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Ministry of Housing and Public Works
Urban Development Directorate (UDD)

Preparation of Development Plan for
Fourteen Upazilas
Package 03

Draft Survey Report

Geological Survey

of

Bagmara Upazila

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Submitted By

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LETTER OF TRANSMITTAL

EXECUTIVE SUMMARY

Development plan of Bagmara Upazila, District Dhaka has been taken under package-3 and the project titled 'Preparation of Development Plan for Fourteen Upazilas' a initiative of Urban Development Directorate (UDD). In this development plan, subsurface geological and geotechnical information's has been considered for a durable and sustainable urban environment. This is basically done to determine the state of the soil below the surface of the project area and natural, such as earthquakes, landslides and soil erosion as a result of the design of the infrastructure development such as geological and hydro-meteorological hazards are evaluated.

To know the subsurface environment of the study area, surveys has been carried out up to 30 meter below the earth surface in the field. Investigations and surveys are geo-morphological survey; drilling of boreholes and preparation of borehole logs; collection of undisturbed and disturbed soil sample as per standard guide line; conducting standard penetration tests (SPTs); drilling of boreholes and casing by PVC pipe for conducting Down-hole seismic test; conducting Down-hole seismic test and conducting Multi-Channel Analysis of Surface Wave (MASW). Laboratory testing of soil samples such as Grain Size analysis, Natural moisture Content, Atterberg Limits, Specific Gravity, Direct Shear Test, Unconfined Compression strength, etc has been performing in the laboratory which will give more qualitative and quantitative information about the subsurface materials. To meet the above geological, geotechnical and geophysical task, 36 boreholes with SPT program, Five MASW and seven Down-hole seismic survey programs have been conducted into the field at Bagmara Upazila.

From geotechnical and geological data base would give a clear idea about the geo-hazard status of particular landscape where newly urban developing activities or any other mega infrastructure project is going on and this mentioned investigation also gives idea about the vulnerability of existing build up infrastructure of a particular area. Based on these results, proper management techniques as well as other necessary adaptation process could be addressed before or after the development activities in the studied area. On the other hand, if the infrastructures are built according to this risk informed physical land-use plan, the long-term maintenance cost will be reduced and the developed structure will withstand against the potential natural hazards.

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ABBREVIATIONS

ASTM	: American Society for Testing and Materials
AVS30	: Average Shear Wave velocity of 30 meter depth
BH	: Borehole
MASW	: Multi-Channel Analysis of Surface Wave
N value	: Soil resistance or compactness
PGA	: Peak Ground Acceleration
PGV	: Peak Ground Velocity
PS logging	: Primary and Shear wave logging (Down-hole seismic test)
SA	: Spectral Acceleration
SPAC	: Spatial Autocorrelation
SPT	: Standard Penetration Tests
UDD	: Urban Development Directorate
EGL	Existing Ground Level
GWL	Ground Water Level

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CHAPTER-01: INTRODUCTION

1.1. BACKGROUND:

Horizontal expansion of urban area is rapidly increasing in Bangladesh with respect to their rapid population growth and increasing life expectancy of the peoples. But present trend of planning practice is mostly oriented towards planning of major cities and towns, not in all other towns or growth centers because huge amount of financial allocation/grants involvement. Recent policy of government, the upazila has been recognized as the most significant tier of administration. So that these areas are need to be planned and developed to accommodate all social, economic, administrative, infrastructure services and service facilities. The government's intention is to reflect the national policy of bringing development administrative and service facilities to the door step of rural masses and to ensure better delivery of government services to the people. Realizing the fact and importance of formulating development plans for upazilas, Urban Development Directorate has come up with a great initiative to plan those areas. At the first phase of this initiative UDD has decided to prepare development plan for 14 Upazilas all over Bangladesh into five different packages. For each package separate consultancy team has been appointed to carry out that job more fruitfully. Desh Upodesh Ltd. in Association with AAIMA International BD Ltd. and Tech-SUS Ltd has been selected for package-3 (covering Bagmara Upazila, Dist: Meherpur; Bagmara Sadar Upazila, Dist: Bagmara; and Baghmara Upazila, Dist: Rajshahi) by project evaluation committee of UDD.

Subsurface geological and geotechnical information's has been considered for a durable and sustainable urban environment. Primarily this work is to determine subsurface soil condition of the project area and evaluating of natural geological and hydro-meteorological hazards such as earthquake, landslide and ground failure which integrate the consequence into the design of the infrastructure.

Regarding this study, following investigations and surveys has been carried out in the field which are geo-morphological survey; drilling of boreholes and preparation of borehole logs; collection of undisturbed and disturbed soil sample as per standard guide line; conducting standard penetration tests (SPTs); drilling of boreholes and casing by PVC pipe for conducting Down-hole seismic test; conducting Down-hole seismic test and conducting Multi-Channel Analysis of Surface Wave (MASW). Geologically and structurally the area is not much complex, that's why geotechnical and geophysical investigations are covered whole floodplain area except low or marshy land up to 30 meter depth from ground level and almost everywhere soil sediments are fluvial type of deposit which are much soft and thicker.

Following laboratory testing of soil samples such as Grain size analysis, Natural moisture content, Atterberg limits, Specific Gravity, Direct Shear Test, Unconfined Compression strength, etc has been performing in the laboratory which will give more qualitative and quantitative information about the subsurface materials. These field and laboratory test data will be analyzed and integrated into a module to produce risk sensitive micro-zonation maps.

1.2. SCOPE OF WORK:

The aim of this work is to determine subsurface soil condition of the project area and evaluating of natural geological and hydro-meteorological hazards such as earthquake, liquefaction, ground failure and integrate the consequence into the design of the infrastructure. The main objective will be achieved through accomplishment of the following sub-objectives:

- a) Preparation of Geological map of the study area.
- b) Preparation of sub-surface lithological 3D model of different layers through geotechnical investigation
- c) Preparation of engineering geological mapping based on AVS30
- d) Determination of soil type in the project area
- e) Foundation layer identification
- f) Preparation of Seismic Hazard Map
- g) Finally intensity map is prepared for high rise and low rise building

CHAPTER-02: METHODOLOGY

The methods and materials used to carry out of these activities have been described below-

2.1. TEST DETAILS AND PROCEDURE OF DOWN-HOLE SEISMIC TEST (PS LOGGING)

Main objectives of downhole seismic test to measure the travelling time of elastic wave from the ground surface to some arbitrary depths beneath the ground. The seismic wave was generated by striking a wooden plank by a sledge hammer. The plank was placed on the ground surface at around 1 m in horizontal direction from the top of borehole. The plank was hit separately on both ends to generate shear wave energy in opposite directions and is polarized in the direction parallel to the plank.

The shear wave emanated from the plank is detected by a tri-axial geophone. The geophone was lowered to 1 m below ground surface and attached to the borehole wall by inflating an air bladder. Then, the measurements were taken at every 1 m interval until the geophone was lowered to 30 m below ground surface. For each elevation, 3 records were taken and then used to calculate the shear wave velocity.



Plate 1: Downhole Seismic Test data logger

2.2.1. Procedure of Field Work and Analysis

- a) A wooden plank with an approximate dimension of 2 ft x 1 ft x 2 ft is fixed to the ground. The wooden plank is placed about 1m from the borehole as shown in Plate 2.



Plate 2: Wooden Plank as the Vibration Source

- b) Cables are wired from the geophone Plate 3 and the trigger to the data acquisition unit Plate 4. Signals in the vertical, radial and transverse directions are recorded by the data acquisition unit.



Plate 3: Geophone



Plate 4: Data Acquisition Unit

- c) The geophone is lowered into the borehole as shown in Plate 5 Then, air is pumped into the air bag to fix the geophone to the casing (PVC pipe) at 1 m interval in depth basically.



Plate 5: Geophone Lowering In the Borehole

- d) Excitations are generated by hitting the wooden plank in three directions by the hammer.



Plate 6: Direction of Excitations

- e) Data is recorded in the data acquisition unit. Figure 1 illustrates a typical dataset in obtaining the arrival time of S-wave. Hitting the wooden plank in opposite directions generates signals as shown in the figure. The time that two curves begin to separate is the arrival time of shear wave. By doing the same analysis for every depth, S-wave profiles are obtained throughout the depth of the borehole.

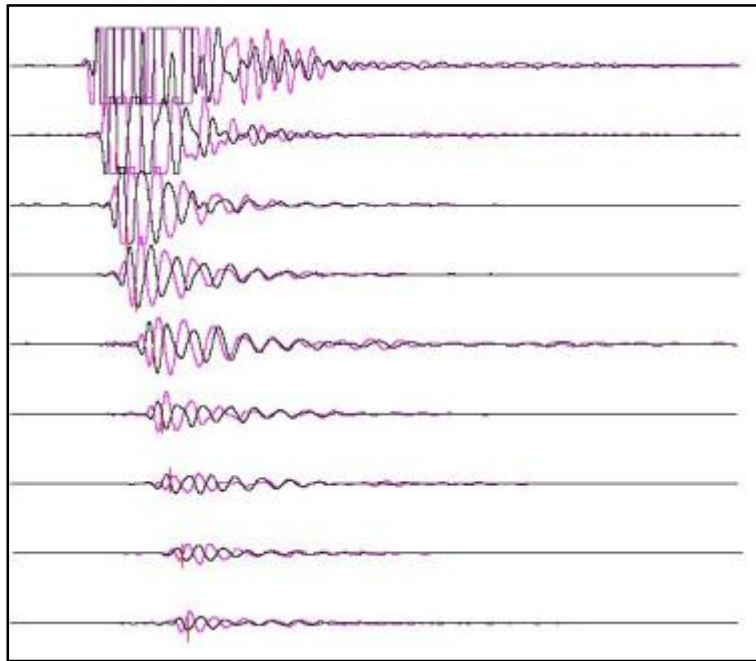
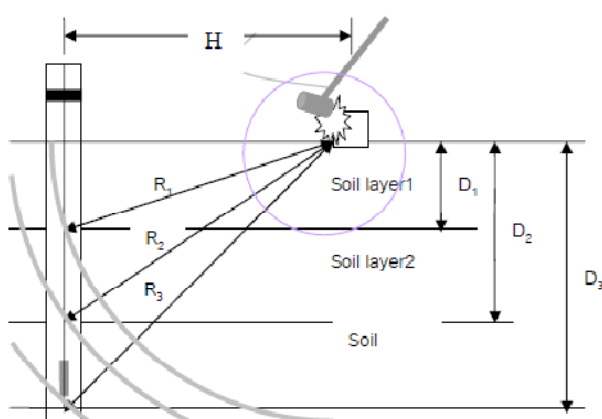


Figure 1: Determination of the Arrival Time of S-Wave

- f) Using the raw data of the test depth (D), the shortest pass (R) and the recorded arrival time of S-wave (t) in the inclined path is calculated to the travel time, t_c , in the vertical path as shown in Figure 2.



$$t_c = D \frac{t}{R}$$

Where

t_c is the corrected travel time

D is the testing depth from ground surface,

t is the first arrival time from test

R is the distance between the source and receiver

[Auld 1977]

Figure 2: Calculation of the Travel Time

- g) By plotting the corrected travel time versus depth, the velocity of every 1 m interval is calculated from (Auld 1977)

$$V_d = \frac{\Delta D}{\Delta t_c} [\text{Auld 1977}]$$

Where, ΔD is depth interval showing similar slope and Δt_c is the corrected travel time difference of ΔD .

2.2. TEST DETAILS AND PROCEDURE OF MULTI-CHANNEL ANALYSIS OF SURFACE WAVE (MASW)

Multichannel Analysis of Surface Wave (MASW) is recent and very popular method for computation of shear wave velocity. This method is widely used for seismic microzonation. A MASW is a seismic surface method, widely used for subsurface characterization and is increasingly being applied for seismic microzonation and site response studies (Anbazhagan and Sitharam, 2008). It is also used for the geotechnical characterization of near surface materials (Park and Miller, 1999; Xia et al., 1999; Miller et al., 1999; Anbazhagan and Sitharam, 2008). MASW is used to identify the subsurface material boundaries, spatial and depth variations of weathered and engineering rocks (Anbazhagan and Sitharam, 2009). We have used the MASW system consisting of 12 channels Geode seismograph with 12 vertical geophones of 10 Hz capacity.

The measuring procedure in this project is shown as follows:

- I. To decide the measuring line
- II. To set receivers along the line at the ground surface. The intervals of each geophone are 3m.
- III. To set an acrylic board at a half interval outside the line
- IV. To shoot it vertically. Then generated elastic waves are recorded by receivers.
- V. To shift the acrylic board between second receiver and the third receiver, and shoot it vertically. Then generated elastic waves are recorded at receivers.
- VI. To iterate this procedure up to setting the acrylic boards at a half interval outside the other side of the line.

The data acquisition parameters are given in table 1.

Table 1: MASW Data Acquisition Parameters

Seismic refraction	
Number of channels	12
Geophone spacing	3m
Array length	33m
Sampling rate	1ms
Record length	2 sec
Natural frequency of Geophone	10 Hz
Source	8 kg hammer
Shot number	13 points, 11 between geophones and 2 outside of measuring line

Source: Park and Miller, 1999; Xia et al. 1999; Miller et al. 1999; Anbazhagan and Sitharam, 2008

2.2.1. Analysis of MASW

Data processing consists of two main steps: (i) Obtaining the dispersion curves of Rayleigh wave phase velocity from the records; (ii) Determining the V s profiles from which the Vs30 values are calculated (see figure 3). In the phase velocity analysis, SPAC (Spatial Autocorrelation) method (Okada, 2003) is employed. Okada (2003) shows Spatial Autocorrelation function $\rho(\omega, r)$ is expressed by Bessel function.

$$\rho(\omega, r) = J_0(\omega r / c(\omega)) \quad [\text{Okada, 2003}]$$

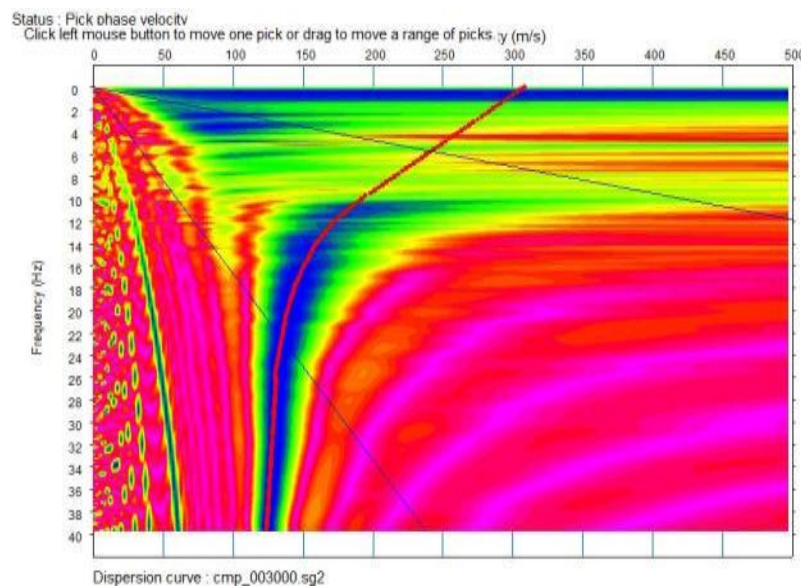
Where, r is the distance between receivers, ω is the angular frequency, c (ω) is phase velocity of waves, J_0 is the first kind of Bessel function. The phase velocity was obtained at each frequency using equation (2). A one dimensional inversion using a non-linear least square method has been applied to the phase velocity curves. In the inversion, the following relationship between P-wave velocity (Vp) and Vs (Kitsunezaki et. al., 1990):

$$Vp = 1.29 + 1.11Vs \quad [\text{Kitsunezaki et. al., 1990}]$$

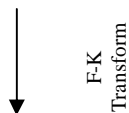
Where, V_s is S-wave velocity (km/s), V_p is P-wave velocity (km/s). In order to assume density ρ (g/cm³) from S-wave velocity, the relationship of Ludwig et al. (1970) is used.

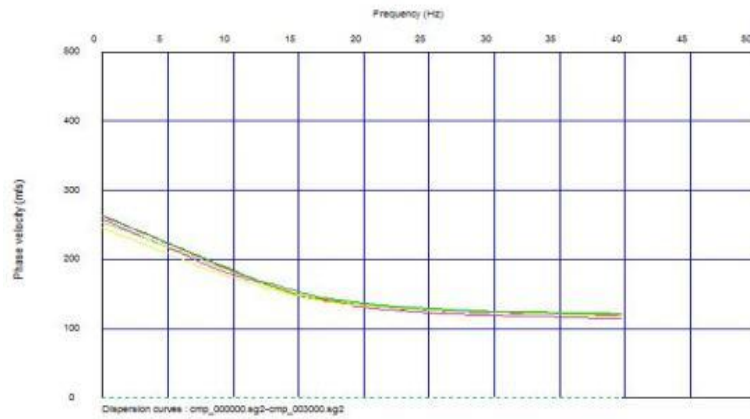
$$\rho = 1.2475 + 0.399V_p - 0.026V_p^2 \quad [\text{Ludwig et al. (1970)}]$$

These calculations are carried out along the measuring line, and the S-wave velocity distribution section was analyzed.



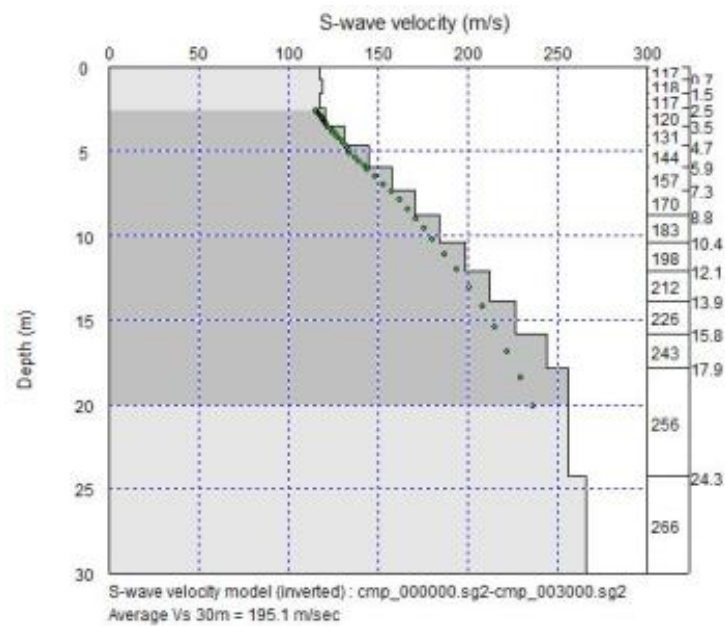
MASW Raw field data





Dipersion for Rayleigh wave

↓
Inversion



Shear wave velocity profile

Figure 3: Main Step of the MASW Processing Technique

2.3. TEST DETAILS AND PROCEDURE OF STANDARD PENETRATION TEST

The geotechnical boreholes have been constructed using wash boring method. In this investigation, 36 numbers of boreholes have been prepared at Bagmara Upazila. The borehole logs are enclosed in the Appendix A. The boring method has been described in the following section.

2.3.1. Drilling

The bore holes are being drilled through mechanical percussion wash boring method at the locations previously decided. As 30 m boring is so complicated and time consuming moreover it has done continuously to the end to prevent the possibility of caving of the boring wall, it will be decided to send two sets of worker who will work in 8 hrs until desired depths will be achieved. In this manner the estimated time for boring execution will 13- shifts and 12- shifts are considered for mobilization, assemble and disassemble of the equipment, site cleanup and backfill the bore holes to their pre-existing condition.

2.3.2. Data Collection

The field data are being collected according to the respective standard methods. First of all the location, areal coverage, topography, geomorphology of the test site are note down. The soil sample collection procedure is mentioned in the section 2.3.4. While SPT soil samples are collected. At the same time, the ground water table is note down.

2.3.3. SPT Execution

As it mentioned earlier, the geotechnical boreholes will be constructed using mechanical boring method. The depth of those boreholes is to 30m. In this method N values (standard Penetration Test) is counted and soil sample also be taken in every 1.5m depth interval. The subsequent procedure which has been followed during the field work is furnished as follows:

- I. Drill a 100-200 mm (2.5-8 in) diameter exploratory boring to the depth of the first test.
- II. Insert the SPT sampler (also known as a Split-spoon Sampler) into the boring. The shape and dimensions of this sampler are shown in Figure 4. It is connected via steel rods to a 63.5 kg (140 lb) hammer, as shown in Figure 5.
- III. An automatic tripping mechanism (in case of rotary drilling used this technique in this investigation), raise the hammer a distance of 760 mm (30 in) and allow it to fall. This energy drives the sampler into the bottom of the boring. Repeat this process until the sampler has penetrated a distance of 450 mm (18 in), recording the number of hammer blows required for each 150 mm (6 in) interval.
- IV. Compute the N-value by summing the blow counts for the last 300 mm (12 in) of penetration. The blow count for the first 150 mm (6 in) is retained for reference purposes, but not used to compute N because the bottom of the boring is likely to be disturbed by the drilling process and may be covered with loose soil that fell from the sides of the boring.
- V. Extract the SPT sampler, then remove and save the soil sample (disturbed sample).
- VI. Drill the boring to the depth of the next test and repeat steps 2 through 6 as required.

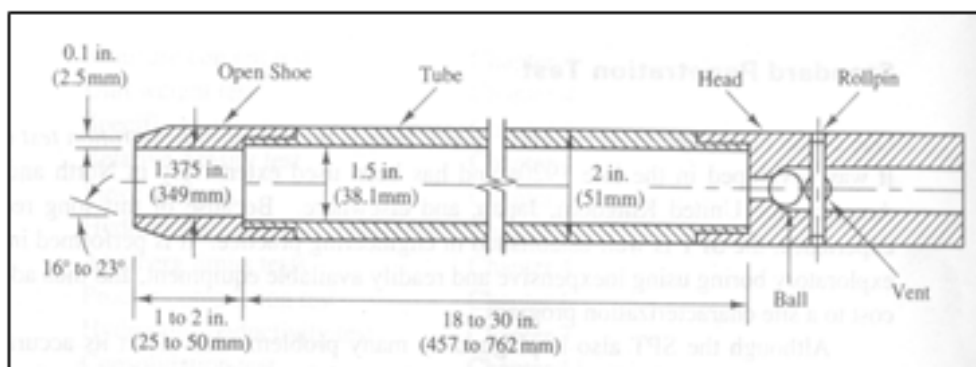


Figure 4: Split-spoon sampler.

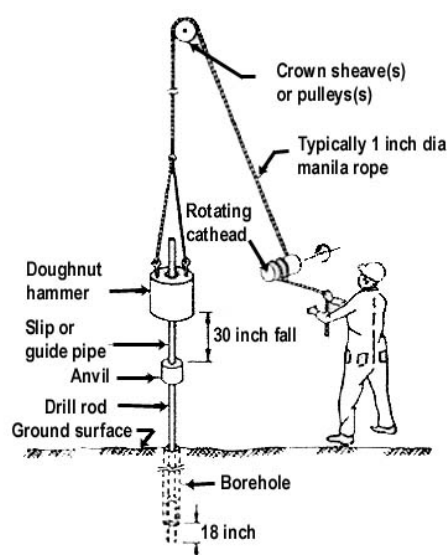


Figure 5: The SPT sampler in place in the boring with hammer

2.3.4. SOIL SAMPLING

Two main categories of soil samples are collected, undisturbed and disturbed. Undisturbed samples, which are required mainly for shear strength and consolidation tests, are obtained by techniques which aim at preserving the in-situ structure and water content of the soil. In boreholes, undisturbed samples can be obtained by withdrawing the boring tools (except when hollow-stem continuous-flight augers are used) and driving or pushing a sample tube into the soil at the bottom of the hole. The sampler is normally attached to a length of boring rod which can be lowered and raised by the cable of the percussion rig. When the tube is brought to the surface, some soil is removed from each end and molten wax is applied, in thin layers, to form a seal approximately 25mm thick: the ends of the tube are then covered by protective caps. Undisturbed block samples can be cut by hand from the bottom or sides of a trial pit. During cutting, the samples must be protected from water, wind and sun to avoid any change in water content: the samples should be covered with molten wax immediately they have been brought to the surface. It is impossible to obtain a sample that is completely undisturbed, no matter how elaborate or careful the ground investigation and sampling technique might be. In the case of clays, for example,

swelling will take place adjacent to the bottom of a borehole due to the reduction in total stresses when soil is removed and structural disturbance may be caused by the action of the boring tools; subsequently, when a sample is removed from the ground the total stresses are reduced to zero.

Soft clays are extremely sensitive to sampling disturbance, the effects being more pronounced in clays of low plasticity than in those of high plasticity. The central core of a soft clay sample will be relatively less disturbed than the outer zone adjacent to the sampling tube. Immediately after sampling, the pore water pressure in the relatively undisturbed core will be negative due to the release of the in-situ total stresses. Swelling of the relatively undisturbed core will gradually take place due to water being drawn from the more disturbed outer zone and resulting in the dissipation of the negative excess pore water pressure: the outer zone of soil will consolidate due to the redistribution of water within the sample. The dissipation of the negative excess pore water pressure is accompanied by a corresponding reduction in effective stresses. The soil structure of the sample will thus offer less resistance to shear and will be less rigid than the in-situ soil.

A disturbed sample is one having the same particle size distribution as the in-situ soil but in which the soil structure has been significantly damaged or completely destroyed; in addition, the water content may be different from that of the in-situ soil. Disturbed samples, which are used mainly for soil classification tests, visual classification and compaction tests, can be excavated from trial pits or obtained from the tools used to advance boreholes (e.g. from augers and the clay cutter). The soil recovered from the shell in percussion boring will be deficient in fines and will be unsuitable for use as a disturbed sample. Samples in which the natural water content has been preserved should be placed in airtight, non-corrosive containers: all containers should be completely filled so that there is negligible air space above the sample.

All samples should be clearly labeled to show the project name, date, location, borehole number, depth and method of sampling; in addition, each sample should be given a serial number. Special care is required in the handling, transportation and storage of samples (particularly undisturbed samples) prior to testing. The types of tube samplers used in this study are described below.

Thin-walled Sampler

Thin-walled samplers (Figure 6) have been used to collect undisturbed samples from boreholes. These samplers are used in soils which are sensitive to disturbance such as soft to firm clays and plastic silts. The sampler does not employ a separate cutting shoe, the lower end of the tube itself being machined to form a cutting edge. The internal diameter may range from 35 to 100 mm. The area ratio is approximately 10% and samples of first-class quality can be obtained provided the soil has not been disturbed in advancing the borehole. In trial pits and shallow boreholes the tube can often be driven manually

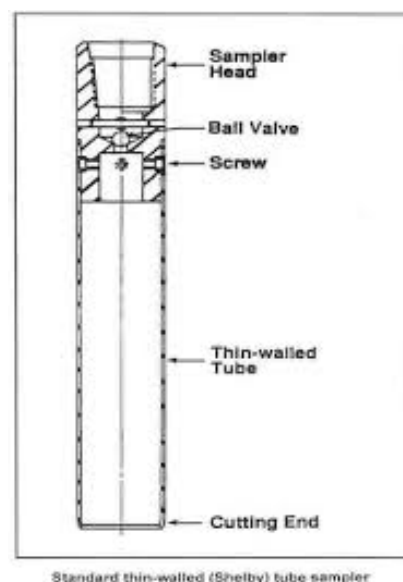


Figure 6: Thin-Walled (Shelby Tube) Sampler

Split-spoon sampler

Split-spoon samplers (Figure 7) have been to collect disturb samples. It consists of a tube which is split longitudinally into two halves: a shoe and a sampler head incorporating air-release holes are screwed onto the ends. The two halves of the tube can be separated when the shoe and head are detached to allow the sample to be removed. The internal and external diameters are 35 and 50 mm, respectively, the area ratio being approximately 100%, with the result that there is considerable disturbance of the sample. This sampler is used mainly in sands, being the tool specified in the standard penetration test (SPT).

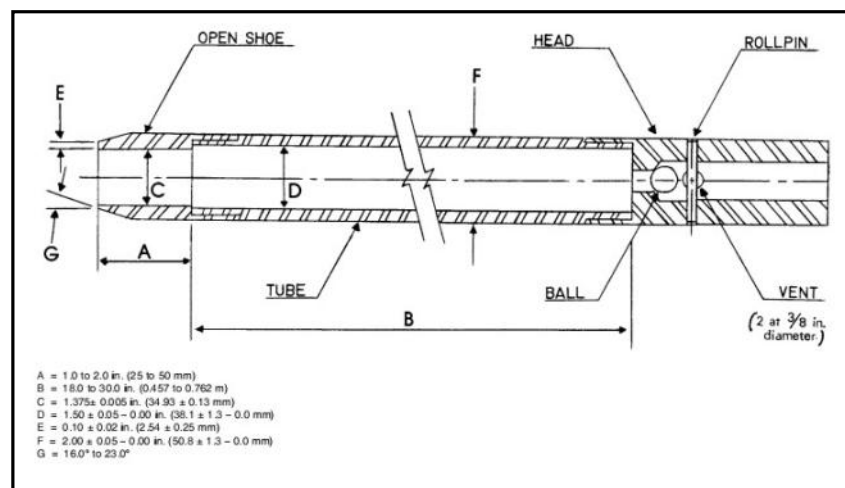


Figure 7: Undisturbed (Split-Spoon) Sampler

2.3.5. CARRYING OUT DIFFERENT ENGINEERING TESTS ON SOIL SAMPLE

A wide variety of laboratory tests is performing on soils to measure number of soil parameters. Some soil properties are intrinsic to the composition of the soil matrix and are not affected by sample disturbance, while other properties depend on the structure of the soil as well as its composition, and can only be effectively tested on relatively undisturbed samples. Some soil tests measure the direct properties of the soil, while others measure "index properties" which provide useful information about the soil without directly measuring the property desired.

The test types and standard which have been following given in the following section. Before explaining each of the engineering tests, the standard followed in each test is mentioned here:

- Grain size analysis
 - Sieve Analysis
 - Hydrometer Analysis
- Natural Moisture Content Tests
- Attarbage Limit Test
- Unconfined Compressional Test
- Traxial Test

All laboratory test result are given in Appendix D.

CHAPTER-03: SURVEY RESULT AT BAGMARA UPAZILA

3.1. GEOPHYSICAL INVESTIGATIONS

The main objectives of these investigation to estimate local site effects against earthquakes and the task has been segregated by three-fold: 1) To determine shear wave velocity profile at various sites, 2) To classify soil conditions according to seismic design specifications and 3) To analyze soil amplifications in the area. Field measurements of shear wave velocities were conducted in Bagmara Upazila and described in below.

Shear wave velocity profile (V_s profile) in the field were carried out by two geophysical exploration methods namely 1) seismic downhole test and 2) Multichannel Analysis of Surface Wave (MASW).

Seismic downhole test is a direct measurement method for obtaining the shear wave velocity profile of soil stratum. However, the test requires borehole which is not time and cost effective for the project. Multichannel analysis of surface waves (MASW) is a non-invasive technique which can be used to determine the V_s profile at sites. In this project, the seismic downhole and MASW tests were performed at 6 and 5 locations respectively. Locations of seismic downhole test and MASW tests are shown in Map 2. The GPS coordinate of the test locations are showing in Table 2.

Table 2: Down-hole Seismic Test (PS logging) and MASW test locations

Survey type	BH ID	Location Name	Lat	Long	Union Name
Downhole Seismic Test (PS Logging)	BH-06	Ganggopara Girls School, Hat Ganggopara, Auch Para Union	24.61902	88.73029	Auch Para Union
	BH-24	Ganipur Union Complex office, Hasnipur Bazar, Ganipur Union	24.52932	88.74364	Ganipur Union
	BH-26	Sahid Sakandar Memorial Adarsho High School, Godaoun Mor, Bhabanigong Pourashava	24.58064	88.82589	Bhabanigong Pourashava
	BH-29	Jhikra High School, Jhikra Bazar, Jhikra Union	24.616	88.89302	Jhikra Union
	BH-32	Sajura Mirzapur, Goalkandi Union	24.54549	88.84274	Goalkandi Union
	BH-37	Tahirpur University (Birshobidalay) college, Tahirpur Bazar, Tahirpur Pourashava	24.51805	88.84495	Tahirpur Pourashava
	BH-09	Mirpur Dimukki Primary and High School, jolapara Hat, Dwippur Union	24.64339	88.803	Dwippur Union
Multi-channel Analysis of Surface Wave (MASW)	MASW-1	Jamgram Govt. Primary School, Jamgram, Tahirpur Pourashava	24.52896	88.82662	Tahirpur Pourashava
	MASW-2	Shreepur govt. primary school, Bagmara	24.55312	88.79897	
	MASW-3	Binorthpur govt. primary school, Subhadanga Union	24.57543	88.75258	Subhadanga Union
	MASW-4	Uttar akdala Govt. Primary School, Uttar akdala Bazar, Bhabanigong Pourashava	24.59876	88.82558	Bhabanigong Pourashava
	MASW-5	Hamir kutsha Union complex office, Hamir Kutsha Union	24.5582	88.87315	Hamir Kutsha Union

Source: Field Survey, 2016

3.1.1. Down-Hole Seismic (PS Logging) Test Results

As a fundamental parameter, shear wave velocity is required to define the dynamic properties of soils. If the soil velocity is less than 180m/s, it can be said as loose or soft soil. Estimation of shear wave velocity (V_s) / average shear wave velocity (AVS) and mapping is a way to characterize varying site conditions, and it can also be used to model earthquake-related ground shaking. Estimation of AVS aims to generate a map of estimated shear wave velocities for the upper 30m of the subsurface. Further this map can be used for seismic site response analysis i.e., to determine peak ground acceleration (PGA) and spectral acceleration (SA) values of both bedrock and ground surface. In this context, Downhole seismic test data acquisition has been completed at Bagmara Upazilla in Seven different locations on date 5th to 8th January, 2016.

The average shear wave velocity (AVS) of each PS logging test are tabulated in Table 3. Work plan of the test depth was 30m, however, in some locations did not reach the geophone to the 30 m in depth due to adverse conditions of PVC.

The shear wave velocities at every 1m interval of each site are given in Appendix A at tabular and also graphical format.

3.1.2. MASW Survey Result

To predict subsurface shear-wave interval velocities, multi-spectral analyses of surface waves (MASW) are popularly used. Shear wave velocities can also extract additional velocity-related information such as mechanical properties of soils and rocks. In general, MASW data compare favorably to other geophysical methods for predicting interval velocities. Furthermore, comparisons to vertical seismic profiles correlate well with MASW predicted shear wave interval velocities. In this perspective, MASW test has been completed at Five different locations at Bagmara Upazilla by 30th November, 2016 and field raw data has been processed and also interpreted.

The results of the MASW test are enclosed in Appendix B at tabular and also graphical format.

3.2. GEOTECHNICAL INVESTIGATIONS

To ensure safety of human beings and materials, geotechnical investigations have become an essential component of every construction, it includes a detailed investigation of soil strength, composition, water content, and other important soil characteristics. Investigation borings with standard penetration test were conducted in order to know vertical geological conditions. The borings with SPT were carried out at 36 points at Bagmara Upazila.

3.2.1. Standard Penetration Test (SPT) Log Analysis and Interpretation

SPT is a common in-situ testing method used to determine the geotechnical engineering properties of subsurface soils. It was developed in the late 1920s and has been used extremely in North and South America, the United Kingdom, Japan, and elsewhere. Because of this long record of experience, the SPT is well-established in engineering practice. It is performed inside exploratory boring using inexpensive and readily available equipment, and thus adds little cost to a site characterization program. Although the SPT also is plagued by many problems that affect its accuracy and reproducibility, it probably will continue to be used for the foreseeable future, primarily because of its low cost. However, it is partially being replaced by other test methods, especially on larger and more critical projects.

All the borings has to be conducted and preparation of field bore log by visual classification has to be done in the presence of the experienced technical personnel. The borehole records have to be taken that include soil type, nature of sample, soil moisture content and consistency, SPT blow counts (N Value), ground water observation and apparent origin (fill, alluvium, recent sediments, etc.) and daily field logs have been prepared. The bore locations are given in following table 5 and the geotechnical borehole log are enclosed in the below section.

Table 3: Bore Hole Information Summary at Bagmara Upazila

BH ID	Location Name	Lat	Long	Union Name
BH-01	Near Gobinda Para Union Complex, Gobinda Para Union	24.65849	88.73728	Gobinda Para Union
BH-02	Hatkhugipur High School, Hatkhugipur Bazar, Near Auch Para union complex	24.62386	88.70332	Auch Para Union
BH-03	Rokittepara Govt. primary school, Palopara, Auch Para Union	24.61088	88.68531	Auch Para Union
BH-04	Sharcol Shimla High School, beside Nasir Bazar, Sondanga Union	24.66983	88.77749	Sondanga Union
BH-05	Village Name- Madila, Boidar Mor, Nardas Union	24.65351	88.76144	Nardas Union, Near Sonadanga union
BH-06	Ganggopara Girls School, Hat Ganggopara, Auch Para Union	24.61902	88.73029	Auch Para Union
BH-07	Shehali Eid gha mat, Auch Para Union	24.61034	88.71178	Auch Para Union
BH-08	Uttar Jamalpur Govt. primary school, Uttar Jamalpur Fatepur, Sondanga Union	24.67196	88.81125	Sondanga Union
BH-09	Mirpur Dimukki Primary and High School, jolapara Hat, Dwippur Union	24.64339	88.803	Dwippur Union
BH-10	Byegacha Govt. primary and high School, Byegacha Bazar, Subhadanga Union	24.61254	88.76151	Subhadanga Union
BH-11	Machmail High School, Machmail Bazar, Subhadanga Union	24.57887	88.73202	Subhadanga Union
BH-12	Mugaipara High School, Mugaipara Bazar, Auch Para Union	24.57418	88.70657	Auch Para Union
BH-13	Baganna Govt. Primary School, Bihanali Bazar, Bara Bihanali Union	24.65396	88.8504	Bara Bihanali Union
BH-14	Dwippur Govt. primary and high School, Village name-Char Horinarayan Kundhu, Dwippur Union	24.62888	88.82063	Dwippur Union
BH-17	Doulatpur Madhomik School, Madha Doulatpur, Subhadanga Union	24.57765	88.76096	Subhadanga Union
BH-19	Gonganarayanpur Namajgram Govt. Primary School, Kumanitola, Ganipur Union	24.5365	88.72177	Ganipur Union
BH-20	21 nos. Bara Bihanali govt. School, Bara Bihanali Union	24.62606	88.85274	Bara Bihanali Union
BH-21	Uttar akdala Govt. Primary School, Uttar akdala Bazar, Bhabanigong Pourashava	24.59941	88.82528	Bhabanigong Pourashava

BH-22	Nandanpur(Chekamara) Bazar, Mohila Dakhil Madrasha, Basu Para Union	24.57737	88.79211	Basu Para Union
BH-24	Ganipur Union Complex office, Hasnipur Bazar, Ganipur Union	24.52932	88.74364	Ganipur Union
BH-25	Boiloshingho Govt. Primary School, Maria Union	24.59821	88.84588	Maria Union
BH-26	Sahid Sakandar Memorial Adarsho High School, Godaoun Mor, Bhabanigong Pourashava	24.58064	88.82589	Bhabanigong Pourashava
BH-27	Bagmara Degree College, Ganipur Union	24.55881	88.80555	Ganipur Union
BH-28	Shadhopara Madrasha, Near post office, Sreepur Union	24.53365	88.78897	Sreepur Union
BH-29	Jhikra High School, Jhikra Bazar, Jhikra Union	24.616	88.89302	Jhikra Union
BH-30	Sakoa Bohumuki High School, Sikdar Bazar, Maria Union	24.58401	88.87783	Maria Union
BH-31	Gangopara Govt. Primary school, Maria Union	24.56969	88.84544	Maria Union
BH-32	Sajura Mirzapur, Goalkandi Union	24.54549	88.84274	Goalkandi Union
BH-33	Jamgram Govt. Primary School, Jamgram, Tahirpur Pourashava	24.52897	88.82679	Tahirpur Pourashava
BH-34	Koyamajampur Govt. Primary School, Durgapur, Near Tahirpur Pourashava	24.52245	88.81128	Near Tahirpur Pourashava
BH-35	Nak para, Jogi para Union	24.59607	88.90939	Jogi Para Union
BH-36	Hamir kutsha Union complex office, Hamir Kutsha Union	24.55917	88.87413	Hamir Kutsha Union
BH-37	Tahirpur University (Birshobidalay) college, Tahirpur Bazar, Tahirpur Pourashava	24.51805	88.84495	Tahirpur Pourashava
BH-38	Jogi Para Union	24.568401	88.9318	Jogi Para Union
BH-39	Talghoria Govt. Primary School, Hamir Kutsha Union	24.55199	88.90859	Hamir Kutsha Union
BH-40	Choukali Govt. Primary School, Choukali Bazar, Goalkandi Union	24.53553	88.87837	Goalkandi Union

Source: Field data, 2015

While boring and SPT testing, soil samples are being visually classified in the following way:

Sieve	Soils	Designations
+No 4 (4.76mm)	Gravel	
No.4 to No 10(2.00mm)	Coarse	Sand
No. 10 to No 40 (0.42mm)	Medium	Sand
No. 40 to No 200 (0.07mm)	Fine	Sand
No.200	Silt or Clay	

Some soil has one dominant lithology with minuscule amount of other soil type. In such cases, minor soil sample are written in the following manner with along with dominant soil type.

- | | |
|-----------|-----------|
| 1. Trace | 1 to 10% |
| 2. Little | 10 to 25% |
| 3. With | 25 to 35% |

SPT- N value is also note down while SPT Testing. Then the collected soil samples are being cross checked with SPT-N values to ensure quality data collection.

Based on N-values, other very useful soil parameters may be obtained from the co-relation charts given by different research workers. Two such useful co-relations for cohesive and non-cohesive soils after K. Terzaghi are given below:

Table 4: Values of Relative Density (Dr.), Friction Angle and Unit Weight of Non-cohesive soil based on N-values

N-values	Condition	Relative Density	Angle of Internal friction (Degree)	Moist Unit Weight (Pcf)
0-4	Very Loose	0-15%	28 ⁰	70-100
4-10	Loose	15-35%	28 ⁰ -30 ⁰	95-125
10-30	Medium dense	35-65%	30 ⁰ -36 ⁰	110-130
30-50	Dense	65-85%	36 ⁰ -41 ⁰	110-140
Over 50	Very dense	85-100%	Over 41 ⁰	> 130

Table 5: Values of Unconfined Compressive Strength based on N-values for Cohesive Soil (Approximate):

N-values	Condition	Unconfined Compressive Strength (Tsf)
Below 2	Very soft	Below 0.25
2-4	Soft	0.25-0.50
4-8	Medium stiff	0.50-1.00
8-16	Stiff	1.00-2.00
16-32	very stiff	2.00-4.00
Over 32	Hard	over 4.00

In the above table the shear strength of cohesive soil is equal to $\frac{1}{2}$ of unconfined compressive strength and the angle of shearing resistance is equal to zero. It should be remembered that the co-relation for cohesive soil is not always much reliable.

The litholog are already written down in a standard format and has been attached in the appendix C.

CHAPTER-04: CONCLUSION

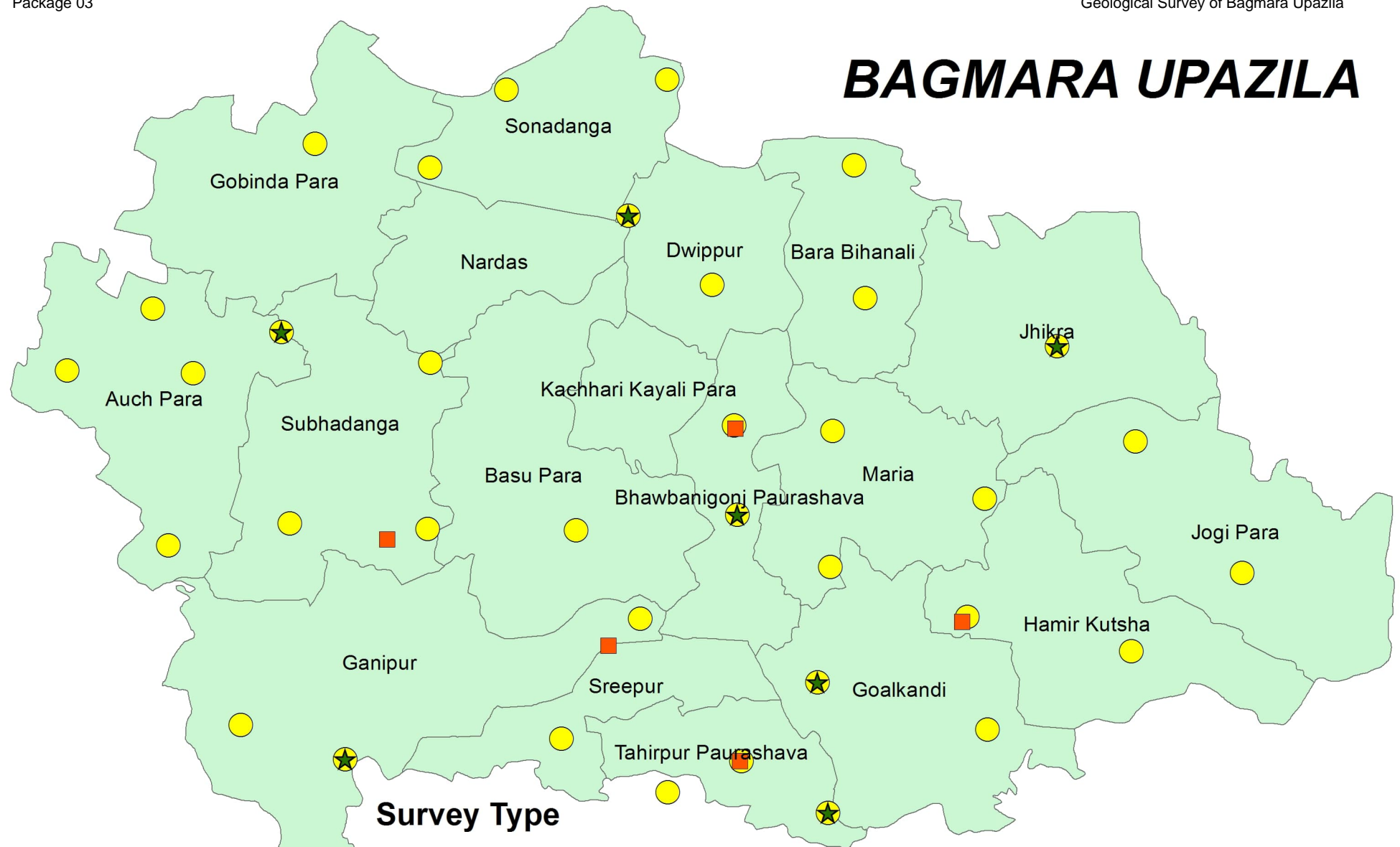
Bagmara Upazila and its adjoining areas is mostly comprises by monotonous flood plain area except few depression. Soil quality of the project area is varying as morphological difference, that's why geological, geotechnical and geophysical investigations has been carried out such a pattern to cover all morphological unit. In this consequences, 36 boreholes with SPT, 7 downhole seismic tests and 5 MASW program has been completed in the field as a part of this survey investigation. During this survey, soil samples (disturbed and undisturbed) are also collected for further laboratory test which will give idea about the soil engineering properties. This investigation data will be analyzed and integrated in a module from which it can possible to generate geomorphologic map, sub-surface litho-logical 3D model of different layers, engineering geological mapping based on AVS30, Seismic Hazard Assessment Map, soil type map, seismic intensity map, Peak Ground Acceleration (PGA) and recommended building height maps for both high rise building and low rise building etc

Above investigation and outcomes would give a clear idea about the geo-hazard status of particular landscape where newly urban developing activities or any other mega infrastructure project is going on and this mentioned investigation also gives idea about the vulnerability of existing build up infrastructure of a particular area. Based on these results, proper management techniques as well as other necessary adaptation process could be addressed before or after the development activities in the studied area. It is to be mentioned that the long-term maintenance cost will be reduced and the developed structure will withstand against the potential natural hazards if the infrastructures are built following the risk informed physical land-use plan.

CHAPTER 5: REFERENCES

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BAGMARA UPAZILA



Survey Type



Downhole Seismic Test (PS Logging)



Multi-channel Analysis of Surface Wave (MASW)

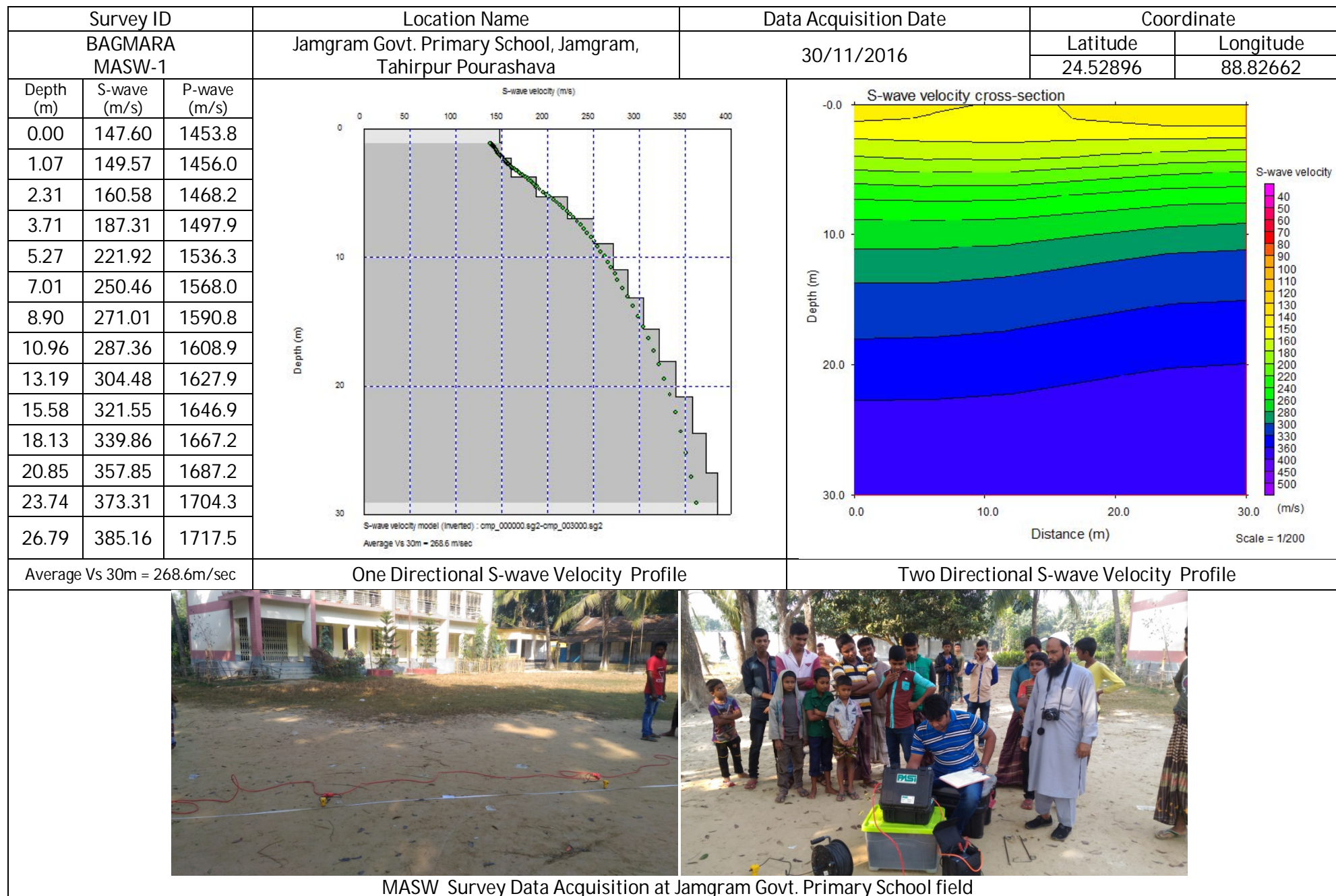


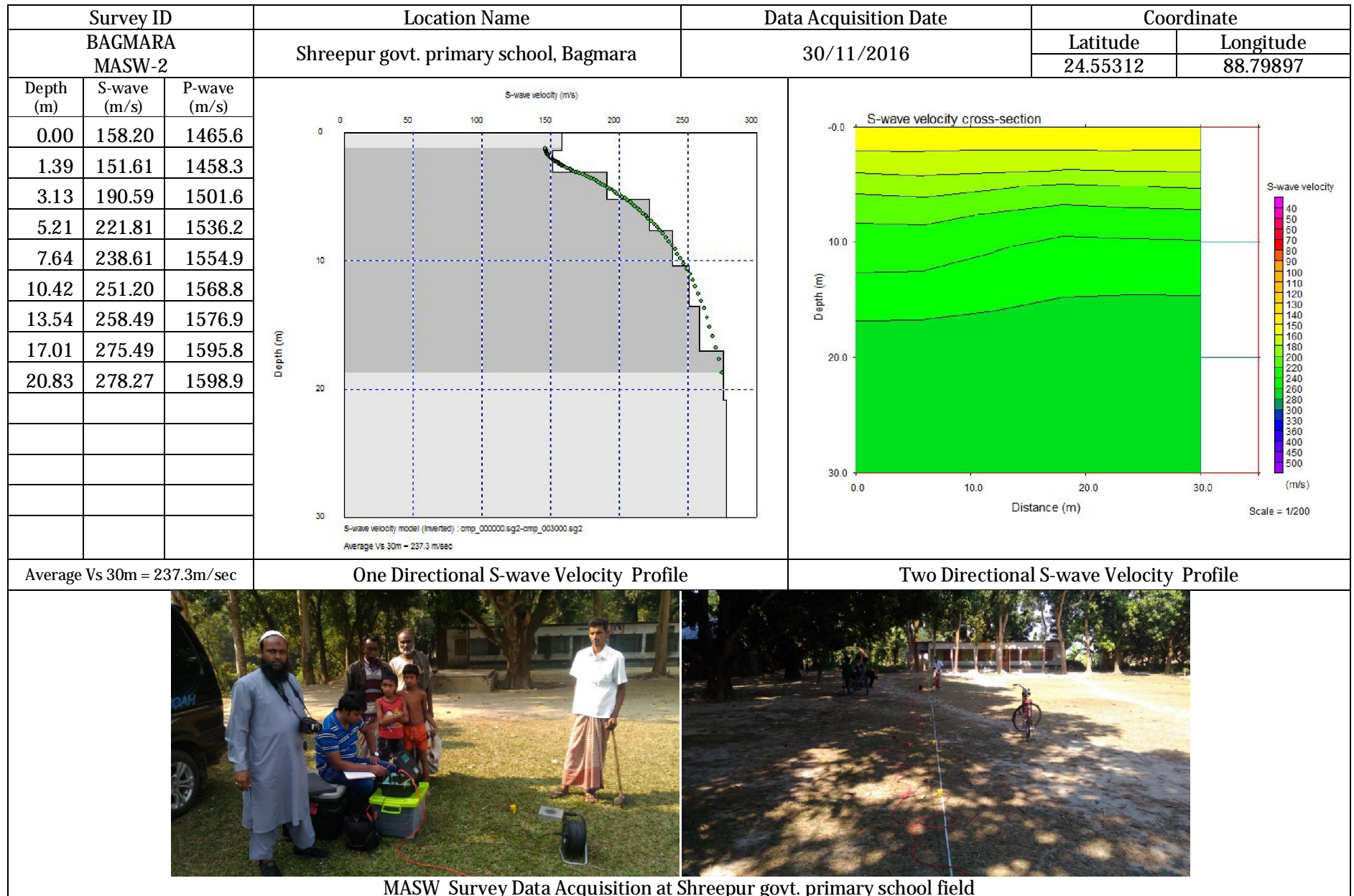
Standard Penetration Test (SPT) Drilling

Engineering Consultants and Associates Limited

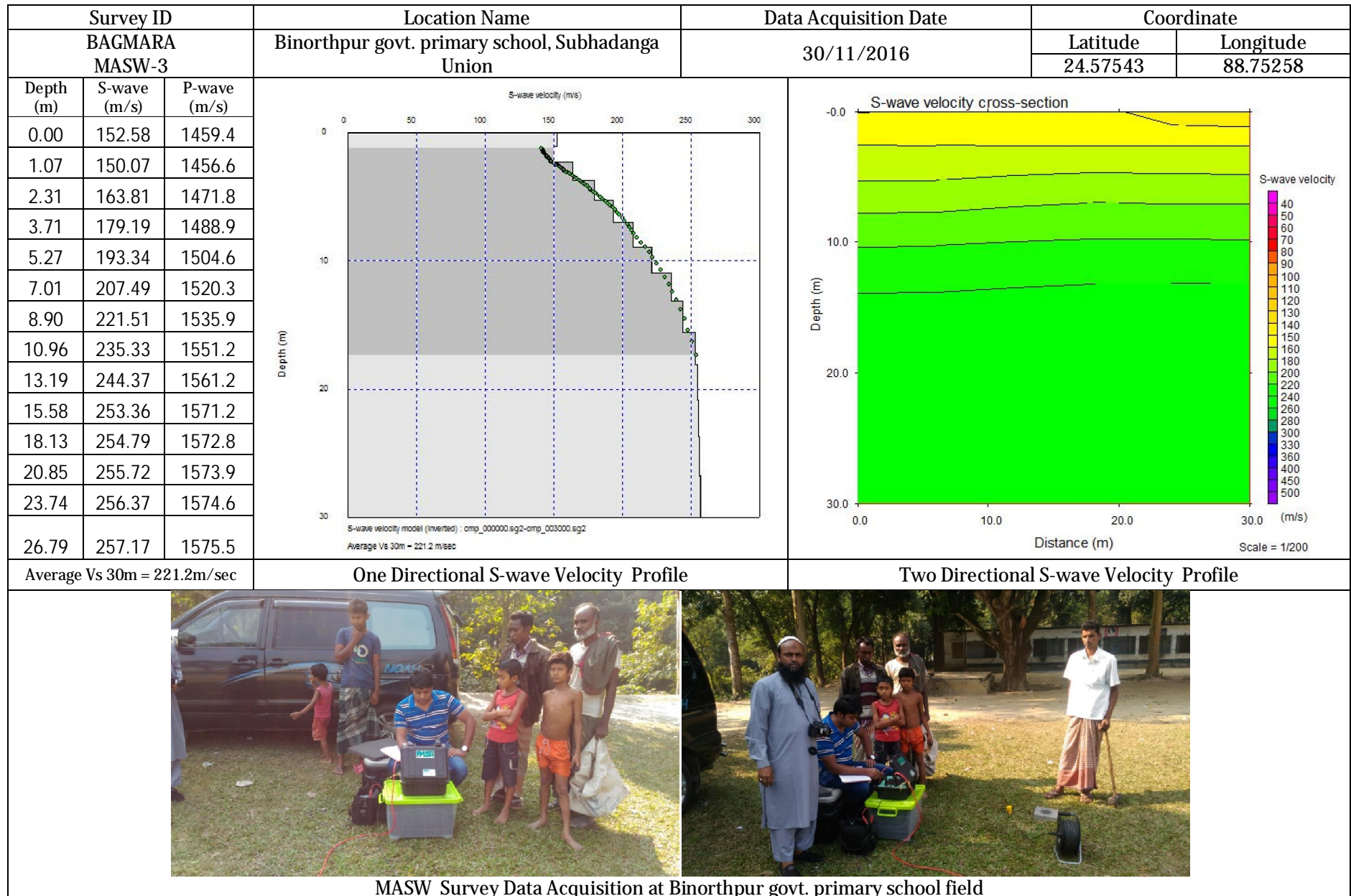
Appendix B

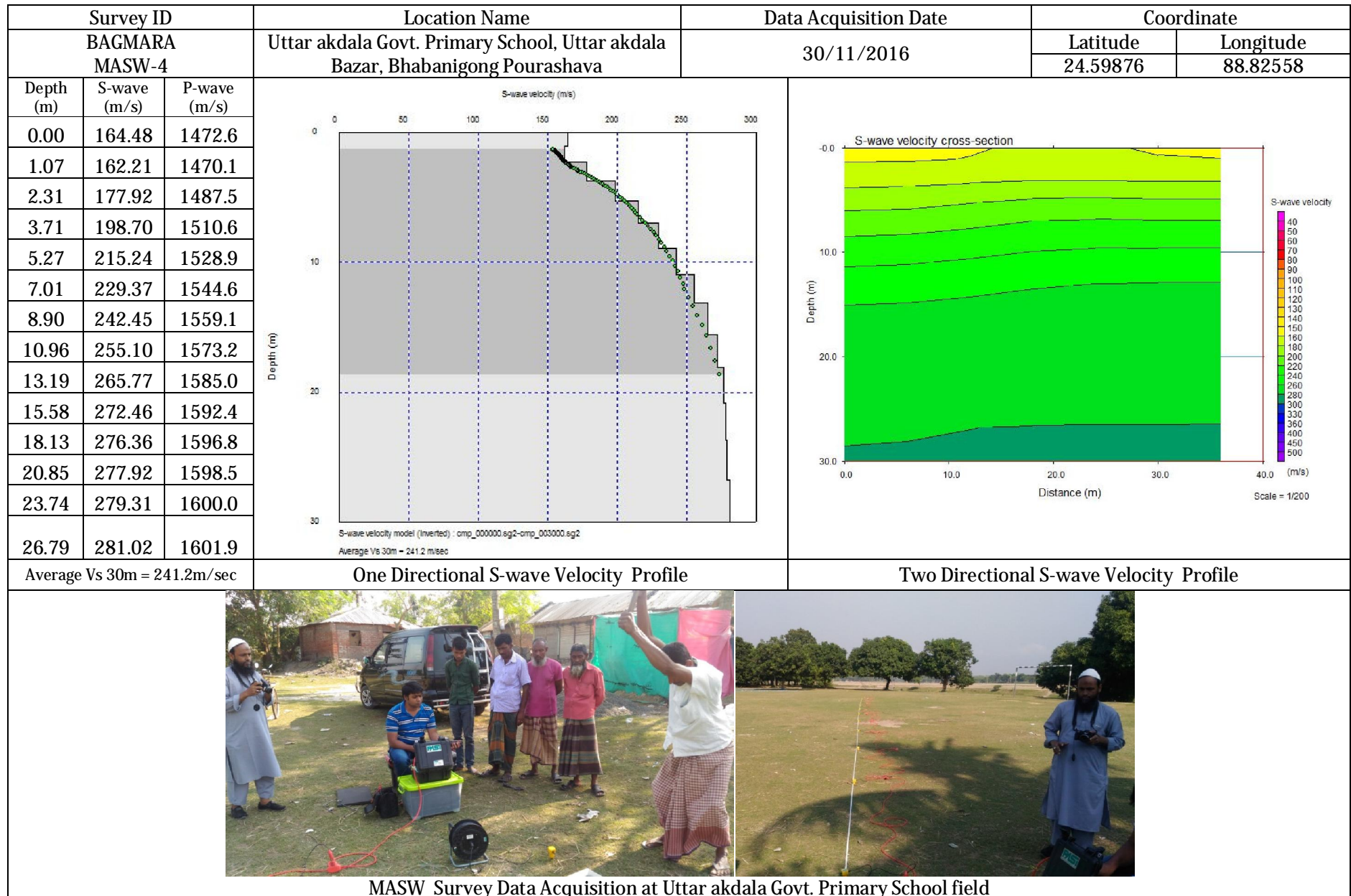
Multi-channel Analysis of Surface Wave (MASW) Results and Graphs

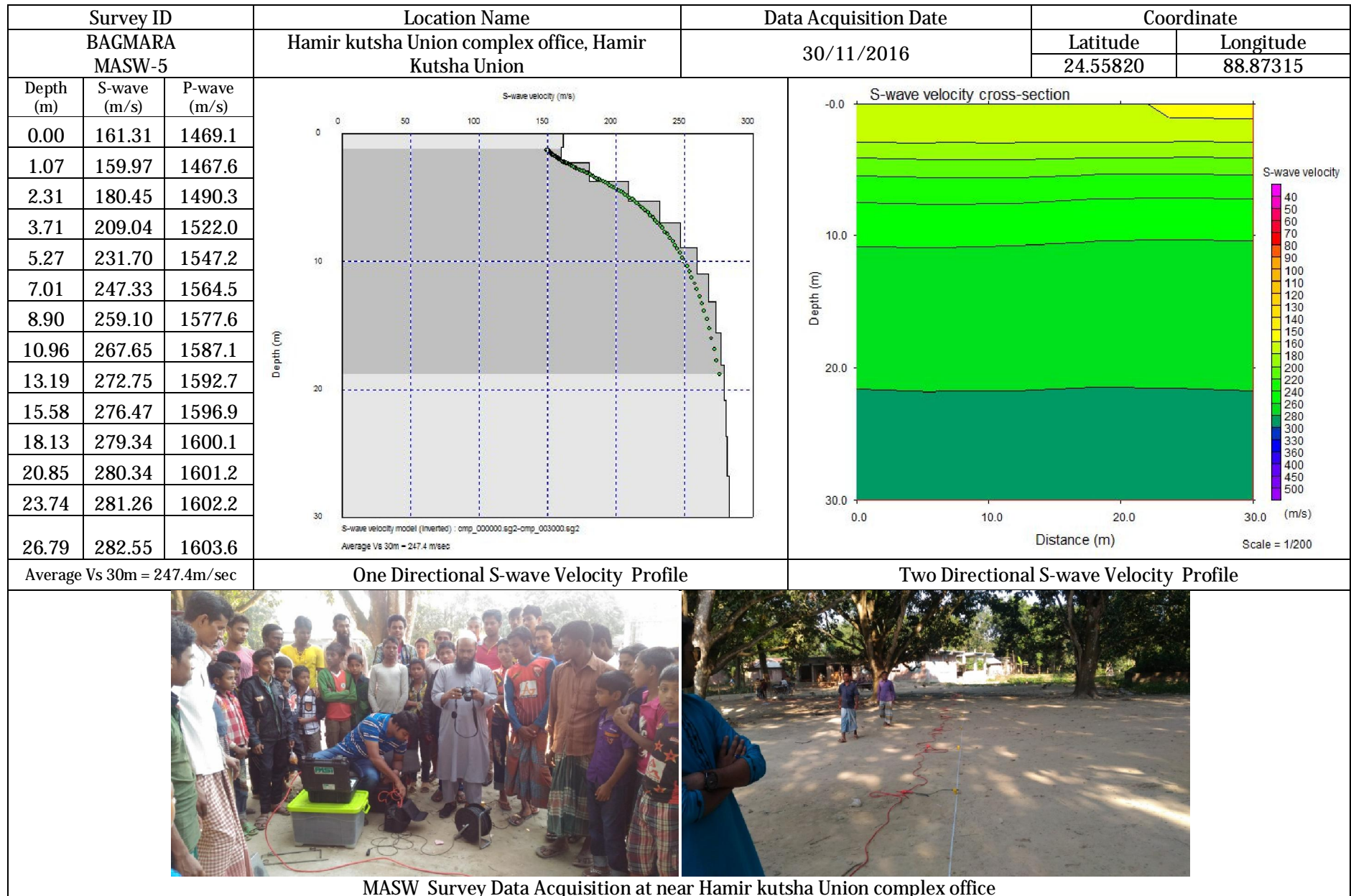




MASW Survey Data Acquisition at Shreepur govt. primary school field

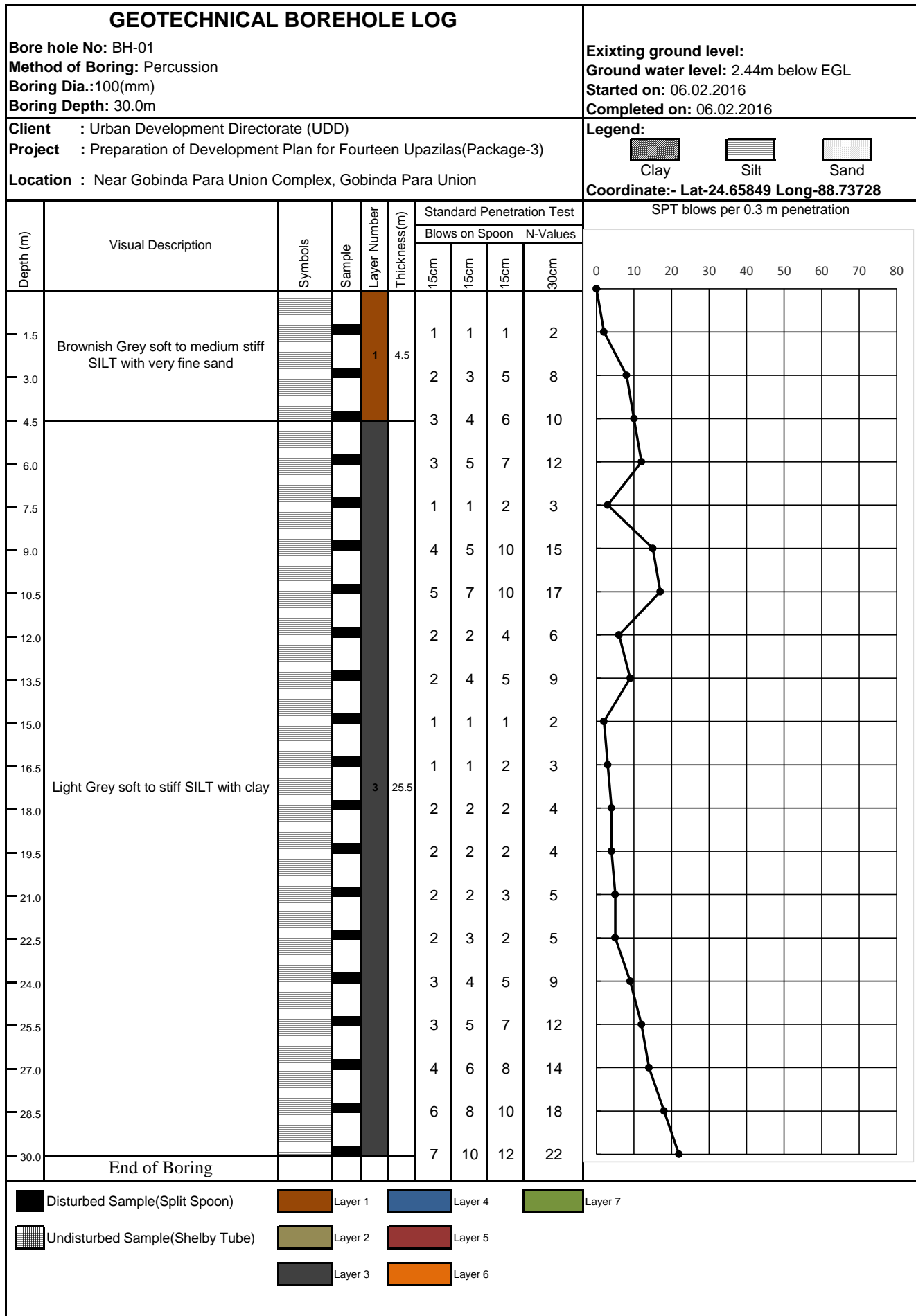


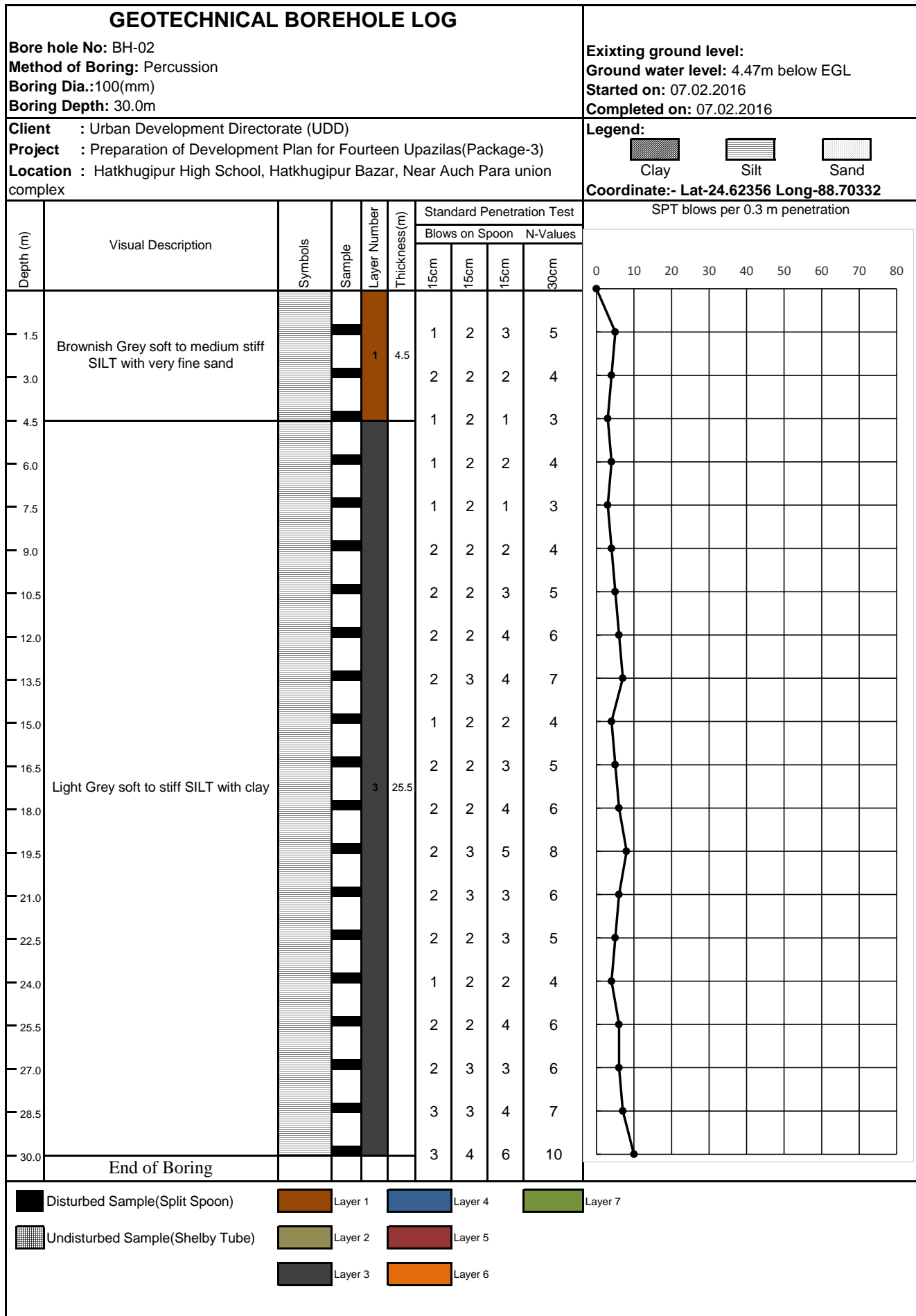


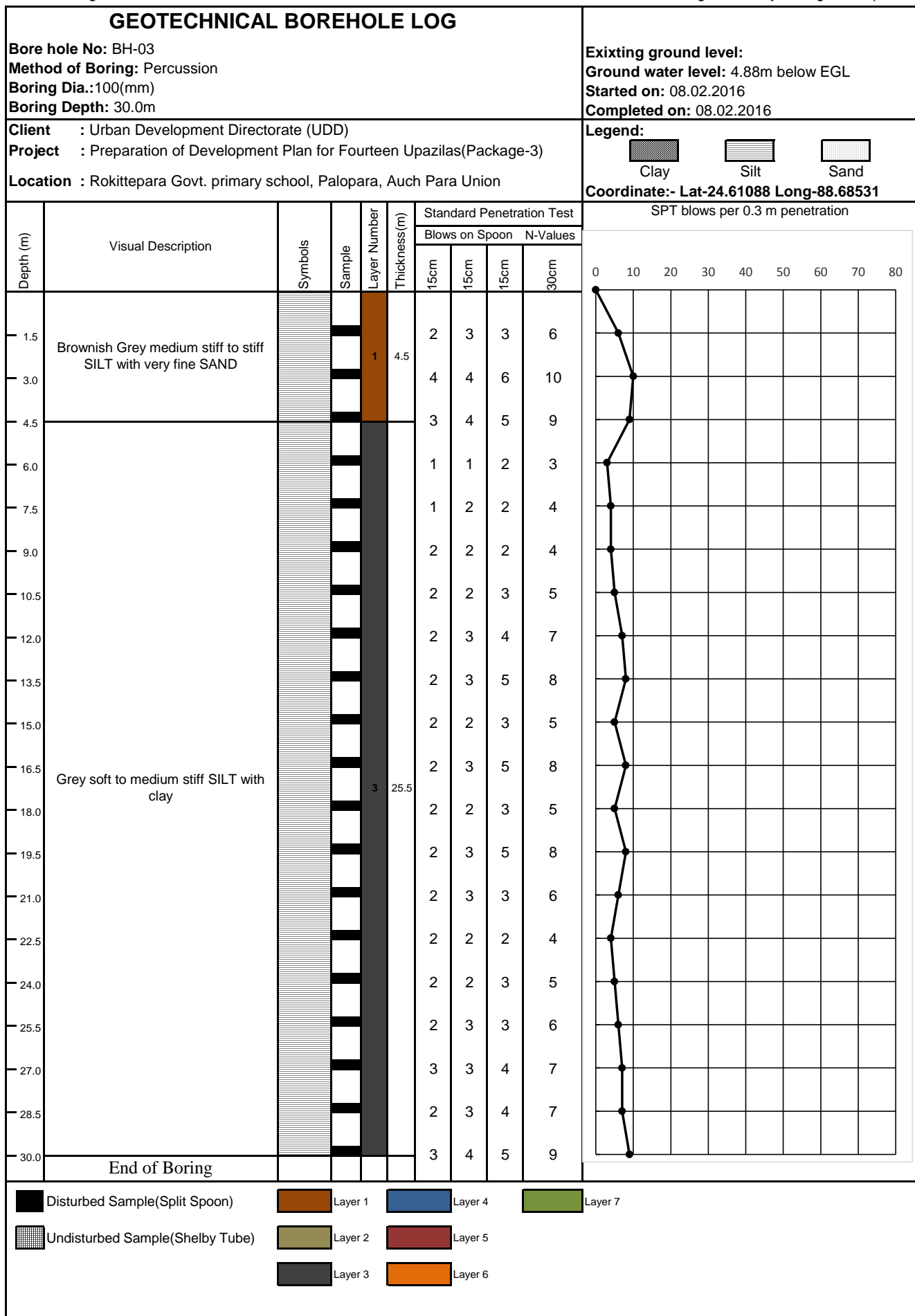


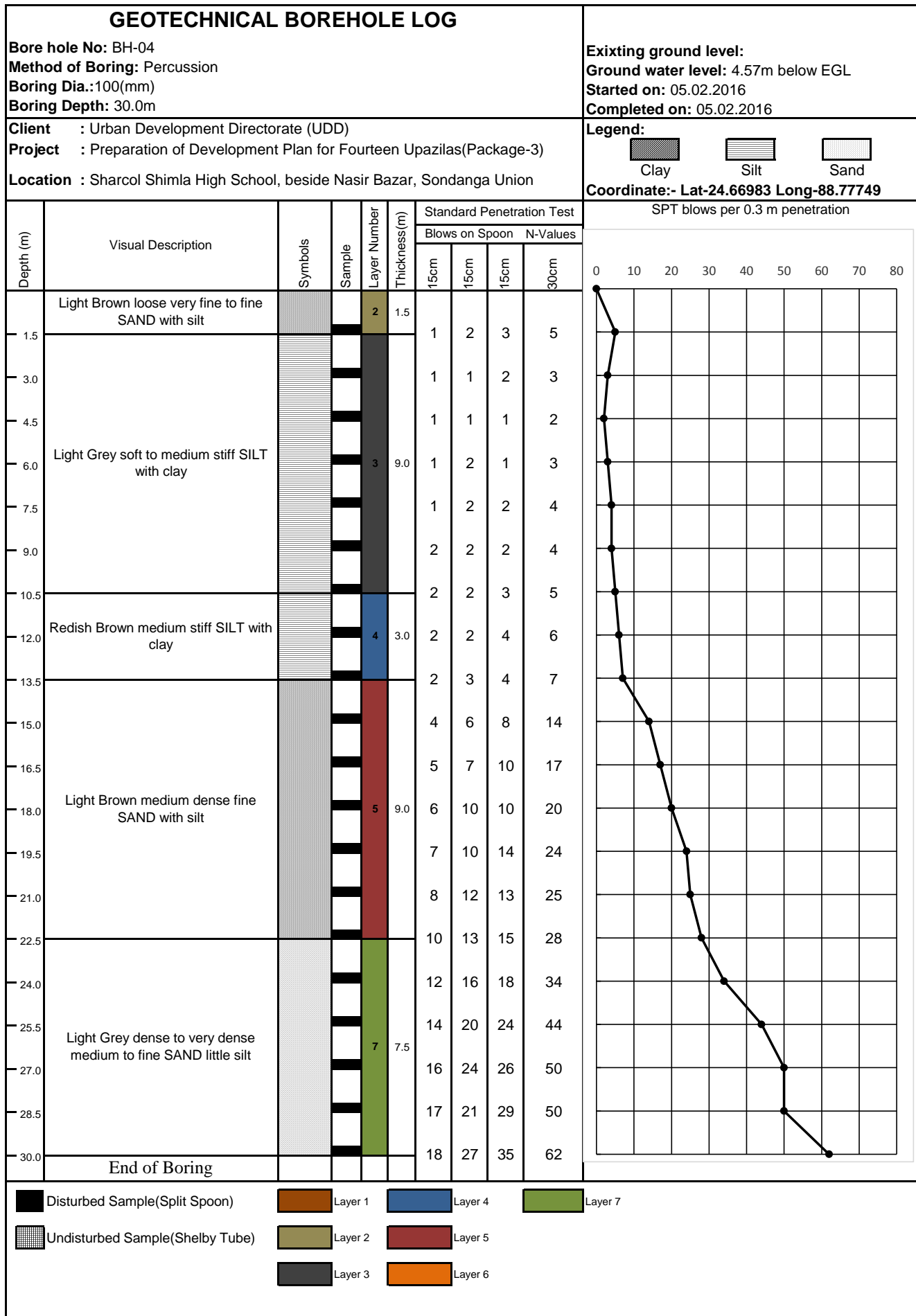
Appendix C

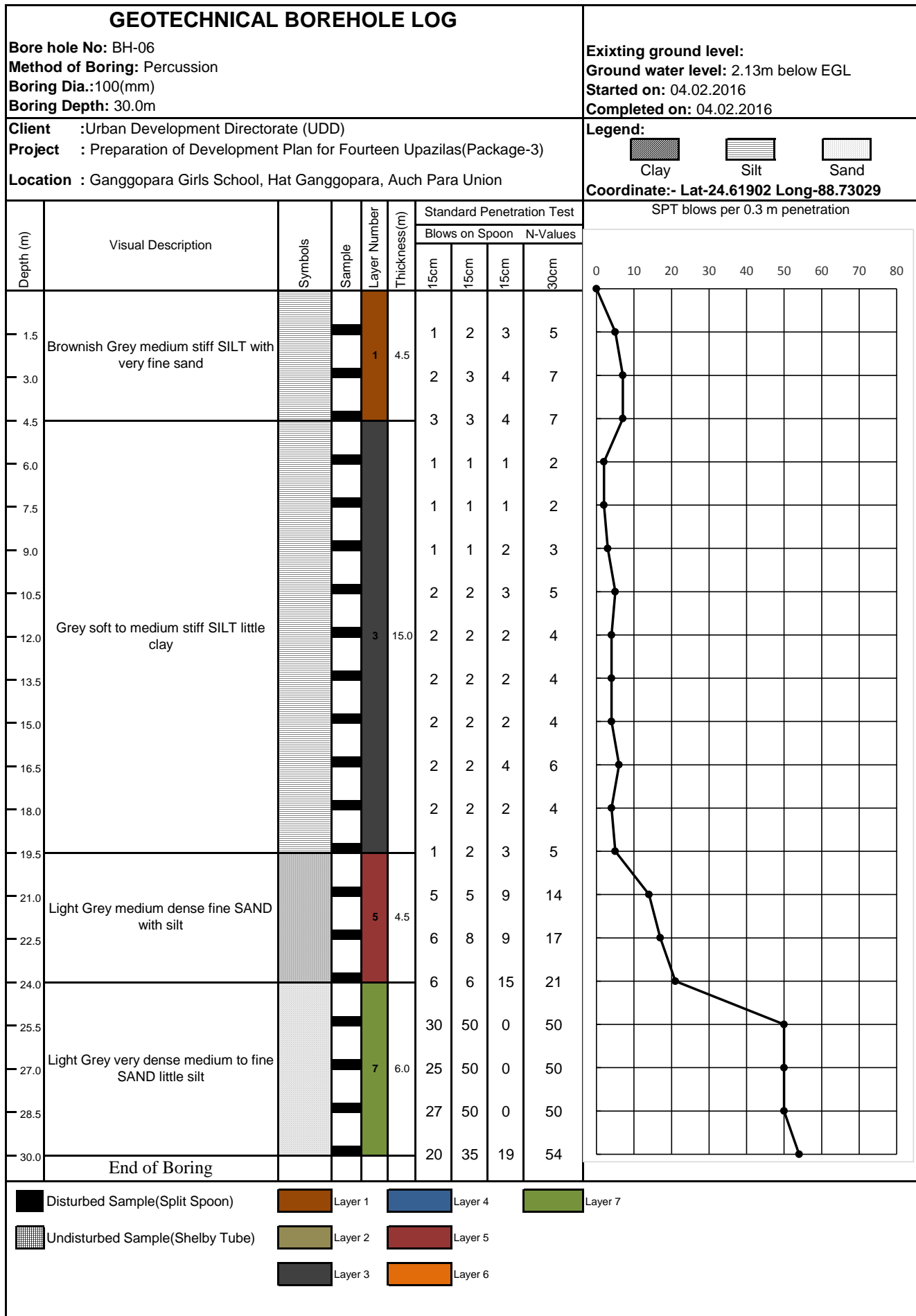
Geotechnical Borehole Logs and Graphs

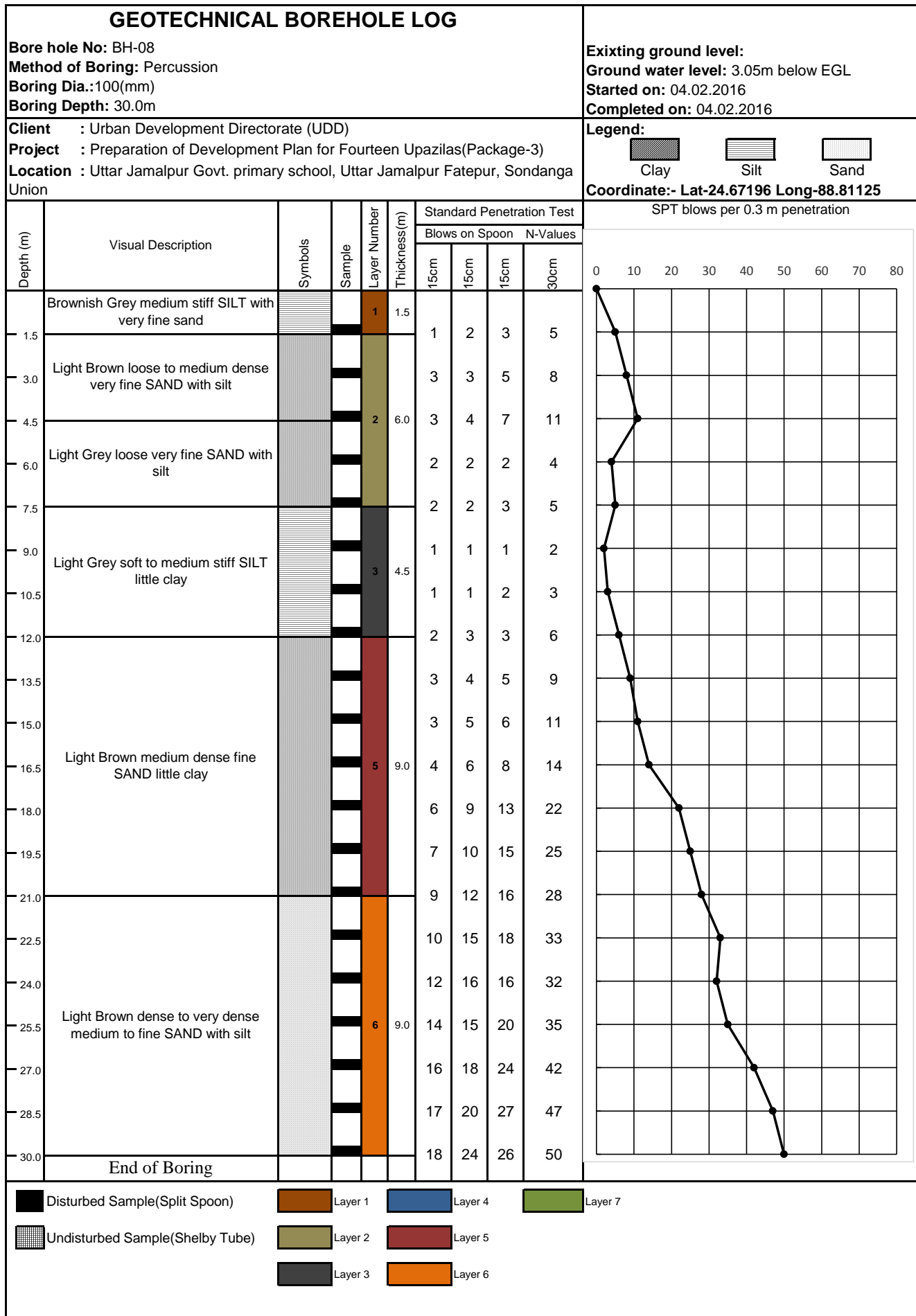


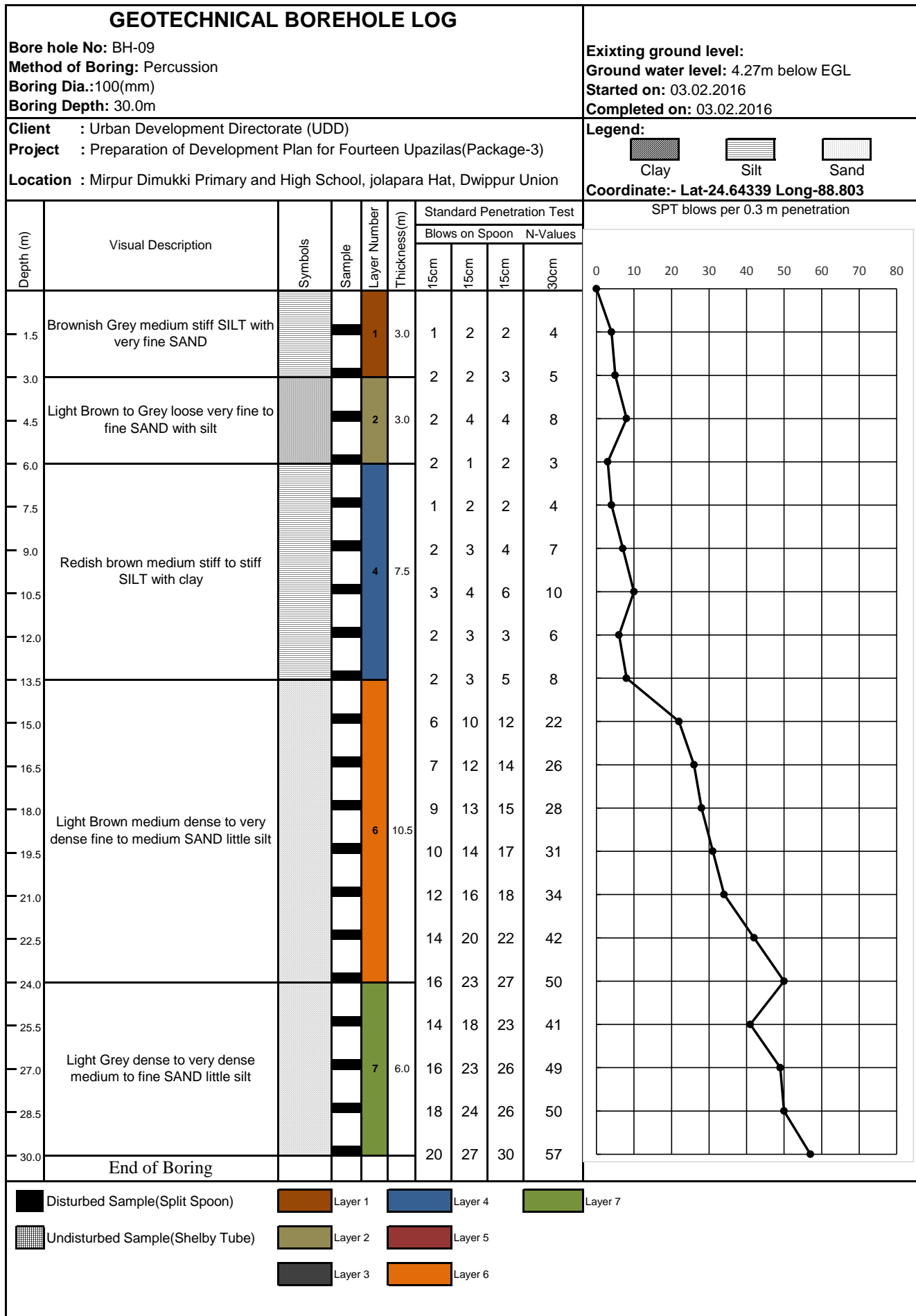


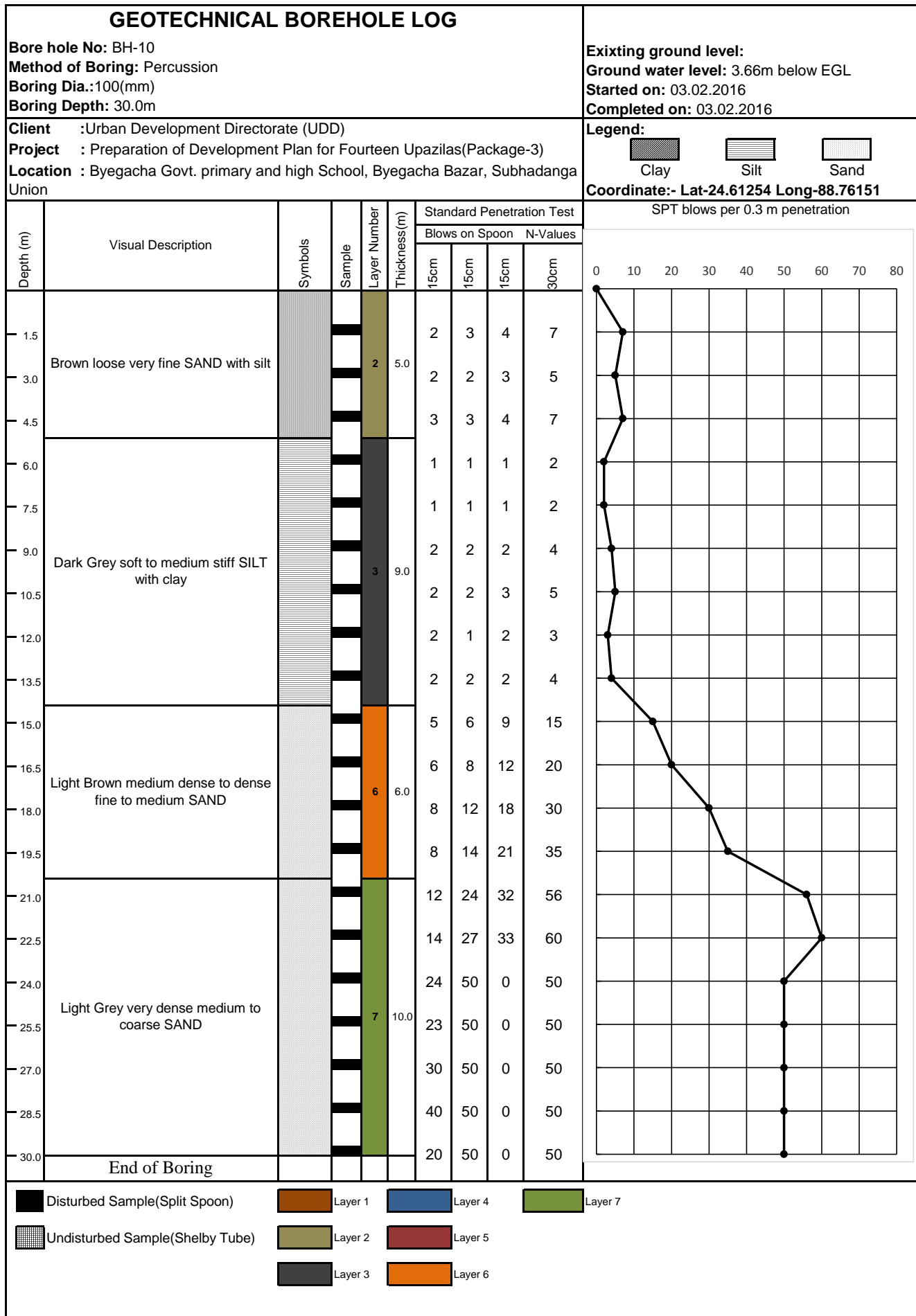


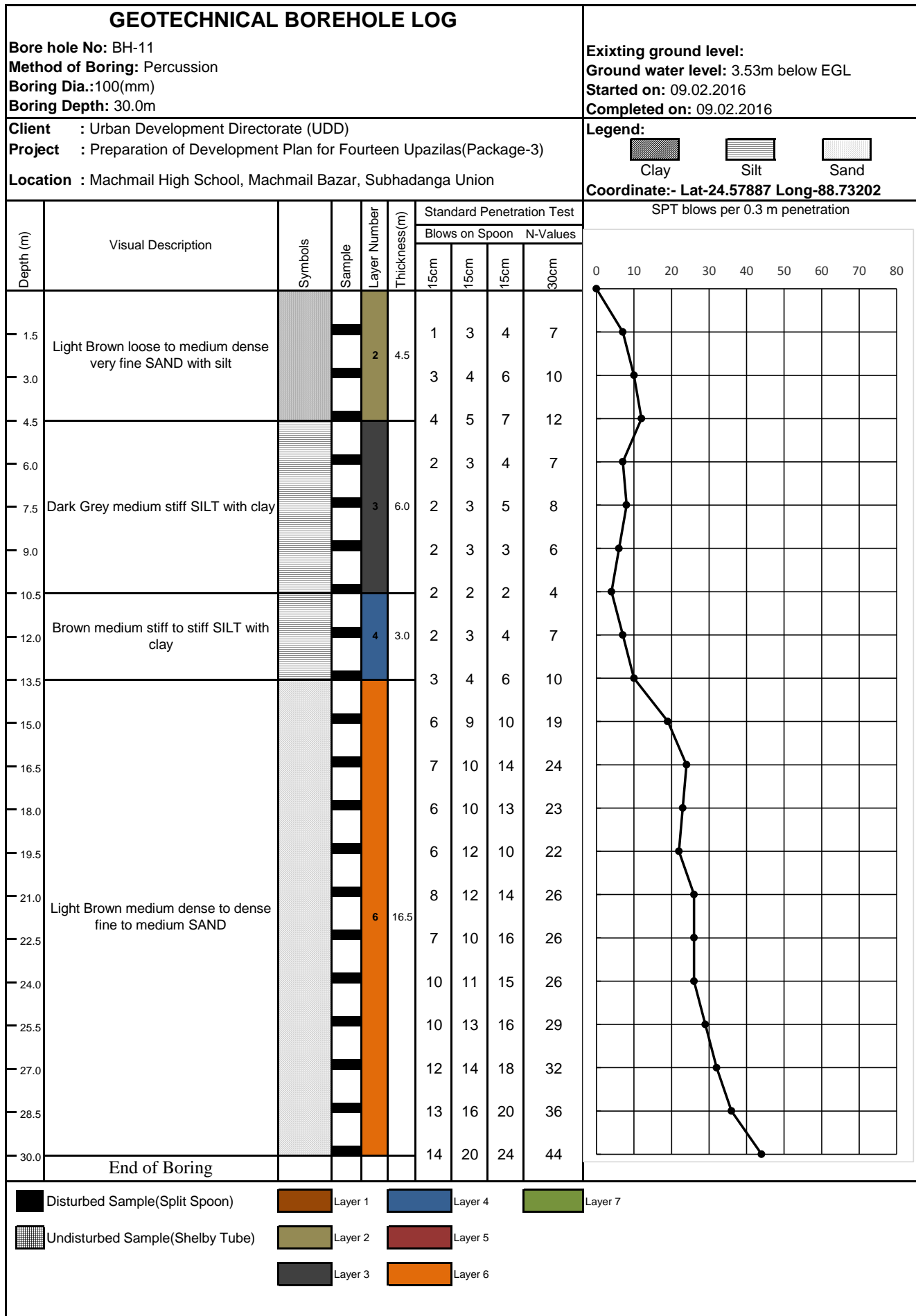


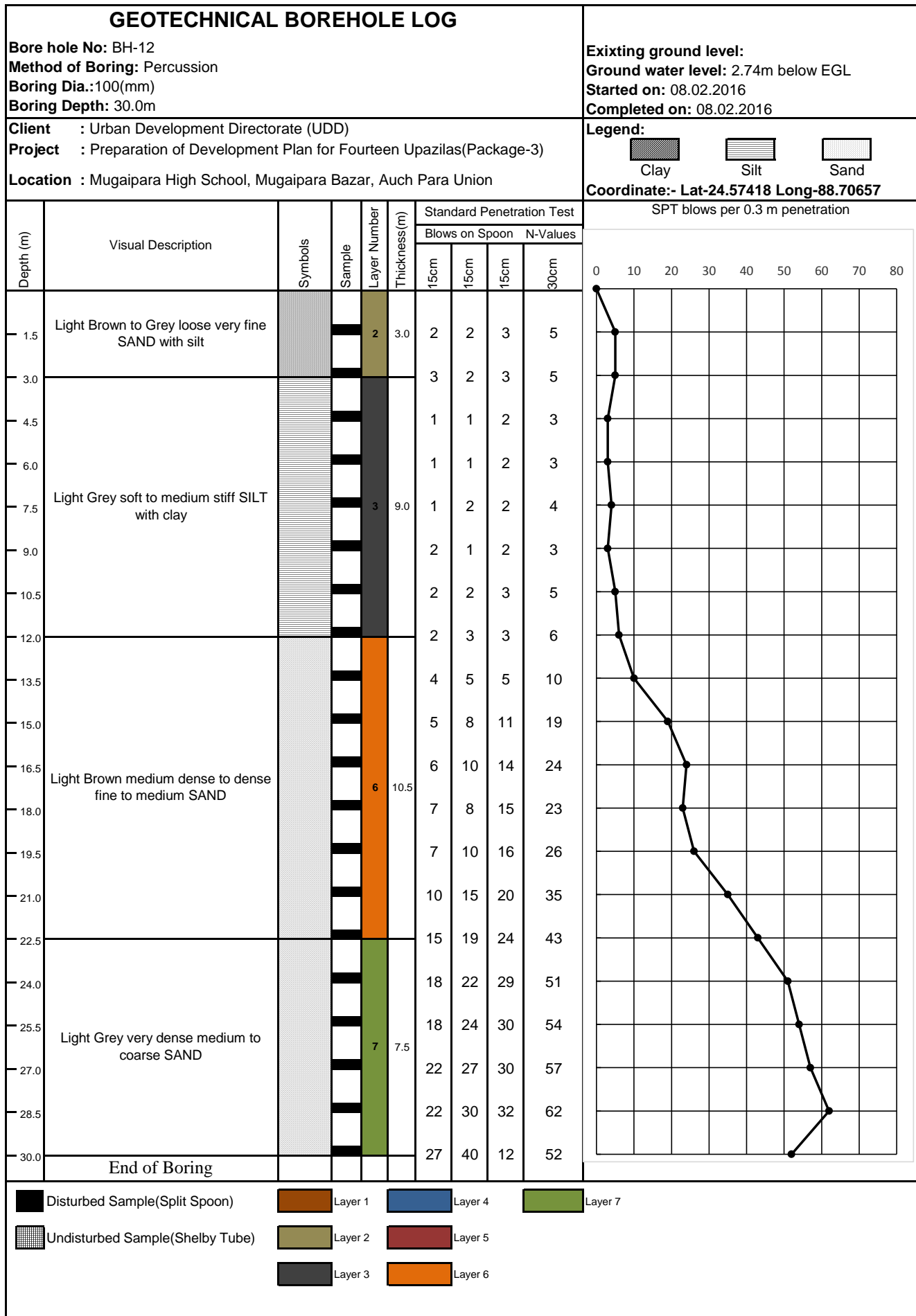


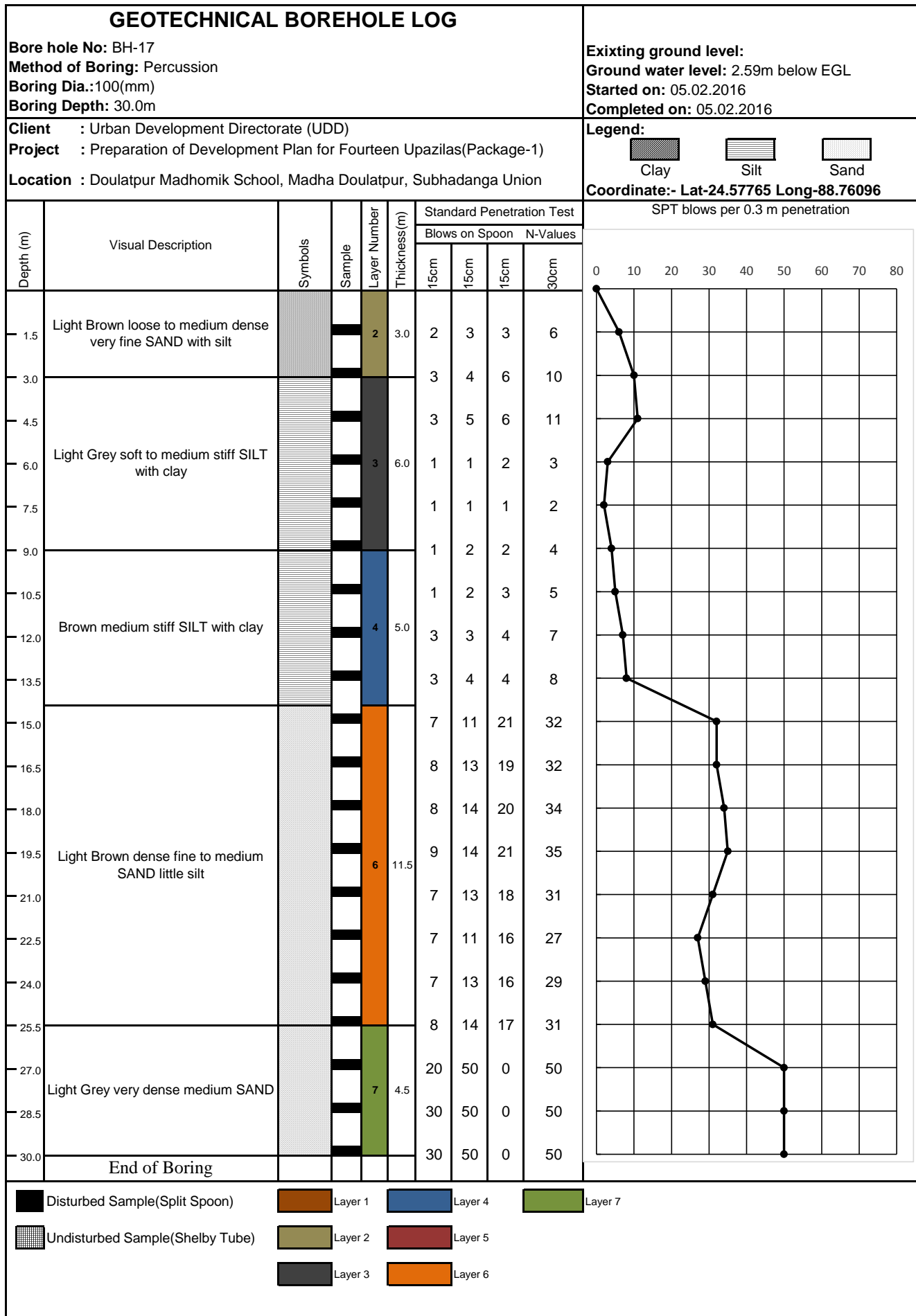


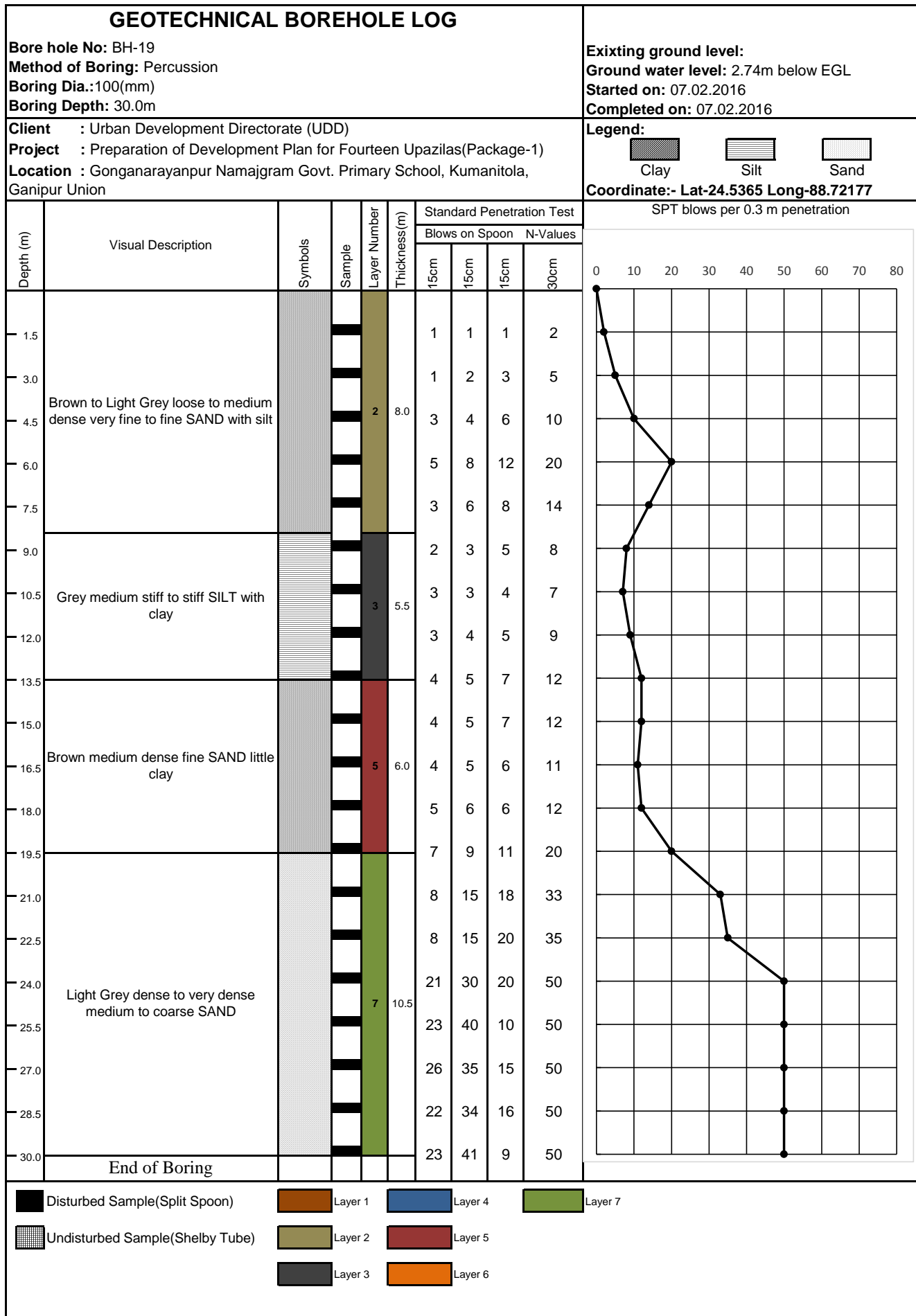


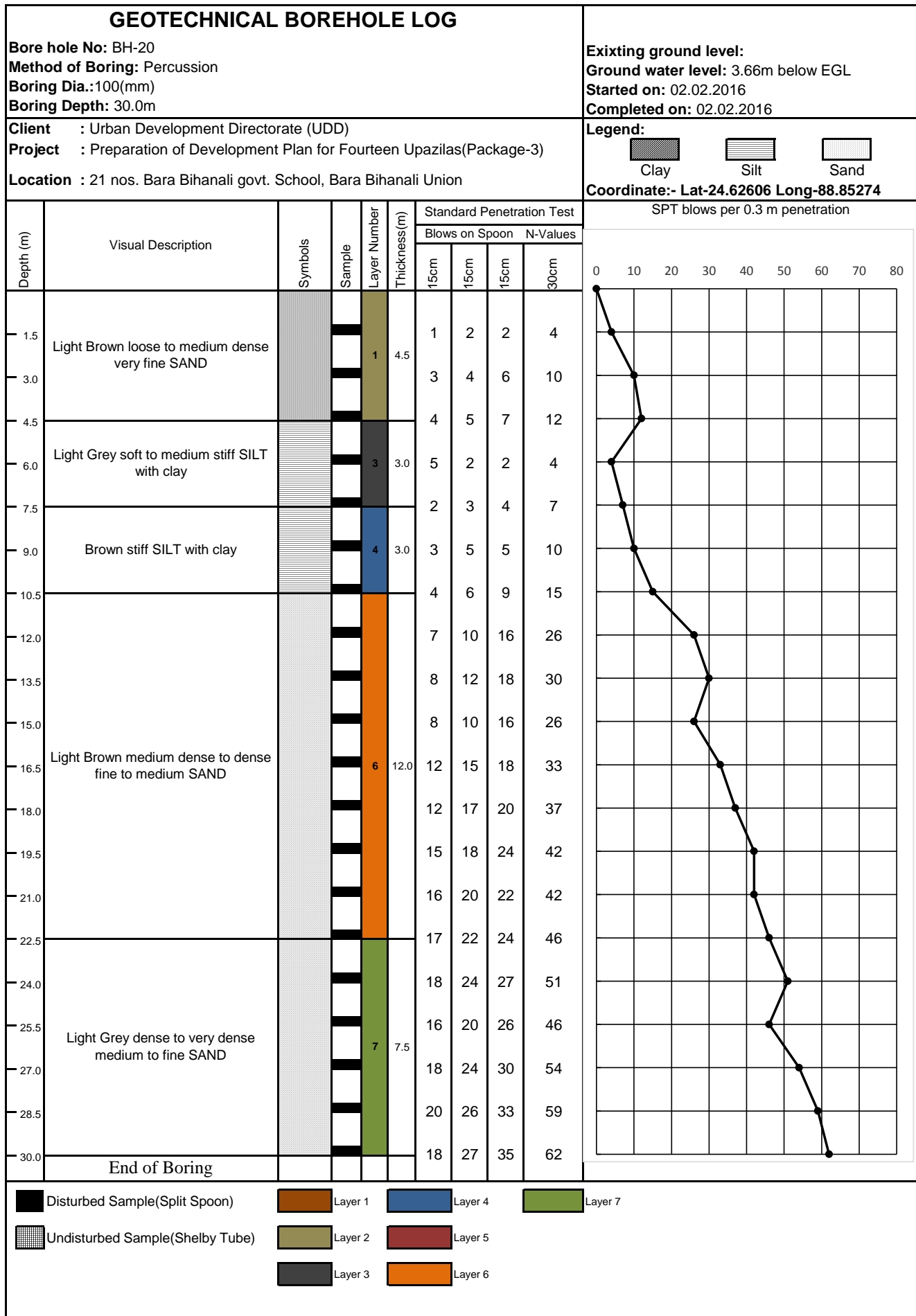


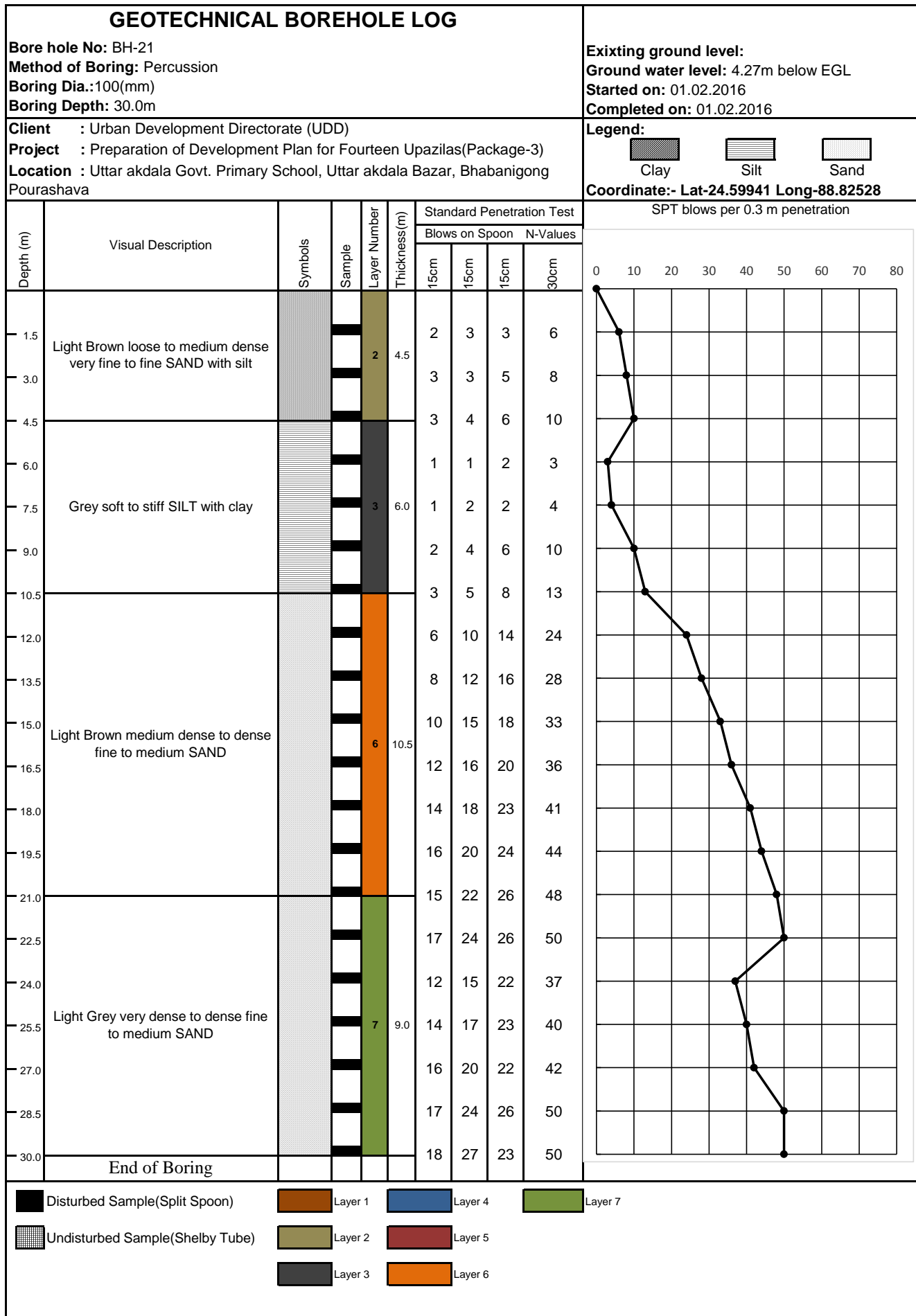


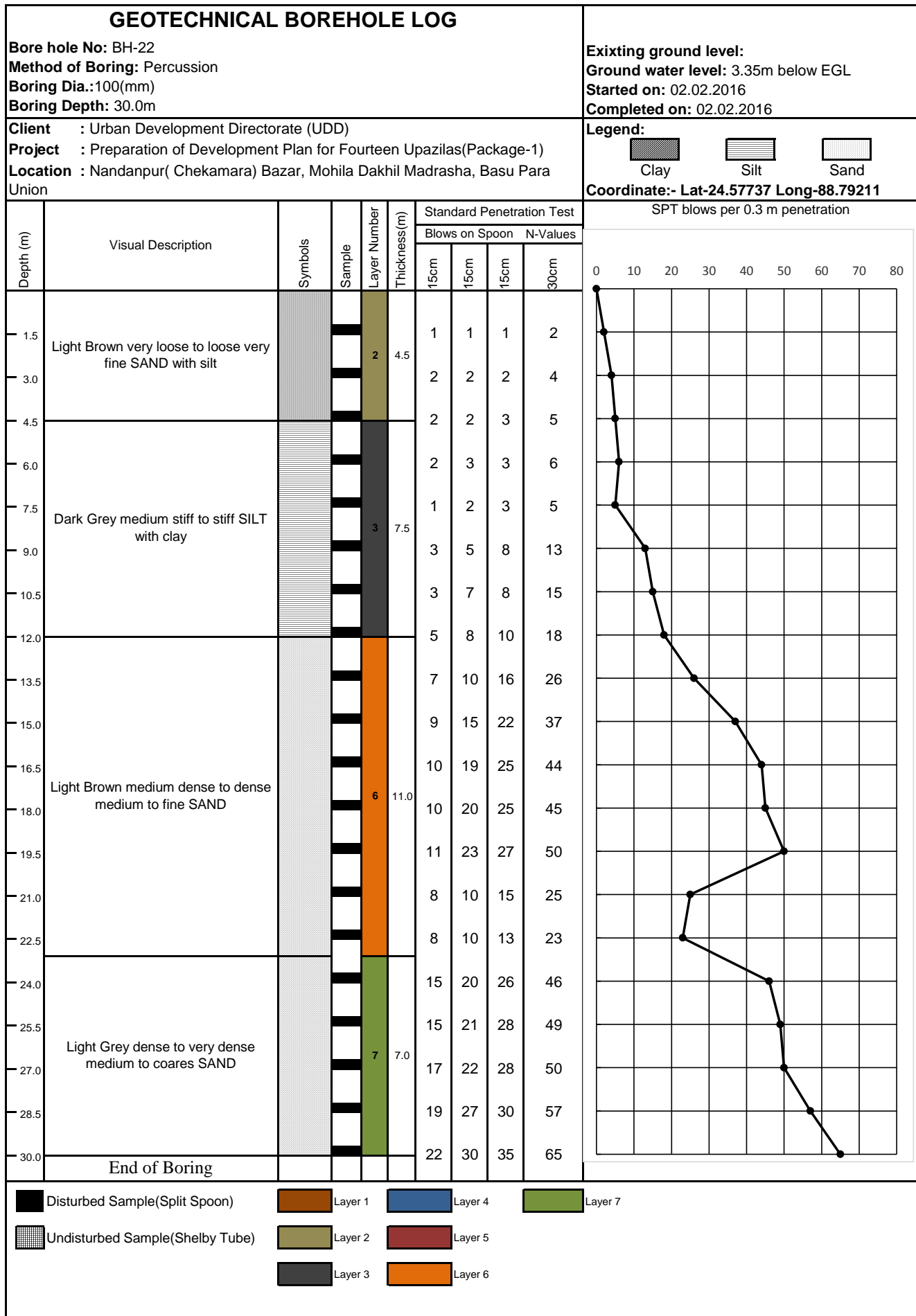


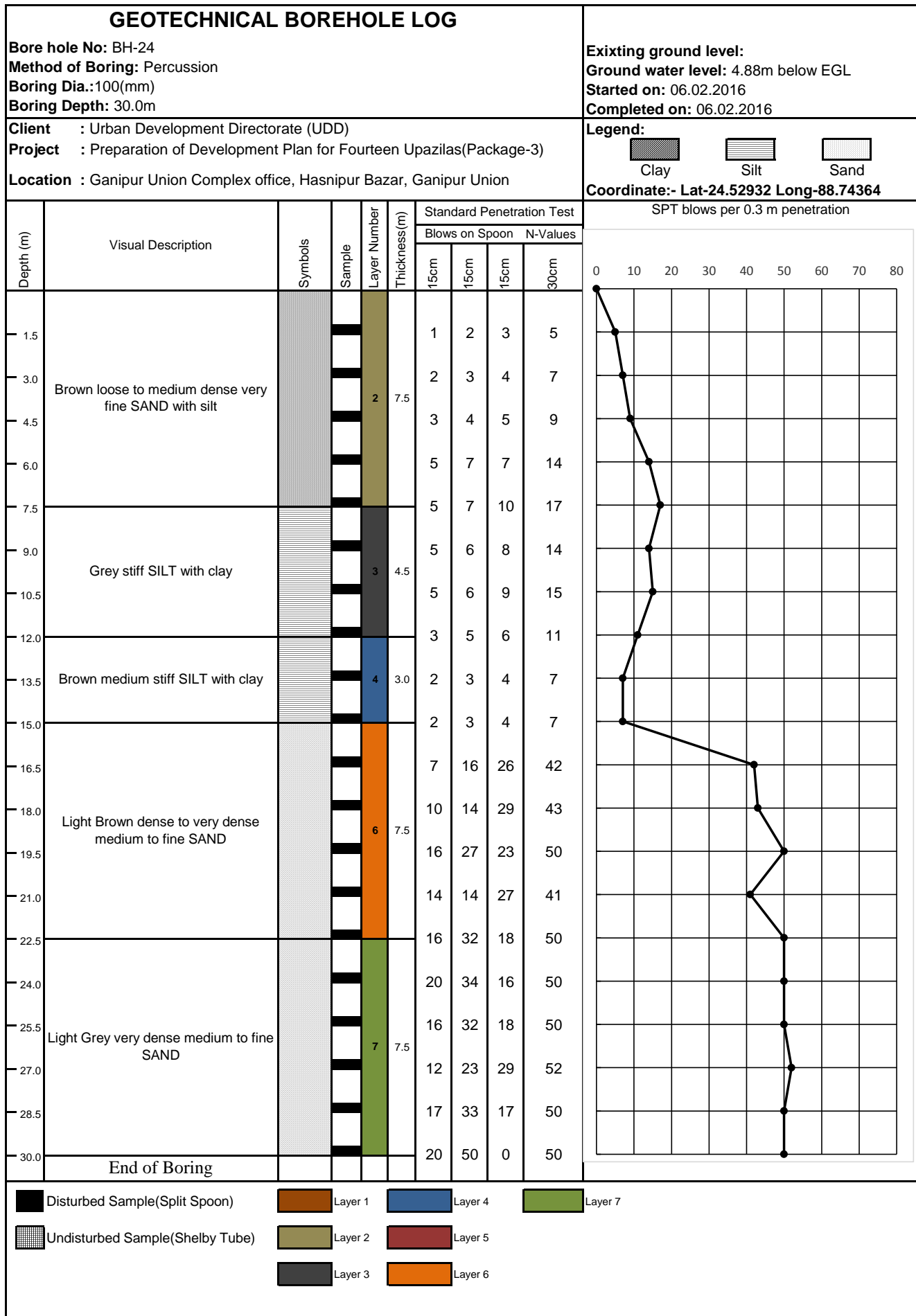


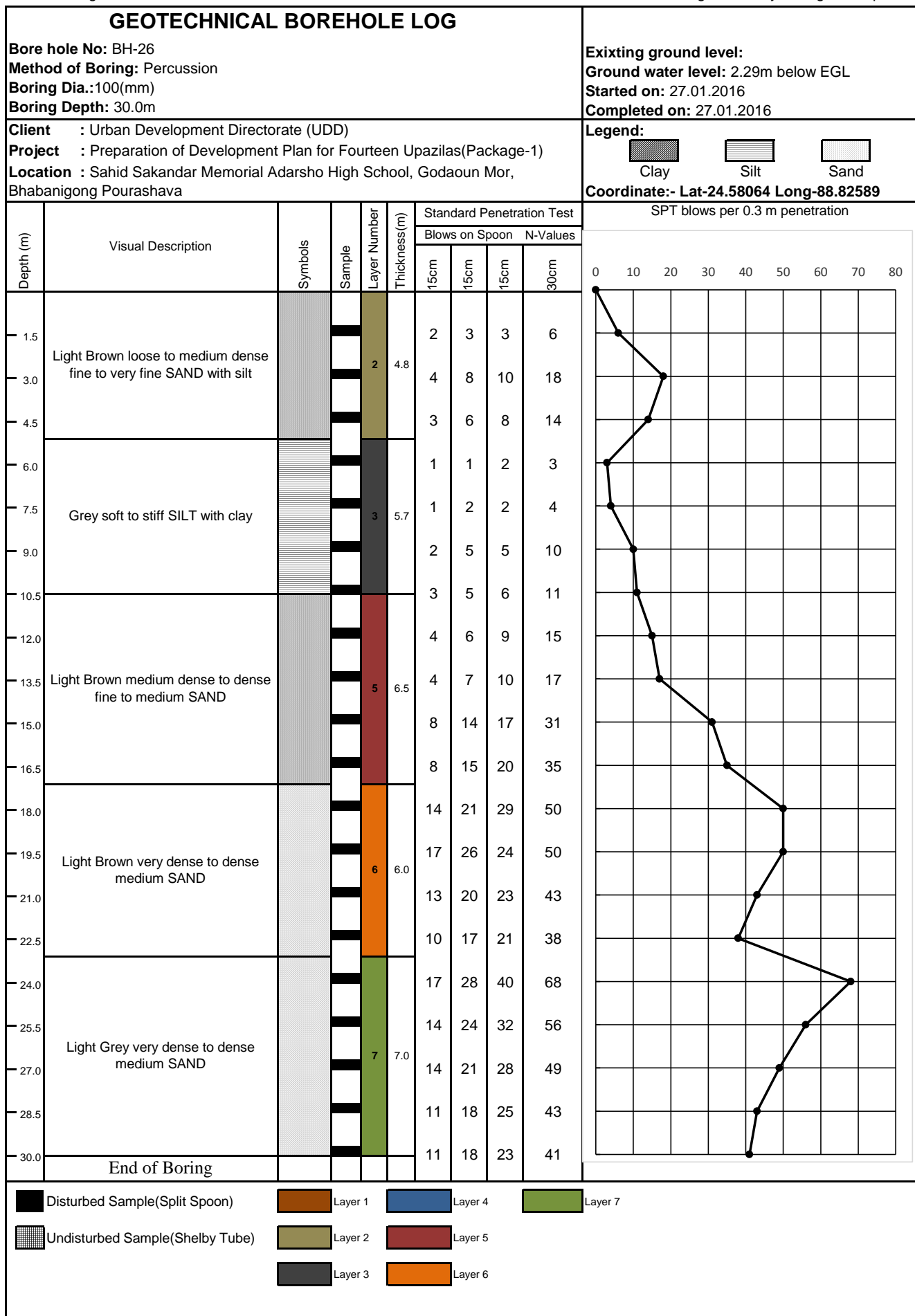


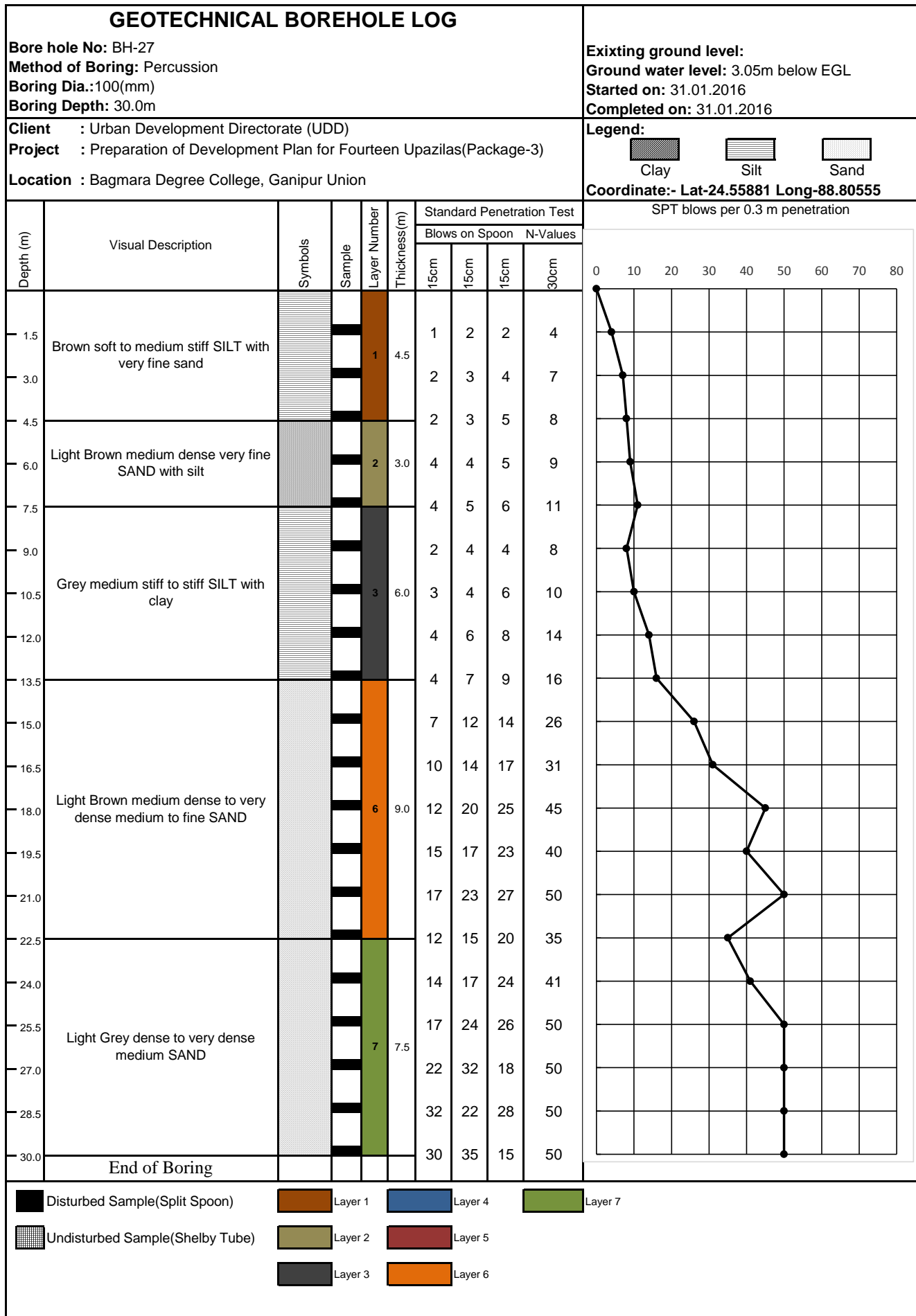


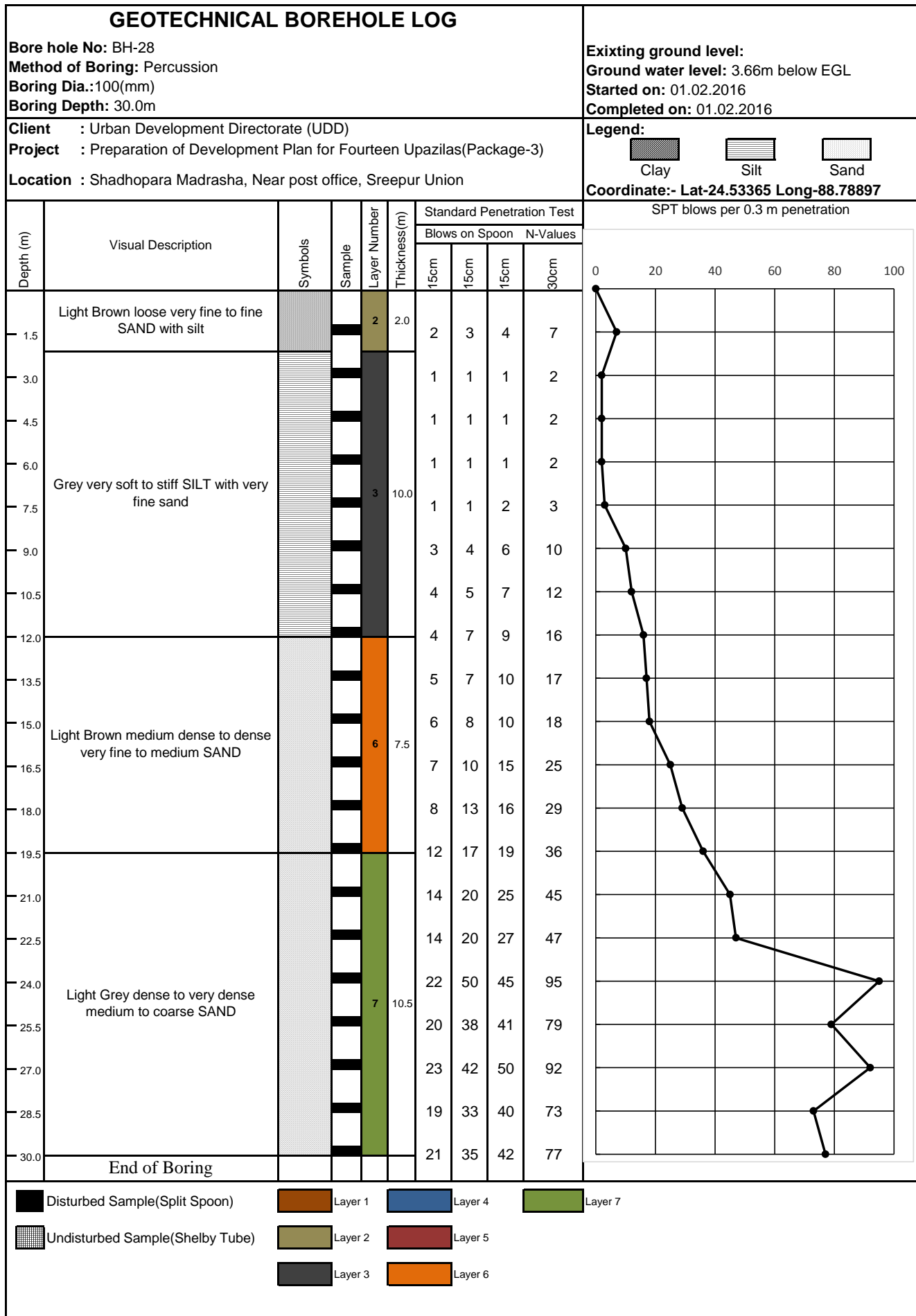


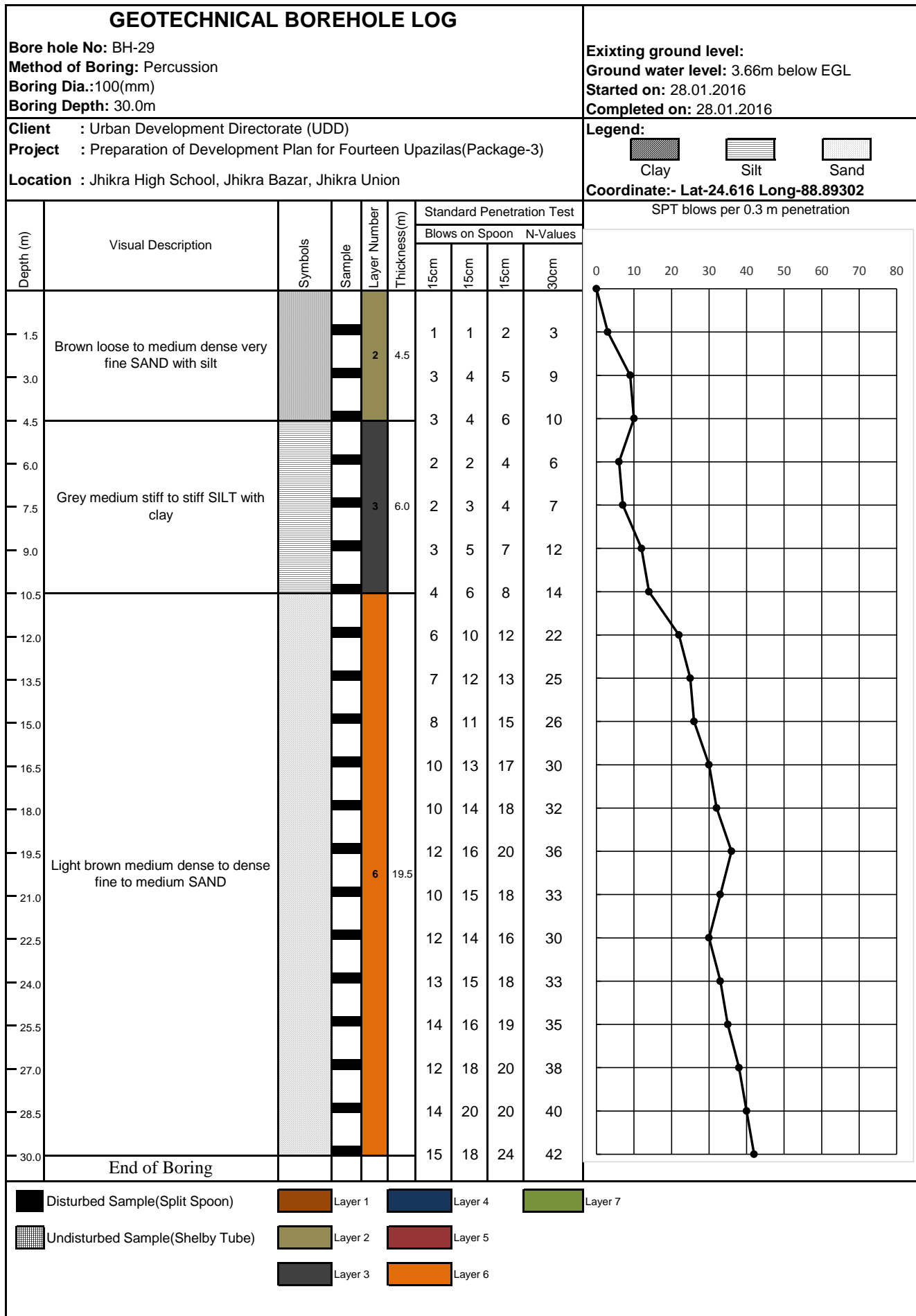


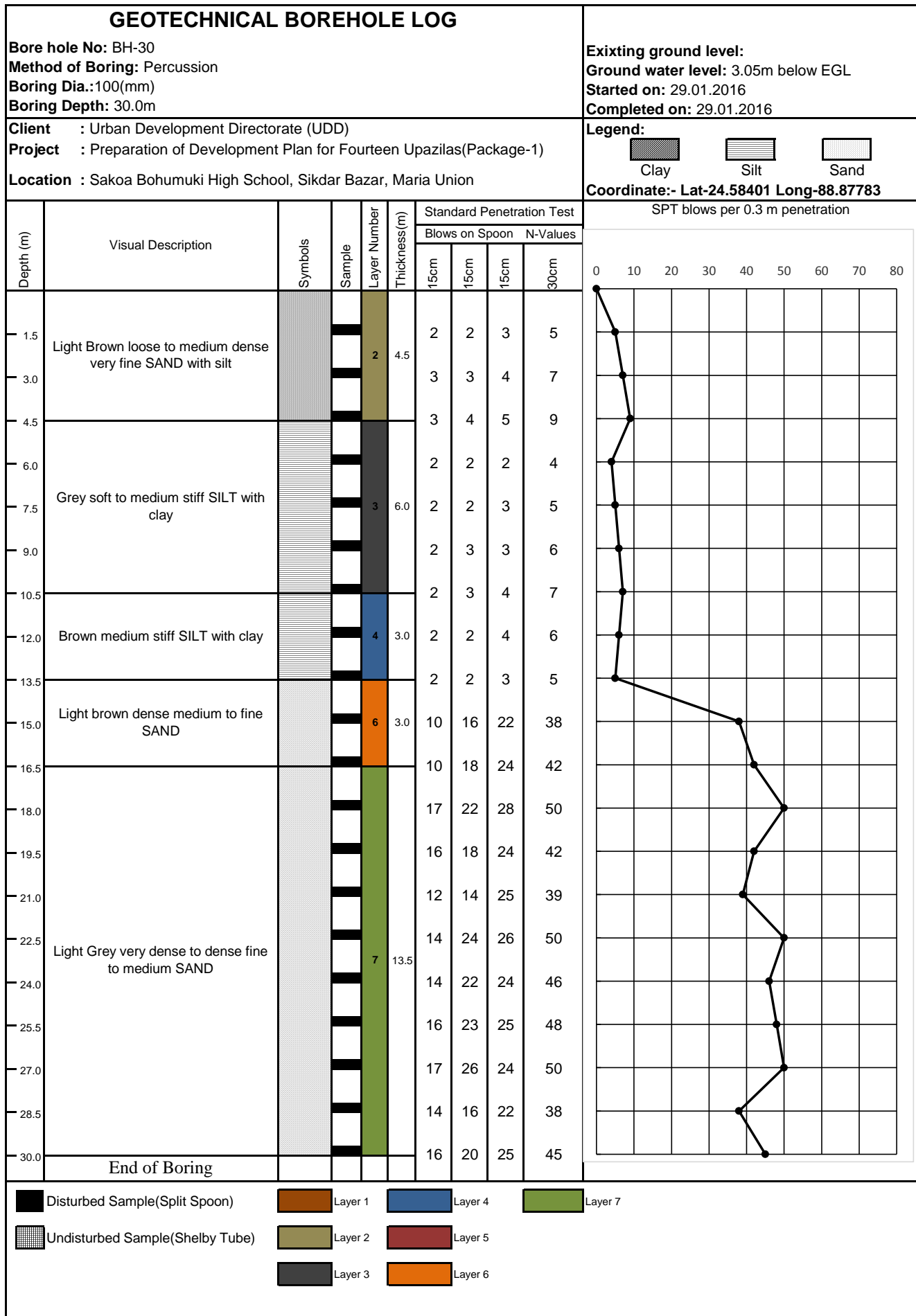


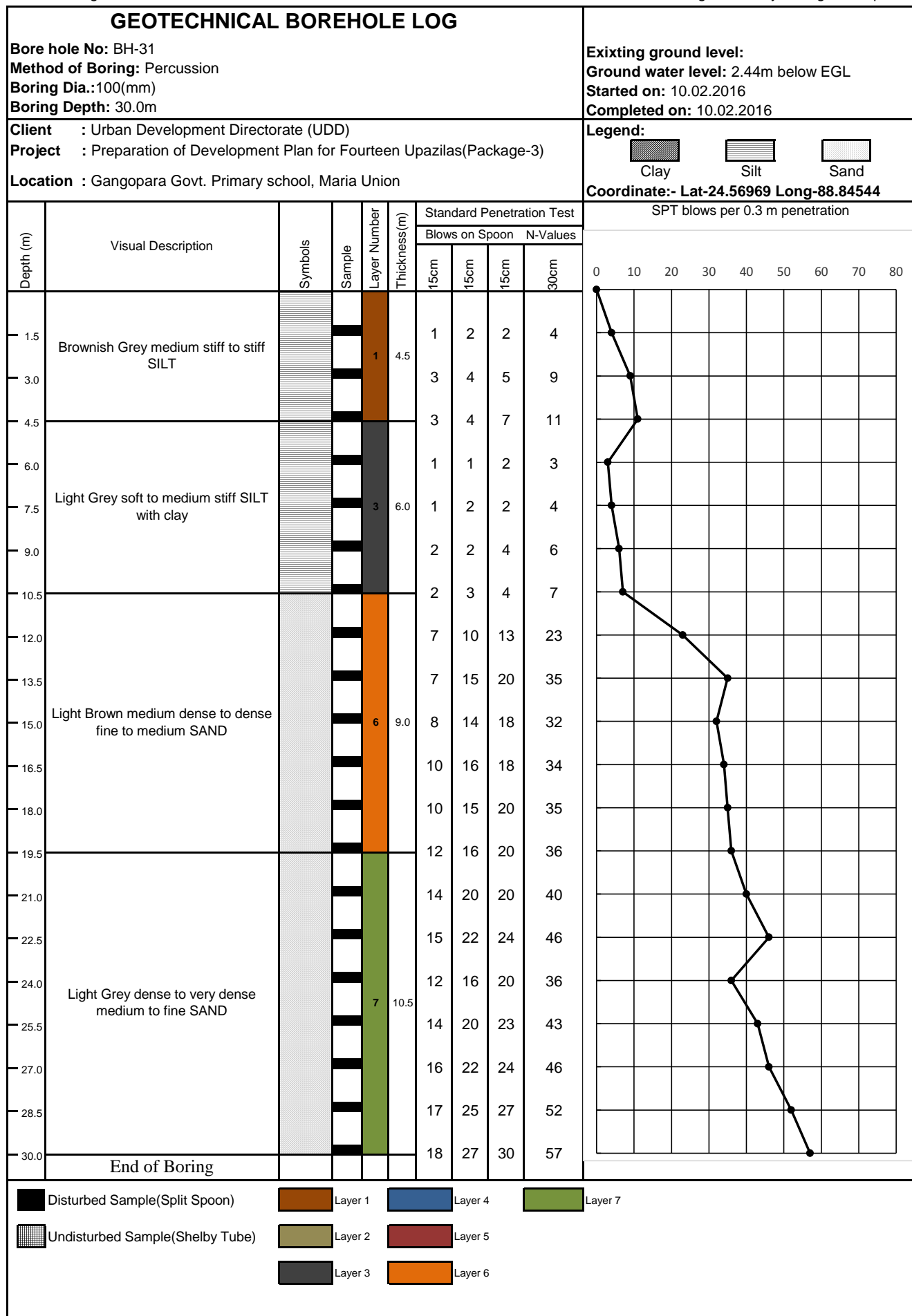












GEOTECHNICAL BOREHOLE LOG

Bore hole No: BH-32

Method of Boring: Percussion

Boring Dia.: 100(mm)

Boring Depth: 30.0m

Existing ground level:

Ground water level: 3.66m below EGL

Started on: 30.01.2016

Completed on: 30.01.2016

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Location : Sajura Mirzapur, Goalkandi Union

Legend:



Clay



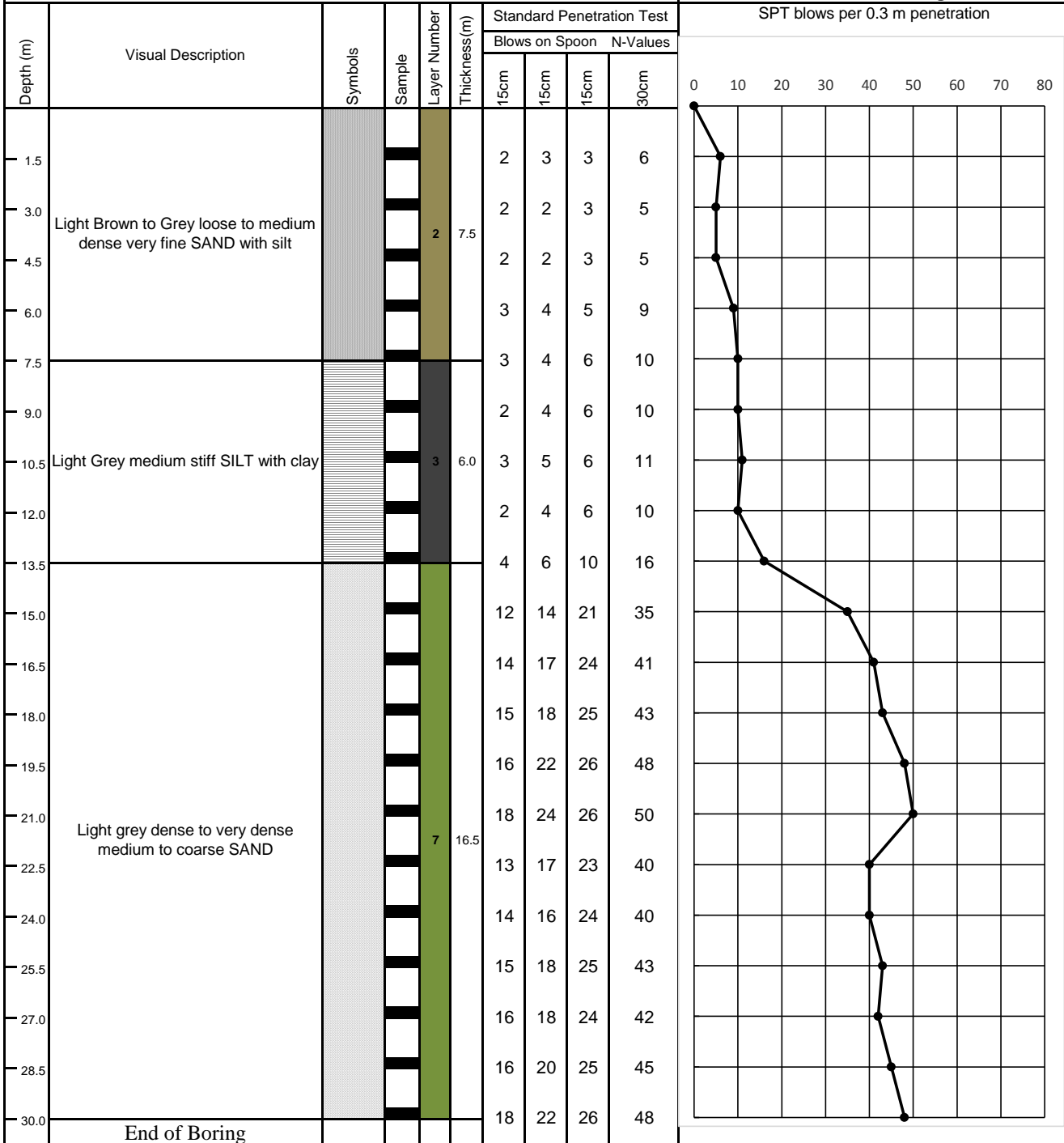
Silt



Sand

Coordinate:- Lat-24.54549 Long-88.84274

SPT blows per 0.3 m penetration



Disturbed Sample(Split Spoon)



Layer 1



Layer 4



Layer 7



Undisturbed Sample(Shelby Tube)



Layer 2



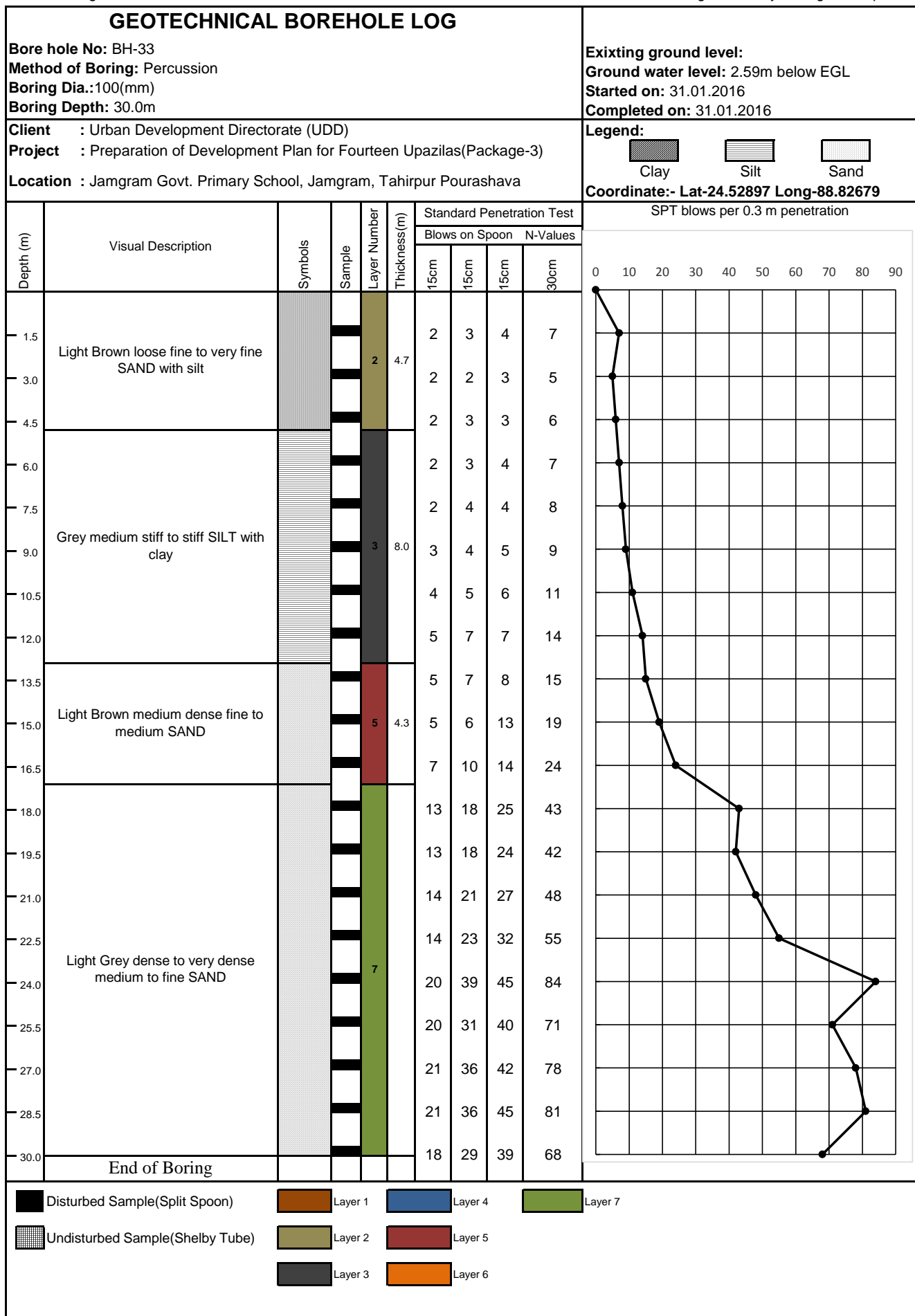
Layer 5

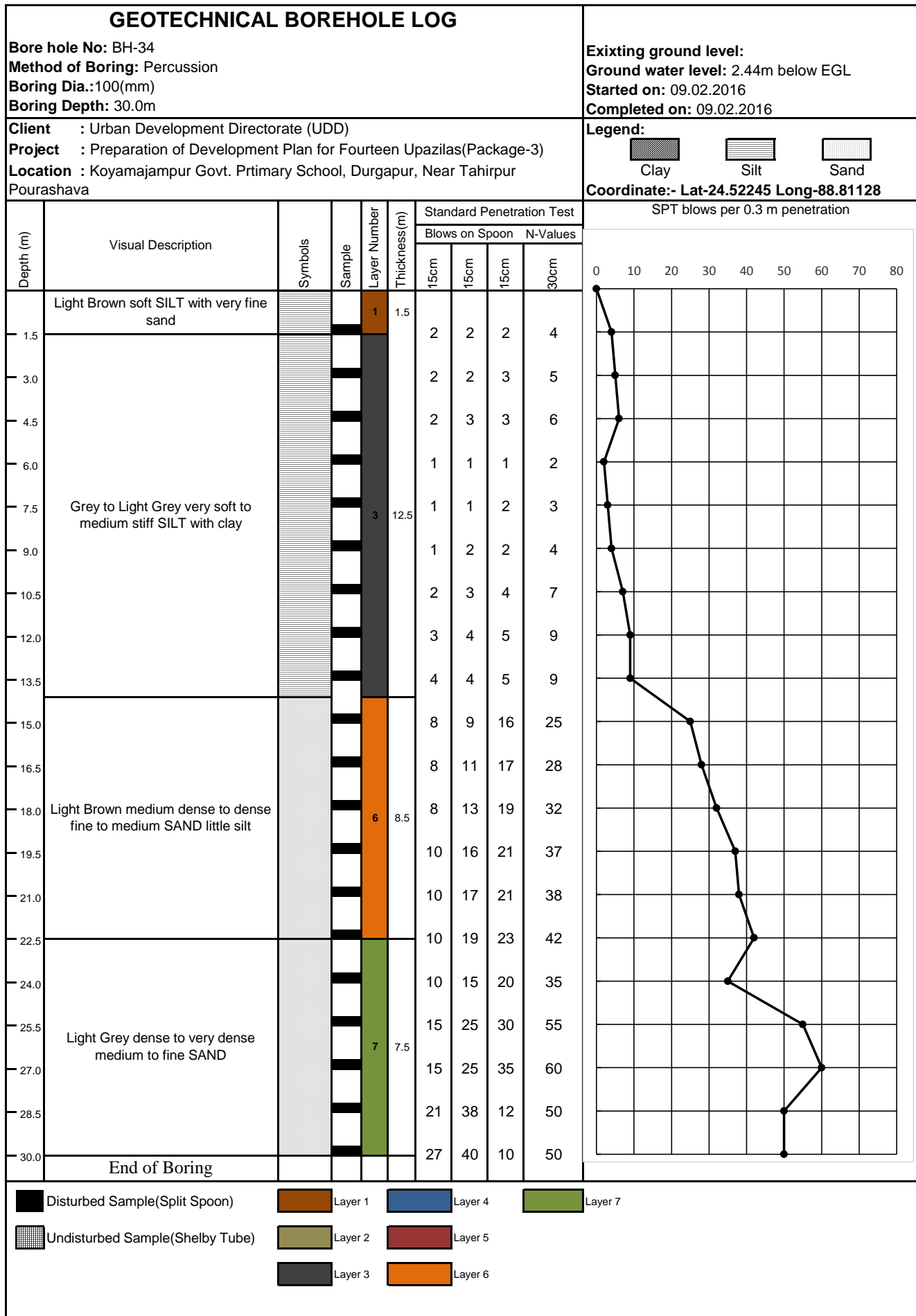


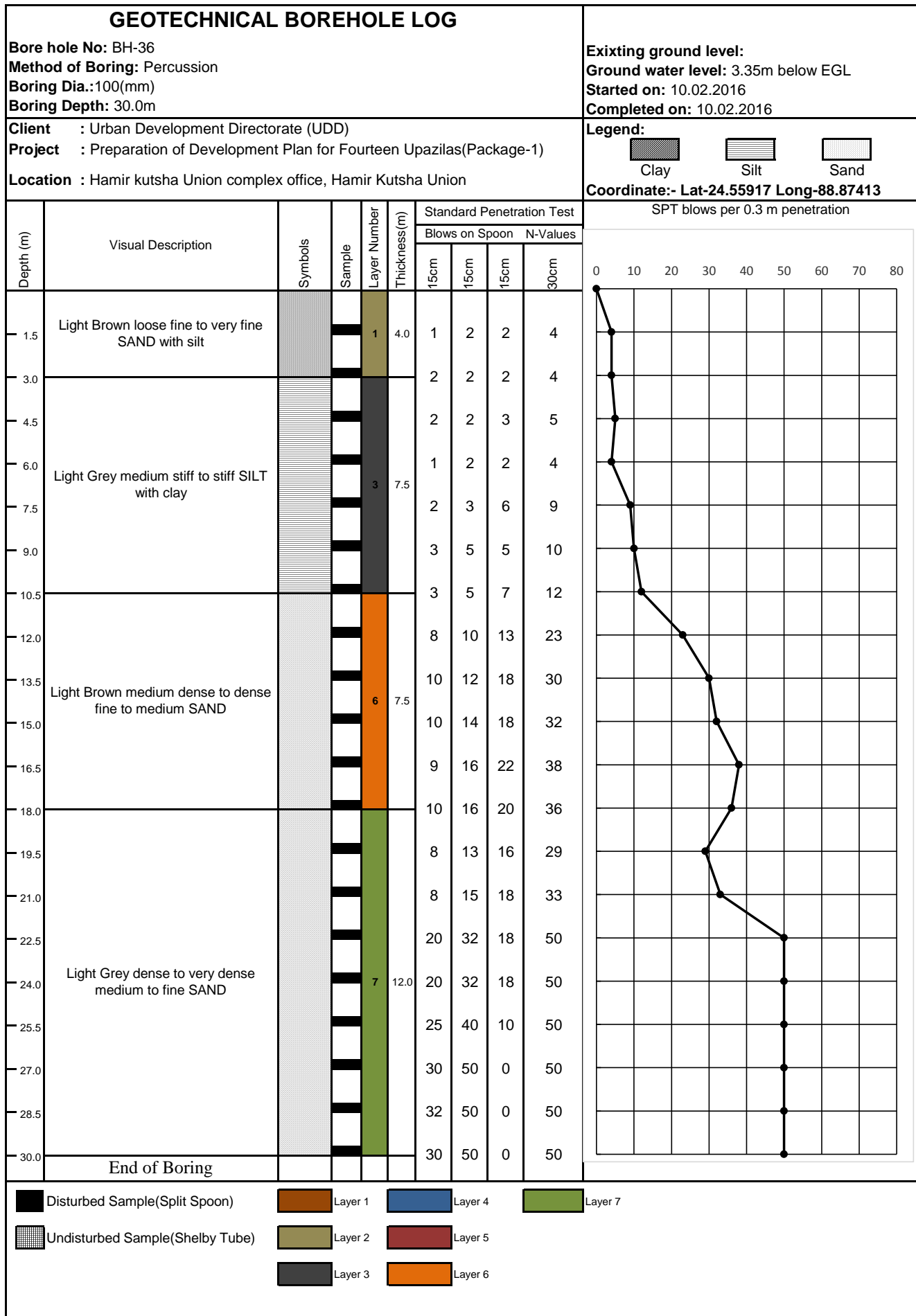
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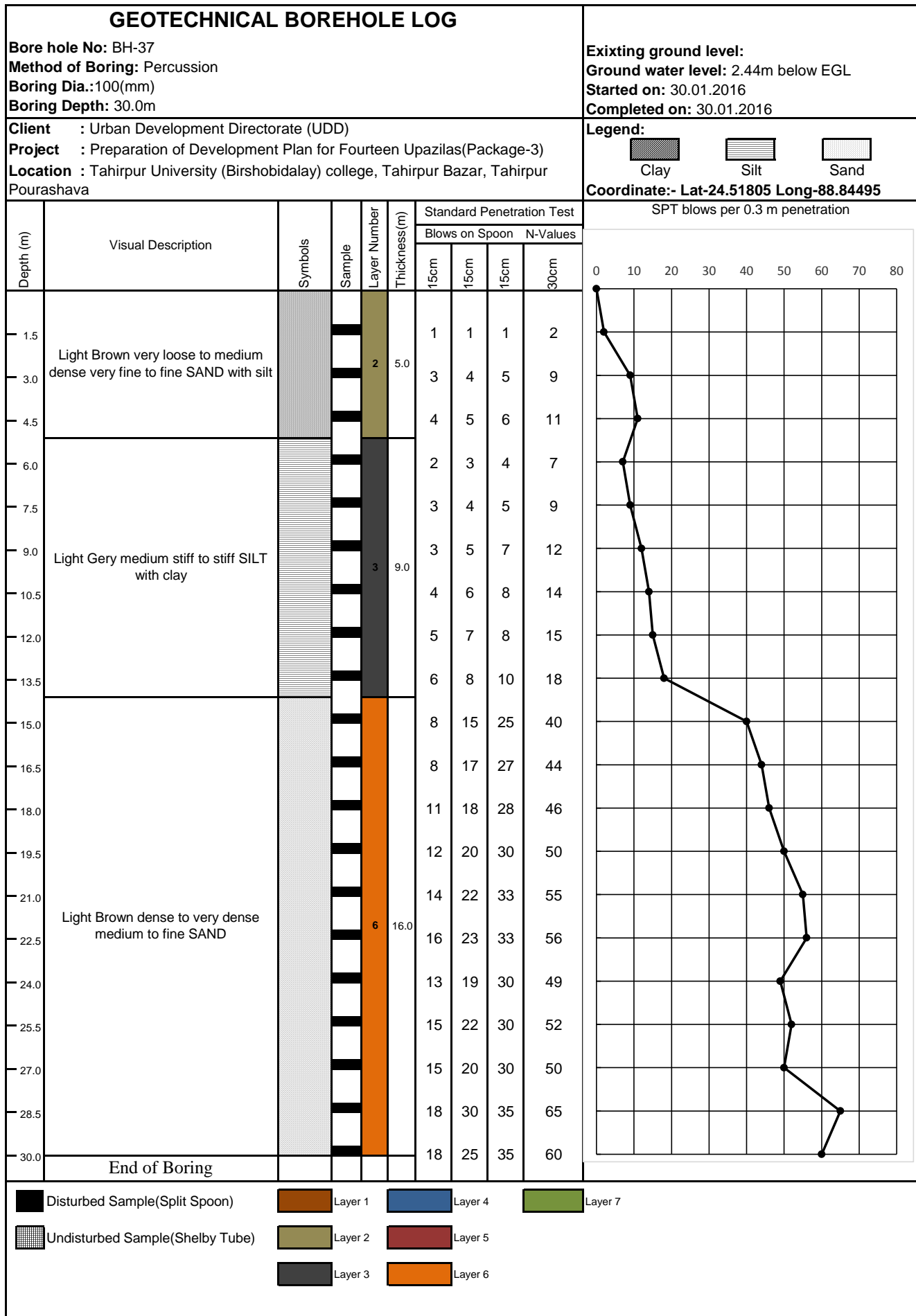


Layer 6









GEOTECHNICAL BOREHOLE LOG

Bore hole No: BH-39

Method of Boring: Percussion

Boring Dia.: 100(mm)

Boring Depth: 30.0m

Existing ground level:

Ground water level: 2.13m below EGL

Started on: 28.01.2016

Completed on: 28.01.2016

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-1)

Location : Talghoria Govt. Primary School, Hamir Kutsha Union

Legend:



Clay



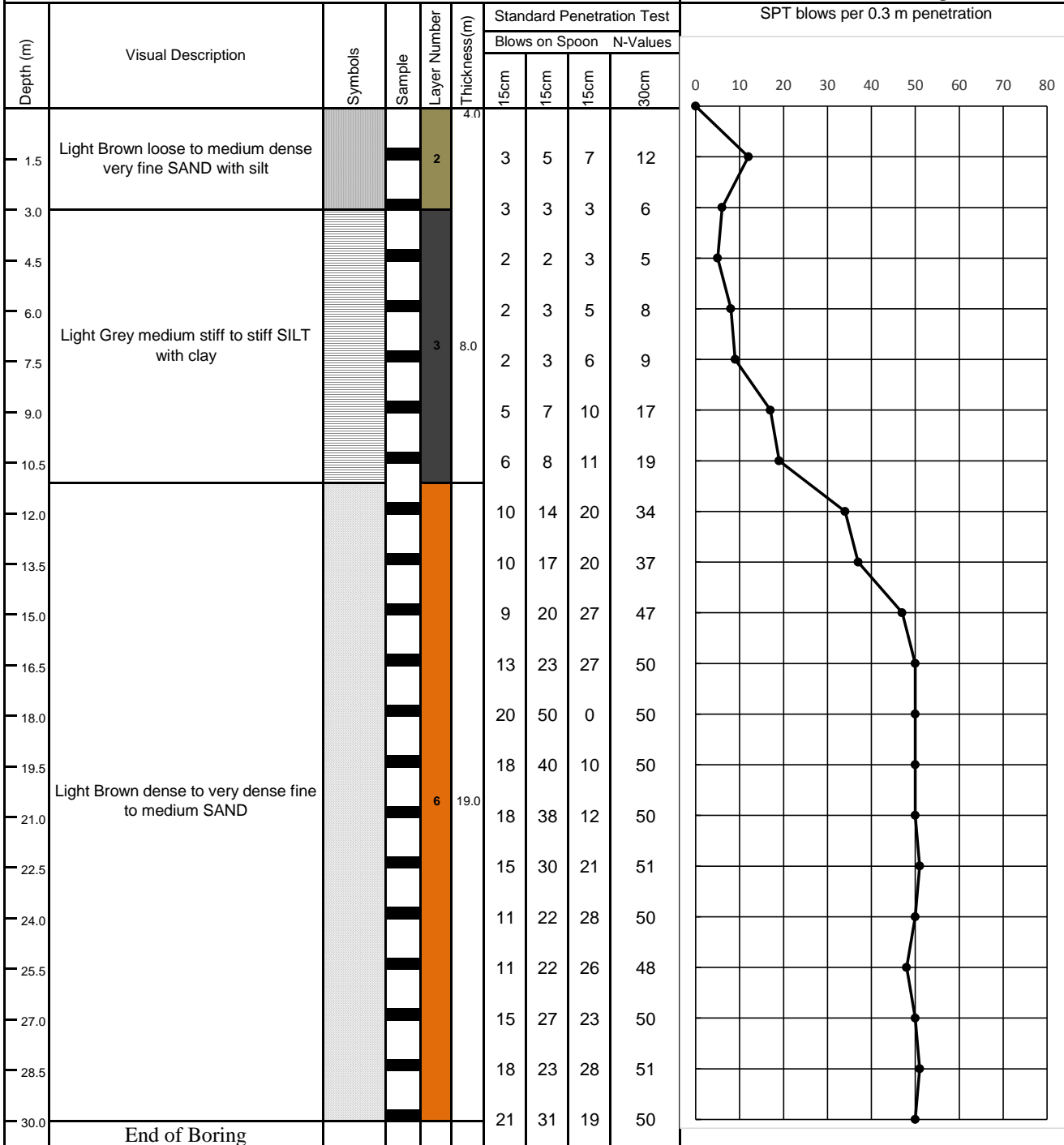
Silt



Sand

Coordinate:- Lat-24.55199 Long-88.90859

SPT blows per 0.3 m penetration



Disturbed Sample(Split Spoon)



Layer 1



Layer 4



Layer 7



Undisturbed Sample(Shelby Tube)



Layer 2



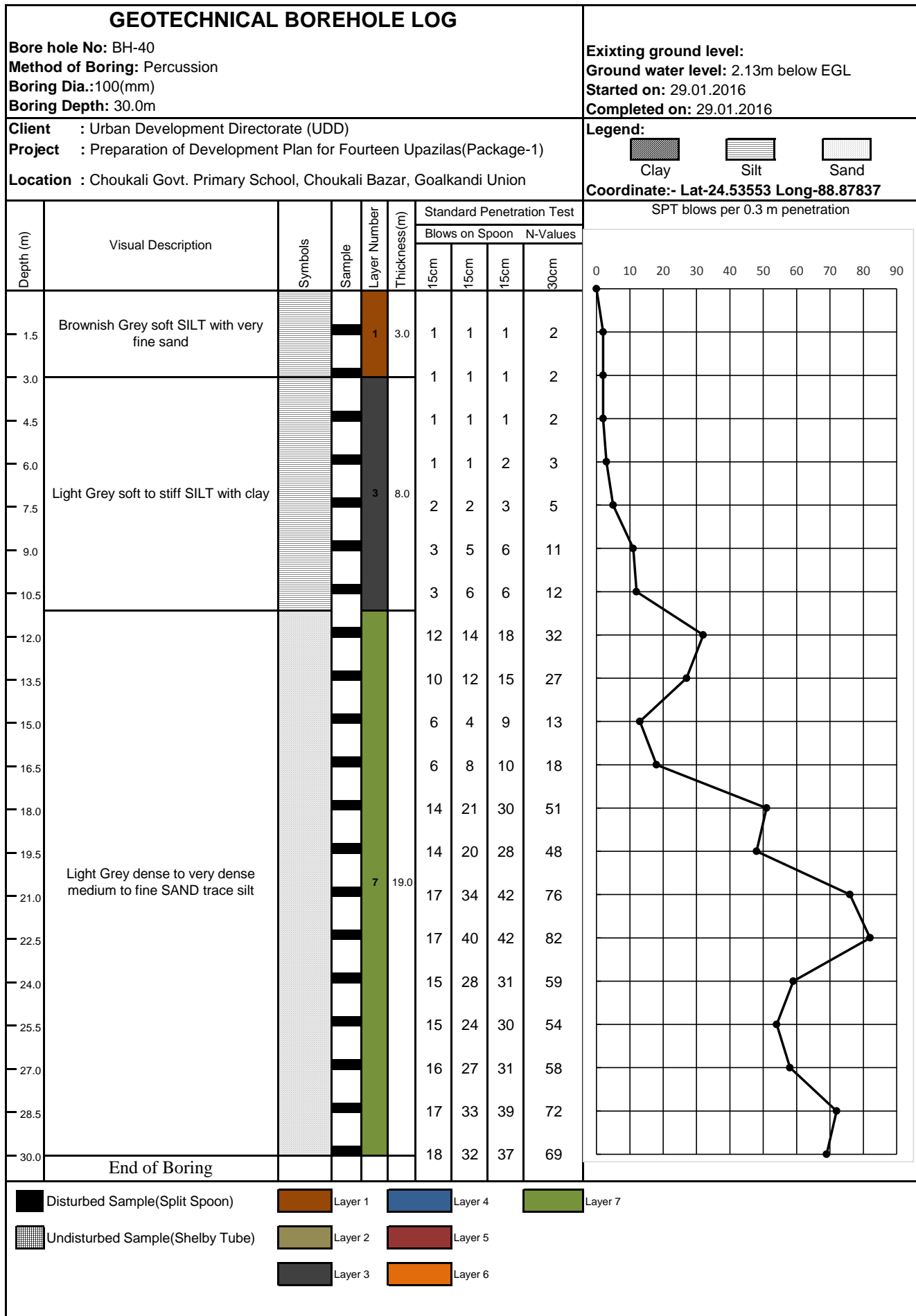
Layer 5



Layer 3



Layer 6



Appendix D

Geotechnical Laboratory Test Results and Graphs

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Sharcol Shimla High School, beside Nasir Bazar, Sondanga Union

Bore Hole No: BH-04

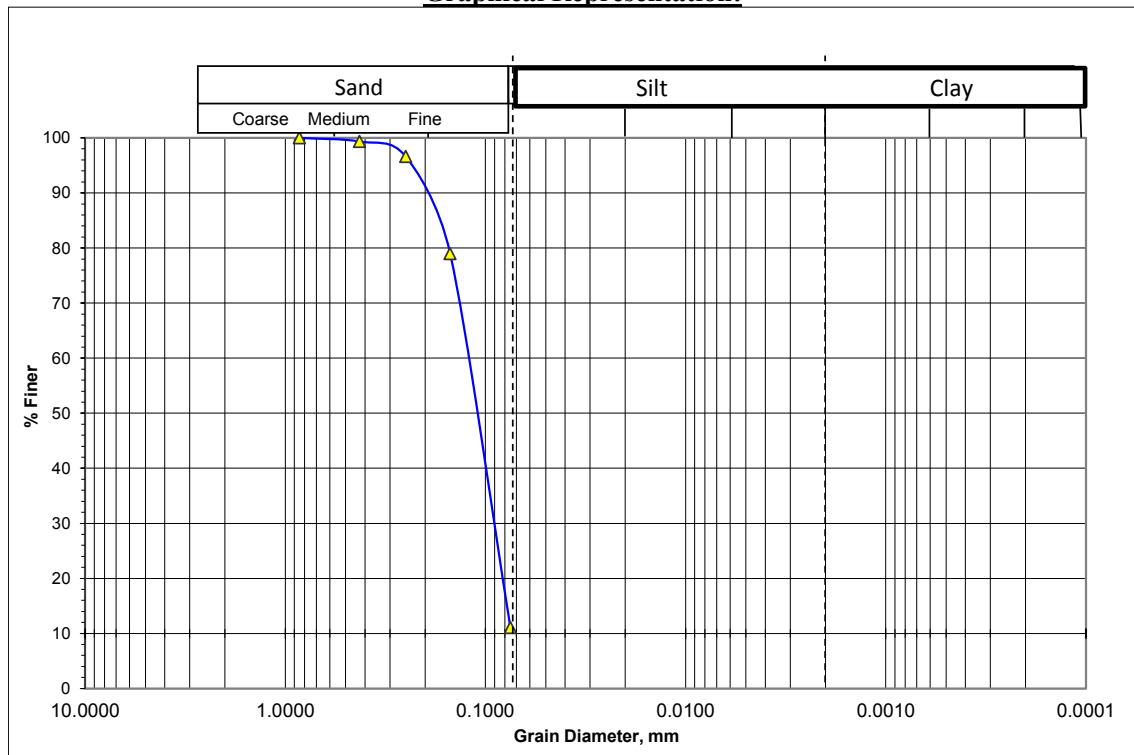
Sampled Date: 05/02/2016

Sample No : D-11

Test Date : 10/04/2016

Depth (m) : 16.5

Graphical Representation:



GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Sharcol Shimla High School, beside Nasir Bazar, Sondanga Union

Bore Hole No: BH-04

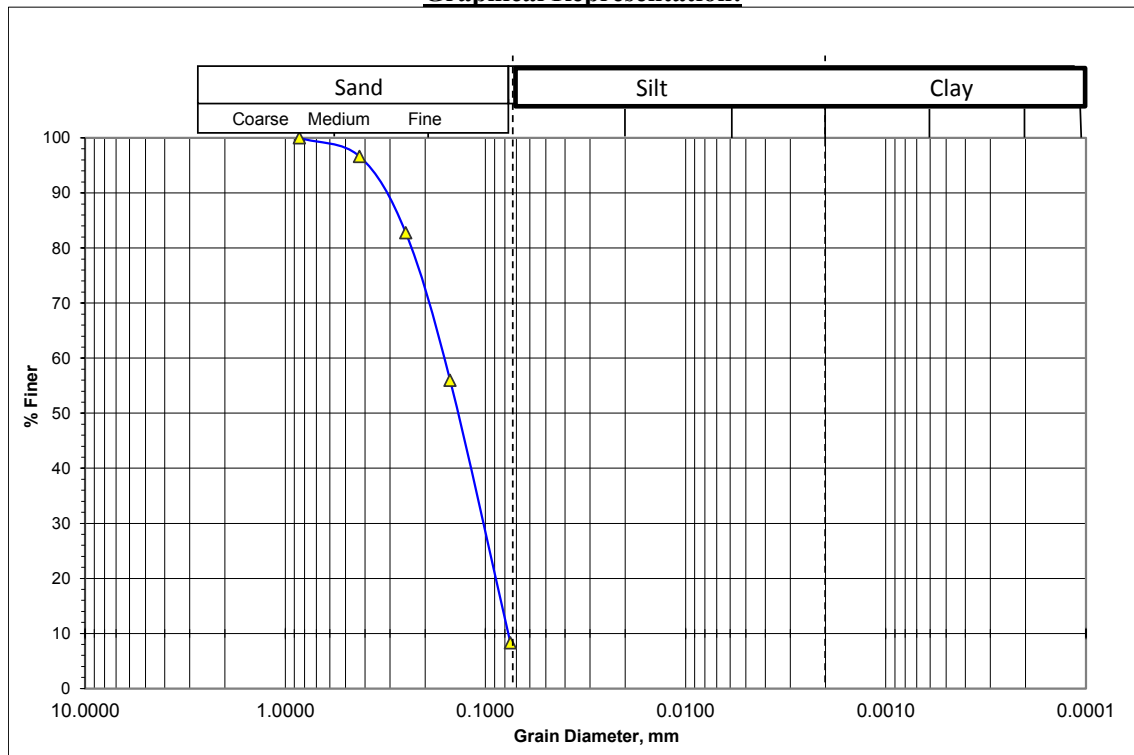
Sampled Date: 05/02/2016

Sample No : D-17

Test Date : 10/04/2016

Depth (m) : 25.5

Graphical Representation:



Fines or % of silt and clay = 8

Mean Diameter, $D_{50} = 0.15$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.68$

% Particles (from the grain -size analysis graph

(0.075mm size) = 92

(0.005mm size) & (0.001mm size) = 8

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Ganggopara Girls School, Hat Ganggopara, Auch Para Union

Bore Hole No: BH-Bg06

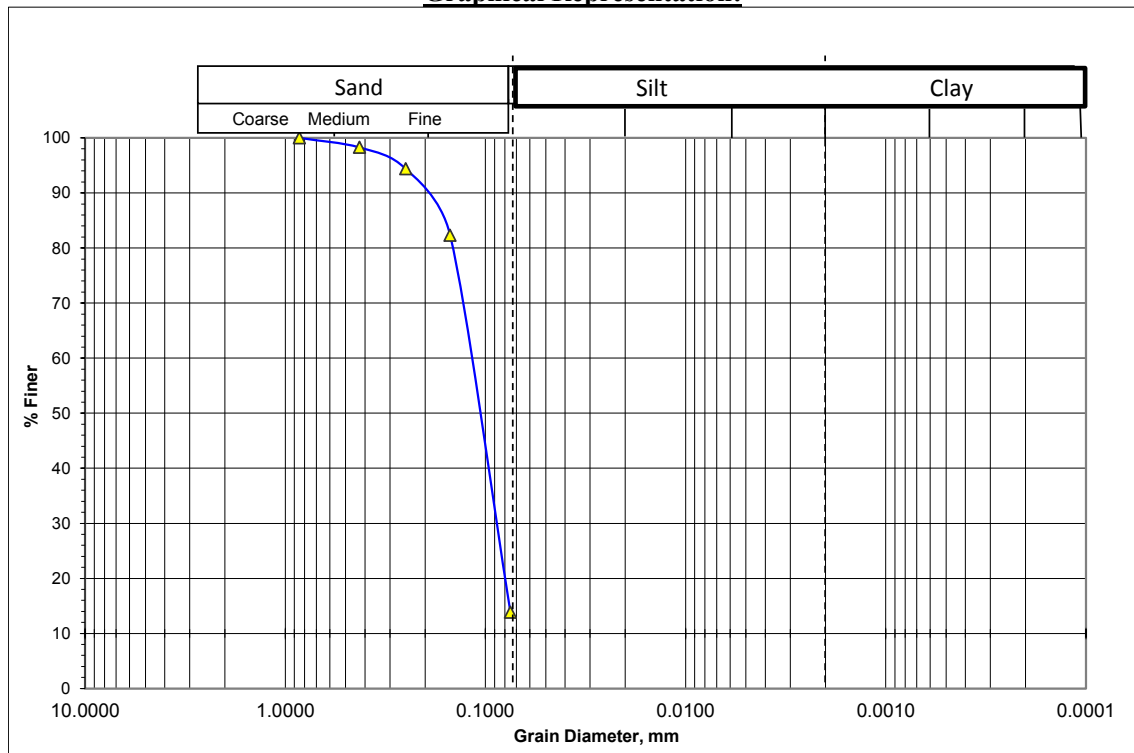
Sampled Date: 04/02/2016

Sample No : D-14

Test Date : 10/04/2016

Depth (m) : 21.0

Graphical Representation:



Fines or % of silt and clay = 14

Mean Diameter, $D_{50} = 0.105$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.57$

% Particles (from the grain -size analysis graph

(0.075mm size) = 86

(0.005mm size) & (0.001mm size) = 14

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Uttar Jamalpur Govt. primary school, Uttar Jamalpur Fatepur, Sondanga

Bore Hole No: BH-08

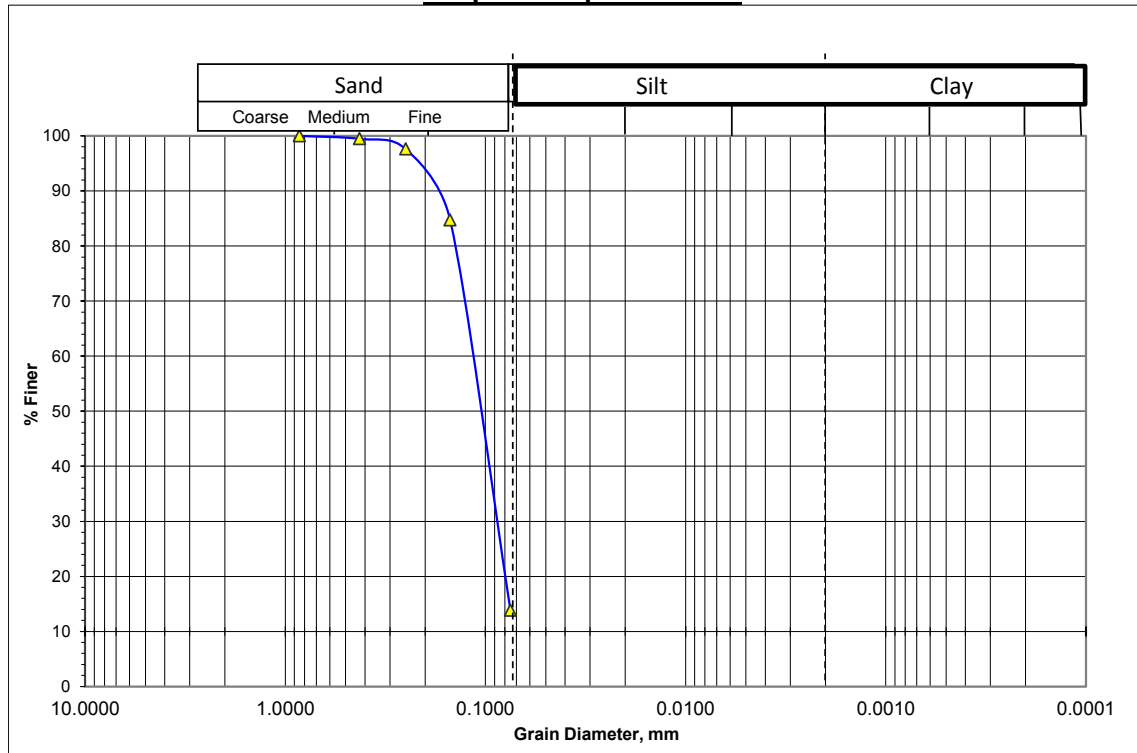
Sampled Date: 04/02/2016

Sample No : D-03

Test Date : 08/04/2016

Depth (m) : 9.0

Graphical Representation:



Fines or % of silt and clay = 14

Mean Diameter, $D_{50} = 0.105$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.57$

% Particles (from the grain -size analysis graph

(0.075mm size) = 86

(0.005mm size) & (0.001mm size) = 14

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Uttar Jamalpur Govt. primary school, Uttar Jamalpur Fatepur, Sondanga

Bore Hole No: BH-08

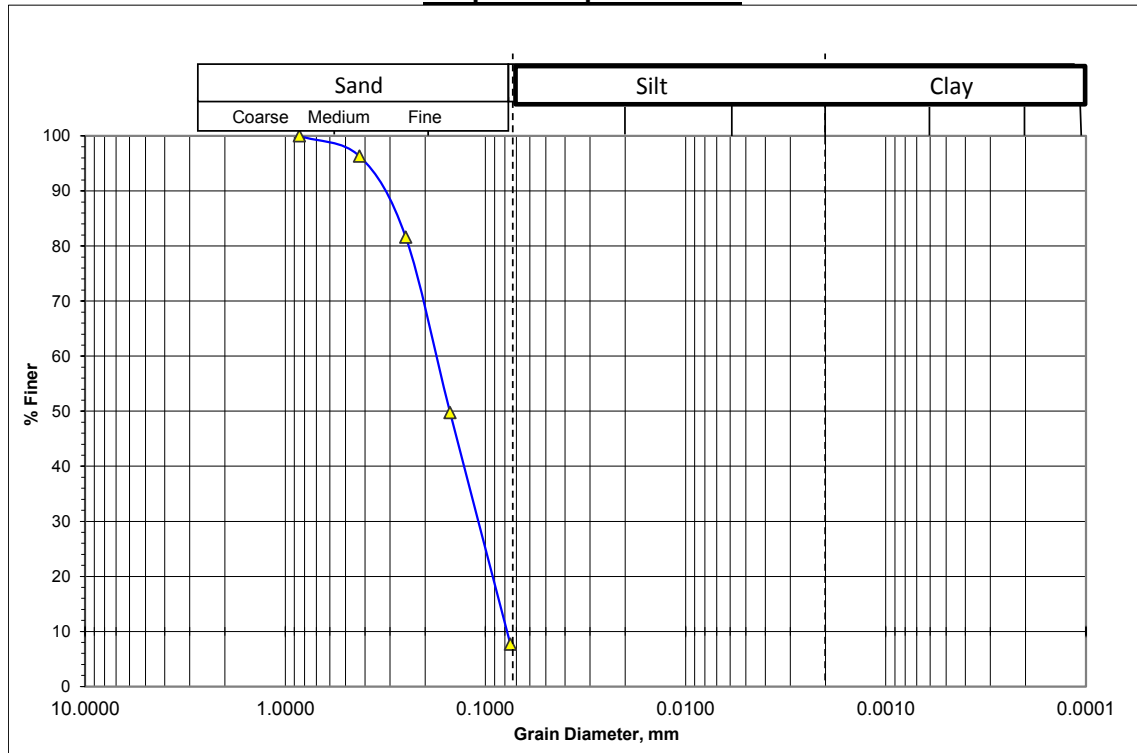
Sampled Date: 04/02/2016

Sample No : D-16

Test Date : 08/04/2016

Depth (m) : 24.0

Graphical Representation:



Fines or % of silt and clay = 7

Mean Diameter, $D_{50} = 0.165$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.71$

% Particles (from the grain -size analysis graph

(0.075mm size) = 93

(0.005mm size) & (0.001mm size) = 7

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Mirpur Dimukki Primary and High School, jolapara Hat, Dwippur Union

Bore Hole No: BH-Bg09

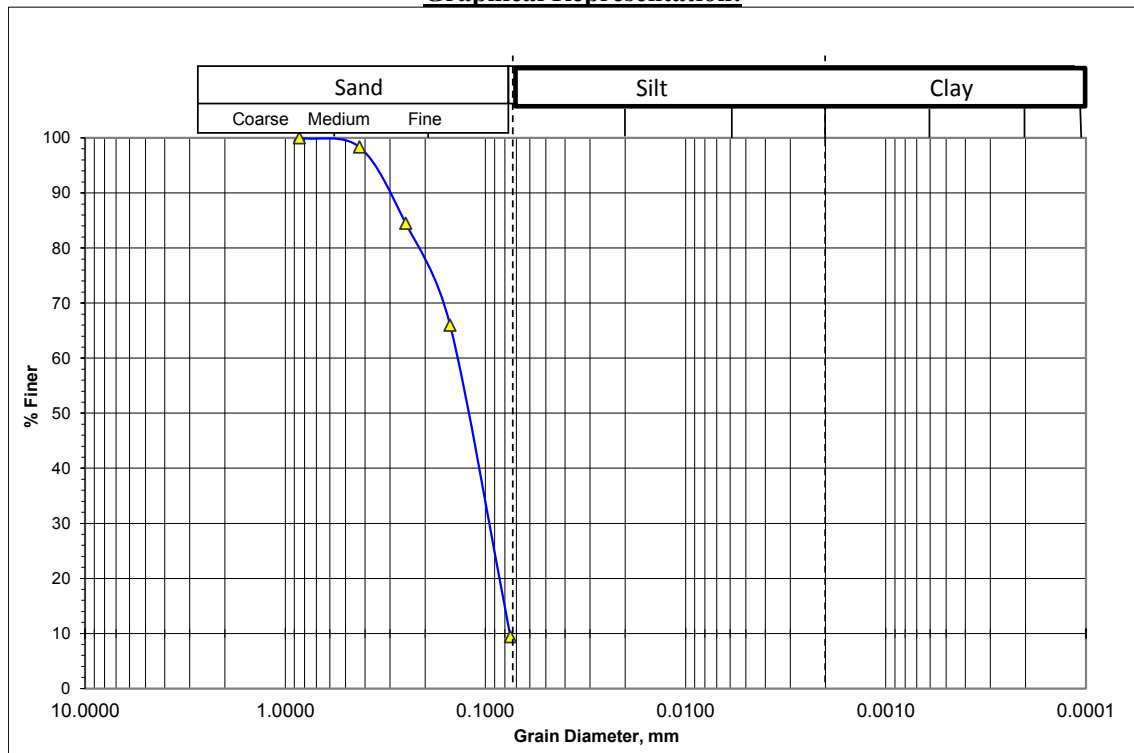
Sampled Date: 03/02/2016

Sample No : D-11

Test Date : 06/04/2016

Depth (m) : 16.5

Graphical Representation:



Fines or % of silt and clay = 10

Mean Diameter, D_{50} = 0.13 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.63$

% Particles (from the grain -size analysis graph

(0.075mm size) = 90

(0.005mm size) & (0.001mm size) = 10

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Mirpur Dimukki Primary and High School, jolapara Hat, Dwippur Union

Bore Hole No: BH-Bg09

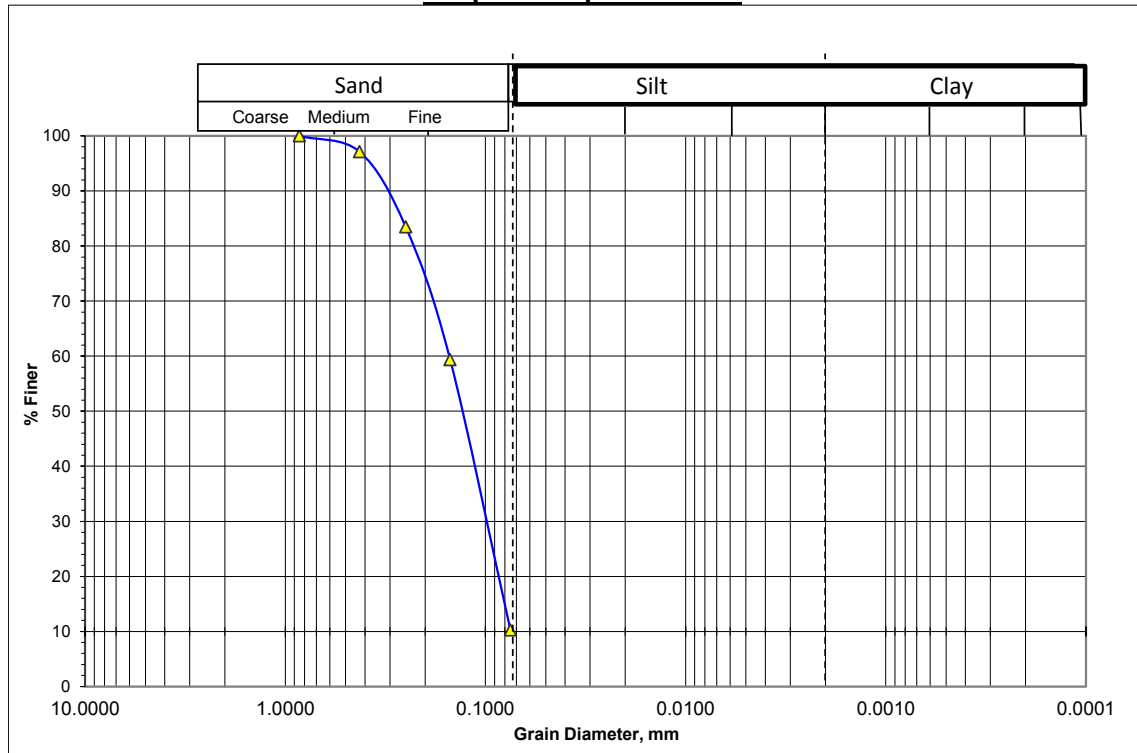
Sampled Date: 03/02/2016

Sample No : D-17

Test Date : 06/04/2016

Depth (m) : 25.5

Graphical Representation:



Fines or % of silt and clay = 10

Mean Diameter, $D_{50} = 0.135$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.65$

% Particles (from the grain -size analysis graph

(0.075mm size) = 90

(0.005mm size) & (0.001mm size) = 10

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Byegacha Govt. primary and high School, Byegacha Bazar, Subhadanga

Bore Hole No: BH-Bg10

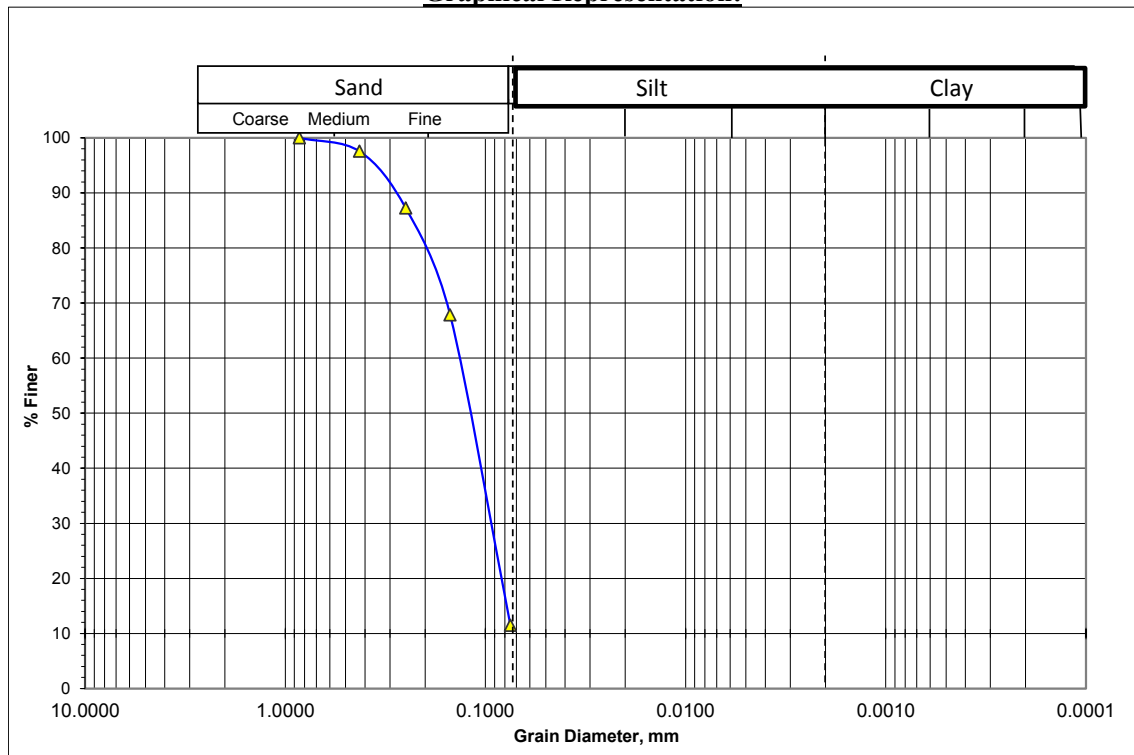
Sampled Date: 03/02/2016

Sample No : D-11

Test Date : 08/04/2016

Depth (m) : 16.5

Graphical Representation:



Fines or % of silt and clay = 11

Mean Diameter, $D_{50} = 0.125$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.62$

% Particles (from the grain -size analysis graph

(0.075mm size) = 89

(0.005mm size) & (0.001mm size) = 11

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Byegacha Govt. primary and high School, Byegacha Bazar, Subhadanga

Bore Hole No: BH-Bg10

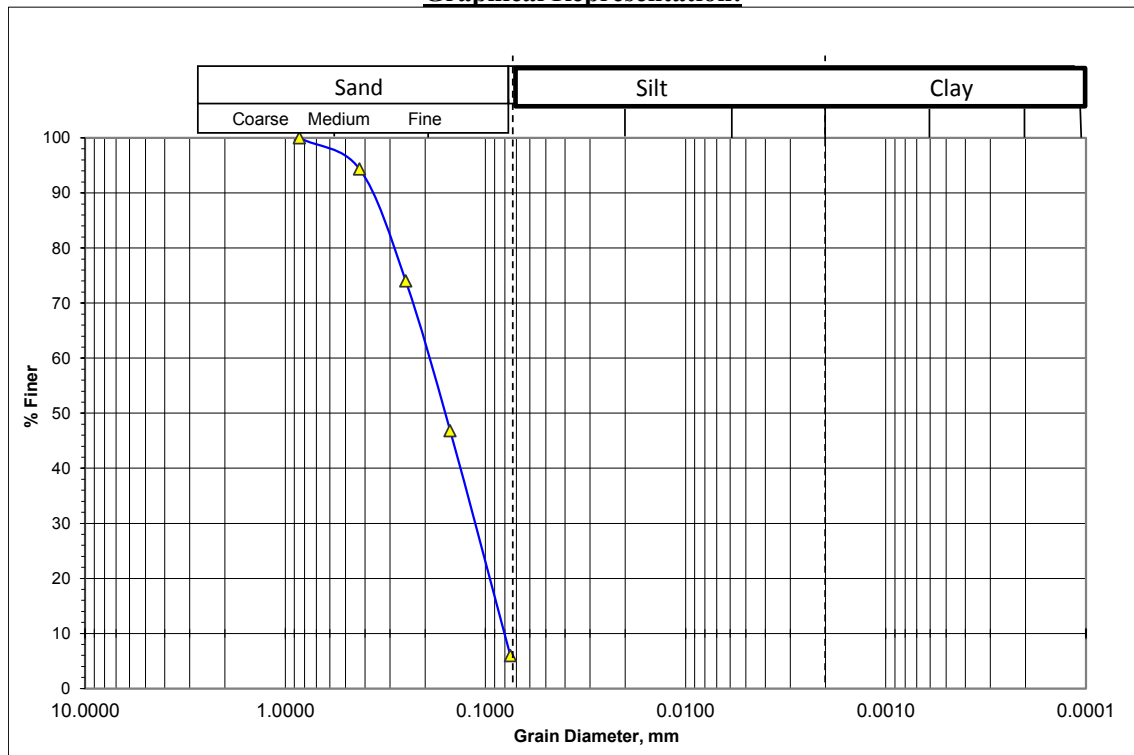
Sampled Date: 03/02/2016

Sample No : D-15

Test Date : 08/04/2016

Depth (m) : 22.5

Graphical Representation:



Fines or % of silt and clay = 6

Mean Diameter, D_{50} = 0.17 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.73$

% Particles (from the grain -size analysis graph

(0.075mm size) = 94

(0.005mm size) & (0.001mm size) = 6

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Machmail High School, Machmail Bazar, Subhadanga

Bore Hole No: BH-Bg11

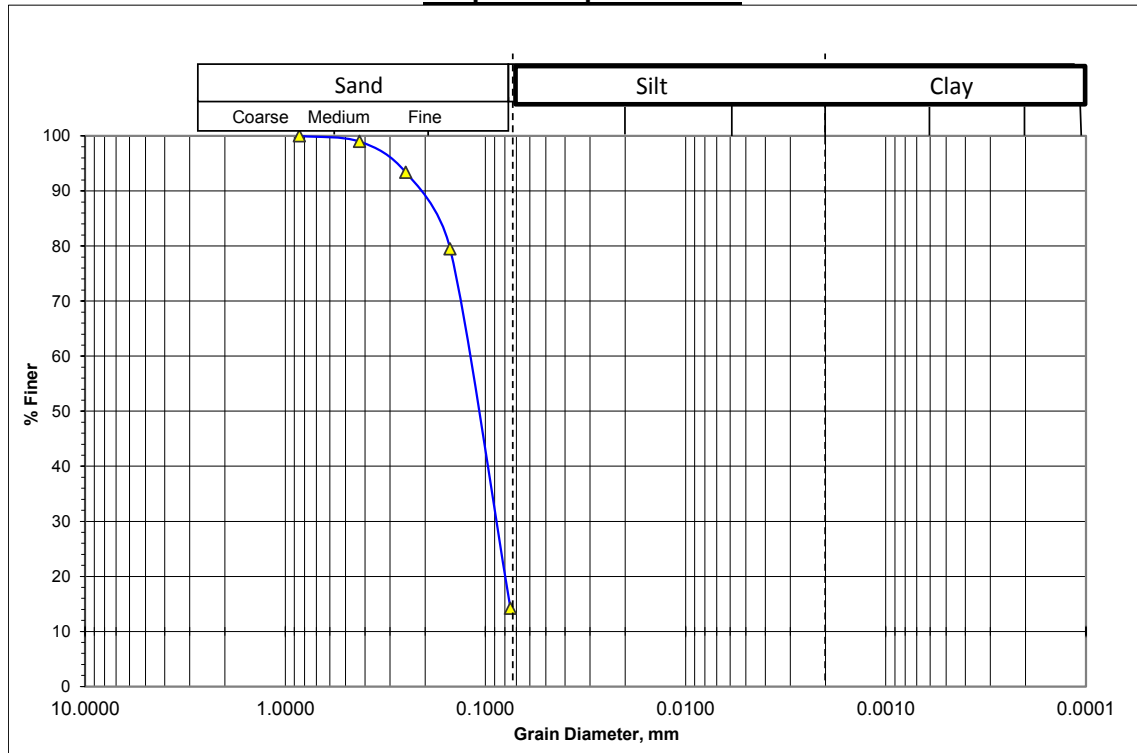
Sampled Date: 09/02/2016

Sample No : D-02

Test Date : 08/04/2016

Depth (m) : 3.0

Graphical Representation:



Fines or % of silt and clay = 14

Mean Diameter, D_{50} = 0.11 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.58$

% Particles (from the grain -size analysis graph

(0.075mm size) = 86

(0.005mm size) & (0.001mm size) = 14

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Machmail High School, Machmail Bazar, Subhadanga

Bore Hole No: BH-Bg11

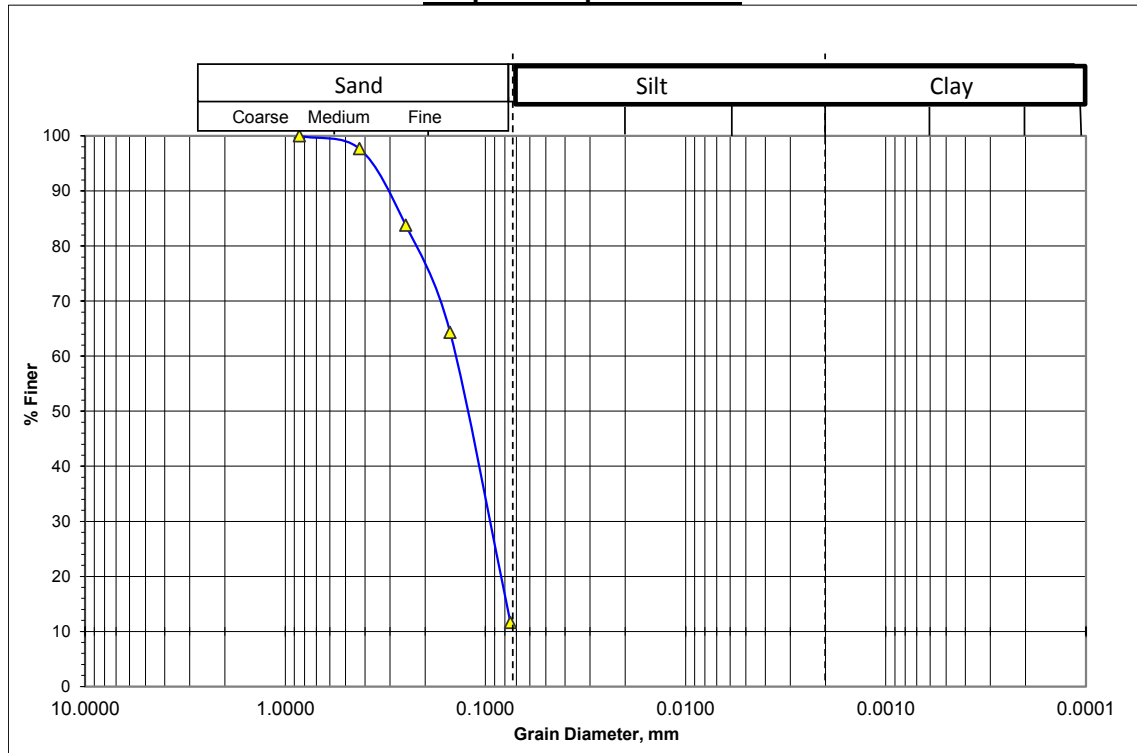
Sampled Date: 09/02/2016

Sample No : D-11

Test Date : 08/04/2016

Depth (m) : 16.5

Graphical Representation:



Fines or % of silt and clay = 11

Mean Diameter, $D_{50} = 0.13$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.63$

% Particles (from the grain -size analysis graph

(0.075mm size) = 89

(0.005mm size) & (0.001mm size) = 11

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Mugaipara High School, Mugaipara Bazar, Auch Para Union

Bore Hole No: BH-Bg12

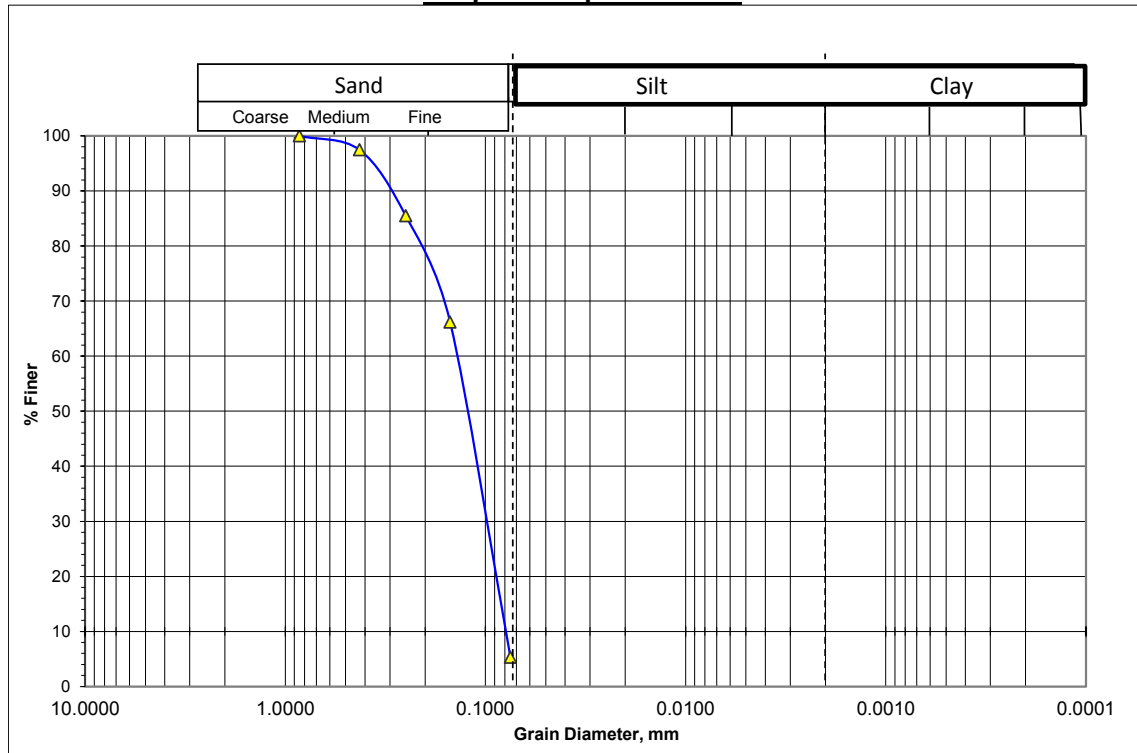
Sampled Date: 08/02/2016

Sample No : D-10

Test Date : 06/04/2016

Depth (m) : 15.0

Graphical Representation:



Fines or % of silt and clay = 5

Mean Diameter, D_{50} = 0.14 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.66$

% Particles (from the grain -size analysis graph

(0.075mm size) = 95

(0.005mm size) & (0.001mm size) = 5

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Mugaipara High School, Mugaipara Bazar, Auch Para Union

Bore Hole No: BH-Bg12

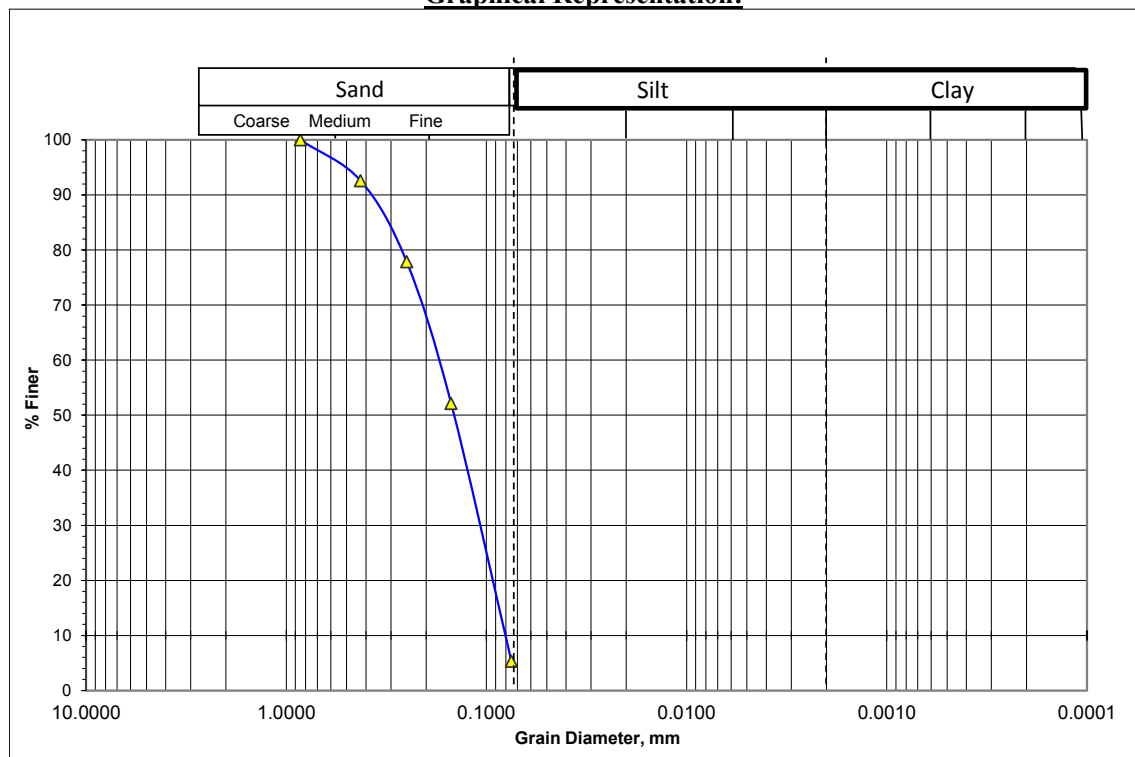
Sampled Date: 08/02/2016

Sample No : D-17

Test Date : 06/04/2016

Depth (m) : 25.5

Graphical Representation:



Fines or % of silt and clay = 5

Mean Diameter, $D_{50} = 0.155$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.69$

% Particles (from the grain -size analysis graph

(0.075mm size) = 95

(0.005mm size) & (0.001mm size) = 5

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Doulatpur Madhomik School, Madha Doulatpur, Subhadanga Union

Bore Hole No: BH-Bg17

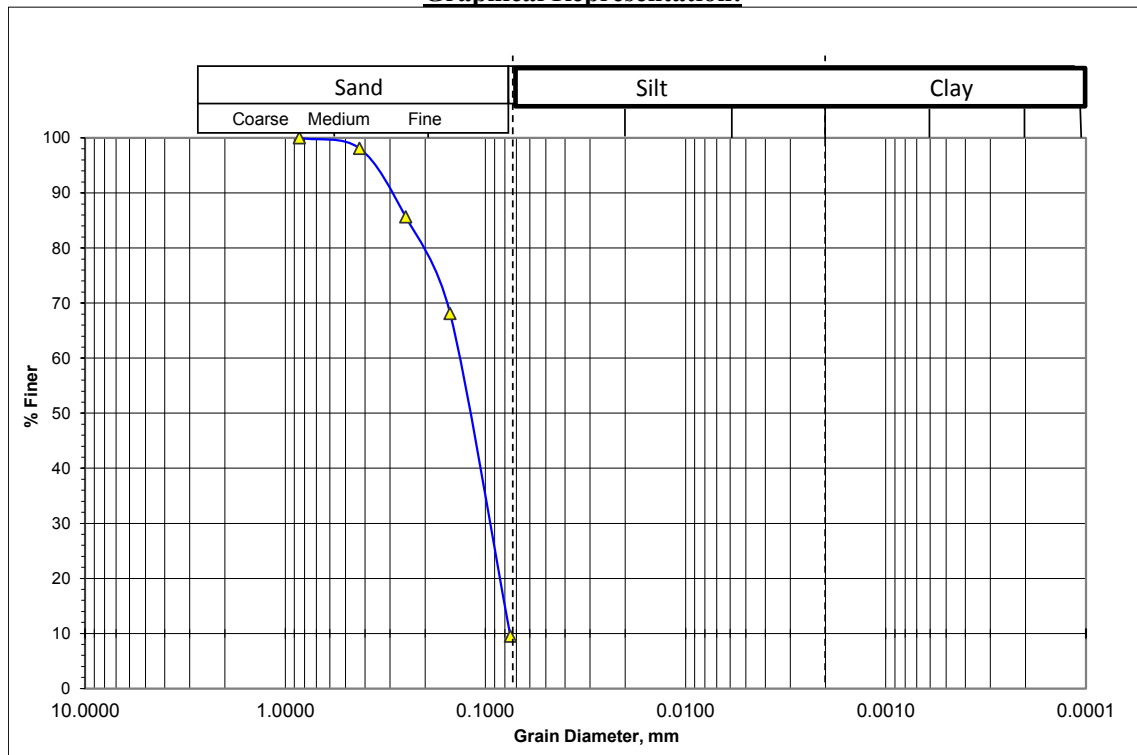
Sampled Date: 05/02/2016

Sample No : D-11

Test Date : 06/04/2016

Depth (m) : 16.5

Graphical Representation:



Fines or % of silt and clay = 10

Mean Diameter, $D_{50} = 0.125$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.62$

% Particles (from the grain -size analysis graph

(0.075mm size) = 90

(0.005mm size) & (0.001mm size) = 10

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Doulatpur Madhomik School, Madha Doulatpur, Subhadanga Union

Bore Hole No: BH-Bg17

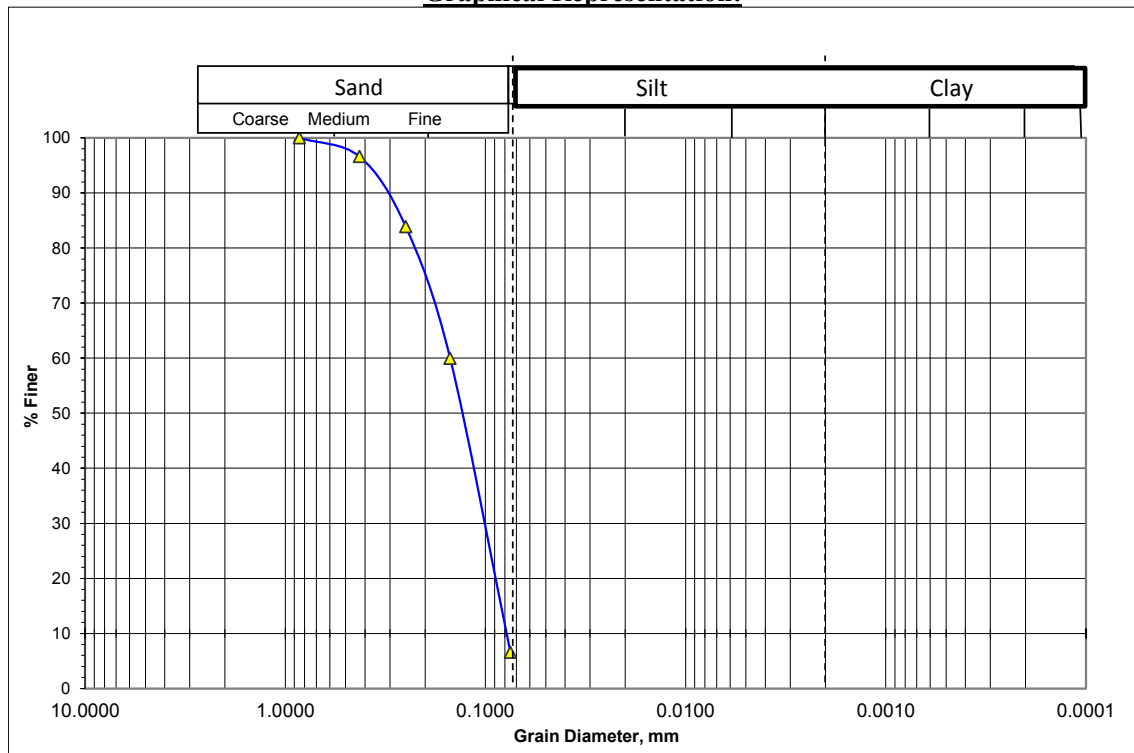
Sampled Date: 05/02/2016

Sample No : D-19

Test Date : 06/04/2016

Depth (m) : 28.5

Graphical Representation:



Fines or % of silt and clay = 6

Mean Diameter, $D_{50} = 0.135$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.65$

% Particles (from the grain -size analysis graph

(0.075mm size) = 94

(0.005mm size) & (0.001mm size) = 6

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Gonganarayanpur Namajgram Govt. Primary School, Kumanitola, Ganipur

Bore Hole No: BH-Bg19

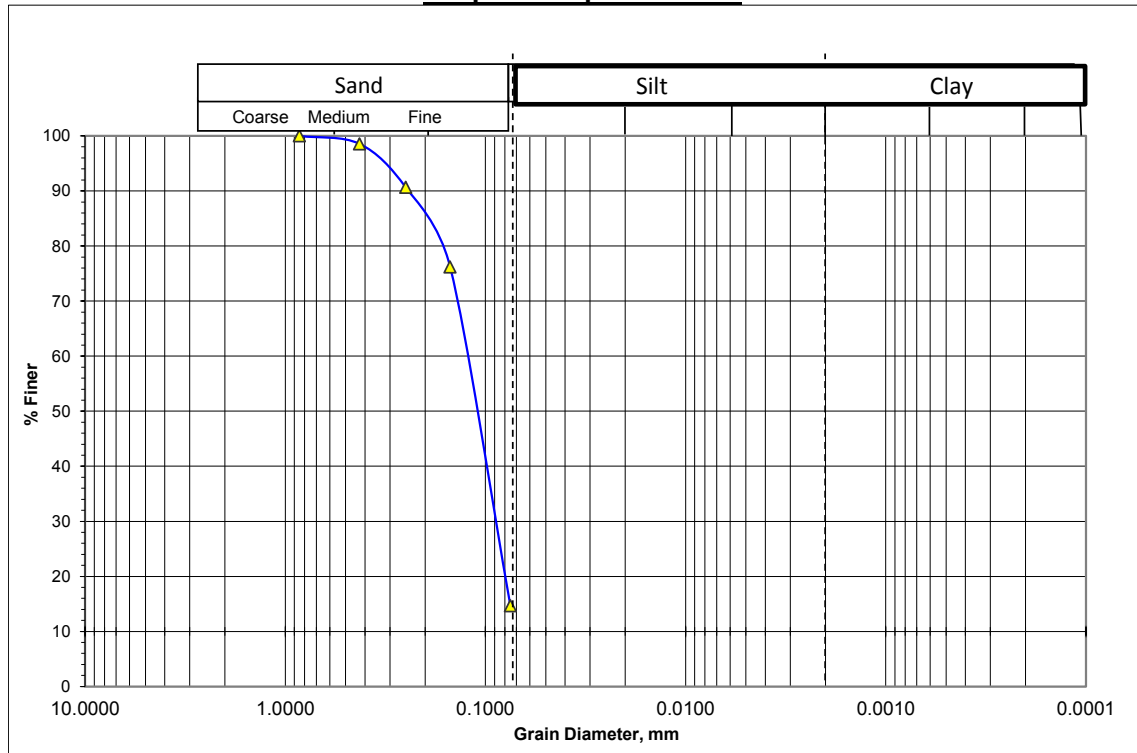
Sampled Date: 07/02/2016

Sample No : D-02

Test Date : 06/04/2016

Depth (m) : 3.0

Graphical Representation:



Fines or % of silt and clay = 14

Mean Diameter, $D_{50} = 0.115$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.60$

% Particles (from the grain -size analysis graph

(0.075mm size) = 86

(0.005mm size) & (0.001mm size) = 14

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Gonganarayanpur Namajgram Govt. Primary School, Kumanitola, Ganipur

Bore Hole No: BH-Bg19

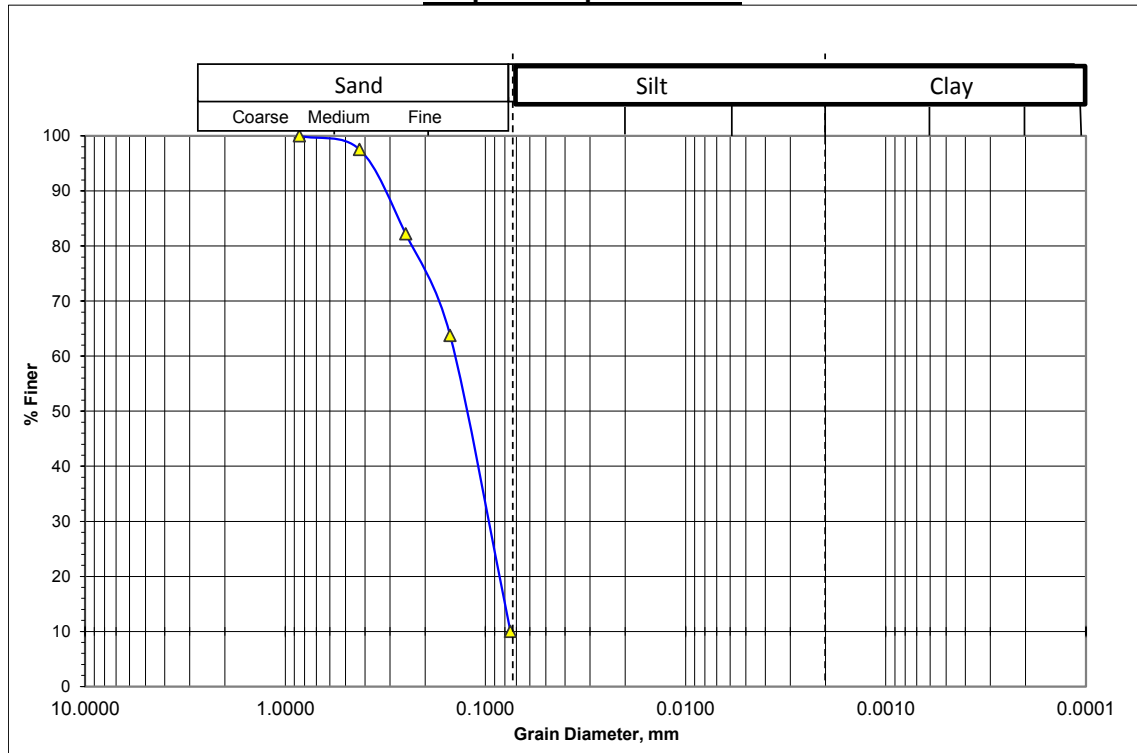
Sampled Date: 07/02/2016

Sample No : D-11

Test Date : 06/04/2016

Depth (m) : 16.5

Graphical Representation:



Fines or % of silt and clay = 10

Mean Diameter, $D_{50} = 0.13$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.63$

% Particles (from the grain -size analysis graph

(0.075mm size) = 90

(0.005mm size) & (0.001mm size) = 10

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : 21 nos. Bara Bihanali govt. School, Bara Bihanali Union

Bore Hole No: BH-Bg20

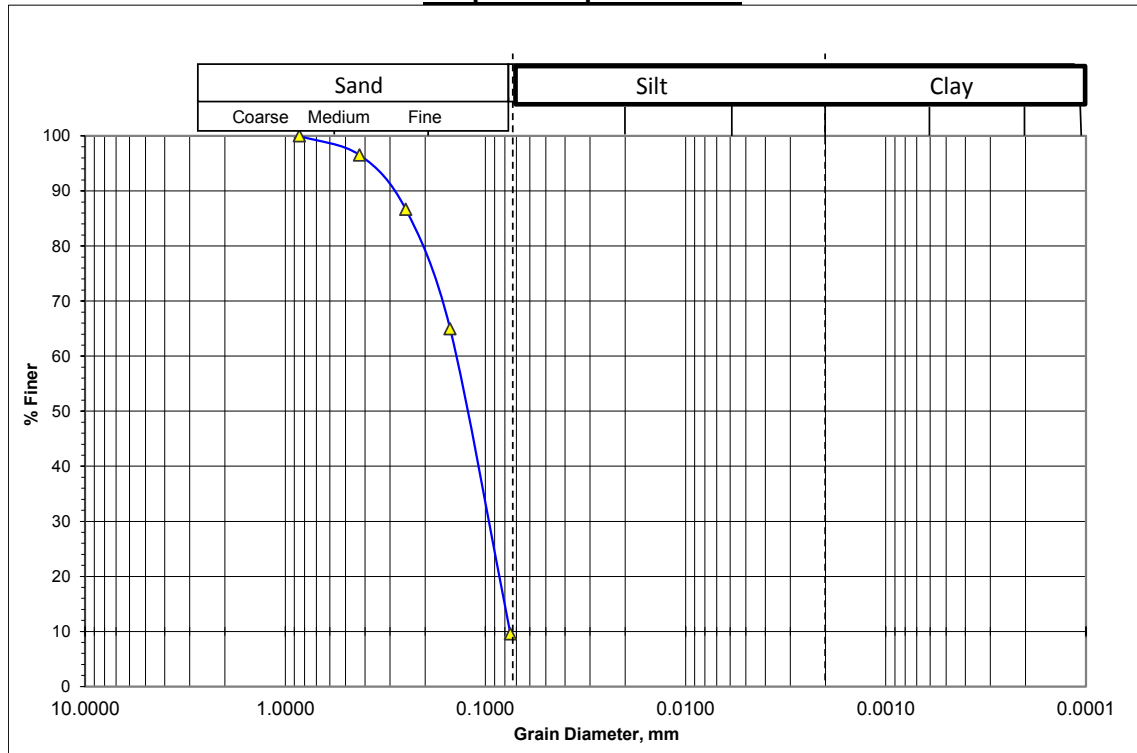
Sampled Date: 02/02/2016

Sample No : D-09

Test Date : 11/04/2016

Depth (m) : 13.5

Graphical Representation:



Fines or % of silt and clay = 9

Mean Diameter, $D_{50} = 0.125$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.62$

% Particles (from the grain -size analysis graph

(0.075mm size) = 91

(0.005mm size) & (0.001mm size) = 9

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : 21 nos. Bara Bihanali govt. School, Bara Bihanali Union

Bore Hole No: BH-Bg20

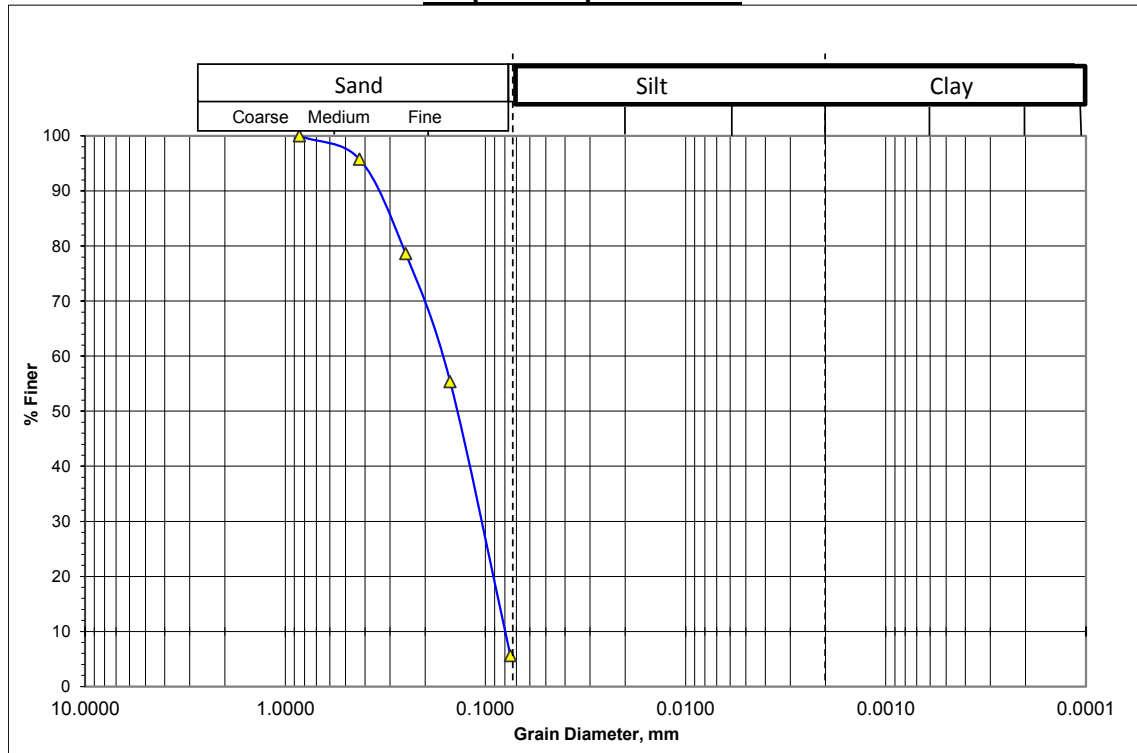
Sampled Date: 02/02/2016

Sample No : D-16

Test Date : 11/04/2016

Depth (m) : 24.0

Graphical Representation:



Fines or % of silt and clay = 5

Mean Diameter, D_{50} = 0.15 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.68$

% Particles (from the grain -size analysis graph

(0.075mm size) = 95

(0.005mm size) & (0.001mm size) = 5

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Uttar akdala Govt. Primary School, Uttar akdala Bazar, Bhabanigong Pourashava

Bore Hole No: BH-Bg21

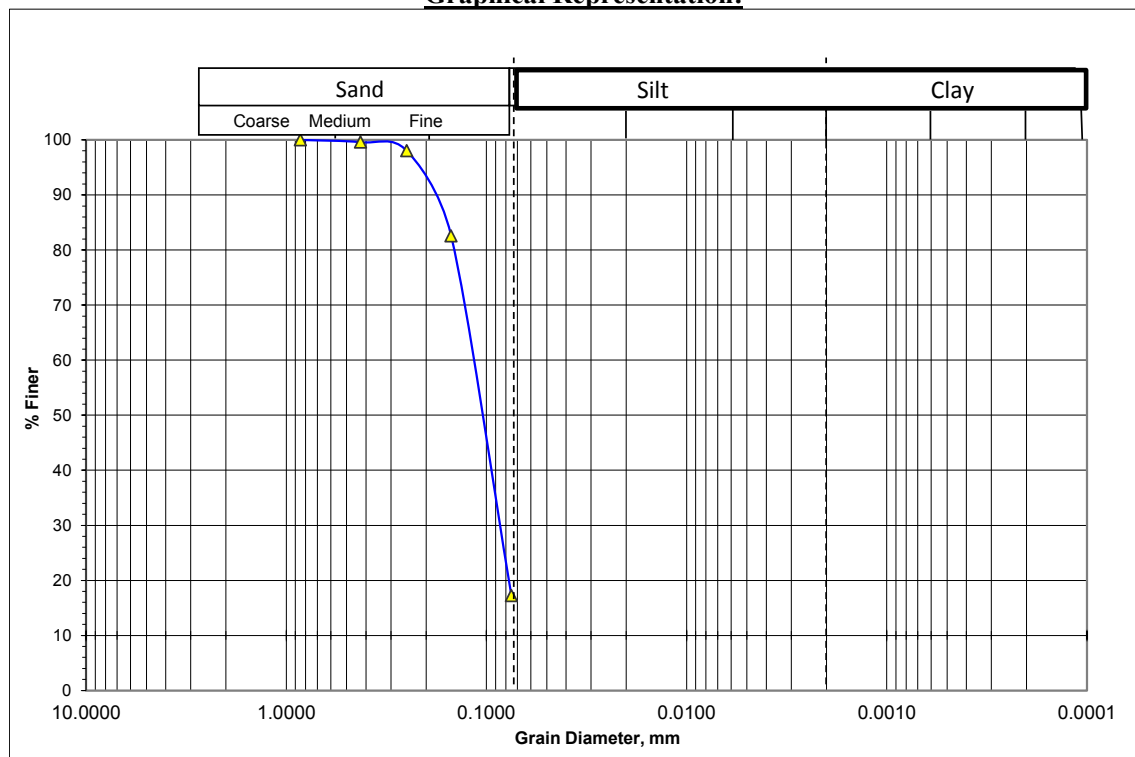
Sampled Date: 01/02/2016

Sample No : D-02

Test Date : 08/04/2016

Depth (m) : 3.0

Graphical Representation:



GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Uttar akdala Govt. Primary School, Uttar akdala Bazar, Bhabanigong Pourashava

Bore Hole No: BH-Bg21

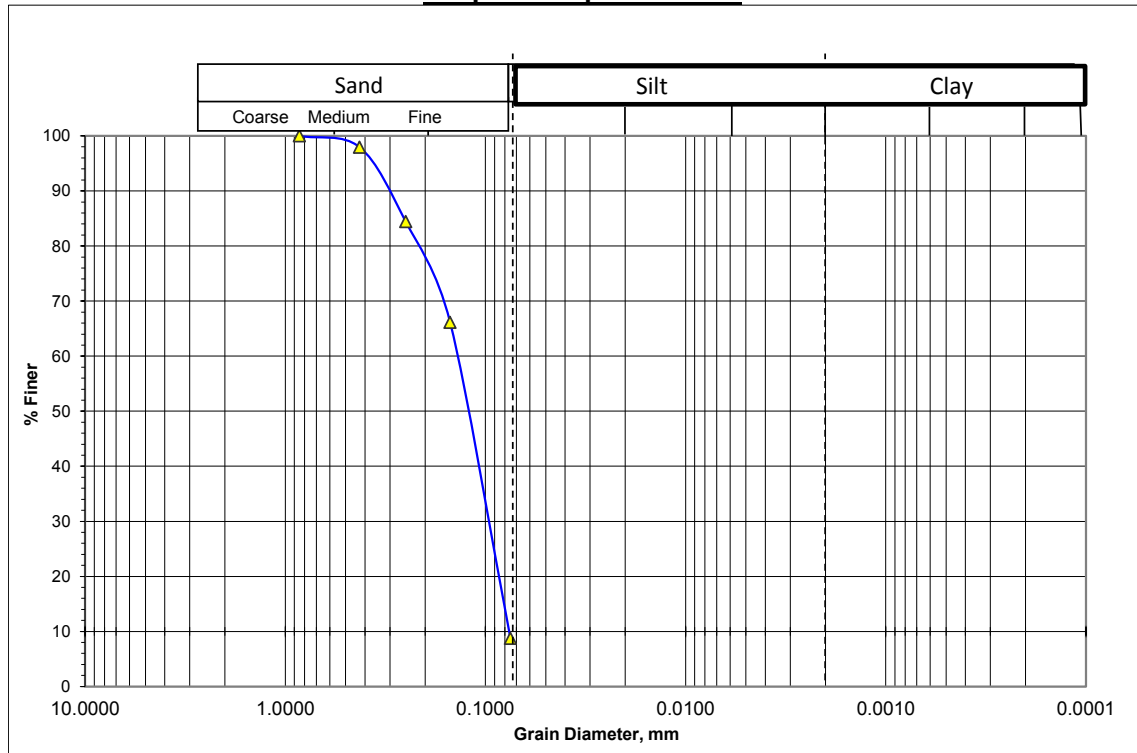
Sampled Date: 01/02/2016

Sample No : D-09

Test Date : 08/04/2016

Depth (m) : 13.5

Graphical Representation:



Fines or % of silt and clay = 9

Mean Diameter, D_{50} = 0.13 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.63$

% Particles (from the grain -size analysis graph

(0.075mm size) = 91

(0.005mm size) & (0.001mm size) = 9

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Nandanpur(Chekamara) Bazar, Mohila Dakhil Madrasha, Basu Para Union

Bore Hole No: BH-Bg22

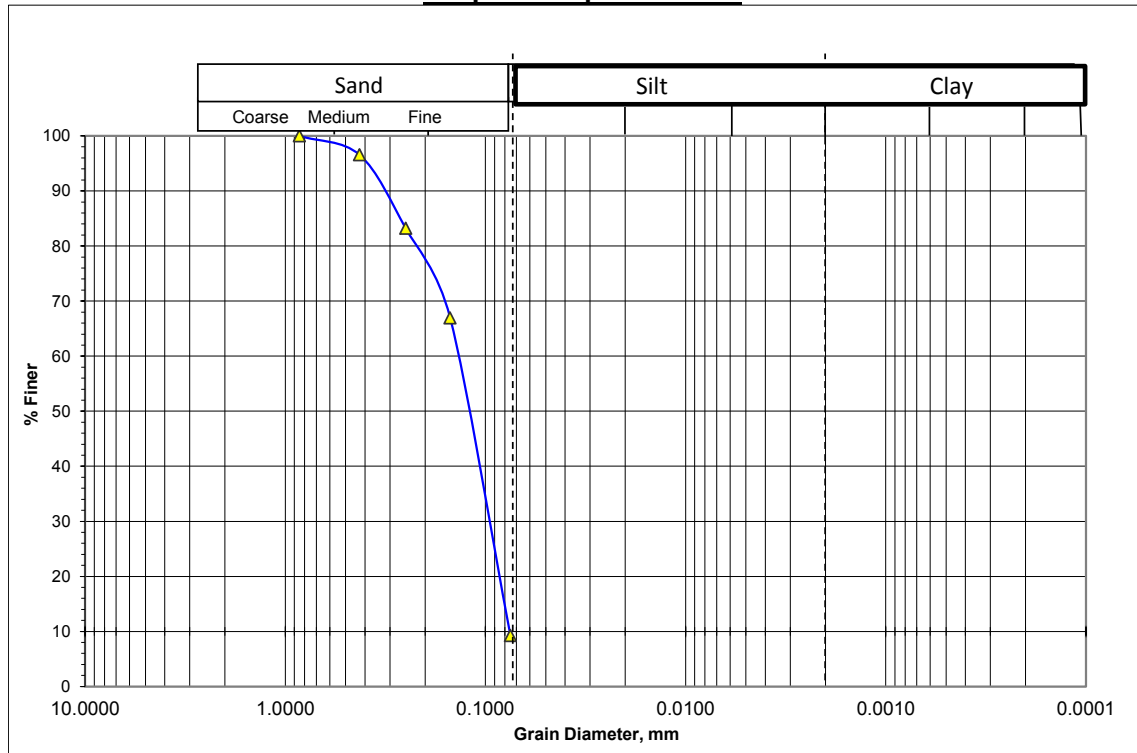
Sampled Date: 02/02/2016

Sample No : D-10

Test Date : 11/04/2016

Depth (m) : 15.0

Graphical Representation:



Fines or % of silt and clay = 9

Mean Diameter, $D_{50} = 0.125$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.62$

% Particles (from the grain -size analysis graph

(0.075mm size) = 91

(0.005mm size) & (0.001mm size) = 9

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Nandanpur(Chekamara) Bazar, Mohila Dakhil Madrasha, Basu Para Union

Bore Hole No: BH-Bg22

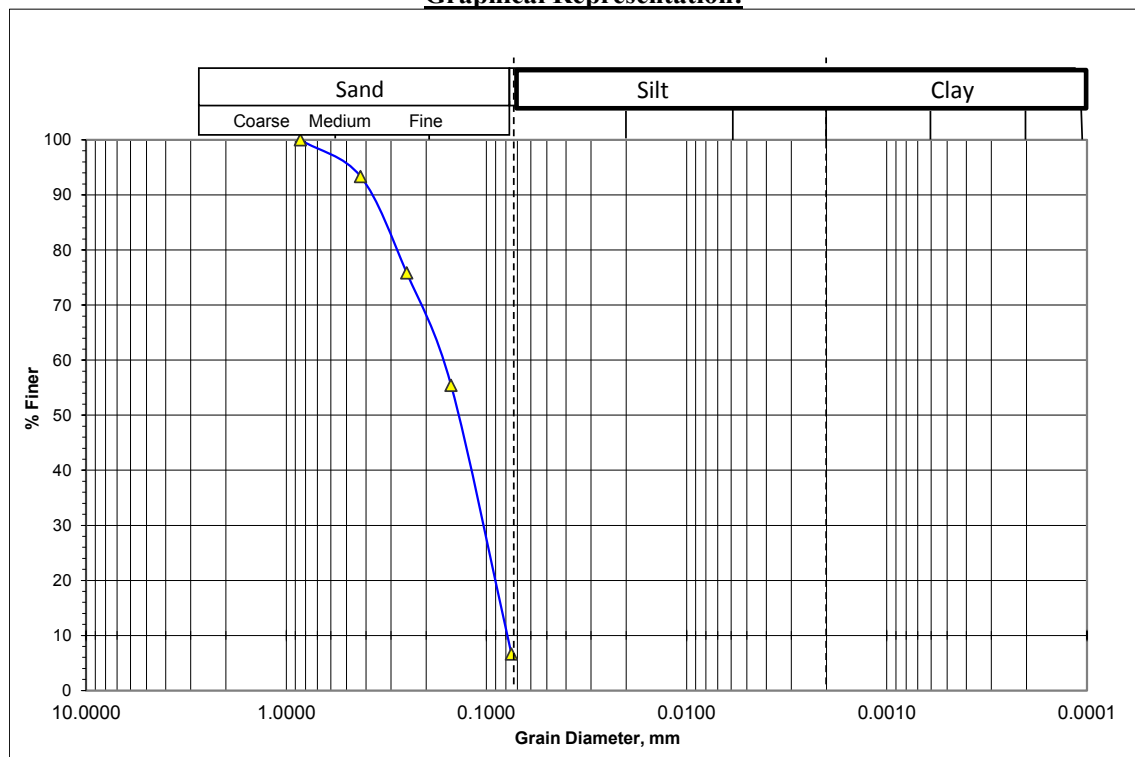
Sampled Date: 02/02/2016

Sample No : D-17

Test Date : 11/04/2016

Depth (m) : 25.5

Graphical Representation:



Fines or % of silt and clay = 6

Mean Diameter, D_{50} = 0.15 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.68$

% Particles (from the grain -size analysis graph

(0.075mm size) = 94

(0.005mm size) & (0.001mm size) = 6

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Ganipur Union Complex office, Hasnipur Bazar, Ganipur Union

Bore Hole No: BH-Bg24

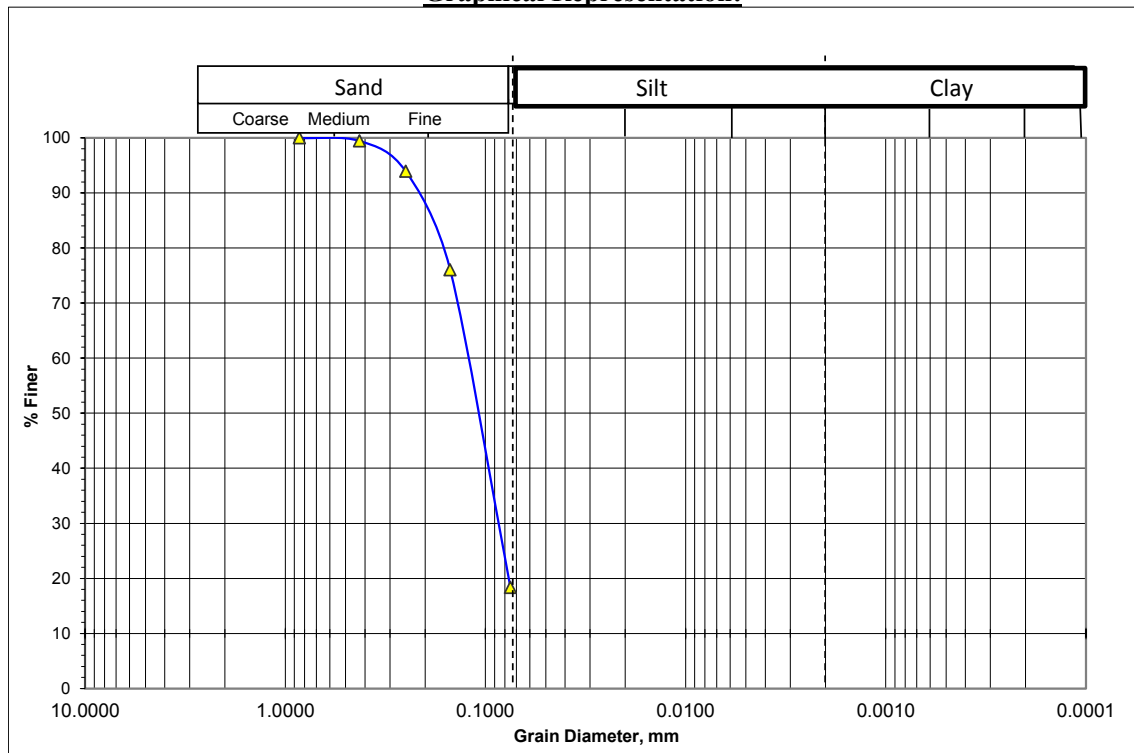
Sampled Date: 06/02/2016

Sample No : D-02

Test Date : 09/04/2016

Depth (m) : 3.0

Graphical Representation:



Fines or % of silt and clay = 18

Mean Diameter, D_{50} = 0.11 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.58$

% Particles (from the grain -size analysis graph

(0.075mm size) = 82

(0.005mm size) & (0.001mm size) = 18

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Ganipur Union Complex office, Hasnipur Bazar, Ganipur Union

Bore Hole No: BH-Bg24

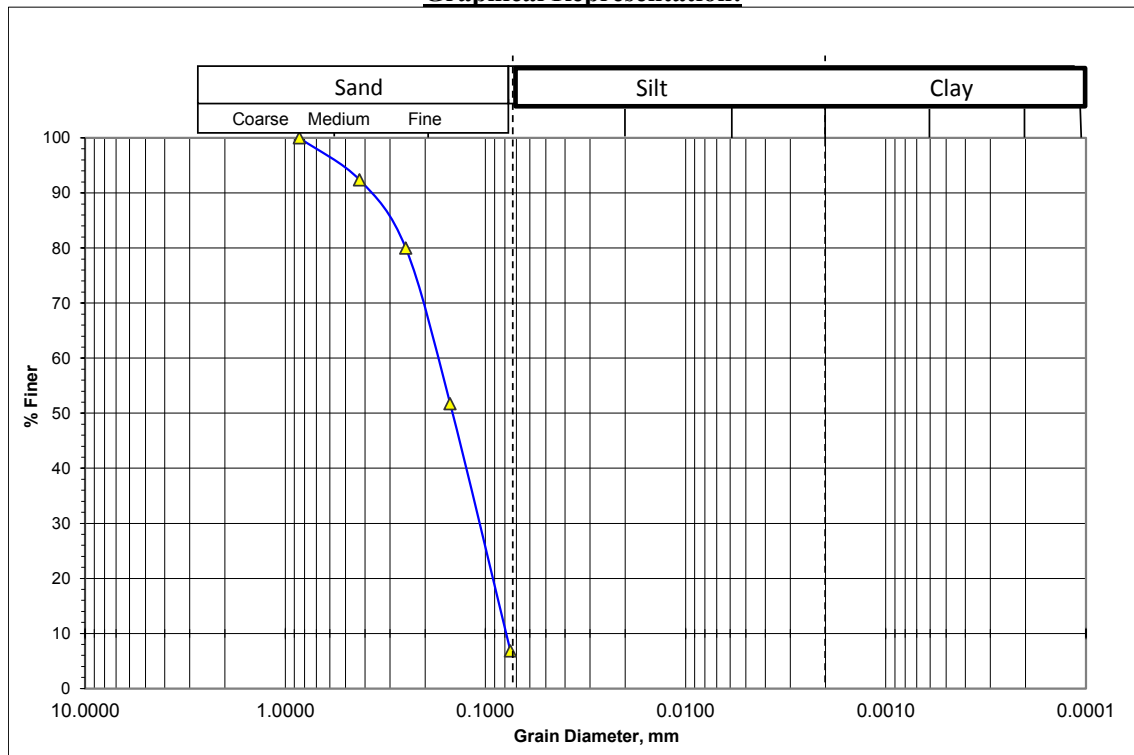
Sampled Date: 06/02/2016

Sample No : D-17

Test Date : 09/04/2016

Depth (m) : 25.5

Graphical Representation:



Fines or % of silt and clay = 7

Mean Diameter, $D_{50} = 0.165$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.71$

% Particles (from the grain -size analysis graph

(0.075mm size) = 93

(0.005mm size) & (0.001mm size) = 7

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Sahid Sakandar Memorial Adarsho High School, Godaoun Mor, Bhabanigong

Bore Hole No: BH-Bg26

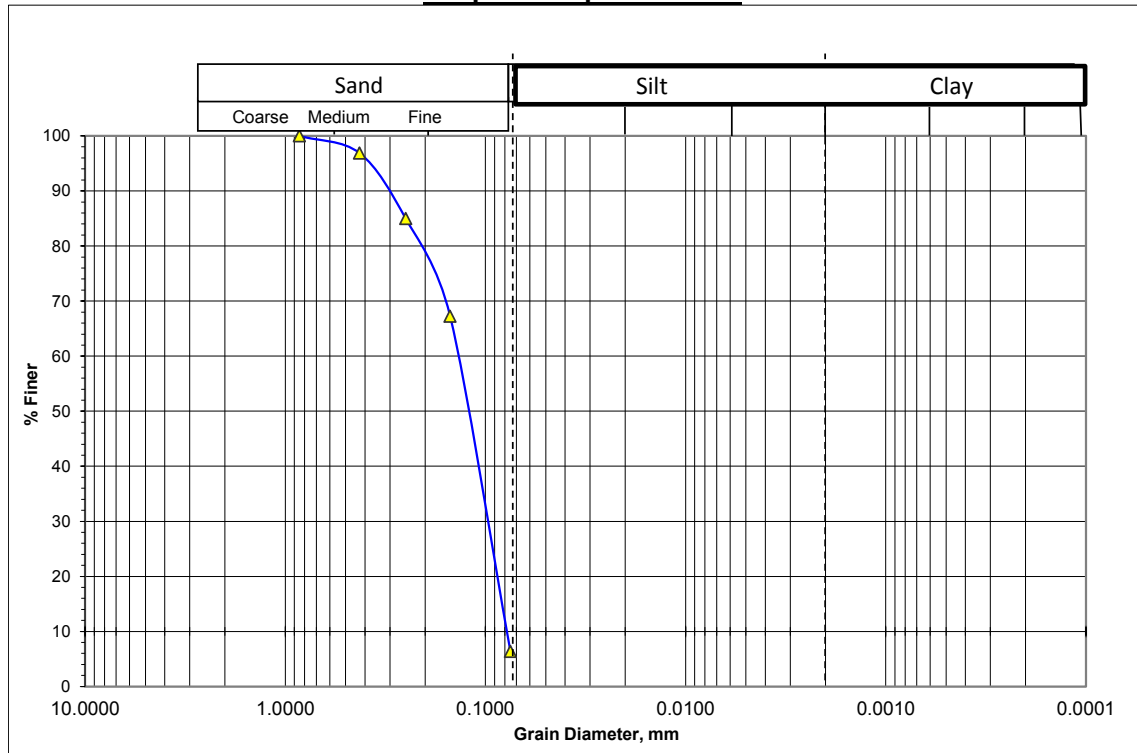
Sampled Date: 27/01/2016

Sample No : D-08

Test Date : 09/04/2016

Depth (m) : 12.0

Graphical Representation:



Fines or % of silt and clay = 6

Mean Diameter, D_{50} = 0.13 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.63$

% Particles (from the grain -size analysis graph

(0.075mm size) = 94

(0.005mm size) & (0.001mm size) = 6

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Sahid Sakandar Memorial Adarsho High School, Godaoun Mor, Bhabanigong

Bore Hole No: BH-Bg26

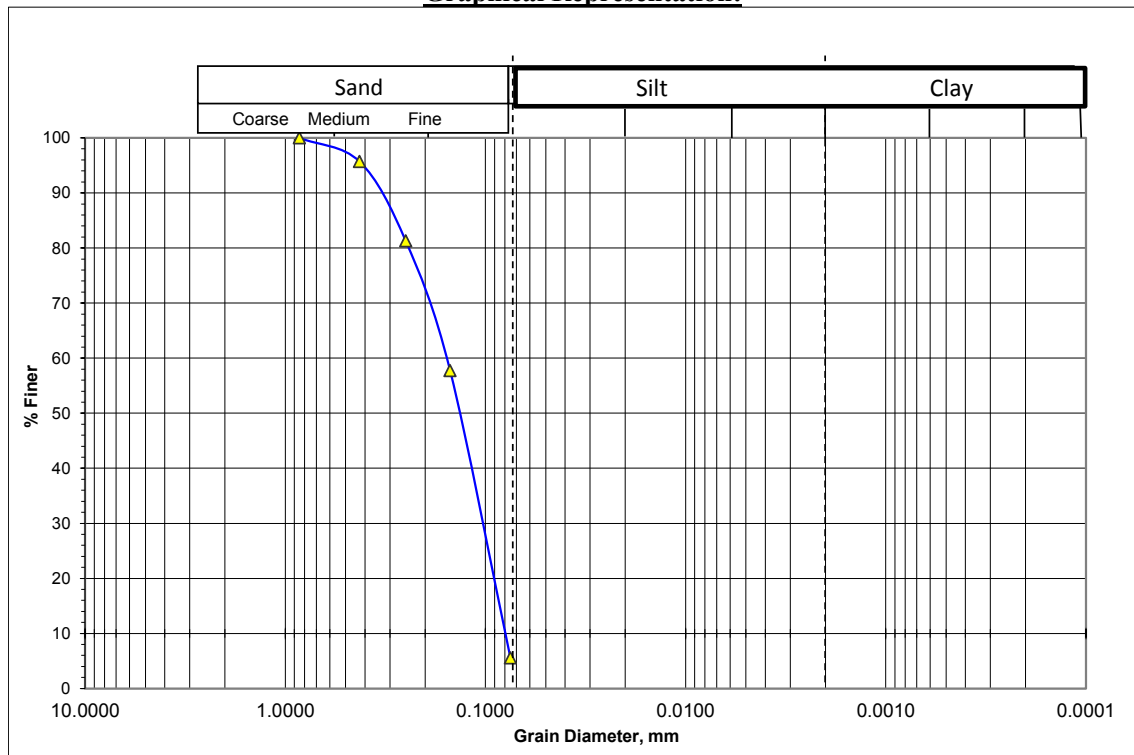
Sampled Date: 27/01/2016

Sample No : D-12

Test Date : 09/04/2016

Depth (m) : 18.0

Graphical Representation:



Fines or % of silt and clay = 5

Mean Diameter, $D_{50} = 0.145$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.67$

% Particles (from the grain -size analysis graph

(0.075mm size) = 95

(0.005mm size) & (0.001mm size) = 5

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Bagmara Degree College, Ganipur Union

Bore Hole No: BH-Bg27

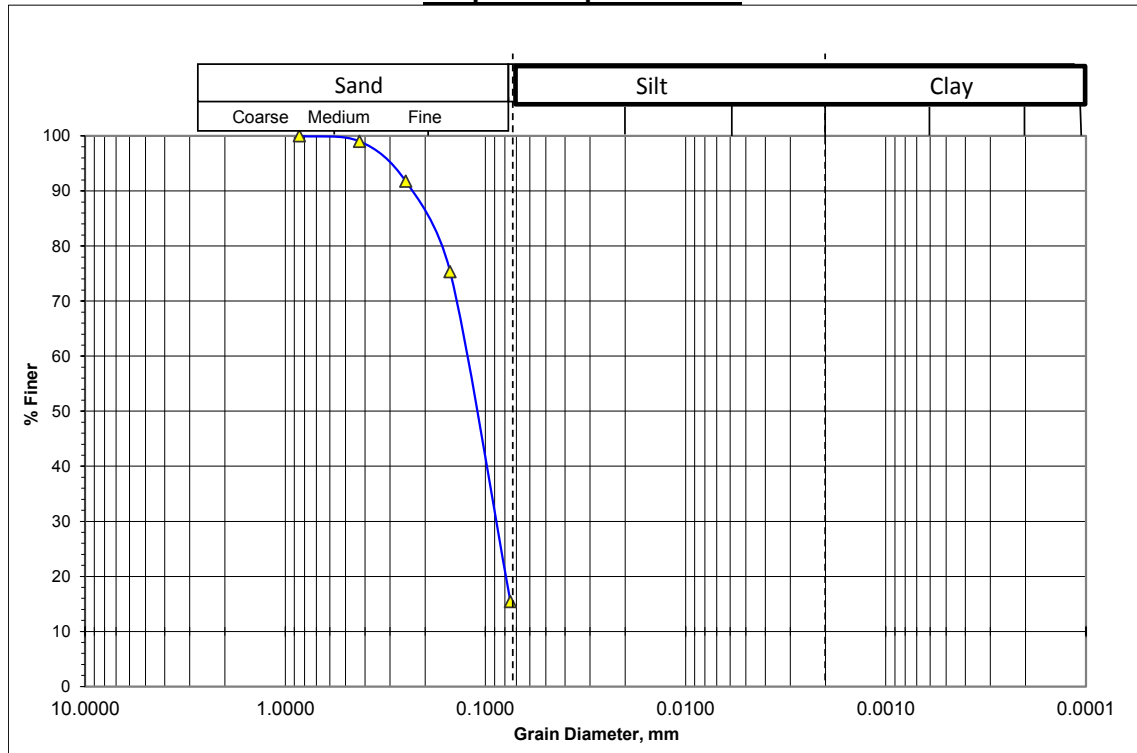
Sampled Date: 31/01/2016

Sample No : D-04

Test Date : 09/04/2016

Depth (m) : 6.0

Graphical Representation:



Fines or % of silt and clay = 15

Mean Diameter, $D_{50} = 0.115$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.60$

% Particles (from the grain -size analysis graph

(0.075mm size) = 85

(0.005mm size) & (0.001mm size) = 15

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Bagmara Degree College, Ganipur Union

Bore Hole No: BH-Bg27

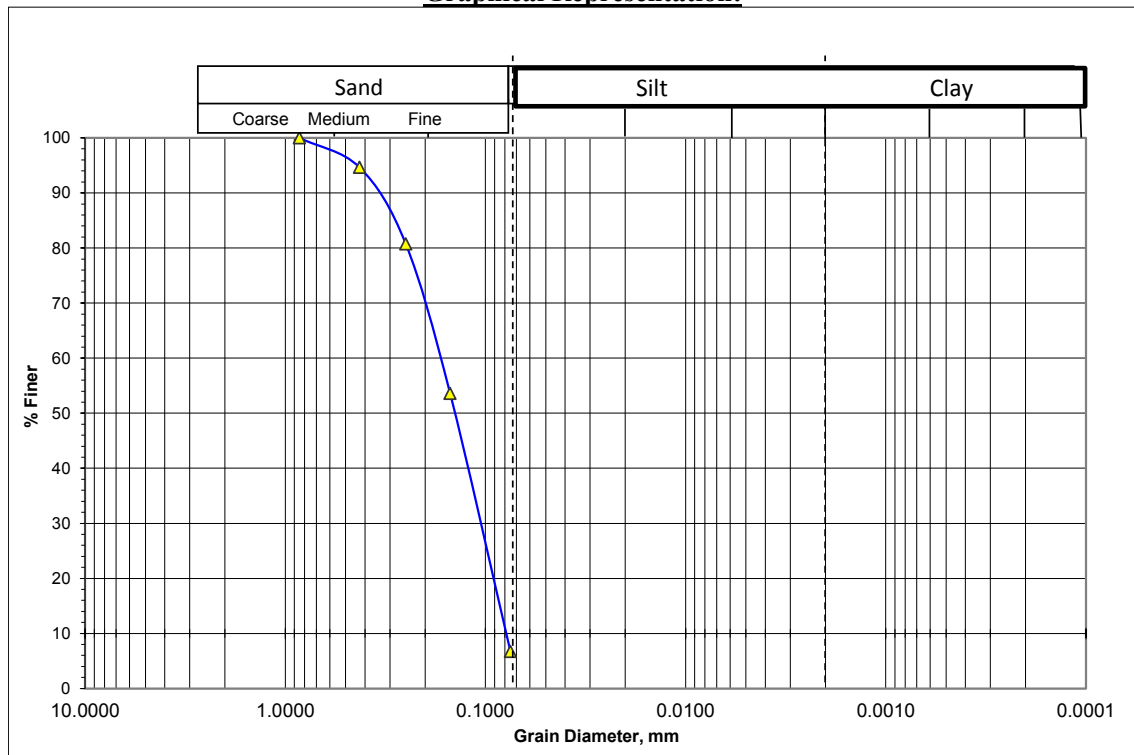
Sampled Date: 31/01/2016

Sample No : D-16

Test Date : 09/04/2016

Depth (m) : 24.0

Graphical Representation:



Fines or % of silt and clay = 6

Mean Diameter, D_{50} = 0.15 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.68$

% Particles (from the grain -size analysis graph

(0.075mm size) = 94

(0.005mm size) & (0.001mm size) = 6

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Shadhopara Madrasha, Near post office, Sreepur Union

Bore Hole No: BH-Bg28

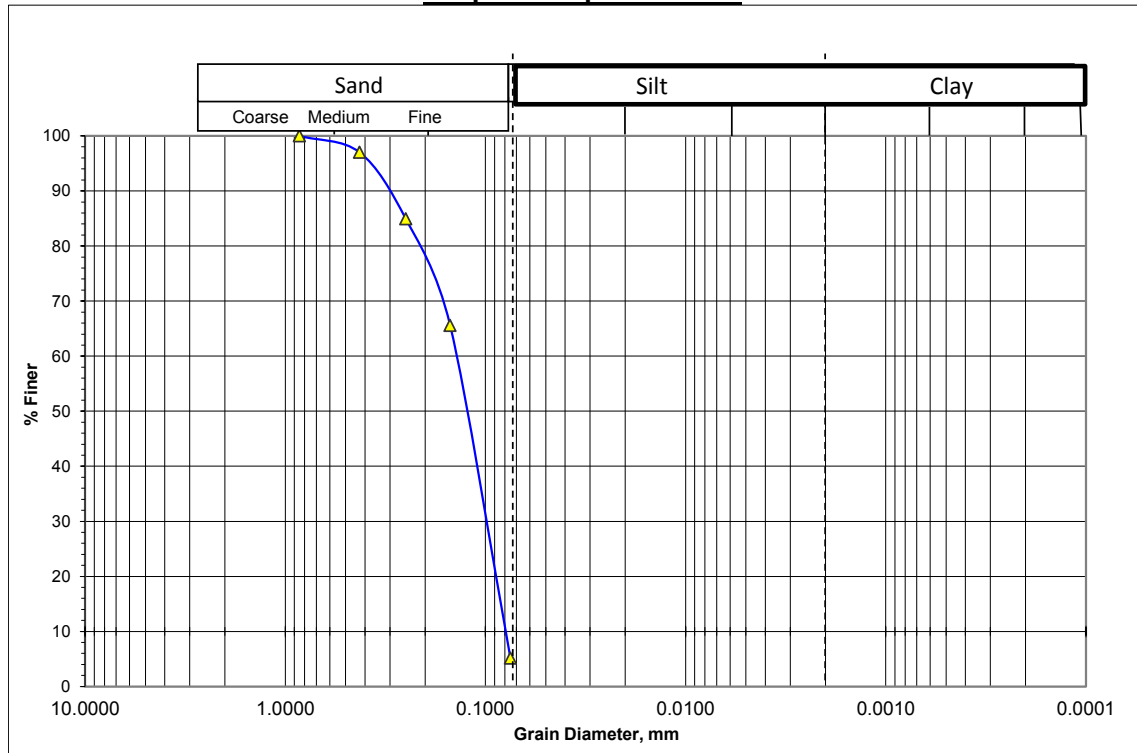
Sampled Date: 01/02/2016

Sample No : D-09

Test Date : 08/04/2016

Depth (m) : 13.5

Graphical Representation:



Fines or % of silt and clay = 4

Mean Diameter, $D_{50} = 0.13$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.63$

% Particles (from the grain -size analysis graph

(0.075mm size) = 96

(0.005mm size) & (0.001mm size) = 4

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Shadhopara Madrasha, Near post office, Sreepur Union

Bore Hole No: BH-Bg28

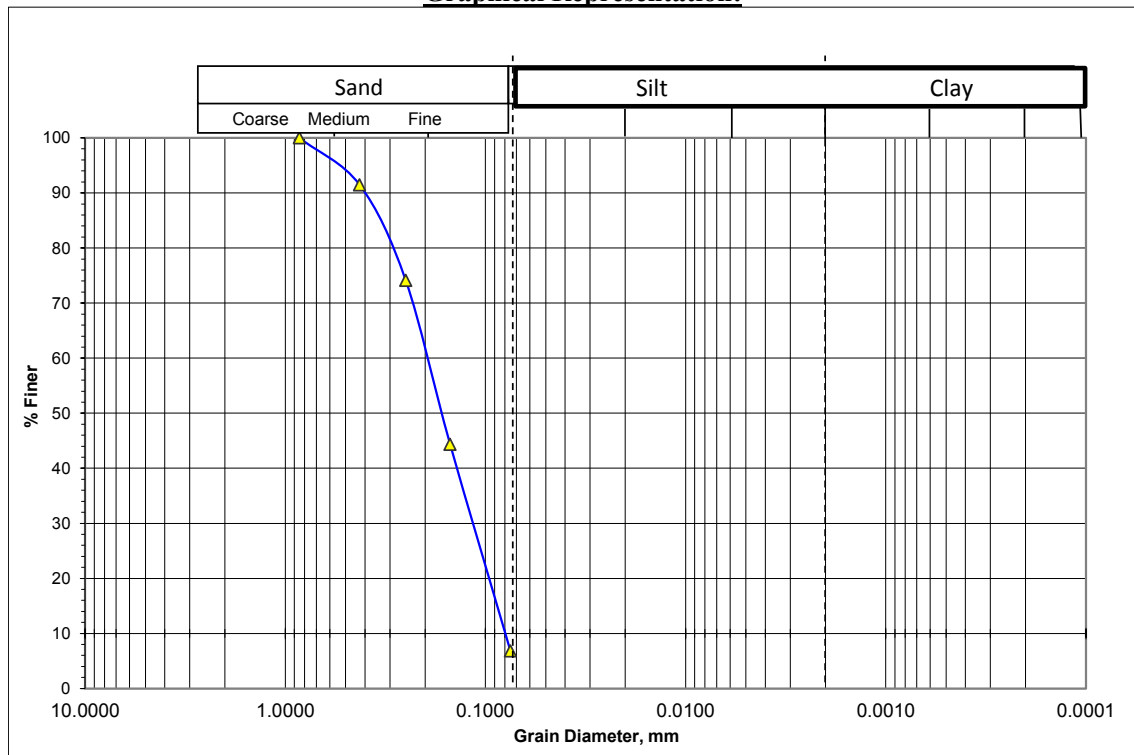
Sampled Date: 01/02/2016

Sample No : D-14

Test Date : 08/04/2016

Depth (m) : 21.0

Graphical Representation:



Fines or % of silt and clay = 7

Mean Diameter, D_{50} = 0.17 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.73$

% Particles (from the grain -size analysis graph

(0.075mm size) = 93

(0.005mm size) & (0.001mm size) = 7

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Jhikra High School, Jhikra Bazar, Jhikra Union

Bore Hole No: BH-Bg29

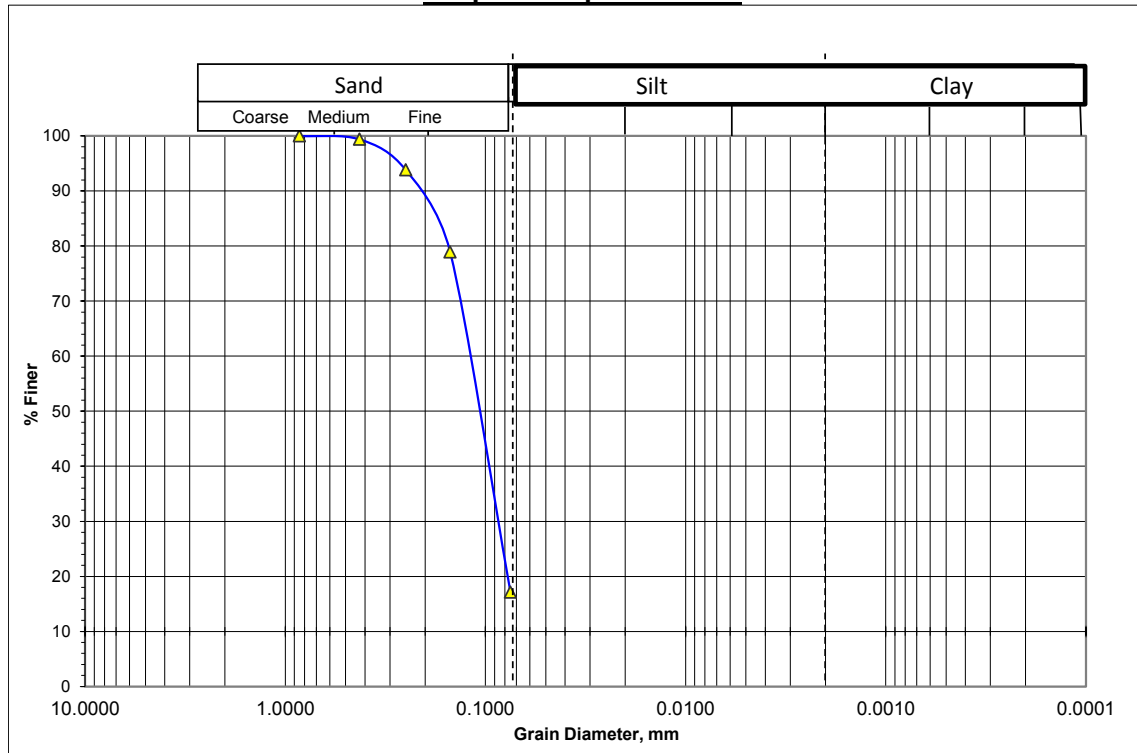
Sampled Date: 28/01/2016

Sample No : D-02

Test Date : 09/04/2016

Depth (m) : 3.0

Graphical Representation:



Fines or % of silt and clay = 17

Mean Diameter, D_{50} = 0.11 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.58$

% Particles (from the grain -size analysis graph

(0.075mm size) = 83

(0.005mm size) & (0.001mm size) = 17

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Jhikra High School, Jhikra Bazar, Jhikra Union

Bore Hole No: BH-Bg29

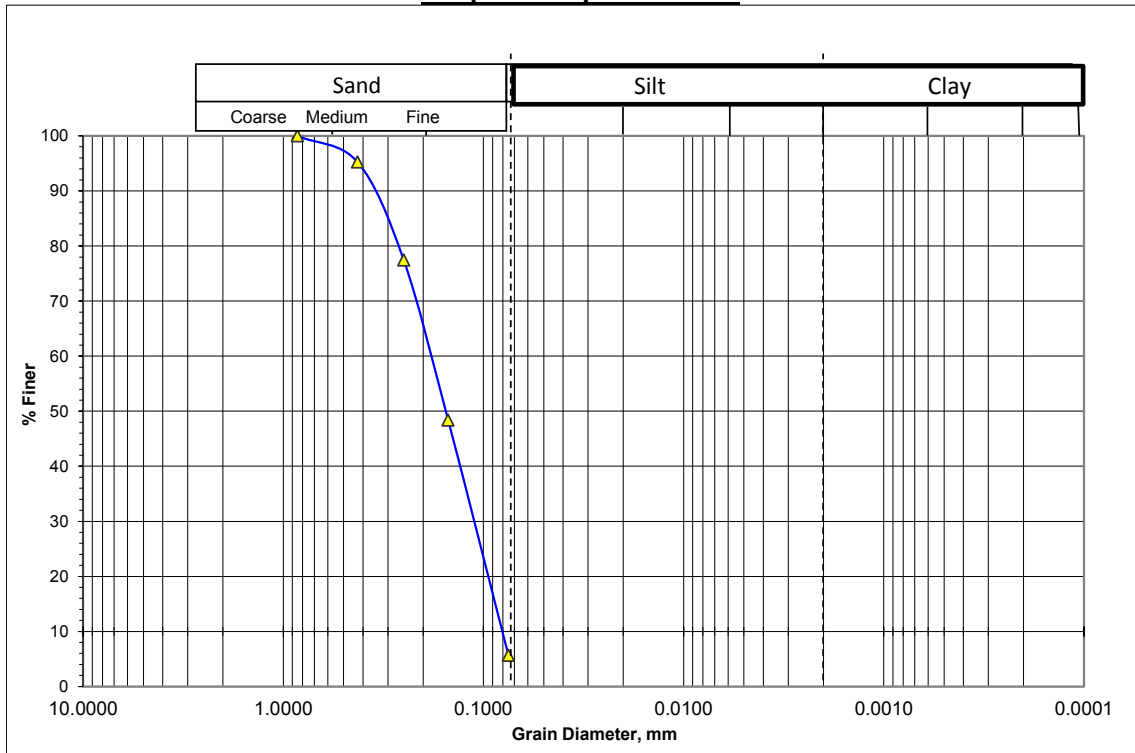
Sampled Date: 28/01/2016

Sample No : D-09

Test Date : 09/04/2016

Depth (m) : 13.5

Graphical Representation:



Fines or % of silt and clay = 5

Mean Diameter, D_{50} = 0.16 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.70$

% Particles (from the grain -size analysis graph

(0.075mm size) = 95

(0.005mm size) & (0.001mm size) = 5

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Sakoa Bohumuki High School, Sikdar Bazar, Maria Union

Bore Hole No: BH-Bg30

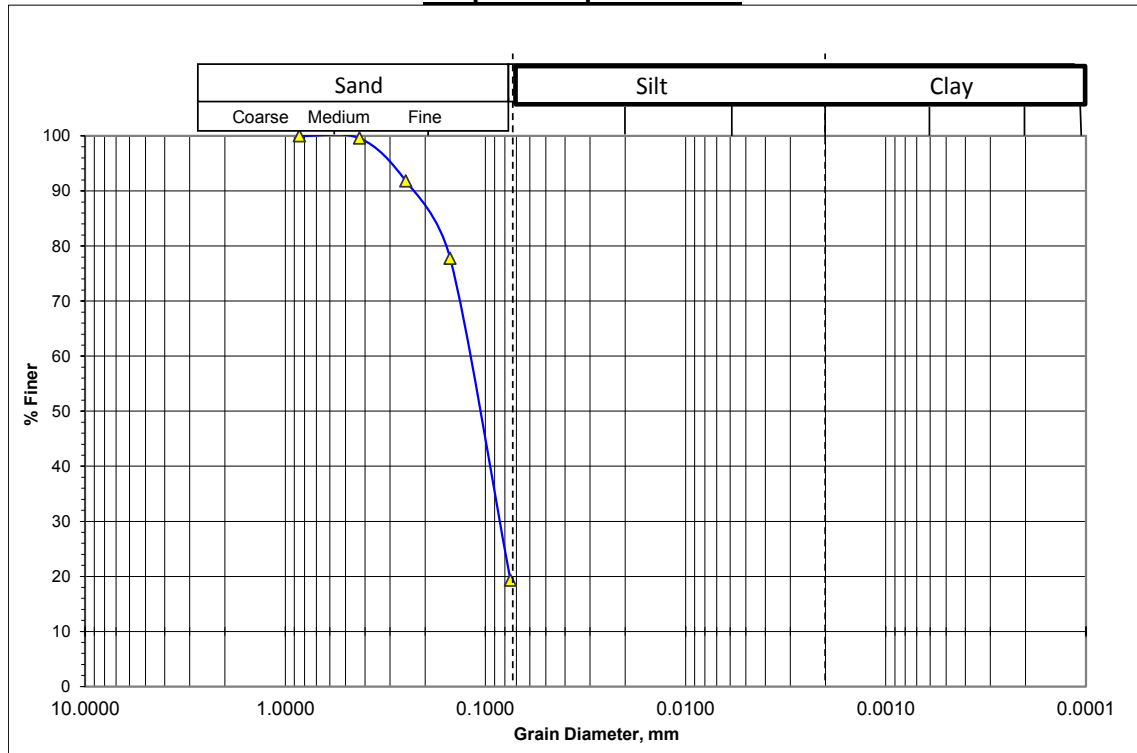
Sampled Date: 29/01/2016

Sample No : D-02

Test Date : 09/04/2016

Depth (m) : 3.0

Graphical Representation:



Fines or % of silt and clay = 19

Mean Diameter, D_{50} = 0.11 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.58$

% Particles (from the grain -size analysis graph

(0.075mm size) = 81

(0.005mm size) & (0.001mm size) = 19

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Sakoa Bohumuki High School, Sikdar Bazar, Maria Union

Bore Hole No: BH-Bg30

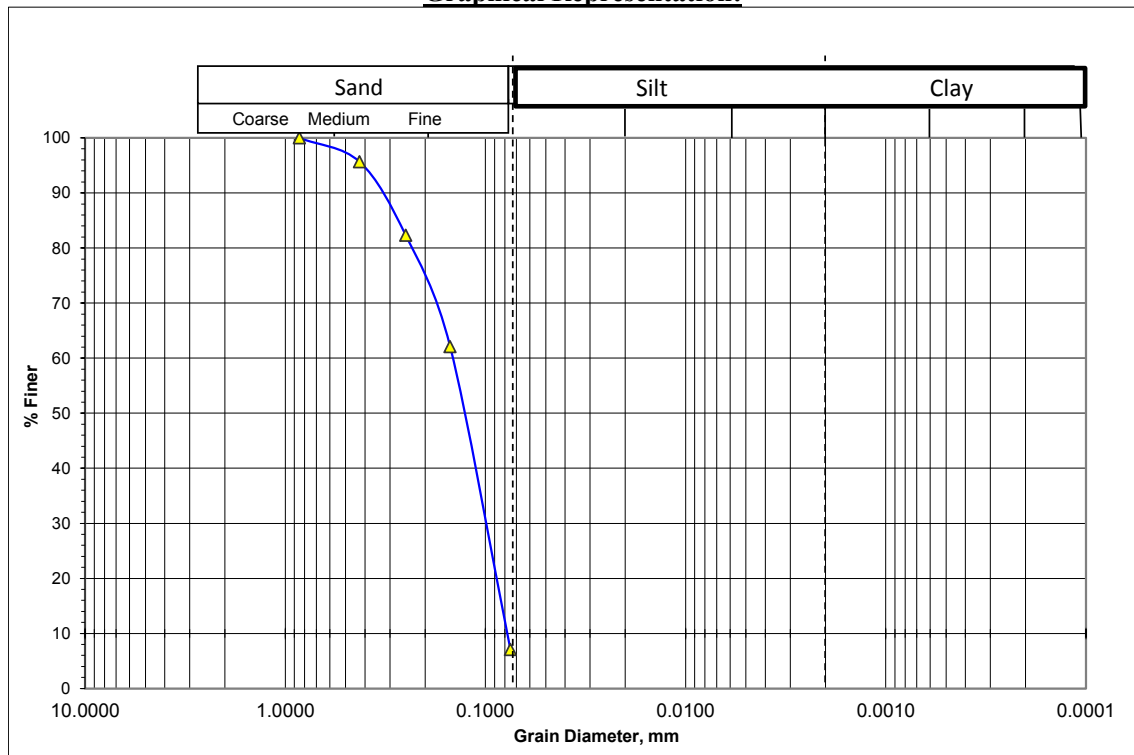
Sampled Date: 29/01/2016

Sample No : D-13

Test Date : 09/04/2016

Depth (m) : 19.5

Graphical Representation:



Fines or % of silt and clay = 6

Mean Diameter, $D_{50} = 0.14$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.66$

% Particles (from the grain -size analysis graph

(0.075mm size) = 94

(0.005mm size) & (0.001mm size) = 6

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Gangopara Govt. Primary school, Maria Union

Bore Hole No: BH-Bg31

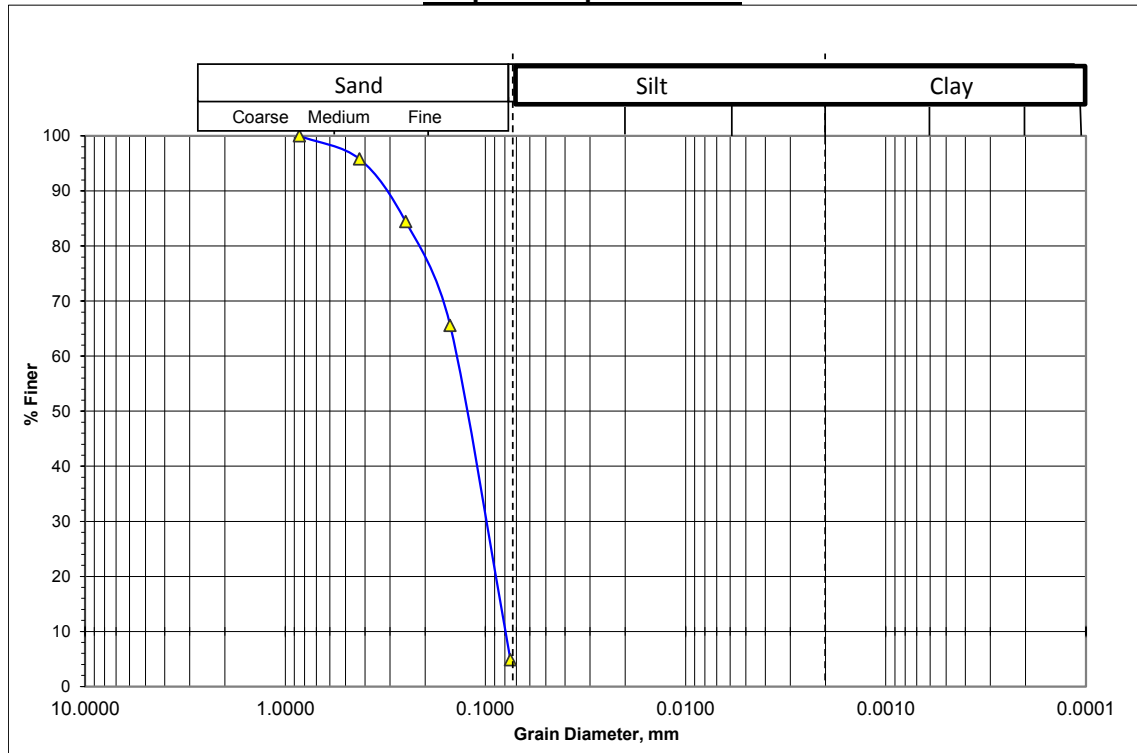
Sampled Date: 10/02/2016

Sample No : D-09

Test Date : 07/04/2016

Depth (m) : 13.5

Graphical Representation:



Fines or % of silt and clay = 5

Mean Diameter, D_{50} = 0.13 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.63$

% Particles (from the grain -size analysis graph

(0.075mm size) = 95

(0.005mm size) & (0.001mm size) = 5

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Gangopara Govt. Primary school, Maria Union

Bore Hole No: BH-Bg31

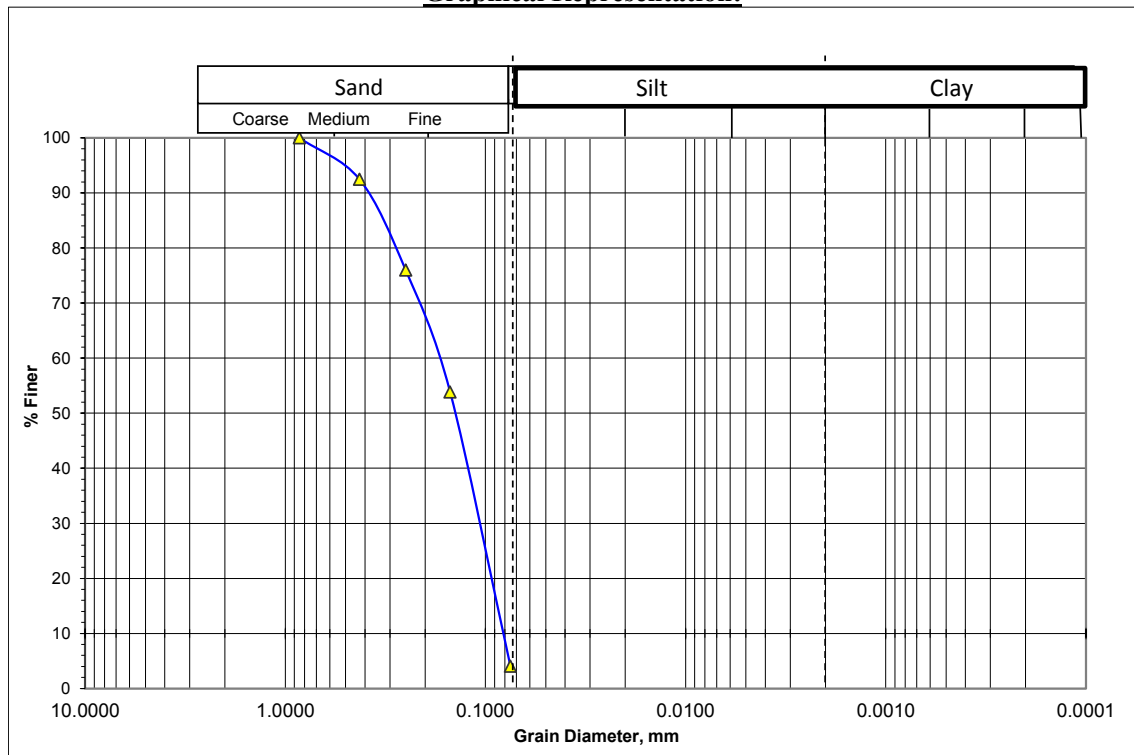
Sampled Date: 10/02/2016

Sample No : D-14

Test Date : 07/04/2016

Depth (m) : 21.0

Graphical Representation:



Fines or % of silt and clay = 4

Mean Diameter, D_{50} = 0.15 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.68$

% Particles (from the grain -size analysis graph

(0.075mm size) = 96

(0.005mm size) & (0.001mm size) = 4

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Sajura Mirzapur, Goalkandi Union

Bore Hole No: BH-Bg32

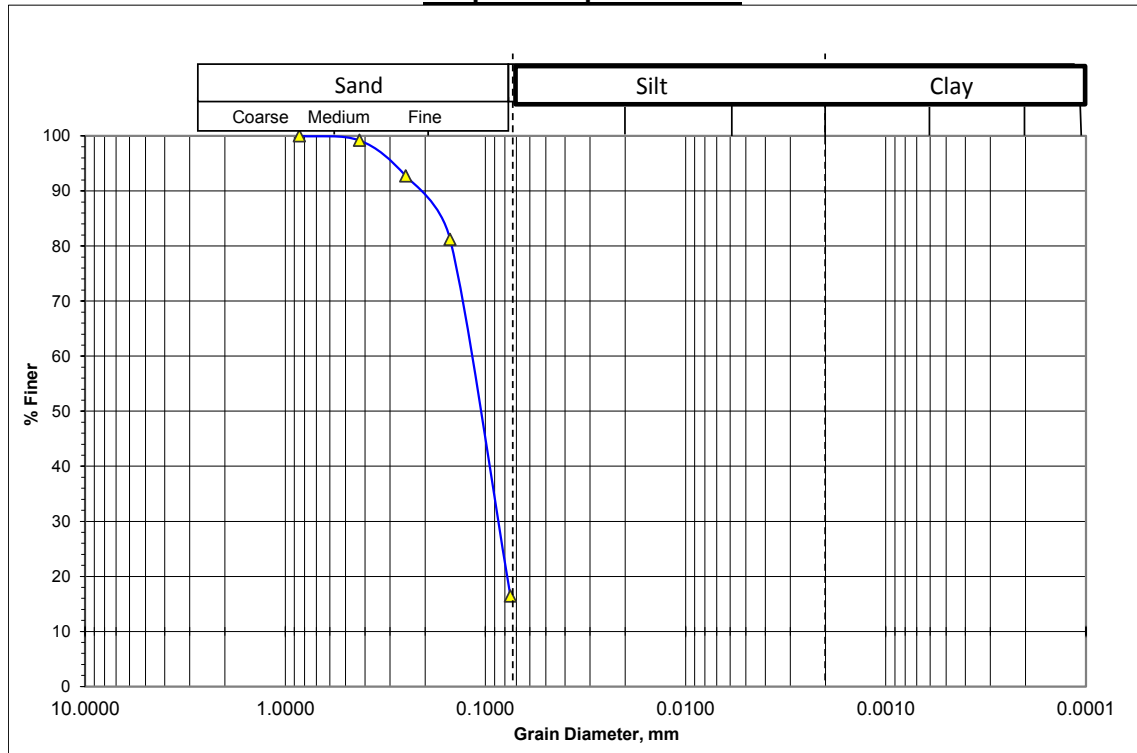
Sampled Date: 30/01/2016

Sample No : D-02

Test Date : 09/04/2016

Depth (m) : 3.0

Graphical Representation:



Fines or % of silt and clay = 16

Mean Diameter, $D_{50} = 0.105$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.57$

% Particles (from the grain -size analysis graph

(0.075mm size) = 84

(0.005mm size) & (0.001mm size) = 16

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Sajura Mirzapur, Goalkandi Union

Bore Hole No: BH-Bg32

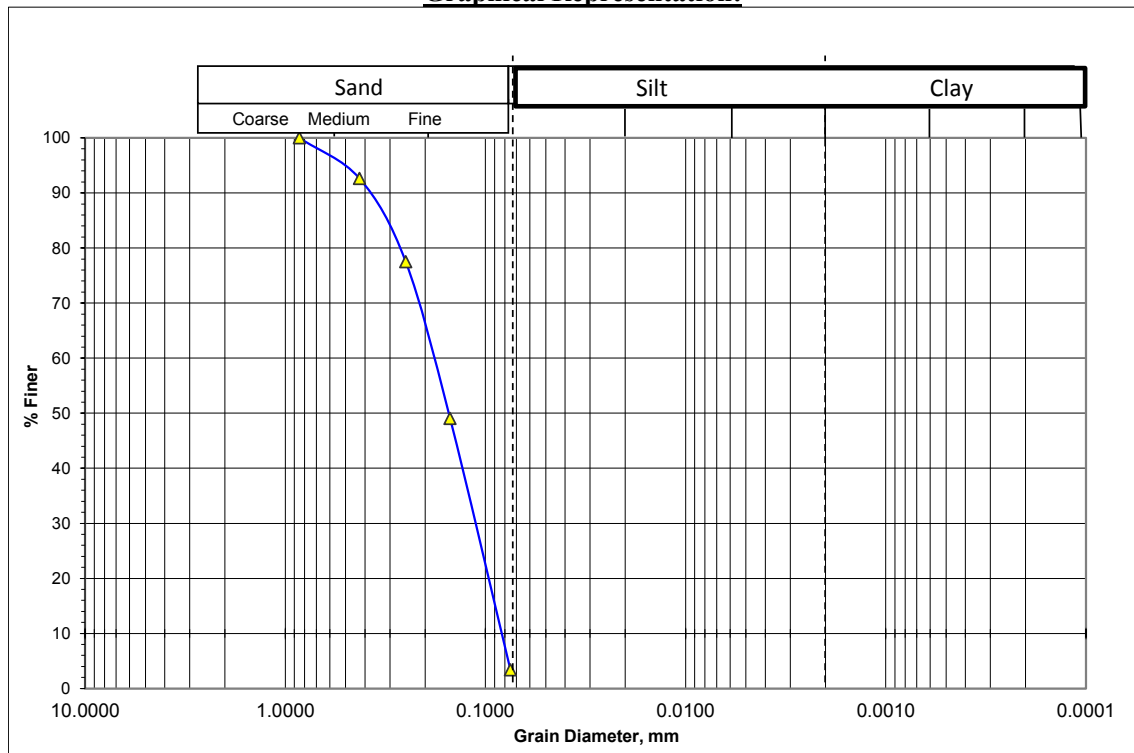
Sampled Date: 30/01/2016

Sample No : D-12

Test Date : 09/04/2016

Depth (m) : 18.0

Graphical Representation:



Fines or % of silt and clay = 3

Mean Diameter, $D_{50} = 0.165$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.71$

% Particles (from the grain -size analysis graph

(0.075mm size) = 97

(0.005mm size) & (0.001mm size) = 3

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Jamgram Govt. Primary School, Jamgram, Tahirpur Pourashava

Bore Hole No: BH-Bg33

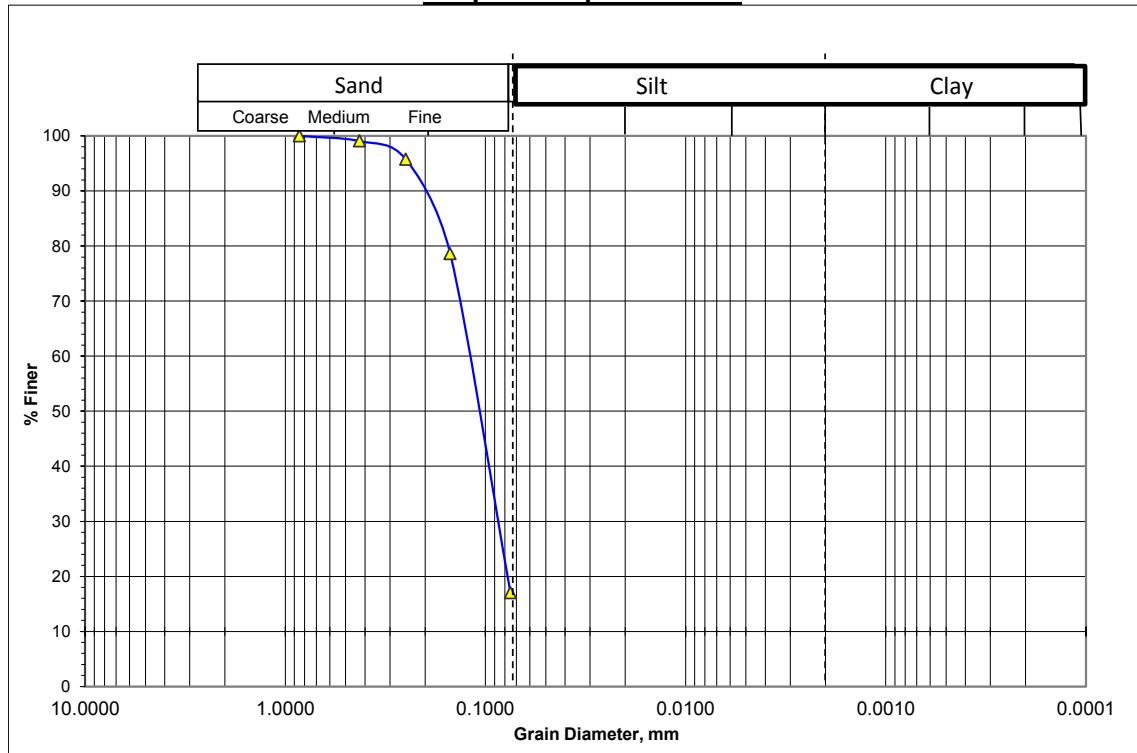
Sampled Date: 31/01/2016

Sample No : D-02

Test Date : 10/04/2016

Depth (m) : 3.0

Graphical Representation:



Fines or % of silt and clay = 17

Mean Diameter, $D_{50} = 0.11$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.58$

% Particles (from the grain -size analysis graph

(0.075mm size) = 83

(0.005mm size) & (0.001mm size) = 17

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Jamgram Govt. Primary School, Jamgram, Tahirpur Pourashava

Bore Hole No: BH-Bg33

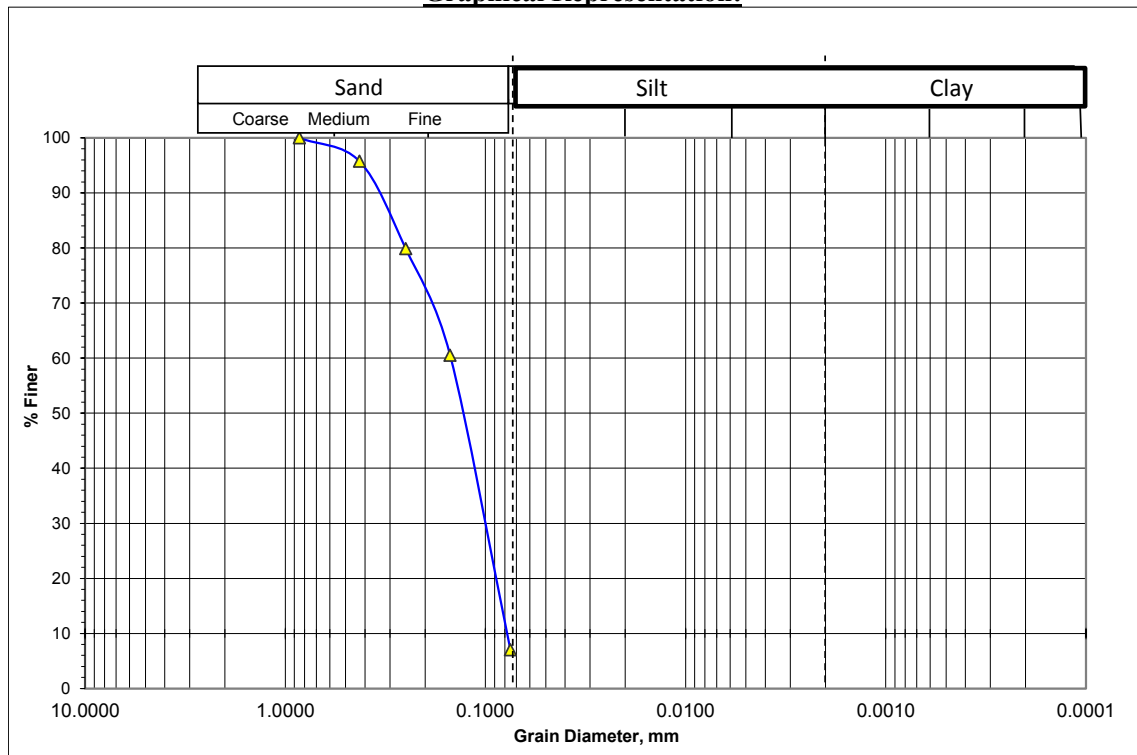
Sampled Date: 31/01/2016

Sample No : D-10

Test Date : 10/04/2016

Depth (m) : 15.0

Graphical Representation:



Fines or % of silt and clay = 6

Mean Diameter, D_{50} = 0.14 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.66$

% Particles (from the grain -size analysis graph

(0.075mm size) = 94

(0.005mm size) & (0.001mm size) = 6

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Koyamajampur Govt. Prtimary School, Durgapur, Near Tahirpur Pourashava

Bore Hole No: BH-Bg34

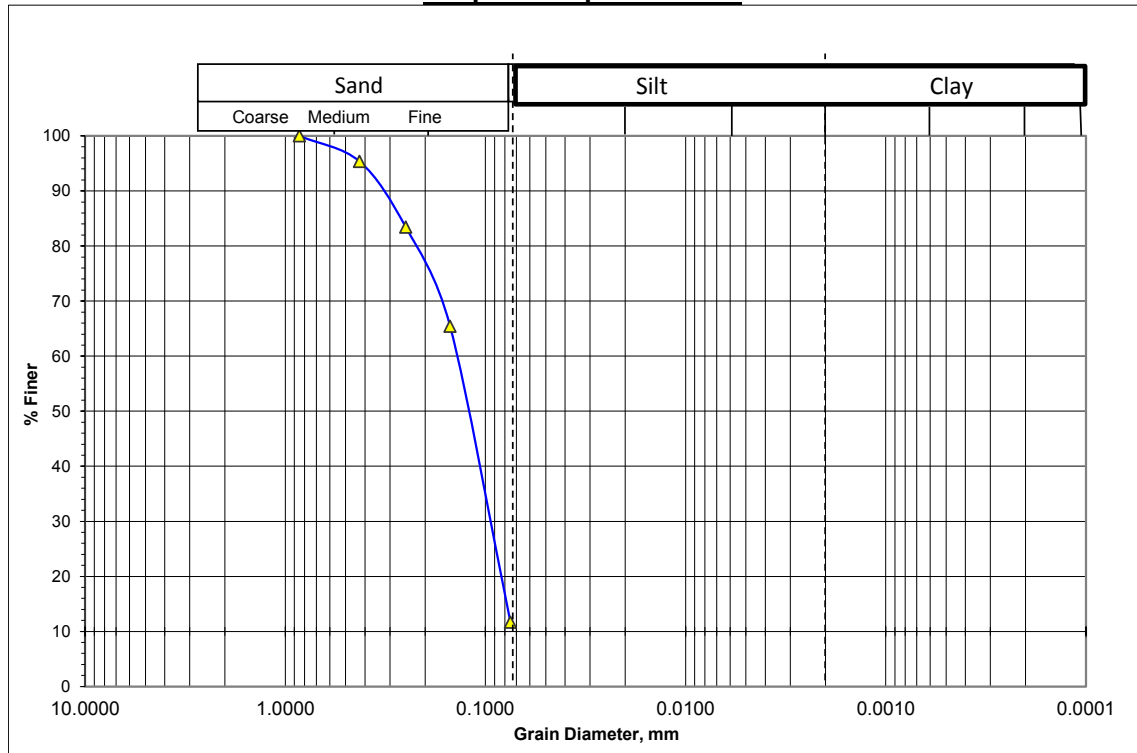
Sampled Date: 09/02/2016

Sample No : D-11

Test Date : 05/04/2016

Depth (m) : 16.5

Graphical Representation:



Fines or % of silt and clay = 11

Mean Diameter, $D_{50} = 0.13$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.63$

% Particles (from the grain -size analysis graph

(0.075mm size) = 89

(0.005mm size) & (0.001mm size) = 11

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Koyamajampur Govt. Prtimary School, Durgapur, Near Tahirpur Pourashava

Bore Hole No: BH-Bg34

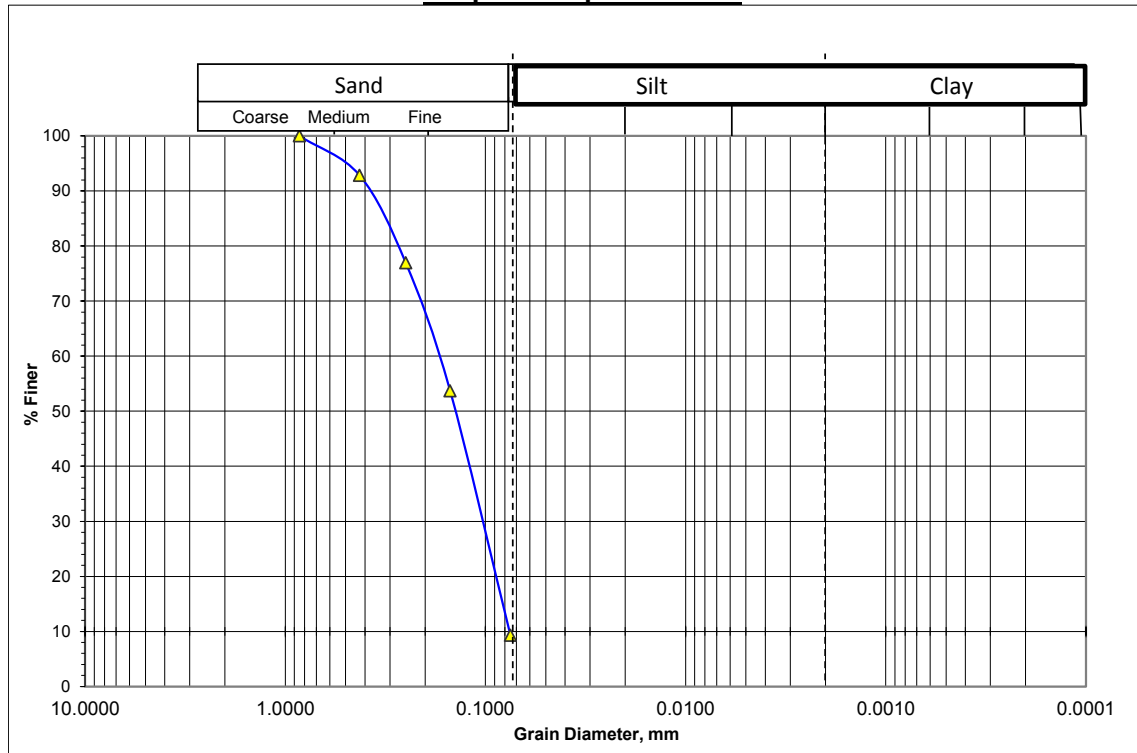
Sampled Date: 09/02/2016

Sample No : D-17

Test Date : 05/04/2016

Depth (m) : 25.5

Graphical Representation:



Fines or % of silt and clay = 9

Mean Diameter, D_{50} = 0.15 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.68$

% Particles (from the grain -size analysis graph

(0.075mm size) = 91

(0.005mm size) & (0.001mm size) = 9

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Hamir kutsha Union complex office, Hamir Kutsha Union

Bore Hole No: BH-Bg36

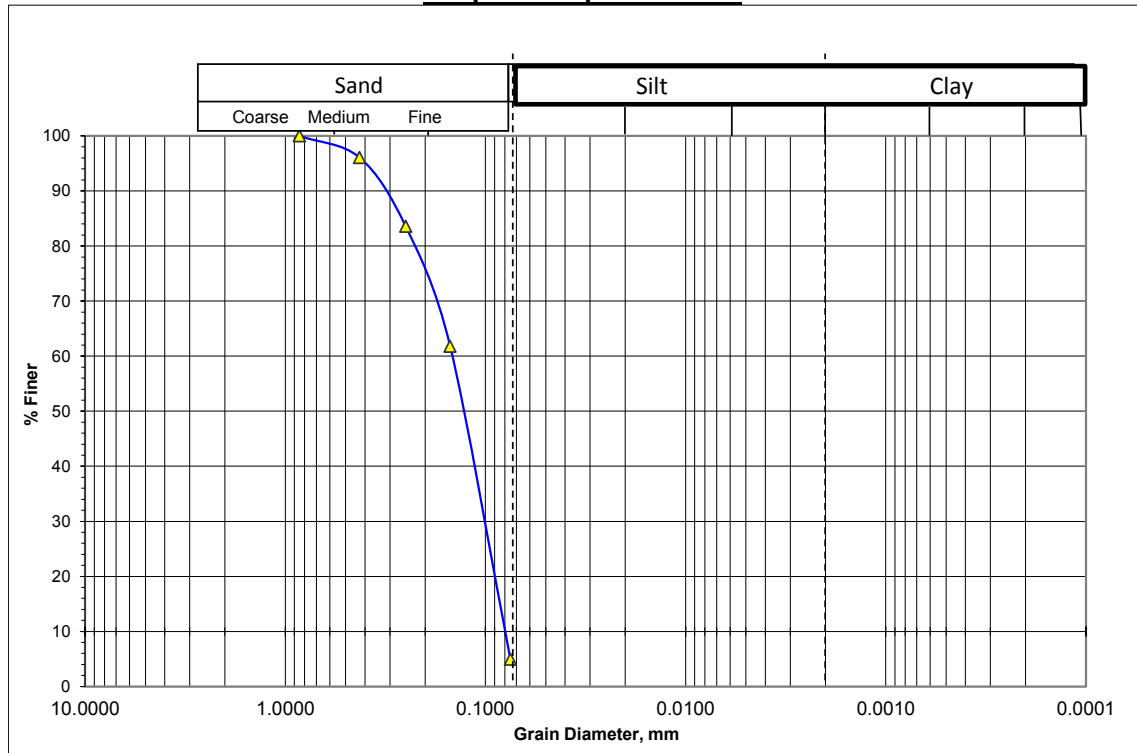
Sampled Date: 10/02/2016

Sample No : D-09

Test Date : 05/04/2016

Depth (m) : 13.5

Graphical Representation:



Fines or % of silt and clay = 5

Mean Diameter, $D_{50} = 0.135$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.65$

% Particles (from the grain -size analysis graph

(0.075mm size) = 95

(0.005mm size) & (0.001mm size) = 5

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Hamir kutsha Union complex office, Hamir Kutsha Union

Bore Hole No: BH-Bg36

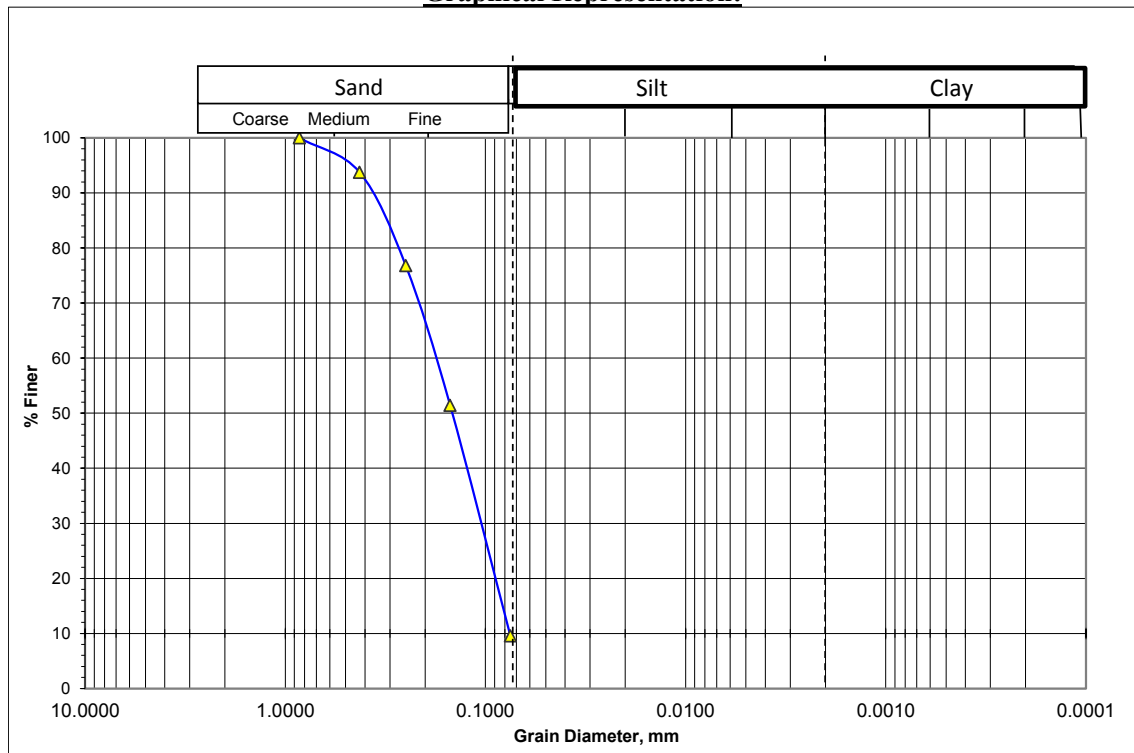
Sampled Date: 10/02/2016

Sample No : D-14

Test Date : 05/04/2016

Depth (m) : 21.0

Graphical Representation:



Fines or % of silt and clay = 9

Mean Diameter, D_{50} = 0.16 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.70$

% Particles (from the grain -size analysis graph

(0.075mm size) = 91

(0.005mm size) & (0.001mm size) = 9

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Tahirpur University (Birshobidalay) college, Tahirpur Bazar, Tahirpur Pourashava

Bore Hole No: BH-Bg37

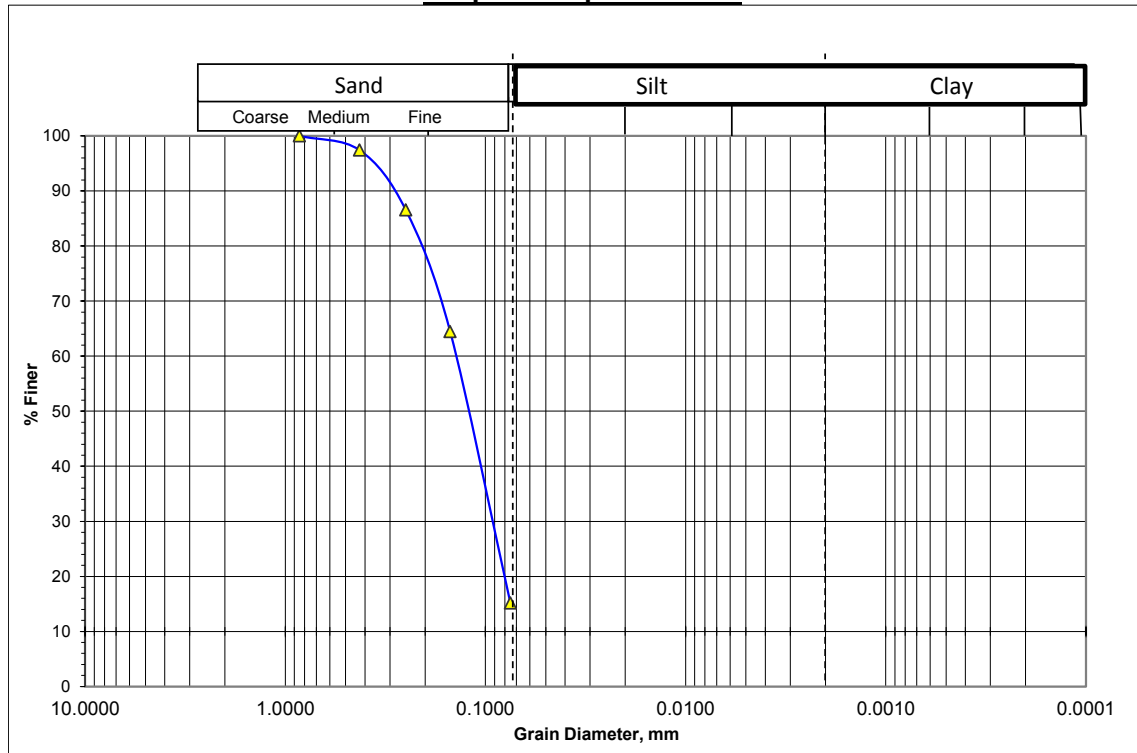
Sampled Date: 30/01/2016

Sample No : D-2

Test Date : 10/04/2016

Depth (m) : 3.0

Graphical Representation:



Fines or % of silt and clay = 15

Mean Diameter, $D_{50} = 0.125$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.62$

% Particles (from the grain -size analysis graph

(0.075mm size) = 85

(0.005mm size) & (0.001mm size) = 15

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Tahirpur University (Birshobidalay) college, Tahirpur Bazar, Tahirpur Pourashava

Bore Hole No: BH-Bg37

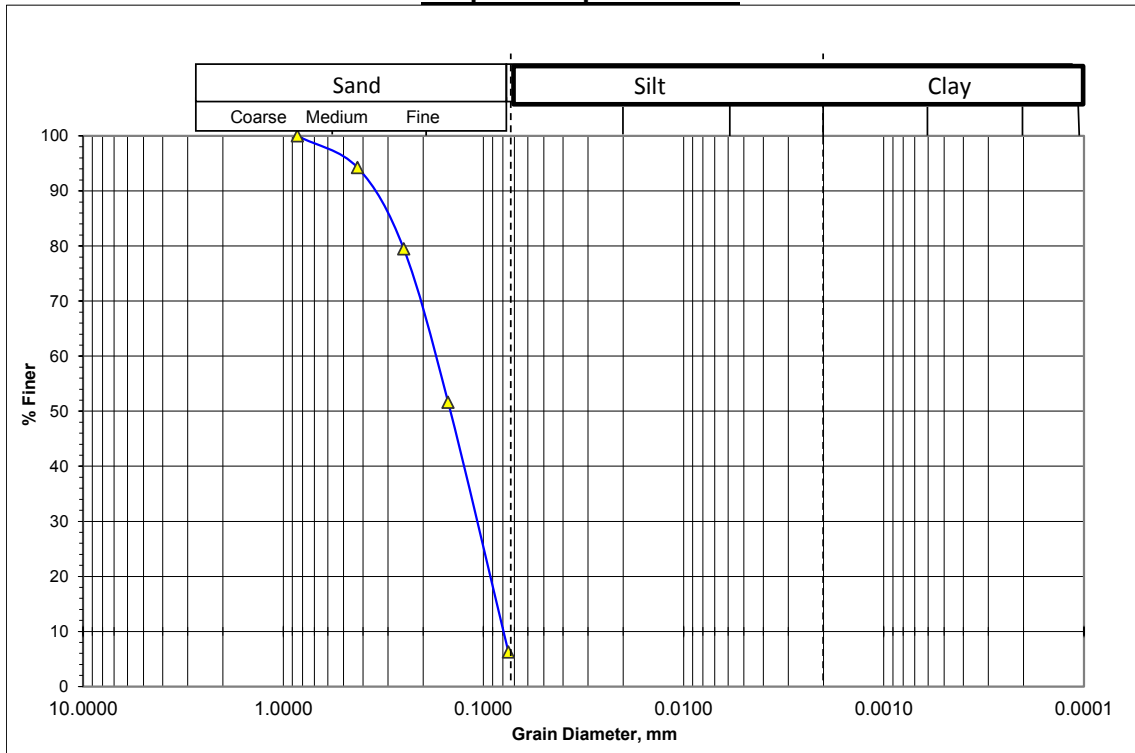
Sampled Date: 30/01/2016

Sample No : D-12

Test Date : 10/04/2016

Depth (m) : 18.0

Graphical Representation:



Fines or % of silt and clay = 6

Mean Diameter, D_{50} = 0.16 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.70$

% Particles (from the grain -size analysis graph

(0.075mm size) = 94

(0.005mm size) & (0.001mm size) = 6

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Talghoria Govt. Primary School, Hamir Kutsha Union

Bore Hole No: BH-Bg39

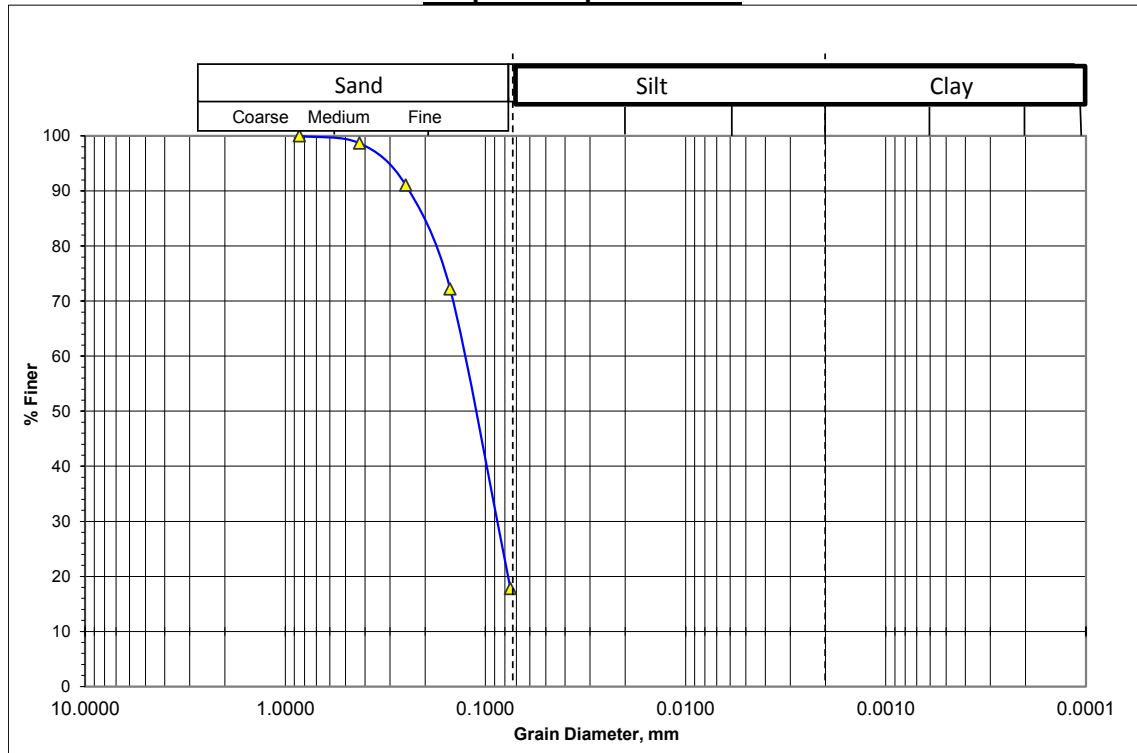
Sampled Date: 28/01/2016

Sample No : D-02

Test Date : 11/04/2016

Depth (m) : 3.0

Graphical Representation:



Fines or % of silt and clay = 17

Mean Diameter, $D_{50} = 0.115$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.60$

% Particles (from the grain -size analysis graph

(0.075mm size) = 83

(0.005mm size) & (0.001mm size) = 17

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Talghoria Govt. Primary School, Hamir Kutsha Union

Bore Hole No: BH-Bg39

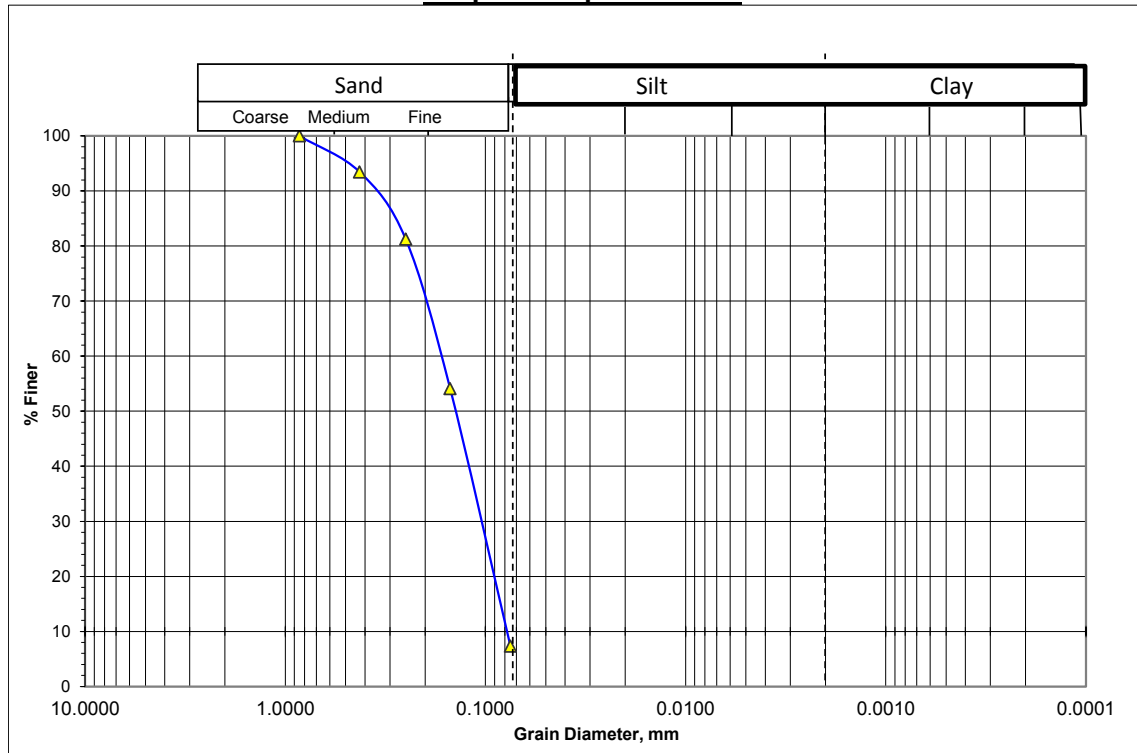
Sampled Date: 28/01/2016

Sample No : D-10

Test Date : 11/04/2016

Depth (m) : 15.0

Graphical Representation:



Fines or % of silt and clay = 7

Mean Diameter, D_{50} = 0.15 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.68

% Particles (from the grain -size analysis graph

(0.075mm size) = 93

(0.005mm size) & (0.001mm size) = 7

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Choukali Govt. Primary School, Choukali Bazar, Goalkandi Union

Bore Hole No: BH-Bg40

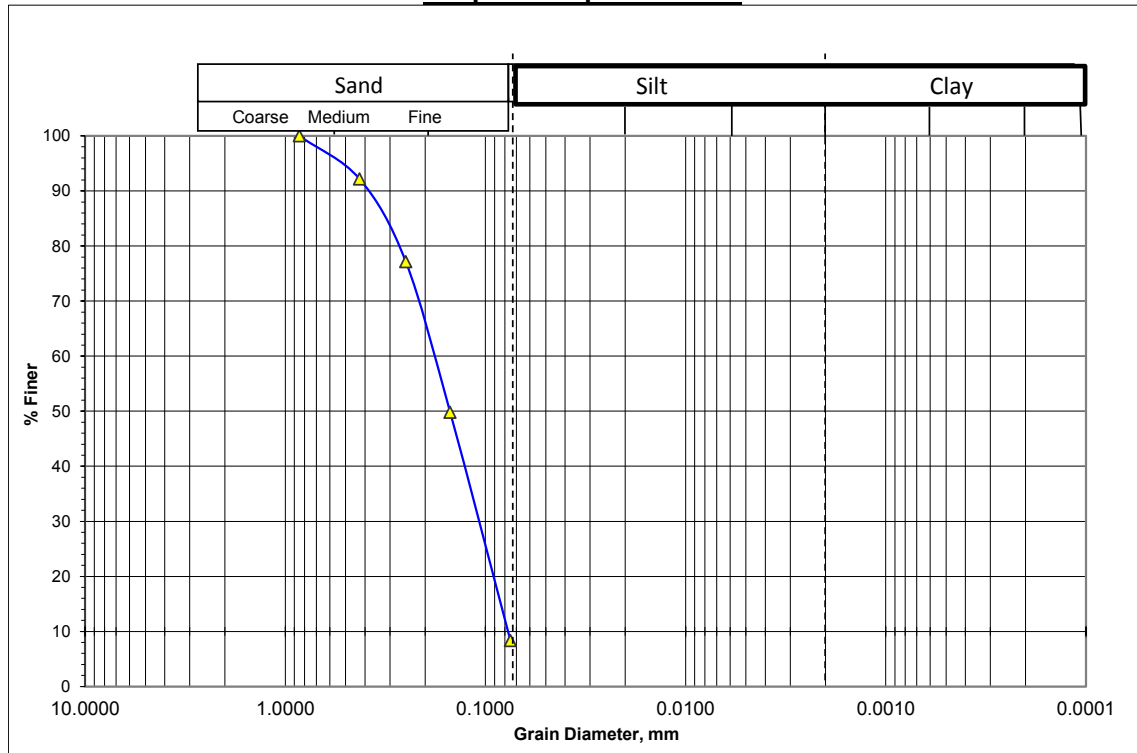
Sampled Date: 29/01/2016

Sample No : D-09

Test Date : 08/04/2016

Depth (m) : 13.5

Graphical Representation:



Fines or % of silt and clay = 8

Mean Diameter, D_{50} = 0.16 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.70$

% Particles (from the grain -size analysis graph

(0.075mm size) = 92

(0.005mm size) & (0.001mm size) = 8

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Near Gobinda Para Union Complex, Gobinda Para Union

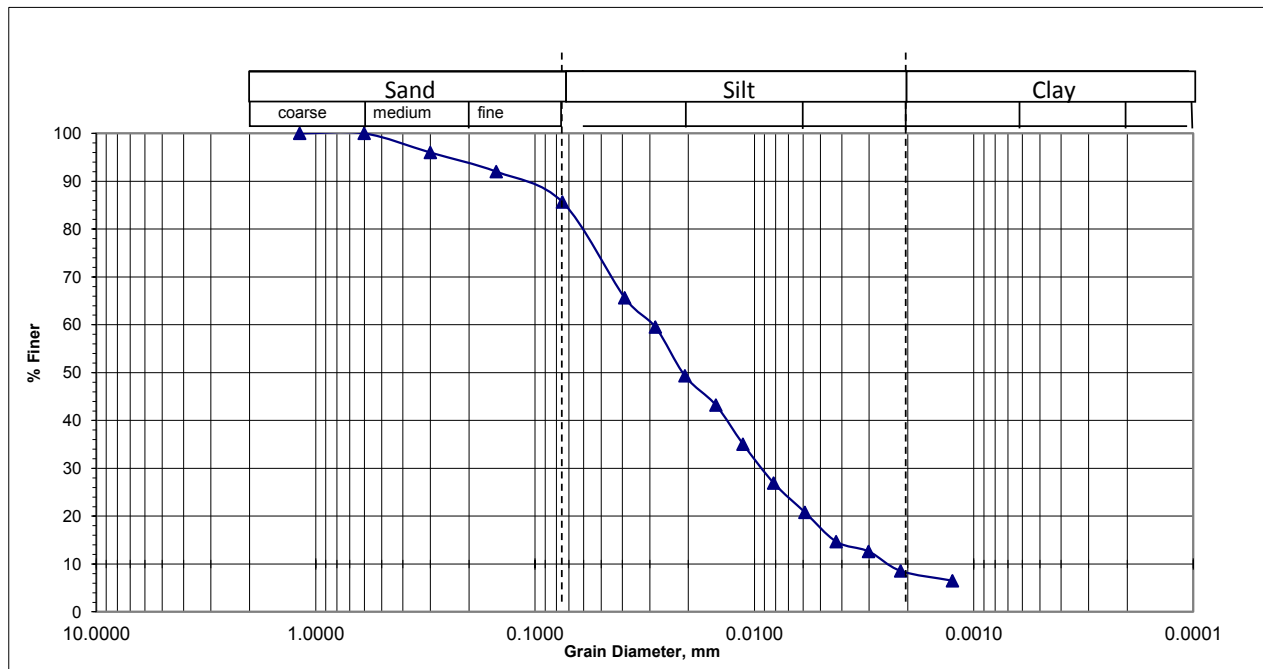
Bore Hole No : BH Bg01 Sample No. D2

Sampled Date: 06/02/2016

Depth (m) : 3.0

Test Date : 22/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.022 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.26

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =15%, Silt (0.005mm size)= 77% & Clay (0.001mm size) = 8%

Test Date : 22/04/2016

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GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Near Gobinda Para Union Complex, Gobinda Para Union

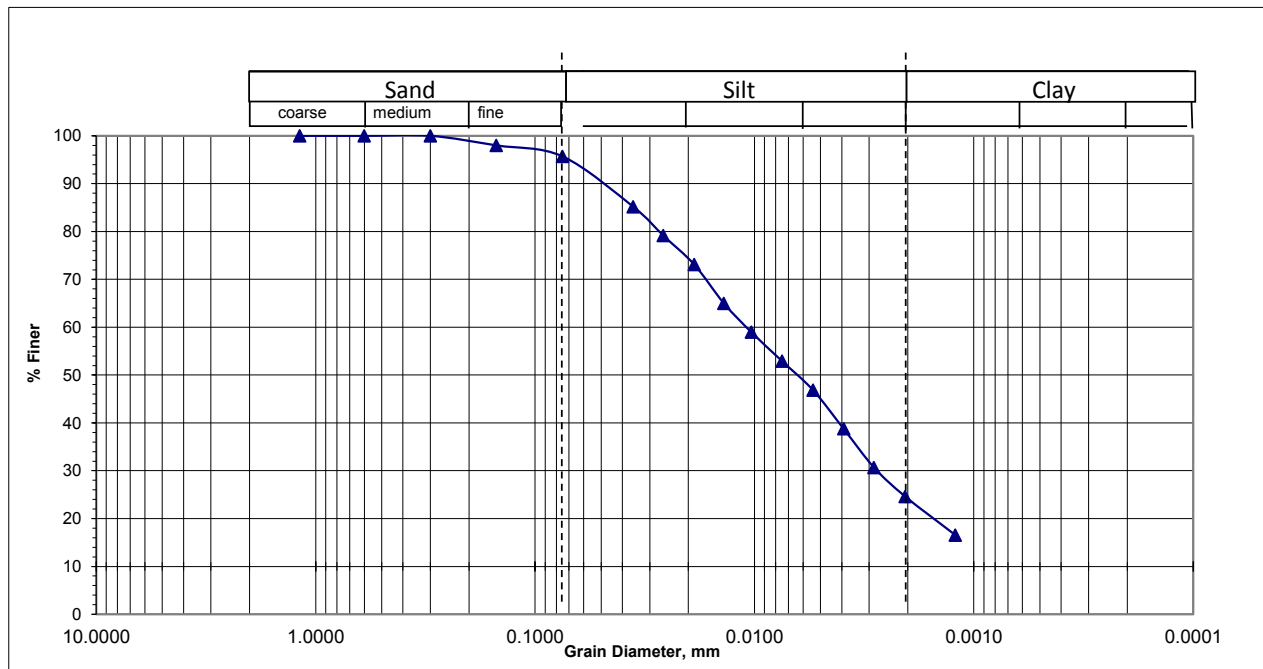
Bore Hole No : BH Bg01 Sample No. D15

Sampled Date: 06/02/2016

Depth (m) : 22.5

Test Date : 22/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.007 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.14

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =5%, Silt (0.005mm size)= 72% & Clay (0.001mm size) = 23%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Hatkhugipur High School, Hatkhugipur Bazar, Near Auch Para union complex

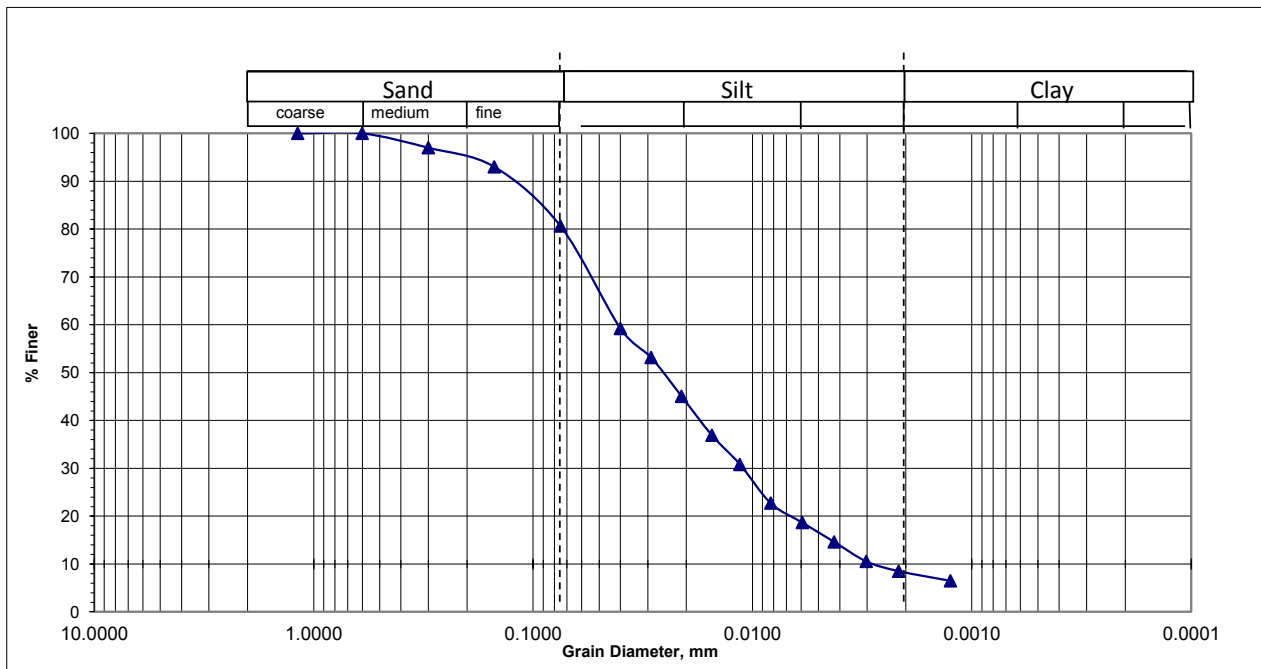
Bore Hole No : BH Bg02 Sample No. D2

Sampled Date: 07/02/2016

Depth (m) : 3.0

Test Date : 22/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.026 mm

Silt-Factor, $f = 1.76\sqrt{D_{50}}$ = 0.28

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =20%, Silt (0.005mm size)= 72% & Clay (0.001mm size) = 8%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Hatkhugipur High School, Hatkhugipur Bazar, Near Auch Para union complex

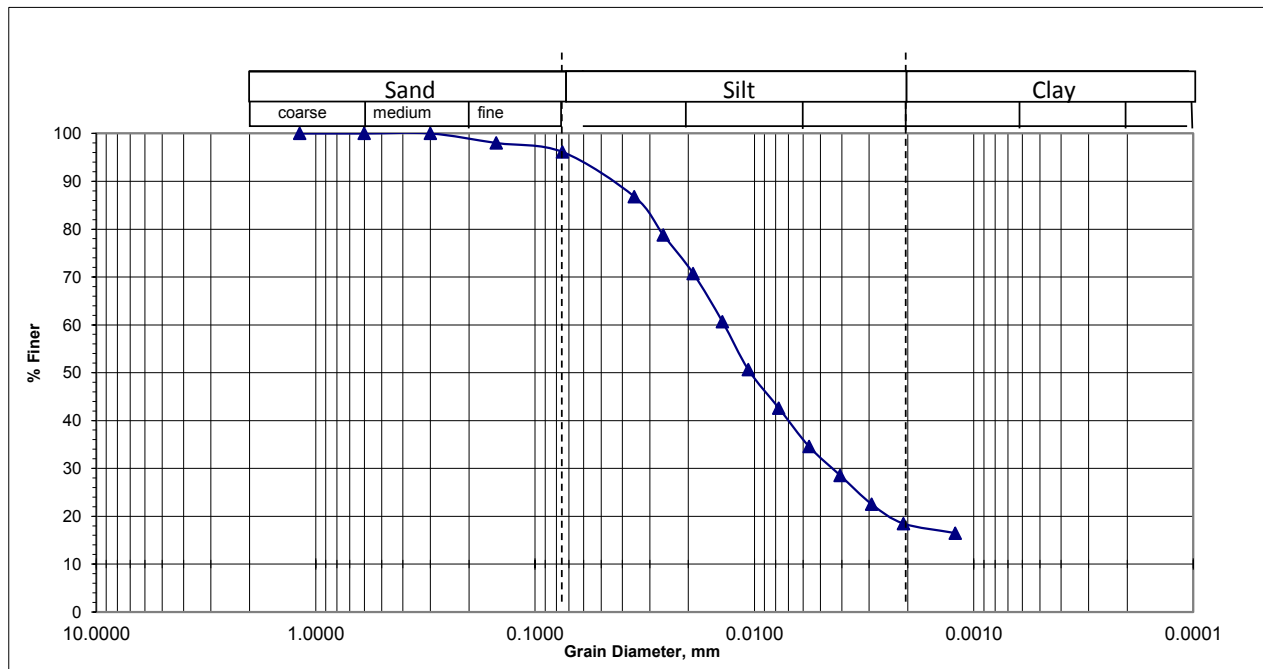
Bore Hole No : BH Bg02 Sample No. D6

Sampled Date: 07/02/2016

Depth (m) : 9.0

Test Date : 22/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.012 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.19$

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =4%, Silt (0.005mm size)= 78% & Clay (0.001mm size) = 18%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Hatkhugipur High School, Hatkhugipur Bazar, Near Auch Para union complex

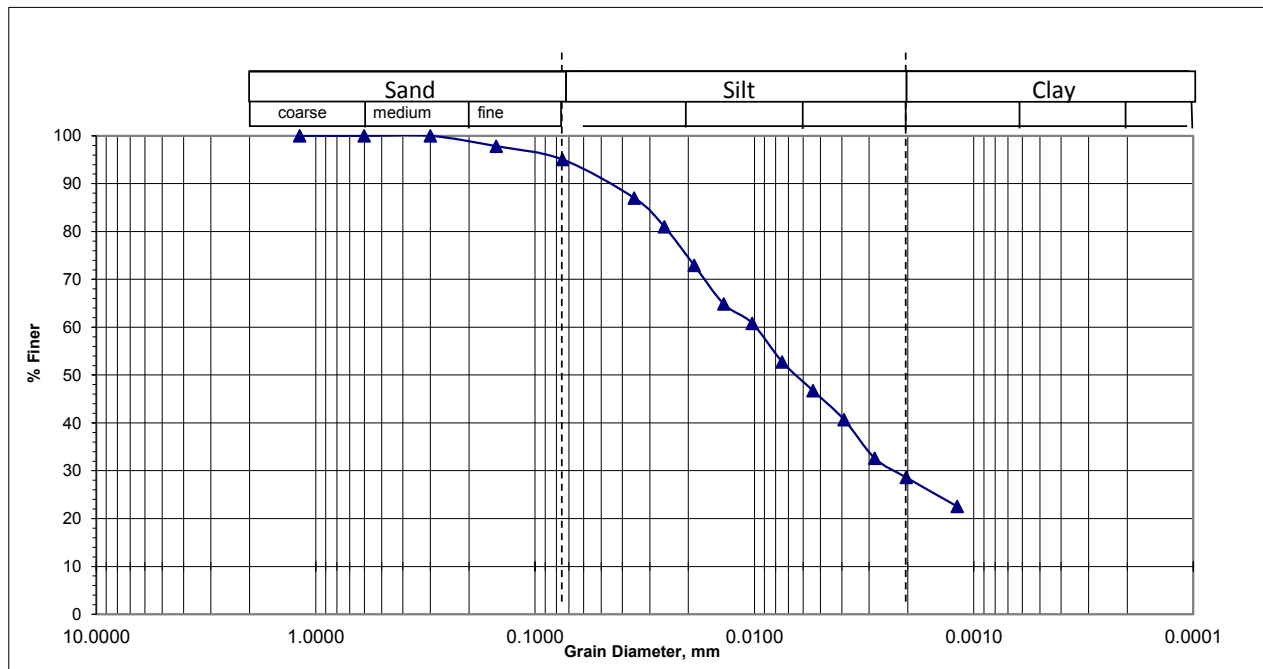
Bore Hole No : BH Bg02 Sample No. D14

Sampled Date: 07/02/2016

Depth (m) : 21.0

Test Date : 22/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.007 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.14

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =5%, Silt (0.005mm size)= 67% & Clay (0.001mm size) = 28%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Rokittepara Govt. primary school, Palopara, Auch Para Union

Bore Hole No : BH 03

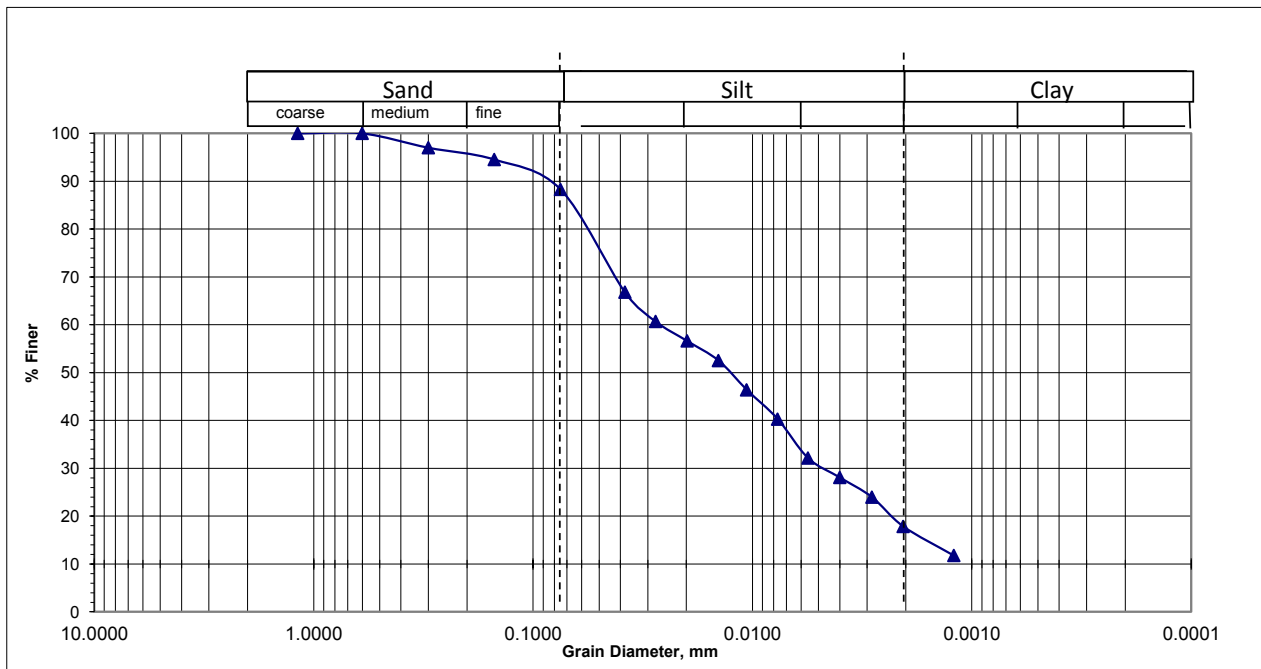
Sample No. D2

Sampled Date: 08/02/2016

Depth (m) : 3.0

Test Date : 22/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.013 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.20

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =13%, Silt (0.005mm size)= 70% & Clay (0.001mm size) = 17%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Rokittepara Govt. primary school, Palopara, Auch Para Union

Bore Hole No : BH 03

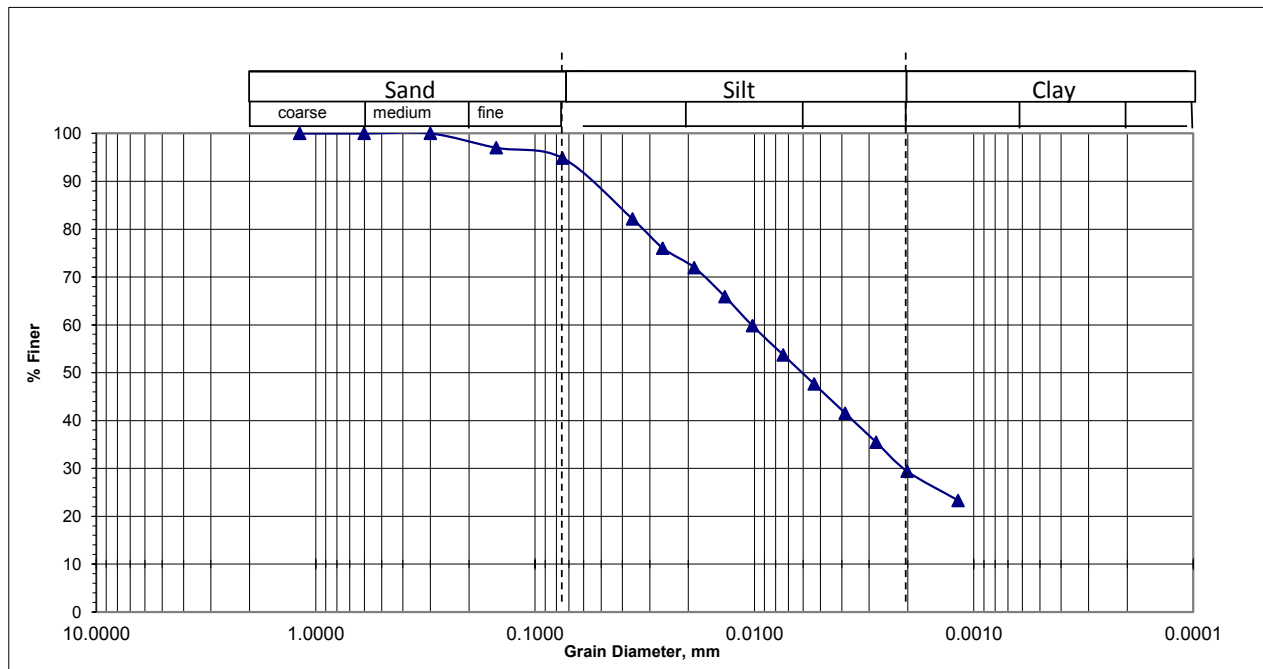
Sample No. D5

Sampled Date: 08/02/2016

Depth (m) : 7.5

Test Date : 22/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.006 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.14

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =5%, Silt (0.005mm size)= 66% & Clay (0.001mm size) = 29%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Rokittepara Govt. primary school, Palopara, Auch Para Union

Bore Hole No : BH 03

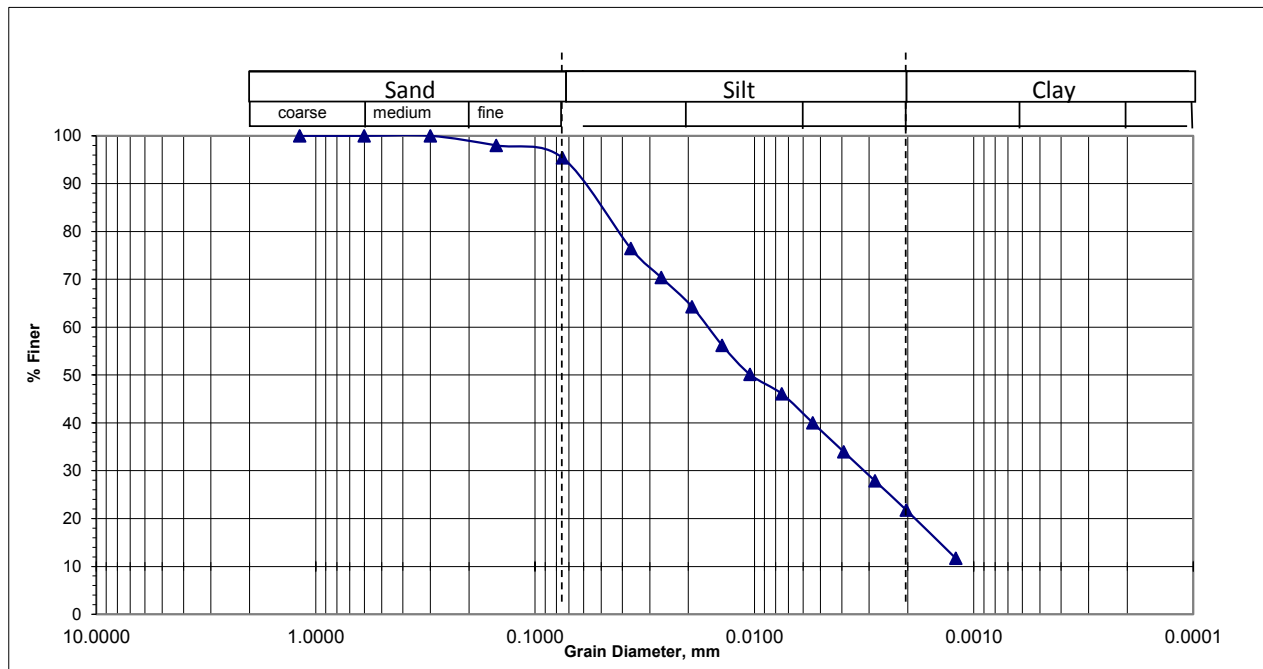
Sample No. D12

Sampled Date: 08/02/2016

Depth (m) : 18.0

Test Date : 22/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.01 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.18

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =5%, Silt (0.005mm size)= 74% & Clay (0.001mm size) = 21%

Depth (m) : 4.5 Test Date : 23/04/2016

Sand			Silt			Clay		
coarse	medium	fine						

Grain size distribution curve showing % Finer versus Grain Diameter (mm). The curve indicates that approximately 100% of the soil is finer than 0.075 mm, and approximately 22% is finer than 0.0075 mm. The soil is classified as Clay.

Sand (0.075mm size)=4%, Silt (0.005mm size)=73% & Clay (0.001mm size) = 23%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Ganggopara Girls School, Hat Ganggopara, Auch Para Union

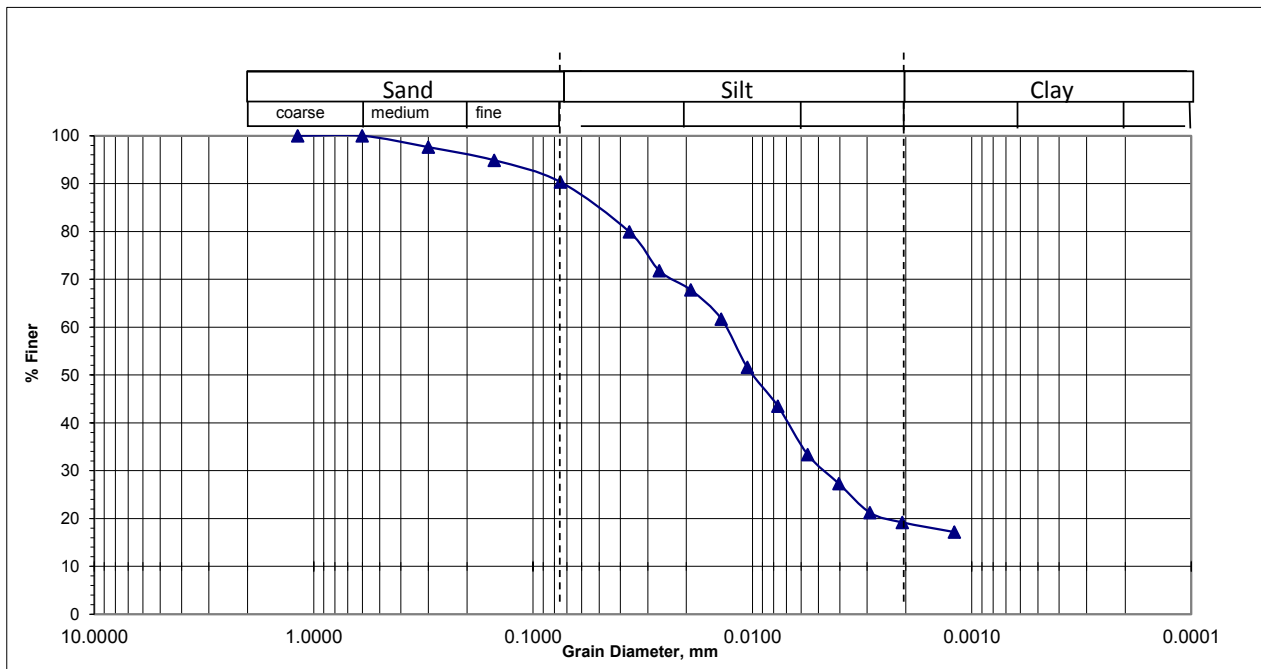
Bore Hole No : BH Bg06 Sample No. D2

Sampled Date: 04/02/2016

Depth (m) : 3.0

Test Date : 23/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.01 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.18$

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =10%, Silt (0.005mm size)= 72% & Clay (0.001mm size) = 18%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Ganggopara Girls School, Hat Ganggopara, Auch Para Union

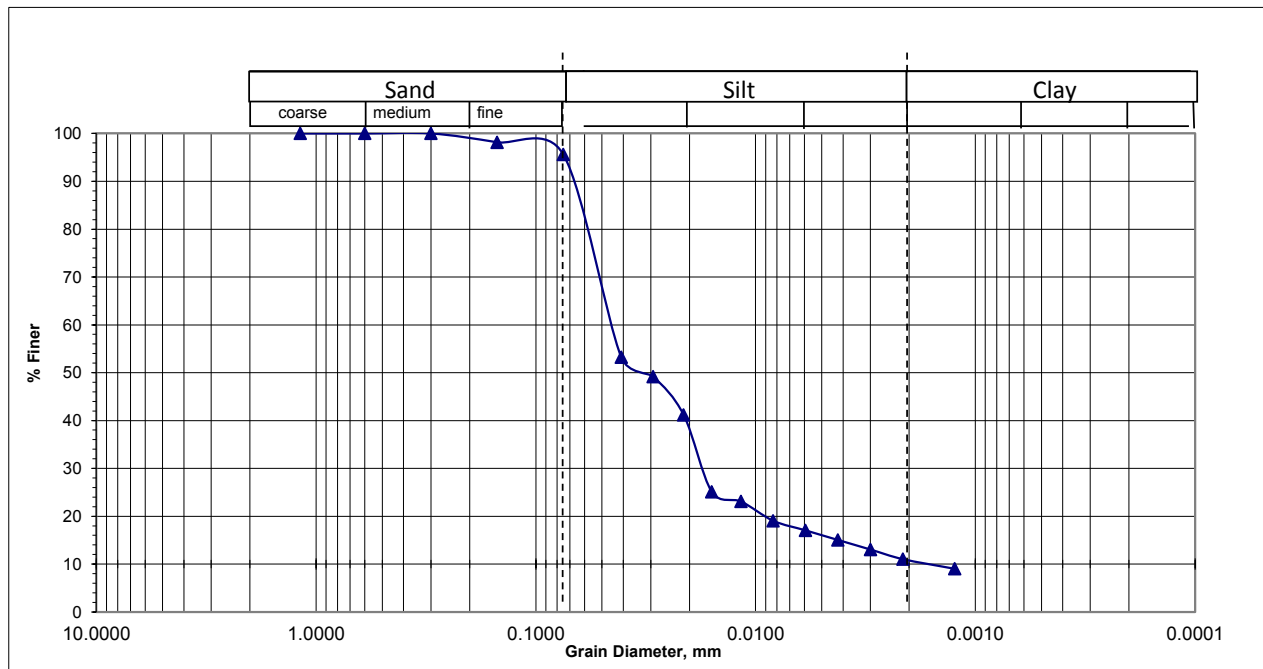
Bore Hole No : BH Bg06 Sample No. D5

Sampled Date: 04/02/2016

Depth (m) : 7.5

Test Date : 23/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.033 mm

Silt-Factor, $f = 1.76\sqrt{D_{50}}$ = 0.32

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =4%, Silt (0.005mm size)= 84% & Clay (0.001mm size) = 12%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Uttar Jamalpur Govt. primary school, Uttar Jamalpur Fatepur, Sondanga

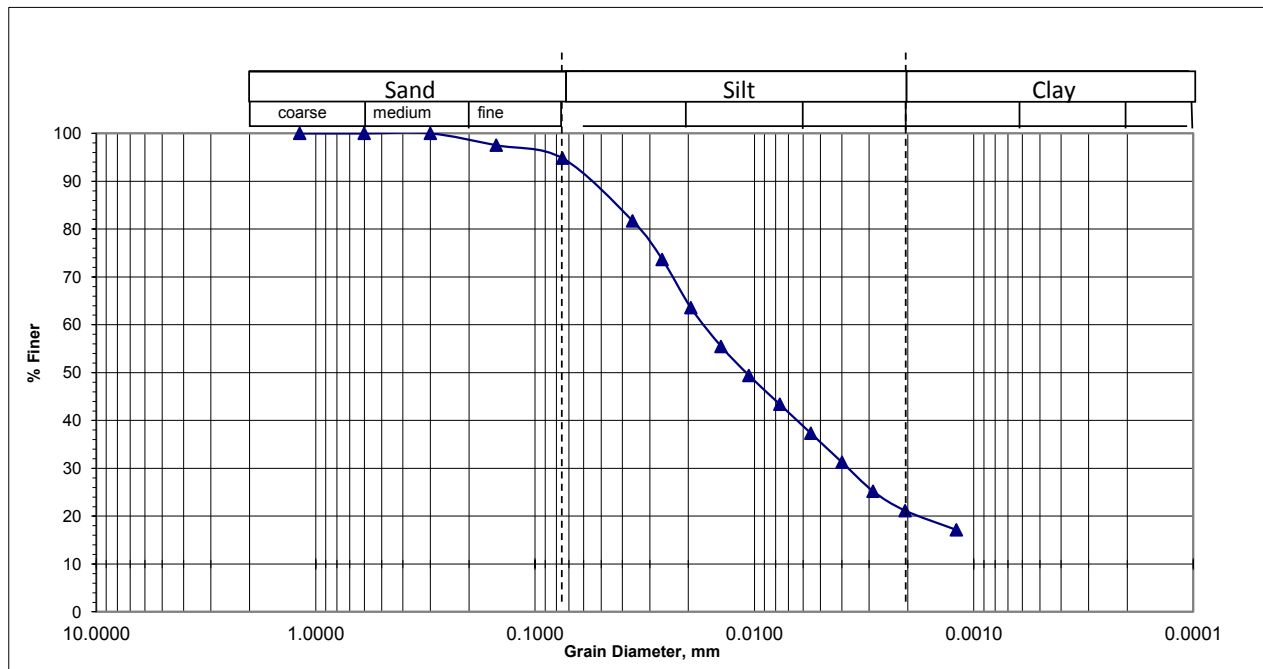
Bore Hole No : BH Bg08 Sample No. D6

Sampled Date: 04/02/2016

Depth (m) : 9.0

Test Date : 13/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.012 mm

Silt-Factor, $f = 1.76\sqrt{D_{50}}$ = 0.19

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =6%, Silt (0.005mm size)= 73% & Clay (0.001mm size) = 21%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Mirpur Dimukki Primary and High School, jolapara Hat, Dwippur Union

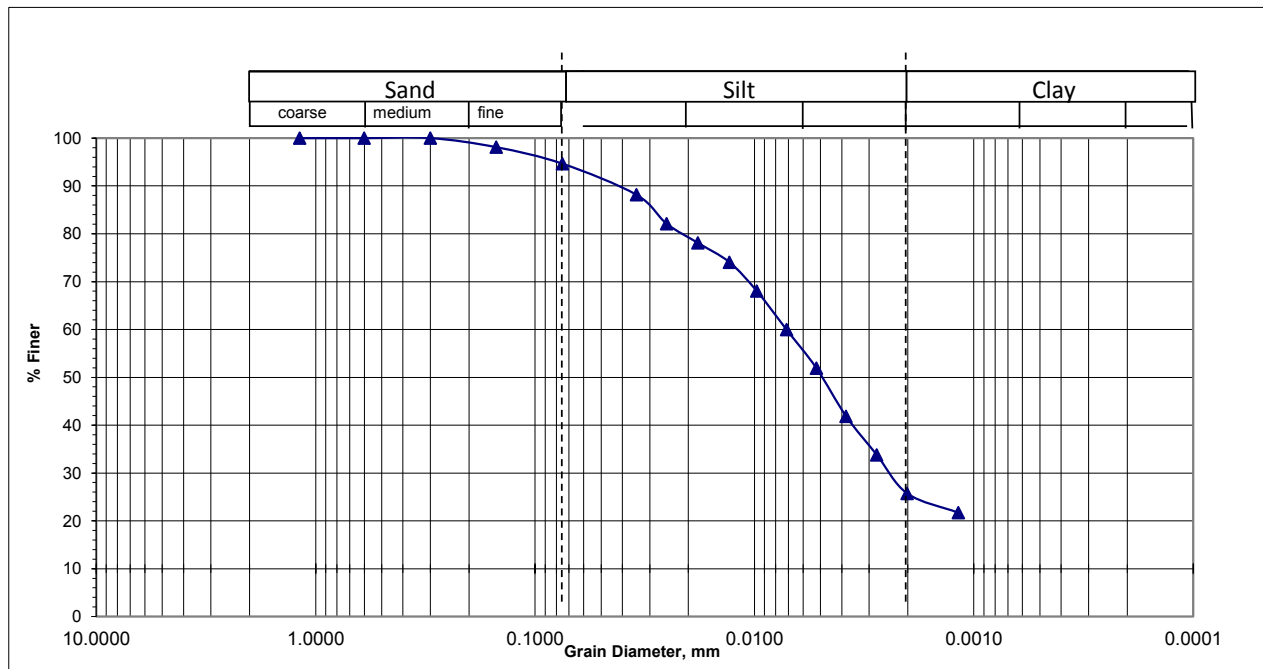
Bore Hole No : BH Bg09 Sample No. D6

Sampled Date: 03/02/2016

Depth (m) : 9.0

Test Date : 13/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.005 mm

Silt-Factor, $f = 1.76\sqrt{D_{50}}$ = 0.12

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =6%, Silt (0.005mm size)= 68% & Clay (0.001mm size) = 26%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Byegacha Govt. primary and high School, Byegacha Bazar, Subhadanga

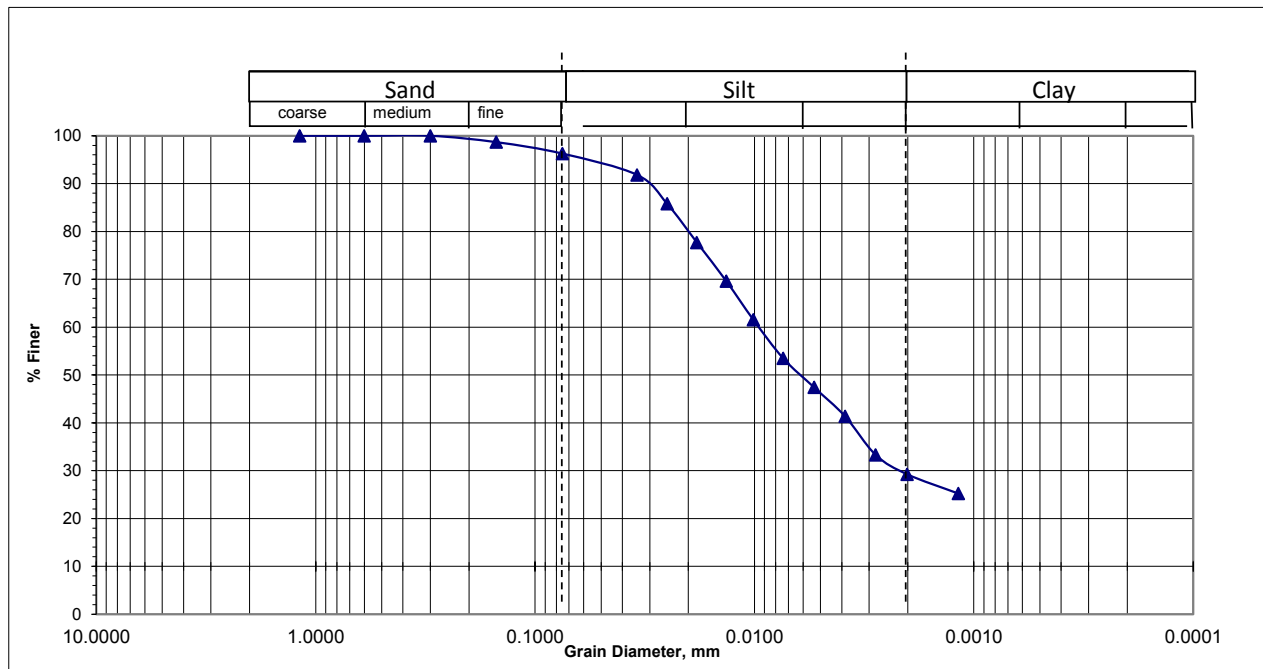
Bore Hole No : BH Bg10 Sample No. D5

Sampled Date: 03/02/2016

Depth (m) : 7.5

Test Date : 15/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.006 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.14

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =4%, Silt (0.005mm size)= 68% & Clay (0.001mm size) = 28%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Machmail High School, Machmail Bazar, Subhadanga Union

Bore Hole No : BH 11

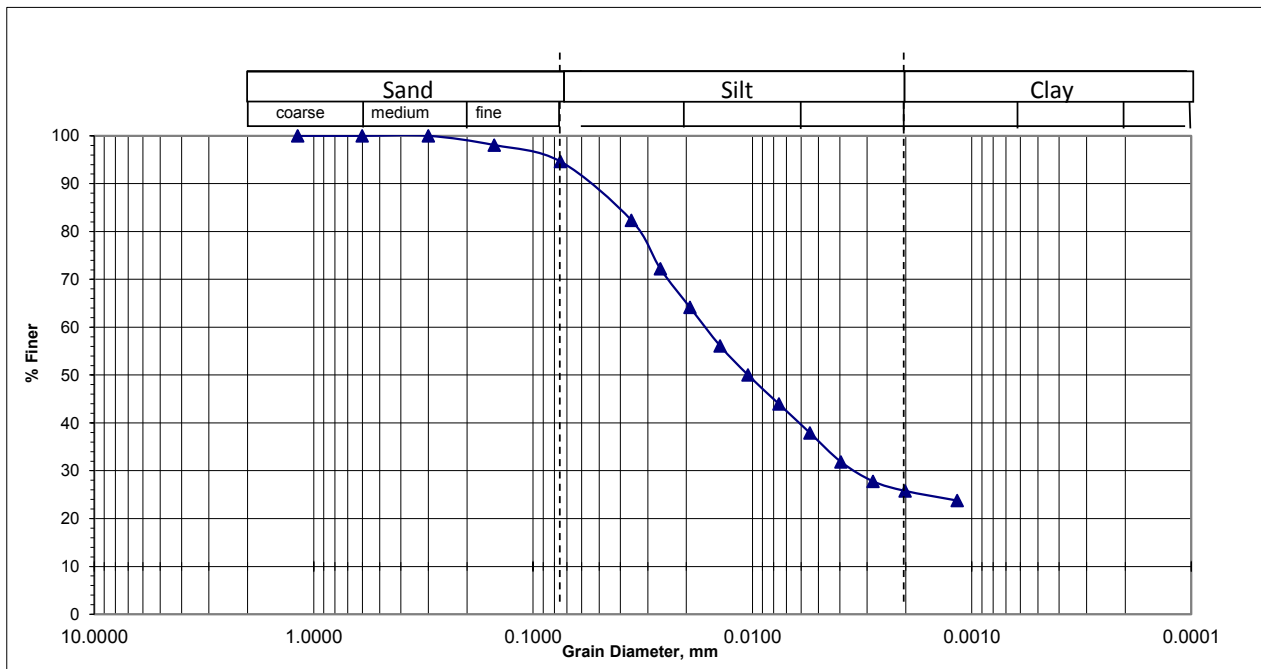
Sample No. D8

Sampled Date: 09/02/2016

Depth (m) : 12.0

Test Date : 16/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.01 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.18

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =6%, Silt (0.005mm size)= 69% & Clay (0.001mm size) = 25%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Mugaipara High School, Mugaipara Bazar, Auch Para Union

Bore Hole No : BH 12

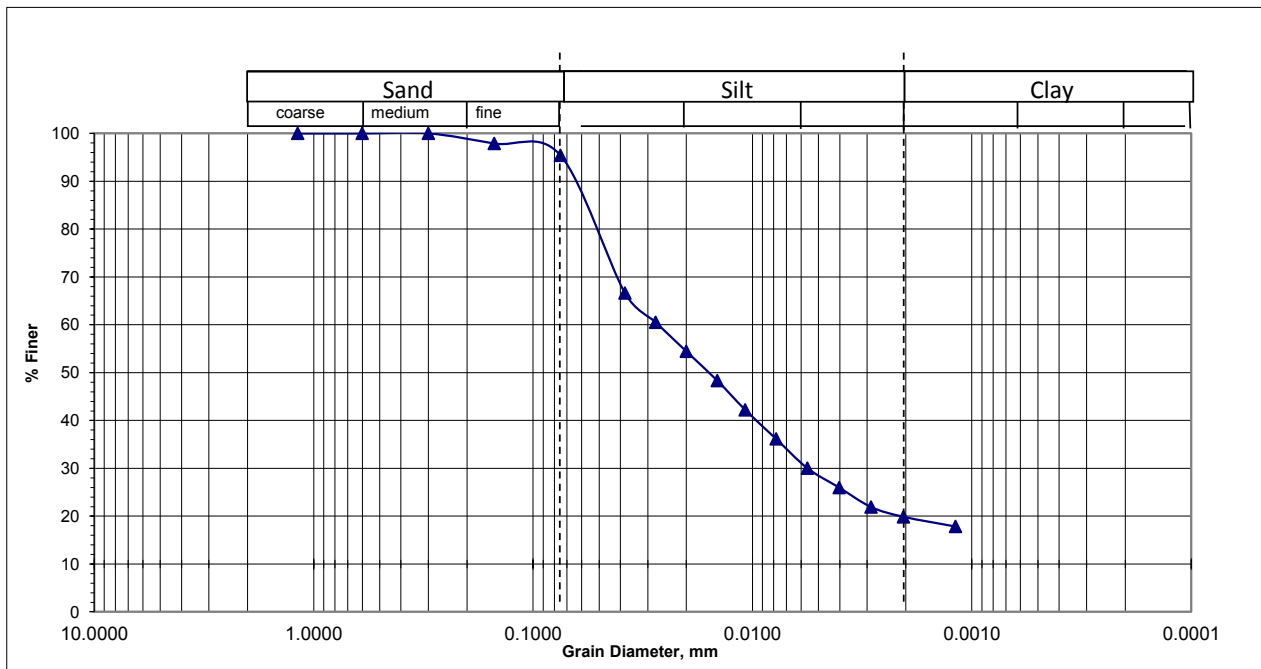
Sample No. D3

Sampled Date: 08/02/2016

Depth (m) : 4.5

Test Date : 16/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.017 mm

Silt-Factor, $f = 1.76\sqrt{D_{50}}$ = 0.23

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =5%, Silt (0.005mm size)= 75% & Clay (0.001mm size) = 20%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Doulatpur Madhomik School, Madha Doulatpur, Subhadanga Union

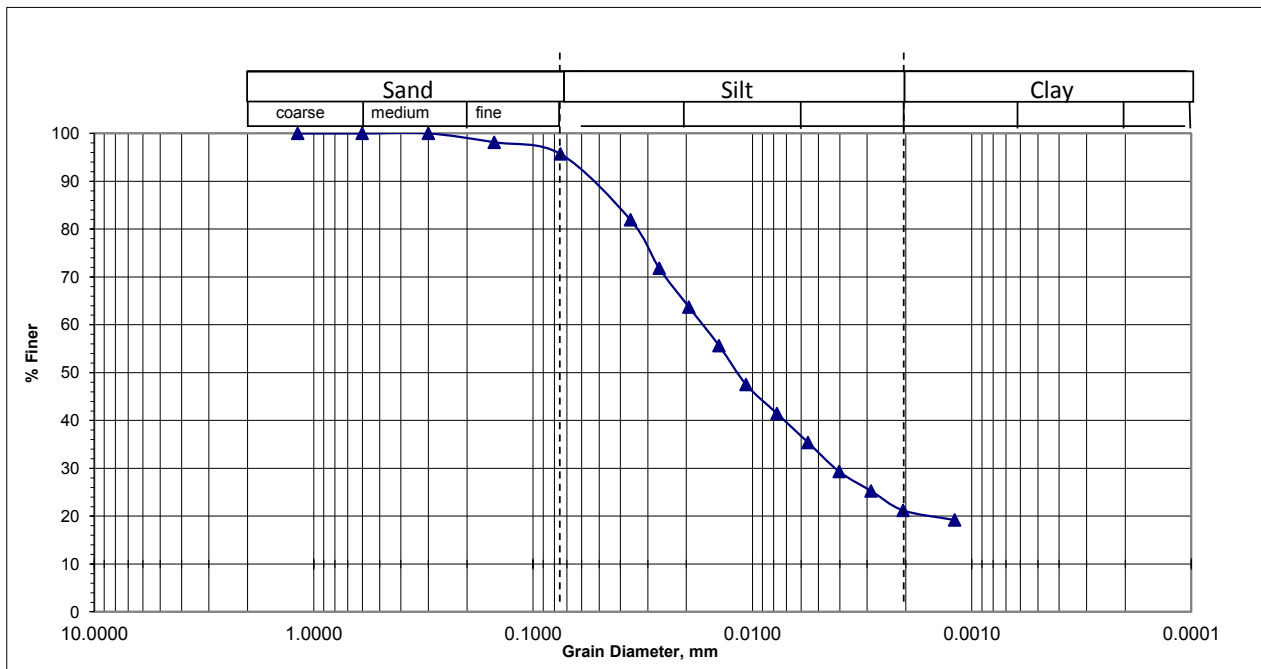
Bore Hole No : BH Bg17 Sample No. D8

Sampled Date: 05/02/2016

Depth (m) : 12.0

Test Date : 16/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.013 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.20

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =4%, Silt (0.005mm size)= 74% & Clay (0.001mm size) = 22%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Gonganarayanpur Namajgram Govt. Primary School, Kumanitola, Ganipur

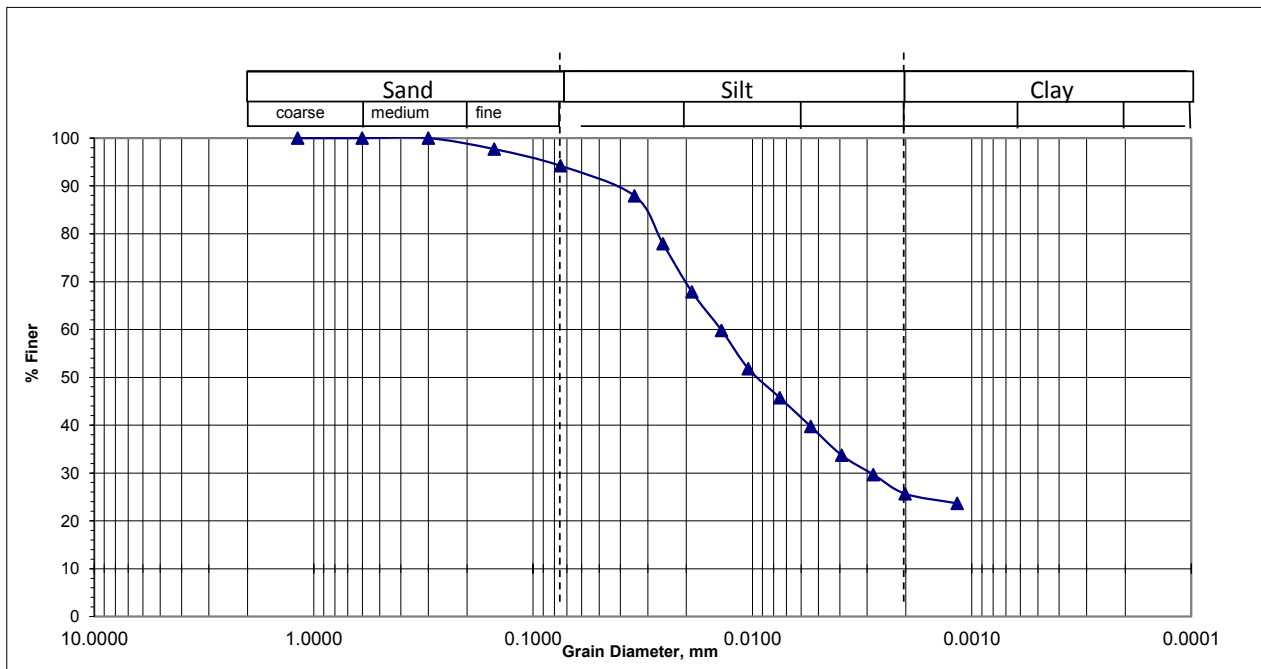
Bore Hole No : BH Bg19 Sample No. D7

Sampled Date: 07/02/2016

Depth (m) : 10.5

Test Date : 16/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.01 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.17

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =6%, Silt (0.005mm size)= 69% & Clay (0.001mm size) = 25%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : 21 nos. Bara Bihanali govt. School, Bara Bihanali Union

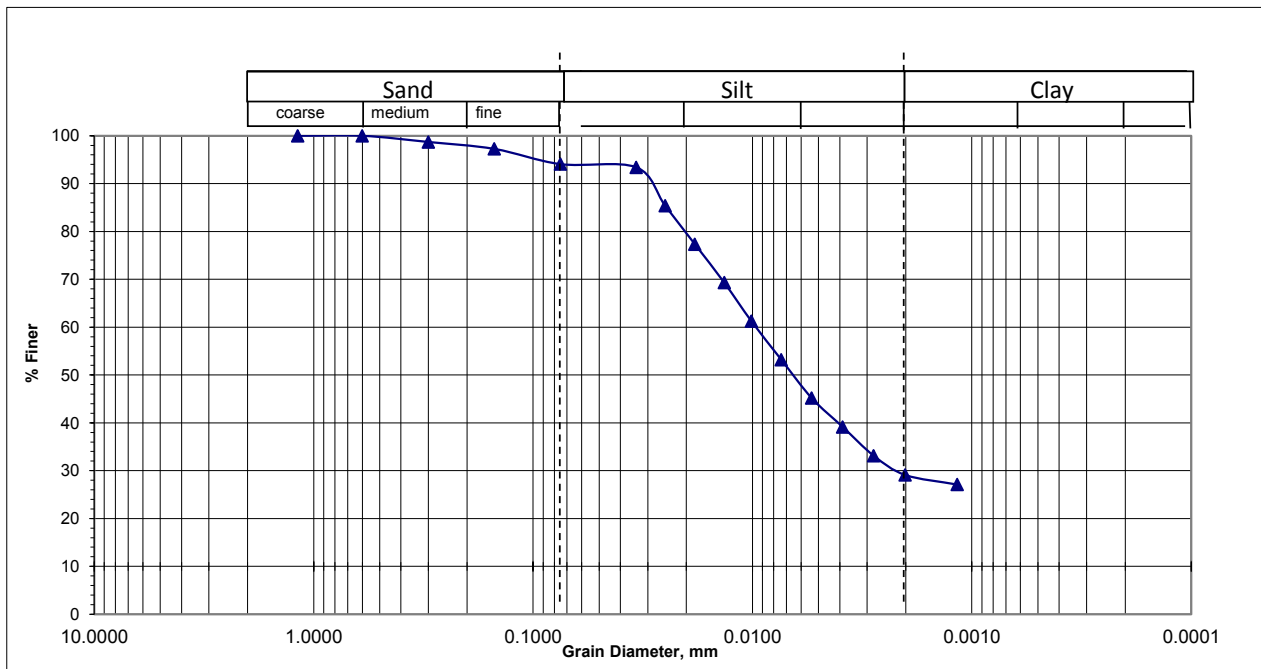
Bore Hole No : BH Bg20 Sample No. D6

Sampled Date: 02/02/2016

Depth (m) : 9.0

Test Date : 16/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.007 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.14

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =6%, Silt (0.005mm size)= 66% & Clay (0.001mm size) = 28%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Uttar akdala Govt. Primary School, Uttar akdala Bazar, Bhabanigong Pourashava

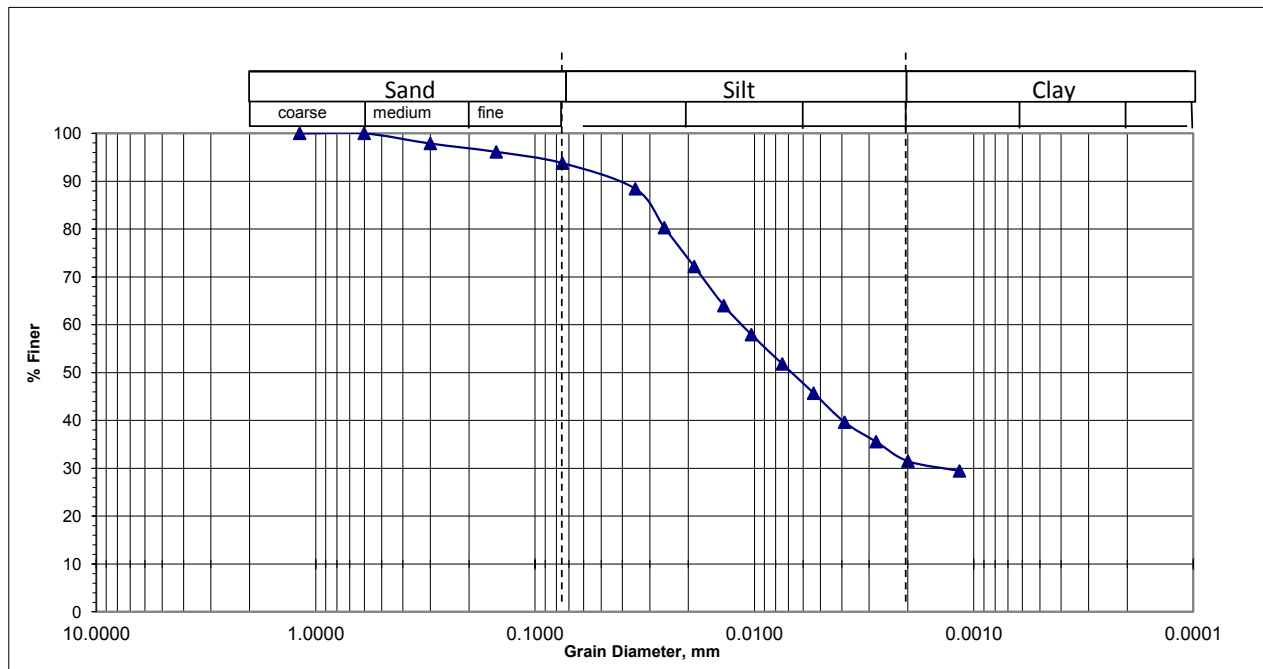
Bore Hole No : BH Bg21 Sample No. D5

Sampled Date: 01/02/2016

Depth (m) : 7.5

Test Date : 16/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.007 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.15

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =7%, Silt (0.005mm size)= 61% & Clay (0.001mm size) = 32%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Nandanpur(Chekamara) Bazar, Mohila Dakhil Madrasha, Basu Para Union

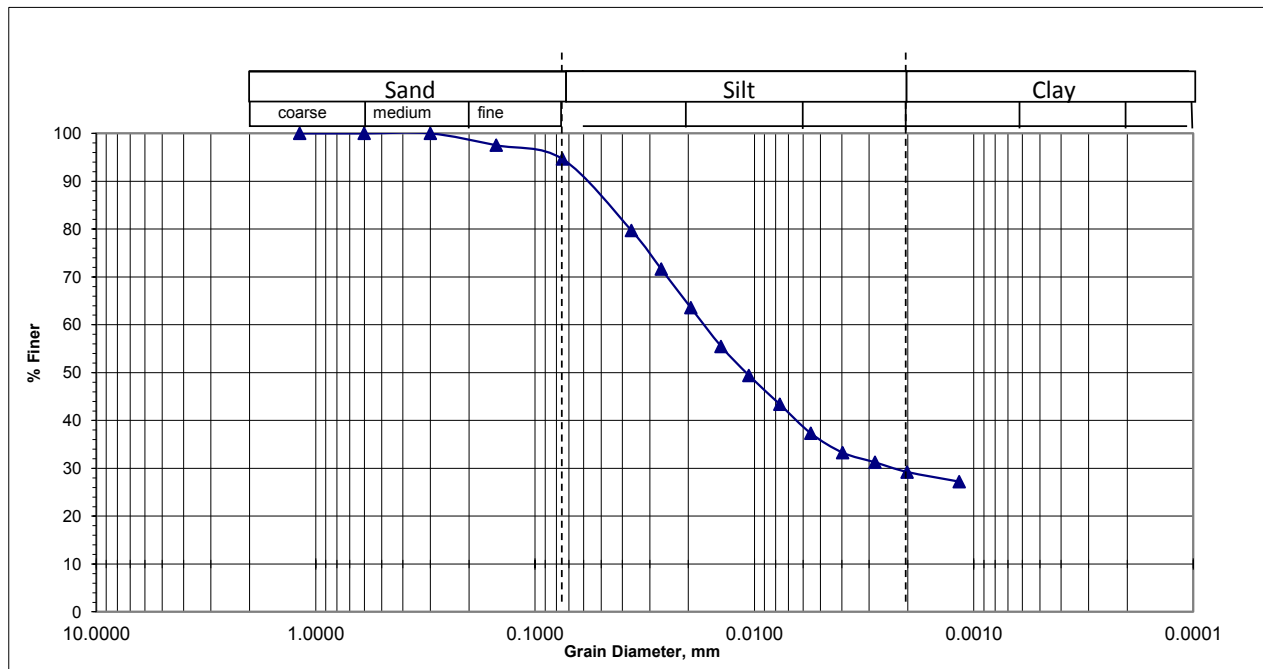
Bore Hole No : BH Bg22 Sample No. D6

Sampled Date: 02/02/2016

Depth (m) : 9.0

Test Date : 16/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.012 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.19

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =6%, Silt (0.005mm size)= 65% & Clay (0.001mm size) = 29%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Ganipur Union Complex office, Hasnipur Bazar, Ganipur Union

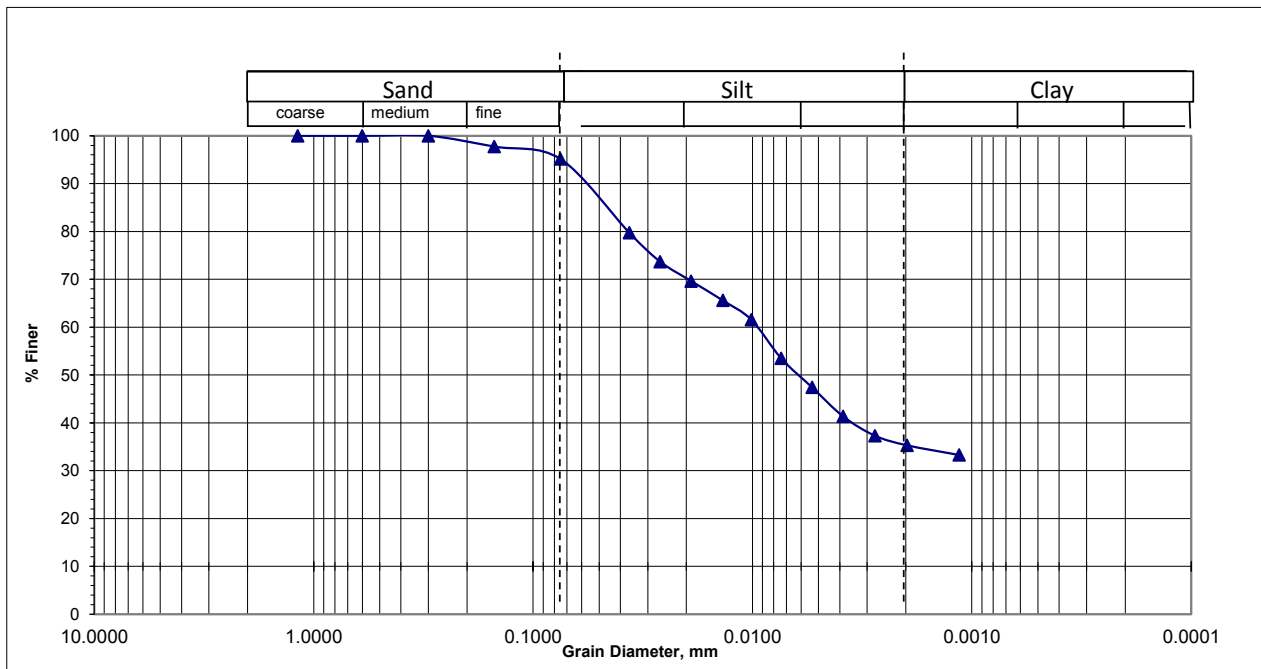
Bore Hole No : BH Bg24 Sample No. D9

Sampled Date: 06/02/2016

Depth (m) : 13.5

Test Date : 16/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.006 mm

Silt-Factor, $f = 1.76 \sqrt{D_{50}}$ = 0.14

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =5%, Silt (0.005mm size)= 60% & Clay (0.001mm size) = 35%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Sahid Sakandar Memorial Adarsho High School, Godaoun Mor, Bhabanigong Pourashava

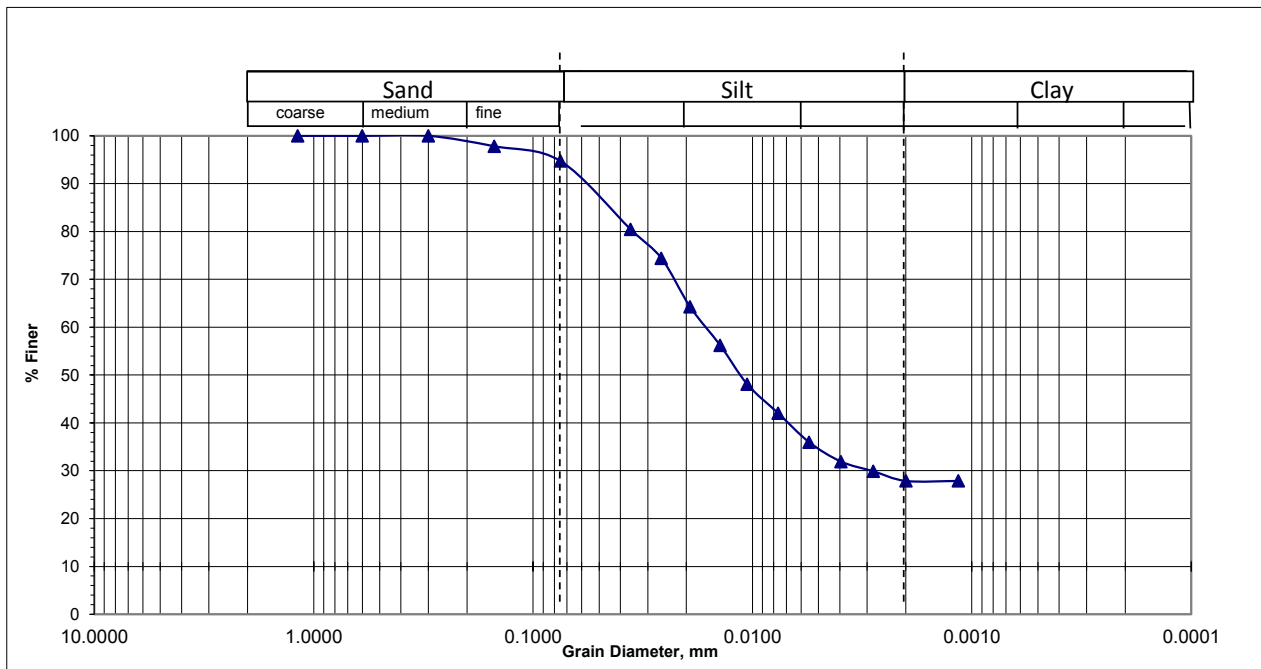
Bore Hole No : BH Bg26 Sample No. D5

Sampled Date: 27/01/2016

Depth (m) : 7.5

Test Date : 15/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.012 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.19

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =5%, Silt (0.005mm size)= 67% & Clay (0.001mm size) = 28%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Bagmara Degree College, Ganipur Union

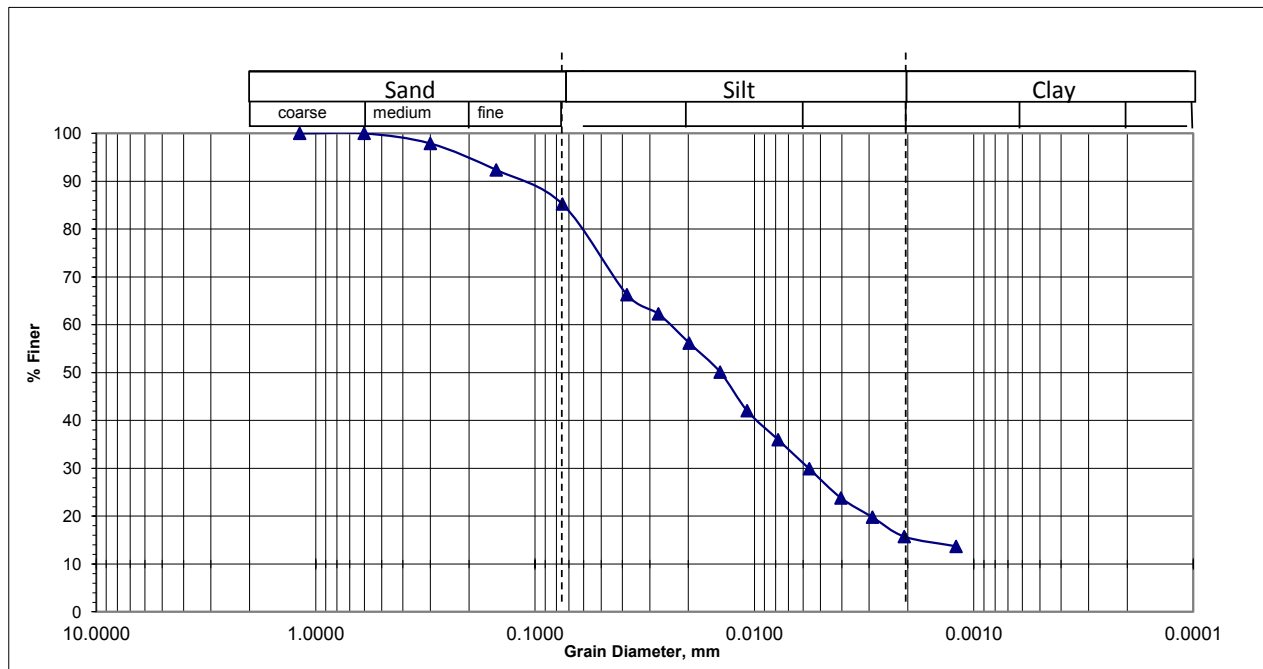
Bore Hole No : BH Bg27 Sample No. D2

Sampled Date: 31/01/2016

Depth (m) : 3.0

Test Date : 15/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.016 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.22

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =15%, Silt (0.005mm size)= 70% & Clay (0.001mm size) = 15%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Shadhopara Madrasha, Near post office, Sreepur Union

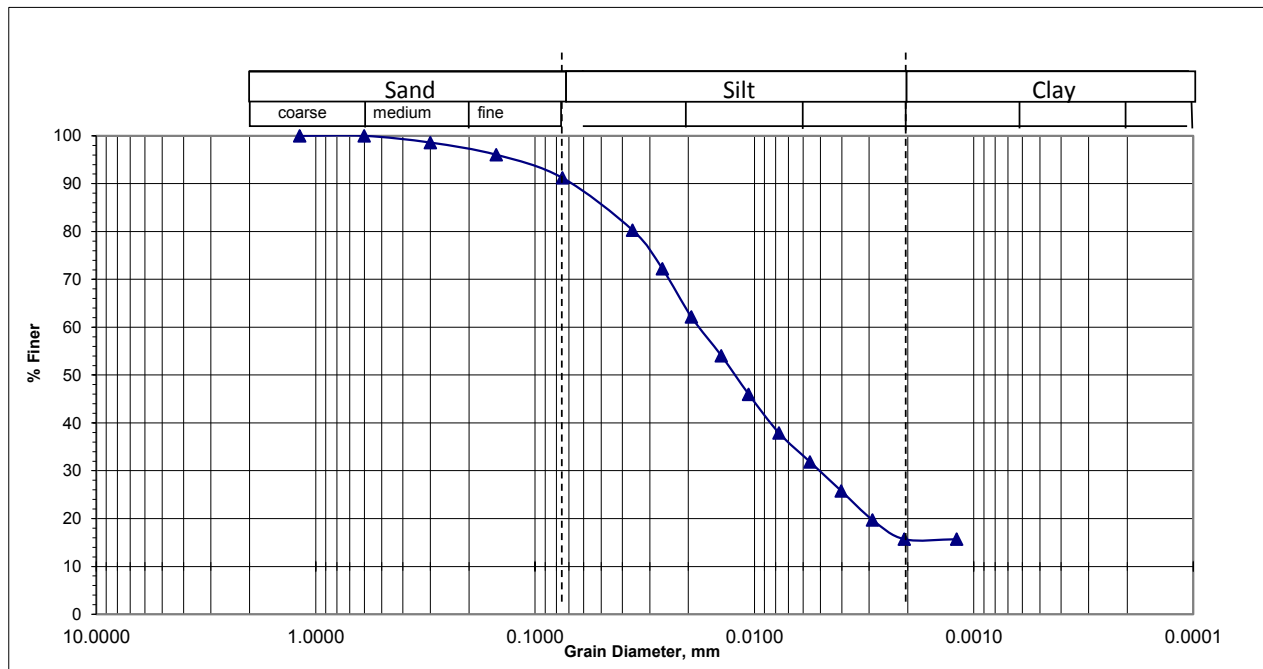
Bore Hole No : BH Bg28 Sample No. D3

Sampled Date: 01/02/2016

Depth (m) : 4.5

Test Date : 13/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.013 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.20$

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =9%, Silt (0.005mm size)= 75% & Clay (0.001mm size) = 16%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Jhikra High School, Jhikra Bazar, Jhikra Union

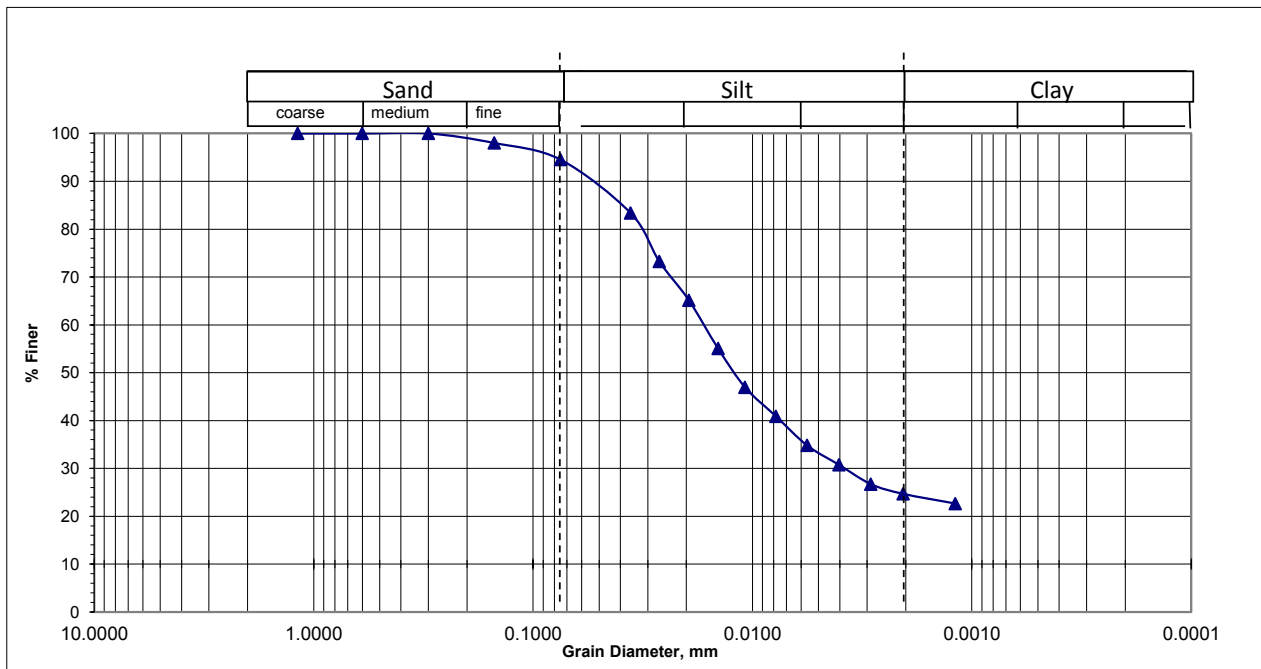
Bore Hole No : BH Bg29 Sample No. D5

Sampled Date: 28/01/2016

Depth (m) : 7.5

Test Date : 13/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.013 mm

Silt-Factor, $f = 1.76\sqrt{D_{50}}$ = 0.20

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =6%, Silt (0.005mm size)= 69% & Clay (0.001mm size) = 25%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Sakoa Bohumuki High School, Sikdar Bazar, Maria Union

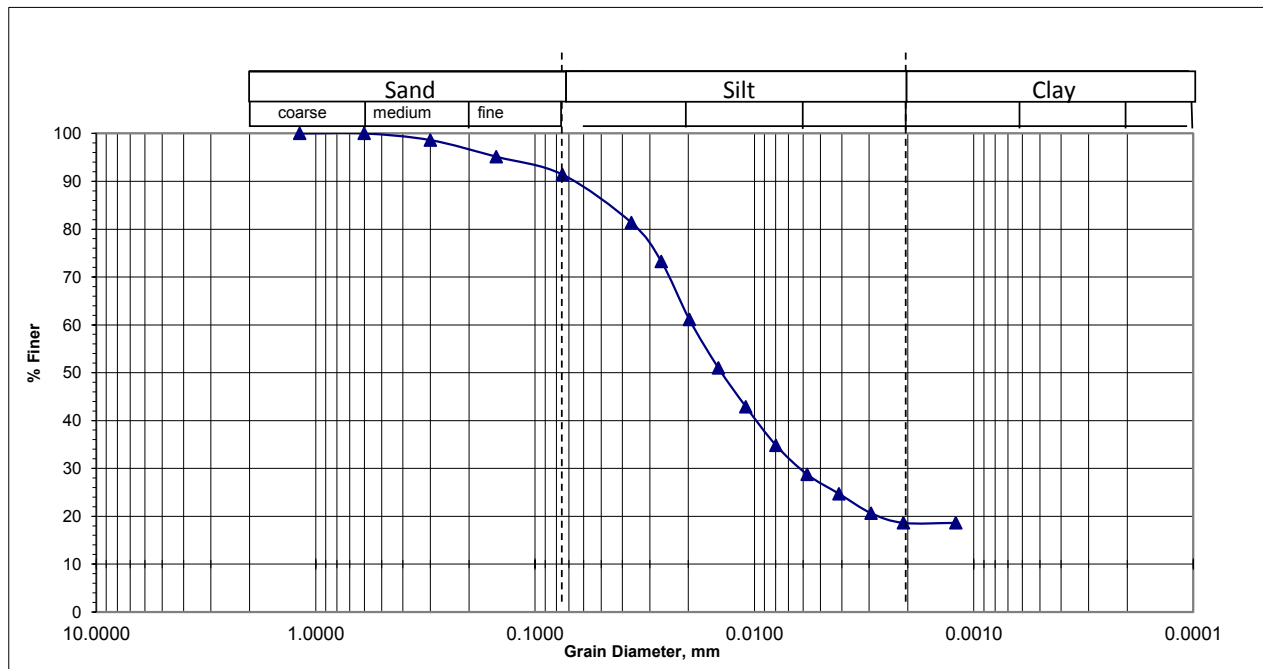
Bore Hole No : BH Bg30 Sample No. D5

Sampled Date: 29/01/2016

Depth (m) : 7.5

Test Date : 15/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.015 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.22

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =9%, Silt (0.005mm size)= 73% & Clay (0.001mm size) = 18%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Gangopara Govt. Primary school, Maria Union

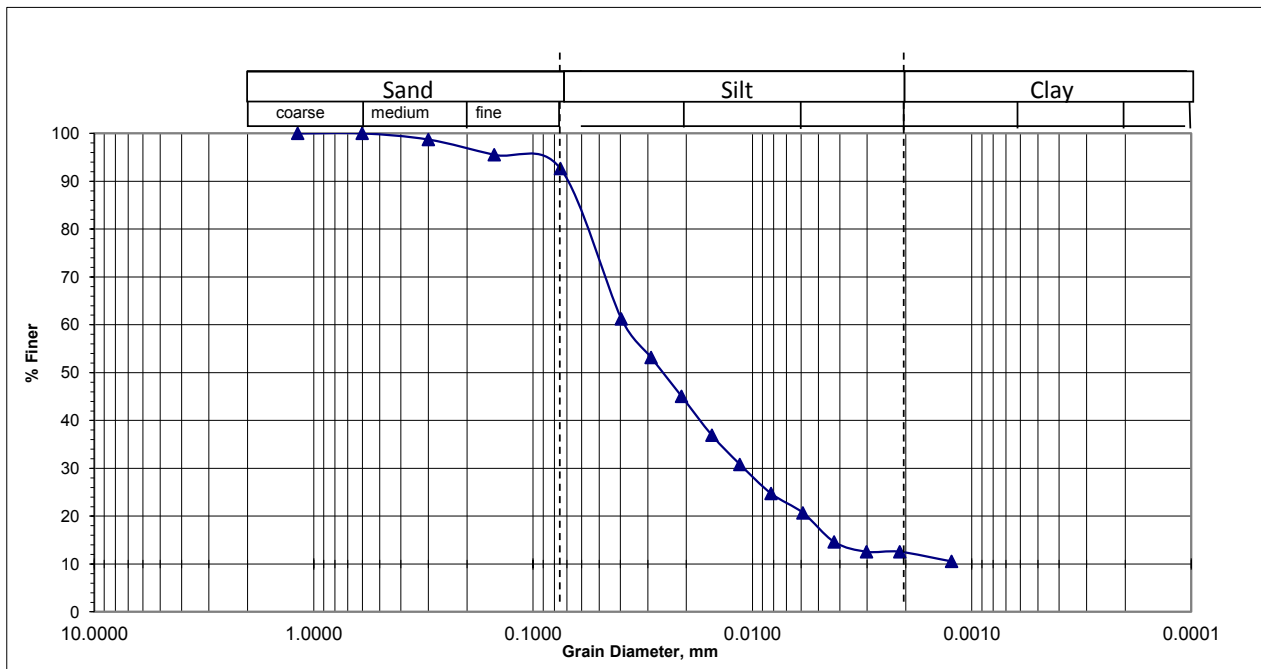
Bore Hole No : BH Bg31 Sample No. D2

Sampled Date: 10/02/2016

Depth (m) : 3.0

Test Date : 13/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.026 mm

Silt-Factor, $f = 1.76\sqrt{D_{50}}$ = 0.28

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =8%, Silt (0.005mm size)= 79% & Clay (0.001mm size) = 13%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Sajura Mirzapur, Goalkandi Union

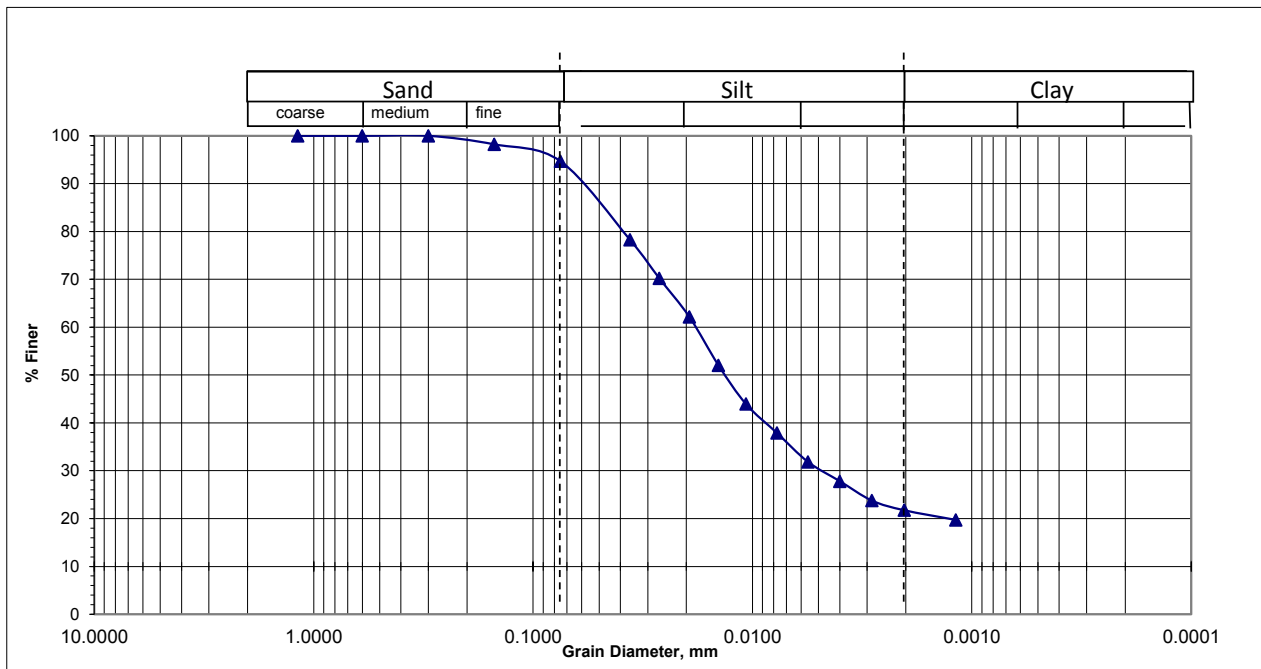
Bore Hole No : BH Bg32 Sample No. D7

Sampled Date: 30/01/2016

Depth (m) : 10.5

Test Date : 16/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.015 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.21

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =6%, Silt (0.005mm size)= 72% & Clay (0.001mm size) = 22%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Jamgram Govt. Primary School, Jamgram, Tahirpur Pourashava

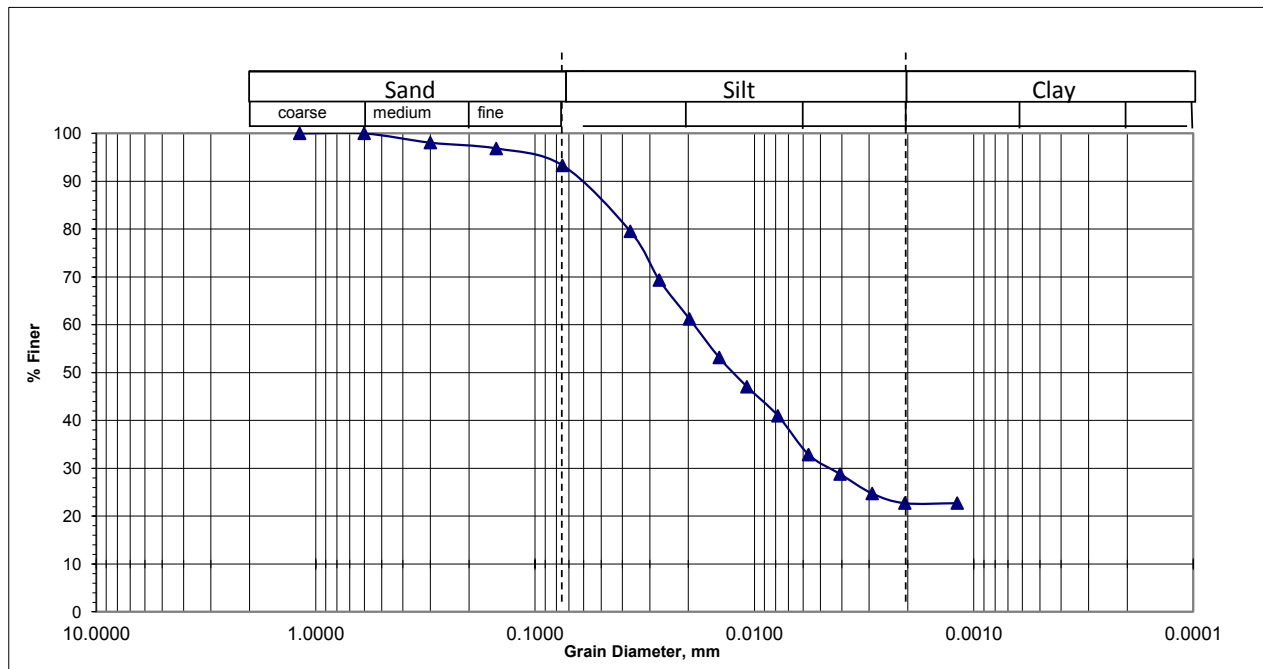
Bore Hole No : BH Bg33 Sample No. D5

Sampled Date: 31/01/2016

Depth (m) : 7.5

Test Date : 16/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.014 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.20$

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =7%, Silt (0.005mm size)= 70% & Clay (0.001mm size) = 23%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Koyamajampur Govt. Prtimary School, Durgapur, Near Tahirpur Pourashava

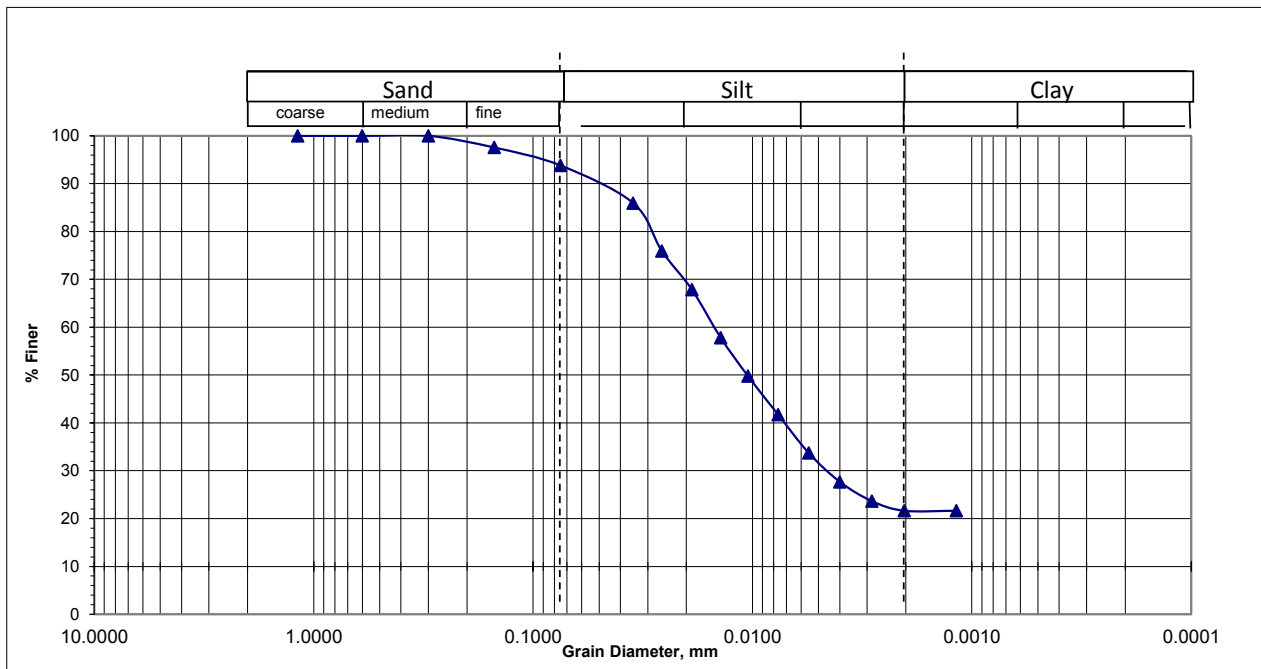
Bore Hole No : BH Bg34 Sample No. D3

Sampled Date: 09/02/2016

Depth (m) : 4.5

Test Date : 13/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.01 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.18$

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =6%, Silt (0.005mm size)= 72% & Clay (0.001mm size) = 22%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Hamir kutsha Union complex office, Hamir Kutsha Union

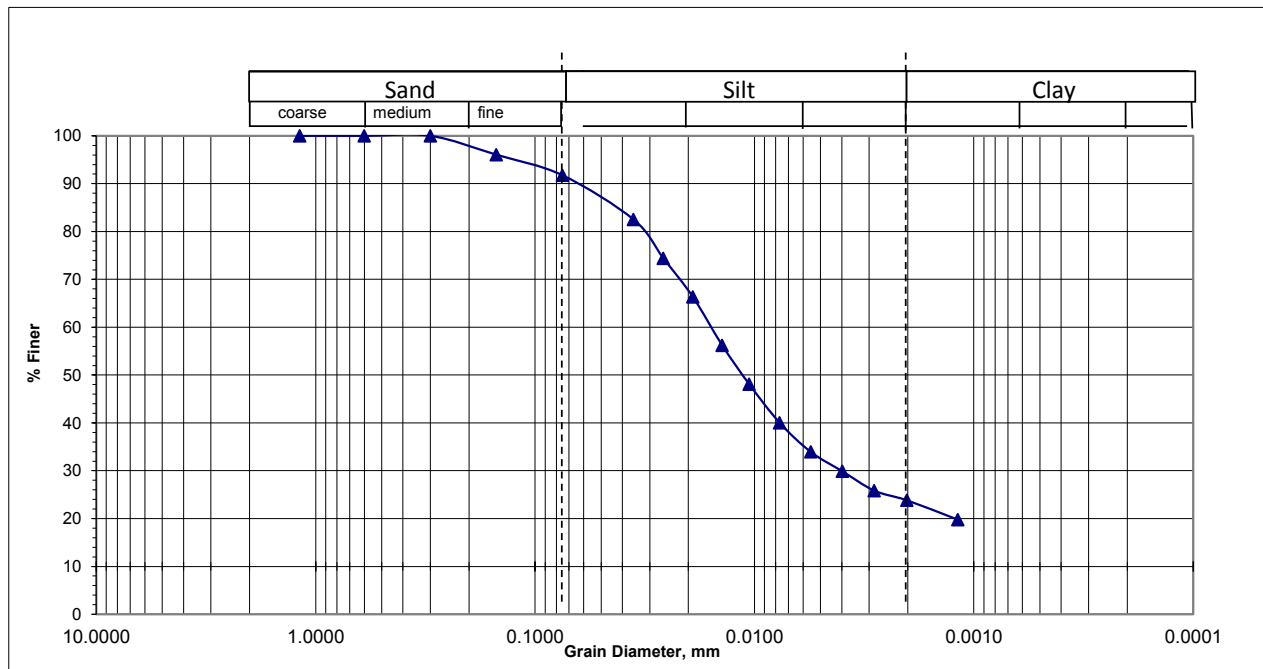
Bore Hole No : BH Bg36 Sample No. D4

Sampled Date: 10/02/2016

Depth (m) : 6.0

Test Date : 17/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.012 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.19$

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =8%, Silt (0.005mm size)= 68% & Clay (0.001mm size) = 24%

Depth (m) : 9.0 Test Date : 16/04/2016

Sand			Silt			Clay		
coarse	medium	fine						
100	100	100	98	80	70	63	55	47
90	90	90	40	30	25	22	20	19
80	80	80	18	15	14	13	12	11
70	70	70	10	9	8	7	6	5
60	60	60	5	4	3	2	1	1
50	50	50	2	1	1	1	1	1
40	40	40	1	1	1	1	1	1
30	30	30	1	1	1	1	1	1
20	20	20	1	1	1	1	1	1
10	10	10	1	1	1	1	1	1
0	0	0	1	1	1	1	1	1

Sand (0.075mm size) =7%, Silt (0.005mm size)= 73% & Clay (0.001mm size) = 18%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Talghoria Govt. Primary School, Hamir Kutsha Union

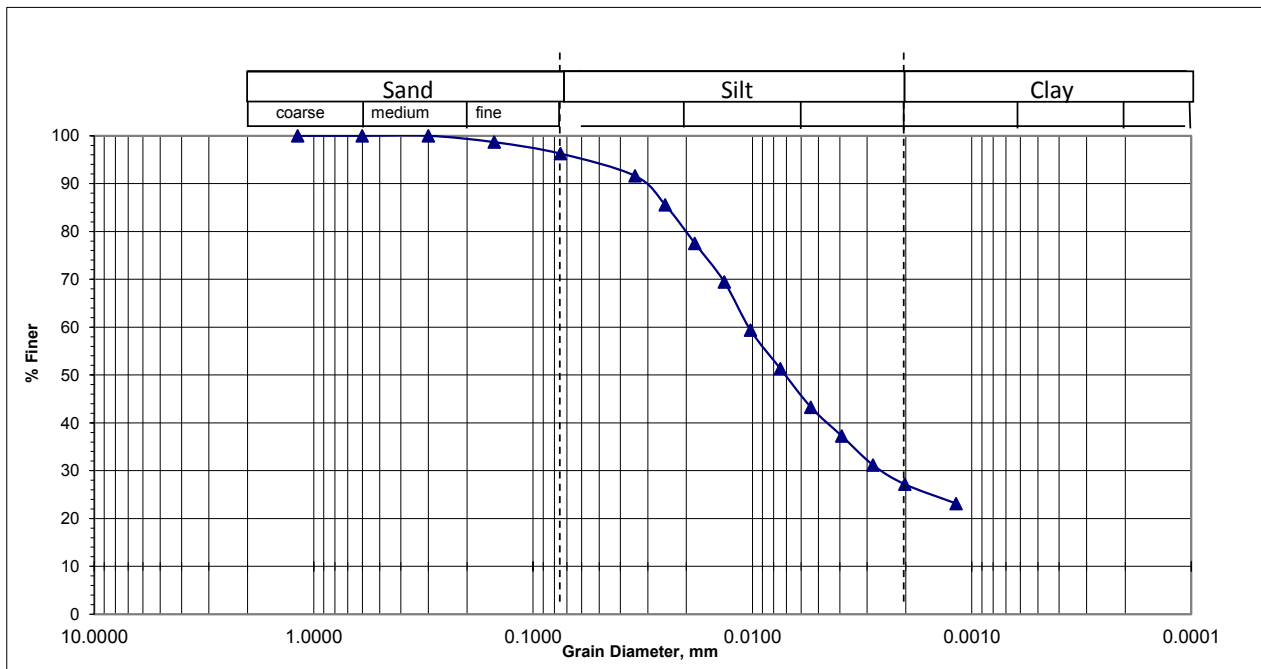
Bore Hole No : BH Bg39 Sample No. D4

Sampled Date: 28/01/2016

Depth (m) : 6.0

Test Date : 17/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.007 mm

Silt-Factor, $f = 1.76\sqrt{D_{50}}$ = 0.15

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =4%, Silt (0.005mm size)= 70% & Clay (0.001mm size) = 26%

Depth (m) : 3.0 Test Date : 17/04/2016

Sand			Silt			Clay		
coarse	medium	fine						
0	0	10	0	0	0	0	0	0

Grain size distribution curve showing % Finer versus Grain Diameter (mm). The curve is plotted on a semi-logarithmic scale. The x-axis (Grain Diameter) ranges from 10.0000 mm to 0.0001 mm. The y-axis (% Finer) ranges from 0 to 100. The curve starts at 100% finer for 10.0000 mm and decreases to approximately 10% finer at 0.0001 mm. The soil is classified as Sand (coarse, medium, and fine) and Clay (fine).

Sand (0.075mm size)=18%, Silt (0.005mm size)= 72% & Clay (0.001mm size)= 10%

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Choukali Govt. Primary School, Choukali Bazar, Goalkandi Union

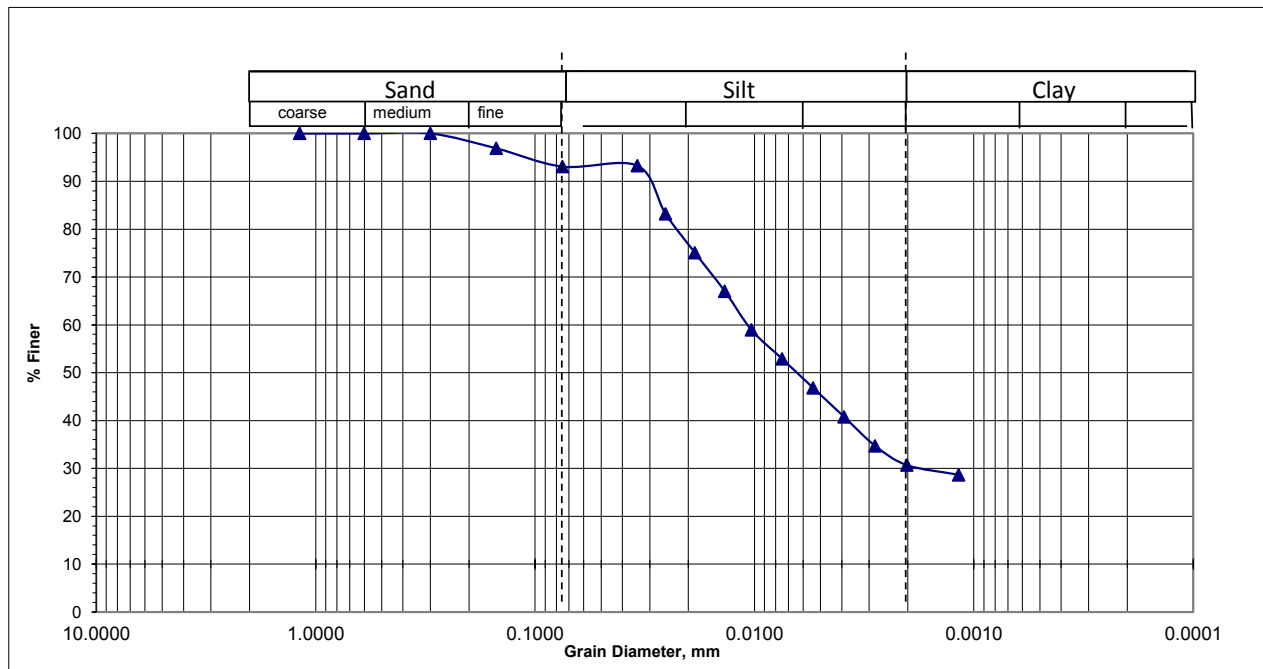
Bore Hole No : BH Bg40 Sample No. D4

Sampled Date: 29/01/2016

Depth (m) : 6.0

Test Date : 17/04/2016

Graphical Representation:



Mean Diameter, D_{50} = 0.006 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.14

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =8%, Silt (0.005mm size)= 61% & Clay (0.001mm size) = 31%

Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Near Gobinda Para Union Complex, Gobinda Para Union

Sample Information:

Sample Date: 6/2/2016

Test Date: 20/9/2016

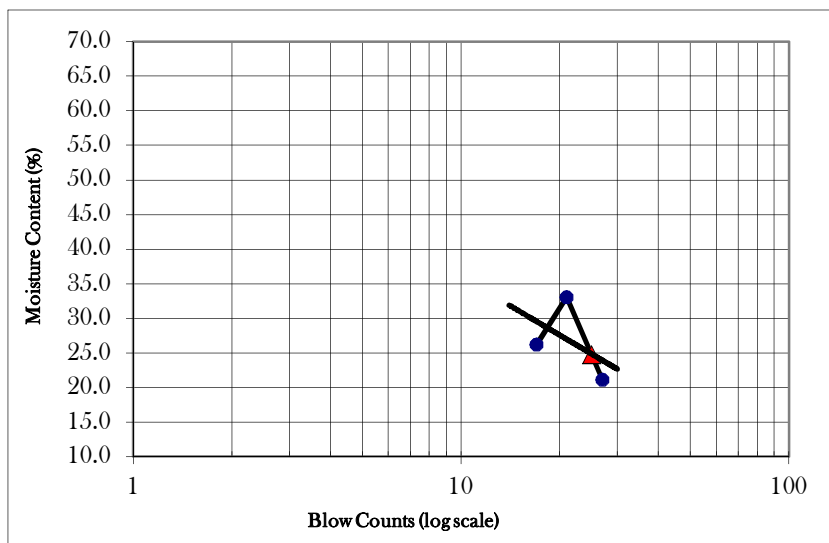
Boring Number BH-01

Sample Number D6

Depth of Sample(m) 9.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C55	C66	C77	Cup Number	Ct103	Ct103
Weight of Cup (g)	42.13	44.27	41.35	Weight of Cup (g)	19.55	19.55
Weight of Wet Soil and Cup (g)	95.09	67.89	70.6	Weight of Wet Soil and Cup (g)	21.26	21.65
Weight of Dry Soil and Cup (g)	84.09	62.02	65.5	Weight of Dry Soil and Cup (g)	21.09	21.39
Moisure Content (%)	26.2	33.1	21.1	Moisure Content (%)	11.0	14.1
Blow Counts	17	21	27			

Compilation of Test Results



Liquid Limit	25
Plastic Limit	13
Plasticity Index	12

Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Rokittepara Govt. primary school, Palopara, Auch Para Union

Sample Information:

Sample Date: 8/2/2016

Test Date: 20/9/2016

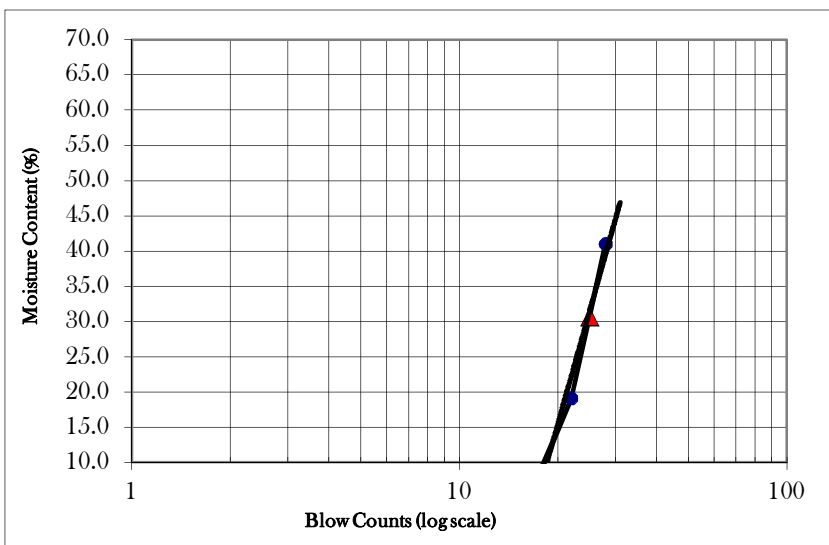
Boring Number BH-03

Sample Number D6

Depth of Sample(m) 9.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C44	C33	C88	Cup Number	Ct104	Ct104
Weight of Cup (g)	42.13	44.27	41.35	Weight of Cup (g)	19.55	19.55
Weight of Wet Soil and Cup (g)	95.89	75.53	79.63	Weight of Wet Soil and Cup (g)	21.96	21.76
Weight of Dry Soil and Cup (g)	91.19	70.52	68.5	Weight of Dry Soil and Cup (g)	21.39	21.33
Moisure Content (%)	9.6	19.1	41.0	Moisure Content (%)	31.0	24.2
Blow Counts	18	22	28			

Compilation of Test Results



Liquid Limit	31
Plastic Limit	28
Plasticity Index	3

Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Sharcol Shimla High School, beside Nasir Bazar, Sondanga Union

Sample Information:

Sample Date: 5/2/2016

Test Date: 20/9/2016

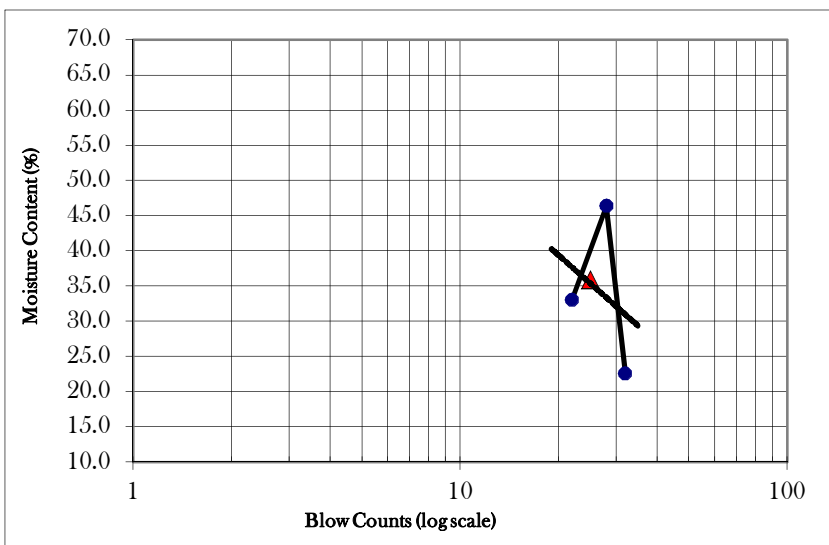
Boring Number BH-04

Sample Number D4

Depth of Sample(m) 6.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C10	C14	C220	Cup Number	Ct302	Ct302
Weight of Cup (g)	36.96	36.45	36.67	Weight of Cup (g)	12.15	12.15
Weight of Wet Soil and Cup (g)	115.08	64.13	53.28	Weight of Wet Soil and Cup (g)	13.87	14.18
Weight of Dry Soil and Cup (g)	95.68	55.36	50.22	Weight of Dry Soil and Cup (g)	13.39	13.76
Moisure Content (%)	33.0	46.4	22.6	Moisure Content (%)	38.7	26.1
Blow Counts	22	28	32			

Compilation of Test Results



Liquid Limit	36
Plastic Limit	32
Plasticity Index	3

Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Nilkhi Union Porishod Bhovon, Shibchor, MadaripurMirpur Dimukki Primary and
Sample Information:

Sample Date: 3/2/2016

Test Date: 20/9/2016

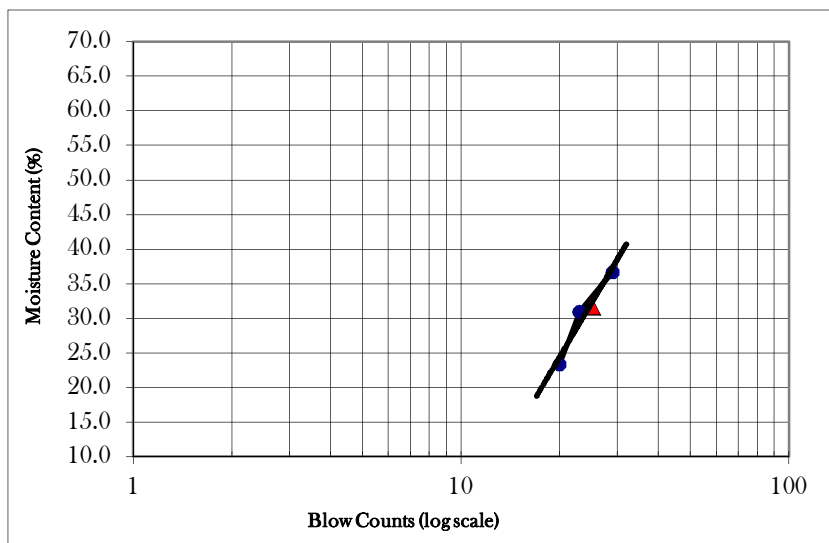
Boring Number BH-09

Sample Number D6

Depth of Sample(m) 9.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C03	C08	C09	Cup Number	Ct111	Ct111
Weight of Cup (g)	42.13	44.27	41.35	Weight of Cup (g)	19.55	19.55
Weight of Wet Soil and Cup (g)	95.95	65.52	71.61	Weight of Wet Soil and Cup (g)	21.96	21.85
Weight of Dry Soil and Cup (g)	85.77	60.5	63.49	Weight of Dry Soil and Cup (g)	21.53	21.26
Moisure Content (%)	23.3	30.9	36.7	Moisure Content (%)	21.7	34.5
Blow Counts	20	23	29			

Compilation of Test Results



Liquid Limit	32
Plastic Limit	28
Plasticity Index	4

Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project

Sample Information:

Sample Date: 3/2/2016

Test Date: 20/9/2016

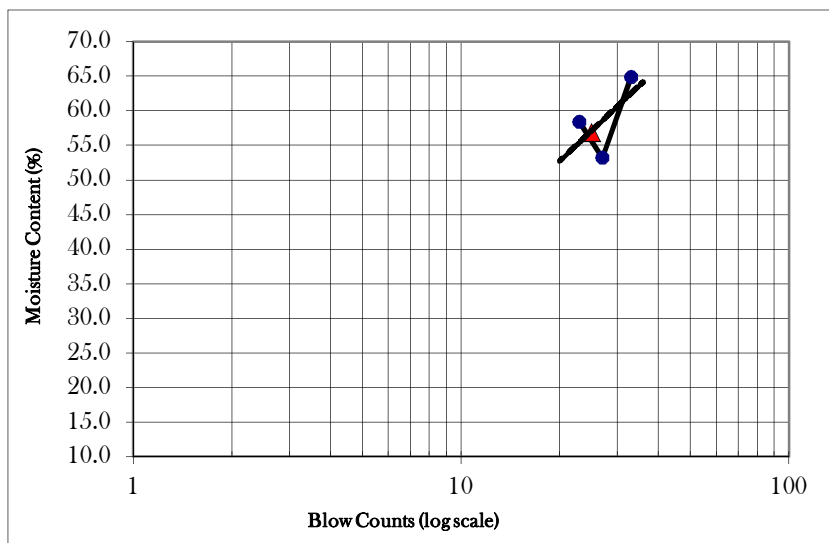
Boring Number BH-10

Sample Number D6

Depth of Sample(m) 9.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C01	C07	C11	Cup Number	Ct102	Ct102
Weight of Cup (g)	36.96	36.45	36.67	Weight of Cup (g)	12.15	12.15
Weight of Wet Soil and Cup (g)	125.18	65.43	56.37	Weight of Wet Soil and Cup (g)	14.75	14.38
Weight of Dry Soil and Cup (g)	92.65	55.37	48.62	Weight of Dry Soil and Cup (g)	13.85	13.66
Moisure Content (%)	58.4	53.2	64.9	Moisure Content (%)	52.9	47.7
Blow Counts	23	27	33			

Compilation of Test Results



Liquid Limit	57
Plastic Limit	50
Plasticity Index	7

Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Machmail High School, Machmail Bazar, Subhadanga Union

Sample Information:

Sample Date: 9/2/2016

Test Date: 21/9/2016

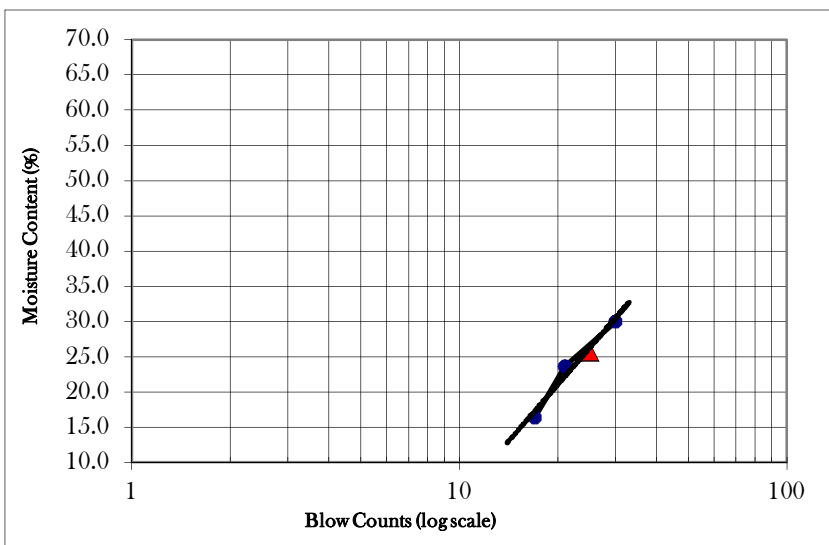
Boring Number BH-11

Sample Number D6

Depth of Sample(m) 9.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C44	C33	C88	Cup Number	Ct104	Ct104
Weight of Cup (g)	42.13	44.27	41.35	Weight of Cup (g)	19.55	19.55
Weight of Wet Soil and Cup (g)	103.89	70.53	76.63	Weight of Wet Soil and Cup (g)	21.76	21.35
Weight of Dry Soil and Cup (g)	95.19	65.52	68.5	Weight of Dry Soil and Cup (g)	21.33	21.13
Moisure Content (%)	16.4	23.6	29.9	Moisure Content (%)	24.2	13.9
Blow Counts	17	21	30			

Compilation of Test Results



Liquid Limit	26
Plastic Limit	19
Plasticity Index	7

Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Machmail High School, Machmail Bazar, Subhadanga UnionMugaipara High School

Sample Information:

Sample Date: 8/2/2016

Test Date: 21/9/2016

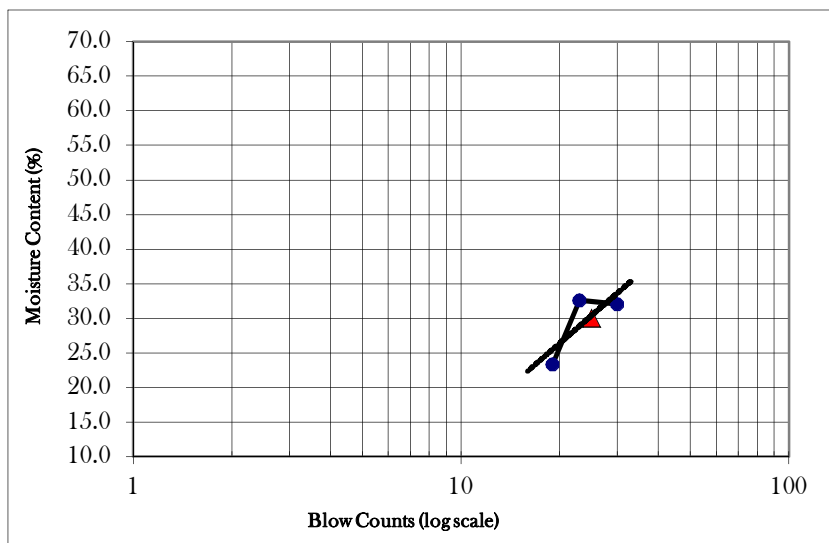
Boring Number BH-12

Sample Number D6

Depth of Sample(m) 9.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C55	C66	C77	Cup Number	Ct103	Ct103
Weight of Cup (g)	42.13	44.27	41.35	Weight of Cup (g)	19.55	19.55
Weight of Wet Soil and Cup (g)	95.09	63.03	70.6	Weight of Wet Soil and Cup (g)	21.66	21.55
Weight of Dry Soil and Cup (g)	85.09	58.42	63.5	Weight of Dry Soil and Cup (g)	21.34	21.13
Moisture Content (%)	23.3	32.6	32.1	Moisture Content (%)	17.9	26.6
Blow Counts	19	23	30			

Compilation of Test Results



Liquid Limit	30
Plastic Limit	22
Plasticity Index	8

Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Chor kasi kata Adarsha Sorkari Prothomic Bidhaloy, Sibchor, MadaripurDoulatur

Sample Information:

Sample Date: 5/2/2016

Test Date: 21/9/2016

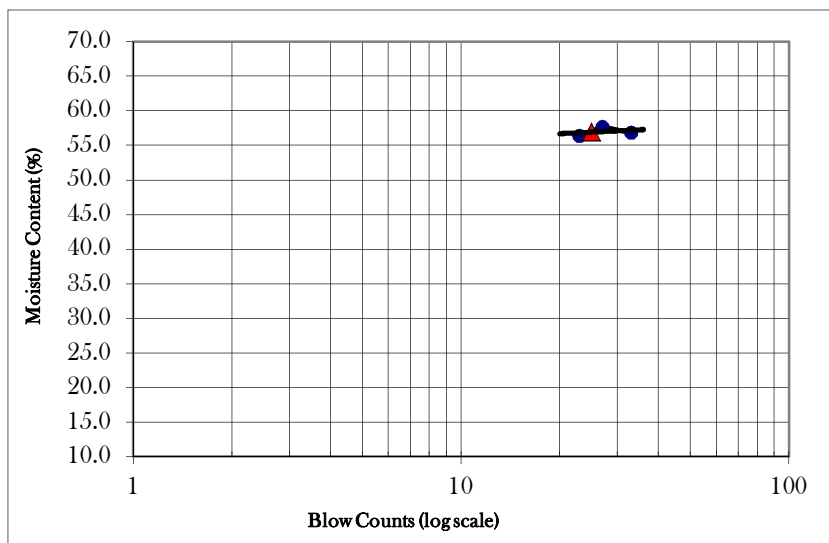
Boring Number BH-17

Sample Number D4

Depth of Sample(m) 6.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C01	C07	C11	Cup Number	Ct102	Ct102
Weight of Cup (g)	36.96	36.45	36.67	Weight of Cup (g)	12.15	12.15
Weight of Wet Soil and Cup (g)	127.18	69.43	56.98	Weight of Wet Soil and Cup (g)	14.79	14.68
Weight of Dry Soil and Cup (g)	94.65	57.37	49.62	Weight of Dry Soil and Cup (g)	13.95	13.78
Moisure Content (%)	56.4	57.6	56.8	Moisure Content (%)	46.7	55.2
Blow Counts	23	27	33			

Compilation of Test Results



Liquid Limit	57
Plastic Limit	51
Plasticity Index	6

Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project

Sample Information:

Sample Date: 7/2/2016

Test Date: 21/9/2016

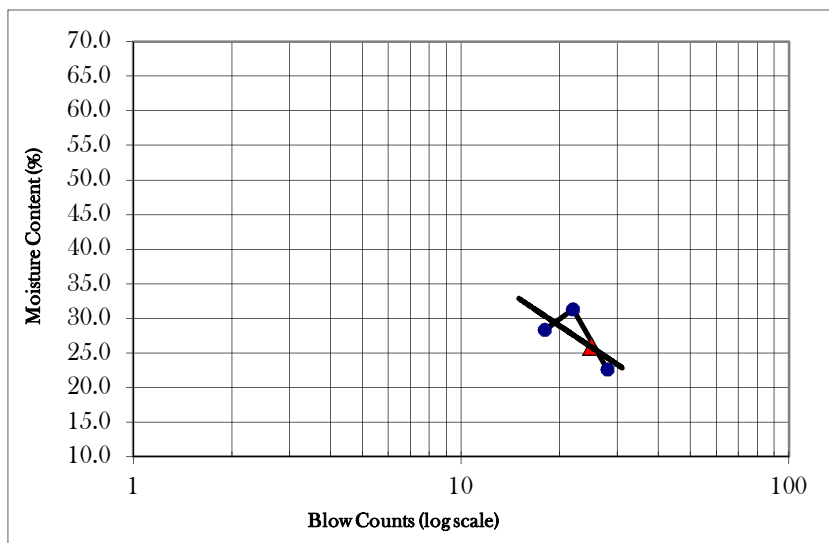
Boring Number BH-19

Sample Number D8

Depth of Sample(m) 12.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C03	C08	C09	Cup Number	Ct111	Ct111
Weight of Cup (g)	42.13	44.27	41.35	Weight of Cup (g)	19.55	19.55
Weight of Wet Soil and Cup (g)	110.95	69.52	74.61	Weight of Wet Soil and Cup (g)	21.86	21.95
Weight of Dry Soil and Cup (g)	95.77	63.5	68.49	Weight of Dry Soil and Cup (g)	21.53	21.36
Moisture Content (%)	28.3	31.3	22.5	Moisture Content (%)	16.7	32.6
Blow Counts	18	22	28			

Compilation of Test Results



Liquid Limit	26
Plastic Limit	25
Plasticity Index	1

Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : 21 nos. Bara Bihanali govt. School, Bara Bihanali Union

Sample Information:

Sample Date: 2/2/2016

Test Date: 21/9/2016

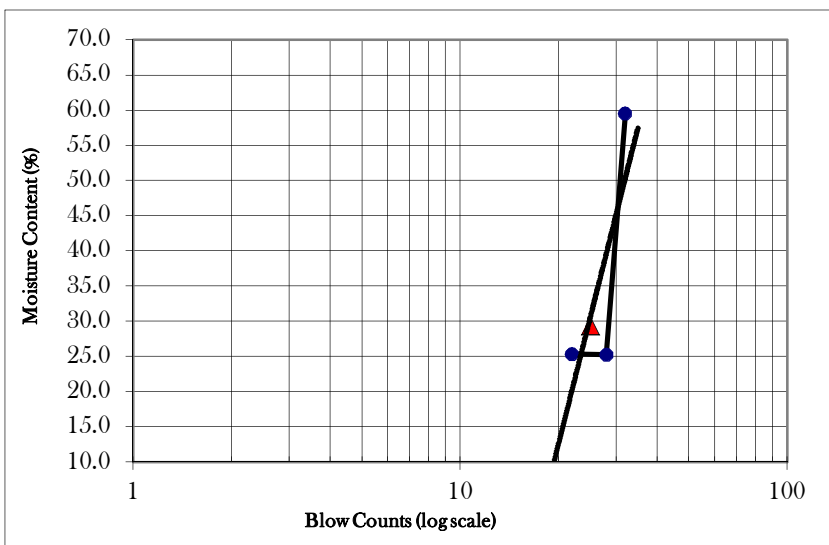
Boring Number BH-20

Sample Number D4

Depth of Sample(m) 6.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C10	C14	C220	Cup Number	Ct302	Ct302
Weight of Cup (g)	36.96	36.45	36.67	Weight of Cup (g)	12.15	12.15
Weight of Wet Soil and Cup (g)	123.08	60.13	58.28	Weight of Wet Soil and Cup (g)	13.77	14.21
Weight of Dry Soil and Cup (g)	105.68	55.36	50.22	Weight of Dry Soil and Cup (g)	13.39	13.86
Moisure Content (%)	25.3	25.2	59.5	Moisure Content (%)	30.6	20.5
Blow Counts	22	28	32			

Compilation of Test Results



Liquid Limit	29
Plastic Limit	26
Plasticity Index	4

Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Uttar akdala Govt. Primary School, Uttar akdala Bazar,

Sample Information:

Sample Date: 1/2/2016

Test Date: 22/9/2016

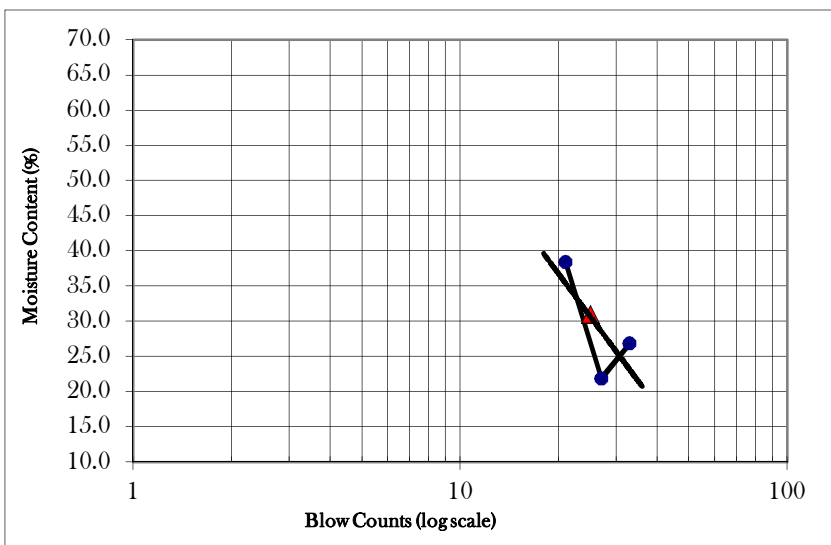
Boring Number BH-21

Sample Number D6

Depth of Sample(m) 9.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C10	C14	C220	Cup Number	Ct302	Ct302
Weight of Cup (g)	36.96	36.45	36.67	Weight of Cup (g)	12.15	12.15
Weight of Wet Soil and Cup (g)	132.08	74.13	65.28	Weight of Wet Soil and Cup (g)	13.45	14.28
Weight of Dry Soil and Cup (g)	105.68	67.36	59.22	Weight of Dry Soil and Cup (g)	13.15	13.88
Moisure Content (%)	38.4	21.9	26.9	Moisure Content (%)	30.0	23.1
Blow Counts	21	27	33			

Compilation of Test Results



Liquid Limit	31
Plastic Limit	27
Plasticity Index	4

Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location :Nandanpur(Chekamara) Bazar, Mohila Dakhil Madrasha,

Sample Information:

Sample Date: 2/2/2016

Test Date: 22/9/2016

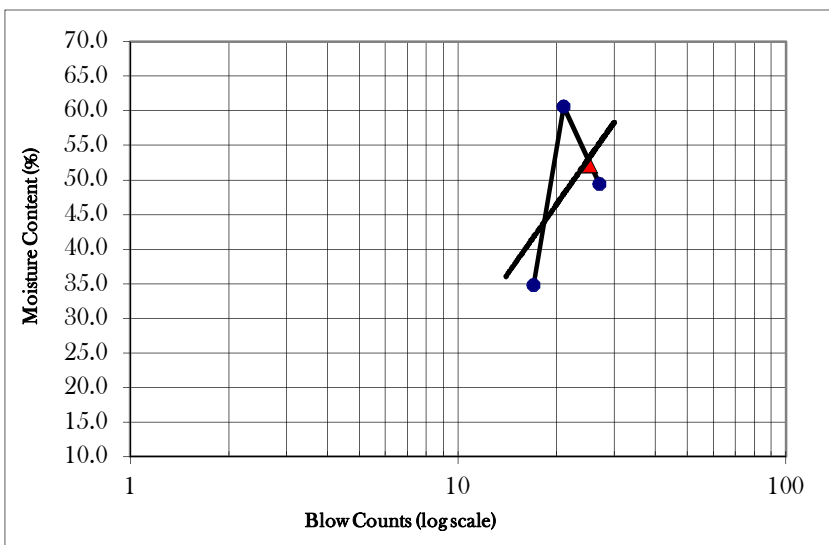
Boring Number BH-22

Sample Number D6

Depth of Sample(m) 9.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C03	C08	C09	Cup Number	Ct111	Ct111
Weight of Cup (g)	42.13	44.27	41.35	Weight of Cup (g)	19.55	19.55
Weight of Wet Soil and Cup (g)	100.95	65.52	66.96	Weight of Wet Soil and Cup (g)	21.16	21.75
Weight of Dry Soil and Cup (g)	85.77	57.5	58.49	Weight of Dry Soil and Cup (g)	20.53	21.45
Moisure Content (%)	34.8	60.6	49.4	Moisure Content (%)	64.3	15.8
Blow Counts	17	21	27			

Compilation of Test Results



Liquid Limit	52
Plastic Limit	40
Plasticity Index	12

Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Ganipur Union Complex office, Hasnipur Bazar, Ganipur Union

Sample Information:

Sample Date: 6/2/2016

Test Date: 22/9/2016

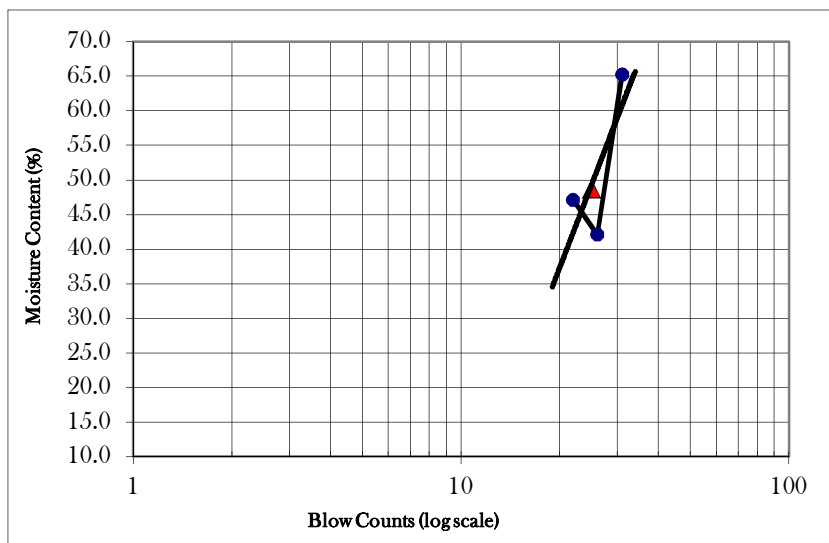
Boring Number BH-24

Sample Number D6

Depth of Sample(m) 9.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C01	C07	C11	Cup Number	Ct102	Ct102
Weight of Cup (g)	36.96	36.45	36.67	Weight of Cup (g)	12.15	12.15
Weight of Wet Soil and Cup (g)	129.18	70.43	61.37	Weight of Wet Soil and Cup (g)	14.59	14.38
Weight of Dry Soil and Cup (g)	99.65	60.37	51.62	Weight of Dry Soil and Cup (g)	13.69	13.88
Moisure Content (%)	47.1	42.1	65.2	Moisure Content (%)	58.4	28.9
Blow Counts	22	26	31			

Compilation of Test Results



Liquid Limit	49
Plastic Limit	44
Plasticity Index	5

Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-1)

Project Location : Sahid Sakandar Memorial Adarsho High School, Godaoun

Sample Information:

Sample Date: 27/1/2016

Test Date: 22/9/2016

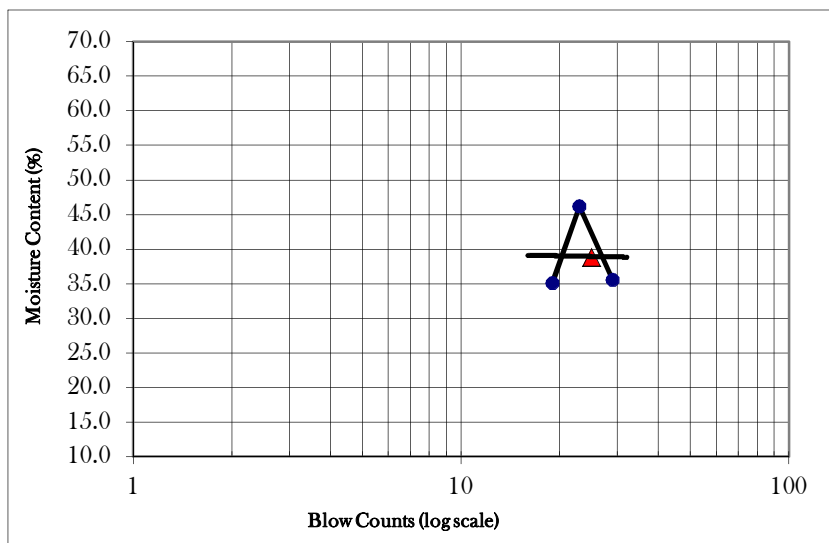
Boring Number BH-26

Sample Number D4

Depth of Sample(m) 6.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C55	C66	C77	Cup Number	Ct103	Ct103
Weight of Cup (g)	42.13	44.27	41.35	Weight of Cup (g)	19.55	19.55
Weight of Wet Soil and Cup (g)	96.09	62.03	64.6	Weight of Wet Soil and Cup (g)	21.76	21.85
Weight of Dry Soil and Cup (g)	82.09	56.42	58.5	Weight of Dry Soil and Cup (g)	21.54	21.333
Moisure Content (%)	35.0	46.2	35.6	Moisure Content (%)	11.1	29.0
Blow Counts	19	23	29			

Compilation of Test Results



Liquid Limit	39
Plastic Limit	20
Plasticity Index	19

Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Bagmara Degree College, Ganipur Union

Sample Information:

Sample Date: 31/1/2016

Test Date: 22/9/2016

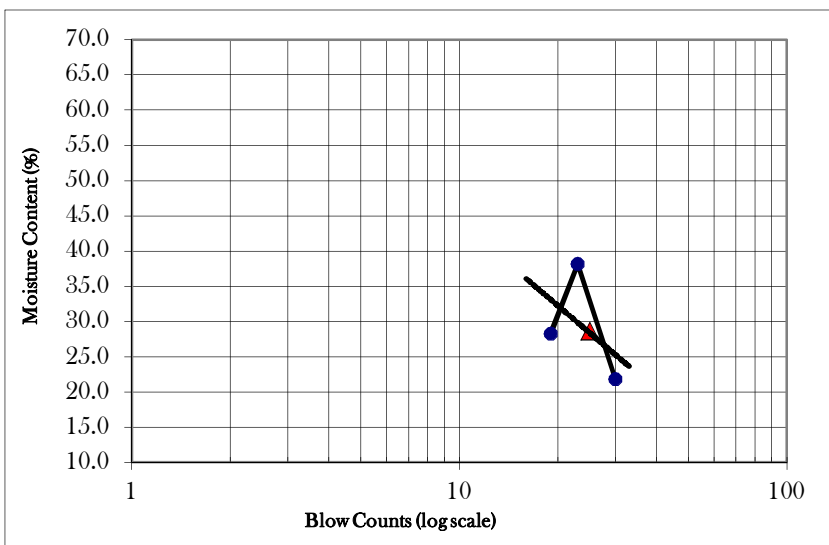
Boring Number BH-27

Sample Number D8

Depth of Sample(m) 12.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C44	C33	C88	Cup Number	Ct104	Ct104
Weight of Cup (g)	42.13	44.27	41.35	Weight of Cup (g)	19.55	19.55
Weight of Wet Soil and Cup (g)	117.89	80.53	75.63	Weight of Wet Soil and Cup (g)	21.76	21.45
Weight of Dry Soil and Cup (g)	101.19	70.52	69.5	Weight of Dry Soil and Cup (g)	21.56	21.23
Moisure Content (%)	28.3	38.1	21.8	Moisure Content (%)	10.0	13.1
Blow Counts	19	23	30			

Compilation of Test Results



Liquid Limit	29
Plastic Limit	12
Plasticity Index	17

Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Jhikra High School, Jhikra Bazar, Jhikra Union

Sample Information:

Sample Date: 28/1/2016

Test Date: 23/9/2016

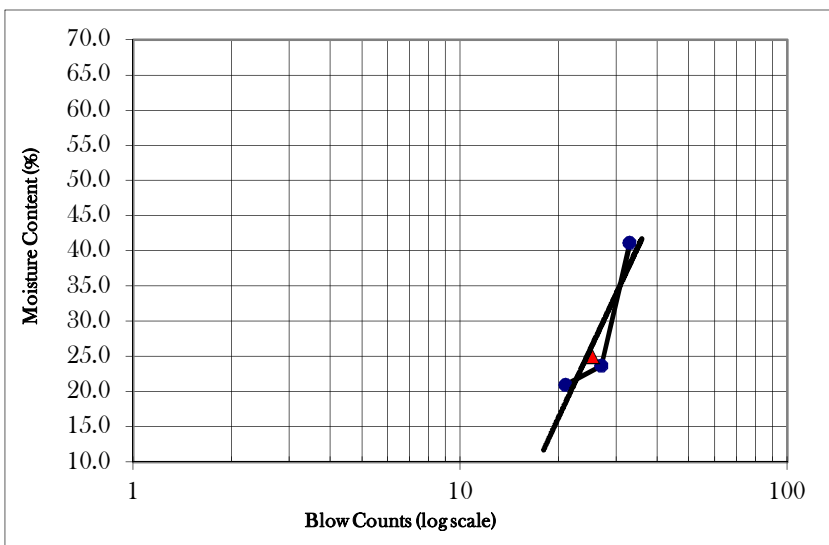
Boring Number BH-29

Sample Number D6

Depth of Sample(m) 9.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C10	C14	C220	Cup Number	Ct302	Ct302
Weight of Cup (g)	36.96	36.45	36.67	Weight of Cup (g)	12.15	12.15
Weight of Wet Soil and Cup (g)	120.08	73.43	67.56	Weight of Wet Soil and Cup (g)	13.45	14.48
Weight of Dry Soil and Cup (g)	105.7	66.36	58.56	Weight of Dry Soil and Cup (g)	13.15	14.23
Moisure Content (%)	20.9	23.6	41.1	Moisure Content (%)	30.0	12.0
Blow Counts	21	27	33			

Compilation of Test Results



Liquid Limit	25
Plastic Limit	21
Plasticity Index	4

Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location :Sakoa Bohumuki High School, Sikdar Bazar, Maria Union

Sample Information:

Sample Date: 29/1/2016

Test Date: 23/9/2016

Boring Number BH-30

Sample Number D6

Depth of Sample(m) 9.0

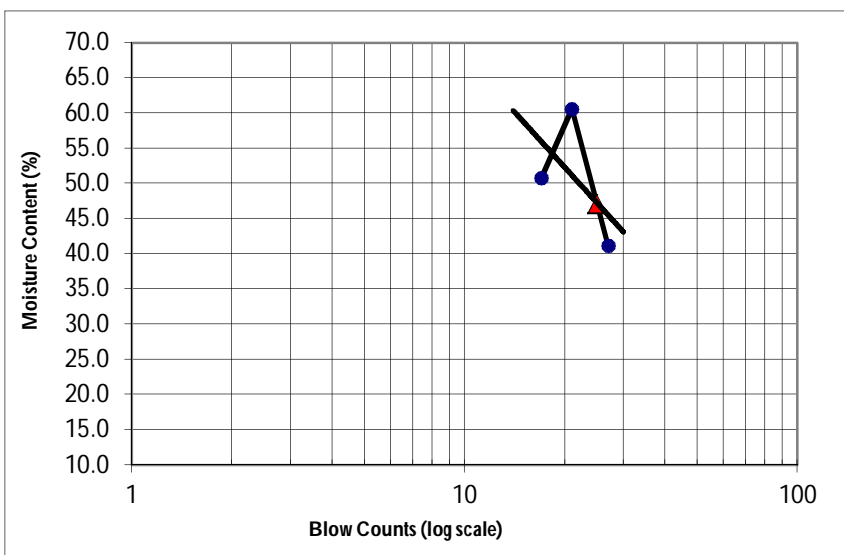
Determination of Liquid Limit

Cup Number	C03	C08	C09
Weight of Cup (g)	42.13	44.27	41.35
Weight of Wet Soil and Cup (g)	107.95	65.52	66.96
Weight of Dry Soil and Cup (g)	85.77	57.5	59.49
Moisture Content (%)	50.8	60.6	41.2
Blow Counts	17	21	27

Determination of Plastic Limit

Cup Number	Ct111	Ct111
Weight of Cup (g)	19.55	19.55
Weight of Wet Soil and Cup (g)	21.16	21.85
Weight of Dry Soil and Cup (g)	20.43	21.65
Moisture Content (%)	83.0	9.5

Compilation of Test Results



Liquid Limit	47
Plastic Limit	46
Plasticity Index	1

Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Gangopara Govt. Primary school, Maria Union

Sample Information:

Sample Date: 10/2/2016

Test Date: 23/9/2016

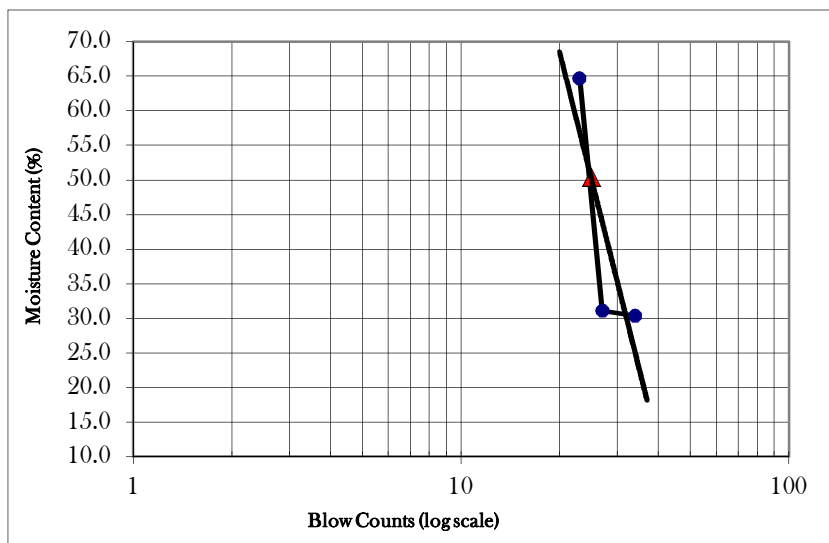
Boring Number BH-31

Sample Number D6

Depth of Sample(m) 9.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C01	C07	C11	Cup Number	Ct102	Ct102
Weight of Cup (g)	36.96	36.45	36.67	Weight of Cup (g)	12.15	12.15
Weight of Wet Soil and Cup (g)	112.18	70.43	61.37	Weight of Wet Soil and Cup (g)	14.59	14.43
Weight of Dry Soil and Cup (g)	82.65	62.37	55.62	Weight of Dry Soil and Cup (g)	13.83	13.88
Moisure Content (%)	64.6	31.1	30.3	Moisure Content (%)	45.2	31.8
Blow Counts	23	27	34			

Compilation of Test Results



Liquid Limit	50
Plastic Limit	39
Plasticity Index	12

Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Sajura Mirzapur, Goalkandi Union

Sample Information:

Sample Date: 30/1/2016

Test Date: 23/9/2016

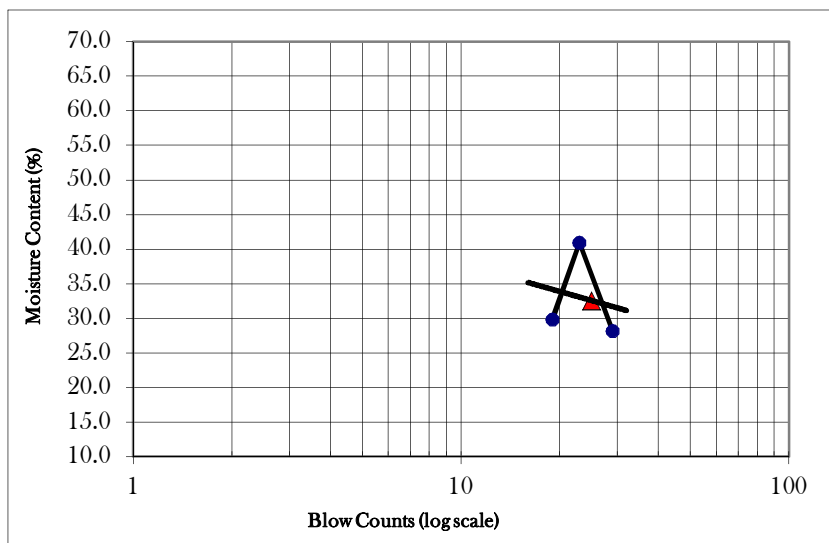
Boring Number BH-32

Sample Number D8

Depth of Sample(m) 12.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C55	C66	C77	Cup Number	Ct103	Ct103
Weight of Cup (g)	42.13	44.27	41.35	Weight of Cup (g)	19.55	19.55
Weight of Wet Soil and Cup (g)	103.09	67.03	64.6	Weight of Wet Soil and Cup (g)	21.56	21.65
Weight of Dry Soil and Cup (g)	89.09	60.42	59.5	Weight of Dry Soil and Cup (g)	21.34	21.23
Moisure Content (%)	29.8	40.9	28.1	Moisure Content (%)	12.3	25.0
Blow Counts	19	23	29			

Compilation of Test Results



Liquid Limit	33
Plastic Limit	19
Plasticity Index	14

Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Hamir kutsha Union complex office, Hamir Kutsha Union

Sample Information:

Sample Date: 10/2/2016

Test Date: 23/9/2016

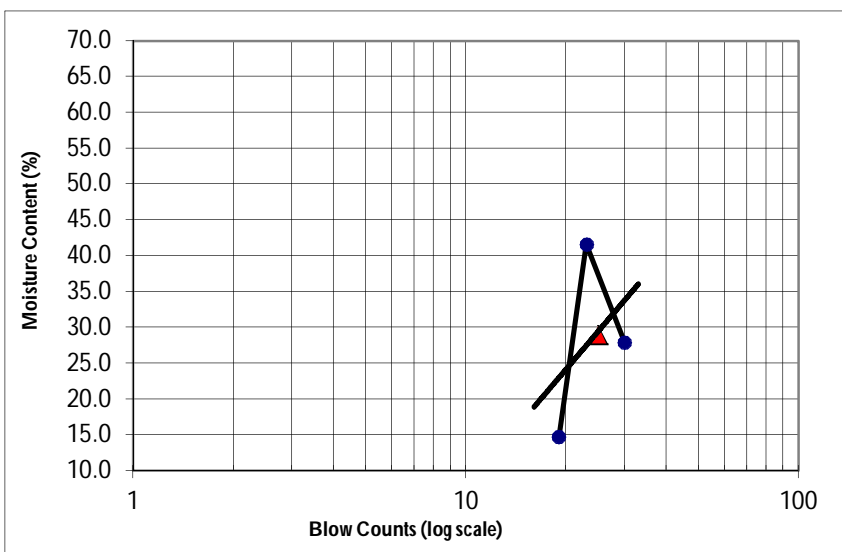
Boring Number BH-36

Sample Number D4

Depth of Sample(m) 6.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C44	C33	C88	Cup Number	Ct104	Ct104
Weight of Cup (g)	42.13	44.27	41.35	Weight of Cup (g)	19.55	19.55
Weight of Wet Soil and Cup (g)	109.89	88.53	78.63	Weight of Wet Soil and Cup (g)	21.16	21.25
Weight of Dry Soil and Cup (g)	101.19	75.52	70.5	Weight of Dry Soil and Cup (g)	21.03	21.11
Moisure Content (%)	14.7	41.6	27.9	Moisure Content (%)	8.8	9.0
Blow Counts	19	23	30			

Compilation of Test Results

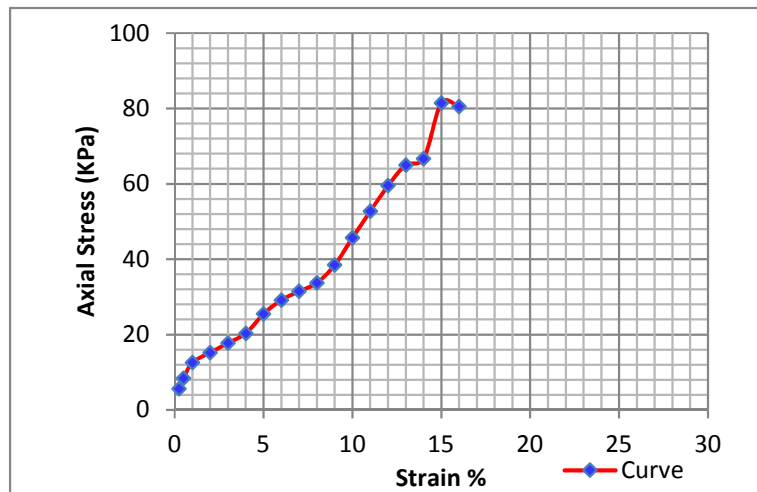


Liquid Limit	29
Plastic Limit	9
Plasticity Index	20

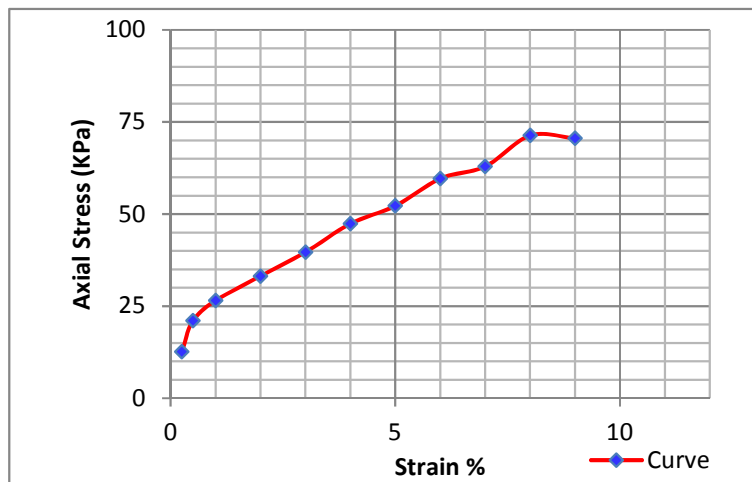
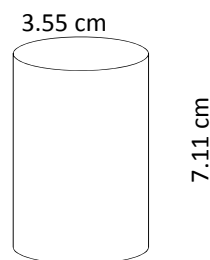
Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Location: Near Gobinda Para Union Complex, Gobinda Para Union & Hatkhugipur High School, Hatkhugipur Bazar, Near Auch Para union complex

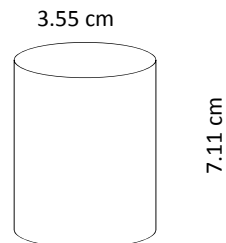
UNCONFINED COMPRESSION STRENGTH TEST



Bore hole No.	BH-01
Sample No.	UD-1
Depth (m)	3.10 to 3.55
Description of soil	Silt with Sand
qu (Kpa)	81.49
% Strain	15.0
γ_{wet} (gm/cc)	1.88
γ_{Dry} (gm/cc)	1.54
% Moisture	22.02
Cohesion (Kpa)	40.75



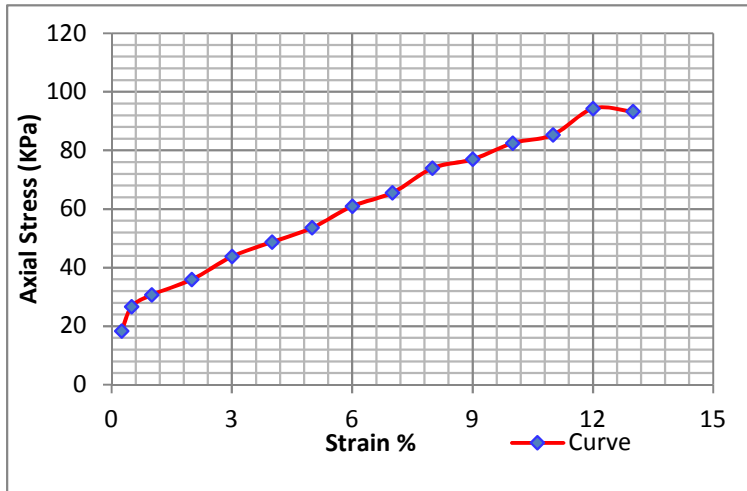
Bore hole No.	BH-02
Sample No.	UD-1
Depth (m)	3.10 to 3.45
Description of soil	Silt with Clay
qu (Kpa)	71.35
% Strain	8.0
γ_{wet} (gm/cc)	2.26
γ_{Dry} (gm/cc)	1.89
% Moisture	19.97
Cohesion (Kpa)	35.67



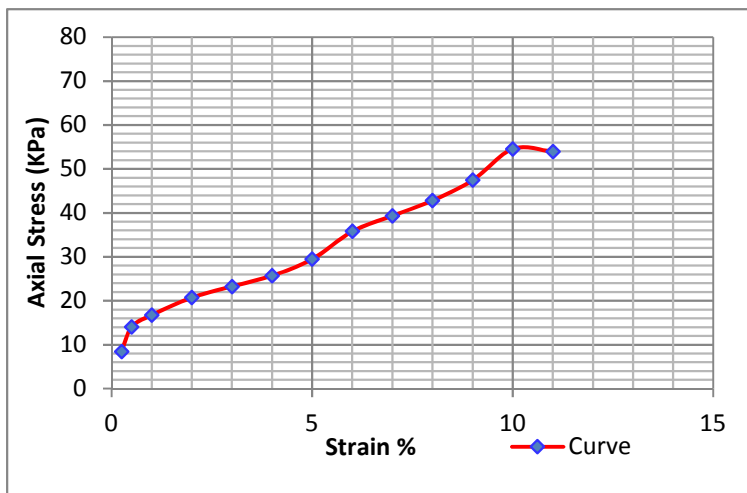
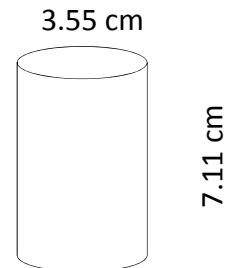
Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)

Location: Rokittepara Govt. primary school, Palopara, Auch Para Union & Sharcol Shimla High School, beside Nasir Bazar, Sondanga Union

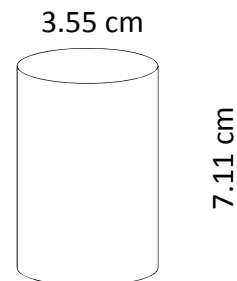
UNCONFINED COMPRESSION STRENGTH TEST



Bore hole No.	BH-03
Sample No.	UD-1
Depth (m)	3.10 to 3.55
Description of soil	Silt with Sand
qu (Kpa)	94.30
% Strain	12.0
γ_{wet} (gm/cc)	1.85
γ_{Dry} (gm/cc)	1.36
% Moisture	35.67
Cohesion (Kpa)	47.15



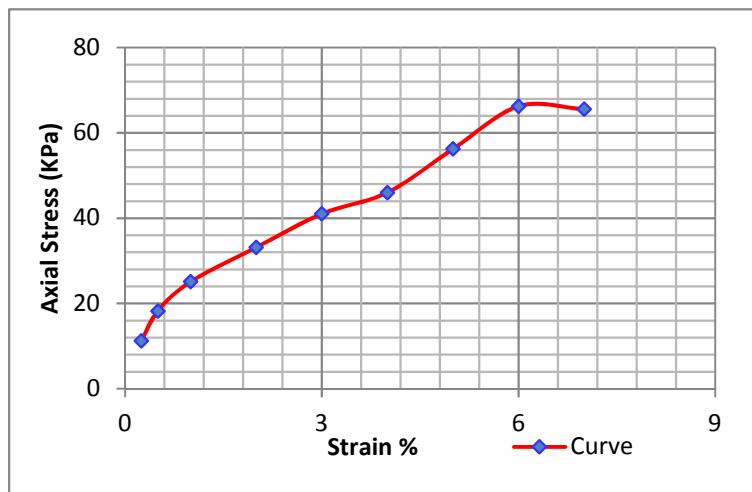
Bore hole No.	BH-04
Sample No.	UD-1
Depth (m)	5.10 to 5.55
Description of soil	Silt with Caly
qu (Kpa)	54.57
% Strain	12.0
γ_{wet} (gm/cc)	2.10
γ_{Dry} (gm/cc)	1.65
% Moisture	26.70
Cohesion (Kpa)	27.28



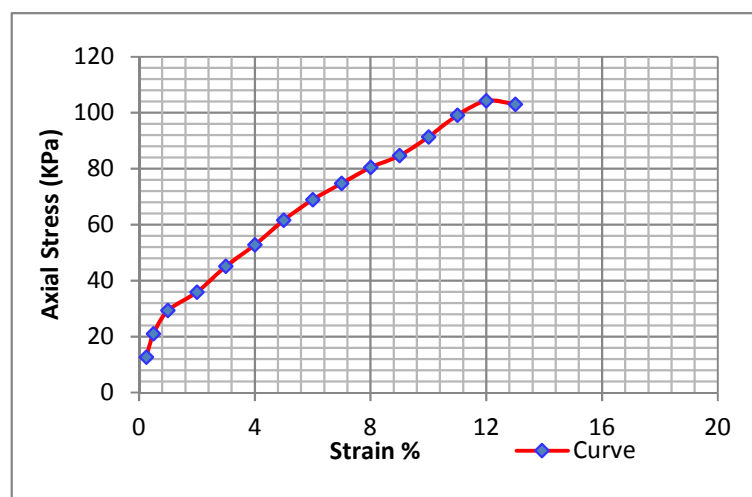
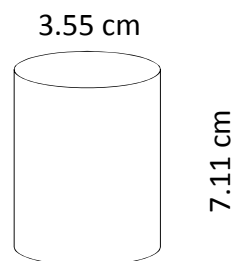
Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)

Location: Ganggopara Girls School, Hat Ganggopara, Auch Para Unionr & Mirpur Dimukki Primary and High School, jolapara Hat,
Dwippur Union

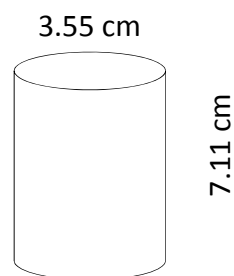
UNCONFINED COMPRESSION STRENGTH TEST



Bore hole No.	BH-06
Sample No.	UD-1
Depth (m)	3.10 to 3.55
Description of soil	Silt with Caly
qu (Kpa)	66.27
% Strain	9.0
γ_{wet} (gm/cc)	1.42
γ_{Dry} (gm/cc)	0.82
% Moisture	72.33
Cohesion (Kpa)	33.13



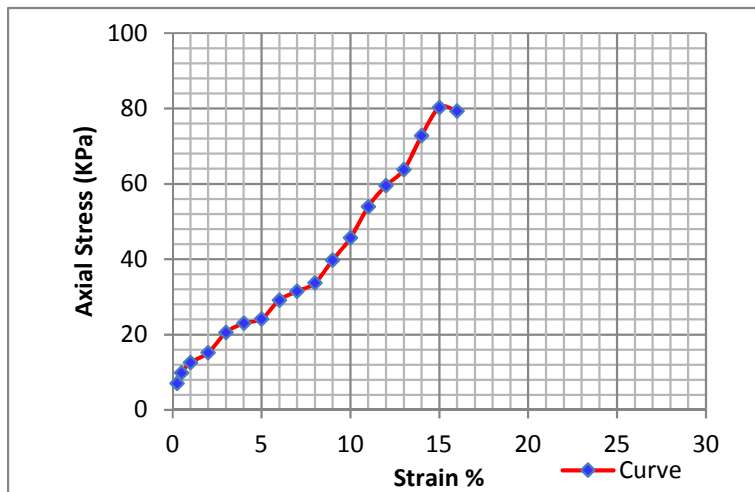
Bore hole No.	BH-09
Sample No.	UD-1
Depth (m)	8.10 to 8.55
Description of soil	Silt with Clay
qu (Kpa)	104.22
% Strain	12.0
γ_{wet} (gm/cc)	1.87
γ_{Dry} (gm/cc)	1.42
% Moisture	32.25
Cohesion (Kpa)	52.11



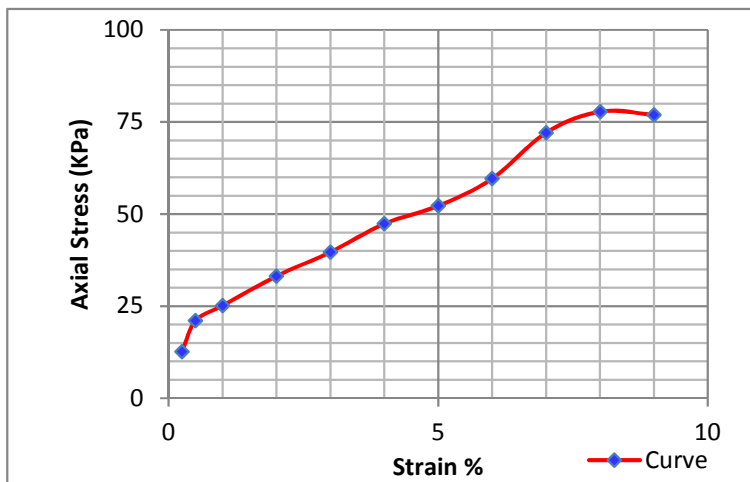
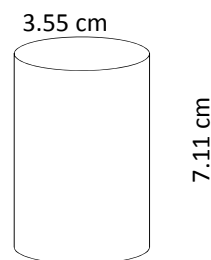
Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Location: Machmail High School, Machmail Bazar, Subhadanga Union & Mugaipara High School, Mugaipara Bazar, Auch Para Union

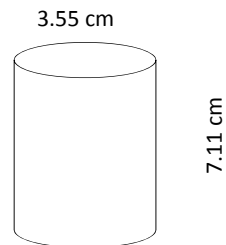
UNCONFINED COMPRESSION STRENGTH TEST



Bore hole No.	BH-11
Sample No.	UD-1
Depth (m)	5.10 to 5.55
Description of soil	Silt with Clay
qu (Kpa)	80.30
% Strain	15.0
γ_{wet} (gm/cc)	1.91
γ_{Dry} (gm/cc)	1.54
% Moisture	23.85
Cohesion (Kpa)	40.15



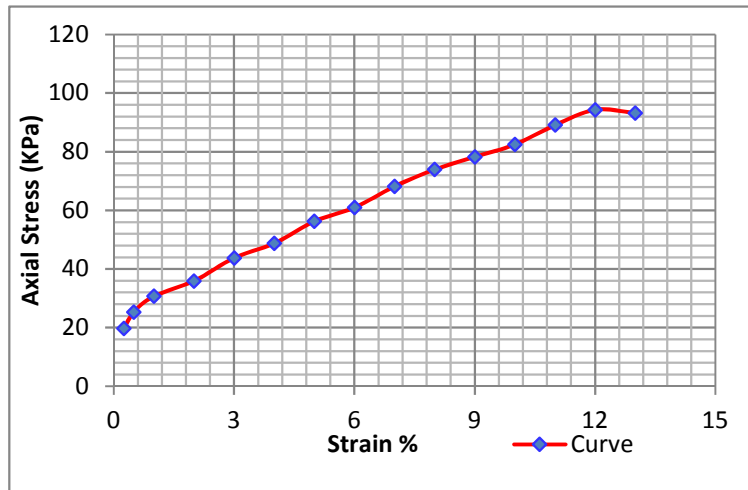
Bore hole No.	BH-12
Sample No.	UD-1
Depth (m)	5.10 to 5.45
Description of soil	Silt with Clay
qu (Kpa)	77.83
% Strain	8.0
γ_{wet} (gm/cc)	2.26
γ_{Dry} (gm/cc)	1.96
% Moisture	15.56
Cohesion (Kpa)	38.92



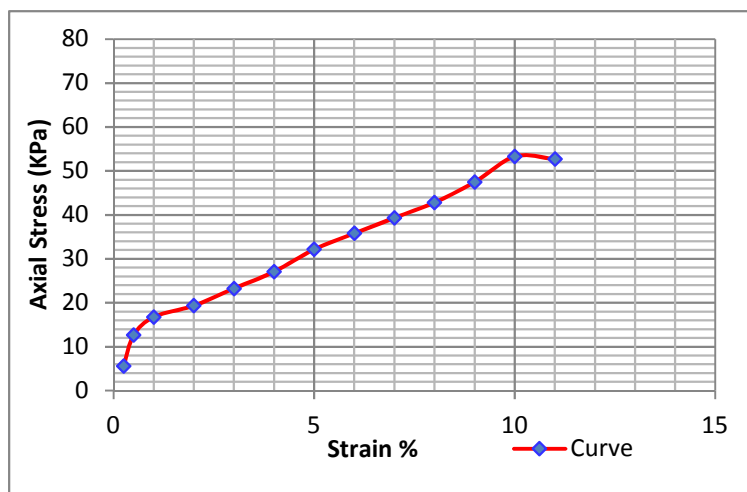
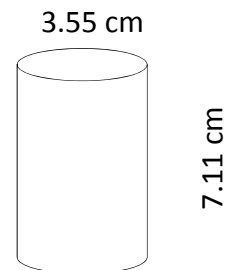
Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)

Location: Doulatpur Madhomik School, Madha Doulatpur, Subhadanga Union & 21 nos. Bara Bihanali govt. School, Bara Bihanali Union

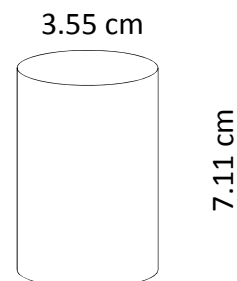
UNCONFINED COMPRESSION STRENGTH TEST



Bore hole No.	BH-17
Sample No.	UD-1
Depth (m)	5.10 to 5.55
Description of soil	Silt with Clay
qu (Kpa)	94.30
% Strain	12.0
γ_{wet} (gm/cc)	1.87
γ_{Dry} (gm/cc)	1.40
% Moisture	33.58
Cohesion (Kpa)	47.15



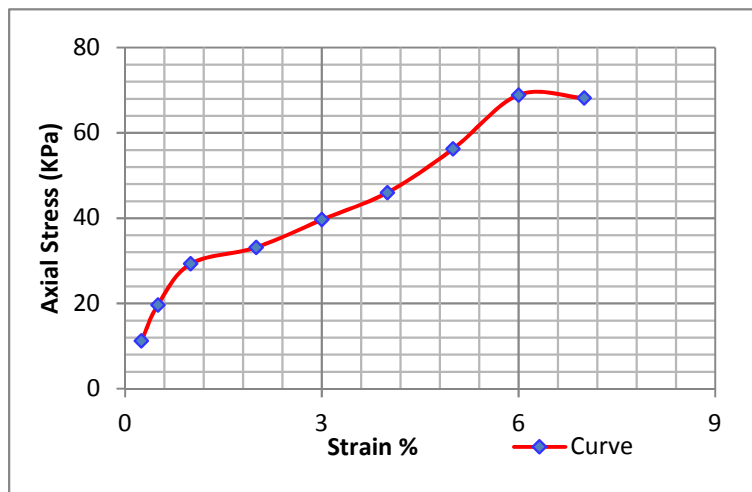
Bore hole No.	BH-20
Sample No.	UD-1
Depth (m)	5.10 to 5.55
Description of soil	Silt with Caly
qu (Kpa)	53.30
% Strain	12.0
γ_{wet} (gm/cc)	2.14
γ_{Dry} (gm/cc)	1.65
% Moisture	29.26
Cohesion (Kpa)	26.65



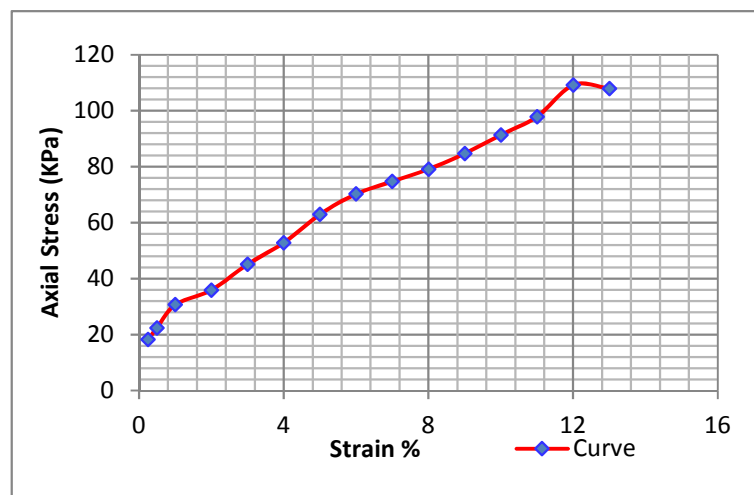
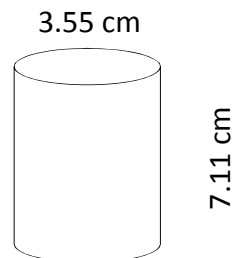
Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)

Location: Uttar akdala Govt. Primary School, Uttar akdala Bazar, Bhabanigong Pourashava & Nandanpur(Chekamara) Bazar,
Mohila Dakhil Madrasha, Basu Para Union

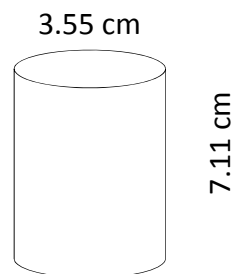
UNCONFINED COMPRESSION STRENGTH TEST



Bore hole No.	BH-21
Sample No.	UD-1
Depth (m)	6.10 to 6.55
Description of soil	Silt with Caly
qu (Kpa)	68.92
% Strain	6.0
γ_{wet} (gm/cc)	1.42
γ_{Dry} (gm/cc)	0.85
% Moisture	66.61
Cohesion (Kpa)	34.46



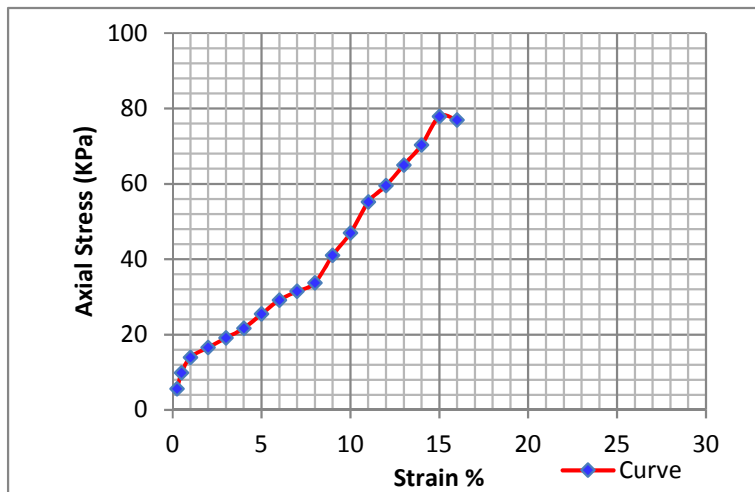
Bore hole No.	BH-22
Sample No.	UD-1
Depth (m)	8.10 to 8.55
Description of soil	Silt with Clay
qu (Kpa)	109.19
% Strain	12.0
γ_{wet} (gm/cc)	1.85
γ_{Dry} (gm/cc)	1.40
% Moisture	31.57
Cohesion (Kpa)	54.59



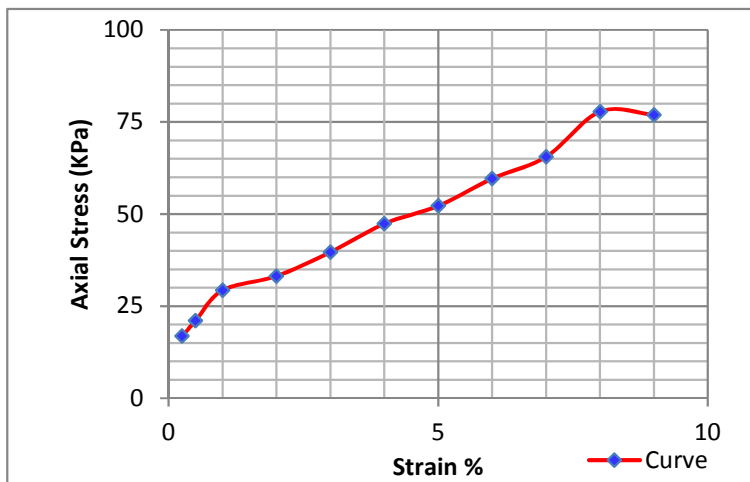
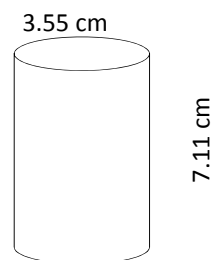
Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Location: Ganipur Union Complex office, Hasnipur Bazar, Ganipur Union& Boiloshingho Govt. Primary School, Maria Union

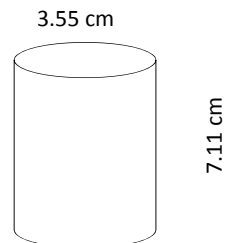
UNCONFINED COMPRESSION STRENGTH TEST



Bore hole No.	BH-24
Sample No.	UD-1
Depth (m)	8.10 to 8.55
Description of soil	Silt with Clay
qu (Kpa)	77.90
% Strain	15.0
γ_{wet} (gm/cc)	1.91
γ_{Dry} (gm/cc)	1.54
% Moisture	23.85
Cohesion (Kpa)	38.95



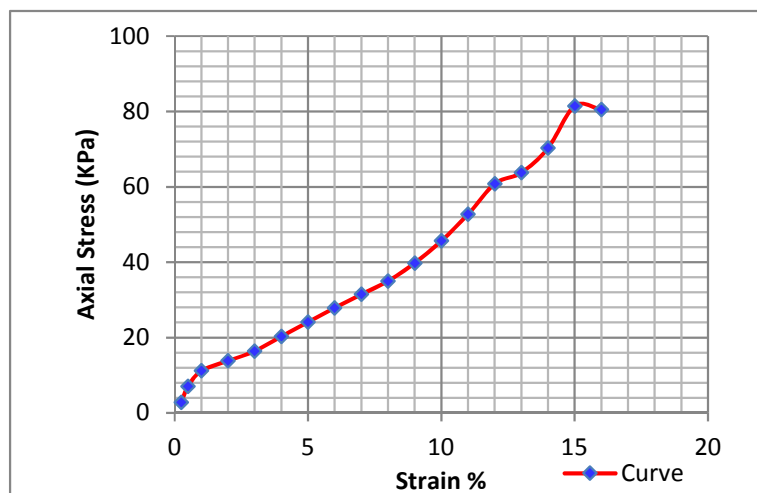
Bore hole No.	BH-25
Sample No.	UD-1
Depth (m)	5.10 to 5.55
Description of soil	Clayey Silt
qu (Kpa)	77.83
% Strain	8.0
γ_{wet} (gm/cc)	2.29
γ_{Dry} (gm/cc)	1.89
% Moisture	21.38
Cohesion (Kpa)	38.92



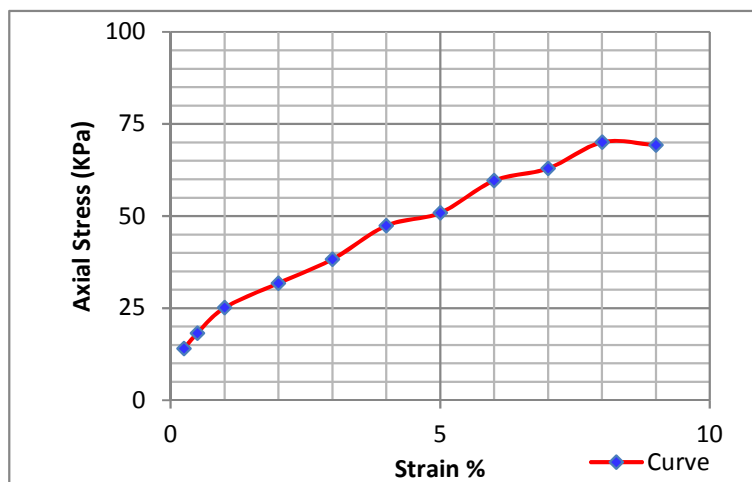
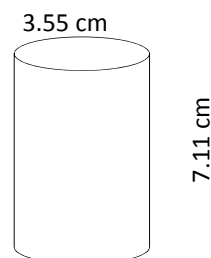
Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Location: Sakoa Bohumuki High School, Sikdar Bazar, Maria Union & Gangopara Govt. Primary school, Maria Union

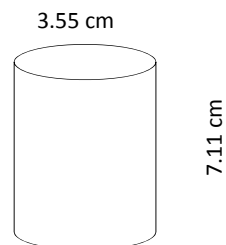
UNCONFINED COMPRESSION STRENGTH TEST



Bore hole No.	BH-30
Sample No.	UD-1
Depth (m)	5.10 to 5.55
Description of soil	Silt with Clay
qu (Kpa)	81.49
% Strain	15.0
γ_{wet} (gm/cc)	1.92
γ_{Dry} (gm/cc)	1.57
% Moisture	22.53
Cohesion (Kpa)	40.75

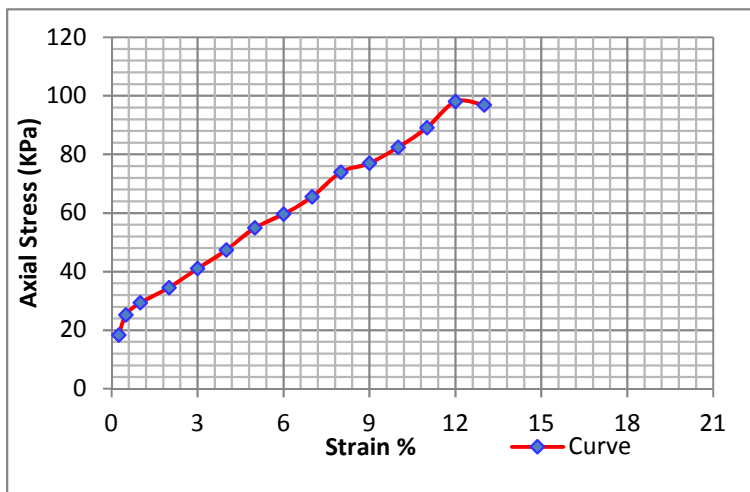


Bore hole No.	BH-31
Sample No.	UD-1
Depth (m)	5.10 to 5.45
Description of soil	Silt with Clay
qu (Kpa)	70.05
% Strain	8.0
γ_{wet} (gm/cc)	2.23
γ_{Dry} (gm/cc)	1.91
% Moisture	16.64
Cohesion (Kpa)	35.02

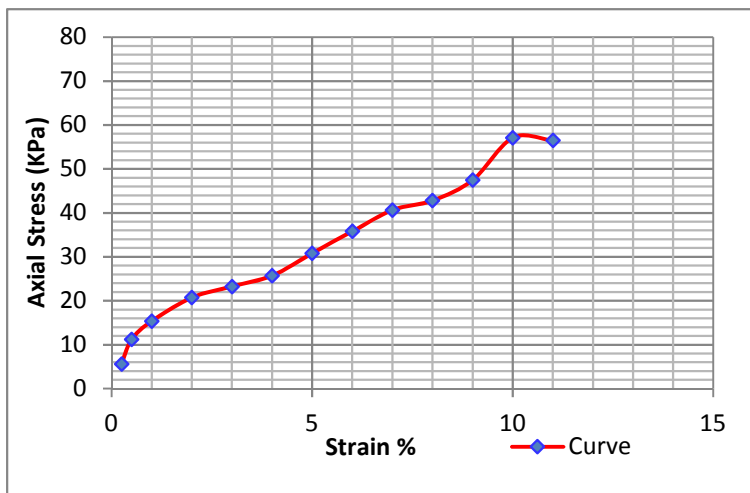
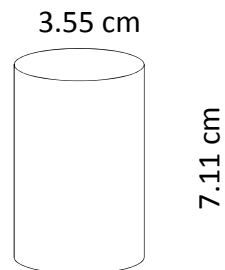


Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)
Location: Sajura Mirzapur, Goalkandi Union & Sahid Sakandar Memorial Adarsho High School, Godaoun
Mor, Bhabanigong Pourashava

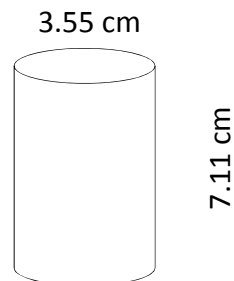
UNCONFINED COMPRESSION STRENGTH TEST



Bore hole No.	BH-32
Sample No.	UD-1
Depth (m)	8.10 to 8.55
Description of soil	Silt with Clay
qu (Kpa)	98.02
% Strain	12.0
γ_{wet} (gm/cc)	1.85
γ_{Dry} (gm/cc)	1.36
% Moisture	35.67
Cohesion (Kpa)	49.01



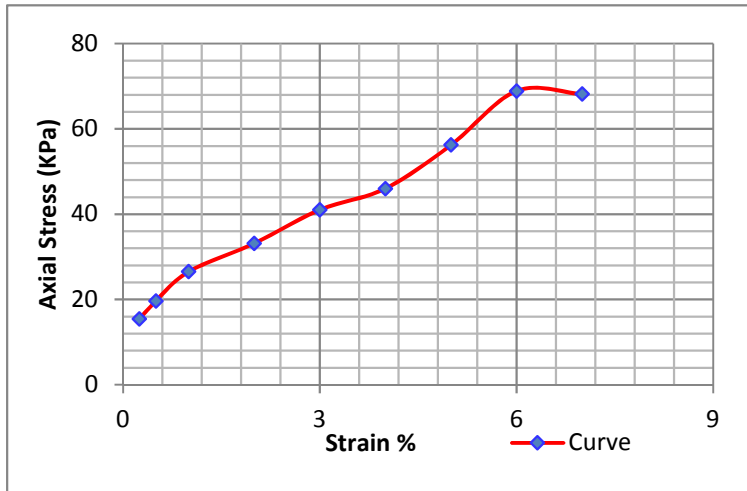
Bore hole No.	BH-26
Sample No.	UD-1
Depth (m)	6.10 to 6.55
Description of soil	Silt with Clay
qu (Kpa)	57.10
% Strain	12.0
γ_{wet} (gm/cc)	2.08
γ_{Dry} (gm/cc)	1.65
% Moisture	25.84
Cohesion (Kpa)	28.55



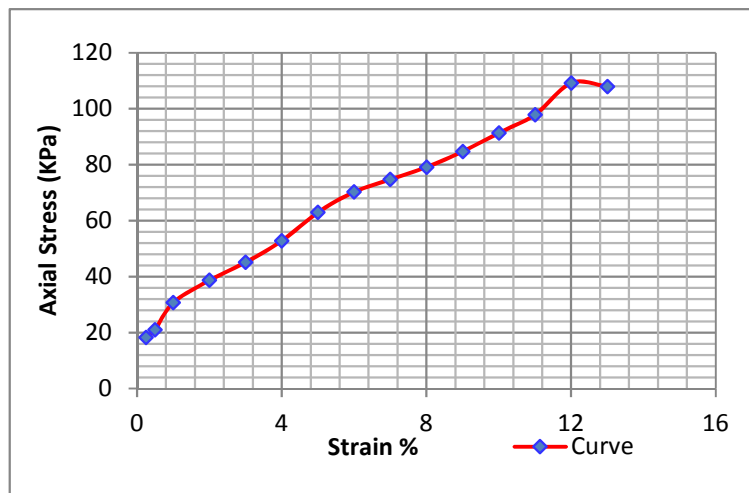
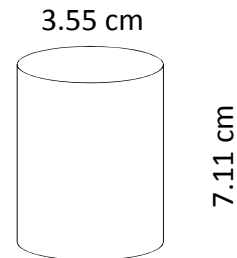
Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)

Location: Shadhopara Madrasha, Near post office, Sreepur Union & Jhikra High School, Jhikra Bazar, Jhikra Union

UNCONFINED COMPRESSION STRENGTH TEST



Bore hole No.	BH-28
Sample No.	UD-1
Depth (m)	5.10 to 5.55
Description of soil	Silt with Sand
qu (Kpa)	68.92
% Strain	9.0
γ_{wet} (gm/cc)	1.46
γ_{Dry} (gm/cc)	0.80
% Moisture	83.77
Cohesion (Kpa)	34.46



Bore hole No.	BH-29
Sample No.	UD-1
Depth (m)	5.10 to 5.55
Description of soil	Silt with Clay
qu (Kpa)	109.19
% Strain	12.0
γ_{wet} (gm/cc)	1.77
γ_{Dry} (gm/cc)	1.36
% Moisture	30.47
Cohesion (Kpa)	54.59

