

Government of Peoples Republic of Bangladesh
Chattogram Water Supply and Sewerage Authority



Chattogram Water Supply Improvement Project (CWSIP)
IDA Credit No. 7675-BD & 7674-BD

Request for Proposals
for

**Design, Construction, Supply, Installation, Testing &
Commissioning for System Improvement and DMA Formation of**

Lot 1: Mohara Water Supply System

Lot 2: Modunaghat and Kalurghat Water Supply System

Volume-1-Part 1+Part 3
Volume 2A and 2B- Employer's Requirements
Volume-3A and 3B- Conceptual Drawing
Volume-4- Supplementary Information

RFP No: CWSIP/W1
Issued on: 12/07/2026

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SUB-SOIL INVESTIGATION REPORT
for
Chittagong WASH Improvement Project

Location: Chandgaon & Dhaka Trunk Road, Chattogram, Bangladesh

Consultant: Joint Venture of SUEZ Consulting (SAFEGE), France and Associates For Development Services Limited, Bangladesh

Project Owner: Chattogram Water Supply and Sewerage Authority (CWASA)

May 2023

Project Information

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Client : Joint Venture of SUEZ Consulting (SAFEGE), France and Associates For
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Project No : 2023

Report Issued By

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Executive Summary

- Site Location : Chandgaon and Dhaka Trunk Road, Chattogram, Bangladesh
- Investigation Date : 7/5/2023 & 11/5/2023-15/5/2023
- Key Observations :
- a) A WASH improvement project has been taken by the CWASA
 - b) Joint Venture of SUEZ Consulting (SAFEGE), France and Associates For Development Services Limited, Bangladesh is the consultant of this project.
 - c) **The consultant has assigned SEKKEI Engineering and Consultant** to conduct the sub-surface investigation at different locations of the proposed locations.
 - d) Based on the reconnaissance survey, practical consideration, and the client's requirement, five borehole locations were considered.
 - e) Samples (Disturbed and Undisturbed in an appropriate case) were extracted at every 1.0m interval for all borehole locations.
 - f) Allowable bearing capacity of soils for the shallow and deep foundations of different sizes was determined analytically.



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1. GENERAL

The Joint Venture of SUEZ Consulting (SAFEGE), France and Associates For Development Services Limited, Bangladesh appointed SEKKEI Engineering and Consultant for sub-soil investigation for the WASH project located in two areas of Chattogram Metropolitan Area. The in-situ investigation carried out by drilling and field tests and, subsequently, laboratory testing of soil samples collected at the site to determine the soil index and engineering properties are the primary moto of this investigation. The subsequent sections briefly discuss the field procedure, laboratory analysis, facts, and findings of the sub-soil investigation conducted for the mentioned project.

2. SCOPE OF THE INVESTIGATION

In line with the preceding introduction, the followings are the specific scope of the sub-soil investigation:

- a) Drilling to the desired depth by wash boring technique.
- b) To record field N value at 1.0m intervals using Standard Penetration Test (SPT).
- c) Collection of disturbed and undisturbed (in an appropriate case) soil samples for visual classification and laboratory testing.
- d) Interpretation of basic soil parameters as obtained from in-situ tests, laboratory tests, and engineering judgment for the substantial variation that exists in soil formation that is mostly heterogeneous in nature.
- e) Estimation of soil capacity for evaluating different foundation types for the proposed project in accordance with BNBC 2020 and other codes of practice.
- f) Provide a generic recommendation about sub-soil conditions.

3. OUTLINE OF THE WORK

The sub-soil investigation road map is shown in Fig.1 below:

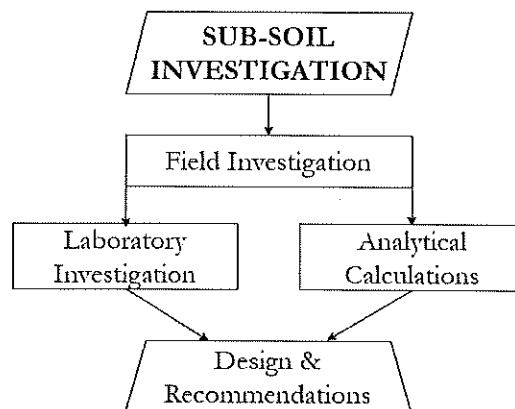


Fig. 1: Outline of Sub-soil Investigation

Firstly, the field execution, which includes drilling, sample collection, and SPT, was done under the direct supervision of an experienced engineer. Later, samples were collected in a separate plastic bag with appropriate identification marks and preserved at the site prior to transferring to the laboratory for necessary testing, and based on the soil properties, bearing capacity for a shallow foundation and axial pile capacity were determined.

4. GENERAL SITE DESCRIPTION

The CWASA has taken a WASH project, and Joint Venture of SUEZ Consulting (SAFEGE), France and Associates For Development Services Limited, Bangladesh is conducting a feasibility study for this project. Their concerned site is in Chandgaon and Alongkar areas of Chattogram Metropolitan Area. The accurate stratification of the concerned area is not available. However, information gathered from the surrounding area shows the existence of soft, thick clayey soils at shallow strata at Chandgaon site, while sandy layer exists from shallow depth at Alongkar site. The location of the borehole at Chandgaon site is shown in Fig. 2.



Fig. 2: Location of borehole for Chandgaon site

The location of boreholes for Dhaka Trunk Road site is shown in the following figure:



Fig.3: Location of boreholes for Dhaka Trunk Road site

The general elevation was found to be between 3.5-4.0m from MSL for Chandgaon site, and 5.0-6.0m for Dhaka Trunk road site, as seen from the available Digital Terrain Model. As part of the sub-soil investigation, Joint Venture of SUEZ Consulting (SAFEGE), France and Associates For Development Services Limited, Bangladesh chose two drilling locations. After that, drilling was continued up to the desired depth as specified by the client, and corresponding SPT was conducted together at every 1.0m interval. The disturbed and undisturbed samples were collected by appropriate extraction methods for visual classification and then recorded and preserved for the necessary laboratory investigation as appropriate. The boring log at the site can be identified using the following information given here:

Borehole No	Location	Date of Drilling	Depth of Drilling (m)
BH-01	22.371640, 91.848396	7/5/2023	35.0
BH-02-1	22.36465, 91.78163	11/5/2023	10.0
BH-02-2	22.36465, 91.78163	13/5/2023	10.0
BH-02-3	22.36489, 91.78164	15/5/2023	10.0
BH-02-4	22.36463, 91.78171	15/5/2023	10.0

5. METHODOLOGY

5.1 Field Investigation

Generally, holes are created at fixed locations up to the desired depth by a suitable method keeping an aim to minimize the disturbance to the soil for a better approximation of parameters. There are a set of options available for drilling. Among several drilling methods, wash boring of 100mm diameter using standard hammer weight operated manually was used for this project. Water was pumped to the bottom of the borehole, and the soil slurry was returned to the surface. A drill bit was rotated and dropped to produce a chopping action to advance to the desired depth. A schematic of the wash boring technique is shown in Fig. 4.

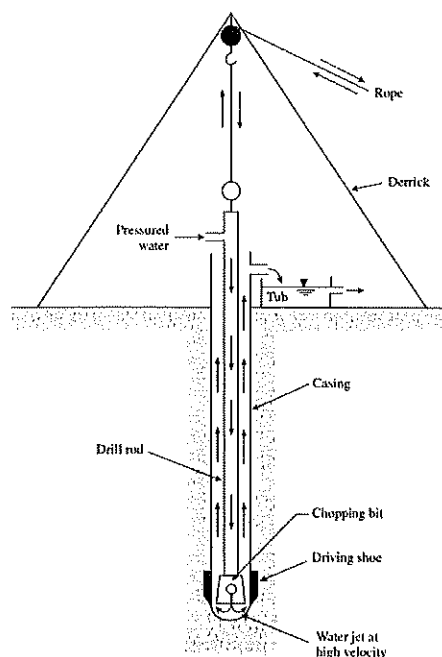


Fig. 4: Outline of Wash Boring (Ref: Geotechnical Engineering by B M Das)



Standard Penetration Test

Simultaneously with the drilling, a *Standard Penetration Test (SPT)* was conducted to record the Field N value at designated intervals up to the end of the drilling. The SPT was performed by driving a standard split spoon sampler into the ground by blows from a drop hammer of mass 63.5kg falling from 760mm as per ASTM D1586. The sampler was driven 152mm into the soil at the bottom of a borehole, and the number of blows (N) required to drive it an additional 304mm was counted. The number of blows required for the last two penetration of 152mm each is regarded as the *Standard Penetration Number* or, simply, the N value. The following figure shows the outline of SPT.

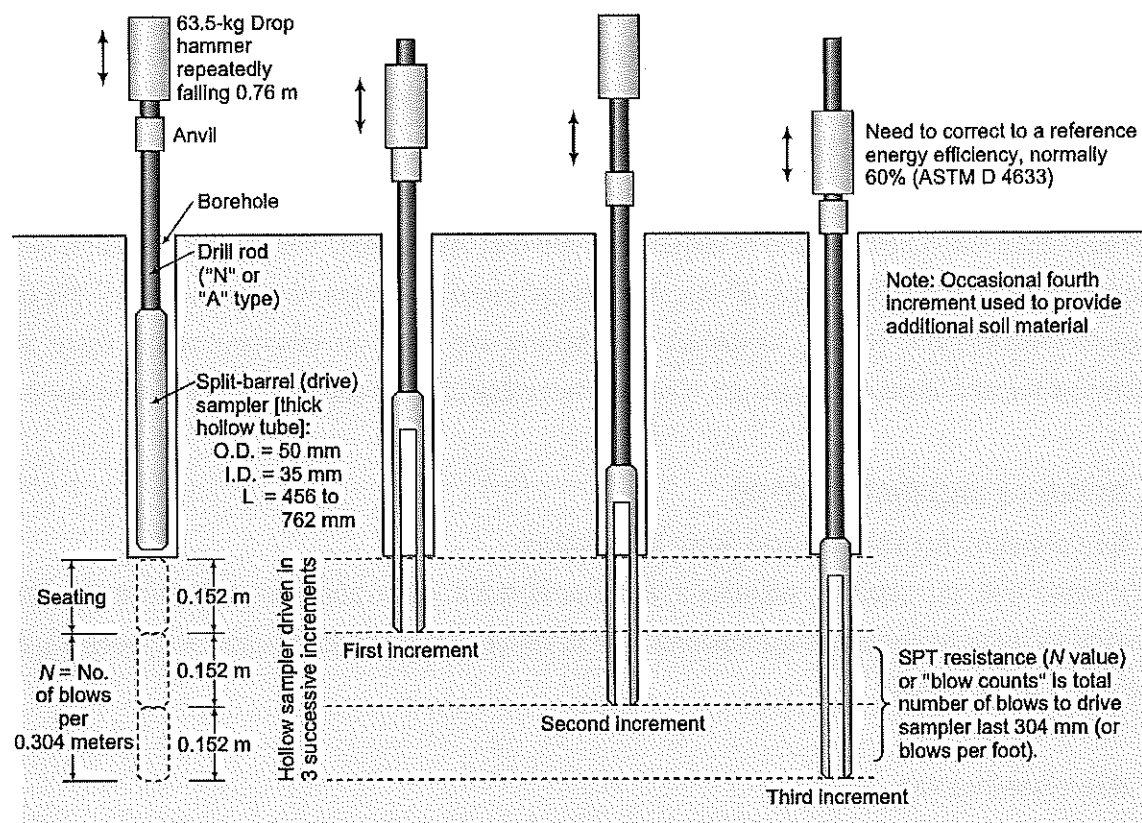


Fig. 5: Outline of Standard Penetration Test (Ref: Soil Mechanics by Muni Budhu)

After the SPT, samples were taken from the split spoon sampler and preserved in a controlled manner to keep their original moisture content and texture. A field bore log depicting the site condition with visual classification and signed by the concerned officials present at the site.

5.2 Laboratory Investigations

All the samples were brought to the laboratory with proper care to maintain minimum disturbance of soil samples to achieve their actual properties. The expert member of the team visually classified all samples, and thereafter, the selected samples were chosen for necessary laboratory investigations. A summary chart, as well as necessary graphs, is given as an annexure in the current report. The following laboratory tests were conducted on selected samples from each borehole location.

Name of the Test	Ref. Standard
Specific Gravity	ASTM D854-14
Grain Size Analysis	ASTM D422-63
Liquid Limit & Plastic Limit	ASTM D4318-10
Direct Shear	ASTM D3080M-11
Unconfined Compressive Strength	ASTM D2166M-13

5.3 Analytical Calculation

The recommendation of foundation/support types mostly depends on the super-imposed load, ground condition, instability criteria, and practical considerations. Bearing capacities for shallow and deep foundations are to be estimated in this report. The input parameters for calculating the bearing capacity of shallow and deep foundations require engineering properties of soils, which can be determined either by laboratory tests or by empirical equations. In the absence of adequate experimental data sets, the correlation between SPT, N, and related parameters is used, and some useful correlations are found in the BNBC 2020. Furthermore, the seismic hazard analysis requires the site class, which depends on average shear wave velocity and N values over the first 30m strata. The exact estimation of shear wave velocity requires the MASW test, which may not be available all the time and is out of the scope of the present investigation. Hence, simplified correlations are used to estimate shear wave velocities to determine the site class of the project. The detailed calculation procedure is given in Annex-A.

6. RESULTS AND DISCUSSIONS

6.1 Soil capacity for shallow and deep foundation

Both static bearing capacity equations and correlations were considered to estimate the allowable capacity for shallow and deep foundations. The detailed calculation for shallow and deep foundations are given for each borehole.

6.2 Site classification

The shear wave velocities were calculated using empirical formulas and given in the bore log. Assuming the same N values in the case of drilling less than 30m, the worst scenario has been analyzed for the site classification. For this report, the site class is not provided as the drilling was terminated before 30m.

6.3 Seismicity of the site

According to the BNBC (2020), the following are the seismic zone and zone coefficient of this project:

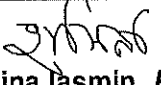
Seismic Zone	Seismic Intensity	Seismic Zone Coefficient, Z
Zone-3	Severe	0.28

7. GENERAL OBSERVATIONS & RECOMMENDATIONS

The contract was made to conduct two boreholes at two prospective sites. In line with the agreement, one borehole was drilled at the Chandgaon site till the desired depth to confirm the dense stratum for a deep foundation. However, difficulties during drilling were encountered at the Dhaka Trunk Road site. After drilling to 10.0m at the Dhaka Trunk Road site, a rigid slab was found (as cement mixes were found at the depth), and further drilling was stopped as the cutter blade broke several times. Discussing with the local engineers, four locations were chosen for the Dhaka Trunk Road site, and a similar geological profile was observed. Results of all four boreholes at the Dhaka Trunk Road site are given in the report. The specific observation for each site is summarized below:

- a) Soft clayey soils were found near the ground surface at the Chandgaon site. Low plastic fine-grained soils, mainly alluvial deposition, have been seen at shallow depths. A dense stratum was encountered after 28.0m and was found to be continuous and sufficiently thick as a bearing stratum.
- b) Medium to dense sandy soil layer was encountered at the Dhaka Trunk Road site from the shallow depth. A shallow foundation may be considered if the superimposed load is not large.
- c) The presence of thick, soft soils requires special consideration while designing a lateral bracing system for deep excavation (if applicable) for the Chandgaon site. Especially the lateral stability and heaving shall be analyzed with careful consideration.
- d) Visually, the soil is inorganic. However, only some samples can be tested to check the organic content of the soils.
- e) The desk study also convinced that the soil is not expansive. Therefore, the hazards associated with alternated drying and wetting may be insignificant and threaten the structure's stability.
- f) The fine-grained soils were low, primarily plastic, and the sand layer mostly contained fine sand for all boreholes.

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CORRECTIONS TO SPT, N

It is desirable to standardize the field SPT as a function of the input driving energy and its dissipation around the sampler. The variations in testing procedures may be at least partially compensated by converting the field N to N_{60} as follows:

$$N_{60} = \frac{E_H C_B C_S C_R N}{0.60} \quad (1)$$

Where, E_H is the Hammer efficiency, C_B is Borehole diameter correction, C_S is Sampler correction, C_R is Rod length correction, N is the field SPT.

The tables provided in the BNBC-2020 is used to get the correction factors:

Table-1: Correction factor for Hammer efficiency (Ref: BNBC 2020)

Hammer Type	Hammer Mechanism	Release Efficiency, E_H
Automatic	Trip	0.70
Donut	Hand dropped	0.60
Donut	Cathead + 2 turns	0.50
Safety	Cathead + 2turns	0.55-0.60
Drop/ Pin	Hand dropped	0.45

Table-2: Correction factors for SPT, N (Ref: BNBC 2020)

Factor	Equipment Variables	Correction Factor
Borehole Diameter Factor, C_B	65 mm – 115 mm	1.00
	150 mm	1.05
	200 mm	1.15
Sampling Method Factor, C_S	Standard sampler	1.00
	Sampler without liner	1.20
Rod Length Factor, C_R	3 m – 4 m	0.75
	4 m – 6 m	0.85
	6 m – 10 m	0.95
	> 10 m	1.00

For cohesionless soils, overburden correction factor has been applied as per following equations:

$$C_N = 0.77 \log \left(\frac{2000}{\sigma'} \right) \quad (2)$$

The above correction factor is multiplied to the N_{60} to consider the overburden stress. In addition, dilatancy correction has been used for sandy soils.



BEARING CAPACITY FOR SHALLOW FOUNDATION

Generally, there are several methods available for the estimation of bearing capacity for shallow foundation. No specific guideline is given for different soil and foundation types. To date, the earliest and mostly used method is Terzaghi's bearing capacity equation. This method has proven to be useful in many practical cases, therefore, used in the current report for estimation of bearing capacity. In addition, in-situ SPT, N value driven bearing capacity is calculated. Finally, these two-bearing capacity are averaged (weighted) to recommend safe bearing capacity for shallow foundation. The following equation depict the Terzaghi's bearing capacity for shallow foundation:

$$q_u = cN_c + q'N_q + \frac{1}{2}\gamma BN_\gamma \quad (3)$$

Where, symbols carry their usual meaning.

The bearing capacity factors are function of soil friction angle, the following chart is used to get the factors:

Table-3: Terzaghi's bearing capacity factors (Ref: Principles of Foundation Engineering by B M Das)

ϕ'	N_c	N_q	N_γ	ϕ'	N_c	N_q	N_γ
0	5.70	1.00	0.00	26	27.09	14.21	9.84
1	6.00	1.10	0.01	27	29.24	15.90	11.60
2	6.30	1.22	0.04	28	31.61	17.81	13.70
3	6.62	1.35	0.06	29	34.24	19.98	16.18
4	6.97	1.49	0.10	30	37.16	22.46	19.13
5	7.34	1.64	0.14	31	40.41	25.28	22.65
6	7.73	1.81	0.20	32	44.04	28.52	26.87
7	8.15	2.00	0.27	33	48.09	32.23	31.94
8	8.60	2.21	0.35	34	52.64	36.50	38.04
9	9.09	2.44	0.44	35	57.75	41.44	45.41
10	9.61	2.69	0.56	36	63.53	47.16	54.36
11	10.16	2.98	0.69	37	70.01	53.80	65.27
12	10.76	3.29	0.85	38	77.50	61.55	78.61
13	11.41	3.63	1.04	39	85.97	70.61	95.03
14	12.11	4.02	1.26	40	95.66	81.27	115.31
15	12.86	4.45	1.52	41	106.81	93.85	140.51
16	13.68	4.92	1.82	42	119.67	108.75	171.99
17	14.60	5.45	2.18	43	134.58	126.50	211.56
18	15.12	6.04	2.59	44	151.95	147.74	261.60
19	16.56	6.70	3.07	45	172.28	173.28	325.34
20	17.69	7.44	3.64	46	196.22	204.19	407.11
21	18.92	8.26	4.31	47	224.55	241.80	512.84
22	20.27	9.19	5.09	48	258.28	287.85	650.67
23	21.75	10.23	6.00	49	298.71	344.63	831.99
24	23.36	11.40	7.08	50	347.50	415.14	1072.80
25	25.13	12.72	8.34				

However, the Terzaghi's method do not consider the shape, depth and inclination factor. Therefore, an updated general bearing capacity equation has been proposed by Meyerhof, which is now commonly used in many practical applications. The general bearing capacity equation given by Meyerhof is written below:

$$q_u = cN_c s_c d_c i_c + q'N_q s_q d_q i_q + \frac{1}{2}\gamma B N_\gamma s_\gamma d_\gamma i_\gamma \quad (4)$$

Where, the bearing capacity factors are estimated by the following equations:

$$N_q = \tan^2 \left(45 + \frac{\phi'}{2} \right) e^{\pi \tan \phi'} \quad (5)$$

$$N_c = (N_q - 1) \cot \phi' \quad (6)$$

$$N_\gamma = (N_q - 1) \tan 1.4\phi' \quad (7)$$

Shape and depth factors are estimated by the following equations:

$$s_c = \begin{cases} 1 + 0.2 \frac{B}{L} & ; \text{ if } \phi = 0 \\ 1 + 0.2 \frac{B}{L} \tan^2 \left(45 + \frac{\phi'}{2} \right) & ; \text{ if } \phi \geq 10 \end{cases} \quad (8)$$

$$s_q = s_\gamma = \begin{cases} 1 & ; \text{ if } \phi = 0 \\ 1 + 0.1 \frac{B}{L} \tan^2 \left(45 + \frac{\phi'}{2} \right) & ; \text{ if } \phi \geq 10 \end{cases} \quad (9)$$

$$d_c = \begin{cases} 1 + 0.2 \frac{D}{B} & ; \text{ if } \phi = 0 \\ 1 + 0.2 \frac{D}{B} \tan \left(45 + \frac{\phi'}{2} \right) & ; \text{ if } \phi \geq 10 \end{cases} \quad (10)$$

$$d_q = d_\gamma = \begin{cases} 1 & ; \text{ if } \phi = 0 \\ 1 + 0.1 \frac{D}{B} \tan \left(45 + \frac{\phi'}{2} \right) & ; \text{ if } \phi \geq 10 \end{cases} \quad (11)$$

To estimate bearing capacity using SPT, N; the equation proposed by Bowels (1977) used in this report.

The equation is given below:

$$q_{net} = \begin{cases} \frac{N_{60}}{2.5} F_d \frac{S_e}{25} & \text{if } B \leq 1.22m \\ \frac{N_{60}}{0.08} F_d \left(\frac{B + 0.3}{B} \right)^2 \frac{S_e}{25} & \text{if } B > 1.22m \end{cases} \quad (12)$$

Where, S_e is the design settlement for the foundation

$$F_d = 1 + 0.33 \frac{D}{B} \quad (13)$$

AXIAL CAPACITY FOR PILE FOUNDATION

Axial capacity for pile foundation can be estimated by using any of the following three methods:

1. Axial capacity by standard bearing capacity equation
2. Axial capacity by load test
3. Axial capacity by in-situ correlations (using SPT, N)

The ultimate pile capacity is the summation of end bearing and skin friction, which is depicted in the following equation:

$$Q_u = Q_b + Q_s = f_b A_b + \sum_{i=1}^n f_{si} A_{si} \quad (14)$$

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The following equations are used for estimation of end bearing and skin friction.

Table-4: Equations for estimation of pile capacity

Method	Sand	Clay
Static Bearing Capacity (Meyerhof)	$f_b = q' N_q^* \leq 0.5 P_a N_q^* \tan \varphi$ $f_s = K \sigma'_0 \tan \delta$ [up to L'] $L' = 15D$ $K = 1.4(1 - \sin \varphi)$	$f_b = 9c_u$ $f_s = \alpha c_u$ $\alpha = \begin{cases} 1.0 & c_u \leq 25 \text{ kPa} \\ 0.5 & c_u \geq 70 \text{ kPa} \\ 1 - \frac{c_u - 25}{70} & 25 < c_u < 70 \end{cases}$
BNBC 2020 (SPT Based)	$f_b = 40 N_{60} \frac{L}{D} \leq 400 N_{60} \leq 11000$ $f_s = 2 N_{60} \leq 60$	$f_b = 45 N_{60} \leq 4000$ $f_s = 1.8 N_{60} \leq 70$

ESTIMATION OF SHEAR WAVE VELOCITIES AND SITE CLASSIFICATION

Site is classified as SA, SB, SC, SD, SE, S1 and S2 based on the provisions of the Bangladesh National Building Code (2020). For the classifications, average shear wave velocities and average SPT, N values of upper 30.0m of the site profiles has been used. The following equations are used to estimate the average shear wave velocity and average SPT, N.

$$\bar{V}_s = \frac{\sum_{i=1}^n d_i}{\sum_{i=1}^n \frac{d_i}{V_{si}}} \quad (15)$$

$$\bar{N} = \frac{\sum_{i=1}^n d_i}{\sum_{i=1}^n \frac{d_i}{N_i}} \quad (16)$$

Where, d_i is the thickness of each layer, V_{si} is the shear wave velocity of each layer, N_i is the uncorrected SPT, N of each layer. SPT, N values has been used to estimate shear wave velocities of entire strata. The following generalized equations are used to estimate shear wave velocity:

$$V_s = \begin{cases} 97.3062 N^{0.3393} & \text{for all soils} \\ 82.01 N^{0.3829} & \text{for sand} \\ 100.58 N^{0.3410} & \text{for clay} \end{cases} \quad (17)$$

The following table is used to define site class of the proposed project:

Site Class	Description of soil profile up to 30 meters depth	Average Soil Properties in top 30 meters		
		Shear wave velocity, $\bar{V}_s$ (m/s)	SPT Value, $\bar{N}$ (blows/30cm)	Undrained shear strength, $\bar{S}_u$ (kPa)
SA	Rock or other rock-like geological formation, including at most 5 m of weaker material at the surface.	> 800	--	--
SB	Deposits of very dense sand, gravel, or very stiff clay, at least several tens of metres in thickness, characterised by a gradual increase of mechanical properties with depth.	360 – 800	> 50	> 250
SC	Deep deposits of dense or medium dense sand, gravel or stiff clay with thickness from several tens to many hundreds of metres.	180 – 360	15 - 50	70 - 250
SD	Deposits of loose-to-medium cohesionless soil (with or without some soft cohesive layers), or of predominantly soft-to-firm cohesive soil.	< 180	< 15	< 70
SE	A soil profile consisting of a surface alluvium layer with V_s values of type SC or SD and thickness varying between about 5 m and 20 m, underlain by stiffer material with $V_s > 800$ m/s.	--	--	--
S ₁	Deposits consisting, or containing a layer at least 10 m thick, of soft clays/silts with a high plasticity index ($PI > 40$) and high water content	< 100 (indicative)	--	10 - 20
S ₂	Deposits of liquefiable soils, of sensitive clays, or any other soil profile not included in types SA to SE or S ₁	--	--	--



ESTIMATION OF LIQUEFACTION SEVERITY

Generally, soil liquefaction occurs when saturated soils loses its strength due to the excess pore water during an intense shake. Liquefaction is responsible for damages of many structures during past earthquakes. Normally, liquefaction severity is estimated by determining the factor of safety against liquefaction. The soil is considered to be safe against liquefaction if factor of safety value is greater than one. The factor of safety is estimated as the ratio of cyclic resistance by cyclic stress. The cyclic resistance is estimated using the in-situ SPT, N values, while the probable maximum earthquake magnitude and seismic acceleration are used to estimate cyclic stress. Among several available methods, the updated version of the Seed's estimation procedure has been used in this report. The following flow chart provides necessary equations used to estimate the liquefaction severity.

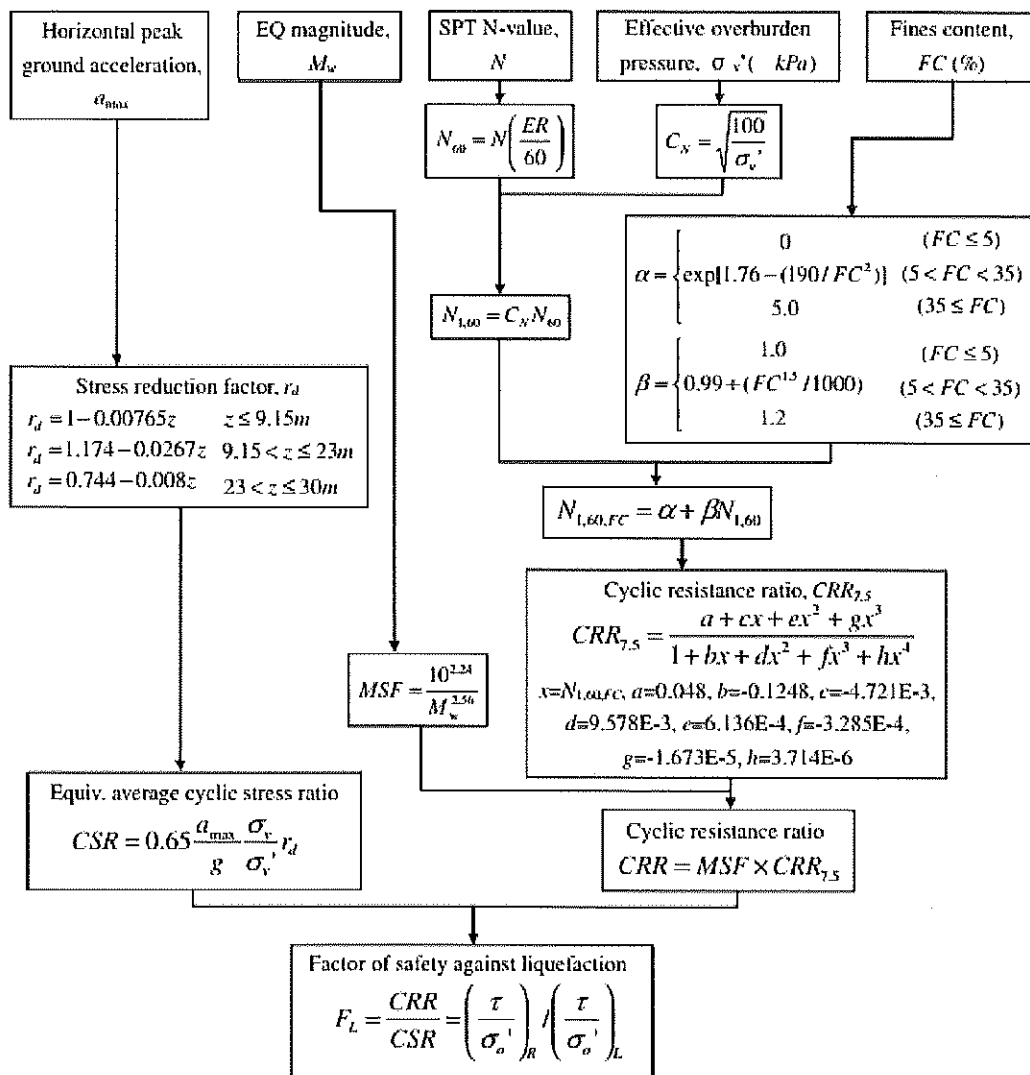


Fig.1: Flow-chart for estimation of liquefaction severity

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Borehole No: **BH-01**

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Bore Log

Project Name:	Chittagong WASH Improvement Project		
Location:	Chandgaon, Chattogram (22.371640, 91.848396)		
Borehole No:	BH-01	Depth of Water Table in m (From EGL) :	0.0
Date of Boring (Starting):	7-May-2023	RL at EGL (m):	0.0000

Drilling Details

Drilling Method:	Wash	Drilling Type:	Manual	Borehole Dia (mm):	100
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Correction Factor (for SPT, N)

Hammer Efficiency	0.80	Borehole Diameter	1.00	Standard Sampler	1.00	Rod Length	0.85
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Elevation (m)	Depth (m)	Sample Type	Soil Type	Visual Description of the Strata	Symbol	Standard Penetration Test (SPT)				Variation of SPT, N	N ₆₀	q' (kPa)	c (kPa)	φ (d)	Vs (m/s)
						15 cm	30 cm	45 cm	SPT, N						
-1.0	1.0	D	Silt	Filling Soils		2	1	2	3		3	7.4	---	28.0	133.1
-2.0	2.0	D	Silt			5	4	5	9		8	14.9	---	29.0	189.4
-3.0	3.0	U	Clay	Clayey Soils; Soft		5	1	5	6		5	21.9	31.3	---	171.1
-4.0	4.0	U	Clay			1	1	1	2		2	28.6	12.5	---	125.3
-5.0	5.0	U	Clay			1	1	2	3		3	35.0	18.8	---	143.8
-6.0	6.0	D	Clay			1	0	1	1		1	42.4	6.3	---	98.9
-7.0	7.0	D	Clay			1	0	1	1		1	48.7	6.3	---	98.9
-8.0	8.0	D	Clay			1	0	1	1		1	55.0	6.3	---	98.9
-9.0	9.0	D	Clay			1	2	3	5		4	61.3	25.0	---	158.6
-10.0	10.0	D	Clay			2	3	4	7		6	67.9	37.5	---	182.0
-11.0	11.0	D	Silt	Silty Soils; Soft		3	3	4	7		6	74.6	---	29.0	170.8
-12.0	12.0	U	Silt			1	1	2	3		3	81.4	---	28.0	133.1
-13.0	13.0	D	Silt			1	1	2	3		3	88.9	---	28.0	133.1
-14.0	14.0	D	Silt			1	1	2	3		3	96.3	---	28.0	133.1
-15.0	15.0	D	Silt	Clayey Soils; Soft		1	1	1	2		2	103.8	---	28.0	115.0
-16.0	16.0	D	Clay			1	1	2	3		3	110.1	18.8	---	143.8
-17.0	17.0	D	Clay			1	2	2	4		3	117.6	18.8	---	143.8
-18.0	18.0	D	Clay			1	2	2	4		3	125.0	18.8	---	143.8
-19.0	19.0	D	Clay			1	2	3	5		4	132.5	25.0	---	158.6
-20.0	20.0	D	Clay			2	2	3	5		4	139.1	25.0	---	158.6
-21.0	21.0	D	Silt	Silty Soils; Medium Stiff		5	5	7	12		10	145.6	---	30.0	205.3
-22.0	22.0	D	Clay	Clayey Soils; Medium Stiff		4	6	7	13		11	152.8	68.8	---	223.7
-23.0	23.0	D	Clay			5	6	8	14		12	160.1	75.0	---	230.4
-24.0	24.0	D	Clay			5	6	6	12		10	167.5	62.5	---	216.5
-25.0	25.0	D	Clay			6	7	8	15		13	174.7	81.3	---	236.8
-26.0	26.0	D	Clay			5	7	8	15		13	182.2	81.3	---	236.8
-27.0	27.0	D	Clay			7	8	9	17		14	189.7	87.5	---	242.8
-28.0	28.0	D	Sand	Sand with Silt; Dense		22	30	20	50		43	197.3	---	40.0	347.4
-29.0	29.0	D	Sand			50+	---	---	50		43	206.5	---	40.0	347.4
-30.0	30.0	D	Sand			50+	---	---	50		43	215.7	---	40.0	347.4
-31.0	31.0	D	Sand			50+	---	---	50		43	224.8	---	40.0	347.4
-32.0	32.0	D	Sand			50+	---	---	50		43	234.0	---	40.0	347.4
-33.0	33.0	D	Sand			50+	---	---	50		43	243.2	---	40.0	347.4
-34.0	34.0	D	Sand			50+	---	---	50		43	252.4	---	40.0	347.4
-35.0	35.0	D	Sand			50+	---	---	50		43	261.6	---	40.0	347.4
-36.0	36.0					---	---	---	---		---	---	---	---	---
-37.0	37.0					---	---	---	---		---	---	---	---	---
-38.0	38.0					---	---	---	---		---	---	---	---	---
-39.0	39.0					---	---	---	---		---	---	---	---	---
-40.0	40.0					---	---	---	---		---	---	---	---	---

** c, φ, and Vs are calculated based on standard correlation with SPT

Sand
 Silt
 Clay
 Shale
 D = Disturbed Sample U = Undisturbed Sample

Project Name:	Chittagong WASH Improvement Project
Location:	Chandgaon, Chattogram (22.371640, 91.848396)

Borehole No:	BH-01	Date of Boring:	7-May-2023	RL at EGL:	0.0000	Factor of Safety :	3.0
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Axial Pile Capacity as per Static Bearing Capacity

Elevation (m)	Depth (m)	N	N ₆₀	Width:1.5 m		Width:2 m		Width:2.5 m		Recommended Allowable Bearing Pressure (kPa)		
				q _a -1 (kPa)	q _a -2 (kPa)	q _a -1 (kPa)	q _a -2 (kPa)	q _a -1 (kPa)	q _a -2 (kPa)	Width:1.5 m	Width:2 m	Width:2.5 m
-1.0	1.0	3	3	69.7	63.7	78.2	69.7	86.7	75.98501	66.7	73.9	81.3
-1.5	1.5	6	5	101.5	97.5	110.5	102.3	119.5	100.1476	99.5	106.4	109.8
-2.0	2.0	9	8	125.0	126.0	134.4	129.2	143.9	121.374	125.5	131.8	132.6
-3.0	3.0	6	5	66.6	82.1	66.6	76.8	66.6	63.28667	74.3	71.7	64.9
-4.0	4.0	2	2	33.2	42.2	33.2	39.4	33.2	32.19567	37.7	36.3	32.7
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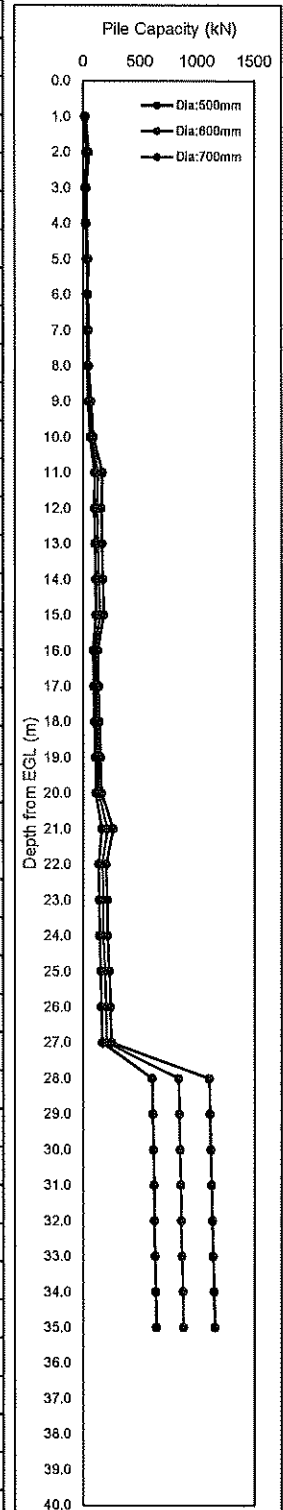
Note: q_a-1: using Terzaghi's bearing capacity formula, q_a-2: using Meyerhof bearing capacity formula
 1kPa=0.010 t/ft²

Project Name:	Chittagong WASH Improvement Project
Location:	Chandgaon, Chattogram (22.371640, 91.848396)

Borehole No:	BH-01	Date of Boring:	7-May-2023	RL at EGL (m):	0.0000	Factor of Safety :	3.0
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Axial Pile Capacity using Static Bearing Capacity

Elevation (m)	Depth (m)	N	N ₆₀	End Bearing & Skin Friction		Allowable Pile Capacity		
				fb(kPa)	fs (kPa)	Dia:500mm	Dia:600mm	Dia:700mm
-1.0	1.0	3	3	153.7	1.0	10.6	15.1	20.4
-2.0	2.0	9	8	366.0	2.0	25.2	36.0	48.7
-3.0	3.0	6	5	140.6	21.3	16.6	22.1	28.4
-4.0	4.0	2	2	56.3	9.4	19.1	23.8	28.8
-5.0	5.0	3	3	84.4	14.1	27.1	33.8	41.0
-6.0	6.0	1	1	28.1	4.7	28.3	34.4	40.7
-7.0	7.0	1	1	28.1	4.7	30.8	37.4	44.1
-8.0	8.0	1	1	28.1	4.7	33.2	40.3	47.5
-9.0	9.0	5	4	112.5	18.8	44.9	55.6	66.9
-10.0	10.0	7	6	168.8	23.1	59.5	74.1	89.5
-11.0	11.0	7	6	681.6	9.8	101.7	132.8	167.4
-12.0	12.0	3	3	549.3	9.8	98.2	126.5	157.6
-13.0	13.0	3	3	549.3	9.8	103.4	132.7	164.8
-14.0	14.0	3	3	549.3	9.8	108.5	138.8	172.1
-15.0	15.0	2	2	549.3	9.8	113.7	145.0	179.3
-16.0	16.0	3	3	84.4	9.8	88.4	107.4	126.8
-17.0	17.0	4	3	84.4	9.8	93.5	113.6	134.1
-18.0	18.0	4	3	84.4	9.8	98.7	119.8	141.3
-19.0	19.0	5	4	112.5	9.8	105.7	128.6	152.1
-20.0	20.0	5	4	112.5	9.8	110.9	134.8	159.3
-21.0	21.0	12	10	845.1	9.8	164.0	210.0	260.5
-22.0	22.0	13	11	309.4	9.8	134.1	165.7	199.0
-23.0	23.0	14	12	337.5	9.8	141.0	174.6	209.8
-24.0	24.0	12	10	281.3	9.8	142.5	175.4	209.8
-25.0	25.0	15	13	365.6	9.8	153.2	189.6	227.9
-26.0	26.0	15	13	365.6	9.8	158.4	195.8	235.1
-27.0	27.0	17	14	393.8	9.8	165.4	204.6	245.9
-28.0	28.0	50	43	7011.6	9.8	603.6	834.5	1102.1
-29.0	29.0	50	43	7011.6	9.8	608.8	840.7	1109.3
-30.0	30.0	50	43	7011.6	9.8	614.0	846.9	1116.5
-31.0	31.0	50	43	7011.6	9.8	619.1	853.1	1123.7
-32.0	32.0	50	43	7011.6	9.8	624.3	859.3	1131.0
-33.0	33.0	50	43	7011.6	9.8	629.4	865.4	1138.2
-34.0	34.0	50	43	7011.6	9.8	634.6	871.6	1145.4
-35.0	35.0	50	43	7011.6	9.8	639.7	877.8	1152.6
-36.0	36.0	---	---	---	---	---	---	---
-37.0	37.0	---	---	---	---	---	---	---
-38.0	38.0	---	---	---	---	---	---	---
-39.0	39.0	---	---	---	---	---	---	---
-40.0	40.0	---	---	---	---	---	---	---



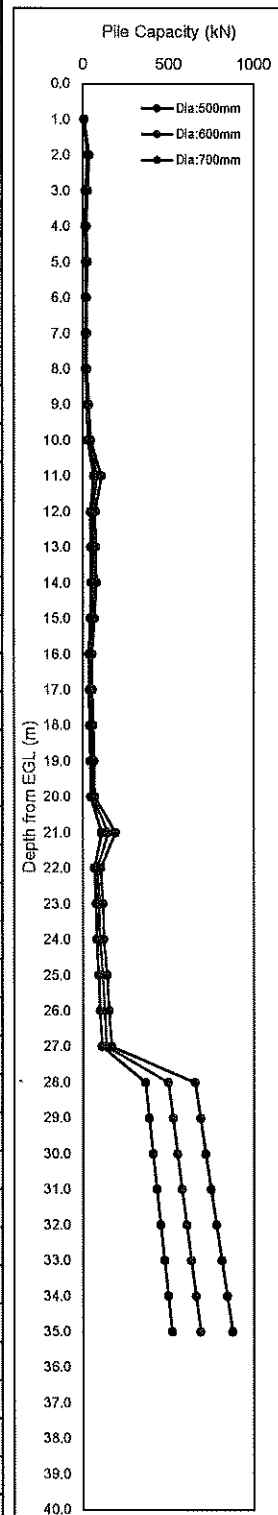
Note: Q_a = Allowable axial pile capacity in kN; $1kN=0.101\text{ Ton}$

Project Name:	Chittagong WASH Improvement Project
Location:	Chandgaon, Chattogram (22.371640, 91.848396)

Borehole No:	BH-01	Date of Boring:	7-May-2023	RL at EGL (m):	0.0000	Factor of Safety :	3.0
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Axial Pile Capacity using SPT, N

Elevation (m)	Depth (m)	N	N ₆₀	End Bearing & Skin Friction		Allowable Pile Capacity		
				f _b (kPa)	f _s (kPa)	Dia:500mm	Dia:600mm	Dia:700mm
-1.0	1.0	3	3	51.0	2.7	5.3	6.4	7.5
-2.0	2.0	9	8	271.7	7.2	24.9	29.9	34.9
-3.0	3.0	6	5	125.0	6.0	15.6	20.7	26.5
-4.0	4.0	2	2	50.0	2.4	12.9	16.3	19.9
-5.0	5.0	3	3	75.0	3.6	16.1	20.5	25.3
-6.0	6.0	1	1	25.0	1.2	14.1	17.3	20.7
-7.0	7.0	1	1	25.0	1.2	14.8	18.1	21.6
-8.0	8.0	1	1	25.0	1.2	15.4	18.8	22.4
-9.0	9.0	5	4	100.0	4.8	21.9	27.8	34.3
-10.0	10.0	7	6	150.0	7.2	28.3	36.3	45.1
-11.0	11.0	7	6	600.0	5.4	61.0	82.7	107.4
-12.0	12.0	3	3	300.0	2.7	43.5	56.9	71.9
-13.0	13.0	3	3	300.0	2.7	44.9	58.6	73.9
-14.0	14.0	3	3	300.0	2.7	46.3	60.3	75.9
-15.0	15.0	2	2	200.0	1.8	41.0	52.3	64.7
-16.0	16.0	3	3	75.0	3.6	34.2	42.2	50.6
-17.0	17.0	4	3	75.0	3.6	36.1	44.5	53.3
-18.0	18.0	4	3	75.0	3.6	38.0	46.7	55.9
-19.0	19.0	5	4	100.0	4.8	41.8	51.7	62.2
-20.0	20.0	5	4	100.0	4.8	44.3	54.8	65.7
-21.0	21.0	12	10	1000.0	9.0	106.8	143.9	186.2
-22.0	22.0	13	11	275.0	13.2	65.2	82.6	101.4
-23.0	23.0	14	12	300.0	14.4	74.1	93.6	114.7
-24.0	24.0	12	10	250.0	12.0	77.7	97.2	117.9
-25.0	25.0	15	13	325.0	15.6	89.8	112.9	137.7
-26.0	26.0	15	13	325.0	15.6	98.0	122.7	149.1
-27.0	27.0	17	14	350.0	16.8	108.1	135.2	164.2
-28.0	28.0	50	43	4000.0	43.0	362.7	498.0	654.3
-29.0	29.0	50	43	4000.0	43.0	385.2	525.1	685.9
-30.0	30.0	50	43	4000.0	43.0	407.7	552.1	717.4
-31.0	31.0	50	43	4000.0	43.0	430.2	579.1	748.9
-32.0	32.0	50	43	4000.0	43.0	452.7	606.1	780.4
-33.0	33.0	50	43	4000.0	43.0	475.2	633.1	811.9
-34.0	34.0	50	43	4000.0	43.0	497.8	660.1	843.5
-35.0	35.0	50	43	4000.0	43.0	520.3	687.2	875.0
-36.0	36.0	---	---	---	---	---	---	---
-37.0	37.0	---	---	---	---	---	---	---
-38.0	38.0	---	---	---	---	---	---	---
-39.0	39.0	---	---	---	---	---	---	---
-40.0	40.0	---	---	---	---	---	---	---



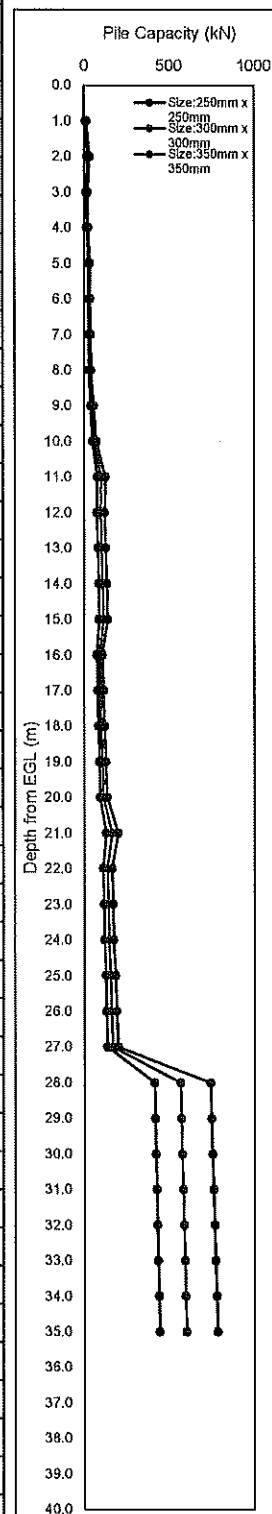
Note: Q_p = Allowable axial pile capacity in kN; $1kN=0.101\text{ Ton}$

Project Name:	Chittagong WASH Improvement Project
Location:	Chandgaon, Chattogram (22.371640, 91.848396)

Borehole No:	BH-01	Date of Boring:	7-May-2023	RL at EGL (m):	0.0000	Factor of Safety :	3.0
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Axial Pile Capacity using Static Bearing Capacity.

Elevation (m)	Depth (m)	N	N ₆₀	End Bearing & Skin Friction		Allowable Pile Capacity		
				fb(kPa)	fs (kPa)	Size:250mm x 250mm	Size:300mm x 300mm	Size:350mm x 350mm
-1.0	1.0	3	3	307.5	1.3	6.8	9.7	13.2
-2.0	2.0	9	8	731.9	2.6	16.3	23.3	31.4
-3.0	3.0	6	5	281.3	28.5	12.1	16.0	20.3
-4.0	4.0	2	2	112.5	12.5	15.4	19.1	22.9
-5.0	5.0	3	3	168.8	18.8	21.8	27.0	32.5
-6.0	6.0	1	1	56.3	6.3	23.6	28.6	33.7
-7.0	7.0	1	1	56.3	6.3	25.7	31.1	36.7
-8.0	8.0	1	1	56.3	6.3	27.8	33.6	39.6
-9.0	9.0	5	4	225.0	25.0	36.5	45.0	53.8
-10.0	10.0	7	6	337.5	30.8	48.2	59.5	71.4
-11.0	11.0	7	6	1363.3	13.1	76.9	99.1	123.5
-12.0	12.0	3	3	1098.6	13.1	75.7	96.4	118.8
-13.0	13.0	3	3	1098.6	13.1	80.1	101.6	125.0
-14.0	14.0	3	3	1098.6	13.1	84.5	106.9	131.1
-15.0	15.0	2	2	1098.6	13.1	88.9	112.1	137.2
-16.0	16.0	3	3	168.8	13.1	73.9	89.5	105.4
-17.0	17.0	4	3	168.8	13.1	78.2	94.7	111.5
-18.0	18.0	4	3	168.8	13.1	82.6	100.0	117.6
-19.0	19.0	5	4	225.0	13.1	88.2	106.9	126.0
-20.0	20.0	5	4	225.0	13.1	92.5	112.2	132.2
-21.0	21.0	12	10	1690.2	13.1	127.4	161.4	198.1
-22.0	22.0	13	11	618.8	13.1	109.5	134.5	160.5
-23.0	23.0	14	12	675.0	13.1	115.0	141.4	168.9
-24.0	24.0	12	10	562.5	13.1	117.1	143.3	170.5
-25.0	25.0	15	13	731.3	13.1	125.0	153.6	183.5
-26.0	26.0	15	13	731.3	13.1	129.3	158.9	189.6
-27.0	27.0	17	14	787.5	13.1	134.9	165.8	198.0
-28.0	28.0	50	43	14023.1	13.1	415.0	568.1	744.6
-29.0	29.0	50	43	14023.1	13.1	419.4	573.4	750.7
-30.0	30.0	50	43	14023.1	13.1	423.8	578.6	756.9
-31.0	31.0	50	43	14023.1	13.1	428.1	583.9	763.0
-32.0	32.0	50	43	14023.1	13.1	432.5	589.1	769.1
-33.0	33.0	50	43	14023.1	13.1	436.9	594.4	775.2
-34.0	34.0	50	43	14023.1	13.1	441.3	599.6	781.4
-35.0	35.0	50	43	14023.1	13.1	445.6	604.9	787.5
-36.0	36.0	---	---	---	---	---	---	---
-37.0	37.0	---	---	---	---	---	---	---
-38.0	38.0	---	---	---	---	---	---	---
-39.0	39.0	---	---	---	---	---	---	---
-40.0	40.0	---	---	---	---	---	---	---



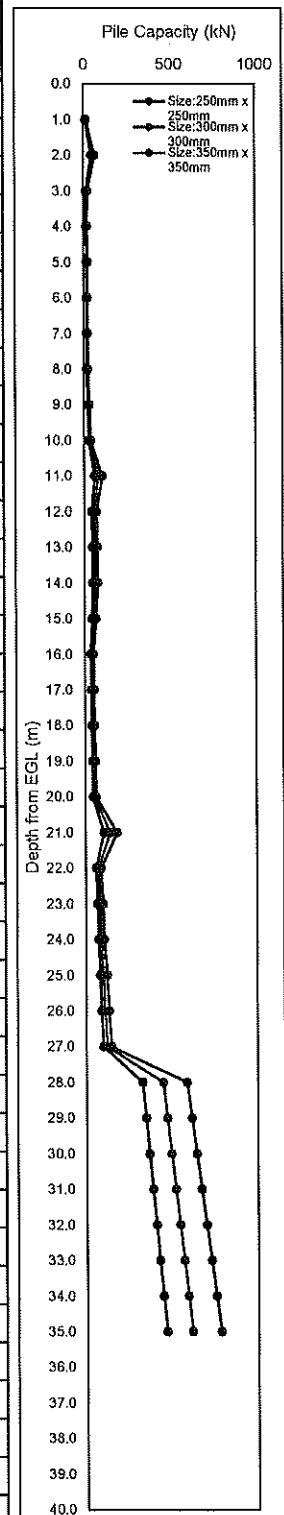
Note: Q_a = Allowable axial pile capacity in kN; 1kN=0.101 Ton

Project Name:	Chittagong WASH Improvement Project
Location:	Chandgaon, Chattogram (22.371640, 91.848396)

Borehole No:	BH-01	Date of Boring:	7-May-2023	RL at EGL (m):	0.0000	Factor of Safety :	3.0
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Axial Pile Capacity using SPT, N

Elevation (m)	Depth (m)	N	N ₆₀	End Bearing & Skin Friction		Allowable Pile Capacity		
				fb(kPa)	fs (kPa)	Size:250mm x 250mm	Size:300mm x 300mm	Size:350mm x 350mm
-1.0	1.0	3	3	305.7	5.1	9.2	11.0	12.9
-2.0	2.0	9	8	1630.5	13.6	44.8	53.8	62.7
-3.0	3.0	6	5	225.0	9.0	13.3	17.1	21.2
-4.0	4.0	2	2	90.0	3.6	12.6	15.5	18.6
-5.0	5.0	3	3	135.0	5.4	15.0	18.7	22.6
-6.0	6.0	1	1	45.0	1.8	14.3	17.4	20.6
-7.0	7.0	1	1	45.0	1.8	14.9	18.1	21.4
-8.0	8.0	1	1	45.0	1.8	15.5	18.9	22.3
-9.0	9.0	5	4	180.0	7.2	19.8	24.7	29.9
-10.0	10.0	7	6	270.0	10.8	24.7	31.0	37.7
-11.0	11.0	7	6	1800.0	10.2	60.1	81.1	105.1
-12.0	12.0	3	3	900.0	5.1	43.9	57.2	71.9
-13.0	13.0	3	3	900.0	5.1	45.6	59.2	74.3
-14.0	14.0	3	3	900.0	5.1	47.3	61.2	76.7
-15.0	15.0	2	2	600.0	3.4	42.5	53.9	66.4
-16.0	16.0	3	3	135.0	5.4	34.2	41.8	49.5
-17.0	17.0	4	3	135.0	5.4	36.0	43.9	52.0
-18.0	18.0	4	3	135.0	5.4	37.8	46.1	54.5
-19.0	19.0	5	4	180.0	7.2	40.9	49.9	59.3
-20.0	20.0	5	4	180.0	7.2	43.3	52.8	62.7
-21.0	21.0	12	10	3000.0	17.0	106.1	142.3	183.5
-22.0	22.0	13	11	495.0	19.8	60.0	74.5	89.8
-23.0	23.0	14	12	540.0	21.6	67.8	84.1	101.3
-24.0	24.0	12	10	450.0	18.0	72.6	89.3	106.8
-25.0	25.0	15	13	585.0	23.4	82.3	101.7	122.0
-26.0	26.0	15	13	585.0	23.4	90.1	111.0	132.9
-27.0	27.0	17	14	630.0	25.2	99.1	122.1	146.1
-28.0	28.0	50	43	11000.0	60.0	329.4	450.2	589.4
-29.0	29.0	50	43	11000.0	60.0	349.4	474.2	617.4
-30.0	30.0	50	43	11000.0	60.0	369.4	498.2	645.4
-31.0	31.0	50	43	11000.0	60.0	389.4	522.2	673.4
-32.0	32.0	50	43	11000.0	60.0	409.4	546.2	701.4
-33.0	33.0	50	43	11000.0	60.0	429.4	570.2	729.4
-34.0	34.0	50	43	11000.0	60.0	449.4	594.2	757.4
-35.0	35.0	50	43	11000.0	60.0	469.4	618.2	785.4
-36.0	36.0	---	---	---	---	---	---	---
-37.0	37.0	---	---	---	---	---	---	---
-38.0	38.0	---	---	---	---	---	---	---
-39.0	39.0	---	---	---	---	---	---	---
-40.0	40.0	---	---	---	---	---	---	---



Note: Q_a = Allowable axial pile capacity in kN; $1\text{kN}=0.101\text{ Ton}$

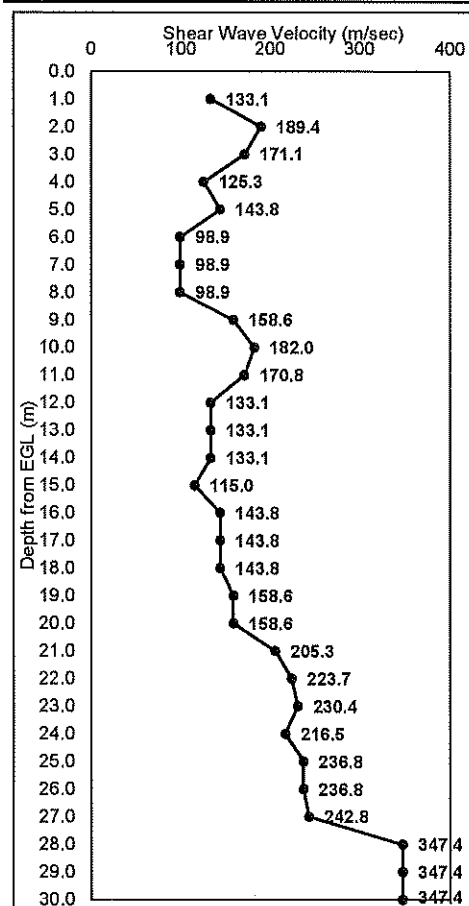
Project Name:	Chittagong WASH Improvement Project
Location:	Chandgaon, Chattogram (22.371640, 91.848396)

Borehole No:	BH-01	Date of Boring:	7-May-2023	RL at EGL (m):	0.0000
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Axial Pile Capacity as per Static Bearing Capacity

Elevation (m)	Depth (m)	N	N ₆₀	Vs (m/sec)
-1.0	1.0	3	3	133.1
-2.0	2.0	9	8	189.4
-3.0	3.0	6	5	171.1
-4.0	4.0	2	2	125.3
-5.0	5.0	3	3	143.8
-6.0	6.0	1	1	98.9
-7.0	7.0	1	1	98.9
-8.0	8.0	1	1	98.9
-9.0	9.0	5	4	158.6
-10.0	10.0	7	6	182.0
-11.0	11.0	7	6	170.8
-12.0	12.0	3	3	133.1
-13.0	13.0	3	3	133.1
-14.0	14.0	3	3	133.1
-15.0	15.0	2	2	115.0
-16.0	16.0	3	3	143.8
-17.0	17.0	4	3	143.8
-18.0	18.0	4	3	143.8
-19.0	19.0	5	4	158.6
-20.0	20.0	5	4	158.6
-21.0	21.0	12	10	205.3
-22.0	22.0	13	11	223.7
-23.0	23.0	14	12	230.4
-24.0	24.0	12	10	216.5
-25.0	25.0	15	13	236.8
-26.0	26.0	15	13	236.8
-27.0	27.0	17	14	242.8
-28.0	28.0	50	43	347.4
-29.0	29.0	50	43	347.4
-30.0	30.0	50	43	347.4

Average Vs (m/s)	161.5
Average N	3.4
Site Class	SD

**Note**

SA: Rock or other rock-like geological formation

SB: Deposits of very dense sand, gravel, or very stiff clay, at least several tens of metres in thickness

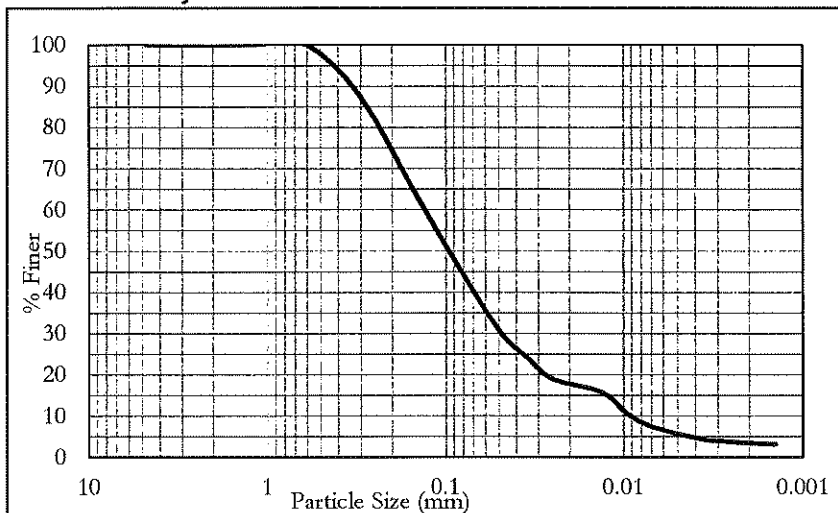
SC: Deep deposits of dense or medium dense sand, gravel or stiff clay with thickness from several tens to many hundreds of metres

SD: Deposits of loose-to-medium cohesionless soil (with or without some soft cohesive layers)

Depth (m)	Elevation (m)	Specific gravity	Water content (%)	Bulk density (g/cm ³)	Bulk density (kN/m ³)	Dry density (kN/m ³)	Grain Size Analysis		Atterberg Limit			Direct Shear Test		Unconfined Compression Test		
							Sand (%)	Fines (%)	LL (%)	PL (%)	PI (%)	c (kPa)	φ (degree)	q _u (kPa)	c _u (kPa)	Strain at Failure (%)
3-3.5	-3	—	28.98	1.73	16.97	13.1581	—	—	37	29	8	—	—	—	—	—
4-4.5	-4	—	30.23	—	—	—	57.81	42.19	—	—	—	—	—	—	—	—
5-5.5	-5	—	32.18	1.76	17.27	13.0622	—	—	—	—	—	—	—	36	18	3.66
6-6.5	-6	2.66	—	—	—	—	—	—	—	—	—	—	—	—	—	—
7-7.5	-7	—	32.23	—	—	—	—	—	—	—	—	—	—	—	—	—
8-8.5	-8	—	—	—	—	—	57.31	42.69	—	—	—	—	—	—	—	—
9-9.5	-9	2.67	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10-10.5	-10	—	—	—	—	—	—	—	35	28	7	—	—	—	—	—
11-11.5	-11	—	29.34	—	—	—	—	—	—	—	—	—	—	—	—	—
12-12.5	-12	—	30.23	1.8	17.66	13.5591	—	—	—	—	—	—	—	—	—	—
13-13.5	-13	2.67	—	—	—	—	—	—	—	—	—	—	—	—	—	—
14-14.5	-14	—	32.98	—	—	—	—	—	—	—	—	—	—	—	—	—
16-16.5	-16	—	—	—	—	—	57.32	42.68	—	—	—	—	—	—	—	—
17-17.5	-17	2.68	—	—	—	—	—	—	—	—	—	—	—	—	—	—
18-18.5	-18	—	29.32	—	—	—	—	—	—	—	—	—	—	—	—	—
20-20.5	-20	—	33.45	—	—	—	50.56	49.44	—	—	—	—	—	—	—	—
22-22.5	-22	—	34.54	—	—	—	—	—	—	—	—	—	—	—	—	—
25-25.5	-25	—	—	—	—	—	—	—	35	27	8	—	—	—	—	—
30-30.5	-30	—	—	—	—	—	90.34	9.66	—	—	—	0	38.7	—	—	—
35-35.5	-35	—	—	—	—	—	—	—	—	—	—	0	35.1	—	—	—

Grain Size Analysis of Soil Sample

Project Name:	Chittagong WASH Improvement Project		
Location:	Chandgaon, Chattogram (22.371640, 91.848396)		
Date of Boring:	7-May-2023	Borehole No.:	BH-01
Sample Type	Disturbed	Depth (m):	4

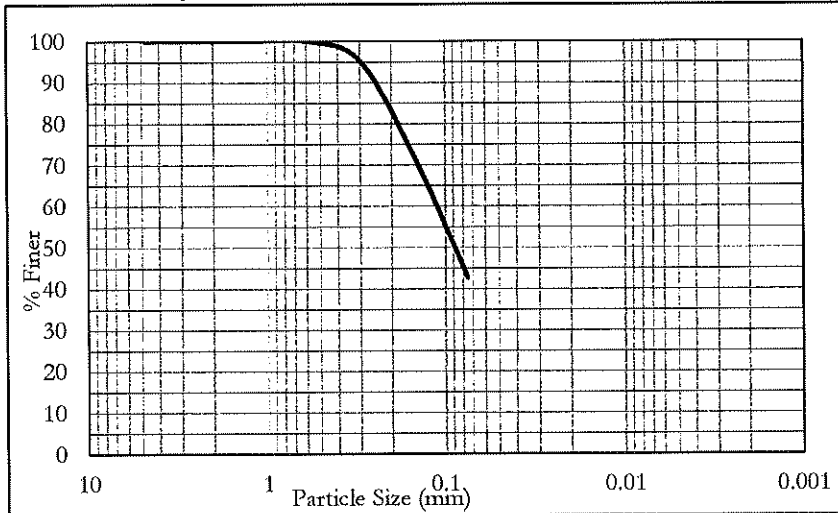
Grain Size Analysis

Particle Size (mm)	% Finer
4.750	100.000
2.380	100.000
1.190	100.000
0.600	100.000
0.300	87.369
0.150	64.141
0.075	42.193
0.048	29.533
0.035	24.259
0.025	18.985
0.013	15.821
0.010	10.547
0.007	7.383
0.003	4.219
0.001	3.164

Soil Type	Unit	Value	Remarks
Sand	%	57.81	Ref: ASTM D2487-11
Coarse Sand	%	0.00	
Medium Sand	%	0.00	
Fine Sand	%	57.81	
Fines	%	42.19	Ref: ASTM D422
Silt	%	38.19	
Clay	%	4.00	Ref: ASTM D2487-11
D ₆₀	%	0.140	
D ₃₀	%	0.048	
D ₁₀	%	0.080	
C _u	%	1.750	
C _c	%	0.206	

Grain Size Analysis of Soil Sample

Project Name:	Chittagong WASH Improvement Project		
Location:	Chandgaon, Chattogram (22.371640, 91.848396)		
Date of Boring:	7-May-2023	Borehole No :	BH-01
Sample Type	Disturbed	Depth (m):	8

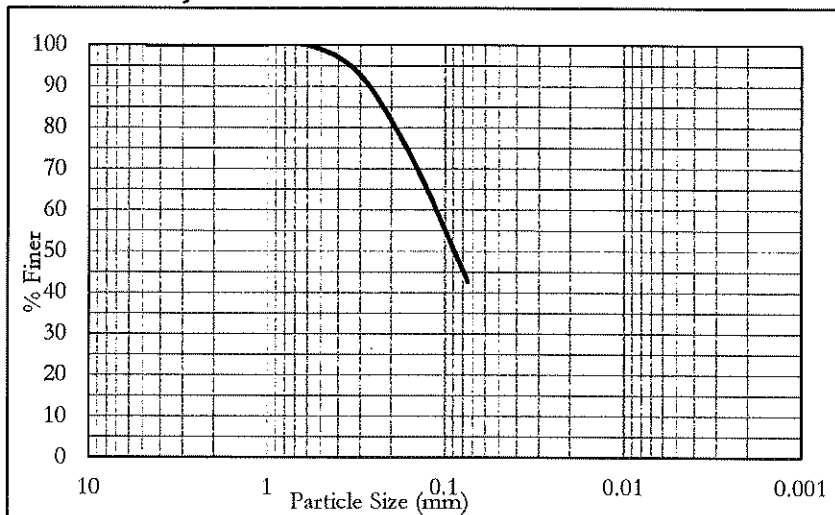
Grain Size Analysis

Particle Size (mm)	% Finer
4.750	100.000
2.380	100.000
1.190	100.000
0.600	100.000
0.300	95.294
0.150	72.268
0.075	42.688
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000

Soil Type	Unit	Value	Remarks
Sand	%	57.31	Ref: ASTM D2487-11
Coarse Sand	%	0.00	
Medium Sand	%	0.00	
Fine Sand	%	57.31	
Fines	%	42.69	Ref: ASTM D422
Silt	%	42.69	
Clay	%	0.00	Ref: ASTM D2487-11
D ₆₀	%	0.120	
D ₃₀	%	----	
D ₁₀	%	----	
C _u	%	----	
C _c	%	----	

Grain Size Analysis of Soil Sample

Project Name:	Chittagong WASH Improvement Project		
Location:	Chandgaon, Chattogram (22.371640, 91.848396)		
Date of Boring:	7-May-2023	Borehole No :	BH-01
Sample Type	Disturbed	Depth (m):	16

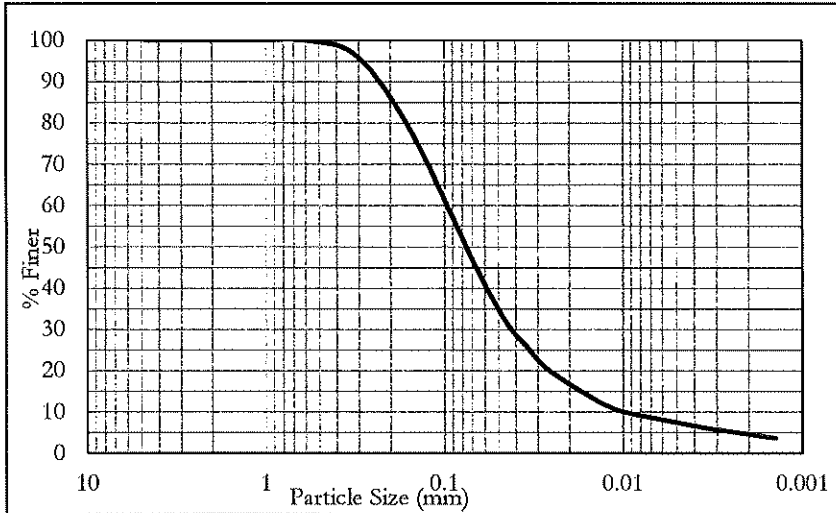
Grain Size Analysis

Particle Size (mm)	% Finer
4.750	100.000
2.380	100.000
1.190	100.000
0.600	100.000
0.300	92.759
0.150	71.729
0.075	42.679
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000

Soil Type	Unit	Value	Remarks
Sand	%	57.32	Ref: ASTM D2487-11
Coarse Sand	%	0.00	
Medium Sand	%	0.00	
Fine Sand	%	57.32	
Fines	%	42.68	Ref: ASTM D422
Silt	%	42.68	
Clay	%	0.00	Ref: ASTM D2487-11
D ₆₀	%	0.130	
D ₃₀	%	----	
D ₁₀	%	----	
C _u	%	----	
C _c	%	----	

Grain Size Analysis of Soil Sample

Project Name:	Chittagong WASH Improvement Project		
Location:	Chandgaon, Chattogram (22.371640, 91.848396)		
Date of Boring:	7-May-2023	Borehole No :	BH-01
Sample Type	Disturbed	Depth (m):	20

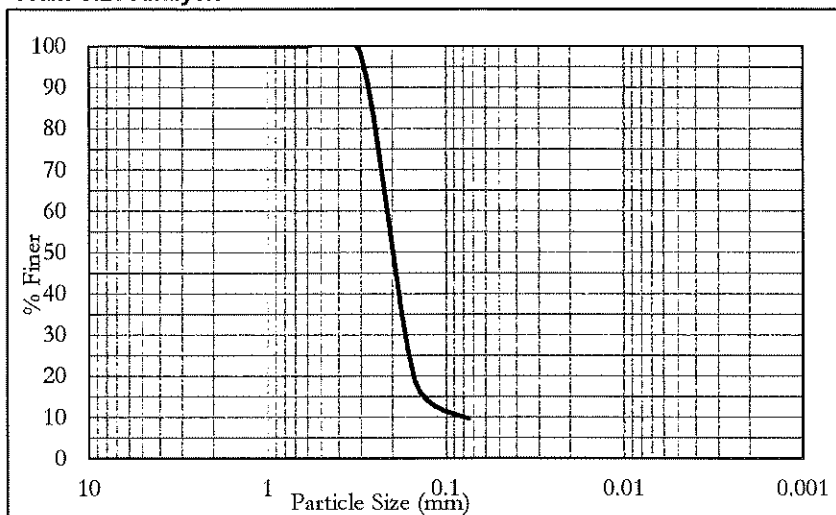
Grain Size Analysis

Particle Size (mm)	% Finer
4.750	100.000
2.380	100.000
1.190	100.000
0.600	100.000
0.300	95.911
0.150	77.087
0.075	49.438
0.048	33.368
0.035	25.953
0.025	19.774
0.014	12.359
0.010	9.887
0.007	8.651
0.003	6.179
0.001	3.708

Soil Type	Unit	Value	Remarks
Sand	%	50.56	Ref: ASTM D2487-11
Coarse Sand	%	0.00	
Medium Sand	%	0.00	
Fine Sand	%	50.56	
Fines	%	49.44	Ref: ASTM D422
Silt	%	45.44	
Clay	%	4.00	Ref: ASTM D2487-11
D ₆₀	%	0.100	
D ₃₀	%	0.040	
D ₁₀	%	0.010	
C _u	%	10.000	
C _c	%	1.600	

Grain Size Analysis of Soil Sample

Project Name:	Chittagong WASH Improvement Project		
Location:	Chandgaon, Chattogram (22.371640, 91.848396)		
Date of Boring:	7-May-2023	Borehole No :	BH-01
Sample Type	Disturbed	Depth (m):	30

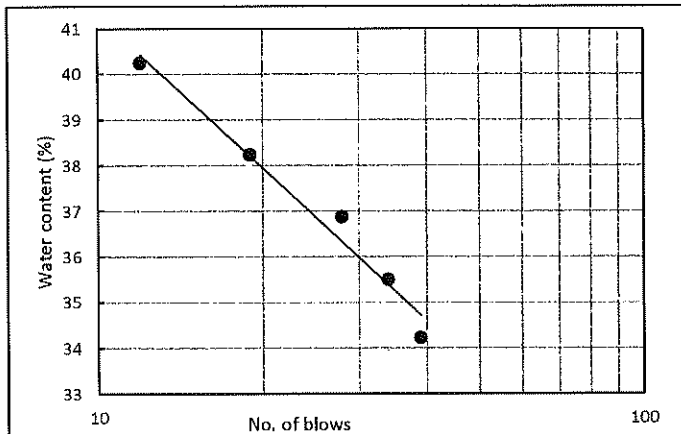
Grain Size Analysis

Particle Size (mm)	% Finer
4.750	100.000
2.380	100.000
1.190	100.000
0.600	100.000
0.300	98.165
0.150	18.777
0.075	9.664
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000

Soil Type	Unit	Value	Remarks
Sand	%	90.34	Ref: ASTM D2487-11
Coarse Sand	%	0.00	
Medium Sand	%	0.00	
Fine Sand	%	90.34	
Fines	%	9.66	Ref: ASTM D422
Silt	%	9.66	
Clay	%	0.00	
	%	0.00	
D ₆₀	%	0.200	Ref: ASTM D2487-11
D ₃₀	%	0.180	
D ₁₀	%	0.080	
C _u	%	2.500	
C _c	%	2.025	

Liquid Limit & Plastic Limit Test of Soil Sample

Project Name:	Chittagong WASH Improvement Project		
Location:	Chandgaon, Chattogram (22.371640, 91.848396)		
Date of Boring:	7-May-2023	Borehole No :	BH-01
Sample Type	Disturbed	Depth:	3

Flow Curve (For Liquid Limit)

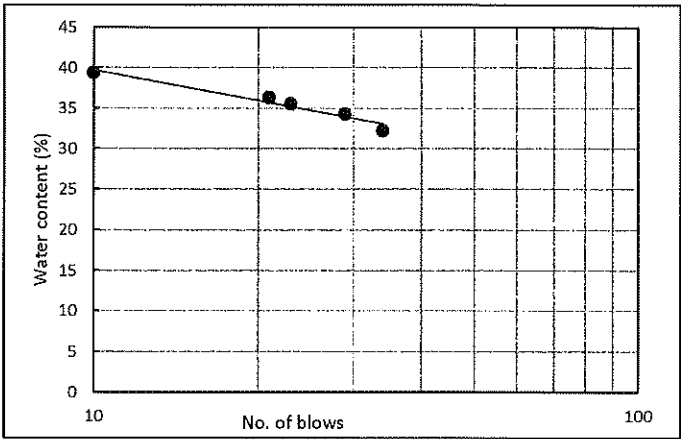
No. of blow	Moisture Content (%)
12	40.23
19	38.23
28	36.87
34	35.49
39	34.21

Parameter	Unit	Value	Remarks
Liquid Limit	%	37.0	-----
Plastic Limit	%	29.0	
Platicity Index	%	8.0	

Liquid Limit & Plastic Limit Test of Soil Sample

Project Name:	Chittagong WASH Improvement Project		
Location:	Chandgaon, Chattogram (22.371640, 91.848396)		
Date of Boring:	7-May-2023	Borehole No :	BH-01
Sample Type	Disturbed	Depth:	3

Flow Curve (For Liquid Limit)

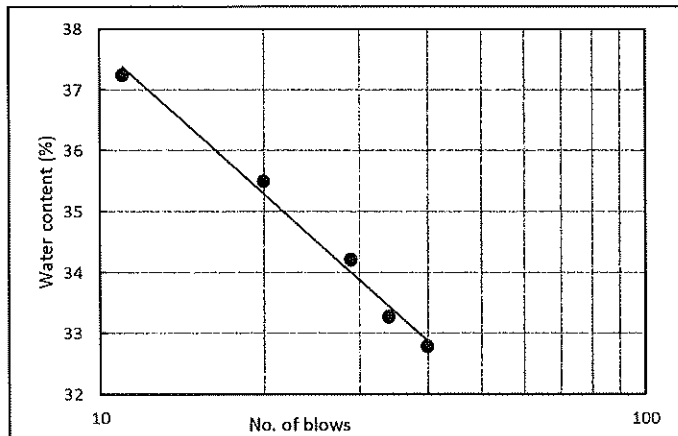


No. of blow	Moisture Content (%)
10	39.29
21	36.23
23	35.48
29	34.23
34	32.19

Parameter	Unit	Value	Remarks
Liquid Limit	%	35.0	-----
Plastic Limit	%	28.0	
Platicity Index	%	7.0	

Liquid Limit & Plastic Limit Test of Soil Sample

Project Name:	Chittagong WASH Improvement Project		
Location:	Chandgaon, Chattogram (22.371640, 91.848396)		
Date of Boring:	7-May-2023	Borehole No :	BH-01
Sample Type	Disturbed	Depth:	25

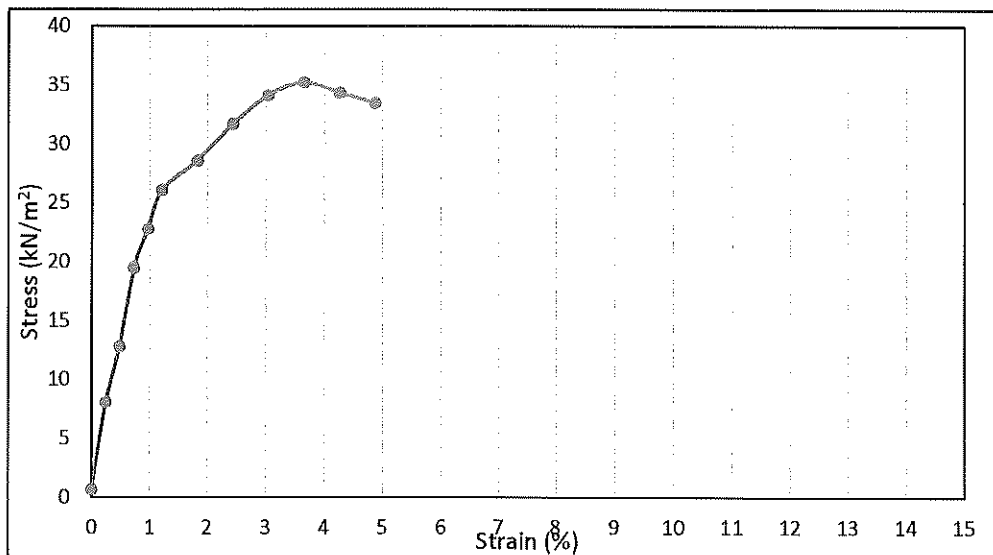
Flow Curve (For Liquid Limit)

No. of blow	Moisture Content (%)
11	37.23
20	35.49
29	34.20
34	33.26
40	32.78

Parameter	Unit	Value	Remarks
Liquid Limit	%	35.0	-----
Plastic Limit	%	27.0	
Plasticity Index	%	8.0	

Unconfined Compressive Strength of Soil Sample

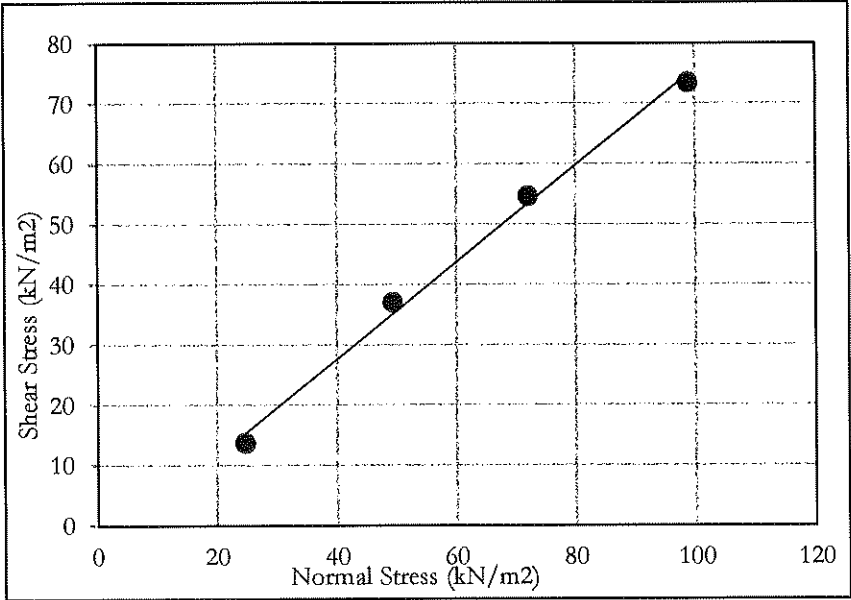
Project Name:	Chittagong WASH Improvement Project		
Location:	Chandgaon, Chattogram (22.371640, 91.848396)		
Date of Boring:	7-May-23	Borehole No:	BH-01
Sample Type	Undisturbed	Depth (m):	5

Stress-Strain Relation of Soil

Parameters	Unit	Value
Test Standard:	---	ASTM D2166M-13
Sample Description:	---	Clayey Soils
Initial Density:	g/cm3	1.76
Natural Moisture Content:	%	32.18
Average Dia of the sample:	mm	40.0
Average Height of the sample:	mm	82.0
Strain at Failure:	%	3.66
Unconfined Compressive Strength:	kPa	36
Shear Strength:	kPa	18

Direct Shear Test (Quick) of Soil Sample

Project Name:	Chittagong WASH Improvement Project		
Location:	Chandgaon, Chattogram (22.371640, 91.848396)		
Date of Boring:	7-May-2023	Borehole No:	BH-01
Sample Type	Disturbed	Depth:	30



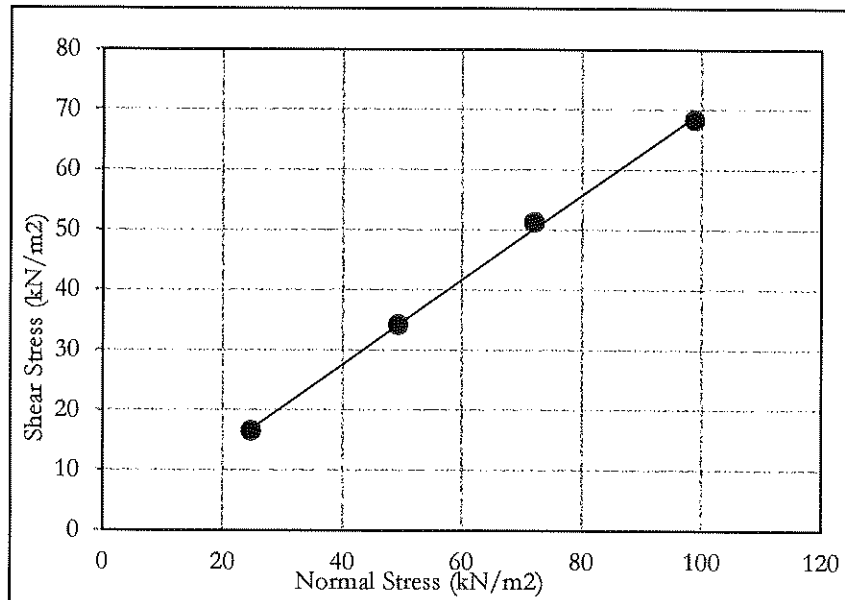
Normal Stress (kPa)	Shear Stress (kPa)
24.70	13.66
49.40	36.98
72.20	54.62
98.80	73.40

Cohesion, c (kPa)	0.0
Angle of Internal Friction, ϕ (Degree)	38.7

Q

Direct Shear Test (Quick) of Soil Sample

Project Name:	Chittagong WASH Improvement Project		
Location:	Chandgaon, Chattogram (22.371640, 91.848396)		
Date of Boring:	7-May-2023	Borehole No:	BH-01
Sample Type	Disturbed	Depth:	35



Normal Stress (kPa)	Shear Stress (kPa)
24.70	16.50
49.40	34.14
72.20	51.21
98.80	68.28

Cohesion, c (kPa)	0.0
Angle of Internal Friction, ϕ (Degree)	35.1

Borehole No: **BH-02-1**

Q

Bore Log

Project Name:	Chittagong WASH Improvement Project		
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36473, 91.78162)		
Borehole No:	BH-02-1	Depth of Water Table in m (From EGL) :	3.0
Date of Boring (Starting):	11-May-2023	RL at EGL (m):	0.0000

Drilling Details

Drilling Method:	Wash	Drilling Type:	Manual	Borehole Dia (mm):	100
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Correction Factor (for SPT, N)

Hammer Efficiency	0.60	Borehole Diameter	1.00	Standard Sampler	1.00	Rod Length	0.85
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Elevation (m)	Depth (m)	Sample Type	Soil Type	Visual Description of the Strata	Symbol	Standard Penetration Test (SPT)				Variation of SPT, N	N ₆₀	q' (kPa)	c (kPa)	φ (d)	Vs (m/s)
						15 cm	15 cm	15 cm	SPT, N						
-1.0	1.0	D	Sand	Sand with Silt; Medium Dense		4	10	14	24		20	18.0	----	33.0	263.6
-2.0	2.0	D	Sand			9	14	16	30		26	36.0	----	35.0	289.7
-3.0	3.0	D	Sand			7	10	12	22		19	54.6	----	33.0	258.7
-4.0	4.0	D	Sand			7	11	13	24		20	62.7	----	33.0	263.6
-5.0	5.0	D	Sand			5	8	11	19		16	70.9	----	32.0	243.2
-6.0	6.0	D	Sand			8	11	18	29		25	78.7	----	35.0	285.7
-7.0	7.0	D	Sand	Sand with Silt; Dense		6	10	14	24		20	87.4	----	33.0	263.6
-8.0	8.0	D	Sand			12	25	26	51		43	95.6	----	40.0	347.4
-9.0	9.0	D	Sand			50+	----	----	50		43	104.7	----	40.0	347.4
-10.0	10.0	D	Sand			50+	----	----	50		43	113.9	----	40.0	347.4
-11.0	11.0					----	----	----			----	----	----	----	----
-12.0	12.0					----	----	----			----	----	----	----	----
-13.0	13.0					----	----	----			----	----	----	----	----
-14.0	14.0					----	----	----			----	----	----	----	----
-15.0	15.0					----	----	----			----	----	----	----	----
-16.0	16.0					----	----	----			----	----	----	----	----
-17.0	17.0					----	----	----			----	----	----	----	----
-18.0	18.0					----	----	----			----	----	----	----	----
-19.0	19.0					----	----	----			----	----	----	----	----
-20.0	20.0					----	----	----			----	----	----	----	----
-21.0	21.0					----	----	----			----	----	----	----	----
-22.0	22.0					----	----	----			----	----	----	----	----
-23.0	23.0					----	----	----			----	----	----	----	----
-24.0	24.0					----	----	----			----	----	----	----	----
-25.0	25.0					----	----	----			----	----	----	----	----
-26.0	26.0					----	----	----			----	----	----	----	----
-27.0	27.0					----	----	----			----	----	----	----	----
-28.0	28.0					----	----	----			----	----	----	----	----
-29.0	29.0					----	----	----			----	----	----	----	----
-30.0	30.0					----	----	----			----	----	----	----	----
-31.0	31.0					----	----	----			----	----	----	----	----
-32.0	32.0					----	----	----			----	----	----	----	----
-33.0	33.0					----	----	----			----	----	----	----	----
-34.0	34.0					----	----	----			----	----	----	----	----
-35.0	35.0					----	----	----			----	----	----	----	----
-36.0	36.0					----	----	----			----	----	----	----	----
-37.0	37.0					----	----	----			----	----	----	----	----
-38.0	38.0					----	----	----			----	----	----	----	----
-39.0	39.0					----	----	----			----	----	----	----	----
-40.0	40.0					----	----	----			----	----	----	----	----

** c, φ, and Vs are calculated based on standard correlation with SPT

Sand
 Silt
 Clay
 Shale
 D = Disturbed Sample U = Undisturbed Sample

Project Name:	Chittagong WASH Improvement Project
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36473, 91.78162)

Borehole No:	BH-02-1	Date of Boring:	11-May-2023	RL at EGL:	0.0000	Factor of Safety :	3.0
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Axial Pile Capacity as per Static Bearing Capacity

Elevation (m)	Depth (m)	N	N ₆₀	Width:1.5 m		Width:2 m		Width:2.5 m		Recommended Allowable Bearing Pressure (kPa)		
				q _a -1 (kPa)	q _a -2 (kPa)	q _a -1 (kPa)	q _a -2 (kPa)	q _a -1 (kPa)	q _a -2 (kPa)	Width:1.5 m	Width:2 m	Width:2.5 m
-1.0	1.0	24	20	337.1	308.0	385.0	342.4	432.9	378.7856	322.5	363.7	405.9
-1.5	1.5	27	23	502.5	484.1	560.5	519.1	618.6	513.7824	493.3	539.8	566.2
-2.0	2.0	30	26	710.5	721.0	780.9	752.9	851.3	710.3305	715.7	766.9	780.8
-3.0	3.0	22	19	731.1	811.8	778.8	807.0	826.4	701.0063	771.5	792.9	763.7
-4.0	4.0	24	20	740.6	895.0	762.4	845.7	784.2	673.397	817.8	804.1	728.8
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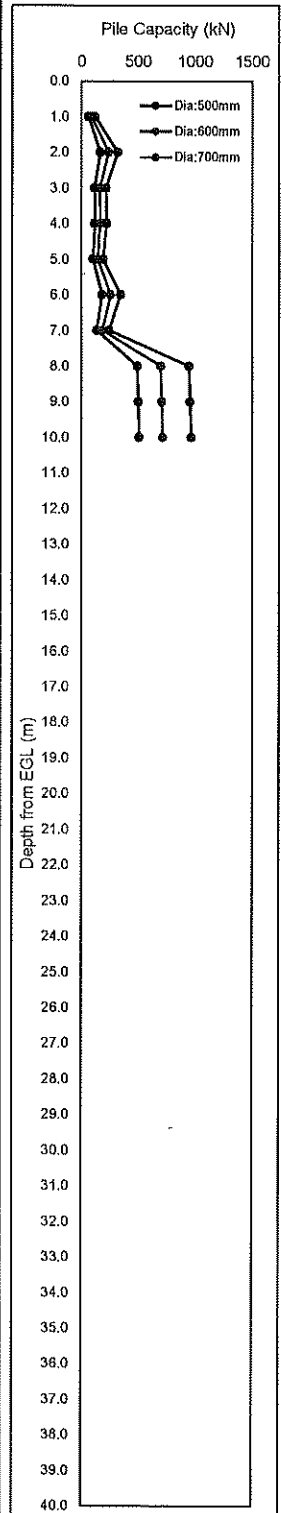
Note: q_a-1: using Terzaghi's bearing capacity formula, q_a-2: using Meyerhof bearing capacity formula
 1kPa=0.010 t/ft²

Project Name:	Chittagong WASH Improvement Project
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36473, 91.78162)

Borehole No:	BH-02-1	Date of Boring:	11-May-2023	RL at EGL (m):	0.0000	Factor of Safety :	3.0
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Axial Pile Capacity using Static Bearing Capacity

Elevation (m)	Depth (m)	N	N ₆₀	End Bearing & Skin Friction		Allowable Pile Capacity		
				fb(kPa)	fs (kPa)	Dia:500mm	Dia:600mm	Dia:700mm
-1.0	1.0	24	20	888.6	2.4	59.4	85.3	115.8
-2.0	2.0	30	26	2448.8	4.8	163.4	234.6	318.6
-3.0	3.0	22	19	1603.0	7.3	111.3	158.7	214.5
-4.0	4.0	24	20	1603.0	8.4	115.4	163.6	220.3
-5.0	5.0	19	16	1295.9	9.5	100.0	140.3	187.4
-6.0	6.0	29	25	2448.8	10.6	180.7	255.3	342.7
-7.0	7.0	24	20	1603.0	11.7	131.1	182.6	242.4
-8.0	8.0	51	43	7011.6	12.5	491.5	699.9	945.0
-9.0	9.0	50	43	7011.6	13.7	498.3	708.1	954.6
-10.0	10.0	50	43	7011.6	14.9	505.8	717.1	965.1
-11.0	11.0	---	---	---	---	---	---	---
-12.0	12.0	---	---	---	---	---	---	---
-13.0	13.0	---	---	---	---	---	---	---
-14.0	14.0	---	---	---	---	---	---	---
-15.0	15.0	---	---	---	---	---	---	---
-16.0	16.0	---	---	---	---	---	---	---
-17.0	17.0	---	---	---	---	---	---	---
-18.0	18.0	---	---	---	---	---	---	---
-19.0	19.0	---	---	---	---	---	---	---
-20.0	20.0	---	---	---	---	---	---	---
-21.0	21.0	---	---	---	---	---	---	---
-22.0	22.0	---	---	---	---	---	---	---
-23.0	23.0	---	---	---	---	---	---	---
-24.0	24.0	---	---	---	---	---	---	---
-25.0	25.0	---	---	---	---	---	---	---
-26.0	26.0	---	---	---	---	---	---	---
-27.0	27.0	---	---	---	---	---	---	---
-28.0	28.0	---	---	---	---	---	---	---
-29.0	29.0	---	---	---	---	---	---	---
-30.0	30.0	---	---	---	---	---	---	---
-31.0	31.0	---	---	---	---	---	---	---
-32.0	32.0	---	---	---	---	---	---	---
-33.0	33.0	---	---	---	---	---	---	---
-34.0	34.0	---	---	---	---	---	---	---
-35.0	35.0	---	---	---	---	---	---	---
-36.0	36.0	---	---	---	---	---	---	---
-37.0	37.0	---	---	---	---	---	---	---
-38.0	38.0	---	---	---	---	---	---	---
-39.0	39.0	---	---	---	---	---	---	---
-40.0	40.0	---	---	---	---	---	---	---



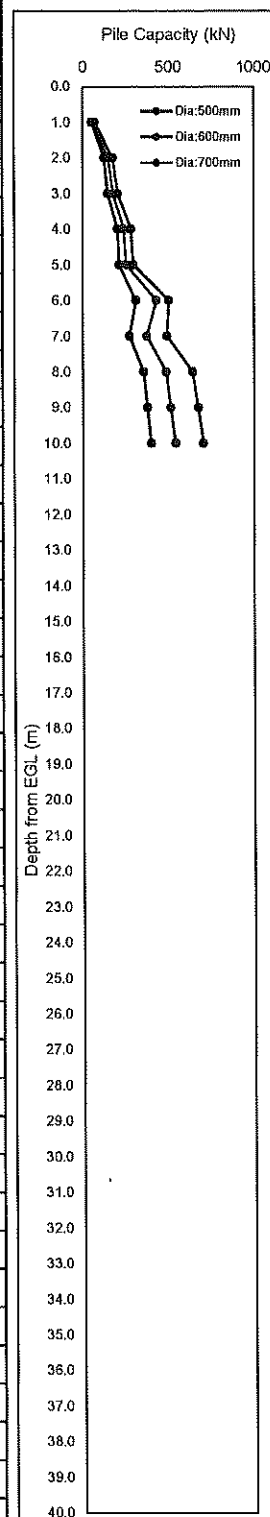
Note: Q_a = Allowable axial pile capacity in kN; $1kN=0.101\text{ Ton}$

Project Name:	Chittagong WASH Improvement Project
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36473, 91.78162)

Borehole No:	BH-02-1	Date of Boring:	11-May-2023	RL at EGL (m):	0.0000	Factor of Safety :	3.0
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Axial Pile Capacity using SPT. N

Elevation (m)	Depth (m)	N	N ₆₀	End Bearing & Skin Friction		Allowable Pile Capacity		
				fb(kPa)	fs (kPa)	Dia:500mm	Dia:600mm	Dia:700mm
-1.0	1.0	24	20	509.5	20.0	49.7	59.7	69.6
-2.0	2.0	30	26	1324.8	26.0	124.6	149.5	174.5
-3.0	3.0	22	19	1452.1	19.0	146.2	175.5	204.7
-4.0	4.0	24	20	2038.1	20.0	201.6	241.9	282.2
-5.0	5.0	19	16	2038.1	16.0	211.0	253.2	295.4
-6.0	6.0	29	25	3571.4	25.0	310.1	431.0	502.9
-7.0	7.0	24	20	3000.0	20.0	272.8	374.5	491.9
-8.0	8.0	51	43	4000.0	43.0	354.7	488.5	643.2
-9.0	9.0	50	43	4000.0	43.0	377.3	515.5	674.8
-10.0	10.0	50	43	4000.0	43.0	399.8	542.6	706.3
-11.0	11.0	---	---	---	---	---	---	---
-12.0	12.0	---	---	---	---	---	---	---
-13.0	13.0	---	---	---	---	---	---	---
-14.0	14.0	---	---	---	---	---	---	---
-15.0	15.0	---	---	---	---	---	---	---
-16.0	16.0	---	---	---	---	---	---	---
-17.0	17.0	---	---	---	---	---	---	---
-18.0	18.0	---	---	---	---	---	---	---
-19.0	19.0	---	---	---	---	---	---	---
-20.0	20.0	---	---	---	---	---	---	---
-21.0	21.0	---	---	---	---	---	---	---
-22.0	22.0	---	---	---	---	---	---	---
-23.0	23.0	---	---	---	---	---	---	---
-24.0	24.0	---	---	---	---	---	---	---
-25.0	25.0	---	---	---	---	---	---	---
-26.0	26.0	---	---	---	---	---	---	---
-27.0	27.0	---	---	---	---	---	---	---
-28.0	28.0	---	---	---	---	---	---	---
-29.0	29.0	---	---	---	---	---	---	---
-30.0	30.0	---	---	---	---	---	---	---
-31.0	31.0	---	---	---	---	---	---	---
-32.0	32.0	---	---	---	---	---	---	---
-33.0	33.0	---	---	---	---	---	---	---
-34.0	34.0	---	---	---	---	---	---	---
-35.0	35.0	---	---	---	---	---	---	---
-36.0	36.0	---	---	---	---	---	---	---
-37.0	37.0	---	---	---	---	---	---	---
-38.0	38.0	---	---	---	---	---	---	---
-39.0	39.0	---	---	---	---	---	---	---
-40.0	40.0	---	---	---	---	---	---	---



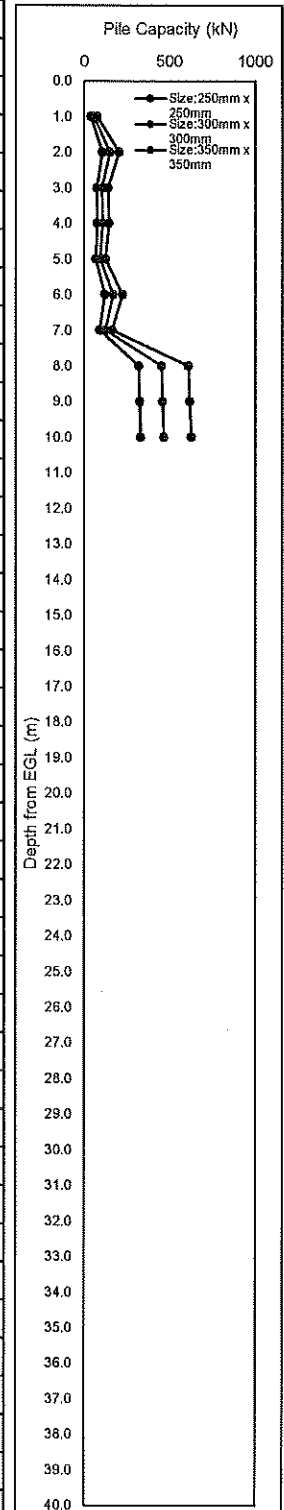
Note: Q_a = Allowable axial pile capacity in kN; $1\text{kN}=0.101\text{ Ton}$

Project Name:	Chittagong WASH Improvement Project
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36473, 91.78162)

Borehole No:	BH-02-1	Date of Boring:	11-May-2023	RL at EGL (m):	0.0000	Factor of Safety :	3.0
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Axial Pile Capacity using Static Bearing Capacity

Elevation (m)	Depth (m)	N	N ₆₀	End Bearing & Skin Friction		Allowable Pile Capacity		
				fb(kPa)	fs (kPa)	Size:250mm x 250mm	Size:300mm x 300mm	Size:350mm x 350mm
-1.0	1.0	24	20	1777.3	3.2	38.1	54.6	74.1
-2.0	2.0	30	26	4897.6	6.4	104.7	150.1	203.7
-3.0	3.0	22	19	3206.0	9.8	72.2	102.6	138.5
-4.0	4.0	24	20	3206.0	11.2	75.7	106.8	143.3
-5.0	5.0	19	16	2591.7	12.7	66.9	93.2	123.8
-6.0	6.0	29	25	4897.6	14.1	119.3	167.7	224.2
-7.0	7.0	24	20	3206.0	15.6	89.1	122.9	162.1
-8.0	8.0	51	43	14023.1	16.6	319.8	453.9	611.3
-9.0	9.0	50	43	14023.1	18.2	325.6	460.8	619.5
-10.0	10.0	50	43	14023.1	19.8	332.0	468.5	628.3
-11.0	11.0	---	---	---	---	---	---	---
-12.0	12.0	---	---	---	---	---	---	---
-13.0	13.0	---	---	---	---	---	---	---
-14.0	14.0	---	---	---	---	---	---	---
-15.0	15.0	---	---	---	---	---	---	---
-16.0	16.0	---	---	---	---	---	---	---
-17.0	17.0	---	---	---	---	---	---	---
-18.0	18.0	---	---	---	---	---	---	---
-19.0	19.0	---	---	---	---	---	---	---
-20.0	20.0	---	---	---	---	---	---	---
-21.0	21.0	---	---	---	---	---	---	---
-22.0	22.0	---	---	---	---	---	---	---
-23.0	23.0	---	---	---	---	---	---	---
-24.0	24.0	---	---	---	---	---	---	---
-25.0	25.0	---	---	---	---	---	---	---
-26.0	26.0	---	---	---	---	---	---	---
-27.0	27.0	---	---	---	---	---	---	---
-28.0	28.0	---	---	---	---	---	---	---
-29.0	29.0	---	---	---	---	---	---	---
-30.0	30.0	---	---	---	---	---	---	---
-31.0	31.0	---	---	---	---	---	---	---
-32.0	32.0	---	---	---	---	---	---	---
-33.0	33.0	---	---	---	---	---	---	---
-34.0	34.0	---	---	---	---	---	---	---
-35.0	35.0	---	---	---	---	---	---	---
-36.0	36.0	---	---	---	---	---	---	---
-37.0	37.0	---	---	---	---	---	---	---
-38.0	38.0	---	---	---	---	---	---	---
-39.0	39.0	---	---	---	---	---	---	---
-40.0	40.0	---	---	---	---	---	---	---



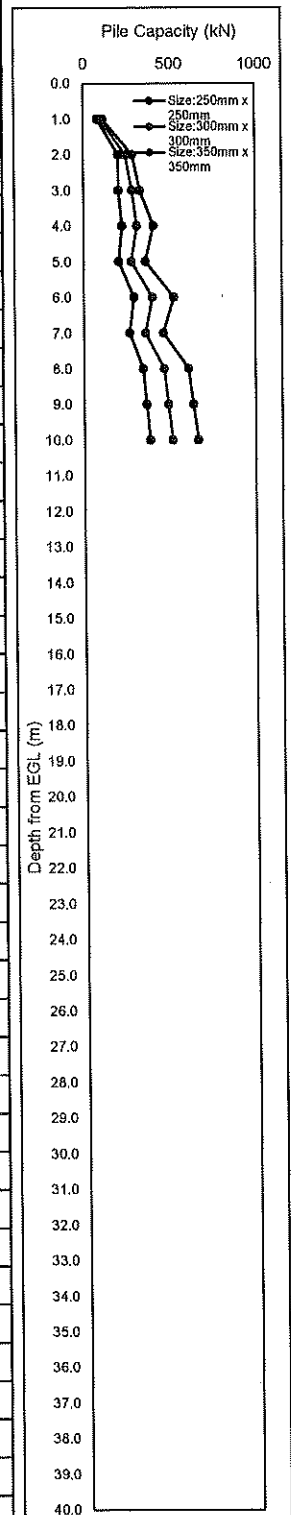
Note: Q_s = Allowable axial pile capacity in kN; $1kN=0.101\text{ Ton}$

Project Name:	Chittagong WASH Improvement Project
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36473, 91.78162)

Borehole No:	BH-02-1	Date of Boring:	11-May-2023	RL at EGL (m):	0.0000	Factor of Safety :	3.0
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Axial Pile Capacity using SPT. N

Elevation (m)	Depth (m)	N	N ₆₀	End Bearing & Skin Friction		Allowable Pile Capacity		
				f _b (kPa)	f _s (kPa)	Size:250mm x 250mm	Size:300mm x 300mm	Size:350mm x 350mm
-1.0	1.0	24	20	2717.5	40.0	80.0	96.0	112.0
-2.0	2.0	30	26	7065.4	52.0	202.0	242.4	282.8
-3.0	3.0	22	19	7238.1	38.0	202.0	280.4	327.1
-4.0	4.0	24	20	8000.0	40.0	223.3	308.0	406.0
-5.0	5.0	19	16	6400.0	32.0	202.0	274.4	357.5
-6.0	6.0	29	25	10000.0	50.0	290.7	398.8	523.6
-7.0	7.0	24	20	8000.0	40.0	264.0	356.8	462.9
-8.0	8.0	51	43	11000.0	60.0	343.2	466.8	608.8
-9.0	9.0	50	43	11000.0	60.0	363.2	490.8	636.8
-10.0	10.0	50	43	11000.0	60.0	383.2	514.8	664.8
-11.0	11.0	---	---	---	---	---	---	---
-12.0	12.0	---	---	---	---	---	---	---
-13.0	13.0	---	---	---	---	---	---	---
-14.0	14.0	---	---	---	---	---	---	---
-15.0	15.0	---	---	---	---	---	---	---
-16.0	16.0	---	---	---	---	---	---	---
-17.0	17.0	---	---	---	---	---	---	---
-18.0	18.0	---	---	---	---	---	---	---
-19.0	19.0	---	---	---	---	---	---	---
-20.0	20.0	---	---	---	---	---	---	---
-21.0	21.0	---	---	---	---	---	---	---
-22.0	22.0	---	---	---	---	---	---	---
-23.0	23.0	---	---	---	---	---	---	---
-24.0	24.0	---	---	---	---	---	---	---
-25.0	25.0	---	---	---	---	---	---	---
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-28.0	28.0	---	---	---	---	---	---	---
-29.0	29.0	---	---	---	---	---	---	---
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-31.0	31.0	---	---	---	---	---	---	---
-32.0	32.0	---	---	---	---	---	---	---
-33.0	33.0	---	---	---	---	---	---	---
-34.0	34.0	---	---	---	---	---	---	---
-35.0	35.0	---	---	---	---	---	---	---
-36.0	36.0	---	---	---	---	---	---	---
-37.0	37.0	---	---	---	---	---	---	---
-38.0	38.0	---	---	---	---	---	---	---
-39.0	39.0	---	---	---	---	---	---	---
-40.0	40.0	---	---	---	---	---	---	---



Note: Q_a = Allowable axial pile capacity in kN; 1kN=0.101 Ton

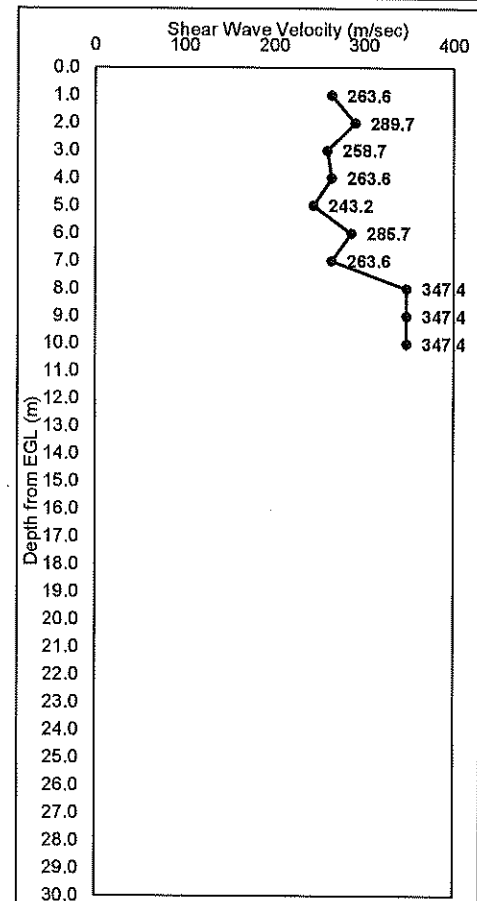
Project Name:	Chittagong WASH Improvement Project
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36473, 91.78162)

Borehole No:	BH-02-1	Date of Boring:	11-May-2023	RL at EGL (m):	0.0000
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Axial Pile Capacity as per Static Bearing Capacity

Elevation (m)	Depth (m)	N	N ₆₀	Vs (m/sec)
-1.0	1.0	24	20	263.6
-2.0	2.0	30	26	289.7
-3.0	3.0	22	19	258.7
-4.0	4.0	24	20	263.6
-5.0	5.0	19	16	243.2
-6.0	6.0	29	25	285.7
-7.0	7.0	24	20	263.6
-8.0	8.0	51	43	347.4
-9.0	9.0	50	43	347.4
-10.0	10.0	50	43	347.4
-11.0	11.0	----	----	----
-12.0	12.0	----	----	----
-13.0	13.0	----	----	----
-14.0	14.0	----	----	----
-15.0	15.0	----	----	----
-16.0	16.0	----	----	----
-17.0	17.0	----	----	----
-18.0	18.0	----	----	----
-19.0	19.0	----	----	----
-20.0	20.0	----	----	----
-21.0	21.0	----	----	----
-22.0	22.0	----	----	----
-23.0	23.0	----	----	----
-24.0	24.0	----	----	----
-25.0	25.0	----	----	----
-26.0	26.0	----	----	----
-27.0	27.0	----	----	----
-28.0	28.0	----	----	----
-29.0	29.0	----	----	----
-30.0	30.0	----	----	----

Average Vs (m/s)	N/A
Average N	N/A
Site Class	N/A

**Note**

SA: Rock or other rock-like geological formation

SB: Deposits of very dense sand, gravel, or very stiff clay, at least several tens of metres in thickness

SC: Deep deposits of dense or medium dense sand, gravel or stiff clay with thickness from several tens to many hundreds of metres

SD: Deposits of loose-to-medium cohesionless soil (with or without some soft cohesive layers)

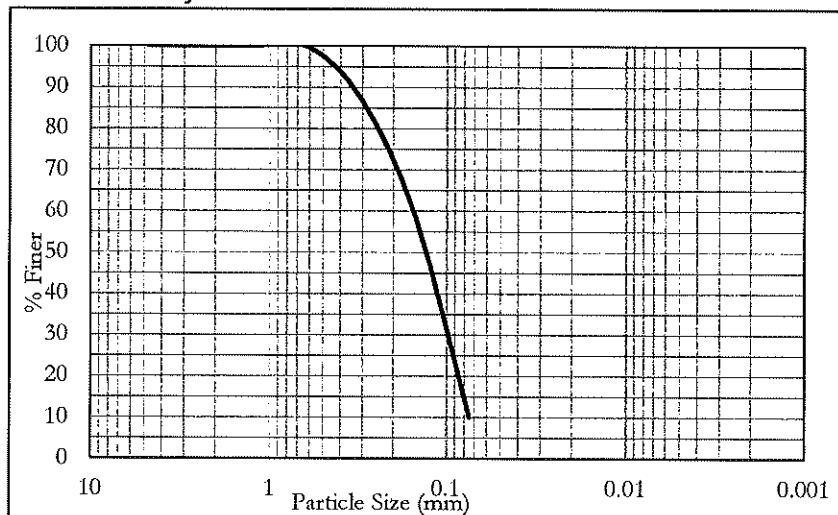
Summary of Laboratory Test Results

Depth (m)	Elevation (m)	Specific gravity	Water content (%)	Bulk density (g/cm ³)	Bulk density (kN/m ³)	Dry density (kN/m ³)	Grain Size Analysis		Atterberg Limit			Direct Shear Test		Unconfined Compression Test		
							Sand (%)	Fines (%)	LL (%)	PL (%)	PI (%)	c (kPa)	φ (degree)	q _u (kPa)	c _u (kPa)	Strain at Failure (%)
1-1.5	-1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2-2.5	-2	—	—	1.72	16.87	—	—	—	—	—	—	—	—	—	—	—
3-3.5	-3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4-4.5	-4	—	28.32	—	—	—	89.93	10.07	—	—	—	—	—	—	—	—
5-5.5	-5	2.66	27.12	1.82	17.85	14.0452	—	—	—	—	—	—	—	—	—	—
6-6.5	-6	—	—	—	—	—	94.64	5.36	—	—	—	—	—	—	—	—
7-7.5	-7	2.68	—	—	—	—	—	—	—	—	—	—	—	—	—	—
8-8.5	-8	—	—	—	—	—	—	—	—	—	—	0	37.3	—	—	—
9-9.5	-9	2.69	—	—	—	—	95.06	4.94	—	—	—	—	—	—	—	—
10-10.5	-10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Q

Grain Size Analysis of Soil Sample

Project Name:	Chittagong WASH Improvement Project		
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36473, 91.78162)		
Date of Boring:	11-May-2023	Borehole No :	BH-02-1
Sample Type	Disturbed	Depth (m):	4

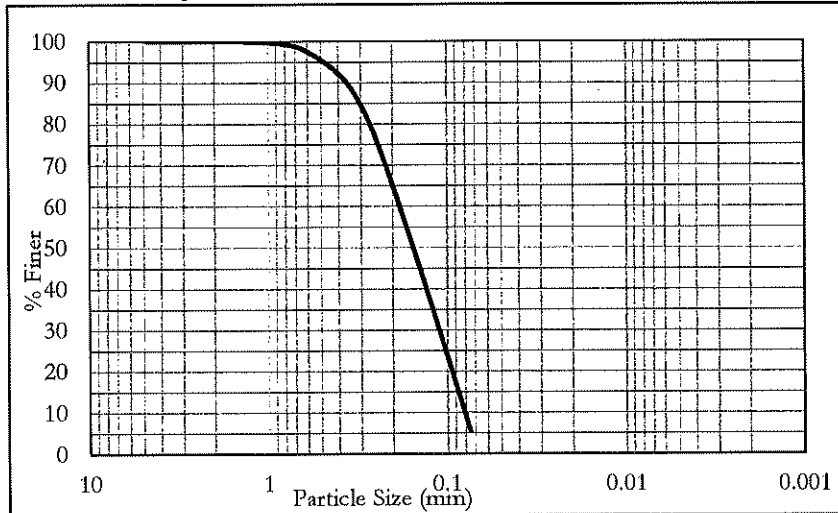
Grain Size Analysis

Particle Size (mm)	% Finer
4.750	100.000
2.380	100.000
1.190	100.000
0.600	99.580
0.300	86.713
0.150	58.322
0.075	10.070
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000

Soil Type	Unit	Value	Remarks
Sand	%	89.93	Ref: ASTM D2487-11
Coarse Sand	%	0.00	
Medium Sand	%	0.00	
Fine Sand	%	89.93	
Fines	%	10.07	Ref: ASTM D422
Silt	%	10.07	
Clay	%	0.00	Ref: ASTM D2487-11
D ₆₀	%	0.160	
D ₃₀	%	0.100	
D ₁₀	%	0.076	
C _u	%	2.105	
C _c	%	0.822	

Grain Size Analysis of Soil Sample

Project Name:	Chittagong WASH Improvement Project		
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36473, 91.78162)		
Date of Boring:	11-May-2023	Borehole No :	BH-02-1
Sample Type	Disturbed	Depth (m):	6

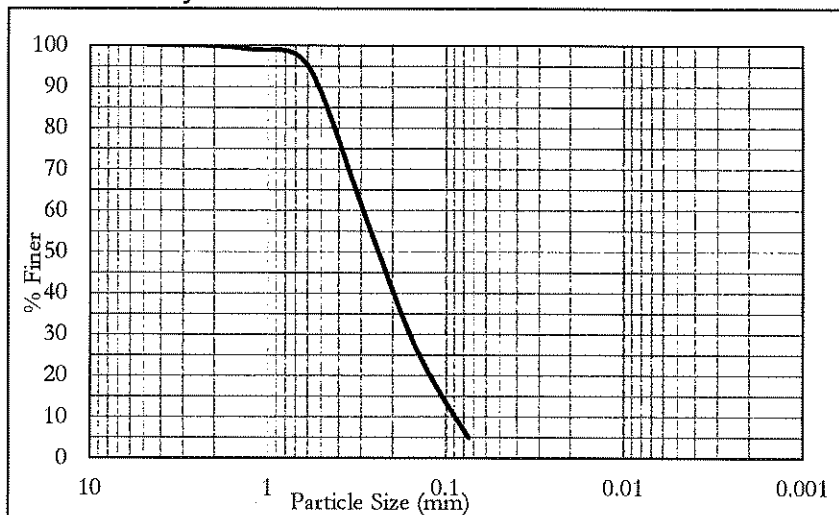
Grain Size Analysis

Particle Size (mm)	% Finer
4.750	100.000
2.380	100.000
1.190	99.875
0.600	97.507
0.300	84.794
0.150	48.361
0.075	5.360
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000

Soil Type	Unit	Value	Remarks
Sand	%	94.64	Ref: ASTM D2487-11
Coarse Sand	%	0.00	
Medium Sand	%	0.00	
Fine Sand	%	94.64	
Fines	%	5.36	Ref: ASTM D422
Silt	%	5.36	
Clay	%	0.00	Ref: ASTM D2487-11
D ₆₀	%	0.180	
D ₃₀	%	0.120	
D ₁₀	%	0.070	
C _u	%	2.571	
C _c	%	1.143	

Grain Size Analysis of Soil Sample

Project Name:	Chittagong WASH Improvement Project		
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36473, 91.78162)		
Date of Boring:	11-May-2023	Borehole No :	BH-02-1
Sample Type	Disturbed	Depth (m):	9

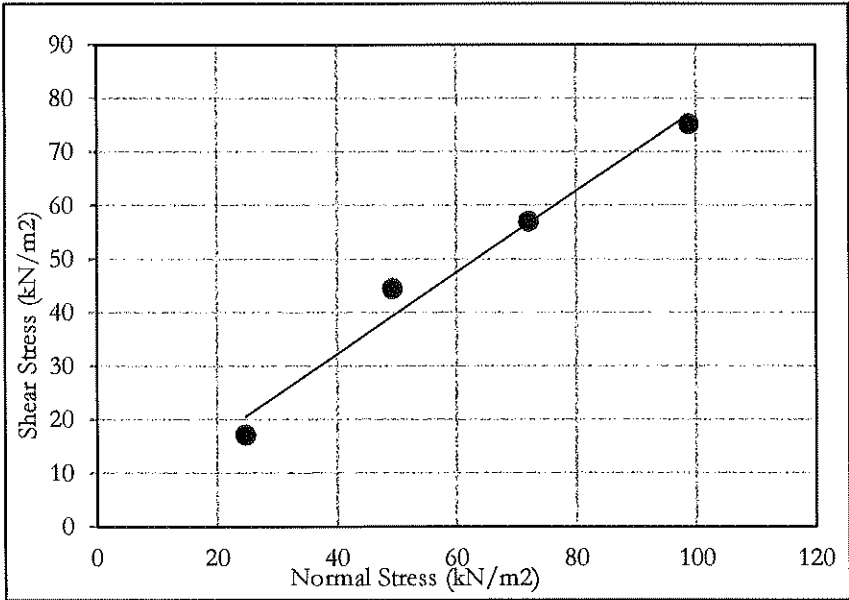
Grain Size Analysis

Particle Size (mm)	% Finer
4.750	100.000
2.380	100.000
1.190	98.966
0.600	95.291
0.300	61.716
0.150	26.993
0.075	4.939
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000

Soil Type	Unit	Value	Remarks
Sand	%	95.06	Ref: ASTM D2487-11
Coarse Sand	%	0.00	
Medium Sand	%	0.00	
Fine Sand	%	95.06	
Fines	%	4.94	Ref: ASTM D422
Silt	%	4.94	
Clay	%	0.00	
	%	0.00	
D ₆₀	%	0.290	Ref: ASTM D2487-11
D ₃₀	%	0.165	
D ₁₀	%	0.090	
C _u	%	3.222	
C _c	%	1.043	

Direct Shear Test (Quick) of Soil Sample

Project Name:	Chittagong WASH Improvement Project		
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36473, 91.78162)		
Date of Boring:		Borehole No:	BH-02-1
Sample Type	Disturbed	Depth:	8



Normal Stress (kPa)	Shear Stress (kPa)
24.70	17.07
49.40	44.38
72.20	56.90
98.80	75.11

Cohesion, c (kPa)	0.0
Angle of Internal Friction, ϕ (Degree)	37.3

Q

Borehole No: **BH-02-2**

11

Bore Log

Project Name:	Chittagong WASH Improvement Project		
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36465, 91.78163)		
Borehole No:	BH-02-2	Depth of Water Table in m (From EGL) :	3.0
Date of Boring (Starting):	13-May-2023	RL at EGL (m):	0.0000

Drilling Details

Drilling Method:	Wash	Drilling Type:	Manual	Borehole Dia (mm):	100
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Correction Factor (for SPT, N)

Hammer Efficiency	0.60	Borehole Diameter	1.00	Standard Sampler	1.00	Rod Length	0.85
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Elevation (m)	Depth (m)	Sample Type	Soil Type	Visual Description of the Strata	Symbol	Standard Penetration Test (SPT)				Variation of SPT, N	N ₆₀	q' (kPa)	c (kPa)	φ (d)	Vs (m/s)
						15 cm	15 cm	15 cm	SPT, N						
-1.0	1.0	D	Sand	Sand with Silt; Medium Dense		5	11	13	24		20	18.0	----	33.0	263.6
-2.0	2.0	D	Sand			10	13	16	29		25	36.0	----	35.0	285.7
-3.0	3.0	D	Sand			6	9	11	20		17	54.5	----	32.0	248.6
-4.0	4.0	D	Sand			6	10	12	22		19	62.4	----	33.0	258.7
-5.0	5.0	D	Sand			4	7	10	17		14	70.5	----	31.0	231.8
-6.0	6.0	D	Sand			7	10	17	27		23	78.1	----	34.0	277.2
-7.0	7.0	D	Sand	Sand with Silt; Dense		5	8	14	22		19	86.6	----	33.0	258.7
-8.0	8.0	D	Sand			11	25	25	50		43	94.7	----	40.0	347.4
-9.0	9.0	D	Sand			50+	----	----	50		43	103.8	----	40.0	347.4
-10.0	10.0	D	Sand			50+	----	----	50		43	113.0	----	40.0	347.4
-11.0	11.0					----	----	----							
-12.0	12.0					----	----	----							
-13.0	13.0					----	----	----							
-14.0	14.0					----	----	----							
-15.0	15.0					----	----	----							
-16.0	16.0					----	----	----							
-17.0	17.0					----	----	----							
-18.0	18.0					----	----	----							
-19.0	19.0					----	----	----							
-20.0	20.0					----	----	----							
-21.0	21.0					----	----	----							
-22.0	22.0					----	----	----							
-23.0	23.0					----	----	----							
-24.0	24.0					----	----	----							
-25.0	25.0					----	----	----							
-26.0	26.0					----	----	----							
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-29.0	29.0					----	----	----							
-30.0	30.0					----	----	----							
-31.0	31.0					----	----	----							
-32.0	32.0					----	----	----							
-33.0	33.0					----	----	----							
-34.0	34.0					----	----	----							
-35.0	35.0					----	----	----							
-36.0	36.0					----	----	----							
-37.0	37.0					----	----	----							
-38.0	38.0					----	----	----							
-39.0	39.0					----	----	----							
-40.0	40.0					----	----	----							

** c, φ, and Vs are calculated based on standard correlation with SPT

Sand
 Silt
 Clay
 Shale
 D = Disturbed Sample U = Undisturbed Sample

1

Project Name:	Chittagong WASH Improvement Project
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36465, 91.78163)

Borehole No:	BH-02-2	Date of Boring:	13-May-2023	RL at EGL:	0.0000	Factor of Safety :	3.0
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Axial Pile Capacity as per Static Bearing Capacity

Elevation (m)	Depth (m)	N	N ₆₀	Width:1.5 m		Width:2 m		Width:2.5 m		Recommended Allowable Bearing Pressure (kPa)		
				q _a -1 (kPa)	q _a -2 (kPa)	q _a -1 (kPa)	q _a -2 (kPa)	q _a -1 (kPa)	q _a -2 (kPa)	Width:1.5 m	Width:2 m	Width:2.5 m
-1.0	1.0	24	20	337.1	308.0	385.0	342.4	432.9	378.7856	322.5	363.7	405.9
-1.5	1.5	26	22	501.6	483.2	559.3	517.9	617.0	512.4654	492.4	538.6	564.7
-2.0	2.0	29	25	708.7	719.1	778.7	750.7	848.7	708.1629	713.9	764.7	778.4
-3.0	3.0	20	17	638.0	706.6	677.6	701.1	717.2	609.5288	672.3	689.3	663.4
-4.0	4.0	22	19	736.1	889.5	757.6	840.4	779.1	669.0191	812.8	799.0	724.1
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Note: q_a-1: using Terzaghi's bearing capacity formula, q_a-2: using Meyerhof bearing capacity formula
 1kPa=0.010 t/ft²

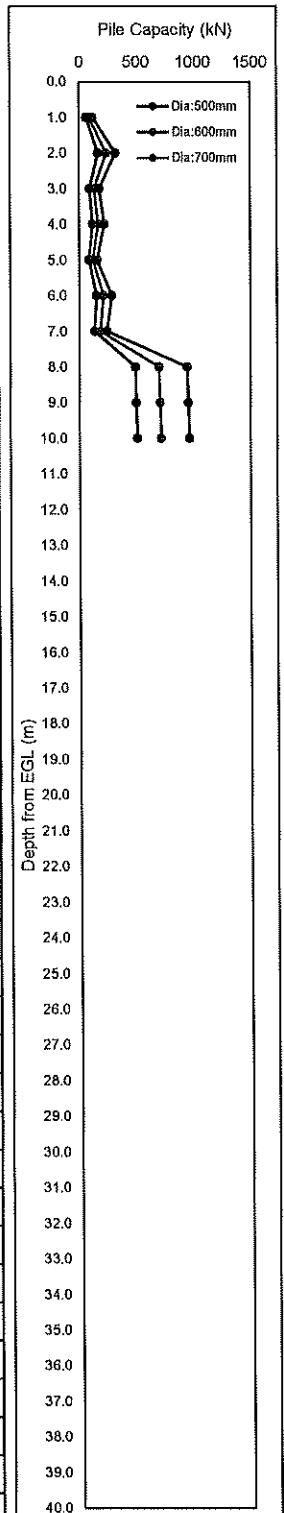


Project Name:	Chittagong WASH Improvement Project
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36465, 91.78163)

Borehole No:	BH-02-2	Date of Boring:	13-May-2023	RL at EGL (m):	0.0000	Factor of Safety :	3.0
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Axial Pile Capacity using Static Bearing Capacity

Elevation (m)	Depth (m)	N	N ₆₀	End Bearing & Skin Friction		Allowable Pile Capacity		
				fb(kPa)	fs (kPa)	Dia:500mm	Dia:600mm	Dia:700mm
-1.0	1.0	24	20	888.6	2.4	59.4	85.3	115.8
-2.0	2.0	29	25	2448.8	4.8	163.4	234.6	318.6
-3.0	3.0	20	17	1295.9	7.3	91.1	129.7	175.1
-4.0	4.0	22	19	1603.0	8.4	115.4	163.6	220.3
-5.0	5.0	17	14	1046.9	9.4	83.6	116.8	155.4
-6.0	6.0	27	23	1981.8	10.5	150.0	211.1	282.6
-7.0	7.0	22	19	1603.0	11.6	131.0	182.4	242.2
-8.0	8.0	50	43	7011.6	12.4	491.3	699.7	944.8
-9.0	9.0	50	43	7011.6	13.6	498.1	707.8	954.3
-10.0	10.0	50	43	7011.6	14.8	505.5	716.7	964.7
-11.0	11.0	---	---	---	---	---	---	---
-12.0	12.0	---	---	---	---	---	---	---
-13.0	13.0	---	---	---	---	---	---	---
-14.0	14.0	---	---	---	---	---	---	---
-15.0	15.0	---	---	---	---	---	---	---
-16.0	16.0	---	---	---	---	---	---	---
-17.0	17.0	---	---	---	---	---	---	---
-18.0	18.0	---	---	---	---	---	---	---
-19.0	19.0	---	---	---	---	---	---	---
-20.0	20.0	---	---	---	---	---	---	---
-21.0	21.0	---	---	---	---	---	---	---
-22.0	22.0	---	---	---	---	---	---	---
-23.0	23.0	---	---	---	---	---	---	---
-24.0	24.0	---	---	---	---	---	---	---
-25.0	25.0	---	---	---	---	---	---	---
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-27.0	27.0	---	---	---	---	---	---	---
-28.0	28.0	---	---	---	---	---	---	---
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-30.0	30.0	---	---	---	---	---	---	---
-31.0	31.0	---	---	---	---	---	---	---
-32.0	32.0	---	---	---	---	---	---	---
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-34.0	34.0	---	---	---	---	---	---	---
-35.0	35.0	---	---	---	---	---	---	---
-36.0	36.0	---	---	---	---	---	---	---
-37.0	37.0	---	---	---	---	---	---	---
-38.0	38.0	---	---	---	---	---	---	---
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-40.0	40.0	---	---	---	---	---	---	---



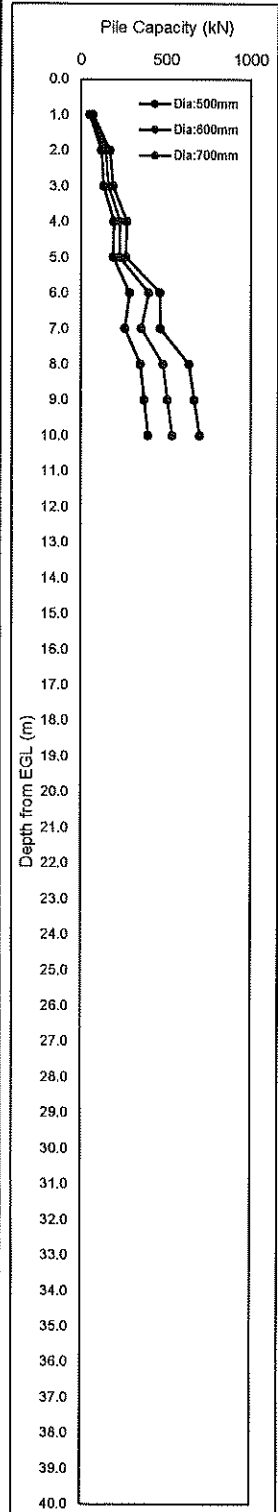
Note: Q_p = Allowable axial pile capacity in kN; $1kN=0.101\text{ Ton}$

Project Name:	Chittagong WASH Improvement Project
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36465, 91.78163)

Borehole No:	BH-02-2	Date of Boring:	13-May-2023	RL at EGL (m):	0.0000	Factor of Safety :	3.0
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Axial Pile Capacity using SPT, N

Elevation (m)	Depth (m)	N	N ₆₀	End Bearing & Skin Friction		Allowable Pile Capacity		
				f _b (kPa)	f _s (kPa)	Dia:500mm	Dia:600mm	Dia:700mm
-1.0	1.0	24	20	509.5	20.0	49.7	59.7	69.6
-2.0	2.0	29	25	1273.8	25.0	120.4	144.5	168.6
-3.0	3.0	20	17	1299.3	17.0	133.4	160.1	186.7
-4.0	4.0	22	19	1936.2	19.0	191.9	230.3	268.7
-5.0	5.0	17	14	1783.3	14.0	188.8	226.5	264.3
-6.0	6.0	27	23	3285.7	23.0	288.8	398.4	464.7
-7.0	7.0	22	19	2850.0	19.0	258.5	355.0	466.4
-8.0	8.0	50	43	4000.0	43.0	350.0	482.9	636.6
-9.0	9.0	50	43	4000.0	43.0	372.5	509.9	668.2
-10.0	10.0	50	43	4000.0	43.0	395.1	536.9	699.7
-11.0	11.0	---	---	---	---	---	---	---
-12.0	12.0	---	---	---	---	---	---	---
-13.0	13.0	---	---	---	---	---	---	---
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-38.0	38.0	---	---	---	---	---	---	---
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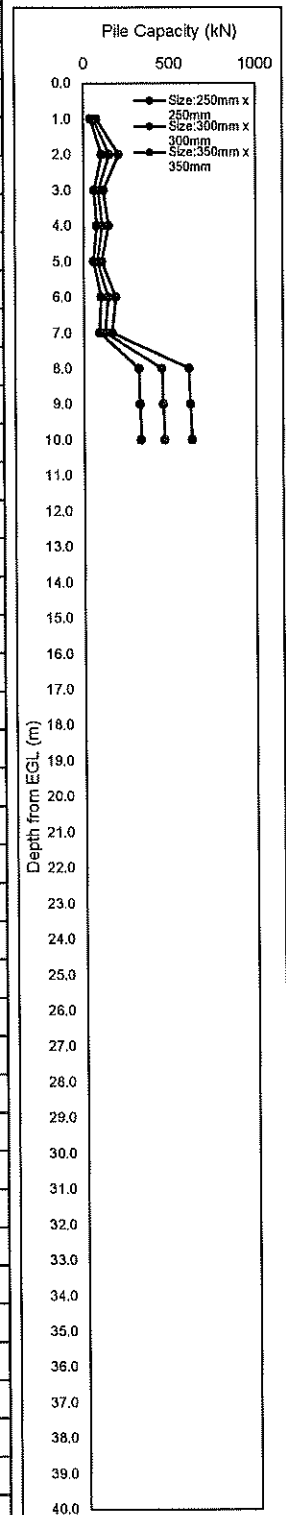
Note: Q_a = Allowable axial pile capacity in kN; 1kN=0.101 Ton

Project Name:	Chittagong WASH Improvement Project
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36465, 91.78163)

Borehole No:	BH-02-2	Date of Boring:	13-May-2023	RL at EGL (m):	0.0000	Factor of Safety :	3.0
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Axial Pile Capacity using Static Bearing Capacity

Elevation (m)	Depth (m)	N	N ₆₀	End Bearing & Skin Friction		Allowable Pile Capacity		
				fb(kPa)	fs (kPa)	Size:250mm x 250mm	Size:300mm x 300mm	Size:350mm x 350mm
-1.0	1.0	24	20	1777.3	3.2	38.1	54.6	74.1
-2.0	2.0	29	25	4897.6	6.4	104.7	150.1	203.7
-3.0	3.0	20	17	2591.7	9.7	59.4	84.2	113.4
-4.0	4.0	22	19	3206.0	11.2	75.7	106.8	143.3
-5.0	5.0	17	14	2093.7	12.5	56.4	78.2	103.4
-6.0	6.0	27	23	3963.6	14.0	99.8	139.6	186.0
-7.0	7.0	22	19	3206.0	15.5	88.9	122.7	161.9
-8.0	8.0	50	43	14023.1	16.5	319.6	453.7	611.1
-9.0	9.0	50	43	14023.1	18.1	325.4	460.6	619.1
-10.0	10.0	50	43	14023.1	19.7	331.7	468.1	628.0
-11.0	11.0	---	---	---	---	---	---	---
-12.0	12.0	---	---	---	---	---	---	---
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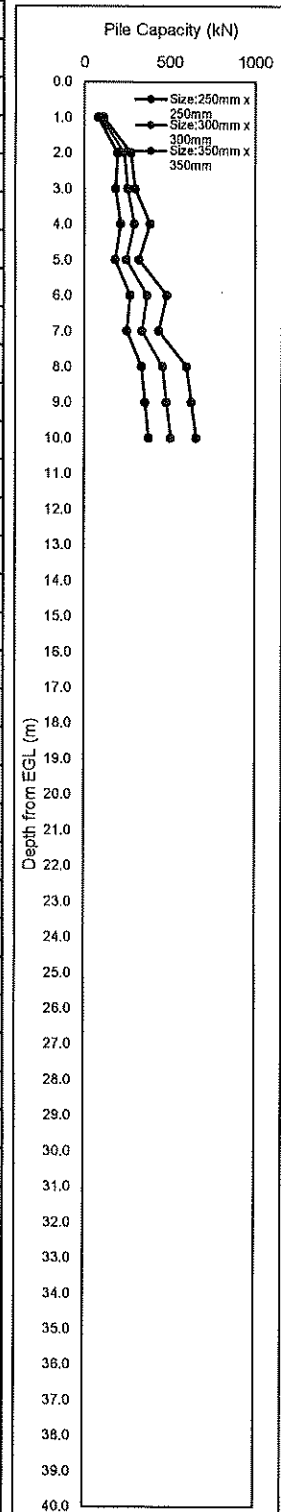
Note: Q_a = Allowable axial pile capacity in kN; 1kN=0.101 Ton

Project Name:	Chittagong WASH Improvement Project
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36465, 91.78163)

Borehole No:	BH-02-2	Date of Boring:	13-May-2023	RL at EGL (m):	0.0000	Factor of Safety :	3.0
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Axial Pile Capacity using SPT, N

Elevation (m)	Depth (m)	N	N ₆₀	End Bearing & Skin Friction		Allowable Pile Capacity		
				fb(kPa)	fs (kPa)	Size:250mm x 250mm	Size:300mm x 300mm	Size:350mm x 350mm
-1.0	1.0	24	20	2717.5	40.0	80.0	96.0	112.0
-2.0	2.0	29	25	6793.7	50.0	195.0	234.0	273.0
-3.0	3.0	20	17	6476.2	34.0	184.0	254.8	297.3
-4.0	4.0	22	19	7600.0	38.0	212.7	293.2	386.4
-5.0	5.0	17	14	5600.0	28.0	182.0	246.4	320.1
-6.0	6.0	27	23	9200.0	46.0	269.3	369.2	484.4
-7.0	7.0	22	19	7600.0	38.0	250.0	338.0	438.7
-8.0	8.0	50	43	11000.0	60.0	337.2	459.6	600.4
-9.0	9.0	50	43	11000.0	60.0	357.2	483.6	628.4
-10.0	10.0	50	43	11000.0	60.0	377.2	507.6	656.4
-11.0	11.0	---	---	---	---	---	---	---
-12.0	12.0	---	---	---	---	---	---	---
-13.0	13.0	---	---	---	---	---	---	---
-14.0	14.0	---	---	---	---	---	---	---
-15.0	15.0	---	---	---	---	---	---	---
-16.0	16.0	---	---	---	---	---	---	---
-17.0	17.0	---	---	---	---	---	---	---
-18.0	18.0	---	---	---	---	---	---	---
-19.0	19.0	---	---	---	---	---	---	---
-20.0	20.0	---	---	---	---	---	---	---
-21.0	21.0	---	---	---	---	---	---	---
-22.0	22.0	---	---	---	---	---	---	---
-23.0	23.0	---	---	---	---	---	---	---
-24.0	24.0	---	---	---	---	---	---	---
-25.0	25.0	---	---	---	---	---	---	---
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-27.0	27.0	---	---	---	---	---	---	---
-28.0	28.0	---	---	---	---	---	---	---
-29.0	29.0	---	---	---	---	---	---	---
-30.0	30.0	---	---	---	---	---	---	---
-31.0	31.0	---	---	---	---	---	---	---
-32.0	32.0	---	---	---	---	---	---	---
-33.0	33.0	---	---	---	---	---	---	---
-34.0	34.0	---	---	---	---	---	---	---
-35.0	35.0	---	---	---	---	---	---	---
-36.0	36.0	---	---	---	---	---	---	---
-37.0	37.0	---	---	---	---	---	---	---
-38.0	38.0	---	---	---	---	---	---	---
-39.0	39.0	---	---	---	---	---	---	---
-40.0	40.0	---	---	---	---	---	---	---



Note: Q_a = Allowable axial pile capacity in kN; $1kN=0.101$ Ton

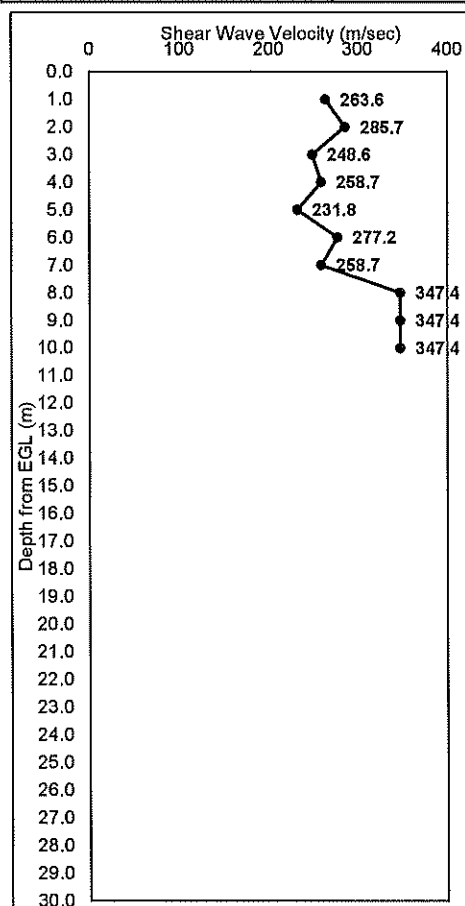
Project Name:	Chittagong WASH Improvement Project
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36465, 91.78163)

Borehole No:	BH-02-2	Date of Boring:	13-May-2023	RL at EGL (m):	0.0000
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Axial Pile Capacity as per Static Bearing Capacity

Elevation (m)	Depth (m)	N	N ₆₀	Vs (m/sec)
-1.0	1.0	24	20	263.6
-2.0	2.0	29	25	285.7
-3.0	3.0	20	17	248.6
-4.0	4.0	22	19	258.7
-5.0	5.0	17	14	231.8
-6.0	6.0	27	23	277.2
-7.0	7.0	22	19	258.7
-8.0	8.0	50	43	347.4
-9.0	9.0	50	43	347.4
-10.0	10.0	50	43	347.4
-11.0	11.0	----	----	----
-12.0	12.0	----	----	----
-13.0	13.0	----	----	----
-14.0	14.0	----	----	----
-15.0	15.0	----	----	----
-16.0	16.0	----	----	----
-17.0	17.0	----	----	----
-18.0	18.0	----	----	----
-19.0	19.0	----	----	----
-20.0	20.0	----	----	----
-21.0	21.0	----	----	----
-22.0	22.0	----	----	----
-23.0	23.0	----	----	----
-24.0	24.0	----	----	----
-25.0	25.0	----	----	----
-26.0	26.0	----	----	----
-27.0	27.0	----	----	----
-28.0	28.0	----	----	----
-29.0	29.0	----	----	----
-30.0	30.0	----	----	----

Average Vs (m/s)	N/A
Average N	N/A
Site Class	N/A

**Note**

SA: Rock or other rock-like geological formation

SB: Deposits of very dense sand, gravel, or very stiff clay, at least several tens of metres in thickness

SC: Deep deposits of dense or medium dense sand, gravel or stiff clay with thickness from several tens to many hundreds of metres

SD: Deposits of loose-to-medium cohesionless soil (with or without some soft cohesive layers)

4

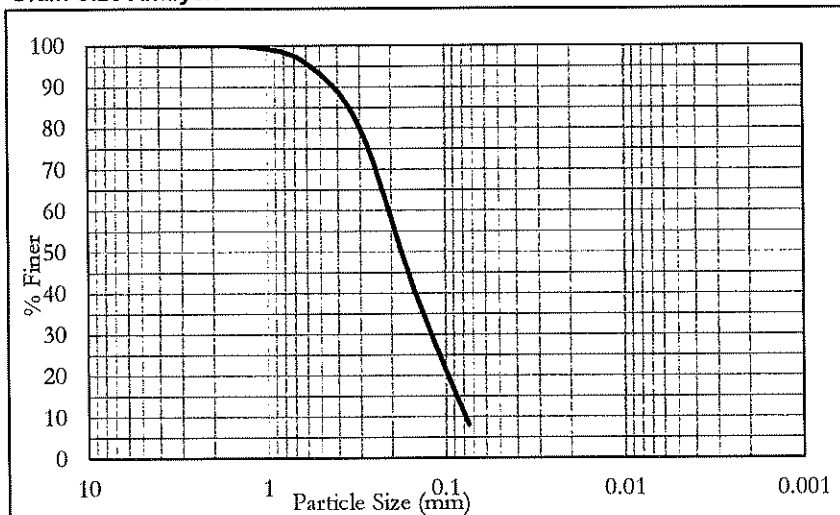
Summary of Laboratory Test Results

Depth (m)	Elevation (m)	Specific gravity	Water content (%)	Bulk density (g/cm ³)	Bulk density (kN/m ³)	Dry density (kN/m ³)	Grain Size Analysis		Atterberg Limit			Direct Shear Test		Unconfined Compression Test		
							Sand (%)	Fines (%)	LL (%)	PL (%)	PI (%)	c (kPa)	φ (degree)	q _u (kPa)	c _u (kPa)	Strain at Failure (%)
1-1.5	-1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2-2.5	-2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3-3.5	-3	—	—	—	—	—	91.86	8.14	—	—	—	—	—	—	—	—
4-4.5	-4	—	28.23	—	—	—	—	—	—	—	—	—	—	—	—	—
5-5.5	-5	2.67	—	1.82	17.85	—	—	—	—	—	—	—	—	—	—	—
6-6.5	-6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
7-7.5	-7	—	26.23	—	—	—	—	—	—	—	—	—	—	—	—	—
8-8.5	-8	—	—	—	—	—	94.69	5.31	—	—	—	—	—	—	—	—
9-9.5	-9	2.7	—	—	—	—	—	—	—	—	—	0	40.7	—	—	—
10-10.5	-10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

1

Grain Size Analysis of Soil Sample

Project Name:	Chittagong WASH Improvement Project		
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36465, 91.78163)		
Date of Boring:	13-May-2023	Borehole No :	BH-02-2
Sample Type	Disturbed	Depth (m):	3

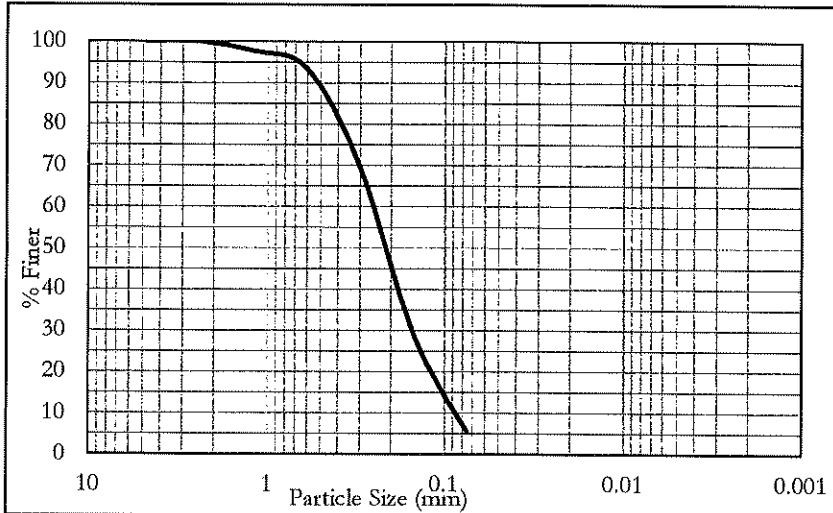
Grain Size Analysis

Particle Size (mm)	% Finer
4.750	100.000
2.380	100.000
1.190	99.661
0.600	95.760
0.300	80.156
0.150	40.756
0.075	8.141
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000

Soil Type	Unit	Value	Remarks
Sand	%	91.86	Ref: ASTM D2487-11
Coarse Sand	%	0.00	
Medium Sand	%	0.00	
Fine Sand	%	91.86	
Fines	%	8.14	Ref: ASTM D422
Silt	%	8.14	
Clay	%	0.00	Ref: ASTM D2487-11
D ₆₀	%	0.200	
D ₃₀	%	0.125	
D ₁₀	%	0.070	
C _u	%	2.857	
C _c	%	1.116	

Grain Size Analysis of Soil Sample

Project Name:	Chittagong WASH Improvement Project		
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36465, 91.78163)		
Date of Boring:	13-May-2023	Borehole No :	BH-02-2
Sample Type	Disturbed	Depth (m):	8

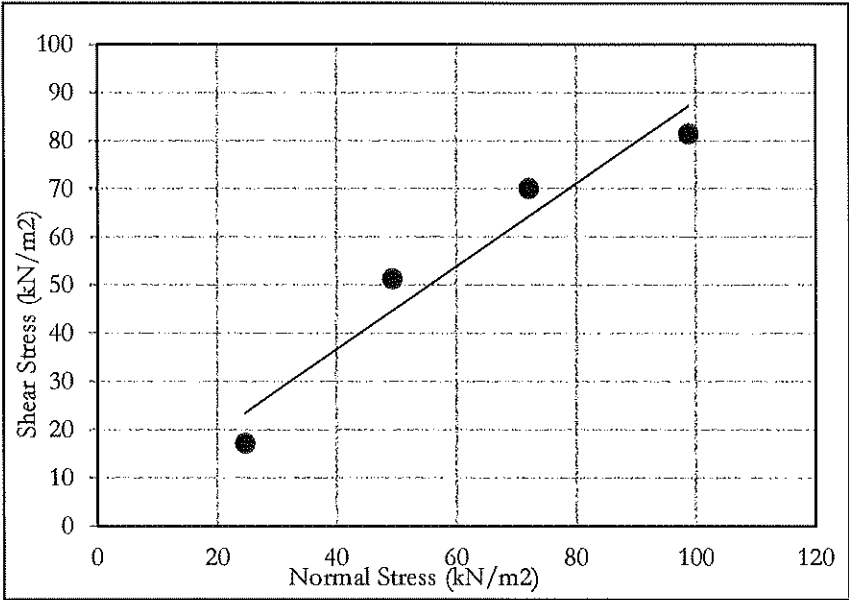
Grain Size Analysis

Particle Size (mm)	% Finer
4.750	100.000
2.380	100.000
1.190	97.653
0.600	93.454
0.300	69.701
0.150	29.064
0.075	5.311
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000

Soil Type	Unit	Value	Remarks
Sand	%	94.69	Ref: ASTM D2487-11
Coarse Sand	%	0.00	
Medium Sand	%	0.00	
Fine Sand	%	94.69	
Fines	%	5.31	Ref: ASTM D422
Silt	%	5.31	
Clay	%	0.00	Ref: ASTM D2487-11
D ₆₀	%	0.250	
D ₃₀	%	0.160	
D ₁₀	%	0.090	
C _u	%	2.778	
C _c	%	1.138	

Direct Shear Test (Quick) of Soil Sample

Project Name:	Chittagong WASH Improvement Project		
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36465, 91.78163)		
Date of Boring:	13-May-2023	Borehole No:	BH-02-2
Sample Type	Disturbed	Depth:	9



Normal Stress (kPa)	Shear Stress (kPa)
24.70	17.07
49.40	51.21
72.20	69.98
98.80	81.36

Cohesion, c (kPa)	0.0
Angle of Internal Friction, ϕ (Degree)	40.7

Q

Borehole No: BH-02-3

Bore Log

Project Name:	Chittagong WASH Improvement Project		
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36489, 91.78164)		
Borehole No:	BH-02-3	Depth of Water Table in m (From EGL) :	3.0
Date of Boring (Starting):	15-May-2023	RL at EGL (m):	0.0000

Drilling Details

Drilling Method:	Wash	Drilling Type:	Manual	Borehole Dia (mm):	100
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Correction Factor (for SPT, N)

Hammer Efficiency	0.80	Borehole Diameter	1.00	Standard Sampler	1.00	Rod Length	0.85
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Elevation (m)	Depth (m)	Sample Type	Soil Type	Visual Description of the Strata	Symbol	Standard Penetration Test (SPT)				Variation of SPT, N	N ₆₀	q' (kPa)	c (kPa)	φ (d)	Vs (m/s)
						15 cm	15 cm	15 cm	SPT, N						
-1.0	1.0	D	Sand	Sand with Silt; Medium Dense		8	10	13	23		20	18.0	----	33.0	263.6
-2.0	2.0	D	Sand			10	13	17	30		26	36.0	----	35.0	289.7
-3.0	3.0	D	Sand			7	8	10	18		15	54.6	----	32.0	237.6
-4.0	4.0	D	Sand			9	10	15	25		21	62.3	----	33.0	268.2
-5.0	5.0	D	Sand			6	11	13	24		20	70.6	----	33.0	263.6
-6.0	6.0	D	Sand			5	7	10	17		14	78.8	----	31.0	231.8
-7.0	7.0	D	Sand	Sand with Silt; Dense		9	10	15	25		21	86.4	----	33.0	268.2
-8.0	8.0	D	Sand			18	20	30	50		43	94.7	----	40.0	347.4
-9.0	9.0	D	Sand			50+	----	----	50		43	103.8	----	40.0	347.4
-10.0	10.0	D	Sand			50+	----	----	50		43	113.0	----	40.0	347.4
-11.0	11.0					----	----	----							
-12.0	12.0					----	----	----							
-13.0	13.0					----	----	----							
-14.0	14.0					----	----	----							
-15.0	15.0					----	----	----							
-16.0	16.0					----	----	----							
-17.0	17.0					----	----	----							
-18.0	18.0					----	----	----							
-19.0	19.0					----	----	----							
-20.0	20.0					----	----	----							
-21.0	21.0					----	----	----							
-22.0	22.0					----	----	----							
-23.0	23.0					----	----	----							
-24.0	24.0					----	----	----							
-25.0	25.0					----	----	----							
-26.0	26.0					----	----	----							
-27.0	27.0					----	----	----							
-28.0	28.0					----	----	----							
-29.0	29.0					----	----	----							
-30.0	30.0					----	----	----							
-31.0	31.0					----	----	----							
-32.0	32.0					----	----	----							
-33.0	33.0					----	----	----							
-34.0	34.0					----	----	----							
-35.0	35.0					----	----	----							
-36.0	36.0					----	----	----							
-37.0	37.0					----	----	----							
-38.0	38.0					----	----	----							
-39.0	39.0					----	----	----							
-40.0	40.0					----	----	----							

** c, φ, and Vs are calculated based on standard correlation with SPT

Sand
 Silt
 Clay
 Shale
 D = Disturbed Sample U = Undisturbed Sample

Project Name:	Chittagong WASH Improvement Project
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36489, 91.78164)

Borehole No:	BH-02-3	Date of Boring:	15-May-2023	RL at EGL:	0.0000	Factor of Safety :	3.0
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Axial Pile Capacity as per Static Bearing Capacity

Elevation (m)	Depth (m)	N	N ₆₀	Width:1.5 m		Width:2 m		Width:2.5 m		Recommended Allowable Bearing Pressure (kPa)		
				q _a -1 (kPa)	q _a -2 (kPa)	q _a -1 (kPa)	q _a -2 (kPa)	q _a -1 (kPa)	q _a -2 (kPa)	Width:1.5 m	Width:2 m	Width:2.5 m
-1.0	1.0	23	20	337.1	308.0	385.0	342.4	432.9	378.7856	322.5	363.7	405.9
-1.5	1.5	26	22	501.6	483.2	559.3	517.9	617.0	512.4554	492.4	538.6	564.7
-2.0	2.0	30	26	709.8	720.3	780.2	752.2	850.6	709.7585	715.1	766.2	780.2
-3.0	3.0	18	15	637.6	706.2	676.8	700.2	715.9	608.4202	671.9	688.5	662.2
-4.0	4.0	25	21	736.6	890.1	758.6	841.6	780.7	670.4071	813.4	800.1	725.6
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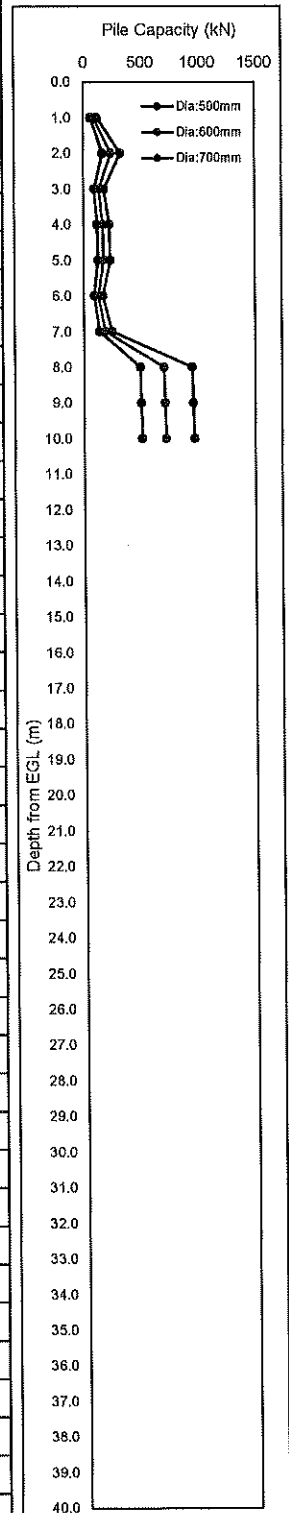
Note: q_a-1: using Terzaghi's bearing capacity formula, q_a-2: using Meyerhof bearing capacity formula
 1kPa=0.010 t/m²

Project Name:	Chittagong WASH Improvement Project
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36489, 91.78164)

Borehole No:	BH-02-3	Date of Boring:	15-May-2023	RL at EGL (m):	0.0000	Factor of Safety:	3.0
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Axial Pile Capacity using Static Bearing Capacity

Elevation (m)	Depth (m)	N	N ₆₀	End Bearing & Skin Friction		Allowable Pile Capacity		
				f _b (kPa)	f _s (kPa)	Dia:500mm	Dia:600mm	Dia:700mm
-1.0	1.0	23	20	888.6	2.4	59.4	85.3	115.8
-2.0	2.0	30	26	2448.8	4.8	163.4	234.6	318.6
-3.0	3.0	18	15	1295.9	7.3	91.2	129.7	175.1
-4.0	4.0	25	21	1603.0	8.4	115.4	163.6	220.3
-5.0	5.0	24	20	1603.0	9.5	120.0	169.2	226.8
-6.0	6.0	17	14	1046.9	10.5	88.9	123.1	162.8
-7.0	7.0	25	21	1603.0	11.6	131.0	182.4	242.2
-8.0	8.0	50	43	7011.6	12.4	491.3	699.7	944.8
-9.0	9.0	50	43	7011.6	13.6	498.1	707.9	954.3
-10.0	10.0	50	43	7011.6	14.8	505.5	716.8	964.7
-11.0	11.0	---	---	---	---	---	---	---
-12.0	12.0	---	---	---	---	---	---	---
-13.0	13.0	---	---	---	---	---	---	---
-14.0	14.0	---	---	---	---	---	---	---
-15.0	15.0	---	---	---	---	---	---	---
-16.0	16.0	---	---	---	---	---	---	---
-17.0	17.0	---	---	---	---	---	---	---
-18.0	18.0	---	---	---	---	---	---	---
-19.0	19.0	---	---	---	---	---	---	---
-20.0	20.0	---	---	---	---	---	---	---
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-25.0	25.0	---	---	---	---	---	---	---
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-28.0	28.0	---	---	---	---	---	---	---
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-31.0	31.0	---	---	---	---	---	---	---
-32.0	32.0	---	---	---	---	---	---	---
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-34.0	34.0	---	---	---	---	---	---	---
-35.0	35.0	---	---	---	---	---	---	---
-36.0	36.0	---	---	---	---	---	---	---
-37.0	37.0	---	---	---	---	---	---	---
-38.0	38.0	---	---	---	---	---	---	---
-39.0	39.0	---	---	---	---	---	---	---
-40.0	40.0	---	---	---	---	---	---	---



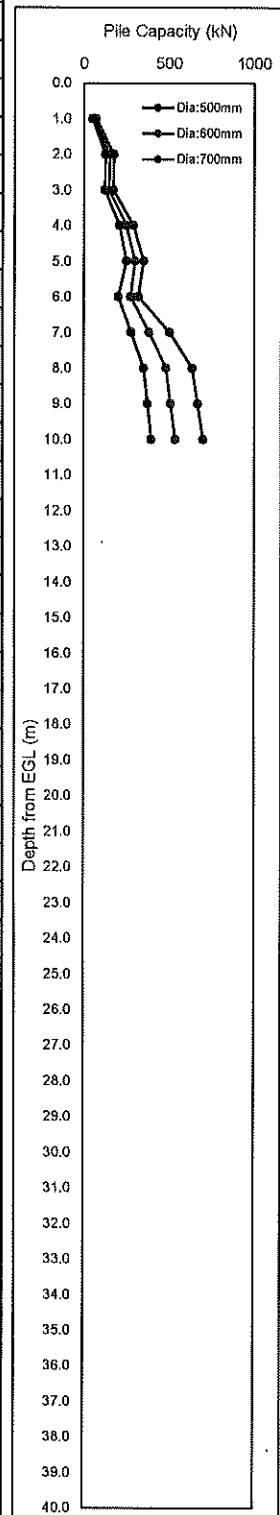
Note: Q_a = Allowable axial pile capacity in kN; 1kN=0.101 Ton

Project Name:	Chittagong WASH Improvement Project
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36489, 91.78164)

Borehole No:	BH-02-3	Date of Boring:	15-May-2023	RL at EGL (m):	0.0000	Factor of Safety :	3.0
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Axial Pile Capacity using SPT, N

Elevation (m)	Depth (m)	N	N ₆₀	End Bearing & Skin Friction		Allowable Pile Capacity		
				f _b (kPa)	f _s (kPa)	Dia:500mm	Dia:600mm	Dia:700mm
-1.0	1.0	23	20	509.5	20.0	49.7	59.7	69.6
-2.0	2.0	30	26	1324.8	26.0	124.6	149.5	174.5
-3.0	3.0	18	15	1146.4	15.0	121.6	145.9	170.2
-4.0	4.0	25	21	2140.0	21.0	207.6	249.1	290.6
-5.0	5.0	24	20	2547.6	20.0	249.8	299.7	349.7
-6.0	6.0	17	14	2000.0	14.0	199.8	272.7	318.1
-7.0	7.0	25	21	3150.0	21.0	277.6	382.6	504.1
-8.0	8.0	50	43	4000.0	43.0	350.0	482.9	636.6
-9.0	9.0	50	43	4000.0	43.0	372.5	509.9	668.2
-10.0	10.0	50	43	4000.0	43.0	395.1	536.9	699.7
-11.0	11.0	---	---	---	---	---	---	---
-12.0	12.0	---	---	---	---	---	---	---
-13.0	13.0	---	---	---	---	---	---	---
-14.0	14.0	---	---	---	---	---	---	---
-15.0	15.0	---	---	---	---	---	---	---
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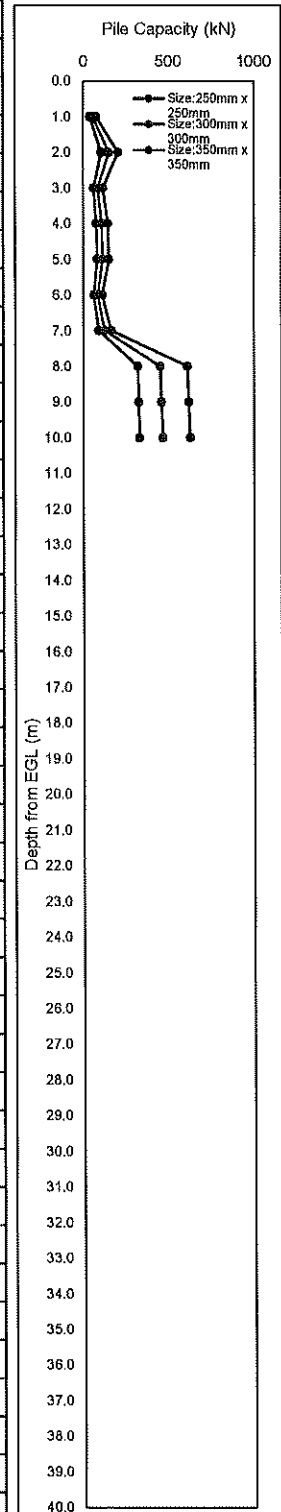
Note: Q_a = Allowable axial pile capacity in kN; 1kN=0.101 Ton

Project Name:	Chittagong WASH Improvement Project
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36489, 91.78164)

Borehole No:	BH-02-3	Date of Boring:	15-May-2023	RL at EGL (m):	0.0000	Factor of Safety :	3.0
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Axial Pile Capacity using Static Bearing Capacity

Elevation (m)	Depth (m)	N	N ₆₀	End Bearing & Skin Friction		Allowable Pile Capacity		
				f _b (kPa)	f _s (kPa)	Size:250mm x 250mm	Size:300mm x 300mm	Size:350mm x 350mm
-1.0	1.0	23	20	1777.3	3.2	38.1	54.6	74.1
-2.0	2.0	30	26	4897.6	6.4	104.7	150.1	203.7
-3.0	3.0	18	15	2591.7	9.7	59.4	84.2	113.4
-4.0	4.0	25	21	3206.0	11.1	75.7	106.8	143.3
-5.0	5.0	24	20	3206.0	12.6	79.6	111.6	148.9
-6.0	6.0	17	14	2093.7	14.0	60.9	83.5	109.7
-7.0	7.0	25	21	3206.0	15.5	89.0	122.8	162.0
-8.0	8.0	50	43	14023.1	16.5	319.6	453.7	611.1
-9.0	9.0	50	43	14023.1	18.1	325.4	460.6	619.2
-10.0	10.0	50	43	14023.1	19.7	331.7	468.2	628.0
-11.0	11.0	---	---	---	---	---	---	---
-12.0	12.0	---	---	---	---	---	---	---
-13.0	13.0	---	---	---	---	---	---	---
-14.0	14.0	---	---	---	---	---	---	---
-15.0	15.0	---	---	---	---	---	---	---
-16.0	16.0	---	---	---	---	---	---	---
-17.0	17.0	---	---	---	---	---	---	---
-18.0	18.0	---	---	---	---	---	---	---
-19.0	19.0	---	---	---	---	---	---	---
-20.0	20.0	---	---	---	---	---	---	---
-21.0	21.0	---	---	---	---	---	---	---
-22.0	22.0	---	---	---	---	---	---	---
-23.0	23.0	---	---	---	---	---	---	---
-24.0	24.0	---	---	---	---	---	---	---
-25.0	25.0	---	---	---	---	---	---	---
-26.0	26.0	---	---	---	---	---	---	---
-27.0	27.0	---	---	---	---	---	---	---
-28.0	28.0	---	---	---	---	---	---	---
-29.0	29.0	---	---	---	---	---	---	---
-30.0	30.0	---	---	---	---	---	---	---
-31.0	31.0	---	---	---	---	---	---	---
-32.0	32.0	---	---	---	---	---	---	---
-33.0	33.0	---	---	---	---	---	---	---
-34.0	34.0	---	---	---	---	---	---	---
-35.0	35.0	---	---	---	---	---	---	---
-36.0	36.0	---	---	---	---	---	---	---
-37.0	37.0	---	---	---	---	---	---	---
-38.0	38.0	---	---	---	---	---	---	---
-39.0	39.0	---	---	---	---	---	---	---
-40.0	40.0	---	---	---	---	---	---	---



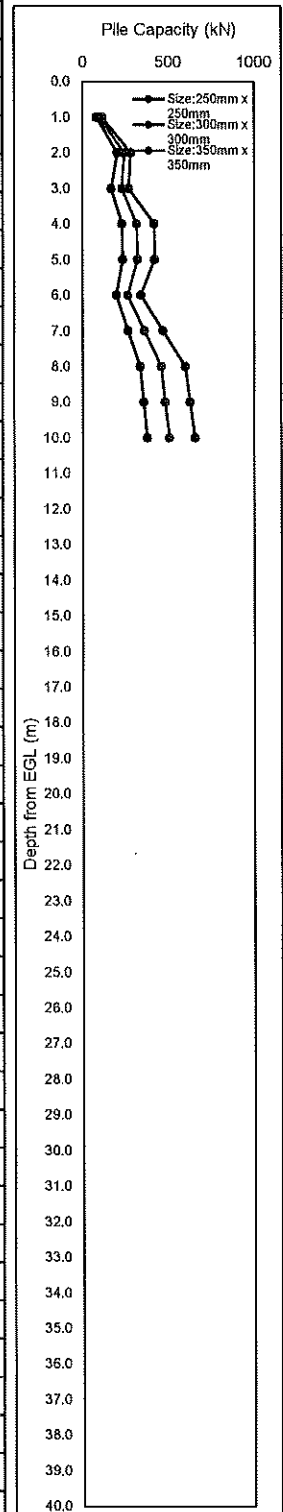
Note: Q_a = Allowable axial pile capacity in kN; 1kN=0.101 Ton

Project Name:	Chittagong WASH Improvement Project
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36489, 91.78164)

Borehole No:	BH-02-3	Date of Boring:	15-May-2023	RL at EGL (m):	0.0000	Factor of Safety :	3.0
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Axial Pile Capacity using SPT, N

Elevation (m)	Depth (m)	N	N ₆₀	End Bearing & Skin Friction		Allowable Pile Capacity		
				fb(kPa)	fs (kPa)	Size:250mm x 250mm	Size:300mm x 300mm	Size:350mm x 350mm
-1.0	1.0	23	20	2717.5	40.0	80.0	96.0	112.0
-2.0	2.0	30	26	7065.4	52.0	202.0	242.4	282.8
-3.0	3.0	18	15	5714.3	30.0	167.3	230.8	269.3
-4.0	4.0	25	21	8400.0	42.0	229.3	317.2	419.1
-5.0	5.0	24	20	8000.0	40.0	234.7	321.6	421.9
-6.0	6.0	17	14	5600.0	28.0	196.0	263.2	339.7
-7.0	7.0	25	21	8400.0	42.0	266.0	361.2	470.4
-8.0	8.0	50	43	11000.0	60.0	337.2	459.6	600.4
-9.0	9.0	50	43	11000.0	60.0	357.2	483.6	628.4
-10.0	10.0	50	43	11000.0	60.0	377.2	507.6	656.4
-11.0	11.0	---	---	---	---	---	---	---
-12.0	12.0	---	---	---	---	---	---	---
-13.0	13.0	---	---	---	---	---	---	---
-14.0	14.0	---	---	---	---	---	---	---
-15.0	15.0	---	---	---	---	---	---	---
-16.0	16.0	---	---	---	---	---	---	---
-17.0	17.0	---	---	---	---	---	---	---
-18.0	18.0	---	---	---	---	---	---	---
-19.0	19.0	---	---	---	---	---	---	---
-20.0	20.0	---	---	---	---	---	---	---
-21.0	21.0	---	---	---	---	---	---	---
-22.0	22.0	---	---	---	---	---	---	---
-23.0	23.0	---	---	---	---	---	---	---
-24.0	24.0	---	---	---	---	---	---	---
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-26.0	26.0	---	---	---	---	---	---	---
-27.0	27.0	---	---	---	---	---	---	---
-28.0	28.0	---	---	---	---	---	---	---
-29.0	29.0	---	---	---	---	---	---	---
-30.0	30.0	---	---	---	---	---	---	---
-31.0	31.0	---	---	---	---	---	---	---
-32.0	32.0	---	---	---	---	---	---	---
-33.0	33.0	---	---	---	---	---	---	---
-34.0	34.0	---	---	---	---	---	---	---
-35.0	35.0	---	---	---	---	---	---	---
-36.0	36.0	---	---	---	---	---	---	---
-37.0	37.0	---	---	---	---	---	---	---
-38.0	38.0	---	---	---	---	---	---	---
-39.0	39.0	---	---	---	---	---	---	---
-40.0	40.0	---	---	---	---	---	---	---



Note: Q_a = Allowable axial pile capacity in kN; $1kN=0.101$ Ton

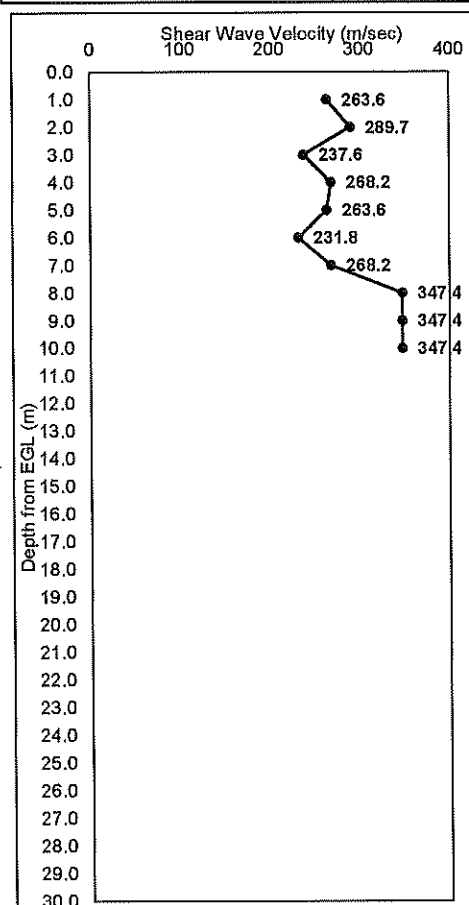
Project Name:	Chittagong WASH Improvement Project
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36489, 91.78164)

Borehole No:	BH-02-3	Date of Boring:	15-May-2023	RL at EGL (m):	0.0000
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Axial Pile Capacity as per Static Bearing Capacity

Elevation (m)	Depth (m)	N	N ₆₀	Vs (m/sec)
-1.0	1.0	23	20	263.6
-2.0	2.0	30	26	289.7
-3.0	3.0	18	15	237.6
-4.0	4.0	25	21	268.2
-5.0	5.0	24	20	263.6
-6.0	6.0	17	14	231.8
-7.0	7.0	25	21	268.2
-8.0	8.0	50	43	347.4
-9.0	9.0	50	43	347.4
-10.0	10.0	50	43	347.4
-11.0	11.0	----	----	----
-12.0	12.0	----	----	----
-13.0	13.0	----	----	----
-14.0	14.0	----	----	----
-15.0	15.0	----	----	----
-16.0	16.0	----	----	----
-17.0	17.0	----	----	----
-18.0	18.0	----	----	----
-19.0	19.0	----	----	----
-20.0	20.0	----	----	----
-21.0	21.0	----	----	----
-22.0	22.0	----	----	----
-23.0	23.0	----	----	----
-24.0	24.0	----	----	----
-25.0	25.0	----	----	----
-26.0	26.0	----	----	----
-27.0	27.0	----	----	----
-28.0	28.0	----	----	----
-29.0	29.0	----	----	----
-30.0	30.0	----	----	----

Average Vs (m/s)	N/A
Average N	N/A
Site Class	N/A

**Note**

SA: Rock or other rock-like geological formation

SB: Deposits of very dense sand, gravel, or very stiff clay, at least several tens of metres in thickness

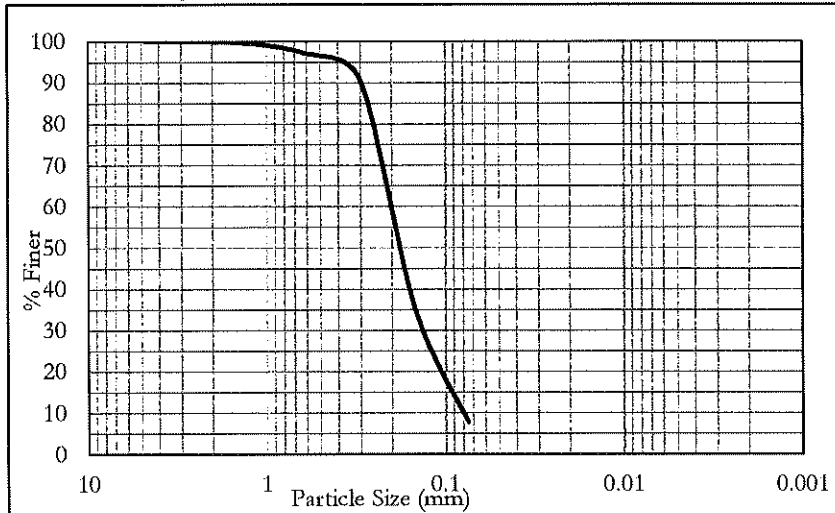
SC: Deep deposits of dense or medium dense sand, gravel or stiff clay with thickness from several tens to many hundreds of metres

SD: Deposits of loose-to-medium cohesionless soil (with or without some soft cohesive layers)

Depth (m)	Elevation (m)	Specific gravity	Water content (%)	Bulk density (g/cm ³)	Bulk density (kN/m ³)	Dry density (kN/m ³)	Grain Size Analysis		Atterberg Limit			Direct Shear Test		Unconfined Compression Test		
							Sand (%)	Fines (%)	LL (%)	PL (%)	PI (%)	c (kPa)	ϕ (degree)	q_u (kPa)	c_u (kPa)	Strain at Failure (%)
1-1.5	-1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2-2.5	-2	2.63	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3-3.5	-3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4-4.5	-4	—	—	—	—	—	92.13	7.87	—	—	—	—	—	—	—	—
5-5.5	-5	—	—	—	—	—	94.82	5.18	—	—	—	—	—	—	—	—
6-6.5	-6	2.66	—	—	—	—	—	—	—	—	—	—	—	—	—	—
7-7.5	-7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
8-8.5	-8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
9-9.5	-9	2.7	—	—	—	—	95.37	4.63	—	—	—	—	—	—	—	—
10-10.5	-10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Grain Size Analysis of Soil Sample

Project Name:	Chittagong WASH Improvement Project		
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36489, 91.78164)		
Date of Boring:	15-May-2023	Borehole No :	BH-02-3
Sample Type	Disturbed	Depth (m):	4

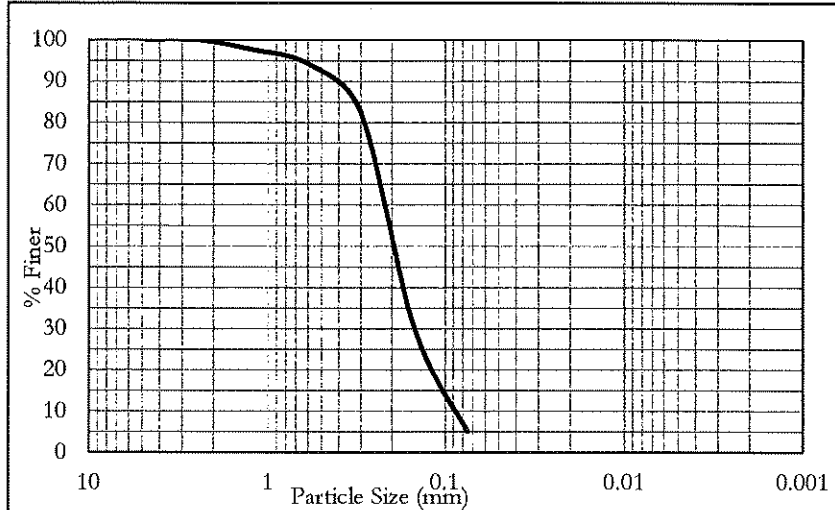
Grain Size Analysis

Particle Size (mm)	% Finer
4.750	100.000
2.380	100.000
1.190	99.457
0.600	97.013
0.300	90.768
0.150	35.650
0.075	7.874
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000

Soil Type	Unit	Value	Remarks
Sand	%	92.13	Ref: ASTM D2487-11
Coarse Sand	%	0.00	
Medium Sand	%	0.00	
Fine Sand	%	92.13	
Fines	%	7.87	Ref: ASTM D422
Silt	%	7.87	
Clay	%	0.00	Ref: ASTM D2487-11
D ₆₀	%	0.200	
D ₃₀	%	0.150	
D ₁₀	%	0.080	
C _u	%	2.500	
C _c	%	1.406	

Grain Size Analysis of Soil Sample

Project Name:	Chittagong WASH Improvement Project		
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36489, 91.78164)		
Date of Boring:	15-May-2023	Borehole No :	BH-02-3
Sample Type	Disturbed	Depth (m):	5

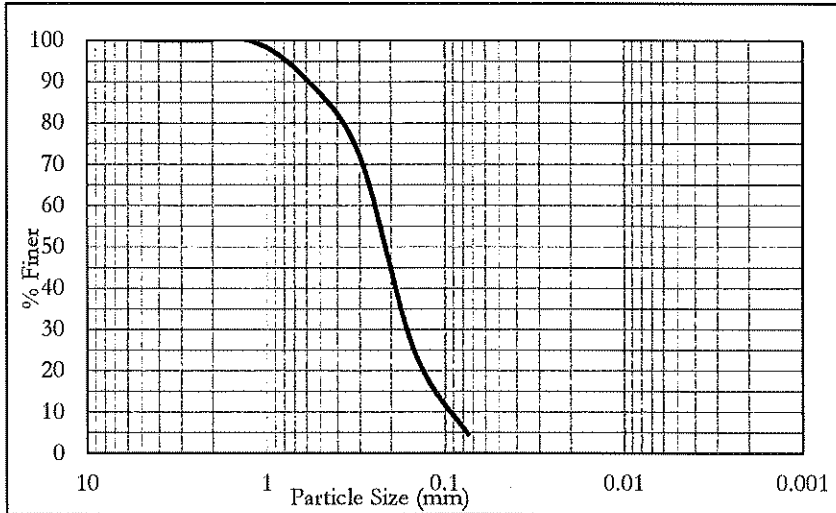
Grain Size Analysis

Particle Size (mm)	% Finer
4.750	100.000
2.380	100.000
1.190	97.548
0.600	94.278
0.300	82.561
0.150	30.245
0.075	5.177
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000

Soil Type	Unit	Value	Remarks
Sand	%	94.82	Ref: ASTM D2487-11
Coarse Sand	%	0.00	
Medium Sand	%	0.00	
Fine Sand	%	94.82	
Fines	%	5.18	Ref: ASTM D422
Silt	%	5.18	
Clay	%	0.00	
	%	0.00	
D ₆₀	%	0.200	Ref: ASTM D2487-11
D ₃₀	%	0.150	
D ₁₀	%	0.080	
C _u	%	2.500	
C _c	%	1.406	

Grain Size Analysis of Soil Sample

Project Name:	Chittagong WASH Improvement Project		
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36489, 91.78164)		
Date of Boring:	15-May-2023	Borehole No :	BH-02-3
Sample Type	Disturbed	Depth (m):	9

Grain Size Analysis

Particle Size (mm)	% Finer
4.750	100.000
2.380	100.000
1.190	99.759
0.600	90.708
0.300	72.204
0.150	25.141
0.075	4.626
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000

Soil Type	Unit	Value	Remarks
Sand	%	95.37	Ref: ASTM D2487-11
Coarse Sand	%	0.00	
Medium Sand	%	0.00	
Fine Sand	%	95.37	
Fines	%	4.63	Ref: ASTM D422
Silt	%	4.63	
Clay	%	0.00	
D ₆₀	%	0.250	Ref: ASTM D2487-11
D ₃₀	%	0.170	
D ₁₀	%	0.090	
C _u	%	2.778	
C _c	%	1.284	

Borehole No: **BH-02-4**



Project Name:	Chittagong WASH Improvement Project		
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36463, 91.78171)		
Borehole No:	BH-02-4	Depth of Water Table in m (From EGL) :	3.0
Date of Boring (Starting):	15-May-2023		RL at EGL (m):

Drilling Method:	Wash	Drilling Type:	Manual	Borehole Dia (mm):	100
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Hammer Efficiency	0.60	Borehole Diameter	1.00	Standard Sampler	1.00	Rod Length	0.85
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** c, ϕ and Vs are calculated based on standard correlation with SPT

④

Project Name:	Chittagong WASH Improvement Project
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36463, 91.78171)

Borehole No:	BH-02-4	Date of Boring:	15-May-2023	RL at EGL:	0.0000	Factor of Safety :	3.0
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Axial Pile Capacity as per Static Bearing Capacity

Elevation (m)	Depth (m)	N	N ₆₀	Width:1.5 m		Width:2 m		Width:2.5 m		Recommended Allowable Bearing Pressure (kPa)		
				q _a -1 (kPa)	q _a -2 (kPa)	q _a -1 (kPa)	q _a -2 (kPa)	q _a -1 (kPa)	q _a -2 (kPa)	Width:1.5 m	Width:2 m	Width:2.5 m
-1.0	1.0	24	20	337.1	308.0	385.0	342.4	432.9	378.7856	322.5	363.7	405.9
-1.5	1.5	20	17	375.6	361.3	415.2	384.3	454.8	379.0386	368.4	399.8	416.9
-2.0	2.0	17	14	400.6	404.4	433.5	416.8	466.3	391.9046	402.5	425.1	429.1
-3.0	3.0	26	22	821.0	914.1	878.7	912.2	936.3	792.9911	867.5	895.4	864.7
-4.0	4.0	30	26	951.4	1158.2	984.6	1097.8	1017.9	870.7307	1054.8	1041.2	944.3
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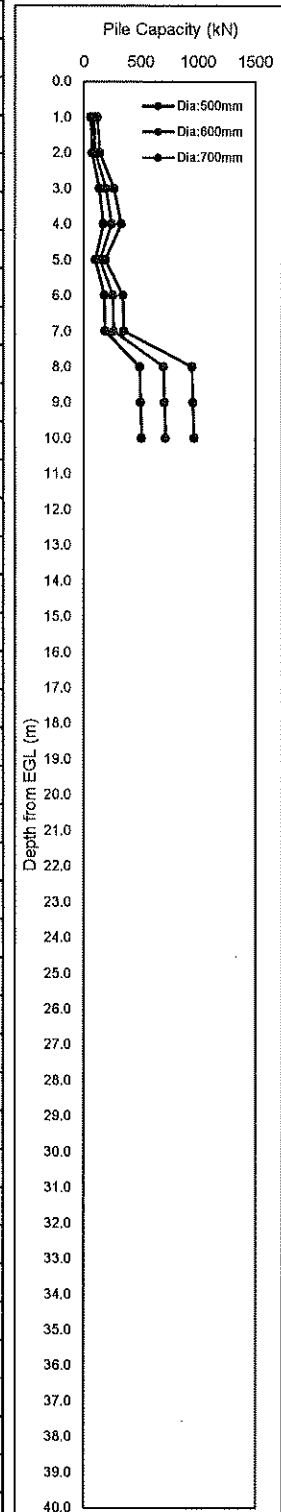
Note: q_a-1: using Terzaghi's bearing capacity formula, q_a-2: using Meyerhof bearing capacity formula
1kPa=0.010 t/m²

Project Name:	Chittagong WASH Improvement Project
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36463, 91.78171)

Borehole No:	BH-02-4	Date of Boring:	15-May-2023	RL at EGL (m):	0.0000	Factor of Safety :	3.0
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Axial Pile Capacity using Static Bearing Capacity

Elevation (m)	Depth (m)	N	N ₆₀	End Bearing & Skin Friction		Allowable Pile Capacity		
				fb(kPa)	fs (kPa)	Dia:500mm	Dia:600mm	Dia:700mm
-1.0	1.0	24	20	888.6	2.4	59.4	85.3	115.8
-2.0	2.0	17	14	1046.9	4.8	71.7	102.4	138.7
-3.0	3.0	26	22	1981.8	7.2	136.0	194.3	263.0
-4.0	4.0	30	26	2448.8	8.3	170.6	243.2	328.6
-5.0	5.0	21	18	1295.9	9.5	99.8	140.1	187.2
-6.0	6.0	29	25	2448.8	10.5	180.5	255.1	342.4
-7.0	7.0	33	28	2448.8	11.7	186.3	262.0	350.6
-8.0	8.0	50	43	7011.6	12.6	491.3	699.7	944.8
-9.0	9.0	50	43	7011.6	13.8	498.2	708.0	954.5
-10.0	10.0	50	43	7011.6	15.0	505.7	717.0	965.0
-11.0	11.0	---	---	---	---	---	---	---
-12.0	12.0	---	---	---	---	---	---	---
-13.0	13.0	---	---	---	---	---	---	---
-14.0	14.0	---	---	---	---	---	---	---
-15.0	15.0	---	---	---	---	---	---	---
-16.0	16.0	---	---	---	---	---	---	---
-17.0	17.0	---	---	---	---	---	---	---
-18.0	18.0	---	---	---	---	---	---	---
-19.0	19.0	---	---	---	---	---	---	---
-20.0	20.0	---	---	---	---	---	---	---
-21.0	21.0	---	---	---	---	---	---	---
-22.0	22.0	---	---	---	---	---	---	---
-23.0	23.0	---	---	---	---	---	---	---
-24.0	24.0	---	---	---	---	---	---	---
-25.0	25.0	---	---	---	---	---	---	---
-26.0	26.0	---	---	---	---	---	---	---
-27.0	27.0	---	---	---	---	---	---	---
-28.0	28.0	---	---	---	---	---	---	---
-29.0	29.0	---	---	---	---	---	---	---
-30.0	30.0	---	---	---	---	---	---	---
-31.0	31.0	---	---	---	---	---	---	---
-32.0	32.0	---	---	---	---	---	---	---
-33.0	33.0	---	---	---	---	---	---	---
-34.0	34.0	---	---	---	---	---	---	---
-35.0	35.0	---	---	---	---	---	---	---
-36.0	36.0	---	---	---	---	---	---	---
-37.0	37.0	---	---	---	---	---	---	---
-38.0	38.0	---	---	---	---	---	---	---
-39.0	39.0	---	---	---	---	---	---	---
-40.0	40.0	---	---	---	---	---	---	---



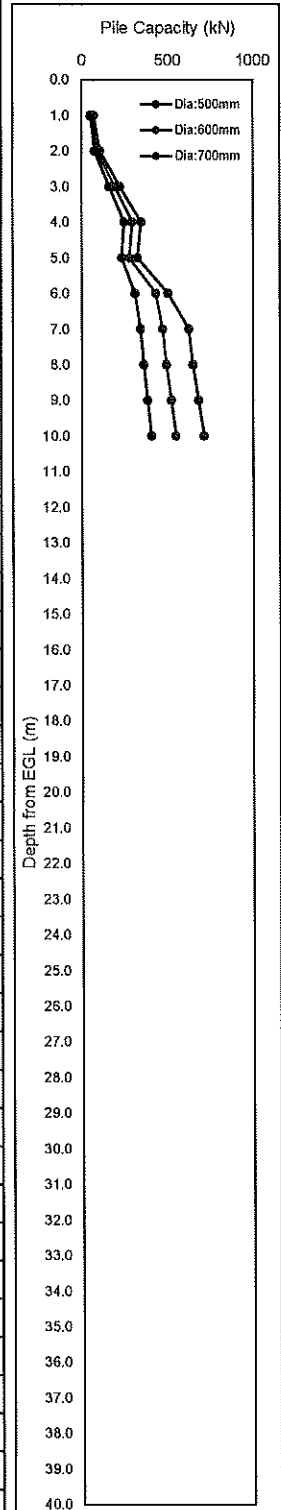
Note: Q_p = Allowable axial pile capacity in kN; $1\text{kN}=0.101\text{ Ton}$

Project Name:	Chittagong WASH Improvement Project
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36463, 91.78171)

Borehole No:	BH-02-4	Date of Boring:	15-May-2023	RL at EGL (m):	0.0000	Factor of Safety :	3.0
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Axial Pile Capacity using SPT. N

Elevation (m)	Depth (m)	N	N ₆₀	End Bearing & Skin Friction		Allowable Pile Capacity		
				f _b (kPa)	f _s (kPa)	Dia:500mm	Dia:600mm	Dia:700mm
-1.0	1.0	24	20	509.5	20.0	49.7	59.7	69.6
-2.0	2.0	17	14	713.3	14.0	74.4	89.2	104.1
-3.0	3.0	26	22	1681.4	22.0	158.4	190.1	221.7
-4.0	4.0	30	26	2649.5	26.0	245.6	294.7	343.8
-5.0	5.0	21	18	2292.9	18.0	229.6	275.5	321.4
-6.0	6.0	29	25	3571.4	25.0	309.6	430.4	502.1
-7.0	7.0	33	28	4000.0	28.0	339.8	470.6	622.3
-8.0	8.0	50	43	4000.0	43.0	358.4	492.9	648.4
-9.0	9.0	50	43	4000.0	43.0	380.9	519.9	679.9
-10.0	10.0	50	43	4000.0	43.0	403.4	547.0	711.4
-11.0	11.0	---	---	---	---	---	---	---
-12.0	12.0	---	---	---	---	---	---	---
-13.0	13.0	---	---	---	---	---	---	---
-14.0	14.0	---	---	---	---	---	---	---
-15.0	15.0	---	---	---	---	---	---	---
-16.0	16.0	---	---	---	---	---	---	---
-17.0	17.0	---	---	---	---	---	---	---
-18.0	18.0	---	---	---	---	---	---	---
-19.0	19.0	---	---	---	---	---	---	---
-20.0	20.0	---	---	---	---	---	---	---
-21.0	21.0	---	---	---	---	---	---	---
-22.0	22.0	---	---	---	---	---	---	---
-23.0	23.0	---	---	---	---	---	---	---
-24.0	24.0	---	---	---	---	---	---	---
-25.0	25.0	---	---	---	---	---	---	---
-26.0	26.0	---	---	---	---	---	---	---
-27.0	27.0	---	---	---	---	---	---	---
-28.0	28.0	---	---	---	---	---	---	---
-29.0	29.0	---	---	---	---	---	---	---
-30.0	30.0	---	---	---	---	---	---	---
-31.0	31.0	---	---	---	---	---	---	---
-32.0	32.0	---	---	---	---	---	---	---
-33.0	33.0	---	---	---	---	---	---	---
-34.0	34.0	---	---	---	---	---	---	---
-35.0	35.0	---	---	---	---	---	---	---
-36.0	36.0	---	---	---	---	---	---	---
-37.0	37.0	---	---	---	---	---	---	---
-38.0	38.0	---	---	---	---	---	---	---
-39.0	39.0	---	---	---	---	---	---	---
-40.0	40.0	---	---	---	---	---	---	---



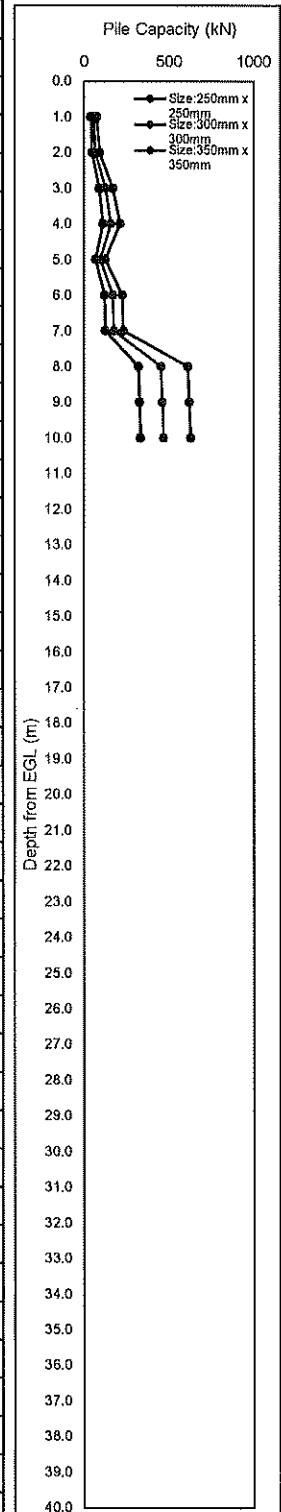
Note: Q_a = Allowable axial pile capacity in kN; 1kN=0.101 Ton

Project Name:	Chittagong WASH Improvement Project
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36463, 91.78171)

Borehole No:	BH-02-4	Date of Boring:	15-May-2023	RL at EGL (m):	0.0000	Factor of Safety :	3.0
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Axial Pile Capacity using Static Bearing Capacity

Elevation (m)	Depth (m)	N	N ₆₀	End Bearing & Skin Friction		Allowable Pile Capacity		
				f _b (kPa)	f _s (kPa)	Size:250mm x 250mm	Size:300mm x 300mm	Size:350mm x 350mm
-1.0	1.0	24	20	1777.3	3.2	38.1	54.6	74.1
-2.0	2.0	17	14	2093.7	6.4	46.3	66.0	89.2
-3.0	3.0	26	22	3963.6	9.6	87.9	125.3	169.3
-4.0	4.0	30	26	4897.6	11.0	110.8	157.5	212.3
-5.0	5.0	21	18	2591.7	12.6	66.7	93.0	123.6
-6.0	6.0	29	25	4897.6	14.0	119.2	167.5	224.0
-7.0	7.0	33	28	4897.6	15.6	124.1	173.4	230.9
-8.0	8.0	50	43	14023.1	16.8	319.6	453.7	611.1
-9.0	9.0	50	43	14023.1	18.4	325.5	460.7	619.3
-10.0	10.0	50	43	14023.1	20.0	331.9	468.4	628.2
-11.0	11.0	---	---	---	---	---	---	---
-12.0	12.0	---	---	---	---	---	---	---
-13.0	13.0	---	---	---	---	---	---	---
-14.0	14.0	---	---	---	---	---	---	---
-15.0	15.0	---	---	---	---	---	---	---
-16.0	16.0	---	---	---	---	---	---	---
-17.0	17.0	---	---	---	---	---	---	---
-18.0	18.0	---	---	---	---	---	---	---
-19.0	19.0	---	---	---	---	---	---	---
-20.0	20.0	---	---	---	---	---	---	---
-21.0	21.0	---	---	---	---	---	---	---
-22.0	22.0	---	---	---	---	---	---	---
-23.0	23.0	---	---	---	---	---	---	---
-24.0	24.0	---	---	---	---	---	---	---
-25.0	25.0	---	---	---	---	---	---	---
-26.0	26.0	---	---	---	---	---	---	---
-27.0	27.0	---	---	---	---	---	---	---
-28.0	28.0	---	---	---	---	---	---	---
-29.0	29.0	---	---	---	---	---	---	---
-30.0	30.0	---	---	---	---	---	---	---
-31.0	31.0	---	---	---	---	---	---	---
-32.0	32.0	---	---	---	---	---	---	---
-33.0	33.0	---	---	---	---	---	---	---
-34.0	34.0	---	---	---	---	---	---	---
-35.0	35.0	---	---	---	---	---	---	---
-36.0	36.0	---	---	---	---	---	---	---
-37.0	37.0	---	---	---	---	---	---	---
-38.0	38.0	---	---	---	---	---	---	---
-39.0	39.0	---	---	---	---	---	---	---
-40.0	40.0	---	---	---	---	---	---	---



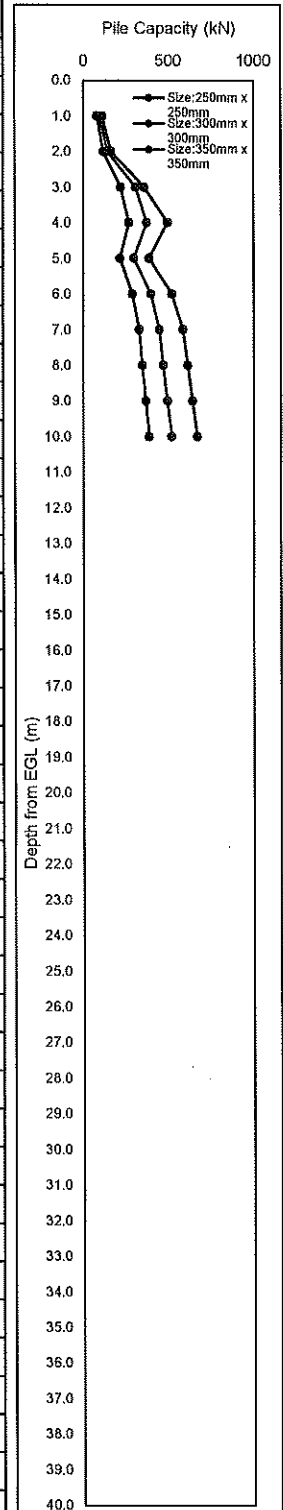
Note: Q_a = Allowable axial pile capacity in kN; $1\text{kN}=0.101\text{ Ton}$

Project Name:	Chittagong WASH Improvement Project
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36463, 91.78171)

Borehole No:	BH-02-4	Date of Boring:	15-May-2023	RL at EGL (m):	0.0000	Factor of Safety :	3.0
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Axial Pile Capacity using SPT, N

Elevation (m)	Depth (m)	N	N ₆₀	End Bearing & Skin Friction		Allowable Pile Capacity		
				fb(kPa)	fs (kPa)	Size:250mm x 250mm	Size:300mm x 300mm	Size:350mm x 350mm
-1.0	1.0	24	20	2717.5	40.0	80.0	96.0	112.0
-2.0	2.0	17	14	3804.4	28.0	118.0	141.6	165.2
-3.0	3.0	26	22	8381.0	44.0	220.0	308.0	359.3
-4.0	4.0	30	26	10400.0	52.0	269.3	375.2	498.4
-5.0	5.0	21	18	7200.0	36.0	217.3	296.8	388.3
-6.0	6.0	29	25	10000.0	50.0	290.0	398.0	522.7
-7.0	7.0	33	28	11000.0	56.0	328.5	449.2	588.2
-8.0	8.0	50	43	11000.0	60.0	347.8	472.4	615.3
-9.0	9.0	50	43	11000.0	60.0	367.8	496.4	643.3
-10.0	10.0	50	43	11000.0	60.0	387.8	520.4	671.3
-11.0	11.0	---	---	---	---	---	---	---
-12.0	12.0	---	---	---	---	---	---	---
-13.0	13.0	---	---	---	---	---	---	---
-14.0	14.0	---	---	---	---	---	---	---
-15.0	15.0	---	---	---	---	---	---	---
-16.0	16.0	---	---	---	---	---	---	---
-17.0	17.0	---	---	---	---	---	---	---
-18.0	18.0	---	---	---	---	---	---	---
-19.0	19.0	---	---	---	---	---	---	---
-20.0	20.0	---	---	---	---	---	---	---
-21.0	21.0	---	---	---	---	---	---	---
-22.0	22.0	---	---	---	---	---	---	---
-23.0	23.0	---	---	---	---	---	---	---
-24.0	24.0	---	---	---	---	---	---	---
-25.0	25.0	---	---	---	---	---	---	---
-26.0	26.0	---	---	---	---	---	---	---
-27.0	27.0	---	---	---	---	---	---	---
-28.0	28.0	---	---	---	---	---	---	---
-29.0	29.0	---	---	---	---	---	---	---
-30.0	30.0	---	---	---	---	---	---	---
-31.0	31.0	---	---	---	---	---	---	---
-32.0	32.0	---	---	---	---	---	---	---
-33.0	33.0	---	---	---	---	---	---	---
-34.0	34.0	---	---	---	---	---	---	---
-35.0	35.0	---	---	---	---	---	---	---
-36.0	36.0	---	---	---	---	---	---	---
-37.0	37.0	---	---	---	---	---	---	---
-38.0	38.0	---	---	---	---	---	---	---
-39.0	39.0	---	---	---	---	---	---	---
-40.0	40.0	---	---	---	---	---	---	---



Note: Q_a = Allowable axial pile capacity in kN; $1kN=0.101$ Ton

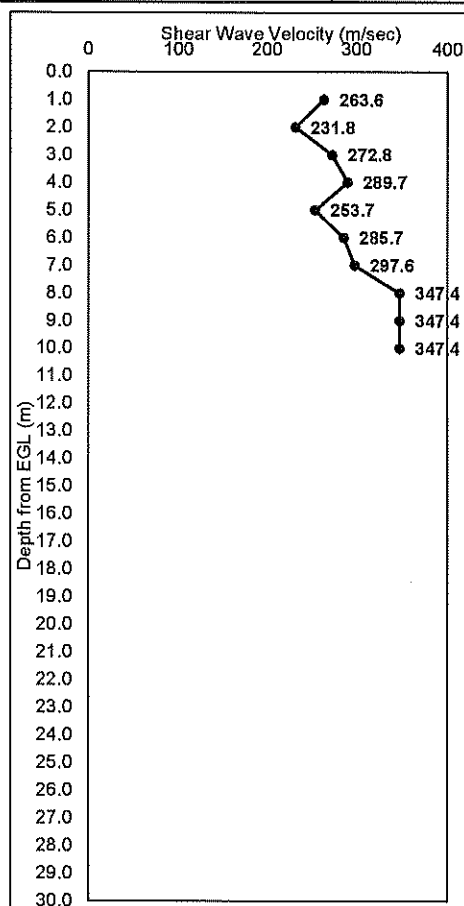
Project Name:	Chittagong WASH Improvement Project
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36463, 91.78171)

Borehole No:	BH-02-4	Date of Boring:	15-May-2023	RL at EGL (m):	0.0000
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Axial Pile Capacity as per Static Bearing Capacity

Elevation (m)	Depth (m)	N	N ₆₀	Vs (m/sec)
-1.0	1.0	24	20	263.6
-2.0	2.0	17	14	231.8
-3.0	3.0	26	22	272.8
-4.0	4.0	30	26	289.7
-5.0	5.0	21	18	253.7
-6.0	6.0	29	25	285.7
-7.0	7.0	33	28	297.6
-8.0	8.0	50	43	347.4
-9.0	9.0	50	43	347.4
-10.0	10.0	50	43	347.4
-11.0	11.0	----	----	----
-12.0	12.0	----	----	----
-13.0	13.0	----	----	----
-14.0	14.0	----	----	----
-15.0	15.0	----	----	----
-16.0	16.0	----	----	----
-17.0	17.0	----	----	----
-18.0	18.0	----	----	----
-19.0	19.0	----	----	----
-20.0	20.0	----	----	----
-21.0	21.0	----	----	----
-22.0	22.0	----	----	----
-23.0	23.0	----	----	----
-24.0	24.0	----	----	----
-25.0	25.0	----	----	----
-26.0	26.0	----	----	----
-27.0	27.0	----	----	----
-28.0	28.0	----	----	----
-29.0	29.0	----	----	----
-30.0	30.0	----	----	----

Average Vs (m/s)	N/A
Average N	N/A
Site Class	N/A

**Note**

SA: Rock or other rock-like geological formation

SB: Deposits of very dense sand, gravel, or very stiff clay, at least several tens of metres in thickness

SC: Deep deposits of dense or medium dense sand, gravel or stiff clay with thickness from several tens to many hundreds of metres

SD: Deposits of loose-to-medium cohesionless soil (with or without some soft cohesive layers)



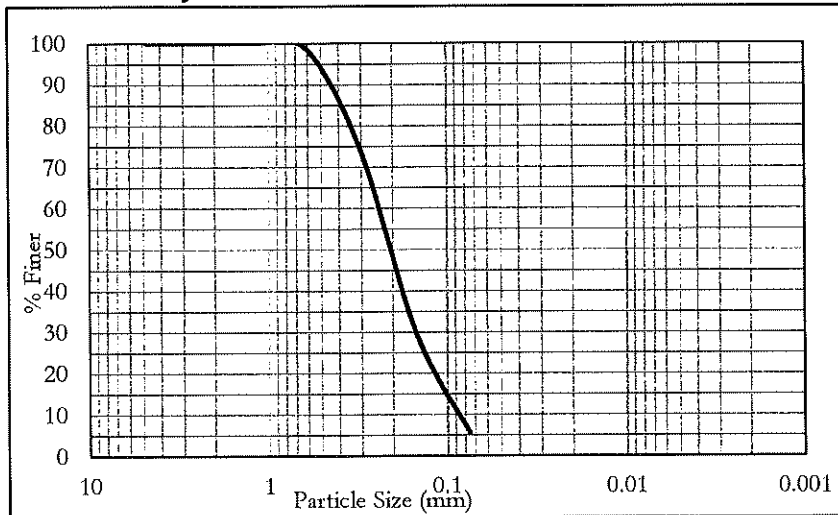
Summary of Laboratory Test Results

Depth (m)	Elevation (m)	Specific gravity	Water content (%)	Bulk density (g/cm ³)	Bulk density (kN/m ³)	Dry density (kN/m ³)	Grain Size Analysis		Atterberg Limit			Direct Shear Test		Unconfined Compression Test		
							Sand (%)	Fines (%)	LL (%)	PL (%)	PI (%)	c (kPa)	φ (degree)	q _u (kPa)	c _u (kPa)	Strain at Failure (%)
1-1.5	-1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2-2.5	-2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3-3.5	-3	—	—	—	—	—	94.50	5.50	—	—	—	—	—	—	—	—
4-4.5	-4	2.66	—	—	—	—	—	—	—	—	—	—	—	—	—	—
5-5.5	-5	—	—	1.81	17.76	—	—	—	—	—	—	—	—	—	—	—
6-6.5	-6	—	—	—	—	—	91.99	8.01	—	—	—	0	34.9	—	—	—
7-7.5	-7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
8-8.5	-8	2.68	—	—	—	—	—	—	—	—	—	—	—	—	—	—
9-9.5	-9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10-10.5	-10	2.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Q

Grain Size Analysis of Soil Sample

Project Name:	Chittagong WASH Improvement Project		
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36463, 91.78171)		
Date of Boring:	15-May-2023	Borehole No :	BH-02-4
Sample Type	Disturbed	Depth (m):	3

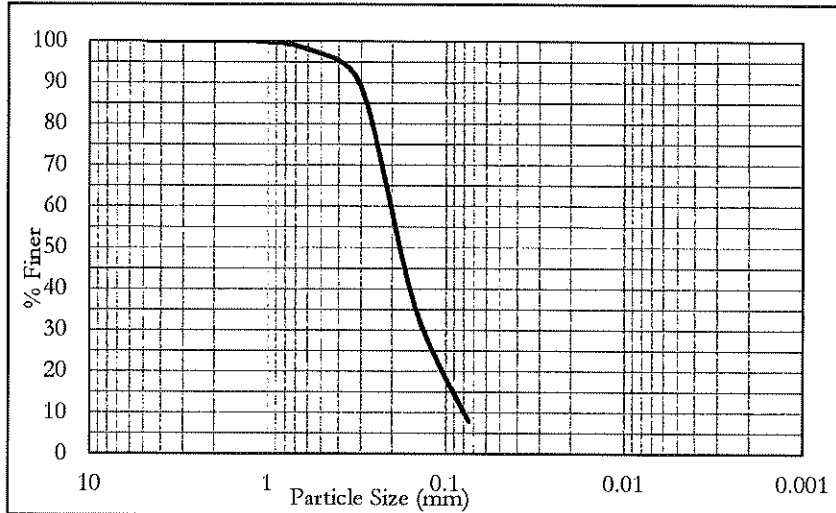
Grain Size Analysis

Particle Size (mm)	% Finer
4.750	100.000
2.380	100.000
1.190	100.000
0.600	98.466
0.300	73.885
0.150	30.040
0.075	5.497
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000

Soil Type	Unit	Value	Remarks
Sand	%	94.50	Ref: ASTM D2487-11
Coarse Sand	%	0.00	
Medium Sand	%	0.00	
Fine Sand	%	94.50	
Fines	%	5.50	Ref: ASTM D422
Silt	%	5.50	
Clay	%	0.00	Ref: ASTM D2487-11
D ₆₀	%	0.200	
D ₃₀	%	0.150	
D ₁₀	%	0.090	
C _u	%	2.222	
C _c	%	1.250	

Grain Size Analysis of Soil Sample

Project Name:	Chittagong WASH Improvement Project		
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36463, 91.78171)		
Date of Boring:	15-May-2023	Borehole No :	BH-02-4
Sample Type	Disturbed	Depth (m):	6

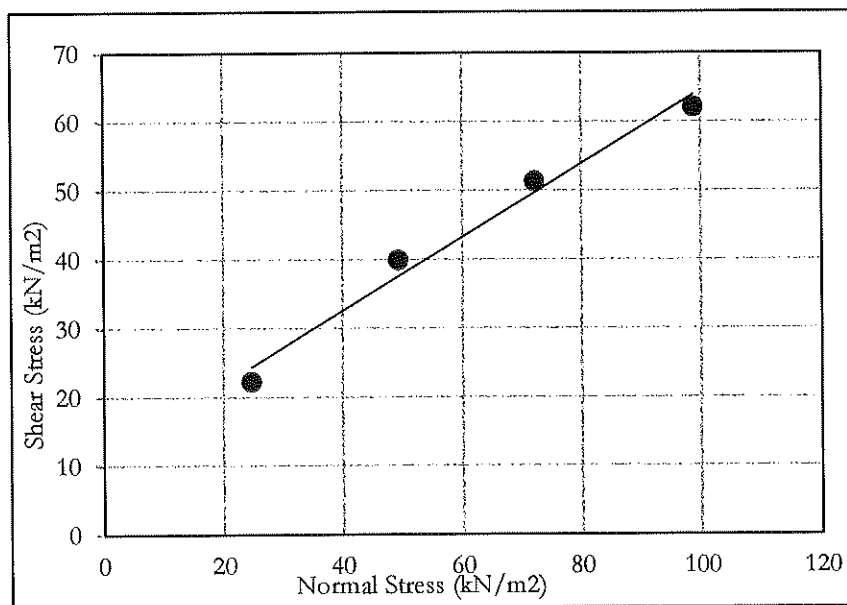
Grain Size Analysis

Particle Size (mm)	% Finer
4.750	100.000
2.380	100.000
1.190	100.000
0.600	98.066
0.300	89.227
0.150	36.188
0.075	8.011
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000
0.000	0.000

Soil Type	Unit	Value	Remarks
Sand	%	91.99	Ref: ASTM D2487-11
Coarse Sand	%	0.00	
Medium Sand	%	0.00	
Fine Sand	%	91.99	
Fines	%	8.01	Ref: ASTM D422
Silt	%	8.01	
Clay	%	0.00	Ref: ASTM D2487-11
D ₆₀	%	0.200	
D ₃₀	%	0.155	
D ₁₀	%	0.078	
C _u	%	2.564	
C _c	%	1.540	

Direct Shear Test (Quick) of Soil Sample

Project Name:	Chittagong WASH Improvement Project		
Location:	Dhaka Trunk Road, Alongkar, Chattogram (22.36463, 91.78171)		
Date of Boring:	15-May-2023	Borehole No:	BH-02-4
Sample Type	Disturbed	Depth:	6



Normal Stress (kPa)	Shear Stress (kPa)
24.70	22.19
49.40	39.83
72.20	51.21
98.80	62.02

Cohesion, c (kPa)	0.0
Angle of Internal Friction, ϕ (Degree)	34.9

