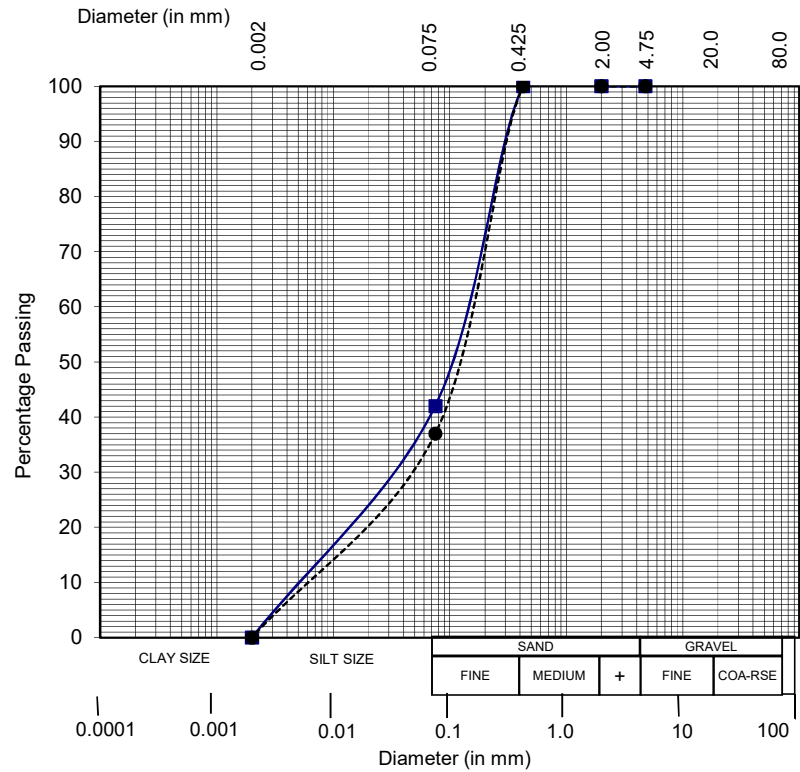


## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 1

Depth

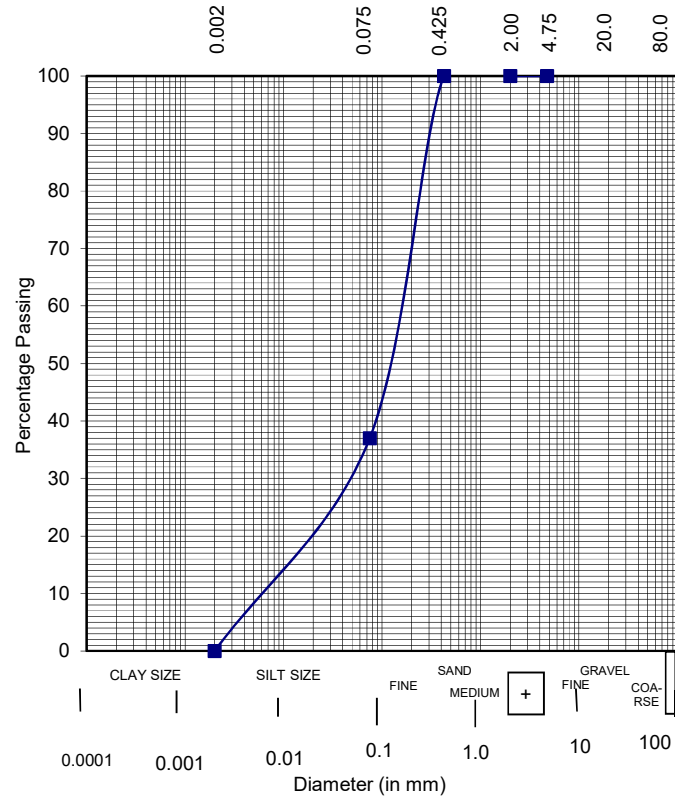


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Bore Hole No. 1  
Depth

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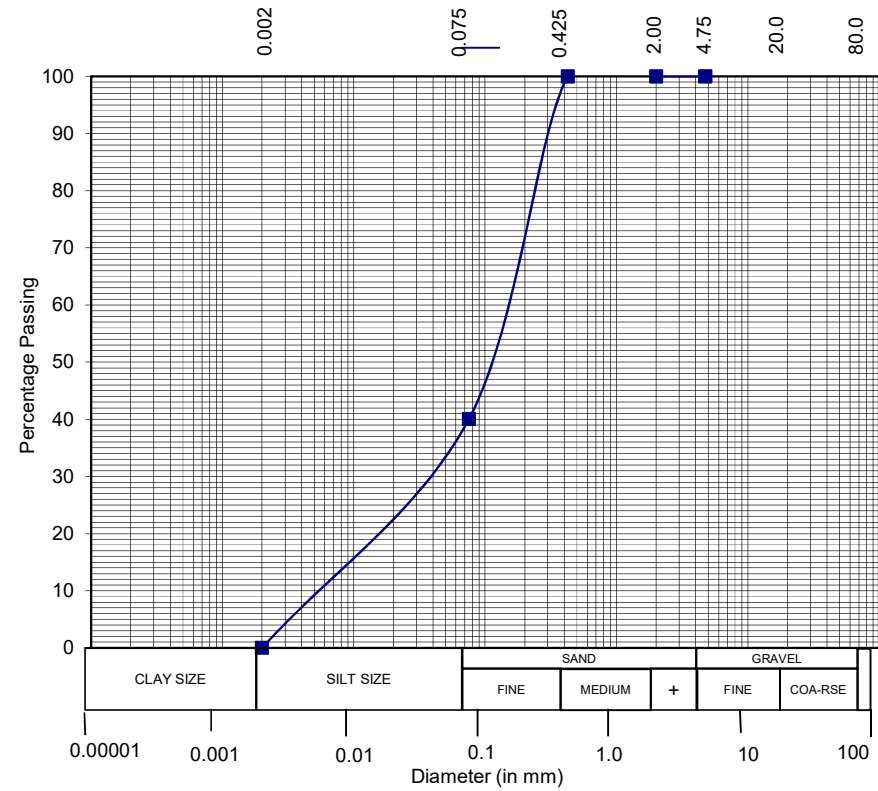


## ABC CONSULTANTS

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Bore Hole No. 1  
Depth

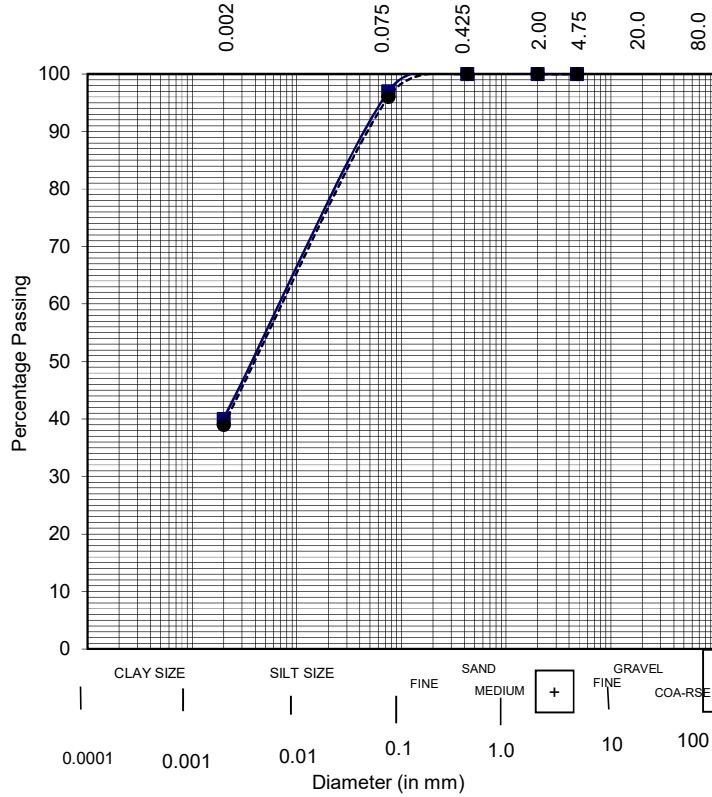
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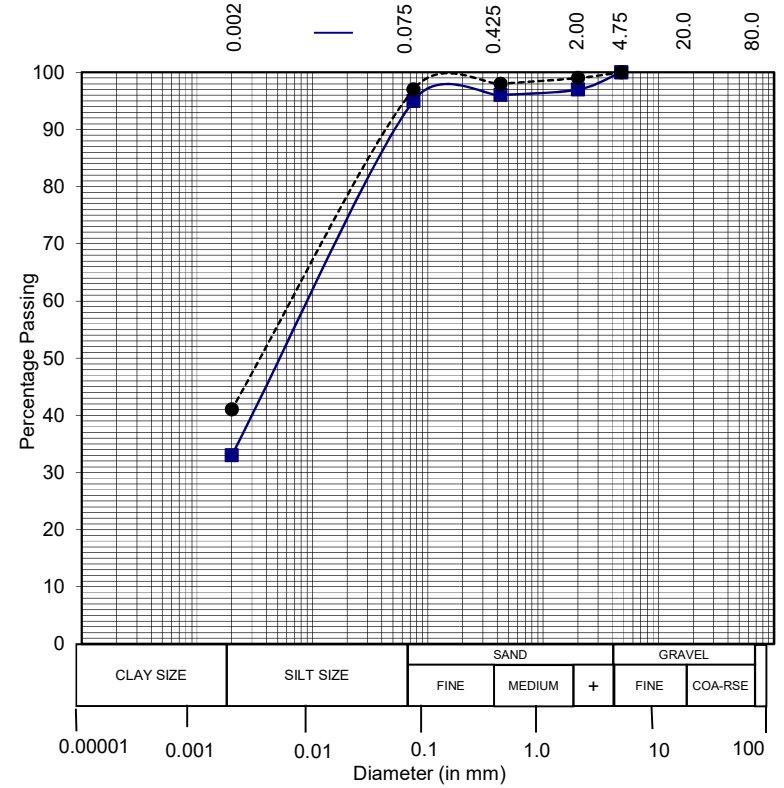
Bore Hole No. 2  
Depth



## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 2  
Depth





## ABC CONSULTANTS

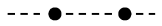
OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 2

Depth



6.00-6.35



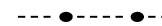
7.50-7.85

Bore Hole No. 2

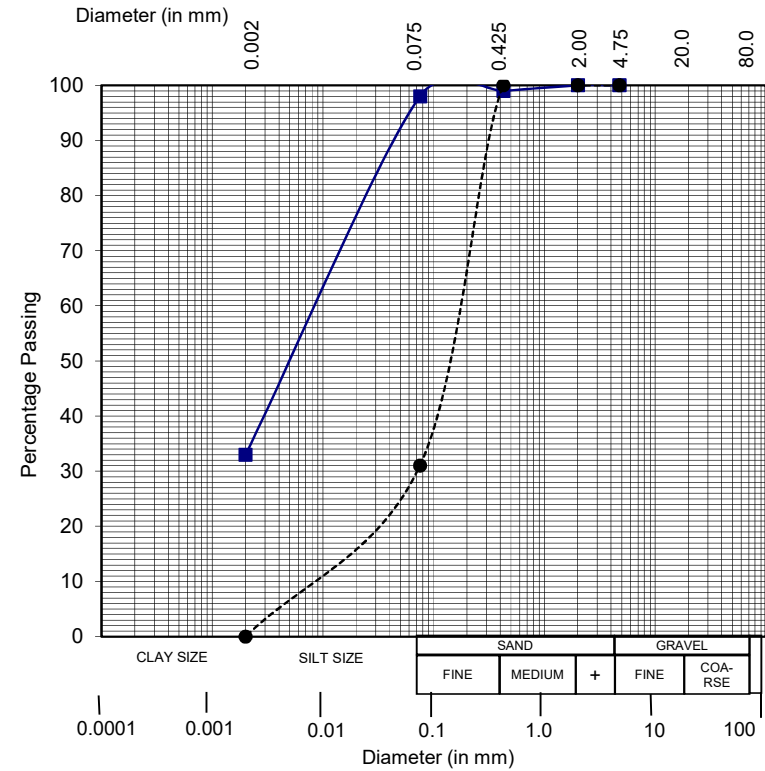
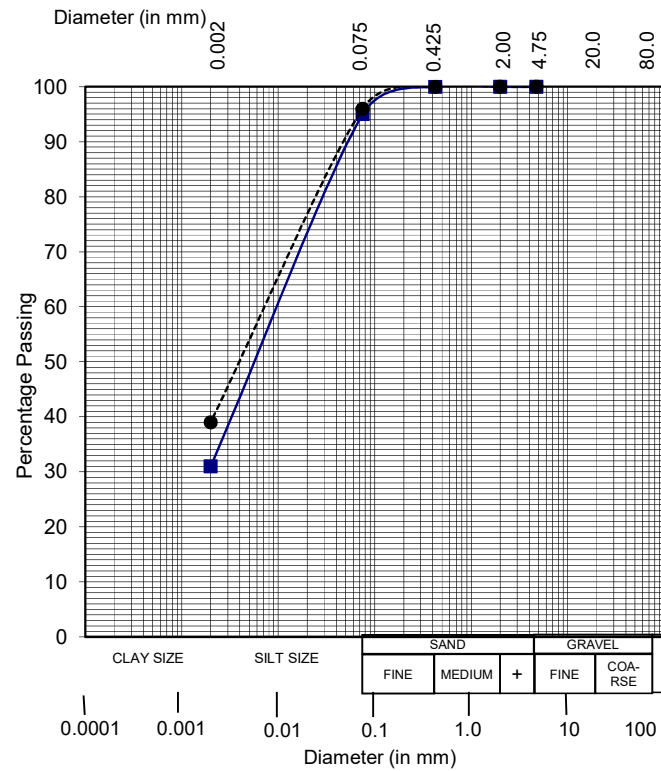
Depth



9.00-9.35



10.50-10.85



## ABC CONSULTANTS

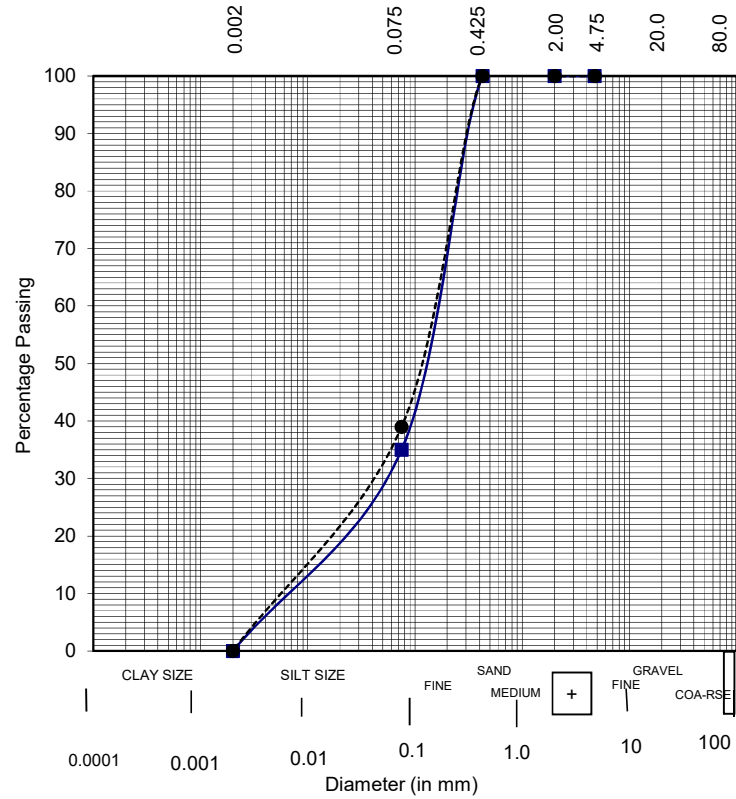
OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 2

Depth

—■—■— 12.00-12.35

---●---●--- 13.50-13.85



## ABC CONSULTANTS

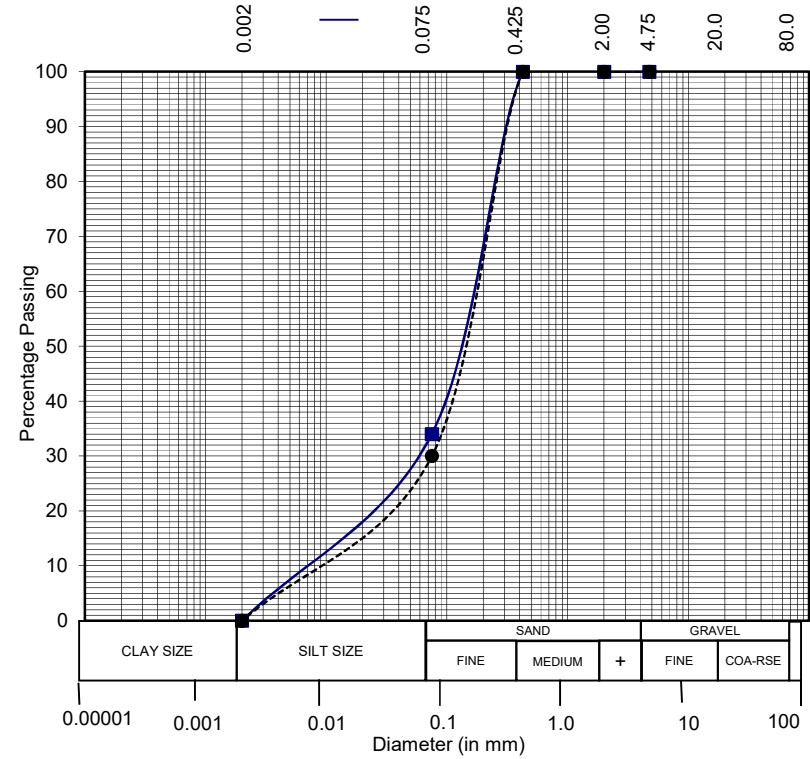
OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 2

Depth

—■—■— 15.00-15.35

---●---●--- 16.50-16.85

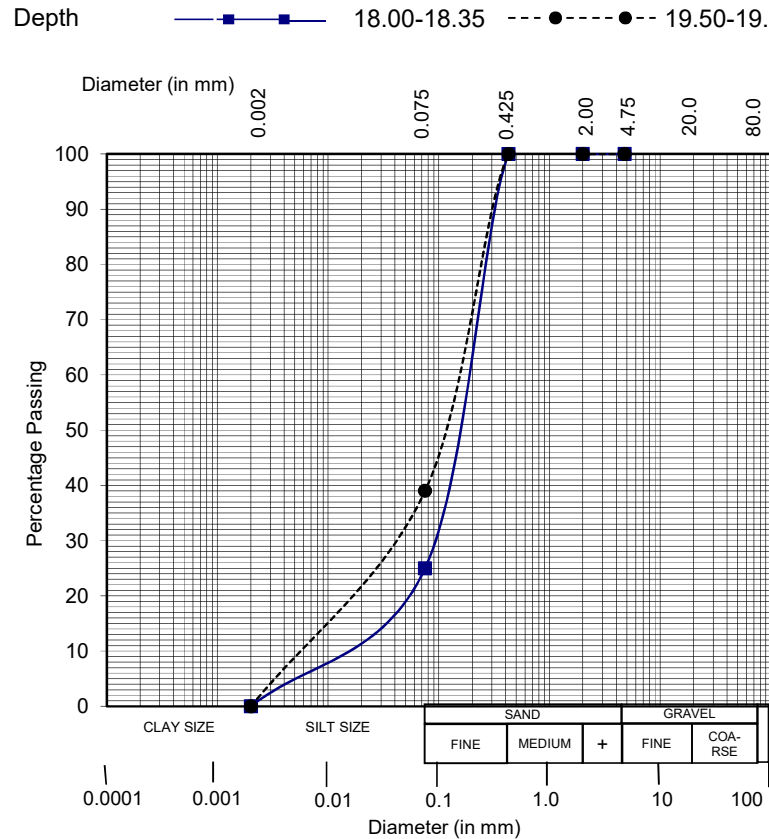


## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 2

Depth

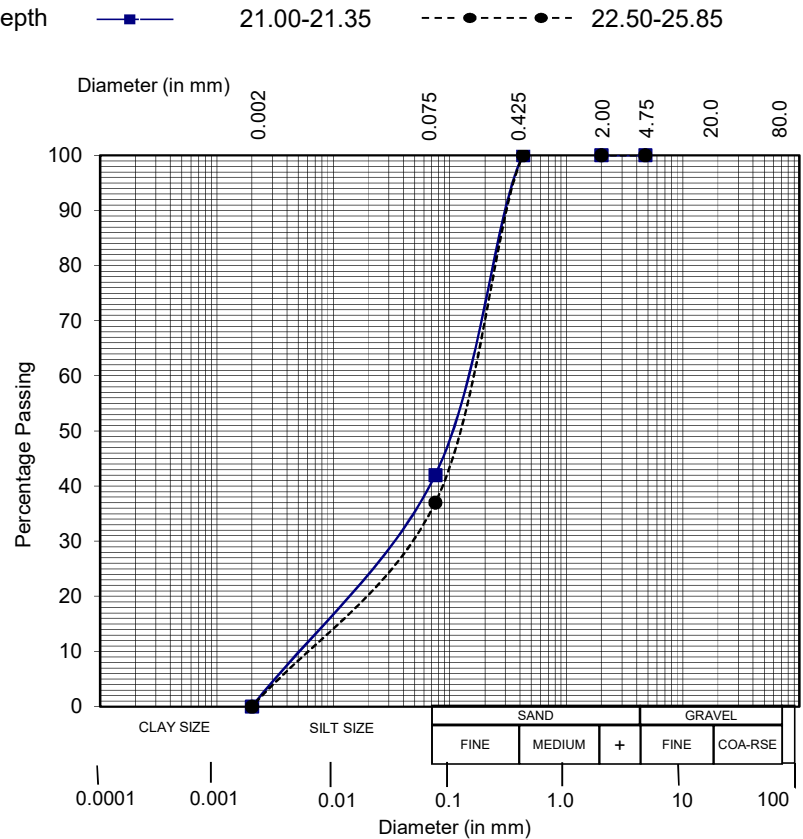


## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 2

Depth



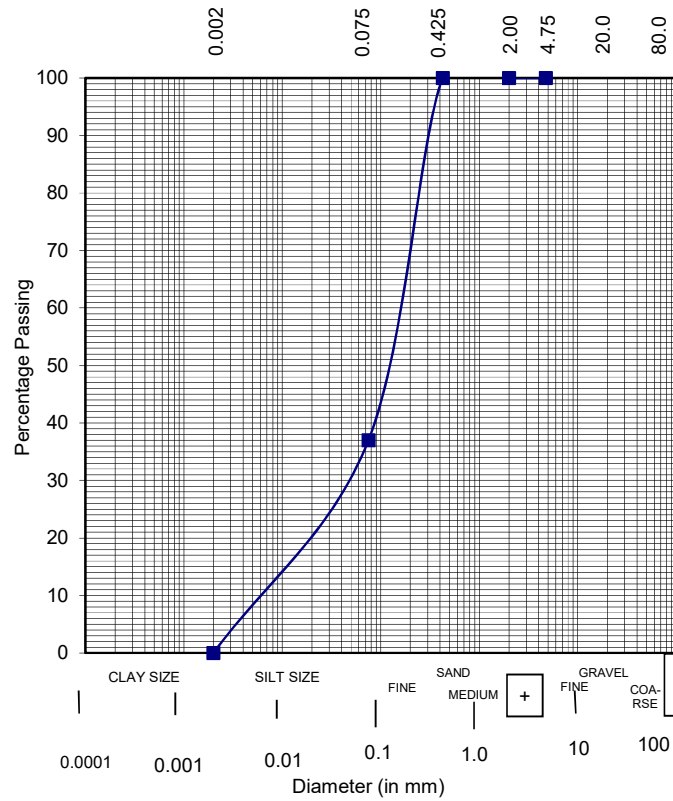
## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 2

Depth

—■—■— 24.00-24.35 ---●---●--- 25.50-25.85



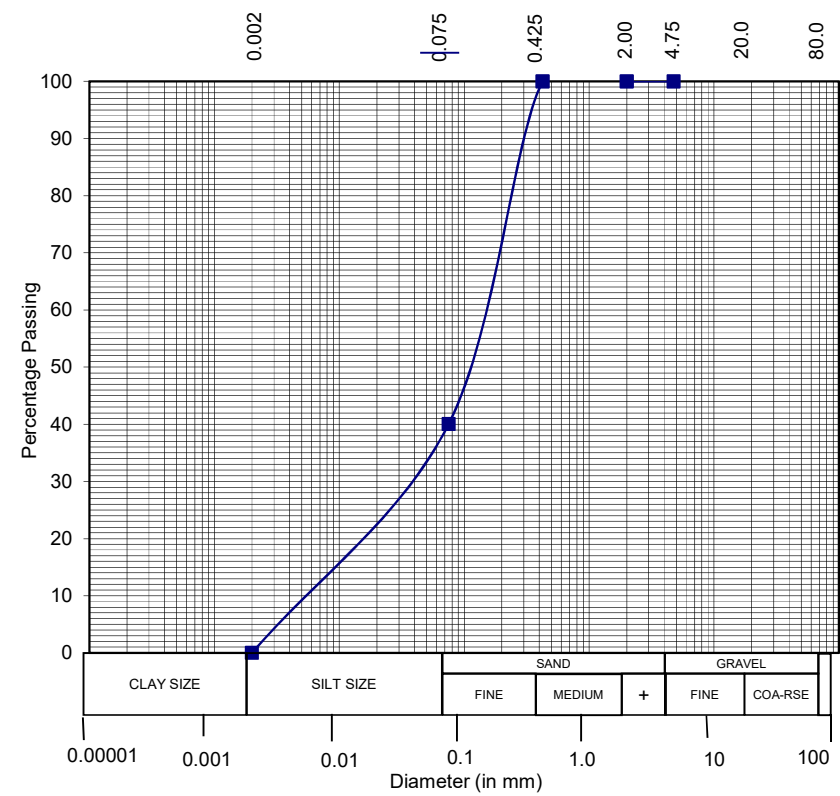
## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 2

Depth

—■—■— 27.00-27.35 ---●---●--- 28.50-28.85

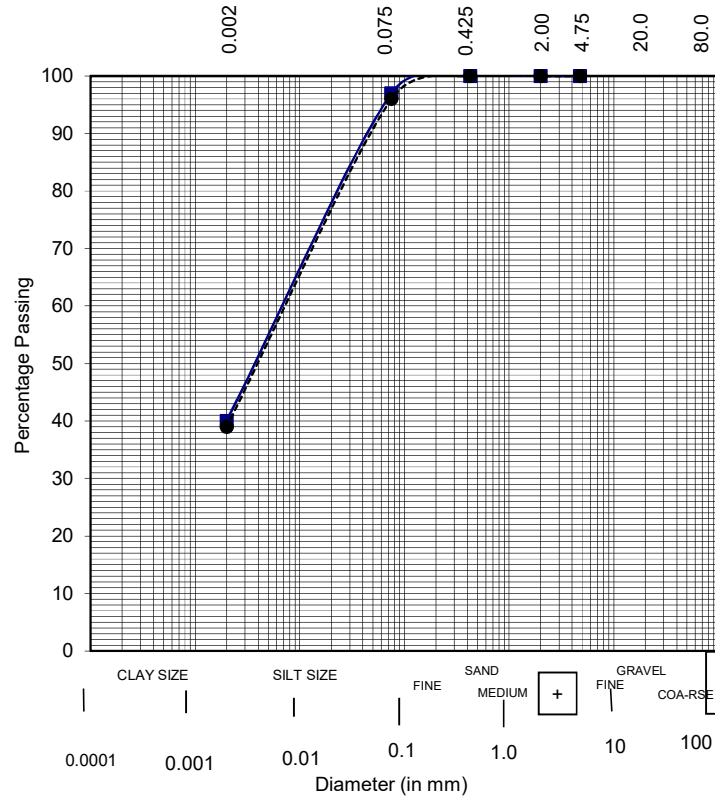


## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 3

Depth 1.50-1.85

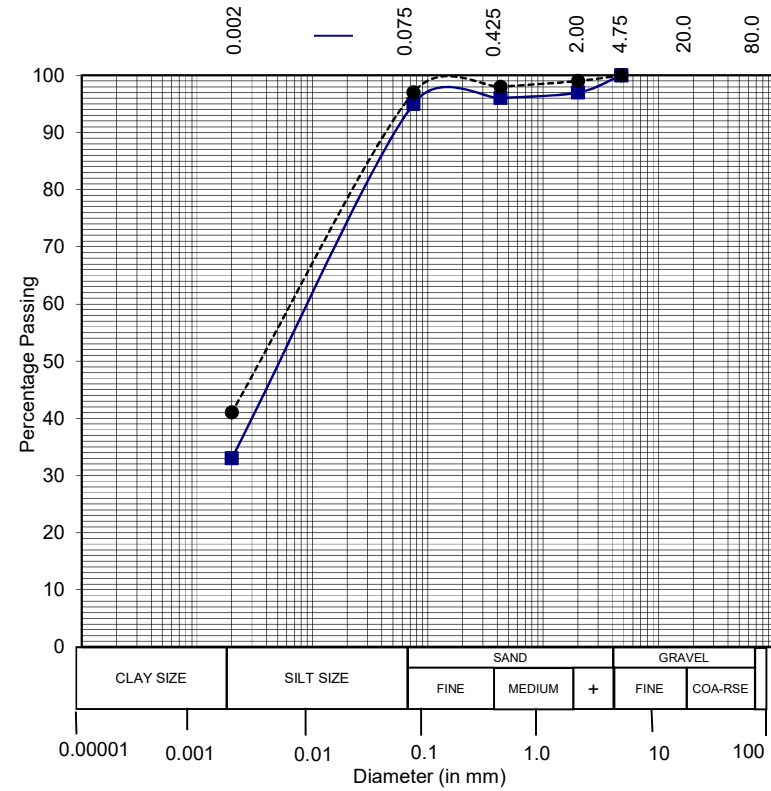


## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 3

Depth 3.00-3.35 4.50-4.85





## ABC CONSULTANTS

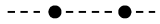
OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 3

Depth



6.00-6.35



7.50-7.85

Bore Hole No. 3

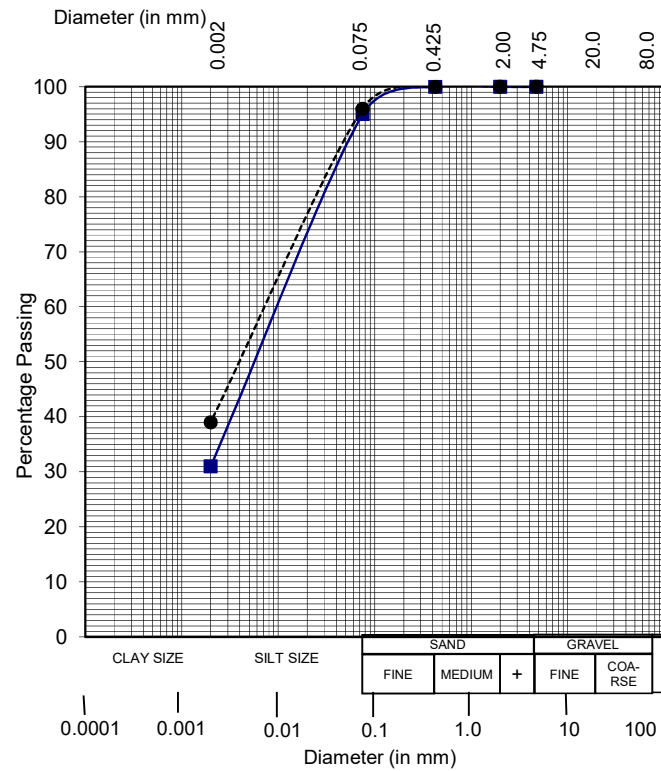
Depth



9.00-9.35



10.50-10.85



## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 3

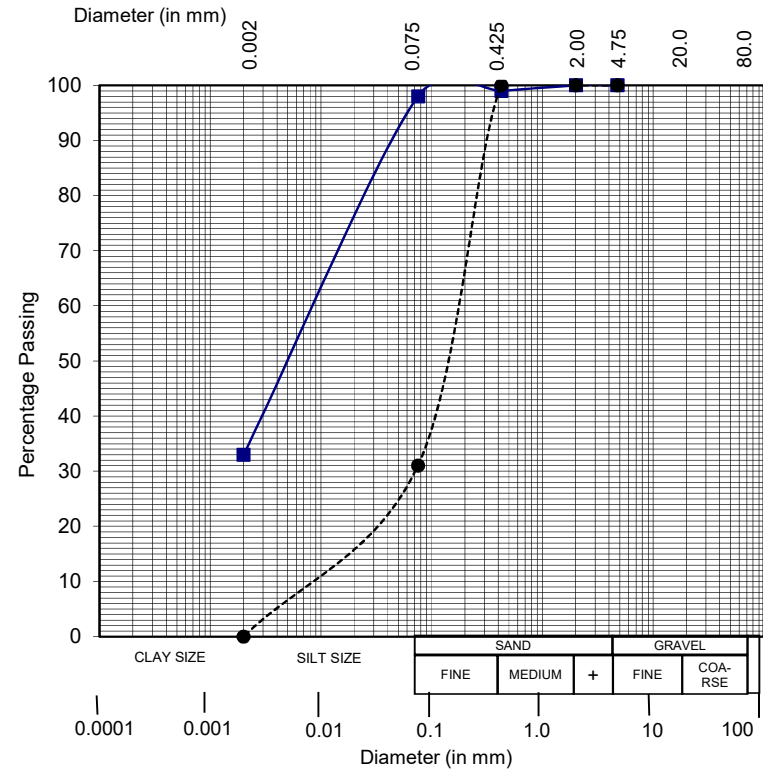
Depth



9.00-9.35



10.50-10.85



## ABC CONSULTANTS

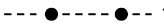
OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 3

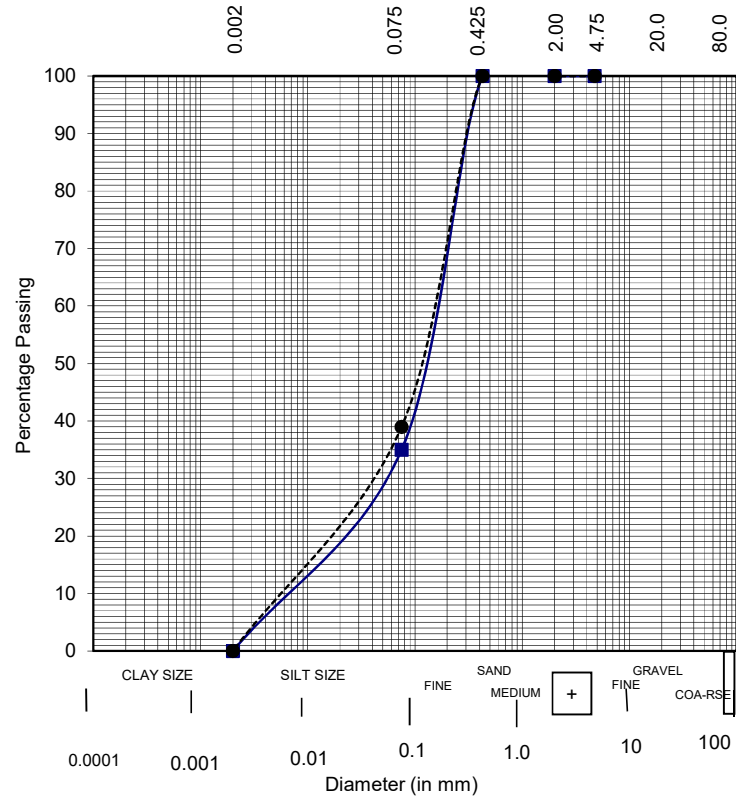
Depth



12.00-12.35



13.50-13.85



## ABC CONSULTANTS

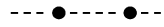
OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 3

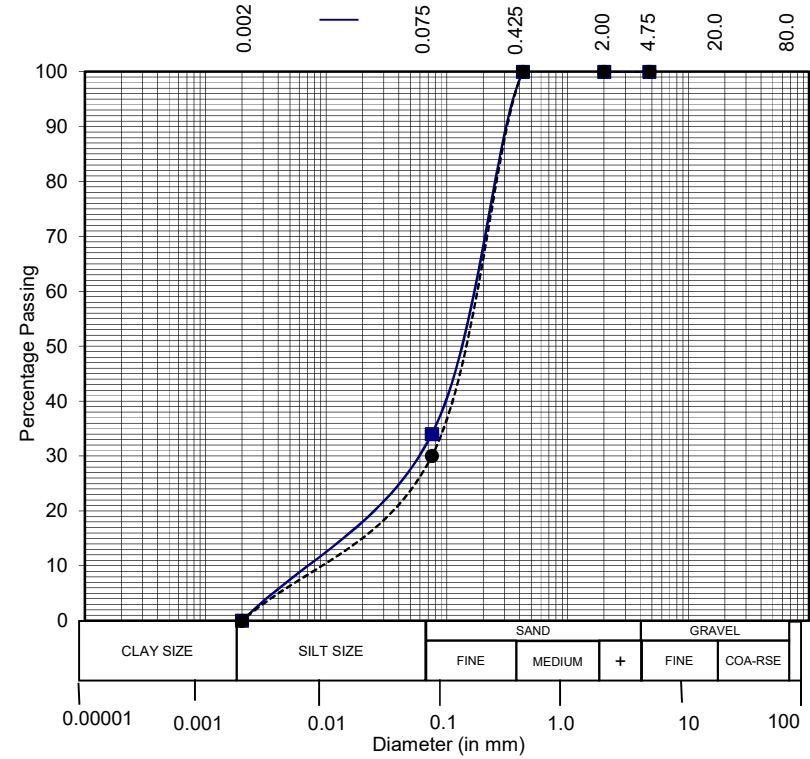
Depth



15.00-15.35



16.50-16.85

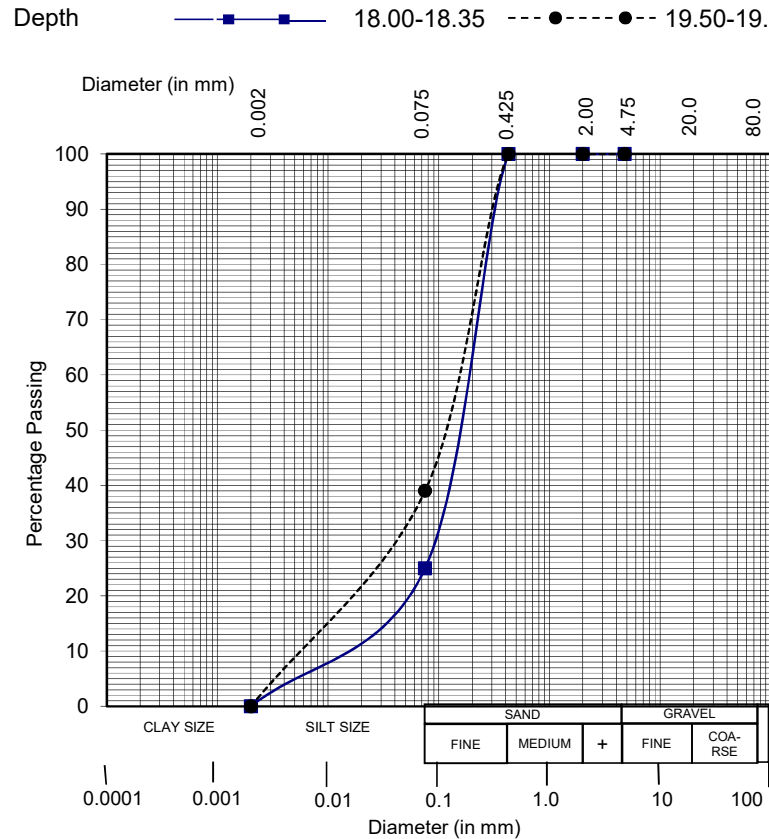


## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 3

Depth

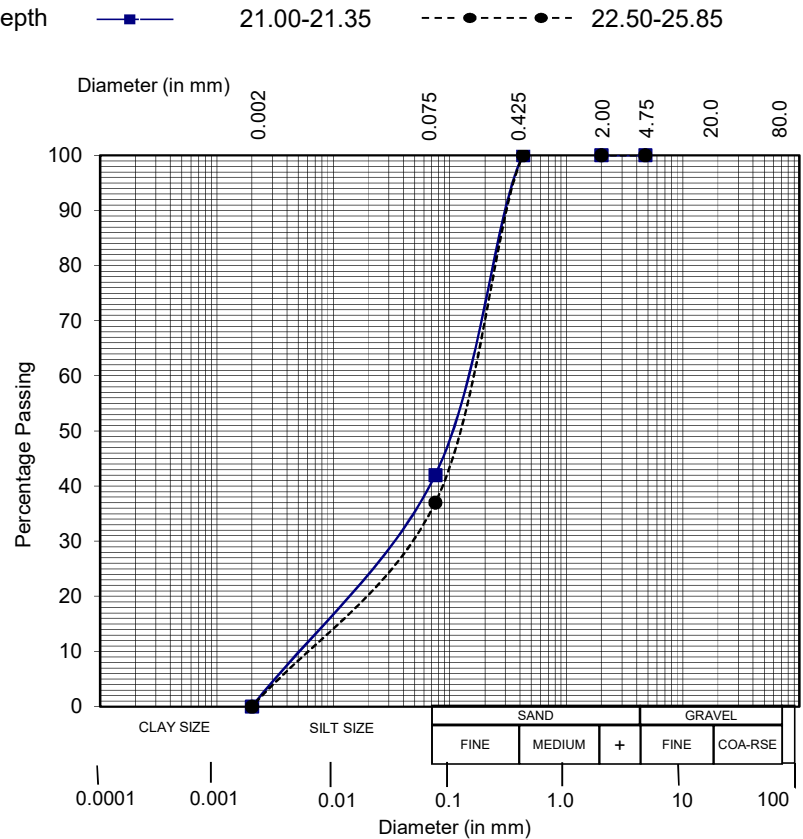


## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 3

Depth



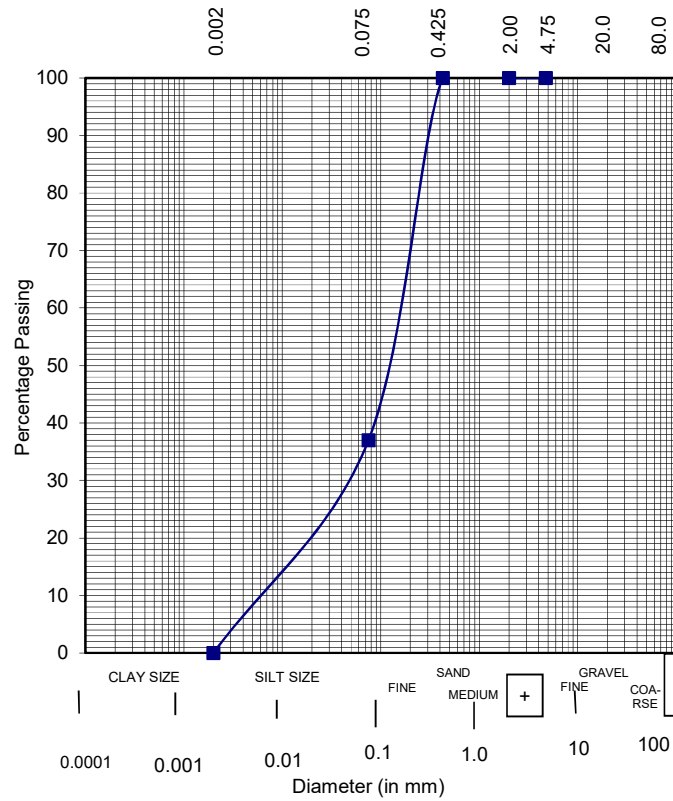
## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 3

Depth

—■—■— 24.00-24.35 ---●---●--- 25.50-25.85



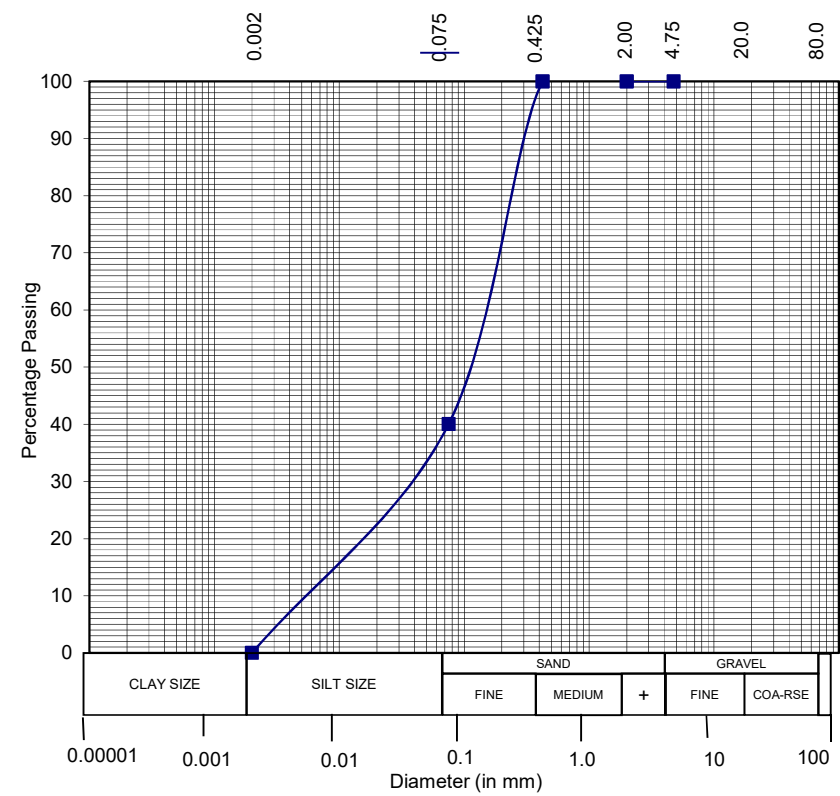
## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 3

Depth

—■—■— 27.00-27.35 ---●---●--- 28.50-28.85

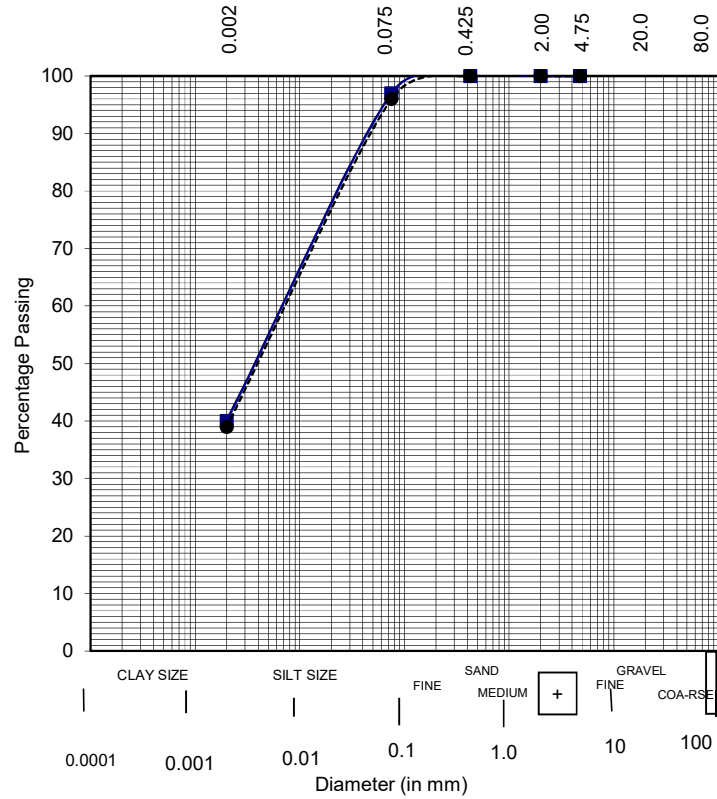


## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 4

Depth 1.50-1.85

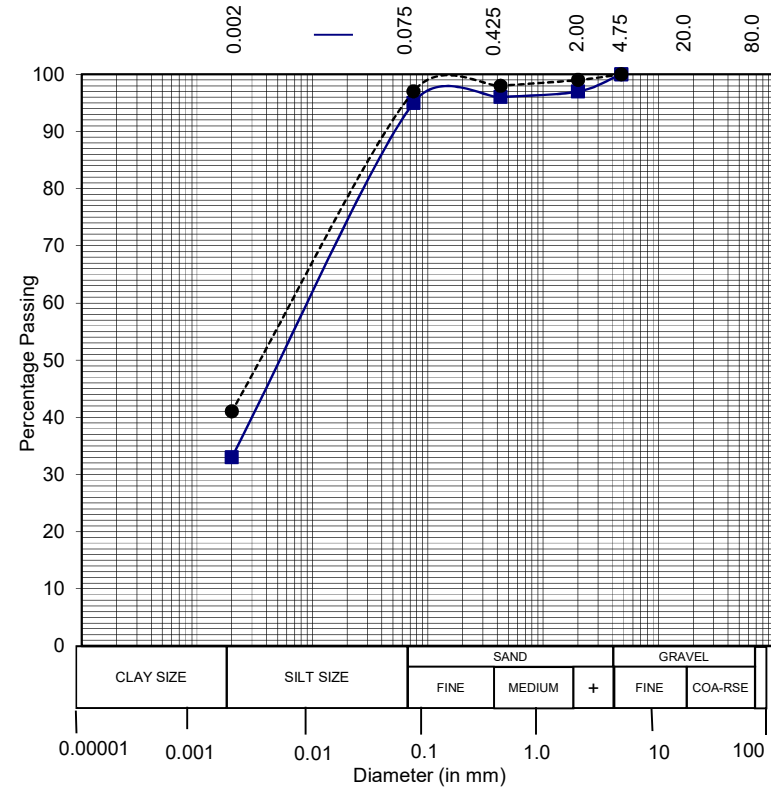


## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 4

Depth 3.00-3.35 4.50-4.85





## ABC CONSULTANTS

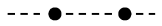
OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 4

Depth



6.00-6.35



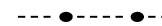
7.50-7.85

Bore Hole No. 4

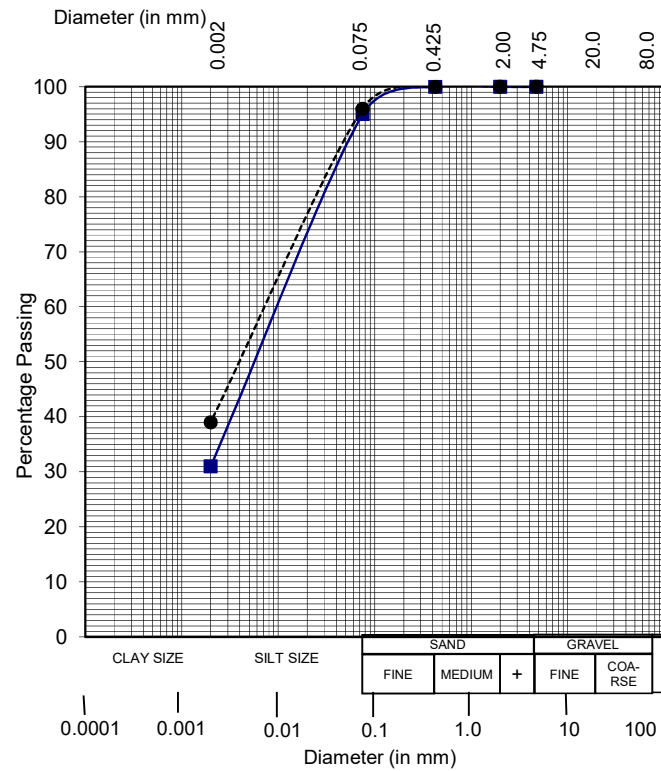
Depth



9.00-9.35



10.50-10.85



## ABC CONSULTANTS

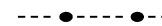
OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 4

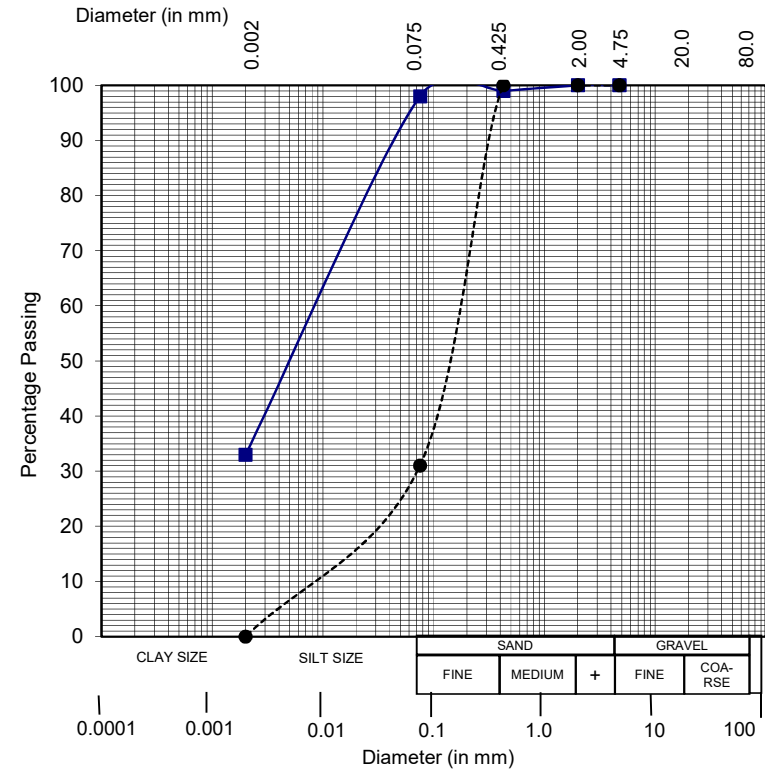
Depth



9.00-9.35



10.50-10.85



## ABC CONSULTANTS

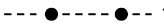
OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 4

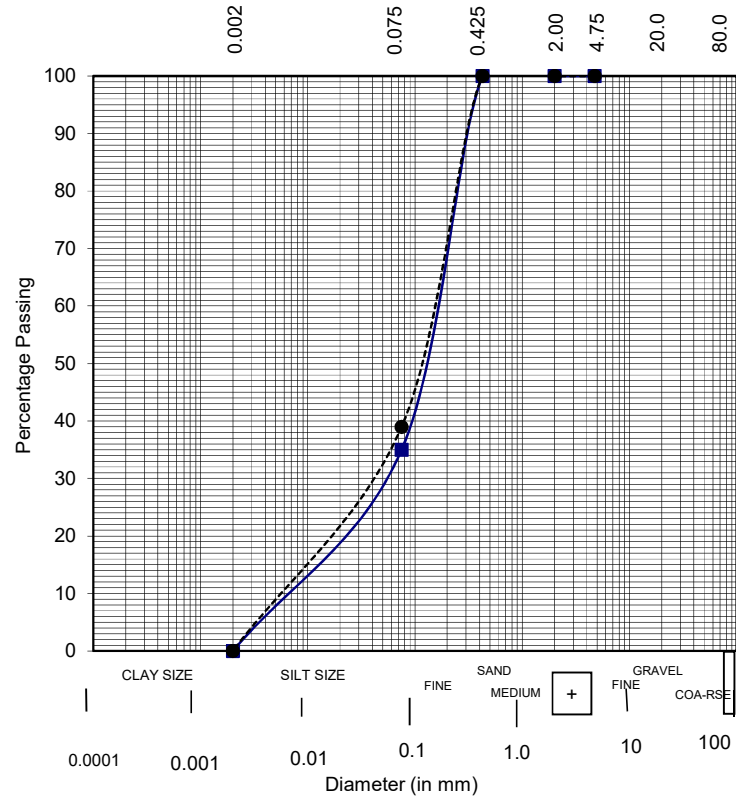
Depth



12.00-12.35



13.50-13.85



## ABC CONSULTANTS

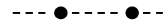
OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 4

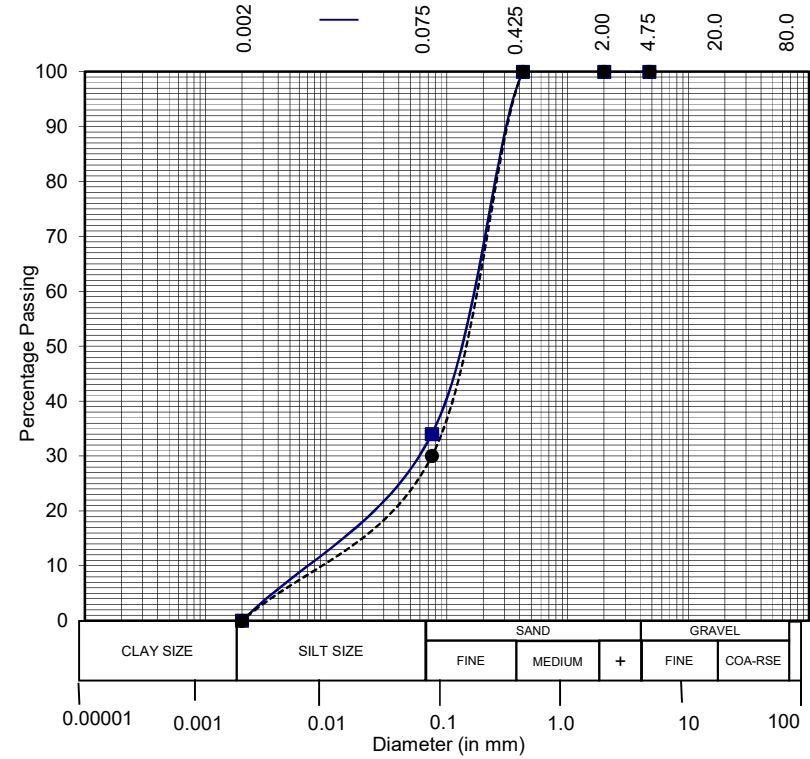
Depth



15.00-15.35



16.50-16.85

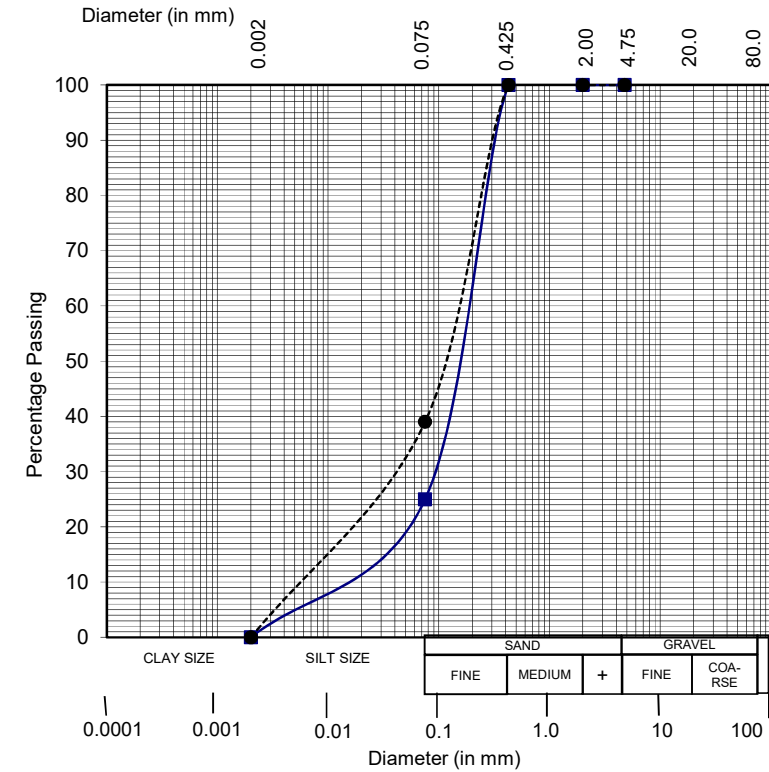


## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 4

Depth

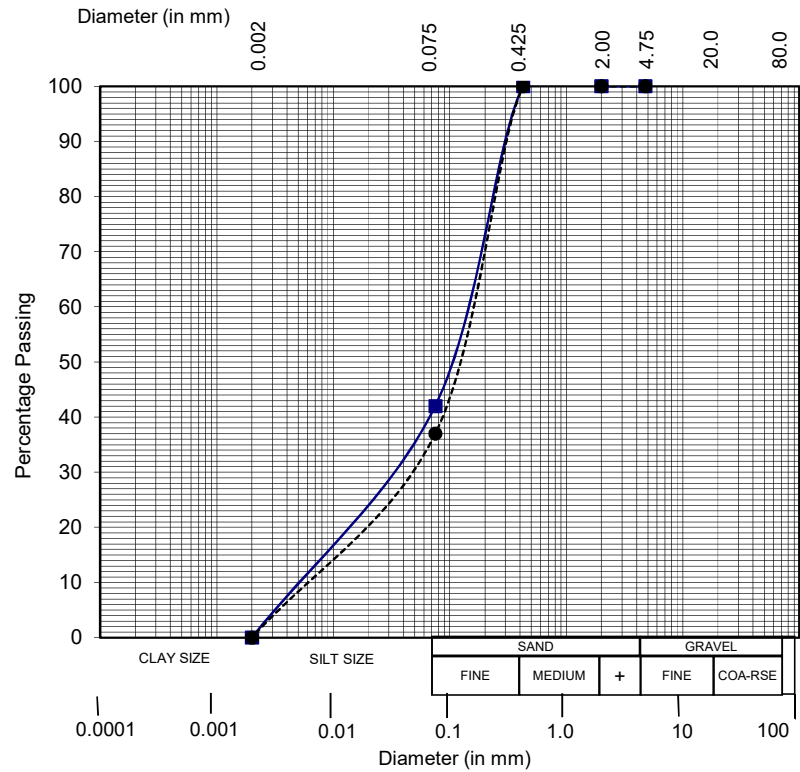


## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 4

Depth



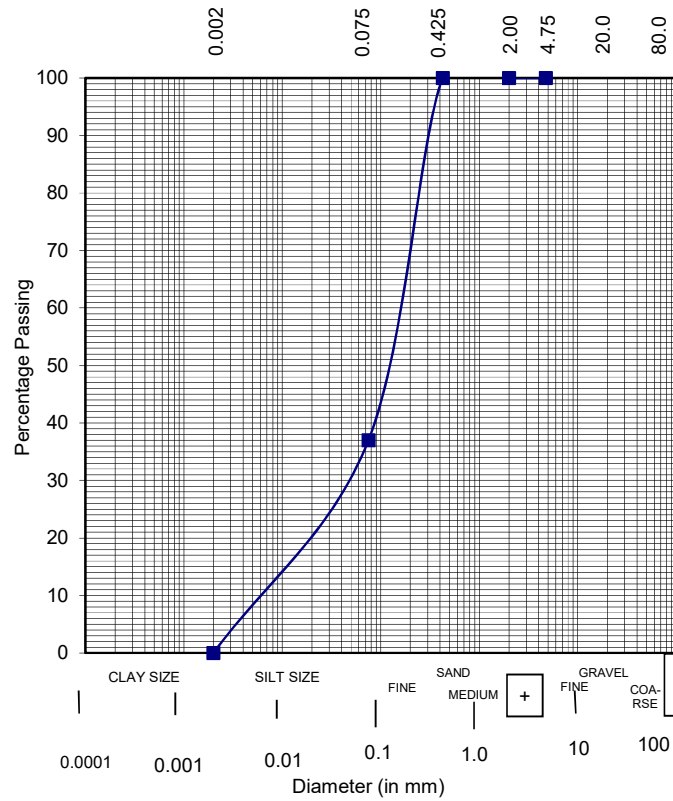
## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 4

Depth

—■—■— 24.00-24.35 ---●---●--- 25.50-25.85



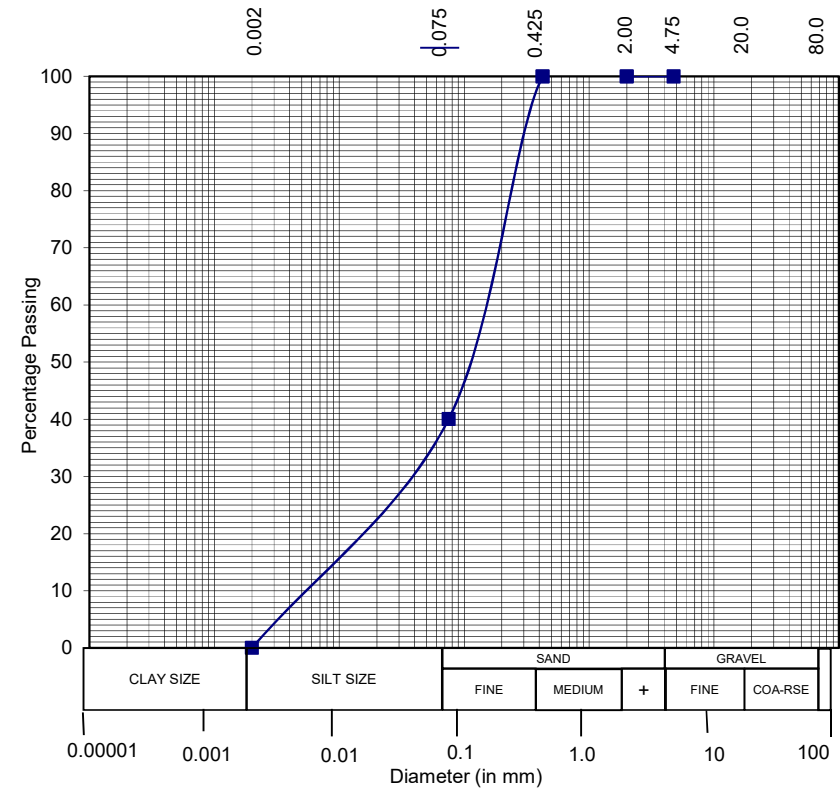
## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 4

Depth

—■—■— 27.00-27.35 ---●---●--- 28.50-28.85

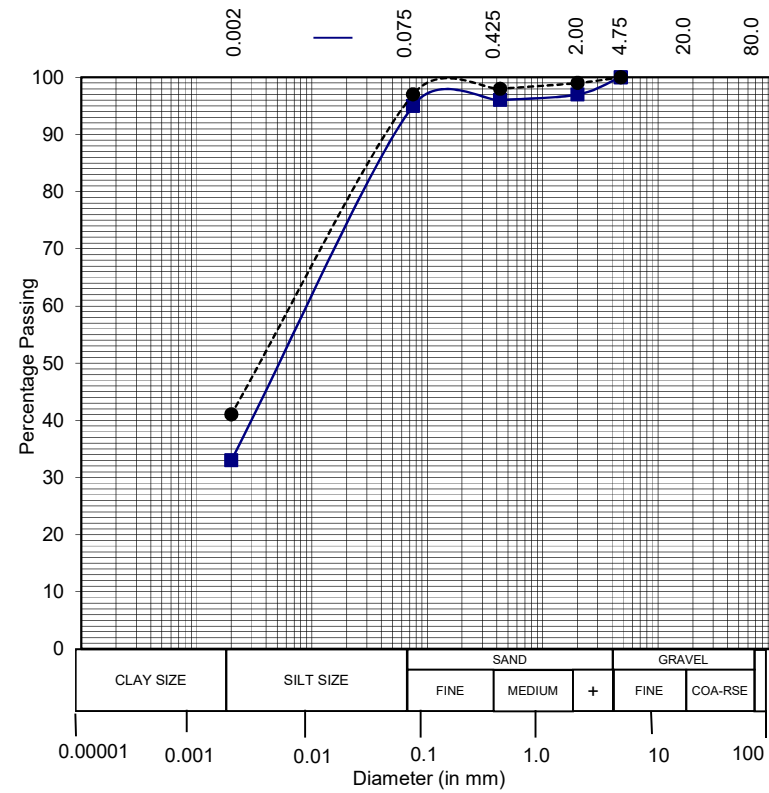


# ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 5

Depth —■— 3.00-3.35    -●- 4.50-4.85





## ABC CONSULTANTS

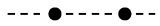
OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 5

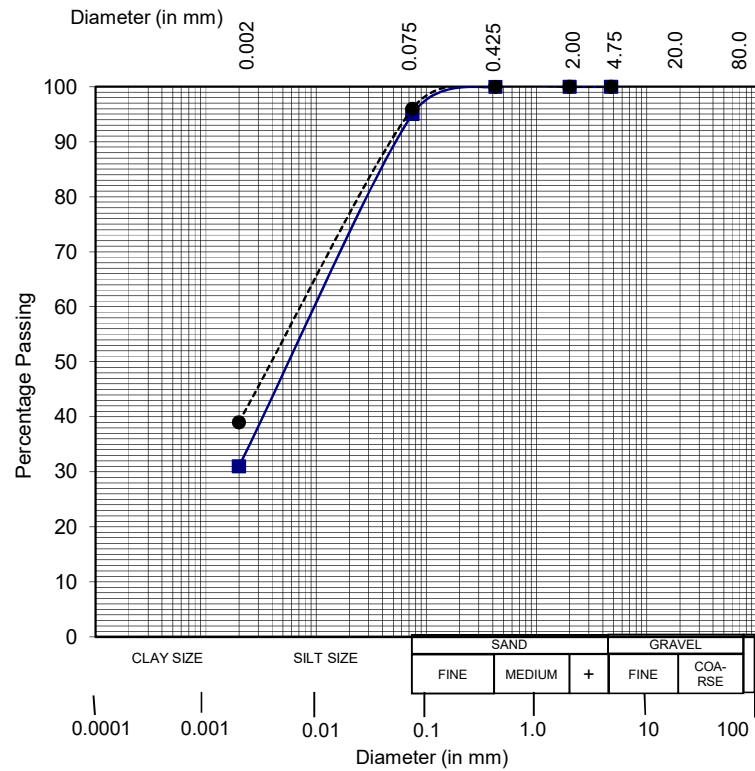
Depth



6.00-6.35



7.50-7.85



## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 5

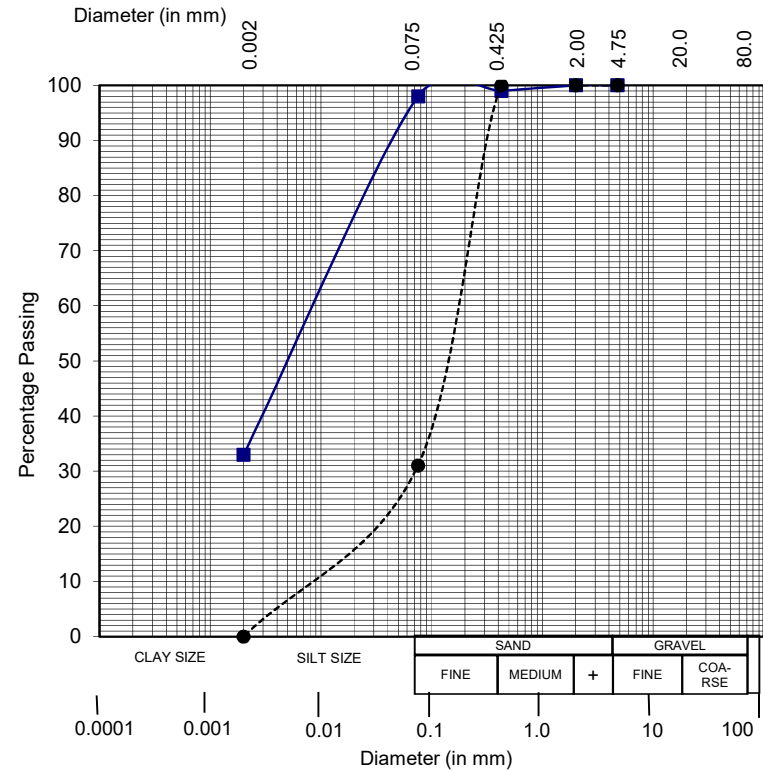
Depth



9.00-9.35



10.50-10.85



## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 5

Depth

12.00-12.35

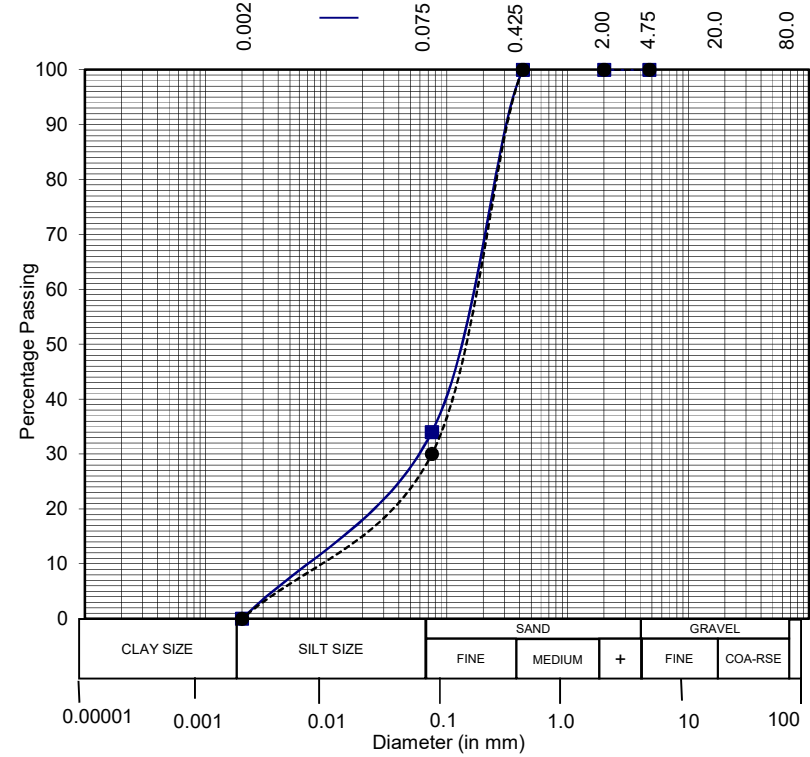
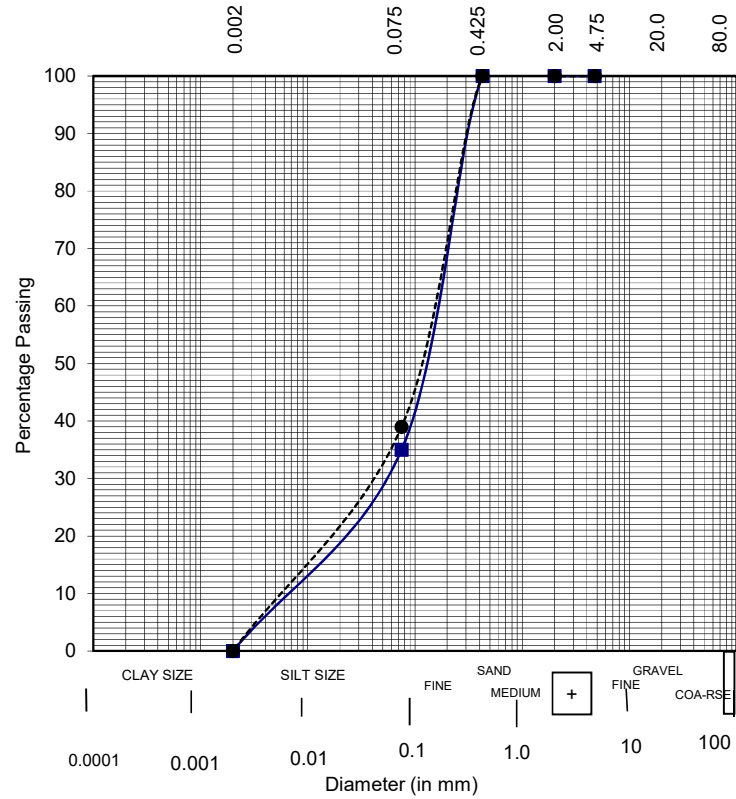
13.50-13.85

Bore Hole No. 5

Depth

15.00-15.35

16.50-16.85

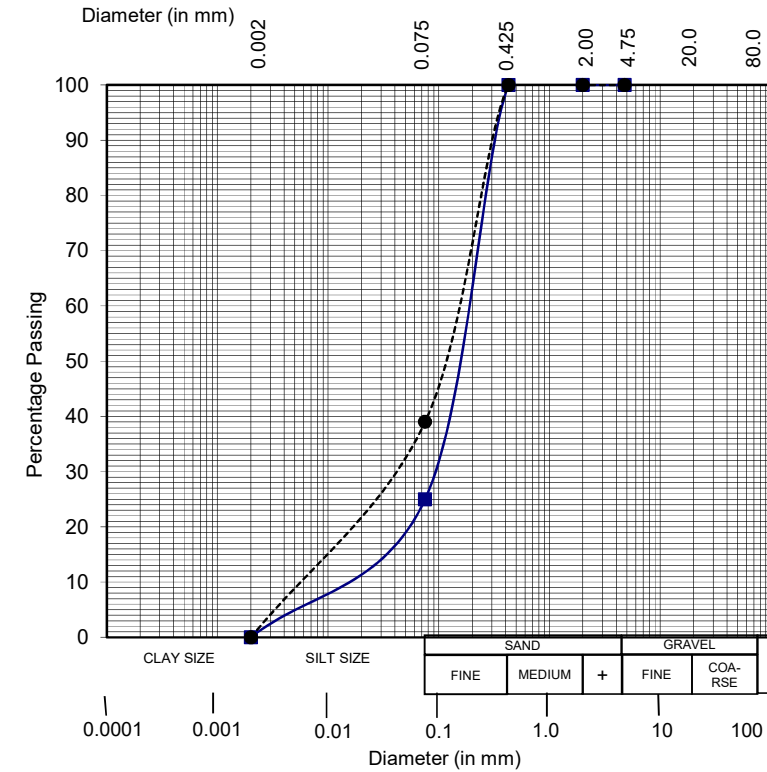


## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 5

Depth

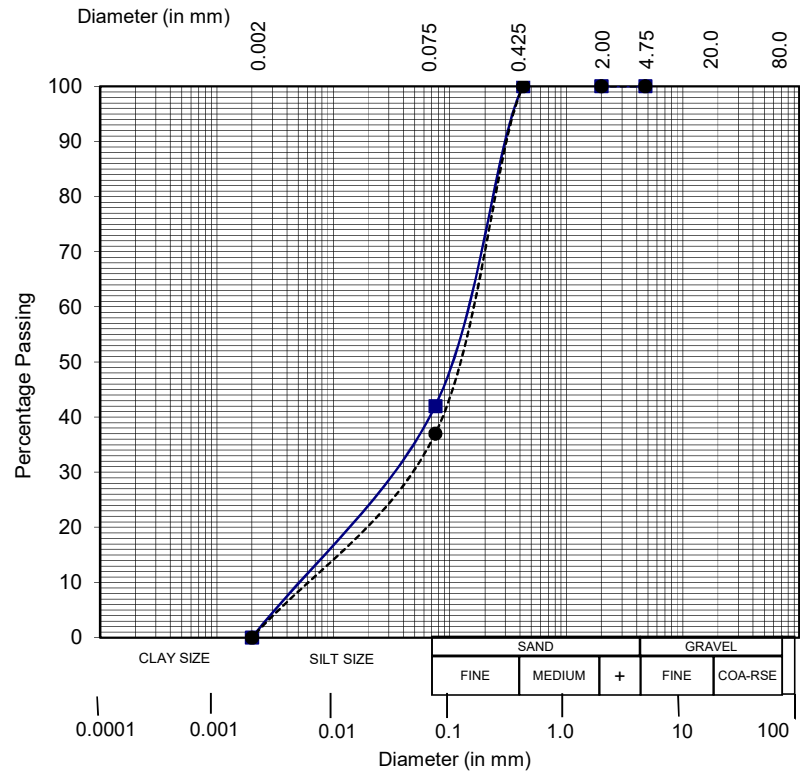


## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 5

Depth



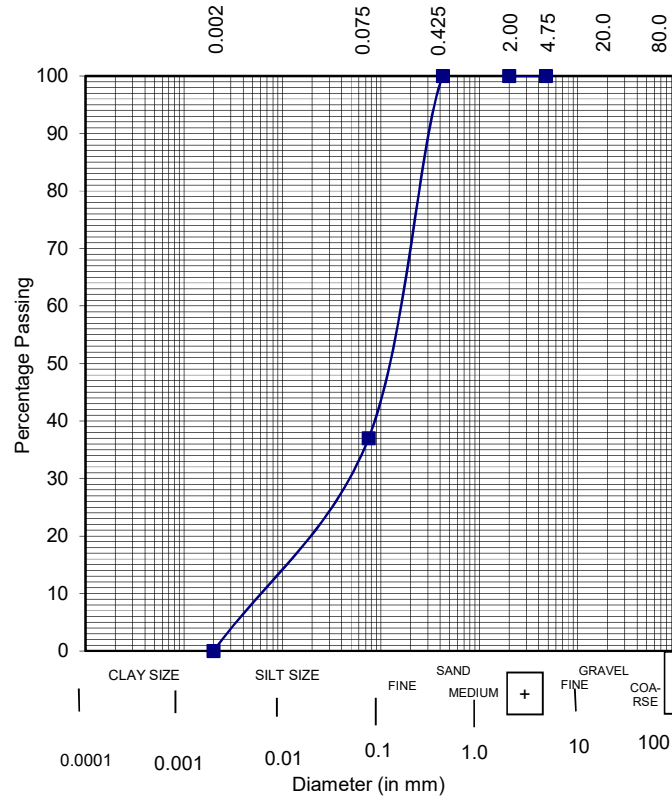
## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 5

Depth

24.00-24.35 --- ●-----●-- 25.50-25.85



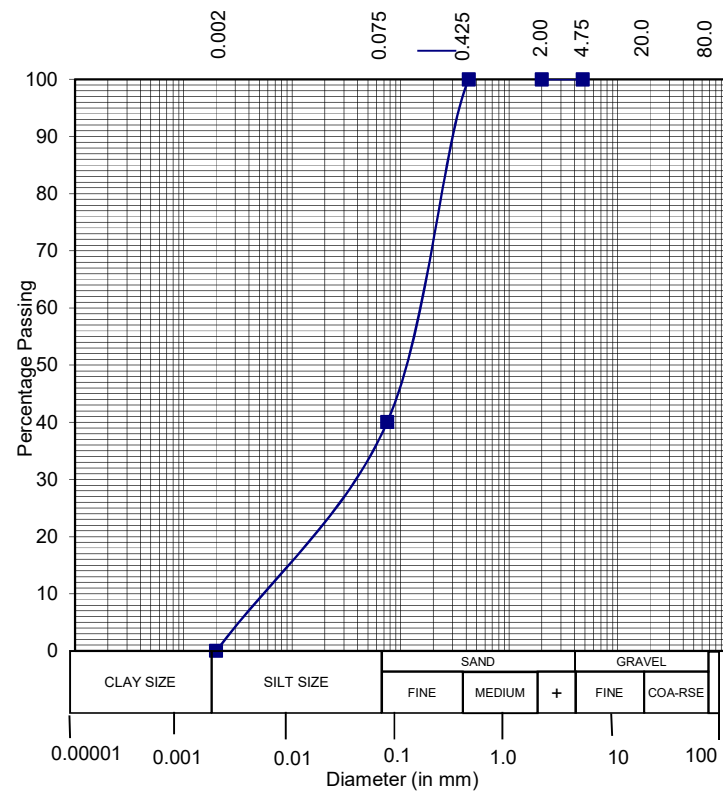
## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 5

Depth

27.00-27.35 --- ●-----●-- 28.50-28.85

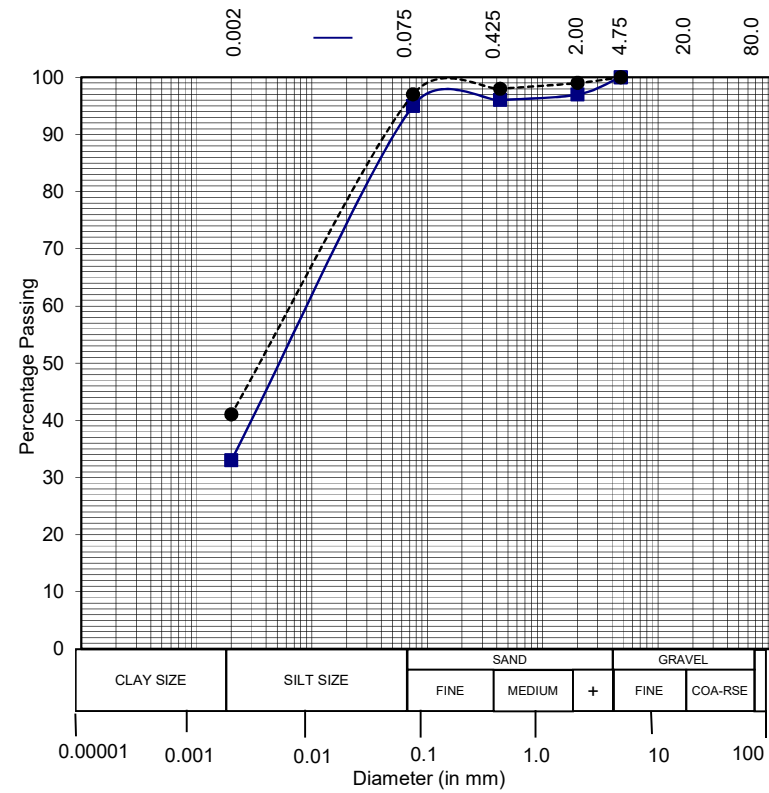


# ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 6

Depth —■— 3.00-3.35    -●- 4.50-4.85



## ABC CONSULTANTS

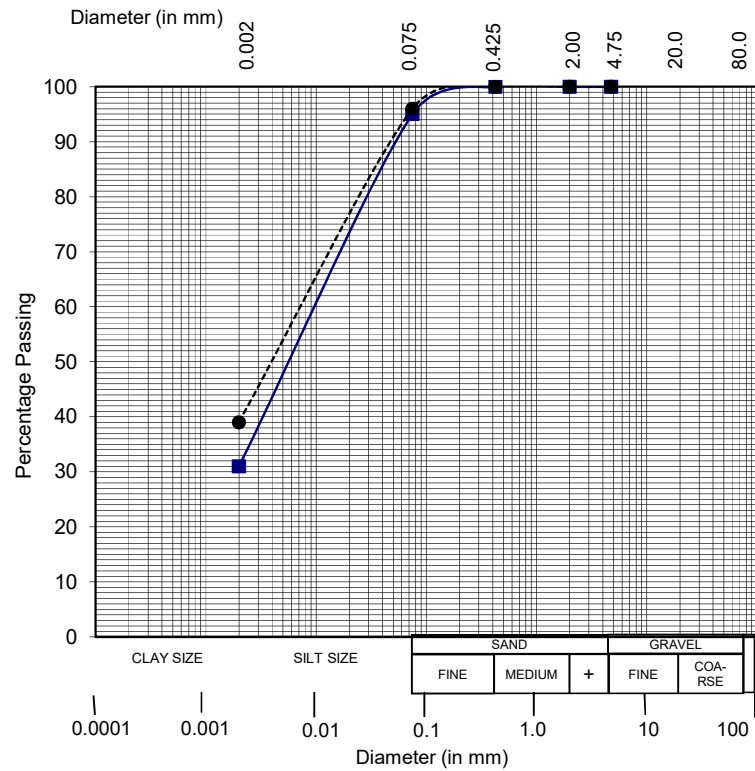
OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 6

Depth

6.00-6.35

7.50-7.85



## ABC CONSULTANTS

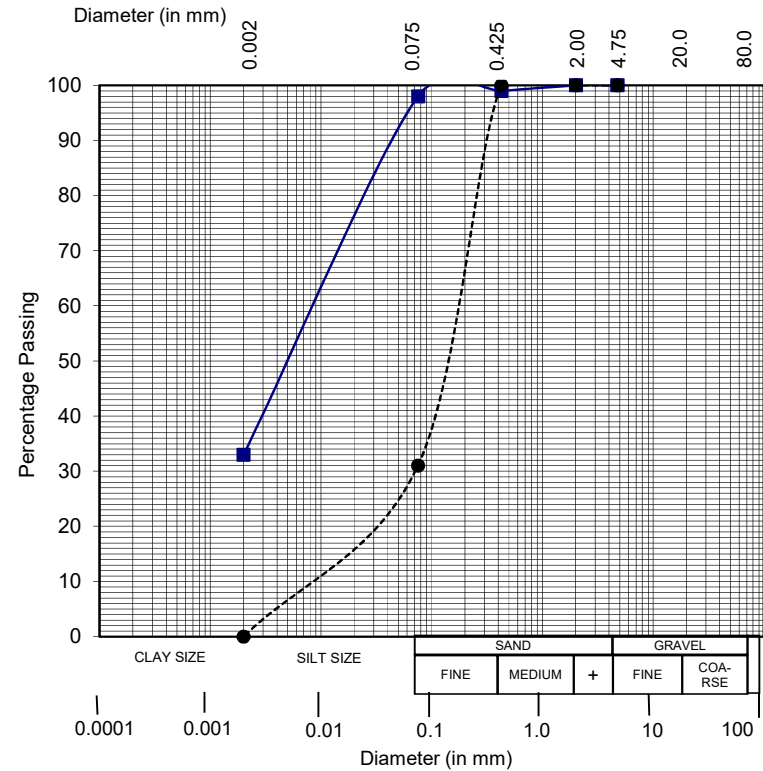
OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 6

Depth

9.00-9.35

10.50-10.85





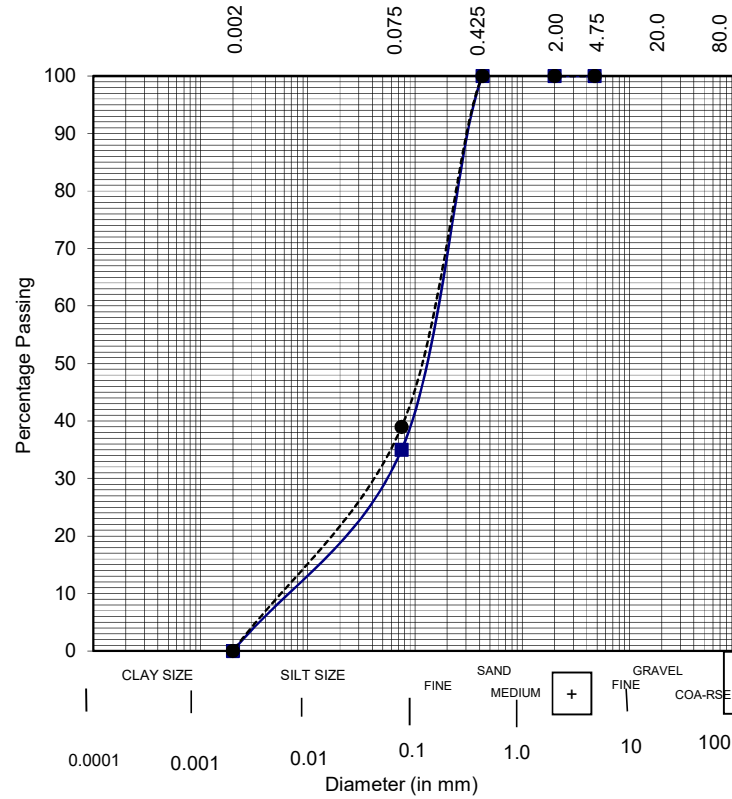
## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 6

Depth

12.00-12.35 --- ● --- ● --- 13.50-13.85



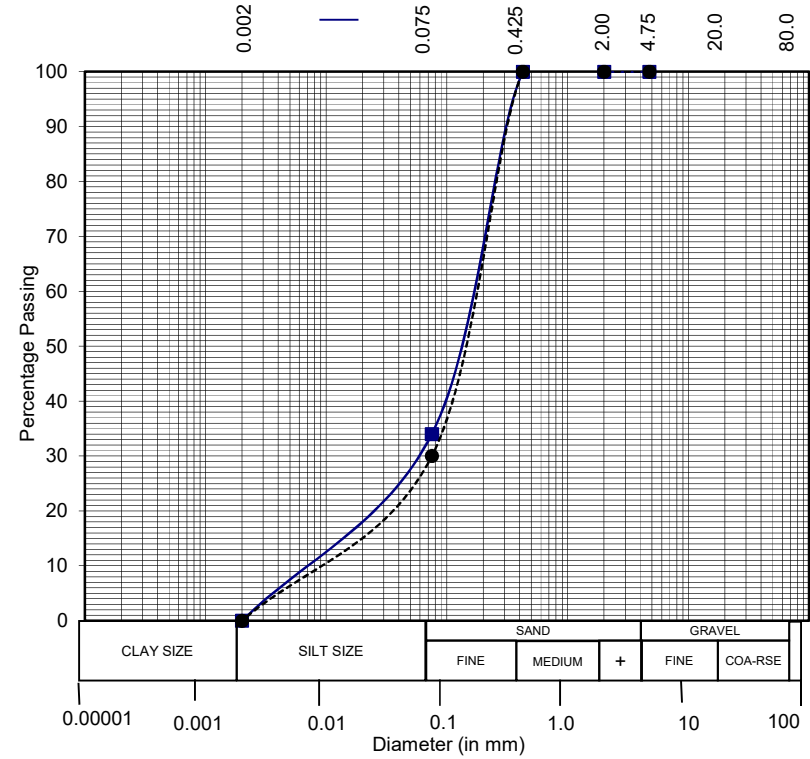
## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 6

Depth

15.00-15.35 --- ● --- ● --- 16.50-16.85

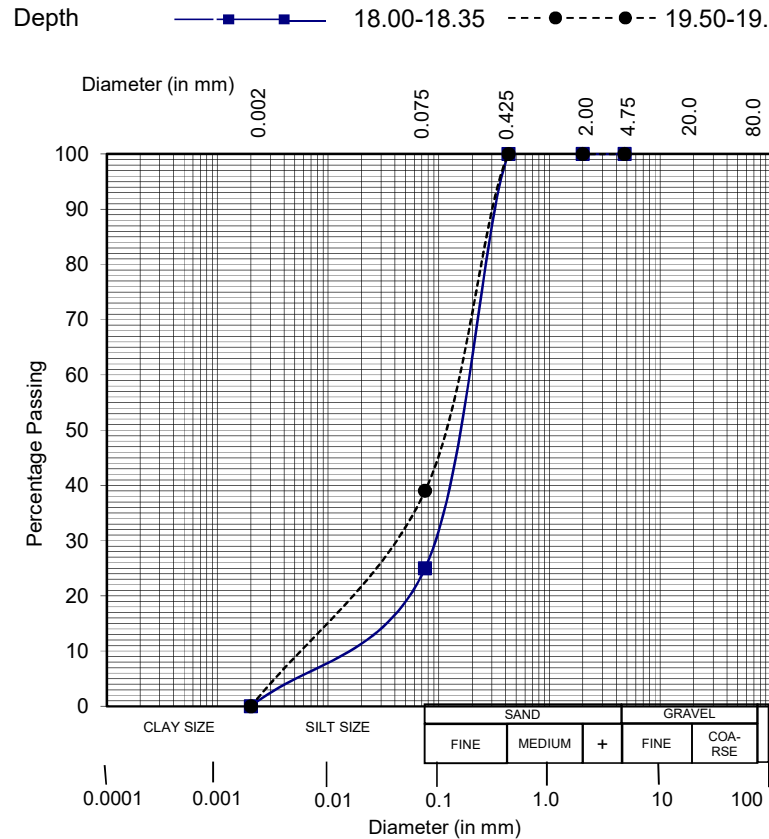


## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 6

Depth

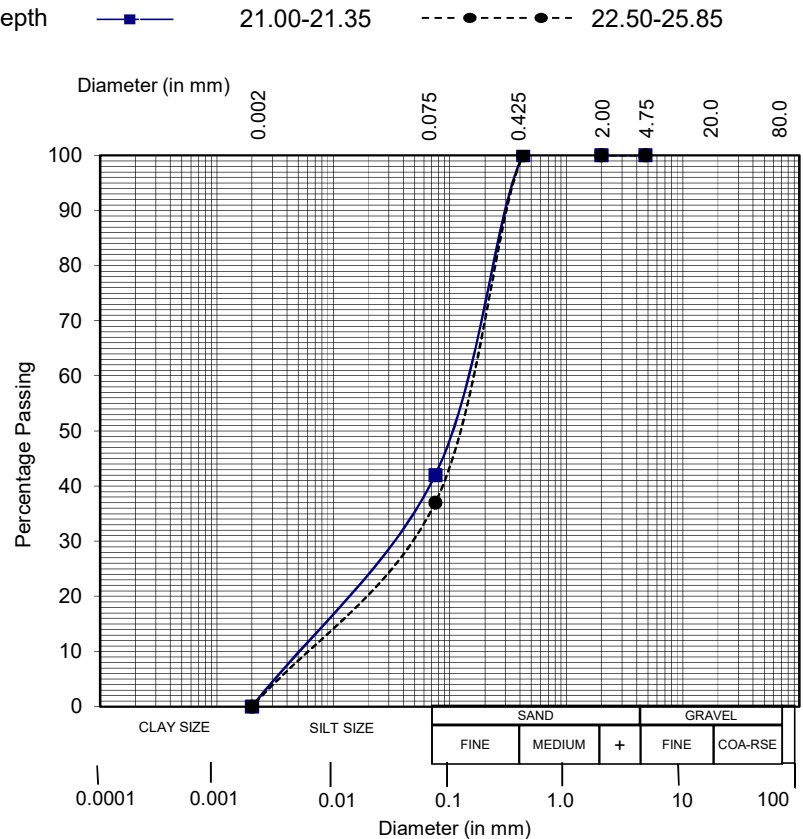


## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 6

Depth



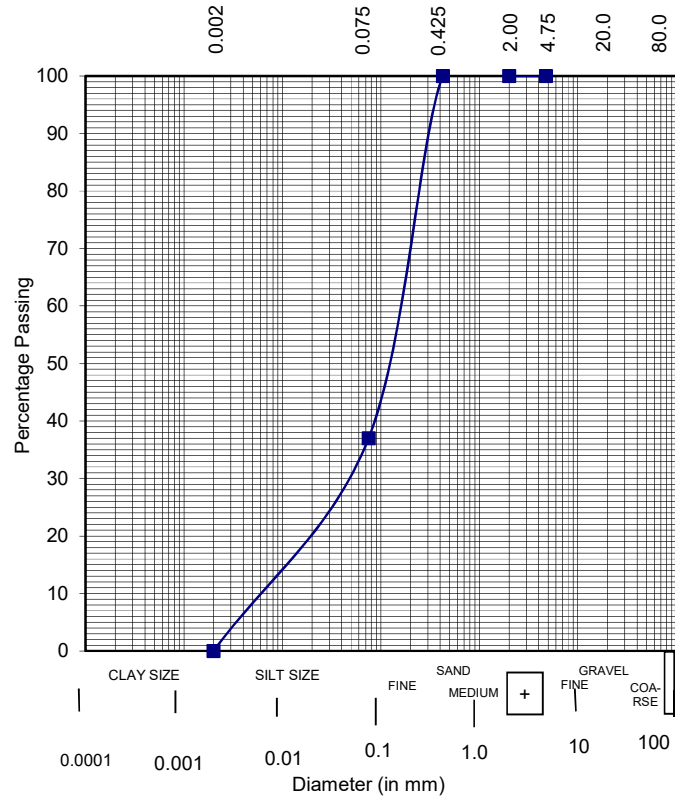
## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 6

Depth

—■— 24.00-24.35 ---●---●--- 25.50-25.85



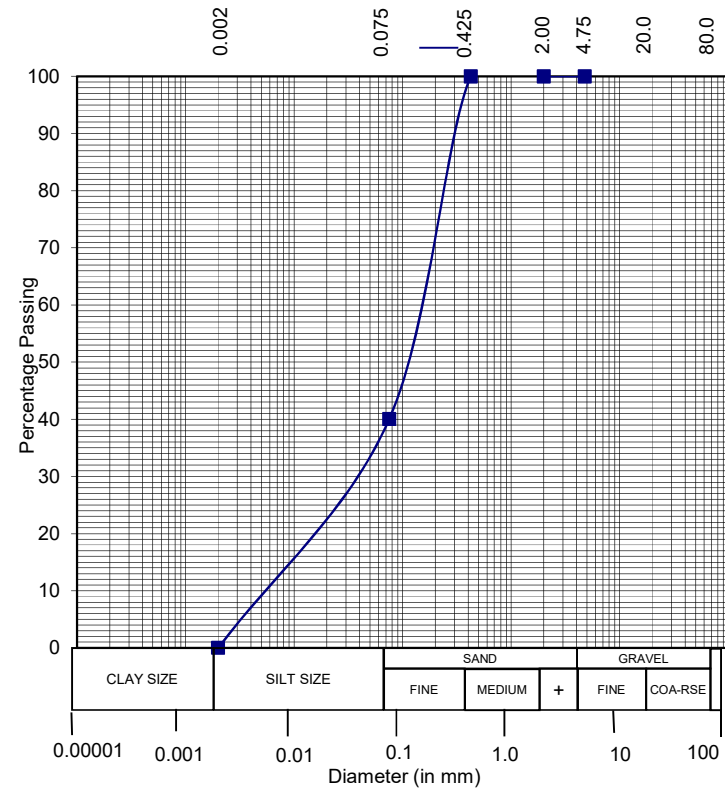
## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 6

Depth

—■— 27.00-27.35 ---●---●--- 28.50-28.85



# ABC CONSULTANTS

OFFICE : C-1074/75, SECTOR – B. MAHANAGAR, LUCKNOW

Phone :- 09451371403, 07275268881, E-mail: abceconsultantlucknow@gmail.com

























**Project : Proposed Construction of 300 Bedded Hospital Building for District Hospital Ballia Campus at District – Ballia(U.P.).**

**Bore Hole No. 01**

**Depth of Bore Hole : 30.0M.**

**Depth of Water table : 13.50 M.**

## LABORATORY TEST RESULTS

S. No.	Depth of Bore Hole	Nature of soil Sample	% Passing on IS Sieve				Atterberg's Limit			Particle Size Analysis				S.P.T. Value	IS Group		Natural Moisture Content %	Wet Density gm/cc	Dry Density gm/cc	Specific Gravity 'G'	Void ratio 'e'	Shear Parameter		Compression Index Cc
			4.75 mm	2.00 mm	0.425mm	0.075 mm	LL %	PL %	PI %	Gravel %	Sand %	Silt %	Clay %		Symbol	hatching						Cohesion 'C' in Kg/Sqcm.	Angle of Internal Friction $\phi$	
1	0.0-0.50	DS	Filled	up	soil	met	up	to	-	0.70 m	depth	-	with	mix	F		bricks	bolder	pieces	below	-	existing	ground	level
2	1.50-1.85	UD	100	100	100	96	44	23	21	0	4	57	39	-	CI		12.2	1.82	1.62	2.70	0.67	0.39	5	0.131
3	1.85-2.30	SPT	-	-	-	-	-	-	-	-	-	-	-	8	-		-	-	-	-	-	-	-	-
4	3.00-3.35	UD	100	100	100	95	39	22	17	0	5	62	33	-	CI		13.9	1.86	1.63	2.71	0.66	0.34	7	0.128
5	3.35-3.80	SPT	-	-	-	-	-	-	-	-	-	-	-	10	-		-	-	-	-	-	-	-	-
6	4.50-4.85	UD	100	100	100	57	Non-Plastic			0	43	57	0	-	ML		14.6	1.75	1.53	2.65	0.73	0	22	0
7	4.85-5.30	SPT	-	-	-	-	-	-	-	-	-	-	-	12	-		-	-	-	-	-	-	-	-
8	6.00-6.35	UD	100	100	100	63	Non-Plastic			0	37	63	0	-	ML		15.7	1.76	1.52	2.66	0.75	0	22	0
9	6.35-6.80	SPT	-	-	-	-	-	-	-	-	-	-	-	14	-		-	-	-	-	-	-	-	-
10	7.50-7.85	U.D.	100	100	100	55	Non-Plastic			0	45	55	0	-	ML		16.4	1.77	1.52	2.66	0.75	0	23	0
11	7.85-8.30	S.P.T.	-	-	-	-	-	-	-	-	-	-	-	16	-		-	-	-	-	-	-	-	-
12	9.00-9.35	U.D.	100	100	100	60	Non-Plastic			0	40	60	0	-	ML		16.9	1.79	1.53	2.67	0.75	0	23	0
13	9.35-9.80	S.P.T.	-	-	-	-	-	-	-	-	-	-	-	18	-		-	-	-	-	-	-	-	-
14	10.50-10.85	UD	100	100	100	72	Non-Plastic			0	28	72	0	-	ML		17.3	1.78	1.52	2.63	0.73	0	22	0
15	10.85-11.30	SPT	-	-	-	-	-	-	-	-	-	-	-	21	-		-	-	-	-	-	-	-	-
16	12.00-12.35	UD	100	100	100	64	Non-Plastic			0	36	64	0	-	ML		18.8	1.82	1.53	2.66	0.74	0	22	-
17	12.35-12.80	SPT	-	-	-	-	-	-	-	-	-	-	-	23	-		-	-	-	-	-	-	-	-
18	13.50-13.85	UD	100	100	100	33	Non-Plastic			0	67	33	0	-	SM		27.9	1.93	1.51	2.61	0.73	0	27	-
19	13.85-14.30	SPT	-	-	-	-	-	-	-	-	-	-	-	26	-		-	-	-	-	-	-	-	-
20	15.00-15.35	UD	100	100	100	30	Non-Plastic			0	70	30	0	-	SM		28.4	1.93	1.50	2.61	0.74	0	27	-
21	15.35-15.80	SPT	-	-	-	-	-	-	-	-	-	-	-	27	-		-	-	-	-	-	-	-	-
22	16.50-16.85	UD	100	100	100	29	Non-Plastic			0	71	29	0	-	SM		28.5	1.93	1.50	2.62	0.75	0	27	-
23	16.85-17.30	SPT	-	-	-	-	-	-	-	-	-	-	-	29	-		-	-	-	-	-	-	-	-
24	18.00-18.35	UD	100	100	100	31	Non-Plastic			0	69	31	0	-	SM		28.7	1.92	1.49	2.60	0.74	0	28	-

25	18.35-18.80	SPT	-	-	-	-	-	-	-	-	-	-	-	31	-		-	-	-	-	-	-	-	-
26	19.50-19.85	UD	100	100	100	42	Non-Plastic			0	58	42	0	-	SM		28.8	1.92	1.49	2.61	0.75	0	28	-
27	19.85-20.30	SPT	-	-	-	-	-	-	-	-	-	-	-	33	-		-	-	-	-	-	-	-	-
28	21.00-21.35	UD	100	100	100	37	Non-Plastic			0	63	37	0	-	SM		28.3	1.94	1.51	2.64	0.75	0	28	-
29	21.35-21.80	SPT	-	-	-	-	-	-	-	-	-	-	-	35	-		-	-	-	-	-	-	-	-
30	22.50-22.85	UD	100	100	100	34	Non-Plastic			0	66	34	0	-	SM		28.6	1.93	1.50	2.63	0.75	0	29	-
31	22.85-23.30	SPT	-	-	-	-	-	-	-	-	-	-	-	37	-		-	-	-	-	-	-	-	-
32	24.00-24.35	UD	100	100	100	32	Non-Plastic			0	68	32	0	-	SM		28.8	1.92	1.49	2.61	0.75	0	29	-
33	24.35-24.80	SPT	-	-	-	-	-	-	-	-	-	-	-	39	-		-	-	-	-	-	-	-	-
34	25.50-25.85	UD	100	100	100	41	Non-Plastic			0	59	41	0	-	SM		28.5	1.93	1.50	2.62	0.75	0	29	-
35	25.85-26.30	SPT	-	-	-	-	-	-	-	-	-	-	-	42	-		-	-	-	-	-	-	-	-
36	27.00-27.35	UD	100	100	100	36	Non-Plastic			0	64	36	0	-	SM		28.9	1.92	1.49	2.62	0.76	0	30	-
37	27.35-27.80	SPT	-	-	-	-	-	-	-	-	-	-	-	45	-		-	-	-	-	-	-	-	-
38	28.50-28.85	UD	100	100	100	40	Non-Plastic			0	60	40	0	-	SM		28.8	1.92	1.49	2.61	0.75	0	30	-
39	28.85-29.30	SPT	-	-	-	-	-	-	-	-	-	-	-	48	-		-	-	-	-	-	-	-	-
40	29.30-30.00	DS	-	-	-	-	-	-	-	-	-	-	-	-	SM		-	-	-	-	-	-	-	-

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**Project : Proposed Construction of 300 Bedded Hospital Building for District Hospital Ballia Campus at District – Ballia(U.P.).**

**Bore Hole No. 02**

**Depth of Bore Hole : 30.0M.**

**Depth of Water table : 14.50 M.**

## LABORATORY TEST RESULTS

S. No.	Depth of Bore Hole	Nature of soil Sample	% Passing on IS Sieve				Atterberg's Limit			Particle Size Analysis				S.P.T. Value	IS Group		Natural Moisture Content %	Wet Density gm/cc	Dry Density gm/cc	Specific Gravity 'G'	Void ratio 'e'	Shear Parameter		Compression Index Cc
			4.75 mm	2.00 mm	0.425mm	0.075 mm	LL %	PL %	PI %	Gravel %	Sand %	Silt %	Clay %		Symbol	hatching						Cohesion 'C' in Kg/Sqcm.	Angle of Internal Friction $\phi$	
1	0.0-0.50	DS	Filled	up	soil	met	up	to	-	0.50 m	depth	-	with	mix	F		bricks	bolder	pieces	below	-	existing	ground	level
2	1.50-1.85	UD	100	100	100	96	41	22	19	0	4	59	37	-	CI		11.3	1.80	1.62	2.72	0.68	0.37	6	0.130
3	1.85-2.30	SPT	-	-	-	-	-	-	-	-	-	-	-	6	-		-	-	-	-	-	-	-	-
4	3.00-3.35	UD	100	99	98	97	41	23	18	0	3	62	35	-	CI		12.5	1.82	1.62	2.70	0.67	0.33	7	0.127
5	3.35-3.80	SPT	-	-	-	-	-	-	-	-	-	-	-	8	-		-	-	-	-	-	-	-	-
6	4.50-4.85	UD	100	100	100	96	38	22	16	0	4	66	30	-	CI		13.1	1.83	1.62	2.69	0.66	0.30	8	0.123
7	4.85-5.30	SPT	-	-	-	-	-	-	-	-	-	-	-	10	-		-	-	-	-	-	-	-	-
8	6.00-6.35	UD	100	100	100	65	Non-Plastic			0	35	65	0	-	ML		14.2	1.75	1.53	2.66	0.74	0	20	0
9	6.35-6.80	SPT	-	-	-	-	-	-	-	-	-	-	-	12	-		-	-	-	-	-	-	-	-
10	7.50-7.85	U.D.	100	100	100	70	Non-Plastic			0	30	70	0	-	ML		15.8	1.76	1.52	2.66	0.75	0	21	0
11	7.85-8.30	S.P.T.	-	-	-	-	-	-	-	-	-	-	-	14	-		-	-	-	-	-	-	-	-
12	9.00-9.35	U.D.	100	100	100	54	Non-Plastic			0	46	54	0	-	ML		16.5	1.78	1.53	2.67	0.75	0	21	0
13	9.35-9.80	S.P.T.	-	-	-	-	-	-	-	-	-	-	-	16	-		-	-	-	-	-	-	-	-
14	10.50-10.85	UD	100	100	100	51	Non-Plastic			0	49	51	0	-	ML		17.3	1.78	1.52	2.63	0.73	0	20	0
15	10.85-11.30	SPT	-	-	-	-	-	-	-	-	-	-	-	17	-		-	-	-	-	-	-	-	-
16	12.00-12.35	UD	100	100	100	57	Non-Plastic			0	43	57	0	-	ML		18.6	1.81	1.53	2.66	0.74	0	20	-
17	12.35-12.80	SPT	-	-	-	-	-	-	-	-	-	-	-	19	-		-	-	-	-	-	-	-	-
18	13.50-13.85	UD	100	100	100	60	Non-Plastic			0	40	60	0	-	ML		19.8	1.82	1.52	2.66	0.75	0	21	-
19	13.85-14.30	SPT	-	-	-	-	-	-	-	-	-	-	-	20	-		-	-	-	-	-	-	-	-
20	15.00-15.35	UD	100	100	100	43	Non-Plastic			0	57	43	0	-	SM		27.5	1.94	1.52	2.61	0.72	0	26	-
21	15.35-15.80	SPT	-	-	-	-	-	-	-	-	-	-	-	22	-		-	-	-	-	-	-	-	-
22	16.50-16.85	UD	100	100	100	40	Non-Plastic			0	60	40	0	-	SM		28.2	1.94	1.51	2.63	0.74	0	26	-
23	16.85-17.30	SPT	-	-	-	-	-	-	-	-	-	-	-	24	-		-	-	-	-	-	-	-	-
24	18.00-18.35	UD	100	100	100	36	Non-Plastic			0	64	36	0	-	SM		28.5	1.93	1.50	2.62	0.75	0	26	-



25	18.35-18.80	SPT	-	-	-	-	-	-	-	-	-	-	-	25	-		-	-	-	-	-	-	-	-	-
26	19.50-19.85	UD	100	100	100	38	Non-Plastic			0	62	38	0	-	SM		29.3	1.91	1.48	2.61	0.76	0	27	-	
27	19.85-20.30	SPT	-	-	-	-	-	-	-	-	-	-	-	27	-		-	-	-	-	-	-	-	-	-
28	21.00-21.35	UD	100	100	100	29	Non-Plastic			0	71	29	0	-	SM		28.3	1.94	1.51	2.64	0.75	0	27	-	
29	21.35-21.80	SPT	-	-	-	-	-	-	-	-	-	-	-	29	-		-	-	-	-	-	-	-	-	-
30	22.50-22.85	UD	100	100	100	35	Non-Plastic			0	65	35	0	-	SM		28.3	1.94	1.51	2.64	0.75	0	27	-	
31	22.85-23.30	SPT	-	-	-	-	-	-	-	-	-	-	-	31	-		-	-	-	-	-	-	-	-	-
32	24.00-24.35	UD	100	100	100	40	Non-Plastic			0	60	40	0	-	SM		28.8	1.92	1.49	2.61	0.75	0	28	-	
33	24.35-24.80	SPT	-	-	-	-	-	-	-	-	-	-	-	33	-		-	-	-	-	-	-	-	-	-
34	25.50-25.85	UD	100	100	100	38	Non-Plastic			0	62	38	0	-	SM		28.3	1.94	1.51	2.64	0.75	0	28	-	
35	25.85-26.30	SPT	-	-	-	-	-	-	-	-	-	-	-	35	-		-	-	-	-	-	-	-	-	-
36	27.00-27.35	UD	100	100	100	42	Non-Plastic			0	58	42	0	-	SM		28.5	1.93	1.50	2.62	0.75	0	28	-	
37	27.35-27.80	SPT	-	-	-	-	-	-	-	-	-	-	-	37	-		-	-	-	-	-	-	-	-	-
38	28.50-28.85	UD	100	100	100	44	Non-Plastic			0	56	44	0	-	SM		29.3	1.91	1.48	2.61	0.76	0	29	-	
39	28.85-29.30	SPT	-	-	-	-	-	-	-	-	-	-	-	39	-		-	-	-	-	-	-	-	-	-
40	29.30-30.00	DS	-	-	-	-	-	-	-	-	-	-	-	-	SM		-	-	-	-	-	-	-	-	-

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**Project : Proposed Construction of 300 Bedded Hospital Building for District Hospital Ballia Campus at District – Ballia(U.P.).**

**Bore Hole No. 03**

**Depth of Bore Hole : 30.0M.**

**Depth of Water table : 14.50 M.**

## LABORATORY TEST RESULTS

S. No.	Depth of Bore Hole	Nature of soil Sample	% Passing on IS Sieve				Atterberg's Limit			Particle Size Analysis				S.P.T. Value	IS Group		Natural Moisture Content %	Wet Density gm/cc	Dry Density gm/cc	Specific Gravity 'G'	Void ratio 'e'	Shear Parameter		Compression Index Cc
			4.75 mm	2.00 mm	0.425mm	0.075 mm	LL %	PL %	PI %	Gravel %	Sand %	Silt %	Clay %		Symbol	hatching						Cohesion 'C' in Kg/Sqcm.	Angle of Internal Friction Φ	
1	0.0-0.50	DS	Filled	up	soil	met	up	to	-	0.70 m	depth	-	with	mix	F		bricks	bolder	pieces	below	-	existing	ground	level
2	1.50-1.85	UD	100	100	100	97	42	22	20	0	3	57	40	-	CI		11.1	1.80	1.62	2.71	0.67	0.40	6	0.129
3	1.85-2.30	SPT	-	-	-	-	-	-	-	-	-	-	-	8	-		-	-	-	-	-	-	-	-
4	3.00-3.35	UD	100	100	100	96	39	23	16	0	4	65	31	-	CI		12.9	1.84	1.63	2.71	0.66	0.32	8	0.122
5	3.35-3.80	SPT	-	-	-	-	-	-	-	-	-	-	-	11	-		-	-	-	-	-	-	-	-
6	4.50-4.85	UD	100	100	100	64	Non-Plastic			0	36	64	0	-	ML		13.6	1.75	1.54	2.62	0.70	0	21	0
7	4.85-5.30	SPT	-	-	-	-	-	-	-	-	-	-	-	12	-		-	-	-	-	-	-	-	-
8	6.00-6.35	UD	100	100	100	67	Non-Plastic			0	33	67	0	-	ML		14.8	1.74	1.52	2.60	0.71	0	21	0
9	6.35-6.80	SPT	-	-	-	-	-	-	-	-	-	-	-	15	-		-	-	-	-	-	-	-	-
10	7.50-7.85	U.D.	100	100	100	53	Non-Plastic			0	47	53	0	-	ML		15.9	1.77	1.53	2.66	0.74	0	22	0
11	7.85-8.30	S.P.T.	-	-	-	-	-	-	-	-	-	-	-	18	-		-	-	-	-	-	-	-	-
12	9.00-9.35	U.D.	100	100	100	69	Non-Plastic			0	31	69	0	-	ML		16.8	1.78	1.52	2.65	0.74	0	22	0
13	9.35-9.80	S.P.T.	-	-	-	-	-	-	-	-	-	-	-	20	-		-	-	-	-	-	-	-	-
14	10.50-10.85	UD	100	100	100	55	Non-Plastic			0	45	55	0	-	ML		18.2	1.80	1.52	2.62	0.72	0	21	0
15	10.85-11.30	SPT	-	-	-	-	-	-	-	-	-	-	-	22	-		-	-	-	-	-	-	-	-
16	12.00-12.35	UD	100	100	100	70	Non-Plastic			0	30	70	0	-	ML		19.4	1.83	1.53	2.65	0.73	0	21	-
17	12.35-12.80	SPT	-	-	-	-	-	-	-	-	-	-	-	25	-		-	-	-	-	-	-	-	-
18	13.50-13.85	UD	100	100	100	35	Non-Plastic			0	65	35	0	-	SM		27.6	1.94	1.52	2.62	0.72	0	27	-
19	13.85-14.30	SPT	-	-	-	-	-	-	-	-	-	-	-	27	-		-	-	-	-	-	-	-	-
20	15.00-15.35	UD	100	100	100	28	Non-Plastic			0	72	28	0	-	SM		28.4	1.93	1.50	2.61	0.74	0	27	-
21	15.35-15.80	SPT	-	-	-	-	-	-	-	-	-	-	-	29	-		-	-	-	-	-	-	-	-
22	16.50-16.85	UD	100	100	100	30	Non-Plastic			0	70	30	0	-	SM		28.1	1.93	1.51	2.62	0.74	0	27	-
23	16.85-17.30	SPT	-	-	-	-	-	-	-	-	-	-	-	33	-		-	-	-	-	-	-	-	-
24	18.00-18.35	UD	100	100	100	37	Non-Plastic			0	63	37	0	-	SM		28.7	1.92	1.49	2.60	0.74	0	28	-

25	18.35-18.80	SPT	-	-	-	-	-	-	-	-	-	-	34	-		-	-	-	-	-	-	-	-
26	19.50-19.85	UD	100	100	100	31	Non-Plastic		0	69	31	0	-	SM		28.4	1.93	1.50	2.61	0.74	0	28	-
27	19.85-20.30	SPT	-	-	-	-	-	-	-	-	-	-	36	-		-	-	-	-	-	-	-	-
28	21.00-21.35	UD	100	100	100	38	Non-Plastic		0	62	38	0	-	SM		28.2	1.94	1.51	2.63	0.74	0	28	-
29	21.35-21.80	SPT	-	-	-	-	-	-	-	-	-	-	38	-		-	-	-	-	-	-	-	-
30	22.50-22.85	UD	100	100	100	40	Non-Plastic		0	60	40	0	-	SM		28.2	1.94	1.51	2.63	0.74	0	29	-
31	22.85-23.30	SPT	-	-	-	-	-	-	-	-	-	-	40	-		-	-	-	-	-	-	-	-
32	24.00-24.35	UD	100	100	100	43	Non-Plastic		0	57	43	0	-	SM		28.4	1.93	1.50	2.61	0.74	0	29	-
33	24.35-24.80	SPT	-	-	-	-	-	-	-	-	-	-	43	-		-	-	-	-	-	-	-	-
34	25.50-25.85	UD	100	100	100	30	Non-Plastic		0	70	30	0	-	SM		28.1	1.93	1.51	2.62	0.74	0	29	-
35	25.85-26.30	SPT	-	-	-	-	-	-	-	-	-	-	46	-		-	-	-	-	-	-	-	-
36	27.00-27.35	UD	100	100	100	37	Non-Plastic		0	63	37	0	-	SM		28.7	1.92	1.49	2.60	0.74	0	30	-
37	27.35-27.80	SPT	-	-	-	-	-	-	-	-	-	-	48	-		-	-	-	-	-	-	-	-
38	28.50-28.85	UD	100	100	100	31	Non-Plastic		0	69	31	0	-	SM		28.4	1.93	1.50	2.61	0.74	0	30	-
39	28.85-29.30	SPT	-	-	-	-	-	-	-	-	-	-	49	-		-	-	-	-	-	-	-	-
40	29.30-30.00	DS	-	-	-	-	-	-	-	-	-	-	-	SM		-	-	-	-	-	-	-	-

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**Bore Hole No. 04**

**Depth of Bore Hole : 30.0M.**

**Depth of Water table : 13.50 M.**

## LABORATORY TEST RESULTS

S. No.	Depth of Bore Hole	Nature of soil Sample	% Passing on IS Sieve				Atterberg's Limit			Particle Size Analysis				S.P.T. Value	IS Group		Natural Moisture Content %	Wet Density gm/cc	Dry Density gm/cc	Specific Gravity 'G'	Void ratio 'e'	Shear Parameter		Compression Index Cc
			4.75 mm	2.00 mm	0.425mm	0.075 mm	LL %	PL %	PI %	Gravel %	Sand %	Silt %	Clay %		Symbol	hatching						Cohesion 'C' in Kg/Sqcm.	Angle of Internal Friction Φ	
1	0.0-0.50	DS	Filled	up	soil	met	up	to	-	1.00 m	depth	-	with	mix	F		bricks	bolder	pieces	below	-	existing	ground	level
2	1.50-1.85	UD	100	100	100	97	42	23	19	0	3	59	38	-	CI		12.0	1.81	1.62	2.69	0.66	0.39	6	0.132
3	1.85-2.30	SPT	-	-	-	-	-	-	-	-	-	-	-	7	-		-	-	-	-	-	-	-	-
4	3.00-3.35	UD	100	100	100	55	Non-Plastic			0	45	55	0	-	ML		13.8	1.76	1.55	2.61	0.68	0	24	0
5	3.35-3.80	SPT	-	-	-	-	-	-	-	-	-	-	-	9	-		-	-	-	-	-	-	-	-
6	4.50-4.85	UD	100	100	100	61	Non-Plastic			0	39	61	0	-	ML		14.1	1.75	1.53	2.62	0.71	0	24	0
7	4.85-5.30	SPT	-	-	-	-	-	-	-	-	-	-	-	14	-		-	-	-	-	-	-	-	-
8	6.00-6.35	UD	100	100	100	29	Non-Plastic			0	71	29	0	-	SM		16.3	1.74	1.50	2.61	0.74	0	26	-
9	6.35-6.80	SPT	-	-	-	-	-	-	-	-	-	-	-	15	-		-	-	-	-	-	-	-	-
10	7.50-7.85	U.D.	100	100	100	35	Non-Plastic			0	65	35	0	-	SM		17.1	1.77	1.51	2.64	0.75	0	26	-
11	7.85-8.30	S.P.T.	-	-	-	-	-	-	-	-	-	-	-	19	-		-	-	-	-	-	-	-	-
12	9.00-9.35	U.D.	100	100	100	38	Non-Plastic			0	62	38	0	-	SM		18.6	1.78	1.50	2.62	0.75	0	26	-
13	9.35-9.80	S.P.T.	-	-	-	-	-	-	-	-	-	-	-	20	-		-	-	-	-	-	-	-	-
14	10.50-10.85	UD	100	100	100	41	Non-Plastic			0	59	41	0	-	SM		20.1	1.79	1.49	2.61	0.75	0	27	-
15	10.85-11.30	SPT	-	-	-	-	-	-	-	-	-	-	-	21	-		-	-	-	-	-	-	-	-
16	12.00-12.35	UD	100	100	100	36	Non-Plastic			0	64	36	0	-	SM		28.3	1.94	1.51	2.64	0.75	0	27	-
17	12.35-12.80	SPT	-	-	-	-	-	-	-	-	-	-	-	24	-		-	-	-	-	-	-	-	-
18	13.50-13.85	UD	100	100	100	27	Non-Plastic			0	73	27	0	-	SM		28.3	1.94	1.51	2.64	0.75	0	27	-
19	13.85-14.30	SPT	-	-	-	-	-	-	-	-	-	-	-	26	-		-	-	-	-	-	-	-	-
20	15.00-15.35	UD	100	100	100	26	Non-Plastic			0	74	26	0	-	SM		28.5	1.93	1.50	2.62	0.75	0	28	-
21	15.35-15.80	SPT	-	-	-	-	-	-	-	-	-	-	-	27	-		-	-	-	-	-	-	-	-
22	16.50-16.85	UD	100	100	100	40	Non-Plastic			0	60	40	0	-	SM		28.3	1.94	1.51	2.64	0.75	0	28	-
23	16.85-17.30	SPT	-	-	-	-	-	-	-	-	-	-	-	30	-		-	-	-	-	-	-	-	-
24	18.00-18.35	UD	100	100	100	37	Non-Plastic			0	63	37	0	-	SM		28.5	1.93	1.50	2.62	0.75	0	28	-
25	18.35-18.80	SPT	-	-	-	-	-	-	-	-	-	-	-	32	-		-	-	-	-	-	-	-	-

26	19.50-19.85	UD	100	100	100	33	Non-Plastic			0	67	33	0	-	SM		28.8	1.92	1.49	2.61	0.75	0	29	-
27	19.85-20.30	SPT	-	-	-	-	-	-	-	-	-	-	-	35	-		-	-	-	-	-	-	-	-
28	21.00-21.35	UD	100	100	100	29	Non-Plastic			0	71	29	0	-	SM		28.3	1.94	1.51	2.64	0.75	0	29	-
29	21.35-21.80	SPT	-	-	-	-	-	-	-	-	-	-	-	38	-		-	-	-	-	-	-	-	-
30	22.50-22.85	UD	100	100	100	27	Non-Plastic			0	73	27	0	-	SM		28.3	1.94	1.51	2.64	0.75	0	29	-
31	22.85-23.30	SPT	-	-	-	-	-	-	-	-	-	-	-	42	-		-	-	-	-	-	-	-	-
32	24.00-24.35	UD	100	100	100	30	Non-Plastic			0	70	30	0	-	SM		28.8	1.92	1.49	2.61	0.75	0	30	-
33	24.35-24.80	SPT	-	-	-	-	-	-	-	-	-	-	-	45	-		-	-	-	-	-	-	-	-
34	25.50-25.85	UD	100	100	100	34	Non-Plastic			0	66	34	0	-	SM		28.3	1.94	1.51	2.64	0.75	0	30	-
35	25.85-26.30	SPT	-	-	-	-	-	-	-	-	-	-	-	47	-		-	-	-	-	-	-	-	-
36	27.00-27.35	UD	100	100	100	39	Non-Plastic			0	61	39	0	-	SM		28.5	1.93	1.50	2.62	0.75	0	30	-
37	27.35-27.80	SPT	-	-	-	-	-	-	-	-	-	-	-	49	-		-	-	-	-	-	-	-	-
38	28.50-28.85	UD	100	100	100	42	Non-Plastic			0	58	42	0	-	SM		28.8	1.92	1.49	2.61	0.75	0	31	-
39	28.85-29.30	SPT	-	-	-	-	-	-	-	-	-	-	-	51	-		-	-	-	-	-	-	-	-
40	29.30-30.00	DS	-	-	-	-	-	-	-	-	-	-	-	-	SM		-	-	-	-	-	-	-	-

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















**Project : Proposed Construction of 300 Bedded Hospital Building for District Hospital Ballia Campus at District – Ballia(U.P.).**

**Bore Hole No. 05**

**Depth of Bore Hole : 30.0M.**

**Depth of Water table : 12.50 M.**

## LABORATORY TEST RESULTS

S. No.	Depth of Bore Hole	Nature of soil Sample	% Passing on IS Sieve				Atterberg's Limit			Particle Size Analysis				S.P.T. Value	IS Group		Natural Moisture Content %	Wet Density gm/cc	Dry Density gm/cc	Specific Gravity 'G'	Void ratio 'e'	Shear Parameter		Compression Index Cc
			4.75 mm	2.00 mm	0.425mm	0.075 mm	LL %	PL %	PI %	Gravel %	Sand %	Silt %	Clay %		Symbol	hatching						Cohesion 'C' in Kg/Sqcm.	Angle of Internal Friction Φ	
1	0.0-0.50	DS	Filled	up	soil	met	up	to	-	1.85 m	depth	-	with	mix	F		bricks	bolder	pieces	below	-	existing	ground	level
2	1.50-1.85	UD	-	-	-	-	-	-	-	-	-	-	-	-	F		-	-	-	-	-	-	-	-
3	1.85-2.30	SPT	-	-	-	-	-	-	-	-	-	-	-	8	-		-	-	-	-	-	-	-	-
4	3.00-3.35	UD	99	98	97	96	39	23	16	1	3	65	31	-	CI		13.8	1.84	1.62	2.70	0.67	0.32	8	0.121
5	3.35-3.80	SPT	-	-	-	-	-	-	-	-	-	-	-	10	-		-	-	-	-	-	-	-	-
6	4.50-4.85	UD	100	97	96	95	40	22	18	0	5	61	34	-	CI		15.1	1.88	1.63	2.71	0.66	0.36	7	0.124
7	4.85-5.30	SPT	-	-	-	-	-	-	-	-	-	-	-	14	-		-	-	-	-	-	-	-	-
8	6.00-6.35	UD	100	100	100	33	Non-Plastic			0	67	33	0	-	SM		16.9	1.74	1.49	2.58	0.73	0	26	-
9	6.35-6.80	SPT	-	-	-	-	-	-	-	-	-	-	-	17	-		-	-	-	-	-	-	-	-
10	7.50-7.85	U.D.	100	100	100	36	Non-Plastic			0	64	36	0	-	SM		17.6	1.78	1.51	2.62	0.74	0	26	-
11	7.85-8.30	S.P.T.	-	-	-	-	-	-	-	-	-	-	-	19	-		-	-	-	-	-	-	-	-
12	9.00-9.35	U.D.	100	100	100	41	Non-Plastic			0	59	41	0	-	SM		18.2	1.78	1.51	2.63	0.74	0	26	-
13	9.35-9.80	S.P.T.	-	-	-	-	-	-	-	-	-	-	-	21	-		-	-	-	-	-	-	-	-
14	10.50-10.85	UD	100	100	100	30	Non-Plastic			0	70	30	0	-	SM		19.7	1.78	1.49	2.60	0.74	0	27	-
15	10.85-11.30	SPT	-	-	-	-	-	-	-	-	-	-	-	24	-		-	-	-	-	-	-	-	-
16	12.00-12.35	UD	100	100	100	34	Non-Plastic			0	66	34	0	-	SM		20.9	1.83	1.51	2.62	0.74	0	27	-
17	12.35-12.80	SPT	-	-	-	-	-	-	-	-	-	-	-	27	-		-	-	-	-	-	-	-	-
18	13.50-13.85	UD	100	100	100	42	Non-Plastic			0	58	42	0	-	SM		28.4	1.93	1.50	2.61	0.74	0	27	-
19	13.85-14.30	SPT	-	-	-	-	-	-	-	-	-	-	-	30	-		-	-	-	-	-	-	-	-
20	15.00-15.35	UD	100	100	100	39	Non-Plastic			0	61	39	0	-	SM		28.4	1.93	1.50	2.61	0.74	0	28	-
21	15.35-15.80	SPT	-	-	-	-	-	-	-	-	-	-	-	33	-		-	-	-	-	-	-	-	-
22	16.50-16.85	UD	100	100	100	26	Non-Plastic			0	74	26	0	-	SM		28.2	1.94	1.51	2.63	0.74	0	28	-
23	16.85-17.30	SPT	-	-	-	-	-	-	-	-	-	-	-	36	-		-	-	-	-	-	-	-	-
24	18.00-18.35	UD	100	100	100	28	Non-Plastic			0	72	28	0	-	SM		28.1	1.93	1.51	2.62	0.74	0	28	-
25	18.35-18.80	SPT	-	-	-	-	-	-	-	-	-	-	-	38	-		-	-	-	-	-	-	-	-



26	19.50-19.85	UD	100	100	100	31	Non-Plastic			0	69	31	0	-	SM		28.4	1.93	1.50	2.61	0.74	0	29	-
27	19.85-20.30	SPT	-	-	-	-	-	-	-	-	-	-	-	40	-		-	-	-	-	-	-	-	-
28	21.00-21.35	UD	100	100	100	43	Non-Plastic			0	57	43	0	-	SM		28.2	1.94	1.51	2.63	0.74	0	29	-
29	21.35-21.80	SPT	-	-	-	-	-	-	-	-	-	-	-	42	-		-	-	-	-	-	-	-	-
30	22.50-22.85	UD	100	100	100	40	Non-Plastic			0	60	40	0	-	SM		28.1	1.93	1.51	2.62	0.74	0	29	-
31	22.85-23.30	SPT	-	-	-	-	-	-	-	-	-	-	-	44	-		-	-	-	-	-	-	-	-
32	24.00-24.35	UD	100	100	100	38	Non-Plastic			0	62	38	0	-	SM		28.7	1.92	1.49	2.60	0.74	0	30	-
33	24.35-24.80	SPT	-	-	-	-	-	-	-	-	-	-	-	46	-		-	-	-	-	-	-	-	-
34	25.50-25.85	UD	100	100	100	37	Non-Plastic			0	63	37	0	-	SM		28.2	1.94	1.51	2.63	0.74	0	30	-
35	25.85-26.30	SPT	-	-	-	-	-	-	-	-	-	-	-	49	-		-	-	-	-	-	-	-	-
36	27.00-27.35	UD	100	100	100	40	Non-Plastic			0	60	40	0	-	SM		28.1	1.93	1.51	2.62	0.74	0	30	-
37	27.35-27.80	SPT	-	-	-	-	-	-	-	-	-	-	-	51	-		-	-	-	-	-	-	-	-
38	28.50-28.85	UD	100	100	100	44	Non-Plastic			0	56	44	0	-	SM		28.4	1.93	1.50	2.61	0.74	0	31	-
39	28.85-29.30	SPT	-	-	-	-	-	-	-	-	-	-	-	53	-		-	-	-	-	-	-	-	-
40	29.30-30.00	DS	-	-	-	-	-	-	-	-	-	-	-	-	SM		-	-	-	-	-	-	-	-

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



















**Project : Proposed Construction of 300 Bedded Hospital Building for District Hospital Ballia Campus at District – Ballia(U.P.).**

**Bore Hole No. 06**

**Depth of Bore Hole : 30.0M.**

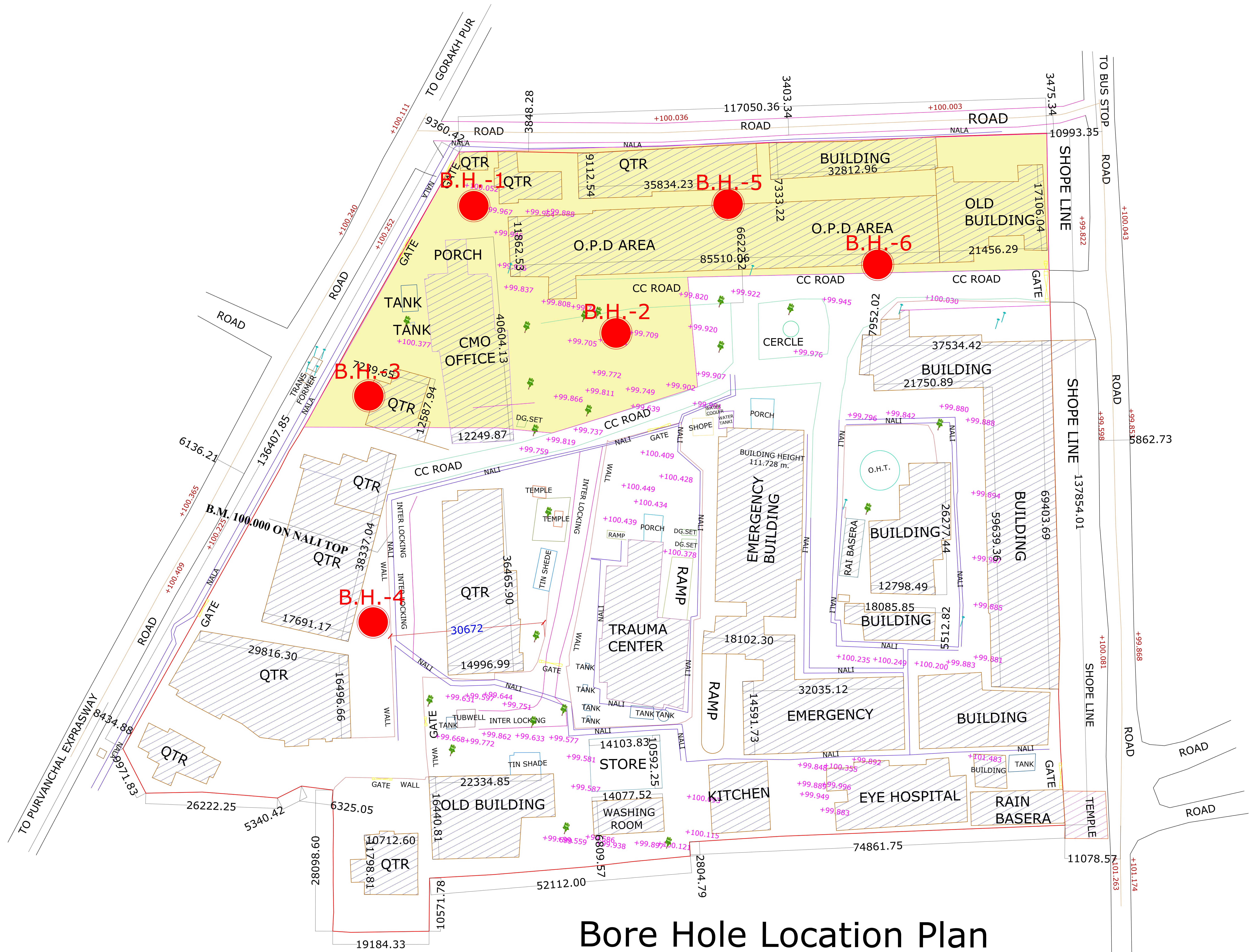
**Depth of Water table : 12.00 M.**

## LABORATORY TEST RESULTS

S. No.	Depth of Bore Hole	Nature of soil Sample	% Passing on IS Sieve				Atterberg's Limit			Particle Size Analysis				S.P.T. Value	IS Group		Natural Moisture Content %	Wet Density gm/cc	Dry Density gm/cc	Specific Gravity 'G'	Void ratio 'e'	Shear Parameter		Compression Index Cc
			4.75 mm	2.00 mm	0.425mm	0.075 mm	LL %	PL %	PI %	Gravel %	Sand %	Silt %	Clay %		Symbol	hatching						Cohesion 'C' in Kg/Sqcm.	Angle of Internal Friction $\phi$	
1	0.0-0.50	DS	Filled	up	soil	met	up	to	-	1.85 m	depth	-	with	mix	F		bricks	bolder	pieces	below	-	existing	ground	level
2	1.50-1.85	UD	-	-	-	-	-	-	-	-	-	-	-	-	F		-	-	-	-	-	-	-	-
3	1.85-2.30	SPT	-	-	-	-	-	-	-	-	-	-	-	8	CI		-	-	-	-	-	-	-	-
4	3.00-3.35	UD	99	98	97	96	39	22	17	1	3	63	33	-	CI		13.2	1.85	1.63	2.71	0.66	0.35	7	0.127
5	3.35-3.80	SPT	-	-	-	-	-	-	-	-	-	-	-	9	-		-	-	-	-	-	-	-	-
6	4.50-4.85	UD	100	100	100	97	44	23	21	0	3	59	38	-	CI		13.7	1.88	1.65	2.70	0.64	0.41	5	0.130
7	4.85-5.30	SPT	-	-	-	-	-	-	-	-	-	-	-	12	-		-	-	-	-	-	-	-	-
8	6.00-6.35	UD	100	100	100	57	Non-Plastic			0	43	57	0	-	ML		14.9	1.75	1.52	2.64	0.74	0	22	0
9	6.35-6.80	SPT	-	-	-	-	-	-	-	-	-	-	-	14	-		-	-	-	-	-	-	-	-
10	7.50-7.85	U.D.	100	100	100	63	Non-Plastic			0	37	63	0	-	ML		15.6	1.76	1.52	2.65	0.74	0	22	0
11	7.85-8.30	S.P.T.	-	-	-	-	-	-	-	-	-	-	-	16	-		-	-	-	-	-	-	-	-
12	9.00-9.35	U.D.	100	100	100	27	Non-Plastic			0	73	27	0	-	SM		16.7	1.74	1.49	2.61	0.75	0	27	0
13	9.35-9.80	S.P.T.	-	-	-	-	-	-	-	-	-	-	-	0.12	-		-	-	-	-	-	-	-	-
14	10.50-10.85	UD	100	100	100	30	Non-Plastic			0	70	30	0	-	SM		18.7	1.78	1.50	2.63	0.75	0	27	0
15	10.85-11.30	SPT	-	-	-	-	-	-	-	-	-	-	-	22	-		-	-	-	-	-	-	-	-
16	12.00-12.35	UD	100	100	100	39	Non-Plastic			0	61	39	0	-	SM		28.8	1.92	1.49	2.61	0.75	0	27	-
17	12.35-12.80	SPT	-	-	-	-	-	-	-	-	-	-	-	24	-		-	-	-	-	-	-	-	-
18	13.50-13.85	UD	100	100	100	31	Non-Plastic			0	69	31	0	-	SM		28.5	1.93	1.50	2.62	0.75	0	28	-
19	13.85-14.30	SPT	-	-	-	-	-	-	-	-	-	-	-	26	-		-	-	-	-	-	-	-	-
20	15.00-15.35	UD	100	100	100	36	Non-Plastic			0	64	36	0	-	SM		28.8	1.92	1.49	2.61	0.75	0	28	-
21	15.35-15.80	SPT	-	-	-	-	-	-	-	-	-	-	-	27	-		-	-	-	-	-	-	-	-
22	16.50-16.85	UD	100	100	100	40	Non-Plastic			0	60	40	0	-	SM		28.5	1.93	1.50	2.62	0.75	0	28	-
23	16.85-17.30	SPT	-	-	-	-	-	-	-	-	-	-	-	29	-		-	-	-	-	-	-	-	-
24	18.00-18.35	UD	100	100	100	36	Non-Plastic			0	64	36	0	-	SM		29.1	1.91	1.48	2.60	0.76	0	29	-

25	18.35-18.80	SPT	-	-	-	-	-	-	-	-	-	-	-	31	-				-	-	-	-	-	-	-	-	-
26	19.50-19.85	UD	100	100	100	42	Non-Plastic			0	58	42	0	-	SM							28.8	1.92	1.49	2.61	0.75	0
27	19.85-20.30	SPT	-	-	-	-	-	-	-	-	-	-	-	36	-							-	-	-	-	-	-
28	21.00-21.35	UD	100	100	100	45	Non-Plastic			0	55	45	0	-	SM							28.6	1.93	1.50	2.63	0.75	0
29	21.35-21.80	SPT	-	-	-	-	-	-	-	-	-	-	-	39	-							-	-	-	-	-	-
30	22.50-22.85	UD	100	100	100	30	Non-Plastic			0	70	30	0	-	SM							28.3	1.94	1.51	2.64	0.75	0
31	22.85-23.30	SPT	-	-	-	-	-	-	-	-	-	-	-	42	-							-	-	-	-	-	-
32	24.00-24.35	UD	100	100	100	34	Non-Plastic			0	66	34	0	-	SM							28.8	1.92	1.49	2.61	0.75	0
33	24.35-24.80	SPT	-	-	-	-	-	-	-	-	-	-	-	43	-							-	-	-	-	-	-
34	25.50-25.85	UD	100	100	100	36	Non-Plastic			0	64	36	0	-	SM							28.5	1.93	1.50	2.62	0.75	0
35	25.85-26.30	SPT	-	-	-	-	-	-	-	-	-	-	-	46	-							-	-	-	-	-	-
36	27.00-27.35	UD	100	100	100	40	Non-Plastic			0	60	40	0	-	SM							28.8	1.92	1.49	2.61	0.75	0
37	27.35-27.80	SPT	-	-	-	-	-	-	-	-	-	-	-	48	-							-	-	-	-	-	-
38	28.50-28.85	UD	100	100	100	43	Non-Plastic			0	57	43	0	-	SM							28.8	1.92	1.49	2.61	0.75	0
39	28.85-29.30	SPT	-	-	-	-	-	-	-	-	-	-	-	49	-							-	-	-	-	-	-
40	29.30-30.00	DS	-	-	-	-	-	-	-	-	-	-	-	-	SM							-	-	-	-	-	-







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Date: 20-February-2026

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WATER CONSULTANTS AND CIVIL ENGINEERING PROJECT

Report No. ABC/25-26/SRS00343

## TEST - REPORT ON SUB-SOIL-INVESTIGATION AT THE PROPOSED SITE FOR CONSTRUCTION OF ADMIN & ACADEMIC BLOCK BUILDING FOR THE PROPOSED MEDICAL COLLAGE CAMPUS IN BALLIA OLD JAIL CAMPUS, AT DISTRICT - BALLIA (U.P.)



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**-: HOUSE FOR :-**

**Soil / Material Testing, Geological Investigation, Quality  
Control & Survey of sites**

**Administrative Office: - C-1074/75, SECTOR - B. MAHANAGAR, LUCKNOW**

**ACKNOWLEDGEMENT**

*We are thankful for providing us the opportunity to prepare and submit the soil investigation report and we appreciate the co-operation & assistance provided by the client. Looking forward to provide, many such reliable & timely services in future.*



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(Soil Investigations and Laboratory Works)

Authorized Signatory

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## **1.0 INTRODUCTION :**

This report cover the results of field and Laboratory test Conducted at the Proposed Site for Construction of Admin & Academic Block Building for The Proposed Medical Collage Campus in Ballia Old jail campus Building at District – Ballia(U.P.). These Investigations have been made to find out the allowable pressure of the soil required for the safe and economical design and execution of engineering works. The work of soil investigation was entrusted to **ABC CONSULTANTS, Administrative Office:- C-1074/75, SECTOR – B. MAHANAGAR, LUCKNOW**

It was decided by the concerned to conduct boring at four points up to depth of 30.0 meter each at the point marked by them at the site. Accordingly, the boring was conducted in accordance to I.S:1892–1979. Disturbed & undisturbed soil samples were collected along with conducting the standard penetration test at an interval of 1.5 meter. Or change of strata which ever met earlier starting from boring points to the termination of bore holes.

### **1.1 UNDISTURBED SOIL SAMPLES:**

These samples have been collected by the oven dry sampler. After recovery of soil samples from the bore holes the ends of the tube have been cleaned waxed and marked properly. The depth of undisturbed soil samples have been indicated on the bore log chart as well on the Laboratory test result sheet attached. The soil samples have been collected as per I.S. 1892 – 1979.

### **2.1.2 DISTURBED SOIL SAMPLES:**

The depth of the disturbed soil samples have been indicated on the bore log chart as well as on the Laboratory test result and were collected in polythene bags & properly leveled.

### **2.2.1 STANDARD PENETRATION TEST:**

The Standard Penetration Test has been conducted in the bore log charts at the intervals of 1.5 meter as per latest IS: 2131-1981 i.e. “Method for standard penetration test for soils”. In this depth Standard split spoon sampler is driven in to the soil are required depth,

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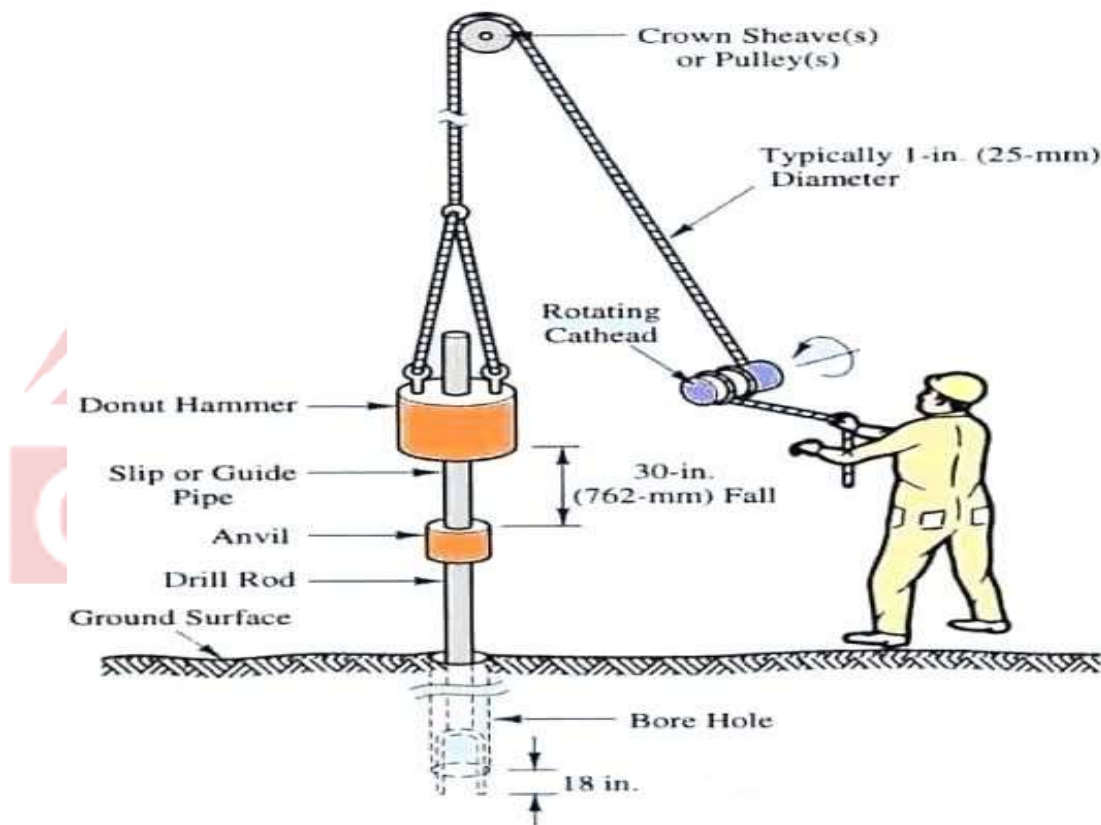
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with the help of drive weight of 63.5 kg falling freely under gravity through a Vertical height of 75cm. The number of blows for every 15 cms is recorded. The number of below for the first 15 cm. is neglected due to local disturbance and as a seating drive. The number of blows next 30 cm. are recorded as penetration blows 'N' of the soil at the depth. The result of the standard penetration test have been indicated on the laboratory test results sheet as well as on the bore log chart. Disturbed Soil samples obtained from standard split spoon sampler were collected in polythene bags of suitable size. These samples were properly sealed, labelled, recorded and carefully transported to laboratory for testing.



**DIAGRAMMATIC OF SPT**

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## 2.2.2 CONSISTENCY/RELATIVE DENSITY OF SOIL WITH SPT VALUES AS PER IRC: 75-2015

CORRELATION FOR CLAY/PLASTIC SILT		CORRELATION FOR SAND/NON-PLASTIC SILT	
Consistency	Penetration Value	Relative Density	Penetration Value
Very Soft	0 to 2 Blows	Very loose	0 to 4 Blows
Soft	2 to 4 Blows	Loose	5 to 10 Blows
Medium Stiff	4 to 8 Blows	Medium	11 to 30 Blows
Stiff	8 to 15 Blows	Dense	31 to 50 Blows
Very Stiff	15 to 30 Blows	Very Dense	Above 50
Hard	Above 30		

### 3.0 LABORATORY WORK

#### 3.1 UNDISTURBED SOIL SAMPLES:

The Undisturbed soils collected from the bore holes have been tested for the following to determine the engineering properties of soil as per requirement.

- Sieve Analysis (I.S. Code 2720 (Part IV)-2007
- Atterberg's Limit (Via Liquid and Plastic Limit & Plasticity Index)  
(I.S. Code 2720 (Part V)-2007
- Particle size analysis (I.S. Code 2720 (Part IV)-2007
- Bulk and Dry Density (I.S. Code 2720 (Part XXIX)-2007
- Natural Moisture Content (I.S. Code 2720 (Part II)-2010
- Shear Parameters C &  $\Phi$  (I.S. Code 2720 (Part XII & XIII)-2007
- Consolidation Test (For determination of Cc values of clayey soil samples) (I.S. Code 2720 (Part XV)-2007
- Specific Gravity (I.S. Code 2720 (Part III)-2007

#### 3.2 DISTURBED SOIL SAMPLES :

The disturbed soil samples have been tested for the following parameters.

- Sieve Analysis (I.S. Code 2720 (Part IV)-2007

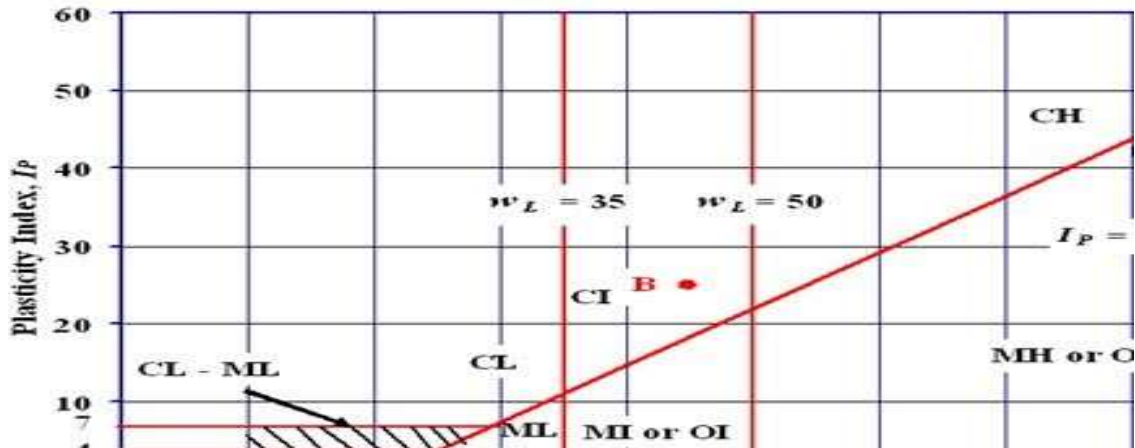
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**4.0 SOIL CLASSIFICATION:** Soil classification has been done with the help of the soil properties obtained by laboratory test as per I.S. 1498 "Methods of classification and identification of soil for general engineering purposes".

b) Atterberg's Limits (I.S. Code 2720 (Part IV)-2007

The entire Laboratory has been carried out as per relevant I.S. code & has been tabulated.



FOR COHESIVE SOIL		FOR NON-COHESIVE SOIL	
Plasticity	Liquid Limit	Soil Classification	% Passing on IS Sieve 0.075 mm
Low Plastic	<35	ML	>50
Medium Plastic	35 to 50	SM	13-49
High Plastic	>50	SM-SP	5-12
		SP	1-4

### ABBREVIATIONS

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>CL - SILTY CLAY OF LOW PLASTICITY</li> <li>CI - SILTY CLAY OF MEDIUM PLASTICITY</li> <li>CH - SILTY CLAY OF HIGH PLASTICITY</li> <li>ML - CLAYEY SILT OF LOW PLASTICITY</li> <li>CL-ML - CLAYEY SILT OF LOW PLASTICITY</li> <li>MI - CLAYEY SILT OF MEDIUM PLASTICITY</li> <li>SC - CLAYEY SAND</li> <li>GL - GROUND LEVEL</li> </ul> | <ul style="list-style-type: none"> <li>ML - SANDY SILT</li> <li>SM - SILTY SAND</li> <li>SM-SP - POORLY GRADED SAND-SILT MIXTURE</li> <li>SW/SP - WELL/POORLY GRADED SAND</li> <li>GSF - GENERAL SHEAR FAILURE</li> <li>LSF - LOCAL SHEAR FAILURE</li> <li>ISF - INTERMEDIATE SHEAR FAILURE</li> <li>BGL - BELOW GROUND LEVEL</li> </ul> |
|--|--|

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## **5.0 GENERAL NATURE OF SOIL STRATA:**

The general nature of the soil strata met during boring in each of bore holes are indicated on the bore log charts as well as on the laboratory test results sheet. The filled-up soil is met up to 0.50m depth in bore hole nos-2, 3 & 4 and bore hole no.-1 is free from filled-up soil below existing ground level. Below filled-up soil the entire Strata is comprising of 'CI' silty clay of medium plasticity, 'ML' sandy silt and 'SM' silty sand.

## **5.1 STANDARD PENETRATION TEST:**

The 'N' values (or SPT values recorded) during penetration test in the strata in the bore hole No. 1, 2, 3 & 4 were found vary from 6 to 49 indicate the consistency of the soil as medium.

## **6.0 WATER TABLE:**

The depth of water table was met up to. 2.50 m depth during boring operation in bore hole at the time of soil exploration in the month of since February 2026. Water is expected 1.00 m rise in post monsoon period. Accordingly, water table is assuming 1.50 m for calculation purpose.

## **7.0 INTERPRETATION OF THE TEST RESULTS (SHEAR CONSIDERATION):**

**7.1** The choice of the type of foundation depends upon the safe bearing capacity, design and layout of super structure, relative economics of various alternatives and practical consideration. In case of strip footing the safe bearing capacity / allowable bearing pressure, calculation is governed by IS: 6403-1981, for shear consideration & IS: 1904-1986 & IS: 8009 (Part-I)-1976, for consideration of settlement. Net Safe Bearing capacity from Shear Failure consideration has been computed in accordance with IS: 6403-1981. A factor of safety of 3.0 is selected based on clause 706.3.1.1.1 of IRC 78- 2014 to estimate the net safe bearing capacity from ultimate net bearing capacity. The modified bearing capacity formula are as below considering the shape of footing, inclination of loading, depth of embedment and effect of water table.

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$$Q_s = 1/F [C.N_c.S_c.d_c.i_c. + q(N_q-1) S_q.d_q.i_q. + 0.50 \gamma B. N_\gamma.s_\gamma.d_\gamma.i_\gamma.w']$$

Where:

$Q_s$  = Bearing capacity on shear consideration in  $\text{Kg/cm}^2$

$F$  = Factor of safety

$\gamma$  = Unit weight of soil

$C$  = Cohesion in  $\text{Kg/cm}^2$

$q$  = effective overburden pressure  $\text{Kg/cm}^2$

$B$  = Width of footing

$w'$  = Correction factor for position of water table.

$N_c.N_q.N_\gamma$  = Non dimensional bearing capacity factors depends upon angle of internal friction  $\phi$  and void ratio  $e$

$S_c.S_q.S_\gamma$  = Shape factors

$d_c.d_q.d_\gamma$  = Depth factors

$i_c.i_q.i_\gamma$  = Inclination factors

### 7.3 SETTLEMENT CONSOLIDATION: (For Plastic soil)

The settlement in the plastic soil indicating some cohesion is given by the formula:

$$S = \frac{C_c}{1 + e_o} \times H \times \log_{10} \frac{P_o + \Delta P}{P_o}$$

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Where:

$C_c$  = Compression Index

$H$  = Thickness of Plastic layer

$P_o$  = Original Pressure at mid depth of Plastic layer

$\Delta P$  = Change in Pressure at mid depth of Plastic layer

$e_o$  = Void ratio for pressure  $P_o$

#### **7.4 SETTLEMENT CONSIDERATION:** (For non-Plastic soils)

The allowable bearing pressure is also to be so restricted that the anticipated settlement does not exceed the permissible settlement as specified in IS: 1904-1986, for a particular type of structure and nature of soil.

#### **7.5 Proposed Design Parameter's for Soil:**

##### **7.5.1 For Cohesionless Soils**

In cohesion-less soils since it is difficult to collect undisturbed samples, it is preferred to estimate the angle of internal friction from corrected SPT values (Ref: IS: 6403, IRC:78, Euro Code / British Code BS:8004). Particle size distribution among the non-cohesive soils will also affect on angle of internal friction, generally all codes and literatures have provided the curves between corrected SPT(N) value and angle of internal friction for sands (SP type soils) however when fine content increases, the angle of friction reduces. Although it is not necessary to conduct tests on cohesionless soils (Sandy Soils) as  $\phi$  value may directly be taken from Corrected SPT N value but to check the values as per laboratory tests also the same have been conducted. Direct shear tests may also be conducted on remoulded samples at simulated density; however, the structure of the soil cannot be duplicated.

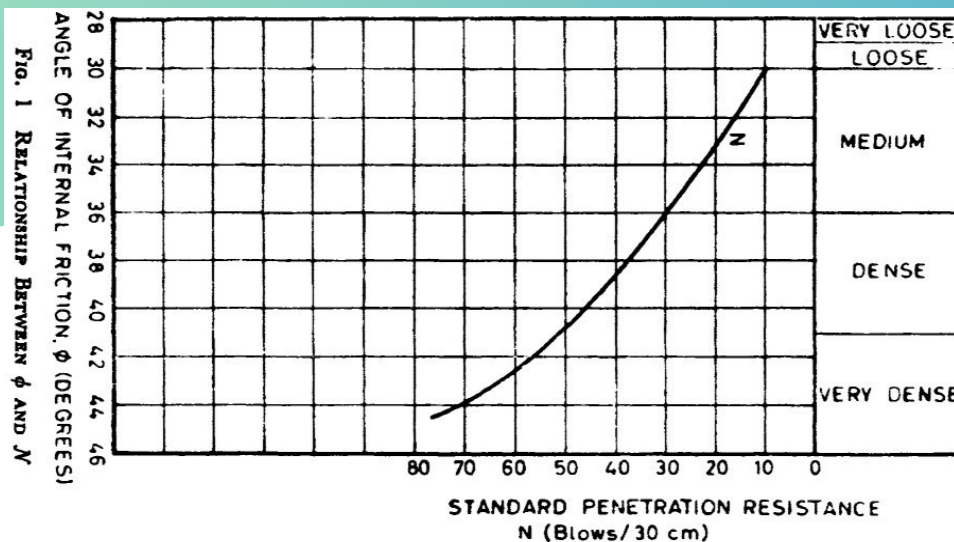
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IS 6403 : 1981

## 7.5.2 Caltrans Geotechnical Manual:

### Soil Correlations

This section of the Geotechnical Manual presents the SPT correlations to be used for friction angle ( $\phi$  angle) and unit weight. The correlations use Standard Penetration Test (N) values corrected for overburden and hammer efficiency (N160). Usage of correlations for geotechnical design is addressed in the various design sections of the Geotechnical Manual. Other correlations, e.g. CPT correlations and shear wave velocity correlations are found elsewhere in the Geotechnical Manual.

### Cohesionless Soil: Friction Angle

Correlations of SPT blow counts to cohesionless soil friction angle and unit weight follow Bowles (1977) and are consistent with many of the NHI manuals used by the department. The correlations use Standard Penetration Test (N) values corrected for overburden and hammer efficiency (N160). Use Chart 1 to correlate N160 to the friction ( $\phi$ ) angle.

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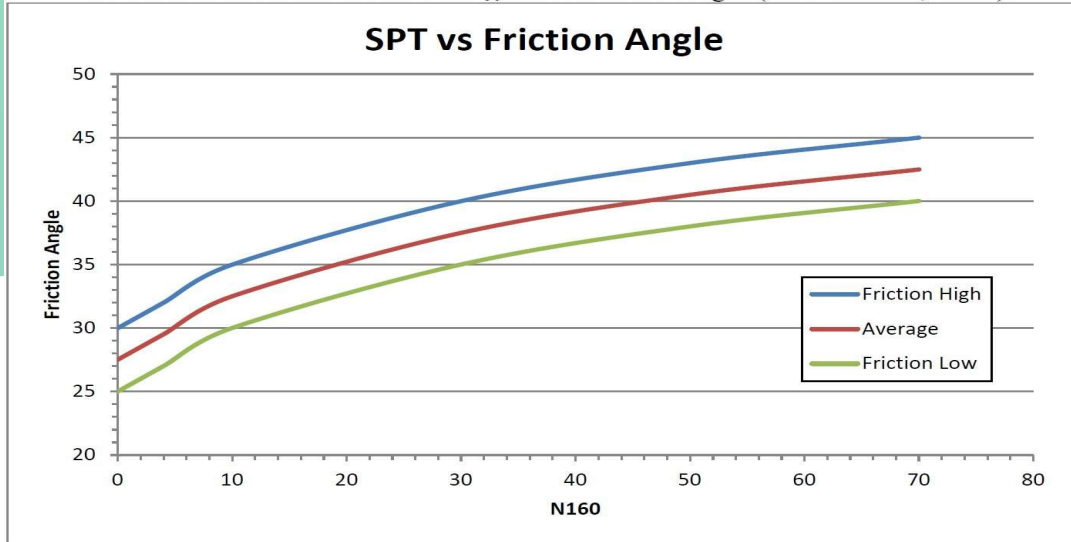
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Chart 1: Correlation of SPT  $N_{160}$  with Friction Angle (after Bowles, 1977)



Choose the friction angle (expressed to the nearest degree) based upon the soil type, particle size(s), and rounding or angularity. Experience should be used to select specific values within the ranges. In general, finer materials or materials with significant (about 30+ %) silt-sized material will fall in the lower portion of the range. Coarser materials with less than 5% fines will fall in the upper portion of the range. The extreme range of phi angles for any  $N_{160}$  is five degrees, so the adjustment factors for particle size and roundness should be only a degree or two. The following bullets provide help in determining which value to select for a given  $N_{160}$  and soil type:

- Use the maximum value for GW
- Use the average for GM and SP
- Use the minimum for SC
- Use the minimum + 0.5 for ML
- Use the average +1 for SW
- Use the average -1 for GC
- Use the Maximum -1 for GP

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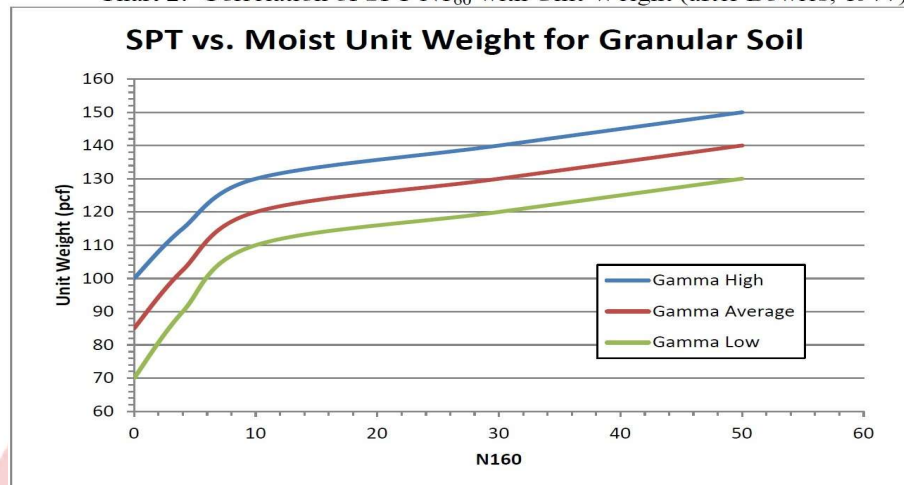
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Values may also be increased with increasing grain size and/or particle angularity and decreased with decreasing grain size and/or increasing roundness. For example, an SP with  $N_{160} = 30$  could be assigned phi angles of 37, 38 or 39 degrees for fine, medium and coarse grain sizes respectively.

#### Cohesion less Soil: Unit Weight

Use Chart 2 to correlate  $N_{160}$  to the moist unit weight for cohesion less (Granular) soil.

Chart 2: Correlation of SPT  $N_{160}$  with Unit Weight (after Bowles, 1977).



Choose the unit weight expressed to the nearest five pcf for the soil type based on the following guidelines:

- Use the higher values for well-graded sands and gravels and average values for poorly-graded sands and gravels.
- Use lower values for elastic silt, and clayey or silty sands and gravel.
- Deduct up to 20% for dry soils.

#### ii. For Cohesive Soil's

For very stiff to hard consistency cohesive/plastic soils where undisturbed samples cannot be collected, correlation for estimating Un-drained cohesion of fine-grained soils based on  $(N)_{60}$  and plasticity index is proposed by M J Tomlinson. "Foundation Design and Construction" seventh edition as below;

$$C_u \text{ (kN/m}^2\text{)} = f_1 \cdot (N)_{60}$$

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Where,

(N)<sub>60</sub> = SPT 'N' value corrected for 100 kPa and 60% of theoretical free fall hammer energy

$f_1$  = factor to be taken from Figure shown below.

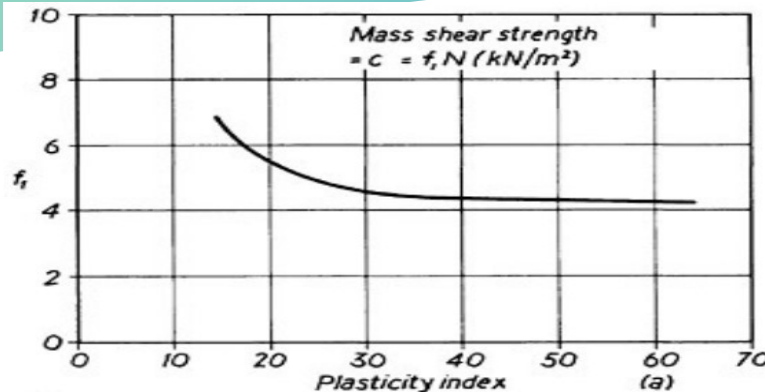


Fig. Relationship between mass shear strength plasticity index and standard penetration test N-values

- **Caltrans Geotechnical Manual:**

Cohesive Soil: Unconfined Compressive Strength ( $Q_u$ ) /Undrained Shear Strength ( $S_u$ )

The standard practice is to determine shear strength of cohesive soils in the field based on measurements with torvane, pocket penetrometer, or vane shear. It is not acceptable to use SPT correlations to determine shear strength or to assign consistency values. For preliminary studies, use Chart 3 to assign shear strength values when only SPT values are available. Usually this is applicable when data are available from old as-built LOTBs where field or laboratory strength tests are not available.

**Chart 3: Correlation of SPT N160 to Unconfined Compressive Strength**

(after Bowles, 1977)

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BHAGAT SING WARD-1(146) KANCHANPUR MATIYARI, KAMTA, LUCKNOW, PH NO.: 0522- 3639933, 09451371403,

07275268881, E-Mail ID :- [abcsoillab@gmail.com](mailto:abcsoillab@gmail.com), [abcconsultants2006@gmail.com](mailto:abcconsultants2006@gmail.com).

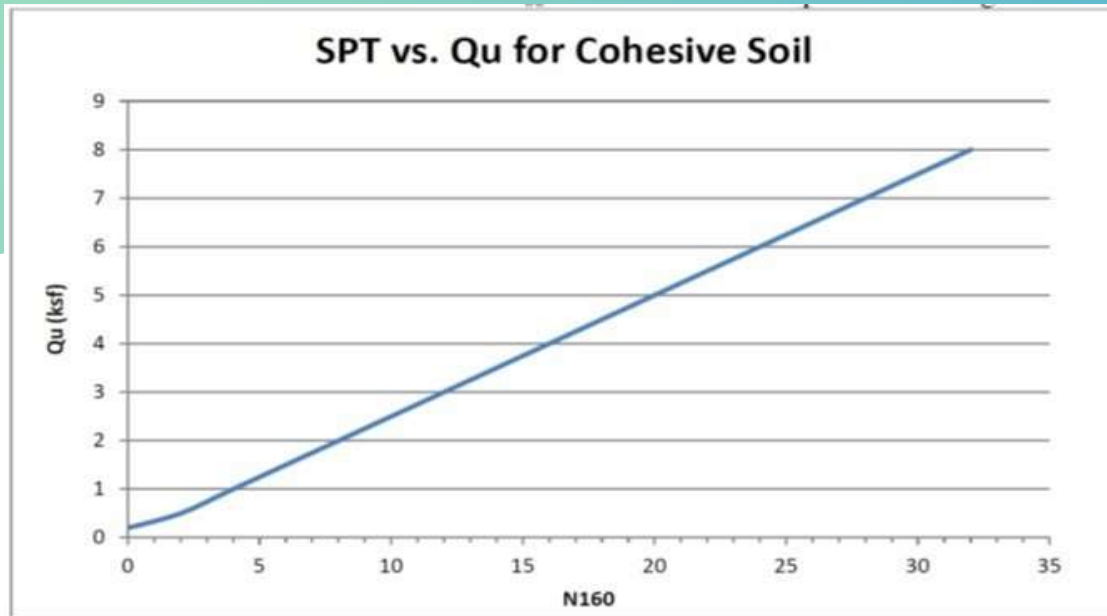
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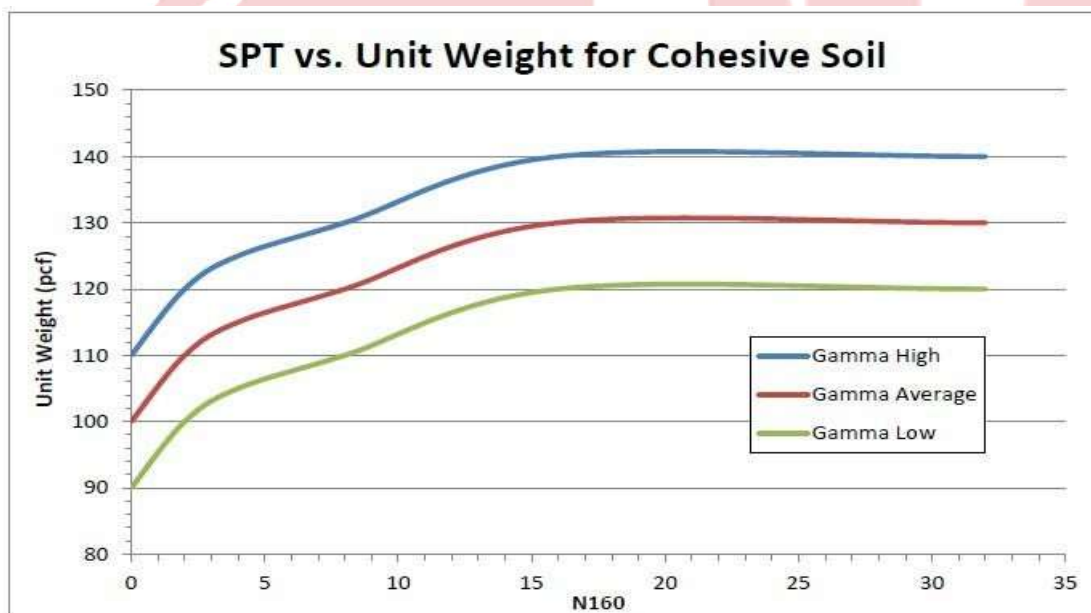
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#### Cohesive Soil: Unit Weight

Use Chart 4 to correlate N160 with the Unit Weight of cohesive soil.

Chart 4: Correlation of SPT N160 with Unit Weight (after Bowles, 1977).



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Comparing field pocket penetrometer and/or torvane readings to Chart 4 is a good way of determining whether high or low values should be used. For example, if the pocket penetrometer reading for a clay with  $N_{160} = 10$  is about 2.5 ksf (the same as the value shown in Chart 3) the unit weight should correspond to the average value. If the pocket penetrometer reading is higher, the unit weight should be increased from the average, and if the pocket penetrometer reading is lower, the unit weight should be decreased from the average. In the absence of SPT data, unit weights can be estimated using Charts 3 and 4 and the strength data (e.g., pocket penetrometer reading). For example, from Chart 3, a pocket penetrometer value of 5 ksf corresponds to an SPT  $N_{160}$  value of 20. Chart 4 shows the average unit weight of a cohesive soil with SPT  $N_{160} = 20$  is 130 pcf.

## 8.0 COMPUTATION OF BEARING CAPACITY:

### 8.1 BEARING CAPACITY FROM SHEAR CRITERIA:

Bearing capacity calculations were carried out Isolated / R.C.C. Raft Foundation at depth 1.20m, 1.50m, 2.00m, 3.00m, 4.50m, 6.00m & 7.50m below ground level with width & size of foundation 1.20m, 1.50m, 2.00m & (10.00x10.00)m However governing values of bearing capacity was found the calculations for the same are produced below:

#### 8.1.1 Bearing capacity Calculation:

Governing soil parameter are from bore hole no. 03

1.	Angle of internal friction $\phi$	=	$5^0$
2.	Cohesion C	=	0.38 Kg/cm <sup>2</sup>
3.	Unit weight of soil $\gamma$	=	1.85 gm/cc
4.	Submerged density. of soil $\gamma$	=	-
5.	Specific Gravity	=	2.73
6.	Dry Density	=	1.59 gm/cc

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7. Void ratio  $e_0$  = 0.72
8. Condition = Medium (Interpolation)
9. Bearing Capacity Factor

Shear Parameters	Nc	Nq	Nr
General Shear failure $e_0 \leq 0.55$	6.490	1.570	0.450
Local Shear failure $> 0.75$	6.040	1.380	0.300
Interpolated value for $e_0 = 0.72$	6.108	1.408	0.322

10. Water Table correction Factor  $w'$  = 0.55
11. Overburden pressure  $q$  at depth 1.20 m = 0.222 Kg/cm<sup>2</sup>
12. Type of foundation = Isolated Foundation
13. Depth of foundation  $d_f$  = 1.20 m
14. Width of foundation = 1.20 m
15. Shape factors  
 $S_c = 1.30$   $S_q = 1.20$ ,  $S_\gamma = 0.80$
16. Inclination factors  
 $i_c = 1.0$ ,  $i_q = 1.0$ ,  $i_\gamma = 1.0$
17. Depth Factors  
 $d_c = 1.218$   $d_q \text{ \& } d_\gamma = 1.0$
18. Factor of safety  $f = 3.0$

**Bearing Capacity: -**

$$\begin{aligned} Q_c &= 1/3[0.2721 \times 6.108 \times 1.218 \times 1.30 \times 1.0 + 0.222 \times (1.408 - 1.0) \times 1.20 \times 1.0 + 0.5 \times 1.85 \\ &\quad \times 1.20 \times 0.322 \times 0.80 \times 1.0 \times 0.55 / 10.0] \\ &= 1/3 [2.631 + 0.109 + 0.016] \text{ Kg/cm}^2 \\ &= 0.919 \text{ Kg/cm}^2 \end{aligned}$$

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## 8.1.2 Bearing capacity Calculation:

Governing soil parameter are from bore hole no. 03

1. Angle of internal friction  $\phi$  =  $5^{\circ}$
2. Cohesion C =  $0.38 \text{ Kg/cm}^2$
3. Unit weight of soil  $\gamma$  =  $1.85 \text{ gm/cc}$
4. Submerged density. of soil  $\gamma$  = -
5. Specific Gravity = 2.73
6. Dry Density =  $1.59 \text{ gm/cc}$
7. Void ratio  $e_0$  = 0.72
8. Condition = Medium (Interpolation)
9. Bearing Capacity Factor

Shear Parameters	Nc	Nq	Nr
General Shear failure $e_0 \leq 0.55$	6.490	1.570	0.450
Local Shear failure $> 0.75$	6.040	1.380	0.300
Interpolated value for $e_0 = 0.72$	6.108	1.408	0.322

10. Water Table correction Factor  $w'$  = 0.50
11. Overburden pressure  $q$  at depth 1.50 m =  $0.278 \text{ Kg/cm}^2$
12. Type of foundation = Isolated Foundation
13. Depth of foundation  $d_f$  = 1.50 m

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14. Width of foundation = 1.50 m

15. Shape factors

$$S_c = 1.30 \quad S_q = 1.20, \quad S_\gamma = 0.80$$

16. Inclination factors

$$i_c = 1.0, \quad i_q = 1.0, \quad i_\gamma = 1.0$$

17. Depth Factors

$$d_c = 1.218 \quad d_q \text{ \& } d_\gamma = 1.0$$

18. Factor of safety  $f = 3.0$

**Bearing Capacity: -**

$$\begin{aligned} Q_c &= 1/3 [0.2721 \times 6.108 \times 1.218 \times 1.30 \times 1.0 + 0.278 \times (1.408 - 1.0) \times 1.20 \times 1.0 + 0.5 \times 1.85 \\ &\quad \times 1.50 \times 0.322 \times 0.80 \times 1.0 \times 0.50 / 10.0] \\ &= 1/3 [2.631 + 0.136 + 0.018] \text{ Kg/cm}^2 \\ &= 0.928 \text{ Kg/cm}^2 \end{aligned}$$

**8.1.3 Bearing capacity Calculation:**

Governing soil parameter are from bore hole no. 03

1. Angle of internal friction  $\phi = 7^\circ$
2. Cohesion  $C = 0.33 \text{ Kg/cm}^2$
3. Unit weight of soil  $\gamma = 2.02 \text{ gm/cc}$
4. Submerged density. of soil  $\gamma = 1.02 \text{ gm/cc}$
5. Specific Gravity = 2.71
6. Dry Density = 1.61 gm/cc

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7. Void ratio  $e_0$  = 0.68
8. Condition = Medium (Interpolation)
9. Bearing Capacity Factor

Shear Parameters	Nc	Nq	Nr
General Shear failure $e_0 \leq 0.55$	7.230	1.930	0.760
Local Shear failure $> 0.75$	6.400	1.533	0.420
Interpolated value for $e_0 = 0.68$	6.691	1.672	0.539

10. Water Table correction Factor  $w'$  = 1.0
11. Overburden pressure  $q$  at depth 2.00 m = 0.204 Kg/cm<sup>2</sup>
12. Type of foundation = Isolated foundation
13. Depth of foundation  $d_f$  = 2.00 m
14. Width of foundation = 2.00 m
15. Shape factors  
 $S_c = 1.30$   $S_q = 1.20$ ,  $S_\gamma = 0.80$
16. Inclination factors  
 $i_c = 1.0$ ,  $i_q = 1.0$ ,  $i_\gamma = 1.0$
17. Depth Factors  
 $d_c = 1.226$   $d_q \text{ \& } d_\gamma = 1.0$
18. Factor of safety  $f = 3.0$

**Bearing Capacity: -**

$$\begin{aligned} Q_c &= 1/3 [0.2584 \times 6.691 \times 1.226 \times 1.30 \times 1.0 + 0.204 \times (1.672 - 1.0) \times 1.20 \times 1.0 + 0.5 \times 1.02 \\ &\quad \times 2.00 \times 0.539 \times 0.80 \times 1.0 \times 1.0 / 10.0] \\ &= 1/3 [2.756 + 0.165 + 0.044] \text{ Kg/cm}^2 \\ &= 0.988 \text{ Kg/cm}^2 \end{aligned}$$

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### 8.1.3 Bearing capacity Calculation:

Governing soil parameter are from bore hole no. 03

1. Angle of internal friction  $\phi$  =  $7^{\circ}$
2. Cohesion C = 0.33 Kg/cm<sup>2</sup>
3. Unit weight of soil  $\gamma$  = 2.02 gm/cc
4. Submerged density. of soil  $\gamma$  = 1.02 gm/cc
5. Specific Gravity = 2.71
6. Dry Density = 1.61 gm/cc
7. Void ratio  $e_0$  = 0.68
8. Condition = Medium (Interpolation)
9. Bearing Capacity Factor

Shear Parameters	Nc	Nq	Nr
General Shear failure $e_0 \leq 0.55$	7.230	1.930	0.760
Local Shear failure $> 0.75$	6.400	1.533	0.420
Interpolated value for $e_0 = 0.68$	6.691	1.672	0.539

10. Water Table correction Factor  $w'$  = 1.0
11. Overburden pressure  $q$  at depth 2.00 m = 0.204 Kg/cm<sup>2</sup>
12. Type of foundation = R.C.C. raft foundation
13. Depth of foundation  $d_f$  = 2.00 m

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14. Width of foundation = (10.00x10.00) m

15. Shape factors

$$S_c = 1.30 \quad S_q = 1.20, \quad S_\gamma = 0.60$$

16. Inclination factors

$$i_c = 1.0, \quad i_q = 1.0, \quad i_\gamma = 1.0$$

17. Depth Factors

$$d_c = 1.045 \quad d_q \text{ \& } d_\gamma = 1.0$$

18. Factor of safety  $f = 3.0$

**Bearing Capacity: -**

$$\begin{aligned} Q_c &= 1/3 [0.2584 \times 6.691 \times 1.045 \times 1.30 \times 1.0 + 0.204 \times (1.672 - 1.0) \times 1.2 \times 1.0 + 0.5 \times 1.02 \\ &\quad \times 10.00 \times 0.539 \times 0.60 \times 1.0 \times 1.0 / 10.0] \\ &= 1/3 [2.349 + 0.165 + 0.165] \text{ Kg/cm}^2 \\ &= 0.893 \text{ Kg/cm}^2 \end{aligned}$$

**8.1.4 Bearing capacity Calculation:**

Governing soil parameter are from bore hole no. 03

- |  |   |                         |
|--|---|-------------------------|
| 1. Angle of internal friction $\phi$   | = | $7^\circ$               |
| 2. Cohesion C                          | = | 0.33 Kg/cm <sup>2</sup> |
| 3. Unit weight of soil $\gamma$        | = | 2.02 gm/cc              |
| 4. Submerged density. of soil $\gamma$ | = | 1.02 gm/cc              |
| 5. Specific Gravity                    | = | 2.71                    |
| 6. Dry Density                         | = | 1.61 gm/cc              |

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7. Void ratio  $e_0$  = 0.68
8. Condition = Medium (Interpolation)
9. Bearing Capacity Factor

Shear Parameters	Nc	Nq	Nr
General Shear failure $e_0 \leq 0.55$	7.230	1.930	0.760
Local Shear failure $> 0.75$	6.400	1.533	0.420
Interpolated value for $e_0 = 0.68$	6.691	1.672	0.539

10. Water Table correction Factor  $w'$  = 1.0
11. Overburden pressure  $q$  at depth 3.00 m = 0.306 Kg/cm<sup>2</sup>
12. Type of foundation = R.C.C. raft foundation
13. Depth of foundation  $d_f$  = 3.00 m
14. Width of foundation = (10.00x10.00) m
15. Shape factors  
 $S_c = 1.30$   $S_q = 1.20$ ,  $S_\gamma = 0.60$
16. Inclination factors  
 $i_c = 1.0$ ,  $i_q = 1.0$ ,  $i_\gamma = 1.0$
17. Depth Factors  
 $d_c = 1.067$   $d_q \text{ \& } d_\gamma = 1.0$
18. Factor of safety  $f = 3.0$

**Bearing Capacity: -**

$$\begin{aligned} Q_c &= \frac{1}{3} [0.2584 \times 6.691 \times 1.067 \times 1.30 \times 1.0 + 0.306 \times (1.672 - 1.0) \times 1.2 \times 1.0 + 0.5 \times 1.02 \\ &\quad \times 10.00 \times 0.539 \times 0.60 \times 1.0 \times 1.0 / 10.0] \\ &= \frac{1}{3} [2.398 + 0.247 + 0.165] \text{ Kg/cm}^2 \\ &= 0.937 \text{ Kg/cm}^2 \end{aligned}$$

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## 8.1.5 Bearing capacity Calculation:

Governing soil parameter are from bore hole no. 03

1. Angle of internal friction  $\phi$  =  $5^{\circ}$
2. Cohesion C =  $0.39 \text{ Kg/cm}^2$
3. Unit weight of soil  $\gamma$  =  $2.01 \text{ gm/cc}$
4. Submerged density. of soil  $\gamma$  =  $1.01 \text{ gm/cc}$
5. Specific Gravity =  $2.70$
6. Dry Density =  $1.61 \text{ gm/cc}$
7. Void ratio  $e_0$  =  $0.68$
8. Condition = Medium (Interpolation)
9. Bearing Capacity Factor

Shear Parameters	Nc	Nq	Nr
General Shear failure $e_0 \leq 0.55$	6.490	1.570	0.450
Local Shear failure $> 0.75$	6.040	1.380	0.300
Interpolated value for $e_0 = 0.68$	6.198	1.446	0.352

10. Water Table correction Factor  $w'$  =  $1.0$
11. Overburden pressure  $q$  at depth  $4.50 \text{ m}$  =  $0.455 \text{ Kg/cm}^2$
12. Type of foundation = R.C.C. raft foundation
13. Depth of foundation  $d_f$  =  $4.50 \text{ m}$

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14. Width of foundation = (10.00x10.00) m

15. Shape factors

$S_c = 1.30$   $S_q = 1.20$ ,  $S_\gamma = 0.60$

16. Inclination factors

$i_c = 1.0$ ,  $i_q = 1.0$ ,  $i_\gamma = 1.0$

17. Depth Factors

$d_c = 1.098$   $d_q \text{ \& } d_\gamma = 1.0$

18. Factor of safety  $f = 3.0$

**Bearing Capacity: -**

$$\begin{aligned} Q_c &= 1/3 [0.3054 \times 6.198 \times 1.098 \times 1.30 \times 1.0 + 0.455 \times (1.446 - 1.0) \times 1.2 \times 1.0 + 0.5 \times 1.01 \\ &\quad \times 10.00 \times 0.352 \times 0.60 \times 1.0 \times 1.0 / 10.0] \\ &= 1/3 [2.702 + 0.243 + 0.107] \text{ Kg/cm}^2 \\ &= 1.017 \text{ Kg/cm}^2 \end{aligned}$$

**8.1.6 Bearing capacity Calculation:**

Governing soil parameter are from bore hole no. 03

- |    |                                     |   |                         |
|----|-------------------------------------|---|-------------------------|
| 1. | Angle of internal friction $\phi$   | = | $8^\circ$               |
| 2. | Cohesion C                          | = | 0.31 Kg/cm <sup>2</sup> |
| 3. | Unit weight of soil $\gamma$        | = | 2.01 gm/cc              |
| 4. | Submerged density. of soil $\gamma$ | = | 1.01 gm/cc              |
| 5. | Specific Gravity                    | = | 2.69                    |
| 6. | Dry Density                         | = | 1.61 gm/cc              |
| 7. | Void ratio $e_o$                    | = | 0.67                    |
| 8. | Condition                           | = | Medium (Interpolation)  |

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9. Bearing Capacity Factor

Shear Parameters	Nc	Nq	Nr
General Shear failure $e_0 \leq 0.55$	7.610	2.110	0.912
Local Shear failure $> 0.75$	6.620	1.630	0.503
Interpolated value for $e_0 = 0.67$	7.016	1.822	0.667

10. Water Table correction Factor  $w'$  = 1.0
11. Overburden pressure  $q$  at depth 6.00 m = 0.606 Kg/cm<sup>2</sup>
12. Type of foundation = R.C.C. raft foundation
13. Depth of foundation  $d_f$  = 6.00 m
14. Width of foundation = (10.00x10.00) m
15. Shape factors  
 $S_c = 1.30$   $S_q = 1.20$ ,  $S_\gamma = 0.60$
16. Inclination factors  
 $i_c = 1.0$ ,  $i_q = 1.0$ ,  $i_\gamma = 1.0$
17. Depth Factors  
 $d_c = 1.138$   $d_q \text{ \& } d_\gamma = 1.0$
18. Factor of safety  $f = 3.0$

**Bearing Capacity: -**

$$\begin{aligned} Q_c &= 1/3 [0.2480 \times 7.016 \times 1.138 \times 1.30 \times 1.0 + 0.606 \times (1.822 - 1.0) \times 1.2 \times 1.0 + 0.5 \times 1.01 \\ &\quad \times 10.00 \times 0.667 \times 0.60 \times 1.0 \times 1.0 / 10.0] \\ &= 1/3 [2.574 + 0.598 + 0.202] \text{ Kg/cm}^2 \\ &= 1.125 \text{ Kg/cm}^2 \end{aligned}$$

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**8.1.7 Bearing capacity Calculation:**

Governing soil parameter are from bore hole no. 03

1. Angle of internal friction  $\phi$  =  $5^{\circ}$
2. Cohesion C =  $0.39 \text{ Kg/cm}^2$
3. Unit weight of soil  $\gamma$  =  $2.03 \text{ gm/cc}$
4. Submerged density. of soil  $\gamma$  =  $1.03 \text{ gm/cc}$
5. Specific Gravity =  $2.71$
6. Dry Density =  $1.64 \text{ gm/cc}$
7. Void ratio  $e_0$  =  $0.65$
8. Condition = Medium (Interpolation)
9. Bearing Capacity Factor

Shear Parameters	Nc	Nq	Nr
General Shear failure $e_0 \leq 0.55$	6.490	1.570	0.450
Local Shear failure $> 0.75$	6.040	1.380	0.300
Interpolated value for $e_0 = 0.65$	6.265	1.475	0.375

10. Water Table correction Factor  $w'$  =  $1.0$
11. Overburden pressure  $q$  at depth  $7.50 \text{ m}$  =  $0.773 \text{ Kg/cm}^2$
12. Type of foundation = R.C.C. raft foundation
13. Depth of foundation  $d_f$  =  $7.50 \text{ m}$

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14. Width of foundation = (10.00x10.00) m

15. Shape factors

$S_c = 1.30$   $S_q = 1.20$ ,  $S_\gamma = 0.60$

16. Inclination factors

$i_c = 1.0$ ,  $i_q = 1.0$ ,  $i_\gamma = 1.0$

17. Depth Factors

$d_c = 1.163$   $d_q \text{ \& } d_\gamma = 1.0$

18. Factor of safety  $f = 3.0$

**Bearing Capacity: -**

$$\begin{aligned} Q_c &= 1/3[0.3249 \times 6.265 \times 1.163 \times 1.30 \times 1.0 + 0.773 \times (1.475 - 1.0) \times 1.2 \times 1.0 + 0.5 \times 1.03 \\ &\quad \times 10.00 \times 0.375 \times 0.60 \times 1.0 \times 1.0 / 10.0] \\ &= 1/3 [3.077 + 0.440 + 0.116] \text{ Kg/cm}^2 \\ &= 1.211 \text{ Kg/cm}^2 \end{aligned}$$

**8.2 BEARING CAPACITY FROM SETTLEMENT CRITERIA:**

**Estimation of Settlement:**

Bearing Capacity from settlement consideration is the bearing pressure, which restricts the settlement within permissible limits. Bearing capacity as obtained from the previous section is tried first as the bearing pressure to compute the settlement of foundation. If settlement thus obtained is excessive, lower values of bearing pressures are tried. The settlement calculation shown below is corresponding to safe bearing pressure. The soil in the effective zone below footing level is non-cohesive soil hence the settlement for both layers has been computed accordingly.

**Settlement of Non - Cohesive soil**

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Standard penetration resistance at different depths in the effective zone will determine the settlement of sandy strata. S.P.T. values of sandy strata in the effective zone have been corrected for overburden as per I.S. 2131 – 1981

The recorded and corrected S.P.T. values are given below.

Depth below ground level (meter)	Over burden (Kg/cm <sup>2</sup> )	correction factor	S.P.T. Value recorded				Lowest Corrected S.P.T. Value	
			Bore hole					
	3	3	1	2	3	4	3	
1.85-2.30	0.425	1.255	9	8	7	8	7	8.78
3.35-3.80	0.578	1.150	8	7	6	8	6	6.90
4.85-5.30	0.729	1.090	11	10	9	10	9	9.81
6.35-6.80	1.030	0.986	15	14	10	13	10	9.86
7.85-8.30	1.184	0.936	18	16	12	17	12	11.23
9.35-9.80	1.338	0.907	21	18	15	20	15	13.60
10.85-11.30	1.479	0.876	24	19	17	22	17	14.89
12.35-12.80	1.618	0.848	27	22	20	26	20	16.96
13.85-14.30	1.759	0.819	29	25	23	28	23	18.83
15.35-15.80	1.897	0.801	30	27	25	30	25	20.02
16.85-17.30	2.036	0.776	33	30	27	33	27	20.95
18.35-18.80	2.174	0.758	35	33	28	34	28	21.22
19.85-20.30	2.313	0.739	37	34	31	36	31	22.91
21.35-21.80	2.449	0.720	39	37	33	39	33	23.76
22.85-23.30	2.588	0.702	41	39	35	38	35	24.57

The average and lowest corrected S.P.T. value is given below.

S.No.	Average Lowest corrected Value
1	14.30
2	14.93
3	16.38
4	17.65
5	18.99

Lowest average corrected S.P.T. Value have been taken used for analysis

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## 8.2.0 BEARING CAPACITY FROM SETTLEMENT FAILURE CRITERIA :

### Settlement of Cohesive soil at 1.20 m Depth

Description	Calculation
Thickness of compressible layer	1.80
Mid depth of clay layer	0.90
Pressure at foundation level	0.222
Po original pressure at mid depth	0.389
Net safe bearing capacity	0.919
Change pressure at foundation level	0.697
Influence factor	0.688
Change pressure at mid layer	0.479
$P_0 + \Delta P / P_0$	2.234
$\log P_0 + \Delta P / P_0$	0.349
Void ratio $e_0$	0.72
Compression Index $C_c$	0.153
Settlement	5.60
Depth factor	0.95
Settlement after applying rigidity & depth factor	4.256

The settlement is less than permissible limit 7.5 cm as per I.S: 1904 - 1986.

Then safe Bearing capacity 9.19 t/m<sup>2</sup>.

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### 8.2.1 BEARING CAPACITY FROM SETTLEMENT FAILURE CRITERIA :

#### Settlement of Cohesive soil at 1.50 m Depth

Description	Calculation
Thickness of compressible layer	2.25
Mid depth of clay layer	1.125
Pressure at foundation level	0.278
Po original pressure at mid depth	0.486
Net safe bearing capacity	0.928
Change pressure at foundation level	0.651
Influence factor	0.688
Change pressure at mid layer	0.448
$P_0 + \Delta P / P_0$	1.922
$\log P_0 + \Delta P / P_0$	0.283
Void ratio $e_0$	0.72
Compression Index $C_c$	0.153
Settlement	5.67
Depth factor	0.95
Settlement after applying rigidity & depth factor	4.309

The settlement is less than permissible limit 7.5 cm as per I.S: 1904 - 1986.

Then safe Bearing capacity 9.28 t/m<sup>2</sup>.

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## 8.2.2 BEARING CAPACITY FROM SETTLEMENT FAILURE CRITERIA :

### Settlement of Cohesive soil at 2.00 m Depth

Description	Calculation
Thickness of compressible layer	3.00
Mid depth of clay layer	1.50
Pressure at foundation level	0.204
Po original pressure at mid depth	0.357
Net safe bearing capacity	0.988
Change pressure at foundation level	0.784
Influence factor	0.688
Change pressure at mid layer	0.539
$P_0 + \Delta P / P_0$	2.511
$\log P_0 + \Delta P / P_0$	0.399
Void ratio $e_0$	0.68
Compression Index $C_c$	0.147
Settlement	10.45
Depth factor	0.95
Settlement after applying rigidity & depth factor	7.942

The settlement is less than permissible limit 7.5 cm as per I.S: 1904 - 1986.

Then safe Bearing capacity 9.88 t/m<sup>2</sup>.

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### **8.2.3 Settlement of Non - Cohesive soil:**

Settlement of a footing with width 'B' under unit intensity of pressure resting on cohesion less deposit with known standard penetration test values can be determine from I.S. 8009: 1981

The settlement of any other pressure is computed by assuming that the settlement is proportional to the intensity of pressure

- (i) Thus, the settlement for unit pressure for the lowest corrected S.P.T. value and for 0.893 Kg/Sqcm<sup>2</sup>. as the allowable pressure for 2.00 m depth with R.C.C. Raft foundation of size (10.00x10.00) m is given below:

Type of Foundation	=	R.C.C. Raft Foundation
Lowest corrected value	=	14.30
Settlement for unit pressure	=	2.485 cm.
Settlement for 0.893 Kg/sqcm <sup>2</sup>	=	2.219 cm.
Settlement after applying rigidity factor	=	1.775 cm.

The settlement is within permissible limit as per I.S: 1904 – 1986

Then safe Bearing capacity 8.93 t/m<sup>2</sup>.

- (ii) Thus, the settlement for unit pressure for the lowest corrected S.P.T. value and for 0.937 Kg/Sqcm<sup>2</sup>. as the allowable pressure for 3.00 m depth with R.C.C. Raft foundation of size (10.00x10.00) m is given below:

Type of Foundation	=	R.C.C. Raft Foundation
Lowest corrected value	=	14.93
Settlement for unit pressure	=	2.3136 cm.
Settlement for 0.937 Kg/sqcm <sup>2</sup>	=	2.313 cm.
Settlement after applying rigidity factor	=	1.734 cm.

The settlement is within permissible limit as per I.S: 1904 – 1986

Then safe Bearing capacity 9.37 t/m<sup>2</sup>.

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(iii) Thus, the settlement for unit pressure for the lowest corrected S.P.T. value and for 1.017 Kg/Sqcm<sup>2</sup>. as the allowable pressure for 4.50 m depth with R.C.C. Raft foundation of size (10.00x10.00) m is given below:

Type of Foundation	=	R.C.C. Raft Foundation
Lowest corrected value	=	16.38
Settlement for unit pressure	=	2.05 cm.
Settlement for 1.017 Kg/sqcm <sup>2</sup>	=	2.084 cm.
Settlement after applying rigidity factor	=	1.667 cm.

The settlement is within permissible limit as per I.S: 1904 – 1986

Then safe Bearing capacity 10.17 t/m<sup>2</sup>.

(iv) Thus, the settlement for unit pressure for the lowest corrected S.P.T. value and for 1.125 Kg/Sqcm<sup>2</sup>. as the allowable pressure for 6.00 m depth with R.C.C. Raft foundation of size (10.00x10.00) m is given below:

Type of Foundation	=	R.C.C. Raft Foundation
Lowest corrected value	=	17.65
Settlement for unit pressure	=	1.8798 cm.
Settlement for 1.125 Kg/sqcm <sup>2</sup>	=	2.114 cm.
Settlement after applying rigidity factor	=	1.691 cm.

The settlement is within permissible limit as per I.S: 1904 – 1986

Then safe Bearing capacity 11.25 t/m<sup>2</sup>.

(v) Thus, the settlement for unit pressure for the lowest corrected S.P.T. value and for 1.211 Kg/Sqcm<sup>2</sup>. as the allowable pressure for 7.50 m depth with R.C.C. Raft foundation of size (10.00x10.00) m is given below:

Type of Foundation	=	R.C.C. Raft Foundation
Lowest corrected value	=	18.99
Settlement for unit pressure	=	1.7086 cm.
Settlement for 1.211 Kg/sqcm <sup>2</sup>	=	2.069 cm.
Settlement after applying rigidity factor	=	1.665 cm.

The settlement is within permissible limit as per I.S: 1904 – 1986

Then safe Bearing capacity 12.11 t/m<sup>2</sup>.

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### **9.0 SAFE LOAD FROM ULTIMATE LOAD CAPACITY:**

The Ultimate bearing capacity of pile can be calculated from soil properties as per IS: 2911 (Part-I /Sec 2)-2010. The soil properties required are strength properties, cohesion, angle of internal friction and soil density. If these properties are not available directly from laboratory and field tests, they may be indirectly obtained from in situ penetration test data.

#### **STATIC FORMULA: -**

##### **(A) Clayey soil: -**

The ultimate bearing capacity of pile in cohesive soil may be worked out from the following formula: -

$$Q_u = A_p \cdot N_c \cdot C_p + \sum_{i=1}^n \alpha_i \cdot C_i \cdot A_{si}$$

Where

$Q_u$  = Ultimate bearing capacity of pile (Kg.).

$A_p$  = Cross sectional area of pile stem at toe Level (Cm<sup>2</sup>).

$N_c$  = Bearing Capacity Factor Usually taken as (9.0).

$C_p$  = Average Cohesion at pile tip (Kg/ Cm<sup>2</sup>).

$\alpha_i$  = Adhesion factor = 1.0

$C_i$  = Average Cohesion throughout the length of pile (Kg/ Cm<sup>2</sup>).

$A_{si}$  = Surface area of the pile shaft (Cm<sup>2</sup>).

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(B) For Sandy Soil: -

The ultimate bearing capacity of pile in non-cohesive soil may be worked out from the following formula: -

$$Q_u = A_p (0.50 \cdot \gamma \cdot D \cdot N_r + P_{D_i} \cdot N_q) + \sum_{i=1}^n K \cdot P_{D_i} \cdot \tan \delta \cdot A_{s_i}$$

Where

$A_p$  = Cross-sectional area of pile toe in  $\text{cm}^2$ .

$D$  = Stem diameter in cm.

$\gamma$  = Effective unit weight of soil at pile toe  $\text{Kgf}/\text{cm}^3$ .

$P_{D_i}$  = Effective over burden pressure at pile toe  $\text{Kgf}/\text{cm}^2$ .

$N_q$  &  $N_r$  = Bearing Capacity Factors depending upon the angle of internal friction  $\Phi$  at toe.

$K$  = Earth pressure coefficient

$\delta$  = Angle of wall friction (may be taken equal to the angle of internal friction of soil).

$\sum_{i=1}^n$  = Summation for n layers which piles is installed

$P_{D_i}$  = Effective over burden pressure in  $\text{Kgf}/\text{cm}^2$  for the  $i^{\text{th}}$  layer where i varies from 1 to n.

$A_{s_i}$  = Surface area of the pile stem in  $\text{cm}^2$  in the  $i^{\text{th}}$  layer where i varies from 1 to n.

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The soil strata comprise of cohesion &amp; non cohesive soil the safe load may be estimated using clayey &amp; sandy soil formula and tabulated below.

Length of pile

= 15.0m

Dia of pile

= 0.50m

Depth (m)	Ap (cm <sup>2</sup> )	Nc	Cp (kg/cm <sup>2</sup> )	$\alpha$	ci (kg/cm <sup>2</sup> )	As / Asi (cm <sup>2</sup> )	D (cm)	Y	Pd	Nq	Nr	K	Pdi	$\phi$	Qu		F.O.C.	Safe load on pile (tone)
															(Kg)	(Tone)		
1.50	1962.5	9	0.38	1	0.38	23550	50.0	-	-	-	-	-	-	-	15660.75	15.66	2.50	6.26
1.50	1962.5	9	0.33	1	0.33	23550	50.0	-	-	-	-	-	-	-	13600.13	13.60	2.50	5.44
1.50	1962.5	9	0.39	1	0.39	23550	50.0	-	-	-	-	-	-	-	16072.88	16.07	2.50	6.43
1.50	1962.5	9	0.31	1	0.31	23550	50.0	-	-	-	-	-	-	-	12775.88	12.78	2.50	5.11
1.50	1962.5	9	0.39	1	0.39	23550	50.0	-	-	-	-	-	-	-	16072.88	16.07	2.50	6.43
1.50	1962.5	9	0.34	1	0.34	23550	50.0	-	-	-	-	-	-	-	14012.25	14.01	2.50	5.60
1.50	1962.5	-	-	1	-	23550	50.0	0.094	0.141	6.102	5.186	1.5	0.141	26	4833.3	4.8333	2.50	1.93
1.50	1962.5	-	-	1	-	23550	50.0	0.093	0.139	5.763	4.742	1.5	0.139	26	4569.6	4.5696	2.50	1.83
1.50	1962.5	-	-	1	-	23550	50.0	0.094	0.141	5.242	4.298	1.5	0.141	26	4421.5	4.4215	2.50	1.77
1.50	1962.5	-	-	1	-	23550	50.0	0.092	0.138	5.79	4.708	1.5	0.138	27	4620.8	4.6208	2.50	1.85
Total length= 15.0m`			Dia of Pile= 500mm										Total Safe load			42.66		

**9.02 Calculation**

The soil strata comprise of cohesion &amp; non cohesive soil the safe load may be estimated using clayey &amp; sandy soil formula and tabulated below.

Length of pile

= 15.0m

Dia of pile

= 0.60m

Depth (m)	Ap (cm <sup>2</sup> )	Nc	Cp (kg/cm <sup>2</sup> )	$\alpha$	ci (kg/cm <sup>2</sup> )	As / Asi (cm <sup>2</sup> )	D (cm)	Y	Pd	Nq	Nr	K	Pdi	$\phi$	Qu		F.O.C.	Safe load on pile (tone)
															(Kg)	(Tone)		
1.50	2826	9	0.38	1	0.38	28260	60.0	-	-	-	-	-	-	-	20403.72	20.40	2.50	8.16
1.50	2826	9	0.33	1	0.33	28260	60.0	-	-	-	-	-	-	-	17719.02	17.72	2.50	7.09
1.50	2826	9	0.39	1	0.39	28260	60.0	-	-	-	-	-	-	-	20940.66	20.94	2.50	8.38
1.50	2826	9	0.31	1	0.31	28260	60.0	-	-	-	-	-	-	-	16645.14	16.65	2.50	6.66
1.50	2826	9	0.39	1	0.39	28260	60.0	-	-	-	-	-	-	-	20940.66	20.94	2.50	8.38
1.50	2826	9	0.34	1	0.34	28260	60.0	-	-	-	-	-	-	-	18255.96	18.26	2.50	7.30
1.50	2826	-	-	1	-	28260	60.0	0.094	0.141	6.102	5.186	1.5	0.141	26	7066.5	7.0665	2.50	2.83
1.50	2826	-	-	1	-	28260	60.0	0.093	0.139	5.763	4.742	1.5	0.139	26	6629.4	6.6294	2.50	2.65
1.50	2826	-	-	1	-	28260	60.0	0.094	0.141	5.242	4.298	1.5	0.141	26	6355.6	6.3556	2.50	2.54
1.50	2826	-	-	1	-	28260	60.0	0.092	0.138	5.79	4.708	1.5	0.138	27	6670.5	6.6705	2.50	2.67
Total length= 15.0m`			Dia of Pile= 600mm										Total Safe load			56.65		

**AIRY BE CREATIVE CONSULTANTS (OPC) PRIVATE LIMITED**

OFFICE ADDRESS : C-1074/75, SECTOR -B, MAHANAGAR, LUCKNOW-226006, LAB ADDRESS HOUSE NO.- TEMP-68, SAHEED

BHAGAT SING WARD-1(146) KANCHANPUR MATIYARI, KAMTA, LUCKNOW, PH NO.: 0522- 3639933, 09451371403,

07275268881, E-Mail ID :- [abcsoillab@gmail.com](mailto:abcsoillab@gmail.com), [abccconsultants2006@gmail.com](mailto:abccconsultants2006@gmail.com).

CIN: U71200UP20230PC194892A

GST NO.: 9AAZCA9203H1Z6

ISO/ ICE 17025 ACCREDITED LABORATORY  
(NABL ACCREDITED LAB)**ABC CONSULTANTS**GEO-TECHNICAL INVESTIGATION, SOIL/ MATERIAL/  
WATER CONSULTANTS AND CIVIL ENGINEERING PROJECT**9.03 Calculation**

The soil strata comprise of cohesion & non cohesive soil the safe load may be estimated using clayey & sandy soil formula and tabulated below.

Length of pile

= 15.0m

Dia of pile

= 0.70m

Depth (m)	Ap (cm <sup>2</sup> )	Nc	c <sub>p</sub> (kg/cm <sup>2</sup> )	α	c <sub>i</sub> (kg/cm <sup>2</sup> )	As /Asil (cm <sup>2</sup> )	D (cm)	Y	P <sub>d</sub>	N <sub>q</sub>	N <sub>r</sub>	K	P <sub>di</sub>	φ	Qu		F.O.C.	Safe load on pile (tone)
															(Kg)	(Tone)		
1.50	3846.5	9	0.38	1	0.38	32970	70.0	-	-	-	-	-	-	-	25683.63	25.68	2.50	10.27
1.50	3846.5	9	0.33	1	0.33	32970	70.0	-	-	-	-	-	-	-	22304.21	22.30	2.50	8.92
1.50	3846.5	9	0.39	1	0.39	32970	70.0	-	-	-	-	-	-	-	26359.52	26.36	2.50	10.54
1.50	3846.5	9	0.31	1	0.31	32970	70.0	-	-	-	-	-	-	-	20952.44	20.95	2.50	8.38
1.50	3846.5	9	0.39	1	0.39	32970	70.0	-	-	-	-	-	-	-	26359.52	26.36	2.50	10.54
1.50	3846.5	9	0.34	1	0.34	32970	70.0	-	-	-	-	-	-	-	22980.09	22.98	2.50	9.19
1.50	3846.5	-	-	1	-	32970	70.0	0.094	0.141	6.102	5.186	1.5	0.141	26	9989.9	9.9899	2.50	4.00
1.50	3846.5	-	-	1	-	32970	70.0	0.093	0.139	5.763	4.742	1.5	0.139	26	9313.6	9.3136	2.50	3.73
1.50	3846.5	-	-	1	-	32970	70.0	0.094	0.141	5.242	4.298	1.5	0.141	26	8861.8	8.8618	2.50	3.54
1.50	3846.5	-	-	1	-	32970	70.0	0.092	0.138	5.79	4.708	1.5	0.138	27	9333.3	9.3333	2.50	3.73
Total length= 15.0m			Dia of Pile= 700mm												Total Safe load		72.86	

**CONSULTANTS****AIRY BE CREATIVE CONSULTANTS (OPC) PRIVATE LIMITED**

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BHAGAT SING WARD-1(146) KANCHANPUR MATIYARI, KAMTA, LUCKNOW, PH NO.: 0522- 3639933, 09451371403,

07275268881, E-Mail ID :- [abcsoillab@gmail.com](mailto:abcsoillab@gmail.com), [abccconsultants2006@gmail.com](mailto:abccconsultants2006@gmail.com).

CIN: U71200UP20230PC194892A

GST NO.: 9AAZCA9203H1Z6

ISO/ ICE 17025 ACCREDITED LABORATORY  
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WATER CONSULTANTS AND CIVIL ENGINEERING PROJECT**9.04 Calculation**

The soil strata comprise of cohesion & non cohesive soil the safe load may be estimated using clayey & sandy soil formula and tabulated below.

Length of pile

= 18.0m

Dia of pile

= 0.50m

Depth (m)	Ap (cm <sup>2</sup> )	Nc	c <sub>p</sub> (kg/cm <sup>2</sup> )	α	c <sub>i</sub> (kg/cm <sup>2</sup> )	As / Asil (cm <sup>2</sup> )	D (cm)	Y	P <sub>d</sub>	N <sub>q</sub>	N <sub>r</sub>	K	P <sub>di</sub>	φ	Qu		F.O.C.	Safe load on pile (tone)
															(Kg)	(Tone)		
1.50	1962.5	9	0.38	1	0.38	23550	50.0	-	-	-	-	-	-	-	15660.75	15.66	2.50	6.26
1.50	1962.5	9	0.33	1	0.33	23550	50.0	-	-	-	-	-	-	-	13600.13	13.60	2.50	5.44
1.50	1962.5	9	0.39	1	0.39	23550	50.0	-	-	-	-	-	-	-	16072.88	16.07	2.50	6.43
1.50	1962.5	9	0.31	1	0.31	23550	50.0	-	-	-	-	-	-	-	12775.88	12.78	2.50	5.11
1.50	1962.5	9	0.39	1	0.39	23550	50.0	-	-	-	-	-	-	-	16072.88	16.07	2.50	6.43
1.50	1962.5	9	0.34	1	0.34	23550	50.0	-	-	-	-	-	-	-	14012.25	14.01	2.50	5.60
1.50	1962.5	-	-	1	-	23550	50.0	0.094	0.141	6.102	5.186	1.5	0.141	26	4833.3	4.8333	2.50	1.93
1.50	1962.5	-	-	1	-	23550	50.0	0.093	0.139	5.763	4.742	1.5	0.139	26	4569.6	4.5696	2.50	1.83
1.50	1962.5	-	-	1	-	23550	50.0	0.094	0.141	5.242	4.298	1.5	0.141	26	4421.5	4.4215	2.50	1.77
1.50	1962.5	-	-	1	-	23550	50.0	0.092	0.138	5.79	4.708	1.5	0.138	27	4620.8	4.6208	2.50	1.85
1.50	1962.5	-	-	1	-	23550	50.0	0.093	0.139	5.79	4.708	1.5	0.139	27	4662.1	4.6621	2.50	1.86
1.50	1962.5	-	-	1	-	23550	50.0	0.092	0.138	5.79	4.708	1.5	0.138	27	4620.8	4.6208	2.50	1.85
Total length= 18.0m`			Dia of Pile= 500mm												Total Safe load		46.35	

**AIRY BE CREATIVE CONSULTANTS (OPC) PRIVATE LIMITED**

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BHAGAT SING WARD-1(146) KANCHANPUR MATIYARI, KAMTA, LUCKNOW, PH NO.: 0522- 3639933, 09451371403,

07275268881, E-Mail ID :- [abcsoillab@gmail.com](mailto:abcsoillab@gmail.com), [abccconsultants2006@gmail.com](mailto:abccconsultants2006@gmail.com).

CIN: U71200UP20230PC194892A

GST NO.: 9AAZCA9203H1Z6

ISO/ ICE 17025 ACCREDITED LABORATORY  
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The soil strata comprise of cohesion & non cohesive soil the safe load may be estimated using clayey & sandy soil formula and tabulated below.

Length of pile = 18.0m

Dia of pile

= 0.60m

Depth (m)	Ap (cm <sup>2</sup> )	Nc	c <sub>p</sub> (kg/cm <sup>2</sup> )	α	c <sub>i</sub> (kg/cm <sup>2</sup> )	As / Asi (cm <sup>2</sup> )	D (cm)	Y	P <sub>d</sub>	N <sub>q</sub>	N <sub>r</sub>	K	P <sub>di</sub>	ø	Qu		F.O.C	Safe load on pile (tone)
															(Kg)	(Tone)		
1.50	2826	9	0.38	1	0.38	28260	60.0	-	-	-	-	-	-	-	20403.72	20.40	2.50	8.16
1.50	2826	9	0.33	1	0.33	28260	60.0	-	-	-	-	-	-	-	17719.02	17.72	2.50	7.09
1.50	2826	9	0.39	1	0.39	28260	60.0	-	-	-	-	-	-	-	20940.66	20.94	2.50	8.38
1.50	2826	9	0.31	1	0.31	28260	60.0	-	-	-	-	-	-	-	16645.14	16.65	2.50	6.66
1.50	2826	9	0.39	1	0.39	28260	60.0	-	-	-	-	-	-	-	20940.66	20.94	2.50	8.38
1.50	2826	9	0.34	1	0.34	28260	60.0	-	-	-	-	-	-	-	18255.96	18.26	2.50	7.30
1.50	2826	-	-	1	-	28260	60.0	0.094	0.141	6.102	5.186	1.5	0.141	26	7066.5	7.0665	2.50	2.83
1.50	2826	-	-	1	-	28260	60.0	0.093	0.139	5.763	4.742	1.5	0.139	26	6629.4	6.6294	2.50	2.65
1.50	2826	-	-	1	-	28260	60.0	0.094	0.141	5.242	4.298	1.5	0.141	26	6355.6	6.3556	2.50	2.54
1.50	2826	-	-	1	-	28260	60.0	0.092	0.138	5.79	4.708	1.5	0.138	27	6670.5	6.6705	2.50	2.67
1.50	2826	-	-	1	-	28260	60.0	0.093	0.139	5.79	4.708	1.5	0.139	27	6732.3	6.7323	2.50	2.69
1.50	2826	-	-	1	-	28260	60.0	0.092	0.138	5.79	4.708	1.5	0.138	27	6670.5	6.6705	2.50	2.67
Total length= 18.0m`		Dia of Pile= 600mm													Total Safe load		62.01	

**CONSULTANTS****AIRY BE CREATIVE CONSULTANTS (OPC) PRIVATE LIMITED**

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BHAGAT SING WARD-1(146) KANCHANPUR MATIYARI, KAMTA, LUCKNOW, PH NO.: 0522- 3639933, 09451371403,

07275268881, E-Mail ID :- [abcsoillab@gmail.com](mailto:abcsoillab@gmail.com), [abccconsultants2006@gmail.com](mailto:abccconsultants2006@gmail.com).



CIN: U71200UP20230PC194892A

GST NO.: 9AAZCA9203H1Z6

ISO/ ICE 17025 ACCREDITED LABORATORY  
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WATER CONSULTANTS AND CIVIL ENGINEERING PROJECT**9.06 Calculation**

The soil strata comprise of cohesion & non cohesive soil the safe load may be estimated using clayey & sandy soil formula and tabulated below.

Length of pile

= 18.0m

Dia of pile

= 0.70m

Depth (m)	Ap (cm <sup>2</sup> )	Nc	Cp (kN/cm <sup>2</sup> )	$\alpha$	Ci (kN/cm <sup>2</sup> )	As / Asi (cm <sup>2</sup> )	D (cm)	Y	Pd	Nq	Nr	K	Pdi	$\phi$	Qu		F.O.C.	Safe load on pile
															(Kg)	(Tone)		
1.50	3846.5	9	0.38	1	0.38	32970	70.0	-	-	-	-	-	-	-	25683.63	25.68	2.50	10.27
1.50	3846.5	9	0.33	1	0.33	32970	70.0	-	-	-	-	-	-	-	22304.21	22.30	2.50	8.92
1.50	3846.5	9	0.39	1	0.39	32970	70.0	-	-	-	-	-	-	-	26359.52	26.36	2.50	10.54
1.50	3846.5	9	0.31	1	0.31	32970	70.0	-	-	-	-	-	-	-	20952.44	20.95	2.50	8.38
1.50	3846.5	9	0.39	1	0.39	32970	70.0	-	-	-	-	-	-	-	26359.52	26.36	2.50	10.54
1.50	3846.5	9	0.34	1	0.34	32970	70.0	-	-	-	-	-	-	-	22980.09	22.98	2.50	9.19
1.50	3846.5	-	-	1	-	32970	70.0	0.094	0.141	6.102	5.186	1.5	0.141	26	9989.9	9.9899	2.50	4.00
1.50	3846.5	-	-	1	-	32970	70.0	0.093	0.139	5.763	4.742	1.5	0.139	26	9313.6	9.3136	2.50	3.73
1.50	3846.5	-	-	1	-	32970	70.0	0.094	0.141	5.242	4.298	1.5	0.141	27	8861.8	8.8618	2.50	3.54
1.50	3846.5	-	-	1	-	32970	70.0	0.092	0.138	5.79	4.708	1.5	0.138	27	9333.3	9.3333	2.50	3.73
1.50	3846.5	-	-	1	-	32970	70.0	0.093	0.139	5.79	4.708	1.5	0.139	27	9422.5	9.4225	2.50	3.77
1.50	3846.5	-	-	1	-	32970	70.0	0.092	0.138	5.79	4.708	1.5	0.138	27	9333.3	9.3333	2.50	3.73
Total length= 18.0m					Dia of Pile= 700mm										Total Safe load		80.36	

**CONSULTANTS****AIRY BE CREATIVE CONSULTANTS (OPC) PRIVATE LIMITED**

OFFICE ADDRESS : C-1074/75, SECTOR -B, MAHANAGAR, LUCKNOW-226006, LAB ADDRESS HOUSE NO.- TEMP-68, SAHEED

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07275268881, E-Mail ID :- [abcsoillab@gmail.com](mailto:abcsoillab@gmail.com), [abccconsultants2006@gmail.com](mailto:abccconsultants2006@gmail.com).



## 10.0 RECOMMENDATION:

- 10.1 The soil strata are effective zone comprises of cohesive & non-cohesive layers. The design load has therefore to ensure safety against failure due to shear failure.
- 10.2 The water table was met at about of 2.50 m depth below existing ground level. Water is expected 1.00 m rise in post monsoon period. Accordingly, water table is assuming 1.50 m for calculation purpose.
- 10.3 The values of net safe bearing capacity for Isolated / R.C.C. Raft foundation below existing ground level are tabulated below: -

S. L. No.	Depth (m)	Type of foundation	Width of foundation (m)	Allowable Bearing Capacity	
				Kg/cm <sup>2</sup>	T/m <sup>2</sup>
1	1.20	Isolated foundation	1.20	0.919	9.19
2	1.50		1.50	0.928	9.28
3	2.00		2.00	0.988	9.88
4	2.00	R.C.C. Raft foundation	(10.00x10.00)	0.893	8.93
5	3.00			0.937	9.37
6	4.50			1.017	10.17
7	6.00			1.125	11.25
8	7.50			1.211	12.11

The 'Cl' group soil is found in the effective zone below footing level. Accordingly, plinth beam, lintel beam and apron all around the structure will be provided.

- 10.4 The safe load on pile is calculated as per I IS: 2911 (Part-I /Sec 2)-2010. As per Static formula calculations are assumed for design and tabulated below

Length of Pile(m)	Dia of Pile (cm)	Safe Load On Pile (Tone)
15.00	50.0	42.66
	60.0	56.65
	70.0	72.86
18.00	50.0	46.35
	60.0	62.01
	70.0	80.36

CIN: U71200UP20230PC194892A

GST NO.: 9AAZCA9203H1Z6

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**Final design diameter & length of pile etc. will depend on incoming loads and capacity of piles, as determine by load test at site.**

The above recommendations are based on the field investigation data and the laboratory test result of the sample collected from site and our experience in this regard.

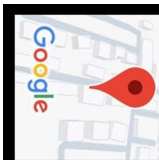
If the actual sub – soil condition during excavation for foundation differs from that has been reported a reference should be made to us for suggestion.



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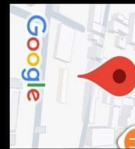
(Soil Investigations and Laboratory Works)

*Yours*  
Authorized Signatory

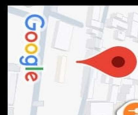
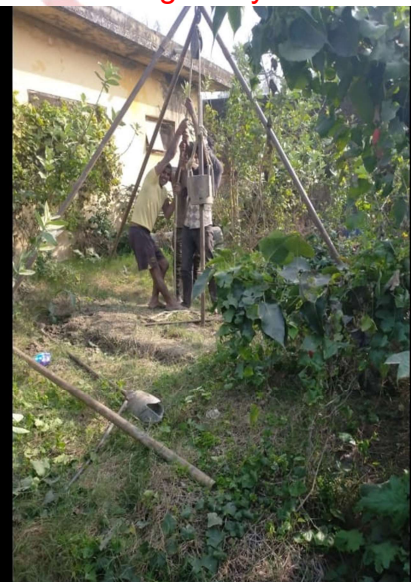


Q49X+H2V, पुलिस लाइन, बलिया  
पुलिस लाइन, बलिया, उत्तर प्रदेश  
277001, भारत  
29 जून 2026 08:52 am

broken  
clouds  
16.0 °C



Q49X+94P, बलिया पुलिस लाइन,  
बलिया, उत्तर प्रदेश 277001, भारत  
30 जून 2026 02:44 pm  
broken  
clouds  
24.0 °C



Q49X+94P, बलिया पुलिस लाइन,  
बलिया, उत्तर प्रदेश 277001, भारत  
31 जून 2026 03:02 pm  
overcast  
clouds  
22.0 °C



## AIRY BE CREATIVE CONSULTANTS (OPC) PRIVATE LIMITED

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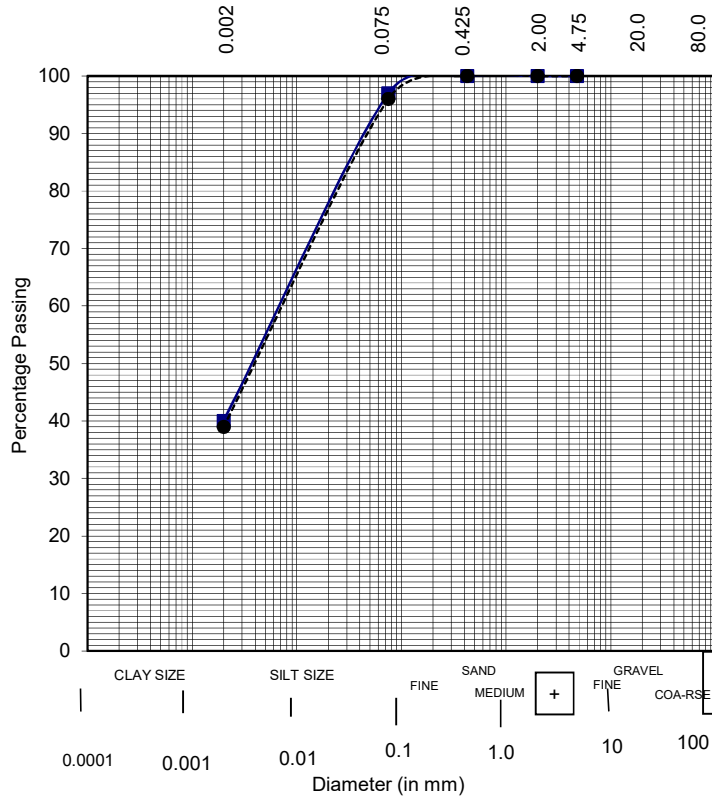
BHAGAT SING WARD-1(146) KANCHANPUR MATIYARI, KAMTA, LUCKNOW, PH NO.: 0522- 3639933, 09451371403,

07275268881, E-Mail ID :- [abcsaillab@gmail.com](mailto:abcsaillab@gmail.com), [abcconsultants2006@gmail.com](mailto:abcconsultants2006@gmail.com).

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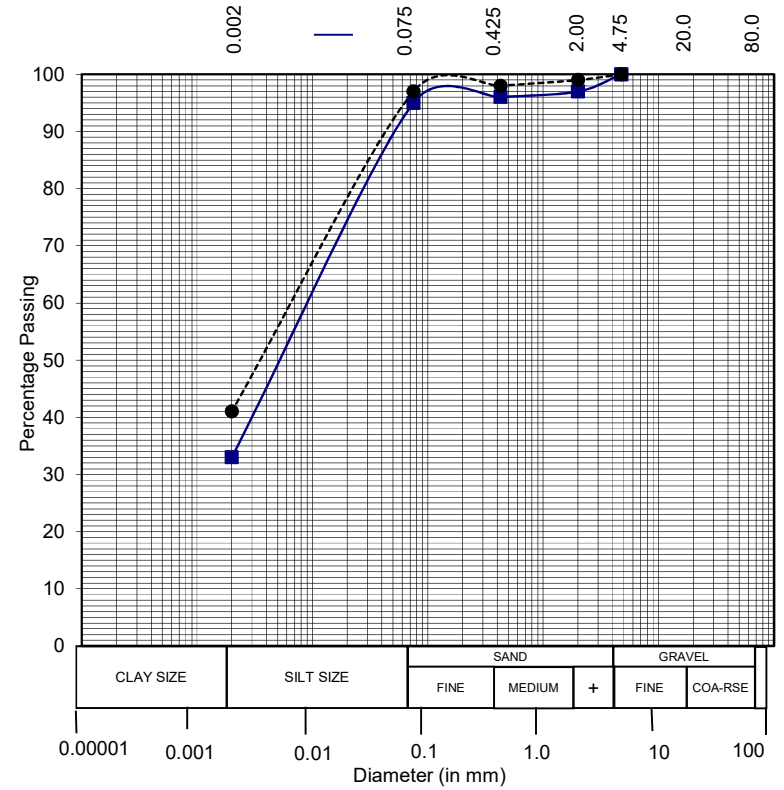
Bore Hole No. 1  
Depth



## ABC CONSULTANTS

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Bore Hole No. 1  
Depth



## ABC CONSULTANTS

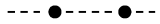
OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 1

Depth



6.00-6.35



7.50-7.85

Bore Hole No. 1

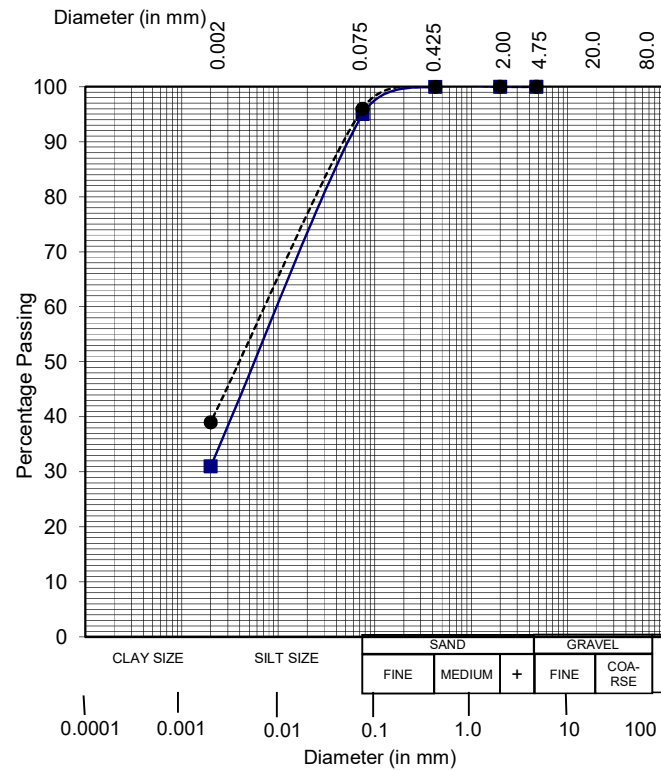
Depth



9.00-9.35



10.50-10.85



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Bore Hole No. 1

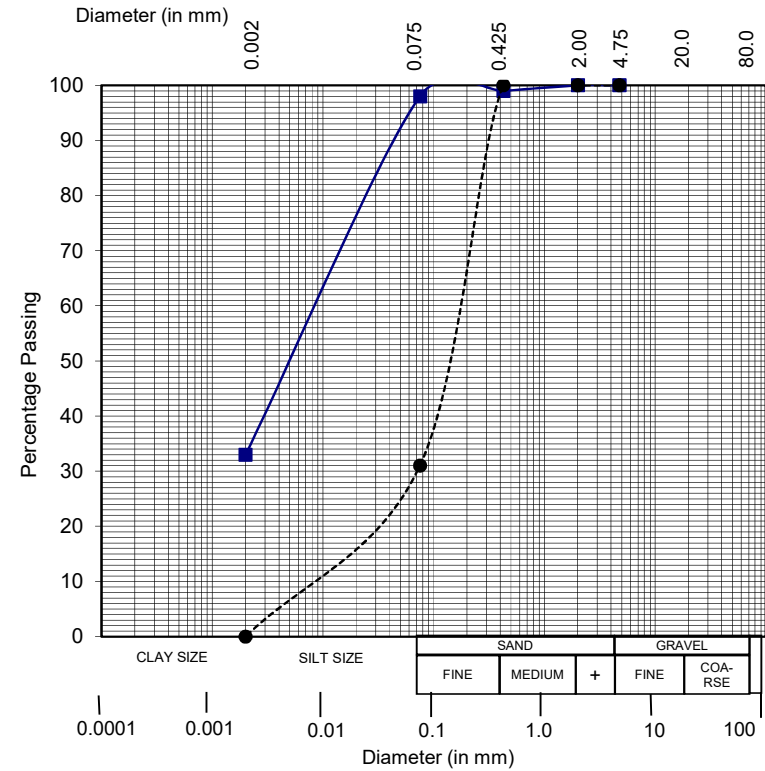
Depth



9.00-9.35



10.50-10.85



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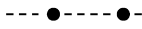
OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 1

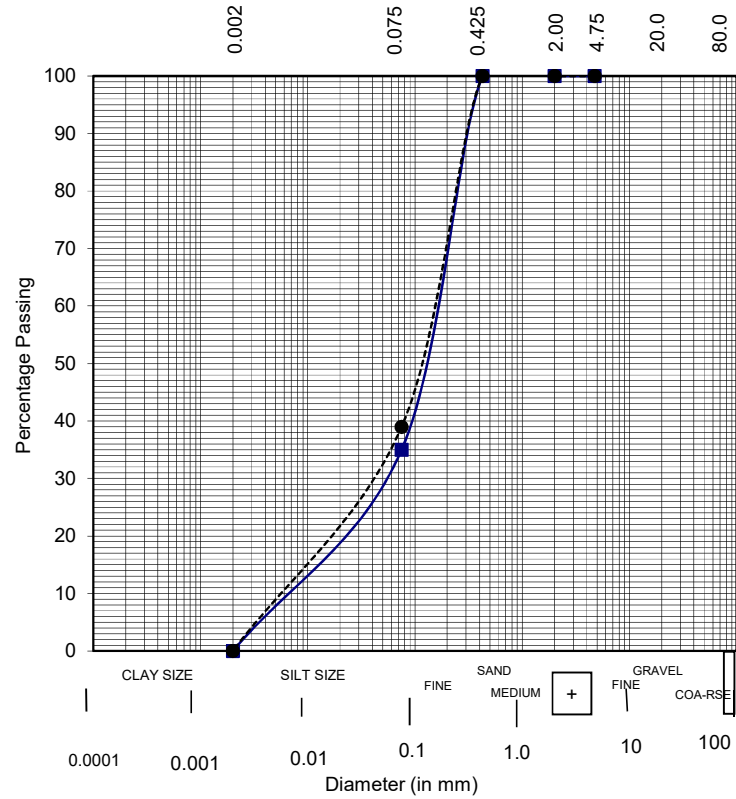
Depth



12.00-12.35



13.50-13.85



## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 1

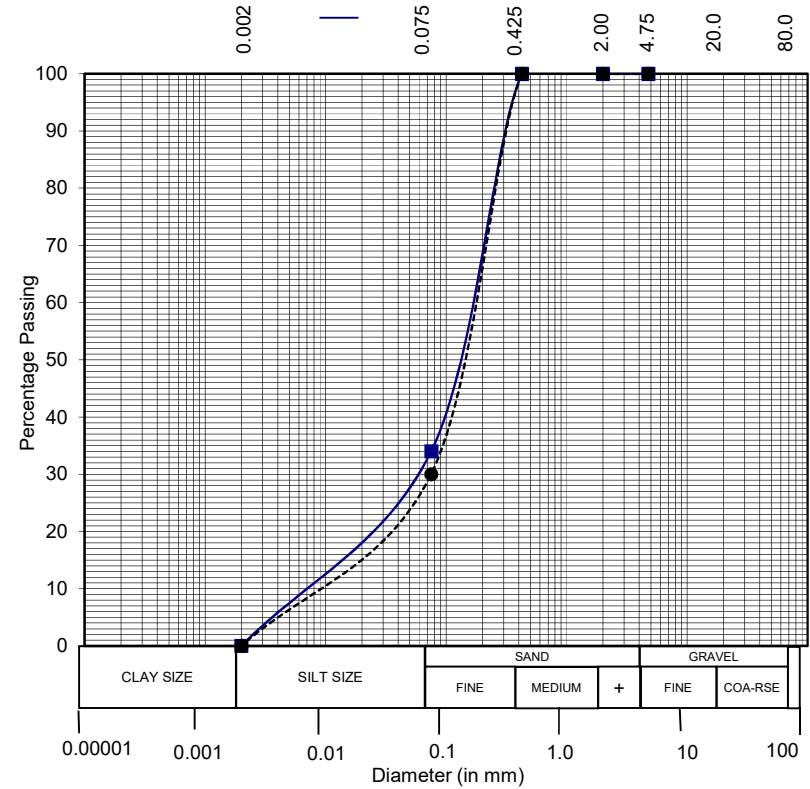
Depth



15.00-15.35



16.50-16.85

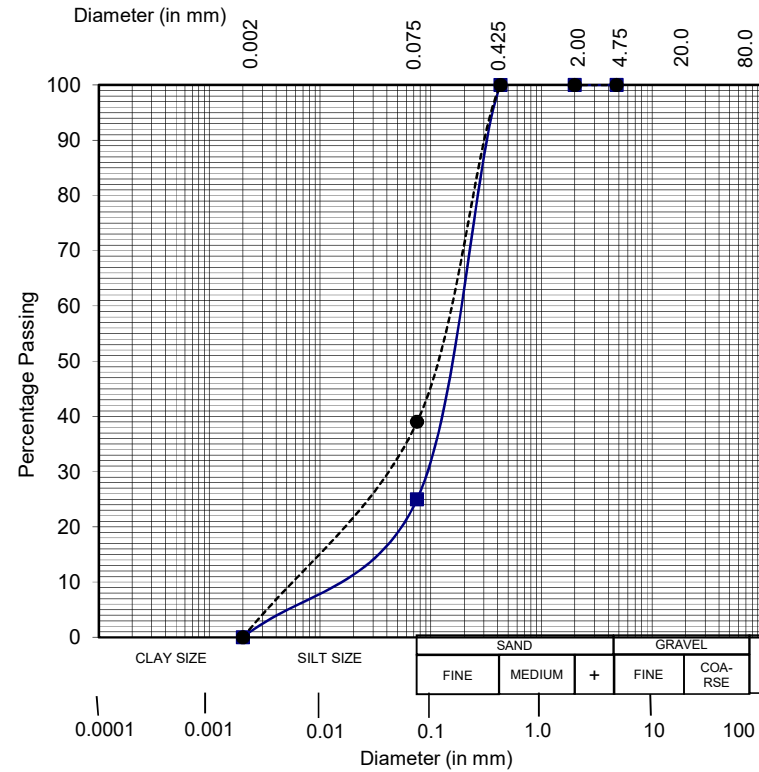


## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 1

Depth

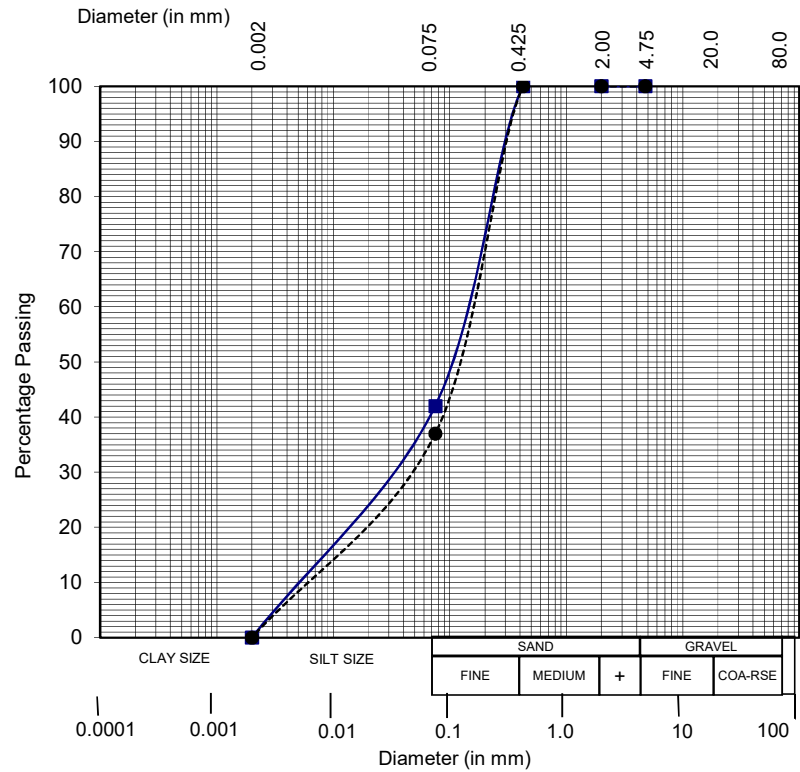


## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 1

Depth

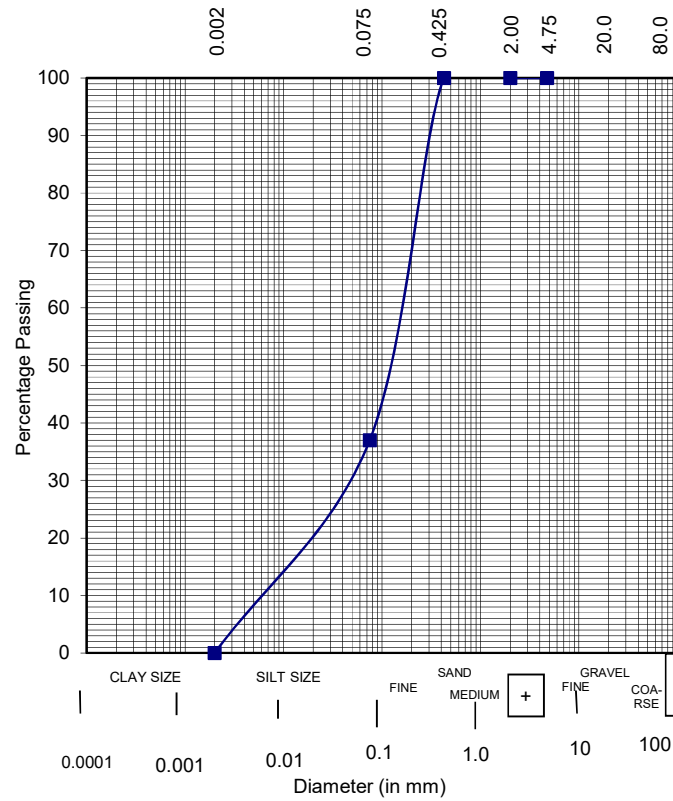




**ABC CONSULTANTS**  
OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 1  
Depth

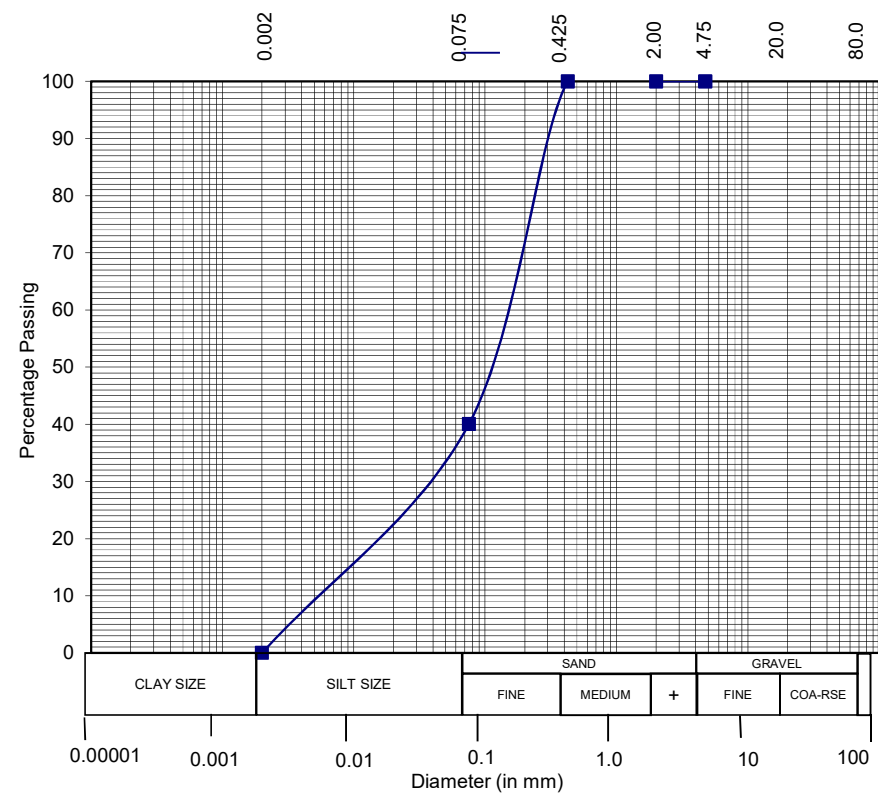
24.00-24.35 --- ●-----●-- 25.50-25.85



**ABC CONSULTANTS**  
OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 1  
Depth

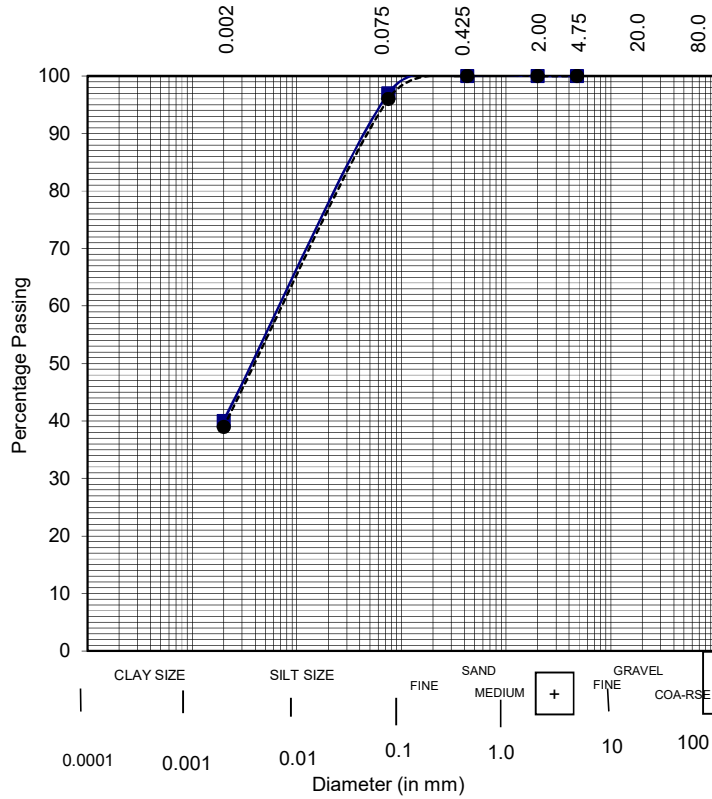
27.00-27.35 --- ●-----●-- 28.50-28.85



## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

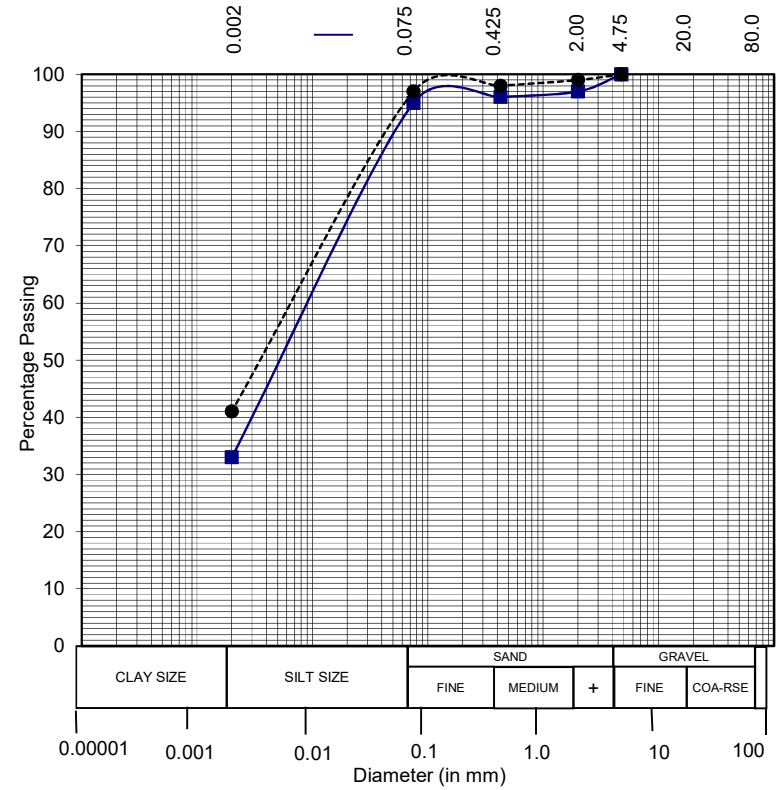
Bore Hole No. 2  
Depth



## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

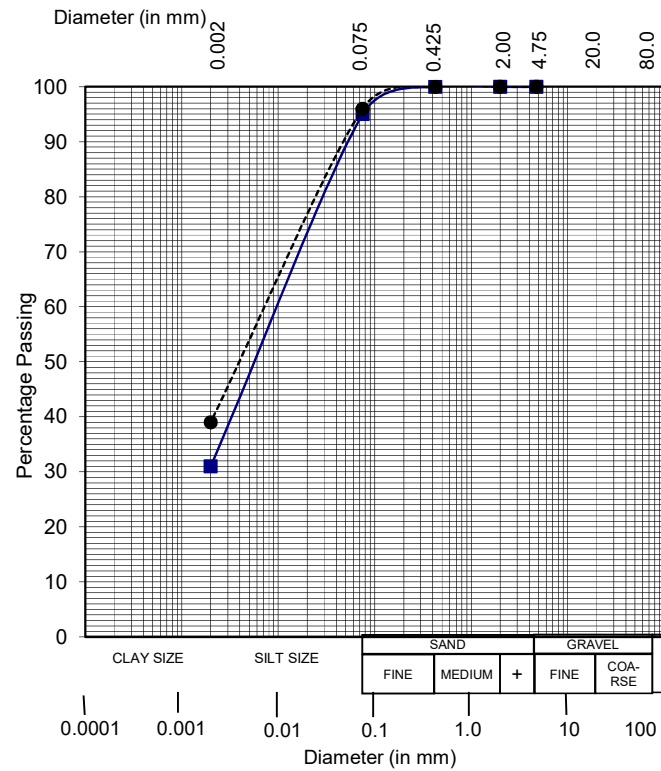
Bore Hole No. 2  
Depth



**OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW**

Depth

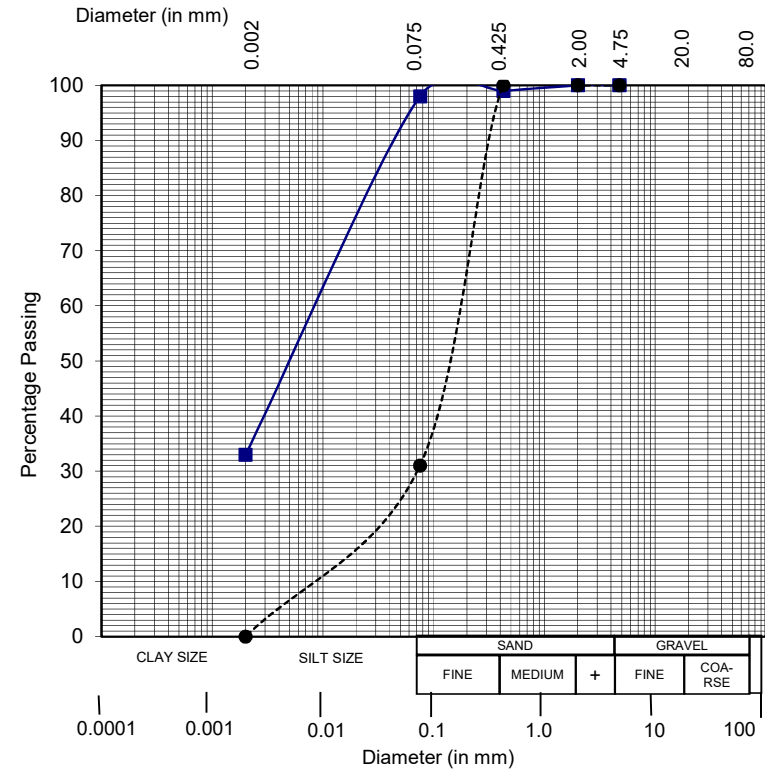
7.50-7.85



**OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW**

## 5 Depth

10.50-10.85



## ABC CONSULTANTS

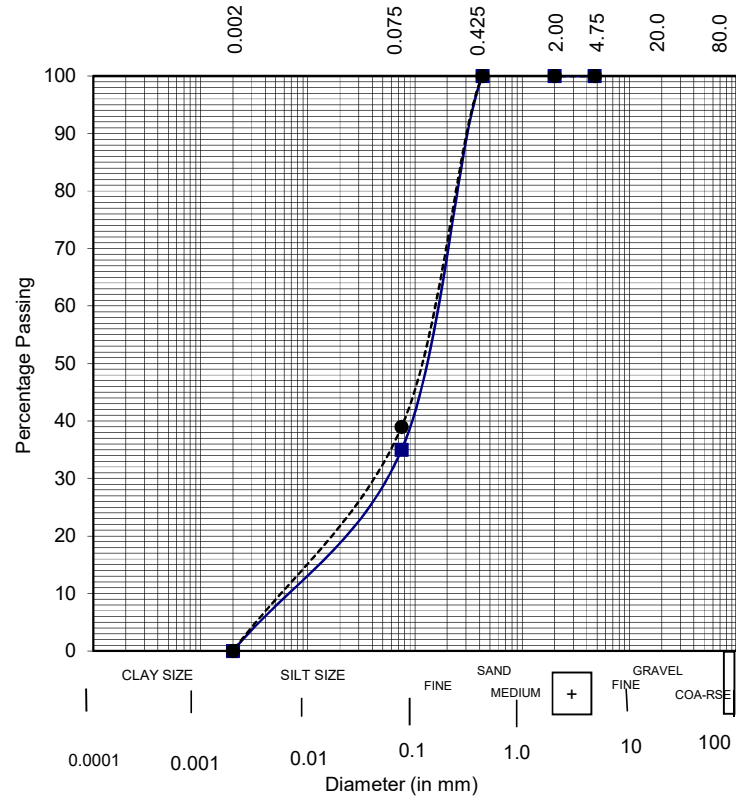
OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 2

Depth

—■—■— 12.00-12.35

---●---●--- 13.50-13.85



## ABC CONSULTANTS

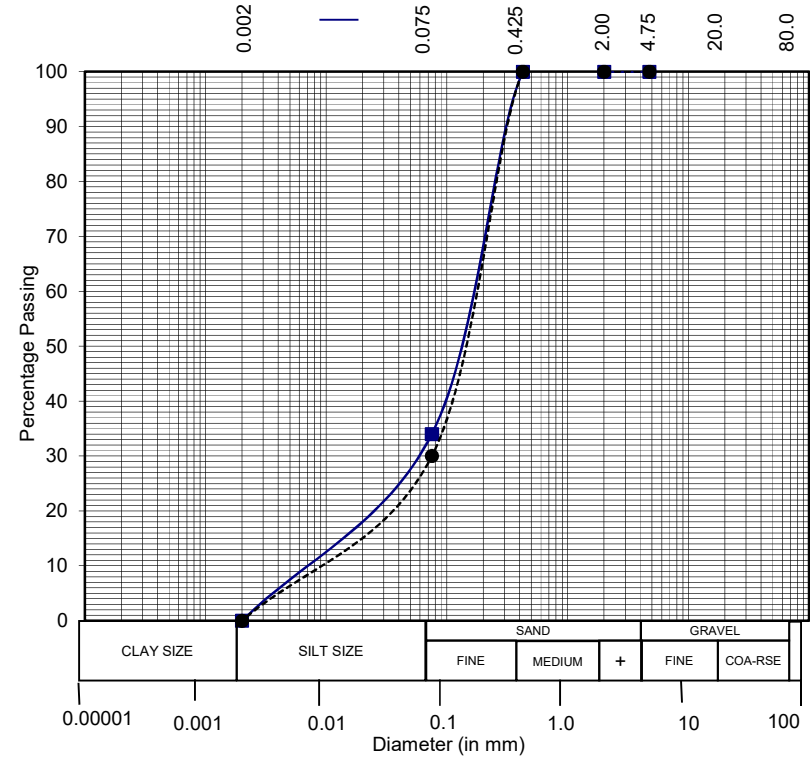
OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 2

Depth

—■—■— 15.00-15.35

---●---●--- 16.50-16.85

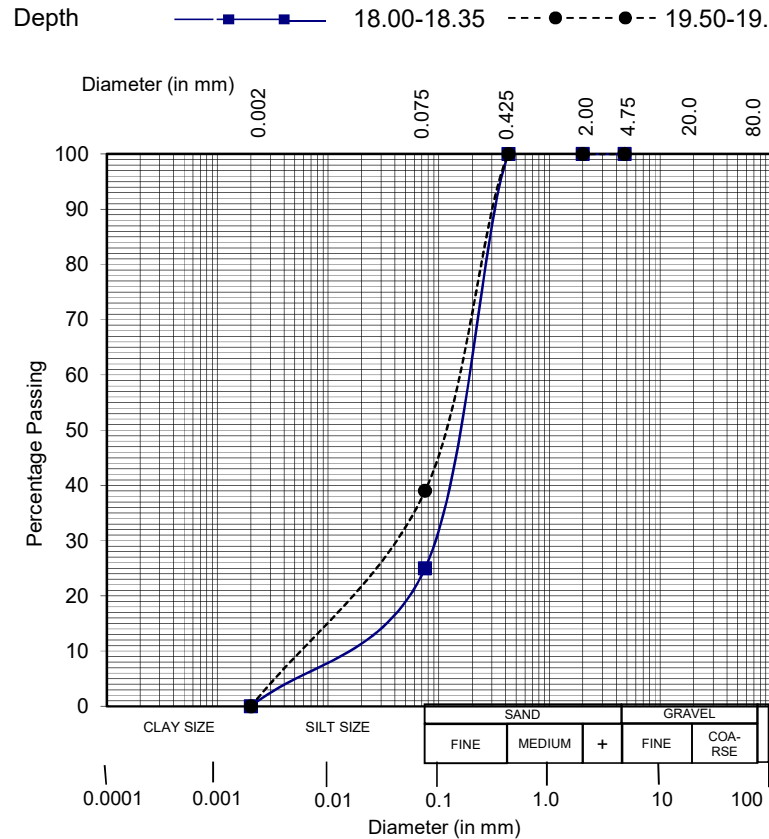


## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 2

Depth

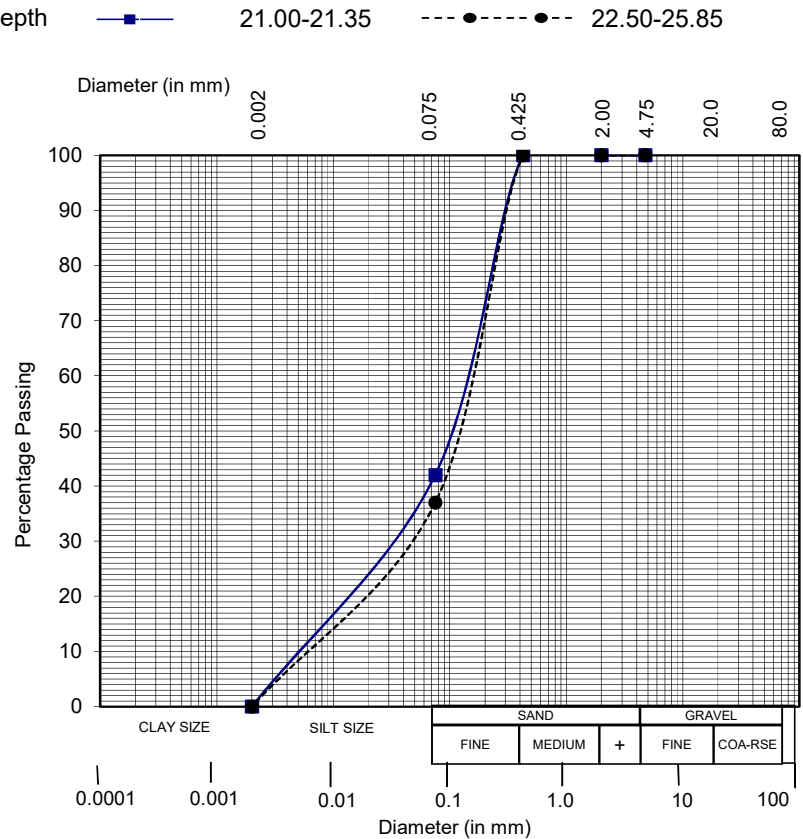


## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 2

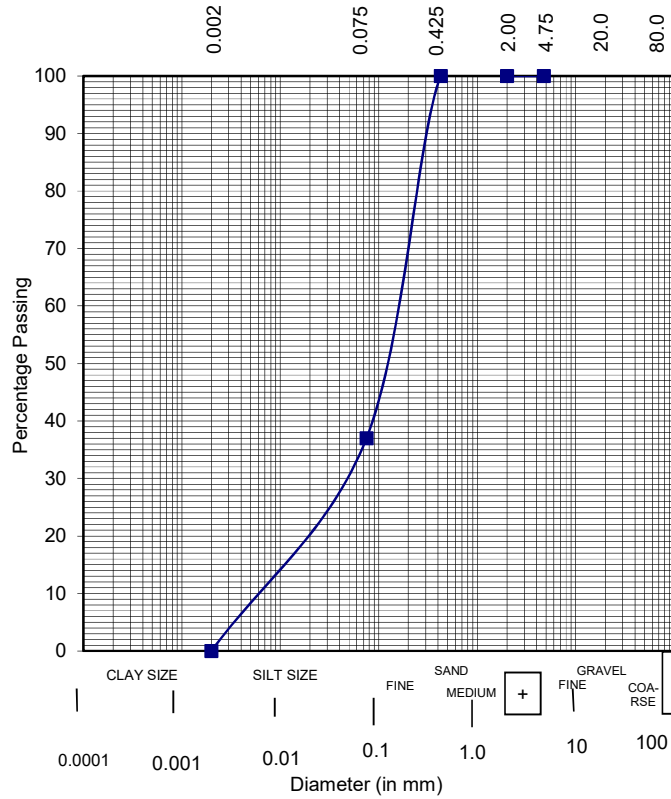
Depth



## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

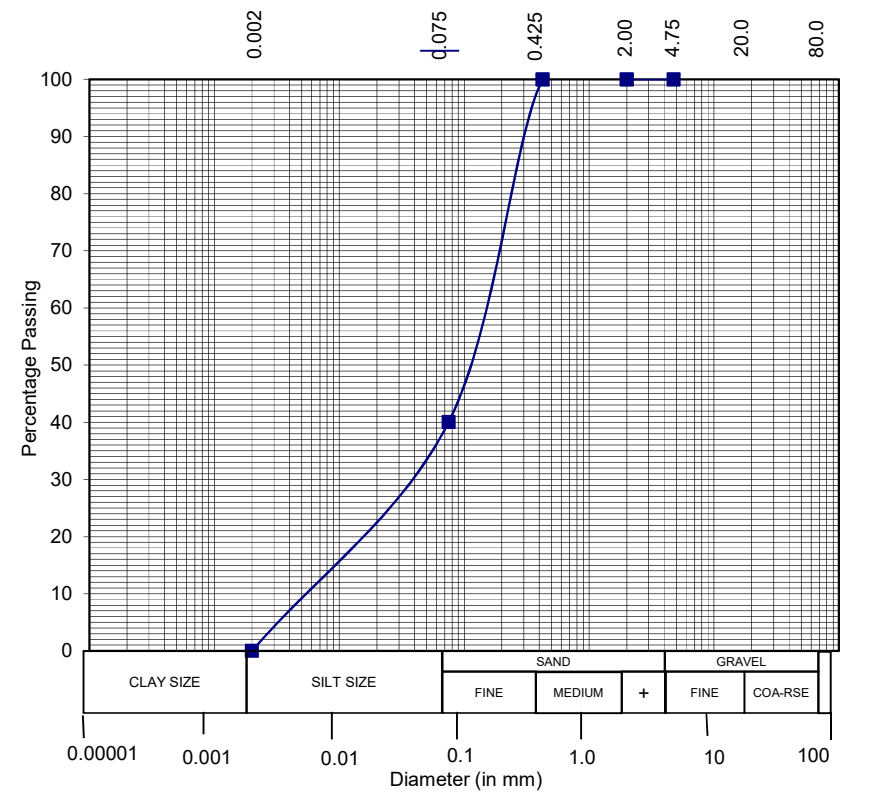
Bore Hole No. 2  
Depth



## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 2  
Depth

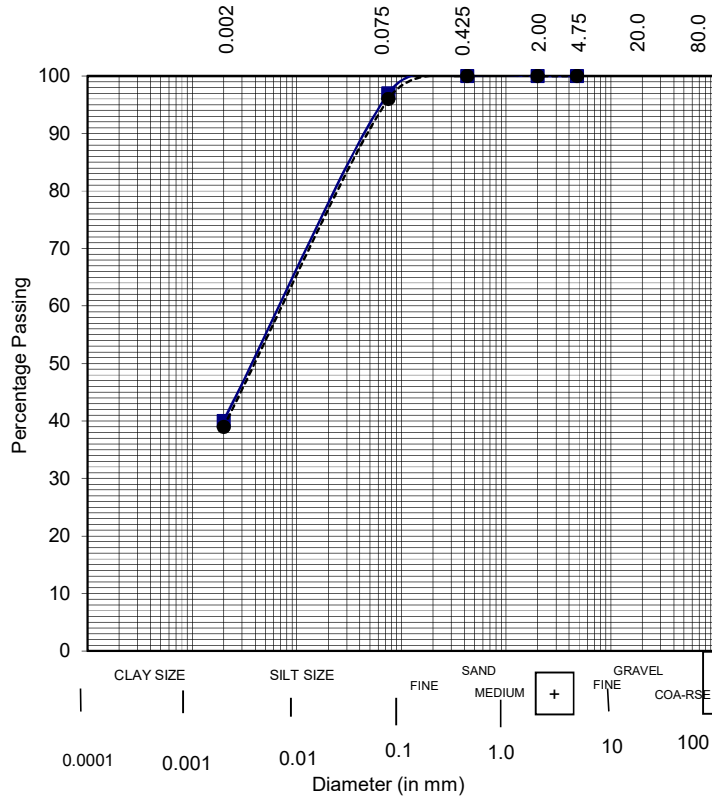




# ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

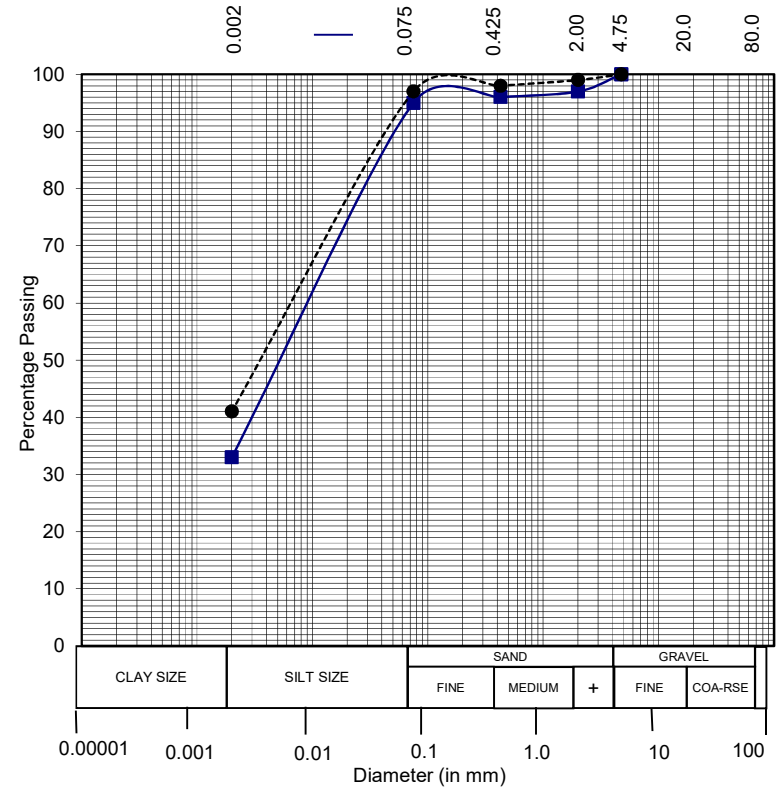
Bore Hole No. 3  
Depth



# ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 3  
Depth



## ABC CONSULTANTS

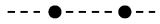
OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 3

Depth



6.00-6.35



7.50-7.85

Bore Hole No. 3

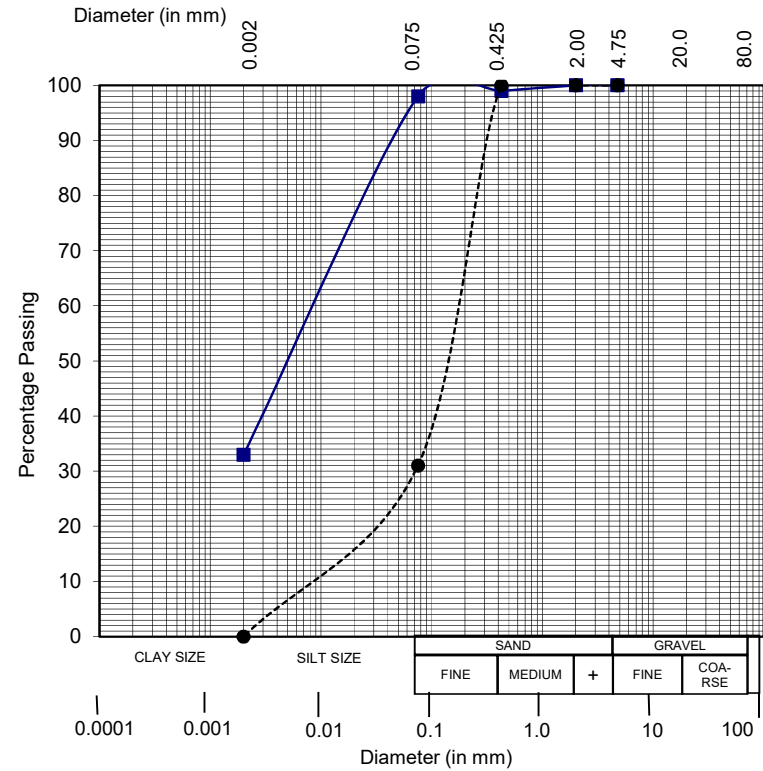
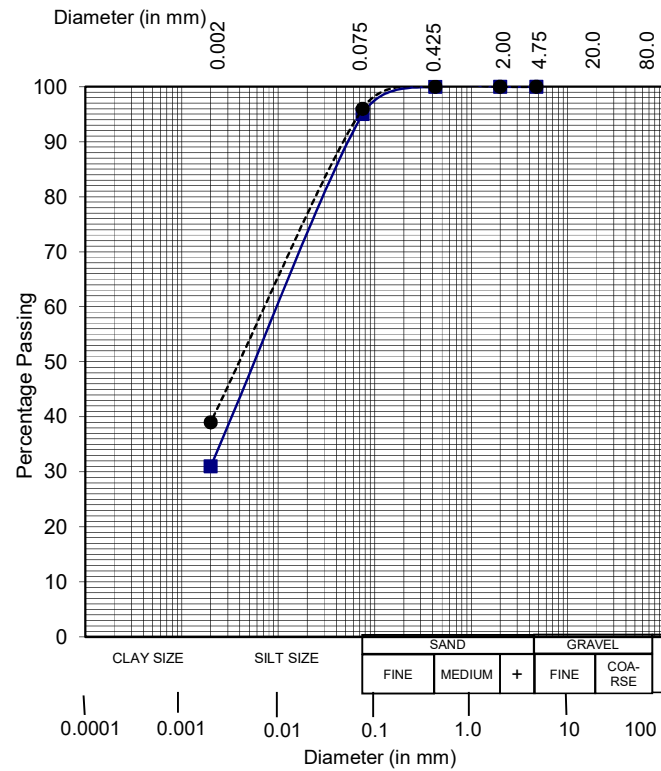
Depth



9.00-9.35



10.50-10.85



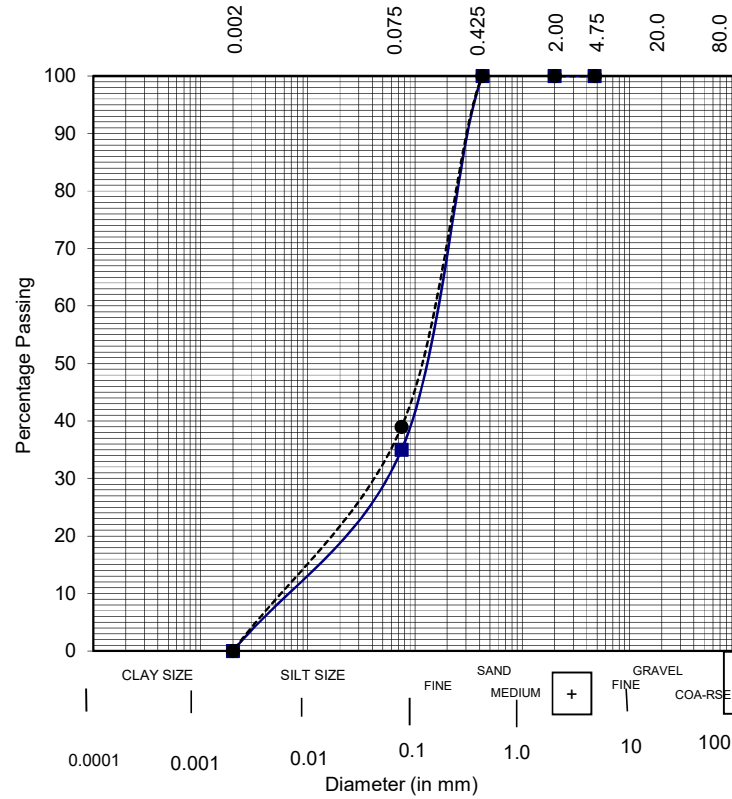
## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 3

Depth

12.00-12.35 --- ● --- ● --- 13.50-13.85



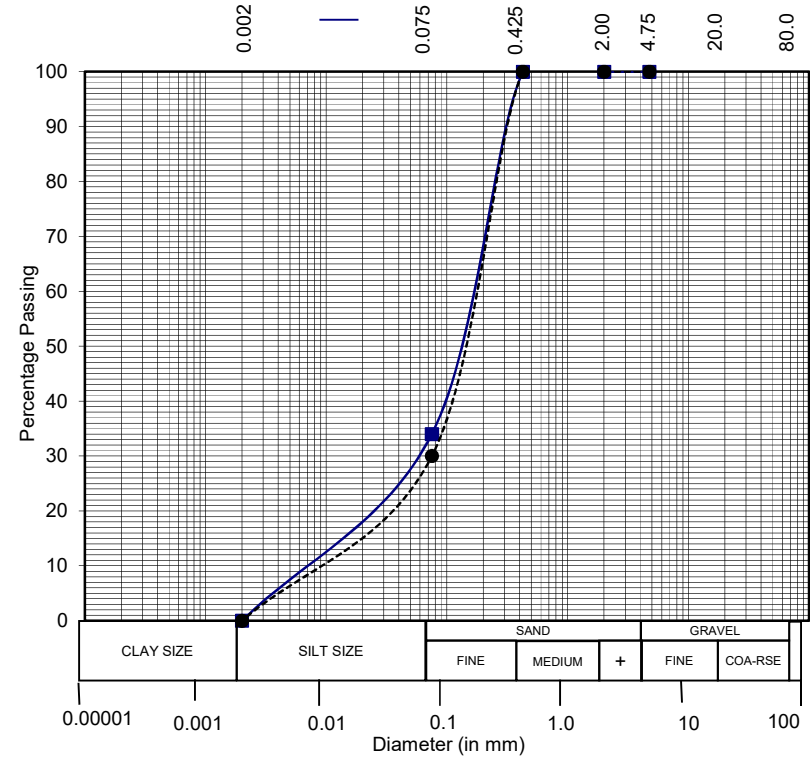
## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 3

Depth

15.00-15.35 --- ● --- ● --- 16.50-16.85



## ABC CONSULTANTS

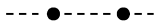
OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 3

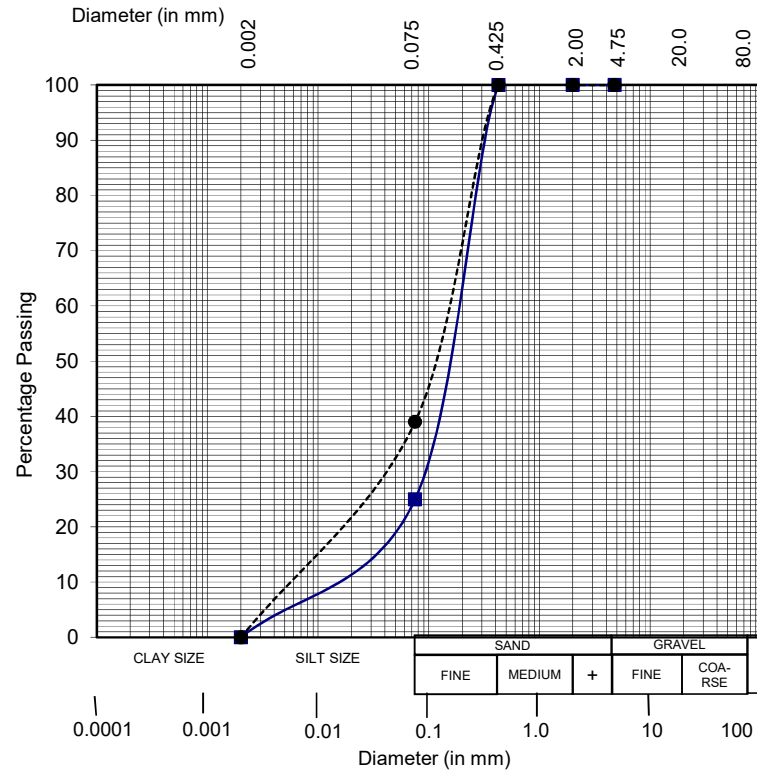
Depth



18.00-18.35



19.50-19.85



## ABC CONSULTANTS

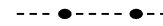
OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 3

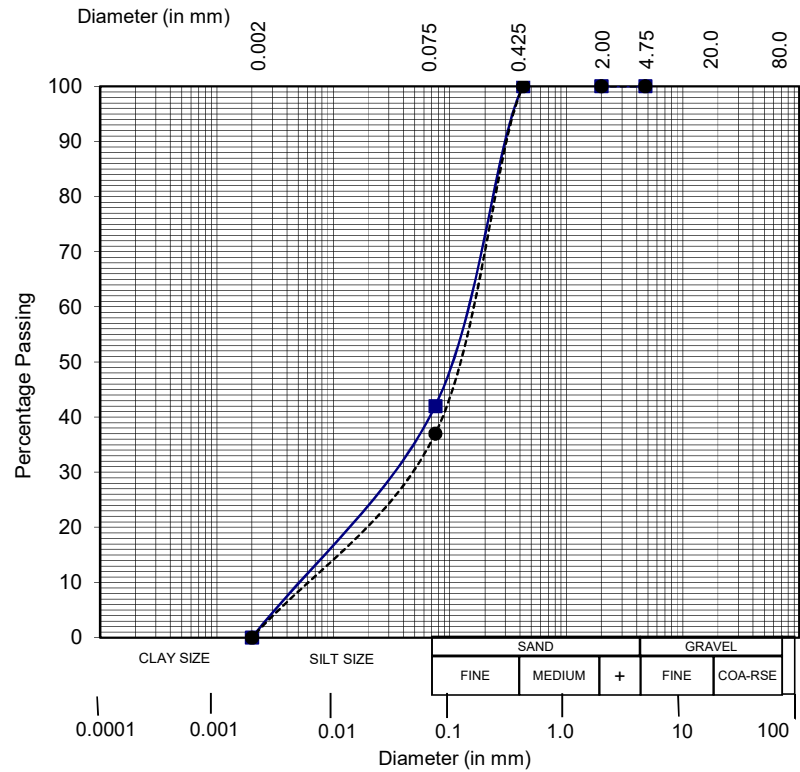
Depth



21.00-21.35



22.50-25.85



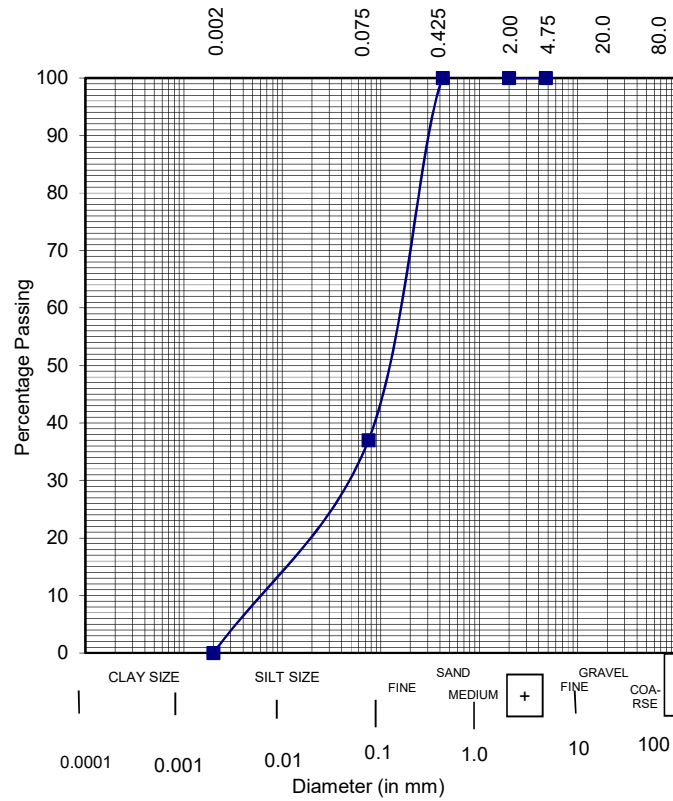
## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 3

Depth

—■—■— 24.00-24.35 ---●---●--- 25.50-25.85



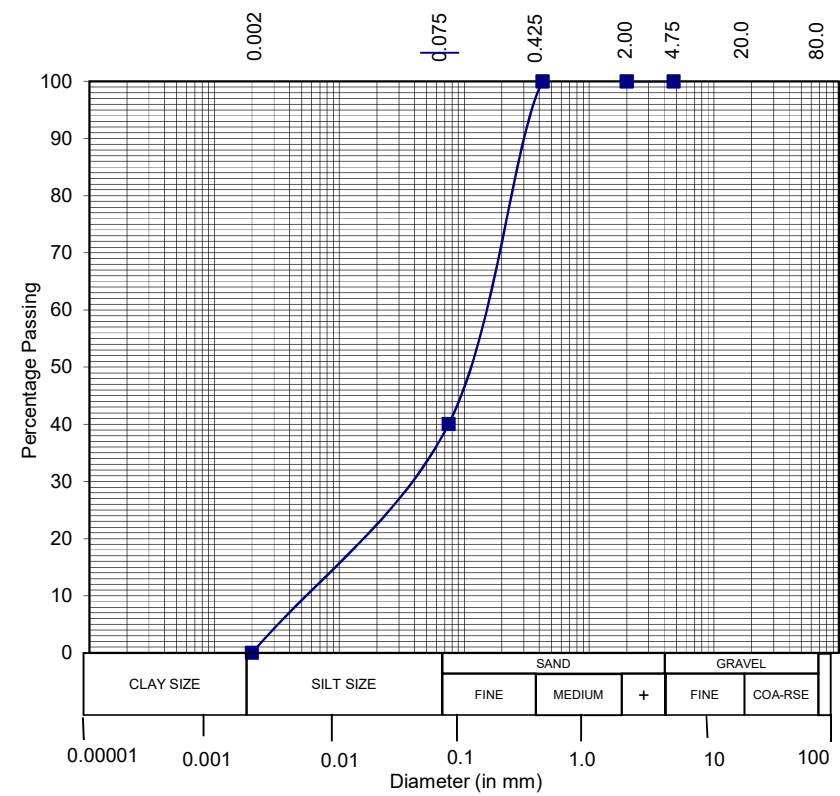
## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 3

Depth

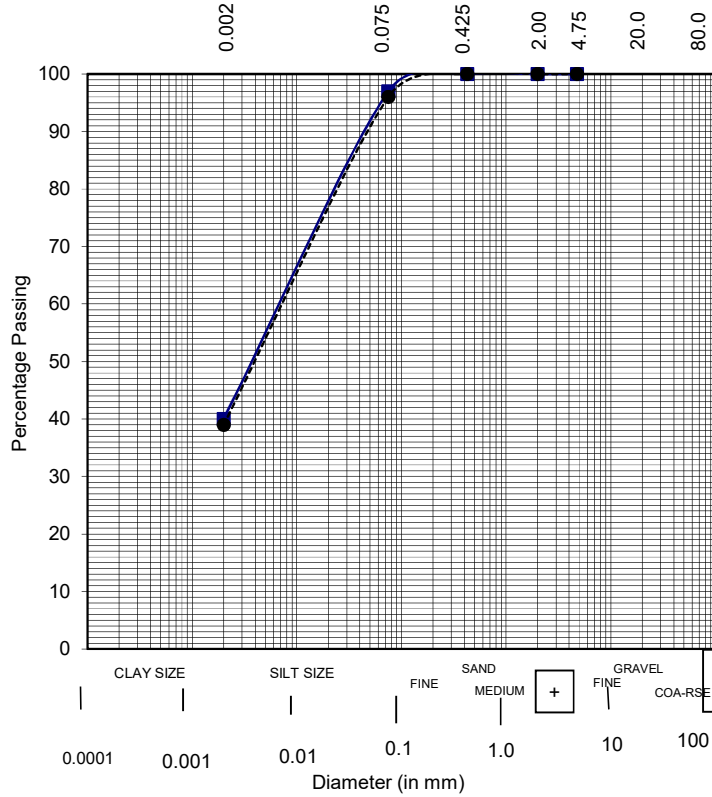
—■—■— 27.00-27.35 ---●---●--- 28.50-28.85



# ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

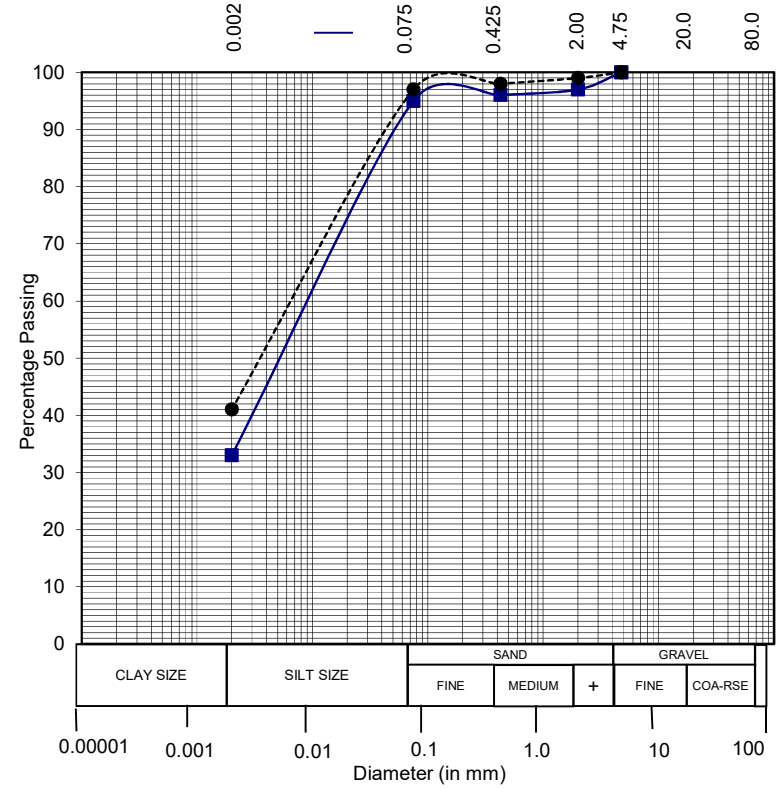
Bore Hole No. 4  
Depth



# ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 4  
Depth





## ABC CONSULTANTS

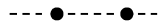
OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 4

Depth



6.00-6.35



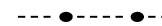
7.50-7.85

Bore Hole No. 4

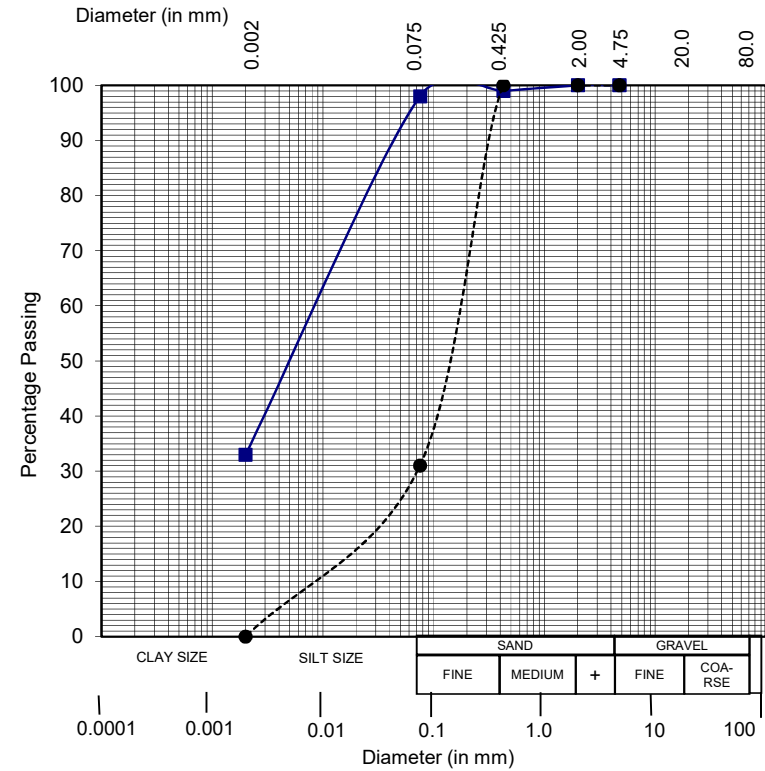
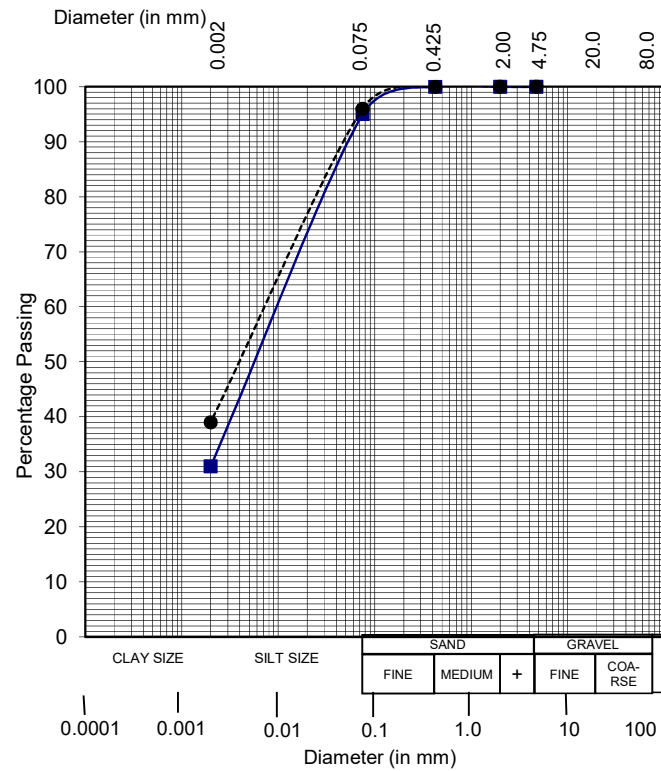
Depth



9.00-9.35



10.50-10.85



## ABC CONSULTANTS

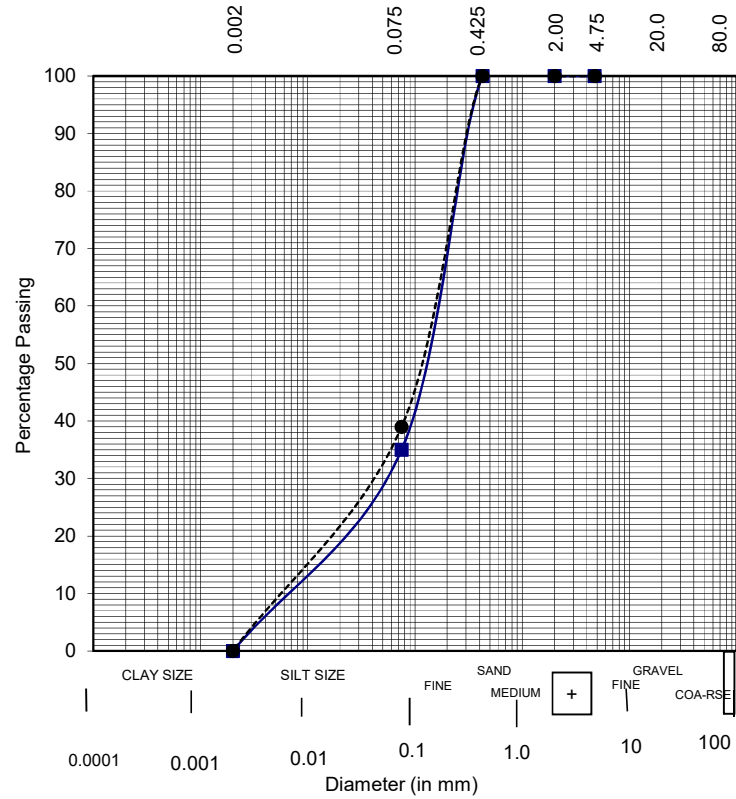
OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 4

Depth

—■—■— 12.00-12.35

---●---●--- 13.50-13.85



## ABC CONSULTANTS

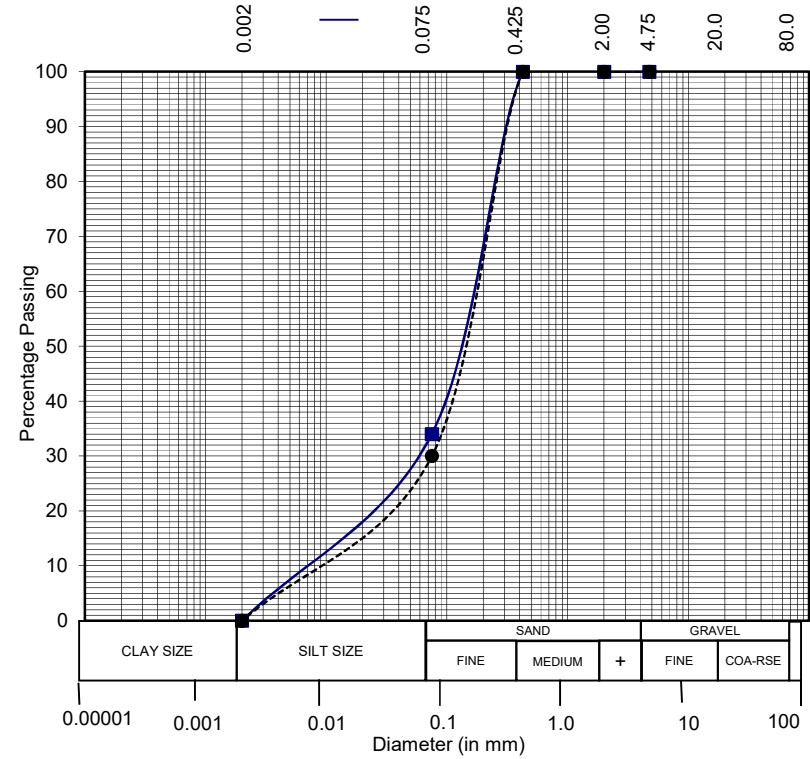
OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 4

Depth

—■—■— 15.00-15.35

---●---●--- 16.50-16.85

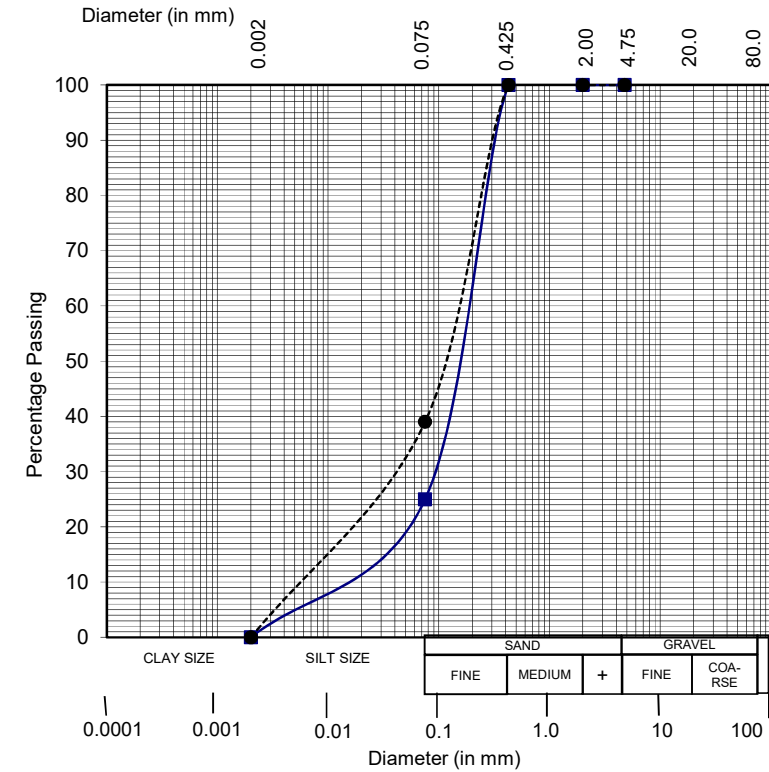


## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 4

Depth

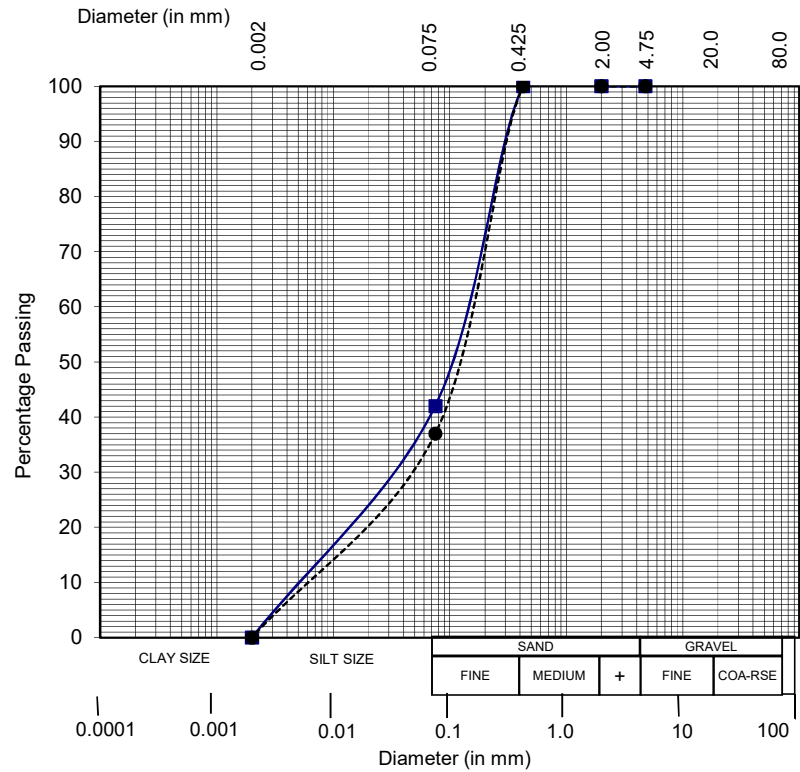


## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 4

Depth



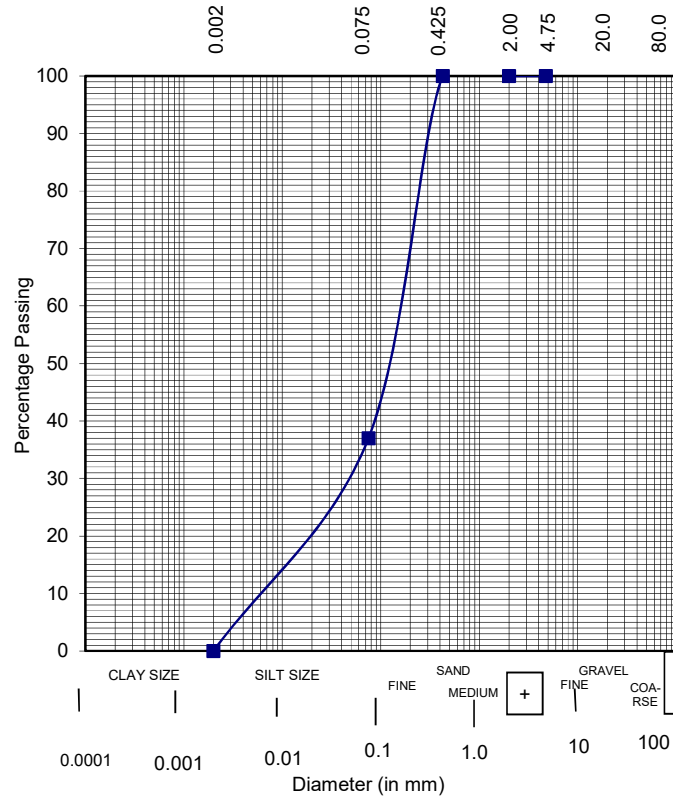
## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 4

Depth

—■—■— 24.00-24.35 ---●---●--- 25.50-25.85



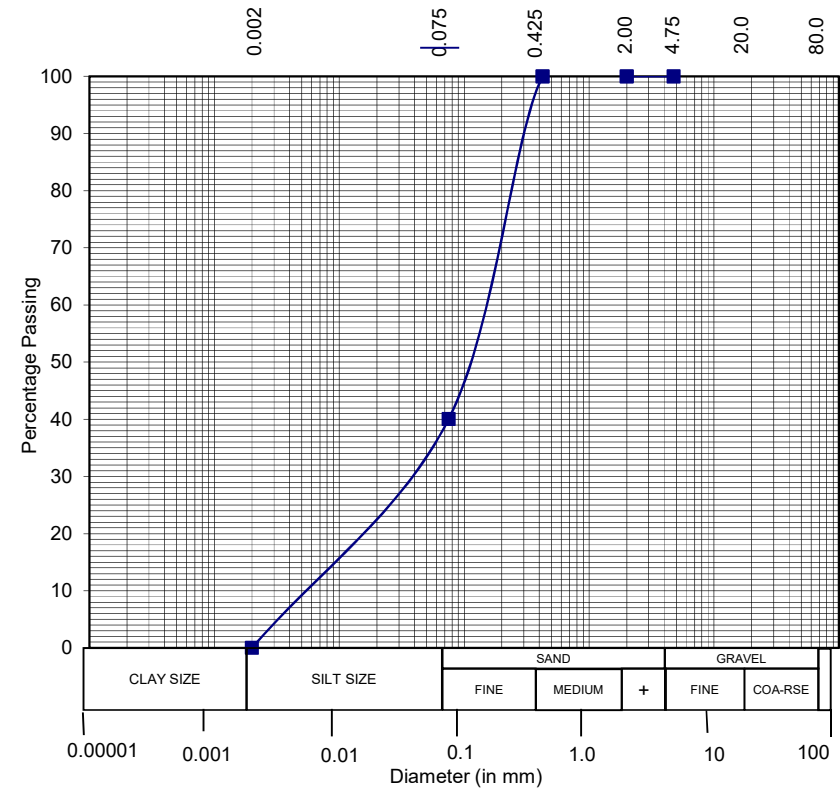
## ABC CONSULTANTS

OFFICE : C-1074/75,Sec-B,Mahanagar, LUCKNOW

Bore Hole No. 4

Depth

—■—■— 27.00-27.35 ---●---●--- 28.50-28.85



# ABC CONSULTANTS

OFFICE : C-1074/75, SECTOR – B. MAHANAGAR, LUCKNOW

Phone :- 09451371403, 07275268881, E-mail: abceconsultantlucknow@gmail.com

**Project : Proposed Construction of Admin & Academic Block Building for The Proposed Medical Collage Campus in Ballia Old Jail Campus Building at District – Ballia(U.P.).**

**Bore Hole No. 01**

**Depth of Bore Hole : 30.0M.**

**Depth of Water table : 2.70 M.**

## LABORATORY TEST RESULTS

S. No.	Depth of Bore Hole	Nature of soil Sample	% Passing on IS Sieve				Atterberg's Limit			Particle Size Analysis				S.P.T. Value	IS Group		Natural Moisture Content %	Wet Density gm/cc	Dry Density gm/cc	Specific Gravity 'G'	Void ratio 'e'	Shear Parameter		Compression Index Cc
			4.75 mm	2.00 mm	0.425mm	0.075 mm	LL %	PL %	PI %	Gravel %	Sand %	Silt %	Clay %		Symbol	hatching						Cohesion 'C' in Kg/Sqcm.	Angle of Internal Friction $\phi$	
1	0.0-0.50	DS	Filled	up	soil	met	up	to	-	0.50 m	depth	-	with	mix	F		bricks	bolder	pieces	below	-	existing	ground	level
2	1.50-1.85	UD	99	98	97	96	42	22	20	1	3	56	40	-	CI		17.4	1.90	1.62	2.70	0.67	0.40	6	0.151
3	1.85-2.30	SPT	-	-	-	-	-	-	-	-	-	-	-	9	-		-	-	-	-	-	-	-	-
4	3.00-3.35	UD	100	99	98	97	39	23	16	0	3	65	32	-	CI		24.1	2.03	1.64	2.71	0.65	0.32	8	0.141
5	3.35-3.80	SPT	-	-	-	-	-	-	-	-	-	-	-	8	-		-	-	-	-	-	-	-	-
6	4.50-4.85	UD	100	100	99	98	41	22	19	0	2	61	37	-	CI		23.2	2.05	1.66	2.70	0.63	0.37	6	0.150
7	4.85-5.30	SPT	-	-	-	-	-	-	-	-	-	-	-	11	-		-	-	-	-	-	-	-	-
8	6.00-6.35	UD	99	98	97	96	41	23	18	1	3	60	36	-	CI		23.4	2.04	1.65	2.69	0.63	0.36	7	0.144
9	6.35-6.80	SPT	-	-	-	-	-	-	-	-	-	-	-	15	-		-	-	-	-	-	-	-	-
10	7.50-7.85	U.D.	98	97	96	95	42	21	21	2	3	56	39	-	CI		23.3	2.05	1.66	2.71	0.63	0.39	5	0.153
11	7.85-8.30	S.P.T.	-	-	-	-	-	-	-	-	-	-	-	18	-		-	-	-	-	-	-	-	-
12	9.00-9.35	U.D.	100	98	97	96	41	23	18	0	4	60	36	-	CI		23.4	2.04	1.65	2.69	0.63	0.36	7	-
13	9.35-9.80	S.P.T.	-	-	-	-	-	-	-	-	-	-	-	21	-		-	-	-	-	-	-	-	-
14	10.50-10.85	UD	100	100	100	37	Non-Plastic			0	63	37	0	-	SM		27.8	1.93	1.51	2.60	0.72	0	27	-
15	10.85-11.30	SPT	-	-	-	-	-	-	-	-	-	-	-	24	-		-	-	-	-	-	-	-	-
16	12.00-12.35	UD	100	100	100	33	Non-Plastic			0	67	33	0	-	SM		27.8	1.94	1.52	2.63	0.73	0	27	-
17	12.35-12.80	SPT	-	-	-	-	-	-	-	-	-	-	-	27	-		-	-	-	-	-	-	-	-
18	13.50-13.85	UD	100	100	100	41	Non-Plastic			0	59	41	0	-	SM		28.1	1.93	1.51	2.62	0.74	0	27	-
19	13.85-14.30	SPT	-	-	-	-	-	-	-	-	-	-	-	29	-		-	-	-	-	-	-	-	-
20	15.00-15.35	UD	100	100	100	38	Non-Plastic			0	62	38	0	-	SM		28.4	1.93	1.50	2.61	0.74	0	28	-
21	15.35-15.80	SPT	-	-	-	-	-	-	-	-	-	-	-	30	-		-	-	-	-	-	-	-	-
22	16.50-16.85	UD	100	100	100	35	Non-Plastic			0	65	35	0	-	SM		28.2	1.94	1.51	2.63	0.74	0	28	-
23	16.85-17.30	SPT	-	-	-	-	-	-	-	-	-	-	-	33	-		-	-	-	-	-	-	-	-
24	18.00-18.35	UD	100	100	100	29	Non-Plastic			0	71	29	0	-	SM		28.4	1.93	1.50	2.61	0.74	0	28	-
25	18.35-18.80	SPT	-	-	-	-	-	-	-	-	-	-	-	35	-		-	-	-	-	-	-	-	-

26	19.50-19.85	UD	100	100	100	32	Non-Plastic			0	68	32	0	-	SM		27.5	1.94	1.52	2.61	0.72	0	26	-
27	19.85-20.30	SPT	-	-	-	-	-	-	-	-	-	-	-	37	-		-	-	-	-	-	-	-	-
28	21.00-21.35	UD	100	100	100	28	Non-Plastic			0	72	28	0	-	SM		27.8	1.94	1.52	2.63	0.73	0	26	-
29	21.35-21.80	SPT	-	-	-	-	-	-	-	-	-	-	-	39	-		-	-	-	-	-	-	-	-
30	22.50-22.85	UD	100	100	100	31	Non-Plastic			0	69	31	0	-	SM		28.4	1.93	1.50	2.61	0.74	0	27	-
31	22.85-23.30	SPT	-	-	-	-	-	-	-	-	-	-	-	41	-		-	-	-	-	-	-	-	-
32	24.00-24.35	UD	100	100	100	37	Non-Plastic			0	63	37	0	-	SM		28.3	1.94	1.51	2.64	0.75	0	27	-
33	24.35-24.80	SPT	-	-	-	-	-	-	-	-	-	-	-	43	-		-	-	-	-	-	-	-	-
34	25.50-25.85	UD	100	100	100	39	Non-Plastic			0	61	39	0	-	SM		27.6	1.94	1.52	2.62	0.72	0	28	-
35	25.85-26.30	SPT	-	-	-	-	-	-	-	-	-	-	-	45	-		-	-	-	-	-	-	-	-
36	27.00-27.35	UD	100	100	100	43	Non-Plastic			0	57	43	0	-	SM		27.9	1.93	1.51	2.61	0.73	0	28	-
37	27.35-27.80	SPT	-	-	-	-	-	-	-	-	-	-	-	47	-		-	-	-	-	-	-	-	-
38	28.50-28.85	UD	100	100	100	45	Non-Plastic			0	55	45	0	-	SM		27.9	1.94	1.52	2.64	0.74	0	28	-
39	28.85-29.30	SPT	-	-	-	-	-	-	-	-	-	-	-	49	-		-	-	-	-	-	-	-	-
40	29.30-30.00	DS	-	-	-	-	-	-	-	-	-	-	-	-	SM		-	-	-	-	-	-	-	-



# ABC CONSULTANTS

OFFICE : C-1074/75, SECTOR – B. MAHANAGAR, LUCKNOW

Phone :- 09451371403, 07275268881, E-mail: abceconsultantlucknow@gmail.com

























**Project : Proposed Construction of Admin & Academic Block Building for The Proposed Medical Collage Campus in Ballia Old Jail Campus Building at District – Ballia(U.P.).**

**Bore Hole No. 02**

**Depth of Bore Hole : 30.0M.**

**Depth of Water table : 3.00 M.**

## LABORATORY TEST RESULTS

S. No.	Depth of Bore Hole	Nature of soil Sample	% Passing on IS Sieve				Atterberg's Limit			Particle Size Analysis				S.P.T. Value	IS Group		Natural Moisture Content %	Wet Density gm/cc	Dry Density gm/cc	Specific Gravity 'G'	Void ratio 'e'	Shear Parameter		Compression Index Cc
			4.75 mm	2.00 mm	0.425mm	0.075 mm	LL %	PL %	PI %	Gravel %	Sand %	Silt %	Clay %		Symbol	hatching						Cohesion 'C' in Kg/Sqcm.	Angle of Internal Friction ϕ	
1	0.0-0.50	DS	Filled	up	soil	met	up	to	-	0.50 m	depth	-	with	mix	F		bricks	bolder	pieces	below	-	existing	ground	level
2	1.50-1.85	UD	100	100	100	96	45	23	22	0	4	55	41	-	CI		16.4	1.86	1.60	2.70	0.69	0.39	5	0.154
3	1.85-2.30	SPT	-	-	-	-	-	-	-	-	-	-	-	8	-		-	-	-	-	-	-	-	-
4	3.00-3.35	UD	100	98	97	96	40	22	18	0	4	60	36	-	CI		24.4	2.03	1.63	2.71	0.66	0.35	7	0.147
5	3.35-3.80	SPT	-	-	-	-	-	-	-	-	-	-	-	7	-		-	-	-	-	-	-	-	-
6	4.50-4.85	UD	100	100	100	55	Non-Plastic			0	45	54	1	-	ML		27.0	1.94	1.53	2.61	0.71	0.05	21	0.085
7	4.85-5.30	SPT	-	-	-	-	-	-	-	-	-	-	-	10	-		-	-	-	-	-	-	-	-
8	6.00-6.35	UD	100	100	100	97	44	21	23	0	3	54	43	-	CI		23.9	2.03	1.64	2.70	0.65	0.46	4	0.167
9	6.35-6.80	SPT	-	-	-	-	-	-	-	-	-	-	-	14	-		-	-	-	-	-	-	-	-
10	7.50-7.85	U.D.	100	100	100	96	42	21	21	0	4	57	39	-	CI		23.8	2.03	1.64	2.69	0.64	0.41	5	0.155
11	7.85-8.30	S.P.T.	-	-	-	-	-	-	-	-	-	-	-	16	-		-	-	-	-	-	-	-	-
12	9.00-9.35	U.D.	100	100	100	95	46	22	24	0	5	51	44	-	CI		23.7	2.04	1.65	2.71	0.64	0.48	4	-
13	9.35-9.80	S.P.T.	-	-	-	-	-	-	-	-	-	-	-	18	-		-	-	-	-	-	-	-	-
14	10.50-10.85	UD	100	100	100	40	Non-Plastic			0	60	40	0	-	SM		28.2	1.92	1.50	2.60	0.73	0	27	-
15	10.85-11.30	SPT	-	-	-	-	-	-	-	-	-	-	-	19	-		-	-	-	-	-	-	-	-
16	12.00-12.35	UD	100	100	100	30	Non-Plastic			0	70	30	0	-	SM		28.2	1.94	1.51	2.63	0.74	0	27	-
17	12.35-12.80	SPT	-	-	-	-	-	-	-	-	-	-	-	22	-		-	-	-	-	-	-	-	-
18	13.50-13.85	UD	100	100	100	36	Non-Plastic			0	64	36	0	-	SM		28.3	1.94	1.51	2.64	0.75	0	27	-
19	13.85-14.30	SPT	-	-	-	-	-	-	-	-	-	-	-	25	-		-	-	-	-	-	-	-	-
20	15.00-15.35	UD	100	100	100	39	Non-Plastic			0	61	39	0	-	SM		28.8	1.92	1.49	2.61	0.75	0	27	-
21	15.35-15.80	SPT	-	-	-	-	-	-	-	-	-	-	-	27	-		-	-	-	-	-	-	-	-
22	16.50-16.85	UD	100	100	100	42	Non-Plastic			0	58	42	0	-	SM		28.5	1.93	1.50	2.62	0.75	0	28	-
23	16.85-17.30	SPT	-	-	-	-	-	-	-	-	-	-	-	30	-		-	-	-	-	-	-	-	-
24	18.00-18.35	UD	100	100	100	37	Non-Plastic			0	63	37	0	-	SM		28.3	1.94	1.51	2.64	0.75	0	28	-
25	18.35-18.80	SPT	-	-	-	-	-	-	-	-	-	-	-	33	-		-	-	-	-	-	-	-	-

26	19.50-19.85	UD	100	100	100	35	Non-Plastic			0	65	35	0	-	SM		28.8	1.92	1.49	2.61	0.75	0	28	-
27	19.85-20.30	SPT	-	-	-	-	-	-	-	-	-	-	-	34	-		-	-	-	-	-	-	-	-
28	21.00-21.35	UD	100	100	100	32	Non-Plastic			0	68	32	0	-	SM		28.6	1.93	1.50	2.63	0.75	0	29	-
29	21.35-21.80	SPT	-	-	-	-	-	-	-	-	-	-	-	37	-		-	-	-	-	-	-	-	-
30	22.50-22.85	UD	100	100	100	38	Non-Plastic			0	62	38	0	-	SM		28.3	1.94	1.51	2.64	0.75	0	29	-
31	22.85-23.30	SPT	-	-	-	-	-	-	-	-	-	-	-	39	-		-	-	-	-	-	-	-	-
32	24.00-24.35	UD	100	100	100	41	Non-Plastic			0	59	41	0	-	SM		28.8	1.92	1.49	2.61	0.75	0	29	-
33	24.35-24.80	SPT	-	-	-	-	-	-	-	-	-	-	-	41	-		-	-	-	-	-	-	-	-
34	25.50-25.85	UD	100	100	100	44	Non-Plastic			0	56	44	0	-	SM		28.5	1.93	1.50	2.62	0.75	0	30	-
35	25.85-26.30	SPT	-	-	-	-	-	-	-	-	-	-	-	43	-		-	-	-	-	-	-	-	-
36	27.00-27.35	UD	100	100	100	35	Non-Plastic			0	65	35	0	-	SM		28.3	1.94	1.51	2.64	0.75	0	30	-
37	27.35-27.80	SPT	-	-	-	-	-	-	-	-	-	-	-	45	-		-	-	-	-	-	-	-	-
38	28.50-28.85	UD	100	100	100	39	Non-Plastic			0	61	39	0	-	SM		28.8	1.92	1.49	2.61	0.75	0	31	-
39	28.85-29.30	SPT	-	-	-	-	-	-	-	-	-	-	-	49	-		-	-	-	-	-	-	-	-
40	29.30-30.00	DS	-	-	-	-	-	-	-	-	-	-	-	-	SM		-	-	-	-	-	-	-	-

# ABC CONSULTANTS

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**Project : Proposed Construction of Admin & Academic Block Building for The Proposed Medical Collage Campus in Ballia Old jail campus Building at District – Ballia(U.P.).**

**Bore Hole No. 03**

**Depth of Bore Hole : 30.0M.**

**Depth of Water table : 2.50 M.**

## LABORATORY TEST RESULTS

S. No.	Depth of Bore Hole	Nature of soil Sample	% Passing on IS Sieve				Atterberg's Limit			Particle Size Analysis				S.P.T. Value	IS Group		Natural Moisture Content %	Wet Density gm/cc	Dry Density gm/cc	Specific Gravity 'G'	Void ratio 'e'	Shear Parameter		Compression Index Cc
			4.75 mm	2.00 mm	0.425mm	0.075 mm	LL %	PL %	PI %	Gravel %	Sand %	Silt %	Clay %		Symbol	hatching						Cohesion 'C' in Kg/Sqcm.	Angle of Internal Friction Φ	
1	0.0-0.50	DS	100	100	100	97	43	23	20	0	3	57	40	-	CI		-	-	-	-	-	-	-	-
2	1.50-1.85	UD	100	100	100	96	43	22	21	0	4	57	39	-	CI		16.2	1.85	1.59	2.73	0.72	0.38	5	0.153
3	1.85-2.30	SPT	-	-	-	-	-	-	-	-	-	-	-	7	-		-	-	-	-	-	-	-	-
4	3.00-3.35	UD	100	97	96	95	40	23	17	0	5	62	33	-	CI		25.2	2.02	1.61	2.71	0.68	0.33	7	0.147
5	3.35-3.80	SPT	-	-	-	-	-	-	-	-	-	-	-	6	-		-	-	-	-	-	-	-	-
6	4.50-4.85	UD	100	99	98	97	44	22	22	0	3	56	41	-	CI		25.1	2.01	1.61	2.70	0.68	0.39	5	0.154
7	4.85-5.30	SPT	-	-	-	-	-	-	-	-	-	-	-	9	-		-	-	-	-	-	-	-	-
8	6.00-6.35	UD	100	100	100	95	39	23	16	0	5	64	31	-	CI		24.9	2.01	1.61	2.69	0.67	0.31	8	0.139
9	6.35-6.80	SPT	-	-	-	-	-	-	-	-	-	-	-	10	-		-	-	-	-	-	-	-	-
10	7.50-7.85	U.D.	100	100	100	96	43	22	21	0	4	57	39	-	CI		24.1	2.03	1.64	2.71	0.65	0.39	5	0.153
11	7.85-8.30	S.P.T.	-	-	-	-	-	-	-	-	-	-	-	12	-		-	-	-	-	-	-	-	-
12	9.00-9.35	U.D.	100	100	99	98	40	23	17	0	2	65	33	-	CI		24.3	2.03	1.63	2.70	0.66	0.34	7	-
13	9.35-9.80	S.P.T.	-	-	-	-	-	-	-	-	-	-	-	15	-		-	-	-	-	-	-	-	-
14	10.50-10.85	UD	100	100	100	31	Non-Plastic			0	69	31	0	-	SM		27.8	1.94	1.52	2.63	0.73	0	26	-
15	10.85-11.30	SPT	-	-	-	-	-	-	-	-	-	-	-	17	-		-	-	-	-	-	-	-	-
16	12.00-12.35	UD	100	100	100	35	Non-Plastic			0	65	35	0	-	SM		28.1	1.93	1.51	2.62	0.74	0	26	-
17	12.35-12.80	SPT	-	-	-	-	-	-	-	-	-	-	-	20	-		-	-	-	-	-	-	-	-
18	13.50-13.85	UD	100	100	100	39	Non-Plastic			0	61	39	0	-	SM		28.3	1.94	1.51	2.64	0.75	0	26	-
19	13.85-14.30	SPT	-	-	-	-	-	-	-	-	-	-	-	23	-		-	-	-	-	-	-	-	-
20	15.00-15.35	UD	100	100	100	34	Non-Plastic			0	66	34	0	-	SM		28.8	1.92	1.49	2.61	0.75	0	27	-
21	15.35-15.80	SPT	-	-	-	-	-	-	-	-	-	-	-	25	-		-	-	-	-	-	-	-	-
22	16.50-16.85	UD	100	100	100	30	Non-Plastic			0	70	30	0	-	SM		28.6	1.93	1.50	2.63	0.75	0	27	-
23	16.85-17.30	SPT	-	-	-	-	-	-	-	-	-	-	-	27	-		-	-	-	-	-	-	-	-
24	18.00-18.35	UD	100	100	100	25	Non-Plastic			0	75	25	0	-	SM		28.8	1.92	1.49	2.61	0.75	0	27	-
25	18.35-18.80	SPT	-	-	-	-	-	-	-	-	-	-	-	28	-		-	-	-	-	-	-	-	-

26	19.50-19.85	UD	100	100	100	28	Non-Plastic			0	72	28	0	-	SM																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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**Project : Proposed Construction of Admin & Academic Block Building for The Proposed Medical Collage Campus in Ballia Old jail campus Building at District – Ballia(U.P.).**

**Bore Hole No. 04**

**Depth of Bore Hole : 30.0M.**

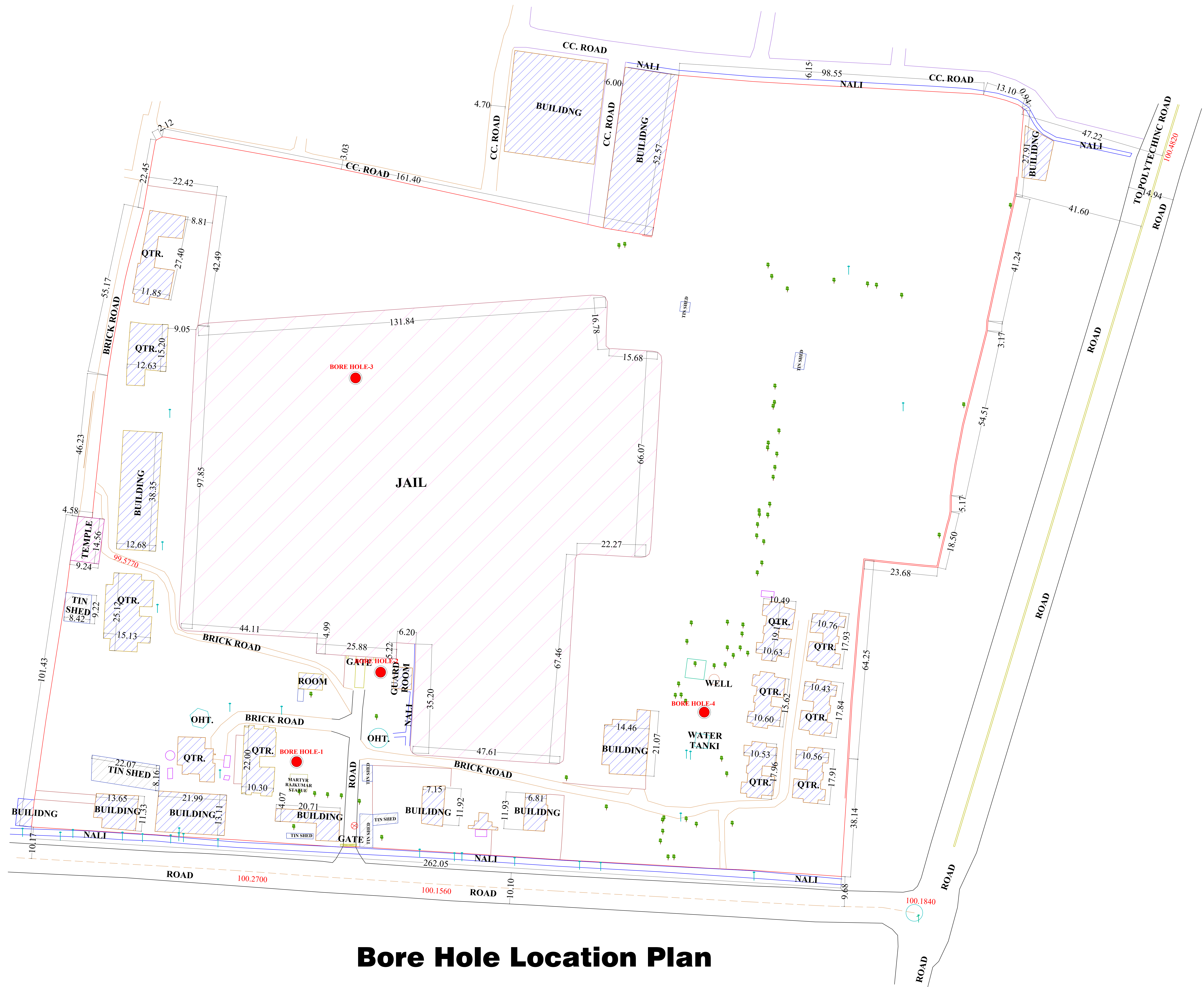
**Depth of Water table : 2.70 M.**

## LABORATORY TEST RESULTS

S. No.	Depth of Bore Hole	Nature of soil Sample	% Passing on IS Sieve				Atterberg's Limit			Particle Size Analysis				S.P.T. Value	IS Group		Natural Moisture Content %	Wet Density gm/cc	Dry Density gm/cc	Specific Gravity 'G'	Void ratio 'e'	Shear Parameter		Compression Index Cc
			4.75 mm	2.00 mm	0.425mm	0.075 mm	LL %	PL %	PI %	Gravel %	Sand %	Silt %	Clay %		Symbol	hatching						Cohesion 'C' in Kg/Sqcm.	Angle of Internal Friction $\phi$	
1	0.0-0.50	DS	Filled	up	soil	met	up	to	-	0.50 m	depth	-	with	mix	F		bricks	bolder	pieces	below	-	existing	ground	level
2	1.50-1.85	UD	100	100	100	96	45	23	22	0	4	55	41	-	CI		16.4	1.86	1.60	2.70	0.69	0.39	5	0.154
3	1.85-2.30	SPT	-	-	-	-	-	-	-	-	-	-	-	8	-		-	-	-	-	-	-	-	-
4	3.00-3.35	UD	100	98	97	96	40	22	18	0	4	60	36	-	CI		24.4	2.03	1.63	2.71	0.66	0.35	7	0.147
5	3.35-3.80	SPT	-	-	-	-	-	-	-	-	-	-	-	8	-		-	-	-	-	-	-	-	-
6	4.50-4.85	UD	100	100	100	55	Non-Plastic			0	45	54	1	-	ML		27.0	1.94	1.53	2.61	0.71	0.05	21	0.085
7	4.85-5.30	SPT	-	-	-	-	-	-	-	-	-	-	-	10	-		-	-	-	-	-	-	-	-
8	6.00-6.35	UD	100	100	100	97	44	21	23	0	3	54	43	-	CI		23.9	2.03	1.64	2.70	0.65	0.46	4	0.167
9	6.35-6.80	SPT	-	-	-	-	-	-	-	-	-	-	-	13	-		-	-	-	-	-	-	-	-
10	7.50-7.85	U.D.	100	100	100	96	42	21	21	0	4	57	39	-	CI		23.8	2.03	1.64	2.69	0.64	0.41	5	0.155
11	7.85-8.30	S.P.T.	-	-	-	-	-	-	-	-	-	-	-	17	-		-	-	-	-	-	-	-	-
12	9.00-9.35	U.D.	100	100	100	95	46	22	24	0	5	51	44	-	CI		23.7	2.04	1.65	2.71	0.64	0.48	4	-
13	9.35-9.80	S.P.T.	-	-	-	-	-	-	-	-	-	-	-	20	-		-	-	-	-	-	-	-	-
14	10.50-10.85	UD	100	100	100	40	Non-Plastic			0	60	40	0	-	SM		28.2	1.92	1.50	2.60	0.73	0	27	-
15	10.85-11.30	SPT	-	-	-	-	-	-	-	-	-	-	-	22	-		-	-	-	-	-	-	-	-
16	12.00-12.35	UD	100	100	100	30	Non-Plastic			0	70	30	0	-	SM		28.2	1.94	1.51	2.63	0.74	0	27	-
17	12.35-12.80	SPT	-	-	-	-	-	-	-	-	-	-	-	26	-		-	-	-	-	-	-	-	-
18	13.50-13.85	UD	100	100	100	36	Non-Plastic			0	64	36	0	-	SM		28.3	1.94	1.51	2.64	0.75	0	27	-
19	13.85-14.30	SPT	-	-	-	-	-	-	-	-	-	-	-	28	-		-	-	-	-	-	-	-	-
20	15.00-15.35	UD	100	100	100	39	Non-Plastic			0	61	39	0	-	SM		28.8	1.92	1.49	2.61	0.75	0	27	-
21	15.35-15.80	SPT	-	-	-	-	-	-	-	-	-	-	-	30	-		-	-	-	-	-	-	-	-
22	16.50-16.85	UD	100	100	100	42	Non-Plastic			0	58	42	0	-	SM		28.5	1.93	1.50	2.62	0.75	0	28	-
23	16.85-17.30	SPT	-	-	-	-	-	-	-	-	-	-	-	33	-		-	-	-	-	-	-	-	-
24	18.00-18.35	UD	100	100	100	37	Non-Plastic			0	63	37	0	-	SM		28.3	1.94	1.51	2.64	0.75	0	28	-
25	18.35-18.80	SPT	-	-	-	-	-	-	-	-	-	-	-	34	-		-	-	-	-	-	-	-	-

26	19.50-19.85	UD	100	100	100	35	Non-Plastic			0	65	35	0	-	SM		28.4	1.93	1.50	2.61	0.74	0	28	-
27	19.85-20.30	SPT	-	-	-	-	-	-	-	-	-	-	-	36	-		-	-	-	-	-	-	-	-
28	21.00-21.35	UD	100	100	100	32	Non-Plastic			0	68	32	0	-	SM		28.6	1.93	1.50	2.63	0.75	0	29	-
29	21.35-21.80	SPT	-	-	-	-	-	-	-	-	-	-	-	39	-		-	-	-	-	-	-	-	-
30	22.50-22.85	UD	100	100	100	38	Non-Plastic			0	62	38	0	-	SM		28.3	1.94	1.51	2.64	0.75	0	29	-
31	22.85-23.30	SPT	-	-	-	-	-	-	-	-	-	-	-	38	-		-	-	-	-	-	-	-	-
32	24.00-24.35	UD	100	100	100	41	Non-Plastic			0	59	41	0	-	SM		28.8	1.92	1.49	2.61	0.75	0	29	-
33	24.35-24.80	SPT	-	-	-	-	-	-	-	-	-	-	-	41	-		-	-	-	-	-	-	-	-
34	25.50-25.85	UD	100	100	100	44	Non-Plastic			0	56	44	0	-	SM		28.5	1.93	1.50	2.62	0.75	0	30	-
35	25.85-26.30	SPT	-	-	-	-	-	-	-	-	-	-	-	42	-		-	-	-	-	-	-	-	-
36	27.00-27.35	UD	100	100	100	35	Non-Plastic			0	65	35	0	-	SM		28.3	1.94	1.51	2.64	0.75	0	30	-
37	27.35-27.80	SPT	-	-	-	-	-	-	-	-	-	-	-	45	-		-	-	-	-	-	-	-	-
38	28.50-28.85	UD	100	100	100	39	Non-Plastic			0	61	39	0	-	SM		29.3	1.91	1.48	2.61	0.76	0	31	-
39	28.85-29.30	SPT	-	-	-	-	-	-	-	-	-	-	-	48	-		-	-	-	-	-	-	-	-
40	29.30-30.00	DS	-	-	-	-	-	-	-	-	-	-	-	-	SM		-	-	-	-	-	-	-	-





**Bore Hole Location Plan**