A

REPORT ON SUB SOIL INVESTIGATION

FOR RAILWAY-OVER-BRIDGE B/W NUNIHAI INDUSTRIAL AREA

&

PRAKASH NAGAR ON AGRA-TUNDLA RAIL SECTION KM. 1267/20-21

UPSBC-BCU, AGRA (U.P.)

Presented By

G. B. S. ENGINEER

NABL Accredited Lab in accordance with ISO/IEC 17025:2017 Certificate no. TC-11120

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ANNEXURES

1.00 INTRODUCTION :

For proposed construction of Railway-over-Bridge at Rail Section No. 1267/20-21 between Nunihai Industrial Area & Prakash Nagar, Agra Tundla Railway Section 1267/20-21 at Agra, the construction agency UPSBC Limited Lucknow, through its Bridge Construction Unit-I Agra, felt the necessity for Safe Bearing Capacity of Subsoil for design of foundation of bridge and accordingly soil investigation was resorted to. The soil investigation is awarded to our concern G.B.S. Engineer, 1 & 2, Bilal market, Near Old Forest Check Post, Khadri, Sitapur road, Lucknow. The results of investigation will be used for footing design for proposed structure. The field investigation was conducted in presence of representatives of the client. This report covers the soil investigation for suggesting Safe Bearing Capacity for Shallow foundations or Safe Load Capacity for Pile footings.

2.00 WORK SCOPE :

Five investigation points each 35.00M deep from RL of the respective Bore holes as per details on bore log chart are taken up for investigation. The field testing such as Standard Penetration Test and Recording of Water Table was carried out and soil samples were collected for determination of Index properties and based on these, to determine Safe Bearing Capacity of the foundation soil and the safety against liquefaction.

3.00 LOCATION AND PERIOD OF INVESTIGATION :

All the investigation points are duly marked on the attached layout plan with this report. The approach to easy and accessible. The investigations have been carried out during June' 2025. The weather was dry and moderate.

4.00 SITE INVESTIGATIONS & IN-SITU TESTS :

The investigation at site itself includes Standard Penetration Test (SPT) and observation of water table. As per procedure laid down in IS:2131-1985, starting from 1.05M depth, the SPT was conducted at a regular interval of 1.50M and also wherever strata changed. Starting from 1.50M depth, the UDS samples were taken up immediately after completion of SPT at the regular interval of 1.50M. All the recorded and corrected SPT values are plotted on the bore log chart Annexure-C in this report.

5.00 STANDARD PENETRATION TEST:

Out of a number of similar tests, this test is one of the most important tests conducted at the site. This test is specially suited for the Cohesionless soils which are difficult to be sampled and is extremely useful for reporting the relative density and angle of shearing resistance of Cohesionless soils. It can also be used for determining the unconfined compressive strength of cohesive soils. The standard penetration test (SPT) is conducted in a borehole using a standard split spoon sampler. The split spoon is consisting of a driving shoe about 75mm long, steel tube about 450mm long which could be split into two halves longitudinally and the coupling at the top of the tube about 150mm long. The inside and outside diameters of

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the split tube are 35mm and 50.8mm respectively. The test is carried out by deriving the split-spoon sampler into the soil by a hammer weighing 63.50 kg and falling freely from a height of 750mm, through the guide rod. Each hammer blow derives the sampler into the soil. The number of blows for each penetration of 150mm of the sampler is recorded in succession till the total penetration becomes 450mm. The number of hammer blows for the first 150mm penetrations are discarded considering them as seating derives. The total number of blows recorded for the last two 150mm penetrations are added to report the Standard Penetration Number (N). The recorded value of standard penetration number is corrected for Dilatency Correction as well as Overburden Correction. The Standard Penetration Tests were conducted as per IS:2131-1963 in each bore hole at a regular interval as specified by IS code upto end of investigation or refusal, whichever occurs earlier and the values are indicated in the Bore log chart attached with this report.

6.00 SAMPLING

The disturbed and undisturbed samples were taken with utmost care and brought to laboratory for testing. Proper attention was paid during extraction of samples for laboratory testing to arrive at rational results. The Thin walled Sampler as per IS:2132-1986 and IS:11594-1985 (Reaffirmed 2006) was used for extracting undisturbed soil samples. The UDS samples were extracted immediately after termination of SPT, if UDS samples could not be extracted then Disturbed Samples (DS) were collected at a regular interval of 1.50M in each bore holes or wherever strata changed.

7.00 POSITION OF WATER TABLE :

The details of the water table encountered in each of the points of investigation during exploration has been duly mentioned in the respective bore holes and also on the lab test results sheet.

8.00 LABORATORY INVESTIGATIONS :

The selected the Disturbed and the Un-disturbed samples collected from the site were tested for the following Index properties in the laboratory:

8.1 Grain Size Distribution/Sieve Analysis as per IS : 2720 (Part4)-1985, (Reaff. 1995)

8.2 Atterberg's limits as per IS:2720 (Part 5) - 1985, (Reaffirmed 1995)

8.3 Natural moisture content as per IS : 2720 (Part II) - 1973, (Reaffirmed 2002)

8.4 Bulk density as per IS : 2720 (Part 28) - 1974, (Reaffirmed 1995)

8.5 Specific Gravity as per IS : 2720 (Part 3/Sec 1 &2) - 1980, (Reaffirmed 1997)

8.6 c & ϕ Test/Tri-axial compression Test as per IS : 2720 (Part 12)-1981, (Reaff. 1997)

8.7 Compression Index/Consolidation - IS : 2720 (Part 15)-1986, (Reaff. 1997)

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9.00 METHODOLOGY AND APPROACH :

The bearing capacity of shallow foundations is worked out on two considerations, firstly, foundations should be safe against shear failure as per IS: 6403-1981 and, secondly, it should be safe against excessive settlement as per IS: 1904-1978. The depth of foundation is governed by para 4.2, sub-para 4.2.1(d) of IS: 1080-1980 or based on desired bearing capacity. Investigations have been carried out in reference to Indian Standard Specifications. In case, sufficient SBC is not available in subsoil stratum for shallow footing, deep footing viz. Pile footing may also be adopted as an alternate.

10.0 BEARING CAPACITY CALCULATIONS :

The due regard have been paid to recorded values of Standard Penetration Test (N-values) as also to economic considerations for type of footing. The client has desired to evaluate Load Capacity of Friction-cum-Bearing Piles of dia. 1200mm with effective length of 25.00M excluding cut-off level of 2.00M. As per IS code, factor of safety on ultimate bearing capacity is to be taken from 2.5 to 3.0 for Deep footing. In the present case 2.50 FOS has been considered as 2.50.

11.0 GENERAL NATURE OF UNDERNEATH SOIL :

Based on investigation conducted at five points each being 35.00M deep for construction of ROB and results obtained from samples collected from therein, an opinion may be framed regarding general nature of sub soil. The location and scope of investigation i.e. number of investigation pois and their respective depth is decided by client. The layout of points are duly marked on the layout plan attached with this report. The results of soil stratum in the bore holes are slighly variable in terms of vertical as well as lateral directions, however, these are comparable, without inviting significant error. The surface soil is cohesive from top to nearly upto 2.00M with Liquid Limit within 35% conforming to Silty Clay of Low Plasticity of CL group as per IS classification of Soils. Thereafter, non cohesive soil starts and continues till around 7.00M depth. This non cohesive soil is containing inorganic fines greater than 12% but remaining limited to within 50% conforming to Silty Sand of SM group. From 7.00M depth onwards, the cohesive soil stratum reappears and continues till the 14.00M depth conforming to Silty Clay of Low Plasticity. Finally the non cohesive soil stratum starts and continues till the end of investigation i.e. 35.00M . This non cohesive soil stratum is containing fines greater than 50% in its upper thickness of 12.00M i.e. from 14.00M to 26.00M conforming to Inorganic Sandy Silt of ML group. From 26.00M depth downwards, the fine contents falls to less than equal to 5% vonforming to Fine Sand of SP group. The Water Table is encountered in each of the investigation point during exploration and is varying from 7.55M to 7.00M, this difference may be attributed to the fluctuation in water table or may be due to variation among NGL of different investigation point. The seasonal variations are expected in present level of water table and during monsoon season 1.00M rise in Water Table with respect to its recorded value has been assumed as per the advise of client and accordingly calculations for Safe Bearing Capacity are carried out. The penetration resistance of the soil is satisfactory.

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13.0 SUGGESTIONS & RECOMMENDATIONS :

For the proposed construction of Rail-over-Bridge B/w Nunihai Industrial Area & Prakash Nagar on Agra-Tundla Rail Section Km 1267/20-21 at Agra, the geotechnical investigation is conducted at Five points each 35.00M from respective RL of bore holes for determination of Safe Bearing Capacity of Isolated Square footing. The depth and numbers of investigation points are decided by the client.

Friction-cum-Bearing Circular Pile Foundation								F.O.S	2.50	
SNo.	Bore Hole	Pile Dia. (mm)	Overall Pile Length (M)	Cut-off (M)	Effective Pile Length (M)	Ultimate Load Capacity (Ton)	Safe Load Capacity (Ton)	Safe Lateral Load Capacity	Average Safe Load Capacity (Ton)	Lateral Thrust (Ton)
1	BH-01	1200	27.000	2.000	25.00	724.96	289.98	29.00	293.44	29.34
2	BH-02					708.54	283.42	28.34		
3	BH-03					719.65	287.86	28.79		
4	BH-04					762.34	304.94	30.49		
5	BH-05					752.56	301.02	30.10		

The safe load capacity of Piles as calculated above may be adopted. It is strongly recommended that Initial & Routine Pile Load test under vertical compression and Lateral Load test must be conducted as per provision of IS: 2911 (Part-IV)-2013 to get actual pile capacity.

CPM (Agra)

Recommended and forwarded for approval of Safe Load Capacity of 1200 mm dia pile at 25.00 m depth from cut off level is 280.00 T.

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Approved as recommended Safe load capacity of 1200 mm dia pile at 25.00 m depth from cut off level is 280.00 T.

(Shashi Bhushan)
Chief Project Manager
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1.0 LIMITATIONS :

Every investigation for any technological work always has its own boundaries within which it is applicable. Therefore a number of assumptions are made for arriving at practicable inference. Some of these may or may not be within the control of investigator, however all possible attention have been paid thereupon. The present report has been prepared with utmost care with respect to investigational results and consequent recommendations within the framework of IS specifications are made. But still it has got the following limitations, which are beyond the control of any engineer, and depends only on given conditions.

a The present report is based on investigation results of carried out by manual auguring and Wash boring/Pressure boring and report, and corresponding recommendations, are based on these values.

b The natural moisture content of soil is an important property and an instant characteristic that changes from time to time depending upon surface drainage conditions as well as surface and ground water recharge conditions. As such value of natural water content represents natural water content at given level refers to that at time of investigations.

c The most important field test, namely Standard Penetration Test has been carried out to assess in-situ penetration resistance of soil at present conditions which may vary under different moisture contents.

d Only those values have been used which are reliable and those giving absurd results are neglected and slipped samples are considered for c & ϕ values, but remoulded.

e The selection of foundation has been adopted as per the desire of client for Friction-cum-Bearing Pile and liquefaction analysis is carried out at and below pile Tip.

f For reasonable and better estimation, normally minimum of three investigation points are adopted. However, in present case only two points have been taken up, as such, results of subsoil investigation would accordingly be affected. It would have been better, had investigation been conducted at three points instead of two.

g As per IS codal provisions, minimum depth of exploration should be 1.5 to 2.0 times the footing dia. In the present case, exploration is conducted upto 35.00M depth, for over all length of 21.50M and the Liquefaction analysis if carried out below pile tip for 13.50M i.e. upto 35.00M

h Grain Size Distribution curves are attached for only one bore hole since these being the graphic presentation and their data is already given in the Results data sheet.

i For estimation of immediate settlement the value of Poisson's ratio has been considered as provided in the IS code i.e. 0.50

j Safe Bearing Capacities for open/deep foundation corresponds to desired size. If safe bearing capacity at any other depth or for any other size is desired, the same could be determined with the procedure given the sample calculations.

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ANNEXURE - A

BEARING CAPACITY ON SHEAR CONSIDERATIONS:

In case of local shear failures, following formula is recommended, as per IS:6403-1981, para 5.1.2

$$q_d' = c_m . N_c' . s_c . d_c . i_c + q (N_q' - 1). s_q . d_q . i_q + 0.5 B . \gamma . N_\gamma' . s_\gamma . d_\gamma . i_\gamma . W'$$

where,

q_d' Ultimate Bearing Capacity based on Mobilised cohesion & friction angle values

q Over burden pressure

N_c' N_q' & N_γ' Bearing Capacity factors corresponding to mobilised friction Angle

S_c, S_q, & S_γ Shape factors

d_c, d_q & d_γ Depth factors

i_c, i_q & i_γ Inclination factors

c_m Mobilised value of cohesion (0.667 c)

W' Water Table Correction factor

γ Unit weight of Soil or Soil density

B Width of foundation

where c is the cohesion

In case of General shear failures, following formula is recommended, as per IS:6403-1981, para

$$q_d = c . N_c . s_c . d_c . i_c + q (N_q - 1). s_q . d_q . i_q + 0.5 B . \gamma . N_\gamma . s_\gamma . d_\gamma . i_\gamma . W'$$

where,

q_d Ultimate Bearing Capacity

q Over burden

N_c N_q & N_γ Bearing Capacity factors corresponding to mobilised friction Angle

S_c, S_q, & S_γ Shape factors

d_c, d_q & d_γ Depth factors

i_c, i_q & i_γ Inclination factors

c Cohesion

W' Water Table Correction factor

γ Unit weight of Soil or Soil density

B Width of foundation

Shape Factors: The shape factors for various shapes of footing as per IS:6403-1981 is as follows:

Shape of footing	S_c	S_q	S_γ
Continuous or Strip footing	1.00	1.00	1.00
Rectangular Footing	1.00 + 0.2 (B/L)	1.00 + 0.2 (B/L)	1.00 - 0.4 (B/L)
Square Footing	1.30	1.20	0.80
Circular Footing	1.30	1.20	0.60

Depth Factors : $d_c = 1.0 + 0.2\ D_f/B . \sqrt{N_\phi}$

$d_q = d_\gamma = 1.0 + 0.1\ D_f/B . \sqrt{N_\phi}$ for $\phi < 10°$

$= 1.0$ for $\phi > 10°$

where, $N_\phi = \tan^2 (45 + \phi/2)$

D_f = Depth of footing

B = Width or Diameter of the footing

Inclination Factors : The inclination factors for the footing are given as follows:

$$I_c = i_q = (1 - \alpha°/90°)^2 \qquad I_\gamma = (1 - \alpha°/\phi°)^2$$

where $\alpha°$ is the inclination of the load with vertical.

For the horizontal ground surface, the Inclination factors as $I_c = i_q = I_\gamma = 1.0$

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Bearing Capacity Factors: Values of Bearing Capacity Factors for General shear failure are given in Table (1) under para 5.1.1. of IS:6403-1981 which are as follows:

ϕ^0	0^0	5^0	10^0	15^0	20^0	25^0	30^0	35^0	40^0	45^0	50^0
N_c	5.14	6.49	8.35	10.98	14.83	20.72	30.14	46.12	75.31	138.88	266.89
N_q	1.00	1.57	2.47	3.94	6.40	10.66	18.40	33.30	64.20	134.88	319.07
N_r	0.00	0.45	1.22	2.65	5.39	10.88	22.40	48.03	109.41	271.76	762.89

The values of mobilised Bearing capacity factors N_c', N_q' and N_γ' may be obtained from the above table corresponding to mobilised angle of internal friction $\phi' = \tan^{-1}(0.667 \tan \phi)$.

Water Table Correction Factor W' :

(a) If Water table is likely permanently to remain at or below the depth of $(D_f + B)$ beneath the ground level surrounding the footing than W' = 1.0

(b) If Water table is located at the depth D_f or likely to rise to the base of the footing or above then the values of W' shall be taken as 0.50

(c) If Water table is likely permanently got located at a depth $D_f < D_w <$ of $(D_f + B)$, then the value of W' be obtained by linear interpolation.

SETTLEMENT CONSIDERATIONS:

The safe bearing capacity pressure is to be so restricted that it neither exceeds the net bearing capacity on shear consideration, nor does it results in settlement exceeding the permissible values as per Indian Standard Code of Practice.

For non-cohesive strata, settlement is worked out on the basis of Standard Penetration Test values in accordance with IS: 8009 (Part I)-1976 (Reaffirmed 1998). The settlement of non cohesive soils takes place rather quickly immediately after application of load. In most of the cases the immediate settlement is the final settlement. In such cases it is not possible to obtain the stress-strain characteristics of in-situ soil and hence semi-empirical methods are used. The SPT could be used for determination of settlement on such soils. IS:8009 (Part I) gives a chart for calculation of settlement per unit pressure as a function of width of footing and standard penetration number.

In case of cohesive strata, the total settlement is the sum of the immediate settlement S_i and the consolidation settlement S_c. The consolidation settlement and immediate settlement are worked out as per IS:8009 (Part-1)-1976 (Reaffirmed 1998) and are given as follows:

For non-precompressed clay soil layer, the Consolidation Settlement S_c, is given as follows

$$S = C_c . H \{\log_{10} (p_o + p)/p_o\}/(1+e_o)$$

where, s = Settlement. p = Original pressure at mid point of clay layer

C_c = Compression Index P_o = Change in pressure at middepth of clay layer

e_o = Void ratio for pressure p_o. H = Thickness of clay layer under consideration

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The immediate settlement beneath the center or corner of a flexible loaded area is given as

$$S_i = q \cdot B \{ - \mu^2 E \} \cdot I$$

where, S_i = Immediate settlement of the footing

μ = Poisson's ratio 0.5 for clays

I = Influence Factor (depends on the Length (L) and Breadth (B) ratio of footing

E = Modulus of Elasticity of the soil.

The total settlement is the sum of immediate and consolidation settlement.

Values of E shall be determined from stress strain curve obtained from Triaxial consolidated undrained test. The consolidation pressure adopted in Triaxial consolidation test should be equal to effective pressure at the depth from which sample has been taken. The values of I may be determined from Fig. 11 for clay layers with various H_f/B ratio and from Table 2 for clay layers of semi-infinite extent as per IS:8009 (Part-I)-1976 (Reaffirmed 1998).

The Values of I for clay layers of Semi-infinite extent

Shape		Influence Factor I		
		Center	Corner	Average
Circle		1.00	0.64	0.85
Square		1.12	0.56	0.95
Rectangle				
L/B =	1.5	1.36	0.68	1.20
=	2.0	1.53	0.77	1.31
=	5.0	2.10	1.05	1.83
=	10.0	2.52	1.26	2.25
=	100.0	3.38	1.69	2.96

Correction for Depth and Rigidity of Foundation on total settlement:

Total computed settlement is subjected to Depth correction & Rigidity correction as under:

Depth correction = Total settlement, S_f . Depth factor

where, Depth factor is read from Fox's correction curves as per Fig. 12 of IS:8009 (Part-I)-1976

Rigidity factor = 0.8

Total corrected settlement = Total settlement, S_f x Depth factor x Rigidity factor

Correction in the SPT / N -values

Overburden Correction $N_C = N_R \times C_l$

The (N_C / N_R) should lie between 0.45 to 2.0 and is to be read from Fig. 1 of IS:2131-1981 (Reaffirmed 1997)

Dilatency correction is applicable only in case of Silty sand and Fine sand

Dilatency correction is applicable only when N > 15

Corrected Values of $N_C = 15 + 0.5 (N_R - 15)$

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B-1 Load Capacity of Piles in Granular Soils: **(Friction- cum-End Bearing Pile)**

The ultimate bearing capacity (Q_u) of piles in granular soils is given by following formula:

$$Q_u = A_p (0.5 \,.\, D \,.\, \gamma \,.\, N_\gamma + P_D \,.\, N_q) + \sum K \, P_{Di} \,.\, \text{Tan}\, \delta \,.\, A_{si}$$

A_p = Cross sectional area of pile toe in cm^2 D = Stem diameter in cm

γ = effective unit weight of soil at pile toe in kgf/cm^3

P_D = effective overburden pressure at pile toe in kgf/cm^2

N_γ and N_q = bearing capacity factors depending upon the angle of internal friction ϕ at toe.

$\sum$ = summation for n layers in which pile is installed.

K = Coefficient of earth pressure

P_{Di} = effective overburden pressure in kgf/cm^2, for the i^{th} layer where i varies from 1 to n.

δ = angle of wall friction between pile and soil, in degrees (may be taken equal to ϕ) and

A_{si} = surface area of pile stem in cm^2 in the i^{th} layer where i varies from 1 to n.

Load Capacity of Piles in Cohesive Soil: **(Friction-cum-End Bearing Pile)**

As per para B-2.1 of Appendix-A of IS:2911(Part I/Sec-I)-1979 the load carrying capacity of piles constructed in cohesive soil, the following formula is used,

$$Q_u = A_p \,.\, N_c \,.\, C_p + \alpha \,.\, C_{av} \,.\, A_s$$

where, Q_u = Ultimate bearing capacity of piles.

A_p = Cross sectional area of pile toe in cm^2.

N_c = Bearing capacity factor usually taken as 9.

C_p = Average cohesion at the pile tip in kg/cm^2.

α = Reduction factor

C_{av} = Average cohesion throughout length of pile in kg/cm^2

A_s = Surface area of pile shaft in cm^2.

Note-1: The following values of α may be taken depending upon the consistency of soil:

Consistency	N-values	Values of α	
		Bored Piles	Driven pile
Soft to very soft	< 4	0.7	1.0
Medium	4 – 8	0.5	0.7
Stiff	8 – 15	0.4	0.4
Stiff to hard	> 15	0.3	0.3

Note-2 (a): Static formula may be used as a guide only for bearing capacity estimates. Better reliance may be made on load test on piles.

Note-2 (b): For working out safe load a minimum factor of safety 2.5 should be used on the ultimate bearing capacity estimated by static formulae.

Note-3 : α may be taken from 0.5 to 0.3 depending upon consistency of soils. Higher values upto 1.0 may be used for softer soils, provided soil is not sensitive.

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ANNEXURE - B

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RECORDED & CORRECTED VALUES OF STANDARD PENETRATION TEST

Name of Site	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section
Client/Agency	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).
Bore Hole 1	G.B.S. Engineer, Sitapur Road, Lucknow

September'2024	NGL	100.000	BH LvL	100.000	Filled Up	0.000	W.T.	11.300

SN	Depth	Recorded SPT/N-Values N_1	N_2	N_3	N'	Soil Type / Fill	Due to Overburden Correction	Due to Overburden $N_{corrected}$	Due to Dilatency Correction	Due to Dilatency $N'_{corrected}$
1	0.55 - 1.00	3	4	4	8	Non Cohesive	2.00	16.00	0.50	15.50
2	2.05 - 2.50	4	5	6	11	Non Cohesive	1.40	15.40	0.20	15.20
3	3.55 - 4.00	5	5	7	12	Non Cohesive	1.20	14.40	0.00	14.40
4	5.05 - 5.50	4	5	6	11	Non Cohesive	1.20	13.20	0.00	13.20
5	6.55 - 7.00	6	8	9	17	Non Cohesive	1.00	17.00	1.00	16.00
6	8.05 - 8.50	7	11	10	21	Non Cohesive	1.00	21.00	3.00	18.00
7	9.55 - 10.00	8	10	12	22	Non Cohesive	0.84	18.48	1.74	16.74
8	11.05 - 11.50	10	11	13	24	Non Cohesive	0.84	20.16	2.58	17.58
9	12.55 - 13.00	12	13	15	28	Non Cohesive	0.78	21.70	3.35	18.35
10	14.05 - 14.50	13	16	15	31	Non Cohesive	0.78	24.03	4.51	19.51
11	15.55 - 16.00	15	14	17	31	Cohesive	0.00	31.00	0.00	31.00
12	17.05 - 17.50	16	19	20	39	Cohesive	0.00	39.00	0.00	39.00
13	18.55 - 19.00	18	21	23	44	Cohesive	0.00	44.00	0.00	44.00
14	20.05 - 20.50	20	22	24	46	Cohesive	0.00	46.00	0.00	46.00
15	21.55 - 22.00	19	22	26	48	Cohesive	0.00	48.00	0.00	48.00
16	23.05 - 23.50	24	26	24	50	Cohesive	0.00	50.00	0.00	50.00
17	24.55 - 25.00	27	31	29	31	Cohesive	0.00	31.00	0.00	31.00
18	26.05 - 26.50	26	32	34	50	Cohesive	0.00	50.00	0.00	50.00
19	27.55 - 28.00	31	34	38	50	Cohesive	0.00	50.00	0.00	50.00
20	29.05 - 29.50	35	39	42	50	Cohesive	0.00	50.00	0.00	50.00
21	30.55 - 31.00	37	38	41	50	Cohesive	0.00	50.00	0.00	50.00
22	32.05 - 32.50	39	43	44	50	Cohesive	0.00	50.00	0.00	50.00
23	33.55 - 34.00	40	42	45	50	Cohesive	0.00	50.00	0.00	50.00
24	35.05 - 35.50	46	45	49	50	Cohesive	0.00	50.00	0.00	50.00

Bore Hole 2	September'2024	NGL	100.000	BH LVL	100.000	Filled Up	0.000	W.T.	11.100

SN	Depth	Field SPT/N-Values N_1	N_2	N_3	N'	Soil Type / Fill	Due to Overburden Correction	Due to Overburden $N_{corrected}$	Due to Dilatency Correction	Due to Dilatency $N'_{corrected}$
1	0.55 - 1.00	2	3	4	7	Non Cohesive	2.00	14.00	0.00	14.00
2	2.05 - 2.50	5	8	8	16	Non Cohesive	1.40	22.40	3.70	18.70
3	3.55 - 4.00	4	4	5	9	Non Cohesive	1.20	10.80	0.00	10.80
4	5.05 - 5.50	5	7	9	16	Non Cohesive	1.20	19.20	2.10	17.10
5	6.55 - 7.00	8	10	9	19	Non Cohesive	1.00	19.00	2.00	17.00
6	8.05 - 8.50	10	12	13	25	Non Cohesive	1.00	25.00	5.00	20.00
7	9.55 - 10.00	9	11	11	22	Non Cohesive	0.84	18.48	1.74	16.74
8	11.05 - 11.50	9	10	12	22	Non Cohesive	0.84	18.48	1.74	16.74
9	12.55 - 13.00	12	13	15	28	Non Cohesive	0.78	21.70	3.35	18.35
10	14.05 - 14.50	14	16	16	32	Non Cohesive	0.78	24.80	4.90	19.90
11	15.55 - 16.00	15	17	20	37	Cohesive	0.00	37.00	0.00	37.00
12	17.05 - 17.50	16	19	21	40	Cohesive	0.00	40.00	0.00	40.00
13	18.55 - 19.00	19	22	24	46	Cohesive	0.00	46.00	0.00	46.00
14	20.05 - 20.50	23	26	29	50	Cohesive	0.00	50.00	0.00	50.00
15	21.55 - 22.00	27	26	30	50	Cohesive	0.00	50.00	0.00	50.00
16	23.05 - 23.50	31	34	32	50	Cohesive	0.00	50.00	0.00	50.00
17	24.55 - 25.00	35	35	38	50	Cohesive	0.00	50.00	0.00	50.00
18	26.05 - 26.50	37	39	42	50	Cohesive	0.00	50.00	0.00	50.00
19	27.55 - 28.00	40	40	43	50	Cohesive	0.00	50.00	0.00	50.00
20	29.05 - 29.50	42	44	46	50	Cohesive	0.00	50.00	0.00	50.00
21	30.55 - 31.00	41	46	47	50	Cohesive	0.00	50.00	0.00	50.00
22	32.05 - 32.50	45	46	48	50	Cohesive	0.00	50.00	0.00	50.00
23	33.55 - 34.00	46	46	49	50	Cohesive	0.00	50.00	0.00	50.00
24	35.05 - 35.50	47	48	49	50	Cohesive	0.00	50.00	0.00	50.00

R. B. DIWAKAR
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Bridge Construction Unit-Agra

Bore Hole 3		September'2024		NGL	100.000	BH LVL 100.000	Filled Up	0.000	W.T.	12.100
		Recorded SPT/N-Values					Due to Overburden		Due to Dilatancy	
SN	Depth	N_1	N_2	N_3	N'	Soil Type / Fill	Correction	$N_{corrected}$	Correction	$N'_{corrected}$
1	0.55 - 1.00	2	2	3	5	Non Cohesive	2.00	10.00	0.00	10.00
2	2.05 - 2.50	3	5	6	11	Non Cohesive	1.40	15.40	0.20	15.20
3	3.55 - 4.00	5	6	8	14	Non Cohesive	1.20	16.80	0.90	15.90
4	5.05 - 5.50	9	8	10	18	Non Cohesive	1.20	21.60	3.30	18.30
5	6.55 - 7.00	10	11	9	20	Non Cohesive	1.00	20.00	2.50	17.50
6	8.05 - 8.50	10	12	12	24	Non Cohesive	1.00	24.00	4.50	19.50
7	9.55 - 10.00	10	9	11	20	Non Cohesive	0.84	16.80	0.90	15.90
8	11.05 - 11.50	13	14	15	29	Non Cohesive	0.78	22.48	3.74	18.74
9	12.55 - 13.00	14	16	16	32	Non Cohesive	0.78	24.80	4.90	19.90
10	14.05 - 14.50	13	15	18	33	Non Cohesive	0.70	23.10	4.05	19.05
11	15.55 - 16.00	17	19	20	39	Cohesive	0.00	39.00	0.00	39.00
12	17.05 - 17.50	18	21	23	44	Cohesive	0.00	44.00	0.00	44.00
13	18.55 - 19.00	18	20	24	44	Cohesive	0.00	44.00	0.00	44.00
14	20.05 - 20.50	22	23	26	49	Cohesive	0.00	49.00	0.00	49.00
15	21.55 - 22.00	24	26	30	50	Cohesive	0.00	50.00	0.00	50.00
16	23.05 - 23.50	26	28	31	50	Cohesive	0.00	50.00	0.00	50.00
17	24.55 - 25.00	22	32	32	50	Cohesive	0.00	50.00	0.00	50.00
18	26.05 - 26.50	31	33	36	50	Cohesive	0.00	50.00	0.00	50.00
19	27.55 - 28.00	34	38	40	50	Cohesive	0.00	50.00	0.00	50.00
20	29.05 - 29.50	36	39	41	50	Cohesive	0.00	50.00	0.00	50.00
21	30.55 - 31.00	39	43	45	50	Cohesive	0.00	50.00	0.00	50.00
22	32.05 - 32.50	40	42	44	50	Cohesive	0.00	50.00	0.00	50.00
23	33.55 - 34.00	43	44	48	50	Cohesive	0.00	50.00	0.00	50.00
24	35.05 - 35.50	44	46	49	50	Cohesive	0.00	50.00	0.00	50.00

R. B. DIWAKAR
Dy. Project Manager
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Bridge Construction Unit-Agra

ANNEXURE - B

NABL Accredited Lab in accordance with ISO/IEC 17025:2017 Certificate no. TC-11120

RECORDED & CORRECTED VALUES OF STANDARD PENETRATION TEST

Name of Site		Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section									
Client/Agency		Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).						G.B.S. Engineer, Sitapur Road, Lucknow			
Bore Hole 1		June'2025	NGL	100.000	BH LvL	100.000		Filled Up	0.000	W.T.	11.500
SN	Depth	Recorded SPT/N-Values				Soil Type / Fill		Due to Overburden		Due to Dilatency	
		N_1	N_2	N_3	N'			Correction	$N'_{corrected}$	Correction	$N'_{corrected}$
1	0.55 - 1.00	3	4	3	7	Non Cohesive		2.00	14.00	0.00	14.00
2	2.05 - 2.50	4	3	5	8	Non Cohesive		1.40	11.20	0.00	11.20
3	3.55 - 4.00	7	8	8	16	Non Cohesive		1.20	19.20	2.10	17.10
4	5.05 - 5.50	6	7	8	15	Non Cohesive		1.20	18.00	1.50	16.50
5	6.55 - 7.00	8	10	11	21	Cohesive		0.00	21.00	0.00	21.00
6	8.05 - 8.50	9	10	12	22	Cohesive		0.00	22.00	0.00	22.00
7	9.55 - 10.00	10	11	12	23	Cohesive		0.00	23.00	0.00	23.00
8	11.05 - 11.50	12	14	15	29	Cohesive		0.00	29.00	0.00	29.00
9	12.55 - 13.00	13	16	17	33	Cohesive		0.00	33.00	0.00	33.00
10	14.05 - 14.50	16	15	18	33	Cohesive		0.00	33.00	0.00	33.00
11	15.55 - 16.00	18	20	19	39	Cohesive		0.00	39.00	0.00	39.00
12	17.05 - 17.50	20	21	23	44	Cohesive		0.00	44.00	0.00	44.00
13	18.55 - 19.00	22	23	25	48	Cohesive		0.00	48.00	0.00	48.00
14	20.05 - 20.50	20	22	25	47	Cohesive		0.00	47.00	0.00	47.00
15	21.55 - 22.00	24	26	26	50	Cohesive		0.00	50.00	0.00	50.00
16	23.05 - 23.50	25	27	28	50	Cohesive		0.00	50.00	0.00	50.00
17	24.55 - 25.00	26	27	30	31	Cohesive		0.00	31.00	0.00	31.00
18	26.05 - 26.50	28	30	31	50	Cohesive		0.00	50.00	0.00	50.00
19	27.55 - 28.00	30	32	33	50	Cohesive		0.00	50.00	0.00	50.00
20	29.05 - 29.50	32	34	36	50	Cohesive		0.00	50.00	0.00	50.00
21	30.55 - 31.00	34	35	35	50	Cohesive		0.00	50.00	0.00	50.00
22	32.05 - 32.50	36	38	39	50	Cohesive		0.00	50.00	0.00	50.00
23	33.55 - 34.00	34	41	40	50	Cohesive		0.00	50.00	0.00	50.00
24	35.05 - 35.50	40	42	43	50	Cohesive		0.00	50.00	0.00	50.00

Bore Hole 2		June'2025	NGL	100.000	BH LVL	100.000		Filled Up	0.000	W.T.	11.500
SN	Depth	Field SPT/N-Values				Soil Type / Fill		Due to Overburden		Due to Dilatency	
		N_1	N_2	N_3	N'			Correction	$N'_{corrected}$	Correction	$N'_{corrected}$
1	0.55 - 1.00	2	3	3	6	Non Cohesive		2.00	12.00	0.00	12.00
2	2.05 - 2.50	3	4	4	8	Non Cohesive		1.40	11.20	0.00	11.20
3	3.55 - 4.00	4	5	7	12	Non Cohesive		1.20	14.40	0.00	14.40
4	5.05 - 5.50	6	5	8	13	Non Cohesive		1.20	15.60	0.30	15.30
5	6.55 - 7.00	7	8	10	18	Cohesive		0.00	18.00	0.00	18.00
6	8.05 - 8.50	8	9	10	19	Cohesive		0.00	19.00	0.00	19.00
7	9.55 - 10.00	10	11	10	21	Cohesive		0.00	21.00	0.00	21.00
8	11.05 - 11.50	12	13	14	27	Cohesive		0.00	27.00	0.00	27.00
9	12.55 - 13.00	14	16	15	31	Cohesive		0.00	31.00	0.00	31.00
10	14.05 - 14.50	16	18	20	38	Cohesive		0.00	38.00	0.00	38.00
11	15.55 - 16.00	18	20	21	41	Cohesive		0.00	41.00	0.00	41.00
12	17.05 - 17.50	20	22	23	45	Cohesive		0.00	45.00	0.00	45.00
13	18.55 - 19.00	21	22	25	47	Cohesive		0.00	47.00	0.00	47.00
14	20.05 - 20.50	23	24	26	50	Cohesive		0.00	50.00	0.00	50.00
15	21.55 - 22.00	24	25	28	50	Cohesive		0.00	50.00	0.00	50.00
16	23.05 - 23.50	26	27	30	50	Cohesive		0.00	50.00	0.00	50.00
17	24.55 - 25.00	30	29	31	50	Cohesive		0.00	50.00	0.00	50.00
18	26.05 - 26.50	32	33	35	50	Cohesive		0.00	50.00	0.00	50.00
19	27.55 - 28.00	34	36	34	50	Cohesive		0.00	50.00	0.00	50.00
20	29.05 - 29.50	35	37	38	50	Cohesive		0.00	50.00	0.00	50.00
21	30.55 - 31.00	40	39	41	50	Cohesive		0.00	50.00	0.00	50.00
22	32.05 - 32.50	42	38	40	50	Cohesive		0.00	50.00	0.00	50.00
23	33.55 - 34.00	44	42	46	50	Cohesive		0.00	50.00	0.00	50.00
24	35.05 - 35.50	44	44	48	50	Cohesive		0.00	50.00	0.00	50.00

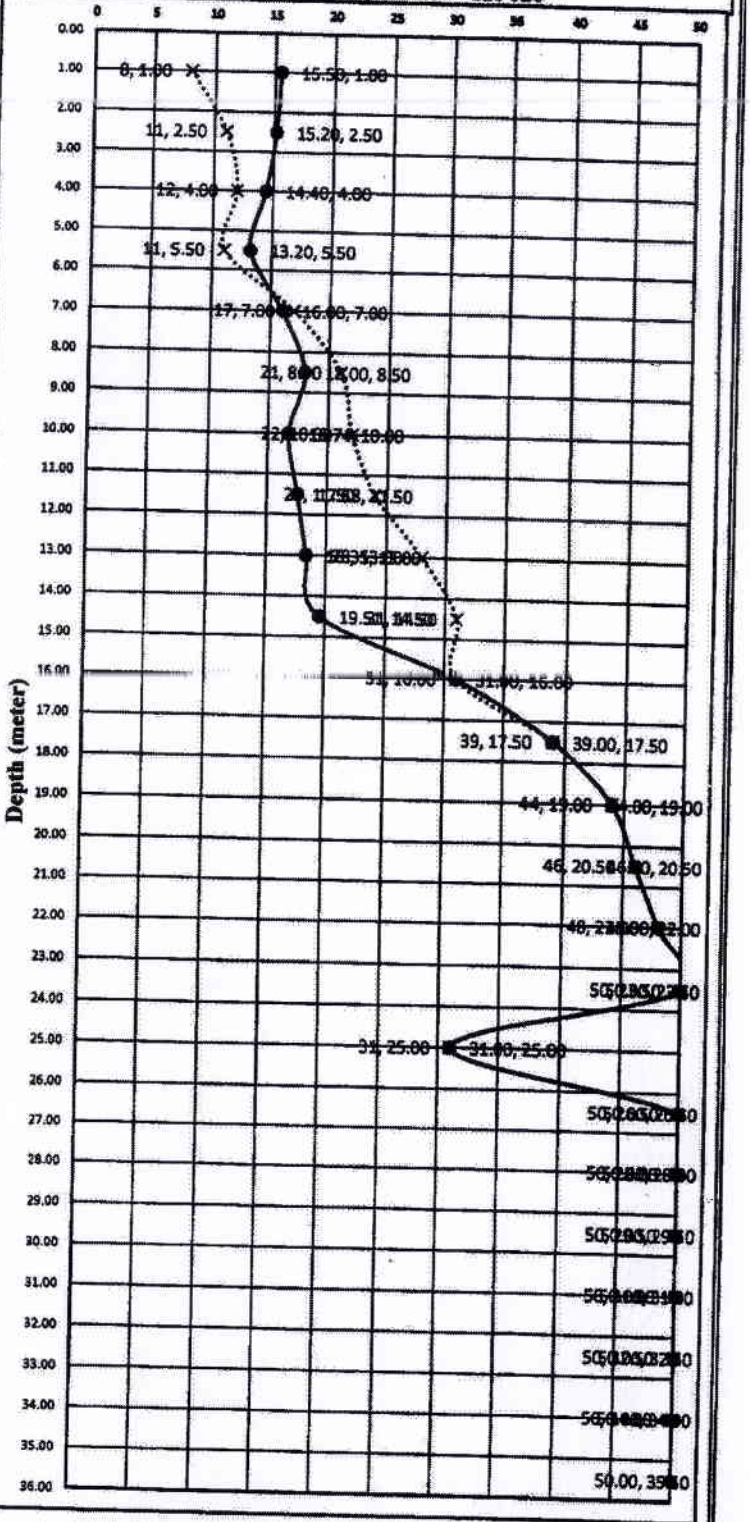
R. B. DIWAKAR
Dy. Project Manager
State Bridge Corporation Ltd
Unit-Agra

ANNEXURE - C

BORE LOG CHART

Site/Location	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section		
Client/ Agency	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).	Longitude 78.051735	Latitude 27.1976
Bore Hole No. 1	Water Table : 11.300	RL of Bore Hole 100.000	NGL 100.000	Filled up : 0.000
September'2024	ROB	Investigator : GBS Engineer, Sitapur Road, Lucknow - 226 020	

Depth	LvL	Soil Type	IS Gr.	Hatching	LvL
0.50	99.500	Silty Sand with Gravels	SM		
1.00	99.000				
1.50	98.500				
2.00	98.000				
3.00	97.000				
3.50	96.500				
4.00	96.000				
4.50	95.500				
5.00	95.000				
5.50	94.500				
6.00	94.000				
6.50	93.500				
7.00	93.000				
7.50	92.500				
8.00	92.000				
8.50	91.500				
9.00	91.000				
9.50	90.500				
10.00	90.000				
10.50	89.500				
11.00	89.000				
11.50	88.500				
12.00	88.000				
12.50	87.500				
13.00	87.000				
13.50	86.500				
14.00	86.000				
14.50	85.500				14.50
15.00	85.000	Sandy Clay of Low Plasticity	CL		
15.50	84.500				
16.00	84.000				
16.50	83.500				
17.00	83.000				
17.50	82.500				
18.00	82.000				
18.50	81.500				
19.00	81.000				
19.50	80.500				
20.00	80.000				
20.50	79.500				
21.00	79.000				
21.50	78.500				
22.00	78.000				
22.50	77.500				
23.00	77.000				
13.50	86.500				
24.00	76.000				
24.50	75.500				
25.00	75.000				
25.50	74.500				
26.00	74.000				
26.50	73.500				
27.00	73.000				
27.50	72.500				
28.00	72.000				
28.50	71.500				
29.00	71.000				
29.50	70.500				
30.00	70.000				
30.50	69.500				
31.00	69.000				
31.50	68.500				
32.00	68.000				
32.50	67.500				
33.00	67.000				
33.50	66.500				
34.00	66.000				
34.50	65.500				
35.00	65.000				
36.00	64.000				35.40



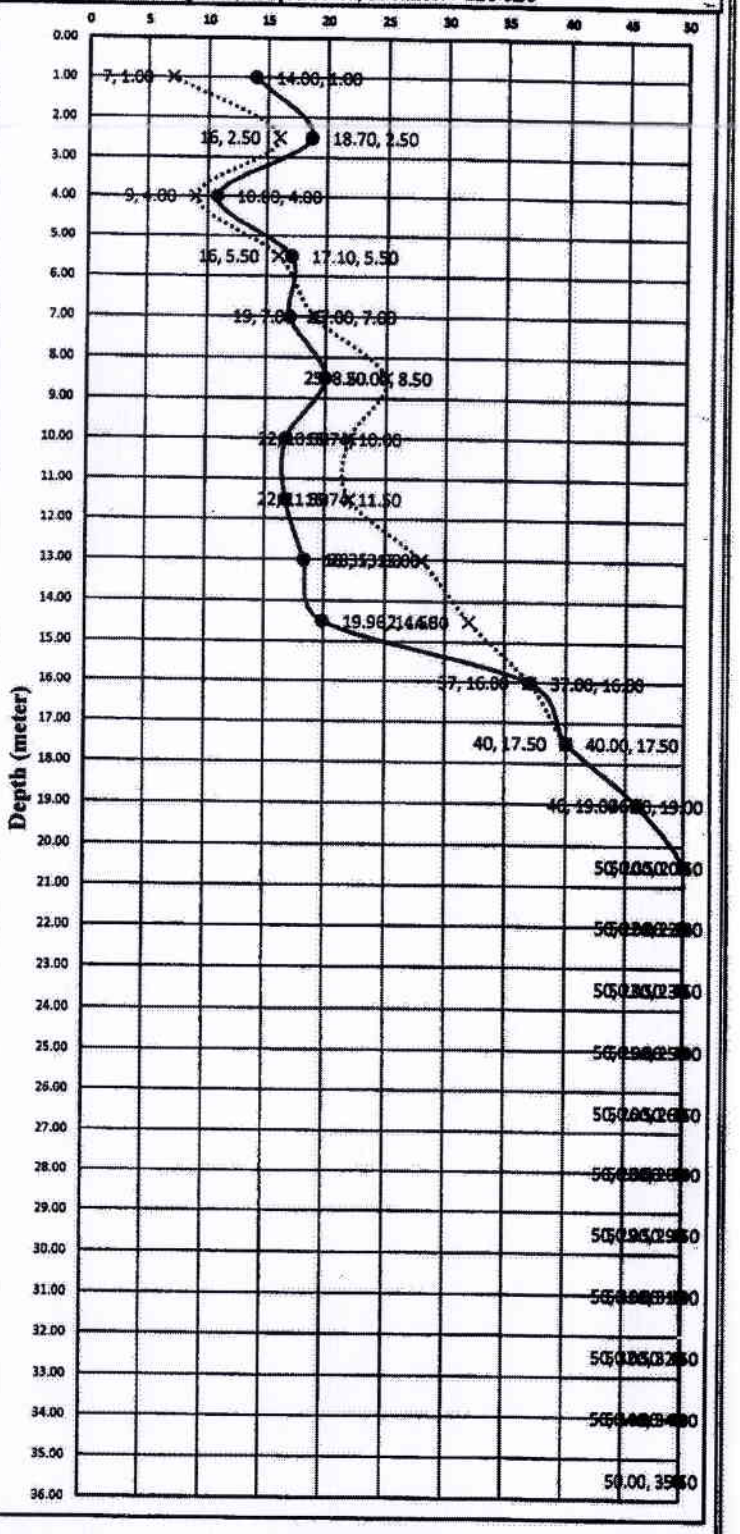
R. B. DIWAKAR
Dy. Project Manager
U. P. State Bridge Corporation Ltd
Construction Unit-Agra

ANNEXURE - C

BORE LOG CHART

Site/Location	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section				
Client/ Agency	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).			Longitude 78.052210	Latitude 27.196585
Bore Hole No. 2	Water Table : 11.100	RL of Bore Hole 100.000		NGL 100.000	Filled up : 0.000
September'2024	ROB	Investigator : GBS Engineer, Sitapur Road, Lucknow - 226 020			

Depth	LvL	Soil Type	IS Gr.	Hatching	LvL
0.50	99.500	Silty Sand with Gravels	SM		
1.00	99.000				
1.50	98.500				
2.00	98.000				
3.00	97.000				
3.50	96.500				
4.00	96.000				
4.50	95.500				
5.00	95.000				
5.50	94.500				
6.00	94.000				
6.50	93.500				
7.00	93.000				
7.50	92.500				
8.00	92.000				
8.50	91.500				
9.00	91.000				
9.50	90.500				
10.00	90.000				
10.50	89.500				
11.00	89.000				
11.50	88.500				
12.00	88.000				
12.50	87.500				
13.00	87.000				
13.50	86.500				
14.00	86.000				
14.50	85.500				14.50
15.00	85.000	Sandy Clay of Low Plasticity	CL		
15.50	84.500				
16.00	84.000				
16.50	83.500				
17.00	83.000				
17.50	82.500				
18.00	82.000				
18.50	81.500				
19.00	81.000				
19.50	80.500				
20.00	80.000				
20.50	79.500				
21.00	79.000				
21.50	78.500				
22.00	78.000				
22.50	77.500				
23.00	77.000				
13.50	86.500				
24.00	76.000				
24.50	75.500				
25.00	75.000				
25.50	74.500				
26.00	74.000				
26.50	73.500				
27.00	73.000				
27.50	72.500				
28.00	72.000				
28.50	71.500				
29.00	71.000				
29.50	70.500				
30.00	70.000				
30.50	69.500				
31.00	69.000				
31.50	68.500				
32.00	68.000				
32.50	67.500				
33.00	67.000				
33.50	66.500				
34.00	66.000				
34.50	65.500				
35.00	65.000				
36.00	64.000				35.40



R. B. DIWAKAR
Dy. Project Manager
U. P. State Bridge Corporation Ltd
Bridge Construction Unit-Agra

ANNEXURE - C

BORE LOG CHART

Site/Location	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section				
Client/ Agency	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).			Longitude 78.051063	Latitude 27.198540
Bore Hole No. 3	Water Table : 12.100	RL of Bore Hole 100.000		NGL 100.000	Filled up : 0.000
September'2024	ROB	Investigator : GBS Engineer, Sitapur Road, Lucknow - 226 020			

Depth	LvL	Soil Type	IS Gr.	Hatching	LvL
0.50	99.500	Silty Sand with Gravels	SM		
1.00	99.000				
1.50	98.500				
2.00	98.000				
3.00	97.000				
3.50	96.500				
4.00	96.000				
4.50	95.500				
5.00	95.000				
5.50	94.500				
6.00	94.000				
6.50	93.500				
7.00	93.000				
7.50	92.500				
8.00	92.000				
8.50	91.500				
9.00	91.000				
9.50	90.500				
10.00	90.000				
10.50	89.500				
11.00	89.000				
11.50	88.500				
12.00	88.000				
12.50	87.500				
13.00	87.000				
13.50	86.500				
14.00	86.000				
14.50	85.500				14.50
15.00	85.000	Sandy Clay of Low Plasticity	CL		
15.50	84.500				
16.00	84.000				
16.50	83.500				
17.00	83.000				
17.50	82.500				
18.00	82.000				
18.50	81.500				
19.00	81.000				
19.50	80.500				
20.00	80.000				
20.50	79.500				
21.00	79.000				
21.50	78.500				
22.00	78.000				
22.50	77.500				
23.00	77.000				
23.50	76.500				
24.00	76.000				
24.50	75.500				
25.00	75.000				
25.50	74.500				
26.00	74.000				
26.50	73.500				
27.00	73.000				
27.50	72.500				
28.00	72.000				
28.50	71.500				
29.00	71.000				
29.50	70.500				
30.00	70.000				
30.50	69.500				
31.00	69.000				
31.50	68.500				
32.00	68.000				
32.50	67.500				
33.00	67.000				
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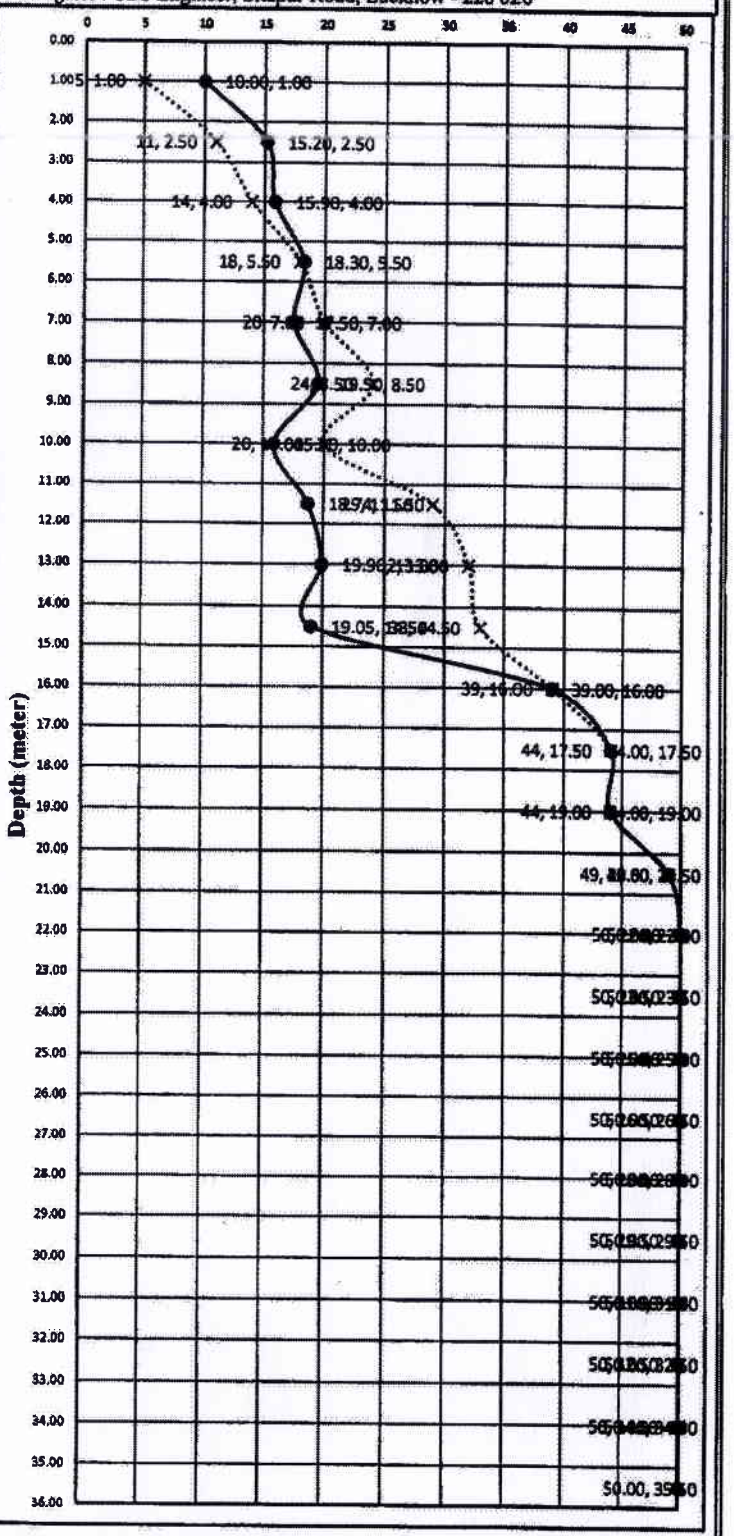
34.00	66.000				
34.50	65.500				
35.00	65.000				
36.00	64.000				35.40



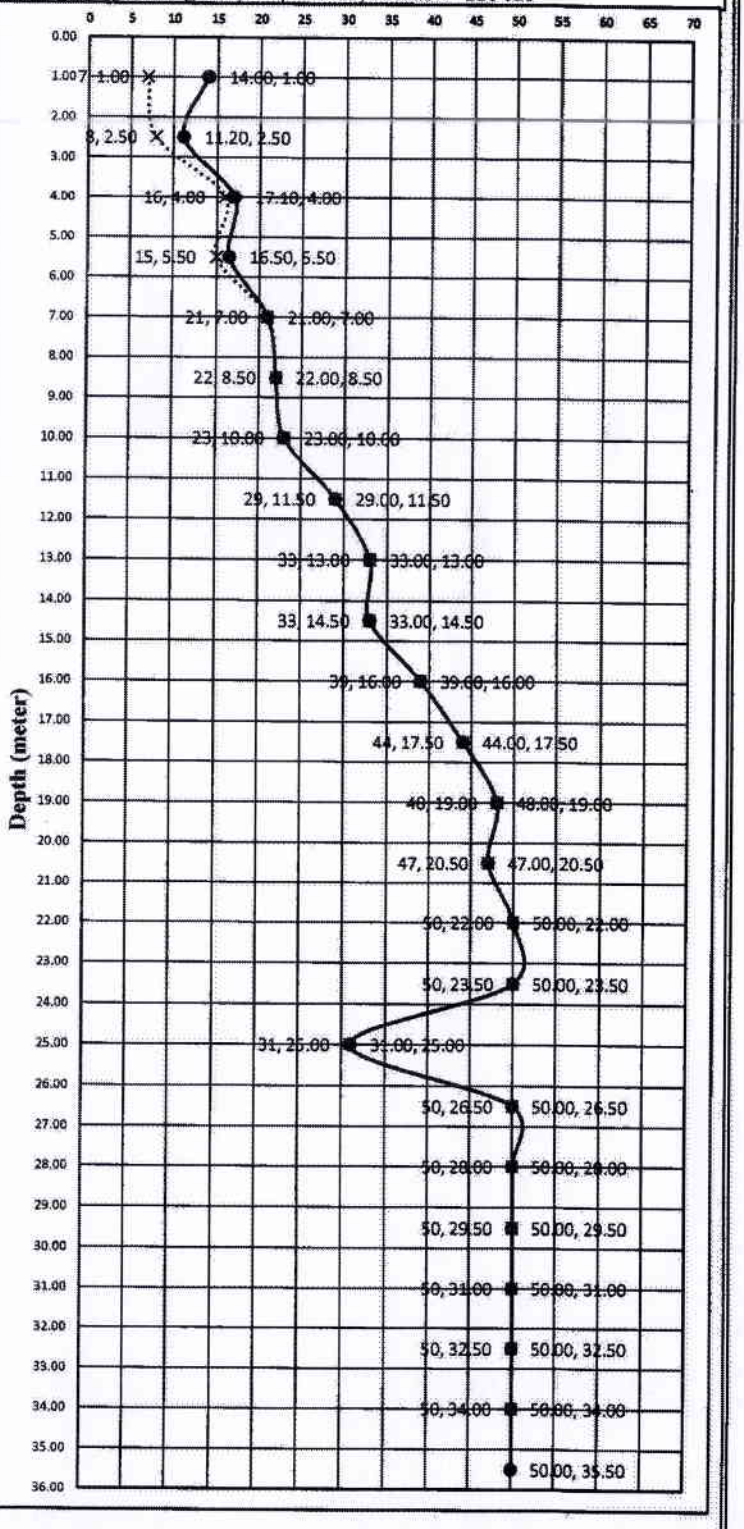
R. B. DIWAKAR
Dy. Project Manager
U. P. State Bridge Corporation Ltd
Construction Unit-Agra

ANNEXURE - C

BORE LOG CHART

Site/Location	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section				
Client/ Agency	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).		Longitude 78.047548	Latitude	27.2006
Bore Hole No. 1	Water Table : 11.500	RL of Bore Hole 100.000	NGL 100.000	Filled up :	0.000
June'2025	ROB	Investigator : GBS Engineer, Sitapur Road, Lucknow - 226 020			

Depth	LvL	Soil Type	IS Gr.	Hatching	LvL
0.50	99.500	Silty Sand	SM		
1.00	99.000				
1.50	98.500				
2.00	98.000				
3.00	97.000				
3.50	96.500				
4.00	96.000				
4.50	95.500				
5.00	95.000				
5.50	94.500				5.50
6.00	94.000	Sandy Clay of Low Plasticity	CL		
6.50	93.500				
7.00	93.000				
7.50	92.500				
8.00	92.000				
8.50	91.500				
9.00	91.000				
9.50	90.500				
10.00	90.000				
10.50	89.500				
11.00	89.000				
11.50	88.500				
12.00	88.000				
12.50	87.500				
13.00	87.000				
13.50	86.500				
14.00	86.000				
14.50	85.500				
15.00	85.000				
15.50	84.500				
16.00	84.000				
16.50	83.500				
17.00	83.000				
17.50	82.500				
18.00	82.000				
18.50	81.500				
19.00	81.000				
19.50	80.500				
20.00	80.000				
20.50	79.500				
21.00	79.000				
21.50	78.500				
22.00	78.000				
22.50	77.500				
23.00	77.000				
13.50	86.500				
24.00	76.000				
24.50	75.500				
25.00	75.000				
25.50	74.500				
26.00	74.000				
26.50	73.500				
27.00	73.000				
27.50	72.500				
28.00	72.000				
28.50	71.500				
29.00	71.000				
29.50	70.500				
30.00	70.000				
30.50	69.500				
31.00	69.000				
31.50	68.500				
32.00	68.000				
32.50	67.500				
33.00	67.000				
33.50	66.500				
34.00	66.000				
34.50	65.500				
35.00	65.000				
36.00	64.000				35.40



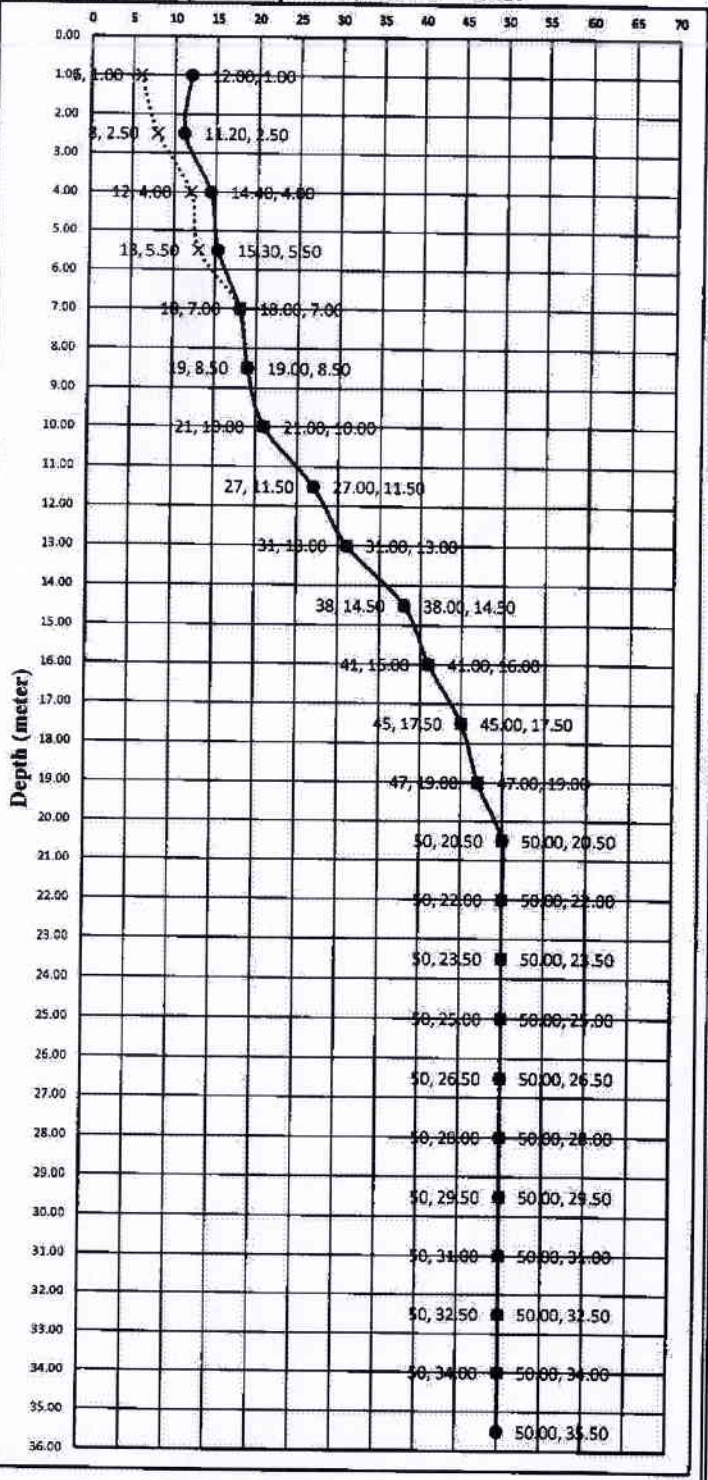
R. B. DIWAKAR
Dy. Project Manager
U. P. State Bridge Corporation Ltd
Bridge Construction Unit-Agra

ANNEXURE - C

BORE LOG CHART

Site/Location	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section				
Client/ Agency	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP)		Longitude 78.050347	Latitude	27.202080
Bore Hole No. 2	Water Table : 11.500	RL of Bore Hole 100.000	NGL 100.000	Filled up :	0.000
June'2025	ROB	Investigator : GBS Engineer, Sitapur Road, Lucknow - 226 020			

Depth	LvL	Soil Type	IS Gr.	Hatching	LvL
0.50	99.500	Silty Sand	SM		
1.00	99.000				
1.50	98.500				
2.00	98.000				
2.50	97.500				
3.00	97.000				
3.50	96.500				
4.00	96.000				
4.50	95.500				
5.00	95.000				
5.50	94.500				5.50
6.00	94.000	Sandy Clay of Low Plasticity	CL		
6.50	93.500				
7.00	93.000				
7.50	92.500				
8.00	92.000				
8.50	91.500				
9.00	91.000				
9.50	90.500				
10.00	90.000				
10.50	89.500				
11.00	89.000				
11.50	88.500				
12.00	88.000				
12.50	87.500				
13.00	87.000				
13.50	86.500				
14.00	86.000				
14.50	85.500				
15.00	85.000				
15.50	84.500				
16.00	84.000				
16.50	83.500				
17.00	83.000				
17.50	82.500				
18.00	82.000				
18.50	81.500				
19.00	81.000				
19.50	80.500				
20.00	80.000				
20.50	79.500				
21.00	79.000				
21.50	78.500				
22.00	78.000				
22.50	77.500				
23.00	77.000				
13.50	86.500				
24.00	76.000				
24.50	75.500				
25.00	75.000				
25.50	74.500				
26.00	74.000				
26.50	73.500				
27.00	73.000				
27.50	72.500				
28.00	72.000				
28.50	71.500				
29.00	71.000				
29.50	70.500				
30.00	70.000				
30.50	69.500				
31.00	69.000				
31.50	68.500				
32.00	68.000				
32.50	67.500				
33.00	67.000				
33.50	66.500				
34.00	66.000				
34.50	65.500				
35.00	65.000				
36.00	64.000				35.40



R. B. DIWAKAR
Dy. Project Manager
U. P. State Bridge Corporation Ltd
Bridge Construction Unit-Agra

ANNEXURE – D

CALCULATION OF PILE LOAD CAPACITY FOR SINGLE PILE

Name of Site	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section						
Client Name	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).						
Bore Hole No. 1	Pile Depth : 23.500		Pile Dia 1.20		Actual Water Table :	11.50 (Beyond))	
Filled up soil :	0.000	K = 1.50	Pile, L_{eff} 21.500		Assumed Water Table :	10.50 (Due to seasonal variations)	
P_{Di} : 18 x pile dia.	Cut-off LvL: 2.000		**Pile : Friction + Bearing**		Reduction Factor, α =	0.50	**GBS ENGINEER**

Depth	Soil Layers		Properties of Soil layers			Length	Resistance		Bearing Capacity Factors			Static & Point Load Capacity			
	from	to	c	$\phi_m = \delta$	γ_{eff}	ΔL	P_{Di}	P_D	N_c	N_q	N_γ	A_s	A_p	Q_s	Q_p
	(m)	(m)	kg/cm²		g/cc	cm	kg/cm²	kg/cm²				cm²	cm²	T	T
1.00	0.00	1.00	0.00	15.81	1.7100	0.0	0.171	0.000	9.00	0.00	0.00	0	0.00	0.00	0.00
2.50	1.00	2.50	0.00	16.54	1.7241	50.0	0.429	0.000	9.00	0.00	0.00	18840	0.00	3.60	0.00
4.00	2.50	4.00	0.00	18.02	1.7780	150.0	0.695	0.000	9.00	0.00	0.00	56520	0.00	19.17	0.00
5.50	4.00	5.50	0.00	18.77	1.7266	150.0	0.954	0.000	9.00	0.00	0.00	56520	0.00	27.49	0.00
7.00	5.50	7.00	0.18	7.39	1.7417	150.0	1.215	0.000	9.00	0.00	0.00	56520	0.00	18.56	0.00
8.50	7.00	8.50	0.21	7.39	1.7721	150.0	1.481	0.000	9.00	0.00	0.00	56520	0.00	22.27	0.00
10.00	8.50	10.00	0.23	7.39	1.8082	150.0	1.752	0.000	9.00	0.00	0.00	56520	0.00	25.61	0.00
11.50	10.00	11.50	0.23	7.39	0.8203	150.0	1.880	0.000	9.00	0.00	0.00	56520	0.00	27.08	0.00
13.00	11.50	13.00	0.23	7.39	0.7378	150.0	1.996	0.000	9.00	0.00	0.00	56520	0.00	28.47	0.00
14.50	13.00	14.50	0.23	7.39	0.8180	150.0	2.122	0.000	9.00	0.00	0.00	56520	0.00	29.83	0.00
16.00	14.50	16.00	0.23	7.39	0.8535	150.0	2.253	0.000	9.00	0.00	0.00	56520	0.00	31.38	0.00
17.50	16.00	17.50	0.24	7.39	0.8590	150.0	2.384	0.000	9.00	0.00	0.00	56520	0.00	32.88	0.00
19.00	17.50	19.00	0.24	7.39	0.8767	150.0	2.518	0.000	9.00	0.00	0.00	56520	0.00	34.40	0.00
20.50	19.00	20.50	0.24	7.39	0.8831	150.0	2.652	0.000	9.00	0.00	0.00	56520	0.00	35.99	0.00
22.00	20.50	22.00	0.25	6.71	0.9066	150.0	2.738	0.000	9.00	0.00	0.00	56520	0.00	34.26	0.00
23.50	22.00	23.50	0.25	6.71	0.9244	150.0	2.692	2.929	9.00	10.00	0.71	56520	11304	34.02	357.35
25.00	23.50	25.00	0.26	6.71	0.9421	150.0	2.653	0.000	9.00	0.00	0.00	56520	0.00	0.00	0.00
26.50	25.00	26.50	0.27	6.03	0.9539	150.0	2.620	0.000	9.00	0.00	0.00	56520	0.00	0.00	0.00
28.00	26.50	28.00	0.27	6.03	0.9675	150.0	2.592	0.000	9.00	0.00	0.00	56520	0.00	0.00	0.00
29.50	28.00	29.50	0.28	6.03	0.9953	150.0	2.570	0.000	9.00	0.00	0.00	56520	0.00	0.00	0.00
31.00	29.50	31.00	0.28	6.03	1.0030	150.0	2.551	0.000	9.00	0.00	0.00	56520	0.00	0.00	0.00
32.50	31.00	32.50	0.29	6.03	0.9894	150.0	2.532	0.000	9.00	0.00	0.00	56520	0.00	0.00	0.00
34.00	32.50	34.00	0.30	6.03	0.9717	150.0	2.513	0.000	9.00	0.00	0.00	56520	0.00	0.00	0.00
														404.99	357.35

Ultimate Load Capacity = 762.34 T
Factor of Safety = 2.50
Safe Load Capacity = 304.94 T

R. B. DIWAKAR
Dy. Project Manager
U P State Bridge Corporation Ltd
Bridge Construction Unit Agra

CALCULATION OF PILE LOAD CAPACITY FOR SINGLE PILE

Name of Site		Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section													
Client Name		Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).													
Bore Hole No. 2		Pile Depth :	23.500	Pile Dia	1.20	Actual Water Table :	11.50 (Beyond))								
Filled up soil :		0.000	K =	1.500	Pile, L_{eff}	21.500	Assumed Water Table :	10.50 (Due to seasonal variations)							
P_{DS} :	18 x pile dia.	Cut-off LvL:	2.000	**Pile : Friction + Bearing**			Reduction Factor, α =	0.50						**GBS ENGINEER**	
Depth	Soil Layers		Properties of Soil layers			Length	Resistance		Bearing Capacity Factors			Static & Point Load Capacity			
	from	to	c	$\phi_m = \delta$	γ_{eff}	ΔL	P_{Ds}	P_D	N_c	N_q	N_γ	A_s	A_p	Q_s	Q_p
	(m)	(m)	kg/cm²		g/cc	cm	kg/cm²	kg/cm²				cm²	cm²	T	T
1.00	0.00	1.00	0.00	16.54	1.7000	0.0	0.170	0.000	9.00	0.00	0.00	0	0.00	0.00	0.00
2.50	1.00	2.50	0.00	17.28	1.7041	50.0	0.426	0.000	9.00	0.00	0.00	18840	0.00	3.74	0.00
4.00	2.50	4.00	0.00	18.02	1.7585	150.0	0.688	0.000	9.00	0.00	0.00	56520	0.00	18.98	0.00
5.50	4.00	5.50	0.00	19.53	1.7837	150.0	0.955	0.000	9.00	0.00	0.00	56520	0.00	28.72	0.00
7.00	5.50	7.00	0.18	7.39	1.8092	150.0	1.226	0.000	9.00	0.00	0.00	56520	0.00	18.67	0.00
8.50	7.00	8.50	0.21	7.39	1.8118	150.0	1.497	0.000	9.00	0.00	0.00	56520	0.00	22.45	0.00
10.00	8.50	10.00	0.23	7.39	1.8144	150.0	1.769	0.000	9.00	0.00	0.00	56520	0.00	25.80	0.00
11.50	10.00	11.50	0.23	6.71	0.8170	150.0	1.897	0.000	9.00	0.00	0.00	56520	0.00	25.33	0.00
13.00	11.50	13.00	0.23	6.71	0.8343	150.0	2.027	0.000	9.00	0.00	0.00	56520	0.00	26.74	0.00
14.50	13.00	14.50	0.23	6.71	0.8388	150.0	2.156	0.000	9.00	0.00	0.00	56520	0.00	28.00	0.00
16.00	14.50	16.00	0.23	6.71	0.8414	150.0	2.286	0.000	9.00	0.00	0.00	56520	0.00	29.40	0.00
17.50	16.00	17.50	0.24	6.71	0.8590	150.0	2.417	0.000	9.00	0.00	0.00	56520	0.00	30.77	0.00
19.00	17.50	19.00	0.24	6.71	0.8635	150.0	2.548	0.000	9.00	0.00	0.00	56520	0.00	32.13	0.00
20.50	19.00	20.50	0.24	6.71	0.8661	150.0	2.680	0.000	9.00	0.00	0.00	56520	0.00	33.56	0.00
22.00	20.50	22.00	0.25	6.71	0.8839	150.0	2.763	0.000	9.00	0.00	0.00	56520	0.00	34.50	0.00
23.50	22.00	23.50	0.25	6.71	0.8885	150.0	2.710	2.948	9.00	10.00	0.71	56520	11304	34.20	359.56
25.00	23.50	25.00	0.26	6.71	0.8912	150.0	2.664	0.000	9.00	0.00	0.00	56520	0.00	0.00	0.00
26.50	25.00	26.50	0.27	6.03	0.9093	150.0	2.625	0.000	9.00	0.00	0.00	56520	0.00	0.00	0.00
28.00	26.50	28.00	0.27	6.03	0.9139	150.0	2.534	0.000	9.00	0.00	0.00	56520	0.00	0.00	0.00
29.50	28.00	29.50	0.28	6.03	0.9166	150.0	2.511	0.000	9.00	0.00	0.00	56520	0.00	0.00	0.00
31.00	29.50	31.00	0.28	6.03	0.9349	150.0	2.488	0.000	9.00	0.00	0.00	56520	0.00	0.00	0.00
32.50	31.00	32.50	0.29	6.03	0.9396	150.0	2.469	0.000	9.00	0.00	0.00	56520	0.00	0.00	0.00
29.50	28.00	29.50	0.28	6.03	0.9166	150.0	2.488	0.000	9.00	0.00	0.00	56520	0.00	0.00	0.00
31.00	29.50	31.00	0.28	6.03	0.9349	150.0	2.469	0.000	9.00	0.00	0.00	56520	0.00	0.00	0.00
32.50	31.00	32.50	0.29	6.03	0.9396	150.0	2.451	0.000	9.00	0.00	0.00	56520	0.00	0.00	0.00
34.00	32.50	34.00	0.30	6.03	0.9424	150.0	2.435	0.000	9.00	0.00	0.00	56520	0.00	0.00	0.00
														393.00	359.56

Ultimate Load Capacity	=	752.56	T
Factor of Safety	=	2.50	
Safe Load Capacity	=	301.02	T

R. B. DIWAKAR
Dy. Project Manager
U. P. State Bridge Corporation Ltd
Bridge Construction Unit-Agra

LABORATORY TEST RESULTS

ANNEXURE - F

(G. B. S. Engineer, Sitapur Road, Lucknow : NABL Accreditation Lab in accordance with ISO/IEC 17025:2017 Certificate no. TC-11120)

Name of Site : Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section | Client: Dy. PM, BCU-I, UPSBC Ltd, Agra (UP). | G.B.S. Engineer, Sitapur Road, Lucknow.

Bore Hole 1 : September'2024 | Water Table 11.300 M | NGL 100.000 | BH LvL 100.000 | Filled Up : 0.000

SN	Depth (mtr)	BH Level	Samp Type	%age Passing mm/micron (μ)							Grain Size Distribution				Atterbergs' Limits			IS symbol	Bulk Den	Moist Cont.	Dry Den	Sp. Gr.	Shear values		void ratio	Comp Index
				80.00	75.00	19.00	4.75	2.00	425	75	Gravel	Sand	Silt	Clay	LL	PL	PI	-	γ	%age	γ_d	G	c	φ	e	C_c
1	1.00	99.000	D/S	100	100	100	94	78	54	24	6	70	24	0	Non Plastic (NP)			SM	1.698	7.24	1.583	2.65	0.000	23	0.674	0.0000
2	2.50	97.500	D/S	100	100	100	92	79	56	23	8	69	23	0	Non Plastic (NP)			SM	1.712	11.36	1.537	2.65	0.000	24	0.724	0.0000
3	4.00	96.000	D/S	100	100	100	93	78	52	23	7	70	23	0	Non Plastic (NP)			SM	1.766	12.50	1.569	2.65	0.000	24	0.689	0.0000
4	5.50	94.500	D/S	100	100	100	95	78	48	22	5	73	22	0	Non Plastic (NP)			SM	1.714	13.01	1.517	2.65	0.000	25	0.747	0.0000
5	7.00	93.000	UDS	100	100	100	91	80	49	21	9	70	21	0	Non Plastic (NP)			SM	1.730	13.75	1.521	2.65	0.000	26	0.743	0.0000
6	8.50	91.500	UDS	100	100	100	94	79	51	20	6	74	20	0	Non Plastic (NP)			SM	1.760	14.31	1.539	2.65	0.000	27	0.721	0.0000
7	10.00	90.000	UDS	100	100	100	93	75	53	23	7	70	23	0	Non Plastic (NP)			SM	1.796	14.20	1.572	2.65	0.000	28	0.685	0.0000
8	11.50	88.500	UDS	100	100	100	94	76	55	24	6	70	24	0	Non Plastic (NP)			SM	1.807	14.54	1.578	2.65	0.000	30	0.679	0.0000
9	13.00	87.000	D/S	100	100	100	95	72	56	25	5	70	25	0	Non Plastic (NP)			SM	1.726	15.52	1.494	2.65	0.000	29	0.774	0.0000
10	14.50	85.500	D/S	100	100	100	90	70	52	26	10	64	26	0	Non Plastic (NP)			SM	1.805	16.17	1.554	2.65	0.000	32	0.705	0.0000
11	16.00	84.000	D/S	100	100	100	89	86	81	78	11	11	14	64	31	18	13	CL	1.840	16.29	1.583	2.66	0.236	12	0.681	0.1232
12	17.50	82.500	D/S	100	100	100	89	87	82	80	11	9	14	66	29	17	12	CL	1.846	16.40	1.586	2.66	0.237	12	0.677	0.1222
13	19.00	81.000	D/S	100	100	100	90	89	82	79	10	11	13	66	31	20	11	CL	1.864	16.52	1.599	2.66	0.237	12	0.663	0.1180
14	20.50	79.500	D/S	100	100	100	91	89	80	77	9	14	17	60	31	20	11	CL	1.870	16.74	1.602	2.66	0.278	12	0.661	0.1172
15	22.00	78.000	D/S	100	100	100	89	87	82	80	11	9	12	68	32	21	11	CL	1.893	17.60	1.610	2.66	0.278	13	0.652	0.1147
16	23.50	76.500	D/S	100	100	100	87	86	84	81	13	6	17	64	30	19	11	CL	1.911	18.11	1.618	2.66	0.302	13	0.644	0.1122
17	25.00	75.000	D/S	100	100	100	88	85	83	81	12	7	19	62	31	20	11	CL	1.928	19.92	1.608	2.69	0.312	14	0.673	0.1208
18	26.50	73.500	D/S	100	100	100	86	84	81	79	14	7	20	59	31	20	11	CL	1.940	25.58	1.545	2.69	0.314	14	0.741	0.1413
19	28.00	72.000	D/S	100	100	100	87	84	81	79	13	8	16	63	32	21	11	CL	1.954	26.48	1.545	2.69	0.316	14	0.741	0.1414
20	29.50	70.500	D/S	100	100	100	89	86	82	79	11	10	15	64	30	19	11	CL	1.981	29.02	1.536	2.69	0.322	15	0.752	0.1445
21	31.00	69.000	D/S	100	100	100	90	88	83	80	10	10	13	67	32	21	11	CL	1.989	29.24	1.539	2.67	0.343	16	0.735	0.1395
22	32.50	67.500	D/S	100	100	100	89	87	85	82	11	7	13	69	31	20	11	CL	1.975	26.58	1.561	2.67	0.441	16	0.711	0.1323
23	34.00	66.000	D/S	100	100	100	88	86	82	80	12	8	14	66	31	19	12	CL	1.958	26.62	1.546	2.67	0.585	17	0.727	0.1370
24	35.50	64.500	D/S	100	100	100	89	89	86	83	11	6	13	70	32	20	12	CL	1.999	27.59	1.567	2.67	0.584	17	0.704	0.1303

R. B. DIWAKAR
Dy. Project Manager
U. P. State Bridge Corporation Ltd
Bridge Construction Unit-Agra

LABORATORY TEST RESULTS

ANNEXURE - F

(G. B. S. Engineer, Sitapur Road, Lucknow : NABL Accredited on Lab in accordance with ISO/IEC 17025:2017 Certificate no. TC-11120)

Name of Site :	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section													Client:	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).														
Bore Hole 2	September'2024		Water Table		11.100	M	NGL		100.000					BH LvL	100.000			Filled Up Soil		0.000	G.B.S. Engineer, Sitapur Road, Lucknow.								
SN	Depth (in mtr)	Bore Hole LVL	Samp Type	Percentage of Material Passing in mm/micron (μ)							Grain Size Distribution				Atterbergs' Limits			IS symbol	Bulk Den	Moist Cont.	Dry Den	Sp. Gr.	Shear values		void ratio	Comp Index				
				80.00	75.00	19.00	4.75	2.00	425	75	Gravel	Sand	Silt	Clay	LL	PL	PI	-	γ	%age	γ_d	G	c	ϕ	e	C_c				
1	1.00	99.000	UDS	100	100	100	93	77	54	26	7	67	26	0	Non Plastic (NP)			SM	1.691	6.67	1.585	2.65	0.000	23	0.672	0.0000				
2	2.50	97.500	UDS	100	100	100	92	76	56	25	8	67	25	0	Non Plastic (NP)			SM	1.695	9.28	1.551	2.65	0.000	23	0.709	0.0000				
3	4.00	96.000	UDS	100	100	100	91	76	52	26	9	65	26	0	Non Plastic (NP)			SM	1.749	10.22	1.587	2.65	0.000	24	0.670	0.0000				
4	5.50	94.500	UDS	100	100	100	92	75	48	24	8	68	24	0	Non Plastic (NP)			SM	1.774	11.70	1.588	2.65	0.000	25	0.668	0.0000				
5	7.00	93.000	UDS	100	100	100	90	74	49	25	10	65	25	0	Non Plastic (NP)			SM	1.800	10.41	1.630	2.65	0.000	25	0.626	0.0000				
6	8.50	91.500	UDS	100	100	100	90	76	51	26	10	64	26	0	Non Plastic (NP)			SM	1.802	11.84	1.611	2.65	0.000	26	0.645	0.0000				
7	10.00	90.000	UDS	100	100	100	91	73	53	28	9	63	28	0	Non Plastic (NP)			SM	1.805	12.40	1.606	2.65	0.000	26	0.650	0.0000				
8	11.50	88.500	D/S	100	100	100	90	72	55	29	10	61	29	0	Non Plastic (NP)			SM	1.807	13.10	1.598	2.65	0.000	26	0.658	0.0000				
9	13.00	87.000	D/S	100	100	100	91	70	56	27	9	64	27	0	Non Plastic (NP)			SM	1.825	13.55	1.607	2.65	0.000	27	0.649	0.0000				
10	14.50	85.500	D/S	100	100	100	89	70	52	31	11	58	31	0	Non Plastic (NP)			SM	1.829	14.65	1.595	2.65	0.000	28	0.661	0.0000				
11	16.00	84.000	D/S	100	100	100	89	86	81	78	11	11	19	59	30	16	14	CL	1.832	14.75	1.596	2.66	0.243	15	0.666	0.1189				
12	17.50	82.500	D/S	100	100	100	89	87	82	80	11	9	21	59	30	15	15	CL	1.849	14.91	1.609	2.66	0.249	15	0.653	0.1149				
13	19.00	81.000	D/S	100	100	100	90	89	82	79	10	11	19	60	29	19	10	CL	1.854	17.05	1.584	2.66	0.264	14	0.680	0.1229				
14	20.50	79.500	D/S	100	100	100	90	89	80	77	10	13	18	59	29	18	11	CL	1.856	18.57	1.565	2.66	0.273	14	0.699	0.1287				
15	22.00	78.000	D/S	100	100	100	90	87	82	80	10	10	14	66	30	19	11	CL	1.874	16.80	1.604	2.66	0.342	15	0.658	0.1164				
16	23.50	76.500	D/S	100	100	100	89	86	84	81	11	8	15	66	31	18	13	CL	1.879	18.94	1.579	2.66	0.368	15	0.684	0.1243				
17	25.00	75.000	D/S	100	100	100	87	85	83	81	13	6	15	66	30	19	11	CL	1.881	18.21	1.591	2.69	0.372	15	0.690	0.1261				
18	26.50	73.500	D/S	100	100	100	88	84	81	79	12	9	17	62	30	19	11	CL	1.899	21.14	1.568	2.69	0.381	15	0.716	0.1338				
19	28.00	72.000	D/S	100	100	100	89	84	81	79	11	10	21	58	31	20	11	CL	1.904	21.48	1.567	2.69	0.385	16	0.717	0.1340				
20	29.50	70.500	D/S	100	100	100	89	86	82	79	11	10	19	60	29	20	9	CL	1.906	21.30	1.572	2.69	0.397	16	0.712	0.1325				
21	31.00	69.000	D/S	100	100	100	90	88	83	80	10	10	18	62	29	20	9	CL	1.925	24.24	1.549	2.67	0.420	16	0.724	0.1361				
22	32.50	67.500	D/S	100	100	100	89	87	85	82	11	7	16	66	30	19	11	CL	1.929	24.24	1.553	2.67	0.412	17	0.719	0.1348				
23	34.00	66.000	D/S	100	100	100	88	86	82	80	12	8	17	63	30	18	12	CL	1.932	24.59	1.551	2.67	0.413	17	0.722	0.1355				
24	35.50	64.500	D/S	100	100	100	89	89	86	83	11	6	18	65	31	19	12	CL	1.951	23.48	1.580	2.67	0.423	17	0.690	0.1261				

R. B. DIWAKAR
Dy. Project Manager
U. P. State Bridge Corporation Ltd
Bridge Construction Unit-Agra

LABORATORY TEST RESULTS

ANNEXURE - F

(G. B. S. Engineer, Sitapur Road, Lucknow : NABL Accreditation Lab in accordance with ISO/IEC 17025:2017 Certificate no. TC-11128)

Name of Site :	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section														Client:	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).											
Bore Hole 3	September'2024		Water Table			12.100	M	NGL		100.000					BH LvL	100.000			Filled Up :		0.000	G.B.S. Engineer, Sitapur Road, Lucknow.					
SN	Depth (in mtr)	Bore Hole LVL	Samp Type	Percentage of Material Passing in mm/micron (μ)							Grain Size Distribution				Atterbergs' Limits			IS symbol	Bulk Den	Moist Cont	Dry Den	Sp. Gr.	Shear values		void ratio	Comp Index
				80.00	75.00	19.00	4.75	2.00	425	75	Gravel	Sand	Silt	Clay	LL	PL	PI	-	γ	%age	γ_d	G	c	ϕ	e	C_c
1	1.00	99.000	UDS	100	100	100	94	78	56	24	6	70	24	0	Non Plastic (NP)			SM	1.741	8.42	1.606	2.63	0.000	24	0.638	0.0000
2	2.50	97.500	UDS	100	100	100	92	79	58	23	8	69	23	0	Non Plastic (NP)			SM	1.813	16.17	1.561	2.63	0.000	24	0.685	0.0000
3	4.00	96.000	UDS	100	100	100	93	78	56	23	7	70	23	0	Non Plastic (NP)			SM	1.745	13.83	1.533	2.63	0.000	25	0.716	0.0000
4	5.50	94.500	UDS	100	100	100	95	78	52	22	5	73	22	0	Non Plastic (NP)			SM	1.817	22.31	1.485	2.63	0.000	26	0.770	0.0000
5	7.00	93.000	UDS	100	100	100	92	80	51	21	8	71	21	0	Non Plastic (NP)			SM	1.784	21.79	1.465	2.63	0.000	26	0.795	0.0000
6	8.50	91.500	UDS	100	100	100	93	79	52	20	7	73	20	0	Non Plastic (NP)			SM	1.894	24.72	1.518	2.63	0.000	27	0.732	0.0000
7	10.00	90.000	UDS	100	100	100	93	75	53	23	7	70	23	0	Non Plastic (NP)			SM	1.846	24.94	1.477	2.63	0.000	28	0.780	0.0000
8	11.50	88.500	D/S	100	100	100	94	76	54	24	6	70	24	0	Non Plastic (NP)			SM	1.926	26.32	1.525	2.63	0.000	29	0.725	0.0000
9	13.00	87.000	D/S	100	100	100	95	72	55	25	5	70	25	0	Non Plastic (NP)			SM	1.887	29.89	1.453	2.63	0.000	29	0.810	0.0000
10	14.50	85.500	D/S	100	100	100	94	70	53	26	6	68	26	0	Non Plastic (NP)			SM	1.972	29.67	1.521	2.63	0.000	28	0.729	0.0000
11	16.00	84.000	D/S	100	100	100	89	86	81	78	11	11	15	63	31	18	13	CL	1.932	29.85	1.488	2.66	0.223	15	0.788	0.1553
12	17.50	82.500	D/S	100	100	100	89	87	82	80	11	9	16	64	29	17	12	CL	2.019	29.72	1.556	2.66	0.274	15	0.709	0.1318
13	19.00	81.000	D/S	100	100	100	90	89	82	81	10	9	19	62	31	20	11	CL	1.978	30.07	1.521	2.66	0.275	14	0.749	0.1437
14	20.50	79.500	D/S	100	100	100	91	89	80	80	9	11	21	59	31	20	11	CL	1.956	30.27	1.501	2.66	0.282	14	0.772	0.1505
15	22.00	78.000	D/S	100	100	100	89	87	82	80	11	9	20	60	32	21	11	CL	1.978	30.16	1.520	2.66	0.342	15	0.750	0.1441
16	23.50	76.500	D/S	100	100	100	87	86	84	81	13	6	23	58	30	19	11	CL	2.005	35.54	1.479	2.66	0.368	15	0.798	0.1585
17	25.00	75.000	D/S	100	100	100	88	85	83	81	12	7	21	60	31	20	11	CL	2.001	35.79	1.473	2.68	0.372	15	0.819	0.1647
18	26.50	73.500	D/S	100	100	100	86	84	81	80	14	6	19	61	31	20	11	CL	2.002	36.04	1.472	2.68	0.381	16	0.821	0.1653
19	28.00	72.000	D/S	100	100	100	87	84	81	82	13	5	22	60	32	21	11	CL	1.985	36.61	1.453	2.68	0.385	16	0.845	0.1724
20	29.50	70.500	D/S	100	100	100	89	86	82	81	11	8	21	60	30	19	11	CL	2.025	36.91	1.479	2.68	0.396	16	0.812	0.1626
21	31.00	69.000	D/S	100	100	100	90	88	83	80	10	10	20	60	32	21	11	CL	2.022	40.48	1.440	2.68	0.430	16	0.862	0.1775
22	32.50	67.500	D/S	100	100	100	89	87	85	82	11	7	19	63	31	20	11	CL	2.032	39.96	1.452	2.68	0.420	18	0.846	0.1727
23	34.00	66.000	D/S	100	100	100	88	86	82	80	12	8	18	62	31	19	12	CL	2.029	39.04	1.459	2.69	0.423	18	0.843	0.1720
24	35.50	64.500	D/S	100	100	100	89	89	86	83	11	6	22	61	32	20	12	CL	2.031	38.27	1.469	2.69	0.427	18	0.832	0.1685

R. B. DIWAKAR
Dy. Project Manager
U.P. State Bridge Corporation Ltd
PMU-I Construction Unit-Agra

LABORATORY TEST RESULTS

ANNEXURE - F

(G. B. S. Engineer, Sitapur Road, Lucknow : NABL Accreditation Lab in accordance with ISO/IEC 17025:2017 Certificate no. TC-11120)

Name of Site : Railway Bridge B/w Numihai Industrial Area Agra-Tundla Rail Section | Client: Dy. PM, BCU-I, UPSBC Ltd, Agra (UP) | G.B.S. Engineer, Sitapur Road, Lucknow

Bore Hole 1 : June'2025 | Water Table 11.500 M | NGL 100.000 | BH Lvl 100.000 | Filled Up : 0.000

SN	Depth (mtr)	BH Level	Samp Type	%age Passing mm/micron (μ)							Grain Size Distribution				Atterbergs' Limits			IS symbol	Bulk Den	Moist Cont.	Dry Den	Sp. Gr.	Shear values		void ratio	Comp Index
				80.00	75.00	19.00	4.75	2.00	425	75	Gravel	Sand	Silt	Clay	LL	PL	PI	-	γ	%age	γ_d	G	c	ϕ	e	C_c
1	1.00	99.000	D/S	100	100	100	100	78	54	27	0	73	27	0	Non Plastic (NP)			SM	1.710	8.65	1.574	2.60	0.000	23	0.652	0.0000
2	2.50	97.500	D/S	100	100	100	100	79	56	26	0	74	26	0	Non Plastic (NP)			SM	1.724	13.57	1.518	2.59	0.000	24	0.706	0.0000
3	4.00	96.000	D/S	100	100	100	100	78	52	24	0	76	24	0	Non Plastic (NP)			SM	1.778	14.94	1.547	2.59	0.000	26	0.674	0.0000
4	5.50	94.500	D/S	100	100	100	100	78	49	23	0	77	23	0	Non Plastic (NP)			SM	1.727	15.54	1.494	2.60	0.000	27	0.740	0.0000
5	7.00	93.000	UDS	100	100	100	100	96	94	90	0	10	21	69	26	14	12	CL	1.742	16.42	1.496	2.64	0.180	11	0.765	0.1484
6	8.50	91.500	UDS	100	100	100	100	97	94	92	0	8	20	72	27	14	13	CL	1.772	17.09	1.513	2.64	0.200	11	0.744	0.1423
7	10.00	90.000	UDS	100	100	100	100	99	96	93	0	7	23	70	27	15	12	CL	1.808	16.96	1.546	2.64	0.221	12	0.708	0.1313
8	11.50	88.500	UDS	100	100	100	100	98	96	93	0	7	24	69	29	16	13	CL	1.820	17.37	1.551	2.64	0.224	10	0.702	0.1297
9	13.00	87.000	D/S	100	100	100	100	97	95	93	0	7	25	68	30	16	14	CL	1.738	18.54	1.466	2.64	0.280	10	0.801	0.1593
10	14.50	85.500	D/S	100	100	100	100	96	95	93	0	7	26	67	30	18	12	CL	1.818	19.32	1.524	2.64	0.230	10	0.733	0.1388
11	16.00	84.000	D/S	100	100	100	89	86	81	78	11	11	14	64	30	18	12	CL	1.853	19.46	1.552	2.65	0.236	13	0.708	0.1314
12	17.50	82.500	D/S	100	100	100	89	87	82	80	11	9	14	66	31	17	14	CL	1.859	19.60	1.554	2.65	0.237	13	0.705	0.1305
13	19.00	81.000	D/S	100	100	100	90	89	82	79	10	11	13	66	31	20	11	CL	1.877	19.73	1.567	2.65	0.237	13	0.691	0.1262
14	20.50	79.500	D/S	100	100	100	91	89	80	77	9	14	17	60	32	20	12	CL	1.883	20.01	1.569	2.65	0.278	14	0.689	0.1256
15	22.00	78.000	D/S	100	100	100	89	87	82	80	11	9	12	68	32	21	11	CL	1.907	21.03	1.575	2.65	0.278	14	0.682	0.1236
16	23.50	76.500	D/S	100	100	100	87	86	84	81	13	6	17	64	32	19	13	CL	1.924	21.63	1.582	2.65	0.302	14	0.675	0.1215
17	25.00	75.000	D/S	100	100	100	88	85	83	81	12	7	19	62	33	20	13	CL	1.942	23.79	1.569	2.65	0.312	14	0.689	0.1258
18	26.50	73.500	D/S	100	100	100	86	84	81	79	14	7	20	59	33	20	13	CL	1.954	30.56	1.497	2.67	0.314	15	0.784	0.1542
19	28.00	72.000	D/S	100	100	100	87	84	81	79	13	8	16	63	34	21	13	CL	1.968	31.64	1.495	2.67	0.316	15	0.786	0.1549
20	29.50	70.500	D/S	100	100	100	89	86	82	79	11	10	15	64	33	19	14	CL	1.995	34.68	1.482	2.67	0.322	16	0.802	0.1597
21	31.00	69.000	D/S	100	100	100	90	88	83	80	10	10	13	67	33	21	12	CL	2.003	34.94	1.484	2.67	0.343	16	0.799	0.1586
22	32.50	67.500	D/S	100	100	100	89	87	85	82	11	7	13	69	34	20	14	CL	1.989	31.76	1.510	2.68	0.441	16	0.775	0.1515
23	34.00	66.000	D/S	100	100	100	88	86	82	80	12	8	14	66	35	19	16	CL	1.972	31.80	1.496	2.68	0.585	17	0.791	0.1564
24	35.50	64.500	D/S	100	100	100	89	89	86	83	11	6	13	70	35	20	15	CL	2.013	32.96	1.514	2.68	0.584	17	0.770	0.1500

B. DIWAKAR
Dy. Project Manager
U. P. State Bridge Corporation Ltd
Bridge Construction Unit-Agra

LABORATORY TEST RESULTS

ANNEXURE - F

(G. B. S. Engineer, Sitapur Road, Lucknow : NABL Accreditation Lab in accordance with ISO/IEC 17025:2017 Certificate no. TC-11120)

Name of Site :		Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section												Client:	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).										
Bore Hole 2		June'2025		Water Table			11.500	M	NGL		100.000			BH Lvl.	100.000			Filled Up Soil		0.000	G.B.S. Engineer, Sitapur Road, Lucknow.				
SN	Depth (in mtr.)	Bore Hole LVL	Samp Type	Percentage of Material Passing in mm/micron (μ)							Grain Size Distribution				Atterbergs' Limits			IS symbol	Bulk Den	Moist Cont.	Dry Den	Sp. Gr.	Shear values		void ratio	Comp Index
				80.00	75.00	19.00	4.75	2.00	425	75	Gravel	Sand	Silt	Clay	LL	PL	PI	-	γ	%age	γ_d	G	c	ϕ	e	C_c
1	1.00	99.000	UDS	100	100	100	100	80	54	27	0	73	27	0	Non Plastic (NP)			SM	1.700	9.25	1.556	2.59	0.000	24	0.664	0.0000
2	2.50	97.500	UDS	100	100	100	100	80	56	26	0	74	26	0	Non Plastic (NP)			SM	1.704	12.88	1.510	2.59	0.000	25	0.716	0.0000
3	4.00	96.000	UDS	100	100	100	100	79	52	24	0	76	24	0	Non Plastic (NP)			SM	1.758	14.17	1.540	2.59	0.000	26	0.682	0.0000
4	5.50	94.500	UDS	100	100	100	100	79	46	25	0	75	25	0	Non Plastic (NP)			SM	1.784	16.22	1.535	2.59	0.000	28	0.688	0.0000
5	7.00	93.000	UDS	100	100	100	100	98	94	90	0	10	25	65	26	14	12	CL	1.809	14.43	1.581	2.64	0.184	11	0.670	0.1199
6	8.50	91.500	UDS	100	100	100	100	98	94	92	0	8	26	66	27	14	13	CL	1.812	16.43	1.556	2.64	0.212	11	0.696	0.1279
7	10.00	90.000	UDS	100	100	100	100	98	96	93	0	7	28	65	27	15	12	CL	1.814	17.20	1.548	2.64	0.225	11	0.705	0.1306
8	11.50	88.500	D/S	100	100	100	100	99	96	93	0	7	29	64	29	16	13	CL	1.817	18.17	1.538	2.64	0.227	10	0.717	0.1341
9	13.00	87.000	D/S	100	100	100	100	98	95	93	0	7	27	66	30	16	14	CL	1.834	18.79	1.544	2.64	0.231	10	0.710	0.1319
10	14.50	85.500	D/S	100	100	100	100	96	95	93	0	7	31	62	30	18	12	CL	1.839	20.32	1.528	2.64	0.230	10	0.727	0.1372
11	16.00	84.000	D/S	100	100	100	89	86	81	78	11	11	19	59	30	16	14	CL	1.841	20.46	1.529	2.64	0.234	13	0.727	0.1371
12	17.50	82.500	D/S	100	100	100	89	87	82	80	11	9	21	59	30	15	15	CL	1.859	20.67	1.540	2.64	0.236	13	0.714	0.1331
13	19.00	81.000	D/S	100	100	100	90	89	82	79	10	11	19	60	31	16	15	CL	1.863	23.65	1.507	2.64	0.238	14	0.752	0.1445
14	20.50	79.500	D/S	100	100	100	90	89	80	77	10	13	18	59	31	16	15	CL	1.866	25.76	1.484	2.64	0.242	14	0.779	0.1527
15	22.00	78.000	D/S	100	100	100	88	87	82	80	12	8	14	66	31	18	13	CL	1.884	23.29	1.528	2.64	0.246	15	0.728	0.1373
16	23.50	76.500	D/S	100	100	100	87	86	84	81	13	6	15	66	32	18	14	CL	1.889	26.27	1.496	2.64	0.254	15	0.765	0.1485
17	25.00	75.000	D/S	100	100	100	87	85	83	81	13	6	15	66	32	19	13	CL	1.891	25.25	1.510	2.65	0.259	15	0.755	0.1455
18	26.50	73.500	D/S	100	100	100	87	84	81	79	13	8	17	62	32	19	13	CL	1.909	29.32	1.476	2.65	0.268	15	0.795	0.1575
19	28.00	72.000	D/S	100	100	100	86	84	81	79	14	7	21	58	32	19	13	CL	1.914	29.79	1.475	2.65	0.272	16	0.797	0.1581
20	29.50	70.500	D/S	100	100	100	86	86	82	79	14	7	19	60	33	18	15	CL	1.917	29.54	1.480	2.65	0.278	16	0.791	0.1563
21	31.00	69.000	D/S	100	100	100	86	88	83	80	14	6	18	62	33	18	15	CL	1.935	33.62	1.448	2.65	0.283	16	0.830	0.1680
22	32.50	67.500	D/S	100	100	100	89	87	85	82	11	7	16	66	34	19	15	CL	1.940	33.62	1.452	2.67	0.286	16	0.839	0.1708
23	34.00	66.000	D/S	100	100	100	88	86	82	80	12	8	17	63	34	19	15	CL	1.942	34.09	1.448	2.67	0.296	17	0.843	0.1720
24	35.50	64.500	D/S	100	100	100	88	89	86	83	12	5	18	65	34	18	16	CL	1.961	32.57	1.479	2.67	0.312	17	0.805	0.1605

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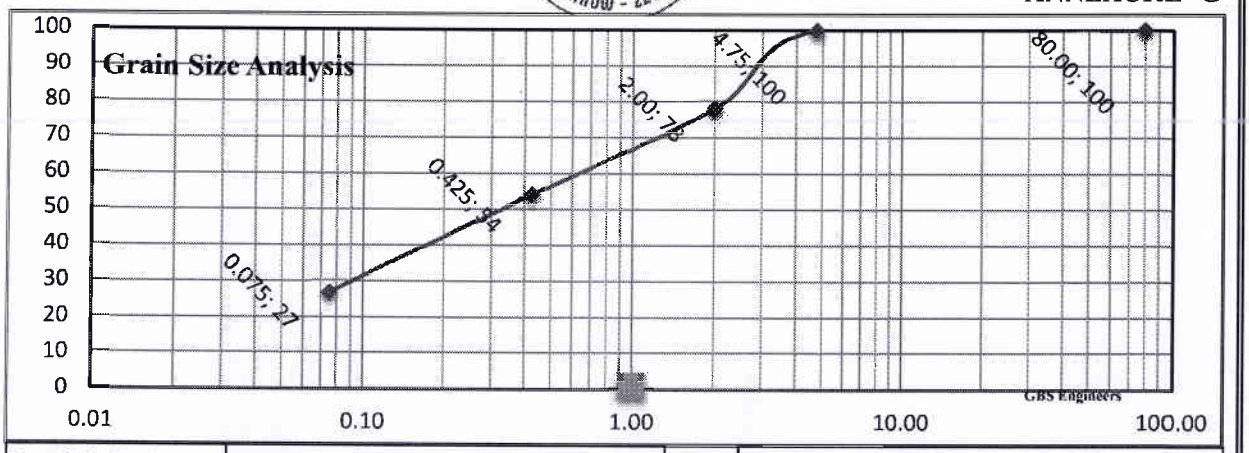
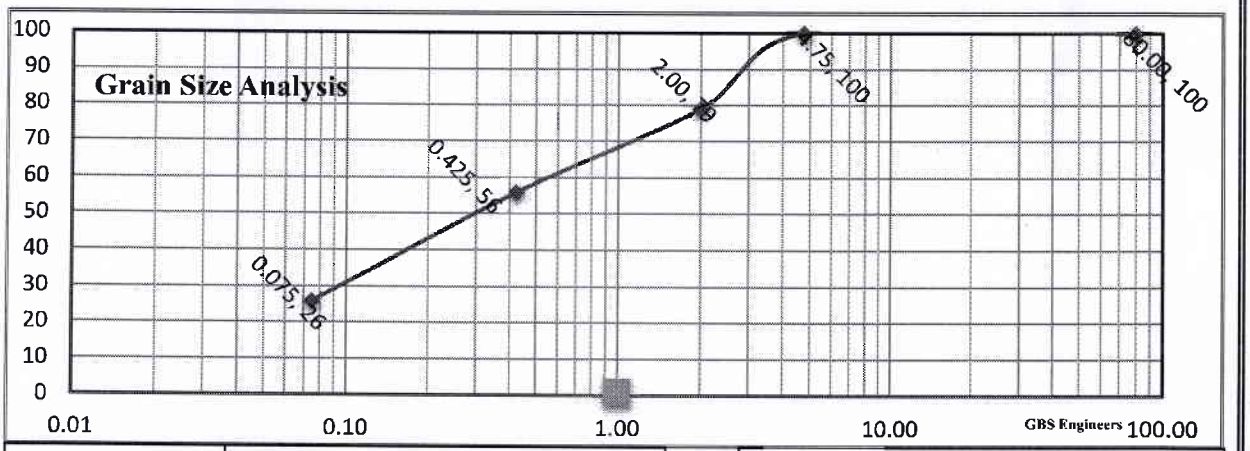
Construction Unit-Agra

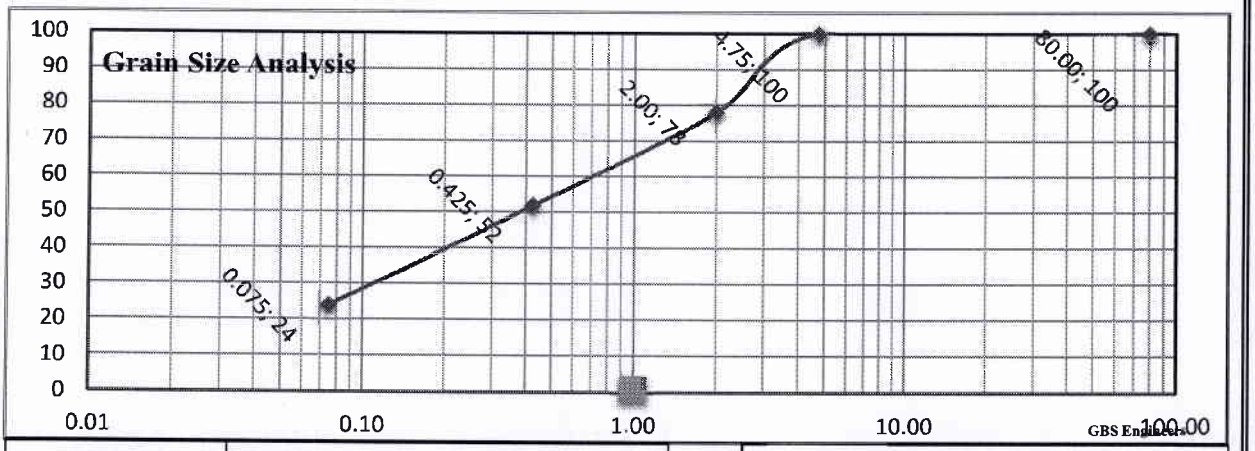
ANNEXURE -G



Bore Hole No. 1	:	Depth: 1.00 - 2.50 M		Client	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).
Name of Site	:	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section			



Bore Hole No. 1	:	Depth: 2.50 - 4.00 M		Client	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).
Name of Site	:	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section			



Bore Hole No. 1	:	Depth: 4.00 - 5.50 M		Client	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).
Name of Site	:	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section			

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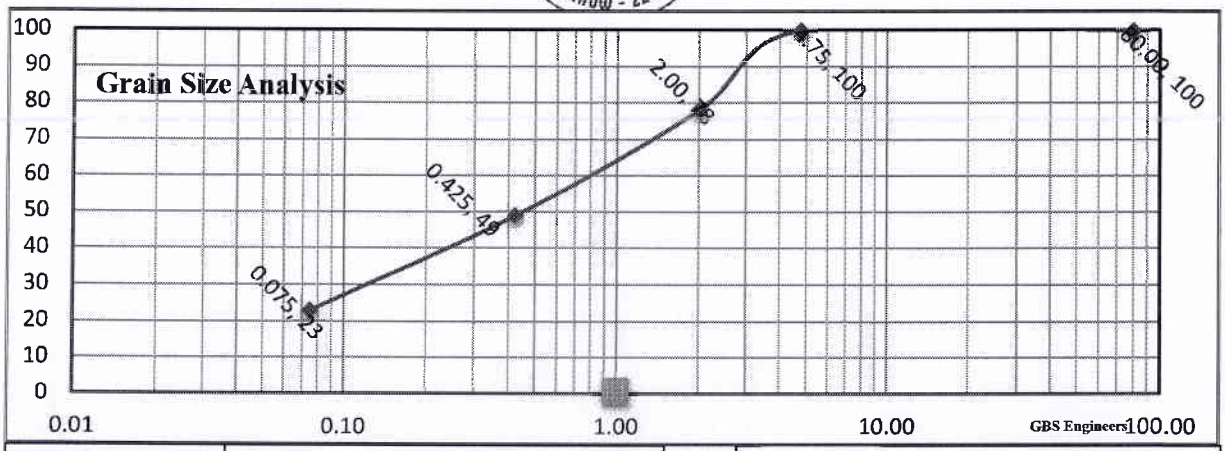
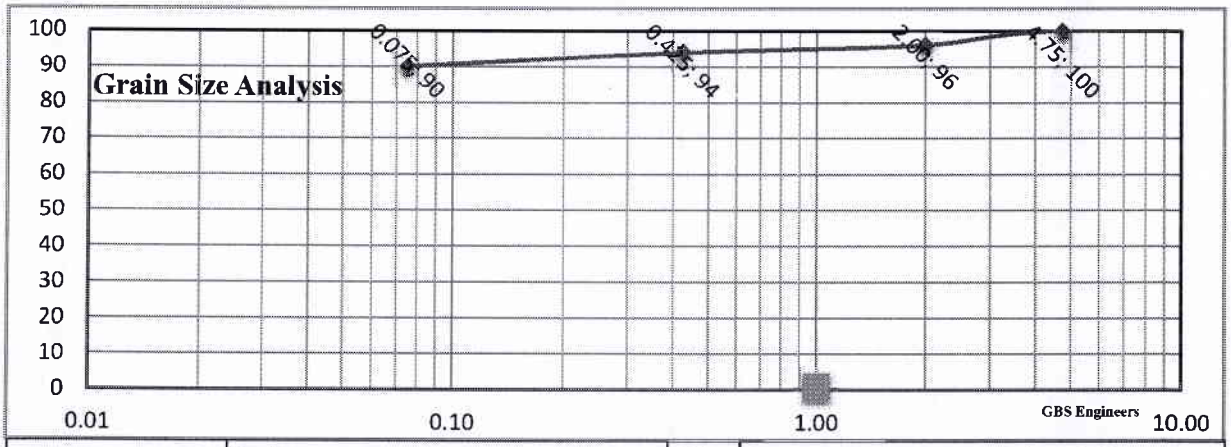
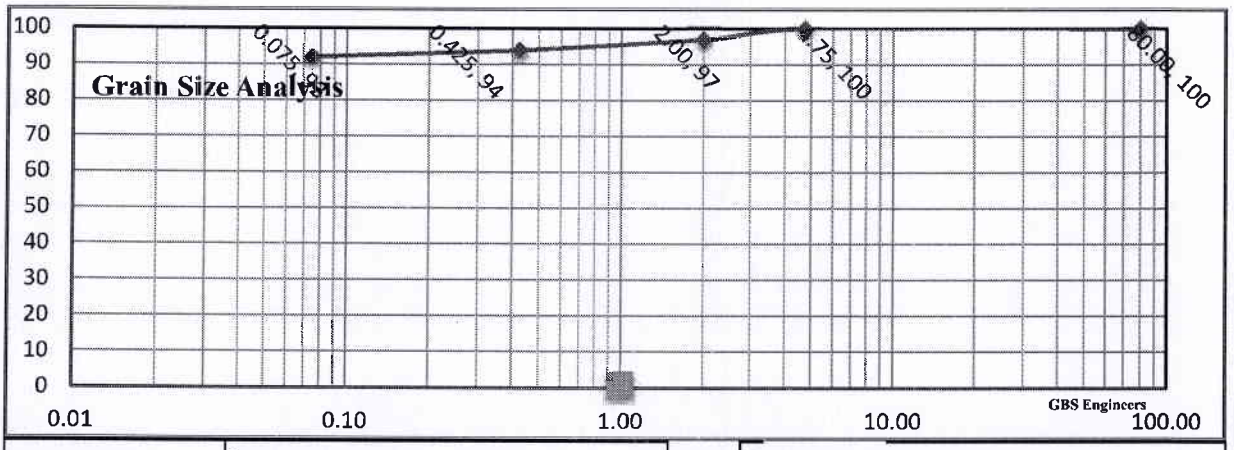


Bore Hole No. 1	:	Depth: 5.50 - 7.00 M		Client	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).
Name of Site	:	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section			



Bore Hole No. 1	:	Depth: 7.00 - 8.50 M		Client	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).
Name of Site	:	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section			



Bore Hole No. 1	:	Depth: 8.50 - 10.00 M		Client	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).
Name of Site	.	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section			

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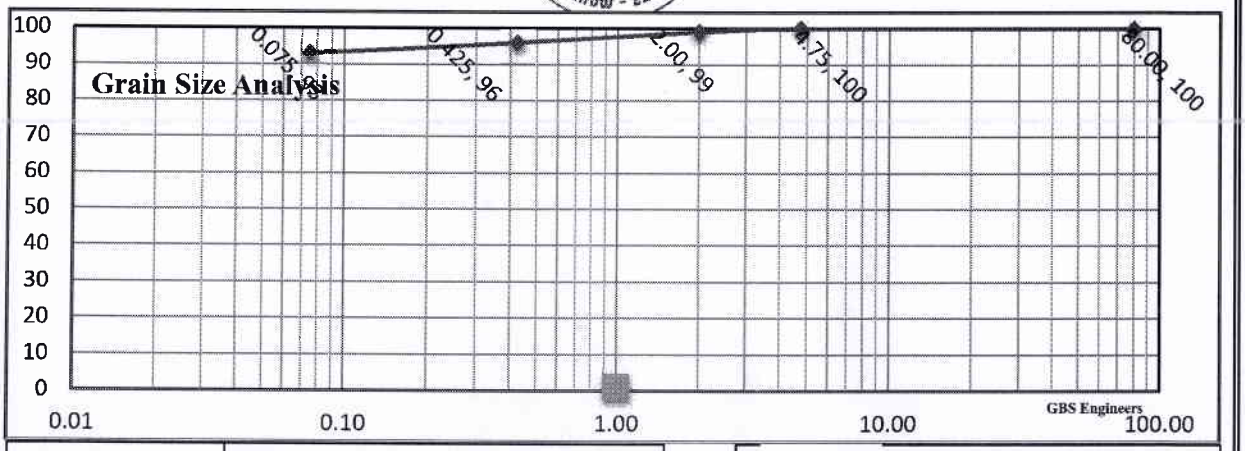
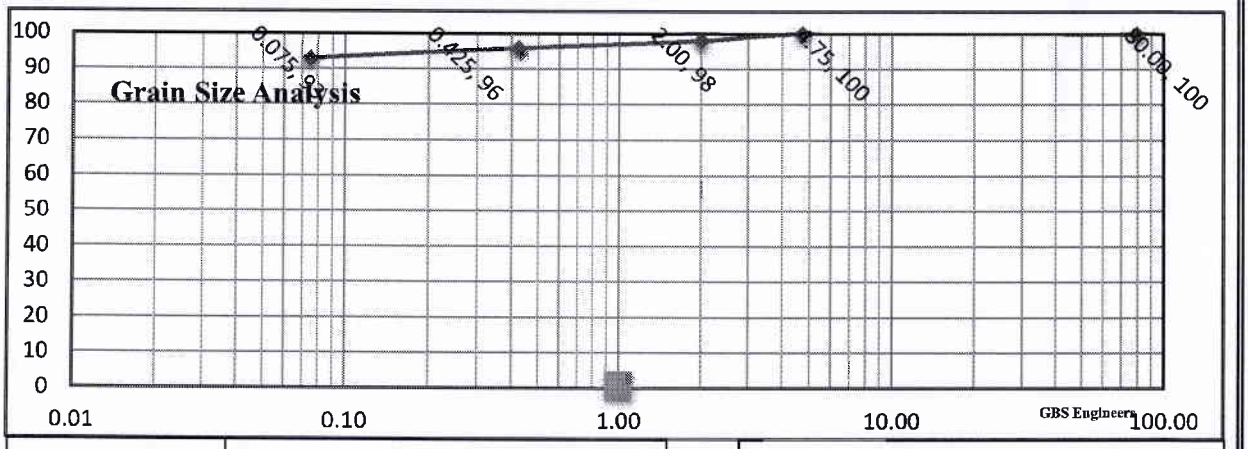
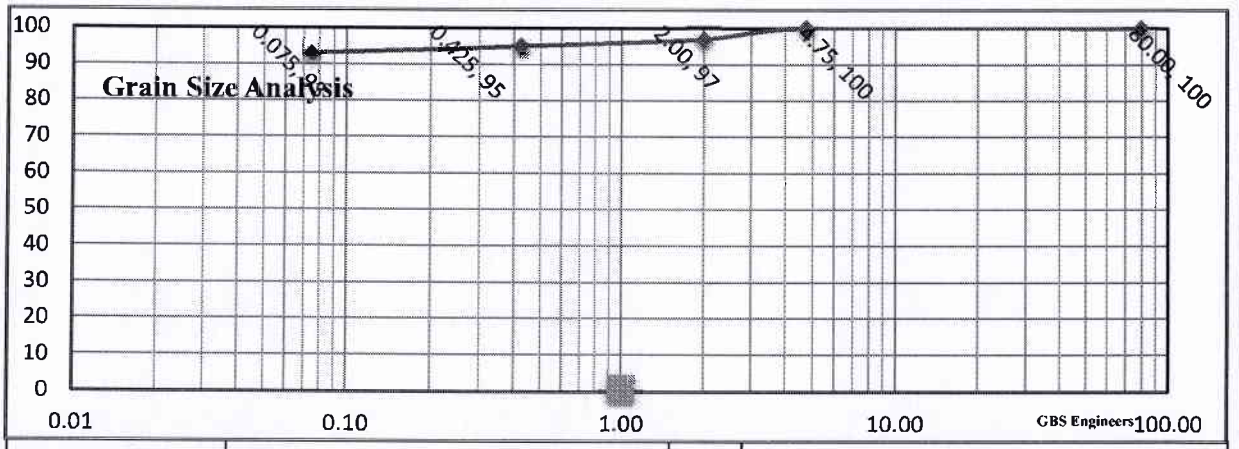


Bore Hole No. 1	:	Depth: 10.00 - 11.50 M		Client	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).
Name of Site	:	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section			



Bore Hole No. 1	:	Depth: 11.50 - 13.00 M		Client	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).
Name of Site	:	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section			



Bore Hole No. 1	:	Depth: 13.00 - 14.50 M		Client	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).
Name of Site	:	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section			

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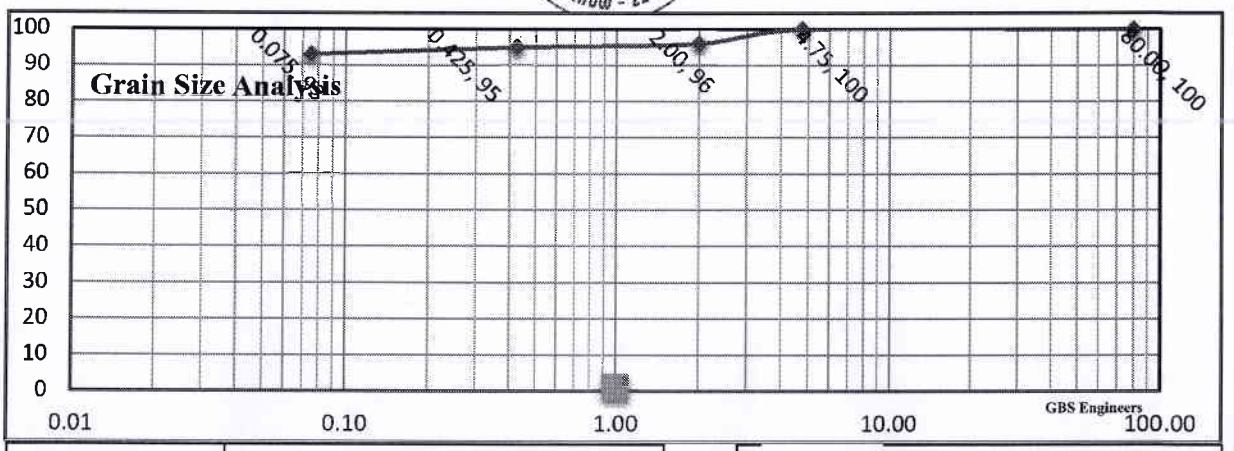
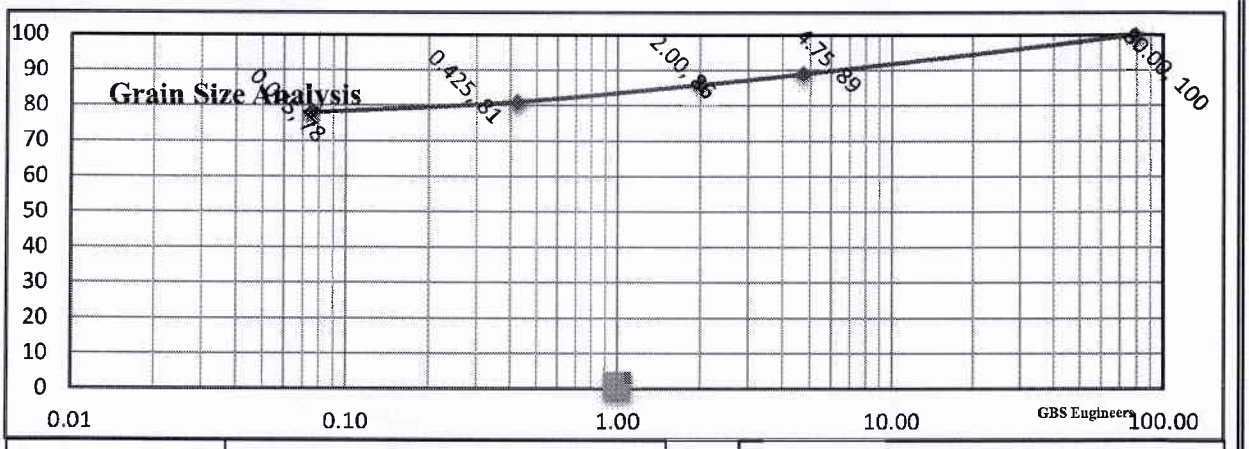
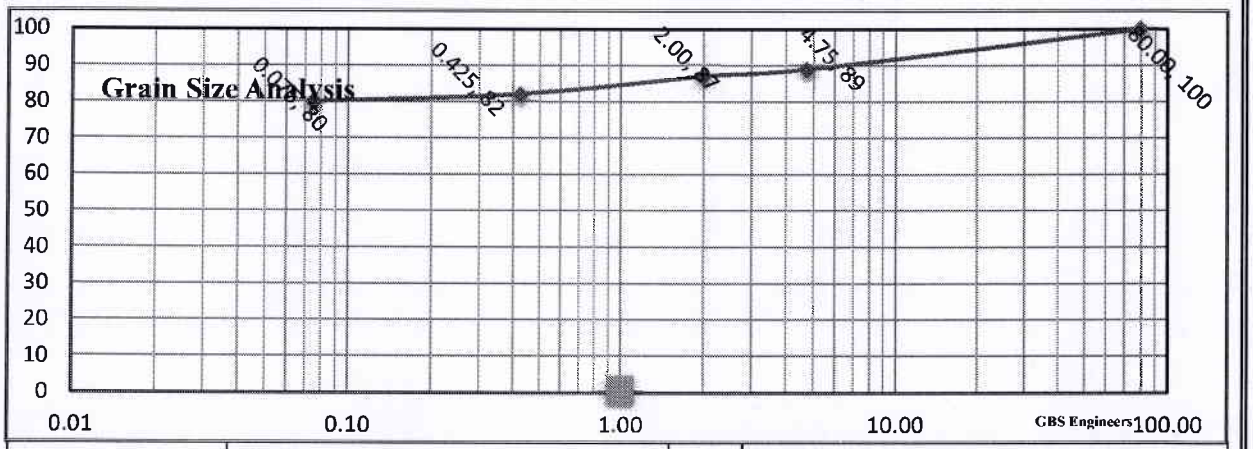
Dy. Project Manager



Bore Hole No. 1	:	Depth: 14.50 - 16.00 M		Client	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).
Name of Site	:	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section			



Bore Hole No. 1	:	Depth: 16.00 - 17.50 M		Client	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).
Name of Site	:	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section			



Bore Hole No. 1	:	Depth: 17.50 - 19.00 M		Client	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).
Name of Site	:	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section			

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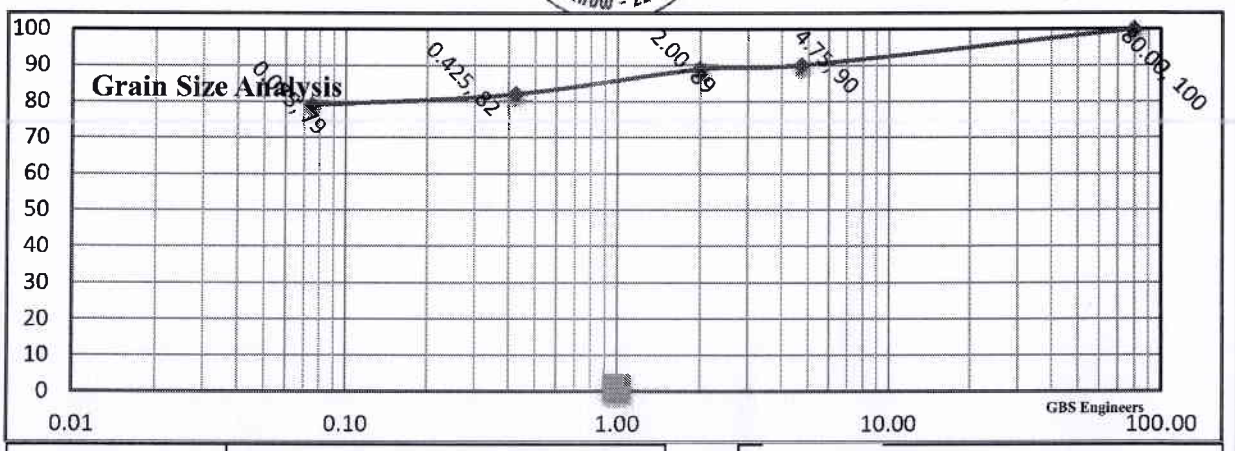
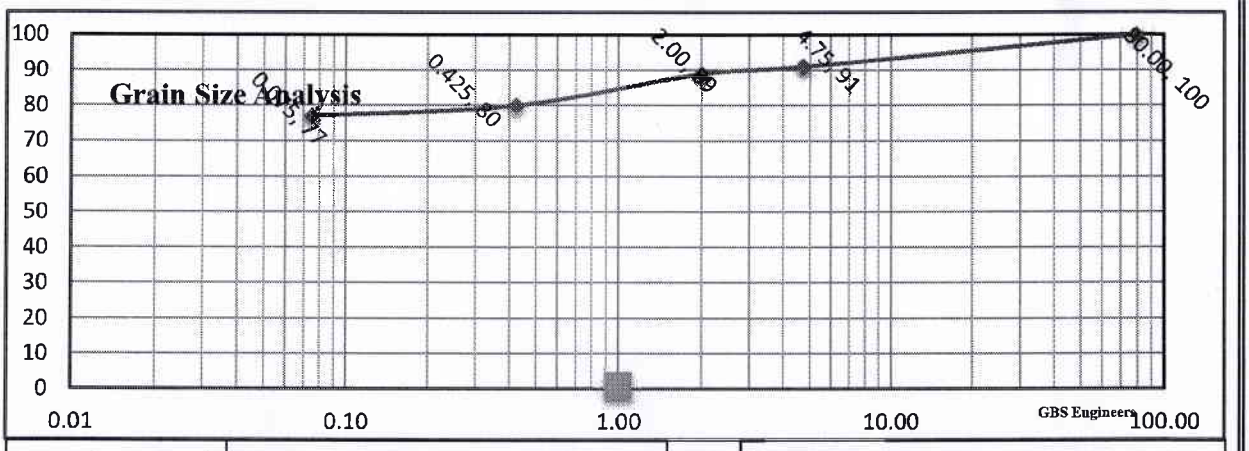
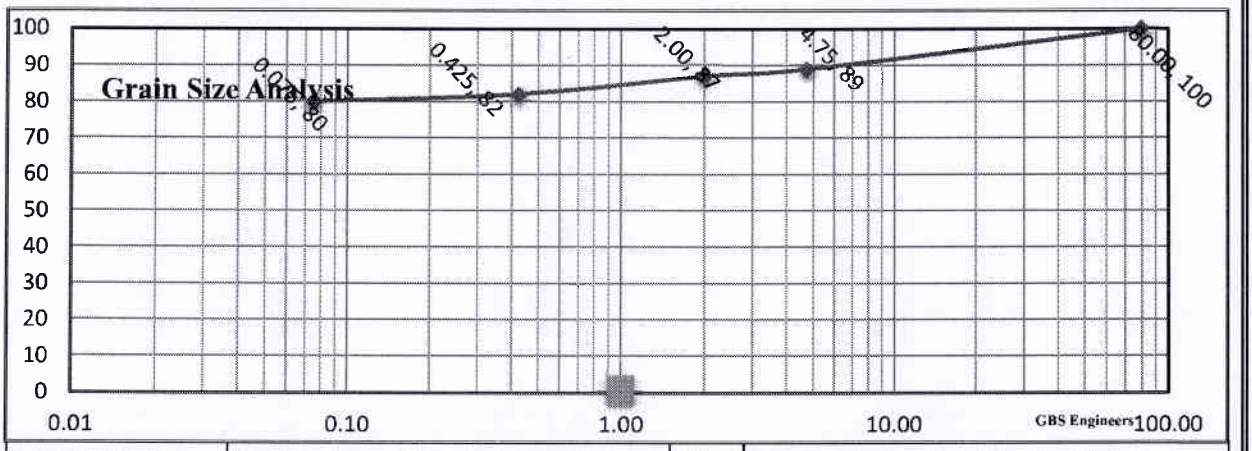


Bore Hole No. 1	:	Depth: 19.00 - 20.50 M		Client	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).
Name of Site	:	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section			



Bore Hole No. 1	:	Depth: 20.50 - 22.00 M		Client	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).
Name of Site	:	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section			



Bore Hole No. 1	:	Depth: 22.00 - 23.50 M		Client	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).
Name of Site	:	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section			

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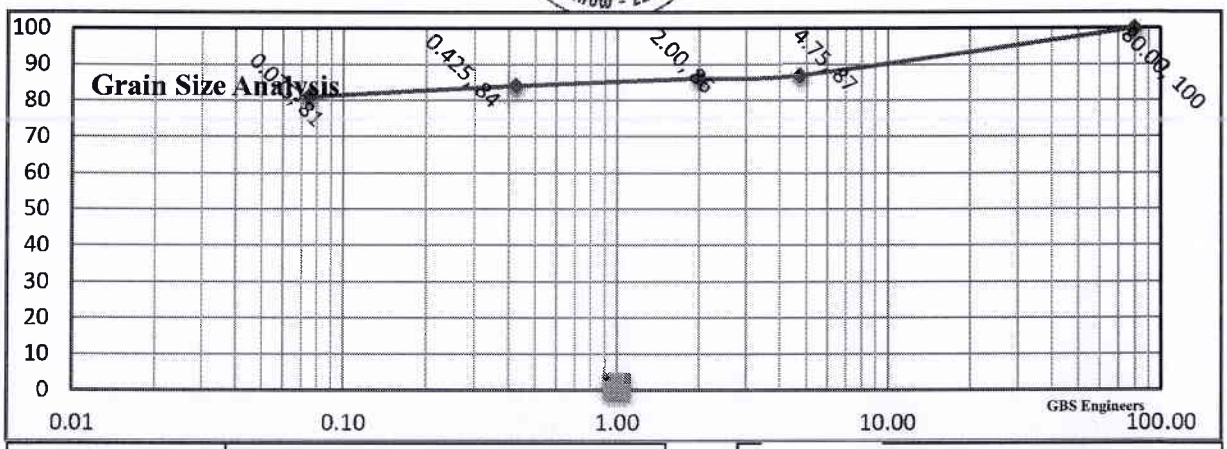
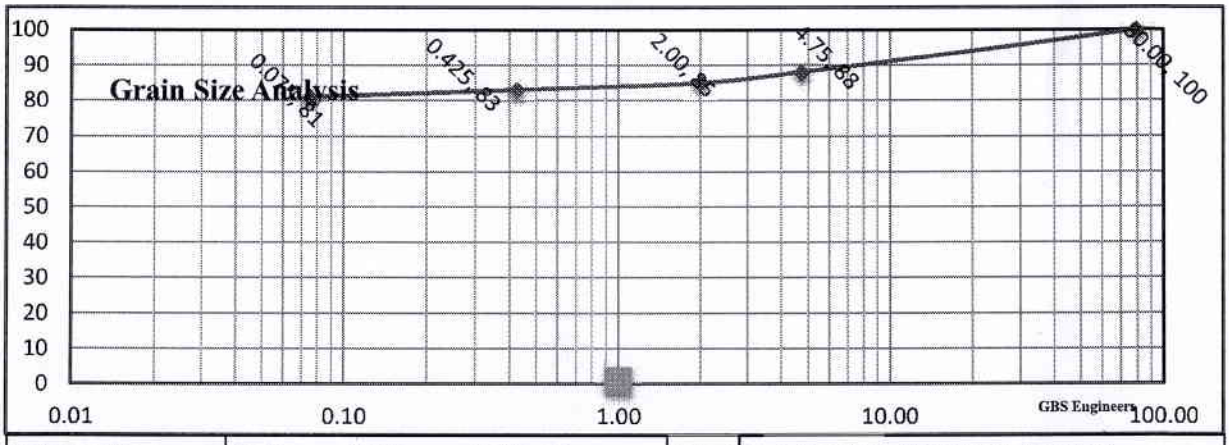
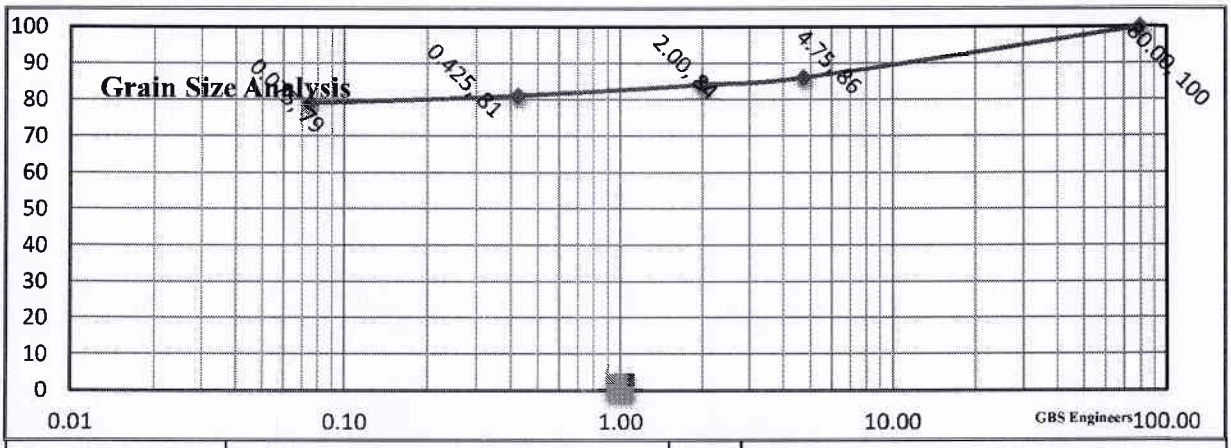


Bore Hole No. 1	:	Depth: 23.50 - 25.00 M		Client	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).
Name of Site	:	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section			



Bore Hole No. 1	:	Depth: 25.00 - 26.50 M		Client	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).
Name of Site	:	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section			



Bore Hole No. 1	:	Depth: 26.50 - 28.00 M		Client	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).
Name of Site	:	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section			

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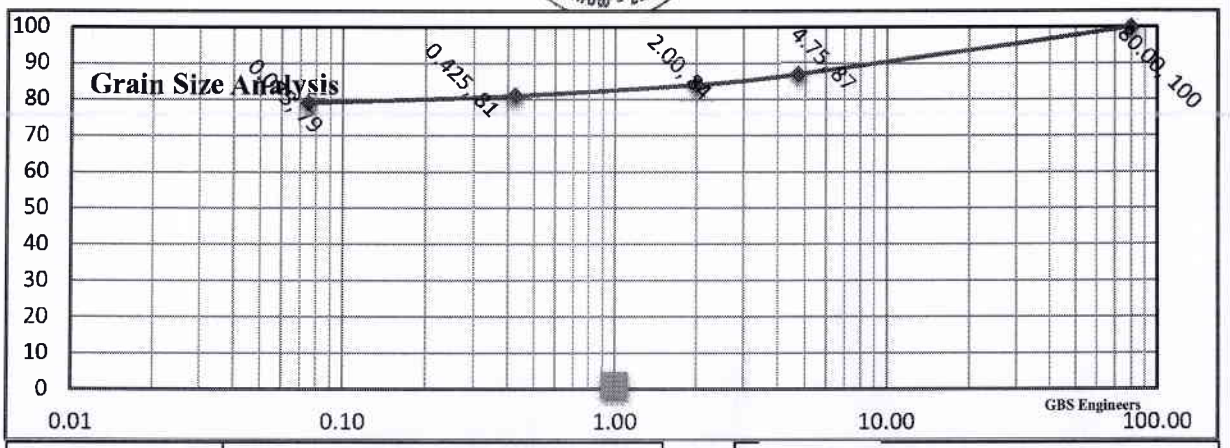
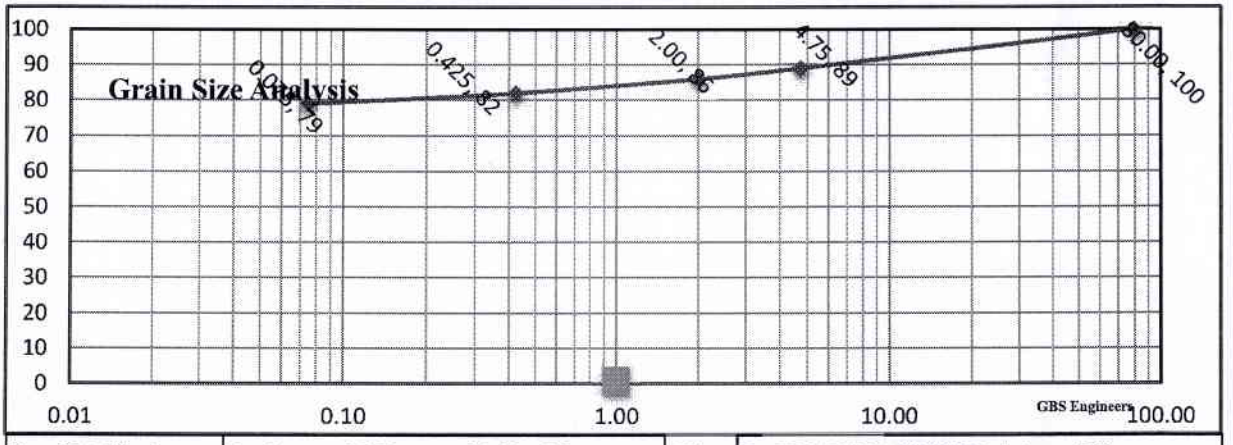
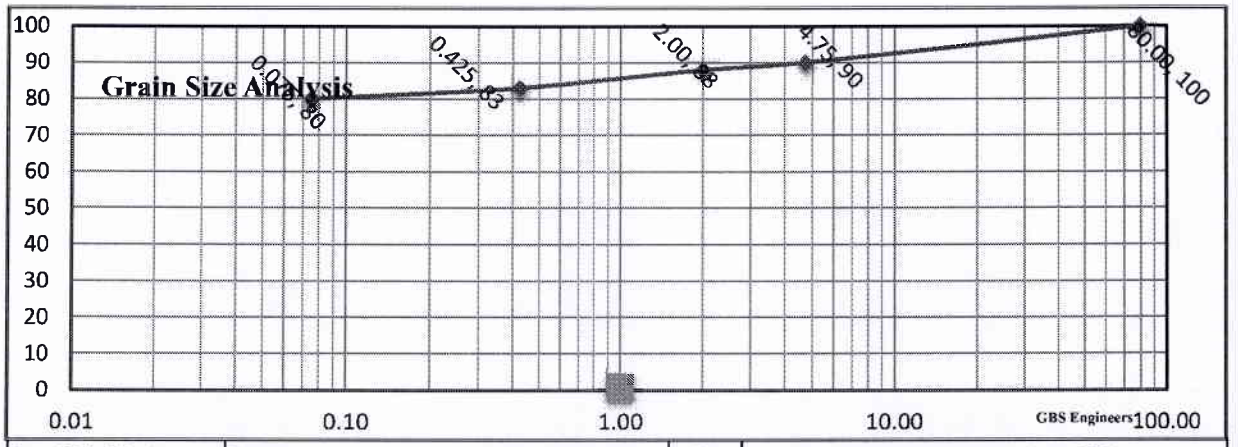


Bore Hole No. 1	:	Depth: 28.00 - 29.50 M		Client	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).
Name of Site	:	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section			



Bore Hole No. 1	:	Depth: 29.50 - 31.00 M		Client	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).
Name of Site	:	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section			



Bore Hole No. 1	:	Depth: 31.00 - 32.50 M		Client	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).
Name of Site	:	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section			

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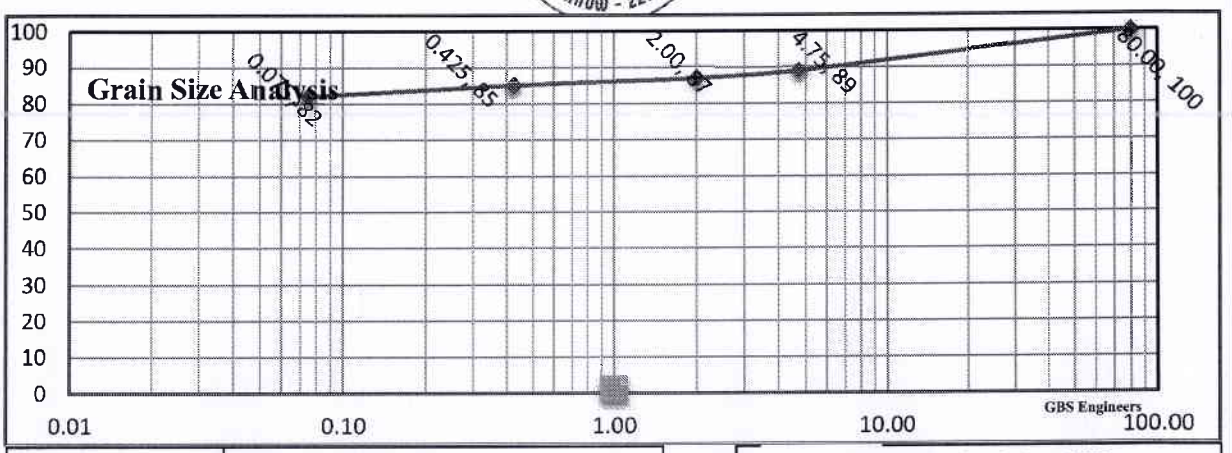
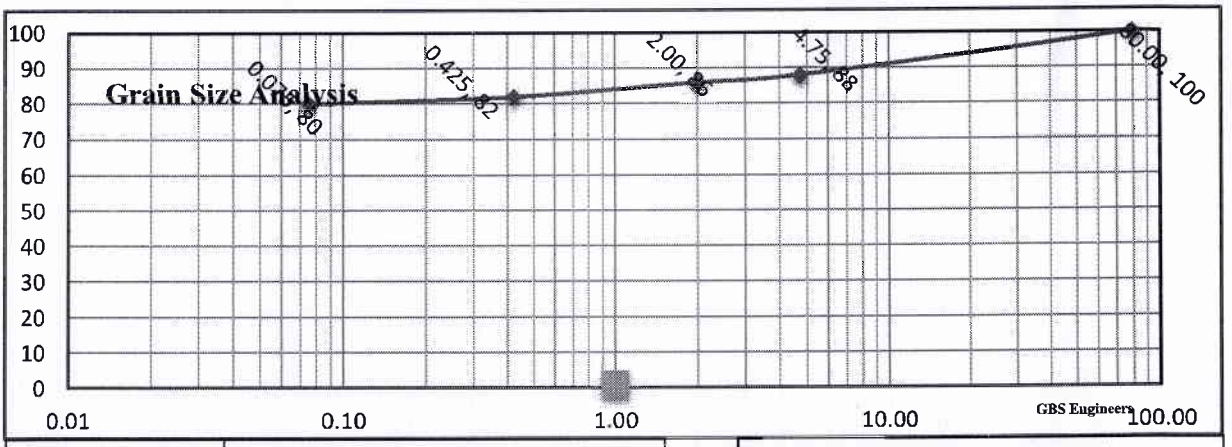


Bore Hole No. 1	:	Depth: 32.50 - 34.00 M		Client	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).
Name of Site	:	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section			



Bore Hole No. 1	:	Depth: 34.00 - 35.50 M		Client	Dy. PM, BCU-I, UPSBC Ltd, Agra (UP).
Name of Site	:	Railway Bridge B/w Nunihai Industrial Area Agra-Tundla Rail Section			

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U. P. State Bridge Corporation Ltd
Bridge Construction Unit-Agra

Signature Not Verified
Digitally signed by DINESH KUMAR YADAV
Date: 2026.05.15 18:59:16 IST
Location: Uttar Pradesh-UP